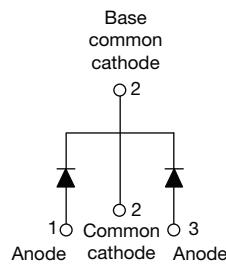


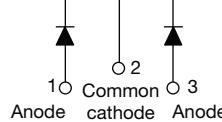
### Schottky Rectifier, 2 x 20 A

VS-48CTQ060SPbF



D<sup>2</sup>PAK

VS-48CTQ060-1PbF



TO-262

#### FEATURES

- 150 °C T<sub>J</sub> operation
- Center tap configuration
- 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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS directive 2002/95/EC
- AEC-Q101 qualified



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

#### DESCRIPTION

This center tap Schottky rectifier series 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.

#### PRODUCT SUMMARY

I <sub>F(AV)</sub>	2 x 20 A
V <sub>R</sub>	60 V

#### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
I <sub>F(AV)</sub>	Rectangular waveform	40	A
V <sub>RRM</sub>		60	V
I <sub>FSM</sub>	t <sub>p</sub> = 5 µs sine	1000	A
V <sub>F</sub>	20 Apk, T <sub>J</sub> = 125 °C (per leg)	0.58	V
T <sub>J</sub>	Range	- 55 to 150	°C

#### VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-48CTQ060SPbF VS-48CTQ060-1PbF	UNITS
Maximum DC reverse voltage	V <sub>R</sub>		
Maximum working peak reverse voltage	V <sub>RWM</sub>	60	V

#### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current per leg See fig. 5	I <sub>F(AV)</sub>	50 % duty cycle at T <sub>C</sub> = 111 °C, rectangular waveform	20	A
per device			40	
Maximum peak one cycle non-repetitive surge current per leg See fig. 7	I <sub>FSM</sub>	5 µs sine or 3 µs rect. pulse	1000	
		10 ms sine or 6 ms rect. pulse	260	
Non-repetitive avalanche energy per leg	E <sub>AS</sub>	T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 1.50 A, L = 11.5 mH	13	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	1.50	A

**ELECTRICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Maximum forward voltage drop per leg See fig. 1	$V_{FM}^{(1)}$	20 A	$T_J = 25 \text{ } ^\circ\text{C}$	0.61	V	
		40 A		0.83		
		20 A	$T_J = 125 \text{ } ^\circ\text{C}$	0.58		
		40 A		0.75		
Maximum reverse leakage current per leg See fig. 2	$I_{RM}^{(1)}$	$T_J = 25 \text{ } ^\circ\text{C}$	$V_R = \text{Rated } V_R$	2	mA	
		$T_J = 125 \text{ } ^\circ\text{C}$		89		
Threshold Voltage	$V_{F(TO)}$	$T_J = T_J \text{ maximum}$		0.37	V	
Forward slope resistance	$r_t$			8.26	$\text{m}\Omega$	
Maximum junction capacitance per leg	$C_T$	$V_R = 5 \text{ } V_{DC}$ (test signal range 100 kHz to 1 MHz), $25 \text{ } ^\circ\text{C}$		1220	pF	
Typical series inductance per leg	$L_S$	Measured lead to lead 5 mm from package body		8.0	nH	
Maximum voltage rate of change	$dV/dt$	Rated $V_R$		10 000	$\text{V}/\mu\text{s}$	

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

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Maximum junction and storage temperature range	$T_J, T_{Stg}$			- 55 to 150	$^\circ\text{C}$	
Maximum thermal resistance, junction to case per leg	$R_{thJC}$	DC operation		2.0	$^\circ\text{C}/\text{W}$	
Maximum thermal resistance, junction to case per package				1.0		
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			6 (5)	$\text{k}\text{gf} \cdot \text{cm}$ (lbf · in)	
	maximum			12 (10)		
Marking device		Case style D <sup>2</sup> PAK		48CTQ060S		
		Case style TO-262		48CTQ060-1		

