

# NTMFS08N004C

## N-Channel Shielded Gate POWER trench<sup>®</sup> MOSFET

80 V, 126 A, 4.0 mΩ

### General Description

This N-Channel MV MOSFET is produced using ON Semiconductor's advanced PowerTrench process that incorporates Shielded Gate technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

### Features

- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 4.0 mΩ at  $V_{GS} = 10$  V,  $I_D = 44$  A
- Max  $r_{DS(on)}$  = 12.5 mΩ at  $V_{GS} = 6$  V,  $I_D = 22$  A
- 50% Lower  $Q_{rr}$  than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive
- Solar

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

| Symbol         | Parameter                                                                                                                                                                              | Value                  | Unit |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|
| $V_{DS}$       | Drain to Source Voltage                                                                                                                                                                | 80                     | V    |
| $V_{GS}$       | Gate to Source Voltage                                                                                                                                                                 | ±20                    | V    |
| $I_D$          | Drain Current:<br>Continuous, $T_C = 25^\circ\text{C}$ (Note 5)<br>Continuous, $T_C = 100^\circ\text{C}$ (Note 5)<br>Continuous, $T_A = 25^\circ\text{C}$ (Note 1a)<br>Pulsed (Note 4) | 126<br>80<br>18<br>637 | A    |
| $E_{AS}$       | Single Pulse Avalanche Energy<br>(Note 3)                                                                                                                                              | 486                    | mJ   |
| $P_D$          | Power Dissipation:<br>$T_C = 25^\circ\text{C}$<br>$T_A = 25^\circ\text{C}$ (Note 1a)                                                                                                   | 125<br>2.5             | W    |
| $T_J, T_{STG}$ | Operating and Storage Junction<br>Temperature Range                                                                                                                                    | -55 to +150            | °C   |

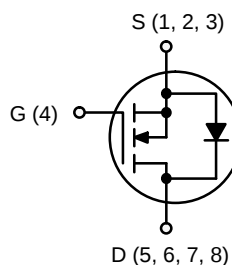
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



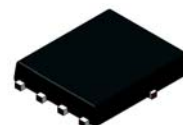
ON Semiconductor<sup>®</sup>

[www.onsemi.com](http://www.onsemi.com)

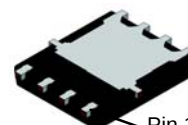
| $V_{DS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| 80 V     | 4.0 mΩ @ 10 V    | 126 A     |
|          | 12.5 mΩ @ 6 V    |           |



N-CHANNEL MOSFET



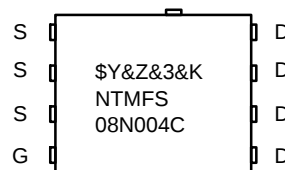
Top



Bottom

Power 56  
(PQFN8)  
CASE 483AE

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
&Z = Assembly Plant Code  
&3 = Numeric Date Code  
&K = Lot Code  
NTMFS08N004C = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# THERMAL CHARACTERISTICS

| Symbol          | Parameter                                         | Value | Unit                        |
|-----------------|---------------------------------------------------|-------|-----------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 1.0   | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50    |                             |

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

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

## OFF CHARACTERISTICS

|                                |                                           |                                                               |    |    |           |                              |
|--------------------------------|-------------------------------------------|---------------------------------------------------------------|----|----|-----------|------------------------------|
| $BV_{DSS}$                     | Drain to Source Breakdown Voltage         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$             | 80 |    |           | V                            |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^{\circ}\text{C}$ |    | 40 |           | $\text{mV}/^{\circ}\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 64\ \text{V}$ , $V_{GS} = 0\ \text{V}$              |    |    | 1         | $\mu\text{A}$                |
| $I_{GSS}$                      | Gate to Source Leakage Current            | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$          |    |    | $\pm 100$ | nA                           |

