

# TSP40N25M

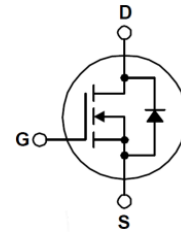
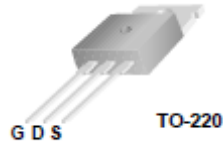
## 250V N-Channel MOSFET

### 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. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

### Features

- 40A,250V,Max.RDS(on)=85mΩ @ VGS=10V
- Low gate charge:Qg=62nC (Typ.)
- Low reverse transfer capacitance: Crss=40pF (Typ.)
- Lower EMI noise
- 100% avalanche tested
- RoHS compliant device



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

| Symbol                            | Parameter                               | TSP40N25M              | 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  | 40    |
|                                   |   | T <sub>C</sub> = 100°C | 25.3  |
| I <sub>DM</sub>                   | Pulsed Drain Current (Note 1)           | 160                    | A     |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2) | 1000                   | mJ    |
| I <sub>AR</sub>                   | Repetitive avalanche current (Note 1)   | 40                     | A     |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)    | 5.8                    | mJ    |
| P <sub>D</sub>                    | Power Dissipation                       | 160                    | W     |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range | -55 to +150            | °C    |

\* Drain current limited by maximum junction temperature.

### Thermal Resistance Characteristics

| Symbol           | Parameter                              | Rating   | Units |
|------------------|--|----------|-------|
| R <sub>θJC</sub> | Thermal Resistance,Junction-to-Case    | Max.0.78 | °C/W  |
| R <sub>θJA</sub> | Thermal Resistance,Junction-to-Ambient | Max.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**

|              |                                   |   |     |    |     |            |
|--------------|-----------------------------------|---|-----|----|-----|------------|
| $V_{GS}$     | 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 | $V_{GS} = 10 \text{ V}, I_D = 20 \text{ A}$ | --  | 70 | 85  | m $\Omega$ |

**Off Characteristics**

|                                |   |  |     |    |      |                     |
|--------------------------------|---|--|-----|----|------|---------------------|
| $BV_{DSS}$                     | Drain-Source Breakdown Voltage            | $V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$              | 250 | -- | --   | V                   |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | 1  | --   | V/ $^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 250 \text{ V}, V_{GS} = 0 \text{ V}$             | --  | -- | 10   | $\mu\text{A}$       |
|                                |   | $V_{DS} = 250 \text{ V}, T_J = 125^\circ\text{C}$          | --  | -- | 100  | $\mu\text{A}$       |
| $I_{GSSF}$                     | Gate-Body Leakage Current, Forward        | $V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$              | --  | -- | 100  | nA                  |
| $I_{GSSR}$                     | Gate-Body Leakage Current, Reverse        | $V_{GS} = -20 \text{ V}, V_{DS} = 0 \text{ V}$             | --  | -- | -100 | nA                  |

**Dynamic Characteristics**

|           |                              |   |    |      |    |    |
|-----------|------------------------------|---|----|------|----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$<br>$f = 1.0 \text{ MHz}$ | -- | 2704 | -- | pF |
| $C_{oss}$ | Output Capacitance           |   | -- | 325  | -- | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |   | -- | 40   | -- | pF |

**Switching Characteristics**

|              |                     |  |    |     |    |    |
|--------------|---------------------|--|----|-----|----|----|
| $t_{d(on)}$  | Turn-On Time        | $V_{DS} = 125 \text{ V}, I_D = 20 \text{ A},$<br>$R_G = 25 \Omega$<br><br>(Note 3,4)       | -- | 42  | -- | ns |
| $t_r$        | Turn-On Rise Time   |  | -- | 26  | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |  | -- | 155 | -- | ns |
| $t_f$        | Turn-Off Fall Time  |  | -- | 32  | -- | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 125 \text{ V}, I_D = 20 \text{ A},$<br>$V_{GS} = 10 \text{ V}$<br><br>(Note 3,4) | -- | 62  | -- | nC |
| $Q_{gs}$     | Gate-Source Charge  |  | -- | 16  | -- | nC |
| $Q_{gd}$     | Gate-Drain Charge   |  | -- | 18  | -- | nC |

