

NSS008N04P5



N-Channel Enhanced Shielded Gate Trench Power MOSFET

Voltage: 40 Volts

Current: 250 Ampers

Package: PDFN5\*6

Features

- NH'S Advanced SGT Technology
- Low Reverse Transfer Capacitances
- Low Gate Charge For Low Switching Loss
- Excellent  $Q_g \cdot R_{ds(on)}$  Product(FOM)

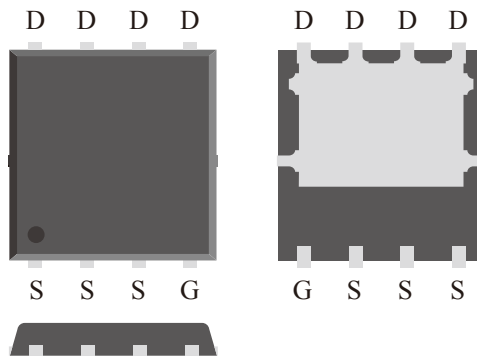
Typical Applications

- Synchronous Rectification
- High-Frequency Circuits
- The Motor Drives
- Automotive Electronics

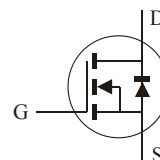
Product Summary

|                                     |     |    |
|-------------------------------------|-----|----|
| V <sub>DS</sub> Min.@T <sub>j</sub> | 40  | V  |
| I <sub>D</sub> Min.@T <sub>a</sub>  | 250 | A  |
| R <sub>DS(ON)</sub> (TYP)@10V       | 0.8 | mΩ |

Diagram:



Polarity:



**\*100% UIS TESTED**

**\*100% ΔV<sub>DS</sub> TESTED**

Absolute Maximum Ratings (T<sub>a</sub>=25°C Unless Otherwise Specified)

| Parameter                                                                    | Test Conditions                                                                                                       | Symbol          | Ratings | Unit |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------|---------|------|
| Drain-Source Voltage                                                         |                                                                                                                       | V <sub>DS</sub> | 40      | V    |
| Gate-Source Voltage                                                          |                                                                                                                       | V <sub>GS</sub> | ±20     | V    |
| Continuous Drain Current (Note 1)                                            | T <sub>a</sub> = 25 °C                                                                                                | I <sub>D</sub>  | 250     | A    |
|                                                                              | T <sub>a</sub> = 100 °C                                                                                               |                 | 160     |      |
| Drain Current-Pulse (Note 1)                                                 | T <sub>j</sub> < 150 °C                                                                                               | I <sub>DM</sub> | 500     | A    |
| Maximum Power Dissipation Power<br>Dissipation Derating Factor Above 25°C    | T <sub>a</sub> = 25 °C                                                                                                | P <sub>D</sub>  | 96      | W    |
|                                                                              | T <sub>a</sub> = 100 °C                                                                                               |                 | 38      |      |
| Derating Factor                                                              |                                                                                                                       | D <sub>F</sub>  | 0.77    | W/°C |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 0.5 mH                                                                                                             | I <sub>AS</sub> | 34      | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.16 | L= 0.5 mH<br>I <sub>AS</sub> = 34 A,R <sub>G</sub> = 10.0 Ω<br>Starting T <sub>j</sub> =25 °C,V <sub>G</sub> = 10.0 V | E <sub>AS</sub> | 289     | mJ   |

Thermal Characteristics (T<sub>a</sub>=25°C Unless Otherwise Specified)

| Parameter                                                   | Test Conditions                                        | Symbol           | Typ.       | Unit |
|-------------------------------------------------------------|--------------------------------------------------------|------------------|------------|------|
| Junction Temperature                                        |                                                        | T <sub>J</sub>   | -55 to 150 | °C   |
| Storage Temperature Range                                   |                                                        | T <sub>STD</sub> | -55 to 150 | °C   |
| Thermal Resistance Junction To Ambient<br>With Steady-State | Still Air Environment<br>With T <sub>a</sub> =25 °C    | R <sub>θJA</sub> | 60.0       | °C/W |
| Thermal Resistance Junction-Case<br>With Steady-State       | Device Mounted On<br>1 in2 FR-4 Board With 2oz. Copper | R <sub>θJC</sub> | 1.3        |      |

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 13).

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**Electrical Characteristics (Ta=25°C Unless Otherwise Specified )**