## ON CHARACTERISTICS

|                                  |                                                          |                                                                              |     |      |      |                              |
|----------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------|-----|------|------|------------------------------|
| $V_{GS(th)}$                     | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$                                 | 2.0 | 3.1  | 4.0  | V                            |
| $\Delta V_{GS(th)} / \Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^{\circ}\text{C}$                |     | -8.3 |      | $\text{mV}/^{\circ}\text{C}$ |
| $r_{DS(on)}$                     | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}$ , $I_D = 44\ \text{A}$                               |     | 3.4  | 4.0  | $\text{m}\Omega$             |
|                                  |                                                          | $V_{GS} = 6\ \text{V}$ , $I_D = 22\ \text{A}$                                |     | 5.2  | 12.5 |                              |
|                                  |                                                          | $V_{GS} = 10\ \text{V}$ , $I_D = 44\ \text{A}$ , $T_J = 125^{\circ}\text{C}$ |     | 5.8  | 7.8  |                              |
| $g_{FS}$                         | Forward Transconductance                                 | $V_{DS} = 5\ \text{V}$ , $I_D = 44\ \text{A}$                                |     | 98   |      | S                            |

## DYNAMIC CHARACTERISTICS

|           |                              |                                                                        |     |      |      |          |
|-----------|------------------------------|------------------------------------------------------------------------|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 40\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$ |     | 3035 | 5100 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                        |     | 940  | 1580 | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        |     | 27   | 50   | pF       |
| $R_g$     | Gate Resistance              |                                                                        | 0.1 | 1.1  | 2.3  | $\Omega$ |

## SWITCHING CHARACTERISTICS

|              |                               |                                                                                                  |  |    |    |    |
|--------------|-------------------------------|--------------------------------------------------------------------------------------------------|--|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 40\ \text{V}$ , $I_D = 44\ \text{A}$ , $V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$ |  | 17 | 30 | ns |
| $t_r$        | Rise Time                     |                                                                                                  |  | 6  | 12 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                  |  | 25 | 40 | ns |
| $t_f$        | Fall Time                     |                                                                                                  |  | 4  | 10 | ns |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $10\ \text{V}$ , $V_{DD} = 40\ \text{V}$ , $I_D = 44\ \text{A}$        |  | 39 | 66 | nC |
|              |                               | $V_{GS} = 0\ \text{V}$ to $6\ \text{V}$ , $V_{DD} = 40\ \text{V}$ , $I_D = 44\ \text{A}$         |  | 25 | 41 | nC |
| $Q_{gs}$     | Gate to Source Charge         | $V_{DD} = 40\ \text{V}$ , $I_D = 44\ \text{A}$                                                   |  | 13 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge | $V_{DD} = 40\ \text{V}$ , $I_D = 44\ \text{A}$                                                   |  | 7  |    | nC |
| $Q_{oss}$    | Output Charge                 | $V_{DD} = 40\ \text{V}$ , $V_{GS} = 0\ \text{V}$                                                 |  | 55 |    | nC |
| $Q_{sync}$   | Total Gate Charge Sync.       | $V_{DS} = 0\ \text{V}$ , $I_D = 44\ \text{A}$                                                    |  | 35 |    | nC |

# NTMFS08N004C

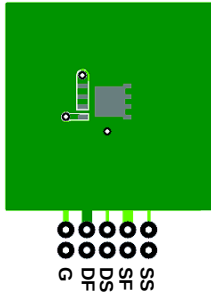
## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

| Symbol                                    | Parameter                             | Test Condition                                         | Min | Typ | Max | Unit |
|-------------------------------------------|---------------------------------------|--------------------------------------------------------|-----|-----|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |                                       |                                                        |     |     |     |      |
| $V_{SD}$                                  | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)     |     | 0.7 | 1.2 | V    |
|                                           |                                       | $V_{GS} = 0\text{ V}, I_S = 44\text{ A}$ (Note 2)      |     | 0.8 | 1.3 |      |
| $t_{rr}$                                  | Reverse Recovery Time                 | $I_F = 22\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$  |     | 26  | 41  | ns   |
| $Q_{rr}$                                  | Reverse Recovery Charge               |                                                        |     | 48  | 76  | nC   |
| $t_{rr}$                                  | Reverse Recovery Time                 | $I_F = 22\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}$ |     | 19  | 31  | ns   |
| $Q_{rr}$                                  | Reverse Recovery Charge               |                                                        |     | 108 | 174 | nC   |

