International
IOR Rectifier

PD -2.469 rev. B 02/99

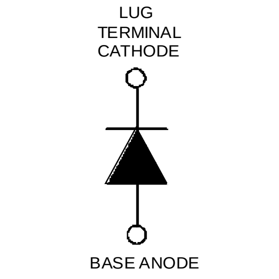
HFA90NH40R

HEXFRED™

Ultrafast, Soft Recovery Diode

Features

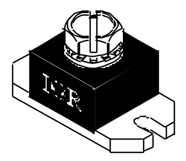
- Reduced RFI and EMI
- Reduced Snubbing
- Extensive Characterization of Recovery Parameters



V_R = 400V
V_F(typ.)③ = 1V
$I_{F(AV)}$ = 90A
Q_{rr} (typ.) = 420nC
I_{RRM}(typ.) = 9.3A
t_{rr}(typ.) = 36ns
$di_{(rec)M}/dt$ (typ.)③ = 260A/µs

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/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.



HALF-PAK

Absolute Maximum Ratings (per Leg)

	Parameter	Max.	Units
V_R	Cathode-to-Anode Voltage	400	V
I_F @ T_C = 25°C	Continuous Forward Current	148	A
I_F @ T_C = 100°C	Continuous Forward Current	72	
I_{FSM}	Single Pulse Forward Current ①	600	
E_{AS}	Non-Repetitive Avalanche Energy ②	1.4	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	260	W
P_D @ T_C = 100°C	Maximum Power Dissipation	104	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C

Thermal - Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
R_{thJC}	Junction-to-Case	——	——	0.48	°C/W K/W
R_{thCS}	Case-to-Sink, Flat, Greased Surface	——	0.15	——	
Wt	Weight	——	26 (0.9)	——	g (oz)
	Mounting Torque ④	15 (1.7)	——	25 (2.8)	lbf•in (N•m)
	Terminal Torque	30 (3.4)	——	40 (4.6)	
	Vertical Pull	——	——	80	lbf•in
	2 inch Lever Pull	——	——	40	

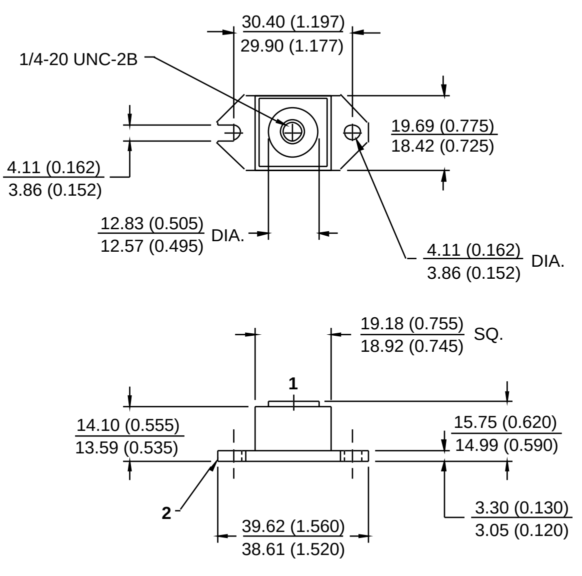
Note: ① Limited by junction temperature
② L = 100µH, duty cycle limited by max T_J
③ 125°C
④ Mounting surface must be smooth, flat, free or burrs or other protrusions. Apply a thin even film or thermal grease to mounting surface. Gradually tighten each mounting bolt in 5-10 lbf•in steps until desired or maximum torque limits are reached. Module

Electrical Characteristics (per Leg) @ T_J = 25°C (unless otherwise specified)

Parameter		Min.	Typ.	Max.	Units	Test Conditions
V_{BR}	Cathode Anode Breakdown Voltage	400	—	—	V	I_R = 100µA
V_{FM}	Max Forward Voltage	—	1.1	1.3	V	I_F = 90A
	See Fig. 1	—	1.3	1.5		I_F = 180A
		—	1.0	1.2		I_F = 90A, T_J = 125°C
I_{RM}	Max Reverse Leakage Current	—	1.0	6.0	µA	V_R = V_R Rated
	See Fig. 2	—	1.5	8.0	mA	T_J = 125°C, V_R = 400V
C_T	Junction Capacitance See Fig. 3	—	180	260	pF	V_R = 200V
L_S	Series Inductance	—	7.0	—	nH	From top of terminal hole to mounting plane

Dynamic Recovery Characteristics (per Leg) @ T_J = 25°C (unless otherwise specified)

