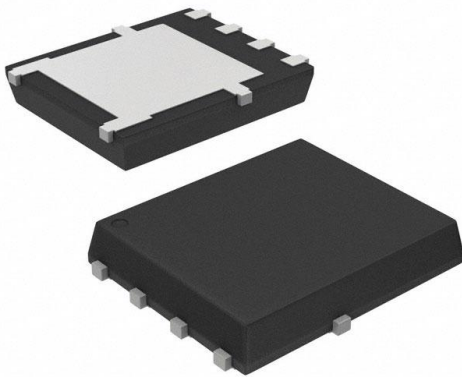


NTMFS4C09NT1G Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

| | |
|------------------------------|--|
| DiGi Electronics Part Number | NTMFS4C09NT1G-DG |
| Manufacturer | onsemi |
| Manufacturer Product Number | NTMFS4C09NT1G |
| Description | MOSFET N-CH 30V 9A 5DFN |
| Detailed Description | N-Channel 30 V 9A (Ta) 760mW (Ta), 25.5W (Tc) Surface Mount 5-DFN (5x6) (8-SOFL) |



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

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Purchase and inquiry

Manufacturer Product Number:

NTMFS4C09NT1G

Series:

-

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

30 V

Drive Voltage (Max Rds On, Min Rds On):

4.5V, 10V

Vgs(th) (Max) @ Id:

2.1V @ 250 μ A

Vgs (Max):

\pm 20V

FET Feature:

-

Operating Temperature:

-55°C ~ 150°C (Tj)

Supplier Device Package:

5-DFN (5x6) (8-SOFL)

Base Product Number:

NTMFS4

Manufacturer:

onsemi

Product Status:

Active

Technology:

MOSFET (Metal Oxide)

Current - Continuous Drain (Id) @ 25°C:

9A (Ta)

Rds On (Max) @ Id, Vgs:

5.8mOhm @ 30A, 10V

Gate Charge (Qg) (Max) @ Vgs:

10.9 nC @ 4.5 V

Input Capacitance (Ciss) (Max) @ Vds:

1252 pF @ 15 V

Power Dissipation (Max):

760mW (Ta), 25.5W (Tc)

Mounting Type:

Surface Mount

Package / Case:

8-PowerTDFN, 5 Leads

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

MOSFET - Power, Single N-Channel, SO-8FL

30 V, 52 A

NTMFS4C09N

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

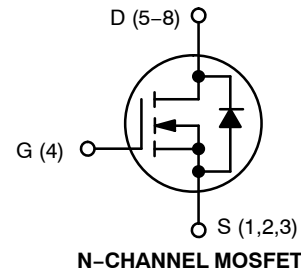
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter | Symbol | Value | Unit |
|---|--|--------------------------|------------------|
| Drain-to-Source Voltage | V_{DS} | 30 | V |
| Gate-to-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | I_D | $T_A = 25^\circ\text{C}$ | 16.4 |
| | | $T_A = 80^\circ\text{C}$ | 12.3 |
| Power Dissipation $R_{\theta JA}$ (Note 2) | P_D | 2.51 | W |
| Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 2) | I_D | $T_A = 25^\circ\text{C}$ | 25.3 |
| | | $T_A = 80^\circ\text{C}$ | 19.0 |
| Power Dissipation $R_{\theta JA} \leq 10$ s (Note 2) | P_D | 6.0 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 3) | I_D | $T_A = 25^\circ\text{C}$ | 9.0 |
| | | $T_A = 80^\circ\text{C}$ | 6.8 |
| Power Dissipation $R_{\theta JA}$ (Note 3) | P_D | 0.76 | W |
| Continuous Drain Current $R_{\theta JC}$ (Note 2) | I_D | $T_C = 25^\circ\text{C}$ | 52 |
| | | $T_C = 80^\circ\text{C}$ | 39 |
| Power Dissipation $R_{\theta JC}$ (Note 2) | P_D | 25.5 | W |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | I_{DM} | 146 |
| Current Limited by Package | $T_A = 25^\circ\text{C}$ | I_{Dmax} | 80 |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 23 | A |
| Drain to Source dV/dt | dV/dt | 7.0 | V/ns |
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}, V_{GS} = 10$ V, $I_L = 29$ A _{pk} , $L = 0.1$ mH, $R_{GS} = 25 \Omega$) (Note 4) | E_{AS} | 42 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

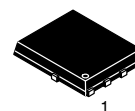
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.
- Parts are 100% tested at $T_J = 25^\circ\text{C}, V_{GS} = 10$ V, $I_L = 20$ A_{pk}, $E_{AS} = 20$ mJ.

