

# STEALTH™ Dual Diode 60 A, 600 V

## ISL9K3060G3

### Description

The ISL9K3060G3 is a STEALTH dual 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

- Stealth Recovery  $t_{rr} = 36$  ns (@  $I_F = 30$  A)
- Max Forward Voltage,  $V_F = 2.4$  V (@  $T_C = 25^\circ\text{C}$ )
- 600 V Reverse Voltage and High Reliability
- Avalanche Energy Rated
- This Device is Pb-Free and is RoHS Compliant

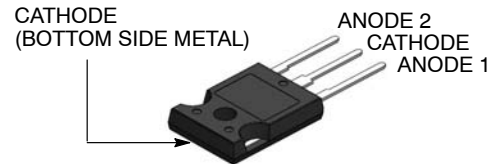
### Applications

- Switch Mode Power Supplies
- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode

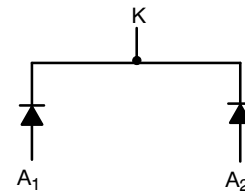


ON Semiconductor®

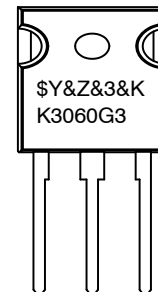
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TO-247-3LD  
CASE 340CK



### MARKING DIAGRAM



|         |                         |
|---------|-------------------------|
| \$Y     | = ON Semiconductor Logo |
| &Z      | = Assembly Plant Code   |
| &3      | = Numeric Date Code     |
| &K      | = Lot Code              |
| K3060G3 | = Specific Device Code  |

### ORDERING INFORMATION

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

# ISL9K3060G3

## DEVICE MAXIMUM RATINGS (per leg) ( $T_C = 25^\circ\text{C}$ 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 ( $T_C = 125^\circ\text{C}$ )                                                                  | $I_{F(AV)}$        | 30          | A                                    |
| Total Device Current (Both Legs)                                                                                                 |                    | 60          | A                                    |
| Repetitive Peak Surge Current (20 kHz Square Wave)                                                                               | $I_{FRM}$          | 70          | A                                    |
| Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60 Hz)                                                                        | $I_{FSM}$          | 325         | A                                    |
| Power Dissipation                                                                                                                | $P_D$              | 200         | W                                    |
| Avalanche Energy (1 A, 40 mH)                                                                                                    | $E_{AVL}$          | 20          | mJ                                   |
| Operating and Storage Temperature Range                                                                                          | $T_J, T_{STG}$     | -55 to +175 | $^\circ\text{C}$                     |
| Maximum Temperature for Soldering<br>Leads at 0.063 in (1.6 mm) from Case for 10 s<br>Package Body for 10 s, See Techbrief TB334 | $T_L$<br>$T_{PKG}$ | 300<br>260  | $^\circ\text{C}$<br>$^\circ\text{C}$ |

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 | Tape Width | Quantity |
|-------------|----------------|-----------|----------------|------------|----------|
| ISL9K3060G3 | K3060G3        | TO-247-3L | Tube           | N/A        | 30       |

## THERMAL CHARACTERISTICS

| Parameter                              | Symbol          | Test Conditions | Min | Typ | Max | Unit               |
|----------------------------------------|-----------------|-----------------|-----|-----|-----|--------------------|
| Thermal Resistance Junction to Case    | $R_{\theta JC}$ |                 | –   | –   | 1.0 | $^\circ\text{C/W}$ |
| Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | TO-247          | –   | –   | 30  | $^\circ\text{C/W}$ |

# ISL9K3060G3

## ELECTRICAL CHARACTERISTICS (per leg) ( $T_C = 25^\circ\text{C}$ 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 | $\mu\text{A}$ |
|                               |       |                      | $T_C = 125^\circ\text{C}$ | – | – | 1.0 | mA            |

### ON STATE CHARACTERISTICS

|                               |       |                     |                           |   |     |     |   |
|-------------------------------|-------|---------------------|---------------------------|---|-----|-----|---|
| Instantaneous Forward Voltage | $V_F$ | $I_F = 30\text{ A}$ | $T_C = 25^\circ\text{C}$  | – | 2.1 | 2.4 | V |
|                               |       |                     | $T_C = 125^\circ\text{C}$ | – | 1.7 | 2.1 | V |

