



## Description

The NTMFS4C09NAT1G 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

$V_{DS} = 30V$   $I_D = 80A$

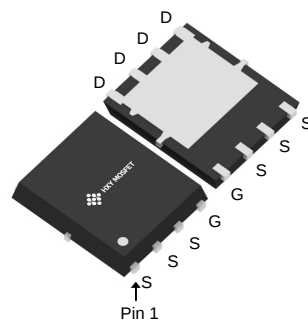
$R_{DS(ON)} < 6m\Omega$   $V_{GS}=10V$

## Application

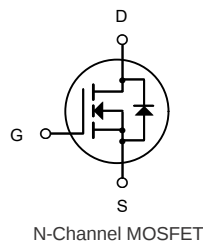
Battery protection

Load switch

Uninterruptible power supply



DFN5X6-8L  
(DFN-8(5x6))



N-Channel MOSFET

## Package Marking and Ordering Information

| Product ID     | Pack                  | Brand      | Qty(PCS) |
|----------------|-----------------------|------------|----------|
| NTMFS4C09NAT1G | DFN5X6-8L(DFN-8(5x6)) | HXY MOSFET | 5000     |

## Absolute Maximum Ratings ( $T_C=25^{\circ}C$ unless otherwise noted)

| Symbol                | Parameter                                        | Rating     | Units         |
|-----------------------|--------------------------------------------------|------------|---------------|
| $V_{DS}$              | Drain-Source Voltage                             | 30         | V             |
| $V_{GS}$              | Gate-Source Voltage                              | $\pm 20$   | V             |
| $I_D@T_C=25^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V$         | 80         | A             |
| $I_D@T_C=70^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V$         | 45         | A             |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>                | 280        | A             |
| EAS                   | Single Pulse Avalanche Energy <sup>3</sup>       | 56         | mJ            |
| $P_D@T_C=25^{\circ}C$ | Total Power Dissipation <sup>4</sup>             | 37         | 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 <sup>1</sup> | 30         | $^{\circ}C/W$ |



