

NTH440N15P3



N-Channel Enhancement Mode Trench Power MOSFET

**Voltage:** 150 Volts

**Current:** 27 Ampers

**Package:** PDFN3\*3

**Features**

- NH'S Advanced Trench Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Excellent Qg\*Rds(on) Product(FOM)

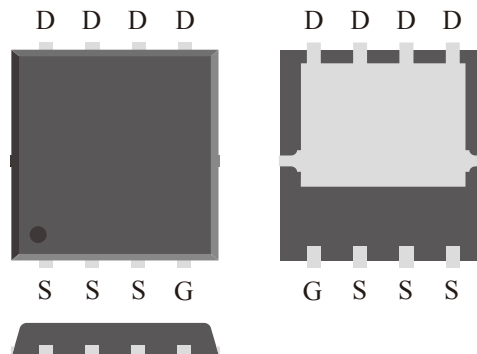
**Typical Applications**

- DC-DC Converter
- Battery Management System(BMS)
- Printed Circuit Board For Control Circuit
- Uninterruptible Power Supplies(UPS)

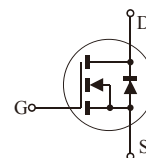
**Product Summary**

|                  |     |    |
|------------------|-----|----|
| VDS Min.@Tj      | 150 | V  |
| ID Min.@Ta       | 27  | A  |
| RDS(ON)(TYP)@10V | 44  | mΩ |

**Diagram:**



**Polarity:**



**\*100% UIS TESTED**

**\*100% ΔVDS TESTED**

**Absolute Maximum Ratings (Ta=25℃ Unless Otherwise Specified)**

| Parameter                                                                    | Test Conditions                                                     | Symbol          | Ratings | Unit |
|------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------|---------|------|
| Drain-Source Voltage                                                         |                                                                     | V <sub>DS</sub> | 150     | V    |
| Gate-Source Voltage                                                          |                                                                     | V <sub>GS</sub> | ±20     | V    |
| Continuous Drain Current (Note 1)                                            | Ta= 25 ℃                                                            | I <sub>D</sub>  | 27      | A    |
|                                                                              | Ta= 100 ℃                                                           |                 | 17      |      |
| Drain Current-Pulse (Note 1)                                                 | Tj< 150 ℃                                                           | I <sub>DM</sub> | 108     | A    |
| Maximum Power Dissipation Power                                              | Ta= 25 ℃                                                            | P <sub>D</sub>  | 69      | W    |
|                                                                              | Ta= 100 ℃                                                           |                 | 28      |      |
| Derating Factor                                                              |                                                                     | D <sub>F</sub>  | 0.56    | W/℃  |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 0.4 mH                                                           | I <sub>AS</sub> | 10      | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.17 | L= 0.4 mH<br>IAS= 10 A, RG= 10.0 Ω<br>Starting Tj=25 ℃, VG = 10.0 V | E <sub>AS</sub> | 20      | mJ   |

**Thermal Characteristics (Ta=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 Ta=25℃                   | R <sub>θJA</sub> | 65         | ℃/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> | 1.8        |      |

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig.14)

