

# TSK110N25M

## 250V N-Channel Power MOSFET

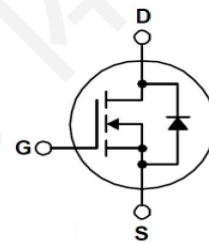
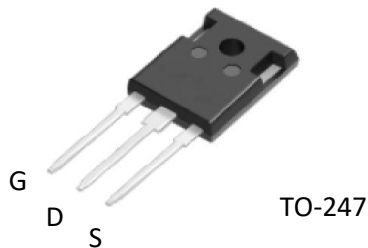
### General Description

This Power MOSFET is produced using Truesemi's advanced planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

### Features

110A,250V,Max.RDS(on)=30mΩ  
@ VGS =10V

- ◆ Drain-Source breakdown voltage: BVDSS=250V (Min.)
- ◆ Low drain-source On resistance: RDS(on)=30mΩ (Max.)
- ◆ 100% avalanche tested
- ◆ RoHS compliant device



### Absolute Maximum Ratings T<sub>c</sub>=25°C unless otherwise specified

| Symbol           | Parameter                                 | Value                  | Units |
|------------------|---|------------------------|-------|
| V <sub>DSS</sub> | Drain-Source Voltage                      | 250                    | V     |
| V <sub>GS</sub>  | Gate-Source Voltage                       | ± 30                   | V     |
| I <sub>D</sub>   | Drain Current *                           | T <sub>C</sub> = 25°C  | 110   |
|                  |   | T <sub>C</sub> = 100°C | 70    |
| I <sub>DM</sub>  | Pulsed Drain Current *                    | 440                    | A     |
| E <sub>AS</sub>  | Single Pulsed Avalanche Energy (Note 2)   | 4500                   | mJ    |
| I <sub>AS</sub>  | Repetitive avalanche current (Note 1)     | 60                     | A     |
| E <sub>AR</sub>  | Repetitive Avalanche Energy (Note 1)      | 69.4                   | mJ    |
| P <sub>D</sub>   | Power Dissipation (T <sub>C</sub> = 25°C) | 694                    | W     |
| T <sub>J</sub>   | Junction temperature                      | 150                    | °C    |
| T <sub>stg</sub> | Storage temperature range                 | -55~150                | °C    |

\* Limited only maximum junction temperature

### Thermal Resistance Characteristics

| Symbol           | Parameter                               | Typ. | Max. | Units |
|------------------|---|------|------|-------|
| R <sub>θJC</sub> | Thermal Resistance, Junction-to-Case    | --   | 0.18 | °C/W  |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | --   | 62.5 | °C/W  |

**Electrical Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**On Characteristics**

|              |                                   |   |     |      |     |            |
|--------------|-----------------------------------|---|-----|------|-----|------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$   | 2.0 | --   | 4.0 | V          |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\ \text{V}, I_D = 55\ \text{A}$ | --  | 25   | 30  | m $\Omega$ |
| $R_g$        | Internal gate resistance          | Open drain, $f=1\ \text{MHz}$               | --  | 0.74 | --  | $\Omega$   |

**Off Characteristics**

|            |                                |  |     |    |           |               |
|------------|--------------------------------|--|-----|----|-----------|---------------|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS} = 0\ \text{V}, I_D = 250\ \mu\text{A}$ | 250 | -- | --        | V             |
| $I_{DSS}$  | Drain-source cut-off current   | $V_{DS}=250\ \text{V}, V_{GS} = 0\ \text{V}$   | --  | -- | 25        | $\mu\text{A}$ |
|            |                                | $V_{DS}=200\ \text{V}, T_c=125^\circ\text{C}$  | --  | -- | 100       | $\mu\text{A}$ |
| $I_{GSS}$  | Gate leakage current           | $V_{DS}=0\ \text{V}, V_{GS}=\pm 30\ \text{V}$  | --  | -- | $\pm 250$ | nA            |

**Dynamic Characteristics**

|           |                              |   |    |       |    |    |
|-----------|------------------------------|---|----|-------|----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\ \text{V}, V_{GS} = 0\ \text{V},$<br>$f = 1.0\ \text{MHz}$ | -- | 10009 | -- | pF |
| $C_{oss}$ | Output Capacitance           |   | -- | 1065  | -- | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |   | -- | 114   | -- | pF |

