

Silicon Carbide (SiC) MOSFET - 33 mohm, 650 V, M2, Power88

Product Preview

NTMT045N065SC1

Features

- Typ. $R_{DS(on)} = 33\text{ m}\Omega @ V_{GS} = 18\text{ V}$
Typ. $R_{DS(on)} = 45\text{ m}\Omega @ V_{GS} = 15\text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 105\text{ nC}$)
- Low Effective Output Capacitance ($C_{oss} = 162\text{ pF}$)
- 100% Avalanche Tested
- $T_J = 175^\circ\text{C}$
- RoHS Compliant

Typical Applications

- SMPS (Switching Mode Power Supplies)
- Solar Inverters
- UPS (Uninterruptable Power Supplies)
- Energy Storage

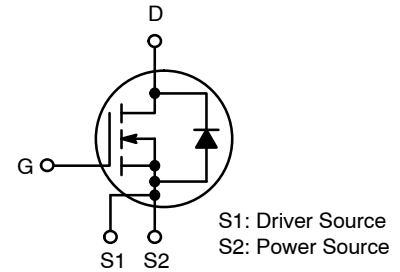
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | | Symbol | Value | Unit | |
|--|--------------|---|-------------|------------------|---|
| Drain-to-Source Voltage | | V_{DSS} | 650 | V | |
| Gate-to-Source Voltage | | V_{GS} | -8/+22 | V | |
| Recommended Operation Values of Gate - Source Voltage | | $T_C < 175^\circ\text{C}$ V_{GSop} | -5/+18 | V | |
| Continuous Drain Current (Note 2) | Steady State | $T_C = 25^\circ\text{C}$ | I_D | 55 | A |
| | | | P_D | 187 | W |
| Continuous Drain Current (Notes 1, 2) | Steady State | $T_C = 100^\circ\text{C}$ | I_D | 39 | A |
| | | | P_D | 94 | W |
| Pulsed Drain Current (Note 3) | | $T_C = 25^\circ\text{C}$ | I_{DM} | 197 | A |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to +175 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | | I_S | 45 | A | |
| Single Pulse Drain-to-Source Avalanche Energy ($I_L = 12\text{ A}_{pk}, L = 1\text{ mH}$) (Note 4) | | E_{AS} | 72 | mJ | |
| Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds | | T_L | 260 | $^\circ\text{C}$ | |

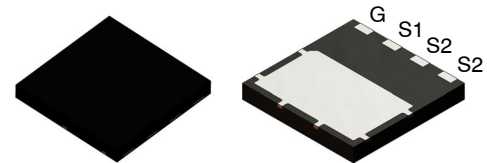
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface mounted on a FR-4 board using 1 in2 pad of 2 oz copper.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3. Repetitive rating, limited by max junction temperature.
4. E_{AS} of 72 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1\text{ mH}$, $I_{AS} = 12\text{ A}$, $V_{DD} = 50\text{ V}$, $V_{GS} = 18\text{ V}$.

| V_{DSS} | $R_{DS(on)}\text{ MAX}$ | $I_D\text{ MAX}$ |
|-----------|-------------------------|------------------|
| 650 V | 50 m Ω @ 18 V | 55 A |

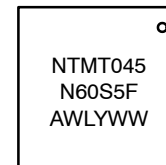


POWER MOSFET



TDFN4 8x8 2P
CASE 520AB

MARKING DIAGRAM



NTMT045N60S5F = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping |
|---------------|-----------------|--------------------|
| NTMT045N60S5F | TDFN4 (Pb-Free) | 3000 / 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.

This document contains information on a product under development. onsemi reserves the right to change or discontinue this product without notice.

