# TT8U2

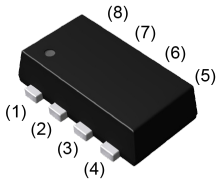
1.5V Drive Pch MOSFET + Schottky Barrier Diode

Datasheet

| | |
|---|---|
| $V_{DSS}$ | -20V |
| $R_{DS(on)}$(Max.) | 105mΩ |
| $I_D$ | ±2.4A |
| $P_D$ | 1.25W |

## ●Outline

TSST8

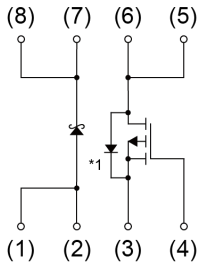



## ●Features

1) Pch MOSFET and shottky barrier diode are put in TSST8 package.
2) High-speed switching and Low on-resistance.
3) Low voltage drive(1.5V)
4) Built in Low $I_R$ shottky barrier diode.

## ●Inner circuit

(1) Anode
(2) Anode
(3) Source
(4) Gate
(5) Drain
(6) Drain
(7) Cathode
(8) Cathode
*1 Body Diode




## ●Packaging specifications

| | | |
|---|---|---|
| Type | Packing | Embossed Tape |
| | Reel size (mm) | 180 |
| | Tape width (mm) | 8 |
| | Basic ordering unit (pcs) | 3000 |
| | Taping code | TR |
| | Marking | U02 |

## ●Application

Switching

## ●Absolute maximum ratings ($T_a$ = 25°C)

**< MOSFET >**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain - Source voltage | $V_{DSS}$ | -20 | V |
| Gate - Source voltage | $V_{GSS}$ | ±10 | V |
| Continuous drain current | $I_D$ | ±2.4 | A |
| Pulsed drain current | $I_{D,\,pulse}$ *1 | ±9.6 | A |
| Continuous source current (body diode) | $I_S$ | -0.8 | A |
| Pulsed source current (body diode) | $I_{S,\,pulse}$ *1 | -9.6 | A |
| Power dissipation | $P_D$ *2 | 1.0 | W/element |
| Junction temperature | $T_j$ | 150 | ℃ |

## ●Absolute maximum ratings ($T_a$ = 25°C)

### < Diode >

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RM}$ | 30 | V |
| Reverse voltage | $V_R$ | 20 | V |
| Forward current | $I_F$ | 1.0 | A |
| Forward current surge peak | $I_{FSM}$*3 | 3.0 | A |
| Power dissipation | $P_D$*2 | 1.0 | W/element |
| Junction temperature | $T_j$ | 150 | ℃ |

### < MOSFET + Diode >

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Power dissipation | $P_D$*2 | 1.25 | W/total |
| Range of storage temperature | $T_{stg}$ | -55 to +150 | ℃ |

## ●Electrical characteristics ($T_a$ = 25°C)

### < MOSFET >

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Gate - Source leakage current | $I_{GSS}$ | $V_{GS}$ = ±10V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = -1mA | -20 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$ = -20V, $V_{GS}$ = 0V | - | - | -1 | μA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = -10V, $I_D$ = -1mA | -0.3 | - | -1.0 | V |
| Static drain - source on - state resistance | $R_{DS(on)}$*4 | $V_{GS}$ = -4.5V, $I_D$ = -2.4A | - | 80 | 105 | mΩ |
| | | $V_{GS}$ = -2.5V, $I_D$ = -1.2A | - | 105 | 140 | |
| | | $V_{GS}$ = -1.8V, $I_D$ = -1.2A | - | 150 | 225 | |
| | | $V_{GS}$ = -1.5V, $I_D$ = -0.5A | - | 180 | 360 | |
| Forward Transfer Admittance | $\|Y_{fs}\|$*4 | $V_{DS}$ = -10V, $I_D$ = -2.4A | 2.4 | - | - | S |

## ●Electrical characteristics ($T_a$ = 25°C)

**< MOSFET >**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V | - | 850 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{DS}$ = -10V | - | 60 | - | |
| Reverse transfer capacitance | $C_{rss}$ | f = 1MHz | - | 50 | - | |
| Turn - on delay time | $t_{d(on)}$ *4 | $V_{DD} \simeq$ -10V, $V_{GS}$ = -4.5V | - | 9 | - | ns |
| Rise time | $t_r$ *4 | $I_D$ = -1.2A | - | 25 | - | |
| Turn - off delay time | $t_{d(off)}$ *4 | $R_L$ = 8.3Ω | - | 55 | - | |
| Fall time | $t_f$ *4 | $R_G$ = 10Ω | - | 45 | - | |

## ●Gate charge characteristics ($T_a$ = 25°C)

**< MOSFET >**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Total gate charge | $Q_g$ *4 | $V_{DD} \simeq$ -10V, $I_D$ = -2.4A $V_{GS}$ = -4.5V | - | 6.7 | - | nC |
| Gate - Source charge | $Q_{gs}$ *4 | | - | 1.7 | - | |
| Gate - Drain charge | $Q_{gd}$ *4 | | - | 0.6 | - | |

