International
IOR Rectifier

Provisional Data Sheet

HFA50PA60C

HEXFRED™ ULTRA FAST, SOFT RECOVERY DIODE 600V, 50A

Major Ratings and Characteristics (per Leg)

Characteristics		Units
V_R V_{RRM}	600	V
$I_{F(AV)}$	25	A
t_{rr} (typ)	23	ns
Q_{rr} (typ)	112	nC
I_{RRM}	10	A
di(rec)M/dt (typ)	250	A/μs
V_F	1.7	V

Features:
- Ultrafast Recovery
- Ultra Soft Recovery
- Very Low I_{RRM}
- Very Low Q_{rr}
- Guaranteed Avalanche
- Specified at Operating Conditions

Benefits:
- Reduced RFI and EMI
- Reduced Power Loss in Diode and Switching Transistor
- Higher Frequency Operation
- Reduced Snubbing
- Reduced Parts Count

Description

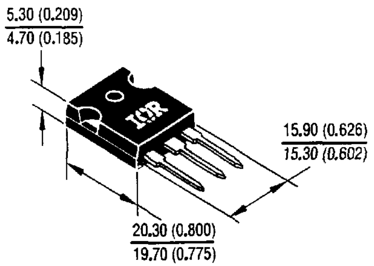
International Rectifier's HFA50PA60C is a state of the art center tap ultra fast recovery diode. Employing the latest in epitaxial construction and advanced processing techniques it features a superb combination of characteristics which result in performance which is unsurpassed by any rectifier previously available.

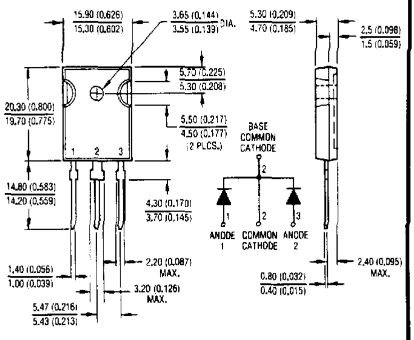
With basic ratings of 600 volts and 25 amps per Leg *continuous current, the HFA50PA60C is especially well* suited for use as the companion diode for IGBTs and MOSFETs. In addition to ultra fast recovery time, the HEXFRED product line features extremely low values of peak recovery current (I_{RRM}) and does not exhibit any tendency to "snap-off" during the t_b portion of recovery.

The HEXFRED features combine to offer designers a rectifier with lower noise and significantly lower switching losses in both the diode and the switching transistor. These HEXFRED advantages can help to significantly reduce snubbing, component count and heatsink sizes.

The HEXFRED HFA50PA60C is ideally suited for applications in power supplies and power conversion *systems (such as inverters, converters, UPS systems,* and power factor correction circuits), motor drives, and many other similar applications where high speed, high efficiency rectification is needed.

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC
Dimensions in millimeters and inches

Voltage Ratings: T_J = 25 – 150°C

Parameter		
V_R	Max D.C. Reverse Voltage (V)	600 Volts
V_{RRM}	Max PK Repetitive Reverse Voltage (V)	
V_{RWM}	Max Working PK Reverse Voltage (V)	

Absolute Maximum Ratings (per Leg)

Parameter		Min	Typ	Max	Units	Conditions
$I_{F(AV)}$	Max Average Forward Current	—	—	25	A	T_C = 100°C, d.c. = 50%, rect. wave V_R = 0.8 V_{RRM}
I_{FRM}	Max Repetitive Forward Current	—	—	100		T_C = 125°C, P.W. = 10 µs, d.c. = 10% V_R = 0.8 V_{RRM}
I_{FSM}	Max Single Pulse Forward Current	—	—	225		T_C = 25°C, 1/2 Sine Wave, 60 Hz P.W. = 8.33 ms
I_{AR}	Max Repetitive Avalanche Current	—	—	2	A	L = 100 µH, duty cycle limited by max T_J

Electrical Specifications (per Leg): T_J = 25°C unless otherwise specified

		Min	Typ	Max	Units	Conditions
V_{FM}	Max Forward Voltage see fig. 1	—	1.3	1.7	V	I_F = 25A
			1.5	2.0		I_F = 50A
			1.3	1.7		I_F = 25A, T_J = 125°C
I_{RM}	Max Reverse Leakage Current see fig. 2	—	1.5	20	µA	V_R = V_R Rated
			600	2000		T_J = 125°C, V_R = 0.8 x V_R Rated
C_T	Junction Capacitance see fig. 3	—	55	100	pF	V_R = 200V
L_S	Series Inductance	—	12	—	nH	Measured lead to lead 5mm from package body

