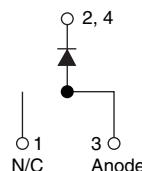


## Hyperfast Rectifier, 5 A FRED Pt®



D-PAK (TO-252AA)



### FEATURES

- Hyperfast recovery time, extremely low  $Q_{rr}$
- 175 °C maximum operating junction temperature
- For PFC CCM operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



RoHS  
COMPLIANT  
HALOGEN  
FREE

### DESCRIPTION/APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, hyperfast recovery time, and soft recovery.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in PFC boost stage in the AC/DC section of SMPS inverters or as freewheeling diodes. Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

PRODUCT SUMMARY	
Package	D-PAK (TO-252AA)
$I_{F(AV)}$	5 A
$V_R$	600 V
$V_F$ at $I_F$	2.9 V
$t_{rr}$ (typ.)	14 ns
$T_J$ max.	175 °C
Diode variation	Single die

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Peak repetitive reverse voltage	$V_{RRM}$			600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 144$ °C	5	A	
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25$ °C	50		
Peak repetitive forward current	$I_{FM}$	$T_C = 144$ °C, $f = 20$ kHz, $d = 50$ %	10		
Operating junction and storage temperatures	$T_J, T_{Stg}$			-65 to 175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25$ °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100$ µA	600	-	-	V
Forward voltage	$V_F$	$I_F = 5$ A	-	2.39	2.9	
		$I_F = 5$ A, $T_J = 150$ °C	-	1.55	1.8	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	20	µA
		$T_J = 150$ °C, $V_R = V_R$ rated	-	-	250	
Junction capacitance	$C_T$	$V_R = 600$ V	-	3.5	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8	-	nH

## VS-5EWX06FN-M3

Vishay Semiconductors Hyperfast Rectifier, 5 A FRED Pt®



DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1 \text{ A}, dI_F/dt = 100 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$	-	14	21	ns
		$I_F = 1 \text{ A}, dI_F/dt = 50 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$	-	16	-	
		$T_J = 25^\circ\text{C}$	-	18	-	
		$T_J = 125^\circ\text{C}$	-	27	-	
Peak recovery current	$I_{RRM}$	$T_J = 25^\circ\text{C}$	-	3.0	-	A
		$T_J = 125^\circ\text{C}$	-	3.9	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25^\circ\text{C}$	-	26	-	nC
		$T_J = 125^\circ\text{C}$	-	54	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-65	-	175	°C
Thermal resistance, junction to case per leg	$R_{thJC}$		-	-	3	°C/W
Approximate weight			0.3			g
			0.01			oz.
Marking device		Case style D-PAK (TO-252AA)	5EWX06FN			