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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>                   | 150  | --   | --   | V    |
| Bvdss Temperature Coefficient                                                               | ID=250uA,Reference25℃        | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | --   | 0.17 | --   | V/℃  |
| Drain-Source Leakage Current                                                                | VDS= 150 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= 13.5 A,VDS= 5 V          | g <sub>fs</sub>                     | --   | 16   | --   | S    |
| Static On Characteristics                                                                   |                              |                                     |      |      |      |      |
| Gate Threshold Voltage                                                                      | VGS= VDS ID=250uA            | V <sub>GS(TH)</sub>                 | 2    | 3    | 4    | V    |
| Drain-Source On Resistance                                                                  | ID= 13.5 A,VGS= 10.0 V       | R <sub>DS(ON)</sub>                 | --   | 44   | 48   | mΩ   |
|                                                                                             | ID= 13.5 A,VGS= 5.0 V        |                                     | --   | 64   | 72   |      |
| Dynamic Characteristics                                                                     |                              |                                     |      |      |      |      |
| Gate Resistance                                                                             | VGS=0V,VDS=0V,<br>Freq.=1MHz | R <sub>g</sub>                      | --   | 6    | --   | Ω    |
| Input Capacitance                                                                           | VDS= 50 V                    | C <sub>iss</sub>                    | --   | 500  | --   | pF   |
| Output Capacitance                                                                          | VGS= 0 V                     | C <sub>oss</sub>                    | --   | 57   | --   | pF   |
| Reverse Transfer Capacitance                                                                | F= 1 MHZ                     | C <sub>rss</sub>                    | --   | 10   | --   | pF   |
| Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)                 |                              |                                     |      |      |      |      |
| Turn-On Delay Time                                                                          | VDS= 50 V                    | t <sub>d(on)</sub>                  | --   | 11   | --   | ns   |
| Turn-On Rise Time                                                                           | VGS= 10.0 V                  | t <sub>r</sub>                      | --   | 7    | --   | ns   |
| Turn-Off Delay Time                                                                         | RG= 10.0 Ω                   | t <sub>d(off)</sub>                 | --   | 12   | --   | ns   |
| Turn-Off Rise Time                                                                          | L= 0.4 mH                    | t <sub>f</sub>                      | --   | 3    | --   | ns   |
| Gate Charge Paramters (Test Circuit & Waveform See Fig.16)                                  |                              |                                     |      |      |      |      |
| Total Gate Charge                                                                           | VDS= 50 V                    | Q <sub>g</sub>                      | --   | 10   | --   | nC   |
| Gate-Source Charge                                                                          | VGS= 10.0 V                  | Q <sub>gs</sub>                     | --   | 3    | --   | nC   |
| Gate-Drain Charge                                                                           | ID= 20.0 A                   | Q <sub>gd</sub>                     | --   | 4    | --   | nC   |
| Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18) |                              |                                     |      |      |      |      |
| Max. Diode Forward Cuurent                                                                  |                              | I <sub>S</sub>                      | --   | --   | 27.0 | A    |
| Max. Pulsed Forward Cuurent                                                                 |                              | I <sub>SM</sub>                     | --   | --   | 108  | A    |
| Diode Forward Voltage                                                                       | ID= 13.5 A,VGS=0V            | V <sub>SD</sub>                     | --   | 0.7  | 1.2  | V    |
| Reverse Recovery Time                                                                       | IS= 13.5 A,di/dt= 100 A/us   | t <sub>rr</sub>                     | --   | 65   | --   | ns   |
| Reverse Recovery Charge                                                                     | VGS= 0.0 V                   | Q <sub>rr</sub>                     | --   | 95   | --   | nC   |
| Reverse Recovery Current                                                                    |                              | I <sub>RRM</sub>                    | --   | 3.0  | --   | A    |

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Typical Characteristics Curves

