

NTMFS4939N

MOSFET – Power, Single, N-Channel, SO-8 FL 30 V, 53 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 ($T_J = 25^\circ\text{C}$ unless otherwise stated)

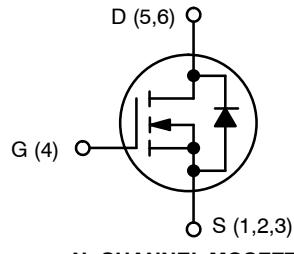
| Parameter | | Symbol | Value | Unit |
|---|--|----------------|-------------|------------------|
| Drain-to-Source Voltage | | V_{DSS} | 30 | V |
| Gate-to-Source Voltage | | V_{GS} | ± 20 | V |
| Steady State | $T_A = 25^\circ\text{C}$ | I_D | 15.7 | A |
| | | | 9.9 | |
| | $T_A = 25^\circ\text{C}$ | P_D | 2.58 | W |
| | $T_A = 25^\circ\text{C}$ | I_D | 26 | A |
| | $T_A = 100^\circ\text{C}$ | | 17 | |
| | $T_A = 25^\circ\text{C}$ | P_D | 7.6 | W |
| | $T_A = 25^\circ\text{C}$ | I_D | 9.3 | A |
| | $T_A = 100^\circ\text{C}$ | | 5.9 | |
| | $T_A = 25^\circ\text{C}$ | P_D | 0.92 | W |
| | $T_C = 25^\circ\text{C}$ | I_D | 53 | A |
| Pulsed Drain Current $R_{\theta,JA}$ (Note 1) | $T_C = 100^\circ\text{C}$ | | 34 | |
| | $T_C = 25^\circ\text{C}$ | P_D | 30 | W |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | I_{DM} | 159 | A |
| Current Limited by Package | $T_A = 25^\circ\text{C}$ | I_{Dmax} | 100 | A |
| Operating Junction and Storage Temperature | | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | | I_S | 27 | A |
| Drain to Source DV/DT | | dV/dt | 7.0 | V/ns |

ON

ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(ON) MAX}$ | $I_D MAX$ |
|---------------|------------------------|-----------|
| 30 V | 5.5 m Ω @ 10 V | 53 A |
| | 8.0 m Ω @ 4.5 V | |



MARKING DIAGRAM



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

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------------|-------------------|-----------------------|
| NTMFS4939NT1G | SO-8 FL (Pb-Free) | 1500 / Tape & Reel |
| NTMFS4939NT3G | 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.

NTMFS4939N

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

| Parameter | Symbol | Value | Unit |
|---|----------|-------|------|
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $V_{GS} = 10\text{ V}$, $I_L = 31\text{ A}_{\text{pk}}$, $L = 0.1\text{ mH}$, $R_G = 25\text{ }\Omega$) | E_{AS} | 48 | 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) | $R_{\theta JC}$ | 4.2 | °C/W |
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 48.5 | |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 136 | |
| Junction-to-Ambient – (t ≤ 10 s) (Note 3) | $R_{\theta JA}$ | 16.6 | |

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 ($T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|-----------------------|--|---------------------------|-----|-----|------|-------|
| OFF CHARACTERISTICS | | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | | 30 | | | V |
| Drain-to-Source Breakdown Voltage (transient) | $V_{(BR)DSS\text{t}}$ | $V_{GS} = 0\text{ V}$, $I_D(\text{aval}) = 13\text{ A}$, $T_{\text{case}} = 25^\circ\text{C}$, $t_{\text{transient}} = 100\text{ ns}$ | | 34 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 19 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}$, $V_{DS} = 24\text{ V}$ | $T_J = 25^\circ\text{C}$ | | | 1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | | 10 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$ | | | | ±100 | nA |

