AXTAL ADVANCED XTAL PRODUCTS

a Q-TECH Company

Next-Gen Crystal Oscillators for advanced New Space Applications

AXTAL & Q-TECH Corporation

High-Reliability Crystal Oscillators

Joint Product Portfolio

Presenter: Henry Halang (MD of AXTAL)

SPCD SPACE PASSIVE COMPONENT DAYS

5TH SPACE PASSIVE COMPONENT DAYS - SPCD 2024

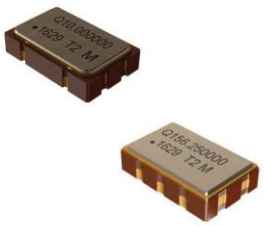
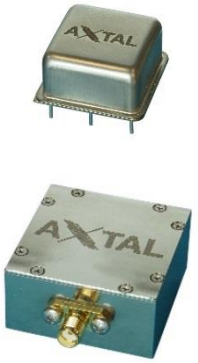
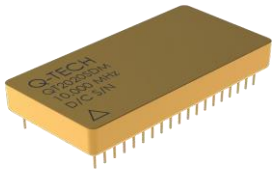
15-18 October 2024 | ESA/ESTEC

Noordwijk, The Netherlands

Our Companies

- **AXTAL GmbH** was founded in 2003 by Bernd & Brigitte Neubig as privately-owned company. Since 2023 AXTAL is an independent German subsidiary of the US-based **Q-Tech Corporation**.
- **AXTAL** manufactures oscillators for Classical space since 2011 including ESA EPPL listed models and started to design & manufacture New Space oscillators about 10 years ago.
- **Q-Tech** was founded in 1972 with the objective of providing state-of-the-art crystal oscillators and frequency control solutions for demanding applications. Q-Tech is also privately owned since its foundation.
- **Q-Tech's** main product focus is on high-reliability crystal oscillators for Military, Aerospace & Space and High Temperature Applications.
- **AXTAL** & **Q-Tech** combined have more than 60 years of experience in the design and manufacturing of oscillators for Space Applications.
- **AXTAL** & **Q-Tech** have built an extensive New Space portfolio over the last years covering all types of crystal oscillators & technologies.

Our New Space Product Portfolio

Clocks (XO)	VCXO	TCXO	OCXO	MCXO
				

Frequency range:	**1.5 MHz ~ 400 MHz** (higher frequencies under development)
Package sizes:	**From small 2.5x3.2 mm ceramic SMD to 38x38 mm with SMA**
Stability:	**From ppm (10^{-6}) down to the sub-ppb (10^{-10}) range**
Phase noise:	**Strong focus on low noise & ultra-low noise designs**
Features:	**Unique MCXO: lowest power consumption with OCXO stability**
Reliability:	**Verified Radiation Hardness – MTBF for 15+ years missions**

Reliability & Missions

- **Radiation (TID):** All our New Space oscillator series have been low dose tested up to at least 50 krad (Si) with excellent results and no detected failures.
- **Radiation (SEE):** Our New Space oscillators are either SEE insensitive by design or have been fully tested showing SEL immunity up to at least 75 MeV·cm²/mg.
- **Acceptance Testing:** MIL-PRF-55310 Level B, B+ and S or customer requirements.
- **Customization:** Many options for customization – component and material selection, test procedures for acceptance testing from screening to qualification.
- **Quartz crystal:** High-Q Quartz, optional Swept Quartz (increased radiation hardness).
- **Missions:** Our New Space oscillators are suitable for various LEO & MEO missions. Special COTS+ designs suitable for GEO missions are available.
- **Heritage:** LEO, MEO and GEO missions including small and Mega Constellations.
- **Data:** Various test, radiation and qualification reports can be provided on request.

Thank you!

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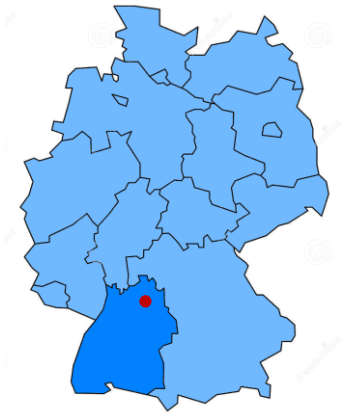

See us @ Conference

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(Managing Director)

Bernd Neubig
(Consultant)

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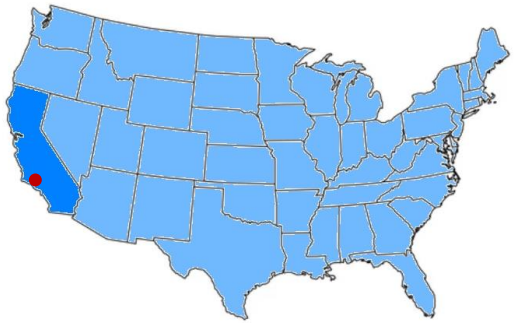

VISHAY
The DNA of tech.™

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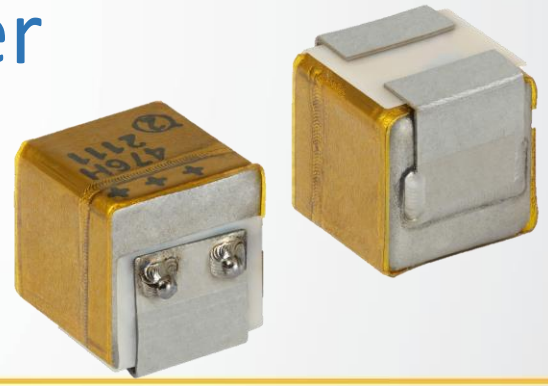
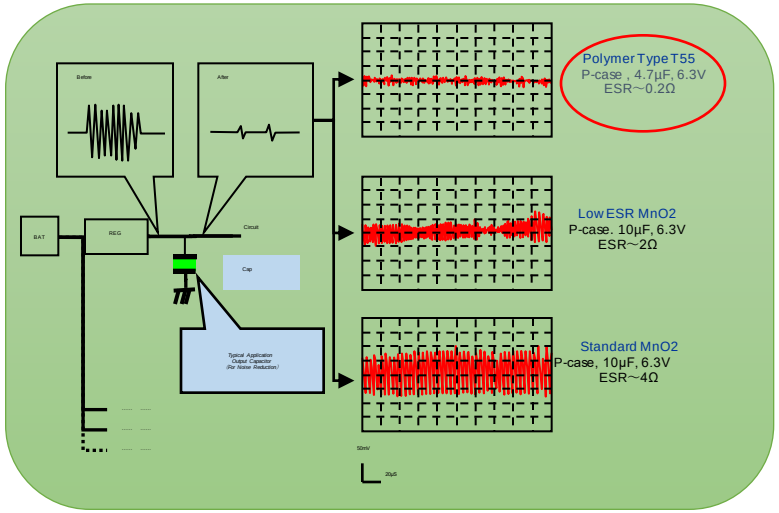
VISHAY
The DNA of tech.™

T27 vPolyTan™ Hermetically Sealed Polymer Surface-Mount Chip Capacitors, Low ESR

Designed to Deliver High Performance and Stability in Challenging Environments over Extended Periods of Time

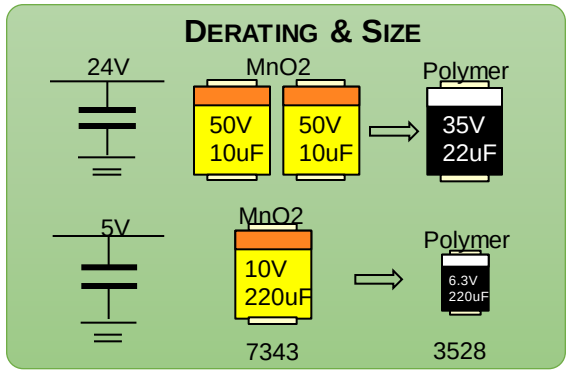


POLYMER ADVANTAGES



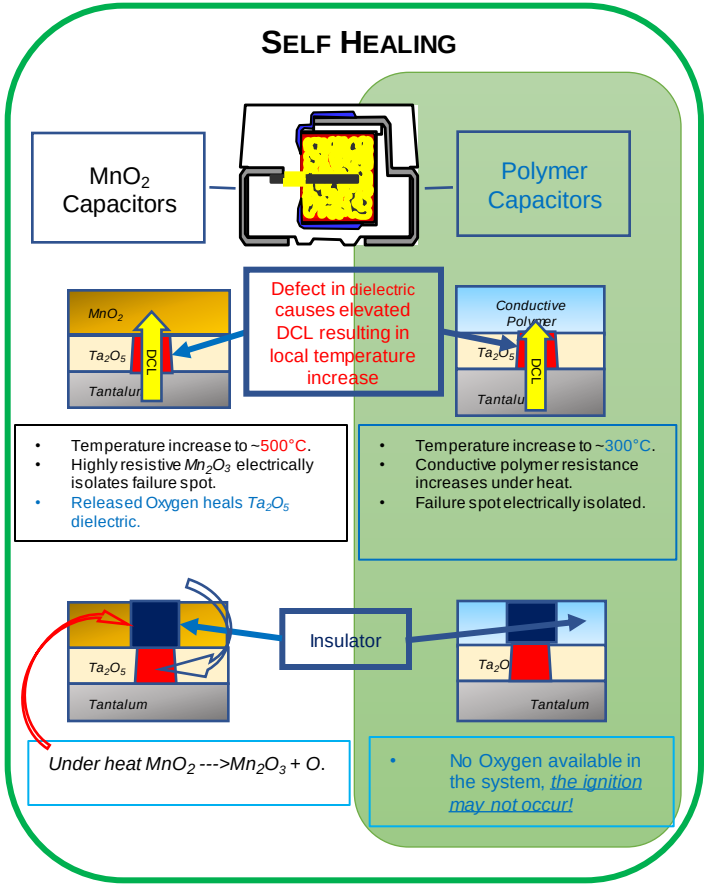
Tantalum Polymer cathode used more and more in power conversion filtering and backup application and ease design work for

