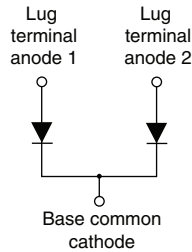


## HEXFRED® Ultrafast Soft Recovery Diode, 167 A


**TO-244**

**FEATURES**

- Very low  $Q_{rr}$  and  $t_{rr}$
- UL approved file E222165
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**BENEFITS**

- Reduced RFI and EMI
- Reduced snubbing

**DESCRIPTION**

HEXFRED® diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. An extensive characterization of the recovery behavior for different values of current, temperature and  $di_F/dt$  simplifies the calculations of losses in the operating conditions. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for power converters, motors drives and other applications where switching losses are significant portion of the total losses.

PRODUCT SUMMARY	
$I_F$ (maximum)	167 A
$V_R$	600 V
$I_{F(DC)}$ at $T_C$	84 A at 100 °C
Package	TO-244
Circuit	Two diodes common cathode

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		600	V
Continuous forward current	$I_F$	$T_C = 25\text{ °C}$	167	A
		$T_C = 100\text{ °C}$	84	
Single pulse forward current	$I_{FSM}$	Limited by junction temperature	400	
Non-repetitive avalanche energy	$E_{AS}$	$L = 100\ \mu\text{H}$ , duty cycle limited by maximum $T_J$	330	$\mu\text{J}$
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	310	W
		$T_C = 100\text{ °C}$	132	
Operating junction and storage temperature range	$T_J, T_{Stg}$		-55 to +150	°C

ELECTRICAL SPECIFICATIONS PER LEG ( $T_J = 25\text{ °C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	$V_{BR}$	$I_R = 100\ \mu\text{A}$	600	-	-	V
Maximum forward voltage	$V_{FM}$	$I_F = 70\text{ A}$	-	1.37	1.89	
		$I_F = 140\text{ A}$	-	1.58	2.1	
		$I_F = 70\text{ A}, T_J = 125\text{ °C}$	-	1.29	1.54	
Maximum reverse leakage current	$I_{RM}$	$T_J = 125\text{ °C}, V_R = 480\text{ V}$	See fig. 2	1.2	4	mA
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	See fig. 3	140	250	pF
Series inductance	$L_S$	From top of terminal hole to mounting plane	-	7.0	-	nH

<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time (fig. 5)	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 200\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$		-	33	-	ns
		$T_J = 25\text{ }^\circ\text{C}$		-	80	120	
		$T_J = 125\text{ }^\circ\text{C}$		-	140	220	
Peak recovery current (fig. 6)	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$		-	8.5	15	A
		$T_J = 125\text{ }^\circ\text{C}$		-	14	25	
Reverse recovery charge (fig. 7)	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$		-	340	900	nC
		$T_J = 125\text{ }^\circ\text{C}$		-	980	2300	
Peak rate of recovery current (fig. 8)	$di_{(rec)M}/dt$	$T_J = 25\text{ }^\circ\text{C}$		-	300	-	A/ $\mu\text{s}$
		$T_J = 125\text{ }^\circ\text{C}$		-	220	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	
Maximum junction and storage temperature range		-55	-	150	$^\circ\text{C}$	
Thermal resistance, junction to case	per leg	$T_J, T_{Stg}$	-	0.38	$^\circ\text{C}/\text{W}$ K/W	
	per module		-	0.19		
Typical thermal resistance, case to heatsink	$R_{thCS}$		0.10	-		
Weight		-	68	-	g	
		-	2.4	-	oz.	
Mounting torque <sup>(1)</sup>		30 (3.4)	-	40 (4.6)	N · m (lbf · in)	
Mounting torque center hole		12 (1.4)	-	18 (2.1)		
Terminal torque		30 (3.4)	-	40 (4.6)		
Vertical pull		-	-	80	lbf · in	
2" lever pull		-	-	35		

**Note**

- (1) Mounting surface must be smooth, flat, free of burrs or other protrusions. Apply a thin even film of thermal grease to mounting surface. Gradually tighten each mounting bolt in 5 - 10 lbf · in steps until desired or maximum torque limits are reached