**Switching Characteristics**

|              |                                |  |    |     |    |    |
|--------------|--------------------------------|--|----|-----|----|----|
| $t_{d(on)}$  | Turn-On Time (Note 3,4)        | $V_{DD}=125\ \text{V}, I_D = 55\ \text{A},$<br>$R_G = 25\ \Omega$      | -- | 104 | -- | ns |
| $t_r$        | Turn-On Rise Time (Note 3,4)   |  | -- | 49  | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time (Note 4,5) |  | -- | 552 | -- | ns |
| $t_f$        | Turn-Off Fall Time (Note 3,4)  |  | -- | 71  | -- | ns |
| $Q_g$        | Total Gate Charge (Note 3,4)   | $V_{DS}=200\ \text{V}, I_D = 55\ \text{A},$<br>$V_{GS} = 10\ \text{V}$ | -- | 202 | -- | nC |
| $Q_{gs}$     | Gate-Source Charge (Note 3,4)  |  | -- | 45  | -- | nC |
| $Q_{gd}$     | Gate-Drain Charge (Note 3,4)   |  | -- | 65  | -- | nC |

**Source-Drain Diode Maximum Ratings and Characteristics**

|          |   |  |    |      |     |               |
|----------|---|--|----|------|-----|---------------|
| $I_S$    | Continuous Source-Drain Diode Forward Current | --   | -- | 110  | A   |               |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current     | --   | -- | 440  |     |               |
| $V_{SD}$ | Source-Drain Diode Forward Voltage            | $I_S = 55\ \text{A}, V_{GS} = 0\ \text{V}$   | -- | --   | 1.5 | V             |
| $t_{rr}$ | Reverse Recovery Time                         | $I_S = 55\ \text{A}, V_{GS} = 0\ \text{V}$<br>$di_F/dt = -100\ \text{A}/\mu\text{s}$ | -- | 279  | --  | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                       | (Note 3, 4)  | -- | 3.17 | --  | $\mu\text{C}$ |

**NOTES:**

1. Repeated rating: Pulse width limited by safe operating area
2.  $L=2\ \text{mH}, I_{AS}=60\ \text{A}, V_{DD}=50\ \text{V}, R_G=25\ \Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse test: Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
4. Essentially independent of operating temperature typical characteristics

