



EPCI INTRODUCTION

Tomas Zednicek Ph.D.
president



EPCI | Bringing European Passive Professionals Together



EPCI European Passive Components Institute

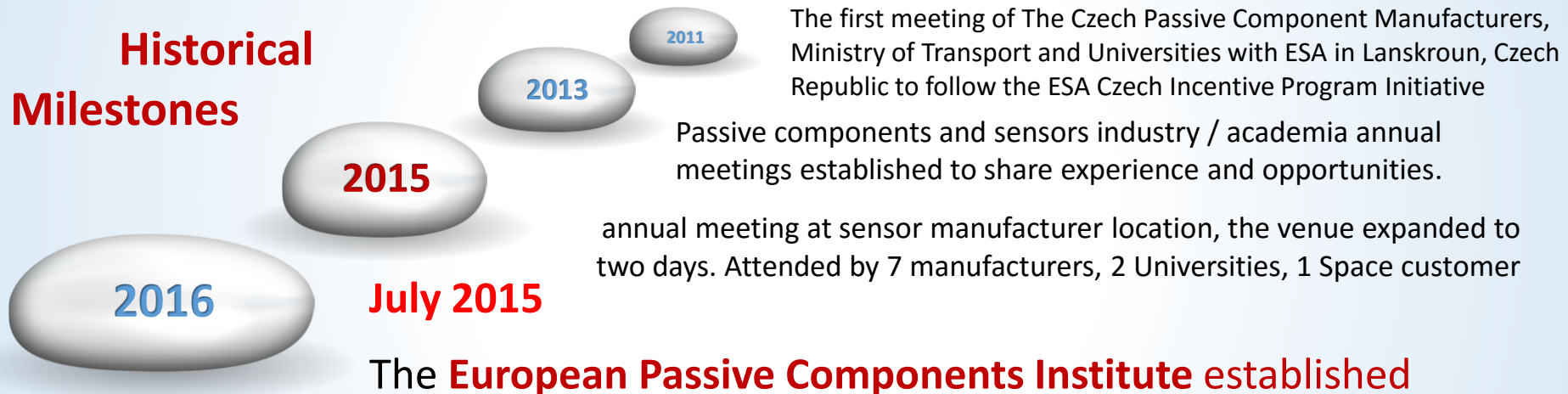


www.passive-components.eu

EPCI | Bringing European Passive Professionals Together

The EPCI Institute will become a premium resource of European passive components industry knowledge, prosperity, awareness and prestige growth.

Historical Milestones



2016

- Web site Up & Running
- Wide Industry Awareness
- Agencies, Government Organisation Links Established
- Elektra Industry Award Finalist, representative of 3 companies at ESA
- ESA Capacitor Lecturing, SPCD Programme Committee, Key Note Presentation



EPCI European Passive Components Institute



European Passive Components Institute

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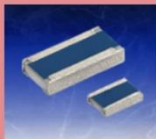
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HOME ABOUT European Passive Industry Database NEWS e-PassiveBook e-Symposium DOWNLOADS MUSEUM COMMUNITIES

IN THE NEWS



30A Supply Monitor with Integrated 300 microOhm Sense Resistor



Vishay Thin Film Chip Resistors Features 1 W Power Rating in Compact 0612 Case Size



EPCI Makes the Shortlist for Elektra 2016 Awards

EVENTS CALENDAR

- 12/10/2016 - 14/10/2016: [Space Passive Component Days](#)
- 08/11/2016 - 11/11/2016: [electronica Munich](#)

INDUSTRY DATABASE

NEWS / DOSSIERS

EVENTS

ePassiveBook®

INTERVIEWS

COMPANY FLASH

EPCI e-PassiveBook



e-PassiveBook is a live Passive Components Handbook with details on components construction, characteristics, reliability etc dedicated to engineers as well as graduate students and wide public.

INTERVIEW OF THE MONTH



EPCI Interview with KEMET CTO Philip Lessner on Passive Component Trends

COMPANY FLASH NEWS

Find Out Company's Hot

- Key Technical Advantage
- Hot / Best Product

click on the company's LOGO to learn more



ANNOUNCEMENTS

- [EPCI Makes the Shortlist for Elektra 2016 Awards](#)
source: EPCI, Electronics Weekly The European Passive Components Institute has been sel...
- [EPCI Introduce "Interview of the month" to its website](#)
source: EPCI European Passive Components Institute has introduced its first interview of the Mont...
- [ESA Space Passive Component Days Programme Issued & Registration Opened](#)
source: EPCI, ESA The European Space Agency (ESA) is glad to publish preliminary program and invite...

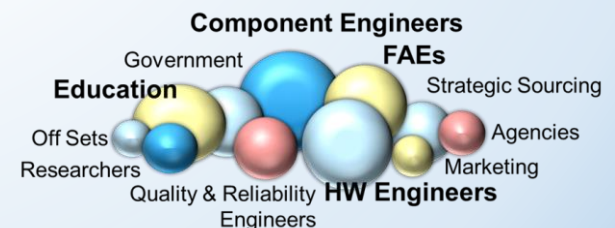


SPONSORS

BD SENSORS®
pressure measurement



Target Group Benefits
(end customers, manufacturers, students)





Support Tools

European Passive Industry Database



database of European passive components manufacturers, distributors, testhouses and universities with passive component continuous research projects

e-PassiveBook



on-line passive components handbook based on famous P-O.Fagerholt's CLR handbook

e-Symposium

Searchable database of passive component technical papers. The papers can be packed in a simple software into a symposium like chapters



Others

- collection of daily worldwide passive components news
- passive components dossier (Q3CY16)
- interviews, Q&A, museum, stories
- hot company news, event calendar
- passive components consultancy services
- job offer announcement etc.

