

## HFA04SD60SPbF

### Ultrafast, Soft Recovery Diode

#### Features

- Ultrafast Recovery Time
- Ultrasoft Recovery
- Very Low  $I_{RRM}$
- Very Low  $Q_{rr}$
- Guaranteed Avalanche
- Specified at Operating Temperature
- Lead-Free

#### Benefits

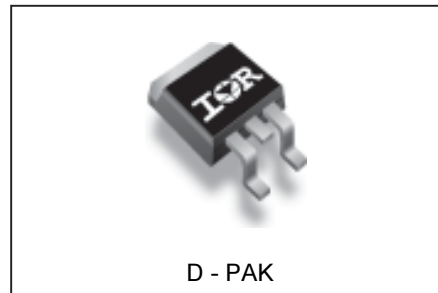
- Reduced RFI and EMI
- Reduced Power Loss in Diode and Switching Transistor
- Higher Frequency Operation
- Reduced Snubbing
- Reduced Parts Count

#### Description/ Applications

These diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for freewheeling, flyback, power converters, motor drives, and other applications where high speed and reduced switching losses are design requirements.

$t_{rr} = 38ns$   
 $I_{F(AV)} = 4Amp$   
 $V_R = 600V$

#### Package Outline



#### Absolute Maximum Ratings

Parameters		Max	Units
$V_{RRM}$	Cathode-to-Anode Voltage	600	V
$I_{F(AV)}$	Continuous Forward Current $T_C = 100^\circ C$	4	A
$I_{FSM}$	Single Pulse Forward Current	25	
$I_{FRM}$	Peak Repetitive Forward Current $T_C = 116^\circ C$	16	
$P_D$	Maximum Power Dissipation $T_C = 100^\circ C$	10	W
$T_J, T_{STG}$	Operating Junction and Storage Temperatures	- 55 to 150	$^\circ C$

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

Parameters	Min	Typ	Max	Units	Test Conditions
V <sub>BR</sub> , V <sub>r</sub> Breakdown Voltage, Blocking Voltage	600	-	-	V	I <sub>R</sub> = 100μA
V <sub>F</sub> Forward Voltage See Fig. 1	-	1.5	1.8	V	I <sub>F</sub> = 4A
	-	1.8	2.2	V	I <sub>F</sub> = 8A
	-	1.4	1.7	V	I <sub>F</sub> = 4A, T <sub>J</sub> = 125°C
I <sub>R</sub> Max. Reverse Leakage Current	-	0.17	3.0	μA	V <sub>R</sub> = V <sub>R</sub> Rated
	-	44	300	μA	T <sub>J</sub> = 125°C, V <sub>R</sub> = 0.8 x V <sub>R</sub> Rated
C <sub>T</sub> Junction Capacitance	-	4	8	pF	V <sub>R</sub> = 200V
L <sub>S</sub> Series Inductance	-	8.0	-	nH	Measured lead to lead 5mm from package body

**Dynamic Recovery Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

Parameters	Min	Typ	Max	Units	Test Conditions
t <sub>rr</sub> Reverse Recovery Time	-	17	-	ns	I <sub>F</sub> = 1.0A, di <sub>F</sub> /dt = 200A/μA, V <sub>R</sub> = 30V
	-	28	42		T <sub>J</sub> = 25°C
	-	38	57		T <sub>J</sub> = 125°C
I <sub>RRM</sub> Peak Recovery Current	-	2.9	5.2	A	T <sub>J</sub> = 25°C
	-	3.7	6.7		T <sub>J</sub> = 125°C
Q <sub>rr</sub> Reverse Recovery Charge	-	40	60	nC	T <sub>J</sub> = 25°C
	-	70	105		T <sub>J</sub> = 125°C
di <sub>(rec)</sub> /dt Rate of Fall of recovery Current	-	280	-	A/μs	T <sub>J</sub> = 25°C
	-	235	-		T <sub>J</sub> = 125°C

