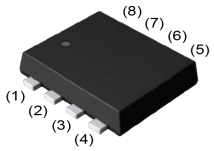
## Features

- **N Channel (Integrated Schottky Diode)**
  30V/7A,
  $R_{DS(ON)}$ = 22mΩ (typ.) @ $V_{GS}$ = 10V
  $R_{DS(ON)}$ = 35mΩ (typ.) @ $V_{GS}$ = 4.5V
- **P Channel**
  -30V/-5.5A,
  $R_{DS(ON)}$ = 37mΩ (typ.) @ $V_{GS}$ =-10V
  $R_{DS(ON)}$ = 55mΩ (typ.) @ $V_{GS}$ =-4.5V
- 100% UIS + $R_g$ Tested
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

## Applications

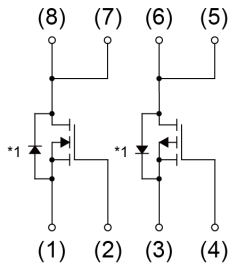
- Synchronous Rectification.
- Motor Control.
- Fan Application.

## Pin Description




Top View of TSMT8

(1) Tr1 (Nch) Source
(2) Tr1 (Nch) Gate
(3) Tr2 (Pch) Source
(4) Tr2 (Pch) Gate
(5) Tr2 (Pch) Drain
(6) Tr2 (Pch) Drain
(7) Tr1 (Nch) Drain
(8) Tr1 (Nch) Drain
*1 Body Diode



## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | | N Channel | P Channel | Unit |
|---|---|---|---|---|---|
| **Common Ratings** | | | | | |
| $V_{DSS}$ | Drain-Source Voltage | | 30 | -30 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | ±20 | |
| $T_J$ | Maximum Junction Temperature | | 150 | | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | | |
| $I_S$ | Diode Continuous Forward Current | $T_A$=25°C | 7 | -5.5 | A |
| $I_D$ | Continuous Drain Current | $T_A$=25°C | 7 | -5.5 | |
| $I_{DM}$ [a] | Pulsed Drain Current | $T_A$=25°C | 21 | -16.5 | |
| $P_D$ | Power Dissipation | $T_A$=25°C | 2 [d] | 2 [d] | W |
| | | $T_A$=70°C | 1.3 [d] | 1.3 [d] | |
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | t ≤ 10s | 60 | 60 | °C/W |
| | | Steady State [b] | 90 | 90 | |
| $I_{AS}$ [c] | Avalanche Current, Single pulse | L=0.1mH | 13 | 16 | A |
| $E_{AS}$ [c] | Avalanche Energy, Single pulse | L=0.1mH | 8 | 13 | mJ |

Note a：Pulse width limited by max. junction temperature.
Note b：$R_{\theta JA}$ steady state t=100s. $R_{\theta JA}$ is measured with the device mounted on 1in$^2$，FR-4 board with 2oz. Copper.
Note c：UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature $T_j$=25°C).
Note d：t < 10s.

## N Channel Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | N Channel | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250μA | 30 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=24V, $V_{GS}$=0V | - | - | 1 | μA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250μA | 1.2 | 1.7 | 2.2 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| $R_{DS(ON)}$ [e] | Drain-Source On-state Resistance | $V_{GS}$=10V, $I_{DS}$=4A | - | 22 | 29 | mΩ |
| | | $V_{GS}$=4.5V, $I_{DS}$=4A | - | 35 | 46 | |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [e] | Diode Forward Voltage | $I_{SD}$=1A, $V_{GS}$=0V | - | 0.41 | 0.6 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$=4A, $dI_{SD}/dt$=100A/μs | - | 9.8 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 3 | - | nC |
| **Dynamic Characteristics** [f] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,F=1MHz | - | 2.7 | - | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, Frequency=1.0MHz | - | 405 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 105 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 45 | - | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=15V, $R_L$=15Ω, $I_{DS}$=1A, $V_{GEN}$=10V, $R_G$=6Ω | - | 5.2 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 10.2 | - | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | - | 15.2 | - | |
| $t_f$ | Turn-off Fall Time | | - | 3.6 | - | |
| **Gate Charge Characteristics** [f] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=4.5V, $I_{DS}$=4A | - | 4.2 | - | nC |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=10V, $I_{DS}$=4A | - | 8.82 | - | |
| $Q_{gs}$ | Gate-Source Charge | | - | 1.69 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 1.56 | - | |
| $Q_{gth}$ | Threshold Gate Charge | | - | 0.78 | - | |

Note e Pulse test ; pulse width≤300μs, duty cycle≤2%.
Note f : Guaranteed by design, not subject to production testing.
:

