

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

- 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_{DSS} | 30 | V | | |
| Gate-to-Source Voltage | V_{GS} | ± 20 | V | | |
| Steady State | Continuous Drain Current $R_{\theta JA}$ (Note 1) | $T_A = 25^\circ\text{C}$ | I_D | 13.5 | A |
| | | $T_A = 85^\circ\text{C}$ | | 9.7 | |
| | Power Dissipation $R_{\theta JA}$ (Note 1) | $T_A = 25^\circ\text{C}$ | P_D | 2.16 | W |
| | | $T_A = 85^\circ\text{C}$ | | 1.1 | |
| | Continuous Drain Current $R_{\theta JA} \leq 10$ s | $T_A = 25^\circ\text{C}$ | I_D | 21.8 | A |
| | | $T_A = 85^\circ\text{C}$ | | 15.7 | |
| | Power Dissipation $R_{\theta JA} \leq 10$ s | $T_A = 25^\circ\text{C}$ | P_D | 5.7 | W |
| | | $T_A = 85^\circ\text{C}$ | | 2.9 | |
| | Continuous Drain Current $R_{\theta JA}$ (Note 2) | $T_A = 25^\circ\text{C}$ | I_D | 8.6 | A |
| | | $T_A = 85^\circ\text{C}$ | | 6.2 | |
| | Power Dissipation $R_{\theta JA}$ (Note 2) | $T_A = 25^\circ\text{C}$ | P_D | 0.87 | W |
| | | $T_A = 85^\circ\text{C}$ | | 0.45 | |
| | Continuous Drain Current $R_{\theta JC}$ (Note 1) | $T_C = 25^\circ\text{C}$ | I_D | 59 | A |
| | | $T_C = 85^\circ\text{C}$ | | 42.5 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | $T_C = 25^\circ\text{C}$ | P_D | 41.7 | W | |
| | $T_C = 85^\circ\text{C}$ | | 21.7 | | |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | $T_A = 25^\circ\text{C}$ | I_{DM} | 177 | A |
| Operating Junction and Storage Temperature | | T_J, T_{STG} | | -55 to +150 | $^\circ\text{C}$ |
| 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, $R_G = 25 \Omega$) | | EAS | | 98 | 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.

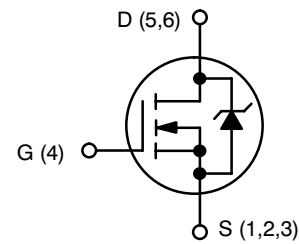
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



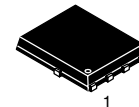
ON Semiconductor®

<http://onsemi.com>

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

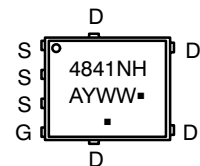


N-CHANNEL MOSFET



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.

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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 ($t \leq 10$ s) | $R_{\theta JA}$ | 22.1 | |

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, $I_D = 250$ 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, $V_{GS} = \pm 20$ 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 | m Ω |
| | | | $I_D = 15$ 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 $\leq 2\%$.

4. Switching characteristics are independent of operating junction temperatures.

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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 | | |

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.

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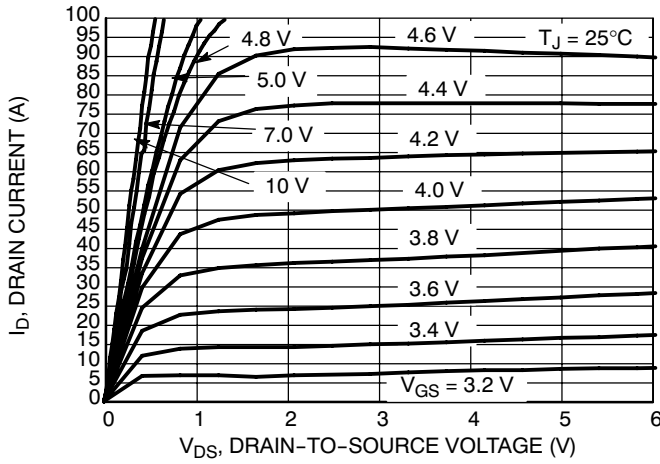


