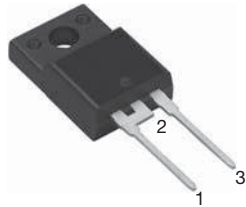
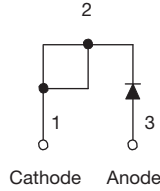




## Fast Soft Recovery Rectifier Diode, 20 A



TO-220 FULL-PAK



### FEATURES

- Glass passivated pellet chip junction
- 150 °C max. operation junction temperature
- Designed and qualified according to JEDEC®-JESD 47
- 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

PRODUCT SUMMARY	
Package	TO-220FP
$I_{F(AV)}$	20 A
$V_R$	200 V, 400 V, 600 V
$V_F$ at $I_F$	1.3 V
$I_{FSM}$	300 A
$t_{rr}$	60 ns
$T_J$ max.	150 °C
Diode variation	Single die
Snap factor	0.6

### 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-20ETF0..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.

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{F(AV)}$	Sinusoidal waveform	20	A
$V_{RRM}$		200 to 600	V
$I_{FSM}$		300	A
$V_F$	10 A, $T_J = 25\text{ °C}$	1.2	V
$t_{rr}$	1 A, 100 A/ $\mu$ s	60	ns
$T_J$		-40 to +150	°C

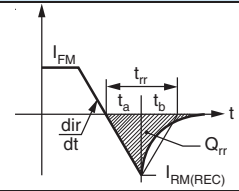
VOLTAGE RATINGS			
PART NUMBER	$V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	$I_{RRM}$ AT 150 °C mA
VS-20ETF02FPPbF, VS-20ETF02FP-M3	200	300	5
VS-20ETF04FPPbF, VS-20ETF04FP-M3	400	500	
VS-20ETF06FPPbF, VS-20ETF06FP-M3	600	700	

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current	$I_{F(AV)}$	$T_C = 51\text{ °C}$ , 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	250	
		10 ms sine pulse, no voltage reapplied	300	
Maximum $I^2t$ for fusing	$I^2t$	10 ms sine pulse, rated $V_{RRM}$ applied	316	$A^2s$
		10 ms sine pulse, no voltage reapplied	442	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1\text{ ms to }10\text{ ms}$ , no voltage reapplied	4420	$A^2\sqrt{s}$



ELECTRICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum forward voltage drop	$V_{FM}$	20 A, $T_J = 25\text{ }^\circ\text{C}$		1.30	V
		60 A, $T_J = 25\text{ }^\circ\text{C}$		1.67	
Forward slope resistance	$r_t$	$T_J = 150\text{ }^\circ\text{C}$		12.5	m $\Omega$
Threshold voltage	$V_{F(TO)}$	$T_J = 150\text{ }^\circ\text{C}$		0.9	V
Maximum reverse leakage current	$I_{RM}$	$T_J = 25\text{ }^\circ\text{C}$	$V_R = \text{Rated } V_{RRM}$	0.1	mA
		$T_J = 150\text{ }^\circ\text{C}$		5.0	

RECOVERY CHARACTERISTICS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Reverse recovery time	$t_{rr}$	$I_F$ at 20 A <sub>pk</sub> 100 A/ $\mu$ s 25 $^\circ\text{C}$	160	ns
Reverse recovery current	$I_{rr}$		10	A
Reverse recovery charge	$Q_{rr}$		1.25	$\mu\text{C}$
Snap factor	S	Typical	0.6	



THERMAL - MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-40 to +150	$^\circ\text{C}$
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	2.5	$^\circ\text{C}/\text{W}$
Maximum thermal resistance, junction to ambient	$R_{thJA}$		62	
Typical thermal resistance, case to heatsink	$R_{thCS}$	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	20ETF02FP 20ETF04FP 20ETF06FP	

