

# International IOR Rectifier

PD -2.463 rev. B 03/99

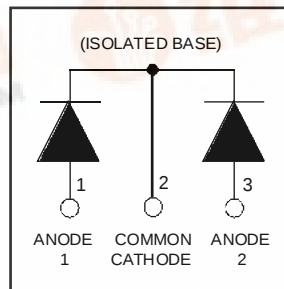
## HFA60MC60C

HEXFRED™

Ultrafast, Soft Recovery Diode

### Features

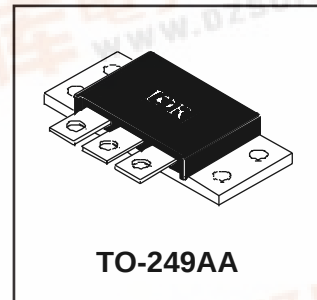
- Reduced RFI and EMI
- Reduced Snubbing
- Extensive Characterization of Recovery Parameters



$V_R = 600V$   
 $V_F(\text{typ.})^{\textcircled{3}} = 1.1V$   
 $I_{F(AV)} = 60A$   
 $Q_{rr}(\text{typ.}) = 200nC$   
 $I_{RRM}(\text{typ.}) = 6A$   
 $t_{rr}(\text{typ.}) = 30ns$   
 $di_{(rec)}/dt(\text{typ.})^{\textcircled{3}} = 170A/\mu s$

### 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.



### Absolute Maximum Ratings (per Leg)

|                           | Parameter                                        | Max.                              | Units      |
|---------------------------|--------------------------------------------------|-----------------------------------|------------|
| $V_R$                     | Cathode-to-Anode Voltage                         | 600                               | V          |
| $I_F @ T_C = 25^\circ C$  | Continuous Forward Current                       | 50                                | A          |
| $I_F @ T_C = 100^\circ C$ | Continuous Forward Current                       | 24                                |            |
| $I_{FSM}$                 | Single Pulse Forward Current <sup>①</sup>        | 200                               |            |
| $E_{AS}$                  | Non-Repetitive Avalanche Energy <sup>②</sup>     | 220                               | $\mu J$    |
| $P_D @ T_C = 25^\circ C$  | Maximum Power Dissipation                        | 125                               | W          |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation                        | 50                                |            |
| $T_J$<br>$T_{STG}$        | Operating Junction and Storage Temperature Range | -55 to +150                       | $^\circ C$ |
|                           | Soldering Temperature, for 10 sec.               | 300 (0.063 in. (1.6mm) from case) |            |

### Thermal - Mechanical Characteristics

|                 | Parameter                               | Min.     | Typ.     | Max.     | Units               |
|-----------------|-----------------------------------------|----------|----------|----------|---------------------|
| $R_{\theta JC}$ | Junction-to-Case, Single Leg Conducting | —        | —        | 1.0      | $^\circ C/W$<br>K/W |
|                 | Junction-to-Case, Both Legs Conducting  | —        | —        | 0.50     |                     |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface     | —        | 0.10     | —        |                     |
| Wt              | Weight                                  | —        | 58 (2.0) | —        | g (oz)              |
|                 | Mounting Torque                         | 35 (4.0) | —        | 50 (5.7) | lbf·in<br>(N·m)     |