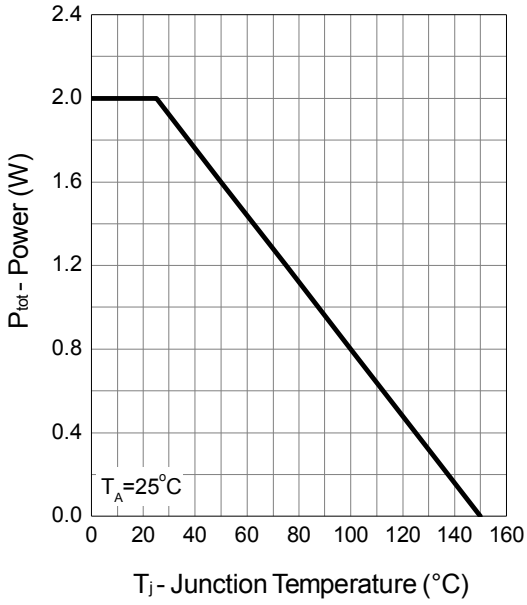
## P Channel Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | P Channel | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=-250μA | -30 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=-24V, $V_{GS}$=0V | - | - | -1 | μA |
| | | $T_J$=85°C | - | - | -30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ , $I_{DS}$=-250μA | -1.2 | -1.7 | -2.2 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| $R_{DS(ON)}$ [e] | Drain-Source On-state Resistance | $V_{GS}$=-10V, $I_{DS}$=-4A | - | 37 | 48 | mΩ |
| | | $V_{GS}$=-4.5V, $I_{DS}$=-3A | - | 55 | 72 | |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [e] | Diode Forward Voltage | $I_{DS}$=-1.2A, $V_{GS}$=0V | - | -0.8 | -1 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$=-4A, $dI_{SD}/dt$=100A/μs | - | 14 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 8 | - | nC |
| **Dynamic Characteristics** [f] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,F=1MHz | - | 3.4 | - | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=-15V, Frequency=1.0MHz | - | 580 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 105 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 80 | - | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=-15V, $R_L$=15Ω, $I_{DS}$=-1A, $V_{GEN}$=-4.5V, $R_G$=1Ω | - | 9 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 11 | - | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | - | 23 | - | |
| $t_f$ | Turn-off Fall Time | | - | 11 | - | |
| **Gate Charge Characteristics** [f] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-15V, $V_{GS}$=-4.5V, $I_{DS}$=-4A | - | 6.7 | - | nC |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-15V, $V_{GS}$=-10V, $I_{DS}$=-4A | - | 13.5 | - | |
| $Q_{gs}$ | Gate-Source Charge | | - | 2 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 2.9 | - | |
| $Q_{gth}$ | Threshold Gate Charge | | - | 1 | - | |

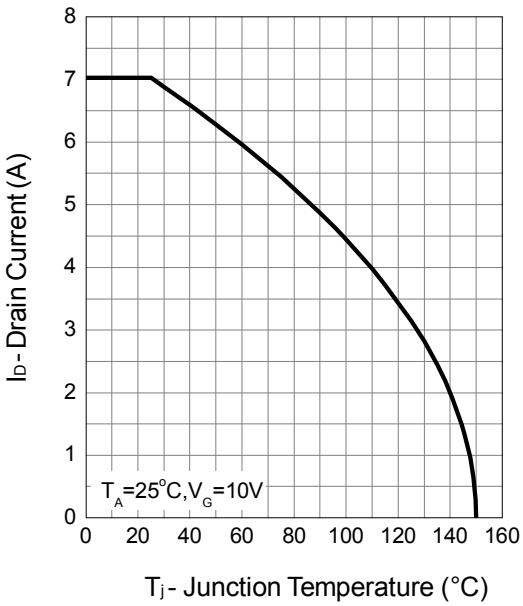
Note e Pulse test; pulse width≤300μs, duty cycle≤2%.
Note f : Guaranteed by design, not subject to production testing.
:

