

## NSH110N15C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



**VOLTAGE:** 150 Volts

**CURRENT:** 91 Amperes

**Package:** TO-220C

**Marking And Polarity**

### FEATURES

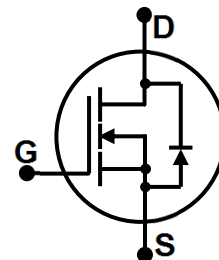
- Low  $R_{DS(ON)}$  For High Efficiency
- Low Gate Charge For High Speed Swithing
- High EAS For High Reliability
- 100% UIS And RG Tested

### TYPICAL APPLICATIONS

- DC/DC Converter And Synchronous Rectification
- High-Frequency Circuits And Battery Management System(BMS)
- The Motor Drives And Printed Circuit Board Control
- Automotive Electronics And UPS (Uninterruptible Power Supplies)
- **Weight:App. 2.057 Grams (0.07255 Ounce)**

### PRODUCT SUMMARY

|                  |       |    |
|------------------|-------|----|
| VDS Min.@Tj      | 150   | V  |
| Id Min.@Ta       | 91    | A  |
| RDS(ON) Type@10V | 11.00 | mΩ |



Remark:

- ①. NH=Nihang Trademark
- ②. FF=Product Line Code,According To Actual Changes  
YWW=Date Code,According To Actual Changes  
LLWWF=Inernal Code,According To Actual Changes
- ③. NSH110N15C=Model

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

| Parameter                                                                    | Test Conditions                                                 | Symbol    | Ratings    | Unit |
|------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------|------------|------|
| Drain-Source Voltage                                                         |                                                                 | $V_{DS}$  | 150        | V    |
| Gate-Source Voltage                                                          |                                                                 | $V_{GS}$  | ±20        | V    |
| Continuous Drain Current (Note 1)                                            | Ta= 25 ℃                                                        | $I_D$     | 91         | A    |
|                                                                              | Ta= 100 ℃                                                       |           | 58         |      |
| Drain Current-Pulsed (Note 1)                                                | Tj< 150 ℃                                                       | $I_{DM}$  | 366        | A    |
| Maximum Power Dissipation Power                                              | Ta= 25 ℃                                                        | $P_D$     | 227        | W    |
| Dissipation Derating Factor Above 25℃                                        | Ta= 100 ℃                                                       |           | 91         |      |
| Derating Factor                                                              |                                                                 | $D_F$     | 1.82       | W/℃  |
| Junction Temperature                                                         |                                                                 | $T_J$     | -55 to 150 | ℃    |
| Storage Temperature Range                                                    |                                                                 | $T_{STD}$ | -55 to 150 | ℃    |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 0.5 mH                                                       | $I_{AS}$  | 22         | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.16 | L= 0.5 mH<br>IAS= 22.4 A,RG= 25 Ω<br>Starting Tj=25 ℃,VG = 10 V | $E_{AS}$  | 125        | mJ   |

### Thermal Characteristics (Ta=25℃ Unless Otherwise Specified)

| Parameter                              | Test Conditions                                            | Symbol          | Typ. | Unit |
|----------------------------------------|------------------------------------------------------------|-----------------|------|------|
| Thermal Resistance Junction To Ambient | Still Air Environment With Ta =25℃                         | $R_{\theta JA}$ | 60.0 | ℃/W  |
| Thermal Resistance Junction-Case       | Device Mounted On<br>1 in <sup>2</sup> FR-4 Board With 2oz | $R_{\theta JC}$ | 0.6  |      |

