

$V_{DSS}$	-12V
$R_{DS(on)}(Max.)$	22m $\Omega$
$I_D$	$\pm 5.5A$
$P_D$	1.5W

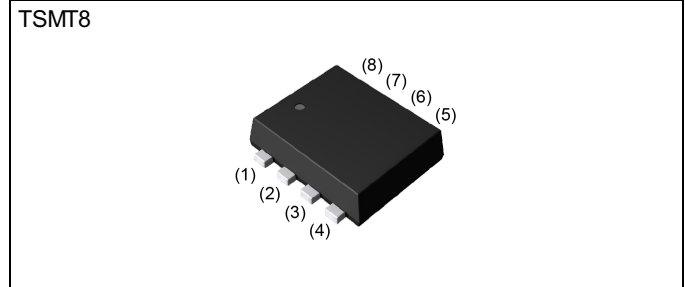
●Features

- 1) Low on - resistance.
- 2) Small Surface Mount Package .
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

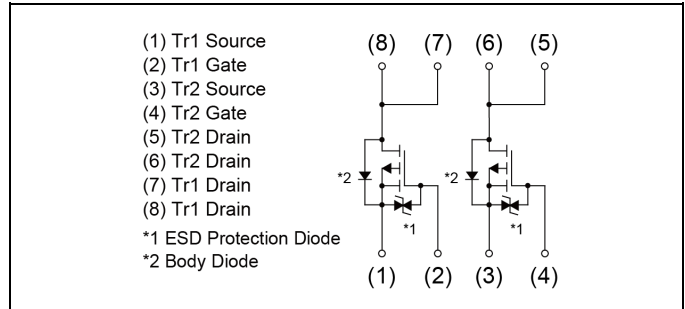
●Application

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	J13	

●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	$I_D^{*1}$	$\pm 5.5$	A
Pulsed drain current	$I_{D,pulse}^{*2}$	$\pm 18$	A
Gate - Source voltage	$V_{GSS}$	0~ -8	V
Power dissipation	total	1.5	W
	element	1.25	
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	-	83.3	-	°C/W
	element	-	100	-	

● Electrical characteristics (T<sub>a</sub> = 25°C) <It is the same characteristics for the Tr1 and Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -1mA	-12	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	I <sub>D</sub> = -1mA referenced to 25°C	-	-5.0	-	mV/°C
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -12V, V <sub>GS</sub> = 0V	-	-	-10	μA
Gate - Source leakage current	I <sub>GSS</sub>	V <sub>DS</sub> = 0V, V <sub>GS</sub> = -8V	-	-	-10	μA
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = -6V, I <sub>D</sub> = -1mA	-0.3	-	-1.0	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	I <sub>D</sub> = -1mA referenced to 25°C	-	2.7	-	V/°C
Static drain - source on - state resistance	R <sub>DS(on)</sub> <sup>*4</sup>	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -5.5A	-	15	22	mΩ
		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2.7A	-	19	28	
		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -2.7A	-	24	38	
		V <sub>GS</sub> = -1.5V, I <sub>D</sub> = -1.1A	-	29	58	
Transconductance	g <sub>fs</sub> <sup>*4</sup>	V <sub>DS</sub> = -6V, I <sub>D</sub> = -5.5A	8.5	-	-	S

\*1 Limited only by maximum temperature allowed.

\*2 Pw ≤ 10μs, Duty cycle ≤ 1%

\*3 Mounted on a ceramic board.

\*4 Pulsed

● **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	$C_{iss}$	$V_{GS} = 0V$	-	6300	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = -6V$	-	750	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	750	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx -6V, V_{GS} = -4.5V$	-	13	-	ns
Rise time	$t_r^{*4}$	$I_D = -2.7A$	-	100	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 2.2\Omega$	-	400	-	
Fall time	$t_f^{*4}$	$R_G = 10\Omega$	-	200	-	

● **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	$Q_g^{*4}$	$V_{DD} \approx -6V, I_D = -5.5A$ $V_{GS} = -4.5V$	-	60	-	nC
Gate - Source charge	$Q_{gs}^{*4}$		-	10	-	
Gate - Drain charge	$Q_{gd}^{*4}$		-	9	-	

● **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	$I_S^{*1}$	$T_a = 25^\circ\text{C}$	-	-	-1	A
Body diode pulse current	$I_{SP}^{*2}$		-	-	-18	
Forward voltage	$V_{SD}^{*4}$	$V_{GS} = 0V, I_S = -5.5A$	-	-	-1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve



