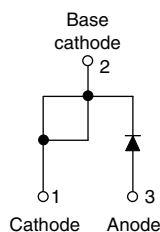




## Fast Soft Recovery Rectifier Diode, 20 A



TO-220AC FULL-PAK



## FEATURES

- 150 °C max. operation junction temperature
- Designed and qualified according to JEDEC-JESD47
- Fully isolated package ( $V_{INS} = 2500 V_{RMS}$ )
- UL E78996 approved
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

## APPLICATIONS

These devices are intended for use in output rectification and freewheeling in inverters, choppers and converters as well as in input rectification where severe restrictions on conducted EMI should be met.

## DESCRIPTION

The VS-20ETF...FP... fast soft recovery rectifier series has been optimized for combined short reverse recovery time and low forward voltage drop.

The glass passivation ensures stable reliable operation in the most severe temperature and power cycling conditions.

## PRODUCT SUMMARY

Package	TO-220FP
$I_{F(AV)}$	20 A
$V_R$	1000 V, 1200 V
$V_F$ at $I_F$	1.31 V
$I_{FSM}$	320 A
$t_{rr}$	95 ns
$T_J$ max.	150 °C
Diode variation	Single die
Snap factor	0.6

## MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$V_{RRM}$		1000 to 1200	V
$I_{F(AV)}$	Sinusoidal waveform	20	A
$I_{FSM}$		320	
$t_{rr}$	1 A, 100 A/μs	95	ns
$V_F$	20 A, $T_J = 25$ °C	1.31	V
$T_J$	Range	- 40 to 150	°C

## VOLTAGE RATINGS

PART NUMBER	$V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	$I_{RRM}$ AT 150 °C mA
VS-20ETF10FPPbF, VS-20ETF10FP-M3	1000	1100	6
VS-20ETF12FPPbF, VS-20ETF12FP-M3	1200	1300	

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current	$I_{F(AV)}$	$T_C = 50$ °C, 180° conduction half sine wave	20	A
Maximum peak one cycle non-repetitive surge current	$I_{FSM}$	10 ms sine pulse, rated $V_{RRM}$ applied	270	
		10 ms sine pulse, no voltage reapplied	320	
Maximum $I^2t$ for fusing	$I^2t$	10 ms sine pulse, rated $V_{RRM}$ applied	365	A <sup>2</sup> s
		10 ms sine pulse, no voltage reapplied	515	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ ms to 10 ms, no voltage reapplied	5150	A <sup>2</sup> √s



## ELECTRICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum forward voltage drop	$V_{FM}$	20 A, $T_J = 25\text{ }^{\circ}\text{C}$		1.31	V
Forward slope resistance	$r_t$	$T_J = 150\text{ }^{\circ}\text{C}$		11.88	$\text{m}\Omega$
Threshold voltage	$V_{F(TO)}$			0.93	V
Maximum reverse leakage current	$I_{RM}$	$T_J = 25\text{ }^{\circ}\text{C}$	$V_R = \text{Rated } V_{RRM}$	0.1	mA
		$T_J = 150\text{ }^{\circ}\text{C}$		6	

## RECOVERY CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Reverse recovery time	$t_{rr}$	$I_F$ at 20 Apk 25 A/ $\mu\text{s}$ 25 $^{\circ}\text{C}$	400	ns	
Reverse recovery current	$I_{rr}$		6.1	A	
Reverse recovery charge	$Q_{rr}$		1.7	$\mu\text{C}$	
Snap factor	S	Typical	0.6		

## THERMAL - MECHANICAL SPECIFICATIONS

THERMAL MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		- 40 to 150	°C
Maximum thermal resistance, junction to case	R <sub>thJC</sub>	DC operation	2.5	°C/W
Maximum thermal resistance, junction to ambient	R <sub>thJA</sub>		62	
Typical thermal resistance, case to heatsink	R <sub>thCS</sub>	Mounting surface, smooth and greased	0.5	
Approximate weight			2	g
			0.07	oz.
Mounting torque	minimum		6 (5)	kgf · cm (lbf · in)
	maximum		12 (10)	
Marking device		Case style TO-220 FULL-PAK	20ETF10FP 20ETF12FP	

