

MOSFET - Power, DUAL COOL[®] N-Channel, DFN8 5x6

60 V, 1.5 mΩ, 235 A NTMFSC1D6N06CL

Features

- Advanced Dual-sided Cooled Packaging
- Ultra Low R_{DS(on)}
- MSL1 Robust Packaging Design

Typical Applications

- Orring FET/Load Switching
- Synchronous Rectifier
- DC-DC Conversion

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|--|---|-----------------------------------|----------------|-------|
| Drain-to-Source Voltage | | V _{DSS} | 60 | V |
| Gate-to-Source Voltage | | V _{GS} | ±20 | V |
| Continuous Drain Current R _{θJC} (Note 2) | Steady State | T _C = 25°C | I _D | 235 A |
| | | | P _D | 166 W |
| Continuous Drain Current R _{θJA} (Notes 1, 2) | Steady State | T _A = 25°C | I _D | 36 A |
| | | | P _D | 3.8 W |
| Pulsed Drain Current | T _A = 25°C, t _p = 10 μs | I _{DM} | 900 | A |
| Operating Junction and Storage Temperature Range | | T _J , T _{stg} | -55 to +175 | °C |
| Source Current (Body Diode) | | I _S | 164 | A |
| Single Pulse Drain-to-Source Avalanche Energy (I _{L(pk)} = 17 A) | | E _{AS} | 451 | mJ |
| Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s) | | T _L | 300 | °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.

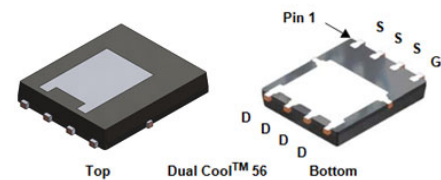
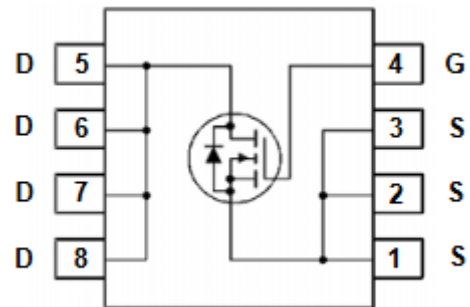
THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|--|------------------|-------|------|
| Junction-to-Case - Steady State (Note 2) | R _{θJC} | 0.9 | °C/W |
| Junction-to-Top Source - Steady State (Note 2) | R _{θJC} | 1.4 | |
| Junction-to-Ambient - Steady State (Note 2) | R _{θJA} | 39 | |

1. Surface-mounted on FR4 board using a 1 in² pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

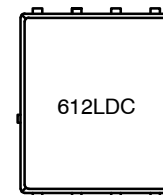
| V _{(BR)DSS} | R _{DS(ON) MAX} | I _{D MAX} |
|----------------------|-------------------------|--------------------|
| 60 V | 1.5 mΩ @ 10 V | 235 A |
| | 2.3 mΩ @ 4.5 V | |

N-Channel MOSFET



DFN8 5x6
CASE 506EG

MARKING DIAGRAM



612LDC = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

NTMFSC1D6N06CL

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

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

OFF CHARACTERISTICS

| | | | | | | |
|---|-------------------|--|---------------------------|------|-----|----------------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 60 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 250\ \mu\text{A}$, ref to 25°C | | 12.7 | | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 10 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 100 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$ | | | 100 | nA |

ON CHARACTERISTICS (Note 3)

| | | | | | | |
|--|------------------|--|-----|------|-----|----------------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 1.2 | | 2.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | $I_D = 250\ \mu\text{A}$, ref to 25°C | | -5.8 | | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 50\text{ A}$ | | 1.25 | 1.5 | $\text{m}\Omega$ |
| | | $V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$ | | 1.65 | 2.3 | |
| Gate-Resistance | R_G | $T_A = 25^\circ\text{C}$ | | 2 | | Ω |

CHARGES & CAPACITANCES

| | | | | | | |
|------------------------------|--------------|--|--|------|--|-------------|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$ | | 6660 | | pF |
| Output Capacitance | C_{OSS} | | | 3000 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 45 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$ | | 41 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | | | 91 | | |
| Gate-to-Source Charge | Q_{GS} | | | 17 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 9 | | |
| Plateau Voltage | V_{GP} | | | 2.9 | | |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|--------------|--|--|------|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 50\text{ A}, R_G = 1\ \Omega$ | | 14.5 | | ns |
| Rise Time | t_r | | | 55.6 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 47.5 | | |
| Fall Time | t_f | | | 14.1 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|--|---------------------------|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 50\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.78 | 1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.66 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$ | | | 76 | | ns |
| Reverse Recovery Charge | Q_{RR} | | | | 130 | | nC |

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.

