# NTMFS4841NH

# Power MOSFET

## 30 V, 59 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
- Low $R_G$
- These are Pb−Free Device*

**Applications**

- Refer to Application Note AND8195/D
- 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<br>$T_A$ = 85°C | $I_D$ | 13.5<br>9.7 | A |
| Power Dissipation $R_{\theta JA}$ (Note 1) | | $T_A$ = 25°C<br>$T_A$ = 85°C | $P_D$ | 2.16<br>1.1 | W |
| Continuous Drain Current $R_{\theta JA}$ ≤ 10 s | | $T_A$ = 25°C<br>$T_A$ = 85°C | $I_D$ | 21.8<br>15.7 | A |
| Power Dissipation $R_{\theta JA}$ ≤ 10 s | | $T_A$ = 25°C<br>$T_A$ = 85°C | $P_D$ | 5.7<br>2.9 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C<br>$T_A$ = 85°C | $I_D$ | 8.6<br>6.2 | A |
| Power Dissipation $R_{\theta JA}$ (Note 2) | | $T_A$ = 25°C<br>$T_A$ = 85°C | $P_D$ | 0.87<br>0.45 | W |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C<br>$T_C$ = 85°C | $I_D$ | 59<br>42.5 | A |
| Power Dissipation $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C<br>$T_C$ = 85°C | $P_D$ | 41.7<br>21.7 | W |
| Pulsed Drain Current | $t_p$ = 10 μs | $T_A$ = 25°C | $I_{DM}$ | 177 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to +150 | °C |
| Source Current (Body Diode) | | | $I_S$ | 35 | A |
| Drain to Source dV/dt | | | dV/dt | 6 | V/ns |
| Single Pulse Drain−to−Source Avalanche Energy ($V_{DD}$ = 24 V, $V_{GS}$ = 10 V, $I_L$ = 25.6 A, L = 0.3 mH, $R_G$ = 25 Ω) | | | EAS | 98 | 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.

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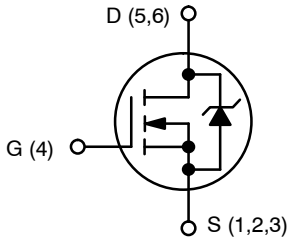
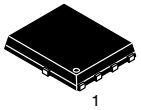
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30 V | 7.0 mΩ @ 10 V | 59 A |
| | 11.6 mΩ @ 4.5 V | |

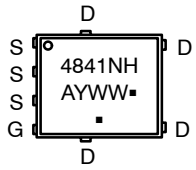



**N−CHANNEL MOSFET**



**SO−8 FLAT LEAD CASE 488AA STYLE 1**

**MARKING DIAGRAM**




A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTMFS4841NHT1G | SO−8FL (Pb−Free) | 1500 / Tape & Reel |
| NTMFS4841NHT3G | SO−8FL (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.

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

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case (Drain) | $R_{\theta JC}$ | 3 | °C/W |
| Junction−to−Ambient − Steady State (Note 1) | $R_{\theta JA}$ | 57.8 | |
| Junction−to−Ambient − Steady State (Note 2) | $R_{\theta JA}$ | 143.5 | |
| Junction−to−Ambient (t ≤ 10 s) | $R_{\theta JA}$ | 22.1 | |