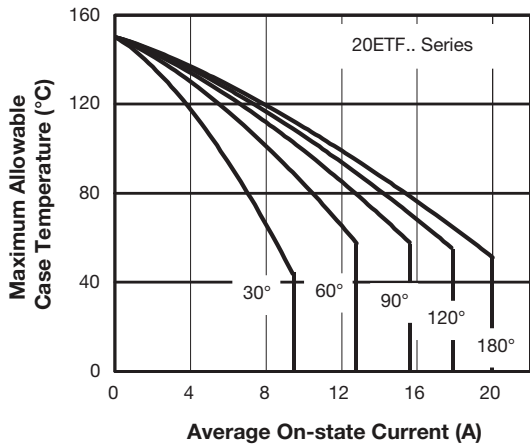


Fig. 1 - Current Rating Characteristics

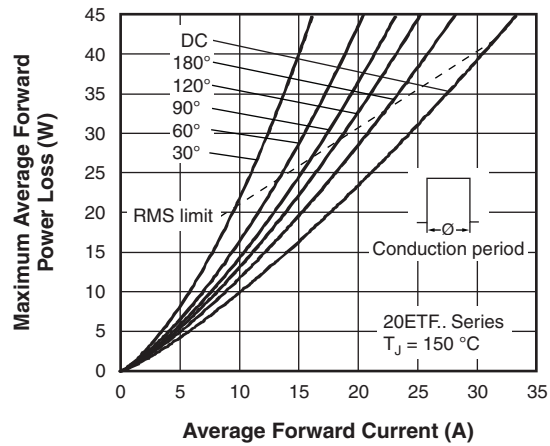


Fig. 4 - Forward Power Loss Characteristics

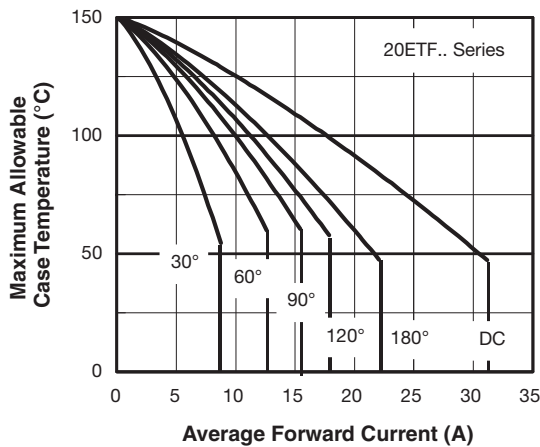


Fig. 2 - Current Rating Characteristics

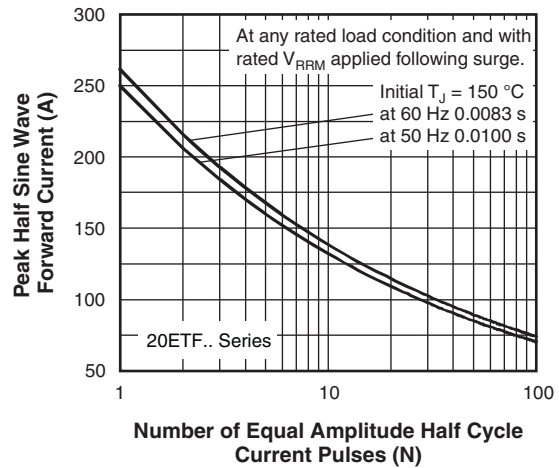


Fig. 5 - Maximum Non-Repetitive Surge Current

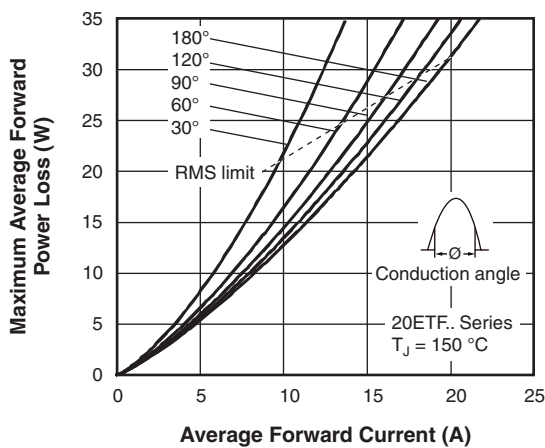


Fig. 3 - Forward Power Loss Characteristics

