

# NTMFS4833N

## Power MOSFET

30 V, 191 A, Single N-Channel, SO-8FL

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These are Pb-Free Devices

### Applications

- Refer to Application Note AND8195/D
- CPU Power Delivery
- DC-DC Converters
- Low Side Switching

### 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   | $V_{GS}$   | $\pm 20$                 | V                |   |
| Continuous Drain Current $R_{\theta JA}$ (Note 1)  | $I_D$  | $T_A = 25^\circ\text{C}$ | 26               | A |
|  |  | $T_A = 85^\circ\text{C}$ | 19               |   |
| Power Dissipation $R_{\theta JA}$ (Note 1)   | $P_D$  | 2.35                     | W                |   |
| Continuous Drain Current $R_{\theta JA}$ (Note 2)  | $I_D$  | $T_A = 25^\circ\text{C}$ | 16               | A |
|  |  | $T_A = 85^\circ\text{C}$ | 12               |   |
| Power Dissipation $R_{\theta JA}$ (Note 2)   | $P_D$  | 0.91                     | W                |   |
| Continuous Drain Current $R_{\theta JC}$ (Note 1)  | $I_D$  | $T_C = 25^\circ\text{C}$ | 191              | A |
|  |  | $T_C = 85^\circ\text{C}$ | 138              |   |
| Power Dissipation $R_{\theta JC}$ (Note 1)   | $P_D$  | 125                      | W                |   |
| Pulsed Drain Current   | $T_A = 25^\circ\text{C}$ ,<br>$t_p = 10 \mu\text{s}$ | $I_{DM}$                 | 288              | A |
| Operating Junction and Storage Temperature   | $T_J, T_{STG}$                                       | -55 to +150              | $^\circ\text{C}$ |   |
| Source Current (Body Diode)  | $I_S$  | 104                      | A                |   |
| Drain to Source $dV/dt$  | $dV/dt$  | 6                        | V/ns             |   |
| Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}$ , $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_L = 35\text{ A}_{pk}$ , $L = 1.0\text{ mH}$ , $R_G = 25\ \Omega$ ) | EAS  | 612.5                    | 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.

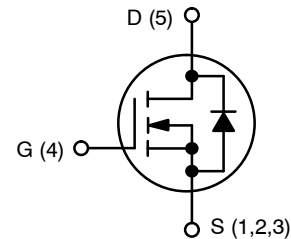
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



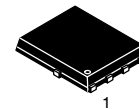
ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 30 V          | 2.0 m $\Omega$ @ 10 V    | 191 A             |
|               | 3.0 m $\Omega$ @ 4.5 V   |                   |

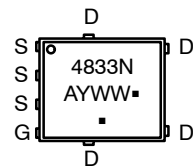


N-CHANNEL MOSFET



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†        |
|---------------|---------------------|------------------|
| NTMFS4833NT1G | SO-8FL<br>(Pb-Free) | 1500/Tape & Reel |
| NTMFS4833NT3G | SO-8FL<br>(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 Specification Brochure, BRD8011/D.

# NTMFS4833N

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case (Drain)                    | $R_{\theta JC}$ | 1.0   | °C/W |
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 53.2  |      |
| Junction-to-Ambient – $t < 10s$ (Note 3)    | $R_{\theta JA}$ | 20.3  |      |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 137.8 |      |

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                   |   |                           |    |           |               |
|---|-------------------|---|---------------------------|----|-----------|---------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$   | 30                        |    |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |   |                           | 17 |           | 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         | $\mu\text{A}$ |
|   |                   |   | $T_J = 125^\circ\text{C}$ |    | 10        |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ |                           |    | $\pm 100$ | nA            |