## N Channel Typical Operating Characteristics

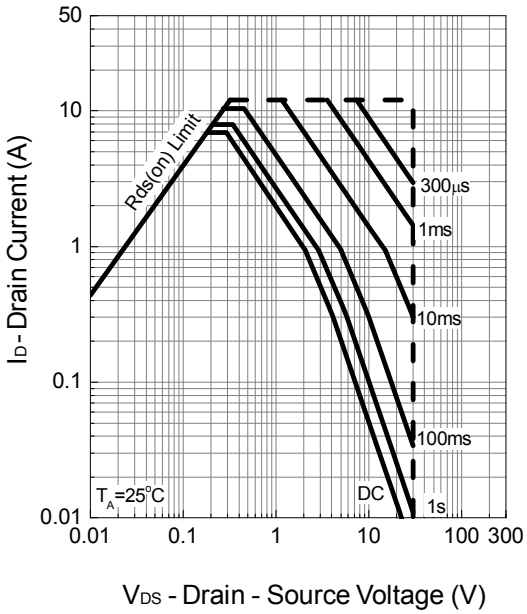
**Power Dissipation**



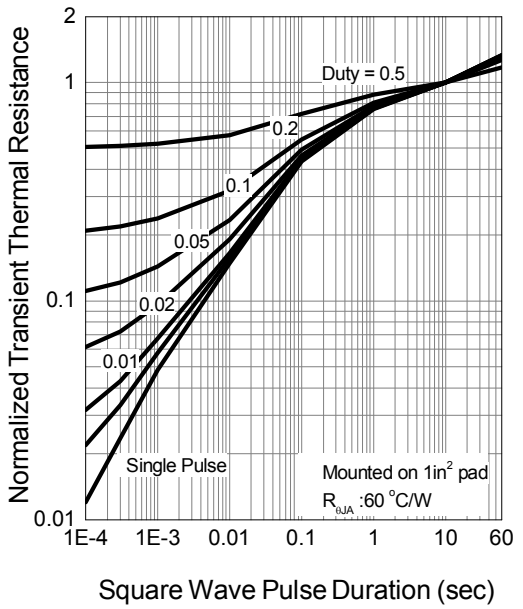

**Drain Current**




**Safe Operation Area**

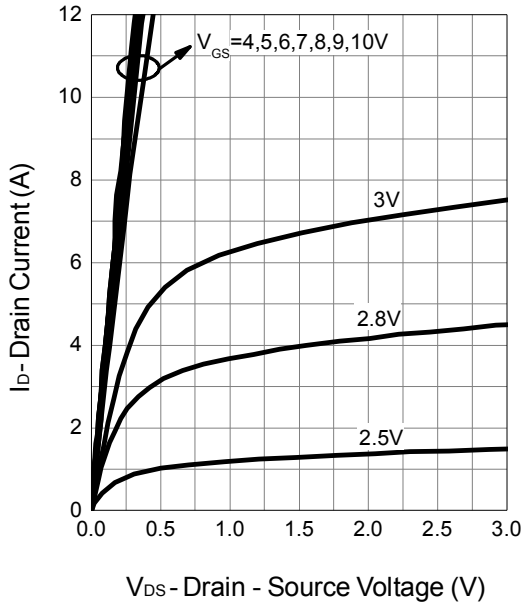



**Thermal Transient Impedance**

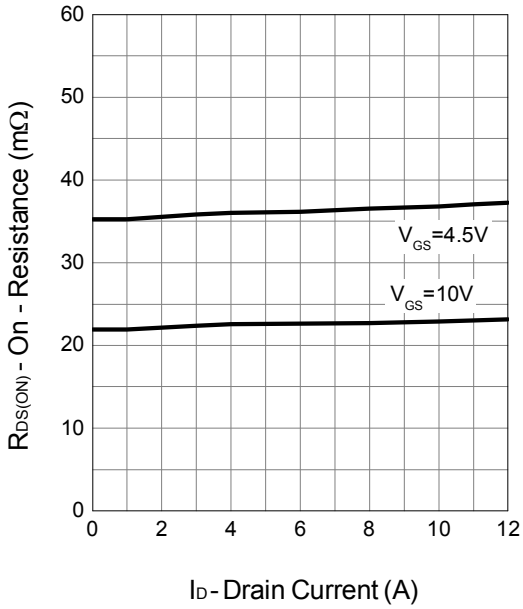


## N Channel Typical Operating Characteristics (Cont.)

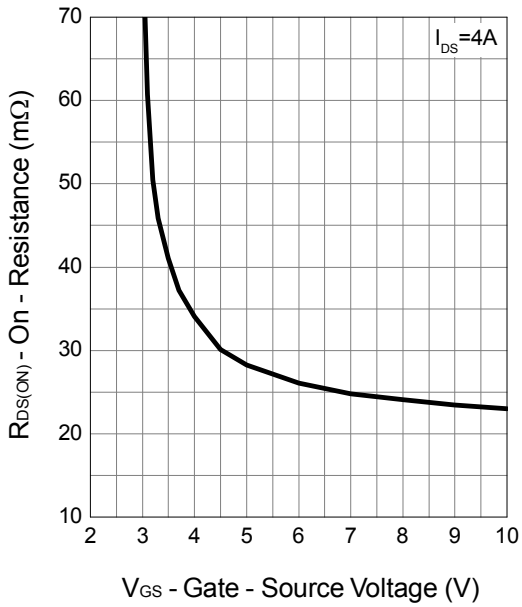
**Output Characteristics**



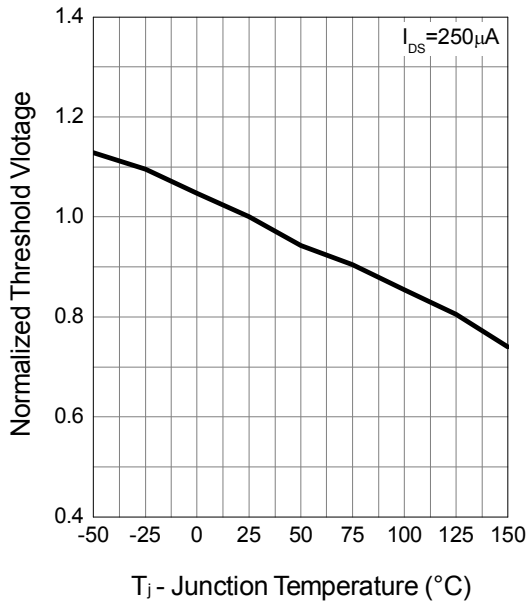

