# RHRU5070, RHRU5080, RHRU5090, RHRU50100

Data Sheet | April 1995 | File Number 3665.1

## 50A, 700V - 1000V Hyperfast Diodes

RHRU5070, RHRU5080, RHRU5090 and RHRU50100 (TA49066) are hyperfast diodes with soft recovery characteristics ($t_{RR}$ < 75ns). 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.

## Ordering Information

**PACKAGING AVAILABILITY**

| PART NUMBER | PACKAGE | BRAND |
|---|---|---|
| RHRU5070 | TO-218 | RHRU5070 |
| RHRU5080 | TO-218 | RHRU5080 |
| RHRU5090 | TO-218 | RHRU5090 |
| RHRU50100 | TO-218 | RHRU50100 |

NOTE: When ordering, use the entire part number.

## Features

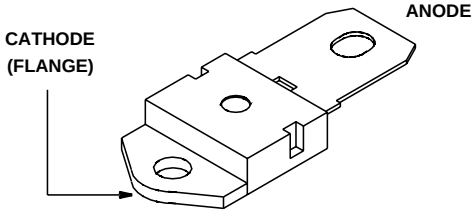
- **Hyperfast with Soft Recovery . . . . . <75ns**
- **Operating Temperature . . . . . +175$^{O}$C**
- **Reverse Voltage Up To . . . . . 1000V**
- **Avalanche Energy Rated**
- **Planar Construction**

## Applications

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

## Package

**JEDEC STYLE TO-218**




## Symbol


**Absolute Maximum Ratings** $T_C$ = +25$^{O}$C, Unless Otherwise Specified

| | | RHRU5070 | RHRU5080 | RHRU5090 | RHRU50100 | 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 ($T_C$ = +65$^{O}$C) | $I_{F(AV)}$ | 50 | 50 | 50 | 50 | A |
| Repetitive Peak Surge Current (Square Wave, 20kHz) | $I_{FSM}$ | 100 | 100 | 100 | 100 | A |
| Nonrepetitive Peak Surge Current (Halfwave, 1 Phase, 60Hz) | $I_{FSM}$ | 500 | 500 | 500 | 500 | A |
| Maximum Power Dissipation | $P_D$ | 150 | 150 | 150 | 150 | W |
| Avalanche Energy (L = 40mH) | $E_{AVL}$ | 40 | 40 | 40 | 40 | mj |
| Operating and Storage Temperature | $T_{STG}$, $T_J$ | -65 to +175 | -65 to +175 | -65 to +175 | -65 to +175 | $^{O}$C |

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

| SYMBOL | TEST CONDITION | RHRU5070 | | | RHRU5080 | | | RHRU5090 | | | RHRU50100 | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_F$ | $I_F$ = 50A, $T_C$ = +25°C | - | - | 3.0 | - | - | 3.0 | - | - | 3.0 | - | - | 3.0 | V |
| | $I_F$ = 50A, $T_C$ = +150°C | - | - | 2.5 | - | - | 2.5 | - | - | 2.5 | - | - | 2.5 | V |
| $I_R$ | $V_R$ = 700V, $T_C$ = +25°C | - | - | 500 | - | - | - | - | - | - | - | - | - | µA |
| | $V_R$ = 800V, $T_C$ = +25°C | - | - | - | - | - | 500 | - | - | - | - | - | - | µA |
| | $V_R$ = 900V, $T_C$ = +25°C | - | - | - | - | - | - | - | - | 500 | - | - | - | µA |
| | $V_R$ = 1000V, $T_C$ = +25°C | - | - | - | - | - | - | - | - | - | - | - | 500 | µA |
| $I_R$ | $V_R$ = 700V, $T_C$ = +150°C | - | - | 3.0 | - | - | - | - | - | - | - | - | - | mA |
| | $V_R$ = 800V, $T_C$ = +150°C | - | - | - | - | - | 3.0 | - | - | - | - | - | - | mA |
| | $V_R$ = 900V, $T_C$ = +150°C | - | - | - | - | - | - | - | - | 3.0 | - | - | - | mA |
| | $V_R$ = 1000V, $T_C$ = +150°C | - | - | - | - | - | - | - | - | - | - | - | 3.0 | mA |
| $t_{RR}$ | $I_F$ = 1A, $dI_F/dt$ = 100A/µs | - | - | 75 | - | - | 75 | - | - | 75 | - | - | 75 | ns |
| | $I_F$ = 50A, $dI_F/dt$ = 100A/µs | - | - | 95 | - | - | 95 | - | - | 95 | - | - | 95 | ns |
| $t_A$ | $I_F$ = 50A, $dI_F/dt$ = 100A/µs | - | 54 | - | - | 54 | - | - | 54 | - | - | 54 | - | ns |
| $t_B$ | $I_F$ = 50A, $dI_F/dt$ = 100A/µs | - | 32 | - | - | 32 | - | - | 32 | - | - | 32 | - | ns |
| $Q_{RR}$ | $I_F$ = 50A, $dI_F/dt$ = 100A/µs | - | 125 | - | - | 125 | - | - | 125 | - | - | 125 | - | nC |
| $C_J$ | $V_R$ = 10V, $I_F$ = 0A | - | 150 | - | - | 150 | - | - | 150 | - | - | 150 | - | pF |
| $R_{\theta JC}$ | | - | - | 1.0 | - | - | 1.0 | - | - | 1.0 | - | - | 1.0 | °C/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).