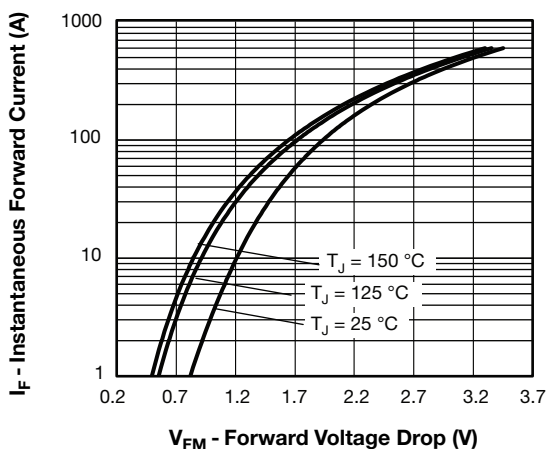


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

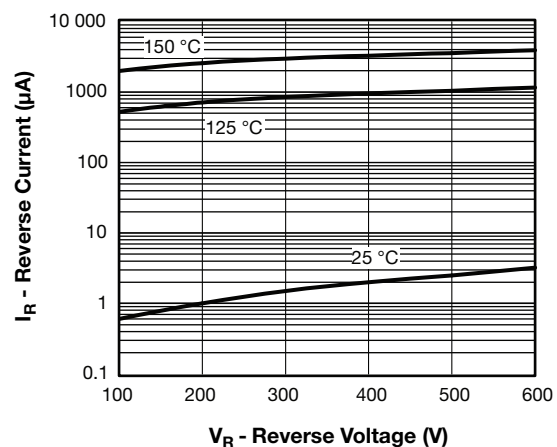


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

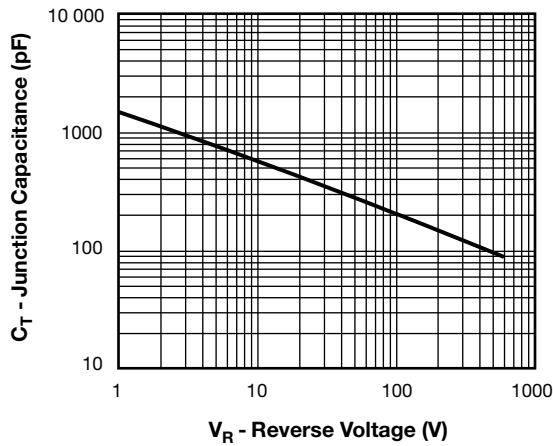


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

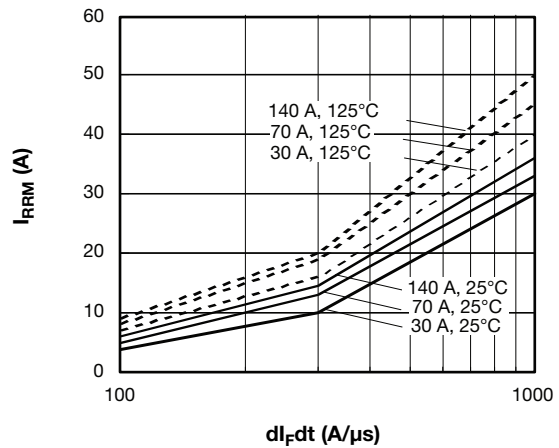


Fig. 6 - Typical Recovery Current vs.  $dI_F/dt$  (Per Leg)

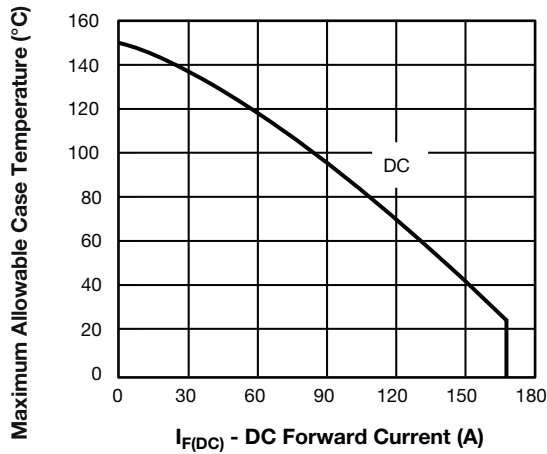


Fig. 4 - Maximum Allowable Case Temperature vs. DC Forward Current (Per Leg)