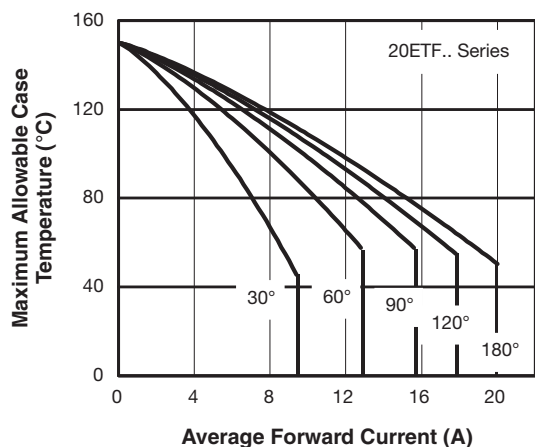


Fig. 1 - Current Rating Characteristics

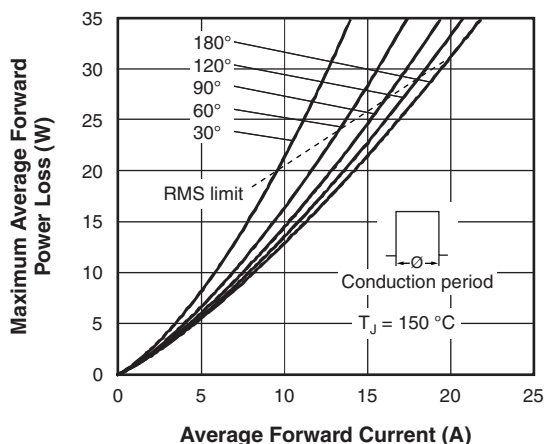


Fig. 4 - Forward Power Loss Characteristics

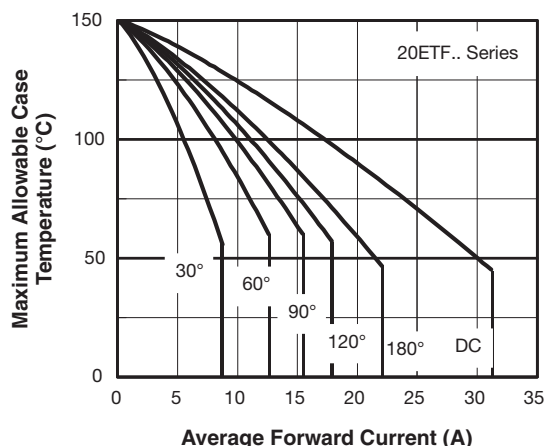


Fig. 2 - Current Rating Characteristics

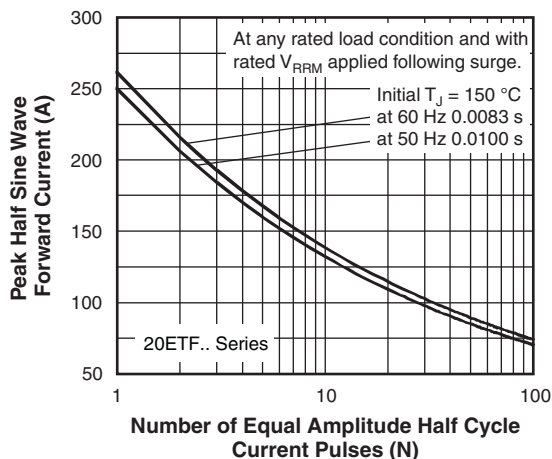


Fig. 5 - Maximum Non-Repetitive Surge Current

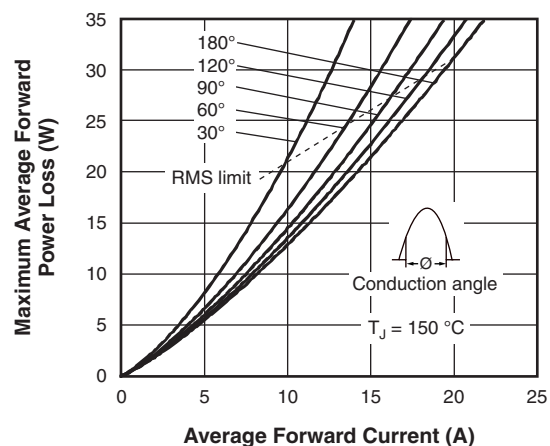


Fig. 3 - Forward Power Loss Characteristics

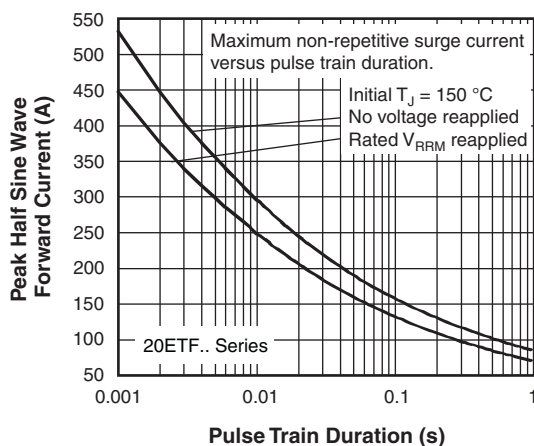


Fig. 6 - Maximum Non-Repetitive Surge Current

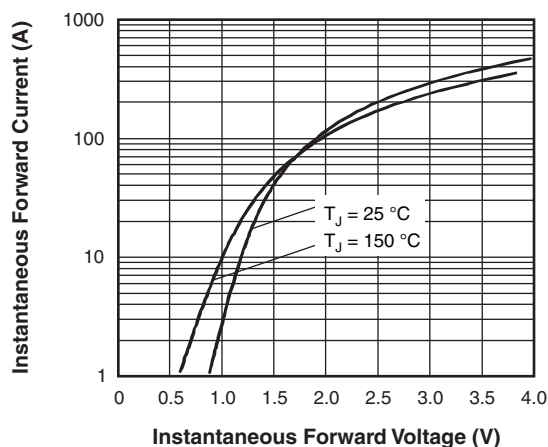


Fig. 7 - Forward Voltage Drop Characteristics

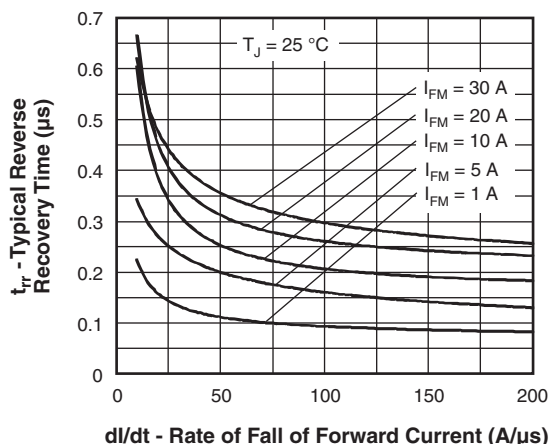


Fig. 8 - Recovery Time Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$

