RHRD440, RHRD450, RHRD460, RHRD440S, RHRD450S, RHRD460S

April 1995

4A, 400V - 600V Hyperfast Diodes

Features

- **Hyperfast with Soft Recovery . . . . . <30ns**
- **Operating Temperature . . . . . +175^{o}C**
- **Reverse Voltage Up to 600V**
- **Avalanche Energy Rated**
- **Planar Construction**

Applications

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

Description

RHRD440, RHRD450, RHRD460, RHRD440S, RHRD450S, and RHRD460S (TA49055) are hyperfast diodes with soft recovery characteristics (t_{RR} < 30ns). 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.

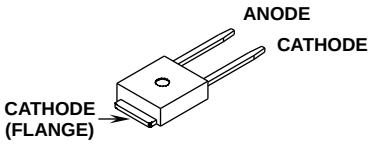
PACKAGING AVAILABILITY

PART NUMBER	PACKAGE	BRAND
RHRD440	TO-251	RHR440
RHRD450	TO-251	RHR450
RHRD460	TO-251	RHR460
RHRD440S	TO-252	RHR440
RHRD450S	TO-252	RHR450
RHRD460S	TO-252	RHR460

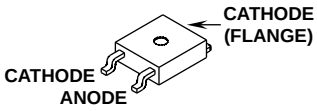
NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-252AA variant in the tape and reel, i.e., RHRD450S9A.

Package

JEDEC STYLE TO-251



JEDEC STYLE TO-252



Symbol

Absolute Maximum Ratings

T_C = +25^{o}C, Unless Otherwise Specified

	RHRD440 RHRD440S	RHRD450 RHRD450S	RHRD460 RHRD460S	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 (T_C = +157^{o}C) . . . . . $I_{F(AV)}$	4	4	4	A
Repetitive Peak Surge Current (Square Wave, 20kHz) . . . . . I_{FSM}	8	8	8	A
Nonrepetitive Peak Surge Current (Halfwave, 1 Phase, 60Hz) . . . . . I_{FSM}	40	40	40	A
Maximum Power Dissipation . . . . . P_D	50	50	50	W
Avalanche Energy (See Figures 10 and 11) . . . . . E_{AVL}	10	10	10	mj
Operating and Storage Temperature . . . . . T_{STG}, T_J	-65 to +175	-65 to +175	-65 to +175	^{o}C

File Number **3613.4**

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

SYMBOL	TEST CONDITION	LIMITS									UNITS
		RHRD440 RHRD440S			RHRD450 RHRD450S			RHRD460 RHRD460S			
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_F	I_F = 4A, T_C = +25°C	-	-	2.1	-	-	2.1	-	-	2.1	V
V_F	I_F = 4A, T_C = +150°C	-	-	1.7	-	-	1.7	-	-	1.7	V
I_R	V_R = 400V, T_C = +25°C	-	-	100	-	-	-	-	-	-	µA
	V_R = 500V, T_C = +25°C	-	-	-	-	-	100	-	-	-	µA
	V_R = 600V, T_C = +25°C	-	-	-	-	-	-	-	-	100	µA
I_R	V_R = 400V, T_C = +150°C	-	-	500	-	-	-	-	-	-	µA
	V_R = 500V, T_C = +150°C	-	-	-	-	-	500	-	-	-	µA
	V_R = 600V, T_C = +150°C	-	-	-	-	-	-	-	-	500	µA
t_{RR}	I_F = 1A, dI_F/dt = 200A/µs	-	-	30	-	-	30	-	-	30	ns
	I_F = 4A, dI_F/dt = 200A/µs	-	-	35	-	-	35	-	-	35	ns
t_A	I_F = 4A, dI_F/dt = 200A/µs	-	16	-	-	16	-	-	16	-	ns
t_B	I_F = 4A, dI_F/dt = 200A/µs	-	7	-	-	7	-	-	7	-	ns
Q_{RR}	I_F = 4A, dI_F/dt = 200A/µs	-	45	-	-	45	-	-	45	-	nC
C_J	V_R = 10V, I_F = 0A	-	15	-	-	15	-	-	15	-	pf
$R_{\theta JC}$		-	-	3	-	-	3	-	-	3	°C/W

DEFINITIONS

V_F = Instantaneous forward voltage (pw = 300µs, 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.

