

STEALTH™ Diode

15 A, 600 V

ISL9R1560G2, ISL9R1560P2, ISL9R1560S3S

Description

The ISL9R1560G2, ISL9R1560P2, ISL9R1560S3S 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 t_a 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

- Stealth Recovery $t_{rr} = 29.4$ ns (@ $I_F = 15$ A)
- Max Forward Voltage, $V_F = 2.2$ V (@ $T_C = 25^\circ\text{C}$)
- 600 V Reverse Voltage and High Reliability
- Avalanche Energy Rated
- These Devices are Pb-Free and are RoHS Compliant

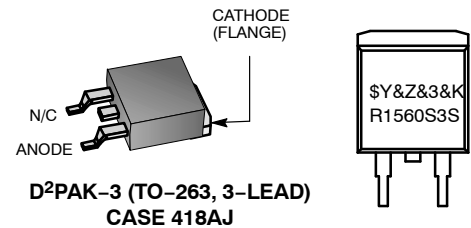
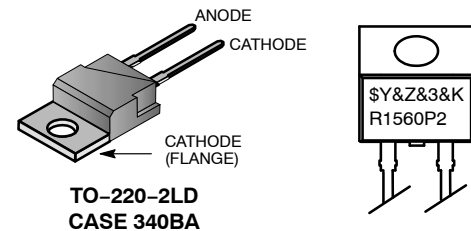
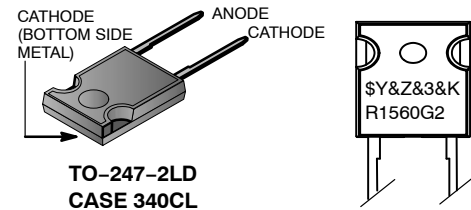
Applications

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



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MARKING DIAGRAM

\$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Numeric Date Code
&K = Lot Code
R1560G2, R1560P2,
R1560S3S = Specific Device Code

SYMBOL



ORDERING INFORMATION

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

ISL9R1560G2, ISL9R1560P2, ISL9R1560S3S

DEVICE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

| Parameter | Symbol | Ratings | Unit |
|--|------------------------------------|-------------|----------|
| Repetitive Peak Reverse Voltage | V _{RRM} | 600 | V |
| Working Peak Reverse Voltage | V _{RWM} | 600 | V |
| DC Blocking Voltage | V _R | 600 | V |
| Average Rectified Forward Current (T _C = 145°C) | I _{F(AV)} | 15 | A |
| Repetitive Peak Surge Current (20 kHz Square Wave) | I _{FRM} | 30 | A |
| Non-repetitive Peak Surge Current (Halfwave 1 Phase 60 Hz) | I _{FSM} | 200 | A |
| Power Dissipation | P _D | 150 | W |
| Avalanche Energy (1 A, 40 mH) | E _{AVL} | 20 | mJ |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +175 | °C |
| Maximum Temperature for Soldering Leads at 0.063 in (1.6 mm) from Case for 10 s Package Body for 10 s, See Techbrief TB334 | T _L T _{PKG} | 300 260 | °C °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

| Device | Device Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---------------|----------------|-----------------------------|----------------|-----------|------------|----------|
| ISL9R1560G2 | R1560G2 | TO-247-2LD | Tube | N/A | N/A | 30 |
| ISL9R1560P2 | R1560P2 | TO-220-2LD | Tube | N/A | N/A | 50 |
| ISL9R1560S3ST | R1560S3S | TO-263(D ² -PAK) | Reel | 13" dia | 24 mm | 800 |

THERMAL CHARACTERISTICS

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--|------------------|-----------------|-----|-----|-----|------|
| Thermal Resistance Junction to Case | R _{θJC} | | - | - | 1.0 | °C/W |
| Thermal Resistance Junction to Ambient | R _{θJA} | TO-247 | - | - | 30 | °C/W |
| Thermal Resistance Junction to Ambient | R _{θJA} | TO-220 | - | - | 62 | °C/W |
| Thermal Resistance Junction to Ambient | R _{θJA} | TO-263 | - | - | 62 | °C/W |

