

| | |
|--------------------|-------|
| V_{DSS} | -12V |
| $R_{DS(on)}(Max.)$ | 62mΩ |
| I_D | ±3.0A |
| P_D | 1.0W |

●Features

- 1) Low on - resistance.
- 2) High Power small mold Package (TSMT3).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

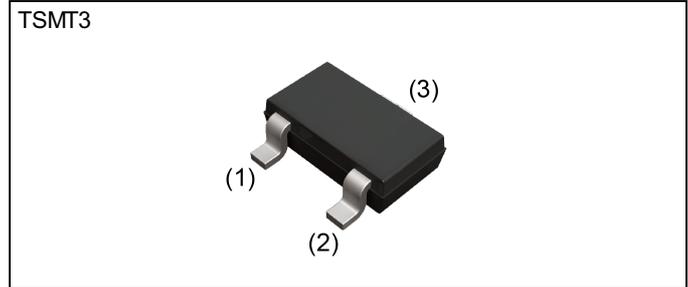
●Application

Switching

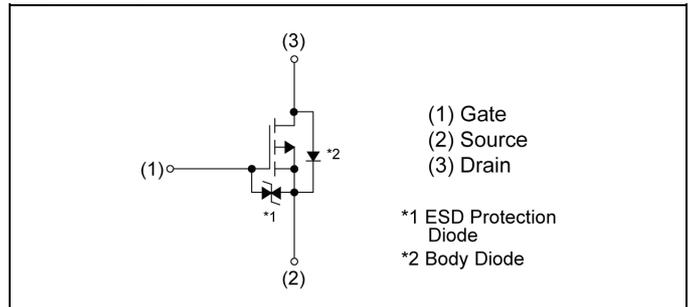
●Absolute maximum ratings ($T_a = 25^{\circ}C$)

| Parameter | Symbol | Value | Unit |
|------------------------------|--------------------|-------------|------|
| Drain - Source voltage | V_{DSS} | -12 | V |
| Continuous drain current | I_D | ±3.0 | A |
| Pulsed drain current | $I_{D,pulse}^{*1}$ | ±9.0 | A |
| Gate - Source voltage | V_{GSS} | 0~-8 | V |
| Power dissipation | P_D^{*2} | 1.0 | W |
| Junction temperature | T_j | 150 | °C |
| Range of storage temperature | T_{stg} | -55 to +150 | °C |

●Outline



●Inner circuit



●Packaging specifications

| Type | Packing | Embossed Tape |
|------|---------------------------|---------------|
| | Reel size (mm) | 180 |
| | Tape width (mm) | 8 |
| | Basic ordering unit (pcs) | 3000 |
| | Taping code | TL |
| | Marking | SD |

● Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|--|-----------------|--------|------|------|------|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - ambient | R_{thJA}^{*2} | - | 125 | - | °C/W |

● Electrical characteristics ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|--|---|--|--------|------|------|---------------|
| | | | Min. | Typ. | Max. | |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -1mA$ | -12 | - | - | V |
| Breakdown voltage temperature coefficient | $\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$ | $I_D = -1mA$ referenced to 25°C | - | -5.0 | - | mV/°C |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = -12V, V_{GS} = 0V$ | - | - | -10 | μA |
| Gate - Source leakage current | I_{GSS} | $V_{GS} = -8V, V_{DS} = 0V$ | - | - | -10 | μA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = -6V, I_D = -1mA$ | -0.3 | - | -1.0 | V |
| Gate threshold voltage temperature coefficient | $\frac{\Delta V_{GS(th)}}{\Delta T_j}$ | $I_D = -1mA$ referenced to 25°C | - | 2.7 | - | mV/°C |
| Static drain - source on - state resistance | $R_{DS(on)}^{*3}$ | $V_{GS} = -4.5V, I_D = -3.0A$ | - | 44 | 62 | m Ω |
| | | $V_{GS} = -2.5V, I_D = -1.5A$ | - | 55 | 77 | |
| | | $V_{GS} = -1.8V, I_D = -1.5A$ | - | 75 | 110 | |
| | | $V_{GS} = -1.5V, I_D = -0.6A$ | - | 90 | 180 | |
| Transconductance | g_{fs}^{*3} | $V_{DS} = -6V, I_D = -3.0A$ | 3.5 | - | - | S |

*1 $P_w \leq 10\mu\text{s}$, Duty cycle $\leq 1\%$

*2 Mounted on a ceramic board

*3 Pulsed

●Electrical characteristics ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|------------------------------|-------------------|--------------------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Input capacitance | C_{iss} | $V_{GS} = 0V$ | - | 2000 | - | pF |
| Output capacitance | C_{oss} | $V_{DS} = -6V$ | - | 130 | - | |
| Reverse transfer capacitance | C_{rss} | $f = 1\text{MHz}$ | - | 120 | - | |
| Turn - on delay time | $t_{d(on)}^{*3}$ | $V_{DD} \approx -6V, V_{GS} = -4.5V$ | - | 11 | - | ns |
| Rise time | t_r^{*3} | $I_D = -1.5A$ | - | 40 | - | |
| Turn - off delay time | $t_{d(off)}^{*3}$ | $R_L = 4\Omega$ | - | 160 | - | |
| Fall time | t_f^{*3} | $R_G = 10\Omega$ | - | 60 | - | |

