# ISL9R460PF2

# 4 A, 600 V, STEALTH™ Diode

**ON Semiconductor®**

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### Description

The ISL9R460PF2 is a STEALTH diode optimized for low loss performance in high frequency hard switched applications. The STEALTH family exhibits low reverse recovery current ($I_{RR}$) and exceptionally soft recovery under typical operating conditions. This device is intended for use as a free wheeling or boost diode in power supplies and other power switching applications. The low $I_{RR}$ and short ta phase reduce loss in switching transistors. The soft recovery minimizes ringing, expanding the range of conditions under which the diode may be operated without the use of additional snubber circuitry. Consider using the STEALTH diode with an SMPS IGBT to provide the most efficient and highest power density design at lower cost.

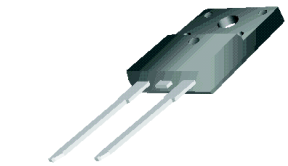
### Features

- Ultrafast Recovery, $t_{RR}$ = 17 ns (@ $I_F$ = 4 A)
- Max Forward Voltage, $V_F$ = 2.4 V (@ $T_C$ = 25°C)
- 600 V Reverse Voltage and High Reliability
- Avalanche Energy Rated
- This Device is Pb−Free and is RoHS Compliant

### Applications

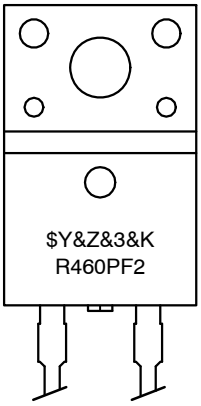
- SMPS
- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode




**TO−220, 2−Lead**
**CASE 221AS**

### MARKING DIAGRAM




| | |
|---|---|
| $Y | = ON Semiconductor Logo |
| &Z&3 | = Data Code (Year & Week) |
| &K | = Lot |
| R460PF2 | = Specific Device Code |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

**DEVICE MAXIMUM RATINGS** $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{RRM}$ | Peak Repetitive Reverse Voltage | 600 | V |
| $V_{RWM}$ | Working Peak Reverse Voltage | 600 | V |
| $V_R$ | DC Blocking Voltage | 600 | V |
| $I_{F(AV)}$ | Average Rectified Forward Current ($T_C$ = 108°C) | 4 | A |
| $I_{FRM}$ | Repetitive Peak Surge Current (20 kHz Square Wave) | 8 | A |
| $I_{FSM}$ | Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60 Hz) | 50 | A |
| $P_D$ | Power Dissipation | 22 | W |
| $E_{AVL}$ | Avalanche Energy (0.5 A, 80 mH) | 10 | mJ |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | −55 to 175 | °C |
| $T_L$ $T_{PKG}$ | Maximum Temperature for Soldering<br>Leads at 0.063in (1.6 mm) from Case for 10s Package Body for 10s, See Techbrief TB334 | 300<br>260 | °C<br>°C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**PACKAGE MARKING AND ORDERING INFORMATION**

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| ISL9R460PF2 | R460PF2 | TO−220F−2L | Tube | N/A | N/A | 50 |

