ACCEDE / ESCCON 2025 DAY 0

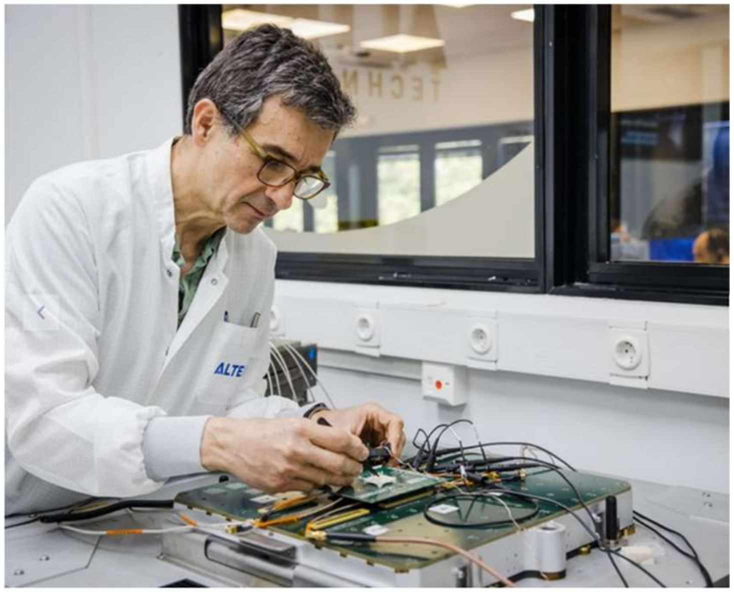
Testing COTS, when & how. From lot validation to lot screening.

Name | Department | 21.03.2025

Introduction

Now we know selection of COTS and risks associated, but how to test them?

For the usage of COTS, testing acts as risk mitigation and Product Assurance compliance, but what do we rely on to define testing flow



- Parts heritage
- Reliability data from manufacturer
- Product Assurance requirements for the mission
- Physical characteristics of the parts

ALTER

Pure COTS Vs Automotive

AEC-Q components

Characteristic	AEC-Q Components	Pure Commercial Components
Reliability	Higher reliability due to automotive-grade standards (AEC-Q100, AEC-Q200, etc).	Lower reliability; not designed for harsh environments.
Environmental Testing	Tested for temperature, vibration, and humidity ranges suitable for automotive applications.	Minimal or no testing for extreme environments.
Radiation Hardening	Not specifically radiation-hardened but may tolerate some radiation.	No radiation tolerance; highly susceptible to space radiation.
Operating Temperature Range	Wider range (-40°C to 150°C typically).	Narrower range (e.g., 0°C to 70°C or -10°C to 85°C).
Cost	Moderately priced; higher than commercial components.	Low cost; designed for consumer markets.

Pure COTS Vs Automotive

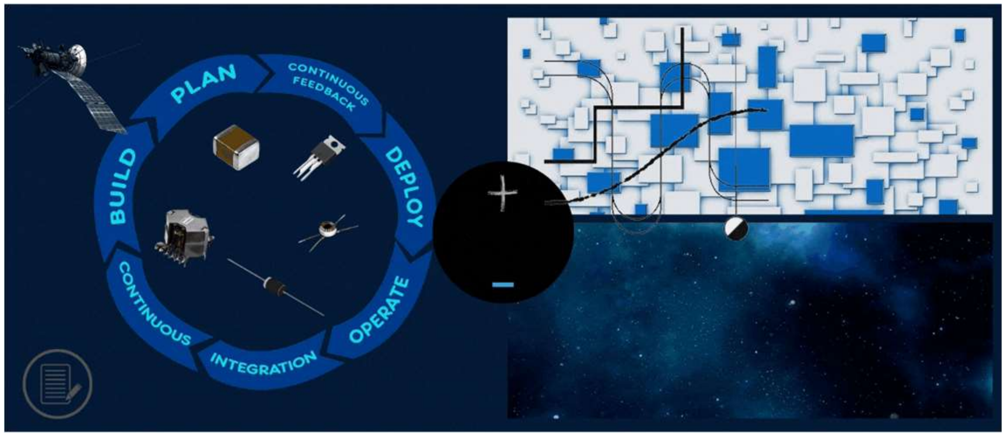
AEC-Q components

Characteristic	AEC-Q Components	Pure Commercial Components
Quality Control	Strict quality control processes (e.g., ISO standards).	Basic quality control for mass production.
Application in Space	Suitable for low-risk or non-critical space missions with screening.	Limited use; requires extensive screening to mitigate risks.
Screening Requirements	Moderate screening needed for space qualification.	Extensive screening and testing required to ensure usability.
Lifecycle	Longer lifecycle due to focus on durability.	Shorter lifecycle; optimized for rapid market turnover.