ON CHARACTERISTICS (Note 5)

| | | | | | | | |
|--|-------------------------|--|---------------------|-----|-----|-------|----|
| Gate Threshold Voltage | $V_{GS(\text{TH})}$ | $V_{GS} = V_{DS}$, $I_D = 250\text{ }\mu\text{A}$ | 1.2 | 1.6 | 2.2 | V | |
| Negative Threshold Temperature Coefficient | $V_{GS(\text{TH})}/T_J$ | | | 4.0 | | mV/°C | |
| Drain-to-Source On Resistance | $R_{DS(\text{on})}$ | $V_{GS} = 10\text{ V}$ | $I_D = 30\text{ A}$ | | 4.1 | 5.5 | mΩ |
| | | | $I_D = 15\text{ A}$ | | 4.1 | | |
| | | $V_{GS} = 4.5\text{ V}$ | $I_D = 30\text{ A}$ | | 6.0 | 8.0 | |
| | | | $I_D = 15\text{ A}$ | | 6.0 | | |
| Forward Transconductance | g_{FS} | $V_{DS} = 1.5\text{ V}$, $I_D = 15\text{ A}$ | | 34 | | S | |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|---------------------|---|--|-------|-------|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$, $V_{DS} = 15\text{ V}$ | | 1954 | | pF |
| Output Capacitance | C_{OSS} | | | 642 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 26.5 | | |
| Capacitance Ratio | C_{RSS} / C_{ISS} | $V_{GS} = 0\text{ V}$, $V_{DS} = 15\text{ V}$, $f = 1\text{ MHz}$ | | 0.014 | 0.027 | |

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

NTMFS4939N

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 | | 12.8 | | nC | |
| Threshold Gate Charge | Q _{G(TH)} | | | 2.9 | | | |
| Gate-to-Source Charge | Q _{GS} | | | 6.0 | | | |
| Gate-to-Drain Charge | Q _{GD} | | | 2.5 | | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 10 V, V _{DS} = 15 V; I _D = 30 A | | 28.5 | | 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 | | 12.7 | | ns | |
| Rise Time | t _r | | | 26 | | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 21.4 | | | |
| Fall Time | t _f | | | 4.5 | | | |
| Turn-On Delay Time | t _{d(ON)} | V _{GS} = 10 V, V _{DS} = 15 V, I _D = 15 A, R _G = 3.0 Ω | | 9.4 | | ns | |
| Rise Time | t _r | | | 21.4 | | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 26.7 | | | |
| Fall Time | t _f | | | 3.0 | | | |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | | |
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 30 A | T _J = 25°C | | 0.9 | 1.1 | V |
| | | | T _J = 125°C | | 0.79 | | |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 30 A | | | 35 | | ns |
| Charge Time | t _a | | | | 18 | | |
| Discharge Time | t _b | | | | 17 | | |
| Reverse Recovery Charge | Q _{RR} | | | | 26 | | nC |
| PACKAGE PARASITIC VALUES | | | | | | | |
| Source Inductance | L _S | T _A = 25°C | | | 0.93 | | 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 \leq 300 μs, duty cycle \leq 2%.

