

NTMFS4709N

Power MOSFET

30 V, 94 A, Single N-Channel, SOIC-8 FL

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These are Pb-Free Devices

Applications

- VCORE Applications
- DC-DC Converters
- Low Side Switching

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

| Rating | | Symbol | Value | Unit |
|---|--|----------------------|-------------|------------------|
| Drain-to-Source Voltage | | V_{DS} | 30 | V |
| Gate-to-Source Voltage | | V_{GS} | ± 20 | V |
| Continuous Drain Current $R_{\theta JA}$ (Note 1) | $T_A = 25^\circ\text{C}$ | I_D | 18 | A |
| | $T_A = 85^\circ\text{C}$ | | 13 | |
| Power Dissipation $R_{\theta JA}$ (Note 1) | $T_A = 25^\circ\text{C}$ | P_D | 2.35 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | $T_A = 25^\circ\text{C}$ | I_D | 11 | A |
| | $T_A = 85^\circ\text{C}$ | | 8.0 | |
| Power Dissipation $R_{\theta JA}$ (Note 2) | $T_A = 25^\circ\text{C}$ | P_D | 0.91 | W |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | $T_C = 25^\circ\text{C}$ | I_D | 94 | A |
| | $T_C = 85^\circ\text{C}$ | | 68 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | $T_C = 25^\circ\text{C}$ | P_D | 62.5 | W |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$ | I_{DM} | 140 | A |
| Current limited by package | $T_A = 25^\circ\text{C}$ | $I_{DmaxPkg}$ | 140 | A |
| Operating Junction and Storage Temperature | | T_J , T_{STG} | -55 to +150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | | I_S | 62.5 | A |
| Drain to Source | | dV/dt | 10 | V/ns |
| Single Pulse Drain-to-Source Avalanche Energy $T_J = 25^\circ\text{C}$, $V_{DD} = 50 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_L = 30 \text{ A}_{pk}$, $L = 1.0 \text{ mH}$, $R_G = 25 \Omega$ | | E_{AS} | 450 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T_L | 260 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

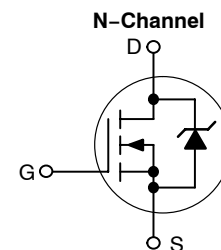
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



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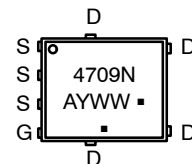
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ | I_D Max |
|---------------|------------------------|-----------|
| 30 V | 2.85 m Ω @ 10 V | 94 A |
| | 4.0 m Ω @ 4.5 V | |



SOIC-8 FLAT LEAD
CASE 488AA
STYLE 1

MARKING DIAGRAM & PIN ASSIGNMENT



4709N = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|---------------------|--------------------|
| NTMFS4709NT1G | SOIC-8 FL (Pb-Free) | 1500 / Tape & Reel |
| NTMFS4709NT3G | SOIC-8 FL (Pb-Free) | 5000 / 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.

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THERMAL RESISTANCE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 2.0 | °C/W |
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 53.2 | |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 137.8 | |

3. Surface-mounted on FR4 board using 1 sq in pad, 1 oz Cu.

4. Surface-mounted on FR4 board using the minimum recommended pad size.

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 | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 5.6 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 10 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 5)

| | | | | | | | |
|--|------------------|---|---------------------|-----|------|------------|-----|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 1.0 | | 3.0 | V | |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 5.6 | | mV/°C | |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 11.5\text{ V}$ | $I_D = 30\text{ A}$ | | 2.8 | m Ω | |
| | | | $I_D = 15\text{ A}$ | | 2.8 | | |
| | | $V_{GS} = 10\text{ V}$ | $I_D = 30\text{ A}$ | | 2.85 | | 3.6 |
| | | | $I_D = 15\text{ A}$ | | 4.0 | | 5.5 |
| Forward Transconductance | g_{FS} | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$ | | 41 | | S | |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|---|--|------|--|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 12\text{ V}$ | | 2370 | | pF |
| Output Capacitance | C_{OSS} | | | 1240 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 305 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 20 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 2.4 | | |
| Gate-to-Source Charge | Q_{GS} | | | 4.5 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 11 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 48 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 4.0 | | |
| Gate-to-Source Charge | Q_{GS} | | | 6.5 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 10.6 | | |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 30\text{ A}, R_G = 3.0\ \Omega$ | | 16 | | ns |
| Rise Time | t_r | | | 173 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 20 | | |
| Fall Time | t_f | | | 105 | | |