3. Switching characteristics are independent of operating junction temperatures.

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TYPICAL CHARACTERISTICS

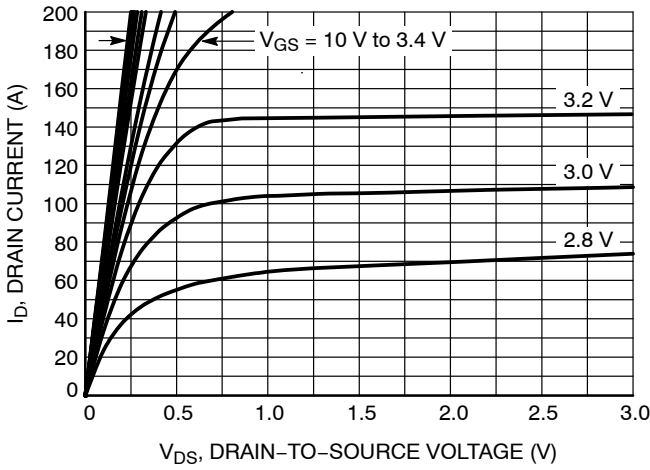


Figure 1. On-Region Characteristics



Figure 2. Transfer Characteristics

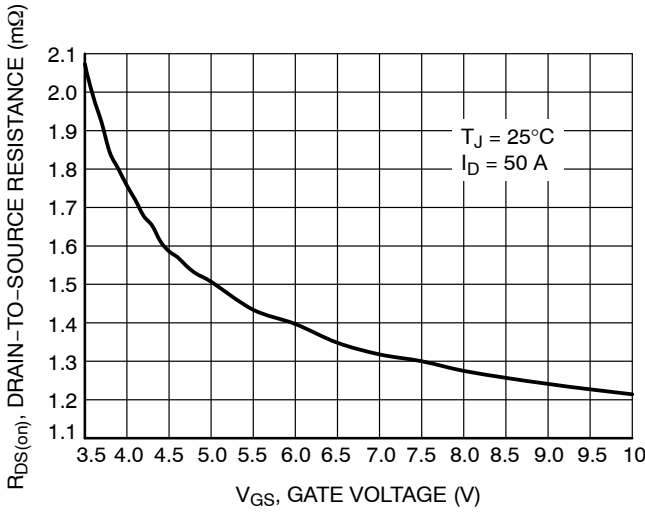


Figure 3. On-Resistance vs. Gate-to-Source Voltage

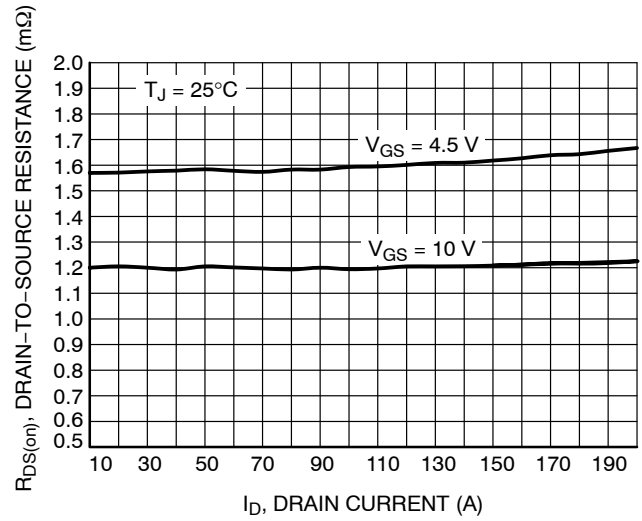


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

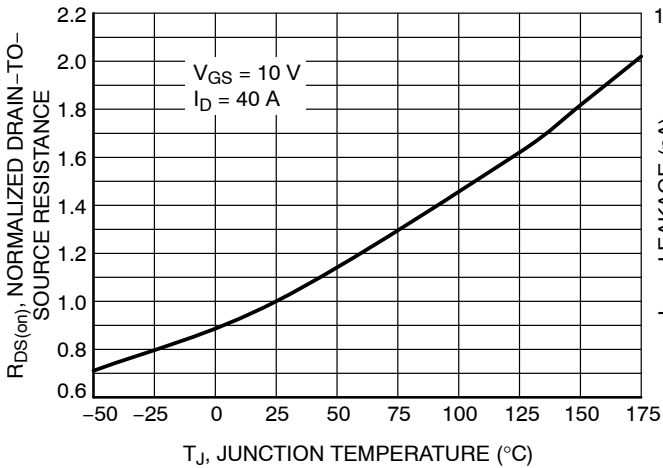


