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Vishay Semiconductor/Diodes Division
VS-16EDU06-M3/I

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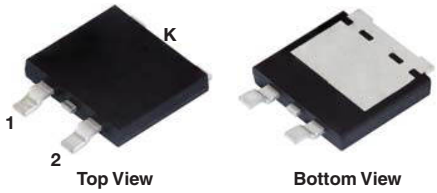
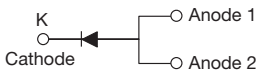
# Ultrafast Rectifier, 16 A FRED Pt®




TO-263AC (SMPD)




## 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

Pb e3 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.

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

| 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 °C | 16 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C, 6 ms square pulse | 160 | |

| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Breakdown voltage, blocking voltage | $V_{BR}$, $V_R$ | $I_R$ = 100 µA | 600 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 16 A | - | 1.04 | 1.25 | |
| | | $I_F$ = 16 A, $T_J$ = 150 °C | - | 0.91 | 1.1 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | - | 15 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 70 | 300 | |
| Junction capacitance | $C_T$ | $V_R$ = 600 V | - | 16 | - | pF |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1 A, $dI_F/dt$ = 50 A/µs, $V_R$ = 30 V | | - | 55 | - | ns |
| | | $I_F$ = 0.5 A, $I_R$ = 1 A, $I_{rr}$ = 0.25 A | | - | - | 55 | |
| | | $T_J$ = 25 °C | $I_F$ = 16 A, $dI_F/dt$ = 500 A/µs, $V_R$ = 400 V | - | 100 | - | |
| | | $T_J$ = 125 °C | | - | 150 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 20 | - | A |
| | | $T_J$ = 125 °C | | - | 27 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 1 | - | µC |
| | | $T_J$ = 125 °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 | °C |
| Thermal resistance, junction to solder pad | $R_{thJ\text{-}Sp}$ | | - | 1.2 | 1.7 | °C/W |
| Approximate weight | | | 0.55 | | | g |
| | | | 0.02 | | | oz. |
| Marking device | | Case style TO-263AC (SMPD) | 16EDU06 | | | |

