



## Description

The NVTFWS4D9N04XMTAG uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

## General Features

$V_{DS} = 40V$   $I_D = 70A$

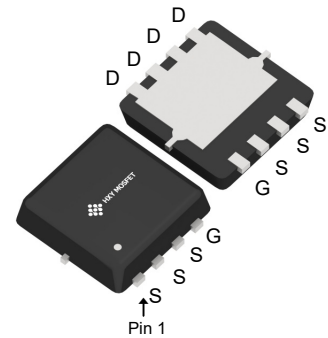
$R_{DS(ON)} < 5.5m\Omega @ V_{GS}=10V$

## Application

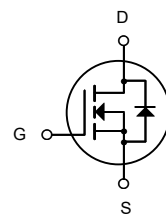
Battery protection

Load switch

Uninterruptible power supply



DFN3X3-8L



N-Channel MOSFET

## Ordering Information

| Product ID        | Pack      | Brand      | Qty(PCS) |
|-------------------|-----------|------------|----------|
| NVTFWS4D9N04XMTAG | DFN3X3-8L | HXY MOSFET | 5000     |

## Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

| Symbol                  | Parameter                                | Rating     | Units        |
|-------------------------|--|------------|--------------|
| $V_{DS}$                | Drain-Source Voltage                     | 40         | V            |
| $V_{GS}$                | Gate-Source Voltage                      | $\pm 20$   | V            |
| $I_D @ T_C=25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V$ | 70         | A            |
| $I_D @ T_C=100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 44.3       | A            |
| $I_{DM}$                | Pulsed Drain Current                     | 280        | A            |
| EAS                     | Single Pulse Avalanche Energy            | 100        | mJ           |
| $I_{AS}$                | Avalanche Current                        | 22         | A            |
| $P_D @ T_C=25^\circ C$  | Total Power Dissipation                  | 52         | W            |
| $T_{STG}$               | Storage Temperature Range                | -55 to 150 | $^\circ C$   |
| $T_J$                   | Operating Junction Temperature Range     | -55 to 150 | $^\circ C$   |
| $R_{\theta JA}$         | Thermal Resistance Junction-Ambient      | 62         | $^\circ C/W$ |
| $R_{\theta JC}$         | Thermal Resistance Junction-Case         | 2.4        | $^\circ C/W$ |