5. Pulse Test: pulse width $\pm 300\ \mu\text{s}$, duty cycle $\pm 2\%$

6. Switching characteristics are independent of operating junction temperatures.

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|--------------|---|-----|------|-----|------|
| SWITCHING CHARACTERISTICS (Note 6) | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 30\text{ A}, R_G = 3.0\ \Omega$ | | 8.5 | | ns |
| Rise Time | t_r | | | 87 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 31.5 | | |
| Fall Time | t_f | | | 8.5 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|--|---------------------------|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V},$ $I_S = 20\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.75 | 1.0 | V |
| | | $V_{GS} = 0\text{ V},$ $I_S = 50\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.85 | | |
| | | $V_{GS} = 0\text{ V},$ $I_S = 20\text{ A}$ | $T_J = 125^\circ\text{C}$ | | 0.7 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V},$ $dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 25\text{ A}$ | | | 48 | | ns |
| Charge Time | t_a | | | | 23 | | |
| Discharge Time | t_b | | | | 25 | | |
| Reverse Recovery Charge | Q_{RR} | | | | 55 | | |

Package Parasitic Values

| | | | | | | |
|-----------------|-------|--------------------------|--|------|--|----------|
| Gate Resistance | R_G | $T_A = 25^\circ\text{C}$ | | 0.65 | | Ω |
|-----------------|-------|--------------------------|--|------|--|----------|

- Pulse Test: pulse width $\pm 300\ \mu\text{s}$, duty cycle $\pm 2\%$
- Switching characteristics are independent of operating junction temperatures.

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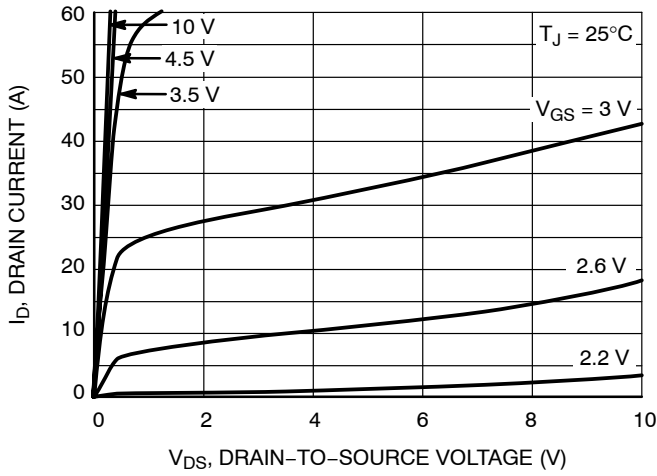


