

$V_{DSS}$	30V
$R_{DS(on)}(Max.)$	35mΩ
$I_D$	±4.5A
$P_D$	1.5W

### ●Features

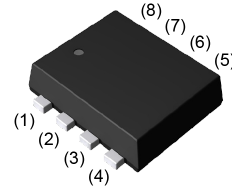
- 1) Low on - resistance.
- 2) Small Surface Mount Package (TSMT8).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

### ●Application

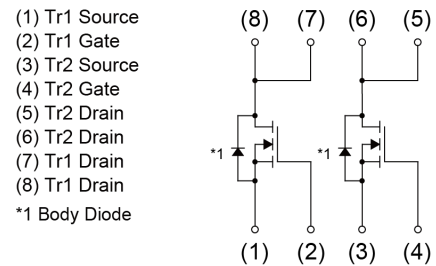
Switching  
Motor Drive

### ●Outline

TSMT8



### ●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	KA2	

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

Parameter	Symbol	Value	Unit
Drain - Source voltage	$V_{DSS}$	30	V
Continuous drain current	$I_D$	±4.5	A
Pulsed drain current	$I_{D,pulse}^{*1}$	±12	A
Gate - Source voltage	$V_{GSS}$	±20	V
Avalanche energy, single pulse	$E_{AS}^{*2}$	1.5	mJ
Avalanche current	$I_{AS}^{*2}$	4.5	A
Power dissipation	$P_D^{*3}$	1.5	W
Junction temperature	$T_j$	150	°C
Range of storage temperature	$T_{stg}$	-55 to +150	°C

### ● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	$R_{thJA}^{*3}$	-	83.3	-	°C/W

### ● 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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	30	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	$I_D = 1mA$ referenced to $25^\circ\text{C}$	-	21	-	mV/°C
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	μA
Gate - Source leakage current	$I_{GSS}$	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 1mA$	1.0	-	2.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	$I_D = 1mA$ referenced to $25^\circ\text{C}$	-	-3	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS} = 10V, I_D = 4.5A$	-	25	35	mΩ
		$V_{GS} = 4.5V, I_D = 4.5A$	-	40	56	
Transconductance	$g_{fs}^{*4}$	$V_{DS} = 5V, I_D = 4.5A$	1.4	-	-	S

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

\*2  $L \approx 0.1\text{mH}$ ,  $V_{DD} = 15V$ ,  $R_G = 25\Omega$ , STARTING  $T_{ch} = 25^\circ\text{C}$  Fig.3-1,3-2

\*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	$C_{iss}$	$V_{GS} = 0V$	-	365	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 10V$	-	62	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	50	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx 15V, V_{GS} = 10V$	-	7.2	-	ns
Rise time	$t_r^{*4}$	$I_D = 2.2A$	-	8.0	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 6.8\Omega$	-	12.0	-	
Fall time	$t_f^{*4}$	$R_G = 10\Omega$	-	5.7	-	

● **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	$Q_g^{*4}$	$V_{DD} \approx 15V$	$V_{GS} = 10V$	-	8.4	-	nC
			$V_{GS} = 4.5V$	-	4.7	-	
Gate - Source charge	$Q_{gs}^{*4}$	$I_D = 4.5A$		-	1.7	-	
Gate - Drain charge	$Q_{gd}^{*4}$	-		1.6	-		

● **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	$I_S$	$T_a = 25^\circ\text{C}$	-	-	1.0	A
Body diode pulse current	$I_{SP}^{*1}$		-	-	12	
Forward voltage	$V_{SD}^{*4}$	$V_{GS} = 0V, I_S = 1.0A$	-	-	1.2	V
Reverse recovery time	$t_{rr}^{*4}$	$I_S = 4.5A, V_{GS} = 0V$ $di/dt = 100A/\mu s$	-	14.1	-	ns
Reverse recovery charge	$Q_{rr}^{*4}$		-	4.7	-	nC

