Bulletin PD-20017 02/01

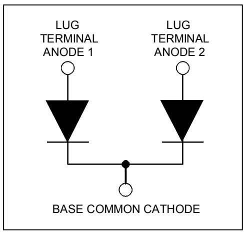
International Rectifier

S1242

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
$I_{F(AV)}$ = 320A
Q_{rr} (typ.) = 420nC
I_{RRM}(typ.) = 8.7A
t_{rr}(typ.) = 45ns
$di_{(rec)M}/dt$ (typ.)③ = 280A/µs

Description/ Applications

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.

Absolute Maximum Ratings

Parameters		Max	Units
V_R	Cathode-to-Anode Voltage	400	V
I_F @ T_C = 25°C	Continuous Forward Current	321	A
I_F @ T_C = 100°C	Continuous Forward Current	160	
I_{FSM}	Single Pulse Forward Current ①	1200	
E_{AS}	Non-Repetitive Avalanche Energy ②	1.4	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	625	W
P_D @ T_C = 100°C	Maximum Power Dissipation	250	
T_J, T_{STG}	Operating Junction and Storage Temperature Range	- 55 to 150	°C

Case Styles

S1242

TO-244

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

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

	Parameters	Min	Typ	Max	Units	Test Conditions	
V_{BR}	Cathode Anode Breakdown Voltage,	400	-	-	V	I_R = 100µA	
V_{FM}	Max. Forward Voltage	-	1.10	1.35	V	I_F = 160A	See Fig. 1
		-	1.30	1.55	V	I_F = 320A	
		-	1.00	1.20	V	I_F = 160A, T_J = 125°C	
I_{RM}	Max. Reverse Leakage Current	-	2.0	12	µA	V_R = V_R Rated	See Fig. 2
		-	3.0	16	mA	T_J = 125°C, V_R = 320V	
C_T	Junction Capacitance	-	370	500	pF	V_R = 200V	See Fig. 3
L_S	Series Inductance	-	5.0	-	nH	From top of terminal hole.to mounting plane	

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

	Parameters	Min	Typ	Max	Units	Test Conditions		
t_{rr}	Reverse Recovery Time	-	45	-	ns	I_F = 1.0A, di_F/dt = 200A/µs, V_R = 30V		
t_{rr1}		-	90	140		T_J = 25°C	See Fig. 5	I_F = 160A V_R = 200V di_F/dt = 200A/µs
t_{rr2}		-	290	440		T_J = 125°C		
I_{RRM1}	Peak Recovery Current	-	8.7	20	A	T_J = 25°C	See Fig. 6	
I_{RRM2}		-	18	30		T_J = 125°C		
Q_{rr1}	Reverse Recovery Charge	-	420	1100	nC	T_J = 25°C	See Fig. 7	
Q_{rr2}		-	2600	7000		T_J = 125°C		
$di_{(rec)M}/dt1$		-	300	-	A/µs	T_J = 25°C	See Fig. 8	
$di_{(rec)M}/dt2$		-	280	-		T_J = 25°C		

Thermal - Mechanical Characteristics

	Parameters		Min	Typ	Max	Units
T_J	Max. Junction Temperature Range		-	-	- 55 to 150	°C
T_{Stg}	Max. Storage Temperature Range		-	-	- 55 to 150	
R_{thJC}	Thermal Resistance, Junction to Case	Per Leg	-	-	0.24	°C/W
	Thermal Resistance, Junction to Case	Per Module	-	-	0.12	K/W
R_{thCS}	Thermal Resistance, Case to Heatsink		-	0.10	-	
Wt	Weight		-	68 (2.4)	-	g (oz)
	Mounting Torque (*)		30 (3.4)	-	40 (4.6)	lbf.in
	Mounting Torque Center Hole		12 (1.4)	-	18 (2.1)	(N.m)
	Terminal Torque		30 (3.4)	-	40 4.6)	
	Vertical Pull		-	-	80	lbf.in
	2 inch Lever Pull		-	-	35	

(*) 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 5-10lbf.in steps until desired or maximum torque limits are reached

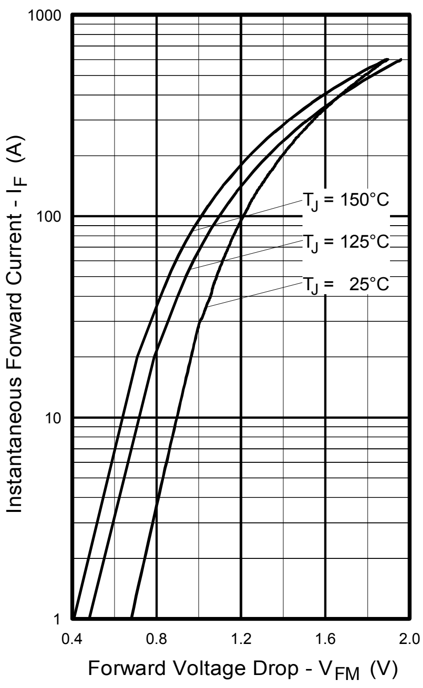


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (per Leg)