ISL9R1560G2, ISL9R1560P2, ISL9R1560S3S

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit | |
|----------------------------------|-----------|--|--|------|------|------------------------|---------------|
| Off State Characteristics | | | | | | | |
| Instantaneous Reverse Current | I_R | $V_R = 600\text{ V}$ | $T_C = 25^\circ\text{C}$ | - | - | 100 | μA |
| | | | $T_C = 125^\circ\text{C}$ | - | - | 1.0 | mA |
| On State Characteristics | | | | | | | |
| Instantaneous Forward Voltage | V_F | $I_F = 15\text{ A}$ | $T_C = 25^\circ\text{C}$ | - | 1.8 | 2.2 | V |
| | | | $T_C = 125^\circ\text{C}$ | - | 1.65 | 2.0 | V |
| Dynamic Characteristics | | | | | | | |
| Junction Capacitance | C_J | $V_R = 10\text{ V}, I_F = 0\text{ A}$ | - | 62 | - | pF | |
| Switching Characteristics | | | | | | | |
| Reverse Recovery Time | t_{rr} | $I_F = 1\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$ | - | 25 | 30 | ns | |
| | | | $I_F = 15\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$ | - | 35 | 40 | ns |
| Reverse Recovery Time | t_{rr} | $I_F = 15\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 25^\circ\text{C}$ | - | 29.4 | - | ns | |
| Reverse Recovery Current | I_{rr} | | - | 3.5 | - | A | |
| Reverse Recovered Charge | Q_{rr} | | - | 57 | - | nC | |
| Reverse Recovery Time | t_{rr} | | - | 90 | - | ns | |
| Softness Factor (t_b/t_a) | S | | - | 2.0 | - | | |
| Reverse Recovery Current | I_{rr} | $I_F = 15\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 125^\circ\text{C}$ | - | 5.0 | - | A | |
| Reverse Recovered Charge | Q_{rr} | | - | 275 | - | nC | |
| Reverse Recovery Time | t_{rr} | | - | 52 | - | ns | |
| Softness Factor (t_b/t_a) | S | | - | 1.36 | - | | |
| Reverse Recovery Current | I_{rr} | | - | 13.5 | - | A | |
| Reverse Recovered Charge | Q_{rr} | $I_F = 15\text{ A}, di_F/dt = 800\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 125^\circ\text{C}$ | - | 390 | - | nC | |
| Maximum di/dt During t_b | di_M/dt | | - | 800 | - | $\text{A}/\mu\text{s}$ | |

