# UFL60FA60P

## Vishay Semiconductors

# Insulated Ultrafast Rectifier Module, 60 A



**SOT-227**

**RoHS**
**COMPLIANT**

## FEATURES

- Two fully independent diodes
- Ceramic fully insulated package ($V_{ISOL}$ = 2500 $V_{AC}$)
- Ultrafast reverse recovery
- Ultrasoft reverse recovery current shape
- Low forward voltage
- Optimized for power conversion: welding and industrial SMPS applications
- Industry standard outline
- Plug-in compatible with other SOT-227 packages
- Easy to assemble
- Direct mounting to heatsink
- UL approved file E78996
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level

| PRODUCT SUMMARY | |
|---|---|
| $V_R$ | 600 V |
| $I_{F(AV)}$ per module at $T_C$ = 114 °C | 60 A |
| $t_{rr}$ | 120 ns |

## DESCRIPTION

The UFL60FA60P insulated modules integrate two state of the art Vishay Semiconductors ultrafast recovery rectifiers in the compact, industry standard SOT-227 package. The planar structure of the diodes, and the platinum doping life time control, provide an ultrasoft recovery current shape, together with the best overall performance, ruggedness, and reliability characteristics.

These devices are thus intended for high frequency applications in which the switching energy is designed not to be a predominant portion of the total energy, such as in the output rectification stage of welding machines, SMPS, and DC/DC converters. Their extremely optimized stored charge and low recovery current reduce both over dissipation in the switching elements (and snubbers) and EMI/RFI.

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Cathode to anode voltage | $V_R$ | | 600 | V |
| Continuous forward current per diode | $I_F$ | $T_C$ = 85 °C | 48 | A |
| Single pulse forward current per diode | $I_{FSM}$ | $T_C$ = 25 °C | 300 | |
| Maximum power dissipation per module | $P_D$ | $T_C$ = 85 °C | 120 | W |
| RMS isolation voltage | $V_{ISOL}$ | Any terminal to case, t = 1 min | 2500 | V |
| Operating junction and storage temperatures | $T_J$, $T_{Stg}$ | | - 55 to 175 | °C |

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## ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Cathode to anode breakdown voltage | $V_{BR}$ | $I_R$ = 100 μA | | 600 | - | - | |
| Forward voltage | $V_{FM}$ | $I_F$ = 30 A | | - | 1.1 | 1.3 | V |
| | | $I_F$ = 60 A | | - | 1.27 | 1.4 | |
| | | $I_F$ = 30 A | $T_J$ = 125 °C | - | 1.0 | 1.23 | |
| | | $I_F$ = 60 A | | - | 1.17 | 1.35 | |
| Reverse leakage current | $I_{RM}$ | $V_R$ = $V_R$ rated | | - | 0.1 | 100 | μA |
| | | $T_J$ = 175 °C, $V_R$ = $V_R$ rated | | - | 0.2 | 1.0 | mA |
| Junction capacitance | $C_T$ | $V_R$ = 600 V | | - | 50 | - | pF |

## DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C | $I_F$ = 30 A $dI_F/dt$ = 200 A/μs $V_R$ = 200 V | - | 120 | 157 | ns |
| | | $T_J$ = 125 °C | | - | 206 | 252 | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 11 | 15 | A |
| | | $T_J$ = 125 °C | | - | 20 | 25 | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 600 | 1178 | nC |
| | | $T_J$ = 125 °C | | - | 2060 | 3150 | |

## THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Junction to case, single leg conducting | $R_{thJC}$ | | - | - | 1.5 | °C/W |
| Junction to case, both leg conducting | | | - | - | 0.75 | |
| Case to heatsink | $R_{thCS}$ | Flat, greased surface | - | 0.05 | - | |
| Weight | | | - | 30 | - | g |
| Mounting torque | | | - | 1.3 | - | N · m |

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Insulated Ultrafast
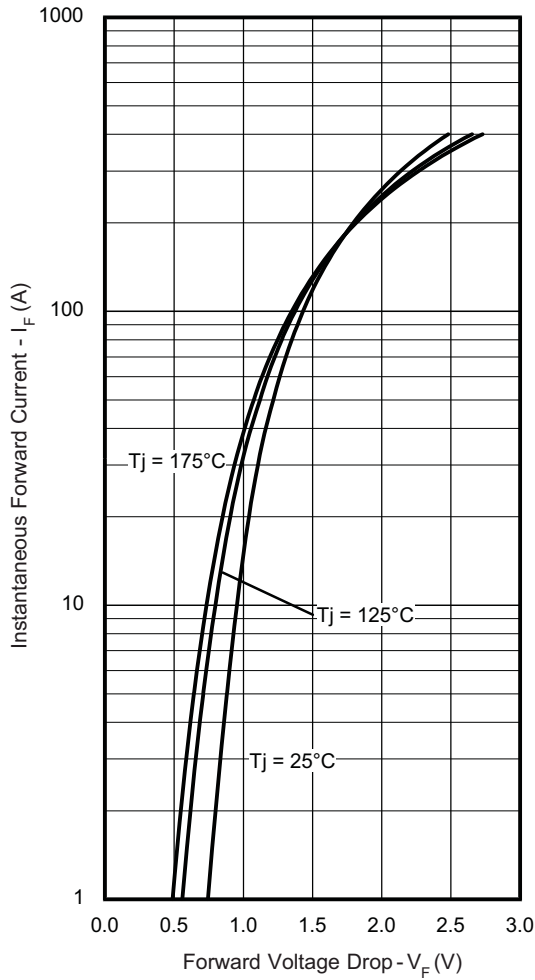Rectifier Module, 60 A

