

April 1995

**30A, 400V - 600V Hyperfast Diodes**

## Features

- Hyperfast with Soft Recovery . . . . . <40ns
- Operating Temperature . . . . . +175°C
- Reverse Voltage Up To . . . . . 600V
- Avalanche Energy Rated
- Planar Construction

## Applications

- Switching Power Supplies
- Power Switching Circuits
- General Purpose

## Description

RHRP3040, RHRP3050 and RHRP3060 (TA49063) are hyperfast diodes with soft recovery characteristics ( $t_{RR} < 40\text{ns}$ ). They have half the recovery time of ultrafast diodes and are silicon nitride passivated ion-implanted epitaxial planar construction.

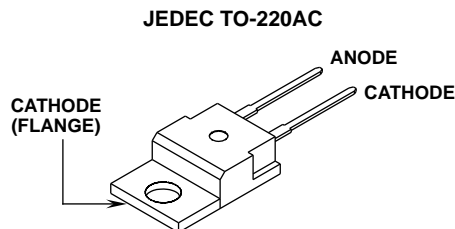
These devices are intended for use as freewheeling/clamping diodes and rectifiers in a variety of switching power supplies and other power switching applications. Their low stored charge and hyperfast soft recovery minimize ringing and electrical noise in many power switching circuits reducing power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

### PACKAGING AVAILABILITY

PART NUMBER	PACKAGE	BRAND
RHRP3040	TO-220AC	RHRP3040
RHRP3050	TO-220AC	RHRP3050
RHRP3060	TO-220AC	RHRP3060

NOTE: When ordering, use the entire part number.

## Package



## Symbol



## Absolute Maximum Ratings $T_C = +25^\circ\text{C}$ , Unless Otherwise Specified

	RHRP3040	RHRP3050	RHRP3060	UNITS
Peak Repetitive Reverse Voltage . . . . . $V_{RRM}$	400	500	600	V
Working Peak Reverse Voltage . . . . . $V_{RWM}$	400	500	600	V
DC Blocking Voltage . . . . . $V_R$	400	500	600	V
Average Rectified Forward Current . . . . . $I_{F(AV)}$ ( $T_C = +120^\circ\text{C}$ )	30	30	30	A
Repetitive Peak Surge Current . . . . . $I_{FSM}$ (Square Wave, 20kHz)	70	70	70	A
Nonrepetitive Peak Surge Current . . . . . $I_{FSM}$ (Halfwave, 1 Phase, 60Hz)	325	325	325	A
Maximum Power Dissipation . . . . . $P_D$	125	125	125	W
Avalanche Energy (See Figures 10 and 11) . . . . . $E_{AVL}$	20	20	20	mJ
Operating and Storage Temperature . . . . . $T_{STG}, T_J$	-65 to +175	-65 to +175	-65 to +175	°C

# Specifications RHRP3040, RHRP3050, RHRP3060

## Electrical Specifications $T_C = +25^\circ\text{C}$ , Unless Otherwise Specified

SYMBOL	TEST CONDITION	RHRP3040			RHRP3050			RHRP3060			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_F$	$I_F = 30\text{A}$ , $T_C = +25^\circ\text{C}$	-	-	2.1	-	-	2.1	-	-	2.1	V
	$I_F = 30\text{A}$ , $T_C = +150^\circ\text{C}$	-	-	1.7	-	-	1.7	-	-	1.7	V
$I_R$	$V_R = 400\text{V}$ , $T_C = +25^\circ\text{C}$	-	-	500	-	-	-	-	-	-	$\mu\text{A}$
	$V_R = 500\text{V}$ , $T_C = +25^\circ\text{C}$	-	-	-	-	-	500	-	-	-	$\mu\text{A}$
	$V_R = 600\text{V}$ , $T_C = +25^\circ\text{C}$	-	-	-	-	-	-	-	-	500	$\mu\text{A}$
$I_R$	$V_R = 400\text{V}$ , $T_C = +150^\circ\text{C}$	-	-	1.0	-	-	-	-	-	-	mA
	$V_R = 500\text{V}$ , $T_C = +150^\circ\text{C}$	-	-	-	-	-	1.0	-	-	-	mA
	$V_R = 600\text{V}$ , $T_C = +150^\circ\text{C}$	-	-	-	-	-	-	-	-	1.0	mA
$t_{RR}$	$I_F = 1\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	-	40	-	-	40	-	-	40	ns
	$I_F = 30\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	-	45	-	-	45	-	-	45	ns
$t_A$	$I_F = 30\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	22	-	-	22	-	-	22	-	ns
$t_B$	$I_F = 30\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	20	-	-	20	-	-	20	-	ns
$Q_{RR}$	$I_F = 30\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	50	-	-	50	-	-	50	-	nC
$C_J$	$V_R = 10\text{V}$ , $I_F = 0\text{A}$	-	85	-	-	85	-	-	85	-	pF
$R_{\theta JC}$		-	-	1.2	-	-	1.2	-	-	1.2	$^\circ\text{C}/\text{W}$

