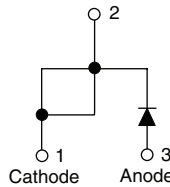


### Ultrafast Soft Recovery Diode, 60 A FRED Pt®

60EPU04PbF

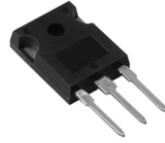


Cathode  
to base

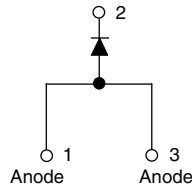


TO247AC modified

60APU04PbF



Cathode  
to base



TO-247AC

#### FEATURES

- Ultrafast recovery
- 175 °C operating junction temperature
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



**RoHS\***  
COMPLIANT

#### 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

$t_{rr}$	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	$I_{F(AV)}$	$T_C = 127\text{ °C}$	60	A
Single pulse forward current	$I_{FSM}$	$T_C = 25\text{ °C}$	600	
Maximum repetitive forward current	$I_{FRM}$	Square wave, 20 kHz	120	
Operating junction and storage temperatures	$T_J, T_{Stg}$		- 55 to 175	°C

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	400	-	-	V
Forward voltage	$V_F$	$I_F = 60\text{ A}$	-	1.05	1.25	
		$I_F = 60\text{ A}, T_J = 175\text{ °C}$	-	0.87	1.03	
		$I_F = 60\text{ A}, T_J = 125\text{ °C}$	-	0.93	1.10	
Reverse leakage current	$I_R$	$V_R = V_R\text{ rated}$	-	-	50	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R\text{ rated}$	-	-	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

\* Pb containing terminations are not RoHS compliant, exemptions may apply

# 60EPU04PbF, 60APU04PbF



Vishay High Power Products Ultrafast Soft Recovery Diode,  
60 A FRED Pt®

DYNAMIC RECOVERY CHARACTERISTICS ( $T_C = 25\text{ }^\circ\text{C}$ 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
		$T_J = 25\text{ }^\circ\text{C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	85	-	
		$T_J = 125\text{ }^\circ\text{C}$		-	145	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	8.8	-	A
		$T_J = 125\text{ }^\circ\text{C}$		-	15.4	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 60\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	-	375	-	nC
		$T_J = 125\text{ }^\circ\text{C}$		-	1120	-	

THERMAL - MECHANICAL SPECIFICATIONS							
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			



