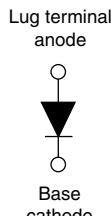


## HEXFRED®

### 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)

#### 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	$I_F$	$T_C = 25^\circ\text{C}$		210	A
		$T_C = 100^\circ\text{C}$		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	$P_D$	$T_C = 25^\circ\text{C}$		329	W
		$T_C = 100^\circ\text{C}$		132	
Operating junction and storage temperature range	$T_J$ , $T_{Stg}$			-55 to +150	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25^\circ\text{C}$ 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	
		$I_F = 180 \text{ A}$		See fig. 1	-	1.2	
		$I_F = 90 \text{ A}$ , $T_J = 125^\circ\text{C}$		See fig. 1	-	0.96	
Maximum reverse leakage current	$I_{RM}$	$T_J = 125^\circ\text{C}$ , $V_R = 400 \text{ V}$		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

DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time See fig. 5	$t_{rr}$	$T_J = 25^\circ\text{C}$	$I_F = 90\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	90	140	ns
		$T_J = 125^\circ\text{C}$		-	158	240	
Peak recovery current See fig. 6	$I_{RRM}$	$T_J = 25^\circ\text{C}$	$V_R = 200\text{ V}$	-	9	17	A
		$T_J = 125^\circ\text{C}$		-	15	30	
Reverse recovery charge See fig. 7	$Q_{rr}$	$T_J = 25^\circ\text{C}$	$V_R = 200\text{ V}$	-	420	1100	nC
		$T_J = 125^\circ\text{C}$		-	1200	3200	
Peak rate of recovery current See fig. 8	$dI_{(rec)M}/dt$	$T_J = 25^\circ\text{C}$	$V_R = 200\text{ V}$	-	370	-	$\text{A}/\mu\text{s}$
		$T_J = 125^\circ\text{C}$		-	270	-	

THERMAL - MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$			-55 to 150	°C
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation See fig. 4		0.38	°C/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 (lbf · in)
	maximum			4 (35.4)	
Terminal torque	minimum			3.4 (30)	
	maximum			5 (44.2)	
Case style		HALF-PAK (D-67)			

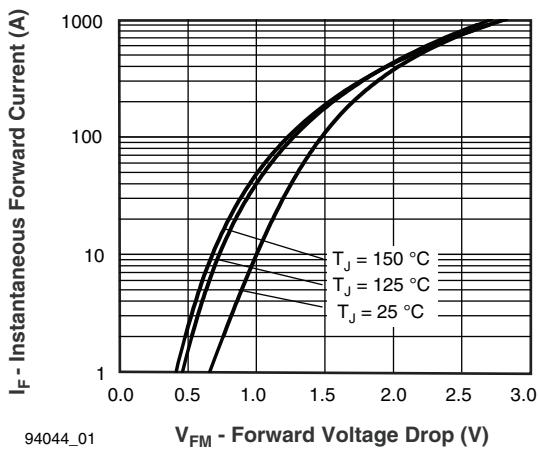


Fig. 1 - Maximum Forward Voltage Drop vs.  
Instantaneous Forward Current

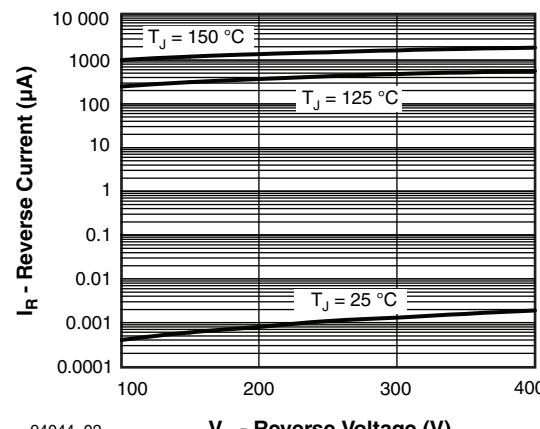
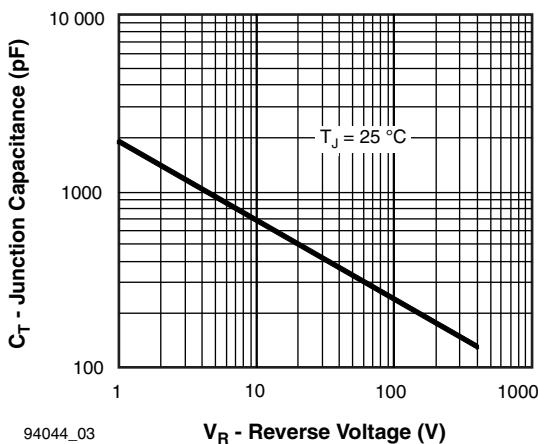
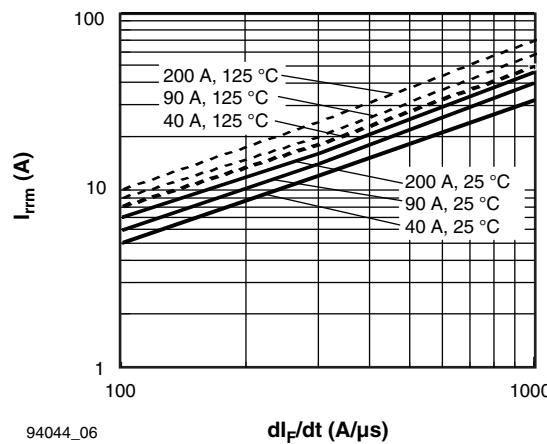


