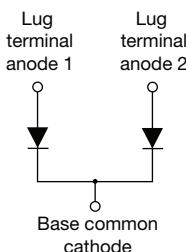


HEXFRED®

Ultrafast Soft Recovery Diode, 320 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



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	
$I_{F(AV)}$	320 A
V_R	400 V
$I_{F(DC)}$ at T_C	255 A at 85 °C
Package	TO-244 (TO-244AB)
Circuit	Two diodes common cathode

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS	
Cathode to anode voltage	V_R			400	V
Continuous forward current	I_F	$T_C = 25^\circ\text{C}$	420	A	
		$T_C = 85^\circ\text{C}$	255		
		$T_C = 115^\circ\text{C}$	160		
Single pulse forward current	I_{FSM}	Limited by junction temperature	1200		
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	$T_C = 25^\circ\text{C}$	625	W	
		$T_C = 100^\circ\text{C}$	250		
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}	$I_F = 160 \text{ A}$	See fig. 1	-	1.10	1.35	
		$I_F = 320 \text{ A}$		-	1.30	1.54	
		$I_F = 160 \text{ A}, T_J = 125^\circ\text{C}$		-	1.00	1.20	
Maximum reverse leakage current	I_{RM}	$T_J = 125^\circ\text{C}, V_R = 400 \text{ V}$	See fig. 2	-	0.9	3	mA
Junction capacitance	C_T	$V_R = 200 \text{ V}$	See fig. 3	-	370	500	pF
Series inductance	L_S	From top of terminal hole to mounting plane	-	5.0	-	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}	$I_F = 1.0 \text{ A}$, $dI_F/dt = 200 \text{ A}/\mu\text{s}$, $V_R = 30 \text{ V}$		-	45	-	ns
		$T_J = 25^\circ\text{C}$		-	90	140	
		$T_J = 125^\circ\text{C}$		-	290	440	
Peak recovery current See fig. 6	I_{RRM}	$T_J = 25^\circ\text{C}$		-	8.7	20	A
		$T_J = 125^\circ\text{C}$		-	18	30	
Reverse recovery charge See fig. 7	Q_{rr}	$T_J = 25^\circ\text{C}$		-	420	1100	nC
		$T_J = 125^\circ\text{C}$		-	2600	7000	
Peak rate of recovery current See fig. 8	$dI_{(rec)M}/dt$	$T_J = 25^\circ\text{C}$		-	300	-	$\text{A}/\mu\text{s}$
		$T_J = 125^\circ\text{C}$		-	280	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	
Maximum junction and storage temperature range	T_J, T_{Stg}	-55	-	150	°C	
Thermal resistance, junction to case	R_{thJC}	-	-	0.19	°C/W	
		-	-	0.095		
Typical thermal resistance, case to heatsink	R_{thCS}	-	0.10	-	K/W	
Weight		-	68	-	g	
		-	2.4	-	oz.	
Mounting torque ⁽¹⁾	center hole	30 (3.4)	-	40 (4.6)	N · m (lbf · in)	
		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 or thermal grease to mounting surface. Gradually tighten each mounting bolt in 5 to 10 lbf · in steps until desired or maximum torque limits are reached.