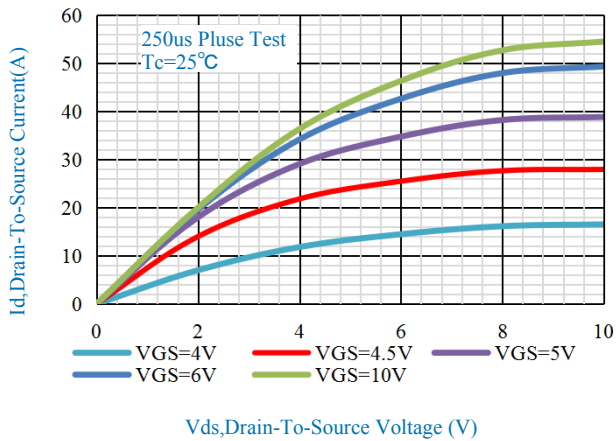


Fig.1-Output Characteristics

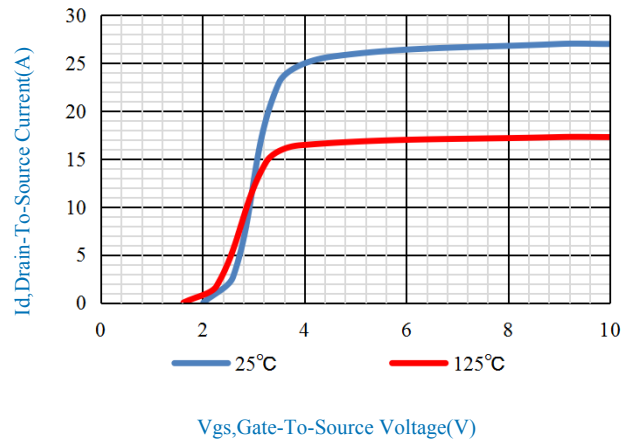


Fig.2-Transfer Characteristics

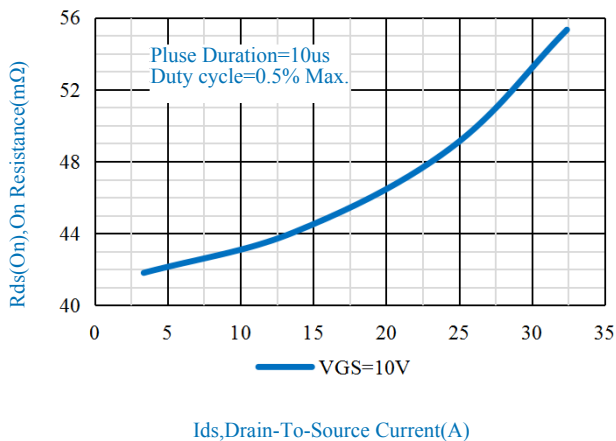


Fig.3-On Resistance Vs. Drain Current

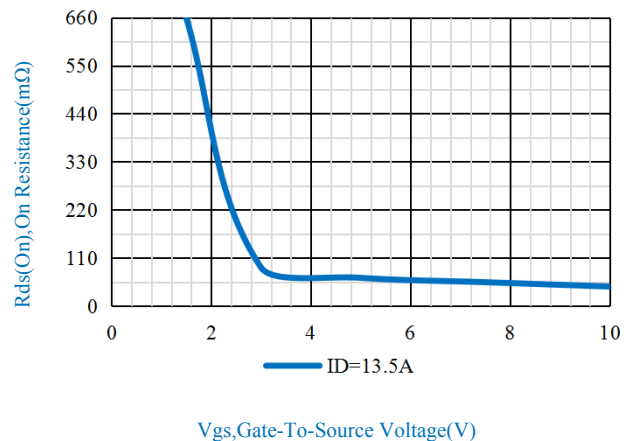


Fig.4-On Resistance Vs. Gate Source Voltage

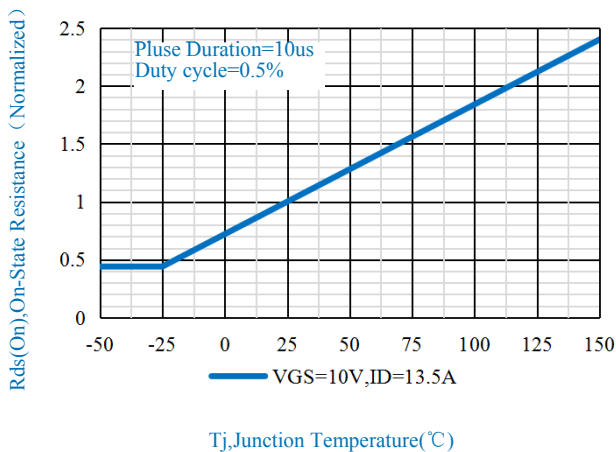


Fig.5-On Resistance Vs. Junction Temperature

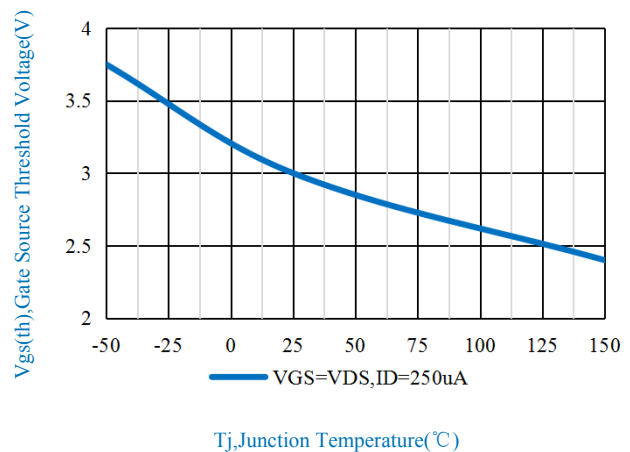


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

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Typical Characteristics Curves

