## MOSFET－Power，Single N－Channel <br> 40 V， $0.45 \mathrm{~m} \Omega, 558$ A

## NTMTS0D4N04C

## Features

－Small Footprint（ 8 x 8 mm ）for Compact Design
－Low $\mathrm{R}_{\mathrm{DS}(\text { on })}$ to Minimize Conduction Losses
－Low $\mathrm{Q}_{\mathrm{G}}$ and Capacitance to Minimize Driver Losses
－Power 88 Package，Industry Standard
－These Devices are $\mathrm{Pb}-$ Free，Halogen Free／BFR Free and are RoHS Compliant

MAXIMUM RATINGS $\left(\mathrm{T}_{J}=25^{\circ} \mathrm{C}\right.$ unless otherwise noted）

| Parameter |  |  | Symbol | Value | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Drain－to－Source Voltage |  |  | $\mathrm{V}_{\text {DSS }}$ | 40 | V |
| Gate－to－Source Voltage |  |  | $\mathrm{V}_{\mathrm{GS}}$ | $\pm 20$ | V |
| Continuous Drain Current $\mathrm{R}_{\text {日JC }}$ （Notes 1，3） | Steady State | $\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}$ | $\mathrm{I}_{\mathrm{D}}$ | 558 | A |
|  |  | $\mathrm{T}_{\mathrm{C}}=100^{\circ} \mathrm{C}$ |  | 394.8 |  |
| Power Dissipation $\mathrm{R}_{\text {日JC }}$（Note 1） |  | $\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}$ | $\mathrm{P}_{\mathrm{D}}$ | 244.0 | W |
|  |  | $\mathrm{T}_{\mathrm{C}}=100^{\circ} \mathrm{C}$ |  | 122.0 |  |
| Continuous Drain Current $\mathrm{R}_{\theta \mathrm{JA}}$ （Notes 1，2，3） | Steady State | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | $I_{\text {D }}$ | 79.8 | A |
|  |  | $\mathrm{T}_{\mathrm{A}}=100^{\circ} \mathrm{C}$ |  | 56.4 |  |
| Power Dissipation <br> $\mathrm{R}_{\text {өJA }}$（Notes 1，2） |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | $\mathrm{P}_{\mathrm{D}}$ | 5.0 | W |
|  |  | $\mathrm{T}_{\mathrm{A}}=100^{\circ} \mathrm{C}$ |  | 2.5 |  |
| Pulsed Drain Current | $\mathrm{T}_{\mathrm{A}}=25$ | ， $\mathrm{t}_{\mathrm{p}}=10 \mu \mathrm{~s}$ | $\mathrm{I}_{\mathrm{DM}}$ | 900 | A |
| Operating Junction and Storage Temperature |  |  | $\mathrm{T}_{\mathrm{J},} \mathrm{T}_{\mathrm{stg}}$ | $\begin{gathered} -55 \text { to } \\ +175 \end{gathered}$ | ${ }^{\circ} \mathrm{C}$ |
| Source Current（Body Diode） |  |  | Is | 203.4 | A |
| Single Pulse Drain－to－Source Avalanche Energy（ $\mathrm{l}_{\mathrm{L}(\mathrm{pk})}=70 \mathrm{~A}$ ） |  |  | $\mathrm{E}_{\text {AS }}$ | 4454 | mJ |
| Lead Temperature for Soldering Purposes （ $1 / 8^{\prime \prime}$ from case for 10 s ） |  |  | $\mathrm{T}_{\mathrm{L}}$ | 260 | ${ }^{\circ} \mathrm{C}$ |

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．

THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
| :--- | :---: | :---: | :---: |
| Junction－to－Case－Steady State | $\mathrm{R}_{\text {日JC }}$ | 0.61 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| Junction－to－Ambient－Steady State（Note 2） | $\mathrm{R}_{\theta \mathrm{JA}}$ | 30 |  |

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．Surface－mounted on FR4 board using a $650 \mathrm{~mm}^{2}$ ， 2 oz ．Cu pad．
3．Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle．

