MILITARY STANDARD

CAPACITORS, SELECTION AND USE OF

TO ALL HOLDERS OF MIL-STD-198E

1. THE FOLLOWING SECTION OF MIL-STD-198E HAS BEEN REVISED AND SUPERSEDES THE SECTION LISTED:

NEW SECTION	DATE	SUPERSEDED SECTION	DATE
701A		701	29 MAY 1984

2. RETAIN THIS NOTICE PAGE AND INSERT BEFORE THE TABLE OF CONTENTS.

3. Holders of MIL-STD-198E will verify that age than es and additions indicated above have been entered. The notice page will be retained as a check sheet. This issuance, together with appended pa es, is a separate publication. Each notice is to be retained by stocking points until the Military Standard Is completely revised or canceled.

Custodians:
Army - ER
Navy - EC
Air Force - 11

Review activities:
Army - MU
Navy - AS, OS
Air Force - 17, 85
DLA - ES

User activities:
Navy - CG, MC
Air Force - 19

Agent:
DSA - ES

Preparing activity:
Army - ER

(Project 5910-1522)

SECTION 701A

CAPACITORS, FIXED, ELECTROLYTIC (SOLID ELECTROLYTE), TANTALUM, ESTABLISHED RELIABILITY

STYLES CSR13, CSR91, AND CSR21

(APPLICABLE SPECIFICATION: MIL-C-39903)

1. SCOPE This section covers established reliability, insulated, tantalum, solid-electrolyte, fixed capacitors, hermetically sealed in metal cases. These capacitors have failure rate levels ranging from O. 1 percent per 1,000 hours to 0.0001 percent per 1,000 hours (1 FIT) 1/ at a 90-percent confidence level (Weibull distribution. When properly derated, These units will operate at +125°C.

2. APPLICATION INFORMATION.

2.1 Use. These capacitors are intended for use in equipment where a known order of reliability is required. These electrolytic capacitors are the most stable and most reliable electrolytic available, having a longer life characteristic than any of the other electrolytic capacitors. Because of their passive electrolyte being solid and dry, these capacitors are not temperature-sensitive; they have a lower capacitance-temperature characteristic than any of the other electrolytic capacitors. Their limitations are the relatively high leakage current, limited voltage range available (6 to 100 volts), and a maximum allowable reverse voltage of 15 percent of the rated dc voltage at +25°C to 1 percent at +125°C. CSR13 and CSR91 style capacitors are generally used where low-frequency pulsdting dc components are to be bypassed or filtered out.

CSR21 style capacitors provide more stable capacitance, equivalent series resistance, and impedance than other tantalum capacitors at high frequency. They have heavier ripple current ratings than other types which make them particularly suitable for applications such as output filtering for switching regulator power supplies. Such uses require low impedance in series with the capacitors (See figure 701.4) Solid tantalum capacitors are used in electronic equipment shere large capacitance values are required, where space is at a premium, and where there are significant quantities of shock and vibration. These capacitors are mainly designed for filter, by-pass, coupling, blocking, energy storage, and other low voltage dc applications (such as transistor circuit in missile, computer, and aircraft electronic equipment) where stability, size, weight, and shelf life are important factors. When designing transistor, timing, phase shifting, and vacuum-tube grid circuits the dissipation factor and power factor should be taken into consideration. Ror bypassing resistors, a ratio of bias resistance to capacitive reactance of 10 to 1 is usually allowed. Ratios up to 20 to 1 may be used in high-fidelity amplifier work or where space and economical considerations permit. In circuits where linear amplification is required, the amount of capacitive reactance shunting a cathode resistor will depend on the percentage of degenerative feedback desired.

These capacitors are available as polarized and nonpolarized tyt)es. Polarized types should have their cases at the same potential as the negative lead; they should be used only in dc circuits with polarity observed. Nonpolarized types should be used where reversal of potential occurs.

2.2 Construction. A porous tantalum pellet or wire serves as the anode of a solid tantalum capacitor: The surfaces of the anode are electrochemically coverted to an oxide of tantalum which serves as the dielectric. These surfaces are coated with an oxide semiconductor which is the working electrolyte in solid form. This oxide semiconductor establishes contact with all of the complex surfaces of the anodized pellet and is capable of healing imperfections of the tantalum oxide dielectric film.

1/ FIT = failure unit = one failure per 10^9 device hours.

Supersedes section 701 of 29 May 1984

NOTE: In high impedance circuits, momentary breakdowns (if present) will self-heal; however, in low impedance circuits, their self-healing characteristics under momentary breakdown of the dielectric film will be nonexistent. The large currents in low impedance circuits will cause permament damage to the capacitor.

2.3 Voltage rating. These capacitors have a voltage rating over a range of 6 to 100 volts.

2.4 Operating temperature range. These capacitors are suitable for operation over a temperature range of -55°C to +85°.

2.5 Voltage derating. When properly derated, these units may be operated over a temperature range of -55°C to +125°C. The derated voltage at +125°C is approximately 66 percent of the full rated voltage.

2.6 Revberse voltage. These capacitors are capable of withstanding peak voltages in teverse direction equal to 15 percent of their dc rating at +25°C; 10 percent at +55°C; 5 percent at +85°C; and 1 percent at +125°C.

2.7 Permissible ripple voltage. These capacitors may be operated with an impressed ripple (at) voltage provided the capacitors do flat exceed their heat-dissipation limits. Total heat-dissipation limits depend on the amibent operating temperature and the operating frequency. For example. A 10-µf capacitor of any voltage may be operated at 1.9 Vrms, 120 Hz, 25 C; or at 0.75 volts rms, 120 Hz, 125°C. (See figure 701-1.) When this same capacitor is subjected to a ripple frequency of 1,000 Hz, the permissible ripple voltage must be reduced by the ratio of permissible ac at 120 Hz (see figure 701-2) as follows: 1.9 times 9.47/1.9 equals 0.47 Vrms at 25°C, 1,000 Hz; or 0.75 times 0.47/1.9 equals 0.19 Vrms at 125°C, 1,000 Hz. The sum of the applied dc BIas voltage and the peak of the ac rIpple voltage should not exceed the dc rated voltage for the applicable ambient temperature. Permissible ac voltage determined from figures 701-1 and 701-2 may be applied when the dc voltage is zero or near zero, provided the negaeive peak of the ac voltage does not exceed the allowable reverse voltage limits of 1 percent of the rated voltage at +125°C. For CSR21 capacitors, ripple voltage is more often limited by restraints on reversal of voltage. Ripple current limitations are more significant because the degradation mode is thermal and must not be allowed to exceed the maximum levels specified for each rating, frequency, and ambient temperatllre. Figures 701-1 and 701-2 should be used with caution with regard to CSR21.

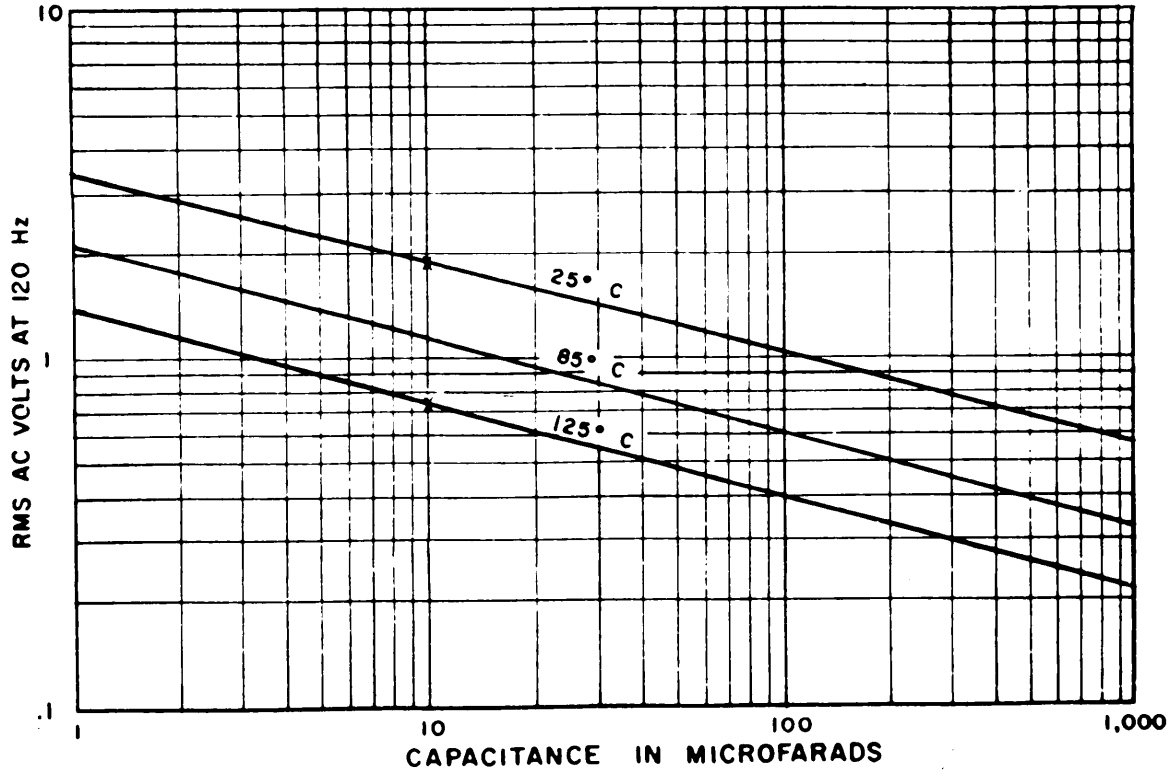


FIGURE 701-1. Permissible ripple voltsge versus capacitance and ambient temperature at 120 Hz.