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

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

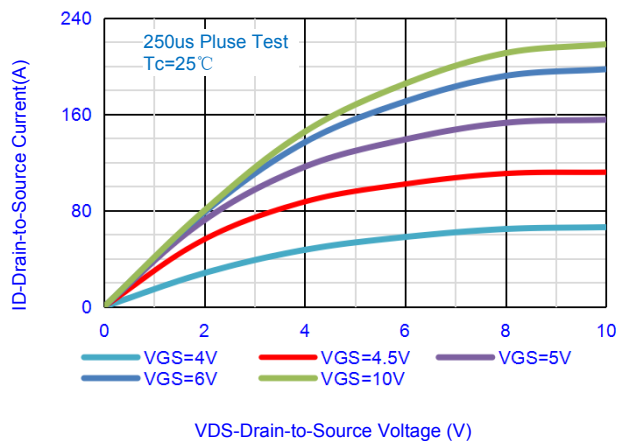
| Parameter                                                                                   | Test Conditions              | Symbol                       | Min. | Typ.   | Max.  | Unit |
|---------------------------------------------------------------------------------------------|------------------------------|------------------------------|------|--------|-------|------|
| Static off Characteristics                                                                  |                              |                              |      |        |       |      |
| Drain-Source Breakdown Voltage                                                              | VGS=0V,ID=250uA              | $BV_{DSS}$                   | 150  | --     | --    | V    |
| Bvdss Temperature Coefficient                                                               | ID=250uA,Reference25℃        | $\Delta BV_{DSS}/\Delta T_J$ | --   | 0.172  | --    | V/℃  |
| Drain-Source Leakage Current                                                                | VDS= 150 V,VGS=0V            | $I_{DSS}$                    | --   | --     | 1     | uA   |
| Gate-Body Leakage Current                                                                   | VGS= ±20 V,VDS=0V            | $I_{GSS}$                    | --   | --     | ±100  | nA   |
| Forward Transconductance                                                                    | ID= 20 A,VDS= 5 V            | $g_{fs}$                     | --   | 33     | --    | S    |
| Static on Characteristics                                                                   |                              |                              |      |        |       |      |
| Gate Threshold Voltage                                                                      | VGS= VDS ID=250uA            | $V_{GS(TH)}$                 | 2.0  | 3.0    | 4.0   | V    |
| Drain-Source On Resistance                                                                  | ID= 20 A,VGS= 10 V           | $R_{DS(ON)}$                 | --   | 11.00  | 13.00 | mΩ   |
|                                                                                             | ID= 20 A,VGS= 4.5 V          |                              | --   | 12.65  | 17.42 |      |
| Dynamic Characteristics                                                                     |                              |                              |      |        |       |      |
| Gate Resistance                                                                             | VGS=0V,VDS=0V,<br>Freq.=1MHz | $R_g$                        | --   | 4.40   | --    | Ω    |
| Input Capacitance                                                                           | VDS= 50 V                    | $C_{iss}$                    | --   | 1882.0 | --    | pF   |
| Output Capacitance                                                                          | VGS= 0 V                     | $C_{oss}$                    | --   | 235.0  | --    | pF   |
| Reverse Transfer Capacitance                                                                | F= 1 MHZ                     | $C_{rss}$                    | --   | 5.5    | --    | pF   |
| Switching Paramters (Test Circuit & Waveform See Fig.14)                                    |                              |                              |      |        |       |      |
| Turn-On Delay Time                                                                          | VDS= 75 V                    | $t_{d(on)}$                  | --   | 10.0   | --    | ns   |
| Turn-On Rise Time                                                                           | VGS= 10 V                    | $t_r$                        | --   | 6.0    | --    | ns   |
| Turn-Off Delay Time                                                                         | RG= 25 Ω                     | $t_{d(off)}$                 | --   | 19.0   | --    | ns   |
| Turn-Off Rise Time                                                                          |                              | $t_f$                        | --   | 7.3    | --    | ns   |
| Gate Charge Paramters (Test Circuit & Waveform See Fig.15)                                  |                              |                              |      |        |       |      |
| Total Gate Charge                                                                           | VDS= 75 V                    | $Q_g$                        | --   | 26.0   | --    | nC   |
| Gate-Source Charge                                                                          | VGS= 10 V                    | $Q_{gs}$                     | --   | 11.0   | --    | nC   |
| Gate-Drain Charge                                                                           | ID= 20 A                     | $Q_{gd}$                     | --   | 3.7    | --    | nC   |
| Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17) |                              |                              |      |        |       |      |
| Max. Diode Forward Cuurent                                                                  |                              | $I_S$                        | --   | --     | 91    | A    |
| Max. Pulsed Forward Cuurent                                                                 |                              | $I_{SM}$                     | --   | --     | 320   | A    |
| Diode Forward Voltage                                                                       | ID= 20 A,VGS=0V              | $V_{SD}$                     | --   | 0.90   | 1.26  | V    |
| Reverse Recovery Time                                                                       | ID= 20 A,di/dt= 100 A/us     | $t_{rr}$                     | --   | 72.0   | --    | ns   |
| Reverse Recovery Charge                                                                     | VGS= 10 V,VDS= 75 V          | $Q_{rr}$                     | --   | 120.0  | --    | nC   |

