

# NTTFS012N12MC

## Product Preview

### Power MOSFET

120 V, 12.0 mΩ, TBD A, Single N-Channel

#### Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- 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 Breakdown Voltage   | $V_{(BR)DSS}$                                  | 120                      | V                |
| Gate-to-Source Voltage  | $V_{GS}$                                       | $\pm 20$                 | V                |
| Continuous Drain Current $R_{\theta JC}$ (Note 2)   | Steady State                                   | $T_C = 25^\circ\text{C}$ | $I_D$ TBD A      |
|   |  | $T_C = 25^\circ\text{C}$ | $P_D$ TBD W      |
| Power Dissipation $R_{\theta JC}$ (Note 2)  | Steady State                                   | $T_A = 25^\circ\text{C}$ | $I_D$ TBD A      |
|   |  | $T_A = 25^\circ\text{C}$ | $P_D$ TBD W      |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2)                                     |  |                          |                  |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2)  | Steady State                                   | $T_A = 25^\circ\text{C}$ | $I_D$ TBD A      |
|   |  | $T_A = 25^\circ\text{C}$ | $P_D$ TBD W      |
| Pulsed Drain Current  | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | $I_{DM}$                 | TBD A            |
| Operating Junction and Storage Temperature Range  | $T_J, T_{stg}$                                 | -55 to +150              | $^\circ\text{C}$ |
| Source Current (Body Diode)   | $I_S$  | TBD                      | A                |
| Single Pulse Drain-to-Source Avalanche Energy ( $I_{AV} = \text{TBD A}, L = \text{TBD}$ ) | $E_{AS}$                                       | TBD                      | mJ               |
| Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)        | $T_L$  | 300                      | $^\circ\text{C}$ |

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.

#### THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit                      |
|---|-----------------|-------|---------------------------|
| Junction-to-Case - Steady State (Note 2)    | $R_{\theta JC}$ | TBD   | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient - Steady State (Note 2) | $R_{\theta JA}$ | TBD   |                           |

1. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

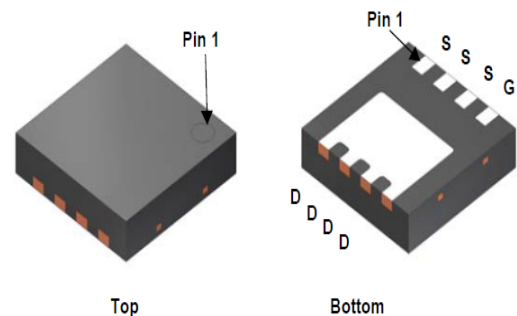
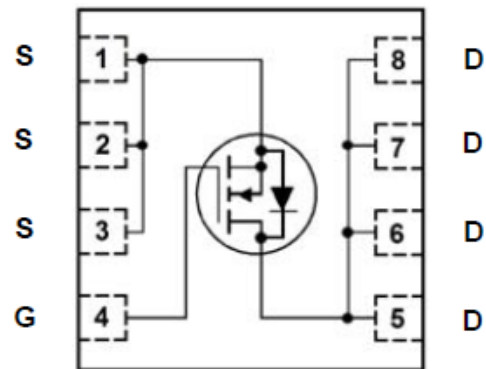
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| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---------------|------------------|-----------|
| 120 V         | 12.0 mΩ @ 10 V   | TBD A     |
|               | TBD mΩ @ 6 V     |           |



PQFN33  
CASE TBD

#### ORDERING INFORMATION

| Device        | Package          | Shipping†          |
|---------------|------------------|--------------------|
| NTTFS012N12MC | PQFN33 (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.

# NTTFS012N12MC

## 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                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$        | 120                       |     |           | V                    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$ |                           | TBD |           | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$          | $T_J = 25^\circ\text{C}$  |     | 10        | $\mu\text{A}$        |
|   |                   |  | $T_J = 125^\circ\text{C}$ |     | 100       |                      |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$      |                           |     | $\pm 100$ | nA                   |

