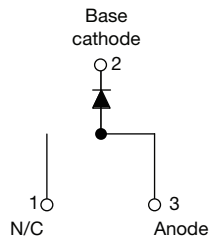


## High Performance Schottky Rectifier, 20 A


**D<sup>2</sup>PAK (TO-263AB)**


### 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
- 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**

### LINKS TO ADDITIONAL RESOURCES



### PRIMARY CHARACTERISTICS

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> typ.	105 mA at 125 °C
T <sub>J</sub> max.	150 °C
E <sub>AS</sub>	27 mJ
Package	D <sup>2</sup> PAK (TO-263AB)
Circuit configuration	Single

### 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.

### MECHANICAL DATA

**Case:** D<sup>2</sup>PAK (TO-268AB)

Molding compound meets UL 94-V0 flammability rating

**Terminals:** matte tin plated leads, solderable per J-STD-002

### 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-20TQ035S-M3	VS-20TQ040S-M3	VS-20TQ045S-M3	UNITS
Maximum DC reverse voltage	V <sub>R</sub>	35	40	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	1800	
		10 ms sine or 6 ms rect. pulse	400	
Non-repetitive avalanche energy	E <sub>AS</sub>	T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 4 A, L = 3.40 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	$V_{FM}^{(1)}$	20 A	$T_J = 25\text{ }^\circ\text{C}$	0.57	V
		40 A		0.73	
		20 A	$T_J = 125\text{ }^\circ\text{C}$	0.51	
		40 A		0.67	
Maximum reverse leakage current	$I_{RM}^{(1)}$	$T_J = 25\text{ }^\circ\text{C}$	$V_R = \text{Rated } V_R$	2.7	mA
		$T_J = 125\text{ }^\circ\text{C}$		150	
Typical reverse leakage current	$I_{RM}^{(1)}$	$T_J = 125\text{ }^\circ\text{C}$	$V_R = \text{Rated } V_R$	105	mA
Maximum junction capacitance	$C_T$	$V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$		1400	pF
Typical series inductance	$L_S$	Measured lead to lead 5 mm from package body		8.0	nH
Maximum voltage rate of change	dV/dt	Rated $V_R$		10 000	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	$R_{thJC}$	DC operation See fig. 4	1.50	$^\circ\text{C/W}$
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 D <sup>2</sup> PAK (TO-263AB)	20TQ035S 20TQ040S 20TQ045S	