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Fig. 1 - Typical Forward Voltage Drop Characteristics
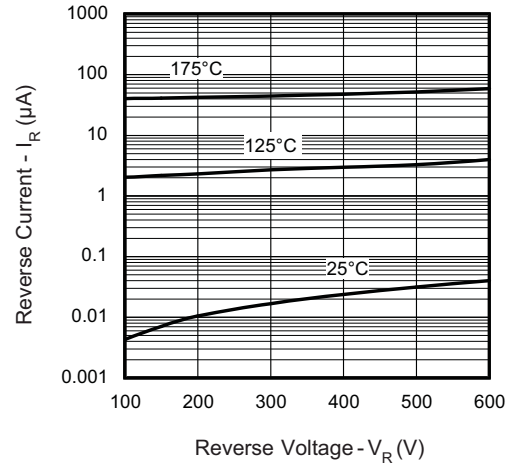(Per Diode)



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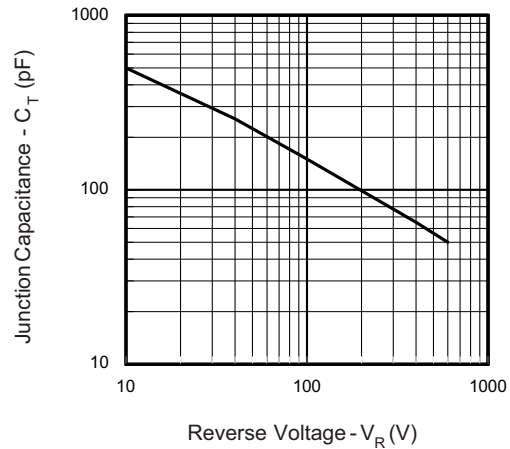Reverse Voltage



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage
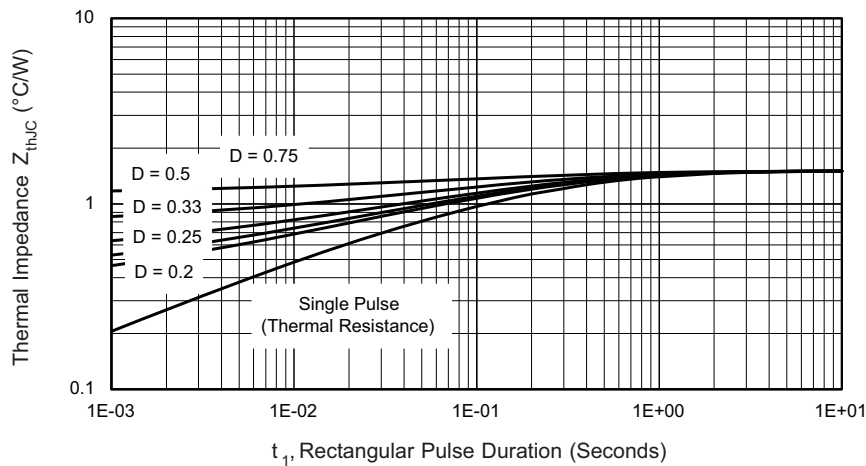


Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics (Per Diode)

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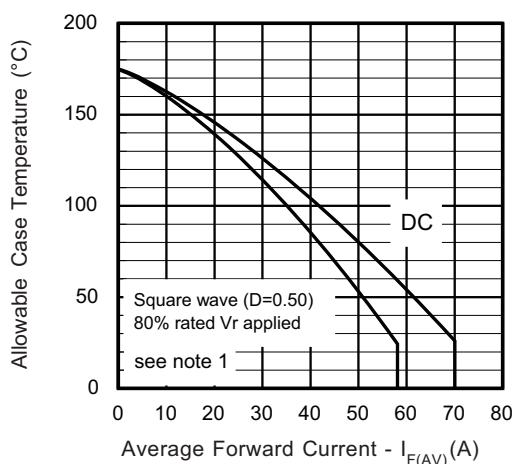
Insulated Ultrafast
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Fig. 5 - Maximum Allowable Case Temperature vs.
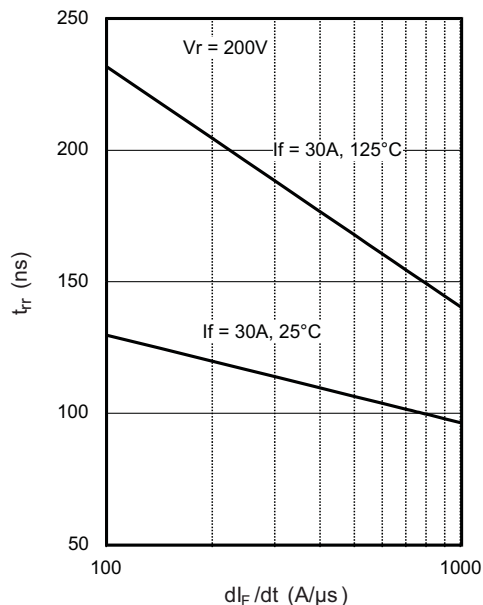Average Forward Current (Per Leg)