25.4.
2016

Community
Conference

EPCI European Passive Components Institute



MANUFACTURERS

Industry Database - Example

Company Name	Group Company	Size	Registration	Products	Application	Location	Manufacturing sites
AB Elektronik	TT Electronics	Global		motion sensors, potentiometers, pressure sensors, temperature sensors, trimming resistors	automotive, industrial		
ACP		Global		potentiometers, trimming resistors	automotive, consumer, industrial		
Alpha3		SME		EMC, filters, inductors, transformers	industrial, telecom		
				inductors, potentiometers, sensors	automotive, consumer, industrial, medical, telecom		
				motion sensors, potentiometers	industrial		
				humidity sensors, pressure sensors, sensors	aerospace, automotive, industrial, medical		
				filters, power capacitors	defence, industrial, medical		

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MANUFACTURERS

BD SENSORS s.r.o.

BD SENSORS®

Group company:
Former name:
Size: SME
Daughter company:
Application: aerospace, industrial
Web site: <http://www.bdsensors.eu>
Location:

Certification: ISO 9001 quality

Description:
BD SENSORS is a mid-sized, owner-managed company, which attaches great importance to independence and sustainability. Founded in 1994 / 1995 by Mr. Denndorfer, Mr. Marecek, and Mr. Simonik with only five employees, BD SENSORS became one of the major global providers of electronic pressure measurement devices within just a few years.

Manufacturing Sites:

Component	Certification	Location
pressure sensors	ISO 9001	



overview of more than 120 EU based manufacturers based on public search

registered manufacturers are presented as „verified“ information with website link (free for SMEs in 2016)



People

Dipl.-Ing. Tomáš Zedníček Ph.D., Czech Republic

email.: tom@passive-components.eu

- Electrotechnology Degree by Technical University of Brno, Czech Republic in 1993
- Ph.D. in Tantalum Capacitors in 2000
- > 21 years working for tantalum capacitor manufacturer
- > 15 years in position of Worldwide Technical Marketing Manager
- more than 60 technical papers and 1 US/international patent
- 4 outstanding/best award technical papers at CARTS passive component conference
- 2005 Dr. Zandman award for a great contribution to passive component industry
- Lecturer of capacitor technologies, presentation skills and inter-culture communication
- July 2015 - Founder of the European Passive Components Institute



President & Founder

Dominique Vignolo, France

- DUT Genie Electrique option Electronique (IUT Nice, France) in 1977
- Field Service Manager for 10 years
- 22 years working for resistor manufacturer
- 13 years in position of Worldwide Global Product Marketing Manager for High Precision Products
- Technical papers about high precision products specially in high temperature and space applications
- Manufacturers' representative at ESA CTB Passive Component Technology Board for five years
- Marketing skills (launching of marketing operations, organization of exhibitions)



Dipl.-Ing. Reiner W. Kühl, Germany



- Dipl.-Ing. degree in Physics by University of Applied Science in Luebeck, Germany in 1973;
- > 25 years product and process R&D, working for thin film resistor manufacturers;
- 15 years in position of Technology and Quality-Customer-Service Senior Management;
- More than 20 technical papers and 1 European / international patent;
- 2 Outstanding Paper Awards at CARTS passive component conferences;
- 2000 Highly Commended Award from the LITERATI Club of MCB University Press;
- 2008 Dr. Felix Zandman Passive Electronic Components Industry Technology Award for Recognition of Acknowledged Industry Leadership & Perseverance of Vision;
- Expertise in components' reliability & failure analysis, thin film resistors' technology (MELF, chip), barrel electroplating, electro-isolation lacquer, laser machining, etc.

***External
Co-Operators***



European Passive Industry Database

call for registration

- Database of more than 120 manufacturers, distributors, testhouses, universities
- Public sources initial entry, registered companies with verified information
- Details on manufacturing locations, products, certifications etc.

e-PassiveBook *under construction*

call for sponsors to financially support transformation into an online handbook

- Online open (free access) passive component handbook
- Basic content based on licensed industry well-known P-O.Fagerholt's CLR handbook
- Application guidelines, updates to be added in next phase (examples completed)

e-Symposium *under preparation*

call for papers

- Passive components mfgs and universities technical paper database
- Annual company small fee for their employees unlimited access
- Custom content selection of papers for e-proceeding/hardprints (fee may apply)