Fig.2 Maximum Safe Operating Area

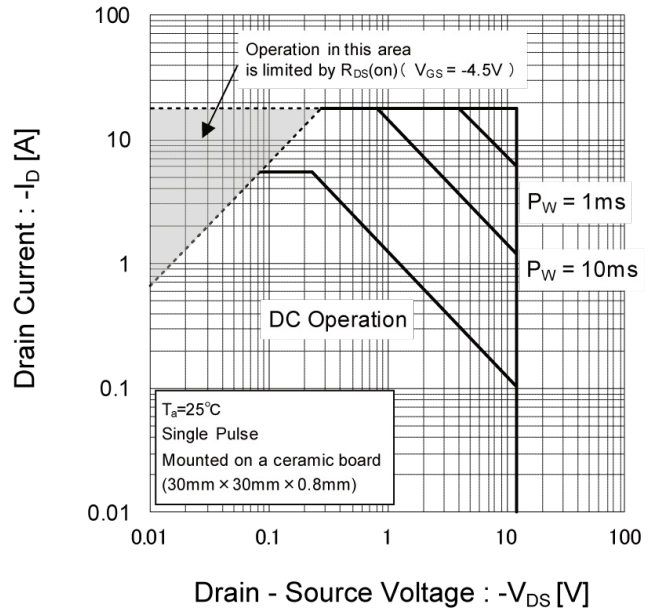


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

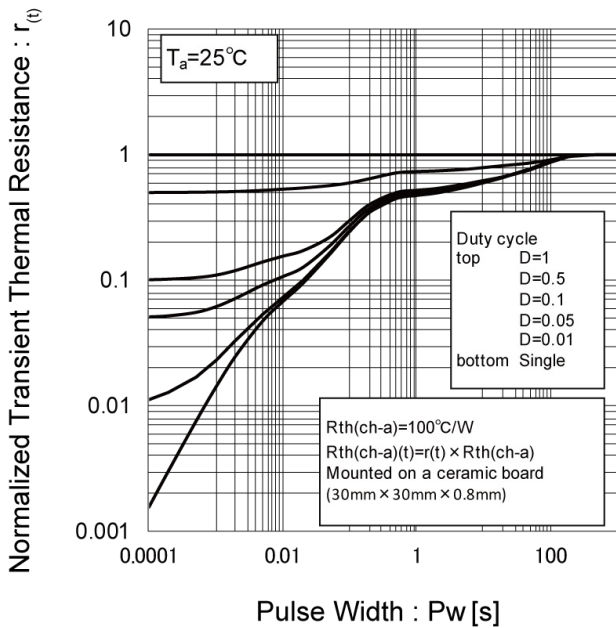
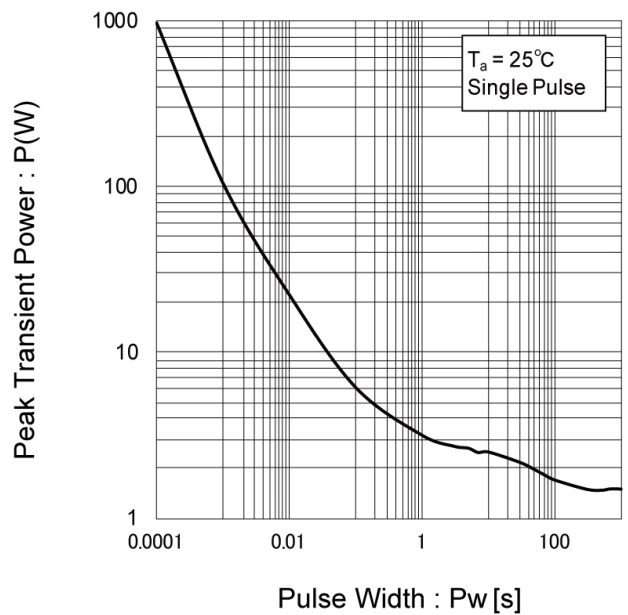


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

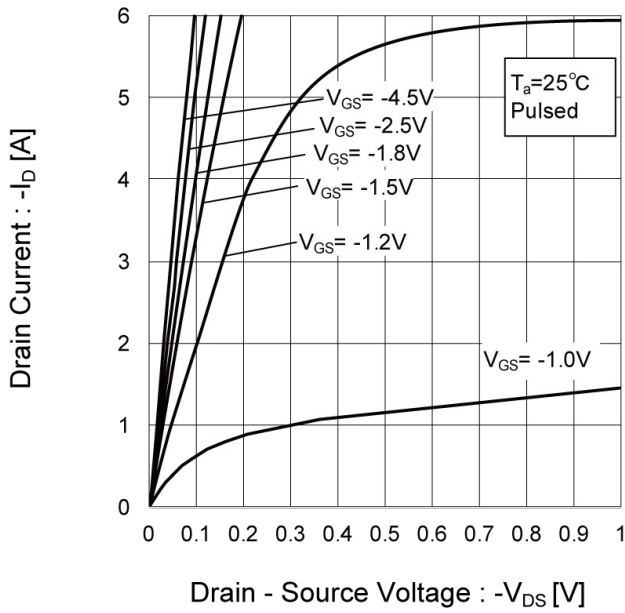


Fig.6 Typical Output Characteristics(II)