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

| Symbol                         | Parameter                               | Conditions  | Min                                     | Typ  | Max       | Units      |
|--------------------------------|---|---|---|------|-----------|------------|
| <b><math>BV_{DSS}</math></b>   | Drain-Source Breakdown Voltage          | $V_{GS}=0V, I_D=250\mu A$                           | 40                                      | ---  | ---       | V          |
| <b><math>I_{DSS}</math></b>    | Zero Gate Voltage Drain Current         | $V_{GS}=0V, V_{DS}=40V$                             | ---                                     | ---  | 1         | $\mu A$    |
| <b><math>I_{GSS}</math></b>    | Gate-Source Leakage Current             | $V_{GS}=\pm 20V, V_{DS}=0A$                         | ---                                     | ---  | $\pm 100$ | nA         |
| <b><math>V_{GS(th)}</math></b> | Gate-Source Threshold Voltage           | $V_{GS}=V_{DS}, I_D=250\mu A$                       | 1.0                                     | 1.6  | 2.1       | V          |
| <b><math>R_{DS(on)}</math></b> | Drain-Source On Resistance <sup>4</sup> | $V_{GS}=10V, I_D=20A$                               | ---                                     | 4.2  | 5.5       | m $\Omega$ |
|                                |   | $V_{GS}=4.5V, I_D=10A$                              | ---                                     | 5.5  | 7         |            |
| <b><math>C_{iss}</math></b>    | Input Capacitance                       | $V_{DS}=25V, V_{GS}=0V, f=1MHz$                     | ---                                     | 2800 | ---       | pF         |
| <b><math>C_{oss}</math></b>    | Output Capacitance                      |   | ---                                     | 233  | --        |            |
| <b><math>C_{rss}</math></b>    | Reverse Transfer Capacitance            |   | ---                                     | 152  | ---       |            |
| <b><math>t_{d(on)}</math></b>  | Turn-On Delay Time                      | $V_{DS}=20V, I_D=1A,$<br>$R_G=3.3\Omega, V_{GS}10V$ | ---                                     | 14.2 | ---       | ns         |
| <b><math>t_r</math></b>        | Rise Time                               |   | ---                                     | 18.3 | ---       | ns         |
| <b><math>t_{d(off)}</math></b> | Turn-Off Delay Time                     |   | ---                                     | 38.8 | ---       | ns         |
| <b><math>t_f</math></b>        | Fall Time                               |   | ---                                     | 13.9 | ---       | ns         |
| <b><math>Q_g</math></b>        | Total Gate Charge                       |   | $V_{GS}=4.5V,$<br>$V_{DS}=32V, I_D=10A$ | ---  | 25        | ---        |
| <b><math>Q_{gs}</math></b>     | Gate-Source Charge                      | ---   |   | 6.4  | ---       | nC         |
| <b><math>Q_{gd}</math></b>     | Gate-Drain "Miller" Charge              | ---   |   | 12.1 | ---       | nC         |
| <b><math>V_{SD}</math></b>     | Diode Forward Voltage                   | $V_{GS}=0V, I_{SD}=1A$                              | ---                                     | ---  | 1         | V          |
| <b><math>I_S</math></b>        | Continuous Drain Current                | $V_D=V_G=0V$  | ---                                     | ---  | 70        | A          |
| <b><math>I_{SM}</math></b>     | Pulsed Drain Current                    |   | ---                                     | ---  | 280       | A          |

**Notes:**

1. Computed continuous current assumes the condition of  $T_{J,Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design
2. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
3. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH$
4. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$