Figure 1. On-Region Characteristics

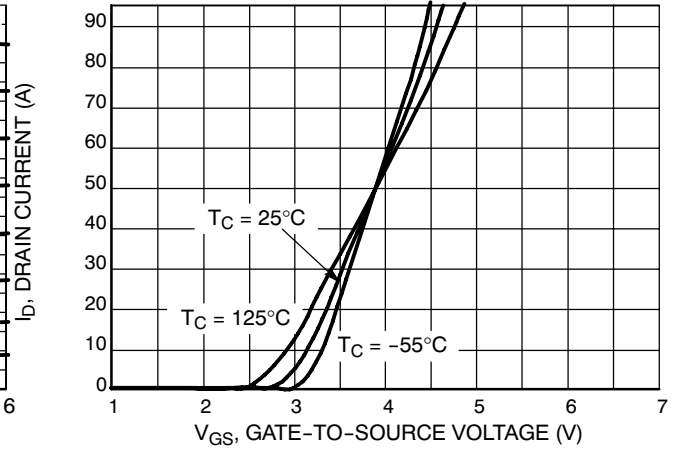


Figure 2. Transfer Characteristics

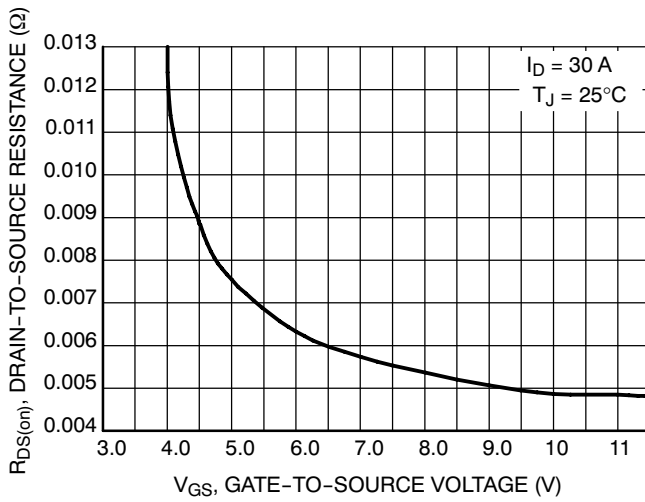


Figure 3. On-Resistance versus Gate-to-Source Voltage

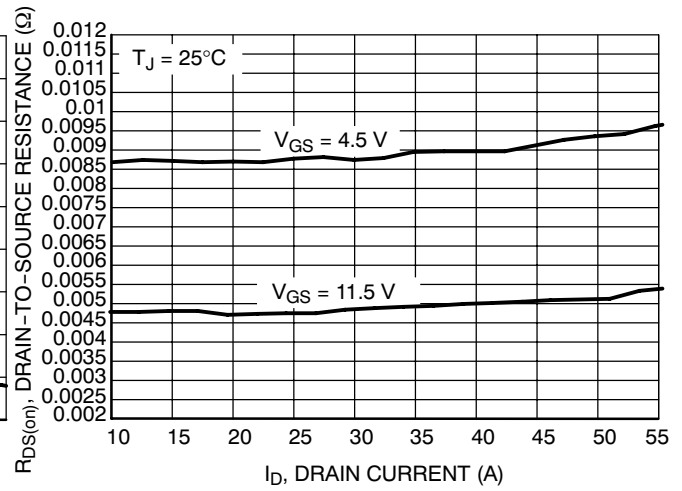


Figure 4. On-Resistance versus Drain Current and Gate Voltage

