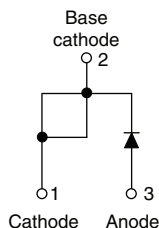


## High Performance Schottky Rectifier, 20 A


**TO-220AC**


### 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
- 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)



### PRODUCT SUMMARY

Package	TO-220AC
I <sub>F(AV)</sub>	20 A
V <sub>R</sub>	35 V, 40 V, 45 V
V <sub>F</sub> at I <sub>F</sub>	0.51 V
I <sub>RM</sub> max.	105 mA at 125 °C
T <sub>J</sub> max.	150 °C
Diode variation	Single die
E <sub>AS</sub>	27 mJ

### DESCRIPTION

The VS-20TQ... Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. 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	20	A
V <sub>RRM</sub>	Range	35 to 45	V
I <sub>FSM</sub>	t <sub>p</sub> = 5 µs sine	1800	A
V <sub>F</sub>	20 A <sub>pk</sub> , T <sub>J</sub> = 125 °C	0.51	V
T <sub>J</sub>	Range	-55 to +150	°C

### VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-20TQ035PbF	VS-20TQ035-N3	VS-20TQ040PbF	VS-20TQ040-N3	VS-20TQ045PbF	VS-20TQ045-N3	UNITS
Maximum DC reverse voltage	V <sub>R</sub>	35	35	40	40	45	45	V
Maximum working peak reverse voltage	V <sub>RWM</sub>							

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current See fig. 5	I <sub>F(AV)</sub>	50 % duty cycle at T <sub>C</sub> = 116 °C, rectangular waveform	20	A
Maximum peak one cycle non-repetitive surge current See fig. 7	I <sub>FSM</sub>	5 µs sine or 3 µs rect. pulse 10 ms sine or 6 ms rect. pulse	1800 400	A
Non-repetitive avalanche energy	E <sub>AS</sub>	T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 4 A, L = 3.4 mH	27	mJ
Repetitive avalanche current	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	4	A



ELECTRICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum forward voltage drop See fig. 1	V <sub>FM</sub> <sup>(1)</sup>	20 A	T <sub>J</sub> = 25 °C	0.57	V
		40 A		0.73	
		20 A	T <sub>J</sub> = 125 °C	0.51	
		40 A		0.67	
Maximum reverse leakage curent See fig. 2	I <sub>RM</sub> <sup>(1)</sup>	T <sub>J</sub> = 25 °C	V <sub>R</sub> = Rated V <sub>R</sub>	2.7	mA
		T <sub>J</sub> = 125 °C		105	
Maximum junction capacitance	C <sub>T</sub>	V <sub>R</sub> = 5 V <sub>DC</sub> , (test signal range 100 kHz to 1 MHz) 25 °C		1400	pF
Typical series inductance	L <sub>S</sub>	Measured lead to lead 5 mm from package body		8.0	nH
Maximum voltage rate of change	dV/dt	Rated V <sub>R</sub>		10 000	V/μs

**Note**
<sup>(1)</sup> Pulse width < 300  $\mu$ s, duty cycle < 2 %

THERMAL - MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-55 to +150	°C
Maximum thermal resistance, junction to case	R <sub>thJC</sub>	DC operation See fig. 4	1.50	°C/W
Typical thermal resistance, case to heatsink	R <sub>thCS</sub>	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-220AC	20TQ035	
			20TQ040	
			20TQ045	

