

## Features

- Uses advanced SGT technology
- Extremely low on-resistance  $R_{DS(on)}$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)

## Application

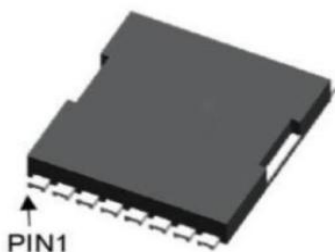
- Motor control and drive
- Battery management
- DC/DC

## Product Summary

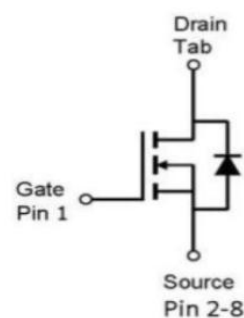
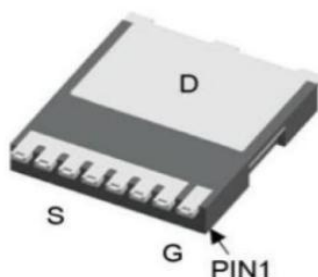
|                             |       |
|-----------------------------|-------|
| Package                     | TOLL  |
| $V_{DS}$                    | 120V  |
| $R_{DS(on)}$ @ $V_{GS}=10V$ | 2.1mΩ |
| $I_D$                       | 220A  |

## Package Marking

TOLL Top View



TOLL Bottom View



| Type         | Package | Marking      | Reel Size  | Tape Width | Packing   | Qty  |
|--------------|---------|--------------|------------|------------|-----------|------|
| LR025N12SM10 | TOLL    | LR025N12SM10 | 330*28.5mm | 24mm       | Reel&Tape | 2000 |

## Maximum Ratings (TC=25°C unless otherwise noted)

| Parameter                                                                                           | Symbol         | Value      | Unit |
|-----------------------------------------------------------------------------------------------------|----------------|------------|------|
| Drain-source voltage                                                                                | $V_{DS}$       | 120        | V    |
| Gate-Source Voltage                                                                                 | $V_{GS}$       | ±20        | V    |
| Continuous drain current<br>$T_c=25^{\circ}C$ (Silicon limit)<br>$T_c=100^{\circ}C$ (Silicon limit) | $I_D$          | 220<br>129 | A    |
| Pulsed Drain Current                                                                                | $I_{DM}$       | 880        | A    |
| Maximum Power Dissipation                                                                           | $P_d$          | 250        | W    |
| Single pulse avalanche energy                                                                       | $E_{AS}$       | 1849       | mJ   |
| Operating Junction and Storage Temperature Range                                                    | $T_J, T_{STG}$ | -55 To 150 | °C   |

## Thermal Characteristic

|                                         |            |     |      |
|-----------------------------------------|------------|-----|------|
| Thermal Resistance,Junction-to-Case     | $R_{thJC}$ | 0.5 | °C/W |
| Thermal resistance, junction-to-ambient | $R_{thJA}$ | 40  |      |

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

| Parameter | Symbol | Condition | min | typ | max | Unit |
|-----------|--------|-----------|-----|-----|-----|------|
|-----------|--------|-----------|-----|-----|-----|------|

### Static Characteristic

|                                  |               |                               |     |     |      |    |
|----------------------------------|---------------|-------------------------------|-----|-----|------|----|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$     | 120 | 132 | -    | V  |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2   | 3.4 | 4    |    |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=120V, V_{GS}=0V$      | -   | -   | 1    | μA |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=\pm 20V, V_{DS}=0V$   | -   | -   | ±100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$  | $I_D=50A, V_{GS}=10V$         | -   | 2.1 | 2.5  | mΩ |
| Forward transconductance         | $g_{fs}$      | $I_D=50A, V_{DS}=5V$          | -   | 159 | -    | S  |