**NSH110N15C**

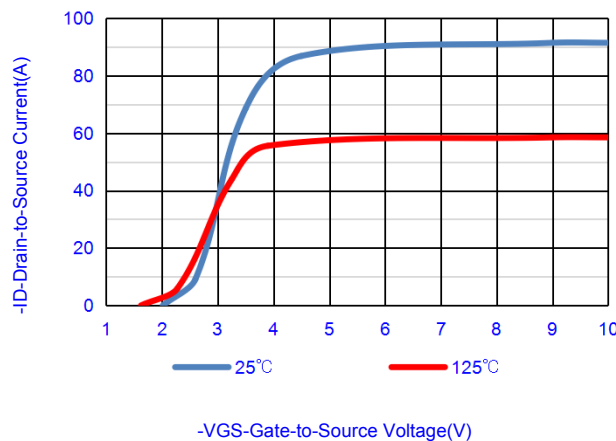
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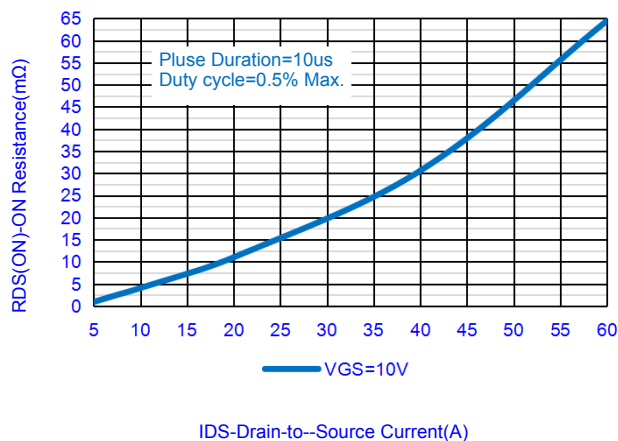
**Typical Characteristics Curves**