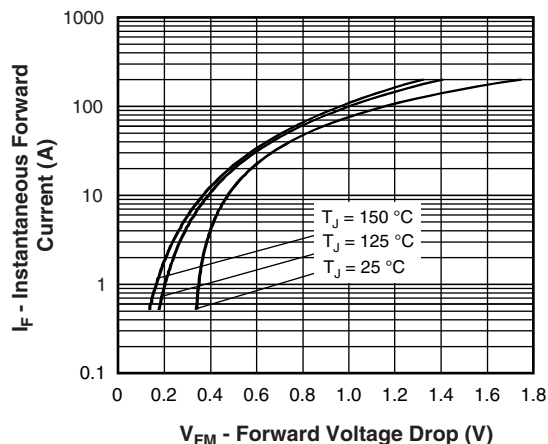


Fig. 1 - Maximum Forward Voltage Drop Characteristics

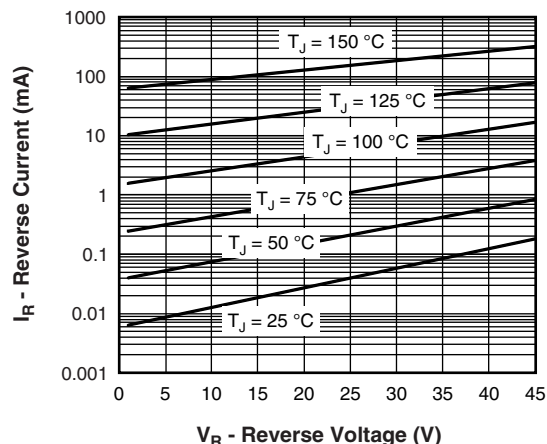


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

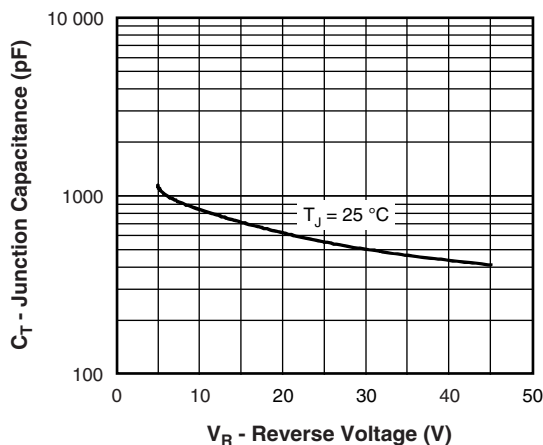
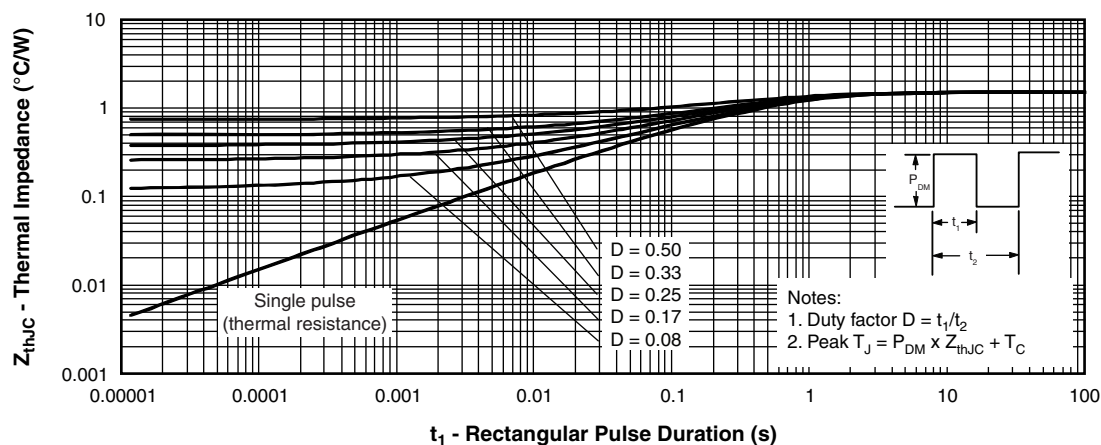