Testing on COTS for different projects

Requirements Dependency

- As mentioned before, the use of COTS have been increasing during last years all along the Space sector.
- Its use on any project is allowed as long as it is justified
- The approval to use it will be highly dependant on:
  - Justification
  - Mission Class
  - Specific PA Requirements
  - COTS Classification



ALTER

Testing on COTS for different projects

ESA Case

- For ESA missions, ECSS-Q-ST-60-13C is the standard defining the required testing. It defines the applicable testing for Class 1-3 missions.

- If the component is passive, mechanical and thermal testing should be conducted. In case the component is an active device, also radiation testing should be conducted. The complete testing scheme is defined in ECSS-Q-ST-60-13C, Tables 8-1 to 8-8.

ECSS-Q-ST-60-13C Rev.1
12 May 2022

EUROPEAN COOPERATION
ECSS
FOR SPACE STANDARDIZATION

Space product assurance

Commercial electrical, electronic and electromechanical (EEE) components

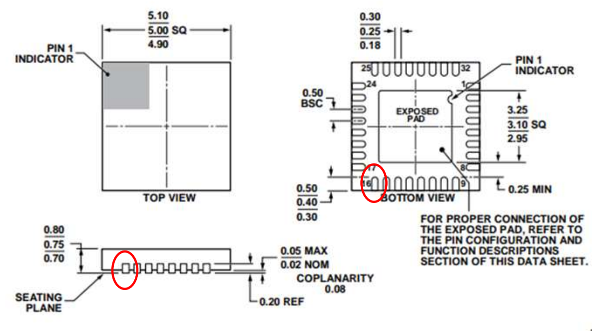
ALTER

Testing on COTS for different projects

ESA Case: Example Microcircuit AD7961BCPZ for Class 1 mission

- Part is a 16-Bit, 5 MSPS, PulSAR Differential ADC
- Initial Considerations:
  - Retinning: This part has a pure tin finish. However, the pad has a L shape, with pure tin only on the bottom side (covered by solder) and side is Cu.
  - Microcircuit: Table 8-6 of ECSS-Q-ST-60-13C Rev.1

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-220-WHHD.

Figure 38. 32-Lead Lead Frame Chip Scale Package [LFCSP_WQ]
5 mm × 5 mm Body, Very Very Thin Quad
(CP-32-7)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
AD7961BCPZ	−40°C to +85°C	32-Lead Lead Frame Chip Scale Package [LFCSP_WQ]	CP-32-7
AD7961BCPZ-RL7	−40°C to +85°C	32-Lead Lead Frame Chip Scale Package [LFCSP_WQ]	CP-32-7
EVAL-AD7961FMCZ		Evaluation Board	

[1] Z = RoHS Compliant Part.

ALTER

Testing on COTS for different projects

ESA Case: Example Microcircuit AD7961BCPZ for Class 1 mission

Table 8–6: Procurement test table for microcircuits

Microcircuits									
Automotive grade	Class 1	Class 2	Class 3	Category	Test type	Sample size	Test Procedure	Specific Test condition	Note
AEC-Q grd 0/1	X	X	X	Evaluation	Radiation evaluation		i.a.w. ECSS-Q-ST-60-15		
AEC-Q grd 0/1	X	X	X	Evaluation	Construction Analysis	5	i.a.w. Annex H + outgassing		Note (d)
AEC-Q grd 0/1	X			Evaluation	Life Test 2000h	15	TM from Table 8-9	2000h LT	Note (a)
AEC-Q grd 0/1	X	X	X	Screening	Hermeticity	all	TM from Table 8-10 and 8-13		for hermetic parts
AEC-Q grd 0/1	X	X	X	Screening	PIND test	all	TM from Table 8-10 and 8-13		for parts with cavity
AEC-Q grd 0/1	X			Screening	Complete screening	all	TM from Table 8-10	240h burn-in	Note (b)
AEC-Q grd 0/1	X	X	X	LAT	RVT		i.a.w. ECSS-Q-ST-60-15		
AEC-Q grd 0/1	X	X	X	LAT	Construction Analysis	5	i.a.w. Annex H		
AEC-Q grd 0/1	X	X		LAT	Life test 1000h	15	TM from Table 8-11 and 8-14	1000h LT	Note (c)
No	X	X	X	Evaluation	Radiation evaluation		i.a.w. ECSS-Q-ST-60-15		
No	X	X	X	Evaluation	Construction Analysis	5	i.a.w. Annex H + outgassing		Note (d)
No	X	X		Evaluation	Complete Evaluation	see tables	TM from Table 8-9 and 8-12		Note (a)
No	X	X	X	Screening	Hermeticity	all	TM from Table 8-10 and 8-13		for hermetic parts
No	X	X	X	Screening	PIND test	all	TM from Table 8-10 and 8-13		for parts with cavity
No	X	X		Screening	Complete screening	all	TM from Table 8-10 and 8-13	240/168h duration in class 1/2	Note (b) in class 2
No	X	X	X	LAT	RVT		i.a.w. ECSS-Q-ST-60-15		
No	X	X	X	LAT	Construction Analysis	5	i.a.w. Annex H		

