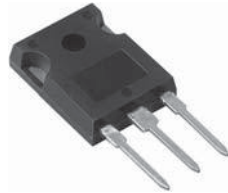
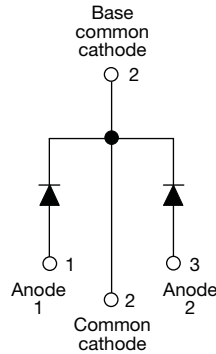


Ultrafast Rectifier, 2 x 30 A FRED Pt®



TO-247AC



FEATURES

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



DESCRIPTION / APPLICATIONS

VS-60CPU04... 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, welding, 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	400 V
V_F at I_F	0.92 V
t_{rr} typ.	37 ns
T_J max.	175 °C
Diode variation	Common cathode

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	V_{RRM}		400	V
Average rectified forward current per leg per device	$I_{F(AV)}$	Rated V_R , $T_C = 134$ °C	30 60	A
Non-repetitive peak surge current per leg	I_{FSM}	$T_J = 25$ °C	300	
Peak repetitive forward current per leg	I_{FM}	Rated V_R , square wave, 20 kHz, $T_C = 134$ °C	60	
Operating junction and storage temperatures	T_J, T_{Stg}		-65 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	$I_R = 100$ μ A	400	-	-	V
Forward voltage	V_F	$I_F = 30$ A	-	1.10	1.30	
		$I_F = 30$ A, $T_J = 150$ °C	-	0.92	1.10	
		$I_F = 60$ A	-	1.25	1.6	
		$I_F = 60$ A, $T_J = 150$ °C	-	1.10	1.4	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	-	10	μ A
		$T_J = 150$ °C, $V_R = V_R$ rated	-	-	100	
Junction capacitance	C_T	$V_R = 400$ V	-	40	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	12	-	nH



DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Reverse recovery time	t_{rr}	$I_F = 1.0\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	37	40	ns	
		$I_F = 1.0\text{ A}$, $dI_F/dt = 50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	46	-		
		$T_J = 25\text{ }^\circ\text{C}$	-	65	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	119	-		
Peak recovery current	I_{RRM}	$I_F = 30\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	6.4	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	14.7	-	
Reverse recovery charge	Q_{rr}	$I_F = 30\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	206	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	874	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J , T_{Stg}		-65	-	+175	$^\circ\text{C}$
Thermal resistance, junction to case per leg	R_{thJC}		-	0.6	1.0	$^\circ\text{C}/\text{W}$
Thermal resistance, junction to ambient per leg	R_{thJA}	Typical socket mount	-	-	40	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth, and greased	-	0.5	-	
Weight			-	6	-	
			-	0.21	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-247AC	60CPU04			

