

**NSH037N085C**



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

**Voltage:** 85 Volts

**Current:** 160.0 Ampers

**Package:** TO-220C

**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)

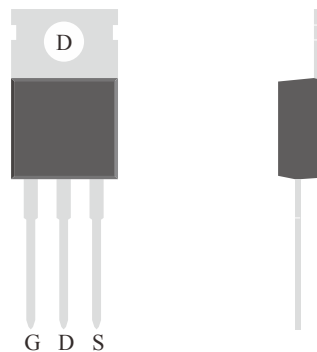
**Typical Applications**

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

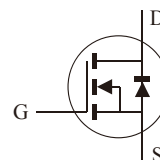
**Product Summary**

|                                     |       |    |
|-------------------------------------|-------|----|
| V <sub>DS</sub> Min.@T <sub>j</sub> | 85    | V  |
| I <sub>D</sub> Min.@T <sub>a</sub>  | 160.0 | A  |
| R <sub>DS(ON)</sub> (TYP)@10V       | 3.7   | mΩ |

**Diagram:**



**Polarity:**



**\*100% UIS TESTED**

**\*100% ΔV<sub>DS</sub> TESTED**

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

| Parameter                                                                    | Test Conditions                                                                                                        | Symbol          | Ratings | Unit |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------|---------|------|
| Drain-Source Voltage                                                         |                                                                                                                        | V <sub>DS</sub> | 85      | V    |
| Gate-Source Voltage                                                          |                                                                                                                        | V <sub>GS</sub> | ±20     | V    |
| Continuous Drain Current (Note 1)                                            | T <sub>a</sub> = 25 ℃                                                                                                  | I <sub>D</sub>  | 160.0   | A    |
|                                                                              | T <sub>a</sub> = 100 ℃                                                                                                 |                 | 102.4   |      |
| Drain Current-Pulse (Note 1)                                                 | T <sub>j</sub> < 150 ℃                                                                                                 | I <sub>DM</sub> | 640     | A    |
| Maximum Power Dissipation Power<br>Dissipation Derating Factor Above 25℃     | T <sub>a</sub> = 25 ℃                                                                                                  | P <sub>D</sub>  | 156     | W    |
|                                                                              | T <sub>a</sub> = 100 ℃                                                                                                 |                 | 63      |      |
| Derating Factor                                                              |                                                                                                                        | D <sub>F</sub>  | 1.25    | W/℃  |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 0.5 mH                                                                                                              | I <sub>AS</sub> | 51.0    | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.16 | L= 0.5 mH<br>I <sub>AS</sub> = 51.0 A,R <sub>G</sub> = 10.0 Ω<br>Starting T <sub>j</sub> =25 ℃,V <sub>G</sub> = 10.0 V | E <sub>AS</sub> | 650     | mJ   |

**Thermal Characteristics (T<sub>a</sub>=25℃ Unless Otherwise Specified)**

| Parameter                                                   | Test Conditions                                     | Symbol           | Typ.       | Unit |
|-------------------------------------------------------------|-----------------------------------------------------|------------------|------------|------|
| Junction Temperature                                        |                                                     | T <sub>J</sub>   | -55 to 150 | ℃    |
| Storage Temperature Range                                   |                                                     | T <sub>STD</sub> | -55 to 150 | ℃    |
| Thermal Resistance Junction To Ambient<br>With Steady-State | Still Air Environment<br>With T <sub>a</sub> =25℃   | R <sub>θJA</sub> | 62.0       | ℃/W  |
| Thermal Resistance Junction-Case<br>With Steady-State       | Device Mounted On<br>75mm x 45mm x 2.5mm Alu. Heat. | R <sub>θJC</sub> | 0.8        |      |

