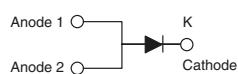
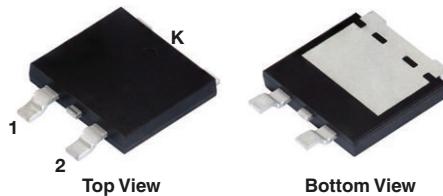


## Ultrafast Rectifier, 16 A FRED Pt®

### eSMP® Series SMPD (TO-263AC)



### LINKS TO ADDITIONAL RESOURCES



### PRIMARY CHARACTERISTICS

$I_{F(AV)}$	16 A
$V_R$	600 V
$V_F$ at $I_F$	0.91 V
$t_{rr}$	55 ns
$T_J$ max.	175 °C
Package	SMPD (TO-263AC)
Circuit configuration	Single

### FEATURES

- Ultrafast recovery time, reduced  $Q_{rr}$ , and soft recovery
- 175 °C maximum operating junction temperature
- For PFC CRM, snubber operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT  
HALOGEN  
FREE

### DESCRIPTION / APPLICATIONS

State of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop and ultrafast recovery time, and soft recovery.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness, and reliability characteristics.

These devices are intended for use in PFC, boost, lighting, in the AC/DC section of SMPS, freewheeling and clamp diodes.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce power dissipation in the switching element and snubbers.

### MECHANICAL DATA

**Case:** SMPD (TO-263AC)

Molding compound meets UL 94 V-0 flammability rating  
Halogen-free, RoHS-compliant

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

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_{solder\ pad} = 141\ ^\circ C$	16	A
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25\ ^\circ C$ , 6 ms square pulse	160	

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\ ^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}$ , $V_R$	$I_R = 100\ \mu A$	600	-	-	V
Forward voltage	$V_F$	$I_F = 16\ A$	-	1.04	1.25	
		$I_F = 16\ A$ , $T_J = 150\ ^\circ C$	-	0.91	1.1	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	15	$\mu A$
		$T_J = 150\ ^\circ C$ , $V_R = V_R$ rated	-	70	300	
Junction capacitance	$C_T$	$V_R = 600\ V$	-	16	-	pF

**DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise specified)**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1 \text{ A}$ , $dI_F/dt = 50 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$	-	55	-	ns
		$I_F = 0.5 \text{ A}$ , $I_R = 1 \text{ A}$ , $I_{rr} = 0.25 \text{ A}$	-	-	55	
		$T_J = 25^\circ\text{C}$	-	100	-	
		$T_J = 125^\circ\text{C}$	-	150	-	
Peak recovery current	$I_{RRM}$	$T_J = 25^\circ\text{C}$	-	20	-	A
		$T_J = 125^\circ\text{C}$	-	27	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25^\circ\text{C}$	-	1	-	$\mu\text{C}$
		$T_J = 125^\circ\text{C}$	-	2	-	

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	$T_J$ , $T_{Stg}$		-55	-	+175	$^\circ\text{C}$
Thermal resistance, junction to mount	$R_{thJM}$		-	1.2	1.7	$^\circ\text{C}/\text{W}$
Approximate weight				0.55		g
Marking device		Case style SMPD (TO-263AC)		0.02		oz.
				16EDU06		

