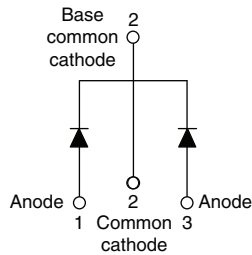


## Schottky Rectifier, 2 x 20 A


**TO-220AB**


### 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
- 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
$I_{F(AV)}$	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
Diode variation	Common cathode
$E_{AS}$	18 mJ

### 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.

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 $A_{pk}$ , $T_J = 125 \text{ }^\circ\text{C}$	0.34	V
$T_J$		- 55 to 150	°C

VOLTAGE RATINGS				
PARAMETER	SYMBOL	VS-47CTQ020PbF	VS-47CTQ020-N3	UNITS
Maximum DC reverse voltage	$V_R$	20	20	V
Maximum working peak reverse voltage	$V_{RWM}$			

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average forward current per leg per device	$I_{F(AV)}$	50 % duty cycle at $T_C = 135 \text{ }^\circ\text{C}$ , rectangular waveform		20	A
				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	$E_{AS}$	$T_J = 25 \text{ }^\circ\text{C}$ , $I_{AS} = 3 \text{ A}$ , $L = 3 \text{ mH}$		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	V		
		40 A		0.51			
		20 A	$T_J = 125\text{ }^\circ\text{C}$	0.34		V	
		40 A		0.44			
		20 A	$T_J = 150\text{ }^\circ\text{C}$	0.31			V
		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	mA		
			$V_R = 3.3\text{ V}$	45			
		$T_J = 150\text{ }^\circ\text{C}$	$V_R = 10\text{ V}$	306		mA	
		$T_J = 25\text{ }^\circ\text{C}$	$V_R = \text{Rated } V_R$	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	$C_T$	$V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^\circ\text{C}$		3000	pF		
Typical series inductance per leg	$L_S$	Measured lead to lead 5 mm from package body		5.5	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 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)	kgf · cm (lbf · in)
	maximum			12 (10)	
Marking device		Case style TO-220AB		47CTQ020	

