

NPS4N80F



N-Channel Enhancement Mode Power MOSFET

**Voltage:** 800 Volts

**Current:** 4 Ampers

**Package:** TO-220F

**Features**

- NH'S Advanced Planar DMOS Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Qualified According To JEDEC Criteria
- Built-in ESD Protected

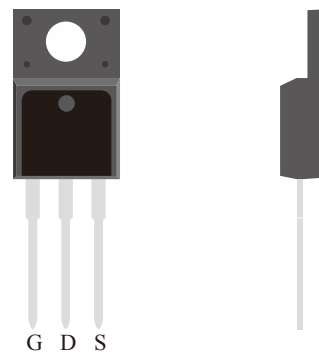
**Typical Applications**

- AC/DC Converter
- Adaptor And Charger
- PC Power
- LED Drives And LED Lighting

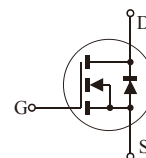
**Product Summary**

|                  |     |   |
|------------------|-----|---|
| VDS Min.@Tj      | 800 | V |
| ID Min.@Ta       | 4   | A |
| RDS(ON)(TYP)@10V | 2.8 | Ω |

**Diagram:**



**Polarity:**



**\*100% UIS TESTED**

**\*100% ΔVDS TESTED**

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

| Parameter                                                                    | Test Conditions                                                      | Symbol          | Ratings | Unit |
|------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------|---------|------|
| Drain-Source Voltage                                                         |                                                                      | V <sub>DS</sub> | 800     | V    |
| Gate-Source Voltage                                                          |                                                                      | V <sub>GS</sub> | ±30     | V    |
| Continuous Drain Current (Note 1)                                            | Ta= 25 °C                                                            | I <sub>D</sub>  | 4       | A    |
|                                                                              | Ta= 100 °C                                                           |                 | 3       |      |
| Drain Current-Pulse (Note 1)                                                 | Tj< 150 °C                                                           | I <sub>DM</sub> | 16      | A    |
| Maximum Power Dissipation Power                                              | Ta= 25 °C                                                            | P <sub>D</sub>  | 49      | W    |
| Dissipation Derating Factor Above 25°C                                       | Ta= 100 °C                                                           |                 | 20      |      |
| Derating Factor                                                              |                                                                      | D <sub>F</sub>  | 0.39    | W/°C |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 10.0 mH                                                           | I <sub>AS</sub> | 4       | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.17 | L= 10.0 mH<br>IAS= 4 A, RG= 10.0 Ω<br>Starting Tj=25 °C, VG = 10.0 V | E <sub>AS</sub> | 88      | mJ   |

**Thermal Characteristics (Ta=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 Ta=25 °C              | R <sub>θJA</sub> | 62.5       | °C/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> | 2.6        |      |