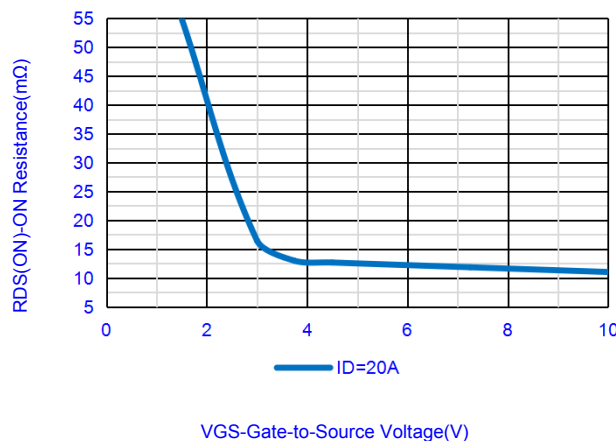
**Fig.1-Output Characteristics**



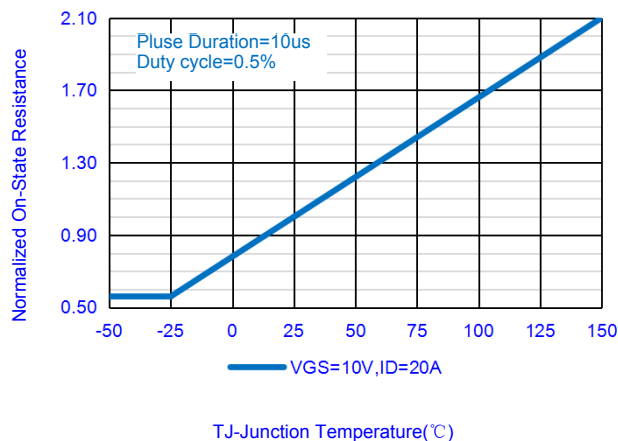
**Fig.2- Transfer Characteristics**



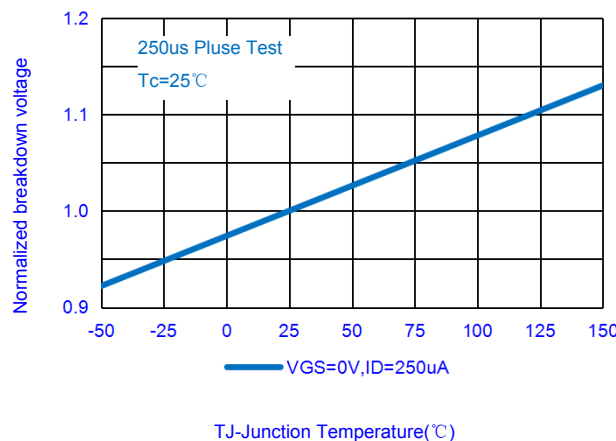
**Fig.3- On Resistance vs. Drain Current**