### ON CHARACTERISTICS (Note 5)

|  |                  |   |                     |      |     |            |
|--|------------------|---|---------------------|------|-----|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 1.5                 |      | 2.5 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |   |                     | 7.12 |     | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V to } 11.5\text{ V}$  | $I_D = 30\text{ A}$ | 1.3  | 2.0 | m $\Omega$ |
|  |                  |   | $I_D = 15\text{ A}$ | 1.3  |     |            |
|  |                  | $V_{GS} = 4.5\text{ V}$                   | $I_D = 30\text{ A}$ | 2.3  | 3.0 |            |
|  |                  |   | $I_D = 15\text{ A}$ | 2.3  |     |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$ |                     | 30   |     | S          |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |              |   |  |      |    |    |
|------------------------------|--------------|---|--|------|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 12\text{ V}$     |  | 5600 |    | pF |
| Output Capacitance           | $C_{OSS}$    |   |  | 1200 |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |   |  | 650  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$  |  | 39   | 58 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |   |  | 6.0  |    |    |
| Gate-to-Source Charge        | $Q_{GS}$     |   |  | 16   |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |   |  | 17   |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ |  | 88   |    | nC |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |              |  |  |    |  |    |
|---------------------|--------------|--|--|----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$  |  | 25 |  | ns |
| Rise Time           | $t_r$        |  |  | 34 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 35 |  |    |
| Fall Time           | $t_f$        |  |  | 17 |  |    |
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ |  | 14 |  | ns |
| Rise Time           | $t_r$        |  |  | 19 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 50 |  |    |
| Fall Time           | $t_f$        |  |  | 10 |  |    |

5. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

6. Switching characteristics are independent of operating junction temperatures.

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |   |                           |    |      |     |    |
|-------------------------|----------|---|---------------------------|----|------|-----|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V},$<br>$I_S = 30\text{ A}$                                     | $T_J = 25^\circ\text{C}$  | -  | 0.8  | 1.0 | V  |
|                         |          |   | $T_J = 125^\circ\text{C}$ | -  | 0.68 | -   |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$<br>$I_S = 30\text{ A}$ | -                         | 38 | -    | ns  |    |
| Charge Time             | $t_a$    |   | -                         | 19 | -    |     |    |
| Discharge Time          | $t_b$    |   | -                         | 19 | -    |     |    |
| Reverse Recovery Charge | $Q_{RR}$ |   | -                         | 36 | -    |     | nC |

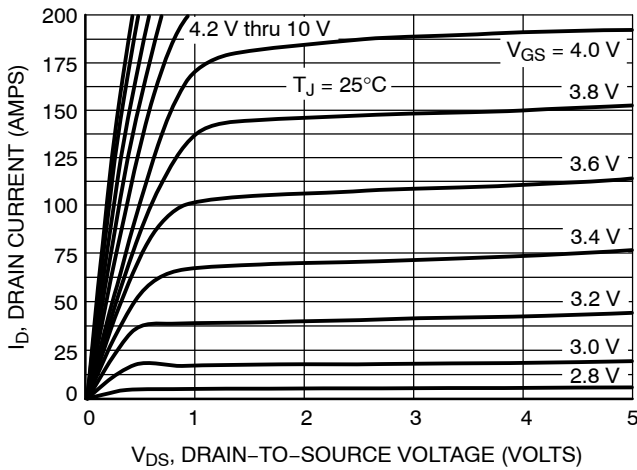
### PACKAGE PARASITIC VALUES

|                   |       |                          |   |       |   |          |
|-------------------|-------|--------------------------|---|-------|---|----------|
| Source Inductance | $L_S$ | $T_A = 25^\circ\text{C}$ | - | 0.50  | - | nH       |
| Drain Inductance  | $L_D$ |                          | - | 0.005 | - | nH       |
| Gate Inductance   | $L_G$ |                          | - | 1.84  | - | nH       |
| Gate Resistance   | $R_G$ |                          | - | 1.0   | - | $\Omega$ |

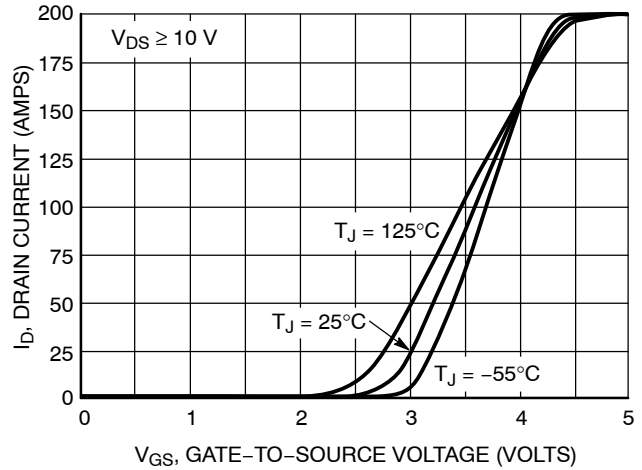
5. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
6. Switching characteristics are independent of operating junction temperatures.