## ●Body diode electrical characteristics (Source-Drain) ($T_a$ = 25°C)

**< MOSFET >**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward voltage | $V_{SD}$ *4 | $V_{GS}$ = 0V, $I_S$ = -2.4A | - | - | -1.2 | V |

● **Electrical characteristics** ($T_a$ = 25°C)

**< Diode >**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 1.0A | - | 0.48 | 0.52 | V |
| Reverse current | $I_R$ | $V_R$ = 10V | - | - | 10 | μA |

*1 Pw≦ 0μs, Duty cycle≦1%

*2 MOUNTED ON A CERAMIC BOARD (30×30×0.8mm)

*3 60Hz・1cycle

*4 Pulsed

## ●Electrical characteristic curves <MOSFET>

Fig.1 Typical Output Characteristics(I)

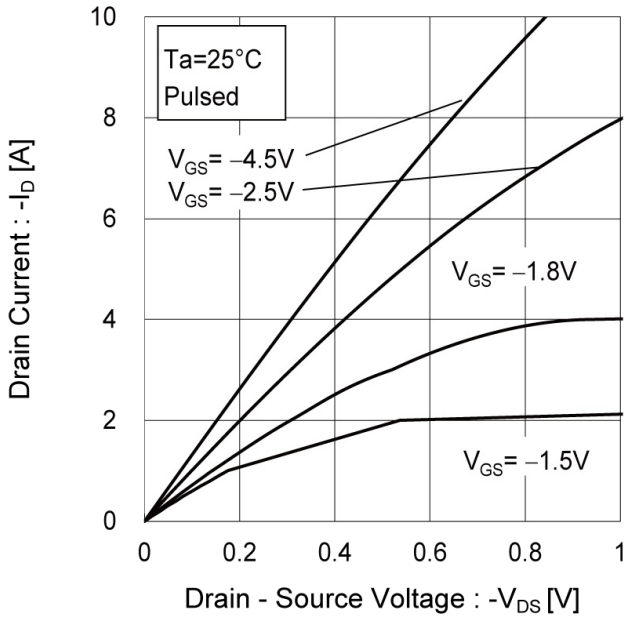



Fig.2 Typical Output Characteristics(II)

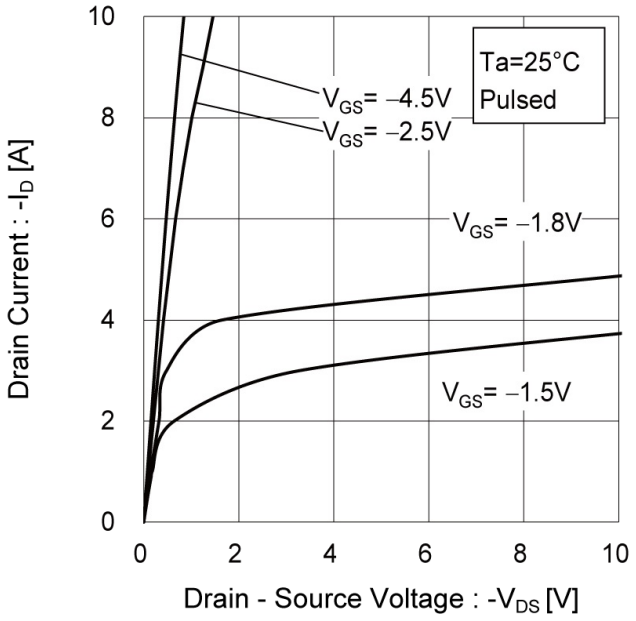



Fig.3 Breakdown Voltage vs. Junction Temperature

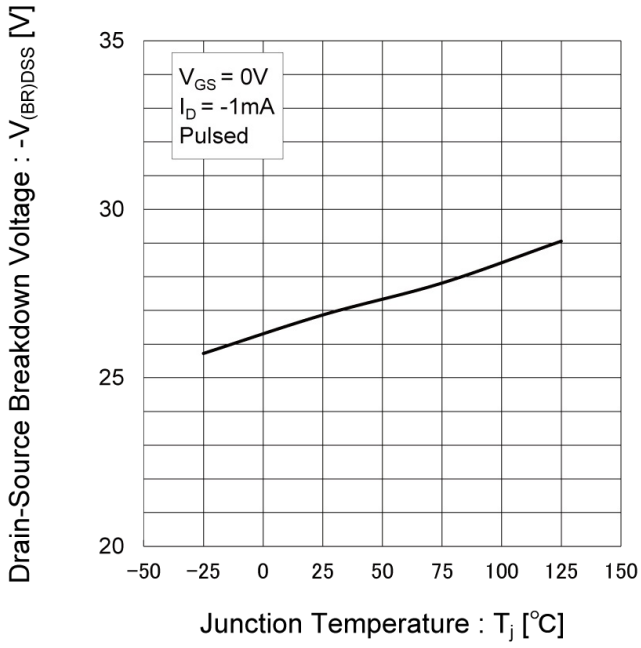
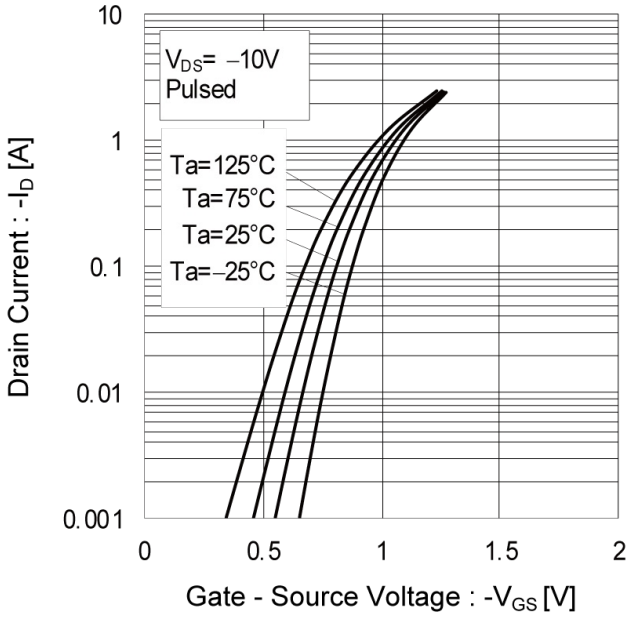



