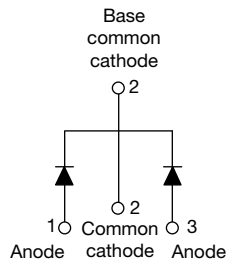
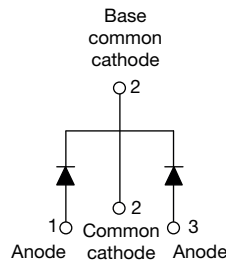


## High Performance Schottky Rectifiers, 2 x 20 A


**D²PAK (TO-263AB)**

**TO-262AA**

**VS-48CTQ060S-M3**

**VS-48CTQ060-1-M3**

### FEATURES

- 150 °C  $T_J$  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 245 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**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.

#### PRIMARY CHARACTERISTICS

$I_{F(AV)}$	2 x 20 A
$V_R$	60 V
$V_F$ at $I_F$	0.58 V
$I_{RM}$ max.	89 mA at 125 °C
$T_J$ max.	150 °C
$E_{AS}$	13 mJ
Package	D²PAK (TO-263AB), TO-262AA
Circuit configuration	Common cathode

#### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{F(AV)}$	Rectangular waveform	40	A
$V_{RRM}$		60	V
$I_{FSM}$	$t_p = 5 \mu s$ sine	1000	A
$V_F$	20 $A_{pk}$ , $T_J = 125$ °C (per leg)	0.58	V
$T_J$	Range	-55 to +150	°C

#### VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-48CTQ060S-M3 VS-48CTQ060-1-M3	UNITS
Maximum DC reverse voltage	$V_R$	60	V
Maximum working peak reverse voltage	$V_{RWM}$		



ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Maximum average forward current See fig. 5	per leg per device	$I_{F(AV)}$	50 % duty cycle at $T_C = 111\text{ }^\circ\text{C}$ , rectangular waveform		20	A
					40	
Maximum peak one cycle non-repetitive surge current per leg See fig. 7	$I_{FSM}$	5 $\mu\text{s}$ sine or 3 $\mu\text{s}$ rect. pulse 10 ms sine or 6 ms rect. pulse	Following any rated load condition and with rated $V_{RRM}$ applied	1000	mJ	
				260		
Non-repetitive avalanche energy per leg	$E_{AS}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_{AS} = 1.50\text{ A}$ , $L = 11.5\text{ mH}$		13		
Repetitive avalanche current per leg	$I_{AR}$	Current decaying linearly to zero in 1 $\mu\text{s}$ Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ 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	$V_{F(TO)}$	$T_J = T_J$ 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)	$\text{kgf} \cdot \text{cm}$ ( $\text{lbf} \cdot \text{in}$ )
	maximum			12 (10)	
Marking device		Case style D <sup>2</sup> PAK (TO-263AB)		48CTQ060S	
		Case style TO-262AA		48CTQ060-1	