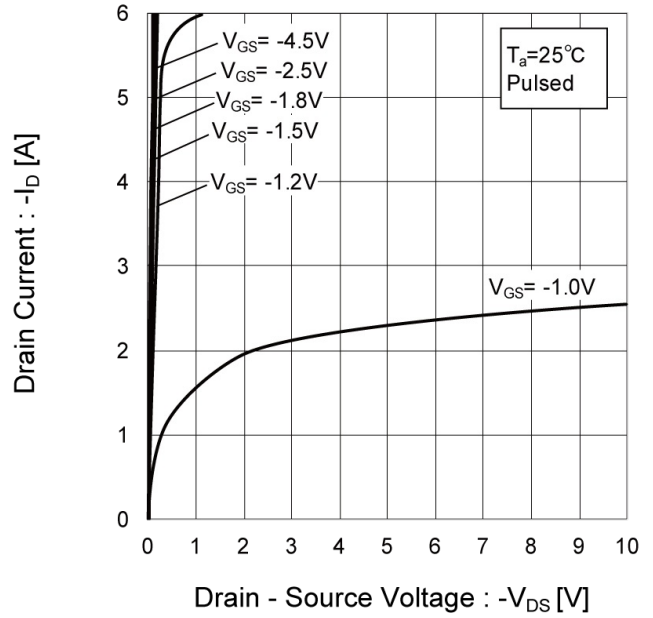
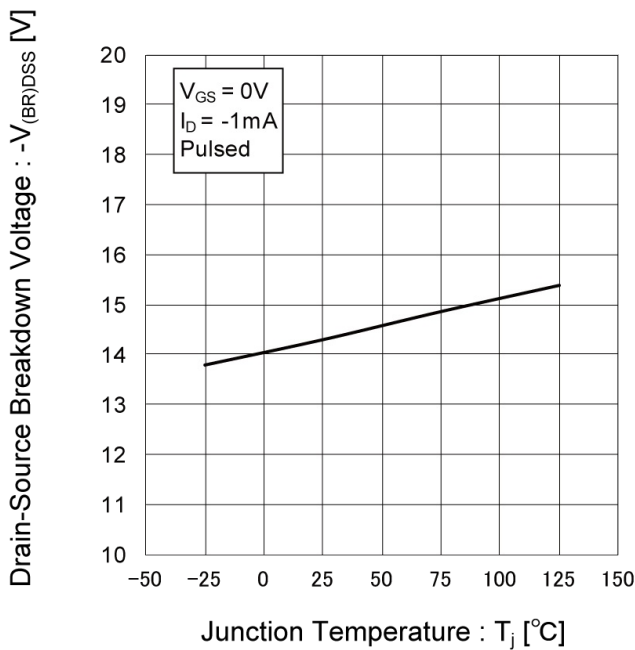