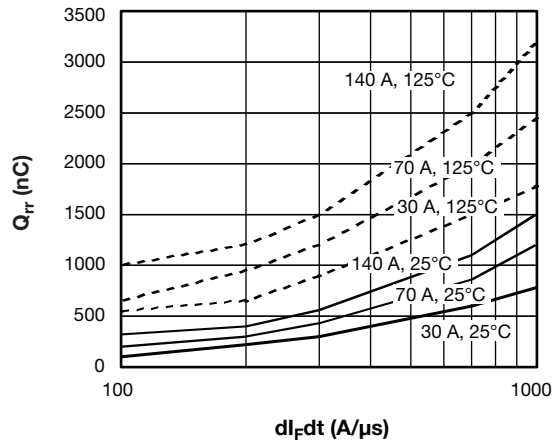


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$  (Per Leg)

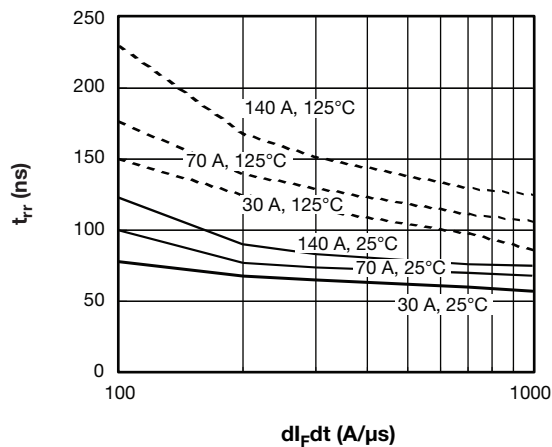


Fig. 5 - Typical Reverse Recovery Time vs.  $dI_F/dt$  (Per Leg)

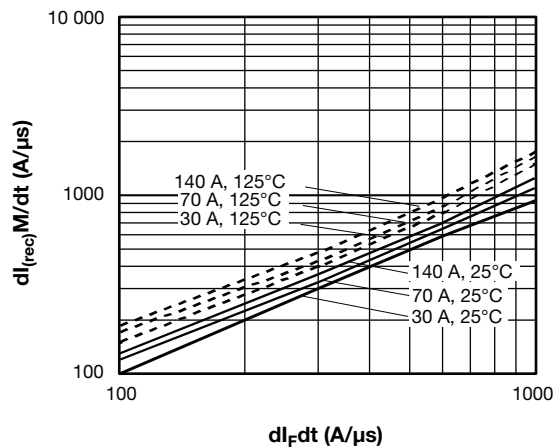


Fig. 8 - Typical  $dI_{(rec)M}/dt$  vs.  $dI_F/dt$  (Per Leg)