Note: <sup>①</sup> Limited by junction temperature

<sup>②</sup> L = 100 $\mu H$ , duty cycle limited by max  $T_J$

<sup>③</sup> 125 $^\circ C$

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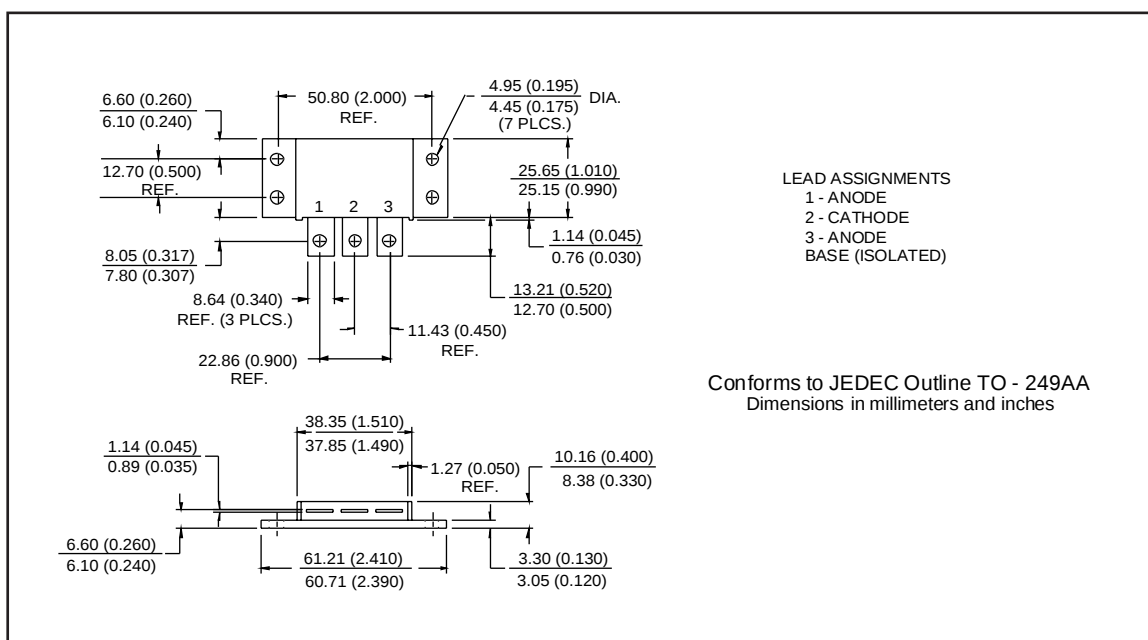
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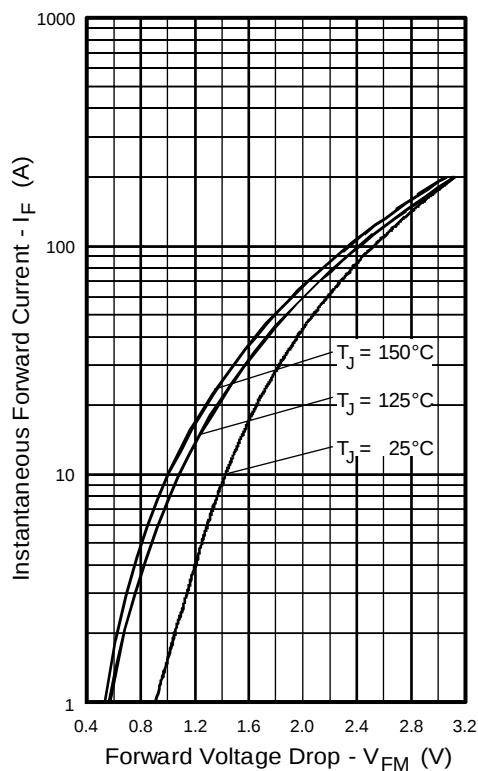
## Electrical Characteristics (per Leg) @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|          | Parameter                       | Min. | Typ. | Max. | Units         | Test Conditions                              |
|----------|---------------------------------|------|------|------|---------------|----------------------------------------------|
| $V_{BR}$ | Cathode Anode Breakdown Voltage | 600  | —    | —    | V             | $I_R = 100\mu\text{A}$                       |
| $V_{FM}$ | Max Forward Voltage             | —    | 1.3  | 1.5  | V             | $I_F = 30\text{A}$                           |
|          |                                 | —    | 1.4  | 1.7  |               | $I_F = 60\text{A}$ See Fig. 1                |
|          |                                 | —    | 1.1  | 1.3  |               | $I_F = 30\text{A}, T_J = 125^\circ\text{C}$  |
| $I_{RM}$ | Max Reverse Leakage Current     | —    | 2.0  | 10   | $\mu\text{A}$ | $V_R = V_R \text{ Rated}$ See Fig. 2         |
|          |                                 | —    | 0.50 | 2.0  | $\text{mA}$   | $T_J = 125^\circ\text{C}, V_R = 480\text{V}$ |
| $C_T$    | Junction Capacitance            | —    | 68   | 100  | $\text{pF}$   | $V_R = 200\text{V}$ See Fig. 3               |
| $L_S$    | Series Inductance               | —    | 8.0  | —    | $\text{nH}$   | From terminal hole to terminal hole          |