# NTMFS4833N

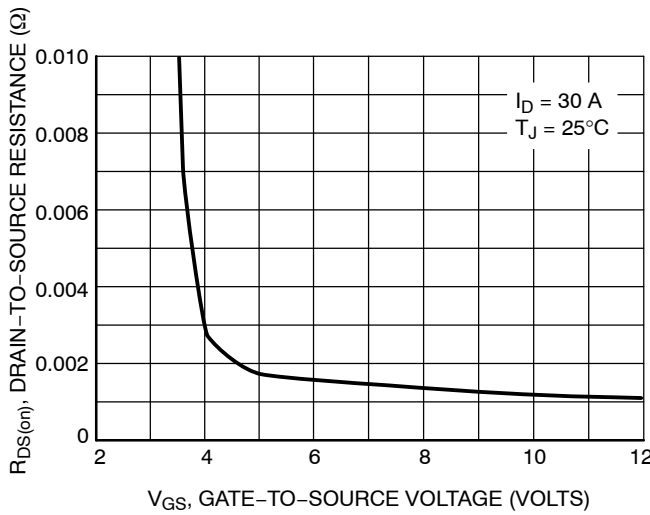
## TYPICAL PERFORMANCE CURVES



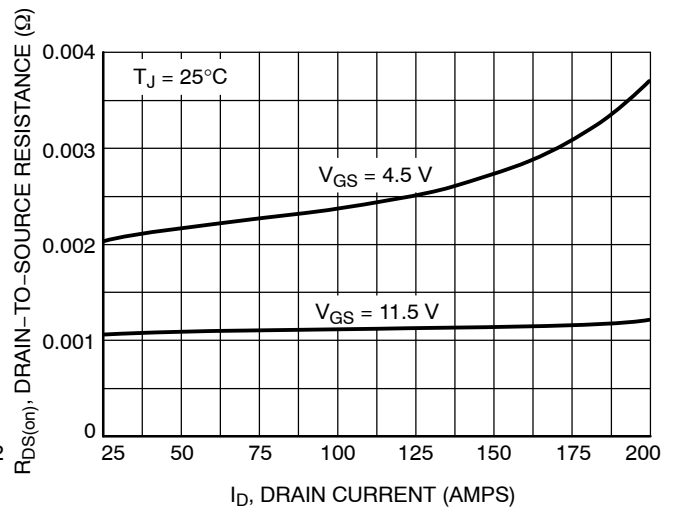
**Figure 1. On-Region Characteristics**



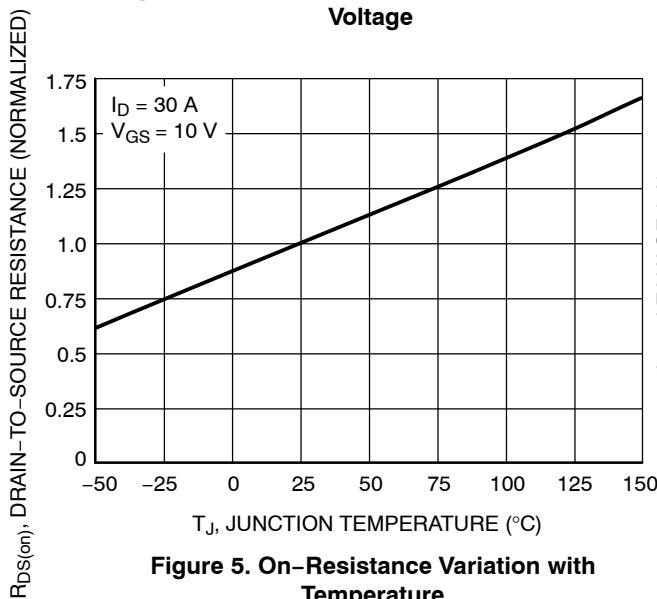
**Figure 2. Transfer Characteristics**



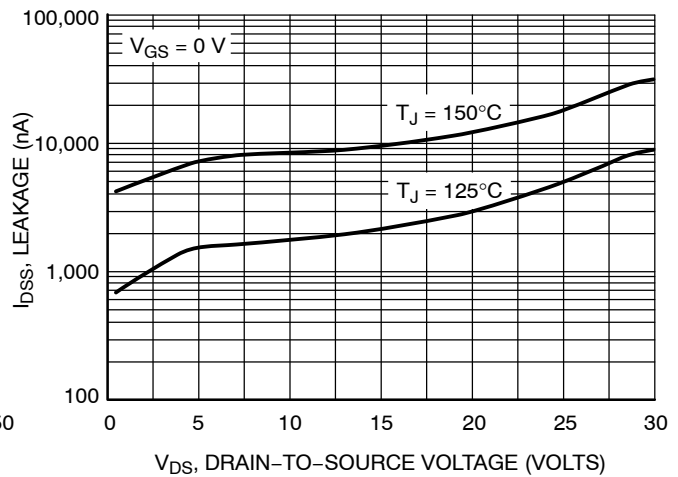
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