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve



Fig.2 Maximum Safe Operating Area

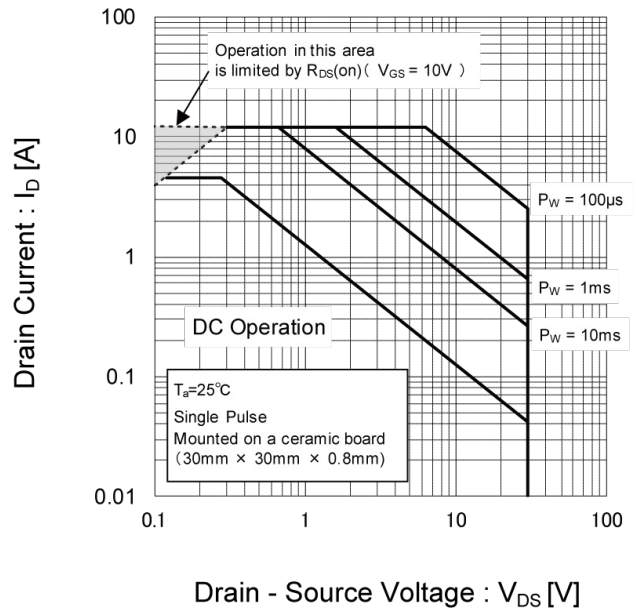


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

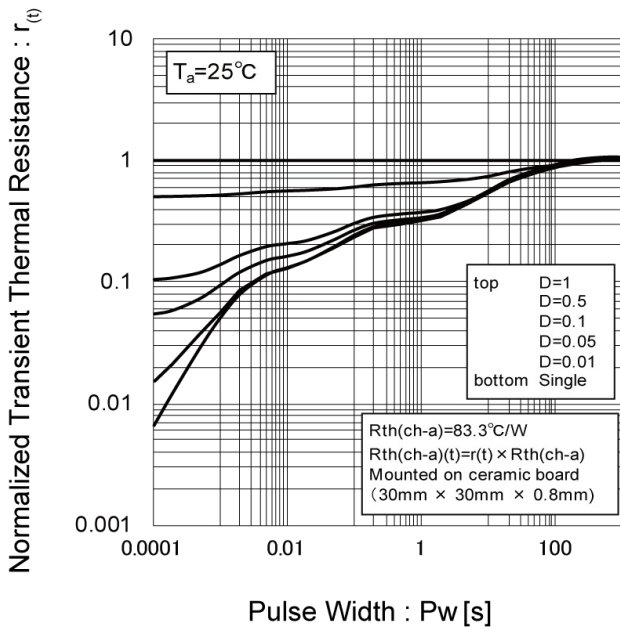
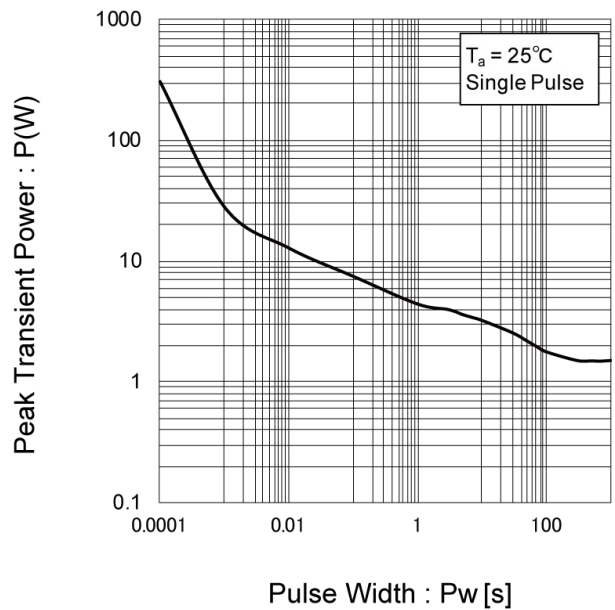


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

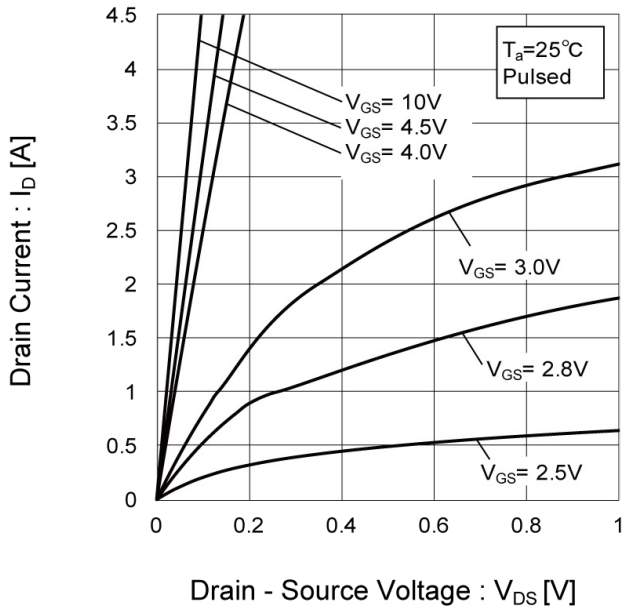


Fig.6 Typical Output Characteristics(II)