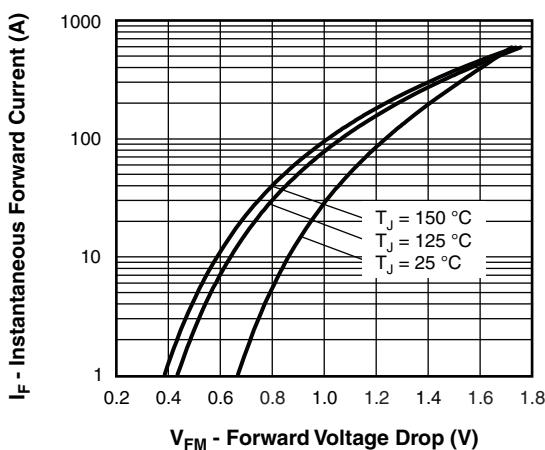


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

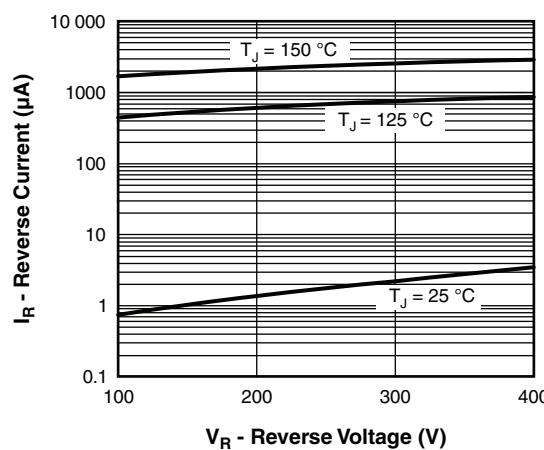


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

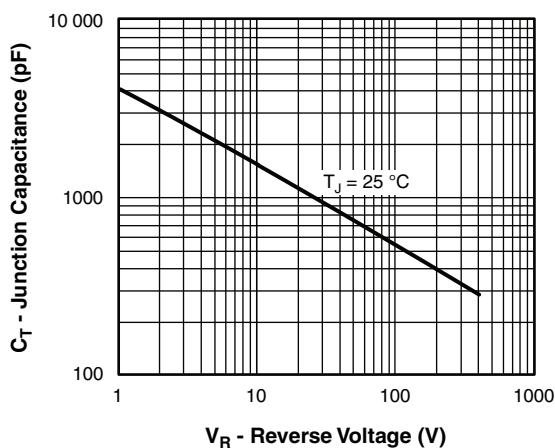


Fig. 3 - Typical Junction Capacitance vs.
Reverse Voltage (Per Leg)

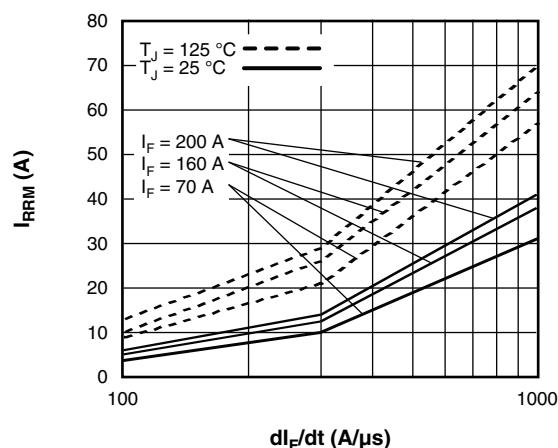


Fig. 6 - Typical Recovery Current vs. dI_F/dt (Per Leg)

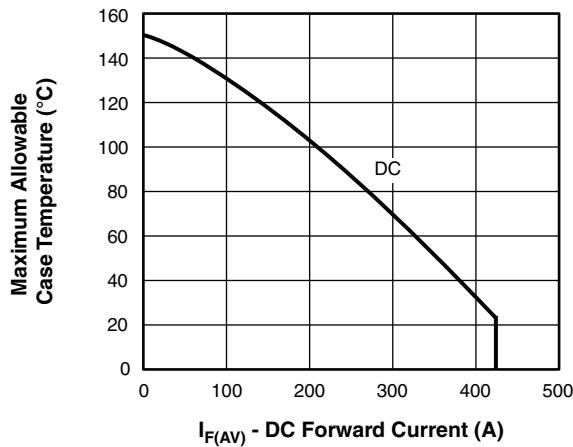


Fig. 4 - Maximum Allowable Case Temperature vs.
DC Forward Current (Per Leg)