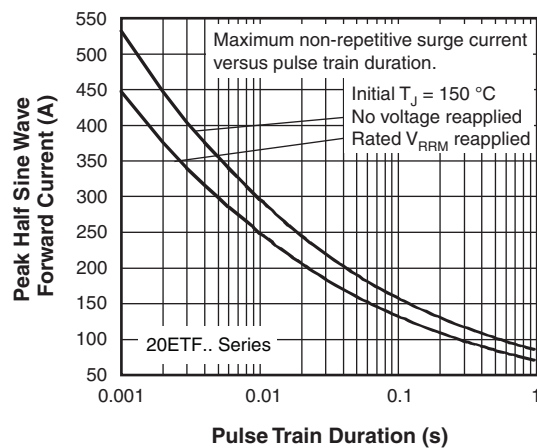


Fig. 6 - Maximum Non-Repetitive Surge Current

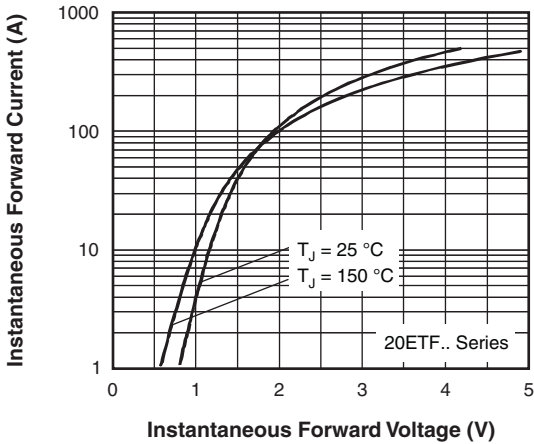


Fig. 7 - Forward Voltage Drop Characteristics

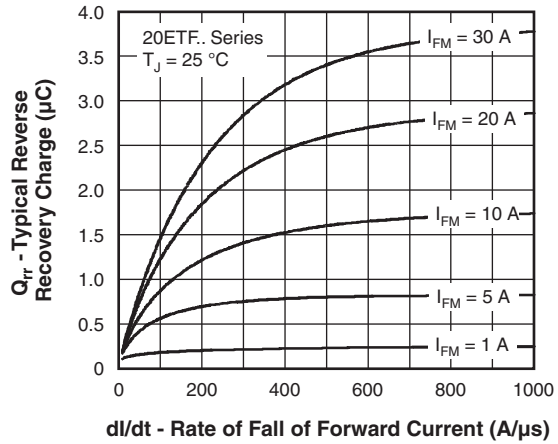


Fig. 10 - Recovery Charge Characteristics, T<sub>J</sub> = 25 °C

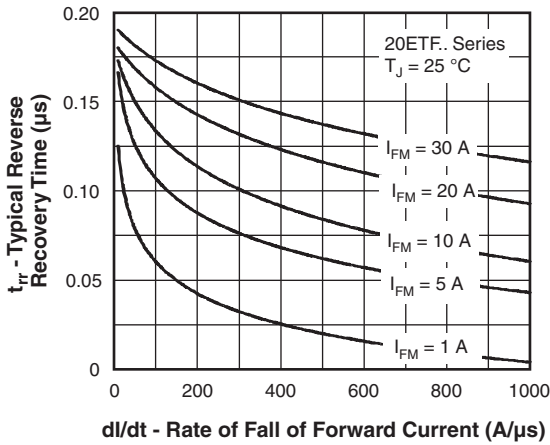


Fig. 8 - Recovery Time Characteristics, T<sub>J</sub> = 25 °C

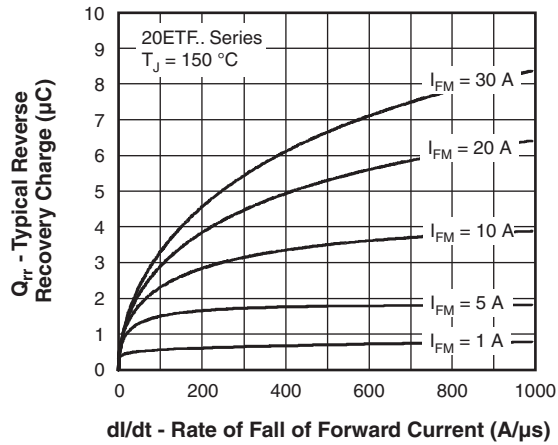


Fig. 11 - Recovery Charge Characteristics, T<sub>J</sub> = 150 °C