### ON CHARACTERISTICS (Note 3)

|  |                  |   |                              |     |      |                      |
|--|------------------|---|------------------------------|-----|------|----------------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = \text{TBD}\ \mu\text{A}$            | 2.0                          |     | 4.0  | V                    |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | $I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$        |                              | TBD |      | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}$                                      | $I_D = \text{TBD}\ \text{A}$ | TBD | 12.0 | m $\Omega$           |
|  |                  | $V_{GS} = 6\text{ V}$                                       | $I_D = \text{TBD}\ \text{A}$ | TBD | TBD  |                      |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = \text{TBD}\ \text{V}, I_D = \text{TBD}\ \text{A}$ |                              | TBD |      | S                    |
| Gate-Resistance                            | $R_G$            | $T_A = 25^\circ\text{C}$                                    |                              | TBD |      | $\Omega$             |

### CHARGES & CAPACITANCES

|                              |                   |  |  |      |  |    |
|------------------------------|-------------------|--|--|------|--|----|
| Input Capacitance            | $C_{ISS}$         | $V_{GS} = 0\text{ V}, f = 1\ \text{MHz}, V_{DS} = 60\text{ V}$           |  | 1338 |  | pF |
| Output Capacitance           | $C_{OSS}$         |  |  | 633  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$         |  |  | 13   |  |    |
| Total Gate Charge            | $Q_G(\text{TOT})$ | $V_{GS} = 10\text{ V}, V_{DS} = 60\text{ V}, I_D = \text{TBD}\ \text{A}$ |  | 20   |  | nC |
| Total Gate Charge            | $Q_G(\text{TOT})$ | $V_{GS} = 6\text{ V}, V_{DS} = 60\text{ V}, I_D = \text{TBD}\ \text{A}$  |  | TBD  |  |    |
| Gate-to-Source Charge        | $Q_{GS}$          |  |  | 5    |  |    |
| Gate-to-Drain Charge         | $Q_{GD}$          |  |  | 7    |  |    |
| Plateau Voltage              | $V_{GP}$          |  |  | TBD  |  | V  |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |              |  |  |     |  |    |
|---------------------|--------------|--|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 60\text{ V}, I_D = \text{TBD}\ \text{A}, R_G = \text{TBD}\ \Omega$ |  | TBD |  | ns |
| Rise Time           | $t_r$        |  |  | TBD |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | TBD |  |    |
| Fall Time           | $t_f$        |  |  | TBD |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |   |                           |     |     |    |   |
|-------------------------|----------|---|---------------------------|-----|-----|----|---|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = \text{TBD}\ \text{A}$   | $T_J = 25^\circ\text{C}$  |     | TBD |    | V |
|                         |          |   | $T_J = 125^\circ\text{C}$ |     | TBD |    |   |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, \text{d}I_S/\text{d}t = 300\ \text{A}/\mu\text{s}, I_S = \text{TBD}\ \text{A}$  |                           | TBD |     | ns |   |
| Reverse Recovery Charge | $Q_{RR}$ |   |                           | TBD |     | nC |   |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, \text{d}I_S/\text{d}t = 1000\ \text{A}/\mu\text{s}, I_S = \text{TBD}\ \text{A}$ |                           | TBD |     | ns |   |
| Reverse Recovery Charge | $Q_{RR}$ |   |                           | TBD |     | nC |   |

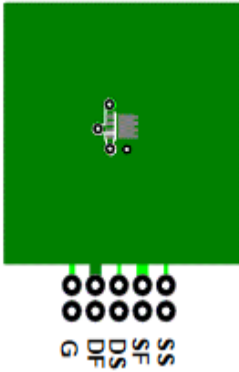
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Switching characteristics are independent of operating junction temperatures.

