

**4A, 400V - 600V Hyperfast Diodes**

The RHRD440, RHRD460, RHRD440S and RHRD460S are hyperfast diodes with soft recovery characteristics ( $t_{rr} < 30ns$ ). They have half the recovery time of ultrafast diodes and are of 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.

Formerly developmental type TA49055.

**Ordering Information**

PART NUMBER	PACKAGE	BRAND
RHRD440	TO-251	RHR440
RHRD460	TO-251	RHR460
RHRD440S	TO-252	RHR440
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., RHRD460S9A.

**Symbol**



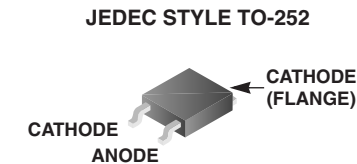
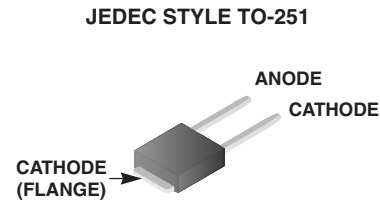
**Features**

- Hyperfast with Soft Recovery . . . . . <30ns
- Operating Temperature . . . . . 175°C
- Reverse Voltage Up to . . . . . 600V
- Avalanche Energy Rated
- Planar Construction

**Applications**

- Switching Power Supplies
- Power Switching Circuits
- General Purpose

**Packaging**



**Absolute Maximum Ratings**  $T_C = 25^\circ C$ , Unless Otherwise Specified

	RHRD440, RHRD440S	RHRD460, RHRD460S	UNITS
Peak Repetitive Reverse Voltage . . . . . $V_{RRM}$	400	600	V
Working Peak Reverse Voltage . . . . . $V_{RWM}$	400	600	V
DC Blocking Voltage . . . . . $V_R$	400	600	V
Average Rectified Forward Current . . . . . $I_{F(AV)}$ ( $T_C = 157^\circ C$ )	4	4	A
Repetitive Peak Surge Current . . . . . $I_{FRM}$ (Square Wave, 20kHz)	8	8	A
Nonrepetitive Peak Surge Current . . . . . $I_{FSM}$ (Halfwave, 1 Phase, 60Hz)	40	40	A
Maximum Power Dissipation . . . . . $P_D$	50	50	W
Avalanche Energy (See Figures 10 and 11) . . . . . $E_{AVL}$	10	10	mJ
Operating and Storage Temperature . . . . . $T_{STG}, T_J$	-65 to 175	-65 to 175	°C
Maximum Lead Temperature for Soldering (Leads at 0.063 in. (1.6mm) from case for 10s) . . . . . $T_L$	300	300	°C
Package Body for 10s, see Tech Brief 334. . . . . $T_{PKG}$	260	260	°C

# RHRD440, RHRD460, RHRD440S, RHRD460S

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

SYMBOL	TEST CONDITION	RHRD440, RHRD440S			RHRD460, RHRD460S			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_F$	$I_F = 4\text{A}$	-	-	2.1	-	-	2.1	V
	$I_F = 4\text{A}, T_C = 150^\circ\text{C}$	-	-	1.7	-	-	1.7	V
$I_R$	$V_R = 400\text{V}$	-	-	100	-	-	-	$\mu\text{A}$
	$V_R = 600\text{V}$	-	-	-	-	-	100	$\mu\text{A}$
	$V_R = 400\text{V}, T_C = 150^\circ\text{C}$	-	-	500	-	-	-	$\mu\text{A}$
	$V_R = 600\text{V}, T_C = 150^\circ\text{C}$	-	-	-	-	-	500	$\mu\text{A}$
$t_{rr}$	$I_F = 1\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	-	-	30	-	-	30	ns
	$I_F = 4\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	-	-	35	-	-	35	ns
$t_a$	$I_F = 4\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	-	16	-	-	16	-	ns
$t_b$	$I_F = 4\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	-	7	-	-	7	-	ns
$Q_{RR}$	$I_F = 4\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	-	45	-	-	45	-	nC
$C_J$	$V_R = 10\text{V}, I_F = 0\text{A}$	-	15	-	-	15	-	pF
$R_{\theta JC}$		-	-	3	-	-	3	$^\circ\text{C}/\text{W}$

### 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 9), summation of  $t_a + t_b$ .

$t_a$  = Time to reach peak reverse current (See Figure 9).