Figure 1. On-Region Characteristics

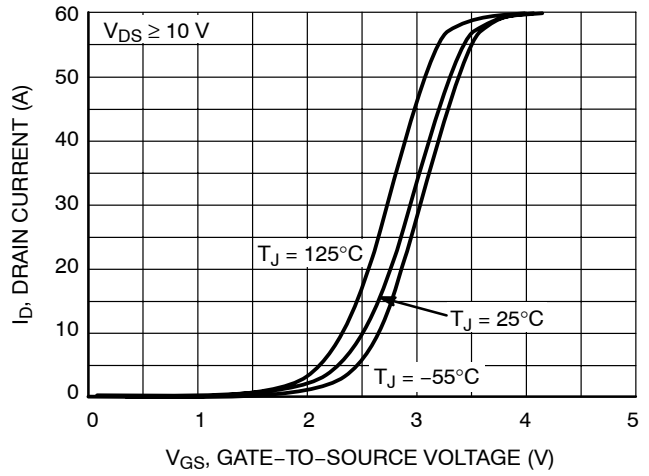


Figure 2. Transfer Characteristics

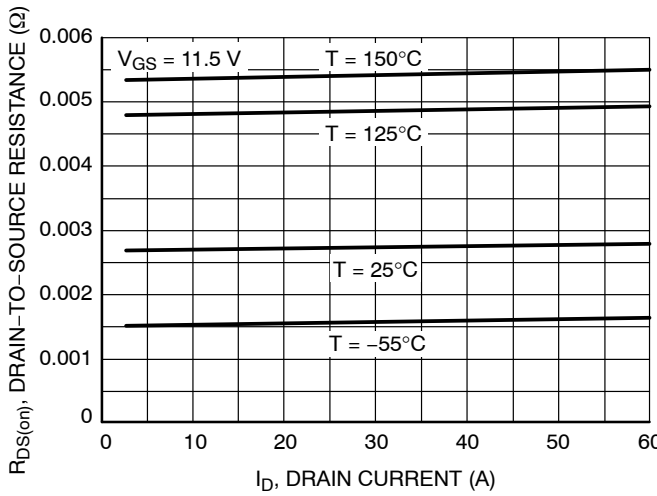


Figure 3. On-Resistance versus Drain Current and Temperature