| Parameter                                                                                   | Test Conditions              | Symbol                              | Min. | Typ.   | Max.   | Unit |
|---------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|------|--------|--------|------|
| Static Off Characteristics                                                                  |                              |                                     |      |        |        |      |
| Drain-Source Breakdown Voltage                                                              | VGS=0V,ID=250uA              | BV <sub>DSS</sub>                   | 40   | --     | --     | V    |
| Bvdss Temperature Coefficient                                                               | ID=250uA,Reference25℃        | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | --   | 0.05   | --     | V/℃  |
| Drain-Source Leakage Current                                                                | VDS= 40 V,VGS=0V             | I <sub>DSS</sub>                    | --   | --     | 1      | uA   |
| Gate-Body Leakage Current                                                                   | VGS= ±20 V,VDS=0V            | I <sub>GSS</sub>                    | --   | --     | ±100   | nA   |
| Forward Transconductance                                                                    | ID= 20.0 A,VDS= 5 V          | g <sub>fs</sub>                     | --   | 45.0   | --     | S    |
| Static On Characteristics                                                                   |                              |                                     |      |        |        |      |
| Gate Threshold Voltage                                                                      | VGS= VDS ID=250uA            | V <sub>GS(TH)</sub>                 | 1.0  | 1.7    | 2.3    | V    |
| Drain-Source On Resistance                                                                  | ID= 20.0 A,VGS= 10.0 V       | R <sub>DS(ON)</sub>                 | --   | 0.8    | 1.0    | mΩ   |
|                                                                                             | ID= 20.0 A,VGS= 4.5 V        |                                     | --   | 1.0    | 1.5    |      |
| Dynamic Characteristics                                                                     |                              |                                     |      |        |        |      |
| Gate Resistance                                                                             | VGS=0V,VDS=0V,<br>Freq.=1MHz | R <sub>g</sub>                      | --   | 1.6    | --     | Ω    |
| Input Capacitance                                                                           | VDS= 20 V                    | C <sub>iss</sub>                    | --   | 4930.0 | --     | pF   |
| Output Capacitance                                                                          | VGS= 0 V                     | C <sub>oss</sub>                    | --   | 2000.0 | --     | pF   |
| Reverse Transfer Capacitance                                                                | F= 1 MHZ                     | C <sub>rss</sub>                    | --   | 65.0   | --     | pF   |
| Switching Paramters (Test Circuit & Waveform See Fig.14)                                    |                              |                                     |      |        |        |      |
| Turn-On Delay Time                                                                          | VDS= 20 V                    | t <sub>d(on)</sub>                  | --   | 11.0   | --     | ns   |
| Turn-On Rise Time                                                                           | VGS= 10.0 V                  | t <sub>r</sub>                      | --   | 25.0   | --     | ns   |
| Turn-Off Delay Time                                                                         | RG= 10.0 Ω                   | t <sub>d(off)</sub>                 | --   | 65.0   | --     | ns   |
| Turn-Off Rise Time                                                                          |                              | t <sub>f</sub>                      | --   | 54.0   | --     | ns   |
| Gate Charge Paramters (Test Circuit & Waveform See Fig.15)                                  |                              |                                     |      |        |        |      |
| Total Gate Charge                                                                           | VDS= 20 V                    | Q <sub>g</sub>                      | --   | 70.0   | --     | nC   |
| Gate-Source Charge                                                                          | VGS= 10.0 V                  | Q <sub>gs</sub>                     | --   | 16.5   | --     | nC   |
| Gate-Drain Charge                                                                           | ID= 20.0 A                   | Q <sub>gd</sub>                     | --   | 10.0   | --     | nC   |
| Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17) |                              |                                     |      |        |        |      |
| Max. Diode Forward Cuurent                                                                  |                              | I <sub>S</sub>                      | --   | --     | 250.0  | A    |
| Max. Pulsed Forward Cuurent                                                                 |                              | I <sub>SM</sub>                     | --   | --     | 1000.0 | A    |
| Diode Forward Voltage                                                                       | ID= 20.0 A,VGS=0V            | V <sub>SD</sub>                     | --   | 0.67   | 1.21   | V    |
| Reverse Recovery Time                                                                       | IS= 20.0 A,di/dt= 100 A/us   | t <sub>rr</sub>                     | --   | 48.5   | --     | ns   |
| Reverse Recovery Charge                                                                     | VGS= 0.0 V                   | Q <sub>rr</sub>                     | --   | 35.5   | --     | nC   |
| Reverse Recovery Current                                                                    |                              | I <sub>RRM</sub>                    | --   | 1.5    | --     | A    |

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Typical Characteristics Curves