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THERMAL CHARACTERISTICS

| Parameter | Symbol | Max | Units |
|---|-----------------|------|-------|
| Junction-to-Case – Steady State (Note 2) | $R_{\theta JC}$ | 0.80 | °C/W |
| Junction-to-Ambient – Steady State (Notes 1, 2) | $R_{\theta JA}$ | 45 | °C/W |

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|-------------------|--|---------------------------|------|-----|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | 650 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 20\text{ mA}$, refer to 25°C | | 0.15 | | V/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}$ $V_{DS} = 650\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 10 | μA |
| | | | $T_J = 175^\circ\text{C}$ | | 1 | mA |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{GS} = +18/-5\text{ V}, V_{DS} = 0\text{ V}$ | | | 250 | nA |

ON CHARACTERISTICS

| | | | | | | |
|-------------------------------|--------------|--|-----|-----|-----|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 8\text{ mA}$ | 1.8 | 2.8 | 4.3 | V |
| Recommended Gate Voltage | V_{GOP} | | -5 | | +18 | V |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 15\text{ V}, I_D = 25\text{ A}, T_J = 25^\circ\text{C}$ | | 45 | | m Ω |
| | | $V_{GS} = 18\text{ V}, I_D = 25\text{ A}, T_J = 25^\circ\text{C}$ | | 33 | 50 | |
| | | $V_{GS} = 18\text{ V}, I_D = 25\text{ A}, T_J = 175^\circ\text{C}$ | | 40 | | |
| Forward Transconductance | g_{FS} | $V_{DS} = 10\text{ V}, I_D = 25\text{ A}$ | | 16 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|--|--|------|--|----------|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = 325\text{ V}$ | | 1870 | | pF |
| Output Capacitance | C_{OSS} | | | 162 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 14 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -5/18\text{ V}, V_{DS} = 520\text{ V},$ $I_D = 25\text{ A}$ | | 105 | | nC |
| Gate-to-Source Charge | Q_{GS} | | | 27 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 30 | | |
| Gate-Resistance | R_G | $f = 1\text{ MHz}$ | | 3.1 | | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|-------------------------|--------------|--|--|----|--|---------------|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = -5/18\text{ V}, V_{DS} = 400\text{ V},$ $I_D = 25\text{ A}, R_G = 2.2\ \Omega,$ Inductive Load | | 13 | | ns |
| Rise Time | t_r | | | 14 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 26 | | |
| Fall Time | t_f | | | 7 | | μJ |
| Turn-On Switching Loss | E_{ON} | | | 47 | | |
| Turn-Off Switching Loss | E_{OFF} | | | 33 | | |
| Total Switching Loss | E_{TOT} | | | 80 | | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--|-----------|--|--|-----|-----|---|
| Continuous Source-Drain Diode Forward Current | I_{SD} | $V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ | | | 45 | A |
| Pulsed Source-Drain Diode Forward Current (Note 3) | I_{SDM} | $V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ | | | 197 | A |
| Forward Diode Voltage | V_{SD} | $V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}, T_J = 25^\circ\text{C}$ | | 4.4 | | V |

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

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

SOURCE-DRAIN DIODE CHARACTERISTICS

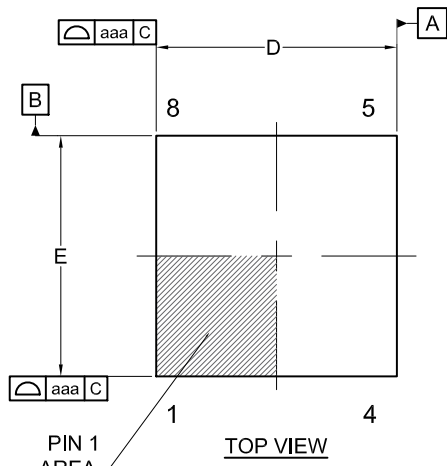
| | | | | | | |
|-------------------------------|------------------|---|--|-----|--|----|
| Reverse Recovery Time | t _{RR} | V _{GS} = -5/18 V, I _{SD} = 25 A, dI _S /dt = 1000 A/μs | | 20 | | ns |
| Reverse Recovery Charge | Q _{RR} | | | 108 | | nC |
| Reverse Recovery Energy | E _{REC} | | | 4.5 | | μJ |
| Peak Reverse Recovery Current | I _{RRM} | | | 11 | | A |
| Charge time | T _a | | | 11 | | ns |
| Discharge time | T _b | | | 8.5 | | ns |

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.