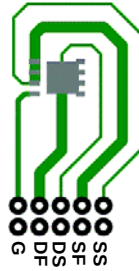
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- $E_{AS}$  of 486 mJ is based on starting  $T_J = 25^\circ\text{C}$ ; N-ch:  $L = 3\text{ mH}$ ,  $I_{AS} = 18\text{ A}$ ,  $V_{DD} = 80\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 57\text{ A}$ .
- Pulsed  $I_d$  please refer to Figure 11 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

## PACKAGE MARKING AND ORDERING INFORMATION

| Device       | Marking      | Package                                      | Reel Size | Tape Width | Quantity   |
|--------------|--------------|----------------------------------------------|-----------|------------|------------|
| NTMFS08N004C | NTMFS08N004C | Power 56 (PQFN8)<br>(Pb-Free / Halogen Free) | 13"       | 12 mm      | 3000 units |

# TYPICAL CHARACTERISTICS

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

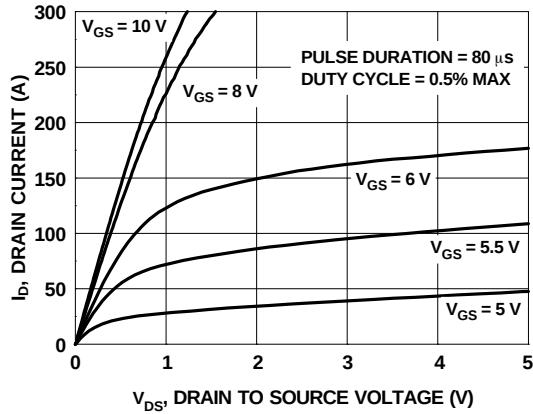


Figure 1. On Region Characteristics

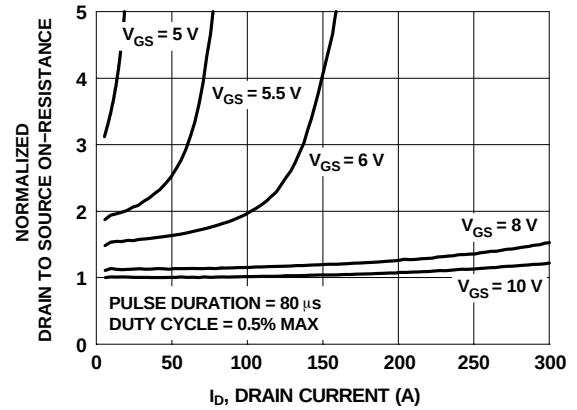


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

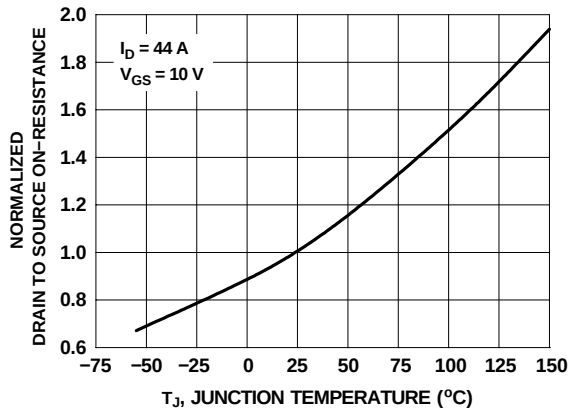


Figure 3. Normalized On-Resistance vs. Junction Temperature

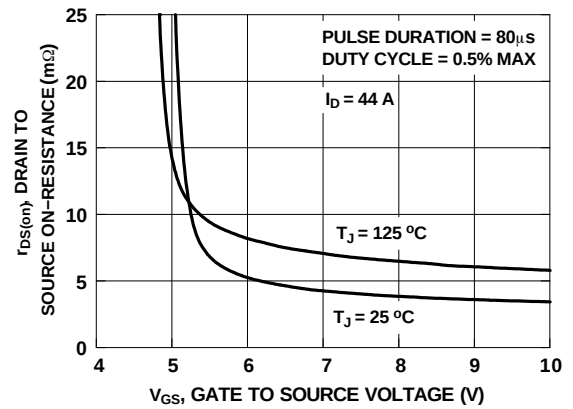


Figure 4. On-Resistance vs. Gate to Source Voltage

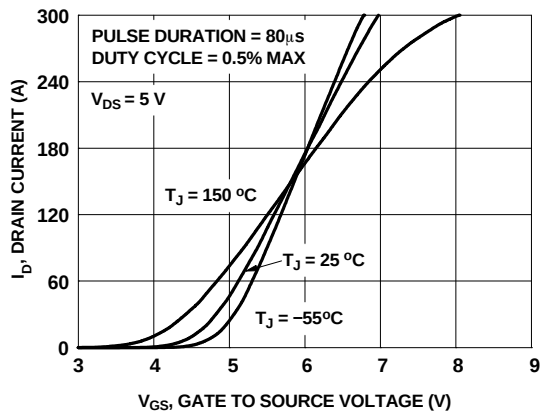


Figure 5. Transfer Characteristics

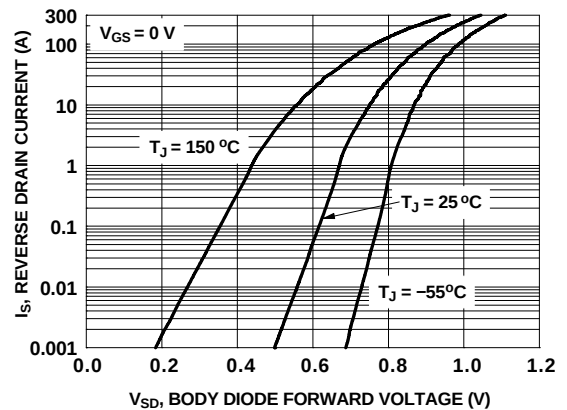


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

# TYPICAL CHARACTERISTICS

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