Fig.4 Typical Transfer Characteristics



## ●Electrical characteristic curves <MOSFET>

Fig.5 Gate Threshold Voltage vs. Junction Temperature

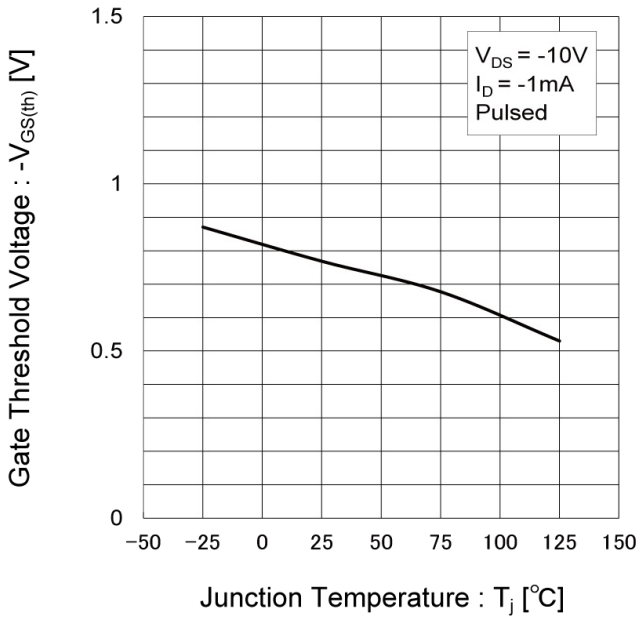



Fig.6 Forward Transfer Admittance vs. Drain Current

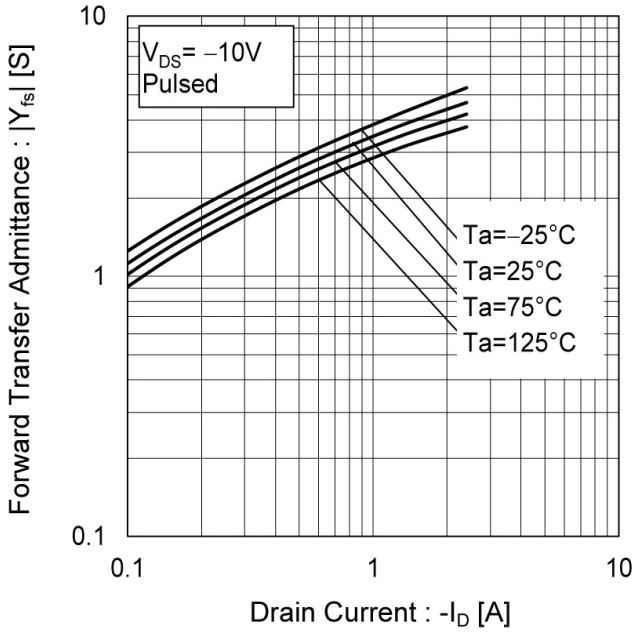



Fig.7 Drain Current Derating Curve

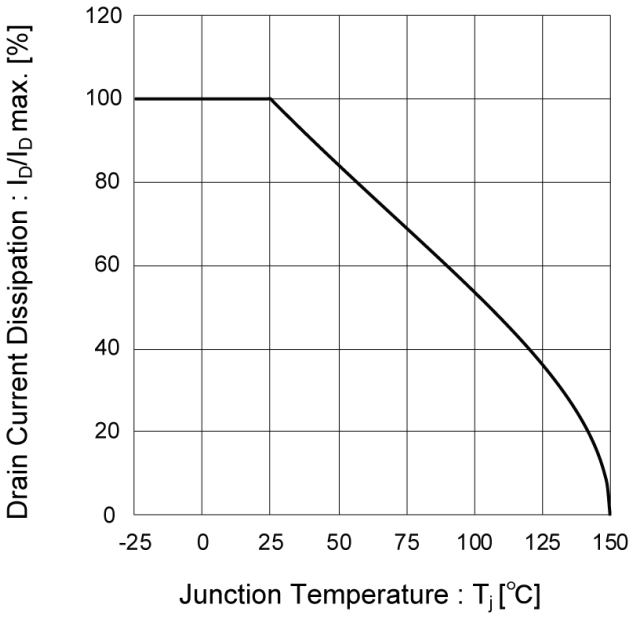
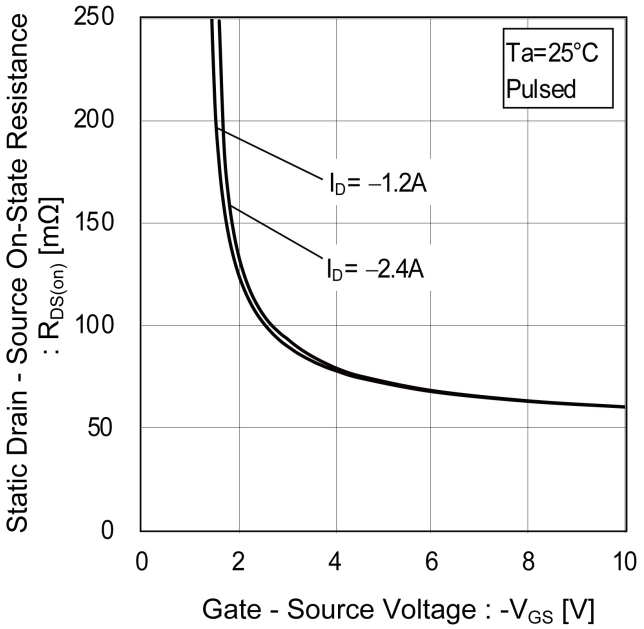