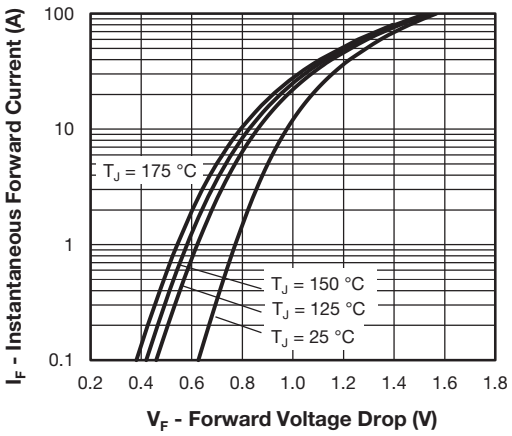



Fig. 1 - Typical Forward Voltage Drop Characteristics

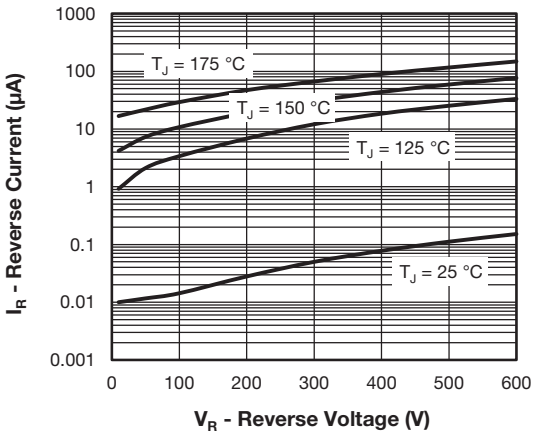



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

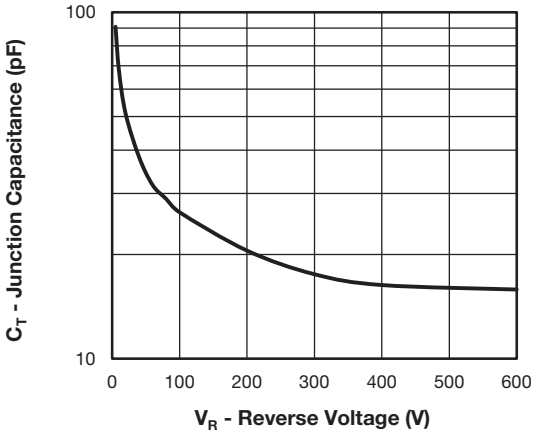



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

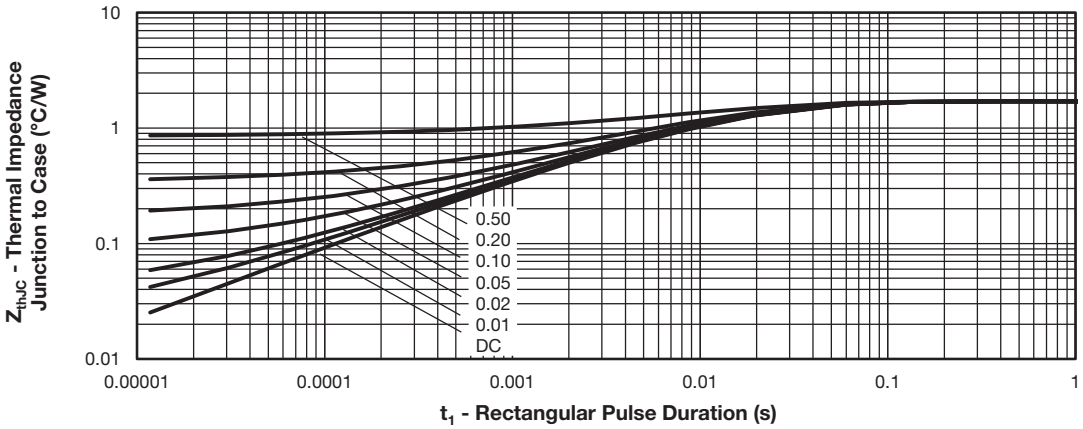



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

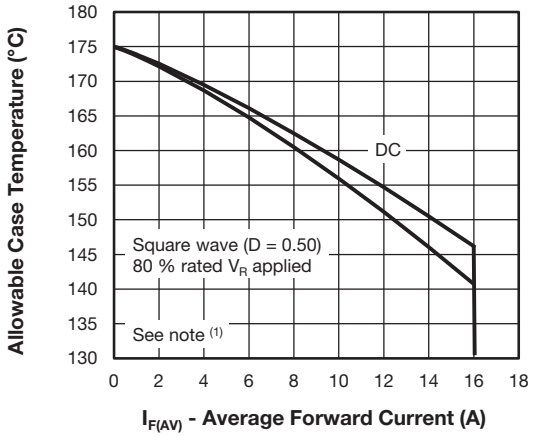



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

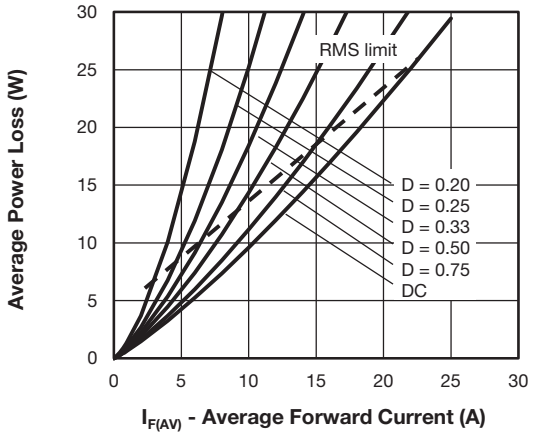



Fig. 6 - Forward Power Loss Characteristics

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

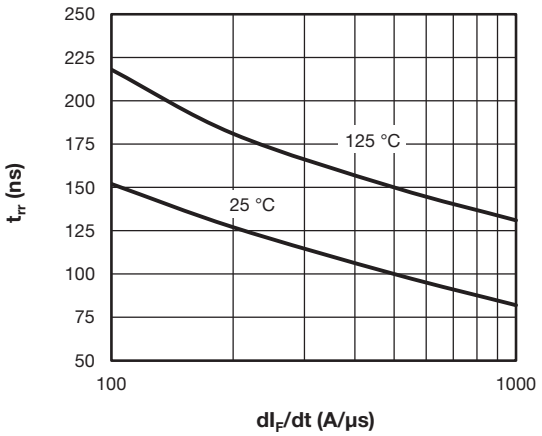



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

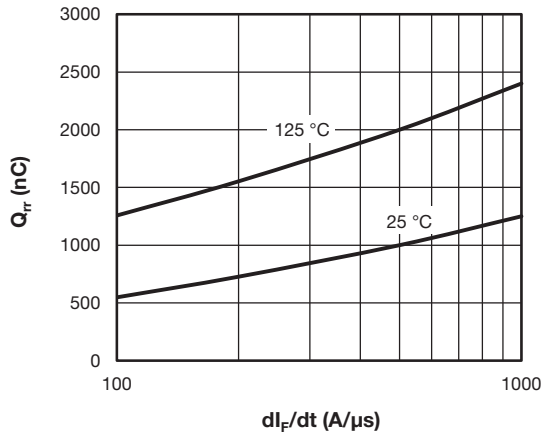
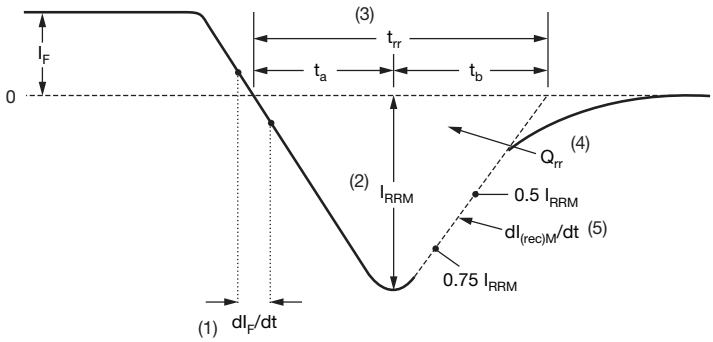