- ❑ Power conversion / energy storage (backup) /detonation /quick energy release (fast boot up) and may open the door to new electronic application in Space applications with thanks to
- ❑ lower ESR
- ❑ Safety of defect mode
- ❑ Smaller case size / lower weigth
- ❑ lower derating requirements
- ❑ Higher working voltage (GaN usage)
- ❑ High Energy density



Keeping most of MnO2 advantages

- ❑ Self healing
- ❑ No cap drop with
  - ✓ Time (within recommanded parameters)
  - ✓ DC BIAS
  - ✓ Temperature (< 100°C recommanded)
  - ✓ Mecanical stress / Piezo effect
  - ✓ Radiation



POLYMER LIMITATIONS

Issues and limitations, encountered by designer and manufacturer are

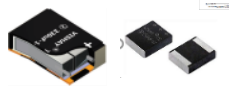
- ❑ Thermo Oxidation of polymer (humidity) leading to cap variations, DCL increase and ESR increase
- ❑ Sensibility to temperature (not above 150°C like MnO2)
- ❑ ACC phenomena
- ❑ cap stability in time
- ❑ higher DCL than MnO2 (issue for power saving, serie association and detonation)

But for space applications, benefits are significant providing some precaution are taken

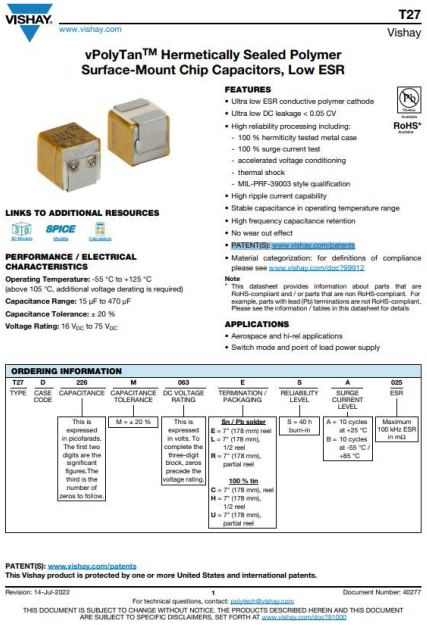
- ❑ AECQ 200 grade or similar proven design (MIL 32700, specific testing)
- ❑ Sufficient extra derating (usually 50% vs 20% recommanded)
- ❑ Controlled Temperature

On a space manufacturing point of view this sensitivity to humidity and high temperature is a constaint during

- ❑ Reflow / soldering process
- ❑ Storage of components => require bake out
- ❑ Storage of board => difficult to control

T52 HI ENERGY LOW PROFILE	T58 ULTRA COMPACT SMALL CASE SIZE	T54 EXTENDED RANGE HI-REL COTS	T51 AECQ-200 AUTOMOTIVE GRADE
			
❑ Operating Temperature: - 55ºC to +105ºC ❑ Capacitance Range: 47µF to 470µF ❑ Capacitance Tolerance: ±10% ± 20% ❑ Voltage Range: 10 VDC to 35 VDC ❑ Case size: ➢ E5 – 7343 - 1.5 (single anode), ➢ M1 – 7360 - 2.0 (double anode) ➢ M9 7360 - 1.9 ➢ B2 – 3528- 1.2	❑ Operating Temp: -55 °C to +105 °C ❑ Capacitance Range: 1 µF to 330 µF ❑ Capacitance Tolerance: ± 20 % ❑ Voltage Rating: 6.3 VDC to 35 VDC ❑ L-shaped face-down termination ❑ 100 % surge current, ❑ Case Size ➢ MM 1608-09 ➢ W9 2012-09 ➢ W0 2012-10 ➢ A0 3216-10	❑ Operating Temp: -55ºC to +125ºC ❑ Cap: 30µF to 2800µF ❑ Tol: ±10% & ± 20% ❑ Voltage: 16 VDC to 75 VDC ❑ EE Case (7.3 x 4.3 x 4.3mm L and EL-Shape termination. ❑ T54 Reliability : ➢ *100 % surge current* ➢ *Accelerated voltage conditioning* ➢ *Thermal shock* ➢ *Statistical DC leakage screening at elevated temperature and voltage,* ❑ Stack version available (2, 3, 4, 6) ❑ DLA 20021 version available	❑ Conductive polymer electrode ❑ Full compliance with AEC–Q200 ❑ -55C to +125C operation temperature ❑ Humidity 85C/85% RH, VR, (1,000 hours) ❑ EIA Case Sizes – B, D & V ❑ Humidity 85C/85% RH VR 1000 hrs ❑ J Lead molded type

T27 Hermetically Sealed Polymer Tantalum


VISHAY
www.vishay.com
T27
Vishay

vPolyTan™ Hermetically Sealed Polymer Surface-Mount Chip Capacitors, Low ESR

FEATURES
- Ultra low ESR conductive polymer cathode
- Ultra low DC leakage < 0.05 CV
- High reliability processing including:
  - 100 % hermiticity tested metal case
  - 100 % surge current test
  - accelerated voltage conditioning
  - thermal shock
  - MIL-PRF-39003 style qualification
- High ripple current capability
- Stable capacitance in operating temperature range
- High frequency capacitance retention
- No wear out effect
- PATENT(S): www.vishay.com/patents
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS*

Note
* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

LINKS TO ADDITIONAL RESOURCES

PERFORMANCE / ELECTRICAL CHARACTERISTICS
Operating Temperature: -55 °C to +125 °C (above 105 °C, additional voltage derating is required)
Capacitance Range: 15 µF to 470 µF
Capacitance Tolerance: ± 20 %
Voltage Rating: 16 V_{DC} to 75 V_{DC}

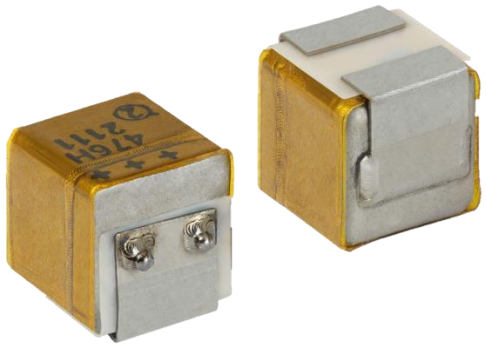
APPLICATIONS
- Aerospace and hi-rel applications
- Switch mode and point of load power supply

ORDERING INFORMATION

T27	D	226	M	063	E	S	A	025
TYPE	CASE CODE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING	TERMINATION / PACKAGING	RELIABILITY LEVEL	SURGE CURRENT LEVEL	ESR
		This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow.	M = ± 20 %	This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating.	Sn / Pb solder: E = 7" (178 mm) reel, L = 7" (178 mm), 1/2 reel, R = 7" (178 mm), partial reel; 100 % tin: C = 7" (178 mm), reel, H = 7" (178 mm), 1/2 reel, U = 7" (178 mm), partial reel	S = 40 h burn-in	A = 10 cycles at +25 °C, B = 10 cycles at -55 °C / +85 °C	Maximum 100 kHz ESR in mΩ

PATENT(S): www.vishay.com/patents
This Vishay product is protected by one or more United States and international patents.

Revision: 14-Jul-2022 — 1 — Document Number: 40277
For technical questions, contact: polytech@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000



For **critical application**, (low DCL, serie or parallel association, detonation, reusable launcher, ESR stability, higher temperature use),

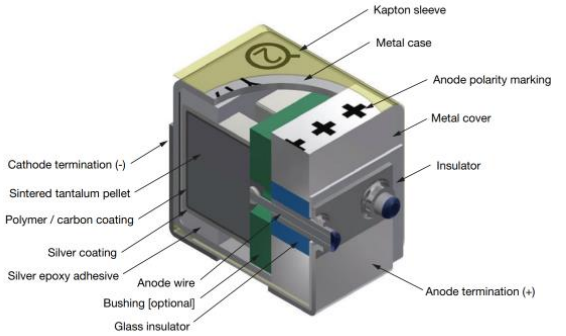
a **better parametric stablility and predictable behaviour** of component may be required during design and longer missions.