Typical Characteristics Curve

Fig. 1 Typical Output Characteristics

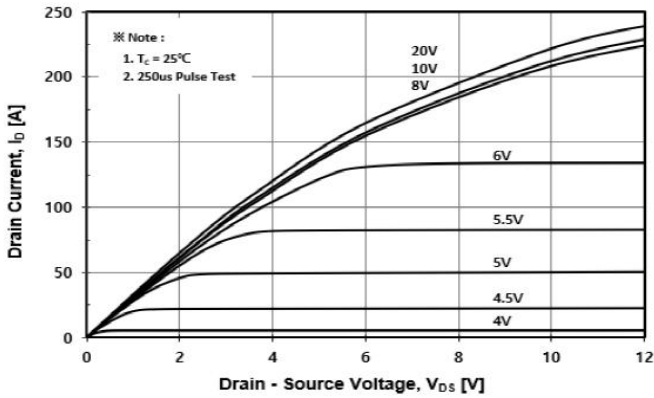


Fig. 2 Typical Transfer Characteristics

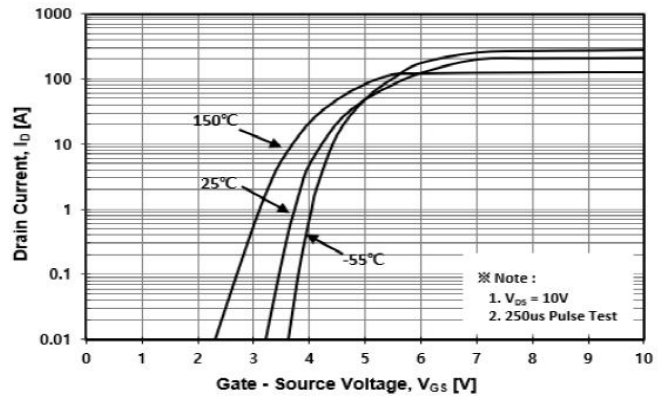


Fig. 3 On-Resistance Variation with Drain Current and Gate Voltage

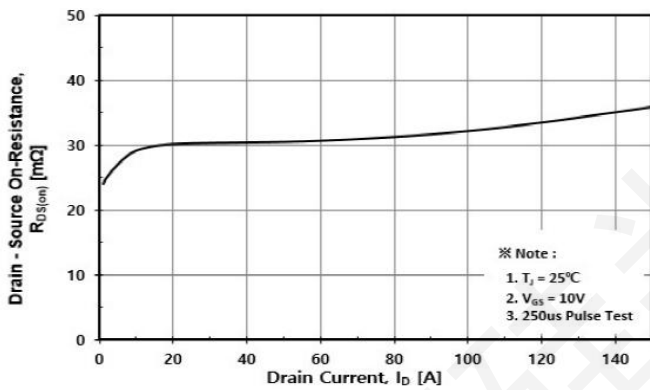


Fig. 4 Body Diode Forward Voltage Variation with Source Current

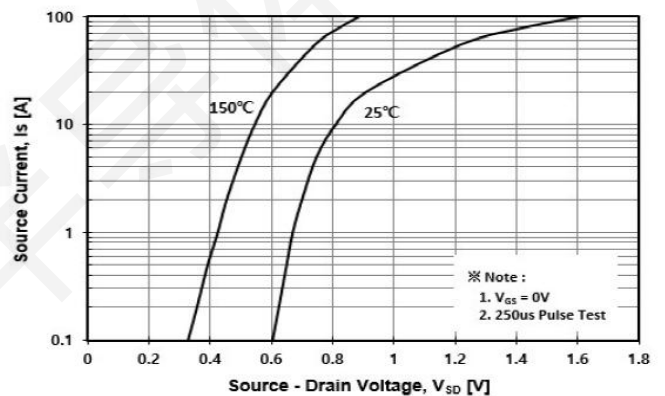


Fig. 5 Typical Capacitance Characteristics

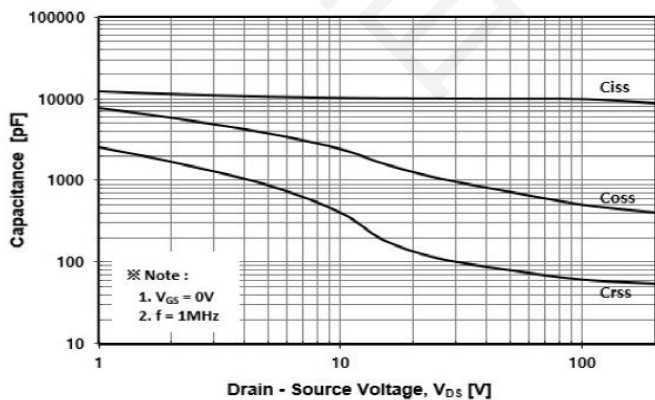
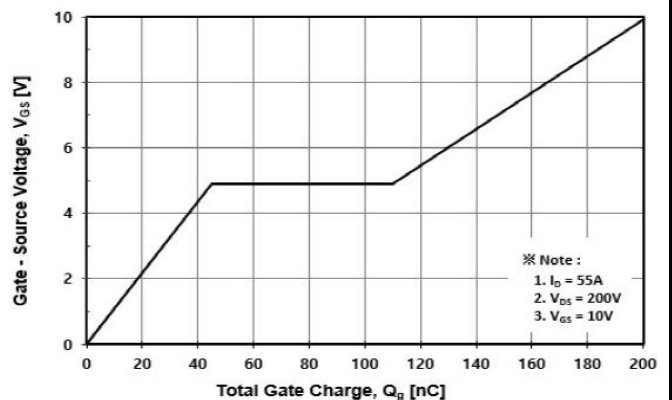


Fig. 6 Typical Total Gate Charge Characteristics



Typical Characteristics Curve (Continue)