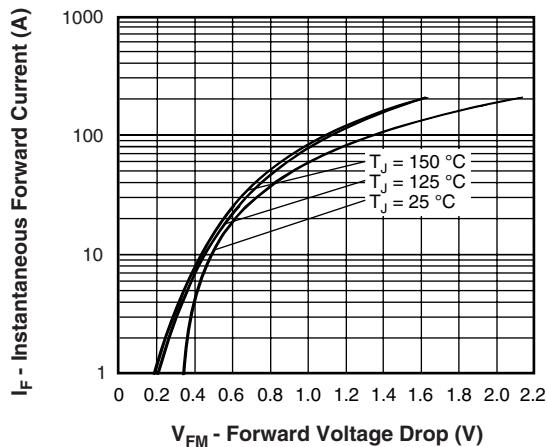


Fig. 1 - Maximum Forward Voltage Drop Characteristics  
(Per Leg)

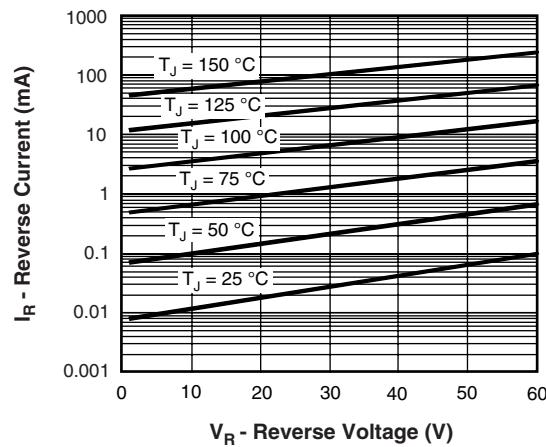


Fig. 2 - Typical Values of Reverse Current vs.  
Reverse Voltage (Per Leg)