By using and applying

- ❑ **100 % hermiticity tested metal case** (Fixed enclosed atmosphere, fixed humidity) based on DLA wet tantalum space qualified)
- ❑ **Advanced anode manufacturing and proprietary process (**delub**,** welded anode, crystal free anode)
- ❑ **appropriate derating**,

all drifts due to Thermo Oxidation and ACC can be kept below acceptable levels

=> **High Performance and Stability in Challenging Environments over Extended Periods of Time**



Reflow conditioning
MIL-PRF-55365 par. 4.7.10

↓

Thermal shock:
-55 °C / +125 °C, 5 cycles
method 107 of MIL-STD-202

↓

Accelerated voltage conditioning
MIL-PRF-55365 par. 4.7.5

↓

Surge current testing, including
+25 °C and -55 °C / +85 °C options
MIL-PRF-55365 par. 4.7.18

MIL-PRF-55365J

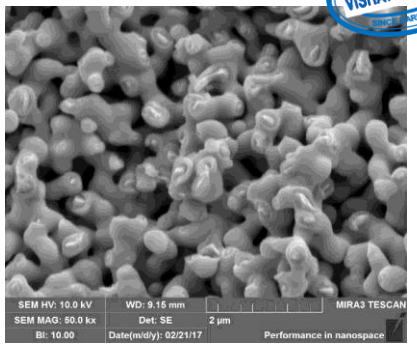
Charge time (ms)	Capacitance value (µF)
1	≤ 330
10	> 330 and ≤ 3300
100	> 3300

MIL-PRF-32700

Maximum Charge time (ms)	Capacitance value (µF)
10	<47
20	≥ 47 and <100
100	≥ 100

↓

Finished individual components
100 % screening: MIL-PRF-55365



PROPRIETARY TECHNOLOGY VISHAY-SPRAGUE SINCE EARLY 90'S

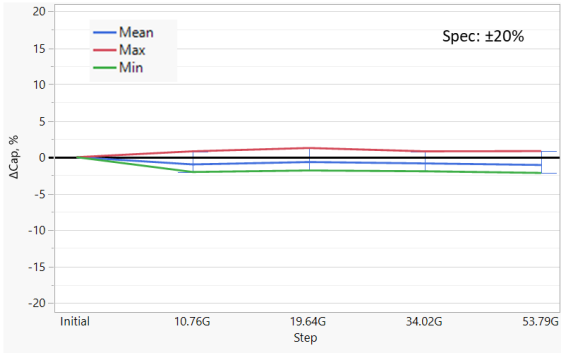
PATENT(S): www.vishay.com/patents

VISHAY
The DNA of tech.™

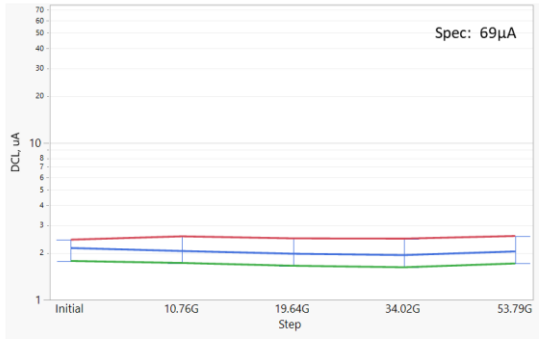
T27 STABILITY & LIFETEST

Mechanical: Stability after Random Vibration

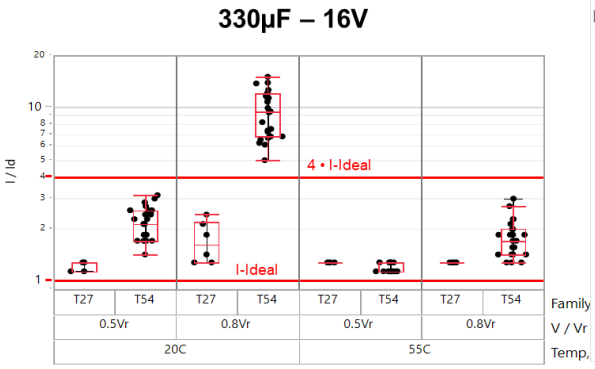
Δ Capacitance %

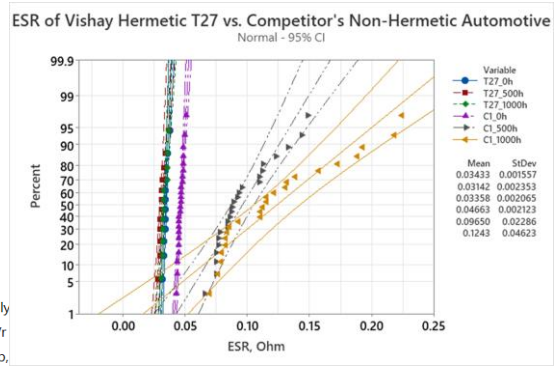


Δ DCL



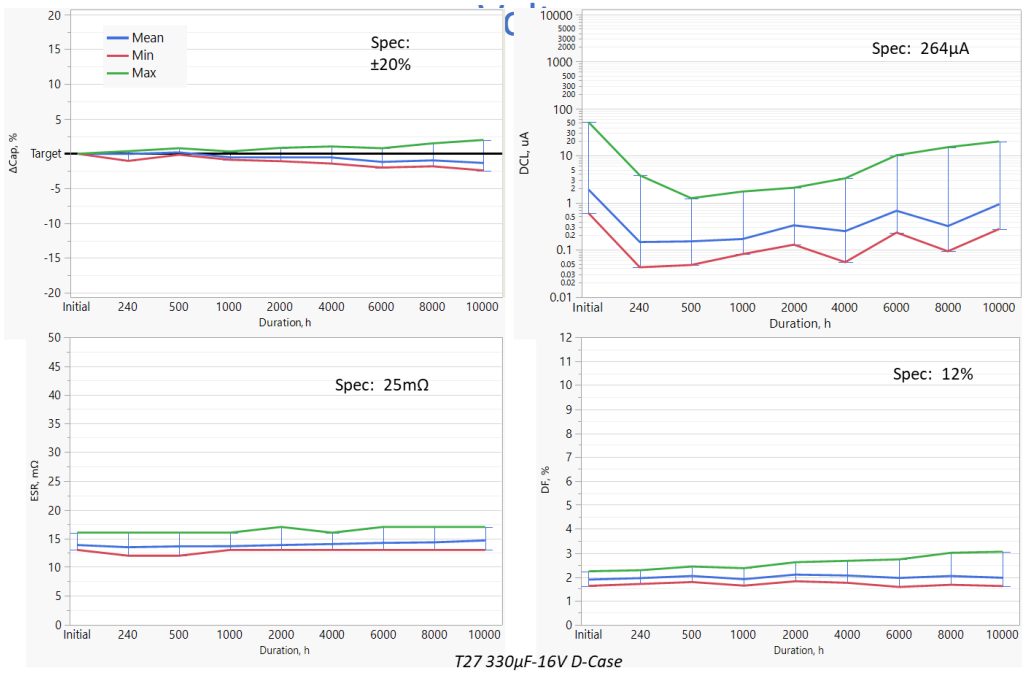
Reduced effects of ACC (stable parameters)





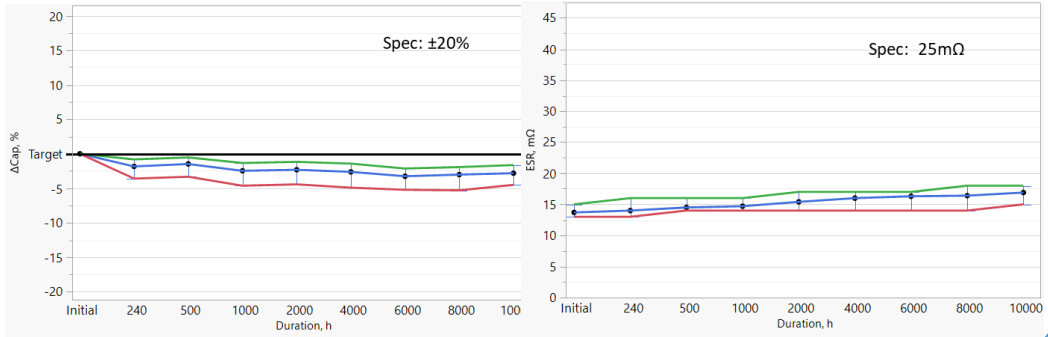
Stable electrical performance over lifetime

- Life Test: 10,000 hours at 85°C and Rated



T27 330µF-16V D-Case

- 10,000 hours at 125°C and 2/3 Rated Voltage



T27 SERIES
HERMETIC POLYMER

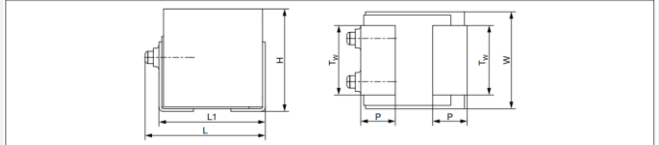
Electrical Characteristics

- *Operating Temperature: -55°C to +125°C*
  - *(above 105°C, additional voltage derating required)*
- *Capacitance Range: 15µF to 470µF*
- *Voltage Range: 16Vdc to 75Vdc*
- *DC Leakage <0.05 CV*