$t_b$  = 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 9).

$Q_{RR}$  = Reverse recovery charge.

$C_J$  = Junction Capacitance.

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

pw = Pulse width.

D = Duty cycle.

## Typical Performance Curves

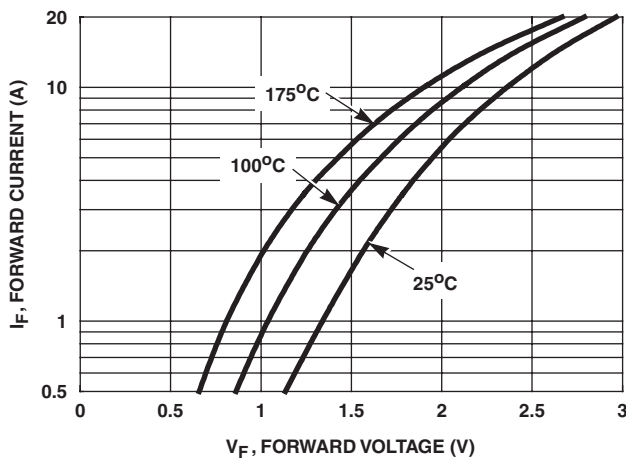


FIGURE 1. FORWARD CURRENT vs FORWARD VOLTAGE

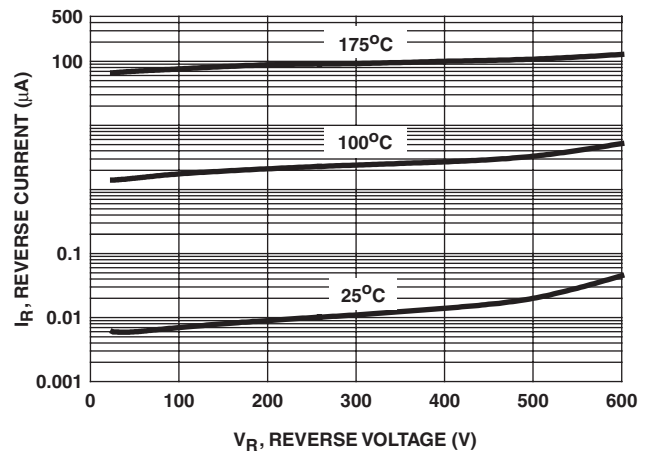


FIGURE 2. REVERSE CURRENT vs REVERSE VOLTAGE

Typical Performance Curves (Continued)

