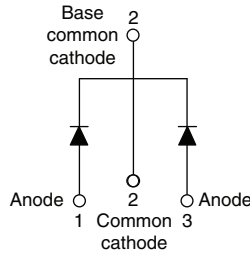




## Schottky Rectifier, 2 x 30 A



TO-220AB



### FEATURES

- 150 °C T<sub>J</sub> operation
- Low forward voltage drop
- High frequency operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified according to JEDEC-JESD47
- Halogen-free according to IEC 61249-2-21 definition (-N3 only)



PRODUCT SUMMARY	
Package	TO-220AB
I <sub>F(AV)</sub>	2 x 30 A
V <sub>R</sub>	35 V, 40 V, 45 V
V <sub>F</sub> at I <sub>F</sub>	0.53 V
I <sub>RM</sub> max.	250 mA at 125 °C
T <sub>J</sub> max.	150 °C
Diode variation	Common cathode
E <sub>AS</sub>	20 mJ

### DESCRIPTION

This center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
I <sub>F(AV)</sub>	Rectangular waveform (per device)	60	A
V <sub>RRM</sub>		35 to 45	V
I <sub>FRM</sub>	T <sub>C</sub> = 113 °C (per leg)	60	A
I <sub>FSM</sub>	t <sub>p</sub> = 5 μs sine	1500	
V <sub>F</sub>	30 A <sub>pk</sub> , T <sub>J</sub> = 125 °C	0.53	V
T <sub>J</sub>	Range	- 65 to 150	°C

VOLTAGE RATINGS								
PARAMETER	SYMBOL	VS-60CTQ035PbF	VS-60CTQ035-N3	VS-60CTQ040PbF	VS-60CTQ040-N3	VS-60CTQ045PbF	VS-60CTQ045-N3	UNITS
Maximum DC reverse voltage	V <sub>R</sub>							V
Maximum working peak reverse voltage	V <sub>RWM</sub>	35	35	40	40	45	45	

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current	I <sub>F(AV)</sub>	50 % duty cycle at T <sub>C</sub> = 113 °C, rectangular waveform	30	A
			60	
Peak repetitive forward current per leg	I <sub>FRM</sub>	Rated V <sub>R</sub> , square wave, 20 kHz, T <sub>C</sub> = 113 °C	60	A
Maximum peak one cycle non-repetitive surge current per leg	I <sub>FSM</sub>	5 μs sine or 3 μs rect. pulse	1500	
		10 ms sine or 6 ms rect. pulse	300	
Non-repetitive avalanche energy per leg	E <sub>AS</sub>	T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 3 A, L = 4.40 mH	20	mJ
Repetitive avalanche current per leg	I <sub>AR</sub>	Current decaying linearly to zero in 1 μs Frequency limited by T <sub>J</sub> maximum V <sub>A</sub> = 1.5 x V <sub>R</sub> typical	3	A



ELECTRICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS		TYP.	MAX.	UNITS
Maximum forward voltage drop	$V_{FM}^{(1)}$	30 A	$T_J = 25\text{ }^\circ\text{C}$	0.51	0.56	V
		60 A		0.66	0.72	
		30 A	$T_J = 125\text{ }^\circ\text{C}$	0.48	0.53	
		60 A		0.68	0.75	
Maximum instantaneous reverse current	$I_{RM}$	$T_J = 25\text{ }^\circ\text{C}$	Rated DC voltage	0.33	2	mA
		$T_J = 125\text{ }^\circ\text{C}$		145	250	
Maximum junction capacitance	$C_T$	$V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^\circ\text{C}$		2000		pF
Typical series inductance	$L_S$	Measured from top of terminal to mounting plane		8.0		nH
Maximum voltage rate of change	dV/dt	Rated $V_R$		10 000		V/ $\mu\text{s}$

**Note**(1) Pulse width < 300  $\mu\text{s}$ , duty cycle < 2 %

THERMAL - MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum junction temperature range	$T_J$			- 65 to 150	$^\circ\text{C}$
Maximum storage temperature range	$T_{Stg}$			- 65 to 175	
Maximum thermal resistance, junction to case per leg	$R_{thJC}$	DC operation		1.2	$^\circ\text{C}/\text{W}$
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth and greased		0.50	
Approximate weight				2	g
				0.07	oz.
Mounting torque	minimum maximum		Non-lubricated threads	6 (5)	kgf · cm (lbf · in)
				12 (10)	
Marking device			Case style TO-220AB	60CTQ035	
				60CTQ040	
				60CTQ045	