## 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 Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 28 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 24 V | $T_J$ = 25 °C | | | 1 | 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 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.5 | 2.1 | 2.5 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 5.6 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V to 11.5 V | $I_D$ = 30 A | | 4.8 | 7.0 | mΩ |
| | | | $I_D$ = 15 A | | 4.8 | | |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 30 A | | 8.8 | 11.6 | |
| | | | $I_D$ = 15 A | | 8.5 | | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 1.5 V, $I_D$ = 50 A | | | 57 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 12 V | | | 1565 | 2113 | pF |
| Output Capacitance | $C_{OSS}$ | | | | 325 | 439 | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 173 | 268 | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V; $I_D$ = 30 A | | | 11.3 | 16.7 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 1.4 | 2.1 | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 5.3 | 7.9 | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 4.5 | 6.8 | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 11.5 V, $V_{DS}$ = 15 V, $I_D$ = 30 A | | | 24.4 | 33 | nC |
| **SWITCHING CHARACTERISTICS** (Note 4) | | | | | | | |
| 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 | | | 12.1 | 18.1 | ns |
| Rise Time | $t_r$ | | | | 23.3 | 34.9 | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 14.1 | 21.1 | |
| Fall Time | $t_f$ | | | | 4.9 | 7.3 | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 11.5 V, $V_{DS}$ = 15 V, $I_D$ = 15 A, $R_G$ = 3.0 Ω | | | 7.2 | 10.7 | ns |
| Rise Time | $t_r$ | | | | 20.6 | 30.9 | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 21.9 | 32.9 | |
| Fall Time | $t_f$ | | | | 2.9 | 4.4 | |

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. 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 |
|---|---|---|---|---|---|---|---|
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 30 A | $T_J$ = 25°C | | 0.86 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.71 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 100 A/μs, $I_S$ = 30 A | | | 18.8 | | ns |
| Charge Time | $t_a$ | | | | 11.4 | | |
| Discharge Time | $t_b$ | | | | 7.4 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 6.7 | | nC |
| **PACKAGE PARASITIC VALUES** | | | | | | | |
| Source Inductance | $L_S$ | $T_A$ = 25°C | | | 0.93 | | nH |
| Drain Inductance | $L_D$ | | | | 0.005 | | |
| Gate Inductance | $L_G$ | | | | 1.84 | | |
| Gate Resistance | $R_G$ | | | | 0.90 | | Ω |