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| $\mathbf{V}_{\text {（BR）DSs }}$ | $\mathbf{R}_{\mathrm{DS}(\mathrm{ON})}$ MAX | $\mathbf{I}_{\mathrm{D}}$ MAX |
| :---: | :---: | :---: |
| 40 V | $0.45 \mathrm{~m} \Omega @ 10 \mathrm{~V}$ | 558 A |

G（1）


N－CHANNEL MOSFET


MARKING DIAGRAM


XXX＝Device Code
（8 A－N characters max）
A＝Assembly Location
WL＝2－digit Wafer Lot Code
Y＝Year Code
WW＝Work Week Code

## ORDERING INFORMATION

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

ELECTRICAL CHARACTERISTICS $\left(\mathrm{T}_{J}=25^{\circ} \mathrm{C}\right.$ unless otherwise specified)


ON CHARACTERISTICS (Note 4)

| Gate Threshold Voltage | $\mathrm{V}_{\mathrm{GS}(\mathrm{TH})}$ | $\mathrm{V}_{\mathrm{GS}}=\mathrm{V}_{\mathrm{DS}}, \mathrm{I}_{\mathrm{D}}=250 \mu \mathrm{~A}$ | 2.0 |  | 4.0 | V |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Threshold Temperature Coefficient | $\mathrm{V}_{\mathrm{GS}(\mathrm{TH})} / \mathrm{T}_{\mathrm{J}}$ |  |  | -8.49 |  | $\mathrm{mV} /{ }^{\circ} \mathrm{C}$ |
| Drain-to-Source On Resistance | $\mathrm{R}_{\mathrm{DS}(\text { on })}$ | $\mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{D}}=50 \mathrm{~A}$ |  | 0.38 | 0.45 |
| Forward Transconductance | $\mathrm{g}_{\mathrm{FS}}$ | $\mathrm{V}_{\mathrm{DS}}=15 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=50 \mathrm{~A}$ |  | 300 | $\mathrm{~m} \Omega$ |  |

CHARGES, CAPACITANCES \& GATE RESISTANCE

| Input Capacitance | $\mathrm{C}_{\text {ISS }}$ | $\mathrm{V}_{\mathrm{GS}}=0 \mathrm{~V}, \mathrm{f}=0.1 \mathrm{MHz}, \mathrm{V}_{\mathrm{DS}}=20 \mathrm{~V}$ | 16500 | pF |
| :---: | :---: | :---: | :---: | :---: |
| Output Capacitance | Coss |  | 8310 |  |
| Reverse Transfer Capacitance | $\mathrm{C}_{\text {RSS }}$ |  | 390 |  |
| Total Gate Charge | $\mathrm{Q}_{\mathrm{G}(\text { (TOT) }}$ | $\mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{~V}_{\mathrm{DS}}=20 \mathrm{~V} ; \mathrm{I}_{\mathrm{D}}=50 \mathrm{~A}$ | 251 | nC |
| Threshold Gate Charge | $\mathrm{Q}_{\mathrm{G}(\mathrm{TH})}$ | $\mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{~V}_{\mathrm{DS}}=20 \mathrm{~V} ; \mathrm{I}_{\mathrm{D}}=50 \mathrm{~A}$ | 40.0 |  |
| Gate-to-Source Charge | $Q_{G S}$ |  | 62.6 |  |
| Gate-to-Drain Charge | $Q_{G D}$ |  | 49.0 |  |
| Plateau Voltage | $\mathrm{V}_{\mathrm{GP}}$ |  | 4.08 | V |
| Gate Resistance | $\mathrm{R}_{\mathrm{G}}$ |  | 0.9 | $\Omega$ |

SWITCHING CHARACTERISTICS (Note 5)

| Turn-On Delay Time | $\mathrm{t}_{\mathrm{d}(\mathrm{ON})}$ | $\begin{gathered} \mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{~V}_{\mathrm{DS}}=20 \mathrm{~V}, \\ \mathrm{I}_{\mathrm{D}}=50 \mathrm{~A}, \mathrm{R}_{\mathrm{G}}=6 \Omega \end{gathered}$ | 55.2 | ns |
| :---: | :---: | :---: | :---: | :---: |
| Rise Time | $\mathrm{t}_{\mathrm{r}}$ |  | 50.8 |  |
| Turn-Off Delay Time | $\mathrm{t}_{\mathrm{d} \text { (OFF) }}$ |  | 200 |  |
| Fall Time | $\mathrm{t}_{\mathrm{f}}$ |  | 78.7 |  |

