

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

### ●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.

### ●Application

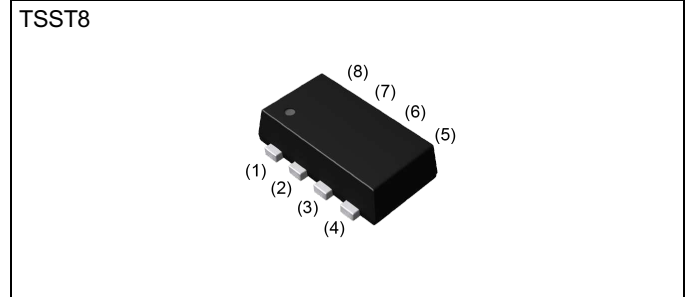
Switching

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

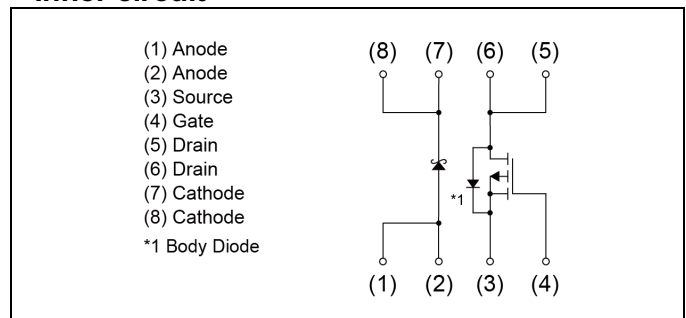
#### < MOSFET >

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	°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	TR
	Marking	U02

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

< 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	$^\circ\text{C}$

< MOSFET + Diode >

Parameter	Symbol	Value	Unit
Power dissipation	$P_D^{*2}$	1.25	W/total
Range of storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

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

< MOSFET >

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

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

< 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	$C_{rss}$	$f = 1\text{MHz}$	-	50	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx -10V, V_{GS} = -4.5V$	-	9	-	ns
Rise time	$t_r^{*4}$	$I_D = -1.2A$	-	25	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 8.3\Omega$	-	55	-	
Fall time	$t_f^{*4}$	$R_G = 10\Omega$	-	45	-	

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

< MOSFET >

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*4}$	$V_{DD} \approx -10V, I_D = -2.4A$ $V_{GS} = -4.5V$	-	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) ( $T_a = 25^\circ\text{C}$ )

< 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** ( $T_a = 25^\circ\text{C}$ )

< Diode >

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 1.0\text{A}$	-	0.48	0.52	V
Reverse current	$I_R$	$V_R = 10\text{V}$	-	-	10	$\mu\text{A}$

\*1  $P_w \leq 0\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*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)

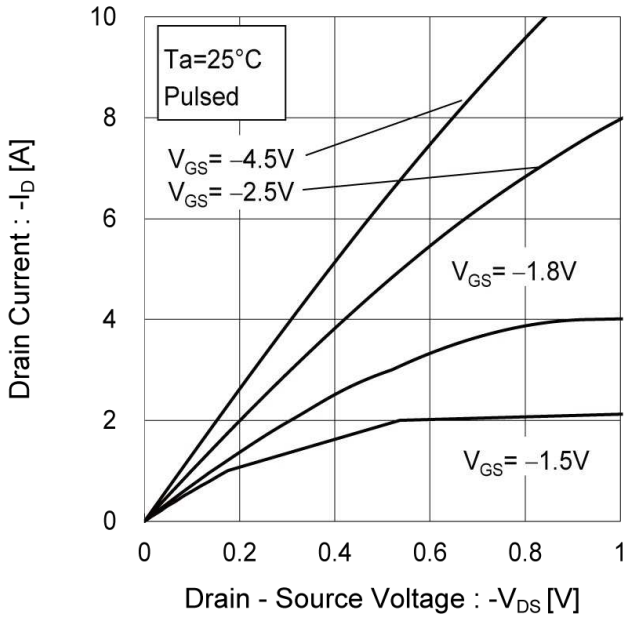


Fig.2 Typical Output Characteristics(II)

