FAIRCHILD SEMICONDUCTOR TM

# RHRG7570, RHRG7580, RHRG7590, RHRG75100

March 2001

## 75A, 700V - 1000V Hyperfast Diode

### Features

- **Hyperfast with Soft Recovery . . . . . <85ns**
- **Operating Temperature . . . . . +175°C**
- **Reverse Voltage Up To . . . . . 1000V**
- **Avalanche Energy Rated**
- **Planar Construction**

### Applications

- **Switching Power Supplies**
- **Power Switching Circuits**
- **General Purpose**

### Description

RHRG7570, RHRG7580, RHRG7590 and RHRG75100 (TA49068) are hyperfast diodes with soft recovery characteristics ($t_{RR}$ < 85ns). They have half the recovery time of ultrafast diodes and are silicon nitride passivated ion-implanted epitaxial planar construction.

These devices are intended for use as freewheeling/clamping diodes and rectifiers in a variety of switching power supplies and other power switching applications. Their low stored charge and hyperfast soft recovery minimize ringing and electrical noise in many power switching circuits reducing power loss in the switching transistors.

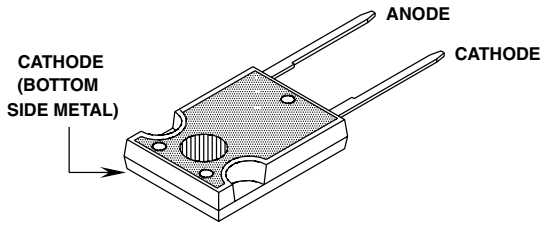
These devices are supplied in the 2 lead JEDEC style TO-247 plastic package.

Due to space limitations, the brand on the RHRG75100 is abbreviated to HRG75100.

To order this part use the full part number, i.e. RHRG75100.

### Package

**JEDEC STYLE TO-247**
TOP VIEW




### Symbol


### Absolute Maximum Ratings ($T_C$ = +25°C), Unless Otherwise Specified

| | RHRG7570 | RHRG7580 | RHRG7590 | RHRG75100 | UNITS |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage $V_{RRM}$ | 700 | 800 | 900 | 1000 | V |
| Working Peak Reverse Voltage $V_{RWM}$ | 700 | 800 | 900 | 1000 | V |
| DC Blocking Voltage $V_R$ | 700 | 800 | 900 | 1000 | V |
| Average Rectified Forward Current $I_{F(AV)}$ ($T_C$ = +52°C) | 75 | 75 | 75 | 75 | A |
| Repetitive Peak Surge Current $I_{FSM}$ (Square Wave, 20kHz) | 150 | 150 | 150 | 150 | A |
| Nonrepetitive Peak Surge Current $I_{FSM}$ (Halfwave, 1 phase, 60Hz) | 750 | 750 | 750 | 750 | A |
| Maximum Power Dissipation $P_D$ | 190 | 190 | 190 | 190 | W |
| Avalanche Energy (L = 40mH) (See Figures 10 and 11) $E_{AVL}$ | 50 | 50 | 50 | 50 | mj |
| Operating and Storage Temperature $T_{STG}$, $T_J$ | -65 to +175 | -65 to +175 | -65 to +175 | -65 to +175 | °C |

