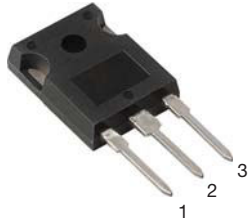
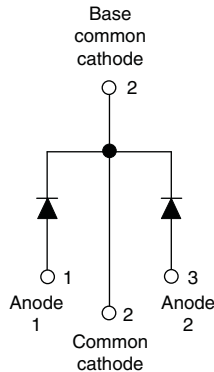


## Hyperfast Rectifier, 2 x 30 A FRED Pt®



TO-247AC



### FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- Low leakage current
- 175 °C operating junction temperature
- Designed and qualified according to JEDEC-JESD47
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTIONS/APPLICATIONS

VS-60CPH03PbF, VS-60CPH03-N3 series are the state of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop and ultrafast recovery time.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in the output rectification stage of SMPS, UPS, DC/DC converters as well as freewheeling diodes in low voltage inverters and chopper motor drives.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

### PRODUCT SUMMARY

Package	TO-247AC
$I_{F(AV)}$	2 x 30 A
$V_R$	300 V
$V_F$ at $I_F$	1.25 V
$t_{rr}$ typ.	See Recovery table
$T_J$ max.	175 °C
Diode variation	Common cathode

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Repetitive peak reverse voltage	$V_{RRM}$		300	V
Average rectified forward current <span style="margin-left: 20px;">per leg</span> <span style="margin-left: 20px;">total device</span>	$I_{F(AV)}$	$T_C = 143\text{ °C}$	30 60	A
Non-repetitive peak surge current per leg	$I_{FSM}$	$T_J = 25\text{ °C}$	300	
Operating junction and storage temperatures	$T_J, T_{Stg}$		- 65 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	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	300	-	-	V
Forward voltage	$V_F$	$I_F = 30\text{ A}$	-	1.08	1.25	
		$I_F = 30\text{ A}, T_J = 125\text{ °C}$	-	0.92	1.00	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.05	60	$\mu\text{A}$
		$T_J = 125\text{ °C}, V_R = V_R$ rated	-	20	300	
Junction capacitance	$C_T$	$V_R = 300\text{ V}$	-	70	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	3.5	-	nH



DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 1.0 A, di <sub>F</sub> /dt = 50 A/μs, V <sub>R</sub> = 30 V	-	-	55	ns
		T <sub>J</sub> = 25 °C	-	39	-	
		T <sub>J</sub> = 125 °C	-	57	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	2.8	-	A
		T <sub>J</sub> = 125 °C	-	7.5	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	55	-	nC
		T <sub>J</sub> = 125 °C	-	214	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		- 65	-	175	°C
Thermal resistance, junction to case per leg	R <sub>thJC</sub>		-	0.5	0.9	°C/W
Thermal resistance, junction to ambient per leg	R <sub>thJA</sub>	Typical socket mount	-	-	40	
Thermal resistance, case to heatsink	R <sub>thCS</sub>	Mounting surface, flat, smooth and greased	-	0.4	-	
Weight			-	6.0	-	g
			-	0.22	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-247AC	60CPH03			