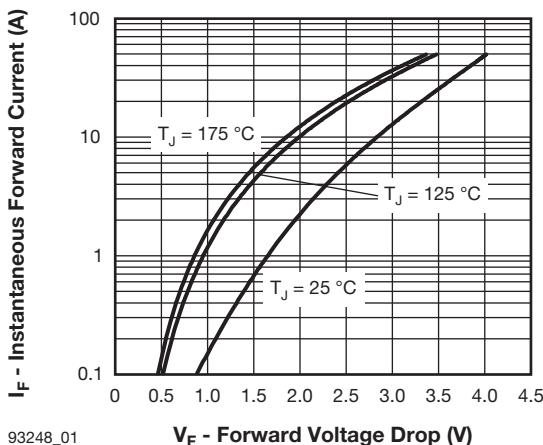


Fig. 1 - Typical Forward Voltage Drop Characteristics

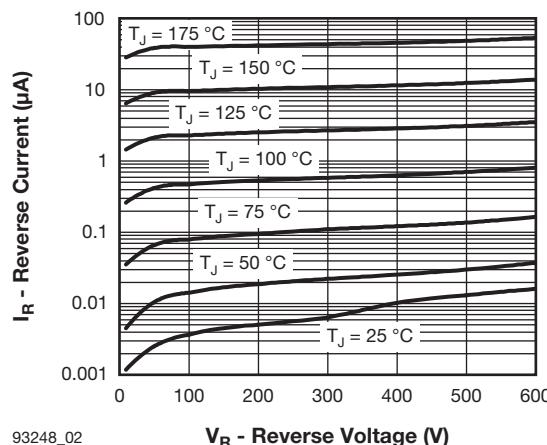


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

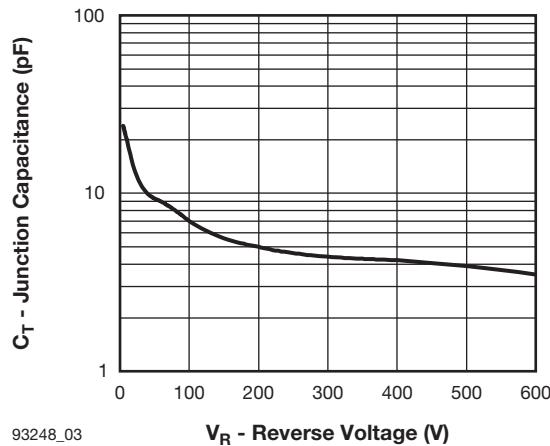
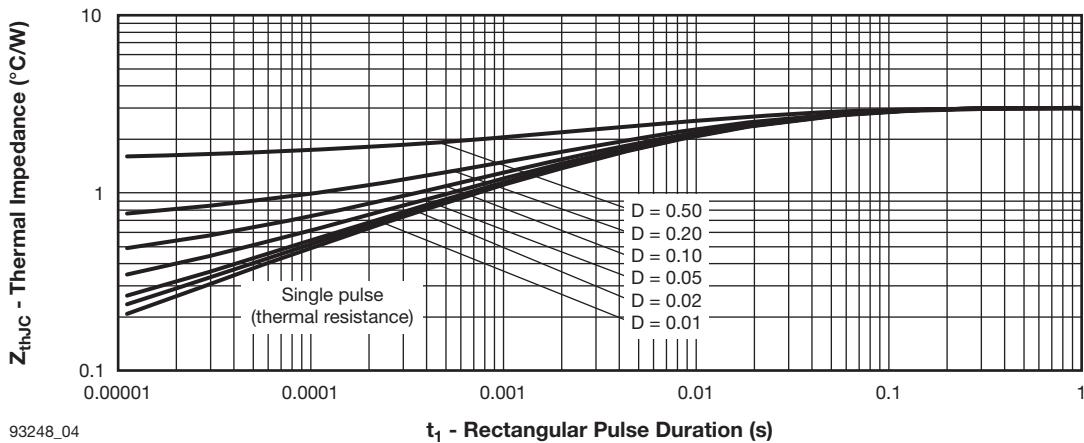


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

Fig. 4 - Maximum Thermal Impedance Z<sub>thJC</sub> Characteristics

## VS-5EWX06FN-M3

Vishay Semiconductors Hyperfast Rectifier, 5 A FRED Pt®

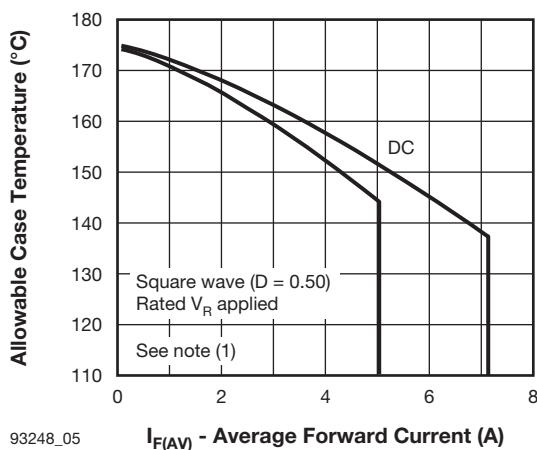
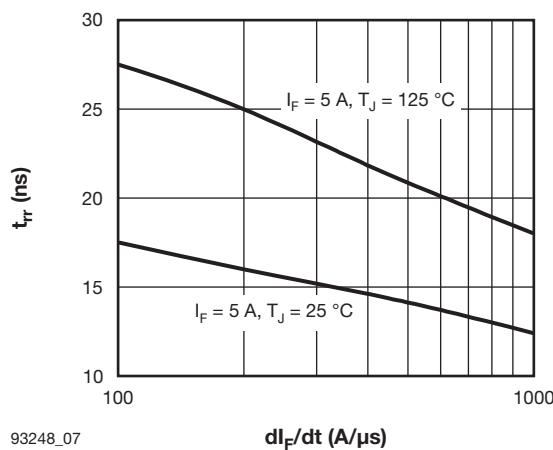
93248\_05  **$I_{F(AV)}$  - Average Forward Current (A)**

Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current



93248\_07

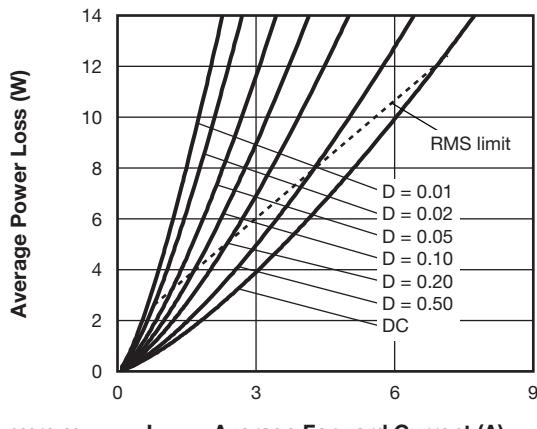
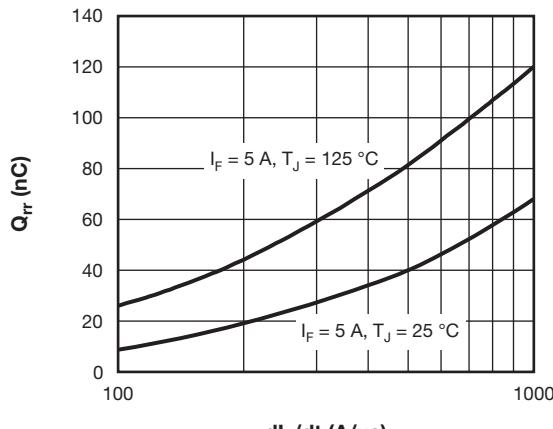
Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 93248\_06  **$I_{F(AV)}$  - Average Forward Current (A)**

Fig. 6 - Forward Power Loss Characteristics



93248\_08

Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$ **Note**

(1) Formula used:  $T_C = T_J - (P_d + P_{d,REV}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{d,REV}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = Rated  $V_R$

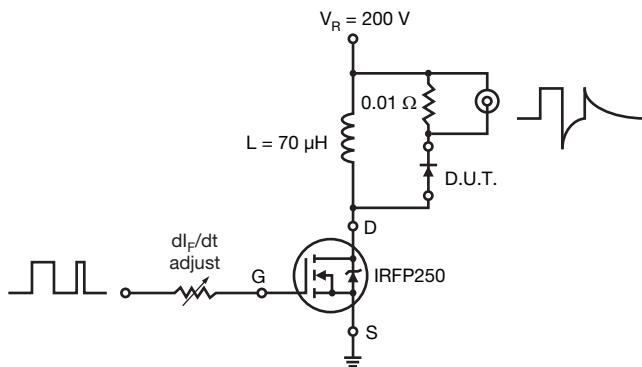
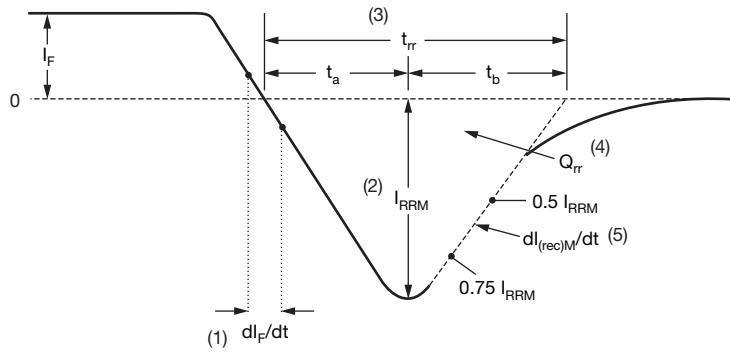


Fig. 9 - Reverse Recovery Parameter Test Circuit



(1)  $dl_F/dt$  - rate of change of current through zero crossing

(4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$

(2)  $I_{RRM}$  - peak reverse recovery current

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated to zero current.

(5)  $dl_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

Fig. 10 - Reverse Recovery Waveform and Definitions

**VS-5EWX06FN-M3**

Vishay Semiconductors Hyperfast Rectifier, 5 A FRED Pt®

**ORDERING INFORMATION TABLE**

Device code	VS-	5	E	W	X	06	FN	TRL	-M3
	1	2	3	4	5	6	7	8	9
<b>1</b> - Vishay Semiconductors product									
<b>2</b> - Current rating (5 = 5 A)									
<b>3</b> - Circuit configuration: E = Single diode									
<b>4</b> - Package identifier: W = D-PAK									
<b>5</b> - X = Hyperfast recovery time									
<b>6</b> - Voltage rating (06 = 600 V)									
<b>7</b> - FN = TO-252AA									
<b>8</b> - • None = Tube • TR = Tape and reel • TRL = Tape and reel (left oriented) • TRR = Tape and reel (right oriented)									
<b>9</b> - Environmental digit: -M3 = Halogen-free, RoHS compliant and terminations lead (Pb)-free									

