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**MIL-STD-975L (NASA)  
31 JANUARY 1994**

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**SUPERSEDING  
MIL-STD-975K (NASA)  
19 FEBRUARY 1993**

# **MILITARY STANDARD**

**NASA STANDARD ELECTRICAL, ELECTRONIC,  
AND ELECTROMECHANICAL (EEE) PARTS LIST**



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**MIL-STD-975L (NASA)**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
WASHINGTON, D.C. 20546**

*NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List*

**MIL-STD-975L (NASA)**

1. This military standard is approved for use by all elements of the *National Aeronautics and Space Administration* and is available for use by all departments and agencies of the Department of Defense.
2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to:

**MANAGER (310.A)  
NASA PARTS PROJECT OFFICE  
GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND 20771**

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## MIL-STD-975L (NASA)

### FOREWORD

This standard is the technical baseline for standardization of Electrical, Electronic, and Electro-mechanical (EEE) parts. The intent of this effort is to focus part selection on EEE parts used in the design and construction of space flight hardware as well as mission-essential ground support equipment (GSE). The overall objectives are to: 1. Provide the designer with a list of acceptable parts and the specifications for procuring those parts for space flight missions. 2. Reduce the quantity of part numbers used in space flight missions in order to derive the benefits associated with standardization. The result of this effort should provide the designer with a standardized selection of EEE parts, including the necessary criteria pertaining to use, choice, and application.

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## MIL-STD-975L (NASA) - Part I

## STANDARD PARTS

## 1. SCOPE

- 1.1 **General.** This standard establishes a list of Electrical, Electronic, and Electromechanical (EEE) Parts for use in the selection, procurement, and application for flight and mission-essential ground support equipment. The list is limited to the following Federal Stock Classes:

<u>Part Types</u>	<u>FSC</u>
* Capacitors	5910
* Circuit Breakers	5925
* Connectors	5935
* Crystals and Crystal Oscillators	5955
* Diodes	5961
* Fiber Optics	60GP (FSG)
* Filters	5915
* Fuses	5920
* Inductors	5950
* Microcircuits	5962
* Relays	5945
* Resistors	5905
* Thermistors	5905
* Transformers	5950
* Transistors	5961
* Wire and cable	6145

- 1.2 **Purpose.** The purpose of this standard is as follows:

- a. To provide equipment designers and manufacturers with a list of electronic parts having two quality levels considered to be most acceptable for flight and mission-essential ground support equipment.
- b. To control and minimize the variety of electronic part types used by government activities in order to maximize economic support of, concentrate improvement on, and facilitate effective logistic support of the electronic parts listed in this standard.

- 1.3 **Classification.** Two levels of quality are used in this standard. Grade 2 parts are high quality, government specification controlled parts for use in applications not requiring Grade 1 parts. Grade 1 parts are higher quality; government specification controlled parts intended for critical applications.

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## 2. REFERENCED DOCUMENTS

Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

## CAPACITORS (FSC 5910)

- MIL-C-20 - Capacitors, Fixed, Ceramic Dielectric (Temperature Compensating), Established and Non-established Reliability, General Specification for.
- MIL-C-123 - Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification for.
- MIL-C-23269 - Capacitors, Fixed, Glass Dielectric, Established Reliability, General Specification for.
- MIL-C-39003 - Capacitors, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification for.
- MIL-C-39006 - Capacitors, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, General Specification for.
- MIL-C-39014 - Capacitors, Fixed, Ceramic Dielectric (General Purpose), Established Reliability, General Specification for.
- MIL-C-55365 - Capacitors, Chip, Fixed, Tantalum, Established Reliability, General Specification for.
- MIL-C-55681 - Capacitor, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification for.
- MIL-C-83421 - Capacitors, Fixed, Metallized Plastic Film Dielectric, (dc, ac, or dc and ac), Hermetically Sealed in Metal Cases, Established Reliability, General Specification for.
- MIL-C-87217 - Capacitors, Fixed, Supermetallized Plastic Film Dielectric, Direct Current for Low Energy, High Impedance Applications, Hermetically Sealed in Metal Cases, High Reliability, General Specification for.

## CONNECTORS (FSC 5935)

- MSFC 40M38277 - Connectors, Electrical, Circular, Miniature, High Density, Environment Resisting, Specification for.
- MSFC 40M38298 - Connectors, Electrical, Special, Miniature Circular, Environment Resisting.

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- MSFC 40M39569 - Connectors, Electrical, Miniature Circular, Environment Resisting, 200°C, Specification for.
- GSFC S-311-P-4 - Connectors (and Contacts), Electrical, Rectangular, for Space Flight Use, General Specification for.
- GSFC S-311-P-10 - Connectors, Subminiature, Electrical and Coaxial Contact, for Space Flight Use.
- MIL-C-5015 - Connector, Electrical, Circular Threaded, AN Type, General Specification for.
- MIL-C-22992 - Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type, General Specification for.
- MIL-C-24308 - Connector, Electric, Rectangular, Miniature Polarized Shell, Rack and Panel, General Specification for.
- MIL-C-26482 - Connector, Electrical, (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specification for.
- MIL-C-83513 - Connector, Electrical, Rectangular Microminiature, Polarized Shell, Crimp and Solder Contacts, General Specification for.
- MIL-C-38999 - Connector, Electrical, Circular, Miniature, High Density, Quick Disconnect, (Bayonet, Threaded and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.
- MIL-C-39012 - Connector, Coaxial, Radio Frequency, General Specification for.
- MIL-C-39029 - Contacts, Electrical Connector, General Specification for.
- MIL-C-55302 - Connectors, Printed Circuit Subassembly and Accessories, General Specification for.
- MIL-C-85049 - Connector Accessories, Electrical, General Specification for.

**CRYSTALS & CRYSTAL OSCILLATORS (FSC 5955)**

- MIL-C-49468 - Crystal Units, Quartz, Precision, General Specification for.
- MIL-O-55310 - Oscillators, Crystal, General Specification for.

**DIODES (FSC 5961)**

- MIL-S-19500 - Semiconductor Devices, General Specification for.

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### FILTERS (FSC 5915)

- MIL-F-28861 - Filters and Capacitors, Radio Frequency/Electromagnetic Interference Suppression, Specification for.

### INDUCTORS (FSC 5950)

- MIL-STD-981 - Design Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.
- MIL-C-39010 - Coils, Fixed, Radio Frequency, Molded, Established Reliability, General Specification for.
- MIL-C-83446 - Coils, Chip, Fixed or Variable, General Specification for.

### MICROCIRCUITS (FSC 5962)

- MIL-M-38510 - Microcircuits, General Specification for.
- MIL-H-38534 - Hybrid Microcircuits, General Specification for.
- MIL-I-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for

### PROTECTIVE DEVICES (FSC 5920 and 5925)

- MIL-F-23419 - Fuses, Instrument Type, General Specification for.
- MIL-C-39019 - Circuit Breakers, Magnetic, Low-Power, Sealed, Trip-Free, General Specification for.

### RELAYS (FSC 5945)

- MIL-R-39016 - Relays, Electromagnetic, Established Reliability, General Specification for.

### RESISTORS (FSC 5905)

- MIL-R-39005 - Resistors, Fixed, Wire-Wound (Accurate), Established Reliability, General Specification for.
- MIL-R-39007 - Resistors, Fixed, Wire-Wound (Power Type), Established Reliability, General Specification for.

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- MIL-R-39008 - Resistors, Fixed Composition (Insulated), Established Reliability, General Specification for.
- MIL-R-39009 - Resistors, Fixed, Wire-Wound (Power Type, Chassis Mounted), Established Reliability, General Specification for.
- MIL-R-39015 - Resistors, Variable, Wire-Wound (Lead Screw Actuated), Established Reliability, General Specification for.
- MIL-R-39017 - Resistors, Fixed, Film (Insulated), Established Reliability, General Specification for.
- MIL-R-39032 - Resistors, Packaging of.
- MIL-R-55182 - Resistors, Fixed, Film, Established Reliability, General Specification for.
- MIL-R-55342 - Resistors, Fixed, Film, Chip, Established Reliability, General Specification for.
- MIL-R-83401 - Resistor Networks, Fixed, Film, General Specification for.

### THERMISTORS (FSC 5905)

- MIL-T-23648 - Thermistor (Thermally Sensitive Resistor), Insulated, General Specification for.
- GSFC S-311-P-18 - Thermistor (Thermally Sensitive Resistor), Insulated, Negative Temperature Coefficient, Style 311P18, Specification for.

### TRANSFORMERS (FSC 5950)

- MIL-STD-981 - Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.

### TRANSISTORS (FSC 5961)

- MIL-S-19500 - Semiconductor Devices, General Specification for.

### WIRE & CABLE (FSC 6145)

- MIL-C-17 - Cable, Radio Frequency, Flexible and Semirigid, General Specification for.
- MIL-W-5086 - Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy.

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- MIL-W-22759 - Wire, Electric, Fluorocarbon Insulated, Copper or Copper Alloy.
- MIL-C-27500 - Cable, Electrical, Shielded and Unshielded, Aerospace.

### OTHER DOCUMENTS

- ASTM E 595 - Standard Test Method for Total Mass Loss and Collected Volatile Condensable Material From Outgassing in a Vacuum Environment.
- MIL-HDBK-978 - Parts Application Handbook
- NHB8060.1 - Flammability, Odor, Offgassing and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion.

(Copies of specifications, standards, drawings, and publications requested by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

NOTE: Additional copies may be obtained from the following center:

STANDARDIZATION DOCUMENTS ORDER DESK  
BUILDING 4, SECTION D  
700 ROBBINS AVENUE  
PHILADELPHIA, PA 19111-5094

### 3. DEFINITIONS

- 3.1 **Standard Part.** An EEE part which is listed in Part I of this standard.
- 3.2 **Nonstandard Part.** An EEE part that is not listed in Part I of this standard. Grade 2 parts used in Grade 1 applications.
- 3.3 **Grade 1 parts.** This is the classification used for parts of higher quality than Grade 2. They are standard parts intended for applications that the responsible NASA project office has determined to be critical. Grade 1 parts can also be used in applications designated as Grade 2.
  - 3.3.1 **Capacitors.** These are military established reliability (ER) parts purchased to either S or C failure rates except where specifically noted.

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- 3.3.2 **Connectors.** These are connectors that are procurable to NASA/MSFC "40M" and NASA/GSFC "S-311" specifications.
  - 3.3.3 **Crystals and Crystal Oscillators.** There are no Grade 1 crystals listed in this standard. Crystal oscillators are Class S qualified to MIL-O-55310
  - 3.3.4 **Diodes.** These are diodes that are MIL-S-19500 JANS qualified.
  - 3.3.5 **Filters.** There are no Grade 1 filters listed in this standard.
  - 3.3.6 **Inductors and Coils.** These are military established reliability (ER) parts purchased to S failure rate.
  - 3.3.7 **Microcircuits.** These are MIL-M-38510 JAN Class S qualified devices.
  - 3.3.8 **Protective Devices.** There are no Grade 1 protective devices listed in this standard.
  - 3.3.9 **Relays.** There are no Grade 1 relays listed in this standard.
  - 3.3.10 **Resistors.** These are military established reliability (ER) parts purchased to S failure rate except where specifically noted.
  - 3.3.11 **Thermistors.** These are thermistors that are procurable to NASA/GSFC specification S-311-P-18.
  - 3.3.12 **Transformers.** This standard contains no transformers. All transformers must be procured to the requirements of MIL-STD-981.
  - 3.3.13 **Transistors.** These are transistors that are MIL-S-19500 JANS qualified.
  - 3.3.14 **Wire and Cable.** This is wire qualified to MIL-W-22759 and cable qualified to MIL-C-17 and MIL-C-27500.
  - 3.3.15 **Fiber Optics.** There are no Grade 1 fiber optics listed in this standard.
- 3.4 **Grade 2 parts.** This is the classification used for standard parts which meet the criteria for inclusion in this standard and are intended for applications not requiring Grade 1 parts. Parts intermediate in quality between Grade 1 and Grade 2 may also be used in applications designated as Grade 2. (Example: If S failure rate is Grade 1 and P failure rate is Grade 2, parts with an R failure rate can be used in Grade 2 applications.)
- 3.4.1 **Capacitors.** These are military established reliability (ER) parts purchased to either P or B failure rate level.
  - 3.4.2 **Connectors.** These are connectors that are procurable to NASA/MSFC "40M," NASA/GSFC "S-311," MIL-C-5015, MIL-C-24308, MIL-C-26482, MIL-C-38999, MIL-C-39012, MIL-C-39029, MIL-C-55302, and MIL-C-83513 specifications.

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- 3.4.3 **Crystals and Crystal Oscillators.** There are no Grade 2 crystals listed in this standard. Crystal oscillators are Class B qualified to MIL-O-55310.
  - 3.4.4 **Diodes.** These are JANTXV diodes that have been evaluated in accordance with the additional testing requirements of section 4 of Part I herein.
  - 3.4.5 **Filters.** These are filters that are qualified to MIL-F-28861.
  - 3.4.6 **Conductors and Coils.** These are military established reliability (ER) parts purchased to P failure rate except where specifically noted.
  - 3.4.7 **Microcircuits.** These are microcircuits which are qualified to MIL-M-38510 Class B specifications.
  - 3.4.8 **Protective Devices.** These are devices that are qualified to MIL-F-23419/8 and MIL-C-39019/1 through MIL-C-39019/6.
  - 3.4.9 **Relays.** These are parts qualified to MIL-R-39016 failure rate level (FRL) P.
  - 3.4.10 **Resistors.** These are military established reliability (ER) parts purchased to P failure rate levels.
  - 3.4.11 **Thermistors.** These are thermistors that are procurable to military control specification MIL-T-23648/19.
  - 3.4.12 **Transformers.** This standard contains no transformers. All transformers must be procured to the requirements of MIL-STD-981.
  - 3.4.13 **Transistors.** These are JANTXV transistors that have been evaluated in accordance with the additional testing requirements of section 13 of Part I herein.
  - 3.4.14 **Wire and Cable.** This is wire qualified to MIL-W-22759 and cable qualified to MIL-C-17 and MIL-C-27500.
  - 3.4.15 **Fiber Optics.** There are no Grade 2 fiber optics listed in this standard
- 3.5 **Preferred Nonstandard Parts.** These are EEE parts listed in Part II of this standard.

## MIL-STD-975L (NASA) - Part I

## 4. GENERAL REQUIREMENTS

4.1 **Criteria for standard parts listing.** Paragraph 4.1.1 through 4.1.3 define the criteria which must be met for listing a part in this standard.

4.1.1 **Criteria for candidate parts selection.** A part will become a candidate for listing in this standard only if it meets all of the criteria in 4.1.1.1 through 4.1.1.4.

4.1.1.1 **Application need.** *There must be multiple applications requiring the specific performance capability peculiar to the part proposed for listing. Consideration will be given to selecting parts capable of satisfying the widest range of design applications, and when applicable, parts should be compatible with existing listings (e.g., select a reference diode that is an extension of a listed series or a microcircuit that is generic to a family already listed). A definite need is assumed to exist for a part that has been used successfully in several recent space applications, if it is nonredundant (with respect to form, fit, or function) to existing listings or provides other compelling advantages (e.g., continuing availability) over such listings. In the latter case, deletion of the original listing may be in order.*

4.1.1.2 **Technological maturity.** *The design of the part must be finalized and must utilize proven materials and technologies. It must have been in production for a period sufficient to provide assurance that the critical design and process parameters have been identified and adequate controls have been developed. The technology also must have demonstrated suitability for flight hardware or mission-essential ground support equipment use.*

4.1.1.3 **Availability of manufacturers.** *The part should be in production by at least one and preferably two manufacturers whose previous performance indicates that they are capable of qualifying their product to specifications adequate for listing in this standard.*

4.1.1.4 **Test or usage history.** *There must be sufficient test or usage experience with the part to:*

- a. *Determine predominant failure modes and mechanisms.*
- b. *Provide reasonable confidence that the part will perform reliably when supplied to an adequate specification.*
- c. *Identify the derating and application restraints necessary for reliable use in flight hardware or mission-essential ground support equipment environments.*

4.1.2 **Criteria for standard parts approval.** The criteria of 4.1.2.1 through 4.1.2.4 should be met before a candidate part can be approved and listed in this standard.

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- 4.1.2.1 **Characterization data.** A comprehensive parameter characterization test program has been conducted to identify the part's performance capability through the operating temperature spectrum and over long life. This data must indicate that the part parameters are stable during the operating temperature range and life, and must reveal peculiarities that should be considered or avoided in usage.
- 4.1.2.2 **Evaluation tests.** An environmental test program is usually conducted to determine actual stress levels at which the part fails or degrades significantly.
- 4.1.2.3 **Specification.** The part shall have an adequate government specification that defines performance, design, materials, quality controls, and test requirements. Parameters in the specification shall realistically characterize the part during its range of specified environment and operating conditions.
- 4.1.2.4 **Qualification.** The part should be qualified to the applicable specification, and this qualification must be maintained in accordance with qualification retention requirements. Some parts may be listed when there is an indication that a QPL listing is imminent. QPL listing shall be reviewed by the user for latest qualification status.
- 4.1.3 **Standard part removal criteria.** A part listed in this standard may be removed for any of the following reasons:
- a. The part becomes obsolete.
  - b. There are no longer any qualified sources for the part.
  - c. The part is replaced with a functionally similar device having improved characteristics or better reliability.
  - d. The part exhibits reliability problems for which no economically adequate controls or screens have been developed.
- 4.2 **Parts procurement.** The user is responsible for procurement of Standard Parts.
- 4.2.1 **Correlation of circuit requirements and detail specification test conditions.** When an application condition varies from the detail specification test condition(s), it shall be the responsibility of the contractor (or hardware designer/builder) to establish a satisfactory correlation between the circuit requirements and the detail specification requirements.
- 4.2.2 **Specification.** All parts listed herein must be procured to the applicable detailed government specifications and be marked with the JAN brand (or approved abbreviation), NASA part number, which signifies satisfactory compliance with all the specification requirements.
- 4.2.3 **Additional testing.** Appendix B defines the additional testing that is required for the parts which do not fully meet the requirements for NASA programs. All parts indicated shall be subjected to these additional tests prior to use.

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- 4.2.4 **QPL Qualified manufacturers.** Qualified manufacturers for Qualified Products List (QPL) are listed in the appropriate QPL. When purchasing QPL parts, the procuring activity shall solicit bids from sources listed in the applicable QPL for the specific part. "Sole source" procurements are discouraged except when only one qualified source exists. The qualifying activity may be contacted to determine if qualification has been granted to additional manufacturers for the part under procurement subsequent to the publication of the current QPL, or if the previous qualification status of any listed manufacturers has changed. The qualifying activity for most QPL's is the Defense Electronics Supply Center (DESC-EQ), Dayton, Ohio 45444.
- 4.2.5 **Receiving inspection.** Receiving inspection should be performed on Standard Parts and should include:
- a. Review of data shipped with parts for compliance.
  - b. Part count.
  - c. Inspection for part markings and external defects.
  - d. Electrical measurement (100%) of critical parameters, except sampling which may be approved by NASA projects.
- Adequate security, such as an environmentally controlled bonded storage area, should be provided for storing the received parts until use, to maintain their integrity and traceability.
- 4.3 **Parts application.** The Standard Parts listed herein must be properly applied by the user in order to give satisfactory and reliable performance. The equipment shall be designed so that it will meet the specified performance and reliability requirements when using Standard Parts. Standard Parts must be used only for those characteristics or parameters which are controlled by the applicable detail specifications. The use of Standard Parts, as required by this standard, does not relieve the contractor (or hardware designer/builder) of the responsibility for complying with all equipment performance and other requirements set forth in the applicable system/equipment specification and contract.
- 4.3.1 **Minimizing parts count.** The variety of Standard Part types used in space equipment design should be the minimum necessary to provide satisfactory performance, and the user should exercise all reasonable design choices to achieve this objective.
- 4.3.2 **Application guidelines.** The application guidelines provided in MIL-HDBK-978, "NASA Parts Application Handbook," are recommended.
- 4.3.3 **Parts derating.** To achieve high reliability and good performance, derating from the qualified maximum ratings is required. All parts shall be derated in accordance with the derating criteria in Appendix A.
- 4.4 **Nonstandard parts usage.** Nonstandard parts shall be used only after they are approved by the responsible government activity.

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- 4.5 Conflict of data.** In the event of conflict between the technical description of Standard Parts described in this standard and the applicable specification, the specification shall govern.
- 4.6 Problem reporting procedure - Standardization Document Improvement Proposal, (DD Form 1426).** Consistent with the parts standardization program, the use of the attached Standardization Document Improvement Proposal (DD form 1426) is encouraged as a communicate for parts and commodity experience. Experience need not be restricted to problems which may lead to a part removal request, but may also include part or commodity additions to the standard. As a minimum, the "Remarks" paragraph should include the following (when appropriate): commodity ID, generic part number, user part number, and any pertinent data which may be of use for approving your request.

Reply to attention of:

MANAGER (310.A)  
NASA PARTS PROJECT OFFICE  
GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND 20771

- 4.7 Material test requirements.** Requirements imposed on materials to be used in the space environment (i.e., thermal vacuum outgassing, flammability, smoke, odor, toxicity) are application specific. EEE parts that are conformally coated by a material that meets project requirements do not need to be tested for compliance to those material requirements, if approved by the specific project.

## MIL-STD-975L (NASA) - Part I

### PREFERRED NONSTANDARD PARTS

#### 5. SCOPE

- 5.1 **General.** Part II of this standard establishes a list of nonstandard EEE parts which are preferred for use in flight and mission essential ground support equipment, when a standard part is not available for listing in Part I.
- 5.2 **Purpose.** The purpose of Part II is to provide equipment designers and manufacturers with a list of preferred electronic parts that are advanced microcircuits which have not yet become fully approved or parts in common use by NASA programs but are not available in Part I of this standard. This section is intended to encourage standardization of device types and specifications. In addition, potential program savings can be realized through shared qualification and other relevant data. The availability of this data will streamline the Nonstandard Part Approval Request (NSPAR) process for listed part types.
- 5.3 **Classification.** These parts do not carry any level of classification and require a Nonstandard Part Approval Request (NSPAR) prior to use on NASA programs.
- 5.4 **Beneficial comments** (recommendations, additions, deletions), inquiries about the parts listed (except Advanced Microcircuit Parts Listing) and any pertinent data which may be of use in improving Part II of this document should be addressed as follows:

MANAGER (310.A)  
NASA PARTS PROJECT OFFICE  
GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND 20771

#### 6. REFERENCED DOCUMENTS

See individual sections.

#### 7. DEFINITIONS

- 7.1 **Preferred Nonstandard Part.** This is a part that does not meet all criteria for Part I listing as a standard part, but is being recommended for use to encourage STANDARDIZATION.
- 7.2 **NSPARS.** Nonstandard Part Approval Request, required for all parts in Part II of this standard.

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### 8. CRITERIA FOR PREFERRED NONSTANDARD PARTS LISTING

8.1 Listing criteria. In order for a part to be listed in this section the following criteria must be met.

- (i) The part was/is listed in the Candidate Part List (CPL)
- (ii) Application need has been identified
- (iii) A suitable specification must be available for procurement of the part
- (iv) Suitable NASA or government approved and NASA surveyed manufacturers exist
- (v) Successful qualification to the suitable specification must have been accomplished

8.2 Removal of a nonstandard part. A part may be removed from this section if serious quality or reliability problems have been found which are of general concern.

9. REQUIREMENTS FOR USE. All projects are responsible to ensure that their program parts requirements are met by these parts and procurement specifications prior to use. A NSPAR is required and NASA approval needed unless specifically waived by the program.

## SECTION 1: SUMMARY OF STANDARD CAPACITORS

Page	Control Specification	Military Style	Description	Seal	Capacitance Range		Voltage Range (Volts, dc)		Operating Temperature Range(°C)		Grade 1	Grade 2
					Min	Max	Min	Max	Min	Max		
1.2	MIL-C-20 (6)	CCR	Fixed, ceramic, temperature compensating	Nonhermetic	1.0 pF	0.082 μF	50	200	-55	+125	S(2)	P
1.15	MIL-C-123	CKS	Fixed, ceramic	Molded and Unencapsulated	1.0 pF	1.0 μF	50	100	-55	+125	(3)	(3)
1.45	MIL-C-23269	CYR	Fixed, glass	Hermetic	0.5pF	0.01 μF	100	100	-55	+125	S	S
1.52	MIL-C-39003	CSR, CSS	Fixed, tantalum (solid) electrolytic	Hermetic	0.0047 μF	560.0 μF	10	75	-55	+125	C (4)	B
1.62	MIL-C-39006	CLR	Fixed, tantalum (non-solid) electrolytic	Hermetic	0.12 μF	1500.0 μF	10	300	-55	+125	R	P
1.80	MIL-C-39014	CKR	Fixed, ceramic	Nonhermetic	10.0 pF	0.33 μF	50	200	-55	+125	(5)	S
1.87	MIL-C-55365	CWR	Chip, fixed, tantalum	Unencapsulated	0.10 μF	100.0 μF	4	50	-55	+125	C	B
1.91	MIL-C-55681 (6)	CDR	Chip, fixed, ceramic dielectric	Unencapsulated	10.0 pF	0.33 μF	50	500	-55	+125	S (7)	P
1.106	MIL-C-83421	CRH	Fixed, metallized plastic film, DC, AC	Hermetic	0.001 μF	22.0 μF	30	400	-65	+100	S	R
1.118	MIL-C-87217	CHS	Fixed, supermetallized, plastic film, DC, low energy, high impedance	Hermetic	0.001 μF	10.0 μF	30	100	-55	+100	(3)	(3)

Refer to MIL-HDBK-978, Vol. 1, for construction and application information.

- (1) Failure rate levels (FRLs). Reference the applicable Control Specification.
- (2) For Grade 1 low voltage applications. Perform lot sample testing of MIL-C-123 group B, Subgroup 2. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2. c & d. Sample parts subjected to this testing shall not be used.
- (3) Failure Rate Level (FRL) not applicable.
- (4) CSR parts shall be subjected to screening in accordance with Appendix B prior to use. Reference MIL-HDBK-978, Vol 1, 2.6.7.2 & 3. Not applicable for style CSS.
- (5) There are no MIL-C-39014 Grade 1 parts available. Use MIL-C-123 for Grade 1 applications.
- (6) MIL-C-123 is the preferred specification for Grade 1 parts.
- (7) Lot performance characteristics shall be assessed by use of the sample tests required by Appendix B. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2 and 3. Sample parts subjected to this testing shall not be used.

# MIL-C-20 CAPACITORS

## Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Part Number Explanation: CCR**	C*	XXX	X	X							
<p>Style - CCR identifies an established reliability, ceramic-dielectric, temperature compensating, fixed capacitor; ** identifies the shape and the dimensions of the capacitor.</p> <p>Characteristics - C identifies the nominal temperature coefficient (0 ppm/°C) while "X" identifies the approximate tolerance envelope for the temperature coefficient. Characteristics available are:</p> <table border="1" style="margin-left: 20px; width: 100px;"> <tr><th>*    * Ppm/°C</th></tr> <tr><td>0    30</td></tr> <tr><td>B    60</td></tr> <tr><td>J    120</td></tr> <tr><td>K    250</td></tr> <tr><td>X    not practically measurable</td></tr> </table>	*    * Ppm/°C	0    30	B    60	J    120	K    250	X    not practically measurable				<p>Capacitance - Nominal value expressed in picofarads. (1)</p>	
*    * Ppm/°C											
0    30											
B    60											
J    120											
K    250											
X    not practically measurable											
				<p>Capacitance tolerance - specified in accordance with the following table:</p> <table border="1" style="margin-left: 20px; width: 100px;"> <tr><th>Tolerance (±)</th></tr> <tr><td>X    0.1pF</td></tr> <tr><td>B    0.25pF</td></tr> <tr><td>D    0.5pF</td></tr> <tr><td>F    1%</td></tr> <tr><td>G    2%</td></tr> <tr><td>J    5%</td></tr> </table>	Tolerance (±)	X    0.1pF	B    0.25pF	D    0.5pF	F    1%	G    2%	J    5%
Tolerance (±)											
X    0.1pF											
B    0.25pF											
D    0.5pF											
F    1%											
G    2%											
J    5%											
				<p>Failure rate level - (percent/1000 hours)</p> <p>P = 0.1  R = 0.01  S = 0.001</p>							

Part Number	Control Specification MIL-C-20	Style	Capacitance		Rated Voltage (Volts, dc) (2)	Dis-sipation Factor (%)	Temperature		Minimum I.R. @ Temperature		Configuration		P.R.L.	
			Range (pF)	Tolerances Available			Range (°C)	Characteristics Available	+25°C	+125°C	Case Type	Lead Type (3)	Grade I (4)	Grade 2
CCR05C* XXX X X	/A5	CCR05	1.0-3,300	B,C,D,F,G,J	50, 100, 200	0.15	-55 to +125	CG,CH,CJ,CK,CX	100K megohm or 1000 megohm	10 K megohm or 100 megohm	Rect molded	Radial	S	P, R
CCR06CG XXX X X	/A6	CCR06	360-10,000	F,G,J				CG						
CCR07CG XXX X X	/A7	CCR07	2,200-22,000	F,G,J				CG						
CCR08CG XXX X X	/A8	CCR08	3,900-68,000	G,J				CG						
CCR75C* XXX X X	/A7	CCR75	1.0-680	B,C,D,F,G,J				CG,CH,CJ,CK,CX						
CCR76CG XXX X X	/A8	CCR76	82-1,000	F,G,J				CG						
CCR77CG XXX X X	/A9	CCR77	150-5,600	F,G,J				CG						
CCR78CG XXX X X	/A0	CCR78	820-27,000	F,G,J				CG						
CCR79CG XXX X X	/A1	CCR79	3,900-82,000	F,G,J				CG						

- (1) See MIL-C-20 for capacitance values.
- (2) For low voltage applications (<10 volts dc), capacitor rated voltage shall be at least 100 volts dc. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2.
- (3) Leads are solderable. For weldable leads contact the project parts engineer.
- (4) For Grade 1 low voltage applications, perform lot sample testing per Group B, Subgroup 2, of MIL-C-123. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2 C and D. Samples subjected to this testing shall not be used.

**MIL-C-20/35, STYLE CCR05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts.dc)	Capacitance		Part Number CCR05C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	1.0	B, C	X1R0*S	X1R0*#
	1.1	B, C	X1R1*S	X1R1*#
	1.2	B, C	X1R2*S	X1R2*#
	1.3	B, C	X1R3*S	X1R3*#
	1.5	B, C	X1R5*S	X1R5*#
	1.6	B, C	X1R6*S	X1R6*#
	1.8	B, C	X1R8*S	X1R8*#
	2.0	B, C	X2R0*S	X2R0*#
	2.2	B, C	K2R2*S	K2R2*#
	2.4	B, C	K2R4*S	K2R4*#
	2.7	B, C, D	K2R7*S	K2R7*#
	3.0	B, C, D	K3R0*S	K3R0*#
	3.3	B, C, D	K3R3*S	K3R3*#
	3.6	B, C, D	K3R6*S	K3R6*#
	3.9	B, C, D	K3R9*S	K3R9*#
	4.3	B, C, D	J4R3*S	J4R3*#
	4.7	B, C, D	J4R7*S	J4R7*#
	5.1	B, C, D	J5R1*S	J5R1*#
	5.6	B, C, D	J5R6*S	J5R6*#
	6.2	B, C, D	J6R2*S	J6R2*#
	6.8	B, C, D	J6R8*S	J6R8*#
	7.5	B, C, D	J7R5*S	J7R5*#
	8.2	B, C, D	H8R2*S	H8R2*#
	9.1	B, C, D	H9R1*S	H9R1*#
	10	F, G, J	H100*S	H100*#
	11	F, G, J	H110*S	H110*#
	12	F, G, J	H120*S	H120*#
	13	F, G, J	H130*S	H130*#
	15	F, G, J	H150*S	H150*#
	16	F, G, J	H160*S	H160*#
18	F, G, J	H180*S	H180*#	
20	F, G, J	G200*S	G200*#	

\* #  
Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/35, STYLE CCR05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating,**  
**Established Reliability (Continued)**

Rated Voltage (Volts,dc)	Capacitance		Part Number CCR05C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	22	F, G, J	G220*S	G220*#
	24		G240*S	G240*#
	27		G270*S	G270*#
	30		G300*S	G300*#
	33		G330*S	G330*#
	36		G360*S	G360*#
	39		G390*S	G390*#
	43		G430*S	G430*#
	47		G470*S	G470*#
	51		G510*S	G510*#
	56		G560*S	G560*#
	62		G620*S	G620*#
	68		G680*S	G680*#
	75		G750*S	G750*#
	82		G820*S	G820*#
	91		G910*S	G910*#
	100		G101*S	G101*#
	110		G111*S	G111*#
	120		G121*S	G121*#
	130		G131*S	G131*#
150	G151*S	G151*#		
160	G161*S	G161*#		
180	G181*S	G181*#		
200	G201*S	G201*#		
220	G221*S	G221*#		
240	G241*S	G241*#		
270	G271*S	G271*#		
300	G301*S	G301*#		
330	G331*S	G331*#		

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/35, STYLE CCR05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating,**  
**Established Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR05C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
100	360	F, G, J	G361*S	G361*#
100	390		G391*S	G391*#
100	430		G431*S	G431*#
100	470		G471*S	G471*#
100	510		G511*S	G511*#
100	560		G561*S	G561*#
100	620		G621*S	G621*#
100	680		G681*S	G681*#
100	750		G751*S	G751*#
100	820		G821*S	G821*#
100	910		G911*S	G911*#
100	1,000		G102*S	G102*#
100	1,100		G112*S	G112*#
100	1,200		G122*S	G122*#
100	1,300		G132*S	G132*#
100	1,500		G152*S	G152*#
100	1,600		G162*S	G162*#
100	1,800		G182*S	G182*#
50	2,000		G202*S	G202*#
50	2,200		G222*S	G222*#
50	2,400	G242*S	G242*#	
50	2,700	G272*S	G272*#	
50	3,000	G302*S	G302*#	
50	3,300	G332*S	G332*#	

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/36, STYLE CCR06 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR06C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	360	F. G. J.	G361*S	G361*#
200	390		G391*S	G391*#
200	430		G431*S	G431*#
200	470		G471*S	G471*#
200	510		G511*S	G511*#
200	560		G561*S	G561*#
200	620		G621*S	G621*#
200	680		G681*S	G681*#
200	750		G751*S	G751*#
200	820		G821*S	G821*#
200	910		G911*S	G911*#
200	1,000		G102*S	G102*#
200	1,100		G112*S	G112*#
200	1,200		G122*S	G122*#
200	1,300		G132*S	G132*#
200	1,500		G152*S	G152*#
200	1,600		G162*S	G162*#
200	1,800		G182*S	G182*#
100	2,000		G202*S	G202*#
100	2,200		G222*S	G222*#
100	2,400		G242*S	G242*#
100	2,700		G272*S	G272*#
100	3,000		G302*S	G302*#
100	3,300		G332*S	G332*#
100	3,600		G362*S	G362*#
100	3,900		G392*S	G392*#
100	4,300		G432*S	G432*#
100	4,700		G472*S	G472*#
50	5,100		G512*S	G512*#
50	5,600		G562*S	G562*#
50	6,200	G622*S	G622*#	
50	6,800	G682*S	G682*#	
50	7,500	G752*S	G752*#	
50	8,200	G822*S	G822*#	
50	9,100	G912*S	G912*#	
50	10,000	G103*S	G103*#	

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/37, STYLE CCR07 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR07C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	2,200	F, G, J	G222*S	G222*#
	2,700		G272*S	G272*#
	3,300		G332*S	G332*#
100	5,600		G562*S	G562*#
	6,800		G682*S	G682*#
	8,200		G822*S	G822*#
	10,000		G103*S	G103*#
	12,000		G123*S	G123*#
50	15,000		G153*S	G153*#
	18,000		G183*S	G183*#
	22,000		G223*S	G223*#

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL)

**MIL-C-20/38, STYLE CCR08 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR08C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	3,900	G, J	G392*S	G392*#
	4,700		G472*S	G472*#
100	15,000		G153*S	G153*#
	18,000		G183*S	G183*#
50	56,000		G563*S	G563*#
	68,000		G683*S	G683*#

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/27, STYLE CCR75 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR75C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	1.0	B, C	X1R0*S	X1R0*#
	1.1	B, C	X1R1*S	X1R1*#
	1.2	B, C	X1R2*S	X1R2*#
	1.3	B, C	X1R3*S	X1R3*#
	1.5	B, C	X1R5*S	X1R5*#
	1.6	B, C	X1R6*S	X1R6*#
	1.8	B, C	X1R8*S	X1R8*#
	2.0	B, C	X2R0*S	X2R0*#
	2.2	B, C	K2R2*S	K2R2*#
	2.4	B, C	K2R4*S	K2R4*#
	2.7	B, C, D	K2R7*S	K2R7*#
	3.0	B, C, D	K3R0*S	K3R0*#
	3.3	B, C, D	K3R3*S	K3R3*#
	3.6	B, C, D	K3R6*S	K3R6*#
	3.9	B, C, D	K3R9*S	K3R9*#
	4.3	B, C, D	J4R3*S	J4R3*#
	4.7	B, C, D	J4R7*S	J4R7*#
	5.1	B, C, D	J5R1*S	J5R1*#
	5.6	B, C, D	J5R6*S	J5R6*#
	6.2	B, C, D	J6R2*S	J6R2*#
	6.8	B, C, D	J6R8*S	J6R8*#
	7.5	B, C, D	J7R5*S	J7R5*#
8.2	B, C, D	H8R2*S	H8R2*#	
9.1	B, C, D	H9R1*S	H9R1*#	
10	F, G, J	H100*S	H100*#	
11	F, G, J	H110*S	H110*#	
12	F, G, J	H120*S	H120*#	
13	F, G, J	H130*S	H130*#	
15	F, G, J	H150*S	H150*#	
16	F, G, J	H160*S	H160*#	
18	F, G, J	H180*S	H180*#	
20	F, G, J	G200*S	G200*#	
22	F, G, J	G220*S	G220*#	

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/27, STYLE CCR75 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating,**  
**Established Reliability (Continued)**

Rated Voltage (Volts.dc)	Capacitance		Tolerances Available	Part Number CCR75C	
	Nominal Value(pF)	F, G, J		Grade 1 FRL = S	Grade 2 FRL = P or R
200	24	F, G, J	G240*S	G240*#	
	27		G270*S	G270*#	
	30		G300*S	G300*#	
	33		G330*S	G330*#	
	36		G360*S	G360*#	
	39		G390*S	G390*#	
	43		G430*S	G430*#	
	47		G470*S	G470*#	
	51		G510*S	G510*#	
	56		G560*S	G560*#	
100	62	F, G, J	G620*S	G620*#	
	68		G680*S	G680*#	
	82		G820*S	G820*#	
	91		G910*S	G910*#	
	100		G101*S	G101*#	
	110		G111*S	G111*#	
	120		G121*S	G121*#	
	130		G131*S	G131*#	
	150		G151*S	G151*#	
	160		G161*S	G161*#	
50	180	F, G, J	G181*S	G181*#	
	200		G201*S	G201*#	
	220		G221*S	G221*#	
	270		G271*S	G271*#	
	300		G301*S	G301*#	
	330		G331*S	G331*#	
	360		G361*S	G361*#	
	390		G391*S	G391*#	
	430		G431*S	G431*#	
	470		G471*S	G471*#	
50	510	F, G, J	G511*S	G511*#	
	560		G561*S	G561*#	
	620		G621*S	G621*#	
	680		G681*S	G681*#	

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/28, STYLE CCR76 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR76C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	82	F, G, J	G820*S	G820*#
	91		G910*S	G910*#
	100		G101*S	G101*#
	110		G111*S	G111*#
	120		G121*S	G121*#
100	270		G271*S	G271*#
	300		G301*S	G301*#
	330		G331*S	G331*#
	360		G361*S	G361*#
	390		G391*S	G391*#
50	750		G751*S	G751*#
	820		G821*S	G821*#
	910	G911*S	G911*#	
	1,000	G102*S	G102*#	

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/29, STYLE CCR77 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR77C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	150	F, G, J	G151*S	G151*#
	160		G161*S	G161*#
	180		G181*S	G181*#
	200		G201*S	G201*#
	220		G221*S	G221*#
	240		G241*S	G241*#
	270		G271*S	G271*#
	300		G301*S	G301*#
	330		G331*S	G331*#
	360		G361*S	G361*#
	390		G391*S	G391*#
	430		G431*S	G431*#
	470		G471*S	G471*#
	510		G511*S	G511*#
560	G561*S	G561*#		
100	620	G621*S	G621*#	
	680	G681*S	G681*#	
	750	G751*S	G751*#	
	820	G821*S	G821*#	
	910	G911*S	G911*#	
	1,000	G102*S	G102*#	
	1,100	G112*S	G112*#	
	1,200	G122*S	G122*#	
	1,300	G132*S	G132*#	
	1,500	G152*S	G152*#	
1,600	G162*S	G162*#		
1,800	G182*S	G182*#		
2,000	G202*S	G202*#		
2,200	G222*S	G222*#		

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/29, STYLE CCR77 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating,**  
**Established Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR77C		
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R	
50	2,400	F, G, J	G242*S	G242*#	
	2,700		G272*S	G272*#	
	3,000		G302*S	G302*#	
	3,300		G332*S	G332*#	
	3,600		G362*S	G362*#	
	3,900		G392*S	G392*#	
	4,300		G432*S	G432*#	
	4,700		G472*S	G472*#	
	5,100		F, G, J, K	G512*S	G512*#
	5,600		F, G, J, K	G562*S	G562*#

\* Choice of allowable tolerances.  
# P or R, allowable Failure Rate Levels (FRL).

**MIL-C-20/30, STYLE CCR78 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number CCR78C	
	Nominal Value (pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	820	F, G, J	G821*S	G821*#
	1,000		G102*S	G102*#
	1,200		G122*S	G122*#
	1,500		G152*S	G152*#
	1,800		G182*S	G182*#
	2,200		G222*S	G222*#
	2,700		G272*S	G272*#
100	3,300	G332*S	G332*#	
	3,900	G392*S	G392*#	
	4,700	G472*S	G472*#	
	5,600	G562*S	G562*#	
	6,800	G682*S	G682*#	
50	8,200	G822*S	G822*#	
	10,000	G103*S	G103*#	
	12,000	G123*S	G123*#	
	15,000	G153*S	G153*#	
	18,000	G183*S	G183*#	
	22,000	G223*S	G223*#	
	27,000	G273*S	G273*#	

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

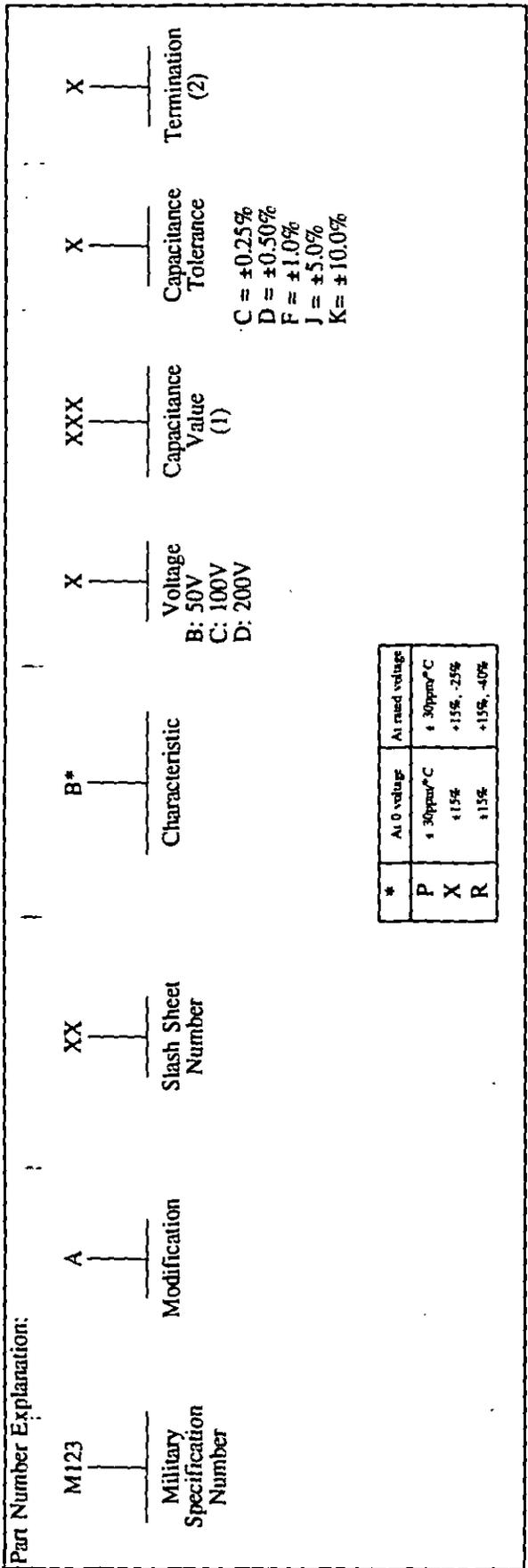
**MIL-C-20/31, STYLE CCR79 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability**

Rated Voltage (Volts,dc)	Capacitance		Part Number CCR79C	
	Nominal Value(pF)	Tolerances Available	Grade 1 FRL = S	Grade 2 FRL = P or R
200	3,900	F, G, J	G392*S	G392*#
	4,700		G472*S	G472*#
	5,600		G562*S	G562*#
	6,800		G682*S	G682*#
	8,200		G822*S	G822*#
	10,000		G103*S	G103*#
	100		15,000	G153*S
18,000			G183*S	G183*#
22,000			G223*S	G223*#
27,000			G273*S	G273*#
33,000			G333*S	G333*#
39,000			G393*S	G393*#
50	47,000		G473*S	G473*#
	56,000		G563*S	G563*#
	68,000	G683*S	G683*#	
	82,000	G823*S	G823*#	

\* # Choice of allowable tolerances.  
P or R, allowable Failure Rate Levels (FRL).

# MIL-C-123 CAPACITORS

## Fixed, Ceramic Dielectric, Temperature Stable and General Purpose, High Reliability



*	Al 0 voltage ± 30ppm/°C	Al rated voltage ± 30ppm/°C
P	± 15%	± 15%, -25%
X	± 15%	± 15%, -40%
R	± 15%	± 15%, -40%

Part Number	Control Specif. MIL-C-123	Style CKS	Capacitance		Rated Voltage (Volts, dc)	Dissipation Factor (%)	Temperature Range (°C)	Temperature Characteristics Available	Minimum I.R. At temperature		Configuration		Grade
			Range (pF)	Tolerances Available					+25°C	+125°C	Case Type	Lead Type	
M123A01BXXXXXXXXXX	/1	05	4.7-10,000	C,D,F,J,K	50, 100						Molded Rectangular	Radial	(4)
M123A02BXXXXXXXXXX	/2	06	270-470,000	F,J,K	50, 100						Molded Rectangular	Radial	
M123A04BXXXXXXXXXX	/4	11	4.7-4700	C,D,F,J,K	50, 100						Molded Tubular	Axial	
M123A05BXXXXXXXXXX	/5	12	110-10,000	F,J,K	50, 100						Molded Tubular	Axial	
M123A06BXXXXXXXXXX	/6(NA)	14	1100-47,000	F,J,K	50			See Table 1 of MIL-C-123			Molded Tubular	Axial	
M123A07BXXXXXXXXXX	/7	15	1100-180,000	F,J,K	50						Molded Tubular	Axial	
M123A08BXXXXXXXXXX	/8	16	2400-1,000,000	F,J,K	50, 100						Molded Tubular	Axial	
M123A10BXXXXXXXXXX	/10	51	1.0-4700	C,D,F,J,K	50						Unencapsulated Chip	Leadless	
M123A11BXXXXXXXXXX	/11(NA)	52	300-47,000	F,J,K	50						Unencapsulated Chip	Leadless	
M123A12BXXXXXXXXXX	/12(NA)	53	300-100,000	F,J,K	50						Unencapsulated Chip	Leadless	
M123A13BXXXXXXXXXX	/13(NA)	54	1100-470,000	F,J,K	50						Unencapsulated Chip	Leadless	
M123A16BXXXXXXXXXX	/16(NA)	22	1.0-100,000	D,F,J,K	50, 100, 200						Molded Rectangular	DIP	
M123A17BXXXXXXXXXX	/17(NA)	23	560-220,000	F,J,K	50, 100, 200						Molded Rectangular	DIP	
M123A18BXXXXXXXXXX	/18(NA)	24	120,000-470,000	K	50, 100						Molded Rectangular	DIP	

(1) See MIL-C-123 for capacitance values.  
(2) See MIL-C-123, Table IV. The available terminations are stated on the QPL.  
(3) Dissipation factor for BX and BR ≤ 2.5 percent and for BP ≤ 0.15 percent.  
(4) Failure Rate Level (FRL) not applicable. These parts may be used in Grade 1 and Grade 2 applications.

**MIL-C-123/1 STYLE CKS05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts.dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value(pf)	Tolerances Available		
100	4.7	C, D	BP	BPC4R7*C
	5.1			BPC3R1*C
	5.6			BPC5R6*C
	6.2			BPC6R2*C
	6.8			BPC6R8*C
	7.5			BPC7R5*C
	8.2			BPC8R2*C
	9.1			BPC9R1*C
	10			BPC100*C
	11	BPC110*C		
	12	BPC120*C		
	13	C, J, K		BPC130*C
	15			BPC150*C
	16			BPC160*C
	18			BPC180*C
	20			BPC200*C
	22			BPC220*C
	24	BPC240*C		
	27	F, J, K		BPC270*C
	30			BPC300*C
	33			BPC330*C
	36			BPC360*C
	39			BPC390*C
	43			BPC430*C
	47	BPC470*C		
	51	BPC510*C		
	56	BPC560*C		
62	BPC620*C			
68	BPC680*C			
75	BPC750*C			

\* Choice of allowable tolerances.

**MIL-C-123/1 STYLE CKS05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose**  
**High Reliability (Continued)**

Rated Voltage (Volts,dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value(pF)	Tolerances Available		
100	82	F, J, K	BP	M123A01
	91			BPC820*C
	100			BPC910*C
	110			BPC101*C
	120			BPC111*C
	130			BPC121*C
	150			BPC131*C
	160			BPC151*C
	180			BPC161*C
	200			BPC181*C
	220			BPC201*C
	240			BPC221*C
50	270	F, J, K	BP	BPC241*C
	300			BPB271*C
	330			BPB301*C
	360			BPB331*C
	390			BPB361*C
	430			BPB391*C
	470			BPB431*C
	510			BPB471*C
	560			BPB511*C
	620			BPB561*C
	680			BPB621*C
	750			BPB681*C
820	BPB751*C			
910	BPB821*C			
1,000	BPB911*C			
1,100	BPB102*C			
				BPB112*C

\* Choice of allowable tolerances.

**MIL-C-123/1, STYLE CKS05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose,**  
**High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	1,200	F, J, K	BP	M123A01
	1,300			BPB122*C
	1,500			BPB132*C
	1,600			BPB152*C
	1,800			BPB162*C
	2,000			BPB182*C
	2,200			BPB202*C
	2,400			BPB222*C
2,700	BPB242*C			
100	270	K	BX	BXC271KC
	330			BXC331KC
	390			BXC391KC
	470			BXC471KC
	560			BXC561KC
	680			BXC681KC
	820			BXC821KC
	1,000			BXC102KC
	1,200			BXC122KC
	1,500			BXC152KC
	1,800			BXC182KC
	2,200			BXC222KC
2,700	BXC272KC			
3,300	BXC332KC			
3,900	BXC392KC			
4,700	BXC472KC			
50	5,600	K	BX	BXB562KC
	6,800			BXB682KC
	8,200			BXB822KC
	10,000			BXB103KC

\* Choice of allowable tolerances.

**MIL-C-123/2 STYLE CKS06 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose,**  
**High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	270	F, J, K	BP	M123A02
	300			BPC271*C
	330			BPC301*C
	360			BPC331*C
	390	BPC361*C		BPC391*C
	430	BPC431*C		BPC471*C
	470	BPC511*C		BPC561*C
	510	BPC621*C		BPC681*C
	560	BPC751*C		BPC821*C
	620	BPC911*C		BPC102*C
	680	BPC112*C		BPC122*C
	750	BPC132*C		BPC152*C
	820	BPC162*C		BPC182*C
	910	BPC202*C		BPC222*C
1,000	BPC242*C	BPC272*C		
1,100	BPB272*C	BPB302*C		
1,200	BPB332*C	BPB362*C		
1,300	BPB392*C	BPB432*C		
1,500	BPB472*C			
1,600				
1,800				
2,000				
2,200				
2,400				
2,700				
3,000				
3,300				
3,600				
3,900				
4,300				
4,700				
50				

\* Choice of allowable tolerances.

**MIL-C-123/2, STYLE CKS06 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose,**  
**High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number (1)
	Nominal Value (pF)	Tolerances Available		
100	5,600	K	BX	BXC562KC
	6,800			BXC682KC
	8,200			BXC822KC
	10,000			BXC103KC
	12,000			BXC123KC
	15,000			BXC153KC
	18,000			BXC183KC
	22,000			BXC223KC
	27,000			BXC273KC
	33,000			BXC333KC
50	39,000	K	BX	BXC393KC
	47,000			BXC473KC
	56,000			BXC563KC
	68,000			BXC683KC
	82,000			BXC823KC
	100,000			BXC104KC
	56,000			BXB563KC
	68,000			BXB683KC
	82,000			BXB823KC
	100,000			BXB104KC
50	120,000	K	BX	BXB124KC
	150,000			BXB154KC
	180,000			BXB184KC
	220,000			BXB224KC
	270,000			BXB274KC
50	330,000	K	BX	BXB334KC
	390,000			BXB394KC
	470,000			BXB474KC

(1) The capacitance tolerance and termination designation shown in this table are the only options currently available.

**MIL-C-123/4, STYLE CKS11 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts. dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	4.7	C, D	BP	M123A04
	5.1			BPC4R7*W
	6.2			BPC5R1*W
	6.8			BPC6R2*W
	7.5	C, D		BPC6R8*W
	8.2			BPC7R5*W
	9.1			BPC8R2*W
	10	C, J, K		BPC9R1*W
	11			BPC100*W
	12			BPC110*W
	13			BPC120*W
	15			BPC130*W
	16			BPC150*W
	18			BPC160*W
	20			BPC180*W
	22			BPC200*W
	24			BPC220*W
	27	BPC240*W		
	30	BPC270*W		
	33	BPC300*W		
36	BPC330*W			
39	BPC360*W			
43	BPC390*W			
47	BPC430*W			
51	BPC470*W			
56	BPC510*W			
62	BPC560*W			
68	BPC620*W			
75	BPC680*W			
82	BPC750*W			
91	BPC820*W			
100	BPC910*W			
		BPC101*W		

\* Choice of allowable tolerances.

**MIL-C-123/4, STYLE CKSII CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	110	F, J, K	BP	M123A04
	120			BPB11*W
	130			BPB12*W
	150			BPB13*W
	160			BPB15*W
	180			BPB16*W
	200			BPB18*W
	220			BPB20*W
	240			BPB22*W
	270			BPB24*W
	300			BPB27*W
	330			BPB30*W
100	360	K	BX	BPB33*W
	390			BPB36*W
	430			BPB39*W
	470			BPB43*W
	510			BPB47*W
	560			BPB51*W
	100			BXC10*W
	120			BXC12*W
	150			BXC15*W
	180			BXC18*W
	220			BXC22*W
	270			BXC27*W
330	BXC33*W			
390	BXC39*W			
470	BXC47*W			
560	BXC56*W			
680	BXC68*W			
820	BXC82*W			
1,000	BXC102*W			

\* Choice of allowable tolerances.

**MIL-C-123/4, STYLE CKS11 CAPACITORS  
Fixed, Ceramic Dielectric, Temperature Stable,  
General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number (1)
	Nominal Value (pF)	Tolerances Available		
50	1,200	K	BX	M123A04
	1,500			BXB122KW
	1,800			BXB152KW
	2,200			BXB182KW
	2,700			BXB222KW
	3,300			BXB272KW
	3,900			BXB332KW
	4,700			BXB392KW
			BXB472KW	

(1) The capacitance tolerance and termination designation shown in this table are the only options currently available.

**MIL-C-123/5, STYLE CKS12 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	110	F, J, K	BP	BPC111*W
	120			BPC121*W
	130			BPC131*W
	150			BPC151*W
	160			BPC161*W
	180			BPC181*W
	200			BPC201*W
	220			BPC221*W
50	240	K	BX	BPB241*W
	270			BPB271*W
	300			BPB301*W
	330			BPB331*W
	360			BPB361*W
	390			BPB391*W
	430			BPB431*W
470	BPB471*W			
100	1,200	K	BX	BXC122KW
	1,500			BXC152KW
	1,800			BXC182KW
	2,200			BXC222KW
	2,700			BXC272KW
	3,300			BXC332KW
50	3,900	K	BX	BXC392KW
	4,700			BXC472KW
	5,600			BXB562KW
	6,800			BXB682KW
	8,200			BXB822KW
	10,000			BXB103KW

\* Choice of allowable tolerances.

**MIL-C-123/6, STYLE CKS14 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	240	F, J, K	BP	M123A06
	270			BPC241*W
	300			BPC271*W
	330			BPC301*W
	360			BPC331*W
	390			BPC361*W
	430			BPC391*W
	470			BPC431*W
	510			BPC471*W
	560			BPC511*W
	620			BPC561*W
	680			BPC621*W
	750			BPC681*W
	820			BPC751*W
910	BPC821*W			
1000	BPC911*W			
50	5,600	K	BX	BXC562KW
	6,800			BXC682KW
	8,200			BXC822KW
	10,000			BXC103KW
	1,100			BPB112*W
	1,200			BPB122*W
	1,300			BPB132*W
	1,500			BPB152*W
	1,600			BPB162*W
	1,800			BPB182*W
2,000	BPB202*W			
2,200	BPB222*W			

\* Choice of allowable tolerances.

**MIL-C-123/6, STYLE CKS14 CAPACITORS  
Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	2,400	F, J, K	BP	M123A06
	2,700			BPB242*W
	3,000			BPB272*W
	3,300			BPB302*W
	3,600	F, J, K		BPB332*W
	3,900			BPB362*W
	4,300			BPB392*W
	4,700			BPB432*W
	5,100	F, J, K		BPB472*W
	5,600			BPB512*W
	6,200			BPB562*W
	6,800			BPB622*W
			BPB682*W	

\* Choice of allowable tolerances.

**MIL-C-123/6, STYLE CKS14 CAPACITORS  
 Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number (1)
	Nominal Value (pF)	Tolerances Available		
50	12,000	K	BX	BXB123KW
	15,000			BXB153KW
	18,000			BXB183KW
	22,000			BXB223KW
	27,000			BXB273KW
	33,000			BXB333KW
	39,000			BXB393KW
	47,000			BXB473KW

(1) The capacitance tolerance and termination designations shown in this table are the only options currently available.

**MIL-C-123/7 STYLE CKS15 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	1,100	F, J, K	BP	M123A07
	1,200			BPC112*W
	1,300			BPC122*W
	1,500			BPC132*W
	1,600			BPC152*W
	1,800			BPC162*W
	2,000			BPC182*W
	2,200			BPC202*W
	2,400			BPC222*W
	2,700			BPB242*W
50	3,000	F, J, K	BP	BPB272*W
	3,300			BPB302*W
	3,600			BPB332*W
	3,900			BPB362*W
	4,300			BPB392*W
	4,700			BPB432*W
	5,100			BPB472*W
	5,600			BPB512*W
	6,200			BPB562*W
	6,800			BPB622*W
	7,500	F, J, K	BP	BPB682*W
	8,200			BPB752*W
	9,100			BPB822*W
	10,000			BPB912*W
	11,000			BPB103*W
	12,000			BPB113*W
	13,000			BPB123*W
	15,000			BPB133*W
	16,000			BPB153*W
	18,000			BPB163*W
20,000	BPB183*W			
22,000	BPB203*W			
				BPB223*W

\* Choice of allowable tolerances.

## MIL-STD-975L (NASA) - Part I

**MIL-C-123/7, STYLE CKS15 CAPACITORS  
Fixed, Ceramic Dielectric, Temperature Stable,  
General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number (1)
	Nominal Value (pF)	Tolerance Available		
100	12,000	K	BX	M123A07
	15,000			BXC123KW
	18,000			BXC153KW
	22,000			BXC183KW
	27,000	BXC223KW		
	33,000	BXC273KW		
	39,000	BXC333KW		
	47,000	BXC393KW		
	56,000	BXC473KW		
	68,000	BXC563KW		
50	82,000		BXC683KW	
	100,000		BXC823KW	
	120,000		BXC104KW	
	150,000		BXB124KW	
	180,000		BXB154KW	
			BXB184KW	

(1) The capacitance tolerance and termination designation shown in this table are the only options currently available.

**MIL-C-123/8, STYLE CKS16 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	2,400	F, J, K	BP	M123A08
	2,700			BPC242*W
	3,000			BPC272*W
	3,300			BPC302*W
	3,600			BPC332*W
	3,900			BPC362*W
	4,300			BPC392*W
	4,700			BPC432*W
	5,100			BPC472*W
	5,600			BPC512*W
50	6,200	F, J, K	BP	BPC562*W
	6,800			BPC622*W
	8,200			BPC682*W
	9,100			BPC822*W
	10,000			BPC912*W
	11,000			BPC103*W
	12,000			BPB113*W
	13,000			BPB123*W
	15,000			BPB133*W
	16,000			BPB153*W
20,000	22,000	F, J, K	BP	BPB163*W
				BPB183*W
				BPB203*W
				BPB223*W

\* Choice of allowable tolerances.

**MIL-C-123/8, STYLE CKS16 CAPACITORS  
Fixed, Ceramic Dielectric, Temperature Stable,  
General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number (1) M123A08
	Nominal Value (pF)	Tolerances Available		
100	120,000	K	BX	BXC124KW
	150,000			BXC154KW
	180,000			BXC184KW
	220,000			BXC224KW
	270,000			BXC274KW
	330,000			BXC334KW
	390,000			BXC394KW
	470,000			BXC474KW
50	560,000	K	BX	BXB564KW
	680,000			BXB684KW
	820,000			BXB824KW
	1,000,000			BXB105KW

(1) The capacitance tolerance and termination designation shown in this table are the only options currently available.

**MIL-C-123/10; STYLE CKS51 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number MI23A10
	Nominal Value (pF)	Tolerances Available		
50	1.0	C, D	BP	BPB1R0*#
	1.1			BPB1R1*#
	1.2			BPB1R2*#
	1.3			BPB1R3*#
	1.5			BPB1R5*#
	1.6			BPB1R6*#
	1.8			BPB1R8*#
	2.0			BPB2R0*#
	2.2			BPB2R2*#
	2.4			BPB2R4*#
	2.7			BPB2R7*#
	3.0			BPB3R0*#
	3.3			BPB3R3*#
	3.6			BPB3R6*#
	3.9			BPB3R9*#
	4.3			BPB4R3*#
	4.7			BPB4R7*#
	5.1			BPB5R1*#
5.6	BPB5R6*#			
6.2	BPB6R2*#			
6.8	BPB6R8*#			
7.5	BPB7R5*#			
8.2	BPB8R2*#			
9.1	BPB9R1*#			

# Choice of allowable terminations (M, G, S or W).  
 \* Choice of allowable tolerances.

**MIL-C-123/10, STYLE CKS51 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	10	C, J, K	BP	M123A10
	11			BPB100*#
	12			BPB110*#
	13			BPB120*#
	15			BPB130*#
	16			BPB150*#
	18			BPB160*#
	20			BPB180*#
	22			BPB200*#
	24			BPB220*#
	27			BPB240*#
	30			BPB270*#
	33			BPB300*#
	36			BPB330*#
39	BPB360*#			
43	BPB390*#	F, J, K		
47	BPB430*#			
51	BPB470*#			
	BPB510*#			

# Choice of allowable terminations (M, G, S or W).  
 \* Choice of allowable tolerances.

**MIL-C-123/10, STYLE CKS51 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage, Temperature Limits	Part Number
	Nominal Value (pF)	Tolerance Available		
50	56	F, J, K	BP	MI23A10
	62			BPB560*#
	68			BPB620*#
	75			BPB680*#
	82	BPB750*#		BPB820*#
	91	BPB910*#		BPB101*#
	100	BPB101*#		BPB111*#
	110	BPB111*#		BPB121*#
	120	BPB121*#		BPB131*#
	130	BPB131*#		BPB151*#
	150	BPB151*#		BPB161*#
	160	BPB161*#		BPB181*#
	180	BPB181*#		BPB201*#
	200	BPB201*#		BPB221*#
220	BPB221*#	BPB241*#		
240	BPB241*#	BPB271*#		
270	BPB271*#			

# Choice of allowable terminations (M, G, S or W).  
\* Choice of allowable tolerances.

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**MIL-C-123/10, STYLE CKS51 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number M123A10
	Nominal Value (pF)	Tolerance Available		
50	330	K	BX	BXB331K#
	390			BXB391K#
	470			BXB471K#
	560			BXB561K#
	680	BXB681K#		BXB152K#
	820	BXB821K#		BXB182K#
	1,000	BXB102K#		BXB222K#
	1,200	BXB122K#		BXB272K#
	1,500	BXB152K#		BXB332K#
	1,800	BXB182K#		BXB392K#
	2,200	BXB222K#		BXB472K#
	2,700	BXB272K#		
	3,300	BXB332K#		
	3,900	BXB392K#		
4,700	BXB472K#			

# Choice of allowable terminations (M, G, S or W).

**MIL-C-123/11; STYLE CKS52 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable,**  
**General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available			
50	300	F, J, K	BP	M123A11	
	330			BPB301*#	
	360			BPB331*#	
	390			BPB361*#	
	430			BPB391*#	
	470			BPB431*#	
	510			BPB471*#	
	560			BPB511*#	
	620			BPB561*#	
	680			BPB621*#	
	750		BPB681*#		
	820		BPB751*#		
	910		BPB821*#		
	1,000		BPB911*#		
	5,600		K	BX	BPB102*#
	6,800				BXB562K#
	8,200				BXB682K#
	10,000				BXB822K#
	12,000				BXB103K#
	15,000				BXB123K#
18,000	BXB153K#				
22,000	BXB183K#				
27,000	BXB223K#				
33,000	BXB273K#				
47,000	BXB333K#				
			BXB473K#		

\* Choice of allowable tolerances.  
# Choice of allowable terminations (M, G, S or W).

**MIL-C-123/12, STYLE CKS53 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	300	F, J, K	BP	BPB301*#
	330			BPB331*#
	360			BPB361*#
	390			BPB391*#
	430			BPB431*#
	470			BPB471*#
	510			BPB511*#
	560			BPB561*#
	620			BPB621*#
	680			BPB681*#
	750	BPB751*#		
	820	BPB821*#		
	910	BPB911*#		
	1,000	BPB102*#		
	5,600	K	BX	BXB562K#
	6,800			BXB682K#
	8,200			BXB822K#
	10,000			BXB103K#
	12,000			BXB123K#
	15,000			BXB153K#
18,000	BXB183K#			
22,000	BXB223K#			
27,000	BXB273K#			
33,000	BXB333K#			
47,000	BXB473K#			
56,000	BXB563K#			
68,000	BXB683K#			
82,000	BXB823K#			
100,000	BXB104K#			

\* Choice of allowable tolerances.  
 # Choice of allowable terminations (S or W).

**MIL-C-123/13, STYLE CKS54 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	1,100	F, J, K	BP	BPB112*#
	1,200			BPB122*#
	1,300			BPB132*#
	1,500			BPB152*#
	1,600			BPB162*#
	1,800			BPB182*#
	2,000			BPB202*#
	2,200			BPB222*#
	2,400			BPB242*#
	2,700			BPB272*#
	3,000			BPB302*#
	3,300			BPB332*#
	3,600			BPB362*#
	3,900			BPB392*#
	4,300			BPB432*#
	4,700			BPB472*#
	5,100			BPB512*#
	5,600			BPB562*#
	6,200			BPB622*#
	6,800			BPB682*#
7,500	BPB752*#			
8,200	BPB822*#			
9,100	BPB912*#			
10,000	BPB103*#			
120,000	K	BX	BXB124K#	
150,000			BXB154K#	
180,000			BXB184K#	
220,000			BXB224K#	
270,000			BXB274K#	
330,000			BXB334K#	
390,000			BXB394K#	
470,000			BXB474K#	

\* Choice of allowable tolerances.

# Choice of allowable terminations (S or W).

**MIL-C-123/16, STYLE CKS22 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
200	1.0	D	BP	BPD1R0DC
	1.2			BPD1R2DC
	1.5			BPD1R5DC
	1.8			BPD1R8DC
	2.2			BPD2R2DC
	2.7			BPD2R7DC
	3.3			BPD3R3DC
	3.9			BPD3R9DC
	4.7	BPD4R7DC		
	5.6	BPD5R6DC		
	6.8	BPD6R8DC		
	8.2	BPD8R2DC		
	10	D, J, K		BPD100*C
	12			BPD120*C
	15			BPD150*C
	18			BPD180*C
	22	F, J, K		BPD220*C
	27			BPD270*C
	33			BPD330*C
	39			BPD390*C
47		BPD470*C		
56		BPD560*C		
68		BPD680*C		
82		BPD820*C		
100		BPD101*C		
120		BPD121*C		
150		BPD151*C		
180		BPD181*C		
220		BPD221*C		
270		BPD271*C		

\* Choice of allowable tolerances.

**MIL-C-123/16, STYLE CKS22 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
200	330	F, J, K	BP	M123A16
	390			BPD331*C
	470			BPD391*C
100	560			BPD471*C
	680			BPC561*C
	820			BPC681*C
	1,000			BPC821*C
	1,200			BPC102*C
	1,500			BPC122*C
50	1,800			BPC152*C
	2,200			BPC182*C
	2,700			BPC222*C
	3,300			BPB272*C
	3,900			BPB332*C
	4,700			BPB392*C
200	270	K	BX	BPB472*C
	330			BXD271KC
	390			BXD331KC
	470			BXD391KC
	560			BXD471KC
	680			BXD561KC
100	820			BXD681KC
	1,000			BXD821KC
	1,200			BXC102KC
	1,500			BXC122KC
	1,800			BXC152KC
	2,200			BXC182KC
100	2,700			BXC222KC
	3,300			BXC272KC
	3,900			BXC332KC
	4,700			BXC392KC
	5,600			BXC472KC
	6,800			BXC562KC
	8,200	BXC682KC		
	10,000	BXC822KC		
		BXC103KC		

\* Choice of allowable tolerances.

**MIL-C-123/16, STYLE CKS22 CAPACITORS  
Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
50	12,000	K	BX	BXB123KC
	15,000			BXB153KC
	18,000			BXB183KC
	22,000			BXB223KC
	27,000			BXB273KC
	33,000			BXB333KC
	39,000			BXB393KC
	47,000			BXB473KC
	56,000			BXB563KC
	68,000			BXB683KC
	82,000			BXB823KC
	100,000			BXB104KC

**MIL-C-123/17, STYLE CKS23 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number		
	Nominal Value (pF)	Tolerances Available				
200	560	F, J, K	BP	BPD561*C		
	680			BPD681*C		
	820			BPD821*C		
	1,000			BPD102*C		
	1,200			BPD122*C		
100	2,700			BPC272*C		
	3,300			BPC332*C		
50	4,700					BPB472*C
	5,600					BPB562*C
	6,800					BPB682*C
	8,200	BPB822*C				
	10,000	BPB103*C				

\* Choice of allowable tolerances.

**MIL-C-123/17, STYLE CKS23 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
200	1,000	K	BX	M123A17
	1,200			BXD102KC
	1,500			BXD122KC
	1,800			BXD152KC
	2,200			BXD182KC
	2,700			BXD222KC
	3,300			BXD272KC
	3,900			BXD332KC
	4,700			BXD392KC
	5,600			BXD472KC
100	5,600	K	BX	BXD562KC
	6,800			BXD682KC
	8,200			BXD822KC
	10,000			BXD103KC
	12,000			BXC123KC
	15,000			BXC153KC
	18,000			BXC183KC
	22,000			BXC223KC
	27,000			BXC273KC
	33,000			BXC333KC
50	39,000	K	BX	BXC393KC
	47,000			BXC473KC
	56,000			BXC563KC
	68,000			BXC683KC
	82,000			BXC823KC
	100,000			BXC104KC
	120,000			BXB124KC
	150,000			BXB154KC
180,000	BXB184KC			
220,000	BXB224KC			

**MIL-C-123/18, STYLE CKS24 CAPACITORS**  
**Fixed, Ceramic Dielectric, Temperature Stable, General Purpose, High Reliability**

Rated Voltage (Volts, dc)	Capacitance		Voltage Temperature Limits	Part Number
	Nominal Value (pF)	Tolerances Available		
100	120,000	K	BR	MI23A18
	150,000			BRC124KC
50	180,000			BRB184KC
	220,000			BRB224KC
	270,000			BRB274KC
	330,000			BRB334KC
	390,000			BRB394KC
	470,000			BRB474KC

**MIL-C-23269, CAPACITORS**  
**Fixed, Glass Dielectric, Established Reliability**

Part number explanation: M23269	/XX	-XXXX
M23269 - Identifies CYR fixed, glass dielectric, established reliability capacitors conforming to MIL-C-23269.	/XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.	-XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated dc voltage, and failure rate level.