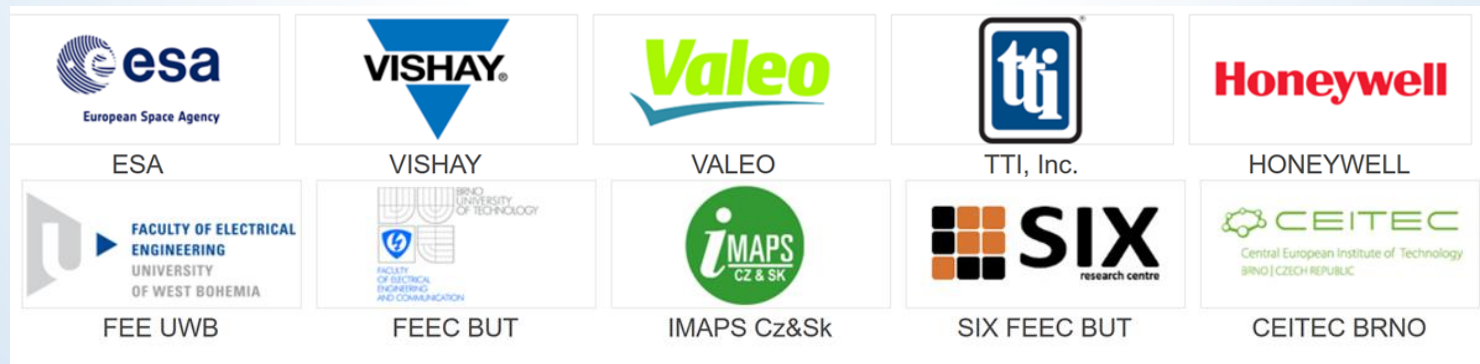


Acknowledgement

Sponsors



Partners & Clients





since September 2016 EPCI is representing the following companies at ESA:



leading global supplier of passive components



- Czech SME company
- pressure sensors & measurements from 1 mbar to 6.000 bars
- development of hydrazine, MON, NMH, Green Propellant, IPA, GHe, GN2, GXe, Deionized H2O, HFE pressure sensors



INNOVATIVE SENSOR TECHNOLOGY

since 1991

- Swiss SME company
- thin-film RTD temperature sensors, capacitive humidity sensors, mass flow sensors and conductivity sensors
- ESA qualification of platinum high vibration resistant thin film temperature sensors (replacing conventional wire-wound sensors)

Thank You

www.passive-components.eu

email: tom@passive-components.eu





AVX Tantalum Electrolytic Capacitors

ESA ECI Presentation 29.9.2016 Roma



A KYOCERA GROUP COMPANY

Tomáš Zedníček

European Passive Components Institute

www.passive-components.eu

AVX Hi-Rel LOCATIONS

- San Salvador
- Juarez, Mexico
- Sun Valley, CA USA
- Colorado Springs, CO USA
- Olean, NY USA
- Lanskroun, Czech**
- Uh. Hradiste, Czech
- Conway, SC USA
- Biddeford, USA**
- Fountain Inn, SC USA
- Raleigh, NC USA
- New Market, UK
- Coleraine, UK
- Betzdorf, Germany
- St. Apollinaire, France
- Jerusalem, Israel
- Penang, Malaysia



AVX is well known for Hi reliability components.

In tantalum we have 2 prestigious manufacturing facilities.

AVX Hi Rel – Mission



**Consumer, Industrial, Automotive, Aerospace, Military,
Medical Components**

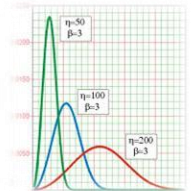
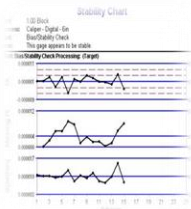
**AVX Is The Premier Supplier of Tantalum Capacitors For
the Most Demanding Applications**

High Reliability

High Quality Standards

High Performance

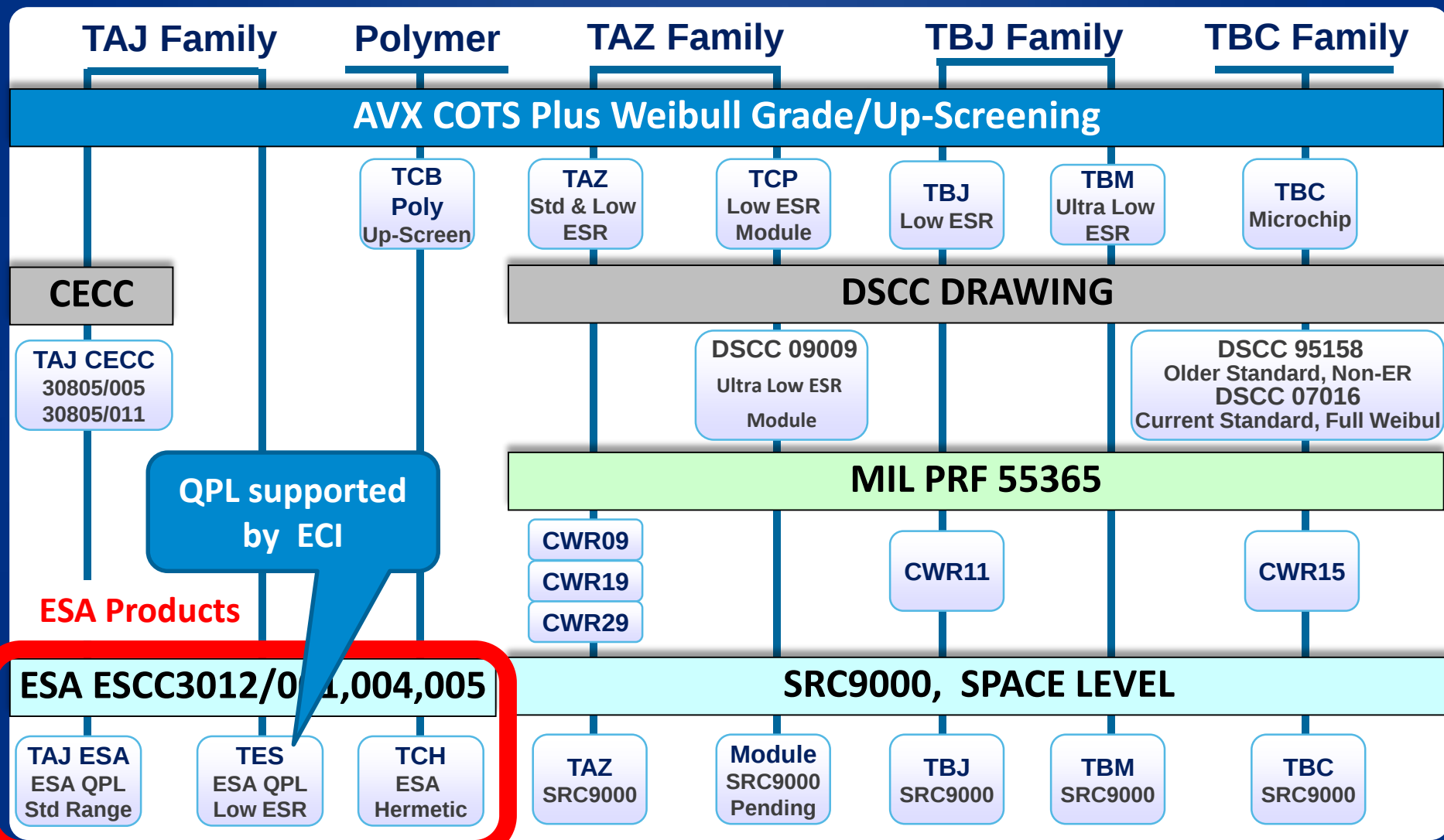
AVX Hi Rel – Respected Qualification Levels



