



## QML Process Optimizations

Texas Instruments is certified and listed by the Defense Supply Center Columbus (DSCC) as a manufacturer of QML Class B and Class V microcircuits (integrated circuits) in accordance with MIL-PRF-38535 (General Specification for Manufacturing Integrated Circuits). The Quality System utilized by Texas Instruments in the manufacture of these microcircuits is fully compliant to the requirements of MIL-PRF-38535 and ISO9001. All processing, screening, and Quality Conformance Inspection (QCI) is performed in compliance with the test methods of MIL-STD-883, Microcircuits Test Method Standard, with exceptions as allowed by Paragraph 1.1 of MIL-PRF-38535. Under MIL-PRF-38535, a QML certified manufacturer is permitted to modify, substitute, or delete tests that do not improve the quality and/or reliability of the finished device as defined by the applicable device specification. All TI QML Class V flows are approved by DLA, NASA, and the Aerospace Corporation.

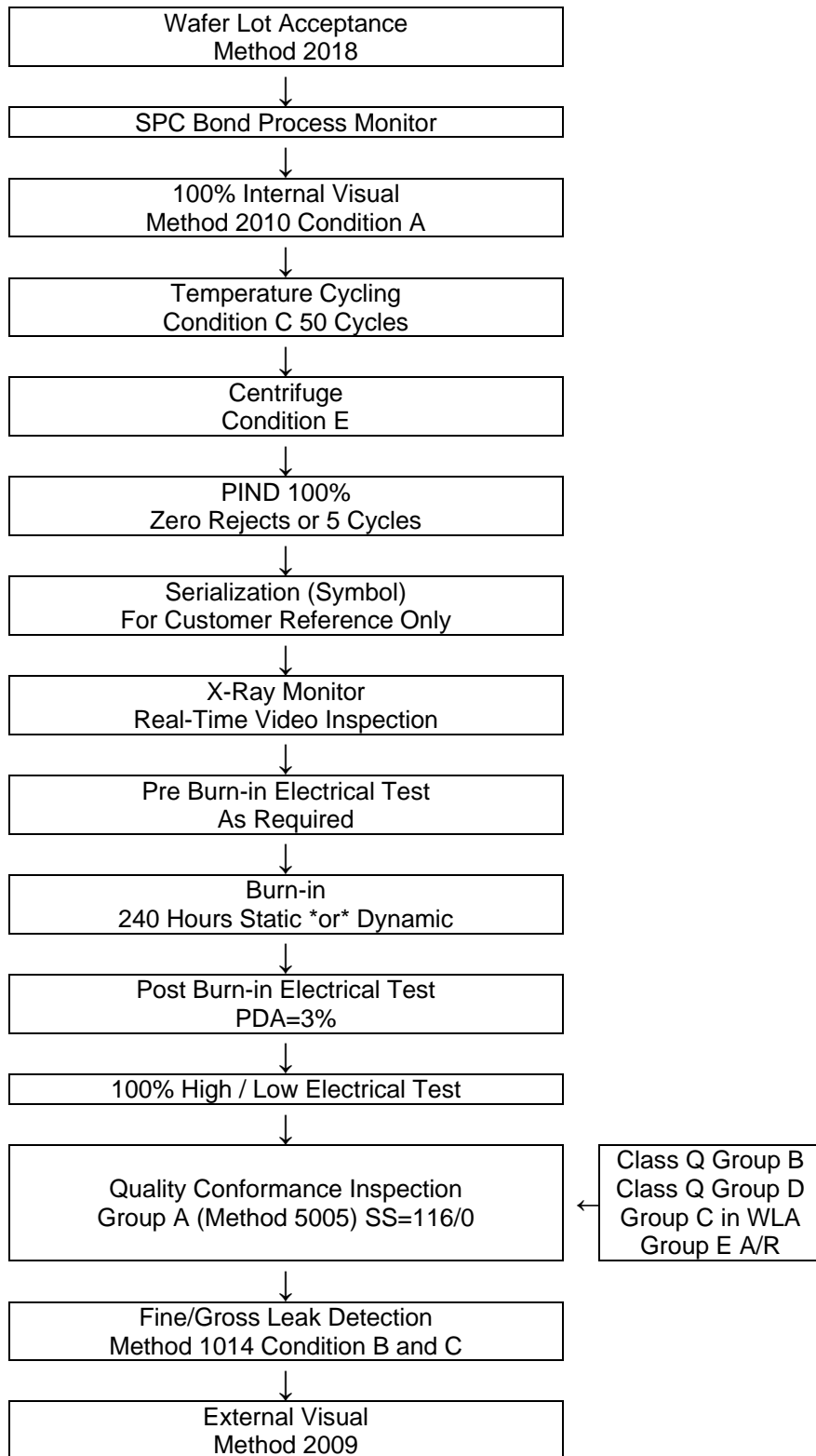
The elimination of screens and test is reflected on the Texas Instruments Processing Conformance Report attached to the Certificate of Conformance provided with each QML ceramic device lot. Approvals for these optimizations are granted by the QML manufacturer's Technology Review Board. Please note that under the QML program, only changes to Form, Fit, or Function are detailed in the DLA Standard Microcircuit Drawing (SMD). As a courtesy to our customers, Texas Instruments provides notification of optimizations via the Government Industry Data Exchange Program (GIDEP) Process Change Notification system.