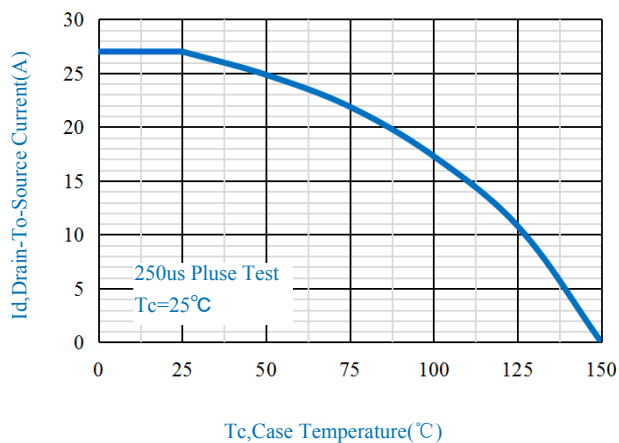


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

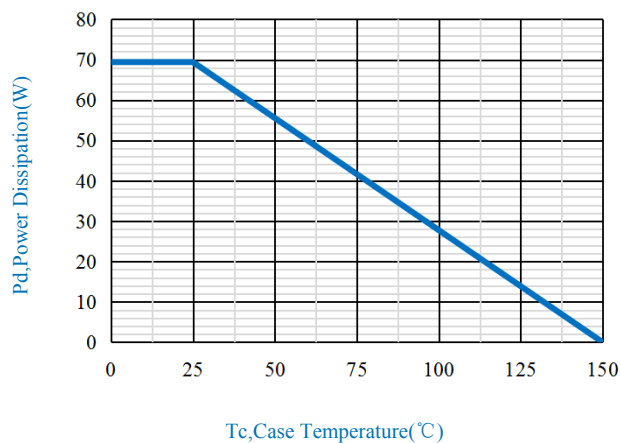


Fig.8-Maximum Power Dissipation Vs. Case Temperature

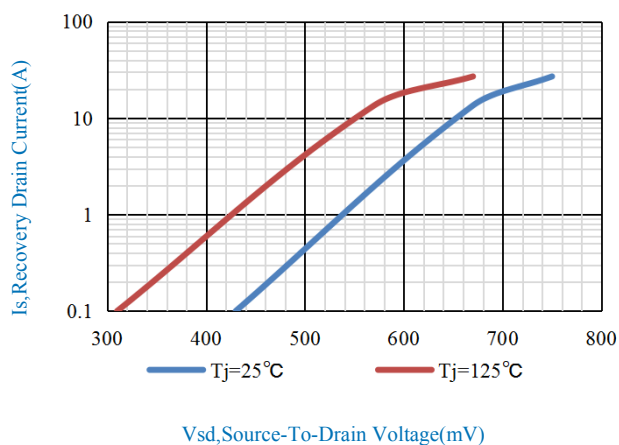


Fig.9-Source-To-Drain Diode Forward Voltage

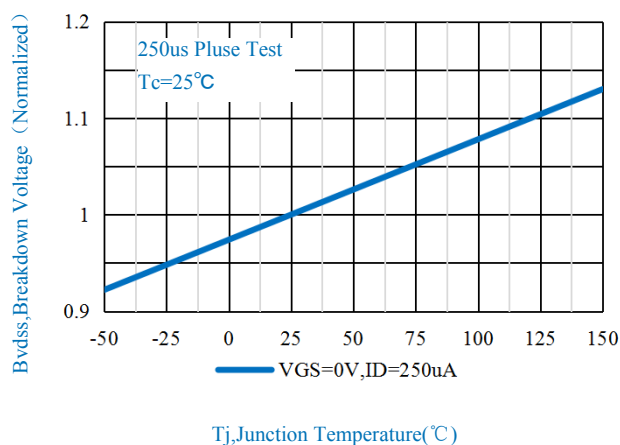


Fig.10-Breakdown Voltage Vs. Junction Temperature

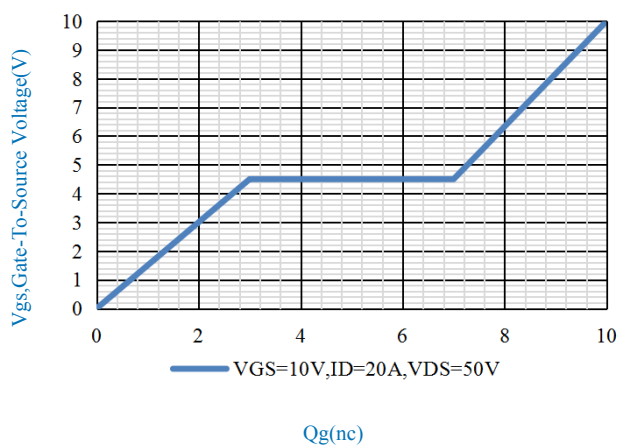


Fig.11-Gate Charge Waveform

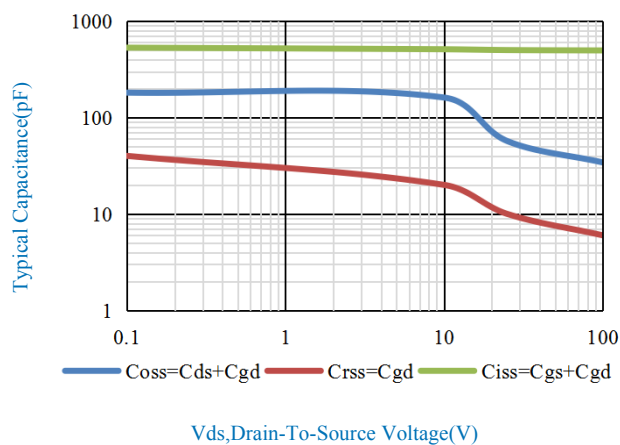


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

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### Typical Characteristics Curves

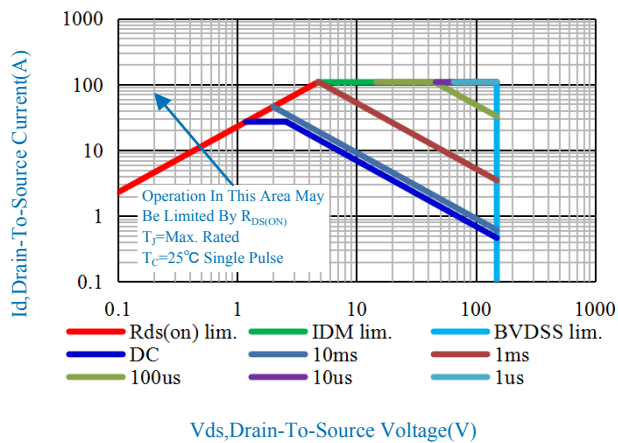


Fig.13-Maximum Safe Operating Area(SOA)