Fig.8 Static Drain - Source On - State Resistance vs. Gate Source Voltage



## ●Electrical characteristic curves <MOSFET>

Fig.9 Static Drain - Source On - State Resistance vs. Junction Temperature

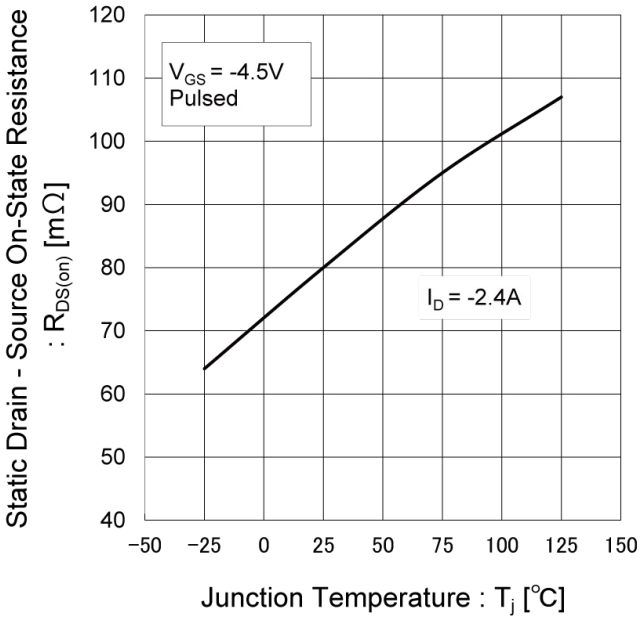
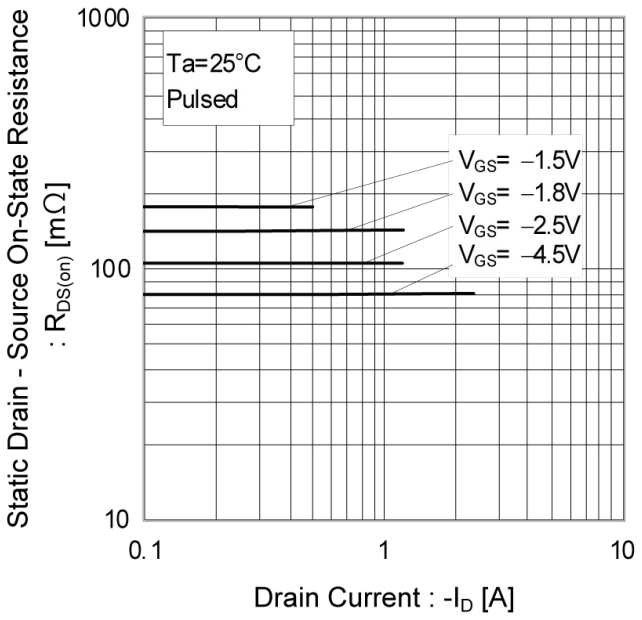



Fig.10 Static Drain - Source On - State Resistance vs. Drain Current (I)



## ●Electrical characteristic curves <MOSFET>

Fig.11 Static Drain - Source On - State Resistance vs. Drain Current (II)