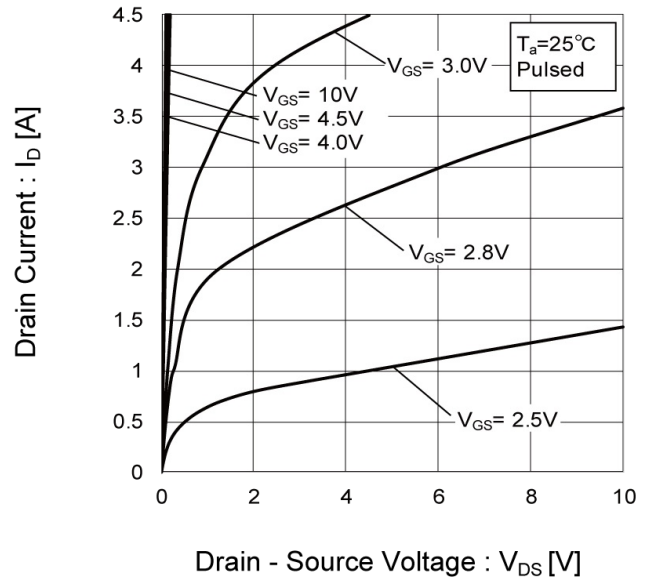
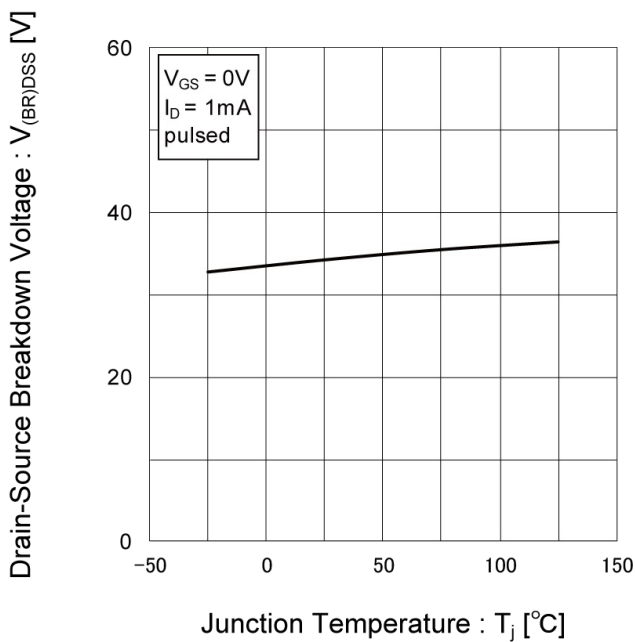


