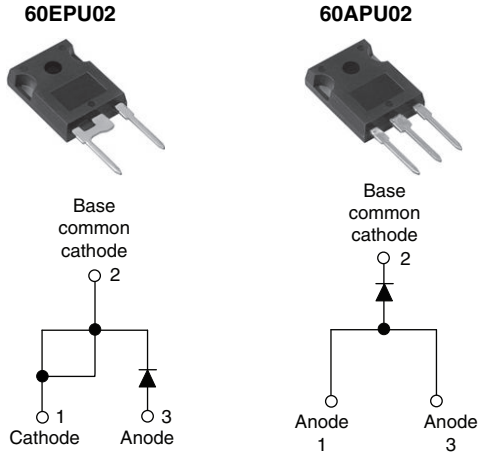
# Ultrafast Soft Recovery Diode, 60 A FRED Pt®




TO-247AC modified | TO-247AC

## FEATURES

- Ultrafast recovery
- 175 °C operating junction temperature
- Designed and qualified for industrial level

## 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.

| PRODUCT SUMMARY | |
|---|---|
| $t_{rr}$ | 35 ns |
| $I_{F(AV)}$ | 60 A |
| $V_R$ | 200 V |

**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 °C | 60 | A |
| Single pulse forward current | $I_{FSM}$ | $T_C$ = 25 °C | 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 °C unless otherwise specified)

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

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 30 V | | - | - | 35 | ns |
| | | $T_J$ = 25 °C | $I_F$ = 60 A<br>$dI_F/dt$ = 200 A/μs<br>$V_R$ = 160 V | - | 28 | - | |
| | | $T_J$ = 125 °C | | - | 50 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 4 | - | A |
| | | $T_J$ = 125 °C | | - | 8 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 59 | - | nC |
| | | $T_J$ = 125 °C | | - | 220 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Thermal resistance, junction to case | $R_{thJC}$ | | - | - | 0.70 | K/W |
| Thermal resistance, case to heatsink | $R_{thCS}$ | Mounting surface, flat, smooth and greased | - | 0.2 | - | |
| Weight | | | - | 5.5 | - | g |
| | | | - | 0.2 | - | oz. |
| Mounting torque | | | - | - | 1.2 | N · m |
| Marking device | | Case style TO-247AC modified | 60EPU02 | | | |
| | | Case style TO-247AC | 60APU02 | | | |

