

Symbol	Tr1:Nch	Tr2:Pch
V_{DSS}	30V	-30V
$R_{DS(on)}(Max.)$	16.0mΩ	28.6mΩ
I_D	±9.0A	±8.0A
P_D	2.6W	

●Features

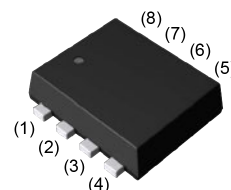
- 1) Low on - resistance.
- 2) Small Surface Mount Package (TSMT8).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

●Application

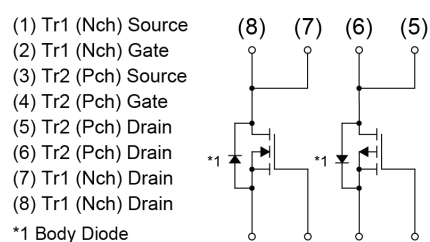
Switching

●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	MA4

●Absolute maximum ratings ($T_a = 25^\circ\text{C}$), unless otherwise specified.

Parameter		Symbol	Value		Unit
			Tr1:Nch	Tr2:Pch	
Drain - Source voltage		V _{DSS}	30	-30	V
Continuous drain current		I _D ^{*1}	±9.0	±8.0	A
Pulsed drain current		I _{D,pulse} ^{*2}	±18	±18	A
Gate - Source voltage		V _{GSS}	±20	±20	V
Avalanche energy, single pulse		E _{AS} ^{*4}	3.5	2.2	mJ
Avalanche current		I _{AS} ^{*4}	7.0	-5.5	A
Power dissipation	total	P _D ^{*1}	2.6		W
		P _D ^{*3}	1.5		
	element	P _D ^{*3}	1.25		
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 ($T_a = 25^{\circ}\text{C}$) , unless otherwise specified

Parameter	Symbol	Type	Conditions	Values			Unit
				Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	Tr1	$V_{GS} = 0V, I_D = 1mA$	30	-	-	V
		Tr2	$V_{GS} = 0V, I_D = -1mA$	-30	-	-	
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}$	Tr1	$I_D = 1mA$, referenced to 25°C	-	21	-	mV/°C
	ΔT_j	Tr2	$I_D = -1mA$, referenced to 25°C	-	-22	-	
Zero gate voltage drain current	I_{DSS}	Tr1	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	μA
		Tr2	$V_{DS} = -30V, V_{GS} = 0V$	-	-	-1	
Gate - Source leakage current	I_{GSS}	Tr1	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	± 100	nA
		Tr2	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	± 100	
Gate threshold voltage	$V_{GS(th)}$	Tr1	$V_{DS} = V_{GS}, I_D = 1mA$	1.0	-	2.5	V
		Tr2	$V_{DS} = V_{GS}, I_D = -1mA$	-1.0	-	-2.5	
Gate threshold voltage temperature coefficient	$\Delta V_{GS(th)}$	Tr1	$I_D = 1mA$, referenced to 25°C	-	-3	-	mV/°C
	ΔT_j	Tr2	$I_D = -1mA$, referenced to 25°C	-	2.9	-	
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	Tr1	$V_{GS} = 10V, I_D = 9A$	-	12.3	16.0	mΩ
			$V_{GS} = 4.5V, I_D = 7A$	-	18.2	23.7	
		Tr2	$V_{GS} = -10V, I_D = -8A$	-	22.0	28.6	
			$V_{GS} = -4.5V, I_D = -5.5A$	-	31.0	40.3	
Gate input resistance	R_G	Tr1	$f=1MHz$, open drain	-	3.3	-	Ω
		Tr2		-	6.0	-	
Transconductance	g_{fs}^{*5}	Tr1	$V_{DS} = 5V, I_D = 7A$	4.4	-	-	S
		Tr2	$V_{DS} = -5V, I_D = -5.5A$	5.5	-	-	

*1 $P_w \leq 1s$, Limited only by maximum temperature allowed.