### QML Class V Processing Baseline

The production baseline processing flow for TI QML Class V products is shown below. MIL-STD-883 Test Method 5004 specifies the processing requirements for Class Level S devices. The requirements are also listed along with any exceptions. Please note that these exceptions are considered non value-added (NVA) as qualification performed in accordance with MIL-PRF-38535 has determined that form, fit, function, or reliability is not affected.

Of particular note is the absence of read-and-record data collection and delta calculation. Texas Instruments warrants products to meet the DSCC SMD or JAN Slash Sheet as specified with respect to delta limits. Full characterization studies including drift analysis are performed at product release and after any major changes to assure shipped product meets these requirements.

**Texas Instruments  
QML Class V Process Flow**



<b>MIL-STD-883 TM-5004 100% Processing For Level S Devices</b>	
<b><i>Level S Requirement</i></b>	<b><i>TI Class V DSCC Approved Flow NVA Exception</i></b>
Wafer lot acceptance	
Nondestructive bond pull by device	Replaced with destructive bond pull monitor
Internal visual	
Temperature cycling	
Constant acceleration	
Visual inspection	
Particle impact noise detection (PIND)	
Serialization	For customer reference only – not used during test or shipment
Pre burn-in electrical parameters	No read and record data
Burn-in test	
Interim (post burn-in)	
Reverse bias burn-in	One burn-in only either static or dynamic
Interim (post burn-in)	
Percent defective	
Final electrical test	
Delta Calculations per device spec	Not performed – devices warranted to meet SMD delta limits
Seal	
Radiographic Inspection 100%	Replaced with real-time x-ray monitor
QCI sample selection	See below
External visual	
Radiation latch-up	Per detail device specification

## QML Class V QCI Baseline

The Quality Conformance Inspection (QCI) baseline for TI QML Class V products is shown below. MIL-STD-883 Test Method 5005 specifies QCI for Class Level S devices. The requirements are listed along with any exceptions. Again note that these exceptions are considered non value-added (NVA) as historical data and qualification performed in accordance with MIL-PRF-38535 has determined that form, fit, function, or reliability is not affected.

The most apparent change is the elimination of the by-lot Level S Group B. In place of this, TI has implemented a life test (Group C) as part of Wafer Lot Acceptance (WLA) and added die shear to the Level B Group B. Level B Group D is performed as shown.

Group B is performed generically for each week of seal using representative samples from each package family. Group D is also performed generically every 26 weeks using representative samples from each package family. The shipping coverage window for Group D is 36 weeks. Note that D8 (lid torque) has been eliminated based on process controls and historical data.

<b>Texas Instruments Class Level V Quality Conformance Inspection (QCI)</b>					
<i>Test / Sub-Group</i>	<i>TEST</i>	<i>MIL-STD-883</i>			
		<i>METHOD</i>	<i>CONDITION</i>	<i>SAMPLE / ACCEPT</i>	<i>COMMENTS</i>
Group B					
B1	a. Resistance to Solvents	2015		3 / 0	Frequency - once each week of seal for each package family and lead finish
B2	a. Bond Strength	2011	C or D	22 / 0	3 devices minimum / 22 wires total
	b. Die shear	2019or /2027		3/0	
B3	a. Solderability	2003	245C +/- 5%	15 / 0	4 devices minimum / 15 wires total

