



ACCEDE
COTS2019

SEVILLE - SPAIN | 6-8 NOVEMBER

THE USE OF **COTS** COMPONENTS FOR SPACE APPLICATIONS

ACCEDE WORKSHOP-
7TH NOVEMBER 2019 SEVILLA

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SOLUTIONS™







AGENDA

- INTRODUCTION
 - Vishay company overview

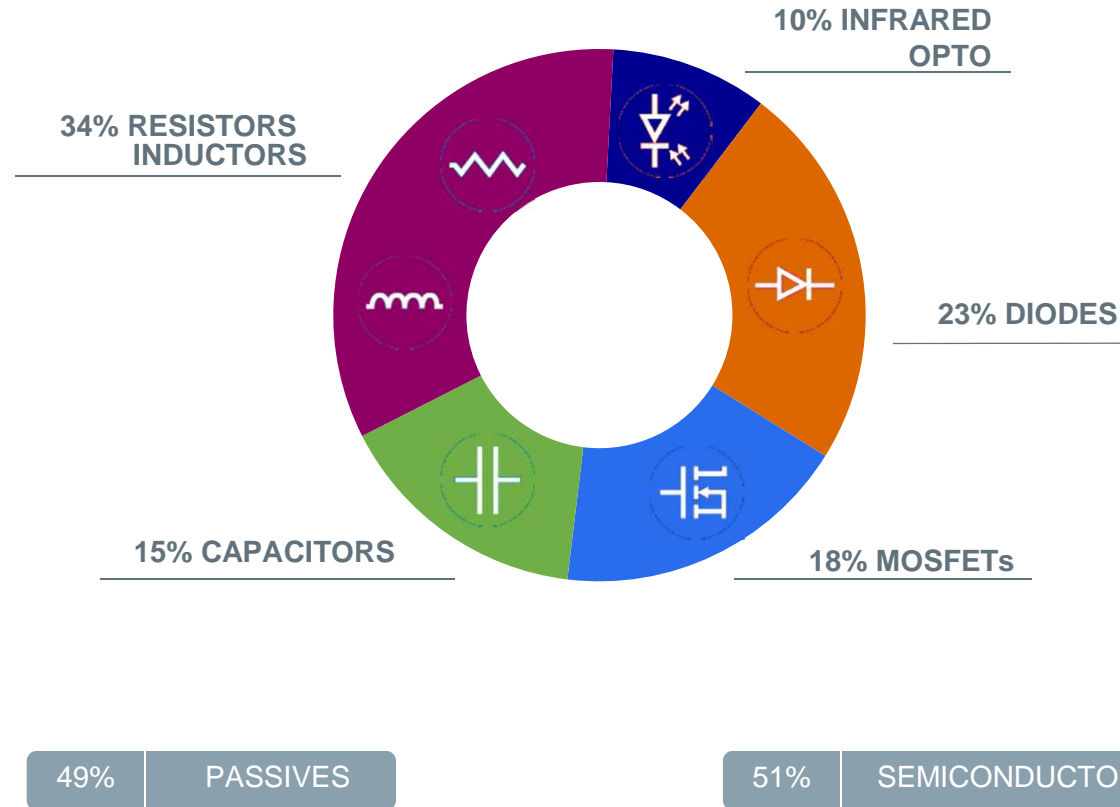
- VISHAY QUALIFICATION LEVEL
 - Vishay qualification Hierarchy
 - Space client's preference
 - Space qualification Vs Automotive qualification

- VISHAY PASSIVE COMPONENTS QUALITY COMPARISON
 - Resistors : Thin Film 
 - Capacitors: Tantalum Molded 