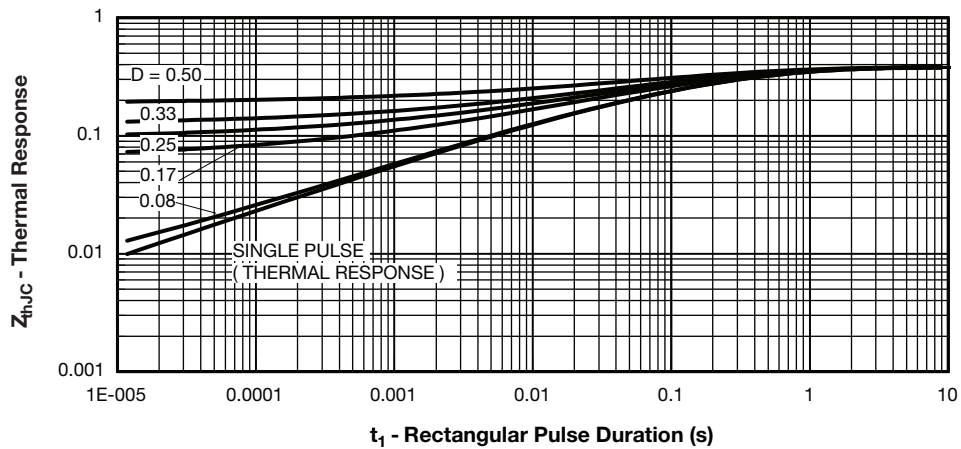


Fig. 9 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

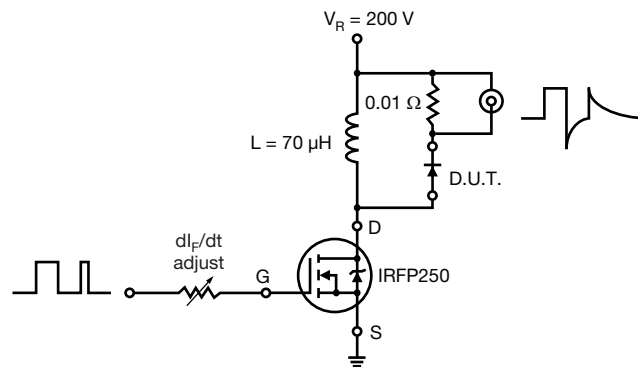
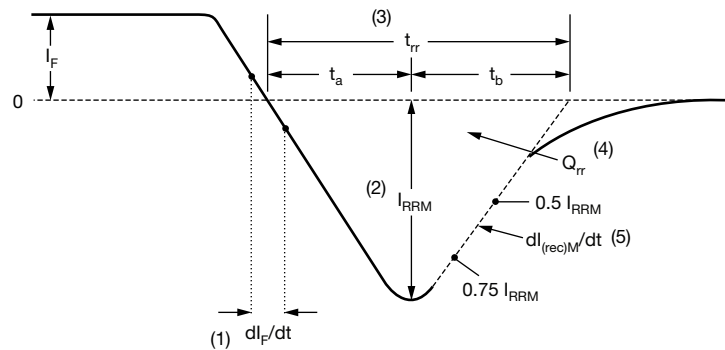


Fig. 10 - Reverse Recovery Parameter Test Circuit



- (1)  $dI_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (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.
- (4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$
- (5)  $dI_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