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

|          |   |  |    |      |     |               |
|----------|---|--|----|------|-----|---------------|
| $I_S$    | Continuous Source-Drain Diode Forward Current | --   | -- | 40   | A   |               |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current     | --   | -- | 160  |     |               |
| $V_{SD}$ | Source-Drain Diode Forward Voltage            | $I_S = 40 \text{ A}, V_{GS} = 0 \text{ V}$       | -- | --   | 1.4 | V             |
| $t_{rr}$ | Reverse Recovery Time                         | $I_S = 20 \text{ A}, V_{GS} = 0 \text{ V}$       | -- | 167  | --  | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                       | $di_F/dt = 100 \text{ A}/\mu\text{s}$ (Note 3,4) | -- | 1.25 | --  | $\mu\text{C}$ |

**NOTES:**

1. Repetitive Rating: Pulse width limited by safe operating area
2.  $L=1\text{mH}, I_{AS}=40\text{A}, V_{DD}=50\text{V}, R_G=25 \Omega$ , 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 Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

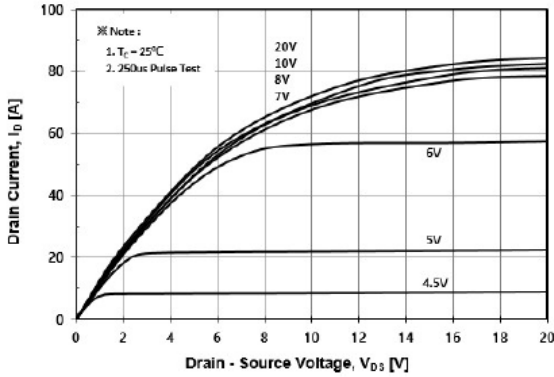


Fig. 2 Typical Transfer Characteristics

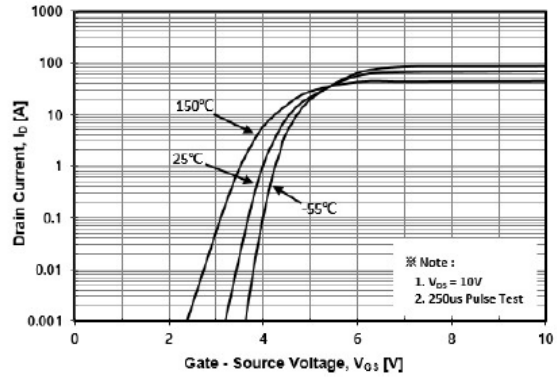


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

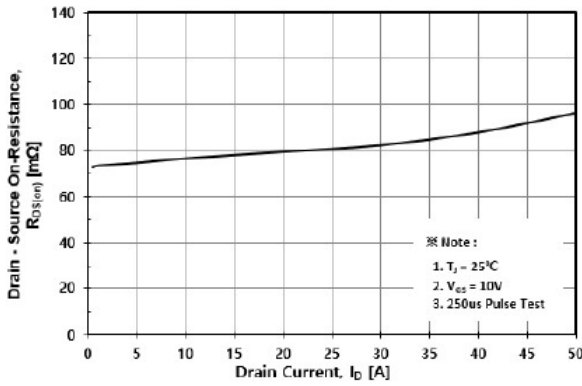


Fig. 4 Body Diode Forward Voltage Variation with Source Current

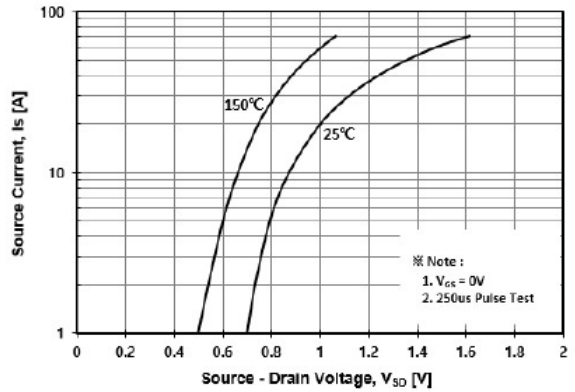


Fig. 5 Typical Capacitance Characteristics

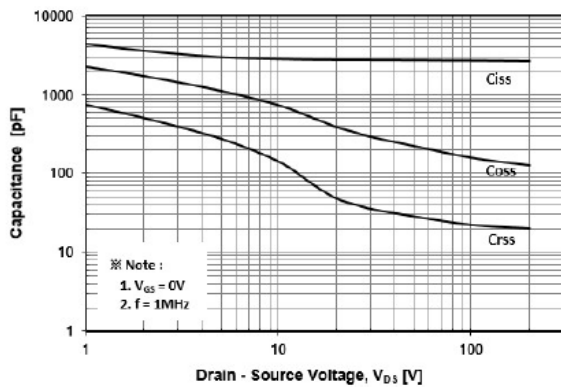
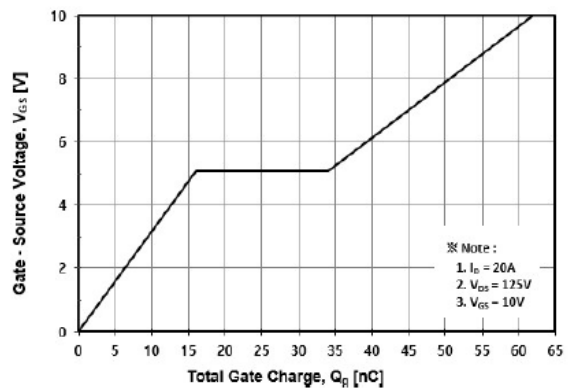


Fig. 6 Typical Total Gate Charge Characteristics



# Typical Electrical Characteristics Curves

Fig. 7 Breakdown Voltage Variation vs. Temperature

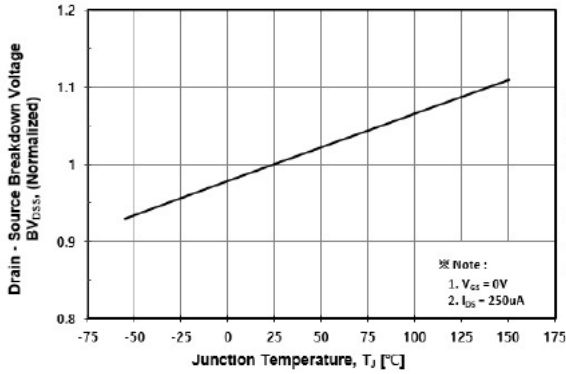


Fig. 8 On-Resistance Variation vs. Temperature

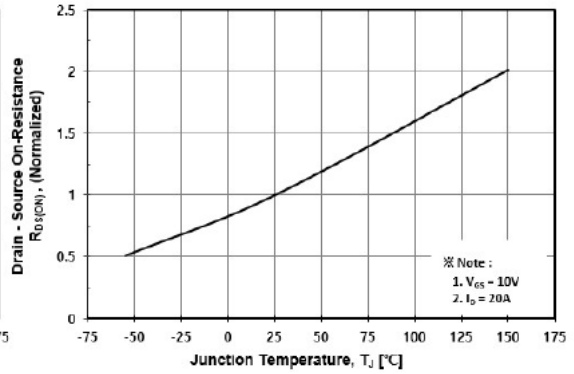


Fig. 9 Maximum Drain Current vs. Case Temperature

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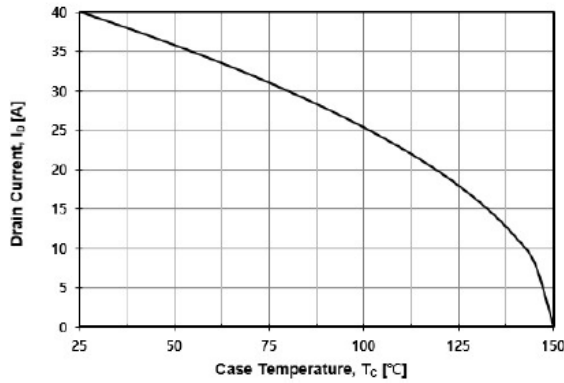