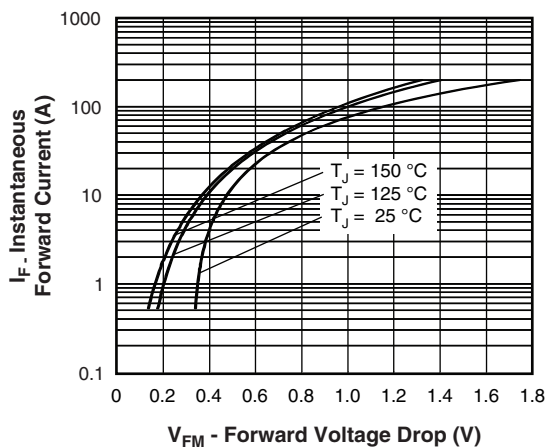


Fig. 1 - Maximum Forward Voltage Drop Characteristics

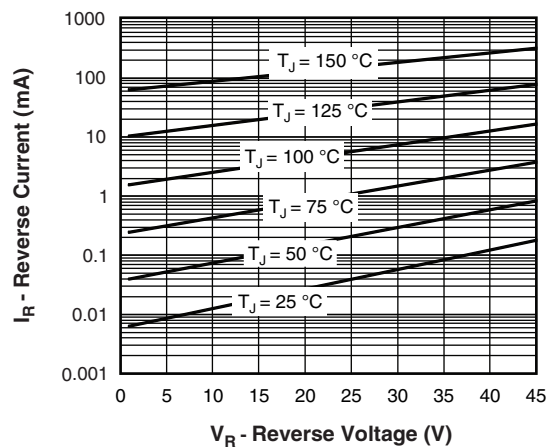


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

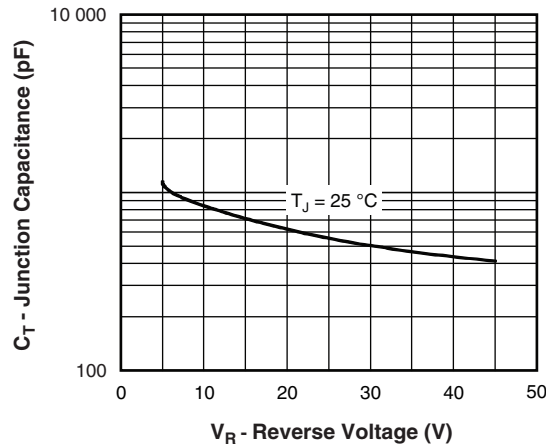


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

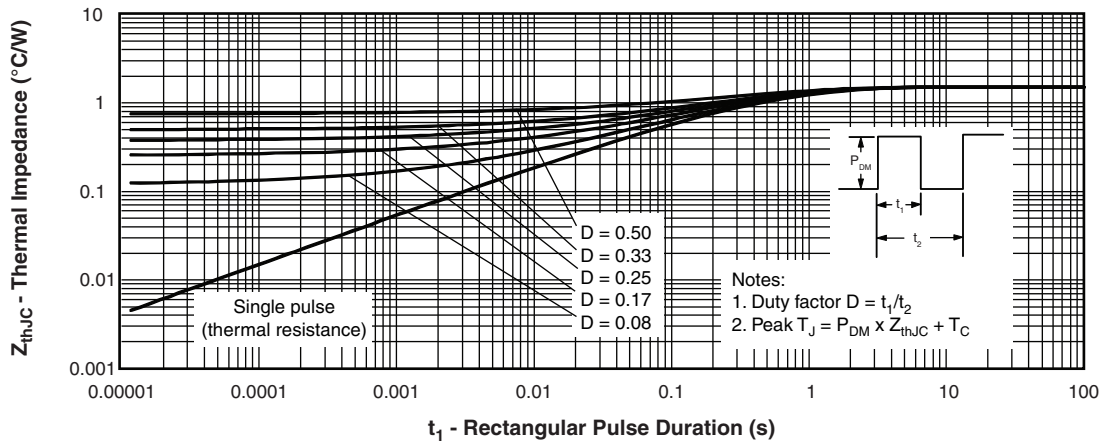


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

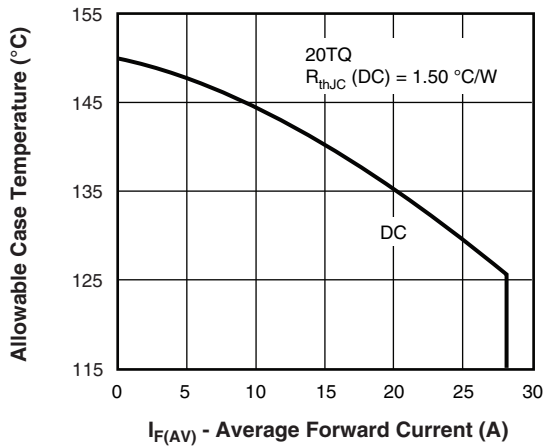


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

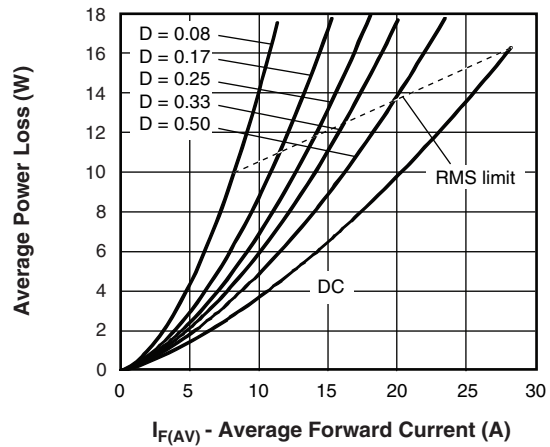


Fig. 6 - Forward Power Loss Characteristics

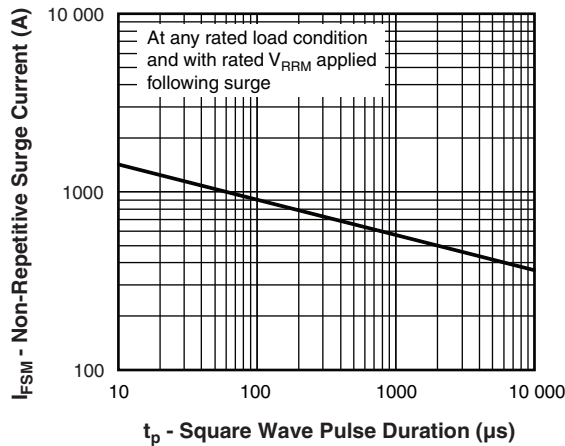


Fig. 7 - Maximum Non-Repetitive Surge Current

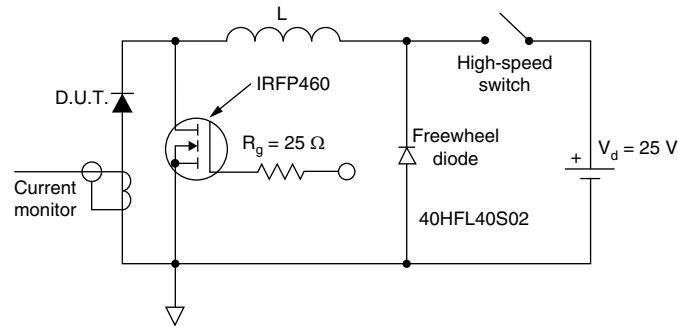


Fig. 8 - Unclamped Inductive Test Circuit

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>20</b>	<b>T</b>	<b>Q</b>	<b>045</b>	<b>S</b>	<b>TRL</b>	<b>-M3</b>
	①	②	③	④	⑤	⑥	⑦	⑧

1	- Vishay Semiconductors product
2	- Current rating (20 A)
3	- Package: T = TO-220
4	- Schottky "Q" series
5	- Voltage ratings
6	- S = D <sup>2</sup> PAK
7	- <ul style="list-style-type: none"> <li>• None = tube</li> <li>• TRL = tape and reel (left oriented)</li> <li>• TRR = tape and reel (right oriented)</li> </ul>
8	- -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

035 = 35 V
040 = 40 V
045 = 45 V



<b>ORDERING INFORMATION</b>		
<b>PREFERRED P/N</b>	<b>BASE QUANTITY</b>	<b>PACKAGING DESCRIPTION</b>
VS-20TQ035S-M3	50	Antistatic plastic tubes
VS-20TQ035STRL-M3	800	13" diameter plastic tape and reel
VS-20TQ035STRR-M3	800	13" diameter plastic tape and reel
VS-20TQ040S-M3	50	Antistatic plastic tubes
VS-20TQ040STRL-M3	800	13" diameter plastic tape and reel
VS-20TQ040STRR-M3	800	13" diameter plastic tape and reel
VS-20TQ045S-M3	50	Antistatic plastic tubes
VS-20TQ045STRL-M3	800	13" diameter plastic tape and reel
VS-20TQ045STRR-M3	800	13" diameter plastic tape and reel

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a>
Part marking information	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
Packaging information	<a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a>
SPICE model	<a href="http://www.vishay.com/doc?96917">www.vishay.com/doc?96917</a>

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

### DIMENSIONS in millimeters and inches

Conforms to JEDEC<sup>®</sup> 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	

