

$V_{DSS}$	-12V
$R_{DS(on)}(Max.)$	43m $\Omega$
$I_D$	$\pm 3.5A$
$P_D$	1.25W

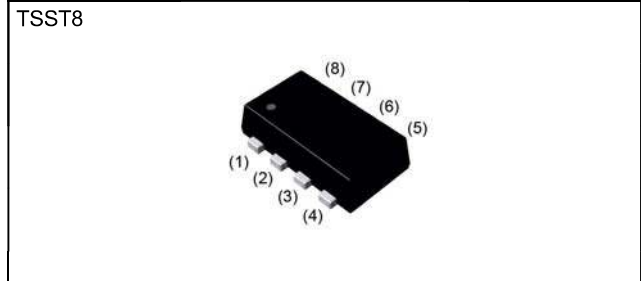
●Features

- 1) Low on - resistance.
- 2) -1.5V Drive.
- 3) Built-in G-S Protection Diode.
- 4) Small Surface Mount Package (TSST8).
- 5) Pb-free lead plating ; RoHS compliant

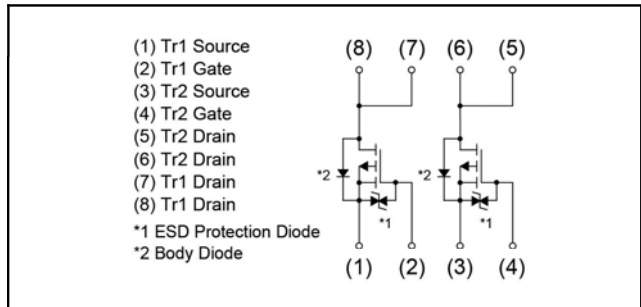
●Application

Switching

●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	J11

●Absolute maximum ratings ( $T_a = 25^\circ C$ ) <It is the same ratings for the Tr1 and Tr2>

Parameter		Symbol	Value	Unit
Drain - Source voltage		$V_{DSS}$	-12	V
Continuous drain current		$I_D$	$\pm 3.5$	A
Pulsed drain current		$I_{D,pulse}^{*1}$	$\pm 12$	A
Gate - Source voltage		$V_{GSS}$	0~-8	V
Power dissipation	total	$P_D^{*2}$	1.25	W
	element		1	
	total	$P_D^{*3}$	0.6	
Junction temperature		$T_j$	150	$^\circ C$
Range of storage temperature		$T_{stg}$	-55 to +150	$^\circ C$

### ● Thermal resistance

Parameter		Symbol	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction - ambient	total	$R_{thJA}^{*2}$	-	-	100	°C/W
	element		-	-	125	
	total	$R_{thJA}^{*3}$	-	-	208	

### ● Electrical characteristics ( $T_a = 25^\circ\text{C}$ ) <It is the same characteristics for the Tr1 and Tr2>

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 $25^\circ\text{C}$	-	-5.0	-	mV/°C
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -12V, V_{GS} = 0V$	-	-	-10	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS}$	$V_{DS} = 0V, V_{GS} = -8V$	-	-	-10	$\mu\text{A}$
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 $25^\circ\text{C}$	-	2.7	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS} = -4.5V, I_D = -3.5A$	-	31	43	m $\Omega$
		$V_{GS} = -2.5V, I_D = -1.7A$	-	43	60	
		$V_{GS} = -1.8V, I_D = -1.7A$	-	60	90	
		$V_{GS} = -1.5V, I_D = -0.7A$	-	80	160	
Gate input resistance	$R_G$	f = 1MHz, open drain	-	10	-	$\Omega$
Forward Transfer Admittance	$ Y_{fs} ^{*4}$	$V_{DS} = -6V, I_D = -3.5A$	4	-	-	S

● **Electrical characteristics** ( $T_a = 25^\circ\text{C}$ ) <It is the same characteristics for the Tr1 and Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	$C_{iss}$	$V_{GS} = 0V$	-	2600	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = -6V$	-	200	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	190	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx -6V, V_{GS} = -4.5V$	-	15	-	ns
Rise time	$t_r^{*4}$	$I_D = -1.7A$	-	30	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 3.5\Omega$	-	170	-	
Fall time	$t_f^{*4}$	$R_G = 10\Omega$	-	60	-	

● **Gate charge characteristics** ( $T_a = 25^\circ\text{C}$ ) <It is the same characteristics for the Tr1 and Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*4}$	$V_{DD} \approx -6V$	-	22	-	nC
Gate - Source charge	$Q_{gs}^{*4}$	$I_D = -3.5A$	-	3.9	-	
Gate - Drain charge	$Q_{gd}^{*4}$	$V_{GS} = -4.5V$	-	3.1	-	

