

# International IOR Rectifier

HEXFRED™

## Features

- Ultrafast Recovery
- Ultrasoft Recovery
- Very Low  $I_{RRM}$
- Very Low  $Q_{rr}$
- Specified at Operating Conditions
- Lead-Free

## Benefits

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

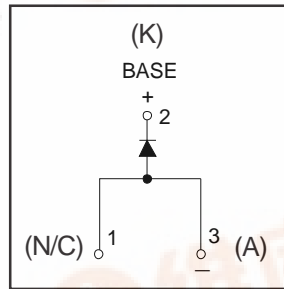
## Description

International Rectifier's HFA04TB60S is a state of the art 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 8 amps per Leg continuous current, the HFA04TB60S 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 HFA04TB60S is ideally suited for applications in power supplies and power conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.

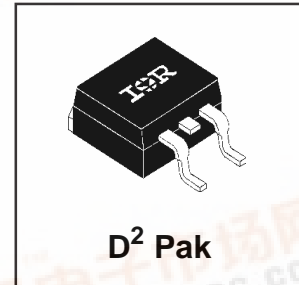
PD-96035

# HFA04TB60SPbF

Ultrafast, Soft Recovery Diode



|                                |
|--------------------------------|
| $V_R = 600V$                   |
| $V_F = 1.8V$                   |
| $Q_{rr}^* = 40nC$              |
| $di_{(rec)}/dt^* = 280A/\mu s$ |
| * 125°C                        |



## Absolute Maximum Ratings

|                           | Parameter                          | Max.        | Units |
|---------------------------|------------------------------------|-------------|-------|
| $V_R$                     | Cathode-to-Anode Voltage           | 600         | V     |
| $I_F @ T_C = 100^\circ C$ | Continuous Forward Current         | 4.0         | A     |
| $I_{FSM}$                 | Single Pulse Forward Current       | 25          |       |
| $I_{FRM}$                 | Maximum Repetitive Forward Current | 16          |       |
| $P_D @ T_C = 25^\circ C$  | Maximum Power Dissipation          | 25          | W     |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation          | 10          |       |
| $T_J$                     | Operating Junction and             | -55 to +150 | °C    |
| $T_{STG}$                 | Storage Temperature Range          |             |       |



# HFA04TB60SPbF

International  
IRF Rectifier

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

|                 | Parameter                       | Min. | Typ.              | Max.              | Units | Test Conditions  |
|-----------------|---------------------------------|------|-------------------|-------------------|-------|--|
| V <sub>BR</sub> | Cathode Anode Breakdown Voltage | 600  | —                 | —                 | V     | I <sub>R</sub> = 100μA   |
| V <sub>FM</sub> | Max Forward Voltage             | —    | 1.5<br>1.8<br>1.4 | 1.8<br>2.2<br>1.7 | V     | I <sub>F</sub> = 4.0A<br>I <sub>F</sub> = 8.0A<br>I <sub>F</sub> = 4.0A, T <sub>J</sub> = 125°C<br>See Fig. 1              |
| I <sub>RM</sub> | Max Reverse Leakage Current     | —    | 0.17<br>44        | 3.0<br>300        | μA    | V <sub>R</sub> = V <sub>R</sub> Rated<br>T <sub>J</sub> = 125°C, V <sub>R</sub> = 0.8 x V <sub>R</sub> Rated<br>See Fig. 2 |
| C <sub>T</sub>  | Junction Capacitance            | —    | 4.0               | 8.0               | pF    | V <sub>R</sub> = 200V<br>See Fig. 3  |
| 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)

