Table of Contents – Processing & Flows

Glossary of Semiconductor Process Flow & Test Terminology

Attributes Data: Gross test results of the various screening steps, such as "ins" and "outs" at the lectrical test points. *(see also Variables Data)*

Baseline: A detailed definition of a device's electrical and mechanical configuration, assembly, processing, and testing used as a base from which to track subsequent changes.

Bond Pull: A destructive test to determine the strength of the bonds.

Burn-In: A destructive test to determine the strength of the bonds.

Centrifuge (Constant Acceleration): Subjective devices to a G force in a centrifuge for a short duration to test die attach, lead bond, and package integrity.

Certificate of Conformance (C of C): A document provided by the manufacturer to confirm that the procured material conforms to all applicable specifications.

CSI: Customer Source Inspection *(see Source Inspection)*

Current Density: The amount of current flowing in a conductor per unit area.

Data Code: A four-digit number marked on the device which indicates the actual seal week of the package.

Delta: The amount an electrical parameter shifts during burn-in or op-life. Pre- and post-stress measurements are taken and the difference between them is compared with an allowable Delta Limit.

Die Shear: A test to insure die attach integrity by measuring the force required to shear the die off the package base.

DPA (Destructive Physical Analysis): A sample of finished devices which are destroyed by various tests to ensure that the quality standards were met.

ESD (Electrostatic Discharge): Discharge of accumulated static current which may cuase device damage.

Fine Leak: See Hermiticity

Generic Data: Qualification or QCI test data on devices or packaging from a similar product as the device shipped.

Group A: QCI tests used to verify compliance to electrical qualifications.

Group B: QCI tests used to verify process-related controls for Class B. Also includes op-life for Class S product.

Group C: QCI tests for op-life for Class B product.

Group D: QCI tests used to verify package-related quality levels.

Group E: QCI radiation tests

GSI (Government Source Inspection): See Source Inspection

Hermiticity: Leak or seal testing performed on all hermetic packages to verify seal integrity.

Inspection Lot: A single lot of devices used for inspection purposes.

Internal Visual: Visual inspection of the device prior to seal to ensure that die, wires, and package meet all applicable specifications.

Internal Wafer Vapor Content (IWVC): The amount of residual moisture trapped within the package cavity after seal.

JAN (Joint Army Navy): The trademark designator used to indicate that a given device has been processes in accordance with a controlled government specification.

JAN Class B: Reliablity screening level for use in ground-based or airborne equipment.

JAN Class S: Reliability screening level for use in space flight equipment.

LAT: Lot Acceptance Test

Lead Fatigue (Lead Integrity): Application of a repetitive bending force to the leads of a device to ensure structural integrity of the leads and package.

Lid Torque: A test to ensure the integrity of the seal process and material by twisting the lid and base of the package in opposite directions.

Lot Tolerance Percent Defective (LTPD): A single-lot-sampling concept that statistically ensures rejection of 90% of all lots having greater than the specified LTPD.

Mechanical Shock: An impact-type shock test to stress the die attach, wire bonds, and seal integrity.

Monitored Line Product (MLP): USAF program of standard space-processed product available to all customers.

Microcuit Line for Space (MLS): Non-JAN products processed to space flow.

Moisture Resistance: Subjection of devices to a cycle of high humidity and temperature to ensure the devices can survive under extreme environmental conditions.

Non-Destruct Bond Pull: Pull stressing of all wires of a sample of devices to a force less than the minimum pull force limit imposed for bond pull.

Operating Life (Op-Life): A test to screen for early mortality failures performed at +125˚C for 1,000 hours. It is possible to accelerate this test by using a higher temperature for a shorter time.

Percent Defective Allowable (PDA): The percentage of failing devices allowed after post-burn-in electrical testing.

Particle Included Noise Detection (PIND): A test performed by vibratng a device and listening with acoustical equipment to detect loose particles within the cavity.

Quality Conformance Inspection (QCI): On-going sample testing on a periodic basis to determine conformance with reliability standards of the qualification level.

Qualified Products List (QPL): Published by DSCC to indicate the JAN qualification status by vendor and device number.

Qualified Manufacturers List (QML): U. S. government system of certifying manufacturers to monitor their processes.