BROAD PRODUCT PORTFOLIO

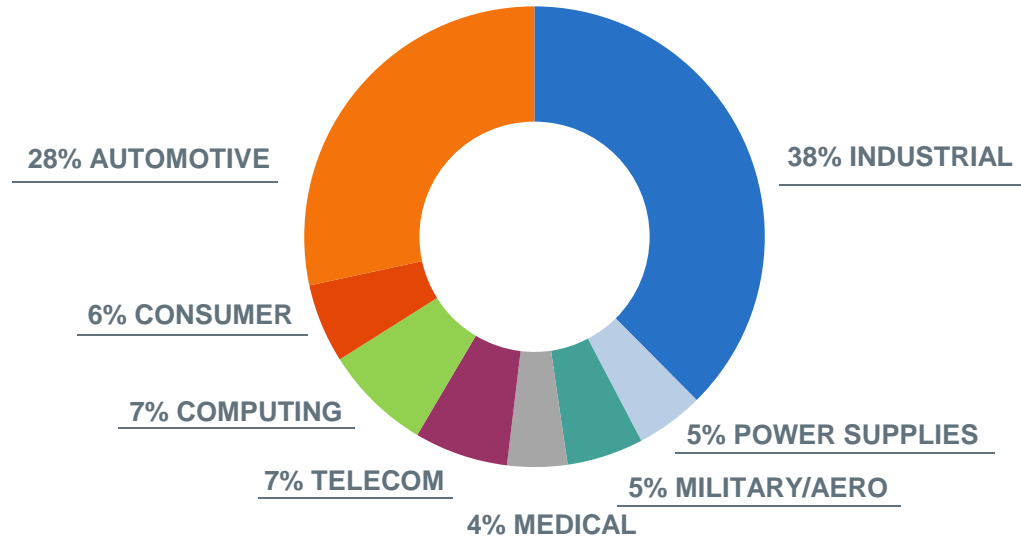
VISHAY TODAY



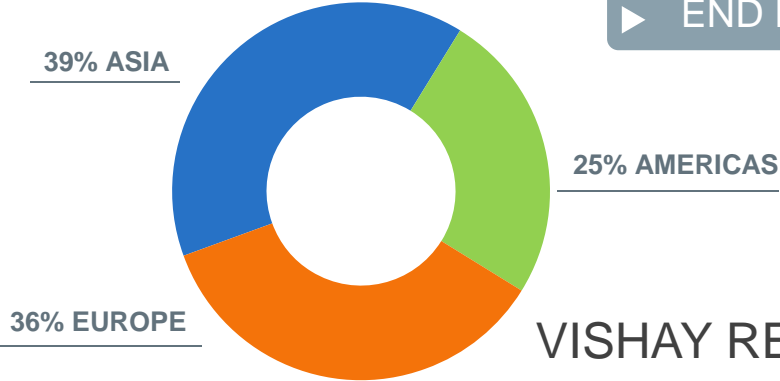
VISHAY REVENUES 2018: \$3BILLION



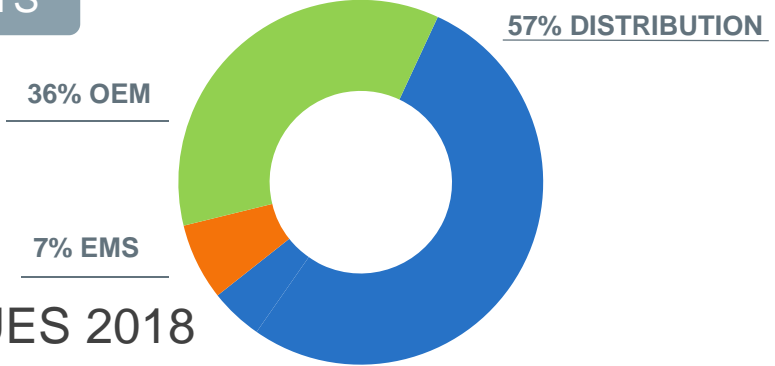
BROAD MARKET PENETRATION



▶ END MARKETS



GEOGRAPHY



▶ SALES CHANNELS

VISHAY REVENUES 2018



BROADEST LINE OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS

	SEMICONDUCTORS					PASSIVE COMPONENTS					
	DIODES	MOSFETs	OPTO			CAPACITORS		RESISTORS			MAGNETICS
	Diodes, Rectifiers	MOSFETs	Infrared Components	Opto-couplers	LEDs	Aluminum, Ceramic	Power, Film, Tantalum	Film, Power	SMD Resistors	Variable, Sensors	Magnetic Components
VISHAY	●	●	●	●	○	○	●	●	●	○	●
