Application Brief

DLA Approved Optimizations for QML Products

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Introduction

The MIL-PRF-38535 is a military specification standard for hermetic and non-hermetic integrated circuits. This specification covers manufacturing general, quality, and reliability requirements for aerospace and defense applications. The goal is to establish a process flow baseline for quality and performance in these high reliability scenarios. Texas Instruments developed specifications and requirements for QML products to meet a level of quality that are defined in accordance with MIL-PRF-38535. The TI supplied and DLA agreed on optimizations for QML are listed in Table 1.

QML Classes

Class N – Items which have been subjected to and passed all applicable requirements of MIL-PRF-38535 including TI defined qualification testing, screening testing, and Technology Conformance Inspection and Quality Conformance Inspection (TCI/QCI), and are encapsulated in plastic (TI supplied).

Class V – Products which have been subjected to and passed all applicable requirements of MIL-PRF-38535 including qualification testing, screening testing, and TCI/QCI inspections, and have been subjected to, and passed all applicable requirements of MIL-PRF-38535 in Table 1 (TI supplied).

Class P – A non-hermetic Plastic Encapsulated Microcircuit (PEM), which meets all applicable requirements of MIL-PRF-38535 including qualification, screening and TCI/QCI inspections, and all applicable requirements in Table 1 (TI supplied).

Class Y – A microcircuit employing a non-hermetic package, which meets all applicable requirements of MIL-PRF-38535 including qualification, screening and TCI/QCI inspections, and all applicable requirements in Table 1 (TI supplied).

Class Q – Items which have been subjected to and passed all applicable requirements of MIL-PRF-38535 including qualification testing, screening testing, and TCI/QCI inspections (TI supplied).

QML Optimizations

Table 1. QML Optimizations

Manufacturer	Specification	Test Optimized	Date
Texas Instruments	MIL-PRF-38535	D-8, lid torque eliminated (all cerdip, cerflat glass sealed packages all classes)	Oct-93
Texas Instruments	MIL-PRF-38535	100% burn-in eliminated (all TTL, LS, STTL products line. All package configurations.) Level B/Q only	Jun-94
Texas Instruments	MIL-PRF-38535	Constant acceleration eliminated (all products in the 8, 14, 16, 20, pin DIP) Level B/Q only	Jun-94
Texas Instruments	MIL-PRF-38535	Temperature cycles eliminated (all products in the 8, 14, 16, 20 pin DIP)	Jun-94
Texas Instruments	MIL-PRF-38535	100% high magnification inspection eliminated (TTL, LS, STTL, ALS HCMOS, F, AS, and 55 series products lines. All packages configurations) Level B/Q only	Jun-94

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Table 1. QML Optimizations (continued)

Manufacturer	Specification	Test Optimized	Date
Texas Instruments	MIL-PRF-38535	100% burn-in on certain linear product eliminated (contact TI or DLA Land and Maritime for specific linear products) Level B/Q only	Sep-94
Texas Instruments	MIL-PRF-38535	Group A sample testing of alpha V10, alpha I10 and various noise tests on certain linear products eliminated (contact TI or DLA Land and Maritime for specific linear products)	Sep-94
Texas Instruments	MIL-PRF-38535	Final electrical, 25°C (ALS, AS, FAST, 54ABT32316 parent device types eliminated) Level B/Q only	Nov-95
Texas Instruments	MIL-PRF-38535	100% burn-in (HCMOS, all packages) eliminated Level B/Q only	Feb-95
Texas Instruments	MIL-PRF-38535	100% burn-in (ALS, AS, FAST) eliminated Level B/Q only	Aug-95
Texas Instruments	MIL-PRF-38535	100% temperature cycle (all CPAK) eliminated Level B/Q only	Aug-95
Texas Instruments	MIL-PRF-38535	100% constant acceleration (all CPAK) eliminated Level B/Q only	Aug-95
Texas Instruments	MIL-PRF-38535	100% -55°C screening and group A (HC and HCT) eliminated Level B/Q only	Mar-95
Texas Instruments	MIL-PRF-38535	100% -55°C screening (ABT, AC, ACT, BCT) eliminated Level B/Q only	Aug-96
Texas Instruments	MIL-PRF-38535	Burn-in reduction on 4 Meg DRAM Level B/Q only	Aug-96
Texas Instruments	MIL-PRF-38535	Physical dimensions (D1), moisture resistance (D3), insulation resistance (D3) (for all ceramic packages in Taiwan and Singapore facilities) eliminated	Oct-96
Texas Instruments	MIL-PRF-38535	Class V, P, Y Eliminated read and record data	May-00
Texas Instruments	MIL-PRF-38535	Class V X-ray (monitor only, for glass-frit seal)	May-00
Texas Instruments	MIL-PRF-38535	Class V Eliminated Non-Destructive Bond Pull	May-00
Texas Instruments	MIL-PRF-38535	Class V Eliminated PIND and Centrifuge on all flip chip mounted die	May-00
Texas Instruments	MIL-PRF-38535	100% burn-in (selected DSP/MCU) eliminated Level B/Q only	Jun-96
Texas Instruments	MIL-PRF-38535	100% -55°C screening (selected DSP/MCU) eliminated Level B/Q only	Jun-98
Texas Instruments	MIL-PRF-38535	100% X-ray eliminated on welded lid parts	Oct-07
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 1 Class V Physical Dimensions and Internal Water Vapor Performed as part of Generic Group D QCI by package family within 36 week window	Aug-00
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 2 Class V Resistance to Solvents, Bond Strength and Die shear are done as part of Generic group B QCI by package family by week of seal. Main body 38535 group B. Internal visual and mechanical is covered by 100% pre-cap inspection.	Aug-00