# NTTFS012N12MC

## NOTES:

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



a. 53°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



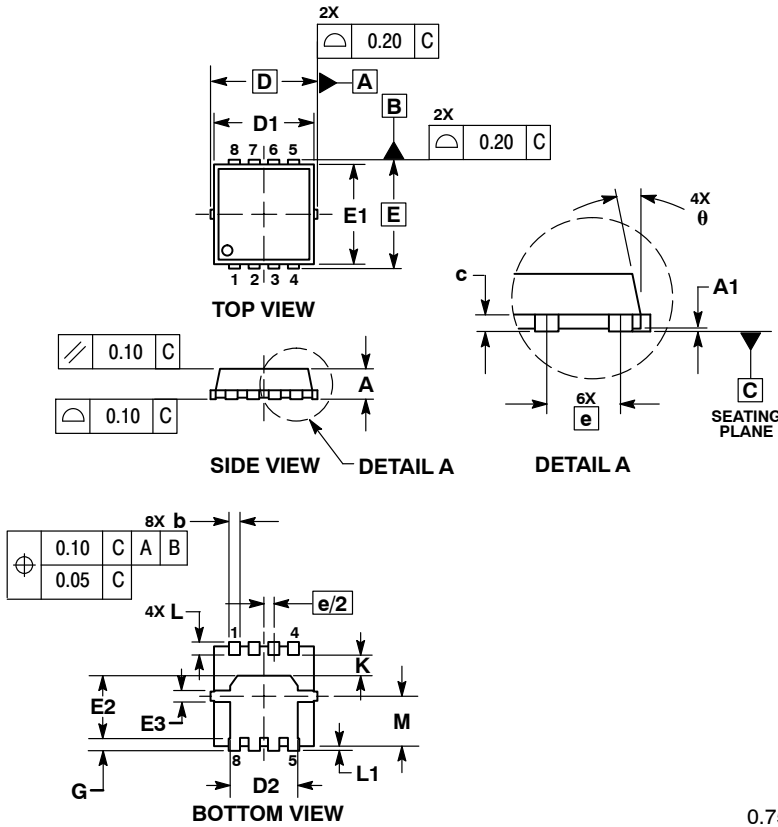
b. 125°C/W when mounted on a minimum pad of 2 oz copper.

5. Pulse Test: Pulse Width < TBD. Duty cycle < TBD.  
6.  $E_{AS}$  of TBD is based on started  $T_J = 25^\circ\text{C}$ ,  $L = \text{TBD}$ ,  $I_{AS} = \text{TBD}$ ,  $V_{DD} = \text{TBD}$ ,  $V_{GS} = \text{TBD}$ . 100% test at  $L = \text{TBD}$ ,  $I_{AS} = \text{TBD}$ .  
7. As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

# NTTFS012N12MC

## PACKAGE DIMENSIONS

PQFN33 3.3x3.3, 0.65P  
CASE TBD  
ISSUE O

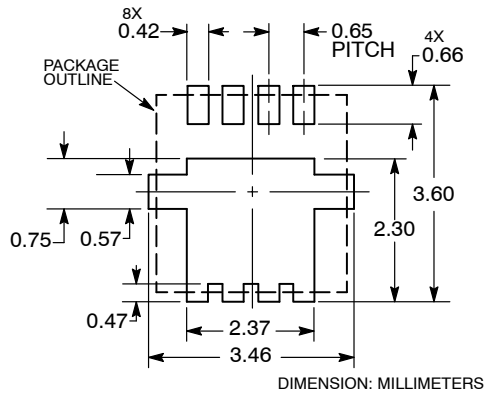


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.70        | 0.75 | 0.80 | 0.028     | 0.030 | 0.031 |
| A1  | 0.00        | ---  | 0.05 | 0.000     | ---   | 0.002 |
| b   | 0.23        | 0.30 | 0.40 | 0.009     | 0.012 | 0.016 |
| c   | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D   | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| D1  | 2.95        | 3.05 | 3.15 | 0.116     | 0.120 | 0.124 |
| D2  | 1.98        | 2.11 | 2.24 | 0.078     | 0.083 | 0.088 |
| E   | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| E1  | 2.95        | 3.05 | 3.15 | 0.116     | 0.120 | 0.124 |
| E2  | 1.47        | 1.60 | 1.73 | 0.058     | 0.063 | 0.068 |
| E3  | 0.23        | 0.30 | 0.40 | 0.009     | 0.012 | 0.016 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| G   | 0.30        | 0.41 | 0.51 | 0.012     | 0.016 | 0.020 |
| K   | 0.65        | 0.80 | 0.95 | 0.026     | 0.032 | 0.037 |
| L   | 0.30        | 0.43 | 0.56 | 0.012     | 0.017 | 0.022 |
| L1  | 0.06        | 0.13 | 0.20 | 0.002     | 0.005 | 0.008 |
| M   | 1.40        | 1.50 | 1.60 | 0.055     | 0.059 | 0.063 |
| θ   | 0 °         | ---  | 12 ° | 0 °       | ---   | 12 °  |

**SOLDERING FOOTPRINT\***



DIMENSION: MILLIMETERS

\*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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