**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 PERFORMANCE CURVES

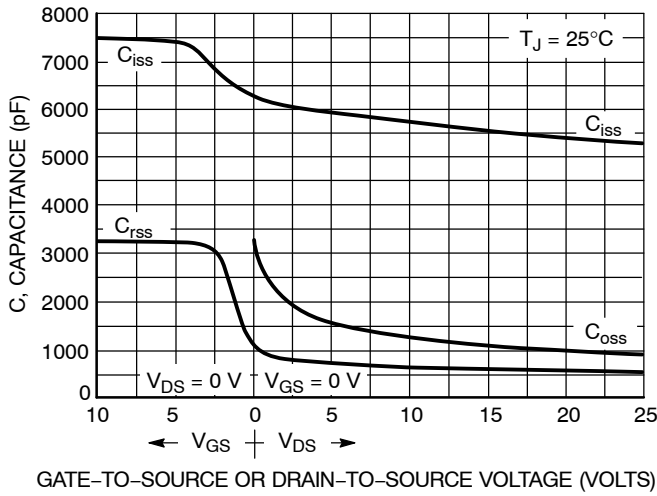


Figure 7. Capacitance Variation

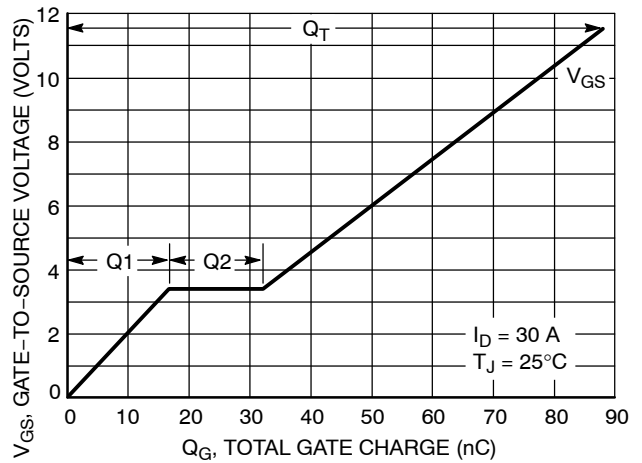


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

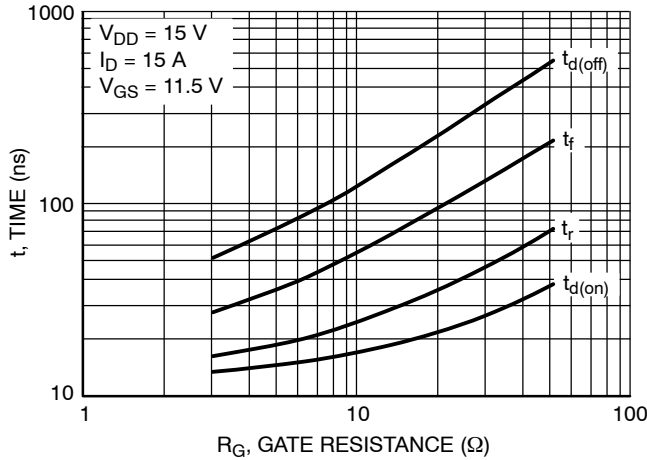


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

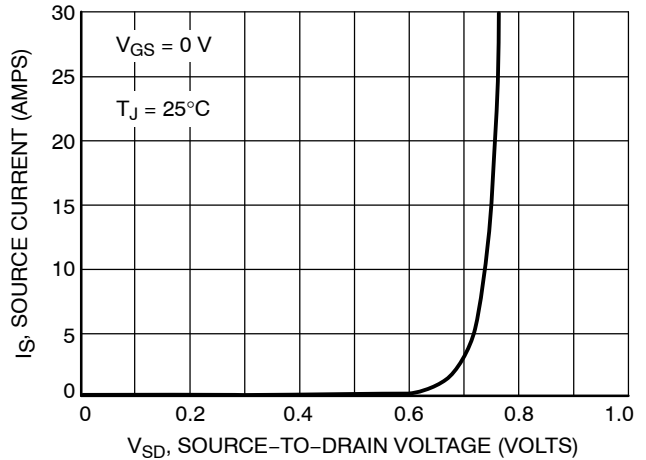


