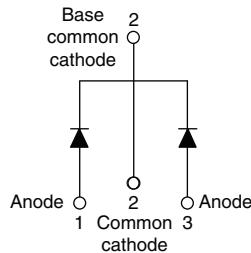


## High Performance Schottky Rectifier, 2 x 20 A



### FEATURES

- 150 °C  $T_J$  operation
- Optimized for 3.3 V application
- Ultralow forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- 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 has been optimized for ultralow forward voltage drop specifically for 3.3 V output power supplies. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, reverse battery protection, and redundant power subsystems.

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	2 x 20 A
$V_R$	20 V
$V_F$ at $I_F$	0.34 V
$I_{RM}$ max.	310 mA at 125 °C
$T_J$ max.	150 °C
$E_{AS}$	18 mJ
Package	TO-220AB 3L
Circuit configuration	Common cathode

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{F(AV)}$	Rectangular waveform	40	A
$V_{RRM}$		20	V
$I_{FSM}$	$t_p = 5 \mu s$ sine	1000	A
$V_F$	$20 A_{pk}, T_J = 125 °C$	0.34	V
$T_J$		-55 to +150	°C

PARAMETER	SYMBOL	VS-47CTQ020-M3	UNITS
Maximum DC reverse voltage	$V_R$		
Maximum working peak reverse voltage	$V_{RWM}$	20	V

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Maximum average forward current per leg	$I_{F(AV)}$	50 % duty cycle at $T_C = 135 °C$ , rectangular waveform		20	A	
per device				40		
Maximum peak one cycle non-repetitive surge current per leg	$I_{FSM}$	5 $\mu s$ sine or 3 $\mu s$ rect. pulse	Following any rated load condition and with rated $V_{RRM}$ applied	1000		
		10 ms sine or 6 ms rect. pulse		250		
Non-repetitive avalanche energy per leg	$E_{AS}$	$T_J = 25 °C, I_{AS} = 3 A, L = 3 mH$		18	mJ	
Repetitive avalanche current per leg	$I_{AR}$	Current decaying linearly to zero in 1 $\mu s$ Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical		3	A	

**ELECTRICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum forward voltage drop per leg	$V_{FM}^{(1)}$	20 A	$T_J = 25 \text{ }^\circ\text{C}$	0.45
		40 A		0.51
		20 A	$T_J = 125 \text{ }^\circ\text{C}$	0.34
		40 A		0.44
		20 A	$T_J = 150 \text{ }^\circ\text{C}$	0.31
		40 A		0.42
Maximum reverse leakage current per leg	$I_{RM}^{(1)}$	$T_J = 125 \text{ }^\circ\text{C}$	$V_R = 5 \text{ V}$	60
			$V_R = 3.3 \text{ V}$	45
		$T_J = 150 \text{ }^\circ\text{C}$	$V_R = 10 \text{ V}$	306
		$T_J = 25 \text{ }^\circ\text{C}$	$V_R = \text{Rated } V_R$	3
		$T_J = 125 \text{ }^\circ\text{C}$		310
Threshold voltage	$V_{F(TO)}$	$T_J = T_J \text{ maximum}$	0.188	V
Forward slope resistance	$r_t$		5.9	$\text{m}\Omega$
Maximum junction capacitance per leg	$C_T$	$V_R = 5 \text{ V}_{\text{DC}}$ (test signal range 100 kHz to 1 MHz) $25 \text{ }^\circ\text{C}$	3000	$\text{pF}$
Typical series inductance per leg	$L_S$	Measured lead to lead 5 mm from package body	5.5	$\text{nH}$
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	1.5	$^\circ\text{C}/\text{W}$
Maximum thermal resistance, junction to case per package			0.75	
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)	$\text{kgf} \cdot \text{cm}$ (lbf · in)
	maximum		12 (10)	
Marking device		Case style 3L TO-220AB	47CTQ020	