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>                   | 85   | --     | --    | V    |
| Bvdss Temperature Coefficient                                                               | ID=250uA,Reference25℃        | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | --   | 0.10   | --    | V/℃  |
| Drain-Source Leakage Current                                                                | VDS= 85 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>                     | --   | 34.0   | --    | S    |
| Static On Characteristics                                                                   |                              |                                     |      |        |       |      |
| Gate Threshold Voltage                                                                      | VGS= VDS ID=250uA            | V <sub>GS(TH)</sub>                 | 2.0  | 3.0    | 4.0   | V    |
| Drain-Source On Resistance                                                                  | ID= 20.0 A,VGS= 10.0 V       | R <sub>DS(ON)</sub>                 | --   | 3.7    | 4.5   | mΩ   |
|                                                                                             | ID= 20.0 A,VGS= 4.5 V        |                                     | --   | 4.8    | 6.8   |      |
| Dynamic Characteristics                                                                     |                              |                                     |      |        |       |      |
| Gate Resistance                                                                             | VGS=0V,VDS=0V,<br>Freq.=1MHz | R <sub>g</sub>                      | --   | 2.0    | --    | Ω    |
| Input Capacitance                                                                           | VDS= 42.5 V                  | C <sub>iss</sub>                    | --   | 3070.0 | --    | pF   |
| Output Capacitance                                                                          | VGS= 0 V                     | C <sub>oss</sub>                    | --   | 870.0  | --    | pF   |
| Reverse Transfer Capacitance                                                                | F= 1 MHZ                     | C <sub>rss</sub>                    | --   | 16.0   | --    | pF   |
| Switching Paramters (Test Circuit & Waveform See Fig.14)                                    |                              |                                     |      |        |       |      |
| Turn-On Delay Time                                                                          | VDS= 42.5 V                  | t <sub>d(on)</sub>                  | --   | 13.0   | --    | ns   |
| Turn-On Rise Time                                                                           | VGS= 10.0 V                  | t <sub>r</sub>                      | --   | 16.3   | --    | ns   |
| Turn-Off Delay Time                                                                         | RG= 10.0 Ω                   | t <sub>d(off)</sub>                 | --   | 27.0   | --    | ns   |
| Turn-Off Rise Time                                                                          |                              | t <sub>f</sub>                      | --   | 14.1   | --    | ns   |
| Gate Charge Paramters (Test Circuit & Waveform See Fig.15)                                  |                              |                                     |      |        |       |      |
| Total Gate Charge                                                                           | VDS= 42.5 V                  | Q <sub>g</sub>                      | --   | 56.0   | --    | nC   |
| Gate-Source Charge                                                                          | VGS= 10.0 V                  | Q <sub>gs</sub>                     | --   | 13.5   | --    | nC   |
| Gate-Drain Charge                                                                           | ID= 20.0 A                   | Q <sub>gd</sub>                     | --   | 20.0   | --    | nC   |
| Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17) |                              |                                     |      |        |       |      |
| Max. Diode Forward Cuurent                                                                  |                              | I <sub>s</sub>                      | --   | --     | 160.0 | A    |
| Max. Pulsed Forward Cuurent                                                                 |                              | I <sub>SM</sub>                     | --   | --     | 640.0 | A    |
| Diode Forward Voltage                                                                       | ID= 20.0 A,VGS=0V            | V <sub>SD</sub>                     | --   | 0.85   | 1.20  | V    |
| Reverse Recovery Time                                                                       | ID= 20.0 A,di/dt= 100 A/us   | t <sub>rr</sub>                     | --   | 40.0   | --    | ns   |
| Reverse Recovery Charge                                                                     | VGS= 10.0 V,VDD= 42.5 V      | Q <sub>rr</sub>                     | --   | 60.0   | --    | nC   |

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Typical Characteristics Curves