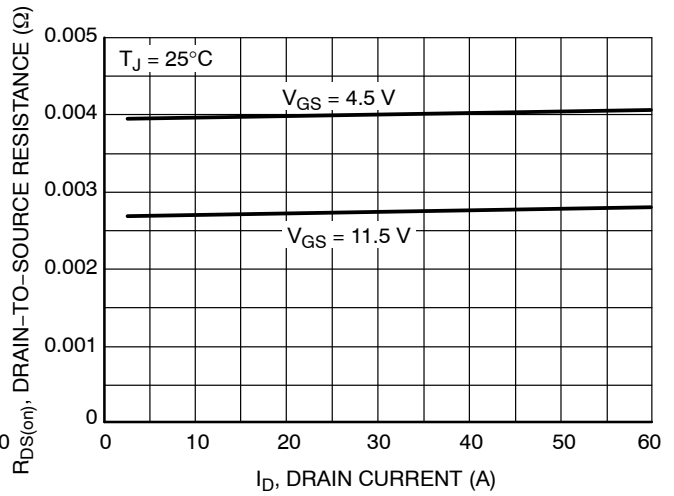


Figure 4. On-Resistance versus Drain Current and Gate Voltage

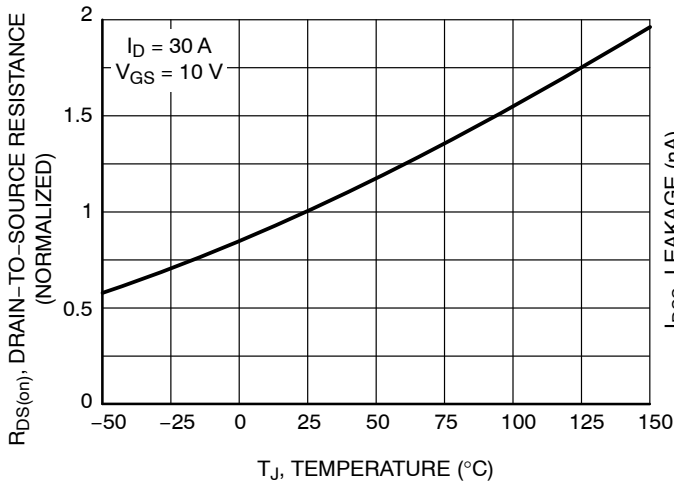


Figure 5. On-Resistance Variation with Temperature

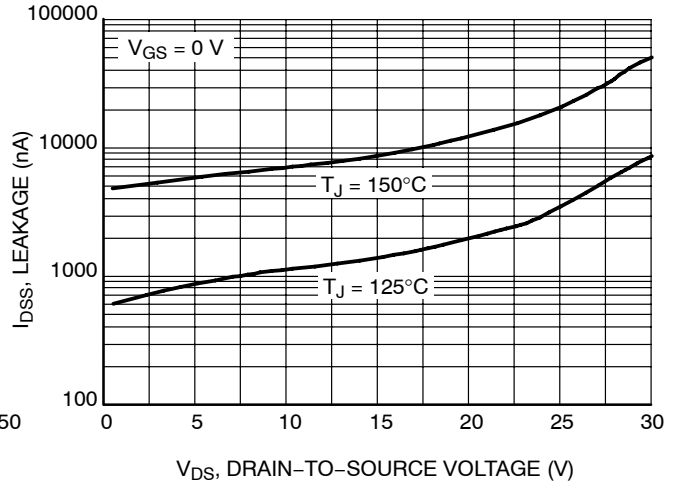