701A (MIL-C-39003)

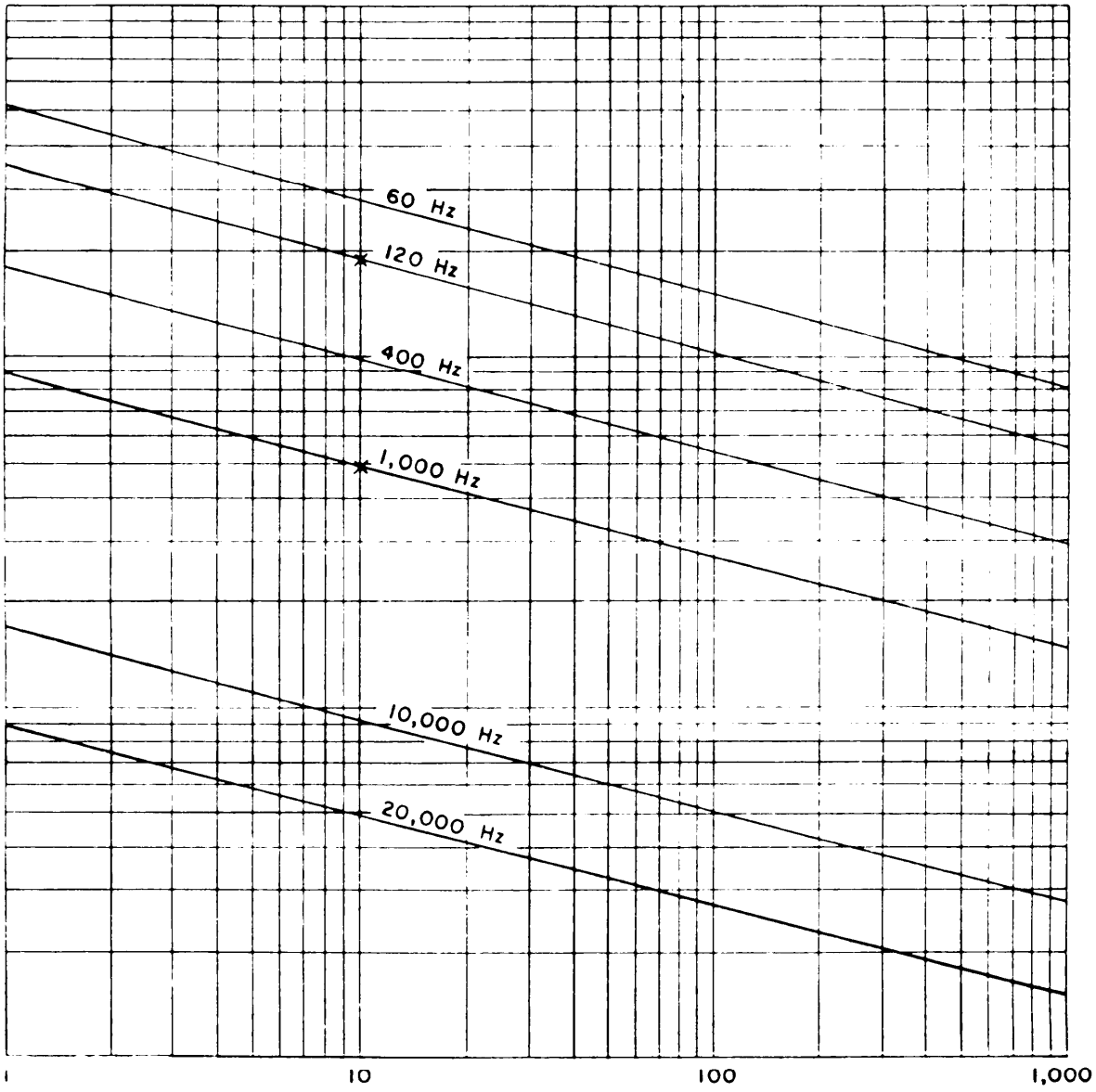


FIGURE 701-2, Permissible ripple voltage versus capacitance and frequency at 25°C.

2.8 Series and parallel networks:

2.8.1 Series. It is recommended that when these capacitors are connected in series, the maximum voltage across the network should not be greater than the lowest voltage rating of any capacitor in the network, or that voltage divider resistors be used to prevent over voltage on one or more units of the series capacitor group.

2.8.2 Parallel. 1-o obtain a higher capacitance than can be obtained from a single capacitor, a number of units may be connected in parallel. However, the sum of the pepeak ripple and the applied dc voltage should not exceed the dc working voltage of the unit with the lowest voltage rating. The connectiong leads of the parallel network should be large enough to carry the combined currents without reducing the effective capacitance due to series lead resistance.

2.9 Dielectric absorption. Dielectric absorption may be observed by the reappearance of potential across the capacitor agter it has been shorted and the short removed. This chatacteristic is important in RC timing circuits, triggering systemms, and phase-shift networks. The curves shoqn on figure 701-3 were established by charging capacitors for 1 hour at rated voltaghe and then discharging them through a dead short for 1 minute.

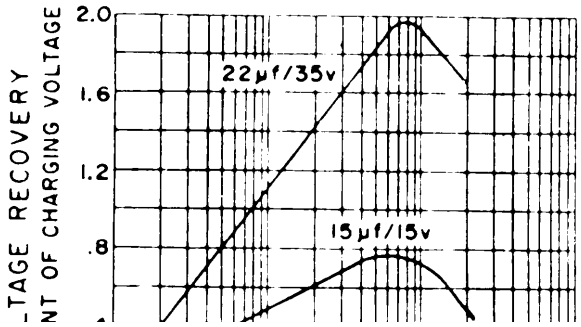


FIGURE 701-3. Typical dielectric absorption of solid-electrolyte tantalum capacitors at 25°C.

Voltage recovery was measured with a high-impedance electrometer at the intervals given on the curves. Increasing the ambient temperature shifts th4e curves to the left and decreases the amplitude but does not effect the shape. Shortening charge time, lengthening discharge time, or decreasing charging voltage results in reduction of the peak amplitude of the curve, but has little effect on ists shape or relative position.

2.10 Comparison with aluminum electrolytic. Tantalum solid electrolytic capacitors differ from aluminum electrolytics in several important aspects; namely, substantially indefinite shelf life, superior low temperature characteristics, complete freecom from electrolyte leakage, and higher operating temperatures. However, because tantalum electrolytic capacitors generally are more costly than aluminum electrolytic capacitors, consideration should be given to the use of aluminum electrolytic capacitors if their performance characteristics and physical sizes are suitable and if the application will permit.

2.11 Mounting. Supplementary mounting means should be used where the application of these capacitors involves vibration frequencies above 55 Hz.

2.12 Increased reliability. Failure rate is a function of temperature, applied voltage, and circuit impedance. Increased reliability may be obtained by derating the temperature and applied voltage and increasing circuit impedances.

DC leakage current increases when either voltage or temperature is increased; the rate of increase is greater at the higher values of voltage and temperature. A point can be reached where the dc leakage current will avalanche and attain proportions that will permanently damage the capacitor. Consequently, capacitors shoukd never be operated above their rated temperature and rated voltage for that temperature.

By increasing the circuit impedance, the leakage current is reduced. In life testing the solid tanatlum capacitor, the capacitance and dissipation factor are very stable over long periods of time and hence are not a suitable measure of deteriora-tion. Leakage current variation is a better indicator of capacitor conditon. In the life test in MIL-C-39007, a maximum impedance of 1 ohm is allowed. It is recommended that a minimum circuit impedance of 1 ohm per applied volt be utilized to attain improved reliability.

Styles CSR13, CSR21 and CSR91	
Circuit impedance Ohms/volt	Multiplying factor
1	1.0
0.9	1.04
0.8	1.14
0.6	1.43
0.5	1.61
0.4	1.82
0.3	2.18
0.2	2.68
0.15	3.21
0.10	4.29

FIGURE 701-4. Failure rate level curves.

2.13 Reliability rating: The reliability rating is identified by the following FR level symbols:

Symbol	Weibull FR level (%/1,000 hr) at 99% confidence level
B	0.1
C	0.01
D	0.001 (1 FIT)

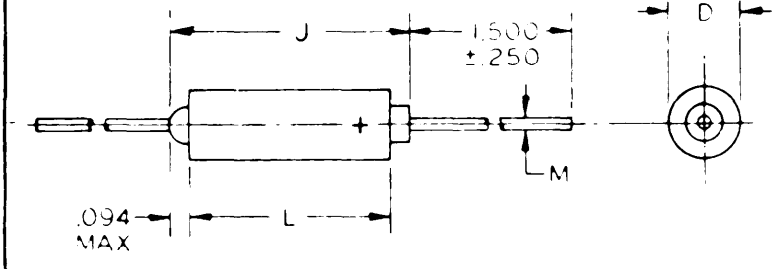
2.14 General. When additional experience and data are obtained relative to the reliability of these units, such information will be added herein.

3. ITEM IDENTIFICATION

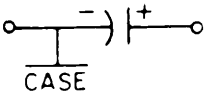
3.1 Standard capacitor. The standard capacitors available in this section are shown on figure 701-5. The figure fives the electrical characteristics, case sizes, failure rate levels, and military part numbers which are standard for design).

STYLE CSR13

NATO TYPE DESIGNATION NCS02
(PER NEPR NO. 17)



CIRCUIT DIAGRAM



Case size	Dimensions J Max	D -.016 -.015	L -.031	M -.002
A	.422	.135	.286	.020
B	.610	.185	.474	.020
C	.822	.289	.686	.025
D	.922	.351	.786	.025

INCHES	MM	INCHES	MM	INCHES	MM
.002	.05	.135	3.43	.474	12.04
.015	.38	.185	4.70	.610	15.49
.016	.41	.250	6.35	.686	17.42
.020	.51	.286	7.26	.786	19.96
.025	.64	.289	7.34	.822	20.88
.031	.79	.351	8.92	.922	23.42
.094	2.39	.422	10.72	1.500	38.10

NOTE:
The case insulation extends .015 inch (.38 mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it laps over the ends of the capacitor body.

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors.

STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1)

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at			Dissipation factor at		Case size	Dash number 39003/01- Failure rate level (%/1,000 hr)		
			+25°C	+85°C	+125°C	-55°C +25°C	+85°C +125°C		B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
6	5.6	5	.3	6.0	7.5	4	4	A	6001	7001	8001
6	5.6	10	.3	6.0	7.5	4	4	A	6002	7002	8002
6	6.8	5	.3	6.0	7.5	6	6	A	6003	7003	8003
6	6.8	10	.3	6.0	7.5	6	6	A	6004	7004	8004
6	6.8	20	.3	6.0	7.5	6	6	A	6005	7005	8005
6	47.0	5	1.5	24.0	30.0	6	6	B	6006	7006	8006
6	47.0	10	1.5	24.0	30.0	6	6	B	6007	7007	8007
6	47.0	20	1.5	24.0	30.0	6	6	B	6008	7008	8008
6	56.0	5	1.5	24.0	30.0	6	6	B	6009	7009	8009
6	56.0	10	1.5	24.0	30.0	6	6	B	6010	7010	8010
6	150.0	5	4.5	90.0	113.0	8	8	C	6011	7011	8011
6	150.0	10	4.5	90.0	113.0	8	8	C	6012	7012	8012
6	150.0	20	4.5	90.0	113.0	8	8	C	6013	7013	8013
6	180.0	5	5.5	110.0	138.0	8	8	C	6014	7014	8014
6	180.0	10	5.5	110.0	138.0	8	8	C	6015	7015	8015
6	270.0	5	6.5	130.0	163.0	8	8	D	6016	7016	8016
6	270.0	10	6.5	130.0	163.0	8	8	D	6017	7017	8017
6	330.0	5	7.5	150.0	188.0	8	8	D	6018	7018	8018
6	330.0	10	7.5	150.0	188.0	8	8	D	6019	7019	8019
6	330.0	20	7.5	150.0	188.0	8	8	D	6020	7020	8020
10	3.9	5	.3	6.0	7.5	4	4	A	6021	7021	8021
10	3.9	10	.3	6.0	7.5	4	4	A	6022	7022	8022
10	4.7	5	.4	7.0	8.8	4	4	A	6023	7023	8023
10	4.7	10	.4	7.0	8.8	4	4	A	6024	7024	8024
10	4.7	20	.4	7.0	8.8	4	4	A	6025	7025	8025
10	27.0	5	2.0	40.0	50.0	6	6	B	6026	7026	8026
10	27.0	10	2.0	40.0	50.0	6	6	B	6027	7027	8027
10	33.0	5	2.5	50.0	63.0	6	6	B	6028	7028	8028
10	33.0	10	2.5	50.0	63.0	6	6	B	6029	7029	8029
10	33.0	20	2.5	50.0	63.0	6	6	B	6030	7030	8030
10	39.0	5	2.5	50.0	63.0	6	6	B	6031	7031	8031
10	39.0	10	2.5	50.0	63.0	6	6	B	6032	7032	8032
10	82.0	5	4.0	80.0	100.0	6	6	C	6033	7033	8033
10	82.0	10	4.0	80.0	100.0	6	6	C	6034	7034	8034
10	100.0	5	5.0	100.0	125.0	8	8	C	6035	7035	8035
10	100.0	10	5.0	100.0	125.0	8	8	C	6036	7036	8036
10	100.0	20	5.0	100.0	125.0	8	8	C	6037	7037	8037
10	120.0	5	6.0	120.0	150.0	8	8	C	6038	7038	8038
10	120.0	10	6.0	120.0	150.0	8	8	C	6039	7039	8039
10	180.0	5	9.0	180.0	226.0	8	8	D	6040	7040	8040
10	180.0	10	9.0	180.0	225.0	8	8	D	6041	7041	8041
10	220.0	5	10	200.0	250.0	8	8	D	6042	7042	8042
10	220.0	10	10	200.0	250.0	8	8	D	6043	7043	8043
10	220.0	20	10	200.0	250.0	8	8	D	6044	7044	8044
15	2.7	5	.3	6.0	7.5	4	4	A	6045	7045	8045
15	2.7	10	.3	6.0	7.5	4	4	A	6046	7046	8046
15	3.3	5	.4	8.0	10.0	4	4	A	6047	7047	8047
15	3.3	10	.4	8.0	10.0	4	4	A	6048	7048	8048
15	3.3	20	.4	8.0	10.0	4	4	A	6049	7049	8049
15	18.0	5	2.0	35.0	44.0	6	6	B	6050	7050	8050

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1 - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at			Dissipation factor at		Case size	Dash number 39003/01- Failure rate level (%/1,000 hr)		
			+25°C	+85°C	+125°C	-55°C +25°C	+85°C +125°C		B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
15	18.0	10	2.0	35.0	44.0	6	6	B	6051	7051	8051
15	22.0	5	2.0	40.0	50.0	6	6	B	6052	7052	8052
15	22.0	10	2.0	40.0	50.0	6	6	B	6053	7053	8053
15	22.0	20	2.0	40.0	50.0	6	6	B	6054	7054	8054
15	56.0	5	4.0	80.0	100.0	6	6	C	6055	7055	8055
15	56.0	10	4.0	80.0	100.0	6	6	C	6056	7056	8056
15	68.0	5	5.0	100.0	125.0	6	6	C	6057	7057	8057
15	68.0	10	5.0	100.0	125.0	6	6	C	6058	7058	8058
15	68.0	20	5.0	100.0	125.0	6	6	C	6059	7059	8059
15	120.0	5	9.0	180.0	226.0	8	8	D	6060	7060	8060
15	120.0	10	9.0	180.0	226.0	8	8	D	6061	7061	8061
15	150.0	5	10.0	200.0	250.0	8	8	D	6062	7062	8062
15	150.0	10	10.0	200.0	250.0	8	8	D	6063	7063	8063
15	150.0	20	10.0	200.0	250.0	8	8	D	6064	7064	8064
20	1.2	5	.3	6.0	7.5	4	4	A	6065	7065	8065
20	1.2	10	.3	6.0	7.5	4	4	A	6066	7066	8066
20	1.5	5	.3	6.0	7.5	4	4	A	6067	7067	8067
20	1.5	10	.3	6.0	7.5	4	4	A	6068	7068	8068
20	1.5	20	.3	6.0	7.5	4	4	A	6069	7069	8069
20	1.8	5	.3	6.0	7.5	4	4	A	6070	7070	8070
20	1.8	10	.3	6.0	7.5	4	4	A	6071	7071	8071
20	2.2	5	.4	8.0	10.0	4	4	A	6072	7072	8072
20	2.2	10	.4	8.0	10.0	4	4	A	6073	7073	8073
20	2.2	20	.4	8.0	10.0	4	4	A	6074	7074	8074
20	8.2	5	1.0	20.0	25.0	6	6	B	6075	7075	8075
20	8.2	10	1.0	20.0	25.0	6	6	B	6076	7076	8076
20	10.0	5	1.5	30.0	38.0	6	6	B	6077	7077	8077
20	10.0	10	1.5	30.0	38.0	6	6	B	6078	7078	8078
20	10.0	20	1.5	30.0	38.0	6	6	B	6079	7079	8079
20	12.0	5	1.8	35.0	44.0	6	6	B	6080	7080	8080
20	12.0	10	1.8	35.0	44.0	6	6	B	6081	7081	8081
20	15.0	5	2.0	40.0	50.0	6	6	B	6082	7082	8082
20	15.0	10	2.0	40.0	50.0	6	6	B	6083	7083	8083
20	15.0	20	2.0	40.0	50.0	6	6	B	6084	7084	8084
20	27.0	5	2.5	50.0	63.0	6	6	C	6085	7085	8085
20	27.0	10	2.5	50.0	63.0	6	6	C	6086	7086	8086
20	33.0	5	3.5	70.0	88.0	6	6	C	6087	7087	8087
20	33.0	10	3.5	70.0	88.0	6	6	C	6088	7088	8088
20	33.0	20	3.5	70.0	88.0	6	6	C	6089	7089	8089
20	39.0	5	4.0	80.0	100.0	6	6	C	6090	7090	8090
20	39.0	10	4.0	80.0	100.0	6	6	C	6091	7091	8091
20	47.0	5	4.5	90.0	113.0	6	6	C	6092	7092	8092
20	47.0	10	4.5	90.0	113.0	6	6	C	6093	7093	8093
20	47.0	20	4.5	90.0	113.0	6	6	C	6094	7094	8094
20	56.0	5	5.5	110.0	138.0	6	6	D	6095	7095	8095
20	56.0	10	5.5	110.0	138.0	6	6	D	6096	7096	8096
20	68.0	5	7.0	140.0	175.0	6	6	D	6097	7097	8097
20	68.0	10	7.0	140.0	175.0	6	6	D	6098	7098	8098
20	68.0	20	7.0	140.0	175.0	6	6	D	6099	7099	8099
20	82.0	5	8.0	160.0	200.0	6	6	D	6100	7100	8100

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at -55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number 39003/01- Failure rate level (%/1,000 hr) B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
20	82.0	10	8.0	160.0	200.0	6	6	D	6101	7101	8101
20	100.0	5	10	200.0	250.0	8	8	D	6102	7102	8102
20	100.0	10	10	200.0	250.0	8	8	D	6103	7103	8103
20	100.0	20	10	200.0	250.0	8	8	D	6104	7104	8104
35	5.6	5	1.3	25.0	32.0	4	4	B	6105	7105	8105
35	5.6	10	1.3	25.0	32.0	4	4	B	6106	7106	8106
35	6.8	5	1.5	30.0	38.0	5	6	B	6107	7107	8107
35	6.8	10	1.5	30.0	38.0	6	6	B	6108	7108	8108
35	6.8	20	1.5	30.0	38.0	6	6	B	6109	7109	8109
35	22.0	5	4.0	80.0	100.0	6	6	C	6110	7110	8110
35	22.0	10	4.0	80.0	100.0	6	6	C	6111	7111	8111
35	22.0	20	4.0	80.0	100.0	6	6	C	6112	7112	8112
35	27.0	5	4.5	90.0	113.0	6	6	D	6113	7113	8113
35	27.0	10	4.5	90.0	113.0	6	6	D	6114	7114	8114
35	33.0	5	5.5	110.0	138.0	6	6	D	6115	7115	8115
35	33.0	10	5.5	110.0	138.0	6	6	D	6116	7116	8116
35	33.0	20	5.5	110.0	138.0	6	6	D	6117	7117	8117
35	39.0	5	7.0	140.0	175.0	6	6	D	6118	7118	8118
35	39.0	10	7.0	140.0	175.0	6	6	D	6119	7119	8119
35	47.0	5	8.0	160.0	200.0	6	6	D	6120	7120	8120
35	47.0	10	8.0	160.0	200.0	6	6	D	6121	7121	8121
35	47.0	20	8.0	160.0	200.0	6	6	D	6122	7122	8122
50	.0047	5	.3	5.0	6.3	2	4	A	6123	7123	8123
50	.0047	10	"	"	"	2	4	A	6124	7124	8124
50	.0047	20	"	"	"	2	4	A	6125	7125	8125
50	.0056	5	"	"	"	2	4	A	6126	7126	8126
50	.0056	10	"	"	"	2	4	A	6127	7127	8127
50	.0068	5	"	"	"	2	4	A	6128	7128	8128
50	.0068	10	"	"	"	2	4	A	6129	7129	8129
50	.0082	20	"	"	"	2	4	A	6130	7130	8130
50	.0082	5	"	"	"	2	4	A	6131	7131	8131
50	.0082	10	"	"	"	2	4	A	6132	7132	8132
50	.01	5	"	"	"	2	4	A	6133	7133	8133
50	.01	10	"	"	"	2	4	A	6134	7134	8134
50	.01	20	"	"	"	2	4	A	6135	7135	8135
50	.012	5	"	"	"	2	4	A	6136	7136	8136
50	.012	10	"	"	"	2	4	A	6137	7137	8137
50	.015	5	"	"	"	2	4	A	6138	7138	8138
50	.015	10	"	"	"	2	4	A	6139	7139	8139
50	.015	20	"	"	"	2	4	A	6140	7140	8140
50	.018	5	"	"	"	2	4	A	6141	7141	8141
50	.018	10	"	"	"	2	4	A	6142	7142	8142
50	.022	5	"	"	"	2	4	A	6143	7143	8143
50	.022	10	"	"	"	2	4	A	6144	7144	8144
50	.022	20	"	"	"	2	4	A	6145	7145	8145
50	.027	5	"	"	"	2	4	A	6146	7146	8146
50	.027	10	"	"	"	2	4	A	6147	7147	8147
50	.033	5	"	"	"	2	4	A	6148	7148	8148
50	.033	10	"	"	"	2	4	A	6149	7149	8149
50	.033	20	"	"	"	2	4	A	6150	7150	8150