6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

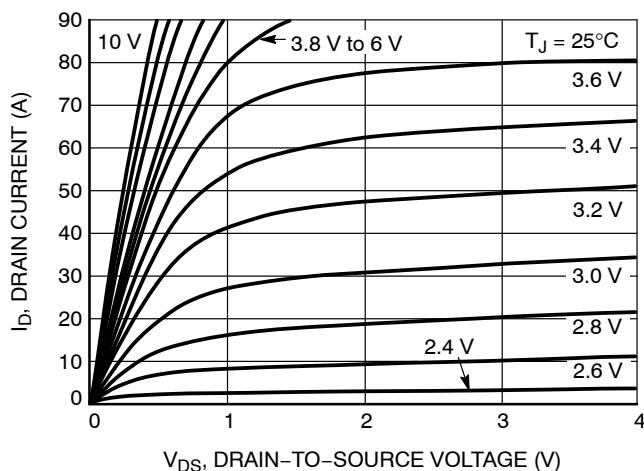


Figure 1. On-Region Characteristics

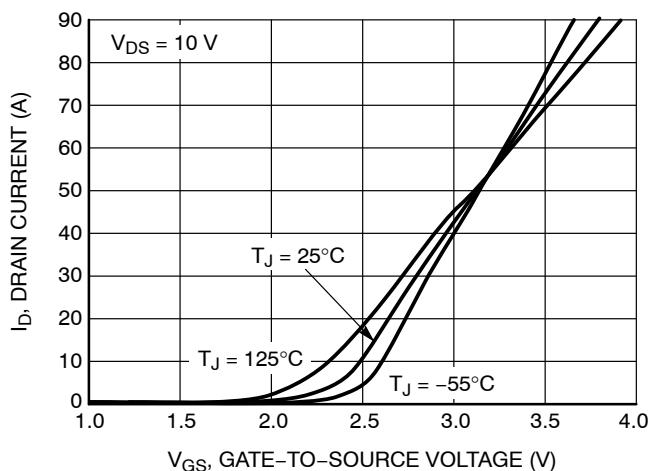


Figure 2. Transfer Characteristics

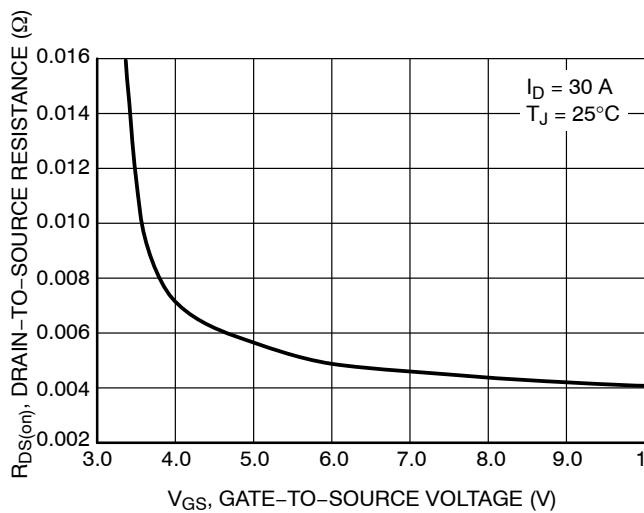
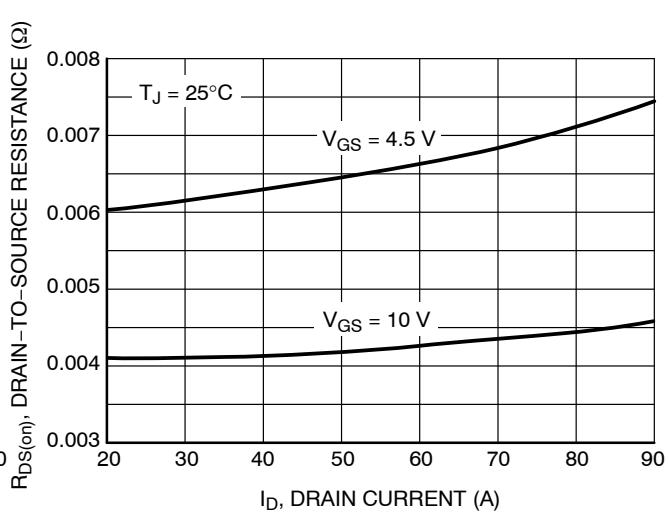
Figure 3. On-Resistance vs. V_{GS} 