Parameter		Min.	Typ.	Max.	Units	Test Conditions	
t_{rr}	Reverse Recovery Time	—	36	—	ns	I_F = 1.0A, di_f/dt = 200A/µs, V_R = 30V	
t_{rr1}	See Fig. 5	—	90	140		T_J = 25°C	I_F = 90A
t_{rr2}		—	160	240		T_J = 125°C	
I_{RRM1}	Peak Recovery Current	—	9.3	17	A	T_J = 25°C	V_R = 200V
I_{RRM2}	See Fig. 6	—	15	30		T_J = 125°C	
Q_{rr1}	Reverse Recovery Charge	—	420	1100	nC	T_J = 25°C	di_f/dt = 200A/µs
Q_{rr2}	See Fig. 7	—	1200	3200		T_J = 125°C	
$di_{(rec)M}/dt1$	Peak Rate of Fall of Recovery Current	—	360	—	A/µs	T_J = 25°C	
$di_{(rec)M}/dt2$	During t_b See Fig. 8	—	260	—		T_J = 125°C	



LEAD ASSIGNMENTS
1 - CATHODE
2 - ANODE

HALF-PAK
Dimensions in millimeters and inches

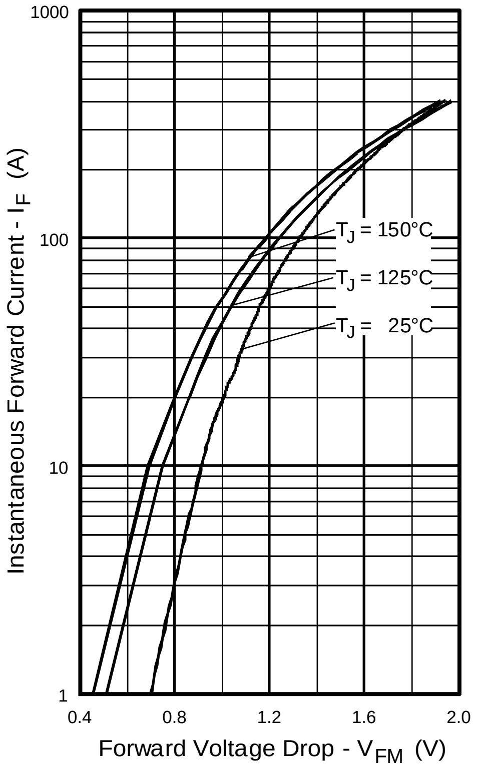


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

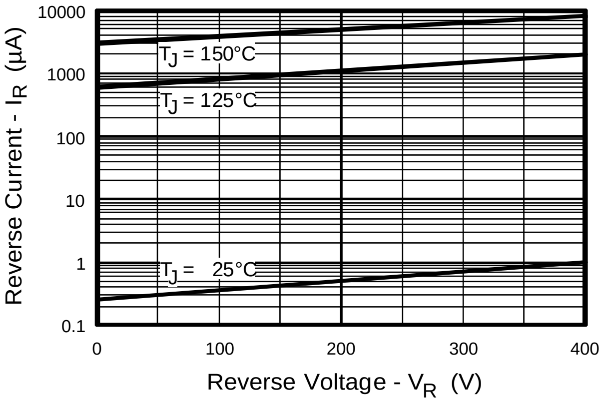


Fig. 2 - Typical Reverse Current vs. Reverse Voltage

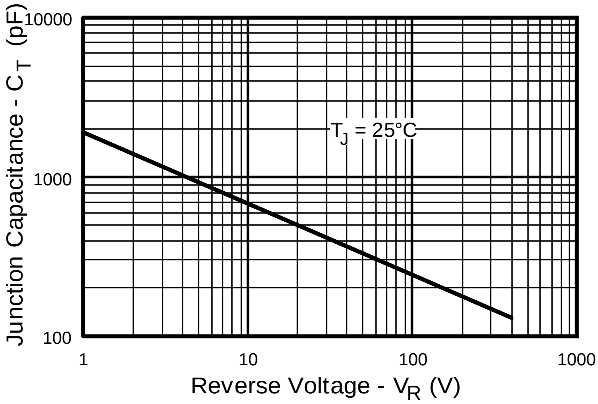


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