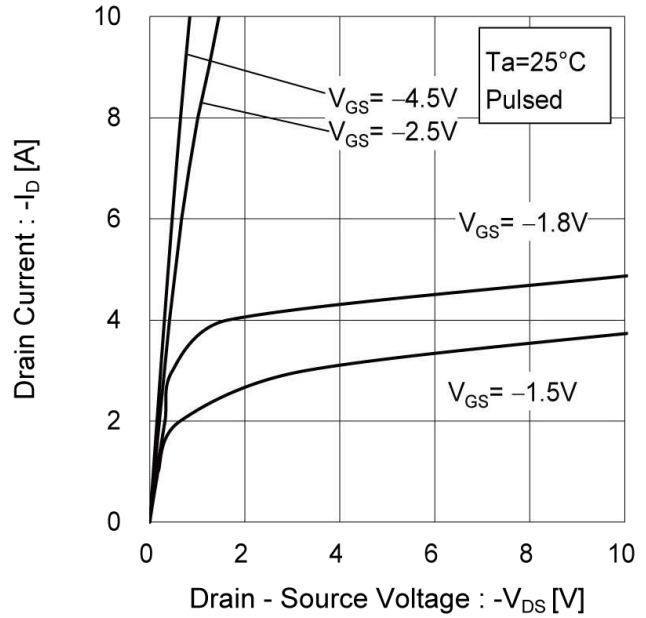


Fig.3 Breakdown Voltage vs. Junction Temperature

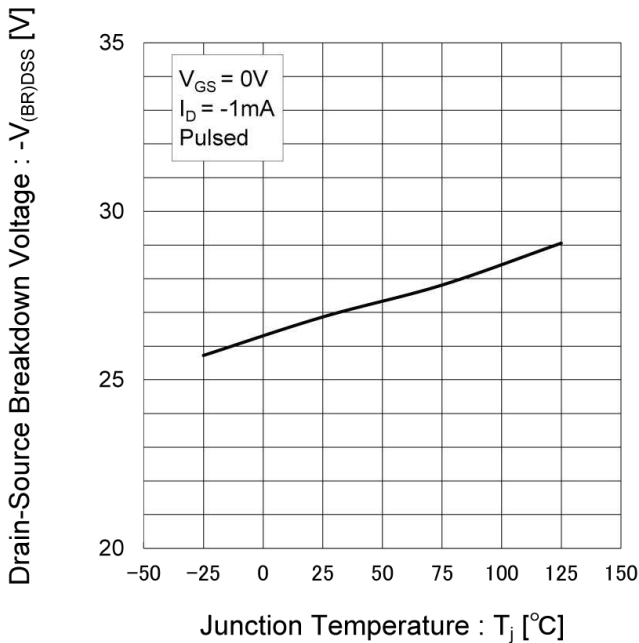
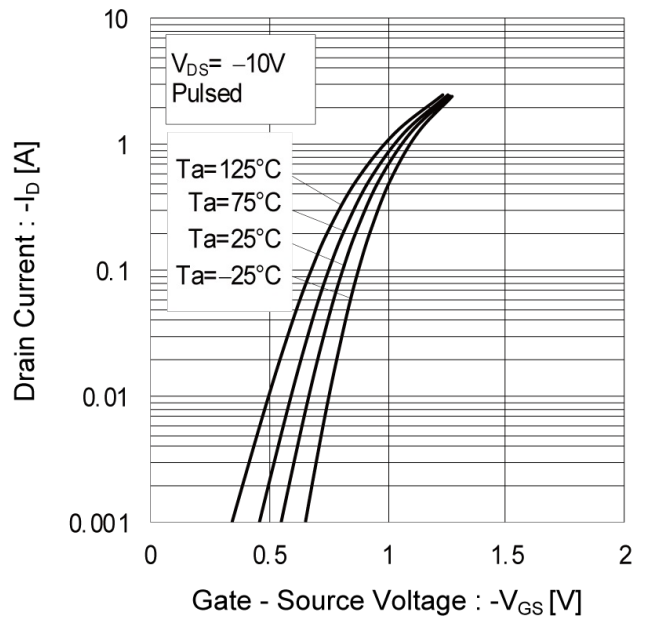