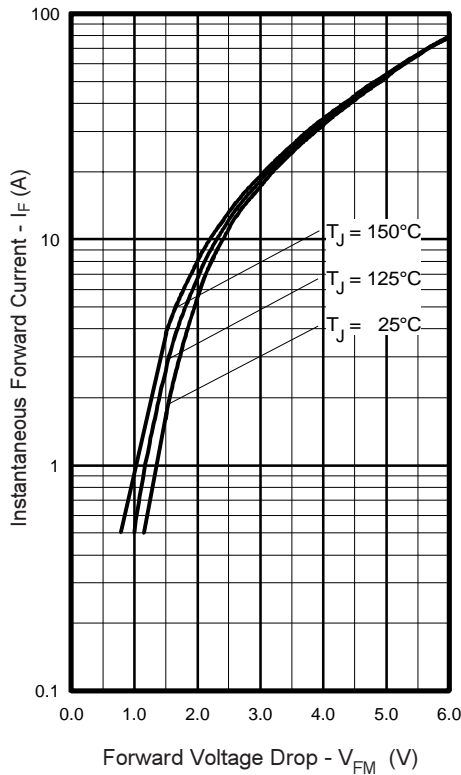
|                           | Parameter   | Min. | Typ. | Max. | Units | Test Conditions   |
|---------------------------|---|------|------|------|-------|---|
| t <sub>rr</sub>           | Reverse Recovery Time   | —    | 17   | —    | ns    | I <sub>F</sub> = 1.0A, di <sub>F</sub> /dt = 200A/μs, V <sub>R</sub> = 30V<br>T <sub>J</sub> = 25°C |
| t <sub>rr1</sub>          | See Fig. 5 & 6  | —    | 28   | 42   |       |   |
| t <sub>rr2</sub>          |   | —    | 38   | 57   |       |   |
| I <sub>RRM1</sub>         | Peak Recovery Current   | —    | 2.9  | 5.2  | A     | T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C   |
| I <sub>RRM2</sub>         |   | —    | 3.7  | 6.7  |       |   |
| Q <sub>rr1</sub>          | Reverse Recovery Charge<br>See Fig. 7                                     | —    | 40   | 60   | nC    | T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C   |
| Q <sub>rr2</sub>          |   | —    | 70   | 105  |       |   |
| di <sub>(rec)M</sub> /dt1 | Peak Rate of Fall of Recovery Current<br>During t <sub>b</sub> See Fig. 8 | —    | 280  | —    | A/μs  | T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C   |
| di <sub>(rec)M</sub> /dt2 |   | —    | 235  | —    |       |   |

## Thermal - Mechanical Characteristics

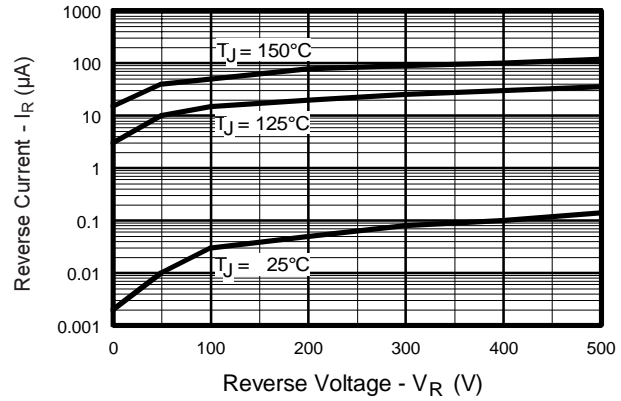
|                     | Parameter                               | Min. | Typ. | Max. | Units |
|---------------------|---|------|------|------|-------|
| T <sub>lead</sub> ① | Lead Temperature                        | —    | —    | 300  | °C    |
| R <sub>thJC</sub>   | Thermal Resistance, Junction to Case    | —    | —    | 5.0  | K/W   |
| R <sub>thJA</sub> ② | Thermal Resistance, Junction to Ambient | —    | —    | 80   |       |
| Wt                  | Weight                                  | —    | 2.0  | —    | g     |
|                     |   | —    | 0.07 | —    | (oz)  |