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

<It is the same characteristics for the Tr1 and Tr2>

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	$I_{SP}^{*1}$		-	-	-12	
Forward voltage	$V_{SD}^{*4}$	$V_{GS} = 0V, I_S = -3.5A$	-	-	-1.2	V

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

\*2 Mounted on a ceramic board (30×30×0.8mm)

\*3 Mounted on a FR4 (20×20×0.8mm)

\*4 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

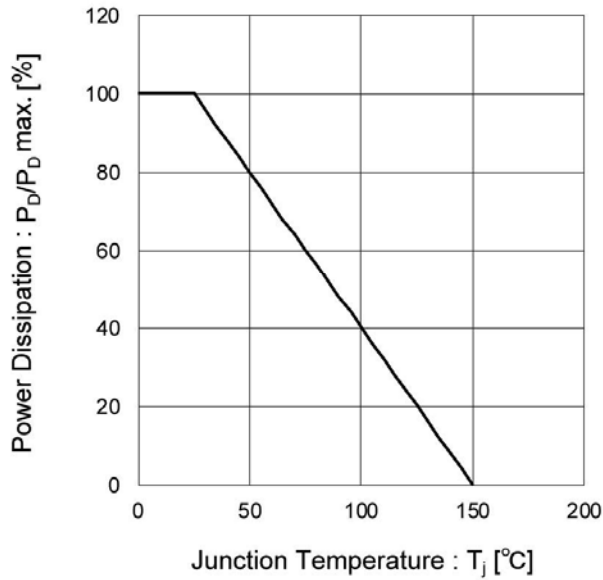


Fig.2 Maximum Safe Operating Area

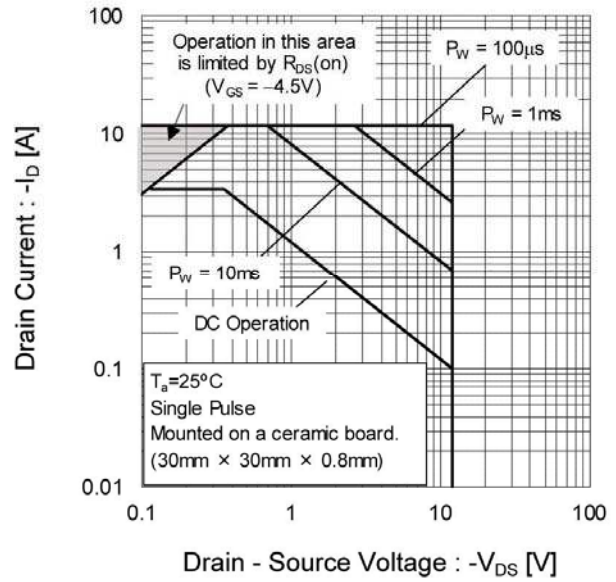


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

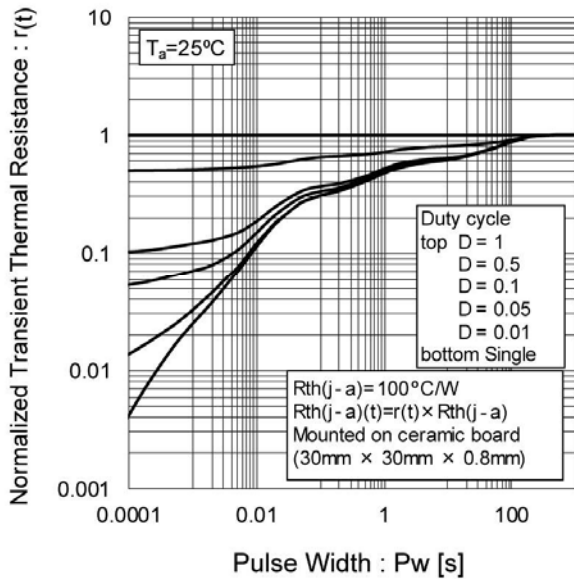
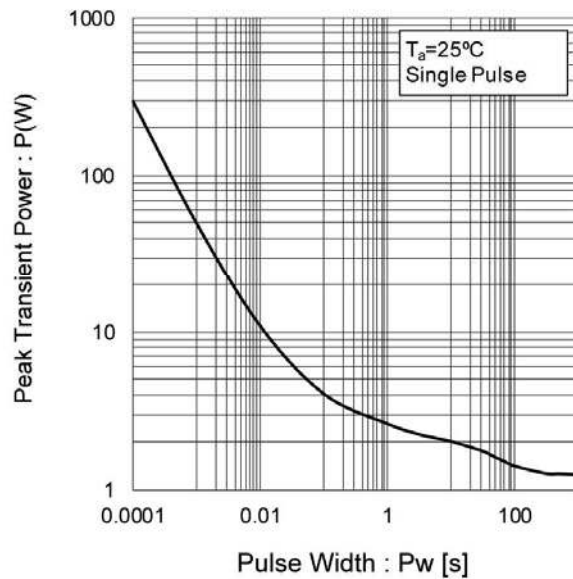