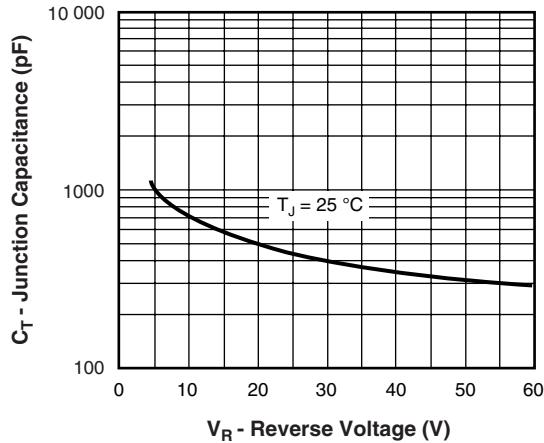


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

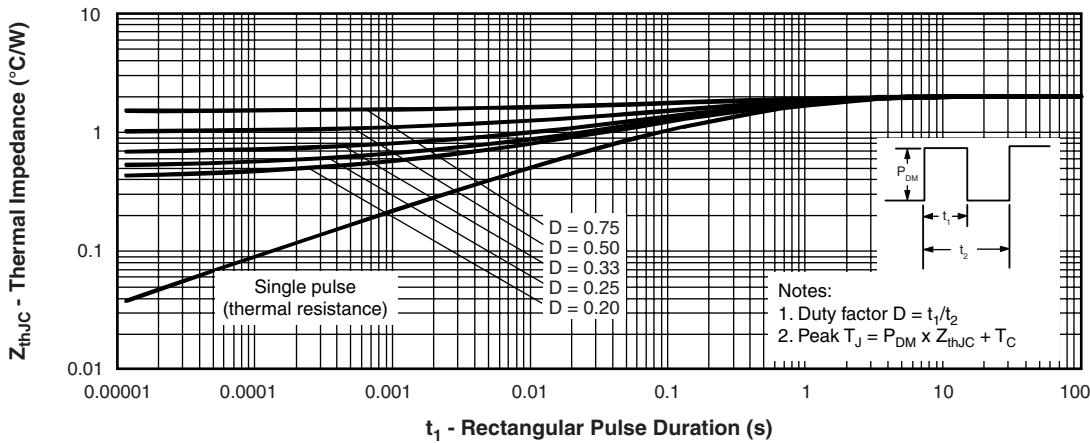


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

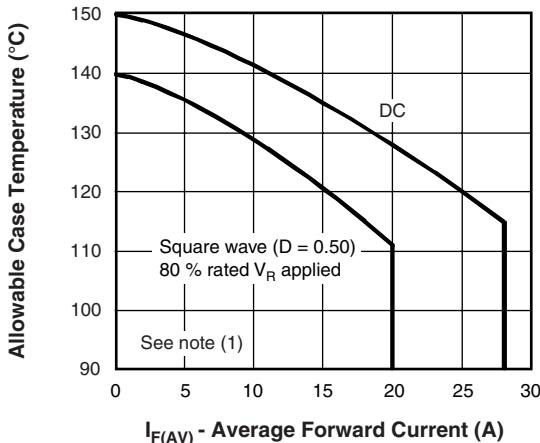


Fig. 5 - Maximum Allowable Case Temperature vs.  
Average Forward Current (Per Leg)

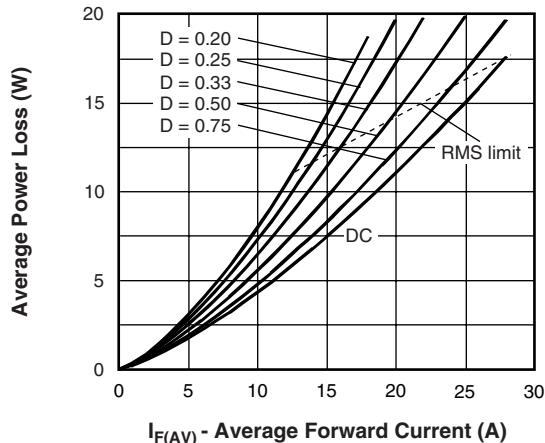


Fig. 6 - Forward Power Loss Characteristics  
(Per Leg)

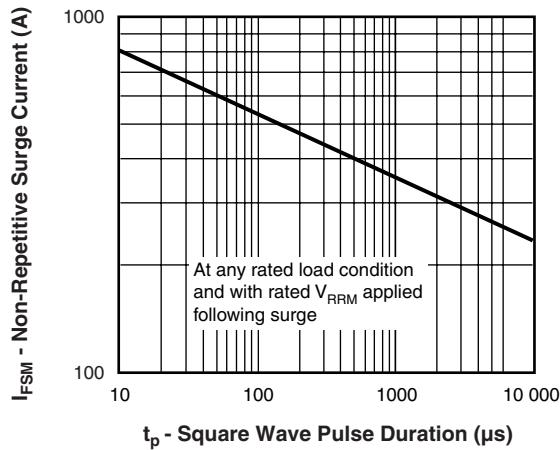


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

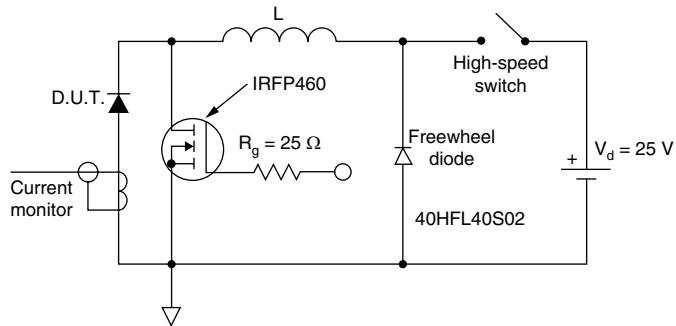


Fig. 8 - Unclamped Inductive Test Circuit

### Note

- <sup>(1)</sup> Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d = \text{Forward power loss} = I_{F(AV)} \times V_{FM} \text{ at } (I_{F(AV)}/D) \text{ (see fig. 6)}$ ;  
 $P_{dREV} = \text{Inverse power loss} = V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 10 \text{ V}$