Dynamic Recovery Specifications (per Leg): T_J = 25°C unless otherwise specified

		Min	Typ	Max	Units	Conditions
t_{rr1}	Reverse Recovery Time see fig. 5, 6 & 16	—	23	—	ns	I_F = 1A, di_f/dt = 200A/µs, V_R = 30V
t_{rr2}			50	75		I_F = 25A, di_f/dt = 200A/µs, V_R = 200V
t_{rr3}			105	160		T_J = 125°C
I_{RRM1}	Max Reverse Recovery Current see fig. 7 & 8	—	4.5	10	A	I_F = 25A, di_f/dt = 200A/µs, V_R = 200V
I_{RRM2}			8	15		T_J = 125°C
Q_{RR1}	Reverse Recovered Charge see fig. 9 & 10	—	112	375	nC	I_F = 25A, di_f/dt = 200A/µs, V_R = 200V
Q_{RR2}			420	1200		T_J = 125°C
di(rec)M/dt	Max Rate of Fall of Recovery Current During t_b see fig. 11 & 12	—	250	—	A/µs	I_F = 25A, di_f/dt = 200A/µs, V_R = 200V
			160			T_J = 125°C

Thermal-Mechanical Specifications

		Min	Typ	Max	Units	Conditions
T_J, T_{STG}	Junction and storage temp range	-55	—	150	°C	
T_{lead}	Lead Temperature	—	—	300		0.063 in. from Case (1.6 mm) for 10 sec
$R_{\theta JC}$	Thermal Resistance; Junction to Case	—	—	0.83	K/W	Single Leg Conducting
				0.42		Both Legs Conducting
$R_{\theta JA}$	Thermal Resistance; Junction to Ambient	—	—	40		Typical Socket Mount
$R_{\theta CS}$	Thermal Resistance; Case to Heat Sink	—	0.25	—		Mounting Surface, Flat, Smooth and Greased
W_T	Weight	—	6	—	g	
			0.21	—	oz	
T	Mounting Torque	6	—	12	Kg-cm	
		5		10	lbf • in	
Case	TO-247AC	—	—	—	—	JEDEC

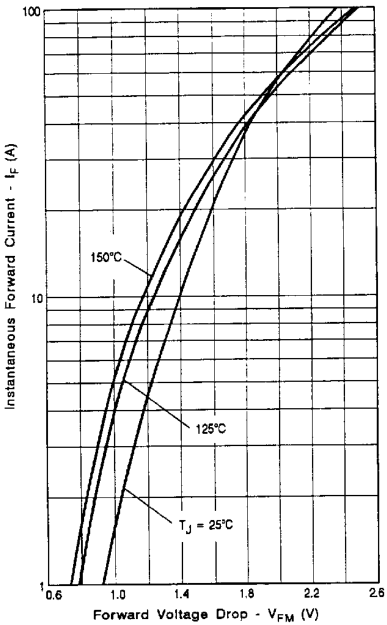


Fig. 1 – Max. Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

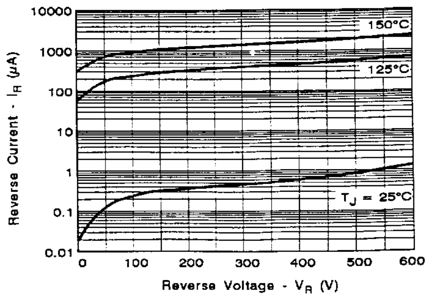


Fig. 2 – Typical Reverse Current vs. Reverse Voltage (Per Leg)

