# NTMFS4C032N

# MOSFET – Power, Single, N-Channel, SO-8 FL
## 30 V, 38 A

### 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°C unless otherwise stated)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current $R_{\theta JA}$ (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | 13.0 | A |
| | | $T_A$ = 80°C | | 9.7 | |
| Power Dissipation $R_{\theta JA}$ (Note 1) | | $T_A$ = 25°C | $P_D$ | 2.46 | W |
| Continuous Drain Current $R_{\theta JA} \le 10$ s (Note 1) | | $T_A$ = 25°C | $I_D$ | 19.1 | A |
| | | $T_A$ = 80°C | | 14.3 | |
| Power Dissipation $R_{\theta JA} \le 10$ s (Note 1) | | $T_A$ = 25°C | $P_D$ | 5.32 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C | $I_D$ | 7.2 | A |
| | | $T_A$ = 80°C | | 5.4 | |
| Power Dissipation $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C | $P_D$ | 0.75 | W |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C | $I_D$ | 38 | A |
| | | $T_C$ =80°C | | 29 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C | $P_D$ | 21.6 | W |
| Pulsed Drain Current | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 106 | A |
| Current Limited by Package | | $T_A$ = 25°C | $I_{Dmax}$ | 70 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to +150 | °C |
| Source Current (Body Diode) | | | $I_S$ | 19 | A |
| Drain to Source DV/DT | | | $dV/d_t$ | 7.0 | V/ns |
| Single Pulse Drain−to−Source Avalanche Energy ($T_J$ = 25°C, $V_{GS}$ = 10 V, $I_L$ = 21 $A_{pk}$, L = 0.1 mH, $R_{GS}$ = 25 Ω) (Note 3) | | | $E_{AS}$ | 22 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °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.

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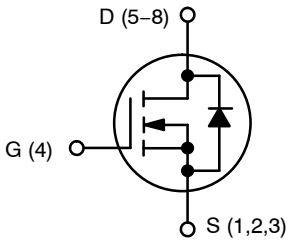
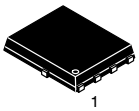
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30 V | 7.35 mΩ @ 10 V | 38 A |
| | 11.15 mΩ @ 4.5 V | |

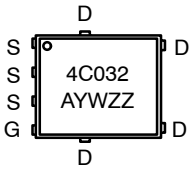



**N−CHANNEL MOSFET**



**SO−8 FLAT LEAD CASE 488AA STYLE 1**

**MARKING DIAGRAM**




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

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTMFS4C032NT1G | SO−8 FL (Pb−Free) | 1500 / Tape & Reel |
| NTMFS4C032NT3G | SO−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.

3. This is the absolute maximum rating. Parts are 100% tested at $T_J$ = 25°C, $V_{GS}$ = 10 V, $I_L$ = 15 Apk, $E_{AS}$ = 11 mJ.

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case (Drain) | $R_{\theta JC}$ | 5.8 | °C/W |
| Junction−to−Ambient − Steady State (Note 4) | $R_{\theta JA}$ | 50.8 | |
| Junction−to−Ambient − Steady State (Note 5) | $R_{\theta JA}$ | 166.6 | |
| Junction−to−Ambient − (t ≤ 10 s) (Note 4) | $R_{\theta JA}$ | 23.5 | |

4. Surface−mounted on FR4 board using 1 sq−in pad, 1 oz Cu.
5. Surface−mounted on FR4 board using the minimum recommended pad size.

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°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 μA | | 30 | | | V |
| Drain−to−Source Breakdown Voltage (transient) | $V_{(BR)DSSt}$ | $V_{GS}$ = 0 V, $I_{D(aval)}$ = 6.1 A, $T_{case}$ = 25°C, $t_{transient}$ = 100 ns | | 34 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}$/$T_J$ | | | | 14.9 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 24 V | $T_J$ = 25°C | | | 1.0 | μA |
| | | | $T_J$ = 125°C | | | 10 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 6) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.3 | | 2.1 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}$/$T_J$ | | | | 4.8 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 30 A | | 6.11 | 7.35 | mΩ |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 12 A | | 9.29 | 11.15 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 1.5 V, $I_D$ = 15 A | | | 40 | | S |
| Gate Resistance | $R_G$ | $T_A$ = 25°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 | | | 770 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 443 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 127 | | |
| Capacitance Ratio | $C_{RSS}$/$C_{ISS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 15 V, f = 1 MHz | | | 0.165 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V; $I_D$ = 30 A | | | 7.8 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 1.4 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 2.9 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 3.7 | | |
| Gate Plateau Voltage | $V_{GP}$ | | | | 3.6 | | V |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 15 V; $I_D$ = 30 A | | | 15.2 | | nC |
| **SWITCHING CHARACTERISTICS** (Note 7) | | | | | | | |