**ELECTRICAL CHARACTERISTICS** $T_C$ = 25°C unless otherwise noted

| Parameter | Conditions | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF STATE CHARACTERISTICS** | | | | | | | |
| $I_R$ | Instantaneous Reverse Current | $V_R$ = 600 V | $T_C$ = 25°C | – | – | 100 | μA |
| | | | $T_C$ = 125°C | – | – | 1.0 | mA |
| **ON STATE CHARACTERISTICS** | | | | | | | |
| $V_F$ | Instantaneous Forward Voltage | $I_F$ = 4 A | $T_C$ = 25°C | – | 2.0 | 2.4 | V |
| | | | $T_C$ = 125°C | – | 1.6 | 2.0 | V |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| $C_J$ | Junction Capacitance | $V_R$ = 10 V, $I_F$ = 0 A | | – | 19 | – | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | | |
| $t_{RR}$ | Reverse Recovery Time | $I_F$ = 1 A, $di_F/dt$ = 100 A/μs, $V_R$ = 30 V | | – | 17 | 20 | ns |
| | | $I_F$ = 4 A, $dI_F/dt$ = 100 A/μs, $V_R$ = 30 V | | – | 19 | 22 | ns |
| $t_{RR}$ | Reverse Recovery Time | $I_F$ = 4 A, $di_F/dt$ = 200 A/μs, $V_R$ = 390 V, $T_C$ = 25°C | | – | 17 | – | ns |
| $I_{RR}$ | Reverse Recovery Current | | | – | 2.6 | – | A |
| $Q_{RR}$ | Reverse Recovered Charge | | | – | 22 | – | nC |
| $t_{RR}$ | Reverse Recovery Time | $I_F$ = 4 A, $di_F/dt$ = 200 A/μs, $V_R$ = 390 V, $T_C$ = 125°C | | – | 77 | – | ns |
| S | Softness Factor ($t_b/t_a$) | | | – | 4.2 | – | |
| $I_{RR}$ | Reverse Recovery Current | | | – | 2.8 | – | A |
| $Q_{RR}$ | Reverse Recovered Charge | | | – | 100 | – | nC |

**ELECTRICAL CHARACTERISTICS** $T_C$ = 25°C unless otherwise noted (continued)

| Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{RR}$ | Reverse Recovery Time | $I_F$ = 4 A, $di_F/dt$ = 400 A/μs, $V_R$ = 390 V, $T_C$ = 125°C | – | 54 | – | ns |
| S | Softness Factor ($t_b/t_a$) | | – | 3.5 | – | |
| $I_{RR}$ | Reverse Recovery Current | | – | 4.3 | – | A |
| $Q_{RR}$ | Reverse Recovered Charge | | | 110 | – | nC |
| $dI_M/dt$ | Maximum di/dt during $t_b$ | | – | 500 | – | A/μs |
| **THERMAL CHARACTERISTICS** | | | | | | |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | | – | – | 5.7 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | TO−220F | – | – | 70 | °C/W |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL PERFORMANCE CURVES