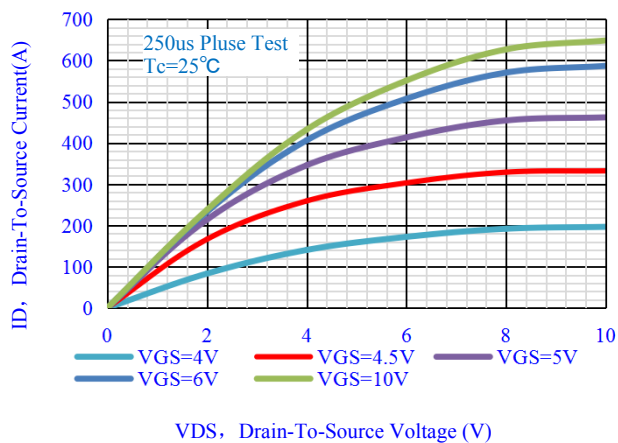


Fig.1-Output Characteristics

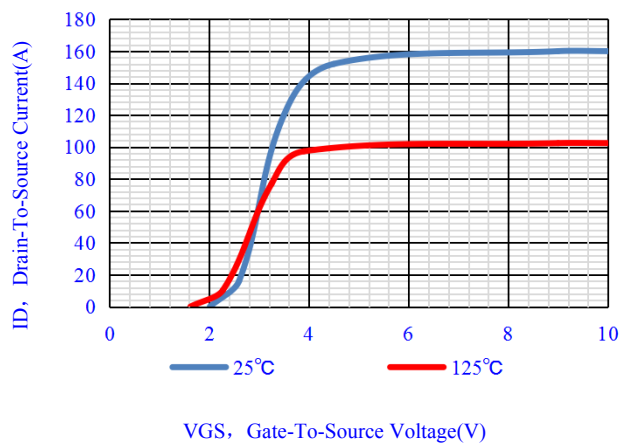


Fig.2- Transfer Characteristics

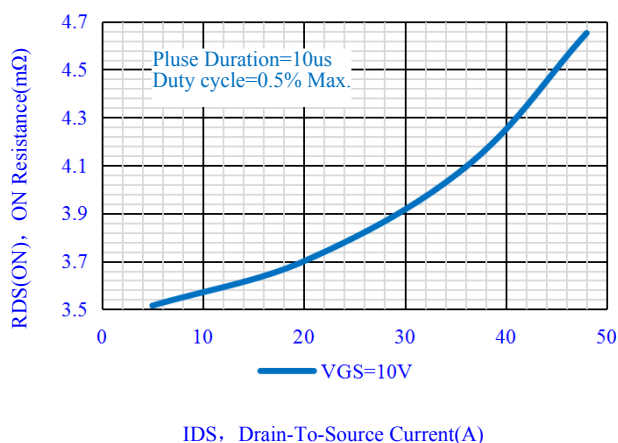


Fig.3- On Resistance vs. Drain Current

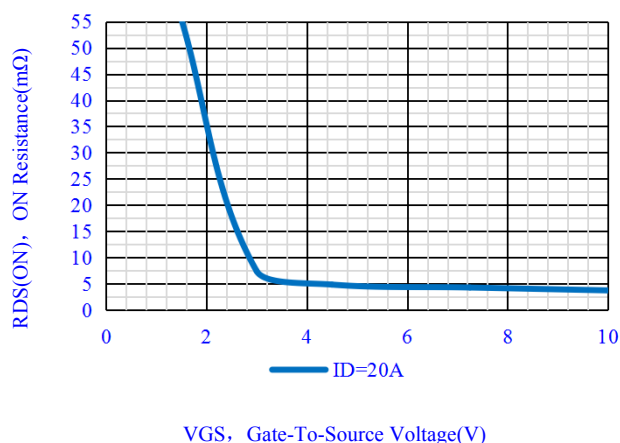


Fig.4- On Resistance vs. Gate Source Voltage

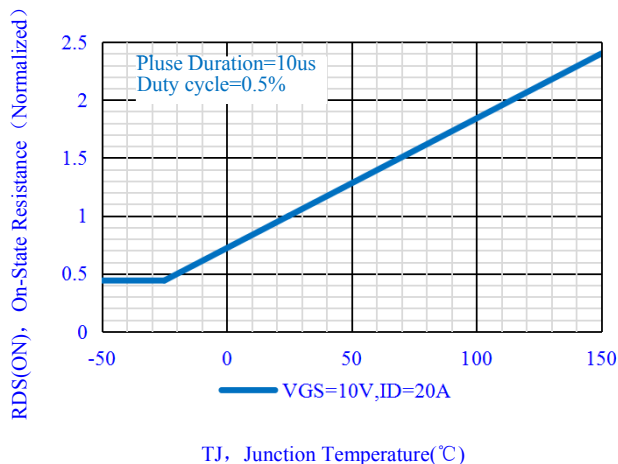


Fig.5- On Resistance vs. Junction Temperature

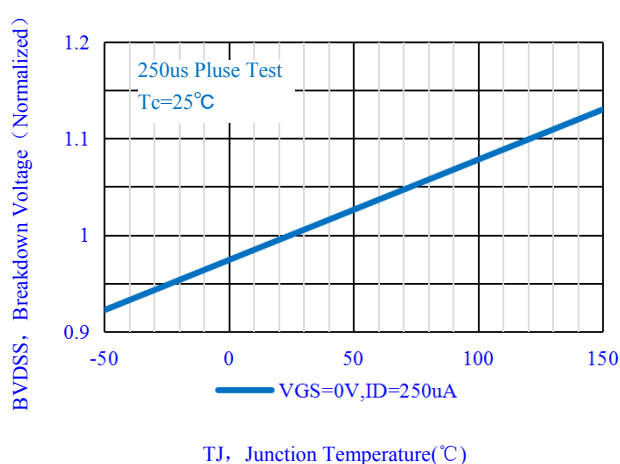


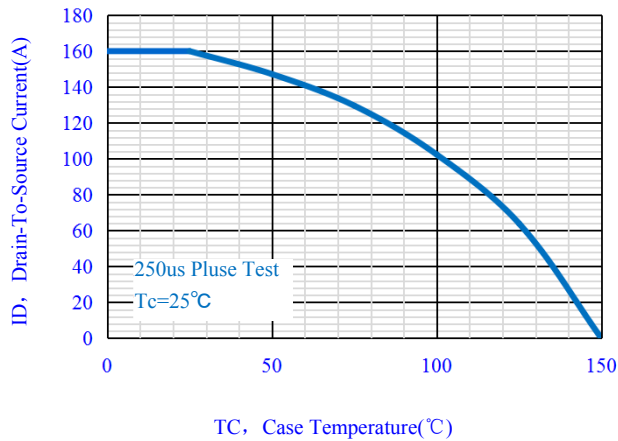
Fig.6- Breakdown Voltage vs. Junction Temperature

