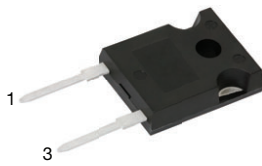
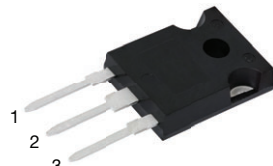
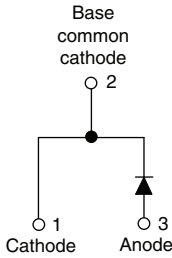
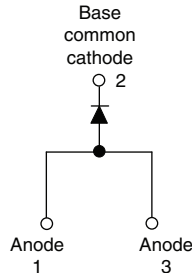


## Ultrafast Soft Recovery Diode, 60 A FRED Pt®



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


**TO-247AC 2L**

**TO-247AC 3L**

**VS-60EPU02-N3**

**VS-60APU02-N3**

### FEATURES

- Ultrafast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Output rectification
- 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)

### BENEFITS

- Reduced RFI and EMI
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

### DESCRIPTION / APPLICATIONS

These diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems.

The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for HF welding, power converters and other applications where switching losses are not significant portion of the total losses.

### PRIMARY CHARACTERISTICS

|                       |                          |
|-----------------------|--------------------------|
| $I_{F(AV)}$           | 60 A                     |
| $V_R$                 | 200 V                    |
| $V_F$ at $I_F$        | 0.81 V                   |
| $t_{rr}$ typ.         | See Recovery table       |
| $T_J$ max.            | 175 °C                   |
| Package               | TO-247AC 2L, TO-247AC 3L |
| Circuit configuration | Single                   |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL         | TEST CONDITIONS                          | VALUES      | UNITS |
|---|----------------|--|-------------|-------|
| Cathode to anode voltage                    | $V_R$          |  | 200         | V     |
| Continuous forward current                  | $I_{F(AV)}$    | $T_C = 127\text{ °C}$                    | 60          | A     |
| Single pulse forward current                | $I_{FSM}$      | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$ | 800         |       |
| Maximum repetitive forward current          | $I_{FRM}$      | Square wave, 20 kHz                      | 120         |       |
| Operating junction and storage temperatures | $T_J, T_{Stg}$ |  | -55 to +175 | °C    |

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified)

| PARAMETER                           | SYMBOL        | TEST CONDITIONS                              | MIN. | TYP. | MAX. | UNITS |
|-------------------------------------|---------------|--|------|------|------|-------|
| Breakdown voltage, blocking voltage | $V_{BR}, V_R$ | $I_R = 100\text{ }\mu\text{A}$               | 200  | -    | -    | V     |
|                                     |               | $I_F = 60\text{ A}$                          | -    | 0.98 | 1.08 |       |
| Forward voltage                     | $V_F$         | $I_F = 60\text{ A}, T_J = 175\text{ °C}$     | -    | 0.81 | 0.88 |       |
|                                     |               | $V_R = V_R$ rated                            | -    | -    | 50   |       |
| Reverse leakage current             | $I_R$         | $T_J = 150\text{ °C}, V_R = V_R$ rated       | -    | -    | 2    | mA    |
|                                     |               |  | -    | 87   | -    | pF    |
| Junction capacitance                | $C_T$         | $V_R = 200\text{ V}$                         | -    | 87   | -    | pF    |
| Series inductance                   | $L_S$         | Measured lead to lead 5 mm from package body | -    | 8.0  | -    | nH    |



| DYNAMIC RECOVERY CHARACTERISTICS (T <sub>C</sub> = 25 °C unless otherwise specified) |                  |   |      |      |      |       |
|--|------------------|---|------|------|------|-------|
| PARAMETER  | SYMBOL           | TEST CONDITIONS   | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time  | t <sub>rr</sub>  | I <sub>F</sub> = 1.0 A, dI <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 30 V | -    | -    | 35   | ns    |
|  |                  | T <sub>J</sub> = 25 °C  | -    | 28   | -    |       |
|  |                  | T <sub>J</sub> = 125 °C   | -    | 50   | -    |       |
| Peak recovery current  | I <sub>RRM</sub> | T <sub>J</sub> = 25 °C  | -    | 4    | -    | A     |
|  |                  | T <sub>J</sub> = 125 °C   | -    | 8    | -    |       |
| Reverse recovery charge  | Q <sub>rr</sub>  | T <sub>J</sub> = 25 °C  | -    | 59   | -    | nC    |
|  |                  | T <sub>J</sub> = 125 °C   | -    | 220  | -    |       |