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

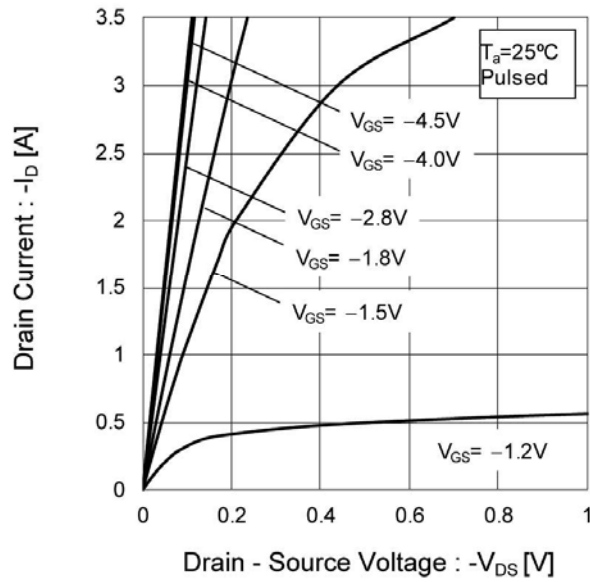


Fig.6 Typical Output Characteristics(II)

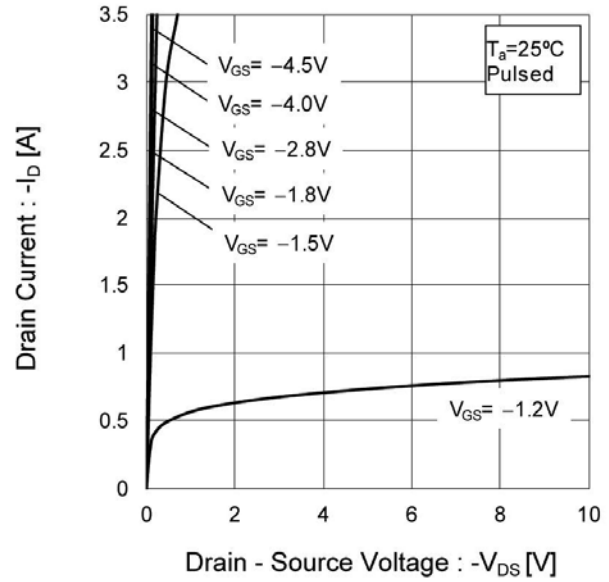


Fig.7 Breakdown Voltage vs. Junction Temperature

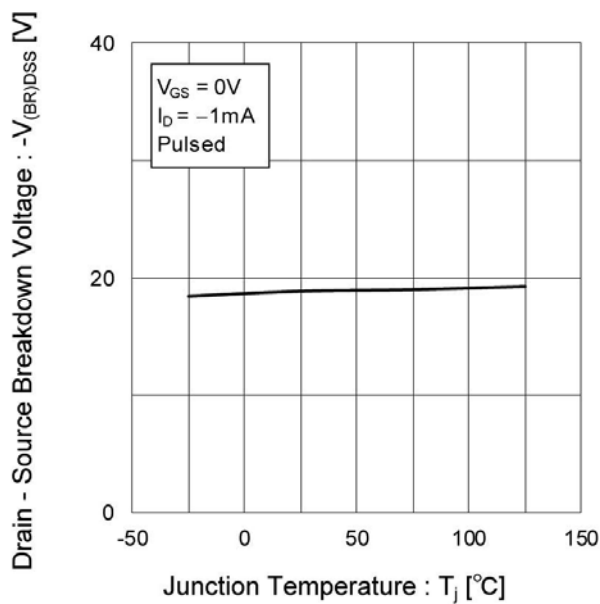
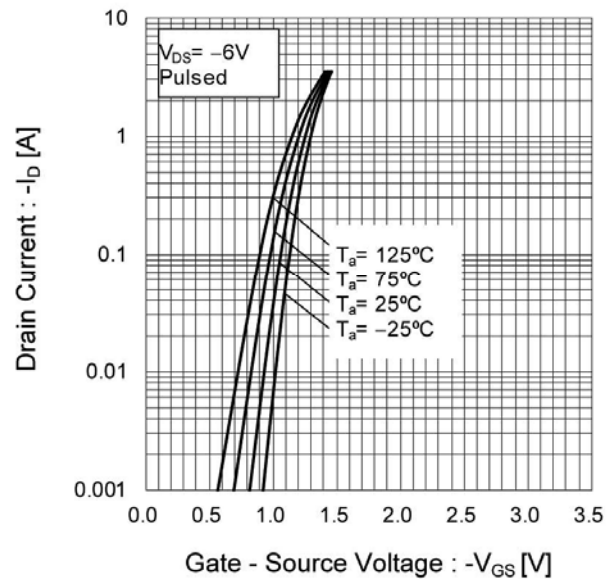