- CWR09/11/15/19/29 Military Products
- DSCC, CECC, COTS +
- SRC9000 and CWR T level Space product lines
- ESA certification
- Quality Certifications:
 - AS9100
 - ISO14001
 - ISO13485
- HRC 5000(Weibull), HRC 6000(Q process) internal specification for medical implantable applications
- HRC4000 (Q process) internal specification for all other medical applications

Materials & Processes Make More Robust Capacitors

Hi Rel – Tantalum Electrolytics Product range



Biddeford for Medical and USA Mil spec

Czech for CECC and ESA and MIL-STD 790 in progress.

TAJ ESCC 3012/001 – Space Level



Description

- Tantalum Solid Electrolytic Capacitors for use in space programmes according to ESCC 3012/001 as recommended by the Space Components Coordination group



Features

- ESA QPL 3012/001
- CV 0.1uF – 220uF, 6V – 50V
- European Manufacture (CZ)
- Inspection Level B (X Ray) option available
- LAT 1,2 & 3 testing options available
- Single Lot Date Code

Applications

- Satellite and space
- Hi-rel applications from aerospace and defence industry

**TES “low ESR”
Tantalum Solid Electrolyte Products
ECI Supported QPL**

TES ESCC – Technology – Low ESR

ESR Equivalent Series Resistance

- Measure of Losses in Capacitor
- Specified at 100kHz represent Higher Frequency Losses
- Lower ESR = high efficiency filtering capability in switching power supplies
 - = higher ripple current capability within the same dimensions **OR**
 - = smaller & lighter component at the same ratings
- Lower ESR parts = less number of capacitors needed

Significant Payload & Space Saving

How to achieve Low ESR ?

Better conductivity of outer electrodes

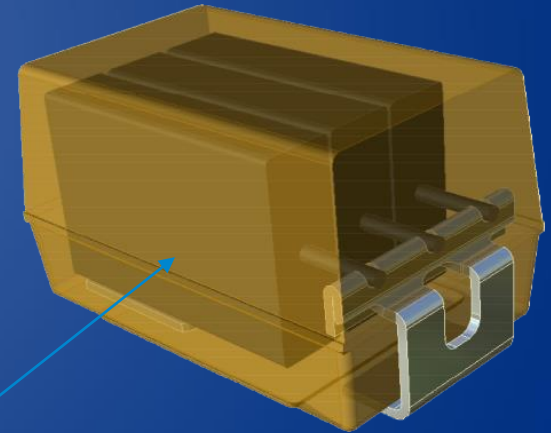
- polymer electrode
- more complex change, no flight heritage – need detail evaluation

TCH

Higher top surface area – multianode

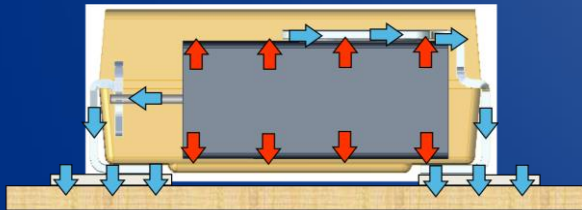
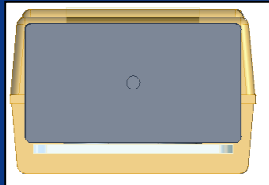
- based on conventional long flight heritage technology

TES



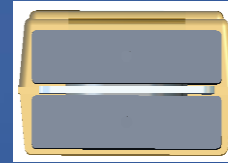
Cross – Section Benchmark

Single Anode (conventional)

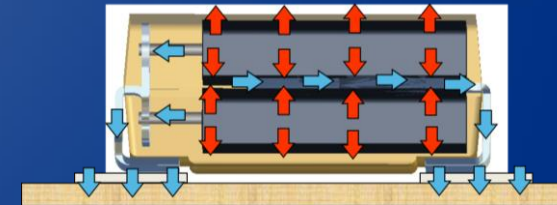
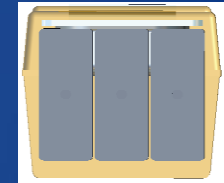


Multianode (TES)

Horizontal “Mirror”



