HEXFRED
ULTRAFAST, SOFT RECOVERY DIODE

Features
- Reduced RFI and EMI
- Reduced Snubbing
- Extensive Characterization of Recovery Parameters
- Hermetically Sealed
- Surface Mount

Description
HFA40HF120C is part of the International Rectifier HiRel family of products. These Ultrafast, soft recovery 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)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Characteristics</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_R$</td>
<td>Cathode to Anode Voltage</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>$I_{F(AV)}$</td>
<td>Continuous Forward Current $\otimes T_C = 100^\circ C$</td>
<td>15</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>Single Pulse Forward Current $\otimes T_C = 25^\circ C$</td>
<td>80</td>
<td>A</td>
</tr>
<tr>
<td>$P_D @ T_C = 25^\circ C$</td>
<td>Maximum Power Dissipation</td>
<td>63</td>
<td>W</td>
</tr>
<tr>
<td>$T_J$, $T_{STG}$</td>
<td>Operating Junction and Storage Temperature Range</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Notes:
- $\otimes$ D.C. = 50% rectangle wave
- $\otimes$ 1/2 sine wave, 60Hz, Pulse Width = 8.33ms

PIN ASSIGNMENTS

<table>
<thead>
<tr>
<th>PIN ASSIGNMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ISOLATED BASE)</td>
</tr>
<tr>
<td>1 ANODE 1</td>
</tr>
<tr>
<td>2 COMMON CATHODE</td>
</tr>
<tr>
<td>3 ANODE 2</td>
</tr>
</tbody>
</table>
### Thermal - Mechanical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{\text{JC}}$</td>
<td></td>
<td>2.0</td>
<td>°C/W</td>
</tr>
<tr>
<td>Wt</td>
<td>2.6</td>
<td></td>
<td>g</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{BR}$</td>
<td>1200</td>
<td>—</td>
<td>—</td>
<td>V</td>
<td>$I_R = 250\mu$A</td>
</tr>
<tr>
<td>$V_{FM}$</td>
<td>—</td>
<td>—</td>
<td>3.9</td>
<td>V</td>
<td>$I_F = 7.0\text{A}, T_J = -55^\circ\text{C}$</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>—</td>
<td>3.3</td>
<td>V</td>
<td>$I_F = 7.0\text{A}, T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>—</td>
<td>4.4</td>
<td>V</td>
<td>$I_F = 15\text{A}, T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>—</td>
<td>2.8</td>
<td>V</td>
<td>$I_F = 7.0\text{A}, T_J = 125^\circ\text{C}$</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>$\mu$A</td>
<td>$V_R = V_R \text{ Rated}$</td>
</tr>
<tr>
<td>$C_T$</td>
<td>—</td>
<td>15</td>
<td>20</td>
<td>pF</td>
<td>$V_R = 200\text{V}$</td>
</tr>
<tr>
<td>$L_S$</td>
<td>—</td>
<td>2.8</td>
<td>—</td>
<td>nH</td>
<td>Measured from center of bond pad to end of anode bonding wire</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{tr1}$</td>
<td>—</td>
<td>58</td>
<td>100</td>
<td>ns</td>
<td>$T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td>$t_{tr2}$</td>
<td>—</td>
<td>110</td>
<td>165</td>
<td>ns</td>
<td>$T_J = 125^\circ\text{C}$</td>
</tr>
<tr>
<td>$I_{RRM1}$</td>
<td>—</td>
<td>5.4</td>
<td>8.1</td>
<td>A</td>
<td>$T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td>$I_{RRM2}$</td>
<td>—</td>
<td>7.2</td>
<td>10.8</td>
<td>A</td>
<td>$T_J = 125^\circ\text{C}$</td>
</tr>
<tr>
<td>$Q_{r1}$</td>
<td>—</td>
<td>185</td>
<td>370</td>
<td>nC</td>
<td>$T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td>$Q_{r2}$</td>
<td>—</td>
<td>395</td>
<td>590</td>
<td>nC</td>
<td>$T_J = 125^\circ\text{C}$</td>
</tr>
<tr>
<td>$\frac{di_{\text{rec}}}{dt}$</td>
<td>—</td>
<td>255</td>
<td>380</td>
<td>A/µs</td>
<td>$T_J = 25^\circ\text{C}$</td>
</tr>
<tr>
<td>$\frac{di_{\text{rec}}}{dt}$</td>
<td>—</td>
<td>160</td>
<td>240</td>
<td>A/µs</td>
<td>$T_J = 125^\circ\text{C}$</td>
</tr>
</tbody>
</table>
Fig. 1 Typical Forward Voltage Drop Vs. Instantaneous Forward Current (Per Leg)

Fig. 2 Typical Values of Reverse Current Vs. Reverse Voltage (Per Leg)

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

Fig. 4 Maximum Thermal Impedance $Z_{\text{thJC}}$ Characteristics (Per Leg)

Notes:
1. Duty factor $D = \frac{t_1}{t_2}$
2. Peak $T_J = P_{DM} \times Z_{\text{thJC}} + T_C$
Fig. 5  Typical Reverse Recovery Vs $\frac{di}{dt}$ (Per Leg)

Fig. 6  Typical Recovery Current Vs $\frac{di}{dt}$ (Per Leg)

Fig. 7  Typical Stored Charge Vs $\frac{di}{dt}$ (Per Leg)

Fig. 8  Typical $\frac{di(\text{rec})}{dt}$ Vs $\frac{di}{dt}$ (Per Leg)

Fig. 9  Typical Reverse Recovery Parameter Test Circuit

Fig. 10  Reverse Recovery Waveform and Definitions

1. $\frac{di}{dt}$ - Rate of change of current through zero crossing.
2. $I_{\text{RRM}}$ - Peak reverse recovery current.
3. $t_{\text{rr}}$ - Reverse recovery time measured from zero crossing point of negative going $I_F$ to point where a line passing through 0.75$I_{\text{RRM}}$ and 0.5$I_{\text{RRM}}$ extrapolated to zero current.
4. $Q_{\text{rr}}$ - Area under curve defined by $t_{\text{rr}}$ and $I_{\text{RRM}}$, $Q_{\text{rr}} = (t_{\text{rr}} \times I_{\text{RRM}}) / 2$
5. $\frac{di(\text{rec})}{dt}$ - Peak rate of change of current during $t_B$ position of $t_{\text{rr}}$. 

$V_R = 200V$
$L = 70\mu H$
$I_F = 14A$
$I_F = 7A$
$I_F = 3.5A$
$V = 200V$
$T_J = 125^\circ C$
$T_J = 25^\circ C$
$R_J$

ADJUST

IRFP250

G
S
D

100 1000
$\frac{di}{dt}$ - (A/\mu s)

10
$Q_{\text{rr}}$ - (nC)

100 1000
$\frac{di(\text{rec})}{dt}$ - (A/\mu s)

10
$0.75 I_{\text{RRM}}$

100 1000
$\frac{di}{dt}$ - (A/\mu s)

10
$I_{\text{RRM}}$

100 1000
$\frac{di}{dt}$ - (A/\mu s)

10
$I_{\text{RRM}}$

100 1000
$\frac{di}{dt}$ - (A/\mu s)

10
$I_{\text{RRM}}$

100 1000
$\frac{di}{dt}$ - (A/\mu s)

10
$I_{\text{RRM}}$
Case Outline and Dimensions — SMD-1

NOTES:
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. DIMENSION INCLUDES METALLIZATION FLASH.
5. DIMENSION DOES NOT INCLUDE METALLIZATION FLASH.

PAD ASSIGNMENTS
Refer to page 1.
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