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage vs. Junction Temperature

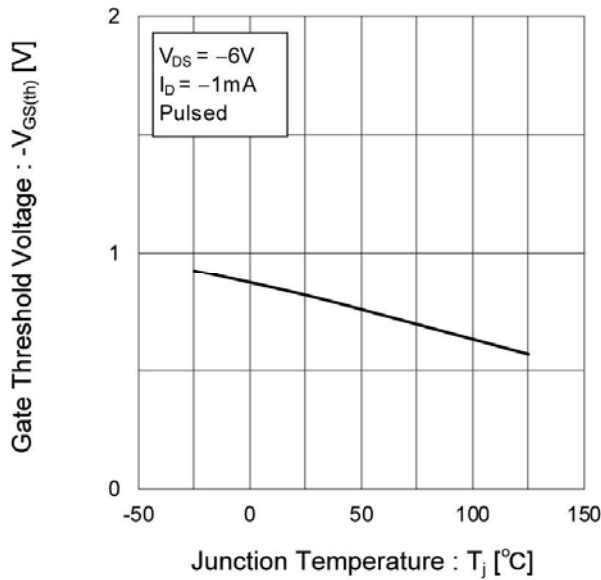


Fig.10 Forward Transfer Admittance vs. Drain Current

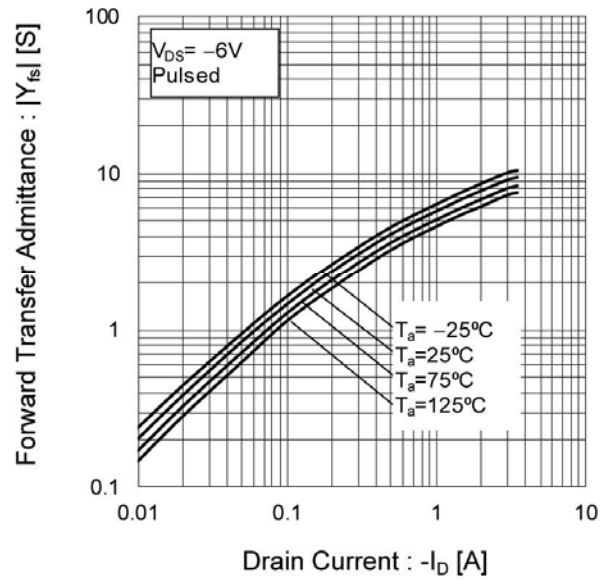


Fig.11 Drain Current Derating Curve

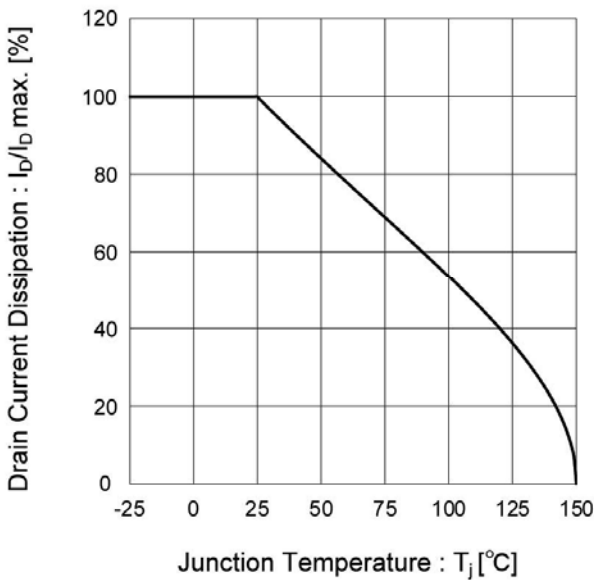
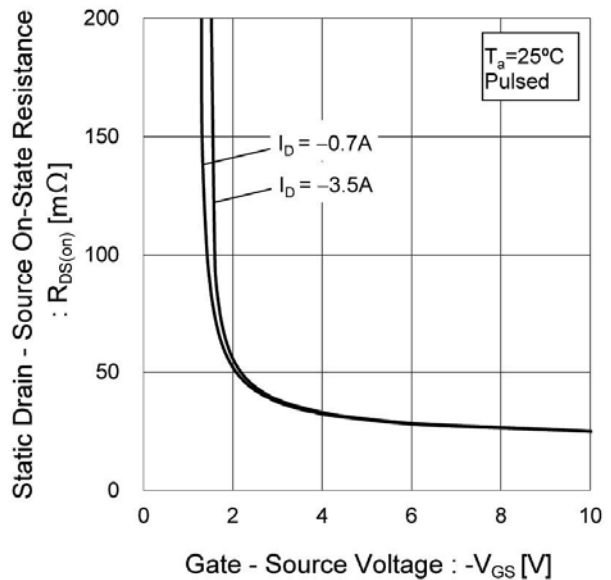