$T_C$ = 25°C unless otherwise noted

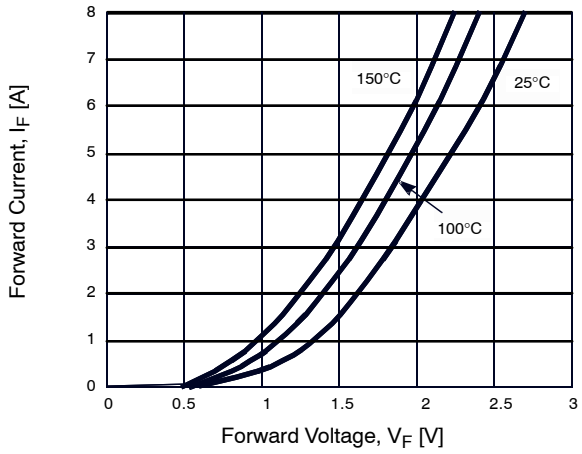



**Figure 1. Forward Current vs Forward Voltage**

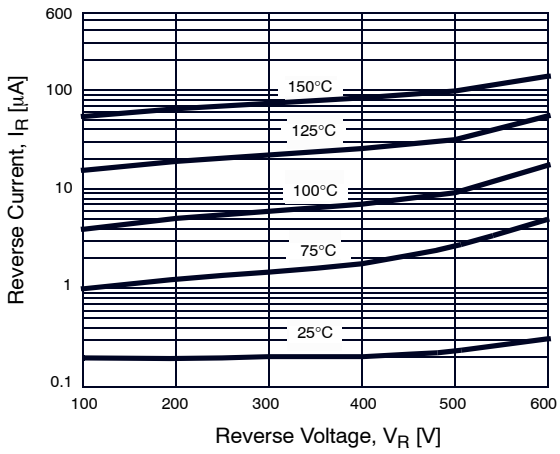



**Figure 2. Reverse Current vs Reverse Voltage**

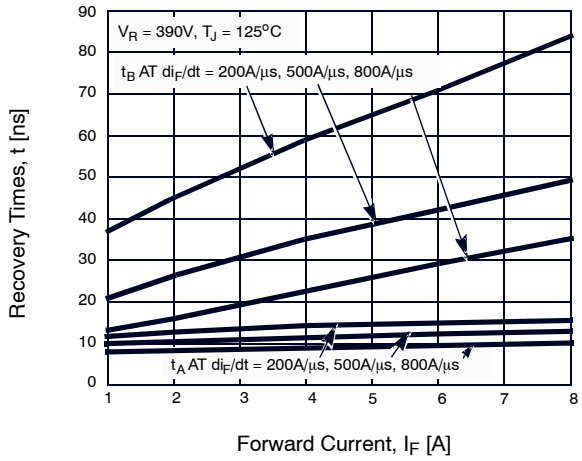



**Figure 3. $t_A$ and $t_B$ Curves vs Forward Current**

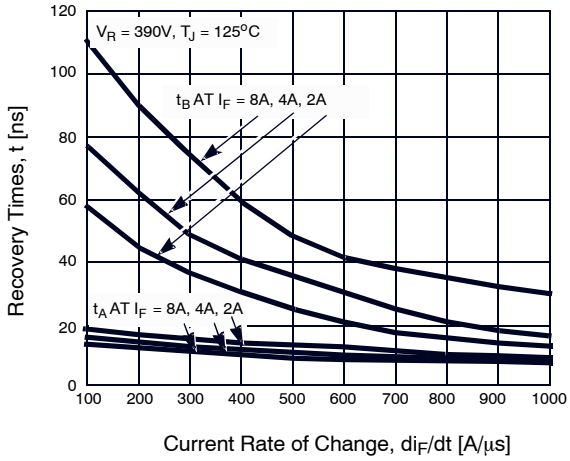



**Figure 4. $t_A$ and $t_B$ Curves vs $di_F/dt$**

## TYPICAL PERFORMANCE CURVES (continued)

$T_C$ = 25°C unless otherwise noted

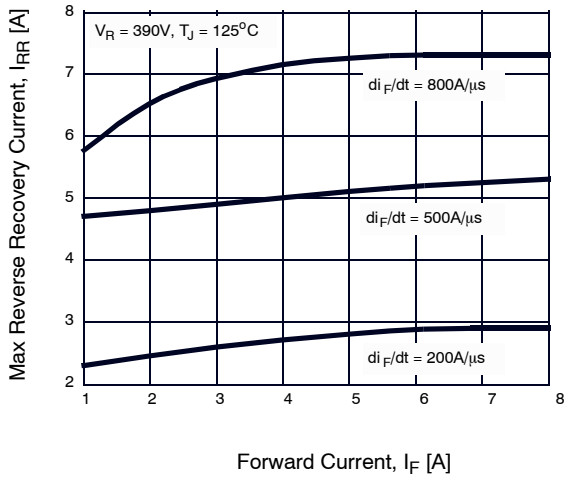