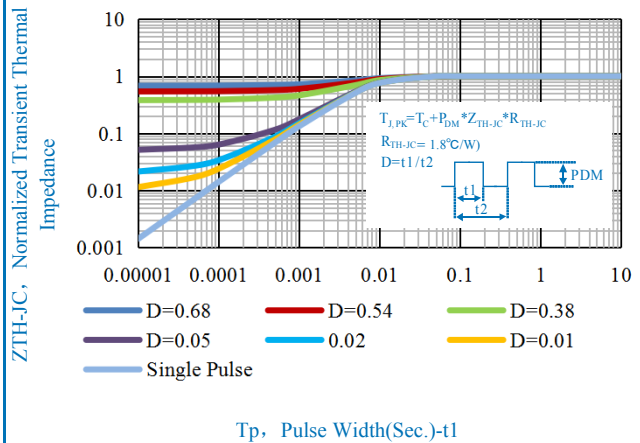


Fig.14- Normalized Maximum Transient Thermal Impedance Vs. Pulse Width

### Inductive Load Test Circuit & Waveform

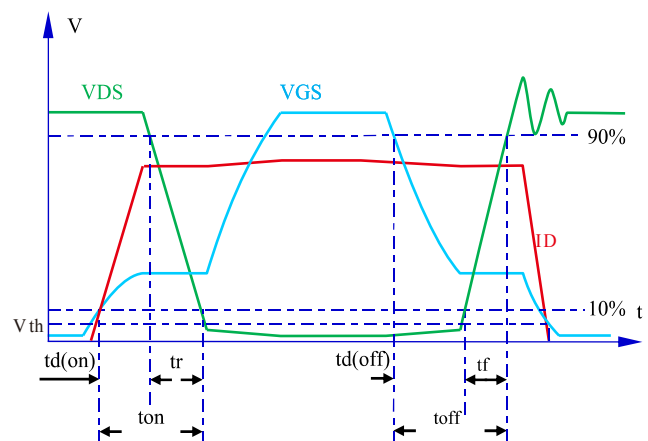
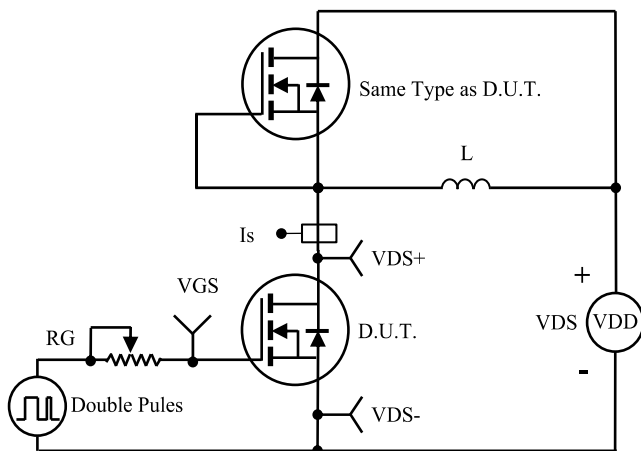