AVX						●	●				
Bourns									○	●	●
Broadcom			●	●	●						
Diodes Inc.	●	●									
Infineon	○	●									
KEMET						○	●				
KOA								●	●		○
Murata						●				○	●
Nichicon						●	○			○	
Nexperia	●	●									
ON Semi	●	●		●	○						
Panasonic						●	●		●	○	○
Rohm	●	●	●	○	○		○	●	●		
Sharp			●	●	○						
ST Micro	●	●									
TDK/EPCOS						●	●			●	●
Toshiba	●	●	●	●	○						
Yageo						●		○	●		○

Source: Company estimates

● = Major Position ○ = Minor Position



VISHAY QUALIFICATION LEVEL

- VISHAY QUALIFICATION HIERARCHY
- SPACE CLIENT'S PREFERENCE
- SPACE VS AUTOMOTIVE QUALIFICATION

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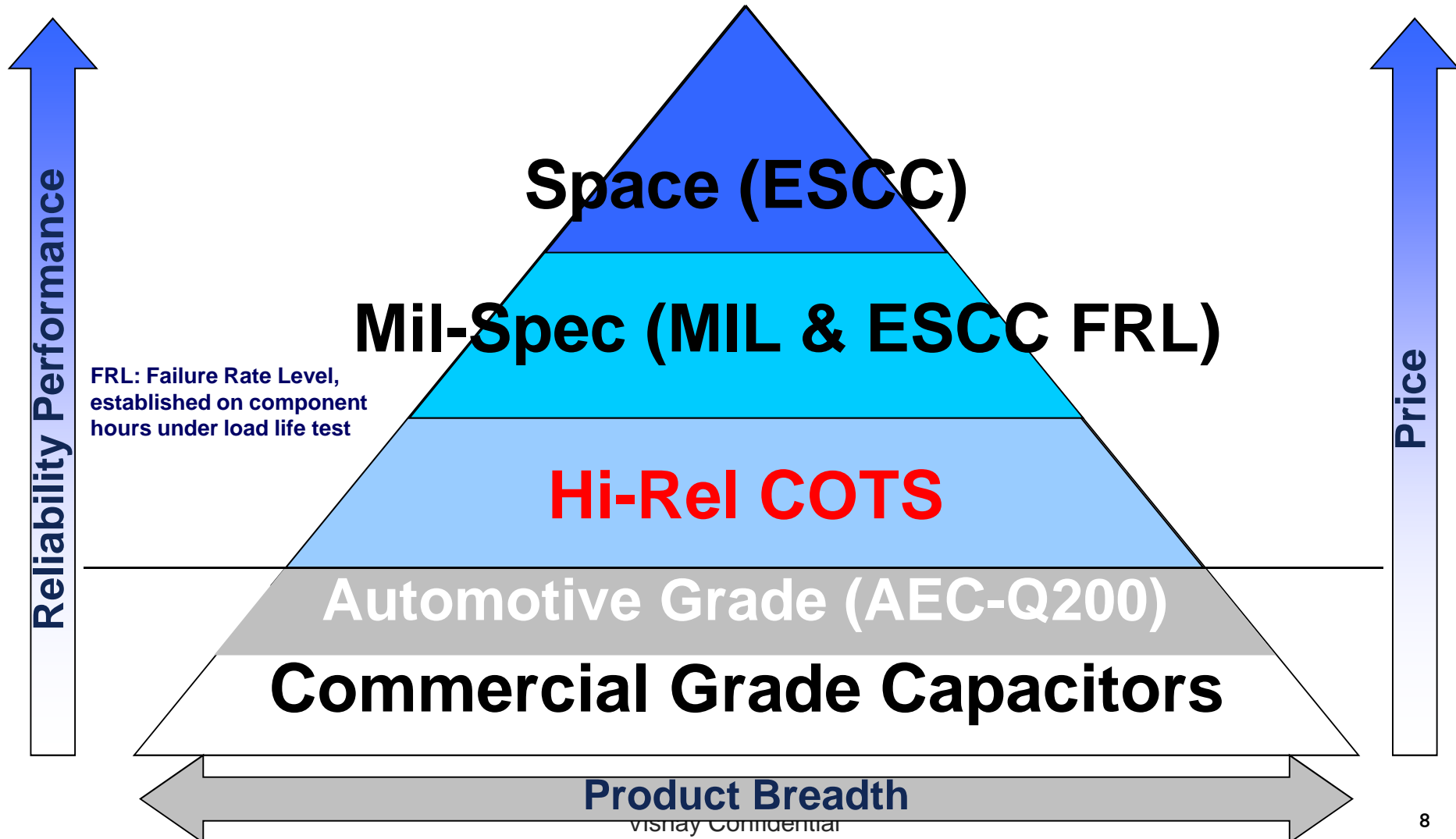