●Gate charge characteristics ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|----------------------|---------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Total gate charge | Q_g^{*3} | $V_{DD} \approx -6V, I_D = -3A$ $V_{GS} = -4.5V$ | - | 16 | - | nC |
| Gate - Source charge | Q_{gs}^{*3} | | - | 2.4 | - | |
| Gate - Drain charge | Q_{gd}^{*3} | | - | 2.2 | - | |

●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---------------------------------------|---------------|----------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Body diode continuous forward current | I_S | $T_a = 25^\circ\text{C}$ | - | - | -0.8 | A |
| Body diode pulse current | I_{SP}^{*1} | | - | - | -9.0 | |
| Forward voltage | V_{SD}^{*3} | $V_{GS} = 0V, I_S = -3.0A$ | - | - | -1.2 | V |

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

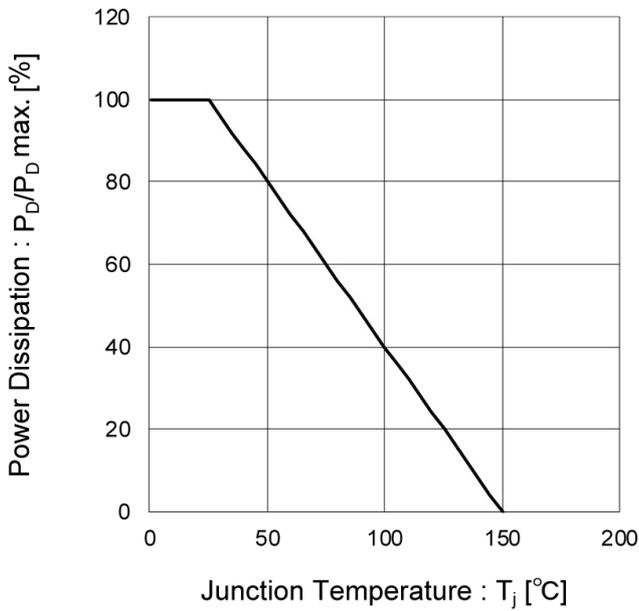


Fig.2 Maximum Safe Operating Area

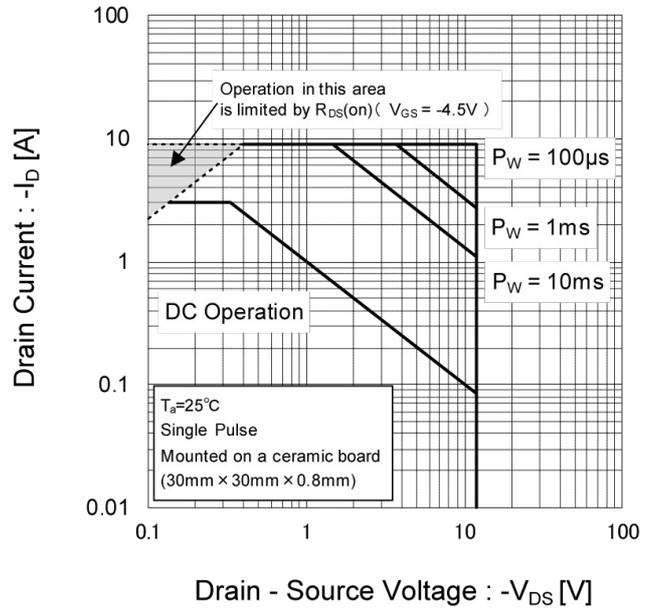


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

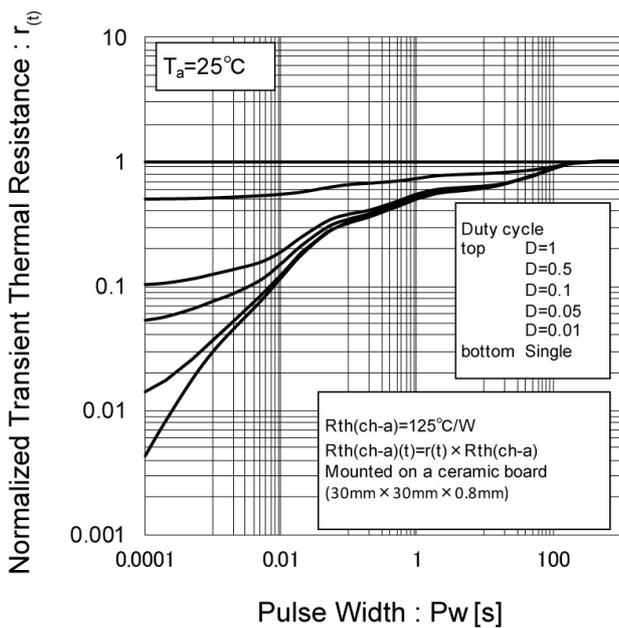
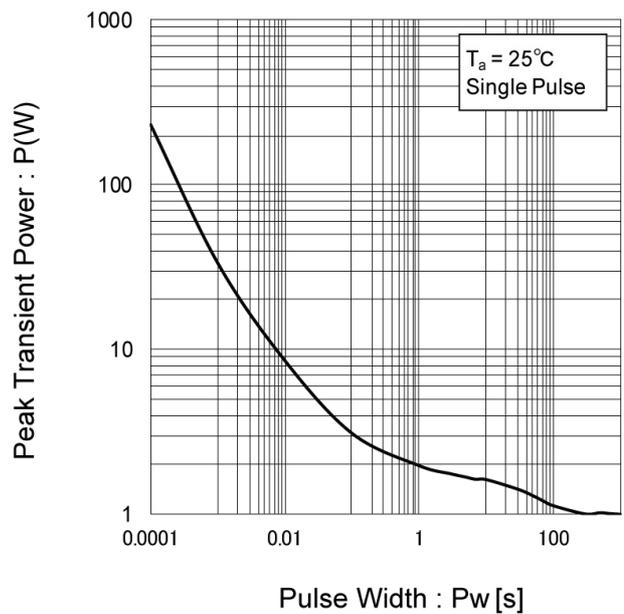