Fig.4 Typical Transfer Characteristics



●Electrical characteristic curves <MOSFET>

Fig.5 Gate Threshold Voltage vs. Junction Temperature

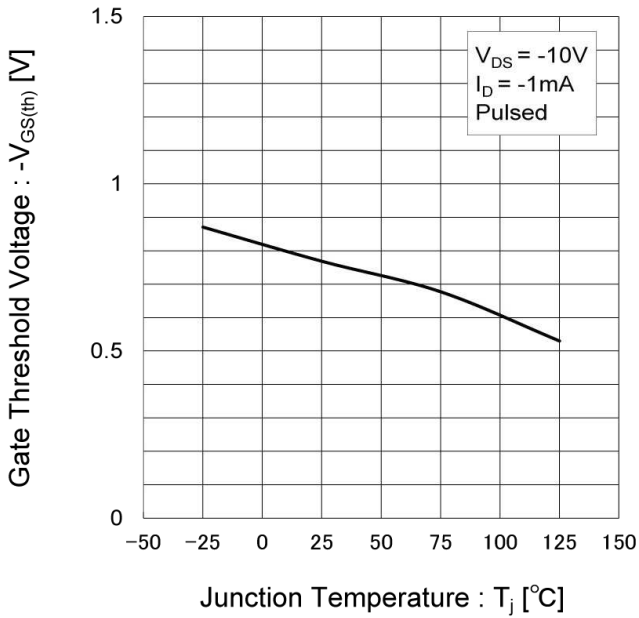


Fig.6 Forward Transfer Admittance vs. Drain Current

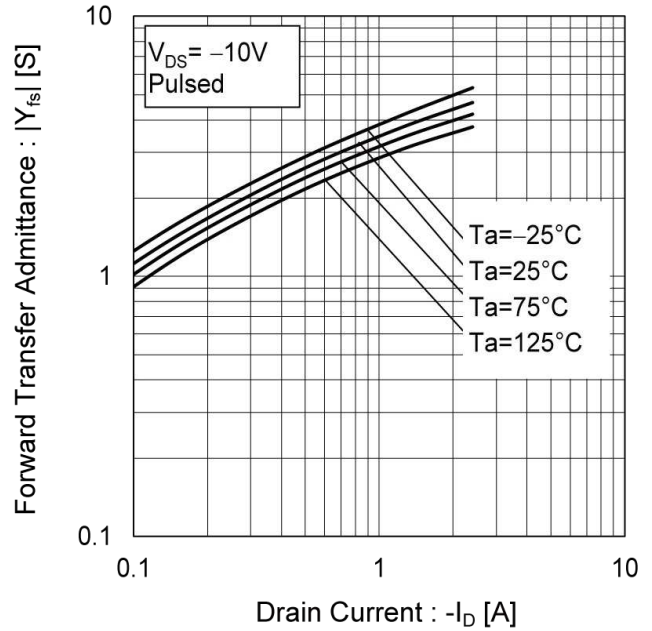


Fig.7 Drain Current Derating Curve

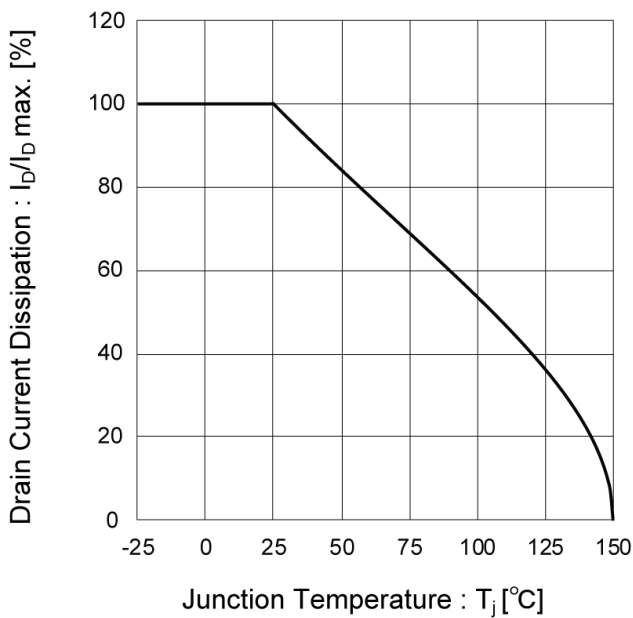
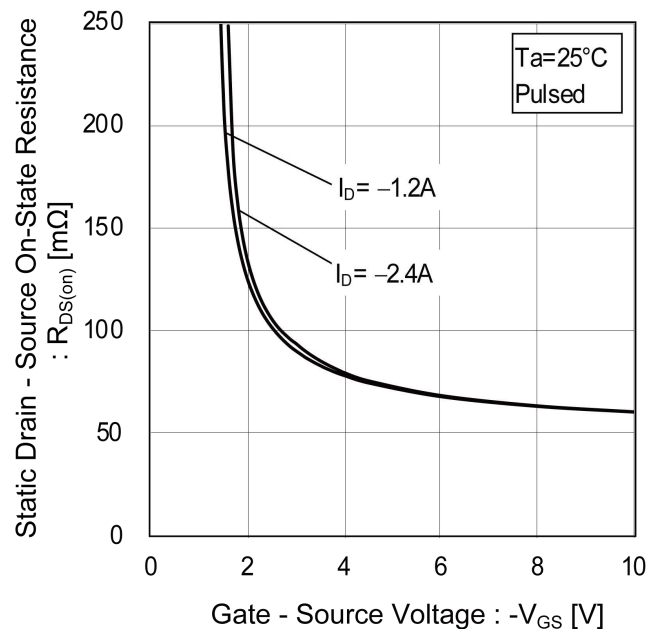