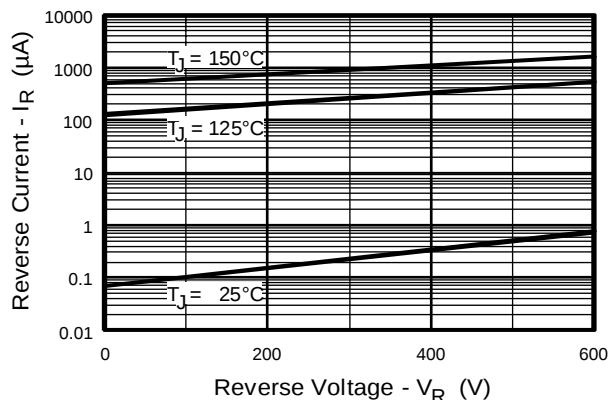
## Dynamic Recovery Characteristics (per Leg) @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                   | Parameter                             | Min. | Typ. | Max. | Units                  | Test Conditions                                                          |
|-------------------|---------------------------------------|------|------|------|------------------------|--------------------------------------------------------------------------|
| $t_{rr}$          | Reverse Recovery Time                 | —    | 30   | —    | ns                     | $I_F = 1.0\text{A}, di_f/dt = 200\text{A}/\mu\text{s}, V_R = 30\text{V}$ |
| $t_{rr1}$         |                                       | —    | 67   | 100  |                        | $T_J = 25^\circ\text{C}$ See Fig. 5                                      |
| $t_{rr2}$         |                                       | —    | 112  | 170  |                        | $T_J = 125^\circ\text{C}$                                                |
| $I_{RRM1}$        | Peak Recovery Current                 | —    | 6.0  | 11   | A                      | $T_J = 25^\circ\text{C}$ See Fig. 6                                      |
| $I_{RRM2}$        |                                       | —    | 9.0  | 16   |                        | $T_J = 125^\circ\text{C}$                                                |
| $Q_{rr1}$         | Reverse Recovery Charge               | —    | 200  | 550  | nC                     | $T_J = 25^\circ\text{C}$ See Fig. 7                                      |
| $Q_{rr2}$         |                                       | —    | 500  | 1400 |                        | $T_J = 125^\circ\text{C}$                                                |
| $di_{(rec)M}/dt1$ | Peak Rate of Fall of Recovery Current | —    | 250  | —    | $\text{A}/\mu\text{s}$ | $T_J = 25^\circ\text{C}$ See Fig. 8                                      |
| $di_{(rec)M}/dt2$ | During $t_b$                          | —    | 170  | —    |                        | $T_J = 125^\circ\text{C}$                                                |

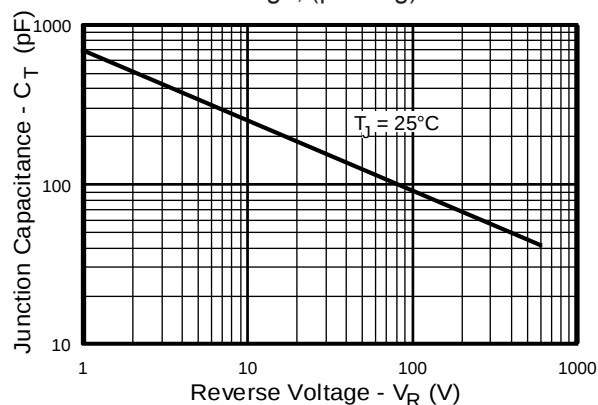




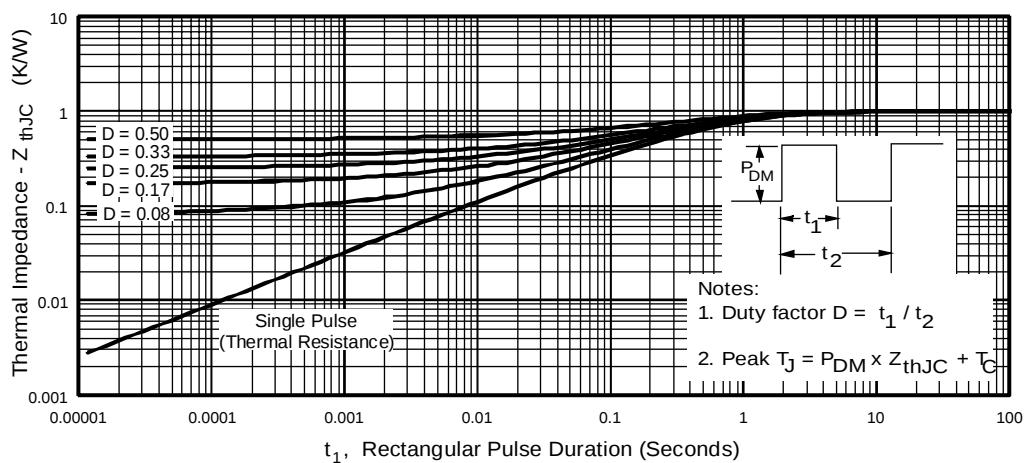
**Fig. 1** - Maximum Forward Voltage Drop vs. Instantaneous Forward Current, (per Leg)



