

MOSFET - SiC Power, Single N-Channel

1200 V, 80 mΩ, 31 A

NTHL080N120SC1

Features

- Typ. $R_{DS(on)} = 80 \text{ m}\Omega$
- Ultra Low Gate Charge (typ. $Q_{G(tot)} = 56 \text{ nC}$)
- Low Effective Output Capacitance (typ. $C_{oss} = 80 \text{ pF}$)
- 100% UIL Tested
- These Devices are RoHS Compliant

Typical Applications

- UPS
- DC/DC Converter
- Boost Inverter

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit | |
|--|---|-------------|------------------|---|
| Drain-to-Source Voltage | V_{DSS} | 1200 | V | |
| Gate-to-Source Voltage | V_{GS} | -15/+25 | V | |
| Recommended Operation Values of Gate-to-Source Voltage | $T_C < 175^\circ\text{C}$ V_{GSop} | -5/+20 | V | |
| Continuous Drain Current $R_{\theta JC}$ | Steady State $T_C = 25^\circ\text{C}$ | I_D | 31 | A |
| | | P_D | 178 | W |
| Continuous Drain Current $R_{\theta JC}$ | Steady State $T_C = 100^\circ\text{C}$ | I_D | 22 | A |
| | | P_D | 89 | W |
| Pulsed Drain Current (Note 2) | $T_A = 25^\circ\text{C}$ | I_{DM} | 132 | A |
| Single Pulse Surge Drain Current Capability | $T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$, $R_G = 4.7 \Omega$ | I_{DSC} | 132 | A |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +175 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | I_S | 18 | A | |
| Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 18.5 \text{ A}$, $L = 1 \text{ mH}$) (Note 3) | E_{AS} | 171 | mJ | |

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.

THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|------------------------------|-----------------|-------|--------------------|
| Junction-to-Case (Note 1) | $R_{\theta JC}$ | 0.84 | $^\circ\text{C/W}$ |
| Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 40 | $^\circ\text{C/W}$ |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Repetitive rating, limited by max junction temperature.
3. E_{AS} of 171 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 18.5 \text{ A}$, $V_{DD} = 120 \text{ V}$, $V_{GS} = 18 \text{ V}$.

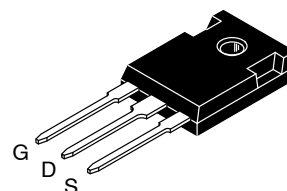
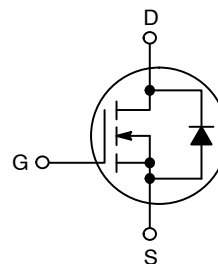


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| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|------------------|-----------|
| 1200 V | 110 mΩ @ 20 V | 31 A |

N-CHANNEL MOSFET



TO-247-3LD
CASE 340CX

MARKING DIAGRAM



\$Y = ON Semiconductor Logo
 &Z = Assembly Plant Code
 &3 = Data Code (Year & Week)
 &K = Lot
 NTHL080N120SC1 = Specific Device Code

ORDERING INFORMATION

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

NTHL080N120SC1

ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----------------|-----|-----|-----|------|
|-----------|--------|-----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|---|-------------------|--|------|-----|---------|----------------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | 1200 | - | - | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 1\text{ mA}$, referenced to 25°C | - | 700 | - | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_J = 25^\circ\text{C}$ | - | - | 100 | μA |
| | | $V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_J = 175^\circ\text{C}$ | - | - | 1 | mA |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{GS} = +25/-15\text{ V}, V_{DS} = 0\text{ V}$ | - | - | ± 1 | μA |

