# NTMFS4936N, NTMFS4936NC

# MOSFET – Power, Single, N-Channel, SO-8 FL
## 30 V, 79 A

**ON Semiconductor®**

**http://onsemi.com**

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30 V | 3.8 mΩ @ 10 V | 79 A |
| | 4.8 mΩ @ 4.5 V | |

### Features

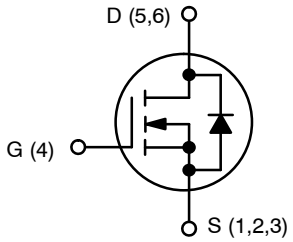
- Low $R_{DS(on)}$, Low Capacitance and Optimized Gate Charge to Minimize Conduction, Driver and Switching Losses
- Next Generation Enhanced Body Diode, Engineered for Soft Recovery, Provides Schottky−Like Performance
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

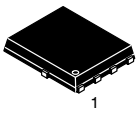
- CPU Power Delivery
- DC−DC Converters

**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 | $I_D$ | 19.5 | A |
| | | $T_A$ = 100°C | | 12.3 | |
| Power Dissipation $R_{\theta JA}$ (Note 1) | | $T_A$ = 25°C | $P_D$ | 2.62 | W |
| Continuous Drain Current $R_{\theta JA} \le 10$ s (Note 1) | | $T_A$ = 25°C | $I_D$ | 35 | A |
| | | $T_A$ = 100°C | | 22 | |
| Power Dissipation $R_{\theta JA} \le 10$ s (Note 1) | | $T_A$ = 25°C | $P_D$ | 8.4 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C | $I_D$ | 11.6 | A |
| | | $T_A$ = 100°C | | 7.3 | |
| Power Dissipation $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C | $P_D$ | 0.92 | W |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C | $I_D$ | 79 | A |
| | | $T_C$ =100°C | | 50 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C | $P_D$ | 43 | W |
| Pulsed DrainCurrent | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 235 | A |
| Current Limited by Package | | $T_A$ = 25°C | $I_{Dmax}$ | 100 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to +150 | °C |
| Source Current (Body Diode) | | | $I_S$ | 39.2 | A |
| Drain to Source DV/DT | | | $dV/d_t$ | 6.0 | V/ns |

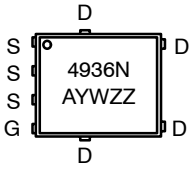



**N−CHANNEL MOSFET**




**SO−8 FLAT LEAD**
**CASE 488AA**
**STYLE 1**

**MARKING DIAGRAM**




4936N = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTMFS4936NT1G | SO−8 FL (Pb−Free) | 1500 / Tape & Reel |
| NTMFS4936NT3G | SO−8 FL (Pb−Free) | 5000 / Tape & Reel |
| NTMFS4936NCT1G | SO−8 FL (Pb−Free) | 1500 / Tape & Reel |
| NTMFS4936NCT3G | 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.

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**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise stated)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Single Pulse Drain−to−Source Avalanche Energy ($T_J$ = 25°C, $V_{DD}$ = 50 V, $V_{GS}$ = 10 V, $I_L$ = 44 $A_{pk}$, L = 0.1 mH, $R_G$ = 25 Ω) | $E_{AS}$ | 96.8 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | $T_L$ | 260 | °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.

**THERMAL RESISTANCE MAXIMUM RATINGS**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case (Drain) | $R_{\theta JC}$ | 2.9 | °C/W |
| Junction−to−Ambient − Steady State (Note 3) | $R_{\theta JA}$ | 47.7 | |
| Junction−to−Ambient − Steady State (Note 4) | $R_{\theta JA}$ | 135.2 | |
| Junction−to−Ambient − (t ≤ 10 s) (Note 3) | $R_{\theta JA}$ | 14.8 | |

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°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) | $V_{(BR)DSSt}$ | VGS = 0 V, $I_{D(aval)}$ = 18.5 A, $T_{case}$ = 25°C, $t_{transient}$ = 100 ns | | 34 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}$/ $T_J$ | | | | 15 | | 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 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.2 | 1.6 | 2.2 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 4.0 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 30 A | | 2.9 | 3.8 | mΩ |
| | | | $I_D$ = 15 A | | 2.9 | | |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 30 A | | 3.9 | 4.8 | |
| | | | $I_D$ = 15 A | | 3.9 | | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 1.5 V, $I_D$ = 15 A | | | 50 | | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 15 V | | | 3044 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 1014 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 39 | | |
| Capacitance Ratio | $C_{RSS}$ / $C_{ISS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 15 V, f = 1 MHz | | | 0.013 | 0.026 | |