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

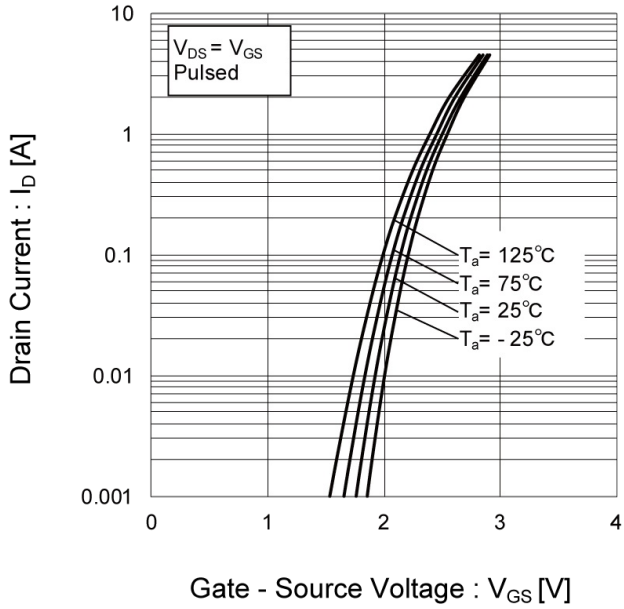


Fig.9 Gate Threshold Voltage vs. Junction Temperature

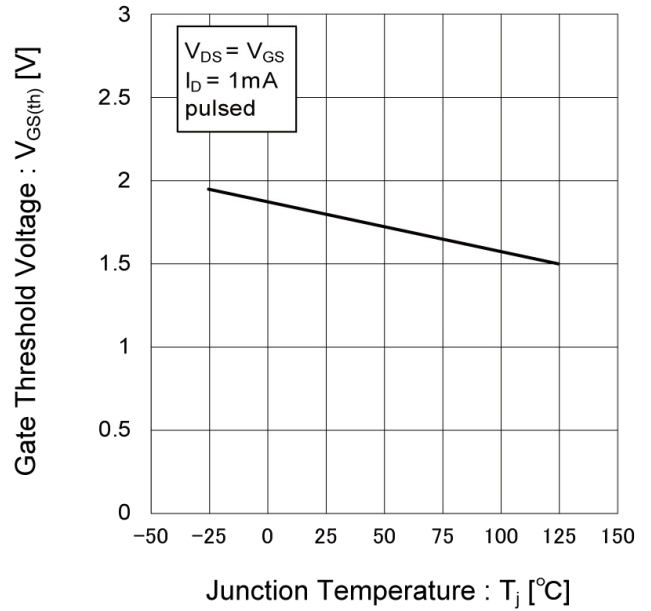
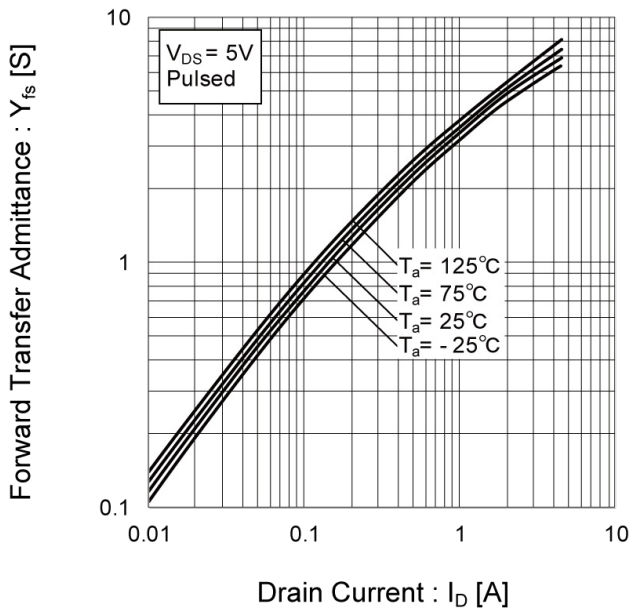