### DEFINITIONS

$V_F$  = Instantaneous forward voltage (pw = 300 $\mu\text{s}$ , D = 2%).

$I_R$  = Instantaneous reverse current.

$t_{RR}$  = Reverse recovery time (See 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.

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

pw = pulse width.

D = duty cycle.

$V_1$  AMPLITUDE CONTROLS  $I_F$   
 $V_2$  AMPLITUDE CONTROLS  $dI_F/dt$   
 $L_1$  = SELF INDUCTANCE OF  
 $R_4 + L_{\text{LOOP}}$

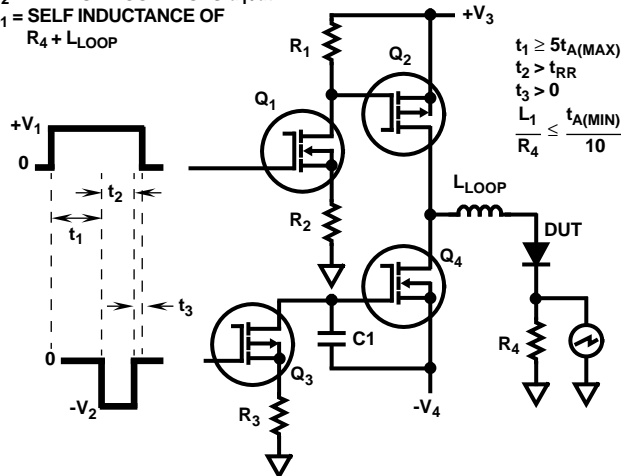


FIGURE 1.  $t_{RR}$  TEST CIRCUIT

