

**NOTICE OF  
CHANGE****INCH-POUND**MIL-STD-976B  
NOTICE 2  
31 August 1990

The documentation and process conversion measures necessary to comply with this notice shall be completed by 31 October 1990

**MILITARY STANDARD****CERTIFICATION REQUIREMENTS FOR JAN MICROCIRCUITS**

TO ALL HOLDERS OF MIL-STD-976B:

1. THE FOLLOWING PAGES OF MIL-STD-976B HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
15	31 August 1990	15	12 February 1988
16	31 August 1990	16	12 February 1988
16a	31 August 1990	NEW	---

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

3. Holders of MIL-STD-976B will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military standard is completely revised or canceled.

NOTE: The margins of this notice are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous notice were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous notice.

**CONCLUDING MATERIAL****Custodians:**

Army - ER  
Navy - EC  
Air Force - 17  
NASA - NA

**Preparing activity:**

NASA - NA

**Agent:**

DLA - ES

**Review activities:**

Army - AR, MI  
Navy - SH  
Air Force - 19, 85, 99  
DLA - ES

(Project 5962-1224)

**User activities:**

Army - SM  
Navy - AS, CG, MC, OS

AMSC N/A

FSC 5962

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MIL-STD-976B  
NOTICE 2

As an alternative to the requirements of 5.3.9.1 and 5.3.9.2, data may be presented to the qualifying activity which demonstrates the stability of the metallization and contacts of actual devices from the lines to be certified under temperature and high current density stresses. The qualifying activity shall evaluate the manufacturer's test procedures and results for acceptability.

**5.3.9.1 Effect of time and temperature.** Data shall be presented to the qualifying activity for each metallization type used on the line(s) to be certified and to demonstrate the stability of contact resistance under accelerated time and temperature conditions. If more than one conductor-contact type is used (e.g., metal-polysilicon, metal-multilayer, polysilicon-silicon, etc.), data shall be presented for each conductor-contact type.

An acceptable test would consist of subjecting the conductor-contact test patterns to a storage temperature of 200° for 2000 hours. Each test pattern should contain at least 60 conductor-contacts of each type, unless otherwise specified.

Five test patterns or actual devices from each of five different deposition runs shall be used for the test. The contact resistance shall be measured before and after the temperature stress test and the data shall be recorded. The manufacturer's test plan, procedures, failure criteria, and test results shall be reviewed for acceptability by the qualifying activity.

Equivalent time and temperature tests are allowed when approved by the qualifying activity.

**5.3.9.2 Effect of current.** Data shall be presented to the qualifying activity for each conductor type and type of deposition system to be certified in order to demonstrate absence of electromigration under current and temperature accelerated test conditions.

Test patterns may be used which contain metallization crossovers, contacts, etc. These test patterns are laid out using design rules (layouts, dimensions, etc.) representative of the worst case design rules used in the production line to be certified.

Five test patterns or actual devices containing each conductor type from five different deposition runs for each metallization equipment type (E-beam, filament, etc.) on the line to be certified shall be tested and the data recorded for review by the qualifying activity. The manufacturer's test plan, procedures, failure criteria, and test results shall be reviewed for acceptability by the qualifying activity.

Equivalent time and temperature tests are allowed when approved by the qualifying activity.

**5.3.10 Inspection by scanning electron microscope (SEM).** A continuing SEM program shall be established to ensure control over metallization at oxide window edges. This program shall consist of the SEM process monitor in accordance with 5.2.17.5 except that the SEM criteria shall be in accordance with method 2018 of MIL-STD-883. SEM wafer lot acceptance data, when available, may be used instead of this monitor.

SEM photographs shall be presented demonstrating capability of meeting the requirements of method 2018, of MIL-STD-883. The angles from which the photographs were taken shall be varying and they shall be from a minimum of four lots per month manufactured over a period of at least the preceding six months. These photographs should include, as a minimum, views of the deepest oxide step covered by metallization lines. These photographs should confirm that the metallization process meets the SEM requirements of method 2018, of MIL-STD-883.