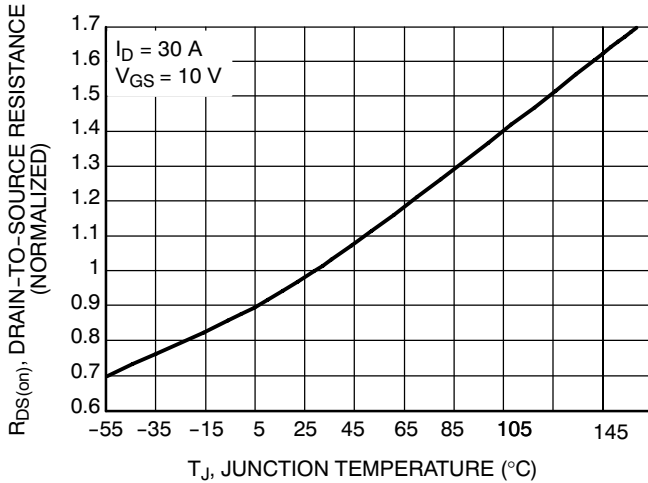


Figure 5. On-Resistance Variation with Temperature

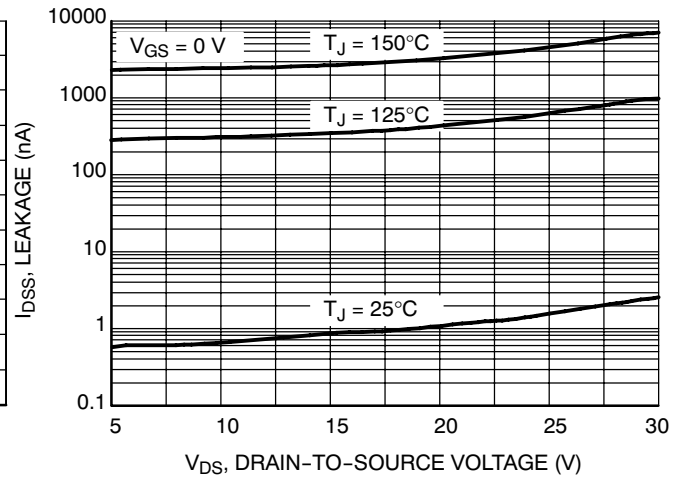


Figure 6. Drain-to-Source Leakage Current versus Voltage

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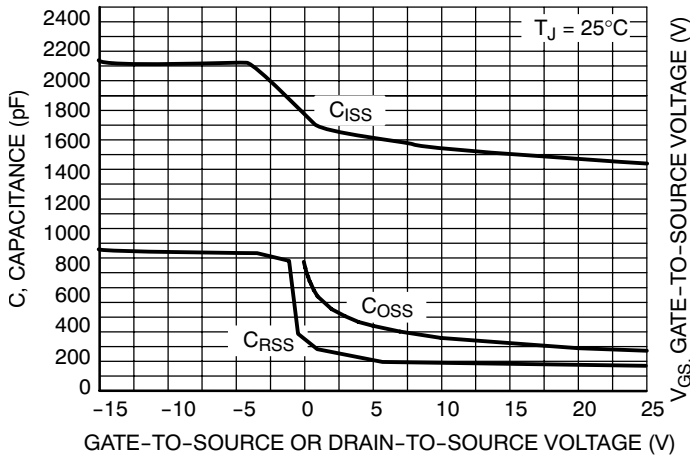