### ORDERING INFORMATION TABLE

Device code	VS-	48	C	T	Q	060	S	TRL	PbF
	1	2	3	4	5	6	7	8	9

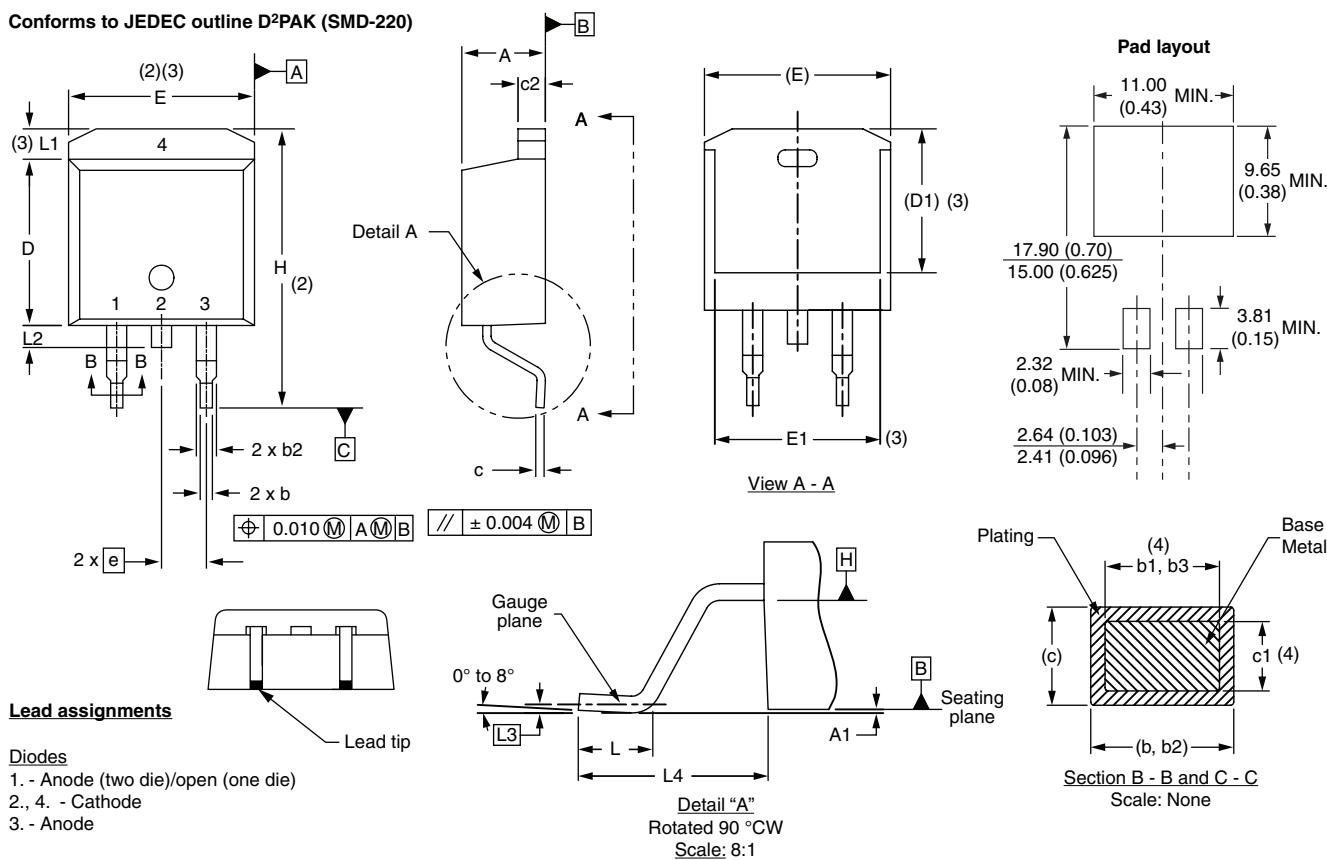
- 1** - HPP product suffix
- 2** - Current rating (40 A)
- 3** - Circuit configuration: C = Common cathode
- 4** - T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage rating (060 = 60 V)
- 7** - • S = D<sup>2</sup>PAK  
• -1 = TO-262
- 8** - • None = Tube (50 pieces)  
• TRL = Tape and reel (left oriented - for D<sup>2</sup>PAK only)  
• TRR = Tape and reel (right oriented - for D<sup>2</sup>PAK only)
- 9** - PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95014">www.vishay.com/doc?95014</a>
Part marking information	<a href="http://www.vishay.com/doc?95008">www.vishay.com/doc?95008</a>
Packaging information	<a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a>