**Thermal - Mechanical Characteristics**

Parameters	Min	Typ	Max	Units
T <sub>J</sub> Max. Junction Temperature Range	-	-	- 55 to 150	°C
T <sub>Stg</sub> Max. Storage Temperature Range	-	-	- 55 to 150	
T <sub>S</sub> Soldering Temperature, 10 sec	-	-	240	
R <sub>thJC</sub> Thermal Resistance, Junction to Case	-	-	5.0	°C/ W
R <sub>thJA</sub> <sup>①</sup> Thermal Resistance, Junction to Ambient	-	-	80	
Wt Weight	-	2.0	-	g
	-	0.07	-	(oz)
T Mounting Torque	6.0	-	12	Kg*cm
	5.0	-	10	lbf*in

① Typical Socket Mount

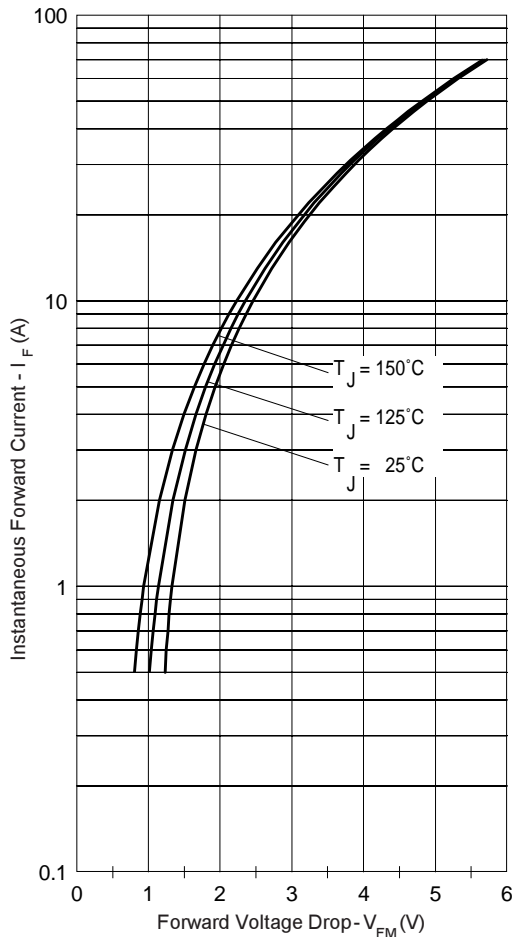