Figure 7. Capacitance Variation

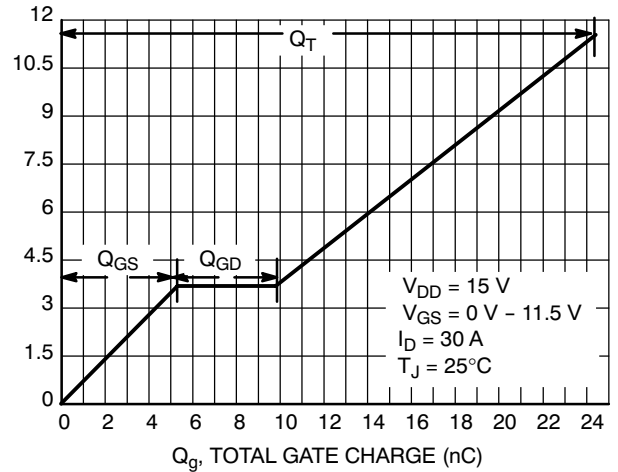


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Gate Charge

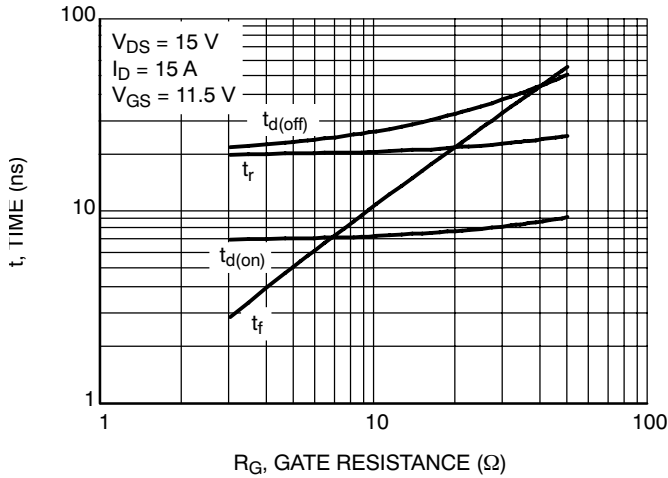


Figure 9. Resistive Switching Time Variation versus Gate Resistance

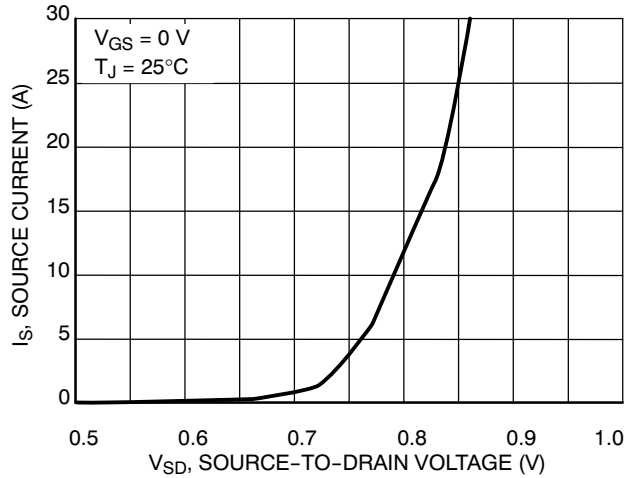


Figure 10. Diode Forward Voltage versus Current

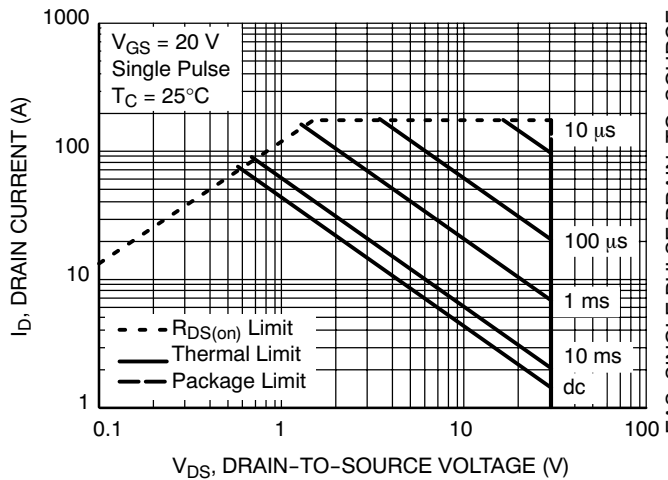


Figure 11. Maximum Rated Forward Biased Safe Operating Area

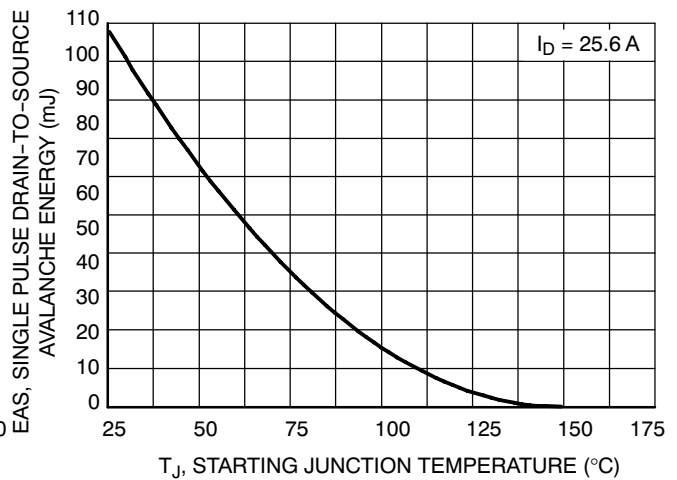


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

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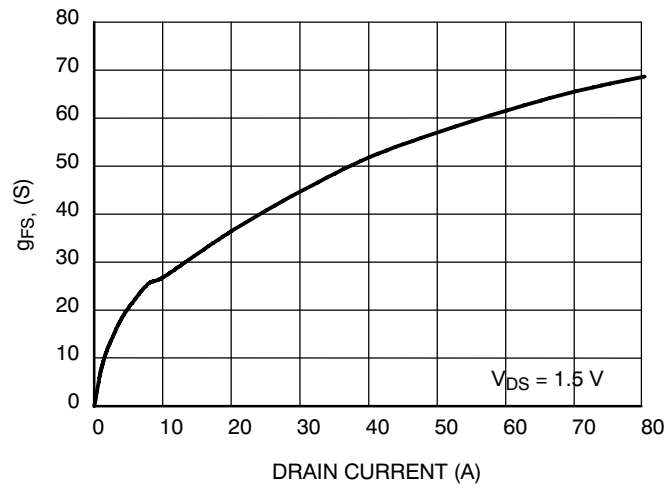