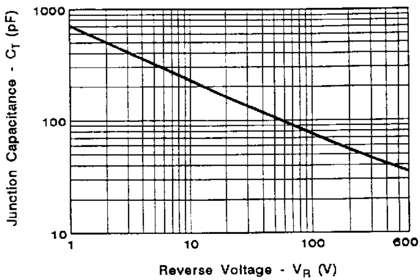


Fig. 3 – Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

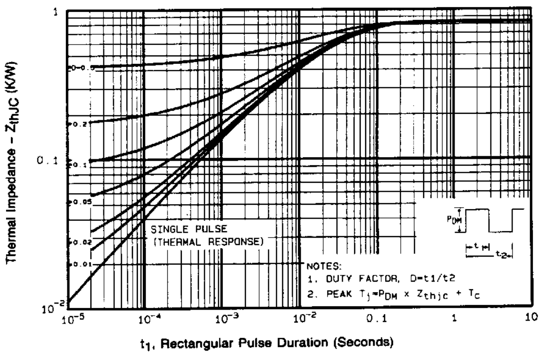


Fig. 4 – Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

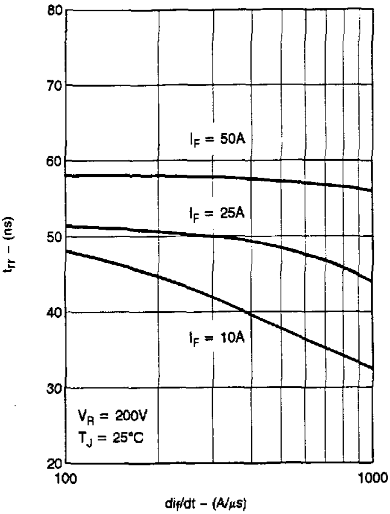


Fig. 5 - Typical Reverse Recovery Time vs. di_f/dt (Per Leg)

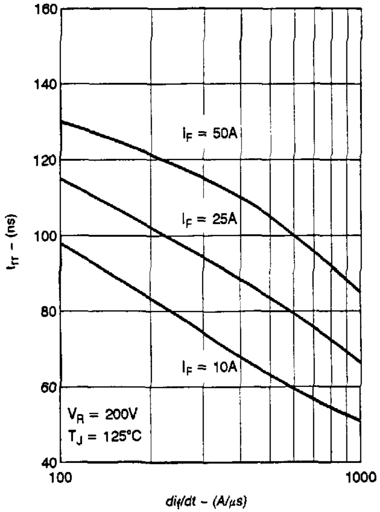


Fig. 6 - Typical Reverse Recovery Time vs. di_f/dt (Per Leg)

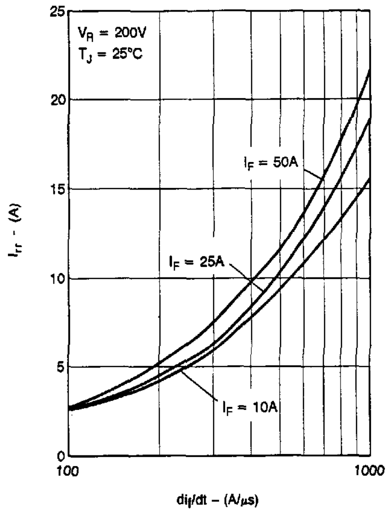


Fig. 7 - Typical Reverse Recovery Current vs. di_f/dt (Per Leg)

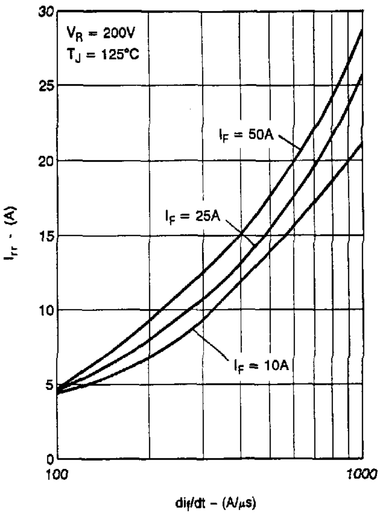


Fig. 8 - Typical Reverse Recovery Current vs. di_f/dt (Per Leg)

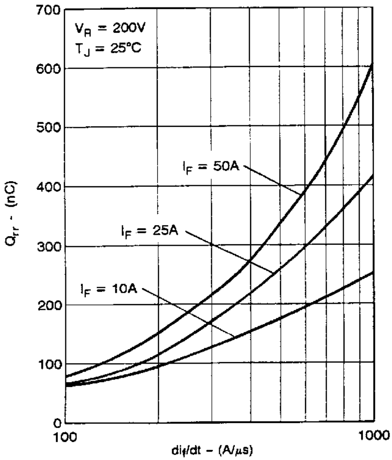


Fig. 9 - Typical Stored Charge vs. dif/dt (Per Leg)

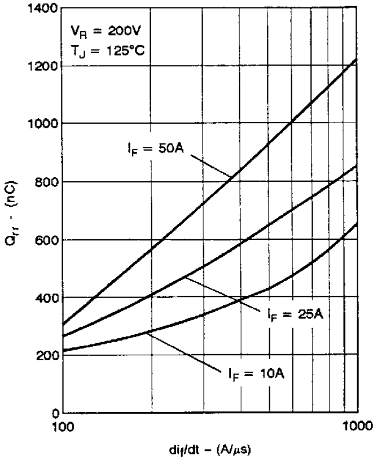


Fig. 10 - Typical Stored Charge vs. dif/dt (Per Leg)

