Engineering Anisotropic Thermal Pathway with Pyrolytic Graphite

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What is the next technological frontier in spacecraft thermal management?

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More Compute

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More Compute

More Watts

Smaller Volume

Less Mass Budget

Cost

Reliability

Environmental Impact

LCA / D4D

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Thermal Path becomes a complex architecture

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Isotropic Materials

Aluminium, Copper

$\lambda x \approx \lambda y \approx \lambda z$

Heat spreads in all directions.
Excellent structural conductors.
Direction is not engineered

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Isotropic Materials

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Excellent structural conductors.
Direction is not engineered

Anisotropic Materials

Pyrolytic Graphite Sheet (PGS)

$\lambda x \lambda y >> \lambda z$ $(AF = \lambda x \lambda y / \lambda z)$

Heat spreads in specific directions

Anisotropy turns a material property into a thermal-design function

→ PGS is Electrically Conductive

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We manufacture PGS Graphite Sheets (GraphiteTIM) by pyrolyzing polymer films as raw materials. The crystal structure of graphite consists of carbon atoms covalently bonded in the plane direction.



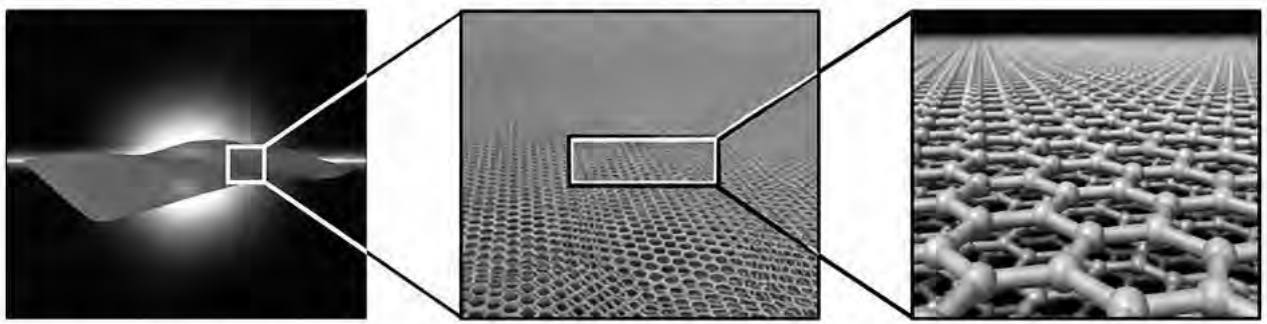
Material: Polymer film

Polymer Graphitizing Method
Pyrolysis
to
Crystallize Graphite

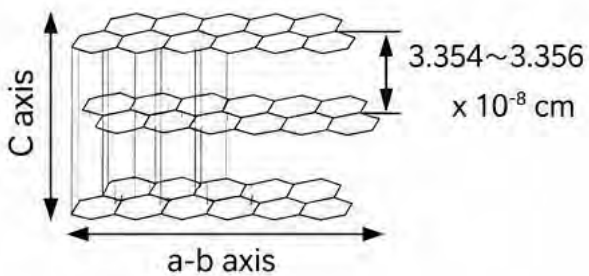


PGS Graphite sheet
(GraphiteTIM)

Crystallized structure of PGS Graphite Sheet



The crystallized graphite is aligned in surface direction.



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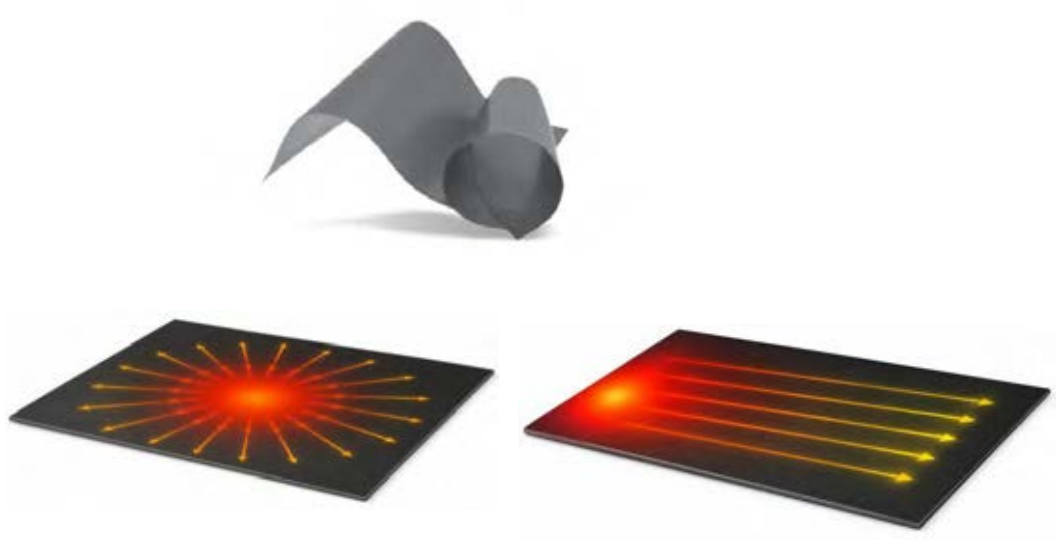
Don’t just conduct heat.

CONTROL WHERE IT GOES

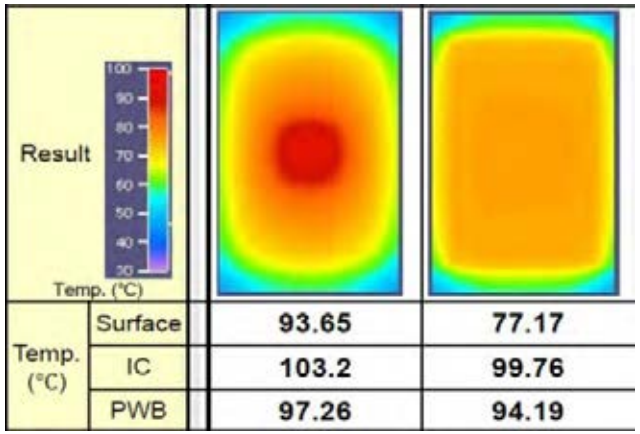
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PGS

Manages WHERE heat goes



λxy up to **1950 W/mK** (@10um thickness)
Density **0.85 g/cm3**
Anisotropic Factor **40**
Thermal Diffusivity **10 cm2/s**
Tensile Strength **20 MPa**

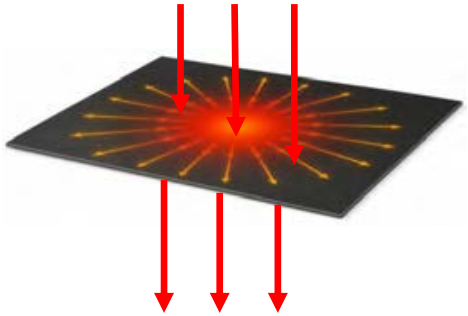


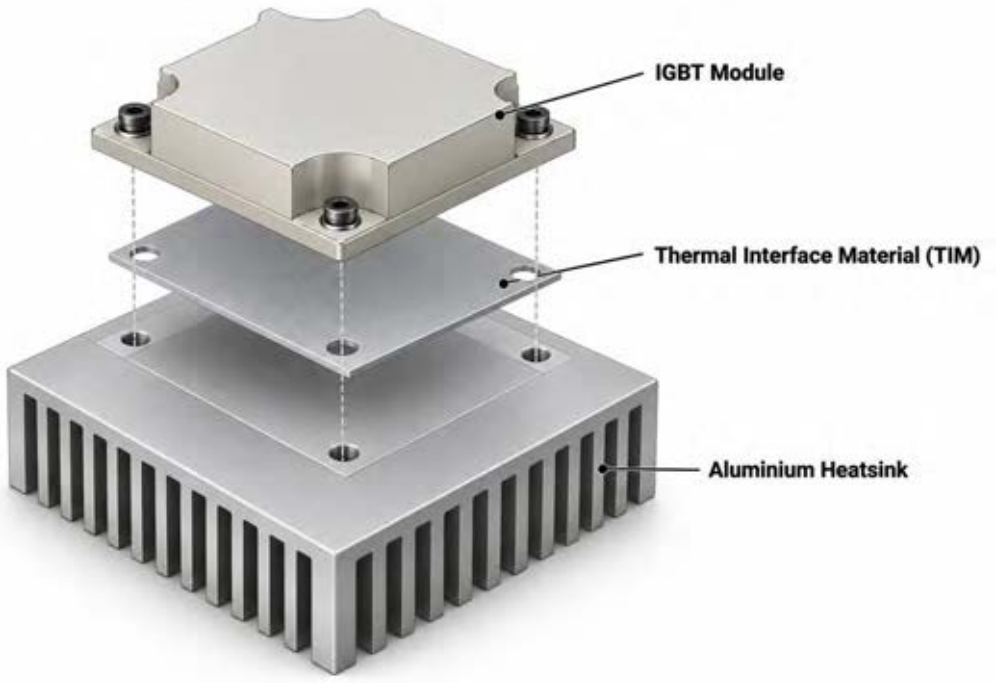
Temp. (°C)	Surface	93.65	77.17
	IC	103.2	99.76
	PWB	97.26	94.19

Function
Hot Spot Heat Diffusion
Heat Transport

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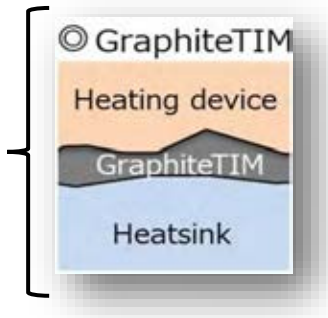




GTIM

Manages HOW heat crosses the interface between Isotropic Materials

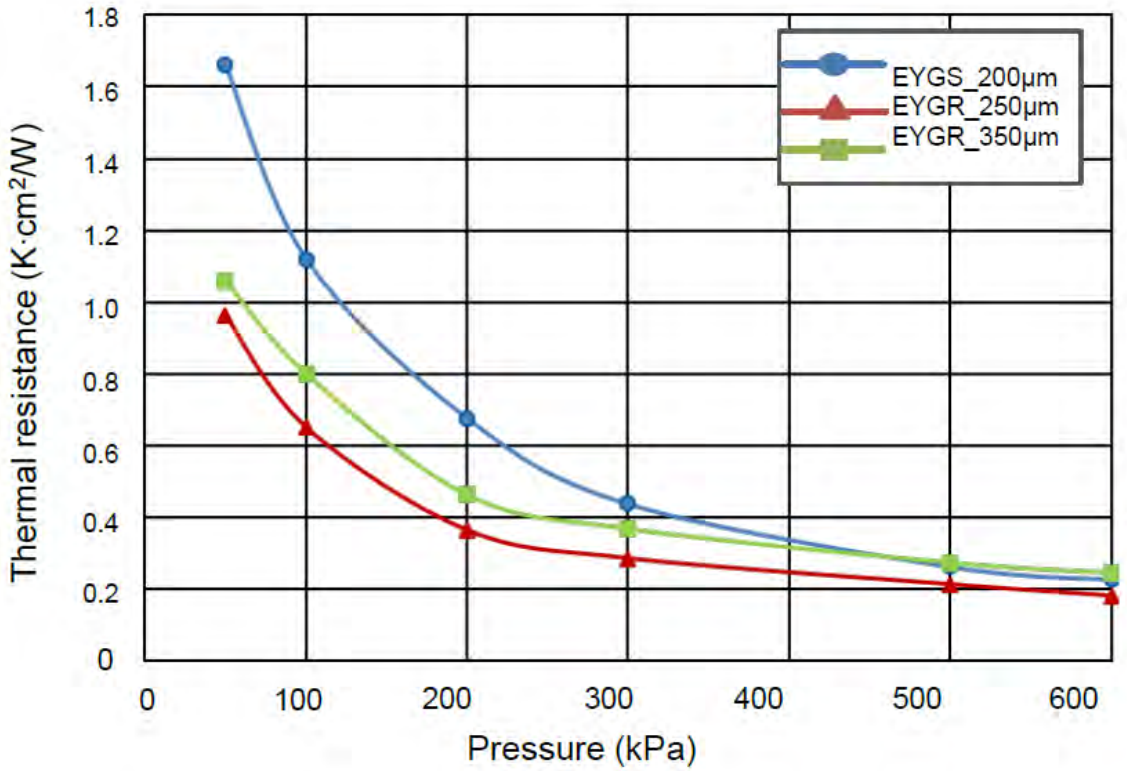
Rth **0.18 Kcm2/W**
λxy up to **400 W/mK**
Density **0.28 g/cm3**
Anisotropic Factor **14**
Thermal Diffusivity **10 cm2/s**
Tensile Strength **20 MPa**
Mechanical Structure: **Compressible**

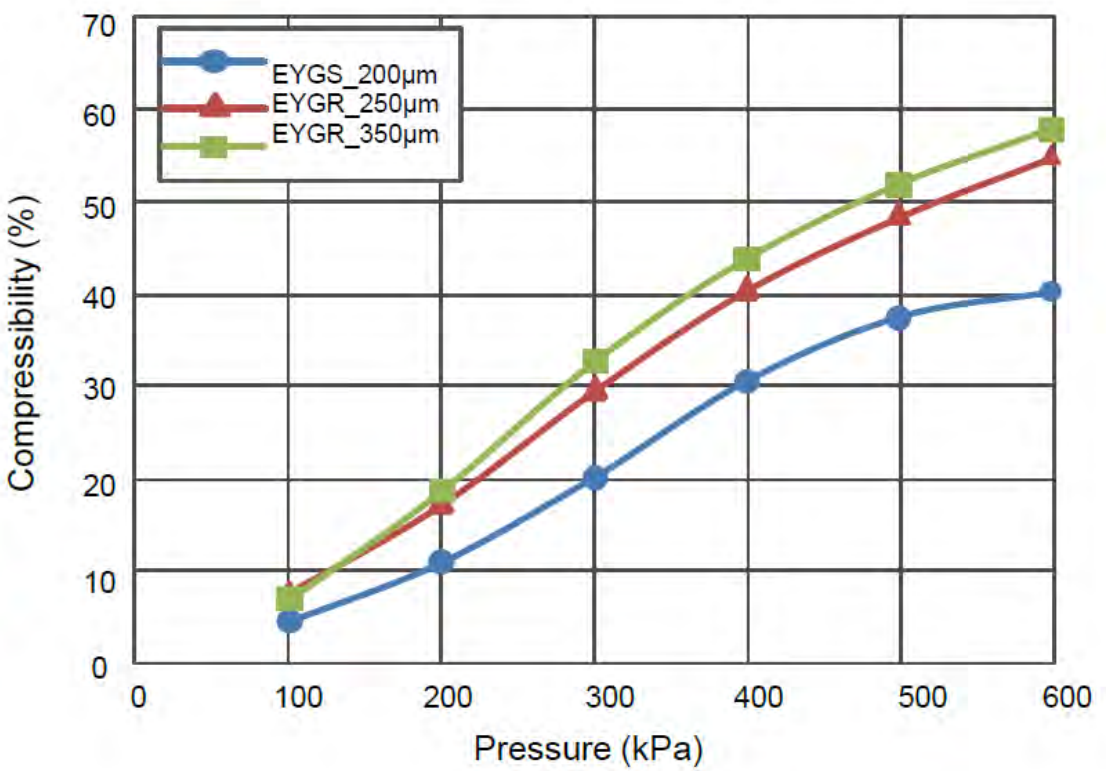


Function
Thermal Interface

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GTIM Compressibility & Rth



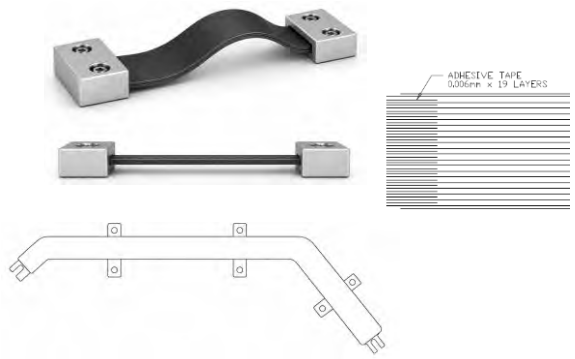


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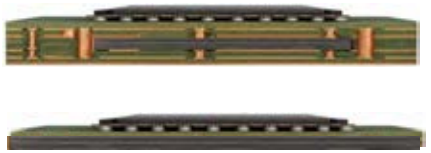
PGS

Use Case

Thermal Strap
Heat Transfer
Deployable radiator



PCB Internal Stack
PCB Backend Layer
(with stiffener)
Hot Spot Diffusion



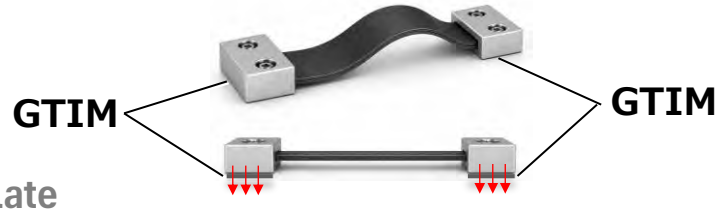
Heat Distribution
Heater Material - Flexibility & Efficiency



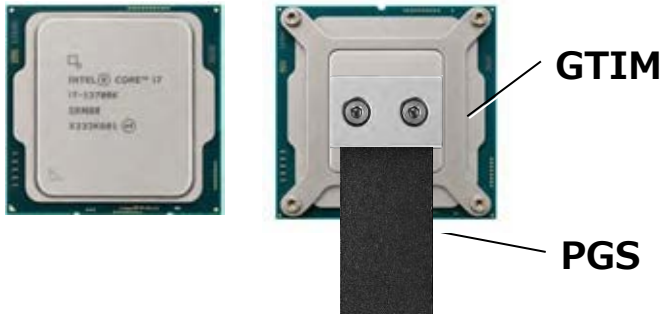
GTIM

Use Case

Thermal Strap
Clamp TIM
Heat Source to Cold Plate



Hot Spot Component
Diffusion & Transfer



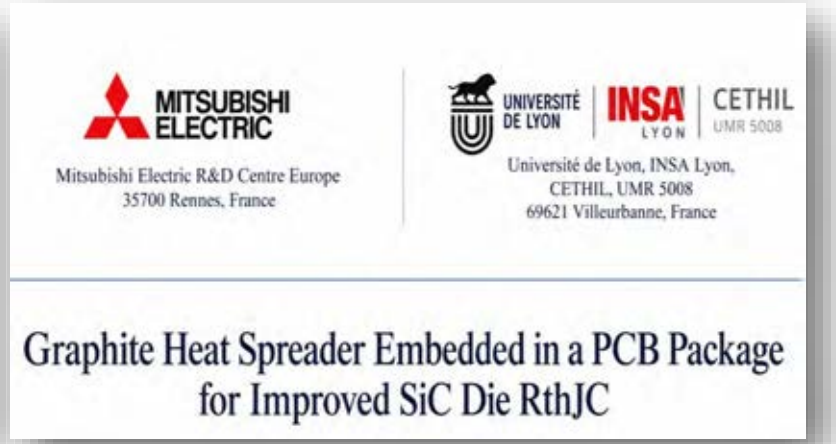
Panasonic INDUSTRY

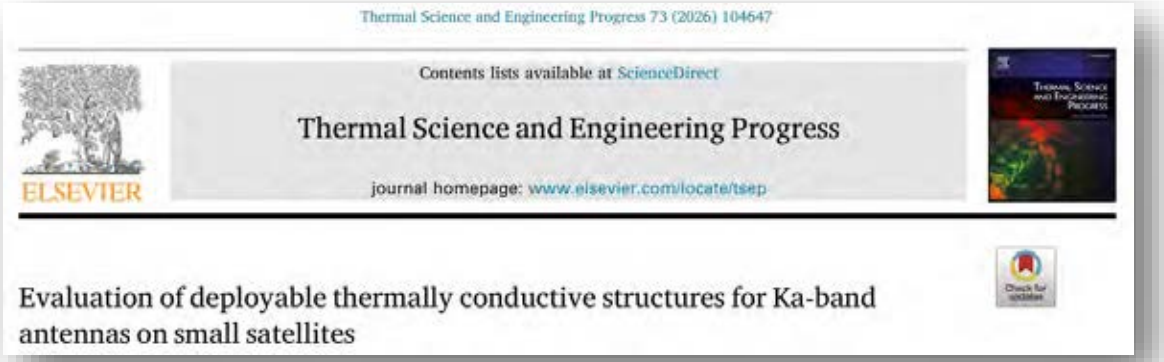
PGS

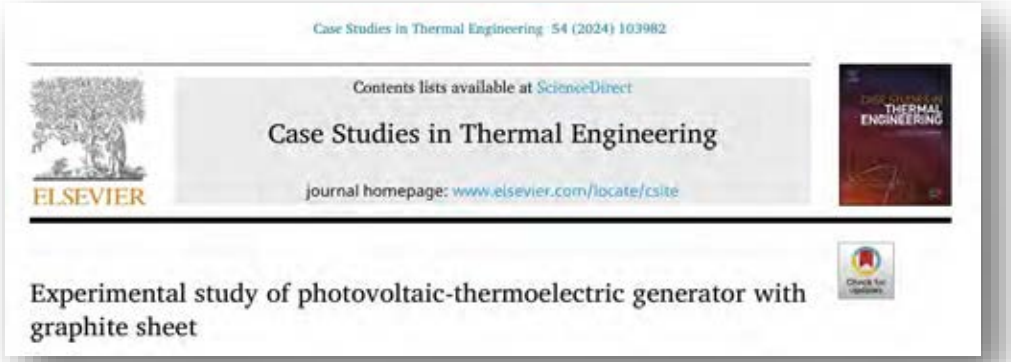
Recommended Publications









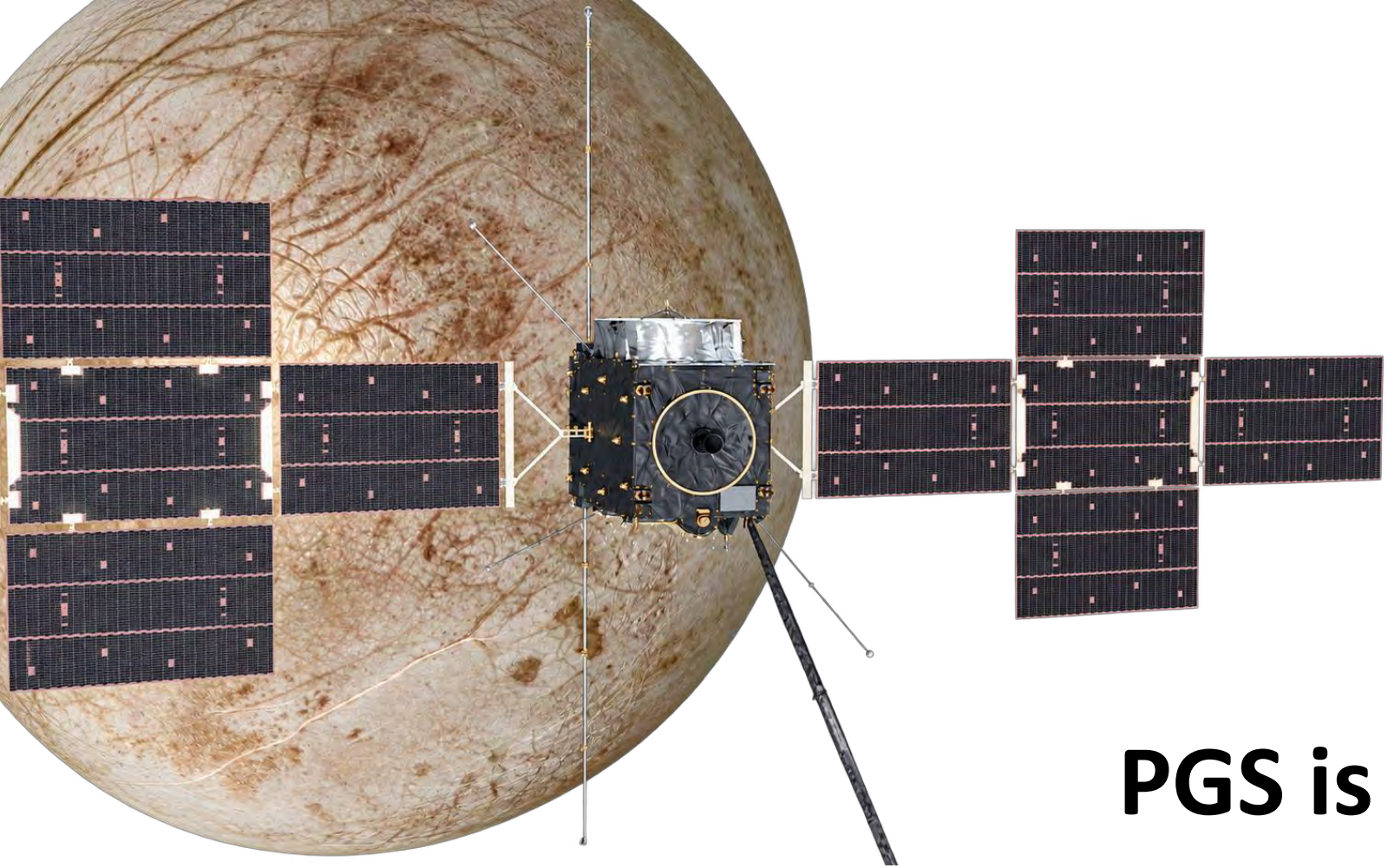


Production

2M Sheets per year

130.000m2

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PGS is present in space
Outgassing tested

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Availability

Global Distribution Network (EYG***)





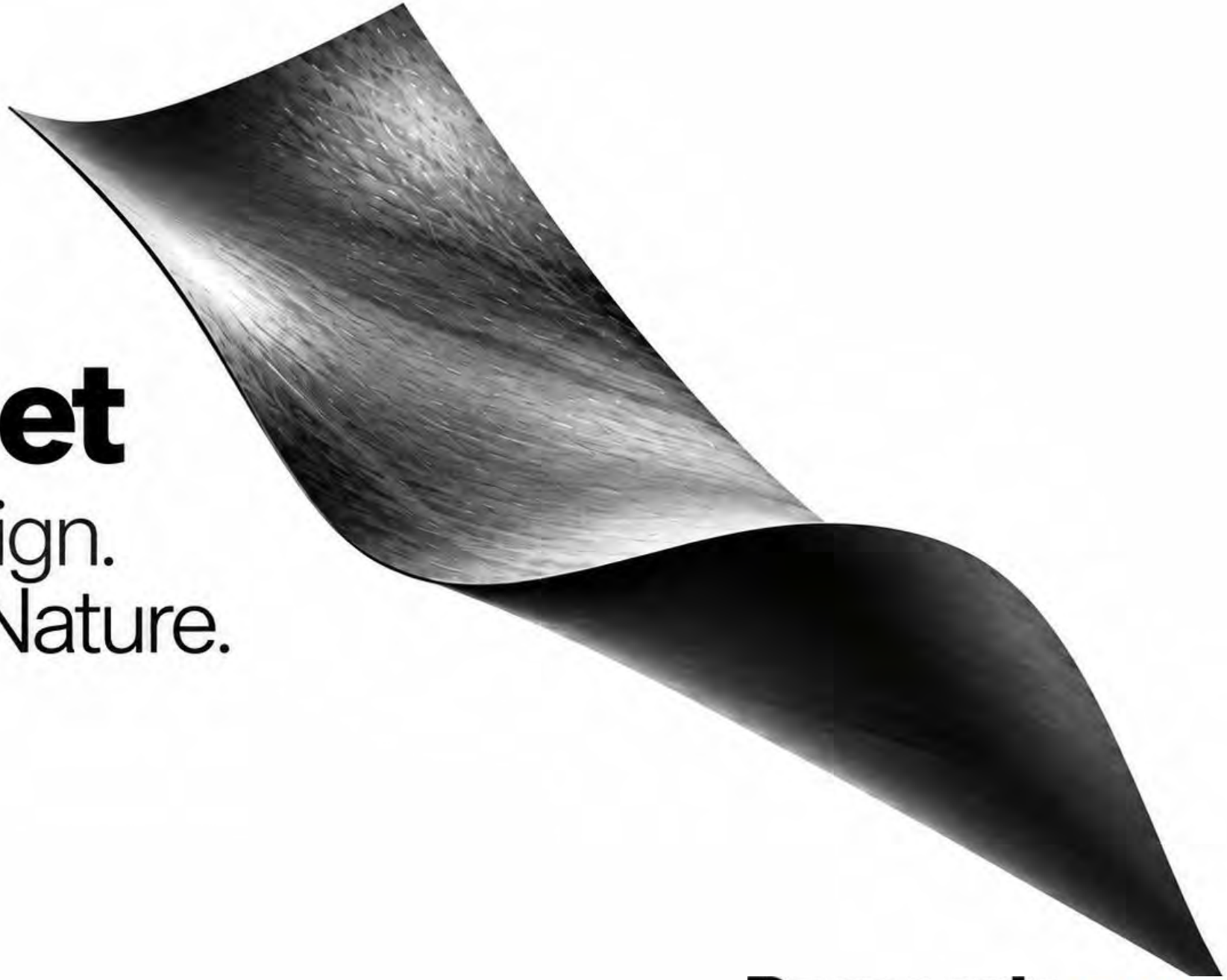
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Thank You



PGS Sheet

Flexible by Design.
Weightless by Nature.



