



WE LOOK AFTER THE EARTH BEAT

Passive Components TAS Road Map

17/10/2016

Ref.:

THALES ALENIA SPACE INTERNAL

ThalesAlenia
A Thales / Finmeccanica Company *Space*

83230353-DOC-TAS-EN-001

➤ **Common requirements for Passive Components**

➤ Chip Passive Components

➤ Custom Passive Components

➤ Connectors

➤ RF Passive Components

THALES ALENIA SPACE INTERNAL

This document is not to be reproduced, modified, adapted, published, translated in any material form in whole or in part nor disclosed to any third party without the prior written permission of Thales Alenia Space - © 2012, Thales Alenia Space

ThalesAlenia
A Thales / Finmeccanica Company *Space*

Common requirements for passive parts

➤ *Main requirements coming from Equipment & Payload Road Map*

- Equipment/ Payload/ design flexibility
- Higher density & integrated solutions
- Increase of dissipated power & operating temperature
- Cost & lead time reductions
- To promote collaboration with European Suppliers

- Common requirements for Passive Components
- **Chip Passive Components**
- Custom Passive Components
- Connectors
- RF Passive Components

➤ Chip Passive components :

- Resistors
- Ceramic Capacitors
- Other Capacitors
- High current Fuses
- RF Inductors

Global requirements

- To improve accuracy (2%,1% or 0.1%) on some dedicated components packages
- Higher admissible voltage and current

Chips resistors : preferred

Size reduction R0603

- To extend resistors family with 0.1% tolerance
- Higher Voltage for pulse operating condition **up to 100 Volts**



⇒ **Need a size reduction**

High Power resistors

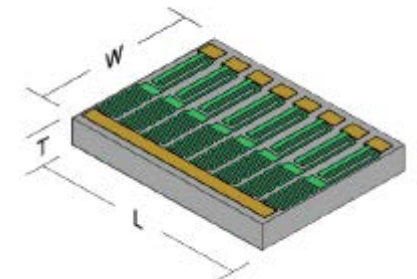
- Widely used on equipment
- To find qualified European solution

⇒ **Need to qualify R2512 package – At least 1W Power**

Resistors Networks

→ Current lead time of 6 months becomes a real constraint

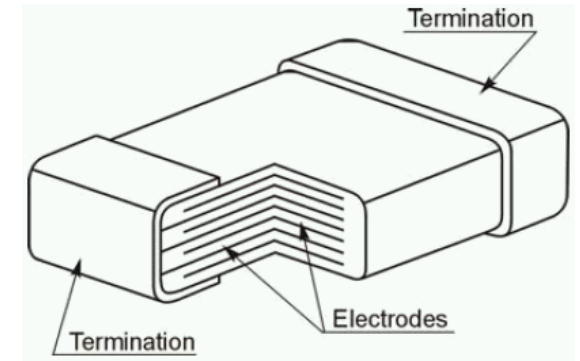
⇒ **European source needs to be qualified**



Ceramic Capacitors

Expected Key performances

- To get High voltage Capacitors : **> +200V to +400V**
- To get higher C / V values reducing the size



⇒ European supplier would be preferred

Film plastic

Expected Key performances

- To get high capacitance values: **> 100 μ F**
- High voltage: **> +63V**

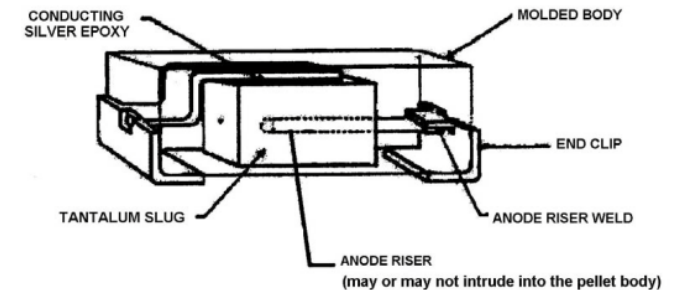
⇒ Need a size reduction with such C/V values