# 60EPU04PbF, 60APU04PbF

Ultrafast Soft Recovery Diode, Vishay High Power Products  
60 A FRED Pt®

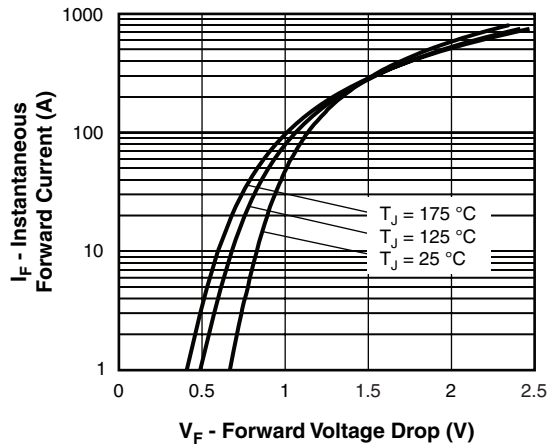


Fig. 1 - Typical Forward Voltage Drop Characteristics

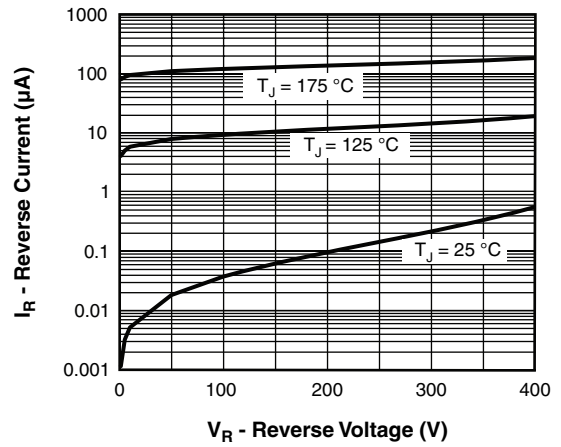


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

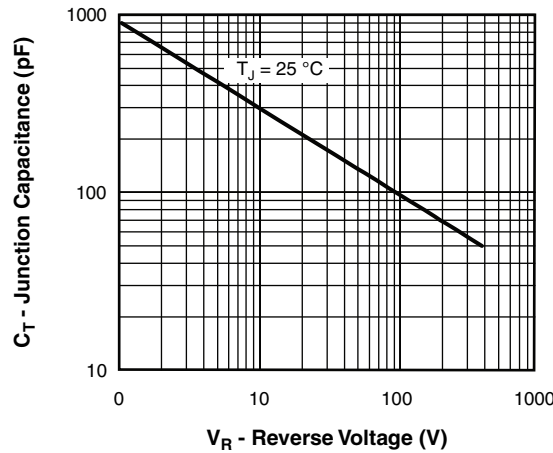


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

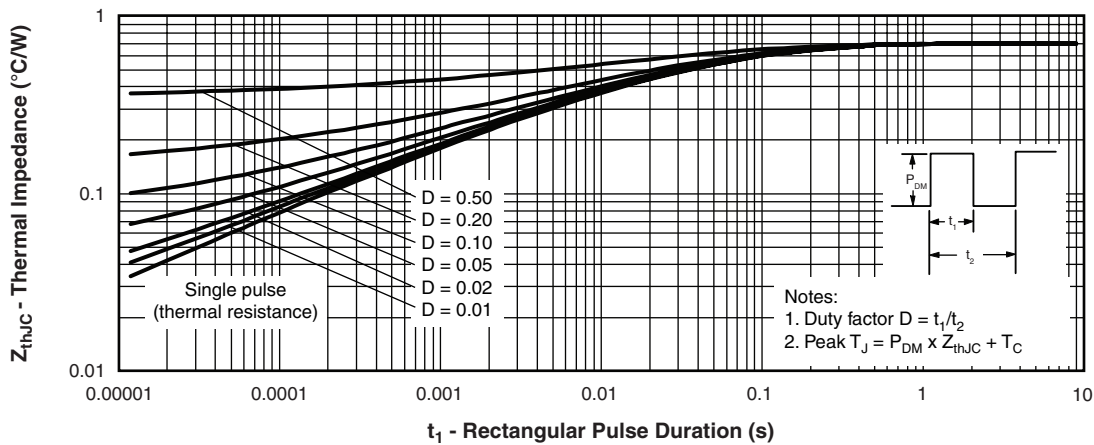


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

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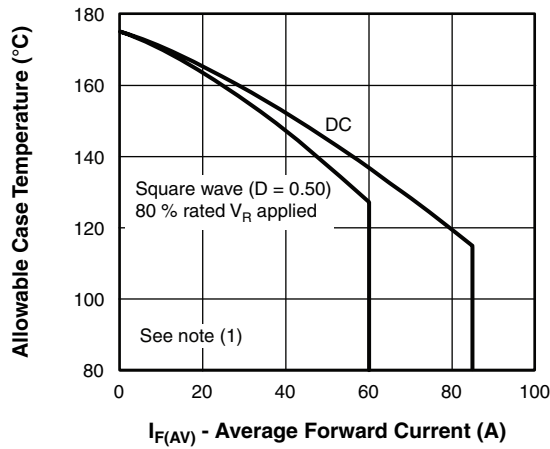