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smiths interconnect
a molex company



EZiCoax RF Interposer Technology

Oct 2026

Smiths Interconnect, a Molex company
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CUTTING-EDGE CONNECTIVITY

OUR VISION

We make a connected world possible by working together as a global team to enable technology that transforms the future and **improves lives.**

OUR COMPANY

$8B REVENUE

7% SALES REINVESTED INTO R&D

50k+ EMPLOYEES WORLDWIDE

40 COUNTRIES

18k+ SUPPLIERS

90+ MANUFACTURING LOCATIONS

160k+ PRODUCTS

88 YEARS OF INNOVATION

OUR APPROACH

CUSTOMER NEEDS ASSESSMENT › PRODUCT DESIGN & INNOVATION › TESTING & QUALITY ASSURANCE › SOURCING & SUPPLY CHAIN OPTIMIZATION › DESIGN VERIFICATION & LAUNCH › DELIVERY EXCELLENCE › TAILORED CUSTOMER SERVICE

OUR MARKETS


AEROSPACE & DEFENSE


CONSUMER/ MOBILE


DATACENTER, CLOUD & TELECOM


HOME APPLIANCE & HVAC


INDUSTRIAL


MEDICAL & PHARMA


TRANSPORTATION/ AUTOMOTIVE

OUR DIFFERENCE

- QUALITY ENGINEERING
- GLOBAL OPERATIONAL EXCELLENCE
- EXPANSIVE KNOWLEDGE NETWORKS
- SOUND ENVIRONMENTAL PRACTICES
- SUPERIOR CUSTOMER EXPERIENCE
- WORLD-CLASS MANUFACTURING CAPABILITIES
- DEEP ENGINEERING EXPERTISE
- PRIVATELY HELD
- STABLE & TENURED MANAGEMENT TEAM
- PRINCIPLE-BASED MANAGEMENT®
- STRONG FINANCIAL FOUNDATION
- SUPPLY CHAIN INTELLIGENCE AND AGILITY
- COMMITMENT TO DIVERSITY AND INCLUSION
- DIGITAL TRANSFORMATION

OUR FOUNDATION

120k+ EMPLOYEES WORLDWIDE

50+ COUNTRIES

$125B+ ANNUAL REVENUE*

1 OF THE LARGEST PRIVATELY-HELD COMPANIES IN THE U.S.

90% EARNINGS REINVESTED

10k PATENTS GRANTED

KOCH

**Our revenues fluctuate with the price of commodities. They have exceeded $125 billion.*

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~$900M
2026 REVENUE

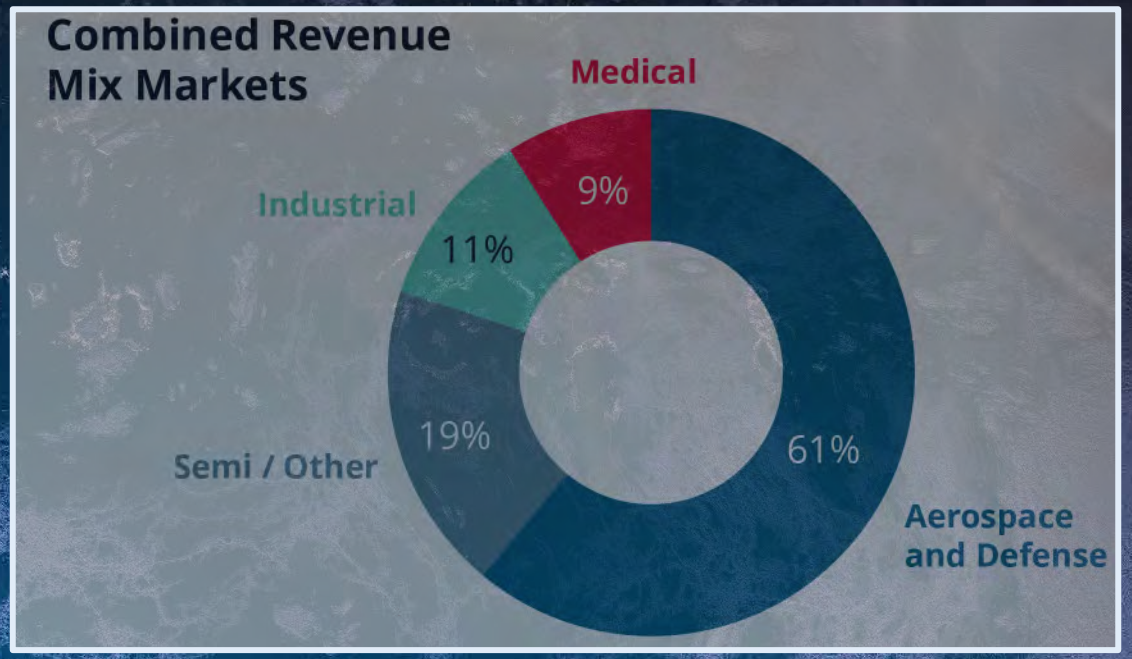
4,300+
EMPLOYEES

22
MANUFACTURING LOCATIONS

65+
YEARS OF **BRAND AWARENESS & TRUST**

HIGH RELIABILITY
INTERCONNECT & ELECTRONIC ASSEMBLIES





molex

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EZiCoax Technology & Value Proposition

What is EZiCoax

One-Piece Coax Design

3.30 mm

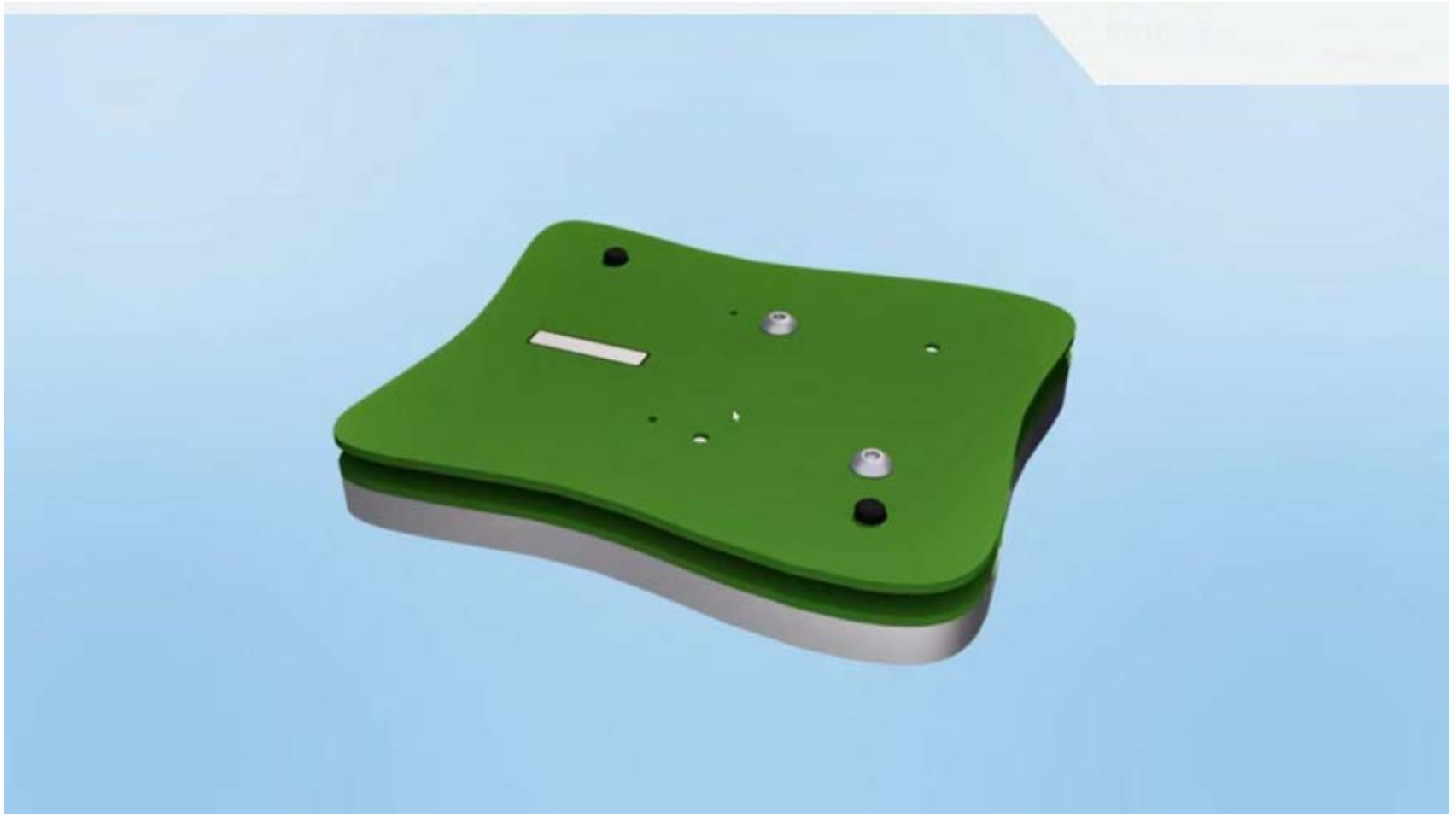


Main Features

- Single-piece coax for parallel board-to-board high-frequency signaling
- Double-ended, spring-loaded signal and ground to accommodate Z-axis tolerance mismatch
- Fully encapsulated design mates directly to the PCB; no connectors or soldering required
- Can be populated into interposers and intermixed with digital, power, and DC probes for a complete solution.
- Low profile (3.30 mm).
- High density (3.0 mm Pitch).

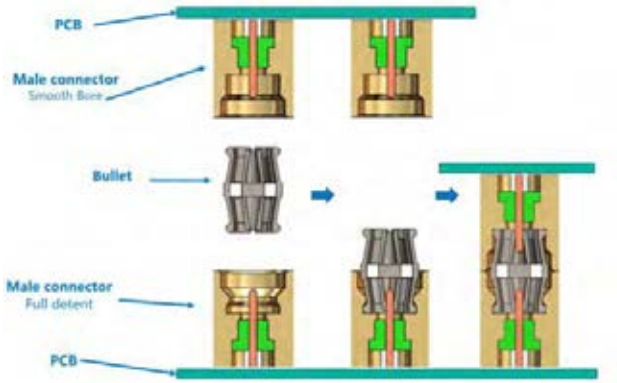
Qualified according to ESCC 3402

EZiCoax – Interposer Solutions Video

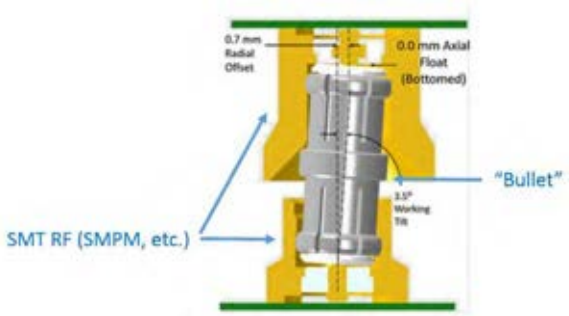


EZiCoax – Value Proposition

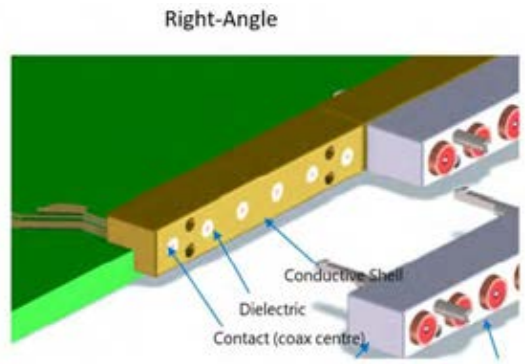
	Current SMP Interconnects	EZiCoax RF BTB Interconnect
No. of Components	3	1
Cost of Ownership	HIGH: Labor Intensive, Multi-Step Process	LOW: Single-Step Alignment
Assembly Difficulty	HIGH: Snap-on Bullet requires 2-4 lbs force	LOW: < 4 oz mating force
Rework Difficulty	HIGH: Requires tool to de-mate; frequent PCB damage	LOW: De-mating requires no tool



Corning Gilbert – GPP0 / G3P0







EZiCoax – Product Features & Benefits

Features & Benefits

Lower Cost of Ownership

- Ease of assembly – single-piece interposer
- Solderless contact
- Ease of rework (can withstand thousands of mates & de-mates)

Reduced Mate and De-mate force

- Less than 4 oz. mating force per coax
- 0 Extraction force (spring-loaded)

Absorbs Tolerance Issues

- Compliant plungers allow Z-axis tolerance up to 0.25 mm
- X-, Y-misalignment allowed up to contact pad radius

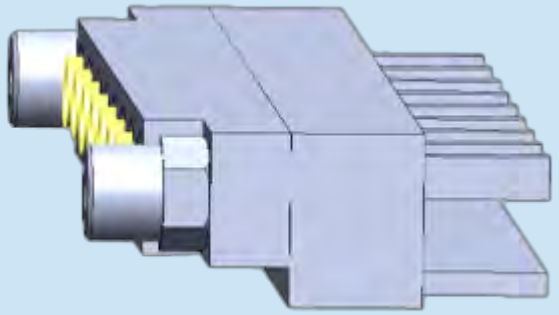
Blind Mating

- No damage to PCB or mating interfaces
- Alignment features can be designed into Interposers with DC probes

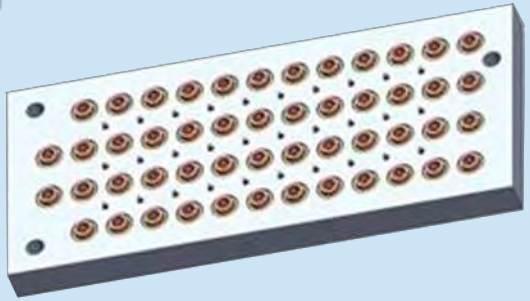
Automated Manufacturing & 100% Screening

- Manufactured at Smiths Interconnect's Kansas City site
- 100% continuity screening of contact prior to shipment

Examples



2-, 4-, 8- way Right-Angle Edge-Mount PCB

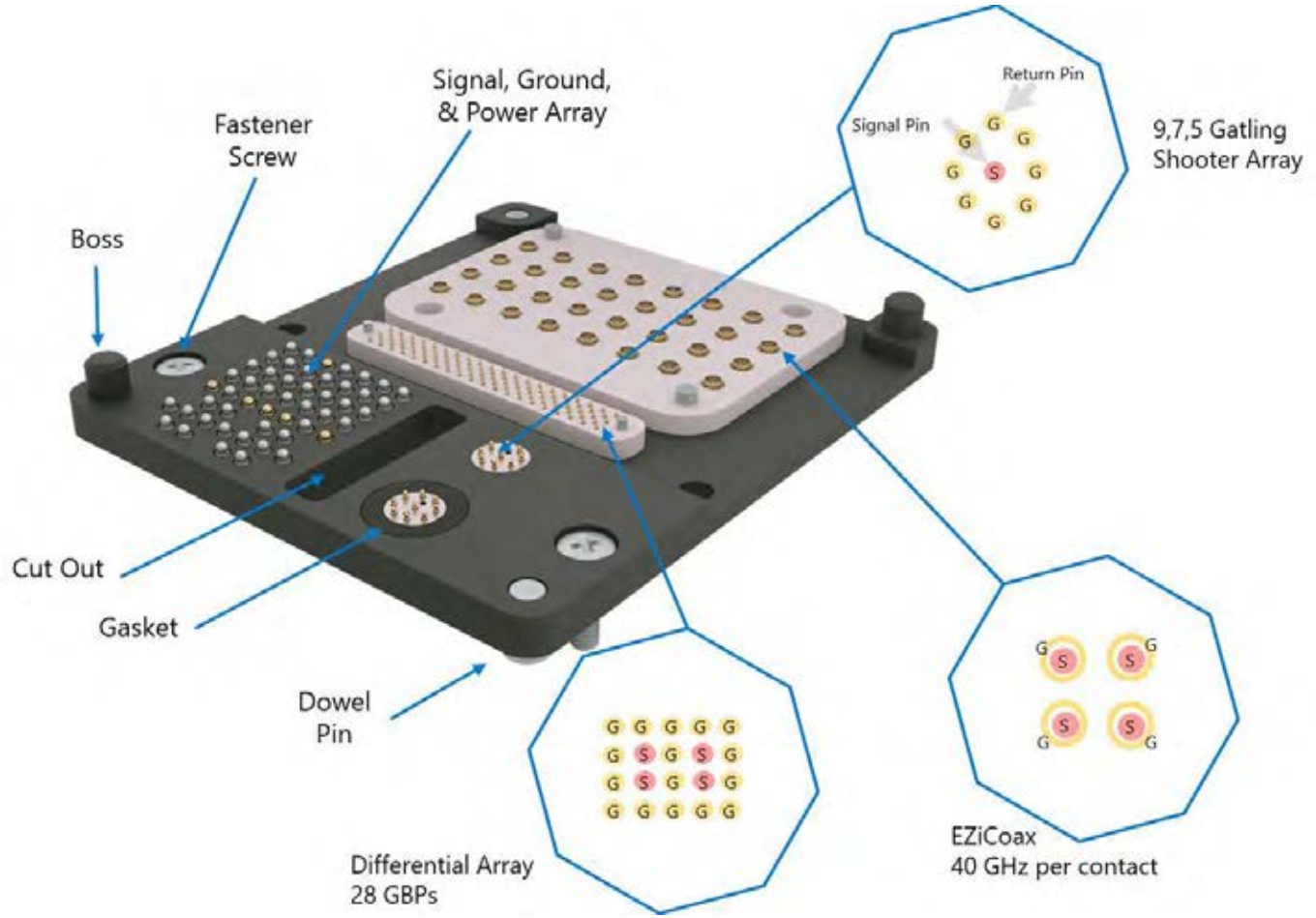


DC and Coax solution

EZiCoax - Custom Interposer Solutions

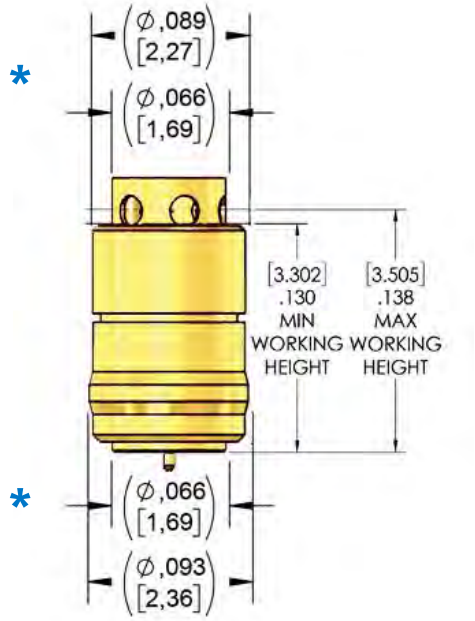
Interposer Design Features

- Smiths Interconnect interposers include elements to optimize performance, conform to footprint constraints and improve installation, such as:
  - **dowel pins** or **bosses** for alignment
  - **through-holes** and hardware for mounting,
  - **cutouts** for component clearance
  - environmental or **EMI gasketing**.
- They can support differential pair, I/O, and power signals in dense arrays .
- RF signals can be transmitted via Gatling Shooter arrays and through stand-alone coaxial probes like EZiCoax, a perfect fit for high-density RF applications.

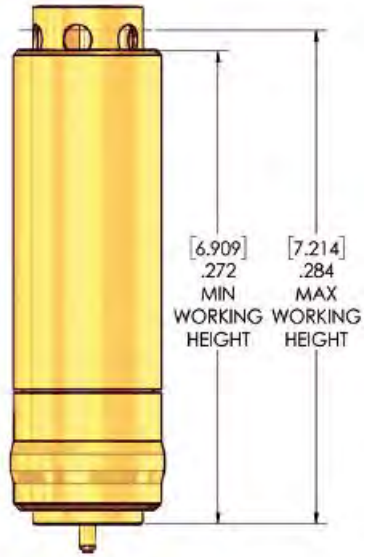


Mechanical Specifications

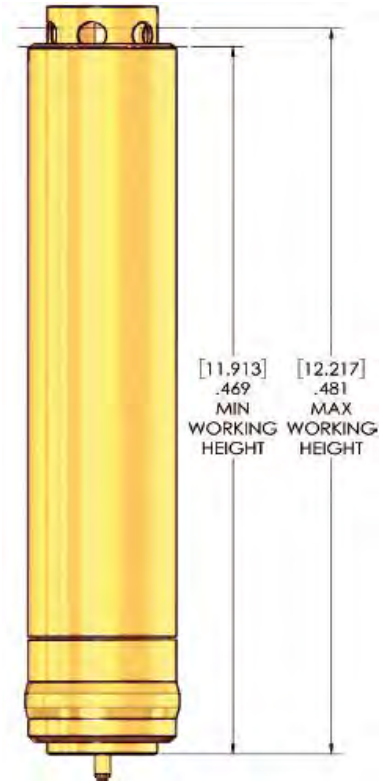
EZiCoax – Board-to-Board Heights & Measurements



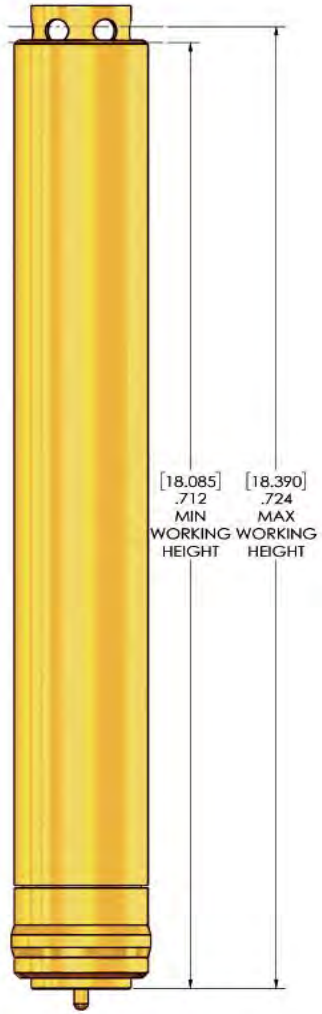
PN 851-1001909-0130



PN 851-1001909-300



PN 851-1001909-500



Consult factory

*** These dimensions are common to all lengths.**

Images not to scale.