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

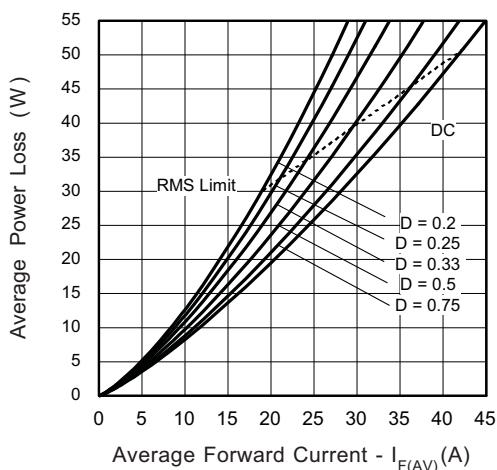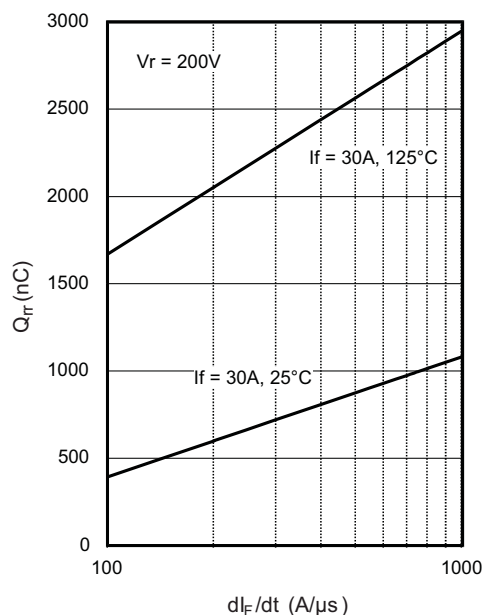

Fig. 6 - Forward Power Loss Characteristics (Per Leg)



Fig. 8 - Typical Stored Charge vs. dl$_F$/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 $V_R$

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Fig. 9 - Typical Stored Current vs. dI$_F$/dt
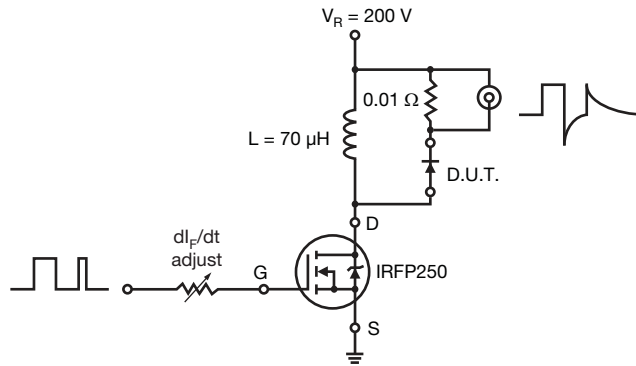


Fig. 10 - Reverse Recovery Parameter Test Circuit

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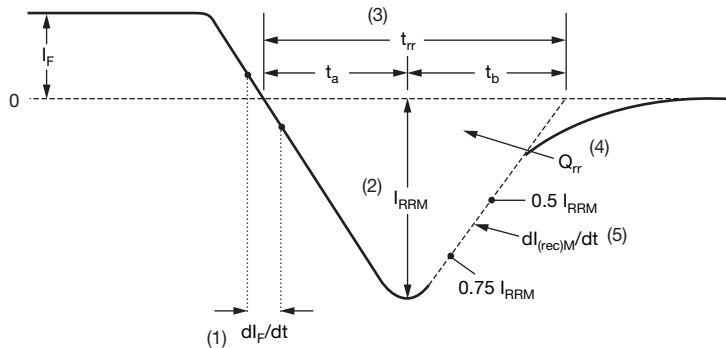


(1) $dI_F/dt$ - rate of change of current
through zero crossing

(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. 11 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE



| Device code | UF | L | 60 | F | A | 60 | P |
|---|---|---|---|---|---|---|---|
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

| 1 | - | Ultrafast rectifier |
|---|---|---|
| 2 | - | Ultrafast Pt low $V_F$ |
| 3 | - | Current rating (60 = 60 A) |
| 4 | - | Circuit configuration (2 separate diodes, parallel pin-out) |
| 5 | - | Package indicator (SOT-227 standard isolated base) |
| 6 | - | Voltage rating (60 = 600 V) |
| 7 | - | P = Lead (Pb)-free |

## CIRCUIT CONFIGURATION
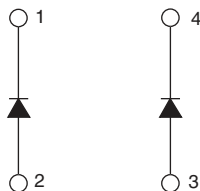


| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95036 |
| Packaging information | www.vishay.com/doc?95037 |

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