**Drain-Source On Resistance**




**Gate-Source On Resistance**

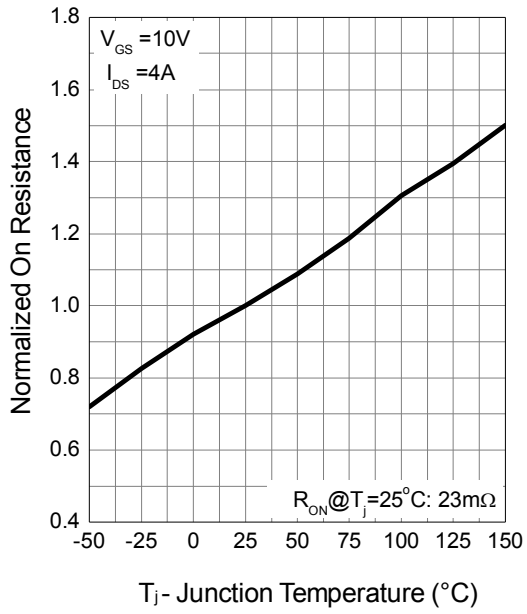



**Gate Threshold Voltage**

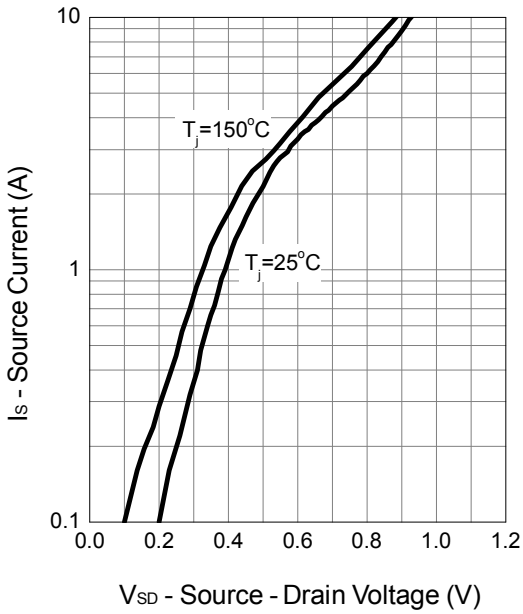


## N Channel Typical Operating Characteristics (Cont.)

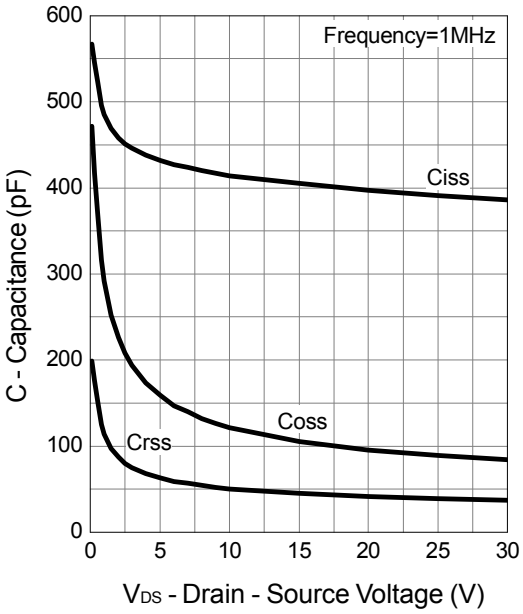
**Drain-Source On Resistance**



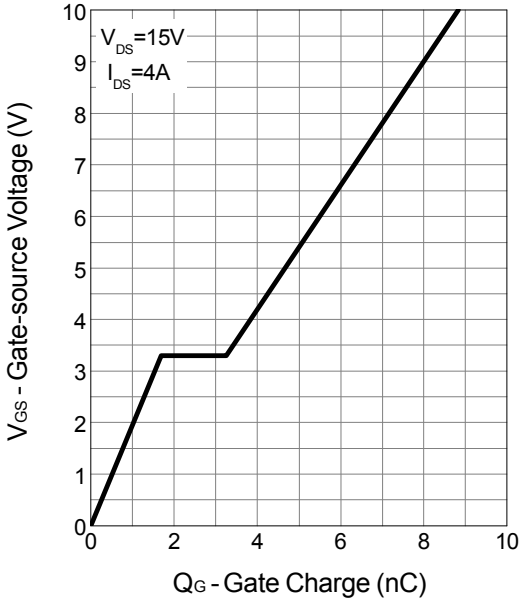

**Source-Drain Diode Forward**



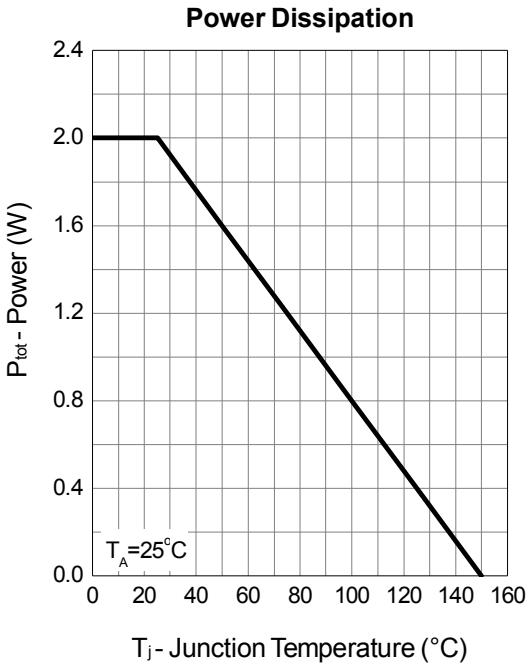

**Capacitance**

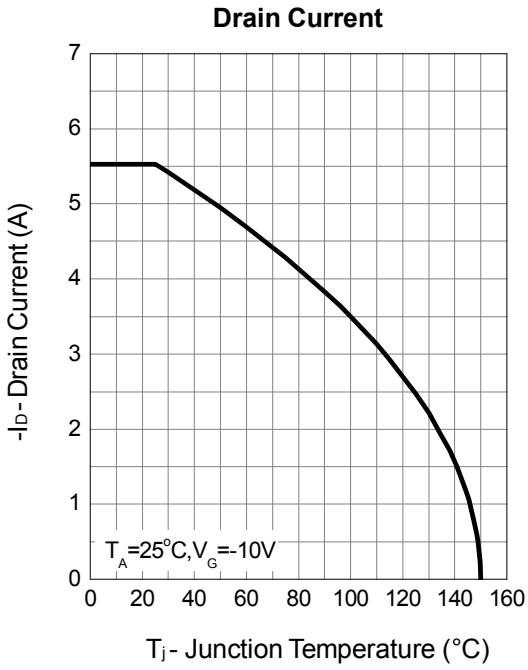


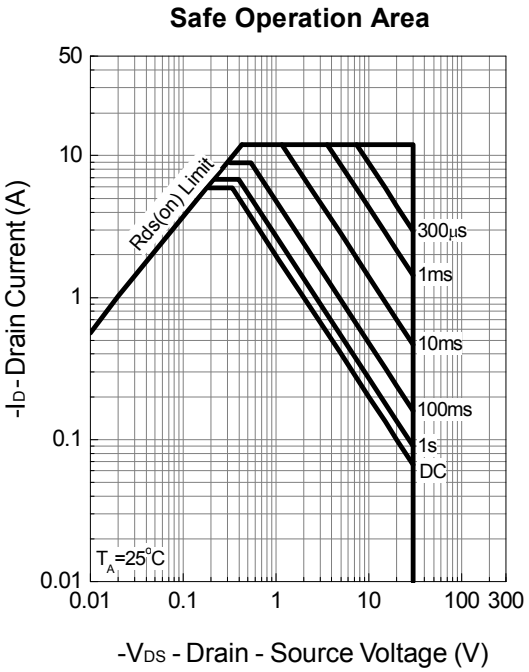