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



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

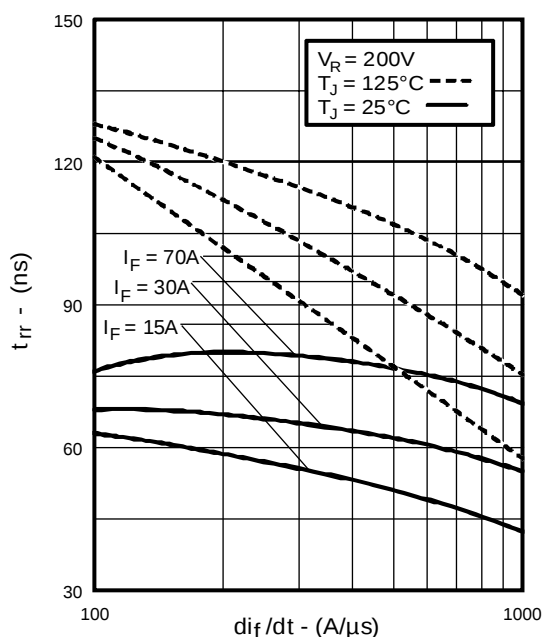


**Fig. 4** - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics, (per Leg)

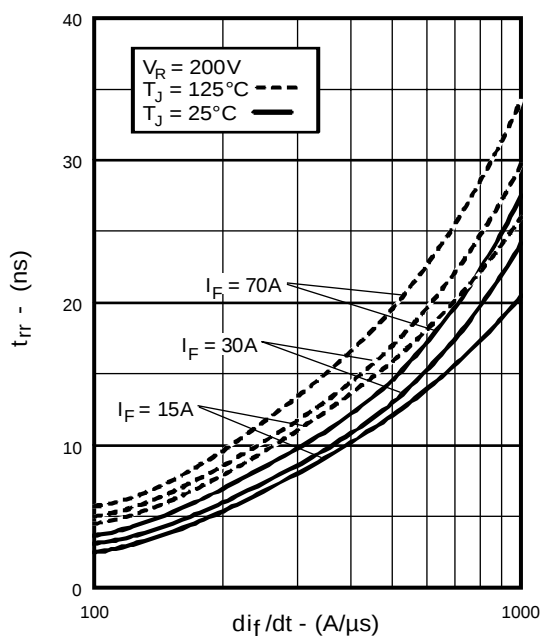
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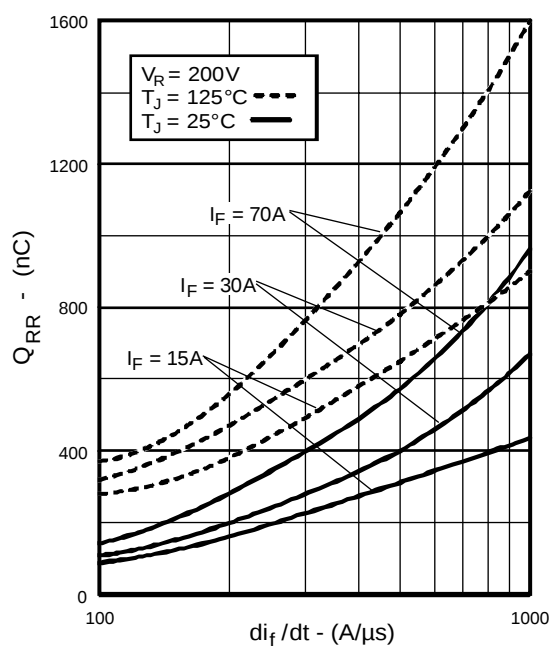
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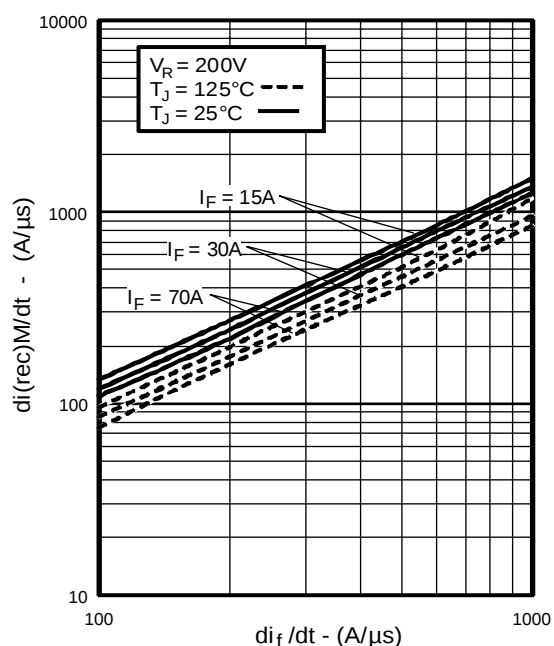
**Fig. 5** - Typical Reverse Recovery vs.  $di_f/dt$ , (per Leg)



