

# NTMFS5844NL, NVMFS5844NL

## MOSFET – Power, Single, N-Channel 60 V, 61 A, 12 mΩ



ON Semiconductor®

<http://onsemi.com>

### Features

- Small Footprint (5x6 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- NVMFS5844NLWF – Wettable Flanks Product
- NVMFS Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter                                                                                                                                                                                              |                                                   |                              | Symbol         | Value      | Unit             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------|----------------|------------|------------------|
| Drain-to-Source Voltage                                                                                                                                                                                |                                                   |                              | $V_{DS}$       | 60         | V                |
| Gate-to-Source Voltage                                                                                                                                                                                 |                                                   |                              | $V_{GS}$       | $\pm 20$   | V                |
| Continuous Drain Current $R_{\psi J-mb}$ (Notes 1, 2, 3, 4)                                                                                                                                            | Steady State                                      | $T_{mb} = 25^\circ\text{C}$  | $I_D$          | 61         | A                |
|                                                                                                                                                                                                        |                                                   | $T_{mb} = 100^\circ\text{C}$ |                | 43         |                  |
|                                                                                                                                                                                                        |                                                   | $T_{mb} = 25^\circ\text{C}$  | $P_D$          | 107        | W                |
|                                                                                                                                                                                                        |                                                   | $T_{mb} = 100^\circ\text{C}$ |                | 54         |                  |
| Power Dissipation $R_{\psi J-mb}$ (Notes 1, 2, 3)                                                                                                                                                      | Steady State                                      | $T_A = 25^\circ\text{C}$     | $I_D$          | 11.2       | A                |
|                                                                                                                                                                                                        |                                                   | $T_A = 100^\circ\text{C}$    |                | 8.0        |                  |
|                                                                                                                                                                                                        |                                                   | $T_A = 25^\circ\text{C}$     | $P_D$          | 3.7        | W                |
|                                                                                                                                                                                                        |                                                   | $T_A = 100^\circ\text{C}$    |                | 1.8        |                  |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4)                                                                                                                                               | Steady State                                      | $T_A = 25^\circ\text{C}$     | $I_D$          | 11.2       | A                |
| Power Dissipation $R_{\theta JA}$ (Notes 1 & 3)                                                                                                                                                        | Steady State                                      | $T_A = 25^\circ\text{C}$     | $P_D$          | 3.7        | W                |
|                                                                                                                                                                                                        |                                                   | $T_A = 100^\circ\text{C}$    |                | 1.8        |                  |
| Pulsed Drain Current                                                                                                                                                                                   | $T_A = 25^\circ\text{C}$ , $t_p = 10 \mu\text{s}$ |                              | $I_{DM}$       | 247        | A                |
| Current Limited by Package (Note 4)                                                                                                                                                                    | $T_A = 25^\circ\text{C}$                          |                              | $I_{DmaxPkg}$  | 80         | A                |
| Operating Junction and Storage Temperature                                                                                                                                                             |                                                   |                              | $T_J, T_{stg}$ | -55 to 175 | $^\circ\text{C}$ |
| Source Current (Body Diode)                                                                                                                                                                            |                                                   |                              | $I_S$          | 60         | A                |
| Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}$ , $V_{DD} = 50 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_{L(pk)} = 31 \text{ A}$ , $L = 0.1 \text{ mH}$ , $R_G = 25 \Omega$ ) |                                                   |                              | $E_{AS}$       | 48         | mJ               |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)                                                                                                                                      |                                                   |                              | $T_L$          | 260        | $^\circ\text{C}$ |

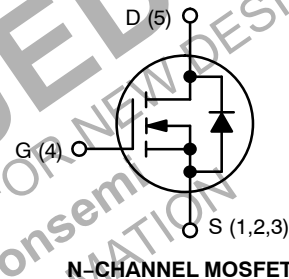
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### THERMAL RESISTANCE MAXIMUM RATINGS

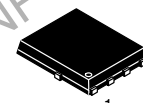
| Parameter                                                    | Symbol          | Value | Unit               |
|--------------------------------------------------------------|-----------------|-------|--------------------|
| Junction-to-Mounting Board (top) – Steady State (Notes 2, 3) | $R_{\psi J-mb}$ | 1.4   | $^\circ\text{C/W}$ |
| Junction-to-Ambient – Steady State (Note 3)                  | $R_{\theta JA}$ | 41    |                    |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Psi ( $\Psi$ ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to single case surface.