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

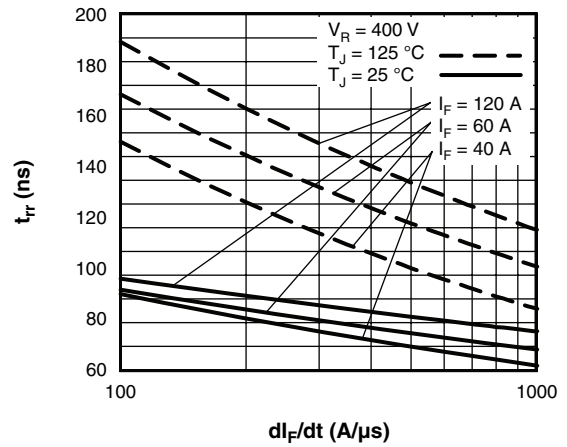


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

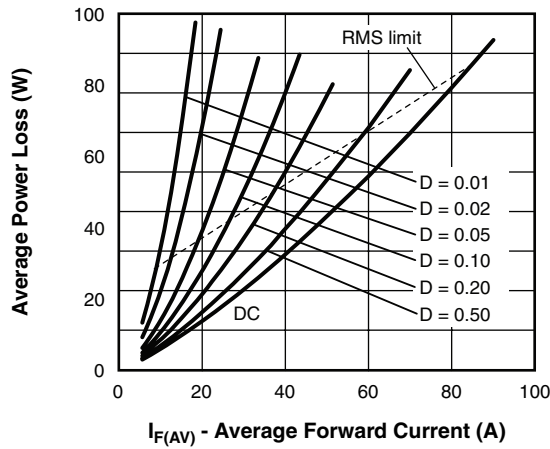


Fig. 6 - Forward Power Loss Characteristics

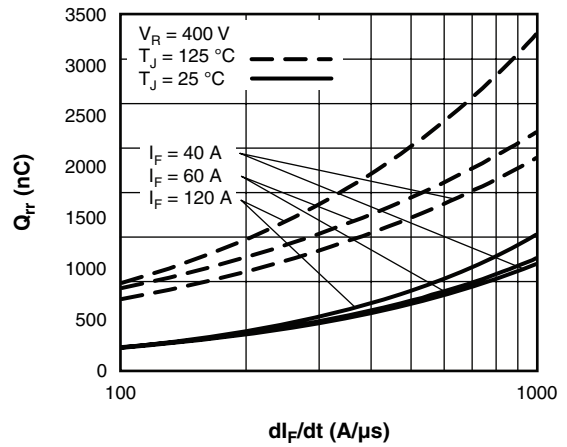


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

## Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\%$  rated  $V_R$

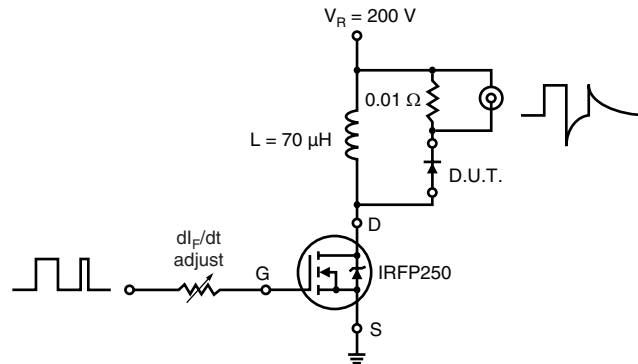
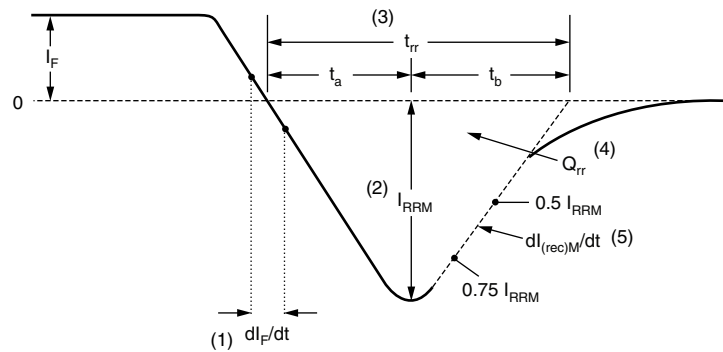


Fig. 9 - Reverse Recovery Parameter Test Circuit



- |  |  |
|--|--|
| (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 $t_{rr}$ |

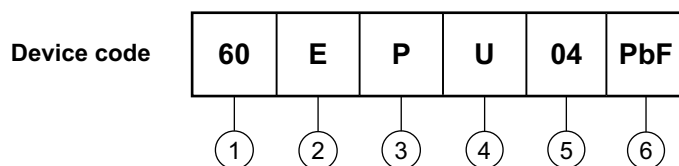
Fig. 10 - Reverse Recovery Waveform and Definitions

# 60EPU04PbF, 60APU04PbF



Vishay High Power Products Ultrafast Soft Recovery Diode,  
60 A FRED Pt®

## ORDERING INFORMATION TABLE



- 1** - Current rating (60 = 60 A)
- 2** - Circuit configuration:
  - E = Single diode
  - A = Single diode, 3 pins
- 3** - Package:
  - P = TO-247AC (modified)
- 4** - Type of silicon:
  - U = Ultrafast recovery
- 5** - Voltage rating (04 = 400 V)
- 6** -
  - None = Standard production
  - PbF = Lead (Pb)-free

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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