Figure 5. On-Resistance Variation with Temperature

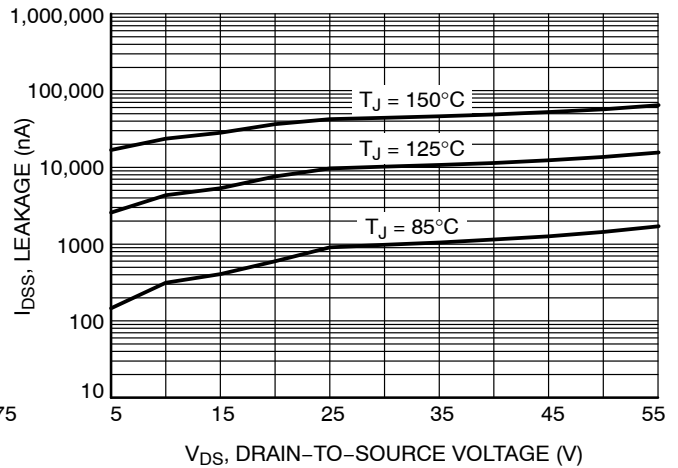


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL CHARACTERISTICS



Figure 7. Capacitance Variation

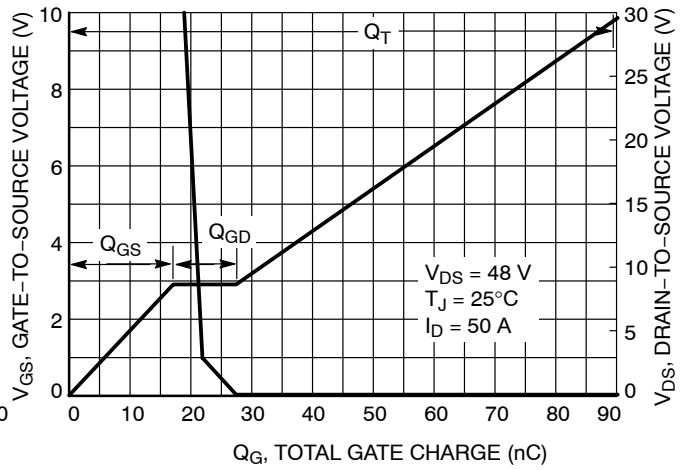


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

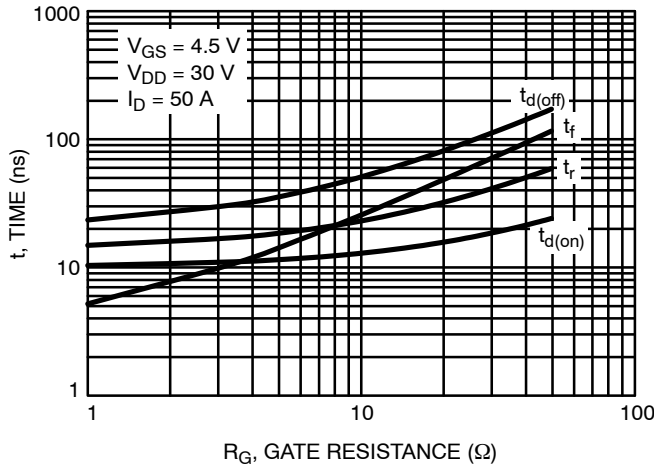


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

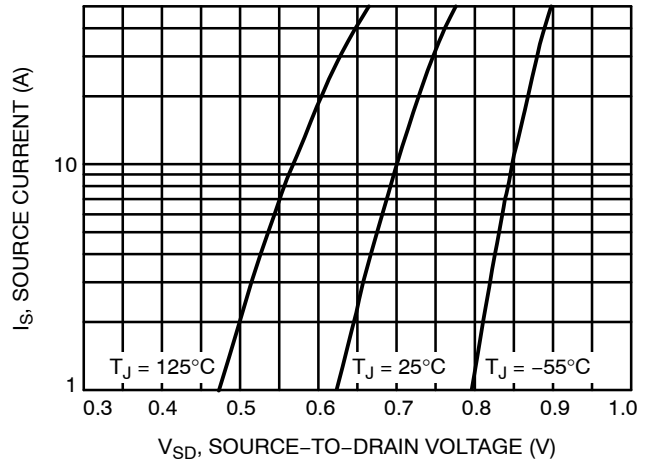


Figure 10. Diode Forward Voltage vs. Current

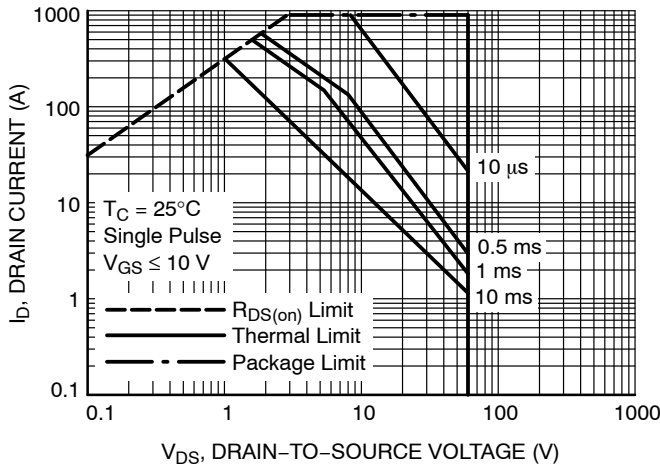