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



●Electrical characteristic curves

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

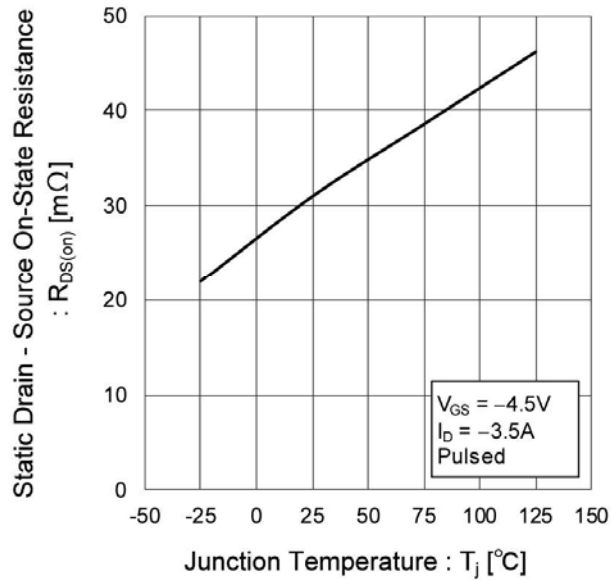
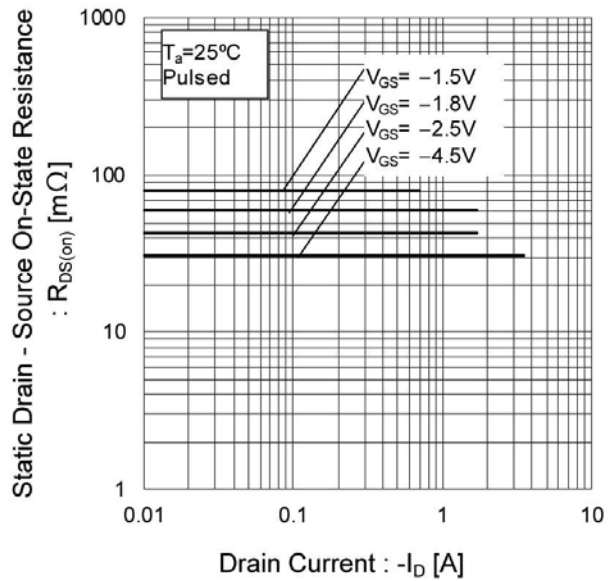


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)