Fig.15- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform

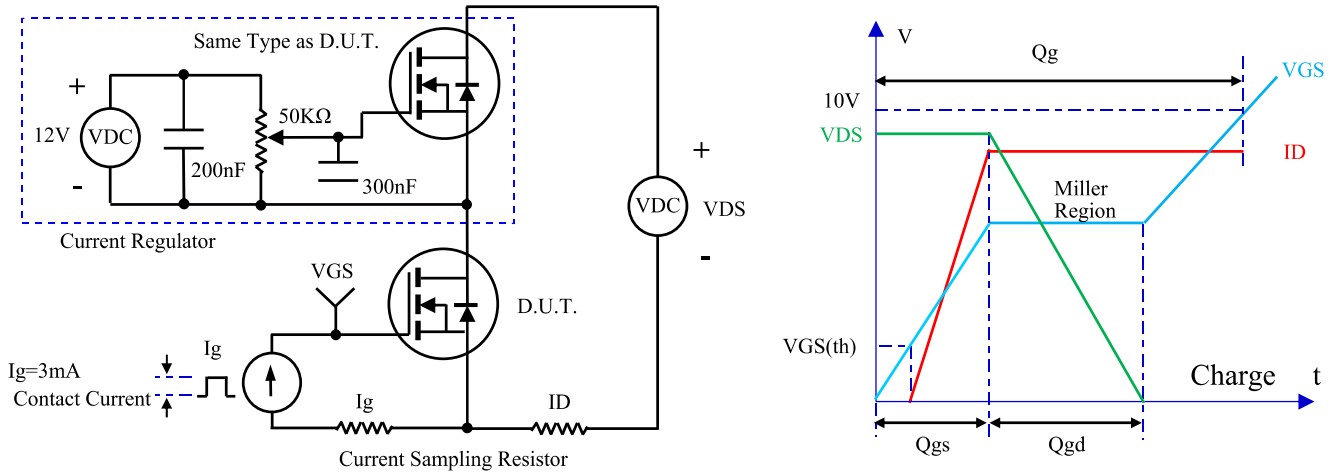


Fig.16- Gate Charge Test Circuit & Waveform

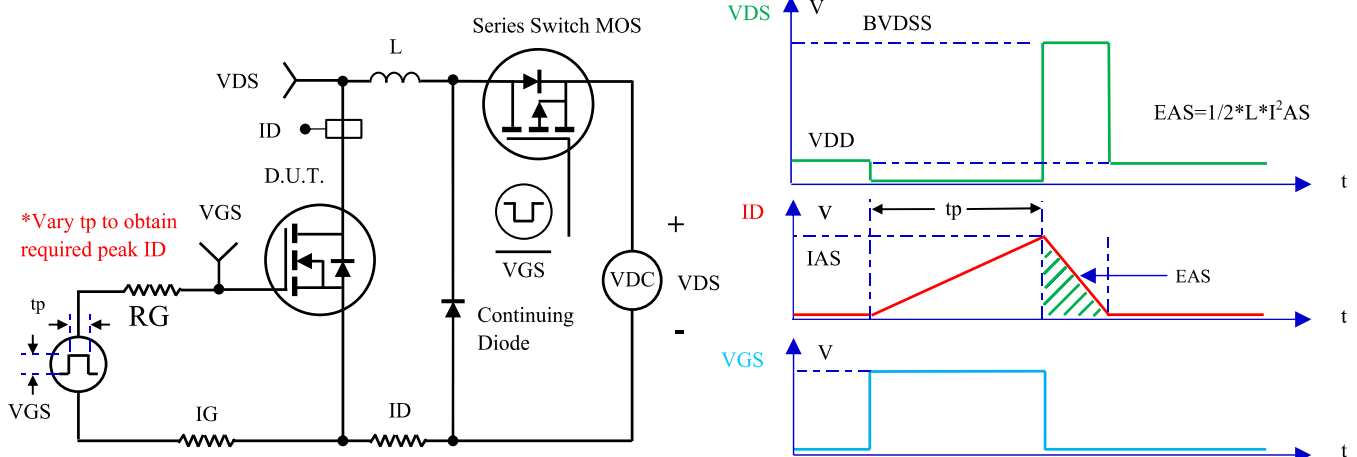