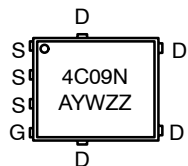
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | I_D MAX |
|---------------|------------------------|-----------|
| 30 V | 5.8 m Ω @ 10 V | 52 A |
| | 8.5 m Ω @ 4.5 V | |



MARKING DIAGRAMS



SO-8 FLAT LEAD CASE 488AA STYLE 1



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

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------------|-------------------|-----------------------|
| NTMFS4C09NT1G | SO-8 FL (Pb-Free) | 1500 / Tape & Reel |

DISCONTINUED (Note 1)

| | | |
|---------------|-------------------|--------------------|
| NTMFS4C09NT3G | 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.

- DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

NTMFS4C09N**THERMAL RESISTANCE MAXIMUM RATINGS**

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 4.9 | °C/W |
| Junction-to-Ambient – Steady State (Note 5) | $R_{\theta JA}$ | 49.8 | |
| Junction-to-Ambient – Steady State (Note 6) | $R_{\theta JA}$ | 164.6 | |
| Junction-to-Ambient – ($t \leq 10$ s) (Note 5) | $R_{\theta JA}$ | 21.0 | |

5. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.

6. 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 (transient) | $V_{(BR)DSSt}$ | $V_{GS} = 0\text{ V}, I_{D(aval)} = 8.4\text{ A}, T_{case} = 25^\circ\text{C}, t_{transient} = 100\text{ ns}$ | 34 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 14.4 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$ | | | 1.0 | μA |
| | | $T_J = 25^\circ\text{C}$ | | | 10 | |
| | | $T_J = 125^\circ\text{C}$ | | | 10 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 7)

| | | | | | | |
|--|------------------|--|-----|-----|-----|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 1.3 | | 2.1 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 4.8 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$ | | 4.6 | 5.8 | m Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$ | | 6.8 | 8.5 | |
| Forward Transconductance | g_{FS} | $V_{DS} = 1.5\text{ V}, I_D = 15\text{ A}$ | | 50 | | S |
| Gate Resistance | R_G | $T_A = 25^\circ\text{C}$ | 0.3 | 1.0 | 2.0 | Ω |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|-------------------|--|--|-------|--|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$ | | 1252 | | pF |
| Output Capacitance | C_{OSS} | | | 610 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 126 | | |
| Capacitance Ratio | C_{RSS}/C_{ISS} | $V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}, f = 1\text{ MHz}$ | | 0.101 | | |
| Total Gate Charge | $Q_G(TOT)$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 10.9 | | nC |
| Threshold Gate Charge | $Q_G(TH)$ | | | 1.9 | | |
| Gate-to-Source Charge | Q_{GS} | | | 3.4 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 5.4 | | |
| Gate Plateau Voltage | V_{GP} | | | 3.1 | | |
| Total Gate Charge | $Q_G(TOT)$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 22.2 | | nC |

SWITCHING CHARACTERISTICS (Note 8)

| | | | | | | |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 10 | | ns |
| Rise Time | t_r | | | 32 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 16 | | |
| Fall Time | t_f | | | 6.0 | | |

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

8. Switching characteristics are independent of operating junction temperatures.

NTMFS4C09N**ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

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

SWITCHING CHARACTERISTICS (Note 8)

| | | | | | | |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 7.0 | | ns |
| Rise Time | t_r | | | 28 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 20 | | |
| Fall Time | t_f | | | 4.0 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|---|---------------------------|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V},$ $I_S = 10\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.79 | 1.1 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.65 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$ | | | 31 | | ns |
| Charge Time | t_a | | | | 15 | | |
| Discharge Time | t_b | | | | 16 | | |
| Reverse Recovery Charge | Q_{RR} | | | | 15 | | nC |

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

8. Switching characteristics are independent of operating junction temperatures.

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.