TYPICAL PERFORMANCE CURVES

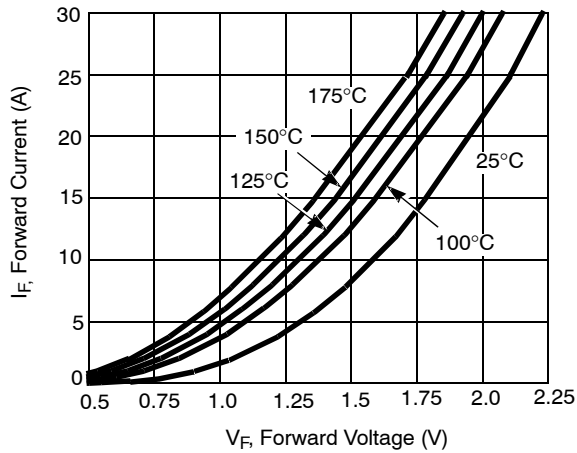


Figure 1. Forward Current vs. Forward Voltage

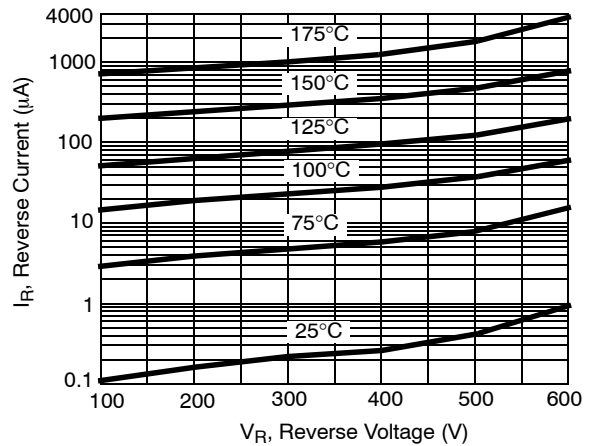


Figure 2. Reverse Current vs. Reverse Voltage

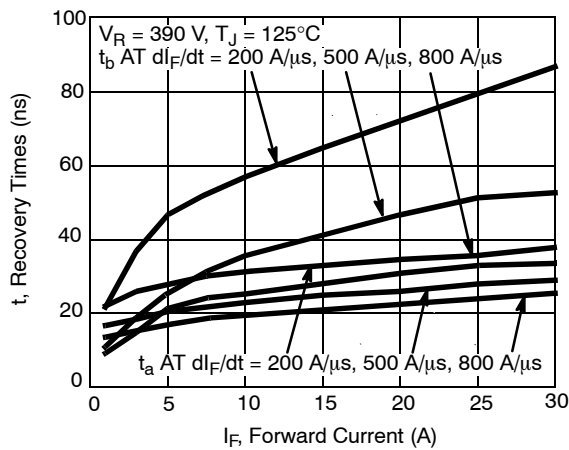


Figure 3. t_a and t_b Curves vs. Forward Current

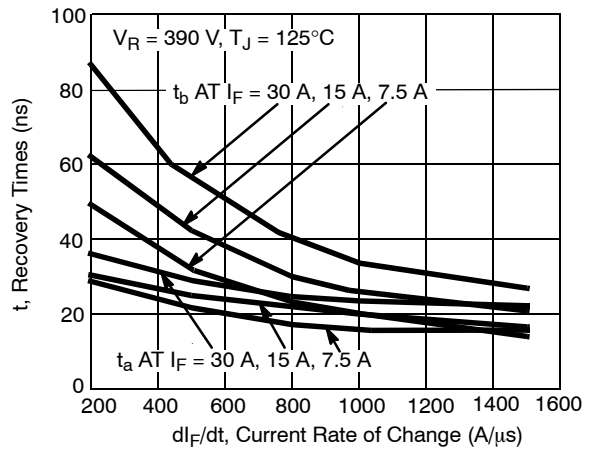


Figure 4. t_a and t_b Curves vs. di_F/dt

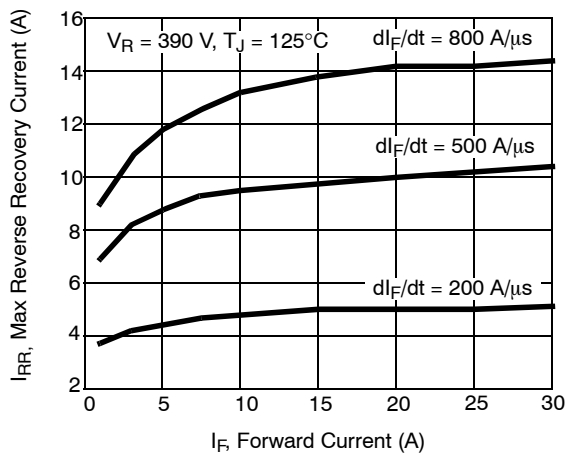


Figure 5. Maximum Reverse Recovery Current vs. Forward Current

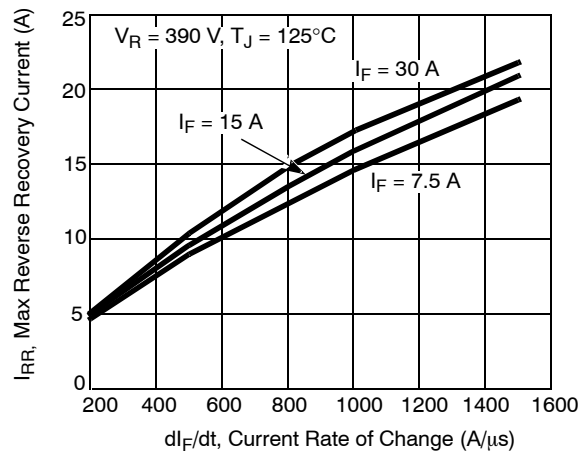


Figure 6. Maximum Reverse Recovery Current vs. di_F/dt

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TYPICAL PERFORMANCE CURVES (continued)