**Electrical Specifications** $T_C = +25^oC$, Unless Otherwise Specified

| SYMBOL | TEST CONDITION | RHRG7570 | | | RHRG7580 | | | RHRG7590 | | | RHRG75100 | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_F$ | $I_F = 75A, T_C = +25^oC$ | - | - | 3.0 | - | - | 3.0 | - | - | 3.0 | - | - | 3.0 | V |
| | $I_F = 75A, T_C = +150^oC$ | - | - | 2.5 | - | - | 2.5 | - | - | 2.5 | - | - | 2.5 | V |
| $I_R$ | $V_R = 700V, T_C = +25^oC$ | - | - | 50 | - | - | - | - | - | - | - | - | - | µA |
| | $V_R = 800V, T_C = +25^oC$ | - | - | - | - | - | 50 | - | - | - | - | - | - | µA |
| | $V_R = 900V, T_C = +25^oC$ | | | | | | | - | - | 50 | | | | µA |
| | $V_R = 1000V, T_C = +25^oC$ | - | - | - | - | - | - | - | - | - | - | - | 50 | µA |
| $I_R$ | $V_R = 700V, T_C = +150^oC$ | - | - | 2.0 | - | - | - | - | - | - | - | - | - | mA |
| | $V_R = 800V, T_C = +150^oC$ | - | - | - | - | - | 2.0 | - | - | - | - | - | - | mA |
| | $V_R = 900V, T_C = +150^oC$ | | | | | | | - | - | 2.0 | | | | mA |
| | $V_R = 1000V, T_C = +150^oC$ | - | - | - | - | - | - | - | - | - | - | - | 2.0 | mA |
| $t_{RR}$ | $I_F = 1A, dI_F/dt = 100A/µs$ | - | - | 85 | - | - | 85 | - | - | 85 | - | - | 85 | ns |
| | $I_F = 75A, dI_F/dt = 100A/µs$ | - | - | 100 | - | - | 100 | - | - | 100 | - | - | 100 | ns |
| $t_A$ | $I_F = 75A, dI_F/dt = 100A/µs$ | - | 55 | - | - | 55 | - | - | 55 | - | - | 55 | - | ns |
| $t_B$ | $I_F = 75A, dI_F/dt = 100A/µs$ | - | 40 | - | - | 40 | - | - | 40 | - | - | 40 | - | ns |
| $Q_{RR}$ | $I_F = 75A, dI_F/dt = 100A/µs$ | - | 240 | - | - | 240 | - | - | 240 | - | - | 240 | - | nC |
| $C_J$ | $V_R = 10V, I_F = 0A$ | - | 220 | - | - | 220 | - | | 220 | | - | 220 | - | pF |
| $R_{\theta JC}$ | | - | - | 0.8 | - | - | 0.8 | | | 0.8 | - | - | 0.8 | $^oC/W$ |

DEFINITIONS

$V_F$ = Instantaneous Forward Voltage (pw = 300µs, D = 2%)

$I_R$ = Instantaneous Reverse Current

$t_{RR}$ = Reverse Recovery Time (Figure 2), Summation of $t_A + t_B$

$t_A$ = Time to Reach Peak Reverse Current (See Figure 2).

$t_B$ = Time from Peak $I_{RM}$ to Projected Zero Crossing of $I_{RM}$ Based on a Straight Line from Peak $I_{RM}$ Through 25% of $I_{RM}$ (See Figure 2)