6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTICS** (Note 7) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V, $I_D$ = 15 A, $R_G$ = 3.0 Ω | | | 9.0 | | ns |
| Rise Time | $t_r$ | | | | 35 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 13 | | |
| Fall Time | $t_f$ | | | | 5.0 | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 15 V, $I_D$ = 15 A, $R_G$ = 3.0 Ω | | | 6.0 | | ns |
| Rise Time | $t_r$ | | | | 26 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 16 | | |
| Fall Time | $t_f$ | | | | 3.0 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 10 A | $T_J$ = 25°C | | 0.82 | 1.1 | V |
| | | | $T_J$ = 125°C | | 0.69 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dIS/dt = 100 A/μs, $I_S$ = 30 A | | | 23.4 | | ns |
| Charge Time | $t_a$ | | | | 12.1 | | |
| Discharge Time | $t_b$ | | | | 11.3 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 9.7 | | nC |

6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

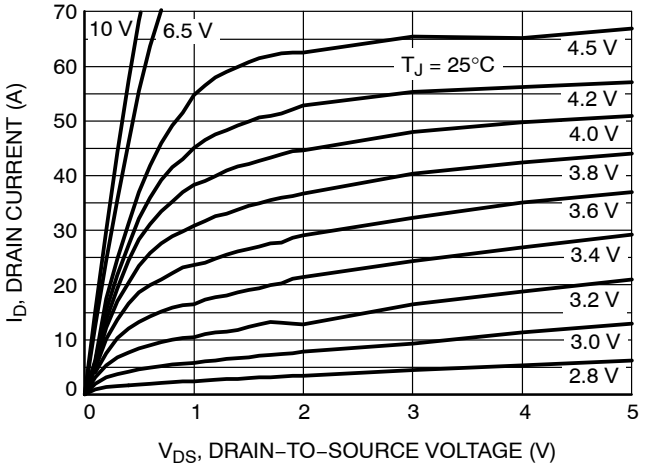



**Figure 1. On−Region Characteristics**

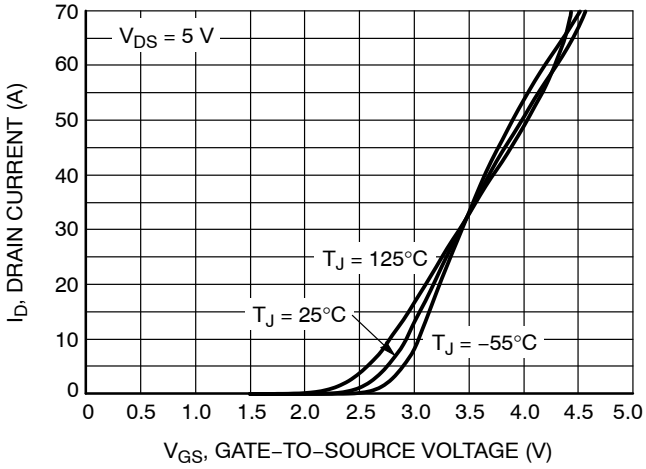



**Figure 2. Transfer Characteristics**

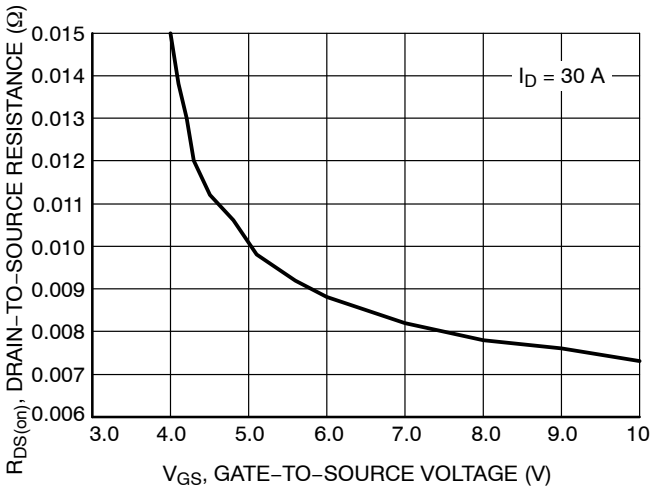



**Figure 3. On−Resistance vs. $V_{GS}$**

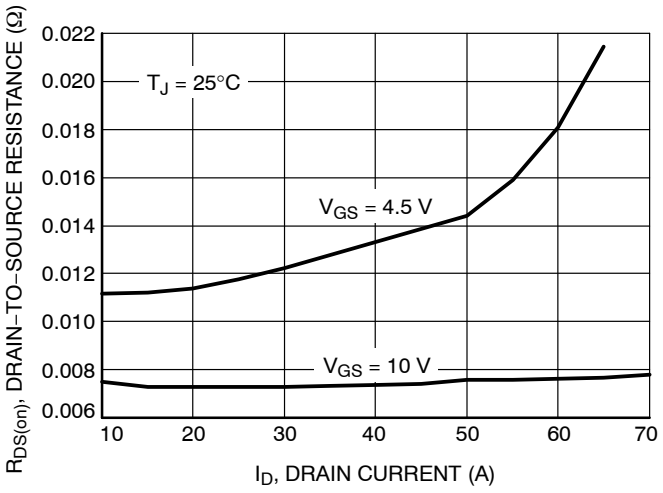



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

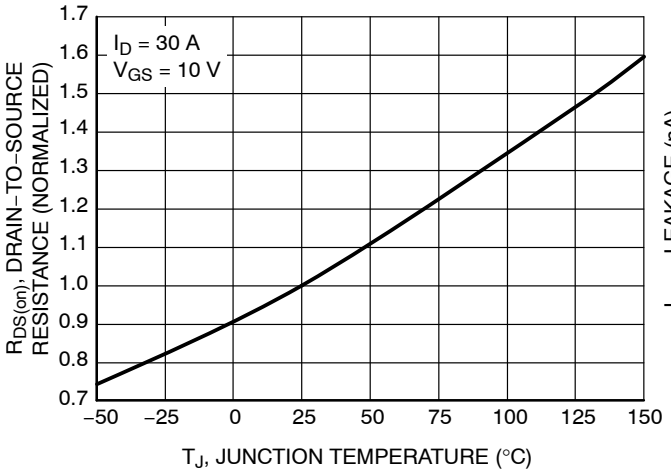



**Figure 5. On−Resistance Variation with Temperature**

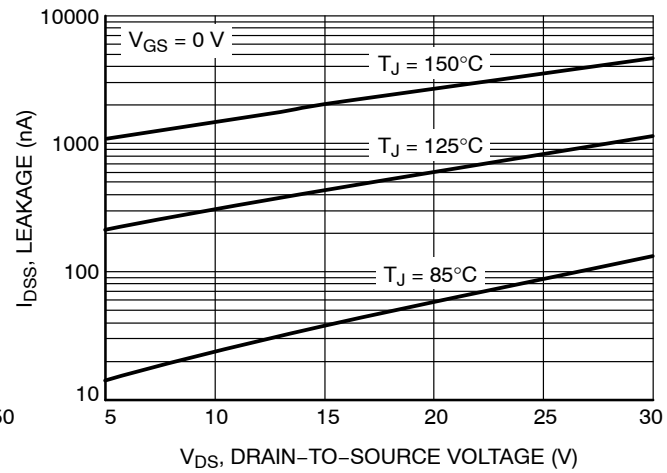



