

# THALES ALENIA SPACE ROADMAP ON PASSIVE COMPONENTS

**SPCD 2022** - 4TH SPACE PASSIVE COMPONENTS DAYS

P.J. Garcia Arribas (TAS-Spain) / M. Bardonnaux (TAS-Belgium) /  
F. Marino (TAS-Italy) / D. Ducasse (TAS-France)



# SUMMARY

1 Common requirements for passive components

2 Capacitors & resistors

3 Fuses, relays & magnetics

4 Crystal & oscillators

5 Connectors

6 RF passive components

# COMMON REQUIREMENTS FOR PASSIVE COMPONENTS

Main requirements are coming from equipment & payload roadmaps

**a** Equipment & payload design flexibility

**b** Higher density & integrated solutions

**c** Increase of dissipated power & operating temperature

**d** To promote collaboration with European Suppliers

**e** Cost & lead time reductions – Introduction of COTS

**f** Application of dedicated Design/Derating rules for COTS ?

2023 - 2024

2025 - 2027

*Increase of (Capacitance x Voltage), Size reduction (0402)*

*Low ESR Polymer Tantalum (SnPb or Au terminations), Low leakage, Better ripple performances, New technology on board or hybrid line*

*Cost & lead time reductions*

- 🕒 MLCC Flexible terminations (PCB assembly)
- 🕒 MLCC High voltage (>500V)
- 🕒 Plastic film capacitors (PM948)
- 🕒 Mica film capacitors high voltage (2kV)
- 🕒 EMI Filter feed-through (C & Pi types)
- 🕒 Wet Tantalum capacitors SMD type (ST97)
- 🕒 **Introduction of COTS Automotive Grade**
  - 🕒 MLCC 0402 – 1210 & stacked type
  - 🕒 RF Microwave MOS
  - 🕒 High temperature Tantalum (>125°C)

- 🕒 High temperature SMD film capacitors Automotive Bank capacitors
- 🕒 High voltage capacitors (3-5kV) with higher capacitance value and smaller size
- 🕒 Wet Tantalum capacitors (high capacitance value) for high energy applications (GaN)
- 🕒 Polymer Aluminum Electrolytic EMI Filter capacitors 3-terminaisons type (filtering)
- 🕒 **COTS Automotive Grade preferred**

2023 - 2024

2025 - 2027

*Power applications : Power rating ↑↑, Size ↓↓*  
*Voltage applications : Voltage rating ↑↑ without size increasing*  
*Precision applications : Better tolerances and TCR*  
*Low ohmic values (≤ 1 Ohm)*

*Cost & lead time reductions*

🕒 Solutions designed to be flexible with stable performances & compliant with automatic assembly processes

🕒 SMD solutions preferred / small size / reduced manufacturing lead time

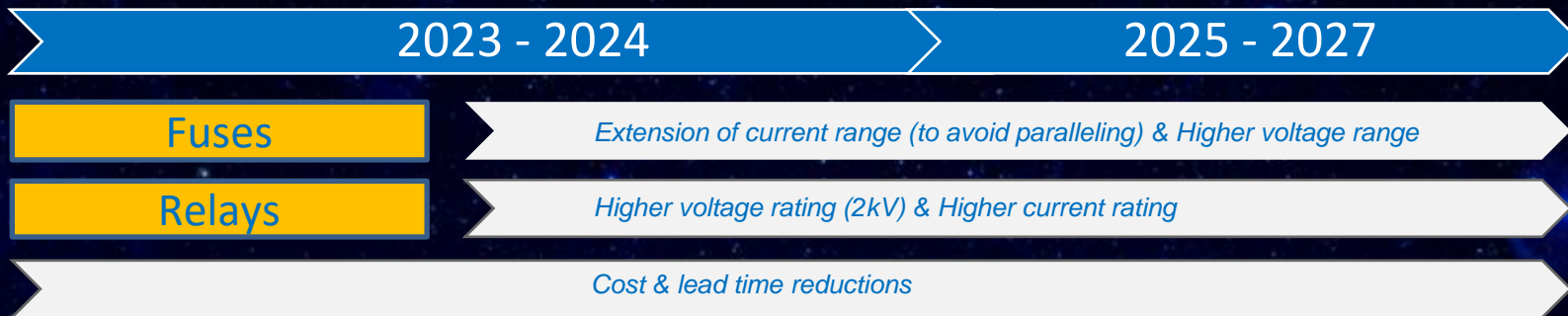
🕒 Introduction of COTS Automotive Grade

🕒 Automatic Process suitable with Pure Tin Terminations components (Whiskers mitigation)

🕒 Mounting Process standardization preferred

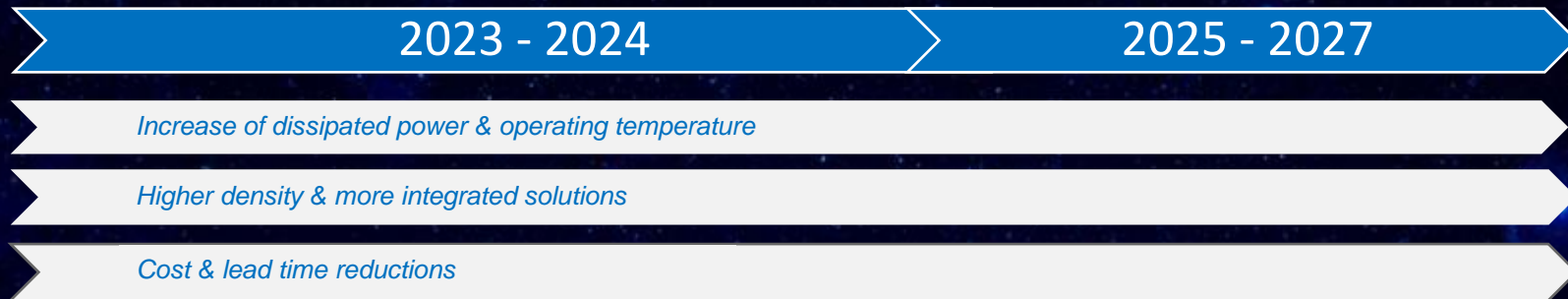
🕒 Compatible with higher base plate temperature (including solder joint behavior)