### Electrical Characteristics (T<sub>C</sub>=25°C Unless Otherwise Noted)

| Symbol                                                                               | Parameter                                              | Condition                                                                                   | Min. | Typ. | Max. | Unit |
|--------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------|------|------|------|------|
| Static Electrical Characteristics @ T <sub>J</sub> =25°C (unless otherwise stated)   |                                                        |                                                                                             |      |      |      |      |
| V <sub>(BR)DSS</sub>                                                                 | Drain-Source Breakdown Voltage                         | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                   | 30   | --   | --   | V    |
| I <sub>DSS</sub>                                                                     | Zero Gate Voltage Drain Current                        | V <sub>DS</sub> =30V,V <sub>GS</sub> =0V                                                    | --   | --   | 0.1  | μA   |
|                                                                                      | Zero Gate Voltage Drain Current(T <sub>J</sub> =125°C) | V <sub>DS</sub> =30V,V <sub>GS</sub> =0V                                                    | --   | --   | 100  | μA   |
| I <sub>GSS</sub>                                                                     | Gate-Body Leakage Current                              | V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V                                                   | --   | --   | ±100 | nA   |
| V <sub>GS(TH)</sub>                                                                  | Gate Threshold Voltage                                 | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                                     | 1.0  | 1.7  | 2.5  | V    |
| R <sub>DS(ON)</sub>                                                                  | Drain-Source On-State Resistance③                      | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                                   | --   | 4.7  | 6    | mΩ   |
| R <sub>DS(ON)</sub>                                                                  | Drain-Source On-State Resistance③                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =16A                                                  | --   | 5.4  | 8    | mΩ   |
| Dynamic Electrical Characteristics @ T <sub>J</sub> = 25°C (unless otherwise stated) |                                                        |                                                                                             |      |      |      |      |
| C <sub>iss</sub>                                                                     | Input Capacitance                                      | V <sub>DS</sub> =15V,V <sub>GS</sub> =0V,<br>f=1MHz                                         | --   | 1930 | --   | pF   |
| C <sub>oss</sub>                                                                     | Output Capacitance                                     |                                                                                             | --   | 310  | --   | pF   |
| C <sub>rss</sub>                                                                     | Reverse Transfer Capacitance                           |                                                                                             | --   | 260  | --   | pF   |
| R <sub>g</sub>                                                                       | Gate Resistance                                        | f=1MHz                                                                                      | --   | 0.85 | --   |      |
| Q <sub>g</sub>                                                                       | Total Gate Charge                                      | V <sub>DS</sub> =15V,I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                           | --   | 38   | --   | nC   |
| Q <sub>gs</sub>                                                                      | Gate-Source Charge                                     |                                                                                             | --   | 5.1  | --   | nC   |
| Q <sub>gd</sub>                                                                      | Gate-Drain Charge                                      |                                                                                             | --   | 12   | --   | nC   |
| Switching Characteristics                                                            |                                                        |                                                                                             |      |      |      |      |
| t <sub>d(on)</sub>                                                                   | Turn-on Delay Time                                     | V <sub>DD</sub> =15V,<br>I <sub>D</sub> =20A,<br>R <sub>G</sub> =3,<br>V <sub>GS</sub> =10V | --   | 8.5  | --   | nS   |
| t <sub>r</sub>                                                                       | Turn-on Rise Time                                      |                                                                                             | --   | 9    | --   | nS   |
| t <sub>d(off)</sub>                                                                  | Turn-Off Delay Time                                    |                                                                                             | --   | 31   | --   | nS   |
| t <sub>f</sub>                                                                       | Turn-Off Fall Time                                     |                                                                                             | --   | 9    | --   | nS   |
| Source- Drain Diode Characteristics@ T <sub>J</sub> = 25°C (unless otherwise stated) |                                                        |                                                                                             |      |      |      |      |
| V <sub>SD</sub>                                                                      | Forward on voltage                                     | I <sub>SD</sub> =20A,V <sub>GS</sub> =0V                                                    | --   | 0.8  | 1.2  | V    |
| t <sub>rr</sub>                                                                      | Reverse Recovery Time                                  | T <sub>J</sub> =25°C,I <sub>sd</sub> =20A,<br>V <sub>GS</sub> =0V                           | --   | 16   | --   | nS   |
| Q <sub>rr</sub>                                                                      | Reverse Recovery Charge                                | di/dt=500A/μs                                                                               |      | 42   |      | nC   |

#### NOTE:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.5mH, R<sub>G</sub> = 25 , I<sub>AS</sub> = 15A, V<sub>GS</sub> =10V. Part not recommended for use above this value
- ③ Pulse width ≤ 300μs; duty cycle≤ 2%.