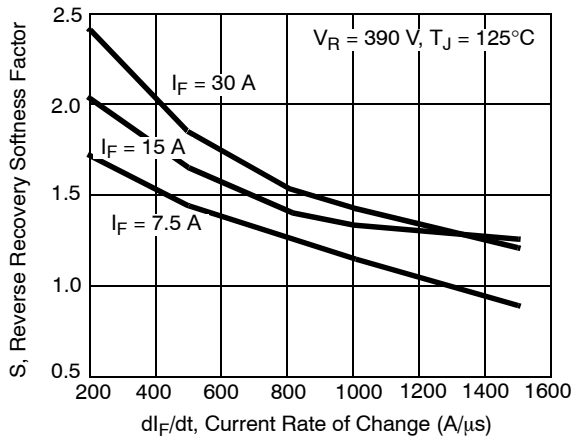


Figure 7. Reverse Recovery Softness Factor vs. di_F/dt

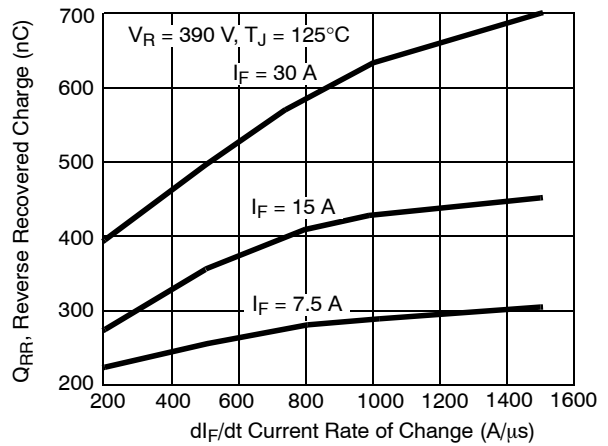


Figure 8. Reverse Recovered Charge vs. di_F/dt

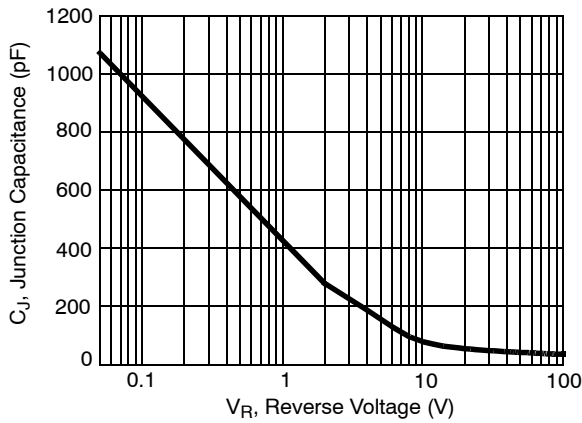


Figure 9. Junction Capacitance vs. Reverse Voltage

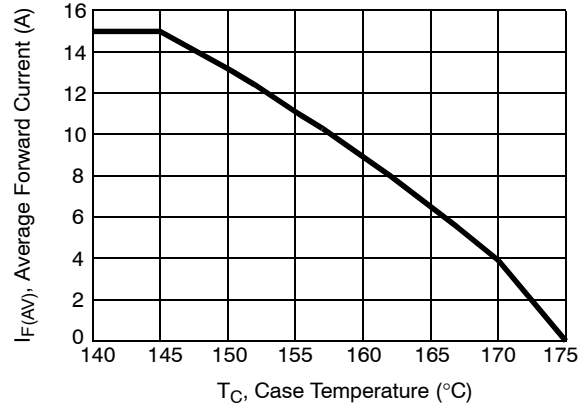


Figure 10. DC Current Derating Curve

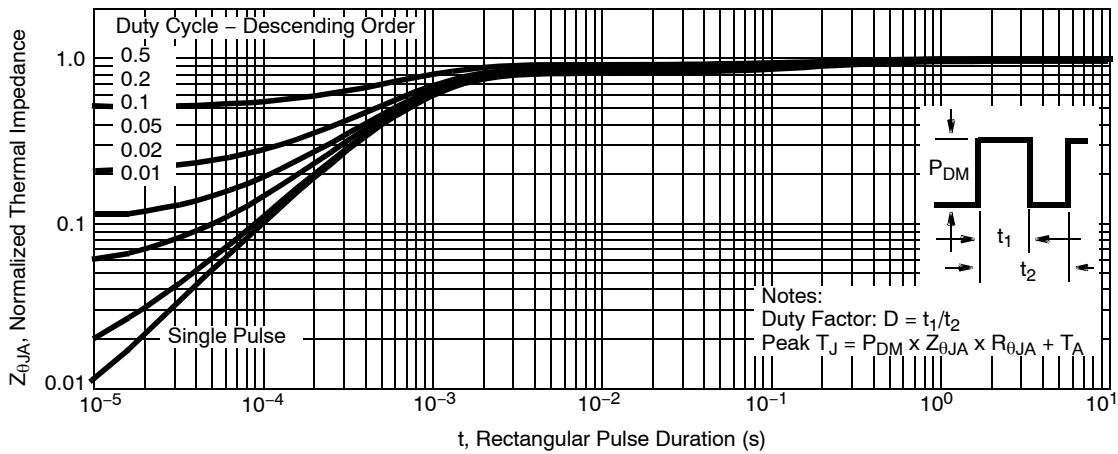


Figure 11. Normalized Maximum Transient Thermal Impedance