Figure 11. Safe Operating Area

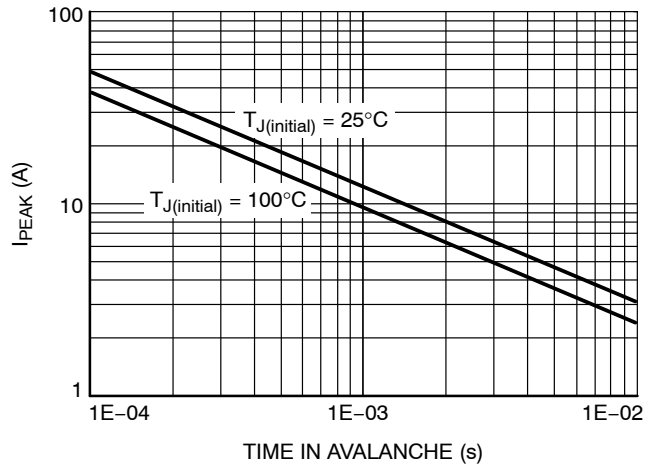


Figure 12. I_{PEAK} vs. Time in Avalanche

NTMFSC1D6N06CL

TYPICAL CHARACTERISTICS

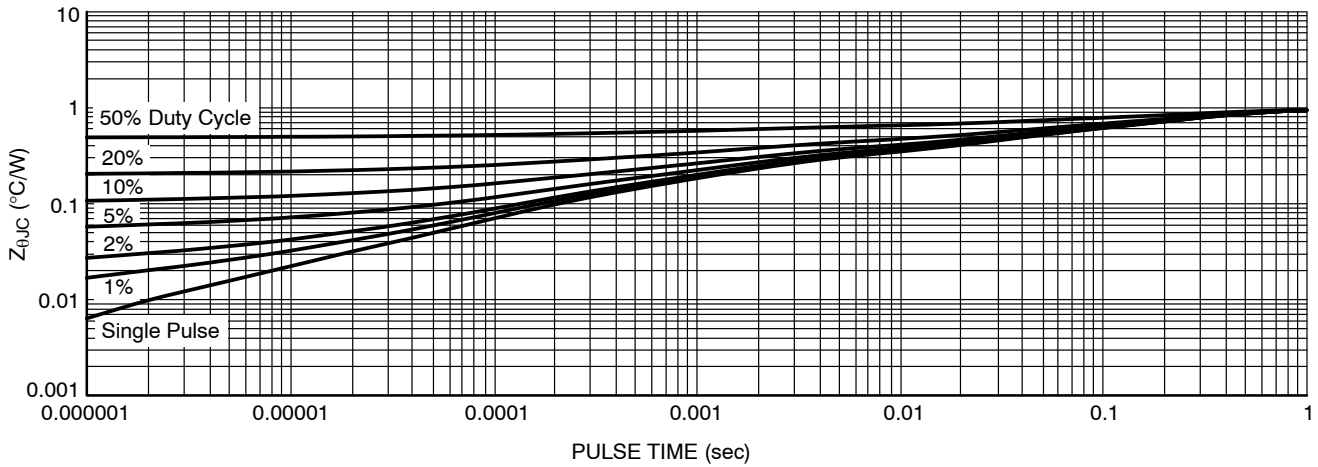


Figure 13. Thermal Characteristics

ORDERING INFORMATION

| Device | Device Marking | Package | Shipping [†] |
|----------------|----------------|------------------------------------|-----------------------|
| NTMFSC1D6N06CL | 612LDC | DFN8 5x6 (Pb-Free/Halogen Free) | 3000 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®