### Dynamic Characteristic

|                              |              |                                            |   |      |   |    |
|------------------------------|--------------|--------------------------------------------|---|------|---|----|
| Input Capacitance            | $C_{iss}$    | $V_{DS}=40V, V_{GS}=0V,$<br>$f=1MHz$       | - | 9318 | - | pF |
| Output Capacitance           | $C_{oss}$    |                                            | - | 2859 | - |    |
| Reverse Transfer Capacitance | $C_{rss}$    |                                            | - | 156  | - |    |
| Gate resistance              | $R_g$        | $f=1MHz$                                   | - | 2.2  | - | Ω  |
| Gate Total Charge            | $Q_G$        | $V_{DS}=60V, I_D=50A,$<br>$V_{GS}=10V$     | - | 144  | - | nC |
| Gate-Source charge           | $Q_{gs}$     |                                            | - | 48   | - |    |
| Gate-Drain charge            | $Q_{gd}$     |                                            | - | 35   | - |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{GS}=10V, V_{DS}=60V,$<br>$R_G=3\Omega$ | - | 58   | - | ns |
| Rise time                    | $t_r$        |                                            | - | 90   | - |    |
| Turn-off delay time          | $t_{d(off)}$ |                                            | - | 102  | - |    |
| Fall time                    | $t_f$        |                                            | - | 91   | - |    |

## Body Diode Characteristic

|                         |          |                                   |   |     |     |    |
|-------------------------|----------|-----------------------------------|---|-----|-----|----|
| Diode Forward Voltage   | $V_{SD}$ | $V_{GS}=0V, I_S=100A$             | - | -   | 1.1 | v  |
| Reverse Recovery Time   | $t_{rr}$ | $I_F=50A$<br>$di/dt = 100A/\mu s$ | - | 85  | -   | ns |
| Reverse Recovery Charge | $Q_{rr}$ |                                   | - | 182 | -   | nC |