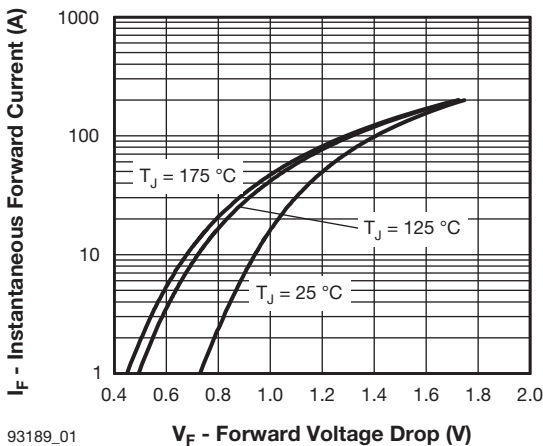


Fig. 1 - Typical Forward Voltage Drop Characteristics

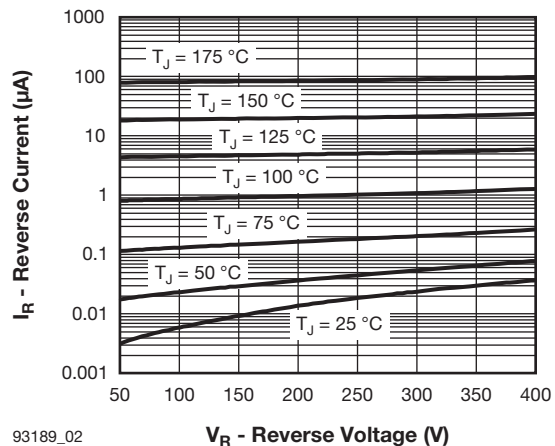
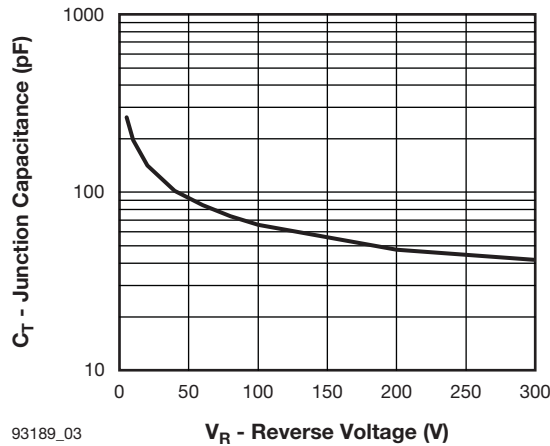
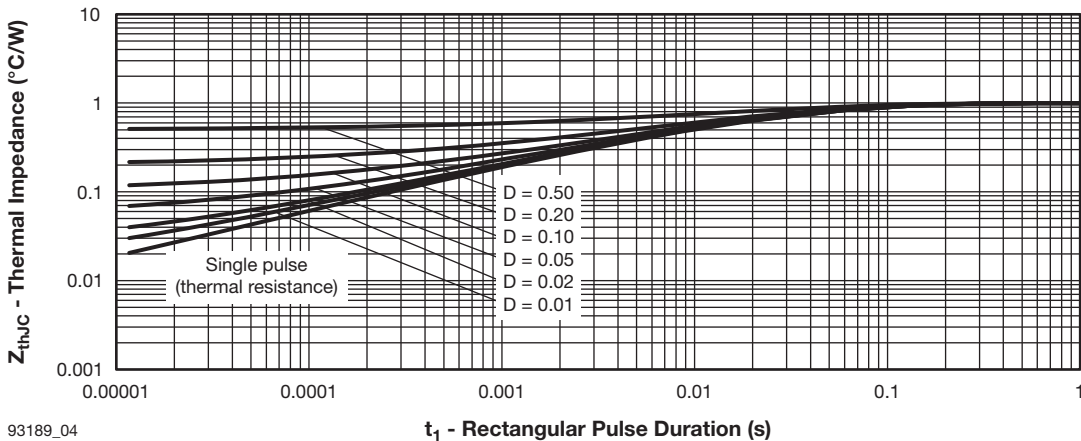


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage



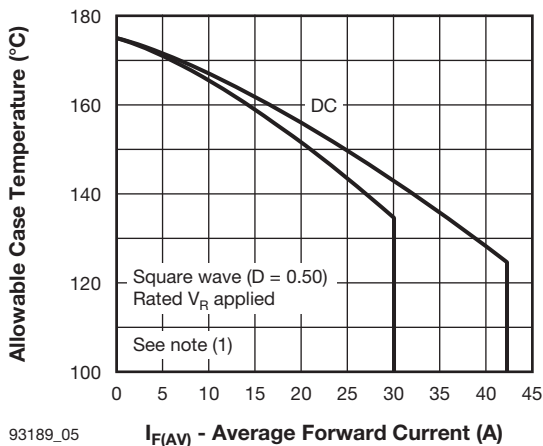
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Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage



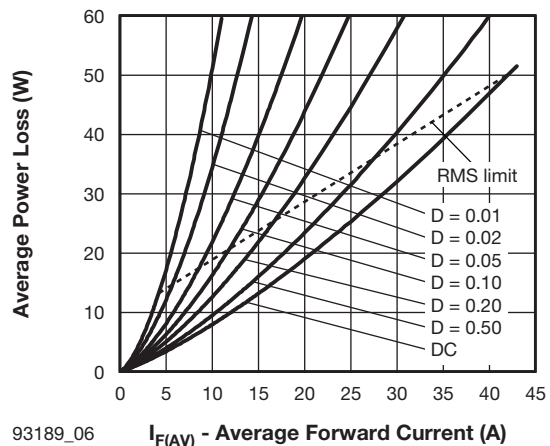
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Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics



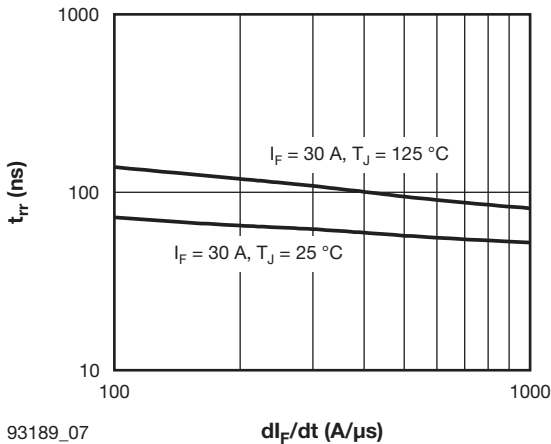
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Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current



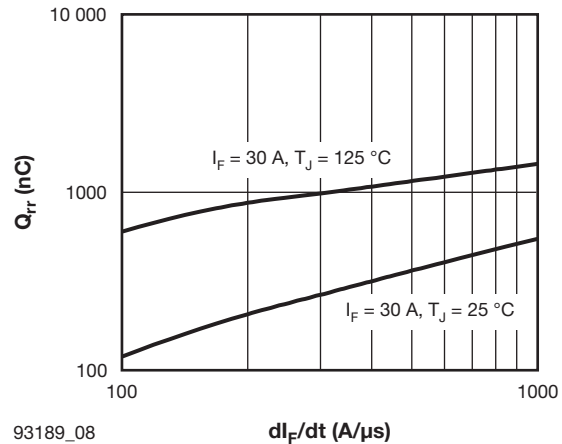
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Fig. 6 - Forward Power Loss Characteristics



93189_07

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



93189_08

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

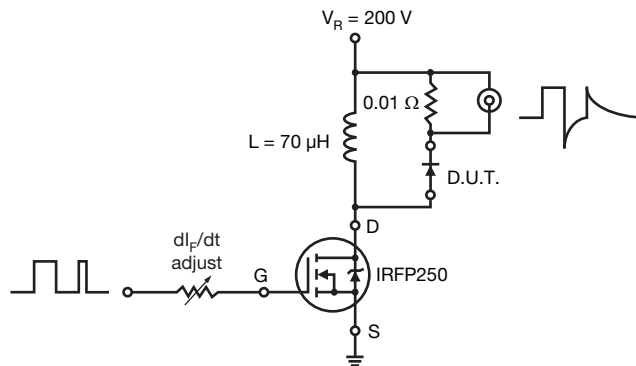
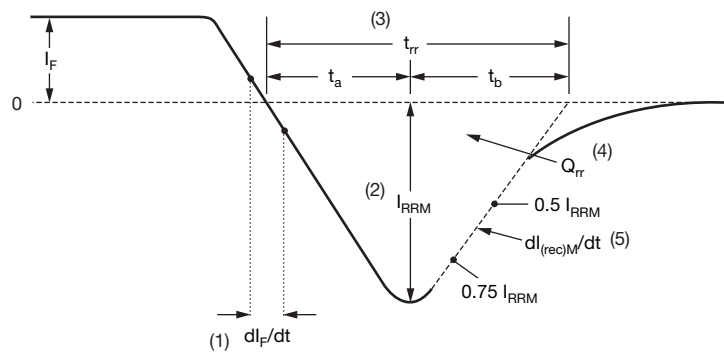


Fig. 9 - Reverse Recovery Parameter Test Circuit



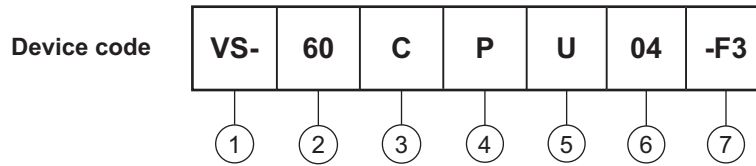
- (1) di_F/dt - rate of change of current through zero crossing
- (2) I_{RRM} - peak reverse recovery current
- (3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current.
- (4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}
- (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** - P = TO-247AC
- 5** - U = Ultrafast rectifier
- 6** - Voltage rating (04 = 400 V)
- 7** - Environmental digit:
 - F3 = RoHS compliant and totally lead (Pb)-free
 - N3 = Halogen-free, RoHS compliant and totally lead (Pb)-free