Radiation Hardness: The ability of a device to withstand radiation exposure without degradation or logic upset.

Radiation Screening: Testing of a device to determine its radiation tolerance.

Rad (Si): A unit of measure for the quantity of radiation energy.

Read and Record: Recording – by device serial number – actual parametric measurements made at a specific electrial test point.

Resistance to Solvents: A test to determine the durability of the device marking.

RHA: Radiation Hardness Assurance

RLAT: Radiation Lot Acceptance Test

Scanning Electron Microscope (SEM): Equipment used to photograph metallization or glassivation thickness or step coverage, and bond wire clearance.

SCD: Source Controlled Drawing

SEM: Scanning Electron Microscope

Serialization: Application of a unique alphanumeric identifier to each device of a lot to allow traceability.

Slash Sheet: A MIL-M-38510 detail device specification giving the specific screening and test requirements for a specific device type.

SMD: Standard Military Drawing

Solderability: Immersion of the leads of sample devices insolder, followed by a visual inspection to ensure the leads will accept a uniform coating of solder.

Source Control Drawing (SCD): A drawing created by an OEM or user which specifies the specific source(s) of the product described.

Source Inspection: Surveliance or inspection by a customer's quality representative or by a government inspector at the vendor's facility.

Temperature Cycle: A test where the device is cycled between alternately high and low temperatures to stress the die attach, bonds, and package seals.

Thermal Resistance: A measure of the package's ability to dissapate the heat generated by the die under bias.

Total Dose: The total accumulated amount of ionizing radiation at a specified dose rate exposure at +25˚C.

Variables Data: Recorded parametric or delta values, traceable to individual devices. *(see also Attributes Data)*

Wafer Lot Acceptance (WLA): QCI tests performed during wafer fabrication. These tests include wafer and metallization thickness, step coverage measurements, glassivation thickness, and SEM examination.

X-Ray: Radiographic analysis of the construction of a device.

Process Flow	Description
Space-Level Systems	
QML V	QML (DSCC Qualified Manufacturers List) product processed to MIL-PRF-38535 for space-level applications.
QML V "R"	QML (DSCC Qualified Manufacturers List) product processed to MIL-PRF-38535 with guaranteed RHA radiation assurance to 100 krads(Si).
JAN Class S	QPL (DSSC Qualified Products List) products processed to MIL-PRF-38535 Appendix B for space-level applications.
JAN Class S "R"	QPL (DSSC Qualified Products List) products processed to MIL-PRF-38535 Appendix B Level S with guaranteed RHA radiation assurance to 100 krads(Si).
MLS	Microcircuit Line for Space — Non-JAN products processed to space flow.
Naval/Air/Ground Systems	
QML Q	QML (DSCC Qualified Manufacturers List) product processed to MIL-PRF-38535 for ground applications.
JAN Class B	QPL (DSSC Qualified Products List) products processed to MIL-PRF-38535 Appendix A, Level B.
JAN Class B "R"	QPL (DSSC Qualified Products List) products processed to MIL-PRF-38535 Appendix A Level B with guaranteed RHA radiation assurance to 100 krads(Si).
SMD	Standard Microcircuit Drawing tactical-level products processed to QML Level Q with electrical specifications controlled by DSSC. (National's SMD products that include an M or Q in the SMD part number are controlled by and fully compliant with MIL-PRF-38535 QML Q.)
/883	Products processed to MIL-STD-883 Level B for military with electrical specifications controlled by manufacturer.
-MCR (also -MC1)	Commercial products processed to the military assembly flow (Military Commercial Room).
-MPC	Military plastic parts processed to commercial assembly and test flows.
Commercial-Grade Systems	
DC, HC	Hermetic commercially processed product
Other Services	
KGD	Known Good Die
Radiation Testing	National Semiconductor has a large radiation-tested product offering. Military and Aerospace devices which are not currently offered as radiation-tolerant product may be procured with Total Dose Testing performed as an add-on option. Radiation test reports performed by National are available on many device types upon request.

