VISHAY INTERTECHNOLOGY, INC.



AUTOMOTIVE GRADE

Overview of Automotive Grade Products

AUTOMOTIVE GRADE PRODUCTS



DISCRETE SEMICONDUCTORS

- MOSFETs
- Optoelectronics

PASSIVE COMPONENTS

- Capacitors
 - Aluminum
 - Tantalum
 - Ceramic
 - Film
- Resistors
 - Film
 - Wirewound
 - Power Metal Strip®
 - Thick Film Power
- Inductors
 - IHLP®

SELECTOR GUIDE

– IHTH



VMN-MS6226-1610

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Program Description

Vishay has incorporated key automotive industry quality initiatives into an Automotive Grade Product line. The goal is zero defects. The requirements cover design, qualification, and manufacturing, and are used to continuously improve Vishay products and processes. Products fulfilling the Vishay Automotive Grade requirements, described below, earn our Automotive Grade stamp on their datasheets.

Design

- Robust Design Policy: New and modified products are designed using design rules, DFMEA, and lessons learned. The design rules ensure Automotive Grade Products are robust through manufacturing and assembly. Testing to failure confirms that design margins meet the demands of automotive use.
- Safe Launch: Vishay's Safe Launch Policy ensures that everything from design through production roll-out happens according to plan. Process corner evaluation, yield analysis, process capability review, and reliability testing are all incorporated.

Qualification

• AEC-Q100-, AEC-Q101-, AEC-Q200-Qualified: Automotive Grade Products are qualified to the latest AEC qualification standards and presented for approval using PPAP.

Manufacturing

- TS16949 Facility: All Automotive Grade Products are produced in facilities certified to TS16949.
- Maverick Lot Program: The Maverick Lot Program employs Part Average Testing (PAT), Statistical Yield Limit (SYL), and Statistical Bin Limit (SBL) according to AEC-Q001 and AEC-Q002 to identify statistically different parts and lots.
- Periodic Verification to AEC Requirements: Product families are verified to AEC Stress Test Qualification standards every two years.

Continuous Improvement

- Error Proofing: Error proofing is performed during the entire process to identify and eliminate potential causes of defects.
- Lessons Learned/Look Across: All continual improvement actions are linked to lessons learned and look across programs to ensure improvement everywhere in the company.





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Automotive Grade Product Table

Discrete Semiconductors AEC-Q101 Qualified	Description / Families	Packages
MOSFETs	 N-channel and p-channel TrenchFET[®] power MOSFETs (avalanche-rated cell density process, very low on-resistance, optimized logic-level and standard-level types) 	PowerPAK [®] 1212-8, PowerPAK SO-8L, DPAK (TO-252), TO-262, TO-263, TO-220, reverse DPAK, bare die, SO-8, TSOP-6, SOT-23, SC-70, SQ
Optoelectronics	 LED - full color palette including white Infrared emitters: - 830 nm, 850 nm, 870 nm, 890 nm, and 940 nm Photodiodes, phototransistors - peak sensitivity matches emitters: 400 nm to 1100 nm, 790 nm to 970 nm Ambient light sensors: - peak sensitivity of 540 nm Optical sensors: - reflective sensors, slotted interrupters 	PLCC-2, PLCC-4, Little Star [®] , TELUX, 1206, 0805, 0603, 1.8 mm gullwing, reverse gullwing, PLCC-4 multicolor, MiniLED, custom packages