**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**

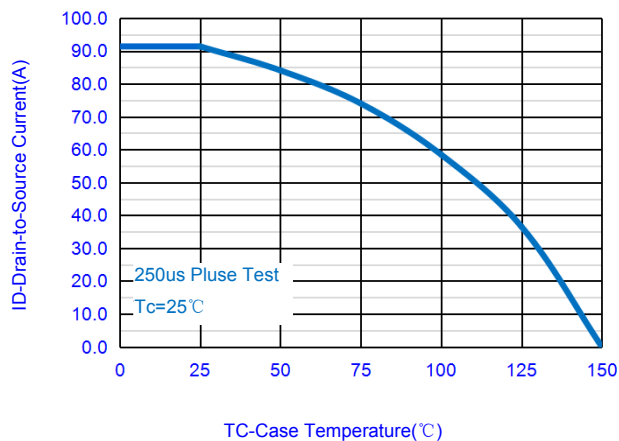


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

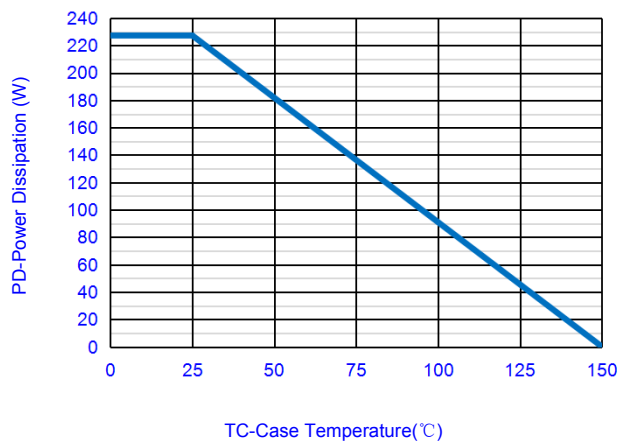


Fig.8-Maximum Power Dissipation vs. Case Temperature

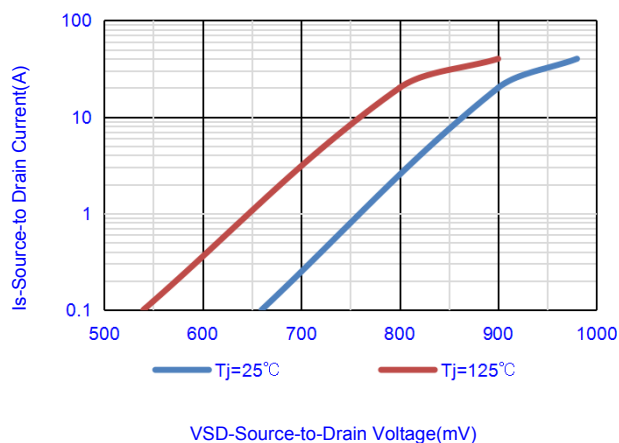


Fig.9- Source-Drain Diode Forward Voltage

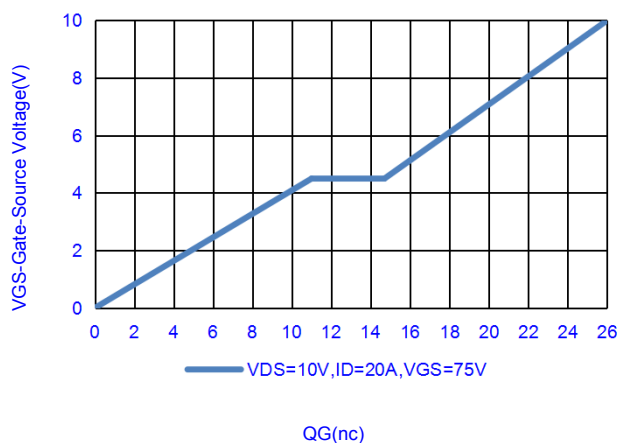


Fig.10-Gate Charge Waveform

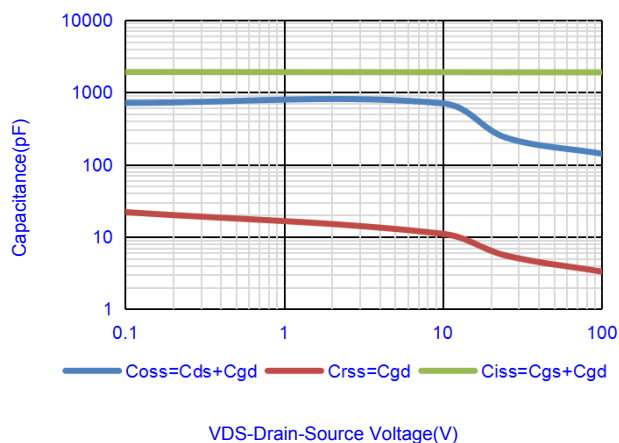


Fig.11- Gate-Source Voltage-VGS(V)

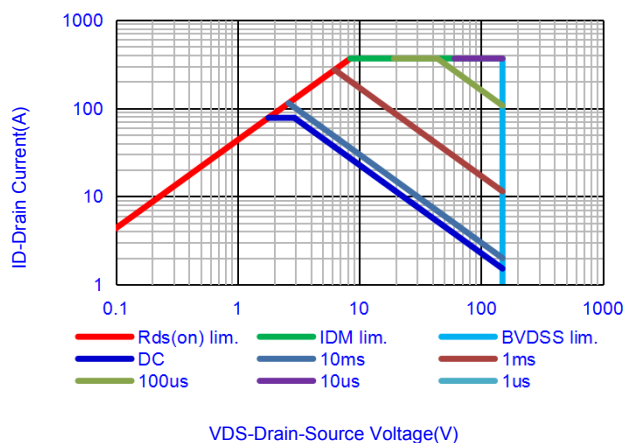


Fig.12-Maximum Safe Operating Area(SOA)

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**Typical Characteristics Curves**

