

Requirements for All Class Levels

DLA Land and Maritime Certified Manufacturing and Test Flow

DLA performs periodic audits of the manufacturer to verify that the manufacturing processes are controlled.

This includes:

- Documented processes
- Control of critical parameters
- Trained operators
- All required testing is performed correctly

DLA Land and Maritime Certified Quality System

Audits to verify the manufacturer's quality system.

This includes:

- Document & configuration control
- Change control & notification of customers of major changes
- Conversion of customer requirements into controlled manufacturing documentation & tools
- Designed verification
- Product release process
- Self audit
- Corrective action system
- System for procurement & acceptance of piece parts

Listed Processes and Materials Qualified to MIL-PRF-38534

All processes and materials are tested to ensure mechanical integrity and performance longevity.

Qualification testing for Classes G, H, and K are the same. Once processes and materials are qualified using test vehicles for Class G or Class H, it is not necessary to repeat the testing for each additional class level.

Standard Qualification of Processes and Material

Subgroup 1

- External visual
- Temperature cycling -65°C to +150°C, 100 cycles
- Mechanical shock 1,500 G, Y1, 5 cycles
- Constant acceleration 5,000 G
- Random vibration when required
- Seal testing
- PIND
- Visual examination
- End point electricals

Subgroup 1 parts then go on to subgroups 3 and 4

Subgroup 2

- Life test; default 1000 hours (per TTR, M38534; Class K max +125°C)
- 496 hrs @ +135°C (see TTR, M38534, customer guidance)

Subgroup 3

- Internal gas analysis, 5000 ppm moisture

Subgroup 4

- Internal visual and mechanical
- Wirebond strength
- Element shear

Class K, H, and G

Class K - Space Applications

Maximum Risk Mitigation

This class level is intended for applications where failure is not acceptable, and where repair is not feasible, such as satellite and other unmanned equipment.

Basic design and manufacturing are qualified and controlled.

- Additional testing is performed to increase confidence in the part
- All changes to the product, manufacturing processes, or materials require customer notification
- Specified process monitor for package seal
- Modified wirebond process monitor
- NASA and Air Force representatives attend the Class K audits
- Production lots require homogeneity of component lots, except for rework
- Failure analysis required for catastrophic burn-in failures

Standard temperature range: -55°C to +125°C, Other ranges can be specified



Class H - Military Applications: Land, Sea, or Air

Critical Performance

This class level is intended for military applications, where a high confidence of performance is critical.

This class is suitable for rugged environments.

Standard temperature range: -55°C to +125°C, Other ranges can be specified



Class G - Military Applications: Land, Sea, or Air

High Performance

This class level is intended for military applications. This class does not have element evaluation and periodic inspection, therefore there is a lower confidence level.

This class is appropriate for routinely replaced and/or repairable equipment.

This class is suitable for rugged environments.

Standard temperature range: -40°C to +85°C, Other ranges can be specified

Note for Class G: The manufacturer certifies that the parts are capable of passing the periodic testing and Group C of Class H. The manufacturer establishes a flow of element evaluation, periodic testing, and group C that will be performed in order to be confident enough to certify that parts can pass the testing.



Class E and D

Class E - Exception, Military or Space Applications

Class E can be:

“K”- like, “H”- like, or “G”- like

Class E must always have a reference class (K, H, or G) and then exceptions listed.

Most military and space SCDs can be more easily covered as Class E.



Examples of Class E - Not Intended to be Recommendations

Missile Application: Class H except the temperature cycle temperatures are -55°C to 125°C. *This is an exception because of an internal element that cannot take the -65°C to +150°C.*

Ground Test Equipment: Class H except element evaluation is not required. *Reduce cost and lead time.*

Adding requirements to a class level does not make it non-compliant to the class. *Class H + PIND screen is still a Class H part.*

Note: Change your 40-page SCD to 10 pages by taking out all of the paragraphs copied from the MIL-PRF-38534 and replace them with the nearest class level and list only the exceptions.

Class D - Military Applications

Quality Level Manufacturer Specific

This class level is defined by the manufacturer, who publishes their QML Testing Flow.

Class D could:

- Be non-hermetic
- Use test methods from a different standard
- Use a high-rel packaging technology not addressed in MIL-PRF-38534
- Be a commercial part modified or tested to meet a military application

Standard temperature range: 0°C to +70°C, Other ranges can be specified

Testing Requirements

No testing is specified for Class D for the following: Element Evaluation, Hybrid Microcircuit 100% Testing, Periodic Testing, and Group C.

Qualification of Processes and Materials: The manufacturer must supply data to support that the processes and materials are capable of meeting the performance they specify.

The manufacturer must publish the performance expectation and the test flow used to validate product.