Supersedes page 15 of MIL-STD-976B

MIL-STD-976B  
NOTICE 2

The manufacturer's SEM operator(s), who make assessments in accordance with method 2018 of MIL-STD-883, shall satisfy the following criteria: (1) demonstrate the ability to attain the required resolution as specified in paragraph 2 of method 2018, of MIL-STD-883; (2) clearly identify all defects in accordance with the documented library of defects; and (3) receive training and retraining on a yearly (minimum) basis.

**5.3.11 Current density verification.** Assumptions for thinning or narrowing shall be verified at initial qualification and upon any major change in design or process that affects worst case current density or upon the request of the qualifying activity.

**5.3.12 Control of materials for assembly area.** The criteria, sampling requirements, acceptable control limits, and handling which reflect the higher reliability requirements of Class S shall be identified. As a minimum, these requirements shall include:

- a. Formation of special inspection lots for critical materials and for packages.
- b. Sample assembly of critical items into packages and their acceptability.

**5.3.13 Effect of time and temperature on electrical resistance and strength of bonds.** Evidence shall be presented to demonstrate the mechanical and electrical integrity of the bonds with respect to such factors as: (1) flexing of bond wire due to thermal expansion; and (2) microcracks or microvoids at the wafer interface.

\* **5.3.14 Die attachment.** The die strength test shall be performed for both eutectic and adhesive (e.g., epoxy, metal-glass) die attach. For eutectic die attach, the die shear strength test shall be performed at the start and finish of operator change, package type change, die size change, and after every two hours of production. A die shear strength test, in accordance with method 2019 of MIL-STD-883, shall be conducted on a minimum of two devices from each die attach station. For adhesive die attach techniques (e.g., metal-glass, epoxy), each lot or subplot die attached on a single machine and processed as a single group through final adhesive cure shall be tested either to the die strength test method 2019 or the substrate attach strength test method 2027 on a randomly selected sample of 0.5 percent of the lot (subplot) size, or two devices, whichever is greater. In the event that the die shear is less than the value of figure 4 of method 2019 or that the attach strength is less than that allowed by method 2027 of MIL-STD-883, the die attach station/process shall be closed down until tests show that satisfactory operation has been re-established. A procedure for the traceability, recovery, and disposition of all units die attached since the last successful die shear test or substrate attach strength test shall be required. This procedure shall provide for sample size, reject criteria, and disposition of failed lots. These tests may be conducted on the same samples used for the wire bond strength test.

MIL-STD-976B  
NOTICE 2

5.3.15 Wire bond strength test. The manufacturer's wire bond strength test shall be conducted on each sample in accordance with the requirements of MIL-STD-883, method 2011, test condition D. The manufacturer shall submit the sampling plan to the qualifying activity for approval, which shall include start and completion of shifts, frequency of sampling during the shift, change of operators, spools, packages, wire size, lot size, and other related factors (e.g. bond pull testing two devices approximately every two hours of production). Pull strength data shall be read, recorded, and maintained in accordance with the specified requirements. Data shall include the force (grams) required for failure, the physical location of the point of failure, and the nature of the failure. In the event that any bond strength is less than the pre-seal value given in table 1, method 2011 of MIL-STD-883, the bonder shall be inactivated immediately and not returned to production until tests show that satisfactory operation has been re-established. A procedure for the traceability, recovery, and disposition of all units bonded since the last successful bond strength test shall be required. This procedure shall provide for sample size, number of bonds and device to be tested, reject criteria, and disposition of failed lots.

5.3.16 Internal visual inspection. The circuits shall be visually inspected using adequate visual aids, inspection criteria, storage, and equipment. Handling and storage shall be documented in accordance with method 2010 (condition A) of MIL-STD-883.

5.3.17 Internal water vapor levels. Documentation from a test laboratory that has been granted suitability from DESC shall be provided at the time of the audit showing the actual internal water vapor level of devices for a package type for which qualification is desired. These devices shall have been processed and screened on the same line which is being evaluated for class S certification.

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