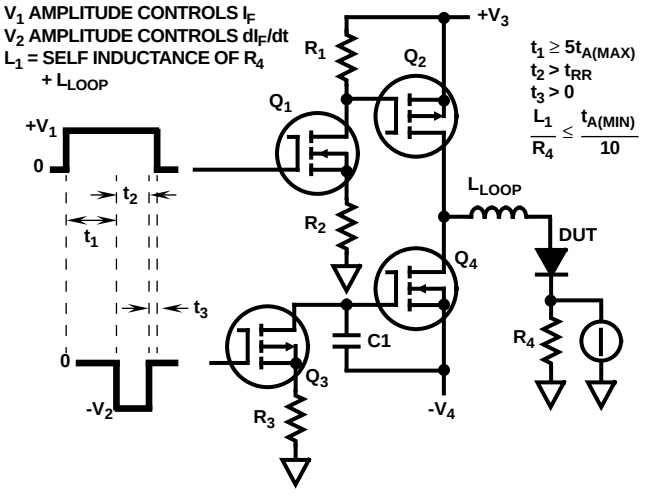


FIGURE 1. t_{RR} TEST CIRCUIT

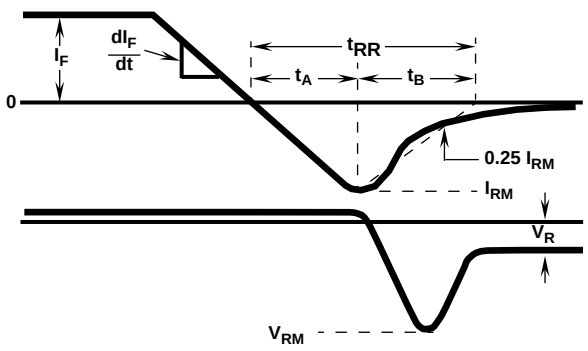


FIGURE 2. t_{RR} WAVEFORMS AND DEFINITIONS

Typical Performance Curves

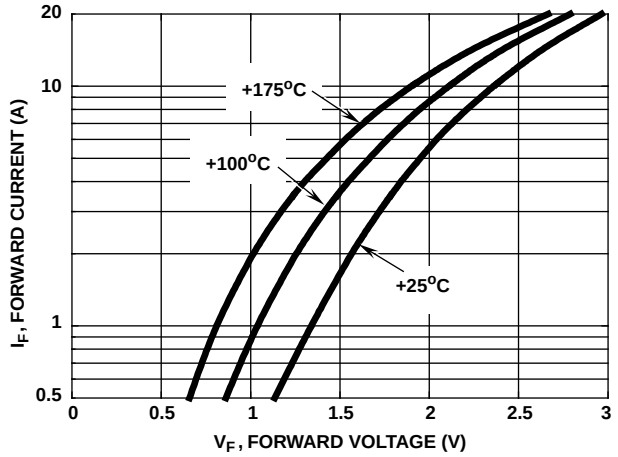


FIGURE 3. TYPICAL FORWARD CURRENT vs FORWARD VOLTAGE DROP

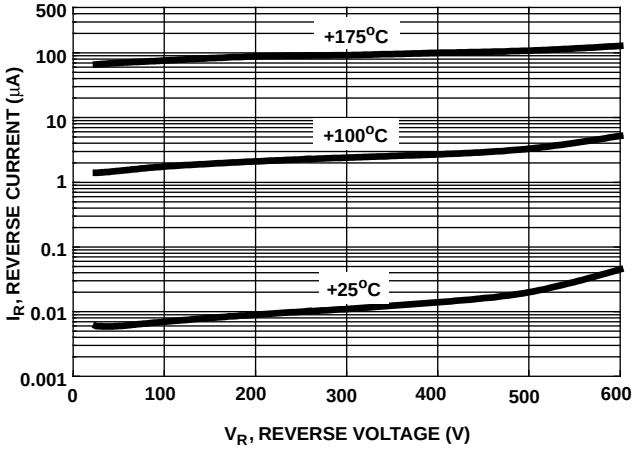


FIGURE 4. TYPICAL REVERSE CURRENT vs REVERSE VOLTAGE