Fig. 2 - Typical Reverse Current vs. Reverse Voltage



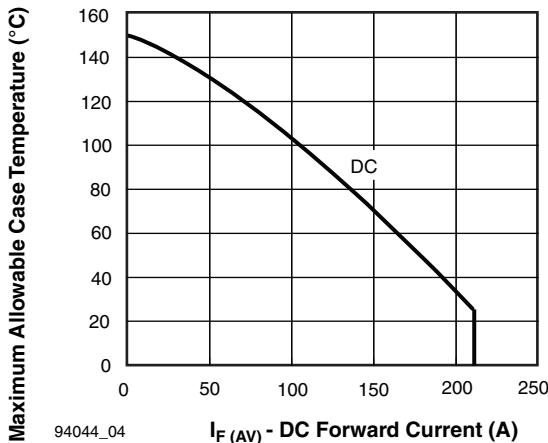
94044\_03      **V<sub>R</sub> - Reverse Voltage (V)**

Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage



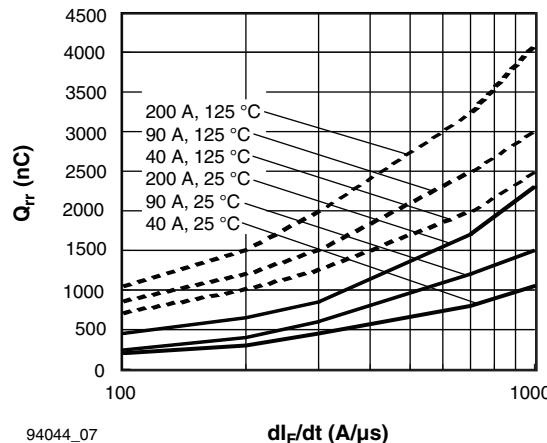
94044\_06      **dI<sub>F</sub>/dt (A/μs)**

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



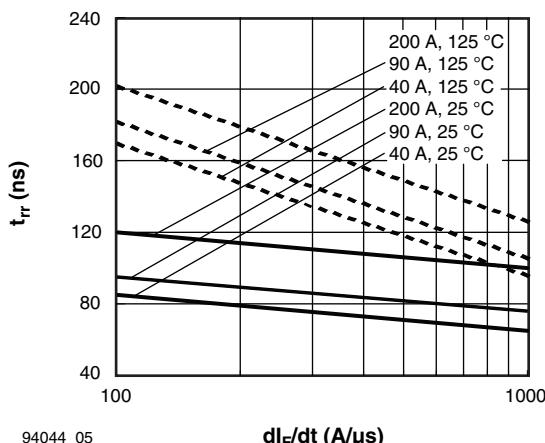
94044\_04      **I<sub>F(AV)</sub> - DC Forward Current (A)**

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



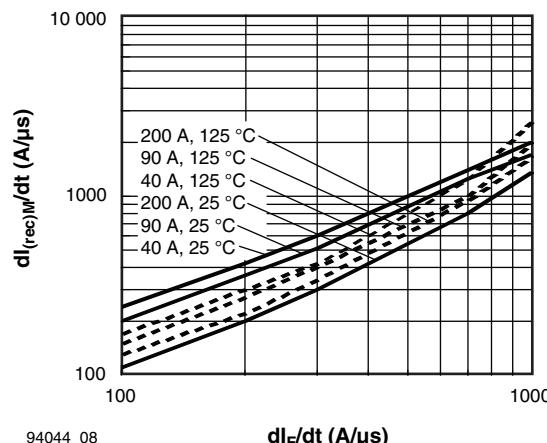
94044\_07      **dI<sub>F</sub>/dt (A/μs)**