<b>Texas Instruments Class Level V Quality Conformance Inspection (QCI)</b>					
<i>Test / Sub-Group</i>	<i>TEST</i>	<i>MIL-STD-883</i>			
		<i>METHOD</i>	<i>CONDITION</i>	<i>SAMPLE / ACCEPT</i>	<i>COMMENTS</i>
Group C					
C1	a. Steady-state life test b. End-point electrical test	1005	1000 hrs/125C or equivalent Use QA final test program/ temperatures	45 / 0	Frequency – each wafer lot

**Texas Instruments Class Level V Quality Conformance Inspection (QCI)**

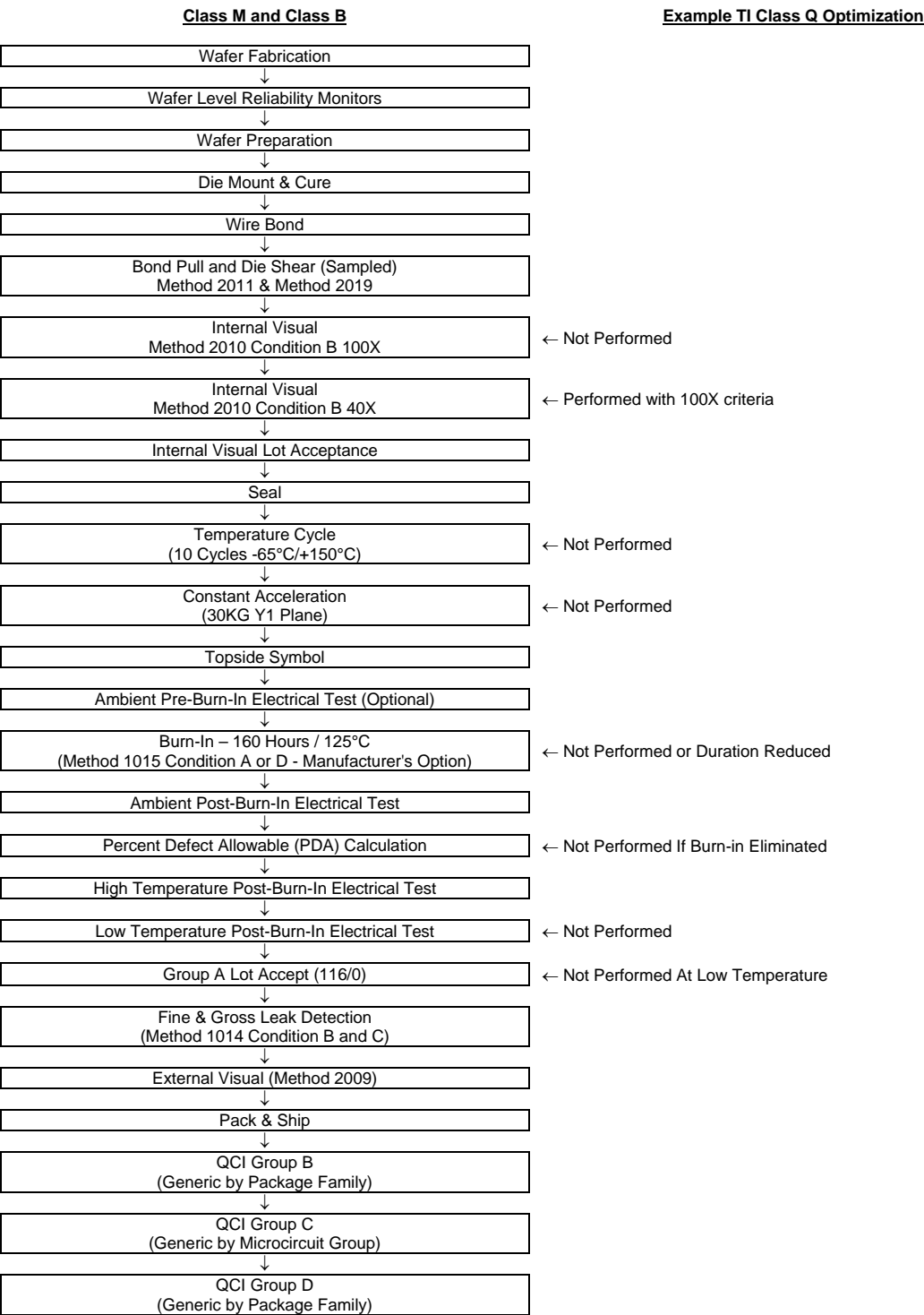
<i>MIL-STD-883</i>					
<i>Test / Sub-Group</i>	<i>TEST</i>	<i>METHOD</i>	<i>CONDITION</i>	<i>SAMPLE / ACCEPT</i>	<i>COMMENTS</i>
Group D					Frequency - once every 26 weeks for each package family with a 36 week shipping window
D1	a. Physical Dimensions	2016		15 / 0	
D2	a. Lead Integrity	2004	Condition B2	45 / 0	3 devices minimum / 45 leads total
	b. Seal (Fine and Gross)	1014	As applicable		
D3	a. Thermal Shock	1011	Condition B, 15 cycles	15 / 0	
	b. Temperature Cycle	1010	Condition C, 100 cycles		
	c. Moisture Resistance	1004			
	d. Visual Examination	1004 and 1010			
	e. Seal (Fine and Gross)	1014	As applicable		
	f. End-point electrical test		Use QA final test program/ temperatures		
D4	a. Mechanical Shock	2002	Condition B	15 / 0	
	b. Vibration, Variable Frequency	2007	Condition A		
	c. Constant acceleration	2001	Condition E Y1 axis only		
	d. Seal (Fine and Gross)	1014	As applicable		
	e. Visual Examination	1010 or 1011			
	f. End-point electrical test		Use QA final test program/ temperatures		
D5	a. Salt Atmosphere	1009	Condition A	15 / 0	
	b. Visual Inspection	1009	As applicable		
	c. Seal (Fine and Gross)	1014	As applicable		
D6	a. Internal water vapor	1018	5000 PPM @ 100C	3 / 0 or 5 / 1	Third party lab
D7	a. Adhesion of lead finish	2025		15 / 0 leads	Not for LCCC
D8	a. Lid torque	2024		None	Not performed for TI