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

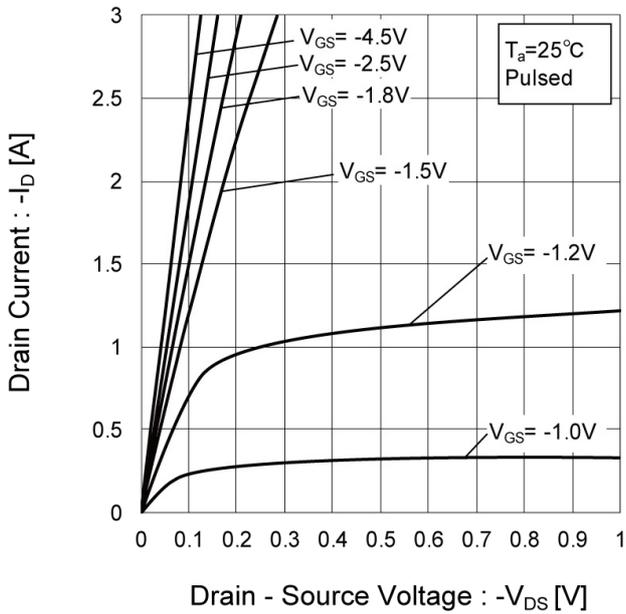


Fig.6 Typical Output Characteristics(II)

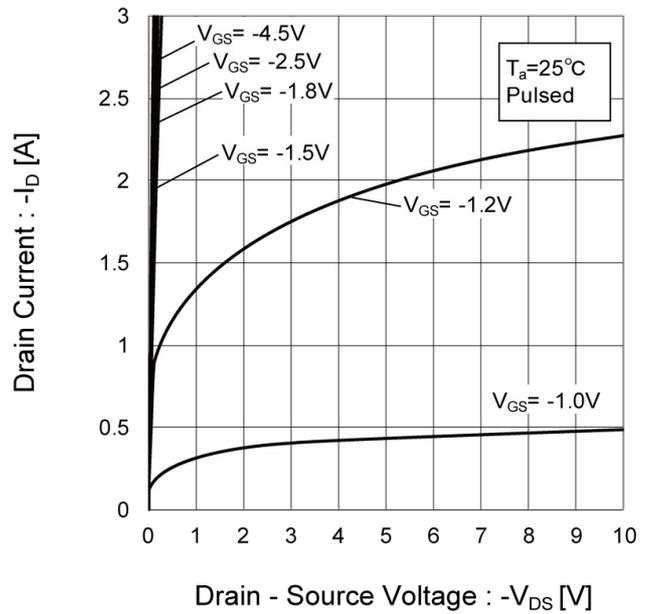


Fig.7 Breakdown Voltage vs. Junction Temperature

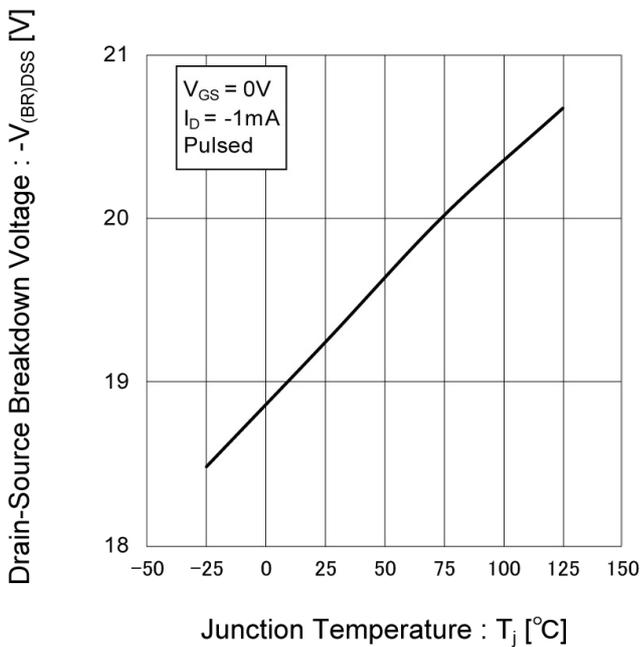
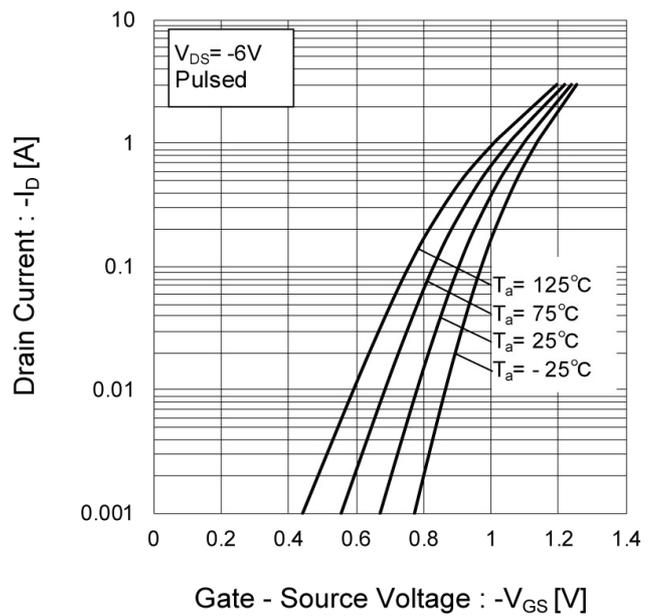