**ORDERING INFORMATION** (Example)

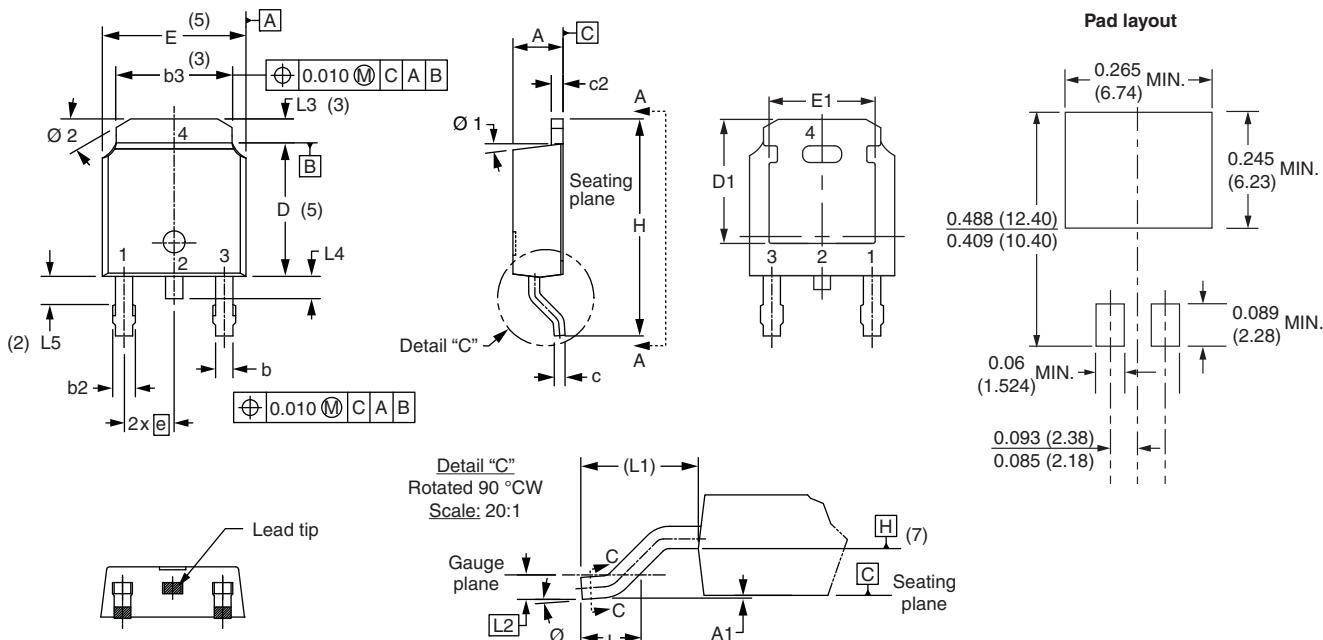
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-5EWX06FN-M3	75	3000	Antistatic plastic tube
VS-5EWX06FNTR-M3	2000	2000	13" diameter reel
VS-5EWX06FNTRL-M3	3000	3000	13" diameter reel
VS-5EWX06FNTRR-M3	3000	3000	13" diameter reel

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95016">www.vishay.com/doc?95016</a>
Part marking information	<a href="http://www.vishay.com/doc?95176">www.vishay.com/doc?95176</a>
Packaging information	<a href="http://www.vishay.com/doc?95033">www.vishay.com/doc?95033</a>
SPICE model	<a href="http://www.vishay.com/doc?95215">www.vishay.com/doc?95215</a>

## D-PAK (TO-252AA)

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	Detail "C" Rotated 90 °CW Scale: 20:1	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.				MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	0.094			e	2.29 BSC		0.090 BSC		
A1	-	0.13	-	0.005			H	9.40	10.41	0.370	0.410	
b	0.64	0.89	0.025	0.035			L	1.40	1.78	0.055	0.070	
b2	0.76	1.14	0.030	0.045			L1	2.74 BSC		0.108 REF.		
b3	4.95	5.46	0.195	0.215	3		L2	0.51 BSC		0.020 BSC		
c	0.46	0.61	0.018	0.024			L3	0.89	1.27	0.035	0.050	3
c2	0.46	0.89	0.018	0.035			L4	-	1.02	-	0.040	
D	5.97	6.22	0.235	0.245	5		L5	1.14	1.52	0.045	0.060	2
D1	5.21	-	0.205	-	3		Ø	0°	10°	0°	10°	
E	6.35	6.73	0.250	0.265	5		Ø1	0°	15°	0°	15°	
E1	4.32	-	0.170	-	3		Ø2	25°		35°		

### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension uncontrolled in L5
- (3) Dimension D1, E1, L3 and b3 establish a minimum mounting surface for thermal pad
- (4) Section C - C dimension apply to the flat section of the lead between 0.13 and 0.25 mm (0.005 and 0.010") from the lead tip
- (5) Dimension D, and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (6) Dimension b1 and c1 applied to base metal only
- (7) Datum A and B to be determined at datum plane H
- (8) Outline conforms to JEDEC outline TO-252AA

## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Vishay](#):

[VS-5EWX06FNTR-M3](#)