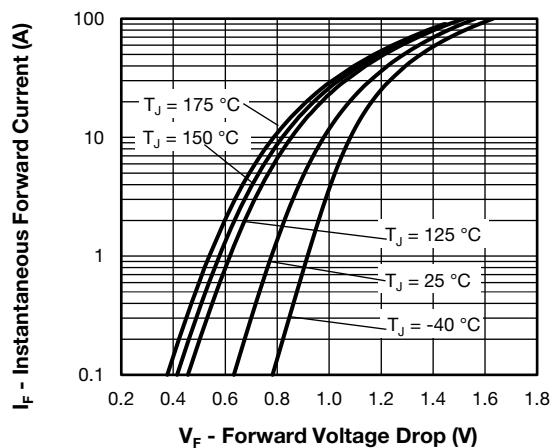


Fig. 1 - Typical Forward Voltage Drop Characteristics

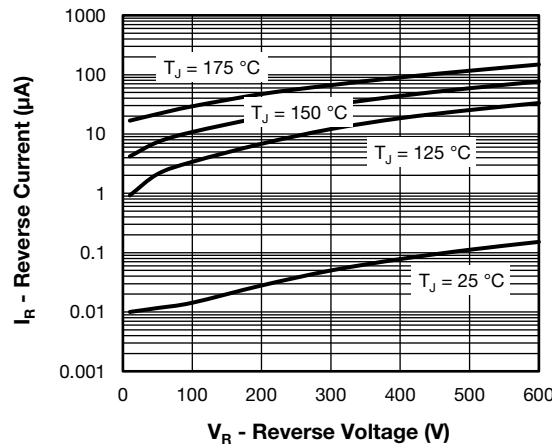


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

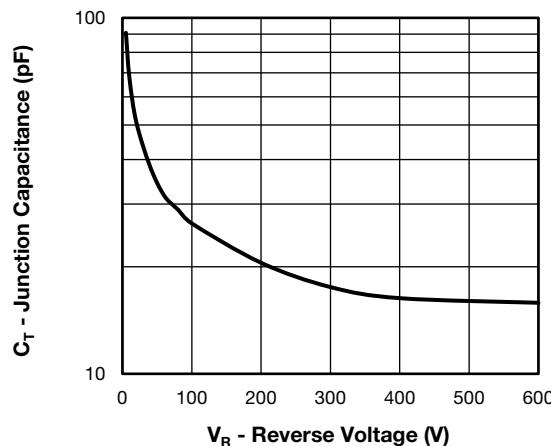


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

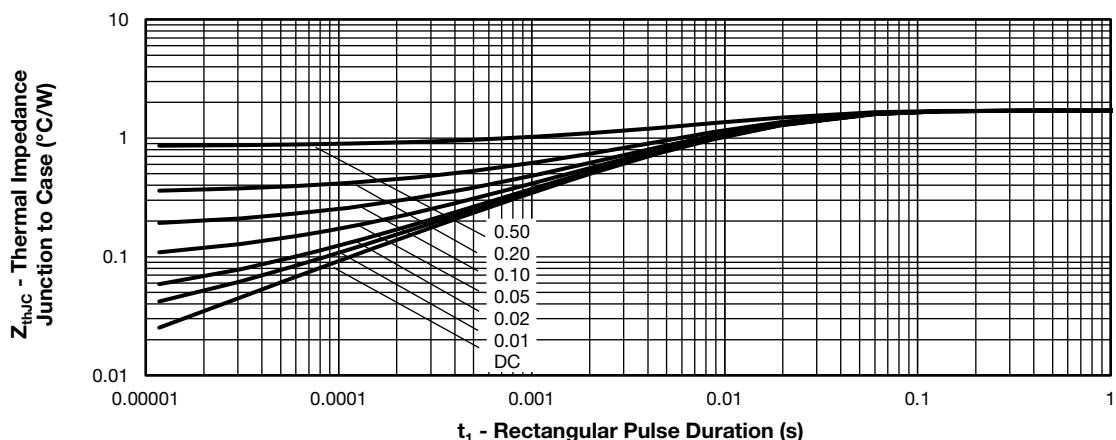


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

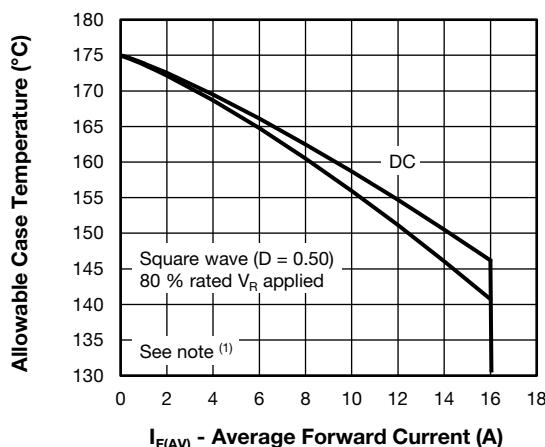


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

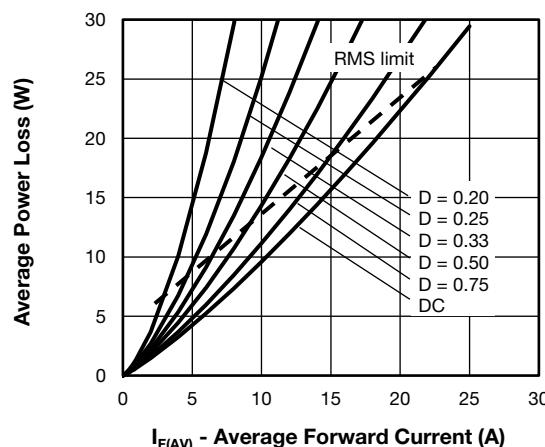


Fig. 6 - Forward Power Loss Characteristics

(1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d = \text{Forward power loss} = I_{F(AV)} \times V_{FM} \text{ at } (I_{F(AV)}/D) \text{ (see fig. 5);}$   