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

**NPS4N80F**
**N-Channel Enhancement Mode Power MOSFET**

**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>                   | 800  | --   | --   | V    |
| Bvdss Temperature Coefficient                                                               | ID=250uA,Reference25℃        | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | --   | 0.95 | --   | V/℃  |
| Drain-Source Leakage Current                                                                | VDS= 800 V,VGS=0V            | I <sub>DSS</sub>                    | --   | --   | 1    | uA   |
| Gate-Body Leakage Current                                                                   | VGS= ±30 V,VDS=0V            | I <sub>GSS</sub>                    | --   | --   | ±100 | nA   |
| Forward Transconductance                                                                    | ID= 2.0 A,VDS= 15 V          | g <sub>fs</sub>                     | --   | 2.2  | --   | S    |
| Static On Characteristics                                                                   |                              |                                     |      |      |      |      |
| Gate Threshold Voltage                                                                      | VGS= VDS ID=250uA            | V <sub>GS(TH)</sub>                 | 3    | 4    | 5    | V    |
| Drain-Source On Resistance                                                                  | ID= 2.0 A,VGS= 10.0 V        | R <sub>DS(ON)</sub>                 | --   | 2.8  | 3.5  | Ω    |
|                                                                                             | ID= 2.0 A,VGS= 5.0 V         |                                     | --   | 4.1  | 5.3  |      |
| Dynamic Characteristics                                                                     |                              |                                     |      |      |      |      |
| Gate Resistance                                                                             | VGS=0V,VDS=0V,<br>Freq.=1MHz | R <sub>g</sub>                      | --   | 2.4  | --   | Ω    |
| Input Capacitance                                                                           | VDS= 50 V                    | C <sub>iss</sub>                    | --   | 600  | --   | pF   |
| Output Capacitance                                                                          | VGS= 0 V                     | C <sub>oss</sub>                    | --   | 55   | --   | 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>                  | --   | 35   | --   | ns   |
| Turn-On Rise Time                                                                           | VGS= 10.0 V                  | t <sub>r</sub>                      | --   | 10   | --   | ns   |
| Turn-Off Delay Time                                                                         | RG= 10.0 Ω                   | t <sub>d(off)</sub>                 | --   | 85   | --   | ns   |
| Turn-Off Rise Time                                                                          | L= 10.0 mH                   | t <sub>f</sub>                      | --   | 30   | --   | ns   |
| Gate Charge Paramters (Test Circuit & Waveform See Fig.16)                                  |                              |                                     |      |      |      |      |
| Total Gate Charge                                                                           | VDS= 50 V                    | Q <sub>g</sub>                      | --   | 27   | --   | nC   |
| Gate-Source Charge                                                                          | VGS= 10.0 V                  | Q <sub>gs</sub>                     | --   | 8.2  | --   | nC   |
| Gate-Drain Charge                                                                           | ID= 4.0 A                    | Q <sub>gd</sub>                     | --   | 11   | --   | nC   |
| Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18) |                              |                                     |      |      |      |      |
| Max. Diode Forward Cuurent                                                                  |                              | I <sub>S</sub>                      | --   | --   | 4.0  | A    |
| Max. Pulsed Forward Cuurent                                                                 |                              | I <sub>SM</sub>                     | --   | --   | 16   | A    |
| Diode Forward Voltage                                                                       | ID= 2.0 A,VGS=0V             | V <sub>SD</sub>                     | --   | 0.8  | 1.4  | V    |
| Reverse Recovery Time                                                                       | IS= 2.0 A,di/dt= 100 A/us    | t <sub>rr</sub>                     | --   | 650  | --   | ns   |
| Reverse Recovery Charge                                                                     | VGS= 0.0 V                   | Q <sub>rr</sub>                     | --   | 7000 | --   | nC   |
| Reverse Recovery Current                                                                    |                              | I <sub>RRM</sub>                    | --   | 22.0 | --   | A    |