Passive Components – TAS Road Map – Chip passive components

Polymer tantalum

Expected Key performances

- Larger range of capacitance values / Voltage
- Replace Solid Tantalum



⇒ European/US suppliers are not qualified yet

High temperature capacitors for use in hermetic package

Expected Key performances

- Dimensions constraints compatible with space micro-electronic applications
- High value: **20 μ F max**
- High Temperature: **> 150°C**

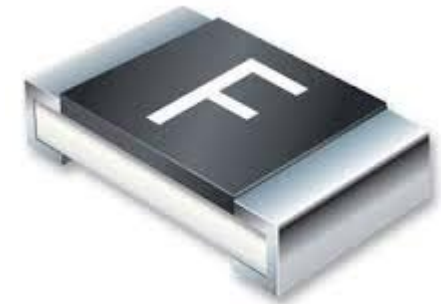
⇒ No product qualified for Space Applications

High current Fuse

→ Potential risks to procure parts under Export restrictions

Key performances

- Full CMS report
- Rated Current : **5, 10, 15, 20 Amp**
- Operating Voltage: **150 V**
- Low sensitivity to **Pulsed current** applications
- Operating temperature range : **- 55°C to + 125°C**



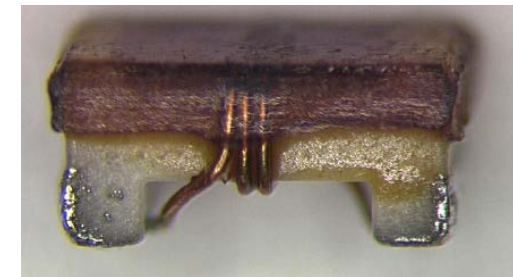
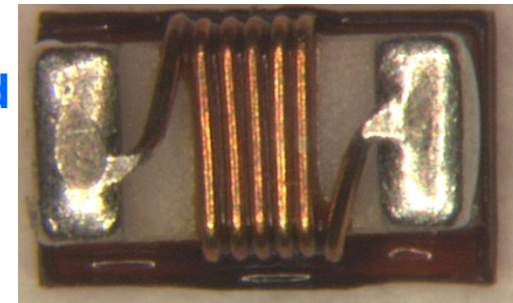
⇒ European supplier to be qualified

RF Inductors

→ European Space qualified solutions not compliant with new Power equipments

Key performances

- Full CMS report and size reduction: **0603 preferred**
- Range value: **7.5nH to 750nH**
- Respectively SRF value: **4GHz - 400MHz**
- Tolerance : **2%**
- Operating temperature : **- 55°C to + 125°C**



⇒ European solution to be developed

- Common requirements for Passive Components
- Chip Passive Components
- **Custom Passive Components**
- Connectors
- RF Passive Components

➤ Custom Passive components :

- Magnetics
- Crystals
- Oscillators

Global requirements

- To get custom & flexible electrical performances with standard solutions (package and technology)
- To develop hybrid integrated solutions
- To improve lead time

Magnetics

Products

➤ Power & Current transformers, Filtering...

3 Key performances for next generation of Power Supply

➤ To improve repeatability of electrical performances (Toroid, RM Core...)



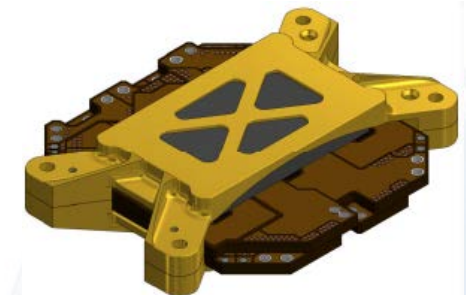
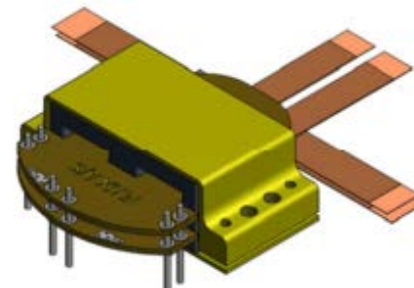
⇒ Solutions available at Exxelia Microspire - ESA/ CNES
Capability Approval in progress

➤ To find integrated solutions (SMD, Planar...)