Testing on COTS for different projects

ESA Case: Example Microcircuit AD7961BCPZ for Class 1 mission

Microcircuits									
Automotive grade	Class 1	Class 2	Class 3	Category	Test type	Sample size	Test Procedure	Specific Test condition	Note
No	X	X	X	LAT	Complete LAT	see tables	TM from Table 8-11, 8-14 and 8-15	Life test duration 1000h	Note (c) in class 3

Note (a): see 8.2b: *Based on the review of representative data, as per 8.2f, the supplier may propose an adaptation and a minimization of these evaluation tests, to be submitted to customer for approval through the JD's approval process.*

Note (b): see 8.2c: *Based on representative data, as per 8.2f, collected in evaluation tests and in the JD, the supplier may propose an adaptation and a minimization of these screening tests to be submitted to customer for approval through the JD's approval process.*

Note (c): see 8.2d: *The supplier may propose an adaptation and a minimization of these LAT tests, to be submitted to customer for approval through the JD's approval process, based on representative data, as per 8.2f, on parts not older than 2 years.*

Note (d): see 8.2e: *Outgassing test shall only be applied if all the three following conditions are met:*
1.part package is based on organic material, AND
2.weight of one part > 100 mg, AND
3.test required by the user program or critical applications.

Note (e): see 8.2g: *DPA shall only be done on representative samples from each procurement batch in class 2 and class 3.*

ALTER

Testing of COTS for different proje

COTS for a Class 3 mission from ESA

- Example: SLIM-MOX104RD Ohmite: Precision, Thick Film, Voltage Divider

- Constructional Analysis
- Outgassing
- Humidity Test
- Life Test 1000h
- Screening: Burn-in 96h 100%

PARTS APPROVAL DOCUMENT

ALTER	PROJECT	Doc nº: SWE-ATN-PAD-10007 Issue: 1	Date: 2023/06/21 Prepared by: M. SANCHEZ

Approval requested by: ALTER TECHNOLOGY TÜV **Line-Item-No:** SWEQ0000000026R
Family: RESISTORS **Fcode:** [10] **Group:** METAL FILM **Gcode:** [08]
Component number: SLIM-MOX104RD
Commercial equivalent designation: SLIM-MOX104RD
Manufacturer/Country OHMITE / USA
Technology/Characteristics (value or range of values with tolerance, voltage, package, etc...):
Precision Thick Film Voltage
Divider
Pure tin free (Y/N) [Y] **Package:** Radial
Generic specification: **Issue:** **Rev:**
Detail specification: Manufacturer Datasheet **Issue:** **Rev:** 6 **Variant:**
Specification amendment: **Issue:** **Rev:** **Variant:**
Quality level: COMMERCIAL **Procurement by:** ALTER TECHNOLOGY TÜV NORD
Remark:

APPROVAL STATUS

EPPL Part 1/2 listed (1/2/N) [N]
ESCC QPL or EQML listed (Y/N) [N]
MIL QPL or QML listed (Y/N) [N] **QPL/QML reference:**
Other aprovals/former usage:
Evaluation programme required (Y/N) [N] **Evaluation programme reference:**
Remark: The solder on the leads is 96% Sn 3.5% Ag 0.5% Cu

PROCUREMENT INSPECTIONS and TESTS

Precap (Y/N) [N]
Lot acceptance:
ESCC LAT/LVT LAT level or subgroup [ ]
Other LAT (Y/N) [N] **MIL QCI/TCI group:**
Buy-off (Y/N) N
DPA (Y/N) [N] **Sample size:** 0
Complementary tests:
Remark: EVAL:Construction Analysis (5 pcs), Humidity Test (15 pcs), Life test 1000h (54 pcs),Outgassing.
SCRE: Burn-in 96h 100%
According to proposal S00000017866

RADIATION HARDNESS DATA

Radiation hardness assurance plan applicable (S/N) [N]
Doc. Ref.:

Total dose effects (Y/N)	[N]	**Level:**	**Report ref:**
SEL (Y/N)	[N]	**Level:**	**Report ref:**
SEU (Y/N)	[N]	**Level:**	**Report ref:**
SET (Y/N)	[N]	**Level:**	**Report ref:**
SEFI (Y/N)	[N]	**Level:**	**Report ref:**
SEB (Y/N)	[N]	**Level:**	**Report ref:**
SEGR (Y/N)	[N]	**Level:**	**Report ref:**
Others (Y/N)	[N]	**Level:**	**Report ref:**