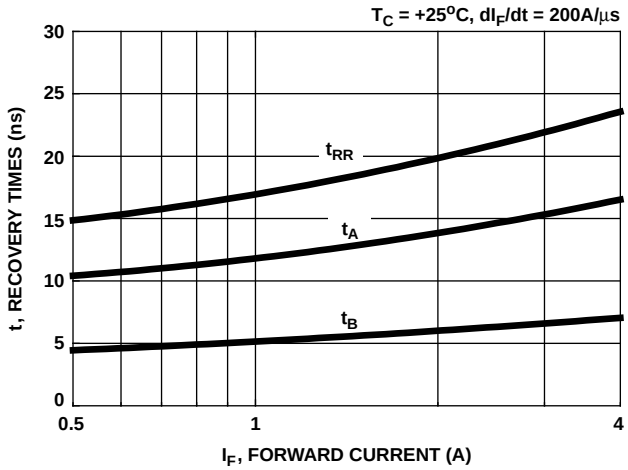


FIGURE 5. TYPICAL t_{RR}, t_A AND t_B CURVES vs FORWARD CURRENT

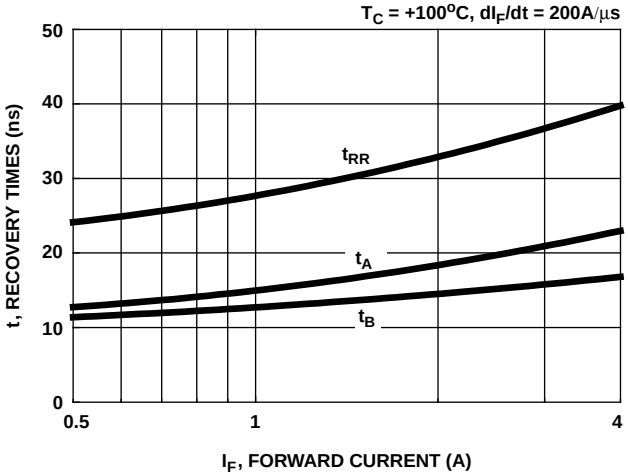


FIGURE 6. TYPICAL t_{RR}, t_A AND t_B CURVES vs FORWARD CURRENT AT 100°C

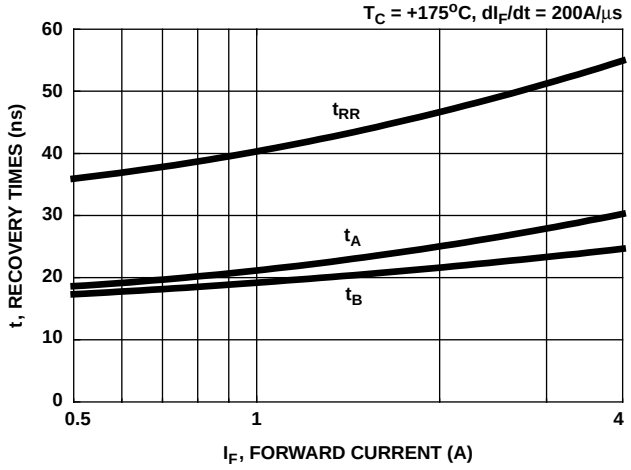


FIGURE 7. TYPICAL t_{RR}, t_A AND t_B CURVES vs FORWARD CURRENT AT 175°C

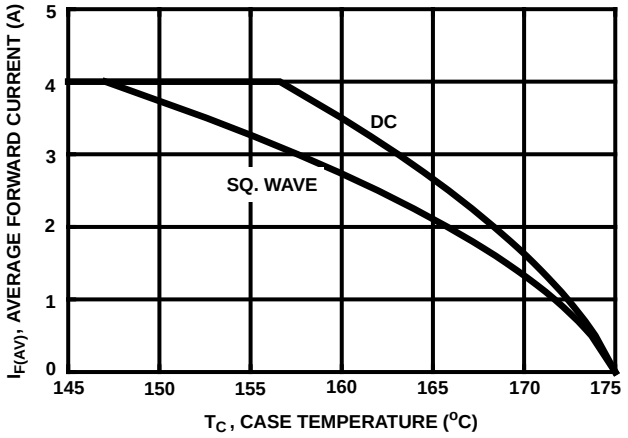


FIGURE 8. CURRENT DERATING CURVE FOR ALL TYPES