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

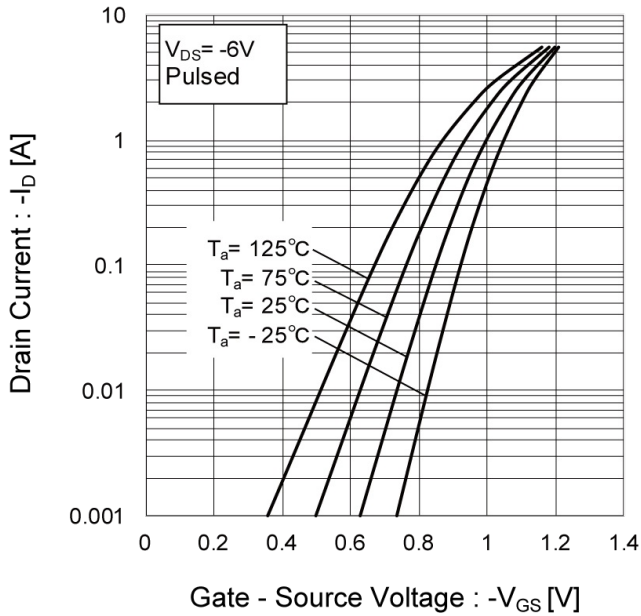


Fig.9 Gate Threshold Voltage vs. Junction Temperature

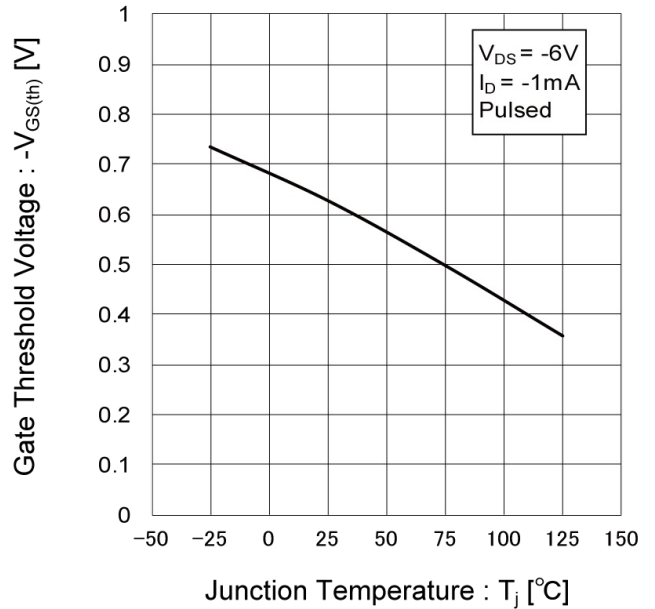
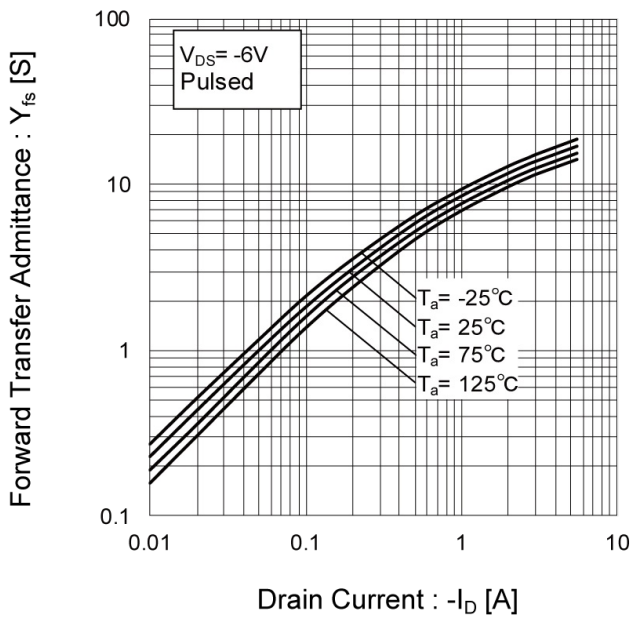


