



ADI Commercial Space Products Program

September 2020

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The electronic content of satellites is expanding exponentially in both traditional GEO satellite signal processing applications and LEO small satellite constellations. These new ambitious design solutions require reduced size, weight, power, and cost. The benefits of using plastic encapsulated microcircuits (PEMs) or commercial-off-the-shelf devices (COTS) in space level applications include advanced technologies, higher levels of integration, higher performance, and better size, weight, and power specifications.

What Are Commercial Space Products?

Commercial space bridges the gap between commercial products and full space qualified hermetic QML V product. Decades of knowledge building space grade parts is being applied to make commercial parts suitable for space use.

ADI has created two new product grades to address the emerging and wide-ranging needs:

- ▶ **CSL**—Cost-constrained or high volume requirements: basic testing and screening suitable for LEO constellations.
- ▶ **CSH**—Highest screening and qualification level, used where no hermetic-package option is available (equivalent to QML V using SAE AS6294 as a guideline).

Balancing reliability with cost to reach an acceptable level of risk is of utmost importance in the era of new space. Features such as wafer lot uniformity and traceability, radiation monitors, and enhanced testing/screening that are not supported with a commercial-grade product.

ADI's commercial space device screening and qualification is based on internally defined equivalent flows per NASA PEM-INST-001 and SAE AS629.

CSL Features:

- ▶ Wafer lot uniformity and traceability
- ▶ Radiation monitors
- ▶ Outgassing characterization
- ▶ High reliability lead finishes and no Cu wire bonds
- ▶ Extended temperature

CSH Features:

- ▶ Everything offered with CSL, plus ...
- ▶ High reliability screening
- ▶ High reliability quality conformance inspection

Commercial Space Data Reports

Data reports can be made available as an option. When required, data reports will include:

- ▶ 100% processing attributes data
- ▶ Electrical test variable data, if applicable
- ▶ Radiographic inspection report, if applicable
- ▶ Failure analysis report, if applicable
- ▶ Certificate of Conformance

Manufacturing Locations

Space Level Screening	Wafer Fab	Assembly	Screening and Quality Conformance Inspection
Standard commercial space product device screening and qualification	<ul style="list-style-type: none"> ▶ ADI Wilmington, MA ▶ ADI Limerick, Ireland ▶ ADI Camas, WA ▶ TSMC Taiwan ▶ Various foundries 	<ul style="list-style-type: none"> ▶ ADI Penang, Malaysia ▶ Various ADI approved subcontractors 	<ul style="list-style-type: none"> ▶ ADI Cavite, Philippines ▶ ADI Chelmsford, MA ▶ ADI Milpitas, CA

Commercial Space Screening Flows

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Wafer fabrication	Single fab location	X	X	
Wafer lot acceptance test	SEM analysis		X	
Assembly	Hi-Rel package finish (nickel palladium gold preferred), if available, and no Cu wire bonds	X	X	No matte tin except where noted
Outgas characterization	ASTM E-595	X	X	Performed once per released assembly BOM
Operating temperature range	Extend operating temperature range from -55°C to +125°C through qualification and performance testing, subject to device limitations	X	X	
Pre-cap source inspection		N/A	N/A	
Serialization			X	Where package size permits, laser mark or register options
Gross bubble test		N/A	X	Air cavity packages only
Fine/gross leak test	MIL-STD-883, TM 1014.A and C	N/A	N/A	
External visual inspection	Per ADI0028 External Visual		X	

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Thermal cycle	MIL-STD-883, TM 1010.B, 20 cycles or equivalent		X	
C-SAM	J-STD-020		X	N/A to air cavity packages
Radiographic	MIL-STD-883, TM 2012 (top view) and inspect for wire sweep		X	
Constant acceleration	MIL-STD-883, TM 2001.E, Y1 axis only		X	Air cavity packages only
PIND	MIL-STD-883, TM 2020.A		X	Air cavity packages only
Pre-burn-in electrical tests	100% of the devices per device specification at room temperature	X	X	
Burn-in	100% of devices from each flight lot and perform burn-in per MIL-STD-883, TM 1015 (240 hours at 125°C, or equivalent, with dc bias), for lots >500 pcs, a sampling plan will be agreed upon		X	Single pass burn-in condition as determined by ADI; conditions may vary by device
Final electrical tests	Perform 100% electrical test (at min, room, and max temperatures) on all burn-in units		X	When serialization not possible, based on lot average
Deltas calculation	Per data sheet specs, performed on all burn-in units		X	
Percent defect allowable (PDA)	5% max, repeat burn-in <10%, second pass <2%		X	
Gross bubble test		N/A	X	Air cavity packages only
Fine/gross leak test	MIL-STD-883, TM 1014.A & C	N/A	N/A	
External visual inspection	Per ADI0028 External Visual	X	X	
Destructive physical analysis (DPA)	Based on NASA PEM-INST-001; 5 samples		X	Tests and lab requirements determined by QA, N/A for hermetic packages
Data report			X	Option at additional cost
Diffusion lot traceability	Listed on box label	X		
	Included in C of C		X	Follow current ADI QA major change PCN guidelines

Commercial Space Quality Conformance Inspection

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Visual inspection and serialization (# samples)			X (37)	Where package size permits, laser mark or register options
Baseline C-SAM	J-STD-020		X	
Preconditioning	Moisture soak per JESD22-A113		X	
Solderability	MIL-STD-883, TM 2003 or J-STD-002		X	Five samples at additional cost, based on package type
Electrical test	100% of the devices per device specification at min, room, and max temperatures		X	
Group 1: 16 samples for CSH from production test				
Physical dimensions	MIL-STD-883, TM 2016		X	
Steady state life test	MIL-STD-883, TM 1005, 1,000 hrs at +125°C		X	Condition based on product type
	Additional 1000 hrs		X	Information only
Thermal cycle	MIL-STD-883, TM 1010.B, 500 cycles or equivalent		X	
C-SAM	J-STD-020		X	
Post burn-in electrical test	100% of devices per device specification at min, room, and max temperatures		X	
External visual inspection	Per ADI0028 External Visual, indentation in metallization and/or copper base metal may be exposed through plating after processing and shall not be grounds for rejection if caused by fixturing and no other visual acceptance criteria are violated		X	
Group 2: 16 samples for CSH from production test				
Unbiased HAST	JESD22-A118, 96 hrs, 130°C at 85% RH		X	N/A to air cavity packages
Electrical test	100% of the devices per device specification at min, room, and max temperatures		X	N/A to air cavity packages
External visual inspection	Per ADI0028 External Visual		X	

Commercial Space Radiation Inspection

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
TID wafer lot specific test	TID up to 30 Krads per data sheet specification, using samples from same wafer used for production build, as required by process	X		Generic report, wafer lot specific data available at additional cost
TID radiation lot acceptance test (RLAT)	TID specified per data sheet, pass/fail to data sheet specification (post rad limits), as required by process		X	
SEE benchmark	SEL performed once at initial qualification, repeated for any major process or mask change, as required by process	X*	X	Generic report *Option at additional cost