NTMFS4C09N

TYPICAL CHARACTERISTICS

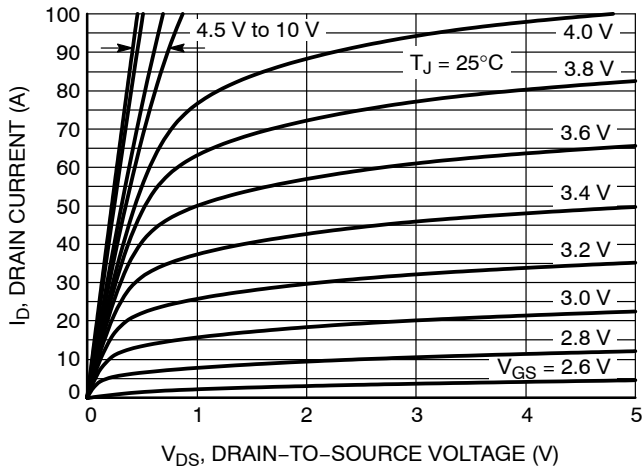


Figure 1. On-Region Characteristics

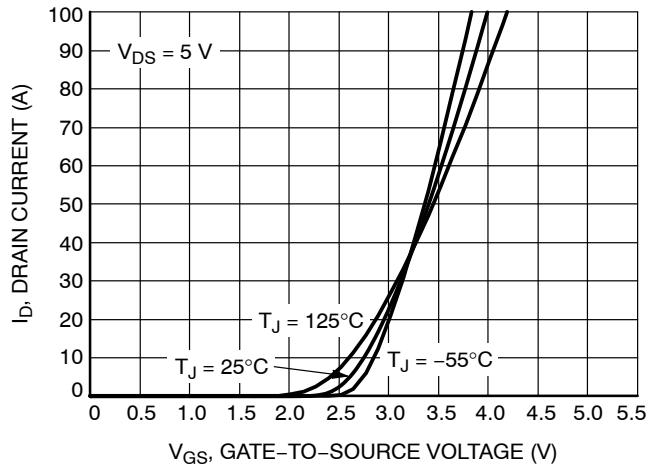


Figure 2. Transfer Characteristics

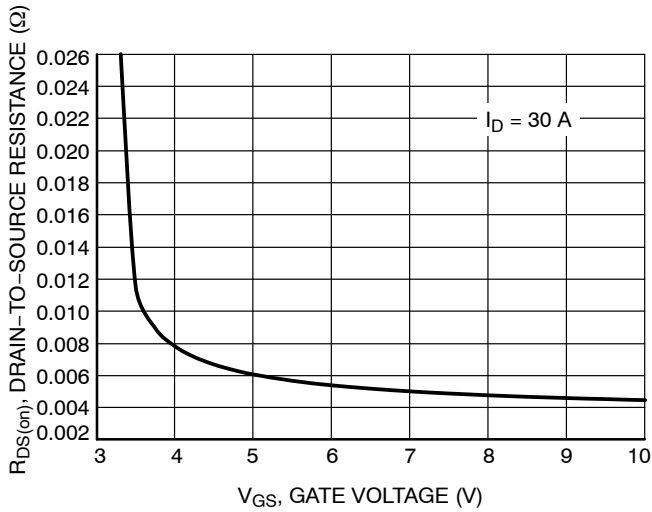


Figure 3. On-Resistance vs. Gate-to-Source Voltage

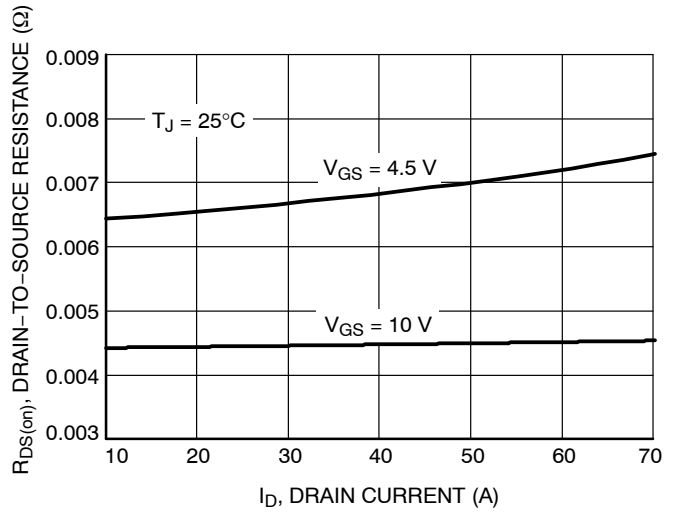


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

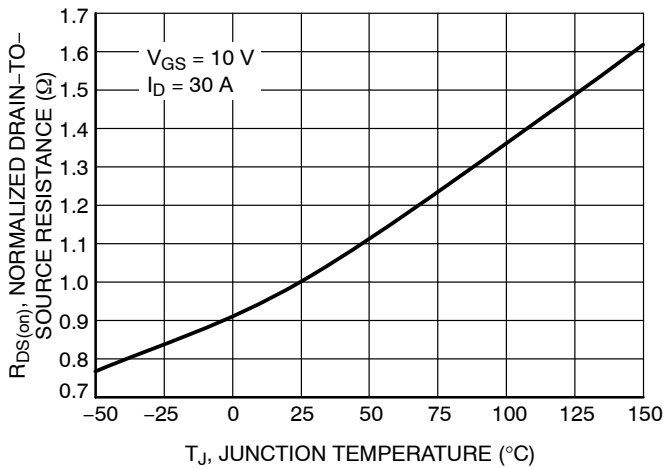