Figure 10. Diode Forward Voltage vs. Current

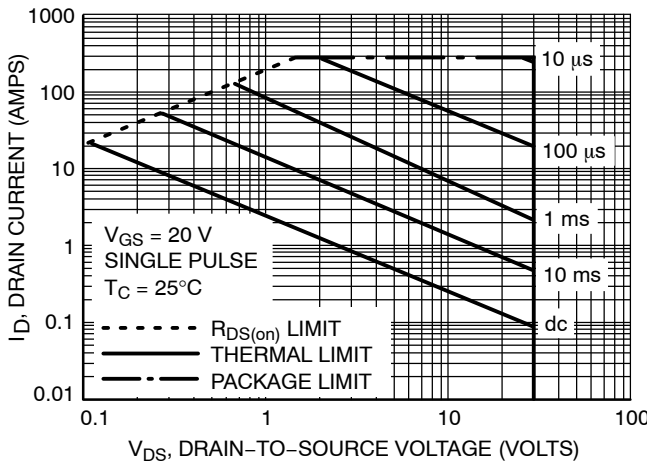


Figure 11. Maximum Rated Forward Biased Safe Operating Area

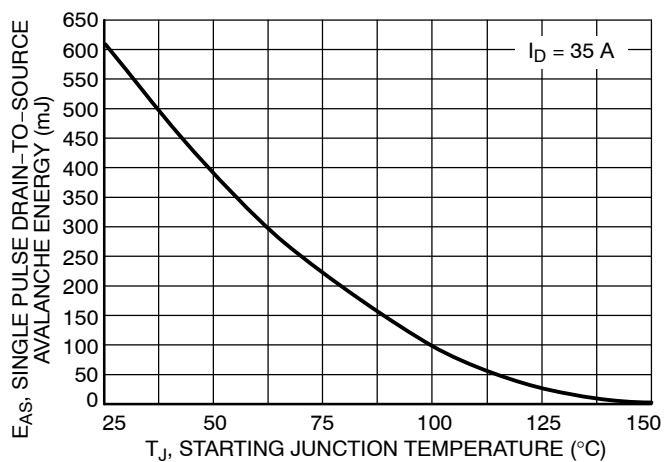


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

# NTMFS4833N

## TYPICAL PERFORMANCE CURVES

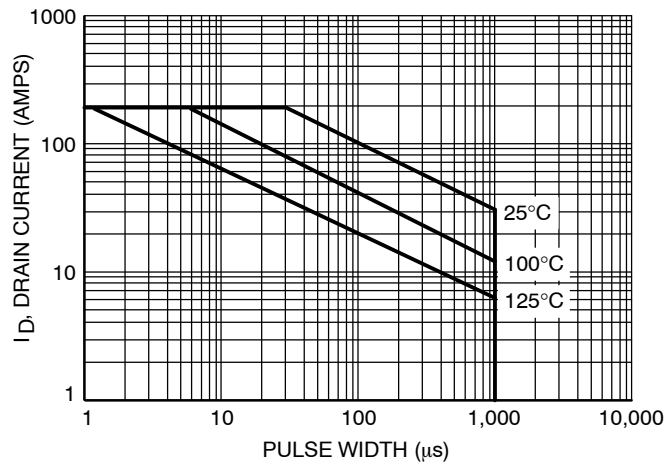


Figure 13. Avalanche Characteristics

