2nd EDITION

TELEDYNE | Teledyne e2v Semiconductors

Teledyne e2v Space Flows Comparison Chart

Overview and comparison chart of globally recognised and Teledyne e2v's own space flows, including military, industrial and commercial flows, to help our customers find the most suitable quality grade. Read more about our products by flashing the following QR Code:

WE DELIVER

Over 6,000 space grade ADC, DAC and Processor flight models and over 40,000 avionics flight models delivered.

ZERO FAULTS

Teledyne e2v devices have never failed in-orbit since delivering the first space grade flight parts over 25 years ago.

GLOBAL STANDARDS

Our Semiconductor manufacturing site has been awarded the highest quality certifications, including EN9100 and QML Q, V and Y.

CLASSIFICATIONS

MIL-PRF-38535 Class Q	US DLA for hermetically sealed parts for military applications (class level B).
MIL-PRF-38535 class V	US DLA for hermetically sealed parts for space applications (class level S).
MIL-PRF-38535 Class Y	US DLA standard for non hermetical parts for Space applications (class level S).
ESCC9000	European standard for hermetic and non hermetic parts for space applications (class level S).
PEM-INST-001	US NASA guidelines for Plastic Encapsulated Microcircuits (PEM) for space applications (Level 1 to 3).
ECSS-Q-ST-60-13	European standard for commercial electronic parts for space applications (Grade 1 to 3).
JESD47	JEDEC standard for commercial parts.
Grade C, V, F, M	Operating temperature range of parts from Commercial Grade to Military Grade.

KEY TERMS

C-SAM	Confocal – Scanning Acoustic Microscopy
PIND	Particle Impact Noise Detection
DPA	Destructive Physical Analysis
HTOL	High Temperature Operating Life
PDA	Percentage Defect Allowed
QCI	Quality Conformance Inspection
LVT	Lot Validation Testing
LAT	Lot Acceptance Test
SMD	Standard Microcircuit Drawing
EM	Engineering Model
EQM	Engineering Qualification Model
FM	Flight Model
-X1	Teledyne X1