EZiCoax – 2-, 4- & 8- ways Standard Interposers

- **EZiCoax is available in both custom interposers and standard single-in-line configurations, with 2-, 4-, and 8-way options, each offered in three height variants**
- **Right-Angle options will also be offered**

EZiCoax P/N	2-way Interposer P/N	4-way Interposer P/N	8-way interposer P/N
851-1001909-0130	806-1025190-132	806-1025190-134	806-1025190-138
851-1001909-300	806-1025190-302	806-1025190-304	806-1025190-308
851-1001909-500	806-1025190-502	806-1025190-504	806-1025190-508



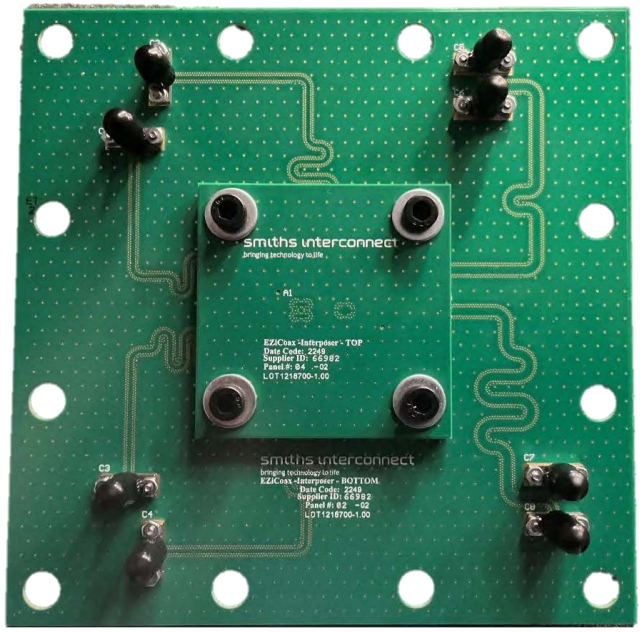
EZiCoax	Interposer Max Height
-0130	0.130 [3.30]
-300	0.272 [6.91]
-500	0.470 [11.94]

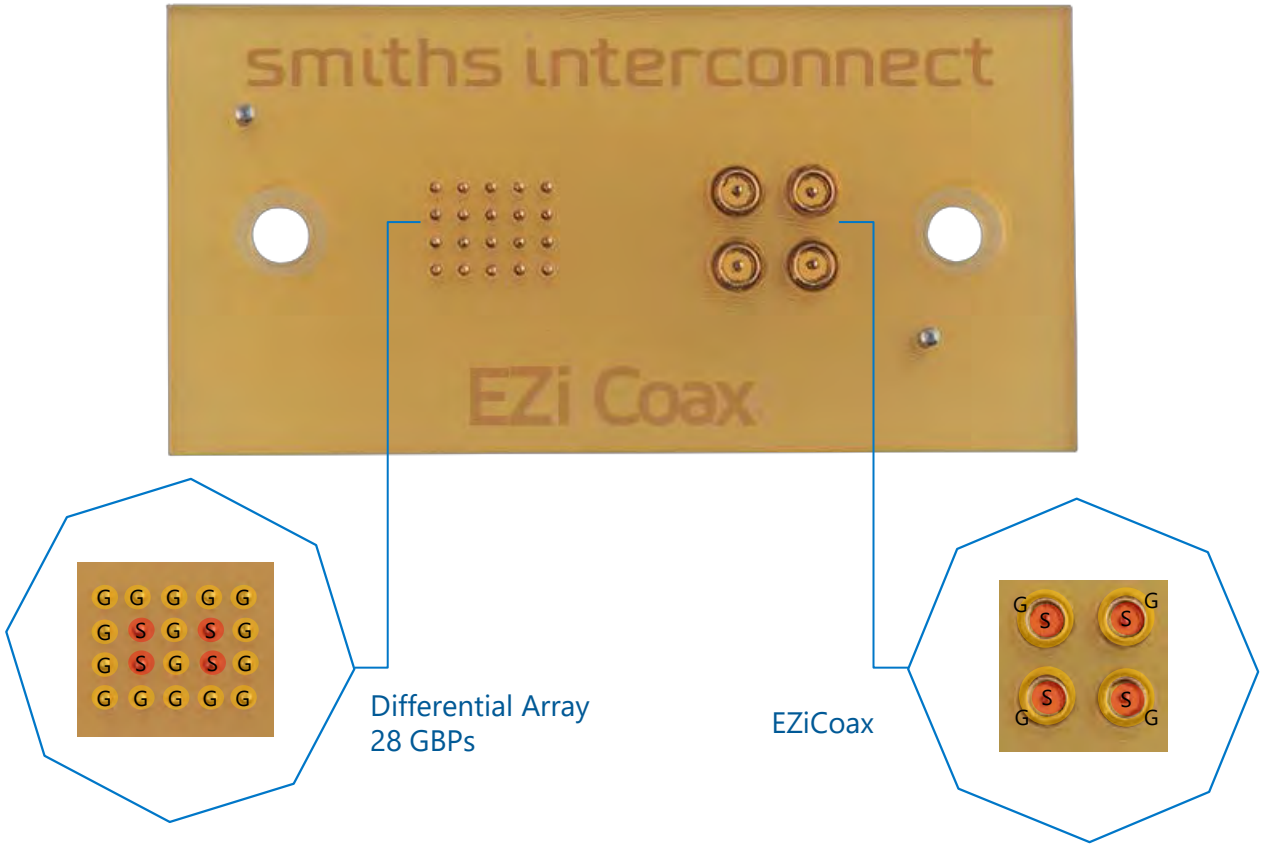


2-Piece Right-Angle Solution

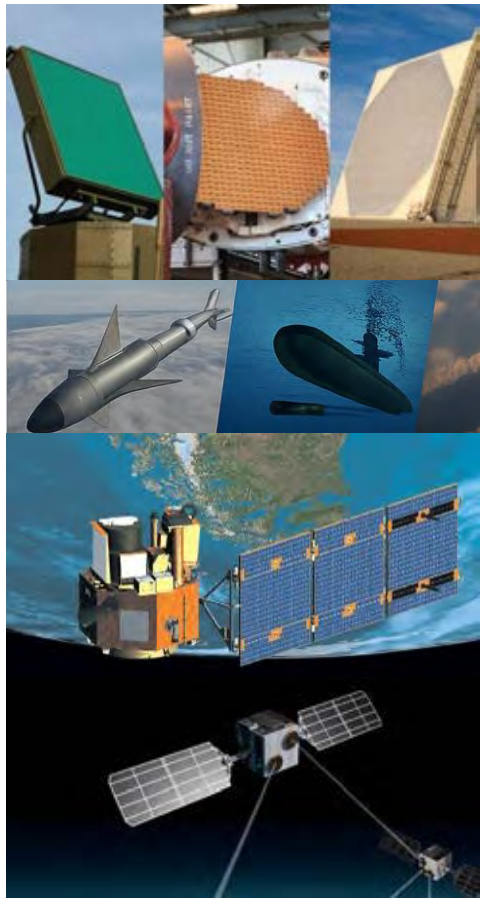
EZiCoax – Test Kit

- Our **Test Kit** allows customers to bench test to evaluate performance and adoption into their applications.





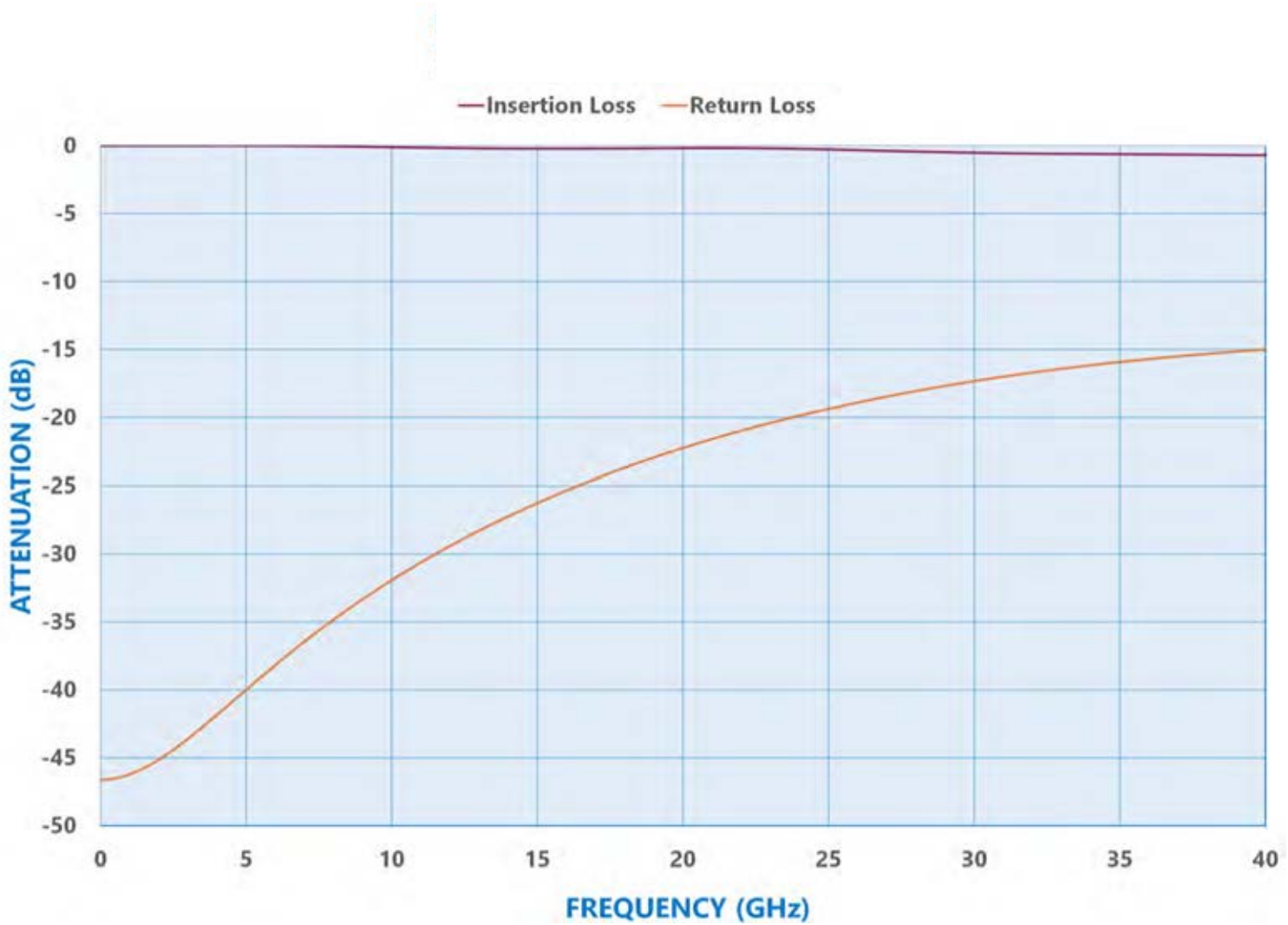
EZiCoax – Applications



Radar	**Early Warning** **Threat Detection** **Target Tracking**	High-density RF interconnect for planar T/R arrays Enables reliable transmit/receive signal routing Supports advanced back-end processing architectures
Missiles **Strike &** **Interceptors**	**Navigation** **Targeting** **Steering**	Compact, lightweight design Ruggedized for harsh environments High-reliability performance
LEO/GEO/MEO **Satellite** **Communications** **(RF)**	**Space-to-ground** **data transmission**	High-speed RF and digital performance Small form factor, high-density packaging
Phased Array **Antennas**	**Electronic Beam** **Steering**	High-density interconnect solutions Weight reduction (solderless designs) High RF bandwidth capability

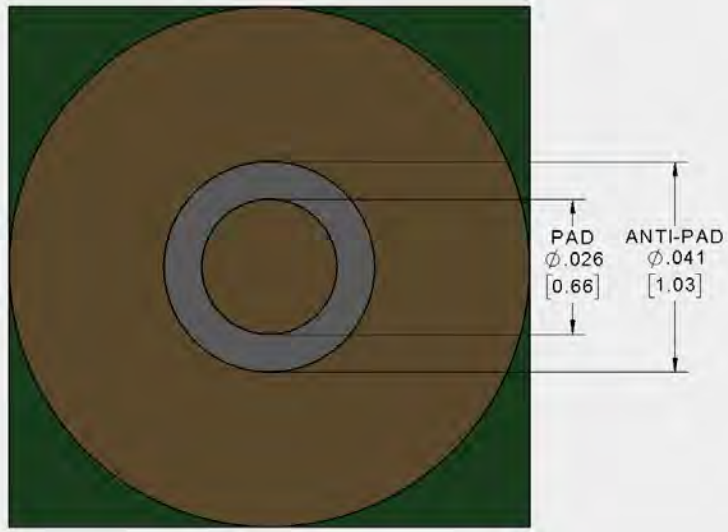
Electrical Performance

EZiCoax – 3.30mm Coax Measurement Data

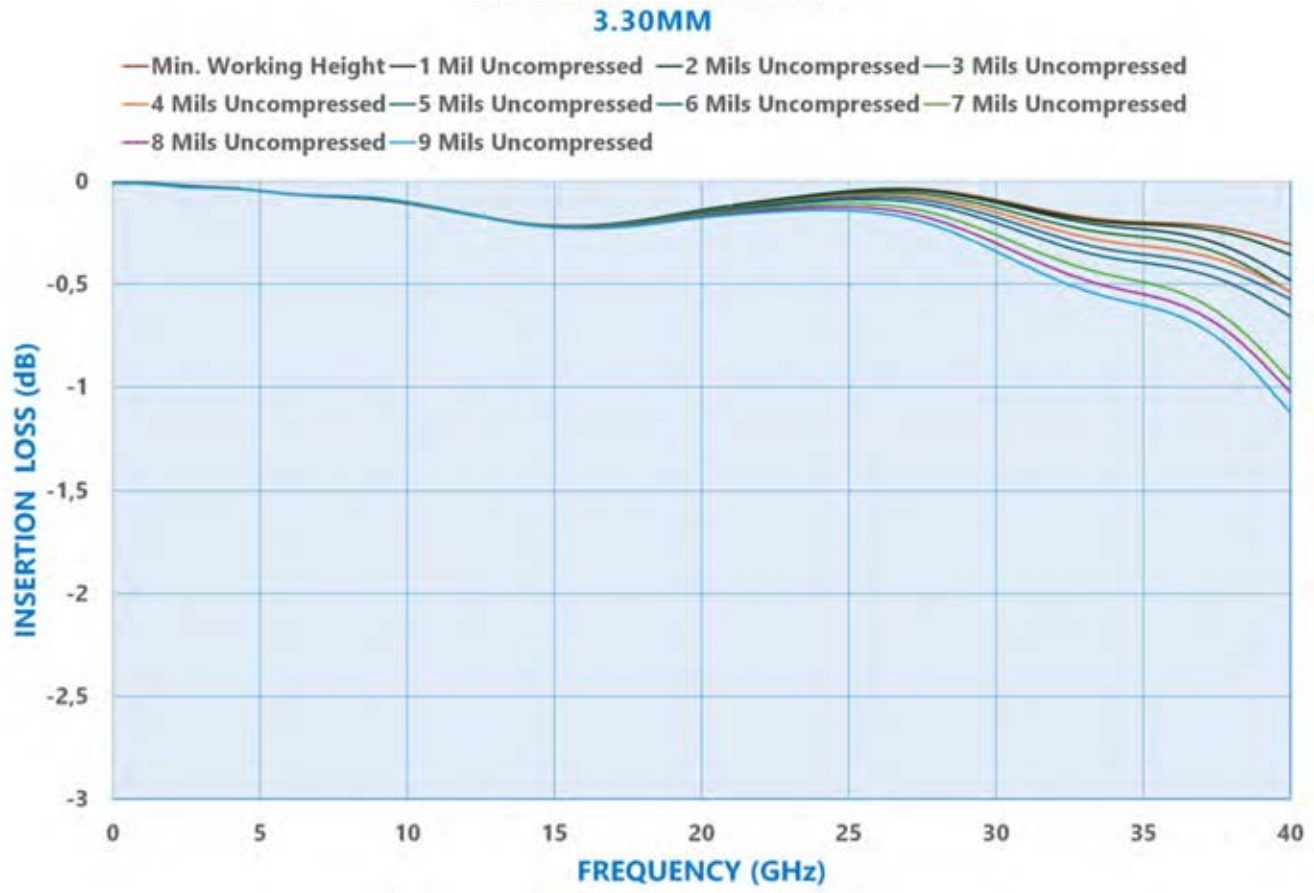


Results with Smiths test fixtures and de-embedded using Agilent PLTS.

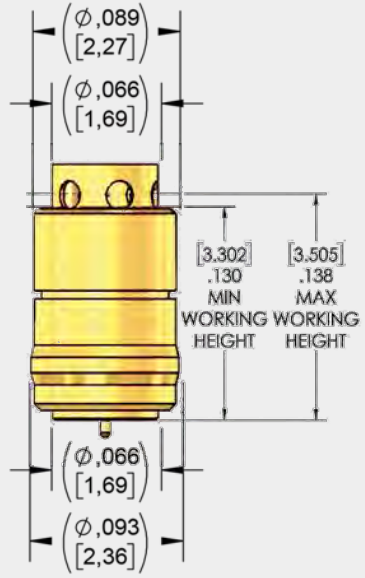
RECOMMENDED PCB LAYOUT:



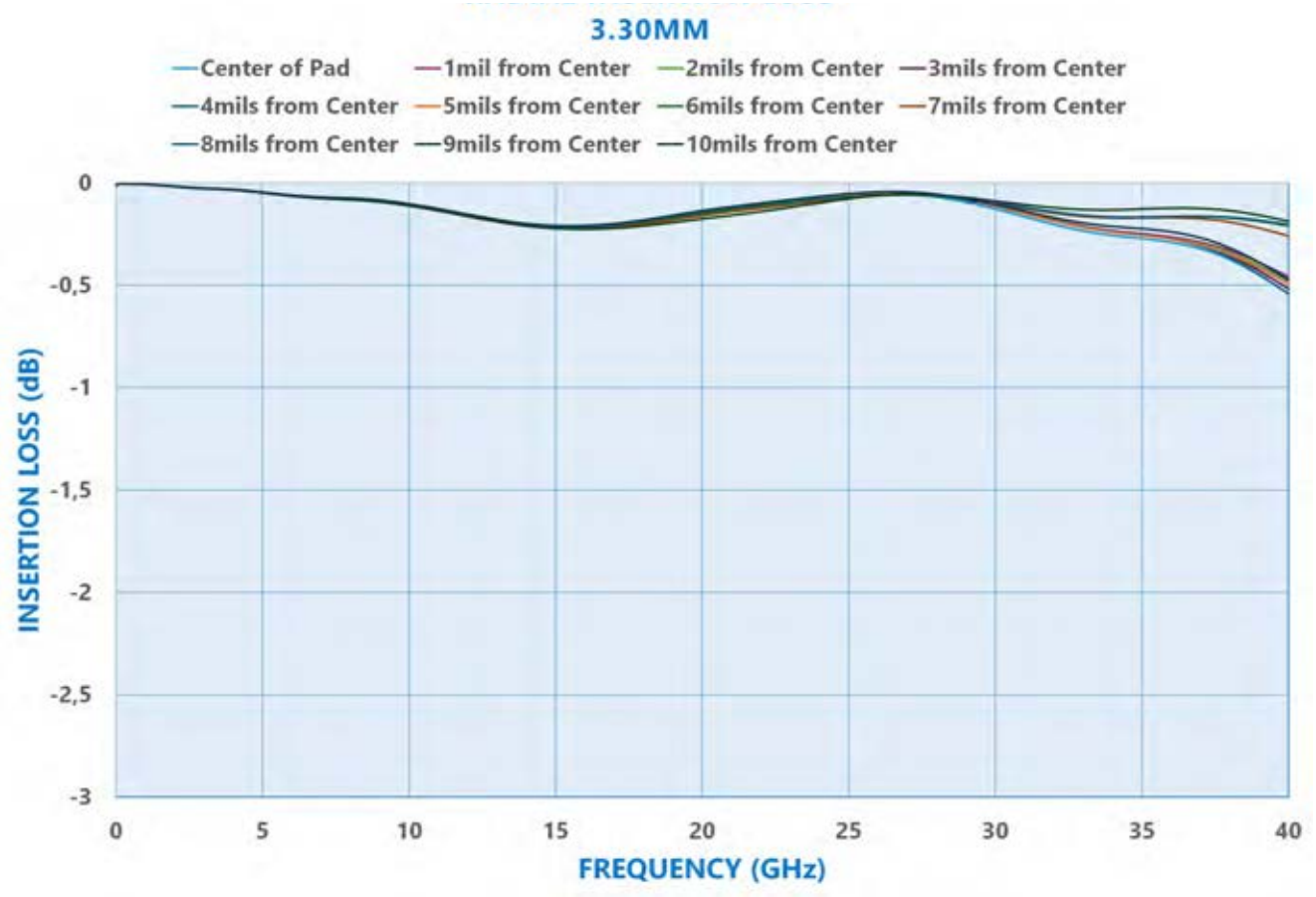
EZiCoax – Axial Insertion Loss



Axial Misalignment occurs as you move away from the minimum working height in the Z direction.
The graph shows insertion loss versus compression, starting at minimum working height and uncompressing it in 1 mil increments.
Insertion loss at max working height is 1.2 dB.



EZiCoax – Radial Misalignment



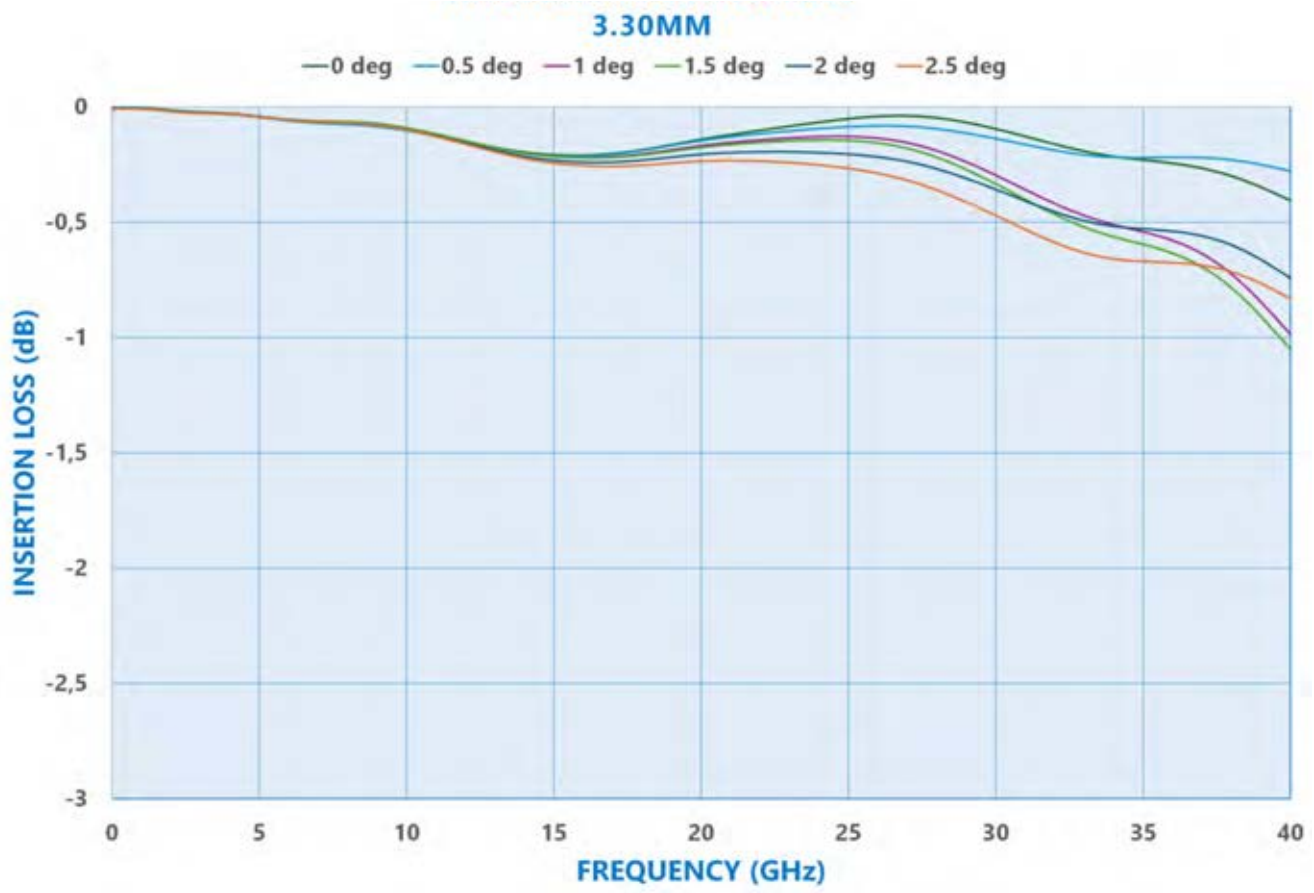
Radial Misalignment occurs as you move away from the center of the signal pad in either X or Y direction.

The graph shows insertion loss versus XY misalignment, starting at center of the signal pad and moving in 1mil increments.

There is approximately 0.5 dB shift in insertion loss at 10 mils from center.

These results are only valid if using the recommended pad layout shown in slide 9.

EZiCoax – Angular Misalignment

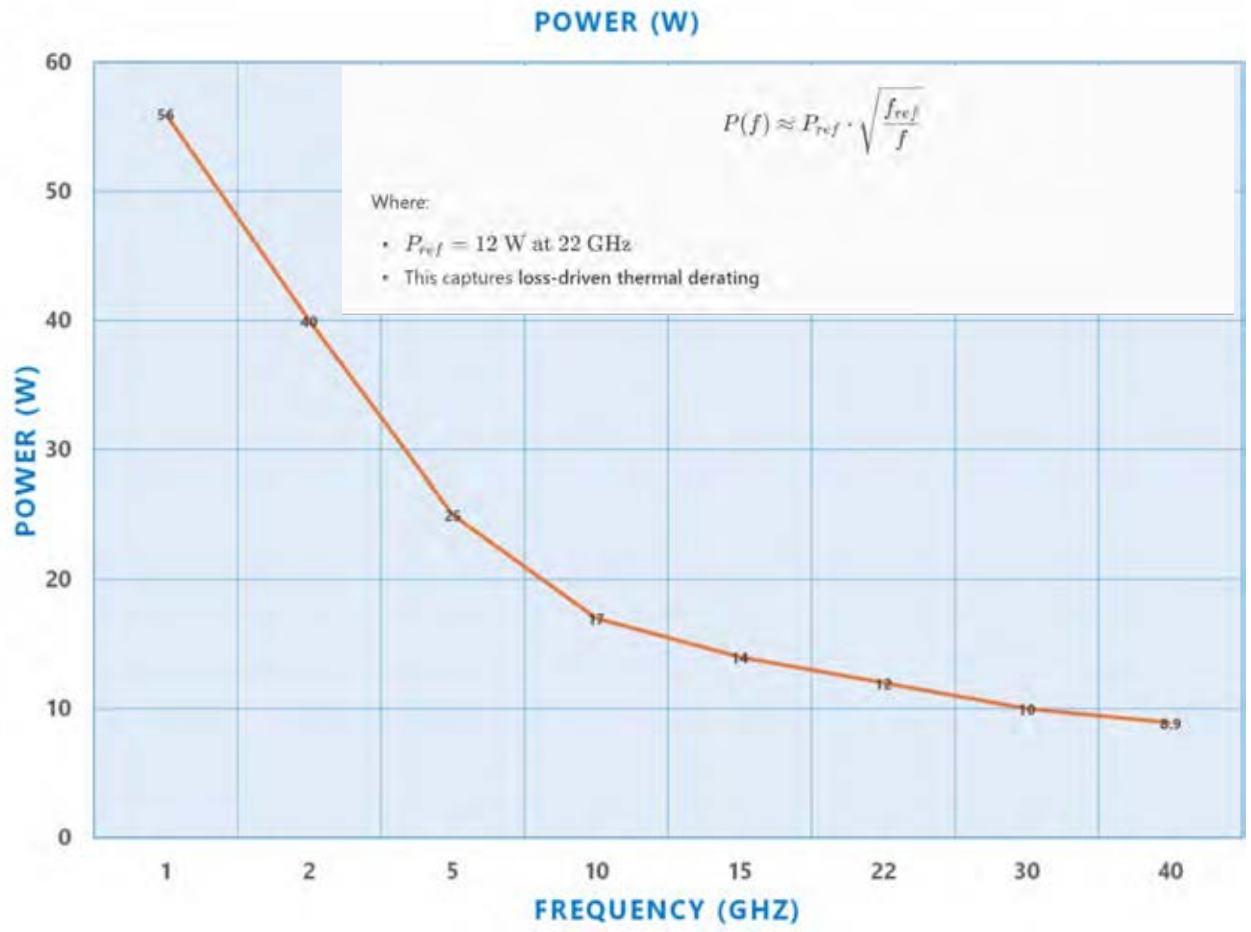


Angular Misalignment occurs when the parallelism of the PCBs are not ideal.

The graph is showing insertion loss versus angular misalignment, starting zero degrees and changing the parallelism in half degree increments.

There is a -1 dB shift in the insertion loss when you change the angular alignment by 2.5 degrees.

EZiCoax – Power Capacity



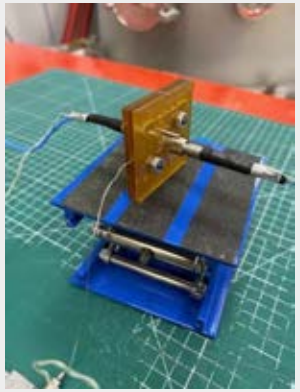
Power testing of EZiCoax was completed by compressing EZiCoax between two 1.85mm Connectors.

Temperature was measured at the 1.85mm connector and the at the shield of the EZiCoax.

Insertion Loss was monitored and the power was increased until the Insertion Loss changed or the temperature reached 100°C.

Insertion loss remained stable and the test was halted when the case temperature reached 100°C.

Power capacity measured 12W at 22 GHz, all other values are calculated.