## Typical Performance Characteristics

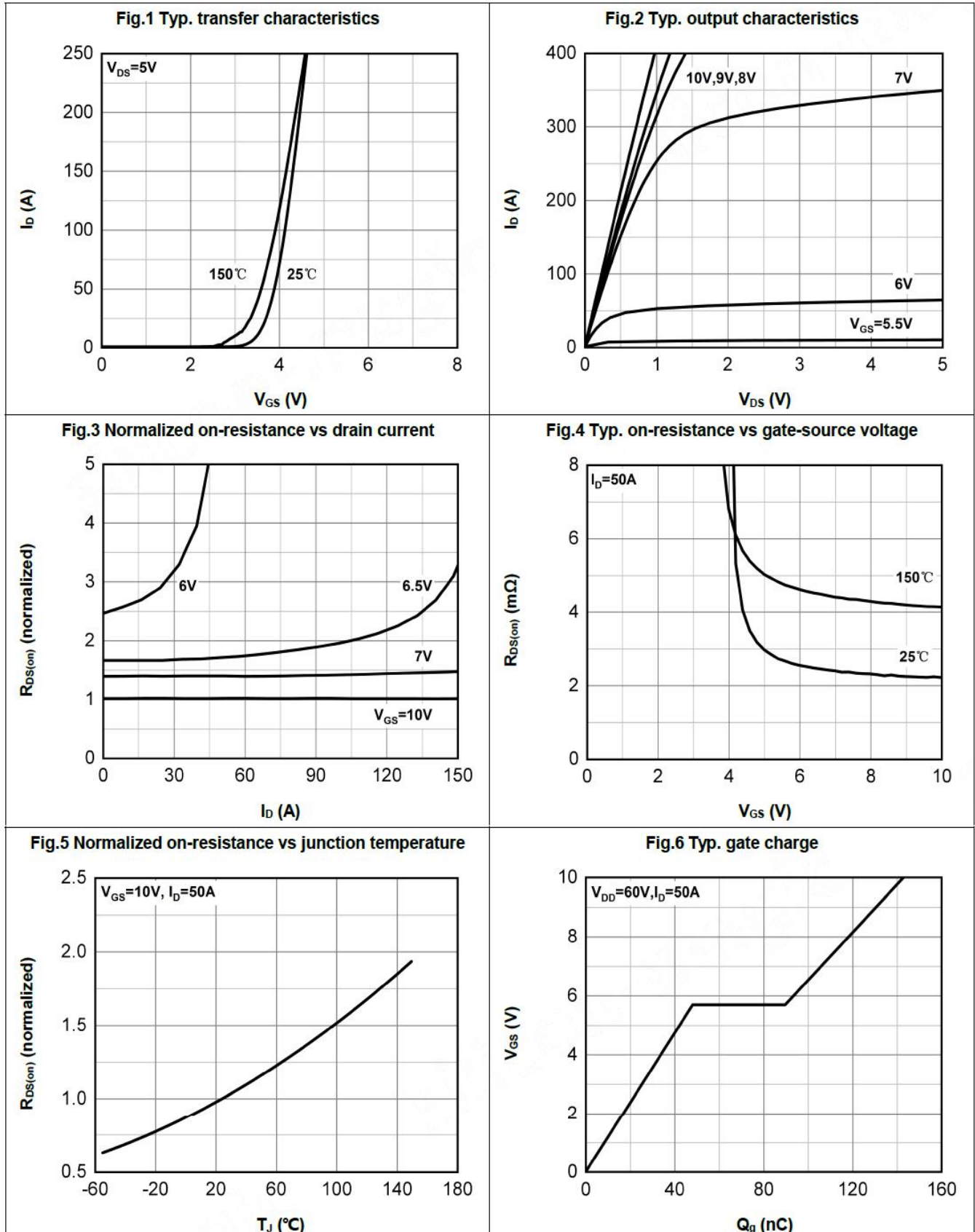


Fig.7 Typ. forward characteristics of body diode

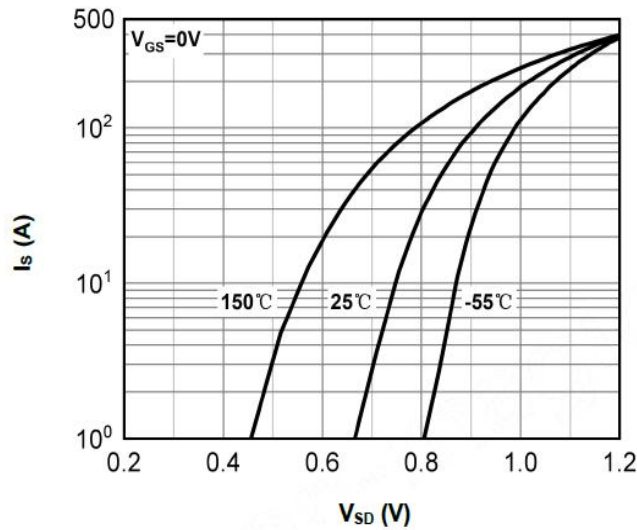


Fig.8 Safe operating area

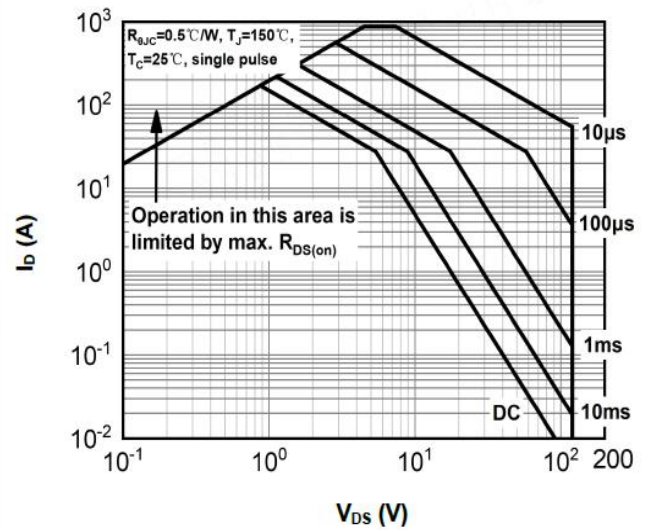


Fig.9 Typ. Capacitance