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 60 V          | 12 mΩ @ 10 V             | 61 A              |
|               | 16 mΩ @ 4.5 V            |                   |

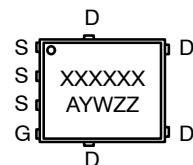


N-CHANNEL MOSFET



DFN5  
(SO-8FL)  
CASE 488AA  
STYLE 1

### MARKING DIAGRAM



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

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NTMFS5844NL, NVMFS5844NL

- Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
- Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

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

### OFF CHARACTERISTICS

|                                                           |                                      |                                                |    |    |      |       |
|-----------------------------------------------------------|--------------------------------------|------------------------------------------------|----|----|------|-------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA | 60 |    |      | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |                                                |    | 57 |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 60 V  |    |    | 1    | μA    |
|                                                           |                                      | T <sub>J</sub> = 125°C                         |    |    | 100  |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V |    |    | ±100 | nA    |

### ON CHARACTERISTICS (Note 5)

|                                            |                                     |                                                             |     |      |     |       |
|--------------------------------------------|-------------------------------------|-------------------------------------------------------------|-----|------|-----|-------|
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 1.5 |      | 2.3 | V     |
| Negative Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |                                                             |     | 6.2  |     | mV/°C |
| Drain-to-Source On Resistance              | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A               |     | 10.2 | 12  | mΩ    |
|                                            |                                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A              |     | 13   | 16  |       |
| Forward Transconductance                   | g <sub>FS</sub>                     | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 10 A                |     | 27   |     | S     |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |                     |                                                                                                                                                     |  |      |  |    |
|------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--|------|--|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V                                                                                            |  | 1460 |  | pF |
| Output Capacitance           | C <sub>OSS</sub>    |                                                                                                                                                     |  | 150  |  |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |                                                                                                                                                     |  | 96   |  |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 10 A<br><br>V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 10 A |  | 30   |  | nC |
| Total Gate Charge            | Q <sub>G(TOT)</sub> |                                                                                                                                                     |  | 15   |  |    |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |                                                                                                                                                     |  | 1.0  |  |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |                                                                                                                                                     |  | 4.0  |  |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |                                                                                                                                                     |  | 8.0  |  |    |
| Plateau Voltage              | V <sub>GP</sub>     |                                                                                                                                                     |  | 3.0  |  |    |
| Gate Resistance              | R <sub>G</sub>      |                                                                                                                                                     |  | 0.62 |  | Ω  |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |                     |                                                                                                |  |    |  |    |
|---------------------|---------------------|------------------------------------------------------------------------------------------------|--|----|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 10 A, R <sub>G</sub> = 2.5 Ω |  | 12 |  | ns |
| Rise Time           | t <sub>r</sub>      |                                                                                                |  | 25 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |                                                                                                |  | 20 |  |    |
| Fall Time           | t <sub>f</sub>      |                                                                                                |  | 10 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |                                                                              |                        |  |      |     |    |
|-------------------------|-----------------|------------------------------------------------------------------------------|------------------------|--|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 A                                 | T <sub>J</sub> = 25°C  |  | 0.79 | 1.2 | V  |
|                         |                 |                                                                              | T <sub>J</sub> = 125°C |  | 0.65 |     |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 10 A |                        |  | 19   |     | ns |
| Charge Time             | t <sub>a</sub>  |                                                                              |                        |  | 13   |     |    |
| Discharge Time          | t <sub>b</sub>  |                                                                              |                        |  | 6.0  |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |                                                                              |                        |  | 15   |     | nC |