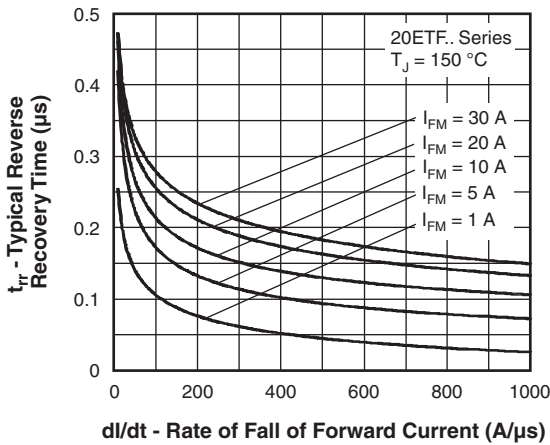


Fig. 9 - Recovery Time Characteristics, T<sub>J</sub> = 150 °C

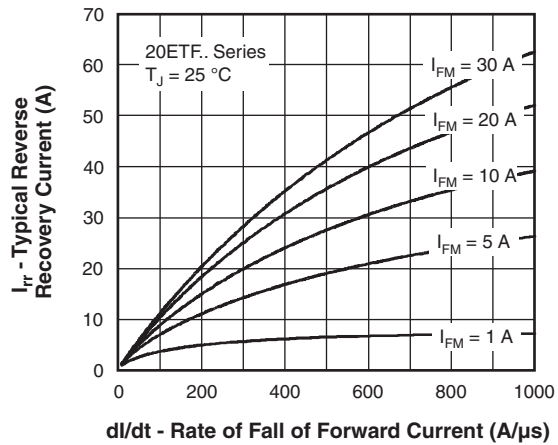


Fig. 12 - Recovery Current Characteristics, T<sub>J</sub> = 25 °C

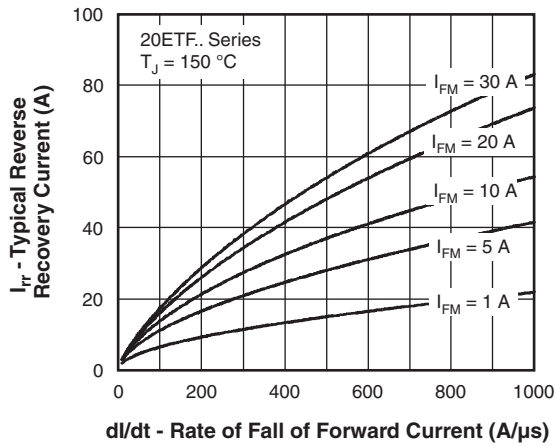


Fig. 13 - Recovery Current Characteristics,  $T_J = 150\text{ }^\circ\text{C}$

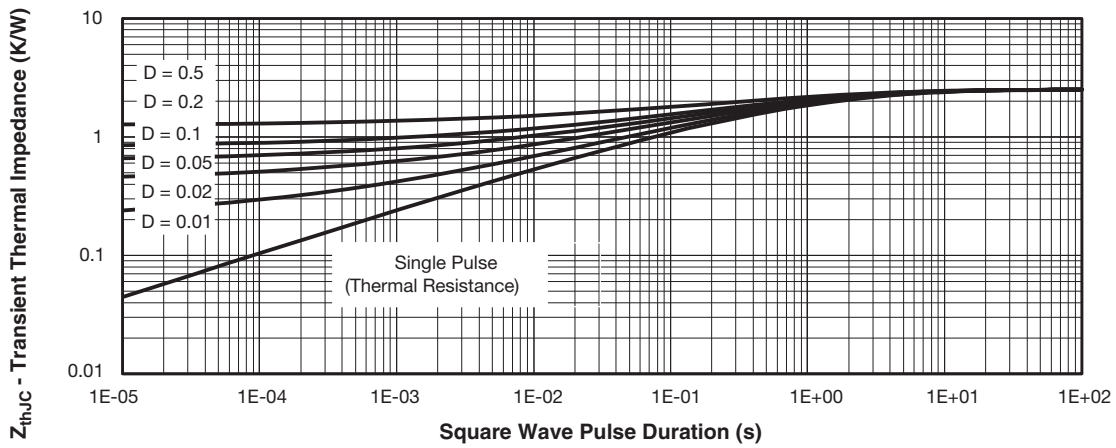
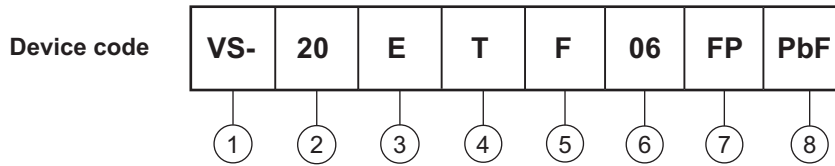