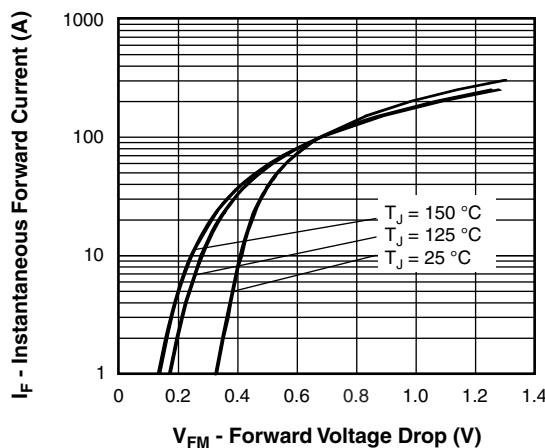


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

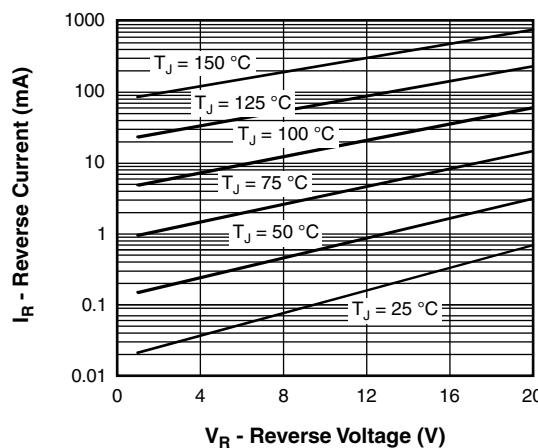


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

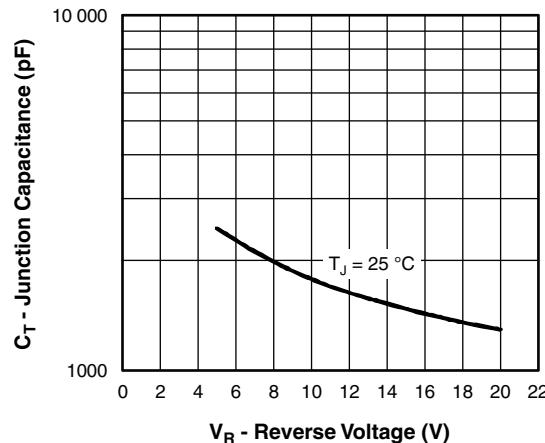


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

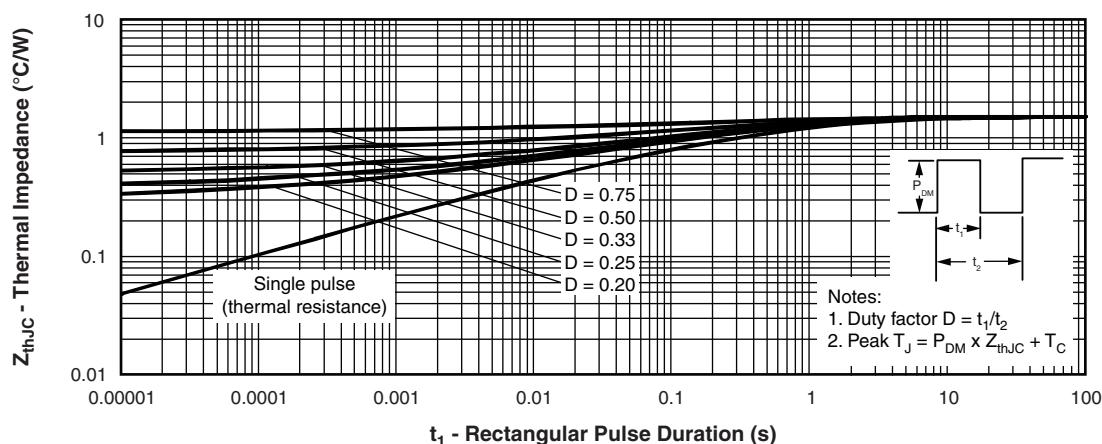


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

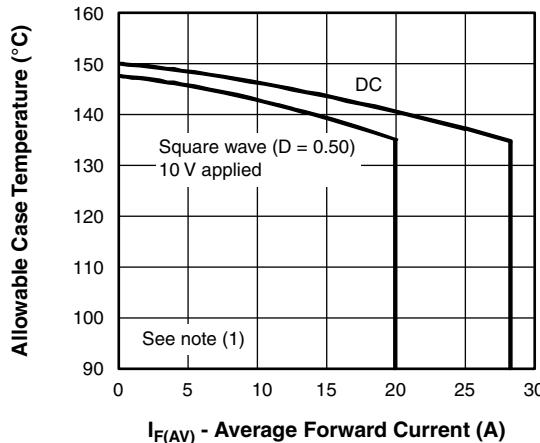


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

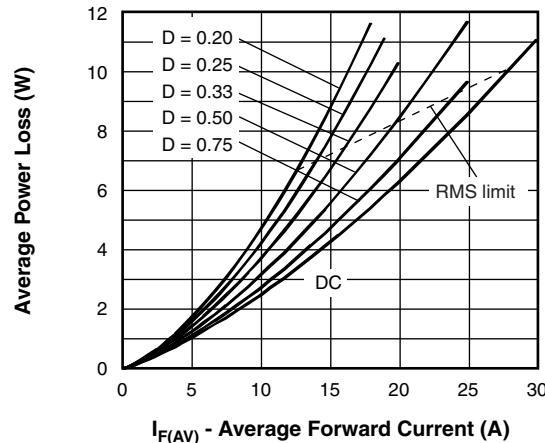


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

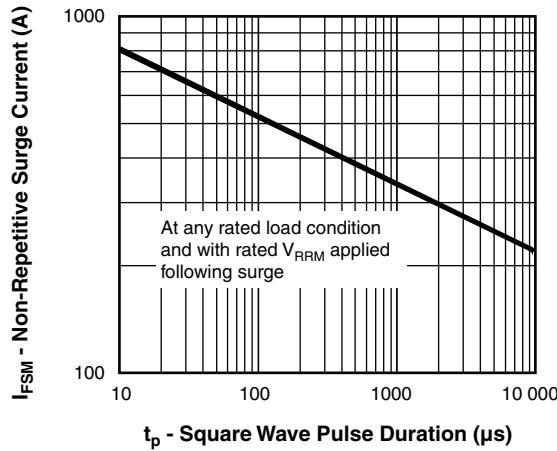


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

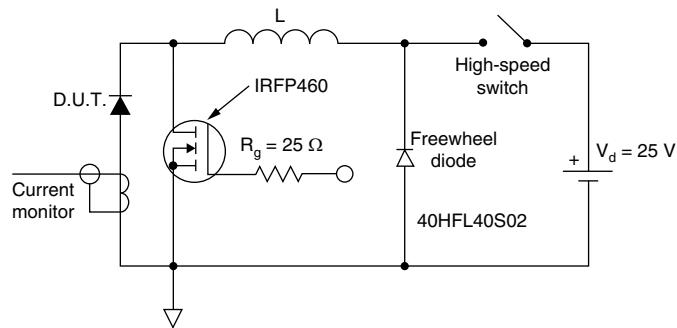


Fig. 8 - Unclamped Inductive Test Circuit

#### Note

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

**ORDERING INFORMATION TABLE**

Device code	VS-	47	C	T	Q	020	-M3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

- 1** - Vishay Semiconductors product
- 2** - Current rating (40 A)
- 3** - Circuit configuration  
C = common cathode
- 4** - Package  
T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage rating (020 = 20 V)
- 7** - Environmental digit  
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