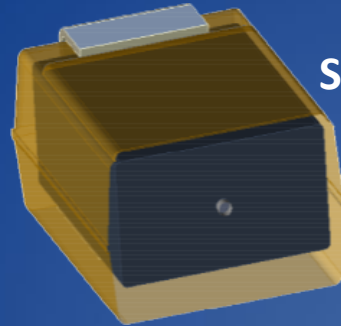
Vertical Anodes



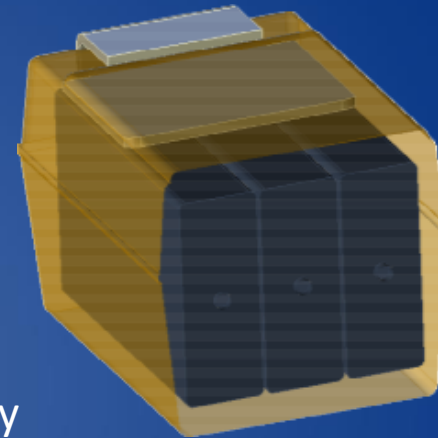
- Low ESR
- Better thermal dissipation
- Higher surge robustness
- Higher ripple current rating
- Mirror used for low profile designs
- Mirror symmetrical design = ESL reduced to half

TES ESCC – Technology – Design

Multianode Design High Rel / Space Application Consideration



Single Anode



Multianode

Positive Impact

- thinner anodes = better powder pressing homogeneity
- better mechanical strength, lower dielectric damage by mechanical handling
- better DCL robustness & stability, higher surge capability
- better electrolyte penetration = higher quality electrode coverage
- better thermal dissipation = higher surge robustness, higher ripple ratings

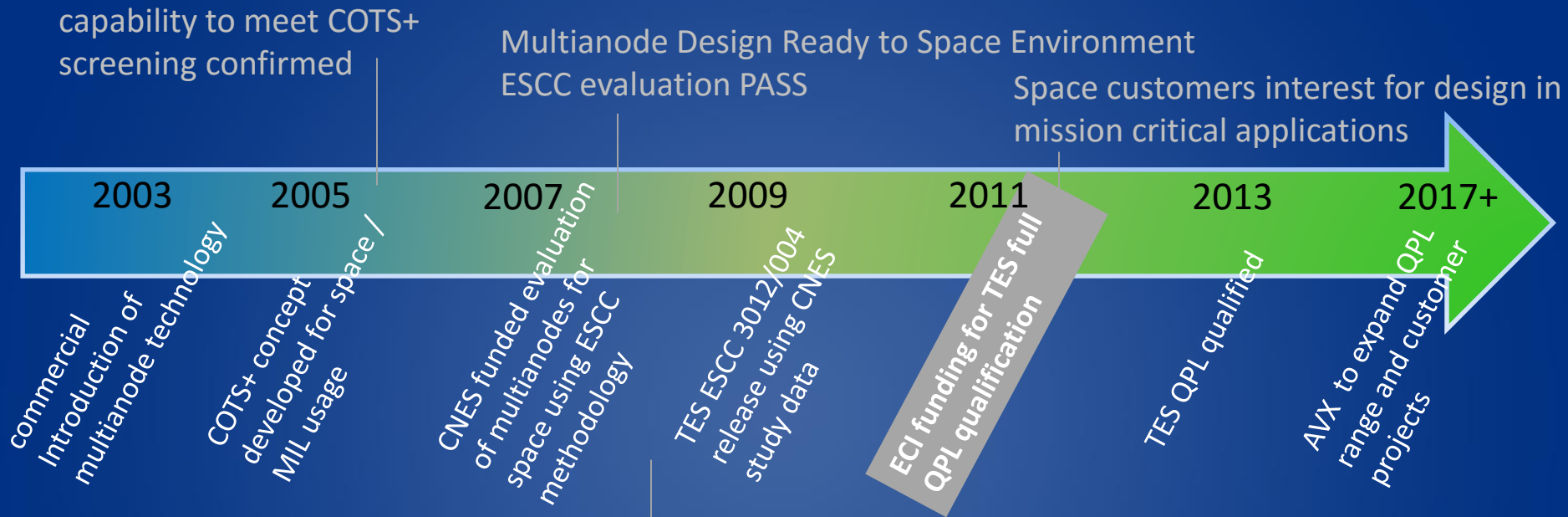


Negative Impact

- Multiple anodes = more anode corners = more potential DCL issues and instability
 - More elements within one body = reliability divided by number of anodes ?

Task for Space Evaluation: What will be the Key Reliability Driver ?

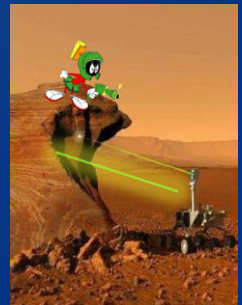
TES ESCC – Milestones



Case Study – COTS+ Curiosity Mars Rover Application

- 630 AVX COTS+ Tantalum Multinodes power the laser of ChemCam module on curiosity Mars rover
- 960 originally single anode tantalums replaced by low ESR Multinode designs – No. of capacitors reduced by **ONE THIRD**

ChemCam was designed by a joint U.S.-French team led by Los Alamos National Laboratory; NASA's Jet Propulsion Laboratory in Pasadena, California; the IRAP and CNES in Toulouse. Tantalum capacitors have been selected and designed by co-operation between IRAP and AVX Lanskroun, Czech Republic