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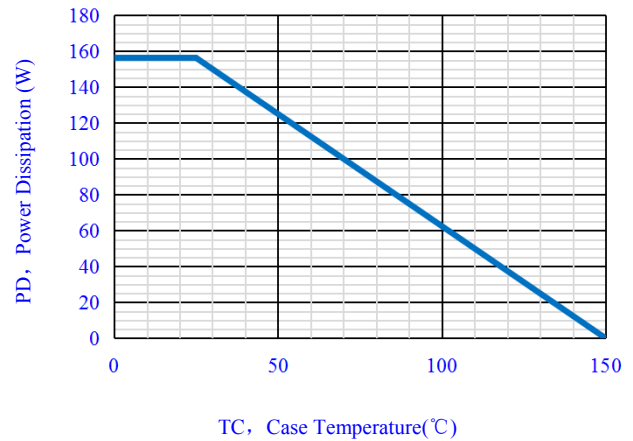
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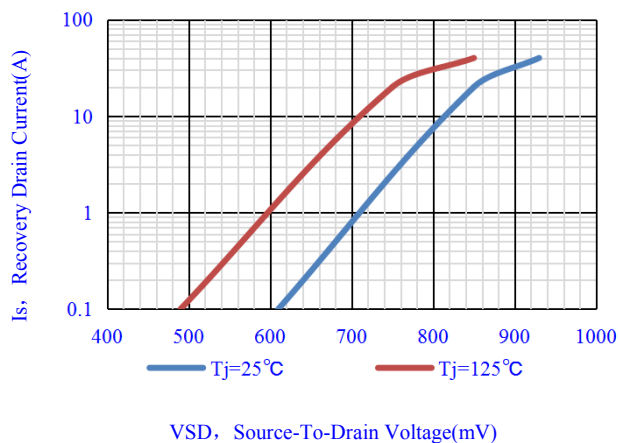
**Typical Characteristics Curves**



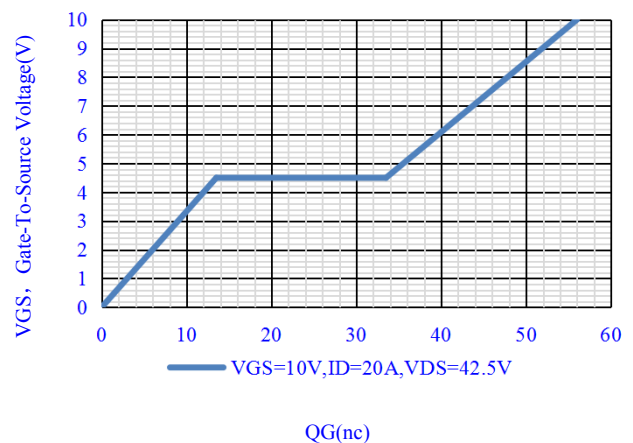
**Fig.7-Maximum Continuous Drain Current vs. Case Temperature**



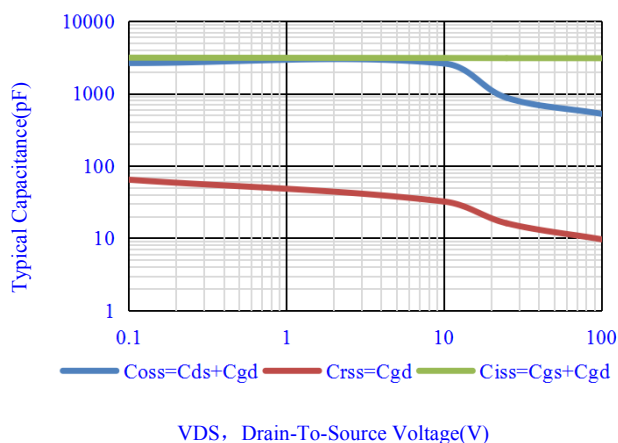
**Fig.8-Maximum Power Dissipation vs. Case Temperature**



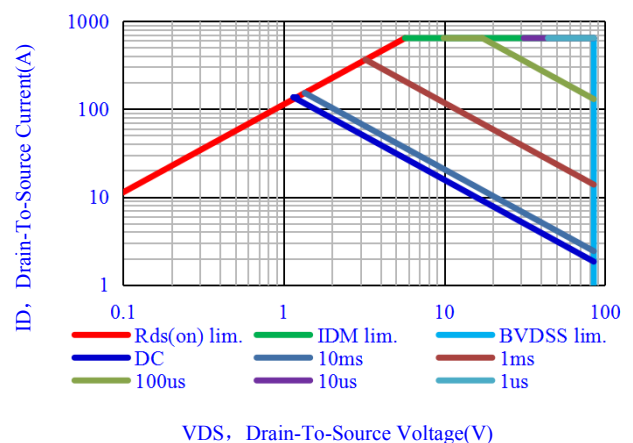
**Fig.9- Source-To-Drain Diode Forward Voltage**