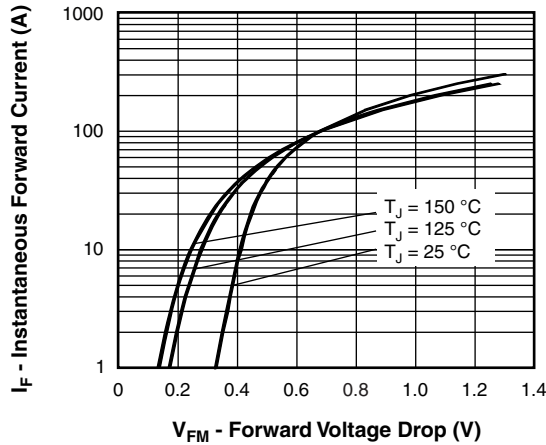


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

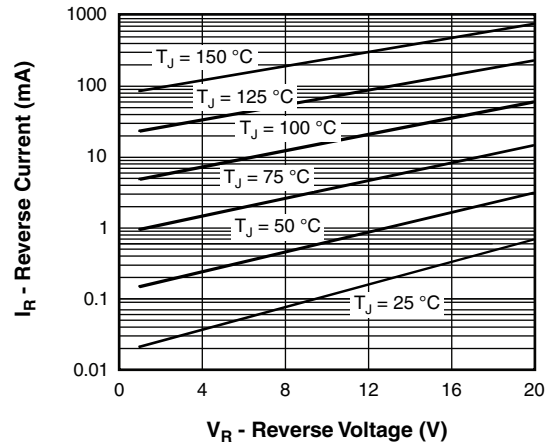


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

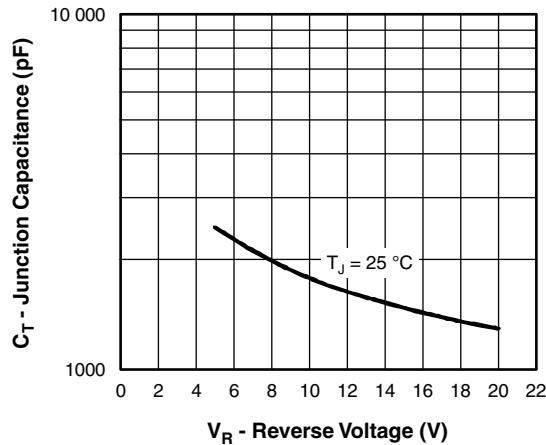


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

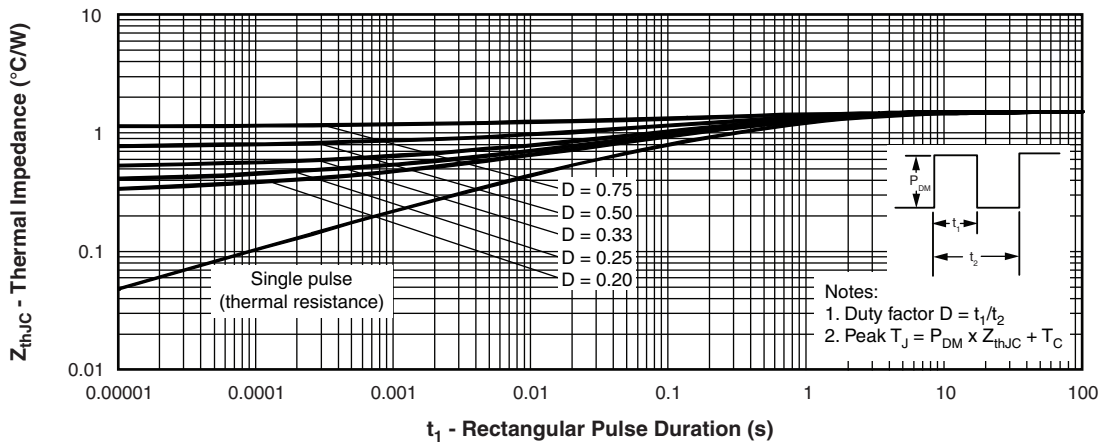


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

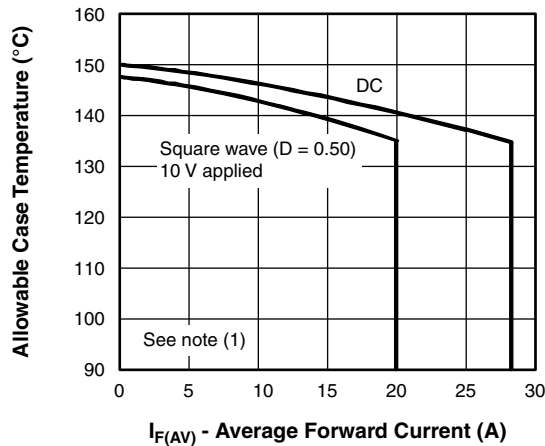


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

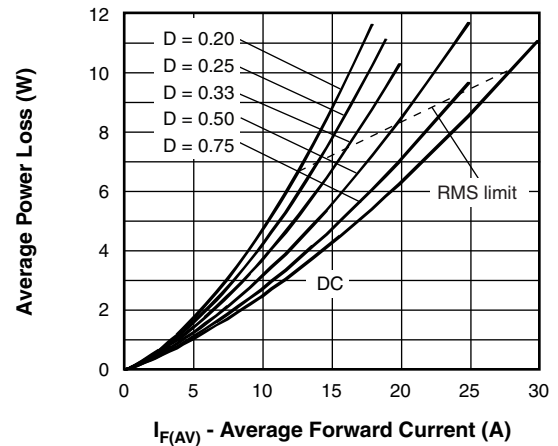


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

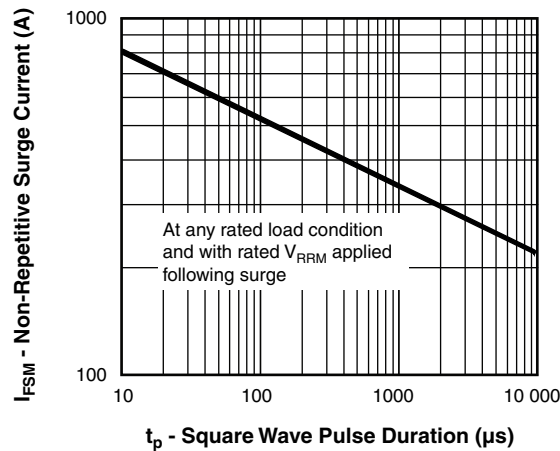


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

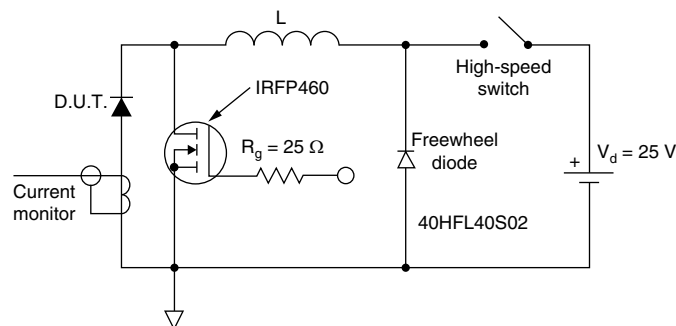


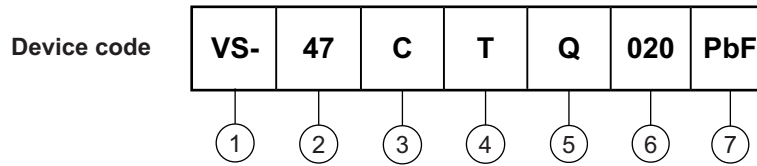