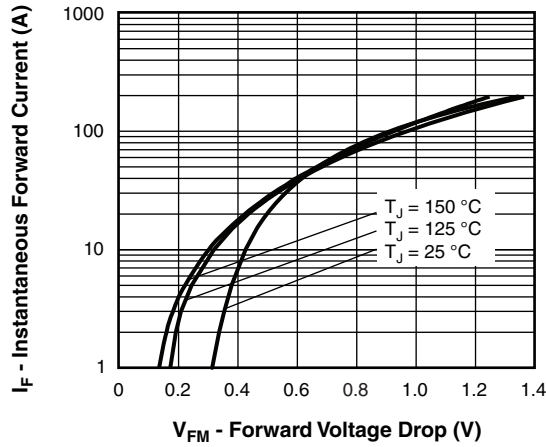


Fig. 1 - Maximum Forward Voltage Drop Characteristics

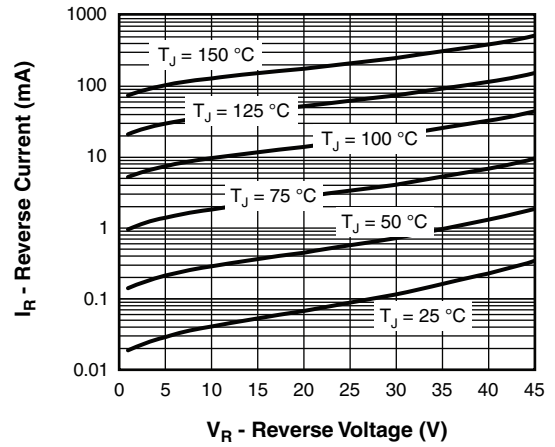


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

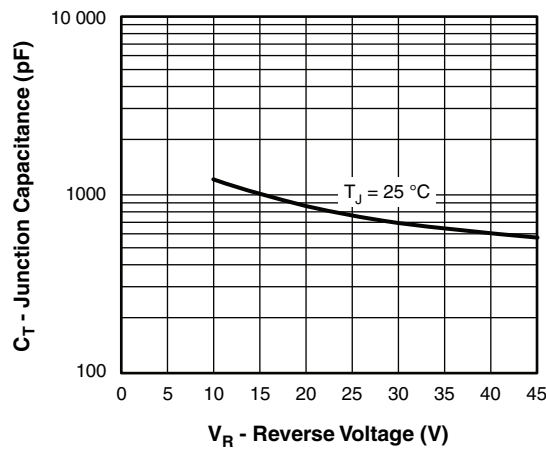


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

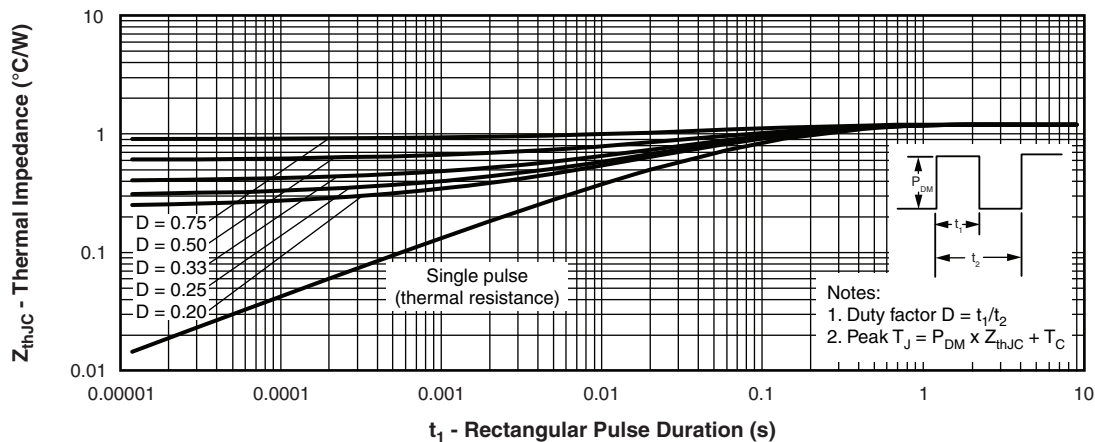


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

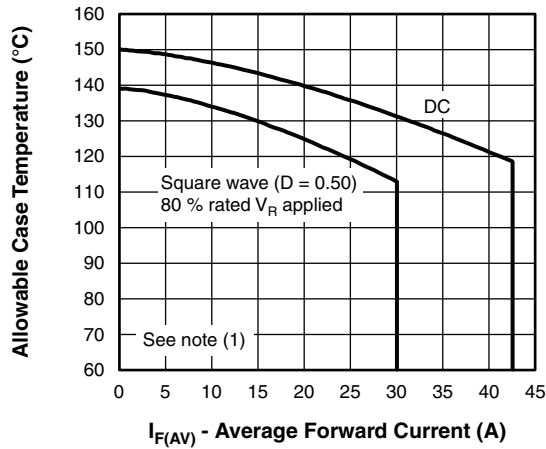


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

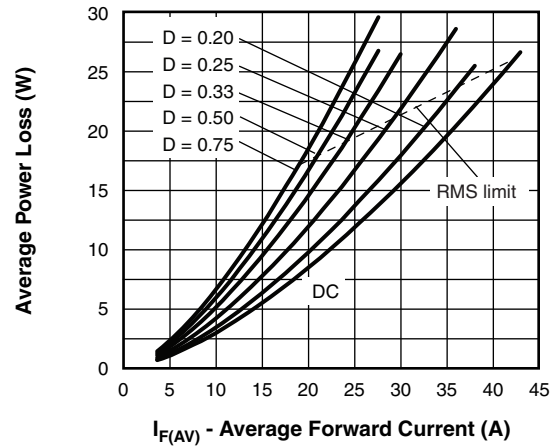


Fig. 6 - Forward Power Loss Characteristics

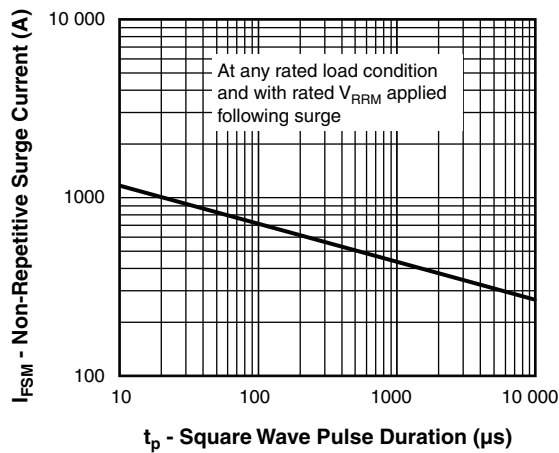


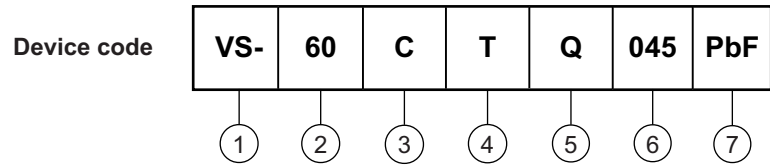
Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

**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  $V_R$



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (60 = 60 A)
- 3** - Circuit configuration  
C = Common cathode
- 4** - Package  
T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage ratings
 

035 = 35 V
040 = 40 V
045 = 45 V
- 7** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

<b>ORDERING INFORMATION (Example)</b>			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-60CTQ035PbF	50	1000	Antistatic plastic tube
VS-60CTQ035-N3	50	1000	Antistatic plastic tube