**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**

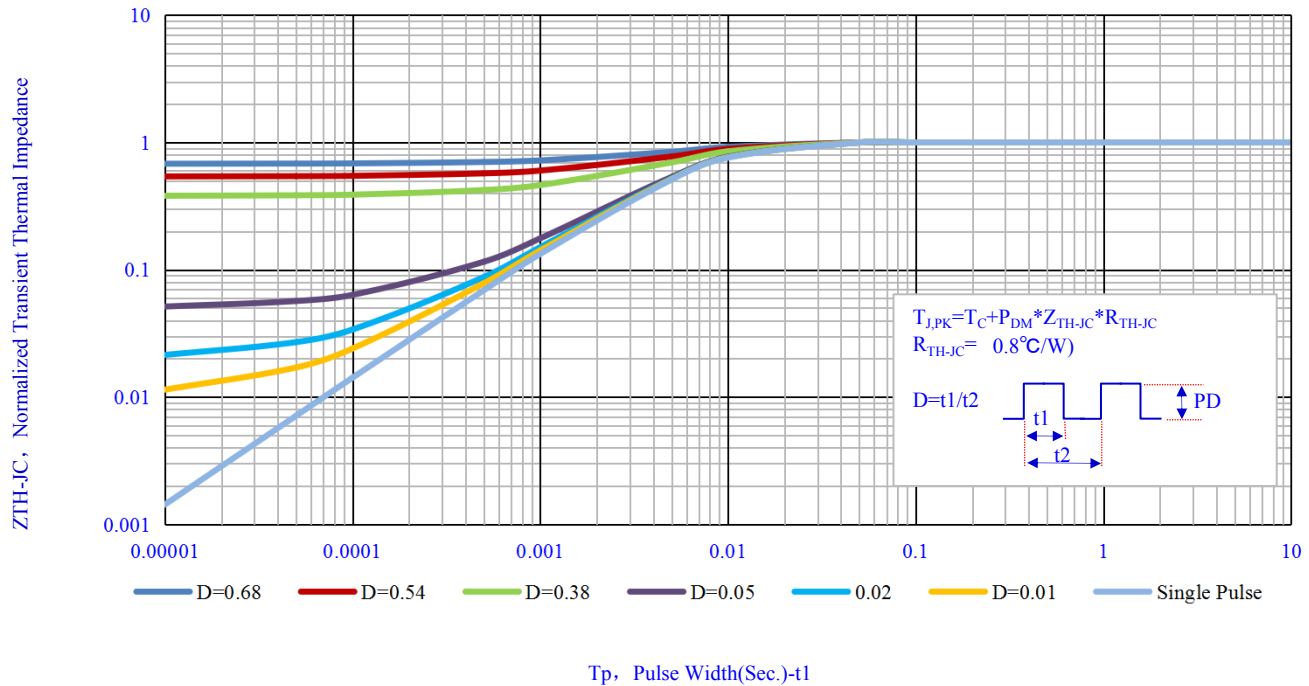


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

**Test Circuit & Waveform**

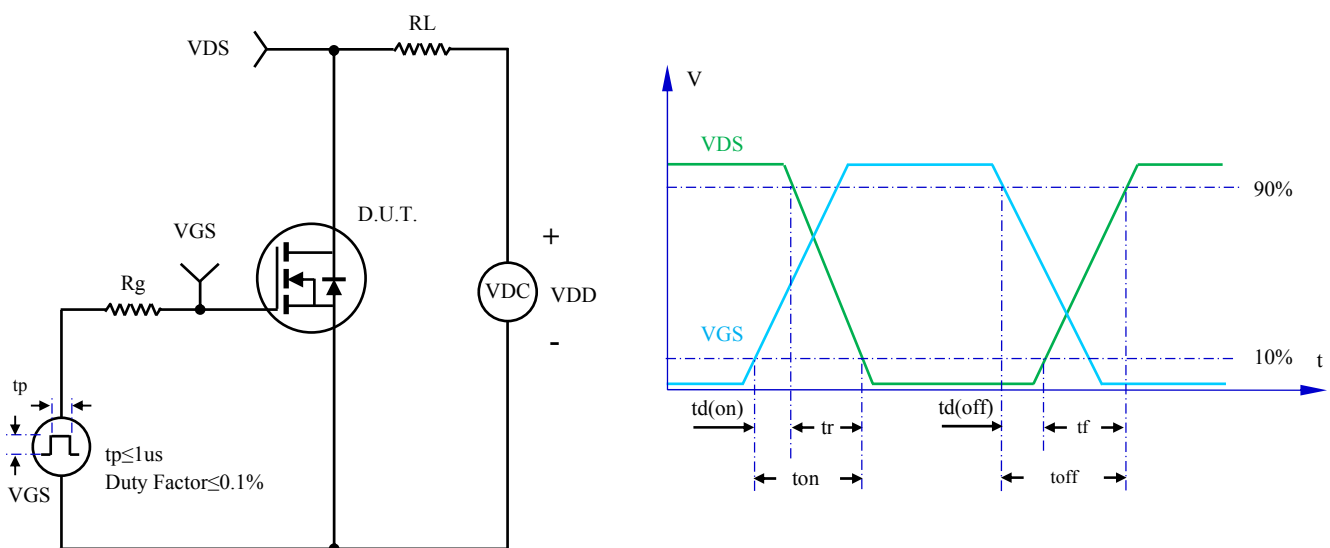