Part Number	Control Specification	Style (1)	Capacitance		Working Voltage (Vdc) at +125 °C	Maximum Dissipation Factor (%)	Temperature		Minimum Insulation Resistance (Gigohms) at +25° C	FRL Grade 1 and 2
			Range (pF)	Tolerance (±)			Range (°C)	Coefficient (ppm/°C)		
M23269/01-XXXX	MIL-C-23269/1	CYR10	0.5-300	0.25 pF 0.50 pF 1%, 2%, 5%	100	0.1	-55 to +125	140 ±25	100	S
M23269/02-XXXX	MIL-C-23269/2	CYR15	220-1,200	1%, 2%, 5%						
M23269/03-XXXX	MIL-C-23269/3	CYR20	560-5,100	1%, 2%, 5%						
M23269/04-XXXX	MIL-C-23269/4	CYR30	3,600-10,000							

(1) Lead material and coating are specified in the detailed specification sheet for each device type.

**MIL-C-23269/1, STYLE CYR10 CAPACITORS  
Fixed, Glass Dielectric, Established Reliability**

Capacitance		Part Number M23269/01- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±)	
12	0.25pF 5%	7033 7034
13	2% 5%	7035 7036
15	2% 5%	7037 7038
16	2% 5%	7039 7040
18	2% 5%	7041 7042
20	2% 5%	7043 7044
22	2% 5%	7045 7046
24	2% 5%	7047 7048
27	1% 2% 5%	7049 7050 7051
30	1% 2% 5%	7052 7053 7054
33	1% 2% 5%	7055 7056 7057
36	1% 2% 5%	7058 7059 7060
39	1% 2% 5%	7061 7062 7063

Capacitance		Part Number M23269/01- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±)	
0.5	0.25pF	7001
1.0	0.25pF	7002
1.5	0.25pF	7003
2.2	0.25pF 0.50pF	7004 7005
2.7	0.25pF	7006
3.0	0.25pF 0.50pF	7007 7008
3.3	0.25pF	7009
3.6	0.25pF 0.50pF	7010 7011
3.9	0.25pF	7012
4.3	0.25pF 0.50pF	7013 7014
4.7	0.25pF	7015
5.1	0.25pF	7016
5.6	0.25pF 5%	7017 7018
6.2	0.25pF 5%	7019 7020
6.8	0.25pF 5%	7021 7022
7.5	0.25pF 5%	7023 7024
8.2	0.25pF 5%	7025 7026
9.1	0.25pF 5%	7027 7028
10	0.25pF 5%	7029 7030
11	0.25pF 5%	7031 7032

**MIL-C-23269/1, STYLE CYR10 CAPACITORS  
 Fixed, Glass Dielectric, Established Reliability (Continued)**

Capacitance		Part Number M23269/01- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
120	1	7097
	2	7098
	5	7099
130	1	7100
	2	7101
	5	7102
150	1	7103
	2	7104
	5	7105
160	1	7106
	2	7107
	5	7108
180	1	7109
	2	7110
	5	7111
200	1	7112
	2	7113
	5	7114
220	1	7115
	2	7116
	5	7117
240	1	7118
	2	7119
	5	7120
270	1	7121
	2	7122
	5	7123
300	1	7124
	2	7125
	5	7126

Capacitance		Part Number M23269/01- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
43	1%	7064
	2	7065
	5	7066
47	1	7067
	2	7068
	5	7069
51	1	7070
	2	7071
	5	7072
56	1	7073
	2	7074
	5	7075
62	1	7076
	2	7077
	5	7078
68	1	7079
	2	7080
	5	7081
75	1	7082
	2	7083
	5	7084
82	1	7085
	2	7086
	5	7087
91	1	7088
	2	7089
	5	7090
100	1	7091
	2	7092
	5	7093
110	1	7094
	2	7095
	5	7096

**MIL-C-23269/2, STYLE CYR15 CAPACITORS  
Fixed, Glass Dielectric, Established Reliability**

Capacitance		Part Number M23269/02- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
560	1	7031
	2	7032
	5	7033
620	1	7034
	2	7035
	5	7036
680	1	7037
	2	7038
	5	7039
750	1	7040
	2	7041
	5	7042
820	1	7043
	2	7044
	5	7045
910	1	7046
	2	7047
	5	7048
1,000	1	7049
	2	7050
	5	7051
1,100	1	7052
	2	7053
	5	7054
1,200	1	7055
	2	7056
	5	7057

Capacitance		Part Number M23269/02- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
220	1	7001
	2	7002
	5	7003
240	1	7004
	2	7005
	5	7006
270	1	7007
	2	7008
	5	7009
300	1	7010
	2	7011
	5	7012
330	1	7013
	2	7014
	5	7015
360	1	7016
	2	7017
	5	7018
390	1	7019
	2	7020
	5	7021
430	1	7022
	2	7023
	5	7024
470	1	7025
	2	7026
	5	7027
510	1	7028
	2	7029
	5	7030

**MIL-C-23269/3, STYLE CYR20 CAPACITORS  
Fixed, Glass Dielectric, Established Reliability**

Capacitance		Part Number M23269/03- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
1,200	1	7025
	2	7026
	5	7027
1,300	1	7028
	2	7029
	5	7030
1,500	1	7031
	2	7032
	5	7033
1,600	1	7034
	2	7035
	5	7036
1,800	1	7037
	2	7038
	5	7039
2,000	1	7040
	2	7041
	5	7042
2,200	1	7043
	2	7044
	5	7045
2,400	1	7046
	2	7047
	5	7048

Capacitance		Part Number M23269/03- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
560	1	7001
	2	7002
	5	7003
620	1	7004
	2	7005
	5	7006
680	1	7007
	2	7008
	5	7009
750	1	7010
	2	7011
	5	7012
820	1	7013
	2	7014
	5	7015
910	1	7016
	2	7017
	5	7018
1,000	1	7019
	2	7020
	5	7021
1,100	1	7022
	2	7023
	5	7024

**MIL-C-23269/3, STYLE CYR20 CAPACITORS  
Fixed, Glass Dielectric, Established Reliability (Continued)**

Capacitance		Part Number M23269/03- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
2,700	1	7049
	2	7050
	5	7051
3,000	1	7052
	2	7053
	5	7054
3,300	1	7055
	2	7056
	5	7057
3,600	1	7058
	2	7059
	5	7060
3,900	1	7061
	2	7062
	5	7063
4,300	1	7064
	2	7065
	5	7066
4,700	1	7067
	2	7068
	5	7069
5,100	1	7070
	2	7071
	5	7072

**MIL-C-23269/4, STYLE CYR30 CAPACITORS  
Fixed, Glass Dielectric, Established Reliability**

Capacitance		Part Number M23269/04- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
6,200	1	7019
	2	7020
	5	7021
6,800	1	7022
	2	7023
	5	7024
7,500	1	7025
	2	7026
	5	7027
8,200	1	7028
	2	7029
	5	7030
9,100	1	7031
	2	7032
	5	7033
10,000	1	7034
	2	7035
	5	7036

Capacitance		Part Number M23269/04- Grades 1 and 2 FRL = S
Value (pF)	Tolerance (±%)	
3,600	1	7001
	2	7002
	5	7003
3,900	1	7004
	2	7005
	5	7006
4,300	1	7007
	2	7008
	5	7009
4,700	1	7010
	2	7011
	5	7012
5,100	1	7013
	2	7014
	5	7015
5,600	1	7016
	2	7017
	5	7018

## MIL-C-39003, CAPACITORS Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability

Part Number Explanation: M39003	/XX	-XXXX	
M39003 - Identifies fixed, tantalum, electrolytic (solid electrolyte), established reliability capacitors that are hermetically sealed in metal cases.	/XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family	-XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated voltage, maximum dc leakage and dissipation factor, and failure rate level.	

Part Number (1) (2)	Control Specification	Style	Capacitance		Rated Voltage (Vdc)	Operating Temperature Range (°C)	Case Type	Configuration			FRL	
			Range (µF)	Tolerance (±%)				Type	Lead Material	Grade 1	Grade 2	
M39003/10-XXXX* (3)	MIL-C-39003/10 Polarized	CSS13	0.12 - 220.0	10	10, 15, 20, 35, 50, 75			Tin-lead coated nickel; Solder coated nickel		C	B	
M39003/01-XXXX (4)	MIL-C-39003/1 Polarized	CSR13	0.0047 - 4.7	10, 20	50	-55 to +125	Tubular	Tin-lead coated nickel; Solder coated nickel		C (5)	B	
M39003/02-XXXX (4)	MIL-C-39003/2 Polarized	CSR09	0.047 - 15.0	10	10, 20, 35, 50, 75			Nickel-iron alloy		C (5)	B	
M39003/10-XXXX* (3)	MIL-C-39003/10 Polarized	CSS33	1.2 - 560.0	10	10, 20, 35, 50			Tin-lead coated nickel; Solder coated nickel		C	B	

- (1) MIL-C-39003 capacitors shall not be used in power supply filters. Reference MIL-HDBK-978, Vol. 1, 2.6.7.2.
- (2) Parts covered by this specification contain internal soldered connections which may reflow during installation. The A, A1, B, B1 case sizes are particularly susceptible and special precautions such as heat sinking are recommended when soldering onto boards.
- (3) The symbol \* completes the dash number thus: \* = S for Sleeved, U for Unsleeved.
- (4) CSR09 and CSR13 capacitors are sleeved (insulated case).
- (5) All CSR13 and CSR09 capacitors must be subjected to the surge current test as specified by Appendix B. Reference MIL-HDBK-978, Vol. 1, para. 2.6.7.2 and 2.6.7.3.

**MIL-C-39003/10, STYLE CSS13 CAPACITORS  
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)		Maximum Dissipation Factor (%)		Case Size (1)	Part Number M39003/10- (2)	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	-55° C & +25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
10	3.9	10	0.3	6.0	4	4	A	3009*	
	4.7	10	0.4	7.0	4	4	A	3010*	
	27.0	10	2.0	40.0	6	6	B	3011*	
	33.0	10	2.5	50.0	6	6	B	3012*	
	39.0	10	2.5	50.0	6	6	B	3013*	
	82.0	10	4.0	80.0	8	8	C	3014*	
	100.0	10	5.0	100.0	8	8	C	3015*	
	120.0	10	6.0	120.0	8	8	C	3016*	
	180.0	10	9.0	180.0	8	8	D	3017*	
	220.0	10	10.0	200.0	8	8	D	3018*	
15	2.7	10	0.3	6.0	4	4	A	3019*	
	3.3	10	0.4	8.0	4	4	A	3020*	
	18.0	10	2.0	35.0	6	6	B	3021*	
	22.0	10	2.0	40.0	6	6	B	3022*	
	56.0	10	4.0	80.0	6	6	C	3023*	
	68.0	10	5.0	100.0	6	6	C	3024*	
	120.0	10	9.0	180.0	8	8	D	3025*	
	150.0	10	10.0	220.0	8	8	D	3026*	

- (1) Case sizes are defined in MIL-C-39003/10.  
(2) The symbol \* completes the dash number thus: \* = S for sleeved, U for unsleeved.

MIL-C-39003/10, STYLE CSS13 CAPACITORS  
 Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)		Case Size (1)	Part Number M39003/10- (2)	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C & +25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
20	1.2		0.3	6.0	7.5	4	4	A	3027*	
	1.5		0.3	6.0	7.5	4	4	A	3028*	
	1.8		0.3	6.0	7.5	4	4	A	3029*	
	2.2		0.4	8.0	10.0	4	4	A	3030*	
	8.2		1.0	20.0	25.0	6	6	B	3031*	
	10.0		1.5	30.0	38.0	6	6	B	3032*	
	12.0		1.8	35.0	44.0	6	6	B	3033*	
	15.0		2.0	40.0	50.0	6	6	B	3034*	
	27.0		2.5	50.0	63.0	6	6	C	3035*	
	33.0		3.5	70.0	88.0	6	6	C	3036*	
35	39.0		4.0	80.0	100.0	6	6	C	3037*	
	47.0		4.5	90.0	113.0	6	6	C	3038*	
	56.0		5.5	110.0	138.0	6	6	D		2039*
	68.0		7.0	140.0	175.0	6	6	D		2040*
	82.0		8.0	160.0	200.0	6	6	D		2041*
	100.0		10.0	200.0	250.0	8	8	D		2042*
	5.6		1.3	25.0	32.0	4	4	A		2043*
	6.8		1.5	30.0	38.0	6	6	B		2044*
	22.0		4.0	40.0	100.0	6	6	C		2045*
	27.0		4.5	90.0	113.0	6	6	D		2046*
50	33.0		5.5	110.0	138.0	6	6	D		2047*
	39.0		7.0	140.0	175.0	6	6	D		2048*
	47.0		8.0	160.0	200.0	6	6	D		2049*
	0.12		0.3	5.0	6.3	2	4	A	3067*	
	0.15		0.3	5.0	6.3	2	4	A	3068*	
	0.18		0.3	5.0	6.3	2	4	A	3069*	
	0.22		0.3	5.0	6.3	2	4	A	3070*	
	0.27		0.3	5.0	6.3	2	4	A	3071*	
	0.33		0.3	5.0	6.3	2	4	A	3072*	
	0.39		0.3	5.0	6.3	2	4	A	3073*	
50	0.47		0.3	5.0	6.3	2	4	A	3074*	
	0.56		0.3	5.0	6.3	2	4	A	3075*	
	0.68		0.3	5.0	6.3	2	4	A	3076*	
	0.82		0.3	5.0	6.3	2	4	A	3077*	
	1.0		0.4	8.0	10.0	2	4	A	3078*	
	1.2		0.4	9.0	11.0	4	4	B	3079*	
	1.5		0.6	12.0	15.0	4	4	B	3080*	
	1.8		0.7	14.0	18.0	4	4	B	3081*	
	2.2		0.8	17.0	22.0	4	4	B	3082*	
	2.7		1.0	20.0	25.0	4	4	B	3083*	
3.3		1.2	25.0	32.0	4	4	B	3084*		

(1) Case sizes are defined in MIL-C-39003/10.  
 (2) The symbol \* completes the dash number thus: \* = S for sleeved, U for unsleeved.

**MIL-C-39003/10, STYLE CSS13 CAPACITORS**  
**Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)		Case Size (1)	Part Number M39003/10- (2)		
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C & +25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B	
50	3.9		1.5	30.0	38.0	4	4	B	3085*	2086*	
	4.7		1.7	35.0	44.0	4	4	B	3087*		
	5.6		2.2	45.0	56.0	4	4	C	3088*		
	6.8		2.2	45.0	56.0	6	6	C	3088*		
	8.2		2.5	50.0	63.0	6	6	C	3089*		
	10.0		2.5	50.0	63.0	6	6	C	3090*	2090*	
	12.0		3.0	60.0	75.0	6	6	C		2091*	
	15.0		4.0	80.0	100.0	6	6	C		2092*	
	18.0		4.5	90.0	113.0	6	6	C		2093*	
	22.0		5.5	110.0	138.0	6	6	D		2094*	
	75	0.15		0.3	5.0	6.3	2	4	A	3097*	
		0.18		0.3	5.0	6.3	2	4	A	3098*	
0.22			0.3	5.0	6.3	2	4	A	3099*		
0.27			0.3	5.0	6.3	2	4	A	3100*		
0.33			0.3	5.0	6.3	2	4	A	3101*		
0.39			0.3	5.0	6.3	2	4	A	3102*		
0.47			0.3	5.0	6.3	2	4	A	3103*		
0.56			0.3	5.0	6.3	2	4	A	3104*		
0.68			0.3	5.0	6.3	2	4	A	3105*		
0.82			0.3	5.0	6.3	2	4	B	3106*		
1.0			0.4	5.0	6.3	2	4	B	3107*		
1.2			0.4	5.0	6.3	4	4	B	3108*		
1.5			0.6	10.0	13.0	4	4	B	3109*		
1.8			0.7	10.0	13.0	4	4	B	3110*		
2.2			0.8	15.0	19.0	4	4	B	3111*		
2.7			1.0	15.0	19.0	4	4	B		2112*	
3.3			1.2	20.0	25.0	4	4	B		2113*	
3.9			1.5	20.0	25.0	4	4	B		2114*	
4.7		3.0	60.0	75.0	4	4	C		2115*		
5.6		3.0	60.0	75.0	4	4	C		2116*		
6.8		5.0	100.0	125.0	6	6	C		2117*		
8.2		5.0	100.0	125.0	6	6	C		2118*		
10.0		5.0	100.0	125.0	6	6	C		2119*		
12.0		5.0	100.0	125.0	6	6	D		2120*		
15.0		7.0	140.0	175.0	6	6	D		2121*		

(1) Case sizes are defined in MIL-C-39003/10.

(2) The symbol \* completes the dash number thus: \* = S for sleeved, U for unsleeved.

**MIL-C-39003/1, STYLE CSR13 CAPACITORS  
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum, Leakage (µA)			Maximum Dissipation Factor (%)		Case Size (1)	Part Number M39003/01-	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C & +25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
50	0.0047	10	0.3	5.0	6.3	2	4	A	7124	6124
	0.0047	20							7125	6125
	0.0056	10							7127	6127
	0.0068	10							7129	6129
	0.0068	20							7130	6130
	0.0082	10							7132	6132
	0.01	10							7134	6134
	0.01	20							7135	6135
	0.012	10							7137	6137
	0.015	10							7139	6139
	0.015	20							7140	6140
	0.018	10							7142	6132
	0.022	10							7144	6144
	0.022	20							7145	6145
	0.027	10							7147	6147
	0.033	10							7149	6149
0.033	20	7150	6150							
0.039	10	7152	6152							
0.047	10	7154	6154							
0.047	20	7155	6155							
0.056	10	7157	6157							
0.068	10	7159	6159							
0.068	20	7160	6160							
0.082	10	7162	6162							

(1) Case sizes are defined in MIL-C-39003/1.

MIL-C-39003/1, STYLE CSR13 CAPACITORS  
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum, Leakage (µA)			Maximum Dissipation Factor (%)		Case Size (1)	Part Number M39003/01-	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C & +25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
50	0.1	10							7164	6164
	0.1	20							7165	6165
	0.12	10							7167	6167
	0.15	10							7169	6169
	0.15	20							7170	6170
	0.18	10							7172	6172
	0.22	10	0.3	5.0	6.3	2		A	7174	6174
	0.22	20							7175	6175
	0.27	10							7177	6177
	0.33	10							7179	6179
	0.33	20							7180	6180
	0.39	10							7182	6182
	0.47	10							7184	6184
	0.47	20							7185	6185
	1.2	10	0.4	9.0	11.0			B	7197	6197
	1.5	10	0.6	12.0	15.0				7199	6199
	1.5	20	0.6	12.0	15.0				7200	6200
	1.8	10	0.7	14.0	18.0				7202	6202
	2.2	10	0.8	17.0	22.0				7204	6204
	2.2	20	0.8	17.0	22.0	4			7205	6205
2.7	10	1.0	20.0	25.0				7207	6207	
3.3	10	1.2	25.0	32.0				7209	6209	
3.3	20	1.2	25.0	32.0				7210	6210	
3.9	10	1.5	30.0	38.0				7212	6212	
4.7	10	1.7	35.0	44.0				7214	6214	
4.7	20	1.7	35.0	44.0				7215	6215	

(1) Case sizes are defined in MIL-C-39003/1.

**MIL-C-39003/2, STYLE CSR09 CAPACITORS**  
**Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)			Case Size (1)	Part Number M39003/02-	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C	+25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
10	1.8		0.6	6.0	8.0	8	6		3006	2006	
	2.2		0.6	6.0	8.0				3008	2008	
	10.0		2.5	20.0	34.0				3010	2010	
	12.0		2.5	24.0	40.8				3012	2012	
	15.0		2.5	30.0	51.0				3014	2014	
20	0.56		0.6	6.0	8.0				3024	2024	
	0.68		0.6	6.0	8.0				3026	2026	
	0.82		0.6	6.0	8.0				3028	2028	
	1.00		0.6	6.0	8.0				3030	2030	
	3.3		1.0	13.2	22.4				3032	2032	
35	3.9	10	2.0	15.6	26.5	4	3	4	3034	2034	
	4.7		2.0	18.8	32.0				3036	2036	
	5.6		2.0	22.4	38.1				3038	2038	
	6.8		2.0	27.2	46.2				3040	2040	
	0.33		0.6	6.0	8.0				3042	2042	
50	0.39		0.6	6.0	8.0				3044	2044	
	0.47		0.6	6.0	8.0				3046	2046	
	2.2		1.4	15.4	26.2				3048	2048	
	2.7		1.4	18.9	32.1				3050	2050	
	0.22		0.6	6.0	8.0				3052	2052	
	0.27		0.6	6.0	8.0				3054	2054	
	1.5		1.4	15.0	25.5				3056	2056	
	1.8		1.4	18.0	30.6				3058	2058	

(1) Case sizes are defined in MIL-C-39003/2.

**MIL-C-39003/2, STYLE CSR09 CAPACITORS  
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)			Case Size (1)	Part Number M39003/02-	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C	-55° C	+25° C	+85° C & +125° C		Grade 1 FRL = C	Grade 2 FRL = B
75	0.047	10	0.6	6.0	8.0	4	3	4	A1	3060	2060
	0.056								A1	3062	2062
	0.068								A1	3064	2064
	0.082								A1	3066	2066
	0.10								A1	3068	2068
	0.12								A1	3070	2070
	0.15								A1	3072	2072
	0.18								A1	3074	2074
	0.22								B1	3076	2076
	0.27								B1	3078	2078
	0.33								B1	3080	2080
	0.39								B1	3082	2082
	0.47								B1	3084	2084
	0.56								B1	3086	2086
0.68	B1	3088	2088								
0.82	B1	3090	2090								
1.0	B1	3092	2092								
1.2	B1	3094	2094								

(1) Case sizes are defined in MIL-C-39003/2.

**MIL-C-39003/10, STYLE CSS33 CAPACITORS  
 Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)	Case Size (1)	Part Number M39003/10- (2)	
	Nominal Value (µF)	Tolerance (±%)	+25° C	+85° C	+125° C			Grade 1 FRL = C	Grade 2 FRL = B
10	6.8	10	0.5	2.0	2.0	6	A	3509*	—
	8.2		0.5	2.0	2.0	6	A	3510*	—
	47.0	1.0	2.0	2.0	6	B	3511*	—	
	56.0	1.0	4.0	4.0	6	B	3512*	—	
	68.0	1.0	4.0	4.0	6	B	3513*	—	
	82.0	1.0	4.0	4.0	6	B	3514*	—	
	220.0	1.0	7.0	7.0	8	C	—	2515*	
	270.0	2.0	10.0	10.0	8	C	—	2516*	
	390.0	2.0	16.0	16.0	10	D	3517*	—	
	470.0	4.0	16.0	16.0	10	D	3518*	—	
20	560.0	10	4.0	16.0	16.0	10	D	3519*	—
	2.7	0.5	2.0	2.0	4	A	3529*	—	
	3.3	0.5	2.0	2.0	4	A	3530*	—	
	3.9	0.5	2.0	2.0	4	A	3531*	—	
	18.0	1.0	2.0	2.0	6	B	3532*	—	
	22.0	1.0	2.0	2.0	6	B	—	2533*	
	27.0	1.0	2.0	2.0	6	B	—	2534*	
	56.0	1.0	10.0	10.0	6	C	3535*	—	
	68.0	1.0	10.0	10.0	6	C	3536*	—	
	82.0	1.0	10.0	10.0	6	C	—	2537*	
100.0	1.0	10.0	10.0	6	C	—	2538*		
120.0	1.0	10.0	10.0	6	C	—	2539*		
150.0	2.0	10.0	10.0	8	D	—	2540*		
180.0	2.0	10.0	10.0	8	D	—	2541*		

(1) Case sizes are defined in MIL-C-39003/10.  
 (2) The symbol \* completes the dash number thus: \* = S for sleeved, U for unsleeved.

**MIL-C-39003/10, STYLE CSS33 CAPACITORS  
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum, Leakage (μA)			Maximum Dissipation Factor (%)	Case Size (1)	Part Number M39003/10- (2)		
	Nominal Value (μF)	Tolerance (±%)	+25° C	+85° C	+125° C			Grade 1 FRL = C	Grade 2 FRL = B	
35	1.8	10	0.5	2.0	2.0	4	A	—	2542*	
	8.2		1.0	2.0	2.0	6	B		2543*	
	10.0		1.0	2.0	2.0	6	B		2544*	
	33.0		1.0	5.0	5.0	6	C		2545*	
	39.0		1.0	5.0	5.0	6	C		2546*	
	47.0		1.0	5.0	5.0	6	C		2547*	
	56.0		2.0	10.0	10.0	6	D		2548*	
	68.0		2.0	10.0	10.0	6	D		2549*	
	1.2		0.5	2.0	2.0	2.0	4		A	2550*
	1.5		0.5	2.0	2.0	2.0	4		A	2551*
50	5.6	1.0	2.0	2.0	2.0	4	B	2552*		
	6.8	1.0	2.0	2.0	6	B	2553*			
	22.0	1.0	5.0	5.0	6	C	2554*			
	27.0	1.0	5.0	5.0	6	C	2555*			
	33.0	1.0	9.0	9.0	6	D	2556*			
	39.0	1.0	9.0	9.0	6	D	2557*			

(1) Case sizes are defined in MIL-C-39003/10.  
(2) The symbol \* completes the dash number thus: \* = S for sleeved, U for unsleeved.

# MIL-C-39006, CAPACITORS

## Fixed, Tantalum (Nonsolid) Electrolytic, Hermetically Sealed, Established Reliability

Part Number Explanation: M39006	/XX	-XXXXH
M39006 - Identifies CLR tantalum, electrolytic (nonsolid electrolyte), fixed capacitors (polarized and nonpolarized), hermetically sealed in metal cases with insulating sleeves, and conforming to MIL-C-39006.	/XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.	-XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated dc voltage, dc leakage, and failure rate level. The 'H' denotes a construction suitable for use in high vibration environments.

Part Number	Control Specification	Style (1)	Capacitance		Working Voltage (Vdc) @ +85°C	Operating Temperature Range (°C)	FRL	
			Range (µF)	Tolerance (±%)			Grade 1	Grade 2
M39006/01-XXXXXH	MIL-C-39006/1 Polarized/Etched Foil	CLR25	8 to 580 3 to 150 1 to 70	+75, -15 +50, -15 +30, -15	15, 25 or 30 50 or 75 100 or 150			
M39006/02-XXXXXH	MIL-C-39006/2 Nonpolarized/Etched Foil	CLR27	4.5 to 350 1.5 to 80 0.5 to 35	+75, -15 +50, -15 +30, -15	15, 25 or 30 50 or 75 100 or 150			
M39006/03-XXXXXH	MIL-C-39006/3 Polarized/Plain Foil	CLR35	4.5 to 160 3 to 100 2.5 to 85 68 1.5 to 55 1 to 40 0.8 to 30 0.5 to 20 0.35 to 15 0.27 to 10	±20 ±20 ±20 ±20 ±20 ±20 ±20 ±20 ±15 ±15	15 25 30 35 50 75 100 150 200 300	-55 to +125	R	P

(1) CLR25, CLR27, and CLR35 are susceptible to vibration failures. Consult the project parts engineer for recommendations.

**MIL-C-39006, CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, Hermetically Sealed,**  
**Established Reliability (Continued)**

Part Number	Control Specification	Style (1)	Capacitance		Working Voltage (Vdc) @ +85°C	Operating Temperature Range (°C)	FRL	
			Range (µF)	Tolerance (±%)			Grade 1	Grade 2
M39006/04-XXXXXH	MIL-C-39006/4 Nonpolarized/Plain Foil	CLR37	2.5 to 100	20	15	-55 to +125	R	P
			1.5 to 60	20	25			
			1.4 to 45	20	30			
			0.8 to 30	20	50			
			0.5 to 20	20	75			
			0.4 to 15	20	100			
			0.25 to 10	20	150			
M39006/22-XXXXXH	MIL-C-39006/22 Polarized/Sintered Slug	CLR79	0.15 to 7.5	15	200	-55 to +125	R	P
			0.15 to 6	15	250			
			0.12 to 4.7	15	300			
			20 to 750	5, 10, 20	10			
			15 to 540	5, 10, 20	15			
			8 to 300	5, 10, 20	30			
			5 to 160	5, 10, 20	50			
M39006/25-XXXXXH	MIL-C-39006/25 Polarized/Sintered Slug Extended Range	CLR81	3.5 to 110	5, 10, 20	75	-55 to +125	R	P
			2.5 to 86	5, 10, 20	100			
			1.7 to 56	5, 10, 20	125			
			150 to 1500	10, 20	10			
			100 to 1000	10, 20	15			
			68 to 680	10, 20	25			
			56 to 560	10, 20	30			
33 to 330	10, 20	50						
27 to 270	10, 20	60						
22 to 220	10, 20	75						
10 to 120	10, 20	100						
6.8 to 82	10, 20	125						

(1) CLR37 style is susceptible to vibration failures. CLR79 and CLR81 can be a source of transient potentials (intermittent shorts) during vibrational stimuli. Consult the project parts engineer for recommendations.

**MIL-C-39006/1, STYLE CLR25 CAPACITORS  
Fixed, Tantalum (Non-solid) Electrolytic, Polarized, Etched Foil, Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/01-	
	Nominal Value (µF)	Tolerance (%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
15	15		2	4			220	G1	3321H	3314H
	60		2	10			55	G2	3088H	3059H
	200		3	40	10	17.2	17	G3	3089H	3060H
	400		6	80			9	G4	3090H	3061H
	580		9	100			6	G5	3091H	3062H
25	10		2	4			330	G1	3322H	3315H
	40		2	13			83	G2	3092H	3063H
	120	+75, -15	3	40	15	28.8	27	G3	3093H	3064H
	250		6	80			.13	G4	3094H	3065H
	350		10	100			10	G5	3095H	3066H
30	8		2	6			424	G1	3323H	3316H
	32		2	14			106	G2	3096H	3067H
	110		4	50	20	34.5	31	G3	3097H	3068H
	220		8	90			16	G4	3098H	3069H
	300		11	120			11	G5	3099H	3070H
50	4.5		2	4			730	G1	3324H	3317H
	18		2	13			180	G2	3100H	3071H
	60	+50, -15	3	40	30	57.5	55	G3	3101H	3072H
	75		4	70			52	G3	3204H	3203H
	100		4	75			33	G4	3103H	3074H
75	150		5	100			22	G5	3104H	3075H
	3		2	4			1000	G1	3325H	3318H
	12		2	13			270	G2	3105H	3076H
	30	+50, -15	3	34	50	86.2	110	G3	3106H	3077H
	70		6	80			47	G4	3107H	3078H
100	100		10	100			33	G5	3108H	3079H
	2		2	4			1600	G1	3326H	3319H
	8		2	12			410	G2	3109H	3080H
	25	+30, -15	2.5	37	65	115	130	G3	3110H	3081H
	50		5	75			66	G4	3111H	3082H
150	70		7	100			47	G5	3112H	3083H
	1		2	4			3000	G1	3327H	3320H
	4		2	13			750	G2	3113H	3084H
	13	+30, -15	3	30	100	172	250	G3	3114H	3085H
	25		5	80			130	G4	3115H	3086H
	36		8	100			94	G5	3116H	3087H

(1) Case sizes are defined in MIL-C-39006/1.

**MIL-C-39006/2, STYLE CLR27 CAPACITORS  
Fixed, Tantalum (Nonsolid) Electrolytic, Non-polarized, Etched Foil, Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/02-	
	Nominal Value (µF)	Tolerance (%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
15	10		2	4			339	G1	2521H	2514H
	40		2	10			85	G2	1284H	1256H
	120		3	40	10	17.2	27	G3	1285H	1257H
	250		6	80			14	G4	1286H	1258H
	350		9	100			10	G5	1287H	1259H
25	5		2	4			680	G1	2522H	2515H
	20		2	13			170	G2	1288H	1260H
	70	+75, -15	3	40	15	28.8	49	G3	1289H	1261H
	140		6	80			24	G4	1290H	1262H
	200		10	100			17	G5	1291H	1263H
30	4.5		2	6			754	G1	2523H	2516H
	18		2	14			188	G2	1292H	1264H
	60		4	50	20	34.5	57	G3	1293H	1265H
	120		8	90			28	G4	1294H	1266H
	170		11	120			20	G5	1295H	1267H
50	2.5		2	4			1355	G1	2524H	2517H
	10		2	13			339	G2	1296H	1268H
	30		3	40	30	57.5	113	G3	1297H	1269H
	60		4	75			57	G4	1298H	1270H
	80	+50, -15	5	100			41	G5	1299H	1271H
75	1.5		2	4			2255	G1	2525H	2518H
	6		2	13			560	G2	1300H	1272H
	15		3	34	50	86.2	226	G3	1301H	1273H
	35		5	80			97	G4	1302H	1274H
	50		10	100			68	G5	1303H	1275H
100	1		2	4			3385	G1	2526H	2519H
	4		2	13			845	G2	1304H	1276H
	12		3	37	65	115	283	G3	1305H	1277H
	25		5	75			135	G4	1306H	1278H
	35	+30, -15	7	100			97	G5	1307H	1279H
150	0.5		2	4			6780	G1	2527H	2520H
	2		2	13			1693	G2	1308H	1280H
	6		3	30	100	172	565	G3	1309H	1281H
	12		5	80			283	G4	1310H	1282H
	18		8	100			188	G5	1311H	1283H

(1) Case sizes are defined in MIL-C-39006/2.

**MIL-C-39006/3, STYLE CLR35 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil, Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/03-	
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
15	4.5	20	1	2	10	17.2	495	G1	2736H	2724H
	18		2	4					1447H	1398H
	55		2	10					1448H	1399H
	110		4	20					1449H	1400H
	160		5	30					1450H	1401H
25	3	20	1	2	15	28.8	744	G1	2737H	2725H
	12		2	4					1451H	1402H
	35		2	10					1452H	1403H
	70		4	20					1453H	1404H
	100		6	30					1454H	1405H
30	2.5	20	2	5	20	34.5	893	G1	2738H	2726H
	10		2	6					1455H	1406H
	30		2	13					1456H	1407H
	60		4	26					1457H	1408H
	85		6	38					1458H	1409H
35	68	20	5	25	25	40.2	40	G5	1459H	1410H
	1.5		1	4					2739H	2727H
50	6	20	2	6	30	57.5	1487	G1	1460H	1411H
	20		2	13					1461H	1412H
	40		4	26					1462H	1413H
	55		6	38					1463H	1414H
	1		1	4					2740H	2728H
75	4	20	2	6	50	86.2	2232	G1	1464H	1415H
	14		2	13					1465H	1416H
	28		4	26					1466H	1417H
	40		6	38					1467H	1418H
	1		1	4					2740H	2728H

(1) Case sizes are defined in MIL-C-39006/3.

**MIL-C-39006/3, STYLE CLR35 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil,**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/03-	
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
100	0.8	20	1	3.5	65	115	2790	G1	2741H	2729H
	3		2	6					1468H	1419H
	10		2	13					1469H	1420H
	20		3	25					1470H	1421H
	30		6	38					1471H	1422H
150	0.5	20	2	4	100	172	4454	G1	2742H	2730H
	2		2	6					1472H	1423H
	7		3	13					1473H	1424H
	14		4	26					1474H	1425H
	20		6	38					1475H	1426H
200	0.35	15	4	25	150	230	5577	G1	2743H	2731H
	1.5		8	32					1476H	1427H
	5		16	64					1477H	1428H
	10		28	100					1478H	1429H
	15		40	160					1479H	1430H
300	0.27	15	6	40	200	345	9000	G1	2745H	2733H
	1		10	50					1484H	1435H
	3		20	100					1485H	1436H
	7		35	175					1486H	1437H
	10		50	250					1487H	1438H

(1) Case sizes are defined in MIL-C-39006/3.

**MIL-C-39006/4, STYLE CLR37 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, Non-polarized, Plain Foil,**  
**Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/04-	
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
15	2.5		1	2			893	G1	2733H	2722H
	10		2	4			223	G2	1335H	1290H
	35		2	10	10	17.2	64	G3	1336H	1291H
	70		4	20			32	G4	1337H	1292H
	100		5	30			23	G5	1338H	1293H
25	1.5		1	3			1487	G1	2734H	2723H
	6		2	6			372	G2	1339H	1294H
	20		2	10	15	28.8	112	G3	1340H	1295H
	40		4	20			56	G4	1341H	1296H
	60		5	30			37	G5	1342H	1297H
30	1.4	20	2	5			1594	G1	2735H	2724H
	5.5		2	6			406	G2	1343H	1298H
	18		2	12	20	34.5	124	G3	1344H	1299H
	36		4	26			62	G4	1345H	1300H
	45		6	36			50	G5	1346H	1301H
50	0.8		1	4			2790	G1	2736H	2725H
	3		2	6			743	G2	1347H	1302H
	10		2	12	30	57.5	223	G3	1348H	1303H
	20		4	24			112	G4	1349H	1304H
	30		6	36			75	G5	1350H	1305H
75	0.5		1	4			4460	G1	2737H	2726H
	2		2	6			1115	G2	1351H	1306H
	7		2	13	50	86.2	319	G3	1352H	1307H
	14		4	24			159	G4	1353H	1308H
	20		6	36			112	G5	1354H	1309H

(1) Case sizes are defined in MIL-C-39006/4.

**MIL-C-39006/4, STYLE CLR37 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, Non-polarized, Plain Foil,**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Case Size (1)	Part Number M39006/04-	
	Nominal Value (μF)	Tolerance (±%)	+25°C	+85°C & +125°C					Grade 1 FRL = R	Grade 2 FRL = P
100	0.4		1	3.5		115	5580	G1	2738H	2727H
	1.5		2	6					1355H	1310H
	5		2	13					1356H	1311H
	10		4	24					1357H	1312H
	15		6	36					1358H	1313H
150	0.25	20	1	4		172	8909	G1	2739H	2728H
	1		2	6					1359H	1314H
	1.2		3	12					1360H	1315H
	3.5		3	13					1361H	1316H
	7		4	24					1362H	1317H
	10		6	36					1363H	1318H
200	0.15	15	4	25		230	14000	G1	2740H	2729H
	0.75		8	32					1364H	1319H
	2.5		16	64					1365H	1320H
	5		28	112					1366H	1321H
	7.5		40	160					1367H	1322H
			6	32						2741H
250	0.15	15	6	32		287	13000	G1	2741H	2730H
	0.6		8	40					1368H	1323H
	2		16	80					1369H	1324H
	4		28	140					1370H	1325H
	6		40	200					1371H	1326H
			4	25						2742H
300	0.12	15	4	25		345	17500	G1	2742H	2731H
	0.47		10	50					1372H	1327H
	1.5		20	100					1373H	1328H
	3.3		35	175					1374H	1329H
	4.7		50	250					1375H	1330H
			4	25						2742H

(1) Case sizes are defined in MIL-C-39006/4.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug), Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (I)	Part Number M39006/22-		
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C C (+%)		Grade 1 FRL = R	Grade 2 FRL = P	
10	20	10	5		6			175	32	10.5	12	T1	0481H	0261H	
													0482H	0262H	
													0483H	0263H	
	47	10	5	1	13			100					T1	0484H	0264H
														0485H	0265H
														0486H	0266H
	100	10	5	4	15		7	60	36	14	16		T2	0487H	0267H
														0488H	0268H
														0489H	0269H
	180	10	5	7	30			40					T2	0490H	0270H
														0491H	0271H
														0492H	0272H
250	10	5	2	30			30	40				T3	0493H	0273H	
													0494H	0274H	
													0495H	0275H	
390	10	5	16	44			25	64	17.5	20		T3	0496H	0276H	
													0497H	0277H	
													0498H	0278H	
750	20	10	4	50			23	80	25	25		T4	0499H	0279H	
													0500H	0280H	

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS  
Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),  
Established Reliability (Continued)**

Rated Voltage @ +85° C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125° C (Volts, dc)	Surge Voltage @ +85° C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (I)	Part Number M39006/22-	
	Nominal Value (µF)	Tolerance (± %)	+25° C	+85° C & +125° C					-55° C (-%)	+85° C (+%)	+125° C (+%)		Grade 1 FRL = R	Grade 2 FRL = P
15	15	20	2	1	5	10	17.2	155	24	10.5	12	T1	0501H	0281H
		10							28	14	16		0502H	0282H
		5							28	28	28		0503H	0283H
15	33	20	4	10	13	10	17.2	90	28	14	16	T1	0504H	0284H
		10							28	28	28		0505H	0285H
		5							28	28	28		0506H	0286H
15	70	20	7	18	18	10	17.2	75	28	17.5	20	T2	0507H	0287H
		10							28	20	20		0508H	0288H
		5							28	20	20		0509H	0289H
15	120	20	10	25	25	10	17.2	50	28	14	16	T2	0510H	0290H
		10							32	14	16		0511H	0291H
		5							32	14	16		0512H	0292H
15	170	20	16	32	32	10	17.2	35	56	17.5	20	T3	0513H	0293H
		10							80	25	25		0514H	0294H
		5							80	25	25		0515H	0295H
15	270	20	24	40	40	10	17.2	30	80	25	25	T3	0516H	0296H
		10							25	25	25		0517H	0297H
		5							25	25	25		0518H	0298H
15	540	20	6	40	40	10	17.2	23	80	25	25	T4	0519H	0299H
		10							25	25	25		0520H	0300H

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (1)	Part Number M39006/22-					
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 FRL = R	Grade 2 FRL = P				
30	8	20	1	2	4	20	34.5	275	16	8	12	T1	0541H	0321H				
		10											0542H	0322H				
		5											0543H	0323H				
	15	20	1	2	5				175	20	24	10.5	12	T1	0544H	0324H		
		10															0545H	0325H
		5															0546H	0326H
	40	20	1	5	10				65	20	24	10.5	12	T2	0547H	0327H		
		10															0548H	0328H
		5															0549H	0329H
	68	20	1	8	13				60	20	24	13	15	T2	0550H	0330H		
		10															0551H	0331H
		5															0552H	0332H
100	20	2	12	17	40	20	28	10.5	12	T3	0553H	0333H						
	10												0554H	0334H				
	5												0555H	0335H				
150	20	2	18	23	35	20	48	13	15	T3	0556H	0336H						
	10												0557H	0337H				
	5												0558H	0338H				
300	20	8	32	31	25	20	60	25	25	T4	0559H	0339H						
	10												0560H	0340H				

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (1)	Part Number M39006/22-	
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 FRL = R	Grade 2 FRL = P
50	5	20	1	2	3	30	57.5	400	16	5	6	T1	0561H	0341H
		10							10	9	0562H		0342H	
		5							5	24	8		0563H	0343H
	10	20	4	5	8	30	57.5	250	20	10.5	12	T1	0564H	0344H
		10							10	20	8		0565H	0345H
5	5	5	8	30	57.5	95	20	10.5	12	T2	0566H	0346H		
50	47	20	9	11	30	57.5	70	28	13	15	T2	0567H	0347H	
		10						10	15	0568H		0348H		
		5						5	16	10.5		12	0569H	0349H
	60	20	12	12	30	57.5	45	16	10.5	12	T3	0570H	0350H	
		10						10	15	13		15	0571H	0351H
5	5	2	15	30	57.5	27	32	13	15	T3	0572H	0352H		
50	82	20	16	15	30	57.5	45	32	13	15	T3	0573H	0353H	
		10						10	15	13		15	0574H	0354H
		5						5	50	25		25	0575H	0355H
50	160	20	32	17	30	57.5	27	50	25	25	T4	0576H	0356H	
		10						10	25	25		25	0577H	0357H
													0578H	0358H
													0579H	0359H
													0580H	0360H

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (1)	Part Number M39006/22-		
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 FRL = R	Grade 2 FRL = P	
75	3.5	20			2.5			650	16	5	6	T1	0601H	0381H	
		10									0602H		0382H		
		5									0603H		0383H		
	6.8	20	1		3.5			300	20	8	9	T1	0604H	0384H	
		10									0605H		0385H		
		5									0606H		0386H		
	15	20			6			150	16	8	9	T2	0607H	0387H	
		10									0608H		0388H		
		5									0609H		0389H		
	33	20			10		50	90	24		15	T2	0610H	0390H	
		10												0611H	0391H
		5												0612H	0392H
40	20	2		9			60	16	10.5	12	T3	0613H	0393H		
	10													0614H	0394H
	5													0615H	0395H
56	20			11			29	28		15	T3	0616H	0396H		
	10												0617H	0397H	
	5												0618H	0398H	
110	20			12				35		20	T4	0619H	0399H		
	10													0620H	0400H

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (I)	Part Number M39006/22-	
	Nominal Value (µF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 FRL = R	Grade 2 FRL = P
100	2.5	20	2	2	2	950	115	16	7	8	T1	0621H	0401H	
		10										0622H	0402H	
		5										0623H	0403H	
	4.7	20	1	4	3	500	115	16	7	8	T1	0624H	0404H	
		10										0625H	0405H	
		5										0626H	0406H	
	11	20	4	5	5	200	115	16	7	8	T2	0627H	0407H	
		10										0628H	0408H	
		5										0629H	0409H	
	22	20	9	7.5	7.5	100	115	16	7	8	T2	0630H	0410H	
		10										0631H	0411H	
		5										0632H	0412H	
30	20	12	7	7	80	115	16	7	8	T3	0633H	0413H		
	10										0634H	0414H		
	5										0635H	0415H		
43	20	2	8.5	8.5	70	115	16	7	8	T3	0636H	0416H		
	10										0637H	0417H		
	5										0638H	0418H		
86	20	9	10	10	30	115	16	7	8	T4	0639H	0419H		
	10										0640H	0420H		

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/22, STYLE CLR79 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Capacitance		Maximum dc Leakage (Microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Maximum Impedance (Ohms)	Capacitance Change @			Case Size (1)	Part Number M39006/22-		
	Nominal Value (μF)	Tolerance (±%)	+25°C	+85°C & +125°C					-55°C (-%)	+85°C (+%)	+125°C C (+%)		Grade 1 FRL = R	Grade 2 FRL = P	
125	1.7	20	1	2	2			1250				T1	0641H	0421H	
		10											0642H	0422H	
		5											0643H	0423H	
	3.6	20	1	2	2.7			600				T1	0644H	0424H	
		10											0645H	0425H	
		5											0646H	0426H	
	9	20	1	5	5			240				T2	0647H	0427H	
		10											0648H	0428H	
		5											0649H	0429H	
	14	20	2	7	6			167		16	7	8	T2	0650H	0430H
		10												0651H	0431H
		5												0652H	0432H
18	20	2	9	5			129					T3	0653H	0433H	
	10												0654H	0434H	
	5												0655H	0435H	
25	20	2	13	6			93					T3	0656H	0436H	
	10												0657H	0437H	
	5												0658H	0438H	
56	20	10	40	6.5			32		25	15	15	T4	0659H	0439H	
	10												0660H	0440H	

(1) Case sizes are defined in MIL-C-39006/22.

**MIL-C-39006/25, STYLE CLR81 CAPACITORS**  
**Fixed, Tantalum (Non-solid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Case Size (1)	Part Number M39006/25-	
	Nominal Value (µF)	Tolerance (±%)		Grade 1 FRL = R	Grade 2 FRL = P
10	150	20	T1	0193H	0105H
	150	10	T1	0194H	0106H
	560	20	T2	0195H	0107H
	560	10	T2	0196H	0108H
	1,200	20	T3	0197H	0109H
	1,200	10	T3	0198H	0110H
	1,500	20	T4	0199H	0111H
	1,500	10	T4	0200H	0112H
15	100	20	T1	0201H	0113H
	100	10	T1	0202H	0114H
	390	20	T2	0203H	0115H
	390	10	T2	0204H	0116H
	820	20	T3	0205H	0117H
	820	10	T3	0206H	0118H
	1,000	20	T4	0207H	0119H
	1,000	10	T4	0208H	0120H
25	68	20	T1	0209H	0121H
	68	10	T1	0210H	0122H
	270	20	T2	0211H	0123H
	270	10	T2	0212H	0124H
	560	20	T3	0213H	0125H
	560	10	T3	0214H	0126H
	680	20	T4	0215H	0127H
	680	10	T4	0216H	0128H

(1) Case sizes are defined in MIL-C-39006/25.

**MIL-C-39006/25, STYLE CLR81 CAPACITORS  
Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),  
Established Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Case Size (1)	Part Number M39006/25-	
	Nominal Value (µF)	Tolerance (±%)		Grade 1 FRL = R	Grade 2 FRL = P
30	56	20	T1	0217H	0129H
	56	10	T1	0218H	0130H
	220	20	T2	0219H	0131H
	220	10	T2	0220H	0132H
	470	20	T3	0221H	0133H
	470	10	T3	0222H	0134H
	560	20	T4	0223H	0135H
	560	10	T4	0224H	0136H
50	33	20	T1	0225H	0137H
	33	10	T1	0226H	0138H
	120	20	T2	0227H	0139H
	120	10	T2	0228H	0140H
	270	20	T3	0229H	0141H
	270	10	T3	0230H	0142H
	330	20	T4	0231H	0143H
	330	10	T4	0232H	0144H
60	27	20	T1	0233H	0145H
	27	10	T1	0234H	0146H
	100	20	T2	0235H	0147H
	100	10	T2	0236H	0148H
	220	20	T3	0237H	0149H
	220	10	T3	0238H	0150H
	270	20	T4	0239H	0152H
	270	10	T4	0240H	0153H

(1) Case sizes are defined in MIL-C-39006/25.

**MIL-C-39006/25, STYLE CLR81 CAPACITORS**  
**Fixed, Tantalum (Nonsolid) Electrolytic, (Polarized, Sintered Slug),**  
**Established Reliability (Continued)**

Rated Voltage (Volts, dc)	Capacitance		Case Size (I)	Part Number M39006/25-	
	Nominal Value ( $\mu$ F)	Tolerance ( $\pm$ %)		Grade 1 FRL = R	Grade 2 FRL = P
75	22	20	T1	0241H	0153H
	22	10	T1	0242H	0154H
	82	20	T2	0243H	0155H
	82	10	T2	0244H	0156H
	180	20	T3	0245H	0157H
	180	10	T3	0246H	0158H
	220	20	T4	0247H	0159H
	220	10	T4	0248H	0160H
100	10	20	T1	0249H	0161H
	10	10	T1	0250H	0162H
	39	20	T2	0251H	0163H
	39	10	T2	0252H	0164H
	68	20	T3	0253H	0165H
	68	10	T3	0254H	0166H
	120	20	T4	0255H	0167H
	120	10	T4	0256H	0168H
125	6.8	20	T1	0257H	0169H
	6.8	10	T1	0258H	0170H
	27	20	T2	0259H	0171H
	27	10	T2	0260H	0172H
	47	20	T3	0261H	0173H
	47	10	T3	0262H	0174H
	82	20	T4	0263H	0175H
	82	10	T4	0264H	0176H

(1) Case sizes are defined in MIL-C-39006/25.

**MIL-C-39014, CAPACITORS**  
**Fixed, Ceramic Dielectric, Established Reliability**

Part number explanation: M39014	XX	-XXXX
M39014 - Identifies CKR fixed, ceramic, insulated, general purpose, established reliability capacitors conforming to MIL-C-39014.	/XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family	-XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated dc voltage, and failure rate level (FRL) in percent/1000 hours.

Part Number	Control specification	Style	Capacitance		Rated Voltage (Vdc) @ +125° C (1)	Maximum Dissipation Factor (%)	Minimum Insulation Resistance @ +25° C	Operating Temperature Range (° C)	Configuration		FRL Grade
			Range (pF)	Tolerance (± %)					Case Type	Lead Type (2)	
M39014/01-XXXX	MIL-C-39014/1	CKR05	10-100,000		50, 100, 200		100,000		Molded	Radial	S
M39014/02-XXXX	MIL-C-39014/2	CKR06	1,200-330,000								
M39014/05-XXXX	MIL-C-39014/5	CKR11	10-10,000	10, 20	50, 100	2.5	1,000 megohm-microfarads, whichever is less	-55 to +125	Tubular	Axial	
M39014/05-XXXX	MIL-C-39014/5	CKR12	5,600-47,000								
M39014/05-XXXX	MIL-C-39014/5	CKR14	12,000-100,000								
M39014/05-XXXX	MIL-C-39014/5	CKR15	56,000-330,000		100	2.5, 3.0					

- (1) For low voltage applications (<10 volts dc), capacitor rated voltage shall be at least 100 volts dc. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2 c and d.
- (2) Leads are solderable. For weldable leads, contact the project parts engineer.

**MIL-C-39014/1, STYLE CKR05 CAPACITORS**  
**Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/01-Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
100	1,500	10	1360
	1,500	20	1561
	2,200	10	1563
	2,200	20	1564
	3,300	10	1566
	3,300	20	1567
	4,700	10	1569
	4,700	20	1570
	6,800	10	1572
	6,800	20	1573
50	10,000	10	1575
	10,000	20	1576
	15,000	10	1578
	15,000	20	1579
	22,000	10	1581
	22,000	20	1582
	33,000	10	1584
	33,000	20	1585
	47,000	10	1587
	47,000	20	1588
	68,000	10	1590
	68,000	20	1591
	100,000	10	1593
	100,000	20	1594

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/01-Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
200	10	10	1321
	10	20	1322
	15	10	1324
	15	20	1325
	22	10	1327
	22	20	1328
	33	10	1330
	33	20	1331
	47	10	1333
	47	20	1334
	68	10	1336
	68	20	1337
	100	10	1339
	100	20	1340
	150	10	1342
	150	20	1343
	220	10	1345
	220	20	1346
	330	10	1348
	330	20	1349
470	10	1351	
470	20	1352	
680	10	1354	
680	20	1355	
1,000	10	1357	
1,000	20	1358	

**MIL-C-39014/2, STYLE CKR06 CAPACITORS  
Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/02- Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
200	1,200	10	1321
	1,500	10	1322
	1,500	20	1323
	2,200	10	1326
	2,200	20	1327
	3,300	10	1329
	3,300	20	1330
	4,700	10	1332
	4,700	20	1333
	6,800	10	1335
100	6,800	20	1336
	10,000	10	1338
	10,000	20	1339
	15,000		1340
	22,000		1342
	33,000		1343
50	47,000	10	1345
	68,000		1347
	100,000		1350
	120,000		1353
	150,000		1354
	180,000		1355
	220,000		1356
	270,000		1357
330,000	1358		

**MIL-C-39014/5, STYLE CKR11 CAPACITORS**  
**Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/05-Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
100	470	10	2231
	470	20	2232
	680	10	2234
	680	20	2235
	1,000	10	2237
	1,000	20	2238
	1,500	10	2240
	1,500	20	2241
	2,200	10	2243
	2,200	20	2244
	3,300	10	2246
	3,300	20	2247
50	4,700	10	2249
	4,700	20	2250
	6,800	10	2252
	6,800	20	2253
	10,000	10	2255
	10,000	20	2256

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/05-Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
100	10	10	2201
	10	20	2202
	15	10	2204
	15	20	2205
	22	10	2207
	22	20	2208
	33	10	2210
	33	20	2211
	47	10	2213
	47	20	2214
	68	10	2216
	68	20	2217
	100	10	2219
	100	20	2220
	150	10	2222
	150	20	2223
	220	10	2225
	220	20	2226
330	10	2228	
330	20	2229	

**MIL-C-39014/5, STYLE CKR12 CAPACITORS**  
**Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/05- Grade 2 FRL = S
	Value (pF)	Tolerance ( $\pm\%$ )	
100	5,600	10	2257
	6,800	10	2258
	6,800	20	2259
	8,200	10	2260
	10,000	10	2261
	10,000	20	2262
50	12,000	10	2263
	15,000	10	2264
	15,000	20	2265
	18,000	10	2266
	22,000	10	2267
	22,000	20	2268
	27,000	10	2269
	33,000	10	2270
	33,000	20	2271
	39,000	10	2272
47,000	10	2273	
47,000	20	2274	

**MIL-C-39014/5, STYLE CKR14 CAPACITORS**  
**Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/05- Grade 2 FRL = S
	Value (pF)	Tolerance ( $\pm\%$ )	
100	12,000	10	2275
	15,000	10	2276
	15,000	20	2277
	18,000	10	2278
	22,000	10	2279
	22,000	20	2280
	27,000	10	2281
	33,000	10	2282
	33,000	20	2283
	39,000	10	2284
50	47,000	10	2285
	47,000	20	2286
	56,000	10	2287
	68,000	10	2288
	68,000	20	2289
	82,000	10	2290
	100,000	10	2291
	100,000	20	2292

**MIL-C-39014/5, STYLE CKR15 CAPACITORS  
Fixed, Ceramic Dielectric, Established Reliability**

Rated Voltage (Volts, dc)	Capacitance		Part Number M39014/05- Grade 2 FRL = S
	Value (pF)	Tolerance (±%)	
100	56,000	10	2306
	68,000	10	2307
	68,000	20	2308
	100,000	10	2310
	100,000	20	2311
	120,000	10	2312
	150,000	10	2313
	150,000	20	2314
	180,000	10	2315
	220,000	10	2316
	220,000	20	2317
	270,000	10	2318
	330,000	10	2319
	330,000	20	2320

## MIL-C-55365, CAPACITORS Chip, Fixed, Tantalum, Established Reliability

Part Number Explanation:

CWRXX

X

X

XXX

X

X

Style - The three-letter symbol "CWR" identifies established reliability, tantalum, fixed, chip capacitors and the XX identifies the design of the capacitor

Voltage - A single letter symbol identifies the voltage (rated, derated, and surge) as follows:

Symbol	Voltage (volts, dc)	
	Rated (+85°C)	Derated (+125°C) Surge (+85°C)
C	4	2.7
D	6	4.0
P	10	7.0
H	15	10.0
J	20	13.0
K	25	17.0
M	35	23.0
N	50	33.0

Termination Finish - A single letter symbol identifies the termination finish as follows:

B: Gold  
C: Hot solder Dipped

Capacitance - the three-digit number identifies the nominal capacitance value, expressed in picofarads (pF). Where the nominal capacitance is 10 pF or greater, the first two digits represent significant figures and the last digit specifies the number of zeros to follow. For example:  
10 pF = 100;  
150 pF = 151;  
1500 pF = 152

Capacitance tolerance - a single letter symbol identifies the capacitance tolerance as follows:

J: ±5%  
K: ±10%  
M: ±20%

Failure Rate Level - A single-letter symbol identifies the Weibull failure rate level as follows:

(%1000 hrs)  
B = 0.1  
C = 0.01

Part Number	Control Specification	Capacitance		Rated Voltage (dc) @ +85°C	Operating Temperature Range (°C)	FRL	
		Range (µF)	Tolerance Available			Grade 1	Grade 2
CWR06XXXXXXX	MIL-C-55365/4	0.10 - 100.0	J, K, M	C, D, F, H, J, K, M, N	-55 to +125	C	B

**MIL-C-55365/4, STYLE CWR06 CAPACITORS  
Chip, Fixed, Tantalum, Established Reliability**

Rated Voltage @ +85°C (Volts, dc)	Nominal Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Case Size (1)	Part Number CWR06 (2)		
	(µF)	Tolerance (±%)	+25°C	+85°C	+125°C	+25°C	+85°C & +125°C				Grade 1 FRL = C	Grade 2 FRL = B	
4	2.2		1.0	10	12	6	8	2.7	5.0		C#225*C	C#225*B	
	4.7		1.0	10	12	6	8				C#475*C	C#475*B	
	6.8		1.0	10	12	6	8				C#685*C	C#685*B	
	10.0		1.0	10	12	8	8				C#106*C	C#106*B	
	15.0		1.0	10	12	12	8				10	C#156*C	C#156*B
	33.0		2.0	20	20	24	8				10	C#336*C	C#336*B
	68.0		3.0	30	30	36	10				12	C#686*C	C#686*B
	100.0		4.0	40	40	48	10				12	C#107*C	C#107*B
6	1.5	5, 10, 20	1.0	10	12	6	8	4.0	8.0		D#155*C	D#155*B	
	3.3		1.0	10	12	6	8				D#335*C	D#335*B	
	4.7		1.0	10	12	6	8				D#475*C	D#475*B	
	6.8		1.0	10	12	6	8				D#685*C	D#685*B	
	10.0		1.0	10	12	12	8				10	D#106*C	D#106*B
	22.0		2.0	20	20	24	8				10	D#226*C	D#226*B
	47.0		3.0	30	30	36	10				12	D#476*C	D#476*B
	68.0		4.0	40	40	48	10				12	D#686*C	D#686*B
10	1.0		1.0	10	12	6	8	7.0	13.0		F#105*C	F#105*B	
	2.2		1.0	10	12	6	8				F#225*C	F#225*B	
	3.3		1.0	10	12	6	8				F#335*C	F#335*B	
	4.7		1.0	10	12	6	8				F#475*C	F#475*B	
	6.8		1.0	10	12	12	8				8	F#685*C	F#685*B
	15.0		2.0	20	20	24	8				8	F#156*C	F#156*B
	33.0		3.0	30	30	36	10				12	F#336*C	F#336*B
	47.0		5.0	50	50	60	10				12	F#476*C	F#476*B

(1) Case sizes are defined in MIL-C-55365.  
 (2) Complete type designation will include termination finish and capacitance tolerance.  
 # Choice of allowable terminations.  
 \* Choice of allowable tolerances.

**MIL-C-55365/4, STYLE CWR06 CAPACITORS  
Chip, Fixed, Tantalum, Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Nominal Capacitance		Maximum dc Leakage (µA)		Maximum Dissipation Factor (%)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Case Size (1)	Part Number CWR06 (2)	
	(µF)	Tolerance (±%)	+25°C	+85°C	+25°C	+85°C & +125°C				Grade 1	Grade 2
15	0.68		1.0	10	12	8			A	H#684*C	H#684*B
	1.5		1.0	10	12	8			B	H#155*C	H#155*B
	2.2		1.0	10	12	8			C	H#225*C	H#225*B
	3.3		1.0	10	12	8	10.0	20.0	D	H#335*C	H#335*B
	4.7		1.0	10	12	8			E	H#475*C	H#475*B
	10.0		2.0	20	24	8			F	H#106*C	H#106*B
	22.0		4.0	40	48	8			G	H#226*C	H#226*B
	33.0		5.0	50	60	8			H	H#336*C	H#336*B
20	0.47		1.0	10	12				A	J#474*C	J#474*B
	0.68		1.0	10	12				B	J#684*C	J#684*B
	1.0		1.0	10	12				B	J#105*C	J#105*B
	1.5	5, 10, 20	1.0	10	12		13.0	26.0	C	J#155*C	J#155*B
	2.2		1.0	10	12				D	J#225*C	J#225*B
	3.3		1.0	10	12				E	J#335*C	J#335*B
	6.8		2.0	20	24	6			F	J#685*C	J#685*B
	15.0		3.0	30	36				G	J#156*C	J#156*B
22.0		4.0	40	48				H	J#226*C	J#226*B	
25	0.33		1.0	10	12				A	K#334*C	K#334*B
	0.68		1.0	10	12				B	K#684*C	K#684*B
	1.0		1.0	10	12				C	K#105*C	K#105*B
	1.5		1.0	10	12				D	K#155*C	K#155*B

- (1) Case sizes are defined in MIL-C-55365.
- (2) Complete type designation will include termination finish and capacitance tolerance.
- # Choice of allowable terminations.
- \* Choice of allowable tolerances.

**MIL-C-55365/4, STYLE CWR06 CAPACITORS  
Chip, Fixed, Tantalum, Established Reliability (Continued)**

Rated Voltage @ +85°C (Volts, dc)	Nominal Capacitance		Maximum dc Leakage (µA)			Maximum Dissipation Factor (%)		Derated Voltage @ +125°C (Volts, dc)	Surge Voltage @ +85°C (Volts, dc)	Case Size (I)	Part Number CWR06 (2)	
	(µF)	Tolerance (±%)	+25°C	+85°C	+125°C	+25°C	+85°C & +125°C				Grade 1 FRL = C	Grade 2 FRL = B
25	2.2		1.0	10	12			17.0	32.0	E	K#225*C	K#225*B
	4.7		2.0	20	24					F	K#475*C	K#475*B
	6.8		2.0	20	24					G	K#685*C	K#685*B
	10.0		3.0	30	36					G	K#106*C	K#106*B
	15.0		4.0	40	48					H	K#156*C	K#156*B
35	0.22	5, 10, 20	1.0	10	12	6	8	23.0	46.0	A	M#224*C	M#224*B
	0.47		1.0	10	12					B	M#474*C	M#474*B
	0.68		1.0	10	12					C	M#684*C	M#684*B
	1.0		1.0	10	12					D	M#105*C	M#105*B
	1.5		1.0	10	12					E	M#155*C	M#155*B
	3.3		1.0	10	12					F	M#335*C	M#335*B
	4.7		2.0	20	24					G	M#475*C	M#475*B
	6.8		3.0	30	36					H	M#685*C	M#685*B
50	0.10		1.0	10	12			33.0	65.0	A	N#104*C	N#104*B
	0.15		1.0	10	12					A	N#154*C	N#154*B
	0.22		1.0	10	12					B	N#224*C	N#224*B
	0.33		1.0	10	12					B	N#334*C	N#334*B
	0.47		1.0	10	12					C	N#474*C	N#474*B
	0.68		1.0	10	12					D	N#684*C	N#684*B
	1.0		1.0	10	12					E	N#105*C	N#105*B
	1.5		1.0	10	12					F	N#155*C	N#155*B
2.2	2.0	20	24	F	N#225*C	N#225*B						
3.3	2.0	20	24	G	N#335*C	N#335*B						
4.7	3.0	30	36	H	N#475*C	N#475*B						

(1) Case sizes are defined in MIL-C-55365.  
(2) Complete type designation will include termination finish and capacitance tolerance.  
# Choice of allowable terminations.  
\* Choice of allowable tolerances.

MIL-C-55681, CAPACITORS, CHIP  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability

Part Number Explanation:

CD	RY	BY	YYY	Y	Y	Y			
Style - CDR	Rated temperature and Voltage Temperature Limits:	Capacitance (1)	Rated Voltage (Vdc) -	Capacitance Tolerance -	Termination Finish -	Failure Rate Level: (%/1000 hrs):			
identifies established reliability, ceramic dielectric, fixed, chip capacitor; YY identifies the dimensions of the capacitor	<table border="1"> <tr> <th>Rated Temperature</th> <th>Voltage Temperature Limits</th> </tr> <tr> <td>B = -55°C to +125°C</td> <td>P = 0 ± 30 ppm/°C X = ±15% Q = 90 ± 20 ppm/°C</td> </tr> </table>	Rated Temperature	Voltage Temperature Limits	B = -55°C to +125°C	P = 0 ± 30 ppm/°C X = ±15% Q = 90 ± 20 ppm/°C	A = 50 B = 100 C = 200 D = 300 E = 500	B = ±0.10pF C = ±0.25pF D = ±0.50pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	S = Solder-coated, final M = Palladium-silver N = Silver-nickel-gold U = Base Metallization-Barrier Metal-Solder coated W = Base Metallization-Barrier Metal-tinned (Tin/Lead Alloy)	P = 0.1 R = 0.01 S = 0.001
Rated Temperature	Voltage Temperature Limits								
B = -55°C to +125°C	P = 0 ± 30 ppm/°C X = ±15% Q = 90 ± 20 ppm/°C								

Part Number	Control Specification	Style	Capacitance		Rated Voltage @ +125°C (Vdc) (2)	Operating Temperature Range (°C)	Rated Temperature & Voltage Temperature Limits	Grade 1	Grade 2
			Range (pF) (1)	Tolerance Available					
CDR01BYYYYYYYY	MIL-C-55681/1	CDR01	10-4,700	J, K, M	100	-55 to +125	BX, BP	S	P, R
CDR03BYYYYYYYY		CDR03	330-68,000	J, K, M	50, 100		BX, BP		
CDR04BYYYYYYYY		CDR04	1,200-180,000	K, M	50, 100		BX		
CDR05BYYYYYYYY	MIL-C-55681/2	CDR05	3,900-330,000	J, K, M	50, 100	-55 to +125	BX, BP	S	P, R
CDR06BYYYYYYYY	MIL-C-55681/3	CDR06	6,800-10,000	J, K	100		BP		
CDR11BYYYYYYYY	MIL-C-55681/4	CDR11	0.1-1,000	B, C, D, F, G, J, K, M	50	-55 to +125	BG, BP	S	P, R
CDR12BYYYYYYYY		CDR12	0.1-1,000		50				
CDR13BYYYYYYYY		CDR13	0.1-5,100		50, 100, 200, 300, 500				
CDR14BYYYYYYYY		CDR14	6.8-5,100						

- (1) The nominal capacitance value expressed in picofarads (pF) is identified by a three-digit number, the first two digits represent significant figures and the last digit specifies the number of zeros to follow.
- (2) For low voltage applications (<10 Vdc) rated voltage shall be at least 100 Vdc. Reference MIL-HDBK-978, Vol. 1, 2.2.7.2 c and d.
- (3) Lot characteristics shall be assessed by performance of the sample tests required by Appendix B. Sample parts subjected to this testing shall not be used.

**MIL-C-55681/1, STYLE CDR01 CHIP CAPACITORS**  
**Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric,**  
**Established Reliability**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR01B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (1)	Grade 2 FRL = P or R
100	10	J, K	0.15	BP	P100B*#S	P100B**#@
	12	J			P120BJ#S	P120BJ#">@
	15	J, K			P150B*#S	P150B**#@
	18	J			P180BJ#S	P180BJ#">@
	22	J, K			P220B*#S	P220B**#@
	27	J			P270BJ#S	P270BJ#">@
	33	J, K			P330B*#S	P330B**#@
	39	J			P390BJ#S	P390BJ#">@
	47	J, K			P470B*#S	P470B**#@
	56	J			P560BJ#S	P560BJ#">@
	68	J, K			P680B*#S	P680B**#@
	82	J			P820BJ#S	P820BJ#">@
	100	J, K			P101B*#S	P101B**#@
	120	J, K			+121B*#S	+121B**#@
	150	J, K			+151B*#S	+151B**#@
	180	J, K			+181B*#S	+181B**#@
220	K, M	X221B*#S	X221B**#@			
270	K	X271BK#S	X271BK#">@			
330	K, M	X331B*#S	X331B**#@			
390	K	X391BK#S	X391BK#">@			

# = Choice of termination finish (M, N, S, U, W).  
\* = Choice of tolerance.  
+ = Choice of voltage temperature limits.  
@ = P or R, allowable Failure Rate Levels (FRL).  
(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/1, STYLE CDR01 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric,  
Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR01B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (1)	Grade 2 FRL = P or R
100	470	K, M	2.50	BX	X471B*#S	X471B*#@
	560	K			X561BK#S	X561BK#@
	680	K, M			X681B*#S	X681B*#@
	820	K			X821BK#S	X821BK#@
	1,000	K, M			X102B*#S	X102B*#@
	1,200	K			X122BK#S	X122BK#@
	1,500	K, M			X152B*#S	X152B*#@
	1,800	K			X182BK#S	X182BK#@
	2,200	K, M			X222B*#S	X222B*#@
	2,700	K			X272BK#S	X272BK#@
50	3,300	K, M	X332B*#S	X332B*#@		
	3,900	K	X392AK#S	X392AK#@		
	4,700	K, M	X472A*#S	X472A*#@		

# = Choice of termination finish (M, N, S, U, W).  
\* = Choice of tolerance.  
@ = P or R, allowable Failure Rate Levels (FRL).  
(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/1, STYLE CDR03 CHIP CAPACITORS**  
**Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR03B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (1)	Grade 2 FRL = P or R
100	330	J, K	0.15	BP	P331B*#S	P331B*#@
	390	J			P391BJ#S	P391BJ#@
	470	J, K			P471B*#S	P471B*#@
	560	J			P561BJ#S	P561BJ#@
	680	J, K	P681B*#S		P681B*#@	
	820	J	P821BJ#S		P821BJ#@	
	1,000	J, K	P102B*#S		P102B*#@	
	12,000	K	X123BK#S		X123BK#@	
	15,000	K, M	X153B*#S		X153B*#@	
	18,000	K	X183BK#S		X183BK#@	
50	22,000	K, M	2.50	BX	X223B*#S	X223B*#@
	27,000	K			X273BK#S	X273BK#@
	33,000	K, M			X333B*#S	X333B*#@
	39,000	K			X393AK#S	X393AK#@
	47,000	K, M			X473A*#S	X473A*#@
	56,000	K			X563AK#S	X563AK#@
	68,000	K, M			X683A*#S	X683A*#@

# = Choice of termination finish (M, N, S, U, W).

\* = Choice of tolerance.

@ = P or R, allowable Failure Rate Levels (FRL).