## Typical Characteristics

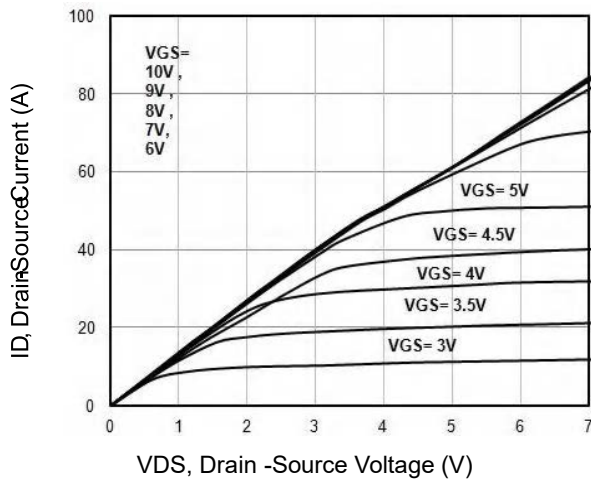


Fig1. Typical Output Characteristics

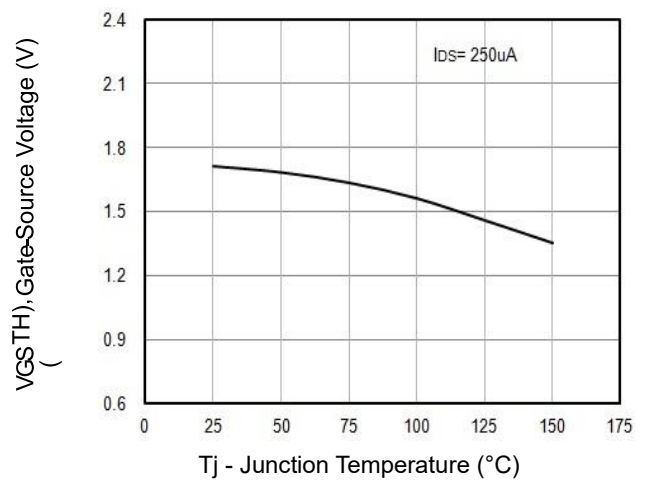


Fig2.  $V_{GS(TH)}$  Gate-Source Voltage Vs.  $T_J$

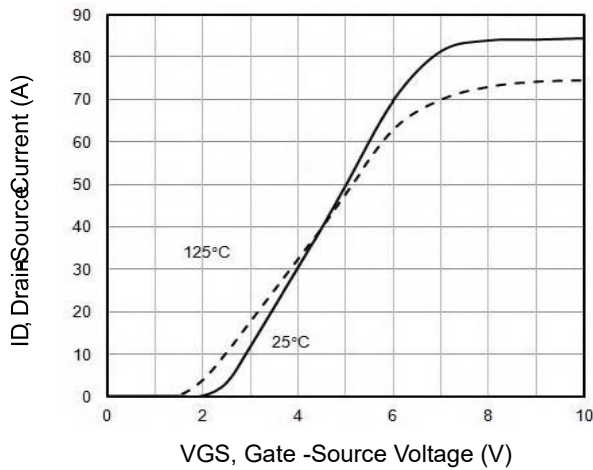


Fig3. Typical Transfer Characteristics

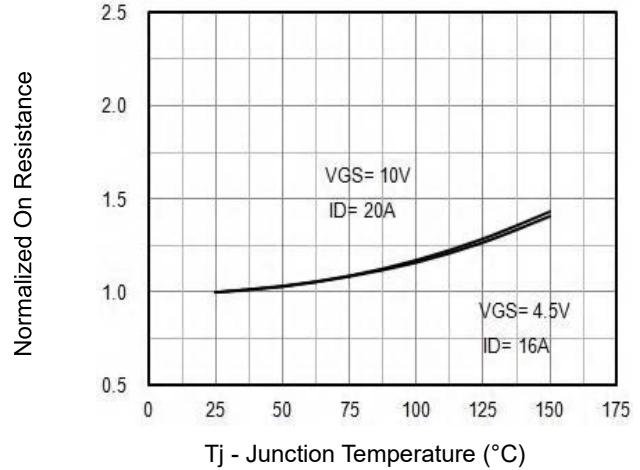


Fig4. Normalized On-Resistance Vs.  $T_J$

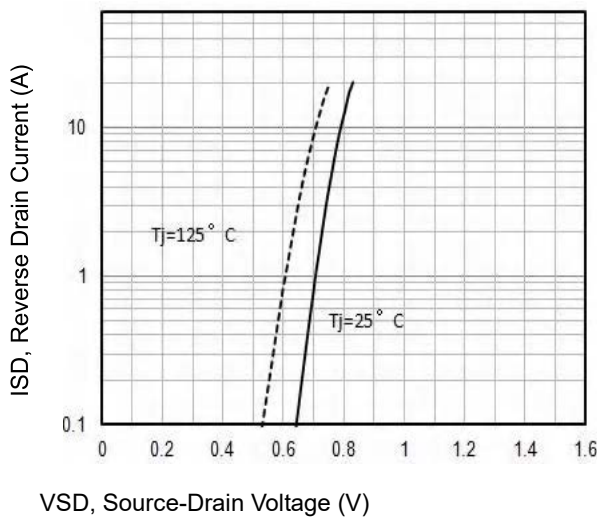


Fig6. Maximum Safe Operating Area Voltage

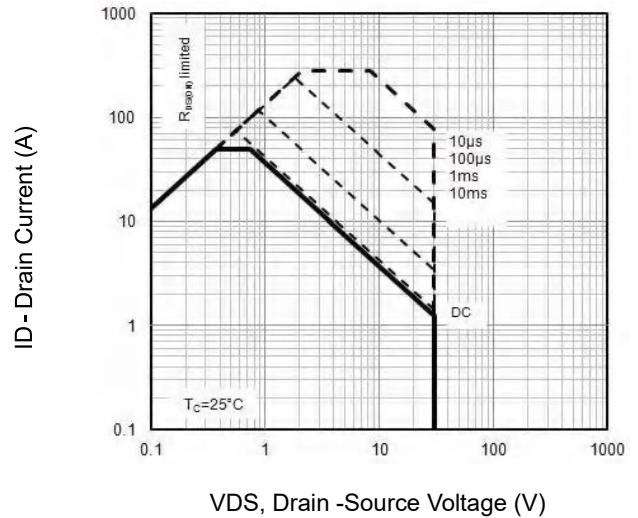


Fig5. Typical Source-Drain Diode Forward

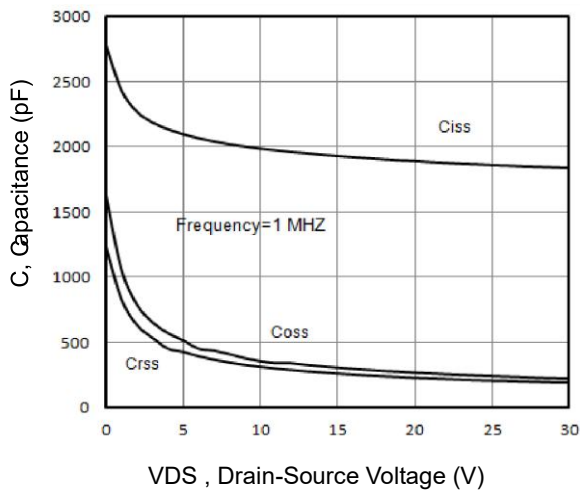


Fig7. Typical Capacitance Vs.Drain-Source Voltage



Fig8. Typical Gate Charge Vs.Gate-Source Voltage

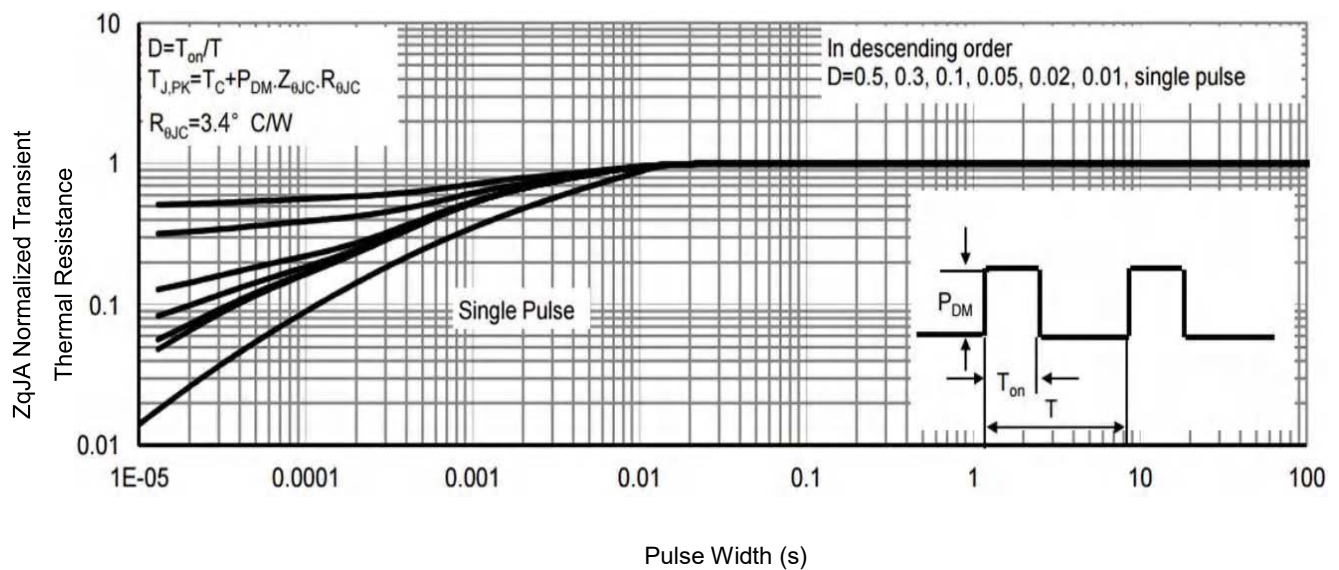