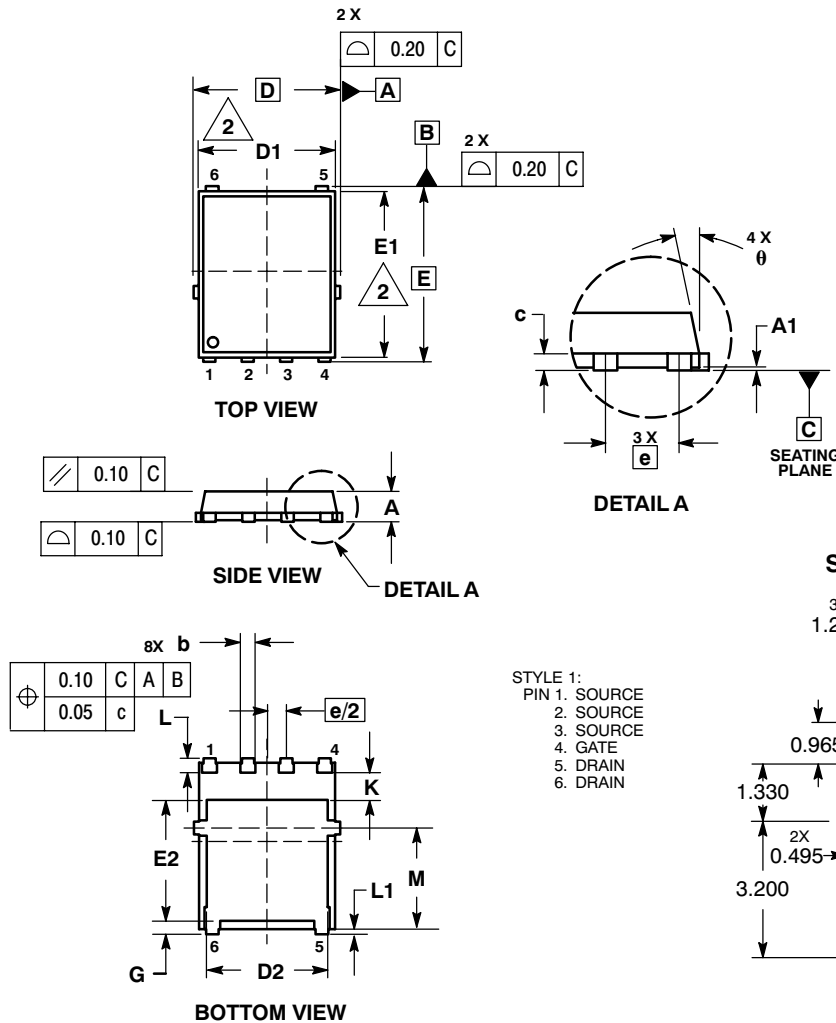


Figure 13. G_{FS} versus Drain Current

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PACKAGE DIMENSIONS

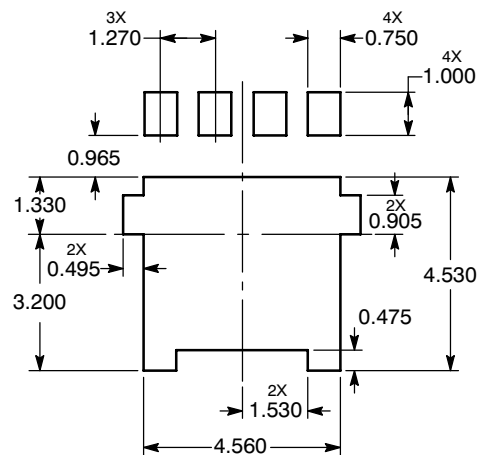
DFN6 5x6, 1.27P (SO8 FL)
CASE 488AA-01
ISSUE C



- 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.

| 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 | 5.15 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° |

SOLDERING FOOTPRINT*



- STYLE 1:
PIN 1. SOURCE
PIN 2. SOURCE
PIN 3. SOURCE
PIN 4. GATE
PIN 5. DRAIN
PIN 6. 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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