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



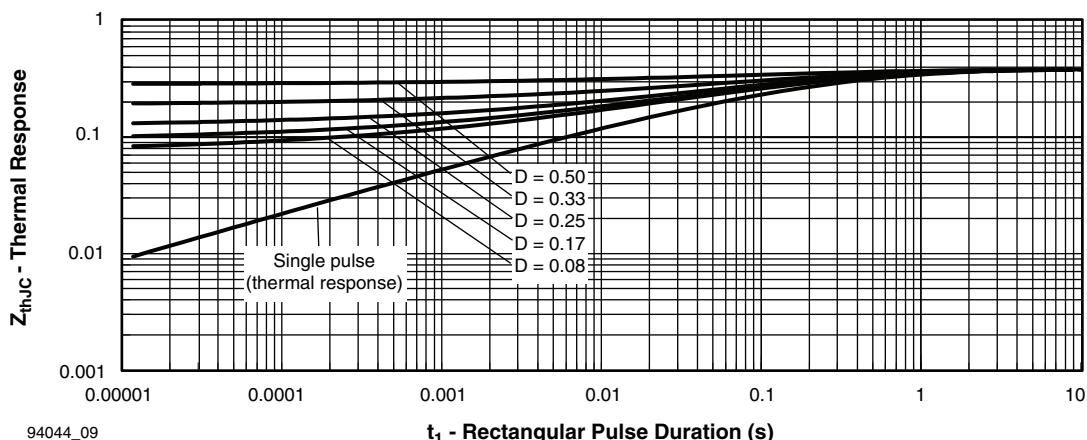
94044\_05      **dI<sub>F</sub>/dt (A/μs)**

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



94044\_08      **dI<sub>F</sub>/dt (A/μs)**

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



94044\_09

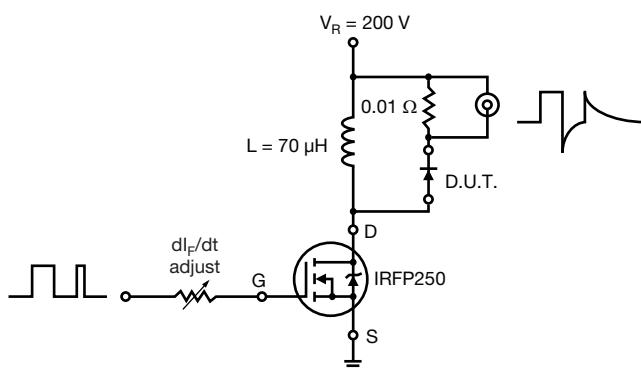
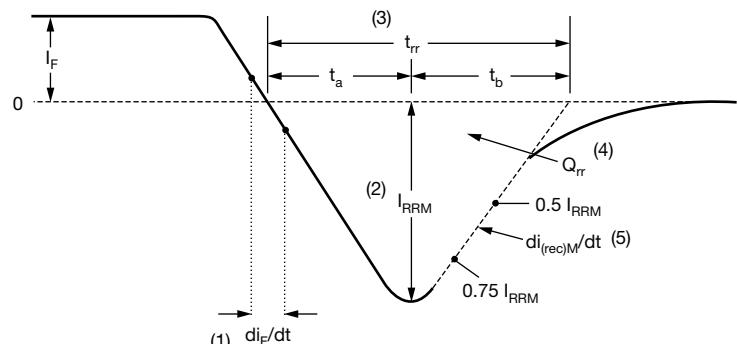
Fig. 9 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)


Fig. 10 - Reverse Recovery Parameter Test Circuit



(1)  $\text{di}_F/\text{dt}$  - 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)  $\text{di}_{(rec)M}/\text{dt}$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