① 0.063 in. from Case (1.6mm) for 10 sec

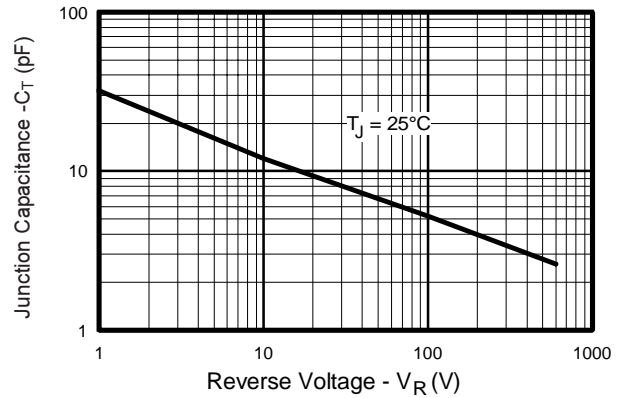
② Typical Socket Mount



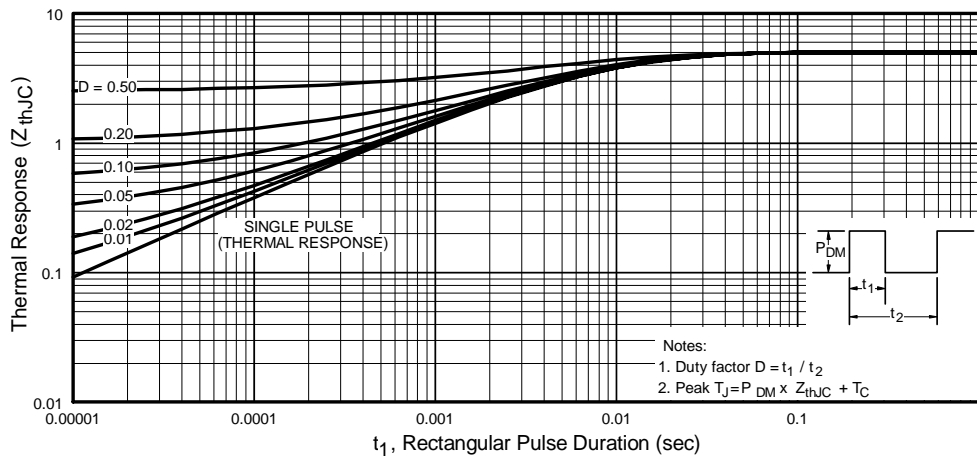
**Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current,**