$R_{\theta JC}$ = Thermal resistance junction to case.

$E_{AVL}$ = Controlled avalanche energy (See Figure 10 and Figure 11).

pw = Pulse width.

D = Duty cycle.

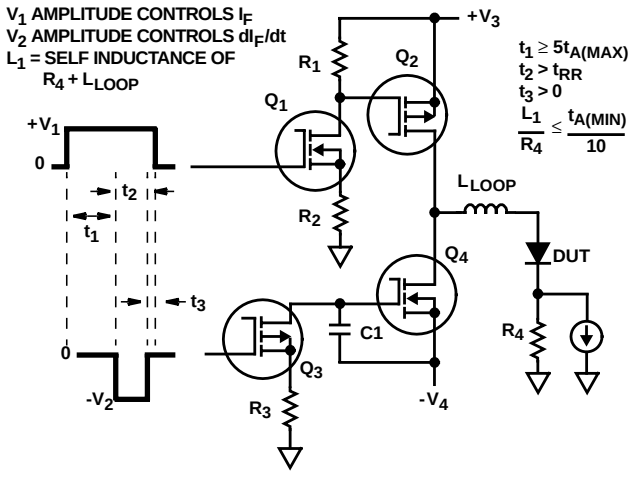



**FIGURE 1. $t_{RR}$ TEST CIRCUIT**

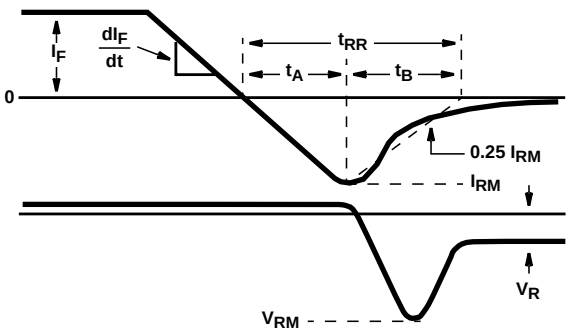



**FIGURE 2. WAVEFORMS AND DEFINITIONS**

## Typical Performance Curves

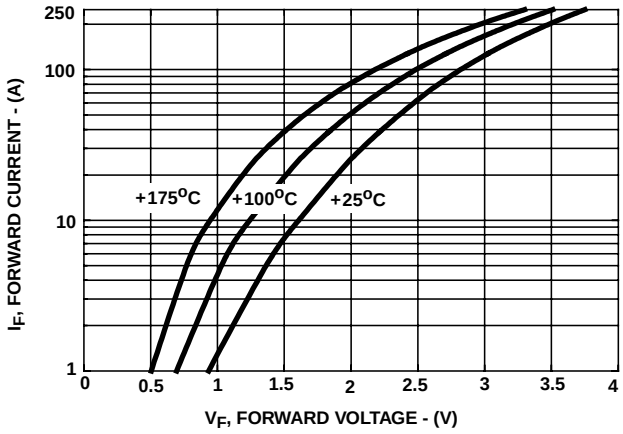