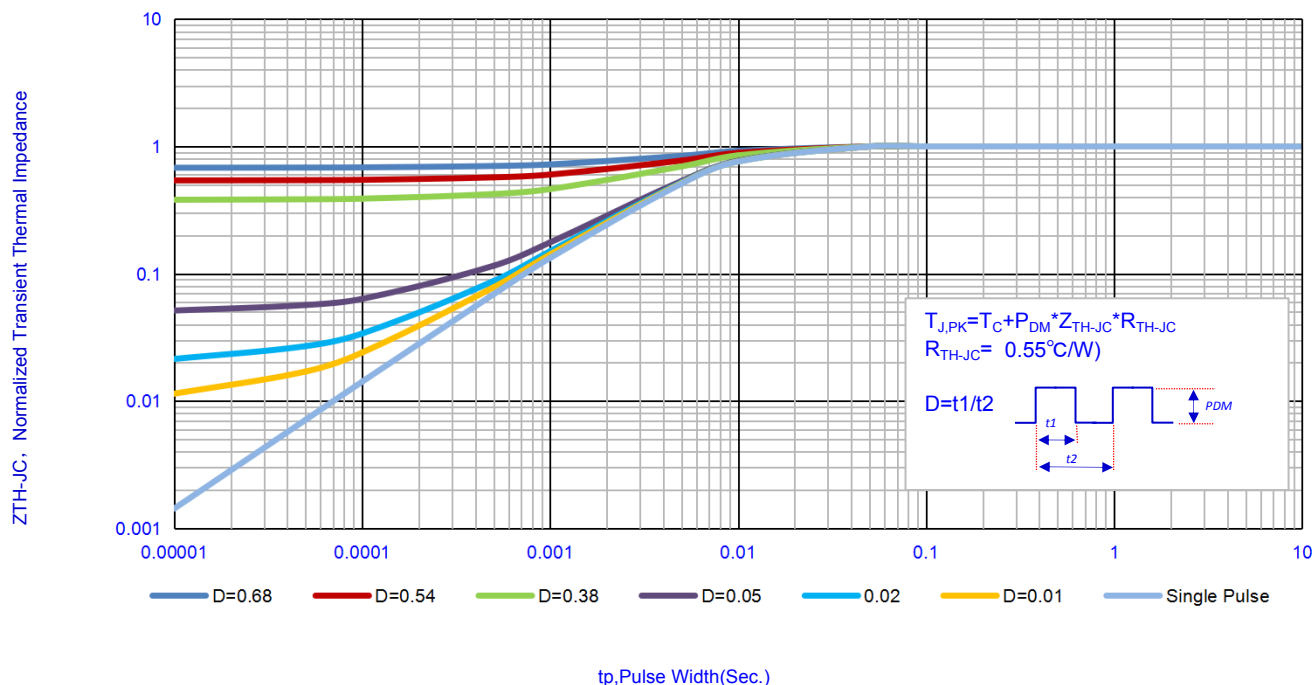


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

**Test Circuit & Waveform**

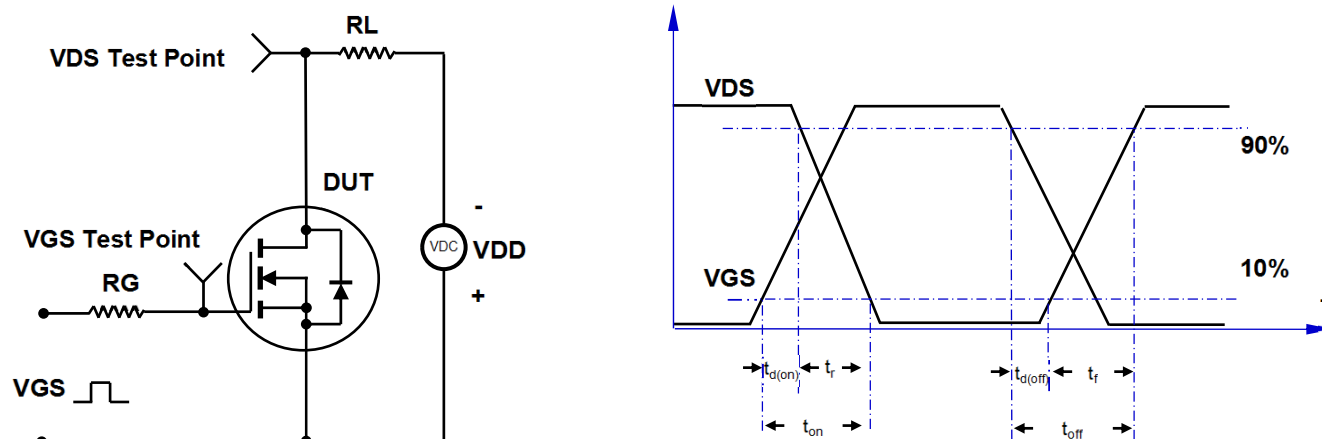


Fig.14- Resistive Switching Test Circuit & Waveform

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**Test Circuit & Waveform**

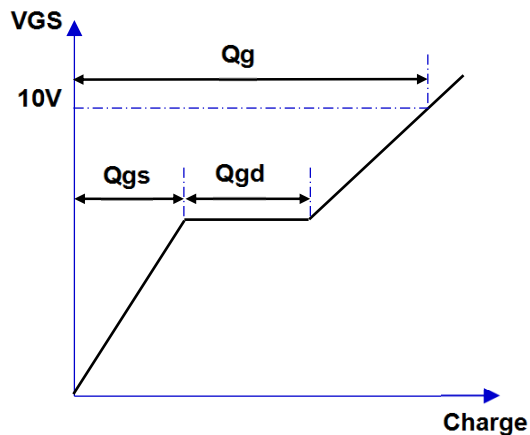
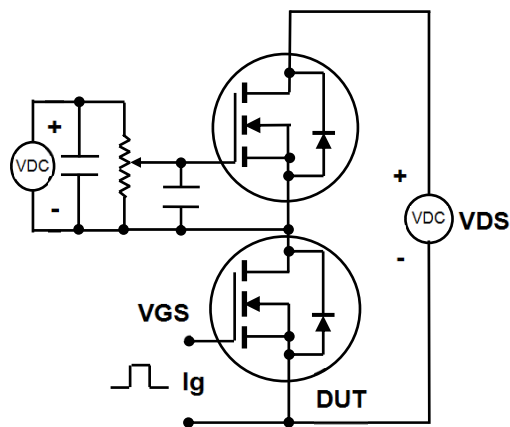