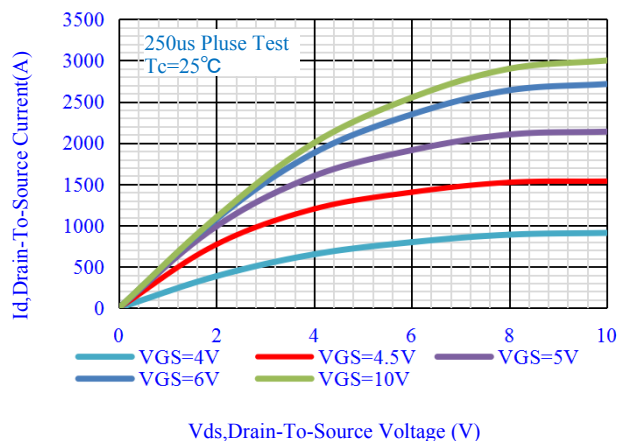


Fig.1-Output Characteristics

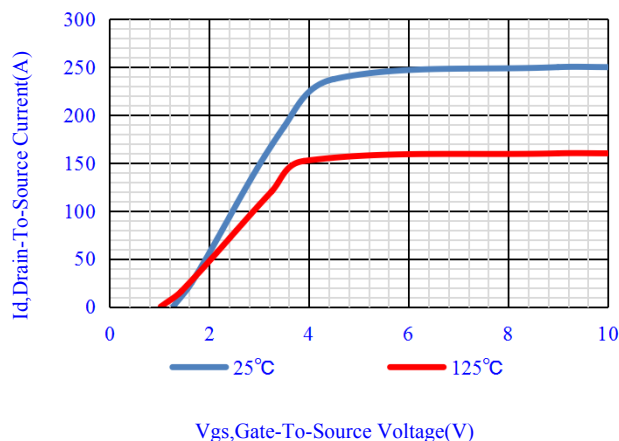


Fig.2-Transfer Characteristics

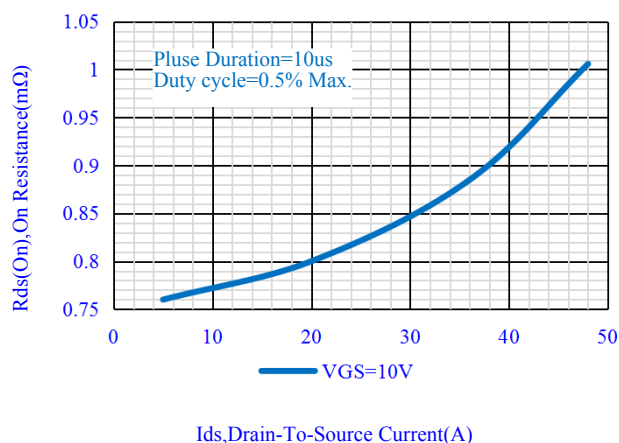


Fig.3-On Resistance Vs. Drain Current

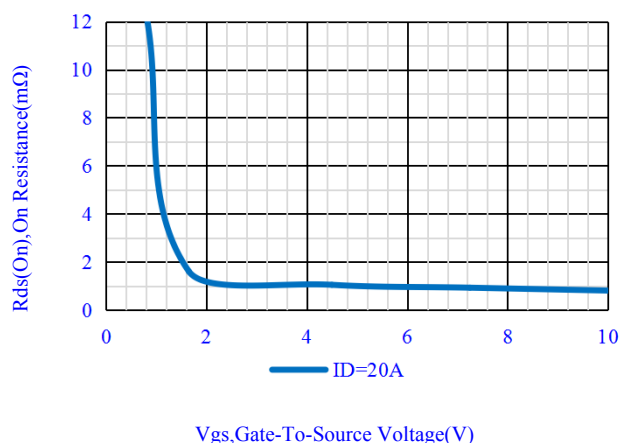


Fig.4-On Resistance Vs. Gate Source Voltage

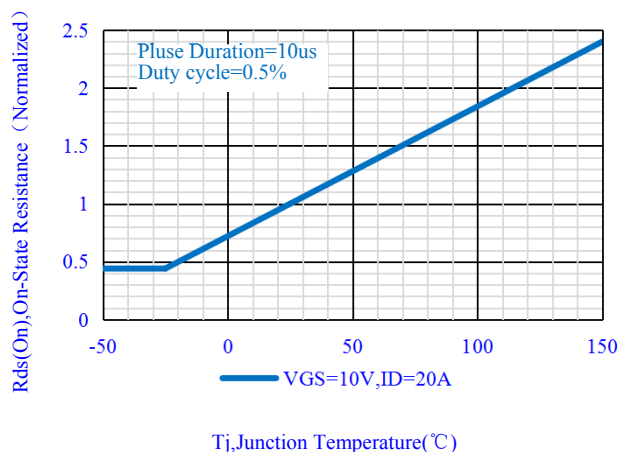


Fig.5-On Resistance Vs. Junction Temperature

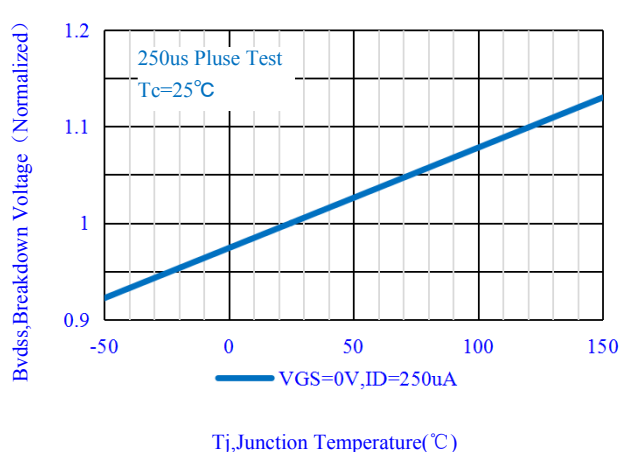


Fig.6-Breakdown Voltage Vs. Junction Temperature

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Typical Characteristics Curves