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage vs. Junction Temperature

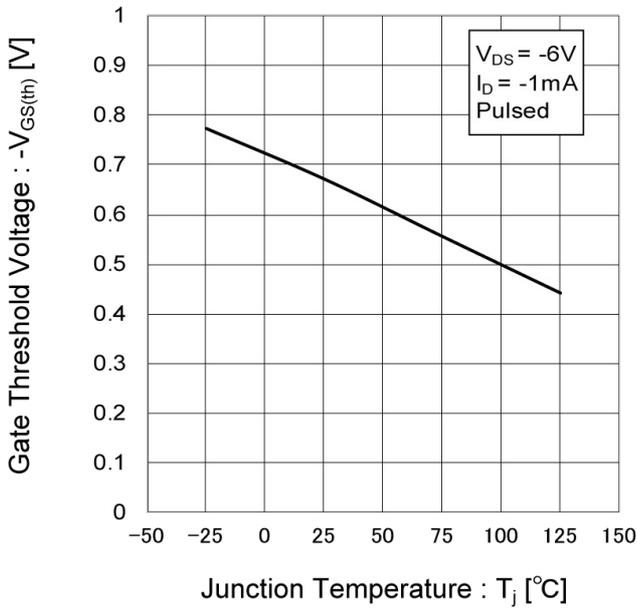


Fig.10 Transconductance vs. Drain Current

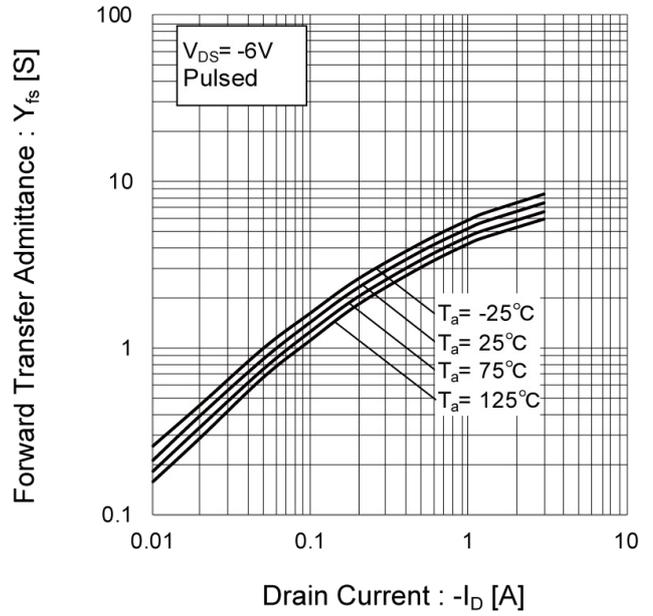


Fig.11 Drain Current Derating Curve

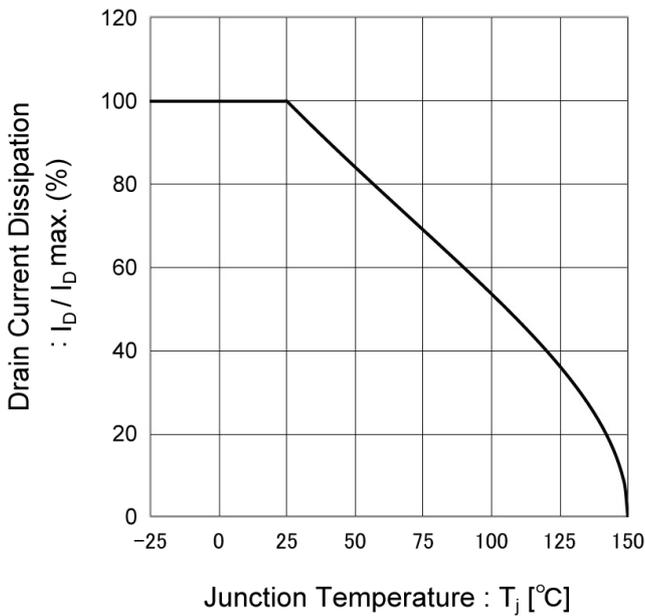
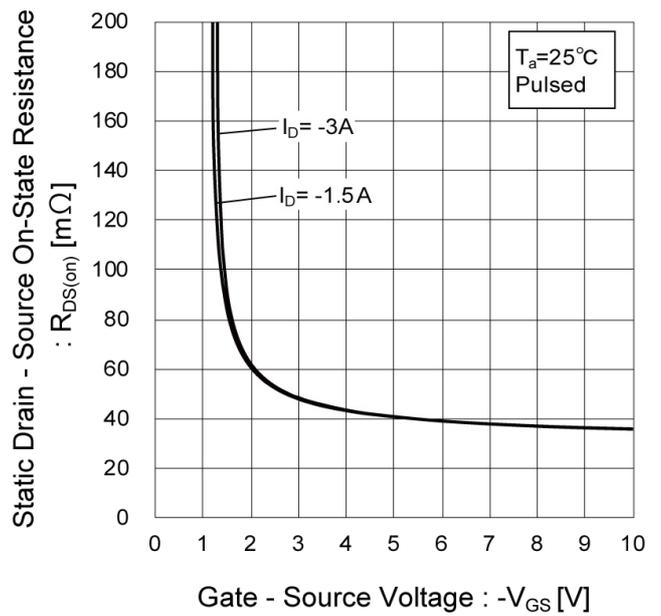