Fig.15- Gate Charge Test Circuit & Waveform

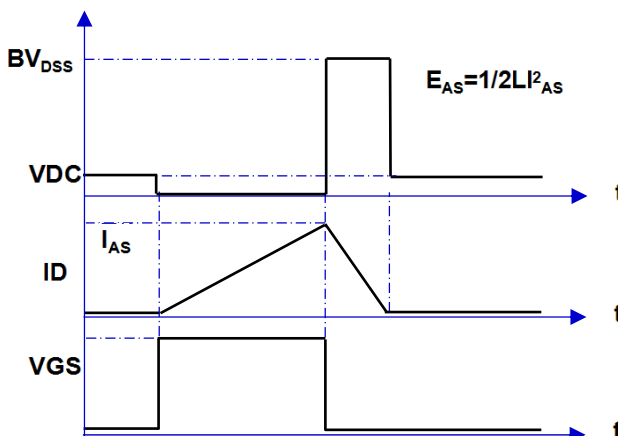
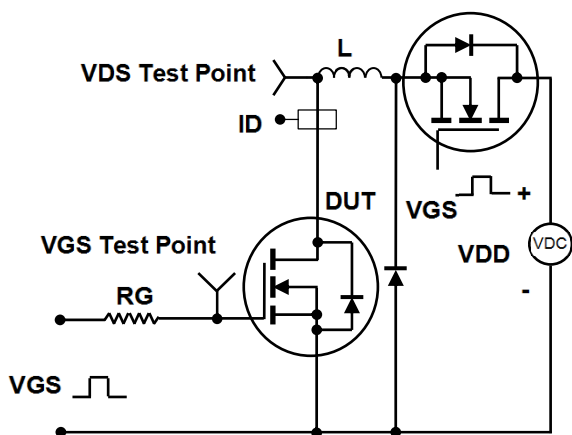


Fig.16- EAS Test Circuit & Waveform

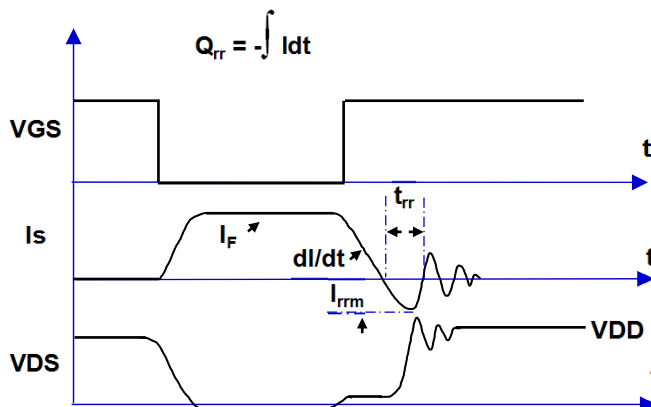
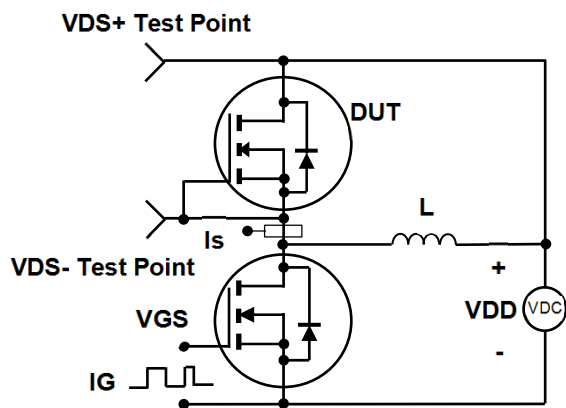


