NASA-STD-8739.11 Tutorial
Monolithic Microcircuit

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Acronyms

AEC	Automotive Electronics Council
COTS	Commercial-Off-The-Shelf
Cpk	Process Capability Index
DLA	Defense Logistics Agency
DoD	Department of Defense
DPPM	Defective Parts Per Million
EEEE	Electrical, Electronic, Electromechanical, Electro-Optical
EOL	End-Of-Line
ETW	Electronics Technology Workshop
FIT	Failure-In-Time
FMEA	Failure Mode and Effects Analysis
GSFC	Goddard Space Flight Center
IL	In-Line
JEDEC	Joint Electron Device Engineering Council
LAT	Lot Acceptance Test

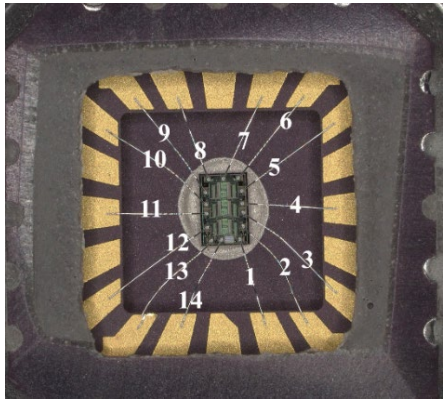
MEAL	Mission Environment, Application, and Lifetime
MIL-SPEC	Military Specification
NASA	National Aeronautics and Space Administration
NEPP	NASA Electronic Parts & Packaging (Program)
PDA	Percent Defective Allowable
PEM	Plastic Encapsulated Microcircuit
PIND	Particle Impact Noise Detection (Test)
PSW	Part Submission Warrant
QML	Qualified Manufacturers List
QPL	Qualified Product List
RHA	Radiation Hardness Assurance
SCD	Source Control Drawing
SMA	Safety and Mission Assurance
SMD	Standard Microcircuit Drawing
SME	Subject Matter Expert

Key Considerations

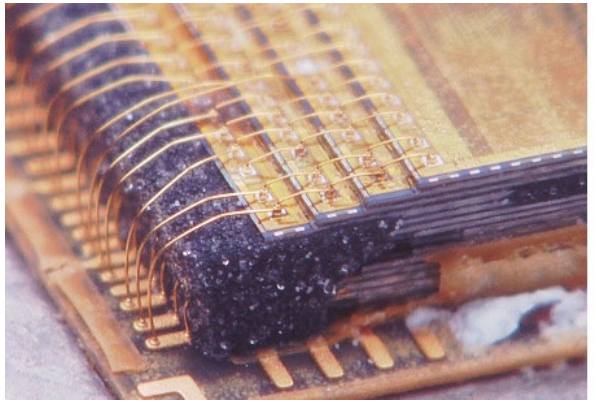
- New in 8739.11, Key Considerations have been added for certain sections. This information is intended to provide technical guidance in part selection and applications, beyond the traditional tables provided for screening and lot acceptance.
  - QML Class Y has been added in Table 1 (Use As Is for all parts assurance levels)
  - Microcircuit design and technology have increased in complexity since EEE-INST-002 was first released. Current microcircuit die are often assembled in very high-density packages. Test coverage for complex microcircuits is significantly reduced during post-procurement screening and lot acceptance testing. It is recommended to have the manufacturer perform screen/lot acceptance test to the extent possible, for increased assurance in device performance characterization.
- Note: This section excludes PEMs (separate section) and therefore, automotive (AEC-Q) parts are not referenced here and are instead referenced in the PEMs Section.