**Figure 5. Maximum Reverse Recovery Current vs Forward Current**

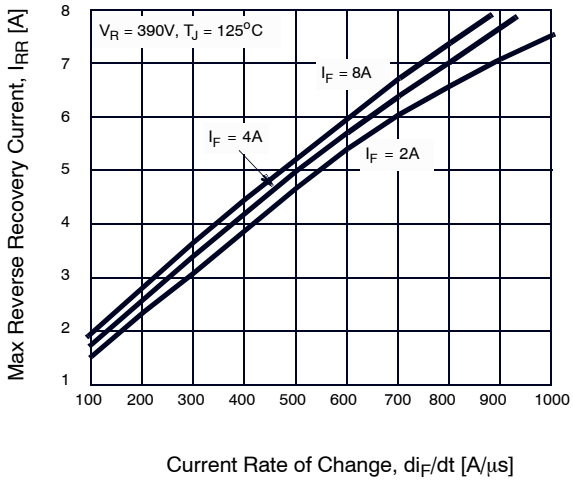



**Figure 6. Maximum Reverse Recovery Current vs $di_F/dt$**

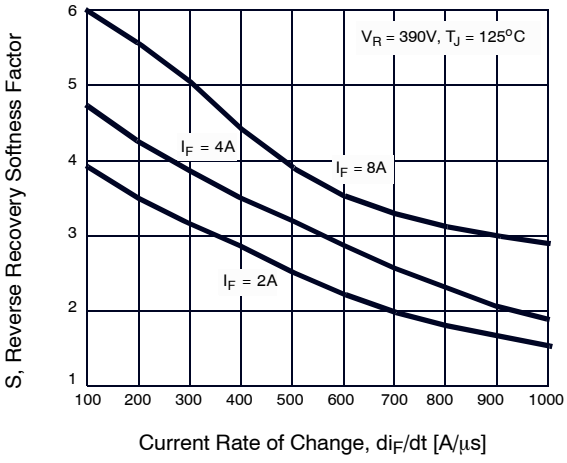



**Figure 7. Reverse Recovery Softness vs $di_F/dt$**

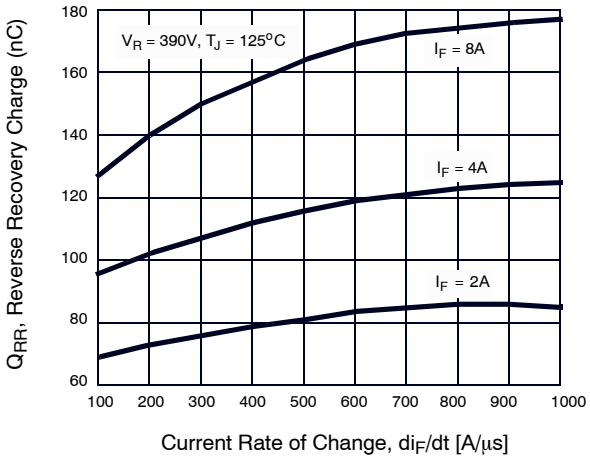



**Figure 8. Reverse Recovery Charge vs $di_F/dt$**

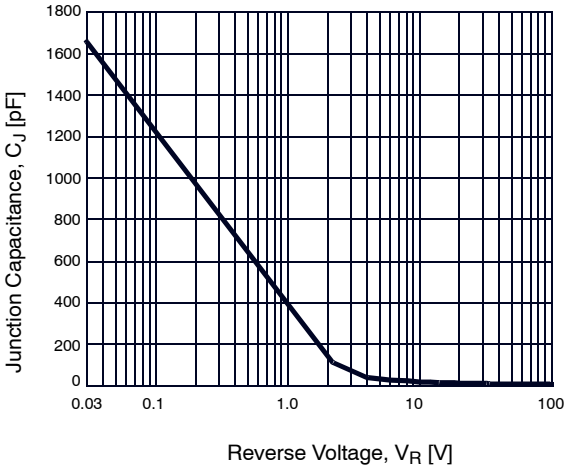



**Figure 9. Junction Capacitance vs Reverse Voltage**

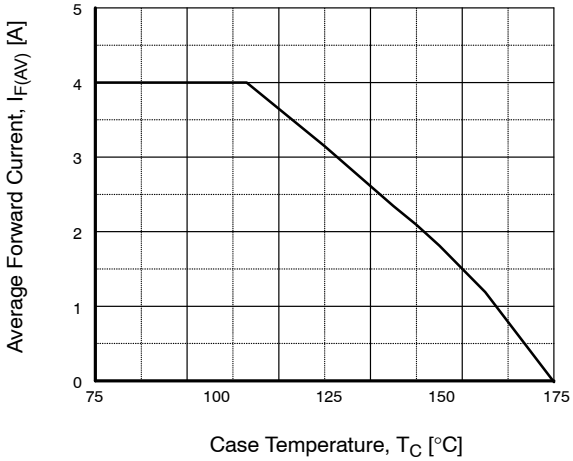