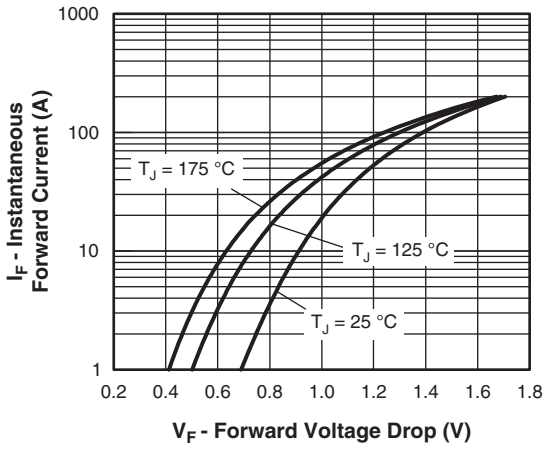


Fig. 1 - Typical Forward Voltage Drop Characteristics

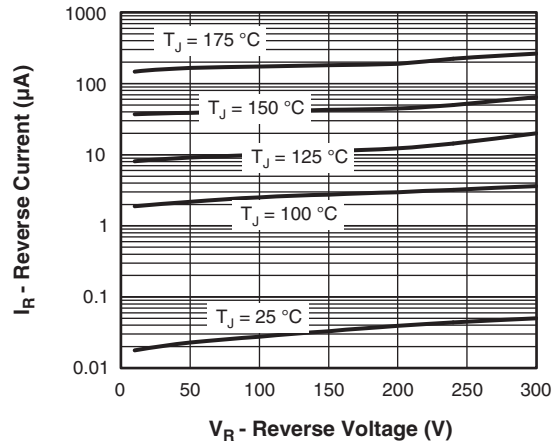


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

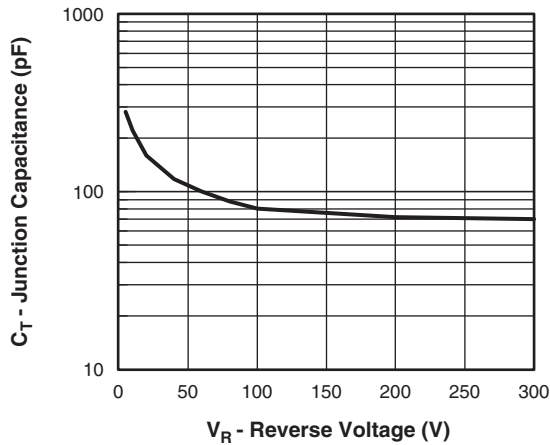


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

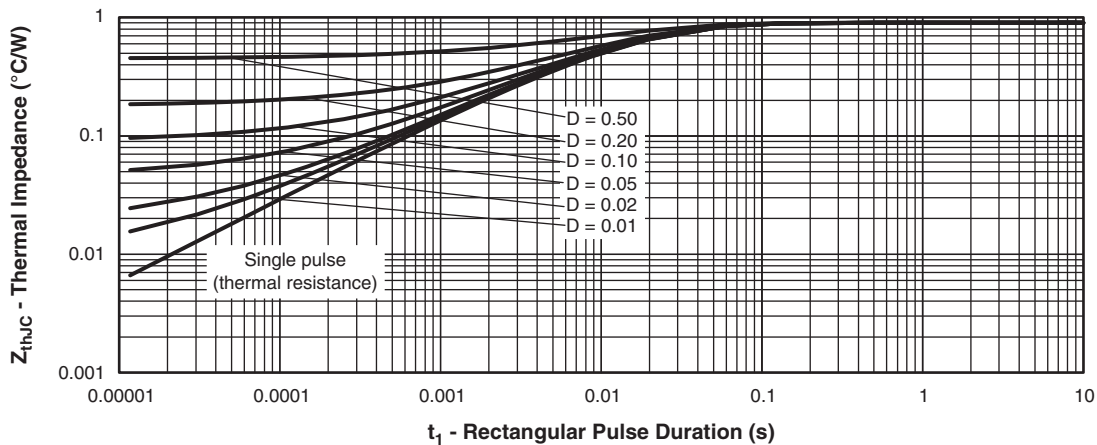


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

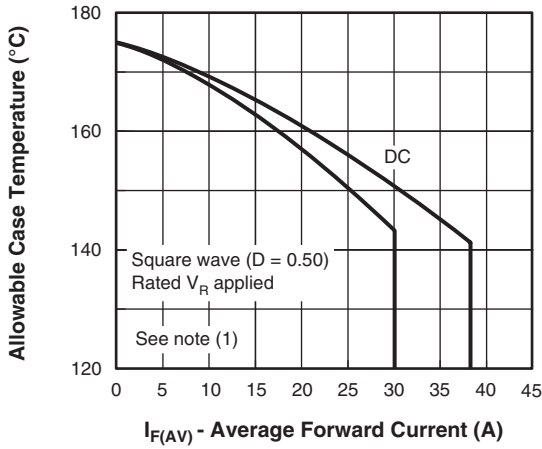


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

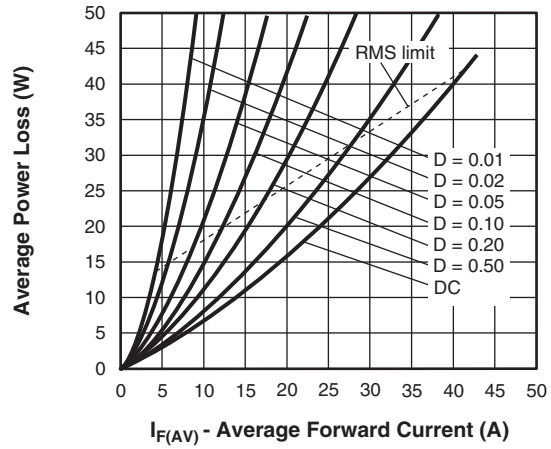


Fig. 7 - Forward Power Loss Characteristics

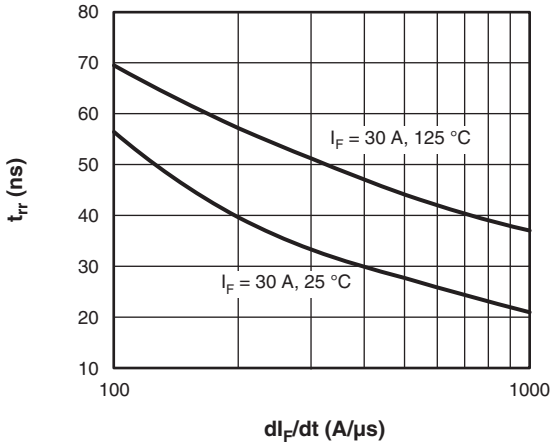