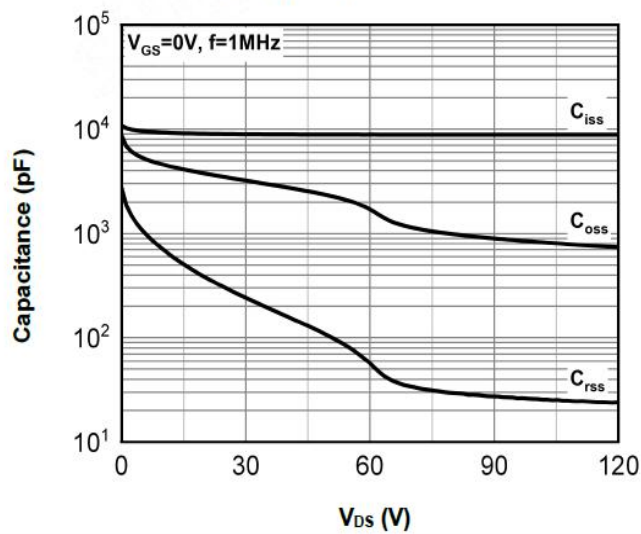


Fig.10 Single pulse maximum power dissipation

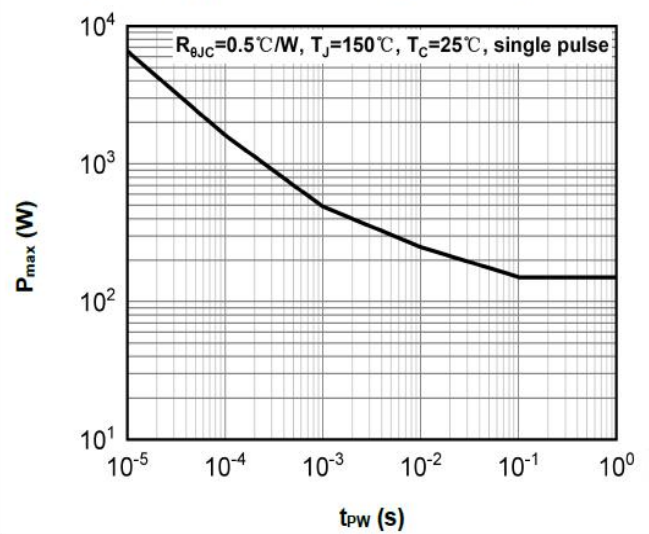


Fig.11 Max. power dissipation vs case temperature

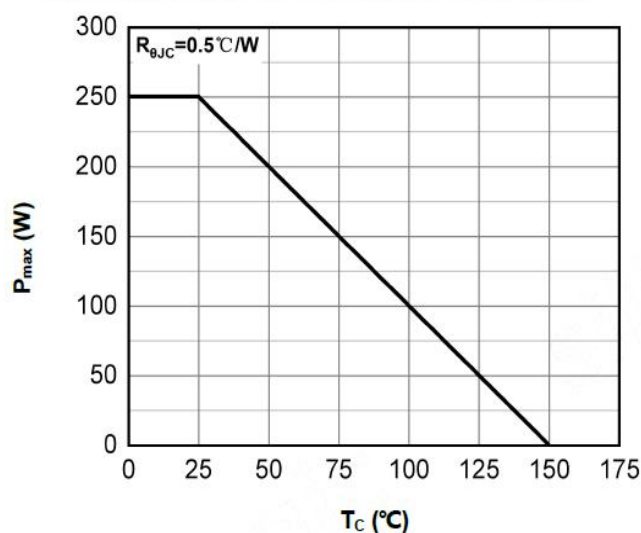
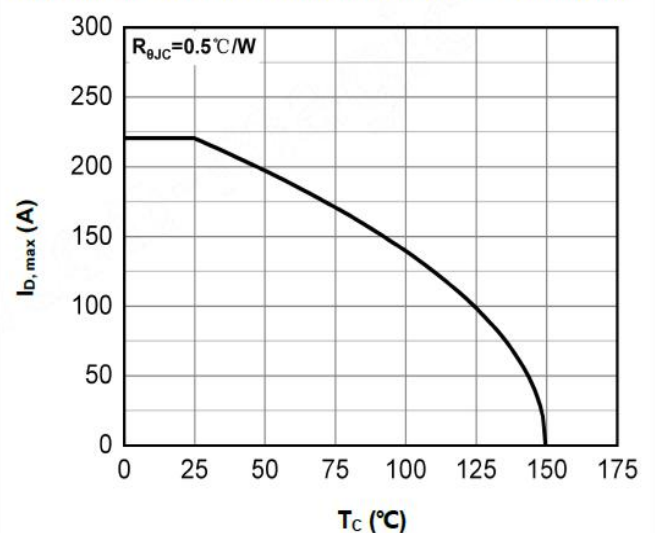
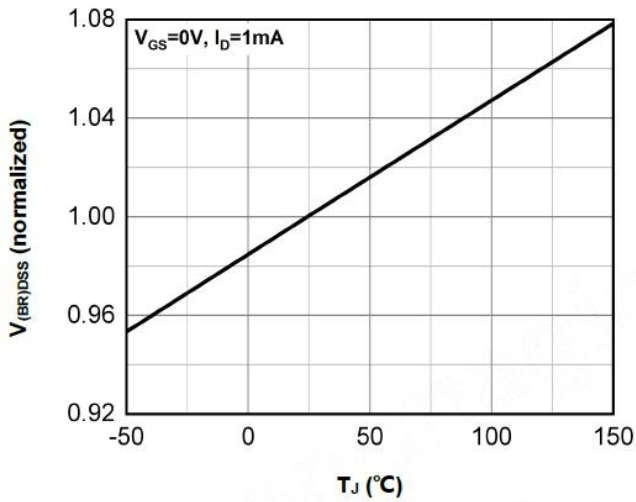