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

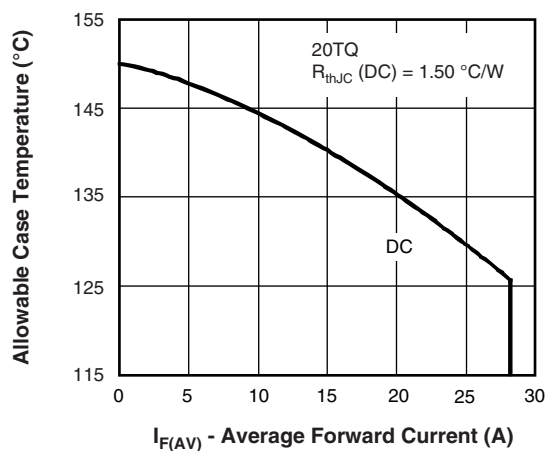


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

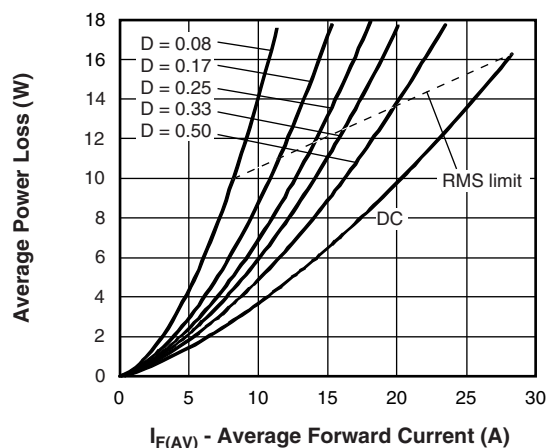


Fig. 6 - Forward Power Loss Characteristics

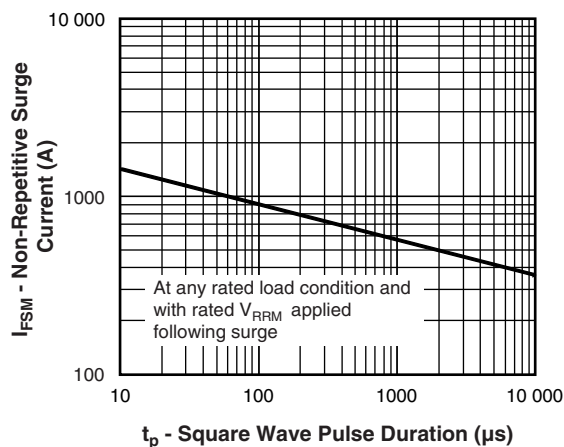


Fig. 7 - Maximum Non-Repetitive Surge Current

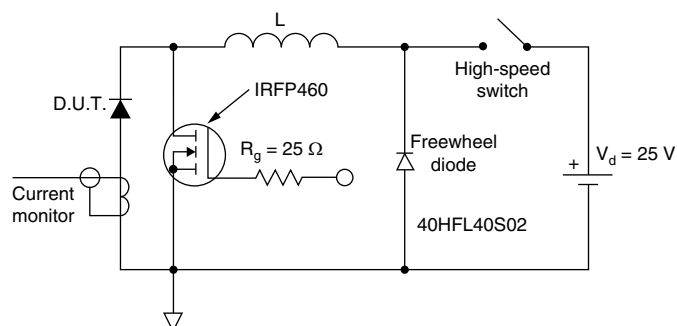


Fig. 8 - Unclamped Inductive Test Circuit

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>20</b>	<b>T</b>	<b>Q</b>	<b>045</b>	<b>PbF</b>
	1	2	3	4	5	6