Fig.17- Diode Recovery Test Circuit & Waveform

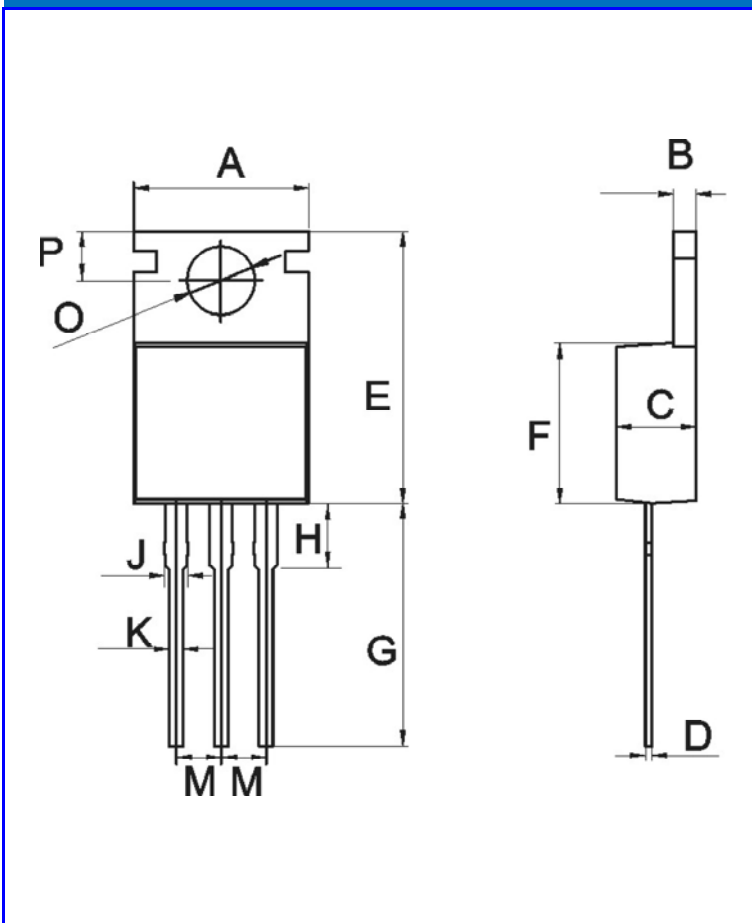
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**OUTLINE DRAWINGS**

**TO-220C**



| OUTLINE DIMENSIONS |             |      |       |        |      |      |
|--------------------|-------------|------|-------|--------|------|------|
| Dim.               | Millimeters |      |       | Inches |      |      |
|                    | Min.        | Typ. | Max.  | Min.   | Typ. | Max. |
| A                  | 9.50        | -    | 10.50 | 0.37   | -    | 0.41 |
| B                  | 1.10        | -    | 1.65  | 0.04   | -    | 0.06 |
| C                  | 4.15        | -    | 4.95  | 0.16   | -    | 0.19 |
| D                  | 0.25        | -    | 0.65  | 0.01   | -    | 0.03 |
| E                  | 14.50       | -    | 16.70 | 0.57   | -    | 0.66 |
| F                  | 8.40        | -    | 9.95  | 0.33   | -    | 0.39 |
| G                  | 12.15       | -    | 14.30 | 0.48   | -    | 0.56 |
| H                  | 3.00        | -    | 3.80  | 0.12   | -    | 0.15 |
| J                  | 1.05        | -    | 1.60  | 0.04   | -    | 0.06 |
| K                  | 0.65        | -    | 0.95  | 0.03   | -    | 0.04 |
| M                  | 2.10        | -    | 2.90  | 0.08   | -    | 0.11 |
| O                  | 3.20        | -    | 4.10  | 0.13   | -    | 0.16 |
| P                  | 2.45        | -    | 3.10  | 0.10   | -    | 0.12 |

**PACKING INFORMATION**

| Package Code | Package Method | Inner Box Size<br>L×W×H(mm) | Quantity<br>(Pcs/Inner Box) | Outer Carton Size<br>L×W×H(mm) | Quantity<br>(Pcs/Carton) |
|--------------|----------------|-----------------------------|-----------------------------|--------------------------------|--------------------------|
| TO-220C      | Tube Packaging | 560x155x55                  | 1000                        | 570×284×185                    | 5000                     |

## N-Channel Enhanced Shielded Gate Trench Power MOSFET



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

| 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(TS min)<br>-Temperature Max(TS max)<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 (TL)<br>- Time (tL)                                 | 183°C<br>60-150 seconds          | 217°C<br>60-150 seconds          |
| Peak Temperature(TP)                                                                       | 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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