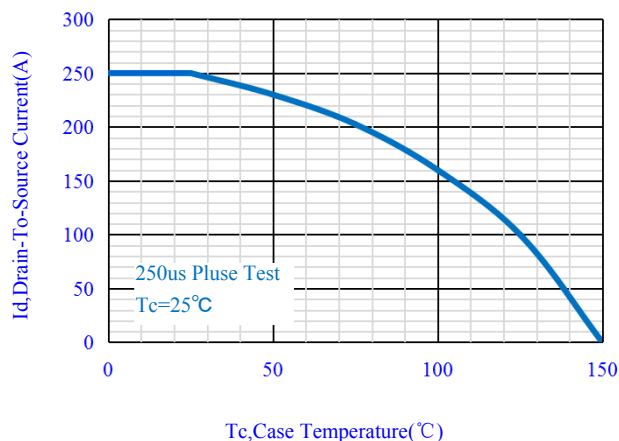


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

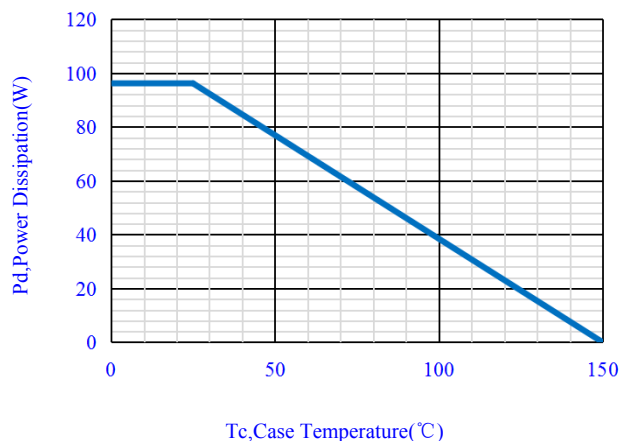


Fig.8-Maximum Power Dissipation Vs. Case Temperature

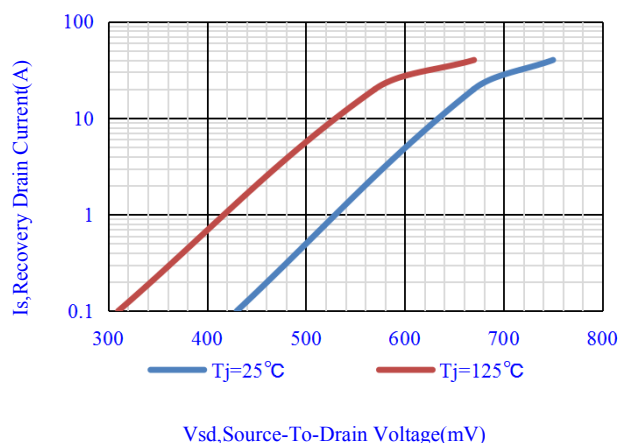


Fig.9-Source-To-Drain Diode Forward Voltage

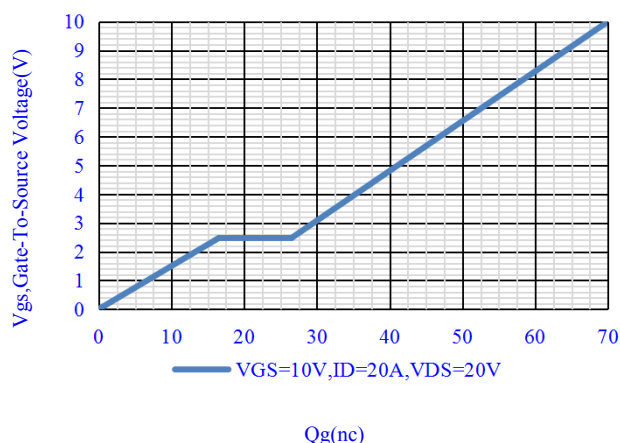


Fig.10-Gate Charge Waveform

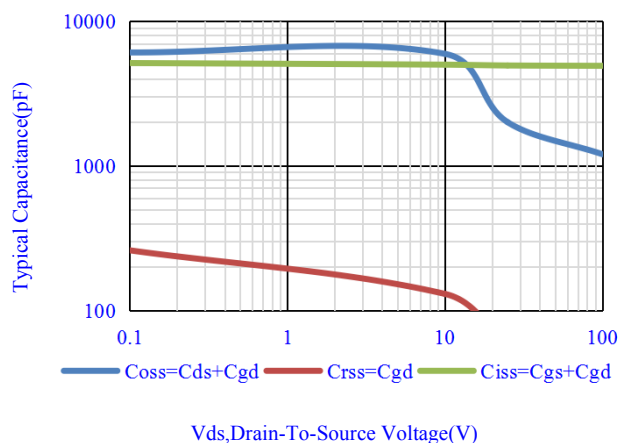


Fig.11-Typical Capacitance Vs. Drain-To-Source Voltage

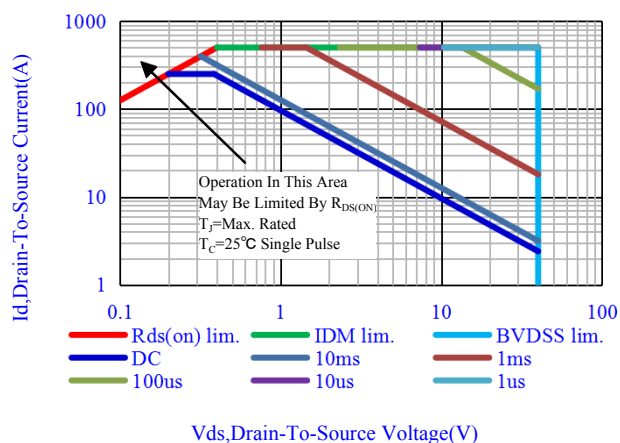


Fig.12-Maximum Safe Operating Area(SOA)

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**Typical Characteristics Curves**