**Gate Charge**

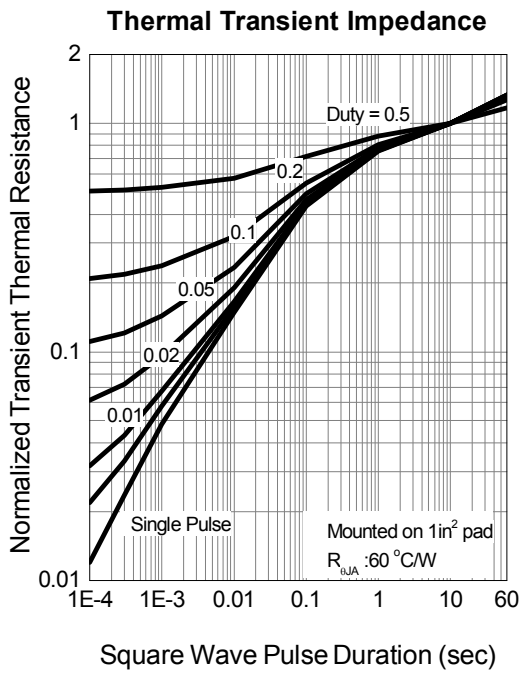


## P Channel Typical Operating Characteristics



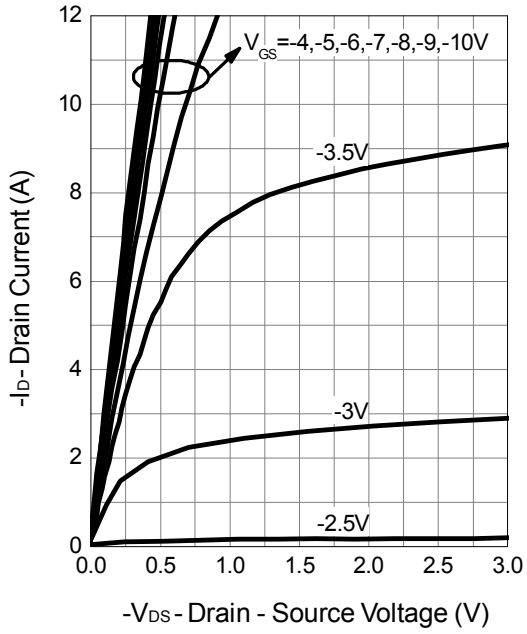



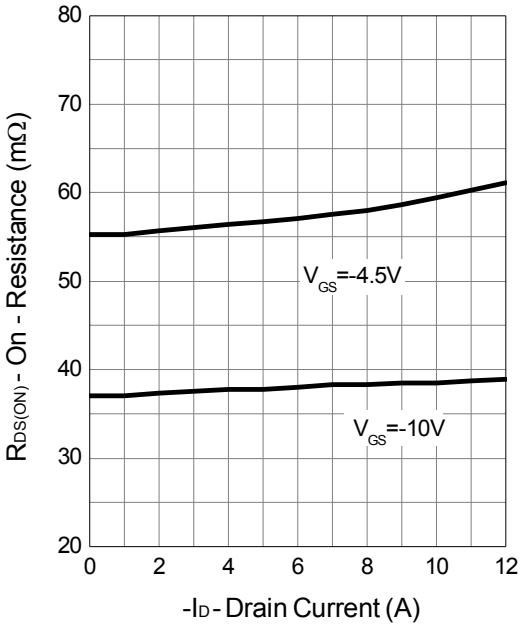



## P Channel Typical Operating Characteristics (Cont.)

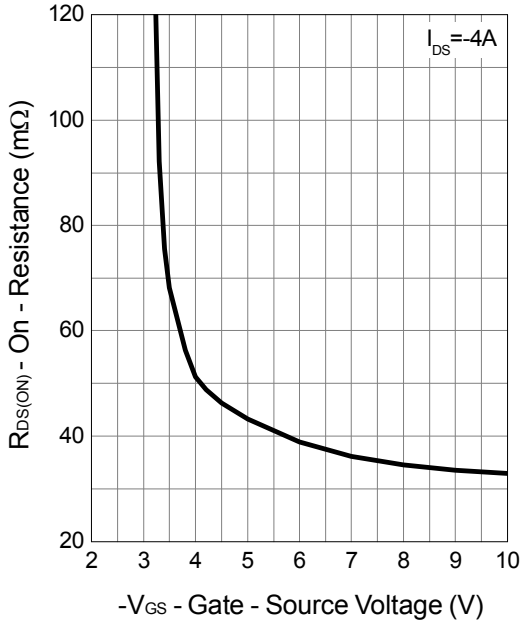
**Output Characteristics**



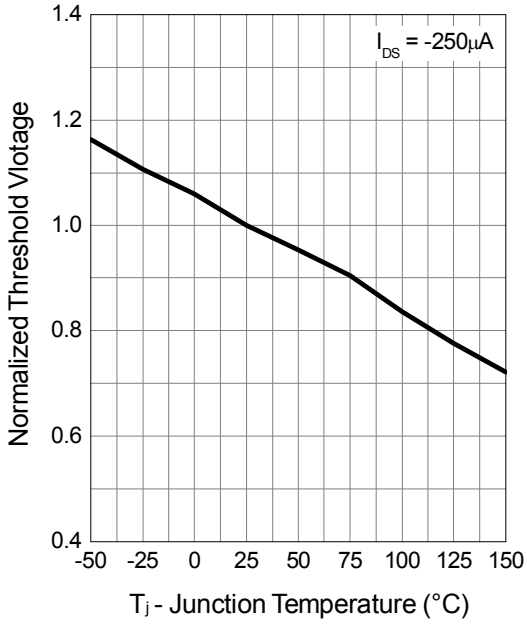

**Drain-Source On Resistance**




**Gate-Source On Resistance**

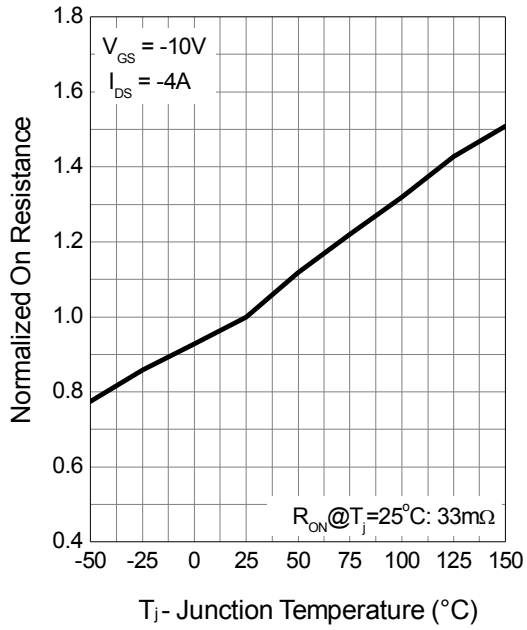



**Gate Threshold Voltage**

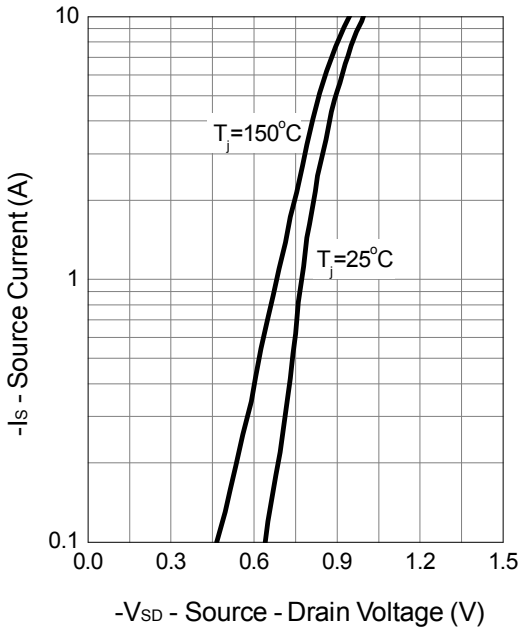