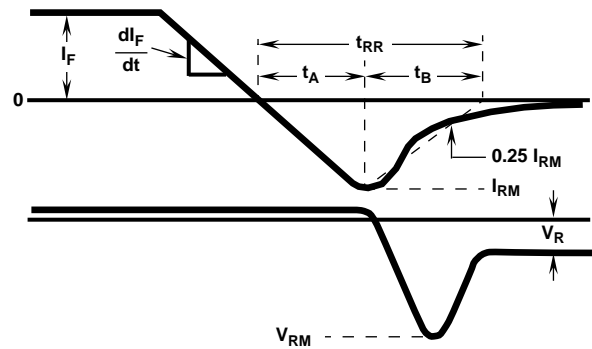


FIGURE 2.  $t_{RR}$  WAVEFORMS AND DEFINITIONS

# Typical Performance Curves

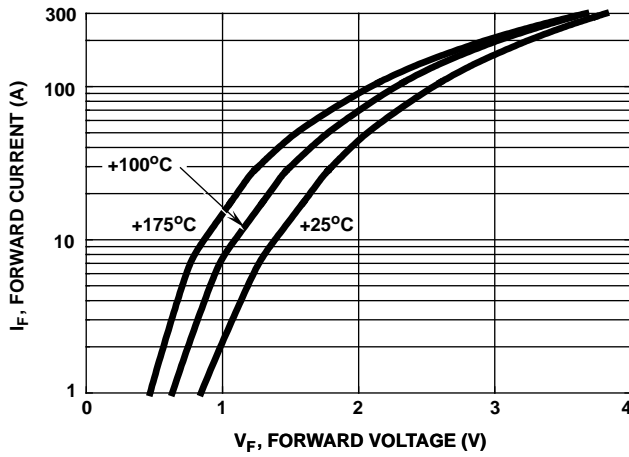


FIGURE 3. TYPICAL FORWARD CURRENT vs FORWARD VOLTAGE DROP

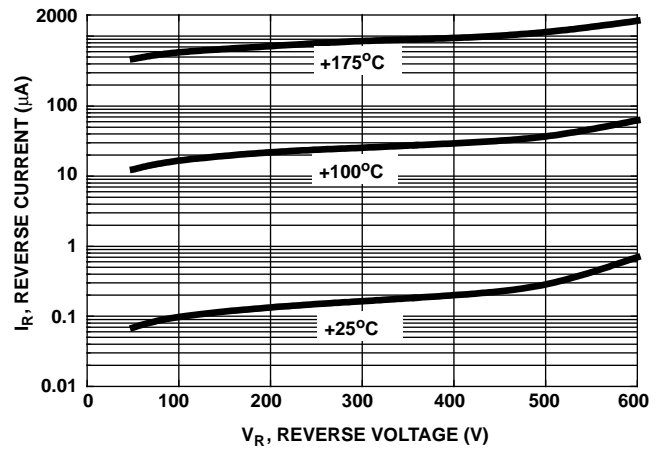


FIGURE 4. TYPICAL REVERSE CURRENT vs REVERSE VOLTAGE

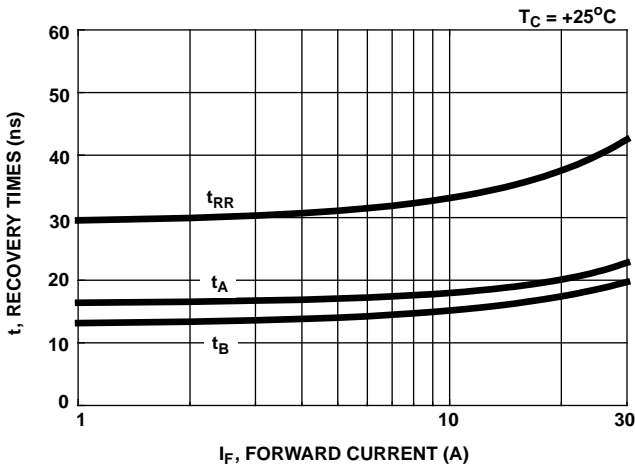


FIGURE 5. TYPICAL  $t_{RR}$ ,  $t_A$  AND  $t_B$  CURVES vs FORWARD CURRENT AT +25°C

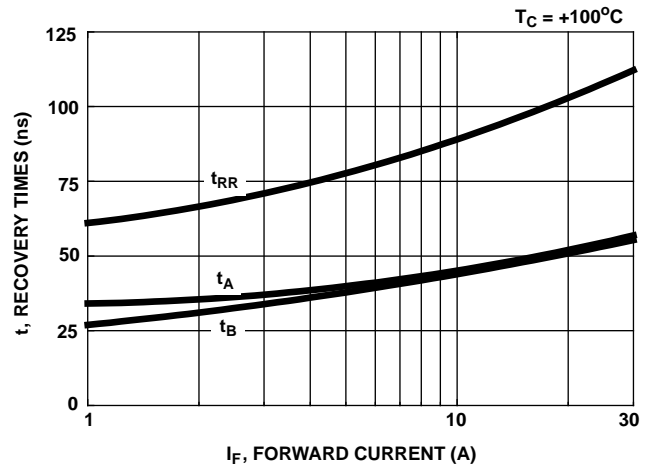


FIGURE 6. TYPICAL  $t_{RR}$ ,  $t_A$  AND  $t_B$  CURVES vs FORWARD CURRENT AT +100°C