Fig.10 Transconductance vs. Drain Current



● Electrical characteristic curves

Fig.11 Drain Current Derating Curve

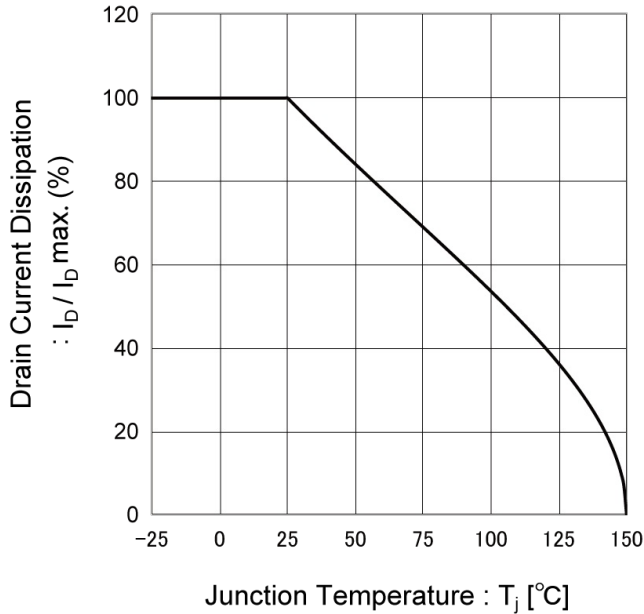


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

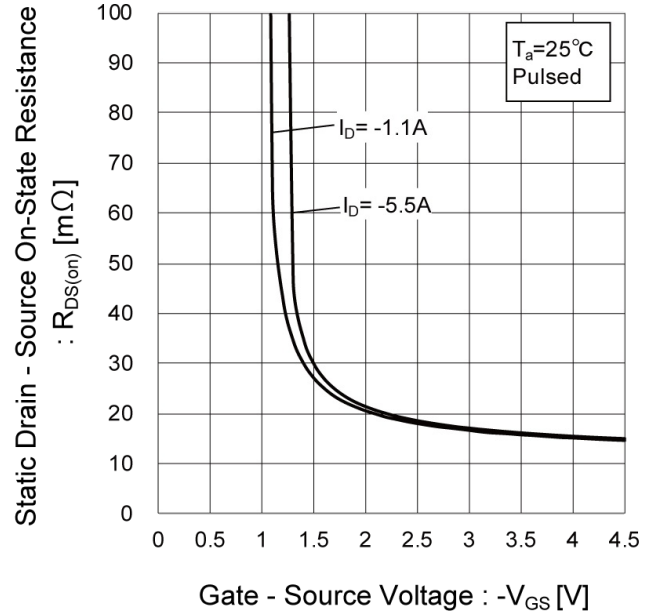


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

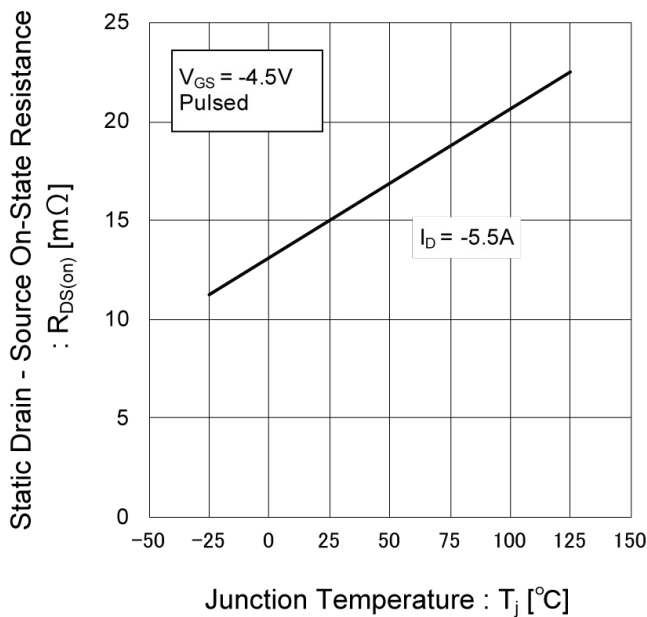
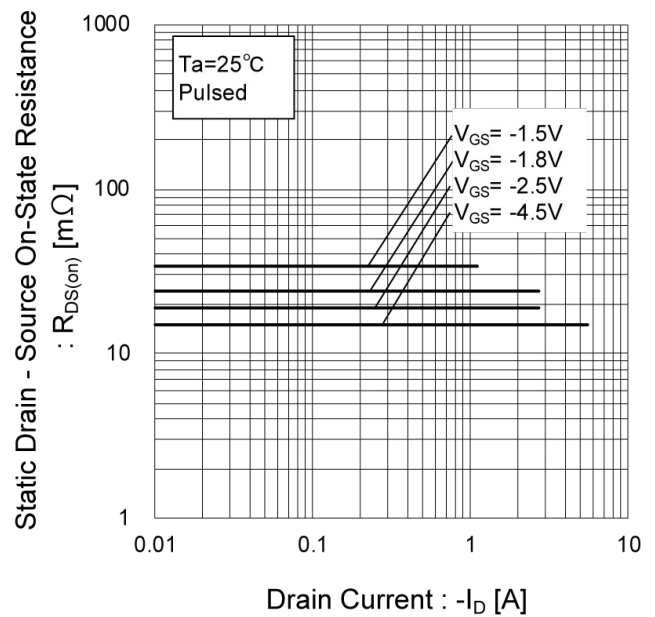


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)