Fig. 1 - Typical Forward Voltage Drop Characteristics

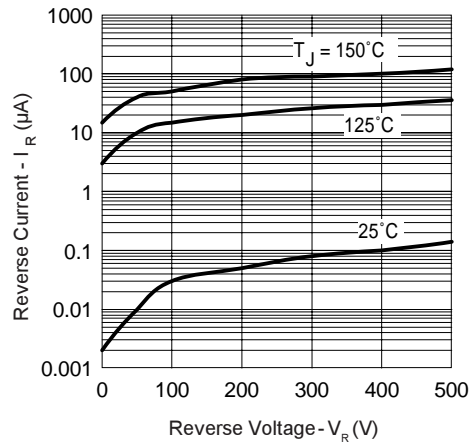


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage

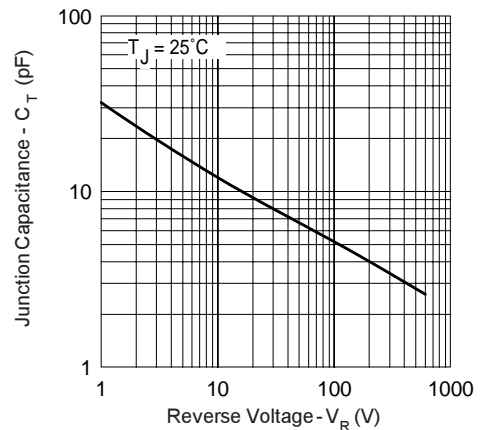


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

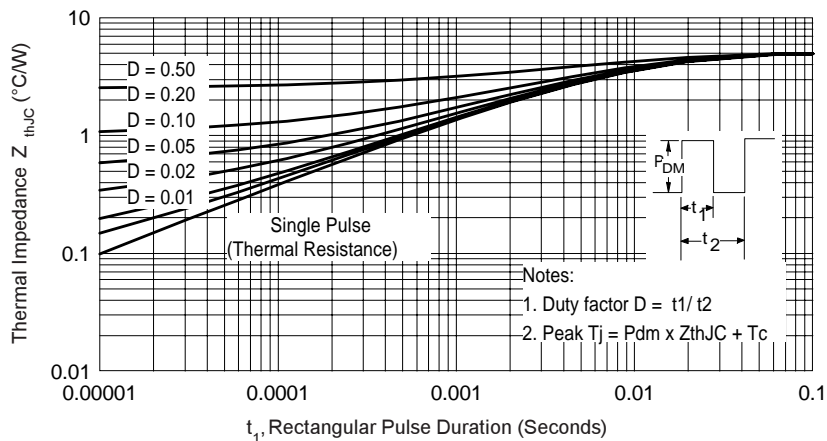


Fig. 4 - Max. Thermal Impedance  $Z_{thJC}$  Characteristics

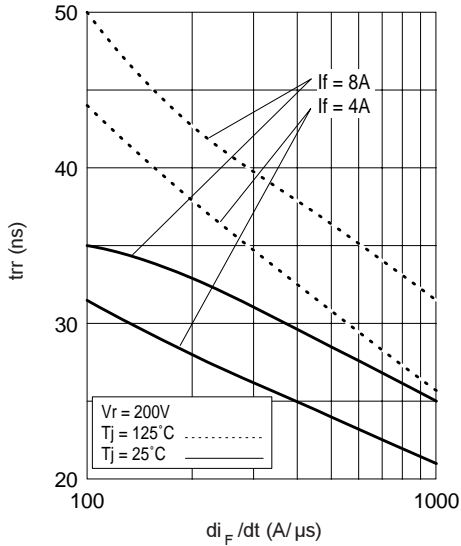


Fig. 5 - Typical Reverse Recovery vs.  $di_F/dt$

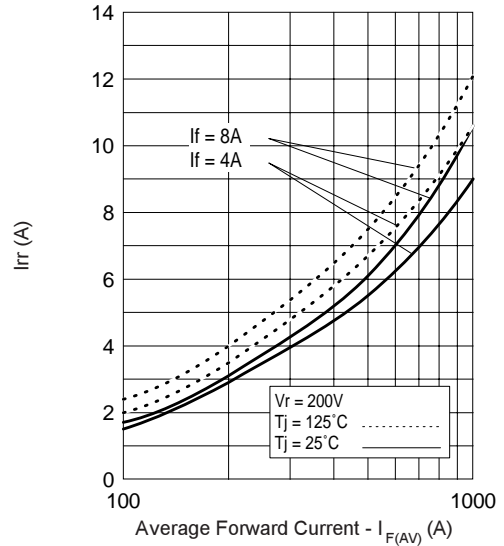


Fig. 6 - Typical Recovery Current vs.  $di_F/dt$