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CRS13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at -55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number 39003/01- Failure rate level (%/1,000 hr) B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
50	.039	5	.3	5.0	6.3	2	4	A	6151	7151	8151
50	.039	10	"	"	"	2	4	A	6152	7152	8152
50	.047	5	"	"	"	2	4	A	6153	7153	8153
50	.047	10	"	"	"	2	4	A	6154	7154	8154
50	.047	20	"	"	"	2	4	A	6155	7155	8155
50	.056	5	"	"	"	2	4	A	6156	7156	8156
50	.056	10	"	"	"	2	4	A	6157	7157	8157
50	.068	5	"	"	"	2	4	A	6158	7158	8158
50	.068	10	"	"	"	2	4	A	6159	7159	8159
50	.068	20	"	"	"	2	4	A	6160	7160	8160
50	.082	5	"	"	"	2	4	A	6161	7161	8161
50	.082	10	"	"	"	2	4	A	6162	7162	8162
50	.1	5	"	"	"	2	4	A	6163	7163	8163
50	.1	10	"	"	"	2	4	A	6164	7164	8164
50	.1	20	"	"	"	2	4	A	6165	7165	8165
50	.12	5	"	"	"	2	4	A	6166	7166	8166
50	.12	10	"	"	"	2	4	A	6167	7167	8167
50	.15	5	"	"	"	2	4	A	6168	7168	8168
50	.15	10	"	"	"	2	4	A	6169	7169	8169
50	.15	20	"	"	"	2	4	A	6170	7170	8170
50	.18	5	"	"	"	2	4	A	6171	7171	8171
50	.18	10	"	"	"	2	4	A	6172	7172	8172
50	.22	5	"	"	"	2	4	A	6173	7173	8173
50	.22	10	"	"	"	2	4	A	6174	7174	8174
50	.22	20	"	"	"	2	4	A	6175	7175	8175
50	.27	5	"	"	"	2	4	A	6176	7176	8176
50	.27	10	"	"	"	2	4	A	6177	7177	8177
50	.33	5	"	"	"	2	4	A	6178	7178	8178
50	.33	10	"	"	"	2	4	A	6179	7179	8179
50	.33	20	"	"	"	2	4	A	6180	7180	8180
50	.39	5	"	"	"	2	4	A	6181	7181	8181
50	.39	10	"	"	"	2	4	A	6182	7182	8182
50	.47	5	"	"	"	2	4	A	6183	7183	8183
50	.47	10	"	"	"	2	4	A	6184	7184	8184
50	.47	20	"	"	"	2	4	A	6185	7185	8185
50	.56	5	"	"	"	2	4	A	6186	7186	8186
50	.56	10	"	"	"	2	4	A	6187	7187	8187
50	.68	5	"	"	"	2	4	A	6188	7188	8188
50	.68	10	"	"	"	2	4	A	6189	7189	8189
50	.68	20	"	"	"	2	4	A	6190	7190	8190
50	.82	5	"	"	"	2	4	A	6191	7191	8191
50	.82	10	.3	5.0	6.3	2	4	A	6192	7192	8192
50	1.0	5	.4	8.0	10.0	2	4	A	6193	7193	8193
50	1.0	10	.4	8.0	10.0	2	4	A	6194	7194	8194
50	1.0	20	.4	8.0	10.0	2	4	A	6195	7195	8195
50	1.2	5	.4	9.0	11.0	1	4	B	6196	7196	8196
50	1.2	10	.4	9.0	11.0	1	4	B	6197	7197	8197
50	1.5	5	.6	12.0	15.0	1	4	B	6198	7198	8198
50	1.5	10	.6	12.0	15.0	1	4	B	6199	7199	8199
50	1.5	20	.6	12.0	15.0	1	4	B	6200	7200	8200

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at			Dissipation factor at		Case size	Dash number 39003/01- Failure rate level (%/1,000 hr)		
			+25°C	+85°C	+125°C	-55°C +25°C	+85°C +125°C		B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
50	1.8	5	.7	14.0	18.0	4	4	B	6201	7201	8201
50	1.8	10	.7	14.0	18.0	4	4	B	6202	7202	8202
50	2.2	5	.8	17.0	22.0	4	4	B	6203	7203	8203
50	2.2	10	.8	17.0	22.0	4	4	B	6204	7204	8204
50	2.2	20	.8	17.0	22.0	4	4	B	6205	7205	8205
50	2.7	5	1.0	20.0	25.0	4	4	B	6206	7206	8206
50	2.7	10	1.0	20.0	25.0	4	4	B	6207	7207	8207
50	3.3	5	1.2	25.0	32.0	4	4	B	6208	7208	8209
50	3.3	10	1.2	25.0	32.0	4	4	B	6209	7209	8209
50	3.3	20	1.2	25.0	32.0	4	4	B	6210	7210	8210
50	3.9	5	1.5	30.0	38.0	4	4	B	6211	7211	8211
50	3.9	10	1.5	30.0	38.0	4	4	B	6212	7212	8212
50	4.7	5	1.7	35.0	44.0	4	4	B	6213	7213	8213
50	4.7	10	1.7	35.0	44.0	4	4	B	6214	7214	8214
50	4.7	20	1.7	35.0	44.0	4	4	B	6215	7215	8215
50	5.6	5	2.2	45.0	56.0	4	4	C	6216	7216	8216
50	5.6	10	2.2	45.0	56.0	4	4	C	6217	7217	8217
50	6.8	5	2.2	45.0	56.0	6	6	C	6218	7218	8218
50	6.8	10	2.2	45.0	56.0	6	6	C	6219	7219	8219
50	6.8	20	2.2	45.0	56.0	6	6	C	6220	7220	8220
50	8.2	5	2.5	50.0	63.0	6	6	C	6221	7221	8221
50	8.2	10	2.5	50.0	63.0	6	6	C	6222	7222	8222
50	10.0	5	2.5	50.0	63.0	6	6	C	6223	7223	8223
50	10.0	10	2.5	50.0	63.0	6	6	C	6224	7224	8224
50	10.0	20	2.5	50.0	63.0	6	6	C	6225	7225	8225
50	12.0	5	3.0	60.0	75.0	6	6	C	6226	7226	8226
50	12.0	10	3.0	60.0	75.0	6	6	C	6227	7227	8227
50	15.0	5	4.0	80.0	100.0	6	6	C	6228	7228	8228
50	15.0	10	4.0	80.0	100.0	6	6	C	6229	7229	8229
50	15.0	20	4.0	80.0	100.0	6	6	C	6230	7230	8230
50	18.0	5	4.5	90.0	113.0	6	6	C	6231	7231	8231
50	18.0	10	4.5	90.0	113.0	6	6	C	6232	7232	8232
50	22.0	5	5.5	110.0	138.0	6	6	D	6233	7233	8233
50	22.0	10	5.5	110.0	138.0	6	6	D	6234	7234	8234
50	22.0	20	5.5	110.0	138.0	6	6	D	6235	7235	8235
75	.1	5	.3	5.0	6.3	2	4	A	6236	7236	8236
75	.1	10	"	"	"	2	4	A	6237	7237	8237
75	.1	20	"	"	"	2	4	A	6238	7238	8238
75	.12	5	"	"	"	2	4	A	6239	7239	8239
75	.12	10	"	"	"	2	4	A	6240	7240	8240
75	.15	5	"	"	"	2	4	A	6241	7241	8241
75	.15	10	"	"	"	2	4	A	6242	7242	8242
75	.15	20	"	"	"	2	4	A	6243	7243	8243
75	.18	5	"	"	"	2	4	A	6244	7244	8244
75	.18	10	"	"	"	2	4	A	6245	7245	8245
75	.22	5	"	"	"	2	4	A	6246	7246	8246
75	.22	10	"	"	"	2	4	A	6247	7247	8247
75	.22	20	"	"	"	2	4	A	6248	7248	8248
75	.27	5	"	"	"	2	4	A	6249	7249	8249
75	.27	10	"	"	"	2	4	A	6250	7250	8250