Mechanical

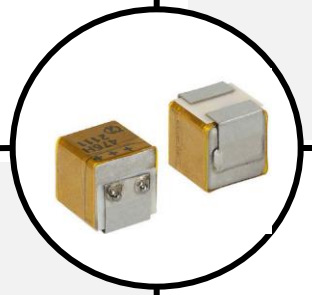
- *Case size:*

DIMENSIONS in inches [millimeters]



CASE CODE	L (MAX.)	L1	W	H	P	T_W
D	0.374 [9.5]	0.303 ± 0.008 [7.7 ± 0.2]	0.275 ± 0.008 [7.0 ± 0.2]	0.291 ± 0.008 [7.4 ± 0.2]	0.098 ± 0.008 [2.5 ± 0.2]	0.197 ± 0.008 [5.0 ± 0.2]

- *Mass: T27 ~ 1.7g (T54 ~ 0.623g)*
- *Mechanical and electrical Design based on enclosure T22 wet tantalum DLA 19001 and Anode on T54 DLA 20021*



Advantages

- *High reliability processing including:*
  - ✓ 100% hermiticity tested metal case
  - ✓ 100% surge current test
  - ✓ Accelerated voltage conditioning
  - ✓ thermal shock
  - ✓ MIL-PRF-39003 style qualification
- *High ripple current capability*
- *Stable capacitance in operating temperature range*
- *No wear out effect*

RATINGS AND CASE CODES (ESR, mΩ)

µF	16 V	25 V	35 V	50 V	63 V	75 V
15					D (100) (1)	D (100) (1)
22				D (100) (1)	D (100) (1)	D (100) (1)
33				D (100) (1)	D (100) (1)	
47			D (70) (1)	D (100)		
150			D (100) (1)			
220		D (55) (1)				
330	D (25)					
470	D (25) (1)					

KYOCERA AVX

ACCELERATING INNOVATION

KAVX Hi Rel CAPACITORS ROADMAP

September 30th, 2024

CERTIFICATIONS

Qualified by European Space Agency (ESA)
ESCC 3012/001 (TAJ ESCC)
ESCC 3012/004 (TES Series)
ESCC 3012/006 (TCS ESCC Series)
ECCC 3009/034 (High Voltage X7R MLCC)
ESCC 3009/041 (BME X7R MLCC)
ESCC 3009 (PME X7R / NP0 MLCC)
ESCC 3001 (X7R Stacks)

Qualified by Defense Logistic Agency (DLA)
MIL-PRF-55365/4 (CWR09)
MIL-PRF-55365/8 (CWR 11)
MIL-PRF-55365/11 (CWR19 and 29)
MIL-PRF-55365/12 (CWR 15 – Ta-Microchips)
DLA 07016 (TBJ)
DLA 95158 (TBJ)
DLA 04051 (TCD - Conductive polymer capacitors)
MIL-PRF-39006 (22/25/30/31/33) Ta-WET capacitors (CLR 93 style)
DLA 13017 (Ta-WET capacitors)
DLA 93026 (Ta-WET capacitors)

Qualified by NASA
G311P838
(MLCC)

HI-REL TA PRODUCT OVERVIEW

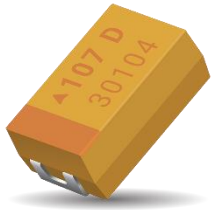
COTS+ Aerospace

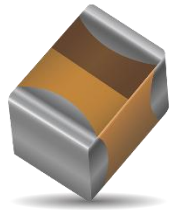
SRC8000 (LEO)
SRC9000
SRW9000 (WET capacitors)

European Standardization Based

ESCC ESA qualified products

3012/001
3012/004 (Low ESR)
3012/006 (Conductive polymer)