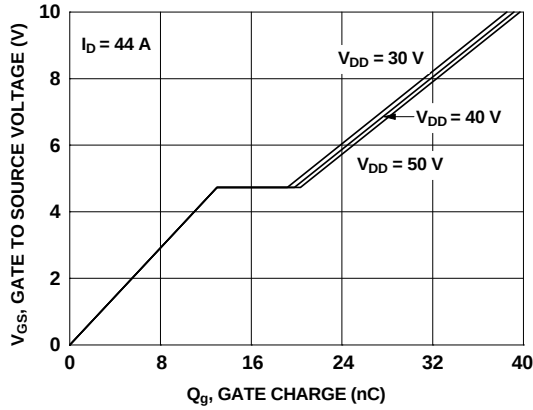


Figure 7. Gate Charge Characteristics

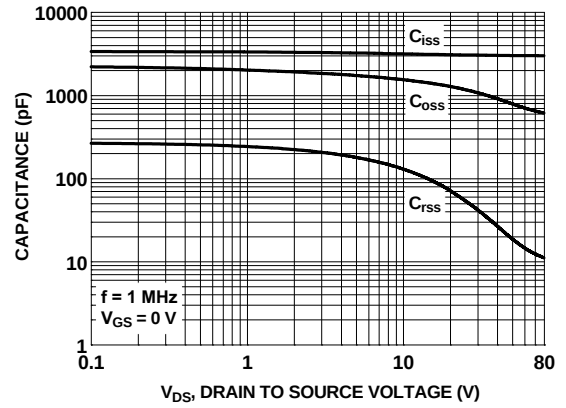


Figure 8. Capacitance vs. Drain to Source Voltage

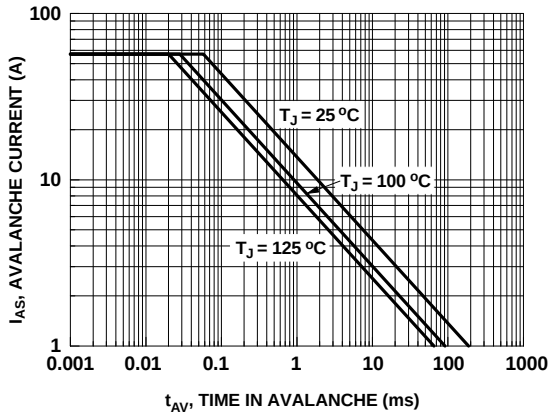


Figure 9. Unclamped Inductive Switching Capability

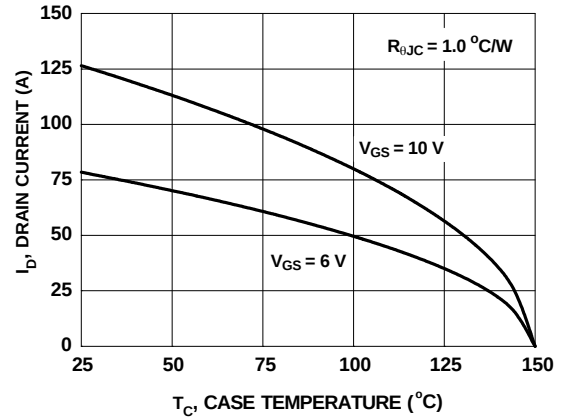


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

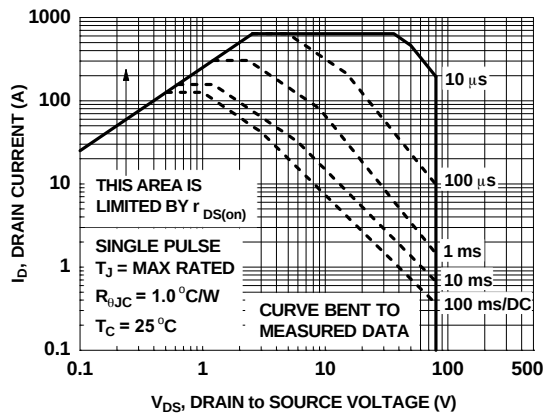


Figure 11. Forward Bias Safe Operating Area

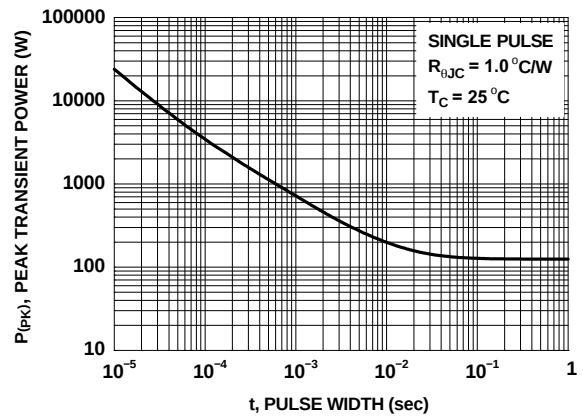


Figure 12. Single Pulse Maximum Power Dissipation

## TYPICAL CHARACTERISTICS

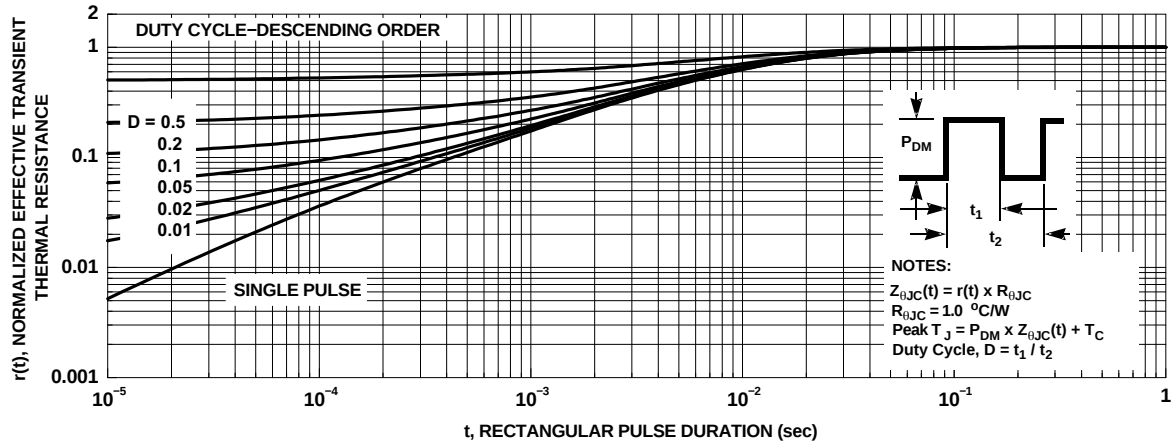
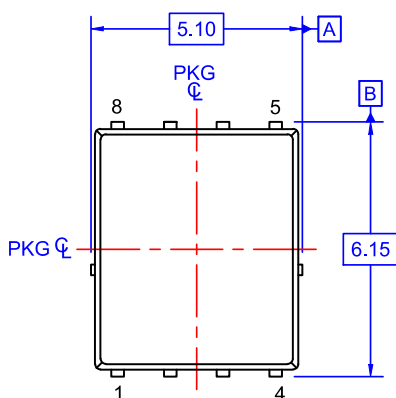
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 13. Junction-to-Case Transient Thermal Response Curve