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

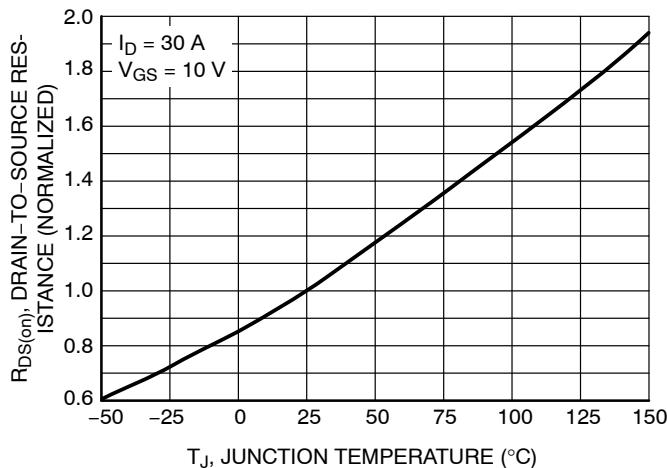


Figure 5. On-Resistance Variation with Temperature

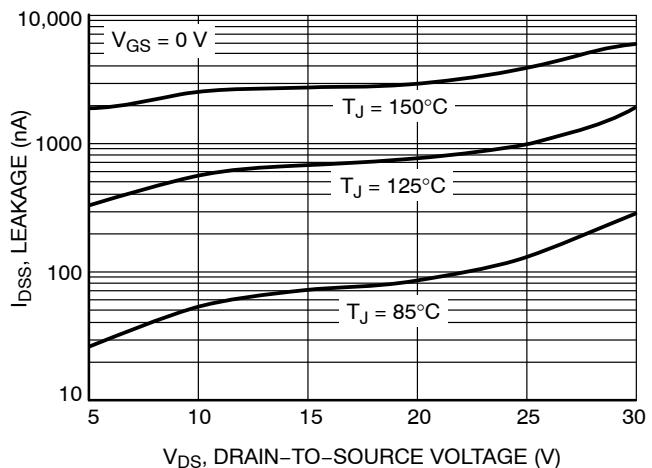


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

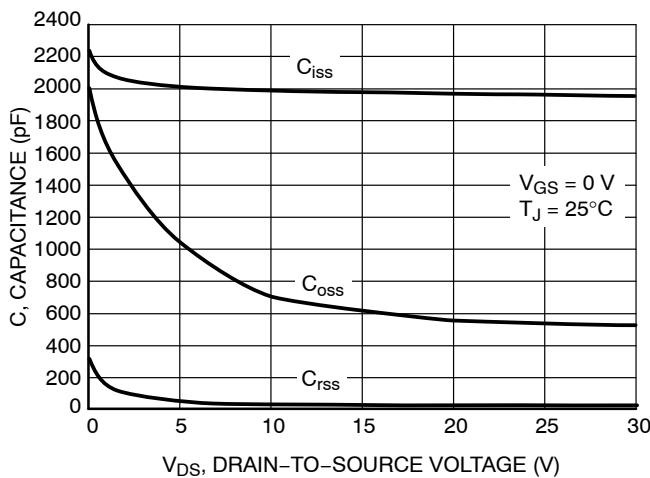


Figure 7. Capacitance Variation

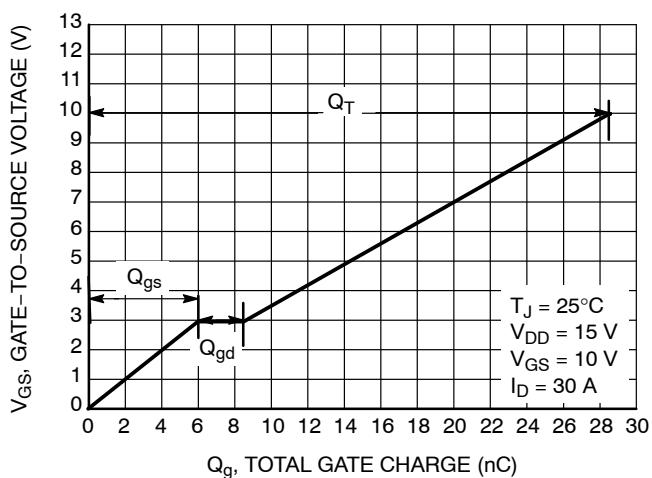


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

