

NTMFS4C06N

Power MOSFET

30 V, 69 A, Single N-Channel, SO-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 Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- CPU Power Delivery
- DC-DC Converters

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

| Parameter | 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) | I_D | $T_A = 25^\circ\text{C}$ | 20.0 |
| | | $T_A = 80^\circ\text{C}$ | 14.9 |
| Power Dissipation $R_{\theta JA}$ (Note 1) | P_D | $T_A = 25^\circ\text{C}$ | 2.55 |
| | | $T_A = 80^\circ\text{C}$ | |
| Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1) | I_D | $T_A = 25^\circ\text{C}$ | 31.6 |
| | | $T_A = 80^\circ\text{C}$ | 23.7 |
| Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1) | P_D | $T_A = 25^\circ\text{C}$ | 6.4 |
| | | $T_A = 80^\circ\text{C}$ | |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | I_D | $T_A = 25^\circ\text{C}$ | 11 |
| | | $T_A = 80^\circ\text{C}$ | 8.2 |
| Power Dissipation $R_{\theta JA}$ (Note 2) | P_D | $T_A = 25^\circ\text{C}$ | 0.77 |
| | | $T_C = 25^\circ\text{C}$ | |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | I_D | $T_C = 25^\circ\text{C}$ | 69 |
| | | $T_C = 80^\circ\text{C}$ | 52 |
| Power Dissipation $R_{\theta JC}$ (Note 1) | P_D | $T_C = 25^\circ\text{C}$ | 30.5 |
| | | $T_C = 80^\circ\text{C}$ | |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | I_{DM} | 166 |
| Current Limited by Package | $T_A = 25^\circ\text{C}$ | I_{Dmax} | 80 |
| Operating Junction and Storage Temperature | T_J, T_{STG} | | -55 to +150 |
| | | | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 28 | A |
| Drain to Source DV/DT | dV/dt | 7.0 | V/ns |
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}, V_{GS} = 10$ V, $I_L = 37$ A _{pk} , $L = 0.1$ mH, $R_{GS} = 25 \Omega$) (Note 3) | E_{AS} | 68 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

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.

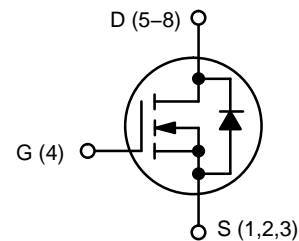
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.
3. Parts are 100% tested at $T_J = 25^\circ\text{C}, V_{GS} = 10$ V, $I_L = 27$ A_{pk}, $E_{AS} = 36$ mJ.



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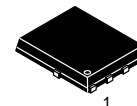
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| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | I_D MAX |
|---------------|------------------------|-----------|
| 30 V | 4.0 m Ω @ 10 V | 69 A |
| | 6.0 m Ω @ 4.5 V | |

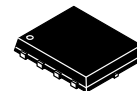
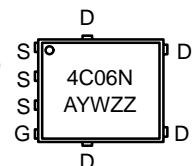


N-CHANNEL MOSFET

MARKING DIAGRAMS



SO-8 FLAT LEAD
CASE 488AA
STYLE 1



DFN5 5x6
(SO-8 FLAT LEAD)
CASE 506CX



A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------------|----------------------|-----------------------|
| NTMFS4C06NT1G | SO-8 FL (Pb-Free) | 1500 / Tape & Reel |
| NTMFS4C06NT1G-001 | SO-8 FL (Pb-Free) | 1500 / 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

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 4.1 | °C/W |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 49 | |
| Junction-to-Ambient – Steady State (Note 5) | $R_{\theta JA}$ | 162.3 | |
| Junction-to-Ambient – ($t \leq 10$ s) (Note 4) | $R_{\theta JA}$ | 19.5 | |

- Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- 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 | $V_{(BR)DSS}$ | $V_{GS} = 0$ V, $I_D = 250$ μ A | 30 | | | V |
| Drain-to-Source Breakdown Voltage (transient) | $V_{(BR)DSSt}$ | $V_{GS} = 0$ V, $I_{D(aval)} = 12.6$ A, $T_{case} = 25^\circ\text{C}$, $t_{transient} = 100$ ns | 34 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 14.4 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0$ V, $V_{DS} = 24$ V | | | 1.0 | μ A |
| | | $T_J = 25^\circ\text{C}$ | | | 10 | |
| | | $T_J = 125^\circ\text{C}$ | | | | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0$ V, $V_{GS} = \pm 20$ V | | | ± 100 | nA |