TEST CIRCUIT AND WAVEFORMS

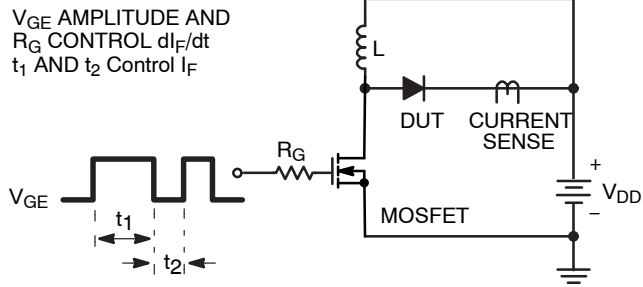


Figure 12. t_{rr} Test Circuit

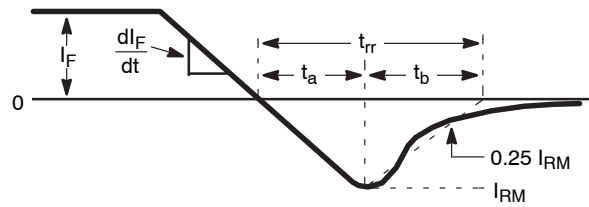


Figure 13. t_{rr} Waveforms and Definitions

$I = 1 \text{ A}$
 $L = 40 \text{ mH}$
 $R < 0.1 \ \Omega$
 $V_{DD} = 50 \text{ V}$
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)}/(V_{R(AVL)} - V_{DD})]$
 $Q_1 = \text{IGBT (} BV_{CES} > \text{DUT } V_{R(AVL)} \text{)}$