FIGURE 3. TYPICAL FORWARD CURRENT vs FORWARD VOLTAGE DROP

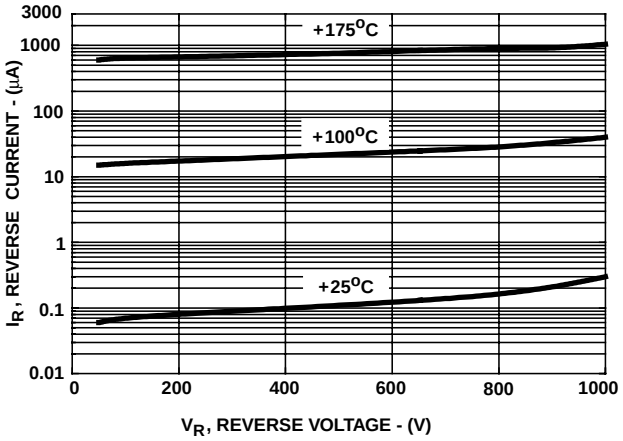



FIGURE 4. TYPICAL REVERSE CURRENT vs REVERSE VOLTAGE

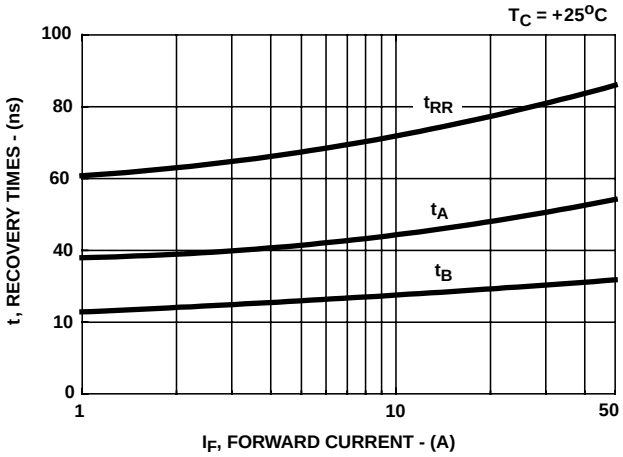



FIGURE 5. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs FORWARD CURRENT AT +25°C

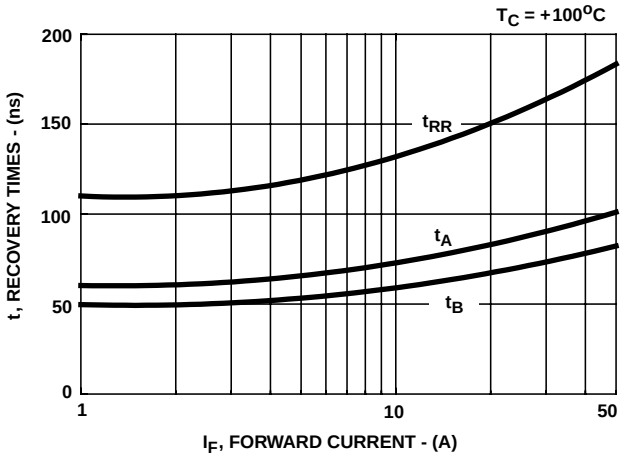



FIGURE 6. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs FORWARD CURRENT AT +100°C