ON CHARACTERISTICS (Note 6)

| | | | | | | |
|--|------------------|---|-----|-----|-----|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = 250$ μ A | 1.3 | | 2.1 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 3.8 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10$ V, $I_D = 30$ A | | 3.2 | 4.0 | m Ω |
| | | $V_{GS} = 4.5$ V, $I_D = 25$ A | | 4.8 | 6.0 | |
| Forward Transconductance | g_{FS} | $V_{DS} = 1.5$ V, $I_D = 15$ A | | 58 | | S |
| Gate Resistance | R_G | $T_A = 25^\circ\text{C}$ | 0.3 | 1.0 | 2.0 | Ω |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|-------------------|---|--|-------|----|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = 15$ V | | 1683 | | pF |
| Output Capacitance | C_{OSS} | | | 841 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 40 | | |
| Capacitance Ratio | C_{RSS}/C_{ISS} | $V_{GS} = 0$ V, $V_{DS} = 15$ V, $f = 1$ MHz | | 0.023 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5$ V, $V_{DS} = 15$ V; $I_D = 30$ A | | 11.6 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 2.6 | | |
| Gate-to-Source Charge | Q_{GS} | | | 4.7 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 4.0 | | |
| Gate Plateau Voltage | V_{GP} | | | 3.1 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | | $V_{GS} = 10$ V, $V_{DS} = 15$ V; $I_D = 30$ A | | 26 | |

SWITCHING CHARACTERISTICS (Note 7)

| | | | | | | |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 4.5$ V, $V_{DS} = 15$ V, $I_D = 15$ A, $R_G = 3.0$ Ω | | 10 | | ns |
| Rise Time | t_r | | | 32 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 18 | | |
| Fall Time | t_f | | | 5.0 | | |

- Pulse Test: pulse width ≤ 300 μ s, duty cycle $\leq 2\%$.
- 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 7) | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 8.0 | | ns |
| Rise Time | t_r | | | 28 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 24 | | |
| Fall Time | t_f | | | 3.0 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|---|---------------------------|----|------|-----|---|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V},$ $I_S = 10\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.8 | 1.1 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.63 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$ | | 34 | | ns | |
| Charge Time | t_a | | | 17 | | | |
| Discharge Time | t_b | | | 17 | | | |
| Reverse Recovery Charge | Q_{RR} | | | 22 | | nC | |