QUALIFICATIONS AND STANDARDS

- MIL (Military Specifications)
- ER (Established Reliability)
- CECC (CENELEC Electronic Components Committee)
- AS9100 (Aerospace Quality Management System)
- NASA (National Aeronautics and Space Administration Standards)
- ESA (European Space Agency)
- AEC-Q100 / 101 / 200 (Automotive Qualification Standard)
- ISO 9001 (Quality Management System)
- IATF 16949:2016 (International Automotive Task Force)
- ISO / TS 16949 (Automotive Quality System)
- VDA 6.3 (German Automotive Industry Quality Standard)
- UL (Underwriters Laboratories)
- ISO 14001 (Environmental Management System)
- OHSAS 18001 (Occupational Health and Safety Management System)
- IRIS (International Railway Industry Standards)
- ISO 13485 (Medical Devices Quality Management System)
- ISO 50001 (Energy Management System)



QUALIFICATION HIERARCHY





SPACE CLIENT'S PREFERENCES (1)

	Auto Quality acc. AEC-Q200	COTS*	Qualified e.g. IECQ-CECC	Space qualified e.g. ESCC
Initial Product Evaluation	NO	NO	NO	YES with DPA
SnPb Plated Version Available	NO	NO	YES	YES
Long Term Quality Record	NO	NO	YES	NO
Screening (Prevention of early failures)	NO	NO	YES	YES
Unique Production Lot per Package (SLDC)	NO	NO	Est. Rel.: YES	YES
Certificate of Conformity	NO	NO	Marking on label only	YES with data
Traceability	YES	YES	YES	YES
Low Quantities Available (< 1000 pcs.)	NO	NO	NO	YES
Lot Validation Tests Available	NO	NO	NO	YES



SPACE CLIENT'S PREFERENCES (2)

	Automotive Quality acc. AEC-Q200	COTS*	Qualified e.g. IECQ-CECC	Space qualified e.g. ESCC
Qualification Test Schedule	YES	NO	YES	YES
Requalification	Upon Product Change	NO	Periodical	Periodical
Quality Conformance Test Schedule	NO	NO	YES	YES
100% Resistance Test	YES	YES	YES	YES
100% Additional Tests	NO	NO	NO	YES
100% Human Visual Inspection	NO	NO	NO	YES
Factory Audits by Qualification Body	NO	NO	YES	YES