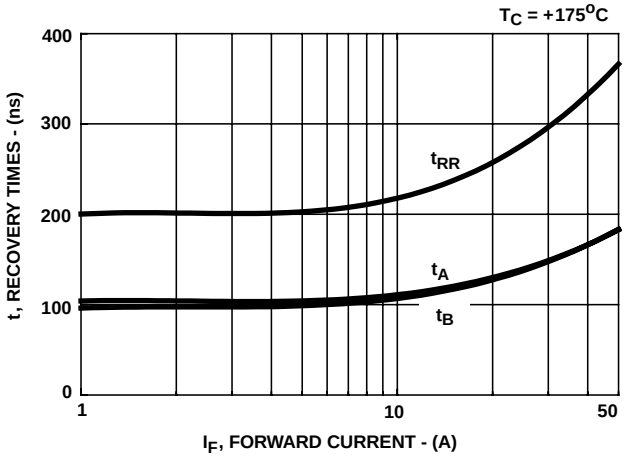



FIGURE 7. TYPICAL $t_{RR}$, $t_A$ AND $t_B$ CURVES vs FORWARD CURRENT AT +175°C

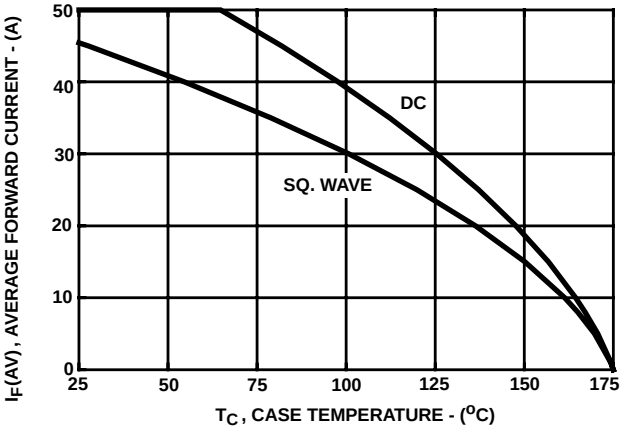



FIGURE 8. CURRENT DERATING CURVE FOR ALL TYPES

## Typical Performance Curves (Continued)

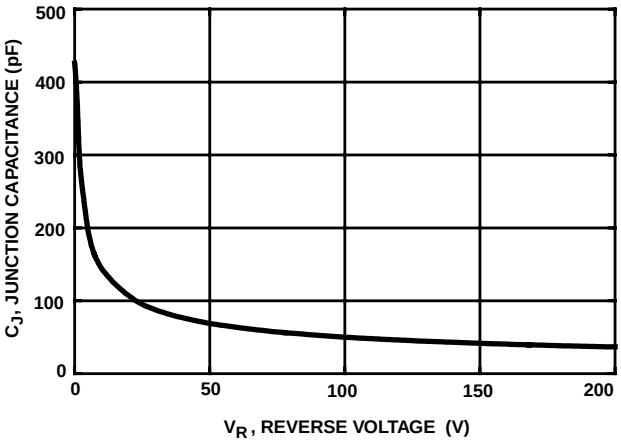



FIGURE 9. TYPICAL JUNCTION CAPACITANCE vs REVERSE VOLTAGE

## Test Circuit and Waveforms

$I_{MAX}$ = 1A
L = 40mH
R < 0.1Ω
$E_{AVL} = 1/2LI^2[V_{AVL}/(V_{AVL} - V_{DD})]$
Q1 AND Q2 ARE 1000V MOSFETS

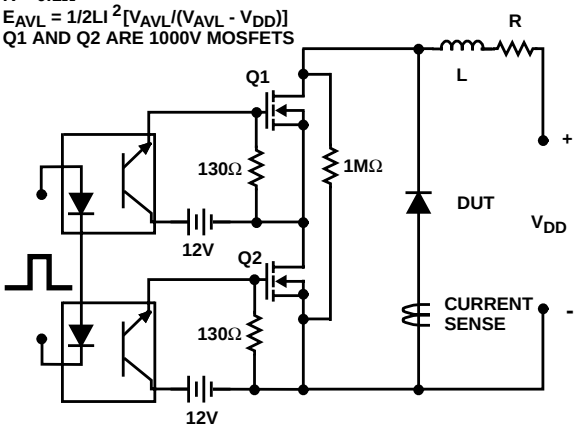



FIGURE 10. AVALANCHE ENERGY TEST CIRCUIT

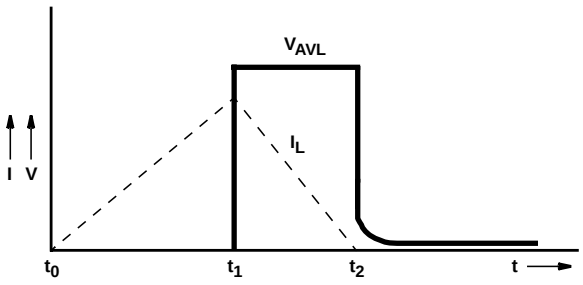



FIGURE 11. AVALANCHE CURRENT AND VOLTAGE WAVEFORMS



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