## P Channel Typical Operating Characteristics (Cont.)

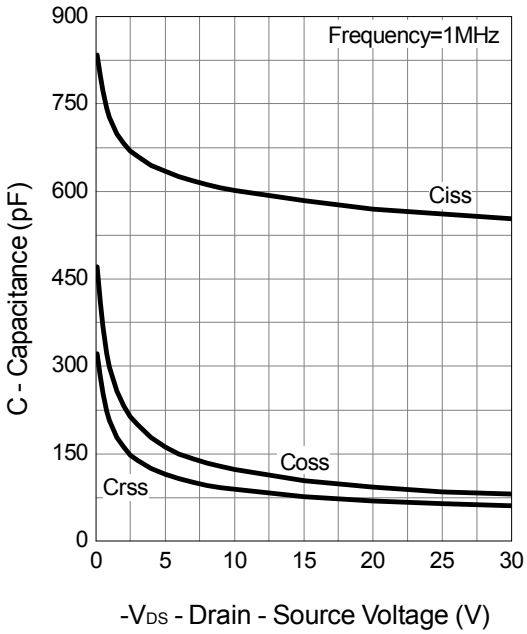
**Drain-Source On Resistance**



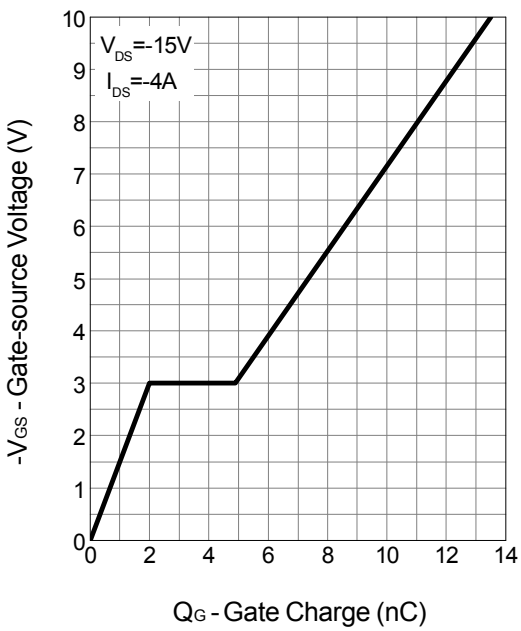

**Source-Drain Diode Forward**




**Capacitance**

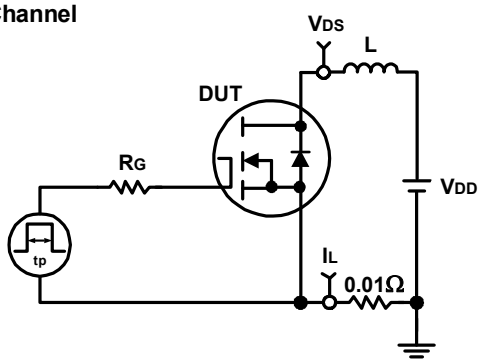


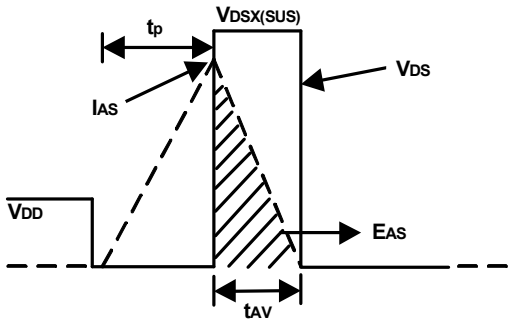

**Gate Charge**



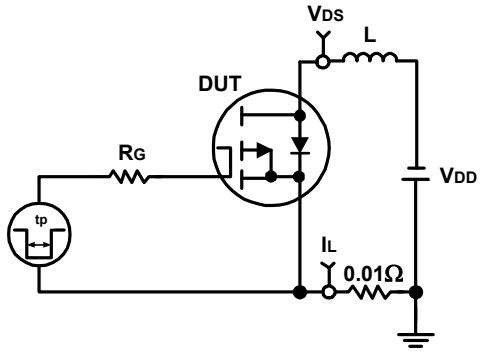
## Avalanche Test Circuit and Waveforms

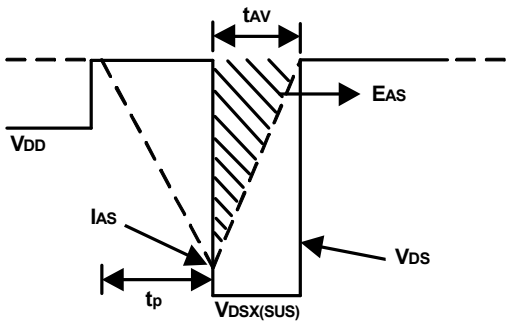
N Channel



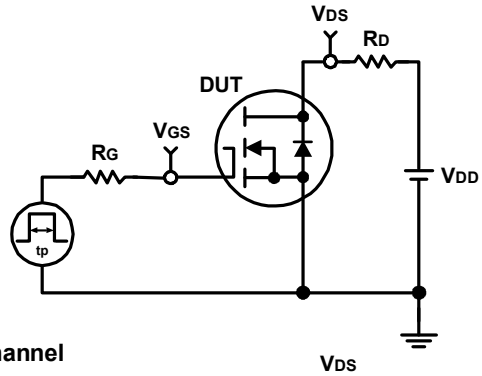

P Channel