DRAIN-SOURCE DIODE CHARACTERISTICS

| Forward Diode Voltage | $\mathrm{V}_{\text {SD }}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{GS}}=0 \mathrm{~V}, \\ & \mathrm{I}_{\mathrm{S}}=50 \mathrm{~A} \end{aligned}$ | $\mathrm{T}_{J}=25^{\circ} \mathrm{C}$ | 0.75 | 1.2 | V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{T}_{\mathrm{J}}=125^{\circ} \mathrm{C}$ | 0.58 |  |  |
| Reverse Recovery Time | $\mathrm{t}_{\mathrm{RR}}$ | $\begin{gathered} \mathrm{V}_{\mathrm{GS}}=0 \mathrm{~V}, \mathrm{dIS} / \mathrm{dt}=100 \mathrm{~A} / \mathrm{us}, \\ \mathrm{I}_{\mathrm{S}}=50 \mathrm{~A} \end{gathered}$ |  | 120 |  | ns |
| Charge Time | $\mathrm{t}_{\mathrm{a}}$ |  |  | 60 |  |  |
| Discharge Time | $\mathrm{t}_{\mathrm{b}}$ |  |  | 60 |  |  |
| Reverse Recovery Charge | $\mathrm{Q}_{\text {RR }}$ |  |  | 338 |  | 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.
4. Pulse Test: pulse width $\leq 300 \mu \mathrm{~s}$, duty cycle $\leq 2 \%$.
5. Switching characteristics are independent of operating junction temperatures.

## NTMTS0D4N04C

## TYPICAL CHARACTERISTICS



Figure 1. On-Region Characteristics


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


Figure 5. On-Resistance Variation with Temperature


Figure 2. Transfer Characteristics


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


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

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TYPICAL CHARACTERISTICS


Figure 7. Capacitance Variation


Figure 9. Resistive Switching Time Variation vs. Gate Resistance


Figure 11. Maximum Rated Forward Biased Safe Operating Area


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


Figure 10. Diode Forward Voltage vs. Current


Figure 12. IPEAK vs. Time in Avalanche

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## TYPICAL CHARACTERISTICS



Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping $^{\dagger}$ |
| :---: | :---: | :---: | :---: |
| NTMTSOD4NO4CTXG | OD4N04C | POWER 88 <br> (Pb-Free) | $3000 /$ Tape \& Reel |

$\dagger$ 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.

## NTMTS0D4N04C

## PACKAGE DIMENSIONS

DFNW8 8.3x8.4, 2P
CASE 507AP
ISSUE B

$\frac{\text { DETAIL A }}{\text { SCALE } 2 \mathrm{X}}$

SCALE: 2X
NOTES

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS
5. SEATING PLANE IS DEFINED BY THE TERMINALS
"A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY

| DIM | MILLIMETERS |  |  |
| :--- | :--- | :--- | :--- |
|  | MIN. | NOM. | MAX. |
| A | 1.00 | 1.10 | 1.20 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.90 | 1.00 | 1.10 |
| b1 | 0.43 | 0.53 | 0.63 |
| c | 0.23 | 0.28 | 0.33 |
| D | 8.20 | 8.30 | 8.40 |
| D1 | 7.90 | 8.00 | 8.10 |
| D2 | 6.80 | 6.90 | 7.00 |
| D3 | 6.90 | 7.00 | 7.10 |
| E | 8.30 | 8.40 | 8.50 |
| E1 | 7.80 | 7.90 | 8.00 |
| E2 | 5.24 | 5.34 | 5.44 |
| E3 | 0.25 | 0.35 | 0.45 |
| e | 2.00 BSC |  |  |
| e/2 | 1.00 BSC |  |  |
| e1 | 2.70 BSC |  |  |
| e1/2 | 1.35 BSC |  |  |
| K | 1.50 | 1.57 | 1.70 |
| L | 0.64 | 0.74 |  |


#### Abstract

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