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. 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 |
|---|---|---|---|---|---|---|---|
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V; $I_D$ = 30 A | | | 19 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 4.6 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 9.2 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 2.4 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 15 V; $I_D$ = 30 A | | | 43 | | nC |
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| 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 | | | 15.5 | | ns |
| Rise Time | $t_r$ | | | | 20.6 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 24.6 | | |
| Fall Time | $t_f$ | | | | 7.0 | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 15 V, $I_D$ = 15 A, $R_G$ = 3.0 Ω | | | 10.4 | | ns |
| Rise Time | $t_r$ | | | | 19 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 29 | | |
| Fall Time | $t_f$ | | | | 8.0 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 30 A | $T_J$ = 25°C | | 0.8 | 1.1 | V |
| | | | $T_J$ = 125°C | | 0.65 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dIS/dt = 100 A/μs, $I_S$ = 30 A | | | 39 | | ns |
| Charge Time | $t_a$ | | | | 21.5 | | |
| Discharge Time | $t_b$ | | | | 17.5 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 36 | | nC |
| **PACKAGE PARASITIC VALUES** | | | | | | | |
| Source Inductance | $L_S$ | $T_A$ = 25°C | | | 0.65 | | nH |
| Drain Inductance | $L_D$ | | | | 0.005 | | nH |
| Gate Inductance | $L_G$ | | | | 1.84 | | nH |
| Gate Resistance | $R_G$ | | | | 1.1 | 2.0 | Ω |