(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/1, STYLE CDR04 CHIP CAPACITORS**  
**Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric,**  
**Established Reliability**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR04B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (1)	Grade 2 FRL = P or R
100	1,200	J	0.15	BP	P122BJ#S	P122BJ#@
	1,500	J,K			P152B**S	P152B**@
	1,800	J			P182BJ#S	P182BJ#@
	200	J,K			P222B**S	P222B**@
	2,700	J			P272BJ#S	P272BJ#@
	3,300	J, K			P332B**S	P332B**@
50	39,000	K	2.5	BX	X393BK#S	X393BK#@
	47,000	K, M			X473B**S	X473B**@
	56,000	K			X563BK#S	X563BK#@
	82,000	K			X823AK#S	X823AK#@
	100,000	K, M			X104A**S	X104A**@
	120,000	K			X124AK#S	X124AK#@
	150,000	K, M			X154A**S	X154A**@
	180,000	K			X184AK#S	X184AK#@

# = Choice of termination finish (M, N, S, U, W).  
\* = Choice of tolerance.  
@ = P or R, allowable Failure Rate Levels (FRL).  
(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/2, STYLE CDR05 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric,  
Established Reliability**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR05B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (I)	Grade 2 FRL = P or R
100	3,900	J, K	0.15	BP	P392B**S	P392B**@
	4,700				P472B**S	P472B**@
	5,600				P562B**S	P562B**@
	68,000	K, M	X683B**S		X683B**@	
	82,000	K	X823BK#S		X823BK#@	
	100,000	K, M	X104B**S		X104B**@	
50	120,000	K	2.50	BX	X124BK#S	X124BK#@
	150,000	K, M			X154B**S	X154B**@
	220,000	K, M			X224A**S	X224A**@
	270,000	K			X274AK#S	X274AK#@
	330,000	K, M			X334A**S	X334A**@

# = Choice of termination finish (M, N, S, U, W).  
\* = Choice of tolerance.  
@ = P or R, allowable Failure Rate Levels (FRL).  
(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/3, STYLE CDR06 CHIP CAPACITORS**  
**Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric,**  
**Established Reliability**

Rated Voltage (Vdc)	Capacitance		DF (%) Max	Rated Temperature and Voltage - Temperature Limits	Part Number CDR06B	
	Nominal Value (pF)	Tolerances Available			Grade 1 FRL = S (1)	Grade 2 FRL = P or R
100	6,800	J, K	0.15	BP	P682B*#S	P682B*#@
	8,200				P822B*#S	P822B*#@
	10,000				P103B*#S	P103B*#@

# = Choice of termination finish (M, N, S, U, W).  
\* = Choice of tolerance.  
@ = P or R, allowable Failure Rate Levels (FRL).  
(1) Currently, there are no qualified suppliers at the S failure rate level for termination finish N.

**MIL-C-55681/4, STYLE CDR11 AND CDR12 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
50	0.1	B	BG, BP	CDR1ΣB+0R1AB#S	CDR1ΣB+0R1AB##@
	0.2	B		CDR1ΣB+0R2AB#S	CDR1ΣB+0R2AB##@
	0.3	B,C		CDR1ΣB+0R3A*#S	CDR1ΣB+0R3A*##@
	0.4	B,C		CDR1ΣB+0R4A*#S	CDR1ΣB+0R4A*##@
	0.5			CDR1ΣB+0R5A*#S	CDR1ΣB+0R5A*##@
	0.6			CDR1ΣB+0R6A*#S	CDR1ΣB+0R6A*##@
	0.7			CDR1ΣB+0R7A*#S	CDR1ΣB+0R7A*##@
	0.8			CDR1ΣB+0R8A*#S	CDR1ΣB+0R8A*##@
	0.9			CDR1ΣB+0R9A*#S	CDR1ΣB+0R9A*##@
	1.0			CDR1ΣB+1R0A*#S	CDR1ΣB+1R0A*##@
	1.1			CDR1ΣB+1R1A*#S	CDR1ΣB+1R1A*##@
	1.2			CDR1ΣB+1R2A*#S	CDR1ΣB+1R2A*##@
	1.3			CDR1ΣB+1R3A*#S	CDR1ΣB+1R3A*##@
	1.4			CDR1ΣB+1R4A*#S	CDR1ΣB+1R4A*##@
	1.5			CDR1ΣB+1R5A*#S	CDR1ΣB+1R5A*##@
	1.6			CDR1ΣB+1R6A*#S	CDR1ΣB+1R6A*##@
	1.7			CDR1ΣB+1R7A*#S	CDR1ΣB+1R7A*##@
	1.8			CDR1ΣB+1R8A*#S	CDR1ΣB+1R8A*##@
	1.9			CDR1ΣB+1R9A*#S	CDR1ΣB+1R9A*##@
	2.0	B, C, D		CDR1ΣB+2R0A*#S	CDR1ΣB+2R0A*##@
2.1		CDR1ΣB+2R1A*#S	CDR1ΣB+2R1A*##@		
2.2		CDR1ΣB+2R2A*#S	CDR1ΣB+2R2A*##@		
2.4		CDR1ΣB+2R4A*#S	CDR1ΣB+2R4A*##@		
2.7		CDR1ΣB+2R7A*#S	CDR1ΣB+2R7A*##@		
3.0		CDR1ΣB+3R0A*#S	CDR1ΣB+3R0A*##@		
3.3		CDR1ΣB+3R3A*#S	CDR1ΣB+3R3A*##@		
3.6		CDR1ΣB+3R6A*#S	CDR1ΣB+3R6A*##@		
3.9		CDR1ΣB+3R9A*#S	CDR1ΣB+3R9A*##@		
4.3		CDR1ΣB+4R3A*#S	CDR1ΣB+4R3A*##@		
4.7		CDR1ΣB+4R7A*#S	CDR1ΣB+4R7A*##@		
5.1		CDR1ΣB+5R1A*#S	CDR1ΣB+5R1A*##@		
5.6		CDR1ΣB+5R6A*#S	CDR1ΣB+5R6A*##@		
6.2		CDR1ΣB+6R2A*#S	CDR1ΣB+6R2A*##@		

Σ = choice of styles  
+ = choice of voltage temperature limits  
\* = choice of tolerance  
# = choice of termination finish (CDR 11 available with M and N; CDR 12 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR11 AND CDR12 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
50	6.8	B, C, J, K, M	BG, BP	CDR1ΣB+6R8A*#Σ	CDR1ΣB+6R8A*#Σ@
	7.5			CDR1ΣB+7R5A*#Σ	CDR1ΣB+7R5A*#Σ@
	8.2			CDR1ΣB+8R2A*#Σ	CDR1ΣB+8R2A*#Σ@
	9.1			CDR1ΣB+9R1A*#Σ	CDR1ΣB+9R1A*#Σ@
	10			CDR1ΣB+100A*#Σ	CDR1ΣB+100A*#Σ@
	11			CDR1ΣB+110A*#Σ	CDR1ΣB+110A*#Σ@
	12			CDR1ΣB+120A*#Σ	CDR1ΣB+120A*#Σ@
	13			CDR1ΣB+130A*#Σ	CDR1ΣB+130A*#Σ@
	15			CDR1ΣB+150A*#Σ	CDR1ΣB+150A*#Σ@
	16			CDR1ΣB+160A*#Σ	CDR1ΣB+160A*#Σ@
	18			CDR1ΣB+180A*#Σ	CDR1ΣB+180A*#Σ@
	20			CDR1ΣB+200A*#Σ	CDR1ΣB+200A*#Σ@
	22			CDR1ΣB+220A*#Σ	CDR1ΣB+220A*#Σ@
	24			CDR1ΣB+240A*#Σ	CDR1ΣB+240A*#Σ@
	27			CDR1ΣB+270A*#Σ	CDR1ΣB+270A*#Σ@
	30			CDR1ΣB+300A*#Σ	CDR1ΣB+300A*#Σ@
	33			CDR1ΣB+330A*#Σ	CDR1ΣB+330A*#Σ@
	36			CDR1ΣB+360A*#Σ	CDR1ΣB+360A*#Σ@
	39			CDR1ΣB+390A*#Σ	CDR1ΣB+390A*#Σ@
	43			CDR1ΣB+430A*#Σ	CDR1ΣB+430A*#Σ@
47		CDR1ΣB+470A*#Σ	CDR1ΣB+470A*#Σ@		
51		CDR1ΣB+510A*#Σ	CDR1ΣB+510A*#Σ@		
56		CDR1ΣB+560A*#Σ	CDR1ΣB+560A*#Σ@		
62		CDR1ΣB+620A*#Σ	CDR1ΣB+620A*#Σ@		
68		CDR1ΣB+680A*#Σ	CDR1ΣB+680A*#Σ@		
75		CDR1ΣB+750A*#Σ	CDR1ΣB+750A*#Σ@		
82		CDR1ΣB+820A*#Σ	CDR1ΣB+820A*#Σ@		
91		CDR1ΣB+910A*#Σ	CDR1ΣB+910A*#Σ@		
100		CDR1ΣB+101A*#Σ	CDR1ΣB+101A*#Σ@		

Σ = choice of styles  
+ = choice of voltage temperature limits  
\* = choice of tolerances  
# = choice of termination finish (CDR 11 available with M and N; CDR 12 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR11 AND CDR12 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
50	110	F, G, J, K, M	BP	CDR1ΣBP111A*#S	CDR1ΣBP111A*#@
	120			CDR1ΣBP121A*#S	CDR1ΣBP121A*#@
	130			CDR1ΣBP131A*#S	CDR1ΣBP131A*#@
	150			CDR1ΣBP151A*#S	CDR1ΣBP151A*#@
	160			CDR1ΣBP161A*#S	CDR1ΣBP161A*#@
	180			CDR1ΣBP181A*#S	CDR1ΣBP181A*#@
	200			CDR1ΣBP201A*#S	CDR1ΣBP201A*#@
	220			CDR1ΣBP221A*#S	CDR1ΣBP221A*#@
	240			CDR1ΣBP241A*#S	CDR1ΣBP241A*#@
	270			CDR1ΣBP271A*#S	CDR1ΣBP271A*#@
	300			CDR1ΣBP301A*#S	CDR1ΣBP301A*#@
	330			CDR1ΣBP331A*#S	CDR1ΣBP331A*#@
	360			CDR1ΣBP361A*#S	CDR1ΣBP361A*#@
	390			CDR1ΣBP391A*#S	CDR1ΣBP391A*#@
	430			CDR1ΣBP431A*#S	CDR1ΣBP431A*#@
	470			CDR1ΣBP471A*#S	CDR1ΣBP471A*#@
510	CDR1ΣBP511A*#S	CDR1ΣBP511A*#@			
560	CDR1ΣBP561A*#S	CDR1ΣBP561A*#@			
620	CDR1ΣBP621A*#S	CDR1ΣBP621A*#@			
680	CDR1ΣBP681A*#S	CDR1ΣBP681A*#@			
750	CDR1ΣBP751A*#S	CDR1ΣBP751A*#@			
820	CDR1ΣBP821A*#S	CDR1ΣBP821A*#@			
910	CDR1ΣBP911A*#S	CDR1ΣBP911A*#@			
1,000	CDR1ΣBP102A*#S	CDR1ΣBP102A*#@			

Σ = choice of styles  
\* = choice of tolerances  
# = choice of termination finish (CDR 11 available with M and N; CDR 12 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR13 AND CDR14 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
500	0.1	B	BG, BP	CDR1ΣB+0R1EB#S	CDR1ΣB+0R1EB#@
	0.2	B		CDR1ΣB+0R2EB#S	CDR1ΣB+0R2EB#@
	0.3	B,C		CDR1ΣB+0R3E*#S	CDR1ΣB+0R3E*#@
	0.4	B,C		CDR1ΣB+0R4E*#S	CDR1ΣB+0R4E*#@
	0.5			CDR1ΣB+0R5E*#S	CDR1ΣB+0R5E*#@
	0.6			CDR1ΣB+0R6E*#S	CDR1ΣB+0R6E*#@
	0.7			CDR1ΣB+0R7E*#S	CDR1ΣB+0R7E*#@
	0.8			CDR1ΣB+0R8E*#S	CDR1ΣB+0R8E*#@
	0.9			CDR1ΣB+0R9E*#S	CDR1ΣB+0R9E*#@
	1.0			CDR1ΣB+1R0E*#S	CDR1ΣB+1R0E*#@
	1.1	B, C, D		CDR1ΣB+1R1E*#S	CDR1ΣB+1R1E*#@
	1.2			CDR1ΣB+1R2E*#S	CDR1ΣB+1R2E*#@
	1.3			CDR1ΣB+1R3E*#S	CDR1ΣB+1R3E*#@
	1.4			CDR1ΣB+1R4E*#S	CDR1ΣB+1R4E*#@
	1.5			CDR1ΣB+1R5E*#S	CDR1ΣB+1R5E*#@
	1.6			CDR1ΣB+1R6E*#S	CDR1ΣB+1R6E*#@
1.7		CDR1ΣB+1R7E*#S	CDR1ΣB+1R7E*#@		
1.8		CDR1ΣB+1R8E*#S	CDR1ΣB+1R8E*#@		
1.9		CDR1ΣB+1R9E*#S	CDR1ΣB+1R9E*#@		
2.0		CDR1ΣB+2R0E*#S	CDR1ΣB+2R0E*#@		
2.1		CDR1ΣB+2R1E*#S	CDR1ΣB+2R1E*#@		
2.2		CDR1ΣB+2R2E*#S	CDR1ΣB+2R2E*#@		
2.4		CDR1ΣB+2R4E*#S	CDR1ΣB+2R4E*#@		
2.7		CDR1ΣB+2R7E*#S	CDR1ΣB+2R7E*#@		

Σ = choice of styles  
+ = choice of voltage temperature limits  
\* = choice of tolerances  
# = choice of termination finish (CDR 13 available with M and N; CDR 14 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR13 AND CDR14 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
500	3.0		BG, BP	CDR1ΣB+3R0E*#S	CDR1ΣB+3R0E*#@
	3.3			CDR1ΣB+3R3E*#S	CDR1ΣB+3R3E*#@
	3.6			CDR1ΣB+3R6E*#S	CDR1ΣB+3R6E*#@
	3.9			CDR1ΣB+3R9E*#S	CDR1ΣB+3R9E*#@
	4.3	B, C, D		CDR1ΣB+4R3E*#S	CDR1ΣB+4R3E*#@
	4.7			CDR1ΣB+4R7E*#S	CDR1ΣB+4R7E*#@
	5.1			CDR1ΣB+5R1E*#S	CDR1ΣB+5R1E*#@
	5.6			CDR1ΣB+5R6E*#S	CDR1ΣB+5R6E*#@
	6.2			CDR1ΣB+6R2E*#S	CDR1ΣB+6R2E*#@
	6.8			CDR1ΣB+6R8E*#S	CDR1ΣB+6R8E*#@
	7.5	B, C, J, K, M		CDR1ΣB+7R5E*#S	CDR1ΣB+7R5E*#@
	8.2			CDR1ΣB+8R2E*#S	CDR1ΣB+8R2E*#@
	9.1			CDR1ΣB+9R1E*#S	CDR1ΣB+9R1E*#@
	10	F, G, J, K, M		CDR1ΣB+100E*#S	CDR1ΣB+100E*#@
	11			CDR1ΣB+110E*#S	CDR1ΣB+110E*#@
	12			CDR1ΣB+120E*#S	CDR1ΣB+120E*#@
	13			CDR1ΣB+130E*#S	CDR1ΣB+130E*#@
	15			CDR1ΣB+150E*#S	CDR1ΣB+150E*#@
16	CDR1ΣB+160E*#S		CDR1ΣB+160E*#@		
18		CDR1ΣB+180E*#S	CDR1ΣB+180E*#@		

Σ = choice of styles  
+ = choice of voltage temperature limits  
\* = choice of tolerances  
# = choice of termination finish (CDR 13 available with M and N; CDR 14 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR13 AND CDR14 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
500	20		BG, BP	CDR1ΣB+200E*#S	CDR1ΣB+200E*#@
	22			CDR1ΣB+220E*#S	CDR1ΣB+220E*#@
	24			CDR1ΣB+240E*#S	CDR1ΣB+240E*#@
	27			CDR1ΣB+270E*#S	CDR1ΣB+270E*#@
	30	F, G, J, K, M		CDR1ΣB+300E*#S	CDR1ΣB+300E*#@
	33			CDR1ΣB+330E*#S	CDR1ΣB+330E*#@
	36			CDR1ΣB+360E*#S	CDR1ΣB+360E*#@
	39			CDR1ΣB+390E*#S	CDR1ΣB+390E*#@
	43			CDR1ΣB+430E*#S	CDR1ΣB+430E*#@
	47			CDR1ΣB+470E*#S	CDR1ΣB+470E*#@
	51			CDR1ΣB+510E*#S	CDR1ΣB+510E*#@
	56			CDR1ΣB+560E*#S	CDR1ΣB+560E*#@
	62			CDR1ΣB+620E*#S	CDR1ΣB+620E*#@
	68			CDR1ΣB+680E*#S	CDR1ΣB+680E*#@
75	CDR1ΣB+750E*#S		CDR1ΣB+750E*#@		
82	CDR1ΣB+820E*#S		CDR1ΣB+820E*#@		
91		CDR1ΣB+910E*#S	CDR1ΣB+910E*#@		
100		CDR1ΣB+101E*#S	CDR1ΣB+101E*#@		

Σ = choice of styles.  
 + = choice of voltage temperature limits.  
 \* = choice of tolerances.  
 # = choice of termination finish (CDR 13 available with M and N; CDR 14 available with S, U and W).  
 @ = P or R, allowable Failure Rate Levels (FRL).

MIL-C-55681/4, STYLE CDR13 AND CDR14 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
300	110			CDR1ΣB+111D*#S	CDR1ΣB+111D*#@
	120			CDR1ΣB+121D*#S	CDR1ΣB+121D*#@
	130			CDR1ΣB+131D*#S	CDR1ΣB+131D*#@
	150			CDR1ΣB+151D*#S	CDR1ΣB+151D*#@
	160			CDR1ΣB+161D*#S	CDR1ΣB+161D*#@
	180			CDR1ΣB+181D*#S	CDR1ΣB+181D*#@
200	200			CDR1ΣB+201D*#S	CDR1ΣB+201D*#@
	220			CDR1ΣB+221C*#S	CDR1ΣB+221C*#@
	240			CDR1ΣB+241C*#S	CDR1ΣB+241C*#@
	270			CDR1ΣB+271C*#S	CDR1ΣB+271C*#@
	300			CDR1ΣB+301C*#S	CDR1ΣB+301C*#@
	330			CDR1ΣB+331C*#S	CDR1ΣB+331C*#@
200	360	F, G, J, K, M	BG, BP	CDR1ΣB+361C*#S	CDR1ΣB+361C*#@
	390			CDR1ΣB+391C*#S	CDR1ΣB+391C*#@
	430			CDR1ΣB+431C*#S	CDR1ΣB+431C*#@
	470			CDR1ΣB+471C*#S	CDR1ΣB+471C*#@
	510			CDR1ΣB+511B*#S	CDR1ΣB+511B*#@
	560			CDR1ΣB+561B*#S	CDR1ΣB+561B*#@
100	620			CDR1ΣB+621B*#S	CDR1ΣB+621B*#@
	680			CDR1ΣB+681A*#S	CDR1ΣB+681A*#@
	750			CDR1ΣB+751A*#S	CDR1ΣB+751A*#@
	820			CDR1ΣB+821A*#S	CDR1ΣB+821A*#@
	910			CDR1ΣB+911A*#S	CDR1ΣB+911A*#@
	1,000			CDR1ΣB+102A*#S	CDR1ΣB+102A*#@

Σ = choice of styles.  
+ = choice of voltage temperature limits.  
\* = choice of tolerances.  
# = choice of termination finish (CDR 13 available with M and N; CDR 14 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

**MIL-C-55681/4, STYLE CDR13 AND CDR14 CHIP CAPACITORS  
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability (Continued)**

Rated Voltage (Vdc)	Capacitance		Rated Temperature and Voltage Temperature Limits	Part Number	
	Nominal Value (pF)	Tolerances Available		Grade 1 FRL = S	Grade 2 FRL = P or R
50	1,100		BP	CDR1ΣBP112A*#S	CDR1ΣBP112A*#@
	1,200			CDR1ΣBP122A*#S	CDR1ΣBP122A*#@
	1,300			CDR1ΣBP132A*#S	CDR1ΣBP132A*#@
	1,500			CDR1ΣBP152A*#S	CDR1ΣBP152A*#@
	1,600	F, G, J, K, M		CDR1ΣBP162A*#S	CDR1ΣBP162A*#@
	1,800			CDR1ΣBP182A*#S	CDR1ΣBP182A*#@
	2,000			CDR1ΣBP202A*#S	CDR1ΣBP202A*#@
	2,200			CDR1ΣBP222A*#S	CDR1ΣBP222A*#@
	2,400			CDR1ΣBP242A*#S	CDR1ΣBP242A*#@
	2,700			CDR1ΣBP272A*#S	CDR1ΣBP272A*#@
	3,000			CDR1ΣBP302A*#S	CDR1ΣBP302A*#@
	3,300			CDR1ΣBP332A*#S	CDR1ΣBP332A*#@
	3,600			CDR1ΣBP362A*#S	CDR1ΣBP362A*#@
	3,900			CDR1ΣBP392A*#S	CDR1ΣBP392A*#@
4,300		CDR1ΣBP432A*#S	CDR1ΣBP432A*#@		
4,700		CDR1ΣBP472A*#S	CDR1ΣBP472A*#@		
5,000		CDR1ΣBP502A*#S	CDR1ΣBP502A*#@		
5,100		CDR1ΣBP512A*#S	CDR1ΣBP512A*#@		

Σ = choice of styles.  
+ = choice of voltage temperature limits.  
\* = choice of tolerances.  
# = choice of termination finish (CDR 13 available with M and N; CDR 14 available with S, U and W).  
@ = P or R, allowable Failure Rate Levels (FRL).

## MIL-C-83421, CAPACITORS Fixed, Metallized Plastic Film Dielectric, Hermetically Sealed, Established Reliability

Part Number	XX	-X	XXX	X
M83421				
M83421 - Identifies CRH established reliability, fixed, metallized plastic film dielectric capacitors that are hermetically sealed in metal cases and that conform to MIL-C-83421	/XX - Identifies the appropriate specification sheet that uniquely specifies the capacitor family	-X - Specifies the capacitor style 1 = CRH01 2 = CRH02 3 = CRH03 4 = CRH04 5 = CRH05	XXX - Uniquely specifies the capacitance value, capacitance tolerance, ac ratings, and physical dimensions of the capacitor	Failure Rate Level: R = 0.01 S = 0.001 (%/1000 hrs)

Part Number	Control Specification	Style (1)	Capacitance		Rated Voltage @ 100°C (Vdc)	Dissipation Factor (% max)	Dielectric Absorption (% max)	Operating Temperature Range (°C)	FRL	
			Range (µF)	Tolerance (±%)					Grade	Grade
M83421/01-XXXXXX (2) (3)	MIL-C-83421/1	CRH01	0.001-22.0		30				1	2
		CRH02	0.001-10.0		50					
		CRH03	0.001-10.0	1, 5, 10	100	0.15	0.1	-65 to +100	S	R
		CRH04	0.001- 3.9		200					
		CRH05	0.001- 2.0		400					

- (1) Lead material and coating are specified in MIL-C-83421/1. For welding applications, consult the project parts engineer for recommendations.
- (2) This capacitor is not approved for use in circuits where the energy is less than 250 microjoules. Reference MIL-HDBK-978, Vol. 1, 2.4.2.
- (3) Parts covered by this specification contain internal soldered connections which may reflow during installation. The plastic dielectric in these parts is also temperature sensitive. Special precautions such as heat sinking are recommended when soldering onto boards.

**MIL-C-83421/1, STYLE CRH01 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability**

Rated Voltage @ 100°C (Volts, dc)		Part Number M83421/01-											
		ac Ratings for Sinusoidal Operation, From -65°C to +100°C						Grade 1 FRL = S			Grade 2 FRL = R		
		0 to 0.4 kHz		@ 4 kHz		@ 40 kHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0		
30	.001			.001			.006	1003S	1005S	1006S	1003R	1005R	1006R
	.0012			.001			.007	1009S	1011S	1012S	1009R	1011R	1012R
	.0015			.001			.008	1015S	1017S	1018S	1015R	1017R	1018R
	.0018			.001			.010	1021S	1023S	1024S	1021R	1023R	1024R
	.002			.001			.011	1027S	1029S	1030S	1027R	1029R	1030R
	.0022			.001			.012	1033S	1035S	1036S	1033R	1035R	1036R
	.0027			.002			.015	1039S	1041S	1042S	1039R	1041R	1042R
	.0033			.002			.018	1045S	1047S	1048S	1045R	1047R	1048R
	.0039			.002			.021	1051S	1053S	1054S	1051R	1053R	1054R
	.0047		22.0	.003		22.0	.026	1057S	1059S	1060S	1057R	1059R	1060R
	.005			.003			.028	1063S	1065S	1066S	1063R	1065R	1066R
	.0056			.003			.031	1069S	1071S	1072S	1069R	1071R	1072R
.0068			.004			.037	1075S	1077S	1078S	1075R	1077R	1078R	
.0082			.005			.045	1081S	1083S	1084S	1081R	1083R	1084R	
.01			.006			.055	1087S	1089S	1090S	1087R	1089R	1090R	
.012			.007			.066	1093S	1095S	1096S	1093R	1095R	1096R	
.015			.008			.082	1099S	1101S	1102S	1099R	1101R	1102R	
.018			.010			.10	1105S	1107S	1108S	1105R	1107R	1108R	
.02			.011			.11	1111S	1113S	1114S	1111R	1113R	1114R	
.022			.012			.12	1117S	1119S	1120S	1117R	1119R	1120R	

**MIL-C-83421/1, STYLE CRH01 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)		Nominal Capacitance Value (μF)		ac Ratings for Sinusoidal Operation, From -65°C to +100°C												Part Number M83421/01-					
				0 to 0.4 kHz						@40 kHz						Grade 1 FRL = S			Grade 2 FRL = R		
				Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
30	.027	.001	.015		.15								1123S	1125S	1126S	1123R	1125R	1126R			
	.033	.002	.018		.18								1129S	1131S	1132S	1129R	1131R	1132R			
	.039	.002	.021		.22								1135S	1137S	1138S	1135R	1137R	1138R			
	.047	.003	.026		.26								1141S	1143S	1144S	1141R	1143R	1144R			
	.05	.003	.028		.28								1147S	1149S	1150S	1147R	1149R	1150R			
	.056	.003	.031		.31	22.0							1153S	1155S	1156S	1153R	1155R	1156R			
	.068	.004	.037		.37								1159S	1161S	1162S	1159R	1161R	1162R			
	.082	.005	.045		.45								1165S	1167S	1168S	1165R	1167R	1168R			
	.1	.006	.055	22.0	.55								1171S	1173S	1174S	1171R	1173R	1174R			
	.12	.007	.066		.66								1177S	1179S	1180S	1177R	1179R	1180R			
	.15	.008	.082		.83								1183S	1185S	1186S	1183R	1185R	1186R			
	.18	.010	.100		1.00								1375S	1377S	1378S	1375R	1377R	1378R			
	.20	.011	.11		1.00	20.0							1189S	1191S	1192S	1189R	1191R	1192R			
	.22	.012	.12		1.02	18.5							1195S	1197S	1198S	1195R	1197R	1198R			
	.27	.015	.15		1.15	17.0							1201S	1203S	1204S	1201R	1203R	1204R			
	.33	.018	.18		1.32	16.0							1207S	1209S	1210S	1207R	1209R	1210R			
.39	.021	.21		1.46	15.0							1213S	1215S	1216S	1213R	1215R	1216R				
.47	.026	.26		1.65	14.0							1219S	1221S	1222S	1219R	1221R	1222R				
.50	.028	.28		1.69	13.5							1225S	1227S	1228S	1225R	1227R	1228R				
.56	.031	.31		1.81	12.9							1231S	1233S	1234S	1231R	1233R	1234R				
.68	.037	.37		2.04	12.0							1237S	1239S	1240S	1237R	1239R	1240R				
.82	.045	.45		2.05	10.0							1243S	1245S	1246S	1243R	1245R	1246R				

**MIL-C-83421/1, STYLE CRH01 CAPACITORS  
Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)		Nominal Capacitance Value (µF)		ac Ratings for Sinusoidal Operation. From -65°C to +100°C								Part Number M83421/01-					
				0 to 0.4 kHz				@40 kHz				Grade 1 FRL = S			Grade 2 FRL = R		
				Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
30	1.0	.055	.55	8.4	2.10	2.10	2.10	2.10	2.10	1249S	1251S	1252S	1249R	1251R	1252R		
	1.2	.066	.66	7.2	2.15	2.15	2.15	2.15	2.15	1255S	1257S	1258S	1255R	1257R	1258R		
	1.5	.082	.83	5.8	2.17	2.17	2.17	2.17	2.17	1261S	1263S	1264S	1261R	1263R	1264R		
	1.8	.099	.99	4.8	2.17	2.17	2.17	2.17	2.17	1267S	1269S	1270S	1267R	1269R	1270R		
	2.0	.110	1.10	4.4	2.20	2.20	2.20	2.20	2.20	1273S	1275S	1276S	1273R	1275R	1276R		
	2.2	.12	1.21	4.0	2.20	2.20	2.20	2.20	2.20	1279S	1281S	1282S	1279R	1281R	1282R		
	2.7	.15	1.49	3.3	2.20	2.20	2.20	2.20	2.20	1387S	1389S	1390S	1387R	1389R	1390R		
	3.0	.17	1.65	2.9	2.20	2.20	2.20	2.20	2.20	1291S	1293S	1294S	1291R	1293R	1294R		
	3.3	.18	1.82	2.7	2.20	2.20	2.20	2.20	2.20	1297S	1299S	1300S	1297R	1299R	1300R		
	3.9	.21	2.14	2.3	2.20	2.20	2.20	2.20	2.20	1303S	1305S	1306S	1303R	1305R	1306R		
	4.7	.26	18.7	1.9	2.20	2.20	2.20	2.20	2.20	1315S	1317S	1318S	1315R	1317R	1318R		
	5.0	.28	17.6	1.8	2.20	2.20	2.20	2.20	2.20	1321S	1323S	1324S	1321R	1323R	1324R		
	5.6	.31	15.7	1.6	2.20	2.20	2.20	2.20	2.20	1327S	1329S	1330S	1327R	1329R	1330R		
	6.8	.37	13.0	1.3	2.20	2.20	2.20	2.20	2.20	1333S	1335S	1336S	1333R	1335R	1336R		
	8.0	.44	11.0	1.1	2.20	2.20	2.20	2.20	2.20	1339S	1341S	1342S	1339R	1341R	1342R		
	8.2	.45	10.7	1.1	2.20	2.20	2.20	2.20	2.20	1345S	1347S	1348S	1345R	1347R	1348R		
10.0	.55	8.8	.88	2.20	2.20	2.20	2.20	2.20	1351S	1353S	1354S	1351R	1353R	1354R			
12.0	.66	7.3	.73	2.20	2.20	2.20	2.20	2.20	1381S	1383S	1384S	1381R	1383R	1384R			
15.0	.83	5.9	.59	2.20	2.20	2.20	2.20	2.20	1357S	1359S	1360S	1357R	1359R	1360R			
20.0	1.10	4.4	.44	2.20	2.20	2.20	2.20	2.20	1363S	1365S	1366S	1363R	1365R	1366R			
22.0	1.21	4.0	.40	2.20	2.20	2.20	2.20	2.20	1369S	1371S	1372S	1369R	1371R	1372R			

**MIL-C-83421/1, STYLE CRH02 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -65°C to +100°C								Part Number M83421/01-					
		0 to 0.4 kHz		@ 4 kHz		@40 kHz		Grade 1 FRL = S			Grade 2 FRL = R				
		Volts	Amps	Volts	Amps	Volts	Amps	Volts	5.0	10.0	1.0	5.0	10.0		
50	.001		.001		.009		2003S	2005S	2006S	2003R	2005R	2006R			
	.0012		.001		.011		2009S	2011S	2012S	2009R	2011R	2012R			
	.0015		.001		.013		2015S	2017S	2018S	2015R	2017R	2018R			
	.0018		.002		.016		2021S	2023S	2024S	2021R	2023R	2024R			
	.002		.002		.018		2027S	2029S	2030S	2027R	2029R	2030R			
	.0022		.002		.020		2033S	2035S	2036S	2033R	2035R	2036R			
	.0027		.002		.024		2039S	2041S	2042S	2039R	2041R	2042R			
	.0033		.003		.030		2045S	2047S	2048S	2045R	2047R	2048R			
	.0039		.004		.035		2051S	2053S	2054S	2051R	2053R	2054R			
	.0047	.001	.004		.042		2057S	2059S	2060S	2057R	2059R	2060R			
	.005		.005		.045		2063S	2065S	2066S	2063R	2065R	2066R			
	.0056		.005		.050		2069S	2071S	2072S	2069R	2071R	2072R			
	.0068		.006		.061	36.0	2075S	2077S	2078S	2075R	2077R	2078R			
	.0082		.007		.074		2081S	2083S	2084S	2081R	2083R	2084R			
	.01		.009		.090		2087S	2089S	2090S	2087R	2089R	2090R			
	.012		.011		.11		2093S	2095S	2096S	2093R	2095R	2096R			
.015	36.0	.013	36.0	.14		2099S	2101S	2102S	2099R	2101R	2102R				
.018		.016		.16		2105S	2107S	2108S	2105R	2107R	2108R				
.02		.018		.18		2111S	2113S	2114S	2111R	2113R	2114R				
.022		.020		.20		2117S	2119S	2120S	2117R	2119R	2120R				
.027		.024		.24		2123S	2125S	2126S	2123R	2125R	2126R				
.033		.030		.30		2129S	2131S	2132S	2129R	2131R	2132R				
.039		.035		.35		2135S	2137S	2138S	2135R	2137R	2138R				
.047		.042		.42		2141S	2143S	2144S	2141R	2143R	2144R				
.05		.045	36.0	.45	36.0	2147S	2149S	2150S	2147R	2149R	2150R				
.056		.050		.50	36.0	2153S	2155S	2156S	2153R	2155R	2156R				
.068		.061		.58	34.0	2159S	2161S	2162S	2159R	2161R	2162R				
.082		.074		.66	32.0	2165S	2167S	2168S	2165R	2167R	2168R				

**MIL-C-83421/1, STYLE CRH02 CAPACITORS  
Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -65°C to +100°C										Part Number M83421/01-		
		0 to 0.4 kHz		@ 4 kHz		@ 40 kHz		Grade 1 FRL = S			Grade 2 FRL = R			
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0	
								Capacitance Tolerance (±%)						
50	.1	.009	.090	30.0	.75	2171S	2173S	2174S	2171R	2173R	2174R			
	.12	.011	.11	30.0	.90	2177S	2179S	2180S	2177R	2179R	2180R			
	.15	.013	.14	26.0	.98	2183S	2185S	2186S	2183R	2185R	2186R			
	.18	.016	.16	25.0	1.13	2189S	2191S	2192S	2189R	2191R	2192R			
	.20	.018	.18	24.0	1.20	2195S	2197S	2198S	2195R	2197R	2198R			
	.22	.020	.20	23.0	1.27	2201S	2203S	2204S	2201R	2203R	2204R			
	.27	.024	.24	19.0	1.28	2207S	2209S	2210S	2207R	2209R	2210R			
	.33	.030	.30	18.0	1.48	2213S	2215S	2216S	2213R	2215R	2216R			
	.39	.035	.35	17.0	1.66	2219S	2221S	2222S	2219R	2221R	2222R			
	.47	.042	.42	15.7	1.85	2225S	2227S	2228S	2225R	2227R	2228R			
	.50	.045	.45	15.2	1.90	2231S	2233S	2234S	2231R	2233R	2234R			
	.56	.050	.50	14.4	2.01	2237S	2239S	2240S	2237R	2239R	2240R			
	.68	.061	.61	14.0	2.38	2243S	2245S	2246S	2243R	2245R	2246R			
	.82	.074	.74	12.0	2.46	2249S	2251S	2252S	2249R	2251R	2252R			
	1.0	.090	.90	10.0	2.50	2255S	2257S	2258S	2255R	2257R	2258R			
	1.2	.11	1.08	9.1	2.73	2261S	2263S	2264S	2261R	2263R	2264R			
	1.5	.14	1.35	7.7	2.90	2267S	2269S	2270S	2267R	2269R	2270R			
	1.8	.16	1.62	6.6	3.00	2273S	2275S	2276S	2273R	2275R	2276R			
	2.0	.18	1.80	6.2	3.10	2279S	2281S	2282S	2279R	2281R	2282R			
	2.2	.20	1.98	5.8	3.20	2285S	2287S	2288S	2285R	2287R	2288R			
2.7	.24	2.43	5.0	3.34	2291S	2293S	2294S	2291R	2293R	2294R				
3.0	.27	2.70	4.5	3.40	2297S	2299S	2300S	2297R	2299R	2300R				
3.3	.30	2.97	4.2	3.50	2303S	2305S	2306S	2303R	2305R	2306R				
3.9	.35	3.51	3.7	3.60	2309S	2311S	2312S	2309R	2311R	2312R				
4.7	.42		3.1		2321S	2323S	2324S	2321R	2323R	2324R				
5.0	.45		2.9		2327S	2329S	2330S	2327R	2329R	2330R				
5.6	.50		2.6		2333S	2335S	2336S	2333R	2335R	2336R				
6.8	.61	3.60	2.1	3.60	2339S	2341S	2342S	2339R	2341R	2342R				
8.0	.72		1.8		2345S	2347S	2348S	2345R	2347R	2348R				
8.2	.74		1.8		2351S	2353S	2354S	2351R	2353R	2354R				
10.0	.90		1.4		2357S	2359S	2360S	2357R	2359R	2360R				

**MIL-C-83421/1, STYLE CRH03 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -65°C to +100°C								Part Number M83421/01-					
		0 to 0.4 kHz		@ 4 kHz		@40 kHz		Grade 1 FRL = S			Grade 2 FRL = R				
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0		
100	.001		.002		.015				3003S	3005S	3006S	3003R	3005R	3006R	
	.0012		.002		.018				3009S	3011S	3012S	3009R	3011R	3012R	
	.0015		.002		.022				3015S	3017S	3018S	3015R	3017R	3018R	
	.0018		.003		.027				3021S	3023S	3024S	3021R	3023R	3024R	
	.002		.003		.030				3027S	3029S	3030S	3027R	3029R	3030R	
	.0022		.003	60.0	.033				3033S	3035S	3036S	3033R	3035R	3036R	
	.0027	.001	.004		.041				3039S	3041S	3042S	3039R	3041R	3042R	
	.0033		.005		.050				3045S	3047S	3048S	3045R	3047R	3048R	
	.0039		.006		.058				3051S	3053S	3054S	3051R	3053R	3054R	
	.0047		.007		.071				3057S	3059S	3060S	3057R	3059R	3060R	
	.005		.008		.075				3063S	3065S	3066S	3063R	3065R	3066R	
	.0056		.008		.084				3069S	3071S	3072S	3069R	3071R	3072R	
	.0068		.010		.10				3075S	3077S	3078S	3075R	3077R	3078R	
	.0082		.012	60.0	.12				3081S	3083S	3084S	3081R	3083R	3084R	
	.01		.015		.15				3087S	3089S	3090S	3087R	3089R	3090R	
	.012		.018		.18				3093S	3095S	3096S	3093R	3095R	3096R	
.015		.022		.22				3099S	3101S	3102S	3099R	3101R	3102R		
.018		.027		.26				3105S	3107S	3108S	3105R	3107R	3108R		
.02		.030		.28				3111S	3113S	3114S	3111R	3113R	3114R		
.022		.033		.29				3117S	3119S	3120S	3117R	3119R	3120R		
.027		.041		.34				3123S	3125S	3126S	3123R	3125R	3126R		
.033		.050		.41				3129S	3131S	3132S	3129R	3131R	3132R		
.039		.059		.47				3135S	3137S	3138S	3135R	3137R	3138R		
.047		.070		.55				3141S	3143S	3144S	3141R	3143R	3144R		
.050		.075		.58				3147S	3149S	3150S	3147R	3149R	3150R		
.056		.084		.64				3153S	3155S	3156S	3153R	3155R	3156R		
.068		.10		.71				3159S	3161S	3162S	3159R	3161R	3162R		
.082		.12		.78				3165S	3167S	3168S	3165R	3167R	3168R		
.10		.15		.90				3171S	3173S	3174S	3171R	3173R	3174R		
.12		.18		1.05				3177S	3179S	3180S	3177R	3179R	3180R		
.15		.23		1.24				3183S	3185S	3186S	3183R	3185R	3186R		
.18		.27		1.40				3189S	3191S	3192S	3189R	3191R	3192R		

**MIL-C-83421/1, STYLE CRH03 CAPACITORS  
Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -55°C to +100°C						Part Number M83421/01-					
		0 to 0.4 kHz		@ 4 kHz		@40 kHz		Grade 1 FRL = S			Grade 2 FRL = R		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
100	.20		.030		30.0	1.50		3195S	3197S	3198S	3195R	3197R	3198R
	.22		.033		27.0	1.50		3201S	3203S	3204S	3201R	3203R	3204R
	.27		.041		24.0	1.62		3207S	3209S	3210S	3207R	3209R	3210R
	.33		.050		23.0	1.90		3213S	3215S	3216S	3213R	3215R	3216R
	.39		.058		22.0	2.15		3219S	3221S	3222S	3219R	3221R	3222R
	.47		.071	60.0	21.0	2.47		3225S	3227S	3228S	3225R	3227R	3228R
	.5		.075		20.0	2.50		3231S	3233S	3234S	3231R	3233R	3234R
	.56		.084		19.0	2.64		3237S	3239S	3240S	3237R	3239R	3240R
	.68		.10		16.0	2.72		3243S	3245S	3246S	3243R	3245R	3246R
	.82		.12		14.0	2.87		3249S	3251S	3252S	3249R	3251R	3252R
	1.00		.15	60.0	12.0	3.00		3255S	3257S	3258S	3255R	3257R	3258R
	1.20		.18		11.0	3.25		3261S	3263S	3264S	3261R	3263R	3264R
	1.50		.23		10.0	3.75		3267S	3269S	3270S	3267R	3269R	3270R
	2.0		.30		8.1	4.10		3273S	3275S	3276S	3273R	3275R	3276R
	2.2		.33		7.5	4.12		3279S	3281S	3282S	3279R	3281R	3282R
	2.7		.41		6.5	4.40		3285S	3287S	3288S	3285R	3287R	3288R
	3.0		.45		6.0	4.51		3291S	3293S	3294S	3291R	3293R	3294R
	3.3		.50		5.5	4.55		3297S	3299S	3300S	3297R	3299R	3300R
3.9		.59		4.90	4.90		3303S	3305S	3306S	3303R	3305R	3306R	
4.7		.71		4.30	5.00		3315S	3317S	3318S	3315R	3317R	3318R	
5.0		.75		4.00			3321S	3323S	3324S	3321R	3323R	3324R	
5.6		.84		3.60			3327S	3329S	3330S	3327R	3329R	3330R	
6.8		1.02	5.00	2.90	5.00	5.00	3333S	3335S	3336S	3333R	3335R	3336R	
8.0		1.20		2.50			3339S	3341S	3342S	3339R	3341R	3342R	
8.2		1.23		2.40		2.4	3345S	3347S	3348S	3345R	3347R	3348R	
10.0		1.50		2.00		2.0	3351S	3353S	3354S	3351R	3353R	3354R	

**MIL-C-83421/1, STYLE CRH04 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability**

Rated Voltage @ 100°C (Volts, dc)		Nominal Capacitance Value (µF)		ac Ratings for Sinusoidal Operation, From -65°C to +100°C						Grade 1 FRL = S			Grade 2 FRL = R		
				0 to 0.4 kHz		@ 4 kHz		@ 40 kHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
				Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
200	.001		.003		.020			4003S	4005S	4006S	4003R	4005R	4006R		
	.0012		.004		.024			4009S	4011S	4012S	4009R	4011R	4012R		
	.0015		.004		.030			4015S	4017S	4018S	4015R	4017R	4018R		
	.0018		.005	.001	.036			4021S	4023S	4024S	4021R	4023R	4024R		
	.002		.006		.040			4027S	4029S	4030S	4027R	4029R	4030R		
	.0022		.007		.044	80.0		4033S	4035S	4036S	4033R	4035R	4036R		
	.0027		.008		.054			4039S	4041S	4042S	4039R	4041R	4042R		
	.0033		.010		.066			4045S	4047S	4048S	4045R	4047R	4048R		
	.0039		.012		.078			4051S	4053S	4054S	4051R	4053R	4054R		
	.0047		.014		.094			4057S	4059S	4060S	4057R	4059R	4060R		
	.005		.015		.10			4063S	4065S	4066S	4063R	4065R	4066R		
	.0056		.017		.11			4069S	4071S	4072S	4069R	4071R	4072R		
	.0068		.020		.14	80.0		4075S	4077S	4078S	4075R	4077R	4078R		
	.0082		.025		.16	80.0		4081S	4083S	4084S	4081R	4083R	4084R		
	.01		.030		.20	80.0	120.0	4087S	4089S	4090S	4087R	4089R	4090R		
	.012		.036		.23	78.0		4093S	4095S	4096S	4093R	4095R	4096R		
	.015		.045		.29	76.0		4099S	4101S	4102S	4099R	4101R	4102R		
	.018		.054		.33	74.0		4105S	4107S	4108S	4105R	4107R	4108R		
.02		.060		.36	71.0		4111S	4113S	4114S	4111R	4113R	4114R			
.022		.066		.37	68.0		4117S	4119S	4120S	4117R	4119R	4120R			
.027		.081		.44	65.0		4123S	4125S	4126S	4123R	4125R	4126R			
.033		.099		.51	62.0		4129S	4131S	4132S	4129R	4131R	4132R			
.039		.12		.59	60.0		4135S	4137S	4138S	4135R	4137R	4138R			
.047		.14		.67	57.0		4141S	4143S	4144S	4141R	4143R	4144R			
.050		.15		.70	56.0		4147S	4149S	4150S	4147R	4149R	4150R			
.056		.17		.78	56.0		4153S	4155S	4156S	4153R	4155R	4156R			
.068		.20		.85	50.0		4159S	4161S	4162S	4159R	4161R	4162R			
.082		.25		.90	44.0		4165S	4167S	4168S	4165R	4167R	4168R			

**MIL-C-83421/1, STYLE CRH04 CAPACITORS  
Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -65°C to +100°C										Part Number M83421/01-					
		0 to 0.4 kHz					@ 4 kHz					Grade 1 FRL = S			Grade 2 FRL = R		
		Volts		Amps		Volts	Amps		Volts		Amps		Capacitance Tolerance (±%)		Capacitance Tolerance (±%)		
		0 to 0.4 kHz		@ 4 kHz			@ 40 kHz		1.0		5.0		10.0		1.0		5.0
200	.10			.030								4171S	4173S	4174S	4171R	4173R	4174R
	.12			.036								4177S	4179S	4180S	4177R	4179R	4180R
	.15			.045								4183S	4185S	4186S	4183R	4185R	4186R
	.18			.054								4189S	4191S	4192S	4189R	4191R	4192R
	.20			.060								4195S	4197S	4198S	4195R	4197R	4198R
	.22			.066								4201S	4203S	4204S	4201R	4203R	4204R
	.27			.081								4207S	4209S	4210S	4207R	4209R	4210R
	.33			.099								4213S	4215S	4216S	4213R	4215R	4216R
	.39			.12		120.0						4219S	4221S	4222S	4219R	4221R	4222R
	.47			.14								4225S	4227S	4228S	4225R	4227R	4228R
	.5			.15								4231S	4233S	4234S	4231R	4233R	4234R
	.56			.17								4237S	4239S	4240S	4237R	4239R	4240R
	.68			.20								4243S	4245S	4246S	4243R	4245R	4246R
	.82			.25								4249S	4251S	4252S	4249R	4251R	4252R
	1.0			.30								4255S	4257S	4258S	4255R	4257R	4258R
	1.2			.36								4261S	4263S	4264S	4261R	4263R	4264R
	1.5			.45		120.0						4267S	4269S	4270S	4267R	4269R	4270R
	1.8			.54		110.0						4273S	4275S	4276S	4273R	4275R	4276R
2.0			.60		100.0						4279S	4281S	4282S	4279R	4281R	4282R	
2.2			.66		90.5						4285S	4287S	4288S	4285R	4287R	4288R	
2.5			.75		80.0						4291S	4293S	4294S	4291R	4293R	4294R	
2.7			.81		77.0						4297S	4299S	4300S	4297R	4299R	4300R	
3.0			.90		70.0						4303S	4305S	4306S	4303R	4305R	4306R	
3.3			.99		65.0						4309S	4311S	4312S	4309R	4311R	4312R	
3.9			1.20		55.0						4315S	4317S	4318S	4315R	4317R	4318R	

**MIL-C-83421/1, STYLE CRH05 CAPACITORS**  
**Fixed, Metallized Plastic Film Dielectric, Established Reliability**

Rated Voltage @ 100°C (Volts, dc)	Nominal Capacitance Value (µF)	ac Ratings for Sinusoidal Operation, From -65°C to +100°C												Part Number M83421/01-					
		0 to 0.4 kHz						@ 4 kHz						Grade 1 FRL = S			Grade 2 FRL = R		
		Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
400	.001	.001	.006										5003S	5005S	5006S	5003R	5005R	5006R	
	.0012	.001	.007										5009S	5011S	5012S	5009R	5011R	5012R	
	.0015	.001	.009										5015S	5017S	5018S	5015R	5017R	5018R	
	.0018	.001	.011										5021S	5023S	5024S	5021R	5023R	5024R	
	.002	.001	.012										5027S	5029S	5030S	5027R	5029R	5030R	
	.0022	.001	.013										5033S	5035S	5036S	5033R	5035R	5036R	
	.0027	.002	.016										5039S	5041S	5042S	5039R	5041R	5042R	
	.0033	.002	.020			100.0							5045S	5047S	5048S	5045R	5047R	5048R	
	.0039	.002	.023										5051S	5053S	5054S	5051R	5053R	5054R	
	.0047	.003	.028										5057S	5059S	5060S	5057R	5059R	5060R	
	.005	.003	.030										5063S	5065S	5066S	5063R	5065R	5066R	
	.0056	.003	.034										5069S	5071S	5072S	5069R	5071R	5072R	
	.0068	.004	.041	240.0									5075S	5077S	5078S	5075R	5077R	5078R	
	.0082	.005	.049										5081S	5083S	5084S	5081R	5083R	5084R	
	.01	.006	.060										5087S	5089S	5090S	5087R	5089R	5090R	
	.012	.007	.072										5093S	5095S	5096S	5093R	5095R	5096R	
.015	.009	.090			94.0							5099S	5101S	5102S	5099R	5101R	5102R		
.018	.011	.11			90.0							5105S	5107S	5108S	5105R	5107R	5108R		
.02	.012	.12			88.0							5273S	5275S	5276S	5273R	5275R	5276R		
.022	.013	.13			85.0							5111S	5113S	5114S	5111R	5113R	5114R		
.027	.016	.16			81.0							5117S	5119S	5120S	5117R	5119R	5120R		
.033	.020	.20			78.0							5123S	5125S	5126S	5123R	5125R	5126R		
.039	.023	.23			75.0							5129S	5131S	5132S	5129R	5131R	5132R		
.047	.028	.28			71.0							5135S	5137S	5138S	5135R	5137R	5138R		
.05	.030	.30			70.0							5141S	5143S	5144S	5141R	5143R	5144R		
.056	.034	.34			67.5							5147S	5149S	5150S	5147R	5149R	5150R		
.068	.041	.41			60.0							5153S	5155S	5156S	5153R	5155R	5156R		
.082	.049	.49			50.0							5159S	5161S	5162S	5159R	5161R	5162R		

**MIL-C-83421/1, STYLE CRH05 CAPACITORS  
Fixed, Metallized Plastic Film Dielectric, Established Reliability (Continued)**

Rated Voltage @ 100°C (Volts, dc)		Nominal Capacitance Value (µF)		ac Ratings for Sinusoidal Operation, From -65°C to +100°C										Part Number M83421/01-					
				0 to 0.4 kHz		@ 4 kHz		@40 kHz		Grade 1 FRL = S			Grade 2 FRL = R						
				Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0		
400	.10	.060	.60	46.0	1.20	5165S	5167S	5168S	5165R	5167R	5168R	5165R	5167R	5168R					
	.12	.072	.72	44.5	1.34	5171S	5173S	5174S	5171R	5173R	5174R	5171R	5173R	5174R					
	.15	.090	.83	40.0	1.50	5177S	5179S	5180S	5177R	5179R	5180R	5177R	5179R	5180R					
	.18	.11	.95	38.0	1.70	5279S	5281S	5282S	5279R	5281R	5282R	5279R	5281R	5282R					
	.20	.12	1.03	37.0	1.85	5183S	5185S	5186S	5183R	5185R	5186R	5183R	5185R	5186R					
	.22	.13	1.10	35.0	1.93	5189S	5191S	5192S	5189R	5191R	5192R	5189R	5191R	5192R					
	.27	.16	1.21	33.0	2.24	5195S	5197S	5198S	5195R	5197R	5198R	5195R	5197R	5198R					
	.33	.20	1.32	32.0	2.65	5201S	5203S	5204S	5201R	5203R	5204R	5201R	5203R	5204R					
	.39	.23	1.48	32.0	3.14	5207S	5209S	5210S	5207R	5209R	5210R	5207R	5209R	5210R					
	.47	.28	1.68	31.0	3.64	5213S	5215S	5216S	5213R	5215R	5216R	5213R	5215R	5216R					
	.5	.30	1.75	30.0	3.75	5219S	5221S	5222S	5219R	5221R	5222R	5219R	5221R	5222R					
	.56	.34	1.92	29.0	4.05	5225S	5227S	5228S	5225R	5227R	5228R	5225R	5227R	5228R					
	.68	.41	2.26	26.0	4.50	5231S	5233S	5234S	5231R	5233R	5234R	5231R	5233R	5234R					
	.82	.49	2.63	23.4	4.80	5237S	5239S	5240S	5237R	5239R	5240R	5237R	5239R	5240R					
	1.0	.60	3.00	20.8	5.20	5243S	5245S	5246S	5243R	5245R	5246R	5243R	5245R	5246R					
	1.2	.72	3.48	18.3	5.50	5249S	5251S	5252S	5249R	5251R	5252R	5249R	5251R	5252R					
	1.5	.90	4.14	16.0	6.00	5255S	5257S	5258S	5255R	5257R	5258R	5255R	5257R	5258R					
	1.8	1.08	4.69	15.0	6.80	5261S	5263S	5264S	5261R	5263R	5264R	5261R	5263R	5264R					
2.0	1.20	5.00	14.0	7.00	5267S	5269S	5270S	5267R	5269R	5270R	5267R	5269R	5270R						

**MIL-C-87217, CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, Direct Current for Low Energy, High Impedance Applications,**  
**Hermetically Sealed in Metal Cases, High Reliability**

Part Number Explanation:

M87217	/01	-X	XXX	X
M87217 - Identifies CHS established reliability, fixed, supermetallized plastic film dielectric capacitors that are hermetically sealed in metal cases and that conform to MIL-C-87217	/01 - Identifies the appropriate specification sheet that uniquely specifies the capacitor family	-X - Specifies the capacitor style and rated voltage 1 = CHS01, 30V 2 = CHS02, 50V 3 = CHS03, 100V	XXX - Nonsignificant dash number from Table I, MIL-C-87217/1	X - Single Letter X = A - Sleeved X = B - Unsleeved

Part Number	Control Specification	Style (1)	Capacitance		Rated Voltage @ +100°C (Vdc)	Operating Temperature Range (°C)
			Range (µF)	Tolerances (±%)		
M87217/01-XXXXXX (1) (2) (3)	MIL-C-87217/1	CHS01 CHS02 CHS03	0.001 - 10.0	0.25, 0.5, 1.0, 2.0, 5.0, 10.0	30 50 100	-55 to +100

- (1) To ensure clearing of breakdown, the circuit in which capacitors of 0.1µF and greater capacitance are intended for use, shall be capable of providing at least 100 microjoules of energy.
- (2) These parts may be used in Grade 1 and Grade 2 applications.
- (3) Parts covered by this specification contain internal soldered connections which may reflow during installation. The plastic dielectric in these parts is also temperature sensitive. Special precautions such as heat sinking are recommended when soldering onto boards.

**MIL-C-87217/1, STYLE CHS01 CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, DC**  
**Low Energy, High Impedance, High Reliability**

Rated Voltage @ +100°C (Volts, dc)	Nominal Capacitance Value (μF)	Part Number M87217/01-										(1)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		Capacitance tolerance value (in %)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		±0.25	±0.5	±1.0	±2.0	±5.0	±10.0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	0.001	1001*	1002*	1003*	1004*	1005*	1006*	1007*	1008*	1009*	1010*	1011*	1012*	1013*	1014*	1015*	1016*	1017*	1018*	1019*	1020*	1021*	1022*	1023*	1024*	1025*	1026*	1027*	1028*	1029*	1030*	1031*	1032*	1033*	1034*	1035*	1036*	1037*	1038*	1039*	1040*	1041*	1042*	1043*	1044*	1045*	1046*	1047*	1048*	1049*	1050*	1051*	1052*	1053*	1054*	1055*	1056*	1057*	1058*	1059*	1060*	1061*	1062*	1063*	1064*	1065*	1066*	1067*	1068*	1069*	1070*	1071*	1072*	1073*	1074*	1075*	1076*	1077*	1078*	1079*	1080*	1081*	1082*	1083*	1084*	1085*	1086*	1087*	1088*	1089*	1090*	1091*	1092*	1093*	1094*	1095*	1096*	1097*	1098*	1099*	1100*	1101*	1102*	1103*	1104*	1105*	1106*	1107*	1108*	1109*	1110*	1111*	1112*	1113*	1114*	1115*	1116*	1117*	1118*	1119*	1120*	1121*	1122*	1123*	1124*	1125*	1126*	1127*	1128*	1129*	1130*	1131*	1132*	1133*	1134*	1135*	1136*	1137*	1138*	1139*	1140*	1141*	1142*	1143*	1144*	1145*	1146*	1147*	1148*	1149*	1150*	1151*	1152*	1153*	1154*	1155*	1156*	1157*	1158*	1159*	1160*	1161*	1162*	1163*	1164*	1165*	1166*	1167*	1168*	1169*	1170*	1171*	1172*	1173*	1174*	1175*	1176*	1177*	1178*	1179*	1180*	1181*	1182*	1183*	1184*	1185*	1186*	1187*	1188*	1189*	1190*	1191*	1192*	1193*	1194*	1195*	1196*	1197*	1198*	1199*	1200*	1201*	1202*	1203*	1204*	1205*	1206*	1207*	1208*	1209*	1210*	1211*	1212*	1213*	1214*	1215*	1216*	1217*	1218*	1219*	1220*	1221*	1222*	1223*	1224*	1225*	1226*	1227*	1228*	1229*	1230*	1231*	1232*	1233*	1234*	1235*	1236*	1237*	1238*	1239*	1240*	1241*	1242*	1243*	1244*	1245*	1246*	1247*	1248*	1249*	1250*	1251*	1252*	1253*	1254*	1255*	1256*	1257*	1258*	1259*	1260*	1261*	1262*	1263*	1264*	1265*	1266*	1267*	1268*	1269*	1270*	1271*	1272*	1273*	1274*	1275*	1276*	1277*	1278*	1279*	1280*	1281*	1282*	1283*	1284*	1285*	1286*	1287*	1288*	1289*	1290*	1291*	1292*	1293*	1294*	1295*	1296*	1297*	1298*	1299*	1300*	1301*	1302*	1303*	1304*	1305*	1306*	1307*	1308*	1309*	1310*	1311*	1312*	1313*	1314*	1315*	1316*	1317*	1318*	1319*	1320*	1321*	1322*	1323*	1324*	1325*	1326*	1327*	1328*	1329*	1330*	1331*	1332*	1333*	1334*	1335*	1336*	1337*	1338*	1339*	1340*	1341*	1342*	1343*	1344*	1345*	1346*	1347*	1348*	1349*	1350*	1351*	1352*	1353*	1354*	1355*	1356*	1357*	1358*	1359*	1360*	1361*	1362*	1363*	1364*	1365*	1366*	1367*	1368*	1369*	1370*	1371*	1372*	1373*	1374*	1375*	1376*	1377*	1378*	1379*	1380*	1381*	1382*	1383*	1384*	1385*	1386*	1387*	1388*	1389*	1390*	1391*	1392*	1393*	1394*	1395*	1396*	1397*	1398*	1399*	1400*	1401*	1402*	1403*	1404*	1405*	1406*	1407*	1408*	1409*	1410*	1411*	1412*	1413*	1414*	1415*	1416*	1417*	1418*	1419*	1420*	1421*	1422*	1423*	1424*	1425*	1426*	1427*	1428*	1429*	1430*	1431*	1432*	1433*	1434*	1435*	1436*	1437*	1438*	1439*	1440*	1441*	1442*	1443*	1444*	1445*	1446*	1447*	1448*	1449*	1450*	1451*	1452*	1453*	1454*	1455*	1456*	1457*	1458*	1459*	1460*	1461*	1462*	1463*	1464*	1465*	1466*	1467*	1468*	1469*	1470*	1471*	1472*	1473*	1474*	1475*	1476*	1477*	1478*	1479*	1480*	1481*	1482*	1483*	1484*	1485*	1486*	1487*	1488*	1489*	1490*	1491*	1492*	1493*	1494*	1495*	1496*	1497*	1498*	1499*	1500*	1501*	1502*	1503*	1504*	1505*	1506*	1507*	1508*	1509*	1510*	1511*	1512*	1513*	1514*	1515*	1516*	1517*	1518*	1519*	1520*	1521*	1522*	1523*	1524*	1525*	1526*	1527*	1528*	1529*	1530*	1531*	1532*	1533*	1534*	1535*	1536*	1537*	1538*	1539*	1540*	1541*	1542*	1543*	1544*	1545*	1546*	1547*	1548*	1549*	1550*	1551*	1552*	1553*	1554*	1555*	1556*	1557*	1558*	1559*	1560*	1561*	1562*	1563*	1564*	1565*	1566*	1567*	1568*	1569*	1570*	1571*	1572*	1573*	1574*	1575*	1576*	1577*	1578*	1579*	1580*	1581*	1582*	1583*	1584*	1585*	1586*	1587*	1588*	1589*	1590*	1591*	1592*	1593*	1594*	1595*	1596*	1597*	1598*	1599*	1600*	1601*	1602*	1603*	1604*	1605*	1606*	1607*	1608*	1609*	1610*	1611*	1612*	1613*	1614*	1615*	1616*	1617*	1618*	1619*	1620*	1621*	1622*	1623*	1624*	1625*	1626*	1627*	1628*	1629*	1630*	1631*	1632*	1633*	1634*	1635*	1636*	1637*	1638*	1639*	1640*	1641*	1642*	1643*	1644*	1645*	1646*	1647*	1648*	1649*	1650*	1651*	1652*	1653*	1654*	1655*	1656*	1657*	1658*	1659*	1660*	1661*	1662*	1663*	1664*	1665*	1666*	1667*	1668*	1669*	1670*	1671*	1672*	1673*	1674*	1675*	1676*	1677*	1678*	1679*	1680*	1681*	1682*	1683*	1684*	1685*	1686*	1687*	1688*	1689*	1690*	1691*	1692*	1693*	1694*	1695*	1696*	1697*	1698*	1699*	1700*	1701*	1702*	1703*	1704*	1705*	1706*	1707*	1708*	1709*	1710*	1711*	1712*	1713*	1714*	1715*	1716*	1717*	1718*	1719*	1720*	1721*	1722*	1723*	1724*	1725*	1726*	1727*	1728*	1729*	1730*	1731*	1732*	1733*	1734*	1735*	1736*	1737*	1738*	1739*	1740*	1741*	1742*	1743*	1744*	1745*	1746*	1747*	1748*	1749*	1750*	1751*	1752*	1753*	1754*	1755*	1756*	1757*	1758*	1759*	1760*	1761*	1762*	1763*	1764*	1765*	1766*	1767*	1768*	1769*	1770*	1771*	1772*	1773*	1774*	1775*	1776*	1777*	1778*	1779*	1780*	1781*	1782*	1783*	1784*	1785*	1786*	1787*	1788*	1789*	1790*	1791*	1792*	1793*	1794*	1795*	1796*	1797*	1798*	1799*	1800*	1801*	1802*	1803*	1804*	1805*	1806*	1807*	1808*	1809*	1810*	1811*	1812*	1813*	1814*	1815*	1816*	1817*	1818*	1819*	1820*	1821*	1822*	1823*	1824*	1825*	1826*	1827*	1828*	1829*	1830*	1831*	1832*	1833*	1834*	1835*	1836*	1837*	1838*	1839*	1840*	1841*	1842*	1843*	1844*	1845*	1846*	1847*	1848*	1849*	1850*	1851*	1852*	1853*	1854*	1855*	1856*	1857*	1858*	1859*	1860*	1861*	1862*	1863*	1864*	1865*	1866*	1867*	1868*	1869*	1870*	1871*	1872*	1873*	1874*	1875*	1876*	1877*	1878*	1879*	1880*	1881*	1882*	1883*	1884*	1885*	1886*	1887*	1888*	1889*	1890*	1891*	1892*	1893*	1894*	1895*	1896*	1897*	1898*	1899*	1900*	1901*	1902*	1903*	1904*	1905*	1906*	1907*	1908*	1909*	1910*	1911*	1912*	1913*	1914*	1915*	1916*	1917*	1918*	1919*	1920*	1921*	1922*	1923*	1924*	1925*	1926*	1927*	1928*	1929*	1930*	1931*	1932*	1933*	1934*	1935*	1936*	1937*	1938*	1939*	1940*	1941*	1942*	1943*	1944*	1945*	1946*	1947*	1948*	1949*	1950*	1951*	1952*	1953*	1954*	1955*	1956*	1957*	1958*	1959*	1960*	1961*	1962*	1963*	1964*	1965*	1966*	1967*	1968*	1969*	1970*	1971*	1972*	1973*	1974*	1975*	1976*	1977*	1978*	1979*	1980*	1981*	1982*	1983*	1984*	1985*	1986*	1987*	1988*	1989*	1990*	1991*	1992*	1993*	1994*	1995*	1996*	1997*	1998*	1999*	2000*

\* = A for sleeved, B for unsleeved  
(1) These parts may be used in either Grade 1 or Grade 2 applications.

**MIL-C-87217/1, STYLE CHS01 CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, DC**  
**Low Energy, High Impedance, High Reliability (Continued)**

Rated Voltage @ +100°C (Volts, dc)	Nominal Capacitance Value (µF)	Part Number M87217/01- (1)						
		Capacitance tolerance value (in %)						
		±0.25	±0.5	±1.0	±2.0	±5.0	±10.0	
30	0.20	1187*	1188*	1189*	1190*	1191*	1192*	
	0.22	1193*	1194*	1195*	1196*	1197*	1198*	
	0.27	1199*	1200*	1201*	1202*	1203*	1204*	
	0.33	1205*	1206*	1207*	1208*	1209*	1210*	
	0.39	1211*	1212*	1213*	1214*	1215*	1216*	
	0.47	1217*	1218*	1219*	1220*	1221*	1222*	
	0.50	1223*	1224*	1225*	1226*	1227*	1228*	
	0.56	1229*	1230*	1231*	1232*	1233*	1234*	
	0.68	1235*	1236*	1237*	1238*	1239*	1240*	
	0.82	1241*	1242*	1243*	1244*	1245*	1246*	
	1.0	1247*	1248*	1249*	1250*	1251*	1252*	
	1.2	1253*	1254*	1255*	1256*	1257*	1258*	
	1.5	1259*	1260*	1261*	1262*	1263*	1264*	
	1.8	1265*	1266*	1267*	1268*	1269*	1270*	
	2.0	1271*	1272*	1273*	1274*	1275*	1276*	
	2.2	1277*	1278*	1279*	1280*	1281*	1282*	
	2.7	1385*	1386*	1387*	1388*	1389*	1390*	
	3.0	1289*	1290*	1291*	1292*	1293*	1294*	
	3.3	1295*	1296*	1297*	1298*	1299*	1300*	
	3.9	1301*	1302*	1303*	1304*	1305*	1306*	
4.7	1313*	1314*	1315*	1316*	1317*	1318*		
5.0	1319*	1320*	1321*	1322*	1323*	1324*		
5.6	1325*	1326*	1327*	1328*	1329*	1330*		
6.8	1331*	1332*	1333*	1334*	1335*	1336*		
8.0	1337*	1338*	1339*	1340*	1341*	1342*		
8.2	1343*	1344*	1345*	1346*	1347*	1348*		
10.0	1349*	1350*	1351*	1352*	1353*	1354*		

\* = A for sleeved, B for unsleeved  
(1) These parts may be used in either Grade 1 or Grade 2 applications.

**MIL-C-87217/1, STYLE CHS02 CAPACITORS  
Fixed, Supermetallized Plastic Film Dielectric, DC  
Low Energy, High Impedance, High Reliability**

Rated Voltage @ +100°C (Volts, dc)	Nominal Capacitance Value (µF)	Part Number M87217/01- (1)							
		Capacitance tolerance value (in %)							
		±0.25	±0.5	±1.0	±2.0	±5.0	±10.0		
	0.001	2001*	2002*	2003*	2004*	2005*	2006*		
	0.0012	2007*	2008*	2009*	2010*	2011*	2012*		
	0.0015	2013*	2014*	2015*	2016*	2017*	2018*		
	0.0018	2019*	2020*	2021*	2022*	2023*	2024*		
	0.002	2025*	2026*	2027*	2028*	2029*	2030*		
	0.0022	2031*	2032*	2033*	2034*	2035*	2036*		
	0.0027	2037*	2038*	2039*	2040*	2041*	2042*		
	0.0033	2043*	2044*	2045*	2046*	2047*	2048*		
	0.0039	2049*	2050*	2051*	2052*	2053*	2054*		
	0.0047	2055*	2056*	2057*	2058*	2059*	2060*		
	0.005	2061*	2062*	2063*	2064*	2065*	2066*		
	0.0056	2067*	2068*	2069*	2070*	2071*	2072*		
	0.0068	2073*	2074*	2075*	2076*	2077*	2078*		
	0.0082	2079*	2080*	2081*	2082*	2083*	2084*		
	0.01	2085*	2086*	2087*	2088*	2089*	2090*		
	0.012	2091*	2092*	2093*	2094*	2095*	2096*		
	0.015	2097*	2098*	2099*	2100*	2101*	2102*		
	0.018	2103*	2104*	2105*	2106*	2107*	2108*		
	0.02	2109*	2110*	2111*	2112*	2113*	2114*		
	0.022	2115*	2116*	2117*	2118*	2119*	2120*		
	0.027	2121*	2122*	2123*	2124*	2125*	2126*		
	0.033	2127*	2128*	2129*	2130*	2131*	2132*		
	0.039	2133*	2134*	2135*	2136*	2137*	2138*		
	0.047	2139*	2140*	2141*	2142*	2143*	2144*		
	0.050	2145*	2146*	2147*	2148*	2149*	2150*		
	0.056	2151*	2152*	2153*	2154*	2155*	2156*		
	0.068	2157*	2158*	2159*	2160*	2161*	2162*		
	0.082	2163*	2164*	2165*	2166*	2167*	2168*		

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\* = A for sleeved, B for unsleeved  
(1) These parts may be used in either Grade 1 or Grade 2 applications.

**MIL-C-87217/1, STYLE CHS02 CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, DC**  
**Low Energy, High Impedance, High Reliability (Continued)**

Rated Voltage @ +100°C (Volts, dc)	Nominal Capacitance Value (µF)	Part Number M87217/01-										(1)	
		Capacitance tolerance value (in %)											
		±0.25	±0.5	±1.0	±2.0	±5.0	±10.0						
	0.1	2169*	2170*	2171*	2172*	2173*	2174*	2175*	2176*	2177*	2178*	2179*	2180*
	0.12	2181*	2182*	2183*	2184*	2185*	2186*	2187*	2188*	2189*	2190*	2191*	2192*
	0.15	2193*	2194*	2195*	2196*	2197*	2198*	2199*	2200*	2201*	2202*	2203*	2204*
	0.18	2205*	2206*	2207*	2208*	2209*	2210*	2211*	2212*	2213*	2214*	2215*	2216*
	0.20	2217*	2218*	2219*	2220*	2221*	2222*	2223*	2224*	2225*	2226*	2227*	2228*
	0.22	2229*	2230*	2231*	2232*	2233*	2234*	2235*	2236*	2237*	2238*	2239*	2240*
	0.27	2241*	2242*	2243*	2244*	2245*	2246*	2247*	2248*	2249*	2250*	2251*	2252*
	0.33	2253*	2254*	2255*	2256*	2257*	2258*	2259*	2260*	2261*	2262*	2263*	2264*
	0.39	2265*	2266*	2267*	2268*	2269*	2270*	2271*	2272*	2273*	2274*	2275*	2276*
	0.47	2277*	2278*	2279*	2280*	2281*	2282*	2283*	2284*	2285*	2286*	2287*	2288*
	0.50	2289*	2290*	2291*	2292*	2293*	2294*	2295*	2296*	2297*	2298*	2299*	2300*
	0.56	2301*	2302*	2303*	2304*	2305*	2306*	2307*	2308*	2309*	2310*	2311*	2312*
	0.68	2319*	2320*	2321*	2322*	2323*	2324*	2325*	2326*	2327*	2328*	2329*	2330*
	0.82	2331*	2332*	2333*	2334*	2335*	2336*	2337*	2338*	2339*	2340*	2341*	2342*
	1.0	2343*	2344*	2345*	2346*	2347*	2348*	2349*	2350*	2351*	2352*	2353*	2354*
	1.2	2355*	2356*	2357*	2358*	2359*	2360*						

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\* = A for sleeved, B for unsleeved  
 (1) These parts may be used in either Grade 1 or Grade 2 applications.