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

7. Switching characteristics are independent of operating junction temperatures.

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TYPICAL CHARACTERISTICS

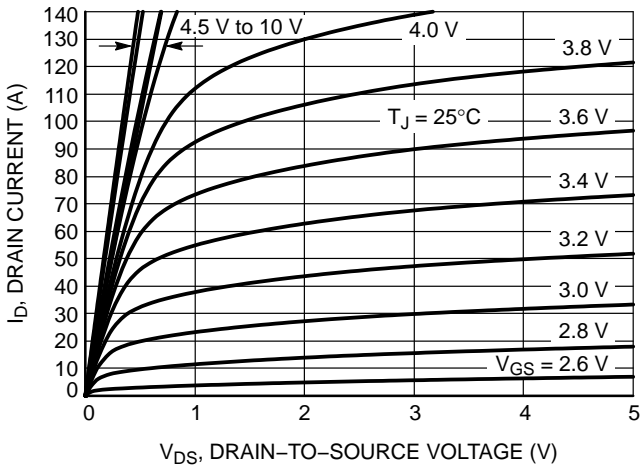


Figure 1. On-Region Characteristics

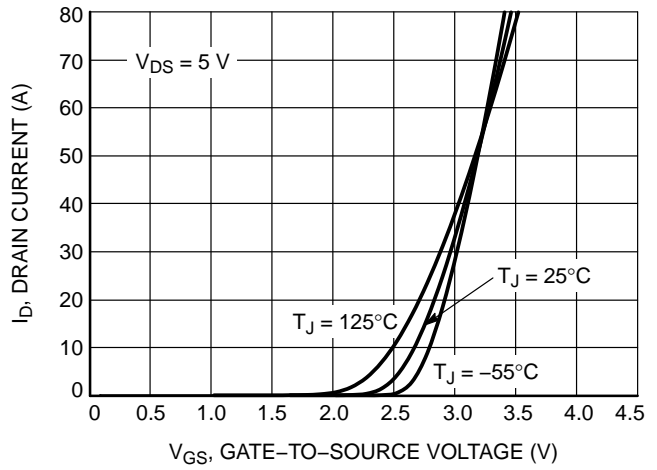


Figure 2. Transfer Characteristics

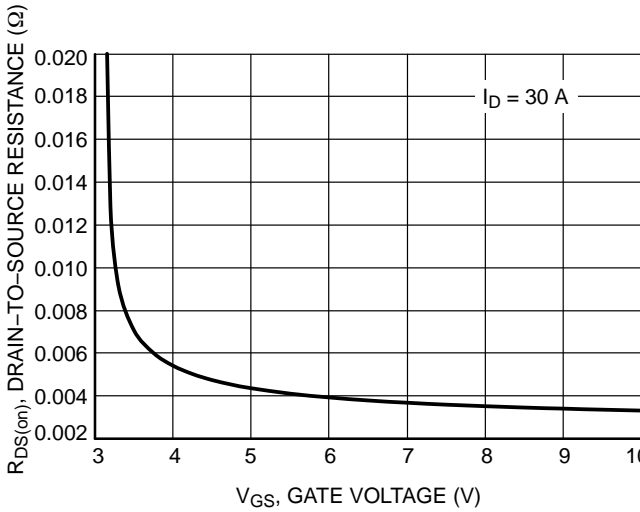