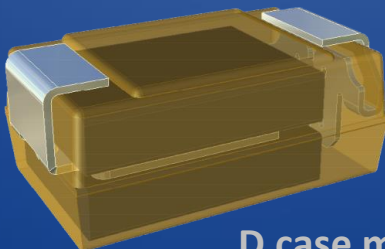
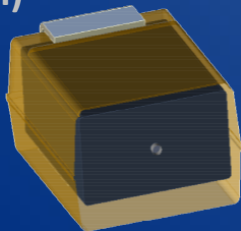


TES ESCC – Qualified Range

Capacitance		Rated Voltage DC (V _R) at 85°C							
μF	Code	6.3V (J)	10V (A)	12V (B)	16V (C)	20V (D)	25V (E)	35V (V)	50V (T)
1.0	105						A(3000)		B(2000)
1.5	155								
2.2	225								
3.3	335					A(2500)	B(1000)	B(1000) C(600)	C(1000) D(200)
4.7	475				A(2000)				
6.8	685								
10	106		A(1800)			B(1000)	C(600)	D(120)	
15	156								
22	226	A(900)			B(600)	C(400)		D(100)	
33	336		B(650)			C(300) D(55)	D(65) E(65)	E(65)	
47	476	B(500)			C(350)				
68	686								
100	107		C(200)		D(55) E(40)	E(45)			
150	157	C(300)	D(45) D(35)						
220	227			E(35)					
330	337	D(35) E(30)	E(35)						
470	477								

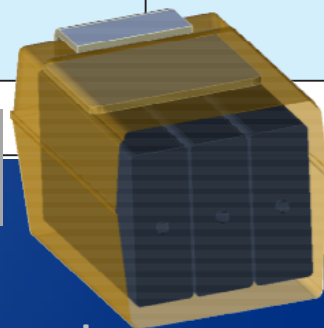
ESR down to 30mΩ

A, B case single anode
(standard design)



D case multianode
"mirror" design

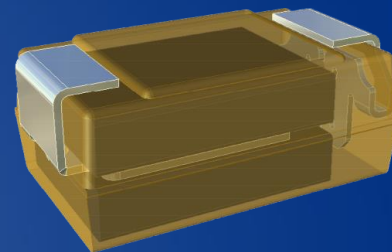
E case multianode
(3 horizontal anode design)



TES ESCC – Qualified Range

TAJ ESCC 3012/01 versus TES ESCC 3012/004 Range Comparison

Capacitance		Rated voltage							
µF	Code	4V	6.3V (J)	10V (A)	16V (C)	20V (D)	25V (E)	35V (V)	50V (T)
0.10	104							A	A
0.15	154							A	B
0.22	224							A	B
0.33	334							A	B
0.47	474						A	A/B	C
0.68	684					A	A	A/B	C
1.0	105				A	A	A	B/T	B/C
1.5	155			A	A	A	B	B/C	D
2.2	225		A	A	A/B	B	B	B/C	D
3.3	335	A	A	A	A/B	A/B	B/C	B/C	C/D
4.7	475	A	A	A/B	A/B	B/C	B/C	C/D	D
6.8	685	A	A/B	B	B/C	C	C/D	D	
10	106	A/B	B	A/B/C	C	B/C	C/D	D	E
15	156	B	B/C	C	C	C/D	D	D	
22	226	B/C	C	C	B/C/D	C/D	D	D/E	
33	336	C	C	B/C/D	D	C/D	D/E	E	
47	476	C/D	C/D	D	C/D	D/E	E		
68	686	C/D	D	D	D	E			
100	107	D	D	C/D	D/E	E			
150	157	D	D	D/E	E				
220	227	E	E	D/E					
330	337		D	E					
470	477		E						



TES ESCC 3012/004
Codes Highlighted
(not present in TAJ ESCC
3012/001 qualified range)

TES ESCC 3012/004 Advantage

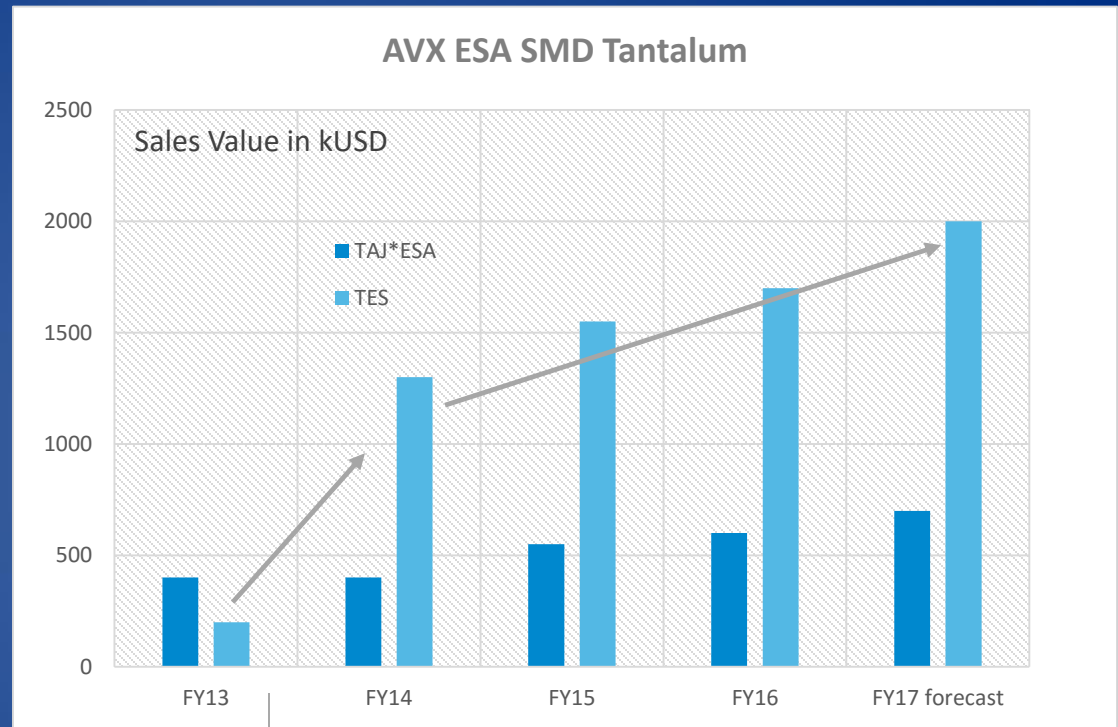
- Low ESR
- Higher CV options
- Downsizing
- Higher ripple current load