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

TYPICAL CHARACTERISTICS

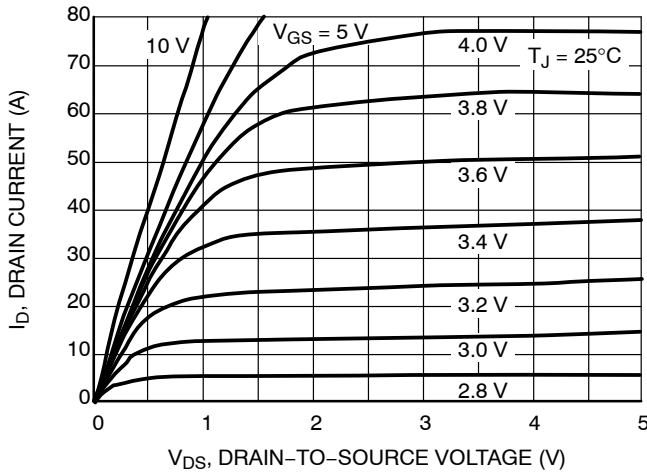


Figure 1. On-Region Characteristics

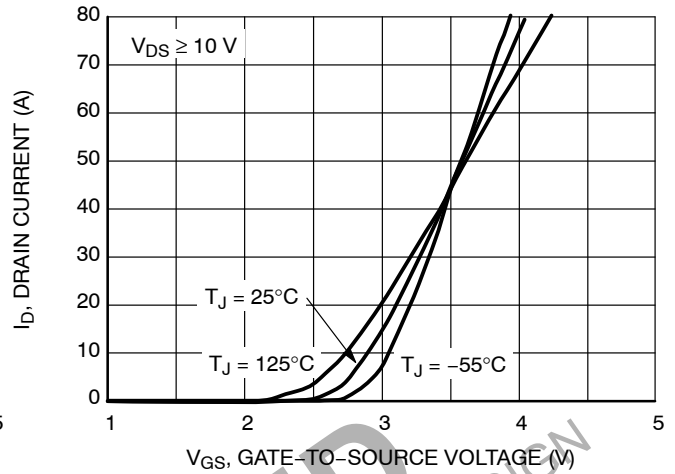


Figure 2. Transfer Characteristics

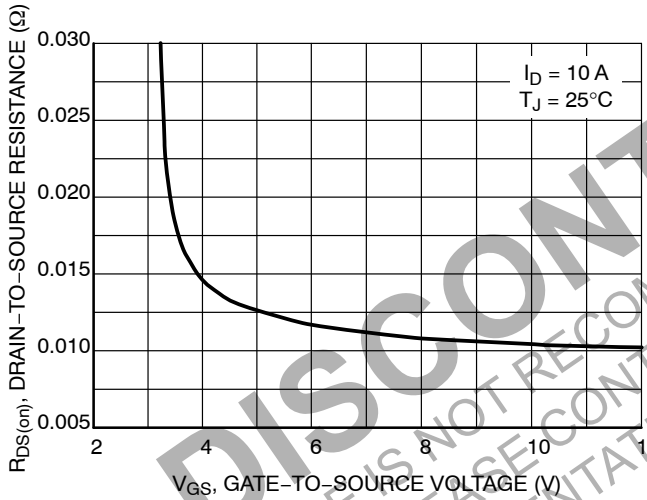


Figure 3. On-Resistance vs. Gate-to-Source Voltage

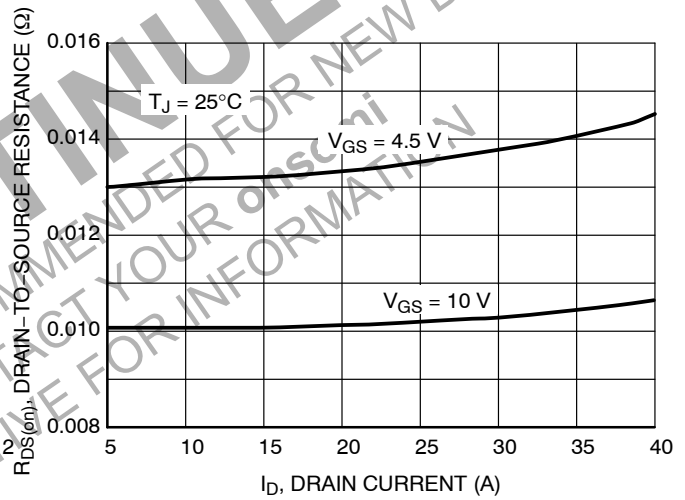


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

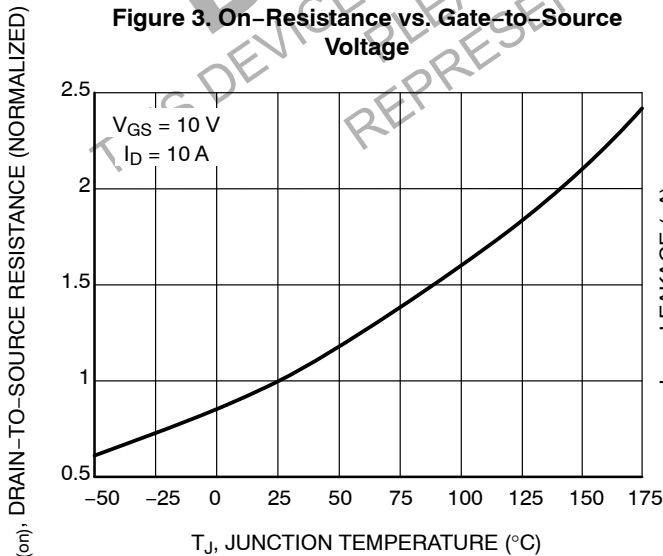


Figure 5. On-Resistance Variation with Temperature

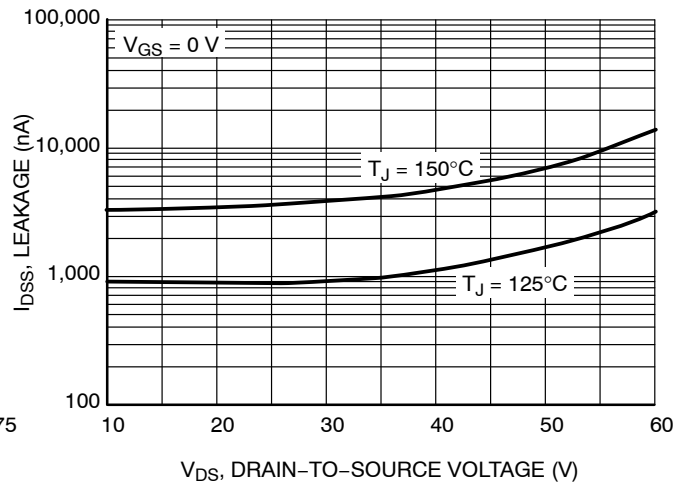