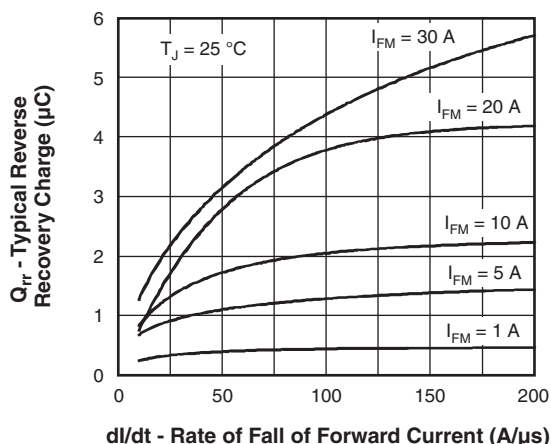


Fig. 10 - Recovery Charge Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$

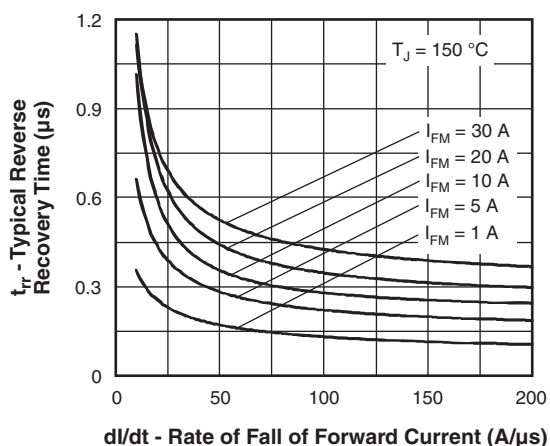


Fig. 9 - Recovery Time Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

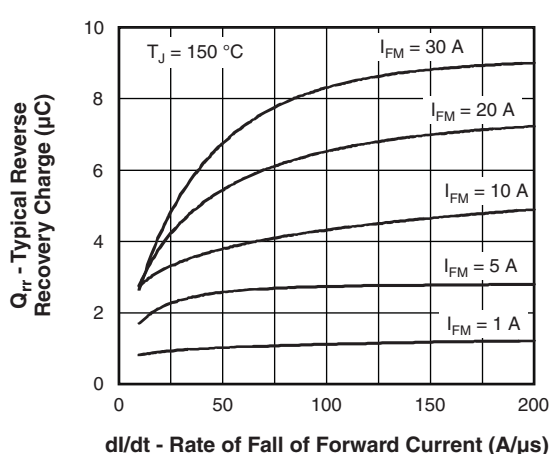


Fig. 11 - Recovery Charge Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

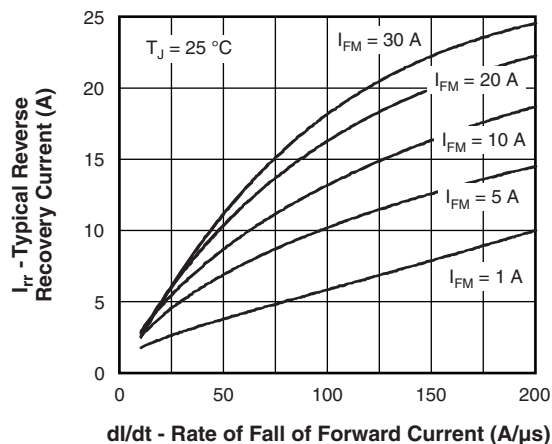


Fig. 12 - Recovery Current Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$

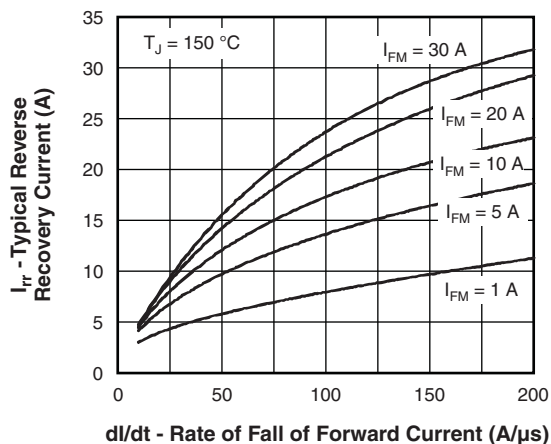


Fig. 13 - Recovery Current Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

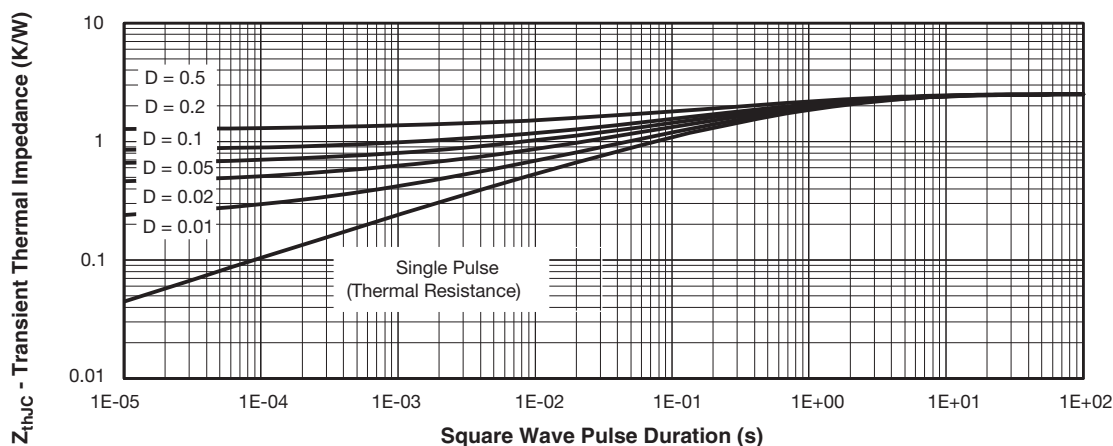


Fig. 14 - Thermal Impedance  $Z_{thJC}$  Characteristics