TES ESCC – Sales



**Main TES ESCC3012/004
users**

Thales (Cosmo project)
EADS Astrium
Russian Satellites



QPL Qualification
Funded by ECI

Thank You ECI

Other ESA and Space Related Tantalum Solid Electrolyte Projects & Products

Other Tantalum Space Projects

ESA – AVX Tantalum Division Long Term Co-operation



AVX Lanskroun CZ - CNES, France - ESA -
Evaluation Project on TES Multianodes

AVX Lanskroun CZ - ESA 1st Call Czech
Incentive Project - TCH Hermetical Polymer

AVX Lanskroun CZ - Qualified
Supplier of TAJ ESA ESCC 3012/004

TES ESCC 3012/004 EPPL
Approved, QPL Initiated

AVX Lanskroun - ESA 3rd Call
Czech Incentive Project -
Embedded Ta Capacitors

TES ESCC
3012/004 QPL
Approved

TAJ ESCC 3012/001
Qualification of
Extended Range

AVX Paignton, UK - Qualified Manufacturer of
Tantalum Capacitors TAJ ESCC 3012/001

1993

1995

1997

1999

2001

2003

2005

2007

2009

2011

2013

2016



<http://www.avx.com>

Other Tantalum Space Projects

ESA – AVX Tantalum Division Project Details

Development Projects

1st Czech Incentive 2010 - 2013

- tantalum hermetically sealed polymer development – 454k EUR
- project completed in 2013, outcome - series TCH ESCC 3012/005 (polymer)
THH commercial high temp 230C series

3rd Czech Incentive 2013 -

- development of 0201 tantalum capacitors for embedding – 199k EUR
- project ongoing - completion 2017

Low ESR direct RFQ 2011-2013 (ECI funded)

- tantalum low ESR evaluation and QPL qualification – 99k EUR
- project completed in 2013, outcome – TES ESCC3012/004 QPL

AVX Lanskroun, CZ Qualificaiton

TAJ-ESA ESCC 3012/001 (1993 – 2010)

TES ESCC 3012/004 (2010 – 2013)

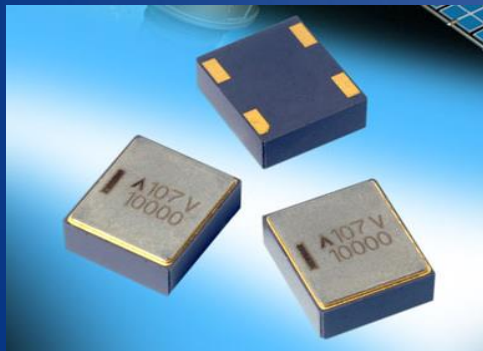
Qualification Projects

ESA Development Projects - TCH Hermetic Polymer

Low ESR Achieved by More Conductive Polymer Electrode

Why Hermetical Packaging ?

reliability improvements by
protecting the polymer cathode
from Humidity and Oxidation



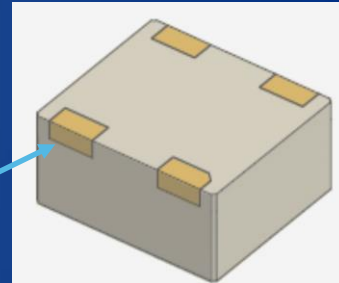
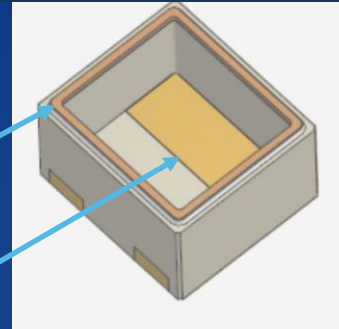
Lid (Kovar)