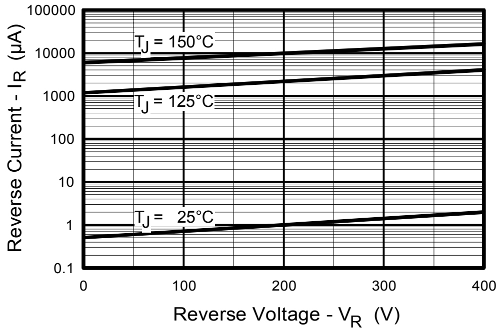


Fig. 2 - Typical Reverse Current vs. Reverse Voltage, (per Leg)

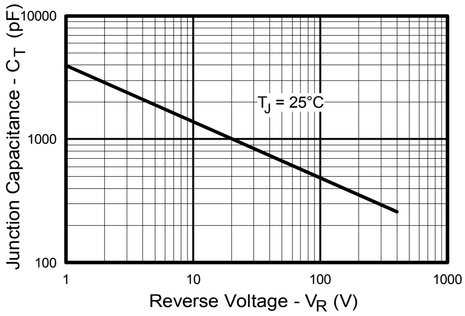


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, (per Leg)

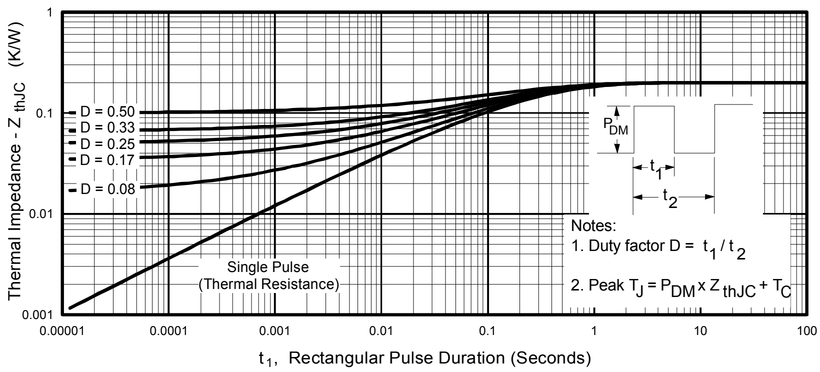


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics, (per Leg)

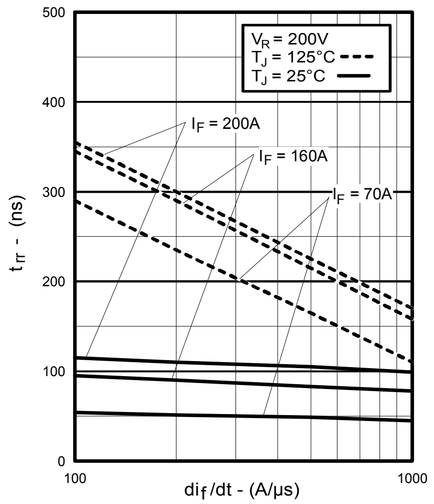


Fig. 5 - Typical Reverse Recovery vs. di_f /dt, (per Leg)

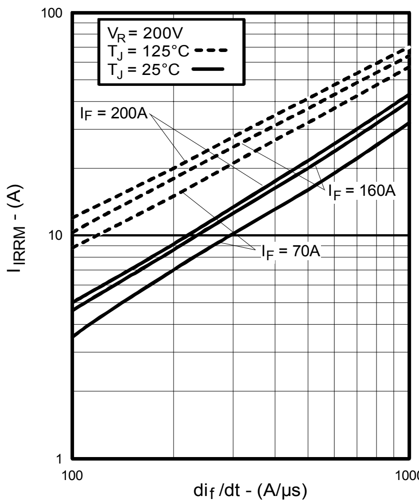


Fig. 6 - Typical Recovery Current vs. di_f /dt, (per Leg)

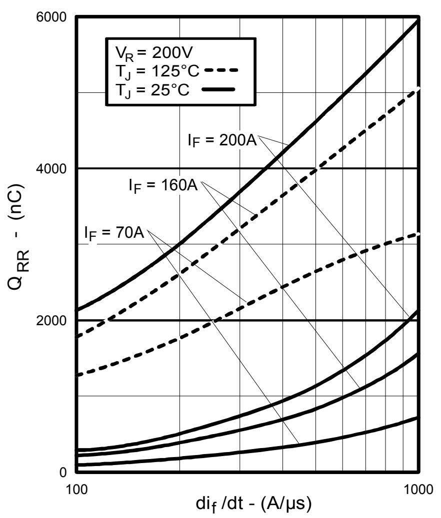


Fig. 7 - Typical Stored Charge vs. di_f /dt, (per Leg)