● Electrical characteristic curves

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

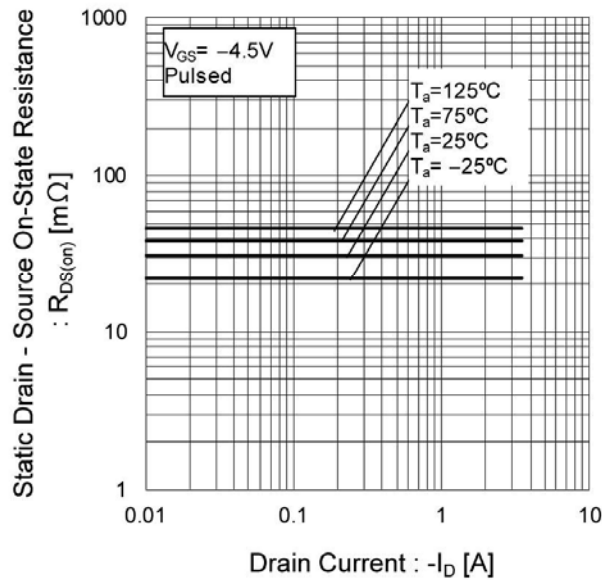


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

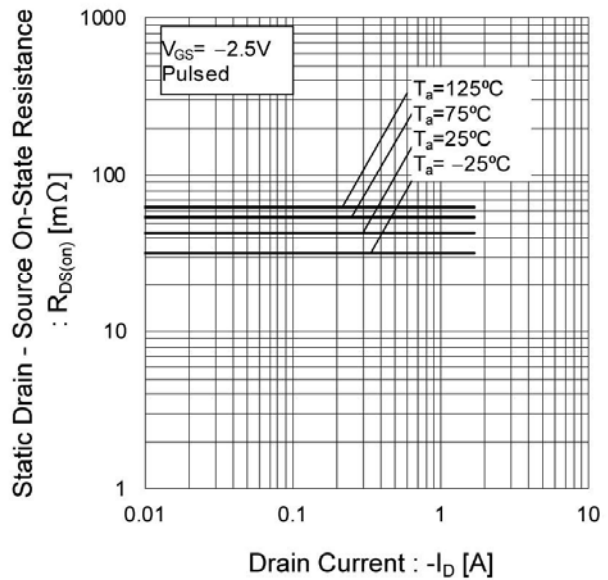


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

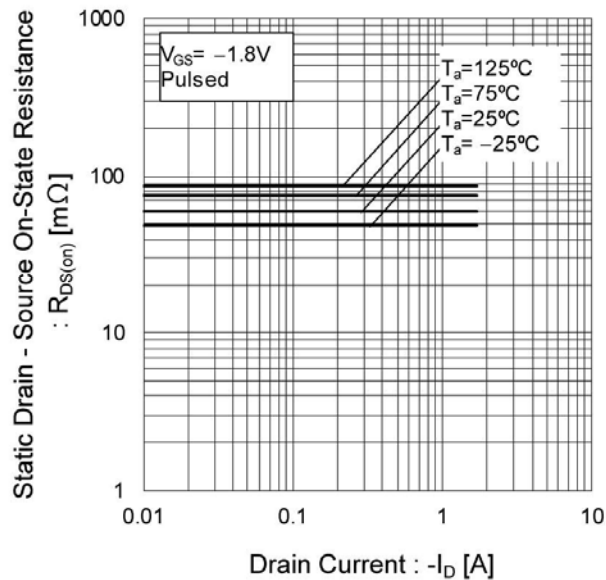
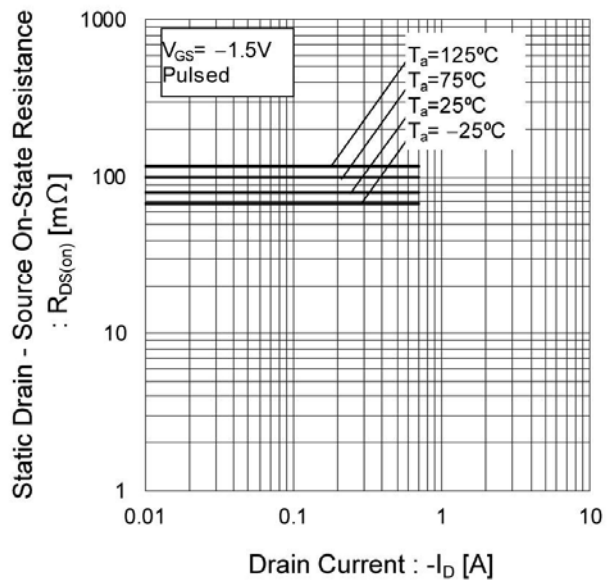


Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(V)





