



### 30A Ultrafast Dual Diode With Soft Recovery Characteristic

May 1991

HARRIS SEMICONDUCTOR

— T-23-07

#### Features

- Ultrafast with Soft Recovery Characteristic ( $t_{rr} < 55\text{ns}$ )
- +175°C Rated Junction Temperature
- Reverse Voltage Up to 600V
- Avalanche Energy Rated

#### Applications

- Switching Power Supply
- Power Switching Circuits
- General Purpose

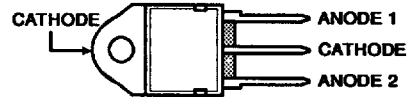
#### Description

RURD3040, RURD3050, RURD3060 are ultrafast dual diodes ( $t_{rr} < 55\text{ns}$ ) with soft recovery characteristics ( $t_a/t_b \approx 1$ ). They have a low forward voltage drop and are of planar, silicon nitride passivated, ion-implanted, epitaxial construction.

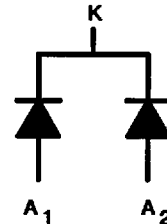
These devices are intended for use as energy steering/clamping diodes and rectifiers in a variety of switching power supplies and other power switching applications. Their low stored charge and ultrafast recovery with soft recovery characteristics minimizes ringing and electrical noise in many power switching circuits thus reducing power loss in the switching transistor.

All are supplied in TO-218AC packages.

#### Package

TO-218AC  
TOP VIEW

#### Symbol



#### Absolute Maximum Ratings ( $T_C = +25^\circ\text{C}$ )

	RURD3040	RURD3050	RURD3060
Peak Repetitive Reverse Voltage .....	400V	500V	600V
Working Peak Reverse Voltage .....	400V	500V	600V
DC Blocking Voltage .....	400V	500V	600V
Average Rectified Forward Current (Total device forward current at rated $V_F$ and $T_C = 150^\circ\text{C}$ ) .....	30A	30A	30A
Peak Forward Repetitive Current (Rated $V_F$ , square wave 20kHz) .....	70A	70A	70A
Nonrepetitive Peak Surge Current (Surge applied at rated load condition halfwave 1 phase 60Hz) .....	325A	325A	325A
Operating and Storage Temperature .....	$T_{STG}, T_J$ -55°C to +175°C	-55°C to +175°C	-55°C to +175°C

Electrical Characteristics (T<sub>C</sub> = +25°C) Unless Otherwise Specified.

T-23-07

SYMBOL	TEST CONDITION	RURD3040 LIMITS			RURD3050 LIMITS			RURD3060 LIMITS			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>F</sub>	I <sub>F</sub> = 30A T <sub>C</sub> = +150°C	-	-	1.30	-	-	1.30	-	-	1.30	V
	I <sub>F</sub> = 30A T <sub>C</sub> = +25°C	-	-	1.50	-	-	1.50	-	-	1.50	V
I <sub>R</sub> @ T <sub>C</sub> = +150°C	V <sub>R</sub> = 400V	-	-	1	-	-	-	-	-	-	mA
	V <sub>R</sub> = 500V	-	-	-	-	-	1	-	-	-	mA
	V <sub>R</sub> = 600V	-	-	-	-	-	-	-	-	1	mA
I <sub>R</sub> @ T <sub>C</sub> = +25°C	V <sub>R</sub> = 400V	-	-	30	-	-	-	-	-	-	μA
	V <sub>R</sub> = 500V	-	-	-	-	-	30	-	-	-	μA
	V <sub>R</sub> = 600V	-	-	-	-	-	-	-	-	30	μA
t <sub>rr</sub>	I <sub>F</sub> = 1A	-	-	55	-	-	55	-	-	55	ns
	I <sub>F</sub> = 30A	-	-	60	-	-	60	-	-	60	ns
t <sub>a</sub>	I <sub>F</sub> = 1A	-	20	-	-	20	-	-	20	-	ns
	I <sub>F</sub> = 30A	-	38	-	-	38	-	-	38	-	ns
t <sub>b</sub>	I <sub>F</sub> = 1A	-	15	-	-	15	-	-	15	-	ns
	I <sub>F</sub> = 30A	-	20	-	-	20	-	-	20	-	ns
R <sub>θjc</sub>		-	-	1.2	-	-	1.2	-	-	1.2	°C/W
W <sub>avl</sub>	see Fig. 7&8	-	-	20	-	-	20	-	-	20	mJ

Definitions

V<sub>F</sub> = Instantaneous forward voltage (pw = 300μs, D = 2%).

I<sub>R</sub> = Instantaneous reverse current (pw = 300μs, D = 2%).

t<sub>rr</sub> = Reverse recovery time at di<sub>F</sub>/dt = 100A/μs (See Figure 2), summation of t<sub>a</sub> + t<sub>b</sub>.

t<sub>a</sub> = Time to reach peak reverse current at di<sub>F</sub>/dt = 100A/μs (See Figure 2).

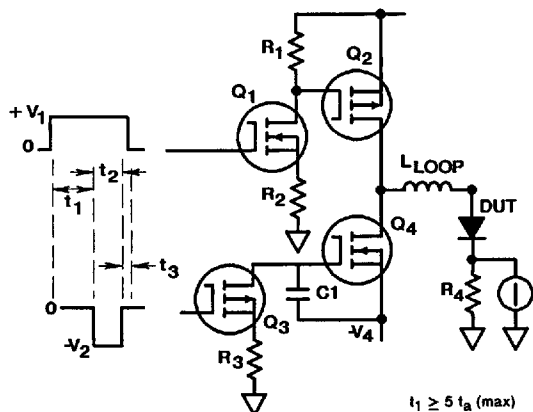
t<sub>b</sub> = Time from peak I<sub>RM</sub> to projected zero crossing of I<sub>RM</sub> based on a straight line from peak I<sub>RM</sub> through 25% of I<sub>RM</sub>. (See Figure 2)

R<sub>θjc</sub> = Thermal resistance junction to case.