Fig.10 Transconductance vs. Drain Current



● Electrical characteristic curves

Fig.11 Drain Current Derating Curve



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

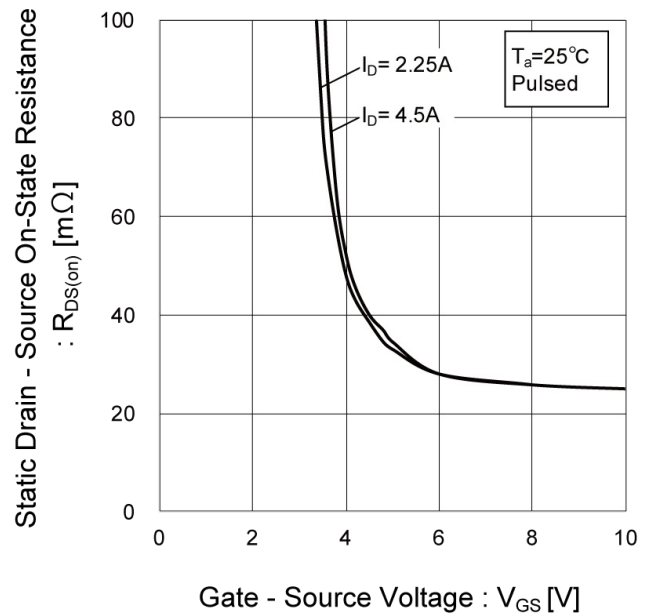
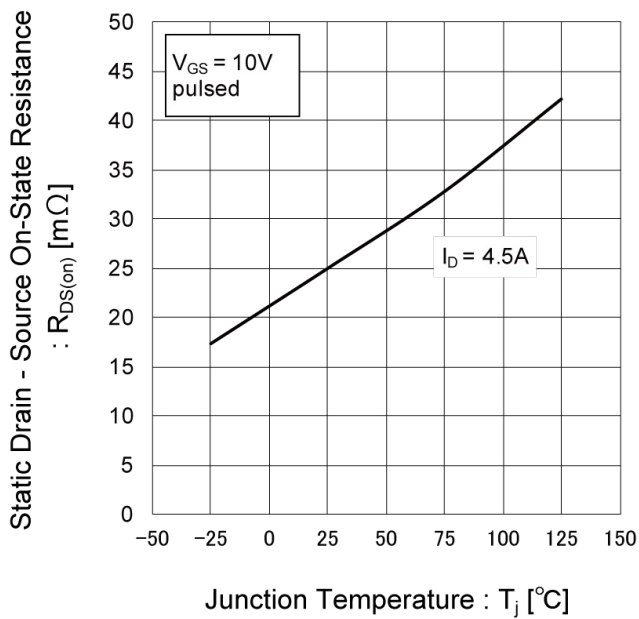


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves

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

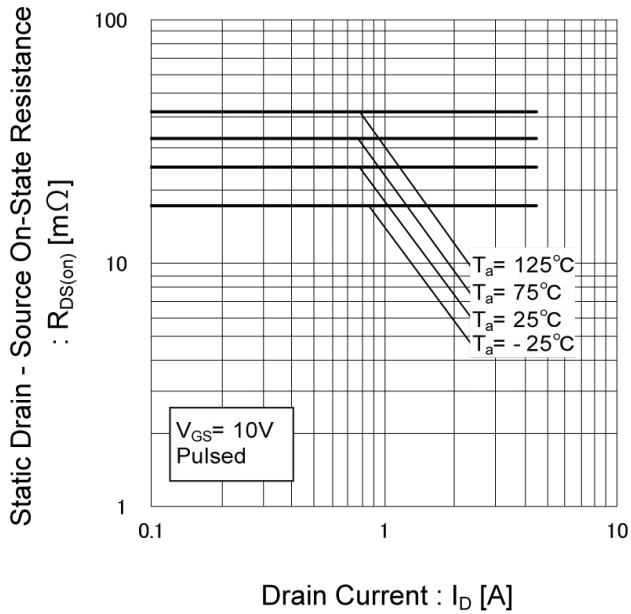


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

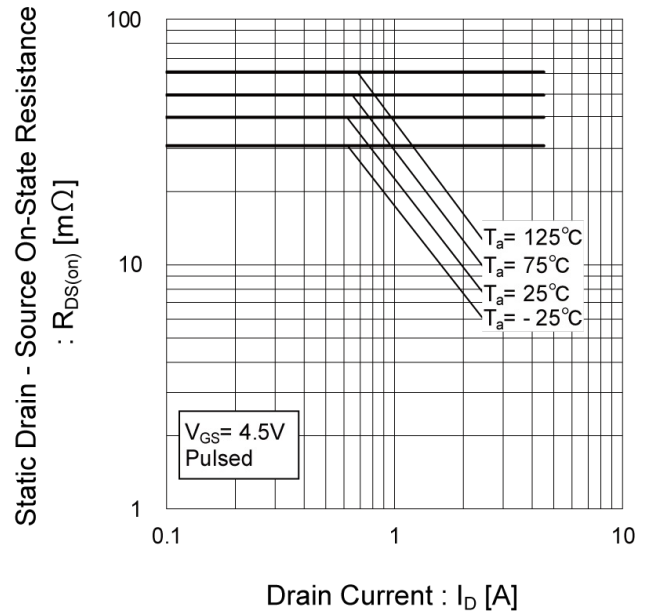
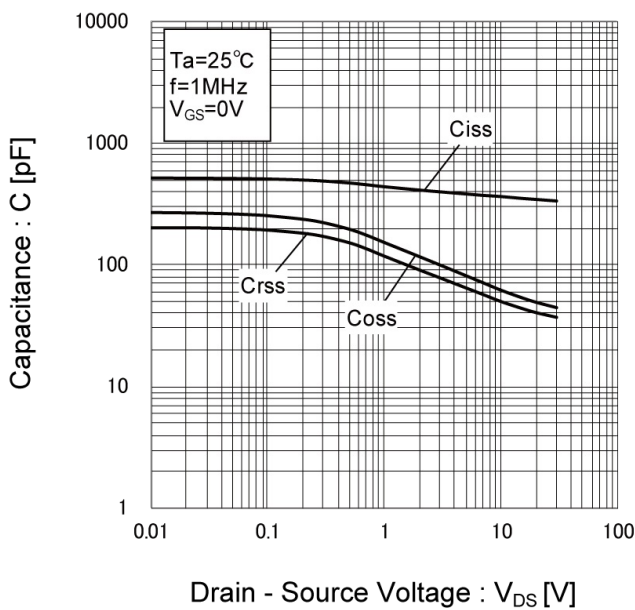