**MIL-C-87217/1, STYLE CHS03 CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, DC**  
**Low Energy, High Impedance, High Reliability**

Rated Voltage @ +100°C (Volts.dc)	Nominal Capacitance Value (μF)	Part Number M87217/01-							(1)																																																																																																																																																																
		Capacitance tolerance value (in %)																																																																																																																																																																							
		±0.25	±0.5	±1.0	±2.0	±5.0	±10.0																																																																																																																																																																		
	0.001	3001*	3002*	3003*	3004*	3005*	3006*	3007*	3008*	3009*	3010*	3011*	3012*	3013*	3014*	3015*	3016*	3017*	3018*	3019*	3020*	3021*	3022*	3023*	3024*	3025*	3026*	3027*	3028*	3029*	3030*	3031*	3032*	3033*	3034*	3035*	3036*	3037*	3038*	3039*	3040*	3041*	3042*	3043*	3044*	3045*	3046*	3047*	3048*	3049*	3050*	3051*	3052*	3053*	3054*	3055*	3056*	3057*	3058*	3059*	3060*	3061*	3062*	3063*	3064*	3065*	3066*	3067*	3068*	3069*	3070*	3071*	3072*	3073*	3074*	3075*	3076*	3077*	3078*	3079*	3080*	3081*	3082*	3083*	3084*	3085*	3086*	3087*	3088*	3089*	3090*	3091*	3092*	3093*	3094*	3095*	3096*	3097*	3098*	3099*	3100*	3101*	3102*	3103*	3104*	3105*	3106*	3107*	3108*	3109*	3110*	3111*	3112*	3113*	3114*	3115*	3116*	3117*	3118*	3119*	3120*	3121*	3122*	3123*	3124*	3125*	3126*	3127*	3128*	3129*	3130*	3131*	3132*	3133*	3134*	3135*	3136*	3137*	3138*	3139*	3140*	3141*	3142*	3143*	3144*	3145*	3146*	3147*	3148*	3149*	3150*	3151*	3152*	3153*	3154*	3155*	3156*	3157*	3158*	3159*	3160*	3161*	3162*	3163*	3164*	3165*	3166*	3167*	3168*

\* = A for sleeved, B for unsleeved  
(1) These parts may be used in either Grade 1 or Grade 2 applications.

**MIL-C-87217/1, STYLE CHS03 CAPACITORS**  
**Fixed, Supermetallized Plastic Film Dielectric, DC**  
**Low Energy, High Impedance, High Reliability (Continued)**

Rated Voltage @ +100°C (Volts, dc)	Part Number M87217/01-										(1)																			
	Capacitance tolerance value (in %)																													
	±0.25	±0.5	±1.0	±2.0	±5.0	±10.0																								
	0.10	0.12	0.15	0.18	0.20	0.22	0.27	0.33	0.39	0.47	0.50	0.56	0.68	0.82	1.0	1.2	1.5	2.0	2.2	2.7	3.0	3.3	3.9	4.7	5.0	5.6	6.8	8.0	8.2	10.0
	3169*	3175*	3181*	3187*	3193*	3199*	3205*	3211*	3217*	3223*	3229*	3235*	3241*	3247*	3253*	3259*	3265*	3271*	3277*	3283*	3289*	3295*	3301*	3313*	3319*	3325*	3331*	3337*	3343*	3349*
	3170*	3176*	3182*	3188*	3194*	3200*	3206*	3212*	3218*	3224*	3230*	3236*	3242*	3248*	3254*	3260*	3266*	3272*	3278*	3284*	3290*	3296*	3302*	3314*	3320*	3326*	3332*	3338*	3344*	3350*
	3171*	3177*	3183*	3189*	3195*	3201*	3207*	3213*	3219*	3225*	3231*	3237*	3243*	3249*	3255*	3261*	3267*	3273*	3279*	3285*	3291*	3297*	3303*	3315*	3321*	3327*	3333*	3339*	3345*	3351*
	3172*	3178*	3184*	3190*	3196*	3202*	3208*	3214*	3220*	3226*	3232*	3238*	3244*	3250*	3256*	3262*	3268*	3274*	3280*	3286*	3292*	3298*	3304*	3316*	3322*	3328*	3334*	3340*	3346*	3352*
	3173*	3179*	3185*	3191*	3197*	3203*	3209*	3215*	3221*	3227*	3233*	3239*	3245*	3251*	3257*	3263*	3269*	3275*	3281*	3287*	3293*	3299*	3305*	3317*	3323*	3329*	3335*	3341*	3347*	3353*
	3174*	3180*	3186*	3192*	3198*	3204*	3210*	3216*	3222*	3228*	3234*	3240*	3246*	3252*	3258*	3264*	3270*	3276*	3282*	3288*	3294*	3300*	3306*	3318*	3324*	3330*	3336*	3342*	3348*	3354*

100

\* = A for sleeved, B for unsleeved  
(1) These parts may be used in either Grade 1 or Grade 2 applications.

**SECTION 2: SUMMARY OF STANDARD CONNECTORS**

Page	Control Specification	Series	Description	Grade 1	Grade 2
2.2	40M38277		High-density, miniature, environment resistant, circular (contacts, backshells, etc., available with connector)		
2.4	40M38298		Electrical, special, miniature circular, environment resisting, +200°C (contacts, backshells available with connector)		
2.6	40M39569		Miniature, +200°C, environment resistant, circular (contacts, backshells, etc., available with connector)	(1)	(1)
2.8	GSFC S-311-P-4		Rack and panel, miniature, polarized shell, removable crimp contacts, rectangular		
2.11	GSFC S-311-P-10		Rack and panel, miniature, polarized shell, soldered contacts, electrical and coaxial contacts, rectangular		
2.13	MIL-C-5015 (2) (4)		Threaded coupling, AN type, circular rear release crimp contacts, hermetic solder contacts, contact sizes 8 and larger only		
2.14	MIL-C-24308 (2)		Rack and panel, polarized shell, miniature rectangular		
2.20	MIL-C-26482 (2) (4)	2	Quick disconnect, environment resistant, miniature, circular (rear release crimp and solder contacts)	(3)	(3)
2.21	MIL-C-38999 (2) (4)	I II III	Scoop proof, bayonet coupling Non-scoop proof, bayonet coupling, low silhouette Scoop-proof, triple start, self-locking, threaded coupling		
2.24	MIL-C-39012 (4)	N, TNC, SC, SMA	Coaxial, radio frequency		
2.26	MIL-C-39029		Contacts, electrical connector	(5)	(5)
2.28	MIL-C-55302 (4)		Printed circuit subassembly and accessories, non-environment-resisting	(3)	(3)
2.29	MIL-C-83513 (2)(4)		Rack and panel, polarized shell, microminiature, rectangular		
2.30	MIL-C-22992 (2)		Plugs and receptacles, waterproof, quick disconnect, heavy duty type	GSE use only	
2.31	MIL-C-85049 (2) (4)		Connector backshells and accessories	(5)	(5)

Refer to MIL-HDBK-978, Vol. 5, for construction and application information.

- (1) Parts may be used for Grade 1 or Grade 2 applications.
- (2) Cadmium plated connectors are not standard parts. Zinc plated connectors are not standard parts.
- (3) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations for Grade 1 requirements.
- (4) Outgassing properties of these connectors may not be controlled. Reference the detailed specification sheet to verify compliance to project outgassing requirements.
- (5) Grade nomenclature is not applicable.

**40M38277 CONNECTORS (4)**  
**Electrical, Circular, Miniature, High-Density, Environment Resisting**

Part Number Explanation:

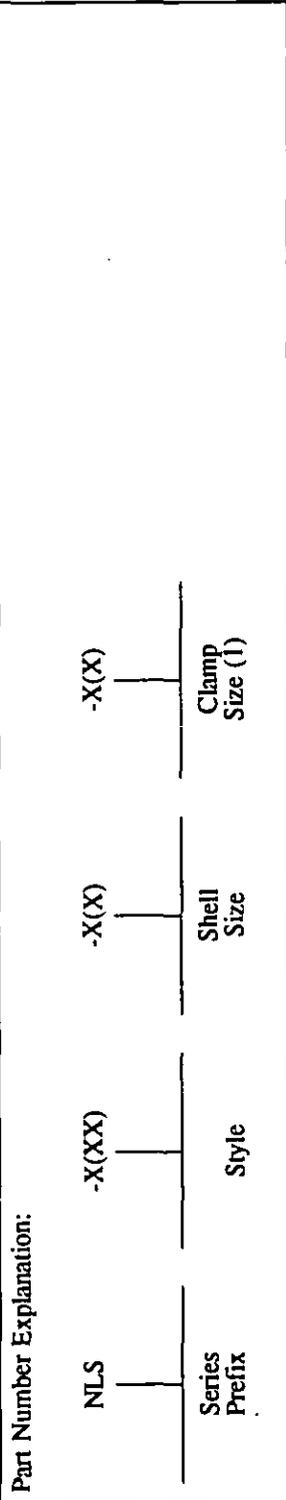
NLS	X(X)	X	X(X)	-35	X(X)	X(X)
Series Prefix	Shell Style	Service Class	Shell Size	Insert Arrangement	Contact Type	Alternate (1) Polarization

Part Number	Control Specification	Specification Appendix	Configuration			Grades 1 and 2
			Style	Type	Mounting	
NLS5HX(X)-35PS(X)		D	Low Silhouette	Bulkhead feed-through Receptacle	Jam-nut	Bayonet (3)
NLS0EX(X)-35X(X)(X)		E		Plug	Flange	
NLS6EX(X)-35X(X)(X)		F		Plug	Cabled	
NLS6GEX(X)-35X(X)(X)	40M38277	G		Receptacle	Cabled (2)	
NLS7EX(X)-35X(X)(X)		H	Receptacle	Jam-nut		
NLS3HX(X)-35X(X)(X)		J	Receptacle	Solder		
NLS7HX(X)-35X(X)(X)		K	Receptacle	Jam-nut		

- (1) No letter is required for normal polarization. See Appendix B of 40M38277 for alternate polarization options.
- (2) Electrical RFI grounding.
- (3) Parts may be used for Grade 1 and 2 applications.
- (4) Contacts and plastic dust covers are supplied with these connectors. Environmental class parts are also supplied with spare contacts, grommet sealing plugs and contact insertion/removal tools. Styles NLS0E, NLS6E, NLS6GE, and NLS7E are also supplied with short, straight backshells. Other types of backshells and accessories can be ordered separately and are listed on the following page. Metal dust covers are listed in Appendix M of 40M38277.

### 40M38277 CONNECTORS

**Electrical, Circular, Miniature, High-Density, Environment Resisting, Backshells, Low Silhouette**



Part Number	Control Specification	Style	Shell Size
NLS-S-X(X)	40M38277	Straight with strain relief	8 through 24
NLS-R-X(X)		90°, with strain relief	
NLS-C-X(X)		Straight	
NLS-SCT-X(X)		Straight with strain relief and cable tie	
NLS-RCT-X(X)		90°, with strain relief and cable tie	
NLS-FCT-X(X)		45°, with strain relief and cable tie	
NLS-RFI-X(X)-X(X)		Straight, RFI	

(1) For RFI Style only.

**40M38298 CONNECTORS (2)**  
**Electrical, Special, Miniature, Circular, Environment Resisting, +200°C**

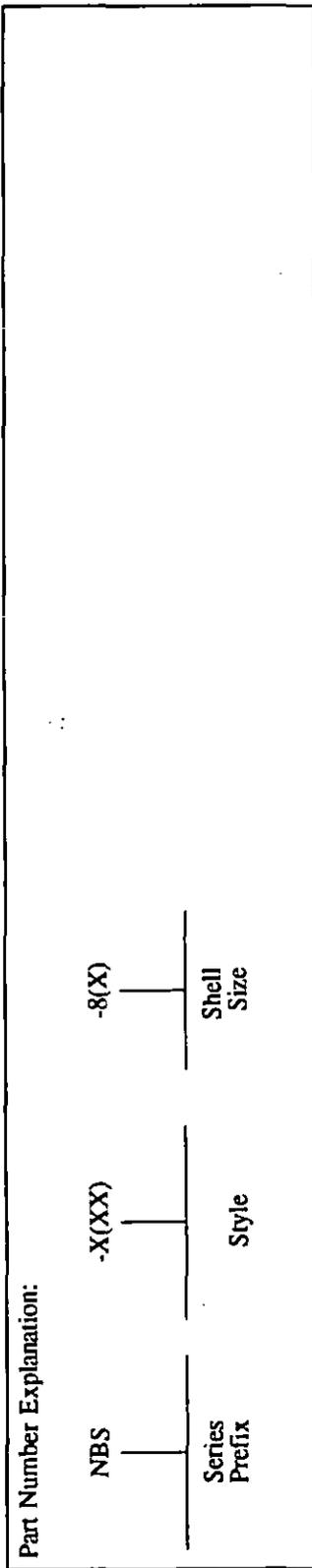
Part Number Explanation:

NBS	X(X)	X	8	-X	X	X
Series Prefix	Shell Style	Service Class	Shell Size	Insert Arrangement	Contact Type	Shell Polarization

Part Number	Control Specification	Specification Appendix	Configuration				Grades 1 and 2
			Style	Type	Mounting	Coupling	
NBS6E8-XXX	40M38298	B		Plug	Cabled	Bayonet	(1)
NBS7E8-XXX		C		Receptacle	Jam-nut		
NBS9E8-XXX		F	RFI Grounding	Plug	Cabled		
NBS0H8-XXX		G		Receptacle	Flange		
NBS3H8-XXX	40M38298	H		Receptacle	Solder	Bayonet	(1)
NBS8E8-XXX		I	90° RFI Grounding	Plug	Cabled		
NBS6GE8-XXX		J	RFI Grounding	Plug	Cabled		
NBS8GE8-XXX		K	90° RFI Grounding	Plug	Cabled		
NBS9GE8-XXX		M	RFI Grounding	Plug	Cabled		

(1) Parts may be used for Grade 1 and 2 applications.  
 (2) Contacts and plastic dust covers are supplied with these connectors. Environmental class parts are also supplied with spare contacts, grommet sealing plugs and contact insertion/removal tools. Only the following styles are supplied with backshells: NBS9E, NBS8E, NBS8G, NBS9G. Refer to the individual appendices above and the following page for backshell options.

**40M38298 CONNECTORS**  
**Electrical, Special, Circular, Miniature, Environment Resisting, +200°C, Backshells**



Part Number	Control Specification	Style
NBS-C-8		Straight
NBS-S-8		Straight, with strain relief
NBS-R-8	40M38298	90°, with strain relief
NBS-RFI-8 (1)		Straight, RFI, with strain relief
NBS-RFI-8R (1)		90°, RFI, with strain relief

(1) Crimp braid follower style designation is: RFI, use Thomas and Betts Ferrule part number GSC17512NP or equivalent. The Ferrule is not supplied by the connector manufacturer.

**40M39569 CONNECTORS (2)**  
**Electrical, Miniature Circular, Environment Resisting, +200°C**

Part Number Explanation:

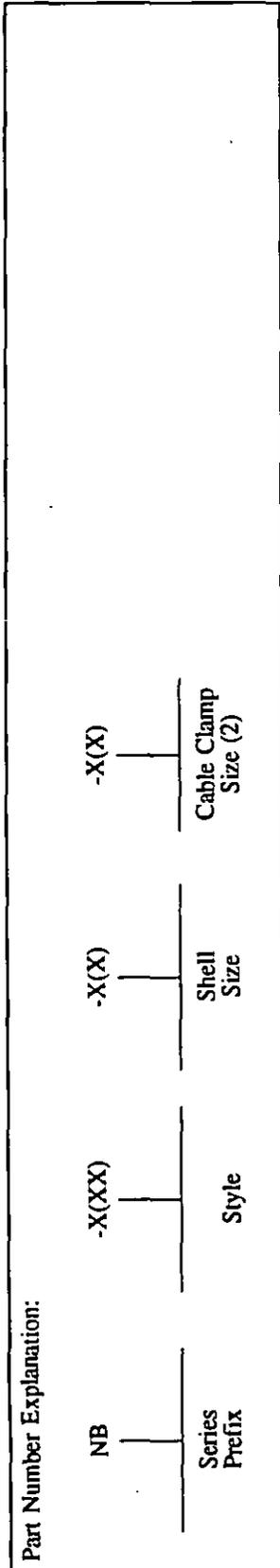
NB	X(X)	X	-X(XX)	X(X)	X	X	(X)
Series Prefix	Shell Style	Service Class	Shell Size	Insert Arrangement	Contact Type	Polarizing Position	Backshell Accessory
							Temperature Class

Part Number	Control Specification	Specification Appendix	Configuration				Grades 1 and 2
			Style	Type	Mounting	Coupling	
NB0EX(X)-X(XX)X(X)X(X)(X)	40M39569	B	—	Receptacle	Narrow flange	Bayonet	(1)
NB0HX(X)-X(XX)X(X)X(X)(X)		I		Receptacle	Narrow flange		
NB4EX(X)-X(XX)X(X)X(X)(X)		C		Receptacle	Wide flange		
NB6EX(X)-X(XX)X(X)X(X)(X)		D		Plug	Cabled		
NB7EX(X)-X(XX)X(X)X(X)(X)		E			Jam-nut		
NB3HX(X)-X(XX)X(X)X(X)(X)		F		Receptacle	Solder		
NB7HX(X)-X(XX)X(X)X(X)(X)		G			Jam-nut		
NB8HX(X)-X(XX)X(X)X(X)(X)		H			Jam-nut		
NB5HX(X)-X(XX)X(X)X(X)(X)		J			Thru-bulkhead		
NB6GEX(X)-X(XX)X(X)X(X)(X)		O			Cabled		

- (1) Parts may be used for Grade 1 and Grade 2 applications.
- (2) Contacts and plastic dust covers are supplied with these connectors. Environmental class parts are also supplied with spare contacts, grommet sealing plugs and contact insertion/removal tools. Only the following styles are supplied with backshells. NB0E, NB4E, NB6E, NB7E, and NB6G. Backshell styles are listed on the following page.

### 40M39569 CONNECTORS

#### Electrical, Miniature, Circular, Environment Resisting, +200°C, Backshells



Part Number	Control Specification	Style	Shell Size
NB-C-X(X)		Straight	
NB-S-X(X)		Straight with strain relief	
NB-R-X(X)		90° with strain relief	
NB-SCT-X(X) (1)	40M39569	Straight with cable tie	8 through 24
NB-RCT-X(X) (1)		Straight with 90° cable tie	
NB-FCT-X(X)		Straight with 45° cable tie	
NB-RFI-X(X)-X(X)		Straight RFI	

(1) Add a "N" to the end of the part number to order without a ground lug.  
 (2) For RFI style only.

### GSFC S-311-P-4 CONNECTORS (1) Connectors, Electrical, Subminiature, Rack and Panel Non-Magnetic

Part Number Explanation:	311P4	XX	-X	X	-X	-XX
GSFC Control Specification						
Detail Specification						
Contact Arrangement						
Contact Type P = pin S = socket						
Residual Magnetism (Gamma) A = 2000 B = 200						
Mounting Hole Diameter 12 = 0.120 inch 15 = 0.154 inch						

Part Number	Control Specification	Contact Type (4)	GSFC Contact Arrangement	Number of Contacts		Grades 1 and 2
				Standard Power	Coaxial and/or High Voltage	
311P407-XX-X-XX	GSFC S-311-P-4	Power, Size 22D	-1 -2 -3 -4 -5 -6	15 26 44 62 78 104	-	(3)

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Refer to individual detail specifications for the MS shell number.
- (3) Parts may be used for Grade 1 and 2 applications.
- (4) Contacts are supplied separately. See the following page listing S-311-P-4/06 and /08 for appropriate part numbers.

**GSFC S-311-P-4 CONNECTORS (1)**  
**Connectors, Electrical, Subminiature, Rack and Panel Non-Magnetic (Continued)**

Part Number	Control Specification	Contact Type (4)	GSFC Contact Arrangement	Number of Contacts		Grades 1 and 2			
				Standard Power	Coaxial and/or High Voltage				
311P405-XX-X-XX	GSFC S-311-P-4	Mixed, Power Size 20 & High Voltage or Coaxial Size 8 (5)	-6	4	1	(3)			
			-7	0	3				
			-8	5	2				
			-9	10	1				
			-10	0	5				
			-11	5	4				
			-12	10	3				
			-13	15	2				
			-14	20	1				
			-15	0	8				
			-16	7	6				
			-17	12	5				
			-18	17	4				
			-19	17	4				
			-20	22	3				
			-21	25	2				
			-22	17	7				
			-23	32	4				
			-24	41	2				
			-25	46	1				
			311P409-XX-X-XX		Power, Size 20		-1	9	
							-2	15	
							-3	25	
							-4	37	
							-5	50	

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Refer to individual detail specifications for the MS shell number.
- (3) Parts may be used for Grade 1 and 2 applications.
- (4) Contacts are supplied separately. See the following page listing S-311-P-4/06 and /08 for appropriate part numbers.
- (5) Coaxial contacts should be used for signals of 1 MHz frequency or less. The nylon hoods used on the high voltage contacts may not meet programs outgassing limits. See page 2.10 for contact part numbers.

### GSFC S-311-P-4 CONTACTS

Part Number Explanation: For Coaxial and High Voltage Contacts:		X		(X)		X		X	
G									
	C = Coaxial H = High Voltage		Blank = Straight R = Right Angle		P = Pin S = Socket		Wire Accommodation (See table below)		Wire Accommodation (See table below)
For Standard Power Contacts:		(X)				X		X	
G	Detail Specification								
					P = Pin S = Socket		Wire Accommodation (See table below)		Wire Accommodation (See table below)

Part Number	Control Specification	Size	Wire Accommodation
GC(X)X1	S-311-P-4/06	8	RG-178B/U
GH(X)X6 (1)	S-311-P-4/06	8	20 AWG, Max
G08X1	S-311-P-4/08	22D	22 to 28 AWG
G10X1	S-311-P-4/10	20	20 to 24 AWG

(1) The nylon hood used on high voltage contacts may not meet program outgassing limits.

**GSFC S-311-P-10 CONNECTORS (1)**  
**Connectors, Electrical, Rectangular, Miniature, Polarized Shell,**  
**Rack and Panel, Combination Solder, Coaxial and High Voltage Contacts, Non-Magnetic**

Part Number Explanation:

311P10	(B)	-X(X)	X	-X	-XX
GSFC Control Specification	Socket Contact Designator No digit = contact springs B = split finger sleeved (PREFERRED)	Insert Arrangement	Contact Type P = pin S = socket	Residual Magnetism (Gamma) B = 200 C = 20	Mounting Hole Diameter 12 = 0.120 inch 15 = 0.154 inch

Part Number	Control Specification	Arrangement Number (2)	Number of Contacts		Grades 1 and 2
			Standard Power	Coaxial and or High Voltage (4)	
311P10-X(X)X-X-XX	GSFC S-311-P-10	1	9		(3)
		2	15		
		3	25		
		4	37		
		5	50		
		6	4	1	
		7	0	3	
		8	5	2	
		9	10	1	
		10	0	5	
		11	5	4	
		12	10	3	
		13	15	2	
		14	20	1	
		15	0	8	

(1) These connectors may require material testing per NHB8060.1 for manned space flight applications.  
(2) Refer to Table II of the control specification for contact arrangements.  
(3) Parts may be used for Grade 1 and 2 applications.  
(4) Coaxial contacts should be used for signals of 1 Mhz frequency or less. The nylon hoods used on the high voltage contacts may not meet program outgassing limits. See page 2.10 for contact part numbers.

**GSFC S-311-P-10 CONNECTORS (1)**  
**Connectors, Electrical, Rectangular, Miniature, Polarized Shell,**  
**Rack and Panel, Combination Solder, Coaxial and High Voltage Contacts,**  
**Non-Magnetic (Continued)**

Part Number	Control Specification	Arrangement Number (2)	Number of Contacts		Grades 1 and 2
			Standard Power	Coaxial and or High Voltage (4)	
311P10-X(X)X-X-XX	GSFC S-311-P-10	16	7	6	(3)
		17	12	5	
		18	17	4	
		20	22	3	
		21	25	2	
		22	17	7	
		23	32	4	
		24	41	2	
		25	46	1	

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.  
(2) Refer to Table II of the control specification for contact arrangements.  
(3) Parts may be used for Grade 1 and 2 applications.  
(4) Coaxial contacts should be used for signals of 1 Mhz frequency or less. The nylon hoods used on the high voltage contacts may not meet program outgassing limits. See page 2.10 for contact part numbers.

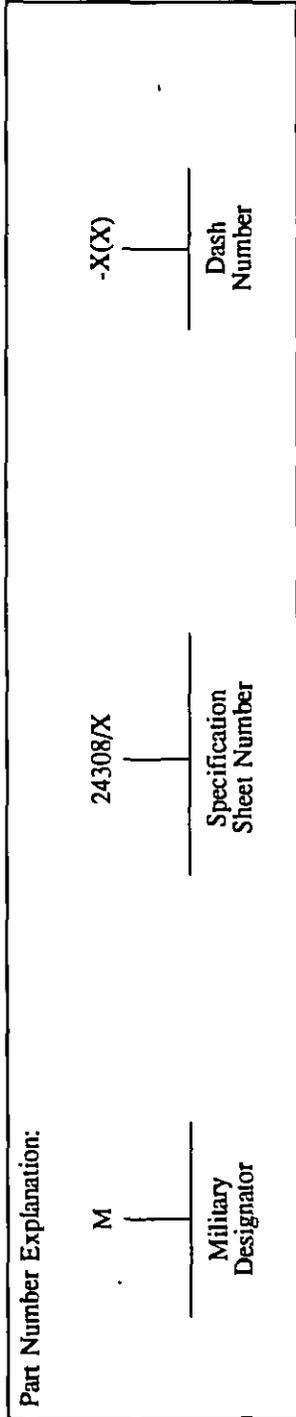
**MIL-C-5015, CONNECTORS (1)**  
**Electrical, Circular, AN Type, Solder and Rear Release Crimp Contacts,**  
**Contact Sizes 0 thru 16**

Part Number	X	X(X)(X)(X)	-X(X)	X	(X)
MSXXXX					
Basic Part Number	Class	Shell Size	Insert Arrangement	Contact Designator	Insert Position

Part Number (2) (3)	Control Specifications	Configuration				Seal	Grade 2
		Type (2)	Mounting	Coupling	Contacts		
MS3450XX(X)(X)(X)-X(X)X(X)		Receptacle - Class L	Wall	Threaded	Crimp, rear release (5)	Environmental	(6)
MS3452XX(X)(X)(X)-X(X)X(X)		Receptacle - Class L	Box (4)				
MS3454XX(X)(X)(X)-X(X)X(X)	MIL-C-5015	Receptacle - Class L	Jam-nut				
MS3456XX(X)(X)(X)-X(X)X(X)		Plug - Class L	Cabled				
MS3459XX(X)(X)(X)-X(X)X(X)		Plug - Class L	Cabled	Threaded, self-locking			
MS3459XX(X)(X)(X)-X(X)X(X)							

- (1) These connectors may require material testing per NHB8060.1 and ASTM E 595. Consult the project engineer for program requirements.
- (2) Cadmium plated connectors are not standard parts.
- (3) Caution: It may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (4) The back of this connector is not protected against moisture or debris.
- (5) Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
- (6) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (I)**  
**Electrical, Rectangular, Miniature, Rack and Panel, Nickel Finished Polarized Shell,**  
**Gold Plated Nonremovable Solder Contacts**



Part Number (2)	Control Specification	Configuration			Seal	Grade 2
		Type	Mounting	Coupling (2)		
M24308/1-34 /1-35 /1-36 /1-37 /1-38	MIL-C-24308	Receptacle	Box	Auxiliary bolt	9 15 25 37 50	
M24308/3-23 /3-24 /3-25 /3-26 /3-27		Plug	Cabled		9 15 25 37 50	Non-environmental (3)

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Caution; it may be necessary to order accessories such as backshells, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (3) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (1)  
 Electrical, Rectangular, Miniature, Rack and Panel, Nickel Finished Polarized Shell,  
 Gold Plated Removable Crimp Contacts**

Part Number (2)	Control Specification	Configuration			Seal	Grade 2
		Type	Mounting	Coupling (2)		
M24308/2-516 /2-517 /2-518 /2-519 /2-520	MIL-C-24308	Receptacle	Box	Friction or Auxiliary bolts	Non- environmental	(4)
M24308/4-335 /4-336 /4-337 /4-338 /4-339		Plug				

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (3) Contacts, if ordered separately, shall be procured to MIL-C-39029.
- (4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (1)**  
**Electrical, Rectangular, Miniature, Rack and Panel, Nickel Finished Polarized Shell**  
**High-Density, Gold Plated Removable Crimp Contacts**

Part Number (2)	Control Specification	Configuration			Seal	Grade 2
		Type	Mounting	Coupling (2)		
M24308/2-526 2-527 2-528 2-529 2-530 2-531	MIL-C-24308	Receptacle	Box	Auxiliary bolt	Non-environmental	(4)
M24308/4-345 4-346 4-347 4-348 4-349 4-350		Plug	Cabled			

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (3) Contacts, if ordered separately, shall be procured to MIL-C-39029.
- (4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (1)**  
**Electrical, Rectangular, Miniature, Rack and Panel, Gold Finished Polarized Shell,**  
**Gold Plated Nonremovable Solder Contacts**

Part Number (2)	Control Specification	Configuration				Seal	Grade 2
		Type	Mounting	Coupling (2)	Solder Contacts		
M24308/5-34 /5-35 /5-36 /5-37 /5-38	MIL-C-24308	Receptacle	Box	Auxiliary bolt	9 15 25 37 50	Non- environmental	(3)
M24308/7-23 7-24 7-25 7-26 7-27		Plug	Cabled		9 15 25 37 50		

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.  
 (2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.  
 (3) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (1)  
Electrical, Rectangular, Miniature, Rack and Panel, Gold Finished Polarized Shell,  
Gold Plated Removable Crimp Contacts**

Part Number (2)	Control Specification	Configuration				Seal	Grade 2
		Type	Mounting	Coupling (2)	Crimp Contacts (3)		
M24308/6-502 /6-503 /6-504 /6-505 /6-506	MIL-C-24308	Receptacle	Box	Friction or Auxiliary bolts	9 15 25 37 50	Non- environmental	(4)
M24308/8-335 /8-336 /8-337 /8-338 /8-339		Plug	Cabled		9 15 25 37 50		

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (3) Contacts, if ordered separately, shall be procured to MIL-C-39029.
- (4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-24308, CONNECTORS (1)**  
**Electrical, Rectangular, Miniature, Rack and Panel, Gold Finished Polarized Shell,**  
**High-Density, Gold Plated Removable Crimp Contacts**

Part Number (2)	Control Specification	Configuration				Grade 2
		Type	Mounting	Coupling (2)	Crimp Contacts (3)	
M24308/6-512	MIL-C-24308	Receptacle	Box	Auxiliary bolt	15	Non- Environmental
/6-513					26	
/6-514					44	
/6-515					62	
/6-516					78	
/6-517					104	
M24308/8-345		Plug	Cabled		15	
/8-346					26	
/8-347					44	
/8-348					62	
/8-349					78	
/8-350	104					

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.  
(2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.  
(3) Contacts, if ordered separately, shall be procured to MIL-C-39029.  
(4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

## MIL-C-26482, CONNECTORS, SERIES 2 (1) Electrical, Circular, Miniature, Quick Disconnect, Environment Resistant

Part Number Explanation:

MSXXXX	X	X(X)	X (or -)	X(X)	X(X)	X	(X)
Basic Part Number	Class	Shell Size	Termination and Shell Material, Hermetic (2)	Insert Arrangement	Contact Style	Insert Position	

Part Number (3) (4)	Control Specification	Configuration				Seal	Grade 2
		Type (3)	Mounting	Coupling	Contacts (5)		
MS3470XX(X)-X(X)XX	MIL-C-26482	Receptacle Classes L & A	Narrow flange	Bayonet	Crimp, rear release	Environmental	(6)
MS3472XX(X)-X(X)XX			Wide flange				
MS3474XX(X)-X(X)XX			Jam-nut				
MS3475XX(X)-X(X)XX		Plug, Class L, RFI shielded	Cabled	Solder			
MS3476XX(X)-X(X)XX		Plug, Classes L & A	Cabled				
MS3449XX(X)XX(X)XX			Receptacles, Class H	Jam-nut		Hermetic	

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Dash (-) denotes nonhermetic.
- (3) Cadmium plated connectors are not standard parts.
- (4) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/ standards listed or referenced in this connector specification.
- (5) Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
- (6) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 application.

**MIL-C-38999, CONNECTORS (SERIES I) (1)**  
**Electrical, Circular, Miniature, High-Density, High-Density, Quick Disconnect**  
**Environment Resistant, Removable Crimp and Hermetic Solder Contacts**

Part Number Explanation:

MSXXXXX	X	X(X)	X	X(X)	X(X)	X	(X)
MS Number	Class T = environmental Y = hermetic	Shell Size	Finish	Insert Arrangement Number	Style (P or S)	Polarization (no letter required for normal)	

Part Number (2) (3)	Control Specification	Configuration				Seal	Grade 2
		Type (2)	Mounting	Coupling	Contacts (4)		
MS27466TX(X)XX(X)X(X)		Receptacle	Wall-flange		Crimp	Environmental	
MS27467TX(X)XX(X)X(X)		Plug, straight	Cabled		Crimp	Environmental	
MS27468TX(X)XX(X)X(X)		Receptacle	Jam-nut		Crimp	Environmental	
MS27470YX(X)XX(X)X(X)	MIL-C-38999	Receptacle	Jam-nut	Bayonet	Solder	Hermetic	(5)
MS27471YX(X)XX(X)X(X)		Receptacle	Solder		Solder	Hermetic	
MS27656TX(X)XX(X)X(X)		Receptacle	Back panel, wall-flange		Crimp	Environmental	
MS27662TX(X)XX(X)X(X)		Receptacle	Thru-bulkhead		Feed through	Environmental	

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Cadmium plated connectors are not standard parts.
- (3) Caution: it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (4) Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
- (5) Parts may be used in Grade 2 applications; consult project engineer for recommendation on Grade 1 applications.

**MIL-C-38999, CONNECTORS (SERIES II, LOW SILHOUETTE) (1)**  
**Electrical, Circular, Miniature, High-Density, Quick Disconnect,**  
**Environment Resistant, Removable Crimp and Hermetic Solder Contacts**

Part Number (2) (3)	Control Specification	Configuration					Seal	Grade 2
		Type (2)	Mounting	Coupling	Contacts (4)			
MS27472TX(X)XX(X)X(X)	MIL-C-38999	Receptacle	Wall-flange	Bayonet	Crimp	Environmental	(5)	
MS27474TX(X)XX(X)X(X)		Receptacle	Jam-nut		Crimp	Environmental		
MS27477YX(X)XX(X)X(X)		Receptacle	Jam-nut		Solder	Hermetic		
MS27478YX(X)XX(X)X(X)		Receptacle	Solder	Solder	Hermetic			
MS27484TX(X)XX(X)X(X)		Plug, straight	Cabled	Crimp	Environmental			
MS27497TX(X)XX(X)X(X)		Receptacle	Back panel, wall-flange	Crimp	Environmental			

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Cadmium plated connectors are not standard parts.
- (3) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (4) Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
- (5) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

**MIL-C-38999, CONNECTORS (SERIES III, SCOOP PROOF) (1)**  
**Electrical, Circular, Miniature, High-Density, Quick Disconnect,**  
**Environment Resistant, Removable Crimp and Hermetic Solder Contacts**

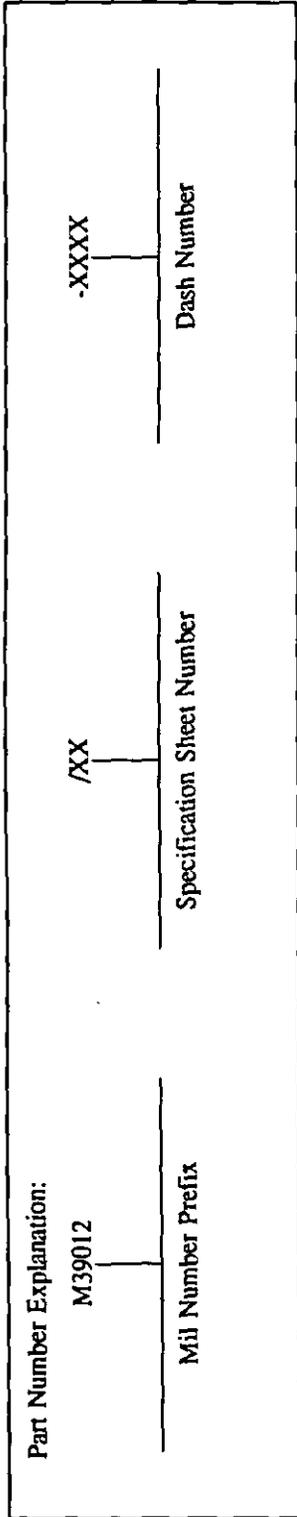
Part Number Explanation:

D38999/	XX	X	X	XX	X	X	X
Military Specification Number	Slash Sheet	Class (5)	Shell	Insert Arrangement Number	Contact Style	Polarization Position	

Part Number (2)	Control Specification	Configuration				Seal	Grade 2
		Type	Mounting	Coupling	Contacts (3)		
D38999/20XXXXXXX		Receptacle	Wall-flange		Crimp	Environmental	
D38999/21XXXXXXX		Receptacle	Box-flange		Solder	Hermetic	
D38999/23XXXXXXX		Receptacle	Jam-nut		Solder	Hermetic	
D38999/24XXXXXXX	MIL-C-38999	Receptacle	Jam-nut	Bayonet	Crimp	Environmental	(4)
D38999/25XXXXXXX		Receptacle	Solder		Solder	Hermetic	
D38999/26XXXXXXX		Plug, straight	Cabled		Crimp	Environmental	
D38999/27XXXXXXX		Receptacle	Weld		Solder	Hermetic	

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification.
- (3) Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
- (4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.
- (5) Cadmium plated connectors are not standard parts.

## MIL-C-39012, CONNECTORS (1) Coaxial, Radio Frequency



Part Number (2)	Control Specification	Series	Configuration		Impedance Nominal (Ohms)	Class	Applicable Cable Number (3)	Grade 2		
			Type	Mounting						
M39012/01-0501	MIL-C-39012	N	Plug	Cabled	50	2	RG-393 RG-142, RG-400 RG-393 RG-142, RG-400	(4)		
M39012/01-0503			Plug	Cabled						
M39012/03-0501			Receptacle	Cabled, jam-nut, rear						
M39012/03-0503			Receptacle	Cabled, jam-nut, rear						
M39012/04-0001			Receptacle, Hermetic	Uncabled, jam-nut, front						
M39012/04-0002			Receptacle	Flange, rear						
M39012/04-0003			Receptacle	Uncabled, jam-nut, rear						
M39012/26-0101			TNC	Cabled					Plug	
M39012/26-0104										
M39012/26-0117										
M39012/26-0018										

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Cadmium plated connectors are not standard parts.
- (3) See Section 14, MIL-C-17, in this standard.
- (4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

### MIL-C-39012, CONNECTORS (1) Coaxial, Radio Frequency (Continued)

Part Number (2)	Control Specification	Series	Configuration		Impedance Nominal (Ohms)	Class	Applicable Cable Number (3)	Grade 2			
			Type	Mounting					Contacts		
M39012/28-0101		TNC	Receptacle	Cabled, jam-nut, rear	50	2	RG-142, RG-400 RG-303 RG-302 RG-316				
M39012/28-0104			Receptacle	Cabled, jam-nut, rear					Socket		
M39012/28-0117			Receptacle	Cabled, jam-nut, rear					Socket		
M39012/28-0018			Receptacle	Cabled, jam-nut, rear					Socket		
M39012/34-0001			Receptacle, hermetic	Uncabled, jam-nut, front					Socket		
M39012/34-0002			Receptacle, hermetic	Uncabled, jam-nut, rear					Socket		
M39012/55-3006			MIL-C-39012						Plug	Cabled	Pin
M39012/55-3007									Plug	Cabled	Pin
M39012/55-3009	Plug	Cabled			Pin						
M39012/55-3010	Plug	Cabled			Pin						
M39012/57-3006		SMA	Receptacle	Cabled	50	2	RG-178 RG-316 RG-142 RG-303 RG-178 RG-316 RG-142 RG-303	(4)			
M39012/57-3007			Receptacle	Cabled					Socket		
M39012/57-3009			Receptacle	Cabled					Socket		
M39012/57-3010			Receptacle	Cabled					Socket		
M39012/60-3001			Receptacle	Uncabled, flange, rear					Socket		
M39012/60-3002			Receptacle	Uncabled, flange, rear					Socket		
M39012/61-3001			Receptacle	Uncabled, jam nut, rear					Socket		
M39012/61-3002			Receptacle	Uncabled, jam-nut, rear					Socket		

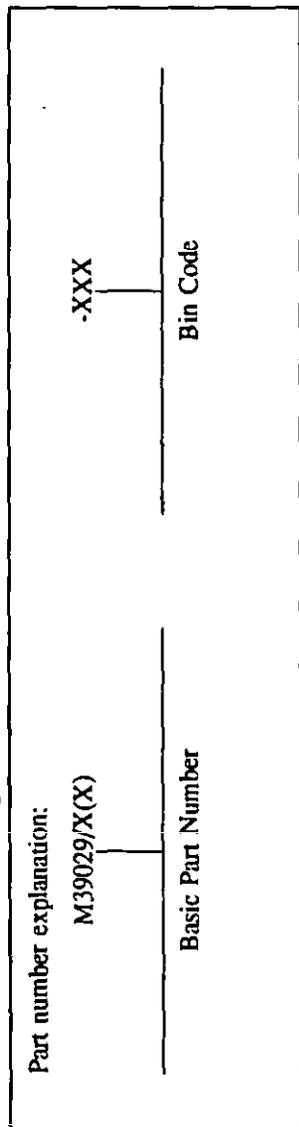
(1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.

(2) Cadmium plated connectors are not standard parts.

(3) See Section 14, MIL-C-17, in this standard.

(4) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

## MIL-C-39029, CONTACTS Crimp Removable, Electrical Connector



Part Number	Control Specification	Connector Specification	Contact Size		Wire Sizes
			Pins	Sockets	
M39029/4-110	MIL-C-39029/4	MIL-C-26482 Series 2 (Pins)	20		20, 22, 24
M39029/4-111			16		16, 18, 20
M39029/4-113			12		12, 14
M39029/5-115	MIL-C-39029/5	MIL-C-26482 Series 2 (Sockets)		20	20, 22, 24
M39029/5-116				16	16, 18, 20
M39029/5-118				12	12, 14
M39029/29-214	MIL-C-39029/29	MIL-C-5015 (Pins)	8		8 10 (1)
M39029/29-215			4		4 6 (1)
M39029/29-216			0		0, 1 2 (1)
M39029/30-220	MIL-C-39029/30	MIL-C-5015 (Sockets)		8	8 10 (1)
M39029/30-221				4	4 6 (1)
M39029/30-222				0	0, 1 2 (1)

(1) These wires require electrically conductive bushings in accordance with MS3348.

**MIL-C-39029, CONTACTS**  
**Crimp Removable, Electrical Connector (Continued)**

Part Number	Control Specification	Connector Specification	Contact Size		Wire Sizes
			Pins	Sockets	
M39029/56-348	MIL-C-39029/56	MIL-C-38999 Series I & III (Sockets)	—	22D	22, 24, 26
M39029/56-351				20	20, 22, 24
M39029/56-352				16	16, 18, 20
M39029/56-353				12	12, 14
M39029/57-354	MIL-C-39029/57	MIL-C-38999 Series II (Sockets)	—	22D	22, 24, 26
M39029/57-357				20	20, 22, 24
M39029/57-358				16	16, 18, 20
M39029/57-359				12	12, 14
M39029/58-360	MIL-C-39029/58	MIL-C-38999 Series I, II & III (Pins)	22D 20 16 12	—	22, 24, 26 20, 22, 24 16, 18, 20 12, 14
M39029/58-363				—	—
M39029/58-364				—	—
M39029/58-365				—	—
M39029/106-614	MIL-C-39029/106	MIL-C-38999 Series III (Sockets)	—	22D	22, 24, 26
M39029/106-615				20	20, 22, 24
M39029/106-616				16	16, 18, 20
M39029/106-617				12	12, 14
M39029/107/620	MIL-C-39029/107	MIL-C-38999 Series III (Pins)	22D 20 16 12	—	—
M39029/107-621				—	—
M39029/107-622				—	—
M39029/107/623				—	—
M39029/63-368	MIL-C-39029/63	MIL-C-24308 (Sockets) MIL-C-24308 (Pins)	—	20	20, 22, 24
M39029/64-369	MIL-C-39029/64		20	—	20, 22, 24

# MIL-C-55302, CONNECTORS, PRINTED CIRCUIT (1) Subassembly And Accessories Non Environment-Resisting

Part Number Explanation:

M55302	/XX	(X)	(X)	XX(X)	(X)
Military Number Prefix	Spec Sheet Number	Type of Contacts	Type of Terminal	Number of Contacts	Type of Mounting Hardware

Part Number	Control Specification	Type	Type of Terminal	Number of Contacts	Type of Mounting Hardware	Grade
M55302/55-XXXX	MIL-C-55302	Plug	(2)	10 thru 70	L = 0.700 slotted turning jackscrew	2
M55302/56-XXXX		Receptacle				
M55302/57-XXXX		Plug		90, 100 and 120	M = 0.500 slotted turning jackscrew	
M55302/58-XXXX		Receptacle				
M55302/59-XXXX	Plug	10 thru 70	H = 0.200 turning jackscrew hex	S = 0.200 slotted turning jackscrew		
M55302/60-XXXX	Receptacle					
M55302/61-XXXX	Plug				Crimp Removable	F = fixed jackscrew
M55302/62-XXXX	Receptacle					
M55302/63-XXXX	Plug	Y = D-shaped				
M55302/64-XXXX	Receptacle					
M55302/65-XXXX	Receptacle					
M55302/66-XXXX	Receptacle					

- (1) These connectors may require material testing per ASTM E 595 and NHB8060.1. Consult the project parts engineer for program requirements.
- (2) Available terminal types: solder cup, 0.109 inch long DIP, 0.140 inch long DIP, 0.172 inch long DIP, 0.058 inch flexible circuit, 0.234 inch long DIP, 0.100 inch flexible circuit. See specification sheets for corresponding letter identifiers.
- (3) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.

## MIL-C-83513, CONNECTORS (1) Electrical, Rectangular, Microminiature, Polarized Shell, Crimp and Solder Contacts

Part Number Explanation:  M83513/0X-	X	(XX)	(N)
Specification	Insert Arrangement A = 9            E = 31 B = 15          F = 37 C = 21          G = 51 D = 25          H = 100	Wire Type (2)	Shell Finish N = Electroless Nickel

Part Number (1)	Type	Contacts	Shell	Grade 2
M83513/1-XN	Plug	Solder	Electroless Nickel Plated	
M83513/2-XN	Receptacle			
M83513/3-XXXN	Plug	Crimp with M22759/11 or M22759/33 Pigtailed	Aluminum	(3), (4)
M83513/4-XXXN	Receptacle			
M83513/6-X	Plug	Solder	All Plastic	
M83513/7-X	Receptacle			
M83513/8-XXX	Plug	Crimp with M22759/11 or M22759/33 Pigtailed		
M83513/9-XXX	Receptacle			

- (1) These connectors may require material testing per NHB8060.1 for manned space flight applications.
- (2) Connectors supplied with wire types 05, 06, 07 and 08 (uninsulated copper wire pigtailed) are not approved as standard parts.
- (3) Parts may be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 applications.
- (4) Mounting hardware is ordered separately. For insert arrangements A through G, use MIL-C-83513/5 configurations A and B. For insert arrangement H, where applicable, use MIL-C-83513/5 configuration C.

**MIL-C-22992, CONNECTORS**

**Electrical, Circular, Heavy Duty, Quick Disconnect Waterproof, Threaded Coupling**  
**(Use for Ground Support Equipment only; may not be used for Space applications.)**

Part Number Explanation:

MSXXXXX	X		XX	X	X(X)	X
Military Spec No.	Type/ Mounting	Class (1)	Shell Size (2)	Finish (3)	Insert Arrangement (4)	Contact Type (5)

Part Number (6)	Control Specification	Configuration			Seal	Grade 2
		Type	Mounting	Coupling		
MS17343XXXXXX(X)X	MIL-C-22992	Receptacle	Wall flange	Threaded	Solder	Classes C and R (1)
MS17344XXXXXX(X)X		Plug	Cabled			
MS17345XXXXXX(X)X		Plug	Cabled			
MS17346XXXXXX(X)X		Receptacle	Box flange			
MS17347XXXXXX(X)X		Receptacle	Wall—jam-nut			
MS17348XXXXXX(X)X		Receptacle	Box—jam-nut			

- (1) Class C = pressurized. Class R = environment resisting.
- (2) Shell sizes: 12, 14, 16, 18, 20, 22, 24, 28, 32, 36, 40, and 44.
- (3) Cadmium plated connectors are not considered standard parts.
- (4) Insert arrangements per MS33681 and MS33691.
- (5) Contact types: P = pin, S = socket.
- (6) Use on ground support equipment only.

**MIL-C-85049**  
**Connector Accessories, Electrical**

Part Number	For Use With Connector Specification	Accessory Description	Configuration	Finish	Category	Notes
M85049/42-XXDN	MIL-C-5015 Solder Contacts	Strain Relief (Saddle Clamp)	Straight	Nickel	4A	(1), (2)
M85049/42-XXDS				Passivate		
M85049/6-XXN	MIL-C-5015 Crimp, Rear Release Contacts	Backshell, Environmental Shield Termination	45°	Nickel	1A	(1)
M85049/8-XXN			90°			
M85049/10-XXN			Straight			
M85049/7-XXN	MIL-C-5015 Crimp, Rear Release Contacts	Backshell, Environmental	45°	Nickel	1A	(1)
M85049/9-XXN			90°			
M85049/11-XXN			Straight			
M85049/24-XXN	MIL-C-5015 Crimp, Rear Release Contacts	Backshell, Nonenvironmental, Shield Termination	90°	Nickel	1A	(1)
M85049/25-XXN			Straight			
M85049/3AXXXX			Straight			
M85049/4AXXXX	MIL-C-22992	Backshell, Cable Sealing	Straight	Black Anodized	1A	(3), (4)
M85049/5AXXXX		Backshell, Cable Sealing, Step-Up				
		Backshell, Cable Sealing, Step-Down				

- (1) The dash number (-XX) corresponds to the shell size and configuration of the connector and wire (cable) bundle accommodation ranges. Consult the specification sheet for application information.
- (2) The MIL-C-85049/42 is also used to provide strain relief for the MIL-C-85049/6, /7, /8, /9, /10, and /11 connector accessories.
- (3) The dash number (XXXX) represents the size, type and style of the accessory. Consult the specification sheet for application information.
- (4) Type A is for use with MS17344. Type B is for use with MS17343, MS17345 and MS17347.

**MIL-C-85049**  
**Connector Accessories, Electrical**

PART NUMBER (1)	For Use With Connector Specification	Accessory Description	Configuration	Finish	Category	Notes	
M85049/6-XXN	MIL-C-26482 Series 2	Backshell, Environmental Shield Termination	45°	Nickel	1A	(1)	
M85049/8-XXN			90°				
M85049/10-XXN			Straight				
M85049/7-XXN		Backshell, Environmental	45°				
M85049/9-XXN			90°				
M85049/11-XXN			Straight				
M85049/24-XXN		Backshell, Nonenvironmental, Shield Termination	90°	Nickel Passivate	3A	(1), (2)	
M85049/25-XXN							
M85049/42-XXDN			Straight				
M85049/42-XXDS					Nickel	4A	(1)
M85049/43-XXN			45°				
M85049/51SXXN		Strain Relief (Saddle Clamp)	90°	Nickel	4B	(1)	
M85049/51SXXA				Anodized Nickel Anodized			
M85049/52SXXN			Straight				
M85049/52SXXA							

- (1) The dash number (-XX) corresponds to the shell size and configuration of the connector and wire bundle accommodation ranges. Consult the specification sheet for application information.
- (2) The MIL-C-85049/42 cable clamp is used to provide strain relief for the connector accessories MIL-C-85049/6, 7, 8, 9, 10, and 11.

**MIL-C-85049**  
**Connector Accessories, Electrical**

Part Number (1)	For Use With Connector Specification	Accessory Description	Configuration	Finish	Category	Notes	
M85049/47SNXX	MIL-C-38999 Series I & II	Cable Clamp	90°	Nickel	4B	(2)	
M85049/47SSXX				Passivate			
M85049/49-2SXXN			Straight	Nickel			
M85049/49-2SXXS				Passivate			
M85049/56-XXN		Strain Relief	Straight	45°	Nickel	4C	
M85049/57SXXN							90°
M85049/63SXXN							
M85049/17XXNXX(X)							Backshell, Environmental, Shield Termination
M85049/36XXNXX(X)	Backshell, Nonenvironmental, Shield Termination						
M85049/38SXXN	MIL-C-38999 Series III	Cable Clamp	Straight	Nickel	4C	(4)	
M85049/38SXXS				Passivate			
M85049/38-XXA				Anodized			
M85049/39SXXN				Nickel			
M85049/39SXXS		Passivate					
M85049/39-XXA		Anodized					
M85049/15SXXN		Strain Relief	45°	90°	Nickel		
M85049/16SXXN						Passivate	
M85049/18XXNXX(X)		Backshell, Environmental, Shield Termination					
M85049/19XXNXX(X)		Backshell, Nonenvironmental, Shield Termination					
M85049/20-XXN	Backshell, Nonenvironmental						

- (1) The "XX" in the part number represents the dash number. Consult the specification sheet for application information.
- (2) The strain relief is used with MS3367-1-X plastic strap, MIL-T-713 lacing twine, or MIL-T-43435 lacing tape or equivalent, that is not supplied with the backshell.
- (3) The "S" is for the self-locking configuration; "G" would be self-locking with groundlug.
- (4) The "XX(X)" is for clamp size and length code. Omit (X) for standard length.

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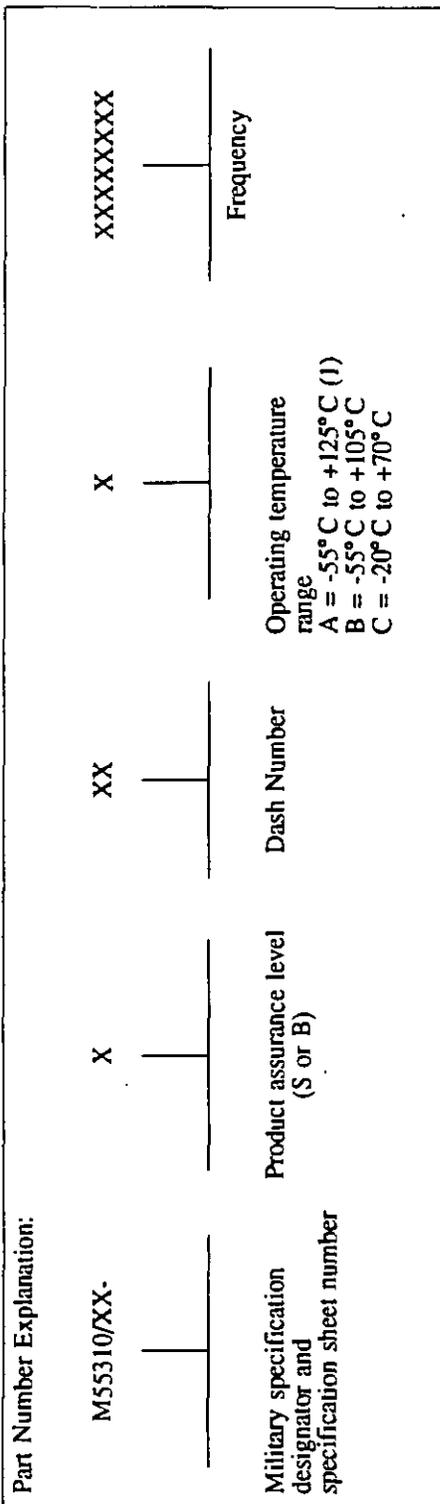
## Section 3: Summary of Standard Crystals and Crystal Oscillators (1)

Page	Control Specification	Description	Frequency Range (Hz)	Grade	
				1	2
3.1	MIL-O-55310	Crystal Oscillators, Type 1	0.1 to 80M	S	B
3.6	MIL-C-49468 (2)	Crystal Units, Quartz, Precision	—	—	—

(1) Refer to MIL-HDBK-978, Vol. 4 for construction and application guidelines.  
 (2) Presently there are no Grade 1 or Grade 2 parts available. Refer to the Candidate Parts List (CPL) for additional information.

MIL-STD-975L (NASA) - Part I

MIL-O-55310, Oscillators, Crystal



Part Number	Type	Out Frequency Range (Hz)		Construction Technology	Output Waveform	Output Compatibility	Grade	
		Min	Max				1	2 (4)
M55310/08-XXXXXXXXXXXXXX	1	50	50M	Hybrid	Square	TTL	S(2)	B
M55310/14-XXXXXXXXXXXXXX	1	0.1	25M				(3)	
M55310/16-XXXXXXXXXXXXXX	1	0.1	60M				S(5)	

- (1) Temperature range A applicable for Class B oscillators only.
- (2) Frequency available for Class S is 512 Hz through 1KHz only.
- (3) Presently there are no Grade 1 parts available.
- (4) For Grade 2 applications, parts shall be screened in accordance with Appendix B.
- (5) Minimum frequency available for Class S is 16KHz.

MIL-STD-975L (NASA) - Part I

**MIL-O-55310/08, Oscillator, Crystal, Type 1  
Hermetic Seal, Square Wave, TTL (1)**

Grade 1 (6)	Dash Number (2)	Output Frequency Range (Hz)		Input Current Max at 5.25 Vdc (mA) (3)	Output Voltage (4)		Rise and Fall Time Max (ns)(5)	Duty Cycle at 1.4 Vdc (%)	Frequency Tolerance (ppm)			Configuration	
		Min	Max		Logic 1 Min (Vdc)	Logic 0 Max (Vdc)			-55 to +125°C A	-55 to +105°C B	-20 to +70°C C		
S10BXXXXXXXX	Grade 2	B01A	1K	150K	158			15	45/55	±50	±40	±25	14 pin DIP 1 = output 2 = case 8 = B-(GND) 14 = B+ 3-7 = NC 9-13 = NC
		B02A	150K	300K	94								
		B03A	300K	600K	94								
		B04A	600K	2.5M	50								
		B05A	2.5M	5M	50	2.4	0.5						
		B06A	5M	10M	35	at	at						
		B07A	10M	20M	25	400µA	16mA						
		B08A	20M	30M	35	source	sink						
		B09A	30M	50M	50								
		B10A	50	1K	158								

- (1) Operating supply voltage of 5.0V ±5%.
- (2) Temperature range A applicable for Class B oscillators only.
- (3) Maximum input current for no load condition.
- (4) Capable of driving 1-10 standard TTL loads. A TTL load = 1.6 mA sink, 0.04 mA source, and 2pF capacitance.
- (5) Measurement taken between 2.0V and 0.8V levels.
- (6) Frequency available for Class S is 512 Hz through 1KHz only.





MIL-STD-975L (NASA) - Part I

**MIL-C-49468, Crystal Units, Quartz, Precision**

There are no qualified sources available for the Grade 1 or Grade 2 Crystals. A number of slash sheets are listed on the Candidate Parts List (CPL) as potential candidates for space flight applications.

**SECTION 4: SUMMARY OF STANDARD DIODES**

Page	Control Specification	Description	Type Designation	
			Grade 1	Grade 2 (1)
4.2		Small signal	JANS	JANTXV
4.2		Power		
4.3		Multiple array		
4.3		Monolithic array		
4.4	MIL-S-19500	Zener - voltage regulator	JANS	JANTXV
4.5	Zener - voltage suppressor			
4.5	Bidirectional voltage suppressor			
4.6	FET - current regulator			
4.6	Schottky barrier			
4.7	Thyristor			

Refer to MIL-HDBK-978, Vol. 2, for construction and application information.

- (1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:
- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
  - b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

# MIL-S-19500 DIODES, SILICON

Part Number Explanation:		TXV		X (2)		IN		XXXX		B		-1	
JAN	Military Qualified	TXV	Quality Level			IN	Component Designation	XXXX	Identification Number	B	Modifier	Metallurgical Bonding	
				Total Ionizing Dose (RAD (SI))		Neutron Fluence (N/cm <sup>2</sup> )							
M		3 x 10 <sup>3</sup>		2 x 10 <sup>11</sup>									
D		1 x 10 <sup>4</sup>		2 x 10 <sup>11</sup>									
R		1 x 10 <sup>4</sup>		1 x 10 <sup>11</sup>									
H		1 x 10 <sup>4</sup>		1 x 10 <sup>11</sup>									

Radiation Hardness Assurance (RHA)

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics					Pkg Outline	Remarks			
				V <sub>F</sub> (Max) at I <sub>F</sub> (pk) (V)	I <sub>F</sub> (A)	I <sub>R</sub> (Max) at V <sub>R</sub> (V)	I <sub>g</sub> (Max avg)	C <sub>t</sub> (Max) (pF)			I <sub>p</sub> (Max) (ns)		
												I <sub>R</sub> (Max) at V <sub>R</sub> (μA)	
Small signal	IN645-1	IN645-1	/240	1.0	400 mA	50 nA	225	400 mA	20	—	A1	Rectifier	
	IN647-1	IN647-1		1.0	10 mA	0.5	75	200 mA	4.0	5			
	IN4148-1 (3)	IN4148-1 (3)	/116	0.86	50 mA	0.1	50	200 mA	2.5	4			
	IN4150-1	IN4150-1	/231	0.81	10 mA	0.05	50	150 mA	2.0	4			
	IN4153-1	IN4153-1	/337	0.8	10 mA	0.5	125	300 mA	2.0	4.5	DO-204		
	IN6638	IN6638	/578	1.0	10 mA	0.5	75	300 mA	5.0	5.0			
	IN6642,U	IN6642,U	/578	1.0	10 mA	0.5	50	300 mA	5.0	6.0			
	IN6643,U	IN6643,U	/578	1.0	10 mA	0.5	50	300 mA	5.0	6.0			
	Power	IN5415	IN5415		1.5	9 A	1.0	50	3 A	550	150	A248	Fast switching
		IN5416	IN5416	/411				100		430	150		
IN5417		IN5417					200		250	150			
IN5418		IN5418					400		165	150			
IN5419		IN5419					500		140	250			
	IN5420	IN5420					600		120	400			

- (1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:
  - (a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
  - (b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table 1, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table 1 parameters described above.
- (2) Include only for JANTXV and JANS product assurance level devices.
- (3) New designs shall use MIL-S-19500/578.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics						Pkg Outline	Remarks		
				V <sub>F</sub> (Max) at I <sub>F</sub> (pk) (V)	I <sub>R</sub> (Max) at V <sub>R</sub> (μA)	I <sub>R</sub> (Max) at V <sub>R</sub> (V)	I <sub>o</sub> (Max avg) (A)	C <sub>i</sub> (Max) (pF)	t <sub>r</sub> (Max) (ns)				
												(A)	(μA)
Power (Continued)	IN5615	IN5615	/429	1.6	3 A	0.5	600	1 A	25	150	A248	Fast switching	
	IN5617	IN5617											400
	IN5619	IN5619											600
	IN5621	IN5621											800
	IN5623	IN5623											1000
	IN3891,A,AR	IN3891,A,AR	/304	1.5	38 A	10	200	12A (T <sub>c</sub> = 100°C)	—	200	DO-203		
	IN3893,A,AR	IN3893,A,AR											400
	IN1202A	IN1202A											200
	IN5550	IN5550	/420	1.2	9 (2)	1.0	600	3	—	2.0 μs	A1	Rectifier	
	IN5551	IN5551											400
	IN5552	IN5552											600
	IN5553	IN5553											800
IN5554	IN5554	1000											
IN5614	IN5614	/427	1.3	3 (2)	0.5	600	1	—	—	A248			
IN5616	IN5616											400	
IN5618	IN5618											600	
IN5620	IN5620											800	
IN5622	IN5622											1000	
IN5804	IN5804	/477	0.975	2.5 (2)	1.0	100	1	—	25	A248	Fast recovery		
IN5806	IN5806											150	
IN5809	IN5809											100	
IN5811	IN5811											150	
IN5814	IN5814											100	
IN5816	IN5816	/478	0.95	20 (2)	10.0	150	5	—	300	DO-203			
IN5768	IN5768											40	
IN5770	IN5770											40	
IN5772	IN5772	/474	1.0	100mA	0.1	40	300 mA	—	8	TO-86	Common cathode Common anode		
IN5774	IN5774											40	
Multiple array	IN6101	IN6101			25 nA	20			4	TO-116	Monolithic		

(1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

(2) Pulsed.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics					Pkg Outline
				P <sub>i</sub> at T <sub>A</sub> = 25°C	V <sub>Z</sub> (Nominal) at I <sub>Z</sub>		V <sub>Z</sub> (Reg) or delta BV (V)		
					(V)	(mA)			
Zener- voltage regulator	1N962B-1 thru 1N973B-1	1N962B-1 thru 1N992B-1	/117	11 - 200	11.5 - 0.65	0.5 - 12			
	1N754A-1 thru 1N759A-1	1N746A-1 thru 1N759A-1		3.3 - 12	20	1.0 - 0.4			
		1N746A thru 1N759A	/127	3.3 - 12	20	1.0 - 0.4			
		1N4370A-1		2.4	20	1.0			DO-204
		1N4371A-1		2.7	20	1.0			
		1N4372A-1		3.0	20	1.0			
		1N4614-1 thru 1N4627-1	/435	400 mW	1.8 - 6.2	120 - 61.0			
		1N4099-1 thru 1N4135-1	/435	400 mW	6.8 - 100	56 - 3.8			
		1N4565A-1 thru 1N4574A-1	/452 (2)	500 mW	6.4	0.5 - 1.0	5 - 100 mV		
		1N6320 thru 1N6336	/533	500 mW (T <sub>L</sub> = 75°C)	6.8 - 33	20 - 3.8	1.6 - 0.35		
		1N6309 thru 1N6336	/533	500 mW (T <sub>L</sub> = 75°C)	2.4 - 33	20 - 3.8	1.6 - 0.3		DO-204
		1N3821A thru 1N3828A	/115	1.0 W	3.3 - 6.2	76 - 41	1.0 - 0.3		DO-202
		1N4460 thru 1N4496	/406	1.5 W	6.2 - 200	40 - 1.2	0.35 - 12		A1
		1N4954 thru 1N4996	/356	2.25 W	6.8 - 360	175 - 3	0.7 - 35		A248
		1N2970 thru 1N2977							
		1N2979B thru 1N2980B							
		1N2982B							
		1N2984B thru 1N2986B							
		1N2988B thru 1N2993B							
		1N2995B, 1N2997B							
	1N2999B thru 1N3005B								
	1N3007B thru 1N3009B	/124	10 W (T <sub>C</sub> = 55°C)	6.8 - 200	370 - 12	0.4 - 9.0		DO-203	

(1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:

a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

(2) Reference: temperature-compensated.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics				Pkg Outline	Remarks
				P <sub>i</sub> at T <sub>a</sub> = 25°C	V <sub>z</sub> (Nominal) at I <sub>z</sub> (V)	V <sub>z</sub> (Reg) or delta BV (mV)			
Zener- voltage regulator (Cont'd)	—	IN3011B thru IN3012B	/124	10 W (T <sub>a</sub> = 55°C)	6.8 - 200	370 - 12	0.4V - 9.0V	DO-203	
		IN3014B thru IN3015B							
		IN821-1					96		
		IN823-1					48		
		IN825-1	/159	250 mW	6.2		19		
		IN827-1					9		
		IN829-1					5		Reference, temperature compensated
		IN935B-1					7.5	184	
		IN937B-1 thru IN939B-1						37 - 9	
		IN941B						239	
IN943B						47			
Zener- voltage suppressor	—	IN5629A thru IN5665A	/500	1 W	6.8 - 200	10 - 1.0		DO-202	Transient voltage suppressor
		IN5907	/500	1 W	6.4	1.0		DO-202	- 1500 watts of peak power dissipation at 1.0 ms
		IN5611	/434	3 W	43.7	1.0		DO-203	500 W 500 W Peak power 1500 W dissipation 1500 W at 1.0 ms
Bidirect- ional voltage suppressor	—	IN6103 thru IN6118	/516	2 W	6.75 - 190	175 - 5.0		A298	
		IN6103A thru IN6137A		2 W					
		IN6139 thru IN6173		3 W					
Bidirect- ional voltage suppressor	—	IN6139A thru IN6173A		3 W					

(1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics					Pkg Outline
				$P_o$ (V)	$I_p$ (mA) (Nom)	$Z_T$ (M $\Omega$ )	$Z_k$ (M $\Omega$ )	$V_L$ (Vdc)	
FET current regulator	—	1N5283 thru 1N5314	/463	100	0.27 - 4.7	14 - 0.235	1.95 - 0.012	1.00 - 2.90	DO-204

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics										Pkg Outline	Remarks
				$V_{(RM)}$ V(pk)	$P_T$ (mW)	$V_{(RR)}$ (10 $\mu$ Adc) (Vdc)	$V_F$ at $I_F$ (pk)		$I_R$ at $V_R$		Carrier Lifetime (ps)	$C_i$ (pf)			
							(V)	(mA)	( $\mu$ A)	(V)					
Schottky barrier	—	1N5711	/444	50	250	70	1.0	15	0.2	50	100	2.0	A1	Hot carrier diode (Schottky)	
		1N5712	/445	16	250	20	1.0	35	0.15	16	100	1.2	A1		
		1N6391	/553	45	—	—	0.68	50A (2)	40 mA (2)	45	—	2000	DO-203AA		
		1N6392	/554	45	—	—	0.68	60A (2)	60 mA (2)	45	—	3000	DO-203AB		

- (1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:
  - a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
  - b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

(2)  $T_c = 125^\circ\text{C}$ , pulsed.

**MIL-S-19500 DIODES, SILICON (Continued)**

Description	Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Electrical Characteristics							Pkg Outline	Remarks
				V <sub>FRM</sub> (V)	I <sub>HDX</sub> (mAdc)	I <sub>G</sub> (A)	V <sub>KGM</sub> (V)	V <sub>GT</sub> (Vdc)	t <sub>on</sub> (μs)			
Thyristor		2N2323A		50								
		2N2324A	776	100	2.2	2.0	0.22	6	0.1/0.8	1.0	TO-205	Low-power SCR
		2N2326A		200								
		2N2328A		300								

(1) Before use in Grade 2 applications, all JANTXV diode part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV diode parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

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**SECTION 5: SUMMARY OF STANDARD FILTERS (1)**

Page	Control Specification	Description	Frequency Range -55°C to +125°C		Grade 1	Grade 2
			Minimum	Maximum		
5.2	MIL-F-28861 (2)	RF & EMI suppression	15 kHz	1.0 GHz		(3)

- (1) Refer to MIL-HDBK-978, Vol. 4, for construction and application information.
- (2) For stud-mounted filters, do not exceed the rated torque specification on the stud nut.
- (3) These parts are for use in Grade 2 applications only. Presently there are no Grade 1 filters.

MIL-STD-975L (NASA) - Part I

MIL-F-28861 FILTERS  
Radio Frequency/Electromagnetic Interference Suppression

Part Number Explanation: M28861	/X	-XXX	X	X
Military Specification Sheet	Military Slash Sheet	Dash Number	Case Finish	Product Assurance Level B, S
			T = Tin-plated/tin-lead plated S = Silver-plated G = Gold-plated (Class S only)	

Part Number (1)	Rated Voltage		Rated Current Maximum Range (Amperes)	Capacitance		Circuit Type	Frequency Range (kHz)	Grade 1 (2)	Grade 2 (3)
	dc	ac		Minimum Range (µF)					
M28861/1-XXXXXX	70 - 200	125 (0 to 400Hz)	15	0.15 - 0.7		C or L <sub>2</sub>	30 - 1,000		
M28861/2-XXXXXX	100	-	0.25 - 5.0	0.45 - 0.9		L <sub>1</sub> , L <sub>2</sub> or P <sub>1</sub>	100 - 1,000		B
M28861/4-XXXXXX	70	-	0.1 - 5.0	0.70 - 1.4		L <sub>1</sub> , L <sub>2</sub> or P <sub>1</sub>	15 - 1,000		
M28861/5-XXXXXX	200	125 (0 to 400Hz)	0.25 - 50	0.15 - 0.3		L <sub>1</sub> , L <sub>2</sub> or P <sub>1</sub>	100 - 1,000		

- (1) Parts covered by these specifications contain internal solder connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Presently there are no Grade 1 filters.
- (3) Grade 2 parts are Class B in accordance with MIL-F-28861.

**MIL-F-28861/1, FILTERS (1)  
RF/EMI Suppression**

Part Number	Style	Ratings		C	IR Limit @ +25°C	Minimum Insertion Loss (MIL) at -55°C and +125°C (2)				Grade 1 (3)	Grade 2 (4)		
		Voltage				Min (μF)	Min (Megohms)	Freq (kHz)	MIL (dB)			Freq (GHz)	MIL (dB)
		Volts dc	Volts ac										
M28861/1-003XX	FS-11	70	—	0.7	1000	30	8	1	70	—	B		
M28861/1-013XX													
M28861/1-004XX		100	15	0.45		4							
M28861/1-014XX													
M28861/1-005XX	FS-11	200	125 (0 to 400Hz)	0.15	1000	150	9	1	70	—	B		
M28861/1-015XX													
M28861/1-006XX		15	0.15	0.15		9							
M28861/1-016XX													
M28861/1-009XX	FS-11	200	125 (0 to 400Hz)	0.15	1000	150	9	1	70	—	B		
M28861/1-019XX													
M28861/1-010XX		15	0.15	0.15		9							
M28861/1-020XX													

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) For slash 1 parts, insertion loss measurements shall be made under full load over the frequency range of 150kHz to 10MHz. Insertion loss measurements above or below this frequency range shall be made under no load.
- (3) Presently there are no Grade 1 filters.
- (4) Grade 2 parts are Class B in accordance with MIL-F-28861.