W<sub>avl</sub> = Controlled avalanche energy (See Figures 7 & 8).

pw = pulse width.

D = duty cycle.



V<sub>1</sub> amplitude controls I<sub>F</sub>  
V<sub>2</sub> amplitude controls di<sub>F</sub>/dt  
L<sub>1</sub> = self inductance of R<sub>4</sub>

$$t_1 \geq 5 t_a \text{ (max)}$$

$$t_2 > t_{rr}$$

$$t_3 > 0$$

$$\frac{L_1}{R_4} \leq \frac{t_a \text{ (min)}}{10}$$

FIGURE 1. t<sub>rr</sub> TEST CIRCUIT

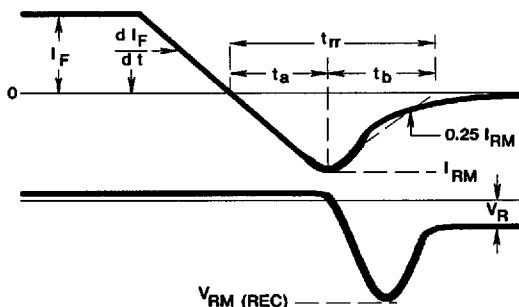


FIGURE 2. DEFINITIONS OF t<sub>rr</sub>, t<sub>a</sub> AND t<sub>b</sub>

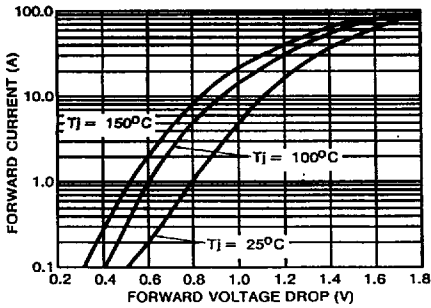


FIGURE 3. FORWARD VOLTAGE vs FORWARD CURRENT CHARACTERISTIC

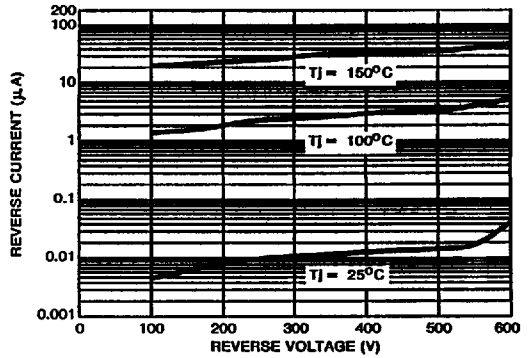


FIGURE 4. REVERSE VOLTAGE vs REVERSE CURRENT CHARACTERISTIC

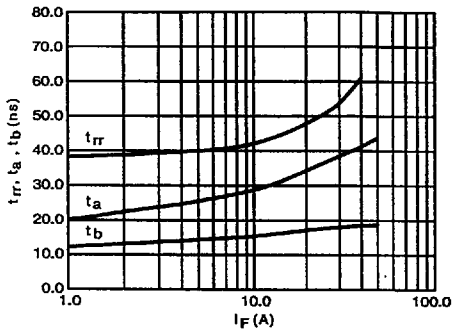


FIGURE 5. TYPICAL trr, ta, tb vs FORWARD CURRENT

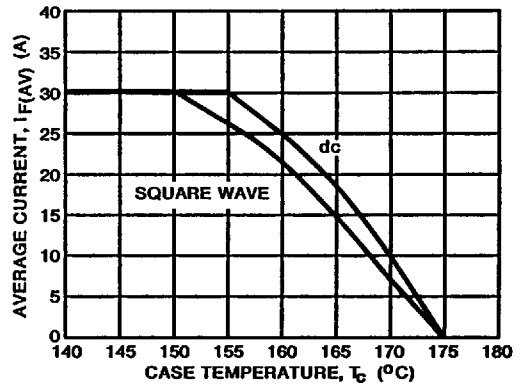


FIGURE 6. TYPICAL CURRENT DERATING CURVE w.r.t. CASE TEMPERATURE

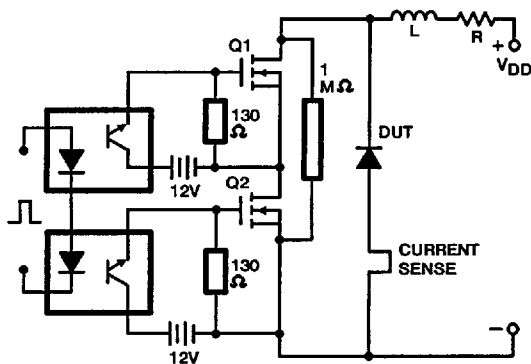


FIGURE 7. AVALANCHE ENERGY TEST CIRCUIT

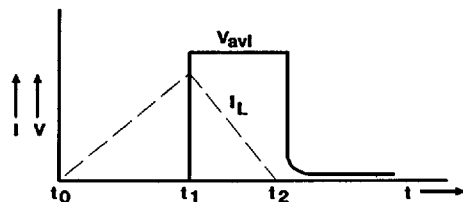


FIGURE 8. CURRENT VOLTAGE WAVEFORM

$$I_{L\text{peak}} = 1\text{A}, L = 40\text{mH}, R < 0.1\Omega, W_{\text{av1}} = (1/2) L I_L^2 [V_{\text{av1}} / (V_{\text{av1}} - V_{\text{DD}})]$$