VS-60CTQ040PbF	50	1000	Antistatic plastic tube
VS-60CTQ040-N3	50	1000	Antistatic plastic tube
VS-60CTQ045PbF	50	1000	Antistatic plastic tube
VS-60CTQ045-N3	50	1000	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a>
Part marking information	TO-220AB PbF <a href="http://www.vishay.com/doc?95225">www.vishay.com/doc?95225</a>
	TO-220AB -N3 <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a>

## TO-220AB

**DIMENSIONS** in millimeters and inches



**Lead assignments**

Diodes

- 1. - Anode/open
- 2. - Cathode
- 3. - Anode

Conforms to JEDEC outline TO-220AB

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183	
A1	1.14	1.40	0.045	0.055	
A2	2.56	2.92	0.101	0.115	
b	0.69	1.01	0.027	0.040	
b1	0.38	0.97	0.015	0.038	4
b2	1.20	1.73	0.047	0.068	
b3	1.14	1.73	0.045	0.068	4
c	0.36	0.61	0.014	0.024	
c1	0.36	0.56	0.014	0.022	4
D	14.85	15.25	0.585	0.600	3
D1	8.38	9.02	0.330	0.355	
D2	11.68	12.88	0.460	0.507	6

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
E	10.11	10.51	0.398	0.414	3, 6
E1	6.86	8.89	0.270	0.350	6
E2	-	0.76	-	0.030	7
e	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
Ø P	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	
θ	90° to 93°		90° to 93°		

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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