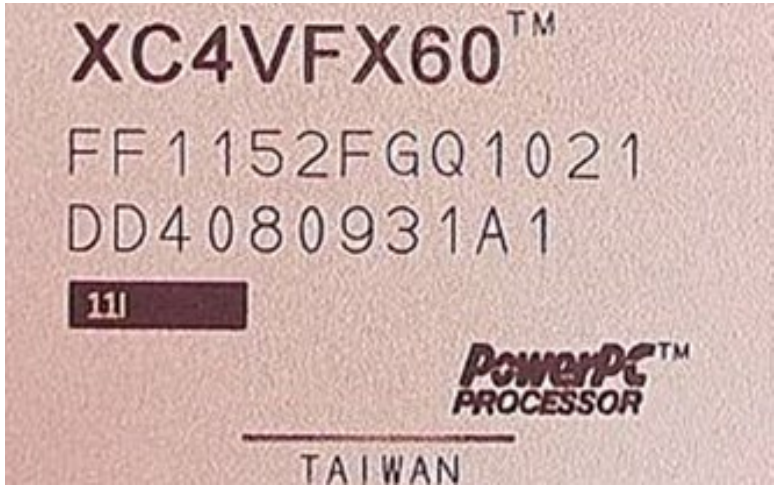
Various Microcircuit parts

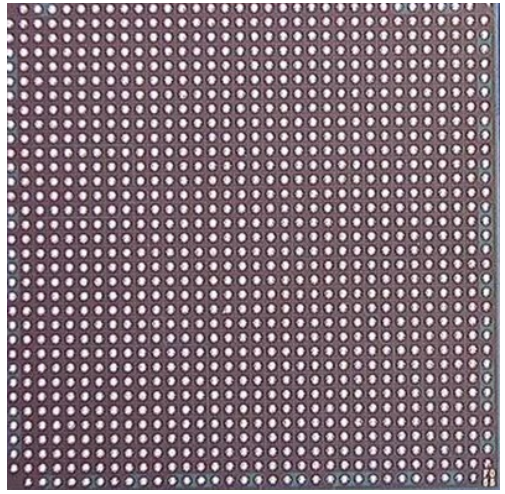


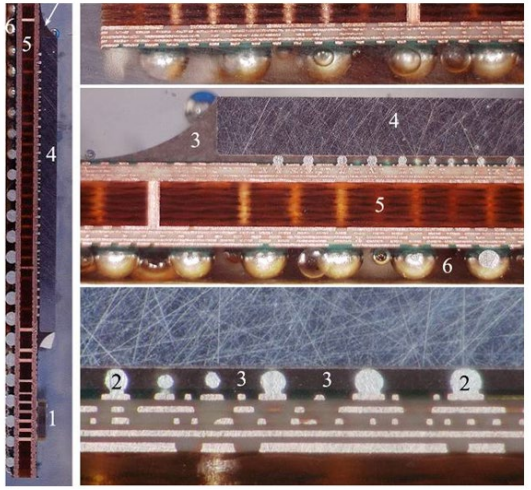












Major Changes from EEE-INST-002

- Monolithic Microcircuits
  - DPA added to the requirements in Table 1
  - Shifted to “lot acceptance test (LAT)” versus “qualification”
  - Screen/LAT requirements have not changed much
    - Biggest change is simplified burn-in test conditions and duration
  - Table 4 Derating requirements slightly updated:
    - For linear microcircuits, derating for max output current and operating frequency was increased (changed from 0.8 to 0.7)

MONOLITHIC MICROCIRCUIT TABLE 1

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Table 1. MONOLITHIC MICROCIRCUIT REQUIREMENTS 1/ 2/

Assurance Level	Monolithic Microcircuit Type	Specification	Use As Is	Screening	LAT	DPA
Level 1	QML Classes V, Y, S	MIL-PRF-38535	X			
	QML Classes; Q, B, 3/	MIL-PRF-38535		X 4/	X	
	All Types	SCD		X	X	X
Level 2	QML Classes V, Y, S	MIL-PRF-38535	X			-
	QML Classes; Q, B, M	MIL-PRF-38535		X 4/		
	All Types	Commercial, SCD		X	X	X
Level 3	QML Classes: V, Y, S	MIL-PRF-38535	X			
	QML Classes; Q, B, M	MIL-PRF-38535		R 4/		
	All Types	Commercial, SCD		X		X

Notes:

1/ The character "X" designates a requirement. The character "R" designates a recommendation.

2/ PEMs are not addressed in this section. Devices that are encapsulated in plastic shall use the guidance in PEM Section M5.

3/ QML Class Q, Class B, and Class M are not acceptable for Level 1 projects, except when there is no QML source of supply fo Class V, Y, or S devices.

4/ PIND required unless already performed by the manufacturer.

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Table 1 MONOLITHIC INTEGRATED CIRCUIT REQUIREMENTS (Page 1 of 2) 1/

Part Designation	Use As Is	Screen To Requirements in Table 2 2/	Qualify To Requirements in Table 3 2/
Level 1:			
1) Class V or Class S	X		
2) Class Q or Class B		X 3/, 4/, 5/	
3) SCD		X 4/, 5/	X
4) 883-Compliant or Class M 5/		X 4/, 5/, 6/	X
Level 2:			
1) Class V or Class S	X		
2) Class Q or Class B		X 4/	
3) 883-Compliant or Class M 6/		X 4/, 8/	X 9/
4) SCD		X 4/, 8/	X 9/
5) Mfr. Hi-Rel 7/		X 4/, 8/	X 9/
6) Commercial		X 4/, 8/	X 9/
Level 3:			
1) Class V (or S)	X		
2) Class Q (or B)		X 4/	
3) 883-Compliant or Class M 4/, 9/		X 4/	
4) SCD 9/		X 8/	
5) Mfr. Hi-Rel 10/		X 8/	
6) Commercial 10/		X 8/	

Notes follow on next page.