### DYNAMIC CHARACTERISTICS

|                      |       |                                       |   |     |   |    |
|----------------------|-------|---------------------------------------|---|-----|---|----|
| Junction Capacitance | $C_J$ | $V_R = 10\text{ V}, I_F = 0\text{ A}$ | – | 120 | – | pF |
|----------------------|-------|---------------------------------------|---|-----|---|----|

### SWITCHING CHARACTERISTICS

|                               |           |                                                                                                                      |   |      |    |                  |
|-------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------|---|------|----|------------------|
| Reverse Recovery Time         | $t_{rr}$  | $I_F = 1\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$                                              | – | 27   | 35 | ns               |
|                               |           | $I_F = 30\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$                                             | – | 36   | 45 | ns               |
| Reverse Recovery Time         | $t_{rr}$  | $I_F = 30\text{ A},$<br>$di_F/dt = 200\text{ A}/\mu\text{s},$<br>$V_R = 390\text{ V},$<br>$T_C = 25^\circ\text{C}$   | – | 36   | –  | ns               |
| Reverse Recovery Current      | $I_{rr}$  |                                                                                                                      | – | 2.9  | –  | A                |
| Reverse Recovered Charge      | $Q_{rr}$  |                                                                                                                      | – | 55   | –  | nC               |
| Reverse Recovery Time         | $t_{rr}$  |                                                                                                                      | – | 110  | –  | ns               |
| Softness Factor ( $t_b/t_a$ ) | S         | $I_F = 30\text{ A},$<br>$di_F/dt = 200\text{ A}/\mu\text{s},$<br>$V_R = 390\text{ V},$<br>$T_C = 125^\circ\text{C}$  | – | 1.9  | –  |                  |
| Reverse Recovery Current      | $I_{rr}$  |                                                                                                                      | – | 6    | –  | A                |
| Reverse Recovered Charge      | $Q_{rr}$  |                                                                                                                      | – | 450  | –  | nC               |
| Reverse Recovery Time         | $t_{rr}$  |                                                                                                                      | – | 60   | –  | ns               |
| Softness Factor ( $t_b/t_a$ ) | S         | $I_F = 30\text{ A},$<br>$di_F/dt = 1000\text{ A}/\mu\text{s},$<br>$V_R = 390\text{ V},$<br>$T_C = 125^\circ\text{C}$ | – | 1.25 | –  |                  |
| Reverse Recovery Current      | $I_{rr}$  |                                                                                                                      | – | 21   | –  | A                |
| Reverse Recovered Charge      | $Q_{rr}$  |                                                                                                                      | – | 730  | –  | nC               |
| Maximum $di/dt$ During $t_b$  | $di_M/dt$ |                                                                                                                      | – | 800  | –  | A/ $\mu\text{s}$ |