*) Commercial Off The Shelf



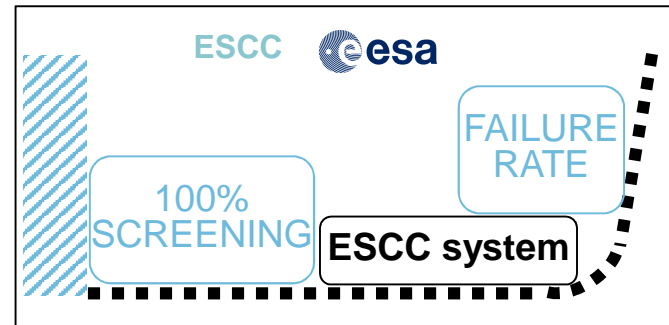
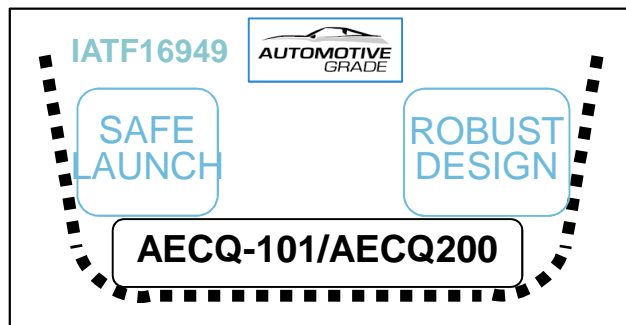


MAIN VARIATIONS BETWEEN ESCC & AEC-Q

AEC-Q

ESCC

Stress tests qualification list only related to the product	Stress tests qualification list for product + process qualification + system qualification
Statistical approach to guaranty conformity on huge volume during all life duration : maintenance possible	Reliability (failure rate) approach : no maintenance possible
100% functional performances evaluated based on statistics	100% screening (burn-in, overload) + 100% visual inspection
Temperature range -40°C / +125°C (Most underhood) No radiation requirement	Temperature range -55° C / +155° C Robustness to radiation (test specification)
Mutual qualification (Manufacturer / Customer)	Third part qualification (ESA)
Typical life time up to 15 years (spare parts)	Typical lifetime 20 years (application)