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

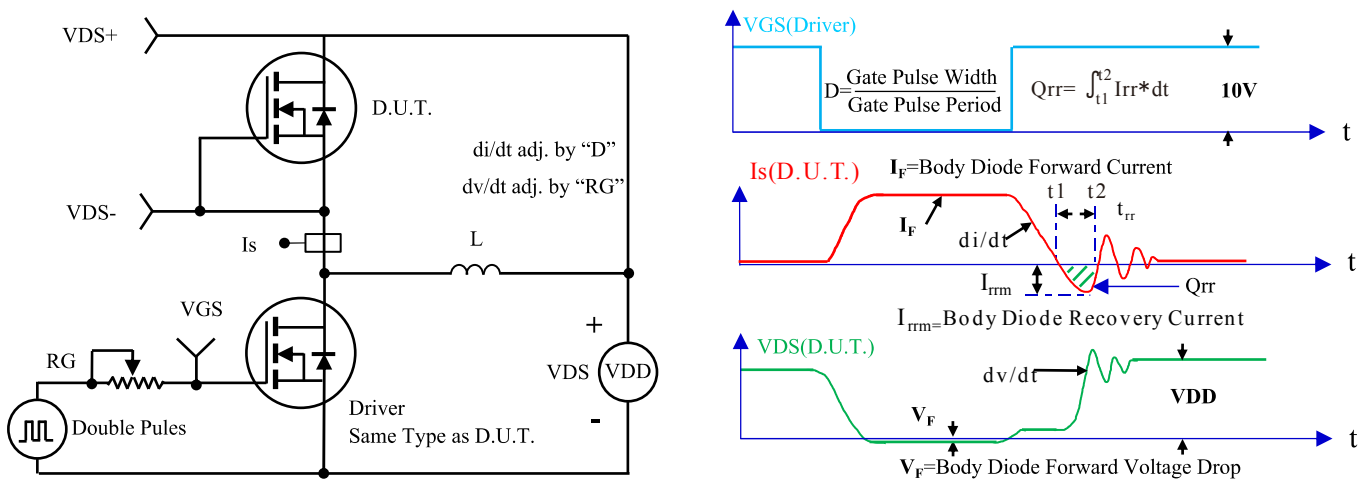


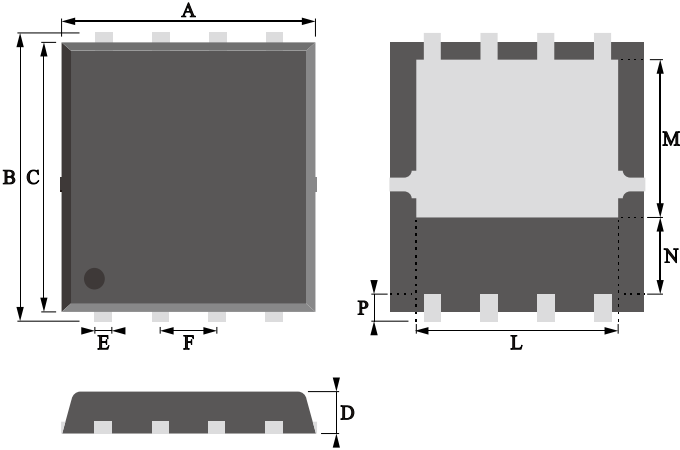
Fig.18- Diode Recovery Test Circuit & Waveform