Fig. 8 - Unclamped Inductive Test Circuit

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;
- $P_d$  = 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  $V_{R1} = 10 V$



## ORDERING INFORMATION TABLE



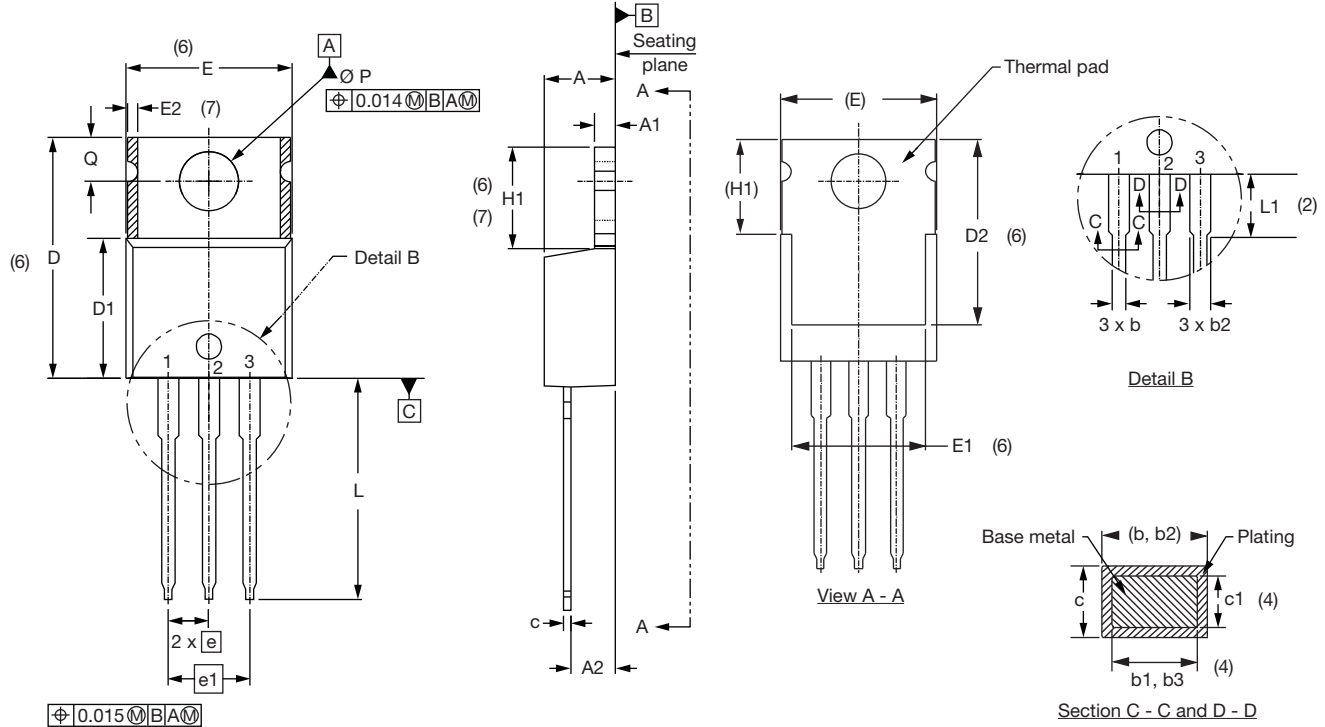
- 1** - Vishay Semiconductors product
- 2** - Current rating (40 A)
- 3** - Circuit configuration  
C = Common cathode
- 4** - Package  
T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage rating (020 = 20 V)
- 7** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-47CTQ020PbF	50	1000	Antistatic plastic tube
VS-47CTQ020-N3	50	1000	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
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
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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