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

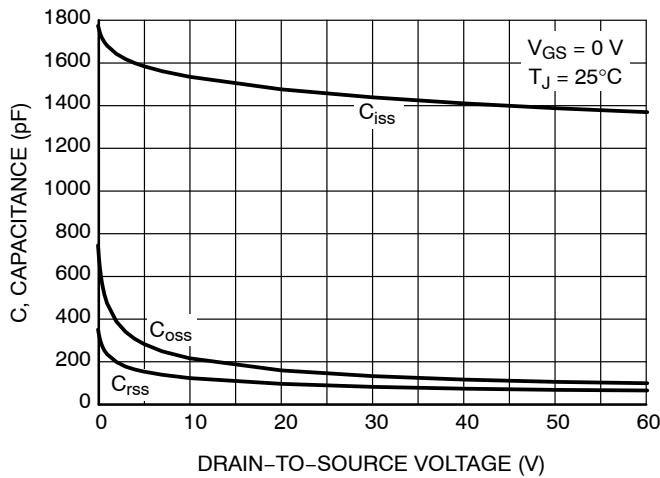


Figure 7. Capacitance Variation

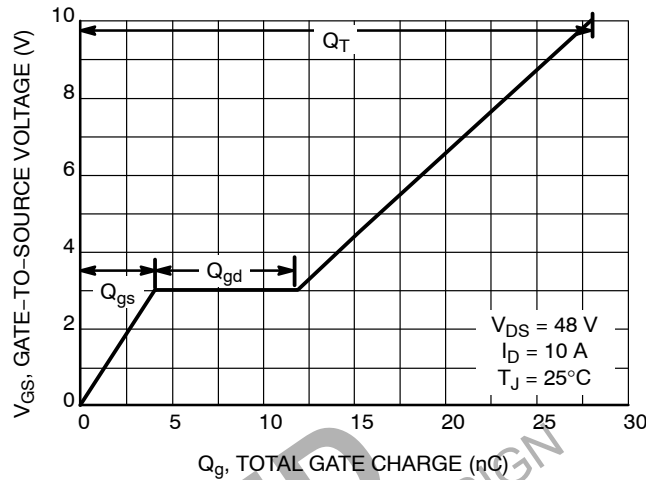


Figure 8. Gate-to-Source Voltage vs. Total Charge

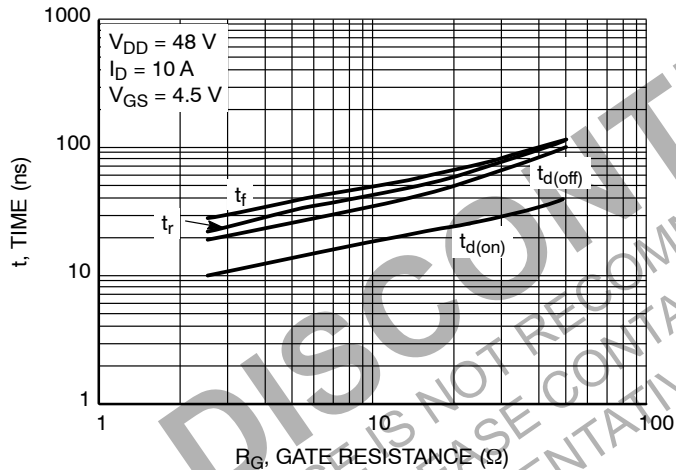


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

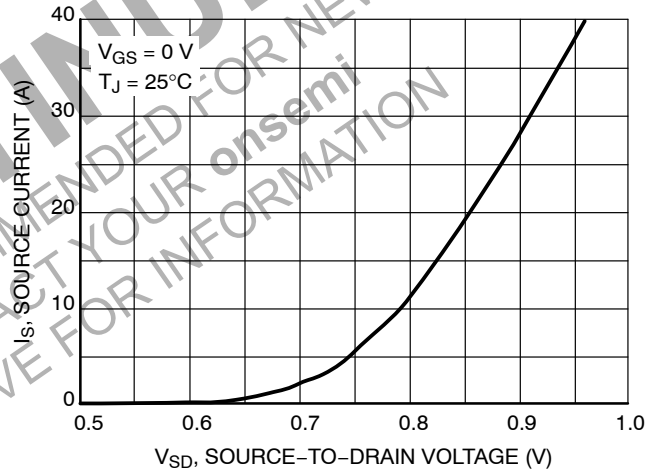


Figure 10. Diode Forward Voltage vs. Current

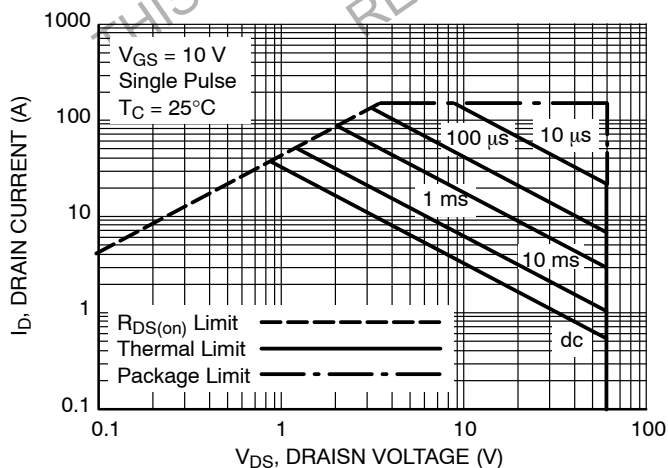


Figure 11. Maximum Rated Forward Biased Safe Operating Area

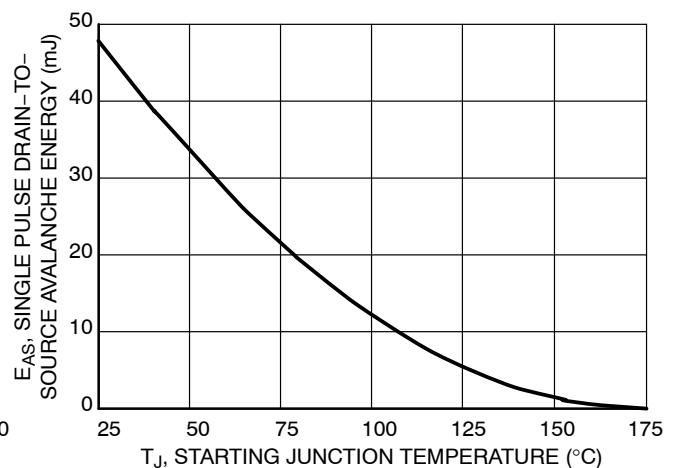


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS