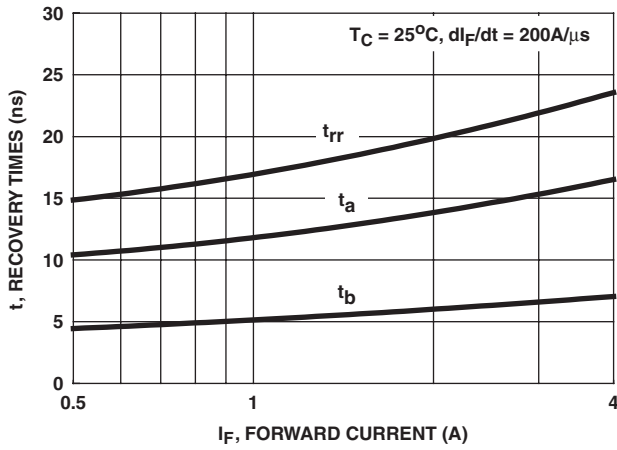


FIGURE 3.  $t_{rr}$ ,  $t_a$  AND  $t_b$  CURVES vs FORWARD CURRENT

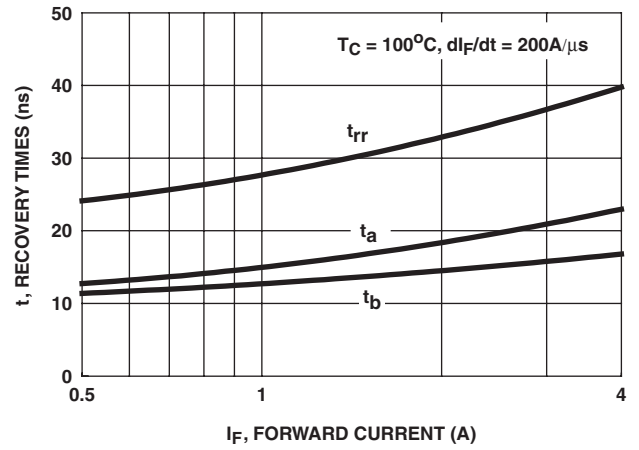


FIGURE 4.  $t_{rr}$ ,  $t_a$  AND  $t_b$  CURVES vs FORWARD CURRENT

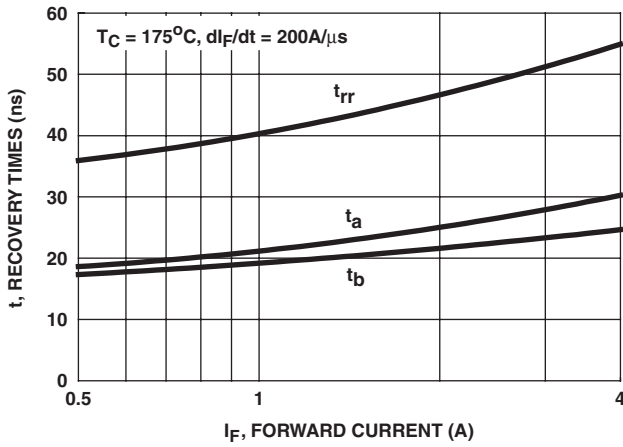


FIGURE 5.  $t_{rr}$ ,  $t_a$  AND  $t_b$  CURVES vs FORWARD CURRENT

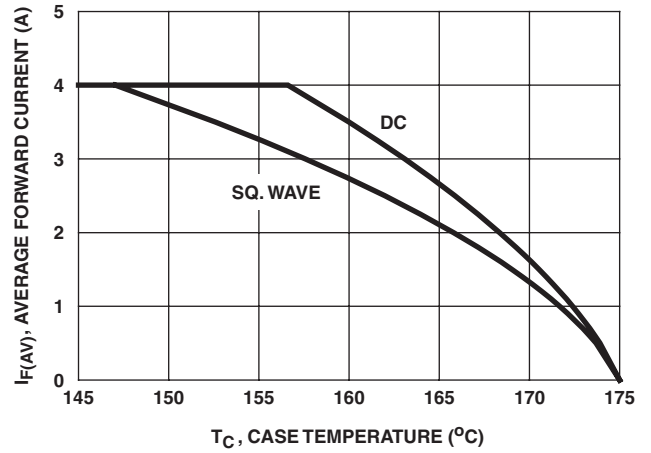


FIGURE 6. CURRENT DERATING CURVE

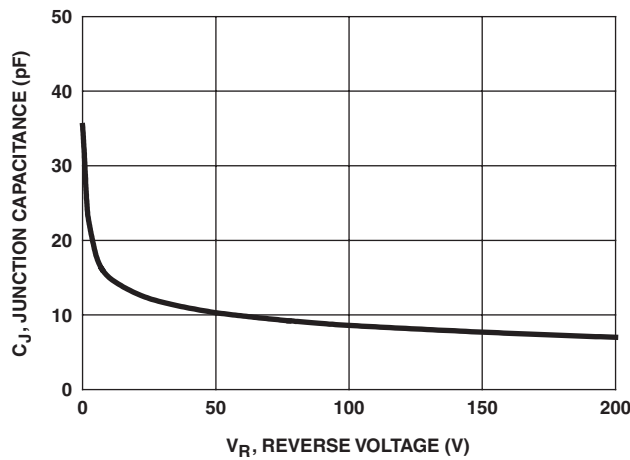


FIGURE 7. JUNCTION CAPACITANCE vs REVERSE VOLTAGE

Test Circuits and Waveforms

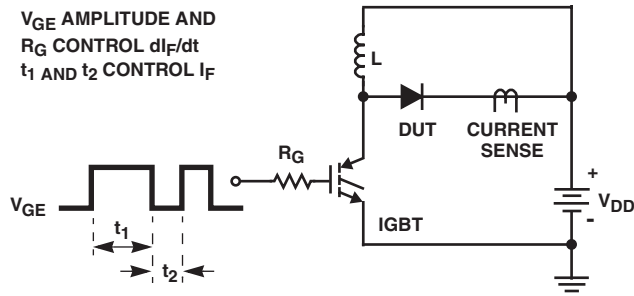


FIGURE 8.  $t_{rr}$  TEST CIRCUIT

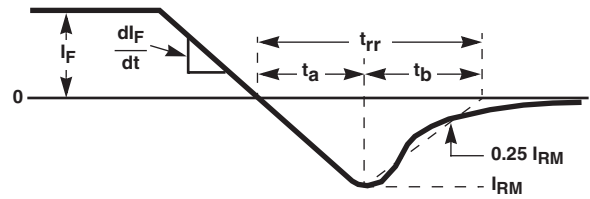


FIGURE 9.  $t_{rr}$  WAVEFORMS AND DEFINITIONS

$I_{MAX} = 1A$   
 $L = 20mH$   
 $R < 0.1\Omega$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)}/(V_{R(AVL)} - V_{DD})]$   
 $Q_1 = IGBT (BV_{CES} > DUT V_{R(AVL)})$

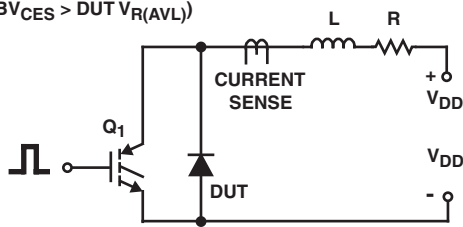


FIGURE 10. AVALANCHE ENERGY TEST CIRCUIT

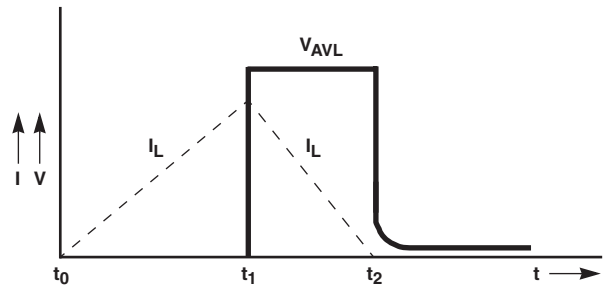


FIGURE 11. AVALANCHE CURRENT AND VOLTAGE WAVEFORMS

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE <sub>x</sub> <sup>TM</sup>	FAST <sup>®</sup>	OPTOLOGIC <sup>TM</sup>	SMART START <sup>TM</sup>	VCX <sup>TM</sup>