Fig. 14 - Thermal Impedance  $Z_{thJC}$  Characteristics



## ORDERING INFORMATION TABLE



- 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 =  $V_{RRM}$ 

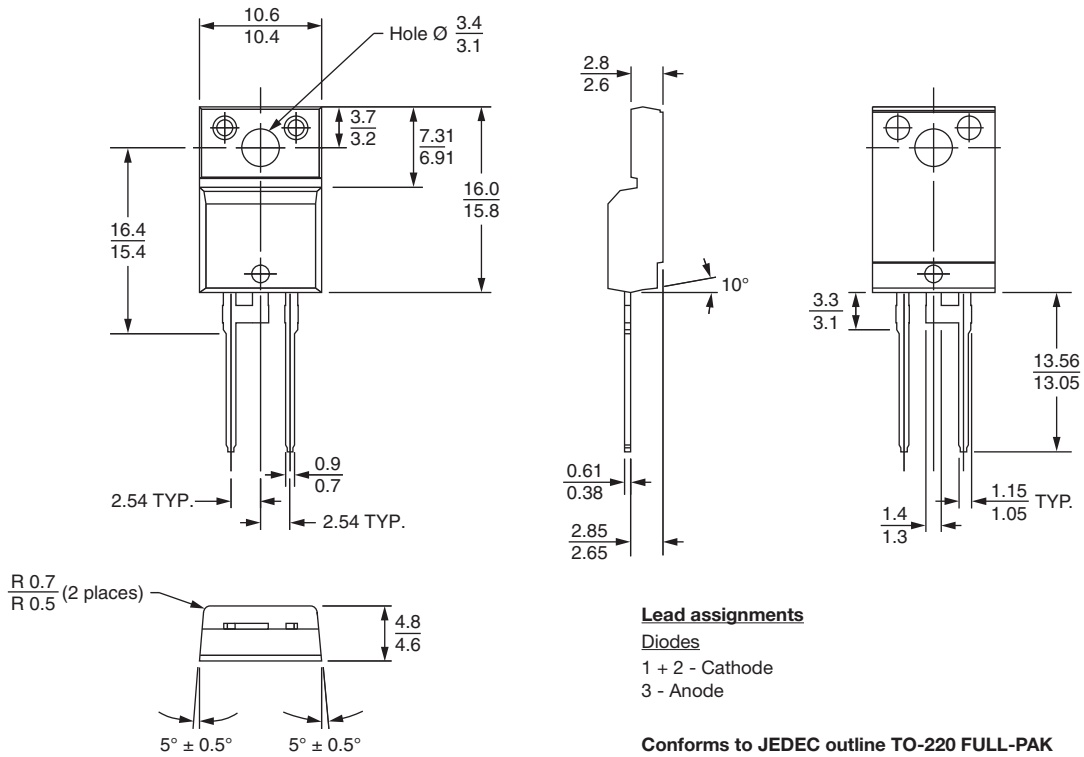
02 = 200 V
04 = 400 V
06 = 600 V
- 7** - FULL-PAK
- 8** - Environmental digit:
  - PbF = lead (Pb)-free and RoHS-compliant
  - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-20ETF02FPPbF	50	1000	Antistatic plastic tubes
VS-20ETF02FP-M3	50	1000	Antistatic plastic tubes
VS-20ETF04FPPbF	50	1000	Antistatic plastic tubes
VS-20ETF04FP-M3	50	1000	Antistatic plastic tubes
VS-20ETF06FPPbF	50	1000	Antistatic plastic tubes
VS-20ETF06FP-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>
SPIICE model	<a href="http://www.vishay.com/doc?95410">www.vishay.com/doc?95410</a>



**DIMENSIONS** in millimeters



### Lead assignments

- Diodes
- 1 + 2 - Cathode
- 3 - Anode

Conforms to JEDEC outline TO-220 FULL-PAK



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