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Table 1. QML Optimizations (continued)

Manufacturer	Specification	Test Optimized	Date
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 3 Class V Solder-ability performed as part of Generic Group B QCI by package family per week of seal.	Aug-00
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 4 Class V Lead Integrity, Seal are performed as part of generic group D CQI by package family within 36-week window. Lid torque testing eliminated for all package families	Aug-00
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 5 Class V End point electrical, Steady State Life and End point electrical performed as part of Wafer Lot acceptance by wafer lot	Aug-00
Texas Instruments	MIL-PRF-38535	QCI Group B Subgroup 6 Class V End-point electrical, temp cycle, constant acceleration, seal and endpoint electrical parameters performed as part of generic Group D QCI by package family within 36 week window	Aug-00
Legacy (National Semiconductor)	MIL-PRF-38535	DS16F95 DS26F31 and 32 DS96F172 through 175 Level S/V only Minimum percentage of the metallization cross sectional area required over the passivation steps in Method 2018, SEM Inspection, reduced from 50% to 30% for Method 5007, Wafer Lot Acceptance	Jun-97
Legacy (National Semiconductor)	MIL-PRF-38535	All part numbers for Level S/V only Method 5007, parts a. and c., Thermal Stability test (C-V plot) reduced from each wafer lot to pre-designated maintenance events of the sputter metal deposition system (for example, venting, and so on.)	Oct-99
Legacy (National Semiconductor)	MIL-PRF-38535	Metal can packages (TO-3, 5, 39, 46) Level B/Q only M2001, Constant Acceleration eliminated for screen	Jun-96
Legacy (National Semiconductor)	MIL-PRF-38535	Specific part numbers for Level S/V only Ultrasonic inspection per Method 2030 is being performed instead of Radiography on ceramic package with a copper-tungsten heat slug	Nov-06
Legacy (National Semiconductor)	MIL-PRF-38535	DS26LS31 for Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Jul-00
Legacy (National Semiconductor)	MIL-PRF-38535	LM124 LM139 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Aug-00 Jan-01
Legacy (National Semiconductor)	MIL-PRF-38535	LM124, LM124A Level B/Q only Screen for A-2, A-3 final electricals moved prior to burn-in	Oct-02

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Table 1. QML Optimizations (continued)

Manufacturer	Specification	Test Optimized	Date
Legacy (National Semiconductor)	MIL-PRF-38535	JL111, LM111 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Jun-02
Legacy (National Semiconductor)	MIL-PRF-38535	LM158 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Nov-02
Legacy (National Semiconductor)	MIL-PRF-38535	DS96F173 and 175 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Aug-02
Legacy (National Semiconductor)	MIL-PRF-38535	JL148, LM148 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Nov-02
Legacy (National Semiconductor)	MIL-PRF-38535	LM139, LM139A Level B/Q only Screen for A-2, A-3 final electricals moved prior to burn-in	Jan-03
Legacy (National Semiconductor)	MIL-PRF-38535	LM741 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Jun-03
Legacy (National Semiconductor)	MIL-PRF-38535	LM136A Level B/Q only Screen for A-2, A-3 final electricals moved prior to burn-in LM136 Screen for 25°C, -55°C, +125°C and temperature coefficient testing can be performed prior to burn-in. LM148 Screen for -55°C, 125°C moved prior to burn-in	Oct-05 May-06 Jun-06
Legacy (National Semiconductor)	MIL-PRF-38535	LM723 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Nov-03
Legacy (National Semiconductor)	MIL-PRF-38535	DS26LS31 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	Dec-05

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Table 1. QML Optimizations (continued)