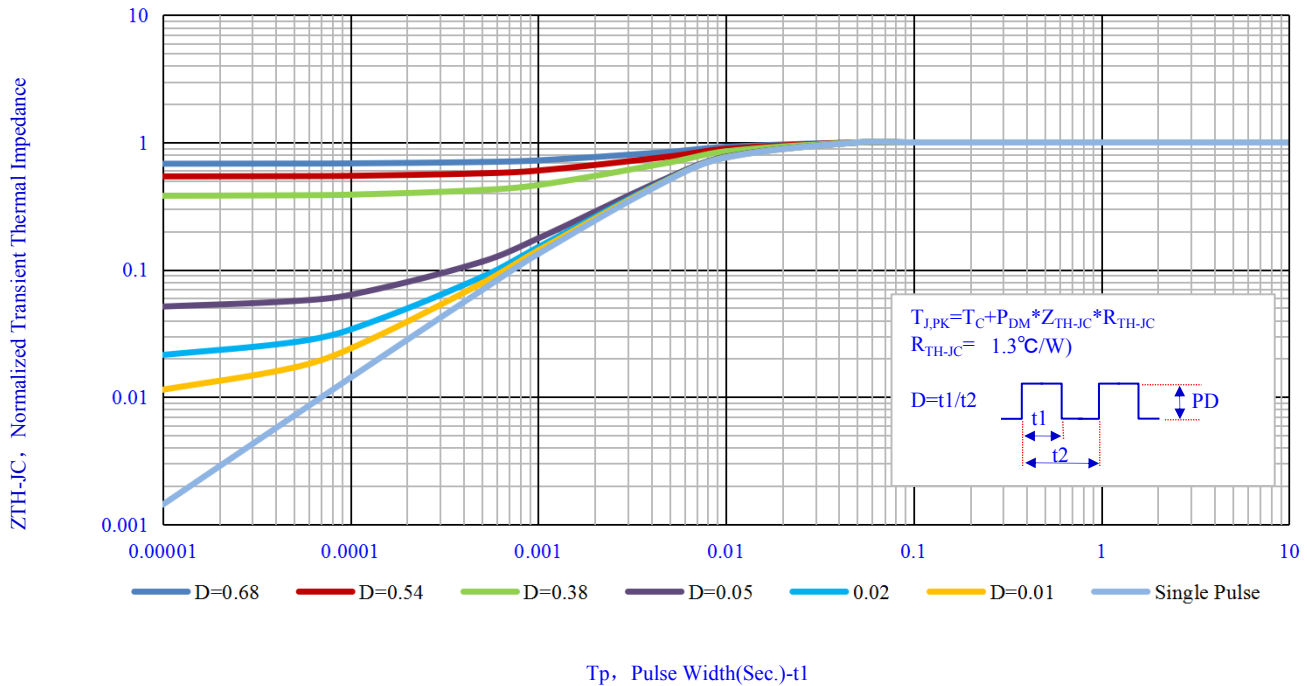


Fig.13- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

**Test Circuit & Waveform**

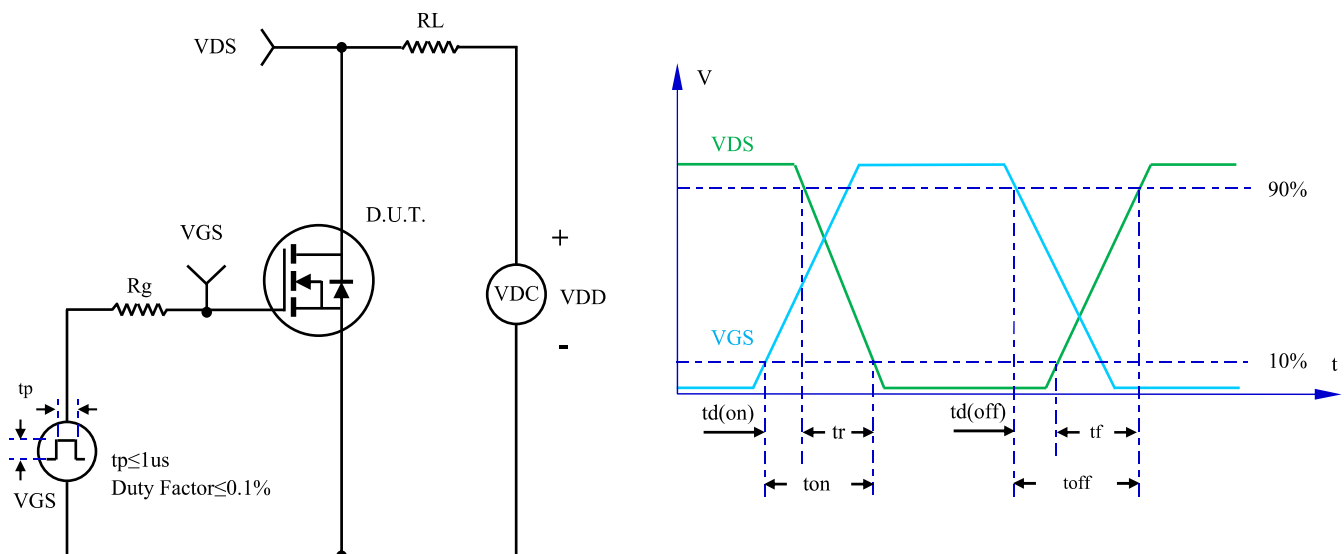


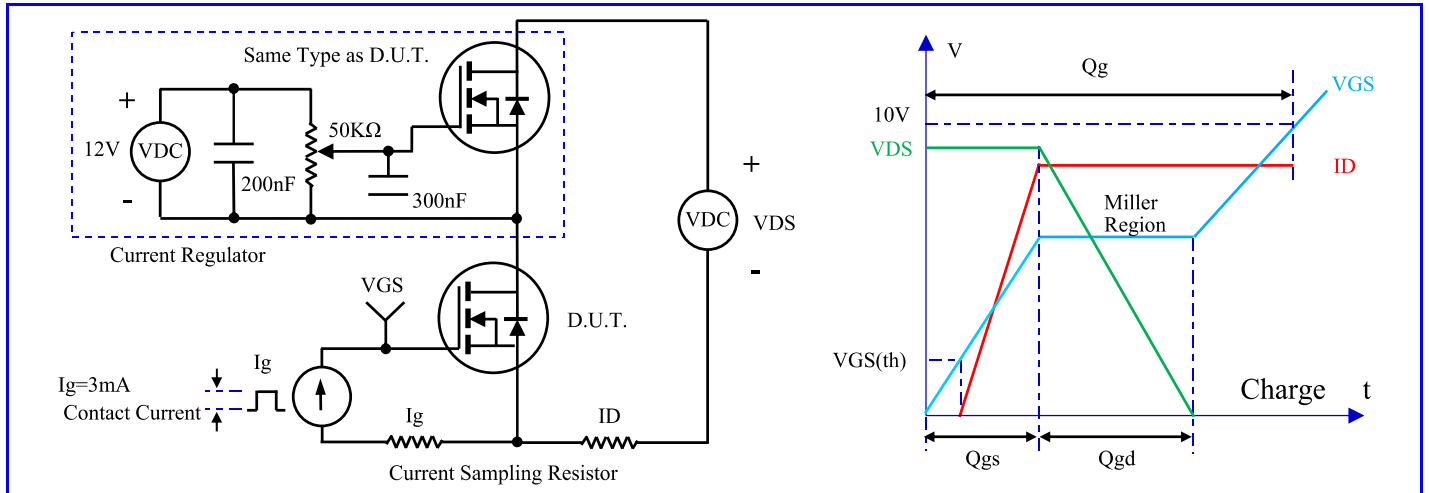
Fig.14- Resistive Switching Test Circuit & Waveform