**MIL-F-28861/2, FILTERS (1)  
RF/EMI Suppression**

Part Number	Style	Ratings		C	IR Limit @ +25°C	Minimum Insertion Loss (MIL) at - 55°C and +125°C (2)				Grade 1 (3)	Grade 2 (4)		
		Voltage	Current			Min (μF)	Min (Megohms)	Freq (kHz)	MIL (dB)			Freq (GHz)	MIL (dB)
M28861/2-001XX	FS-20	—	—	0.45	1000	100	—	—	—	—	—	70	
M28861/2-013XX				0.45								28	70
M28861/2-002XX				0.45								0.25	70
M28861/2-014XX				0.45								70	
M28861/2-003XX				0.90								52	80
M28861/2-015XX				0.90								52	80
M28861/2-004XX				0.45								13	70
M28861/2-016XX				0.45								13	70
M28861/2-005XX				0.45								13	70
M28861/2-017XX				0.45								13	70
M28861/2-006XX				0.90								38	80
M28861/2-018XX				0.90								38	80
M28861/2-007XX				0.45								12	70
M28861/2-019XX				0.45								12	70
M28861/2-008XX				0.45								12	70
M28861/2-020XX				0.45								12	70
M28861/2-009XX	0.90	23	80										
M28861/2-021XX	0.90	23	80										
M28861/2-010XX	0.45	12	70										
M28861/2-022XX	0.45	12	70										
M28861/2-011XX	0.45	12	70										
M28861/2-023XX	0.45	12	70										
M28861/2-012XX	0.90	36	80										
M28861/2-024XX	0.90	36	80										

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Insertion loss measurements shall be made under full load over the frequency range of 100kHz to 10MHz. Insertion loss measurements above or below this frequency range shall be made under no load.
- (3) Presently there are no Grade 1 filters.
- (4) Grade 2 parts are Class B in accordance with MIL-F-28861.

**MIL-F-28861/4, FILTERS (1)**  
**RF/EMI Suppression**

Part Number	Style	Ratings		C	IR Limit @ +25°C	Minimum Insertion Loss (MIL) at -55°C and +125°C (2)				Grade 1 (3)	Grade 2 (4)
		Voltage	Current			Freq (kHz)	MIL (dB)	Freq (GHz)	MIL (dB)		
M28861/4-001XX				0.70	1000	15	7			70	
M28861/4-019XX				0.70	1000	15	7			70	
M28861/4-002XX			0.10	0.70	1000	15	7			70	
M28861/4-020XX				0.70	1000	15	7			70	
M28861/4-003XX				1.4	715	15	13			80	
M28861/4-021XX				1.4	715	15	13			80	
M28861/4-004XX				0.7	1000	15	4			70	
M28861/4-022XX				0.7	1000	15	4			70	
M28861/4-005XX	FS-40	70		0.7	1000	15	4		1	70	B
M28861/4-023XX			0.30	0.7	1000	15	4			70	
M28861/4-006XX				1.4	715	30	27			80	
M28861/4-024XX				1.4	715	30	27			80	
M28861/4-007XX				0.7	1000	15	3			70	
M28861/4-025XX				0.7	1000	15	3			70	
M28861/4-008XX			0.50	0.7	1000	15	3			70	
M28861/4-026XX				0.7	1000	15	3			70	
M28861/4-009XX				1.4	715	30	19			80	
M28861/4-027XX				1.4	715	30	19			80	

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Insertion loss measurements shall be made under full load over the frequency range of 100kHz to 10MHz. Insertion loss measurements above or below this frequency range shall be made under no load.
- (3) Presently there are no Grade 1 filters.
- (4) Grade 2 parts are Class B in accordance with MIL-F-28861.

**MIL-F-28861/4, FILTERS (1)  
RF/EMI Suppression (Continued)**

Part Number	Style	Ratings		C	IR Limit @ +25°C (Megohms)	Minimum Insertion Loss (MIL) at -55°C and +125°C (2)				Grade 1 (3)	Grade 2 (4)
		Voltage	Current			MIL (dB)	Freq (GHz)	MIL (dB)	Freq (kHz)		
M28861/4-010XX	FS-40	70	—	0.7	1000	15	3	70	1	—	B
M28861/4-028XX				0.7	1000	15	3	70			
M28861/4-011XX				0.7	1000	15	3	70			
M28861/4-029XX				0.7	1000	15	3	70			
M28861/4-012XX				1.4	715	30	18	80			
M28861/4-030XX				1.4	715	50	18	80			
M28861/4-013XX				0.7	1000	15	3	70			
M28861/4-031XX				0.7	1000	15	3	70			
M28861/4-014XX				0.7	1000	15	3	70			
M28861/4-032XX				0.7	1000	15	3	70			
M28861/4-015XX				1.4	715	100	15	80			
M28861/4-033XX				1.4	715	100	15	80			
M28861/4-016XX				0.70	1000	100	12	70			
M28861/4-034XX				0.70	1000	100	12	70			
M28861/4-017XX				0.70	1000	100	12	70			
M28861/4-035XX				0.70	1000	100	12	70			
M28861/4-018XX	1.4	715	150	14	80						
M28861/4-036XX	1.4	715	150	14	80						

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Insertion loss measurements shall be made under full load over the frequency range of 100kHz to 10MHz. Insertion loss measurements above or below this frequency range shall be made under no load.
- (3) Presently there are no Grade 1 filters.
- (4) Grade 2 parts are Class B in accordance with MIL-F-28861.

**MIL-F-28861/5, FILTERS (1)  
RF/EMI Suppression**

Part Number	Style	Ratings		C	IR Limit @ +25°C Min (Megohms)	Minimum Insertion Loss (MIL) at -55°C and +125°C (2)				Grade 1 (3)	Grade 2 (4)
		Voltage Volts dc Volts ac	Current Max (Amps)			Freq (kHz)	MIL (dB)	Freq (GHz)	MIL (dB)		
M28861/5-001XX				0.15		20			70		
M28861/5-013XX				0.15		20			70		
M28861/5-002XX			0.25	0.15		20			70		
M28861/5-014XX				0.15		20			70		
M28861/5-003XX				0.30		32			80		
M28861/5-015XX				0.30		32			80		
M28861/5-004XX				0.15		6			70		
M28861/5-016XX				0.15		6			70		
M28861/5-005XX			1.0	0.15		6			70		
M28861/5-017XX				0.15		6			70		
M28861/5-006XX				0.30		16			80		
M28861/5-018XX				0.30	1000	16		I	80		B
M28861/5-007XX	FS-50	200		0.15		3			70		
M28861/5-019XX				0.15		3			70		
M28861/5-008XX			3.0	0.15		3			70		
M28861/5-020XX				0.15		3			70		
M28861/5-009XX				0.30		17			80		
M28861/5-021XX				0.30		17			80		
M28861/5-010XX				0.15		3			70		
M28861/5-022XX				0.15		3			70		
M28861/5-011XX			5.0	0.15		3			70		
M28861/5-023XX				0.15		3			70		
M28861/5-012XX				0.30		49			80		
M28861/5-024XX				0.30		49			80		

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Insertion loss measurements shall be made under full load over the frequency range of 100kHz to 10MHz. Insertion loss measurements above or below this frequency range shall be made under no load.
- (3) Presently there are no Grade 1 filters.
- (4) Grade 2 parts are Class B in accordance with MIL-F-28861.

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## SECTION 6: SUMMARY OF STANDARD INDUCTORS (1)

Page	Control Specification	Description	Inductance Range		Q (min) Range	FRL	
			Min	Max		Grade 1	Grade 2
6.2	MIL-C-39010	Fixed, molded, radio frequency coil	0.1 $\mu$ H	100.0 mH	75 - 18	(2)	P
6.9	MIL-C-83446	Chip, radio frequency, fixed or variable	0.01 $\mu$ H	1,000 $\mu$ H	75 - 19		

(1) Refer to MIL-HDBK-978, Vol. 4, for construction and application information.

(2) Presently there are no Grade 1 coils.

(3) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1 herein).

### MIL-C-39010 COILS (1) Fixed, Radio Frequency, Molded, Established Reliability

Part Number Explanation:

M39010	/XX	-X	XXX	X	X
Military Specification Designator	Slash Sheet	Class Temperature A = +105°C B = +125°C F = +150°C	Inductance Value	Inductance Tolerance J = ±5% K = ±10% L = ±20%	Failure Rate Level S = 0.001% / 1000 hrs P = 0.1% / 1000 hrs

Part Number	Inductance Range (µH)	Inductance Tolerance (±%)	Q Min Range	Self-Resonant Frequency (MHz) Min	Rated dc Current (mA)	Core Type	Construction	Operating Temperature (°C)		FRL	
								Min	Max	Grade 1	Grade 2 (3)
M39010/01-AXXXXXX	0.10 - 0.82		40 - 50	180 - 250	370 - 1790	Phenolic core & iron sleeve	Shielded		+105		
M39010/02-AXXXXXX	1.00 - 12.0		44 - 55	44 - 140	200 - 1070	Iron	Shielded		+105		
M39010/03-AXXXXXX	15 - 100,000	5, 10	18 - 60	0.11 - 49	11 - 315	Ferrite	Shielded	-55	+105	(2)	P
M39010/06-BXXXXXX	0.15 - 4.7	5, 10, 20	33 - 50	90 - 525	260 - 2450	Phenolic	Unshielded		+125		
M39010/07-AXXXXXX	5.6 - 33	5, 10	45 - 75	19 - 60	165 - 495	Iron	Unshielded		+105		

- (1) Parts covered by this specification contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow.
- (2) Presently there are no Grade 1 parts.
- (3) Grade 2 parts shall meet class B requirements of MIL-STD-981.

## MIL-STD-975L (NASA) - Part I

**MIL-C-39010/01 COILS, MICROMINIATURE  
Magnetically Shielded (Phenolic Core, Iron Sleeve), Established Reliability**

Dash Number		Inductance ( $\mu$ H)	Q Min	Test Frequency (MHz)	Self Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current (mA)
Grade 1	Grade 2						
(1)	AR10*P	0.10		25	250	0.025	1790
	AR12*P	0.12	50			0.034	1530
	AR15*P	0.15				0.037	1470
	AR18*P	0.18				0.047	1300
	AR22*P	0.22	49			0.067	1100
	AR27*P	0.27	47			0.11	853
	AR33*P	0.33	46			0.13	780
	AR39*P	0.39	44			0.18	670
	AR47*P	0.47	44			0.25	565
	AR56*P	0.56	43			0.33	490
AR68*P	0.68	42	0.45	420			
AR82*P	0.82	40	0.59	370			

\* Choice of tolerances: J ( $\pm 5\%$ ), K ( $\pm 10\%$ ).

(1) Presently there are no Grade 1 coils.

## MIL-STD-975L (NASA) - Part I

**MIL-C-39010/02 COILS, MICROMINIATURE  
Magnetically Shielded (Iron Core, Iron Sleeve), Established Reliability**

Grade 1	Dash Number		Inductance ( $\mu$ H)	Q Min	Test Frequency (MHz)	Self Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current (mA)	Operating Temperature (°C)	
	Grade 2								Min	Max
(1)	A1R0*P		1.00		2.5	140	0.07	1070	-55	+105
	A1R2*P		1.20			130	0.10	895		
	A1R5*P		1.50		7.9	115	0.12	815		
	A1R8*P		1.80			105	0.14	755		
	A2R2*P		2.20	44		100	0.19	650		
	A2R7*P		2.70			92	0.28	535		
	A3R3*P		3.30		85	0.35	480			
	A3R9*P		3.90		75	0.40	450			
	A4R7*P		4.70		2.5	70	0.55	380		
	A5R6*P		5.60			65	0.72	335		
	A6R8*P		6.80	50		55	1.02	280		
	A8R2*P		8.20	50		50	1.32	245		
	A100*P		10.0	50		46	1.62	220		
	A120*P		12.0	55		44	2.00	200		

\* Choice of tolerances: J ( $\pm 5\%$ ), K ( $\pm 10\%$ ).  
(1) Presently there are no Grade 1 coils.

## MIL-STD-975L (NASA) - Part I

**MIL-C-39010/06 COILS, MICROMINIATURE  
Phenolic Core, Established Reliability**

Grade 1	Dash Number		Inductance ( $\mu$ H)	Q Min	Test Frequency (MHz)	Self Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current (mA)	Operating Temperature (°C)	
	Grade 2								Min	Max
		BR15*P	0.15	50		525	0.030	2450		
		BR22*P	0.22	50		460	0.055	1810		
		BR33*P	0.33	45		360	0.090	1400		
		BR47*P	0.47	45	25.0	310	0.120	1225		
		BR56*P	0.56	50		280	0.135	1150		
		BR68*P	0.68	50		250	0.150	1100		
		BR82*P	0.82	50		220	0.220	900		
(1)		B1R0*P	1.00	50		200	0.290	785	-55	+125
		B1R2*P	1.20			180	0.420	650		
		B1R5*P	1.50			160	0.500	600		
		B1R8*P	1.80			150	0.650	525		
		B2R2*P	2.20			135	0.950	435		
		B2R7*P	2.70	33	7.9	120	1.20	385		
		B3R3*P	3.30			110	2.00	300		
		B3R9*P	3.90			100	2.30	280		
		B4R7*P	4.70			90	2.60	260		

\* Choices of tolerances: J ( $\pm 5\%$ ), K ( $\pm 10\%$ ), L ( $\pm 20\%$ ,  $0.15\mu\text{H}$  to  $0.47\mu\text{H}$  only).  
(1) Presently there are no Grade 1 coils.

## MIL-STD-975L (NASA) - Part I

**MIL-C-39010/07 COILS, MICROMINIATURE  
Powdered Iron Core, Established Reliability**

Dash Number		Inductance ( $\mu$ H)	Q Min	Test Frequency (MHz)	Self Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current (mA)	Operating Temperature (°C)	
Grade 1	Grade 2							Min	Max
(1)	A5R6*P	5.6	45	7.9	60	0.32	495	-55	+105
	A6R8*P	6.8	50		55	0.50	395		
	A8R2*P	8.2	50		50	0.60	360		
	A100*P	10	55	45	0.90	290			
	A120*P	12	65	42	1.10	265			
	A150*P	15	65	40	1.40	240			
	A180*P	18	75	34	2.25	185			
	A220*P	22	75	30	2.50	175			
	A270*P	27	60	25	2.60	170			
	A330*P	33	65	19	3.00	165			

\* Choice of tolerances: J ( $\pm 5\%$ ), K ( $\pm 10\%$ ).  
(1) Presently there are no Grade 1 coils.

MIL-STD-975L (NASA) - Part I

**MIL-C-83446 COILS, CHIP  
Fixed or Variable, Radio-frequency**

Part Number Explanation:

M83446	/XX	-XX	X
Military Specification Designator	Military Slash Sheet	Dash Number	Termination Finish

A = Gold over nickel  
 B = Tin-lead over nickel  
 C = Tin plated  
 D = Platinum-gold  
 E = Palladium-silver  
 F = Tin-lead

Part Number	Inductance Range ( $\mu$ H)	Inductance Tolerance ( $\pm$ %)	Q Min Range	Self Resonant Frequency Range Min (MHz)	Rated dc Current Range (mA)	Configuration	Operating Temperature ( $^{\circ}$ C)	
							Construction	Min
M83446/04XXX	0.010 - 27.0	10, 20	22 - 60	22.0 - 2700	120 - 1270	Fixed		
M83446/05XXX	0.01 - 10.0	10	42 - 60	33.0 - 2000	87 - 750	Fixed		
M83446/07XXX	0.016 - 76.1	—	19 - 55	5.0 - 1200	22 - 750	Variable	Unshielded	+125
M83446/09XXX	0.015 - 150	—	22 - 55	3.0 - 1200	22 - 750	Variable		
M83446/10XXX	0.01 - 1000.0	10	30 - 75	1.7 - 2000	25 - 1000	Fixed		

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/4 COILS, CHIP  
Fixed, Radio-frequency**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C) (3)		Grades I and 2
							Min	Max	
01X	0.12	30		750	0.125	880			
02X	0.15	25		650	0.175	745			
03X	0.18	25		550	0.200	695			
04X	0.22	25		450	0.220	665			
05X	0.27	25		375	0.230	650			
06X	0.33	25	25	300	0.235	645			
07X	0.39	22		235	0.240	635			
08X	0.47	22		215	0.260	610			
09X	0.56	22		195	0.278	590			
10X	0.68	22		175	0.520	435			
11X	0.82	22		160	0.530	430			
12X	1.0	22		145	0.540	425			
13X	1.2	22		130	0.740	360			
14X	1.5	22		115	0.840	340			
15X	1.8	22		105	0.920	325			
16X	2.2	22		85	1.00	310			
17X	2.7	24		77	1.15	290			
18X	3.3	24	7.9	70	1.40	260			
19X	3.9	24		68	1.55	250			
20X	4.7	24		60	1.80	230			
21X	5.6	22		55	2.00	220			
22X	6.8	22		50	2.20	210			
23X	8.2	22		48	2.50	195			
24X	10.0	24		40	3.45	165			

(1) X = Choice of allowable termination finish (A, B, C, D, E, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

(3) These epoxy coated coils are sensitive to operation at or near the maximum operating temperature of +125°C. It is recommended that these coils be restricted in application to a temperature of +105°C maximum.

## MIL-STD-975L (NASA) - Part 1

**MIL-C-83446/4 COILS, CHIP  
Fixed, Radio-frequency (Continued)**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C) (3)		Grades 1 and 2
							Min	Max	
25X	12.0	25		35	3.80	160			
26X	15.0	25		30	5.60	135			
27X	18.0	25	2.5	28	5.80	130			
28X	22.0	25		25	6.40	125			
29X	27.0	25		22	6.90	120			
30X	0.010 $\pm 20\%$	60		2700	0.060	1270	-55	+125	(2)
31X	0.015 $\pm 20\%$	55		2200	0.078	1110			
32X	0.022 $\pm 20\%$	50		1800	0.108	950			
33X	0.033 $\pm 20\%$	48	50	1450	0.120	900			
34X	0.047 $\pm 20\%$	42		1220	0.145	820			
35X	0.068 $\pm 20\%$	36		1000	0.195	705			
36X	0.100 $\pm 20\%$	32		830	0.230	650			

(1) X = Choice of allowable termination finish (A, B, C, D, E, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

(3) These epoxy coated coils are sensitive to operation at or near the maximum operating temperature of +125°C. It is recommended that these coils be restricted in application to a temperature of +105°C maximum.

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/5 COILS, CHIP**  
**Fixed, Radio-frequency**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
01X	0.010	60		2000	0.025				
02X	0.012	60	150	2000	0.025	750			
03X	0.015	60		1800	0.040				
04X	0.018	60		1500	0.040				
05X	0.022	51		1400	0.040	750			
06X	0.027	51		1200	0.040	750			
07X	0.033	47		1200	0.050	640			
08X	0.039	47	100	1200	0.070	600			
09X	0.047	47		1000	0.080	550			
10X	0.056	47		900	0.090	520			
11X	0.068	47		900	0.10	480			
12X	0.082	47		750	0.11	470			
13X	0.100	47		700	0.11	470	-55	+125	(2)
14X	0.120	47		600	0.11	470			
15X	0.150	47		500	0.12	450			
16X	0.180	51	50	450	0.14	430			
17X	0.220	51		420	0.20	350			
18X	0.270	51		400	0.25	310			
19X	0.330	51		320	0.30	280			
20X	0.390	47		270	0.45	240			
21X	0.470	47		250	0.50	230			
22X	0.560	52		200	0.55	220			
23X	0.680	52	25	180	0.58	210			
24X	0.820	52		150	0.60	200			
25X	1.00	52		120	0.65	190			

(1) X = Choice of allowable termination finish (A, C, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/5 COILS, CHIP  
Fixed, Radio-frequency (Continued)**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
26X	1.20	42		110	0.75	180			
27X	1.50	42		100	1.1	160			
28X	1.80	48		95	1.2	150			
29X	2.20	48		90	1.3	140			
30X	2.70	48		65	1.5	130			
31X	3.30	48	7.9	55	1.8	120			
32X	3.90	48		45	2.0	110			
33X	4.70	48		43	2.3	100			
34X	5.60	48		40	2.5	100			
35X	6.80	46		38	2.6	98			
36X	8.20	46		35	2.8	95			
37X	10.0	46		33	3.3	87			(2)

- (1) X = Choice of allowable termination finish (A, C, F).  
 (2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/7 COILS, CHIP  
Variable, Radio-frequency**

Dash Number (1)	Inductance Range ( $\mu$ H)	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
01X	0.016 - 0.019	52	150	1200	0.02	750			(2)
02X	0.019 - 0.024	55	150	1100	0.02				
03X	0.024 - 0.030	55	150	1000	0.03				
04X	0.029 - 0.037	52	150	900	0.03				
05X	0.035 - 0.043	52	150	750	0.03				
06X	0.042 - 0.052	52	100	660	0.04				
07X	0.049 - 0.062	55	100	610	0.04				
08X	0.060 - 0.076	55	100	550	0.05				
09X	0.072 - 0.092	55	100	520	0.06	640			
10X	0.090 - 0.110	50	50	490	0.07	600			
11X	0.105 - 0.135	50	50	460	0.07	600			
12X	0.13 - 0.17	45	50	430	0.10	480	-55	+125	
13X	0.16 - 0.20	45	50	385	0.12	450			
14X	0.19 - 0.25	45	50	330	0.15	400			
15X	0.24 - 0.31	45	50	275	0.20	350			
16X	0.29 - 0.37	45	50	240	0.25	300			
17X	0.35 - 0.44	42	50	210	0.35	260			
18X	0.42 - 0.52	40	25	190	0.40	250			
19X	0.50 - 0.62	40	25	165	0.50	230			
20X	0.60 - 0.76	40	25	155	0.75	180			
21X	0.73 - 0.92	40	25	145	0.90	160			
22X	0.88 - 1.12	40	25	130	1.80	120			
23X	1.05 - 1.35	40	25	120	1.90	115			
24X	1.3 - 1.7	22	7.9	105	3.00	90			
25X	1.5 - 2.0	22	7.9	95	3.50	85			

- (1) X = Choice of allowable termination finishes (A, C, F).  
 (2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/7 COILS, CHIP  
Variable, Radio-frequency (Continued)**

Dash Number (1)	Inductance Range ( $\mu$ H)	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
26X	1.9 - 2.5	19		85	6.5	62			
27X	2.4 - 3.0	19		80	7.0	60			
28X	2.9 - 3.7	19		75	7.5	55			
29X	3.5 - 4.3	19		70	10.0	50			
30X	4.2 - 5.2	19	7.9	38	2.5	100			
31X	5.0 - 6.2	22		36	2.5	100			
32X	6.0 - 7.5	22		35	3.5	85			
33X	7.3 - 9.1	21		30	4.5	75			
34X	8.8 - 11.2	21		25	5.0	70			
35X	10.6 - 13.4	21		20	5.5	65			
36X	13.2 - 16.8			18	6.5	60			(2)
37X	15.8 - 20.1			17	11.0	47			
38X	19.4 - 24.6			16	12.0	45			
39X	23.7 - 30.2			13	13.5	43			
40X	29.1 - 36.9	22	2.5	11	14.0	42			
41X	34.3 - 43.6			10	18.0	37			
42X	41.3 - 52.6			9	20.0	35			
43X	49.2 - 62.7			8	22.0	34			
44X	59.8 - 76.1			7	24.0	32			

(1)

X = Choice of allowable termination finish (A, C, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/9 COILS, CHIP  
Variable, Radio-frequency**

Dash Number (1)	Inductance Range ( $\mu$ H)	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
01X	0.015 - 0.021	50		1200	0.03				
02X	0.018 - 0.026	55	150	1100	0.03	750			
03X	0.022 - 0.032	55		1000	0.03				
04X	0.027 - 0.039	55		900	0.04				
05X	0.033 - 0.047		150	750	0.04	750			
06X	0.039 - 0.056	55	100	660	0.04	750			
07X	0.047 - 0.068		100	610	0.05	700			
08X	0.055 - 0.083		100	550	0.05	700			
09X	0.067 - 0.099	55	100	520	0.06	645			
10X	0.080 - 0.120	55	100	490	0.06	645			
11X	0.096 - 0.144	50	50	460	0.07	600			
12X	0.120 - 0.180	50	50	430	0.08	560	-55	+125	(2)
13X	0.140 - 0.220		50	385	0.09	525			
14X	0.170 - 0.270	50	50	330	0.10	500			
15X	0.210 - 0.330		50	300	0.15	400			
16X	0.260 - 0.400		50	275	0.19	360			
17X	0.320 - 0.470		50	240	0.25	300			
18X	0.370 - 0.570		25	210	0.30	280			
19X	0.460 - 0.680		25	190	0.40	250			
20X	0.540 - 0.820	40	25	165	0.60	200			
21X	0.680 - 1.000			155	0.70	180			
22X	0.750 - 1.250		25	140	0.90	160			
23X	0.900 - 1.500			125	1.1	150			

(1) X = Choice of allowable termination finish (A, C, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

**MIL-C-83446/9 COILS, CHIP  
Variable, Radio-frequency (Continued)**

Dash Number (1)	Inductance Range ( $\mu$ H)	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
24X	1.13 - 1.87	35		115	1.3	135			
25X	1.35 - 2.25	35		105	1.7	120			
26X	1.65 - 2.75	35		100	2.3	100			
27X	2.02 - 3.37	25		85	3.0	90			
28X	2.48 - 4.12	25	7.9	75	3.9	80			
29X	2.92 - 4.87	25		47	3.9	80			
30X	3.52 - 5.88	25		30	3.9	80			
31X	4.20 - 7.00	22		24	4.0	75			
32X	5.10 - 8.50			23	4.0	75			
33X	6.10 - 10.2		22	4.5	72				
34X	7.50 - 12.5		21	4.5	72				
35X	9.00 - 15.0		17	5.0	70				
36X	11.2 - 18.7	22	2.5	15	6.0	65	-55	+125	(2)
37X	13.5 - 22.5			14	8.0	55			
38X	16.5 - 27.5			13	10.0	50			
39X	20.2 - 31.3			11	11.0	45			
40X	24.7 - 41.2			10	13.0	43			
41X	29.2 - 48.8	9	14.0	42					
42X	35.2 - 58.8	8	15.0	40					
43X	42.0 - 70.0	7	19.0	36					
44X	51.0 - 85.0	22	6	24.0	32				
45X	62.0 - 102.0	25	5	31.0	28				
46X	75.0 - 125.0	25	4	40.0	25				
47X	90.0 - 150.0	25	3	50.0	22				

(1) X = Choice of allowable termination finish (A, C, F).  
(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/10 COILS, CHIP  
Fixed, Radio-frequency**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
01X	0.010	60		2000	0.04				
02X	0.012	70	150	1800	0.04				
03X	0.015	75		1500	0.04	1000			
04X	0.018	75		1500	0.04				
05X	0.022			1300	0.05	1000			
06X	0.027	60		1300	0.05	1000			
07X	0.033			1000	0.05	1000			
08X	0.039		100	1000	0.06	900			
09X	0.047			800	0.06	900			
10X	0.056	65		760	0.06	900			
11X	0.068			700	0.07	840			
12X	0.082			650	0.07	840			
13X	0.100	65		570	0.07	840			
14X	0.120	65		520	0.07	840			
15X	0.150	75		400	0.08	790			
16X	0.180	75	50	360	0.08	790			
17X	0.220			320	0.08	790			
18X	0.270	70		270	0.10	700			
19X	0.330			240	0.10	700			
20X	0.390			220	0.10	700			

- (1) X = Choice of allowable termination finish (A, C, F).  
 (2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/10 COILS, CHIP  
Fixed, Radio-frequency (Continued)**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
21X	0.470	70		190	0.14	590			
22X	0.560	70	25	170	0.19	510			
23X	0.680	70		160	0.26	430			
24X	0.820	75		150	0.30	400			
25X	1.00	75	25	130	0.34	380			
26X	1.20	65	7.9	120	0.45	330			
27X	1.50	65	7.9	110	0.57	290			
28X	1.80	65	7.9	100	0.72	260			
29X	2.20	65		80	0.9	230			
30X	2.70	65		60	1.1	210			(2)
31X	3.30	60		50	1.2	200			
32X	3.90	60	7.9	45	1.4	180			
33X	4.70	60		42	1.6	170			
34X	5.60	65		40	1.8	160			
35X	6.80	65		37	2.4	140			
36X	8.20	65		34	3.0	130			
37X	10.0	65	7.9	29	3.5	120			
38X	12.0	60	2.5	27	3.6	118			
39X	15.0	60	2.5	22	3.7	115			
40X	18.0	60	2.5	17	3.8	114			

- (1) X = Choice of allowable termination finish (A, C, F).  
 (2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

## MIL-STD-975L (NASA) - Part I

**MIL-C-83446/10 COILS, CHIP  
Fixed, Radio-frequency (Continued)**

Dash Number (1)	Inductance ( $\pm 10\%$ ) ( $\mu\text{H}$ )	Q (Min)	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	dc Resistance (@ +25°C) Max (Ohms)	Rated dc Current Max (mA)	Operating Temperature (°C)		Grades 1 and 2
							Min	Max	
41X	22.0	60		16	3.9	113			
42X	27.0	65		15	4.0	110			
43X	33.0	65		14	5.0	100			
44X	39.0	65	2.5	13	7.0	84			
45X	47.0	70		12	8.0	79			
46X	56.0	70		11	10.0	70			
47X	68.0	65		10	11.0	67			
48X	82.0	60		9	12.0	64			
49X	100.0	60	2.5	8	13.0	62			
50X	120.0	40	0.79	7	14.0	59	-55	+125	(2)
51X	150.0	40	0.79	6	16.0	56			
52X	180.0	40	0.79	5	18.0	52			
53X	220.0			4	24.0	45			
54X	270.0	40		3.3	25.0	44			
55X	330.0			3.1	29.0	41			
56X	390.0		0.79	2.9	32.0	39			
57X	470.0	35		2.4	35.0	37			
58X	560.0	35		2.1	45.0	33			
59X	680.0	35		1.9	55.0	30			
60X	820.0	30		1.8	70.0	26			
61X	1000.0	30		1.7	80.0	25			

(1) X = Choice of allowable termination finish (A, C, F).

(2) These inductors may be used in Grade 2 applications. They may be used in Grade 1 applications if they meet the Class S requirements of MIL-STD-981 (see Appendix C, Table 1).

**SECTION 7: SUMMARY OF STANDARD MICROCIRCUITS**

Page	Control Specification	Description	Grade 1	Grade 2
7.2		Microcircuit information	JAN Class S	JAN Class B
7.3		Digital, Schottky, low-power TTL		
7.7		Digital, Schottky, advanced low-power TTL		
7.9		Digital, Schottky, fast TTL		
7.11	MIL-M-38510	Digital, CMOS, 4000B series	JAN Class S	JAN Class B
7.13		Linear, CMOS		
7.14		Digital, CMOS, high speed		
7.16		Digital, CMOS, high-speed, TTL compatible		
7.17		Digital, interface	JAN Class S	JAN Class B
7.18		Bipolar, memories		
7.19		CMOS, memories		
7.20		Microprocessors		
7.21		Linear	JAN Class S	JAN Class B
7.25		Semiconductom		
7.26		Interface peripherals		
7.27		Digital, Advanced CMOS		
7.29		Digital, Advanced CMOS, TTL-compatible		

Refer to MIL-HDBK-978, Vol. 3, for construction and application information.

## MIL-M-38510, MICROCIRCUIT INFORMATION

Part Number Explanation:

M38510	X (1)	XXX	XX	X (3)	X	X
Military Designator	Radiation Hardness Assurance (RHA) Designator	Detail Specification	Device Type	Device Class	Case Outline (2)	Lead Finish
		Establishes the general requirements, quality and reliability requirements, detail specific characteristics of the microcircuits	Determines the specific circuit or device type. (See detail specification for list.)	Two levels of microcircuit quality and reliability assurance are provided: Class S Class B	Single alphanumeric character defined either in MIL-M-38510 or the detailed specification	A - Hot solder dip B - Tin plate C - Gold plate

RHA Designator	Total Dose Radiation Tolerance PAD (Si)	Level Neutron Fluence (n/cm <sup>2</sup> )
/	No Radiation Tolerance Specified	No RHA
M	3 x 10 <sup>3</sup>	2 x 10 <sup>12</sup>
D	1 x 10 <sup>4</sup>	2 x 10 <sup>13</sup>
R	1 x 10 <sup>5</sup>	2 x 10 <sup>12</sup>
H	1 x 10 <sup>6</sup>	2 x 10 <sup>13</sup>

- (1) The device has successfully met the requirements of Method 1019, MIL-STD-883 for radiation hardness. Total dose radiation testing shall be performed only when specifically required by the purchase order or contract. The device may be supplied as a non rad-hard JAN microcircuit.
- (2) The detail specification and QPL must be consulted to determine the availability of various packages (case outlines) and lead finishes. All variations are not available on all part types.
- (3) Some of the Class S microcircuits listed herein appear in the Part II listing of QPL-38510. Microcircuits ordered from the Part II listing of QPL-38510 require qualifying activity approval of certain lot acceptance test data prior to shipment. See paragraph 6.3.1.1 of MIL-M-38510 for further clarification.

**MIL-M-38510, MICROCIRCUITS  
Digital, Schottky, Low-Power TTL**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Gates	54LS00	Quad, 2-input positive NAND	/30001	S*X	B*X
	54LS02	NOR, quad 2-input	/30301	S*X(3)	B*X
	54LS03	Quad, 2-input positive NAND (open collector outputs)	/30002	S*X	B*X
	54LS04	Hex inverter	/30003	S*X	B*X
	54LS05	Hex inverter (open collector outputs)	/30004	S*X	B*X
	54LS08	AND, quad 2-input	/31004	S*X(3)	B*X
	54LS09	AND, quad 2-input, open collector outputs	/31005	S*X	B*X
	54LS10	Triple, 3-input positive NAND	/30005	S*X	B*X
	54LS11	AND, triple 3-input	/31001	S*X	B*X
	54LS14	Hex inverter Schmitt trigger	/31302	S*X(3)	B*X
	54LS20	Dual, 4-input positive NAND	/30007	S*X(3)	B*X
	54LS21	AND, dual 4-input	/31003	S*X	B*X
	54LS27	NOR, triple 3-input	/30302	S*X	B*X
	54LS30	Single, 8-input positive NAND	/30009	S*X	B*X
	54LS32	OR, quad 2-input	/30501	S*X(3)	B*X
	54LS51	AND-OR-invert, 2 wide 2 input & 2 wide 3 input	/30401	S*X(3)	B*X
	54LS54	AND-OR-invert, 4-wide, 2-3-3-2-input	/30402	S*X(3)	B*X
	54LS86	Exclusive-OR, quad 2-input	/30502	S*X	B*X
	54LS132	Quad 2-input Schmitt trigger, positive NAND	/31303	S*X	B*X
	54LS266	Exclusive-NOR, quad 2-input (open collector)	/30303	S*X	B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.  
(3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with your supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, Schottky, Low-Power TTL (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	
Buffers	54LS26	Quad, 2-input inverter buffer/driver, 15 volt output	732102	S*X(3)	B*X
	54LS37	Quad, 2-input positive NAND buffer	730202	S*X(3)	B*X
	54LS38	Quad, 2-input positive NAND buffer (open collector outputs)	730203	S*X(3)	B*X
	54LS40	Dual, 4-input positive NAND buffer	730201	S*X(3)	B*X
Drivers	54LS125A	Quad, bus buffer (inverting control inputs)	732301		B*X
	54LS126	Buffer, quad 3-state outputs	732302		B*X
	54LS240	Octal, inverting buffer (inverting control inputs)	732401	S*X(3)	B*X
	54LS241	Octal, noninverting buffer (complementary control inputs)	732402		B*X
	54LS244	Noninverting Octal buffer gates (inverting control inputs)	732403	S*X	B*X
	54LS365	Hex, bus driver, gated enable inputs for x-y coincident bus control	732201	S*X(3)	B*X
	54LS366	Buffer/driver, Hex, inverting, with 3-state outputs	732202	S*X(3)	B*X
	54LS367	Buffer/driver, Hex, noninverting, with 3-state outputs	732203	S*X(3)	B*X
	54LS368	Hex, inverter bus driver, 4-line and 2-line enable inputs	732204	S*X(3)	B*X
	54LS90	Decade counter	731501	S*X(3)	B*X
	54LS92	Divide-by-twelve counter	731510		B*X
	54LS93	4-bit binary counter	731502	S*X(3)	B*X
Counters	54LS160A	Synchronous 4-bit decade (asynchronous clear)	731503	S*X(3)	B*X
	54LS161A	Synchronous 4-bit binary (asynchronous clear)	731504	S*X(3)	B*X
	54LS162A	Synchronous 4-bit decade (synchronous clear)	731511		B*X
	54LS163A	Synchronous 4-bit binary counter (synchronous clear)	731512	S*X(3)	B*X
	54LS190	Synchronous 4-bit decade counter (with mode control)	731513	S*X(3)	B*X
	54LS191	Synchronous 4-bit up/down binary (mode control)	731509	S*X(3)	B*X
	54LS192	Synchronous 4-bit up/down decade counter (dual clock with clear)	731507		B*X
	54LS193	Synchronous 4-bit up/down binary (dual clock with clear)	731508	S*X(3)	B*X
	54LS290	Decade counter (BCD or biquinary)	732003		B*X
	54LS293	4-bit binary counter	732004		B*X
	54LS390	Dual decade counter with A and B inputs	732701		B*X
	54LS393	Dual 4-bit binary counter	732702	S*X(3)	B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.  
(3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, Schottky, Low-Power TTL (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Flip Flops	54LS73	J-K with clear, dual	/30101	S*X(3)	B*X
	54LS74A	D-type with preset/clear, dual	/30102	S*X(3)	B*X
	54LS76	J-K with preset/clear, dual	/30110	S*X(3)	B*X
	54LS109	J-K with preset/clear, dual (positive)	/30109	S*X(3)	B*X
	54LS112	J-K with preset/clear, dual (negative)	/30103	S*X(3)	B*X
	54LS113	J-K with preset, dual (negative)	/30104		B*X
	54LS122	Single monostable multivibrator retriggerable, with clear	/31403		B*X
	54LS123	Dual monostable multivibrator retriggerable, with clear	/31401	S*X(3)	B*X
	54LS173A	D-type, register, 4-bit, 3-state outputs	/36101	S*X(3)	B*X
	54LS174	Hex, D-type with common clear and common clock	/30106	S*X(3)	B*X
	54LS175	Quad, D-type with common clear and common clock	/30107	S*X(3)	B*X
	54LS221	Dual monostable multivibrator, Schmitt trigger with clear	/31402	S*X(3)	B*X
	54LS273	Octal D-type flip-flop with clear, cascadable	/32501	S*X(3)	B*X
	54LS374	Octal D-type with 3-state outputs, cascadable	/32503	S*X(3)	B*X
54LS377	D-type, octal flip-flop with enable	/32504	S*X(3)	B*X	
Latches	54LS75	4-bit bistable latch	/31601		B*X
	54LS259	8-bit addressable latch	/31603		B*X
	54LS259B	8-bit addressable latch	/31605	S*X(3)	B*X
	54LS279	Quad S-R Latch	/31602		B*X
Shift- registers	54LS373	D-type, octal transparent latch and 3-state outputs, noncascadable	/32502	S*X(3)	B*X
	54LS375	4-bit bistable latch	/31604		B*X
	54LS96	5-bit asynchronous preset	/30604		B*X
	54LS164	8-bit parallel-out/serial shift	/30605	S*X	B*X
	54LS165	8-bit parallel-in with clock inhibit	/30608	S*X(3)	B*X
	54LS166	8-bit parallel input shift register with clear	/30609	S*X(3)	B*X
	54LS194A	4-bit bidirectional	/30601	S*X	B*X
	54LS195A	4-bit parallel access	/30602		B*X
	54LS395A	4-bit cascadable with 3-state outputs	/30607		B*X
	54LS670	4 x 4 register file with 3-state outputs, cascadable	/31901		B*X

- (1) Use the JAN M38510 part number for ordering.  
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**MIL-M-38510, MICROCIRCUITS**  
**Digital, Schottky, Low-Power TTL (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	
Adders/comparators/ALUs	54LS83A	4-bit binary full adder with fast carry	β1201	B*X	
	54LS85	4-bit magnitude comparator	β1101	S*X(3)	
	54LS181	Arithmetic logic unit/function generator	β0801	B*X	
	54LS283	4-bit binary full adder with fast carry	β1202	S*X(3)	
	54LS42	BCD-to-decimal decoder	β0703	B*X	
	54LS47	BCD-to-seven segment decoder/driver (open collector)	β0704	B*X	
	54LS138	Single 3-to-8 line decoder/demultiplexer	β0701	B*X	
	54LS139	Dual 2-to-4 line decoder/demultiplexer	β0702	B*X	
	54LS148	8-to-3 line priority encoder	β6001	B*X	
	54LS151	8-input data selector/multiplexer, with enable	β0901	B*X	
	54LS153	Dual, 4-input data selector/multiplexer, with enable	β0902	B*X	
	54LS155	Dual 2-line to 4-line decoder/demultiplexer (totem pole outputs)	β2601	B*X	
	Decoders/encoders/multiplexers	54LS157	Quad, 2-input data selector/multiplexer, with enable	β0903	B*X
		54LS158	Quad, 2-input data selector/multiplexer, with enable, with inverted outputs	β0904	B*X
		54LS251	8-output data selector/multiplexer, with 3-state outputs, with enable	β0905	B*X
54LS253		Dual, 4-input data selector/multiplexer, 3-state outputs with enable	β0908	B*X	
54LS257		Quad 2-input data selector/multiplexer, 3-state outputs, with enable	β0906	B*X	
54LS258A		Quad 2-input data selector/multiplexer, inverting 3-state outputs, with enable	β0907	B*X	
54LS298		Cascadable quad, 2-input data selector/multiplexer with storage	β0909	B*X	
54LS348		8-to-3 line priority encoder with 3-state outputs	β6002	B*X	
Parity checker	54LS280	9-bit odd/even parity generator/checker	β2901	B*X	
Transceivers	54LS245	Octal noninverting bus transceivers with 3-state outputs	β2803	B*X	

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, Schottky, Advanced Low-Power TTL**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1
Gates	54ALS00	Quad, 2-input positive NAND	/37001	S*X(3) B*X
	54ALS02	Quad, 2-input positive NOR gate	/37301	S*X(3) B*X
	54ALS04	Hex inverter gate	/37006	S*X(3) B*X
	54ALS08	AND, quad 2-input	/37401	S*X(3) B*X
	54ALS10	Triple, 3-input positive NAND	/37002	S*X(3) B*X
	54ALS11	AND, triple 3-input	/37402	S*X(3) B*X
	54ALS20	Dual, 4-input positive NAND	/37003	S*X(3) B*X
	54ALS27	Triple, 3-input positive NOR gate	/37302	S*X(3) B*X
	54ALS28	Quad, 2-input NOR gate, buffer outputs	/38402	S*X(3) B*X
	54ALS30	8-input positive NAND	/37004	S*X(3) B*X
	54ALS32	Quad, 2-input positive OR gate	/37501	S*X(3) B*X
	54ALS37	Quad, 2-input NAND gate, buffer outputs	/38401	S*X(3) B*X
	54ALS40	Dual 4-input NAND gate, buffer	/38407	S*X(3) B*X
	54ALS133	13-input positive NAND	/37005	S*X(3) B*X
	54ALS1000	Quad, 2-input NAND gate, buffer outputs	/38401	S*X(3) B*X
	54ALS1002	Quad, 2-input NOR gate, buffer outputs	/38402	S*X(3) B*X
54ALS1020	Dual 4-input NAND gate, buffer	/38407	S*X(3) B*X	
54ALS1034	Hex noninverting gate, buffer outputs	/38411	S*X(3) B*X	

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS**  
**Digital, Schottky, Advanced Low-Power TTL (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Drivers	54ALS240	Inverting octal buffer gate (inverting control inputs)	/38301	S*X(3) B*X
	54ALS241A	Noninverting octal buffer gate (complementary control inputs)	/38302	S*X(3) B*X
	54ALS244	Inverting octal buffer gate (inverting control inputs)	/38303	S*X(3) B*X
Counters	54ALS161	Synchronous 4-bit cascadable binary counter (asynchronous clear)	/38001	S*X(3) B*X
	54ALS163	Synchronous 4-bit cascadable binary counter (direct clear)	/38002	S*X(3) B*X
	54ALS169	Synchronous 4-bit cascadable up/down binary counter	/38003	S*X(3) B*X
	54ALS74	D-type, dual with clear and preset	/37101	S*X(3) B*X
Flip-flops	54ALS109	J-K, dual with clear and preset	/37102	S*X(3) B*X
	54ALS112A	J-K, dual with clear and preset	/37103	S*X(3) B*X
	54ALS174	Hex D-type with clear, cascadable	/37201	S*X(3) B*X
	54ALS175	D-type, quad with clear	/37202	S*X(3) B*X
	54ALS374	Octal D-type flip-flop, 3-state outputs	/37204	S*X(3) B*X
	54ALS574	Octal D-type flip-flop, 3-state outputs, cascadable	/37104	S*X(3) B*X
Latches	54ALS373	Octal D-type flip-flop with transparent latch, 3-state outputs, cascadable	/37203	S*X(3) B*X
	54ALS573	Octal D-type transparent latch, 3-state outputs, cascadable	/38201	S*X(3) B*X
Decoders/Encoders, MUX	54ALS138	3 line to 8 line decoder	/37701	S*X(3) B*X
Transceivers	54ALS645	Octal bus transceiver, 3-state outputs	/38505	S*X(3) B*X

- (1) Use the JAN M38510 part number for ordering.
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- (3) The only remaining QPL supplier for this device will no longer be producing this device in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS**  
**Digital, Schottky, Fast TTL**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
	54F00	Quad, 2-input positive NAND	/33001	S*X B*X
	54F02	Quad, 2-input positive NOR	/33301	S*X B*X
	54F04	Hex inverter	/33002	S*X B*X
	54F08	AND, quad 2-input	/34001	S*X B*X
Gates	54F10	Triple, 3-input positive NAND	/33003	S*X B*X
	54F11	Triple, 3-input positive AND	/34002	S*X B*X
	54F20	Dual, 4-input positive NAND	/33004	S*X B*X
	54F32	Quad, 2-input positive OR	/33501	S*X B*X
	54F64	4-2-3-2 input, positive AND-OR-Invert	/33401	S*X B*X
	54F86	XOR, quad 2-input	/34501	S*X B*X
Drivers	54F240	Octal buffers/line drivers with 3-state inverting outputs	/33201	S*X(3) B*X
	54F241	Octal buffers/line drivers with 3-state outputs	/33202	S*X B*X
	54F244	Octal buffers/line drivers with 3-state outputs	/33203	S*X B*X
Counters	54F160A	Synchronous 4-bit decade counter (asynchronous master reset)	/34401	S*X B*X
	54F161A	Synchronous 4-bit binary counter (asynchronous master reset)	/34301	S*X B*X
	54F163A	Synchronous presettable binary counter	/34302	S*X B*X
	54F193	Up/down binary counter with separate up/down clocks	/34304	S*X B*X
Flip-flops	54F74	Dual D-type positive edge-triggered	/34101	S*X B*X
	54F109	Dual, J-K positive edge-triggered	/34102	S*X(3) B*X
	54F174	Hex, D-type positive edge-triggered	/34107	S*X B*X
	54F175	Quad, D-type positive edge-triggered	/34104	S*X B*X
	54F374	Octal, D-type positive edge-triggered with 3-state outputs	/34105	S*X B*X

(1) Use the JAN M38510 part number for ordering.  
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(3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, Schottky, Fast TTL (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Latch	54F373	Octal transparent latch with active low enable	3-state outputs	S*X	B*X
	54F533	Octal transparent latch with active low enable	3-state outputs		B*X
Register	54F398	Quad, 2-port register with complementary outputs		S*X	B*X
	54F399	Quad, 2-port register		S*X	B*X
Adder/ Comparator	54F283	4-bit binary full adder with fast carry		S*X	B*X
	54F521	8-bit identity comparator		S*X	B*X
Decoders/ MUXs	54F138	1-of-8 decoder, active low outputs with enable inputs		S*X	B*X
	54F139	Dual 1-of-4 decoder, active low outputs with enable inputs		S*X	B*X
	54F151A	8-input multiplexer		S*X	B*X
	54F153	Dual 4-input multiplexer		S*X	B*X
	54F157A	Quad 2-input multiplexer		S*X	B*X
	54F158A	Quad 2-input multiplexer with inverted outputs		S*X	B*X
	54F251A	8-input multiplexer with 3-state outputs		S*X	B*X
Combinational Transceiver	54F253	Dual 4-input multiplexer with 3-state outputs		S*X	B*X
	54F257A	Quad 2-input multiplexer with 3-state outputs		S*X	B*X
	54F258A	Quad 2-input multiplexer with 3-state inverted outputs		S*X	B*X
	54F352	Dual 4-input multiplexer with inverted outputs		S*X	B*X
	54F353	Octal transparent latch with active low enable, 3-state outputs		S*X	B*X
	54F280	9-bit odd/even parity generator/checker		S*X	B*X
	54F245	Octal noninverting bus transceiver w/ 3-state outputs		S*X	B*X

(1) Use the JAN M38510 part number for ordering.

(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Digital, CMOS, 4000B Series**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Gates	4001B	NOR, quad, 2-input	H05252	S*X B*X
	4002B	NOR, dual 4-input	H05253	S*X B*X
	4007UB	Complementary pair, dual plus inverter	H05351	S*X B*X
	4011B	NAND, quad 2-input	H05051	S*X B*X
	4012B	NAND, dual 4-input	H05052	S*X B*X
	4019B	Quad AND-OR select gate	H05352	S*X B*X(3)
	4019B	Quad AND-OR select gate	H05352	S*X B*X
	4023B	NAND, triple 3-input	H05053	S*X B*X
	4025B	NOR, triple 3-input	H05254	S*X B*X
	4030B	Quad, 2-input exclusive OR gate	H05353	S*X B*X
	4070B	Exclusive-OR, quad, 2-input	H17203	S*X B*X
	4071B	OR, quad, 2-input	H17101	S*X B*X
	4072B	OR, dual, 4-input	R17102	B*X B*X
	4073B	AND, triple, 3-input	R17003	B*X B*X
	4075B	OR, triple, 3-input	H17103	S*X B*X
	4077B	Exclusive-NOR, quad, 2-input	R17204	B*X B*X
4081B	AND, quad, 2-input	H17001	S*X B*X	
4082B	AND, dual, 4-input	R17002	B*X B*X	
4085B	AND-OR-invert, dual, 2-wide, 2-input	H17201	S*X B*X	
4086B	AND-OR-invert, expandable, 4-wide, 2-input	H17202	S*X B*X	

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.  
(3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, CMOS, 4000B Series (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Gates	4049UB	Inverter, hex buffer	H05553	S*X B*X
	4050B	Buffer, hex	/05554	B*X(3)
	4050B	Buffer, hex	H05554	S*X B*X
Buffer	4041UB	Quad true/complement buffer	R05555	S*X B*X
	4069UB	Hex, inverter	H17401	S*X B*X
	4502B	Hex, inverter/buffer, strobed	R17403	S*X B*X
	4098B	Dual, monostable multivibrator	R17504	B*X
Flip-flops/ Latches	4099B	8-bit, addressable latch	R17601	B*X
	4013B	D-type, dual	H05151	S*X B*X
	4013B	D-type dual edge-triggered flip-flop	/05151	B*X
	4027B	J-K, dual master-slave flip-flop	H05152	S*X B*X
	4008B	Four bit full adder	R05451	S*X B*X
	4017B	Decade counter/divider	H05651	S*X B*X
Counter/ Dividers	4018B	OR, triple, 3-input	H05652	S*X B*X
	4020B	14-stage ripple-carry binary counter/divider	H05653	S*X B*X
	4022B	Octal counter with 8 decoded outputs	H05654	S*X B*X
	4024B	7-stage ripple-carry binary counter/divider	H05655	S*X B*X
	4014B	8-stage synchronous parallel or serial input/serial output static	H05752	S*X B*X
	4015B	Dual, 4-stage serial input/parallel outputs	H05753	S*X B*X
	4021B	8-state asynchronous parallel input/serial outputs or synchronous serial input/serial output static shift register	H05754	S*X B*X
Registers	4028B	BCD to decimal decoder	R05951	S*X B*X
	4066B	QUAD bilateral switch	H05852	S*X B*X

- (1) Use the JAN M38510 part number for ordering.  
 (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.  
 (3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS**  
**Linear, CMOS**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1
Analog switches	200	Dual SPST, CMOS, negative logic	/12301	B*X
	201	Quad SPST, CMOS, negative logic	/12302	B*X
	300A	Dual SPST switch (TTL compatible)	/11601	B*X
	301A	Single SPDT switch (TTL compatible)	/11602	B*X
	302A	Dual DPST switch (TTL compatible)	/11603	B*X
	303A	Dual SPDT switch (TTL compatible)	/11604	B*X
	304A	Dual SPST switch (50 ohm, CMOS input compatible)	/11605	B*X
	305A	Single SPDT switch (50 ohm, CMOS input compatible)	/11606	B*X
	306A	Dual DPST switch (50 ohm, CMOS compatible)	/11607	B*X
	307A	Dual SPDT switch (50 ohm, CMOS compatible)	/11608	B*X
Multiplexers	506	16 channel multiplexer/demultiplexer	/19001	B*X
	507	8 channel differential multiplexer/demultiplexer	/19003	B*X
	508	8 channel multiplexer/demultiplexer	/19007	B*X
	509	4 channel differential multiplexer/demultiplexer	/19008	B*X

- (1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS**  
**Digital, CMOS, High Speed**

Description	Generic Type (1) (3)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Gates	54HC00	NAND, quad 2-input	/65001	S*X(4) B*X
	54HC02	NOR, quad 2-input	/65101	S*X(4) B*X
	54HC04	HEX inverter	/65701	S*X(4) B*X
	54HC08	AND, quad 2-input	/65203	S*X(4) B*X
	54HC10	NAND, triple 3-input	/65002	S*X(4) B*X
	54HC11	AND, triple 3-input	/65204	S*X(4) B*X
	54HC14	Hex inverting, Schmitt trigger	/65702	S*X(4) B*X
	54HC20	NAND, dual 4-input	/65003	S*X(4) B*X
	54HC27	NOR, triple 3-input	/65102	S*X(4) B*X
	54HC30	NAND, 8-input	/65004	S*X(4) B*X
Counters	54HC32	OR, quad 2-input	/65201	S*X(4) B*X
	54HC86	XOR, quad 2-input	/65202	S*X(4) B*X
	54HC244	Octal non-inverting buffers with 3-state buffers	/65705	S*X(4) B*X
	54HC4002	NOR, dual 4-input	/65104	S*X(4) B*X
	54HC161	4-bit binary counter, asynchronous reset, synchronous load	/66302	S*X(4) B*X
	54HC163	4-bit binary counter, synchronous reset and load	/66304	S*X(4) B*X
	54HC393	Dual 4-bit synchronous binary counter, asynchronous reset	/66309	S*X(4) B*X
	54HC74	Dual D-type, positive-edge triggered with clear and preset	/65302	S*X(4) B*X
	54HC109	Dual J-K positive-edge triggered with clear and preset	/65304	S*X(4) B*X
	54HC112	Dual J-K negative-edge triggered with clear and preset	/65305	S*X(4) B*X
Flip-flops /latches	54HC173	Quad D-type with 3-state outputs and clear	/65306	S*X(4) B*X
	54HC174	Hex D-flip-flop with clear	/65307	S*X(4) B*X
	54HC175	Quad D-flip-flop with clear	/65308	S*X(4) B*X
	54HC259	8-Bit addressable latch	/65402	S*X(4) B*X
	54HC273	Octal D-flip-flop with direct clear input	/65601	S*X(4) B*X
	54HC373	Octal D-type latch with 3-state outputs	/65403	S*X(4) B*X
	54HC374	Octal D-type flip-flop with 3-state outputs	/65602	S*X(4) B*X
	54HC573	Octal D-type latch with 3-state outputs	/65406	S*X(4) B*X
	54HC574	Octal D-type flip-flop with 3-state outputs	/65604	S*X(4) B*X(4)
	54HC164	8-Bit parallel-out shift register	/66501	S*X(4) B*X
54HC165	8-Bit parallel-in shift register with clock inhibit	/66502	S*X(4) B*X	

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The "HC" technology has been shown to be vulnerable to total dose radiation levels as low as 3 Krads. D.C. parameter specification limits were exceeded after radiation exposures as low as 3 Krads and functional failures occurred at levels as low as 20 Krads. Lot by lot radiation testing is recommended.
- (4) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
 Digital, CMOS, High-Speed (Continued)**

Description	Generic Type (1) (3)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Transceivers	54HC245	Octal noninverting bus transceiver with 3-state outputs	/65503	S*X(4) B*X
Decoder/MUX	54HC138	3-to-8 line decoder	/65802	S*X(4) B*X
	54HC139	Dual 2-to-4 line decoder	/65803	S*X(4) B*X
	54HC158	Quad 2-input data selector/multiplexer with enable	/66204	S*X(4) B*X
Buffers/Drivers	54HC240	Octal inverting buffer with 3-state outputs	/65703	S*X(4) B*X
	54HC241	Octal buffer with 3-state outputs	/65704	S*X(4) B*X(4)
	54HC365	Hex bus driver, gated enable inputs for X-Y coincident bus control with 3-state outputs	/65706	S*X B*X
	54HC367	Hex bus driver, 4-line and 2-line enable inputs with 3-state outputs	/65708	S*X B*X
	54HC368	Hex inverter bus driver 4-line and 2-line enable inputs with 3-state outputs	/65709	S*X B*X
	54HC540	Octal inverter bus driver with 3-state outputs	/65710	S*X B*X
	54HC541	Octal noninverting bus driver with 3-state outputs	/65711	S*X B*X

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The "HC" technology has been shown to be vulnerable to total dose radiation levels as low as 3 Krads. D.C. parameter specification limits were exceeded after radiation exposures as low as 3 Krads and functional failures occurred at levels as low as 20 Krads. Lot by lot radiation testing is recommended.
- (4) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
 Digital, CMOS, High-Speed, TTL Compatible**

Description	Generic Type (1) (3)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Gate	54HCT04	Hex inverter	/65751	S*X(4) B*X
Buffers	54HCT240	Inverting Octal 3-state buffer	/65753	S*X(4) B*X
	54HCT244	Octal buffer with 3-state outputs	/65755	S*X(4) B*X
	54HCT540	Octal inverter bus driver with 3-state outputs	/65760	S*X(4) B*X
	54HCT541	Octal noninverting bus driver with 3-state outputs	/65761	S*X(4) B*X
Transceivers	54HCT245	Octal noninverting bus transceiver with 3-state outputs	/65553	S*X(4) B*X
Decoders	54HCT138	3-to-8 line decoder (TTL compatible)	/65852	S*X(4) B*X
Flip-flops/Latches	54HCT74	Dual D-type flip-flop with preset and clear with LSTTL compatible inputs	/65352	S*X(4) B*X
	54HCT373	Octal D-type flip-flop with 3-state and TTL compatible inputs	/65453	S*X(4) B*X
	54HCT374	Octal D-type flip-flop with 3-state outputs (LSTTL inputs)	/65652	S*X(4) B*X

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The "HC" technology has been shown to be vulnerable to total dose radiation levels as low as 3 Krads. D.C. parameter specification limits were exceeded after radiation exposures as low as 3 Krads and functional failures occurred at levels as low as 20 Krads. Lot by lot radiation testing is recommended.
- (4) The only remaining QPL supplier for this device will no longer be producing in this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
Digital, Interface**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Digital to Analog Converters	DAC-08	8-bit D/A converters, 0.19% linearity	/11301	S*X	B*X
	DAC-08A	8-bit D/A converters, 0.10% linearity	/11302	S*X	B*X
	562	12 bit digital to analog converter, external reference	/12101		B*X
	565	12 bit digital to analog converter, internal reference, high speed	/12103		B*X
Analog to Digital Converters	7521	12 bit D/A converter with 10 bit end-point linearity	/12703		B*X
	561	10 bit binary D/A converter, internal reference	/13301		B*X
	574AT	12 bit, analog to digital converter with microprocessor interface	/14002		B*X
	574AU	12 bit, analog to digital converter with microprocessor interface	/14001		B*X

- (1) Use the JAN M38510 part number for ordering.  
 (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

## MIL-STD-975L (NASA) - Part I

### MIL-M-38510, MICROCIRCUITS Bipolar, Memories

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
RAM	93L422	Static, 256 x 4, Low power, 3-state output	Z3112		B*X
	82S23	32 x 8 with open collector outputs	Z20701		B*X(3)
	82S115	512 x 8 with 3-state outputs	Z20803		B*X(3)
	82S123A	32 x 8 with 3-state output	Z20704	S*X(3)	B*X(3)
PROM	82S126	256 x 4 with open collector	Z20301		B*X(3)
	82S129	256 x 4 with active pull-up and 3-state output	Z20302	S*X(3)	B*X(3)
	82S129A	256 x 4 with active pull-up and 3-state output	Z20304		B*X(3)
	82S130	512 x 4 with open collector	Z20401		B*X(3)
	82S131	512 x 4 with active pull-up and 3-state output	Z20402		B*X(3)
	82S131A	512 x 4 with active pull-up and 3-state output	Z20404		B*X(3)
	82S137	1K x 4 with 3-state output	Z20602		B*X(3)
	82S137A	1K x 4 with 3-state outputs	Z20604	S*X(3)	B*X(3)
	82S141	512 x 8 with active pull-up and 3-state output	Z20802		B*X(3)
	82S181	1K x 8 with active pull-up and 3-state output	Z20904	S*X(3)	B*X
	82S181A	1K x 8 with active pull-up and 3-state output	Z20909		B*X(3)
	82S191	2K x 8 with active pull-up and 3-state output	Z21002	S*X(3)	B*X
	82S185	2K x 4 with active pull-up and 3-state output	Z20902		B*X
	82S185A	2K x 4 with active pull-up and 3-state output	Z20910		B*X(3)
	82S191A	2K x 8 with active pull-up and 3-state output	Z21004	S*X(3)	B*X(3)

(1)

Use the JAN M38510 part number for ordering.

(2)

The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

(3)

The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

**MIL-M-38510, MICROCIRCUITS  
CMOS, Memories**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			Part No.	Grade 1 Grade 2
RAM	2147	Static, 4096 x 1, 3-state output	M38510/23801	B*X
	7C147	Static, 4096 x 1, 35ns	M38510/28901	B*X
	6504	Static, 4096 x 1, 3-state output	M38510/24501	B*X
	6504RH	Static, 4k x 1, synchronous, 3-state output	M38510R24503	S*X
	6514	Static, 1024 x 4, 3-state output	M38510/24502	B*X
	6516	Static, 2k x 8, 200 ns	M38510/29102	B*X
	65642	Static, 8k x 8, selectable mode	M38510/29205	B*X
	6716485	Static, 8k x 8, Rad-hard, 85ns	5962H3829435	S*X
	6716470	Static, 8k x 8, Rad-hard, 70ns	5962H3829436	S*X
	6716455	Static, 8k x 8, Rad-hard, 55ns	5962H3829437	S*X
	65262	Static, 16k x 1, 85ns	M38510/29103	B*X

(1) Use the JAN M38510 part number for ordering.

(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Microprocessors**

Generic Part No. (1)	Word Size (Bits)	Fixed Instruction	Technology	Case Size	Clock Frequency (Max)	JAN Part Number (2)	
						M38510	Grade 1 Grade 2
Z80A	8	Yes	NMOS	40-pin DIP	4 Mhz	/48001	B*X(3)
Z8002	16	Yes	NMOS	40-pin DIP	4 Mhz	/52002	B*X(3)
Z8002A	16	Yes	NMOS	40-pin DIP	6 Mhz	/52004	B*X(3)
8086	16	Yes	NMOS	40-pin DIP	5 Mhz	/53001	B*X

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.
- (3) The only remaining QPL supplier for this device will no longer be producing this device type in this grade. These parts are not recommended for new designs. Consult with the supplier for final shipment dates and/or availability information.

## MIL-M-38510, MICROCIRCUITS Linear

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Operational amplifiers	741A	Single, internally compensated	/10101	S*X	B*X
	747A	Dual, internally compensated	/10102	S*X	B*X
	101A	Single, externally compensated	/10103	S*X	B*X
	108A	Single, externally compensated	/10104	S*X	B*X
	771	Single, low noise, BI-FET	/11904		B*X
	772	Dual, low noise, BI-FET	/11905		B*X
	774	Quad, low noise, BI-FET	/11906		B*X
	2101A	Dual, externally compensated	/10105	S*X	B*X
	2108A	Dual, externally compensated	/10106	S*X	B*X
	118	Precision, high-speed	/10107	S*X	B*X
	1558	Dual, internally compensated	/10108	S*X	B*X
	148	Quad (medium power, internal compensation)	/11001	S*X	B*X
	124	Quad (single supply, low power)	/11005	S*X	B*X
	155	JFET input, low power	/11401	S*X	B*X
	156	JFET input, wide band	/11402	S*X	B*X
	155A	JFET input, high performance, low power, low offset	/11404	S*X	B*X
	156A	JFET (high performance, wideband, low offset)	/11405	S*X	B*X
	157A	JFET (high performance, wideband, low offset undercompensated)	/11406		B*X
	2500	High slew rate, internally compensated, precision	/12204		B*X
	2510	Single, internally compensated, high slew rate	/12205		B*X
2520	Single, externally compensated, high slew rate	/12206		B*X	
2600	Single, high impedance, internally compensated, wide band	/12202		B*X	
2620	Single, externally compensated, high impedance, wide band	/12203		B*X	
0P07	Single, low offset, internal compensation	/13502	S*X	B*X	
0P07A	Single, internal compensation, ultra-low offset	/13501	S*X	B*X	
0P27A	Single, internal compensation, ultra-low noise and offset	/13503	S*X	B*X	

(1) Use the JAN M38510 part number for ordering.  
 (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Linear (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Voltage regulators	723	Positive or negative voltage regulator	/10201	S*X B*X
	109	5-volt positive regulator, 1.5 A	/10701	S*X B*X
	78M05	5-volt positive voltage regulator, 0.5 A	/10702	S*X B*X
	78M12	12-volt positive voltage regulator, 0.5 A	/10703	S*X B*X
	78M15	15-volt positive voltage regulator, 0.5 A	/10704	S*X B*X
	140K-05	5-volt positive voltage regulator, 1.0 A	/10706	S*X B*X
	140K-12	12-volt positive voltage regulator, 1.0 A	/10707	S*X B*X
	140K-15	15-volt positive voltage regulator, 1.0 A	/10708	S*X B*X
	140K-24	24-volt positive voltage regulator, 1.0 A	/10709	S*X B*X
	120H-05	5-volt negative voltage regulator, 0.5 A	/11501	S*X B*X
	120H-12	12-volt negative voltage regulator, 0.5 A	/11502	S*X B*X
	120H-15	15-volt negative voltage regulator, 0.5 A	/11503	S*X B*X
	120K-05	5-volt negative voltage regulator, 1.0 A	/11505	S*X B*X
	120K-12	12-volt negative voltage regulator	/11506	S*X B*X
	120K-15	15-volt negative voltage regulator, 1.0 A	/11507	S*X B*X
Switching Regulator	117H	3-terminal adjustable regulator, 0.5 A	/11703	S*X B*X
	117K	3-terminal adjustable regulator, 1.5 A	/11704	S*X B*X
	137H	3-terminal adjustable regulator, 0.5 A	/11803	S*X B*X
	137K	3-terminal adjustable regulator, 1.5 A	/11804	S*X B*X
	1524	Regulating pulse-width modulator	/12601	S*X B*X
	1525A	Regulating pulse-width modulator	/12602	S*X B*X
	1526	Regulating pulse-width modulator	/12603	S*X B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Linear (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)		
			M38510	Grade 1	Grade 2
Voltage comparators	710	Single, differential	/10301		B*X
	111	Precision buffer	/10304	S*X	B*X
	119	Dual, high speed	/10306	S*X	B*X
	2111	Dual precision voltage comparator/buffer	/10305	S*X	B*X
	139	Quad, single supply, low power	/11201	S*X	B*X
	193	Dual, low power, low offset	/11202		B*X
Line drivers/ receivers	9614	Dual differential line driver (2-state outputs)	/10403		B*X
	55113	Dual differential line driver (tri-state outputs)	/10405		B*X
	55107	Dual line receiver	/10401		B*X
	55108	Dual line receiver (open collector)	/10402		B*X
Timers	9615	Dual differential line receiver	/10404		B*X
	55463	Dual high voltage, OR gate and transistor (connected), medium speed switching	/12909		B*X
Multiplier	555	Single, precision	/10901	S*X	B*X
	556	Dual, precision	/10902		B*X
Multiplier	532S	4-quadrant multiplier (4% max multiplying error)	/13903		B*X
	534T	4-quadrant multiplier (1% max multiplying error)	/13901		B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Linear (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Sample and Hold Circuit	198	Sample and hold circuit, 10 K Ohms	/12501	S*X B*X
Analog Switches	181A	Dual channel 30 Ohm SPST	/11101	B*X
	182A	Dual channel 75 Ohm SPST	/11102	B*X
	184A	Dual channel 30 Ohm DPST	/11103	B*X
	185A	Dual channel 75 Ohm DPST	/11104	B*X
	187A	Single channel 30 Ohm SPDT	/11105	B*X
	188A	Single channel 75 Ohm SPDT	/11106	B*X
	190A	Dual channel 30 Ohm SPDT	/11107	B*X
	191A	Dual channel 75 Ohm SPDT	/11108	B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Semicustom**

Description	Function	JAN Part Number (1)		
		M38510	Grade 1	Grade 2
Gate Array	≤ 4,000 gate array	/60504		B*X
	≤ 25,000 gate array	H60514	S*X	
	≤ 3,000 gate array	/60603		B*X
	≤ 4,000 gate array	/60604		B*X
	≤ 6,000 gate array	/60606		B*X
	≤ 8,000 gate array	/60608		B*X
	≤ 11,000 gate array	/60611		B*X
	≤ 25,000 gate array	H60614	S*X	
	45,001-55,000 gate array	H60617	S*X	B*X
	≤ 8,000 gate array	/60708		B*X
	≤ 11,000 gate array	/60711		B*X
	≤ 25,000 gate array	H60714	S*X	
45,001-55,000 gate array	H60717	S*X	B*X	
10,001-11,000 gate array	/60811		B*X	
15,001-25,000 gate array	H60814	S*X		
45,001-55,000 gate array	H60817	S*X	B*X	

(1) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Interface Peripherals**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			M38510	Grade 1 Grade 2
Remote Terminal Interface	1553BRTI	Remote terminal interface (clock duty cycle logical high 10 percent to 35 percent)	/55501	- B*X
	1553BRTIA	Remote terminal interface (clock duty cycle logical high 40 percent to 60 percent)	/55502	- B*X

- (1) Use the JAN M38510 part number for ordering.
- (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

## MIL-M-38510, MICROCIRCUITS Digital, Advanced CMOS

Description	Generic Type (1)	Function	JAN Part Number (2)	
			Part No.	Grade 1 Grade 2
Counters	54AC161	Synchronous Presettable Binary Counter	M38510/76302	S*X B*X
	54AC163	Synchronous Presettable Binary Counter	M38510/76304	S*X B*X
	54AC191	Up/down Counter w/Preset and Ripple Clock	M38510/76305	S*X B*X
	54AC00	NAND, quad 2-input	M38510R75001	S*X B*X
	54AC02	NOR, quad 2-input	M38510R75101	S*X B*X
	54AC04	Hex inverter	M38510R75701	S*X B*X
	54AC05	Hex inverter with open drain outputs	5962-9059001	S*X B*X
	54AC08	AND, quad 2-input	M38510R75203	S*X B*X
Gates	54AC10	NAND, triple, 3-input	M38510R75002	S*X B*X
	54AC11	AND, triple, 3-input	M38510/75204	S*X B*X
	54AC14	HEX inverting Schmitt trigger	M38510R75702	S*X B*X
	54AC20	NAND, dual 4-input	M38510R75003	S*X B*X
	54AC32	OR, quad, 2-input	M38510R75201	S*X B*X
	54AC86	XOR, quad 2-input	M38510R75202	S*X B*X
	54AC74	Dual D-type flip-flop, positive edge-triggered	M38510/75302	S*X B*X
	54AC109	Dual JK positive edge-triggered flip-flop.	M38510/75304	S*X B*X
Flip-Flops/ Latches	54AC174	Hex D flip-flop with master reset	M38510/75307	S*X B*X
	54AC273	Octal D-type flip-flop with reset	M38510/75601	S*X B*X
	54AC373	Octal transparent latch with 3-state outputs	M38510/75403	S*X B*X
	54AC373	Octal transparent latch with 3-state outputs	M38510R75403	S*X B*X
	54AC374	Octal D-type flip-flop with 3-state outputs	M38510/75602	S*X B*X
	54AC377	Octal D flip-flop w/clock enable	M38510/75603	S*X B*X
	54AC574	Octal D flip-flop w/3-state outputs	M38510/75604	S*X B*X
	54AC138	1-of-8 decoder/demultiplexer	M38510/75802	S*X B*X
	54AC139	Dual 1-of-4 decoder/demultiplexer	M38510/75803	S*X B*X
	Decoder/MUX	54AC151	8-input multiplexer	M38510/76201
54AC153		Dual 4-input multiplexer	M38510/76202	S*X B*X
54AC157		Quad 2-input multiplexer	M38510/76203	S*X B*X

(1) Use the JAN M38510 part number for ordering.  
(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS  
Digital, Advanced CMOS (Continued)**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			Part No.	Grade 1 Grade 2
Drivers	54AC240	Octal buffer/line driver with inverting 3-state outputs	M38510R75703	S*X B*X
	54AC241	Octal buffer/line driver with 3-state outputs	M38510R75704	S*X B*X
	54AC244	Octal buffer/line driver with 3-state outputs	M38510R75705	S*X B*X
	54AC541	Octal buffer/line driver w/3 state outputs	M38510/75711	S*X B*X
Transceivers	54AC245	Octal, bidirectional transceiver with 3-state outputs	M38510R75503	S*X B*X
Shift Registers	54AC299	8-bit universal shift register with common parallel I/O pins	M38510R76506	S*X B*X
	54AC520	8-bit magnitude comparator	5962-9091601	S*X B*X
Comparators	54AC521	8-bit identify comparator	5962-9098501	S*X B*X
	54AC521	8-bit identify comparator	5962R9098501	S*X B*X

- (1) Use the JAN M38510 part number for ordering.  
 (2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

**MIL-M-38510, MICROCIRCUITS**  
**Digital, Advanced CMOS, TTL Compatible**

Description	Generic Type (1)	Function	JAN Part Number (2)	
			Part No.	Grade I Grade 2
Gates	54ACT00	Quad 2-input NAND gate	5962-8769901	S*X B*X
	54ACT00	Quad 2-input NAND gate	5962R8769901	S*X B*X
Flip Flop	54ACT74	Dual D Positive Edge-Triggered Flip-Flop	5962-8752501	S*X B*X
	54ACT112	Dual J-K Negative Edge-Triggered Flip-Flop	5962-8995001	S*X B*X
	54ACT377	Octal D Flip-Flop with clock enable	5962-8769701	S*X B*X
	54ACT574	Octal D Flip-Flop with 3-state outputs	5962-8960101	S*X B*X
Decoder/MUX	54ACT138	1-of-8 Decoder/Demultiplexer	5962-8755401	S*X B*X
	54ACT151	8-input multiplexer	5962-8875601	S*X B*X
Drivers	54ACT240	Octal buffer/line driver w/3-state outputs	5962-8775901	S*X B*X
	54ACT240	Octal buffer/line driver w/3-state outputs	5962R8775901	S*X B*X
	54ACT244	Octal buffer/line driver w/3-state outputs	5962-8776001	S*X B*X
	54ACT244	Octal buffer/line driver w/3-state outputs	5962R8776001	S*X B*X
Transceivers	54ACT245	Octal bidirectional transceiver w/3-state inputs/outputs	5962-8766301	S*X B*X
	54ACT245	Octal bidirectional transceiver w/3-state inputs/outputs	5962R8766301	S*X B*X

(1) Use the JAN M38510 part number for ordering.