FIGURE 701-5. Eswtablished reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE C5R13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +95°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at			Dissipation factor at		Case size	Dash number 39003/01- Failure rate level (%/1,000 hr)		
			+25°C	+85°C	+125°C	-55°C +25°C	+85°C +125°C		B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
75	.33	5	.3	5.0	6.3	2	4	A	6251	7251	8251
75	.33	10	"	"	"	2	4	A	6252	7252	8252
75	.33	20	"	"	"	2	4	A	6253	7253	8253
75	.39	5	"	"	"	2	4	A	6254	7254	8254
75	.39	10	"	"	"	2	4	A	6255	7255	8255
75	.47	5	"	"	"	2	4	A	6256	7256	8256
75	.47	10	"	"	"	2	4	A	6257	7257	8257
75	.47	20	"	"	"	2	4	A	6258	7258	8258
75	.56	5	"	"	"	2	4	A	6259	7259	8259
75	.56	10	"	"	"	2	4	A	6260	7260	8260
75	.68	5	"	"	"	2	4	A	6261	7261	8261
75	.68	10	"	"	"	2	4	A	6262	7262	8262
75	.68	20	"	"	"	2	4	A	6263	7263	8263
75	.82	5	"	"	"	2	4	B	6264	7264	8264
75	.82	10	"	"	"	2	4	B	6265	7265	8265
75	1.0	5	"	"	"	2	4	B	6266	7266	8266
75	1.0	10	"	"	"	2	4	B	6267	7267	8267
75	1.0	20	"	"	"	2	4	B	6268	7268	8268
75	1.2	5	"	"	"	4	4	B	6269	7269	8269
75	1.2	10	"	"	"	4	4	B	6270	7270	8270
75	1.5	5	.6	10.0	13.0	4	4	B	6271	7271	8271
75	1.5	10	.6	10.0	13.0	4	4	B	6272	7272	8272
75	1.5	20	.6	10.0	13.0	4	4	B	6273	7273	8273
75	1.8	5	.7	10.0	13.0	4	4	B	6274	7274	8274
75	1.8	10	.7	10.0	13.0	4	4	B	6275	7275	8275
75	2.2	5	.8	15.0	19.0	4	4	B	6276	7276	8276
75	2.2	10	.8	15.0	19.0	4	4	B	6277	7277	8277
75	2.2	20	.8	15.0	19.0	4	4	B	6278	7278	8278
75	2.7	5	1.0	15.0	19.0	4	4	B	6279	7279	8279
75	2.7	10	1.0	15.0	19.0	4	4	B	6280	7280	8280
75	3.3	5	1.2	20.0	25.0	4	4	B	6281	7281	8281
75	3.3	10	1.2	20.0	25.0	4	4	B	6282	7282	8282
75	3.3	20	1.2	20.0	25.0	4	4	B	6283	7283	8283
75	3.9	5	1.5	20.0	25.0	4	4	B	6284	7284	8284
75	3.9	10	1.5	20.0	25.0	4	4	B	6285	7285	8285
75	4.7	5	3.0	60.0	75.0	4	4	C	6286	7286	8286
75	4.7	10	3.0	60.0	75.0	4	4	C	6287	7287	8287
75	4.7	20	3.0	60.0	75.0	4	4	C	6288	7288	8288
75	5.6	5	3.0	60.0	75.0	4	4	C	6289	7289	8289
75	5.6	10	3.0	60.0	75.0	4	4	C	6290	7290	8290
75	6.8	5	5.0	100.0	125.0	6	6	C	6291	7291	8291
75	6.8	10	"	"	"	6	6	C	6292	7292	8292
75	6.8	20	"	"	"	6	6	C	6293	7293	8293
75	8.2	5	"	"	"	6	6	C	6294	7294	8294
75	8.2	10	"	"	"	6	6	C	6295	7295	8295
75	10.0	5	"	"	"	6	6	C	6296	7296	8296
75	10.0	10	"	"	"	6	6	C	6297	7297	8297
75	10.0	20	"	"	"	6	6	C	6298	7298	8298
75	12.0	5	"	"	"	6	6	D	6299	7299	8299
75	12.0	10	"	"	"	6	6	D	6300	7300	8300

FIGURE 701-5. Established reliabiltiy, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at -55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number 39003/01- Failure rate level (%/1,000 hr) B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
75	15.0	5	7.0	140.0	175.0	6	6	D	6301	7301	8301
75	15.0	10	7.0	140.0	175.0	6	6	D	6302	7302	8302
75	15.0	20	7.0	140.0	175.0	6	6	D	6303	7303	8303
100	.0047	5	.3	5.0	6.3	2	4	A	6304	7304	8304
100	.0047	10	"	"	"	2	4	A	6305	7305	8305
100	.0047	20	"	"	"	2	4	A	6306	7306	8306
100	.0056	5	"	"	"	2	4	A	6307	7307	8307
100	.0056	10	"	"	"	2	4	A	6308	7308	8308
100	.0068	5	"	"	"	2	4	A	6309	7309	8309
100	.0068	10	"	"	"	2	4	A	6310	7310	8310
100	.0068	20	"	"	"	2	4	A	6311	7311	8311
100	.0082	5	"	"	"	2	4	A	6312	7312	8312
100	.0082	10	"	"	"	2	4	A	6313	7313	8313
100	.01	5	"	"	"	2	4	A	6314	7314	8314
100	.01	10	"	"	"	2	4	A	6315	7315	8315
100	.01	20	"	"	"	2	4	A	6316	7316	8316
100	.012	5	"	"	"	2	4	A	6317	7317	8317
100	.012	10	"	"	"	2	4	A	6318	7318	8318
100	.015	5	"	"	"	2	4	A	6319	7319	8319
100	.015	10	"	"	"	2	4	A	6320	7320	8320
100	.015	20	"	"	"	2	4	A	6321	7321	8321
100	.018	5	"	"	"	2	4	A	6322	7322	8322
100	.018	10	"	"	"	2	4	A	6323	7323	8323
100	.022	5	"	"	"	2	4	A	6324	7324	8324
100	.022	10	"	"	"	2	4	A	6325	7325	8325
100	.022	20	"	"	"	2	4	A	6326	7326	8326
100	.027	5	"	"	"	2	4	A	6327	7327	8327
100	.027	10	"	"	"	2	4	A	6328	7328	8328
100	.033	5	"	"	"	2	4	A	6329	7329	8329
100	.033	10	"	"	"	2	4	A	6330	7330	8330
100	.033	20	"	"	"	2	4	A	6331	7331	8331
100	.039	5	"	"	"	2	4	A	6332	7332	8332
100	.039	10	"	"	"	2	4	A	6333	7333	8333
100	.047	5	"	"	"	2	4	A	6334	7334	8334
100	.047	10	"	"	"	2	4	A	6335	7335	8335
100	.047	20	"	"	"	2	4	A	6336	7336	8336
100	.056	5	"	"	"	2	4	A	6337	7337	8337
100	.056	10	"	"	"	2	4	A	6338	7338	8338
100	.068	5	"	"	"	2	4	A	6339	7339	8339
100	.068	10	"	"	"	2	4	A	6340	7340	8340
100	.068	20	"	"	"	2	4	A	6341	7341	8341
100	.082	5	"	"	"	2	4	A	6342	7342	8342
100	.082	10	"	"	"	2	4	A	6343	7343	8343
100	.1	5	"	"	"	2	4	A	6344	7344	8344
100	.1	10	"	"	"	2	4	A	6345	7345	8345
100	.1	20	"	"	"	2	4	A	6346	7346	8346
100	.12	5	"	"	"	2	4	A	6347	7347	8347
100	.12	10	"	"	"	2	4	A	6348	7348	8348
100	.15	5	"	"	"	2	4	A	6349	7349	8349
100	.15	10	"	"	"	2	4	A	6350	7350	8350

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed Capacitors - Continued.

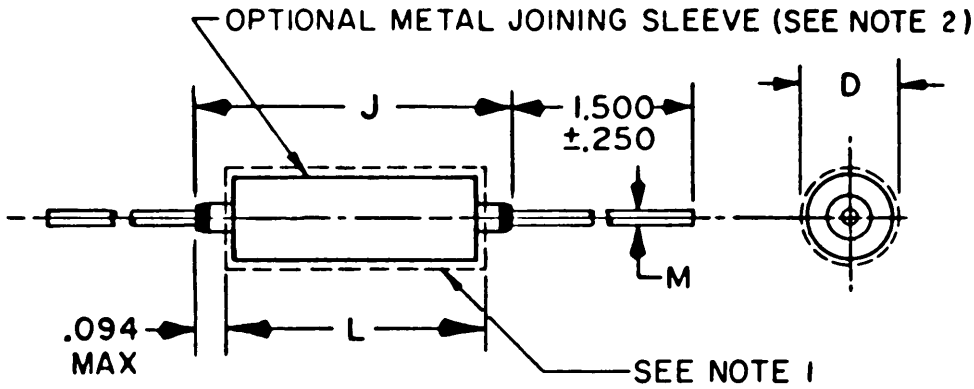
STANDARD CAPACITORS
STYLE CSR13 (MIL-C-39003/1) - CONTINUED

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

DC rated voltage	Cap. (nom)	Cap. tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at -55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number 39003/01- Failure rate level (%/1,000 hr) B (0.1)	C (0.01)	D (0.001)
volts	µF	percent	µA	µA	µA	percent	percent				
100	.15	20	.3	5.0	6.3	2	4	A	6351	7351	8351
100	.18	5	"	"	"	2	4	A	6352	7352	8352
100	.18	10	"	"	"	2	4	A	6353	7353	8353
100	.22	5	"	"	"	2	4	A	6354	7354	8354
100	.22	10	"	"	"	2	4	A	6355	7355	8355
100	.22	20	"	"	"	2	4	A	6356	7356	8356
100	.27	5	"	"	"	2	4	A	6357	7357	8357
100	.27	10	"	"	"	2	4	A	6358	7358	8358
100	.33	5	"	"	"	2	4	A	6359	7359	8359
100	.33	10	"	"	"	2	4	A	6360	7360	8360
100	.33	20	"	"	"	2	4	A	6361	7361	8361
100	.39	5	"	"	"	2	4	A	6362	7362	8362
100	.39	10	"	"	"	2	4	A	6363	7363	8363
100	.47	5	"	"	"	2	4	A	6364	7364	8364
100	.47	10	"	"	"	2	4	A	6365	7365	8365
100	.47	20	"	"	"	2	4	A	6366	7366	8366
100	.56	5	"	"	"	2	4	A	6367	7367	8367
100	.56	10	"	"	"	2	4	A	6368	7368	8368
100	.68	5	"	"	"	2	4	B	6369	7369	8369
100	.69	10	"	"	"	2	4	B	6370	7370	8370
100	.68	20	"	"	"	2	4	B	6371	7371	8371
100	.82	5	.4	"	"	2	4	B	6372	7372	8372
100	.82	10	.4	"	"	2	4	B	6373	7373	8373
100	1.0	5	.5	"	"	2	4	B	6374	7374	8374
100	1.0	10	.5	"	"	2	4	B	6375	7375	8375
100	1.0	20	.5	"	"	2	4	B	6376	7376	8376
100	1.2	5	.5	"	"	4	4	B	6377	7377	8377
100	1.2	10	.5	"	"	4	4	B	6378	7378	8378
100	1.5	5	.7	10.0	13.0	4	4	B	6379	7379	8379
100	1.5	10	.7	10.0	13.0	4	4	B	6380	7380	8380
100	1.5	20	.7	10.0	13.0	4	4	B	6381	7381	8381
100	1.8	5	.7	10.0	13.0	4	4	B	6382	7382	8382
100	1.8	10	.7	10.0	13.0	4	4	B	6383	7383	8383
100	2.2	5	.9	15.0	19.0	4	4	B	6384	7384	8384
100	2.2	10	.9	15.0	19.0	4	4	B	6385	7385	8385
100	2.2	20	.9	15.0	19.0	4	4	B	6386	7386	8386
100	2.7	5	1.1	15.0	19.0	4	4	B	6387	7387	8387
100	2.7	10	1.1	15.0	19.0	4	4	B	6388	7388	8388
100	3.3	5	1.5	30.0	38.0	6	6	C	6389	7389	8389
100	3.3	10	1.5	30.0	38.0	6	6	C	6390	7390	8390
100	3.3	20	1.5	30.0	38.0	6	6	C	6391	7391	8391
100	3.9	5	1.5	30.0	38.0	6	6	C	6392	7392	8392
100	3.9	10	1.5	30.0	38.0	6	6	C	6393	7393	8393
100	4.7	5	2.5	50.0	63.0	6	6	C	6394	7394	8394
100	4.7	10	2.5	50.0	63.0	6	6	C	6395	7395	8395
100	4.7	20	2.5	50.0	63.0	6	6	C	6396	7396	8396
100	5.6	5	2.5	50.0	63.0	6	6	C	6397	7397	8397
100	5.6	10	2.5	50.0	63.0	6	6	C	6398	7398	8398
100	6.8	5	2.5	50.0	63.0	6	6	C	6399	7399	8399
100	6.8	10	2.5	50.0	63.0	6	6	C	6400	7400	8400
100	6.8	20	2.5	50.0	63.0	6	6	C	6401	7401	8401