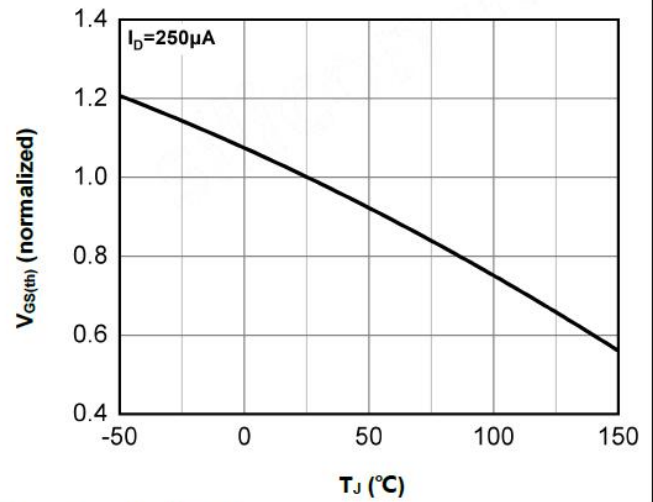
Fig.12 Max. continuous drain current vs case temperature



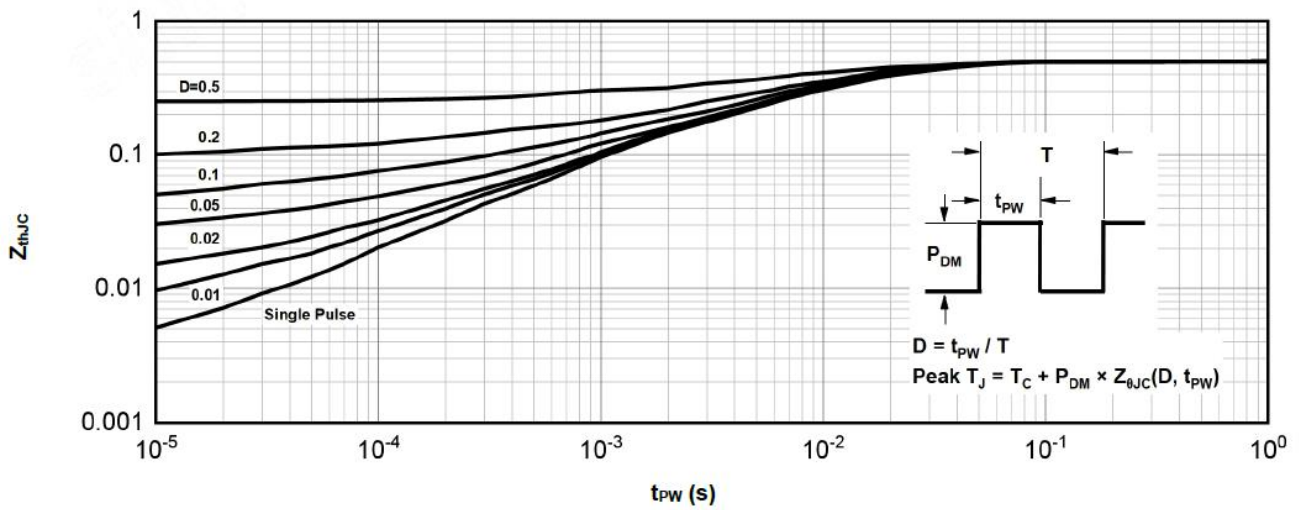
**Fig.13 Normalized  $V_{(BR)DSS}$  vs junction temperature**