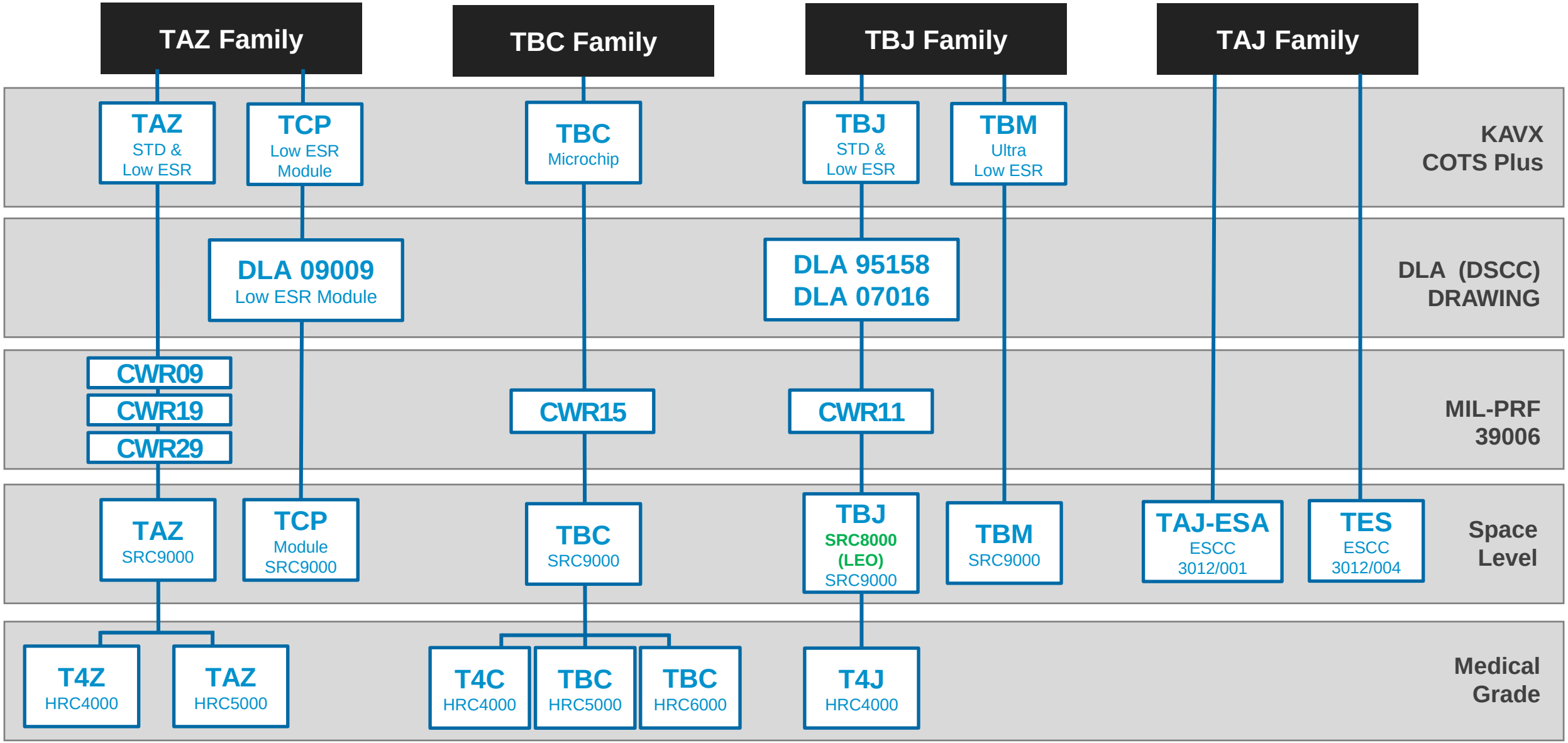
US Standardization Based

MIL group family

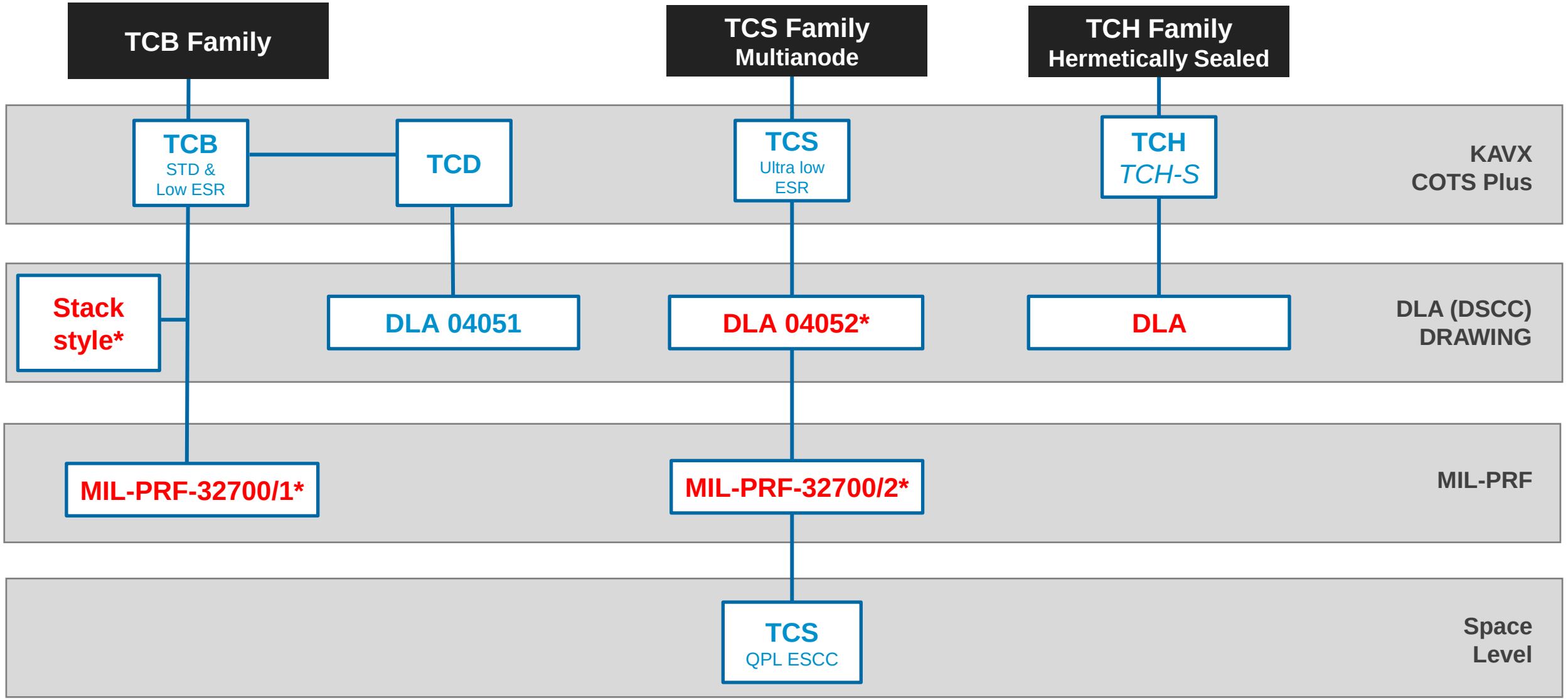
CWR 09
CWR 11
CWR 15 (Microchip)
CWR 19 (Ext. range)
CWR 29 (Low ESR)

DLA 95158
DLA 07016 (Low ESR, ext. range)
DLA 04051 (Conductive polymer)
DLA 93026 (Wet)
DLA 13017 (Wet)

HIGH RELIABILITY SERIES LINE | TANTALUM CAPACITORS

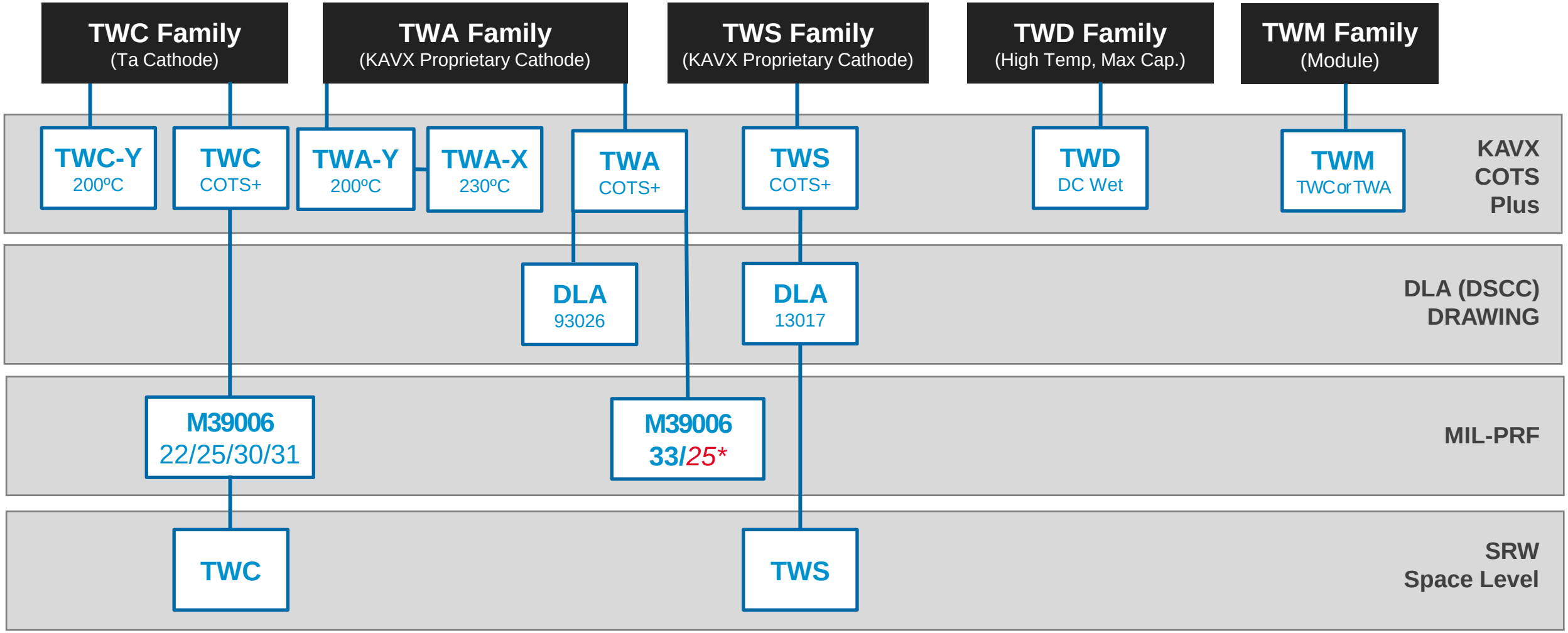


HIGH RELIABILITY SERIES LINE | POLYMER CAPACITORS



* Under qualification

AXIAL LEADED SERIES LINE | WET ELECTROLYTIC CAPACITORS



Wet Tantalum produced in Biddeford for USA (MIL) and Lanskroun, Czech Republic

* Under qualification

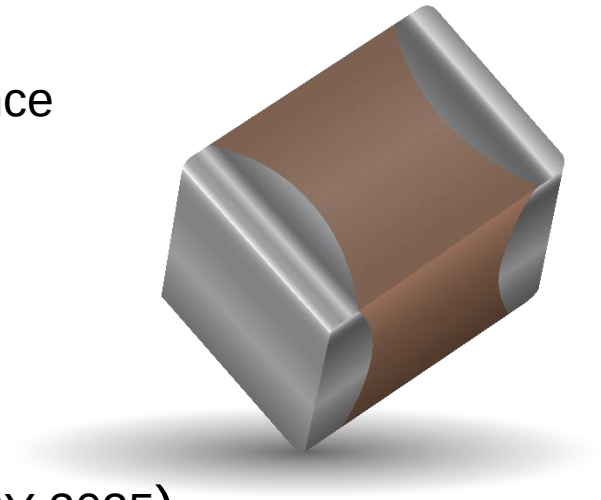
PLANT VISION | LANSKROUN

- HIGH REL PRODUCTS FOR HIGH END MARKET
- R&D FOCUS ON POLYMERS
- CV EXPANSION ON LEO APLICATIONS
- DEVELOPING NEW BUSINESS OPPORTUNITIES

KAVX Space/Mil Ceramic Road Map

Space/Mil X7R extension plan

- Lower voltages, 10 volts , smaller case sizes higher capacitance
- Large cases (1812 and 2220) , 50 to 100 volts.

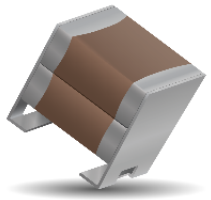


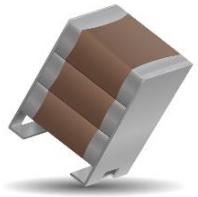
QPL M32535 NP0 range development

- Phase I: approved (Nov 2022)
- Phase II: expansion to 1206 - 1210 (Q4 CY 2024)
- Phase III: aimed at higher CV within 0402 - 0805 values (Q4 CY 2025)

QPL Mil stack Mini BME range

- Using core technology and knowledge from mil /space production line
- 2220 inserts in a 2 or 3 horizontal chip stack as a first step.
- Followed by 2220 inserts used in vertical stacks , min 3 to max 10 chip inserts.