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

Fig. 11 - Reverse Recovery Waveform and Definitions

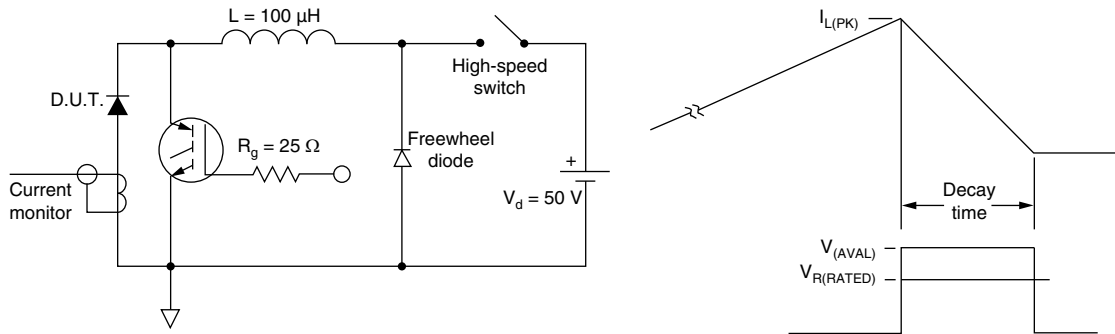


Fig. 12 - Avalanche Test Circuit and Waveforms

## ORDERING INFORMATION TABLE

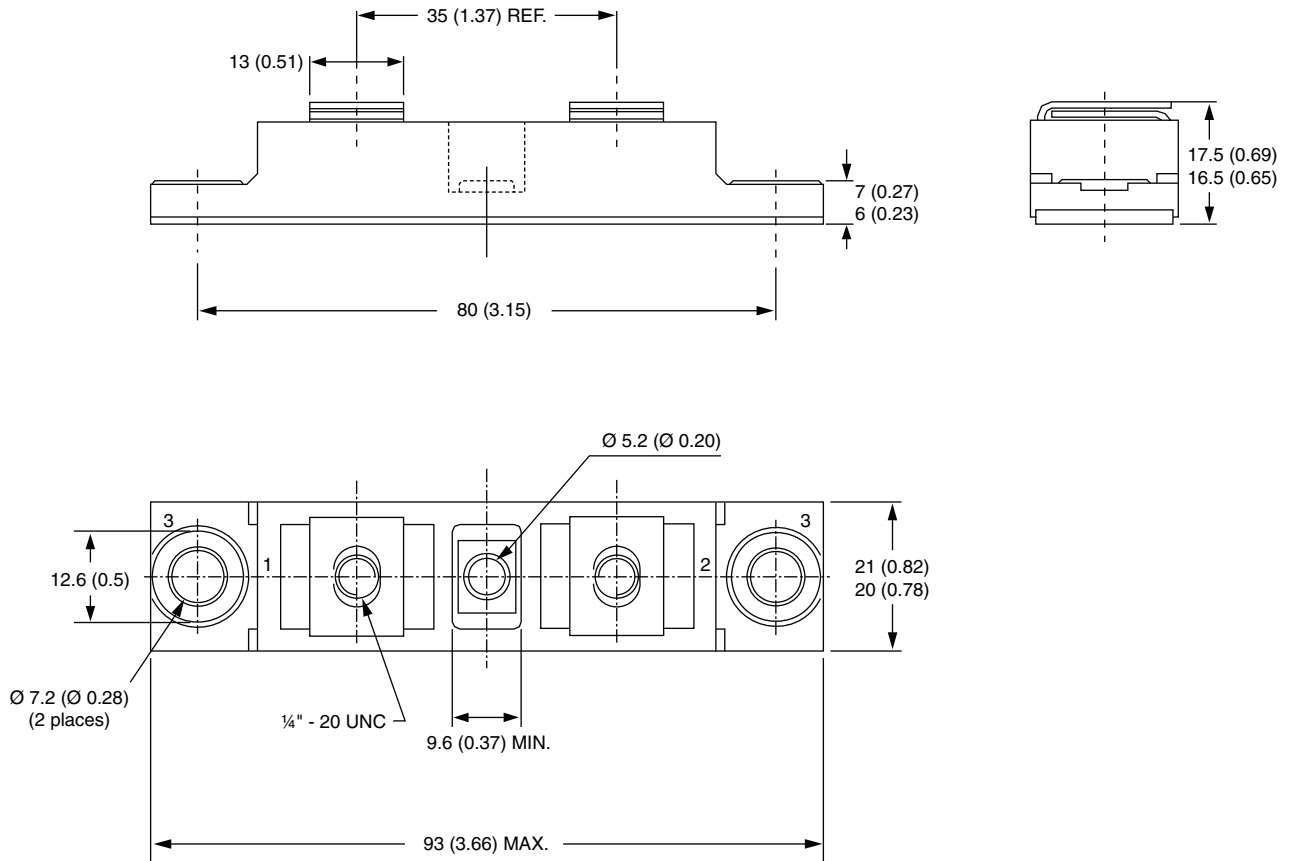
Device code	<b>VS-</b>	<b>HFA</b>	<b>140</b>	<b>NJ</b>	<b>60</b>	<b>C</b>	<b>PbF</b>		
	①	②	③	④	⑤	⑥	⑦		
	<b>1</b>	-	Vishay Semiconductors product	<b>2</b>	-	HEXFRED® family	<b>3</b>	-	Average current rating
	<b>4</b>	-	NJ = TO-244	<b>5</b>	-	Voltage rating (600 V)	<b>6</b>	-	C = Common cathode
	<b>7</b>	-	Lead (Pb)-free						

### LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?95021">www.vishay.com/doc?95021</a>
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# TO-244

**DIMENSIONS** in millimeters (inches)





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