**Fig.14 Normalized  $V_{GS(th)}$  vs junction temperature**

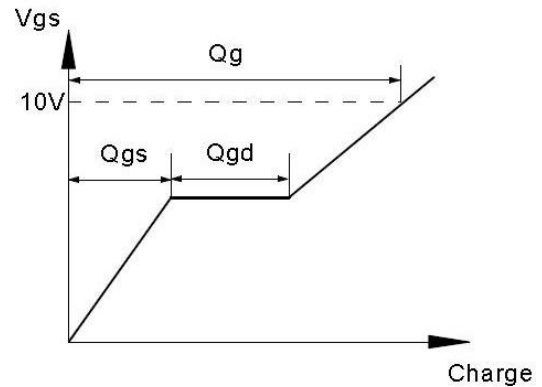
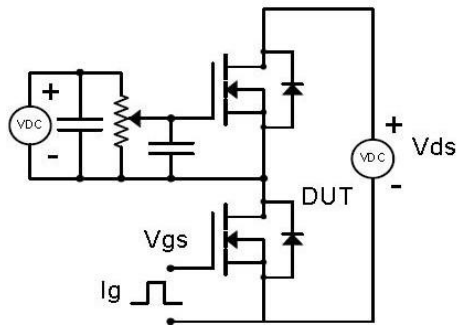


**Fig.15 Transient thermal impedance from junction to case**

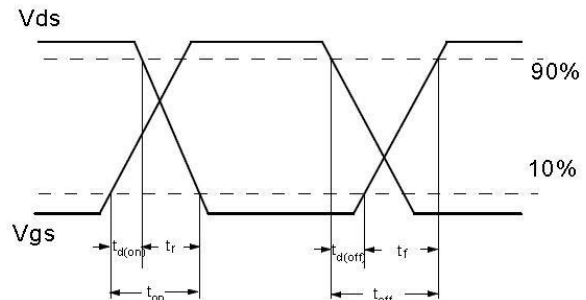
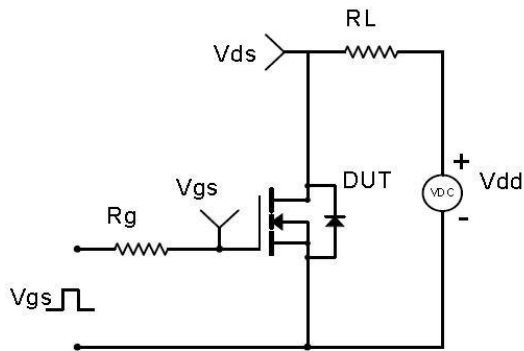


## Test Circuit & Waveform

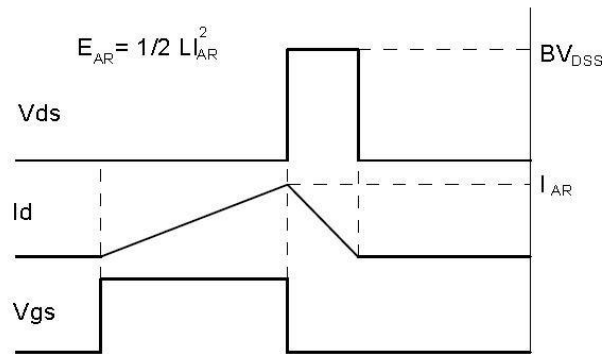
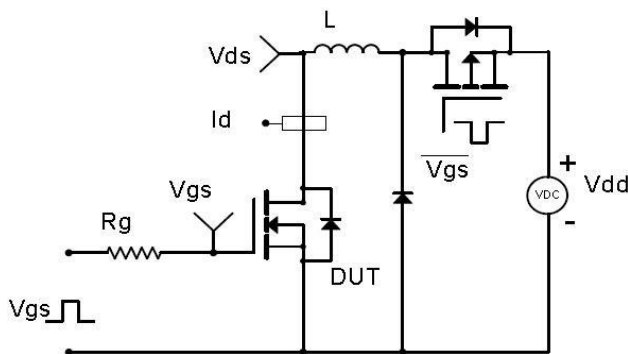
Gate Charge Test Circuit & Waveform