Fig.8 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves <MOSFET>

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

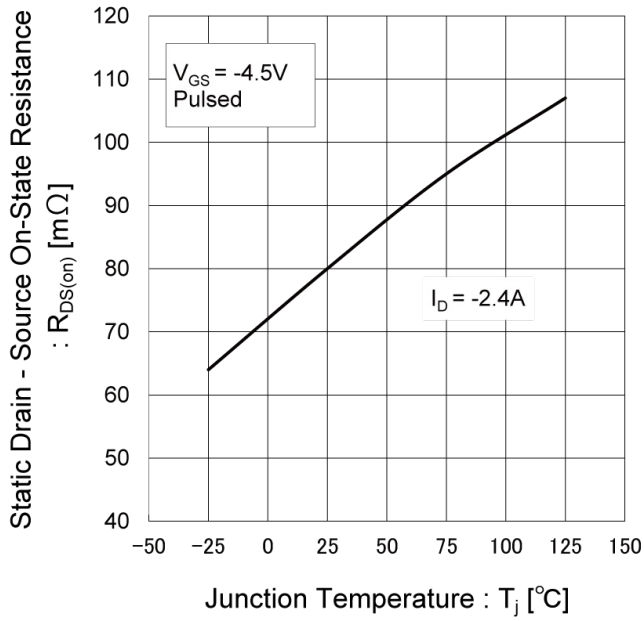
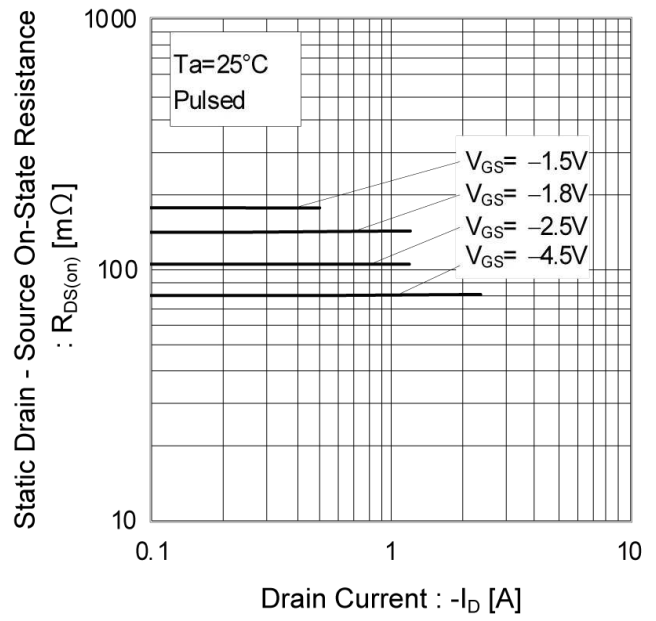


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current (I)



● Electrical characteristic curves <MOSFET>

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

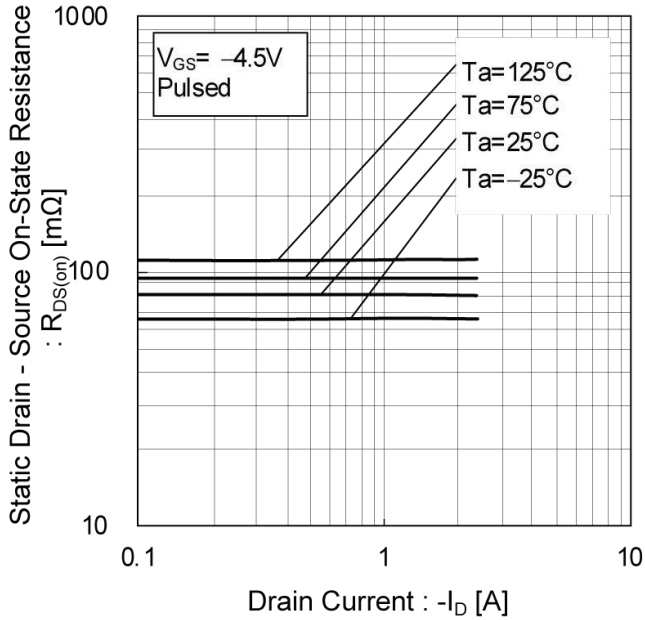


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current (III)