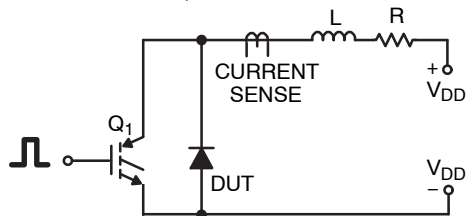


Figure 14. Avalanche Energy Test Circuit

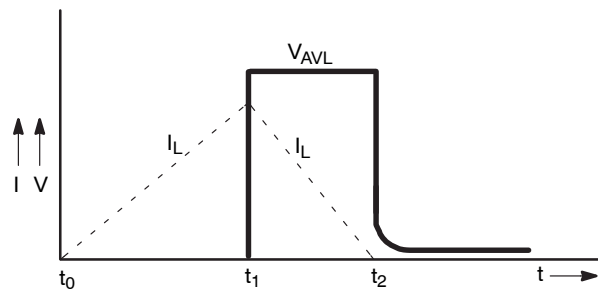
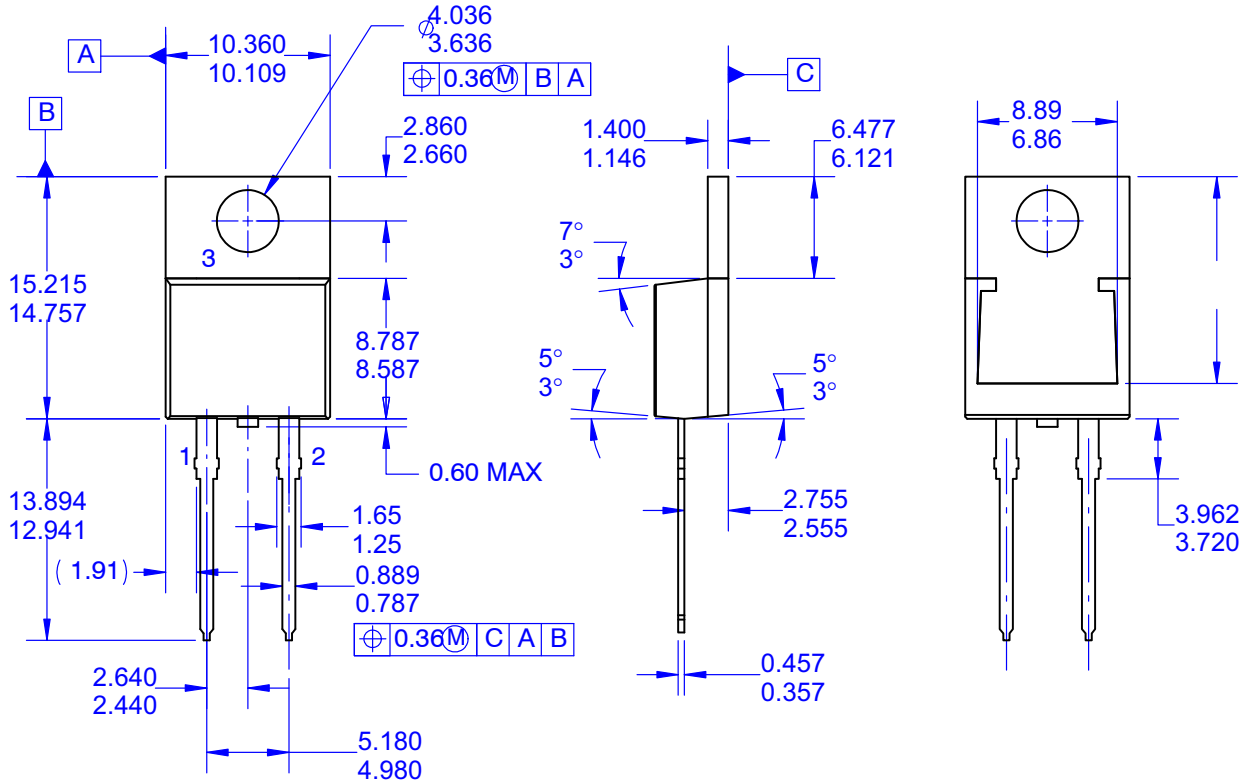


Figure 15. Avalanche Current and Voltage Waveforms

TO-220-2LD
CASE 340BA
ISSUE O

DATE 31 AUG 2016



NOTES:

