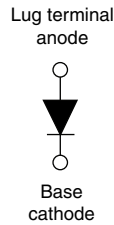


# HEXFRED®

## Ultrafast Soft Recovery Diode, 210 A


**HALF-PAK (D-67)**

**FEATURES**

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


**RoHS**  
COMPLIANT

**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.

PRIMARY CHARACTERISTICS	
$I_F$ (maximum)	210 A
$V_R$	400 V
$I_{F(DC)}$ at $T_C$	106 A at 100 °C
Package	HALF-PAK (D-67)
Circuit configuration	Single diode

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		400	V
Continuous forward current	$I_F$	$T_C = 25\text{ °C}$	210	A
		$T_C = 100\text{ °C}$	106	
Single pulse forward current	$I_{FSM}$	Limited by junction temperature	600	
Non-repetitive avalanche energy	$E_{AS}$	$L = 100\ \mu\text{H}$ , duty cycle limited by maximum $T_J$	1.4	mJ
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	329	W
		$T_C = 100\text{ °C}$	132	
Operating junction and storage temperature range	$T_J, T_{Stg}$		-55 to +150	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	$V_{BR}$	$I_R = 100\ \mu\text{A}$	400	-	-	V
Maximum forward voltage	$V_{FM}$	$I_F = 90\text{ A}$	-	1.06	1.45	
		$I_F = 180\text{ A}$	-	1.2	1.67	
		$I_F = 90\text{ A}, T_J = 125\text{ °C}$	-	0.96	1.23	
Maximum reverse leakage current	$I_{RM}$	$T_J = 125\text{ °C}, V_R = 400\text{ V}$	See fig. 2	0.6	2	mA
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	See fig. 3	180	260	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 See fig. 5	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 90\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	90	140	ns
		$T_J = 125\text{ }^\circ\text{C}$		-	158	240	
Peak recovery current See fig. 6	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$		-	9	17	A
		$T_J = 125\text{ }^\circ\text{C}$		-	15	30	
Reverse recovery charge See fig. 7	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$		-	420	1100	nC
		$T_J = 125\text{ }^\circ\text{C}$		-	1200	3200	
Peak rate of recovery current See fig. 8	$di_{(rec)M}/dt$	$T_J = 25\text{ }^\circ\text{C}$	-	370	-	$\text{A}/\mu\text{s}$	
		$T_J = 125\text{ }^\circ\text{C}$	-	270	-		

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-55 to 150	$^\circ\text{C}$
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation See fig. 4	0.38	$^\circ\text{C}/\text{W}$
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth, and greased	0.05	
Approximate weight			30	g
			1.06	oz.
Mounting torque	minimum	Non-lubricated threads	3 (26.5)	N · m (lb · in)
	maximum		4 (35.4)	
Terminal torque	minimum	3.4 (30)		
	maximum	5 (44.2)		
Case style		HALF-PAK (D-67)		