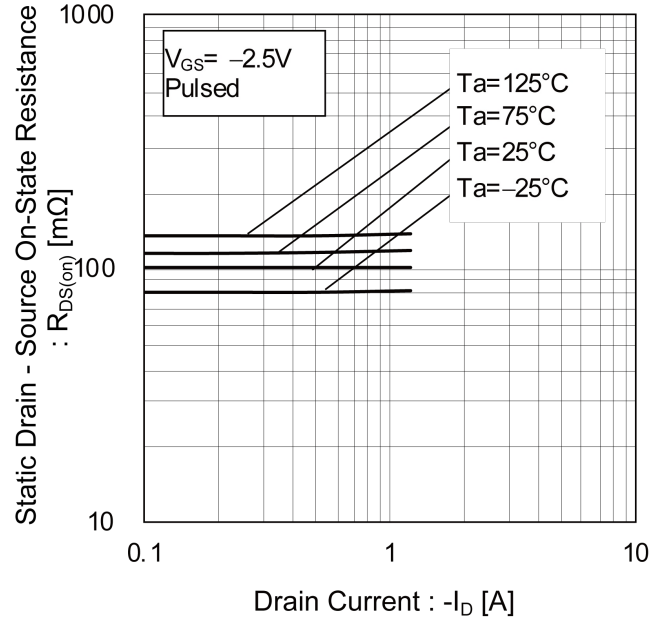


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current (IV)

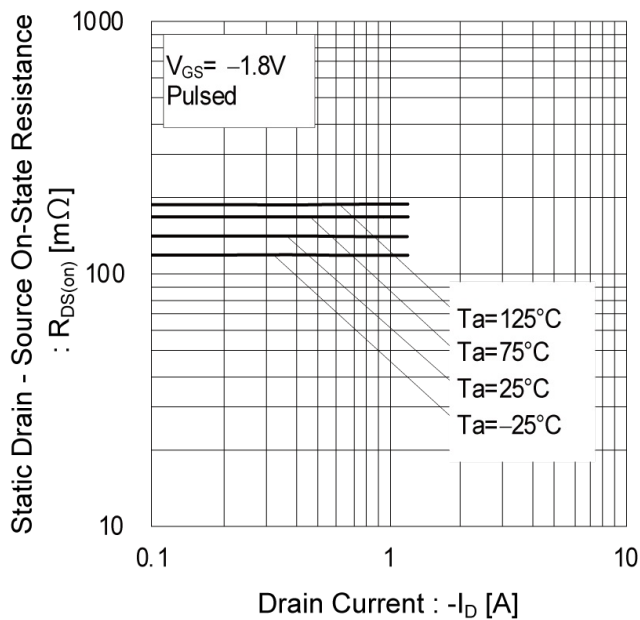
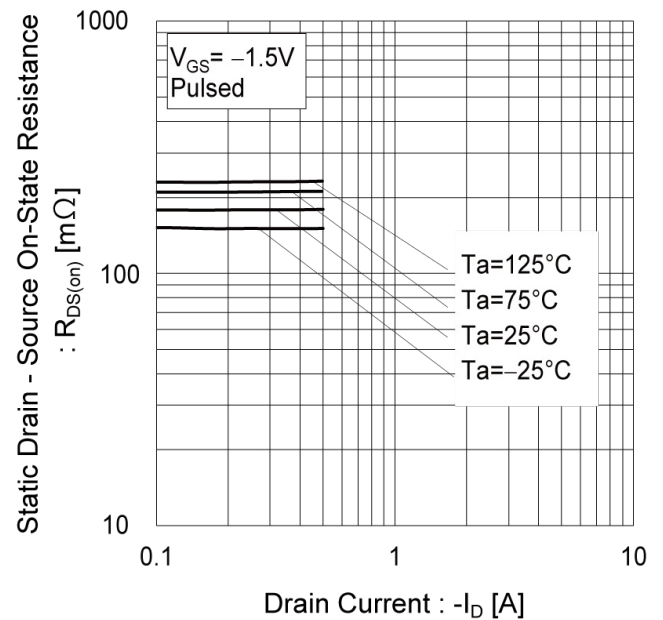


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (V)