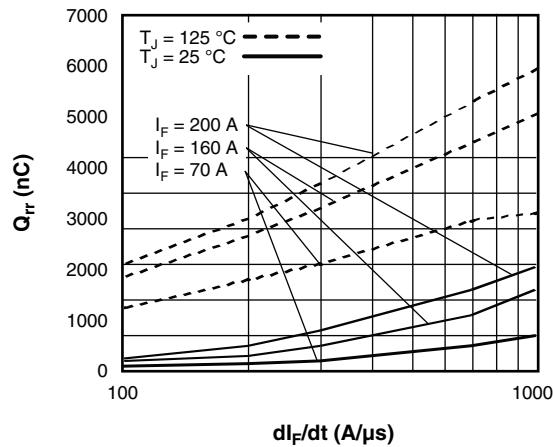


Fig. 7 - Typical Stored Charge vs. dI_F/dt (Per Leg)

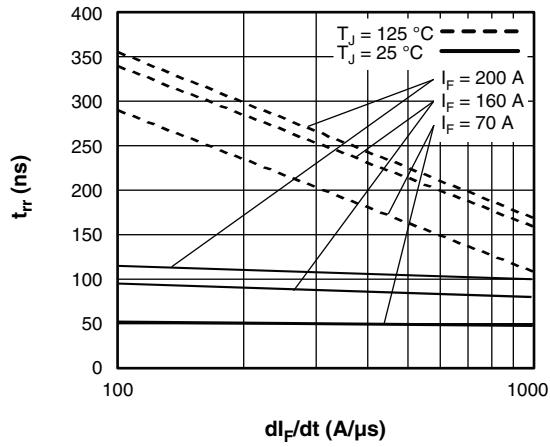


Fig. 5 - Typical Reverse Recovery Time vs. dI_F/dt (Per Leg)

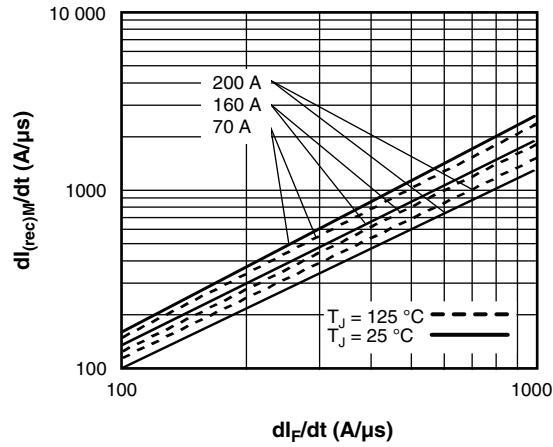


Fig. 8 - Typical $dI_{(\text{rec})M}/dt$ vs. dI_F/dt (Per Leg)