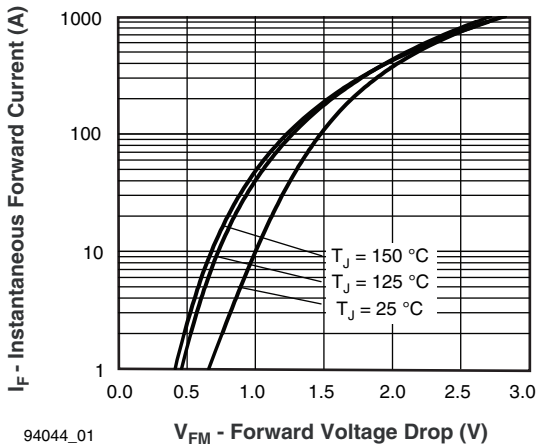


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

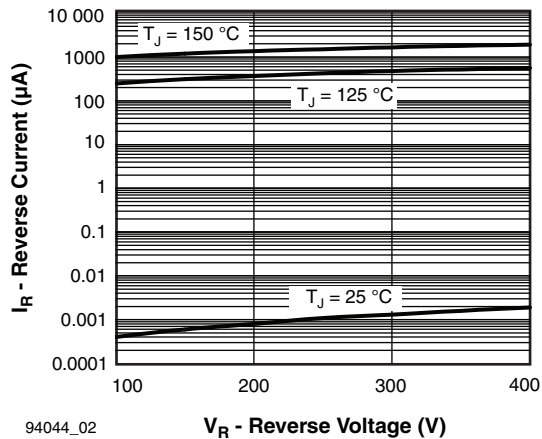


Fig. 2 - Typical Reverse Current vs. Reverse Voltage

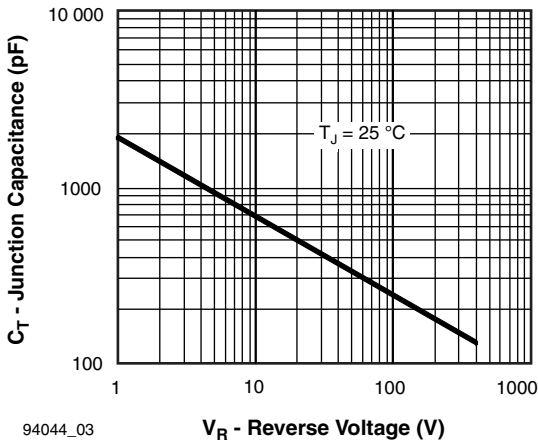


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

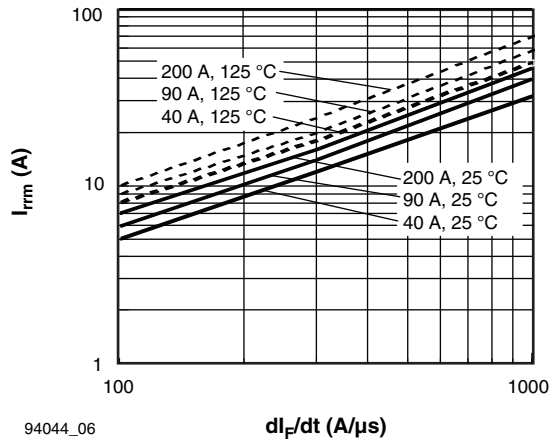


Fig. 6 - Typical Recovery Current vs.  $dI_F/dt$

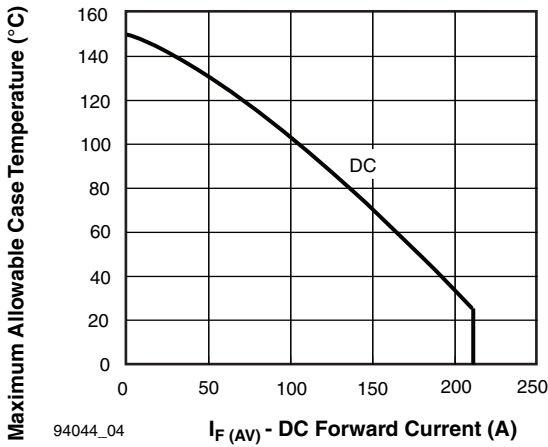


Fig. 4 - Maximum Allowable Case Temperature vs. DC Forward Current

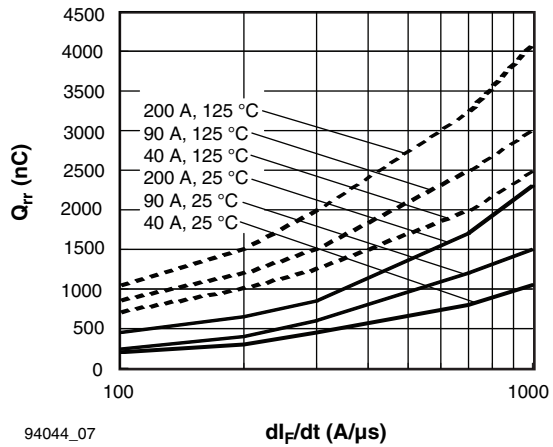


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$