● Electrical characteristic curves <MOSFET>

Fig.15 Typical Capacitance vs. Drain - Source Voltage

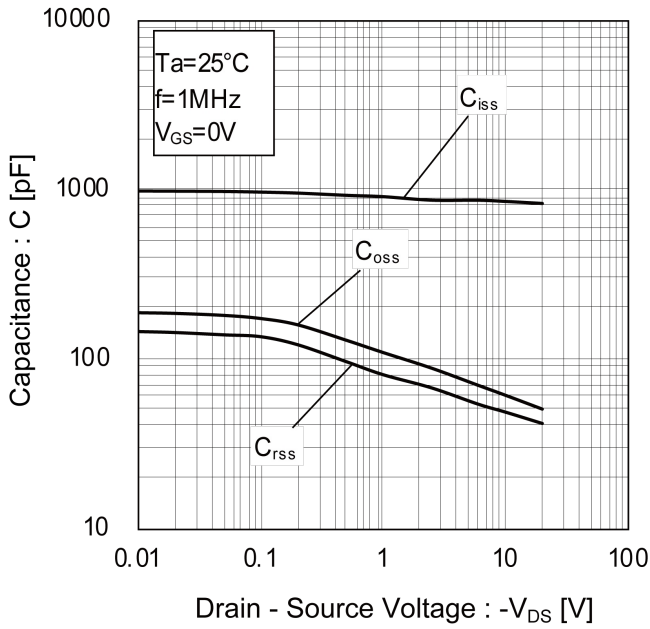


Fig.16 Switching Characteristics

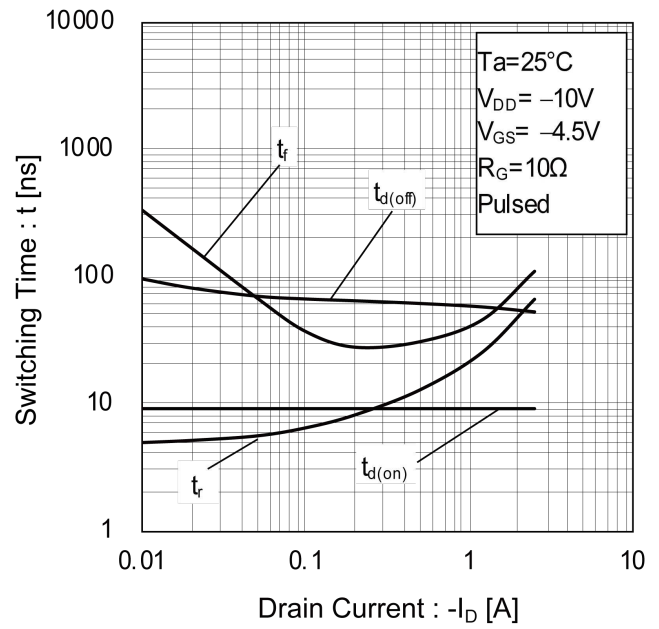


Fig.17 Dynamic Input Characteristics

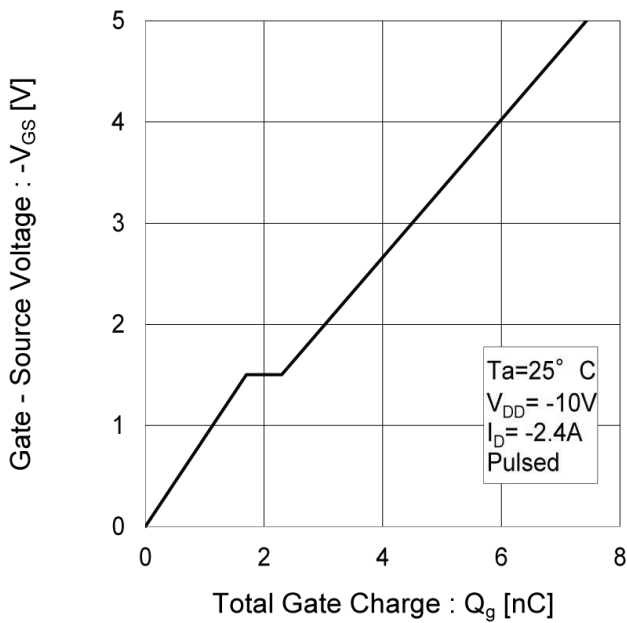
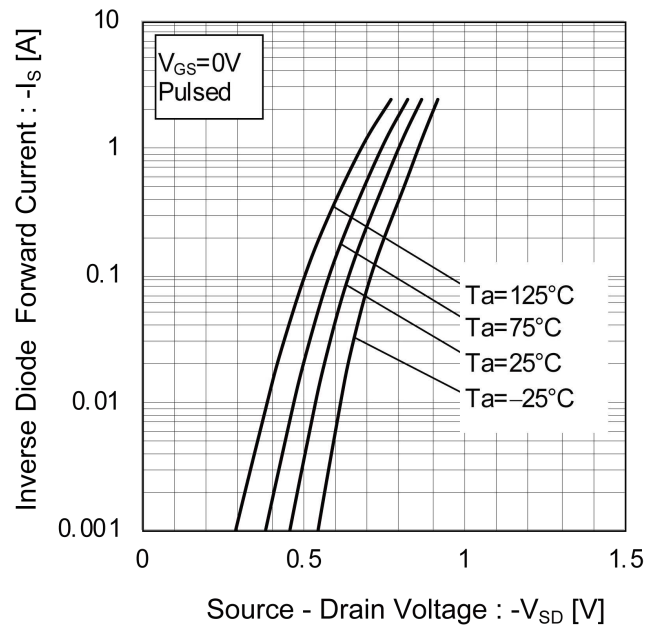