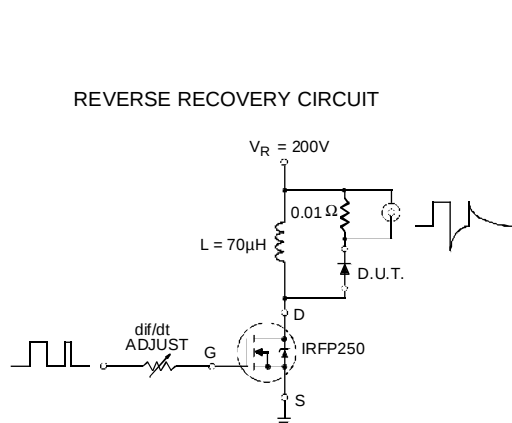
**Fig. 6** - Typical Recovery Current vs.  $di_f/dt$ , (per Leg)



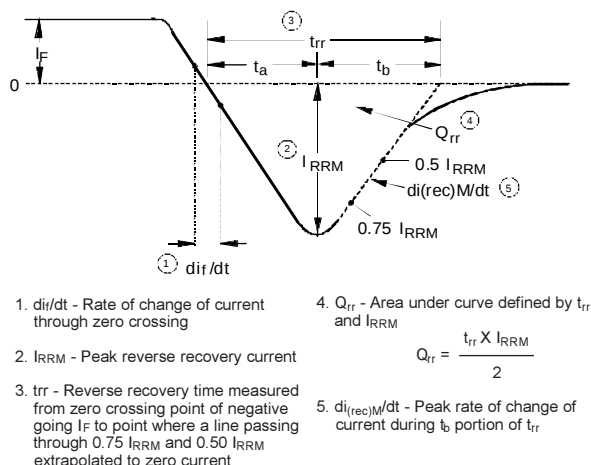
**Fig. 7** - Typical Stored Charge vs.  $di_f/dt$ , (per Leg)



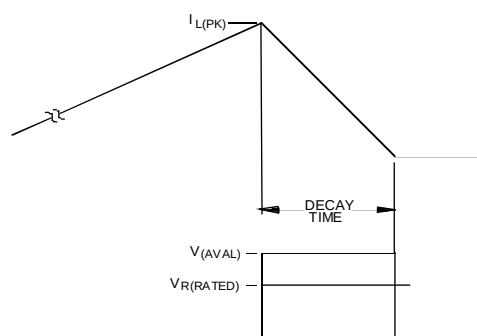
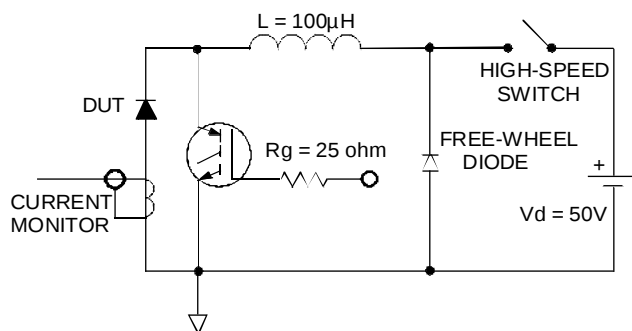
**Fig. 8** - Typical  $di_{(rec)M}/dt$  vs.  $di_f/dt$ , (per Leg)



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



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



**Fig. 11 - Avalanche Test Circuit and Waveforms**