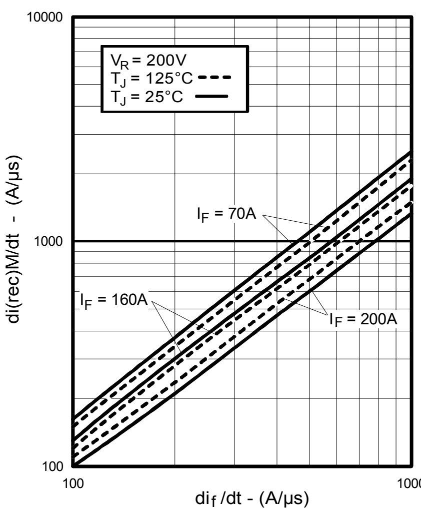


Fig. 8 - Typical $di_{(rec)M}$/dt vs. di_f /dt, (per Leg)

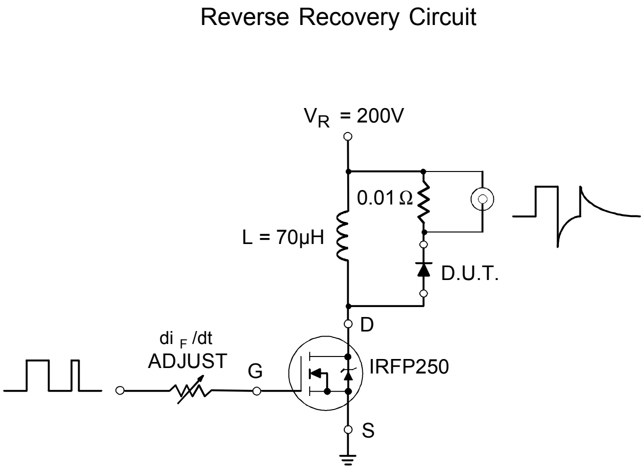
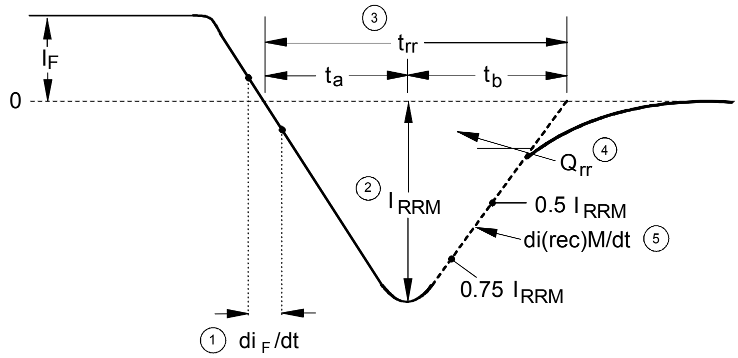


Fig. 9- Reverse Recovery Parameter Test Circuit



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

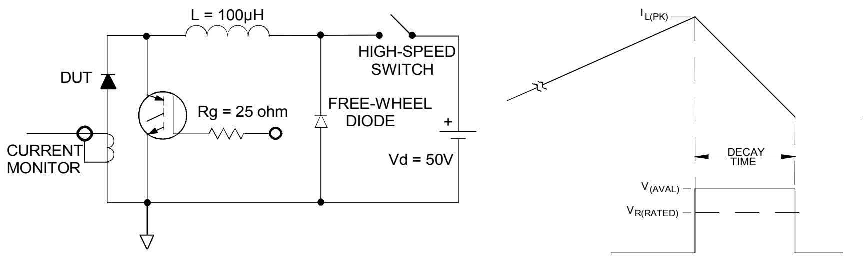
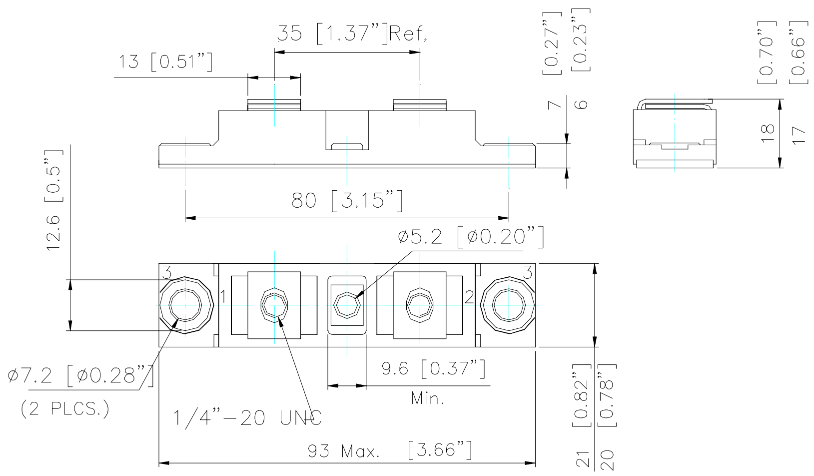


Fig. 11 - Avalanche Test Circuit and Waveforms

Outline Table



Conforms to JEDEC Outline TO-244
Dimensions in millimeters and (inches)

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

International IOR Rectifier

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