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

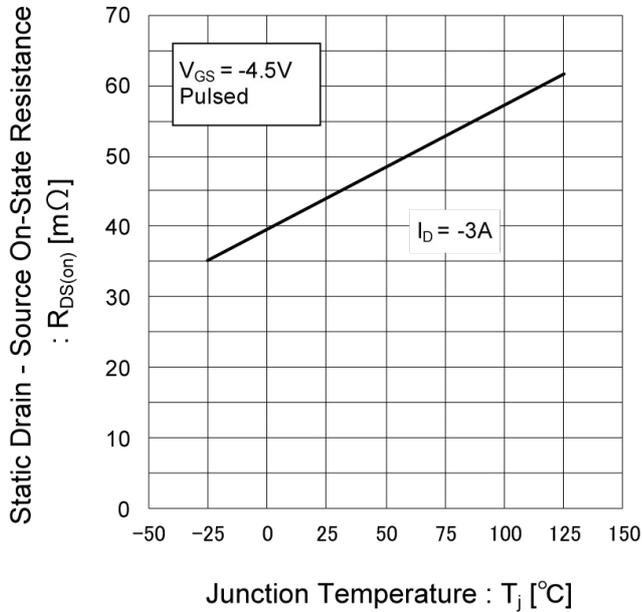


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

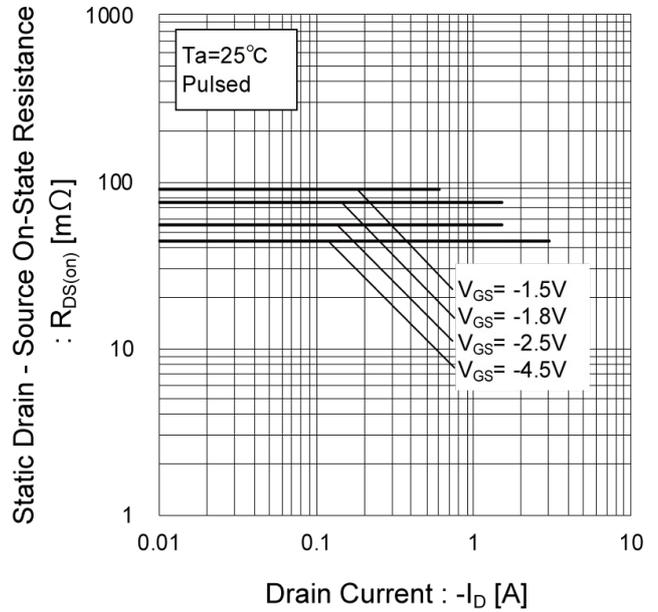


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

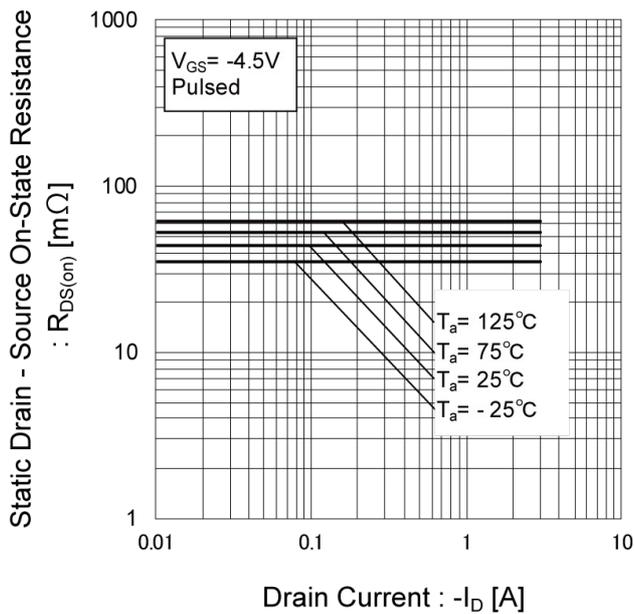
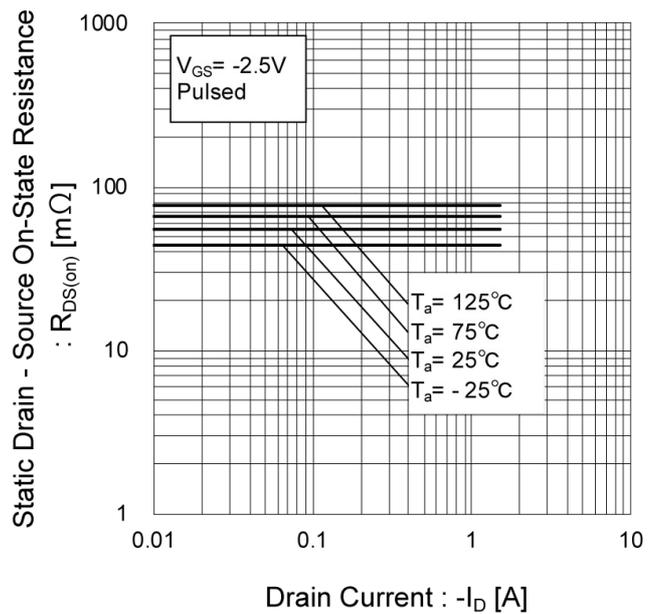


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



● Electrical characteristic curves

Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

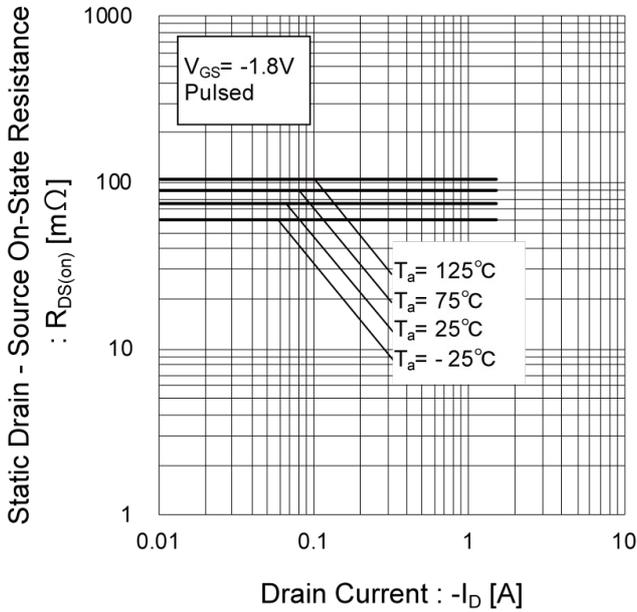


Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(V)