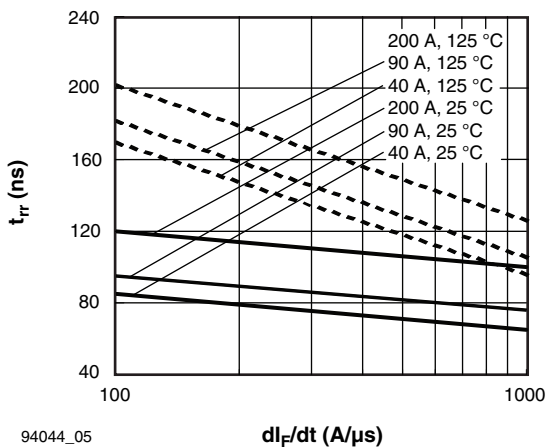


Fig. 5 - Typical Reverse Recovery Time vs.  $dI_F/dt$

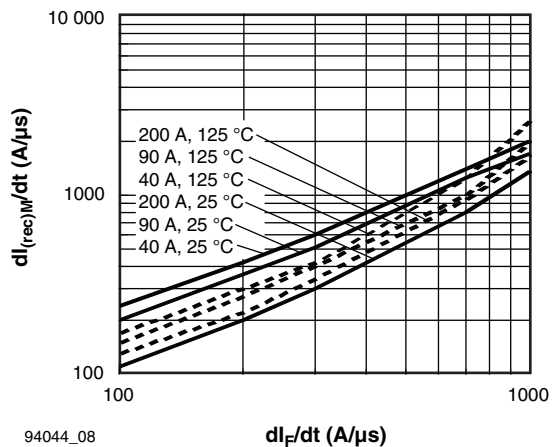


Fig. 8 - Typical  $dI_{(rec)M}/dt$  vs.  $dI_F/dt$

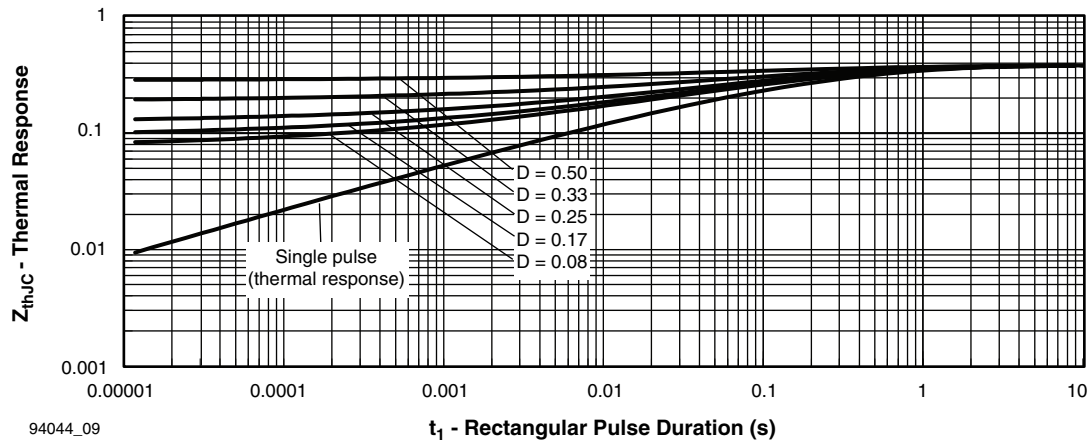


Fig. 9 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

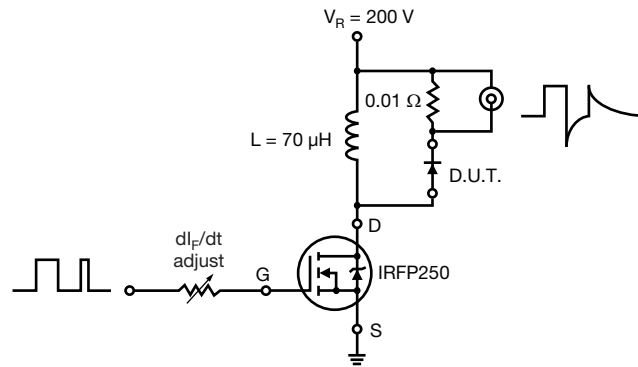
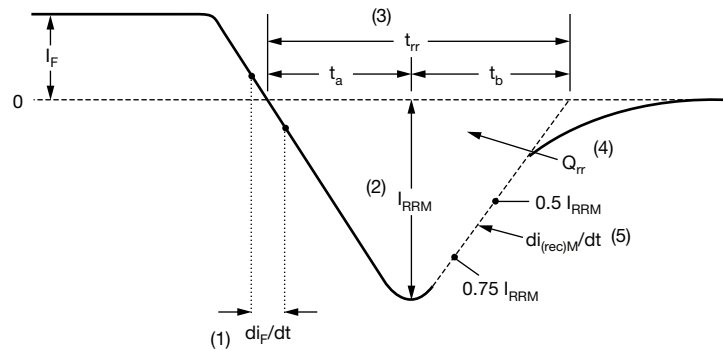


Fig. 10 - Reverse Recovery Parameter Test Circuit



- (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  $0.5 I_{RRM}$  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