FIGURE 701-5. Estableished reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STYLE CSR91 (MIL-C-39003/4)



CIRCUIT DIAGRAM

Case size	Dimensions			
	L ±.031	D +.010 -.015	M ±.002	J Max
W	.575	.161	.020	.750
X	.955	.207	.020	1.130
Y	1.350	.314	.025	1.525
Z	1.550	.376	.025	1.725

INCHES	MM	INCHES	MM	INCHES	MM
.002	.05	.161	4.09	.955	24.26
.010	.25	.207	5.26	1.130	28.70
.015	.38	.250	6.35	1.350	34.29
.020	.51	.314	7.98	1.500	38.10
.025	.64	.376	9.55	1.525	38.74
.031	.79	.575	14.61	1.550	39.37
.094	2.39	.750	19.05	1.725	43.82

NOTES:
1. The case insulation shall extend .015(.38 mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
2. Two style CSR13 capacitors placed "back-to-back" (negative terminal-to-negative terminal).

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR91 (MIL-C-39003/4)

OPERATING TEMPERATURE RANGE -55° to +85°C (DERATED to +125°C)

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash numbers Failure rate level (%/1,000 hr) B (0.01)	C (0.01)	D (0.001)
Volts,NP	µF	percent	µA	percent				
6	2.8	10	.3	4	W	3001	4001	5001
6	3.4	10	.3	6	W	3002	4002	5002
6	3.4	20	.3	6	W	3003	4003	5003
6	23.0	10	1.5	6	X	3004	4004	5004
6	23.0	20	1.5	6	X	3005	4005	5005
6	28.0	10	1.5	6	X	3006	4006	5006
6	75.0	10	4.5	8	Y	3007	4007	5007
6	75.0	20	4.5	8	Y	3008	4008	5008
6	90.0	10	5.5	8	Y	3009	4009	5009
6	130.0	10	6.5	8	Z	3010	4010	5010
6	160.0	10	7.5	8	Z	3011	4011	5011
6	160.0	20	7.5	8	Z	3012	4012	5012
10	1.9	10	.3	4	W	3013	4013	5013
10	2.3	10	.4	4	W	3014	4014	5014
10	2.3	20	.4	4	W	3015	4015	5015
10	13.0	10	2.0	6	X	3016	4016	5016
10	16.0	10	2.5	6	X	3017	4017	5017
10	16.0	20	2.5	6	X	3018	4018	5018
10	19.0	10	2.5	6	X	3019	4019	5019
10	41.0	10	4.0	6	Y	3020	4020	5020
10	50.0	10	5.0	8	Y	3021	4021	5021
10	50.0	20	5.0	8	Y	3022	4022	5023
10	60.0	10	6.0	8	Y	3023	4023	5023
10	90.0	10	9.0	8	Z	3024	4024	5024
10	110.0	10	10.0	8	Z	3025	4025	5025
10	110.0	20	10.0	8	Z	3026	4026	5026
15	1.3	10	.3	4	W	3027	4027	5027
15	1.6	10	.4	4	W	3028	4028	5028
15	1.6	20	.4	4	W	3029	4029	5029
15	9.0	10	2.0	6	X	3030	4030	5030
15	11.0	10	2.0	6	X	3031	4031	5031
15	11.0	20	2.0	6	X	3032	4032	5032
15	28.0	10	4.0	6	Y	3033	4033	5033
15	34.0	10	5.0	6	Y	3034	4034	5034
15	34.0	20	5.0	6	Y	3035	4035	5035
15	60.0	10	9.0	8	Z	3036	4036	5036
15	75.0	10	10.0	8	Z	3037	4037	5037
15	75.0	20	10.0	8	Z	3038	4038	5038
20	.6	10	.3	4	W	3039	4039	5039
20	.75	10	.3	4	W	3040	4040	5040
20	.75	20	.3	4	W	3041	4041	5041
20	.9	10	.3	4	W	3042	4042	5042
20	1.1	10	.4	4	W	3043	4043	5043
20	1.1	20	.4	4	W	3044	4044	5044
20	4.1	10	1.0	6	X	3045	4045	5045
20	5.0	10	1.5	6	X	3046	4046	5046
20	5.0	20	1.5	6	X	3047	4047	5047

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR91 (MIL-C-39003/4) - Continued

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash numbers Failure rate level (%/1,000 hr) B (0.01)	C (0.01)	D (0.001)
Volts,WP	µF	percent	µA	percent				
20	6.0	10	1.8	6	X	3048	4048	5048
20	7.5	10	2.0	6	X	3049	4049	5049
20	7.5	20	2.0	6	X	3050	4050	5050
20	13	10	2.5	6	Y	3051	4051	5051
20	16	10	3.5	6	Y	3052	4052	5052
20	16	20	3.5	6	Y	3053	4053	5053
20	19	10	4.0	6	Y	3054	4054	5054
20	23	10	4.5	6	Y	3055	4055	5055
20	23	20	4.5	6	Y	3056	4056	5056
20	28	10	5.5	6	Z	3057	4057	5057
20	34	10	7.0	6	Z	3058	4058	5058
20	34	20	7.0	6	Z	3059	4059	5059
20	41	10	8.0	6	Z	3060	4060	5060
20	50	10	10.0	6	Z	3061	4061	5061
20	50	20	10.0	6	Z	3062	4062	5062
35	2.8	10	1.3	4	X	3063	4063	5063
35	3.4	10	1.5	6	X	3064	4064	5064
35	3.4	20	1.5	6	X	3065	4065	5065
35	11.0	10	4.0	6	Y	3066	4066	5066
35	11.0	20	4.0	6	Y	3067	4067	5067
35	13.0	10	4.5	6	Z	3068	4068	5068
35	16.0	10	5.5	6	Z	3069	4069	5069
35	16.0	20	5.5	6	Z	3070	4070	5070
35	19.0	10	7.0	6	Z	3071	4071	5071
35	23.0	10	8.0	6	Z	3072	4072	5072
35	23.0	20	8.0	6	Z	3073	4073	5073
50	.0023	10	.3	2	W	3074	4074	5074
50	.0023	20	.3	2	W	3075	4075	5075
50	.0028	10	.3	2	W	3076	4076	5076
50	.0034	10	.3	2	W	3077	4077	5077
50	.0034	20	.3	2	W	3078	4078	5078
50	.0041	10	.3	2	W	3079	4079	5079
50	.005	10	.3	2	W	3080	4080	5080
50	.005	20	.3	2	W	3081	4081	5081
50	.006	10	.3	2	W	3082	4082	5082
50	.0075	10	.3	2	W	3083	4083	5083
50	.0075	20	.3	2	W	3084	4084	5084
50	.009	10	.3	2	W	3085	4085	5085
50	.011	10	.3	2	W	3086	4086	5086
50	.011	20	.3	2	W	3087	4087	5087
50	.013	10	.3	2	W	3088	4088	5088
50	.016	10	.3	2	W	3089	4089	5089
50	.016	20	.3	2	W	3090	4090	5090
50	.019	10	.3	2	W	3091	4091	5091
50	.023	10	.3	2	W	3092	4092	5092
50	.023	20	.3	2	W	3093	4093	5093
50	.028	10	.3	2	W	3094	4094	5094
50	.034	10	.3	2	W	3095	4095	5095
50	.034	20	.3	2	W	3096	4096	5096
50	.041	10	.3	2	W	3097	4097	5097

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR91 (MIL-C-39003/4) - Continued

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash numbers Failure rate level (%/1,000 hr) B (0.01)	C (0.01)	D (0.001)
Volts,NP	µF	percent	µA	percent				
50	.05	10	.3	2	W	3098	4098	5098
50	.05	20	.3	2	W	3099	4099	5099
50	.06	10	.3	2	W	3100	4100	5100
50	.075	10	.3	2	W	3101	4101	5101
50	.075	20	.3	2	W	3102	4102	5102
50	.09	10	.3	2	W	3103	4103	5103
50	.11	10	.3	2	W	3104	4104	5104
50	.11	20	.3	2	W	3105	4105	5105
50	.13	10	.3	2	W	3106	4106	5106
50	.16	10	.3	2	W	3107	4107	5107
50	.16	20	.3	2	W	3108	4108	5108
50	.19	10	.3	2	W	3109	4109	5109
50	.23	10	.3	2	W	3110	4110	5110
50	.23	20	.3	2	W	3111	4111	5111
50	.28	10	.3	2	W	3112	4112	5112
50	.34	10	.3	2	W	3113	4113	5113
50	.34	20	.3	2	W	3114	4114	5114
50	.41	10	.3	2	W	3115	4115	5115
50	.50	10	.4	2	W	3116	4116	5116
50	.50	20	.4	2	W	3117	4117	5117
50	.60	10	.4	4	X	3118	4118	5118
50	.75	10	.6	4	X	3119	4119	5119
50	.75	20	.6	4	X	3120	4120	5120
50	.90	10	.7	4	X	3121	4121	5121
50	1.1	10	.8	4	X	3122	4122	5122
50	1.1	20	.8	4	X	3123	4123	5123
50	1.3	10	1.0	4	X	3124	4124	5124
50	1.5	10	1.2	4	X	3125	4125	5125
50	1.6	20	1.2	4	X	3126	4126	5126
50	1.9	10	1.5	4	X	3127	4127	5127
50	2.3	10	1.7	4	X	3128	4128	5128
50	2.3	20	1.7	4	X	3129	4129	5129
50	2.8	10	2.2	4	Y	3130	4130	5130
50	3.4	10	2.2	6	Y	3131	4131	5131
50	3.4	20	2.2	6	Y	3132	4132	5132
50	4.1	10	2.5	6	Y	3133	4133	5133
50	5.0	10	2.5	6	Y	3134	4134	5134
50	5.0	20	2.5	6	Y	3135	4135	5135
50	6.0	10	3.0	6	Y	3136	4136	5136
50	7.5	10	4.0	6	Y	3137	4137	5137
50	7.5	20	4.0	6	Y	3138	4138	5138
50	9.0	10	4.5	6	Y	3139	4139	5139
50	11.0	10	5.5	6	Z	3140	4140	5140
50	11.0	20	5.5	6	Z	3141	4141	5141
75	.34	10	.3	2	W	3142	4142	5142
75	.34	20	.3	2	W	3143	4143	5143
75	.41	10	.3	2	X	3144	4144	5144
75	.50	10	.4	2	X	3145	4145	5145
75	.50	20	.4	2	X	3146	4146	5146
75	.60	10	.4	4	X	3147	4147	5147