Fig.18 Source Current vs. Source Drain Voltage



● Electrical characteristic curves <Di>

Fig.19 Reverse Current vs. Reverse Voltage

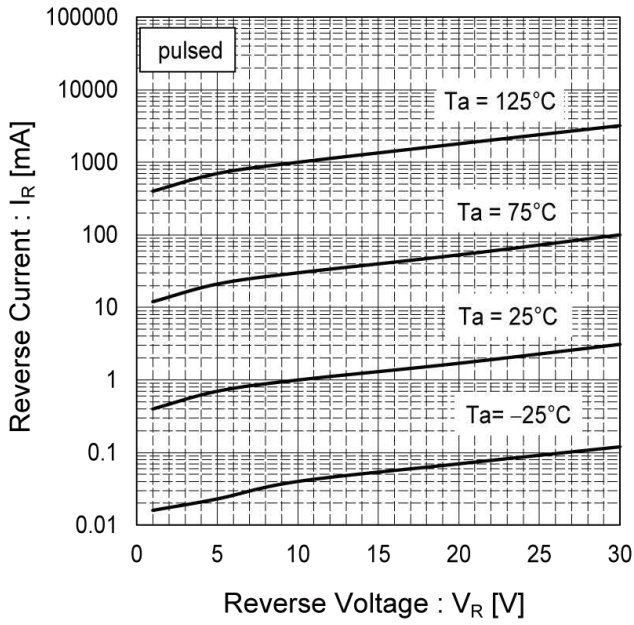
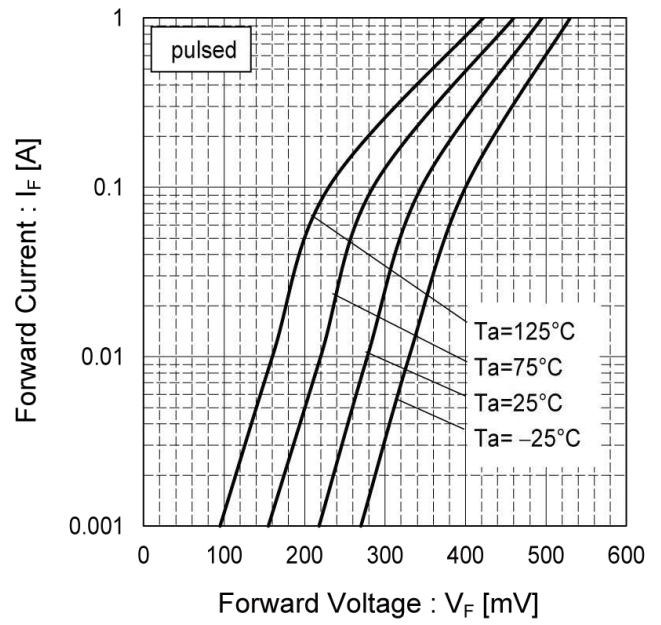


