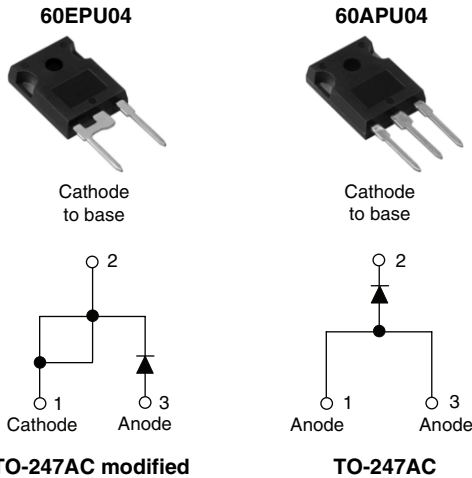


## Ultrafast Soft Recovery Diode, 60 A FRED Pt<sup>®</sup>



### FEATURES

- Ultrafast recovery
- 175 °C operating junction temperature
- Designed and qualified for industrial level

### BENEFITS

- Reduced RFI and EMI
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

### DESCRIPTION/APPLICATIONS

These diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for HF welding, power converters and other applications where switching losses are not significant portion of the total losses.

### PRODUCT SUMMARY

$t_{rr}$ (typical)	50 ns
$I_{F(AV)}$	60 A
$V_R$	400 V

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		400	V
Continuous forward current	$I_{F(AV)}$	$T_C = 127\text{ }^\circ\text{C}$	60	A
Single pulse forward current	$I_{FSM}$	$T_C = 25\text{ }^\circ\text{C}$	600	
Maximum repetitive forward current	$I_{FRM}$	Square wave, 20 kHz	120	
Operating junction and storage temperatures	$T_J, T_{Stg}$		- 55 to 175	$^\circ\text{C}$

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100\ \mu\text{A}$	400	-	-	V
Forward voltage	$V_F$	$I_F = 60\text{ A}$	-	1.05	1.25	
		$I_F = 60\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	0.87	1.03	
Reverse leakage current	$I_R$	$V_R = V_R\text{ rated}$	-	-	50	$\mu\text{A}$
		$T_J = 150\text{ }^\circ\text{C}, V_R = V_R\text{ rated}$	-	-	2	mA
Junction capacitance	$C_T$	$V_R = 400\text{ V}$	-	50	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	3.5	-	nH

# 60EPU04, 60APU04



Vishay High Power Products Ultrafast Soft Recovery Diode,  
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<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_C = 25\text{ °C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1\text{ A}$ , $di_F/dt = 200\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$		-	50	60	ns
		$T_J = 25\text{ °C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	85	-	
		$T_J = 125\text{ °C}$		-	145	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ °C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	8.8	-	A
		$T_J = 125\text{ °C}$		-	15.4	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ °C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	375	-	nC
		$T_J = 125\text{ °C}$		-	1120	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction to case	$R_{thJC}$		-	-	0.70	K/W
Thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth and greased	-	0.2	-	
Weight			-	5.5	-	g
			-	0.2	-	oz.
Mounting torque			1.2 (10)	-	2.4 (20)	N · m (lbf · in)
Marking device		Case style TO-247AC modified	60EPU04			
		Case style TO-247AC	60APU04			