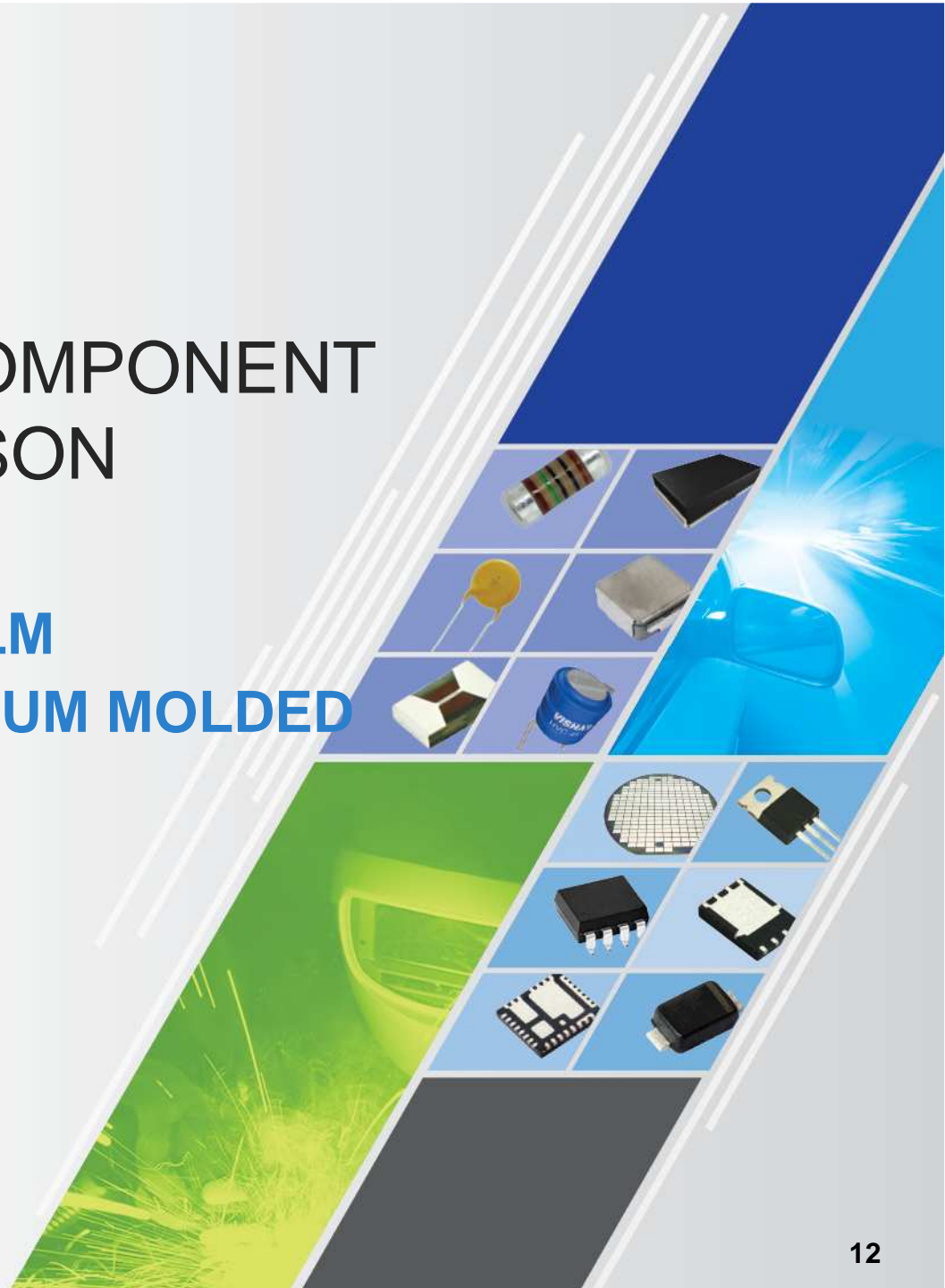




VISHAY PASSIVE COMPONENT QUALITY COMPARISON







- RESISTORS : THIN FILM
- CAPACITORS: TANTALUM MOLDED

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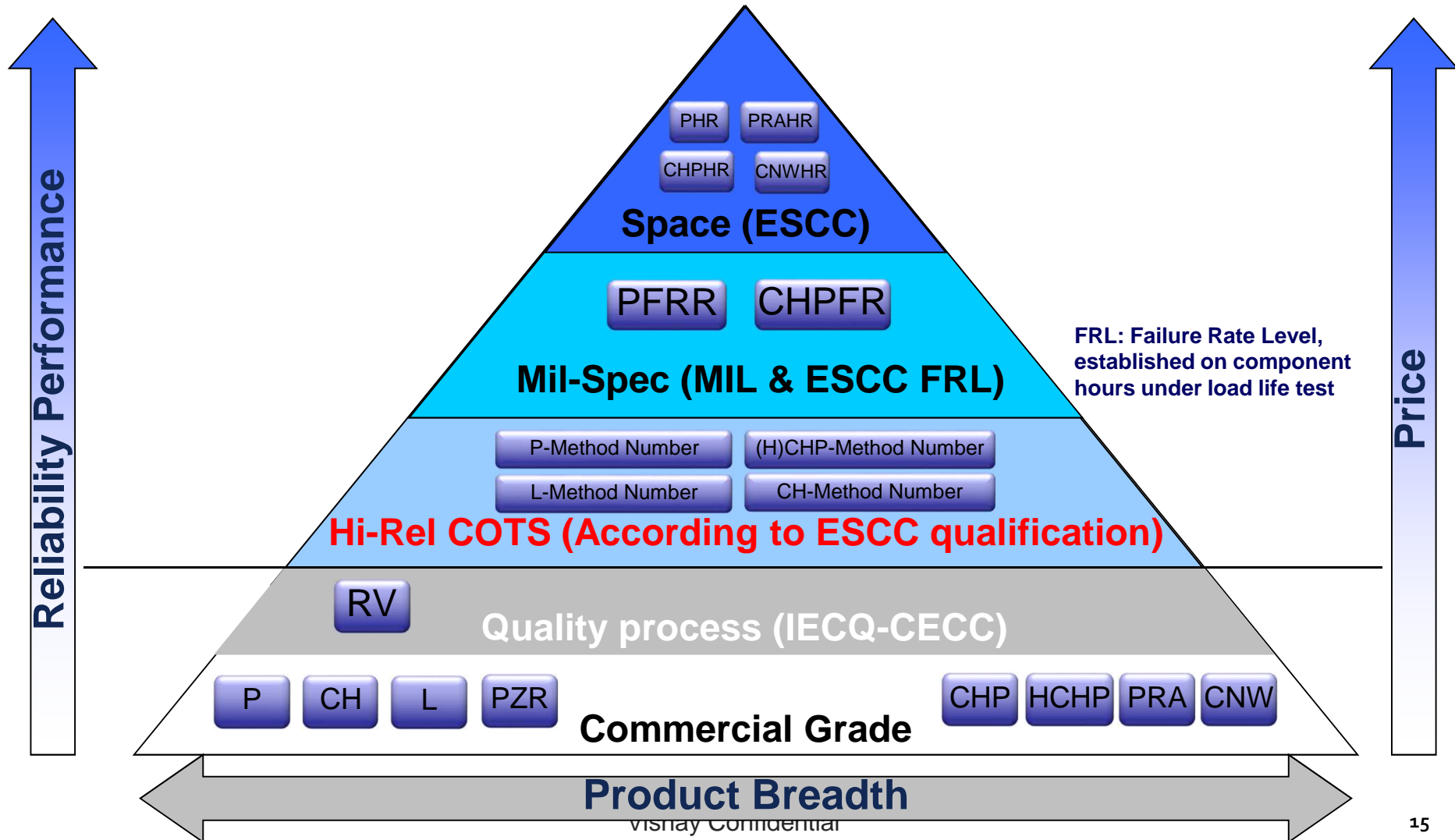


THIN FILM RESISTORS MATRIX

Serie	Resistor Type	Qualif	Temp range °C	Load life stability	Tol %	TC ±ppm/°C
P PHT		EN9100	-55°C +155°C -55°C +215°C	± 0.1 % typ (8000h @P70)	± 0.01 to ± 5	± 5 to ± 100
PHR	Chip		-55°C+155°C	± 0.02 % typ (2000h @P70)	± 0.01 to ± 0.1	± 5 to ± 25
PFRR			-55°C+155°C	± 0.05 % typ (8000h @P70)	± 0.05 to ± 0.1	± 10 to ± 25
PTN		MIL	-55°C+155°C	± 0.03 % typ (2000h @P70)	± 0.05 to ± 5	± 10 to ± 100
MC-AT			-55°C+125°C	± 0.15 % typ (1000h @P70)	± 0.5 to ± 1	± 25 to ± 50
TNPU			-55°C+125°C	± 0.05 % typ (1000h @P70)	± 0.02 to ± 0.1	± 5 to ± 10
PRA CNW	Network	EN9100	-55°C+155°C	± 0.1 % abs ± 0.02 % ratio (1000h @P70)	± 0.1 to 0.5 abs ± 0.01 to 0.1 ratio	± 10 abs ± 1 to 2 ratio
PRAHR CNWHR			-55°C+155°C	± 0.1 % abs ± 0.02 % ratio (1000h @P70)	± 0.1 to 1 abs ± 0.05 to 0.1 ratio	± 10 abs ± 3 ratio
ACAS			-55°C+155°C	± 0.1 % abs ± 0.05 % ratio (1000h @P70)	± 0.1 abs ± 0.05 ratio	± 10 abs ± 5 ratio