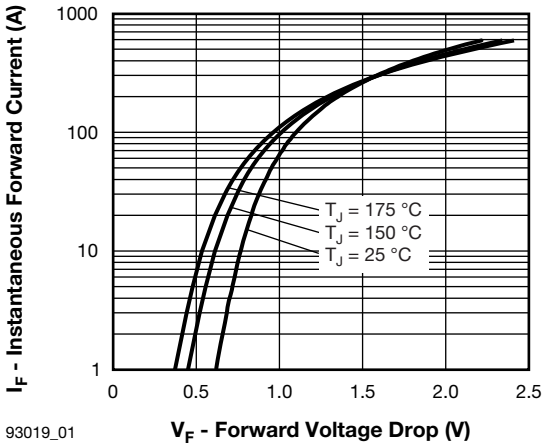



Fig. 1 - Typical Forward Voltage Drop Characteristics

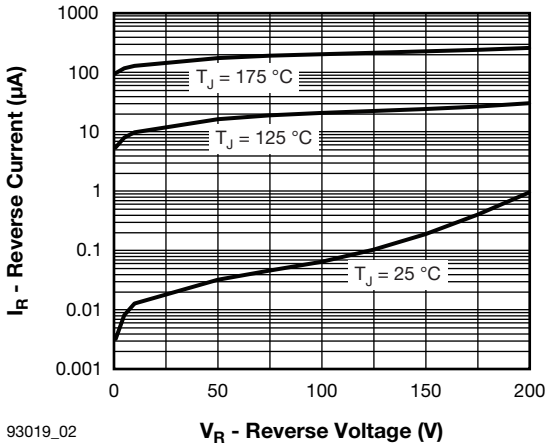



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

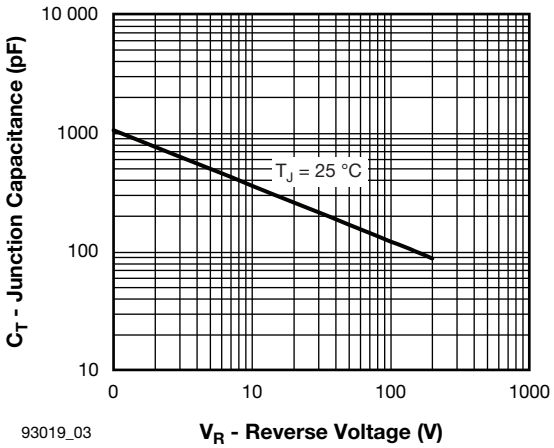



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

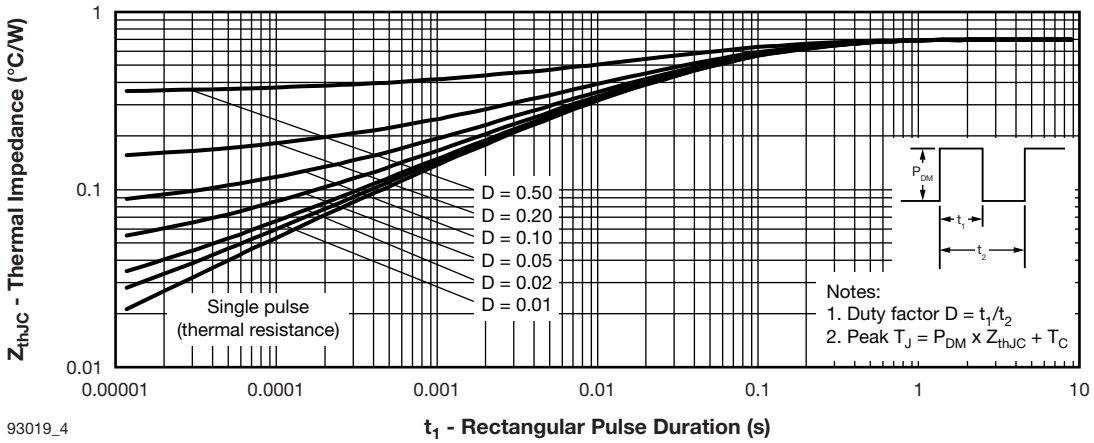



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

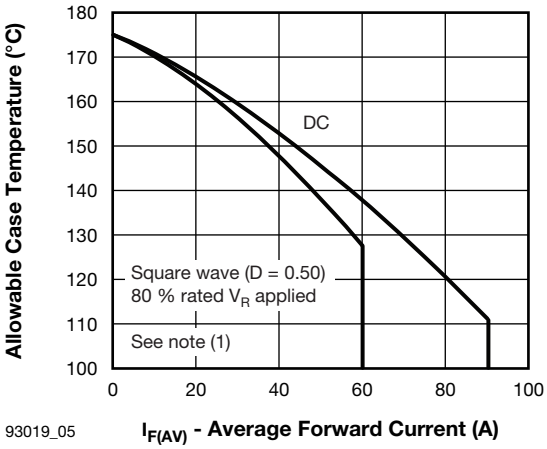



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

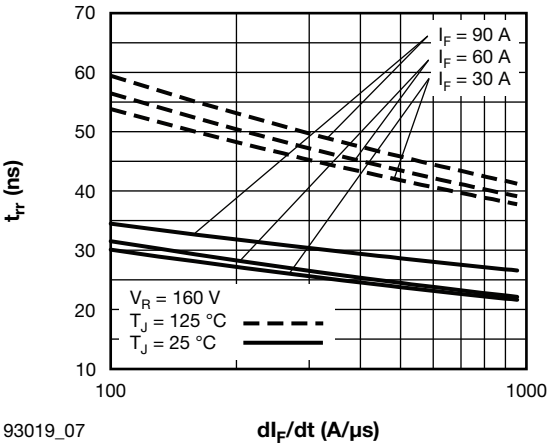



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

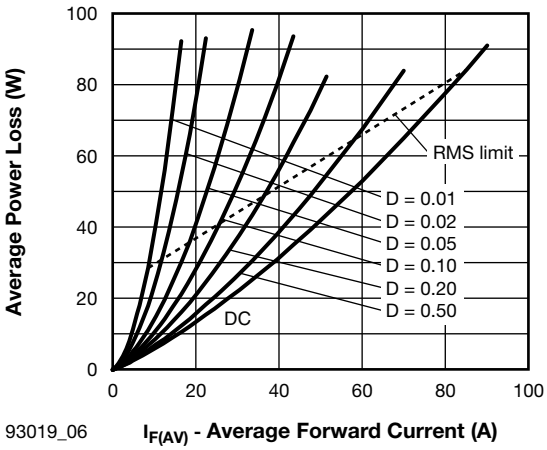



Fig. 6 - Forward Power Loss Characteristics

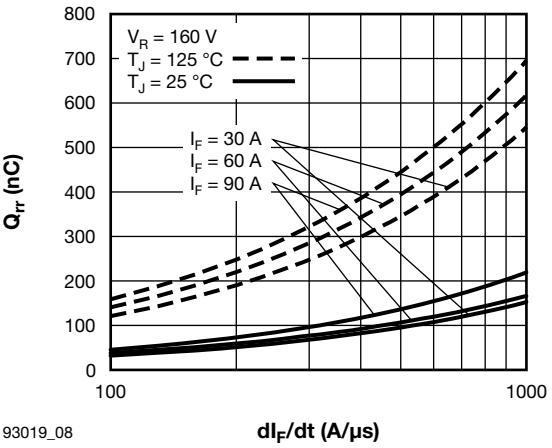



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

**Note**

(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. 6);
$Pd_{REV}$ = Inverse power loss = $V_{R1} \times I_R$ (1 - D); $I_R$ at $V_{R1}$ = 80 % rated $V_R$

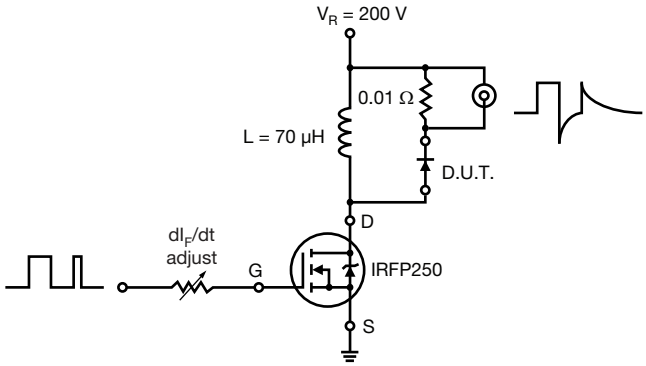