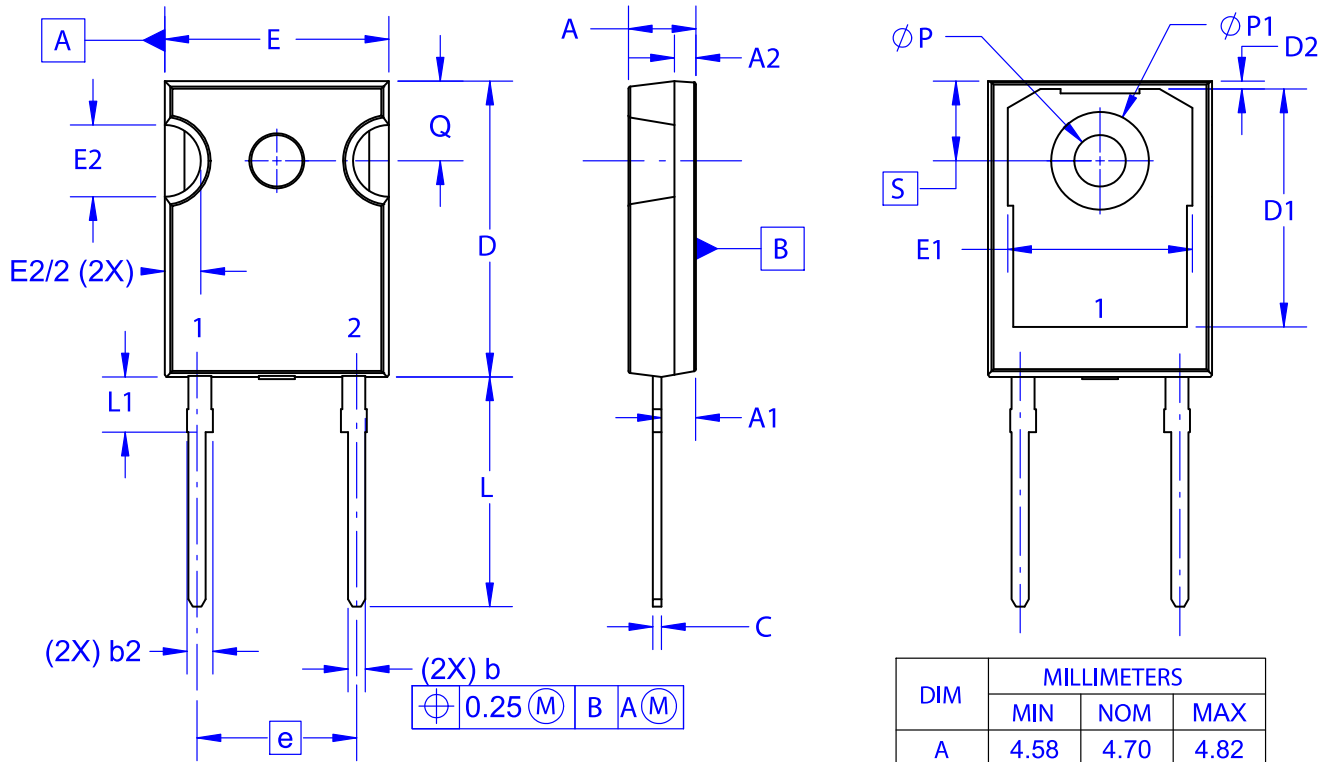
- A. PACKAGE REFERENCE: JEDEC TO220 VARIATION AC.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.

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CASE 340CL
ISSUE A

DATE 03 DEC 2019

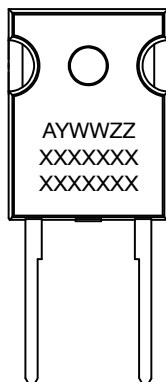


NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

| DIM | MILLIMETERS | | |
|-----|-------------|-------|-------|
| | MIN | NOM | MAX |
| A | 4.58 | 4.70 | 4.82 |
| A1 | 2.29 | 2.40 | 2.66 |
| A2 | 1.30 | 1.50 | 1.70 |
| b | 1.17 | 1.26 | 1.35 |
| b2 | 1.53 | 1.65 | 1.77 |
| c | 0.51 | 0.61 | 0.71 |
| D | 20.32 | 20.57 | 20.82 |
| D1 | 16.37 | 16.57 | 16.77 |
| D2 | 0.51 | 0.93 | 1.35 |
| E | 15.37 | 15.62 | 15.87 |
| E1 | 12.81 | ~ | ~ |
| E2 | 4.96 | 5.08 | 5.20 |
| e | ~ | 11.12 | ~ |
| L | 15.75 | 16.00 | 16.25 |
| L1 | 3.69 | 3.81 | 3.93 |
| ØP | 3.51 | 3.58 | 3.65 |
| ØP1 | 6.61 | 6.73 | 6.85 |
| Q | 5.34 | 5.46 | 5.58 |
| S | 5.34 | 5.46 | 5.58 |

GENERIC MARKING DIAGRAM*

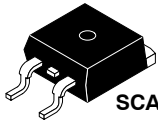


XXXX = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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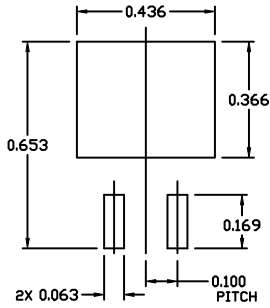
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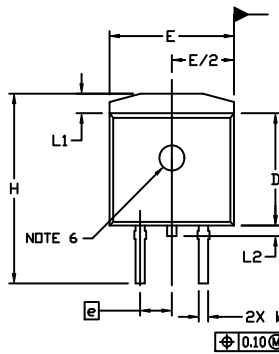
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CASE 418AJ
ISSUE F