 $P_{dREV} = \text{Inverse power loss} = V_{R1} \times I_R (1 - D); I_R \text{ at } V_{R1} = \text{rated } V_R$

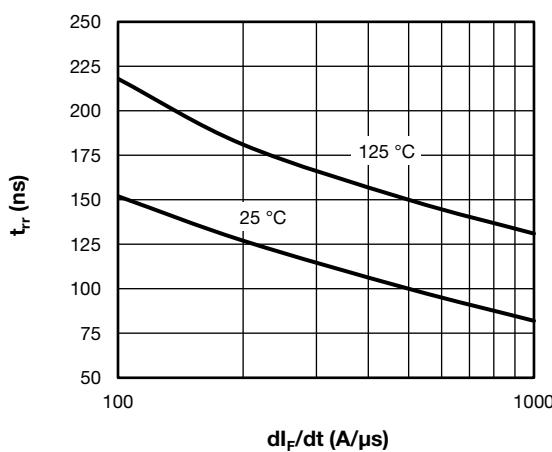


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

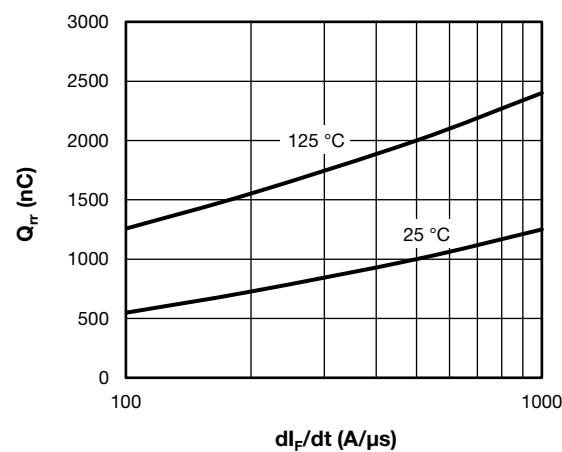
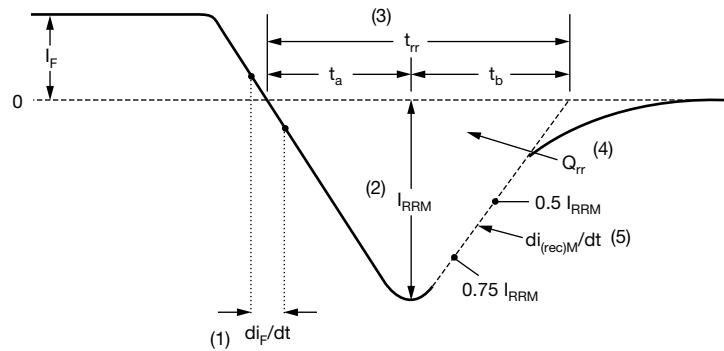


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$



(1)  $dI_F/dt$  - rate of change of current through zero crossing

(2)  $I_{RRM}$  - peak reverse recovery current

(3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through 0.75  $I_{RRM}$  and 0.50  $I_{RRM}$  extrapolated to zero current.