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

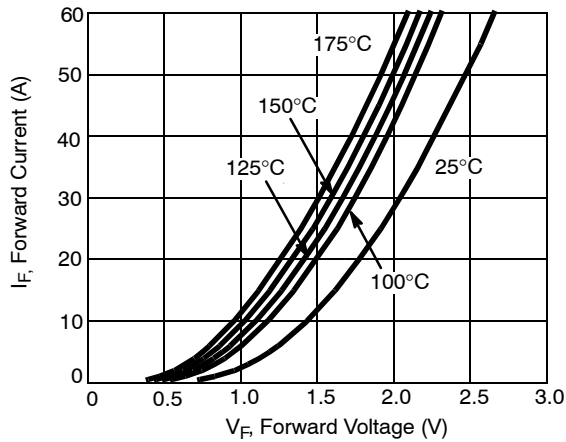


Figure 1. Forward Current vs. Forward Voltage

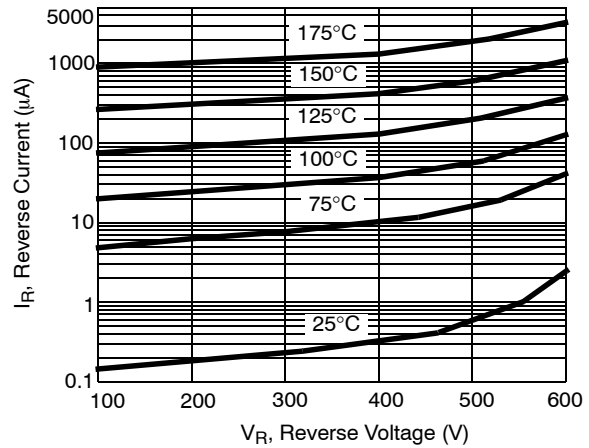


Figure 2. Reverse Current vs. Reverse Voltage

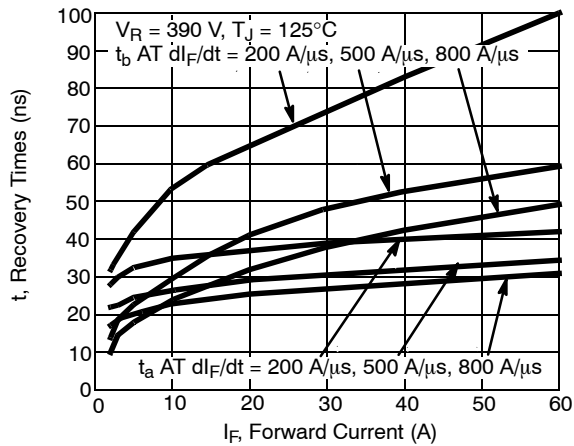


Figure 3.  $t_a$  and  $t_b$  Curves vs. Forward Current

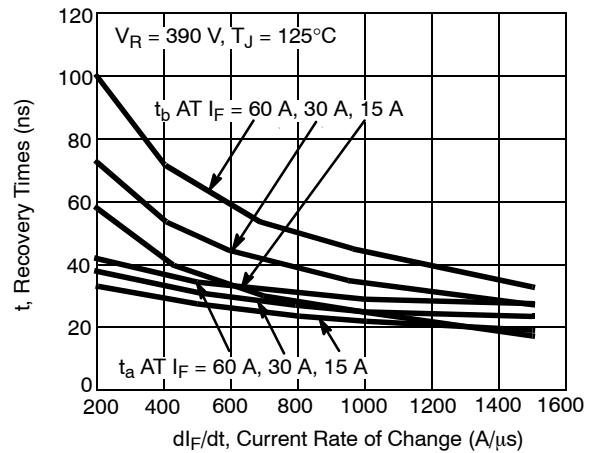


Figure 4.  $t_a$  and  $t_b$  Curves vs.  $dl_F/dt$

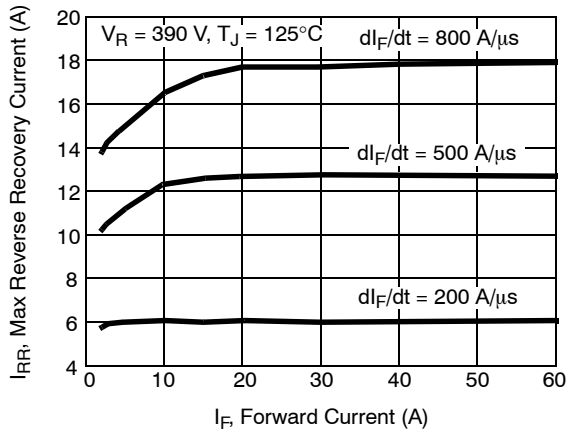


Figure 5. Maximum Reverse Recovery Current vs. Forward Current

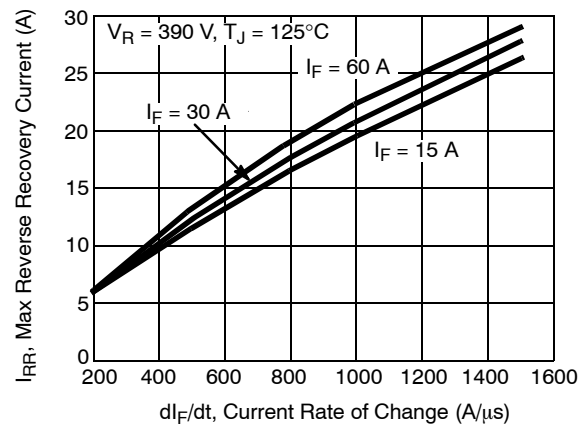


Figure 6. Maximum Reverse Recovery Current vs.  $dl_F/dt$

TYPICAL PERFORMANCE CURVES (continued)