⇒ Planar solutions available at Flux A/S – Space
qualified Designs / ESA Project

⇒ Significant Size reduction
achieved



THALES ALENIA SPACE INTERNAL

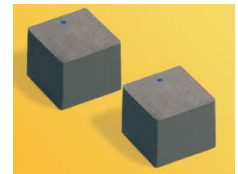
- To find technical solutions compliant with an increase of global temperature **+20°C** and compliant with TAS industrial process

⇒ **Investigations are still in progress to cover all needs (core, ferrite, coil former, materials...)**



✈ Additional requirement from specific equipment

- Wide Band RF Transformers, Current Transformers, Power Inductors...
- Reproducible performances, SMD cases and attractive cost



⇒ **Technical and Quality evaluation of first findings is in progress**



⇒ **European solution to be developed**

THALES ALENIA SPACE INTERNAL

Crystal

Key component to achieve great performances on telecom satellite receivers. Improve lead time delivery and phase noise behavior.

Products:

- 50 to 100 Mhz, T807 or SMC Crystal Resonator

Key performances

- Available in SC, AT,...cut
- High long term stability : **< 1ppm /20 years**
- Low noise around F0 between **10 Hz & 1 KHz**
- Rated power **500 μ watt**
- Low lead time



⇒ **Critical manufacturing path**

⇒ **Increase of digital and high-speed communications**

→ **2 mains manufacturers qualified by TAS (interchangeability)**

→ **Stronger specifications required (stability, phase noise,...)**

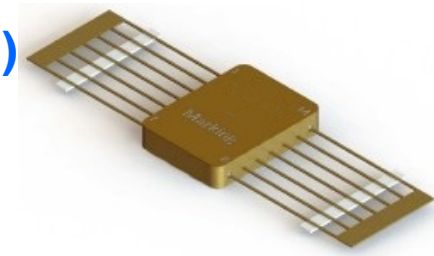
Oscillateur XO

➤ Clock reference for numeric board, No european qualified supplier for these products

➤ Product: 10 to 160 Mhz, FP20, FP16 low size

➤ Key performances

- Global frequency Stability : **+/- 70 ppm (or better → +/- 50ppm)**
- Aging : **+/- 15 ppm (or better → +/- 5 ppm)**
- Supply Voltage : **5,5V or 3,3V preferred (low consumption)**
- AHCMOS Compatible
- Similar cost Vs non european supplier
- Temperature range: **-40°C/+105°C (or better -55°C/+125°C)**

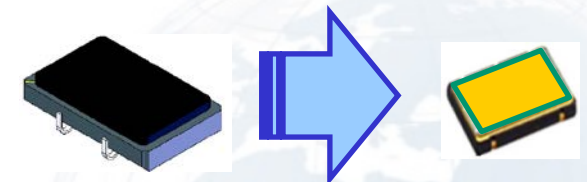


⇒ European supplier qualification is on-going (mid 2017) - ESCC

⇒ New JLead package under evaluation (easy mounting)