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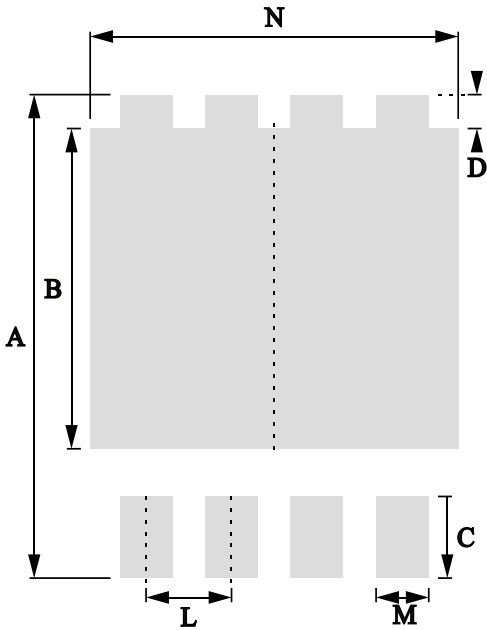
OUTLINE DRAWINGS



PDFN3\*3

| OUTLINE DIMENSIONS |            |      |      |        |      |        |
|--------------------|------------|------|------|--------|------|--------|
| Dim.               | Milimeters |      |      | Inches |      |        |
|                    | Min.       | Typ. | Max. | Min.   | Typ. | Max.   |
| A                  | 2.80       | -    | 3.60 | 0.1102 | -    | 0.1417 |
| B                  | 2.70       | -    | 3.50 | 0.1063 | -    | 0.1378 |
| C                  | 3.00       | -    | 3.80 | 0.1181 | -    | 0.1496 |
| D                  | 0.55       | -    | 1.05 | 0.0217 | -    | 0.0413 |
| E                  | 0.15       | -    | 0.45 | 0.0059 | -    | 0.0177 |
| F                  | 0.40       | 0.65 | 0.90 | 0.0157 | -    | 0.0354 |
| M                  | 1.50       | -    | 2.10 | 0.0591 | -    | 0.0827 |
| L                  | 2.30       | -    | 2.90 | 0.0906 | -    | 0.1142 |
| N                  | 0.45       | -    | 0.95 | 0.0177 | -    | 0.0374 |
| P                  | 0.20       | -    | 0.60 | 0.0079 | -    | 0.0236 |

RECOMMEDND LAYOUT DRAWINGS



PDFN3\*3

| OUTLINE DIMENSIONS |            |      |      |        |        |      |
|--------------------|------------|------|------|--------|--------|------|
| Dim.               | Milimeters |      |      | Inches |        |      |
|                    | Min.       | Typ. | Max. | Min.   | Typ.   | Max. |
| A                  | -          | 3.55 | -    | -      | 0.1398 | -    |
| B                  | -          | 2.35 | -    | -      | 0.0925 | -    |
| C                  | -          | 0.60 | -    | -      | 0.0236 | -    |
| D                  | -          | 0.25 | -    | -      | 0.0098 | -    |
| L                  | -          | 0.65 | -    | -      | 0.0256 | -    |
| M                  | -          | 0.40 | -    | -      | 0.0157 | -    |
| N                  | -          | 2.80 | -    | -      | 0.1102 | -    |

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MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhan Trademark  
FF=Product Line Code,According To Actual Changes  
YWW=Date Code,According To Actual Changes  
LLWWF=Inernal Code,According To Actual Changes  
NTH440N15P3=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) |
|--------------|--------------|---------------------------------|----------------|------------------------------|-----------------------------|--------------------------|
| PDFN3*3      | P1           | 0.0198                          | 13" Reel       | 5000                         | 10000                       | 50000                    |

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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 (T <sub>smax</sub> to T <sub>p</sub> )                                                                              | 3°C/second max.                  | 3°C/second max.                  |
|  | Preheat-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 temperature (t <sub>p</sub> )                                                                             | 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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Specification Revision History

| Rev.        | Date       | Changed Items | Pre-Changed Content | Changed Content |
|-------------|------------|---------------|---------------------|-----------------|
| A/1         | 2014-10-20 | First Issue   |                     |                 |
| Blank Below |            |               |                     |                 |