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MONOLITHIC MICROCIRCUIT TABLE 2

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Table 2. MONOLITHIC MICROCIRCUITS SCREENING 1/

Test	Test Sequence	Test Methods, Conditions, and Requirements	Assurance Level		
			Level 1	Level 2	Level 3
1	Wafer Lot Acceptance	MIL-STD-883, Methods 5010 Appendix II and 5007	X		
2	Nondestructive Bond Pull	MIL-STD-883, Method 2023, 2% PDA	X	X	
3	Internal Visual	MIL-STD-883, Method 2010	Condition A	Condition B	
4	Temperature Cycling	MIL-STD-883, Method 1010, Condition C, 10 Cycles min.	X	X	
5	Constant Acceleration	MIL-STD-883, Method 2001, Condition E, Y_1 Orientation Only	X		
7	PIND	MIL-STD-883, Method 2020, Condition A	X	X	R
8	Serialization		X		
9	Radiographic 2/	MIL-STD-883, Method 2012, Two Views	X		
10.	Initial Electrical Measurements	Applicable device specification at +25°C	X	X	
11	Burn-in 3/	MIL-STD-883, Method 1015, Condition C or D.	X 240 hr. @125°C	X 160 hr. @125°C	R 96 hr. @125°C
12	Final Electrical Measurements	Applicable device specification at +25°C, Minimum, and Maximum Operating Temperatures	X	X	R
13	Calculate Delta	Post Burn-in @ 25°C	X		
14	Calculate PDA	Pre-Post Burn-in 25°C DC Electrical 25°C Functional	5% 3%	10%	
15	Seal (Hermetic Types only) a. Fine Leak b. Gross Leak	MIL-STD-883, Method 1014 Condition CH or B (or A as Alternate) for Fine Leak Condition CH, B3, or C4 for Gross Leak	 X X	 X X	
16	External Visual	MIL-STD-883, Method 2009 (3X to 10X)	X	X	X

Notes:

1/ The character "X" designates a requirement. The character "R" designates a recommendation.

2/ Only one view is required for flat packages and leadless chip carriers having lead terminal metal on four sides.

3/ Limit burn-in temperature to below the maximum junction temperature (T_j) as specified by the manufacturer.

Table 2 SCREENING REQUIREMENTS FOR MONOLITHIC INTEGRATED CIRCUITS (Page 1 of 2)

Inspection/Test	MIL-STD-883		Level 1			Level 2			Level 3		
	Methods	Conditions	Class Q or B	SCD	883 or Class M 1/	Class Q or B	883 or Class M 1/	SCD/Mfr. Hi-Rel/ Commercial 1/	Class Q or B	883 or Class M	SCD/Mfr. Hi-Rel/ Commercial 1/
1. Wafer Lot Acceptance	5007			X	X		X	X			
2. Nondestructive Bond Pull	2023			X							
3. Internal Visual 2/	2010	A or B	X	X	X		X	X			X
4. Temperature Cycling	1010	C		X	X		X	X			
5. Constant Acceleration	2001	E Y_1 Orientation Only		X	X		X	X			
6. PIND 3/	2020	A	X	X	X	X	X	X	X	X	X
7. Radiographic 4/	2012	Two views		X	X						
8. Serialization				X							
9. Initial Electrical Measurements @ 25 °C 5/, 6/		Per Table 2A herein and applicable device specification	X Read/ Record	X Read/ Record	X Read/ Record		X Read/ Record	X Read/ Record			X
10. Burn-in 7/, 8/, 9/	1015	A, C, or D duration (hrs.)	X 48/160	X 72/240	X 48/160		X 160	X 160			X 160
11. Final Electrical Measurements @ 25 °C, min. and max Operating Temp. 7/, 10/		Per Table 2A herein and applicable device specification	X Read/ Record	X Read/ Record	X Read/ Record		X Read/ Record	X Read/ Record			X
12. Calculate Delta 7/, 11/		Per Table 2A herein and applicable device specification	X	X	X		X	X			
13. Calculate PDA 12/		PDA	5%	5%	5%		10%	10%			20%
14. Hermetic Seal a. Fine Leak b. Gross Leak	1014	 A or B C	 X X	 X X	 X X		 X X	 X X			
15. External Visual 13/	2009	3 to 10x	X	X	X		X	X			X

Notes at end of table.

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