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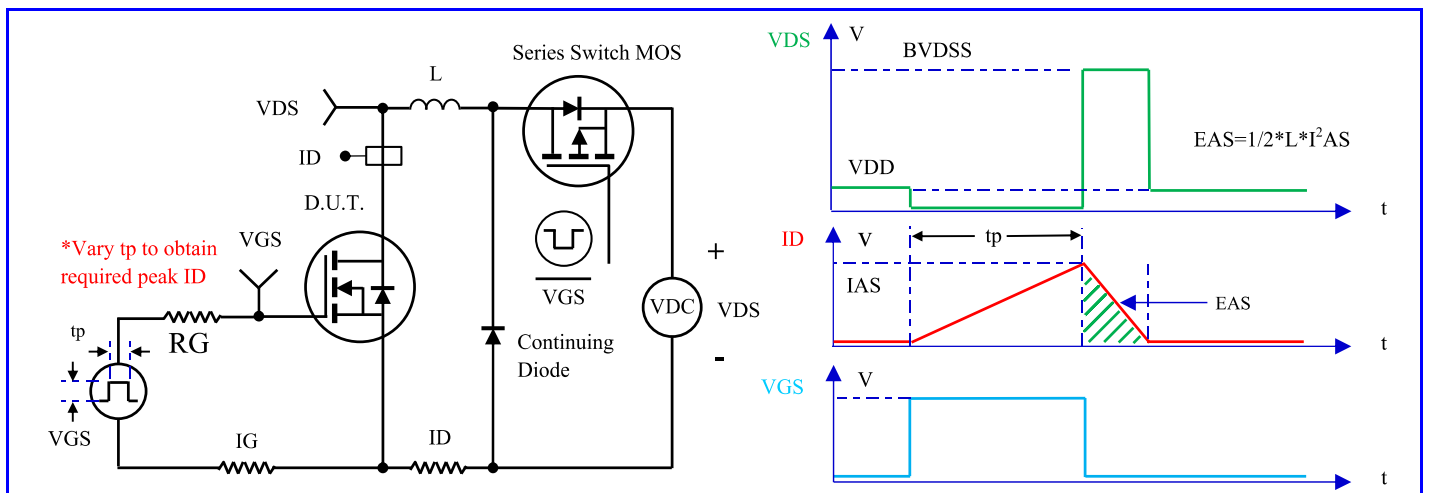


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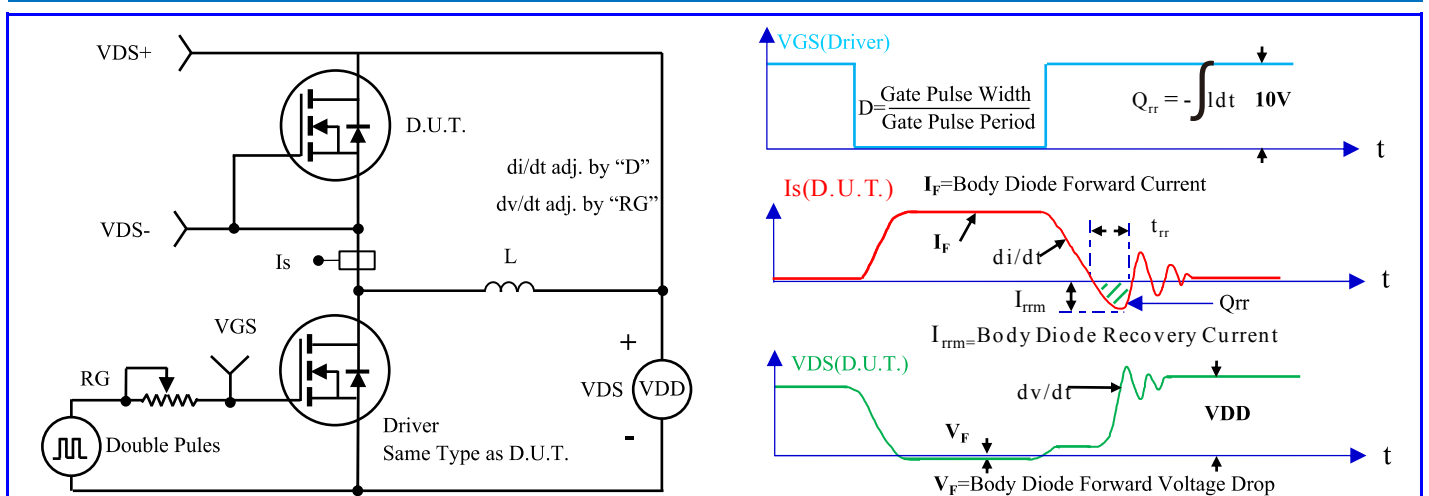
**Test Circuit & Waveform**