RVT required (Y/N) [N]
Remark:

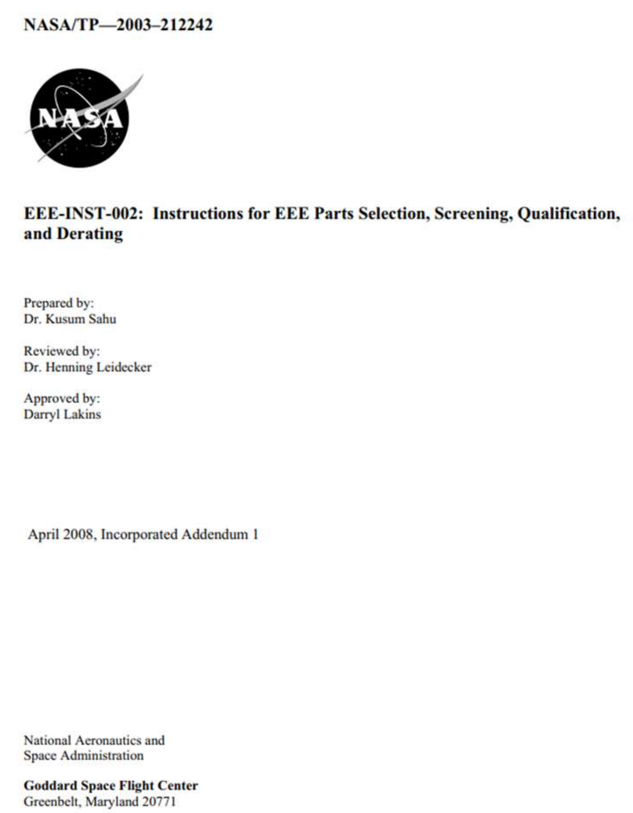
ALTER

Testing on COTS for different proje

NASA Case

- For NASA missions, EEE-INST-002 is the standard defining the required testing. It defines the applicable testing for Class 1-3 missions.

- There is currently NASA-STD-8739.11R in Draft Version, updating the approach, but cannot currently be used or shared before approval. It is of particular interest the change of screening by sampling to screening 100% approach.



NASA/TP—2003–212242

EEE-INST-002: Instructions for EEE Parts Selection, Screening, Qualification, and Derating

Prepared by:
Dr. Kusum Sahu

Reviewed by:
Dr. Henning Leidecker

Approved by:
Darryl Lakins

April 2008, Incorporated Addendum 1

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

Testing on COTS for different projects

NASA Case

- In relation to COTS, NASA EEE-INST-002 states:

6.2.5 Commercial Parts. For the purpose of GSFC projects, this part designation represents all parts that do not conform to the categories defined above. These parts are procured per manufacturer's data sheet specifications. It is the responsibility of the user to assess the part manufacturer's quality capability to produce space quality parts and perform additional screening and qualification tests as defined in this document.

6.2.6 Plastic Encapsulated Microcircuits (PEMs). The use of Plastic Encapsulated Microcircuits shall be restricted to applications where no similar high reliability hermetically sealed device exists. The use of PEMs is permitted on GSFC space flight applications, provided each use is thoroughly evaluated for thermal, mechanical, and radiation implications of the specific application and found to meet mission requirements. A PEM shall not be substituted for a form, fit, and functional equivalent, high reliability, hermetic device in space flight applications. Refer to Section M4 on the detailed instructions for selection, screening qualification, and derating of these parts. Due to significant lot-to-lot variability that can occur in the fabrication processes and technology, each procurement of PEMs requires a separate evaluation that includes radiation effects. The use of Plastic Encapsulated semiconductor devices and hybrids shall follow similar guidelines as for PEMs.

6.2.7 Commercial Off-the-Shelf (COTS) Assemblies and Sub-Assemblies. Occasionally it is necessary to use sensors or other equipment of commercial origin. When commercial units or assemblies are purchased as off-the-shelf hardware items, PCB shall review their function and reliability for mission criticality.

6.2.7.1 Critical Applications for COTS. When failure of such units represents significant compromise to mission success, an analysis of the parts for compliance to the requirements of this document shall be performed. Following the results of this analysis, units may be required to undergo modification for use of higher reliability parts, or radiation hardened parts. All upgrade parts shall be subject to PCB approval. Modifications such as additional shielding for radiation effectiveness or replacement of radiation soft parts with radiation hardened parts, may be recommended and may be performed at the user's facility or user-approved facility.

6.2.7.2 Non-critical Applications for COTS. When loss of off-the-shelf units does not compromise mission success, a waiver may be granted on a case-by-case basis that exempts the unit from the requirements of this document, subject to written approval of the project. However, additional unit level testing, such as thermal cycling or thermal vacuum testing, may be directed by the project in lieu of piece part level screening.