$Q_{RR}$ = Reverse Recovery Charge

$C_J$ = Junction Capacitance

$R_{\theta JC}$ = Thermal Resistance Junction to Case

pw = Pulse Width

D = Duty Cycle

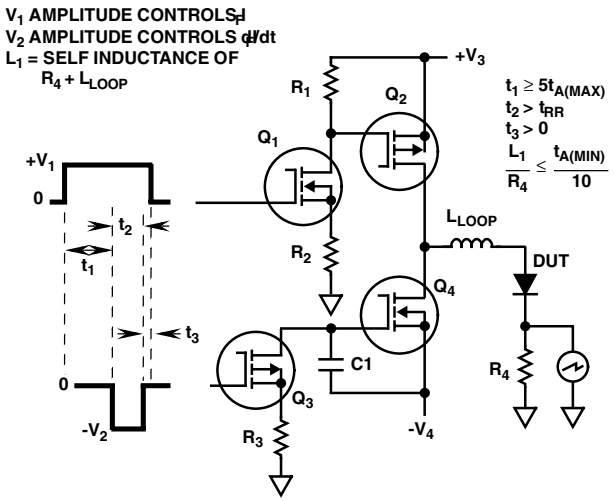



**FIGURE 1. $t_{RR}$ TEST CIRCUIT**

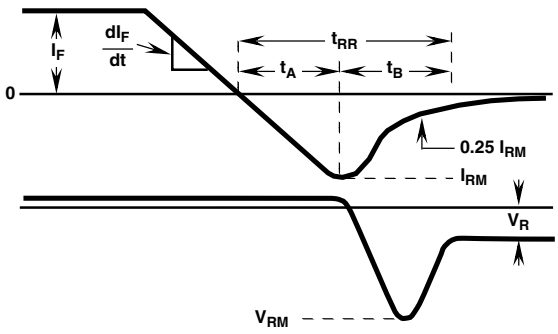



**FIGURE 2. $t_{RR}$ WAVEFORMS AND DEFINITIONS**

## *Typical Performance Curves*

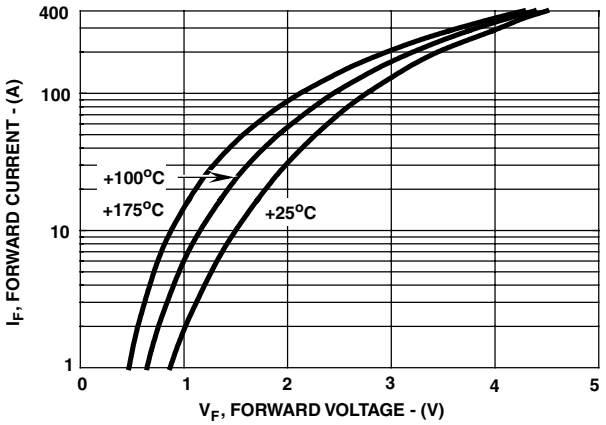



**FIGURE 3. TYPICAL FORWARD CURRENT vs. FORWARD VOLTAGE DROP**

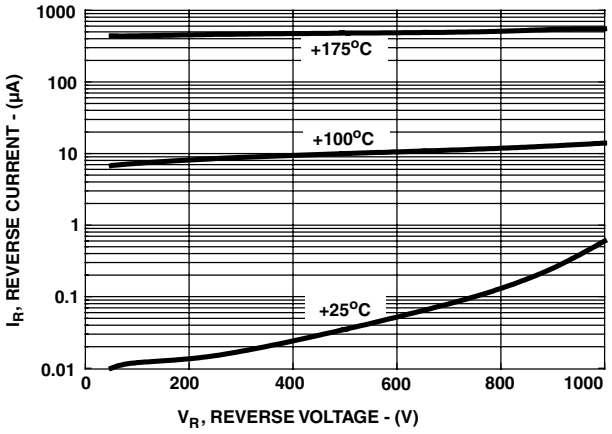



**FIGURE 4. TYPICAL REVERSE CURRENT vs. REVERSE VOLTAGE**

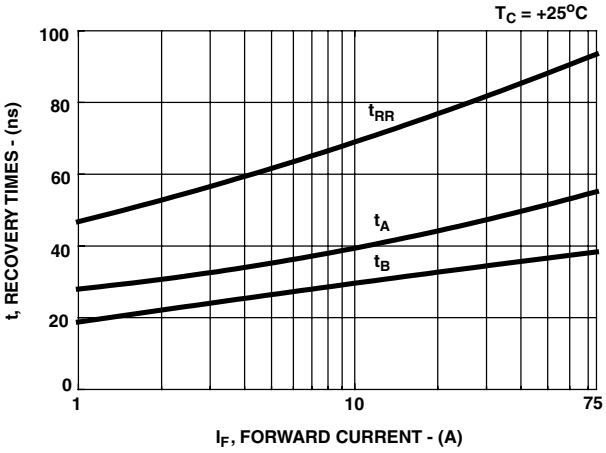



**FIGURE 5. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs. FORWARD CURRENT AT +25°C**

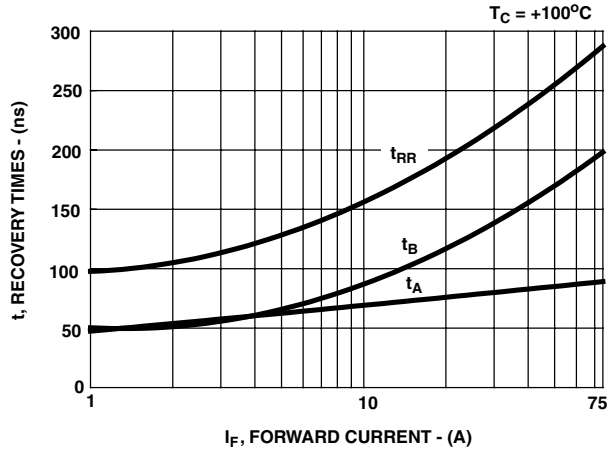



**FIGURE 6. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs. FORWARD CURRENT AT +100°C**

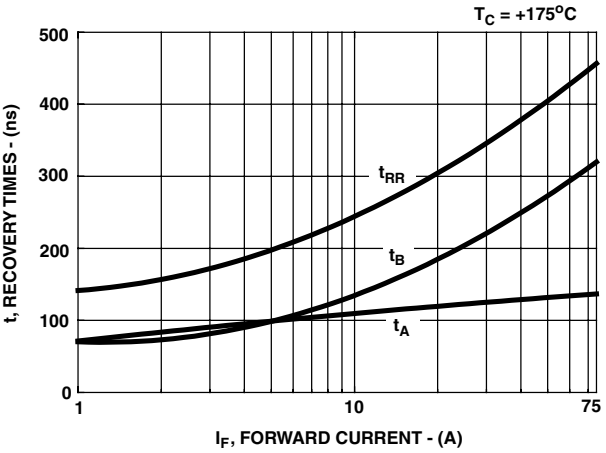