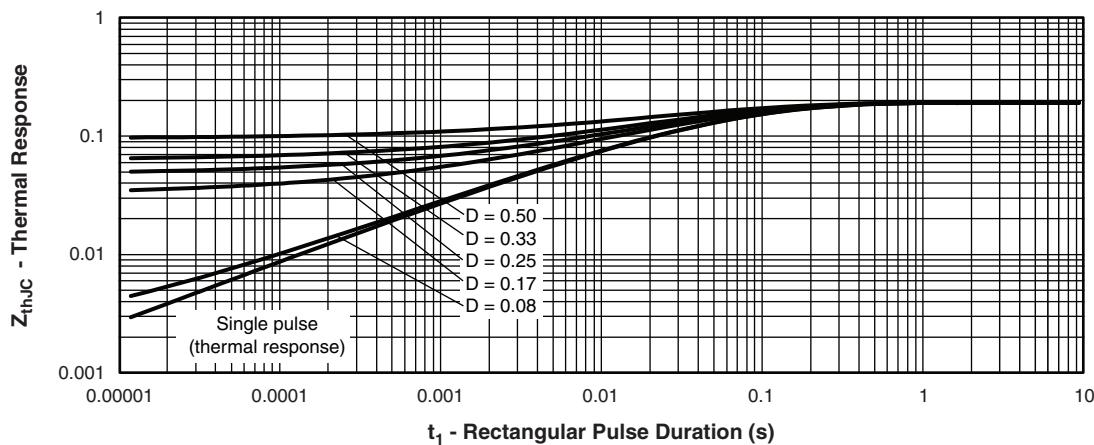


Fig. 9 - Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

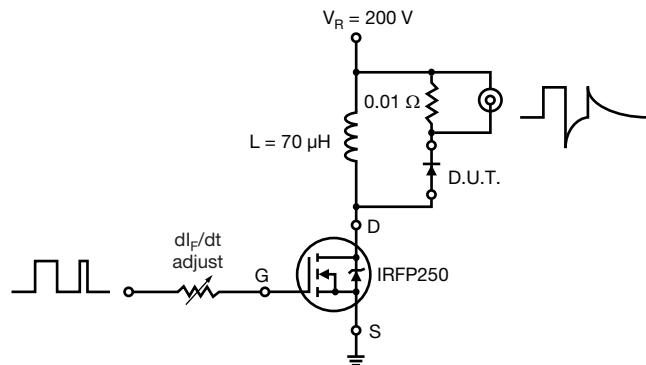
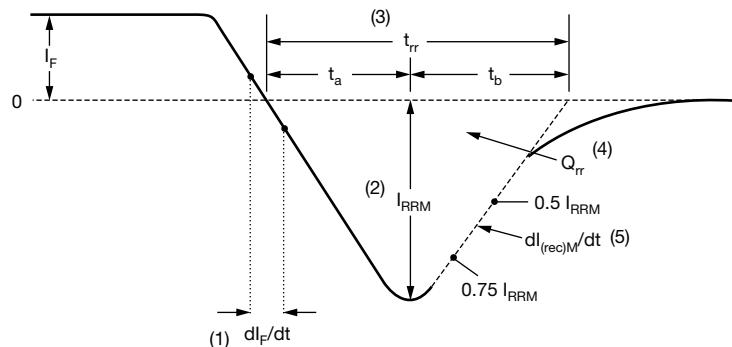


Fig. 10 - Reverse Recovery Parameter Test Circuit



(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}

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

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

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

(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.