Space Level MBH20... Series			
Voltage			
Cap u F M Tol	10/16/25	50	100
10			X2
12			X2
15			X3
18		X2	X3
22		X2	
27	X2	X3	
33	X2	X3	
47	X2	X3	
56	X3		
68	X3		
100			
120			
150			
180			
220			

KAVX High Rel Product Guide

CERAMIC CAPACITORS

SURFACE MOUNT CERAMIC CAPACITORS

NASA

- QPL BME technology available
- High CV technology enabling case size downsizing, PCB weight and size reduction
- FLEXITERM® for enhanced mechanical stress resistance available for BME
- SnPb termination for BME

Oper. Temp: -55°C to +125°C **Case:** 0603 - 2220 **Voltage:** 16V - 100V **Capacitance:** 2.2 nF - 8.2µF	NASA S-311-P-838

ESA ESCC QPL

- QPL BME and PME technologies available
- Low ESR / ESL compared to other technologies
- FLEXITERM® for enhanced mechanical stress resistance available for BME
- PdPtAg or SnPb terminations for PME, SnPb termination for BME

Oper. Temp: -55°C to +125°C **Case:** 0402 – 2220 **Voltage:** 16V – 3KV **Capacitance:** 2.2nF – 22µF	ESCC 3009 • ESA 3009034 ESCC 3009041

MIL PRF 32535

- M and T reliability levels available
- Higher CV capability for PCB weight/size reduction
- Flexiterm® technology for greater protection
- Max cap value 22µF
- Termination with Sn/Pb

Oper. Temp: -55°C to +150°C **Case:** 0402 – 2225 **Voltage:** 16V – 100V **Capacitance:** 2.2nF – 22µF	MIL PRF 32535

CECC

- PME technology available
- NP0 and X7R technologies available
- Terminations; Hybrid, Ni/SnPb, Ni/Sn
- Burn in options available from 0/48/96/168 hours
- Capacitance Tolerance from 1% to 20% available

Oper. Temp: -55°C to +125°C **Case:** 0805 – 2220 **Voltage:** 25V – 500V **Capacitance:** 4.7pF – 1.5µF	CECC 32101 • CECC 32100

MIL / DSCC / DLA / COTS-PLUS

- MIL/DSCC dielectrics BP, BG and where wider variation can be accepted, BX, BR
- APS COTS Plus dielectrics NP0, X7R, X8R/L
- Low ESR / ESL compared to other technologies
- Au, PdAg, Tin Lead or Pure Tin terminations available
- APS COTS Plus X7R available with Flexiterm®

Oper. Temp: -55°C to +150°C **Case:** 0402 – 2225 **Voltage:** 10V – 500V **Capacitance:** 0.1pF – 22uF	MIL PRF 123 • MIL PRF 55681 (CDR) APS COTS+ • DSCC 03029 (0402) DSCC 03028 (0603) • DSCC 05006 (0805) DSCC 05007 (1206)

HIGH TEMPERATURE AT RANGE

- Max Temperature Range 250°C
- Terminations Pd/Ag, SN, Ni/Au
- Dielectrics: VHT (Class II) and C0G/NP0 (Class I)
- Uses PME and BME technologies for maximum capacitance ranges

Oper. Temp: -55°C to +250°C **Case:** 0603 – 2225 **Voltage:** 10V – 50V **Capacitance:** 2.2nF – 1µF	MIL STD 202

LEADED CERAMIC CAPACITORS

MIL / DSCC / DLA / BS9100

- Excellent reliability and low ESR / ESL compared to other capacitor technologies
- Radial & Axial epoxy encapsulated for harsh environment
- High voltage range 1-5kV also available

Oper. Temp: -55°C to +125°C **Case:** Radial, Axial **Voltage:** 50V – 5000V **Capacitance:** 1pF – 2µF	MIL PRF 20 • MIL PRF 123 • MIL PRF 11015 MIL PRF 39014 • DSCC 87045 • DSCC 87114 DSCC 87081 • DSCC 87043 • DSCC 87047 DSCC 87040 • DSCC 87076 • DSCC 87077 DSCC 89044 • DSCC 87070 • BS9100

ESA ESCC / CECC

- QPL PME technologies available
- Excellent reliability and low ESR / ESL compared to other capacitor technologies
- High voltage range 1-5kV also available
- A range of lead types: Leaded Radial (Epoxy coated, Polyurethane Varnish), Straight Dual In Line, L Dual In Line

Oper. Temp: -55°C to +125°C **Case:** Radial **Voltage:** 50V – 5000V **Capacitance:** 820pF – 180µF	ESCC 3001030 • ESCC 3001034 CECC 30701

CERAMIC CAPACITORS

RF SURFACE MOUNT CERAMIC CAPACITOR

MIL / DSCC / DLA / COTS-PLUS

- High Q ultra low ESR
- High current handling
- High self resonance
- BG and BP dielectrics
- Tight tolerances from ±0.01pF
- Au, PdAg, Tin Lead or Pure Tin terminations

Oper. Temp: -55°C to +125°C **Case:** 01005 – 1210 **Voltage:** 50V – 500V **Capacitance:** 0.1pF – 5100pF	MIL PRF 55681 (CDR) MIL PRF 123 • DSCC 06019 (0605) DSCC 06022 (1210)

SWITCH MODE POWER SUPPLY CAPACITORS (SMPS)

MIL / DSCC / BS9100

- Designed for programs requiring high reliability performance in harsh environment
- Suitable for high current, high power & high temperature applications
- Low ESR / ESL & excellent high frequency performance compared to other technologies

Oper. Temp: -55°C to +200°C **Case:** Stacked **Voltage:** 50V – 500V **Capacitance:** 0.15µF – 270µF	MIL-PRF-49470 • BS9100 DSCC 87106/88011

ESA ESCC / CECC

- Designed for space based programs requiring ultra-high reliability performance
- Designed for high current, high power applications
- Low ESR / ESL and excellent high frequency performance
- A range of lead types: Leaded Radial (Epoxy coated, Polyurethane Varnish), Straight Dual In Line, L Dual In Line

Oper. Temp: -55°C to +125°C **Case:** Stacked, Radial **Voltage:** 50V – 5000V **Capacitance:** 620pF – 180µF	ESCC 3001030 • ESCC 3001034 CECC 30701 ESCC 3012 (In preparation)

TANTALUM & POLYMER CAPACITORS

SURFACE MOUNT TANTALUM & POLYMER

MIL / DSCC/ DLA / SRC / COTS-PLUS

- TAZ (CWR), TBJ, TBM, TCS, TCP Series
- Available with MnO_2 or polymer cathode in SMD chip case size
- Polymer offers low ESR & higher inrush current robustness
- MnO_2 chips & multianodes offer excellent reliability & are qualified to the highest MIL/Space reliability levels

Oper. Temp: -55°C to +105/125°C **Case:** SMD **Voltage:** 2V – 50V **Capacitance:** 0.1µF – 1500µF	MIL-PRF-55365 (CWR) MIL PRF 55365 (T Level) • SRC9000 DSCC 07016 • DSCC 95158 DSCC 09009 • COTS-Plus

ESA ESCC / CECC

- TES, TAJ, TAJ ESCC
- Long term stability, high capacitance in small case sizes
- Manufactured in EU, ESA qualified plant
- TCS – polymer multianode – ongoing ESA qualification

Oper. Temp: -55°C to +125°C **Case:** 3216 – 7343 **Voltage:** 4V – 50V **Capacitance:** 0.1µF – 470µF	ESCC 3012/004 • ESCC 3012/001 CECC 30801-01 • CECC 30801-005

MIL / SRC / COTS-PLUS

- TBC (CWR) microchip
- Available in standard MnO_2 SMD chip with case sizes down to 0603
- MnO_2 chips offer excellent reliability and parameters stability over temperature, voltage, and time
- Qualified to the highest MIL/Space reliability levels

Oper. Temp: -55°C to +125°C **Case:** 0603, 0805, 1206 **Voltage:** 4V - 20V **Capacitance:** 0.47µF - 68µF	COTS-Plus • SRC9000 MIL-PRF-55365/12 (CRW)

ESA EPPL2 (under preparation)

- TCH Low ESR Hermetic Series
- Designed for Aerospace & HI-Rel applications
- Endurance minimum up to 10,000 hrs. on selected codes
- Excellent stability under humidity and ambient conditions due to ceramic case hermetic packaging
- Effective up-screen testing for high reliability

Oper. Temp: -55°C to +125°C **Case:** (CTC-21D) **Voltage:** 10V – 100V **Capacitance:** 22µF – 330µF	ESCC 3012 (In preparation)

TANTALUM & POLYMER CAPACITORS

WET ELECTROLYTIC TANTALUM

SRW / MIL / DSCC / DLA / COTS-PLUS

- TWA, TWA-X, TWA-Y, TWC, TWC-Y, TWM, TWD, TWS
- Includes a welded tantalum can & header assembly that provides a hermetic seal to withstand harsh shock & vibration requirements
- Customized capacitance & voltage ratings are possible
- TWC-Y and TWA-Y capable of continuous operation at 200°C, TWA-X 230°C

Oper. Temp: -55°C to +200/230°C **Case:** T1,T2,T3,T4, TWM module **Voltage:** 6V – 125V **Capacitance:** 2.5µF – 50mF	DSCC 93026 • SRW9000 MIL-PRF-39006 • COTS-Plus

LEADED TANTALUM

CECC

- Tantalum Capacitors with dipped resin encapsulation with SnPb terminations
- Optional radial lead wire terminations
- Low leakage current
- Very small physical sizes
- Excellent temperature stability