ON CHARACTERISTICS

| | | | | | | |
|-------------------------------|--------------|--|-----|-----|-----|------------|
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 5\text{ mA}$ | 1.8 | 2.7 | 4.3 | V |
| Recommended Gate Voltage | V_{GOP} | | -5 | - | +20 | V |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$ | - | 80 | 110 | m Ω |
| | | $V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 150^\circ\text{C}$ | - | 114 | - | |
| Forward Transconductance | g_{FS} | $V_{DS} = 20\text{ V}, I_D = 20\text{ A}$ | - | 13 | - | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|---|---|------|---|----------|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 800\text{ V}$ | - | 1112 | - | pF |
| Output Capacitance | C_{OSS} | | - | 80 | - | |
| Reverse Transfer Capacitance | C_{RSS} | | - | 6.5 | - | |
| Total Gate Charge | $Q_{G(tot)}$ | $V_{GS} = -5/20\text{ V}, V_{DS} = 600\text{ V}, I_D = 20\text{ A}$ | - | 56 | - | nC |
| Gate-to-Source Charge | Q_{GS} | | - | 11 | - | |
| Gate-to-Drain Charge | Q_{GD} | | - | 12 | - | |
| Gate Resistance | R_G | $f = 1\text{ MHz}$ | - | 1.7 | - | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|-------------------------|--------------|---|---|-----|---|---------------|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = -5/20\text{ V}, V_{DS} = 800\text{ V}, I_D = 20\text{ A}, R_G = 4.7\ \Omega,$ Inductive Load | - | 13 | - | ns |
| Rise Time | t_r | | - | 20 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 22 | - | |
| Fall Time | t_f | | - | 10 | - | |
| Turn-On Switching Loss | E_{ON} | | - | 258 | - | μJ |
| Turn-Off Switching Loss | E_{OFF} | | - | 52 | - | |
| Total Switching Loss | E_{TOT} | | - | 311 | - | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|---|-----------|---|---|----|-----|---------------|
| Continuous Drain-to-Source Diode Forward Current | I_{SD} | $V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ | - | - | 18 | A |
| Pulsed Drain-to-Source Diode Forward Current (Note 2) | I_{SDM} | $V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ | - | - | 132 | A |
| Forward Diode Voltage | V_{SD} | $V_{GS} = -5\text{ V}, I_{SD} = 10\text{ A}, T_J = 25^\circ\text{C}$ | - | 4 | - | V |
| Reverse Recovery Time | t_{RR} | $V_{GS} = -5/20\text{ V}, I_{SD} = 20\text{ A},$ $di_S/dt = 1000\text{ A}/\mu\text{s}$ | - | 16 | - | ns |
| Reverse Recovery Charge | Q_{RR} | | - | 62 | - | nC |
| Reverse Recovery Energy | E_{REC} | | - | 5 | - | μJ |
| Peak Reverse Recovery Current | I_{RRM} | | - | 8 | - | A |

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 CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