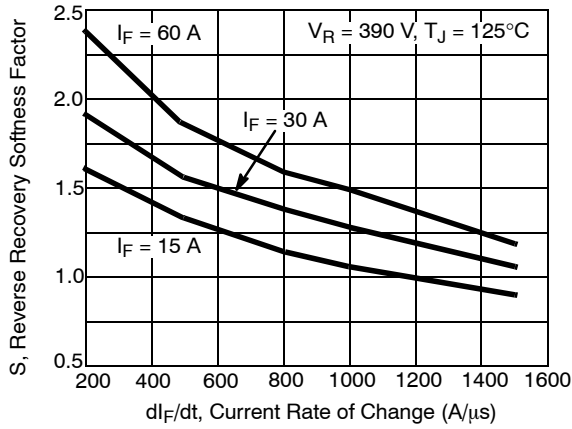


Figure 7. Reverse Recovery Softness Factor vs.  $dI_F/dt$

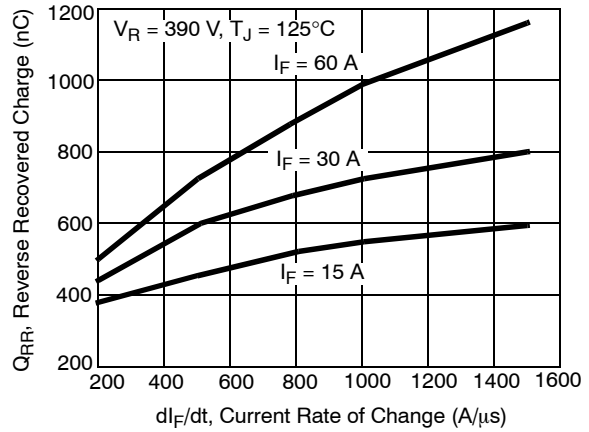


Figure 8. Reverse Recovered Charge vs.  $dI_F/dt$

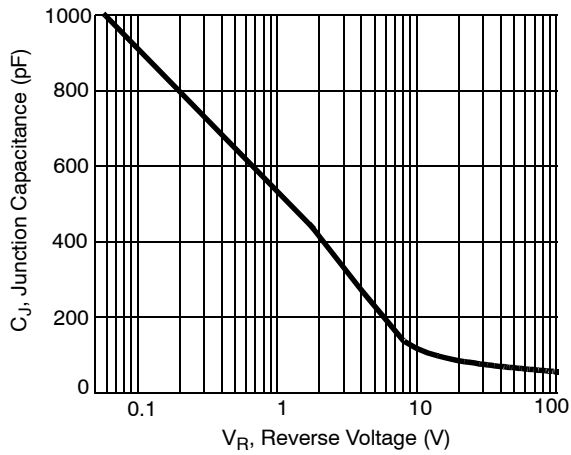


Figure 9. Junction Capacitance vs. Reverse Voltage

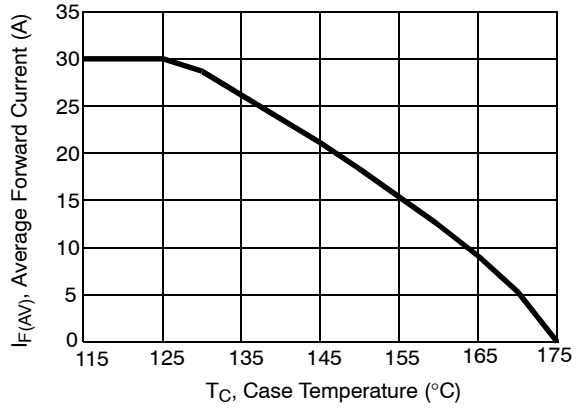


Figure 10. DC Current Derating Curve

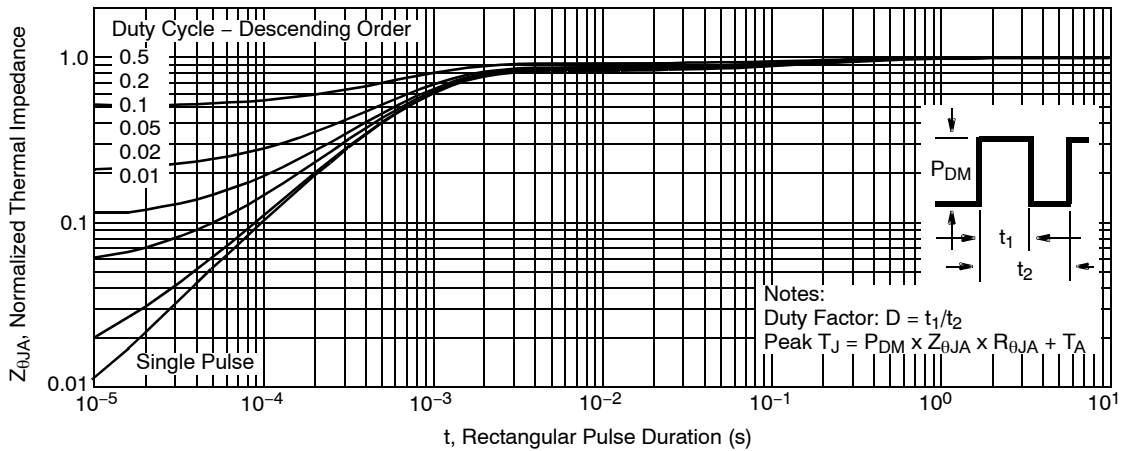


Figure 11. Normalized Maximum Transient Thermal Impedance

TEST CIRCUIT AND WAVEFORMS

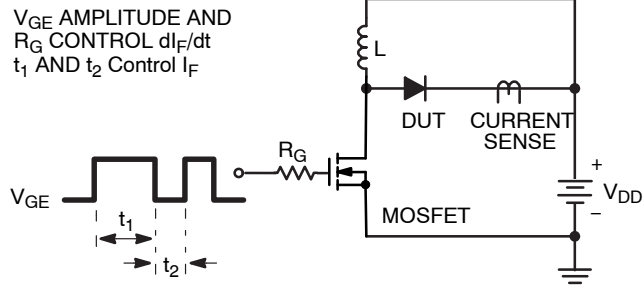


Figure 12.  $t_{rr}$  Test Circuit

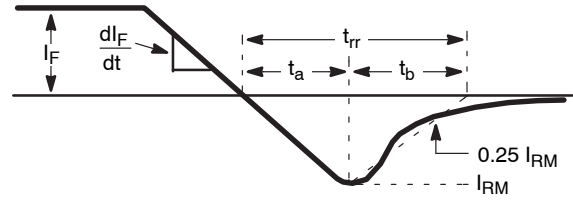


Figure 13.  $t_{rr}$  Waveforms and Definitions

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

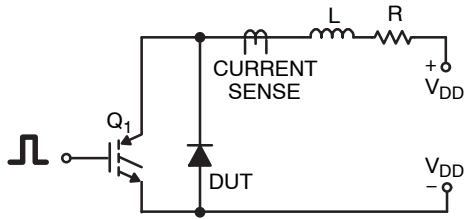


Figure 14. Avalanche Energy Test Circuit