## Typical Characteristics

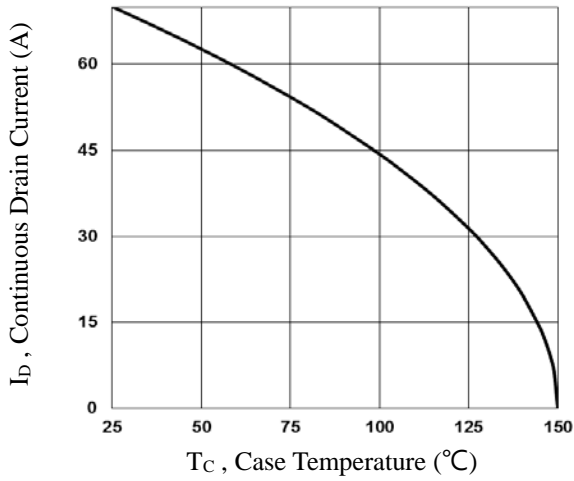


Fig.1 Continuous Drain Current vs.  $T_C$

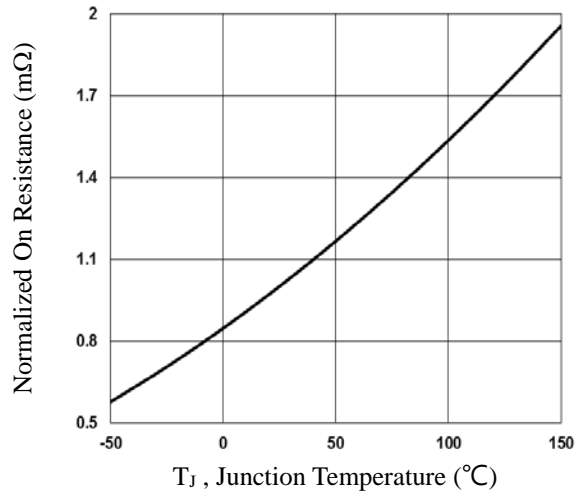


Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$

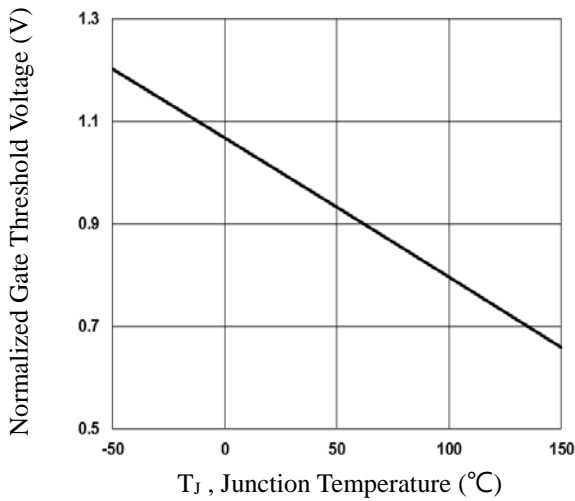


Fig.3 Normalized  $V_{th}$  vs.  $T_J$

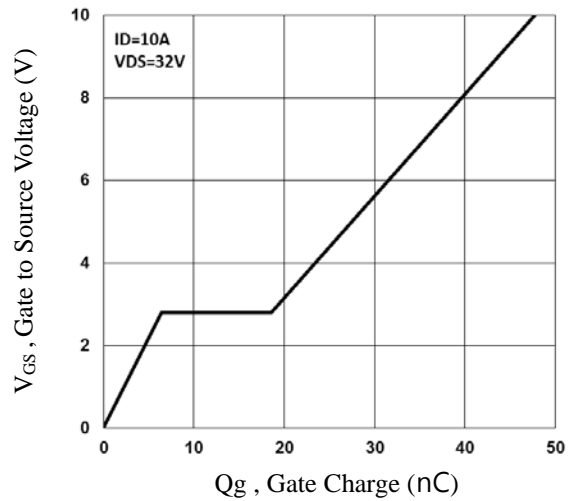


Fig.4 Gate Charge Waveform

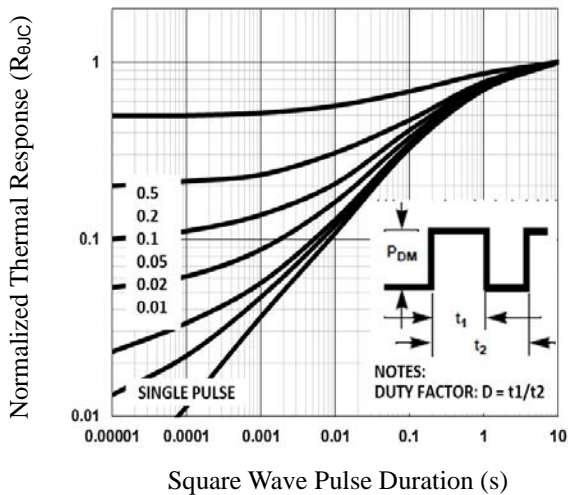


Fig.5 Normalized Transient Impedance

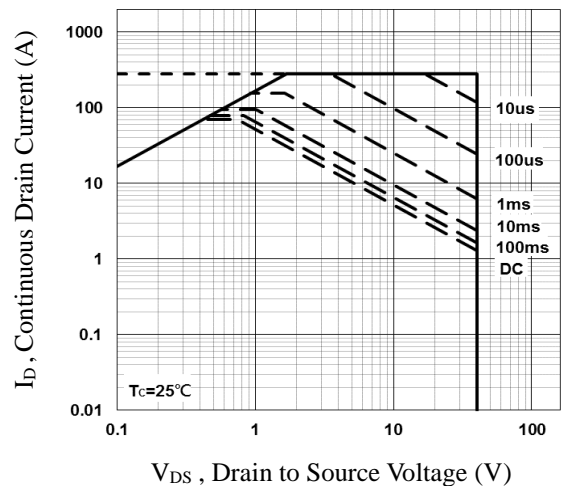


Fig.6 Maximum Safe Operation Area

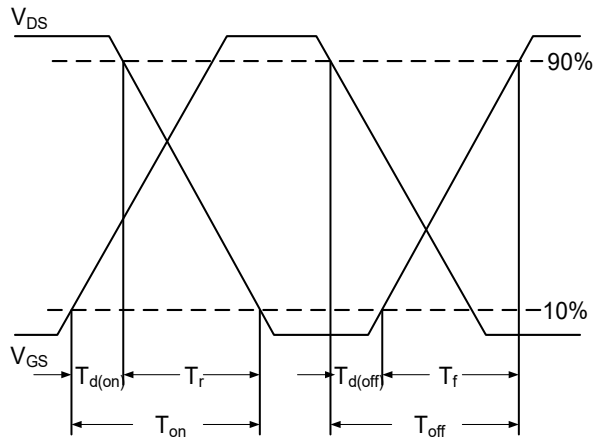


Fig.7 Switching Time Waveform

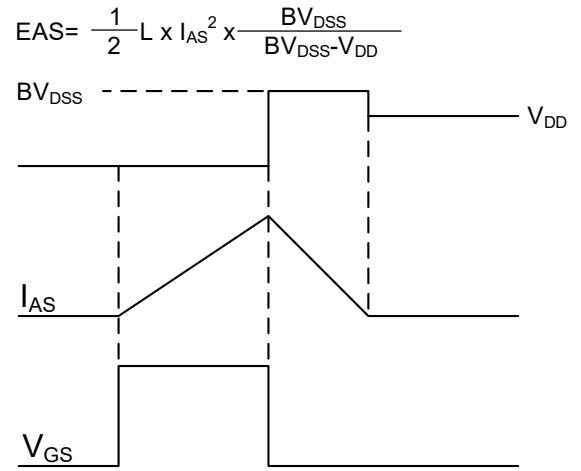
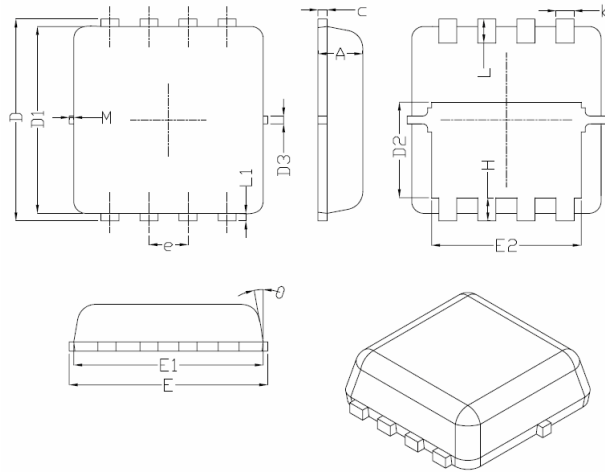


Fig.8 EAS Waveform



### DFN3X3-8L Package Information



| Symbol   | Dimensions In Millimeters |      |      |
|----------|---------------------------|------|------|
|          | Min.                      | Nom. | Max. |
| A        | 0.70                      | 0.75 | 0.80 |
| b        | 0.25                      | 0.30 | 0.35 |
| c        | 0.10                      | 0.15 | 0.25 |
| D        | 3.25                      | 3.35 | 3.45 |
| D1       | 3.00                      | 3.10 | 3.20 |
| D2       | 1.48                      | 1.58 | 1.68 |
| D3       | -                         | 0.13 | -    |
| E        | 3.20                      | 3.30 | 3.40 |
| E1       | 3.00                      | 3.15 | 3.20 |
| E2       | 2.39                      | 2.49 | 2.59 |
| e        | 0.65BSC                   |      |      |
| H        | 0.30                      | 0.39 | 0.50 |
| L        | 0.30                      | 0.40 | 0.50 |
| L1       | -                         | 0.13 | -    |
| M        | *                         | *    | 0.15 |
| $\theta$ |                           | 10°  | 12°  |



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