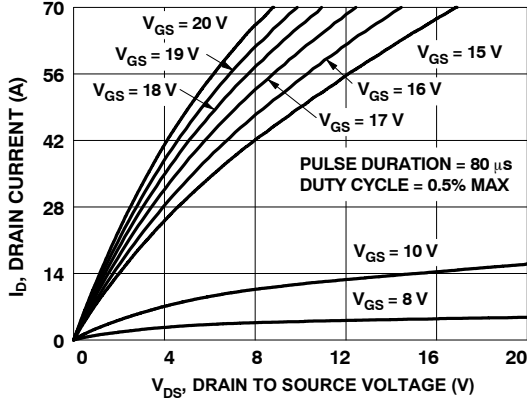


Figure 1. On Region Characteristics

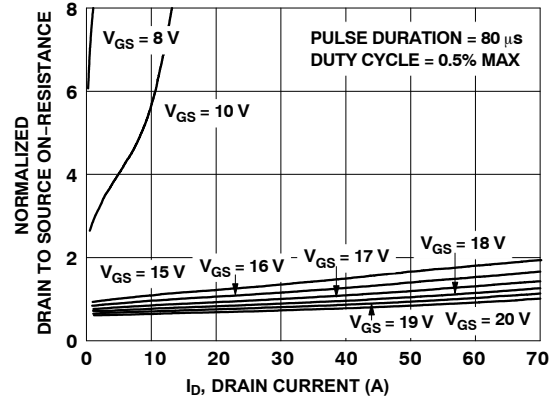


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

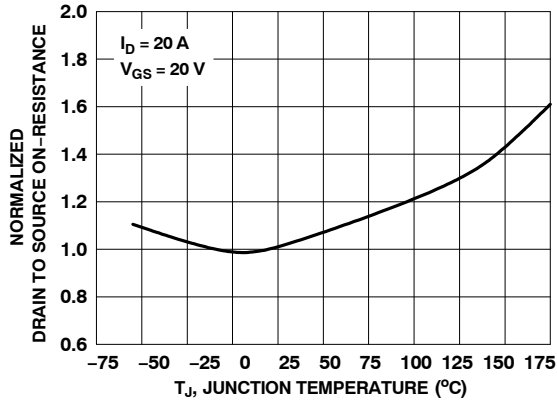


Figure 3. Normalized On Resistance vs. Junction Temperature

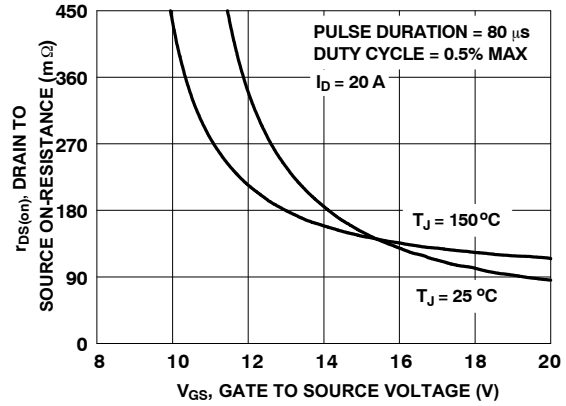


Figure 4. On-Resistance vs. Gate-to-Source Voltage

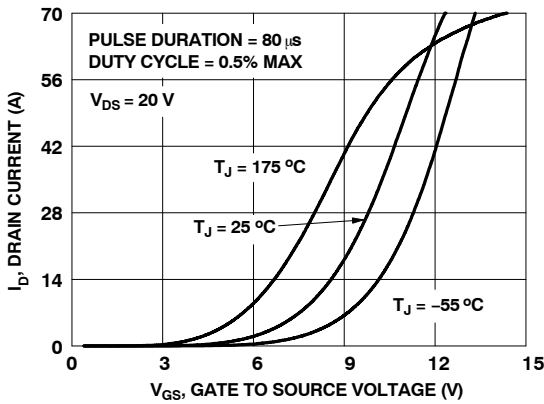


Figure 5. Transfer Characteristics

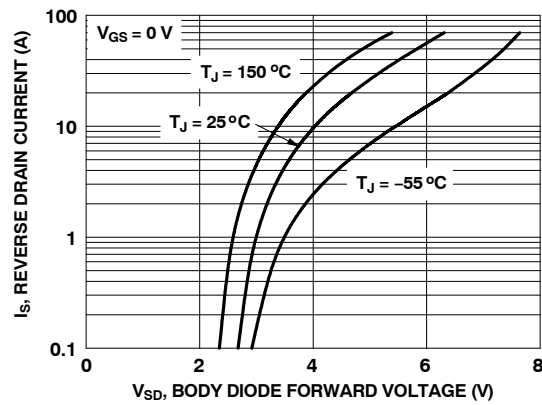


Figure 6. Source-to-Drain Diode Forward Voltage vs. Source Current

NTHL080N120SC1

TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

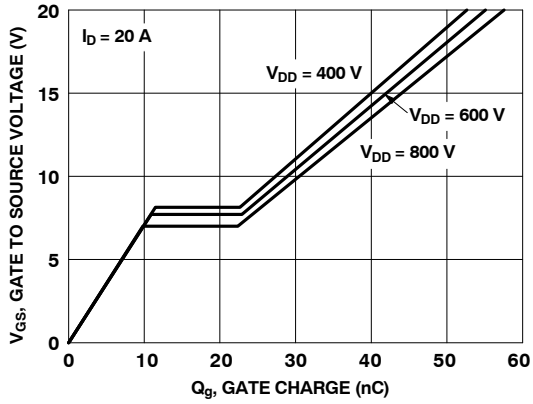


Figure 7. Gate Charge Characteristics

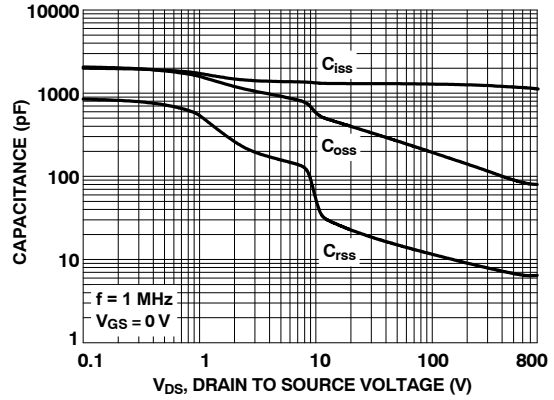


Figure 8. Capacitance vs. Drain-to-Source Voltage