Figure 5. On-Resistance Variation with Temperature

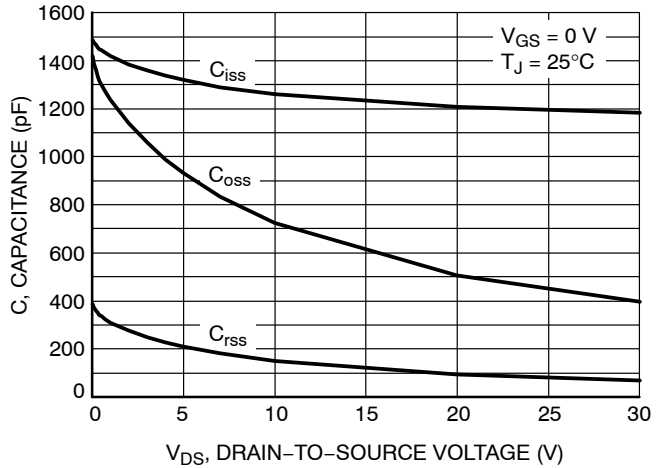


Figure 6. Capacitance Variation

NTMFS4C09N

TYPICAL CHARACTERISTICS

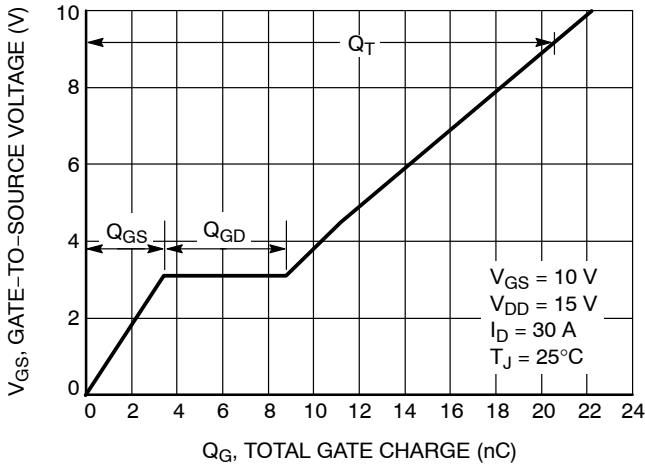


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

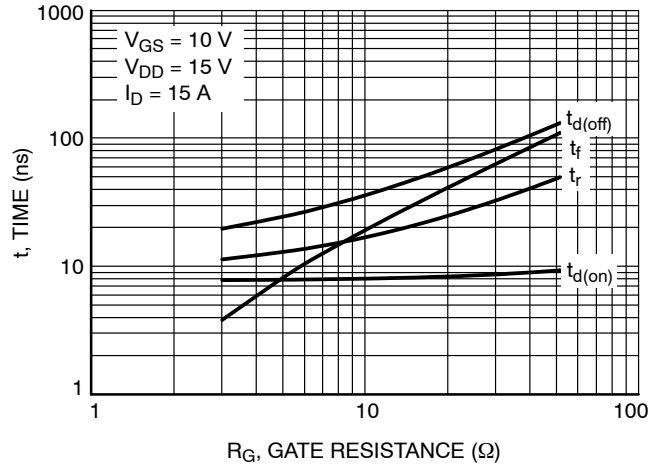


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

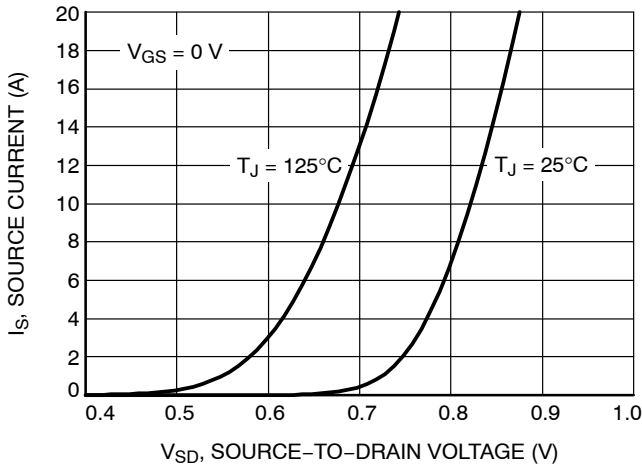


Figure 9. Diode Forward Voltage vs. Current