DATE 11 MAR 2021



RECOMMENDED
MOUNTING FOOTPRINT

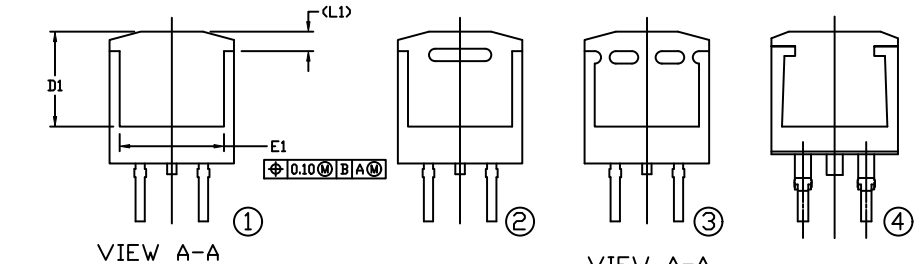
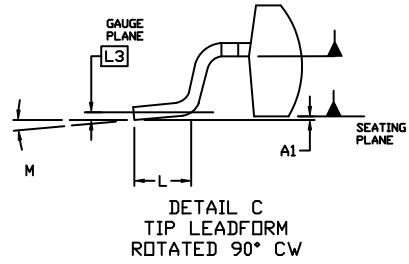
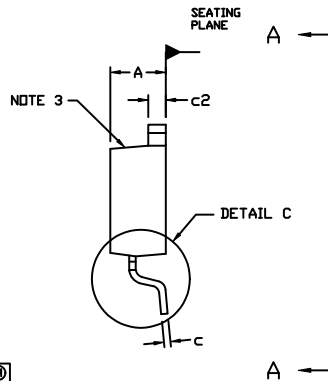
For additional information on our Pb-free strategy and soldering details, please download the IN Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.



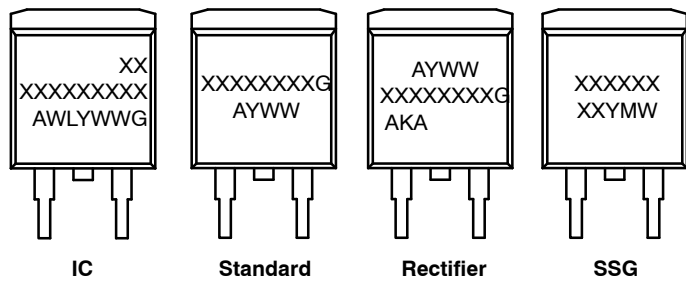
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: INCHES
- CHAMFER OPTIONAL.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- OPTIONAL MOLD FEATURE.
- ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.160 | 0.190 | 4.06 | 4.83 |
| A1 | 0.000 | 0.010 | 0.00 | 0.25 |
| b | 0.020 | 0.039 | 0.51 | 0.99 |
| c | 0.012 | 0.029 | 0.30 | 0.74 |
| c2 | 0.045 | 0.065 | 1.14 | 1.65 |
| D | 0.330 | 0.380 | 8.38 | 9.65 |
| D1 | 0.260 | --- | 6.60 | --- |
| E | 0.380 | 0.420 | 9.65 | 10.67 |
| E1 | 0.245 | --- | 6.22 | --- |
| e | 0.100 | BSC | 2.54 | BSC |
| H | 0.575 | 0.625 | 14.60 | 15.88 |
| L | 0.070 | 0.110 | 1.78 | 2.79 |
| L1 | --- | 0.066 | --- | 1.68 |
| L2 | --- | 0.070 | --- | 1.78 |
| L3 | 0.010 | BSC | 0.25 | BSC |
| M | 0° | 8° | 0° | 8° |



GENERIC MARKING DIAGRAMS*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- W = Week Code (SSG)
- M = Month Code (SSG)
- G = Pb-Free Package
- AKA = Polarity Indicator

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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