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

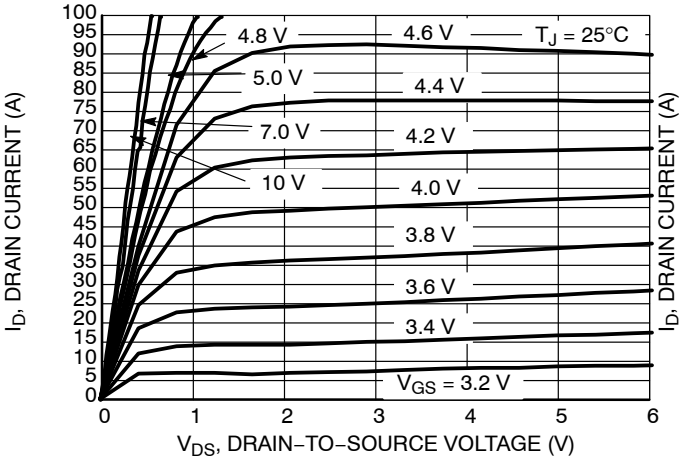



**Figure 1. On−Region Characteristics**

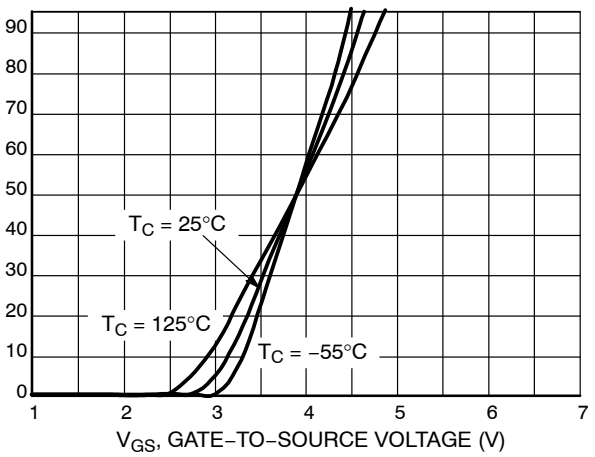



**Figure 2. Transfer Characteristics**

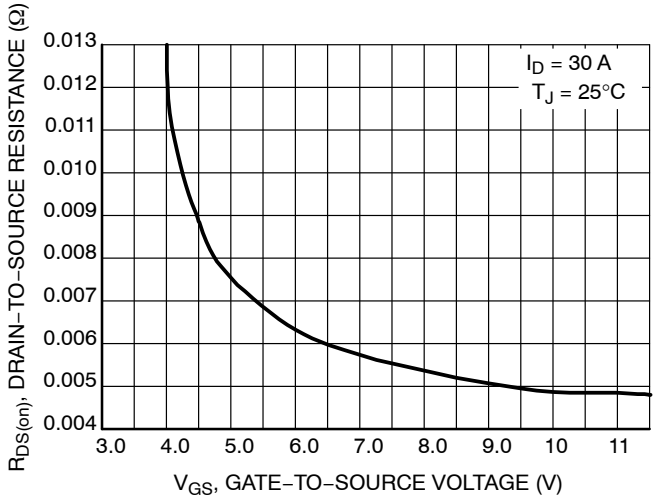



**Figure 3. On−Resistance versus Gate−to−Source Voltage**

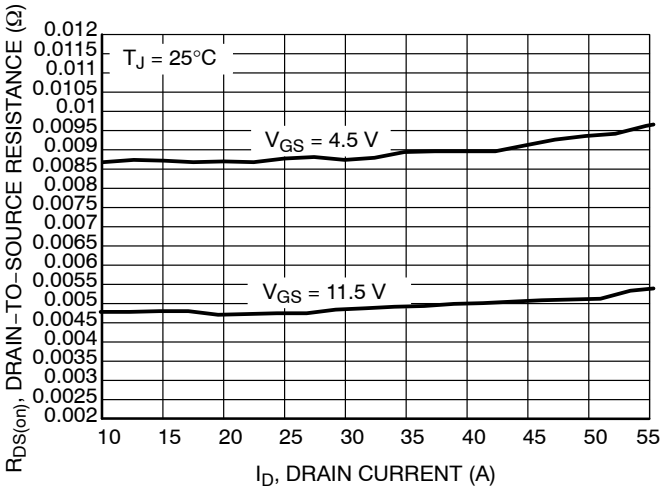



**Figure 4. On−Resistance versus Drain Current and Gate Voltage**

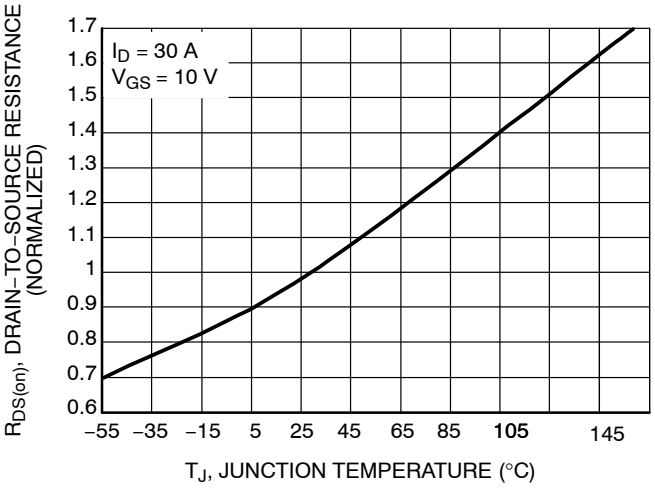