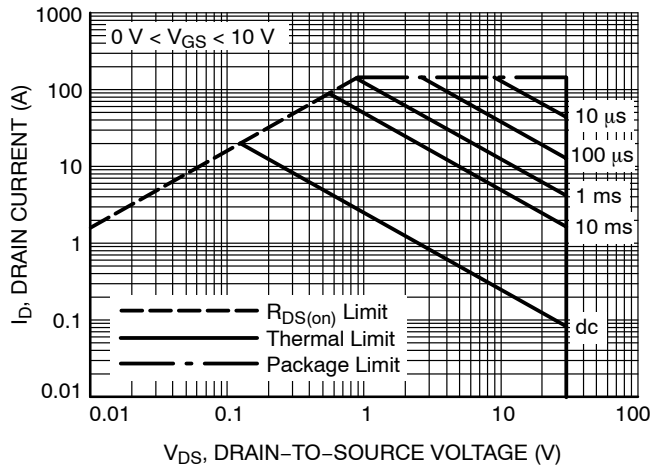


Figure 10. Maximum Rated Forward Biased Safe Operating Area

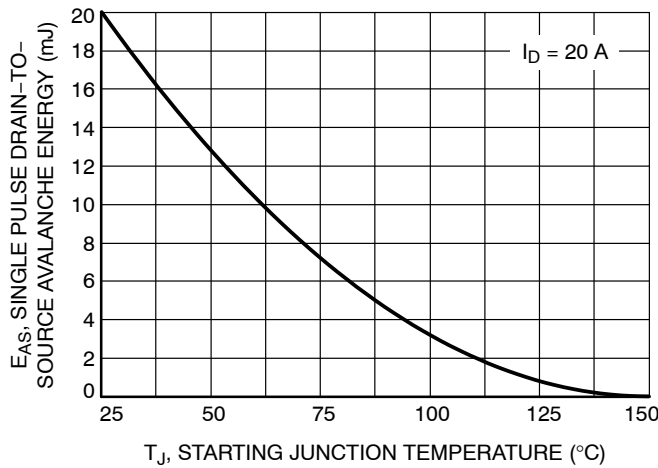


Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature

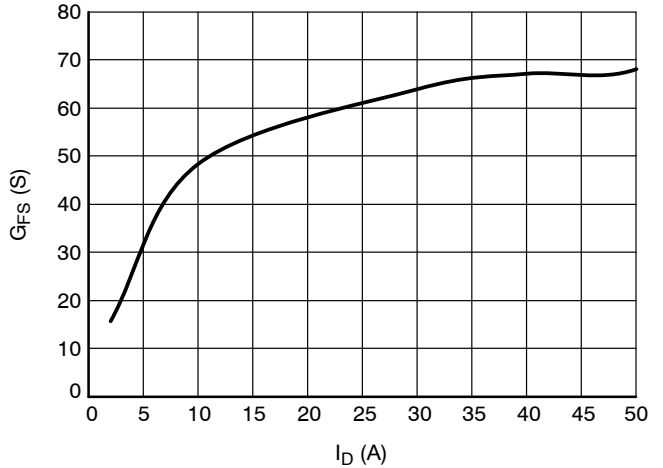


Figure 12. G_{FS} vs. I_D

NTMFS4C09N

TYPICAL CHARACTERISTICS

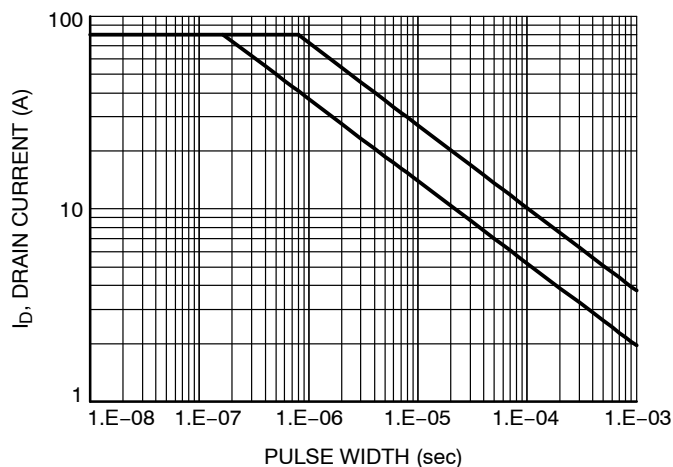


Figure 13. Avalanche Characteristics

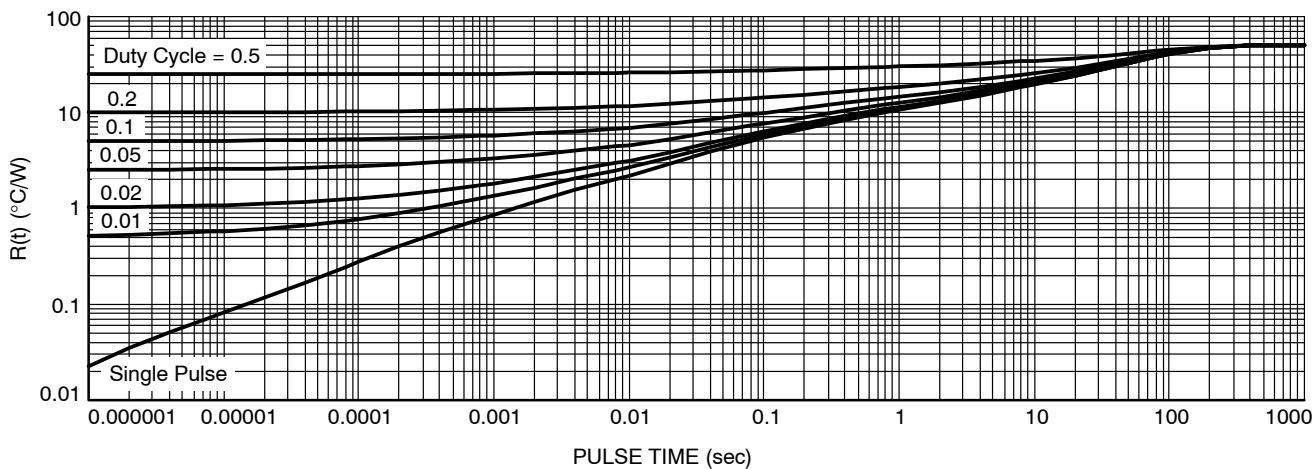


Figure 14. Thermal Response