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR91 (MIL-C-39003/4) - Continued

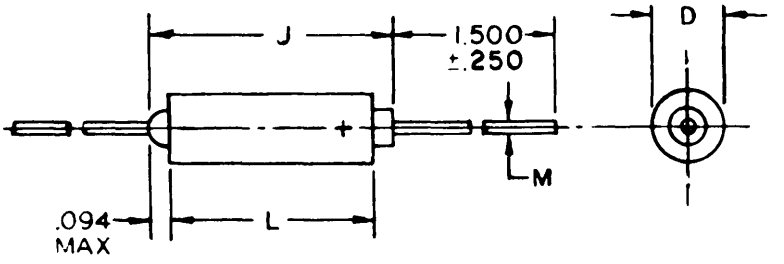
Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash numbers Failure rate level (%/1,000 hr) B (0.01)	C (0.01)	D (0.001)
Volts,NP	µF	percent	µA	percent				
75	.75	10	.6	4	X	3148	4148	5148
75	.75	20	.6	4	X	3149	4149	5149
75	.90	10	.7	4	X	3150	4150	5150
75	1.1	10	.8	4	X	3151	4151	5151
75	1.1	20	.8	4	X	3152	4152	5152
75	1.3	10	1.0	4	X	3153	4153	5153
75	1.6	10	1.2	4	X	3154	4154	5154
75	1.6	20	1.2	4	X	3155	4155	5155
75	1.9	10	1.5	4	X	3156	4156	5156
75	2.3	10	3.0	4	Y	3157	4157	5157
75	2.3	20	3.0	4	Y	3158	4158	5158
75	2.8	10	3.0	6	Y	3159	4159	5159
75	3.4	10	5.0	6	Y	3160	4160	5160
75	3.4	20	5.0	6	Y	3161	4161	5161
75	4.1	10	5.0	6	Y	3162	4162	5162
75	5.0	10	5.0	6	Y	3163	4163	5163
75	5.0	20	5.0	6	Y	3164	4164	5164
75	6.0	10	5.0	6	Z	3165	4165	5165
75	7.5	10	7.0	6	Z	3166	4166	5166
75	7.5	20	7.0	6	Z	3167	4167	5167
100	.0023	10	.3	2	W	3168	4168	5168
100	.0023	20	.3	2	W	3169	4169	5169
100	.0028	10	.3	2	W	3170	4170	5170
100	.0034	10	.3	2	W	3171	4171	5171
100	.0034	20	.3	2	W	3172	4172	5172
100	.0041	10	.3	2	W	3173	4173	5173
100	.005	10	.3	2	W	3174	4174	5174
100	.005	20	.3	2	W	3175	4175	5175
100	.006	10	.3	2	W	3176	4176	5176
100	.0075	10	.3	2	W	3177	4177	5177
100	.0075	20	.3	2	W	3178	4178	5178
100	.009	10	.3	2	W	3179	4179	5179
100	.011	10	.3	2	W	3180	4180	5180
100	.011	20	.3	2	W	3181	4181	5181
100	.013	10	.3	2	W	3182	4182	5182
100	.016	10	.3	2	W	3183	4183	5183
100	.016	20	.3	2	W	3184	4184	5184
100	.019	10	.3	2	W	3185	4185	5185
100	.023	10	.3	2	W	3186	4186	5186
100	.023	20	.3	2	W	3187	4187	5187
100	.028	10	.3	2	W	3188	4188	5188
100	.034	10	.3	2	W	3189	4189	5189
100	.034	20	.3	2	W	3190	4190	5190
100	.041	10	.3	2	W	3191	4191	5191
100	.05	10	.3	2	W	3192	4192	5192
100	.05	20	.3	2	W	3193	4193	5193
100	.06	10	.3	2	W	3194	4194	5194
100	.075	10	.3	2	W	3195	4195	5195
100	.075	20	.3	2	W	3196	4196	5196
100	.09	10	.3	2	W	3197	4197	5197
100	.11	10	.3	2	W	3198	4198	5198
100	.11	20	.3	2	W	3199	4199	5199

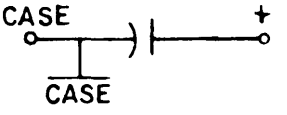
FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR91 (MIL-C-39003/4) - Continued

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash numbers Failure rate level (%/1,000 hr) B (0.01)	C (0.01)	D (0.001)
Volts,NP	µF	percent	µA	percent				
100	.13	10	.3	2	W	3200	4200	5200
100	.16	10	.3	2	W	3201	4201	5201
100	.16	20	.3	2	W	3202	4202	5202
100	.19	10	.3	2	W	3203	4203	5203
100	.23	10	.3	2	W	3204	4204	5204
100	.23	20	.3	2	W	3205	4205	5205
100	.28	10	.3	2	W	3206	4206	5206
100	.34	10	.3	2	X	3207	4207	5207
100	.34	20	.3	2	X	3208	4208	5208
100	.41	10	.4	2	X	3209	4209	5209
100	.50	10	.5	2	X	3210	4210	5210
100	.50	20	.5	2	X	3211	4211	5211
100	.60	10	.5	4	X	3212	4212	5212
100	.75	10	.7	4	X	3213	4213	5213
100	.75	20	.7	4	X	3214	4214	5214
100	.90	10	.7	4	X	3215	4215	5215
100	1.1	10	.9	4	X	3216	4216	5216
100	1.1	20	.9	4	X	3217	4217	5217
100	1.3	10	1.1	4	X	3218	4218	5218

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.





CIRCUIT DIAGRAM

Case Size	Dimensions			
	L ±.031	D ±.016 -.015	M ±.002	J Max
C	.686	.289	.025	.822
D	.786	.351	.025	.922

INCHES	MM	INCHES	MM	INCHES	MM
.002	.05	.094	2.39	.786	19.96
.015	.38	.250	6.35	.822	20.88
.016	.41	.289	7.34	.922	23.42
.025	.64	.351	8.92	1.500	38.10
.031	.79	.686	17.42		

NOTES:
1. Dimensions are in
2. Metric equivalents
   are based upon 1.00 inch = 25.4 mm.
3. The case insulation shall extend .015 (.38 mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
4. Lead length may be a minimum of 1 inch long for use in tape and reel automatic insertion equipment, when specified.

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitors - Continued.

STANDARD CAPACITORS
STYLE CSR21 (MIL-C-39003-9)

OPERATING TEMPRATURE RANGE -55°C to +85°C (DERATED TO +125°C)

DC rated voltage	Capacitance	Capacitance tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor 1 kHz +25°C	ESR 100 kHz +25°C (max)	Ripple current 40 kHz 25°C (max)	Derated ripple current 40 kHz 25°C (max)	Case size	Part No. M39003/09- Failure rate level for (%/1,000 hr) B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Ohms	A					
6	150	5	4.5	90	113	10	.065	3.3	2.0	C	2001	3001	4001
6	150	10	4.5	90	113	10	.065	3.3	2.0	C	2002	3002	4002
6	150	20	4.5	90	113	10	.065	3.3	2.0	C	2003	3003	4003
6	180	5	5.5	110	138	10	.060	3.4	2.4	C	2004	3004	4004
6	180	10	5.5	110	138	10	.060	3.4	2.4	C	2005	3005	4005
6	270	5	6.5	130	163	10	.050	4.1	3.4	D	2006	3006	4006
6	270	10	6.5	130	163	10	.050	4.1	3.4	D	2007	3007	4007
6	330	5	7.5	150	188	12	.045	4.3	3.8	D	2008	3008	4008
6	330	10	7.5	150	188	12	.045	4.3	3.8	D	2009	3009	4009
6	330	20	7.5	150	188	12	.045	4.3	3.8	D	2010	3010	4010
10	82	5	4	80	100	8	.085	2.9	1.8	C	2011	3011	4011
10	82	10	4	80	100	8	.085	2.9	1.8	C	2012	3012	4012
10	100	5	5	100	125	8	.075	3.0	2.2	C	2013	3013	4013
10	100	10	5	100	125	8	.075	3.0	2.2	C	2014	3014	4014
10	100	20	5	100	125	8	.075	3.0	2.2	C	2015	3015	4015
10	120	5	6	120	150	8	.070	3.2	2.5	C	2016	3016	4016
10	120	10	6	120	150	8	.070	3.2	2.5	C	2017	3017	4017
10	180	5	9	180	226	8	.060	3.7	3.4	D	2018	3018	4018
10	180	10	9	180	226	8	.060	3.7	3.4	D	2019	3019	4019
10	220	5	10	200	250	10	.055	3.9	3.4	D	2020	3020	4020
10	220	10	10	200	250	10	.055	3.9	3.4	D	2021	3021	4021
10	220	20	10	200	250	10	.055	3.9	3.4	D	2022	3022	4022
15	56	5	4	80	100	6	.100	2.6	1.8	C	2023	3023	4023
15	56	10	4	80	100	6	.100	2.6	1.8	C	2024	3024	4024
15	68	5	5	100	125	6	.095	2.7	2.2	C	2025	3025	4025
15	68	10	5	100	125	6	.095	2.7	2.2	C	2026	3026	4026
15	68	20	5	100	226	6	.095	2.7	2.2	C	2027	3027	4027
15	120	5	9	180	226	8	.070	3.5	2.8	D	2028	3028	4028
15	120	10	9	180	226	8	.070	3.5	2.8	D	2029	3029	4029
15	150	5	10	200	250	8	.065	3.6	3.1	D	2030	3030	4030
15	150	10	10	200	250	8	.065	3.6	3.1	D	2031	3031	4031
15	150	20	10	200	250	8	.065	3.6	3.1	D	2032	3032	4032
20	27	5	2.5	50	63	5	.145	2.2	1.2	C	2033	3033	4033
20	27	10	2.5	50	63	5	.145	2.2	1.2	C	2034	3034	4034
20	33	5	3.5	70	88	5	.130	2.3	1.4	C	2035	3035	4035
20	33	10	3.5	70	88	5	.130	2.3	1.4	C	2036	3036	4036
20	33	20	3.5	70	88	5	.130	2.3	1.4	C	2037	3037	4037
20	39	5	4.0	80	100	5	.120	2.4	1.7	C	2038	3038	4038
20	39	10	4.0	80	100	5	.120	2.4	1.7	C	2039	3039	4039
20	47	5	4.5	90	113	6	.110	2.5	1.8	C	2040	3040	4040
20	47	10	4.5	90	113	6	.110	2.5	1.8	C	2041	3041	4041