●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

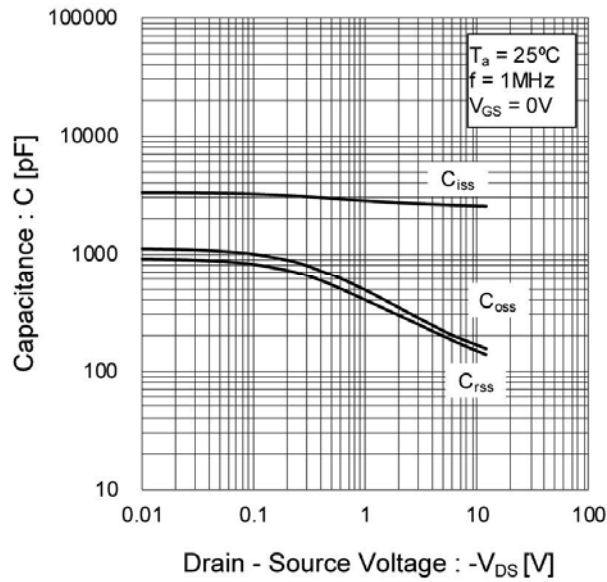


Fig.20 Switching Characteristics

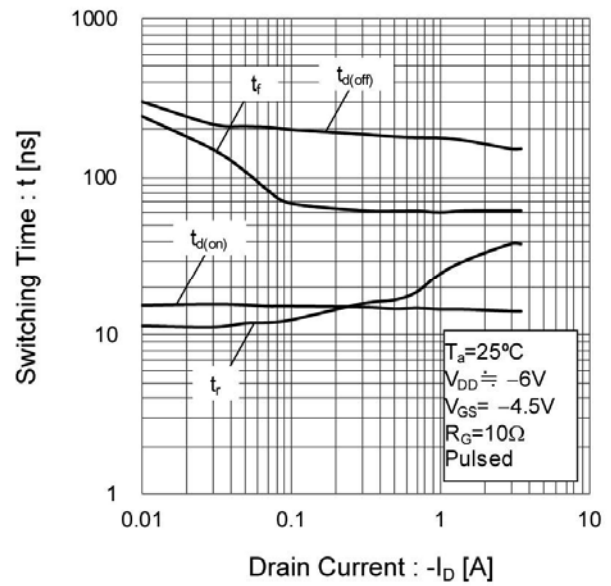


Fig.21 Dynamic Input Characteristics

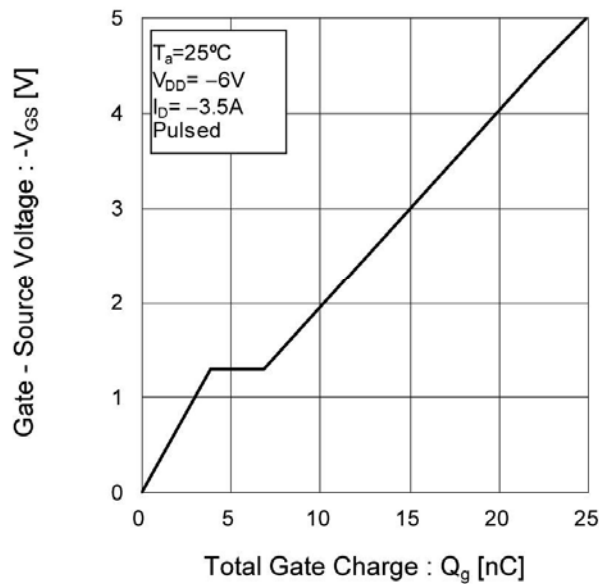
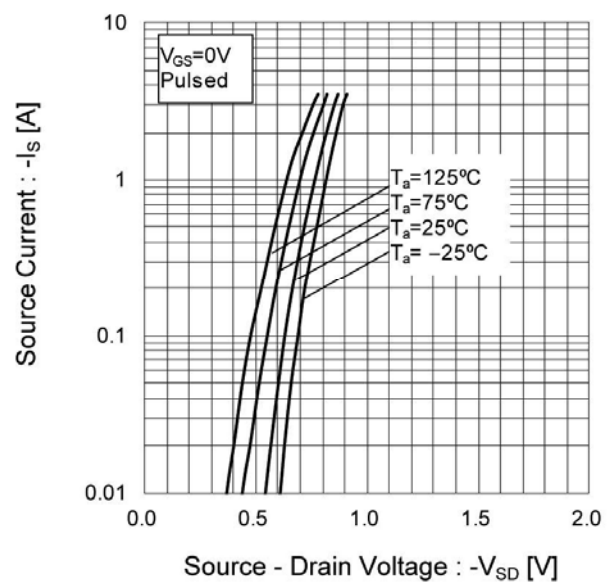