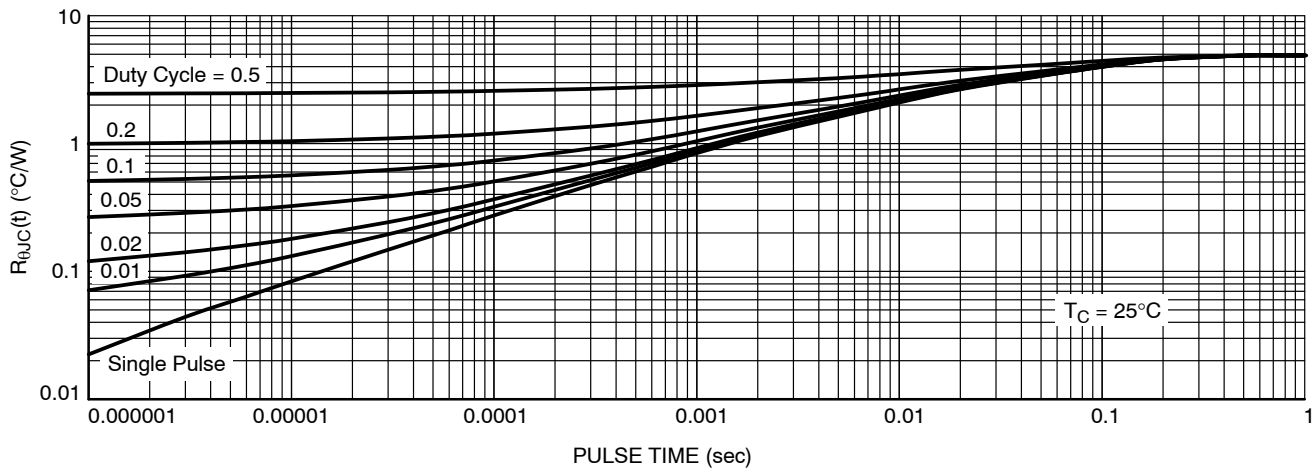
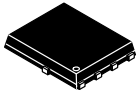


Figure 15. Thermal Response



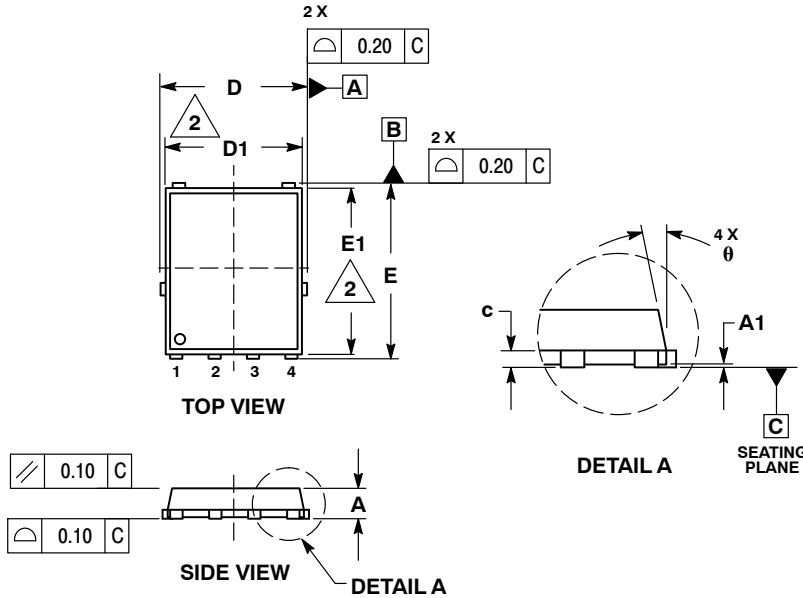
**MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS**



1
SCALE 2:1

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

DATE 25 JUN 2018

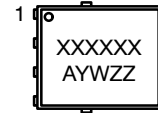


NOTES:

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.

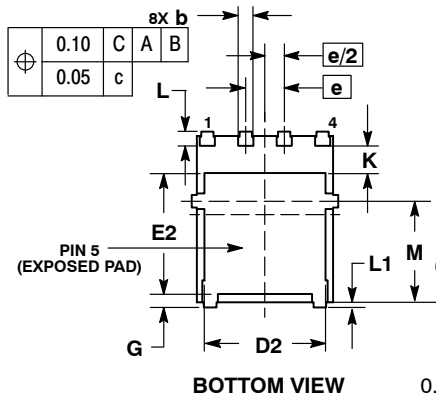
| DIM | MILLIMETERS | | |
|-----|-------------|-------|------|
| | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.00 | 5.15 | 5.30 |
| D1 | 4.70 | 4.90 | 5.10 |
| D2 | 3.80 | 4.00 | 4.20 |
| E | 6.00 | 6.15 | 6.30 |
| 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.



- 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

*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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