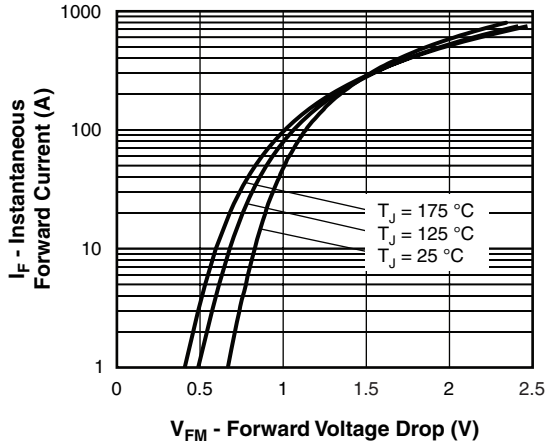


Fig. 1 - Typical Forward Voltage Drop Characteristics

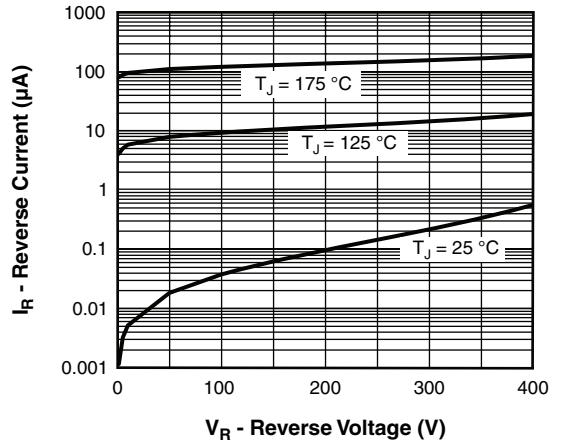


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

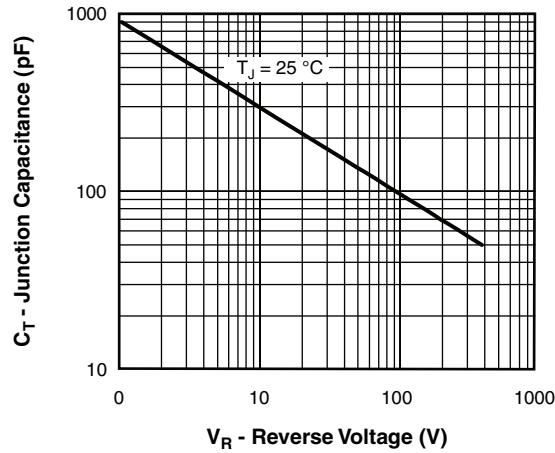
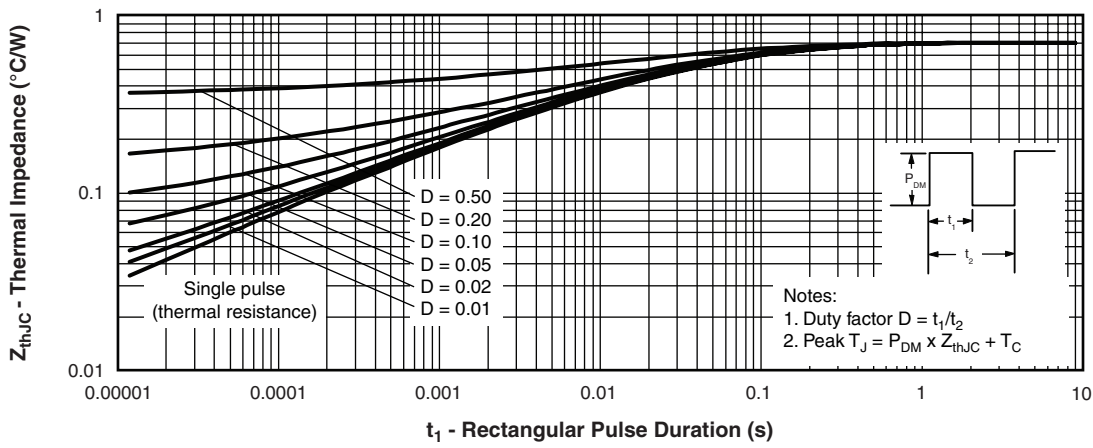