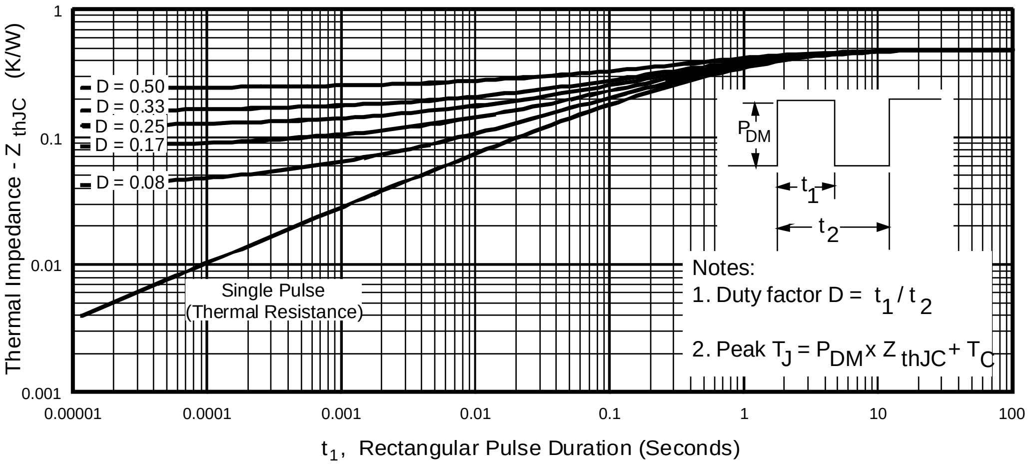


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

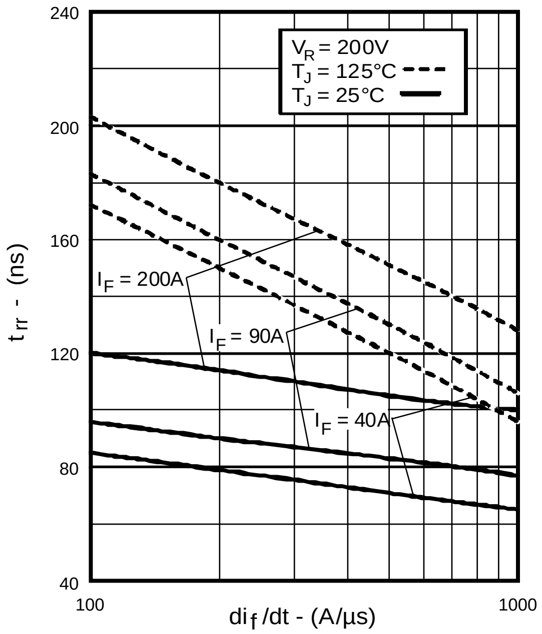


Fig. 5 - Typical Reverse Recovery vs. di_f/dt

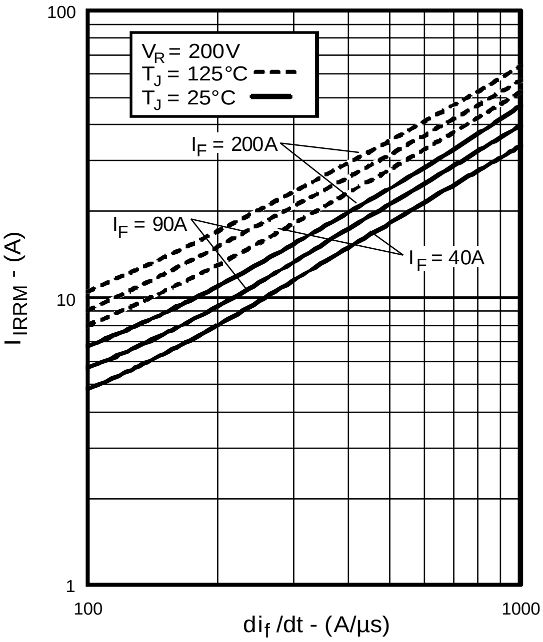


Fig. 6 - Typical Recovery Current vs. di_f/dt

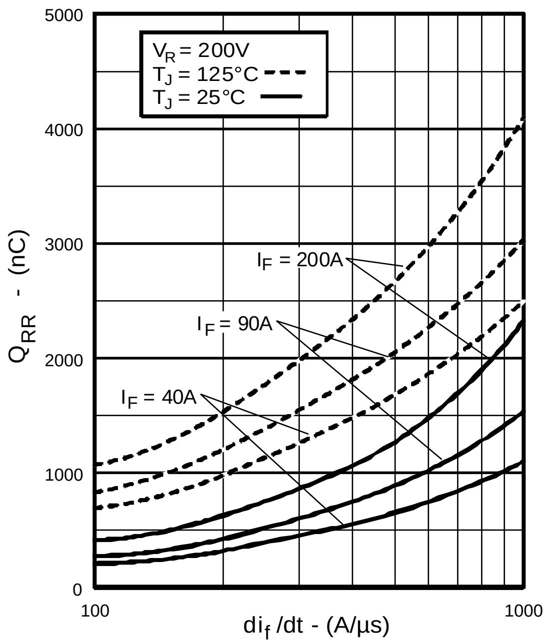


Fig. 7 - Typical Stored Charge vs. di_f/dt

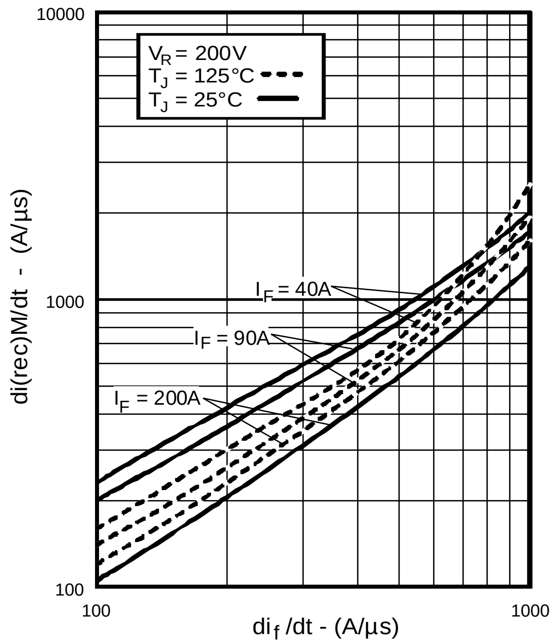


Fig. 8 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

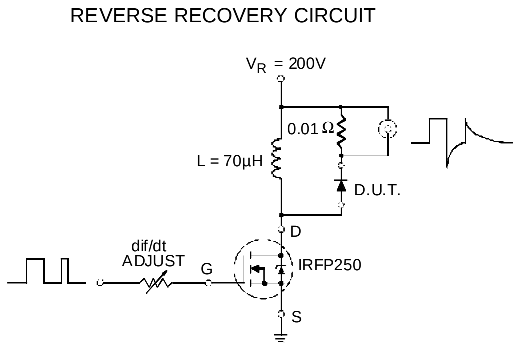
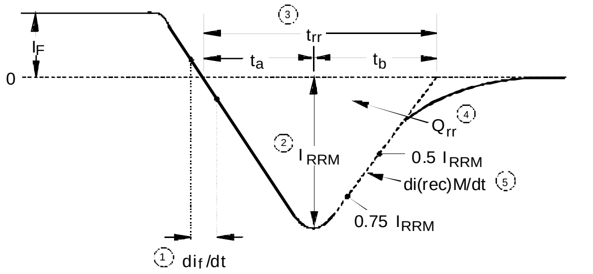


Fig. 9 - Reverse Recovery Parameter Test Circuit



1. di_f/dt - Rate of change of current through zero crossing
2. I_{RRM} - Peak reverse recovery current
3. trr - 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}

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

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

Fig. 10 - Reverse Recovery Waveform and Definitions

