International Rectifier

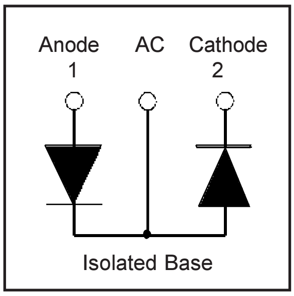
PD-2.508 rev. A 12/98

HFA120MD40D

HEXFRED™ — Ultrafast, Soft Recovery Diode

Features

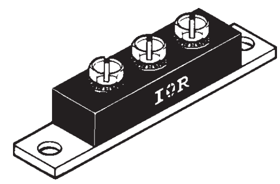
- Reduced RFI and EMI
- Reduced Snubbing
- Extensive Characterization of Recovery Parameters



V_R = 400V
V_F(typ.)③ = 0.9V
$I_{F(AV)}$ = 120A
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.



TO-244AB (ISOLATED)

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	111	A
I_F @ T_C = 100°C	Continuous Forward Current	53	
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	179	W
P_D @ T_C = 100°C	Maximum Power Dissipation	71	
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, Single Leg Conducting	——	——	0.70	°C/W K/W
	Junction-to-Case, Both Legs Conducting	——	——	0.35	
R_{thCS}	Case-to-Sink, Flat , Greased Surface	——	0.10	——	
Wt	Weight	——	79 (2.8)	——	g (oz)
	Mounting Torque ④	30 (3.4)	——	40 (4.6)	lbf•in (N•m)
	Terminal Torque	30 (3.4)	——	40 (4.6)	
	Vertical Pull	——	——	80	lbf•in
	2 inch Lever Pull	——	——	35	

Note: ① Limited by junction temperature
② L = 100μH, duty cycle limited by max T_J
③ 125°C

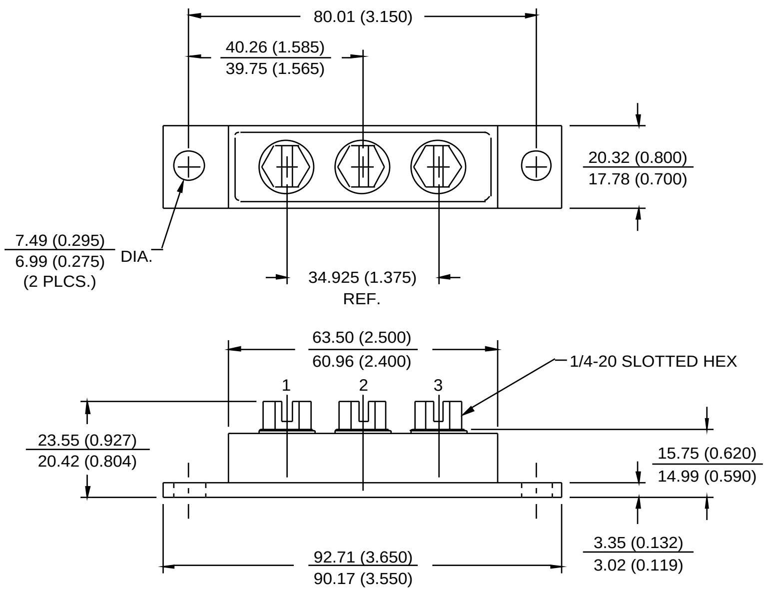
④ Mounting surface must be smooth, flat, free or burrs or other protrusions. Apply a thin even film or thermal grease to mounting surface. Gradually tighten each mounting bolt in 5-10 lbf•in steps until desired or maximum torque limits are reached. Module

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	——	1.0	1.2	V	I_F = 60A	See Fig. 1
		——	1.2	1.4		I_F = 120A	
		——	0.90	1.1		I_F = 60A, 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 = 320V	
C_T	Junction Capacitance	——	180	260	pF	V_R = 200V	See Fig. 3
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}		——	90	140		T_J = 25°C	See	I_F = 80A
t_{rr2}		——	160	240		T_J = 125°C	Fig. 5	
I_{RRM1}	Peak Recovery Current	——	9.3	17	A	T_J = 25°C	See	V_R = 200V
I_{RRM2}		——	15	30		T_J = 125°C	Fig. 6	
Q_{rr1}	Reverse Recovery Charge	——	420	1100	nC	T_J = 25°C	See	di_f/dt = 200A/µs
Q_{rr2}		——	1200	3200		T_J = 125°C	Fig. 7	
$di_{(rec)M}/dt1$	Peak Rate of Fall of Recovery Current	——	360	——	A/µs	T_J = 25°C	See	
$di_{(rec)M}/dt2$	During t_b	——	260	——		T_J = 125°C	Fig. 8	