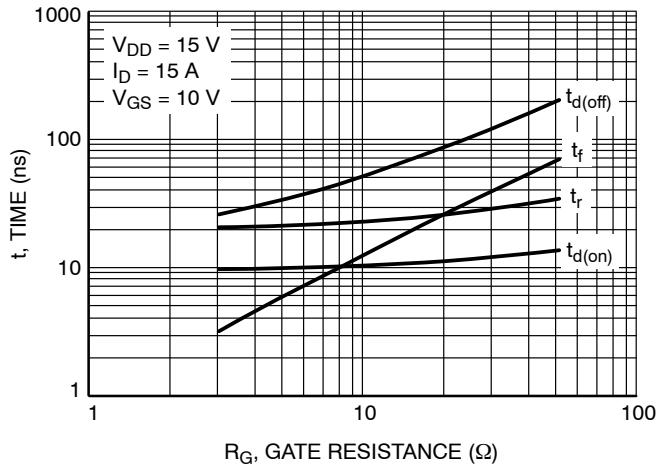


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

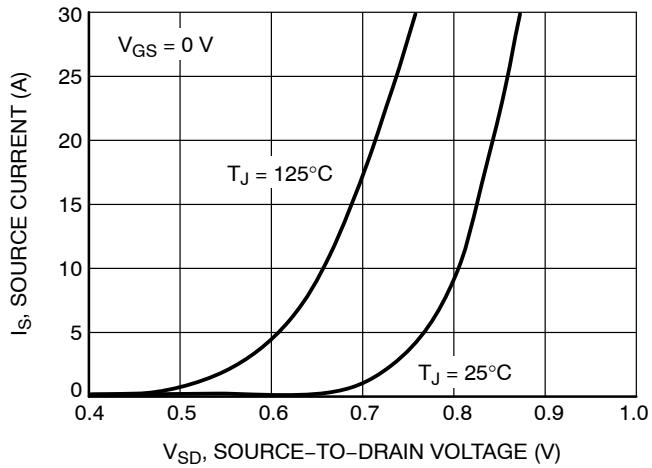


Figure 10. Diode Forward Voltage vs. Current

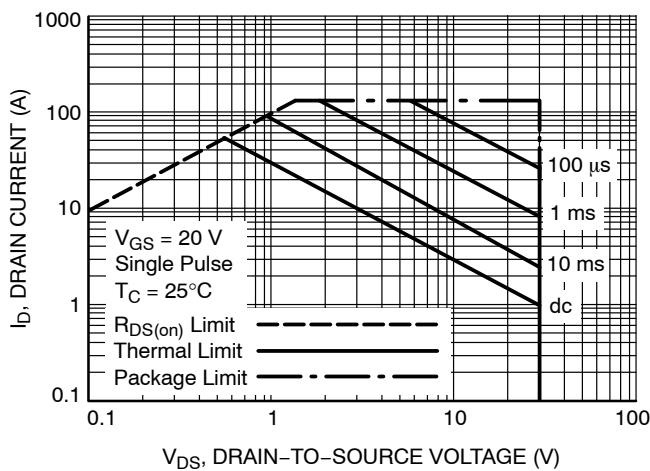


Figure 11. Maximum Rated Forward Biased Safe Operating Area

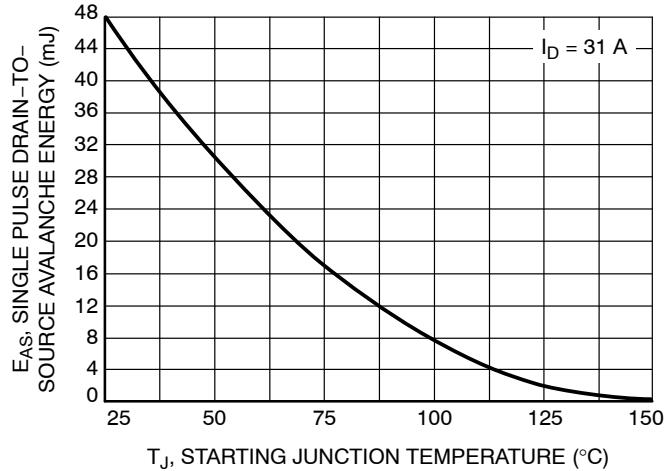
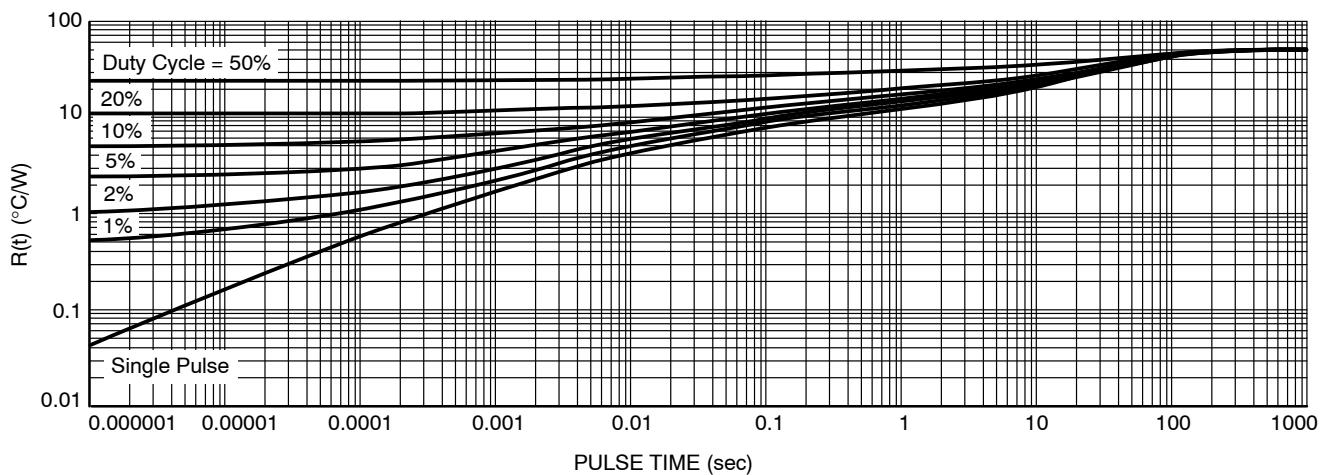
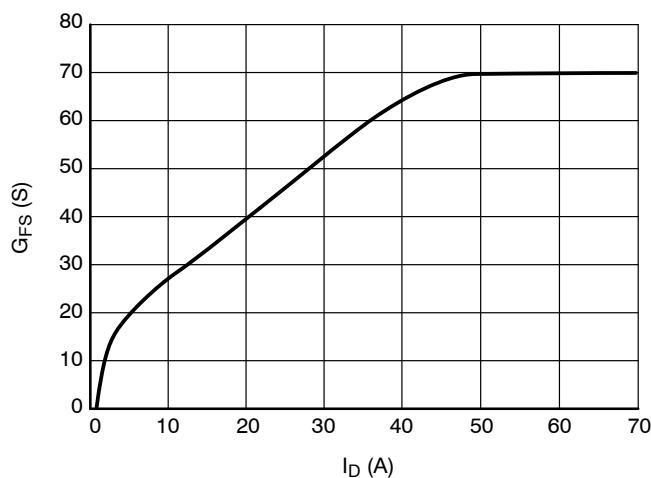
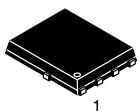