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

## TYPICAL CHARACTERISTICS

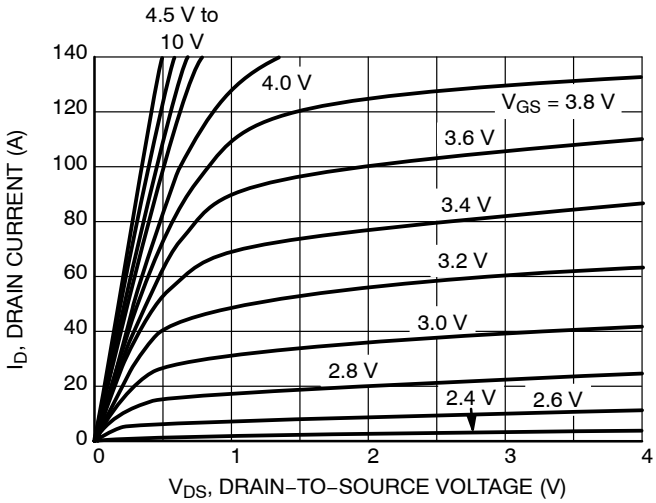


**Figure 1. On−Region Characteristics**

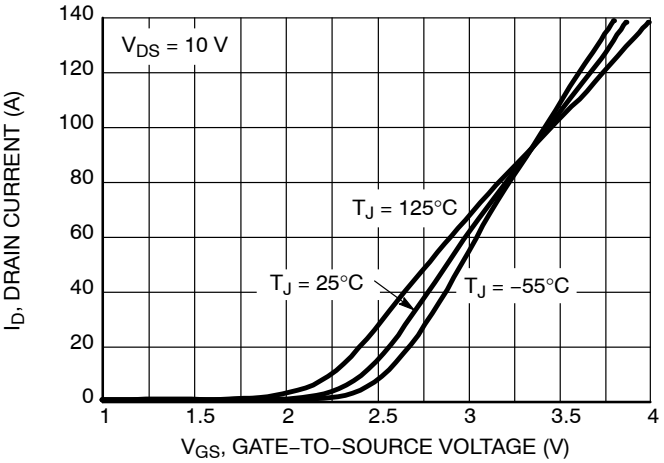


**Figure 2. Transfer Characteristics**

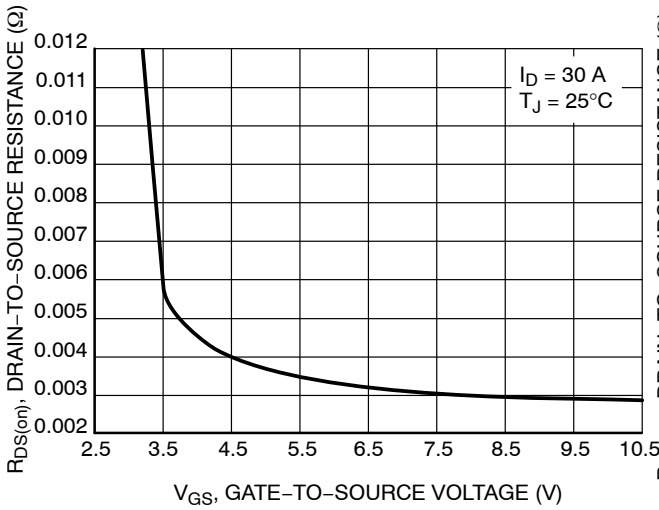


**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

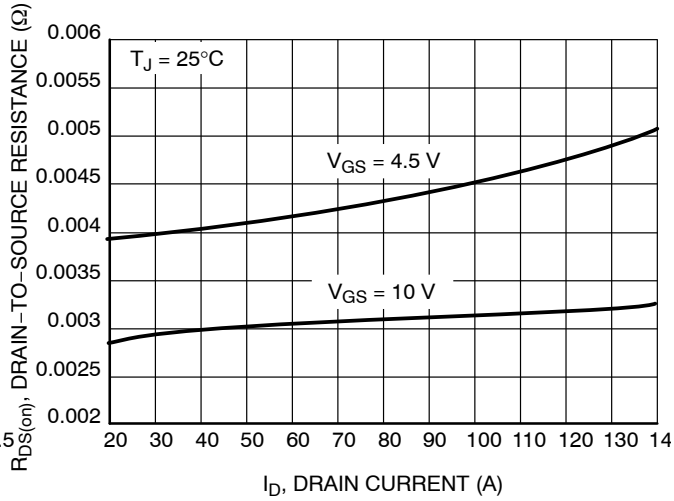


**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

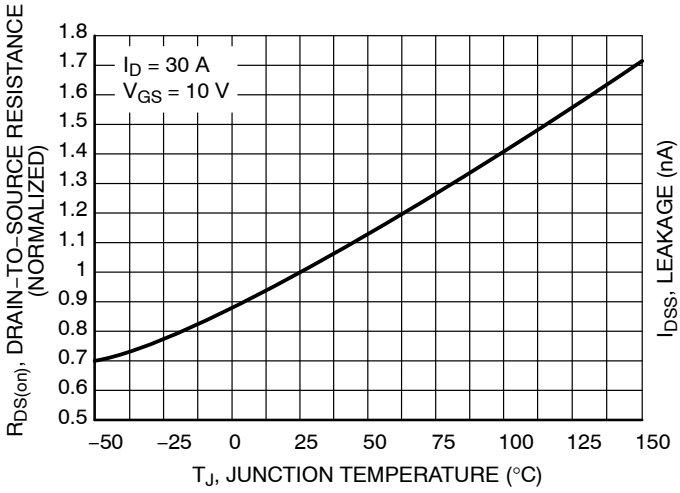


**Figure 5. On−Resistance Variation with Temperature**

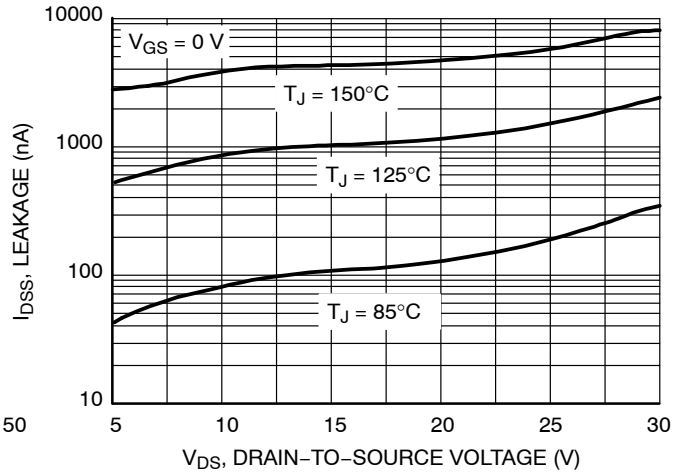