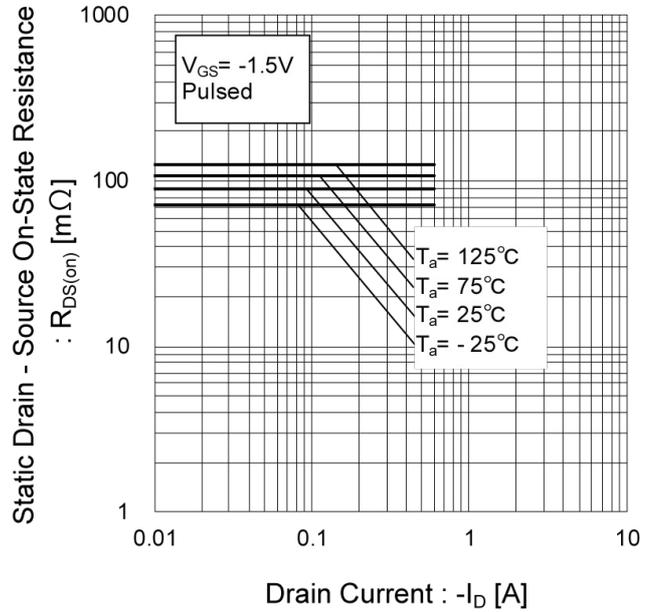


Fig.19 Typical Capacitance vs. Drain - Source Voltage

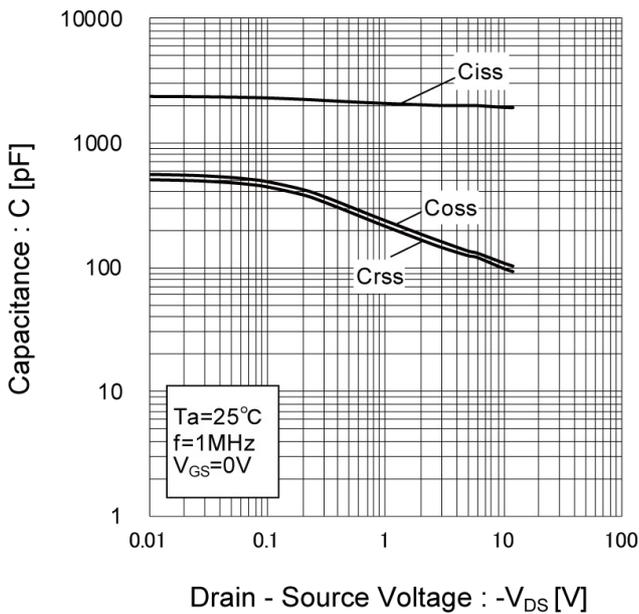
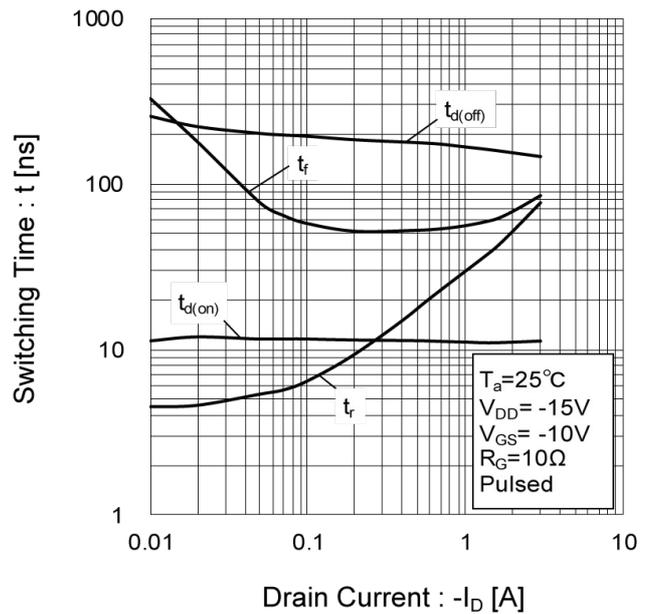