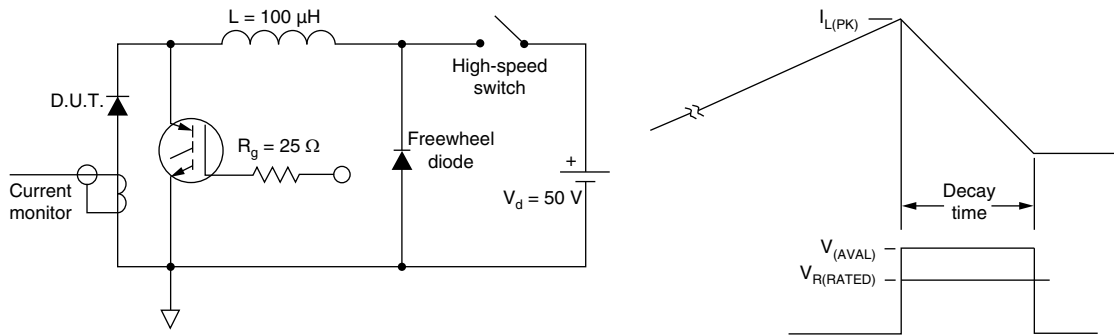


Fig. 12 - Avalanche Test Circuit and Waveforms

**ORDERING INFORMATION TABLE**

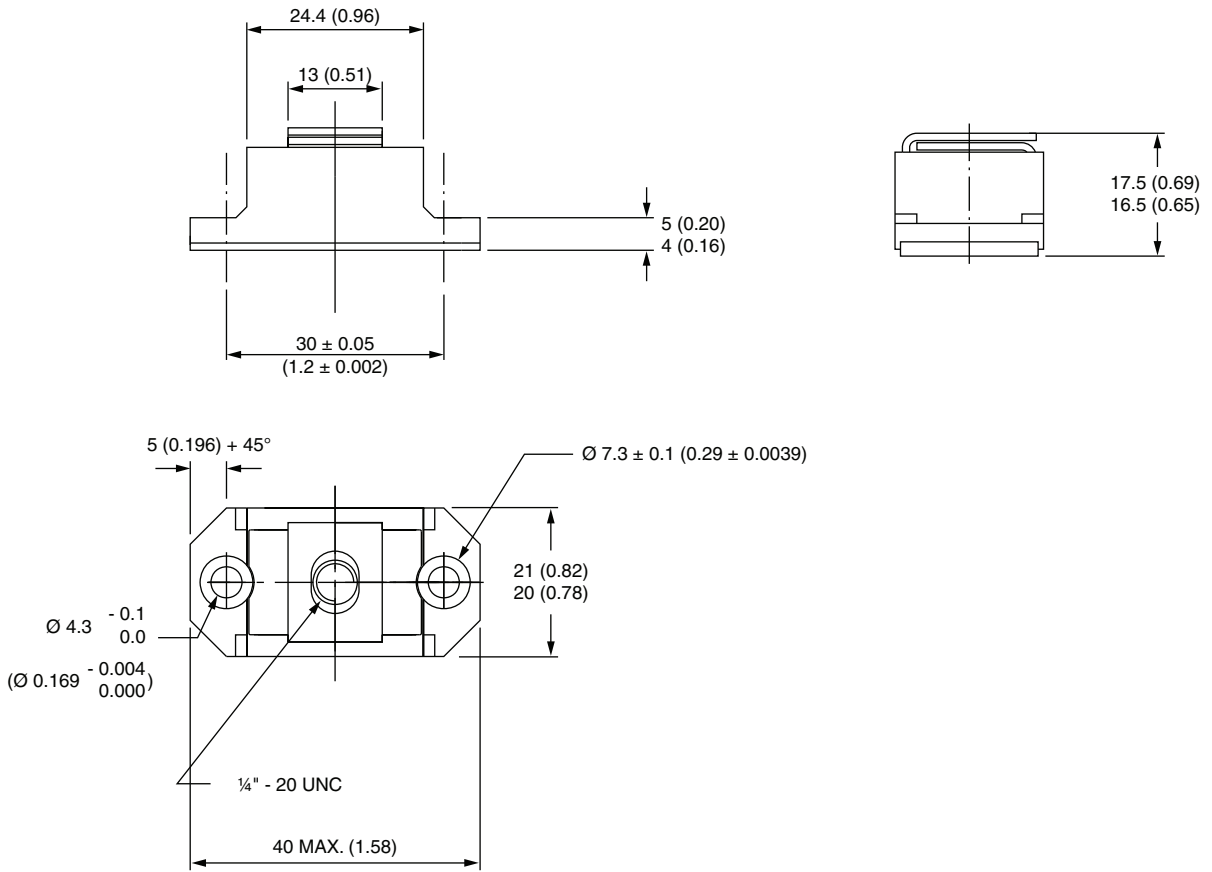
Device code	<b>VS-</b>	<b>HFA</b>	<b>90</b>	<b>N</b>	<b>H</b>	<b>40</b>	<b>PbF</b>
	①	②	③	④	⑤	⑥	⑦

- 1** - Vishay Semiconductors product
- 2** - HEXFRED® family
- 3** - Average current rating
- 4** - N = not isolated
- 5** - H = HALF-PAK (D-67)
- 6** - Voltage rating (400 V)
- 7** - Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95020">www.vishay.com/doc?95020</a>

## D-67 HALF-PAK

**DIMENSIONS** in millimeters (inches)





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