| THERMAL - MECHANICAL SPECIFICATIONS             |                   |   |         |      |      |       |
|---|-------------------|---|---------|------|------|-------|
| PARAMETER                                       | SYMBOL            | TEST CONDITIONS                             | MIN.    | TYP. | MAX. | UNITS |
| Thermal resistance, junction to case            | R <sub>thJC</sub> |   | -       | -    | 0.70 | K/W   |
| Thermal resistance, junction to ambient per leg | R <sub>thJA</sub> | Typical socket mount                        | -       | -    | 40   | °C/W  |
| Thermal resistance, case to heatsink            | R <sub>thCS</sub> | Mounting surface, flat, smooth, and greased | -       | 0.2  | -    | K/W   |
| Weight  |                   |   | -       | 5.5  | -    | g     |
|   |                   |   | -       | 0.2  | -    | oz.   |
| Mounting torque                                 |                   |   | -       | -    | 1.2  | N · m |
| Marking device                                  |                   | Case style TO-247AC 2L                      | 60EPU02 |      |      |       |
|   |                   | Case style TO-247AC 3L                      | 60APU02 |      |      |       |

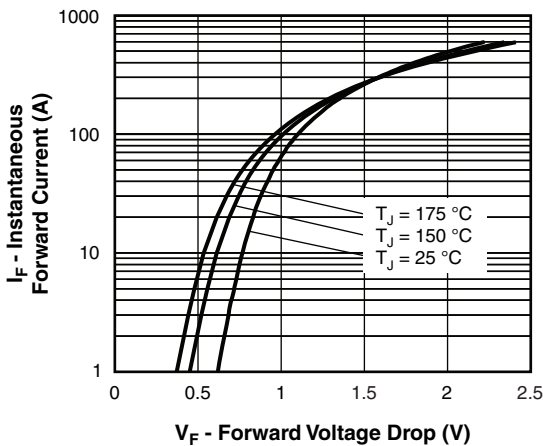


Fig. 1 - Typical Forward Voltage Drop Characteristics

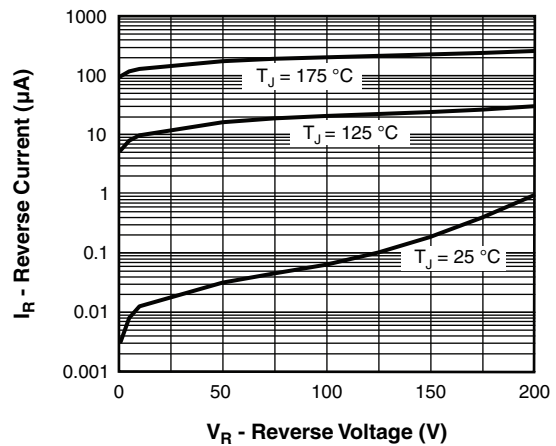


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

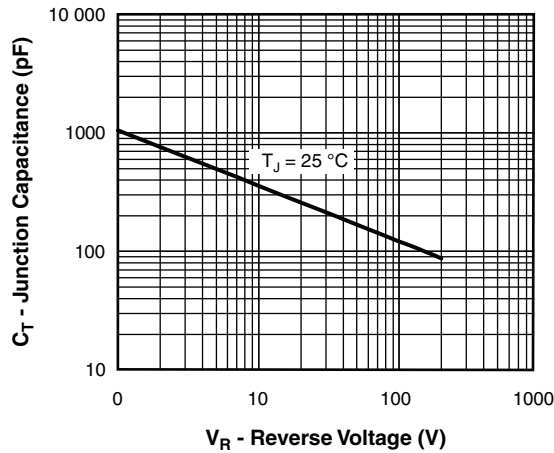


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

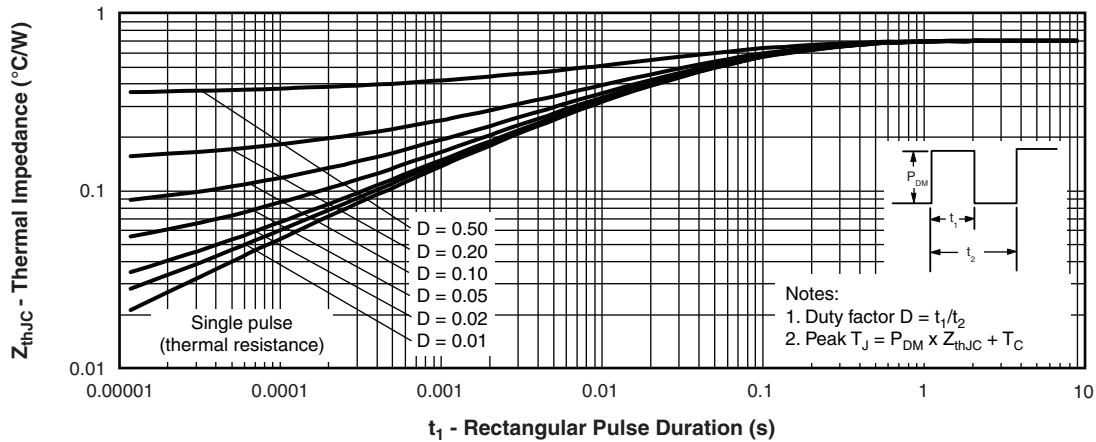


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

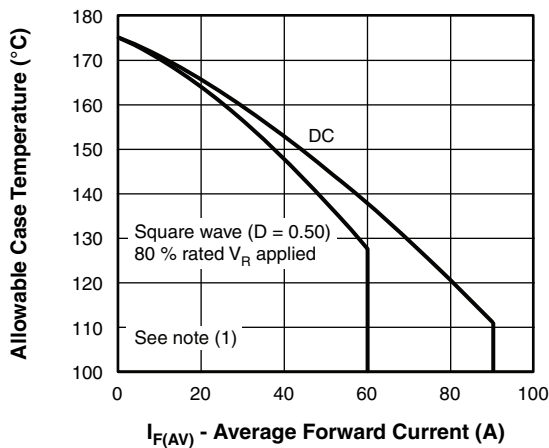


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

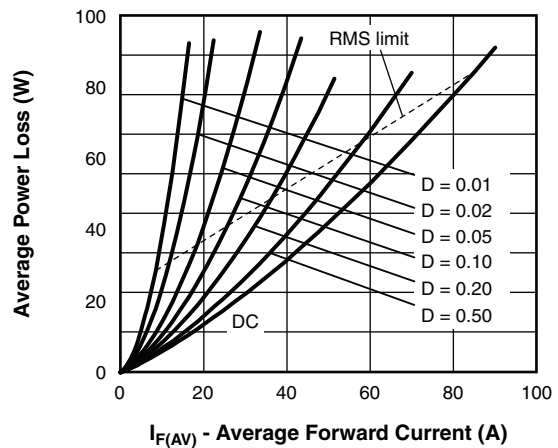


Fig. 6 - Forward Power Loss Characteristics

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\%$  rated  $V_R$

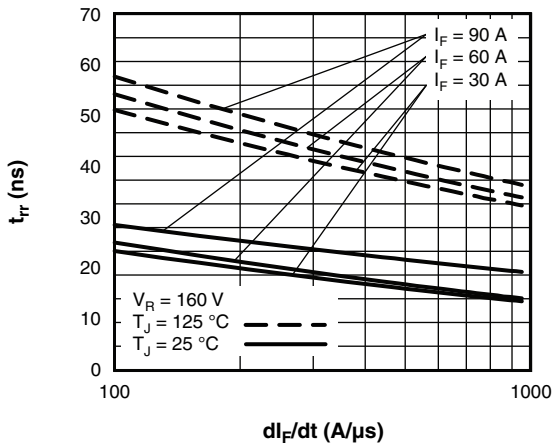


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

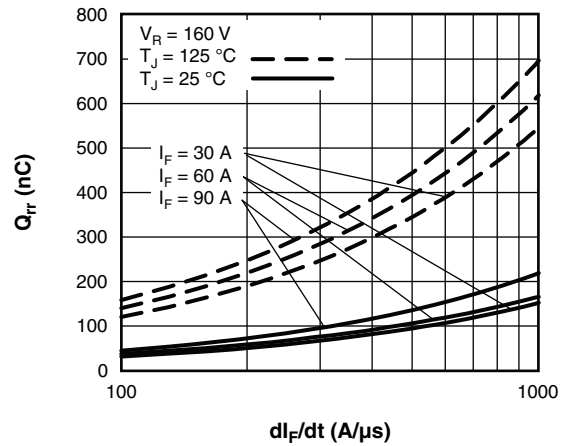


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

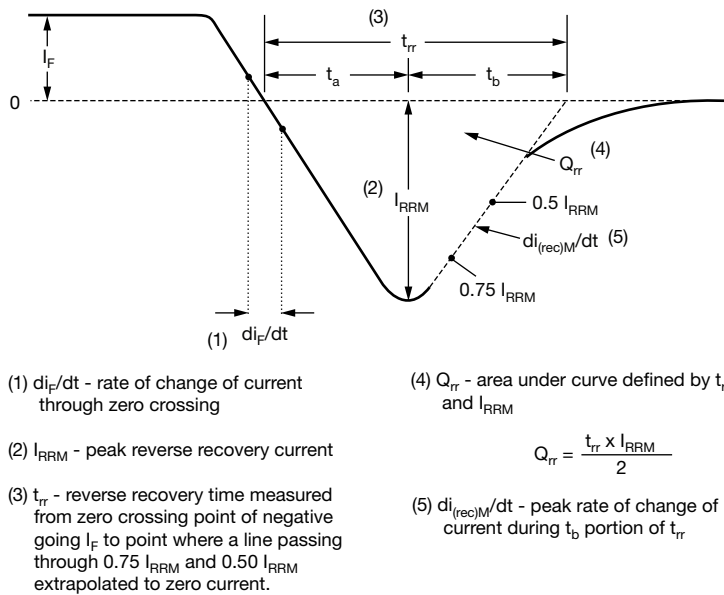
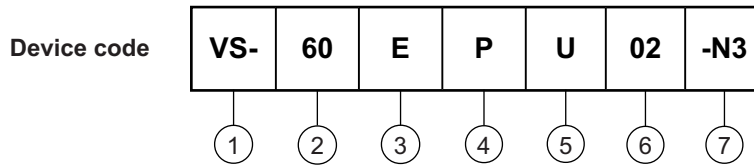


Fig. 9 - Reverse Recovery Waveform and Definitions



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (60 = 60 A)
- 3** - Circuit configuration:
  - E = single diode, 2 pins
  - A = single diode, 3 pins
- 4** - Package:
  - P = TO-247AC
- 5** - Type of silicon:
  - U = ultrafast recovery
- 6** - Voltage rating (02 = 200 V)
- 7** - Environmental digit:
  - N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-60EPU02-N3                  | 25               | 500                    | Antistatic plastic tube |
| VS-60APU02-N3                  | 25               | 500                    | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |                 |  |
|----------------------------|-----------------|--|
| Dimensions                 | TO-247AC 2L     | <a href="http://www.vishay.com/doc?96144">www.vishay.com/doc?96144</a> |
|                            | TO-247AC 3L     | <a href="http://www.vishay.com/doc?96138">www.vishay.com/doc?96138</a> |
| Part marking information   | TO-247AC 2L -N3 | <a href="http://www.vishay.com/doc?95648">www.vishay.com/doc?95648</a> |
|                            | TO-247AC 3L -N3 | <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a> |
| SPICE model                |                 | <a href="http://www.vishay.com/doc?96049">www.vishay.com/doc?96049</a> |



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