EZiCoax – Electrical & Environmental Characteristics

Attribute	Spec	Units	Comments
Impedance	50	Ohms	+/- 10%
Mating Cycles	1000	Cycles	
Current Capacity	1	A	DC
Power Capacity	12	W	CW at 22 GHz (Sea Level)
Voltage Rating	60	V rms	
Dielectric Withstanding Voltage	500	V	DC (Sea Level)
Insertion Loss	≥-1	dB	10MHz to 40 GHz
Return Loss	≤-15	dB	10MHz to 40 GHz
NEXT	< -60	dB	10MHz to 40 GHz
FEXT	< -60	dB	10MHz to 40 GHz
Temperature Range	-55 to 165	° C	
Outgassing	TML 0.50	CVCM	0.17
Vibration	10 to 2000	Hz	EIA-364-28, Condition VI, 53.79 g rms
Shock	100	G	IEC 60068-2-27 Half Sine, 100G
EMI	> 65	dB	Immunity
Power	12	W	at 22 GHz
Qualified according to ESCC 3402			

EZiCoax – Automation

- 100% Automated Assembly
- 100% In-Situ Electrical Test
- Automated Optical Inspection



Pioneers of Progress

Advancing the world through cutting-edge connectivity

smithsinterconnect.com

smiths interconnect
a molex company

Smiths Interconnect, a Molex company
Proprietary Information – For Exclusive Use of the Addressed Party Only

CUTTING-EDGE CONNECTIVITY

Space

axon' cables & connectors

MICRO-D CONNECTORS
REMOVABLE CONTACTS, EMI & FAST-LOCK

Marc Auvray

21/10/2026

AXON' PRESENTATION

- French company
- 60+ years of experience
  - From cables to full interconnect solutions
- 2400+ employees worldwide
- 20 subsidiaries & offices worldwide
- Markets from automotive to space
- QPL: 18 certificates
  - 11 cables
  - 3 assemblies
  - 4 connectors



ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ?

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ? NO

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ? NO

Standard hardware :

- Tooling
- Space

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ? NO

Standard hardware :

- Tooling
- Space

Shielding connection

- Hardware
- No Connection on D Shape

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ? NO

Standard hardware :
- Tooling
- Space

Shielding connection
- Hardware
- No Connection on D Shape

Potted version
- Use splices

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ?

D-Click hardware :

- No Tooling
- Easy installation

ESCC 3401/091

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ?

D-Click hardware :

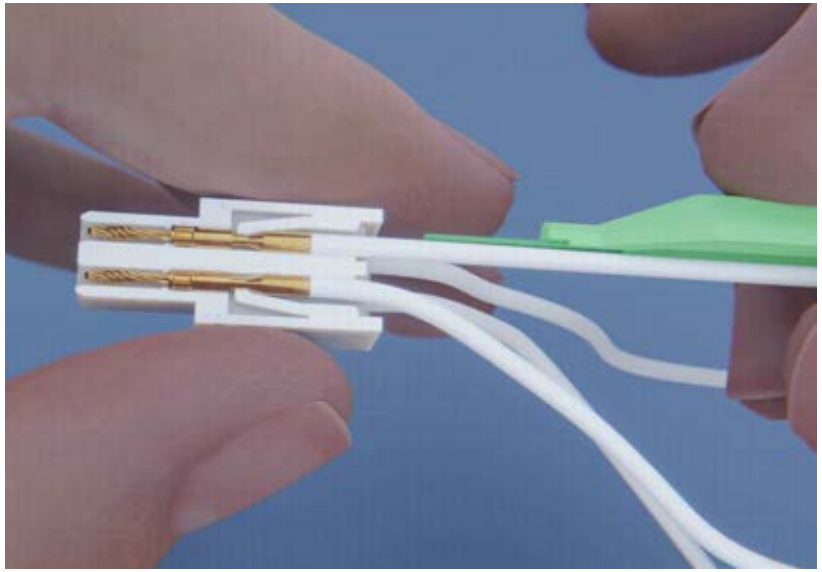
- No Tooling
- Easy installation

ESCC 3401/091

Shielding connection

- EMI Clip
- Enclosed backshell
- Panel gasket

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ?

D-Click hardware :
- No Tooling
- Easy installation

ESCC 3401/091

Shielding connection
- EMI Clip
- Enclosed backshell
- Panel gasket

Removable Contacts
To be published :
ESCC 3401/101
ESCC 3401/102

ESCC 3401/029 & 032



UNIVERSAL CONNECTOR ? YES

D-Click hardware :
- No Tooling
- Easy installation

ESCC 3401/091

Shielding connection
- EMI Clip
- Enclosed backshell
- Panel gasket

Removable Contacts
To be published :
ESCC 3401/101
ESCC 3401/102

SEE YOU AT BOOTH 25

Swistor

TECHNICAL INTRODUCTION OF COMPONENTS | SPCD 2026

HIGH-POWER ENERGY STORAGE COMPONENTS FOR SPACE AND CRITICAL INFRASTRUCTURE



Supercapacitor cells that deliver peak power instantly. **3x the energy of an EDLC**, no lithium, no cobalt.

Clara Moldovan, PhD · clara.moldovan@swistor.com
CEO and Co-founder, Swistor SA | 15 October 2026, ESA/ESTEC



Swistor

SPIN-OFF FROM EPFL · SEPTEMBER 2022 · ESA BIC SWITZERLAND

FROM MATERIALS SCIENCE TO POWER SYSTEMS

Spun out of EPFL and developed in EPFL and Empa research facilities, from materials and cell chemistry to in-house cell fabrication.

EPFL · Empa · LIMNO







Research and fabrication facilities · CMi, EPFL

© SWISTOR

TECHNOLOGY

SWISTOR'S PROPRIETARY TECHNOLOGY

> 10x	> 60x	< 1 ms	< 40 %
Higher power density vs Li-ion battery	Longer cycle life vs Li-ion battery	Response time	CO2-equivalent, eco-friendly



> 3x

Wh/kg vs standard EDLC

TECHNOLOGY HIGHLIGHTS

- **Hybrid supercapacitor architecture:** high energy density without lithium
- **Nanostructured high-performance electrodes:** optimal trade-off between energy and power
- **Green electrolytes with high voltage window:** 3.3 to 3.6 V (vs 2.7 V standard)
- **No lithium, cobalt, toxic or combustible solvents:** radiation-tolerant chemistry, to be confirmed by test

© SWISTOR

BRIDGING THE GAP BETWEEN ENERGY AND POWER

Swistor

Swistor combines battery-class energy with supercapacitor-class power and life.

Metric	Supercapacitor (EDLC)	Hybrid Li-ion capacitor	Li-ion battery	Swistor
Energy density	5 to 20 Wh/kg	40 to 120 Wh/kg	200 Wh/kg	**64 to 75 Wh/kg**
Power density	1 to 20 kW/kg	below 1 kW/kg	0.3 kW/kg	**10 to 15 kW/kg**
Max voltage	2.7 V	3.8 to 4.2 V	4.2 V	**3.6 V**
Cycle life	>100,000	10,000	1,000	**60,000 100,000 @90% Vmax**
Temperature	-40 to 85 °C	-25 to 85 °C	-10 to 60 °C	**-20 to 85 °C**
Lithium content	none	pre-lithiated anode	Li, Co, flammable	**none**

Best of both worlds: high energy and high power, with long lifetime. *EDLC keep the longest cycle life; Swistor values are measured on pouch cells.*

© SWISTOR

MARKET APPLICATIONS

ONE TECHNOLOGY PLATFORM, VARIOUS MARKETS

Swistor



AI DATA CENTERS

Millisecond UPS and GPU rack buffering



IoT & WEARABLES

Batteryless self-powered sensors storing harvested energy, decade-long lifetime



E-MOBILITY

48 V mild hybrid, regenerative braking, peak delivery



ROBOTICS & POWER TOOLS

Full charge in seconds, instant actuation, cold-start buffering



GRID & RENEWABLES

Frequency regulation, MW-class UPS, EV forecourt buffering



SPACE & AEROSPACE

Seconds-scale pulses on 24 to 28 V buses: propulsion, welding, laser drivers, mechanisms

© SWISTOR

WHERE MILLISECOND TO SECONDS-SCALE PULSE POWER IS NEEDED IN SPACE

SPACE APPLICATIONS

< 100 W SMALL SATELLITES

CubeSat power bursts
Radio TX bursts, payload switch-on, reaction wheel desaturation

OBC reserve and pyro firing
Anomaly recovery and release mechanisms with zero battery cycling

Onboard edge AI
Compute spikes on data-handling units, buffered from the bus

100 W to 10 kW PULSED LOADS

Pulsed plasma propulsion
High bursts at 100 Hz from a 28 V bus delivering 100 to 300 W

In-orbit welding
Repeated 110 A pulses at 28 V, about 3 kW for a few seconds

Laser drivers
100 W class high-power laser on a defence payload

> 10 kW PLATFORMS AND LAUNCHERS

SAR and radar pulse power
Higher duty cycles without stressing the battery

GEO bus regulation
Ripple filtering and transient isolation on 25 kW class arrays

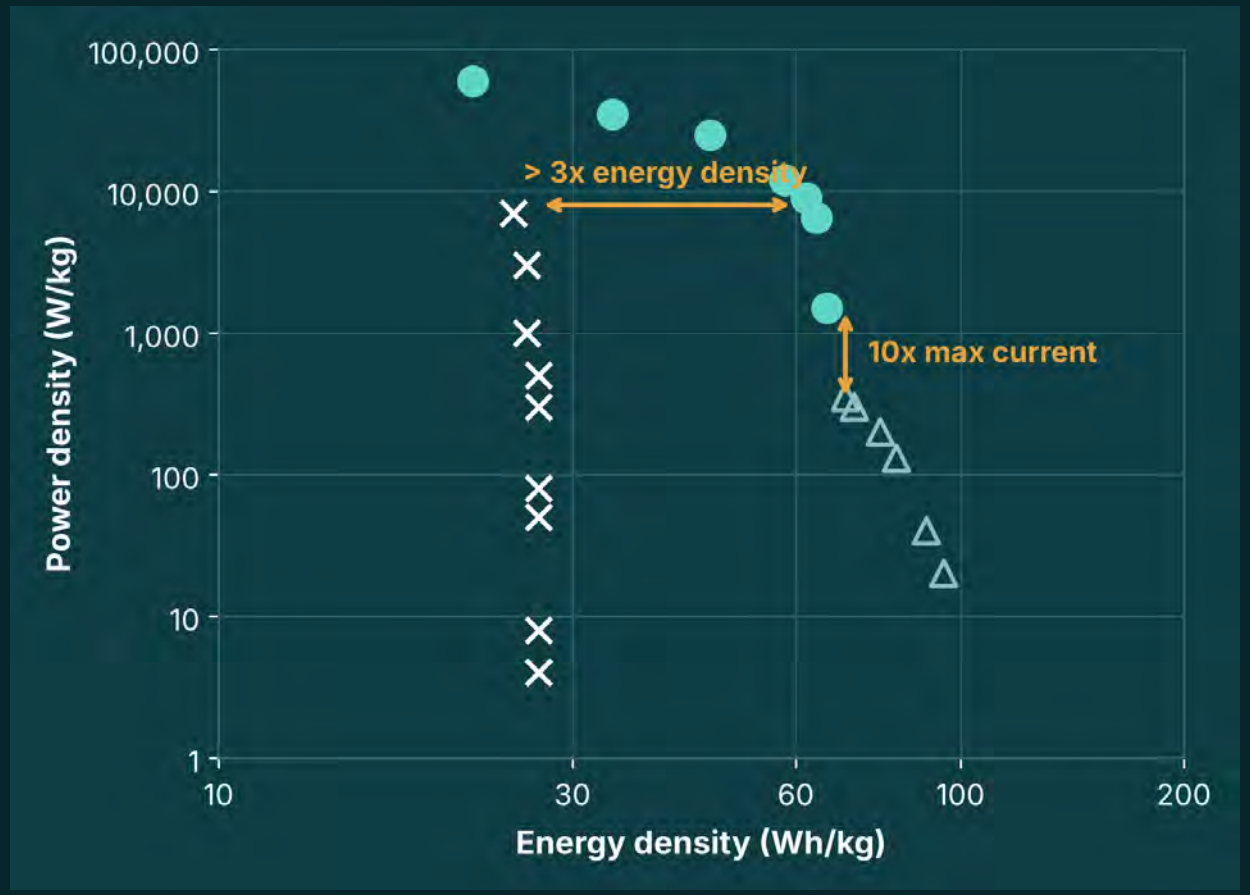
Launcher thrust vector control
Electromechanical actuators, 10 to 100 kW for short steering bursts

COMMON ENVELOPE 24 to 28 V buses · milliseconds-seconds-scale pulses · recharge in seconds · **3 to 5x the energy of an EDLC = 3 to 5x less mass**

© SWISTOR

IDEAL TRADE-OFF BETWEEN ENERGY AND POWER

High energy and high power have always been a trade-off. Swistor shows a unique balance between the two.



- Swistor, measured data
- Supercapacitor, high power (EDLC)
- Lithium-ion capacitor, high energy

> 3x
energy density vs high-power supercapacitors

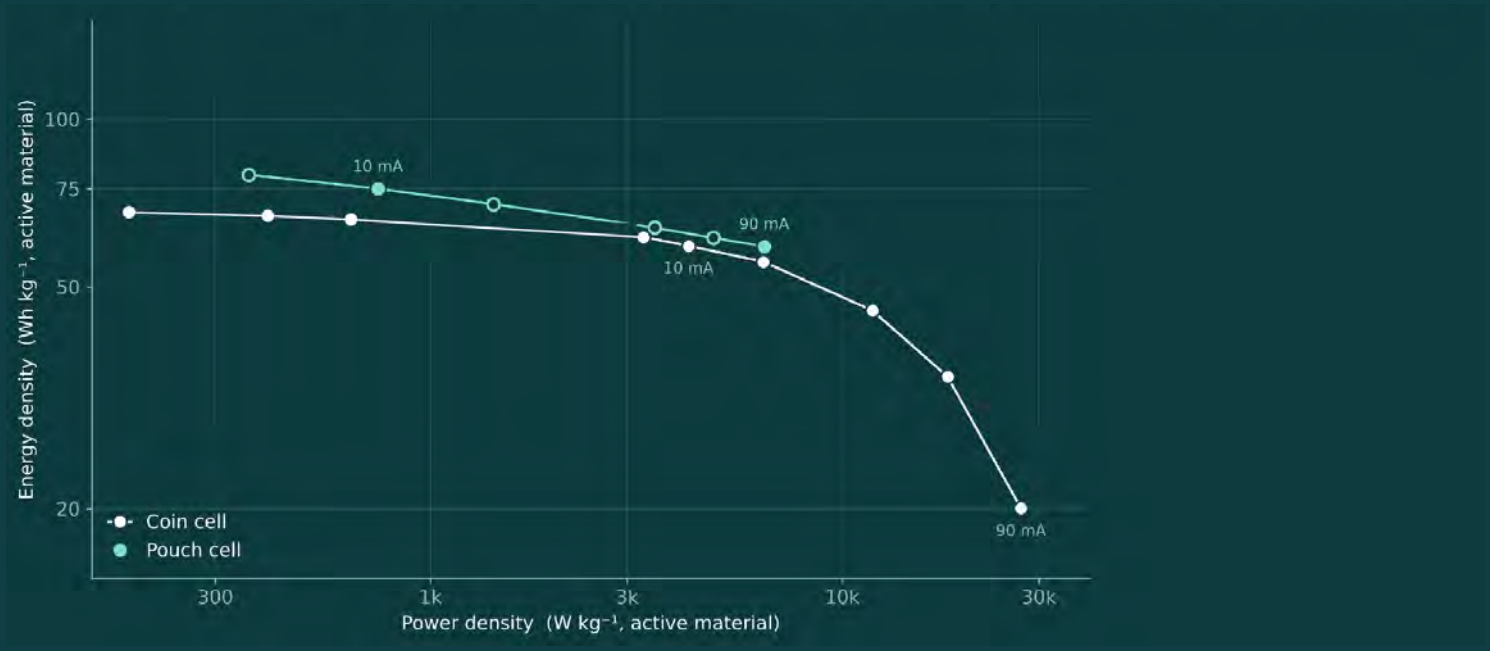
10x
maximum current vs lithium-ion capacitors

✓ **Benchmarking tests with commercial supercapacitors**

Company benchmarking; approximate values. Max current is not the same metric as power density.

© SWISTOR

THE PERFORMANCE SCALES: MORE ENERGY PER KILOGRAM IN THE LARGER FORMAT



Per kg of active material, both electrodes.

+ 20 %

capacitance per cm² in the pouch cell: nothing lost in the larger format

75 Wh/kg

at 10 mA; 59 Wh/kg at 90 mA, 79 % of the energy kept over a 9x increase in current

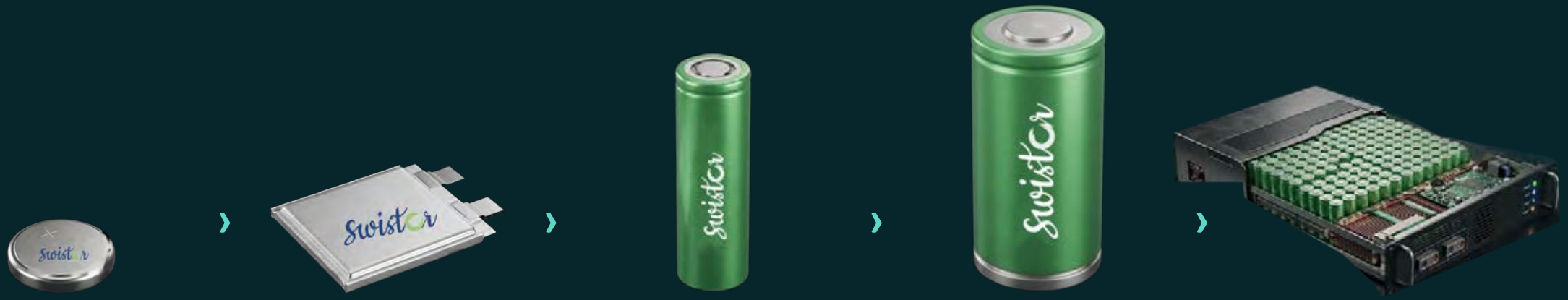
2.6 Ω cm²

areal ESR (0.42 Ω, 10 to 90 mA); a 21700 winding of a few hundred cm² lands under 10 mΩ

© SWISTOR

PRODUCT ROADMAP

FROM CELL TO COMPLETE MODULE



2024

1 F

Coin cell
4 Ω · 60k cycles · TRL 6
In-vehicle field test, long-term validation

2025

1 to 5 F

Pouch cell
1 Ω · 60k cycles
Sold IoT pilot; implantable R&D

2026

100 F

Cylindrical cell
3.3 V / 3.6 V
UPS customer tests; space conditions tests

2027

350 F

Cylindrical cell
3.3 V/3.6 V
Pilot batch on a partner line

2028+

× N

Same cell, replicated
1-25 kW module

© SWISTOR

CUSTOMER TRACTION

TRACTION ACROSS THREE CELL FORMATS

Each cell format has moved from validated prototype to paying pilot; the cylindrical cell now scales into high-power data center and space evaluation.

2023 | Validated



COIN CELL

AUTOMOTIVE · VALIDATED

Power safety function for automotive

Coin-cell devices tested in-vehicle to power a safety function. First real-world automotive validation.

Renault Technologies

2024 to 25 | Revenue



POUCH CELL

IoT & MEDICAL · SOLD PILOT

IoT and implantable devices

Pouch cell developed and sold as a pilot for an IoT use case, plus development for implantable medical devices.

IoT pilot · implantable R&D

Now | Scaling



CYLINDRICAL CELL

DATA CENTERS & SPACE · ENG. SAMPLES

High-power cells for data centers and space

Specifications validated with Tier-1 power leaders. Engineering samples for space partners from 2027.

UPS manufacturers · OEM integrators

© SWISTOR

PRODUCT UNDER DEVELOPMENT

INTRODUCING THE HIGH POWER SERIES



DEVELOPMENT TARGETS, 25 °C

100 F

rated capacitance

3.3 V

rated, 3.6 V max, 0 V min; no lithium

260 W

peak power for 1 s

< 10 mΩ

DC ESR; -25 to +85 °C operating range

CHEMISTRY MEASURED ON POUCH CELLS, 25 °C, PER KG ACTIVE MATERIAL

75 Wh/kg at 10 mA, 59 at 90 mA · **10 to 15 kW/kg** · DC ESR **2.6 Ω cm²** · AC ESR **0.35 Ω cm²** at 1 kHz · **>60,000 cycles** validated · response **below 1 ms**

Cylindrical values are targets of the current sample generation at 25 °C; cycle-life target over 100,000. Engineering samples with per-cell data from Q4 2026.

© SWISTOR

Swistor

POWER UP THE FUTURE OF SPACE

LET'S BOOST THE POWER AND EFFICIENCY FOR YOUR MISSION

Evaluate samples against your pulse profile

Test cells and modules in your system: propulsion, welding, laser drivers, mechanisms. Bring the load profile, we bring the cells, with per-cell data.

Co-develop the space-grade cell

Share your -40 °C, vacuum, radiation and form-factor requirements. We run the environmental campaign with you and shape the cells and the ESCC evaluation route around them.

Clara Moldovan, PhD · clara.moldovan@swistor.com · www.swistor.com

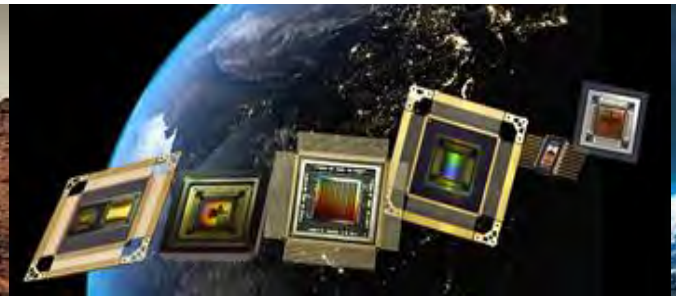
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Oscillators for LEO Constallations

manufactured in Germany

MICROCHIP
Aerospace & Defense

A Leading Provider of Smart, Connected and Secure Embedded Control Solutions


SMART | CONNECTED | SECURE

Oliver Terasa

Oct 2026

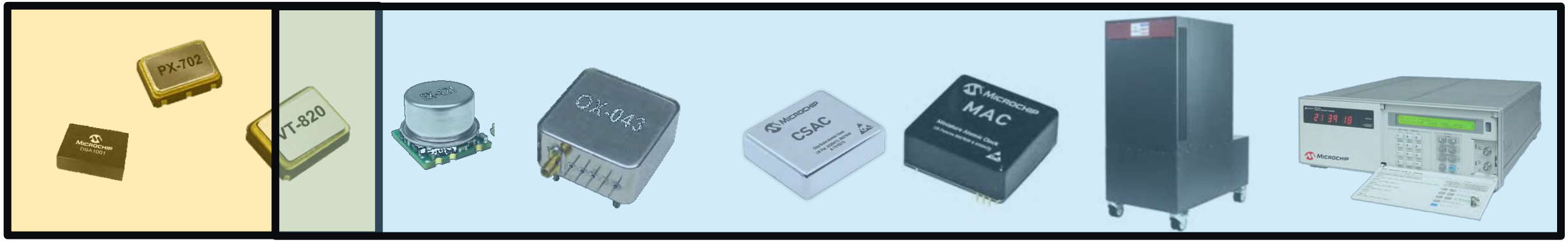
Content

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  - Frequency Control Product Range
  - European Footprint
  - Neckarbischofsheim / German Facility
- **Flight Heritage of Microchip Crystals/Oscillators**
  - Microchip Space Qualified Oscillators
  - Reference Designs
  - Solutions from COTS to Traditional Space
- **LT-802 – TCXO for LEO**
  - Features
- **CSAC – Chip Scale Atomic Clock**
  - Features
  - Space CSAC
- **Atomic Clock Manufacturing in NBH**
  - CSAC / Space CSAC / MAC

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MICROCHIP

MCHP Frequency Control Products



1E-7 1E-8 1E-9 1E-10 1E-11 1E-16

Daily Frequency Aging

- MEMS
- Crystal Oscillator (XO)
- Temperature Compensated (TCXO)
- Evacuated Miniature (EMXO)
- Oven Controlled (OCXO)
- Chip Scale Atomic Clock (CSAC)
- Rubidium
- Hydrogen Maser
- Cesium

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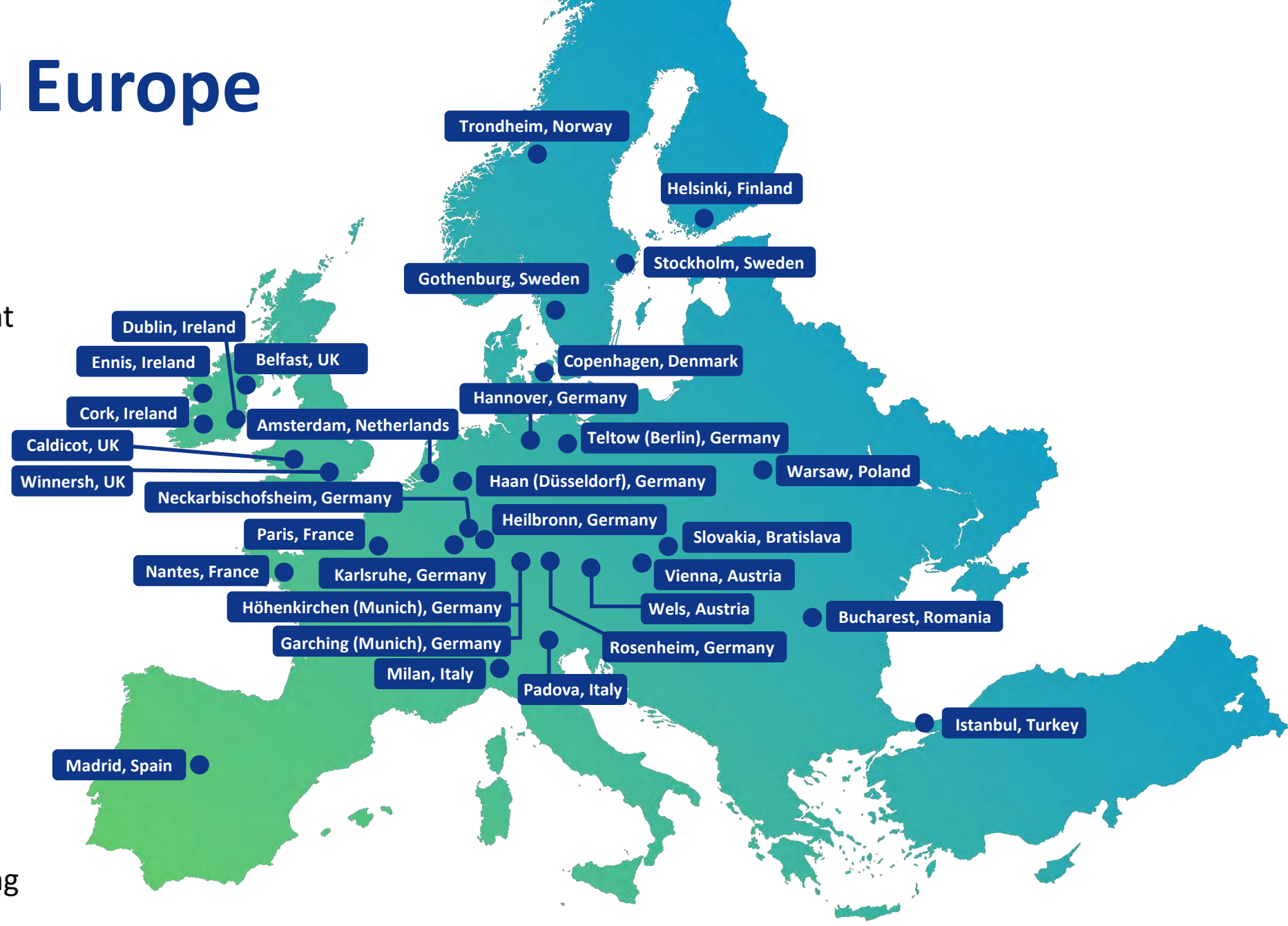
MICROCHIP

Microchip in Europe

- **>2700 employees**

- **Job Functions**
  - Research & Development
  - Procurement
  - Engineering
  - Manufacturing
  - Quality
  - Test
  - Sales Support
  - Technical Support

- **Key Markets**
  - Aerospace & Defense
  - Industrial
  - Automotive
  - Communications
  - Consumer Appliance
  - Data Center & Computing



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Microchip Frequency Technology GmbH

Neckarbischofsheim – Germany

- **Manufacturing**
  - Discrete Manufacturing
    - OCXO, TCXO, and VCXO Oscillators
    - Atomic Clocks
    - High Level of Automation
  - Crystal Manufacturing
    - Cold Weld SC Cut Crystals
- **Markets**
  - Communications
    - Wireless and Wireline Markets
  - Industrial
    - Medical
    - Test and Measurement
  - A&D
    - Defense
    - Space (LEO Constellations)



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Microchip Frequency Technology GmbH – NBH

- Founded 1974 (as Tele Quarz GmbH)
- Located close to Heidelberg in the south of Germany
- Products – Oscillators (Clocks, VCXO, VCSO, TCXO, OCXO, Atomic Clocks) / Crystals
- Highly automated/customized manufacturing lines
- ISO 9001 & 14001 certified
- ~8.000m²
- ~140 employees







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MICROCHIP

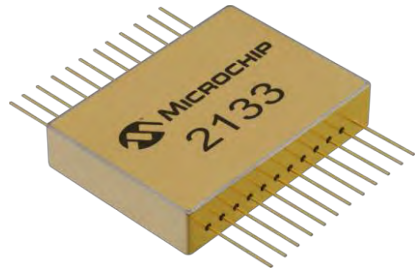
Extensive Flight Heritage

Microchip frequency control devices on-board…..