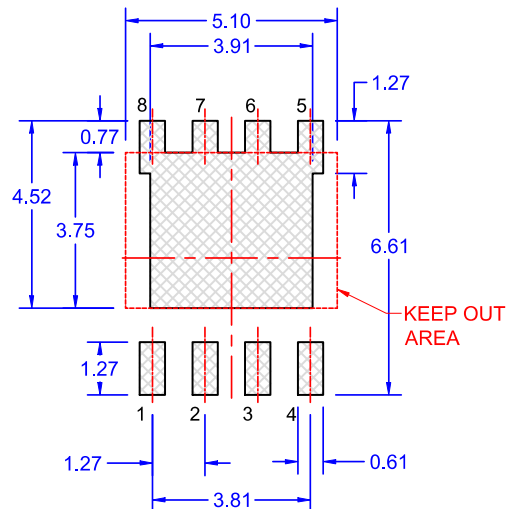
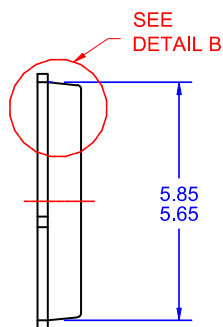
# NTMFS08N004C

## PACKAGE DIMENSIONS

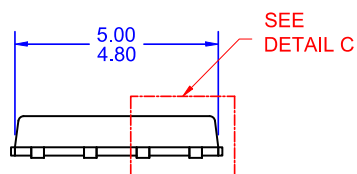
PQFN8 5X6, 1.27P  
CASE 483AE  
ISSUE A



TOP VIEW

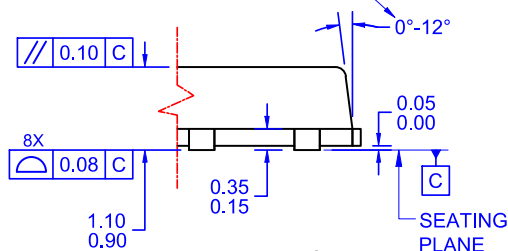


LAND PATTERN  
RECOMMENDATION

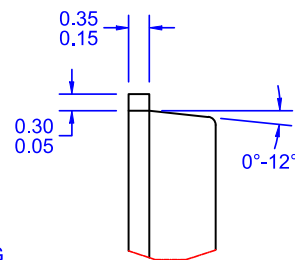


SIDE VIEW

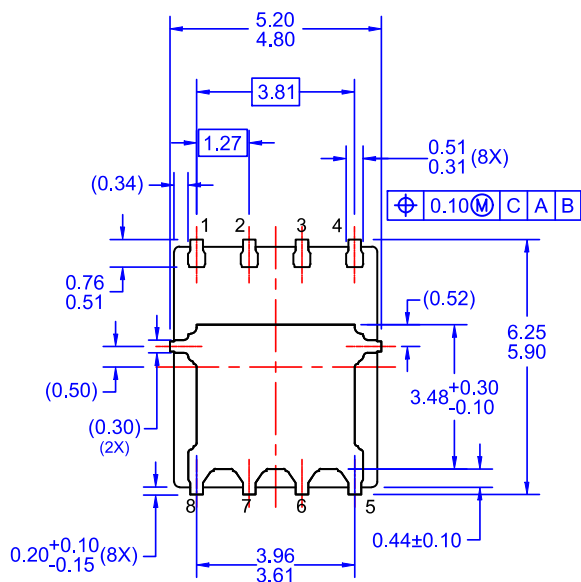
OPTIONAL DRAFT  
ANGLE MAY APPEAR  
ON FOUR SIDES  
OF THE PACKAGE



DETAIL C  
SCALE: 2:1



DETAIL B  
SCALE: 2:1



NOTES: UNLESS OTHERWISE SPECIFIED

- PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA.
- DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

POWERTRENCH is registered trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910

**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative



**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331