Is part standardization becoming obsolete?

The switch from MIL-M-38510 (QPL) to MIL-PRF-38535 (QML) has created a condition where military standardized parts do not conform to best commercial practices and may even violate current configuration management practices. This article takes you through the historical changes that have led to the dilution of requirements within MIL-PRF-38535 and shows how the DLA has tailored this document to create this condition against the advice of users and manufacturers of the products.

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Originally, there were source control drawings (SCDs). These documents defined the environmental, electrical, marking, packaging and processing requirements for the parts. The problem with SCDs was that multiple NSNs were created for essentially the same part number.

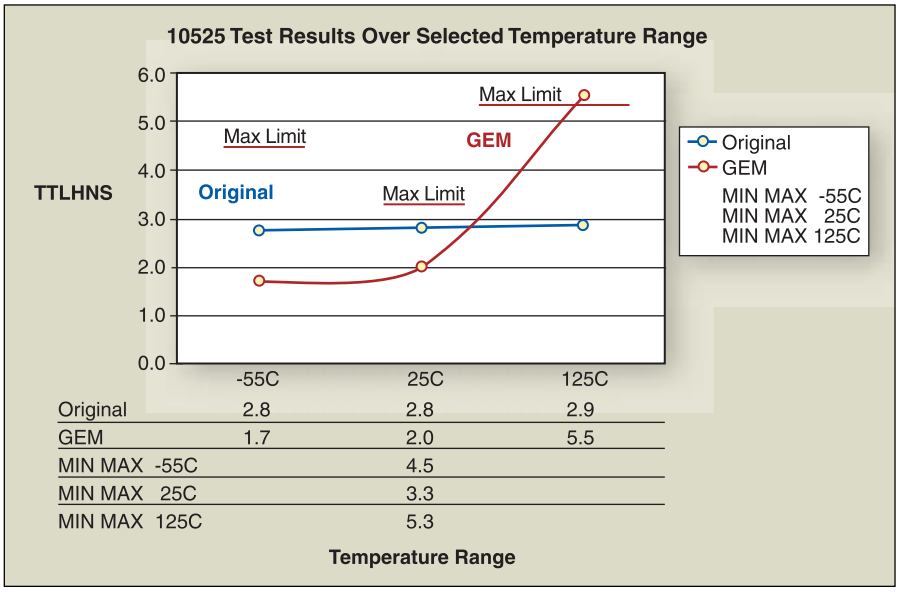
Then military standard parts were born. MIL-M-38510 (general specification for microcircuits) defined the quality system, wafer processing, assembly and package, qualification, quality conformance inspection requirements for all slash sheet and SMD parts. It also defined microcircuit groups that were based on the device technology. The major advantage was that with standardized parts there was only one NSN per part. Parts were listed on the qualified parts list (QPL).

MIL-STD-883 defines the standardized test procedures, as well as the test requirements for Class B and S products. Paragraph 1.2.1 of MIL-STD-883 drew in many of the requirements of MIL-M-38510.

M-38510/XXX and 5962-XXXXX became the standard part numbers. The individual device specifications defined the electrical test requirements so that multiple manufacturers could qualify the same product to a single specification (i.e., TI, National and Motorola 5400 TTL although manufactured slightly differently would be qualified under the same part number). Microcircuit group numbers for all parts on the slash sheet were defined in section 3 requirements.

New definitions

The system changed when MIL-PRF-38535 (general specification for integrated circuit manufacturing) QML (qualified manufacturing line) was created. QML is a performance specification meaning it is descriptive not prescriptive, with most appendices providing guidelines not true requirements. QML gives the device manufacturer the flexibility to eliminate non-value-added testing based on statistical data. The specification is intended to document best commercial practices. Initially, only previously qualified QPL (MIL-M-38510) certified suppliers were allowed to transition to MIL-PRF-38535. That later changed and allowed MIL-STD-883 suppliers to transition. Many of the definitions in MIL-M-38510 were changed or eliminated, many of the requirements were removed and new definitions were added. The electrical test requirements are still covered by the M-38510/XXX and 5962-XXXXX specifications.



Unlike the original, the tests show that GEM parts cross maximum limit over the temperature range.