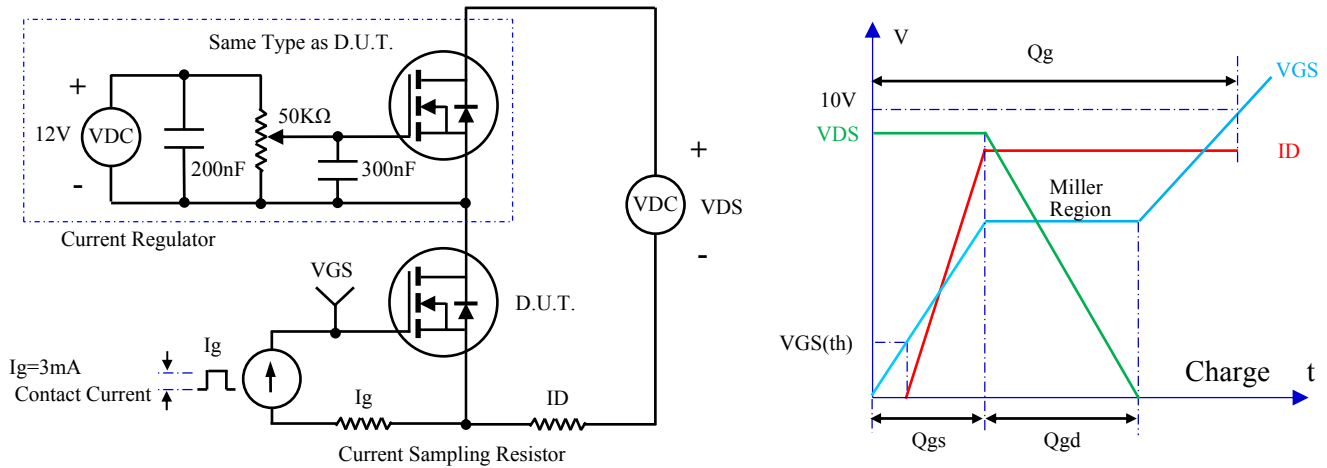
Fig.14- Resistive Switching Test Circuit & Waveform

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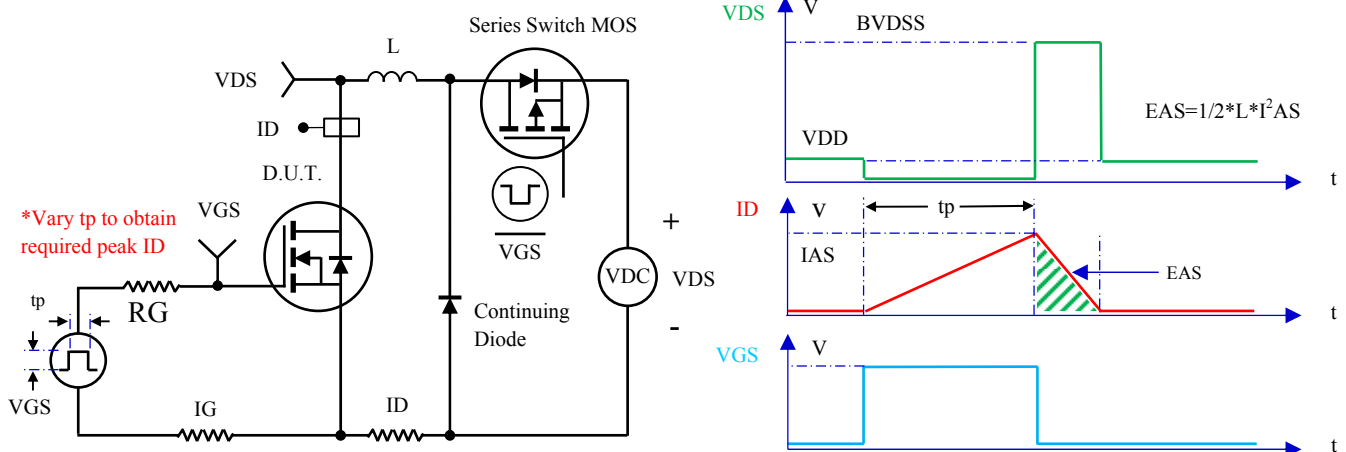