LEAD ASSIGNMENTS
1 - ANODE
2 - CATHODE
3 - ANODE

OUTLINE TO-244AB (ISOLATED)
Dimensions in Millimeters and (Inches)

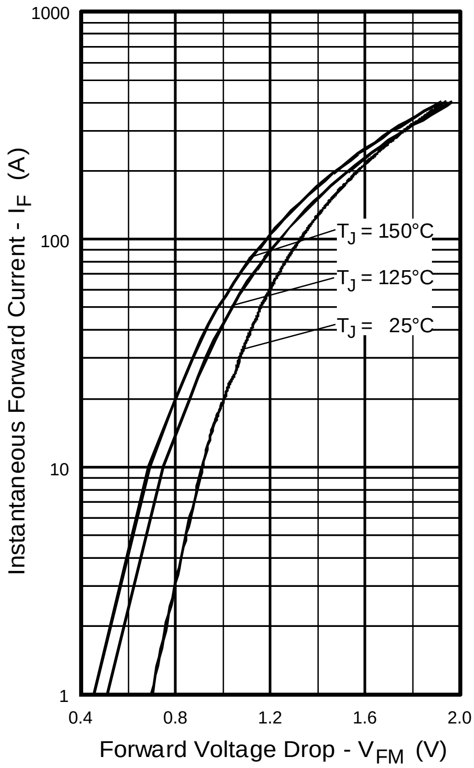


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current, (per Leg)

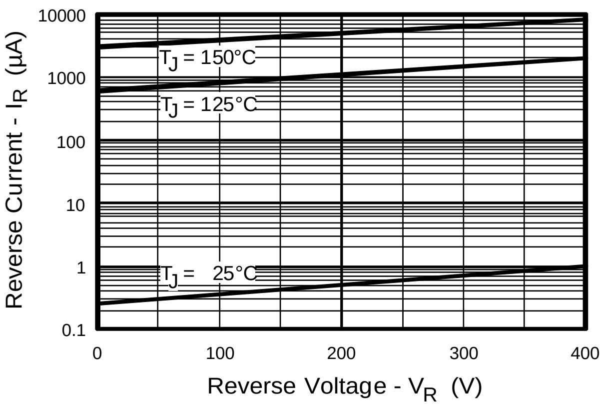


Fig. 2 - Typical Reverse Current vs. Reverse Voltage, (per Leg)

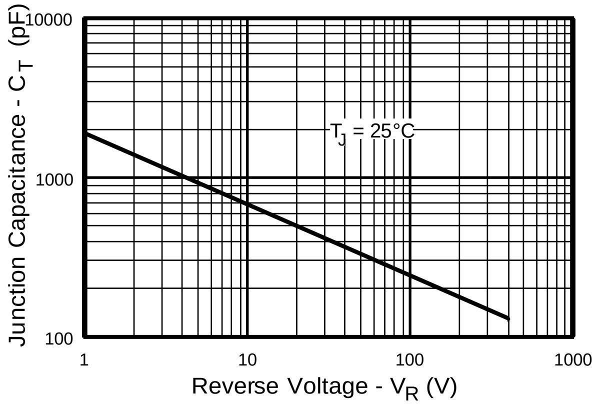


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, (per Leg)