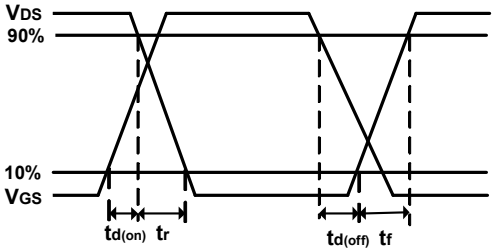


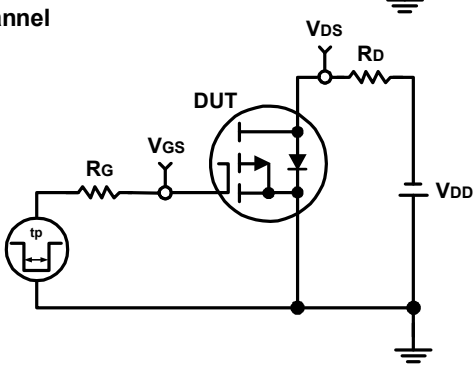

## Switching Time Test Circuit and Waveforms

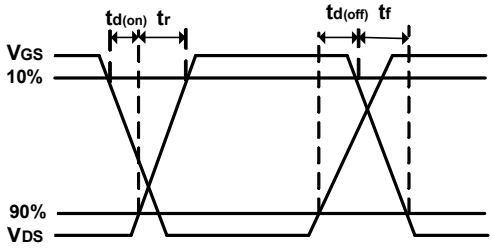
N Channel



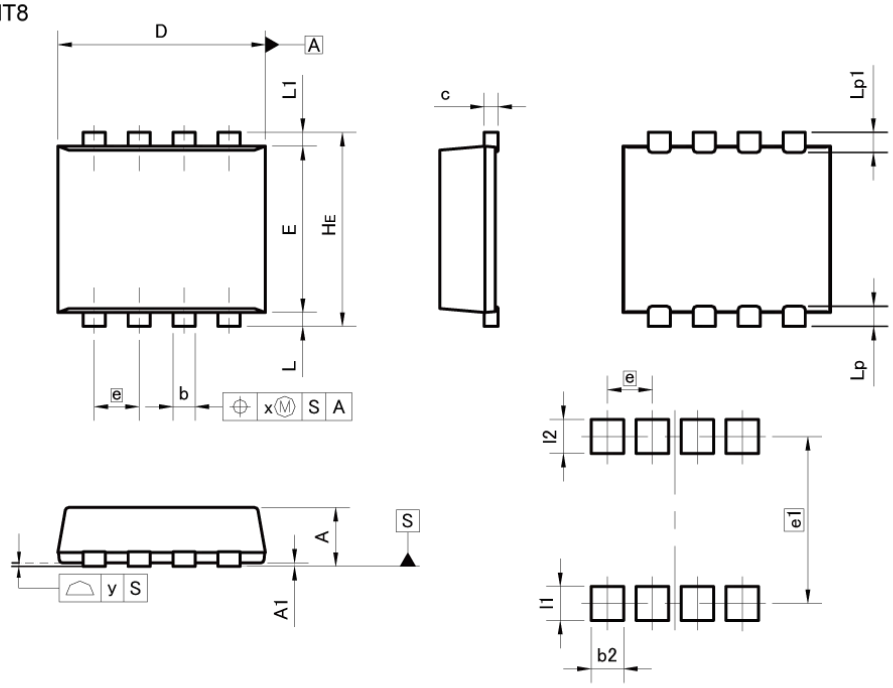

P Channel



● **Dimensions**

TSMT8




Pattern of terminal position areas
[Not a pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.75 | 0.85 | 0.030 | 0.033 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| b | 0.27 | 0.37 | 0.011 | 0.015 |
| c | 0.12 | 0.22 | 0.005 | 0.009 |
| D | 2.90 | 3.10 | 0.114 | 0.122 |
| E | 2.30 | 2.50 | 0.091 | 0.098 |
| e | 0.65 | | 0.026 | |
| HE | 2.70 | 2.90 | 0.106 | 0.114 |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| L1 | 0.10 | 0.30 | 0.004 | 0.012 |
| Lp | 0.19 | 0.39 | 0.007 | 0.015 |
| Lp1 | 0.19 | 0.39 | 0.007 | 0.015 |
| x | – | 0.10 | – | 0.004 |
| y | – | 0.10 | – | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | – | 0.47 | – | 0.019 |
| e1 | 2.41 | | 0.095 | |
| l1 | – | 0.49 | – | 0.019 |
| l2 | – | 0.49 | – | 0.019 |

Dimension in mm/inches