**Fig.15- Gate Charge Test Circuit & Waveform**



**Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform**



**Fig.17- Diode Recovery Test Circuit & Waveform**

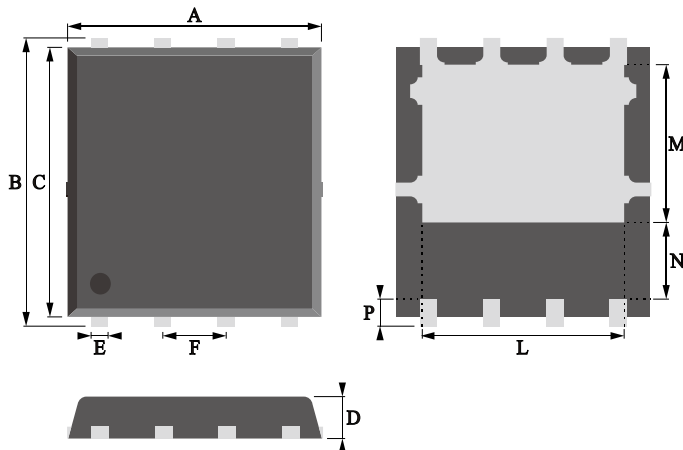
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**OUTLINE DRAWINGS**

**PDFN5\*6**

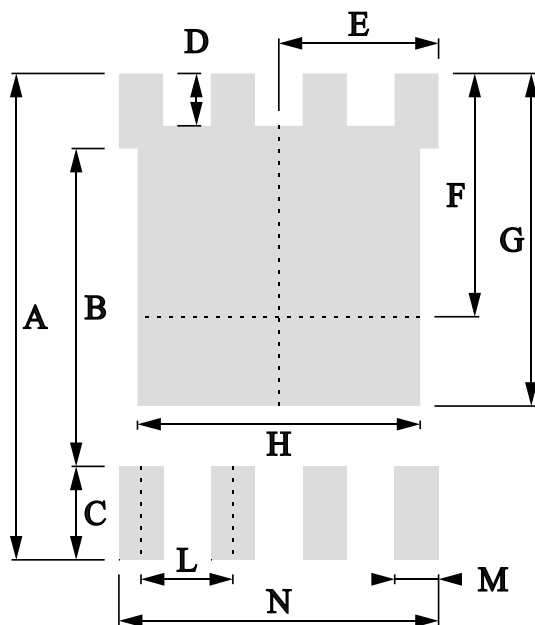


**OUTLINE DIMENSIONS**

| Dim. | Milimeters |      |      | Inches |      |        |
|------|------------|------|------|--------|------|--------|
|      | Min.       | Typ. | Max. | Min.   | Typ. | Max.   |
| A    | 4.70       | -    | 5.70 | 0.1850 | -    | 0.2244 |
| B    | 5.60       | -    | 6.60 | 0.2205 | -    | 0.2598 |
| C    | 5.10       | -    | 6.10 | 0.2008 | -    | 0.2402 |
| D    | 0.70       | -    | 1.20 | 0.0276 | -    | 0.0472 |
| E    | 0.15       | -    | 0.45 | 0.0059 | -    | 0.0177 |
| F    | 1.30       | -    | 1.90 | 0.0512 | -    | 0.0748 |
| M    | 3.10       | -    | 3.90 | 0.1220 | -    | 0.1535 |
| L    | 3.50       | -    | 4.00 | 0.1378 | -    | 0.1575 |
| N    | 1.00       | -    | 1.60 | 0.0394 | -    | 0.0630 |
| P    | 0.25       | -    | 0.75 | 0.0098 | -    | 0.0295 |