Fig. 11 - Reverse Recovery Waveform and Definitions

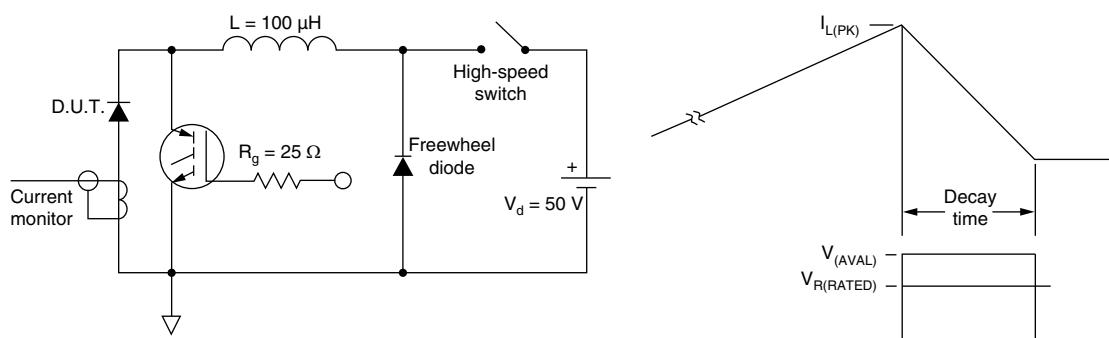


Fig. 12 - Avalanche Test Circuit and Waveforms

### ORDERING INFORMATION TABLE

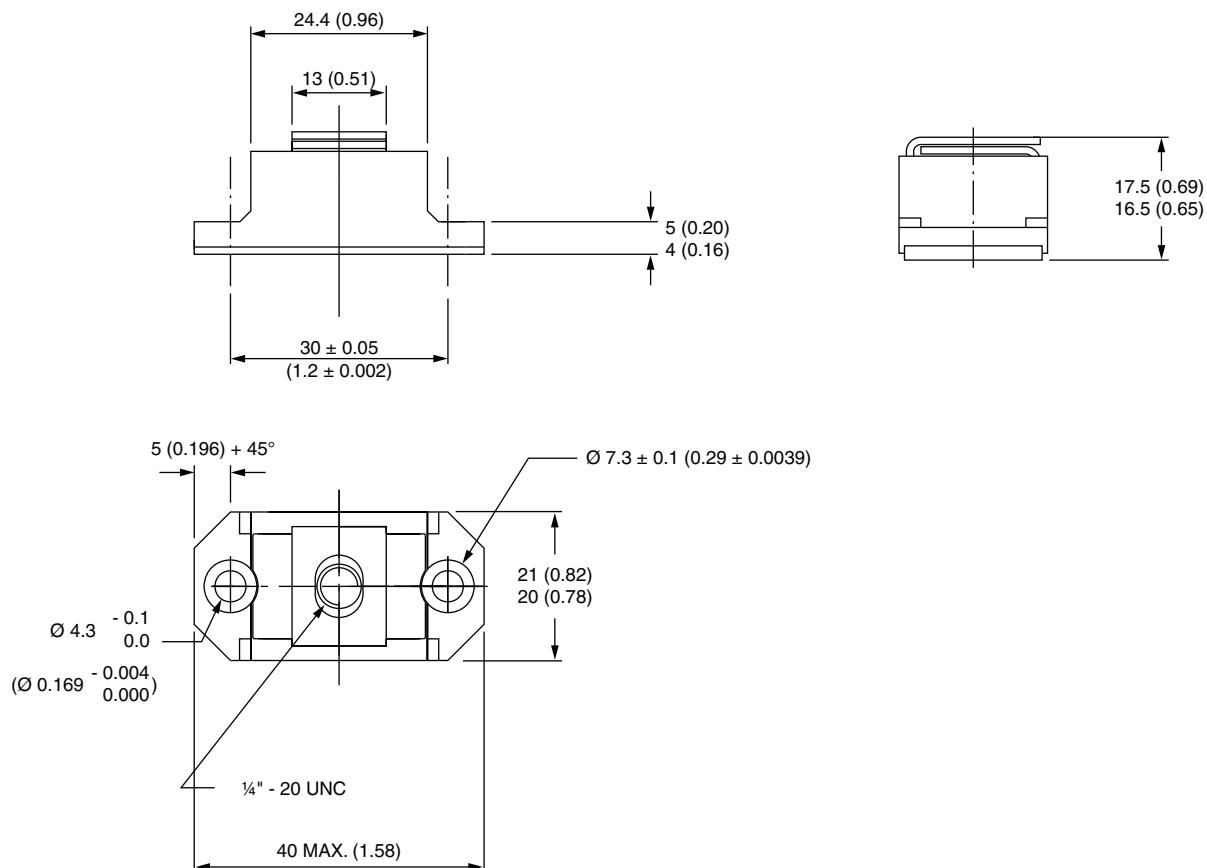
Device code	VS-	HFA	90	N	H	40	PbF
	1	2	3	4	5	6	7

- 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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