NPS4N80F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

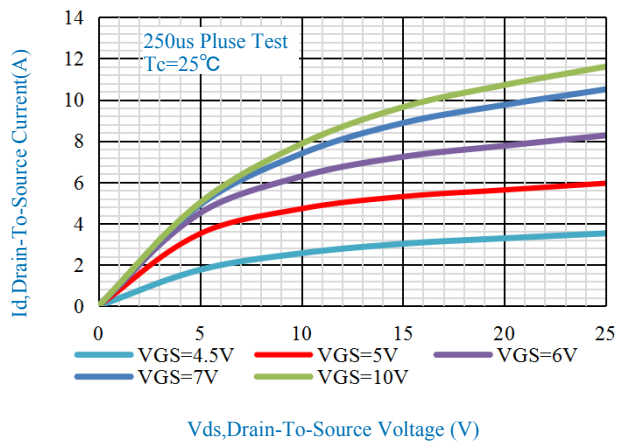


Fig.1-Output Characteristics

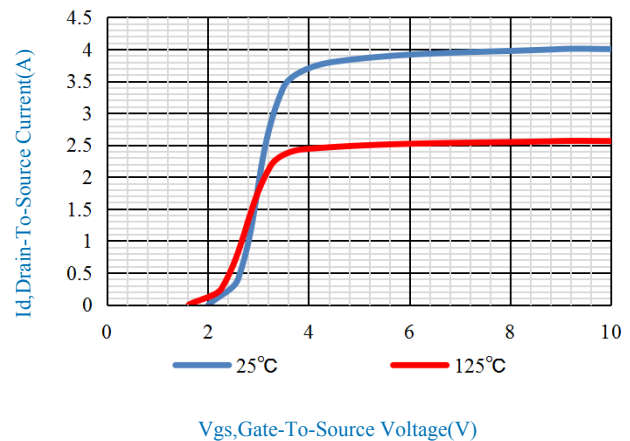


Fig.2-Transfer Characteristics

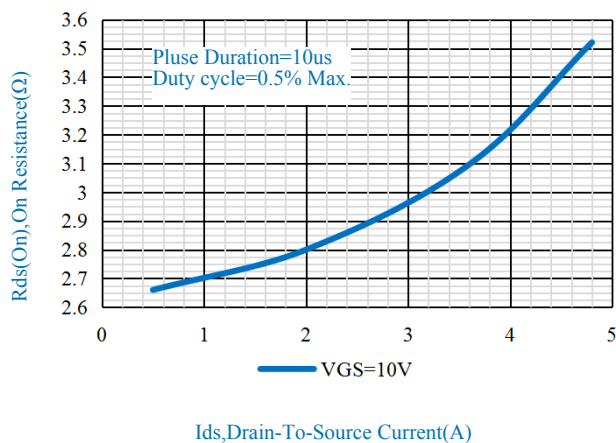


Fig.3-On Resistance Vs. Drain Current

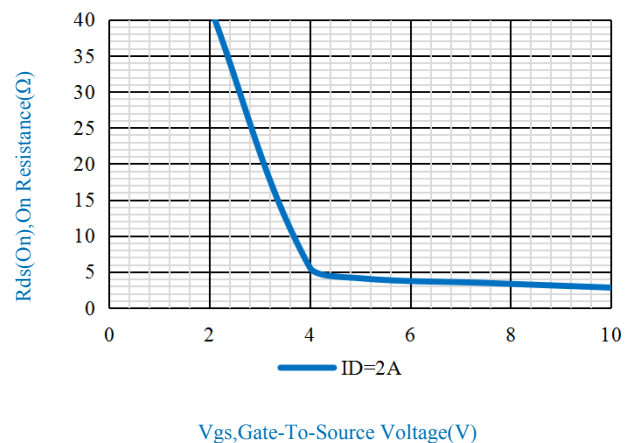


Fig.4-On Resistance Vs. Gate Source Voltage

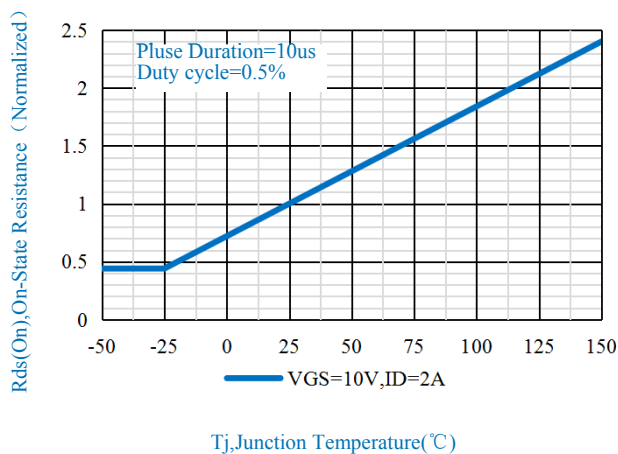