- Founded as McCoy Electronics in Mount Holly Springs, PA in the 1950's
- First successful US space mission in 1958
- First Lunar Landing in 1969
- Furthest manmade object from Earth – Voyager 1 – launched in 1977
  - ✓ 24 billion kilometers
  - ✓ 47 years of operation
- Fly-by of every planet in our solar system
- Spacecraft on surface of Moon, Venus, Mars, and Titan
- Spacecraft intentionally impacted Mercury, Jupiter, Saturn and Sun
- Deep Space, GEO, LEO, Telescopes, Landers, Rovers, Manned, Launch Vehicles
- Occupying eleven sockets on NASA's Perseverance rover
- Primary supplier of clock oscillators for JPL's upcoming Europa mission



1960s	Apollo	Gemini	Pioneer	Intelsat
1970s	GPS	Viking	Nimbus	Voyager
1980s	Galileo	Milstar	Magellan	Space Shuttle
1990s	Centaur	Cassini-Huygens	Hubble Telescope	ISS
2000s	Mars Spirit	Mars Odyssey	New Horizons	Global Star II
2010s	Orion	GPS III	GOES-R	Juno
2020s	JWST	Perseverance	Vulcan Centaur	Europa (planned)

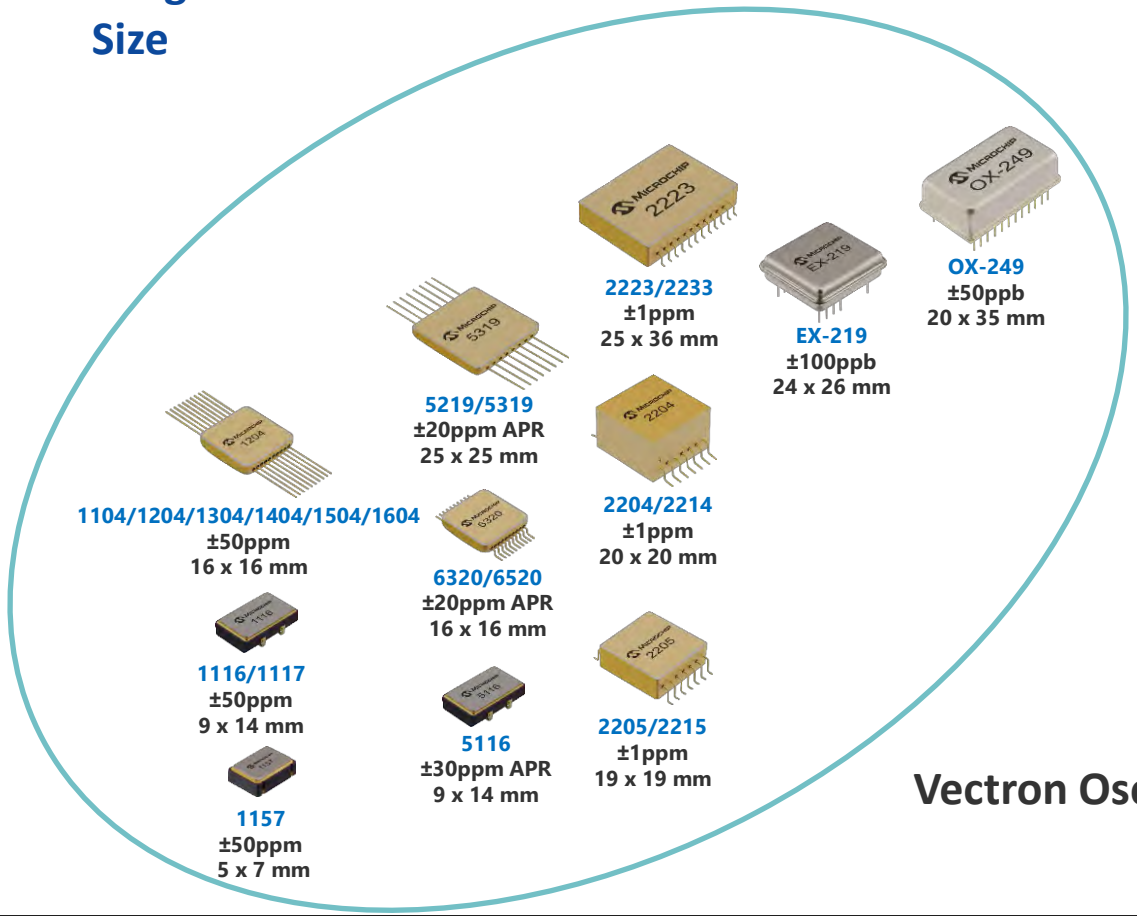


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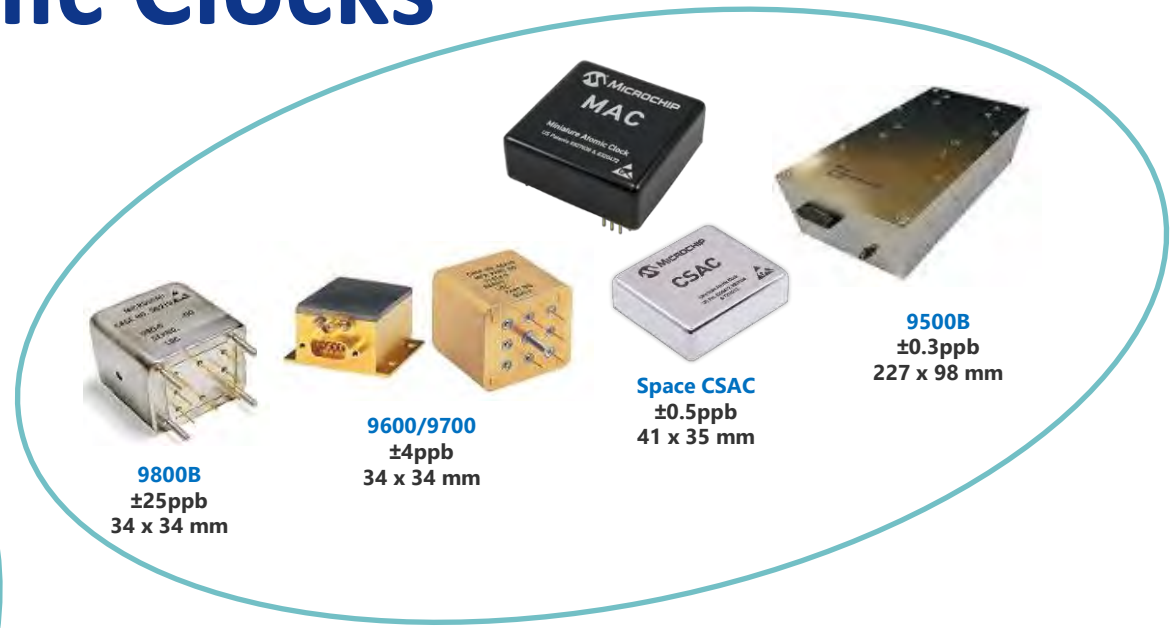
Space Oscillators & Atomic Clocks

Broadest Portfolio in the Industry

Package Size



Vectron Oscillator Products

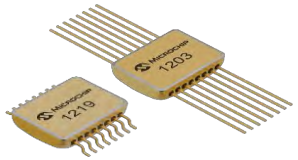


System Clocks

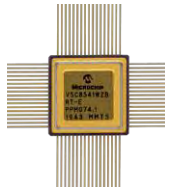
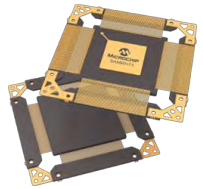
Temperature Stability Performance

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Characterized Reference Clocks





Microchip Platform	Product Type	REFCLK App Note
RTG4	Rad Hard FPGA	AN3216
VSC854(x)RT	Rad Tolerant Ethernet PHY	AN3503
SAMRH71FA20	Rad Hard Microcontroller	AN3520
ATmegaS64M1	Rad Tolerant MCU	AN3567
ATmegaS128	Rad Tolerant MCU	AN3568
SAM3X8ERT	Rad Tolerant MCU	AN3659
SAMV71Q2RT	Rad Tolerant MCU	AN3660
RT PolarFire	Rad Hard FPGA	AN5225
VSC8574RT	**Rad Tolerant Ethernet PHY**	**AN5894** NEW!!!
SAMD21RT	**Rad Tolerant MCU**	**AN5952** NEW!!!
PIC64-HPSC	Rad Hard MPU	Planned

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Solutions from COTS to Traditional Space



Cubesat

TID ≥ 100krad Tested
SEE/DDD Characterized

Quality Grade



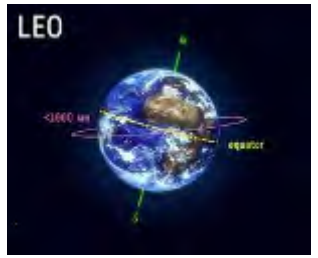
Ground Based Systems

TID < 50krad By Design
SEL Verified

Traditional Space
RHBD – Radiation Hardened By Design

L-Series
RT – Radiation Tolerant

COTS



Low Earth Orbit





MEO/GEO/Deep Space Applications

Extended Temp, Rugged

Radiation Performance

© 2026 Microchip Technology Inc. and its subsidiaries

L-Series – LEO Quartz Oscillator Family

LT-400 - TCXO

- 20MHz – 160MHz SINE
- ≤ 5 ppm Temp Stability
- 4 Pin DIP Package



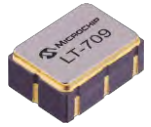
LT-802 - TCXO

- 10 to 50MHz CMOS/Clip.Sine
- ±280ppb (-40/105°C)
- 5x3.2mm SMT Package



LT-709 - TCXO

- 10MHz to 52MHz and
- 100MHz to 160MHz
- HCMOS
- Stability ±1ppm
- 5x7mm package



LX-703 - XO

- 1.25MHz – 135MHz CMOS
- **LVDS** version Q2-2026
- ≤ 100 ppm Temp Stability
- 5x7mm SMT Package



LO-20x - OCXO

- 10MHz-120MHz SINE
- ≤ 20 ppb Temp Stability
- 1” x 1” Package



LM-010 - PPS Disciplined Osc

- 12 Hour Holdover < 4 µS
- 24 Hour Holdover < 8 µS
- < 5ppb Temp Stability
- 74.9x87.6mm Package



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MICROCHIP

L-Series – LEO Quartz Oscillator Family

LT-400 - TCXO

- 20MHz – 160MHz SINE
- ≤ 5 ppm Temp Stability
- 4 Pin DIP Package

LT-802 - TCXO

- 10 to 50MHz CMOS/Clip.Sine
- ±280ppb (-40/105°C)
- 5x3.2mm SMT Package



LT-709 - TCXO

- 10MHz to 52MHz and
- 100MHz to 160MHz
- HCMOS
- Stability ±1ppm
- 5x7mm package

LX-703 - XO

- 1.25MHz – 135MHz CMOS
- **LVDS** version Q2-2026
- ≤ 100 ppm Temp Stability
- 5x7mm SMT Package

LO-20x - OCXO

- 10MHz-120MHz SINE
- ≤ 20 ppb Temp Stability
- 1” x 1” Package

LM-010 - PPS Disciplined Osc

- 12 Hour Holdover < 4 µS
- 24 Hour Holdover < 8 µS
- < 5ppb Temp Stability
- 74.9x87.6mm Package

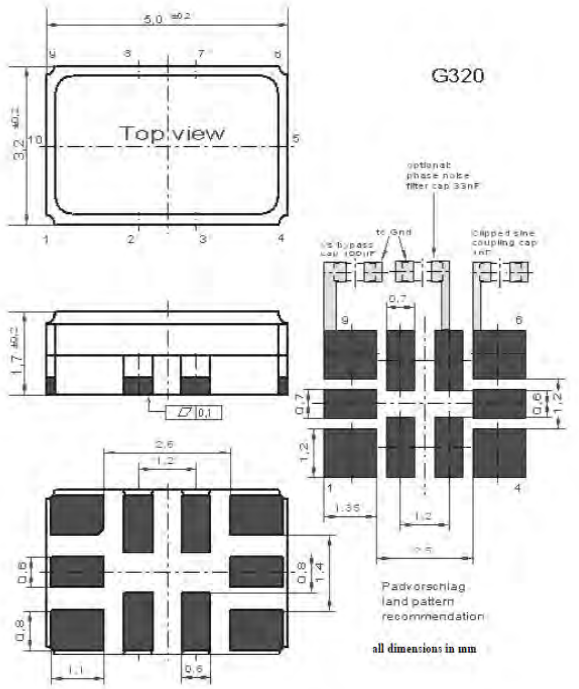
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LT-802 Radiation Tolerant TCXO for LEO applications

- **Frequency**
  - 10 to 52MHz
- **Radiation Tolerant**
  - TID: 50kRad (Si)
  - SEL: 40MeV*cm²/mg
- **Freq Stability vs. temperature**
  - ±280ppb (-40 to +85°C)
- **Phase Noise @10MHz**
  - -103dBc/Hz @10Hz
  - -150dBc/Hz @1kHz
  - -159dBc/Hz @100kHz
- **Aging**
  - ±3ppm/10 Years
- **Power supply**
  - Low power consumption 3 to 7.5 mA
  - 2.5 or 2.8V
- **RF-Output Power**
  - CMOS, Clipped Sinewave



5.0mm x 3.2mm x 1.7mm



Lead finish

Au 0.76mμ over Ni 1.91μm min.

Possibility to solder dip with tin/lead (SNPB)

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CSAC – Chip Scale Atomic Clock

- **Features CSAC-SA65**
  - 120mW power consumption
  - 16 cm^3 volume (L x W x H: 35 x 41 x 11 mm)
  - Warm-up time <180s
  - ± 3 x 10^{-10} temperature stability
  - < 3 x 10^{-10} ADEV at 1 second
  - Built-in 1PPS steering features
  - Extremely low sensitivity to acceleration

- **Rugged physics package by design**
  - Specification compliant to $10g_{rms}$
  - >1000g shock resistant



Atomic clock accuracy and stability with low Size, Weight, and Power (SWaP) and radiation tolerance for space applications

- **Space CSAC-SA45**
  - Designed as a COTS product – “New Space”
  - Modified to survive LEO environments
    - 20krad TID
    - 64MeV*cm^2 /mg SEL, SEU
    - Shock, Steady state life, TVAC tested

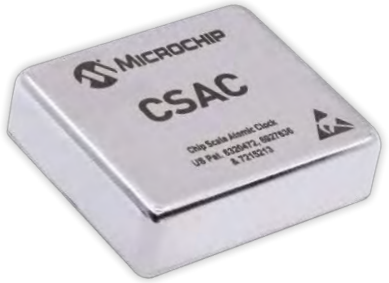
- **Space CSAC-SA65**
  - Improved SA65 electronics & performance
  - Released Sept 2026

	Space CSAC-SA45	**Space CSAC-SA65**
Rad. Tolerance	20krad	**30krad**
Temp. Range	-10°C to 70°C	**-40°C to 80°C**
Tempco	±5E-10	**±3E-10**

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Atomic Clock Manufacturing Plans in NBH

- **CSAC – Chip Scale Atomic Clock**
  - NBH currently builds PCBA for CSACs
  - System build (full assembly and test capabilities) planned by **Q1 2027**
  - **Space** CSAC SA65 planned by **Q4 2027**



Item# manufactured in Europe:

CPN	Description
090-02789-001-EU	CSAC SA65 (CSAC B) Commercial -10...+65°C
090-02789-002-EU	CSAC SA65 (CSAC B) Industrial -40...+80°C

- **MAC – Miniature Atomic Clock**
  - NBH System build (full assembly and test capabilities) planned by **Q4 2026**

Item# manufactured in Europe:

CPN	Description
090-44530-01-EU	MAC-SA53-EU (BASE PERFORMANCE)
090-44550-01-EU	MAC-SA55-EU (HIGH PERFORMANCE)
090-44570-01-EU	MAC-SA57-EU (ULTRA-HIGH PERFORMANCE)



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MICROCHIP

Thank You!

Where Possibilities Connect™



BizLink Cables for Space Applications

Jogli Maldonado
Aerospace Applications Engineer

BizLink

About BizLink

- Founded in 1996 and headquartered in Silicon Valley, BizLink provides essential components including wire harnesses, connectors, and cables to diverse industries.
- Our global presence and R&D teams in America, Europe, and Asia drive innovation, enabling future possibilities.
- With a customer-centric approach, we deliver zero-distance service and continuous performance optimization, making a positive global impact.
- At BizLink, we turn possibilities into reality and connect them to world-changing visions.

30th since 1996 BizLink

Years of Expertise



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BizLink

Milestones

BizLink

OPERATION

1996
Founded BizLink as an IT & CE interconnect focused business



1997
Founded Fremont, CA (USA) Headquarters



1998
Expanded our footprint to Xiamen, Ireland, and Mexico



1999
Established a branch in Malaysia



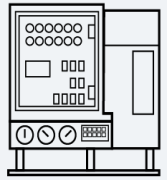
2011
Listed on the TWSE (3665.TT)



2017
Entered into electrical appliance interconnect business via acquisition (EABU)



2020
Acquired Speedy (a Singapore company)



2022
Completed the merger of the Industrial Solutions business group (INBG)



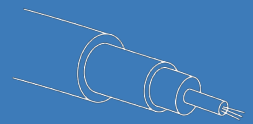
2024
Acquired EASYS s.r.o.



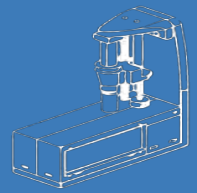
PRODUCT



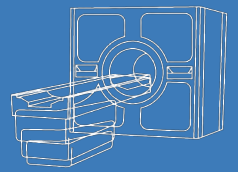
1999
Launched interconnect product line for motor vehicles



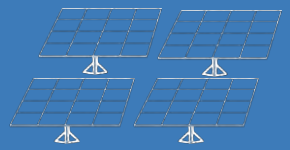
2000
Began making optical devices & cables



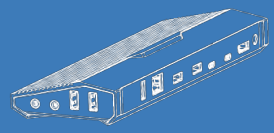
2001
Started making interconnect products for industrial markets



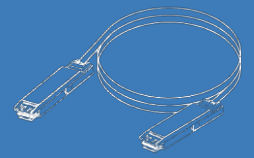
2002
Began making medical interconnect products



2008
Began making solar power interconnect products



2014
Mass-produced 4K2K docking stations



2019
Launched 400G QSFP-DD cables

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Global Footprint Network



NPI Centers/ R&D Centers/ Laboratories
in America, Europe & Asia

Global Resources
Local Services

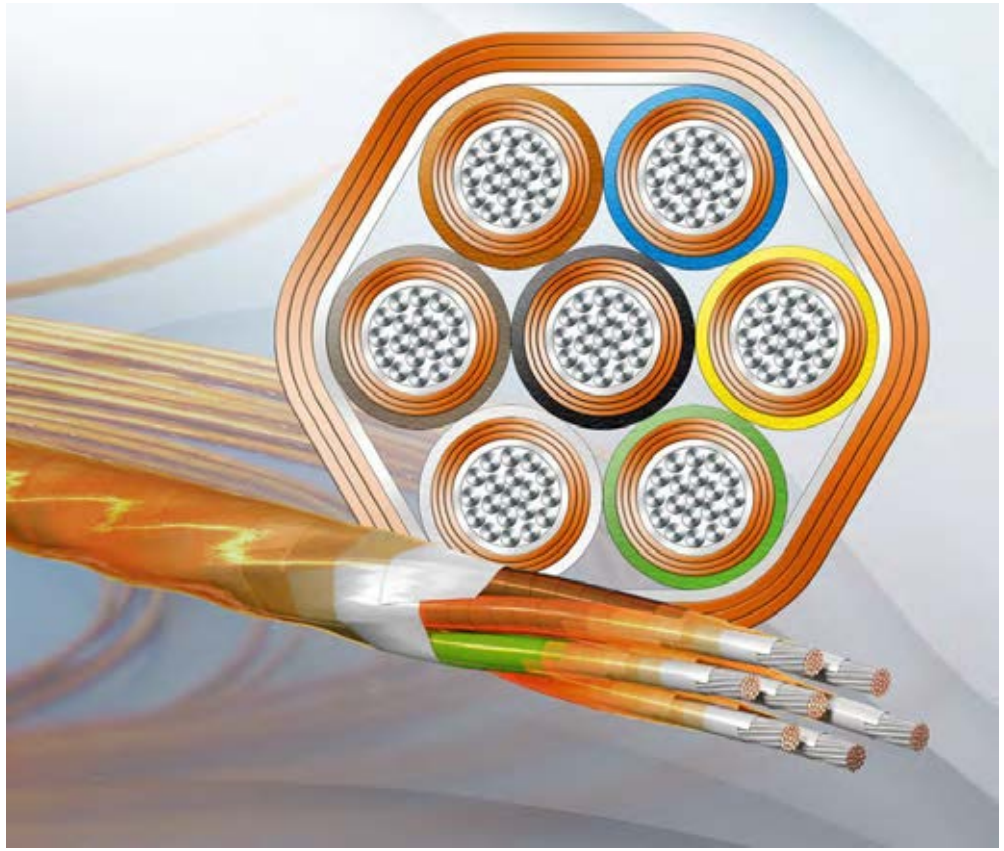
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Global Footprint Network



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ESCC space grade cables

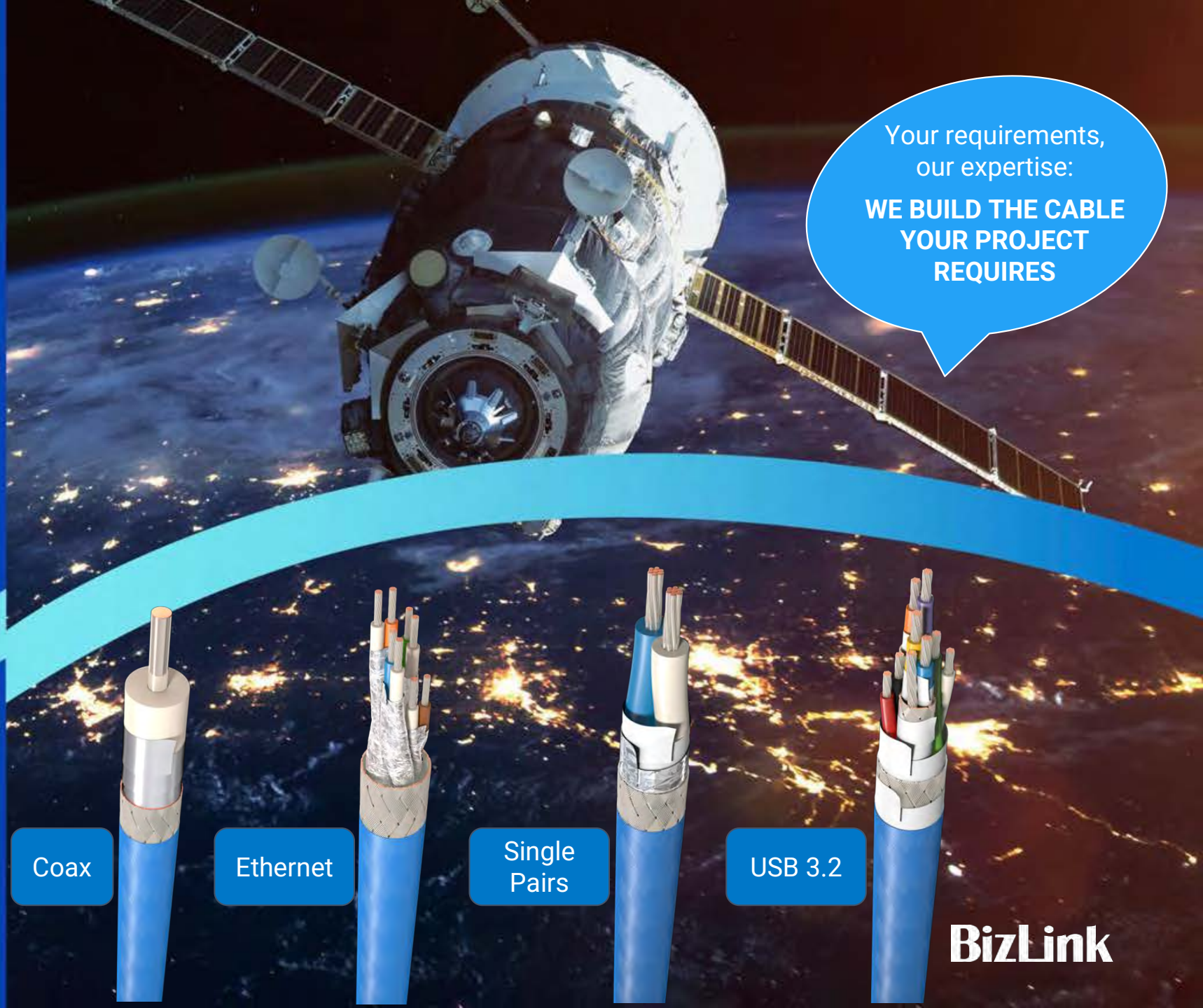


- Listed on QPL: ESCC 3901-018,-019 or -021
- Lightweight and thin
- Highly flexible
- Low-outgassing material use
- Resistant to extreme temperature ranges from -200 to +200 °C
- Vibration and shock resistant
- Electromagnetic compatible
- Voltage rating: up to 600 V