Fig. 10 Maximum Safe Operating Area

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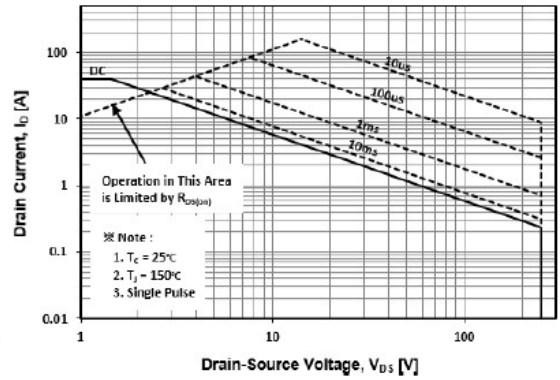
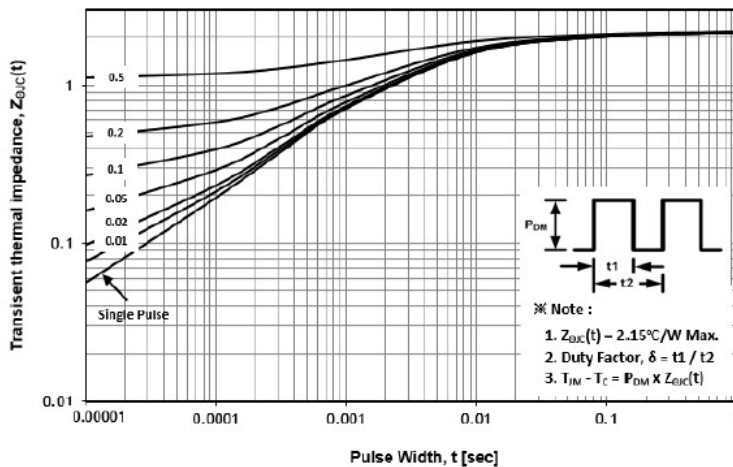
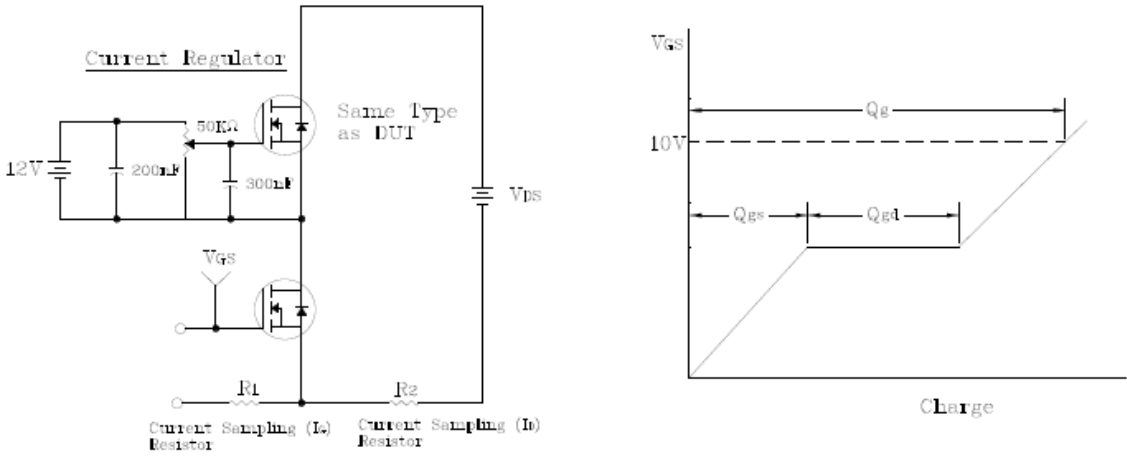