Fig.16 Typical Capacitance vs. Drain - Source Voltage





● Electrical characteristic curves

Fig.17 Switching Characteristics

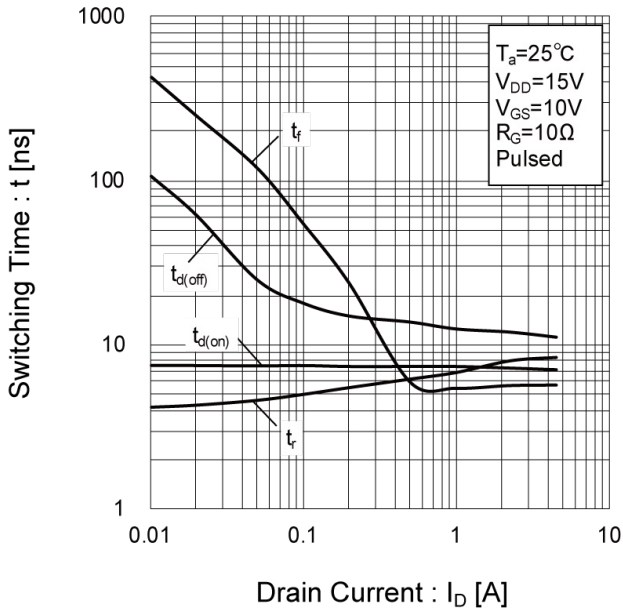


Fig.18 Dynamic Input Characteristics

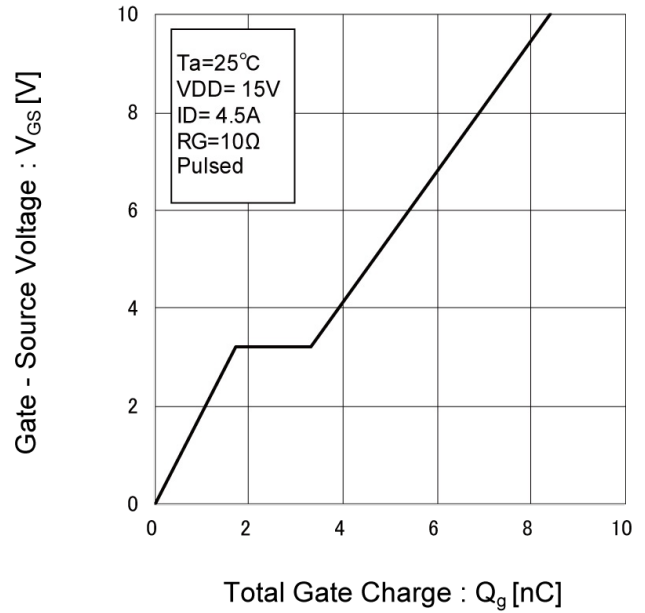
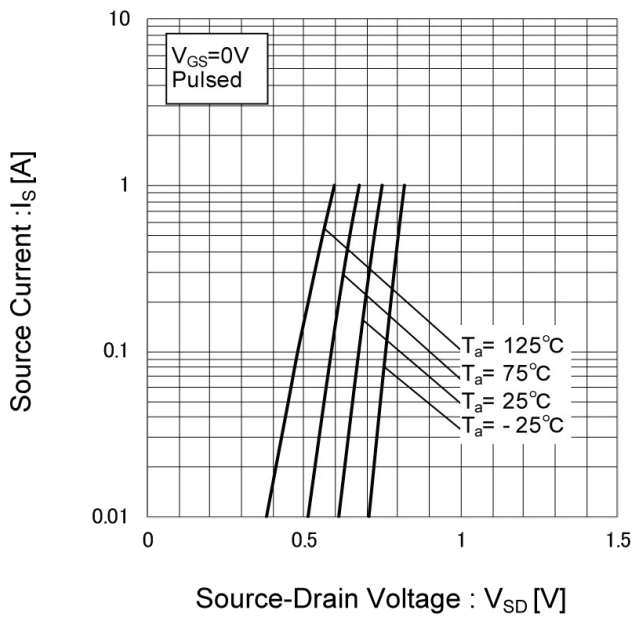