Testing Requirements Class K, H, & G

Standard Microcircuit Drawing (SMD)

Hybrid Microcircuits for Military & Space

Note: Class G requirements are areas in blue.
Class H requirements include Class G, and all areas in black.
Class K requirements include Class G & Class H, and all areas in red.

Materials and Components - Element Evaluation

Active Elements (every wafer lot)

- 100% high magnification visual
- 100% probe at room temperature
- Samples assembled and put through standard environmental screening, including burn-in and electrical at min, max, and room temperature
- Life Test
- Scanning electron microscope (SEM)
- Wire bond pull

Passive Elements (capacitors, resistors, inductors - per component manufacturing lot)

- 100% visual
- 100% electrical on select parameters at room temperature
- Sample screening requirements, including voltage conditioning and full electrical at room temperature
- Wire bond pull

Packages (samples per plating lot, Group D if performed in-line)

- Physical dimensions
- Thermal shock, high temperature bake, lead integrity, seal
- Solderability
- Salt atmosphere (one time for Class H, every six months for Class K)
- Metal package isolation

Hybrid Microcircuit 100% Testing

- Non-destructive bond pull
- Internal visual inspection
- Temperature cycling 10 times from -65°C to +150°C
- Constant acceleration 3,000 G
- PIND 1% PDA on 5th run and under 25% total
- Burn-in 320 hours at +125°C, PDA 2% second half of burn in/ Burn-in 160 hours at +125°C, PDA 10%
- Seal (fine and gross)
- Full electrical test at min, max, and room temperature
- Radiography
- External visual

Conformance Inspection - Group A Electrical at min, max, and room temp

Periodic Inspection (Group B in-line or end-of-line)

- Physical dimensions
- Resistance to solvents
- Internal visual and mechanical
- Element shear (end of line only)
- Destructive wire bond strength after +300°C bake
- Solderability

Group C – Initial and for Changes as Required

Subgroup 1

- Resistance to soldering heat
- External visual
- Temperature cycling
- Constant acceleration 3,000 G
- Seal testing
- Visual examination
- End point electricals

Subgroup 1 parts then go on to subgroups 3 and 4

Subgroup 2

- Life test; default 1000 hours (per TTR, M38534; Class K max +125°C)
- 496 hrs @ +135°C (see TTR, M38534, customer guidance)

Subgroup 3

- Internal gas analysis, 5000 ppm moisture

Subgroup 4

- Internal visual and mechanical
- Wirebond strength
- Element shear

Subgroup 5

- ESD

What is an SMD?

A Standard Microcircuit Drawing (SMD) is a document that depicts the Government's requirements for an off-the-shelf microcircuit, tested for a military application. An SMD discloses applicable configuration, envelope dimensions, mounting and mating dimensions, interface dimensional characteristics, specified performance requirements, and inspection and acceptance test requirements as appropriate for a military environment.

Purpose of the SMD Program

The purpose of the SMD program is to prevent the proliferation of contractor-developed drawings describing generic microcircuits as if they were program-unique devices. SMDs cover off-the-shelf high-reliability microcircuits targeted for military applications, using only one standardized document. The SMD program increases the manufacturing base for DoD procurement and provides substantial savings in both acquisition and logistics.

Benefits to Equipment Manufacturers

- No need to generate special drawings
- You know you are getting a QML part
- MIL-HDBK-103, QML-38534, and QML-38535 provide lists of devices for ease of choosing
- Preferred parts, therefore less parts control problems

Buyer Beware

Manufacturers offer their parts with their own quality designators.

When you simply buy to a screening flow on a data sheet, do you know...

- If the product was built on the certified line?
- If the process and materials are qualified?
- If Group C life test been done on this model?
- If you will be notified of major changes?
- If there is an in-process bond pull monitor?
- If the parts are hermetic?
- If the parts contain pure tin?

Registered Users List

To be notified of proposed changes to Standard Microcircuit Drawings, sign up for DLA Land and Maritime's SMD Registered Users List.

Call: 614-692-8108 or E-mail: CMOS@dla.mil

DLA Land and Maritime maintains a list of registered users of Standard Microcircuit Drawings (SMDs), which are used to coordinate drawing changes with industry and military users. Participation in this program allows users to stay abreast of drawing changes which may affect weapon systems using the SMD devices.



MIL-PRF-38534 SPECIFICATION FOR HYBRID MICROCIRCUITS

FIVE QUALITY LEVELS: ONE IS RIGHT FOR YOUR APPLICATION

Class K
Space Applications

Class H
Military, Ruggedized

Class G
Military, Ruggedized, less testing than Class H

Class E
Military or Space - G, H, or K with one or more documented exception(s) to the referenced class level

Class D
Military, unique vendor specified test flows due to market or technology

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