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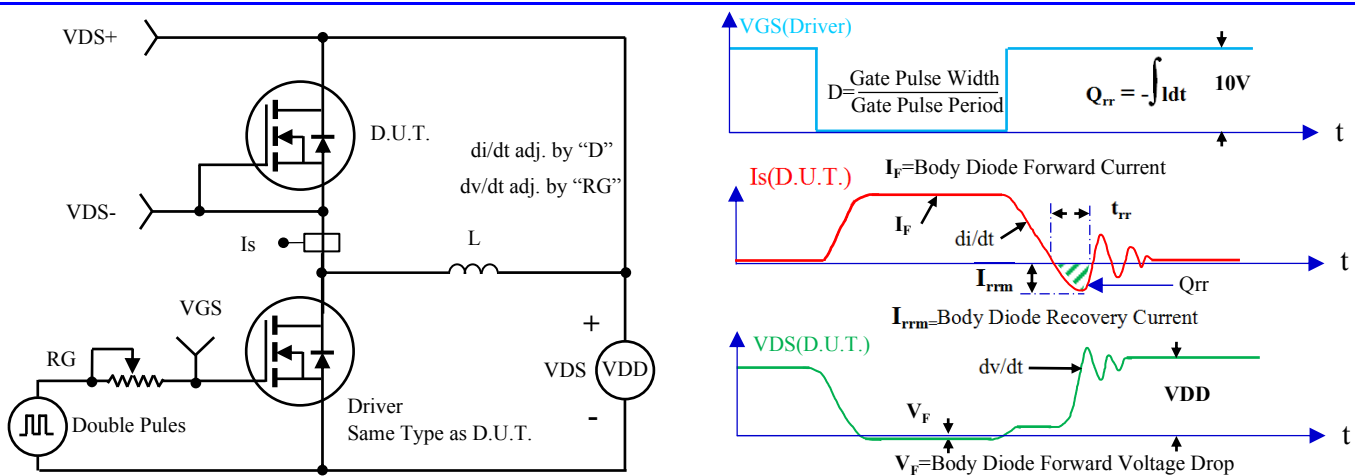
**Test Circuit & Waveform**



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



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



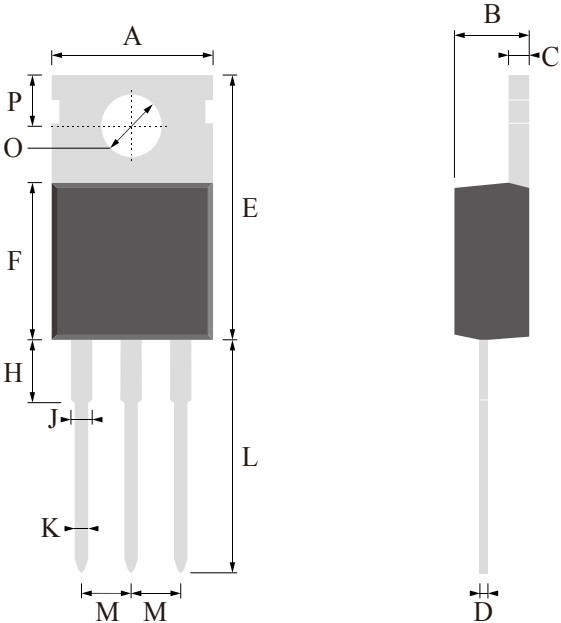
**Fig.17- Diode Recovery Test Circuit & Waveform**

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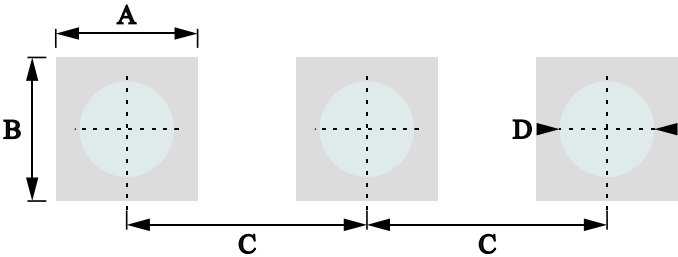
OUTLINE DRAWINGS