Fig.5-On Resistance Vs. Junction Temperature

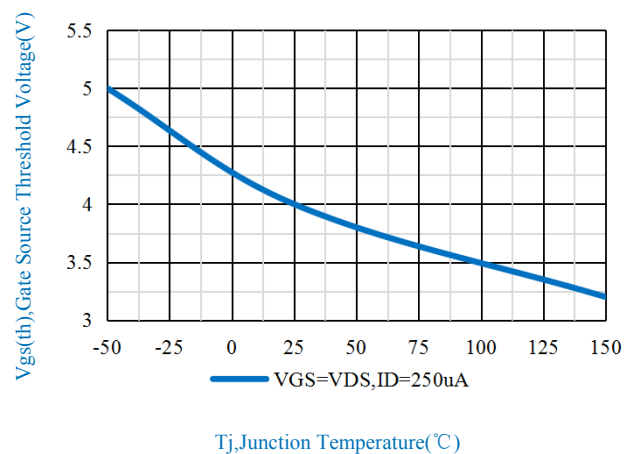


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

NPS4N80F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

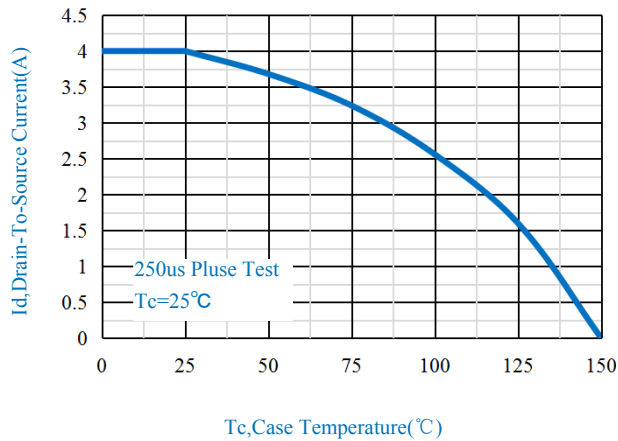


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

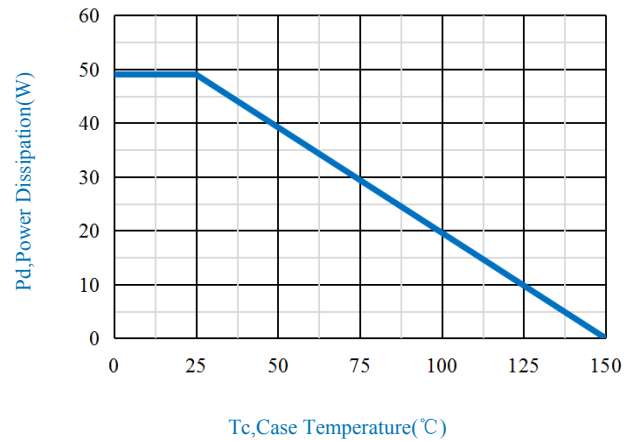


Fig.8-Maximum Power Dissipation Vs. Case Temperature

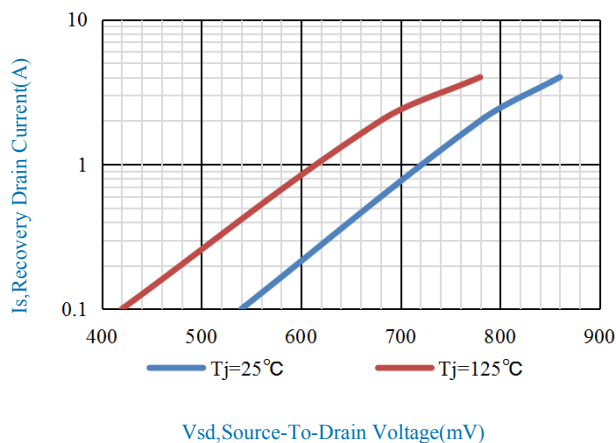