FIGURE 701-5. Established reliability, tantalum, solid electrolyte, fixed capacitor - Continued.

STANDARD CAPACITORS
STYLE CSR21 (MIL-C-39003-9) - Continued

OPERATING TEMPERATURE RANGE -55°C to +85°C (DERATED TO +125°C)

DC rated voltage	Capacitance	Capacitance tolerance	DC leakage at			Dissipation factor 1 kHz +25°C	ESR 100 kHz +25°C (max)	Ripple current 40 kHz 25°C (max)	Derated ripple current 40 kHz 25°C (max)	Case size	Part No. 39003/09- Failure rate level for (1,000 hr)		
			+25°C	+85°C	+125°C						S	C	D
											0.1	0.01	0.001
Volts	µF	Percent	µA	µA	µA	Percent	Ohms	A					
20	47	20	4.5	90	113	6	.110	2.5	1.8	C	2042	3042	4042
20	56	5	5.5	110	138	6	.100	2.9	2.2	D	2043	3043	4043
20	56	10	5.5	110	138	6	.100	2.9	2.2	D	2044	3044	4044
20	68	5	7	140	175	6	.095	3.0	2.4	D	2045	3045	4045
20	68	10	7	140	175	6	.095	3.0	2.4	D	2046	3046	4046
20	68	20	7	140	175	5	.095	3.0	2.4	D	2047	3047	4047
20	82	5	8	160	200	6	.085	3.1	2.5	D	2048	3048	4048
20	82	10	8	160	200	6	.085	3.1	2.5	D	2049	3049	4049
20	100	5	10	200	250	8	.075	3.3	2.5	D	2050	3050	4050
20	100	10	10	200	250	8	.075	3.3	2.5	D	2051	3051	4051
20	100	20	10	200	250	8	.075	3.3	2.5	D	2052	3052	4052
35	22	5	4	80	100	4	.160	2.1	1.5	C	2053	3053	4053
35	22	10	4	80	100	4	.160	2.1	1.5	C	2054	3054	4054
35	22	20	4	80	100	4	.160	2.1	1.5	C	2055	3055	4055
35	27	5	4.5	90	113	4	.145	2.4	1.9	D	2056	3056	4056
35	27	10	4.5	90	113	4	.145	2.4	1.9	D	2057	3057	4057
35	33	5	5.5	110	138	5	.130	2.5	1.9	D	2058	3058	4058
35	33	10	5.5	110	138	5	.130	2.5	1.9	D	2059	3059	4059
35	33	20	5.5	110	138	5	.130	2.5	1.9	D	2060	3060	4060
35	39	5	7	140	175	5	.120	2.6	2.0	D	2061	3061	4061
35	39	10	7	140	175	5	.120	2.6	2.0	D	2062	3062	4062
35	47	5	8	160	200	5	.110	2.7	2.2	D	2063	3063	4063
35	47	10	8	160	200	5	.110	2.7	2.2	D	2064	3064	4064
35	47	20	8	160	200	5	.110	2.7	2.2	D	2065	3065	4065
50	5.6	5	2.2	45	56	3	.300	1.5	.6	C	2066	3066	4066
50	5.6	10	2.2	45	56	3	.300	1.5	.6	C	2067	3067	4067
50	6.8	5	2.2	45	56	3	.275	1.6	.7	C	2068	3068	4068
50	6.8	10	2.2	45	56	3	.275	1.6	.7	C	2069	3069	4069
50	6.8	20	2.2	45	56	3	.275	1.6	.7	C	2070	3070	4070
50	8.2	5	2.5	50	63	3	.250	1.6	.9	C	2071	3071	4071
50	8.2	10	2.5	50	63	3	.250	1.6	.9	C	2072	3072	4072
50	10	5	2.5	50	63	3	.230	1.7	1.1	C	2073	3073	4073
50	10	10	2.5	50	63	3	.230	1.7	1.1	C	2074	3074	4074
50	10	20	2.5	50	63	3	.230	1.7	1.1	C	2075	3075	4075
50	12	5	3	60	75	3	.210	1.8	1.3	C	2076	3076	4076
50	12	10	3	60	75	3	.210	1.8	1.3	C	2077	3077	4077
50	15	5	4	80	100	3	.190	1.9	1.4	C	2078	3078	4078
50	15	10	4	80	100	3	.190	1.9	1.4	C	2079	3079	4079
50	15	20	4	80	100	3	.190	1.9	1.4	C	2080	3080	4080
50	18	5	4.5	90	113	4	.175	2.0	1.4	C	2081	3081	4081
50	18	10	4.5	90	113	4	.175	2.0	1.4	C	2082	3082	4082
50	22	5	5.5	110	138	4	.160	2.3	1.7	D	2083	3083	4083
50	22	10	5.5	110	138	4	.160	2.3	1.7	D	2084	3084	4084
50	22	20	5.5	110	138	4	.160	2.3	1.7	D	2085	3085	4085

FIGURE 701-5. Established reliability, tantalum, solid electrolyte fixed capacitor - Continued.

APPLICATION NOTES:

1. Rated ripple current is the rms value of the maximum allowable alternating current of a specified frequency, at which the capacitor may be operated continuously at a specified temperature. Derate ripple current for ambient temperature in accordance with the curve given on figure 701-6.

2. For derating for frequency, use the derated ripple currents at 1 kHz given in table I. Below 1 kHz these same currents are applicable provided the peak ambient voltage does not result in voltage reversal or exceeding the rated dc voltage. Between 1 kHz and 40 kHz the ripple current may be interpolated linearly with frequency. The ripple current at 40 kHz is applicable at and above 40 kHz.

3. Although CSR21 capacitors are rated to operate with the specified levels of rms ripple current, they are basically polar devices. Care must be exercised to assure that sufficient dc bias is applied to prevent ac voltage reversal in excess of specified reverse voltage ratings.

4. When two or more CSR21 capacitors are used in parallel, ripple current may not divide equally as a result of unequal ESR's of the capacitors, It is imperative that each capacitor be operated within the specified limit of rms ripple current.

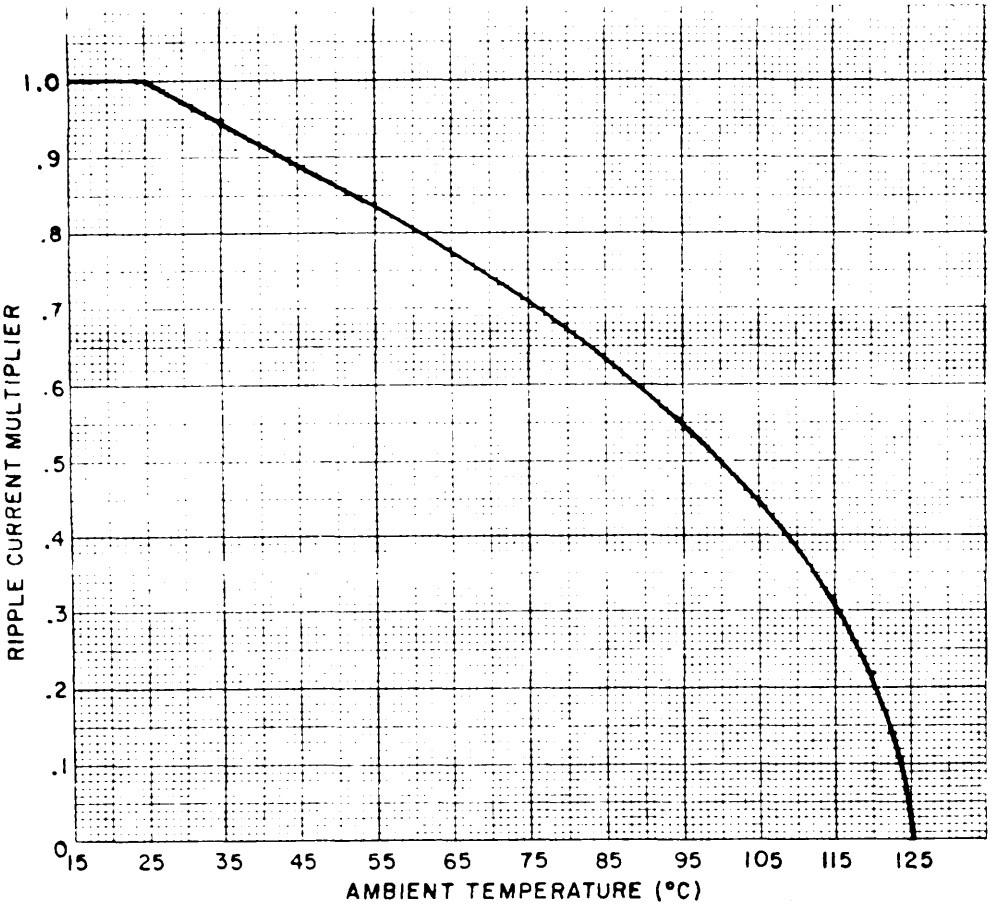


FIGURE 701-6. Ripple current derating with respect to temperature.