Fig. 11 - Reverse Recovery Waveform and Definitions

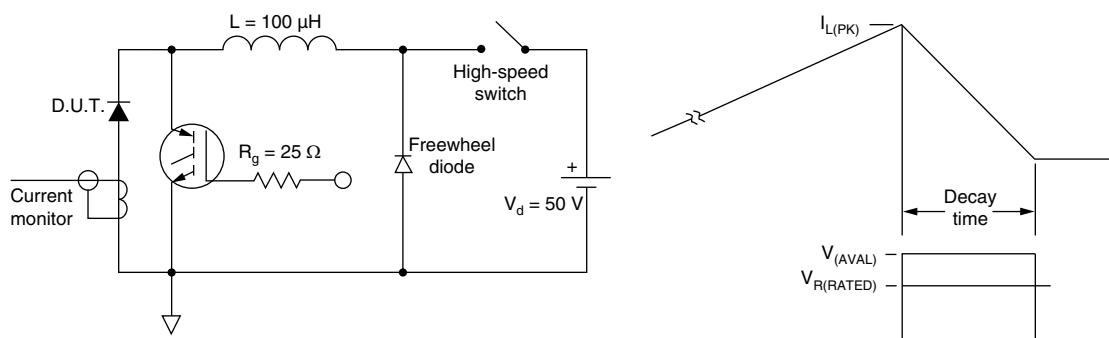


Fig. 12 - Avalanche Test Circuit and Waveforms

ORDERING INFORMATION TABLE

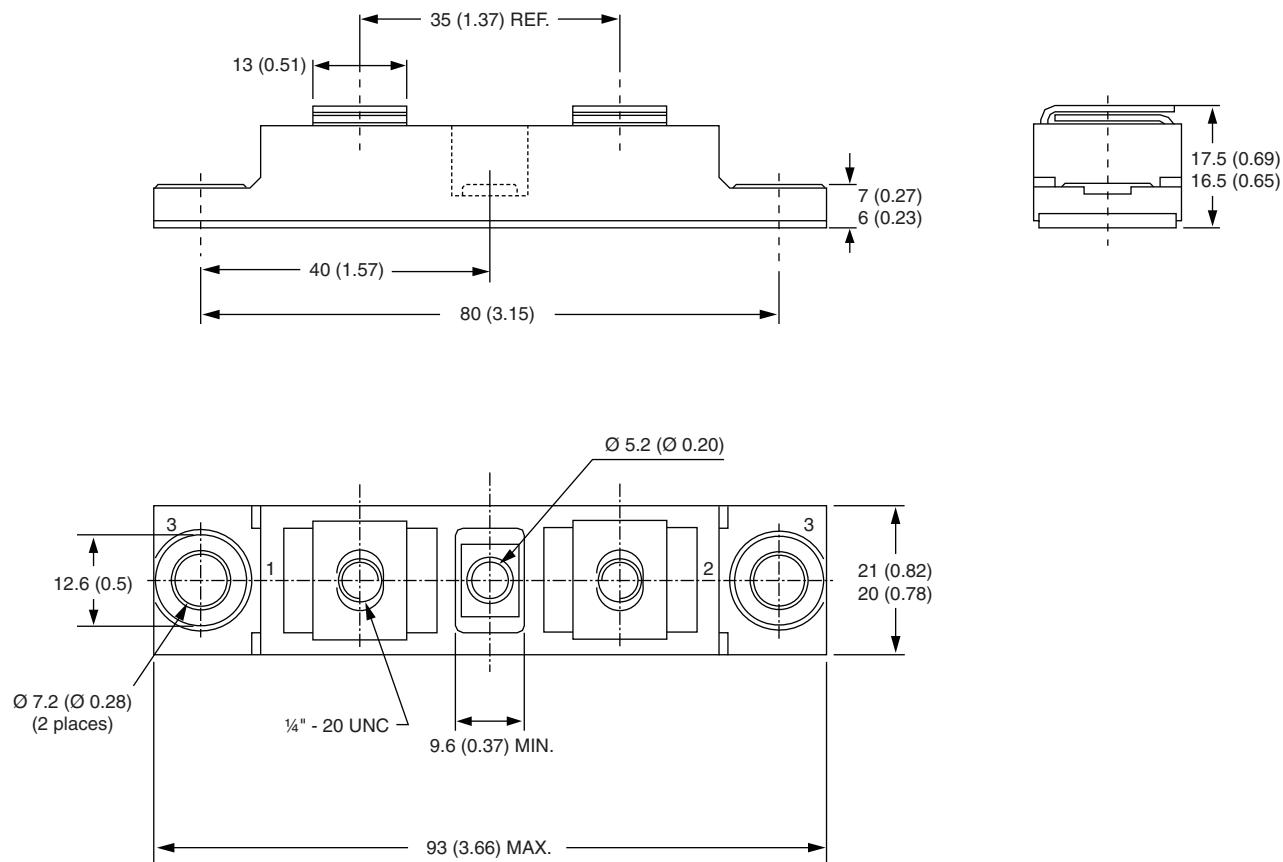
Device code	VS-	HFA	320	NJ	40	C	PbF
	1	2	3	4	5	6	7

- 1** - Vishay Semiconductors product
- 2** - HEXFRED® family, electron irradiated
- 3** - Average current rating
- 4** - NJ = TO-244
- 5** - Voltage rating (400 V)
- 6** - C = Common cathode
- 7** - Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95021

TO-244

DIMENSIONS in millimeters (inches)



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