Fig.22 Source Current vs. Source Drain Voltage



● Measurement circuits <It is the same for the Tr1 and Tr2>

Fig. 1-1 SWITCHING TIME MEASUREMENT CIRCUIT

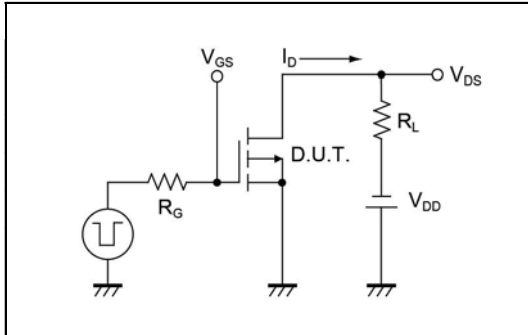


Fig. 1-2 SWITCHING WAVEFORMS

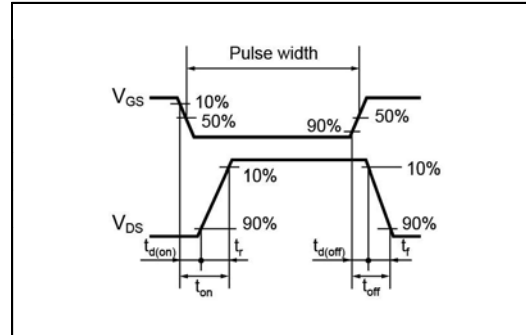


Fig. 2-1 GATE CHARGE MEASUREMENT CIRCUIT

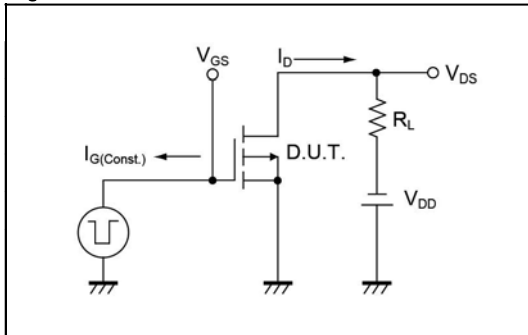
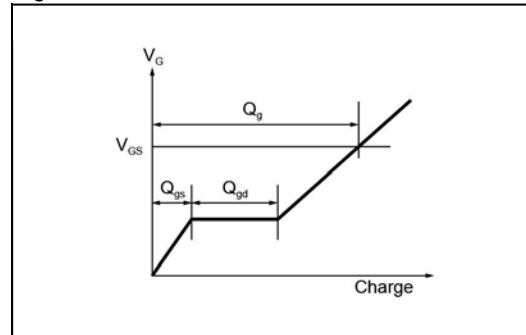


Fig. 2-2 GATE CHARGE WAVEFORM

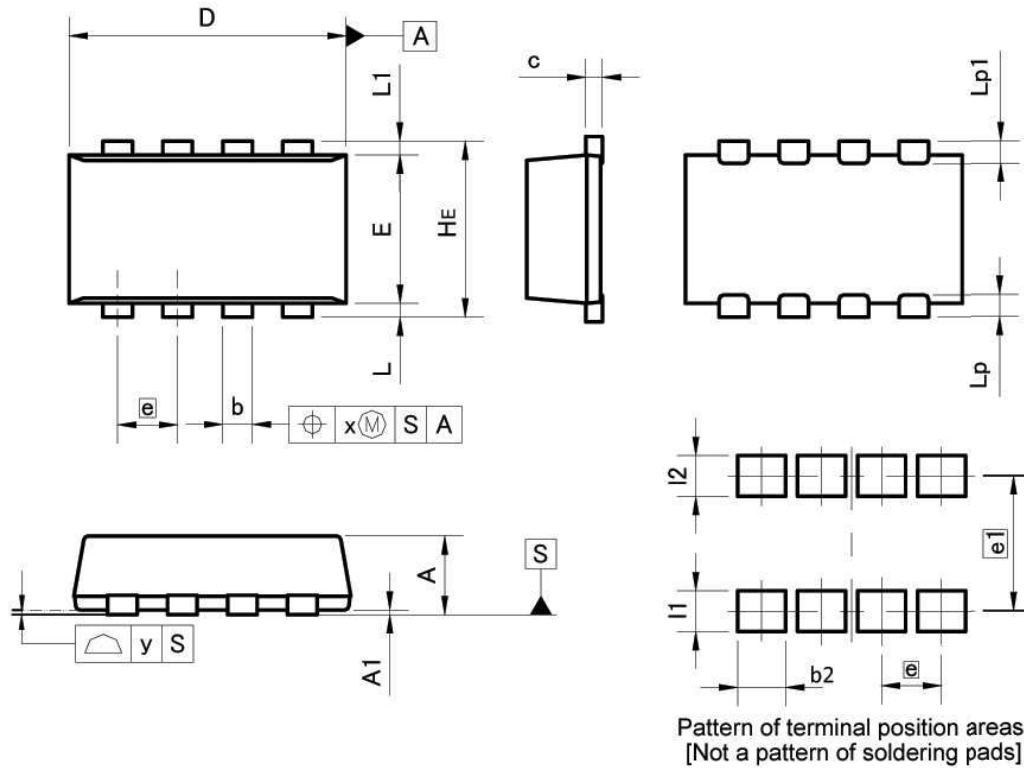


● Notice

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	
I1	-	0.44	-	0.017
I2	-	0.44	-	0.017

Dimension in mm/inches

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