ALTER

Testing on COTS for different proj

NASA Case

- Therefore, due to their complexity and criticality, NASA has a specific Standard for procurement and testing Plastic Encapsulated Microcircuits, PEM-INST-001

NASA/TP—2003–212244

PEM-INST-001: Instructions for Plastic Encapsulated Microcircuit (PEM) Selection, Screening, and Qualification

Prepared by:
Dr. Alexander Teverovsky and Dr. Kusum Sahu

Reviewed by:
Dr. Henning Leidecker

Approved by:
Darryl Lakins

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

ALTER

Testing on COTS for different projects

NASA Case: Example 2 – Commercial PEM

- PEM is based on 3 testing: Screening, Qualification & DPA

Table 1. GSFC PEM Requirements 1/

Selection Priority	Screening (See Section 3)	Qualification (See Section 4)	DPA (See Section 5)
Level 1	X	X	X
Level 2	X	X	X
Level 3	X	X	X

Notes:

1/ PEMs qualified according to this document are intended for operation within the manufacturer's data sheet limits. **Any uprating and use of PEMs outside the manufacturer's specified range, particularly the temperature limits, is not acceptable.**

Testing on COTS for different projects

NASA Case: Example 2 – Commercial PEM

- Testing: Screening

Table 2. Screening Requirements for PEMs 1/

Screen	Test Method and Conditions	Level 1	Level 2	Level 3
1. External visual, and serialization 2/	Per paragraph 5.3.1.	X	X	X
2. Temperature cycling	MIL-STD-883, Method 1010, Condition B (or to the manufacturer's storage temperature range, whichever is less). Temperature cycles, minimum.	20	20	20
3. Radiography 3/	Per paragraph 5.3.2.	X	X	X
4. C-SAM inspection 4/	Per paragraph 5.3.3.	X	X	X
5. Initial (pre-burn-in) electrical measurements (EM) 5/	Per device specification, at 25 °C At min. and max. rated operational temperatures.	X X	X X	X -
6. Engineering review (steps 1 to 5) 6/				
7. Static (steady-state) burn-in (BI) test at 125 °C or at max. operating temperature 7/	MIL-STD-883, Method 1015, condition A or B. Hours, minimum depending on the BI temperature.	240 hrs. at 125 °C 445 hrs. at 105 °C 885 hrs. at 85 °C 1,560 hrs. at 70 °C	160 hrs. at 125 °C 300 hrs. at 105 °C 590 hrs. at 85 °C 1,040 hrs. at 70 °C	160 hrs. at 125 °C 300 hrs. at 105 °C 590 hrs. at 85 °C 1,040 hrs. at 70 °C
7a. Post static BI electrical measurements at 25 °C	Per device specification. Calculate Delta when applicable.	X	X	X
9. Dynamic burn-in test at 125 °C or at max. operating temperature 7/	MIL-STD-883, Method 1015, Cond. D. Hours, minimum.	Same as test step 7.	Same as test step 7.	Same as test step 7.
10. Final parametric and functional tests	Per device specification (at 25 °C, maximum, and minimum rated operating temperatures).	X	X	X
11. Calculate percent defective (steps 7 to 10) 6/	Maximum acceptable PDA.	5%	10%	10%
12. External visual/packing 2/	Per paragraph 5.3.1 and Section 8.	X	X	X

Notes on next page.

ALTER

Testing on COTS for different projects

NASA Case: Example 2 – Commercial PEM

- Testing: Qualification

3/ Radiation hardness of the parts must be assessed on a lot-specific basis according to the project requirements. So that analysis can be completed prior to screening and qualification, unscreened samples can be used for this test. An additional number of samples, depending on radiation requirements, shall be provided by the project to perform this test.

Radiation lot acceptance testing (RLAT) of PEMs should be performed independently of any data that may exist for equivalent or similar hermetically sealed devices, and should be performed under the direction of the project radiation specialist. This is necessary as market conditions may drive unannounced process changes, creating differences in radiation response. It may be possible to dispense with single-event qualification of the PEM if data exist for the hermetic device. However, because PEMs are passivated with nitride layers, which are known to be responsible for TID sensitivity to pre-irradiatiation elevated thermal stresses (PETS), TID characterization should always be independently performed.