Fig. 6 - Typical Reverse Recovery Time vs.  $di_F/dt$

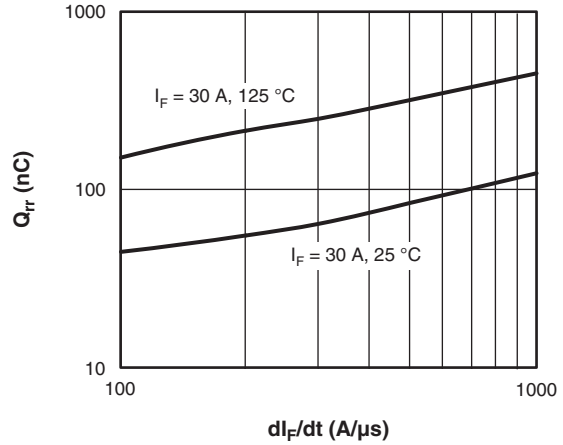


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

**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  $V_{R1}$  = Rated  $V_R$

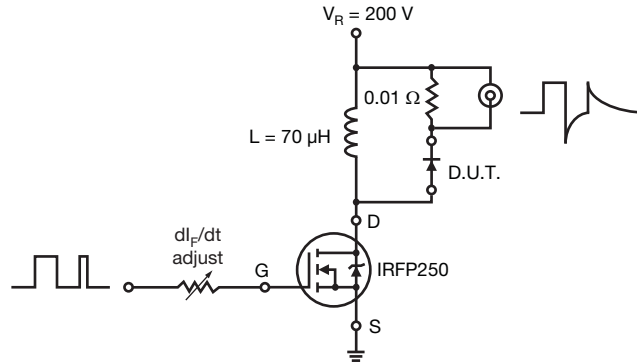
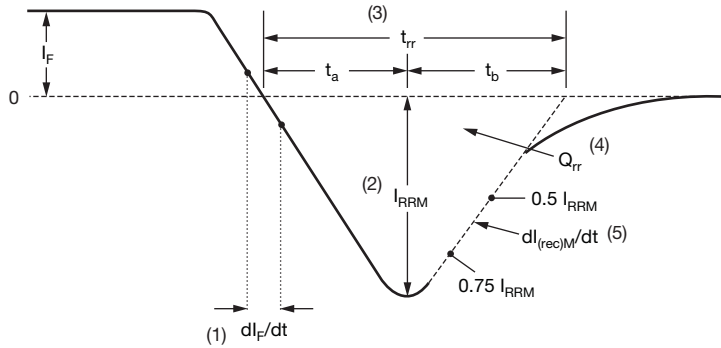


Fig. 9 - Reverse Recovery Parameter Test Circuit



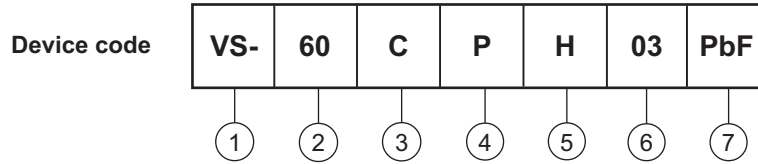
- (1)  $dl_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated to zero current.
- (4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$
- (5)  $dl_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