**Figure 5. On−Resistance Variation with Temperature**

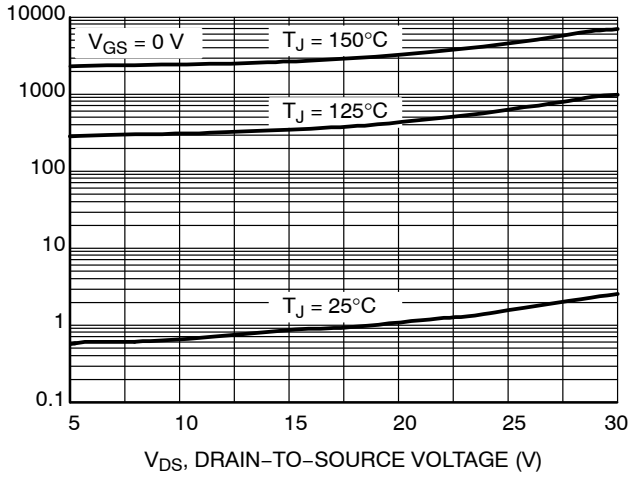



**Figure 6. Drain−to−Source Leakage Current versus Voltage**

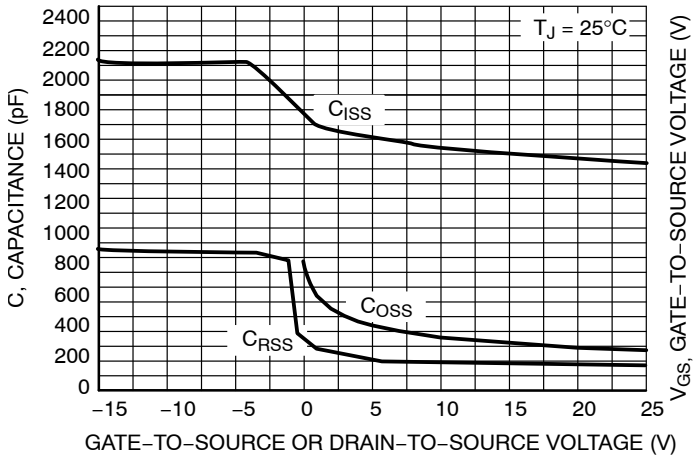



**Figure 7. Capacitance Variation**

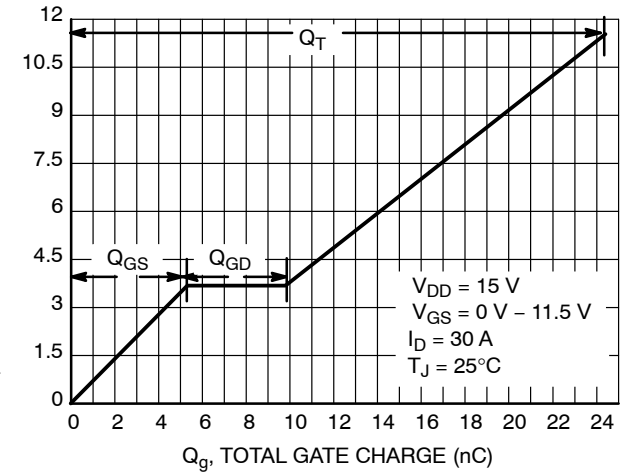



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Gate Charge**

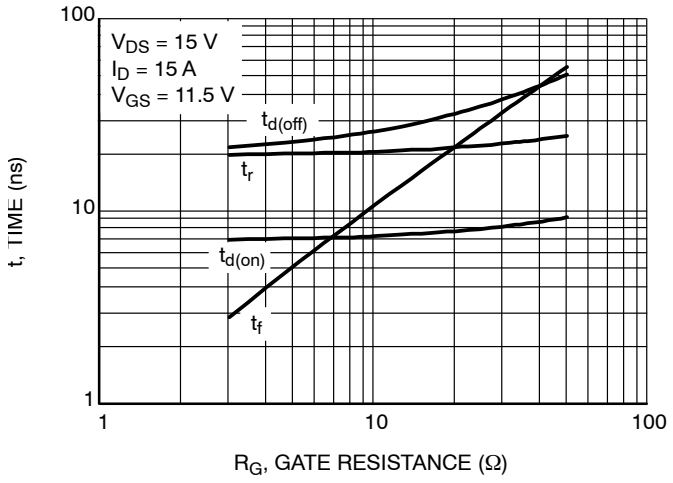



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