VISHAY SFERNICE RESISTOR AND NETWORK PRODUCTS FOR SPACE APPLICATIONS



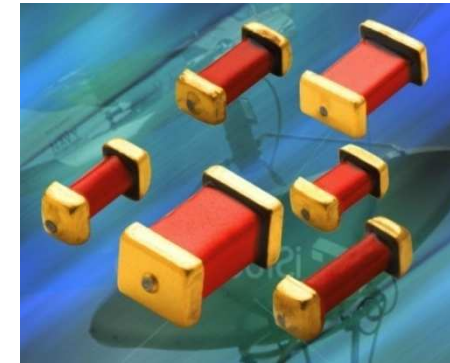


Solid Tantalum: SMD, Space or “T level”

- MIL-PRF-55365:** CWR06 – Standard Values
- CWR16 – Extended Range Values
- CWR26 – Low ESR
- CWR11 – molded case

Failure Rate: “C” (0.01%/1000 Hours)

Surge Current Test Option “C”: -55° C & +85° C



Group A Inspection	Sample	Description
Reflow Conditioning	100%	230°C Minimum, 5 Seconds Minimum
Thermal Shock (Unmounted)	100%	5 Cycles, -65°C to +125°C
Weibull FRL Grading	100%	"C" Level Minimum (0.01%/1k Hours)
Surge Current Test	100%	-55°C & +85°C, Before Weibull Grading
Radiographic Inspection	100%	2 plane X-ray
DPA (Destructive Physical Analysis)	5	MIL-STD-1580 Modified by MIL-PRF-55365
Visual	100%	10X Magnification
Temperature Stability	13	-55°C to +125°C
Solderability	13	MIL-STD-202, Method 208
Group C Inspection	Sample	Description
Thermal Shock (Mounted)	12	10 Cycles, -65°C to +125°C
Resistance to Solder Heat	18	235°C for 30 seconds, 1 Cycle
Mositure Resistance		+25°C to +65°C for 24 hours, 20 cycles
Life	24	2000 Hours at +125°C



MIL-PRF-55365, Level “T” processing meets NASA/TP-2003-212242, Level 1 requirements.



Solid Tantalum: Conformal Coat & Molded Space Level

Series: T83, T95, T97, TM8

MIL-PRF-55365 (CWRXX “T” Level), DSCC specified and COTS products are available for Space applications.

Meets Class K, Element Evaluation per MIL-PRF-38534 (Hybrids)

Supports NASA/TP-2003-212242; EEE-INST-002, Level 1

SPACE LEVEL SMD PROCESSING COMPARISON

Test Description	Test Method	Level T	Hybrid (MIL-PRF-38534)	Vishay COTS
100% Reflow Conditioning	MIL-PRF-55365	X	X	X
100% Thermal Shock (Unmounted)	MIL-PRF-55365	X	X	X
100% Voltage Aging (Weibull B or better)	MIL-PRF-55365	X	X	X
100% Surge Current (Option C: -55°C & +85°C)	MIL-PRF -55365	X	X	X
100% Electrical Screening	MIL-PRF-55365	X	X	X
100% Visual/Mechanical	MIL-PRF-55365	X	X	X
Solderability	MIL-PRF-55365	X	X	X
Temperature Stability	MIL-PRF-55365	X	X	X
DPA Analysis	MIL-STD-1580	X	X	X
100% X-ray	MIL-PRF-55365	X	X	X
Group C Testing (Each Lot)	MIL-PRF-55365	X		Available



TANTALUM MOLDED FOR SPACE APPLICATIONS