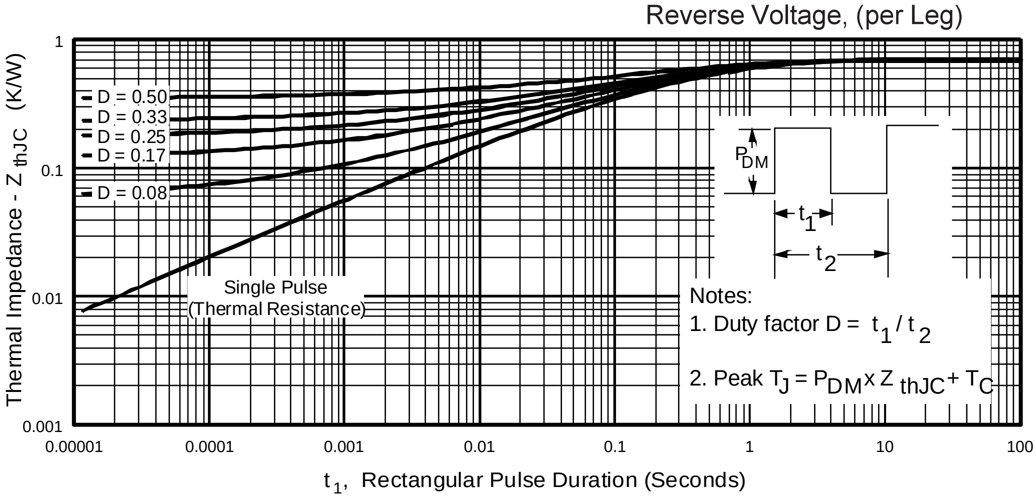


Fig. 4 - Maximum Thermal Impedance Z_{thjc} Characteristics, (per Leg)

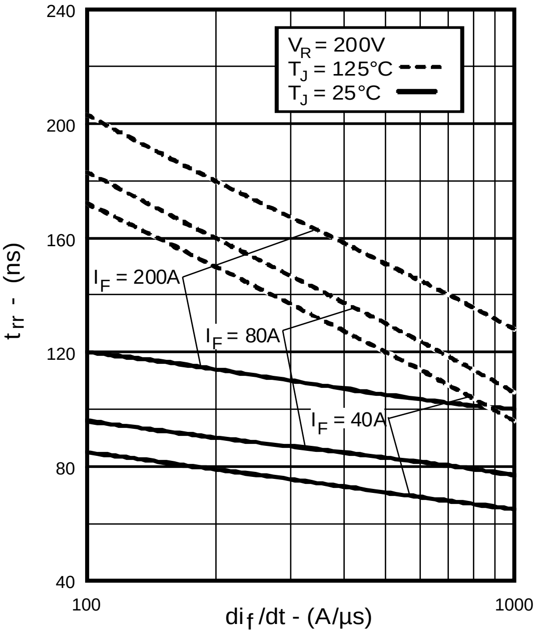


Fig. 5 - Typical Reverse Recovery vs. di_f/dt, (per Leg)

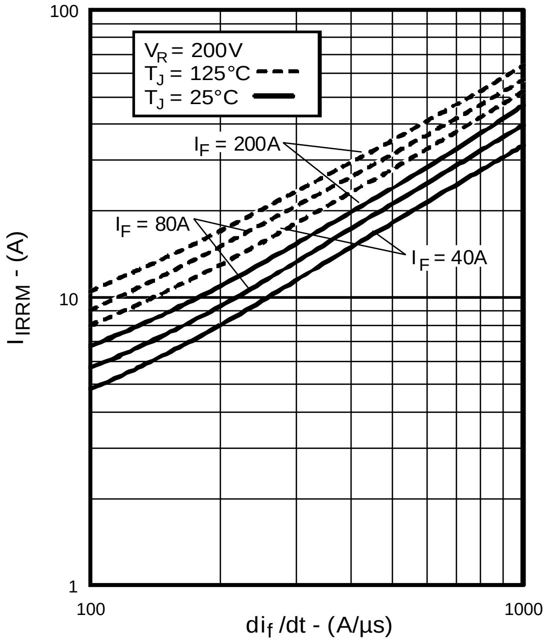


Fig. 6 - Typical Recovery Current vs. di_f/dt, (per Leg)

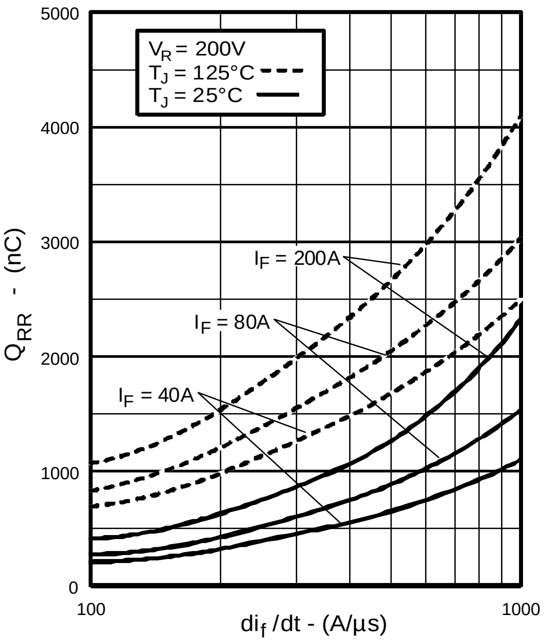


Fig. 7 - Typical Stored Charge vs. di_f/dt, (per Leg)