Fig.20 Switching Characteristics



● Electrical characteristic curves

Fig.21 Dynamic Input Characteristics

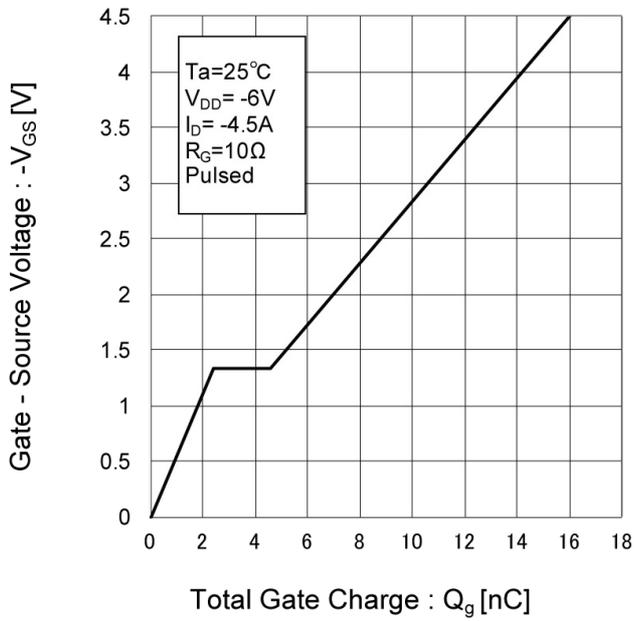
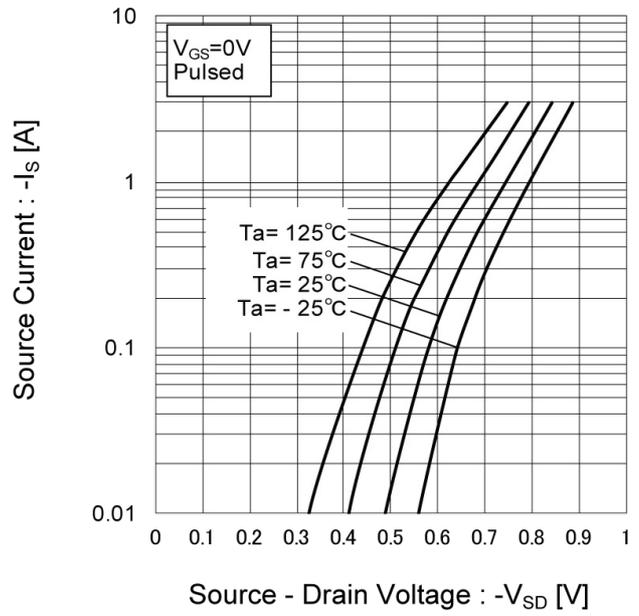