Fig.9-Source-To-Drain Diode Forward Voltage

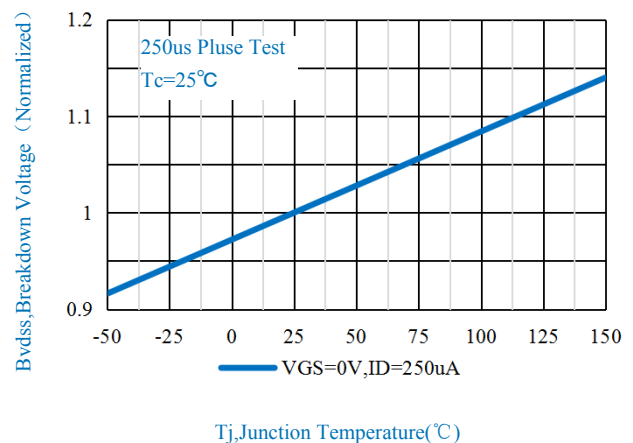


Fig.10-Breakdown Voltage Vs. Junction Temperature

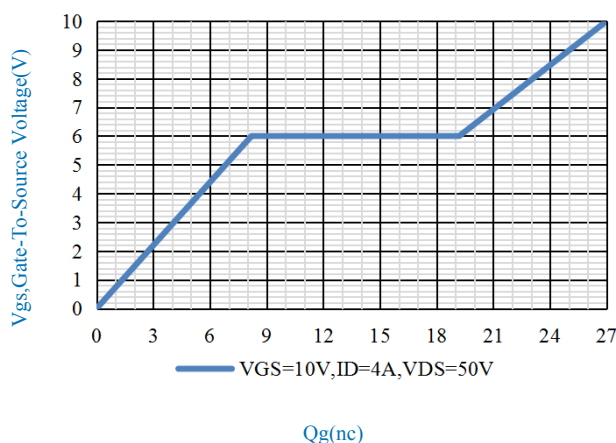


Fig.11-Gate Charge Waveform

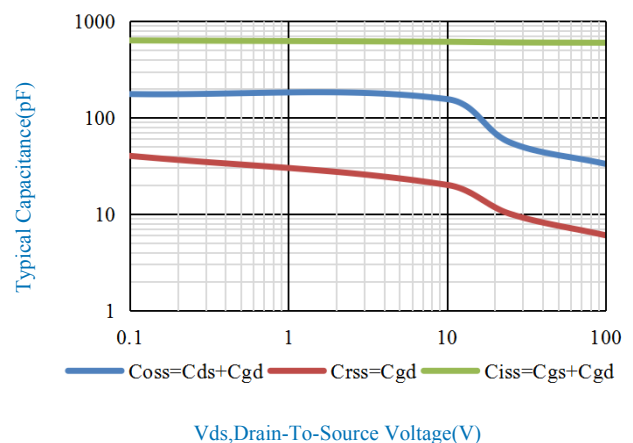


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

NPS4N80F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

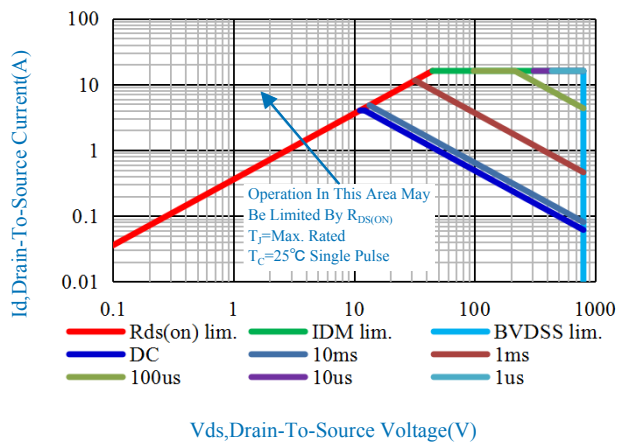


Fig.13-Maximum Safe Operating Area(SOA)