● Electrical characteristic curves

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

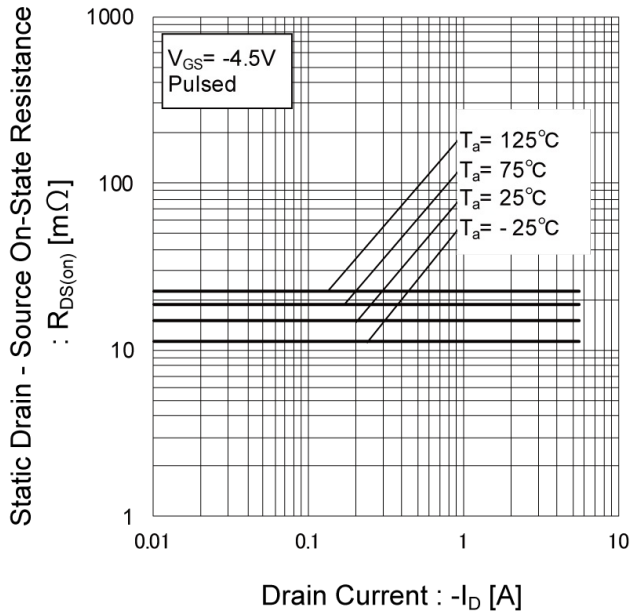


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

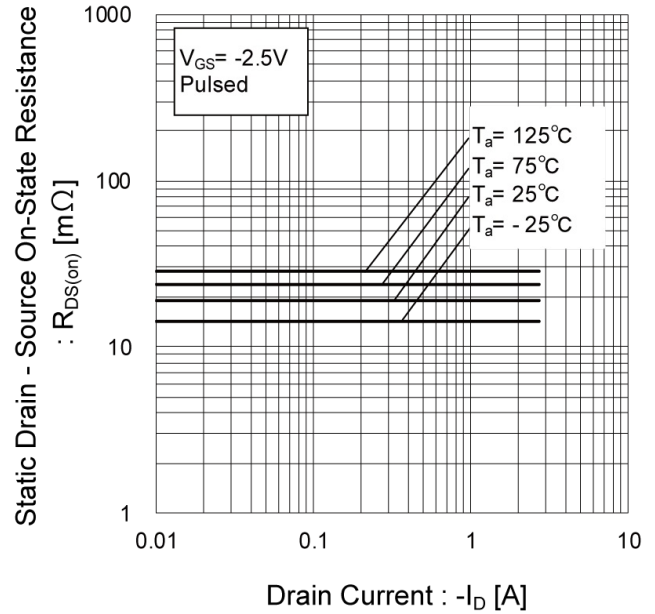


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

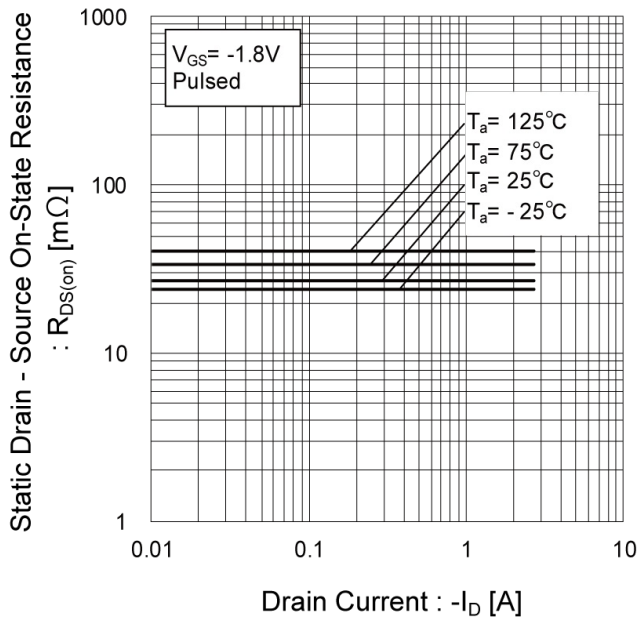
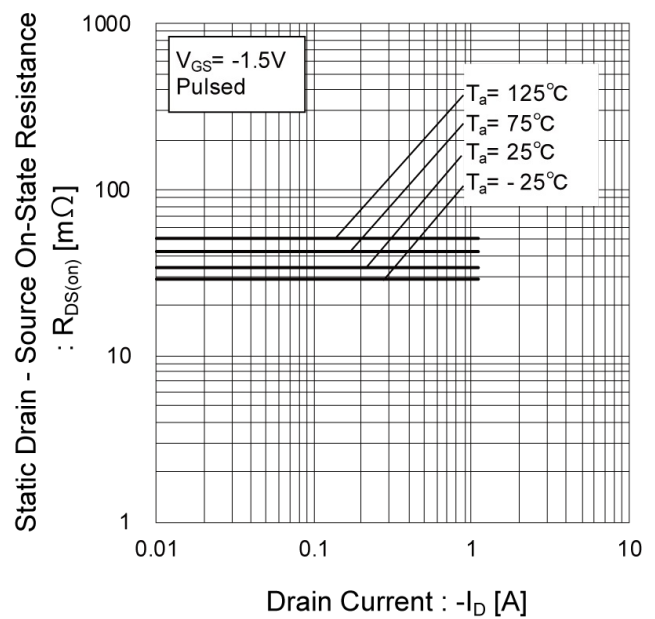


Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(V)





● Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

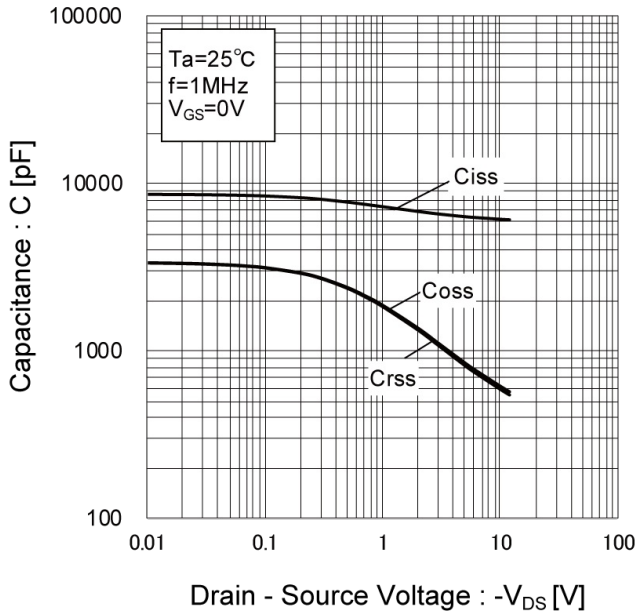


Fig.20 Switching Characteristics

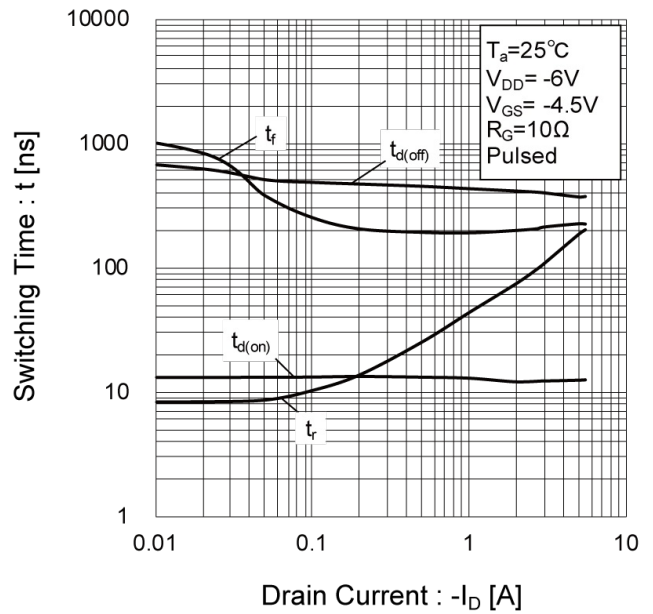


Fig.21 Dynamic Input Characteristics

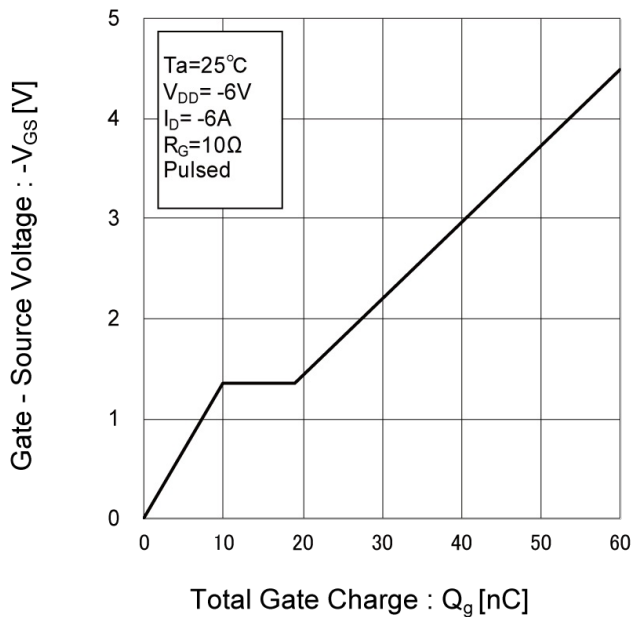
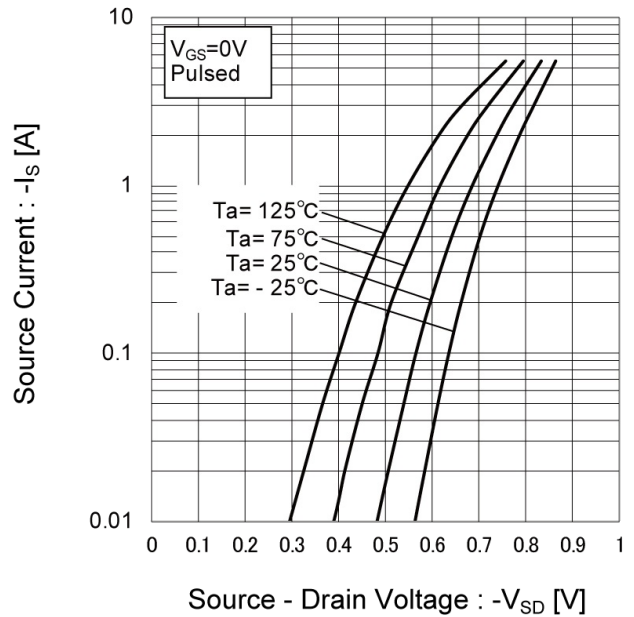