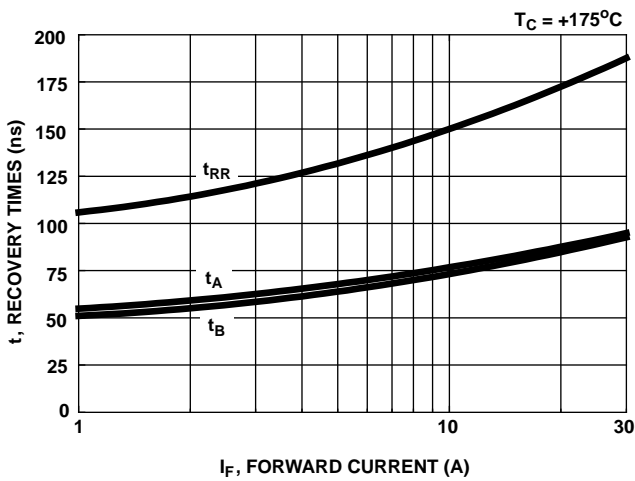


FIGURE 7. TYPICAL  $t_{RR}$ ,  $t_A$  AND  $t_B$  CURVES vs FORWARD CURRENT AT +175°C

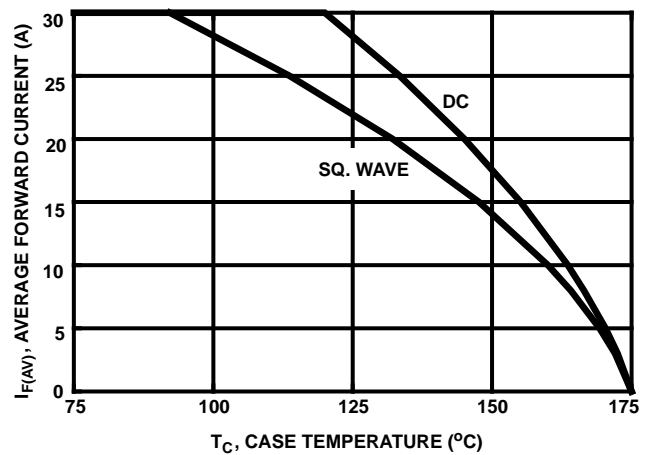


FIGURE 8. CURRENT DERATING CURVE FOR ALL TYPES

Typical Performance Curves (Continued)

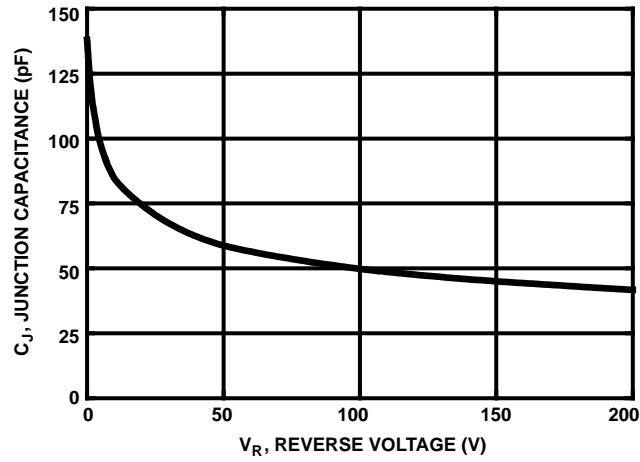


FIGURE 9. TYPICAL JUNCTION CAPACITANCE vs REVERSE VOLTAGE

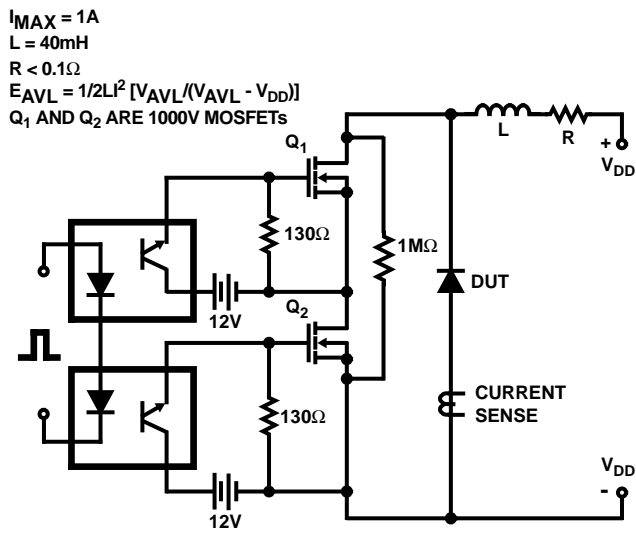


FIGURE 10. AVALANCHE ENERGY TEST CIRCUIT

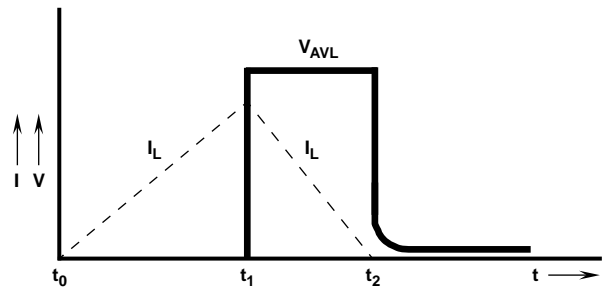


FIGURE 11. AVALANCHE CURRENT AND VOLTAGE WAVEFORMS