Table 3. GSFC Qualification Requirements for PEMs 1/

Process	Sub Test	Test Methods & Conditions	QTY (Failures)		
			Level 1	Level 2	Level 3
1. Visual inspection & serialization 2/		Section 5, paragraph 5.3.1.	32	32	17
2. Radiation analysis		TID and SEE	3/	3/	3/
3. Baseline C-SAM	(Parts in subgroup 1 only)	Section 5, paragraph 5.3.3.1.	22	22	N/A
5. Preconditioning	Moisture soak 4/	JESD22 – A113-B, para. 3.1.5, condition A (168 hours, +85 °C, 60% RH).	32	32	17
	SMT devices Reflow simulation (with flux application, cleaning, and drying)	JESD22-A113-B, Table 2 and paragraphs 3.1.6 through 3.1.9. Peak solder reflow temperature +235 °C.	32	32	17
	Through-hole devices Resistance to soldering temperature	JESD22-B106-B.	32	32	17
4. Electrical measurements	Per device specification	Measure at 25 °C, min. & max. rated temperatures.	32(0)	32(0)	17(0)
6. Life testing Subgroup 1	HTOL, 125 °C 5/, 6/	MIL-STD-883, Method 1005, Cond. D Hours, minimum.	22 1,500	22 1,000	10 500
	Electrical measurement (per specification)	Measure at 25 °C, min. & max. rated temperatures.	22(0)	22(0)	10(0)
6a. Temperature cycling Subgroup 1	Temperature cycling 5/, 7/	MIL-STD-883 Method 1010, Cond. B (-55 °C to +125 °C), cycles, minimum.	22 500	22 200	10 100
	Electrical measurement (per specification)	Measure at 25 °C, min. & max. rated temperatures.	22(0)	22(0)	10(0)
	C-SAM 8/	Section 5, paragraph 5.3.3.	22	22	N/A
	DPA or FA	9/	X	X	N/A
7. Highly accelerated stress test (HAST)	Biased HAST 5/	JESD22-A110, with continuous bias (96 hours, +130 °C, 85% RH).	10	N/A	N/A
Subgroup 2	Unbiased HAST 5/	JESD22-A118, Condition A (96 hours, +130 °C, 85% RH).	N/A	10	7
	Electrical measurement (per specification)	Measure at 25 °C, min. & max. rated temperatures.	N/A	10(0)	7(0)

Notes on next page.

ALTER

Testing on COTS for different projec

NASA Case: Example 2 – Commercial PEM

- Testing: DPA

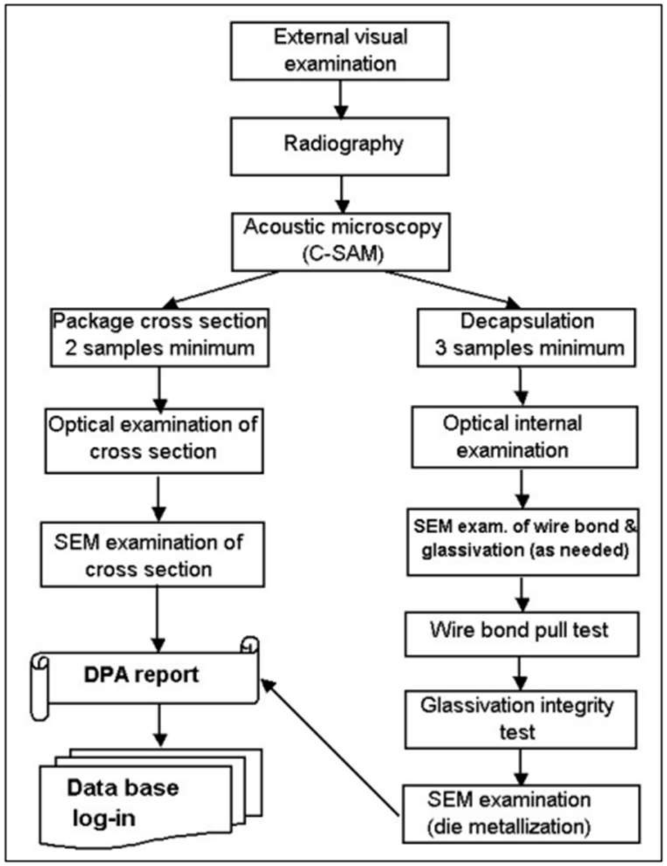


Figure 4. A Typical DPA Test Flow for PEMs (See Section 5.3 for GSFC DPA procedure.)

ALTER

Testin of COTS for different projects

COTS for a New Space Example:

	Space /Military/Automotive qualified	Non-qualified with complete quality/reliability data	Non-qualified parts without data
Justification Document	No JD	JD	JD
Additional Screening	No Additional Screening	No Additional Screening	No Additional Screening
Lot Test	No Lot Test	No Lot Test	Lot Test

- Radiation Testing: Depending on Environment and mission time, shall be managed per difusión lot or per wafer fab

Testing of COTS for different projects

COTS for a New Space Example:

- Commercial components must be operative under (-40°C, +85°C) range.
- ECSS-Q-ST-60C restriction list is aplicable, adding commercial and non-hermetic relays. Wire link fuses up to 3A can be used.
- Derating requirements: NASA, ESA or User are aplicable.
- Pure Tin terminations allowed: JESD-201 Class 2 evaluated or Risk Mitigation Plan.
- Parts to be procured directly from manufacturer or franchised distributors.
- Configuration Control is Required to track changes in the parts (mask, manufacturing or assembly process).
- Rely on Quality/Reliability Data instead of process control and reliability.
- Relifing Tests not Required, but parts older tan 15 years forbidden.
- Errata sheets considered as alerta.
- Tracecode to be managed for COTS.

Radiation on COTS

Which approach to follow?

The criteria it must be followed to choose the approach depends on:

- Selection of the correct type, technology and manufacturer is already the preliminary step to minimize the associated risk. This selection will be based also on the specific application, type of mission and duration, radiation requirements.

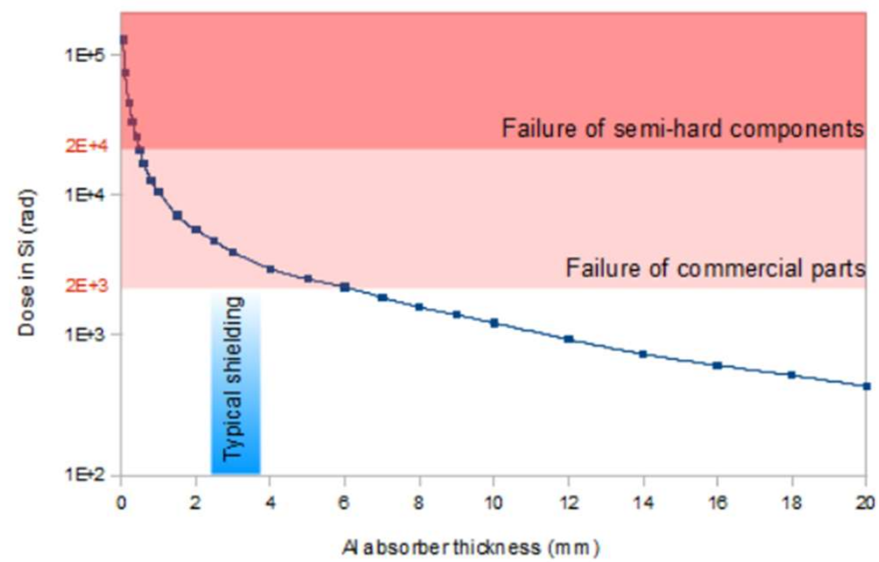
- Regarding radiation characteristics, following key points must be considered:
  - On active and discrete parts, SEE are a fundamental aspect. SEL, SEB, SEDR are destructive events applicable to technologies such as CMOS, BiCMOS…
  - It is critical to perform an optimum selection of MOSFETs devices (in terms of SEE and TID) considering SOA (Safe Operating Area) and derating requirements.
  - Optoelectronics parts are also very critical due to them inherit high sensitivity to TNID effects (Displacement Damage effects).
  - Finally, for bipolar transistors or IC's using bipolar technology (including BiCMOS), it is extremely important to consider ELDRS effects.

Radiation on COTS

Behaviour against TID

- The behaviour of a COTS component, independent of the reliability level, depends on the orbit and mission duration. A trade-off between shielding and testing must be performed, as some COTS devices may be not functional after 1-5 krad.

- The radiation effects affects significantly the duration of the mission. In the same environment, an additional aluminium shielding will improve the survivability of the equipment.



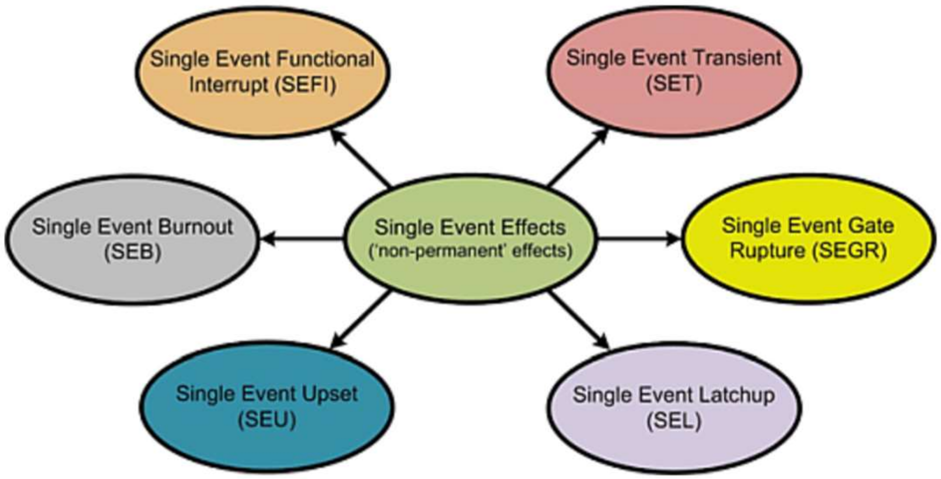
ALTER

Radiation on COTS

Behaviour against SEE

- COTS components are typically sensitive to SEE. As only a SEE can result in a complete destruction of a mission, it is important to perform a risk analysis.