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

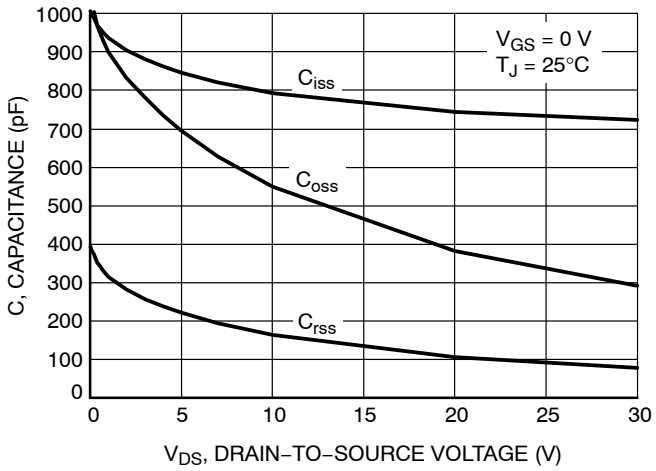



**Figure 7. Capacitance Variation**

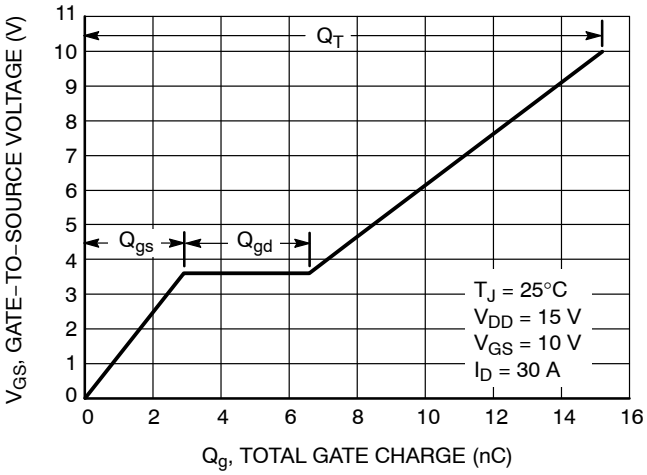



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

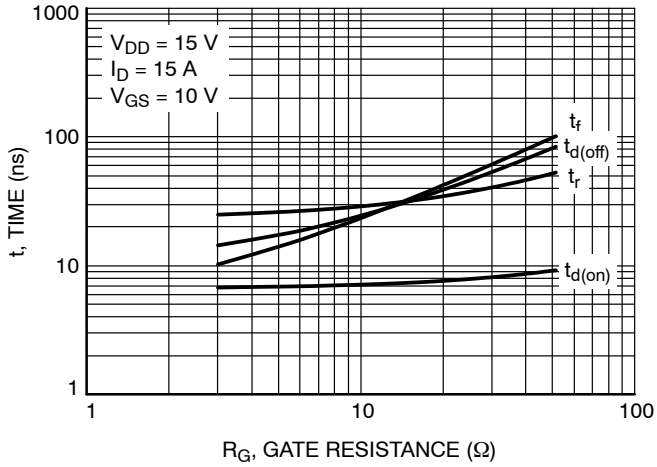



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

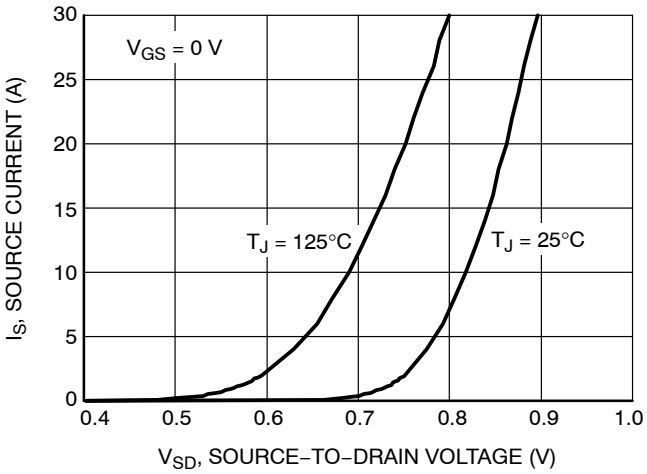



**Figure 10. Diode Forward Voltage vs. Current**

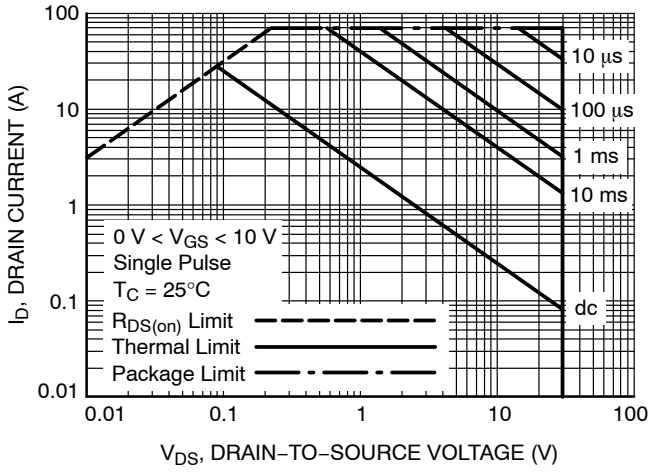



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

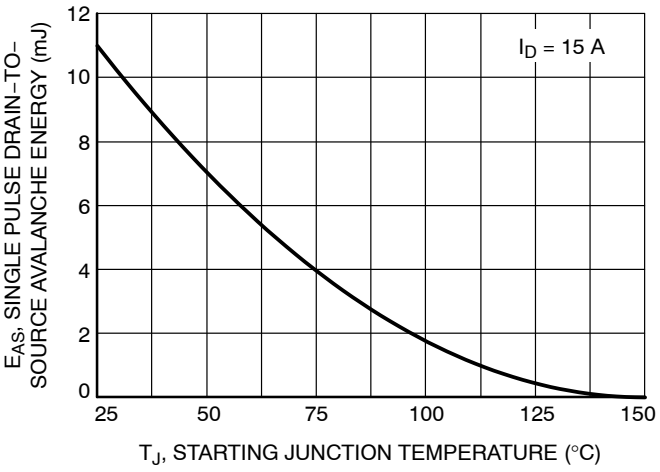



**Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature**

## TYPICAL CHARACTERISTICS

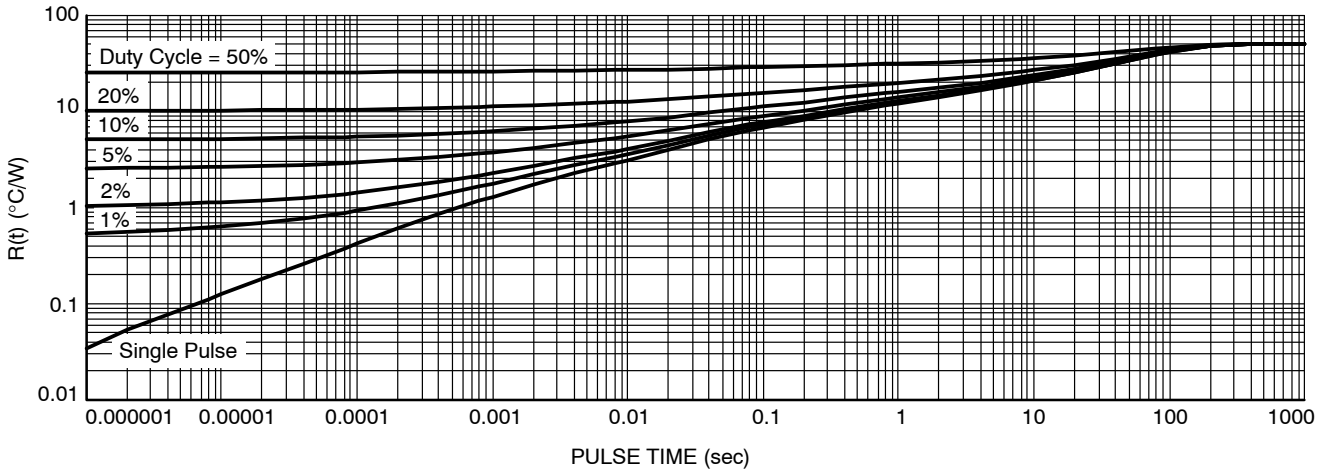