Bottomless <sup>TM</sup>	FAST <sub>r</sub> <sup>TM</sup>	OPTOPLANAR <sup>TM</sup>	STAR*POWER <sup>TM</sup>	
CoolFET <sup>TM</sup>	FRFET <sup>TM</sup>	PACMAN <sup>TM</sup>	Stealth <sup>TM</sup>	
CROSSVOLT <sup>TM</sup>	GlobalOptoisolator <sup>TM</sup>	POP <sup>TM</sup>	SuperSOT <sup>TM</sup> -3	
DenseTrench <sup>TM</sup>	GTO <sup>TM</sup>	Power247 <sup>TM</sup>	SuperSOT <sup>TM</sup> -6	
DOME <sup>TM</sup>	HiSeC <sup>TM</sup>	PowerTrench <sup>®</sup>	SuperSOT <sup>TM</sup> -8	
EcoSPARK <sup>TM</sup>	ISOPLANAR <sup>TM</sup>	QFET <sup>TM</sup>	SyncFET <sup>TM</sup>	
E <sup>2</sup> CMOS <sup>TM</sup>	LittleFET <sup>TM</sup>	QST <sup>TM</sup>	TinyLogic <sup>TM</sup>	
EnSigna <sup>TM</sup>	MicroFET <sup>TM</sup>	QT Optoelectronics <sup>TM</sup>	TruTranslation <sup>TM</sup>	
FACT <sup>TM</sup>	MicroPak <sup>TM</sup>	Quiet Series <sup>TM</sup>	UHC <sup>TM</sup>	
FACT Quiet Series <sup>TM</sup>	MICROWIRE <sup>TM</sup>	SILENT SWITCHER <sup>®</sup>	UltraFET <sup>®</sup>	

STAR\*POWER is used under license

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.