Fig.19 Source Current vs. Source Drain Voltage



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

Fig.1-1 Switching Time Measurement Circuit

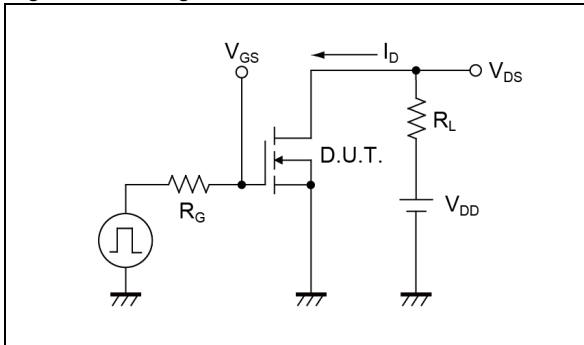


Fig.1-2 Switching Waveforms

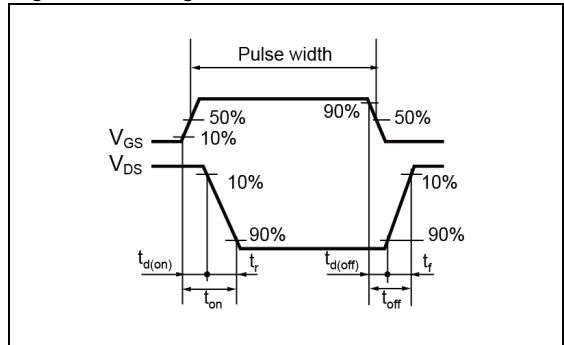


Fig.2-1 Gate Charge Measurement Circuit

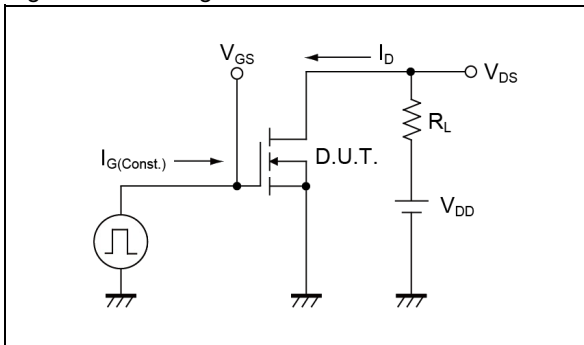