Figure 3. On-Resistance vs. Gate-to-Source Voltage

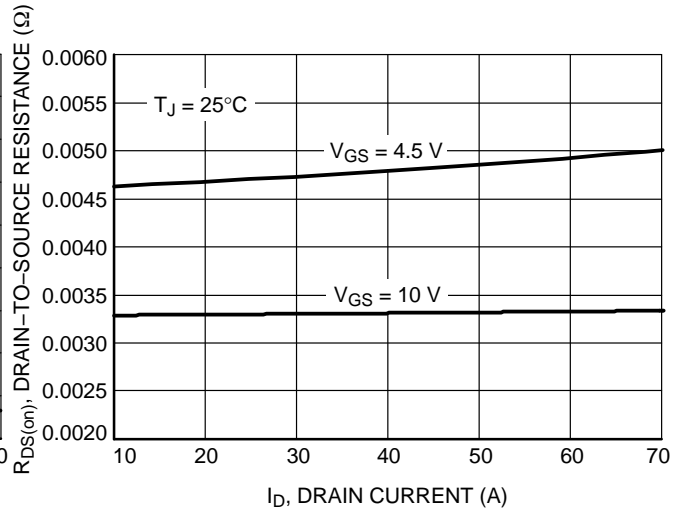


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

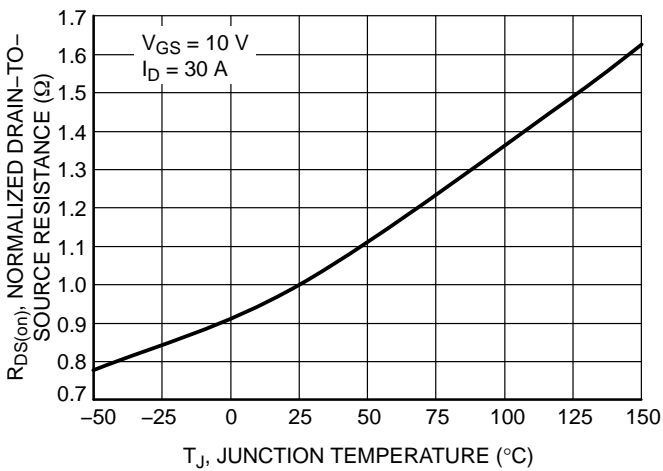


Figure 5. On-Resistance Variation with Temperature

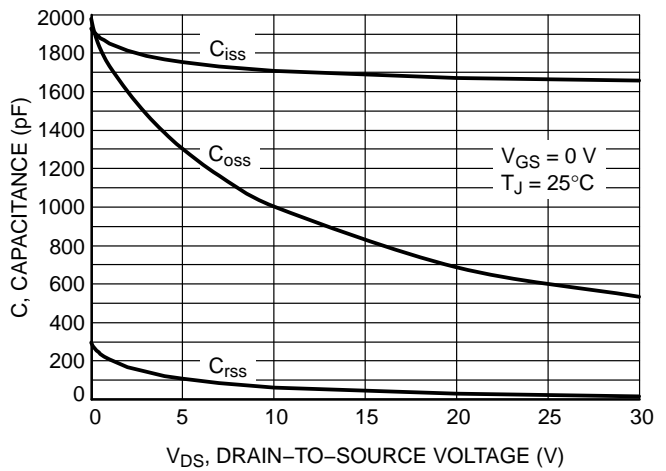


Figure 6. Capacitance Variation

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TYPICAL CHARACTERISTICS

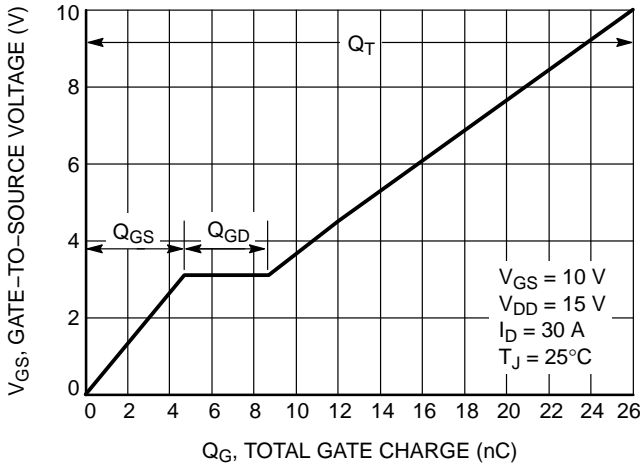