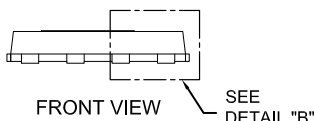


DFN8 5x6.15, 1.27P, DUAL COOL CASE 506EG ISSUE D

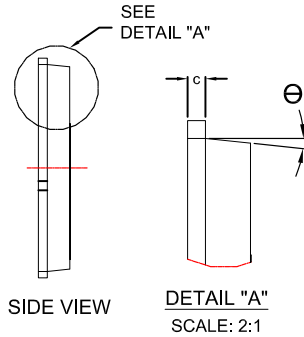
DATE 25 AUG 2020



TOP VIEW



FRONT VIEW

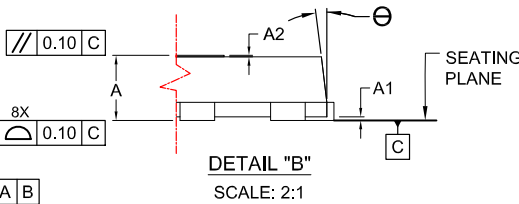


SIDE VIEW

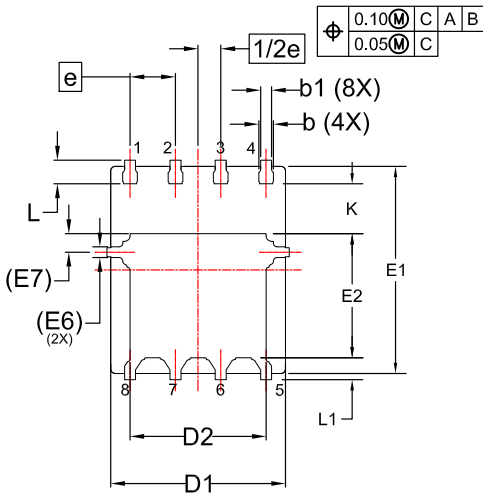
DETAIL "A"
SCALE: 2:1

NOTES:

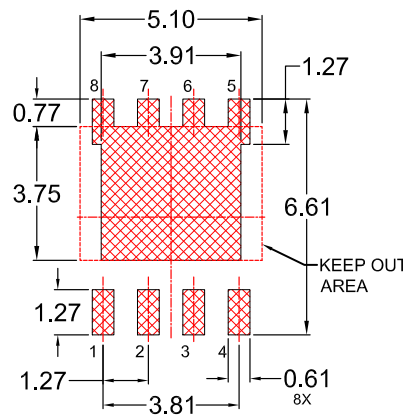
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



DETAIL "B"
SCALE: 2:1



BOTTOM VIEW

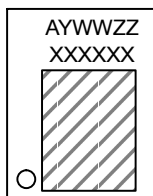


LAND PATTERN
RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| DIM | MILLIMETERS | | |
|------|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 0.85 | 0.90 | 0.95 |
| A1 | - | - | 0.05 |
| A2 | - | - | 0.05 |
| b | 0.31 | 0.41 | 0.51 |
| b1 | 0.21 | 0.31 | 0.41 |
| c | 0.20 | 0.25 | 0.30 |
| D | 4.90 | 5.00 | 5.10 |
| D1 | 4.80 | 4.90 | 5.00 |
| D2 | 3.67 | 3.82 | 3.97 |
| D3 | 2.60 REF | | |
| D4 | 0.86 REF | | |
| E | 6.05 | 6.15 | 6.25 |
| E1 | 5.70 | 5.80 | 5.90 |
| E2 | 3.38 | 3.48 | 3.58 |
| E3 | 3.30 REF | | |
| E4 | 0.50 REF | | |
| E5 | 0.34 REF | | |
| E6 | 0.30 REF | | |
| E7 | 0.52 REF | | |
| e | 1.27 BSC | | |
| 1/2e | 0.635 BSC | | |
| K | 1.30 | 1.40 | 1.50 |
| L | 0.56 | 0.66 | 0.76 |
| L1 | 0.52 | 0.62 | 0.72 |
| θ | 0° | --- | 12° |

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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| DESCRIPTION: | DFN8 5x6.15, 1.27P, DUAL COOL | PAGE 1 OF 1 |

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