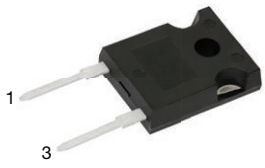
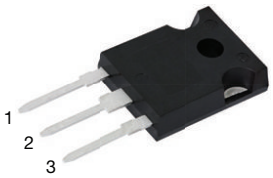
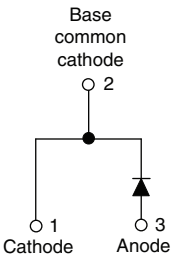
Ultrafast Soft Recovery Diode, 60 A FRED Pt®



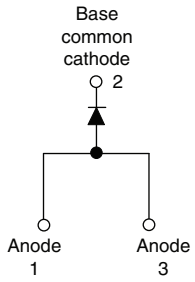
TO-247AC 2L



TO-247AC 3L



VS-60EPU04-N3



VS-60APU04-N3

FEATURES

- Ultrafast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

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.

MECHANICAL DATA

Case: TO-247AC 2L, TO-247AC 3L

Molding compound meets UL 94 V-0 flammability rating

Terminals: matte tin plated leads, solderable per J-STD-002

LINKS TO ADDITIONAL RESOURCES

3D Models

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	60 A
V_R	400 V
V_F at I_F	0.87 V
t_{rr} typ.	See Recovery table
T_J max.	175 °C
Package	TO-247AC 2L, TO-247AC 3L
Circuit configuration	Single

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 °C	60	A
Single pulse forward current	I_{FSM}	T_C = 25 °C, t_p = 10 ms	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 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Breakdown voltage, blocking voltage	V_{BR}, V_R	I_R = 100 µA	400	-	-	V
Forward voltage	V_F	I_F = 60 A	-	1.05	1.25	
		I_F = 60 A, T_J = 175 °C	-	0.87	1.03	
		I_F = 60 A, T_J = 125 °C	-	0.93	1.10	
Reverse leakage current	I_R	V_R = V_R rated	-	-	50	µA
		T_J = 150 °C, V_R = V_R rated	-	-	2	mA
Junction capacitance	C_T	V_R = 400 V	-	50	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	3.5	-	nH

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DYNAMIC RECOVERY CHARACTERISTICS (T_C = 25 °C unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	I_F = 1 A, di_F/dt = 200 A/μs, V_R = 30 V		-	50	60	ns
		T_J = 25 °C	I_F = 60 A di_F/dt = 200 A/μs V_R = 200 V	-	85	-	
		T_J = 125 °C		-	145	-	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	8.8	-	A
		T_J = 125 °C		-	15.4	-	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	375	-	nC
		T_J = 125 °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, junction to ambient per leg	R_{thJA}	Typical socket mount	-	-	40	°C/W
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth, and greased	-	0.2	-	K/W
Weight			-	5.5	-	g
			-	0.2	-	oz.
Mounting torque			1.2	-	2.4	N · m
			10	-	20	lbf · in
Marking device		Case style TO-247AC 2L	60EPU04			
		Case style TO-247AC 3L	60APU04			