Fig.22 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

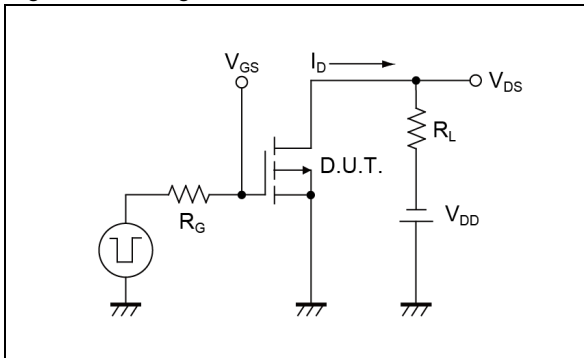


Fig.1-2 Switching Waveforms

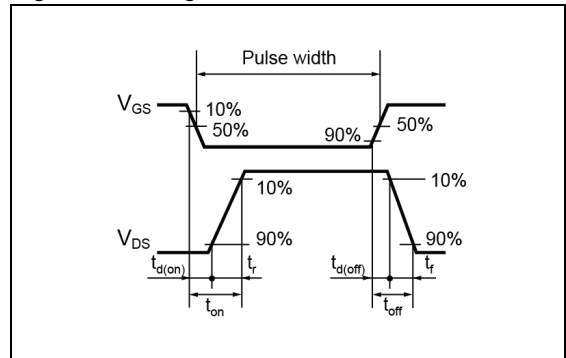


Fig.2-1 Gate Charge Measurement Circuit

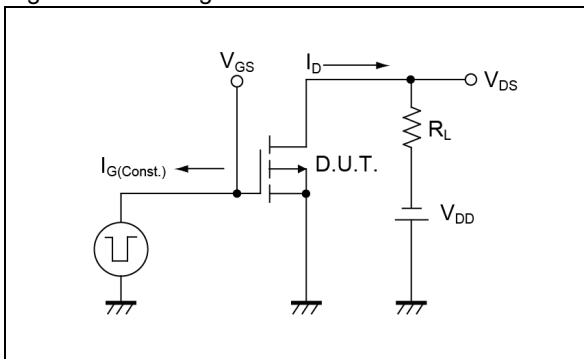
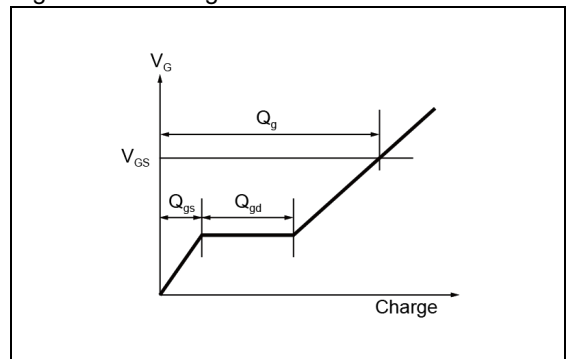
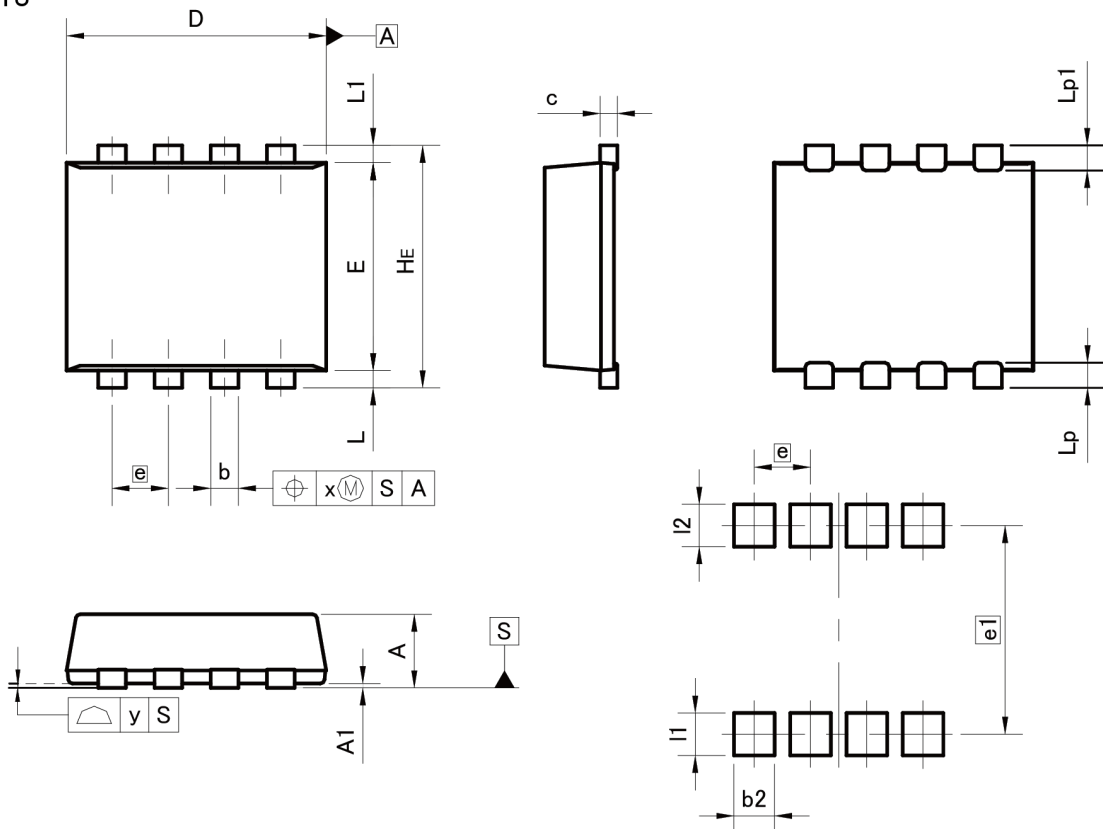


Fig.2-2 Gate Charge Waveform



●Dimensions

TSMT8



Pattern of terminal position areas  
[Not a recommended 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

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