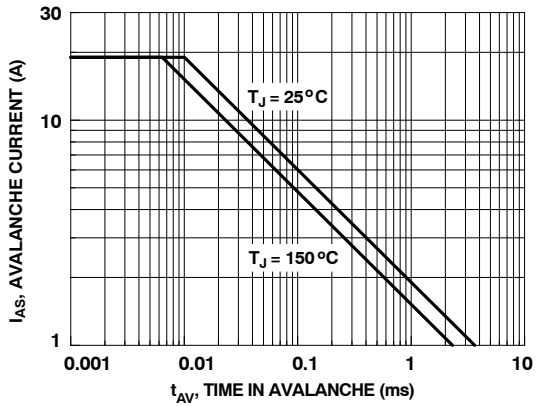


Figure 9. Unclamped Inductive Switching Capability

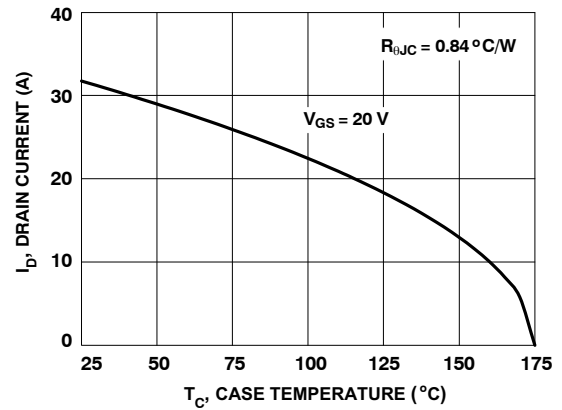


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

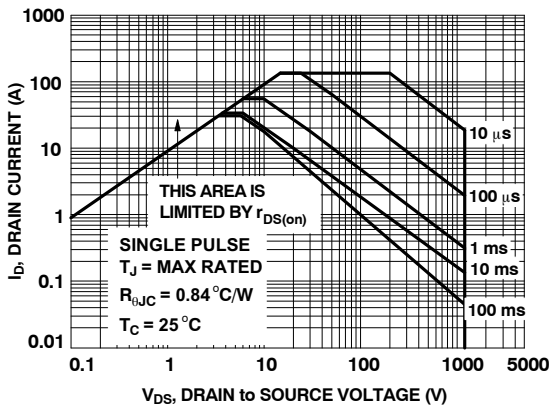


Figure 11. Forward Bias Safe Operating Area

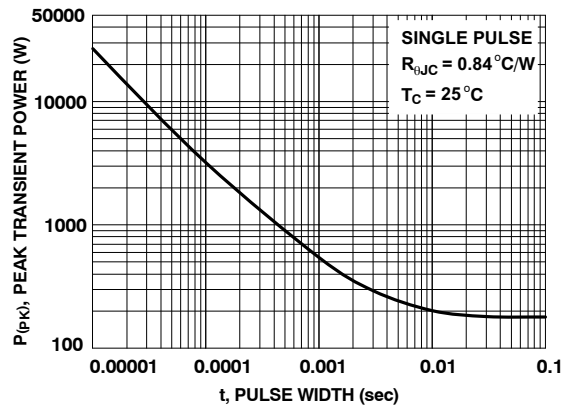


Figure 12. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted

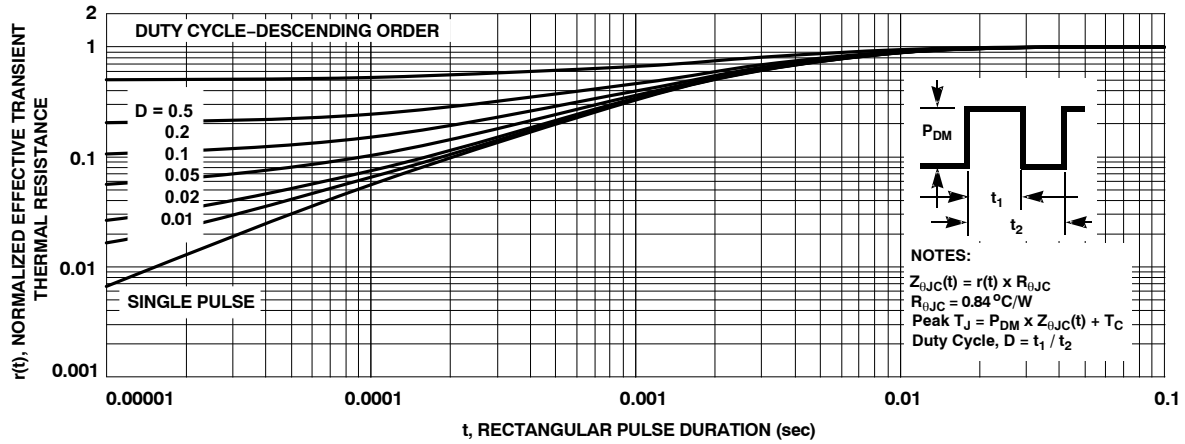


Figure 13. Junction-to-Case Transient Thermal Response Curve

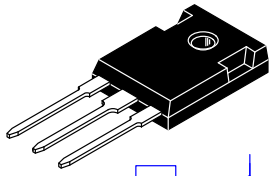
PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|----------------|----------------|------------------|----------------|-----------|------------|----------|
| NTHL080N120SC1 | NTHL080N120SC1 | TO-247 Long Lead | Tube | N/A | N/A | 30 Units |