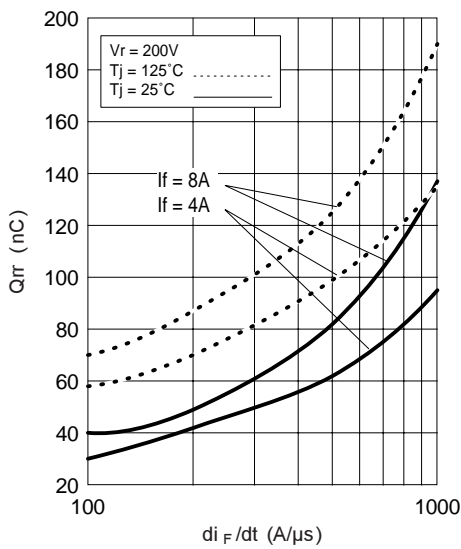


Fig. 7 - Typical Stored Charge vs.  $di_F/dt$

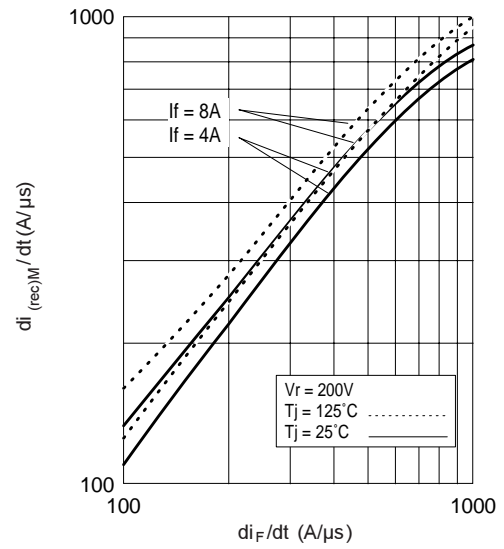


Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_F/dt$

Reverse Recovery Circuit

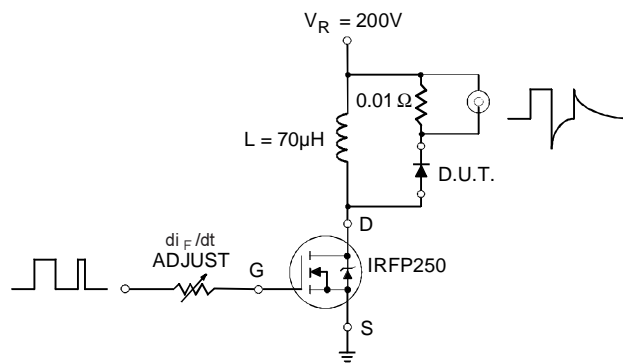
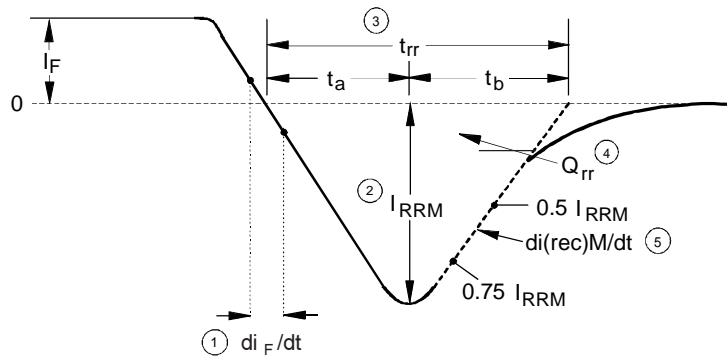


Fig. 9- Reverse Recovery Parameter Test Circuit



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  $I_{RRM}$

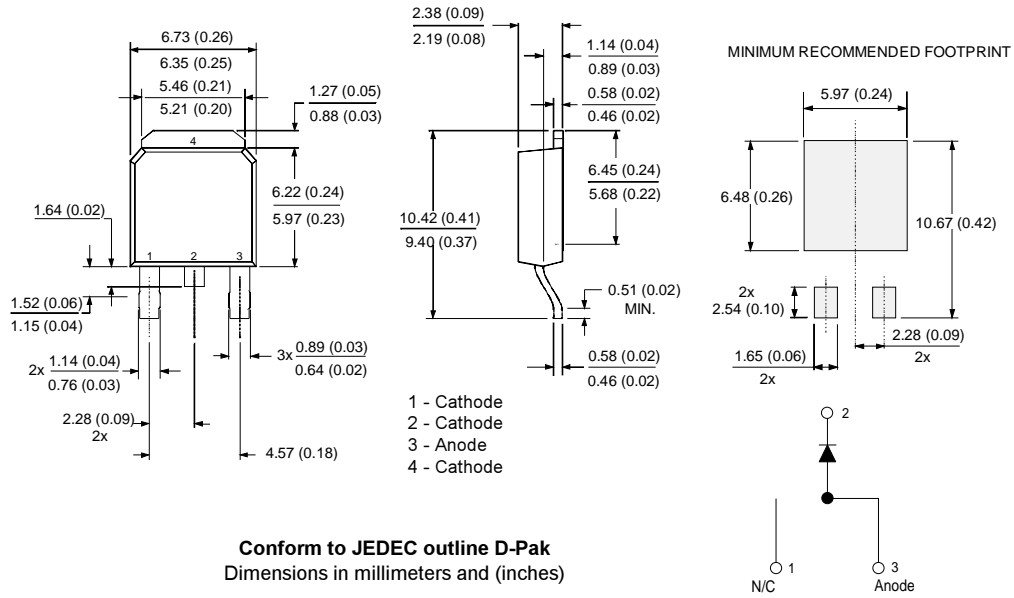
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