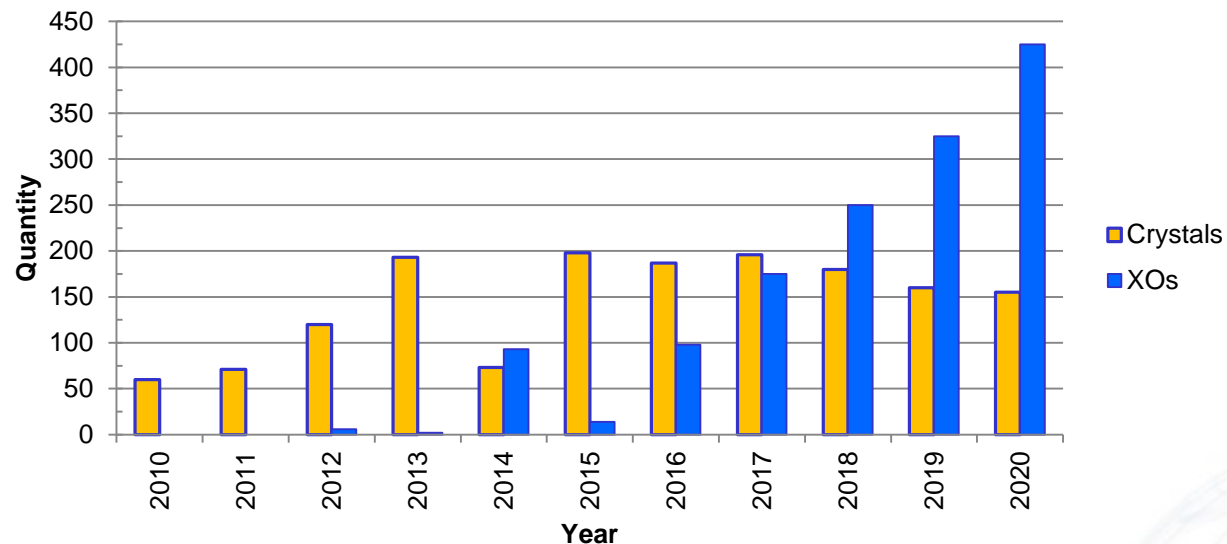
⇒ Critical manufacturing path : lead time improvement

⇒ SMD package (automatic mounting, size and cost reduction)



TAS-F Quartz & Oscillators market

- A lot of new developments using digital communication and data processing
- Stable crystal market up to 2017 then slight decrease
- Strong increase on XOs



- Stable OCXO market (today in-house OCXO, external in development)

- Common requirements for Passive Components
- Chip Passive Components
- Custom Passive Components
- **Connectors**
- RF Passive Components

✦ Connectors :

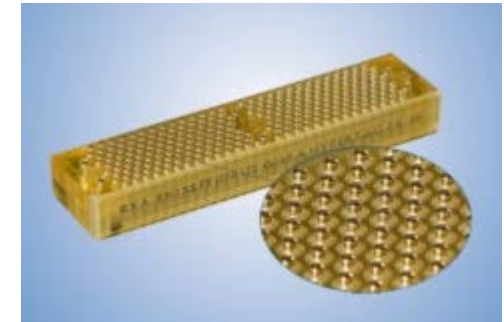
- ✦ Interposer Connectors
- ✦ SMD & Press-fit Connectors
- ✦ High Data Rate Connectors
- ✦ 2.4 Connectors
- ✦ High power Connectors
- ✦ Fast locking SMP Connectors

Global requirements

- ✦ High density solutions
- ✦ Solderless and competitive solutions
- ✦ Fast plugging solutions

➤ Interposer Connectors :

- Integrated solutions for Board to board / Hybrid to board connection (up to 48 contacts)
 - Dimensional constraints at equipment level (thickness).
 - Expected benefits : significant cost reductions (solderless connectors). Higher flexibility during assembly phase. Easy to repair at unit level if needed.



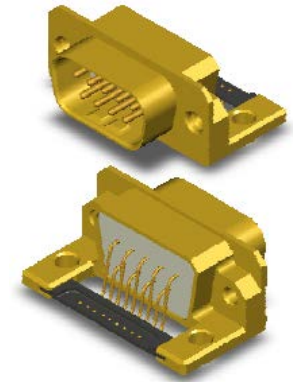
- ⇒ Development on-going up to 67 contacts
- ⇒ Thickness flexibility improved
- ⇒ Improvement to be done for easier mounting

⇒ Development of an interposer Component to board connection

⇒ Interposer connectors for RF applications (up to 20 GHz)

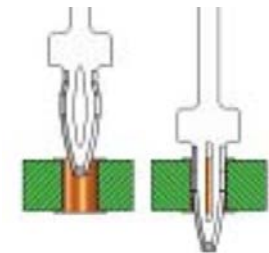
➤ SMD Connectors (Sub-D & Micro-D) :

- To reduce dimensional constraints at equipment level.
- Significant cost reductions
- Easy to mount (automatic) and to repair



➤ Press-Fit connectors (Sub-D, Micro-D, board to board,...)