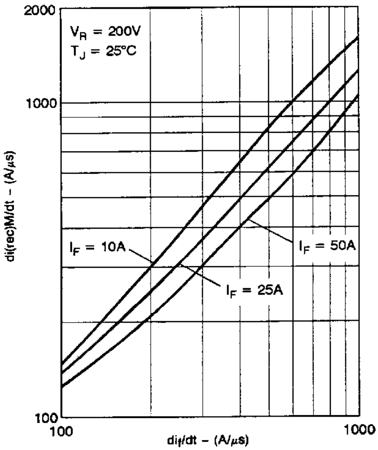


Fig. 11 - Typical di(rec)M/dt vs. dif/dt (Per Leg)

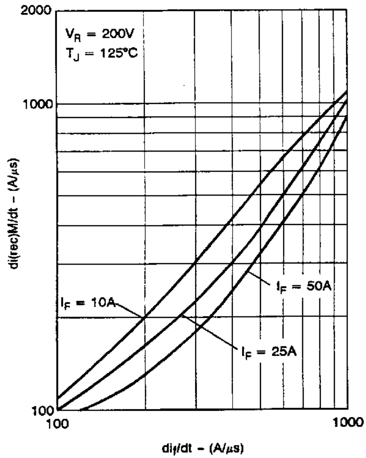


Fig. 12 - Typical di(rec)M/dt vs. dif/dt (Per Leg)

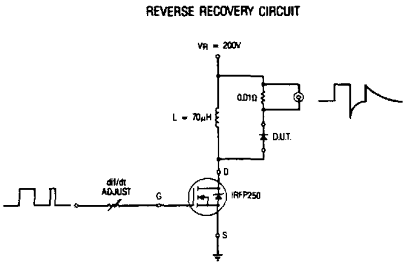
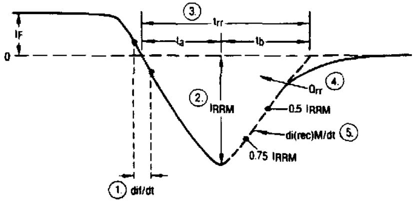


Fig. 13 – Reverse Recovery Parameter Test Circuit



1. dif/dt — Rate of change of current through zero crossing
2. IRRM — Peak reverse recovery current
3. trr — Reverse recovery time measured from zero crossing point of negative going IF to point where a line passing through 0.75 IRRM and 0.50 IRRM extrapolated to zero current
4. Qrr — Area under curve defined by trr and IRRM

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

5. di(rec)M/dt — Peak rate of change of current during tb portion of trr

Fig. 14 – Reverse Recovery Waveform and Definitions

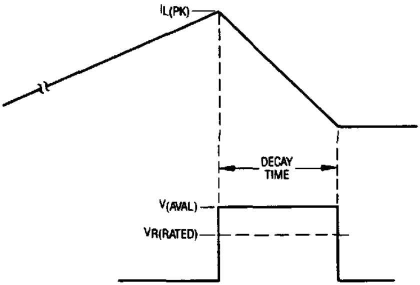
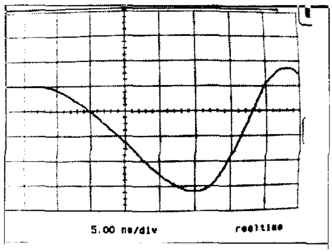


Fig. 15 – Avalanche Current and Voltage Waveforms



COND.	READINGS
I_F = 1A	t_{rr} = 23 ns
di_f/dt = 200A/μs	I_{RRM} = 3.25A
T_J = 25°C	Q_{rr} = 37.4 nC
V_R = 30V	di(rec)M/dt = 500A/μs

Fig. 16 – Oscilloscope Display of Recovery Characteristic

International
IOR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322-3331, Twx: 4720403
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB England, Tel: (0883) 713215, Twx: 95219

IR CANADA: 101 Bentley St., Markham, Ontario L3R 3L1 Tel (416) 475-1897 IR GERMANY: Saalburgstrasse 157 D-6380 Bad Homburg, Tel 6172-37066 IR ITALY: Via Liguria 49 10071 Borgaro, Torino, Tel (011) 470 1484 IR FAR EAST: K&H Building, 30-4 Nishiikebukuro 3-Chrome, Toshima-ku, Tokyo 171 Japan, Tel (03) 983 0641 IR SOUTHEAST ASIA: 190 Middle Road, HEX 10-01 Fortune Centre, Singapore 0718, Tel (65) 336 3922

Sales Offices, Agents and Distributors in Major Cities Throughout the World.

Printed in the USA 4/92