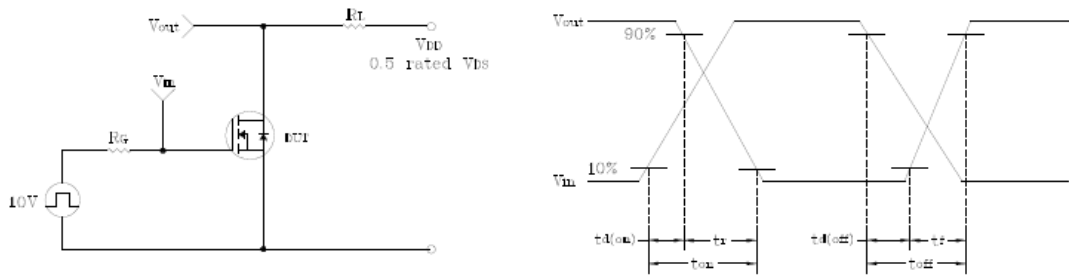
Fig. 11 Transient Thermal Impedance



**Fig. 12 Gate Charge Test Circuit & Waveform**



**Fig. 13 Resistive Switching Test Circuit & Waveform**



**Fig. 14 EAS Test Circuit & Waveform**

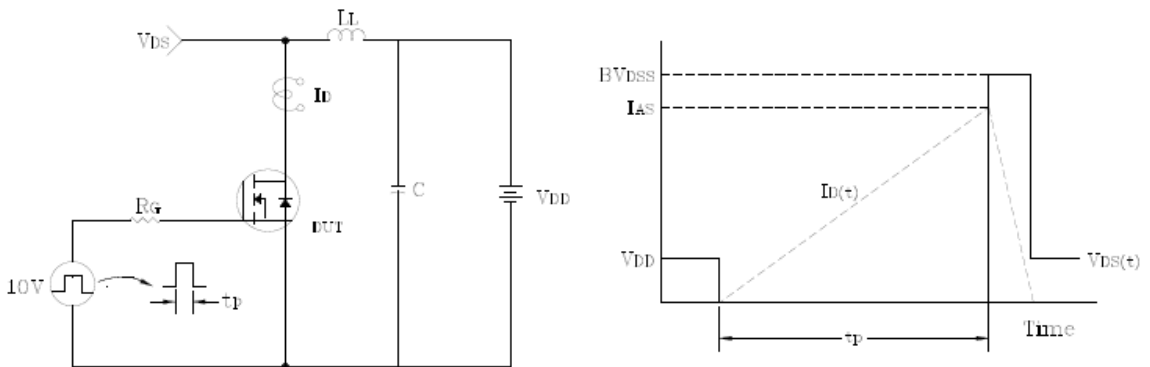
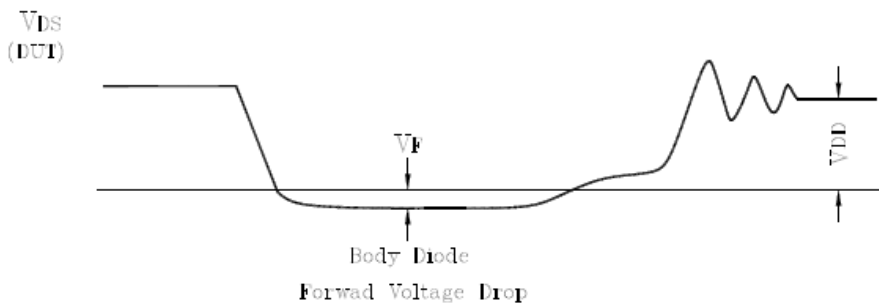
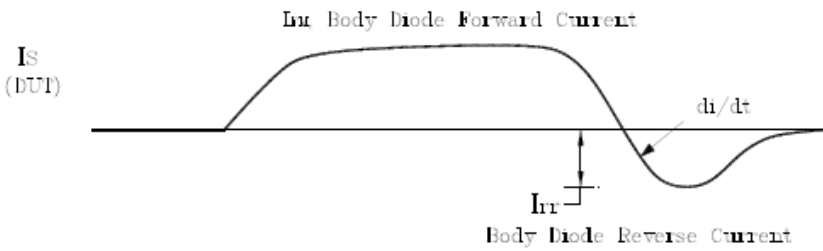
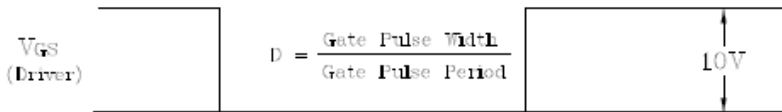
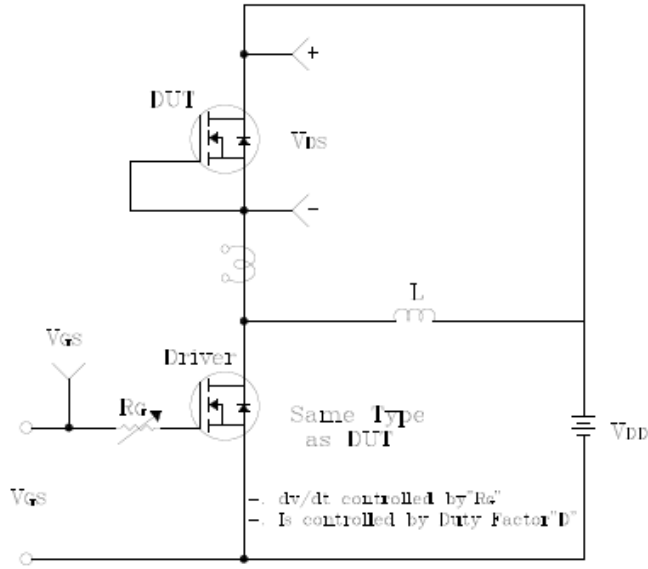


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



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