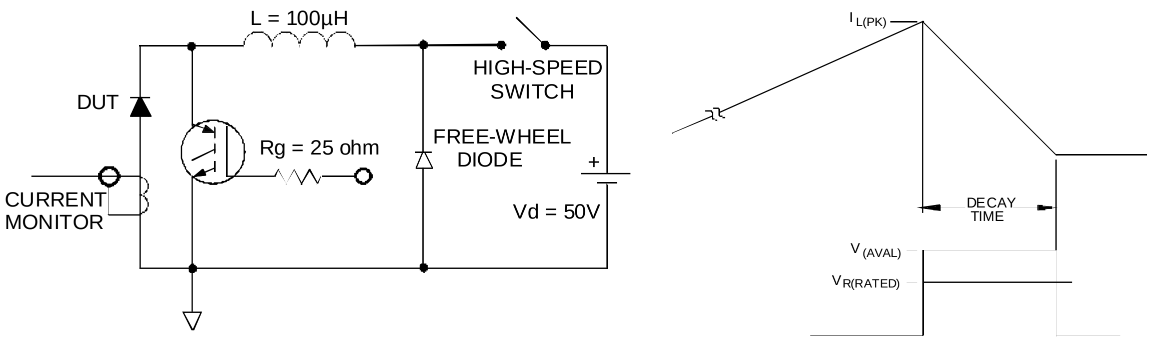


Fig. 11 - Avalanche Test Circuit and Waveforms

International
IOR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 U.S.A. Tel: (310) 322 3331. Fax: (310) 322 3332.
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, U.K. Tel: ++ 44 1883 732020. Fax: ++ 44 1883 733408.
IR CANADA: 15 Lincoln Court, Brampton, Markham, Ontario L6T3Z2. Tel: (905) 453 2200. Fax: (905) 475 8801.
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg. Tel: ++ 49 6172 96590. Fax: ++ 49 6172 965933.
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino. Tel: ++ 39 11 4510111. Fax: ++ 39 11 4510220.
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo, Japan 171. Tel: 81 3 3983 0086.
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower,13-11, Singapore 237994. Tel: ++ 65 838 4630.
IR TAIWAN: 16 Fl. Suite D.207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan. Tel: 886 2 2377 9936.