**Figure 10. DC Current Derating Curve**

## TYPICAL PERFORMANCE CURVES (continued)

$T_C$ = 25°C unless otherwise noted

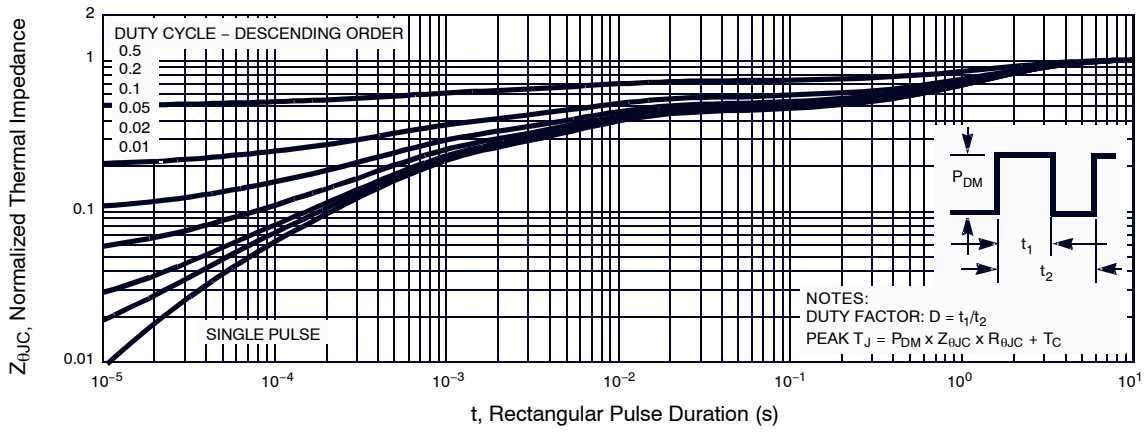



**Figure 11. Normalized Maximum Transient Thermal Impedance**

## TEST CIRCUIT AND WAVEFORMS

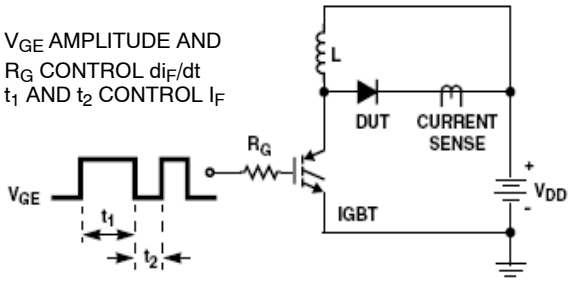



**Figure 12. $It_{RR}$ Test Circuit**

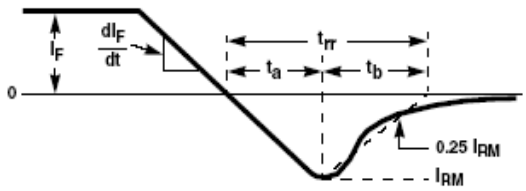



**Figure 13. $t_{RR}$ Waveforms and Definitions**

I = 0.5 A
L = 80 mH
R < 0.1 Ω
$V_{DD}$ = 200 V
$E_{AVL} = 1/2LI^2[V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$
$Q_1$ = IGBT ($B_{VCES}$ > DUT $V_{R(AVL)}$)