**Figure 13. Thermal Response**

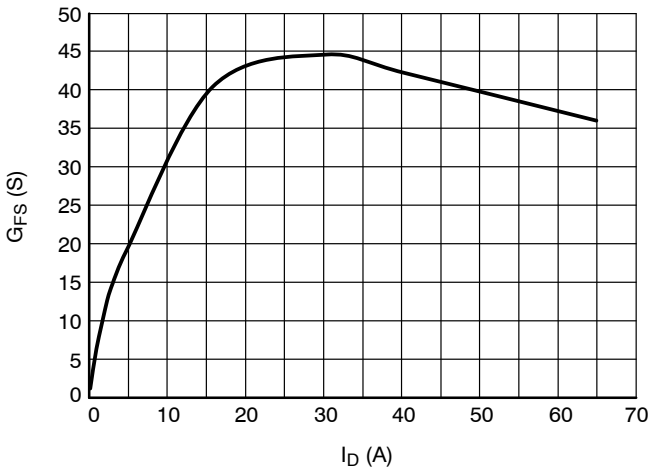



**Figure 14. $G_{FS}$ vs. $I_D$**

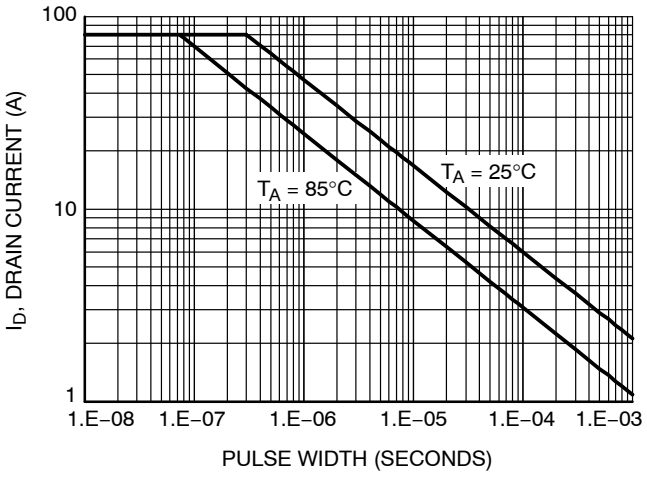



**Figure 15. Avalanche Characteristics**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

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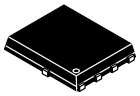
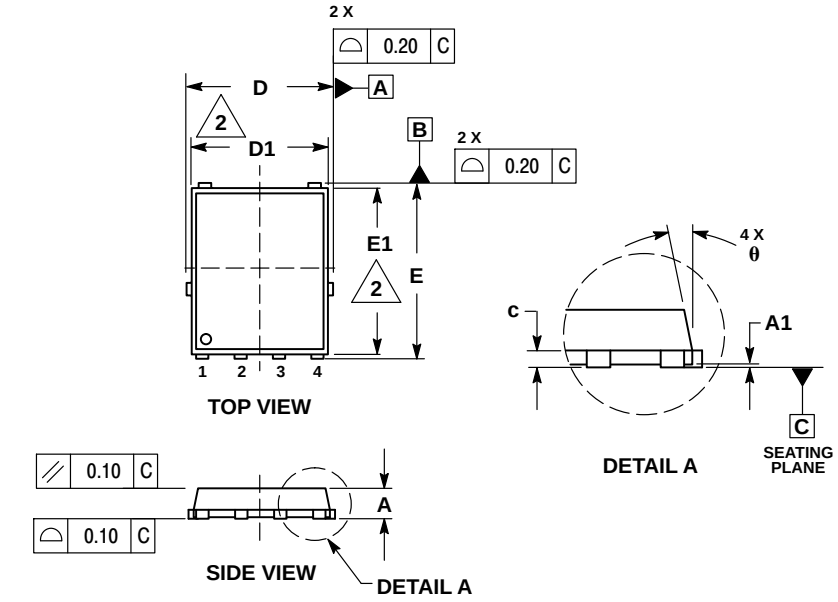


SCALE 2:1

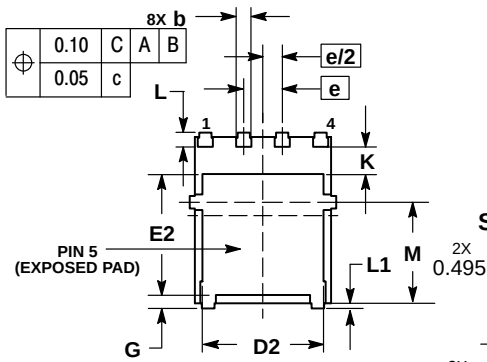
**DFN5 5x6, 1.27P**
**(SO−8FL)**
CASE 488AA
ISSUE N

DATE 25 JUN 2018

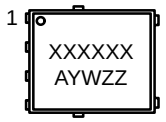



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.90 | 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 | 0.575 | 0.71 |