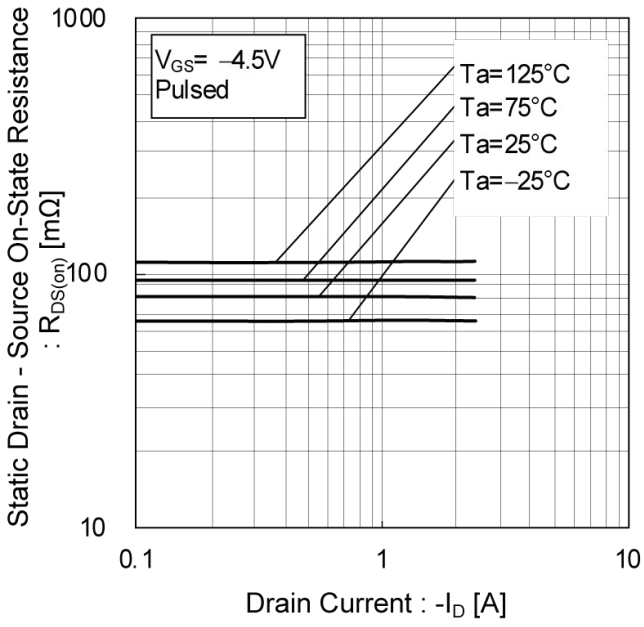



Fig.12 Static Drain - Source On - State Resistance vs. Drain Current (III)

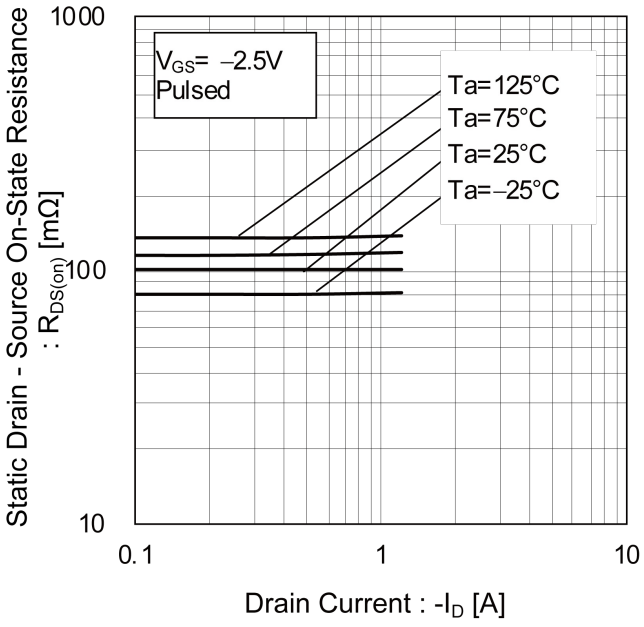



Fig.13 Static Drain - Source On - State Resistance vs. Drain Current (IV)

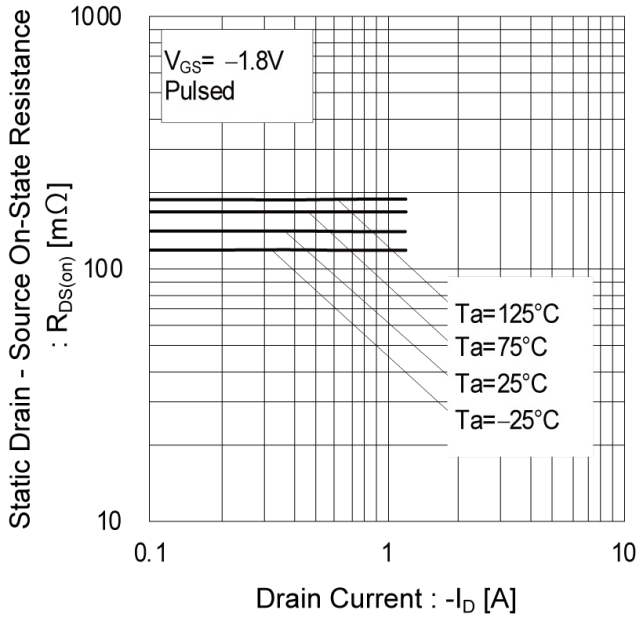
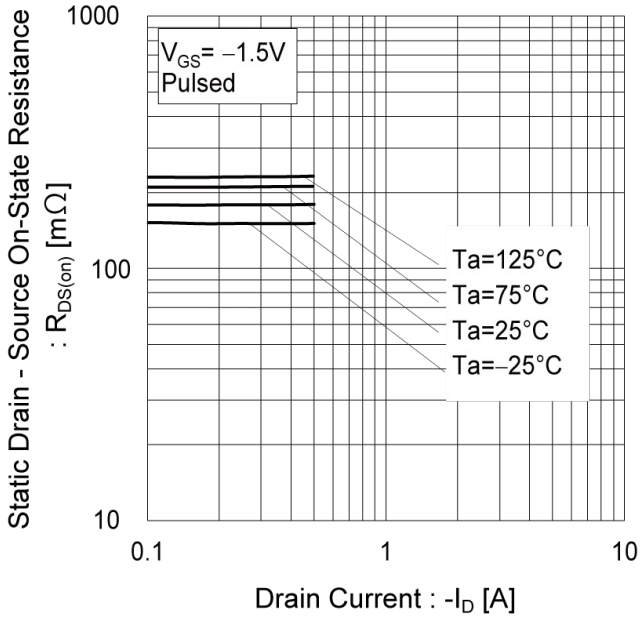



Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (V)