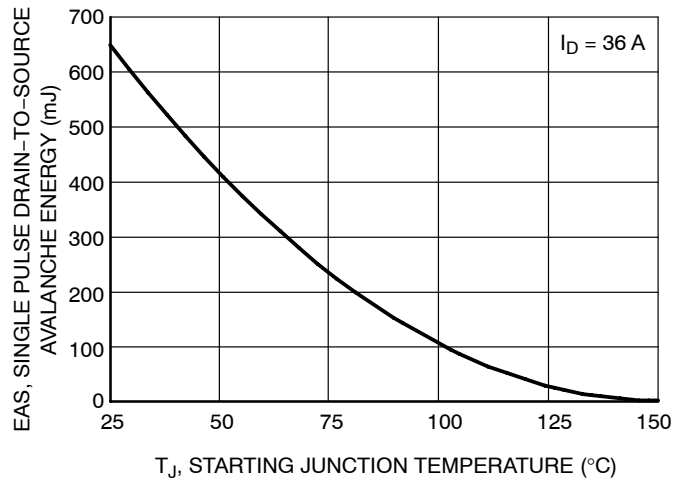
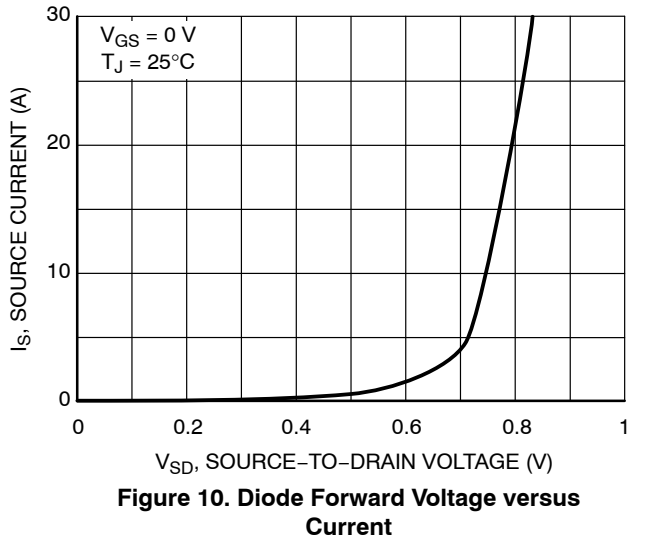
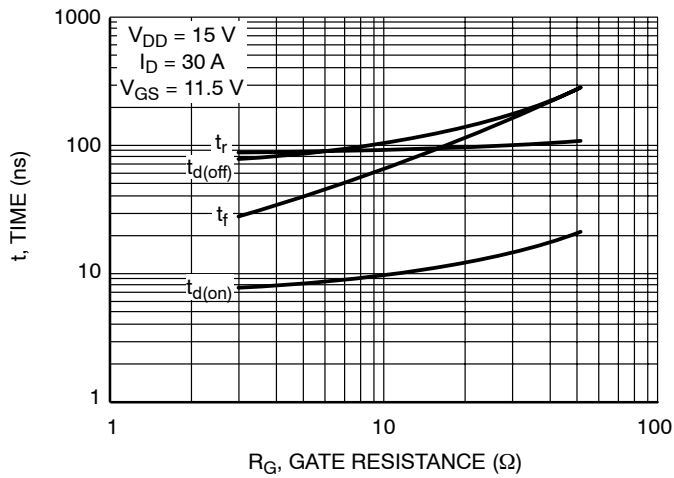
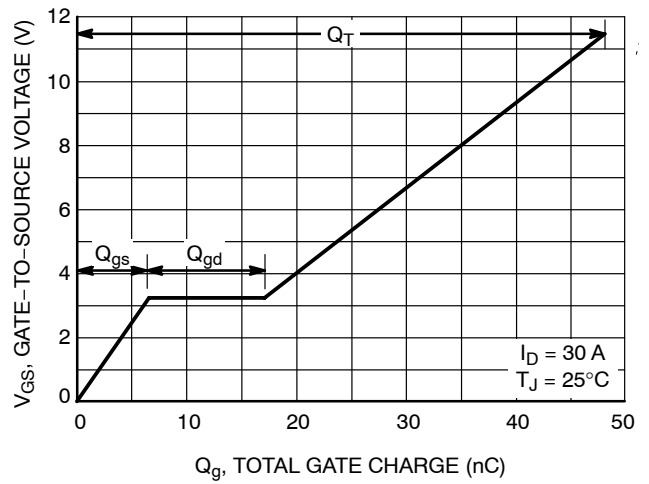
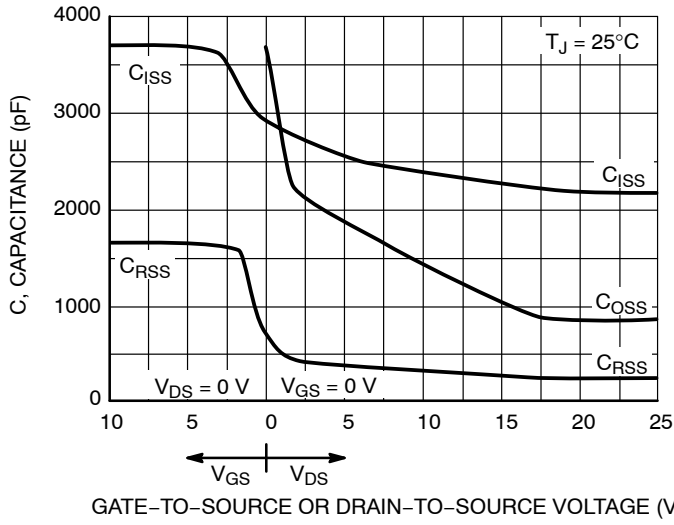