(4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5)  $di_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

Fig. 9 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

Device code	VS-	16	E	D	U	06	-M3
	1	2	3	4	5	6	7

- 1** - Vishay Semiconductors product
- 2** - Current rating (16 A)
- 3** - Circuit configuration:  
E = single die
- 4** - D = SMPD package
- 5** - Process type,  
U = ultrafast recovery
- 6** - Voltage code (06 = 600 V)
- 7** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

**ORDERING INFORMATION (Example)**

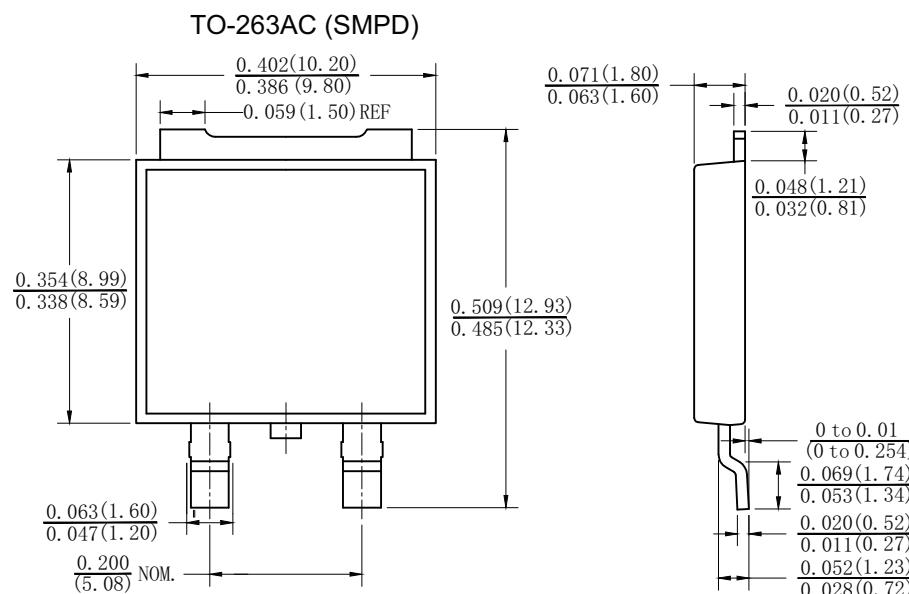
PREFERRED P/N	QUANTITY PER REEL	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-16EDU06-M3/I	2000	2000	13" diameter plastic tape and reel

**LINKS TO RELATED DOCUMENTS**

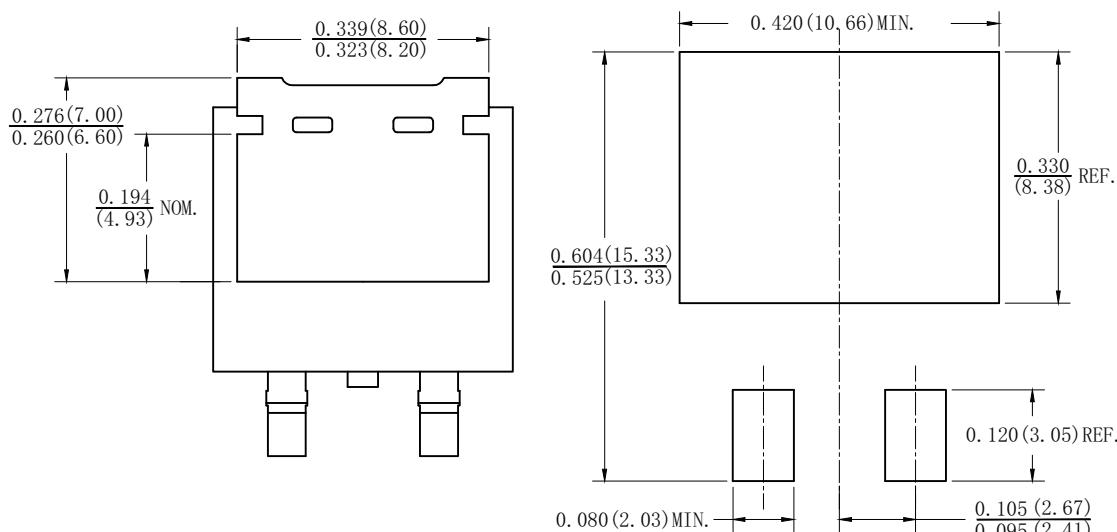
Dimensions	<a href="http://www.vishay.com/doc?95604">www.vishay.com/doc?95604</a>
Part marking information	<a href="http://www.vishay.com/doc?95566">www.vishay.com/doc?95566</a>
Packaging information	<a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a>
SPICE model	<a href="http://www.vishay.com/doc?96771">www.vishay.com/doc?96771</a>

## TO-263AC (SMPD)

**DIMENSIONS** in inches (millimeters)



### Mounting Pad Layout



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