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

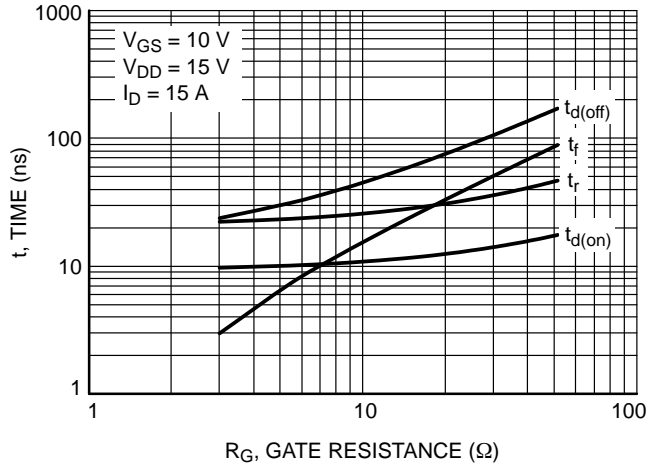


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

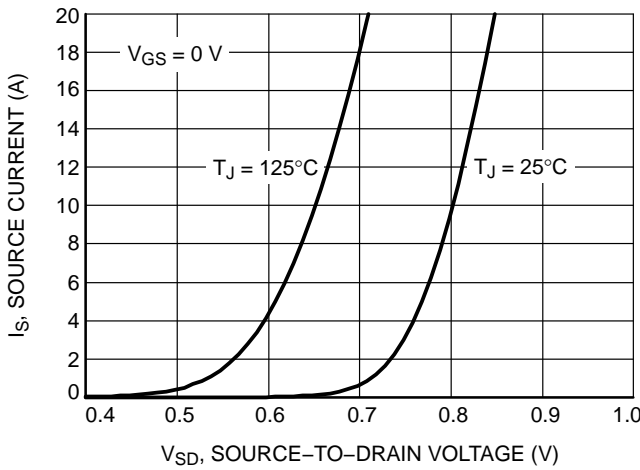


Figure 9. Diode Forward Voltage vs. Current

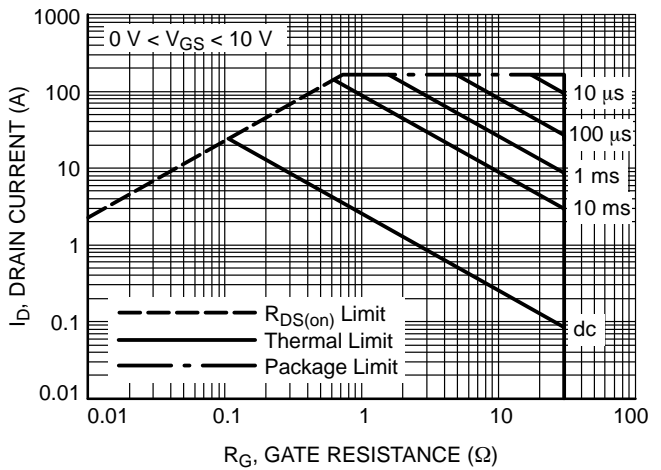


Figure 10. Maximum Rated Forward Biased Safe Operating Area

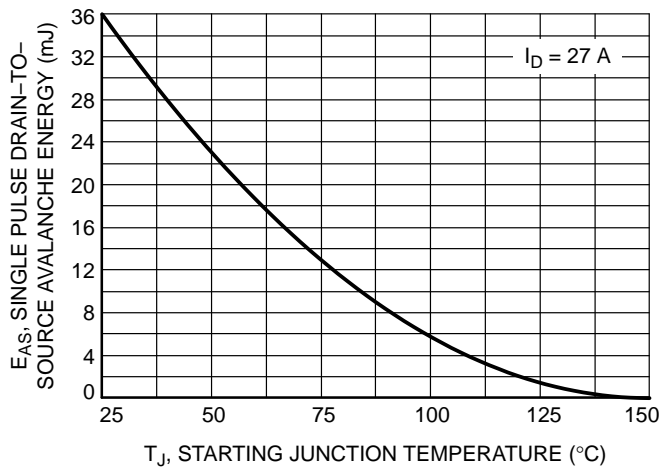


Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature

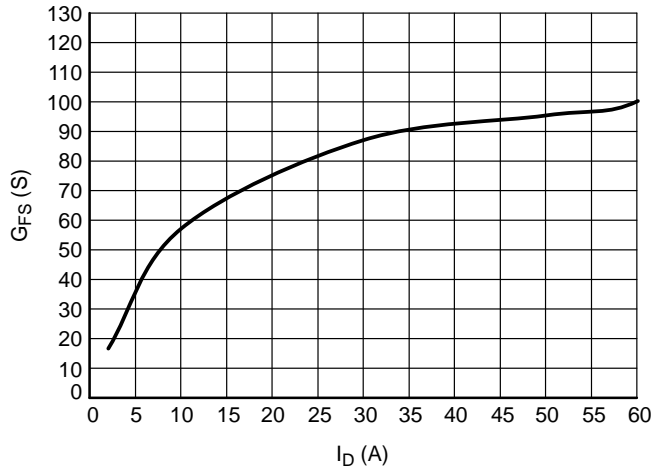


Figure 12. G_{FS} vs. I_D

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TYPICAL CHARACTERISTICS

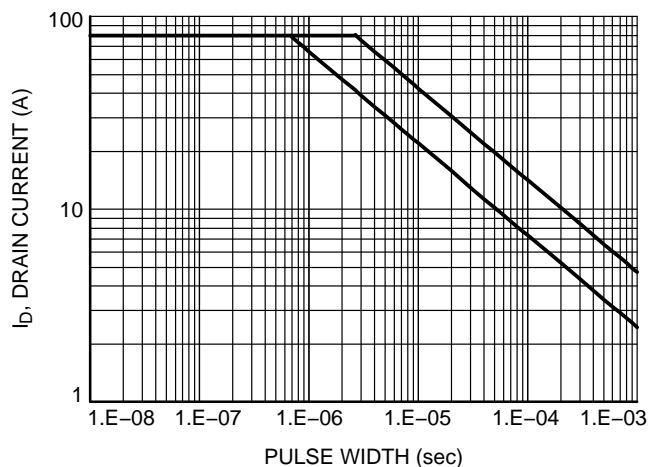


Figure 13. Avalanche Characteristics

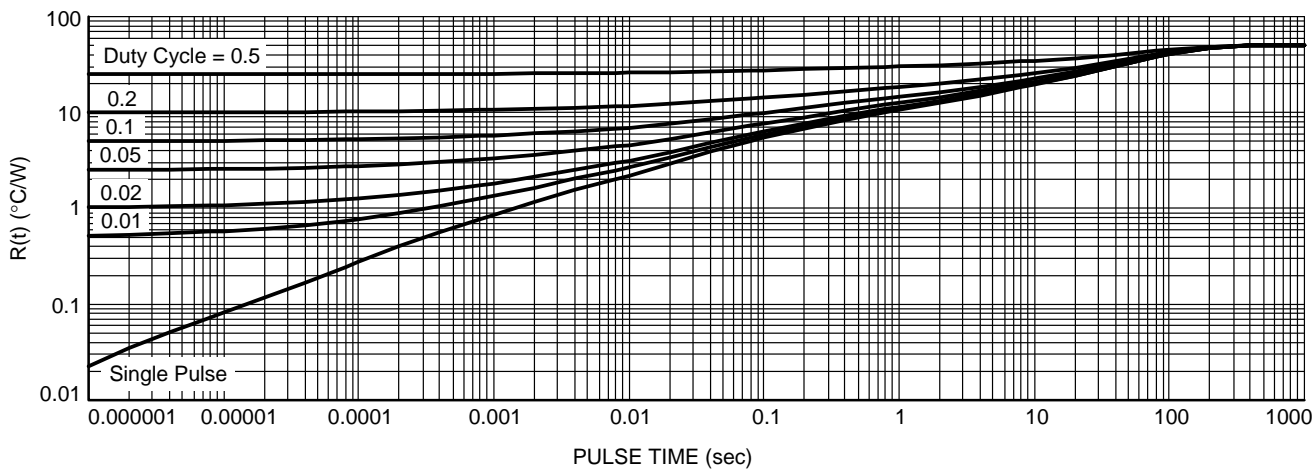


Figure 14. Thermal Response

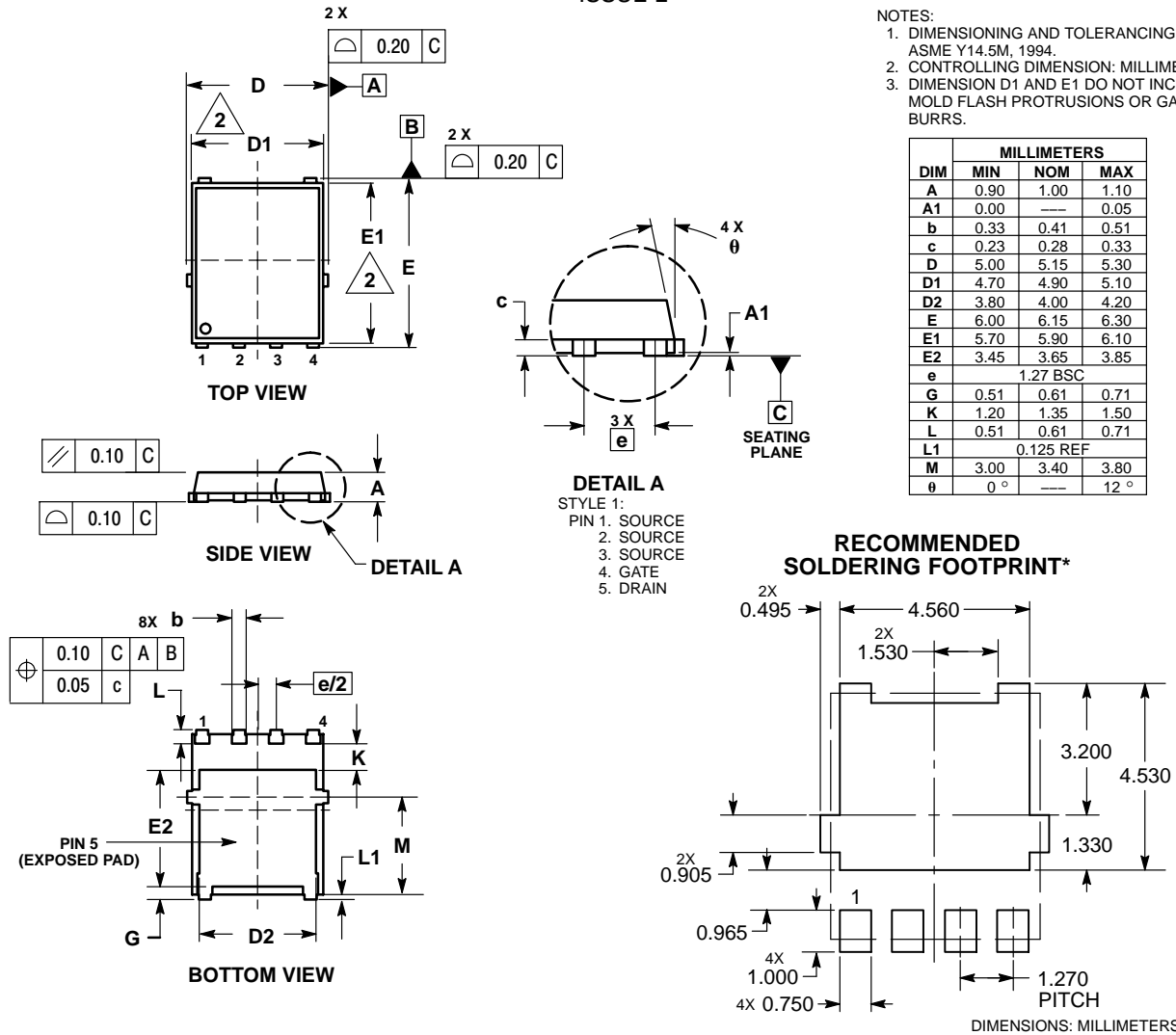
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PACKAGE DIMENSIONS