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

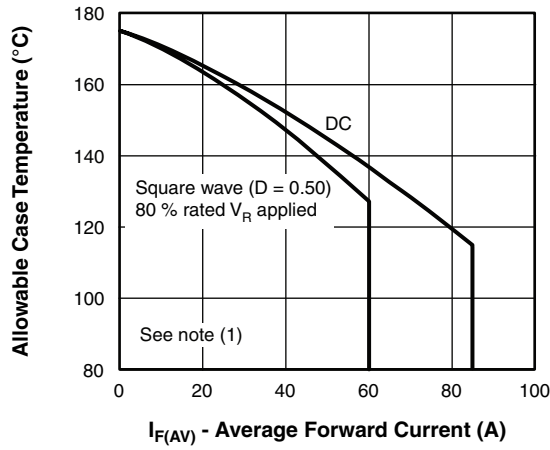


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

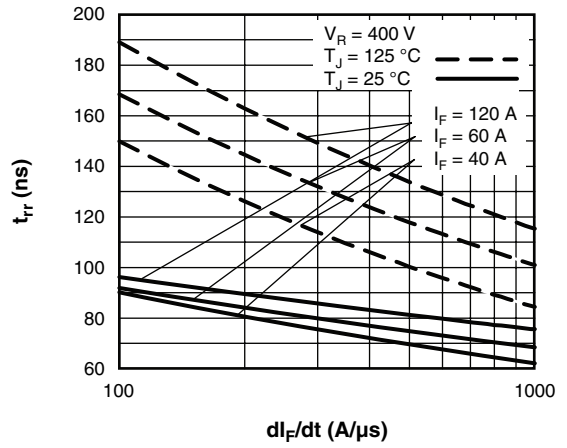


Fig. 7 - Typical Reverse Recovery Time vs. diF/dt

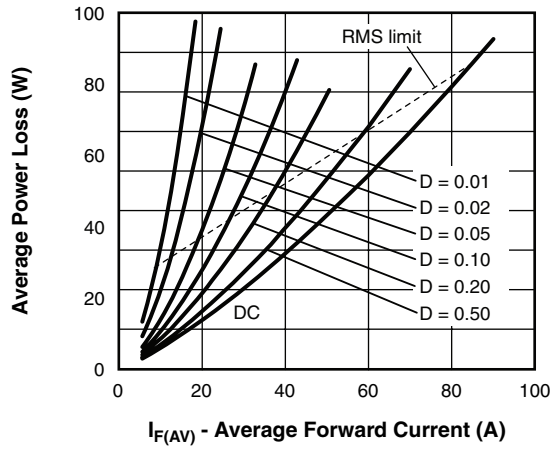


Fig. 6 - Forward Power Loss Characteristics

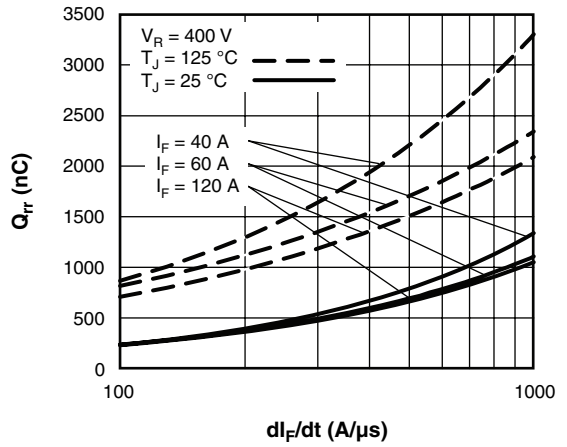


Fig. 8 - Typical Stored Charge vs. diF/dt

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 P<sub>d</sub> = Forward power loss = I<sub>F(AV)</sub> × V<sub>FM</sub> at (I<sub>F(AV)</sub>/D) (see fig. 6);  
 P<sub>dREV</sub> = Inverse power loss = V<sub>R1</sub> × I<sub>R</sub> (1 - D); I<sub>R</sub> at V<sub>R1</sub> = 80 % rated V<sub>R</sub>