## ●Electrical characteristic curves <MOSFET>

Fig.15 Typical Capacitance vs. Drain - Source Voltage

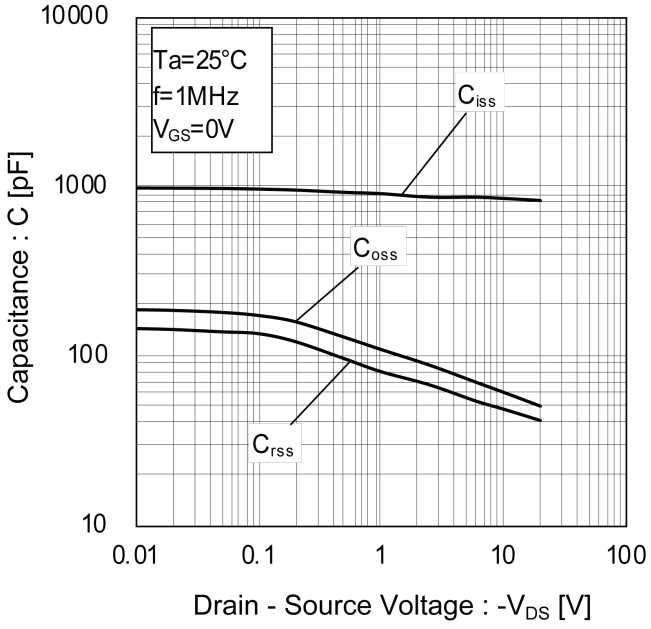



Fig.16 Switching Characteristics

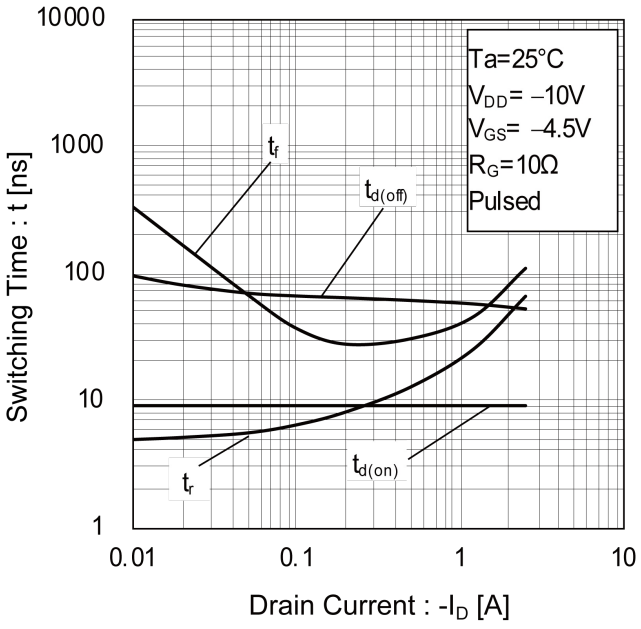



Fig.17 Dynamic Input Characteristics

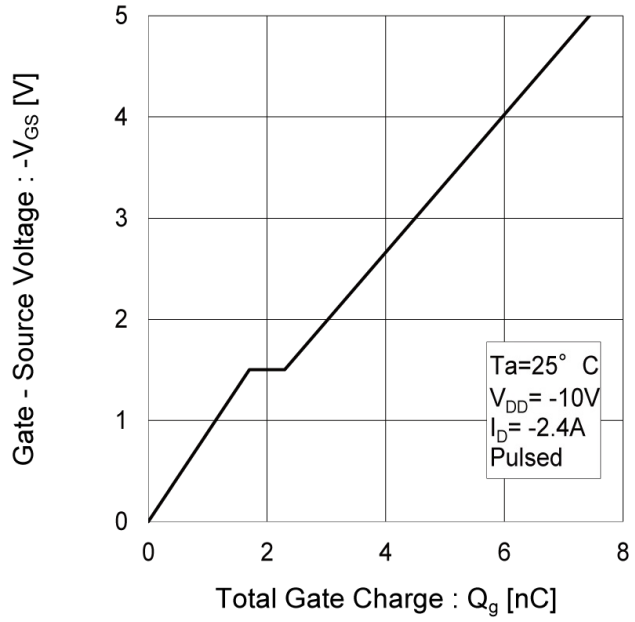
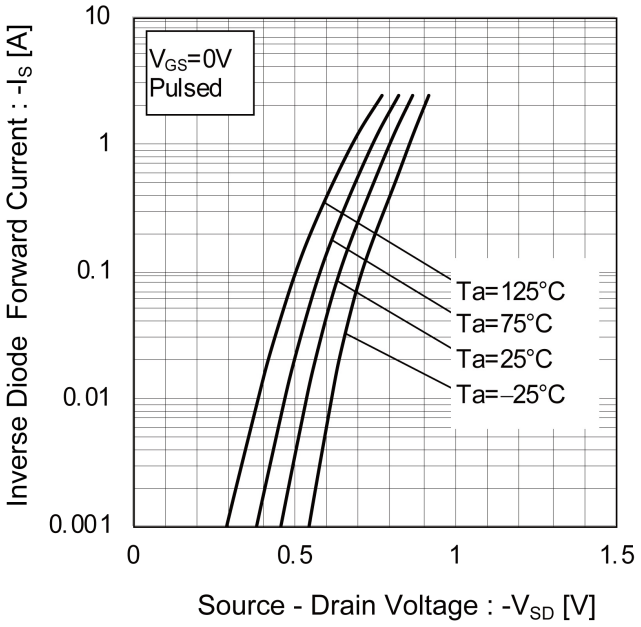