MECHANICAL CASE OUTLINE

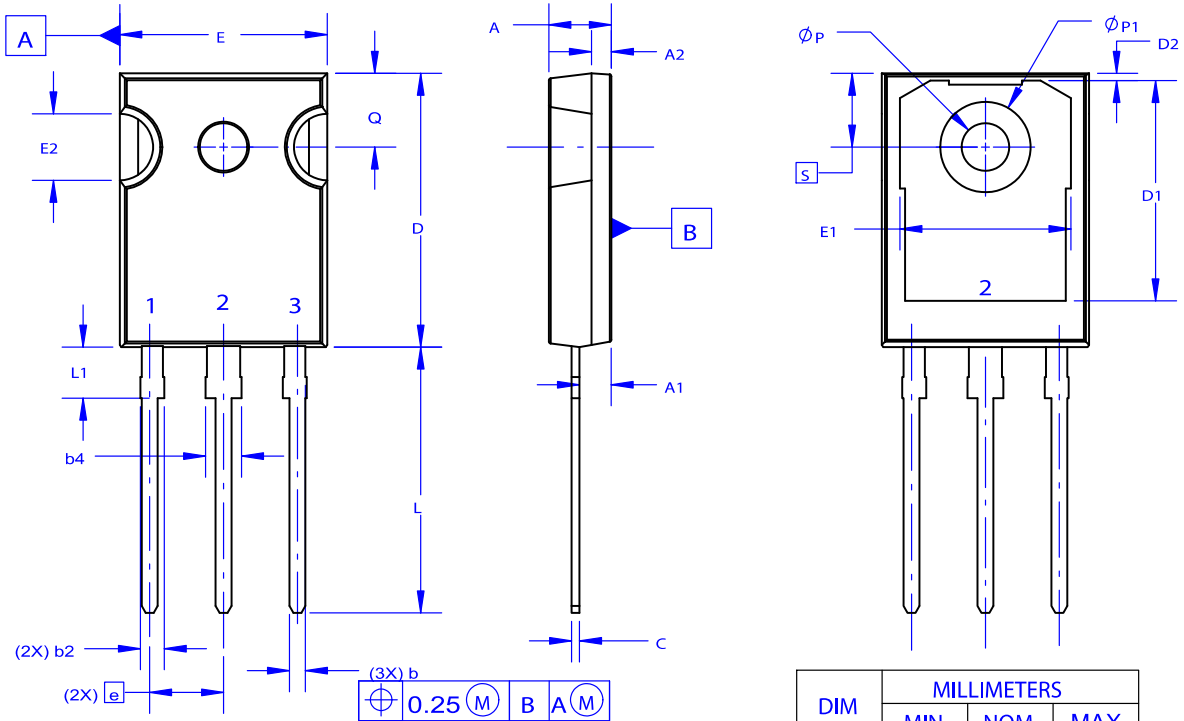
PACKAGE DIMENSIONS

ON Semiconductor®



TO-247-3LD
CASE 340CX
ISSUE O

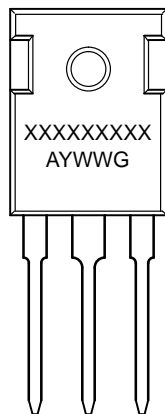
DATE 27 JUN 2018



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*



- XXXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*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 |
| D | 20.32 | 20.57 | 20.82 |
| E | 15.37 | 15.62 | 15.87 |
| E2 | 4.96 | 5.08 | 5.20 |
| e | ~ | 5.56 | ~ |
| L | 19.75 | 20.00 | 20.25 |
| L1 | 3.69 | 3.81 | 3.93 |
| φP | 3.51 | 3.58 | 3.65 |
| Q | 5.34 | 5.46 | 5.58 |
| S | 5.34 | 5.46 | 5.58 |
| 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 |
| D1 | 13.08 | ~ | ~ |
| D2 | 0.51 | 0.93 | 1.35 |
| E1 | 12.81 | ~ | ~ |
| φP1 | 6.60 | 6.80 | 7.00 |

| | | |
|------------------|-------------|--|
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| DESCRIPTION: | TO-247-3LD | PAGE 1 OF 1 |

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