- Higher flexibility during assembly phases
- Fast plug-in/out
- Significant cost reductions



⇒ Evaluation of these connectors on-going (CNES contract)

⇒ Development of a Sub-D or Micro-D solution with spring contacts

High Data Rate Connectors (End to End solution)

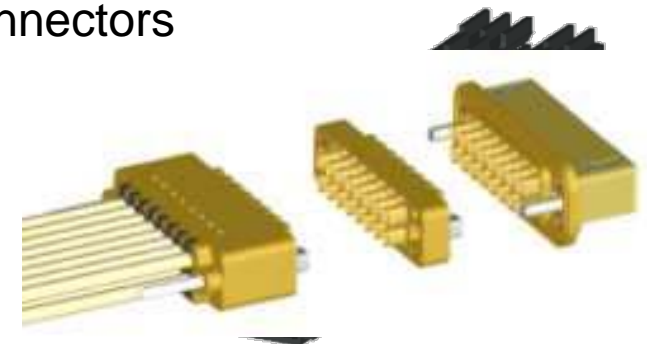
➤ Increase **flow of digital data** between board to board & Unit to unit. High density and important number of connections are required.

➤ Products:

- Up to 48 high density contacts, mother & daughter board connectors
- Module of 4 coaxial or twinax links, unit & cable connectors

➤ Key performances

- Solderless, Flexible & Modular solution
- High density, pitch/contact : **3 mm**
- Digital Speed : **6.25 Gbit/s.**
- Mixed Signal : **High speed + Power + DC signal modules**



⇒ **Development/Qualification on-going with a European supplier**

⇒ **Need of Optical Solutions for Ultra high speed flow of data**

2.4 Connectors

➤ Increase of space operating frequency **up to 50 Ghz** for dual use broadband payload.

➤ Products

- Thread-IN & Four Hole Flange, SMA 2.4 Female connector
- END to END solution, Unit connectors & Coaxial cables

➤ Key performances

- For glass seal
- Return loss (VSWR) : **22 dB (1.15) typical**
- Low RF leakage : **<- 90 dB**
- Wide operating temperature range : **- 55°C to + 165°C**



⇒ **Qualification completed at Radiall (under CNES program)**

⇒ **Should be extended up to 65 Ghz, with 1.85 connectors**

High power Connectors

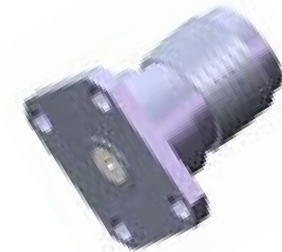
➤ Increase of power at payload level, development of SSPA & OMUX high power solution up to **C band**.

➤ Products:

- Four Hole Flange, venting holes, TNC Female connector
- END to END solution, Unit connector & Coaxial cables

➤ Key performances

- CW power : 300 W
- **Low sensibility** of Multipactor & Corona
- Return loss (VSWR) : **25 dB (1.12) typical**
- Wide operating temperature range : **- 55°C to + 165°C**



⇒ **Qualification completed at Radiall (ARTES 3-4 contract)**

Fast locking SMP Connectors

➤ Increase of unit density on telecom payload integration with a size reduction of 20 % on unit.

➤ Products

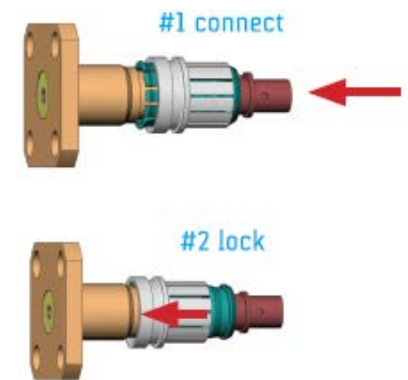
- Thread-IN, 2 or 4 Hole Flange, Fast locking Female connector
- Male connector for multi-size coaxial cable
- END to END solution, Unit connectors & Coaxial cables

➤ Key performances

- Smaller than 30% of SMA & High density
- Robust Locking 450 N , - 3 second to connect & disconnect
- Frequency Range : DC – 22 Ghz (KU, Low KA Band)
- Return loss (VSWR) : **22 dB (1.15) typical**
- Low RF leakage : **< - 90 dB at 22 Ghz**