## ORDERING INFORMATION TABLE

Device code	VS-	20	E	T	F	12	FP	PbF
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Vishay Semiconductors product
- 2** - Current rating (20 = 20 A)
- 3** - Circuit configuration:  
E = Single diode
- 4** - Package:  
T = TO-220
- 5** - Type of silicon:  
F = Fast soft recovery rectifier
- 6** - Voltage code x 100 =  $V_{RRM}$ 

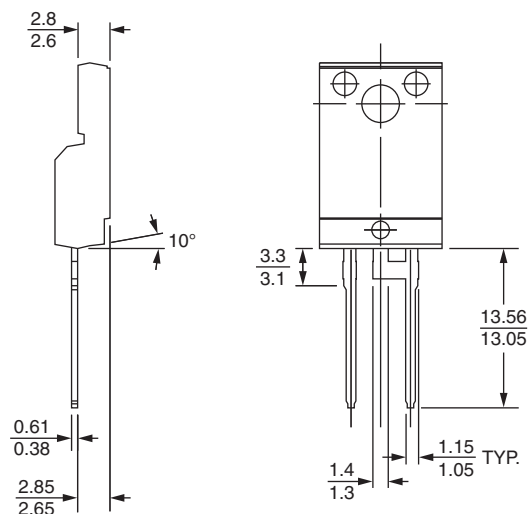
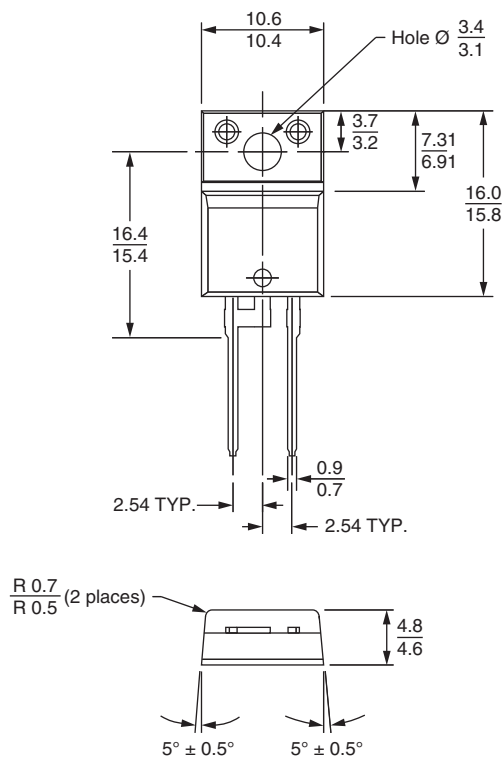
10 = 1000 V
12 = 1200 V
- 7** - FULL-PAK
- 8** - Environmental digit:
  - PbF = Lead (Pb)-free and RoHS compliant
  - -M3 = Halogen-free, RoHS compliant and terminations lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-20ETF10FPPbF	50	1000	Antistatic plastic tubes
VS-20ETF10FP-M3	50	1000	Antistatic plastic tubes
VS-20ETF12FPPbF	50	1000	Antistatic plastic tubes
VS-20ETF12FP-M3	50	1000	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS		
Dimensions		<a href="http://www.vishay.com/doc?95005">www.vishay.com/doc?95005</a>
Part marking information	TO-220 FP PbF	<a href="http://www.vishay.com/doc?95009">www.vishay.com/doc?95009</a>
	TO-220 FP -M3	<a href="http://www.vishay.com/doc?95440">www.vishay.com/doc?95440</a>



**DIMENSIONS** in millimeters



**Lead assignments**

Diodes

1 + 2 - Cathode  
3 - Anode

Conforms to JEDEC outline TO-220 FULL-PAK



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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