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Cables for New Space

- CoTs products upscreened / optimized to meet Space requirements.
- Low-outgassing materials TML < 1 % and CVCM <0.1%
- Temperature range -200°C to 200°C
- Cables in “BizSpace”
- Suitable for LEO and GEO applications



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ParaLink® High Speed data cables for LEO Applications

- For transmission of signals with speeds up to 224 Gbit/s per lane (PAM 4). Suck-out free till 60GHz.
- Parallel pairs (Twinax), separately shielded
- Various construction options, e.g.
  - AWG sizes 24 to 34
  - Number of pairs 1 to 24
  - Hybrid solutions
  - Space suitable

- **100Gbit/s Assemblies with FM Status exclusively in TESAT Projects**

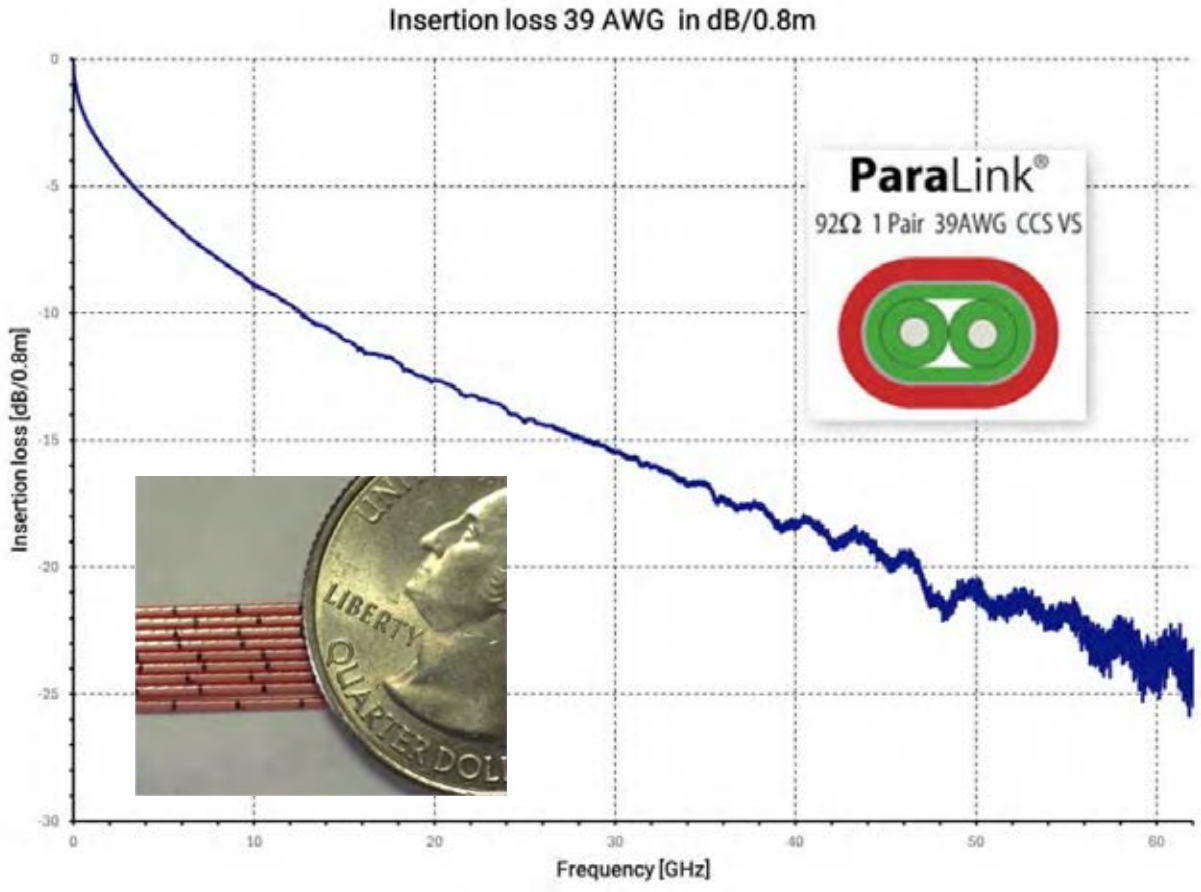






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Size matters… 39AWG High Speed Pair



- Requires manufacturing setup capable of producing very small cables with custom tooling.
- Inner jacket to improve symmetry.
- Taping without creating shear stress by torsion.
- Impedance 85Ω and 100 Ω possible.
- Low insertion loss while keeping modeconversion controlled.

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BizLink

High Voltage Cable for Electrical Propulsion Systems

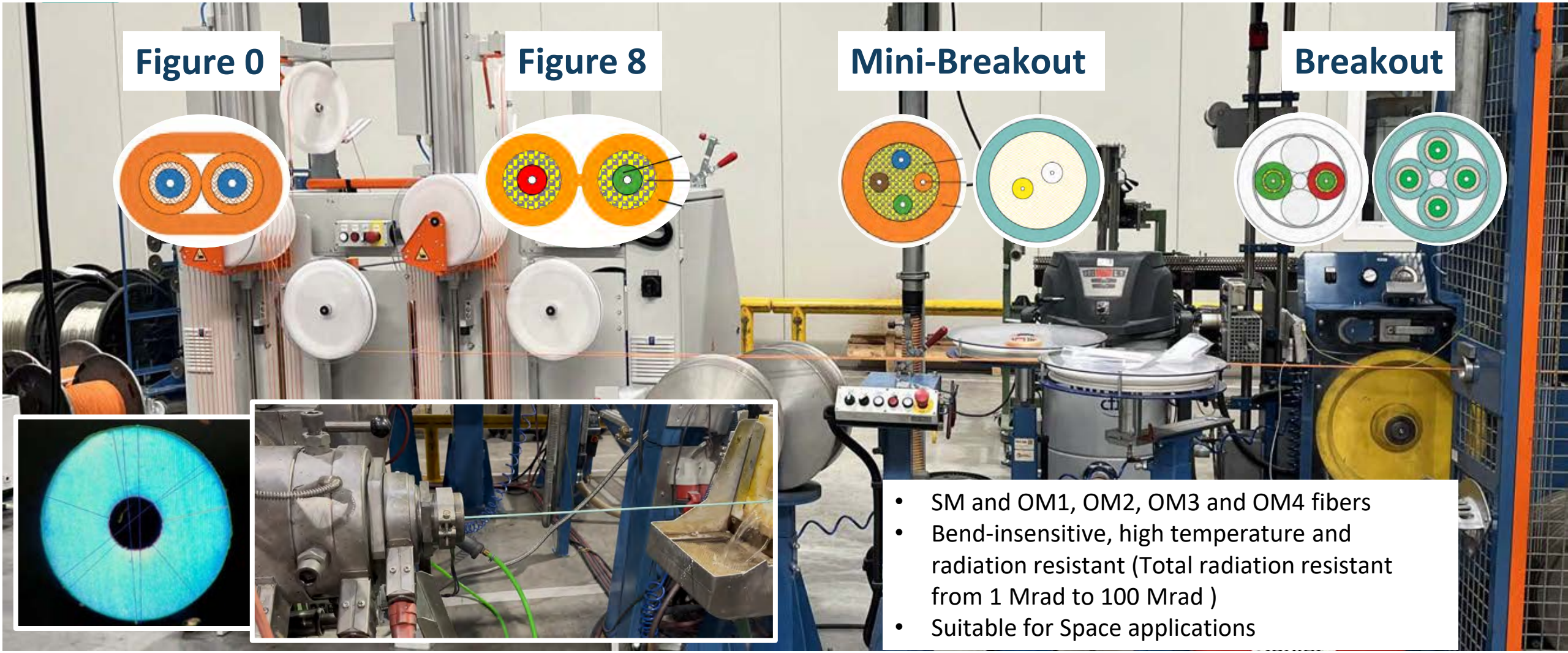


- Fit for interplanetary missions
- Operating Voltage > 2kV
- Tested until 70kV DC without failure
- Low Outgassing as per ECSS-Q-ST-70-02C
- High Flexibility
- In Qualification Phase at ArianeGroup for future missions

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BizLink

Fiber Optic

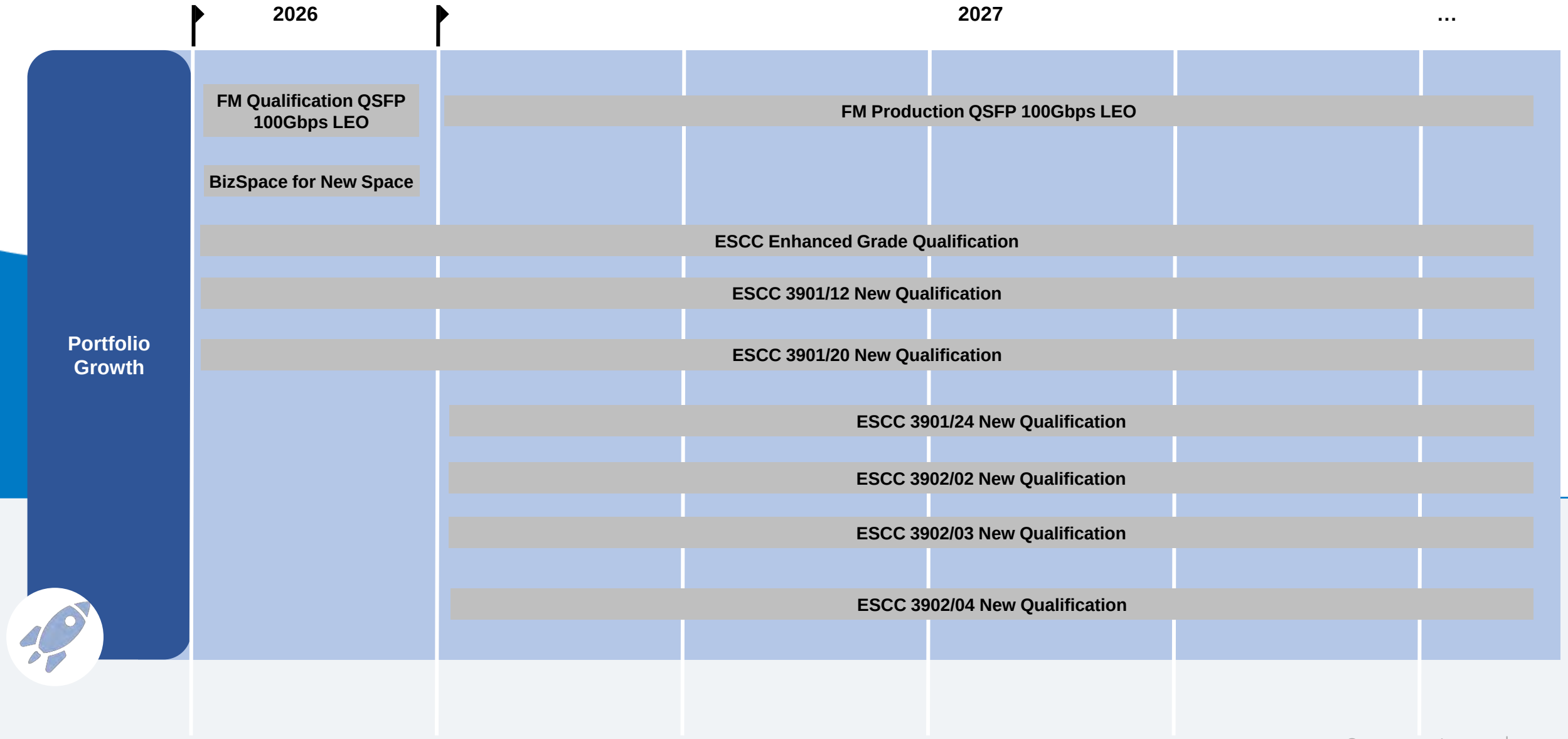


- SM and OM1, OM2, OM3 and OM4 fibers
- Bend-insensitive, high temperature and radiation resistant (Total radiation resistant from 1 Mrad to 100 Mrad)
- Suitable for Space applications

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BizLink Space Products

Status: 01/10/2026



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AZIMUT SPACE

Enabling Precision Thermal Control: Rugged TECs for Space & Defence

Marko Piskacev

6th SPCD – 15.10.26, ESTEC

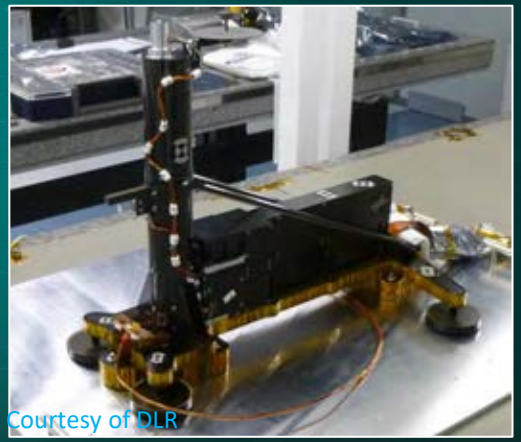
Company at a Glance

German SME developing thermal engineering solutions and specialized in products for demanding applications.

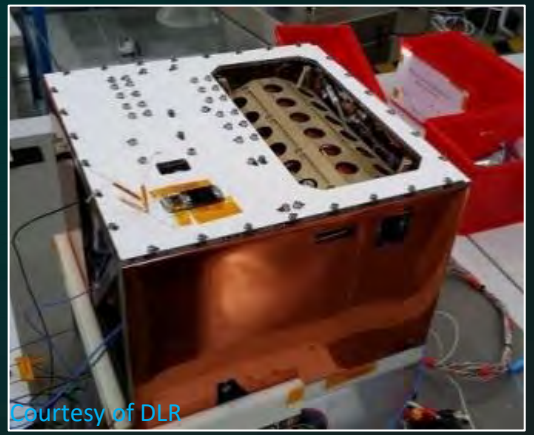
€2M+
Annual Turnover

100%
Privately EU-Owned

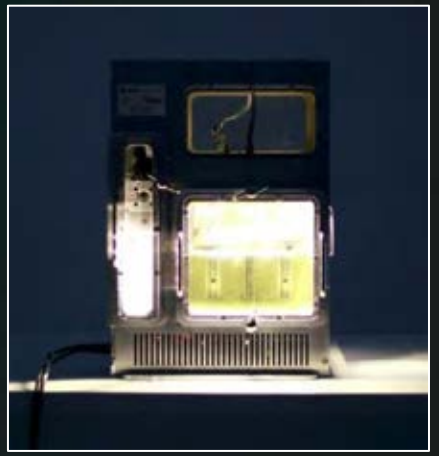
15
Employees



Mars

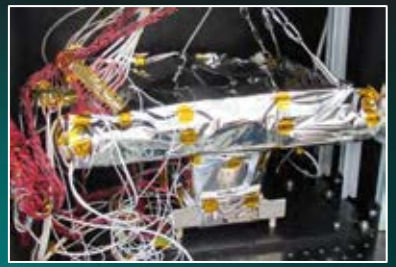


Asteroid Ryuku



ISS

Products & Capabilities

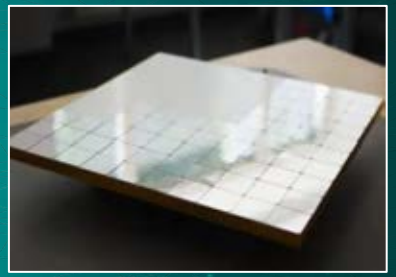


Heat Accumulators

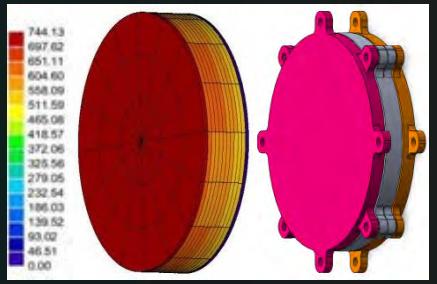


Thermal Vacuum Chambers

AZIMUT SPACE



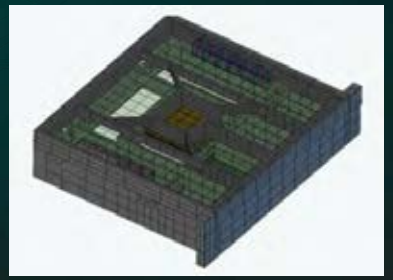
Radiators

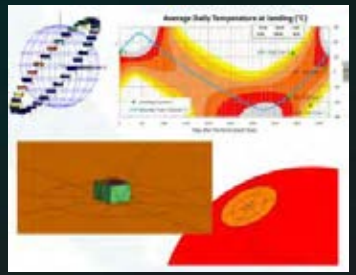


Heat Switches



Flexible Thermal Straps





Thermal Engineering, Analysis, Testing, Correlation



Thermo-electric Coolers

STARTEC

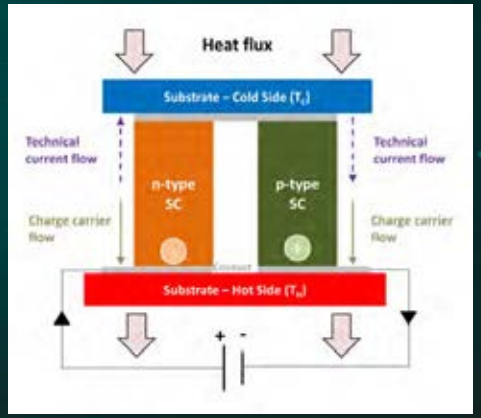
ESA ITT: European Thermo-Electric Cooler for Star Trackers (ESA Contract No. 4000143393/23/NL/Mgu)

Partners: Azimut Space GmbH & Fraunhofer Institute for Physical Measurement Techniques (IPM)

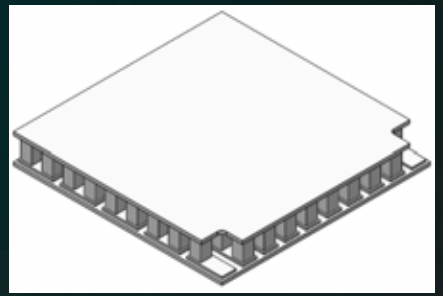
Goal: To establish an independent European supply chain for thermoelectric coolers (TECs) used in European-made star trackers.

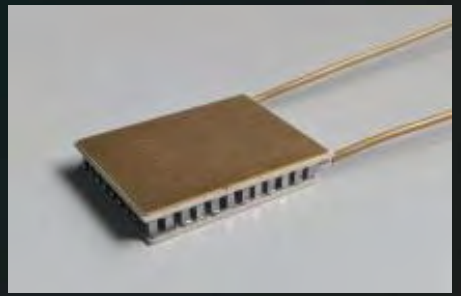


StarTracker (Sodern)



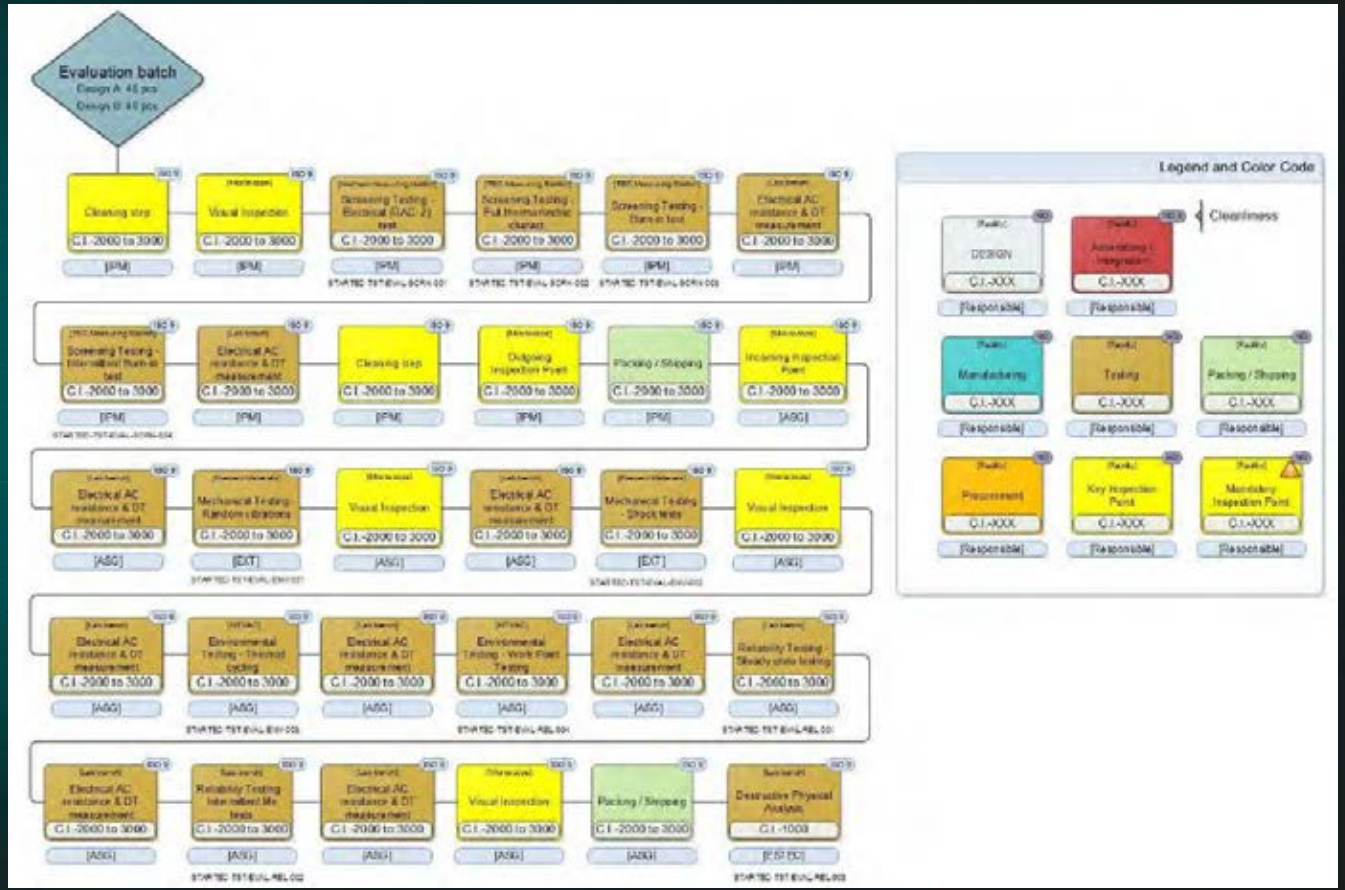
Thermo-Electric Cooling fundamentals



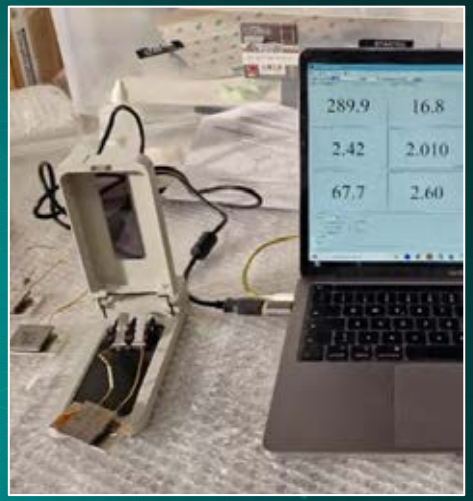


STARTEC – Design 01

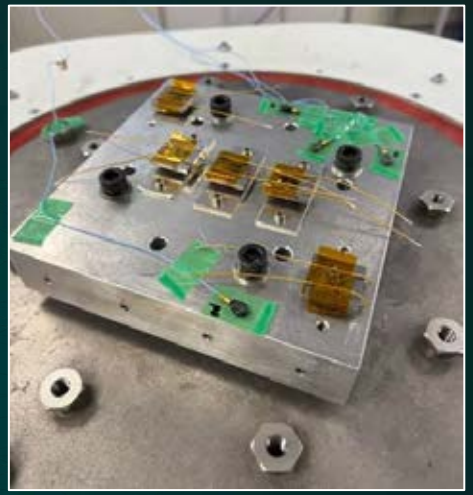
Design & Characterization



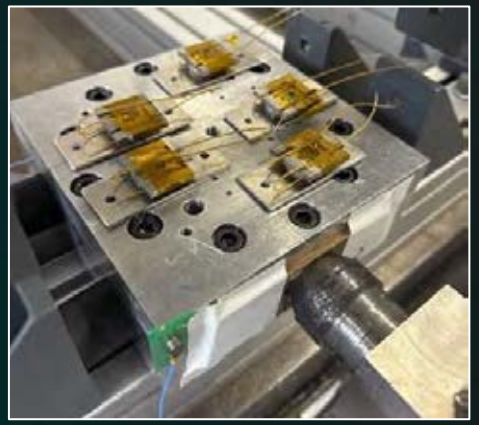
Tests Execution



AC resistance and figure of merit measurements



Random Vibration
Up to 70.1g RMS



Mechanical Shock
0.5ms half-sine
[up to 1800g]



Reliability Tests

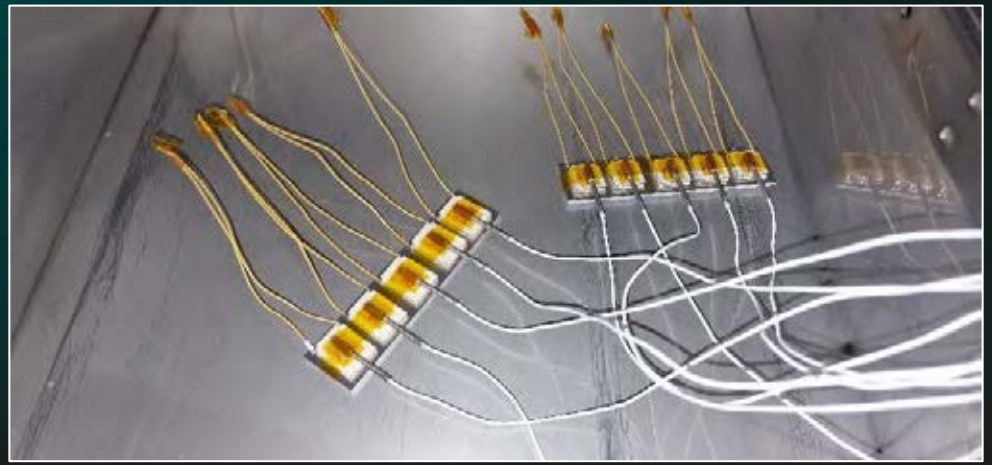
- AC electrical resistance (Ri/Rac)
- Figure of Merit (Z/ZT)
- Maximum temperature difference (Δtmax)
- Maximum cooling power (Qmax)
- Current-voltage (I-V) characteristics

- Cooling power vs. temperature difference (Qc-ΔT)
- Coefficient of Performance (COP)
- Work-point characterization
- Thermal and eletrical FEM simulations

- Steady-state and Intermittent burn-in
- Random Vibration and Mechanical Shock
- Thermal Cycling
- Steady-state and Intermittent life tests
- Destructive Physical Analysis (DPA)

Validation & Key Results

- **TRL6 reached!**
- The TEC modules **survived** the tests and **passed** the performance checks!
- Thermal environment and reliability tests are not as detrimental for the modules as the mechanical tests, BUT they are more impactful on the performances.
- **Better test planning and execution needed**: best is to run a complete campaign with cross-test GSE (avoid mounting/dismounting)



Next Steps

1. **Qualification Campaign**
2. **Production Scale-Up**
3. **Develop different designs: sizes, options, multi-stages**
4. **Upgrade for harsher environments and payloads**

Thank you for your attention!