(2) The \* is for choice of package style. The X is for choice of lead finish. Refer to the QPL for specific choices.

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## SECTION 8: SUMMARY OF STANDARD PROTECTIVE DEVICES (1)

Page	Control Specification	Description	Grade 1	Grade 2
8.2	MIL-F-23419/8	Fuses, instrument type, style FM08, subminiature, high performance	(2)	(3)
8.3	MIL-C-39019	Circuit breakers, magnetic, low-power		

- (1) Refer to MIL-HDBK-978, Vol. 5, for construction and application information.  
 (2) Presently no Grade 1 parts available.  
 (3) For Grade 2 application only.

**MIL-F-23419/8 STYLE FM08 FUSES**  
**Instrument Type (Subminiature, High-Performance)**

Part Number Explanation:			
FM08	A	XXXV	XXXXXA
Style	Characteristic A = normal interrupt time	Voltage Rating Followed by letter V	Current Rating Followed by letter A

Part Number (1)	Control Specification	Style	Current Rating (Amps)	Overload Interrupt Time -55°C to +125°C		Maximum Voltage Rating (Volts)	Cold Resistance (Ohms) (3)		Voltage Drop (Volts) (4)	
				200% (2)	300% (2)		Min	Max	Min	Max
FM08A125V 1/8A	MIL-F-23419/8	FM08	1/8	5	0.1	125	1.89	2.31	0.85	1.15
FM08A125V 1/4A			1/4				.639	.781	0.59	0.80
FM08A125V 3/8A			3/8				.378	.462	0.527	0.713
FM08A125V 1/2A			1/2				.252	.308	0.488	0.660
FM08A125V 3/4A			3/4				.153	.187	0.145	0.197
FM08A125V 1A			1				.112	.138	0.157	0.213
FM08A125V 1.5A			1-1/2				.072	.088	0.153	0.207
FM08A125V 2A			2				.0495	.0605	0.144	0.196
FM08A125V 2.5A			2-1/2				.0378	.0462	0.125	0.169
FM08A125V 3A			3				.0315	.0388	0.139	0.187
FM08A125V 4A			4				.0207	.0253	0.110	0.150
FM08A125V 5A			5				.0126	.0154	0.087	0.118
FM08A125V 7A			7				.0090	.0110	0.087	0.118
FM08A125V 10A			10				.0059	.0070	0.085	0.110
FM08A32V 15A			15				10.0	0.3	32	0.036

(1) These parts are to be used in Grade 2 applications only.

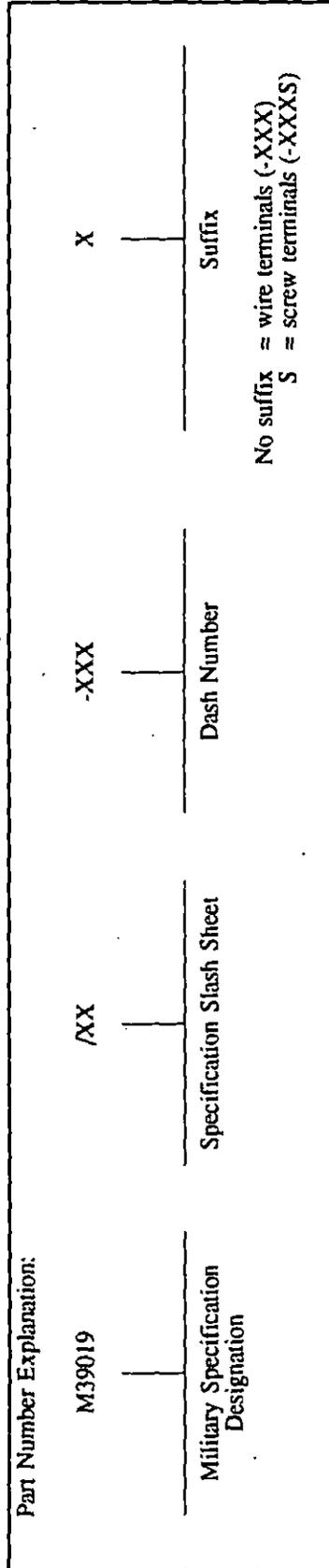
(2) Percentage of nominal current rating.

(3) Cold resistance is measured at 10 percent or less of rated current.

(4) Voltage drop is measured after the fuse has been subjected to rated current for not less than 5 minutes and not more than 10 minutes.

MIL-STD-975L (NASA) - Part I

**MIL-C-39019, MAGNETIC CIRCUIT BREAKERS**  
**Low Powered, Sealed, Trip-Free**



Part Number (1) (2) (3)	Control Specification	Current Range, Amps	Contact Configuration	Voltage Rating
M39019/01-XXXXX	MIL-C-39019	0.05 to 20.0	One pole	50 Vdc max and 240 Vac max at 60 and 400 Hz
M39019/02-XXXXX			One pole with SPDT aux contacts (4)	
M39019/03-XXXXX			Two pole	
M39019/04-XXXXX			Two pole with SPDT aux contacts (4)	
M39019/05-XXXXX			Three pole	
M39019/06-XXXXX			Three pole with SPDT aux contacts (4)	

- (1) See slash sheet for dimensions and configurations.
- (2) Three trip characteristics available. Time delay A: fast; Time delay B: slow; Time delay C: no delay.
- (3) High inrush capability available for time delay A and B configurations.
- (4) Single-pole, double-throw auxiliary contacts rated at 0.5 amp lamp load at 50 Vdc or 120 Vac.

**MIL-STD-975L (NASA) - Part I**

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**SECTION 9: SUMMARY OF STANDARD RELAYS (1)**

Page	Control Specification	Description	FRL	
			Grade 1	Grade 2
9.2	MIL-R-39016	Nonlatching	(2)	P

- (1) Refer to MIL-HDBK-978, Vol. 5, for construction and application information.
- (2) There are no Grade 1 parts.

## MIL-R-39016, RELAYS (I) Electromagnetic

Part Number Explanation:  M39016	/XX	-XXX	X
Military Specification Designation	Specification Slash Sheet	Dash Number	(%/10,000 cycles) P = 0.1

Type	Part Number	Control Specification	Contact Rating (Amps) (2)	Contact Configuration	Package Outline (3)	FRL	
						Grade 1	Grade 2
Nonlatching	M39016/6-XXXX	MIL-R-39016	2.0	DPDT	1/2 size crystal can (TO-205) TO-5 (TO-205) TO-5 1/2 size crystal can (TO-205) TO-5 (TO-205) TO-5 1/2 size crystal can	(4)	P
	M39016/9-XXXX		1.0				
	M39016/11-XXXX		1.0				
	M39016/13-XXXX		2.0				
	M39016/20-XXXX		1.0				
	M39016/21-XXXX		1.0				
M39016/38-XXXX	2.0						

- (1) Platings of cadmium or zinc shall not be used. Molybdenum contact material shall not be used. Use of "unfused bright tin" plating is not recommended. Tin plating shall be fused if such plating is used externally. Unfused bright tin plate has been associated with tin whisker growth.
- (2) Contact resistive rating at 28 Vdc.
- (3) See appropriate slash sheet for dimensions and configurations.
- (4) Suitable Grade 1 parts are not available.

**SECTION 10: SUMMARY OF STANDARD RESISTORS**

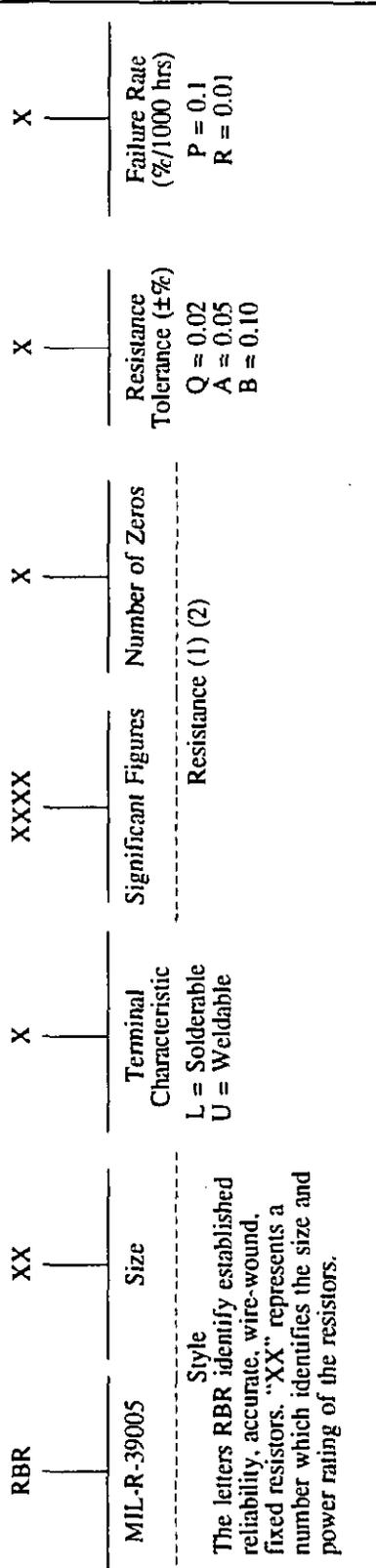
Page	Control Specification	Style	Description	Resistance Range (Ohms) (1)		Power Range (Watts)		FRL	
				Min	Max	Min	Max	Grade 1	Grade 2
10.2	MIL-R-39005	RBR	Fixed, wirewound (accurate), ER	4.99	1.37 M	0.125	0.75	R	P or R
10.4	MIL-R-39007	RWR	Fixed, wirewound (power type), ER	0.1	39.2 K	1.0	10.0	S	P or R
10.7	MIL-R-39008	RCR	Fixed, composition (insulated), ER	1.0	22.0 M	0.125	2.0	S	P or R
10.9	MIL-R-39009	RER	Fixed, wirewound (power type), chassis mounted, ER	0.1	39.2 K	5.0	30.0	R	P or R
10.11	MIL-R-39015(2)	RTR	Variable, wirewound (lead screw actuated), ER	10.0	20.0 K	—	0.75	(3)	P or R
10.13	MIL-R-39017	RLR	Fixed, film (insulated), ER	4.3	10.0 M	0.125	1.0	S	P or R
10.15	MIL-R-55182	RNR	Fixed, film (hermetic) ER	10.0	7.5 M	0.1	0.5	S	P or R
10.16	MIL-R-55182	RNC	Fixed, film, ER	4.99	7.5 M	0.05	0.5	S	P or R
10.19	MIL-R-55342	RM	Fixed, Film, Chip, ER	5.6	15.0 M	0.05	1.0	S	P or R
10.21	MIL-R-83401(2)	RZO	Fixed, film, networks	50.0	0.1 M	0.025	0.2	(3)	(4)

Refer to MIL-HDBK-978, Vol. 1, for construction and application information.

- (1) The resistance values may be any value within the limits of the specification; however, it is preferred that the values be chosen from the decade table following the respective detail listing. Part numbers containing nonstandard combinations of resistance values and tolerances may be considered nonconforming to the specification and may not carry the JAN certification mark.
- (2) Parts covered by this specification may contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow. Welded connections are recommended for space flight use. Consult manufacturer.
- (3) There are no Grade 1 parts.
- (4) For use in Grade 2 applications, parts shall be subjected to additional testing in accordance with Appendix B.

## MIL-R-39005, RESISTORS Fixed, Wirewound (Accurate), Established Reliability

Part Number Explanation:



Part Number	Control specification	Style Size	Characteristics					FRL	
			Rated Power (Watts) at +125°C	Resistance (Ohms)		Tolerance (±%)	Max Volts (dc)	Grade 1	Grade 2
				Min	Max				
RBR52XXXXXXXXXX	MIL-R-39005/1	RBR52	1/2	10	1.21 M	0.02, 0.05, 0.10	600		
RBR54XXXXXXXXXX	MIL-R-39005/3	RBR54	1/4	4.99	562 K	0.02, 0.05, 0.10	300		
RBR56XXXXXXXXXX	MIL-R-39005/5	RBR56	1/8	10	220 K	0.02, 0.05, 0.10	150		
RBR57XXXXXXXXXX	MIL-R-39005/7	RBR57	3/4	10	1.37 M	0.02, 0.05, 0.10	600	R	P
RBR71XXXXXXXXXX	MIL-R-39005/6	RBR71	1/8	10	0.15 M	0.02, 0.05, 0.10	150		
RBR74XXXXXXXXXX (3)	MIL-R-39005/8	RBR74	1/8	100	6520	0.1	150		
RBR75XXXXXXXXXX	MIL-R-39005/9	RBR75	1/8	10	150 K	0.02, 0.05, 0.10	150		

- (1) For R ≥ 1000Ω, expressed by five digits, the first four are significant and the fifth is the number of zeros.
- (2) For R < 1000Ω, the letter R replaces one of the digits and is used as a decimal point and all digits are significant.
- (3) For resistance, select values from chart on page 10.3.  
Not recommended for new design. (See MIL-R-39005/8).

**MIL-R-39005, RESISTORS**  
**Fixed, Wirewound (Accurate), Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade  
at a resistance tolerance of  $\pm 0.02\%$ ,  $\pm 0.05\%$ , and  $\pm 0.10\%$  (Q, A, B)**

10.00	12.10	14.70	17.80	21.50	26.10	31.60	38.30	46.40	56.20	68.10	82.50
10.10	12.30	14.90	18.00	21.80	26.40	32.00	38.80	47.00	56.90	69.00	83.50
10.20	12.40	15.00	18.20	22.10	26.70	32.40	39.20	47.50	57.60	69.80	84.50
10.40	12.60	15.20	18.40	22.30	27.10	32.80	39.70	48.10	58.30	70.60	85.60
10.50	12.70	15.40	18.70	22.60	27.40	33.20	40.20	48.70	59.00	71.50	86.60
10.60	12.90	15.60	18.90	22.90	27.70	33.60	40.70	49.30	59.70	72.30	87.60
10.70	13.00	15.80	19.10	23.20	28.00	34.00	41.20	49.90	60.40	73.20	88.70
10.90	13.20	16.00	19.30	23.40	28.40	34.40	41.70	50.50	61.20	74.10	89.80
11.00	13.30	16.20	19.60	23.70	28.70	34.80	42.20	51.10	61.90	75.00	90.90
11.10	13.50	16.40	19.80	24.00	29.10	35.20	42.70	51.70	62.60	75.90	92.00
11.30	13.70	16.50	20.00	24.30	29.40	35.70	43.20	52.30	63.40	76.80	93.10
11.40	13.80	16.70	20.30	24.60	29.80	36.10	43.70	53.00	64.20	77.70	94.20
11.50	14.00	16.90	20.50	24.90	30.10	36.50	44.20	53.60	64.90	78.70	95.30
11.70	14.20	17.20	20.80	25.20	30.50	37.00	44.80	54.20	65.70	79.60	96.50
11.80	14.30	17.40	21.00	25.50	30.90	37.40	45.30	54.90	66.50	80.60	97.60
12.00	14.50	17.60	21.30	25.80	31.20	37.90	45.90	55.60	67.30	81.60	98.80

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

## MIL-R-39007, RESISTORS Fixed, Wirewound (Power Type), Established Reliability

Part Number Explanation:		Terminal Characteristics		Significant Figures		Number of Zeros		Resistance Tolerance		Failure Rate (%/1000 hrs)	
RWR	XX	X	XXX	X	X	X	X	X	X	X	X
MIL-R-39007		Size		Resistance (1) (2)		Resistance (1) (2)		Resistance Tolerance		Failure Rate (%/1000 hrs)	
<p><b>Style</b> The letters RWR identify established reliability, axial lead, power type, wire-wound, fixed resistors. "XX" represents a number which identifies the size, wattage rating and construction of the resistors.</p> <p><b>Terminal Characteristics</b> W = Weldable, inductively wound S = Solderable, inductively wound N = Solderable, noninductively wound Z = Weldable, noninductively wound</p>											

Part Number	Control Specification	Style Size	Rated Power (Watts) at +25°C	Terminal Characteristic	Resistance Range (Ohms) (3)(4)				Tolerance (±%)	Maximum Voltage Rating	FRL	
					Min		Max				Grade 1	Grade 2
					Min	Max	Min	Max				
RWR78XXXXXXXXXX	MIL-R-39007/7	RWR78	10	S, W N, Z	0.1 0.1	39.2 K 19.6 K						
RWR80XXXXXXXXXX	MIL-R-39007/8	RWR80	2	S, W N, Z	0.1 0.1	1210 640						
RWR81XXXXXXXXXX	MIL-R-39007/9	RWR81	1	S, W N, Z	0.1 0.1	492 234						
RWR84XXXXXXXXXX	MIL-R-39007/10	RWR84	7	S, W N, Z	0.1 0.1	12.4 K 6.19 K						
RWR89XXXXXXXXXX	MIL-R-39007/11	RWR89	3	S, W N, Z	0.1 0.1	3570 1780						

- (1) For R ≥ 100 Ω, the first three digits are significant and the fourth is the number of zeros. For R < 100 Ω the letter R replaces one of the digits and is used as a decimal point. All digits are significant.
- (2) For resistance, select value from chart on pages 10.5 & 10.6.
- (3) For tolerance "B" (0.1%), terminals S and W, the minimum resistance value is 0.499 ohms.
- (4) Wire size of less than 0.001 inch (0.03 mm) in nominal diameter is not approved for NASA use. See detail specification.

**MIL-R-39007, RESISTORS**  
**Fixed, Wirewound (Power Type), Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade  
 at a resistance tolerance of  $\pm 0.1\%$ ,  $\pm 0.5\%$  and  $\pm 1.0\%$  (B, D, F)**

B (1) (0.1)	D (0.5)	F (1.0)												
10.0	12.4	15.4	15.4	19.1	19.1	23.7	23.7	29.4	29.4	29.4	29.4	29.4	29.4	29.4
10.1	12.6	15.6	15.6	19.3	19.3	24.0	24.0	29.8	29.8	29.8	29.8	29.8	29.8	29.8
10.2	12.7	15.8	15.8	19.6	19.6	24.3	24.3	30.1	30.1	30.1	30.1	30.1	30.1	30.1
10.4	12.9	16.0	16.0	19.8	19.8	24.6	24.6	30.5	30.5	30.5	30.5	30.5	30.5	30.5
10.5	13.0	16.2	16.2	20.0	20.0	24.9	24.9	30.9	30.9	30.9	30.9	30.9	30.9	30.9
10.6	13.2	16.4	16.4	20.3	20.3	25.2	25.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
10.7	13.3	16.5	16.5	20.5	20.5	25.5	25.5	31.6	31.6	31.6	31.6	31.6	31.6	31.6
10.9	13.5	16.7	16.7	20.8	20.8	25.8	25.8	32.0	32.0	32.0	32.0	32.0	32.0	32.0
11.0	13.7	16.9	16.9	21.0	21.0	26.1	26.1	32.4	32.4	32.4	32.4	32.4	32.4	32.4
11.1	13.8	17.2	17.2	21.3	21.3	26.4	26.4	32.8	32.8	32.8	32.8	32.8	32.8	32.8
11.3	14.0	17.4	17.4	21.5	21.5	26.7	26.7	33.2	33.2	33.2	33.2	33.2	33.2	33.2
11.4	14.2	17.6	17.6	21.8	21.8	27.1	27.1	33.6	33.6	33.6	33.6	33.6	33.6	33.6
11.5	14.3	17.8	17.8	22.1	22.1	27.4	27.4	34.0	34.0	34.0	34.0	34.0	34.0	34.0
11.7	14.5	18.0	18.0	22.3	22.3	27.7	27.7	34.4	34.4	34.4	34.4	34.4	34.4	34.4
11.8	14.7	18.2	18.2	22.6	22.6	28.0	28.0	34.8	34.8	34.8	34.8	34.8	34.8	34.8
12.0	14.9	18.4	18.4	22.9	22.9	28.4	28.4	35.2	35.2	35.2	35.2	35.2	35.2	35.2
12.1	15.0	18.7	18.7	23.2	23.2	28.7	28.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
12.3	15.2	18.9	18.9	23.4	23.4	29.1	29.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1

(Table continued) See end of table for footnote.

**MIL-R-39007, RESISTORS**  
**Fixed, Wirewound (Power Type), Established Reliability, Standard Values (Continued)**

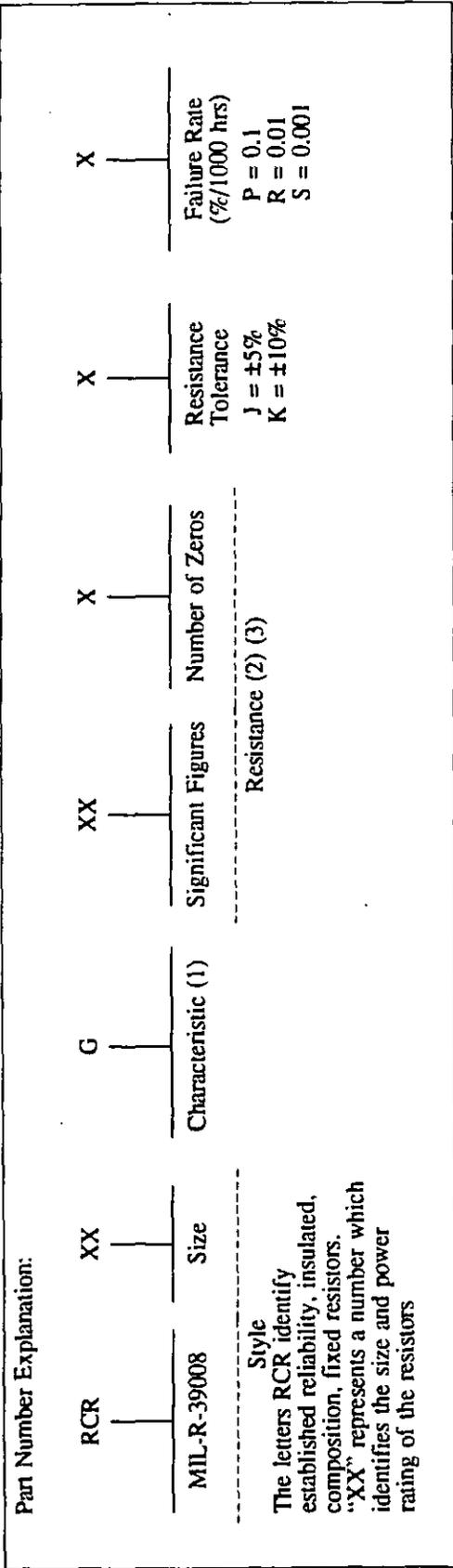
**Standard resistance values for the 10 to 100 decade  
 at a resistance tolerance of  $\pm 0.1\%$ ,  $\pm 0.5\%$  and  $\pm 1.0\%$  (B, D, F)**

B (1) (0.1)	D (0.5)	F (1.0)												
36.5	37.0	37.4	37.9	38.3	38.8	39.2	39.7	40.2	40.7	41.2	41.7	42.2	42.7	43.2
44.2	44.8	45.3	45.9	46.4	47.0	47.5	48.1	48.7	49.3	49.9	50.5	51.1	51.7	52.3
53.6	54.2	54.9	55.6	56.2	56.9	57.6	58.3	59.0	59.7	60.4	61.2	61.9	62.6	63.4
64.9	65.7	66.5	67.3	68.1	69.0	69.8	70.6	71.5	72.3	73.2	74.1	75.0	75.9	76.8
78.7	79.6	80.6	81.6	82.5	83.5	84.5	85.6	86.6	87.6	88.7	89.8	90.9	92.0	93.1
95.3	96.5	97.6	98.8											

(1) The resistance values for "B" tolerance may be of any value, but it is preferred that the values be chosen from tolerance "D" values in this table.

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

## MIL-R-39008, RESISTORS Fixed, Composition (Insulated), Established Reliability



Part Number	Control specification	Style Size (4)	Characteristics				FRL		
			Rated Power (Watts) at +70°C	Resistance (Ohms)		Tolerance (±%)	Max Volts (dc)	Grade 1	Grade 2
				Range	Max				
RCR05GXXXXXX	MIL-R-39008/4	RCR05	1/8	2.7		150			
RCR07GXXXXXX	MIL-R-39008/1	RCR07	1/4	2.7		250			
RCR20GXXXXXX	MIL-R-39008/2	RCR20	1/2	1.0	22.0 M	350	S	P or R	
RCR32GXXXXXX	MIL-R-39008/3	RCR32	1.0	1.0		500			
RCR42GXXXXXX	MIL-R-39008/5	RCR42	2.0	10.0		500			

- (1) Only characteristic G is available.
- (2) The nominal resistance value expressed in ohms is identified by a 3 digit number. The first two digits represent significant figures and the last digit specifies the number of zeros to follow. When resistance values less than 10Ω are required, the letter "R" is substituted for one of the significant digits to represent the decimal point.
- CAUTION:** Resistance values can change up to 15 percent because of moisture absorption. See (4).
- (3) For resistance, select value from chart on page 10.8.
- (4) These resistors are sensitive to moisture. It is recommended that these resistors be baked at +100°C (with no power applied) prior to use if resistance measurements indicate they are not within limits for the following schedule: style RCR05, 25 ±4 hours; style RCR42, 130 ±4 hours; all other styles, 96 ±4 hours. Reference MIL-R-39008, Para. 6.9.

**MIL-R-39008, RESISTORS**  
**Fixed, Composition (Insulated), Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade  
at a resistance tolerance of  $\pm 5\%$  (J) and  $\pm 10\%$  (K)**

$\pm 5\%$ (J)	$\pm 10\%$ (K)	$\pm 5\%$ (J)	$\pm 10\%$ (K)
10	10	33	33
11	—	36	—
12	12	39	39
13	—	43	—
15	15	47	47
16	—	51	—
18	18	56	56
20	—	62	—
22	22	68	68
24	—	75	—
27	27	82	82
30	—	91	—

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

## MIL-R-39009, RESISTORS Fixed, Wirewound (Power Type, Chassis Mounted), Established Reliability

Part Number Explanation:

RER	XX	X	XXX	X	X
MIL-R-39009	Size	Resistance Tolerance	Significant Figures	Number of Zeros	Failure Rate (%/1000 hrs)
Style		Resistance (1)(4)			
The letters RER identify established reliability, chassis mounted, power-type, wire-wound, fixed resistors. "XX" represents a number which identifies the size and power rating of the resistors		F = ±1.0%			
		P = 0.1 R = 0.01			

Part Number	Control specification	Style Size	Rated Power (Watts) (2) at +25°C	Characteristics			FRL	
				Resistance (Ohms)		Tolerance (±%)	Grade 1	Grade 2
				Range (3)	Max			
RER60FXXXXXX		RER60	5.0	Min	Max	1.0	R	P
RER65FXXXXXX	MIL-R-39009/1 (inductive)	RER65	10.0	0.10	3.32 K			
RER70FXXXXXX		RER70	20.0		5.62 K			
RER75FXXXXXX		RER75	30.0		12.1 K			
RER40FXXXXXX		RER40	5.0	1.0	39.2 K			
RER45FXXXXXX	MIL-R-39009/2 (noninductive)	RER45	10.0		1.65 K			
RER50FXXXXXX		RER50	20.0		2.80 K			
RER55FXXXXXX		RER55	30.0		6.04 K			
					19.6 K			

- (1) For resistance, select value from chart on page 10.10.
- (2) These aluminum-housed, chassis-mounted styles are assigned power ratings when mounted on test chassis areas of a specific size at an ambient temperature of 25°C. Reference MIL-HDBK-978, Vol. 1, 3.7.
- (3) Based on use of 0.001-inch nominal diameter wire.
- (4) For R ≥ 100Ω, the first three digits are significant and the fourth signifies the number of zeros. For R < 100Ω, all digits are significant; the letter R is substituted for one of the digits indicating a decimal point.

**MIL-R-39009, RESISTORS  
Fixed, Wirewound (Power Type, Chassis Mounted), Established Reliability**

**Standard resistance values for the 1 to 10 decade (F = ±1.0%)**

1.00	1.21	1.47	1.78	2.15	2.61	3.16	3.83	4.64	5.62	6.81	8.25
1.02	1.24	1.50	1.82	2.21	2.67	3.24	3.92	4.75	5.76	6.98	8.45
1.05	1.27	1.54	1.87	2.26	2.74	3.32	4.02	4.87	5.90	7.15	8.66
1.07	1.30	1.58	1.91	2.32	2.80	3.40	4.12	4.99	6.04	7.32	8.87
1.10	1.33	1.62	1.96	2.37	2.87	3.48	4.22	5.11	6.19	7.50	9.09
1.13	1.37	1.65	2.00	2.43	2.94	3.57	4.32	5.23	6.34	7.68	9.31
1.15	1.40	1.69	2.05	2.49	3.01	3.65	4.42	5.36	6.49	7.87	9.53
1.18	1.43	1.74	2.10	2.55	3.09	3.74	4.53	5.49	6.65	8.06	9.76

**NOTE:** The standard resistance values up to and including the maximum value for every decade shall follow the sequence demonstrated for the "1 to 10" decade, above.

**MIL-R-39015, RESISTORS (1)  
Variable, Wirewound (Lead Screw Actuated), Established Reliability**

Part Number Explanation:				
M39015	/X	-XXX	X	X
Document Number	Specification Sheet Number	Dash Number	Terminal Type	Failure Rate (%/1000 hrs) P = 0.1
			L - Flexible insulated wire leads P - Printed circuit pin (base mount) W - Printed circuit pin (edge mount) X - Printed circuit pin (edge mount - alternate con-figuration).	

Part Number	Control specification	Style Size	Characteristics						FRL (2)		
			Rated Power (Watts) at +85°C	Resistance (Ohms)		Resolution Range (%)		Voltage Range (Volts)			
				Tolerance (±%)	Min	Max	Min	Max		Min	Max
M39015/2-XXXXXX	MIL-R-39015/2	RTR22	0.75	5.0	100	20 K	0.51	1.3	8.7	86.7	P
M39015/3-XXXXXX	MIL-R-39015/3	RTR24			10	10 K	0.25	1.3	2.7	61.3	

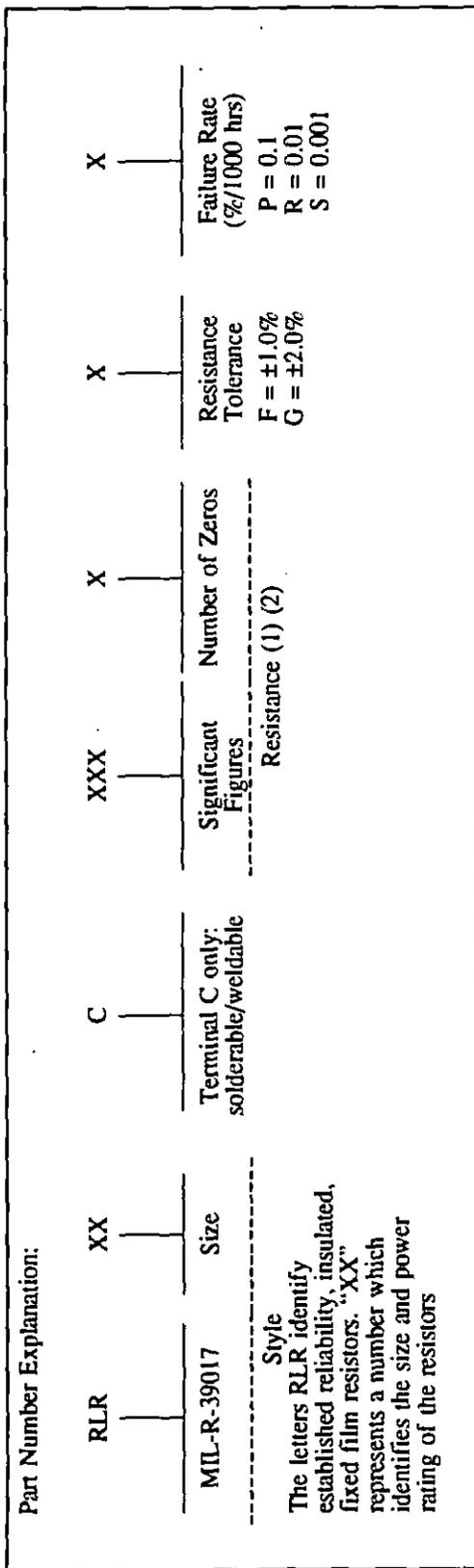
(1) Parts covered by this specification may contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow. Welded connections are recommended for space flight use. Consult manufacturer.

(2) Variable resistors shall not be used for Grade 1 applications.

**MIL-R-39015, RESISTORS**  
**Variable, Wirewound (Lead Screw Actuated), Established Reliability**  
**Standard Resistance Values**

M39015/2 - Style RTR22				M39015/3 - Style RTR24			
Nominal Resistance Value (Ohms)	Maximum Resolution (%)	Maximum Working Voltage (Volts)	Dash Number	Nominal Resistance Value (Ohms)	Maximum Resolution (%)	Maximum Working Voltage (Volts)	Dash Number
100	0.51	8.7	001	10	1.3	2.7	001
200	0.42	12.3	002	20	1.1	3.8	002
500	0.42	19.4	003	50	0.77	6.1	003
1.0 K	0.36	27.4	004	100	0.62	8.7	004
2.0 K	0.29	38.7	005	200	0.55	12.3	005
5.0 K	0.26	61.3	006	500	0.51	19.4	006
10.0 K	0.14	86.7	007	1.0 K	0.37	27.4	007
20.0 K	0.11	122.0	008	2.0 K	0.30	38.7	008
				5.0	0.25	61.3	009
				10.0 K	0.10	86.7	010

## MIL-R-39017, RESISTORS Fixed, Film (Insulated), Established Reliability



Part Number	Control specification	Style Size	Rated Power (Watts) at +70°C	Characteristics			FRL		
				Resistance (Ohms)		Tolerance (±%)	Max Volts (dc)	Grade 1	Grade 2
				Range	Max				
RLR05CXXXXXX	MIL-R-39017/5	RLR05	1/8	Min	Max	1.0, 2.0	200	S	P or R
RLR07CXXXXXX	MIL-R-39017/1	RLR07	1/4	4.7	10.0	1.0, 2.0	250		
RLR20CXXXXXX	MIL-R-39017/2	RLR20	1/2	4.3	3.01 M	1.0, 2.0	350		
RLR32CXXXXXX	MIL-R-39017/3	RLR32	1	10.0	2.7 M	1.0, 2.0	500		

- (1) For R > 100Ω, the first three digits are significant and the fourth is the number of zeros
- (2) For R < 100Ω, the letter R replaces one of the digits and represents a decimal point. All digits are significant.

## MIL-STD-975L (NASA) - Part I

**MIL-R-39017, RESISTORS**  
**Fixed, Film (Insulated), Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade**  
**(A resistance tolerance of  $\pm 1.0\%$  (F) is recommended.)**

G (2.0)	F (1.0)	G (2.0)	F (1.0)	G (2.0)	F (1.0)	G (2.0)	F (1.0)
10.00	10.00		18.70		33.20		56.20
	10.20		19.10		34.00		57.60
	10.50		19.60		34.80		59.00
	10.70	20.00	20.00		35.70		60.40
11.00	11.00		20.50	36.00	36.50	62.00	61.90
	11.30		21.00		37.40		63.40
	11.50		21.50		38.30		64.90
	11.80	22.00		39.00			66.50
12.00	12.10		22.10		39.20	68.00	
	12.40		22.60		40.20		68.10
	12.70		23.20		41.20		69.80
	13.00	24.00	23.70		42.20		71.50
13.00	13.00		24.30	43.00	43.20	75.00	73.20
	13.30		24.90		44.20		75.00
	13.70		25.50		45.30		76.80
	14.00		26.10		46.40		78.70
	14.30	27.00	26.70	47.00	47.50	82.00	80.60
15.00	14.70		27.40		48.70		82.50
	15.00		28.00		49.90		84.50
	15.40		28.70	51.00	51.10		86.60
	15.80	30.00	29.40		52.30	91.00	88.70
16.00	16.20		30.10		53.60		90.90
	16.50		30.90		54.90		93.10
	16.90		31.60	56.00			95.30
	17.40		32.40				97.60
18.00	17.80	33.00					
	18.20						

## MIL-R-55182, RESISTORS Fixed, Film, Solderable Established Reliability

Part Number Explanation:

RNR	XX	X	XXX	X	X	X
MIL-R-55182	Size	Characteristic	Significant Figures	Number of Zeros	Resistance Tolerance	Failure Rate (%/1000 hrs)
Style			----- Resistance (1) (2)			
<p>E = Hermetic <math>\pm 25</math> ppm/<math>^{\circ}</math>C  C = Hermetic <math>\pm 50</math> ppm/<math>^{\circ}</math>C</p> <p>The letters RNR identify established reliability, fixed film, resistors with a solderable type terminal. "XX" represents a number which identifies the size of the resistors.</p>						

Part Number	Control Specification	Style Size (3)	Rated Power (Watts) at +125 $^{\circ}$ C	Characteristics				FRL	
				Resistance (Ohms)		Tolerance ( $\pm$ %) (4)	Max Volts (dc)	Grade 1	Grade 2
				Min	Max				
RNR55XXXXXXX	MIL-R-55182/1	RNR55	1/10	10.0	1.21 M	0.1, 0.5, 1.0	200		
RNR60XXXXXXX	MIL-R-55182/3	RNR60	1/8	10.0	2.49 M	0.1, 0.5, 1.0	250		
RNR65XXXXXXX	MIL-R-55182/5	RNR65	1/4	24.9	4.99 M	0.1, 0.5, 1.0	300	S	P or R
RNR70XXXXXXX	MIL-R-55182/6	RNR70	1/2	24.9	7.5 M	0.1, 0.5, 1.0	350		

- (1) All styles are expressed by four digits; for R  $\geq$  100 $\Omega$ , the first three digits are significant and the fourth is the number of zeros. For R < 100 $\Omega$ , the letter R replaces one of the digits and represents a decimal point.
- (2) For resistance, select value from charts on pages 10.17 & 10.18.
- (3) To prevent corona effects, hollow core resistors are restricted to applied voltages below 100 Vdc. Reference GSFC AID 07-01 (Application Information and Data). Samples of lots of resistors with unknown internal structure shall be subjected to destructive physical analysis to determine application restrictions.
- (4) These resistors are electrostatic sensitive. For tolerance B ( $\pm 0.1\%$ ), package in accordance with MIL-R-39032 as specified for field-force protection.

## MIL-R-55182, RESISTORS

### Fixed, Film, Solderable and Weldable, Established Reliability

Part Number Explanation:

RNC	XX	X	XXX(XX)	X	X
MIL-R-55182	Size	Characteristic (3)	Significant Figures	Number of Zeros	Resistance Tolerance
Style			Resistance (1) (2)		Failure Rate (%/1000 hrs)
<p>The letters RNC identify established reliability, fixed film resistors with a solderable/weldable terminal. "XX" represents a number which identifies the size of the resistors.</p> <p>H = Nonhermetic (<math>\pm 50</math> ppm/<math>^{\circ}</math>C)            J = Nonhermetic (<math>\pm 25</math> ppm/<math>^{\circ}</math>C)            K = Nonhermetic (<math>\pm 100</math> ppm/<math>^{\circ}</math>C)            Y = Nonhermetic (<math>\pm 5</math> ppm/<math>^{\circ}</math>C, up to <math>+125^{\circ}</math>C) (<math>\pm 10</math> ppm/<math>^{\circ}</math>C, <math>+125^{\circ}</math>C to <math>+175^{\circ}</math>C)</p>					
<p>(6) T = <math>\pm 0.01\%</math>            (7) B = <math>\pm 0.1\%</math>            D = <math>\pm 0.5\%</math>            F = <math>\pm 1.0\%</math></p>					

Part Number	Control Specification	Style Size (4) (5)	Rated Power (Watts) at $+125^{\circ}$ C	Characteristics	Resistance (Ohms)			FRL		
					Range		Tolerance ( $\pm\%$ )	Max Volts (dc)	Grade 1	Grade 2
					Min	Max				
RNC50XXXXXXX	MIL-R-55182/7	RNC50	0.05	H, J, K	10	796 K	0.1, 0.5, 1.0	200		
RNC55XXXXXXX	MIL-R-55182/1	RNC55	0.1	H, J, K	10	1.21 M	0.1, 0.5, 1.0	200		
RNC60XXXXXXX	MIL-R-55182/3	RNC60	0.125	H, J, K	10	3.01 M	0.1, 0.5, 1.0	250		
RNC65XXXXXXX	MIL-R-55182/5	RNC65	0.25	H, J, K	10	4.99 M	0.1, 0.5, 1.0	300		
RNC70XXXXXXX	MIL-R-55182/6	RNC70	0.5	H, J, K	10	7.50 M	0.1, 0.5, 1.0	350		
RNC90YXXXXXX	MIL-R-55182/9	RNC90	0.3	Y	4.99	49.9 K	0.01, 0.1, 0.5, 1.0	300	R	
					4.99	121 K				

(1) All styles except RNC90 are expressed by four digits; for  $R \geq 100\Omega$ , the first three digits are significant and the fourth is the number of zeros. For  $R < 100\Omega$ , the letter R replaces one of the digits and represents a decimal point. Style RNC90 is expressed as five significant digits and a letter. For  $R < 1000\Omega$ , the letter R is used as a decimal point. For values  $> 1000\Omega$  but  $< 1.0 M\Omega$  the letter K is used to represent a decimal point and multiplier. All digits preceding and following the letter (R or K) of the group represent significant figures.

(2) For resistance, select value from charts on pages 10.17 & 10.18.

(3) Characteristic "Y" is only available in RNC90 style.

(4) To prevent corona effects, hollow core resistors are restricted to applied voltages below 100 Vdc. Reference GSFC AID 07-01 (Application Information and Data). Samples of lots of resistors with unknown internal structure shall be subjected to destructive physical analysis to determine application restrictions.

(5) All styles except RNC90 are electrostatic sensitive. For tolerance B ( $\pm 0.1\%$ ), package in accordance with MIL-R-39032 as specified for field force protection.

(6) Tolerance T is for RNC90 style only.

(7) Tolerance B is not applicable for characteristic K.

**MIL-R-55182, RESISTORS**  
**Fixed, Film, Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade for a resistance tolerance of  $\pm 1\%$  (F).**

10.0	12.4	15.4	18.7	23.2	28.7	35.7	44.2	54.9	68.1	84.5
10.2	12.7	15.8	19.1	23.7	29.4	36.5	45.3	56.2	69.8	86.6
10.5	13.0	16.2	19.6	24.3	30.1	37.4	46.4	57.6	71.5	88.7
10.7	13.3	16.5	20.0	24.9	30.9	38.3	47.5	59.0	73.2	90.9
11.0	13.7	16.9	20.5	25.5	31.6	39.2	48.7	60.4	75.0	93.1
11.3	14.0	17.4	21.0	26.1	32.4	40.2	49.9	61.9	76.8	95.3
11.5	14.3	17.8	21.5	26.7	33.2	41.2	51.1	63.4	78.7	97.6
11.8	14.7	18.0	22.1	27.4	34.0	42.2	52.3	64.9	80.6	
12.1	15.0	18.2	22.6	28.0	34.8	43.2	53.6	66.5	82.5	

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

## MIL-STD-975L (NASA) - Part I

**MIL-R-55182, RESISTORS**  
**Fixed, Film, Established Reliability, Standard Values**

**Standard resistance values for the 10 to 100 decade at a resistance tolerance of  $\pm 0.01\%$ ,  $\pm 0.1\%$  and  $\pm 0.5\%$  (T, B and D).**

10.00	12.10	14.70	17.80	21.50	26.10	31.60	38.30	46.40	56.20	68.10	82.50
10.10	12.30	14.90	18.00	21.80	26.40	32.00	38.80	47.00	56.90	69.00	83.50
10.20	12.40	15.00	18.20	22.10	26.70	32.40	39.20	47.50	57.60	69.80	84.50
10.40	12.60	15.20	18.40	22.30	27.10	32.80	39.70	48.10	58.30	70.60	85.60
10.50	12.70	15.40	18.70	22.60	27.40	33.20	40.20	48.70	59.00	71.50	86.60
10.60	12.90	15.60	18.90	22.90	27.70	33.60	40.70	49.30	59.70	72.30	87.60
10.70	13.00	15.80	19.10	23.20	28.00	34.00	41.20	49.90	60.40	73.20	88.70
10.90	13.20	16.00	19.30	23.40	28.40	34.40	41.70	50.50	61.20	74.10	89.80
11.00	13.30	16.20	19.60	23.70	28.70	34.80	42.20	51.10	61.90	75.00	90.90
11.10	13.50	16.40	19.80	24.00	29.10	35.20	42.70	51.70	62.60	75.90	92.00
11.30	13.70	16.50	20.00	24.30	29.40	35.70	43.20	52.30	63.40	76.80	93.10
11.40	13.80	16.70	20.30	24.60	29.80	36.10	43.70	53.00	64.20	77.70	94.20
11.50	14.00	16.90	20.50	24.90	30.10	36.50	44.20	53.60	64.90	78.70	95.30
11.70	14.20	17.20	20.80	25.20	30.50	37.00	44.80	54.20	65.70	79.60	96.50
11.80	14.30	17.40	21.00	25.50	30.90	37.40	45.30	54.90	66.50	80.60	97.60
12.00	14.50	17.60	21.30	25.80	31.20	37.90	45.90	55.60	67.30	81.60	98.80

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

# MIL-R-55342, RESISTORS Fixed, Film, Chip, Established Reliability

Part Number Explanation: X55342	X	XX	X	XXXX	X
MIL Number Indicating MIL-R-55342(3)	Characteristic K = ±100 ppm/°C M = ±300 ppm/°C	Specification Sheet Number	Termination Material	Resistance Value and Tolerance (I)	Failure Rate (%/1000 hrs) P = 0.1 R = 0.01 S = 0.001

tol.	Multiplier	Symbol
1.0	X 1	D
1.0	X 1,000	B
1.0	X 1,000,000	P
2.0	X 1	G
2.0	X 1,000	H
2.0	X 1,000,000	F
5.0	X 1	J
5.0	X 1,000	K
5.0	X 1,000,000	L
10.0	X 1	M
10.0	X 1,000	N
10.0	X 1,000,000	P

B - Solderable, base metallization barrier metal, solder coated  
 S - Solderable, pretinned  
 C - Epoxy bondable, palladium/silver or platinum/silver

Mil Sheet	Style	Chars.	Resistance Range (Ohms)	Tolerance (±%)	Voltage Raging (V)	Power Rating (mW)	FRL	
							One Surface	Wraparound
55342/2	RM0505	K,M	10 - 0.470 M	1.0, 2.0, 5.0	40	50	S (2)	Grade 1
		K,M	5.6 - 0.470 M	10.0				
55342/4	RM1505	K	5.6 - 2.000 M	1.0, 2.0, 5.0, 10.0	40	150	S (2)	Grade 2
		M	5.6 - 4.700 M	1.0, 2.0, 5.0, 10.0				
55342/5	RM2208	K	5.6 - 2.000 M	1.0, 2.0, 5.0, 10.0	40	225	S (2)	S
		M	5.6 - 15.000 M	1.0, 2.0, 5.0, 10.0				
55342/6	RM0705	K,M	5.6 - 1.000 M	1.0, 2.0, 5.0, 10.0	40	100	S (2)	P or R
55342/7	RM1206	K,M	5.6 - 1.000 M	1.0, 2.0, 5.0, 10.0	100	250	S (2)	
55342/8	RM2010	K	5.6 - 2.000 M	1.0, 2.0, 5.0, 10.0	150	800	S (2)	B, C
		M	5.6 - 15.000 M	1.0, 2.0, 5.0, 10.0				
55342/9	RM2512	K	5.6 - 2.000 M	1.0, 2.0, 5.0, 10.0	200	1000	S (2)	S
		M	5.6 - 15.000 M	1.0, 2.0, 5.0, 10.0				

- (1) Nominal Resistance in ohms is identified by four characters consisting of three digits and a letter. All digits, whether preceding or following the letter, are significant. The letter, inserted in a standard resistance value, is used simultaneously as a decimal point, multiplier, and resistance tolerance indicator as shown in the subtable above.
- (2) Grade 1 part is not available. This termination material may not be available for the full resistance range; consult latest QPL.
- (3) MIL-R-55342/7 part numbers begin D55342, all others begin M55342.

## MIL-STD-975L (NASA) - Part I

**MIL-R-55342, RESISTORS**  
**Fixed, Film, Chips, Established Reliability**

**Standard Resistance Values for the 10 to 100 Decade**

(1.0)	(2.0) (5.0)	(10.0)												
10.00	10.00	10.00	16.50			26.70	27.00	27.00	41.20			63.40		
10.20			16.90			27.40			42.20			64.90		
10.50			17.40			28.00			43.20	43.00		66.50		
10.70			17.80			28.70			44.20			68.10	68.00	68.00
11.00	11.00		18.20	18.00	18.00	29.40			45.30			69.80		
11.30			18.70			30.10	30.00		46.40			71.50		
11.50			19.10			30.90			47.50			73.20		
11.80			19.60			31.60			48.70			75.00	75.00	
12.10	12.00	12.00	20.00	20.00		32.40			49.90			76.80		
12.40			20.50			33.20			51.10			78.70		
12.70			21.00			34.00	33.00	33.00	52.30	51.00		80.60		
13.00	13.00		21.50	22.00	22.00	34.80			53.60			82.50	82.00	82.00
13.30			22.10			35.70			54.90			84.50		
13.70			22.60			36.50			56.20			86.60		
14.00			23.20			37.40	36.00		57.60	56.00	56.00	88.70		
14.30			23.70	24.00		38.30			59.00			90.90	91.00	
14.70			24.30			39.20			60.40			93.10		
15.00	15.00	15.00	24.90			40.20	39.00	39.00	61.90	62.00		95.30		
15.40			25.50									97.60		
15.80	16.00		26.10											
16.20														

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

# MIL-R-83401, RESISTORS (1) Networks, Fixed, Film

Part Number Explanation: M83401	XX	X	XXXX	X	X	Schematic A B (5) C G
Detail Spec Number	Specification Sheet Number	Characteristic (2)	Resistance	Tolerance		
		C = ±50 ppm/°C (hermetic) H and V = ±50 ppm/°C (nonhermetic)	(3) (4)	B = ±0.1% D = ±0.5% F = ±1.0% G = ±2.0% J = ±5.0%		

Part Number	Control Specification	Style	Pins/Package	Schematic (5)	Power Rating at +70°C				Resistance Range (Ohms)		Tolerance (±%)	Maximum Working Voltage/Element (Volts)	Grade 2
					Characteristics C and V		Characteristic H		Min	Max			
					Element (Watts)	Network (Watts)	Element (Watts)	Network (Watts)					
M8340101XXXXXXX	MIL-R-83401/1 (6)	RZ010	14/DIP	A	—	—	0.2	1.4	50	0.1 M	0.1, 0.5, 1.0, 2.0, 5.0	100	(7)
M8340102XXXXXXX	MIL-R-83401/2 (6)	RZ020	16/DIP	B	—	—	0.1	1.3	50	70 K		100	
M8340103XXXXXXX	MIL-R-83401/3	RZ030	14/FLAT	A	—	—	0.1	1.5	50	70 K	0.1, 0.5, 1.0, 2.0, 5.0	100	
M8340107XXXXXXX	MIL-R-83401/7	RZ070	6/SIP	A	—	—	0.8	—	100	10 K		50	
M8340108XXXXXXX	MIL-R-83401/8	RZ080	8/SIP	B	—	—	—	0.05	0.35	150	51.1 K	50	
M8340109XXXXXXX	MIL-R-83401/9	RZ090	10/SIP	A	—	—	—	0.05	0.325	150	121 K	50	
				B	—	—	—	0.05	0.325	150	121 K	50	

- (1) Parts covered by this specification may contain internal soldered connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow. Welded connections are recommended for space flight use. Consult manufacturer.
- (2) Use only hermetically sealed units for space flight applications.
- (3) For R ≥ 100Ω, the first three digits are significant and the fourth signifies the number of zeros. For R < 100Ω, all digits are significant; the letter R is substituted for one of the digits indicating a decimal point.
- (4) For resistance, select value from the chart on page 10.22.
- (5) See control specification for applicable schematic diagram.
- (6) Ceramic sandwich construction shall not be used. Reference MIL-HDBK-978, Para. 3.10.6.1.
- (7) There are no Grade 1 parts. For Grade 2 applications, parts shall be screened in accordance with Appendix B.

## MIL-STD-975L (NASA) - Part I

**MIL-R-83401, RESISTORS**  
**Network, Fixed, Film, Standard Resistance Values for the 10 to 100 Decade**

F (1.0)	G (2.0)	J (5.0)									
10.00	10.00		16.50			27.00			42.20		
10.20			16.90						43.20	43.00	
10.50			17.40						44.20		68.00
10.70			17.80						45.30		
11.00	11.00		18.20	18.00		30.00			46.40		
11.30			18.70						47.00	47.00	
11.50			19.10						47.50		75.00
11.80			19.60						48.70		
12.10		12.00	20.00	20.00		33.00			49.90	51.00	
12.40			20.50						51.10		82.00
12.70			21.00						52.30		
13.00	13.00		21.50						53.60		
13.30			22.10	22.00					54.90		
13.70			22.60						56.20	56.00	
14.00			23.20			36.00			57.60		91.00
14.30			23.70						59.00		
14.70			24.30	24.00		39.00			60.40		
15.00	15.00		24.90						61.90		
15.40			25.50						63.40	62.00	
15.80		16.00	26.10						64.90		
16.20			26.70						66.40		

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

## SECTION 11: SUMMARY OF STANDARD THERMISTORS

Page	Control Specification	Description	Resistance Range @ +25°C (Ohms)		Grade 1	Grade 2
			Min	Max		
11.2	MIL-T-23648/19 (3)	Positive temperature coefficient	10	10 K	(1)	
11.5	GSFC S-311-P-18 (3)	Negative temperature coefficient	22.52	30 K	(2)	

Refer to MIL-HDBK-978, Vol. 1, for construction and application information

(1) Presently there are no Grade 1 parts. Parts may be used in Grade 2 applications only.

(2) Parts may be used in Grades 1 and 2 applications.

(3) Parts covered by this specification contain internal connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow. Heat sinking is strongly recommended.

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MIL-T-23648, THERMISTORS, INSULATED (5)

Part Number Explanation:				
RTHXX	X	X	XXX	X
Style	Resistance Ratio Characteristic: E = 0.55 ± 10%	Lead Type S = Solderable (S only)	Zero Power Resistance @ +25°C (1)	Zero Power Resistance Tolerance @ +25°C (2) J = ± 5%
RTH- Identifies general purpose thermistors and "XX" represents a two-digit number which identifies the physical configuration				

Part Number	Control Specification	Style	Temperature Coefficient	Seal	Resistance Ratio	Resistance Values @ +25°C (ohms)		Thermal Time Constant (sec) Max	Dissipation Constant Min (mW/°C)	Power Rating @ +25°C (watts)	FRL	
						Min	Max				Grade	Grade
RTH42ESXXX	MIL-T-23648/19	RTH42	Positive	Hermetic	E = 0.55 ± 10%	10	10 K	60	2.5	0.25	(3)	(4)

- (1) The resistance is expressed in ohms and identified by a three-digit number. The first two digits represent significant figures and the last digit specifies the number of zeros to follow.
- (2) See Resistance vs Temperature Table following.
- (3) Presently there are no Grade 1 parts.
- (4) FRL (failure rate level) is not applicable to these devices.
- (5) Parts covered by this specification contain internal connections that may reflow during installation. Special care must be exercised when soldering to prevent internal solder reflow. Heat sinking is strongly recommended.

**MIL-T-23648, THERMISTORS, INSULATED**  
**Standard Resistance Values for the 10 to 100 Decade at a**  
**Resistance Tolerance of  $\pm 5\%$  (J)**

10	22	47
11	24	51
12	27	56
13	30	62
15	33	68
16	36	75
18	39	82
20	43	91

NOTE: For values up to and including the maximum value, use the value listed in this table multiplied by the appropriate power of 10.

**MIL-T-23648, THERMISTORS, INSULATED**  
**Resistance Tolerance Versus Temperature for Tolerance**  
**Characteristics J**

Temperature (°C)	J (± percent)
-55	20
-15	13
0	7
+25	5
+50	7
+75	9
+100	12
+125	15

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**MIL-T-23648, THERMISTORS, INSULATED**  
**Factors for Determining Resistance at Various Temperatures**

Temperature (°C)	Resistance Range (Ohms)					
	10-68	82-150	180-470	560-1.2K	1.5K-5.6K	6.8K-10K
-55	0.615	0.582	0.560	0.550	0.515	0.510
-15	0.790	0.770	0.755	0.740	0.730	0.730
0	0.863	0.847	0.838	0.835	0.825	0.825
+25	1.000	1.000	1.000	1.000	1.000	1.000
+50	1.160	1.170	1.180	1.200	1.230	1.190
+75	1.350	1.370	1.400	1.420	1.450	1.400
+100	1.545	1.584	1.623	1.656	1.670	1.610
+125	1.750	1.800	1.860	1.920	1.960	1.830

The appropriate factor is selected from the column headed by the resistance range which includes the zero-power +25° C resistance of the thermistor in question. The +25° C resistance of the thermistor is multiplied by the factor selected to obtain the resistance at any given temperature.

**Example:** Given a thermistor with a +25° C resistance of 220 ohms, calculate the resistance at +75° C.  
 Select +75° C under the temperature column and go across the table to the resistance range column containing 220 ohms. The column heading is 180-470 and the factor is 1.400.  
 Multiply this factor by 220 ohms to obtain the resistance of 308 ohms at +75° C.

**GSFC S-311-P-18, THERMISTORS**

Part Number Explanation:		311P18	-XX	X	XXX
GSFC Control Specification	Dash Number corresponds to the zero-power resistance of the thermistor @ +25°C	Lead Material: S = 32 AG, type C per MIL-STD-1276 T = 28 AG, type ET per MIL-W-16878 N = 32 AG, type N-2 per MIL-STD-1276 E = insulated lead, TFE, 32 AG per MIL-I-22129; bare lead, style S; FEP tubing, M23053/11-105C			

Part Number	Control Specification	Temperature Coefficient	Seal	Zero Power Resistance (at +25°C) (Ohms)	Tolerance Limits (0 to +70°C) (±%)	Operating and Storage Temperature Limits(°C)	Thermal Time Constant (sec)Max	Dissipation Constant (mW/°C) Min	FRL Grades 1 and 2
311P18-01XXXX	GSFC S-311-P-18	Negative	Nonhermetic	2252	1.02	-55 to +90	10.0 (1)	1.0 (2)	(3)
311P18-02XXXX				2252	0.51	-55 to +70			
311P18-03XXXX				3000	1.02	-55 to +90			
311P18-04XXXX				3000	0.56	-55 to +70			
311P18-05XXXX				5000	1.02	-55 to +90			
311P18-06XXXX				5000	0.51	-55 to +70			
311P18-07XXXX				10000	0.93	-55 to +90			
311P18-08XXXX				10000	0.56	-55 to +70			
311P18-09XXXX				30000	1.00	-55 to +90			
311P18-10XXXX				30000	0.50	-55 to +70			

(1) For a thermistor suspended in still air, the thermal constant is 10.0 seconds maximum, except lead style "E", 25 seconds maximum.

(2) For thermistors suspended in still air only (does not apply for lead style "E").

(3) Parts may be used in Grades 1 and 2 applications.

(4) Standard lead lengths are from 7.6 cm to 100 cm. The lead length in centimeters (cm) is specified by three characters. For lengths from 7.6 cm to 9.9 cm the letter "R" is used as the decimal point (e.g., 7R6 (7.6)). For lengths 10 cm to 99 cm the letter "R" is used as the last character (e.g., 76R (76)). For 100 cm the characters are 101, where the last character signifies the number of zeros following the first two characters.

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## **SECTION 12: SUMMARY OF STANDARD TRANSFORMERS**

This standard contains no transformers. All transformers must be procured to the requirements of MIL-STD-981. Refer to MIL-HDBK-978, Vol. 4, for construction and application information and Appendix C for special requirements.

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**SECTION 13: SUMMARY OF STANDARD TRANSISTORS**

Page	Control Specification	Description	Type Designation	
			Grade 1	Grade 2 (1)
13.2	MIL-S-19500	Low-power, NPN	JANS	JANTXV
13.3		Low-power, PNP		
13.3		Matched pair, NPN, PNP		
13.4		High Power, NPN, PNP		
13.5		Silicon RF, NPN, PNP		
13.6		FETs, N-channel, P-channel		
13.7		Choppers		
13.8		Optocoupler		

Refer to MIL-HDBK-978, Vol. 2, for construction and application information.

- (1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:
  - a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
  - b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

## MIL-S-19500, TRANSISTORS Silicon, Low Power (Less Than 2W)

Part Number Explanation:		X (1)	YN	BBBB	I		
JAN	Military Qualified	AAA	Quality Level S = Grade 1 TXV = Grade 2	Radiation Hardness Assurance (RHA)	Component Designator	Identification Number	Suffix Letter
				Total Dose Radiation Tolerance RAD (Si)	Level Neutron Fluence (n/cm)	Y = number one less than the number of active element terminations.	A, B, C, etc. (excluding L, M, R, S) - indicates a modified version which is substitutable for the non-suffixed device. M - indicates matching of specified parameters of separate devices. R - indicates reverse polarity packaging of the non-suffixed device. L or S - indicates that the terminal leads are longer or shorter, respectively, than those of the non-suffixed device.
		M D		3 x 10 <sup>3</sup> 1 x 10 <sup>4</sup>	2 x 10 <sup>12</sup> 2 x 10 <sup>12</sup>		
		R H		1 x 10 <sup>5</sup> 1 x 10 <sup>6</sup>	1 x 10 <sup>12</sup> 1 x 10 <sup>12</sup>		

Grade 1 JANS	Grade 2 JANTXV (2)	Specification MIL-S-19500	Pkg Outline	P <sub>T</sub> at T <sub>A</sub> = +25°C	Maximum Ratings			Electrical Characteristics				Switching Time	Remarks		
					BV <sub>CEO</sub> (V)	BV <sub>CBO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> at I <sub>C</sub>	V <sub>CE(SAT)</sub> at I <sub>C</sub>	I <sub>CEO</sub> (Max) at V <sub>CE</sub> (Max)	I <sub>em</sub> (ns)			I <sub>off</sub> (ns)	
					800 mW	75	50	0.8	100/300	1.0	500 mA	10 nA	35	300	Comp to 2N2905A
		/251	TO-205	800 mW	75	50	0.8	100/300	1.0	500 mA	10 nA	10 nA	35	300	Comp to 2N2907A
		/255	TO-206	500 mW	40	15	0.2	40/120	10 mA	0.2	10 mA	0.2 μA	12	18	F <sub>T</sub> = 500 MHz min
		/317	TO-206	360 mW	60	60	0.05	225/800	10 mA	0.3	1.0 mA	5 nA	—	—	—
		/376	TO-206	360 mW	60	60	0.05	225/800	10 mA	0.3	1.0 mA	5 nA	—	—	—
		/391	TO-205	800 mW	140	80	1.0	100/300	150 mA	0.2	150 mA	10(I <sub>CEB</sub> ) nA	—	—	I <sub>em</sub> + I <sub>off</sub> = 30 ns
		/393	TO-205	1.0 W	85	60	3.0	20/60	1.0 A	0.25	1.0 A	—	300	1300	—
		/393	TO-205	1.0 W	125	80	3.0	20/60	1.0 A	0.25	1.0 A	—	300	1300	—
		/393	TO-205	1.0 W	85	60	3.0	40/120	1.0 A	0.25	1.0 A	—	300	1300	—

**Low Power NPN**

(1) Included only for JANTXV and JANS product assurance level devices.

(2) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table 1, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table 1 parameters described above.

**MIL-S-19500, TRANSISTORS**  
**Silicon, Low Power (Less Than 2W) (Continued)**

Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Pkg Outline	Maximum Ratings			Electrical Characteristics					Remarks		
				P <sub>T</sub> at T <sub>A</sub> = +25°C	BV <sub>CE0</sub> (V)	BV <sub>CE0</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> at I <sub>C</sub> Min/Max	V <sub>CE</sub> (SAT) at I <sub>C</sub> (V)	I <sub>CEO</sub> (Max) at V <sub>CE</sub> (Max)	Switching Time			
											I <sub>on</sub> (ns)	t <sub>off</sub> (ns)		
<b>Low Power PNP</b>														
2N3421.S	2N3421.S	/393	TO-205	1.0 W	125	80	3.0	40/120	1.0 A	0.25	1.0 A	300	1300	—
2N3501L	2N3501L	/366	TO-205	1.0 W	150	150	0.3	100/300	150 mA	0.4	150 mA	115	1150	—
2N3700	2N3700	/391	TO-206	500 mW	140	80	1.0	100/300	150 mA	0.2	150 mA	—	—	I <sub>on</sub> + t <sub>off</sub> = 30 ns
2N4150.S	2N4150.S	/394	TO-205	1.5 W	100	70	10	40/120	5 A	0.6	5 A	550	2000	—
2N5666	2N5666	/455	TO-205	1.2 W	250	200	5	40/120	1 A	0.4	3 A	250	1500	—
2N5667	2N5667	/455	TO-205	1.2 W	400	300	5	25/75	1 A	0.4	3 A	250	2000	—
2N2605	2N2605	/354	TO-206	400 mW	70	60	0.03	100/300	0.010 mA	0.3	10 mA	—	—	low-noise amp
2N2905A.AL	2N2905A.AL	/290	TO-205	600 mW	60	60	0.6	100/300	150 mA	0.4	150 mA	45	300	Comp to 2N2219A
2N2907A	2N2907A	/291	TO-206	400 mW	60	60	0.6	100/300	150 mA	0.4	150 mA	45	300	Comp to 2N2222A
	2N3251A	/323	TO-206	360 mW	60	60	0.2	100/300	10 mA	0.25	10 mA	70	250	—
	2N3468.L	/348	TO-205	1.0 W	50	50	1.0	25/75	500 mA	0.6	500 mA	40	90	—
	2N3637.L	/357	TO-205	1.0 W	175	175	1.0	100/300	50 mA	0.6	50 mA	200	650	—
	2N3763.L	/396	TO-205	1.0 W	60	60	1.5	40/140	500 mA	0.5	500 mA	43	115	—
	2N3765	/396	TO-206	500 mW	60	60	1.5	40/140	500 mA	0.5	500 mA	43	115	—
2N3867.S	2N3867.S	/350	TO-205	1.0 W	40	40	3.0	40/200	1.5 A	0.75	1.5 A	100	600	—
2N3868.S	2N3868.S	/350	TO-205	1.0 W	60	60	3.0	30/150	1.5 A	0.75	1.5 A	100	600	—
	2N5416.S	/485	TO-205	750 mW	350	300	1.0	30/120	50 mA	2.0	50 mA	1000	10000	—
<b>PNP Matched Pair</b>														
2N2060	2N2060.L	/270	TO-78	600(both) mW	100	60	0.5	40/120	1 mA	0.3	50 mA	—	—	h <sub>FE</sub> matched±10%, V <sub>BE</sub> matched±5mV
2N2919	2N2919.L	/355	TO-99	500(both) mW	70	60	0.03	60/240	10 μA	0.3	1.0 mA	—	—	—
2N2920	2N2920.L	/355	TO-99	500(both) mW	70	60	0.03	175/600	10 μA	0.3	1.0 mA	—	—	—
<b>PNP Matched Pair</b>														
2N3810	2N3810.L	/336	TO-78	600(both) mW	60	60	0.05	150/450	1 mA	0.25	1.0 mA	—	—	h <sub>FE</sub> matched±10%, V <sub>BE</sub> matched±5 mV
2N3811	2N3811.L	/336	TO-78	600(both) mW	60	60	0.05	300/900	1 mA	0.25	1.0 mA	—	—	—

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

## MIL-STD-975L (NASA) - Part I

**MIL-S-19500, TRANSISTORS**  
**Silicon, High-Power (Greater Than 2 W)**

Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Pkg Outline	Maximum Ratings			Electrical Characteristics						Remarks			
				$P_T$ at $T_C = +100^\circ\text{C}$ (W)	$BV_{CEO}$ (V)	$BV_{CBO}$ (V)	$I_C$ (A)	$h_{FE}$ at $I_C$	$V_{CE(sat)}$ at $I_C$	$I_{CEO}$ (Max) at $V_{CB}$ (Max)	Switching Time					
								Min/Max	(V)	(A)	(V)	(A)	$t_{on}$ ( $\mu\text{s}$ )	$t_{off}$ ( $\mu\text{s}$ )		
<b>High-Power NPN</b>																
	2N3716	/408	TO-204	85.7	100	80	10	50/150	1.0	1.0	5	5	1.5	2.4	Comp to 2N3792	
	2N3749	/315	MT53	30	110	80	5	40/120	1.0	0.25	1	1	0.36	2.0	Similar to 2N2880. Isolated collector	
	2N3996	/374	TO-111	30	100	80	5	40/120	1.0	2.0	5	5	0.3	1.5	—	
	2N5038	/439	TO-204	80	150	90	20	50/200	2.0	1.0	12	12	0.5	2.0	—	
	2N5664	/455	TO-213	30	250	200	5	40/120	1.0	0.4	3	3	0.25	1.5	—	
	2N5665	/455	TO-213	30	400	300	5	25/75	1.0	0.4	3	3	0.25	2.0	—	
	2N5672	/488	TO-204	80	150	120	30	20/100	15.0	0.75	15	15	0.5	1.5	—	
	2N6308	/498	TO-204	62.5	700	350	8	12/60	3.0	1.5	3	3	0.60	3.0	—	
<b>High-Power PNP</b>																
	2N3741	/441	TO-213	14	80	80	4	30/120	0.25	0.6	1	1	0.4	1.0	—	
	2N3792	/379	TO-204	85.7	80	80	10	50/150	1.0	1.0	5	5	1.5	2.4	Comp to 2N3716	
	2N4399	/433	TO-204	115	60	60	30	25/—	15.0	1.0	15	15	1.2	2.5	—	
	2N5745	/433	TO-204	115	80	80	20	25/—	10.0	1.5	15	15	1.2	2.5	—	
	2N6546	/525	TO-204	100	—	300	15	12/60	5.0	1.5	10	10	1.0	4.7	Pulsed $V_{CE(sat)}$	
	2N6547	/525	TO-204	100	—	400	15	12/60	5.0	1.5	10	10	1.0	4.7	Pulsed $V_{CE(sat)}$	

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

**MIL-S-19500, TRANSISTORS  
Silicon, RF Devices, NPN, PNP**

Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Pkg Outline	Maximum Ratings		Electrical Characteristics						Remarks	
				P <sub>T</sub> T <sub>C</sub> = +25°C (W)	BV <sub>CBO</sub> (Volts)	h <sub>FE</sub> (Min/Max)	h <sub>re</sub>   at f		P <sub>OUT</sub> (Min/Max) (Watts)	P <sub>IN</sub> (Watts)	@		
							Min/Max	(MHz)			f (MHz)		n (%)
<b>NPN</b>													
2N918	2N918	/301	TO-206	0.3	30	20/200	6/18	100	G <sub>re</sub> = 15db min	—	200	—	
2N2857	2N2857	/343	TO-206	0.3	30	30/150	10/21	100	G <sub>re</sub> = 12.5/21 db	—	450	—	
	2N3375	/341	TO-60	11.6	65	15/150	3.5 min	100	7.5/14	1	100	65	
	2N3553	/341	TO-205	7.0	65	15/150	3.5 min	100	2.5/5	0.25	175	50	
	2N3866	/398	TO-205	1.0 @ T <sub>A</sub> = 25°C	60	15/200	2.5/8	200	1.0/2.0	0.15	400	45	
<b>PNP</b>													
	2N4957	/426	TO-206	0.2 @ T <sub>A</sub> = 25°C	30	30/165	12/36	100	G <sub>re</sub> = 17/25 db	—	450	—	

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

## MIL-STD-975L (NASA) - Part I

**MIL-S-19500, TRANSISTORS**  
**Silicon, Field Effect**

Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Pkg Outline	Maximum Ratings			Electrical Characteristics						Remarks	
				$P_T$ at $T_A = +25^\circ\text{C}$ (mW)	$V_{DG}$ (V)	$V_{DS}$ (V)	$I_G$ (mA)	$V_{GS(OFF)}$ (Min/Max) (V)	$I_{DSS}$ ( $V_{GS}=0$ ) (Min/Max) (mA)	$r_{DS(ON)}$ Max (Ohm)	$y_f$ ( $\mu\text{mho}$ )	$C_{in}$ Max (pF)		$C_{out}$ Max (pF)
N-Channel														
	2N3821	/375	TO-206	300	50	50	10	-4 max	0.5/2.5	—	1500/4500	6.0	3.0	$ y_f $ @ 1 kHz
	2N3822	/375	TO-206	300	50	50	10	-6 max	2/10	—	3000/6500	6.0	3.0	$ y_f $ @ 1 kHz
	2N3823	/375	TO-206	300	30	30	10	-8 max	4/20	—	3500/6500	6.0	2.0	$ y_f $ @ 1 kHz
	2N4416A	/428	TO-206	300	35	35	10	-2.5/-6.0	5/15	—	4500/7500	4.0	0.8	$ y_f $ @ 1 kHz
	2N4856	/385	TO-206	360	40	40	50	-4/-10	50/175	25	—	18	8.0	Analog Sw/Chopper
	2N4857	/385	TO-206	360	40	40	50	-2/-6	20/100	40	—	18	8.0	Analog Sw/Chopper
	2N4858	/385	TO-206	360	40	40	50	-0.8/-4	8/80	60	—	18	8.0	Analog Sw/Chopper
P-Channel														
	2N5114	/476	TO-206	500	30	30	50	5/10	-30/-90	75	—	25	7.0	Analog Sw/Chopper
	2N5115	/476	TO-206	500	30	30	50	3/6	-15/-60	100	—	25	7.0	Analog Sw/Chopper
	2N5116	/476	TO-206	500	30	30	50	1/4	-5/-25	175	—	27	7.0	Analog Sw/Chopper
	2N6804	/562	TO-204	4000	-100	-100	—	—	-/-0.025	0.3	—	800	200	—
	2N6806	/562	TO-204	4000	-200	-200	—	—	-/-0.025	0.8	—	800	90	—
	2N6845	/563	TO-205	800	-100	-100	—	—	-/-0.025	0.6	—	400	100	—
	2N6847	/563	TO-205	800	-200	-200	—	—	-/-0.025	1.50	—	400	45	—

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

**MIL-S-19500, TRANSISTORS  
Silicon, Chopper**

Grade 1 JANS 2N2432A	Grade 2 JANTXV (1) 2N2432A 2N2945A	Specification MIL-S-19500 /313 /382	Pkg Outline TO-206 TO-206	Maximum Ratings			Electrical Characteristics				Remarks		
				P <sub>T</sub> at T <sub>A</sub> = +25°C (mW)	BV <sub>CEO</sub> (V)	BV <sub>CBO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> at I <sub>C</sub>		V <sub>BE(sat)</sub> at I <sub>E</sub> = 0		r <sub>ext(sat)</sub> Min/Max (Ohms)	
								Min/Max	(mA)	Min/Max (mV)			I <sub>B</sub> (mA)
				300	45	45	100	80/400	1	-0.7	1	-15	NPN
				400	-25	-20	-100	70/—	-1	-1.0	-1	-6	PNP

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table I, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table I parameters described above.