Figure 6. Drain-to-Source Leakage Current versus Voltage

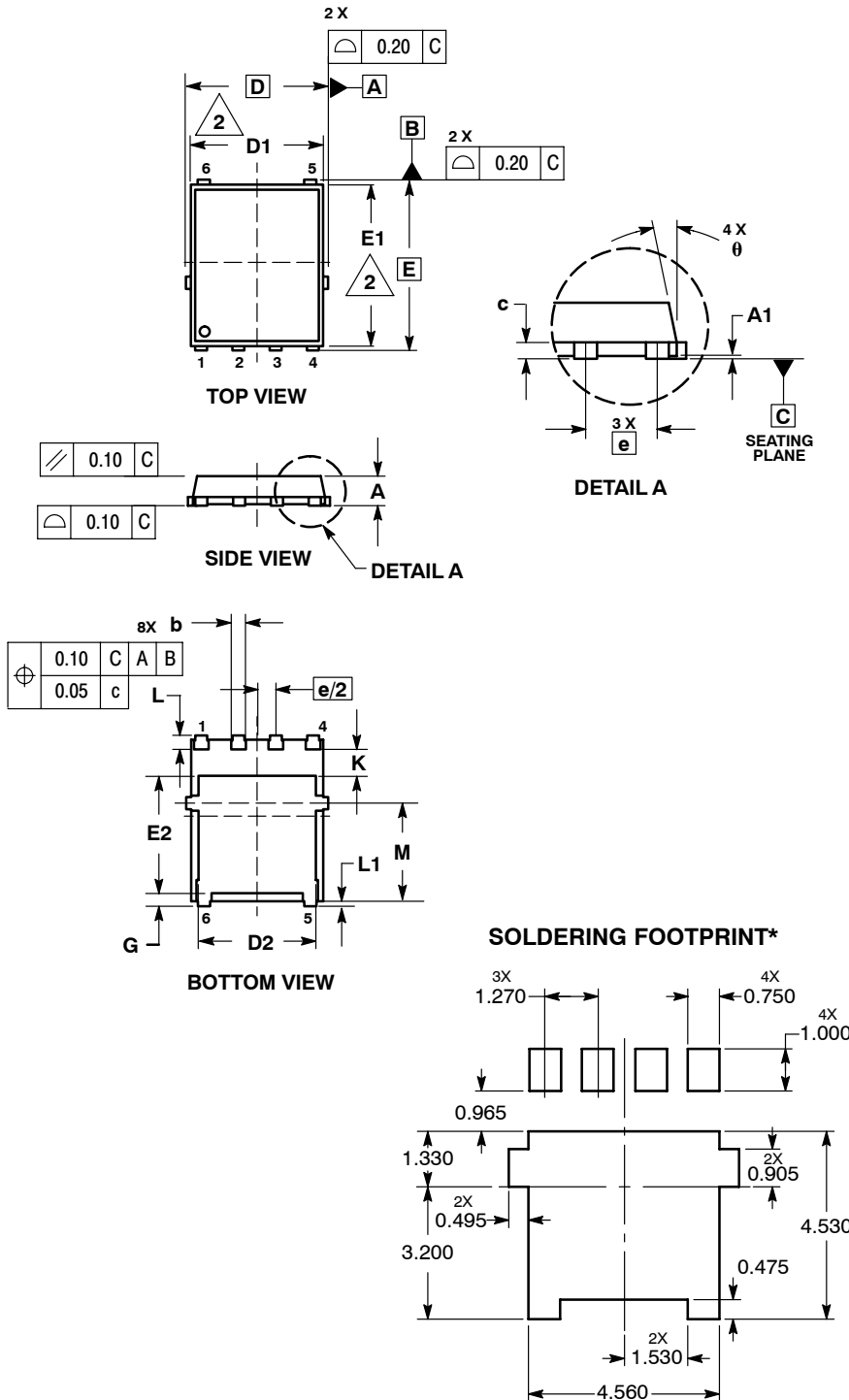
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PACKAGE DIMENSIONS

DFN6 5*6*1 1.27 PITCH
(SO8 FL)
CASE 488AA-01
ISSUE B



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.


| MILLIMETERS | | | |
|-------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.90 | 0.99 | 1.20 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.15 BSC | | |
| D1 | 4.50 | 4.90 | 5.10 |
| D2 | 3.50 | --- | 4.22 |
| E | 6.15 BSC | | |
| E1 | 5.50 | 5.80 | 6.10 |
| E2 | 3.45 | --- | 4.30 |
| e | 1.27 BSC | | |
| G | 0.51 | 0.61 | 0.71 |
| K | 0.51 | --- | --- |
| L | 0.51 | 0.61 | 0.71 |
| L1 | 0.05 | 0.17 | 0.20 |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0° | --- | 12° |

STYLE 1:

- PIN 1. SOURCE
- SOURCE
- SOURCE
- GATE
- DRAIN
- DRAIN

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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