QML V and JAN Class S Process Flow

Process Step	Method	Condition	Requirement
Wafer Lot Acceptance	5007		All lots
Non-Destructive Bond Pull	2023		100% [1]
Internal Visual	2010	A	100% [1]
Stabilization Bake	1008	C	100% [1]
Temperature Cycling	1010	C	100% [1[
Constant Acceleration	2001	E	100% [1[
PIND Testing	2020	A	100% [1]
Mark		MIL-PRF-38535 format	100% [1[
Serialization		100%	
Radiographic	2012		100% [1]
Pre-Burn-In Electricals	5004	[2]	100% [1]
Burn-In	1015	D, 240 hours/+125˚C Min.	100% [1]
PDA		3% Functional or 5% DC Max.	100% [1]

Final Electricals	Method	Condition	Requirement
DC +25˚C*	5004	[2]	100% [1]
DC +125˚C*	5004	[2]	100% [1]
Solder Lead Finish			
DC -55˚C*	5004	[2]	100% [1]
AC +25˚C	5004	[2]	100% [1]
AC +125˚C (if required)	5004	[2]	100% [1]
AC -55˚C (if required)	5004	[2]	100% [1]

Group A	Method	Condition	Requirement
DC +25˚C*	5005	[2]	100% [1]
DC +125˚C*	5005	[2]	100% [1]
DC -55˚C*	5005	[2]	100% [1]
AC +25˚C	5005	[2]	100% [1]
AC +125˚C	5005	[2]	100% [1]
AC -55˚C	5005	[2]	100% [1]
Fine Leak	1014	B	100% [1]
Gross Leak	1014	C	100% [1]
External Visual	2009		100% [1]
Groups B and D	5005	MIL-PRF-38535	Sampled
Group E	5005	MIL-PRF-38535	Sampled

* *Includes Functional Testing*

Note [1] A QML manufacturer with approval of a Technical Review Board may eliminate 100% screening within the requirement defined by MIL-PRF-38535. Products with process elimination flows must continue to perform and meet the same quality and reliability requirements.

Note [2] Per Device Specification: JAN Slashsheet, SMD (Standard Microcircuit Drawing) or MDS (National Semiconductor's Military Datasheet), as applicable

QML M, QML Q, and JAN Class B Process Flow

Process Step	Method	Condition	Requirement
Internal Visual	2010	B	100% [1]
Stabilization Bake	1008	C	100% [1]
Temperature Cycling	1010	C	100% [1]
Constant Acceleration	2001	E	100% [1]
Solder Lead Finish			100% [1]
Fine Leak	1014	B	100% [1]
Gross Leak	1014	C	100% [1]
Mark		MIL-PRF-38535 format	
Pre-Burn-In Electricals	5004	[2]	100% [1]
Burn-In	1015	D, +125˚C Min.	100% [1]
PDA		DC, +25˚C, 5% Max.	

Final Electricals	Method	Condition	Requirement
DC +25˚C*	5004	[2]	100% [1]
DC +125˚C*	5004	[2]	100% [1]
Solder Lead Finish			100%
Fine Leak	1014	B	100% [1]
Gross Leak	1014	C	100% [1]
DC -55˚C*	5004	[2]	100% [1]
AC +25˚C	5004	[2]	100% [1]

Group A	Method	Condition	Requirement
DC +25˚C*	5005	Slashsheet [2]	116/0 [1]
DC +125˚C*	5005	Slashsheet [2]	116/0 [1]
DC -55˚C*	5005	Slashsheet [2]	116/0 [1]
AC +25˚C	5005	Slashsheet [2]	116/0 [1]
AC +125˚C (if required)	5005	Slashsheet [2]	116/0 [1]
AC -55˚C (if required)	5005	Slashsheet [2]	116/0 [1]
External Visual	2009	B	100% [1]
Groups B, C, D, and E	5005	MIL-PRF-38535	Sampled

* *Includes Functional Testing*

Note [1] A QML manufacturer with approval of a Technical Review Board may eliminate 100% screening within the requirement defined by MIL-PRF-38535. Products with process elimination flows must continue to perform and meet the same quality and reliability requirements.

Note [2] Per Device Specification: JAN Slashsheet, SMD (Standard Microcircuit Drawing) or MDS (National Semiconductor's Military Datasheet), as applicable

Notes