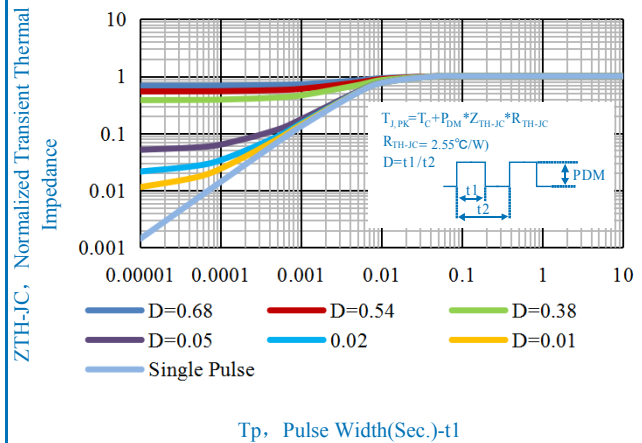


Fig.14- Normalized Maximum Transient Thermal Impedance Vs. Pulse Width

Inductive Load Test Circuit & Waveform

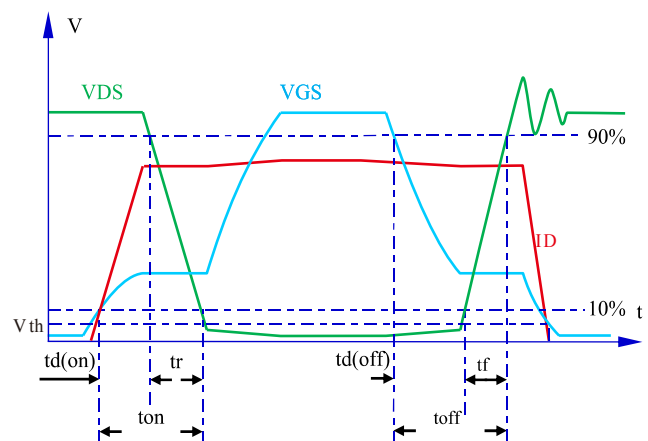
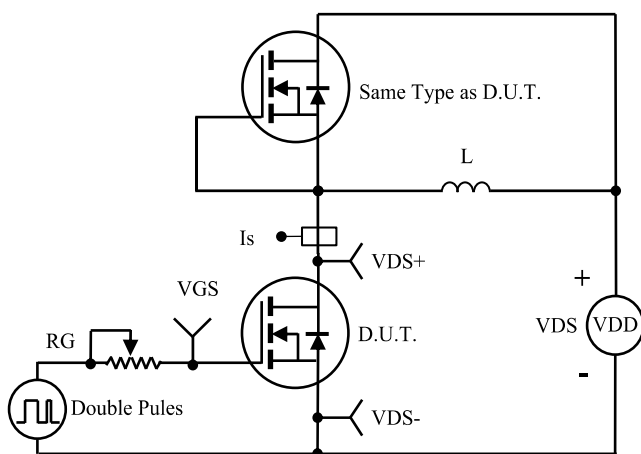