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	e Components 200 Qualified		Description / Families	Packages
CA	PACITORS			
Aluminum Electrolytic		 Very high lifetime, high ripple current, low ESR, high temperature up to 150 °C, low impedance 		
		- Radial		146 RTI, 140 RTM, 150 RMI, 152 RMH
		- SN	ID	160 CLA, 146 CTI, 140 CRH, 150 CRZ
		TP3	High performance, low ESR	Cases A, B, C, D, and E
т	Tantalum		High temperature: 150 °C	Cases A, B, C, D, and E
Tantaium		TH4	High temperature: 175 °C	Cases B, C, and D
			Small case sizes, maximum capacitance	Cases: 0603, 0805, low-profile A & B
Ceramic	Surface-Mount MLCC	optio • AgP • C0G • Size • Exce	te tin terminations incl. Polymer layer (Soft-/Flex-) on d terminations for conductive epoxy assembly is (NP0), X7R and X8R 0402 up to 1812 with ranges from 16 V to 3000 V ellent ESD performance: 100 V (0805, 10 nF) up to V ESD, 200 V (0805, 10 nF) up to 25 kV ESD	SMD (VJ31X ROHS Automotive series) SMD (VJ31 and VJ34 Automotive series)
	Leaded MLC	AR Series, KR SeriesAxial, radial crimped or straight leadsTin plated copper-clad steel wire, 0.5 mm		 50 V_{DC}, 100 V_{DC}, 200 V_{DC} Class 1 and Class 2 ceramic Lead spacing of 2.5 mm and 5.0 mm
		 HOTCap[®] (K H series) Radial crimped or straight leads Tin plated copper Maximum operating temperature: 175 °C 		50 V_{DC} , 100 V_{DC} , 200 V_{DC} Class 1 and class 2 ceramic Lead spacing of 2,5 mm and 5,0 mm
	Ceramic Singlelayer	 AY2 Series X1/Y2 safety capacitor Radial leaded, straight leads Tin-plated, copper-clad steel wire, 0.6 mm Temperature cycle: 3000 cycles (-55 °C to +125 °C) 		 Safety Class X1, 440 V_{AC}, Y2, 300 V_{AC} (IEC 60384-14.3) Lead spacing of 5 mm, 7.5 mm and 10.0 mm
Film Capacitor		 MK1 MKF MK1 	DC lacquered radial DC potted radial RFI Y2 potted radial RFI X2 potted radial DC-Link potted radial	5 mm - 27.5 mm : BFC2 365-366-367- 368-369-467-468-469 10 mm - 27.5 mm: MKT 1820 7.5 mm - 27.5 mm: BFC2 338 6 15 mm - 27.5 mm: F1772-2 310V X2 (<= 470 nF) 27.5 mm - 52.5 mm: MKP 1848 DC-Link



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Passive Components AEC-Q200 Qualified	Description / Families	Packages				
INDUCTORS						
IHLP	 Low profile, high current, surface-mount Shielded construction Handles high transient current spikes without hard saturation Ultra-low buzz noise due to composite construction 	1616 to 6767 (-A1 and -1A suffix) Frequency range up to 5 MHz 1616 to 8787 (-5A suffix) High operating temperature, up to +155 °C				
ІНТН	 High current, through-hole High operating temperature range from -55 to +155 °C Shielded construction Handles high transient current spikes without hard saturation Ultra-low buzz noise due to composite construction 	0750 and 1125				
RESISTORS*						
Film	 MELF (SMM, MMA, MMB, MMU), Carbon film MELF (2.2 Ω to 200 kΩ) Thin film (TNPW e3-size 0402-1210, TNPU e3, MC AT, ACAS AT all sizes) WSF (10 Ω to 100 kΩ) 	Most SMD packages available				
Wirewound	WSC, WSN, WSZSR (1 W to 5 W radial leads)	2515 to 7532 packaging (inch)				
Power Metal Strip®	 WSH WSK WSL WSL high power WSLP 	2818 0612, 2512 0603, 0805, 1020, 1206, 2010, 2512, 2816, 3921, 5931, 2726, 4026, 3637 WSLxxxx18's 0603, 0805, 1206, 2010, 2512, 3921, 5931, 2726, 4026				
	 WSLS WSLT WSMS WSR 	2512 201018, 2512, 3921, 5931, 2726, 4026 2908 4527 (2, 3 and 5 [high power])				
Thick Film Power	 D2TO020 and D2TO035 : SMD power resistor 20 W and 35 W at 25 °C Wide resistive range from .01 Ω to 550 kΩ Non-inductive LTO100: Power resistor 100 W at 25 °C Wide resistive range from 0.15 Ω to 1 MΩ Non-inductive 	D²РАК / TO-263 TO-247				

*Flame Retardance testing might not be applicable to all resistor technologies. Contact Vishay Sales or Product Marketing for additional information.