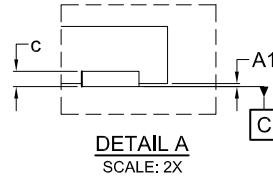
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PACKAGE DIMENSIONS

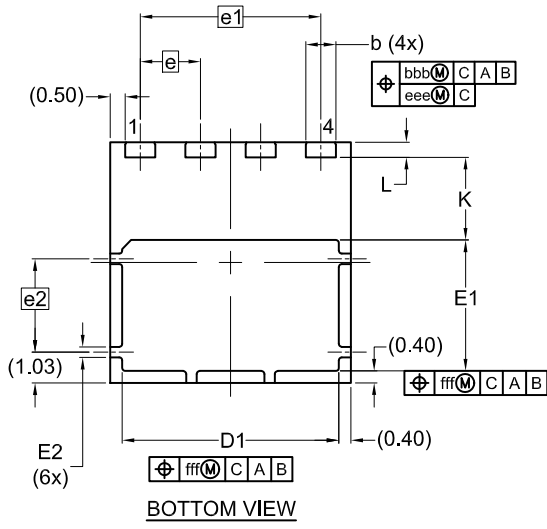
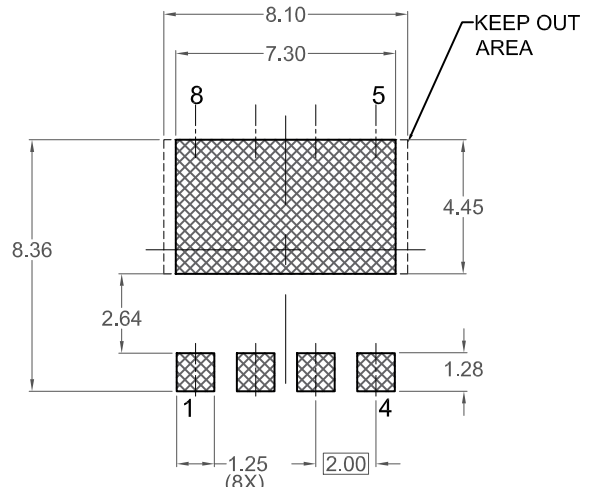
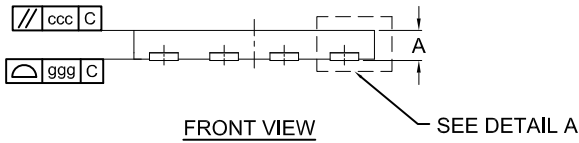
TDFN4 8x8, 2P
CASE 520AB
ISSUE O



- NOTES: UNLESS OTHERWISE SPECIFIED
 A) DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-220.
 B) ALL DIMENSIONS ARE IN MILLIMETERS.
 C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
 D) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.90 | 1.00 | 1.10 |
| c | 0.10 | 0.20 | 0.30 |
| D | 7.90 | 8.00 | 8.10 |
| D1 | 7.10 | 7.20 | 7.30 |
| E | 7.90 | 8.00 | 8.10 |
| E1 | 4.25 | 4.35 | 4.45 |
| E2 | 0.15 | 0.25 | 0.35 |
| e | 2.00 BSC | | |
| e1 | 6.00 BSC | | |
| e2 | 3.10 BSC | | |
| K | (2.75) | | |
| L | 0.40 | 0.50 | 0.60 |
| aaa | 0.10 | | |
| bbb | 0.10 | | |
| ccc | 0.05 | | |
| eee | 0.05 | | |
| fff | 0.10 | | |
| ggg | 0.15 | | |



*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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