### D<sup>2</sup>PAK, TO-262

#### DIMENSIONS FOR D<sup>2</sup>PAK in millimeters and inches

Conforms to JEDEC outline D<sup>2</sup>PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES		SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.				MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190			D1	6.86	8.00	0.270	0.315	3
A1	0.00	0.254	0.000	0.010			E	9.65	10.67	0.380	0.420	2, 3
b	0.51	0.99	0.020	0.039			E1	7.90	8.80	0.311	0.346	3
b1	0.51	0.89	0.020	0.035	4		e	2.54 BSC		0.100 BSC		
b2	1.14	1.78	0.045	0.070			H	14.61	15.88	0.575	0.625	
b3	1.14	1.73	0.045	0.068	4		L	1.78	2.79	0.070	0.110	
c	0.38	0.74	0.015	0.029			L1	-	1.65	-	0.066	3
c1	0.38	0.58	0.015	0.023	4		L2	1.27	1.78	0.050	0.070	
c2	1.14	1.65	0.045	0.065			L3	0.25 BSC		0.010 BSC		
D	8.51	9.65	0.335	0.380	2		L4	4.78	5.28	0.188	0.208	

#### Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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 outmost extremes of the plastic body
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch

(7) Outline conforms to JEDEC outline TO-263AB

# Outline Dimensions

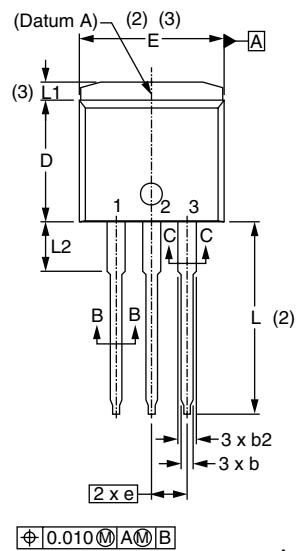
Vishay High Power Products

D<sup>2</sup>PAK, TO-262

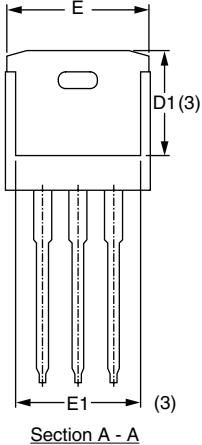
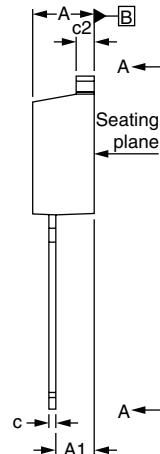


## DIMENSIONS FOR TO-262 in millimeters and inches

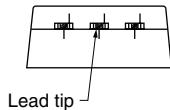
Modified JEDEC outline TO-262



$\pm 0.010$  M A M B



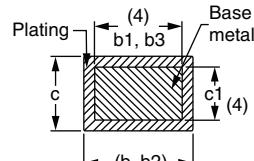
Section A - A



### Lead assignments

#### Diodes

1. - Anode (two die)/open (one die)
- 2., 4. - Cathode
3. - Anode



Section B - B and C - C

Scale: None

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	2.03	3.02	0.080	0.119	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65	0.335	0.380	2
D1	6.86	8.00	0.270	0.315	3
E	9.65	10.67	0.380	0.420	2, 3
E1	7.90	8.80	0.311	0.346	3
e	2.54 BSC		0.100 BSC		
L	13.46	14.10	0.530	0.555	
L1	-	1.65	-	0.065	3
L2	3.56	3.71	0.140	0.146	

### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) 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 outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Controlling dimension: inches

- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline

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