**FIGURE 7. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs. FORWARD CURRENT AT +175°C**

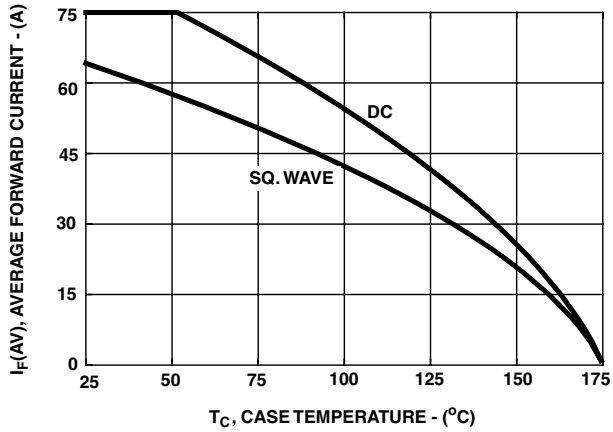



**FIGURE 8. CURRENT DERATING CURVE FOR ALL TYPES**

## *Typical Performance Curves* (Continued)

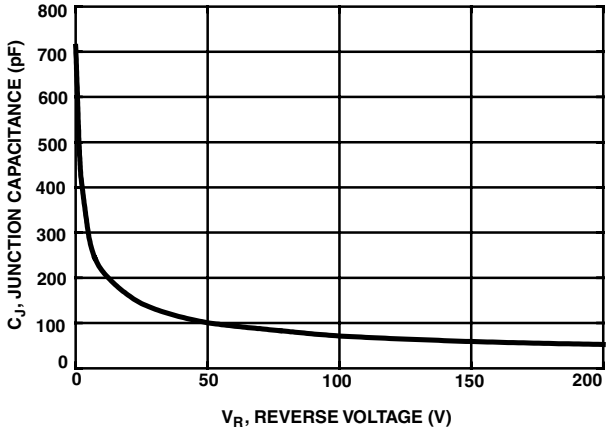



**FIGURE 9. TYPICAL JUNCTION CAPACITANCE vs. REVERSE VOLTAGE**

$I_{MAX}$ = 1A
L = 40mH
R < 0.1Ω
$E_{AVL} = 1/2LI^2 [V_{AVL}/(V_{AVL} - V_{DD})]$
$Q_1$ AND $Q_2$ ARE 1000V MOSFETs

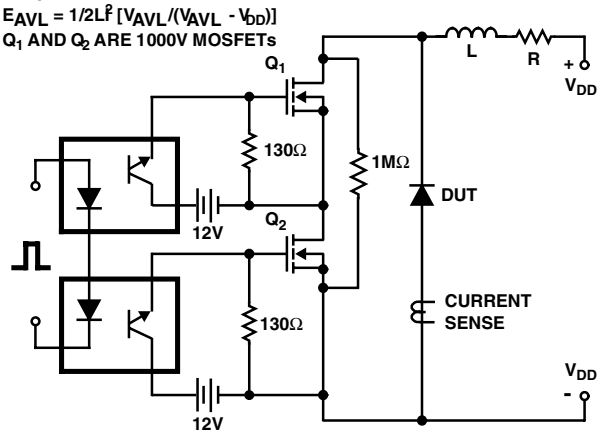



**FIGURE 10. AVALANCHE ENERGY TEST CIRCUIT**

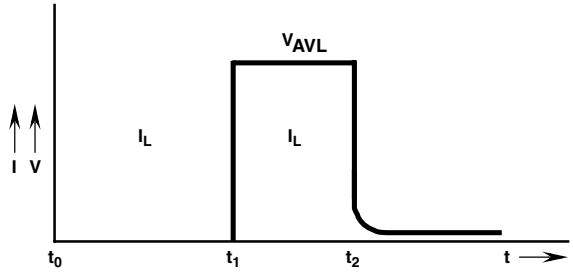
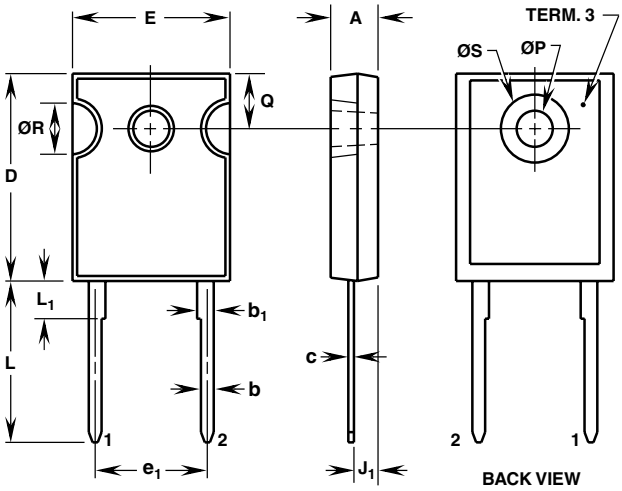



**FIGURE 11. AVALANCHE CURRENT AND VOLTAGE WAVEFORMS**

## *Packaging* (Continued)




### TO-247

**2 LEAD JEDEC STYLE TO-247 PLASTIC PACKAGE (FOR RECTIFIERS ONLY)**

| SYMBOL | INCHES | | MILLIMETERS | | NOTES |
|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | |
| A | 0.180 | 0.190 | 4.58 | 4.82 | - |
| b | 0.046 | 0.051 | 1.17 | 1.29 | 2, 3 |