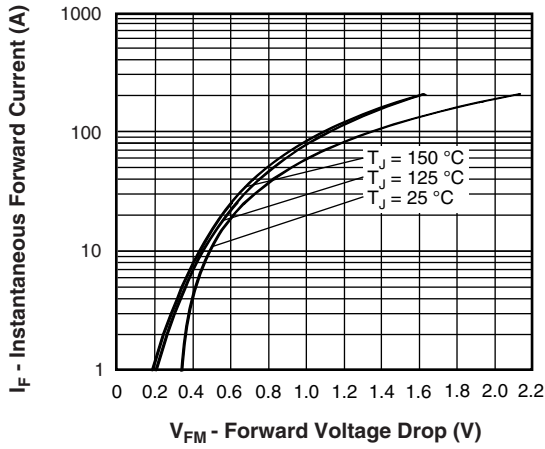


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

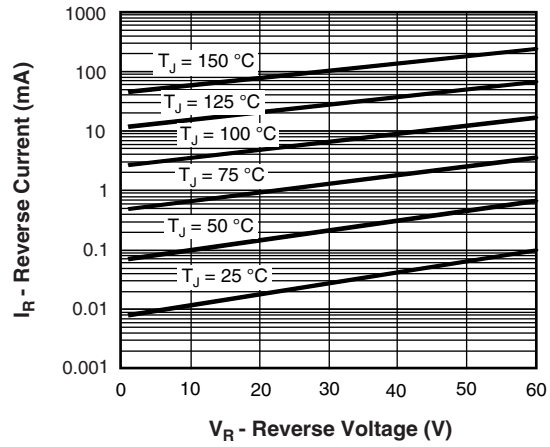


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

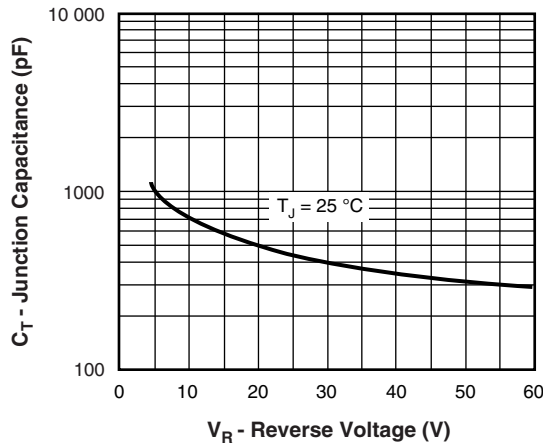


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

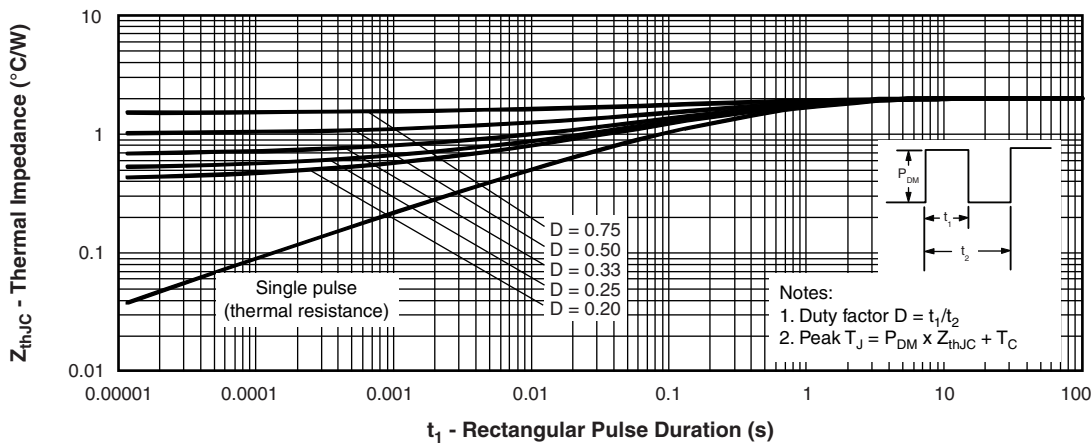


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

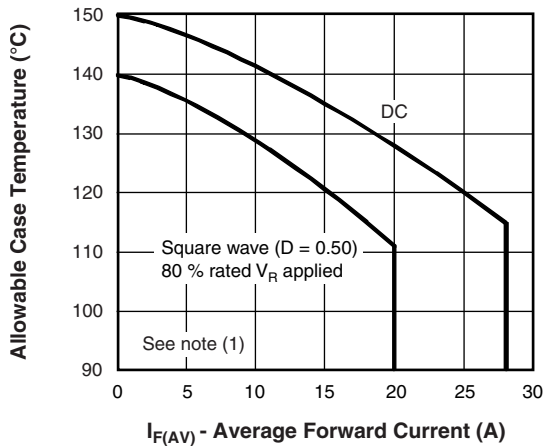


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

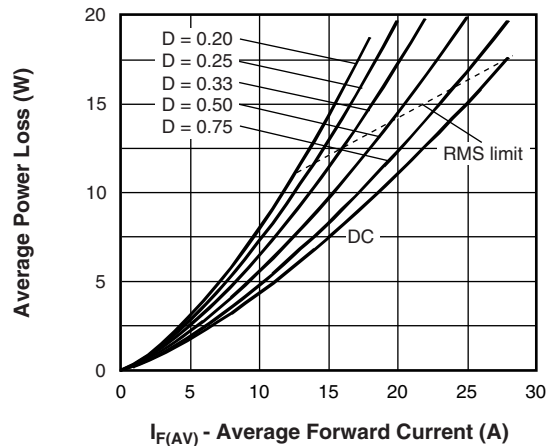


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

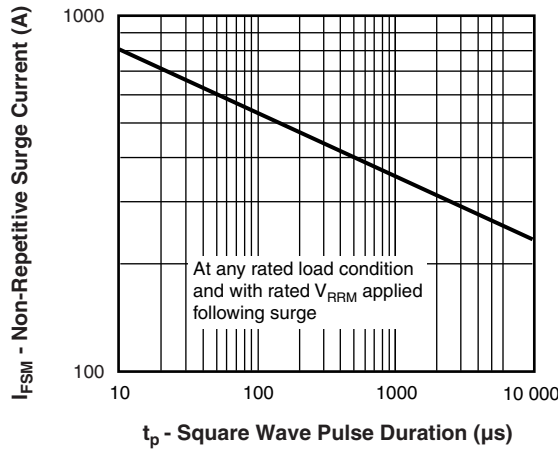


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

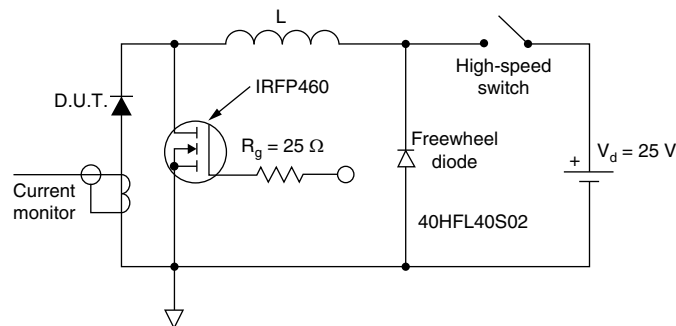


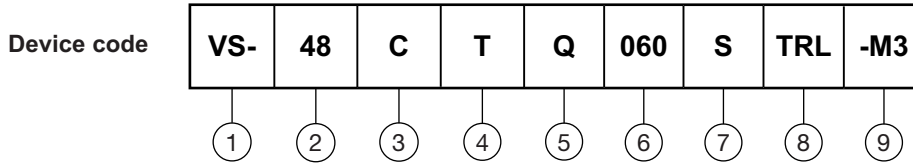
Fig. 8 - Unclamped Inductive Test Circuit

**Note**

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



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 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 (TO-263AB)
  - -1 = TO-262AA
- 8** -
  - None = tube
  - TRL = tape and reel (left oriented - for D<sup>2</sup>PAK (TO-263AB) only)
  - TRR = tape and reel (right oriented - for D<sup>2</sup>PAK (TO-263AB) only)
- 9** - -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

<b>ORDERING INFORMATION</b>			
<b>PREFERRED P/N</b>	<b>QUANTITY PER T/R</b>	<b>MINIMUM ORDER QUANTITY</b>	<b>PACKAGING DESCRIPTION</b>
VS-48CTQ060S-M3	50	1000	Antistatic plastic tubes
VS-48CTQ060STRR-M3	800	800	13" diameter reel
VS-48CTQ060STRL-M3	800	800	13" diameter reel
VS-48CTQ060-1-M3	50	1000	Antistatic plastic tubes

<b>LINKS TO RELATED DOCUMENTS</b>		
Dimensions	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a>
	TO-262AA	<a href="http://www.vishay.com/doc?96165">www.vishay.com/doc?96165</a>
Part marking information	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a>
Packaging information		<a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a>

## D<sup>2</sup>PAK

### DIMENSIONS 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
- Outline conforms to JEDEC® outline TO-263AB

### TO-262

**DIMENSIONS** in millimeters and inches

Modified JEDEC® outline TO-262



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	3.36	3.71	0.132	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), D1 (minimum) and L2 where dimensions derived the actual package outline



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