Note: Any deviations to test methods or conditions, such as centrifuge, will be specified in the device traveler.

<b>MIL-STD-883 TM-5005 Group B (By Lot) QCI For Level S</b>	
<b><i>Level S Requirement</i></b>	<b><i>TI Class V DSCC Approved Flow NVA Exception</i></b>
Subgroup 1 a. Physical dimensions b. Internal water-vapor	Performed as part of Generic Group D QCI by package family with 36 week window
Subgroup 2 a. Resistance to solvents b. Internal visual and mechanical c. Bond strength d. Die shear/substrate attach strength test	Subgroups a, c, and d are performed as part of Generic Group B QCI by package family by week of seal. Subgroup b is covered by 100% pre-cap inspection.
Subgroup 3 a. Solderability	Performed as part of Generic Group B QCI by package family by week of seal.
Subgroup 4 a. Lead integrity b. Seal c. Lid torque, lead fatigue	Performed as part of Generic Group D QCI by package family with 36 week window. Lid Torque testing eliminated for all package families.
Subgroup 5 a. End-point electrical parameters b. Steady state life c. End-point electrical parameter	Performed as part of Wafer Lot Acceptance by wafer lot.
Subgroup 6 a. End-point electrical parameters b. Temperature cycling c. Constant acceleration d. Seal e. End-point electrical parameters	Performed as part of Generic Group D QCI by package family with 36 week window

<b>MIL-STD-883 TM-5005 Group D QCI Levels B and S</b>	
<b><i>Level S Requirement</i></b>	<b><i>TI Class V DSCC Approved Flow NVA Exception</i></b>
Group D per MIL-STD-883	D8 Lid Torque testing eliminated for all package families - Class Q and Class V

# TI QML Class Q Process Flow with Example Optimizations



For QML Class Q devices Texas Instruments has qualified the modification and/or elimination of several screens and tests as approved by the Texas Instruments Technology Review Board (TRB). These include, but are not limited, to:

- Elimination of -55°C testing on multiple logic products including the TTL, LS, S, HC, AHC, AHCT, ALS, AS, F, ABT, AC, ACT, and BCT families.
- Elimination of -55°C testing on specific mixed signal products including the majority of CMOS technology based product families.
- Elimination of burn-in or replacing 100% burn-in with lot acceptance on multiple product technologies.
- Elimination of Group A lot acceptance testing on specific DSP and logic product families.
- Elimination of 100% temperature cycle and centrifuge for all low pin count ceramic devices (28 pin and below).
- Replace 100X pre-cap inspection with 40X pre-cap inspection using the 100X criteria for all product families.

Texas Instruments is committed to providing the highest quality products to the defense and aerospace marketplace. For more information please contact your local TI representative or the TI Technical Support line at <http://support.ti.com>.



## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)