**RECOMMEDND LAYOUT DRAWINGS**

**PDFN5\*6**



**OUTLINE DIMENSIONS**

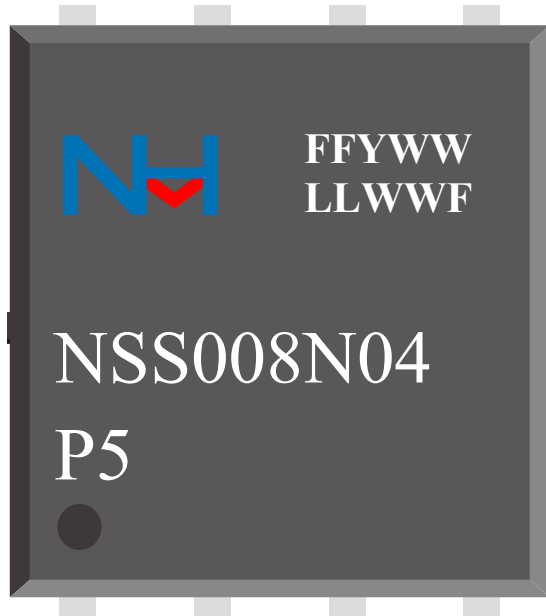
| Dim. | Milimeters |      |      | Inches |        |      |
|------|------------|------|------|--------|--------|------|
|      | Min.       | Typ. | Max. | Min.   | Typ.   | Max. |
| A    | -          | 6.61 | -    | -      | 0.2602 | -    |
| B    | -          | 4.32 | -    | -      | 0.1701 | -    |
| C    | -          | 1.27 | -    | -      | 0.0500 | -    |
| D    | -          | 0.71 | -    | -      | 0.0280 | -    |
| E    | -          | 2.21 | -    | -      | 0.0870 | -    |
| F    | -          | 3.31 | -    | -      | 0.1301 | -    |
| G    | -          | 4.52 | -    | -      | 0.1780 | -    |
| H    | -          | 3.91 | -    | -      | 0.1539 | -    |
| L    | -          | 1.27 | -    | -      | 0.0500 | -    |
| M    | -          | 0.61 | -    | -      | 0.0240 | -    |
| N    | -          | 4.42 | -    | -      | 0.1740 | -    |

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MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhang Trademark  
FF=Product Line Code,According To Actual Changes  
YWW=Date Code,According To Actual Changes  
LLWWF=Inernal Code,According To Actual Changes  
NSS008N04P5=Model

PACKING INFORMATION

| Package Type | Package Code | Product Weight<br>Approx(g/Pcs) | Package Method | Quantity<br>(Pcs/Min. Pack.) | Quantity<br>(Pcs/Inner Box) | Quantity<br>(Pcs/Carton) |
|--------------|--------------|---------------------------------|----------------|------------------------------|-----------------------------|--------------------------|
| PDFN5*6      | P1           | 0.087                           | 13" Reel       | 5000                         | 10000                       | 50000                    |

**NSS008N04P5**

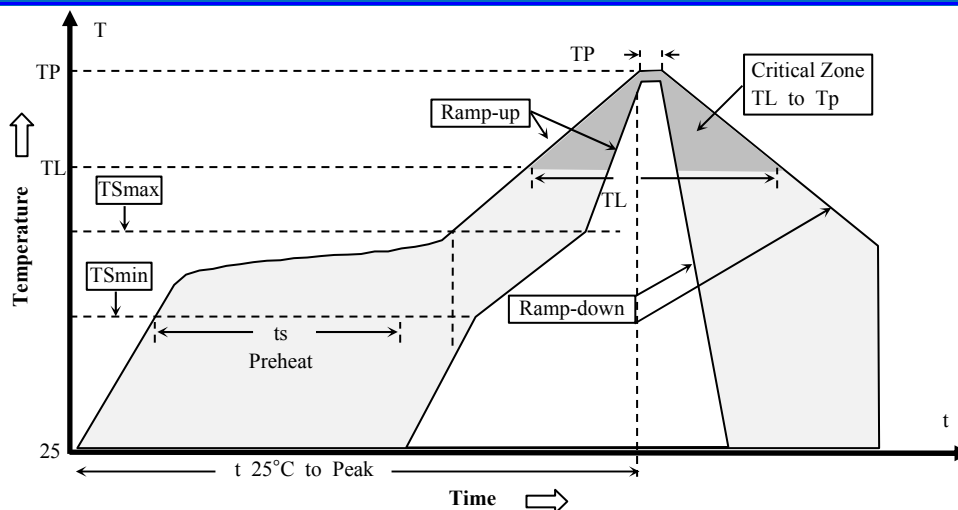
**N-Channel Enhanced Shielded Gate Trench Power MOSFET**



**Recommended wave soldering condition**

| Product         | Peak Temperature | Soldering Time  |
|-----------------|------------------|-----------------|
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

**Recommended temperature profile for IR reflow**



| Profile feature                                                                                                                            | Sn-Pb eutectic Assembly          | Pb-free Assembly                 |
|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| Average ramp-up rate<br>(T <sub>smax</sub> to T <sub>p</sub> )                                                                             | 3°C/second max.                  | 3°C/second max.                  |
| Preheat<br>-Temperature Min(T <sub>S</sub> min)<br>-Temperature Max(T <sub>S</sub> max)<br>-Time(t <sub>s</sub> min to t <sub>s</sub> max) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>-Temperature (T <sub>L</sub> )<br>- Time (t <sub>L</sub> )                                                       | 183°C<br>60-150 seconds          | 217°C<br>60-150 seconds          |
| Peak Temperature(T <sub>P</sub> )                                                                                                          | 240 +0/-5 °C                     | 260 +0/-5 °C                     |
| Time within 5°C of actual peak<br>temperature(tp)                                                                                          | 10-30 seconds                    | 20-40 seconds                    |
| Ramp down rate                                                                                                                             | 6°C/second max.                  | 6°C/second max.                  |
| Time 25 °C to peak temperature                                                                                                             | 6 minutes max.                   | 8 minutes max.                   |

Note : All temperatures refer to topside of the package, measured on the package body surface.

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**N-Channel Enhanced Shielded Gate Trench Power MOSFET**



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