## MIL-S-19500, TRANSISTORS Optocoupler

Grade 1 JANS	Grade 2 JANTXV (1)	Specification MIL-S-19500	Pkg Outline	Maximum Ratings				Electrical Characteristics						Remarks	
				$P_T$ at $T_A = +25^\circ\text{C}$ (W)	$V_{CE0}$ (Max) (V)	$V_R$ (Max) (V)	$I_C$ Max (mA)	$I_F$ Max (mA)	$I_{GON}$ $V_{CE} = 5.0\text{ V}$		$V_{CE(SAT)}$ @ $I_C$ & $I_F$		$I_{COFF}$ @ $V_{CE}$ $I_C$ & $I_B = 0$		
									Min/Max (mA)	$I_F$ (mA)	Min/Max (V)	(mA)	Min/Max (nA)		(V)
—	4N23	/486	PH13	0.3	35	2	50	40	6.0/—	10	—/0.3	5	20	20	
	4N23A	/486			35				6.0/—	10		5	20		
	4N24	/486			35				10.0/—	10		10	20		
	4N24A	/486			35				10.0/—	10		10	20		
	4N47	/548							0.5/—			0.5	2.0		
	4N48	/548			40				1.0/5.0	1.0		1.0	2.0		
4N49	/548		2.0/10.0		2.0	2.0									

(1) Before use in grade 2 applications, all JANTXV transistor part lots that contain an internal cavity shall be 100% PIND tested. In addition, all JANTXV transistor parts with lot date codes:

- a) before 1986 shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.
- b) including 1986 to present shall be electrically tested to an LTPD of 5% in accordance with Table 1, group A, subgroup 2 of the applicable detailed specification of MIL-S-19500. All devices in lots exceeding the above LTPD reject criteria shall be electrically tested to the Table 1 parameters described above.

**SECTION 14: SUMMARY OF STANDARD WIRE (1)**

Page	Control Specification	Description	Wire Size (AWG)		Voltage Rating Max (Volts)	Grades 1 and 2
			Min	Max		
14.2	MIL-W-22759 (2)	Extruded TFE/ETFE	30	00	600	(3)
14.14	MIL-W-5086	Polyvinyl-chloride, nylon jacket	16	0000	600	GSE only

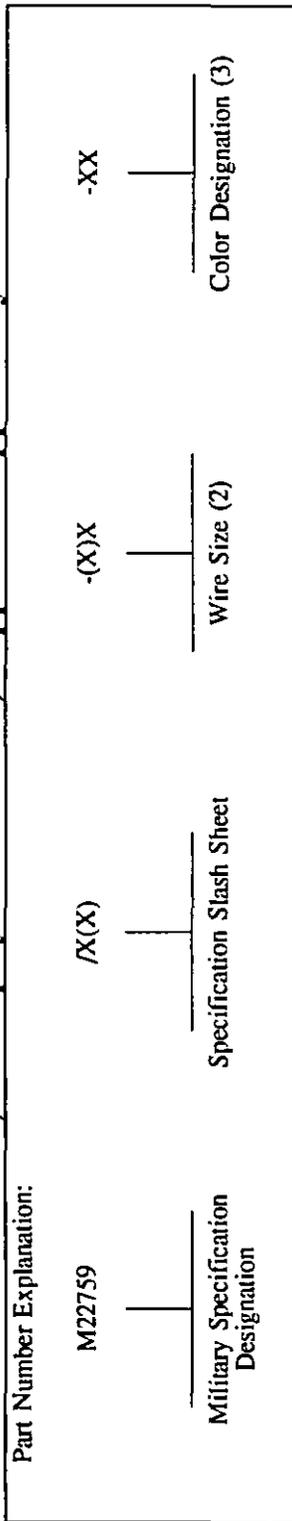
**SECTION 14: SUMMARY OF STANDARD CABLE (1)**

Page	Control Specification	Description	Voltage Rating Range (V)		Grades 1 and 2
			Min	Max	
14.16	MIL-C-17	Radio frequency, flexible, coaxial (50, 75, and 93 ohms)	750	1875	(3)
14.17	MIL-C-27500	Electrical, shielded and unshielded (wire size: 000-30)	600	600	(3)

Refer to MIL-HDBK-978, Vol. 5, for construction and application information.

- (1) These parts may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) May be used in Grade 1 or Grade 2 applications.

**MIL-W-22759, WIRE (1)  
Electric, Fluoropolymer-Insulated, Copper or Copper Alloy**



Part Number	Control Specification	Wire Size Range (2)	Insulation (4)	Coating (5)	Voltage Rating Maximum (Volts/rms)	Temperature (°C)	Grades 1 and 2
M22759/9-XX-XX	MIL-W-22759	28 - 8	Extruded TFE	Silver	1000	+200	(6)
M22759/11-XX-XX		28 - 8	Extruded TFE	Silver	600	+200	
M22759/12-XX-XX		28 - 8	Extruded TFE	Nickel		+260	
M22759/16-XX-XX		24 - 00	ETFE	Tin	+150		
M22759/18-XX-XX		26 - 10	ETFE	Tin	+150		
M22759/22-XX-XX		28 - 20	Extruded TFE	Silver	+200		
M22759/23-XX-XX		28 - 20	Extruded TFE	Nickel	+260		
M22759/32-XX-XX		30 - 12	Crosslinked ETFE	Tin	+150		
M22759/33-XX-XX		30 - 20	Crosslinked ETFE	Silver	+200		
M22759/34-XX-XX		24 - 02	Crosslinked ETFE	Tin	+150		
M22759/35-XX-XX	24 - 20	Crosslinked ETFE	Silver (7)	+200			

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Wire size is a number which is the nearest AWG to actual wire size.
- (3) Substitute the appropriate color code designator from MIL-STD-681.
- (4) Some ETFE (Ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (5) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (6) Wire may be used in Grades 1 and 2 applications.
- (7) High strength copper alloy conductor.

**MIL-W-22759/9, WIRE**  
**Electric, Fluoropolymer-Insulated, Extruded TFE**  
**Silver-Coated Copper Conductor, 1000-Volt, +200°C (1) (2)**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/9-28-XX	28	7 x 36	0.014	0.015	63.8	0.043 ± 0.002	1.90	(4)
M22759/9-26-XX	26	19 x 38	0.018	0.020	38.4	0.048 ± 0.002	2.57	
M22759/9-24-XX	24	19 x 36	0.023	0.025	24.3	0.053 ± 0.002	3.33	
M22759/9-22-XX	22	19 x 34	0.029	0.032	15.1	0.060 ± 0.002	4.60	
M22759/9-20-XX	20	19 x 32	0.037	0.040	9.19	0.068 ± 0.002	6.40	
M22759/9-18-XX	18	19 x 30	0.046	0.050	5.79	0.078 ± 0.002	9.10	
M22759/9-16-XX	16	19 x 29	0.052	0.057	4.52	0.085 ± 0.002	11.0	
M22759/9-14-XX	14	19 x 27	0.065	0.072	2.88	0.100 ± 0.003	16.4	
M22759/9-12-XX	12	19 x 25	0.082	0.090	1.81	0.120 ± 0.004	25.3	
M22759/9-10-XX	10	37 x 26	0.106	0.112	1.19	0.141 ± 0.004	38.2	
M22759/9-8-XX	8	133 x 29	0.158	0.169	0.558	0.207 ± 0.003	68.8	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/9-20-9; white with orange stripe - M22759/9-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/11, WIRE**  
**Electric, Fluoropolymer-Insulated, Extruded TFE**  
**Silver-Coated Copper Conductor, 600-Volt, +200°C (1) (2)**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20° C (+68° F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/11-28-XX	28	7 x 36	0.014	0.015	63.8	0.033 ± 0.002	1.36	(4)
M22759/11-26-XX	26	19 x 38	0.018	0.020	38.4	0.038 ± 0.002	1.90	
M22759/11-24-XX	24	19 x 36	0.023	0.025	24.3	0.043 ± 0.002	2.58	
M22759/11-22-XX	22	19 x 34	0.029	0.032	15.1	0.049 ± 0.002	3.72	
M22759/11-20-XX	20	19 x 32	0.037	0.040	9.19	0.058 ± 0.002	5.43	
M22759/11-18-XX	18	19 x 30	0.046	0.050	5.79	0.068 ± 0.002	8.14	
M22759/11-16-XX	16	19 x 29	0.052	0.057	4.52	0.075 ± 0.002	10.0	
M22759/11-14-XX	14	19 x 27	0.065	0.072	2.88	0.090 ± 0.002	15.1	
M22759/11-12-XX	12	19 x 25	0.082	0.090	1.81	0.111 ± 0.003	24.1	
M22759/11-10-XX	10	37 x 26	0.106	0.112	1.19	0.139 ± 0.004	37.8	
M22759/11-8-XX	8	133 x 29	0.158	0.169	0.658	0.202 ± 0.004	65.5	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/11-20-9; white with orange stripe - M22759/11-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/12, WIRE**  
**Electric, Fluoropolymer-Insulated, Extruded TFE**  
**Nickel-Coated Copper Conductor, 600-Volt, +260°C (1)**

Part Number (2)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20° C (+68° F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/12-28-XX	28	7 x 36	0.014	0.016	67.9	0.033 ± 0.002	1.36	(3)
M22759/12-26-XX	26	19 x 38	0.018	0.021	42.2	0.038 ± 0.002	1.90	
M22759/12-24-XX	24	19 x 36	0.023	0.026	25.9	0.043 ± 0.002	2.58	
M22759/12-22-XX	22	19 x 34	0.029	0.033	16.0	0.049 ± 0.002	3.72	
M22759/12-20-XX	20	19 x 32	0.037	0.041	9.77	0.058 ± 0.002	5.43	
M22759/12-18-XX	18	19 x 30	0.046	0.051	6.10	0.068 ± 0.002	8.14	
M22759/12-16-XX	16	19 x 29	0.052	0.058	4.76	0.075 ± 0.002	10.0	
M22759/12-14-XX	14	19 x 27	0.065	0.073	3.00	0.090 ± 0.002	15.6	
M22759/12-12-XX	12	19 x 25	0.082	0.092	1.89	0.111 ± 0.003	24.4	
M22759/12-10-XX	10	37 x 26	0.106	0.114	1.24	0.139 ± 0.004	39.0	
M22759/12-8-XX	8	133 x 29	0.158	0.173	0.694	0.204 ± 0.004	67.0	

(1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.

(2) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/12-20-9; white with orange stripe - M22759/12-20-93.

(3) Wire may be used in Grades 1 and 2 applications.

## MIL-STD-975L (NASA) - Part I

**MIL-W-22759/16, WIRE (1) (2)**  
**Electric, Fluoropolymer-Insulated, Extruded ETFE, Medium Weight,**  
**Tin-Coated Copper, 600 Volt, +150°C**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/16-24-XX	24	19 x 36	0.023	0.024	26.2	0.045 ± 0.002	2.57	(4)
M22759/16-22-XX	22	19 x 34	0.029	0.031	16.2	0.052 ± 0.002	3.68	
M22759/16-20-XX	20	19 x 32	0.037	0.039	9.88	0.060 ± 0.002	5.36	
M22759/16-18-XX	18	19 x 30	0.046	0.049	6.23	0.071 ± 0.002	7.89	
M22759/16-16-XX	16	19 x 29	0.052	0.055	4.81	0.079 ± 0.002	9.95	
M22759/16-14-XX	14	19 x 27	0.065	0.069	3.06	0.093 ± 0.002	14.9	
M22759/16-12-XX	12	37 x 28	0.084	0.089	2.02	0.114 ± 0.003	22.6	
M22759/16-10-XX	10	37 x 26	0.106	0.112	1.26	0.139 ± 0.003	35.1	
M22759/16-8-XX	8	133 x 29	0.158	0.169	0.701	0.199 ± 0.003	63.5	
M22759/16-6-XX	6	133 x 27	0.198	0.212	0.445	0.250 ± 0.003	99.9	
M22759/16-4-XX	4	133 x 25	0.250	0.268	0.280	0.312 ± 0.004	157.0	
M22759/16-2-XX	2	665 x 30	0.320	0.340	0.183	0.388 ± 0.004	245.0	
M22759/16-1-XX	1	817 x 30	0.360	0.380	0.149	0.431 ± 0.005	314.0	
M22759/16-01-XX	0	1045 x 30	0.395	0.425	0.116	0.479 ± 0.006	391.0	
M22759/16-02-XX	00	1330 x 30	0.440	0.475	0.091	0.546 ± 0.007	504.0	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethylene/fluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/16-20-9; white with orange stripe - M22759/16-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/18, WIRE (1) (2)**  
**Electric, Fluoropolymer-Insulated, Extruded ETFE, Lightweight,**  
**Tin-Coated Copper, 600 Volt, +150°C**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/18-26-XX	26	19 x 38	0.018	0.020	41.3	0.032 ± 0.002	1.52	(4)
M22759/18-24-XX	24	19 x 36	0.023	0.024	26.2	0.036 ± 0.002	2.12	
M22759/18-22-XX	22	19 x 34	0.029	0.031	16.2	0.043 ± 0.002	3.16	
M22759/18-20-XX	20	19 x 32	0.037	0.039	9.88	0.051 ± 0.002	4.76	
M22759/18-18-XX	18	19 x 30	0.046	0.049	6.23	0.061 ± 0.002	7.10	
M22759/18-16-XX	16	19 x 29	0.052	0.055	4.81	0.070 ± 0.002	9.14	
M22759/18-14-XX	14	19 x 27	0.065	0.069	3.06	0.085 ± 0.002	14.1	
M22759/18-12-XX	12	37 x 28	0.084	0.089	2.02	0.107 ± 0.003	21.6	
M22759/18-10-XX	10	37 x 26	0.106	0.112	1.26	0.134 ± 0.003	34.1	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethylene tetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/18-20-9; white with orange stripe - M22759/18-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

## MIL-STD-975L (NASA) - Part I

**MIL-W-22759/22, WIRE (1) (2)**  
**Electric, Fluoropolymer-Insulated, Extruded TFE,**  
**Silver-Coated, High-Strength Copper Alloy Conductor, 600-Volt, +200°C**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/22-28-XX	28	7 x 36	0.014	0.015	74.4	0.033 ± 0.002	1.32	(4)
M22759/22-26-XX	26	19 x 38	0.018	0.020	44.8	0.038 ± 0.002	1.91	
M22759/22-24-XX	24	19 x 36	0.023	0.024	28.4	0.043 ± 0.002	2.61	
M22759/22-22-XX	22	19 x 34	0.029	0.031	17.5	0.049 ± 0.002	3.68	
M22759/22-20-XX	20	19 x 32	0.037	0.039	10.7	0.058 ± 0.002	5.38	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/22-20-9; white with orange stripe - M22759/22-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/23, WIRE (1)**  
**Electric, Fluoropolymer-Insulated, Extruded TFE,**  
**Nickel-Coated, High-Strength Copper Alloy Conductor, 600-Volt, +260°C**

Part Number (2)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/23-28-XX	28	7 x 36	0.014	0.016	79.0	0.033 ± 0.002	1.34	(3)
M22759/23-26-XX	26	19 x 38	0.018	0.020	49.4	0.038 ± 0.002	1.92	
M22759/23-24-XX	24	19 x 36	0.023	0.025	30.1	0.043 ± 0.002	2.63	
M22759/23-22-XX	22	19 x 34	0.029	0.031	18.6	0.049 ± 0.002	3.73	
M22759/23-20-XX	20	19 x 32	0.037	0.040	11.4	0.058 ± 0.002	5.44	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Part number. The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/23-20-9; white with orange stripe - M22759/23-20-93.
- (3) Wire may be used in Grades 1 and 2 applications.

## MIL-STD-975L (NASA) - Part I

**MIL-W-22759/32, WIRE (1) (2)**  
**Electric Fluoropolymer Insulated, Crosslinked Modified ETFE**  
**Lightweight, Tin-Coated Copper Conductor, 600V, 150°C**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/32-30-XX	30	7 x 38	.011	.013	108.4	.024 ± .002	.66	(4)
M22759/32-28-XX	28	7 x 36	.014	.016	68.6	.027 ± .002	.91	
M22759/32-26-XX	26	19 x 38	.018	.020	41.3	.032 ± .002	1.4	
M22759/32-24-XX	24	19 x 36	.023	.025	26.2	.037 ± .002	2.0	
M22759/32-22-XX	22	19 x 34	.029	.031	16.2	.043 ± .002	2.8	
M22759/32-20-XX	20	19 x 32	.037	.039	9.88	.050 ± .002	4.3	
M22759/32-18-XX	18	19 x 30	.046	.049	6.23	.060 ± .002	6.5	
M22759/32-16-XX	16	19 x 29	.052	.055	4.81	.068 ± .002	8.3	
M22759/32-14-XX	14	19 x 27	.065	.069	3.06	.085 ± .003	13.0	
M22759/32-12-XX	12	37 x 28	.084	.089	2.02	.103 ± .003	19.7	

(1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.

(2) Some ETFE (ethylene tetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.

(3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/23-20-9; white with orange stripe - M22759/23-20-93.

(4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/33, WIRE (1) (2) (3)**  
**Electric, Fluoropolymer Insulated, Crosslinked Modified ETFE,  
Lightweight, Silver Coated, High Strength, Copper Alloy, 600 V, +200°C**

Part Number (4)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/33-30-XX	30	7 x 38	.011	.012	117.4	.024 ± .002	.66	(5)
M22759/33-28-XX	28	7 x 36	.014	.016	74.4	.027 ± .002	.91	
M22759/33-26-XX	26	19 x 38	.018	.020	44.8	.032 ± .002	1.4	
M22759/33-24-XX	24	19 x 36	.023	.025	28.4	.037 ± .002	2.0	
M22759/33-22-XX	22	19 x 34	.029	.032	17.5	.043 ± .002	2.9	
M22759/33-20-XX	20	19 x 32	.037	.039	10.7	.050 ± .002	4.4	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (4) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/23-20-9; white with orange stripe - M22759/23-20-93.
- (5) Wire may be used in Grades 1 and 2 applications.

## MIL-STD-975L (NASA) - Part I

**MIL-W-22759/34, WIRE**  
**Electric, Fluoropolymer-Insulated, Crosslinked Modified ETFE**  
**Normal Weight, Tin-Coated Copper Conductor, 600-Volt, +150°C (1) (2)**

Part Number (3)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/34-24-XX	24	19 x 36	0.023	0.025	26.2	0.045 ± 0.002	2.3	(4)
M22759/34-22-XX	22	19 x 34	0.029	0.031	16.2	0.050 ± 0.002	2	
M22759/34-20-XX	20	19 x 32	0.037	0.039	9.88	0.058 ± 0.002	4.7	
M22759/34-18-XX	18	19 x 30	0.046	0.049	6.23	0.070 ± 0.003	7.2	
M22759/34-16-XX	16	19 x 29	0.052	0.055	4.81	0.077 ± 0.003	9.0	
M22759/34-14-XX	14	19 x 27	0.065	0.069	3.06	0.094 ± 0.003	13.8	
M22759/34-12-XX	12	37 x 28	0.084	0.089	2.02	0.111 ± 0.003	20.5	
M22759/34-10-XX	10	37 x 26	0.106	0.113	1.26	0.134 ± 0.004	32.4	
M22759/34-8-XX	8	133 x 29	0.158	0.173	0.701	0.195 ± 0.008	60.3	
M22759/34-6-XX	6	133 x 27	0.198	0.217	0.445	0.241 ± 0.010	94.5	
M22759/34-4-XX	4	133 x 25	0.250	0.274	0.280	0.310 ± 0.010	150	
M22759/34-2-XX	2	665 x 30	0.320	0.340	0.183	0.405 ± 0.016	239	
M22759/34-1-XX	1	817 x 30	0.360	0.380	0.149	0.445 ± 0.016	290	
M22759/34-01-XX	0	1045 x 30	0.395	0.425	0.116	0.485 ± 0.016	377	
M22759/34-02-XX	00	1130 x 30	0.440	0.425	0.091	0.545 ± 0.016	487	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/34-20-9; white with orange stripe - M22759/34-20-93.
- (4) Wire may be used in Grades 1 and 2 applications.

**MIL-W-22759/35, WIRE**  
**Electric, Fluoropolymer-Insulated, Crosslinked Modified ETFE,**  
**Normal Weight, Silver-Coated High Strength Copper Alloy Conductor, 600-Volt, +200° C (1) (2) (3)**

Part Number (4)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire			Grades 1 and 2
			Min	Max	Resistance at +20° C (+68° F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max	
M22759/35-26-XX	26	19 x 38	0.018	0.020	44.8	0.040 ± 0.002	1.7	(5)
M22759/35-24-XX	24	19 x 36	0.023	0.025	28.4	0.045 ± 0.002	2.3	
M22759/35-22-XX	22	19 x 34	0.029	0.031	17.5	0.050 ± 0.002	3.3	
M22759/35-20-XX	20	19 x 32	0.037	0.039	10.7	0.058 ± 0.002	4.8	

- (1) These wires may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Some ETFE (ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.
- (3) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (4) Part number. The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/35-20-9; white with orange stripe - M22759/35-20-93.
- (5) Wire may be used in Grades 1 and 2 applications.

**MIL-W-5086, WIRE**  
**Electric, Polyvinyl-Chloride-Insulated, Copper or Copper Alloy**

Part Number Explanation:

M5086	/X	-XX	-X(X)
Military Specification Designation	Specification Slash Sheet	Wire Size	Color Designation (1)

**MIL-W-5086/1, WIRE**  
**Electric, Polyvinyl-Chloride (PVC) Insulated,**  
**Nylon Jacket, Tin-Coated Copper Conductor, 600 Volts, +105°C**  
**(Use for Ground Support Equipment only.)**

Part Number (1) (2)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire		
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max
M5086/1-16-XX	16	19 x 29	0.052	0.058	4.81	0.098 ± 0.004	10.70
M5086/1-14-XX	14	19 x 27	0.065	0.073	3.06	0.117 ± 0.005	16.40
M5086/1-12-XX	12	37 x 28	0.084	0.090	2.02	0.137 ± 0.005	24.70

(1) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 14, white - M5086/1-14-9; white with orange stripe - M5086/1-14-93.  
 (2) White insulation is preferred.

**MIL-W-5086/2, WIRE**  
**Electric, Polyvinyl-Chloride-Insulated, PVC-Glass-Nylon,**  
**Tin-Coated Copper Conductor, 600-Volt, +105°C**  
**(Use for Ground Support Equipment only.)**

Part Number (1) (2)	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (Inches)		Finished Wire		
			Min	Max	Resistance at +20°C (+68°F) (Ohms/1000 ft) Max	Diameter (Inches)	Weight (lbs/1000 ft) Max
M5086/2-10-XX	10	37 x 26	0.106	0.114	1.26	0.189 ± 0.007	44.0
M5086/2-8-XX	8	133 x 29	0.158	0.173	0.701	0.240 ± 0.007	70.0
M5086/2-6-XX	6	133 x 27	0.198	0.217	0.445	0.293 ± 0.007	110.0
M5086/2-4-XX	4	133 x 25	0.250	0.274	0.280	0.355 ± 0.010	165.0
M5086/2-2-XX	2	665 x 30	0.320	0.340	0.183	0.425 ± 0.010	250.0
M5086/2-1-XX	1	817 x 30	0.360	0.380	0.149	0.470 ± 0.010	305.0
M5086/2-01-XX	0	1045 x 30	0.395	0.425	0.116	0.525 ± 0.015	400.0
M5086/2-02-XX	00	1330 x 30	0.440	0.475	0.091	0.590 ± 0.015	500.0
M5086/2-03-XX	000	1665 x 30	0.500	0.540	0.071	0.650 ± 0.015	620.0
M5086/2-04-XX	0000	2109 x 30	0.565	0.605	0.056	0.720 ± 0.015	785.0

(1) Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 8, white - M5086/2-8-9; white with orange stripe - M5086/2-8-93.  
(2) White insulation is preferred.

**MIL-C-17, CABLE (1)**  
**Radio Frequency, Flexible, Coaxial**

Part number explanation:	M17	/XX(X)	RGXXX
Military Specification Designation	Specification Slash Sheet		
Part Type			

Part Number	Control Specification	Characteristic Impedance (Ohms)	Operating Frequency Max (GHz)	Voltage Working Max (Vrms)	Braid	Attenuation Max Range (dB/100/ft)		Power Max Range (Watts)	Capacitance (pF/ft)	Diameter (Inches)		Grades 1 and 2
						(at +25° C - Sea Level)				Min	Max	
M17/60-RG142		50 ± 2	12.4	1,400	Double	4 @ 50 MHz - 66 @ 8 GHz	3500 @ 50 MHz - 180 @ 8 GHz	29.3 Nom	0.190	0.20		
M17/93-RG178		50 ± 2	3	750	Single	11.6 @ 50 MHz - 94 @ 3 GHz	380 @ 50 MHz - 36 @ 3 GHz	32 Max	0.067	0.075		
M17/94-RG179		75 ± 3	3	900	Single	21 @ 400 MHz	1250 @ 50 MHz - 145 @ 3 GHz	23 Max	0.095	0.105		
M17/95-RG180		95 ± 5	3	1,100	Single	17 @ 400 MHz	1050 @ 50 MHz - 130 @ 3 GHz	17.4 Max	0.137	0.145		
M17/110-RG302	MIL-C-17	75 ± 3	3	1,700	Single	8 @ 400 MHz - 26 @ 3 GHz	3500 @ 150 MHz - 350 @ 3 GHz	22 Max	0.197	0.207	(2)	
M17/111-RG303		50 ± 2	3	1,400	Single	2.7 @ 50 MHz - 28 @ 3 GHz	3800 @ 50 MHz - 370 @ 3 GHz	32 Max	0.165	0.175		
M17/113-RG316		50 ± 2	3	900	Single	7.5 @ 50 MHz - 58 @ 3 GHz	600 @ 50 MHz - 76 @ 3 GHz	32 Max	0.094	0.102		
M17/127-RG393		50 ± 2	11	1,875	Double	1.7 @ 50 MHz - 45 @ 11 GHz	9000 @ 50 MHz - 20 @ 10 GHz	32 Max	0.380	0.400		
M17/128-RG400		50 ± 2	12.4	1,400	Double	3.2 @ 50 MHz - 90 @ 12.4 GHz	3500 @ 50 MHz - 160 @ 10 GHz	32 Max	0.190	0.200		
M17/152-00001		50 ± 2	12.4	900	Double	7.5 @ 50 MHz - 200 @ 12.4 GHz	600 @ 50 MHz - 37 @ 12.4 GHz	32 Max	0.110	0.118		

(1) These cables may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.  
(2) Parts may be used in Grades 1 and 2 applications.

### MIL-C-27500 CABLE (1) Electrical, Shielded and Unshielded, Aerospace

Part Number Explanation:

M27500	X	XX	XX	X	X	XX
Military Specification Designation	Identification Method of Cable (2)	Wire Size (3)	Basic Wire Specification (4)	No. of Wires in Cable (5)	Shield Style and Material (6)	Jacket Material (7)

- (1) These cables may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) A letter symbol shall be used to designate the color coding method used for unshielded or minimum 85% shield coverage (-, A or B) or minimum 90% shield coverage (C, D, E). See MIL-C-27500 for details.
- (3) Wire size is a number which is the nearest AWG to the actual wire size. All wires used in the cable shall be of the same size.
- (4) A letter symbol shall be used to designate the specification, type, and class in accordance with the table on the following page.
- (5) For shielded or shielded and jacketed cables, the number of wires shall be from 1 to 10. For unshielded and unjacketed or unshielded jacketed cables, the number of wires shall be from 2 to 10.
- (6) Shield style and material of the overall shield(s) shall be designated by a single letter in accordance with the applicable paragraph of the latest revision of MIL-C-27500.
- (7) The single jacket style shall consist of an outer jacket only. The double jacket style shall be used in conjunction with a double shield jacket only and shall consist of a jacket between the two shields and an outer jacket. The inner and outer jackets shall be of the same material. The jacket style and material shall be designated by two digits in accordance with the applicable paragraph of the latest revision of MIL-C-27500.

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**MIL-C-27500, CABLE (1)  
Single Conductor Wire**

Spec. Type. Class Symbol	Basic Wire Specification	(3) Insulation	Conductor Plating (2)	Material	Wire Size Range (AWG)	Voltage Rating (V)	Temperature Rating (°C)
LE	MIL-W-22759/9	Extruded TFE	Silver	Copper	28-8	1000	+200
RC	/11	Extruded TFE	Silver	Copper	28-8		+200
RE	/12	Extruded TFE	Nickel	Copper	28-8		+260
TE	/16	ETFE	Tin	Copper	24-00		+150
TG	/18	ETFE	Tin	Copper	26-10		+150
TM	/22	Extruded TFE	Silver	Copper alloy	28-20		+200
TN	/23	Extruded TFE	Nickel	Copper alloy	28-20	600	+260
SB	/32	Crosslinked ETFE	Tin	Cooper	30-12		+150
SC	/33	Crosslinked ETFE	Silver	Copper alloy	30-20		+200
SD	/34	Crosslinked ETFE	Tin	Copper	24-02		+150
SE	/35	Crosslinked ETFE	Silver	Copper alloy	24-20		+200

- (1) These cables may require material testing per ASTM E 595 and NHB 8060.1. Consult the project parts engineer for program requirements.
- (2) Silver-coated copper is susceptible to cuprous oxide corrosion ("red plague") when produced, stored or used in a moist or high humidity environment. The environment for this wire must be controlled.
- (3) Some ETFE (ethyltetrafluoroethylene) insulated wire has been found to fail flammability testing in a 30% oxygen environment. Consult part specialist for flammability requirements.

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### **Summary of Standard Photonic Parts**

There are no Grade 1 or Grade 2 photonic parts acceptable as NASA Standard Parts. The Candidate Parts List for this document includes connector, termini, fiber and cable specifications that have been developed for NASA use. Consult the project parts engineer for a listing of these specifications.

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## MIL-STD-975L (NASA) - Part II

## SECTION 21: ADVANCED MICROCIRCUIT PARTS LISTING (AMPL)

## 1.0 SCOPE

The Advanced Microcircuit Parts Listing (AMPL) section of MIL-STD-975 contains advanced microcircuits not listed in QPL-38510. The parts contained in the AMPL are considered nonstandard and as such shall require a Nonstandard Part Approval Request for usage.

1.1 **Definition of Advanced Microcircuit.** An advanced microcircuit is defined for the purposes of this document as any device that meets one of the following characteristics:

- a. A monolithic digital microcircuit
  - (1) with more than 2,000 active transistors, or
  - (2) intended for use as a peripheral to a microcircuit as defined in (1) above, regardless of number of transistors, provided it is manufactured on the same production line using the same processes, or
  - (3) having 32 or more active pins exclusive of power and ground.
- b. A monolithic memory microcircuit meeting any of the following criteria:
  - (1) Static RAM with 64 Kbits or more.
  - (2) Dynamic RAM with 1 Mbit or more.
  - (3) Fusible link PROM with 16 Kbits or more.
  - (4) EPROM with 256 Kbits or more.
  - (5) Specialized memory (FIFO, dual-port, etc.) with 4 Kbits or more.
- c. A monolithic linear/analog microcircuit that combines two or more functions to form a more complex function and has 20 or more active pins exclusive of power and ground.
- d. A monolithic mixed-signal microcircuit (such as an analog-to-digital or digital-to-analog converter) capable of handling 12 or more bits on the digital side.
- e. A multichip or hybrid microcircuit that meets one or both of the following criteria:
  - (1) Contains at least one die meeting the monolithic microcircuit criteria defined in a, b, c, or d above.
  - (2) Contains three or more internally interconnected microcircuit die of any size and has 32 or more active pins exclusive of power and ground.

1.2 **Requests for Adding Parts to the Listing.** Recommendations for addition of a part to the AMPL shall be submitted in written form to:

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AMPL Task Manager  
Jet Propulsion Laboratory  
M/S 125-105  
4800 Oak Grove Drive  
Pasadena, CA 91109  
FAX: (818)393-5245

Submissions should include identification of the part (part number and description), manufacturer, and specification number. Information regarding the project and application for the part may also be included.

### 2.0 PART SPECIFICATIONS, PROCUREMENT, AND APPLICATION

- 2.1 **Part Specifications.** In order to be approved and listed in this standard, a part shall have a specification that defines physical design, material, quality, controls, test requirements, as well as performance and function over maximum operating ranges. The specification may be any one of the following types:
- a. A NASA Detail Specification prepared in accordance with this document.
  - b. A Qualified Manufacturer's List (QML) Standardized Military Drawing (SMD) prepared in accordance with MIL-I-38535 or MIL-H-38534.
  - c. A Source Control Drawing (SCD) with requirements for wafer lot acceptance, screening and at least the life test portion of lot acceptance testing (Quality Conformance Inspection (QCI) or Technology Conformance Inspection (TCI)) essentially similar to those of MIL-M-38510 Class S, MIL-I-38535 Class V or MIL-H-38534 Class K. The SCD may be prepared by a NASA center, a NASA contractor or a contractor for military or commercial spacecraft systems.
- 2.2 **Procurement.** All parts listed herein shall be procured to the applicable detail specifications and shall be marked with a part number that signifies that the part meets all specification requirements. The "Ordering Data" paragraph of the detail specifications should be consulted to assure that proper information is listed in the purchase order or contract. In the event of conflict between the technical description of a part in this listing and the applicable detail specification, the detail specification shall govern.
- 2.3 **Application.** The NASA Advanced Microcircuits listed herein must be properly applied by the acquiring activity in order to obtain satisfactory and reliable performance. When an application condition varies from the detail specification test condition(s), it shall be the responsibility of the acquiring activity to establish a satisfactory correlation between the circuit requirements and the detail part specification requirements.

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**3.0 PARTS LISTING CRITERIA**

The criteria of 3.1, 3.2, or 3.3 as applicable shall be met before an advanced microcircuit is approved and listed in this standard.

**3.1 Listing Criteria for Parts with NASA Detail Specifications**

- 3.1.1 Vendor Validation.** The NASA AMPL preparing activity shall conduct an on-site vendor validation survey in the areas of fabrication, assembly and test, design, and organization, to verify the vendor's conformance to paragraphs 3.1.2 through 3.1.5. When the validation survey is scheduled, NPPO and the NASA center that requested the part shall be notified and invited to participate.
- 3.1.1.1 Deficiency Correction Procedures.** If, at any time during the initial vendor validation survey, the vendor is found to be deficient in any areas that are required in this listing, the vendor shall produce a plan for correcting these deficiencies. Two copies of this plan shall be provided by the manufacturer to the qualifying activity. If all deficiencies are not corrected and duly documented within six (6) months after the survey, the vendor shall not be listed on this standard and a new on-site validation survey shall be required before considering the parts for listing.
- 3.1.2 Quality Assurance Program.** The manufacturer shall have a quality assurance program plan equivalent to that in MIL-M-38510, Appendix A, or a quality management program plan equivalent to that in MIL-I-38535, or MIL-H-38534.
- 3.1.2.1 Configuration Management and Traceability.** The vendor shall have a configuration management system in place to ensure traceability of all materials, procedures and test information through the part serial number and date code.
- 3.1.2.2 Field Failures.** The manufacturer shall have a documented procedure for logging and dispositioning of field failures returned by the customer, including the capability to perform failure analysis. Failure analysis reports shall be made available to any acquiring activity upon request.
- 3.1.3 Device Maturity.** The manufacturer shall have fabricated the product on a production line using proven materials and technology. The critical design and process parameters shall be identified and controlled.
- 3.1.4 Characterization Data.** The AMPL validation team shall review characterization data from the manufacturer and any characterization data provided by NASA centers or other agencies. The data shall indicate the consistency of the part parameters when operating over the full temperature, voltage, and current ranges. Operation over the full military operating range is a goal and not a requirement.

## MIL-STD-975L (NASA) - Part II

**3.1.5 Qualification.** The part shall be qualified to method 5005 of MIL-STD-883. The inspections shall include groups A, B, D, and E (group E when applicable) as specified in MIL-STD-883 for Class S devices.

**3.1.5.1 Pending Qualification.** Parts may also be listed when qualification has not been completed. In such cases, an appropriate notation will be included in the listing, indicating either that qualification is in process or under contract, or that the manufacturer will qualify the part on the first lot of parts procured to the specification.

### **3.2 Listing Criteria for Parts with QML SMDs**

**3.2.1 Qualified Manufacturer's List (QML).** Advanced microcircuits as defined above (paragraph 1.1) that are listed in QML-38535 or QML-38534 shall be considered for inclusion in this listing.

**3.2.2 Vendor Validation.** Listing of the manufacturer in QML-38535 or QML-38534 shall be considered evidence of the adequacy of the quality management program plan and of the manufacturer's capability to produce parts of suitable quality and reliability for space applications.

### **3.3 Listing Criteria for Parts with SCDs**

**3.3.1 Consent of Preparing Activity.** Prior to listing of any part controlled by a NASA center or contractor SCD, the preparing activity shall furnish written consent for the use of the SCD to procure parts for use by other NASA centers or contractors. Copies of the consent shall be sent to the AMPL Task Manager at the address provided in paragraph 1.2 above and to the manufacturer.

**3.3.2 Vendor Validation.** The SCD preparing activity shall indicate the procedure used to validate the vendor, such as on-site visits, use of information provided by other users, DESC certification, etc.

**3.3.3 Qualification.** The SCD preparing activity shall indicate the current status of qualification in accordance with the SCD. The status should be classified in one of the following categories, which shall be indicated in the listing.

- a. Successfully completed.
- b. In process.
- c. Under contract.
- d. Contract in negotiation.
- e. Required on the first lots of parts procured to the specification.

**3.3.4 Changes.** Any revision to the SCD or change in the qualification status should be promptly reported to the AMPL Task Manager at the address given in paragraph 1.2 above.

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## 4.0 LISTED PART REMOVAL CRITERIA

A part listed in this standard may be removed for any of the following reasons:

- a. The part becomes obsolete.
- b. There are no longer any qualified sources for the part.
- c. The part is replaced with a functionally similar device having markedly improved characteristics or better reliability.
- d. The part exhibits functionality or reliability problems.
- e. Failure of the manufacturer to respond to a Government-Industry Data Exchange Program (GIDEP) Alert or to take corrective action.
- f. If, at a later date, a part on this listing attains qualification for QPL-38510 it shall then be removed from this section and added to the Part I microcircuit section of this standard.

4.1 **Problem Reporting.** The GIDEP Alert program provides a mechanism to report problems with the performance or reliability of a part. The NASA AMPL preparing activity will evaluate all Alerts and other problem reports issued against parts listed in the AMPL.

## 5.0 PART NUMBERING SYSTEM

The numbering system for NASA Detail Specifications follows the basic format of the SMD one part, one part number system. All parts bearing the NASA Specification part number shall be in full conformance with the applicable detail specification. The part number consists of two segments, the specification number and the part suffix. For paragraphs 5.1 through 5.2.4, NA62-WWXXXZZSYY will be used as an example part number.

5.1 **Specification Number.** The specification number consists of the first ten symbols in the part number. The specification number would therefore be NA62-WWXXX.

5.1.1 **Stock Class Designator.** NA indicates NASA and 62 are the last two digits of the federal stock class designator (5962). NA has been substituted for 59 to avoid conflict with numbers assigned by DESC.

5.1.2 **Radiation Hardness Designator.** The dash position indicates the radiation-hardness of the part. A dash means the part is not radiation-hard. If the part is assured to be radiation-hard, the following letters would take the place of the dash in the part number:

3 krad	M	100 krad	R
5 krad	N	200 krad	S
10 krad	D	300 krad	T
20 krad	E	500 krad	U
30 krad	F	1000 krad	H
50 krad	G		

## MIL-STD-975L (NASA) - Part II

- 5.1.3 **Drawing Number Year.** WW are the last two digits of the calendar year in which the drawing number was assigned.
- 5.1.4 **Drawing Number.** XXX is a sequential drawing number within the calendar year.
- 5.1.5 **Revision Letter.** Revisions to the specification are indicated by a sequential revision letter. The revision letter is not a part of the part number.
- 5.2 **Part Number Suffix.** The part number suffix consists of the last five symbols in the part number. The part number suffix would therefore be ZZSYY.
  - 5.2.1 **Type Number.** ZZ is the type number within the drawing.
  - 5.2.2 **Class Designator.** S is the class designator (since the parts are Class S equivalent).
  - 5.2.3 **Package Designator.** The first Y is the package designator (case outline letters) in accordance with MIL-M-38510 and MIL-STD-1835.
  - 5.2.4 **Lead Finish Designator.** The second Y is the lead finish designator in accordance with MIL-M-38510.

ADVANCED MICROCIRCUIT PARTS LISTING

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Microcircuit Information

Part Numbering System for NASA Detail Part Specifications:

Specification Number		Part Number				
NA62	X	XX	XXX	XX	S	X
Stock Class Designator	Total Dose Radiation Hardness Designator	Drawing Number Year	Drawing Number	Type Number	Class Designator	Package Designator
NA62 is the designator for microcircuits based on the Federal Stock Class.	3 krad M 5 krad N 10 krad D 20 krad E 30 krad F 50 krad G 100 krad R 200 krad S 300 krad T 500 krad U 1000 krad H	Last two digits of the year the drawing number was assigned.	Sequential drawing number within the fiscal year.	The type number within the drawing.	Class S- Equivalent	Package designator per MIL-M-38510.
						Lead finish per MIL-M-38510.

Package Type Abbreviations:

DIP = Dual In-line Package; FP = Flatpack Package; LCC = Leadless Chip Carrier; PGA = Pin Grid Array.

ADVANCED MICROCIRCUIT PARTS LISTINGS

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Hybrid Microcircuits  
MIL-STD-1553B Bus Interface Circuits 1/

Description	Generic Type	Supply Voltage	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
Single Channel Driver/Receiver	ARX-2402	-15 to +15 V	H	DIP	24	5962-86049	03YX	DESC
Single Channel Driver/Receiver	NHI-1509	-15 to +15 V	H	DIP	24	5962-86049	06YX	DESC
Single Channel Driver/Receiver, Low Power	BUS-63106II	-15 to +15 V	H	FP	24	5962-86049	02TX	DESC
Single Channel Driver/Receiver, Low Power	BUS-63105II	-15 to +15 V	H	DIP	24	5962-86049	02ZX	DESC
RTU Dual Redundant	BUS-65112	-15 to +15 V	H	Hybrid Package	78	5962-87535	01XA	DESC
RTU Dual Redundant	BUS-65117	-15 to +15 V	H	FP	82	5962-87535	01YA	DESC
Dual Channel Driver/Receiver, Low Power	MR63125MPR	-15 V	H	DIP	36	5962-87579	08XX	DESC
Transceiver, Dual Channel	BUS-63125II	-15 V	H	DIP	36	5962-87579	02XA	DESC
Transceiver, Dual Channel	BUS-63126II	-15 V	H	FP	36	5962-87579	02YC	DESC
BC/RTU/MT Dual Redundant	BUS-65600		H	DIP	78	5962-88585	01XX	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61555	+5 V	H	DIP	78	5962-88692	03XC	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61565	+5 V	H	FP	82	5962-88692	03YC	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61554	+5 V, -12 V	H	DIP	78	5962-88692	02XA	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61564	+5 V, -12 V	H	FP	82	5962-88692	02YC	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61553	+5 V, -15 V	H	DIP	78	5962-88692	01XA	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61563	+5 V, -15 V	H	FP	82	5962-88692	01YA	DESC
BC/RTU/MT Integrated MUX with 8K x 16 RAM	BUS-61556	+5 V	H	DIP	78	5962-88692	04XC	DESC
Transceiver, Dual Channel	BUS-63135II	-15 V	H	DIP	36	5962-89447	04HXC	DESC
Transceiver, Dual Channel	BUS-63136II	-15 V	H	FP	36	5962-89447	04HYC	DESC
Transceiver, Dual Channel	ARX-2453	+5 V	H	DIP	36	5962-89522	02XX	DESC
Transceiver, Dual Channel	BUS-63127II	-12 V	H	DIP	36	5962-89826	01XC	DESC
Transceiver, Dual Channel	BUS-63128II	-12 V	H	FP	36	5962-89826	01YC	DESC

1/ The parts listed on this page do not have a guaranteed radiation level.

ADVANCED MICROCIRCUIT PARTS LISTING

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Monolithic Microcircuits  
MIL-STD-1553B Bus Interface Circuits

Description	Generic Type	Radiation (total dose)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
Bus Controller/Remote Terminal/Monitor	1553B BCRTM	100 krad (Si)	S-Equiv.	FP	84	NA62R91006	01SKC	JPL/AMPL

ADVANCED MICROCIRCUIT PARTS LISTING

WARNING

These are nonstandard of parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Hybrid Microcircuits  
Analog-to-Digital Converters I/

Description	Generic Type	Number of Bits	Analog Input Voltage	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
6.0 $\mu$ s Conversion Time, $\pm$ 15 V Supply	AD578SD	12	0 to +20 V	H	DIP	32	5962-88658	01XX	DESC
4.5 $\mu$ s Conversion Time, $\pm$ 15 V Supply	AD578TD	12	0 to +20 V	H	DIP	32	5962-88658	02XX	DESC
6.0 $\mu$ s Conversion Time, $\pm$ 12 V Supply	AD578ZSD	12	0 to +20 V	H	DIP	32	5962-88658	03XX	DESC
4.5 $\mu$ s Conversion Time, $\pm$ 12 V Supply	AD578ZTD	12	0 to +20 V	H	DIP	32	5962-88658	04XX	DESC
External Reference	MN5215H/B	12	-10 to +10 V	H	DIP	24	5962-89584	06YX	DESC
Internal Reference	MN5212H/B	12	-10 to +10 V	H	DIP	24	5962-89584	05YX	DESC
External Reference	MN5205H/B	12	-10 to +10 V	H	DIP	24	5962-89583	06YX	DESC
Internal Reference	MN5202H/B	12	-10 to +10 V	H	DIP	24	5962-89583	05YX	DESC
850 ns Conversion Time	MN5246H/B	12	-2.5 to +2.5 V	H	DIP	40	5962-89595	03XX	DESC
850 ns Conversion Time, 3-state Output	MN5246AH/B	12	-2.5 to +2.5 V	H	DIP	40	5962-89595	04XX	DESC
External Reference	MN5204H/B	12	-5 to +5 V	H	DIP	24	5962-89583	04YX	DESC
External Reference	MN5214H/B	12	-5 to +5 V	H	DIP	24	5962-89584	04YX	DESC
Internal Reference	MN5201H/B	12	-5 to +5 V	H	DIP	24	5962-89583	03YX	DESC
Internal Reference	MN5211H/B	12	-5 to +5 V	H	DIP	24	5962-89584	03YX	DESC
Internal Reference	MN5216H/B	12	-5 to +5 V	H	DIP	24	5962-89584	07YX	DESC
850 ns Conversion Time	MN5245H/B	12	0 to +10 V	H	DIP	40	5962-89595	01XX	DESC
850 ns Conversion Time, 3-state Output	MN5245AH/B	12	0 to +10 V	H	DIP	40	5962-89595	02XX	DESC

I/ The parts listed on this page do not have a guaranteed radiation level.

ADVANCED MICROCIRCUIT PARTS LISTING

WARNING

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Hybrid Microcircuits  
Analog-to-Digital Converters I (Cont'd)

Description	Generic Type	Number of Bits	Analog Input Voltage	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
External Reference	MNS213H/B	12	0 to -10 V	H	DIP	24	5962-89584	02YX	DESC
External Reference	MNS203H/B	12	0 to -10 V	H	DIP	24	5962-89583	02YX	DESC
Internal Reference	MNS200H/B	12	0 to -10 V	H	DIP	24	5962-89583	01YX	DESC
Internal Reference	MNS210H/B	12	0 to -10 V	H	DIP	24	5962-89584	01YX	DESC
Internal Reference	MNS210H/B	12	0 to +10 V	H	DIP	24	5962-89583	07YX	DESC
Track/Hold	ADC-00300-112	12	-10 to +10 V	H	DIP	40	5962-88542	01XC	DESC
20 $\mu$ s Converter Time	ADC-HX	12	0 to +10 V	H	DIP	32	5962-88508	01XX	DESC
8 $\mu$ s Converter Time	MNADC87H/B	12	0 to +10 V	H	DIP	32	5962-88508	02XX	DESC
8 $\mu$ s Converter Time	ADC-HZ	12	0 to +10 V	H	DIP	32	5962-88508	02XX	DESC
17 $\mu$ s Converter Time	MNS295H/B	16	0 to +10 V	H	DIP	32	5962-89569	01HXX	DESC

I The parts listed on this page do not have a guaranteed radiation level.

## ADVANCED MICROCIRCUIT PARTS LISTING

WARNING

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Monolithic Microcircuits  
Analog-to-Digital Converters

Description	Generic Type	Number of Bits	Radiation (total dose)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
16 $\mu$ s Converter Time	5016	16	10 krad (Si)	S-Equiv.	DIP	40	S-311-P-704		GSFC

ADVANCED MICROCIRCUIT PARTS LISTING

WARNING

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Hybrid Microcircuits  
Digital-to-Analog Converters 1/

Description	Generic Type	Number of Bits	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
2's Complement	DAC HKB-2	12	H	DIP	24	5962-89528	02XX	DESC
Bipolar	AD394SD	12	H	DIP	28	5962-88510	01XX	DESC
Bipolar Linear Quad	AD390TD	12	H	DIP	28	5962-88509	02XX	DESC
Bipolar Linear Quad	AD390SD	12	H	DIP	28	5962-88509	01XX	DESC
Programmable Binary Input	DAC87CB1	12	H	DIP	24	5962-83002	01X	DESC
Quad Bipolar	AD394TD	12	H	DIP	28	5962-88510	02XX	DESC
Quad Unipolar	AD395SD	12	H	DIP	28	5962-88510	03XX	DESC
Quad Unipolar	AD395TD	12	H	DIP	28	5962-88510	04XX	DESC
Binary Input Code	DAC HKB	12	H	DIP	24	5962-89528	01XX	DESC
De-glitched	DAC02310-113	14	H	DIP	32	5962-88517	02XA	DESC
De-glitched	DAC02310-113	14	H	DIP	32	5962-88517	02XC	DESC
De-glitched	DAC02311-113	14	H	FP	32	5962-88517	02YC	DESC
De-glitched	DAC02310-112	14	H	DIP	32	5962-88517	01XA	DESC
De-glitched	DAC02310-112	14	H	DIP	32	5962-88517	01XC	DESC
De-glitched	DAC02311-112	14	H	FP	32	5962-88517	01YA	DESC
De-glitched	DAC02311-112	14	H	FP	32	5962-88517	01YC	DESC
De-glitched	DAC02311-113	14	H	FP	32	5962-88517	02YA	DESC
-10 to +10 V Out	DAC HPB-1	16	H	DIP	24	5962-89531	02HXX	DESC
0 to +10 V and -5 to +5 V	DAC HPB	16	H	DIP	24	5962-89531	01HXX	DESC

1/ The parts listed on this page do not have a guaranteed radiation level.

ADVANCED MICROCIRCUIT PARTS LISTING

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975, Section 21, Advanced Microcircuit Parts Listing.

Hybrid Microcircuits  
Resolver or Synchro-to-Digital Converters I/

Description	Generic Type	Number of Bits	Reference Frequency	Input Voltage/Type	Accuracy (Arc Minutes)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
Direct Resolver-to-Digital, Trimmed Velocity	SDC14569-112	16	400 Hz	1 V Direct Inputs	+/- 4.0	H	DIP	36	5962-90551	06XC	DESC
Direct Resolver-to-Digital, Trimmed Velocity	SDC14569-111	16	400 Hz	1 V Direct Inputs	+/- 6.0	H	DIP	36	5962-90551	05XC	DESC
Direct Resolver-to-Digital, Trimmed Velocity	SDC14569-115	16	400 Hz	1 V Direct Inputs	+/- 1.0	H	DIP	36	5962-90551	08XC	DESC
Direct Resolver-to-Digital, Trimmed Velocity	SDC14569-114	16	400 Hz	1 V Direct Inputs	+/- 2.0	H	DIP	36	5962-90551	07XC	DESC
Direct Resolver-to-Digital	SDC14567-115	16	400 Hz	1 V Direct Inputs	+/- 1.0	H	DIP	36	5962-90551	04XC	DESC
Direct Resolver-to-Digital	SDC14567-114	16	400 Hz	1 V Direct Inputs	+/- 2.0	H	DIP	36	5962-90551	03XC	DESC
Direct Resolver-to-Digital	SDC14567-112	16	400 Hz	1 V Direct Inputs	+/- 4.0	H	DIP	36	5962-90551	02XC	DESC
Direct Resolver-to-Digital	SDC14567-111	16	400 Hz	1 V Direct Inputs	+/- 6.0	H	DIP	36	5962-90551	01XC	DESC
Resolver-to-Digital	SDC14565-616	16	400 Hz	11.8 V	+/- 2.0	H	DIP	36	5962-89908	03XC	DESC
Resolver or Synchro-to-Digital	HSDC-8915	14	400 Hz	Voltage Follower Inputs	+/- 4.0	H	DIP	36	5962-90554	02XC	DESC
Resolver or Synchro-to-Digital	HSDC-8915A	14	400 Hz	Voltage Follower Inputs	+/- 2.6	H	DIP	36	5962-90554	01XC	DESC
Resolver or Synchro-to-Digital	HSDC-8920	14	400 Hz	11.8 V	+/- 4.0	H	DIP	36	5962-87687	02XC	DESC
Resolver or Synchro-to-Digital	HSDC-8920A	14	400 Hz	11.8 V	+/- 2.6	H	DIP	36	5962-87687	01XC	DESC
Synchro-to-Digital	SDC14500-635	14	400 Hz	11.8 V	+/- 2.6	H	DIP	36	5962-90707	01HXC	DESC
Synchro-to-Digital	SDC14500-636	14	400 Hz	11.8 V	+/- 4.0	H	DIP	36	5962-90707	02HXC	DESC
Synchro-to-Digital	SDC14502-605	14	60 Hz	90.0 V	+/- 2.6	H	DIP	36	5962-90707	03HXC	DESC
Synchro-to-Digital	SDC14502-606	14	60 Hz	90.0 V	+/- 4.0	H	DIP	36	5962-90707	04HXC	DESC
Synchro-to-Digital	SDC14560-605	16	400 Hz	11.8 V	+/- 2.0	H	DIP	36	5962-89499	03XC	DESC

I/ The parts listed on this page do not have a guaranteed radiation level.

ADVANCED MICROCIRCUIT PARTS LISTING

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 21, Advanced Microcircuit Parts Listing.

Monolithic Microcircuits  
Memories

Description	Generic Type	Organization	Radiation (total dose)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
FIFO	7001	512 x 9	100 krad (Si)	S-Equiv.	DIP	28	S-311-P-705		GSFC
FIFO	7001	512 x 9	100 krad (Si)	S-Equiv.	FP	28	S-311-P-705		GSFC
PROM	6617	2K x 8	100 krad (Si)	S-Equiv.	DIP	24	NA62R9 005	01SJC	JPL/AMPL
PROM	6617	2K x 8	100 krad (Si)	S-Equiv.	FP	24	NA62R9 005	01SKC	JPL/AMPL
SRAM	2568CRH	32K x 8	2 Mrad (Si)	Q	FP	36	5962-92153		DESC
SRAM	2568CRH	32K x 8	2 Mrad (Si)	Q	FP	40	5962-92153		DESC
SRAM	2568CRH	32K x 8	2 Mrad (Si)	V	FP	36	5962-92153		DESC
SRAM	2568CRH	32K x 8	2 Mrad (Si)	V	FP	40	5962-92153		DESC

## MIL-STD-975L (NASA) - Part II

## ADVANCED MICROCIRCUIT PARTS LISTING

**WARNING**

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part II, Section 2I, Advanced Microcircuit Parts Listing.

Monolithic Microcircuits  
Processors/Controllers and Peripherals

Description	Generic Type	Number of Bits	Frequency	Radiation (total dose)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
Microprocessor, MIL-STD-1750 Fixed Point	FXPC-Q49F		21.3 MHz	2 Mrad (Si)	Q	FP	220	5962-92026	01QZX	DESC
Microprocessor, MIL-STD-1750 Fixed Point	FXPC-V49F		21.3 MHz	2 Mrad (Si)	V	FP	220	5962-92026	01VZX	DESC
Microprocessor, MIL-STD-1750 Floating Point	MFLPC-Q47F	16	21.3MHz	2 Mrad (Si)	Q	FP	220	5962-92103	01QZX	DESC
Microprocessor, MIL-STD-1750 Floating Point	MFLPC-V47F	16	21.3 MHz	2 Mrad (Si)	V	FP	220	5962-92103	01VZX	DESC
Microprocessor <i>I/</i>	80C86RH	16	5.0 MHz	100 krad (Si)	S-Equiv.	DIP	40	NA62R91001	01SQC	JPL/AMPL
Microprocessor <i>I/</i>	80C86RH	16	5.0 MHz	100 krad (Si)	S-Equiv.	FP	42	NA62R91001	01SXC	JPL/AMPL
Peripheral, Static Clock Controller/Generator	82C85RH		5.0 MHz	100 krad (Si)	S-Equiv.	DIP	24	NA62R91004	01SJC	JPL/AMPL
Peripheral, Static Clock Controller/Generator	82C85RH		5.0 MHz	100 krad (Si)	S-Equiv.	FP	24	NA62R91004	01SKC	JPL/AMPL
Peripheral, Programmable Interval Timer	82C54RH		5.0 MHz	100 krad (Si)	S-Equiv.	DIP	24	NA62R91002	01SJC	JPL/AMPL
Peripheral, Programmable Interval Timer	82C54RH		5.0 MHz	100 krad (Si)	S-Equiv.	FP	24	NA62R91002	01SKC	JPL/AMPL
Peripheral, Priority Interrupt Controller	82C59A		5.0 MHz	100 krad (Si)	S-Equiv.	FP	28	S-311-P-708		GSFC
Peripheral, Priority Interrupt Controller	82C59A		5.0 MHz		S-Equiv.	DIP	28	NA62-91003	01SJC	JPL/AMPL
Peripheral, Priority Interrupt Controller	82C59A		5.0 MHz		S-Equiv.	LCC	28	NA62-91003	01S3A	JPL/AMPL
Microprocessor	80386	32	20 MHz		Q	PGA	132	5962-87668	03QXX	DESC
Microprocessor	80386	32	20 MHz		Q	LCC	164	5962-87668	03QYX	DESC
Microprocessor	80386	32	25 MHz		Q	PGA	132	5962-87668	04QXX	DESC
Microprocessor	80386	32	25 MHz		Q	LCC	164	5962-87668	04QYX	DESC
Peripheral, Mathematical Coprocessor	80387	80	20 MHz		Q	FP	68	5962-89534	02QYX	DESC
Peripheral, Mathematical Coprocessor	80387	80	25 MHz		Q	FP	68	5962-89534	02QYX	DESC

*I/* This part is currently not available as a full military temperature range part. The current production temperature range is -35° C to +125° C.

ADVANCED MICROCIRCUIT PARTS LISTING

WARNING

These are nonstandard parts. For additional information refer to paragraph 1.0 of MIL-STD-975 Part ii, Section 21, Advanced Microcircuit Parts Listing.

Monolithic Microcircuits  
Processors/Controllers and Peripherals (Cont'd)

Description	Generic Type	Number of Bits	Frequency	Radiation (total dose)	Quality Level	Package Type	Number of Leads	Specification Number	Type Number	Preparing Activity
Microcontroller	2010RH	16		1 Mrad (Si)	S-Equiv.	FP	84	S-311-P-704		GSFC
Microcontroller	2010RH	16		1 Mrad (Si)	S-Equiv.	PGA	84	S-311-P-704		GSFC
Microprocessor, Digital Signal	DSP-16	16			Q	PGA	133	5962-90704	01QXX	DESC
Standard Cell ASIC Peripheral, Serial Communication Controller	1HK84			1 Mrad (Si)	Q	FP	84	5962H92A01	01QYX	DESC

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## MIL-STD-975L (NASA) - Part II

**SECTION 22: HIGH NASA USAGE**

The following parts are in common use by various NASA space centers, contractors and subcontractors. They may be procured to the listed specifications, but are considered nonstandard. Nonstandard Parts Approval Requests (NSPARs) must be submitted (in accordance with the individual program requirements) in order to use these parts since they do not meet the requirements necessary for listing in Part I of this standard (see paragraph 4.0 of Part I).

Generic Number	Specification Number	Description of Part Type
REF-01	5962-8958102	Microcircuit, Voltage Reference, Adjustable, +10V
AMP-01A	5962-8863001	Microcircuit, Instrumentation Amp, Low Noise
LM104	5962-8760501	Microcircuit, Voltage Regulator, Adjustable, Neg.
LM105	5962-8958801	Microcircuit, Voltage Regulator, Adjustable, Pos.
LM110	5962-8760601	Microcircuit, Voltage Follower, High Speed
LM136A	8418001	Microcircuit, Voltage Reference, Precision, 2.5V
LM158A	5962-8771002	Microcircuit, OP Amp, Dual, Low Power
26LS31	7802301	Microcircuit, Differential Line Driver, Quad
26LS32	7802001	Microcircuit, Differential Line Receiver, Quad

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**MIL-STD-975L (NASA)**

**APPENDIX A**  
**STANDARD PARTS DERATING**

## MIL-STD-975L (NASA)

APPENDIX A  
STANDARD PARTS DERATING

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## MIL-STD-975L (NASA)

### STANDARD PARTS DERATING

**1.0 SCOPE.** Inclusion of parts in this standard is based on the premise that certain characteristics of the parts are derated for reliable operation.

**2.0 INTRODUCTION.** Derating is the reduction of electrical, thermal, and mechanical stresses applied to a part in order to decrease the degradation rate and prolong the expected life of the part. Derating increases the margin of safety between the operating stress level and the actual failure level for the part, providing added protection from system anomalies unforeseen by the designer. The following guidelines give basic information for the derating of component parts. The specified derating percentages and notes will assist the designer in obtaining reliable operation of parts used in space equipment. It must be emphasized that the user should evaluate all parts to the project requirements and assure that adequate deratings are accomplished. These recommended derating factors are based on the best information currently available.

**3.0 DERATING CRITERIA.** The derating criteria contained herein indicate the maximum recommended stress values and do not preclude further derating. When derating, the designer must first take into account the specified environmental and operating condition rating factors, consider the actual environmental and operating conditions of the application, and then apply the recommended derating criteria contained herein. Parts not appearing in these guidelines are lacking in empirical data and failure history. The derating instructions are listed for each commodity in the following paragraphs.

**NOTE 1:** To assure that these derating criteria are observed, an EEE parts list (item by item) shall be generated for each hardware assembly. This list shall, as a minimum, contain the maximum rated capability (such as voltage, current, power, temperature, etc.) of the part in comparison with the design requirements of the application, indicating conformance to the derating criteria specified herein.

**NOTE 2:** In the following derating sections, the term "ambient temperature" as applied to low pressure or space vacuum operation, is defined as follows:

For operation under conditions of very low atmospheric pressure or space vacuum, heat loss by convection is essentially zero, so ambient temperature is the maximum temperature of the heat sink or other mounting surface in contact with the part, or the temperature of the surface of the part itself (case temperature).

## MIL-STD-975L (NASA)

## 3.1 CAPACITOR DERATING CRITERIA

## Capacitors

Voltage derating is accomplished by multiplying the maximum operating voltage by the appropriate derating factor appearing in the chart below.

Type	Military Style	Voltage Derating Factor (2)	Specification	Maximum Ambient Temperature
Ceramic	CCR (3)	0.60	MIL-C-20	110° C
	CKS	0.60	MIL-C-123	110° C
	CKR (3)	0.60	MIL-C-39014	110° C
	CDR (3)	0.60	MIL-C-55681	110° C
Glass	CYR	0.50	MIL-C-23269	110° C
Plastic film	CRH	0.60	MIL-C-83421	85° C
	CHS	0.60	MIL-C-87217	85° C
Tantalum, foil	CLR25	0.50	MIL-C-39006/1	70° C
	CLR27	0.50	MIL-C-39006/2	70° C
	CLR35	0.50	MIL-C-39006/3	70° C
	CLR37	0.50	MIL-C-39006/4	70° C
Tantalum, wet slug	CLR79	0.60	MIL-C-39006/22	70° C
		0.40		110° C
	CLR81	0.60	MIL-C-39006/25	70° C
		0.40		110° C
Tantalum, solid	CSR (1)	0.50	MIL-C-39003/1,2	70° C
		0.30		110° C
	CSS (1)	0.50	MIL-C-39003/10	70° C
		0.30		110° C
	CWR (1)	0.50	MIL-C-55365	70° C
		0.30		110° C

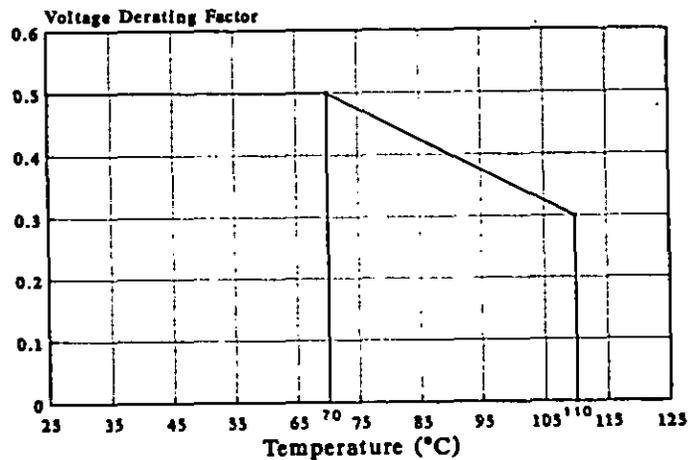
- (1) For applications where the effective circuit resistance is less than 1 ohm per volt, contact parts specialist.
- (2) Applies to the sum of peak AC ripple and DC polarizing voltages.
- (3) For low-voltage applications (<10 Vdc), rated voltage shall be at least 100 Vdc.

## MIL-STD-975L (NASA)

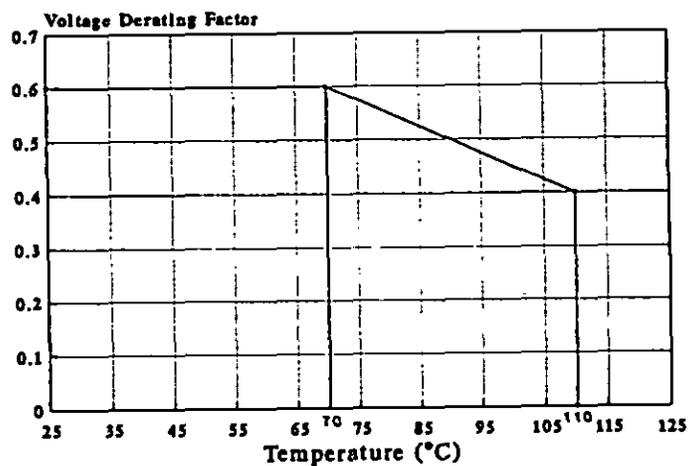
## 3.1.1 CAPACITOR DERATING CHARTS

Capacitors

## Tantalum, Solid (CSR/CSS/CWR)



## Tantalum, Wet Slug (CLR79 and CLR81)



## 3.1.2 CAPACITOR DERATING EXAMPLE

The principal stress parameters for capacitors are temperature and DC and/or AC voltage.

**Example:** A CYR style glass capacitor rated at 10 pF, 100 VDC is operated at a maximum of 70°C ambient temperature.

Applying the 0.50 derating factor, (0.5 x 100 VDC) gives a derated maximum voltage of 50 VDC.

The 70°C ambient temperature is within the maximum allowed.

## MIL-STD-975L (NASA)

### 3.2 CONNECTOR DERATING CRITERIA

Connectors

Connectors are derated by limiting the temperature seen by the dielectric insert due to ambient temperature and the effects of resistive heating. See 3.16 for current derating of wire and cable.

Operating voltage derating: 25% of the rated Dielectric Withstanding Voltage at Sea Level.

Temperature rating of the dielectric insert:

$$T_{(\text{ambient})} + T_{(\text{ohmic heating})} + 50^{\circ}\text{C}$$

## MIL-STD-975L (NASA)

## 3.2.1 CONNECTOR DERATING EXAMPLE

Connectors

*Temperature Derating*

To choose an appropriate connector temperature rating for a 100°C operating temperature (ambient + ohmic heating temperatures):

$$\begin{aligned} T_{(rating)} &= \text{connector temperature} + 50^{\circ}\text{C} \\ &= 100^{\circ}\text{C} + 50^{\circ}\text{C} \\ &= 150^{\circ}\text{C} \end{aligned}$$

Choose a connector that has an operating temperature rating of greater than 150°C.