| $b_1$ | 0.060 | 0.070 | 1.53 | 1.77 | 1, 2 |
| c | 0.020 | 0.026 | 0.51 | 0.66 | 1, 2, 3 |
| D | 0.800 | 0.820 | 20.32 | 20.82 | - |
| E | 0.605 | 0.625 | 15.37 | 15.87 | - |
| $e_1$ | 0.438 BSC | | 11.12 BSC | | 4 |
| $J_1$ | 0.090 | 0.105 | 2.29 | 2.66 | 5 |
| L | 0.620 | 0.640 | 15.75 | 16.25 | - |
| $L_1$ | 0.145 | 0.155 | 3.69 | 3.93 | 1 |
| ØP | 0.138 | 0.144 | 3.51 | 3.65 | - |
| Q | 0.210 | 0.220 | 5.34 | 5.58 | - |
| ØR | 0.195 | 0.205 | 4.96 | 5.20 | - |
| ØS | 0.260 | 0.270 | 6.61 | 6.85 | - |

NOTES:

1. Lead dimension and finish uncontrolled in $L_1$.
2. Lead dimension (without solder).
3. Add typically 0.002 inches (0.05mm) for solder coating.
4. Position of lead to be measured 0.250 inches (6.35mm) from bottom of dimension D.
5. Position of lead to be measured 0.100 inches (2.54mm) from bottom of dimension D.
6. Controlling dimension: Inch.
7. Revision 2 dated 12-93.

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