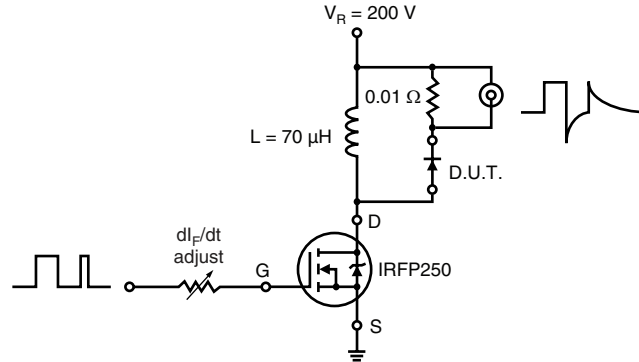
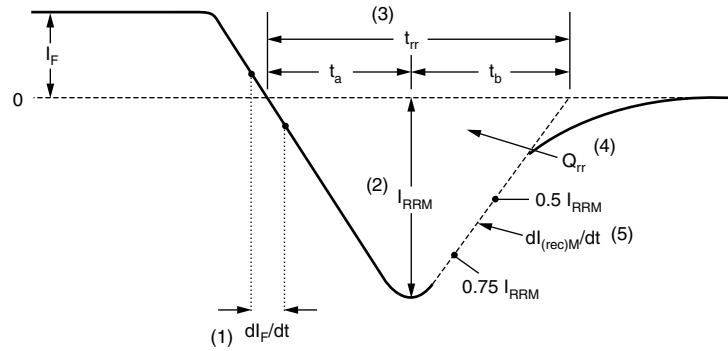


Fig. 9 - Reverse Recovery Parameter Test Circuit



(1)  $di_f/dt$  - rate of change of current through zero crossing

(4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$

(2)  $I_{RRM}$  - peak reverse recovery current

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated to zero current.

(5)  $di_{(rec)M'}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

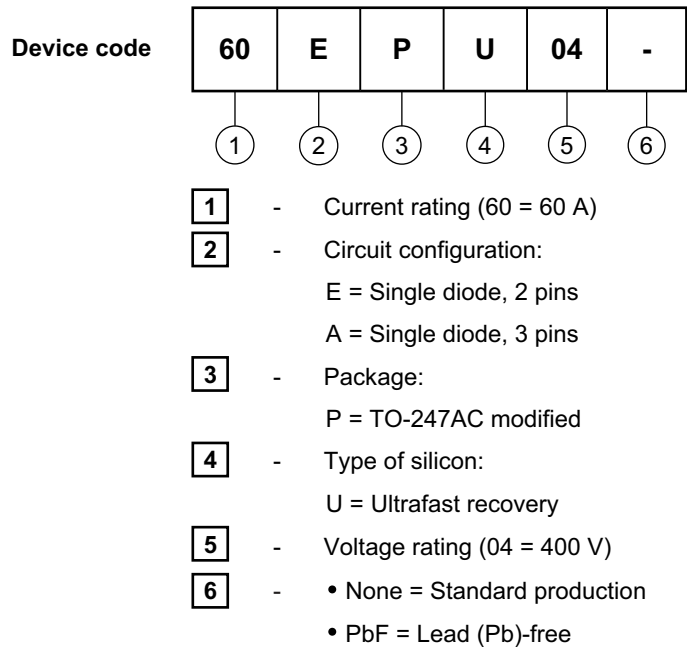
Fig. 10 - Reverse Recovery Waveform and Definitions

# 60EPU04, 60APU04

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## ORDERING INFORMATION TABLE



LINKS TO RELATED DOCUMENTS		
Dimensions	TO-247AC modified	<a href="http://www.vishay.com/doc?95253">www.vishay.com/doc?95253</a>
	TO-247AC	<a href="http://www.vishay.com/doc?95223">www.vishay.com/doc?95223</a>
Part marking information	TO-247AC modified	<a href="http://www.vishay.com/doc?95255">www.vishay.com/doc?95255</a>
	TO-247AC	<a href="http://www.vishay.com/doc?95226">www.vishay.com/doc?95226</a>



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