Fig.22 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

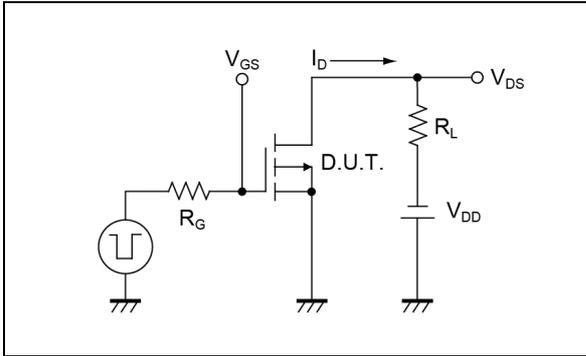


Fig.1-2 Switching Waveforms

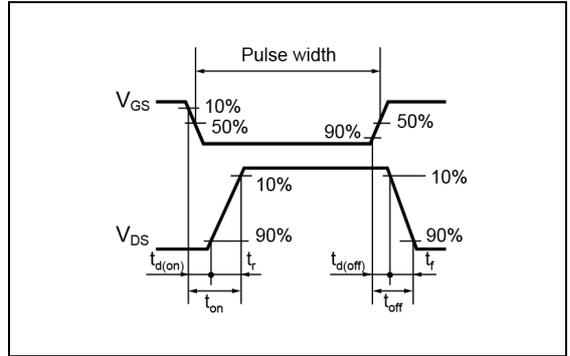


Fig.2-1 Gate Charge Measurement Circuit

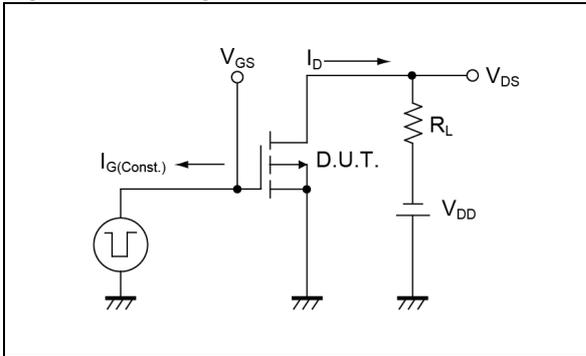
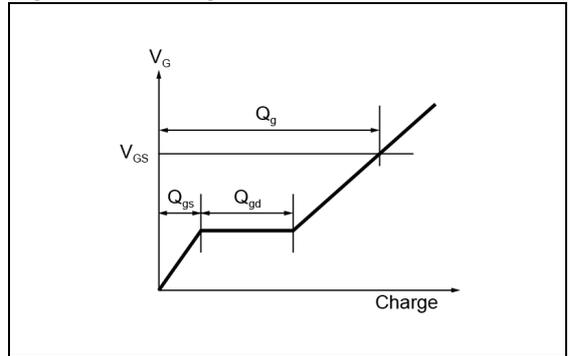
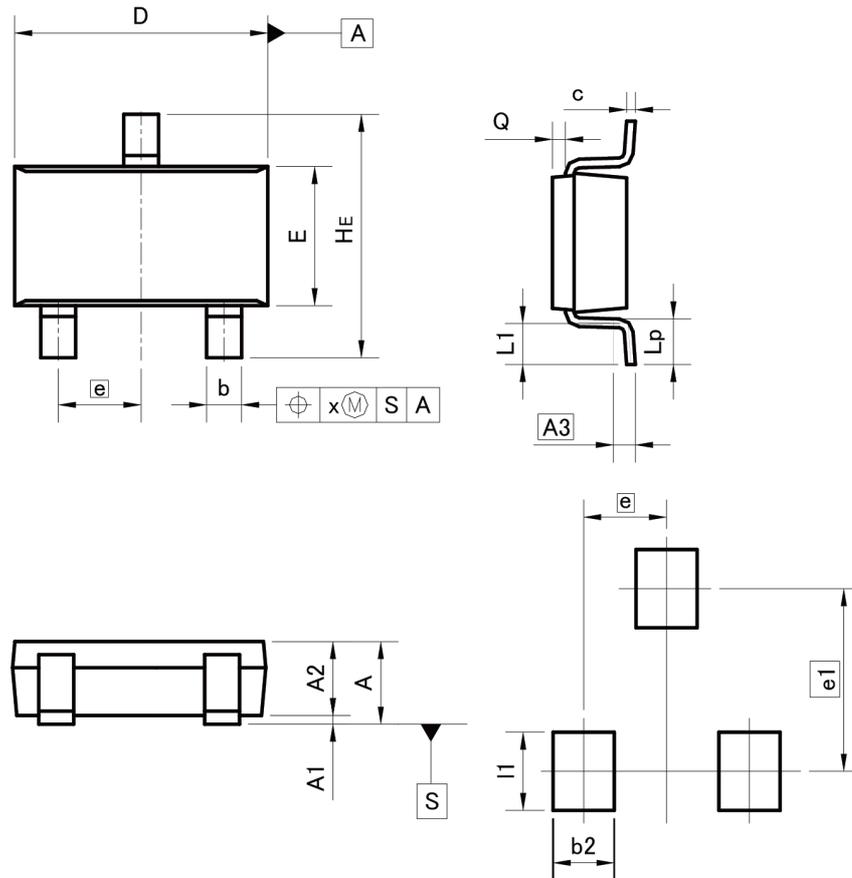


Fig.2-2 Gate Charge Waveform



●Dimensions

TSMT3



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

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | - | 1.00 | - | 0.039 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.75 | 0.95 | 0.030 | 0.037 |
| A3 | 0.25 | | 0.010 | |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.10 | 0.26 | 0.004 | 0.010 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 1.50 | 1.80 | 0.059 | 0.071 |
| e | 0.95 | | 0.037 | |
| HE | 2.60 | 3.00 | 0.102 | 0.118 |
| L1 | 0.30 | 0.60 | 0.012 | 0.024 |
| Lp | 0.40 | 0.70 | 0.016 | 0.028 |
| Q | 0.05 | 0.25 | 0.002 | 0.010 |
| x | - | 0.20 | - | 0.008 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.70 | - | 0.028 |
| e1 | 2.10 | | 0.083 | |
| l1 | - | 0.90 | - | 0.035 |

Dimension in mm/inches

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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.