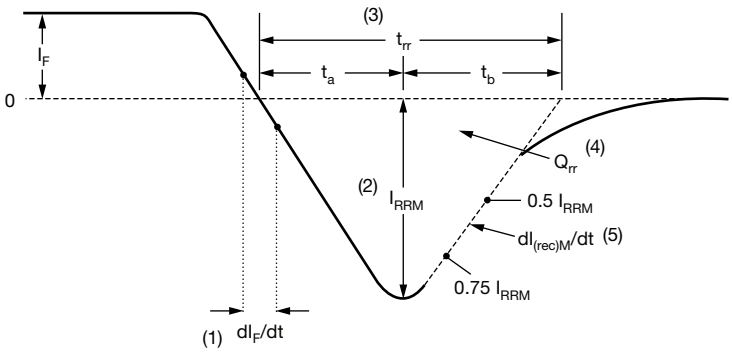



Fig. 9 - Reverse Recovery Parameter Test Circuit




(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. 10 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

**Device code**

| 60 | E | P | U | 02 | - |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |

1 - Current rating (60 = 60 A)

2 - Circuit configuration:
E = Single diode
A = Single diode, 3 pins

3 - Package:
P = TO-247AC (modified)

4 - Type of silicon:
U = Ultrafast recovery

5 - Voltage rating (02 = 200 V)

6 - • None = Standard production
• PbF = Lead (Pb)-free

| LINKS TO RELATED DOCUMENTS | | |
|---|---|---|
| Dimensions | TO-247AC modified | www.vishay.com/doc?95253 |
| | TO-247AC | www.vishay.com/doc?95223 |
| Part marking information | TO-247AC modified | www.vishay.com/doc?95255 |
| | TO-247AC | www.vishay.com/doc?95226 |
| SPICE model | | www.vishay.com/doc?95416 |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