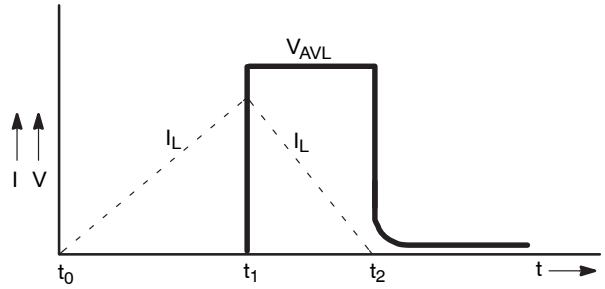
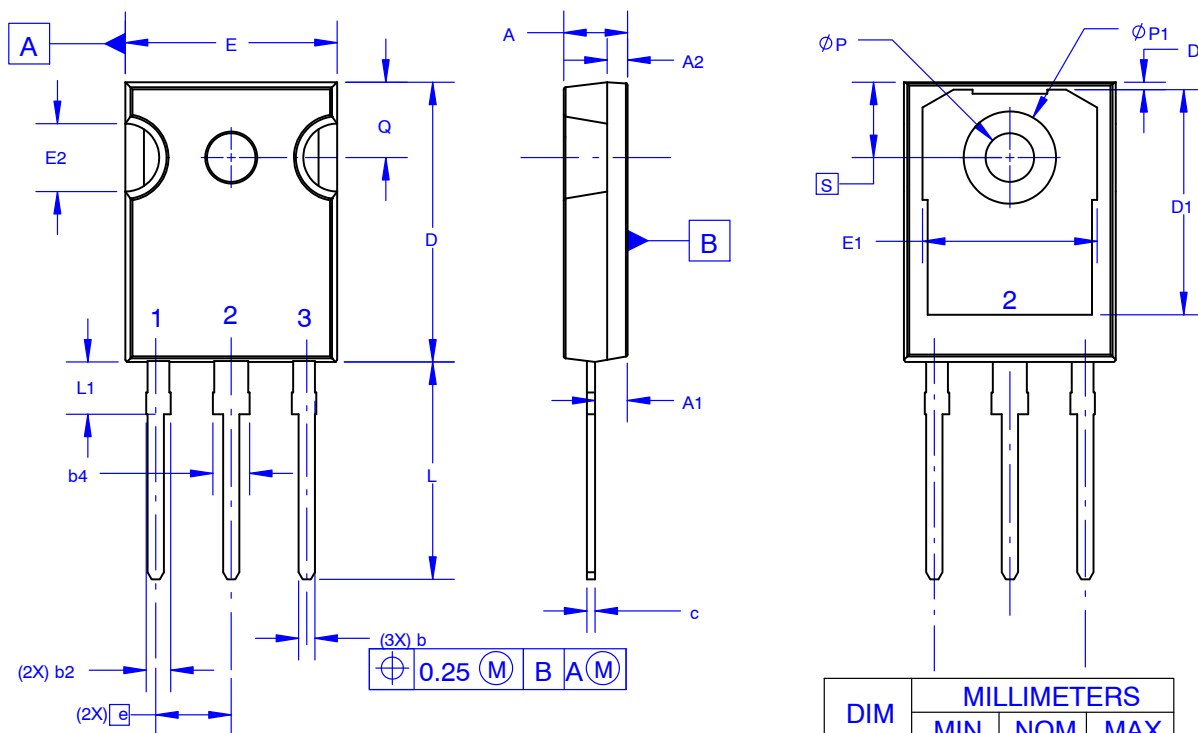


Figure 15. Avalanche Current and Voltage Waveforms

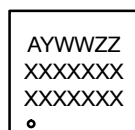
**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

DATE 31 JAN 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.

**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.

| DIM       | MILLIMETERS |       |       |
|-----------|-------------|-------|-------|
|           | MIN         | NOM   | MAX   |
| A         | 4.58        | 4.70  | 4.82  |
| A1        | 2.20        | 2.40  | 2.60  |
| A2        | 1.40        | 1.50  | 1.60  |
| b         | 1.17        | 1.26  | 1.35  |
| b2        | 1.53        | 1.65  | 1.77  |
| b4        | 2.42        | 2.54  | 2.66  |
| c         | 0.51        | 0.61  | 0.71  |
| D         | 20.32       | 20.57 | 20.82 |
| D1        | 13.08       | ~     | ~     |
| 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         | ~           | 5.56  | ~     |
| L         | 15.75       | 16.00 | 16.25 |
| L1        | 3.69        | 3.81  | 3.93  |
| $\phi P$  | 3.51        | 3.58  | 3.65  |
| $\phi P1$ | 6.60        | 6.80  | 7.00  |
| Q         | 5.34        | 5.46  | 5.58  |
| S         | 5.34        | 5.46  | 5.58  |

|                         |                              |                                                                                                                                                                                     |
|-------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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