**ORDERING INFORMATION** (Example)

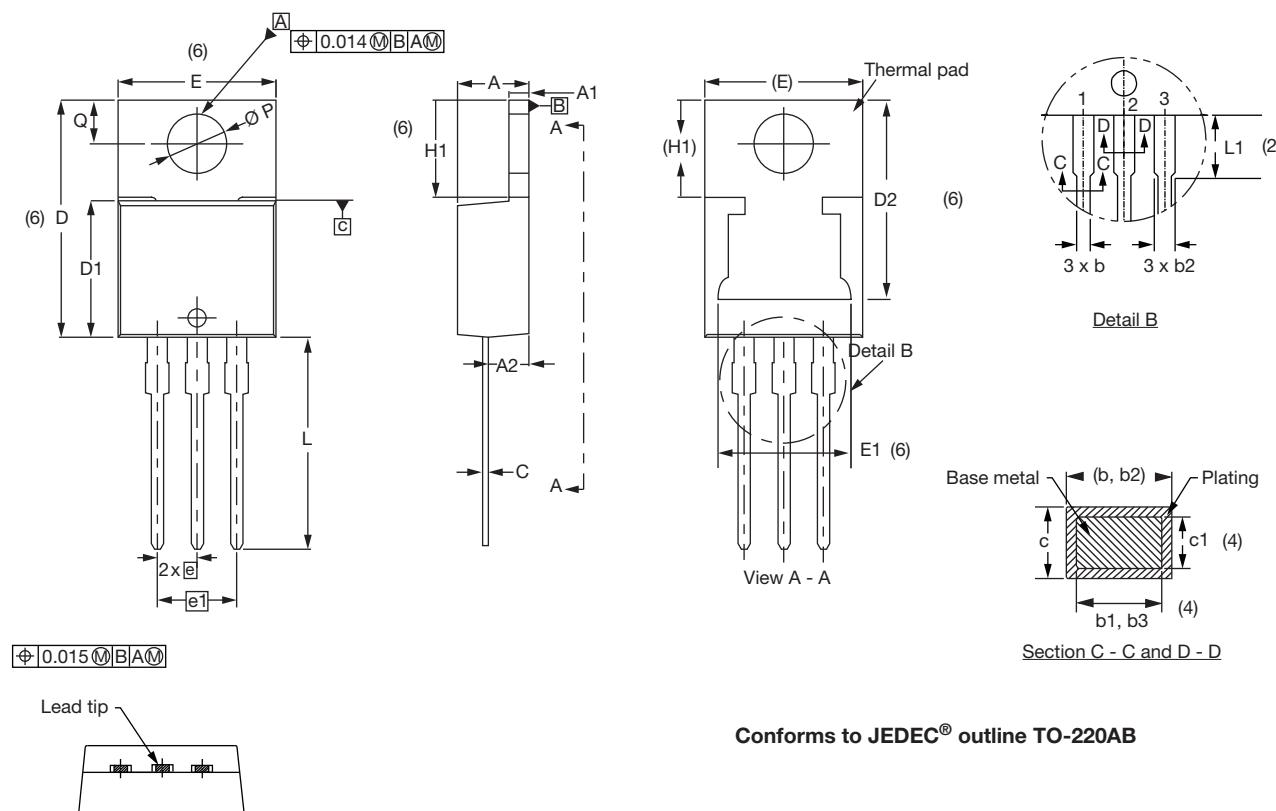
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-47CTQ020-M3	50	Antistatic plastic tubes

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?96154">www.vishay.com/doc?96154</a>
Part marking information	<a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a>

## 3L TO-220AB

**DIMENSIONS** in millimeters and inches



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	2.50	2.92	0.098	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	15.35	0.585	0.604	3
D1	8.38	9.02	0.330	0.355	

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	11.68	13.30	0.460	0.524	6, 7
E	10.11	10.51	0.398	0.414	3, 6
E1	6.86	8.89	0.270	0.350	6
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
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
ØP	3.54	3.91	0.139	0.154	
Q	2.60	3.00	0.102	0.118	

**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) Outline conforms to JEDEC® TO-220, except D2

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