As stated within the main body of MIL-PRF-38535, many of the definitions previously contained in MIL-M-38510 were either changed or deleted. Notable among these are what has happened to the definitions of device type and microcircuit group. The previous definition of device type that required parts being electrically and functionally interchangeable at the die or substrate level has been dropped in the new definition. The definition of microcircuit group, which required the product be of the same basic circuit technology has been deleted altogether. Both of these definitions within appendix A of MIL-PRF-38535 are similar to the old requirements of MIL-M-38510, however, appendix A of MIL-PRF-38535, is not required for QML manufacturers (although they are still required for Class M, MIL-STD-883 suppliers). Table A-VI, which numbers microcircuit groups, is also still in Appendix A and defines a Standard TTL gate to be in microcircuit group 1; it also states that a BiCMOS gate is in group 125.

So what do these changes mean to the users and manufacturers? Currently, a part that is manufactured to be compliant to MIL-STD-883 paragraph 1.2.1 must follow the original requirements of MIL-M-38510 as defined in appendix A of MIL-PRF-38535. A MIL-PRF-38535 QML manufacturer does not have to comply with the requirements of appendix A.

So is this a problem? One QML manufacturer has been given special allowance by Defense Logistics Agency/Defense Supply Center Columbus (DLA/DSCC) to supply a 1.5 micron BiCMOS part to the same part number as a 7 micron gold-doped Bipolar TTL part, even though the slash sheet defines the part as being in microcircuit group 1 instead of 125, and electrical testing shows the parts respond differently than the original over the military temperature range[1]. No other manufacturers are allowed to do this, as all changes they make in device technology require a part number change.

Other new definitions within MIL-PRF-38535 include 6.4.24 form, 6.4.25 fit and 6.4.26 function. Form as defined in MIL-PRF-38535 defines only physical and visual parameters and doesn't mention the device technology. Fit refers only to the ability to physically interface. Function refers to the action or actions an item is designed to perform, which has been interpreted as strictly specification requirements without any undocumented parameters.

Is MIL-PRF-38535 truly best commercial practice? The EIA Engineering Aerospace Qualified Electronic Component (AQEC) requirements document that will become the best commercial practice for avionics parts doesn't think so. It specifically states that parts of different device technologies shall not be furnished under the same part number because they are not the same form, fit and function. What this means is that QML devices that are capable of being supplied via the Generalized Emulation Microcircuits (GEM) program as non-Gem devices shall not be allowed as AQEC devices.

In May of 2003 a joint letter from the JC13.2 and the G-12 committees was written to the DLA. This letter stated that although there is benefit to the GEM program supporting obsolete integrated circuits for weapon system logistics, they were concerned about the re-use of existing standardized part numbers. One of the basic principles of configuration management states that if form, fit or function of an item changes, you must change the associated item number. In the case of GEM emulated devices, the form because of the device technology clearly changes and with that the potential exists for differences in unspecified or untested parameters (functional performance, ESD, radiation hardness, etc). G-12 unanimously passed the following motion:

"G-12 does not support an older technology product being emulated with a newer technology having the same part number because it is not identical in form, fit and function."

The JC13.2 committee passed a similar motion to support the G-12 position.

Conclusion

MIL-PRF-38535 has lost sight of the fact that these parts are being used in military weapon systems. Instead, it has focused on the manufacturing systems used to produce them. The MIL-M-38510 specification did not allow parts emulated using a different device technology to use the same part number as original devices, however, it appears that MIL-PRF-38535 (QML) has been written specifically to allow this, even though it violates best commercial practices as defined in the EIA specification for AQEC parts and configuration management definitions from the G-12 and JC13.2 committees.

If MIL-PRF-38535 does not come back in line with best commercial practices and configuration management practices, more manufacturers will stop using it.

The main reason for allowing emulated parts to keep the same part number as the original product is the cost of changing bills of materials for military systems, saying that it costs too much to change the part numbers. It is our contention that not changing the part numbers may be much more costly. If the GEM part is not behavioral compatible with the system it is being placed in, that system may not function when under stress (see the figure). Another reason given is that the GEM parts were studied for five years and they have had no reported failures. Our response to that is that the GEM parts were tailored to the systems in these studies and not all systems have been verified to be able to use the GEM part in their application.

Although emulation of unprocurable parts is a good thing for weapons system logistic support, these parts should not have the same part number because they "just aren't the same." DE

Reference:

1. Lansdale web site http://www.lansdale.com/gemhtml/wkparts.htm.

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