⇒ **Development/Qualification on-going with a European supplier in the frame of CNES program**

⇒ **Should be extended up to 32 Ghz for Ka band**



- Common requirements for passive parts
- Chip Passive components
- Custom Passive components
- Connectors
- **RF Passive components**

RF Passive components

- RF passive components with Fast Locking SMP connectors
- High power coaxial Isolators (L, S and C band)
- Power Divider with integrated isolators

Global requirements

- Designed to be glitch free.
- Designed to achieve a shielding effectiveness equal or greater than 75dBi for low power devices / 65dBi for high power devices.

RF passive components with Fast Locking SMP connectors.

Expected benefits : significant cost reductions during Test and Assembly phases.

Products

- Low power Ku+ band Coaxial **Isolators/Circulators** (Male/Female connectors)
- 0 – 30 dB, DC - 22 Ghz Coaxial **Attenuators**
- 1W, DC – 22 GHz Coaxial **Loads**

Key performances

- Robust Locking , - 3 second to connect & disconnect
- Frequency Range : DC – 22 Ghz (Ku, Low Ka Band)
- Return loss (VSWR) : **23 dB typical**
- Low RF leakage : **< - 75 dB at 22 Ghz**



⇒ **Development/Qualification on-going with European suppliers in the frame of CNES program**

⇒ **Should be extended up to 32 Ghz for Ka band**

High power coaxial Isolators (L, S and C band)

Increase of RF power at equipment level (SSPA)

- in the short term (< 2 years)
 - ➔ up to 360W (L&S band - bandwidth : 100MHz) – $A_{\text{ref}}=90^\circ$
- in the mid term (2 to 5 years)
 - ➔ up to 280W (C band - bandwidth : 500MHz) – $A_{\text{ref}}=90^\circ$

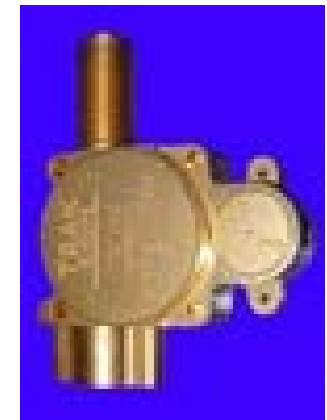
Key performances

- Return loss and isolation : **23dB**
- Insertion loss : **< 0.15dB**

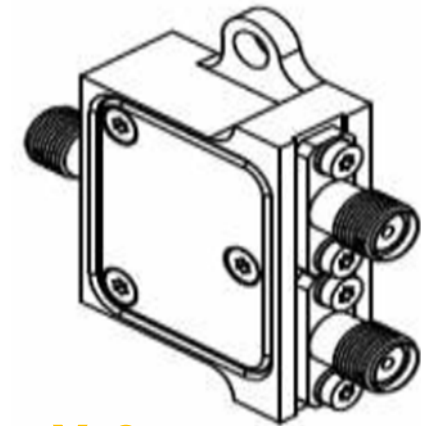
Other requirements

- Use of high power connectors with venting holes. Reduced weight and small size.
- Corona and Multipactor free.

⇒ **Development/Evaluation/Qualification on-going with a European supplier in the frame of ECI-3**



- Power Divider with integrated isolators (2 or 4 ways)
 - Baseplate dimension reduction in IMUX → integrated solutions
 - Expected benefits :
 - A better integration of IMUX channels with power divider
 - A significant gain in term of mass and size of the units.
 - Key performances :
 - Return loss and isolation : **20dB**
 - Insertion loss : **< 0.7dB**



⇒ Development on-going with a European supplier for X & Ku band devices

⇒ Should be extended to Ka band / 10 ways

THANK YOU
FOR YOUR ATTENTION

17/10/2016

Ref.:

THALES ALENIA SPACE INTERNAL

This document is not to be reproduced, modified, adapted, published, translated in any material form in whole or in part nor disclosed to any third party without the prior written permission of Thales Alenia Space - © 2012, Thales Alenia Space

ThalesAlenia
A Thales / Finmeccanica Company *Space*