*Voltage Derating*

To choose an appropriate connector voltage rating for a 100 Vdc maximum application voltage:

$$\begin{aligned} V_{(rating)} &= V(\text{max operating})/0.25 \\ &= 100 \text{ Vdc}/0.25 \\ &= 400 \text{ Vdc} \end{aligned}$$

Choose a connector that has a Dielectric Withstanding Voltage (at Sea Level) rating greater than 400 Vdc.

## MIL-STD-975L (NASA)

### 3.3 CRYSTAL AND CRYSTAL OSCILLATOR DERATING CRITERIA

Crystals

Presently there are no approved crystals in MIL-STD-975L.

Crystal oscillators shall be derated to the individual component level. Crystal current shall be limited to 50% of the rated value. In cases where start up time is critical, 75% of the rated value can be used.

## MIL-STD-975L (NASA)

### 3.3.1 CRYSTAL AND CRYSTAL OSCILLATOR DERATING EXAMPLE

Crystals

Presently there are no approved crystals in MIL-STD-975L.

This page is intended for future use.

## MIL-STD-975L (NASA)

## 3.4 DIODE DERATING CRITERIA

Diodes

Derating is accomplished by multiplying the critical stress parameter by the appropriate derating factor appearing in the chart below.

Diode Type	Critical Stress Parameter	Derating	Maximum Junction Temperature
General purpose, Rectifier, Switching, Pin/Schottky, and Thyristors	PIV	0.70	125°C (all types)
	Surge current	0.50	
	Forward current	0.50	
Varactor	Power	0.50	125°C
	Reverse voltage	0.75	
	Forward current	0.75	
Voltage Regulator	Power	0.50	125°C
	Zener current	$0.5(I_{Lmax} + I_{Lnom})$	
Voltage reference	Zener current	N/A (1)	125°C
Zener Voltage Suppressor	Power dissipation	0.50	125°C
Bidirectional Voltage Suppressor	Power dissipation	0.50	125°C
FET Current Regulator	Peak operating voltage	0.80	125°C

- (1) Operate at the manufacturer's specified zener current ( $I_{ZT}$ ) to optimize temperature compensation.

## MIL-STD-975L (NASA)

## 3.4.1 DIODE DERATING EXAMPLE

Diodes

For silicon-switching and small-signal diodes, temperature, voltage, and current are the principal stress parameters. High junction temperature is the most destructive stress for diodes. Junction temperature must also be calculated and maintained below the limits allowed.

Example: A general purpose diode rated at 1 A, 200 VDC, with a thermal resistance (junction to air)  $\theta_{JA}$  of  $0.3^{\circ}\text{C}/\text{mW}$ , is operating in an ambient temperature of  $30^{\circ}\text{C}$  ( $T_A$ ).

Applying the derating criteria we have:

Current:  $0.5\text{ A}$  max. ( $.5 \times 1.0\text{ A}$ ) =  $0.5\text{ A}$   
 PIV:  $140\text{ VDC}$  max. ( $.7 \times 200\text{ VDC}$ ) =  $140\text{ VDC}$

Note that the maximum forward voltage (typically  $0.7\text{ V}$ ) and derated forward current ( $0.5\text{ A}$ ) will give an expended power of  $350\text{ mW}$ .

Calculating the junction temperature:

$$\begin{aligned} T_J &= T_A + \theta_{JA} * W \\ T_J &= 30^{\circ}\text{C} + (350\text{ mW})(0.3^{\circ}\text{C}/\text{mW}) \\ T_J &= 30^{\circ}\text{C} + 105^{\circ}\text{C} \\ T_J &= 135^{\circ}\text{C} \end{aligned}$$

This is greater than the allowable junction temperature of  $125^{\circ}\text{C}$ , so we must reduce the junction temperature by  $10^{\circ}\text{C}$  by reducing the forward current to  $0.45\text{ A}$ .

Decreasing the current and recalculating  $T_J$  we have:

$$\begin{aligned} T_J &= T_A + \theta_{JA} * W \\ T_J &= 30^{\circ}\text{C} + (315\text{ mW})(0.3^{\circ}\text{C}/\text{mW}) \quad (0.45\text{ A} * 0.7\text{ V}) = 315\text{ mW} \\ T_J &= 30^{\circ}\text{C} + 94.5^{\circ}\text{C} \\ T_J &= 124.5^{\circ}\text{C} \end{aligned}$$

This is less than the maximum allowable junction temperature of  $125^{\circ}\text{C}$ .

## MIL-STD-975L (NASA)

## 3.5 FILTER DERATING CRITERIA

Filters

Derating is accomplished by multiplying the current and voltage by the appropriate derating factor appearing in the chart below.

Class	Derating Factor (1)	Maximum Ambient Temperature
All	0.50 of rated current 0.50 of rated voltage	+ 85°C

(1) Rated operating current or voltage, not absolute maximum.

## MIL-STD-975L (NASA)

### 3.5.1 FILTER DERATING EXAMPLE

Filters

The critical parameters are dielectric voltage, current, and temperature.

**Example:** An EMI filter rated at 10 A, 220 VDC, and 105°C shall be derated 50% and used at no more than 5 A and 110 VDC. The ambient temperature shall be limited to 85°C maximum.

## MIL-STD-975L (NASA)

## 3.6 INDUCTOR DERATING CRITERIA

## Inductors

Insulation Class		Maximum Operating Parameters		
MIL-C-39010	MIL-C-15305	Rated Operating Temperature	Derated Operating Temperature	Operating Voltage
-	O	+85°C	+65°C	Derate to 50% of the rated Dielectric Withstanding Voltage
A	A	+105°C	+85°C	
B	B	+125°C	+105°C	
F	-	+150°C	+130°C	

"Inductors are derated by reducing the maximum operating temperature based on the insulation class used and reducing the operating voltage. See notes below."

- a) Maximum operating temperature equals ambient temperature plus temperature rise, plus 10°C (allowance for hot spot). Compute temperature rise as follows:

Temperature Rise Test (per MIL-T-27, para. 4.8.12)

$$\text{Temperature rise (°C)} = \frac{(R - r)}{r} (t + 234.5^\circ\text{C}) - (T - t)$$

Where  $R$  = winding resistance at elevated temperature

$r$  = winding resistance at ambient temperature  $t$

$t$  = specified initial ambient temperature (°C)

$T$  = maximum ambient temperature (°C) at time of power shutoff.

$T$  shall not differ from  $t$  by more than 5°C

- b) The insulation classes of MIL-style inductive parts generally have maximum operating temperature ratings based on a life expectancy of 10,000 hours. The maximum operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.
- c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the materials used. Devices having a maximum rated operating temperature in the range from +85° to +130°C shall be derated as follows: maximum operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature range, consult the project parts engineer for temperature derating recommendations.

## MIL-STD-975L (NASA)

## 3.6.1 INDUCTOR DERATING EXAMPLE

Inductors

The parameters to be derated are dielectric stress (voltage), maximum current, and temperature.

**Example:** A coil rated at 1 A, 100 volts, and 105°C shall be used at no more than 1.0 A and 50 volts (50% of 100 V). The temperature rise and maximum operating temperature are calculated as follows, using the temperature rise test described in paragraph 4.8.12 of MIL-T-27. The following is a typical example.

If  $R=17$  ohms winding resistance at the elevated temperature of 25°C, and  $r=15$  ohms winding resistance at 21°C, then:

$$\begin{aligned} T_{\text{RISE}} &= \frac{(R - r)}{r} (t + 234.5^\circ\text{C}) - (T - t) \\ &= \frac{(17 - 15)}{15} (21^\circ\text{C} + 234.5^\circ\text{C}) - (25^\circ\text{C} - 21^\circ\text{C}) \\ &= 0.1333(255.5^\circ\text{C}) - 4^\circ\text{C} \\ &= 34.058^\circ\text{C} - 4^\circ\text{C} \\ T_{\text{RISE}} &= 30.058^\circ\text{C} \end{aligned}$$

$$\begin{aligned} \text{Max. operating temperature} &= T_A + T_{\text{RISE}} + 10^\circ\text{C} \\ &= 21^\circ\text{C} + 30.06^\circ\text{C} + 10^\circ\text{C} \\ &= 61.06^\circ\text{C} \end{aligned}$$

The coil is wound with 105°C (class B) insulation, which can handle well over the calculated maximum operating temperature of 61.06°C. In fact, class O (65°C) insulation would be sufficient here.

## MIL-STD-975L (NASA)

## 3.7 LINEAR MICROCIRCUIT DERATING CRITERIA

Microcircuits Linear
-------------------------

Derating of microcircuits is accomplished by multiplying the appropriate parameter by the derating factor listed below. Junction temperature must be calculated and maintained below the limit of 100°C.

Parameters	Operational or Differential Amplifiers	Comparators	Sense Amplifiers	Current Amplifiers	Voltage Regulators	Analog Switches
Absolute maximum supply voltage	0.80	0.90	0.80	0.80	N/A (2)	0.90
Power dissipation (percent of rated power at maximum operating temperature)	0.75	0.75	0.75	0.75	0.80	0.80
AC input voltage (1)	1.00	1.00	1.00	1.00	N/A	N/A
Output voltage	1.00	N/A	N/A	1.00	N/A	N/A
Open collector (or drain) DC output voltage	N/A	0.90	0.90	N/A	N/A	N/A
Operating AC or DC output current	0.80	0.80	0.80	0.80	0.80	0.80
Maximum short-circuit output current	0.90	0.90	0.90	0.90	0.90	N/A
Maximum junction temp.	100°C	100°C	100°C	100°C	100°C	100°C

- (1) Under no circumstances shall the input voltage be allowed to exceed the supply voltage.
- (2)  $V_{IN} - V_{OUT}$  should be derated 0.80.

## MIL-STD-975L (NASA)

## 3.7.1 LINEAR MICROCIRCUIT DERATING EXAMPLE

Microcircuits  
Linear

The principal stress parameters for linear microcircuits are the supply voltage, input voltage, output current, total device power, and junction temperature.

Note that package thermal rating will affect the junction temperature and limit the output current and power allowed.

Example: A  $\mu$ A741 op amp is rated at:

$V^+$	=	+22 VDC	supply voltage, (max)
$V^-$	=	-22 VDC	supply voltage, (max)
$V_{ID}$	=	$\pm 30$ VDC	input differential voltage (max)
$I_{OS}$	=	20 mA	output short-circuit current (max)
$V_O$	=	$\pm 14$ VDC	output voltage swing (typical)
$T_J$	=	175°C	metal package (TO-5)
$W$	=	500 mW	
$\theta_{JC}$	=	70°C/W	thermal resistance (case junction) above 70°C; derate at -14.3 mW/°C

Applying the derating criteria, listed in the op amp column on the previous page, we have:

$V_{CC}$	=	+17.6 VDC (maximum)	(0.8 x 22 VDC)
$V_{EE}$	=	-17.6 VDC (maximum)	(0.8 x 22 VDC)
$I_{OS}$	=	18 mA	(0.9 x 20 mA)
$V_O$	=	$\pm 14$ VDC	(1.0 x 14 VDC)
$T_J$	=	100°C	100°C is max
$W$	=	375 mW @100°C	(0.75 x 500 mW)

Operating the junction at 100°C with a case temperature of 80°C, our maximum allowable device wattage is;

$$T_J = T_C + W \cdot \theta_{JC} \quad (\text{vacuum, no ambient air})$$

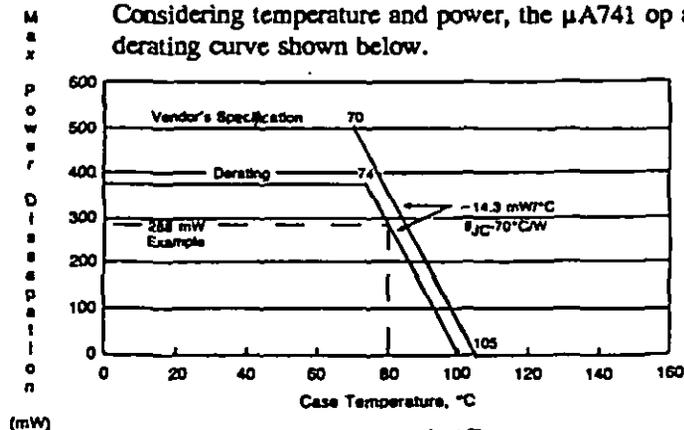
$$\text{or } W = \frac{T_J - T_C}{\theta_{JC}}$$

$$W = \frac{100^\circ\text{C} - 80^\circ\text{C}}{70^\circ\text{C/W}}$$

$$W = 0.2857 \text{ W} = 285.7 \text{ mW}$$

285.7 mW is the maximum allowable wattage at a case temperature of 80°C.

Considering temperature and power, the  $\mu$ A741 op amp must be operated within the derating curve shown below.



## MIL-STD-975L (NASA)

## 3.8 DIGITAL MICROCIRCUIT DERATING CRITERIA

Microcircuits Digital
--------------------------

Derating of microcircuits is accomplished by multiplying the appropriate parameter by its derating factor listed below. Junction temperature must also be calculated and maintained below the maximum limit.

Parameters (1) (2)	Bipolar	MOS	CMOS 4000 A&B (3)	CMOS HC & HCT (4)	CMOS AC & ACT (5)	Line Drivers and Receivers	Gate Arrays Bipolar MOS
Maximum junction temperature	100°C	100°C	100°C	100°C	100°C	100°C	100°C
Open collector (or drain) DC output voltage	0.80 (6)	N/A	N/A	N/A	N/A	0.75	0.80
Operating AC or DC output current or fanout	0.80 (7)	0.80 (7)	0.80 (7)	0.80 (7)	0.80 (7)	0.80	0.80
Maximum clock frequency	N/A	0.85	0.85	0.85	0.85	0.80	0.80

- (1) Under no circumstances shall the input voltage be allowed to exceed the supply voltage.
- (2) For those technologies where no supply voltage derating is given, in no case shall the device be operated at the absolute maximum supply voltage.
- (3) The operating supply voltage shall not exceed 70% of the absolute maximum voltage.
- (4) The operating supply voltage shall not exceed 79% of the absolute maximum voltage.
- (5) The operating supply voltage shall not exceed 92% of the absolute maximum voltage.
- (6) The derating factor for TTL open collector devices shall be 0.75.
- (7) Further derating may be required for radiation environments (i.e., minimum Vcc to insure minimum DC reference for transients).

## MIL-STD-975L (NASA)

## 3.8.1 DIGITAL MICROCIRCUIT DERATING EXAMPLE

Microcircuits Digital
--------------------------

The principal stress parameters for digital microcircuits are the output current (fanout), total device power, and junction temperature. Note that package thermal rating will affect the junction temperature and limit the output current and power allowed.

Example: A TTL 5402 quad two-input NOR gate is rated at:

$V_{CC}$	=	5.0 $\pm$ 5% VDC supply voltage
$I_{CC}$	=	27 mA supply current
$V_{IH}$	=	2.0 VDC (min) input high
$V_{IL}$	=	0.8 VDC (max) input low
$V_{OH}$	=	2.4 VDC (min) output high
$V_{OL}$	=	0.4 VDC (max) output low
$I_{OL}$	=	1.6 mA each output
Fanout	=	20 TTL Loads
$T_J$	=	175°C maximum.
$\theta_{JC}$	=	28°C/W (14 pin CER-DIP)

Applying the derating criteria, we have:

$$\begin{aligned} \text{Fanout} &= 16 \quad (0.8 \times 20) \\ T_J &= 100^\circ\text{C} \quad (\text{maximum}) \end{aligned}$$

For worst-case package power:

$$\begin{aligned} V_{CC} &= 5.0 \text{ V } \} \\ I_{CC} &= 27 \text{ mA } \} \quad (5.0 \text{ V} \times 27 \text{ mA}) = 135 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{Fanout} &= 16 \} \\ V_{OL} &= 0.4 \text{ V } \} \quad 16(0.4 \text{ V} \times 1.6 \text{ mA}) = 10.24 \text{ mW} \\ I_{OL} &= 1.6 \text{ mA } \} \end{aligned}$$

$$\text{Maximum dissipated power} = 145.24 \text{ mW. (1)}$$

Operating the junction at 100°C, and assuming there is no contribution from ambient air (no convection) in space:

$$T_J = T_C + W \cdot \theta_{JC}$$

Note that  $W \cdot \theta_{JC} = 0.145 \text{ W} (28^\circ\text{C/W}) = 4.06^\circ\text{C}$  rise.  $T_J = 100^\circ\text{C}$  and  $100^\circ\text{C} - 4.06^\circ\text{C} = 95.94^\circ\text{C}$   $T_C$ , which is the maximum allowable case temperature we may operate with.

Also note that the device wattage (output current) must be decreased as case temperature increases to maintain the junction temperature,  $T_J$ , below 100°C.

(1) For MOS operation also calculate and add the AC wattage contribution.

## MIL-STD-975L (NASA)

## 3.9 PROTECTIVE DEVICE DERATING CRITERIA

Protective  
Devices

## A. Fuses

Fuses are derated by multiplying the rated amperes by the appropriate Derating Factor listed below.

Fuse Current Rating (amperes)	Derating Factor (1) (2)	Remarks
2 - 15	0.50	Rating at 25°C ambient. Derating of fuses allows for loss of pressure, which lowers the blow current rating and allows for a decrease of current capability with time. (1) (3)
1 & 1.5	0.45	
0.5 & 0.75	0.40	
0.375	0.35	
0.25	0.30	
0.125	0.25	

- (1) If calculations result in fractional values, use the next highest standard fuse rating.
- (2) Derating factors are based on data from fuses mounted on printed circuit boards and conformally coated. For other types of mounting, consult the project parts engineer for recommendations.
- (3) There is an additional derating of 0.5 percent/°C for an increase in the ambient temperature above 25°C.

## B. Circuit Breakers

Circuit breaker contacts are derated by multiplying the maximum rated contact current (*resistive*) by the appropriate contact derating factor listed below.

Contact Application	Contact Derating Factor	Maximum Ambient Temperature
Resistive	0.75	20°C below the maximum specified
Capacitive	0.75 (4)	
Inductive	0.40	
Motor	0.20	
Filament	0.10	

- (4) Series resistance shall be used to assure that circuits do not exceed the derated level.

## MIL-STD-975L (NASA)

<b>Protective Devices</b>
-------------------------------

## 3.9.1 PROTECTIVE DEVICE DERATING EXAMPLE

## A. Fuses

The principal stress parameter is current.

Example: A board expected to be operating at 80°C ambient has a calculated maximum current of 0.9 A. The additional derating required due to temperature is calculated as shown.

$$0.5\% / ^\circ\text{C} \times (80^\circ\text{C} - 25^\circ\text{C}) = 27.5\%$$

The total derating factor is calculated as follows;

$$50\% - 27.5\% = 22.5\%$$

and the fuse rating is calculated as shown;

$$0.9/0.225 = 4 \text{ A}$$

A fuse with rating equal to or greater than 4 A must be used in this circuit.

## B. Circuit Breakers

Contact current is the principal stress parameter. Derating level is predicated on application load. Maximum ambient temperature allowed is reduced 20°C from the specification limit.

Example: A circuit breaker is to be selected to control an electrical motor rated at 17 A, full load, 24 Vdc. The circuit breaker is to be installed in an environment with an ambient temperature ranging from 10°C to 30°C.

The temperature derating is;

$$30^\circ\text{C} + 20^\circ\text{C} = 50^\circ\text{C}$$

The contact current derating is;

$$17 \text{ A}/0.20 = 85 \text{ A}$$

A circuit breaker with maximum ratings equal to or greater than 50°C and 85 A must be used for this application.

Vendor information must be consulted to determine the proper trip current/time curve of the selected circuit breaker. Thermal circuit breakers may have an additional derating or trip time due to ambient temperature effects.

## MIL-STD-975L (NASA)

## 3.10 RELAY DERATING CRITERIA

Relays

The derated contact current ( $I_{DR}$ ) is found by multiplying the contact rating ( $I$ ) and the product of T, R, and L from the following tables.

- Table T, Ambient Operating Temperature
- Table R, Cycle Rate
- Table L, Load Application

$$I_{DR} = I \times T \times R \times L$$

TABLE T (Temperature)

Temp Range	-65°C to -21°C	-20°C to +39°C	+40°C to +84°C	+85°C to +125°C
Factor	0.85	0.9	0.85	0.7

TABLE R (Cycle Rate)

Cycle rate per hour	<1.0	1.0 to 10	>10
Factor	0.85	0.9	0.85

TABLE L (Load)

Load Application	A to 0.5 sec	B to 5.0 min	C Other
Factor	1.0	1.5	0.8

Load A. Make, break and/or carry loads with an on-time duration of 0 to 500 milliseconds. Off-time is equal to or greater than on-time.

Load B. Carry-only (1) loads. Relay does not make or break the load. Maximum on-time is 5 minutes. Off-time is equal to or greater than on-time

Load C. Make, break and/or carry. Those loads that do not fall into the category of loads A or B. (Limited use)

- (1) "Carry-only" means that the relay contacts are closed before there is current flowing through the contacts.

## MIL-STD-975L (NASA)

## 3.10.1 RELAY DERATING EXAMPLE

Relays

The principal stress parameters are continuous contact current and temperature. Using reduced coil voltages and abnormal contact voltages can reduce the life of the relay and compromise relay operation.

**Example 1:** A 1.0 A relay is operated in an environment with a temperature of +70° C. The relay is cycled at a rate of 5 cycles per hour. The load application is make, break, and carry, with a time duration of 400 msec.

From Table T select the +40° C to +84° C factor.  
From Table R and Table L select the appropriate factors.

Contact derating factor is  $T \times R \times L = 0.85 \times 0.9 \times 1.0 = 0.765$ . The derated contact load is  $0.765 \times 1.0 \text{ A} = 0.765 \text{ A}$ .

**Example 2:** A 10 A relay is operated in an environment with a temperature of -40° C. The relay is turned on for 3 minutes once every 2 hours. The load application is carry-only. Select the appropriate factors from Tables T, R, and L.

Contact derating factor =  $0.85 \times 0.85 \times 1.5 = 1.0838$ .

The derated contact load is  $1.0838 \times 10 \text{ A} = 10.84 \text{ A}$ .

**NOTE:** Although the relay is a 10 A rated relay, the derated contact load capability is 10.84 A when this unique low-use application is considered.

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## 3.11 RESISTOR DERATING CHARTS

## Resistors

The derated power level of a resistor is obtained by multiplying the resistor's nominal power rating by the appropriate power ratio found on the (y) axis in the graphs below and on the next page. This ratio is also a function of the resistor's ambient temperature maximum (x axis).

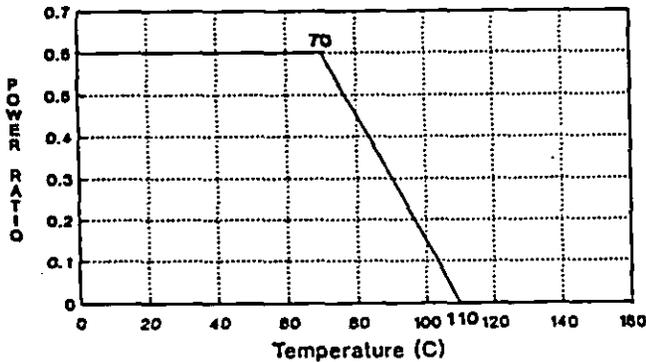
The voltage applied to resistors must also be controlled. The maximum applied voltage should not exceed 80% of the specification maximum voltage rating or  $\sqrt{PR}$  whichever is less, where:

P = Derated power (watts).

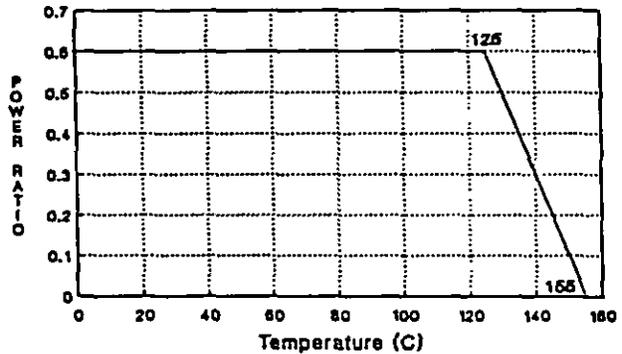
R = Resistance of that portion of the element actually active in the circuit.

This voltage derating applies to dc and regular waveform ac applications. For pulse and other irregular waveform applications, consult MIL-HDBK-978 Vol. 1 3.1.6.2 (general), 3.2.5.2 (MIL-R-39008), 3.2.5.3 (MIL-R-55182 and 39017) or consult the manufacturer.

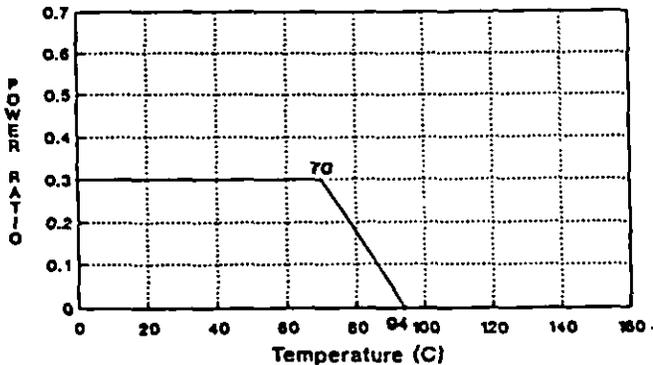
**FIXED CARBON**  
MIL-R-39008  
Type RCR



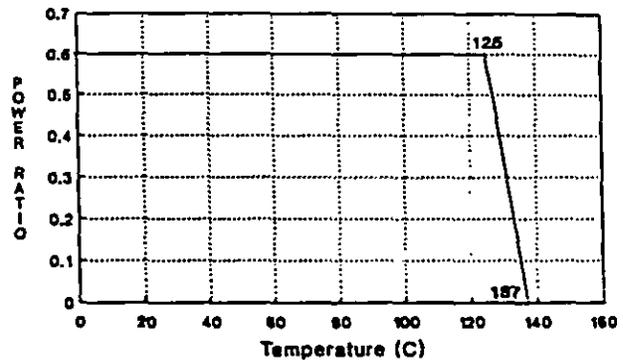
**METAL FILM**  
MIL-R-55182  
Type RNC, RNR, RNN



**METAL FILM**  
MIL-R-39017  
Type RLR



**FIXED WIRE WOUND**  
MIL-R-39005  
Type RBR

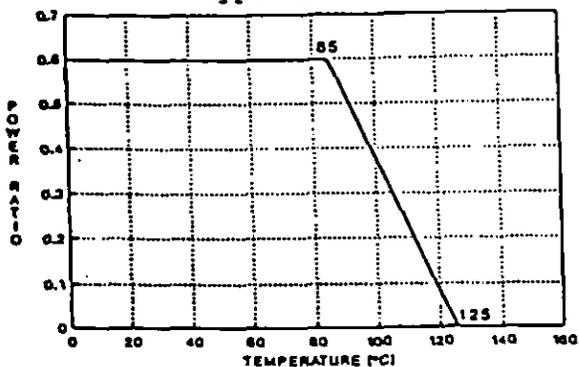


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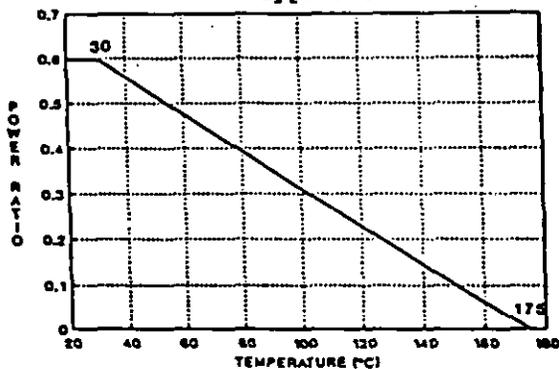
3.11 RESISTOR DERATING CHARTS

Resistors

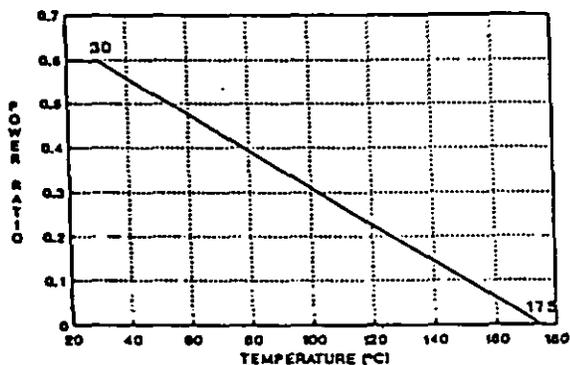
VARIABLE WIRE-WOUND  
MIL-R-39015  
Type RTR



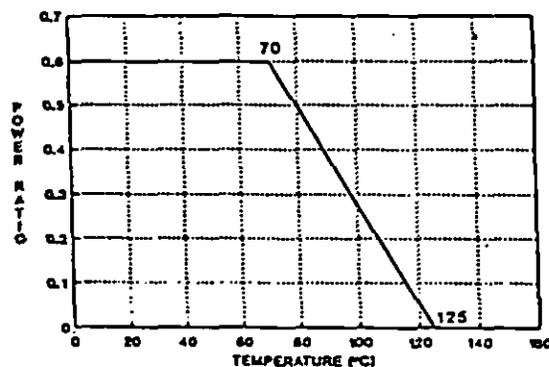
POWER WIRE-WOUND  
MIL-R-39007  
Type RWR



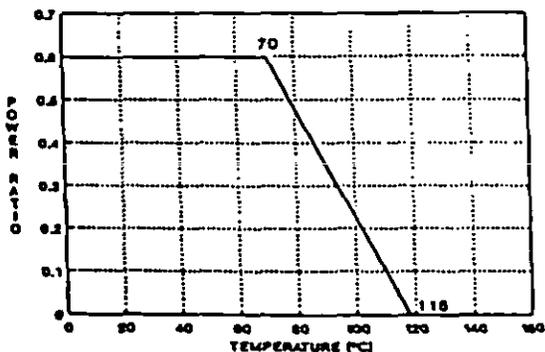
POWER, FIXED WIRE-WOUND (1)  
MIL-R-39009  
Type RER



RESISTOR NETWORK  
MIL-R-83401  
Type RZO



FIXED FILM CHIP  
MIL-R-55342  
Type RM



(1) Chassis mount

## MIL-STD-975L (NASA)

## 3.11.1 RESISTOR DERATING EXAMPLE

Resistors

Power and ambient temperature are the principal stress parameters.

**Example 1:** A 0.5 W metal film resistor, type RNR70C1001FM, is used in an application where the ambient temperature is 130°C.

The derating chart for RNR resistors on page A.24 indicates that at an ambient temperature of 130°C, this resistor should be derated to 0.5 of its rated power.

Therefore:  $P = (0.5 \times 0.5 \text{ W}) = 0.25 \text{ watt}$

Current must be limited to maintain the derated power at 0.25 W.

**Example 2:** A 0.1W metal film resistor type RNC55H4753FP, is used in an application where the ambient temperature is 100°C.

The derating chart for RNC resistors on page A.24 indicates that at an ambient temperature of 100°C, this resistor should be derated to 0.6 of its rated power. This resistor has a value of 475K $\Omega$  and a specification maximum voltage rating of 200 volts.

Derated power  $P = (0.6 \times 0.1 \text{ W}) = 0.06 \text{ W}$

At this power, the applied voltage  $E_{APP} = \sqrt{(0.06 \times 475,000)}$   
 $\approx 168.8 \text{ volts.}$

But 80% of specification maximum voltage rating is 160 volts. So this resistor cannot be used above a continuous power level of  $\frac{160^2}{475,000} = 0.054 \text{ W,}$

or 0.54 of its maximum rated power.

## MIL-STD-975L (NASA)

### 3.12 SWITCH DERATING CRITERIA

Switches

Presently there are no approved switches for inclusion in MIL-STD-975L.

This sheet is intended for future use.

## MIL-STD-975L (NASA)

### 3.12.1 SWITCH DERATING EXAMPLE

Switches

Presently there are no approved switches for inclusion in MIL-STD-975L.

This sheet is intended for future use.

## MIL-STD-975L (NASA)

## 3.13 THERMISTOR DERATING CRITERIA (1)

Thermistors

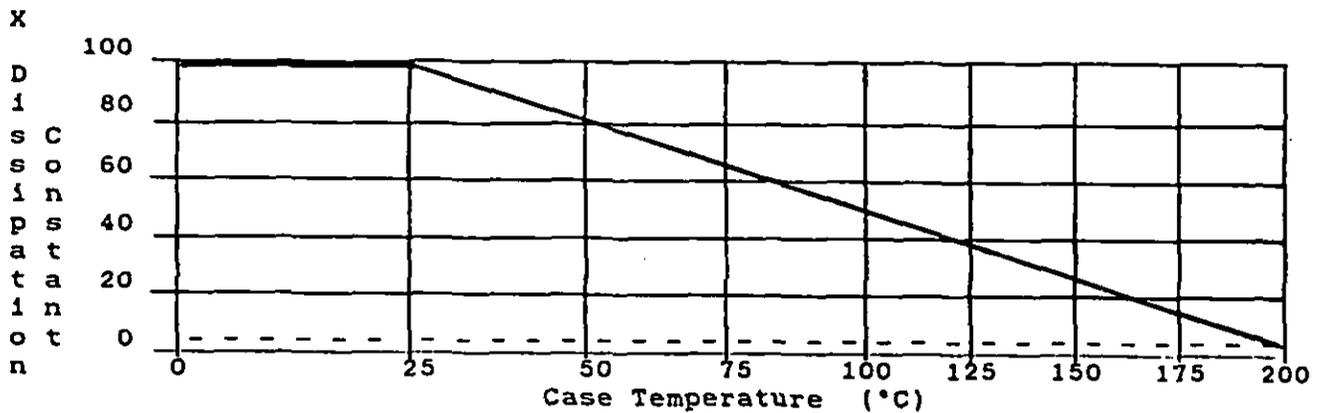
## Positive Temperature Coefficient (PTC)

Positive temperature coefficient thermistors are generally operated in the self-heat mode. Derate to 50 percent of the rated power, or as required by the detailed specification.

## Negative Temperature Coefficient (NTC)

Negative temperature coefficient thermistors operated in the self-heat mode shall be derated in accordance with the figure below to prevent thermal runaway. Such parts should be derated to a power level causing a maximum increase of 50 times the dissipation constant, or a maximum part temperature of 100°C, whichever is less.

DERATING CURVE FOR NEGATIVE COEFFICIENT THERMISTORS



- (1) Applied voltage should not exceed 80% of the maximum rating. ( $E_{APP}=0.8\sqrt{PR}$ )

## MIL-STD-975L (NASA)

## 3.13.1 THERMISTOR DERATING EXAMPLE

Thermistors

Power and ambient temperature are the principal stress parameters.

Example: Negative Temperature Coefficient

A 0.15 Watt NTC thermistor rated at 5000 ohms at 25°C has an operating temperature range of -40°C to +200°C and a dissipation constant of 0.8 mW/°C.

For power derating multiply the dissipation constant by 50.

$$(50)(0.8 \text{ mW/}^\circ\text{C}) = 40 \text{ mW}$$

The thermistor should be limited to a maximum power dissipation of 40 mW. The graph on page A.29 indicates that at a value of 40, the thermistor is limited in use to 125°C max. This is above the maximum allowable derated temperature of 100°C, as stated in the criteria, page A.29, so 100°C is used.

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## 3.14 TRANSFORMER DERATING CRITERIA

Transformers

Transformers are derated by limiting the maximum operating temperature based on the insulation class used, and limiting the rated operating voltage to 50% of its maximum.

Insulation Class		Derated Maximum Operating Parameters	
MIL-T-27	MIL-T-21038	Temperature	Dielectric Withstanding Voltage
Q (85°C)	Q (85°C)	+ 65°C	50% of maximum rated operating voltage
R (105°C)	R (105°C)	+ 85°C	
S (130°C)	S (130°C)	+ 105°C	
V (155°C)	T (155°C)	+ 130°C	
T (170°C)	U (170°C)	+ 155°C	

- a) Maximum operating temperature equals ambient temperature plus temperature rise, plus 10°C (allowance for hot spot). Compute temperature rise as follows:

Temperature rise test (per MIL-T-27, para 4.8.12)

$$\text{Temperature rise (°C)} = \frac{(R - r)}{r} (t + 234.5^\circ\text{C}) - (T - t)$$

Where  $R$  = winding resistance at elevated temperature

$r$  = no-load winding resistance at ambient temperature  $t$

$t$  = initial ambient temperature (°C)

$T$  = maximum ambient temperature (°C) at time of power shutoff.

$T$  shall not differ from  $t$  by more than +5°C.

- b) The insulation classes of MIL-style inductive parts generally have maximum operating temperature ratings based on a life expectancy of at least 10,000 hours. The maximum operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.
- c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the materials used. Devices having a maximum rated operating temperature in the range from +85°C to +130°C, shall be derated as follows: maximum operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature range, consult the project parts engineer for temperature derating recommendations.

## MIL-STD-975L (NASA)

## 3.14.1 TRANSFORMER DERATING EXAMPLE

Transformers

The parameters to be derated are temperature and dielectric stress. Frequency and winding voltage are not derated.

Example: A 110 VAC / 24 VAC step-down transformer is to operate in an ambient temperature of 40°C.

Insulation is class Q.

Winding resistance is 2.5 ohms with no load (r), 2.95 ohms under load (R).

Maximum ambient temperature T reached, when loaded, was 30°C.

Ambient temperature t for the temperature rise test was 25°C.

Calculating the temperature rise per MIL-T-27, paragraph 4.8.12;

$$\delta T = \frac{(R - r)}{r} (t + 234.5^\circ C) - (T - t)$$

$$\delta T = \frac{(2.95 - 2.5)}{2.5} (25^\circ C + 234.5^\circ C) - (30^\circ C - 25^\circ C)$$

$$\delta T = \frac{0.45}{2.5} (259.5^\circ C) - 5^\circ C$$

$$\delta T = 0.18 (259.5^\circ C) - 5^\circ C \quad t = 25^\circ C$$

$$\delta T = 46.7^\circ C - 5^\circ C$$

$$\delta T = 41.7^\circ C$$

The maximum operating temperature for this application is 41.7°C + 40°C + 10°C = 91.7°C. Class Q insulation is not adequate since its derated maximum operating temperature is only 65°C. Class S insulation (105°C) must be used. The dielectric withstanding voltage of the insulation must be rated at 220 VAC. (220 VAC x 50% = 110 VAC).

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## 3.15 TRANSISTOR DERATING CRITERIA

## Transistors

Derating of transistors is accomplished by multiplying the appropriate stress parameter by its derating factor. Junction temperature must also be calculated and maintained below 125°C.

Transistor Type	Critical Stress Parameter	Derating Factor	Maximum Junction Temperature
<b>BIPOLAR</b>			125°C (all types)
General purpose, Switching, and Power	Power	0.50	
	Current	0.75	
	Voltage	0.75 (1)	
<b>FIELD EFFECT</b>			
JFET and MOSFET (2)	Power	0.50	
	Current ( $I_D$ )	0.75	
	Voltage	0.75 (1)	

- (1) Worst-case combination of DC, AC, and transient voltages should be no greater than the derated limit.
- (2) For power MOSFET devices, also derate the gate to source voltage ( $V_{GS}$ ) to 60% of the maximum rated.

## MIL-STD-975L (NASA)

## 3.15.1 TRANSISTOR DERATING EXAMPLE

Transistors

Junction temperature is the most destructive stress for transistors. This parameter along with power, voltage, and current (safe operating area) must be derated.

Example: A 2N6756 MOS power transistor is derated as follows:

MAXIMUM RATINGS		DERATINGS
Power: 75 W	(75 X 0.5)	= 37.5 W
Current, $I_D$ : 14 A	(14 X 0.75)	= 10.5 A
Voltage, $V_{DS}$ : 100 V	(100 X 0.75)	= 75 V

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## 3.16 WIRE AND CABLE DERATING CRITERIA

Wire/Cable

Derating is accomplished by determining a single wire maximum current from a combination of wire size and bundle size as listed below. Adjustments are made if the insulation is other than Teflon\*.  
(see remark 3 below)

Wire Size (AWG)	Single Wire Current ( $I_{sw}$ ) (A)	Remarks
30	1.3	1. Current ratings are based on wires at +70°C in a hard vacuum. (10 <sup>-6</sup> to 10 <sup>-9</sup> torr).
28	1.8	
26	2.5	2. When wires are bundled, the maximum design current for each individual wire shall be derated according to:  FOR $1 < N \leq 15$ :      where: $I_{BW} = I_{sw} \times (29-N)/28$ $N =$ number of wires  FOR $N > 15$ $I_{BW} =$ current, bundled wire $I_{BW} = (0.5)I_{sw}$ $I_{sw} =$ current, single wire
24	3.3	
22	4.5	
20	6.5	
18	9.2	
16	13.0	
14	19.0	
12	25.0	
10	33.0	
8	44.0	
6	60.0	3. Deratings listed are for Teflon* insulated wire (TYPE TFE) rated for +200°C  a. For 150°C wire, use 80% of value shown in table.  b. For 135°C wire, use 70% of value shown in table.  c. For 105°C wire, use 50% of value shown in table.
4	81.0	
2	108.0	
0	147.0	
00	169.0	
		4. Dielectric withstanding voltage rating required: at least two times the highest application voltage.
		5. Derating values listed apply only to round single conductors on helically wound bundles. See project parts engineer for derating information for ribbon cable and flat conductors.

\* Reg. Trademark, E.I. DuPont Chemical Co.

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## 3.16.1 WIRE AND CABLE DERATING EXAMPLE

Wire/Cable

Parameters to be derated are conductor current, insulation dielectric withstanding voltage, and temperature.

Example: A wiring bundle is made up of 5 conductors which will carry the following currents: 1 at 1 amperes, 2 at 6 amperes, and 2 at 8 amperes. The maximum ambient temperature will be 70°C. The highest voltage will be 100 V.

Solve for the single wire current ( $I_{SW}$ ). The table on A.35 gives the wire size allowed for use.

For a 70°C ambient temperature, 200°C, 150°C or 135°C rated insulation may be used (see Remark 3, page A.35).

Case 1: 200°C rated insulation:

$$\begin{aligned} I_{BW(8A)} &= I_{SW} \times (29 - N)/28 && \text{where } N = 5 \text{ and} \\ 8A &= I_{SW} \times 0.86 && I_{BW(8A)} = 8 \text{ amperes} \\ I_{SW} &= 8 A/0.86 \\ I_{SW} &= 9.33 A \end{aligned}$$

The table on page A.35 gives size 16 wire as the smallest size wire that should be used for 8 amperes of application current.

$$\begin{aligned} I_{BW(6A)} &= I_{SW} \times (29 - N)/28 && \text{where } N = 5 \text{ and} \\ 6A &= I_{SW} \times 0.86 && I_{BW(6A)} = 6 \text{ amperes} \\ I_{SW} &= 6 A/0.86 \\ I_{SW} &= 7.00 A \end{aligned}$$

The table on page A.35 gives size 18 wire as the smallest size wire that should be used for 6 amperes of application current.

$$\begin{aligned} I_{BW(1A)} &= I_{SW} \times (29 - N)/28 && \text{where } N = 5 \text{ and} \\ 1A &= I_{SW} \times 0.86 && I_{BW(1A)} = 1 \text{ ampere} \\ I_{SW} &= 1 A/0.86 \\ I_{SW} &= 1.17 A \end{aligned}$$

The table on page A.35 gives size 30 wire as the smallest size wire that should be used for 1 ampere of application current.

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Case 2 and Case 3: 150°C and 135°C rated insulations:

The table on page A.35 defines  $I_{sw}$  values for these insulations as 80% and 70%, respectively, of the  $I_{sw}$  values shown for the 200°C rated insulation. To determine wire sizes required for 150°C and 135°C rated insulation, divide the answers found above as follows:

Application Current	Insulation Temperature Rating					
	200°C		150°C		135°C	
(A)	$I_{sw}$ (A)	Wire Size Required	$I_{sw}$ (A)	Wire Size Required	$I_{sw}$ (A)	Wire Size Required
8	9.33	16	11.66	16	13.34	14
6	7.00	18	8.75	18	10.01	16
1	1.17	30	1.46	28	1.67	28

The minimum dielectric withstanding voltage of the insulation must be:  $100 \text{ V}/0.5 = 200 \text{ V}$

Choose wire that is rated for a minimum of 200 V dielectric withstanding voltage. The choice of insulation may further be defined by other material requirements such as weight, flammability or durability.

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**APPENDIX B**  
**ADDITIONAL TESTING REQUIREMENTS**

## MIL-STD-975L (NASA)

## ADDITIONAL TESTING REQUIREMENTS

## 1.0 SCOPE

This appendix contains additional testing requirements for parts to be used in the design and construction of space hardware, as well as essential ground support equipment.

## 2.0 GENERAL

**2.1 Introduction.** To support the designs required by NASA Programs, this Standard Parts List includes parts that require additional testing prior to use. Therefore, the specified additional tests must be fully complied with in order to use a part for applicable grade level, and part documentation shall reflect the successful completion of additional testing requirements.

**2.2 Marking.** Upon successful completion of additional testing, each part shall be permanently and legibly marked with a NU, except when the contractor utilizes a Part Control Procedure to implement these requirements and specifies a unique marking, so that the part may be identified and controlled. The marking shall be legible (with a contrasting color), nontoxic, and permanent such that it meets the resistance-to-solvents requirements of MIL-STD-883, Method 2015. In addition, the marking shall meet the following outgassing criteria: a maximum total mass loss of 1.0 percent and a maximum of 0.10 percent volatile condensable materials when tested in accordance with American Society for Testing and Material (ASTM) Standard Test Method E595.

Alternate methods of part marking shall be approved by the NASA Project Parts Engineer.

## 3.0 ADDITIONAL TESTING REQUIREMENTS

## 3.1 Additional Testing Requirements for Grade 1 Applications.

## 3.1.1 Capacitors

**3.1.1.1 Capacitors, Fixed, Tantalum (Solid) Electrolytic, (CSR).** Each part shall be subjected to a surge current test of five charge/discharge surge current cycles of at least 1 second each per cycle at +25°C, -55°C, and +85°C and maximum rated voltage.<sup>1</sup> The surge current test circuit shall comply with the following conditions:

- A. The power supply used for charging the capacitors shall be capable of supplying a regulated direct voltage, variable from 0 to 150 volts, at a 15 amp minimum current capability.
- B. The energy storage bank shall be placed across the dc-power supply. It shall consist of parallel aluminum electrolytic capacitors having an aggregate capacitance of 100,000 $\mu$ F, -0, +30 percent, rated at 150 volts dc working or higher.

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<sup>1</sup>Definition of surge current (inrush current) is the peak current, for a given duration, that the capacitor will receive from the turn-on of a bank of 100,000  $\mu$ F aluminum electrolytic capacitors charged to the rated voltage of a given capacitor under test with a maximum series resistance of less than or equal to 0.3 ohm including the mercury relay, fuse, and wire.

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- C. A 30-ampere mercury relay shall be used to switch the capacitor under test to the energy bank for charge and into a short circuit for discharge.
- D. The total resistance of all wiring between the energy source and the capacitors under test, including the mercury relays but excluding fuses, shall not exceed 0.1 ohm.
- E. The fuses in the test circuit shall have a rating of not less than 1 amp, nor more than 5 amps. A fuse shall be placed in series with each capacitor undergoing the surge current test. Each fuse shall have a maximum resistance of not more than 0.2 ohm.
- F. A capacitor under test shall be considered a failure either when a fuse blows or the dc leakage current is exceeded or both.

**3.1.1.2 Capacitors, Fixed, Ceramic, (CDR).** Parts shall meet the destructive physical analysis criteria given in Table X, Group A Inspection, of MIL-C-123, and the humidity, steady state, low voltage criteria given in Table XI, Group B Inspection of MIL-C-123. Samples subjected to humidity, steady-state, low voltage test shall not be used.

### 3.2 Additional Testing Requirements for Grade 2 Application.

**3.2.1 Resistor Networks.** The requirements for screening resistor networks (MIL-R-83401) for use in Grade 2 applications are shown in Table 3.1.

**TABLE 3.1. Additional Screening Requirements for Networks (MIL-R-83401) Prior To Use in Grade 2 Applications**

Screening per MIL-STD-202 (100%)

Screen	Method	Requirements
Thermal shock	107 Test Condition B	Paragraph 4.6.3 of MIL-R-83401
Burn-in	108	MIL-R-83401 (150 hours)
Electrical	MIL-R-83401 Group A	Shall be within spec limits before and after screen

#### Marking

A unique marking to signify compliance with these requirements. See Para 2.2.

**3.2.2 Crystal Oscillators.** The requirements for screening the type 1 crystal oscillators for use in Grade 2 applications shall be as follows:

**3.2.2.1 Particle Impact Noise Detection (PIND).** Each part shall be subjected to the PIND test in accordance with MIL-STD-883, method 2020, test condition B. The test shall be performed using five independent passes and all failures found at the end of each pass are rejected. The survivors of the last pass are considered acceptable.

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**3.2.2.2 Radiography.** Each parts shall be subjected to the radiographic examination in accordance with MIL-STD-883, method 2012, two views 90 degrees apart.

**3.2.2.3 Internal Water Vapor Content.** Parts shall be subjected to the internal water vapor test in accordance with MIL-STD-883, method 1018. Samples of three devices with zero failures or five devices with one failure shall be used for this test.

**3.2.2.4 Marking.** A unique marking to signify compliance with these requirements. See paragraph 2.2.

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**APPENDIX C**

**SPECIAL REQUIREMENTS FOR  
CUSTOM ELECTROMAGNETIC DEVICES**

## MIL-STD-975L (NASA)

**TABLE 1. Summary of the Requirements of MIL-STD-981 Electromagnetics—Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications**

TYPICAL DIFFERENCES BETWEEN GRADE 1 AND GRADE 2 ELECTROMAGNETICS  
 APPLICABLE SPECIFICATIONS: MIL-C-83446, MIL-T-21038, MIL-T-55361, MIL-T-27, MIL-C-15305

Element	Grade 1 (Class S) (1)	Grade 2 (Class B)
Soldering Flux	Type R	Type R or RMA
Minimum Wire Size:		
- Families 03, 04, 36, 37, 40, 41	AWG 38	AWG 44
- Families 11-14, 20, 21, 31, 50, 51	AWG 44	AWG 50
- Termination limitations:		
- Interconnected lead termination	AWG 29	AWG 32
- External terminal/self lead (2)	AWG 26	AWG 28
Lot Control	Same as Class B, plus: 1. Each design element from a single lot; 2. Solder from one supplier; 3. Each process in one continuous run; 4. Lot Date Code and production lot traceability maintained through acceptance	Lot identification, operation, quantity, date of operation, operator identification

- (1) For new designs, transformers that meet Class S processing inspection and 100 percent screening requirements of MIL-STD-981 shall be used in Grade 1 applications.
- (2) Spliced internal lead diameter ratios shall not exceed 5 to 1 for magnet wire sizes larger than number 44.

## MIL-STD-975L (NASA)

**TABLE 1. Summary of the Requirements of MIL-STD-981 Electromagnetics—Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications (Continued)**

Element	Grade 1 (Class S) (1)	Grade 2 (Class B)
Group A Screening	Ref. Appendix B, MIL-STD-981	Ref. Appendix B, MIL-STD-981
Group B Tests	Table IV, V, VI, or VII per MIL-STD-981 as applicable	As specified by the procurement document
Rework of rejected lots	Ref. MIL-STD-981	Ref. MIL-STD-981
Group B inspection	<ul style="list-style-type: none"> <li>- Randomly sampled units from Group A lots.</li> <li>- Two sample units subjected to tests of Subgroup 1 and two sample units to Subgroup 2 (Group B tests). A total of four samples.</li> <li>- Lot has failed when number of failures exceeds number allowed in applicable table.</li> <li>- Failure analysis shall be performed and forwarded to procuring activity.</li> </ul>	<ul style="list-style-type: none"> <li>- As specified by procurement document.</li> <li>- As specified by procurement document.</li> <li>- As specified by procurement document.</li> <li>- Group B inspection repeated on additional sample units.</li> </ul>
Radiographic Inspection	- Ref. Appendix C, MIL-STD-981	- Ref. Appendix C, MIL-STD-981

(1) For new designs, transformers that meet Class S processing inspection and 100 percent screening requirements of MIL-STD-981 shall be used in Grade 1 applications.

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**APPENDIX D**

**JAN CLASS S STOCK PROGRAM**

## MIL-STD-975L (NASA)

### JAN CLASS S STOCK PROGRAM

#### 1.0 SCOPE.

This appendix explains the procedures for obtaining JAN Class S microcircuits and semiconductors from the JAN Class S Stock Program with as little as a ten (10) day delivery time. Included are simple instructions on obtaining a DoDAAC, requisitioning parts from stock, and pursuing emergency procurement without a DoDAAC.

#### 2.0 INTRODUCTION.

This program was established to stock JAN Class S (space quality) parts. It was initiated in 1985 by NASA, the Defense Logistics Agency (DLA), and the Space and Missile Systems Center (SMC/SDFP), specifically for NASA, SMC/SDFP, approved contractors and their supporting contractors, and manufacturers of expendable launch vehicles.

**2.1 Purpose.** The program allows JAN Class S parts to be obtained with reduced lead times and costs compared to typical acquisition from manufacturers.

**2.2 Advantages.** The program provides the following advantages:

- 1) Reduced procurement lead time - as little as ten (10) days.
- 2) Avoidance of minimum-buy requirements imposed by the parts manufacturers - buy only what is absolutely needed.
- 3) Rapid availability of spare parts for maintenance and emergencies.
- 4) Substantially reduced overall procurement costs.

#### 2.3 Definitions.

- 1) MILSTRIP/FEDSTRIP - Military/Federal Standard Requisitioning and Issue Procedures.
- 2) DoDAAC - Department of Defense Activity Address Code issued to contractors and subcontractors as an access code to the JAN Class S stock.
- 3) LOA - Letter of Authorization written by the NASA contract officer to the contractor/subcontractor, authorizing the contractor/subcontractor to buy parts from the JAN Class S stock.

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### 3.0 OBTAINING ACCESS TO THE PROGRAM.

To buy from the JAN Class S Stock, you must have a DoDAAC and a LOA. These can be obtained through the NASA contract officer for the prime contract. It generally takes three (3) months to obtain a DoDAAC, but if time is critical, then the process can be expedited by the NASA contract officer stating on the request for a DoDAAC that the request be expedited.

### 4.0 EMERGENCY PROCUREMENT WITHOUT A DoDAAC.

Under the following conditions, parts may be obtained without a DoDAAC:

- 1) A small amount of parts are needed.
- 2) Failure to meet delivery dates will involve a substantial cost increase to the Government.
- 3) Processes must be initiated to obtain the normally required DoDAAC.

Call the NASA JAN S Support Desk for more information. (See Paragraph 8.0.)

### 5.0 PROCEDURES FOR REQUISITIONING.

Once a DoDAAC is obtained, orders for the JAN Class S Stock should be through Colene Ledbetter, AF-SMC/SDFP, (310) 363-2490. To place an order, the following information is required on a MILSTRIP Form DD 1348:

- 1) DoDAAC.
- 2) National Stock Number (NSN).
- 3) Quantity.
- 4) Billing Address.
- 5) Shipping Address.

### 6.0 USING THE JAN CLASS S STOCK BULLETIN BOARD.

The Space and Missile Systems Center, Component Engineering Group provides an electronic bulletin board for the JAN S Stock Program. This system lists the current availability and prices of stocked parts. It displays the NSNs, Military specification part numbers, generic part numbers, device descriptions, prices, number of parts in Destructive Physical Analysis testing, and number of parts in stock.

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**6.1 ACCESS.** To connect to the bulletin board, use a modem to dial 310-363-1914/1915 (if you have AUTOVON access, dial 833-1914/1915) with the following modem settings:

Terminal emulation:	VT220
Baud rate:	2400 (or 1200)
Data bits:	8
Parity:	none
Stop bits:	1

Once connected, you will see the word "CONNECT". Press <return> twice, wait two seconds and press <return> twice more. You will see "ENTER USERNAME>". Enter anything here and press <return>. At the "LOCAL" prompt, type "C SD" or "C SPACE" and press <return>. Wait two seconds and press <return> again. You will be prompted for the OSS "USERNAME:" and a first "PASSWORD:". Enter:

USERNAME:	OSSUSER
PASSWORD:	MUKRIR

Next you will see the Authorization Form screen and again be prompted by "USERNAME:" and a second "PASSWORD:". Enter:

USERNAME:	OSSUSER
PASSWORD:	LAFBEE

You will then be at the JAN Class S Stock main menu. To obtain a listing of available parts, choose the first choice on each of the first three screens ("Status Report"), then you can make your desired choices. It is suggested to down-load the list to a file and then print the file using your local word processor, rather than to print directly to the printer.

If you have problems accessing the bulletin board, call Colene Ledbetter at (310) 363-2490 or Dave Davis at (310) 363-2406 of the SMC/SDFP.

**7.0 PARTS' DATA ACQUISITION PROCEDURES.**

Destructive Physical Analysis (DPA) is performed by DESC on each lot. Copies of the DPA reports and Quality Conformance Inspection (QCI) data can be obtained free of charge on request from the NASA JAN S Support Desk. (See paragraph 8.0.) Screening data should be obtained from the manufacturer.

**8.0 NASA JAN S SUPPORT DESK.**

Contact the following office for all questions regarding the JAN Class S Stock Program:

NASA Parts Project Office  
 Paramax Systems, UNISYS Corporation  
 4700 Boston Way  
 Lanham, Maryland 20706

POC: JAN S Support Desk  
 Phone: (301) 731-8918 or 731-8692  
 FAX: (301) 731-8603

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## 9.0 JAN CLASS S STOCK PROGRAM FLOW.

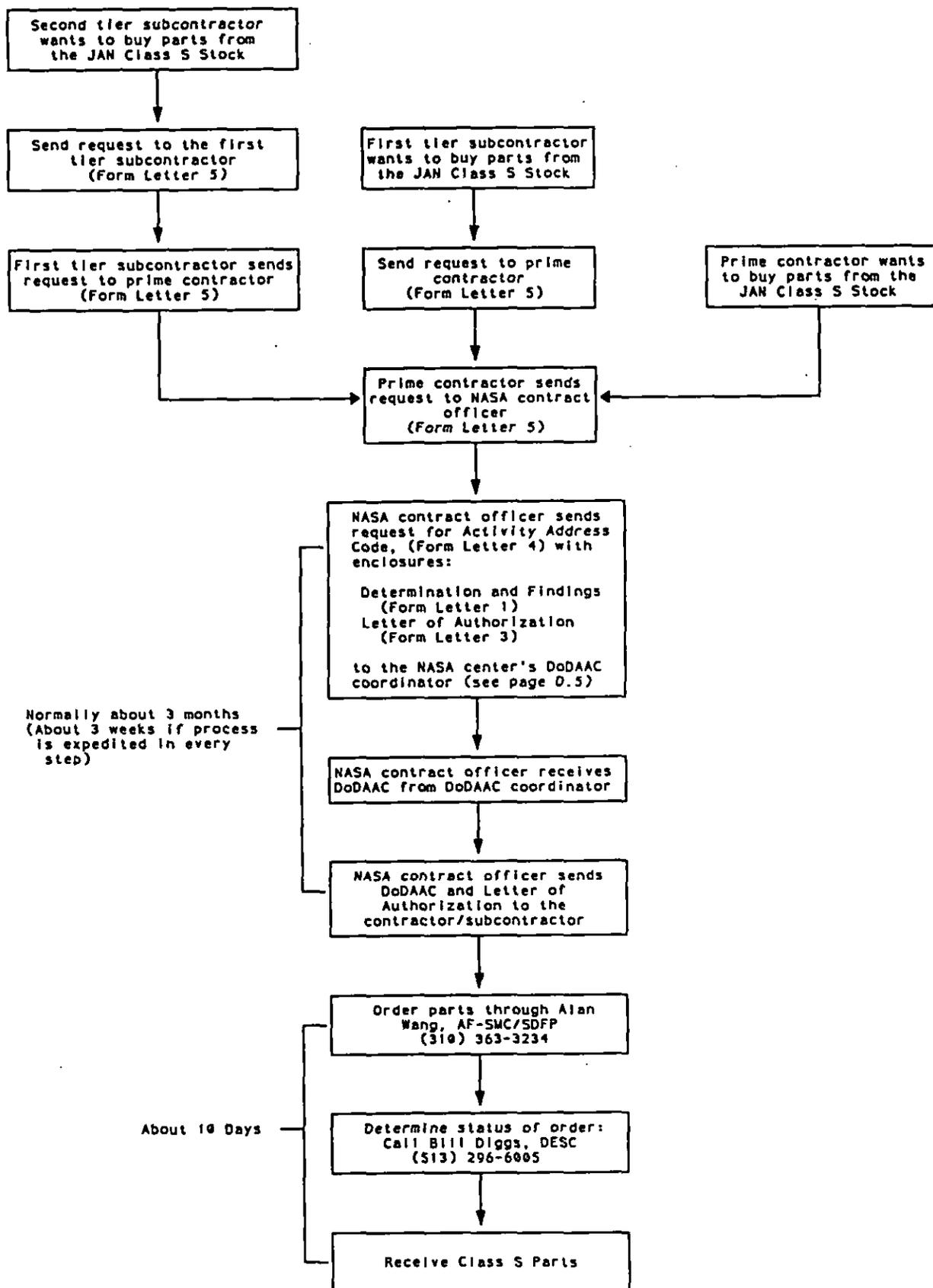
The flowchart on the following page demonstrates the process of obtaining a DoDAAC and LOA, ordering parts from DESC, and checking the status of orders. The next pages are form letters that the NASA contract officer sends to the DoDAAC coordinator of their NASA center to process requests for DoDAACs. These letters should be sufficient for the contract officer to simply add the appropriate information (eg., DoDAAC, contractor, contract number, contract dates).

The first letter is the Determination and Findings (D & F), which explains that it is in the best interest of the Government to allow the contractor to acquire parts from the JAN Class S Stock Program. The second letter is used to extend the authority of a DoDAAC to include the acquisition of JAN Class S parts from this Program. The third letter is the LOA written to the contractor/subcontractor that needs to be sent to the DoDAAC coordinator along with the D & F letter and the fourth letter. The fourth letter is the request for a DoDAAC, which is to be sent to the NASA center's DoDAAC coordinator (see below). The fifth letter is to help prime contractors and subcontractors assist their subcontractors in obtaining a DoDAAC. All subcontractors must have the NASA prime contractor request the NASA contract officer to submit Form Letter 4 with the enclosures to the appropriate DoDAAC coordinator.

The following is a list of the DoDAAC coordinators for each NASA center.

<u>NASA Center</u>	<u>DoDAAC Coordinator</u>	<u>Phone</u>	<u>Code/Mail Stop</u>
Ames Research Center	Paul Pinault	(415) 604-5206	AEL: 255-3
Goddard Space Flight Center Headquarters	Glenn Harris	(301) 286-3385	235.3
Jet Propulsion Lab	Gloria Taliaferro	(202) 358-2306	JIE
Johnson Space Center	Frank Malinowski	(818) 354-4970	M/S: 180801
Kennedy Space Center	Gloria Crowston	(713) 483-6694	JF-5
Langley Research Center	Mike Murray	(407) 867-3493	SI-SAT-1
Lewis Research Center	Susan Campbell	(804) 864-3572	380
Marshall Space Flight Center	Charles Noe	(216) 433-3079	M/S: 21-9
Stennis Space Center	Pegi Dunnigan	(205) 544-5658	CN44
	Don Griffeth	(601) 688-2144	GA20

## JAN Class S Stock Program Flow



## MIL-STD-975L (NASA)

## FORM LETTER 1

**SUBJECT: Determination and Findings Supporting Issuance of Authorization to Use Government Supply Sources (JAN Class S Stock Program)**

This Determination and Findings is to provide authorization under NASA contract number \_\_\_\_\_ for the contractor/subcontractor \_\_\_\_\_. This is a cost-reimbursement contract. The following is in accordance with the FAR 51.102, and supports issuance of authorization to requisition and use the JAN Class S Stock Program maintained by the DLA, DESC.

## FINDINGS

Administrative costs of placing orders with the JAN Class S Stock Program are comparable to those costs the contractor/subcontractor would incur when ordering direct from a manufacturer or distributor. All orders must have prior approval by the NASA contract officer.

The following factors were found to support authorization:

a. **Lower Cost of Items Available Through Government Supply Source.** The increased use of the standard parts available in the JAN Class S Stock Program would save money by reducing the need for expensive nonstandard parts and their associated engineering cost. Actual costs of items available from the Government supply source will be comparable to costs of similar items available from industry; however, substantial cost savings will be realized since contractors will be able to order smaller quantities from the Government supply source, thus avoiding minimum buy requirements imposed by part manufacturers.

b. **Suitability of Items Available Through Government Supply Source.** The Department of the Air Force, Space Systems Division Commander's Policy, SDR 540-12, requires the use of JAN Class S parts on all USAF space systems. The NASA Associate Administrator for Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA), encourages the use of JAN Class S parts on all NASA space systems and requires their use on certain systems. JAN Class S parts are military standard high reliability electronic parts. They are bought to fully utilize military specifications, built on government audited and certified production lines, and qualified for listing on the military qualified products list (QPL). JAN Class S parts increase reliability and reduce life cycle costs through standardization.

c. **Delivery Factors Such as Cost and Time.** Procurement lead time for contractor acquisition of the parts will be reduced by approximately one year; the parts will have already undergone the required stringent testing and will be delivered 8 to 31 days after the requisition date. Parts analysis reports are available free of charge upon request. Contact the NASA JAN S Support Desk (301-731-8918).

d. **Recommendations of Contractors.** The JAN Class S Stock Program was initiated at a Senior Executive Forum hosted by the Commander of United States Air Force Space Systems Division. Industry executives specifically requested that a program such as this be implemented as soon as possible. By agreement between the DLA and NASA, this stock is also made available to authorized NASA and NASA contractor activities.

## DETERMINATION

Based on the foregoing, I hereby determine that it is in the best interest of the Government, consistent with NASA's policy as set forth in NASA FAR Supplement 18-51.102, to authorize the contractor/subcontractor \_\_\_\_\_ to obtain and use the JAN Class S Stock Program under government contract number \_\_\_\_\_.

For further information contact \_\_\_\_\_  
(Contract Officer)

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## FORM LETTER 2

I have previously determined, in accordance with the Federal Acquisition Regulation (FAR) 51.102, that it is in the Government's best interest to authorize (contractor/subcontractor) to obtain materials required in the performance of the subject contract from government sources.

(Contractor's/Subcontractor's) authorization under Activity Address Code \_\_\_\_\_ is hereby extended to include the acquisition of JAN Class S parts in Federal Stock Code (FSC) 5961 (semiconductors) and FSC 5962 (microcircuits) from the Defense Logistics Agency (DLA), Defense Electronics Supply Center (DESC). JAN Class S parts as used in this authorization are space-quality military standard electronic parts as described by MIL-S-19500 for semiconductors and MIL-M-38510 for microcircuits, and associated specifications for passive electronic parts.

All orders must have prior approval by the contract officer. Orders for JAN Class S parts shall be placed in accordance with the requisitioning procedures specified by the acquisition activity. For information concerning procedures, contact the Defense Logistics Agency, Defense Electronics Supply Center, DESC-OMA, 1507 Wilmington Pike, Dayton, OH 45444-5000, phone: (513) 296-6005. For information concerning parts (stock availability), contact the Space and Missile Systems Center, Component Engineering Group (SMC/SDFP), P.O. Box 92960, Los Angeles AFB, CA 90009-2960, phone (310) 363-2490. Bills from DESC shall be paid promptly upon receipt of billings. All payments shall be addressed to the Defense Electronics Supply Center, 1507 Wilmington Pike, Dayton, OH 45444-5000.

JAN Class S parts procured pursuant to the authorization shall be used solely in performance of Contract No. \_\_\_\_\_ . This authority hereby granted is not transferable or assignable.

Contract Officer/Installation

FORM LETTER 3

SUBJECT: Authorization to Purchase From Government Supply Source

You are hereby authorized to utilize Government sources in performing under NASA contract number \_\_\_\_\_ from \_\_\_\_\_ (start date) through \_\_\_\_\_ (end date) in support of \_\_\_\_\_ (NASA Installation) as follows:

a. Definition: "JAN Class S parts" as used in this authorization are space-quality military standard electronic parts as described by MIL-S-19500 for semiconductors and MIL-M-38510 for microcircuits.

b. \_\_\_\_\_ (Contractor/Subcontractor) is authorized to acquire JAN Class S parts in Federal Stock Code FSC-5961 (semiconductors) and FSC-5962 (microcircuits) from the Defense Electronics Supply Center (DESC). JAN Class S parts procured pursuant to this authorization shall be used solely in performance of the contract identified above.

All orders must be placed in accordance with the following procedures:

a. Orders will be placed in accordance with the Federal Standard Requisitioning and Issue Procedures (FEDSTRIP)/Military Standard Requisitioning and Issue Procedures (MILSTRIP) and this authorization. FEDSTRIP parallels the MILSTRIP of the Department of Defense. Orders shall include the assigned Activity Address Code (AAC). For information concerning procedures contact Defense Logistics Agency, Defense Electronics Supply Center, DESC-OMA, 1507 Wilmington Pike, Dayton, OH 45444-5000, phone: (513) 296-6005. For information concerning parts' data, contact the NASA JAN S Support Desk, 4700 Boston Way, Lanham, MD 20706, phone: (301) 731-8918.

b. Bills will not be issued by the Government supply source until after the supplies have been shipped. Payment shall be made promptly upon receipt of billings. Payment shall be addressed to:

The Defense Electronics Supply Center  
1507 Wilmington Pike  
Dayton, OH 45444-5000

This authority hereby granted is not transferable or assignable.

Use of the Federal Standard Requisitioning and Issue Procedures (FEDSTRIP) system is mandatory for all civilian agencies and their authorized contractors. An Activity Address Code (AAC) is required to obtain supplies and equipment through the FEDSTRIP system from GSA and DoD sources. AACs are assigned through this office and NASA Headquarters by the General Services Administration (GSA) Central Office. This authorization is provided for in FPRM 101-26.2, and DoD Activity Address Code, and the NASA Materials Inventory Handbook (NHB 4100.1B Draft).

This authorization expires upon termination or completion of the contract specified in the first paragraph above.

Contract Officer

MIL-STD-975L (NASA)

FORM LETTER 4

TO: NASA Headquarters  
NIE/Supply Systems Analyst

THRU: Installation AAC Coordinator

FROM: (NASA Contract Officer)

SUBJECT: Request for FEDSTRIP/MILSTRIP Activity Address Code for  
(Contractor/Subcontractor) under contract number \_\_\_\_\_

I have determined in accordance with the Federal Acquisition Regulation (FAR) 51.102, that it is in the Government's best interest to authorize the contractor to obtain supplies required in the performance of the subject contract from a government source under contract number \_\_\_\_\_.

The contractor's authorization includes use of the Federal Standard Requisitioning and Issue Procedures (FEDSTRIP)/Military Standard Requisitioning and Issue Procedures (MILSTRIP) to requisition JAN Class S parts in Federal Stock Code (FSC) 5961 (semiconductors) and FSC 5962 (microcircuits) from the Defense Logistics Agency (DLA), Defense Electronics Supply Center (DESC). Therefore, please obtain a FEDSTRIP/MILSTRIP Activity Address Code from the General Services Administration for the subject contractor.

The Determination and Findings (D & F) and the intended Letter of Authorization (LOA) to the contractor are enclosed. The duration of this authorization is from (start date) through (end date).

The contractor's complete name and address to which mail, freight, and billing documents are to be directed are as follows.

MAIL: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

FREIGHT: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

BILLING: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Please contact me at \_\_\_\_\_ (Contract Officer Information) \_\_\_\_\_, if further information is needed regarding this request.

Contract Officer

2 Enclosures

1. Determination and Findings
2. Letter of Authorization

MIL-STD-975L (NASA)

FORM LETTER 5

TO: (NASA Contract Officer)

FROM: (Prime Contractor)

SUBJECT: Request to obtain an Activity Address Code for our subcontractor \_\_\_\_\_  
under NASA contract number \_\_\_\_\_.

(Prime Contractor) certifies that (Subcontractor) is a subcontractor under the NASA contract  
(Contract Name) with NASA contract number \_\_\_\_\_. In order for (Subcontractor)  
to perform the necessary tasks to complete this program I request that you submit the attached letter  
with its enclosures to the Activity Address Code Coordinator for (NASA Installation).

Please contact me if further information is needed regarding this request.

(Prime Contract Administrator)

Attachment: Request for Activity Address Code  
Determination and Findings  
Letter of Authorization

**MIL-STD-975L (NASA)**

**CONCLUDING MATERIAL**

**Custodian:**

**NASA-NA**

**Preparing Activity:**

**NASA-NA**

**Project 59GP-K122**

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8 in block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE</b>	1. DOCUMENT NUMBER <b>MIL-STD-975 L</b>	2. DOCUMENT DATE (YYMMDD) <b>931210</b>
3. DOCUMENT TITLE <b>NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List</b>		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (include Area Code)	7. DATE SUBMITTED (YYMMDD)
	(1) Commercial  (2) AUTOVON (if applicable)	
8. PREPARING ACTIVITY		
a. NAME <b>NASA Parts Project Office</b>	b. TELEPHONE (include Area Code) (1) Commercial <b>(301) 731-8680</b> (2) AUTOVON	
c. ADDRESS (Include Zip Code) <b>Manager (310.A) NASA Parts Project Office Goddard Space Flight Center Greenbelt, MD 20771</b>	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703)756-2340 AUTOVON 289-2340	