Please refer to definition NE 60S 220869

FLOW CHARTS

		CERAMIC / HERMETIC				ORGANIC / NON-HERMETIC										
Main Process Flow Steps	**Method / Condition**	**JESD47**	**EQM Manufactured Internally**		**QML-Q**	**QML-V**		**NB1**		**QML-Y**	**"-Nx" NASA level**			**"-Ex" ECSS Class**			**EQM Manufactured Internally**		**JESD47**	**Teledyne X1**
		C, V, F, M	(wired)	(Flip Chip)	(wired)	(wired)	(Flip Chip)	(wired)	(Flip Chip)	(Flip Chip)	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	(wired)	(Flip Chip)	C, V, F, M	-X1
	Specification reference	INTERNAL PROCEDURE			MIL-PRF-38535			ESCC 9000		MIL-PRF-38535	EEE-INST-002 / PEM-INST-001			ECSS-Q-ST-60 / ECSS-Q-ST-60-13			INTERNAL PROCEDURE		INTERNAL PROCEDURE	INTERNAL PROCEDURE
Wafer Lot Acceptance	MIL-STD-883 TM5007 / QM Plan	✓ if appl.	✓ if appl.		✓	✓		✓		✓							✓ if appl.			
Die Sawing / Select	Internal procedure / MIL-STD-883 TM2010 / ESCC 20400	✓ Cond B	✓ Cond A		✓ Cond B	✓ Cond A		✓ Cond A		✓ Cond A							✓ Cond A			
Die attach / cure	Internal or Subcontractor procedure	✓	✓		✓	✓		✓												
Internal Visual Inspection	MIL-STD-883 TM2010 / ESCC 20400					✓			✓	✓ Cond A										
Customer Precap	MIL-STD-883 TM2010 / ESCC 20400					✓			✓	✓ if appl.										
Flip Chip die attach / cure	Internal or Subcontractor procedure			✓		✓			✓	✓								✓		
Wire bonding	Internal or Subcontractor procedure	✓	✓		✓	✓		✓									✓			
Underfill dispense / cure / C-SAM	Internal procedure / MIL-STD-883 TM 2030			✓			✓		✓	✓								✓		
SMD report / reflow	Internal procedure			✓ if appl.			✓ if appl.		✓ if appl.	✓ if appl.								✓ if appl.		
Molding / Dam & Fill / Cure	Internal or Subcontractor procedure										Internal or Subcontractor procedure			Internal or Subcontractor procedure					Internal or Subcontractor procedure	Internal or Subcontractor procedure
Solder balls report / reflow	Internal or Subcontractor procedure			✓ if appl.			✓ if appl.		✓ if appl.	✓ if appl.								✓ if appl.		
Internal Visual Inspection	MIL-STD-883 TM2010 / ESCC 20400	✓	✓		✓	✓		✓		✓							✓			
Customer Precap	MIL-STD-883 TM2010 / ESCC 20400					✓		✓		✓ if appl.										
Heat sink attach	Internal Procedure							✓ if appl.		✓ if appl.										
Lid report / Sealing	Internal Procedure	✓	✓		✓	✓		✓		✓ if appl.							✓			
Stabilization	MIL-STD-883 TM1008		✓			✓		✓									✓			
PIND test	MIL-STD-883 TM2020 / A					✓		✓ if appl.		✓ if appl.										
Constant acceleration	MIL-STD-883 TM2001 / E / Y1 orientation				✓ if appl.	✓ if appl.		✓ if appl.												
Incoming inspection	Internal Procedure										✓ if appl.			✓ if appl.					✓ if appl.	✓ if appl.
Marking	Internal or Subcontractor procedure	✓	✓		✓	✓		✓		✓	✓			✓			✓		✓	✓
Serialization Marking	Internal procedure		✓			✓		✓		✓	✓			✓			✓			
Temperature Cycling	MIL-STD-883 TM1010 Cond B / +125°C / -55°C		✓							✓ 10cy organic	✓ 20cy			✓ 10cy						✓ 20cy
Temperature Cycling	MIL-STD-883 TM1010 Cond C / +150°C / -65°C				✓ 10cy	✓ 10cy		✓ 10cy		✓ 10cy ceramic										
Xray inspection	MIL-STD-883 TM 2012		✓ if appl.			✓					✓ if appl.			✓			✓			✓ sampl.
C-SAM	Internal procedure / 1 view per interface			✓ if appl.			✓ if appl.			✓ if appl.	✓ if appl.							✓		✓ sampl.
Pre-ambient electrical	Per Device Specification (25°C)		✓		✓	✓		✓		✓	✓			✓			✓		✓	
Extreme temp. Electrical	Per Device Specification										✓									
Dynamic Burn-In	MIL-STD-883, TM1015 cond. D (125°C)		✓ 160Hrs		✓ 160Hrs	✓ 240Hrs		✓ 240Hrs		✓ 240Hrs	✓ 240Hrs	✓ 160Hrs		✓ 240Hrs	✓ 160Hrs		✓ 160Hrs			
Intermediate-ambient Elect.	Per Device Specification / +25°C		✓		✓	✓		✓		✓	✓			✓			✓			
Static Burn-in	MIL-STD-883 TM1015 cond. A or B or C (125°C)					✓ 144Hrs				✓ 144Hrs	✓ 120Hrs									
Post-Burn-In Electrical	Per Device Specification / +25°C					✓				✓	✓									
Extreme temp. Electrical	Per Device Specification		✓								✓						✓			
Drift calculation	Internal procedure / per Device Spec.					✓		✓		✓										
PDA	PDA (at all temp and after all Burn-in steps)		✓ 20%								✓ 5%	✓ 10%					✓ 20%			
PDA	PDA (amb temp post Dyn.)				✓ 5%	✓ 5% / 3% (functional)		✓ 5%		✓ 5% / 3% (functional)				✓ 5%						
Extreme temp. Electrical	Per Device Specification (-55°C / +125°C)					✓		✓		✓	✓			✓						
Termination report	Internal or Subcontractor procedure	✓ if appl.	✓ if appl.		✓ if appl.	✓ if appl.		✓ if appl.		✓ if appl.							✓ if appl.		✓ if appl.	
Fine & Gross leaks test	MIL-STD-883, TM1014 / A / C	✓	✓		✓	✓		✓ if appl.												
Final Electrical	Per Device Specification / +25°C	✓	✓ if appl.		✓	✓		✓		✓							✓ if appl.		✓	✓
Extreme temp. Electrical	Per Device Specification	✓			✓	✓ if appl.				✓ if appl.									✓	✓
Physical dimension control	Per Device Specification	✓	✓		✓	✓		✓		✓	✓			✓			✓		✓	✓
External Visual inspection	MIL-STD-883 TM2009	✓	✓		✓	✓		✓		✓	✓			✓			✓		✓	✓
Final source inspection	MIL-STD-883 TM2009 / A					✓		✓		✓	✓			✓						
Bake	J-STD-033 / 125°C							✓ if appl.		✓	✓			✓			✓		✓	✓
Packing	J-STD-033 / Internal procedure	✓	✓		✓	✓		✓		✓	✓			✓			✓		✓	✓
Certificate of Compliance	MIL-PRF-38535	✓	✓		✓	✓		✓		✓	✓			✓			✓		✓	✓