Fig. 7 Breakdown Voltage Variation vs. Temperature

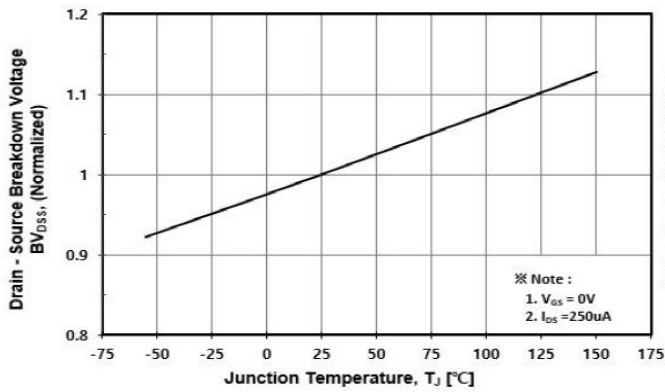


Fig. 8 On-Resistance Variation vs. Temperature

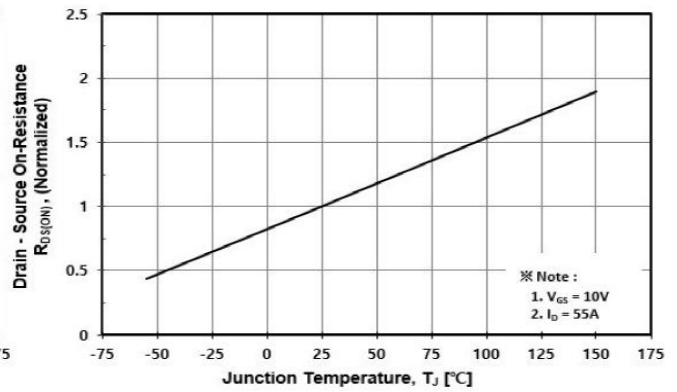


Fig. 9 Maximum Drain Current vs. Case Temperature

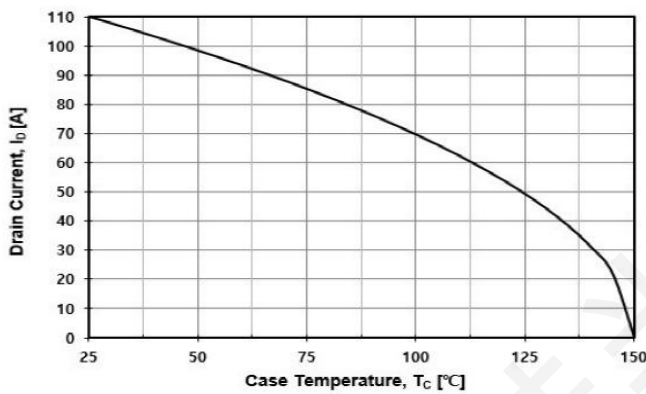


Fig. 10 Maximum Safe Operating Area

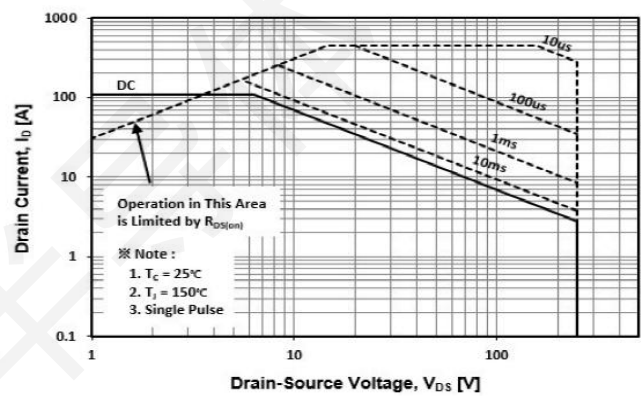


Fig. 11 Transient Thermal Impedance