🕒 COTS Automotive Grade preferred



- 🕒 SMD solutions preferred / small size / reduced manufacturing lead time
- 🕒 Fuses : Introduction of COTS

- 🕒 Automatic Process suitable with Pure Tin Terminations components (Whiskers mitigation)
- 🕒 Mounting Process standardization preferred
- 🕒 Compatible with higher base plate temperature (including solder joint behavior)
- 🕒 Fuses : COTS Automotive Grade preferred
- 🕒 Relays : Selection of reliable COTS could be considered in the long term



- 🕒 Standard series with wide range of customization
- 🕒 Planar technologies
- 🕒 Materials compliant to new operating temperature
  
- 🕒 Cost and manufacturing lead time optimization
- 🕒 Need for detailed thermal performance characterization
- 🕒 Compliance to industrial standard mounting processes
  
- 🕒 **Introduction of COTS for new space application**

- 🕒 Chip inductors in small size 0603 and below, with higher Q and lower DCR
- 🕒 SMT Common Mode Chokes with reduced size and values greater than 1mH/15A
- 🕒 **COTS preferred for new space applications**

2023 - 2024

2025 - 2027

*Increase of performances (phase noise, jitter, ageing precision)*

*Higher density & more integrated solutions*

*Cost & lead time reductions*

✓ **Increasing of Oscillators performances towards more stringent Environmental and Design Conditions**

- Increase of Frequency Band in Transmitters application
- Increase of Frequency Speed in ADC
- High Radiation Tolerance
- Need for a very stable frequency (no activity dips, frequency jumps)

**WHERE WE ARE**

- 🕒 **Crystal resonators:**  
Aging +/- 0.5ppm  
frequency stability  
Mounting automation
- 🕒 **XO, TCXO, VCXO, OCXO**
  - Low phase noise
  - Very high stability vs environment
  - Rad. Tolerant

**Red Flags:**

- 🕒 **Radiation – cost driver; still stringent requirements for New Space missions**
- 🕒 **Traceability – difficulty to keep lot homogeneity for high volumes on COTS products**
- 🕒 **Cost – still high price for New Space requirements (increasing also due to shortage);**

**WHAT ABOUT THE FUTURE?**

- ➡ **Evaluation of MEMS Technology for short term missions (Green Flags – Stability, Low cost, very small dimensions; Red Flags – Radiations)**
- ➡ **Oscillators in SAW Technology (Green Flags – Stability, Low Phase Noise, Higher Freq)**
- ➡ **Leadless devices (GreenFlags)**
- ➡ **Possible future evolution : Introduction of COTS**



2023 - 2024

2025 - 2027

- ✓ Components designed to be Glitch free & to achieve a Shielding effectiveness of 75dBi
- ✓ SMD solutions (manufacturing & assembly efficiency)

*Increase of frequency & of Power at payload & at equipment level*

*Fast locking & integrated solutions*

*Cost reductions*

- 🕒 2.4 connectors (up to 50GHz)
- 🕒 SMD RF connectors for fully automated assembly
- 🕒 RF cable assy with phase stability over temperature
- 🕒 High power coaxial ISO (130W / L, S & C band) / dropin ISO (250W / L band)
- 🕒 Surface mount ISO/CIRC (X & Ku & 20GHz band)
- 🕒 Surface mount Switches
- 🕒 Introduction of COTS RF connectors for new space applications

- 🕒 1.85 connectors (up to 65GHz)
- 🕒 Fast locking connectors & RF cable assy (DC – 32GHz – VSWR of 20dB)
- 🕒 Fast locking connectors (up to V band)
- 🕒 Multiport RF connectors (up to V band)
- 🕒 Rack & panel multiport connectors with nano RF contacts assembled on RF cables
- 🕒 High power coaxial ISO (250W L band - 400MHz bandwidth / 80W X band)
- 🕒 Surface mount ISO/CIRC (up to 40GHz)
- 🕒 High integration RF passive components (from L to Ku band)
- 🕒 Introduction of COTS RF passive components for new space applications

2023 - 2024

2025 - 2027

- ✓ High density solutions
- ✓ Reliable interconnection solutions
- ✓ Manufacturing & assembly efficiency

*Modular / Flexible – Power & signal connectors*

*Solderless solutions – Connectors easy to mount & to repair at unit level*

*Fast locking & integrated solutions / Cost reductions*

- 🕒 Connectors with SMD terminations for fully automated assembly
- 🕒 Connectors with Pressfit terminations
- 🕒 High data rate connectors up to 25Gbps (for rack, panel & harness configurations / applications)
- 🕒 Board to board interconnection with floating mounting capability
- 🕒 Optical interconnections (increase of data exchanges inside equipment)
- 🕒 Introduction of COTS solutions for new space applications

- 🕒 Connectors device to board with solderless terminations
- 🕒 High data rate connectors up to 56Gbps
- 🕒 Optical interconnections various solutions (harness complexity limitation)
- 🕒 **COTS solutions preferred**

## CONCLUSION

- Passive components are instrumental for Thales Alenia Space satellites and payloads
- There is a Thales Alenia Space coordinated and harmonized policy for all Competence Centers
- The introduction of COTS is promoted everytime it is permitted and in concertation with the final users and customers



# THANKS FOR YOUR ATTENTION