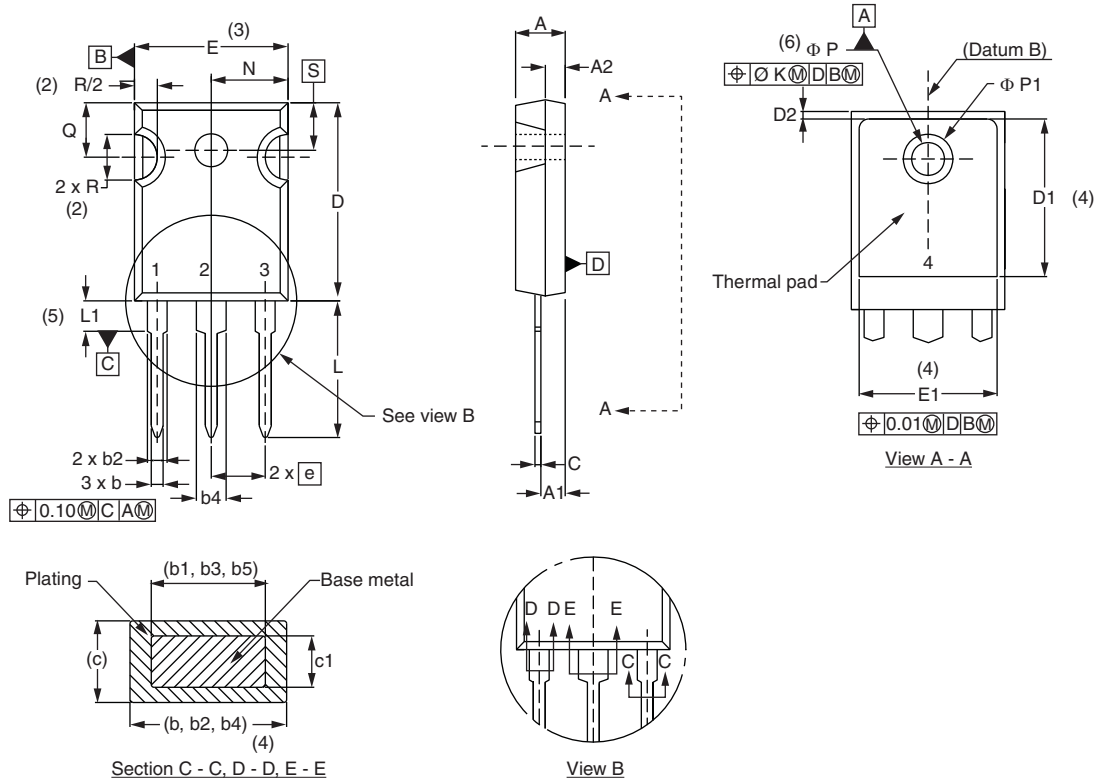
ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-60CPU04-F3	25	500	Antistatic plastic tube
VS-60CPU04-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95542
Part marking information	www.vishay.com/doc?95007
SPICE model	www.vishay.com/doc?95398



TO-247 - 50 mils L/F

DIMENSIONS in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209		D2	0.51	1.35	0.020	0.053	
A1	2.21	2.59	0.087	0.102		E	15.29	15.87	0.602	0.625	3
A2	1.17	1.37	0.046	0.054		E1	13.46	-	0.53	-	
b	0.99	1.40	0.039	0.055		e	5.46 BSC		0.215 BSC		
b1	0.99	1.35	0.039	0.053		ϕK	0.254		0.010		
b2	1.65	2.39	0.065	0.094		L	14.20	16.10	0.559	0.634	
b3	1.65	2.34	0.065	0.092		L1	3.71	4.29	0.146	0.169	
b4	2.59	3.43	0.102	0.135		N	7.62 BSC		0.3		
b5	2.59	3.38	0.102	0.133		ϕP	3.56	3.66	0.14	0.144	
c	0.38	0.89	0.015	0.035		$\phi P1$	-	7.39	-	0.291	
c1	0.38	0.84	0.015	0.033		Q	5.31	5.69	0.209	0.224	
D	19.71	20.70	0.776	0.815	3	R	4.52	5.49	0.178	0.216	
D1	13.08	-	0.515	-	4	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) ϕP 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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