Fig.15- Inductive Switching Test Circuit & Waveform

NPS4N80F



N-Channel Enhancement Mode Power MOSFET

Test Circuit & Waveform

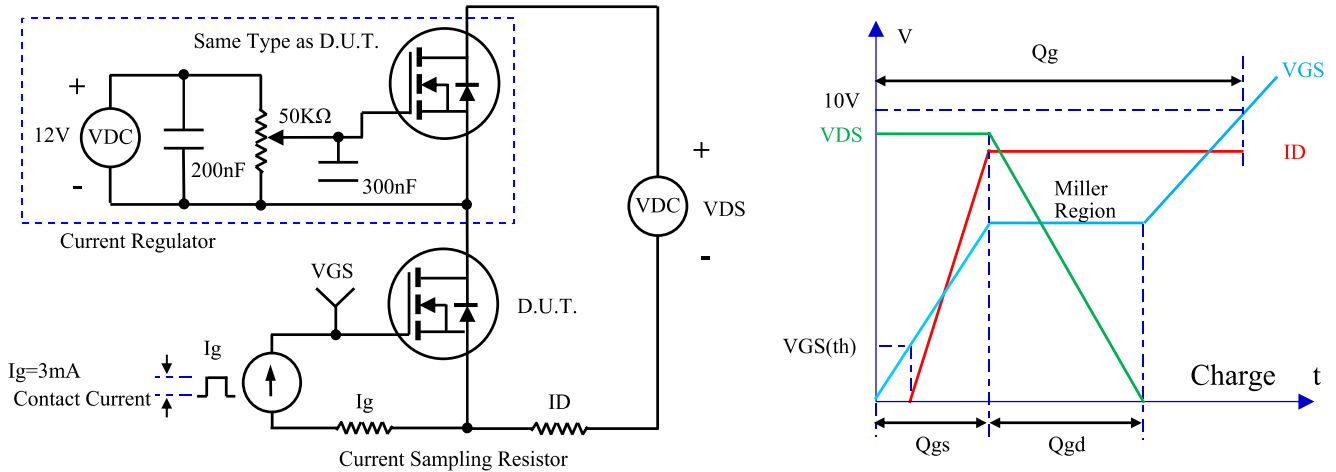


Fig.16- Gate Charge Test Circuit & Waveform

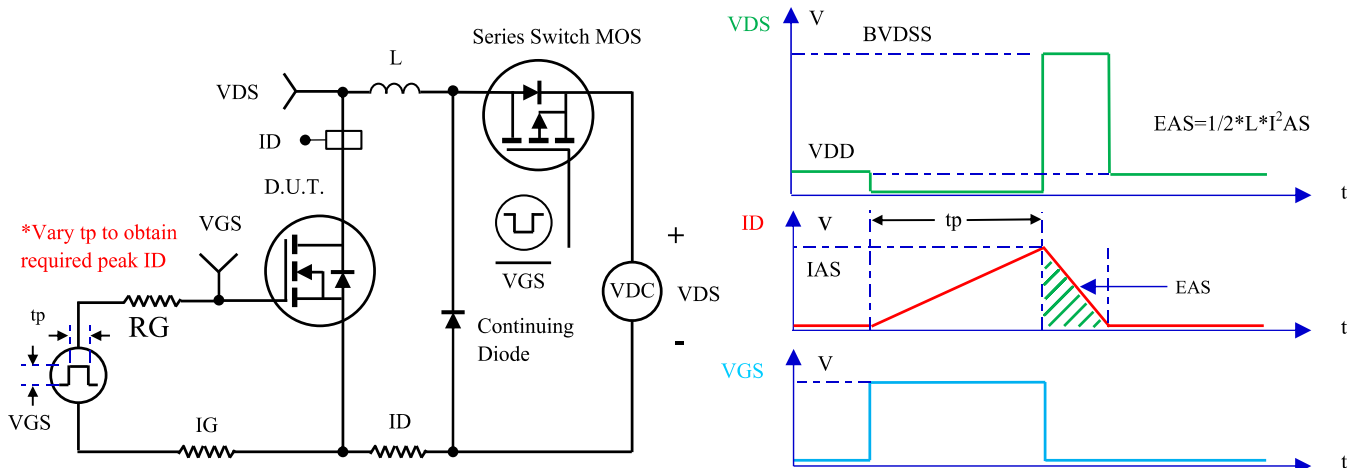


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

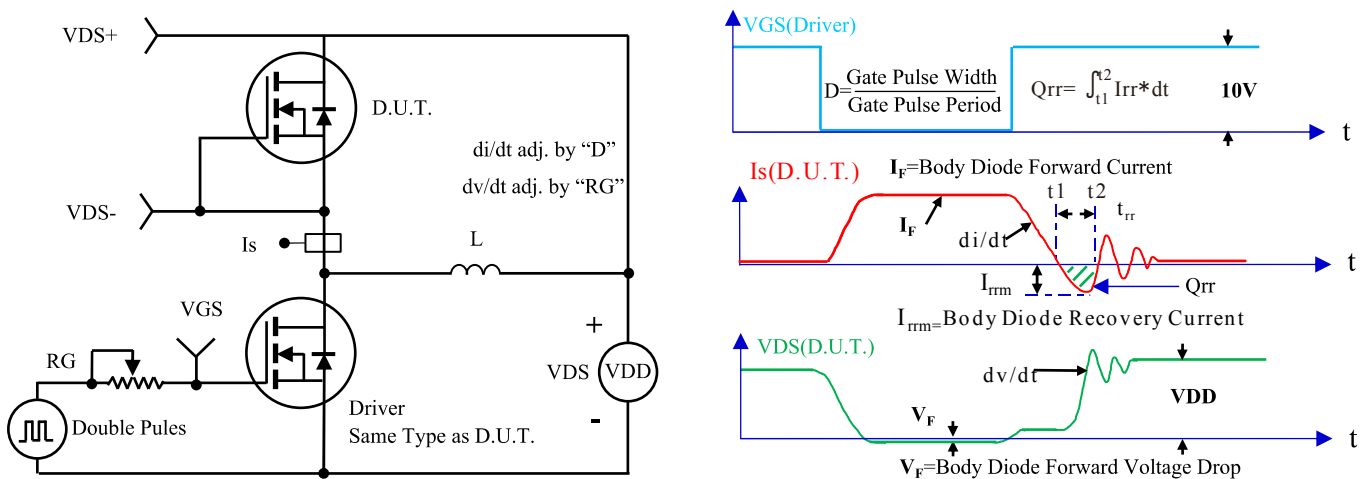


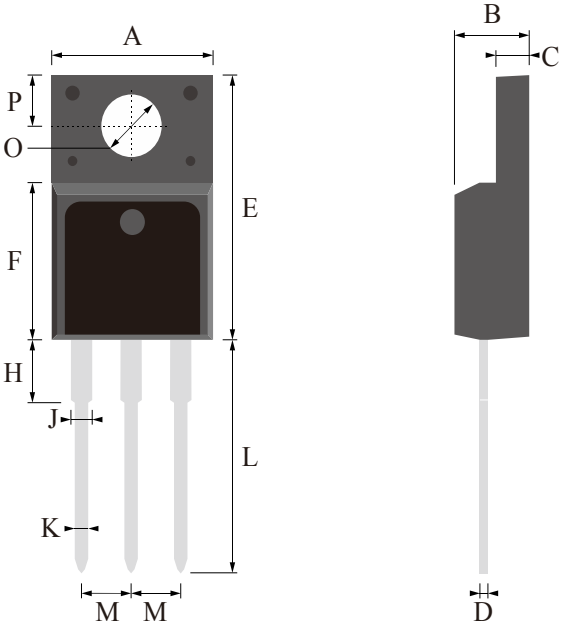
Fig.18- Diode Recovery Test Circuit & Waveform

NPS4N80F



N-Channel Enhancement Mode Power MOSFET

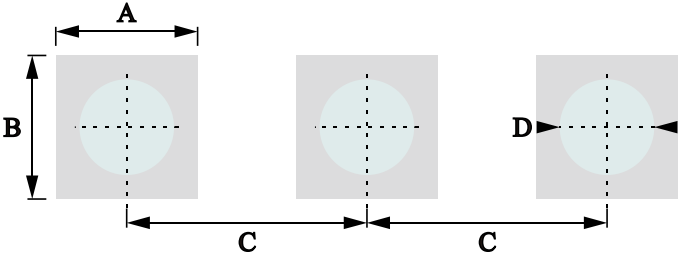
OUTLINE DRAWINGS



TO-220F

| OUTLINE DIMENSIONS |            |      |       |        |      |        |
|--------------------|------------|------|-------|--------|------|--------|
| Dim.               | Milimeters |      |       | Inches |      |        |
|                    | Min.       | Typ. | Max.  | Min.   | Typ. | Max.   |
| A                  | 9.25       | -    | 10.75 | 0.3642 | -    | 0.4232 |
| B                  | 4.20       | -    | 5.20  | 0.1654 | -    | 0.2047 |
| C                  | 2.30       | -    | 2.90  | 0.0906 | -    | 0.1142 |
| D                  | 0.35       | -    | 0.75  | 0.0138 | -    | 0.0295 |
| E                  | 14.80      | -    | 16.80 | 0.5827 | -    | 0.6614 |
| F                  | 8.25       | -    | 9.75  | 0.3248 | -    | 0.3839 |
| L                  | 12.15      | -    | 14.15 | 0.4783 | -    | 0.5571 |
| H                  | 2.60       | -    | 3.80  | 0.1024 | -    | 0.1496 |
| J                  | 1.10       | -    | 1.60  | 0.0433 | -    | 0.0630 |
| K                  | 0.60       | -    | 1.00  | 0.0236 | -    | 0.0394 |
| M                  | 2.20       | -    | 3.00  | 0.0866 | -    | 0.1181 |
| O                  | 2.70       | -    | 3.50  | 0.1063 | -    | 0.1378 |
| P                  | 3.10       | -    | 3.80  | 0.1220 | -    | 0.1496 |

RECOMMEDND LAYOUT DRAWINGS



TO-220F

| 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 | -    |

NPS4N80F



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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  
NPS4N80F=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-220F      | P1           | 2.048                           | Tube           | 50                           | 1000                        | 5000                     |

NPS4N80F



N-Channel Enhancement Mode 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 (T <sub>Smax</sub> to T <sub>P</sub> )                                                      | 3°C/second max.                  | 3°C/second max.                  |
|  | Preheat-Temperature Min (T <sub>Smin</sub> )<br>-Temperature Max (T <sub>Smax</sub> )<br>-Time(ts min to ts 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 (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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- When the appearance of the product and chip size does not change, in order to product the customer. quality, change the internal structure and the production process Niuhang can not notify

NPS4N80F

N-Channel Enhancement Mode Power MOSFET



Specification Revision History

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