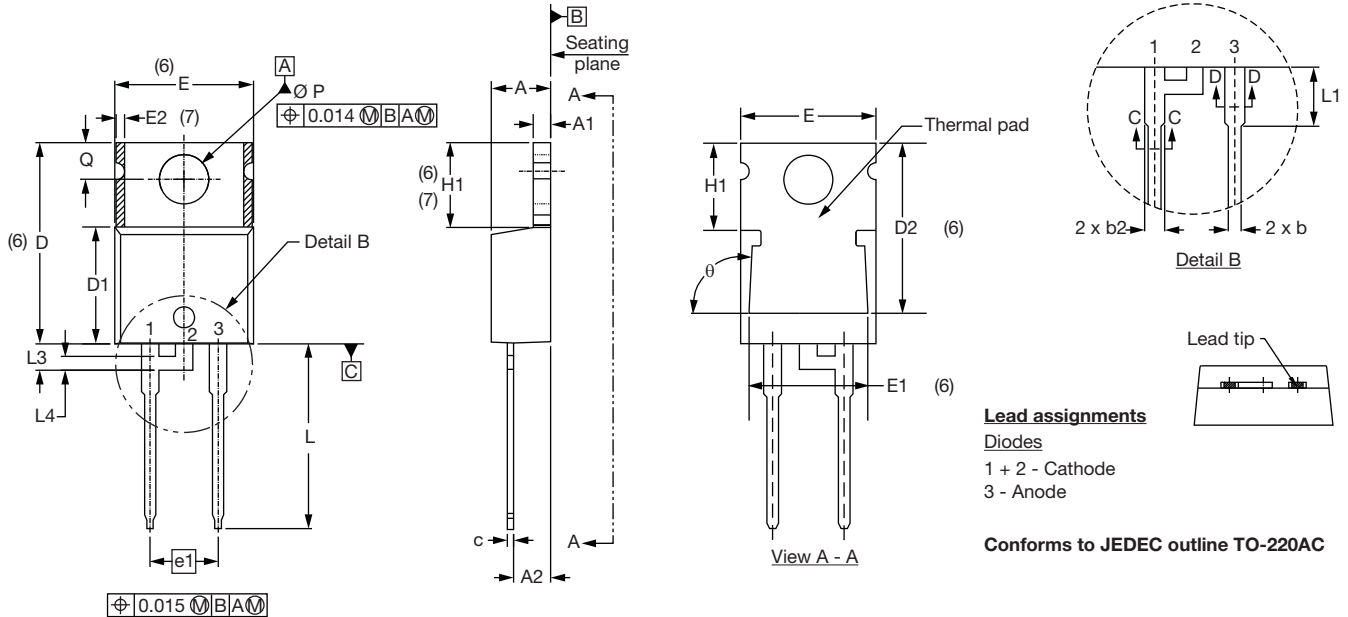
- |          |   |                               |            |
|----------|---|-------------------------------|------------|
| <b>1</b> | - | Vishay Semiconductors product |            |
| <b>2</b> | - | Current rating (20 = 20 A)    |            |
| <b>3</b> | - | Package:<br>T = TO-220        |            |
| <b>4</b> | - | Schottky "Q" series           | 035 = 35 V |
| <b>5</b> | - | Voltage ratings               | 040 = 40 V |
| <b>6</b> | - | Environmental digit           | 045 = 45 V |
- PbF = lead (Pb)-free and RoHS compliant
  - -N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

<b>ORDERING INFORMATION</b> (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-20TQ035PbF	50	1000	Antistatic plastic tube
VS-20TQ035-N3	50	1000	Antistatic plastic tube
VS-20TQ040PbF	50	1000	Antistatic plastic tube
VS-20TQ040-N3	50	1000	Antistatic plastic tube
VS-20TQ045PbF	50	1000	Antistatic plastic tube
VS-20TQ045-N3	50	1000	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>		
Dimensions		<a href="http://www.vishay.com/doc?95221">www.vishay.com/doc?95221</a>
Part marking information	TO-220AC PbF	<a href="http://www.vishay.com/doc?95224">www.vishay.com/doc?95224</a>
	TO-220AC -N3	<a href="http://www.vishay.com/doc?95068">www.vishay.com/doc?95068</a>

### TO-220AC

**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	2.56	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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
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
L3	1.78	2.13	0.070	0.084	
L4	0.76	1.27	0.030	0.050	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 dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline



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