AZIMUT
SPACE

www.azimutspace.com
marko.piskacev@azimutspace.com

ESA SPCD · 12-15 October, Noordwijk

Press-fit contacts

How ESA qualification unlocked exponential growth

Stéphane DE MONICAULT

Sales Manager EMEA · Amphenol Positronic

0

450 000

ESA-qualified contacts delivered in 2026

Qualification as a passport to the ecosystem

1
ESCC qualification
Proven against ESA's requirements

2
EPPL / QPL listing
Visible where designers look first

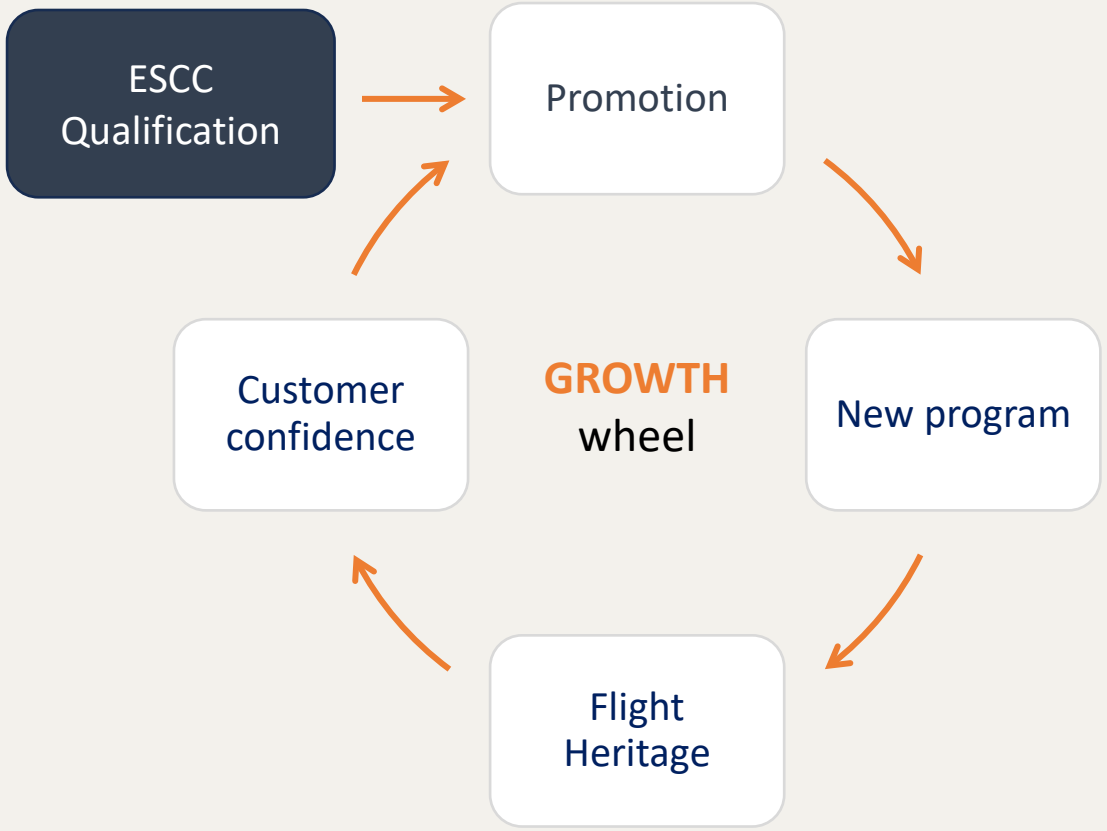
3
Dialogue with primes
A common language with integrators

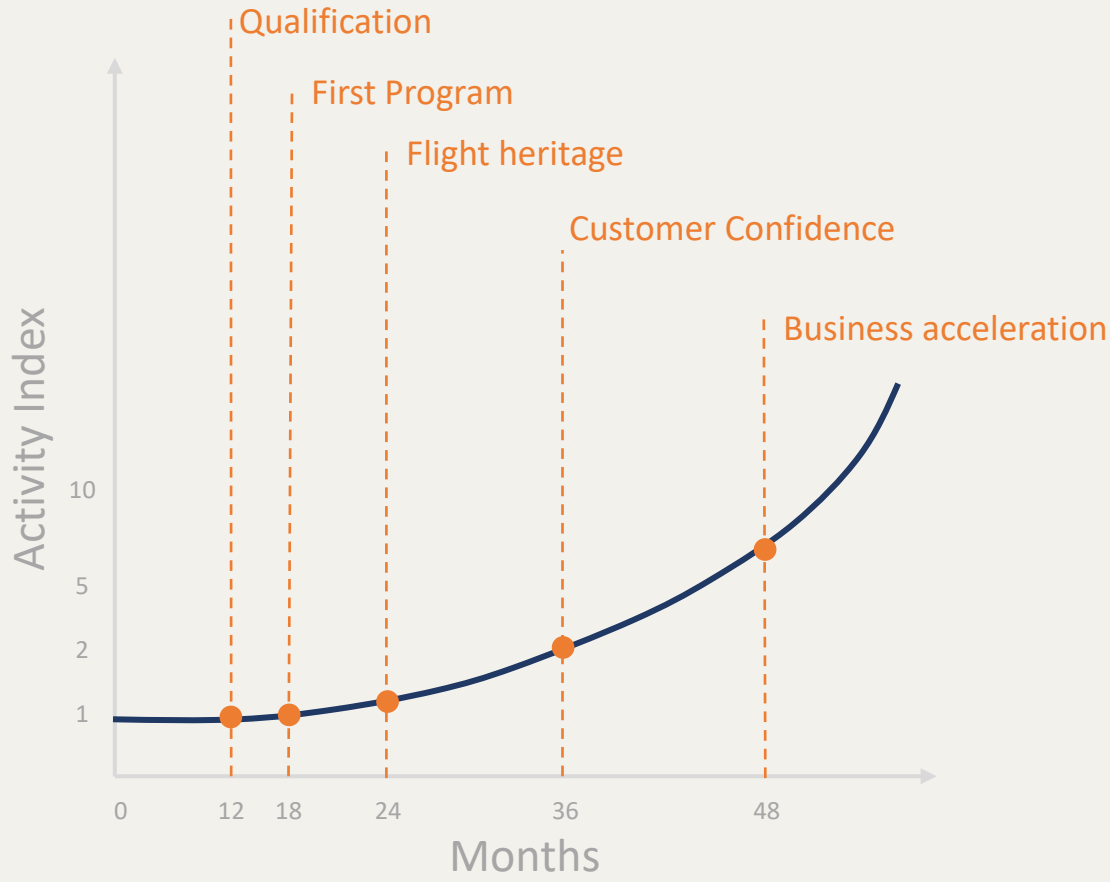
4
Design-ins
Selected at the start of new missions

5
Flight heritage
The reference that opens the next door

Whatever the product family, the qualification is what opens the door to ESA's ecosystem.

The heritage flywheel





Lessons learned, shared value

What qualification taught us

- It is a marathon. Plan 24 months from kick-off to listing.
- Test investment pays back across every program that follows.
- Early, open dialogue with ESA, Agencies and ESCC teams makes the difference.

What qualified press-fit brings to programs

- Solderless assembly, with no thermal stress on the PCB.
- Repairability and simpler rework during integration.
- A qualified European source that secures the supply chain.







TAKEAWAY

More qualified European suppliers means a stronger, more resilient European space supply chain.

Thank you to ESA and the ESCC teams.

Stéphane de Monicault ·
sdemonicault@connectpositronic.com

ISOCOM®
LIMITED

Implementation of Latching and Non-Latching Solid-State Relays in Space Systems

Delivered By Thomas Bayat
(CEO and Managing Director Of Isocom)



Choosing a solid-state relay suitable for space environmental applications involves finding a compact, lightweight device that satisfies all electrical requirements



ISOCOMS LONG SPACE HERITAGE



INTERNATIONAL SPACE STATION
CD501, CS200, CSM165-4
416 km

EnMAP
CS600, 6N134
643 km

OBZOR-O
CD501, CSM165
700 km

E-STAR
CD501
643 km

SPACESYSTEM IONOZOND
CSM165
800 km

GLONASS
CD501, CSM1200, CSM165-4
19,000 km

ANGOSAT 1
CD501
35,786 km

GALILEO
CD501
23,000 km

ELECTRO-L
CSM165-4
36,000 km

LUCH-M
IS49, CSM168-5, CSM1801
36,000 km

PANCAM EXOMARS
CS249
225,000 km

MOMA EXOMARS
CSM100
225,000 km

ISOCOM LIMITED

CONTINUING SPACE HERITAGE WITH SOLID-STATE RELAYS



RAD HARD

Solid State Relay for Digital Systems



HIGH ISOLATION (> 1,000VDC)

SINGLE, DUAL AND QUAD CHANNEL

60 TO 800VDC

60 TO 200VDC

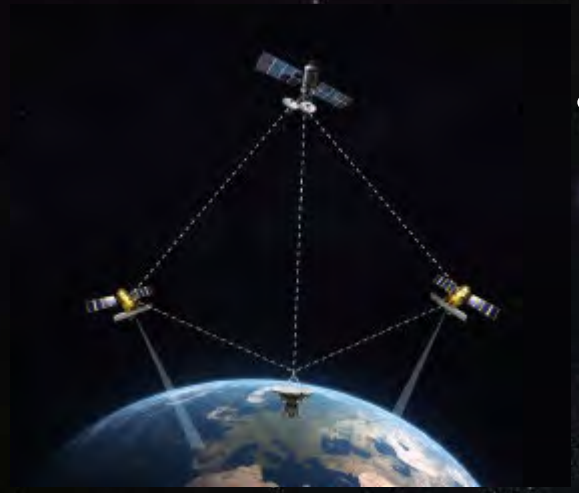
100VDC

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SOLID-STATE RELAY APPLICATIONS IN SPACE

Communication relay satellites (routing data between Earth, Spacecraft, and rovers)

- Earth observation downlinks



- SmallSat Support





- Deep space exploration





- Launch Support

Solar Array Pointing Mechanisms

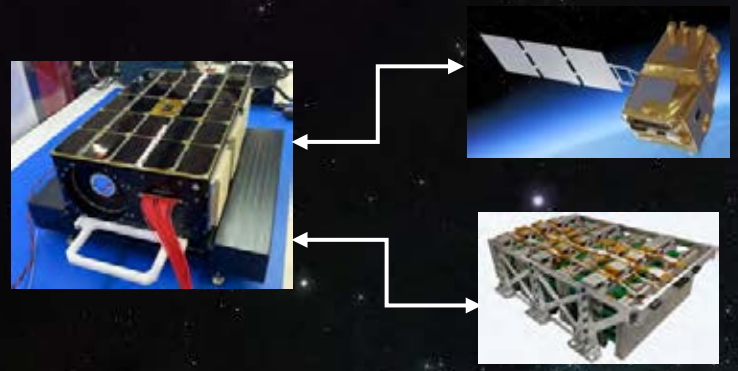
Proportional Valve Pulsing

ISOCOM LIMITED

SOLID-STATE RELAY APPLICATIONS IN SPACE

CRITICAL ARCHITECTURE BLOCKS IN SPACECRAFT'S ELECTRICAL POWER SYSTEMS

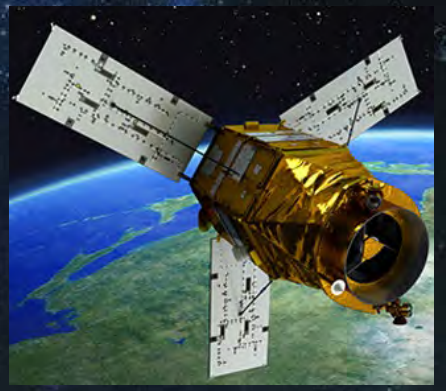
- Power distribution & conditioning





- Robotics

- Deployment mechanisms



- Testing and telemetry



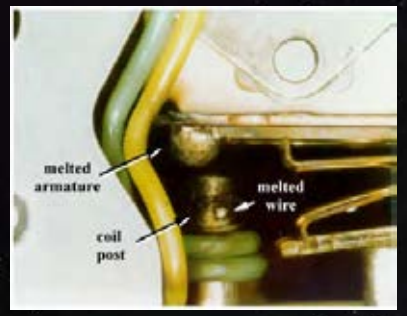
Relays bridge low-power control systems—like microcontrollers—with high-power space hardware

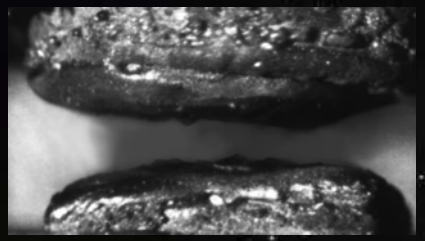
- Thermal Control Heaters:
- Pyrotechnic Actuators:
- Radio Frequency (RF) Transmitters:
- Ion Thruster Power Supplies:

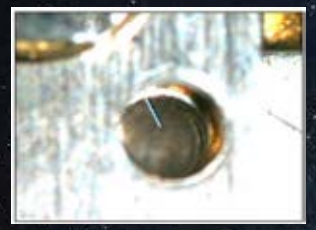
WHY SOLID-STATE ?

Typical failures of electromechanical relays







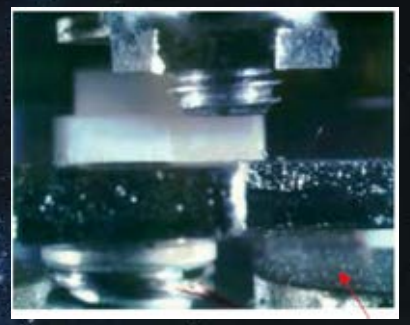




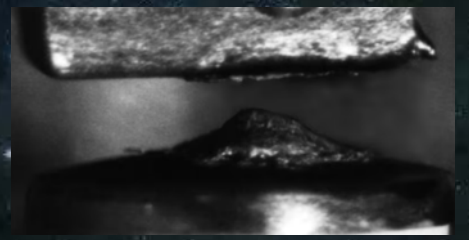












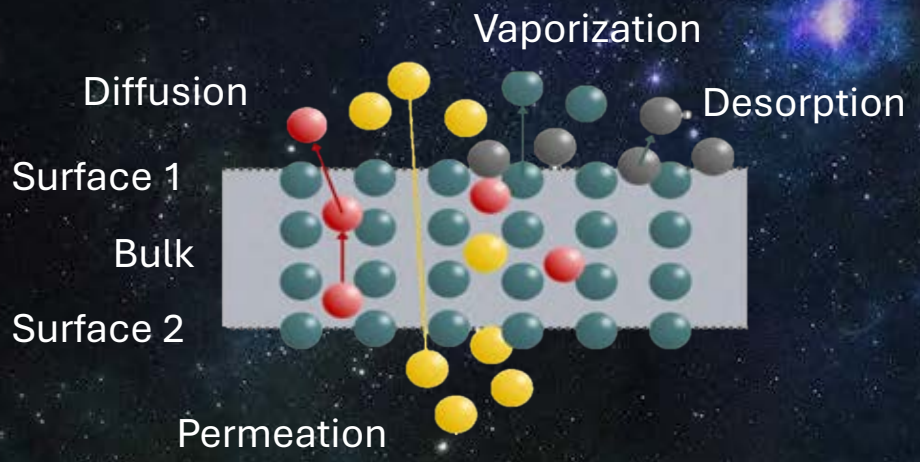
SOURCE: Davy, Gordon. “Relay failure caused by tin whiskers.” Northrop Grumman Electron. Syst. Tech. Article 2006, 2002

WHY SOLID-STATE ?

Typical failures of electromechanical relays

Outgassing





Source: https://www.te.com/en/products/relays-and-contactors/electromechanical-relays/intersection/contact-arc-phenomenon.html?tab=pgp-story [visited 09/10/2026]

Source: https://www.gluespec.com/blog/low-outgassing-materials-for-spacecraft-electronics-a-buyer-s-guide [visited 09/10/2026]

NEXT GENERATION SOLID-STATE RELAY



ISOCOM LIMITED

NEXT GENERATION SOLID-STATE RELAY

LATCHING !

A RELAY THAT HOLDS ITS CURRENT STATE

ISOCOM LIMITED

ISOCOM LATCHING and NON-LATCHING SOLID-STATE RELAYs

Solid-State Relays


CDMR2010

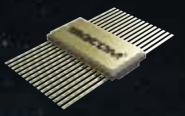

CSMR240


CDMR310A


CSMR540


CDMR310B

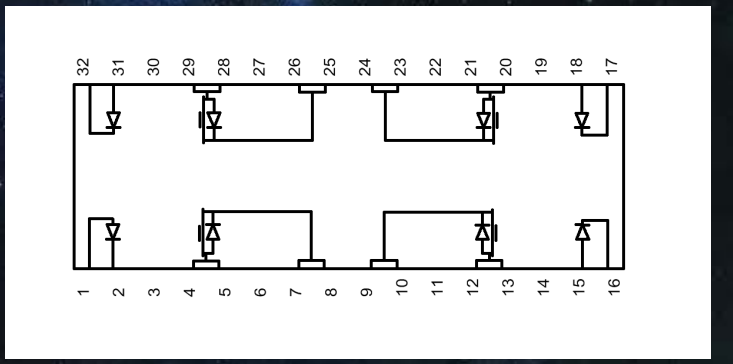

CDMR1010

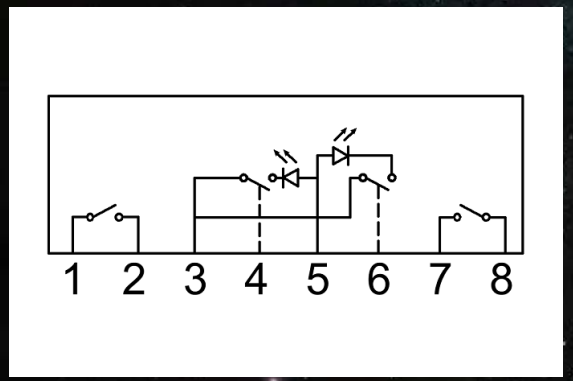

CQMR310

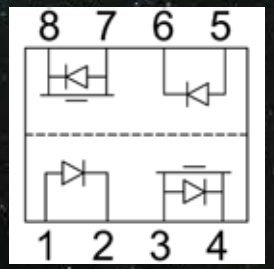

CSMRLXXXA

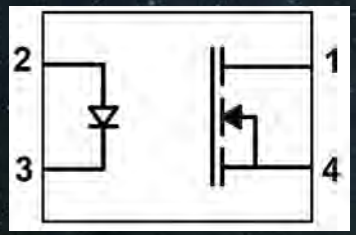

CSMRLGXXXA


CSMRLXXXT8





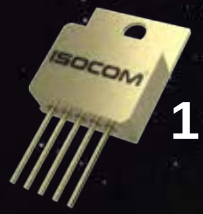




LATCHING SOLID-STATE RELAY

2PDT

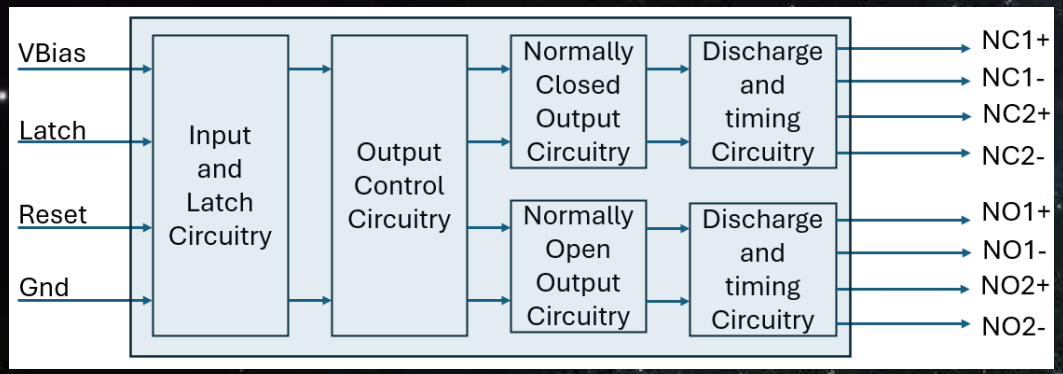


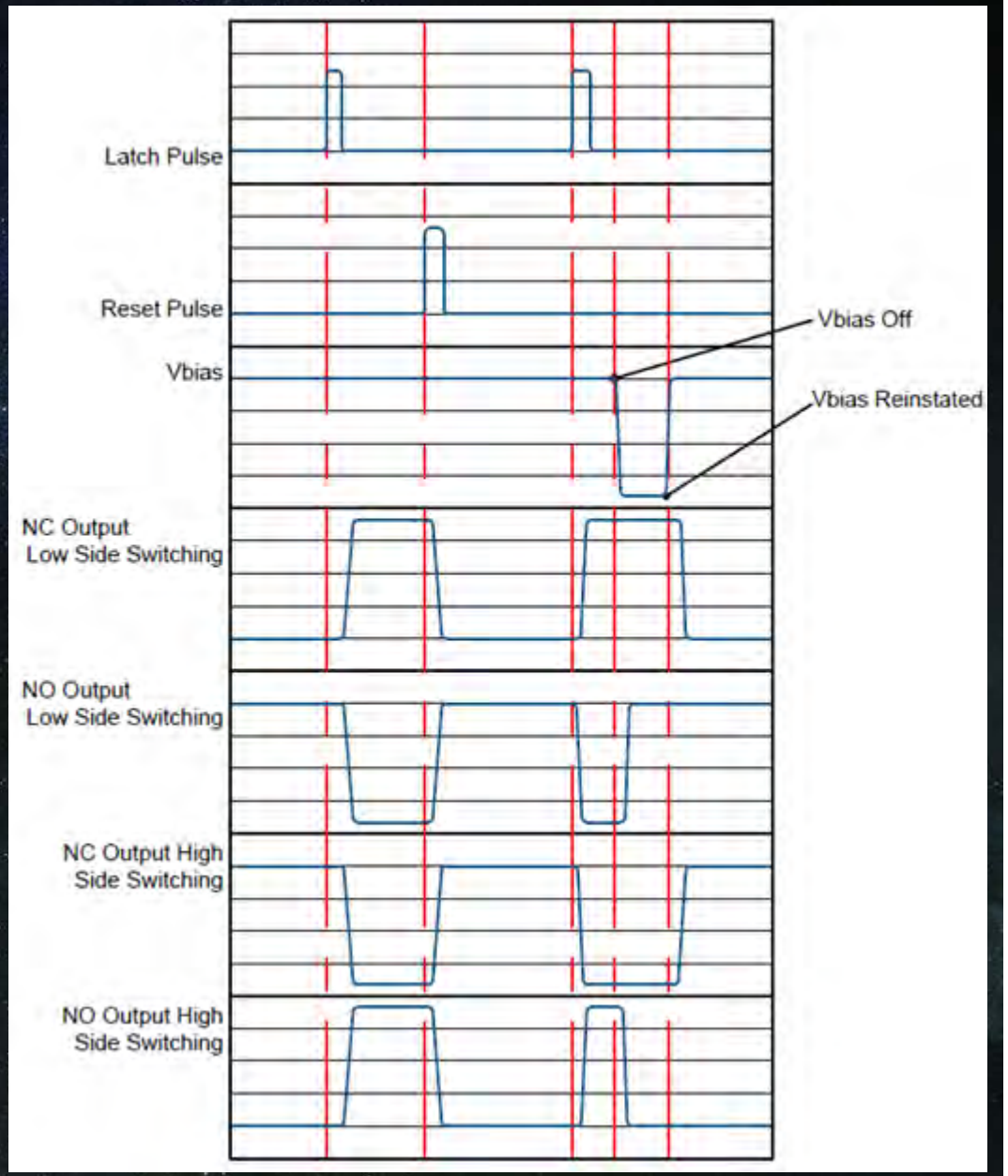


1PST

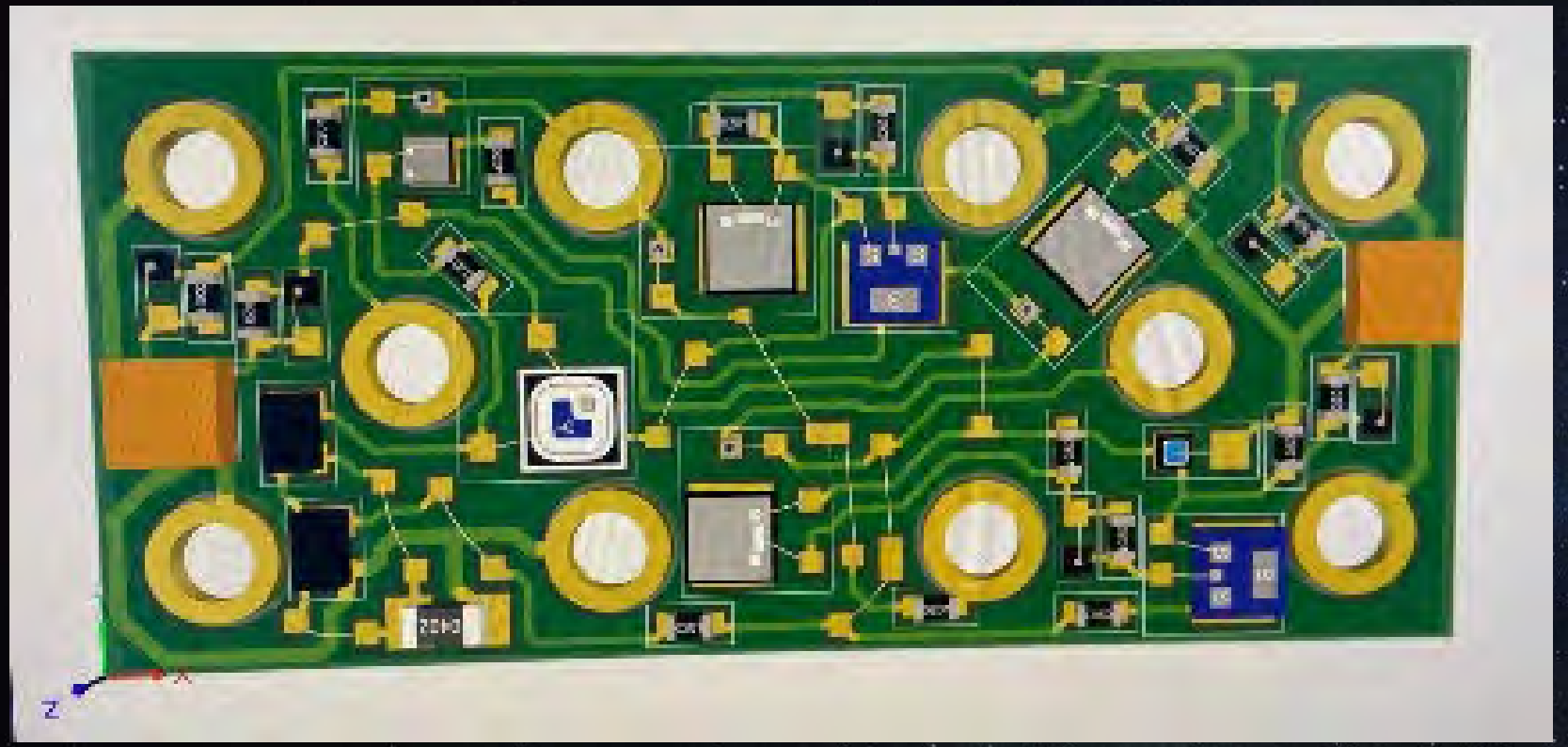
1PST
1PDT
2PST



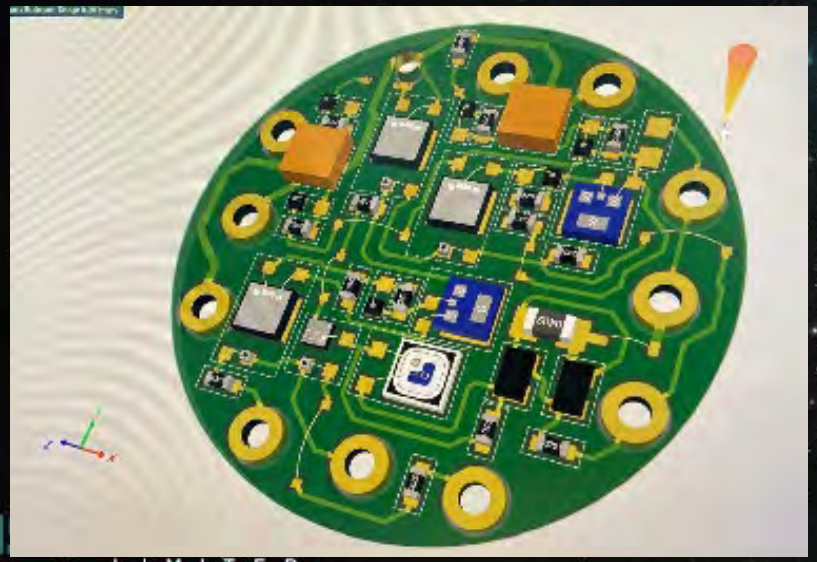




ISOCOM LIMITED











ISOCOM LIMITED

Design & Screening Services

SUMMARY

- ISOCOM have a long and successful space heritage
- Expanding into the Solid-state Relay market for space
- Have an extensive Solid-state Relay catalogue
- Designing the worlds first Latching Solid-state Relay
- Excellent design and manufacturing facilities

ISOCOM®
LIMITED

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- Peterlee, County Durham, SR8 2RR,
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- sales@isocom.uk.com

www.isocom.uk.com





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smiths interconnect
a molex company



SPCD 2026 TIC
RF Filters and Multifunctional Assemblies: Enabling High-Performance Space Systems

October 2026

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CUTTING-EDGE CONNECTIVITY

Smiths Interconnect, a Molex company

Who we are

- RF component provider within the Aerospace and Defense Solutions division, focused on delivering high-performance configured RF solutions for mission-critical and high-reliability applications.