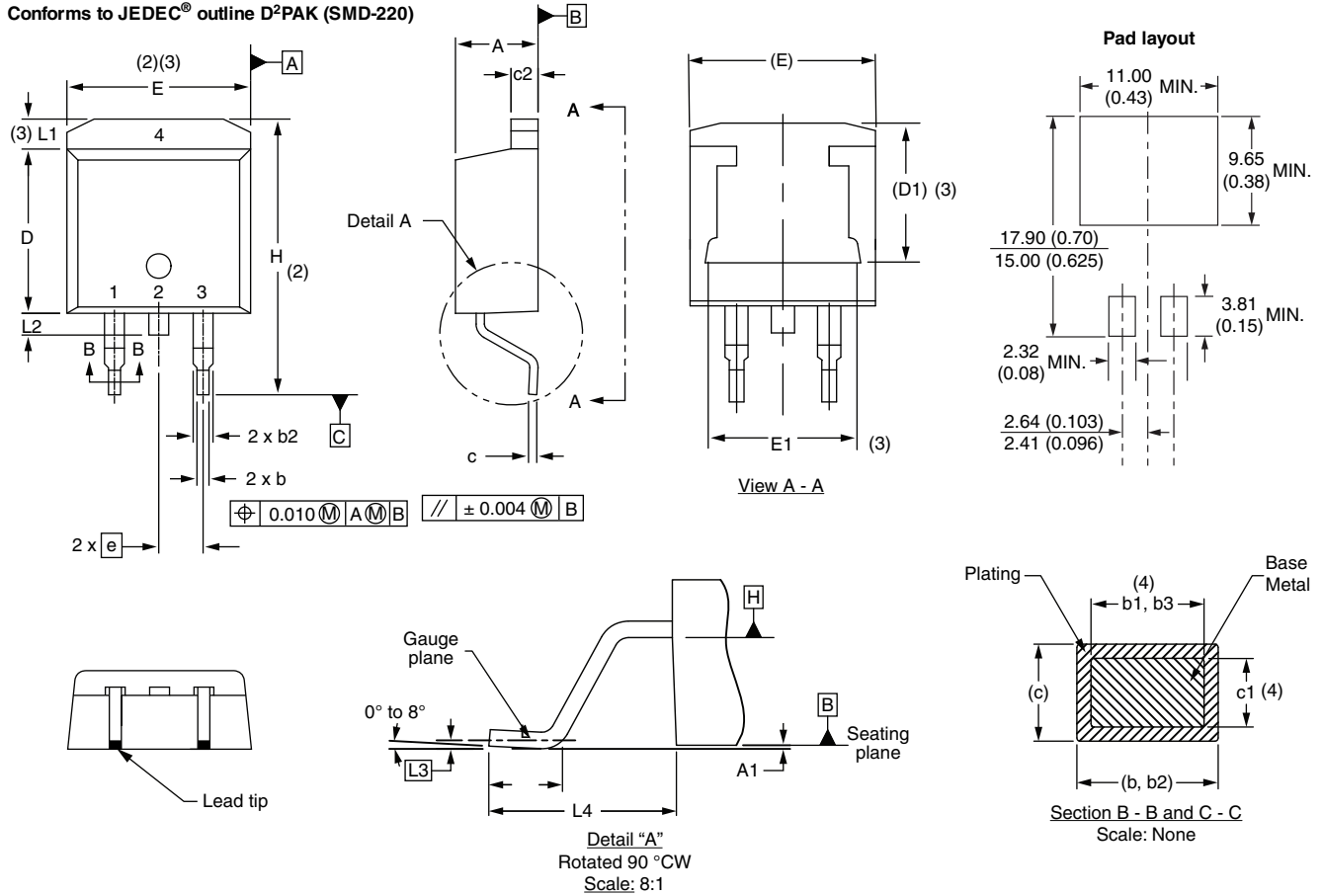
#### Notes

- 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<sup>®</sup> outline TO-263AB

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

**DIMENSIONS** in millimeters and inches

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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	
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**Notes**

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