Manufacturer	Specification	Test Optimized	Date
Legacy (National Semiconductor)	MIL-PRF-38535	LM117, JL117 LM119 Level B/Q only Burn-in reduced from inspection lot screen to fab lot sample. Life test frequency increased from yearly to quarterly and can use non-burned-in parts.	May-08
Texas Instruments	MIL-PRF-38535	TI systems do not support Marking as described in Section 3.1 (p.13-14): Marking for plastic packages. Follow TI Standard Marking/Symbolization. Actual product symbolization can be documented in the SMD.	Aug-23
Texas Instruments	MIL-PRF-38535 Table IA: Screening procedure (p. 20)	Allow 1X Reflow in lieu of temp cycle in Table IA.TM1010, Condition B, -55/125C, 15cy – nonstandard flow. When TC is performed, it can be in accordance with JESD22-A104.	Aug-23
Texas Instruments	MIL-PRF-38535 Table V: Group D (p 37-43) D3 / TM1010	Perform TC with accordance to JESD22- A104 to align with Appendix H and standard factory specifications.	Aug-23
Texas Instruments	MIL-PRF-38535 Table V: Group D (p 37-43) D3 / Clarification	Clarification: Perform UHAST per one of the following conditions: 130C, 85%RH – 96 Hours 110C, 85%RH – 264 Hours. Allowed per Note 18. TI can perform UHAST, not BHAST for QCI. Allowed per MIL-PRF-38535.	Aug-23
Texas Instruments	MIL-PRF-38535 Table V: Group D (p 37-43) D3 / Clarification	Clarification: TI can use separate units for UHAST and TC. Allowed option per Note 17.	Aug-23
Texas Instruments	MIL-PRF-38535 Table V: Group D (p 37-43) D3 / Moisture resistance condition	Moisture resistance per JESD22-A118 Unbiased HAST condition A or B.	Aug-23
Texas Instruments	MIL-PRF-38535 Table V: Group D (p 37-43) D7 / Adhesion of lead finish	TI uses internal procedure (QSS 009- 109).	Aug-23
Texas Instruments	MIL-PRF-38535 Table A-III (p 80) Coating Thickness	Clarified NiPdAu thickness. TI devices meet NiPdAu thickness indicated below. Over plating thickness (microinch/micrometer): Min 20/0.51 Max NS	Aug-23
Texas Instruments	MIL-PRF-38535 Table H-I. Assembly process technology testing for flip chip packages containing Pb free bump [p196]	Flip Chip containing PB free bumps: Biased Humidity option to run JESD22- A101 (THB) or A110 (Biased HAST) Conditions: • 85C/ 85% relative humidity, 1000 hours or • 130C/85% relative Humidity, 96 hours, or • 110C/85% relative humidity, 264 hours Thermal Shock is not applicable to organic substrates.	Aug-23

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Table 1. QML Optimizations (continued)

Manufacturer	Specification	Test Optimized	Date
Texas Instruments	MIL-PRF-38535 Table H-IA. Assembly process technology testing for hermetic (classes Q, V) and non-hermetic packages (class Y). [197-198]	Class Q, V, Y (flip chip): Final Package testing High temperature Storage TM 1008 (1,000 hours at +150°C) or JESD 22 A103 (1,000 hours at +150°C or equivalent).	Aug-23
Texas Instruments	MIL-PRF-38535 Table H-IIA. Technology characterization testing for hermetic (classes Q, V) and non-hermetic packages (class Y) [200-202]	Class Q, V, Y (flip chip): Group 2: a. Thermal shocks N/A b. Temperature cycles TM 1010, condition C, 100 cycles or JESD22-A104 c. HAST(Biased) JESD22-A110 or THB JESD22-A101 d. Visual inspection TM 1010 and TM 1004 visual criteria e. Not applicable	Aug-23
Texas Instruments	MIL-PRF-38535 Table H-IB. Assembly process technology testing for plastic packages (classes N, P)	Class N, P: Group #3 Temperature Cycling per one of the following: - 55/125C, 700 cycle (product release), 1000 cycle (technology release) or-65/150C, 500 cycle (product release), 1000 cycle (technology release). Group #5 High Temp Storage performed per JESD 22 A103 Bake 150C, 1000 Hours or equivalent.	Aug-23
Texas Instruments	MIL-PRF-38535 Table H-IIB. Technology characterization testing for plastic packages (classes N, P)	Class N, P: Group#2 Moisture sensitivity level per manufacturer's specification or JEDEC JSTD- 020/ JESD 22-A113 Group #3 b. Biased HAST (130C/85%RH/96, 192hr) or (110C/85% RH/264, 528hr) or (85C/85%RH/1000, 2000hr) per JESD22-A110/JESD22-A101 Group #6 Lead Integrity - For plastic packages, TI uses internal test method, QSS 009-134. TM is not applicable for plastic packages. For trim and form leaded packages this is N/A per Test Method 2004 section 3.2 Group #7 - Can perform MSL testing per J-STD-020/JESD 22-A113 instead of this test. Group #9 - Does not perform Fungus testing. Group #12 – Thermal characteristics based on Modeling.	Aug-23
Texas Instruments	MIL-STD-883 TM5007	Alternate method of inline measurements can be used in lieu of cross section (applies to planar technologies only).	Dec 23

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