Fig9. Normalized Maximum Transient Thermal Impedance

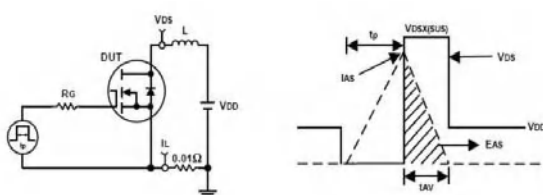


Fig10. Unclamped Inductive Test Circuit and waveforms

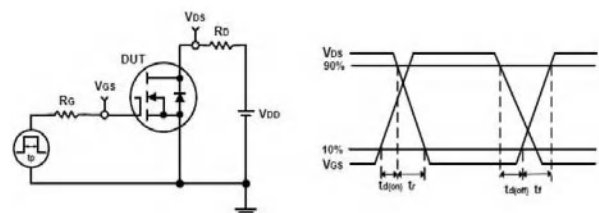


Fig11. Switching Time Test Circuit and waveforms



## DFN5X6-8L(DFN-8(5x6)) Package Information



| SYMBOL | MM       |      |       | INCH     |       |       |
|--------|----------|------|-------|----------|-------|-------|
|        | MIN      | NOM  | MAX   | MIN      | NOM   | MAX   |
| A      | 4.95     | 5    | 5.05  | 0.195    | 0.197 | 0.199 |
| A1     | 4.82     | 4.9  | 4.98  | 0.190    | 0.193 | 0.196 |
| D      | 5.98     | 6    | 6.02  | 0.235    | 0.236 | 0.237 |
| D1     | 5.67     | 5.75 | 5.83  | 0.223    | 0.226 | 0.230 |
| B      | 0.9      | 0.95 | 1     | 0.035    | 0.037 | 0.039 |
| B1     | 0.254REF |      |       | 0.010REF |       |       |
| C      | 3.95     | 4    | 4.05  | 0.156    | 0.157 | 0.159 |
| C1     | 0.35     | 0.4  | 0.45  | 0.014    | 0.016 | 0.018 |
| C2     | 1.27TYP  |      |       | 0.5TYP   |       |       |
| θ1     | 8°       | 10°  | 12°   | 8°       | 10°   | 12°   |
| L1     | 0.63     | 0.64 | 0.65  | 0.025    | 0.025 | 0.026 |
| L2     | 1.2      | 1.3  | 1.4   | 0.047    | 0.051 | 0.055 |
| L3     | 3.415    | 3.42 | 3.425 | 0.134    | 0.135 | 0.135 |
| H      | 0.24     | 0.25 | 0.26  | 0.009    | 0.010 | 0.010 |



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