Sealing ring

Ceramic case

Inert gas

Anode + contacts

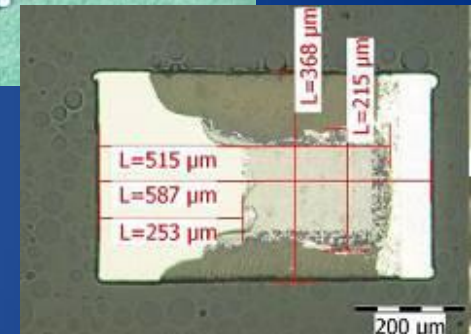
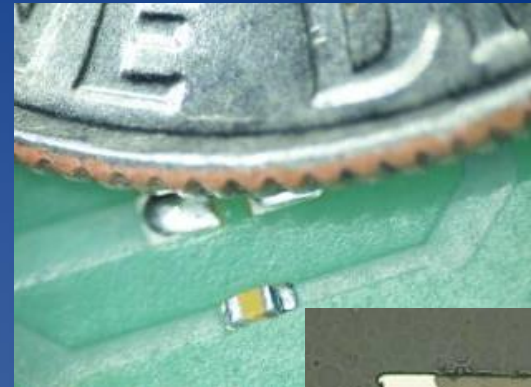
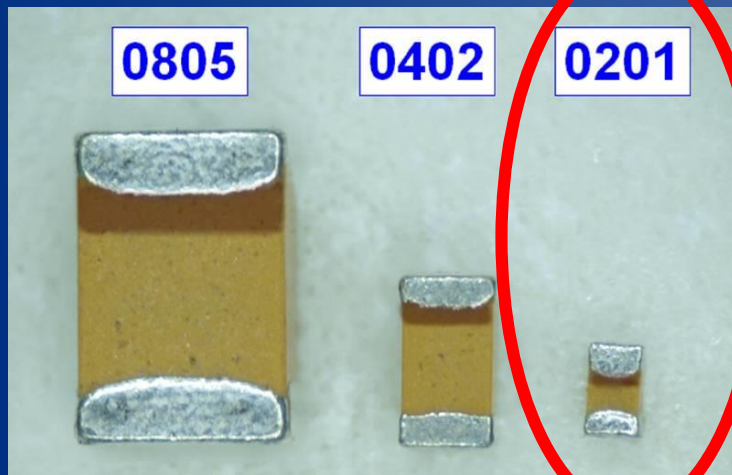


- Improves Low ESR Stability
- Maintains performance in extreme conditions
- Conductive Polymer for Mission Critical Aerospace & Hi-Rel applications
- ESCC 3012/005 in draft as referenced specification – approval in process
- Project completed in 2013

ESA Development Projects - Embedded Ta Capacitor

Small & Flat Tantalum Capacitor

- Smallest Tantalum 0201 size $0.47\mu\text{F}$ 6.3V dimensions: $0.6 \times 0.35 \times 0.35\text{mm}$
- Thin & Flat Design 1206 size $10\mu\text{F}$ 6.3V with max thickness 0.5mm dim: $3.2 \times 1.6 \times 0.5$
- Project ongoing, completion in 2017



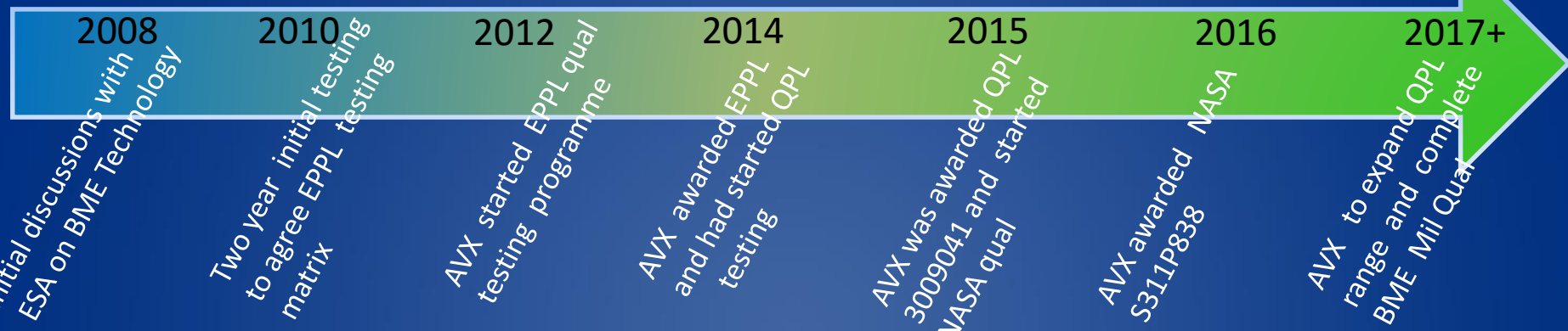
0.5mm max

3.2 x 1.6 mm

Other Space Related AVX Products

A close-up photograph of a microchip. Two labels, 'R36' and 'R35', are visible on the left side of the chip, pointing to specific components or pins.

AVX Coleraine Ltd, N.Ireland was the first company to be awarded the ESA 3009041 and the NASA S311P838 for its Space Approved BME technology



ESCC Approved AVX Ceramic Capacitor Ranges		
AVX App Series	Ceramic Capacitor	Series Type
ESCC 3001030	Cap Ceramic fixed Type II	CH/CV Stacked
ESCC 3001034	Cap Ceramic fixed Type II High Volt , 1 Kv – 5 Kv	CH/CV Stacked
ESCC 3009034	Cap Ceramic fixed Type II High Volt , 1 Kv – 3 K v	1812 - 1825
ESCC 3009	TPC Cap Ceramic Type I & II , 25 - 200 volt	0805 - 2220
ESCC 3009041	Cap Ceramic Type II,	0603 - 1812

First BME used in Space: Mars Curiosity LICA (Low Inductance Capacitor Array)

Exo Mars recent projects

Quantum Satellites

Sentinel Satellites

Meteosat Weather Satellites

Solar Orbiter

Euclid

Orion Space craft

ISS space transport



AVX other products

Space Heritage Products



FeedThru Filters

- used on small satellite power filters - solar array to power board filters
- W2H series with conservative design dedicated to extreme reliability.
- non ferrous based LC T filter – no hysteresis from high currents or high temperatures. Its used in critical drive by wire auto applications.

Upcoming – (No Space Heritage)

Non-Flammable Supercapacitors

- novel non-flammable electrolyte type developer
- high Capacitance, high Energy capabilities
- will be annouced during Autumn 2016



Thank you