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS**Figure 13. Thermal Response****Figure 14. G_{FS} vs. I_D**



SCALE 2:1

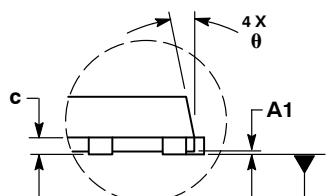
DFN5 5x6, 1.27P
(SO-8FL)
CASE 488AA
ISSUE N

DATE 25 JUN 2018

NOTES:

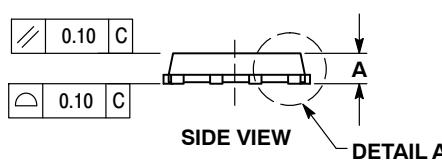
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| 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 | 0.575 | 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 ° |

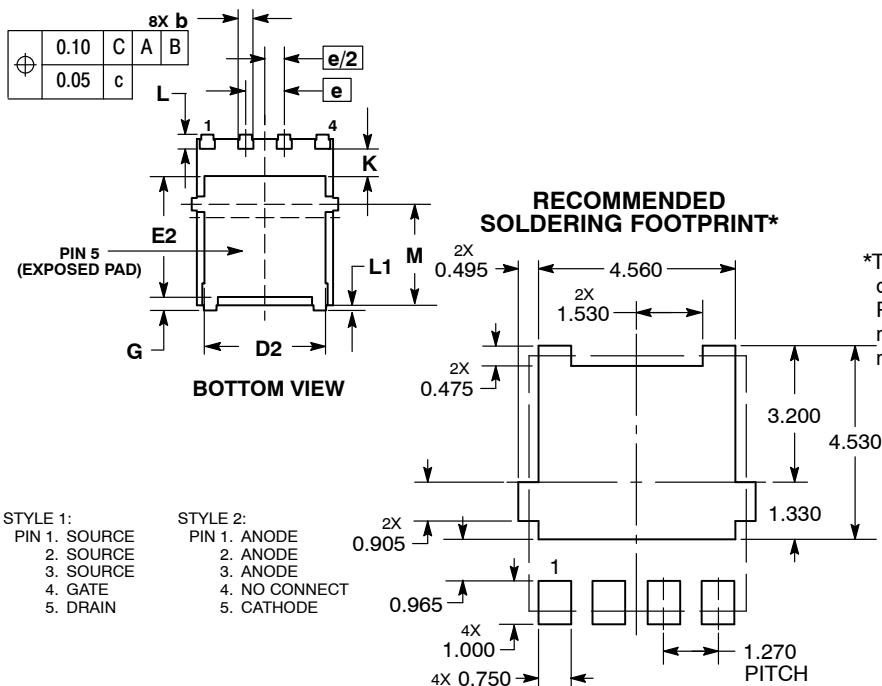


DETAIL A

SEATING PLANE



DETAIL A



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

DIMENSIONS: MILLIMETERS

*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.

*For additional information on our Pb-Free strategy and soldering details, please download the onsemi 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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