**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

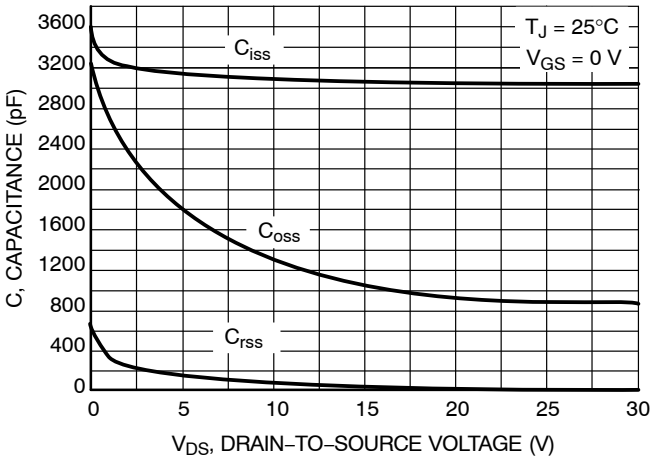


**Figure 7. Capacitance Variation**

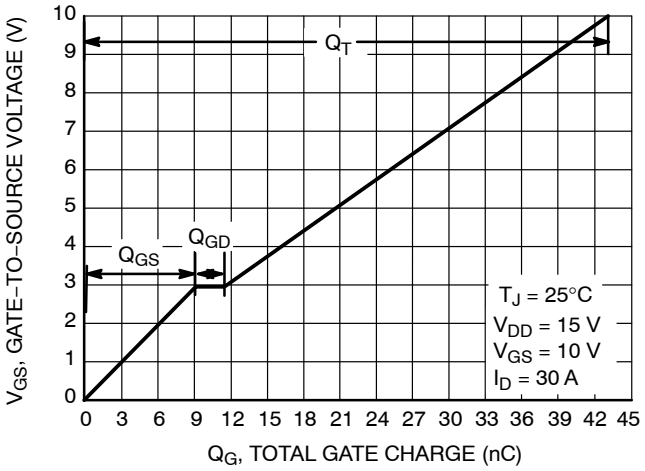


**Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge**

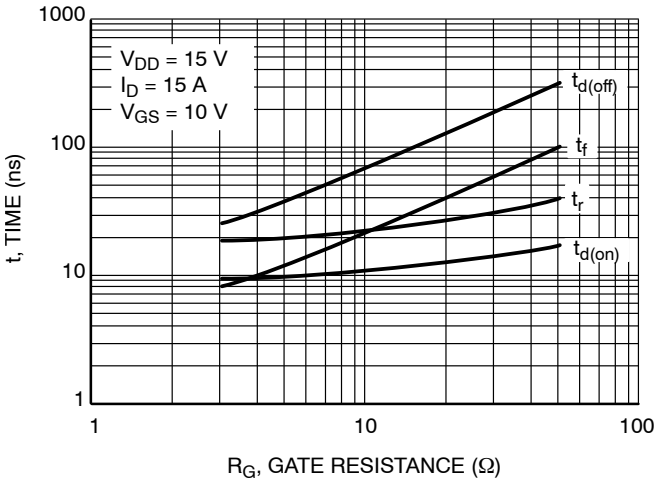


**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

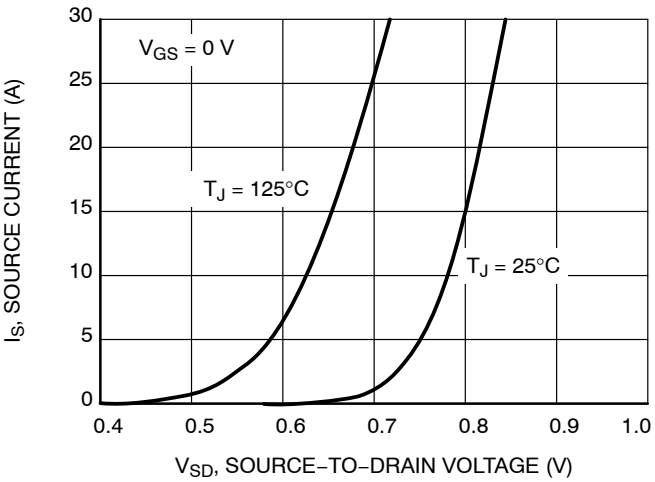


**Figure 10. Diode Forward Voltage vs. Current**

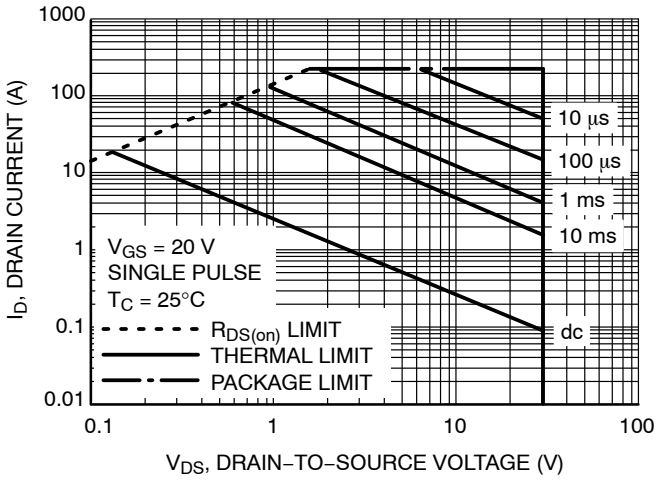