TO-220C

| OUTLINE DIMENSIONS |            |      |       |        |      |        |
|--------------------|------------|------|-------|--------|------|--------|
| Dim.               | Milimeters |      |       | Inches |      |        |
|                    | Min.       | Typ. | Max.  | Min.   | Typ. | Max.   |
| A                  | 9.25       | -    | 10.75 | 0.3642 | -    | 0.4232 |
| B                  | 4.15       | -    | 4.95  | 0.1634 | -    | 0.1949 |
| C                  | 1.10       | -    | 1.65  | 0.0433 | -    | 0.0650 |
| D                  | 0.25       | -    | 0.65  | 0.0098 | -    | 0.0256 |
| E                  | 14.50      | -    | 16.70 | 0.5709 | -    | 0.6575 |
| F                  | 8.40       | -    | 9.95  | 0.3307 | -    | 0.3917 |
| L                  | 12.15      | -    | 14.30 | 0.4783 | -    | 0.5630 |
| H                  | 3.00       | -    | 3.80  | 0.1181 | -    | 0.1496 |
| J                  | 1.05       | -    | 1.60  | 0.0413 | -    | 0.0630 |
| K                  | 0.65       | -    | 0.95  | 0.0256 | -    | 0.0374 |
| M                  | 2.10       | -    | 2.90  | 0.0827 | -    | 0.1142 |
| O                  | 3.20       | -    | 4.10  | 0.1260 | -    | 0.1614 |
| P                  | 2.45       | -    | 3.10  | 0.0965 | -    | 0.1220 |

RECOMMEDND LAYOUT DRAWINGS



TO-220C

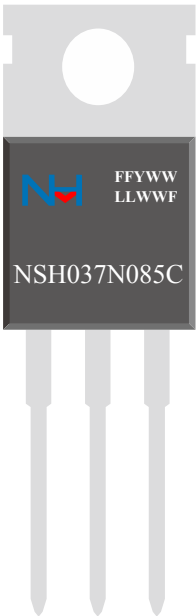
| OUTLINE DIMENSIONS |            |      |      |        |        |      |
|--------------------|------------|------|------|--------|--------|------|
| Dim.               | Milimeters |      |      | Inches |        |      |
|                    | Min.       | Typ. | Max. | Min.   | Typ.   | Max. |
| A                  | -          | 1.60 | -    | -      | 0.0630 | -    |
| B                  | -          | 1.60 | -    | -      | 0.0630 | -    |
| C                  | -          | 2.54 | -    | -      | 0.1000 | -    |
| D                  | -          | 1.00 | -    | -      | 0.0394 | -    |

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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  
NSH037N085C=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) |
|--------------|--------------|---------------------------------|----------------|------------------------------|-----------------------------|--------------------------|
| TO-220C      | P1           | 2.057                           | Tube           | 50                           | 1000                        | 5000                     |

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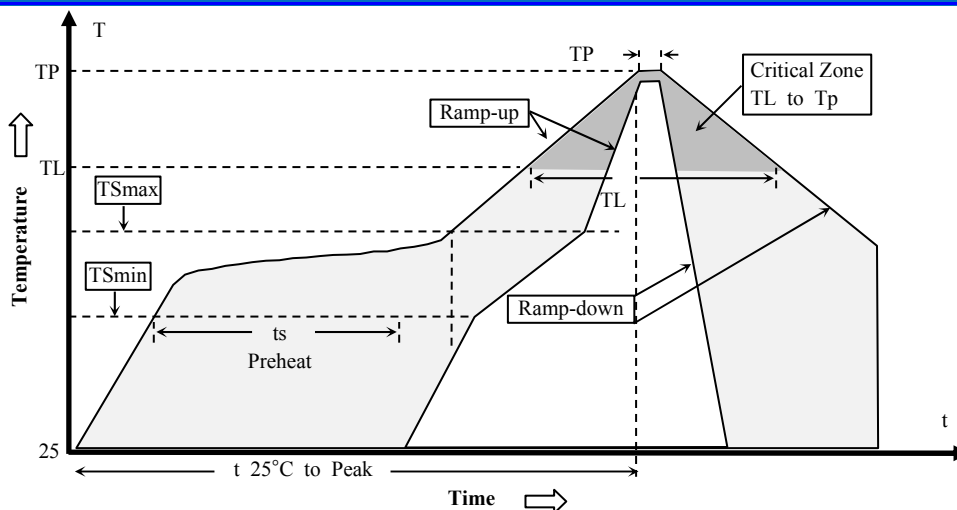
**N-Channel Enhanced Shielded Gate Trench Power MOSFET**



**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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