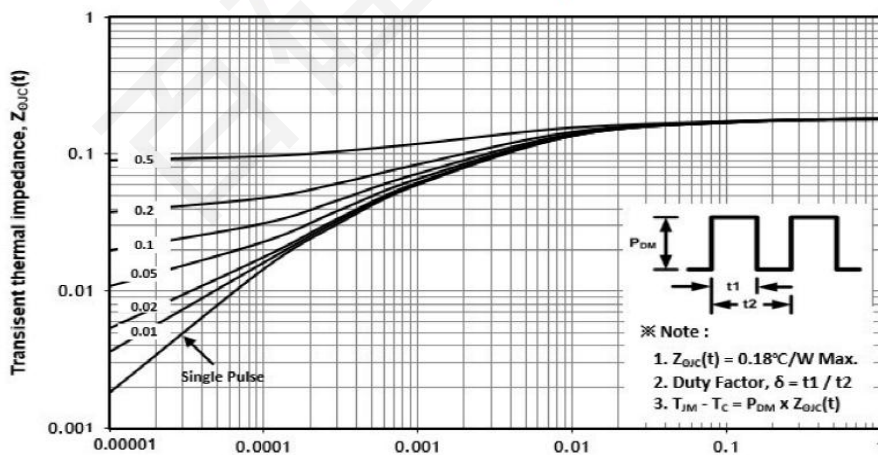


Fig. 12 Gate Charge Test Circuit & Waveform

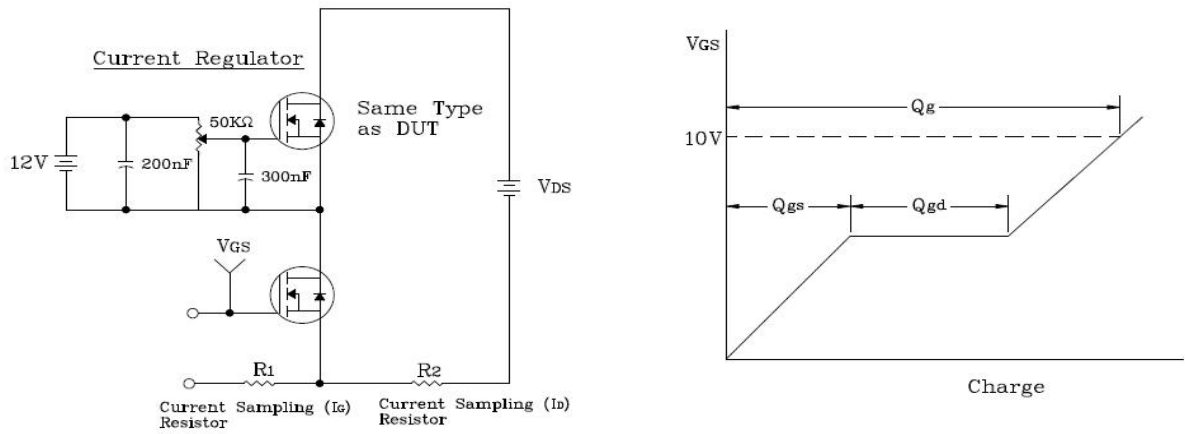


Fig. 13 Resistive Switching Test Circuit & Waveform

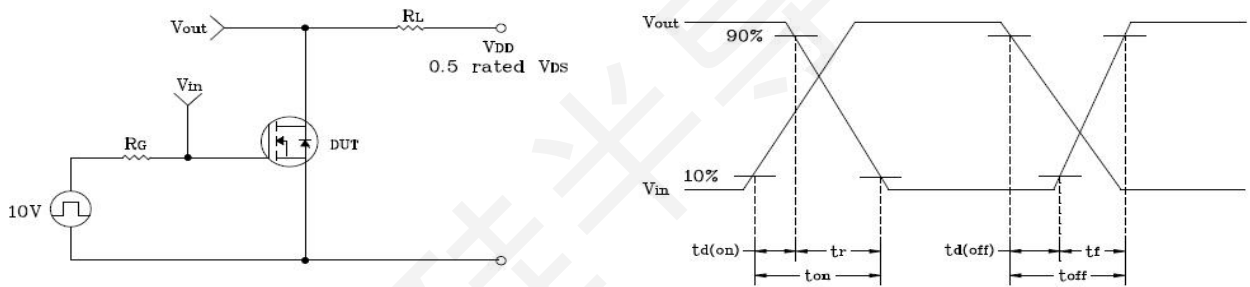


Fig. 14 E<sub>AS</sub> Test Circuit & Waveform

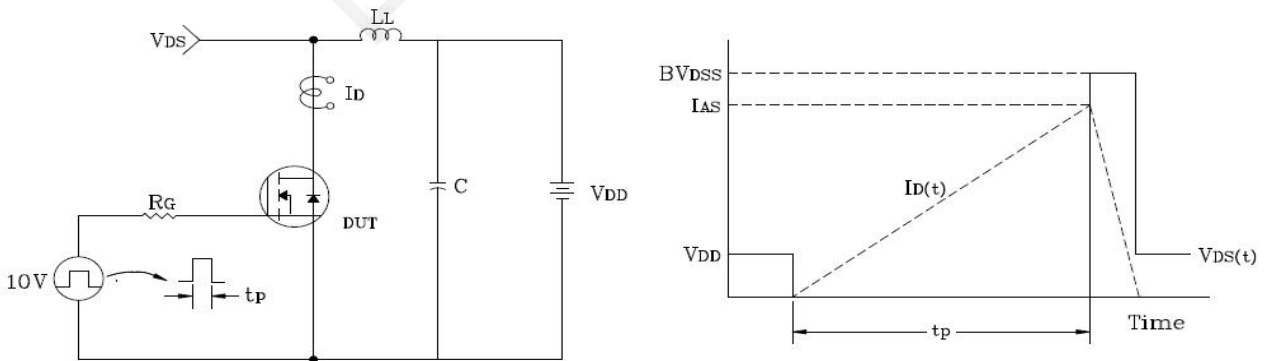


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform