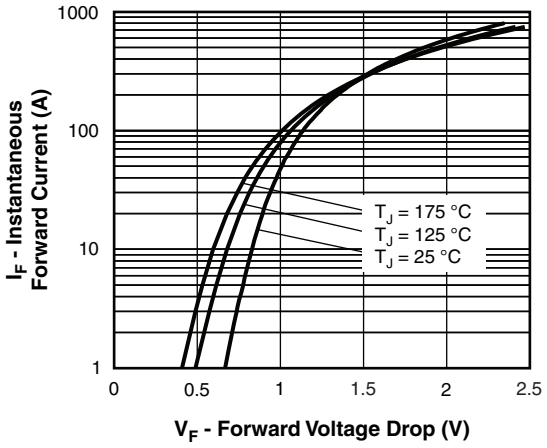

Fig. 1 - Typical Forward Voltage Drop Characteristics

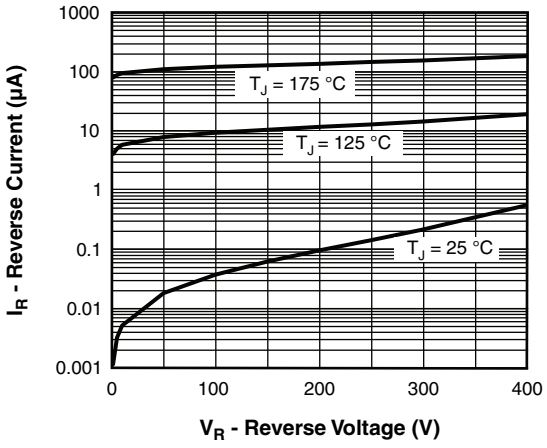

Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

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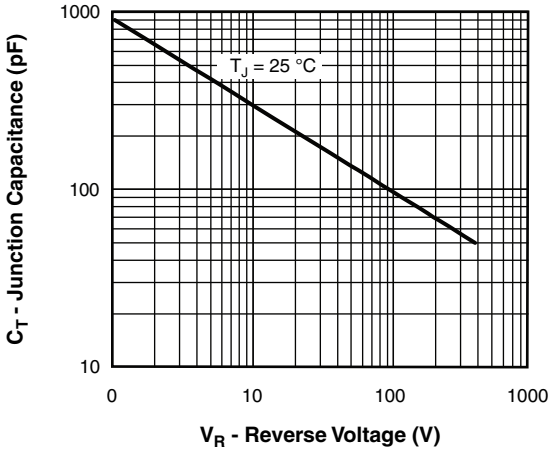

Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

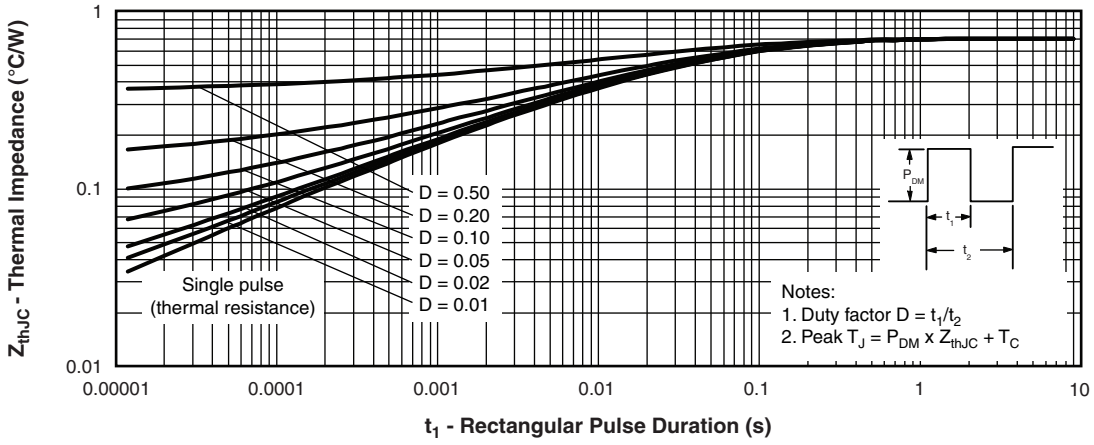

Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

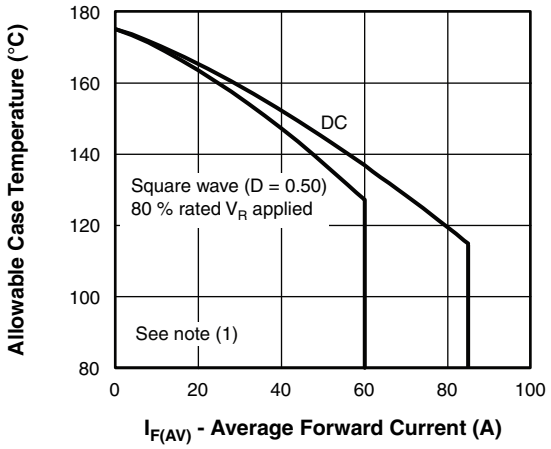

Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

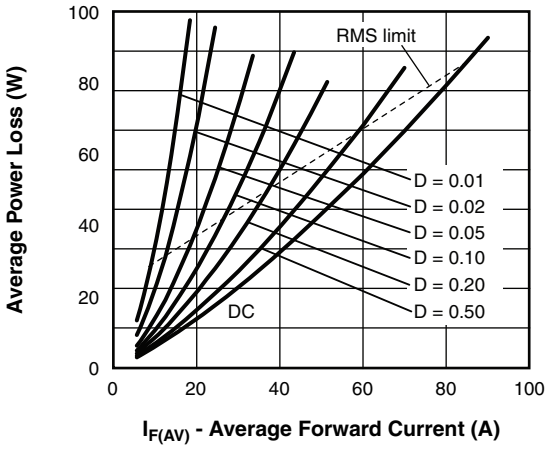

Fig. 6 - Forward Power Loss Characteristics

Note

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

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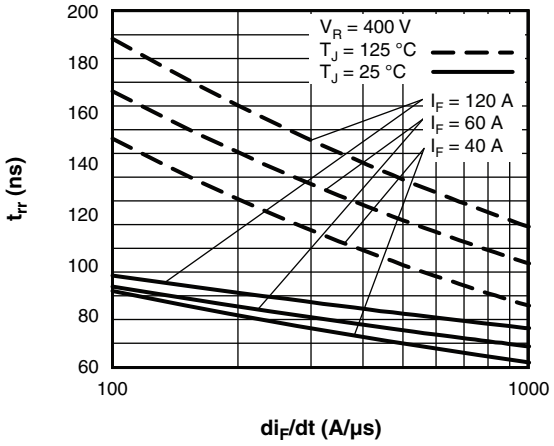


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

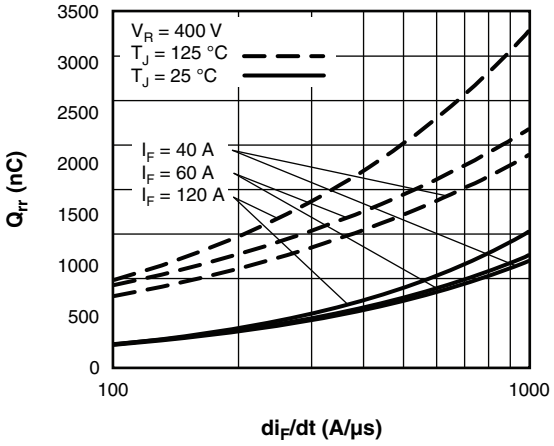
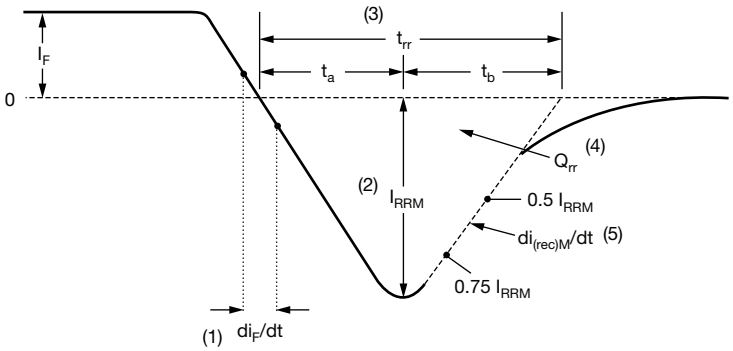


Fig. 8 - Typical Stored Charge vs. di_F/dt



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

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

(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.

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

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

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

Fig. 9 - Reverse Recovery Waveform and Definitions

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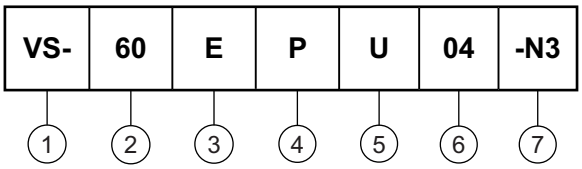
ORDERING INFORMATION TABLE

Device code



1 - Vishay Semiconductors product

2 - Current rating (60 = 60 A)

3 - Circuit configuration:

- E = single diode, 2 pins
- A = single diode, 3 pins

4 - Package:

P = TO-247AC

5 - Type of silicon:

U = ultrafast recovery

6 - Voltage rating (04 = 400 V)

7 - Environmental digit:

-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	**QUANTITY PER T/R**	**MINIMUM ORDER QUANTITY**	**PACKAGING DESCRIPTION**
VS-60EPU04-N3	25	500	Antistatic plastic tube
VS-60APU04-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-247AC 2L	www.vishay.com/doc?96144
	TO-247AC 3L	www.vishay.com/doc?96138
Part marking information	TO-247AC 2L	www.vishay.com/doc?95648
	TO-247AC 3L	www.vishay.com/doc?95007
SPICE model		www.vishay.com/doc?96899

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