**Fig. 2 - Typical Reverse Current vs. Reverse Voltage**



**Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage**



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

# HFA04TB60SPbF

International  
**IR** Rectifier

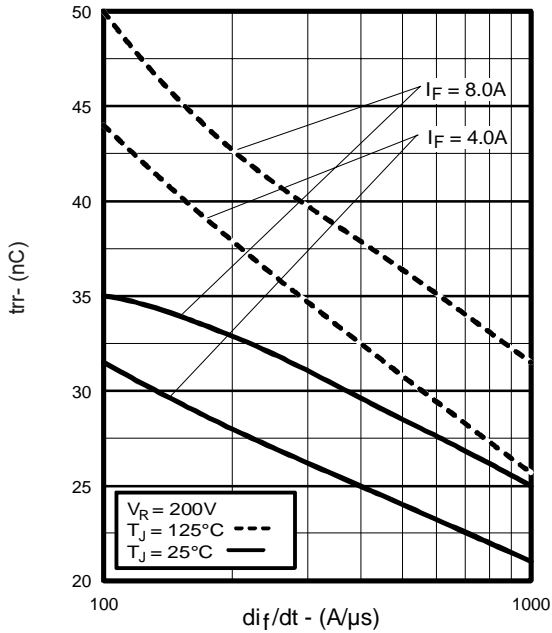


Fig. 5 - Typical Reverse Recovery vs.  $di_f/dt$

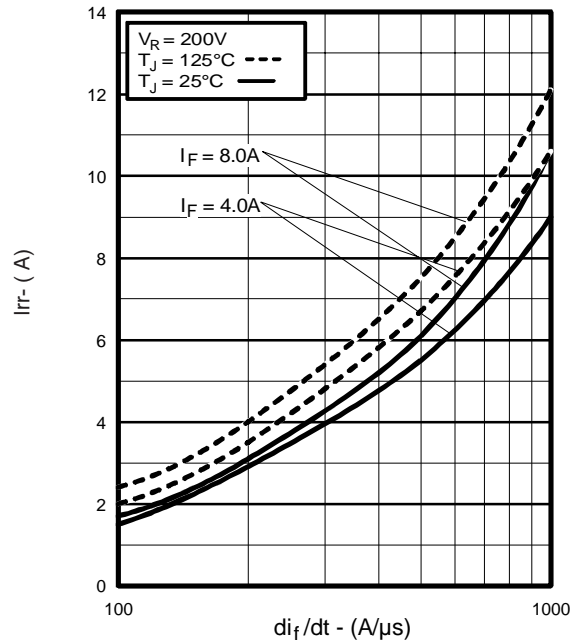


Fig. 6 - Typical Recovery Current vs.  $di_f/dt$

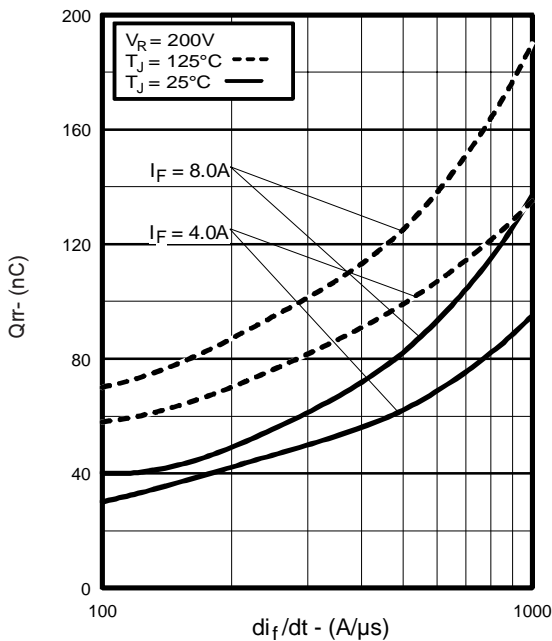


Fig. 7 - Typical Stored Charge vs.  $di_f/dt$

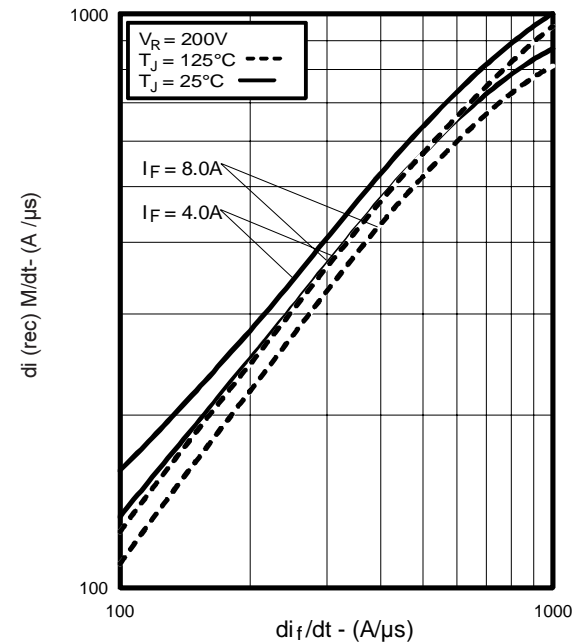
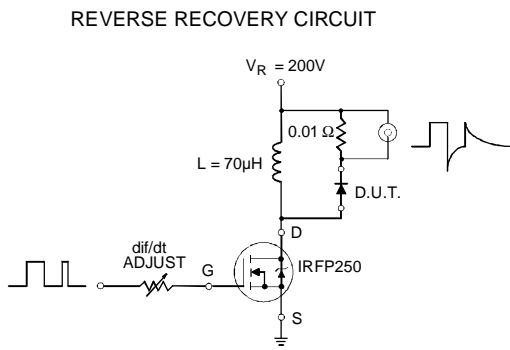
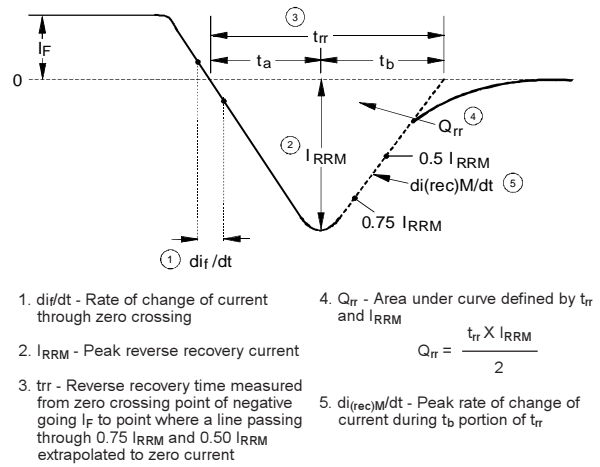


Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_f/dt$ ,



**Fig. 9 - Reverse Recovery Parameter Test Circuit**



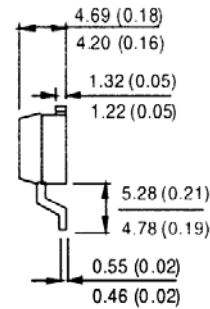
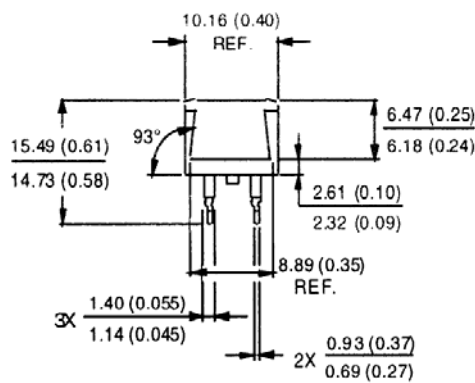
**Fig. 10 - Reverse Recovery Waveform and Definitions**