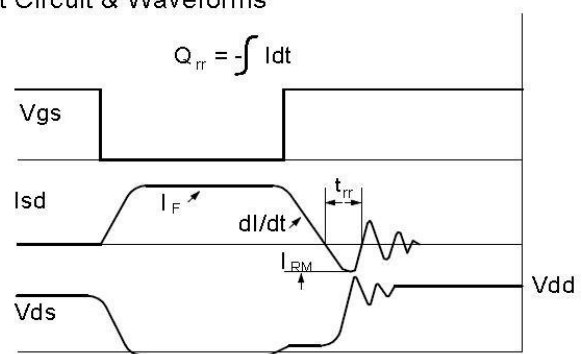
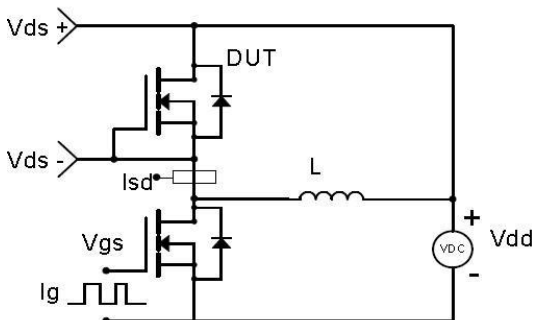
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

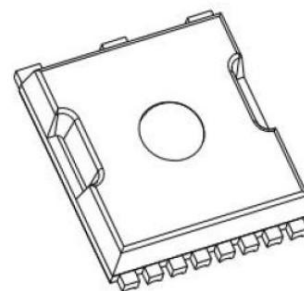
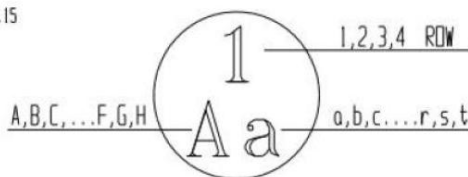
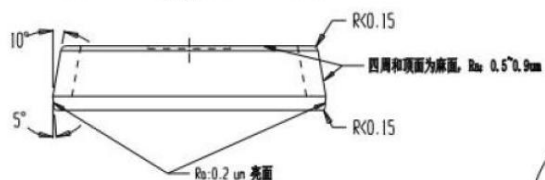
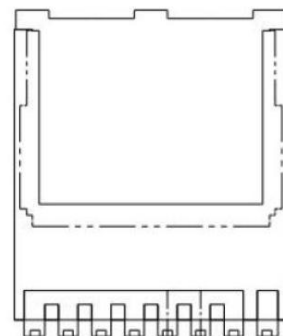
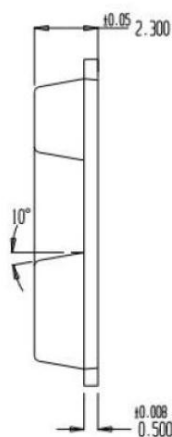


Diode Recovery Test Circuit & Waveforms



Technical drawing of a square metal plate with dimensions and tolerances. The drawing shows a square plate with a central circular hole. The dimensions are as follows:

- Overall width: 9.900  $\pm 0.05$
- Overall height: 11.700  $\pm 0.10$
- Inner width: 9.800  $\pm 0.05$
- Inner height: 10.400  $\pm 0.05$
- Top flange width: 0.700  $\pm 0.10$
- Top flange height: 0.600  $\pm 0.05$
- Side flange width: 0.630  $\pm 0.05$
- Side flange height: 0.300  $\pm 0.05$
- Bottom flange width: 0.700  $\pm 0.10$
- Bottom flange height: 0.600  $\pm 0.05$
- Central hole diameter:  $\varnothing 3.000 \pm 0.03$
- Central hole position: 1.000  $\pm 0.05$
- Central hole label: Aa
- Bottom flange label: 0.750\*2X
- Bottom flange label: 0.700\*6X
- Bottom flange label: 9.200  $\pm 0.025$
- Bottom flange label: (0.35)



**Revision History:**

| Revision | Date      | Major changes                   |
|----------|-----------|---------------------------------|
| 1.0      | 2025/6/6  | Release of Preliminary version. |
| 2.0      | 2025/9/23 | Release of official version.    |