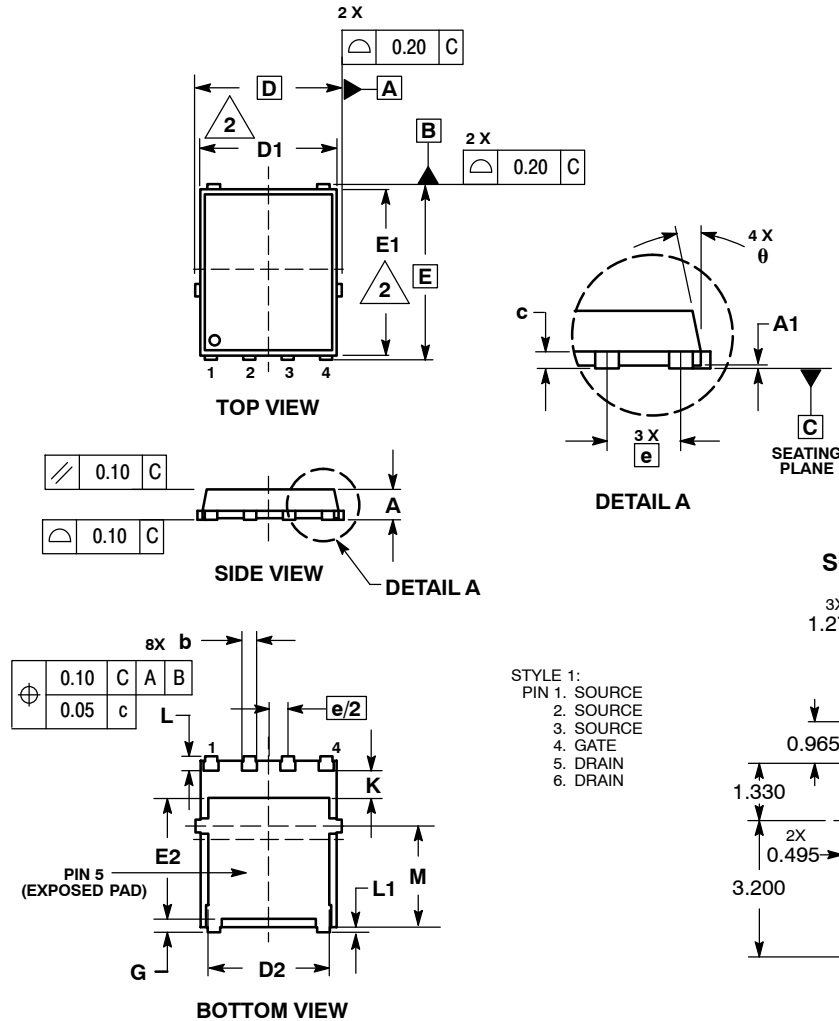
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## PACKAGE DIMENSIONS

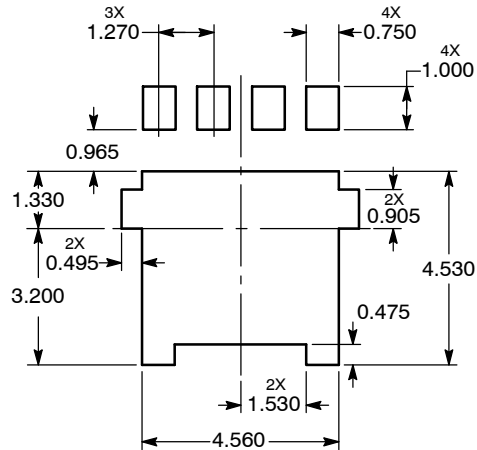
DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA-01  
ISSUE D

- 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\*



\*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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