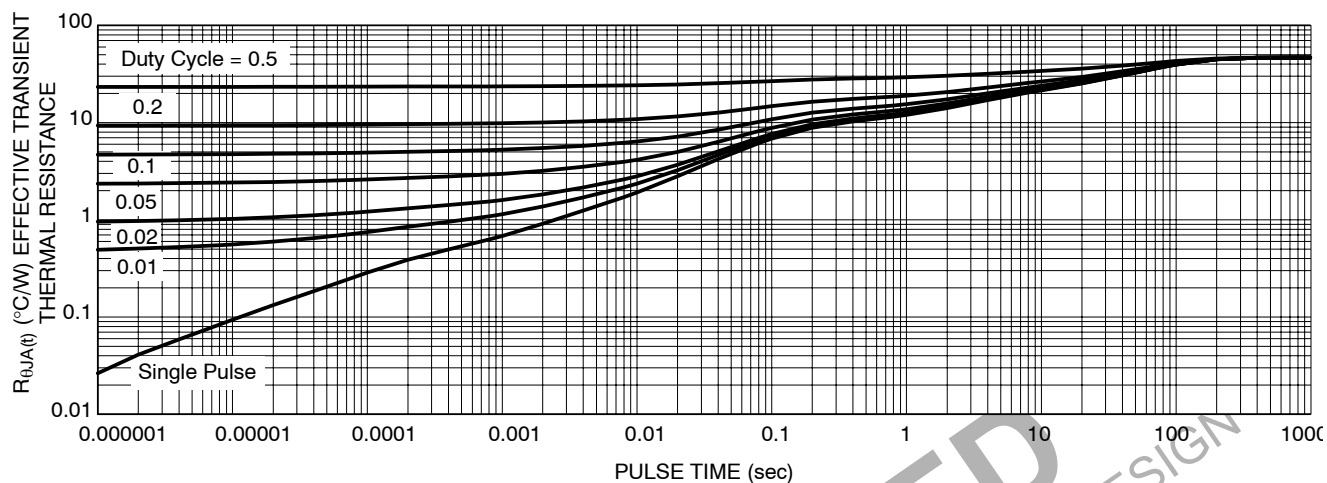


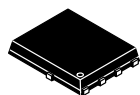
Figure 13. Thermal Response

DEVICE ORDERING INFORMATION

| Device           | Marking | Package        | Shipping <sup>†</sup> |
|------------------|---------|----------------|-----------------------|
| NTMFS5844NLT1G   | 5844NL  | DFN5 (Pb-Free) | 1500 / Tape & Reel    |
| NVMFS5844NLT1G   | V5844L  | DFN5 (Pb-Free) | 1500 / Tape & Reel    |
| NVMFS5844NLWFT1G | 5844LW  | DFN5 (Pb-Free) | 1500 / Tape & Reel    |
| NVMFS5844NLT3G   | V5844L  | DFN5 (Pb-Free) | 5000 / Tape & Reel    |
| NVMFS5844NLWFT3G | 5844LW  | DFN5 (Pb-Free) | 5000 / Tape & Reel    |

<sup>†</sup>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.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



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 ° |

## 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.



\*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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| <b>DESCRIPTION:</b>     | <b>DFN5 5x6, 1.27P (SO-8FL)</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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