Typical Performance Curves (Continued)

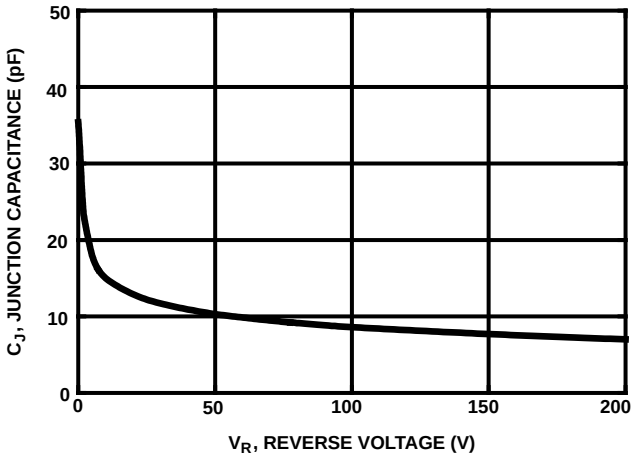


FIGURE 9. TYPICAL JUNCTION CAPACITANCE vs REVERSE VOLTAGE

Test Circuit and Waveforms

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

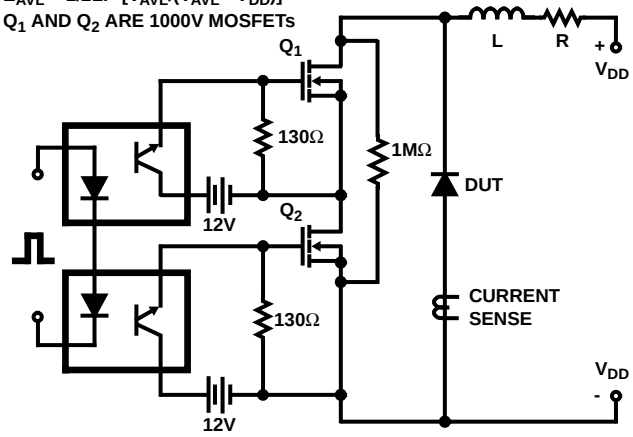


FIGURE 10. AVALANCHE ENERGY TEST CIRCUIT

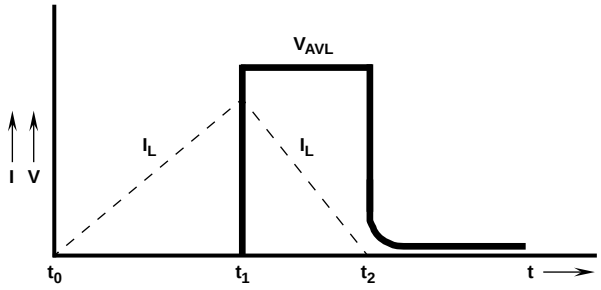


FIGURE 11. AVALANCHE CURRENT AND VOLTAGE WAVEFORMS