Oper. Temp: -55°C to +125°C **Case:** Radial **Voltage:** 6.3V – 50V **Capacitance:** 0.1µF – 330µF	CECC 30201-032

THIN FILM PRODUCTS

RF THIN FILM CAPACITORS

DLA

- Ultra tight capacitance tolerances
- Low ESR at VHF, UHF and microwave frequencies
- Enhanced RF power handling capability
- High stability with respect to time, temperature, frequency and voltage variation

Oper. Temp: -55°C to +125°C **Case:** 0402 – 1210 **Capacitance:** 0.05 pF – 68 pF **Tolerances:** from ±0.01 pF	DLA 09024 (0402) DLA 09025 (0603) DLA 09026 (0805) DLA 09027 (1210)

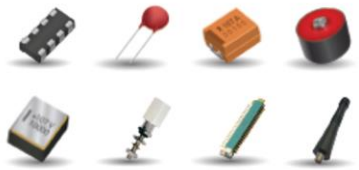
RF THIN FILM INDUCTORS

DLA

- High Q
- RF Power Capability
- High SRF
- Low DC Resistance
- Ultra-Tight Tolerance

Oper. Temp: -55°C to +125°C **Case:** 0402 – 0805 **Inductance:** 0.56nH – 22nH **Tolerances:** from ±0.05nH	DLA 11017 (0402) DLA 11018 (0603) DLA 11019 (0805)

ESTABLISHED RELIABILITY PRODUCTS



Tantalum Capacitors
- THH 230°C Hermetically Sealed
- Niobium Oxide

Antennas
- Omni-direction Transceiver Antennas

Multilayer Varistors
- DSCC AA555682 (Industrial Grade)

NTC Thermistors
- SMT and Leaded

MIL C 55074 Hermaphrocon Style
- MIL-C-55074 Compliant

Film Capacitors
- High Power
- Medium Power
- DC Film

M55032 DIN
- M55302 Compliant

Varicon • Rack and Panel
- MIL-E-5400, MIL-E-8189, MIL-T-21200, MIL-C-21097, MIL-C-28731, MIL-C-55302 Compliant

Click to follow link → [High Reliability, Defense, & Space Application Guide (kyocera-avx.com)]

THANK YOU.

KYOCERA-AVX.com

smiths interconnect

SPCD
SPACE PASSIVE COMPONENT DAYS

SPCD, ESA - ESTEC Noordwijk, 15-18th October 2024

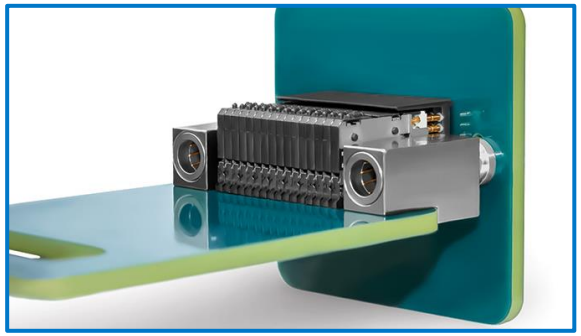
New SPL Series of fixed attenuator and Thermopad® products for New Space Applications

Dave Raymond – Product Line Manager BLC's
Julien PICARD – Sales Manager EMEA

CUTTING-EDGE
CONNECTIVITY

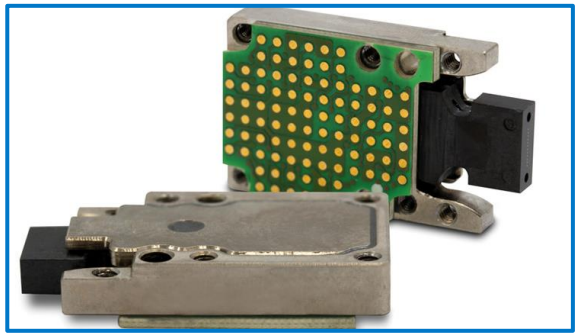
Smiths Interconnect Business Unit Structure

A Business Unit structure focused on offering cutting-edge solutions to address customers' needs across many markets



Connectors

High-reliability electrical interconnect solutions from highly integrated assemblies to microminiature connectors and spring probe contacts

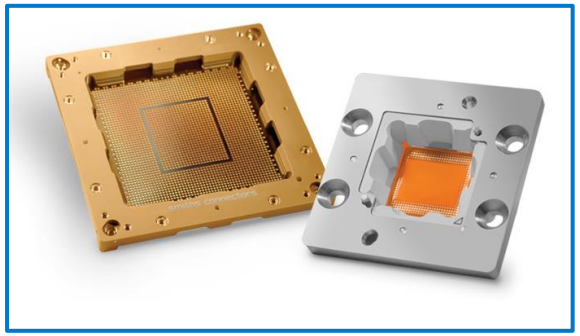


Fibre Optics and RF Components

Broad range of RF and MW devices, transceivers and transceivers modules for demanding high reliability environments

RF/MW Subsystems Smiths Interconnect Inc.

Antenna systems, multi-function RF systems, as well as SATCOM antenna solutions for Aerospace and Defence subsystem applications



Semiconductor Test

Test socket and probe card solutions with spring probe contact technology for semiconductor test applications

Fibre Optics and RF Components | Quick Facts and Technology Portfolio

- Broad range of RF and MW devices, transceivers and transmitter/receiver modules in a variety of packages and footprints for demanding high reliability environments
- Targeting Aerospace, Space, Defence and Communication market segments

6 Customer Service Centres

4 Manufacturing Sites

4 R&D Locations

Americas

Alajuela, **Costa Rica**
Salisbury **MD, US**
Stuart **FL, US**
Kirkland **QC, Canada**

Asia

Bangalore, **India**
Shanghai, **China**

Europe

Dundee, **UK**

Board Level Components

- RF devices used to attenuate, level or terminate signals
- Extensive portfolio of commercial and application-specific components in a variety of packages and footprints

RF Cable Assemblies

- High performance microwave cable assemblies and coaxial components
- Application specific premium interconnects for durability and harsh environments

Ferrites/Waveguides

- Ferrite devices and waveguide products for space applications
- Product range includes isolators circulators, combiners, terminations, iso-adapters, integrated assemblies

Fibre Optics

- Rugged 10G and 25G optical transceivers qualified for harsh environments
- Mount mid-board, MPO on front panel, or as a SOSA-aligned backplane connector

RF Filters

- RF/Microwave conditioning products with high selectivity using multiple topologies.
- Broad range of applications from 600 kHz to 65 GHz

Fibre Optics and RF Components - Space Heritage

Space Heritage

Smiths Interconnect has been supplying RF Passive Components, Cables and Optical Transceivers for space flight missions for over 40 years. We have participated in over 150 military, commercial and scientific satellite programs such as the Mars Exploration Rover.

40+

Years Experience

Board level Components

- High Reliability Fixed Attenuators
- Thermopad® High Reliability Temperature Variable Attenuators
- High Power Chip Attenuators
- Coaxial Terminations
- Stripline Flange Terminations
- Stripline Pill terminations
- High Power Flange Terminations
- High Power Chip Resistors

RF Filters

- L-Band Low Pass Filters
- S-Band Ceramic Filters
- K-Band Waveguide Filters
- Ka-Band Waveguide Filters

Cable Assemblies

- Semi-Rigid Cable Assemblies
- SpaceNXT™ Q Cable Assemblies
- SpaceNXT™ QT Cable Assemblies

Ferrites & Waveguides

- W112 Waveguides
- Waveguide Couplers and Splitters
- MW Isolators and Circulators
- SpaceNXT™ MWC and KU Series

Optical Transceivers

SpaceABLE® family includes:

- 4+4 Transceivers
- 12-channel Transmitters & Receivers
- Engineering & Flight Model versions
- LAT services

SPL Series Attenuators and Thermopads®

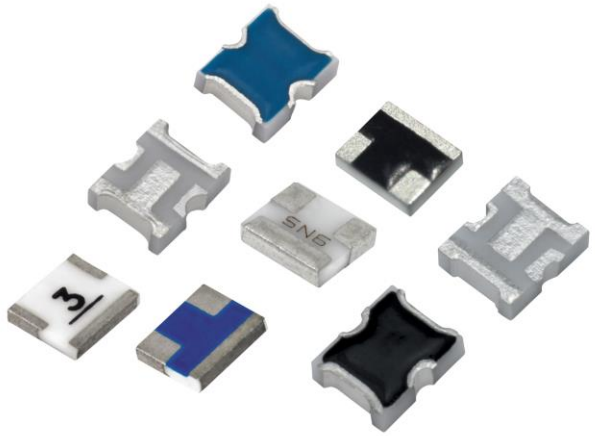
for New Space Applications

SPL - Series of Fixed Attenuators and Thermopads®| High Volume New Space Applications

The new SPL Series of attenuator and Thermopad® products is tested to meet the space orbit environmental criteria and is offered in a high-volume solution that leverages the Smiths Interconnect's space heritage to improve reliability and performance over a QPL or COTS product. This series is supplied with all the necessary test and qualification data to ensure flight compliance at a low cost of ownership.