**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

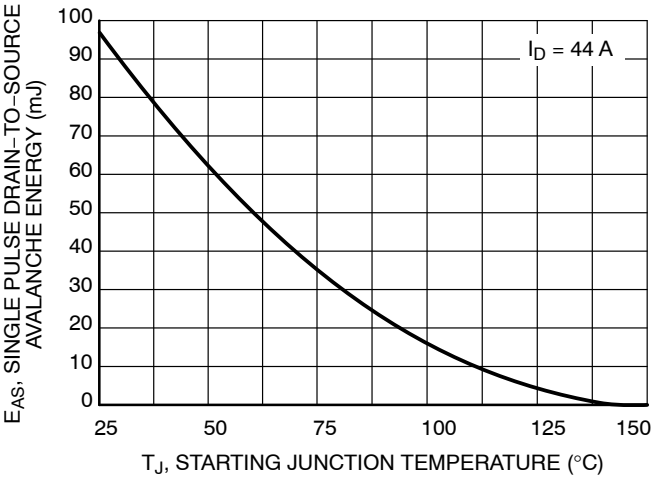


**Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature**

## TYPICAL CHARACTERISTICS

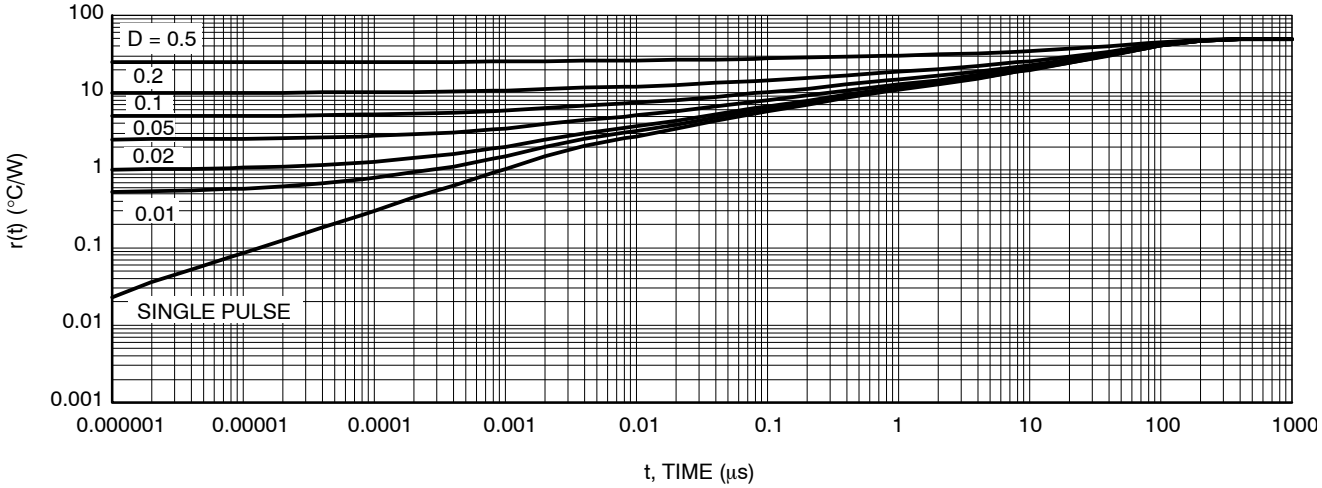


**Figure 13. Thermal Response**

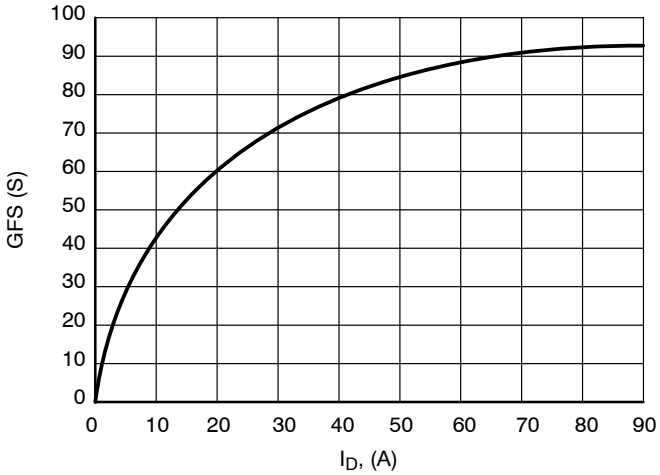


**Figure 14. GFS vs. $I_D$**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

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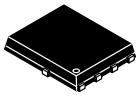
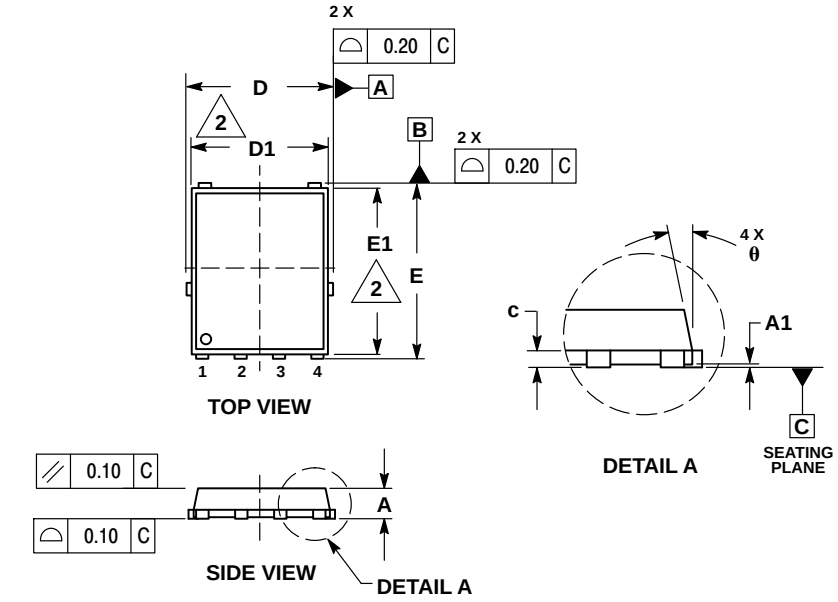


SCALE 2:1

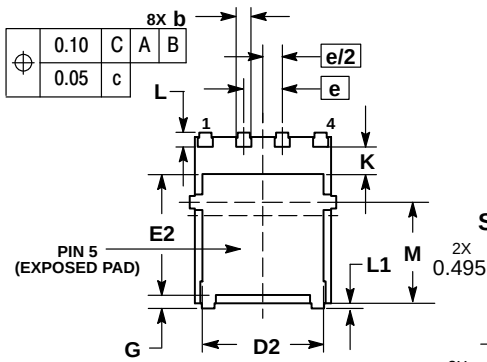
**DFN5 5x6, 1.27P**
**(SO−8FL)**
CASE 488AA
ISSUE N

DATE 25 JUN 2018

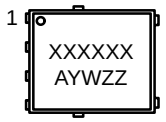



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| | 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 ° |



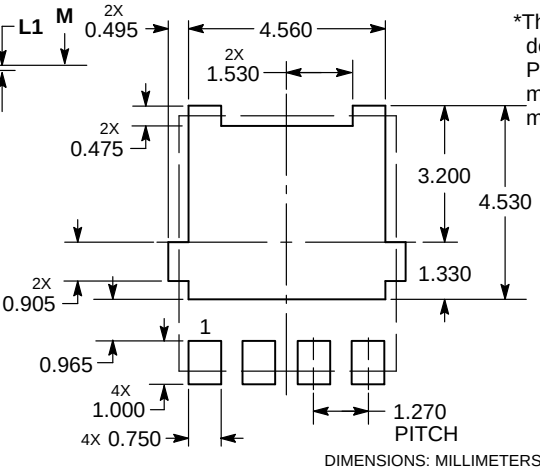

### GENERIC MARKING DIAGRAM*




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.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON14036D** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **DFN5 5x6, 1.27P (SO−8FL)** | **PAGE 1 OF 1** |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