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$




(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

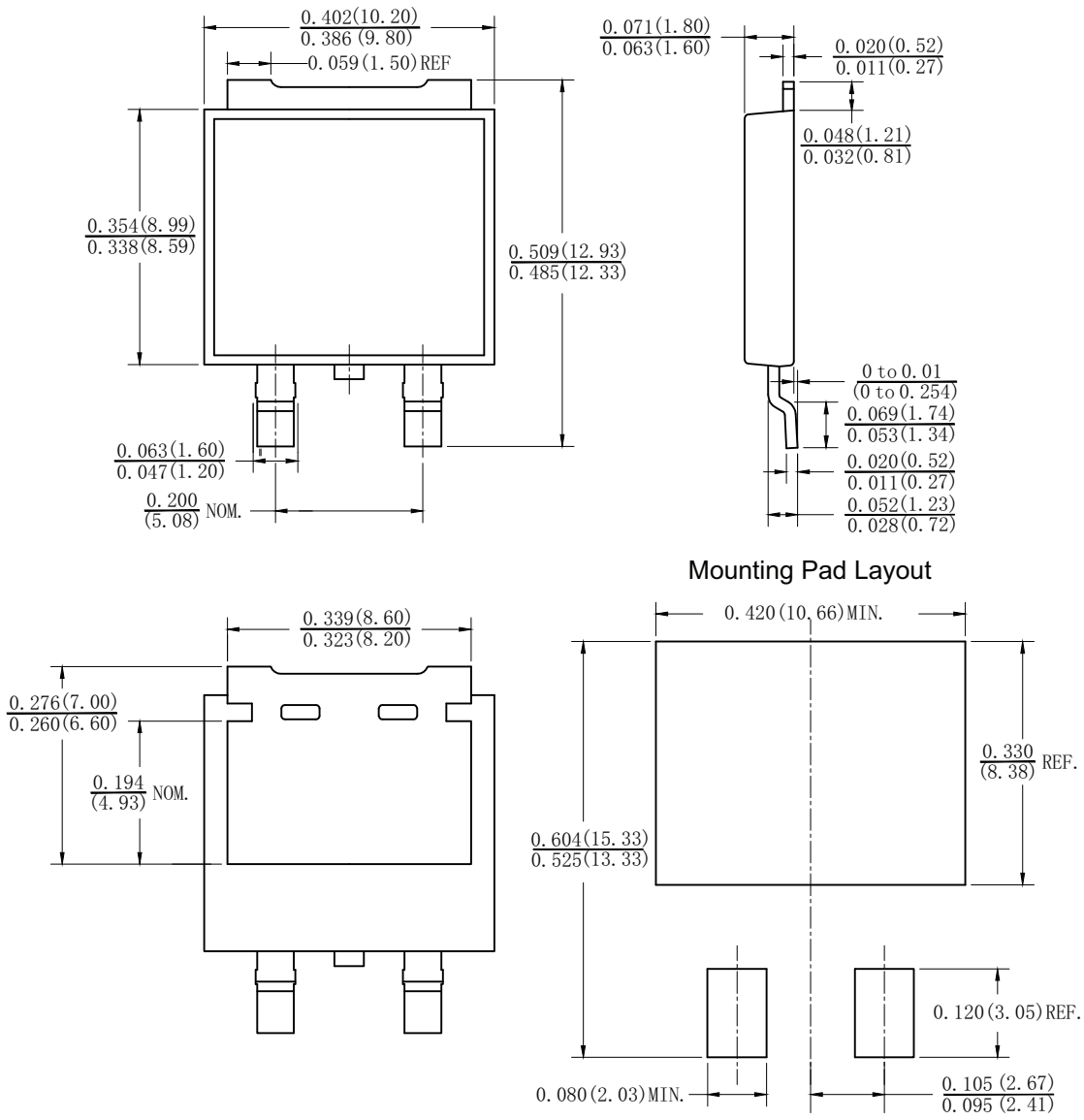
| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER REEL** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-16EDU06-M3/I | 2000 | 2000 | 13" diameter plastic tape and reel |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?95604 |
| Part marking information | www.vishay.com/doc?95566 |
| Packaging information | www.vishay.com/doc?88869 |

# TO-263AC (SMPD)

**DIMENSIONS** in inches (millimeters)

TO-263AC (SMPD)




Mounting Pad Layout

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