

ADI Commercial Space Products Program

2025

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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:

- ▶ **Commercial Space Low (CSL)**—Cost-constrained or high-volume requirements: testing and screening suitable for LEO constellations.
- ▶ **Commercial Space High (CSH)**—Highest screening and qualification level, used where no hermetic-package option is available (based on SAE AS6294 guidelines and drawing from QML-V standards).

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 AS6294.

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

CSH Data Reports

Data reports are included for CSH products, and include the following:

- ▶ 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	▶ ADI Wilmington, MA ▶ ADI Limerick, Ireland ▶ ADI Camas, WA ▶ Various foundries	▶ ADI Penang, Malaysia ▶ Various ADI approved subcontractors	▶ ADI Cavite, Philippines ▶ ADI Chelmsford, MA

Commercial Space Screening Requirements

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Wafer fabrication	Single fab location with wafer diffusion lot traceability provided	✓	✓	
Lot acceptance test	SEM analysis		✓	SEM inspection is not required on planar oxide interconnect technology.
Assembly	NiPdAu finish preferred, if available, and no Cu wire bonds. Separate Branding for CS Devices	✓	✓	Solder dip not recommended
Outgas characterization	ASTM E-595	✓	✓	Performed once per released assembly BOM

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Operating temperature range	Minimum operating temperature range: -40°C to 85 °C. Preferred operating temperature range: -55 °C to 125 °C	✓	✓	
Pre-cap source inspection		N/A	N/A	Not applicable for commercially assembled products
Serialization	Laser mark or embedded memory options, where package size permits		✓	
Gross bubble test		N/A	✓	Air cavity packages only
Fine/gross leak test	MIL-STD-883, TM1014 A & C	N/A	N/A	
External visual inspection	Per ADI0028	✓	✓	
Thermal cycle	MIL-STD-883, TM1010B, 20 cycles or equivalent		✓	
C-SAM	J-STD-020		✓	N/A to air cavity packages
Radiographic	MIL-STD-883, TM2012 (top view) and inspect for wire sweep		✓	Wire sweep inspection when applicable
Constant acceleration	MIL-STD-883, TM2001E, Y1 Axis only		✓	Air cavity packages only
PIND	MIL-STD-883, TM2020A		✓	Air cavity packages only
Electrical test	100% of the devices per device specification at room temperature	✓		
Initial (pre-burn-in) electrical test	100% of the devices per device specification at min, room, and max temperatures		✓	
Burn-in	100% of devices from each flight lot and perform burn-in per MIL-STD-883, TM1015 (240 hrs at Tcase = 125°C). For lots >500 pcs, a sampling plan can be negotiated.		✓	*Tcase might change based on product type. Single pass burn-in condition as determined by ADI, conditions may vary by device

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Final electrical tests	Perform 100% electrical test (at min, room and max temperatures) on all burn-in units		✓	
Deltas calculation	Per data sheet specs, performed on all burn-in units.		✓	When serialization is not possible, delta calculation based on Min vs Max from each subplot
Percent defect allowable (PDA)	5% max, repeat burn-in <10%, 2nd pass <3%		✓	
Destructive physical analysis (DPA)	Based on NASA PEM-INST-001		✓	Tests and lab requirements per ADP00902 as determined by QA. N/A for hermetic
Data report			✓	
Wafer diffusion lot traceability	Box Label	✓		Follow current ADI QA major change PCN guidelines
	C of C		✓	

Commercial Space Quality Conformance Inspection

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Qualification report	Qualification per ADI0012 requirements	✓		Qualification based on process/assembly BOM
Visual inspection and serialization	Per ADI0028		✓	Where package size permits, laser mark or register options
C-SAM	J-STD-020		✓	C-SAM is N/A for air cavity packages.
Preconditioning	Moisture soak per JESD22-A113		✓	
Electrical test	Performed on QCI samples per device specification at min, room, & max temperatures		✓	
Group 1: 16 samples per CSH wafer diffusion lot				
Physical dimensions	MIL-STD-883, TM2016		✓	
Steady state life test	MIL-STD-883, TM1005, 1000 hrs at Tcase = +125°C		✓	Tcase setting might change based on product type. Life test conditions as determined by ADI, conditions may vary per device
Post- Steady state life electrical test	Per device specification at min, room, & max temperatures		✓	Tested at 1000 hrs life test.
External visual inspection	Per ADI0028, 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.		✓	
Group 1A: 16 samples per CSH package assembly lot				
Thermal cycle	MIL-STD-883, TM1010B, 500 cycles or equivalent		✓	
Electrical test	Per device specification at min, room, & max temperatures		✓	
C-SAM	J-STD-020		✓	

External visual inspection	Per ADI0028		✓	
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Group 2: 16 samples per CSH package assembly lot

Unbiased HAST	JESD22-A118		✓	Conditions are mission profile dependent
Electrical test	Per device specification at min, room, & max temperatures		✓	
External visual inspection	Per ADI0028		✓	

Commercial Space Radiation Inspection

Screen/Test	Test Method/Requirements	CSL	CSH	Notes
Total Ionizing Dose (TID) Benchmark Testing	TID testing per data sheet specifications and performed using initial qualification samples.	✓	✓	Generic report
TID Radiation Lot Acceptance Test (RLAT)	Pass/fail to data sheet specifications (rad limits), per MIL-STD-883, TM1019 (with exceptions noted).	✓	✓	CSL: Pass/fail only, data not provided. CSH: RLAT summary provided in data report.
Single Event Effects (SEE) Benchmark Testing	Performed once at initial qualification, repeated only for any major process or mask change.	✓	✓	Generic report