| K | 1.20 | 1.35 | 1.50 |
| L | 0.51 | 0.575 | 0.71 |
| L1 | 0.125 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0 ° | ––– | 12 ° |



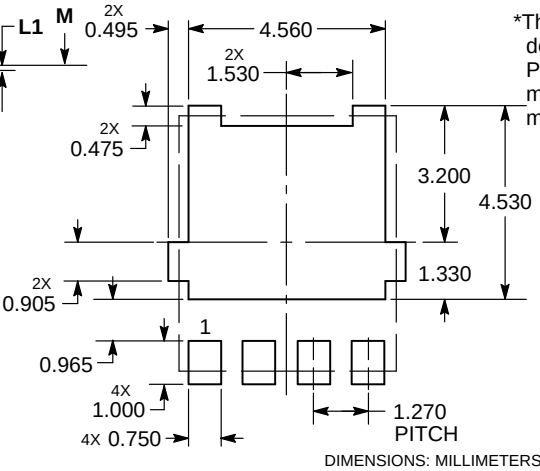

### GENERIC MARKING DIAGRAM*




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

*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.

### RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

STYLE 2:
PIN 1. ANODE
2. ANODE
3. ANODE
4. NO CONNECT
5. CATHODE

*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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| **DESCRIPTION:** | **DFN5 5x6, 1.27P (SO−8FL)** | **PAGE 1 OF 1** |

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