# HFA04TB60SPbF

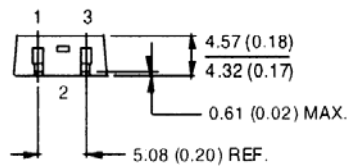
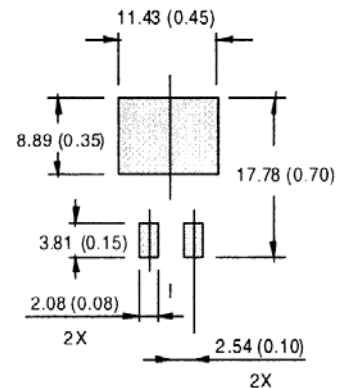
International  
**IR** Rectifier

## D<sup>2</sup>PAK Package Outline

Dimensions are shown in millimeters (inches)



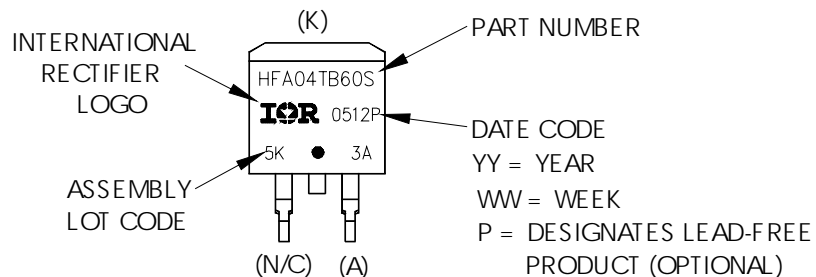
MINIMUM RECOMMENDED FOOTPRINT



Conforms to JEDEC Outline D<sup>2</sup>PAK  
 Dimensions in millimeters and inches

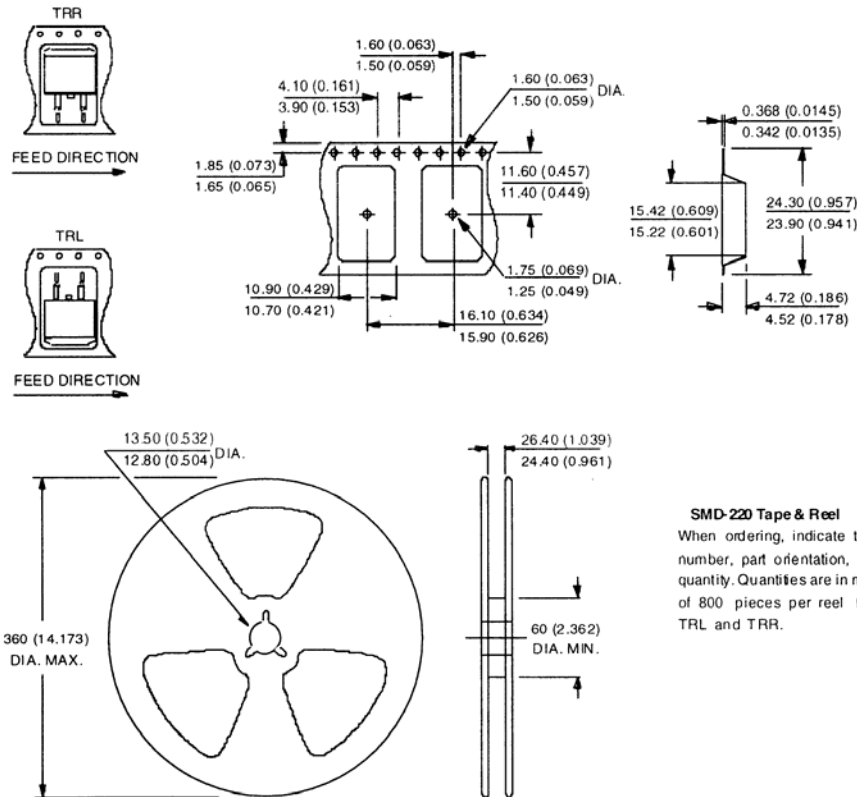
## D<sup>2</sup>PAK Part Marking Information

EXAMPLE: THIS IS A HFA04TB60S



## D<sup>2</sup>PAK Tape & Reel Information

Dimensions are shown in millimeters (inches)



**SMD-220 Tape & Reel**  
 When ordering, indicate the part number, part orientation, and the quantity. Quantities are in multiples of 800 pieces per reel for both TRL and TRR.

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