DFN5 5x6, 1.27P
(SO-8FL)
CASE 488AA
ISSUE L

- 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.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.00 | 5.15 | 5.30 |
| D1 | 4.70 | 4.90 | 5.10 |
| D2 | 3.80 | 4.00 | 4.20 |
| E | 6.00 | 6.15 | 6.30 |
| E1 | 5.70 | 5.90 | 6.10 |
| E2 | 3.45 | 3.65 | 3.85 |
| e | 1.27 BSC | | |
| G | 0.51 | 0.61 | 0.71 |
| K | 1.20 | 1.35 | 1.50 |
| L | 0.51 | 0.61 | 0.71 |
| L1 | 0.125 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0° | --- | 12° |

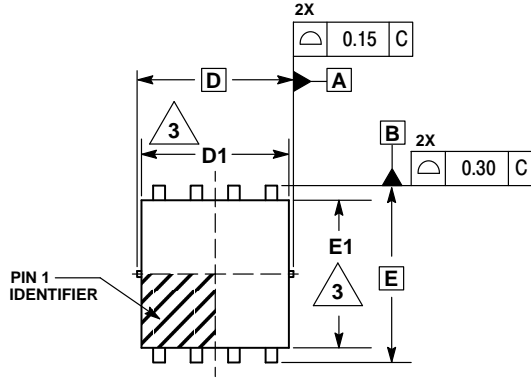


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

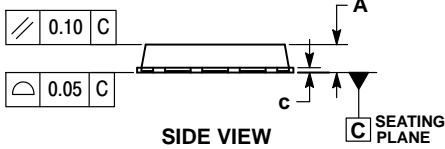
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PACKAGE DIMENSIONS

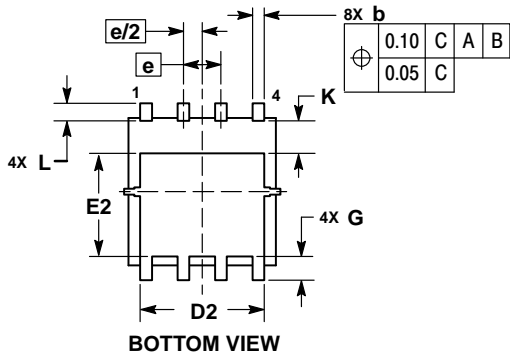
DFN5 5x6, 1.27P
(SO-8FL)
CASE 506CX
ISSUE O



TOP VIEW



SIDE VIEW



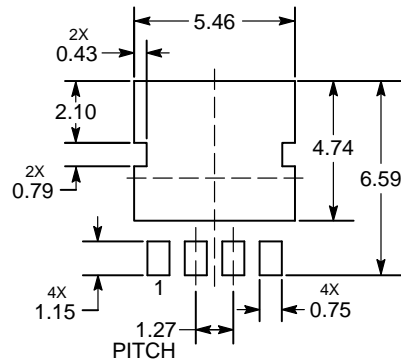
BOTTOM VIEW

NOTES:


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

| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | 0.90 | 1.00 |
| b | 0.30 | 0.50 |
| c | 0.11 | 0.22 |
| D | 5.30 BSC | |
| D1 | 4.80 | 5.20 |
| D2 | 4.05 | 4.45 |
| E | 6.00 BSC | |
| E1 | 4.80 | 5.20 |
| E2 | 3.30 | 3.70 |
| e | 1.27 BSC | |
| G | 0.70 | 0.90 |
| K | 0.90 | 1.30 |
| L | 0.50 | 0.70 |

SOLDERING FOOTPRINT*



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

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