Fig.20 Forward Current vs. Forward Voltage



● Measurement circuits

Fig. 1-1 SWITCHING TIME MEASUREMENT CIRCUIT

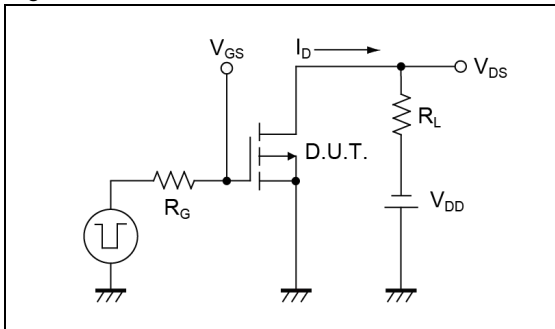


Fig. 1-2 SWITCHING WAVEFORMS

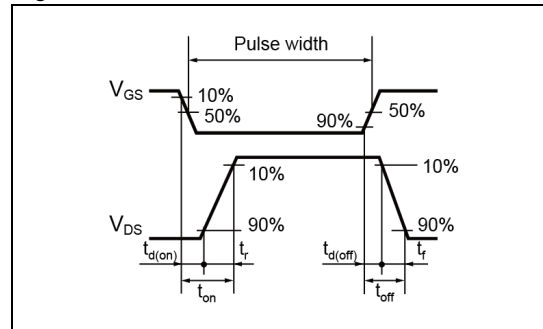


Fig. 2-1 GATE CHARGE MEASUREMENT CIRCUIT

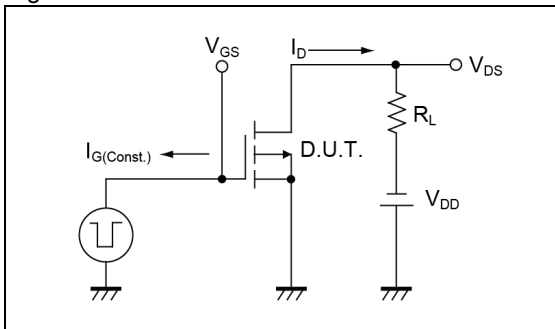
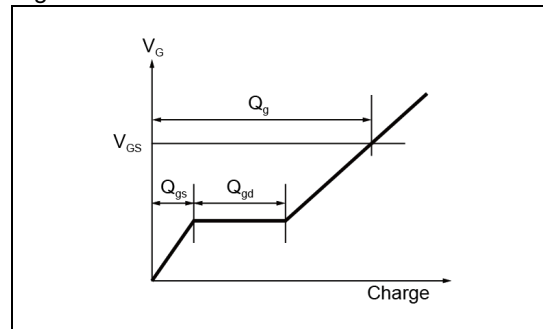


Fig. 2-2 GATE CHARGE WAVEFORM

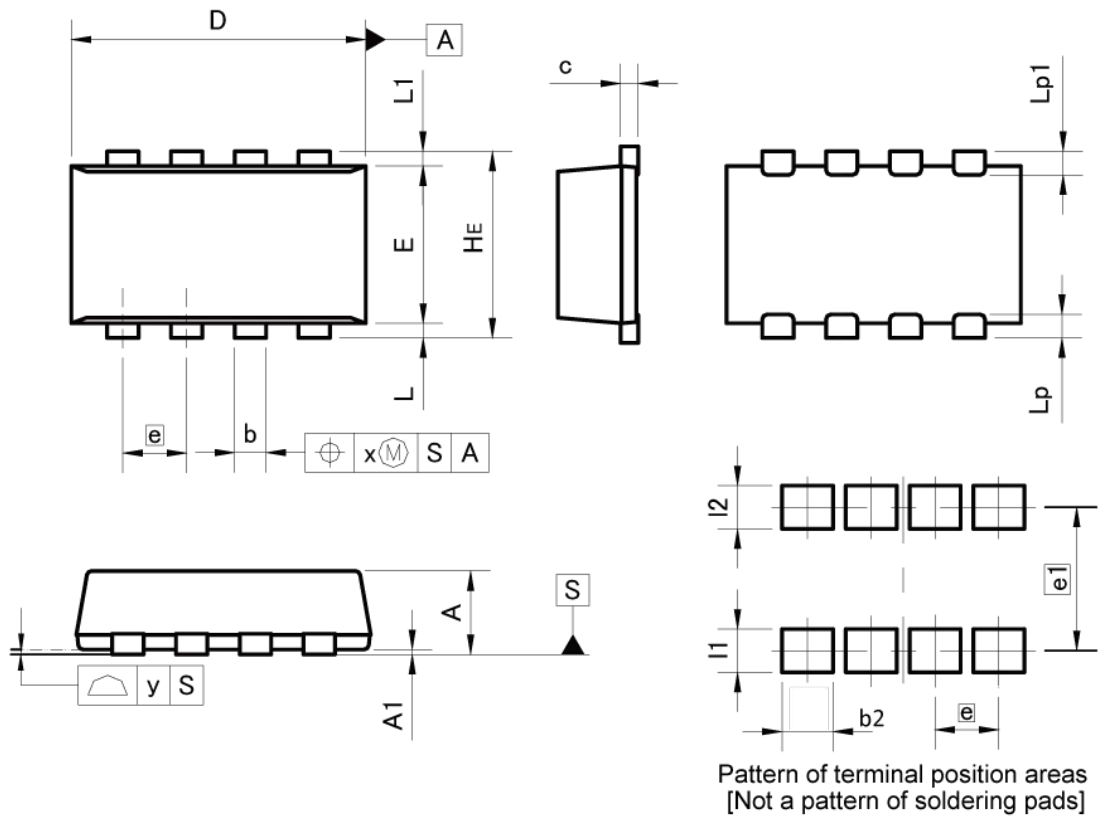


● Notice

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



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	
i1	-	0.44	-	0.017
i2	-	0.44	-	0.017

Dimension in mm/inches

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