Fig.18 Source Current vs. Source Drain Voltage



## ●Electrical characteristic curves <Di>

Fig.19 Reverse Current vs. Reverse Voltage

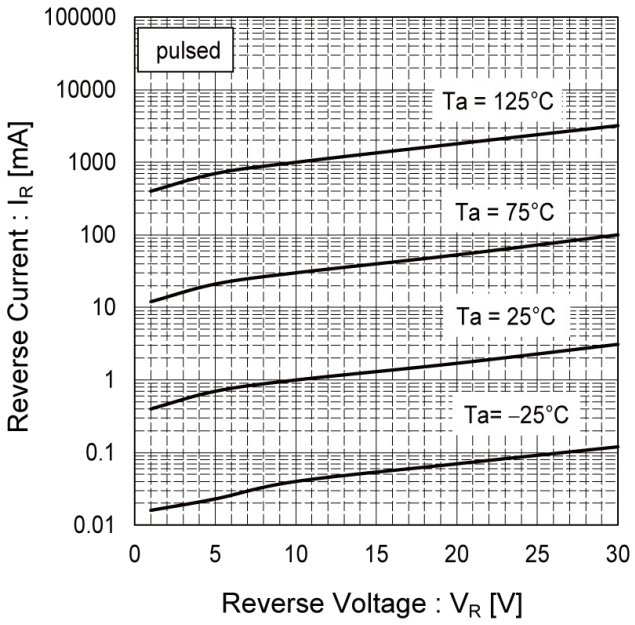
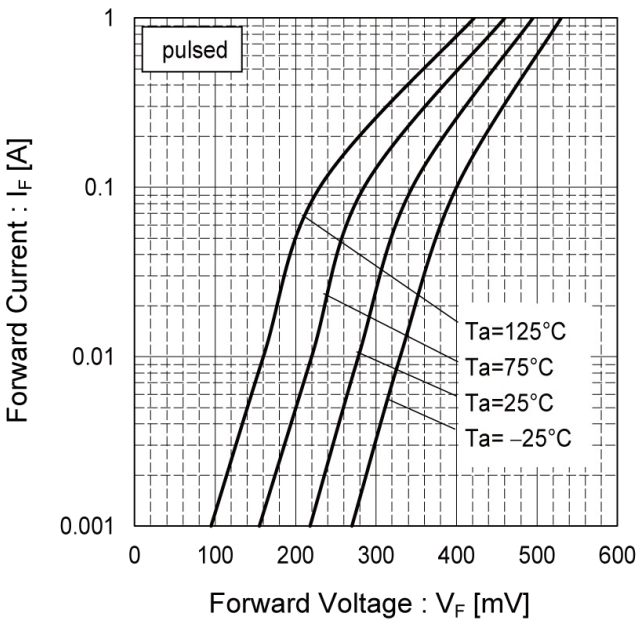