- One of the main issue of using COTS is that SEE testing is expensive and might result in long lead times, due to the lack of beam time availability. For that reason, using rad-hard components is typically more cost-effective if the requested number of pieces is not extensive and if previous SEE data is not provided.



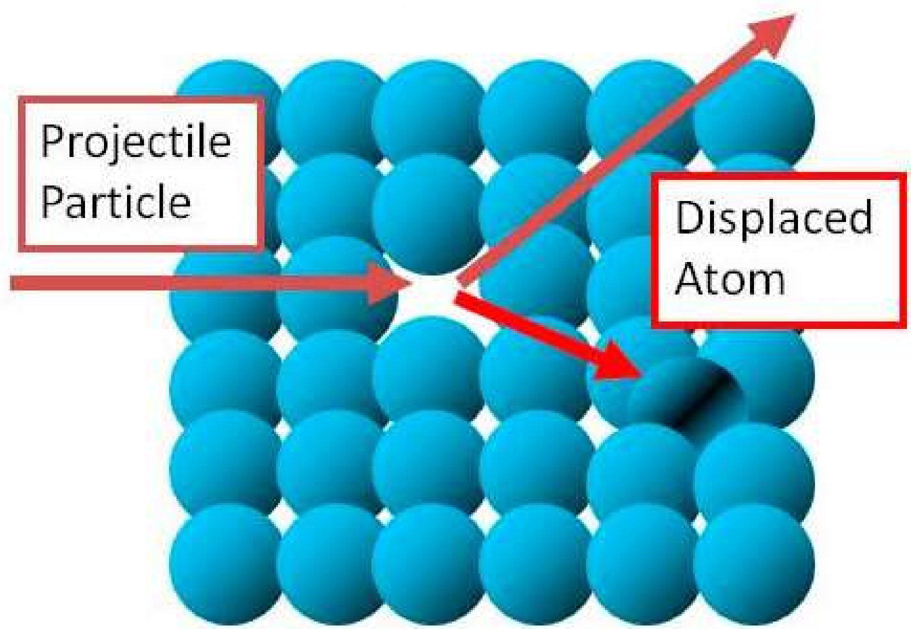
ALTER

Radiation on COTS

Behaviour against DD

- There are not a great amount of qualified optoelectronic devices. Typically, optoelectronics COTS are chosen if necessary for the design.

- In this case, DD needs to be performed in these components. DD testing has been widely studied and wafer testing needs to be performed in optocouplers, UV leds or photodiodes.



ALTER

Lessons Learnt

- CLASSIC SPACE USES A VERY CONSERVATIVE APPROACH, BUT CHANGES IN SPACE BUSINESS REQUIRE NEW APPROACHES.
- COTS PARTS OFFER A WIDER PORTFOLIO AND PERFORMANCE OPTIONS THAN SPACE OR MILITARY PARTS.
- THE QUESTION IS NOT IF TO USE COTS OR NOT, BUT WHEN, WHICH AND HOW.
- SOMETIMES USING COTS IS THE ONLY OPTION.
- DIFFERENT CONSIDERATIONS NEED TO BE DONE FROM DIFFERENT PERSPECTIVES FOR THE USE OF COTS: FROM MANUFACTURER, TO DESIGN AND MISSION REQUIREMENTS.
- THESE CONSIDERATIONS WILL LEAD TO THE APPROPRIATE APPROACH TO FOLLOW.
- A DEEP ANALYSIS OF ALL ASPECTS INVOLVED WILL LEAD TO AN ACCURATE TAILORING OF THE REQUIREMENTS.
- RADIATION IS A KEY DIFFERENCE BETWEEN SPACE BUSINESS AND OTHER INDUSTRIES. HERITAGE AND EXISTING INFORMATION IS KEY FOR COTS SELECTION.
- RISKS ARE INHERENT TO COTS, BUT A GOOD ANALYSIS AND CORRECT APPROACH SHOULD MINIMIZE THEM.
- ALTER HAS EXPERIENCE IN THE USE OF COTS, EVEN INCLUDING THEM WITHIN OUR TOOLS.

COTS ? YES; CAREFULLY AND JUSTIFIED

Conclusion

USE OF COTS REPRESENTS ALWAYS A TRADE-OFF BETWEEN RISK AN

ALTER

AOB

Questions?

ALTER

THANK YOU!

Manuel Sánchez
manuel.sanchez@altertechnology.com
+34 664 703 203

www.altertechnology-group.com
info@altertechnology.com
+34 95 446 70 50

ALTER