Unique Selling Point

- Engineering-led consultation, rapid development cycles, and the ability to meet stringent electrical and environmental performance requirements based on decades of space heritage.

Key products & services

- **Filters, Isolators / Circulator**s, Splitters/Combiners & **Mutli-fucntional Assemblies (MFAs)**
- **RF Board-Level Components:** Attenuators, Resistors, Terminations, Equalizers
- **RF Cable Assemblies**
- **Rugged optical transceivers**

Key applications

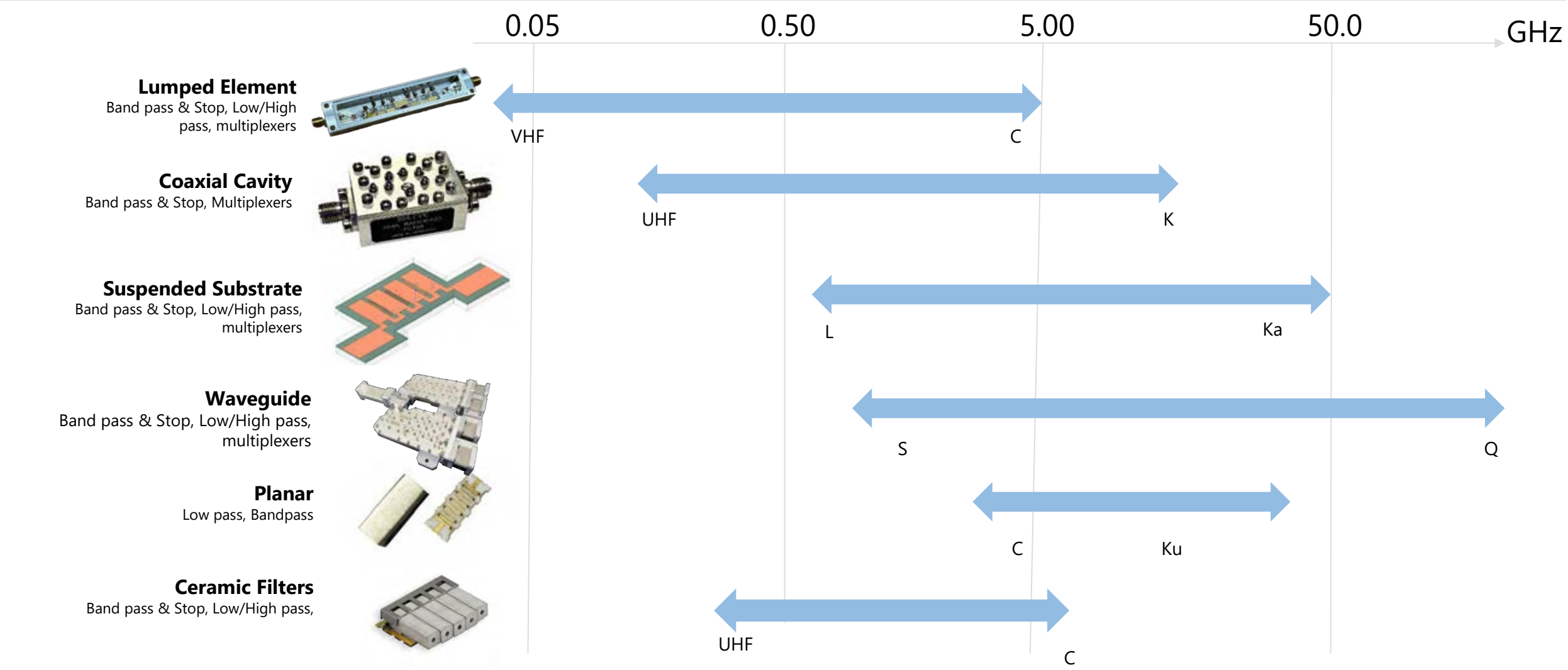
- Signal conditioning of spacecraft payloads and TT&C chains and ground stations within LEO/MEO/GEO and other New Space systems.
  Examples: Temperature compensation for amplifier drop (temperature variable attenuators), filtered duplexed front ends (multi-function assemblies), Surface mount Strip-line circulators.



William Wilson
Product Line Manager
RF Components
William.wilson1@molex.com
https://www.smithsinterconnect.com/



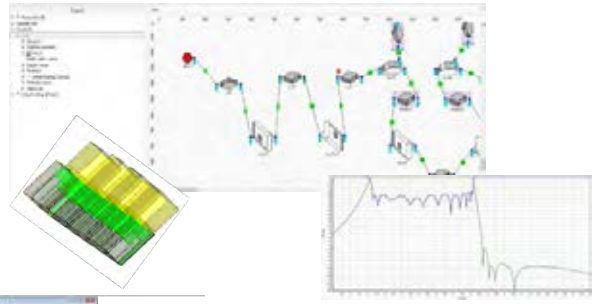
Filters: Capability & Experience



Microwave Design Capability

Mician
µWave
Wizard

Full wave 3D EM design Hybrid solver approach combining Finite-Element-Method flexibility with Mode-Matching (MM) speed and accuracy. Ideal for very fast and accurate simulation of waveguide and coaxial filters



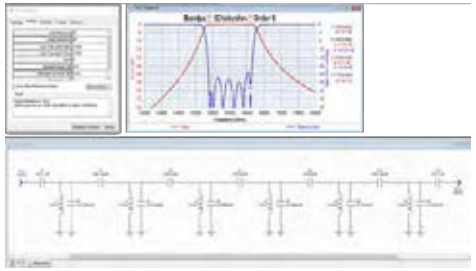
Keysight
Genesys
Pathwave

Rapid filter synthesis tool

RF simulation, tune and optimisation

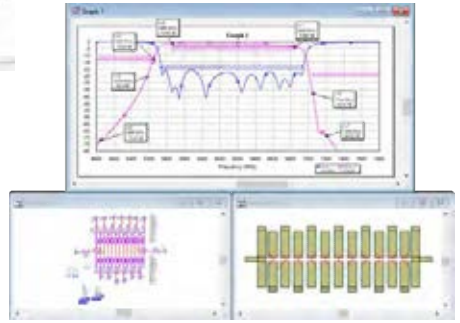
Ideal lumped models and transmission lines

Schematic capture



AWR
Microwave
Office

Industry standard RF multipaction and corona breakdown analysis tool

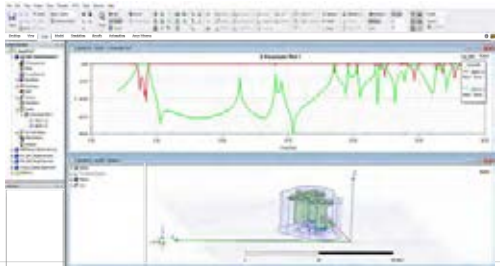


Ansys
HFSS

Full 3D electromagnetic (EM) simulation

Multiple solvers including multipaction

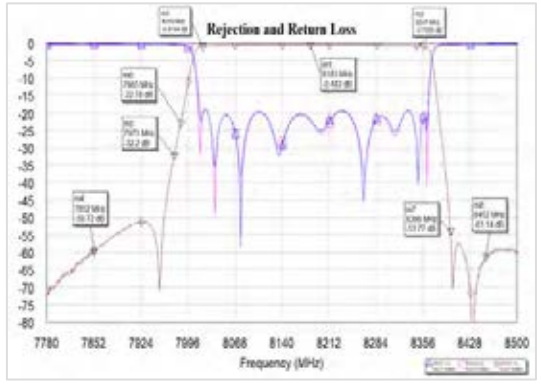
Ideal for accurate simulation of all RF filters and components

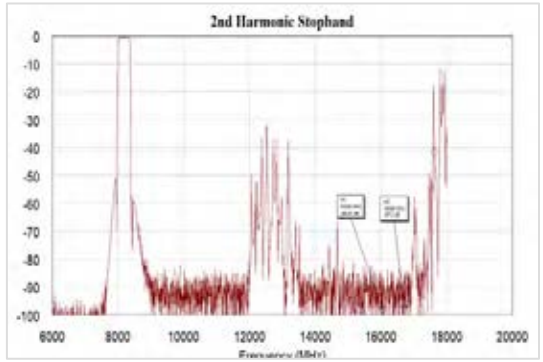


Satellite Constellation TT&C and Deep Space Communications

Satellite Constellation TT&C System





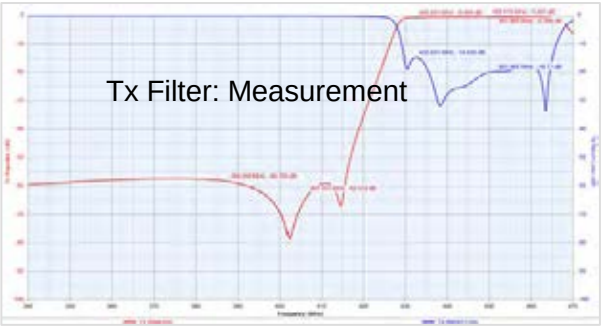


- TNC connectors
- Reduced height waveguide elliptic bandpass and corrugated low pass filter
- **Produced in INVAR for optimal temperature compensation**

Deep Space Communications



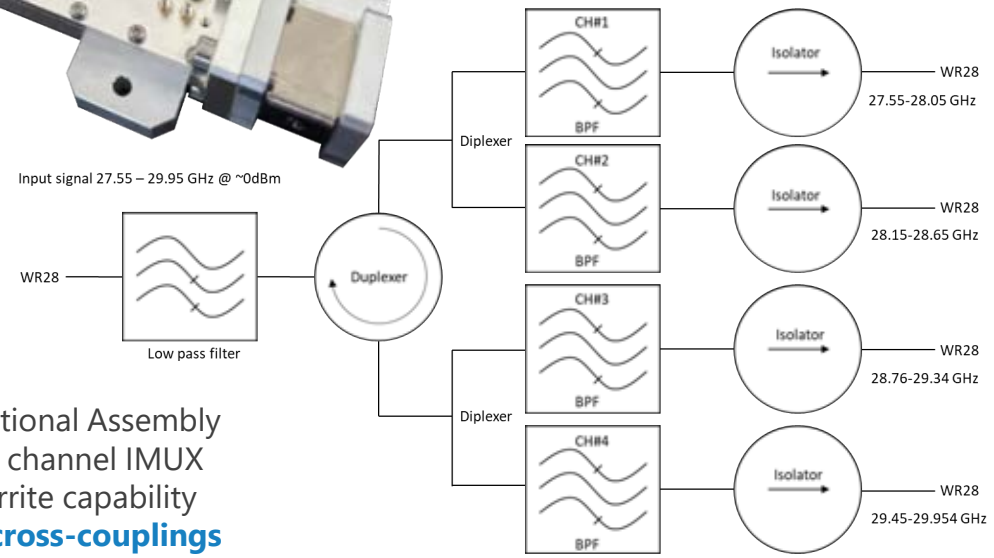




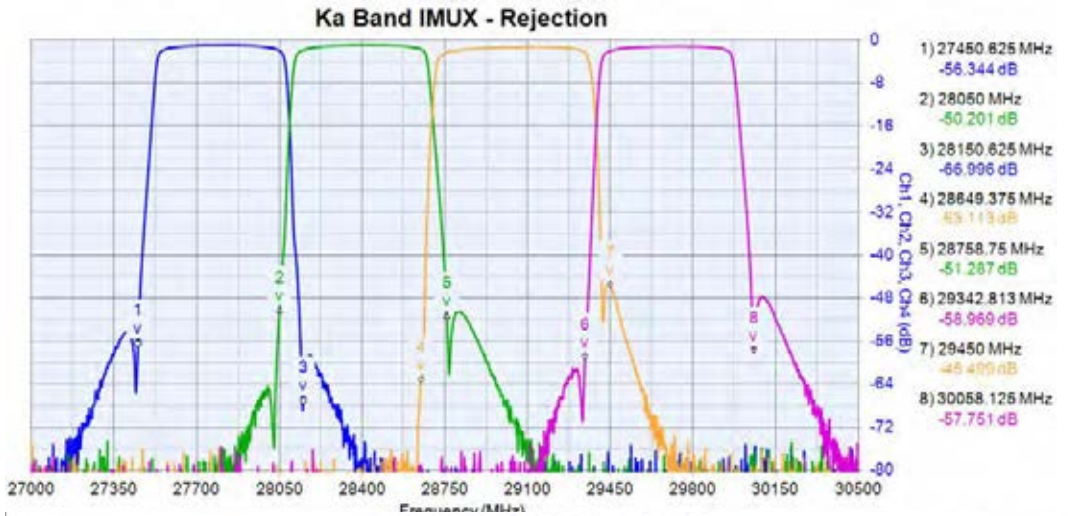
- 10 W proximity transceiver
- Cross-coupled cavity, with MP suppression
- **Itegrated circulator**
- 500 W UHF test source

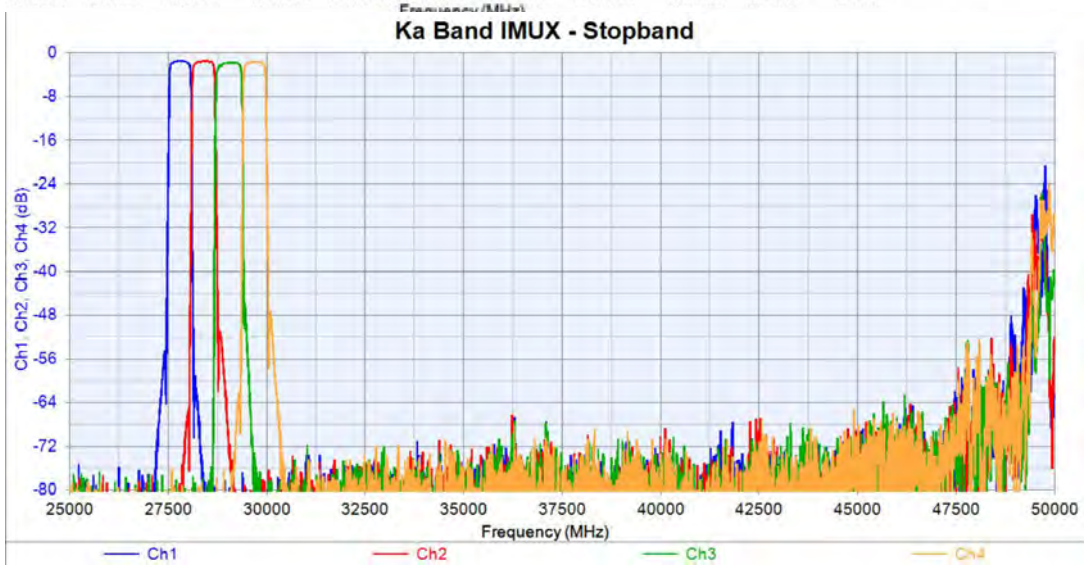
Satellite Constellation TT&C System



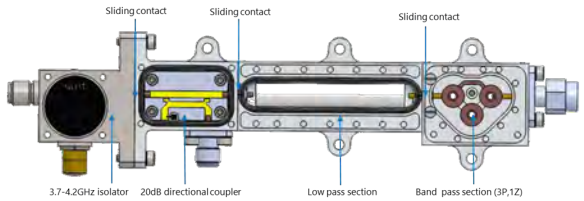


- Multi-functional Assembly
- Ka-band 4 channel IMUX
- Integral ferrite capability
- **Multiple cross-couplings**



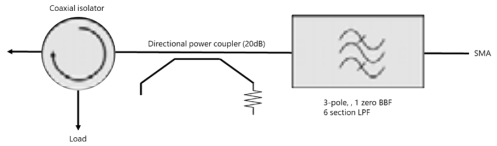


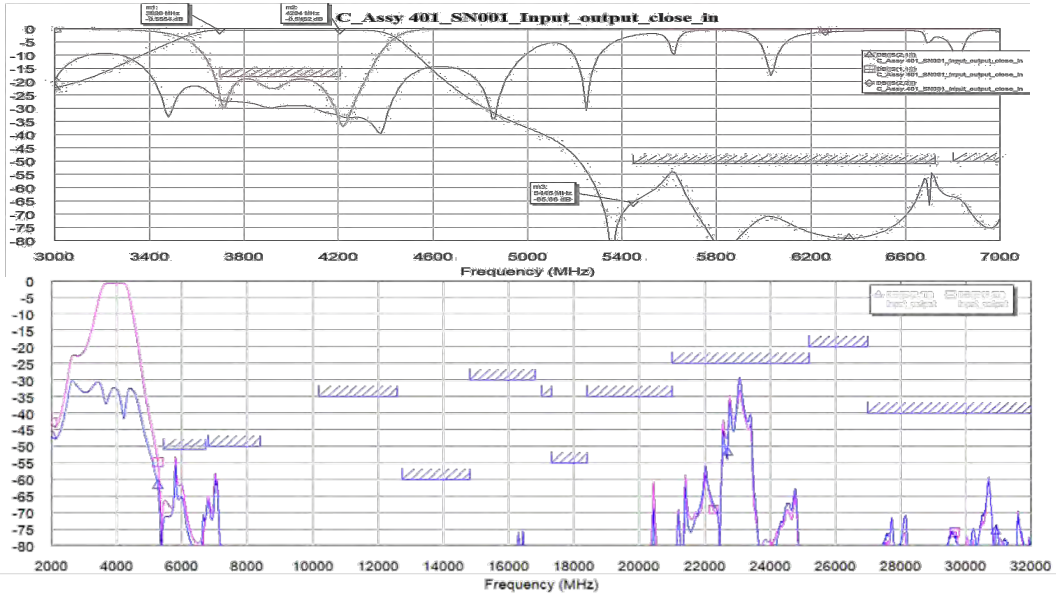
Satellite constellation TT&C system



- C-Band
- A compact TT&C transmit section operating in 3.7-4.2 GHz intended for use aboard a small constellation of large **LEO satellites**

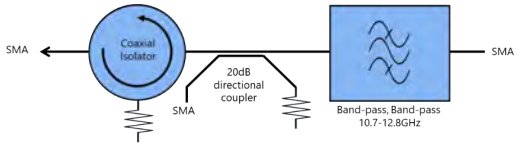




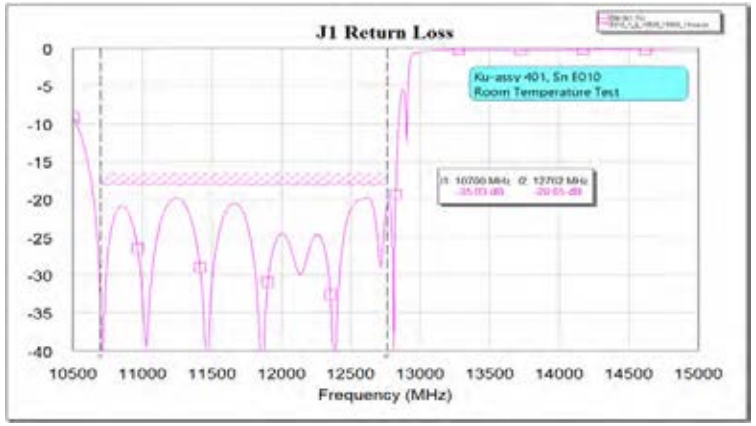


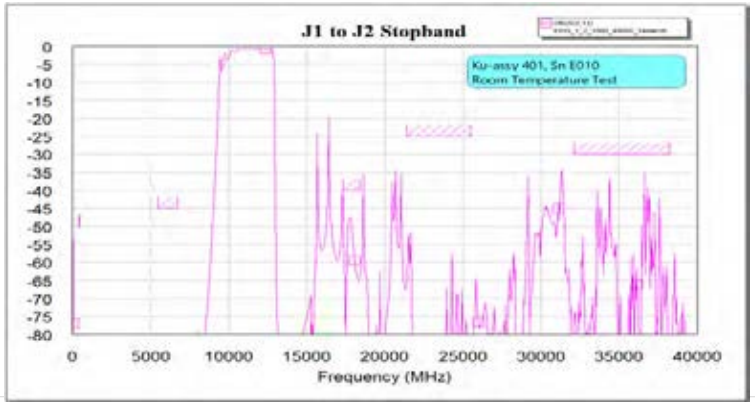
Satellite constellation TT&C system





- Ku-Band
- A compact space-based TT&C transmit section operating in 10.7-12.8 GHz
- We are a preferred supplier of ferrite isolators to a customer who has an impressive filter design capability.





In-House Capabilities



Electrical Test

- VNA to 110GHz (2 and 4 port)
- Thermal Vacuum x 3
- Seeded Multipaction (UHF to 23 GHz)
- HPAs (UHF to 52 GHz)
- Corona Discharge
- DC withstanding
- Continuous IL monitoring
- Reverberation Chamber (EMC) x 2

Inspection

- 3D X-Ray
- X200 optical with camera capture
- Automated GII CMM
- xRF
- DPA lab

Environmental Stress

- SRS Mechanical shock
- Vibration x 4
- Thermal chambers x 16
- Thermal shock
- Humidity
- External subcontractors for
  - PIND
  - DPA
  - Acceleration

Other

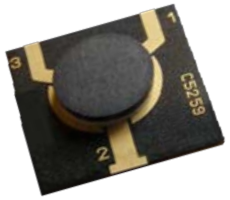
- CNC machining
- Ceramic Grinding
- 3D spark erosion
- Laser ablation, marking and cutting
- Vapour phase soldering
- Automated bond pull testing
- Plasma cleaning

smiths interconnect



RF Filters

Circulators & Isolators

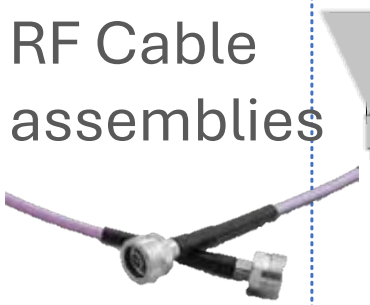


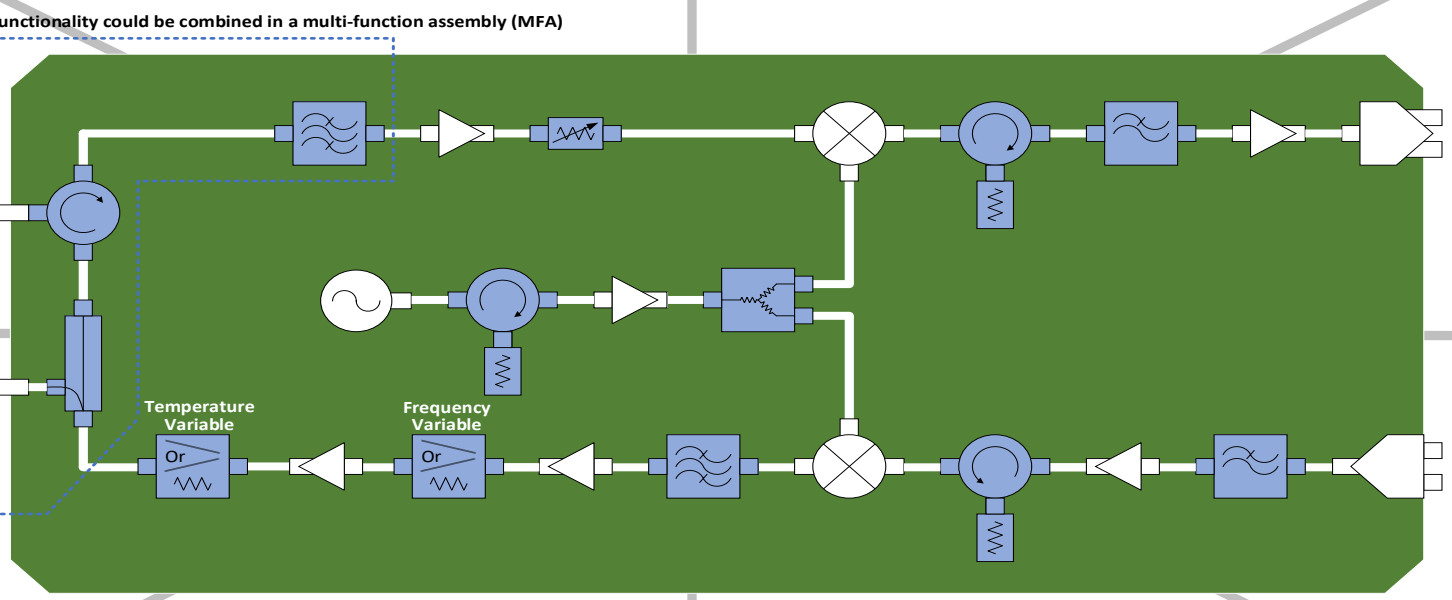


Power Dividers & Equalizers



RF Cable assemblies





Couplers



Resistors



Attenuators & Thermopads®



Terminations



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smiths interconnect

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BEYOND CONNECTIVITY