Fig.20 Forward Current vs. Forward Voltage



## ●Measurement circuits

Fig. 1-1 SWITCHING TIME MEASUREMENT CIRCUIT

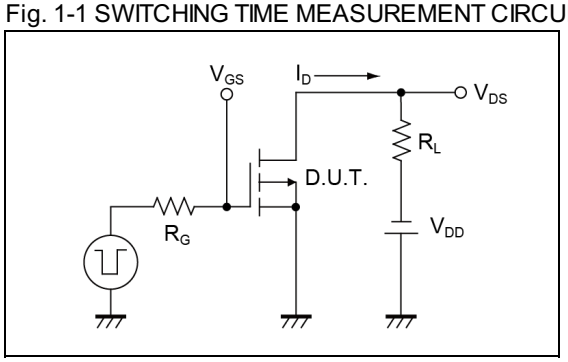



Fig. 1-2 SWITCHING WAVEFORMS

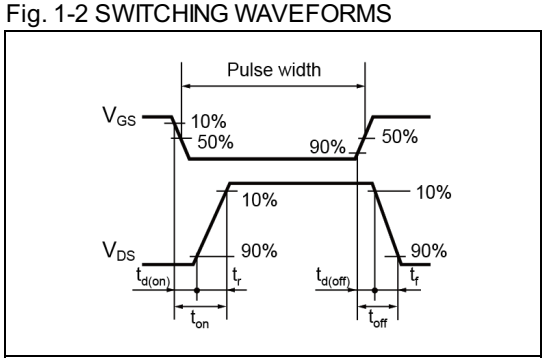



Fig. 2-1 GATE CHARGE MEASUREMENT CIRCUIT

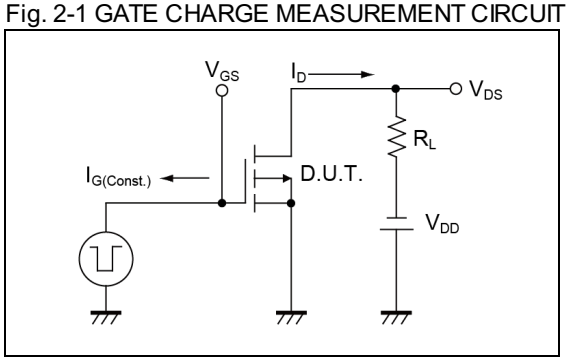
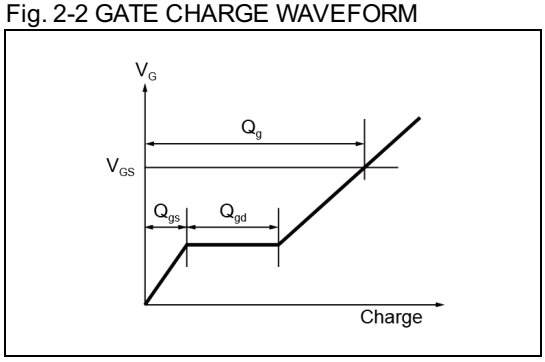



Fig. 2-2 GATE CHARGE WAVEFORM



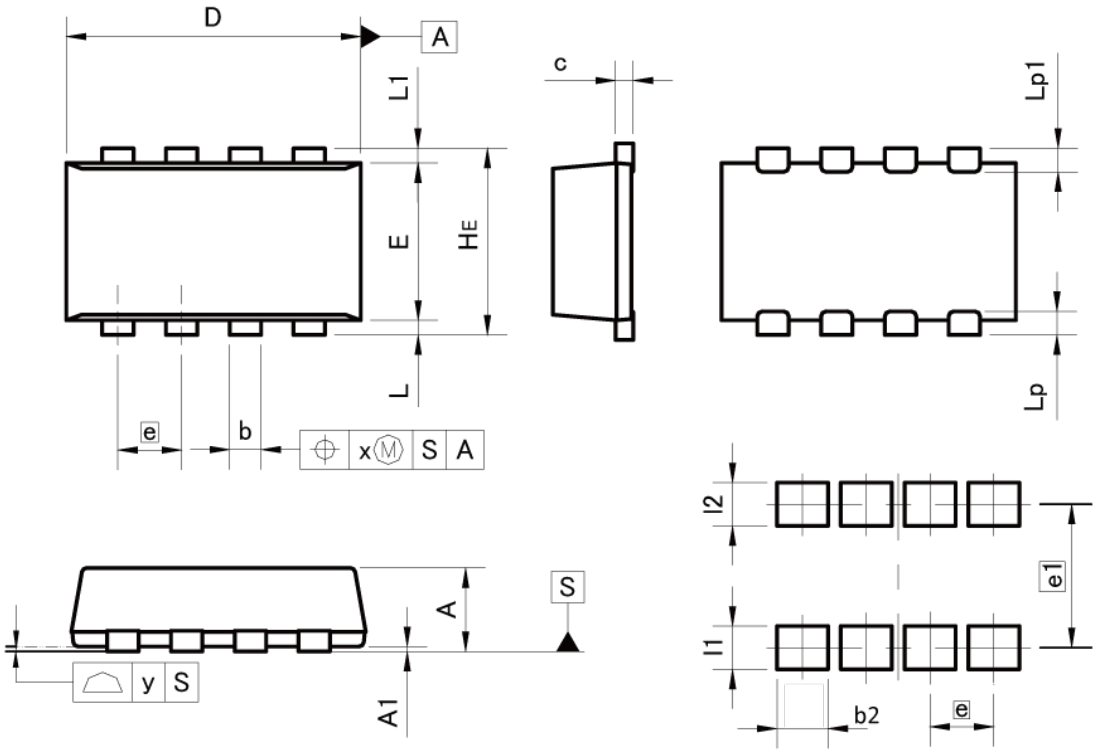

## ●Notice

1. SBD has a large reverse leak current compared to other type of diode. Therefore, it would raise a junction temperature, and increase a reverse power loss. Further rise of inside temperature would cause a thermal runaway. This built-in SBD has low $V_F$ characteristics and therefore, higher leak current. Please consider enough the surrounding temperature, generating heat of MOSFET and the reverse current.

2. This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

## ●Dimensions

TSST8




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 | 0.22 | 0.42 | 0.009 | 0.017 |
| c | 0.12 | 0.22 | 0.005 | 0.009 |
| D | 2.90 | 3.10 | 0.114 | 0.122 |
| E | 1.50 | 1.70 | 0.059 | 0.067 |
| e | 0.65 | | 0.026 | |
| HE | 1.80 | 2.00 | 0.071 | 0.079 |
| L | 0.05 | 0.25 | 0.002 | 0.010 |
| L1 | 0.05 | 0.25 | 0.002 | 0.010 |
| Lp | 0.15 | 0.34 | 0.006 | 0.013 |
| Lp1 | 0.15 | 0.34 | 0.006 | 0.013 |
| x | – | 0.10 | – | 0.004 |
| y | – | 0.10 | – | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | – | 0.52 | – | 0.020 |
| e1 | 1.46 | | 0.057 | |
| l1 | – | 0.44 | – | 0.017 |
| l2 | – | 0.44 | – | 0.017 |

Dimension in mm/inches

## Notes

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