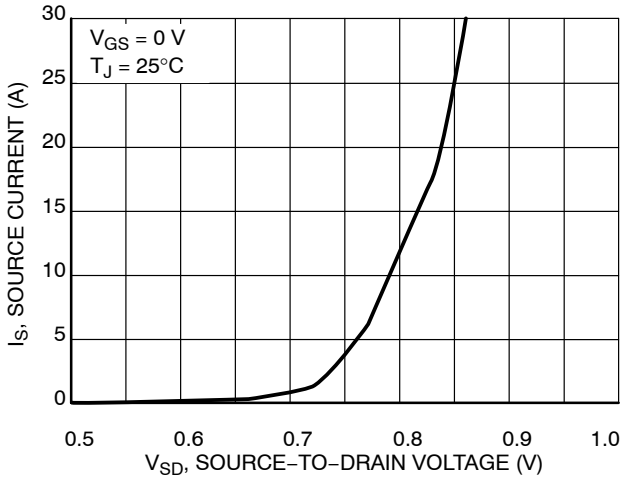



**Figure 10. Diode Forward Voltage versus Current**

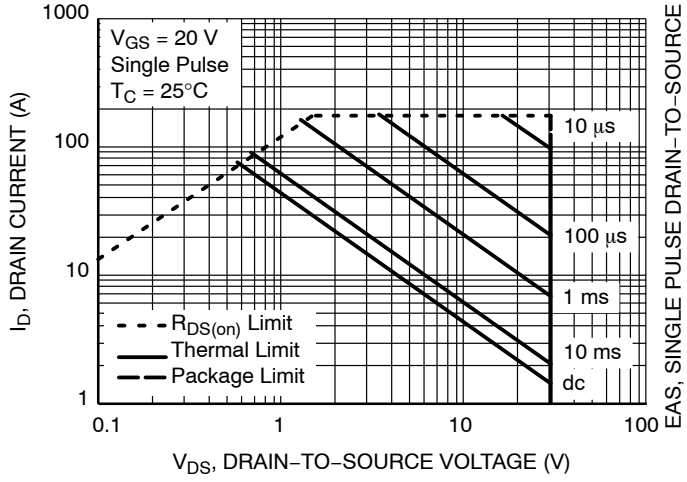



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

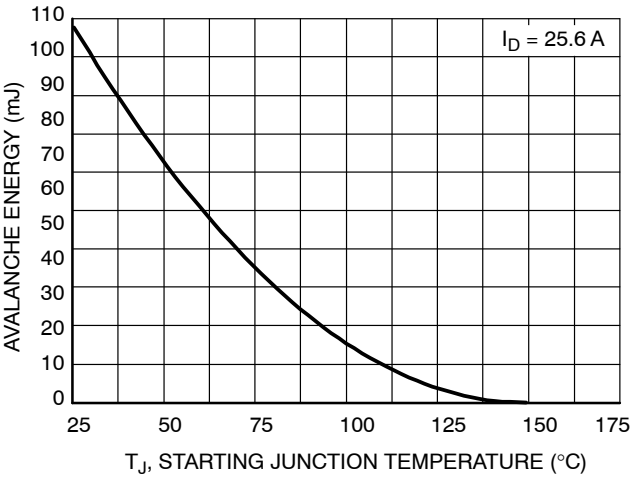



**Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature**

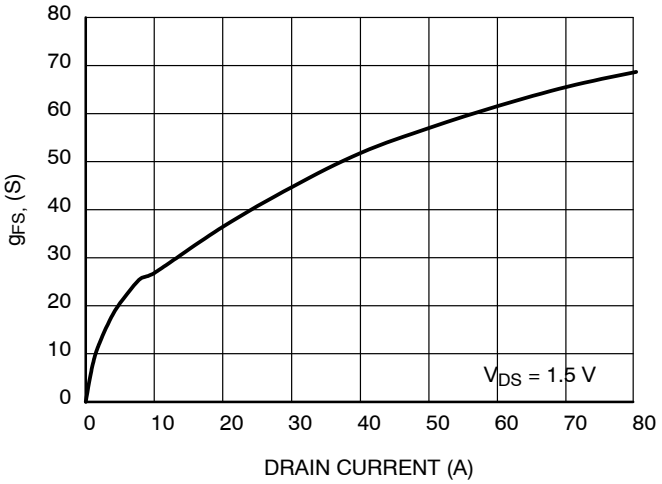
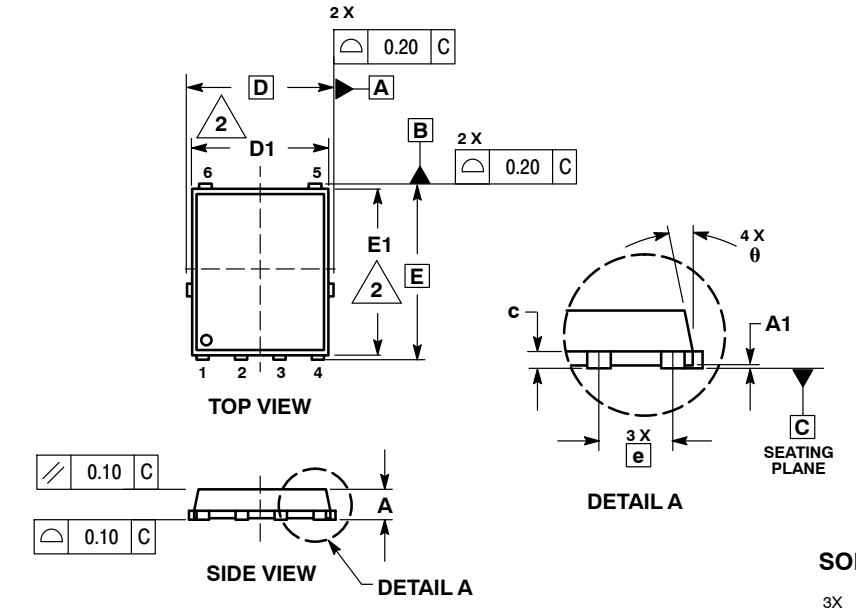
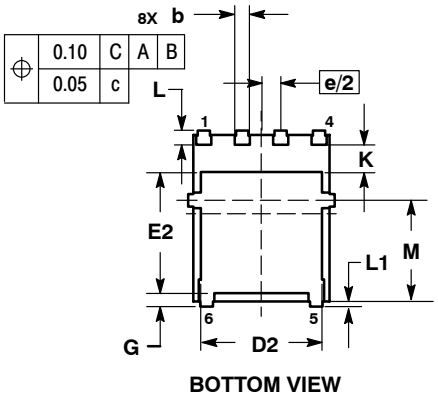



**Figure 13. $G_{FS}$ versus Drain Current**

## PACKAGE DIMENSIONS

**DFN6 5x6, 1.27P (SO8 FL)**
CASE 488AA−01
ISSUE C



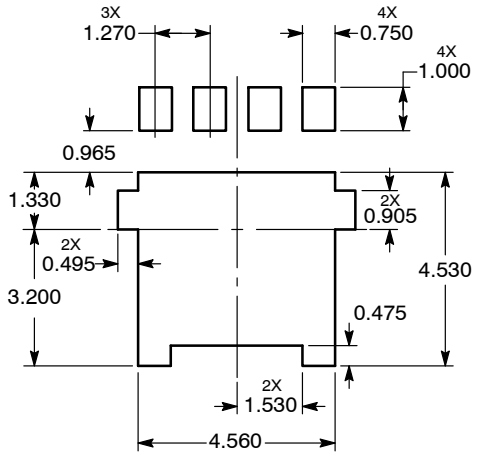




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| | 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 | | 5.15 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
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN

### SOLDERING FOOTPRINT*




*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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