Fig.2-2 Gate Charge Waveform

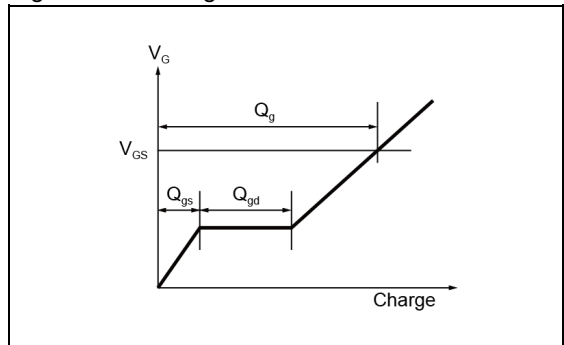


Fig.3-1 Avalanche Measurement Circuit

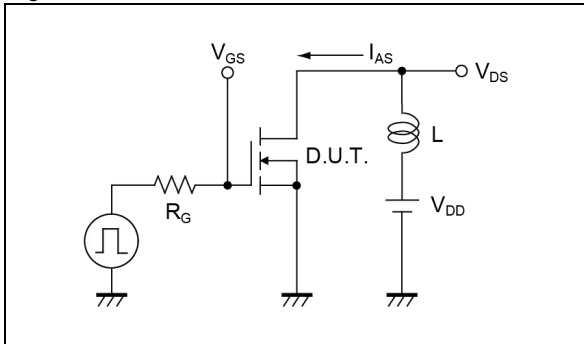
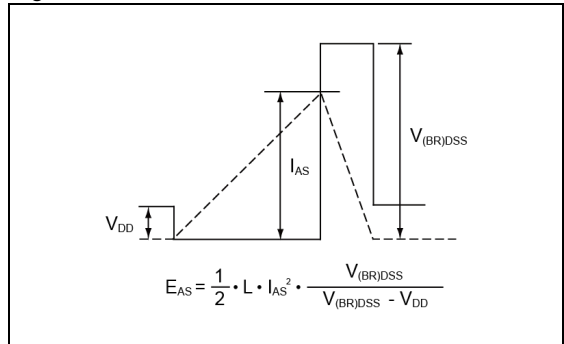
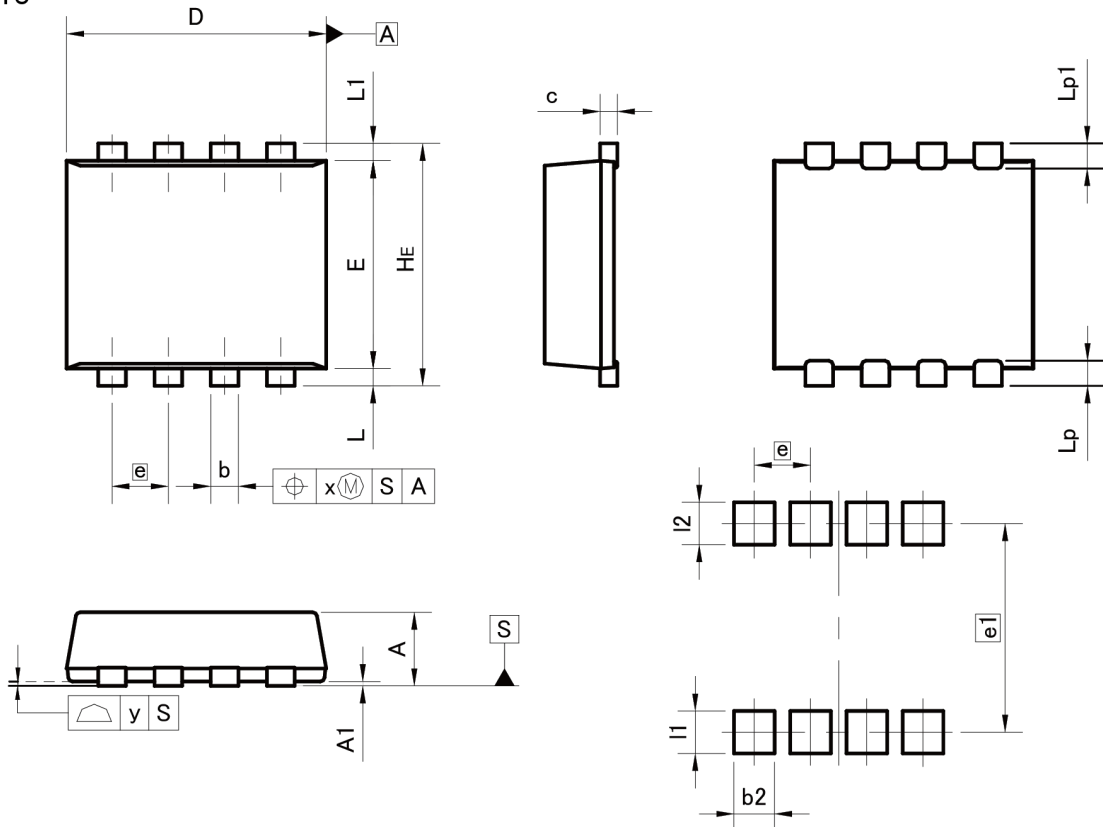


Fig.3-2 Avalanche Waveform



●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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