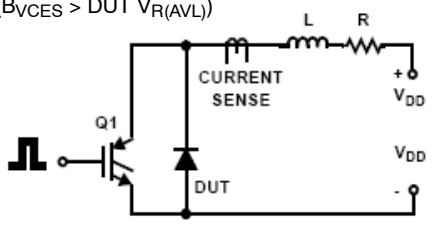



**Figure 14. Avalanche Energy Test Circuit**

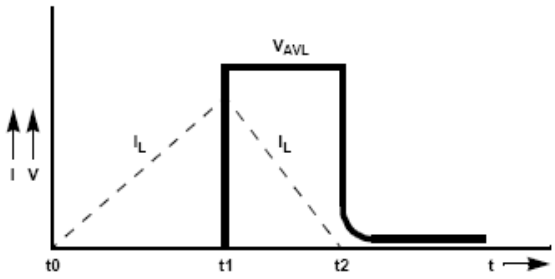


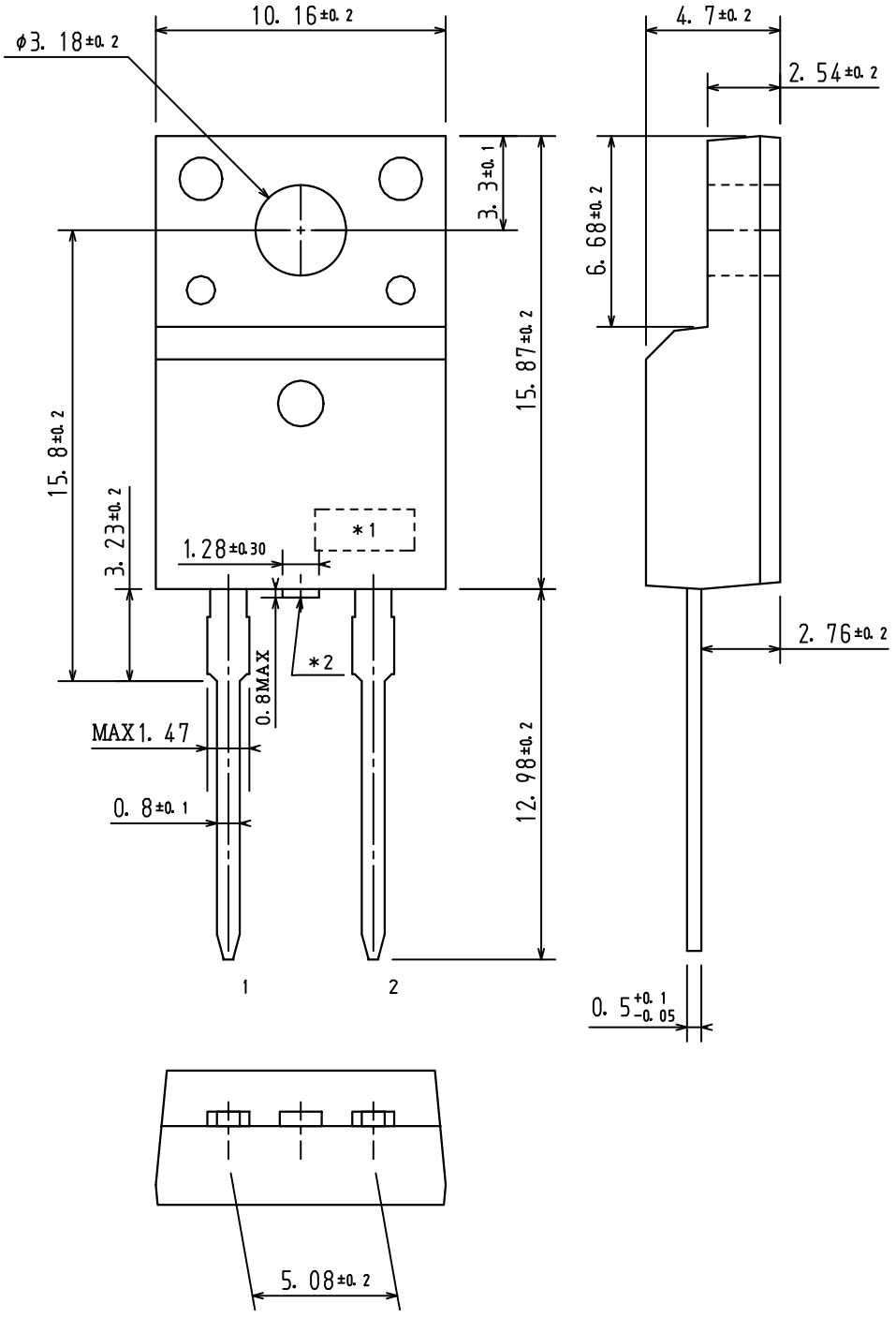

**Figure 15. Avalanche Current and Voltage Waveforms**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

**TO−220 Fullpack, 2−Lead / TO−220F−2FS**
CASE 221AS
ISSUE O

DATE 29 FEB 2012

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|---|---|---|
| **DOCUMENT NUMBER:** | **98AON67438E** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| **DESCRIPTION:** | **TO−220 FULLPACK, 2−LEAD / TO−220F−2FS** | **PAGE 1 OF 1** |

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