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

Fig. 10 - Reverse Recovery Waveform and Definitions



## ORDERING INFORMATION TABLE



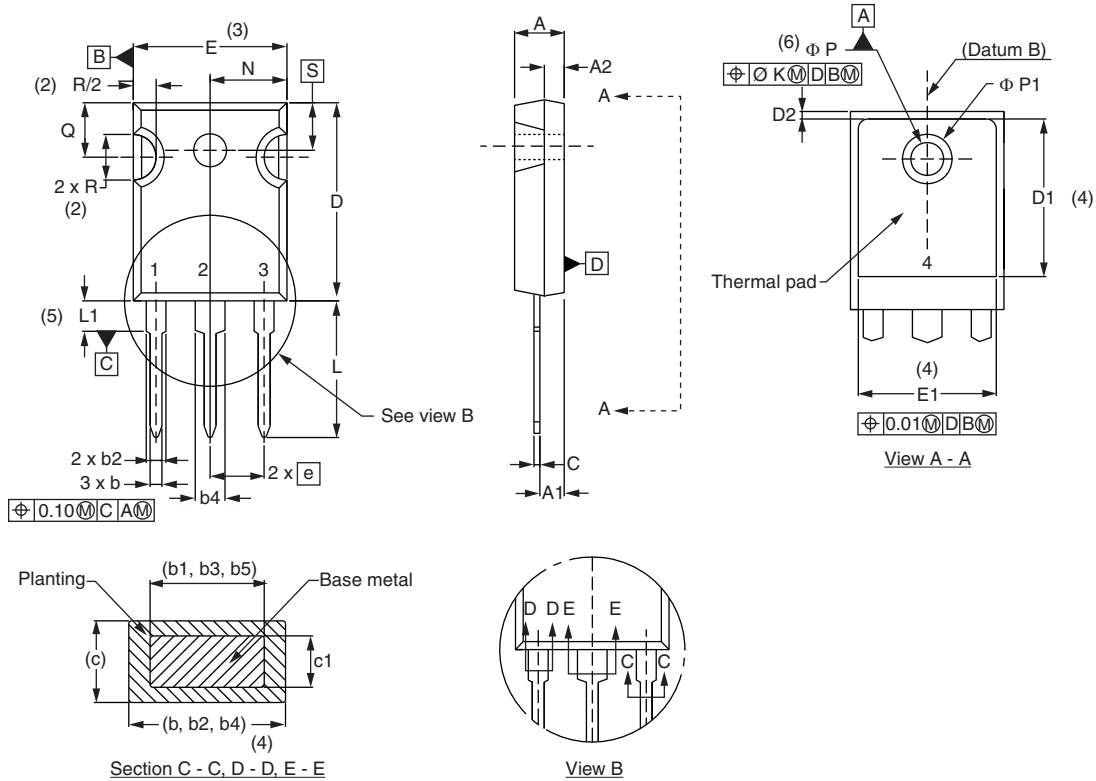
- 1** - Vishay Semiconductors product
- 2** - Current rating (60 = 60 A)
- 3** - Circuit configuration:  
C = Common cathode
- 4** - Package:  
P = TO-247AC (modified)
- 5** - H = Hyperfast recovery
- 6** - Voltage code (03 = 300 V)
- 7** - Environmental digit:  
PbF = Lead (Pb)-free and RoHS compliant  
-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-60CPH03PbF	25	500	Antistatic plastic tube
VS-60CPH03-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95542">www.vishay.com/doc?95542</a>
Part marking information	TO-247ACPbF <a href="http://www.vishay.com/doc?95226">www.vishay.com/doc?95226</a>
	TO-247AC-N3 <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a>

## TO-247

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209	
A1	2.21	2.59	0.087	0.102	
A2	1.17	1.37	0.046	0.054	
b	0.99	1.40	0.039	0.055	
b1	0.99	1.35	0.039	0.053	
b2	1.65	2.39	0.065	0.094	
b3	1.65	2.33	0.065	0.092	
b4	2.59	3.43	0.102	0.135	
b5	2.59	3.38	0.102	0.133	
c	0.38	0.89	0.015	0.035	
c1	0.38	0.84	0.015	0.033	
D	19.71	20.70	0.776	0.815	3
D1	13.08	-	0.515	-	4

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	0.51	1.35	0.020	0.053	
E	15.29	15.87	0.602	0.625	3
E1	13.46	-	0.53	-	
e	5.46 BSC		0.215 BSC		
Ø K	0.254		0.010		
L	14.20	16.10	0.559	0.634	
L1	3.71	4.29	0.146	0.169	
N	7.62 BSC		0.3		
Ø P	3.56	3.66	0.14	0.144	
Ø P1	-	7.39	-	0.291	
Q	5.31	5.69	0.209	0.224	
R	4.52	5.49	0.178	0.216	
S	5.51 BSC		0.217 BSC		

**Notes**

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension c and Q



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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