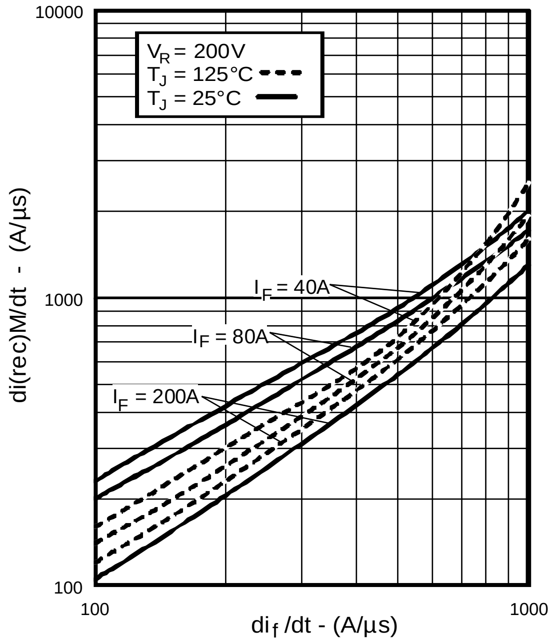


Fig. 8 - Typical $di_{(rec)M}/dt$ vs. di_f/dt, (per Leg)

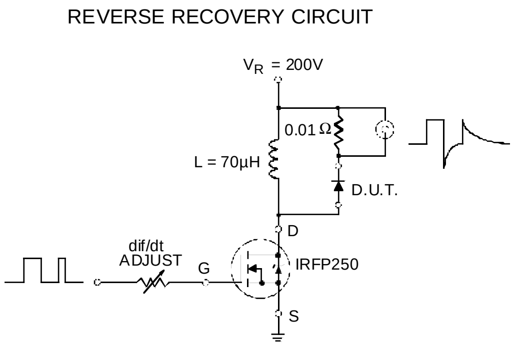
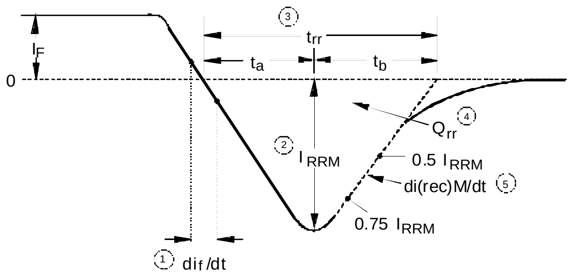


Fig. 9 - Reverse Recovery Parameter Test Circuit



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

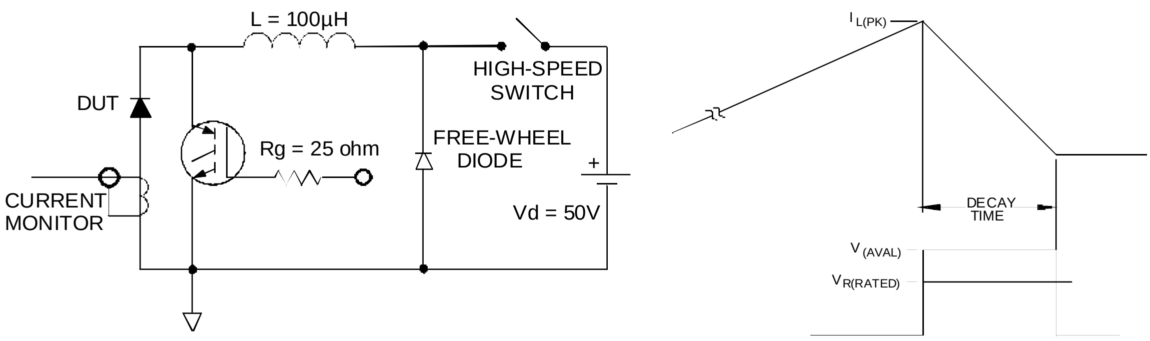


Fig. 11 - Avalanche Test Circuit and Waveforms

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