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

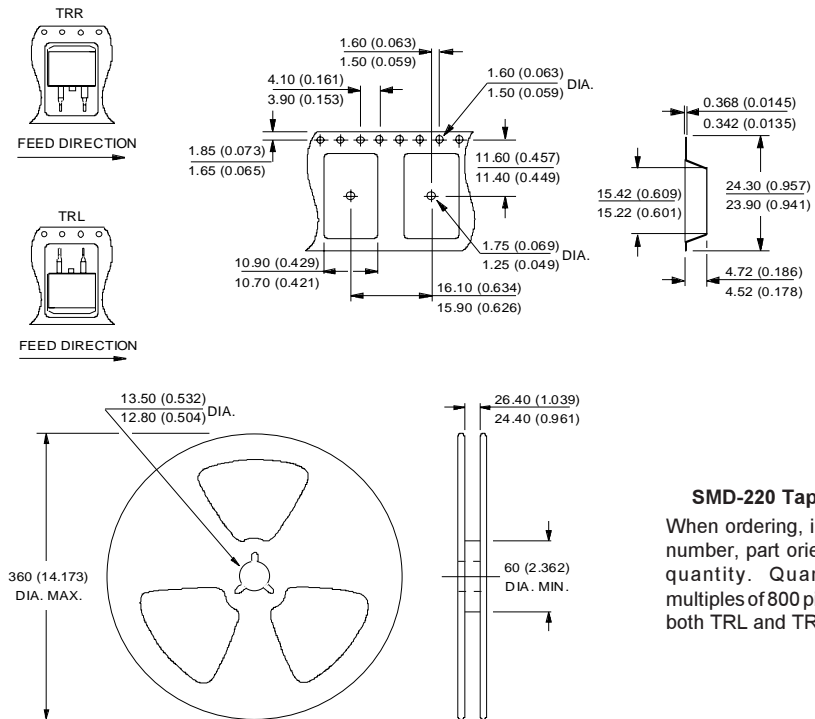
Fig. 10 - Reverse Recovery Waveform and Definitions

# HFA04SD60SPbF

## Outline Table

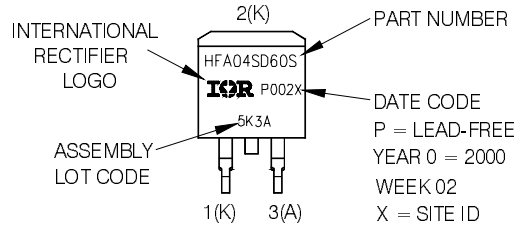


## Tape & Reel Information



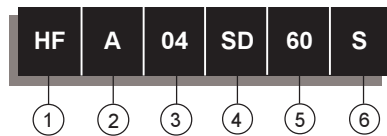
Marking Information

EXAMPLE: THIS IS A HFA04SD60S



Ordering Information Table

Device Code



- 1** - Hexfred Family
- 2** - Electron Irradiated
- 3** - Current Rating (04 = 4A)
- 4** - D-PAK
- 5** - Voltage Rating (60 = 600V)
- 6** - Suffix

- |     |                            |
|-----|----------------------------|
| S   | = D <sup>2</sup> PAK/ Dpak |
| TR  | = Tape & Reel              |
| TRL | = Tape & Reel Left         |
| TRR | = Tape & Reel Right        |

Note: "PbF" suffix at the end of the part number indicates Lead-Free.

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