QUALITY REQUIREMENTS

Teledyne-e2v program benefits													
Applied Quality Management System		ISO9001 or EN9100	EN9100	EN9100	EN9100	EN9100	EN9100	EN9100	EN9100	EN9100	EN9100	ISO9001 or EN9100	ISO9001 or EN9100
Single Fab, assembly and test sites			✓	✓	✓	✓	✓	✓	✓	✓	✓		
Single wafer diffusion lot	Per delivery (on customer request)			✓	✓	✓	✓	✓	✓	✓	✓		
Single lot date code	Per delivery (on customer request)		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Change Notification Process	J-STD-046	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Product Discontinuance Notification Process	J-STD-048	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lot traceability report	Main production steps		✓		✓	✓		✓	✓	✓	✓		Limited
Electrical datalog	For delivered parts		✓		✓	✓		✓	✓	✓	✓		
Initial qualification	Available for customer on request	based on JESD47	based on JESD47	MIL-PRF-38535	MIL-PRF-38535	ESCC 9000	MIL-PRF-38535	PEM-INST-001 or ECSS-Q-ST-60-13 or based on JESD47	PEM-INST-001 or ECSS-Q-ST-60-13 or based on JESD47	based on JESD47	based on JESD47	based on JESD47	based on JESD47
Lot Verification Testing (ESCC9000)	LVT report delivered with parts												
LVT1 - Environmental	ESCC 9000 - Chart F4					✓							
LVT1 - Mechanical	ESCC 9000 - Chart F4					✓							
LVT2 - Endurance	ESCC 9000 - Chart F4					✓							
LVT3 - Capability	ESCC 9000 - Chart F4					✓							
Quality Conformance Insp. (MIL-PRF-38535)	QCI report delivered with parts												
Group A - Electrical test	MIL-PRF-38535 / delivered parts			✓	✓		✓						
Group B – Assembly Capability	MIL-PRF-38535			✓	✓		✓						
Group C - Steady-state life test	MIL-PRF-38535			✓	✓		✓						
Group D - Thermal & Mechanical	MIL-PRF-38535			✓	✓		✓						
Group E – RHA	MIL-PRF-38535			✓ on request	✓ on request		✓ on request						
Wafer acceptance lot	QM plan			✓	✓		✓						
Outgassing test	ASTM E595 or ECSS-Q-ST-70-02						✓						
Preconditioning / CSAM	J-STD-020 / MIL-STD-883 TM 2030						✓						
Qualification Lot (NASA)	Qualification report delivered with parts												
Radiation Verification Tests	TID and SEE - ESCC 22900 / MIL STD 883 1019 /ESCC 25100								✓				
C-SAM	PEM-INST-001								✓				
Preconditioning	Moisture soak / Reflow simulation								32 parts	17 parts			
Subgroup 1a - Life testing	MIL-STD-883 TM1005 / D / 125°C								1500H / 22 #	1000H / 22 #	500H / 10 #		
Subgroup 1b - Temp cycling	MIL-STD-883 TM 1010 / B + DPA								500cy / 22 #	200cy / 22 #	100cy / 10 #		
- DPA/FA	PEM-INST-001 and internal standards								✓				
- CSAM T1	PEM-INST-001								✓				
Subgroup 2 - Biased HAST	JESD22-A110 / 96 hours / +130°C / 85% RH								✓ on 10 #				
- Unbiased HAST	JESD22-A118 / A / 96 hours / +130°C / 85% RH									✓ on 10 #	✓ on 7 #		
Lot Acceptance Test (ECSS-Q-ST-60-13	LAT report delivered with parts												
Construction analysis	ESCC 21400										✓ on 5 #		
Outgassing test	ECSS-Q-ST-70-02										✓		
Precond + Biased HAST or THB	JESD22-A110 96H / +130°C / 85%RH or JESD22-A101										✓ on 10 #		
Precond / Temp.Cycling / C-SAM	MIL-STD-883 TM 1010 / B / 100cy / -55°C to 125°C										✓ on 10 #		
HTOL	MIL-STD-883 TM 1005 / D / / 125°C / per diffusion lot										2000H / 15#	1000H / 15#	
Radiation Verification Tests	TID and SEE - ESCC 22900 / MIL STD 883 1019 /ESCC 25100										✓		
Lot Trace Code validation	No evaluation report delivered with parts												
Radiation Evaluation	TID and SEE - ESCC 22900 / MIL STD 883 1019 /ESCC 25100												✓

Authors: Christelle BISSONNIER - Semiconductors Products Quality Engineer/ Carine NIKITINE - Semiconductors Products Quality Engineer/ Yoann BRUNEL - Semiconductors Products Quality and Reliability Technician/ Sébastien RENAUD - Semiconductors Products Quality Engineer and Point of Contact for the DLA.