- **Smiths Interconnect's SPL Series of attenuator and Thermopad® products use a proven product to provide increase reliability at a lower cost point over conventional high reliability tested product in a surface mount solutions.**
- **This product series are 100% electrical, mechanical and visually inspected back up by annual lot qualification. This ensures a quality tested product that reduces both cost of ownership and lead time.**
- **The SPL series is back by decades of space heritage from our HR series products tested to MIL-PRF-55342. It offers the same base product with and alternative to longer lead time products and is ideal where reliability is needed in high volume price sensitive programs.**
- **This product series is offered in surface mount configurations with edge metallization for ease of inspection after installation. This adds to the reliability of the product in the assembly.**

SPL -Series



- **Surface mount edge wrap**
- **Thick and Thin film construction**
- **Multiple dB values and TCA shifts available**
- **Cost effective**

SPL - Series of Fixed Attenuators and Thermopads® | Value Proposition

Which are the unmet needs that our product solves?

100% testing

- This product series are 100% electrical, mechanical and visually inspected to guarantee product compliance. The data is shipped with each product order.

Annual Qualification

- Annual qualification is performed on the series to validate product reliability and performance with group A, B and C testing to MIL-PRF-55342. This test data is supplied with each product offered.

Cost Effective

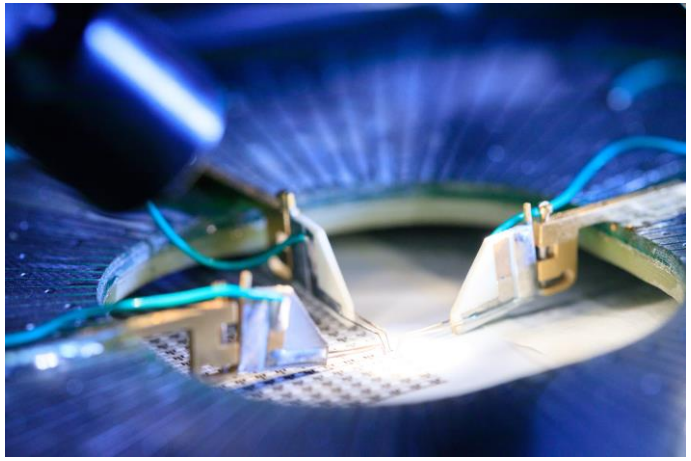
- The Series offers a single unit price with no additional associated test charges. Making this an affordable solution where reliability is necessary for cost sensitive programs.

Robust Process Technology

- Use of robust proven thick and thin film process technology provides products suitable for harsh environments such as space and defense applications.

SMT Mounting

- This product is offer in SMT mount with edge metallization to make inspection after installation possible. This is also offer in tape and reel packaging for automated pick and place.

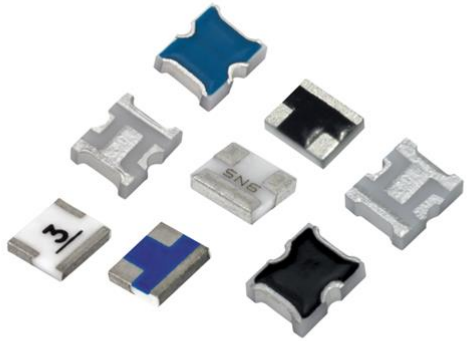


SPL Series Thermopads and Attenuators | Specifications

Fixed Attenuator Products

Standard Product Series	SPL (Smiths Product List) Series		Frequency Range (GHz)	Input Power CW (Watts)	Component Size (Inches)	Component Size (mm)
TS03	SPL-TS03		DC-12.4	2.00	0.145 X 0.122	3.68 X 3.10
TS05	SPL-TS05		DC-18	0.75 TO 5 WATTS*	0.075 X 0.060	1.90 X 1.52
TS09	SPL-TS09		DC-20	0.20	0.060 X 0.075	1.52 X 1.90

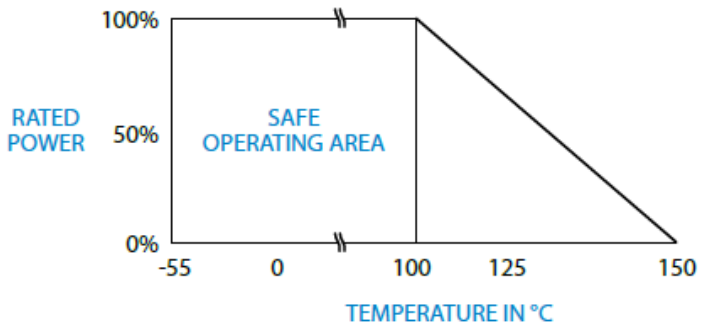
* POWER DEPENDS ON dB VALUE CHOSEN



Thermopad® Products

Standard Product Series	SPL (Smiths Product List) Series		Frequency Range (GHz)	Input Power CW (Watts)	Component Size (Inches)	Component Size (mm)
TVA	SPL-TVA		DC-6	2.00	0.145 X 0.122	3.68 X 3.10
MTVA	SPL-MTVA		DC-18	0.20	0.075 X 0.060	1.90 X 1.52
WTVA	SPL-WTVA		DC-20	0.20	0.060 X 0.075	1.52 X 1.90

Environmental Specifications	
Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to 150°C
Temperature Coefficient	±200 PPM/°C Max
Moisture Sensitivity Level	MSL-1 Unlimited

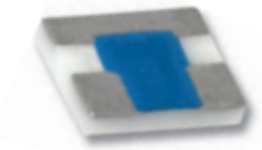


SPL Series Attenuators and Thermopads

Test Parameters per Test Plan TP-8965

Test	Sample Qty	Test Standard and Method	Test Condition
Pre-Cap Visual and Mechanical	100%	MIL-PRF-55342	30X to 60X Magnification
100% Inspection			
Visual / Mechanical	100%	MIL-PRF-55342	30X to 60X Magnification
Electrical (RF) Inspection	100%	MIL-PRF-55342	VSWR @1.0 GHz and Attenuation @ DC & 1.0 GHz – Limits per datasheet and dB Value
Subgroup 1 [TVA product only]	3		
Temperature Coefficient of Attenuation TCA (If Temp Variable Product)	3	Per Smiths Interconnect TP-8965	-55°C to +125°C – ±0.001 dB/dB/°C allowable

NOTE: Grp A, B, & C similarity test data provided with each lot / date code per Smiths work instruction 824W199.



Larger High Frequency Product Portfolio

SPCD
SPACE PASSIVE COMPONENT DAYS

SPL serie Testing structure can be applied to all our board level products, feel free to contact us!

Dave Raymond
Global Product Manager Board Level Devices

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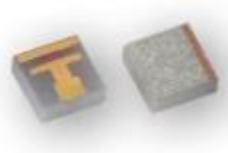
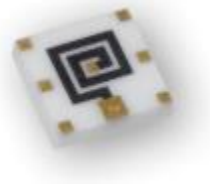
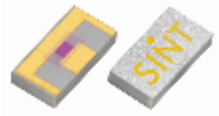


Wirebondable Terminations
(CT Series, DC-64 GHz, 0.040"x0.040")

SMT Outrigger Resistors
(CHX Series, DC-27 GHz, as small as 0402)

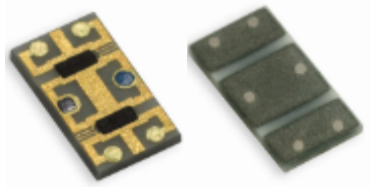


SMT Spiral Terminations
(DC-40 GHz, 0.055"x0.055")

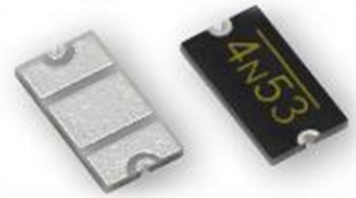


SMT RF Terminations
(CTH Series, DC-67 GHz, 0.060"x0.030")

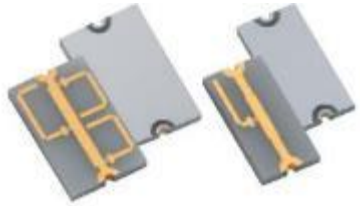
SMT Planar Filters
(DC-40 GHz, 0.200'x0.100")



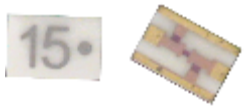
Wirebondable Temperature Variable Attenuators
(K2TVA Series, DC-32 GHz, 0.120"x0.065")



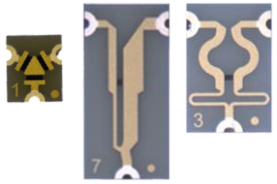
SMT Temperature Variable Attenuators
(K2TVA Series, DC-32 GHz, 0.120"x0.065")



SMT Frequency Equalizers
(CEX Series, DC-40 GHz, 0.120"x0.065")



SMT Fixed Attenuators
(TSX Series, DC-40 GHz, 0.060"x0.040")



SMT Resistive and Wilkinson Dividers
(DC-40 GHz, as small as 0.060"x0.050")

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