*2 $P_w \leq 10\mu s$, Duty cycle $\leq 1\%$

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

*4 Tr1: $L \approx 0.1mH$, $V_{DD} = 15V$, $R_G = 25\Omega$, STARTING $T_j = 25^{\circ}\text{C}$ Fig.3-1,3-2

Tr2: $L \approx 0.1mH$, $V_{DD} = -15V$, $R_G = 25\Omega$, STARTING $T_j = 25^{\circ}\text{C}$ Fig.6-1,6-2

*5 Pulsed

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

<Tr1>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	640	-	pF
Output capacitance	C_{oss}	$V_{DS} = 15V$	-	110	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	90	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 15V, V_{GS} = 10V$	-	8	-	ns
Rise time	t_r^{*5}	$I_D = 4.5A$	-	19	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 3.3\Omega$	-	33	-	
Fall time	t_f^{*5}	$R_G = 10\Omega$	-	7	-	

<Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	890	-	pF
Output capacitance	C_{oss}	$V_{DS} = -15V$	-	160	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	125	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx -15V, V_{GS} = -10V$	-	10	-	ns
Rise time	t_r^{*5}	$I_D = -4A$	-	16	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 3.8\Omega$	-	55	-	
Fall time	t_f^{*5}	$R_G = 10\Omega$	-	22	-	

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

<Tr1>

Parameter	Symbol	Conditions		Values			Unit
				Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} \simeq 15V$ $I_D = 9A$	$V_{GS} = 10V$	-	15.5	-	nC
Gate - Source charge	Q_{gs}^{*5}		$V_{GS} = 4.5V$	-	7.9	-	
Gate - Drain charge	Q_{gd}^{*5}			-	3.1	-	
				-	2.8	-	

<Tr2>

Parameter	Symbol	Conditions		Values			Unit
				Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} \simeq -15V$ $I_D = -8A$	$V_{GS} = -10V$	-	19.6	-	nC
Gate - Source charge	Q_{gs}^{*5}		$V_{GS} = -4.5V$	-	9.8	-	
Gate - Drain charge	Q_{gd}^{*5}			-	3.0	-	
				-	3.7	-	

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

<Tr1>

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}^{*2}		-	-	18	
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0\text{V}, I_S = 1\text{A}$	-	-	1.2	V

<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}^{*2}		-	-	-18	
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0\text{V}, I_S = -1\text{A}$	-	-	-1.2	V

●Electrical characteristic curves <Tr1>

Fig.1 Power Dissipation Derating Curve

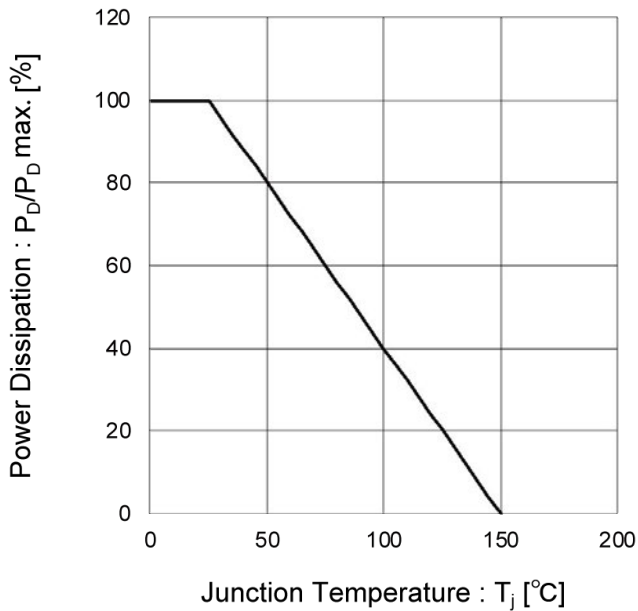


Fig.2 Maximum Safe Operating Area

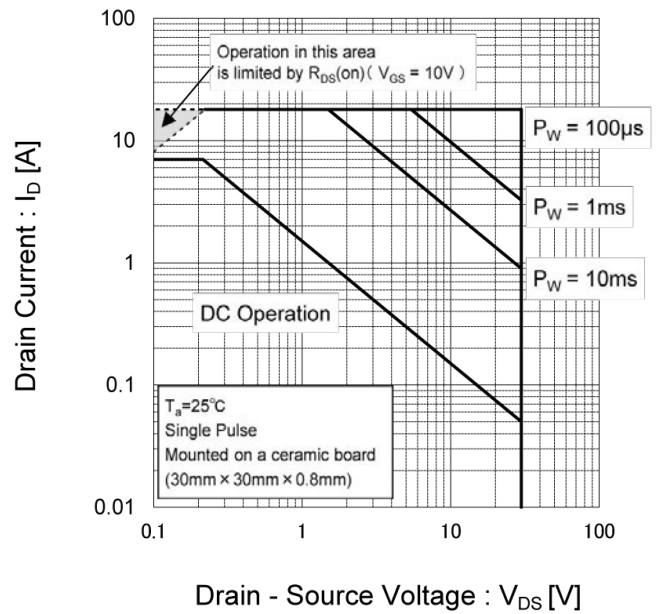


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

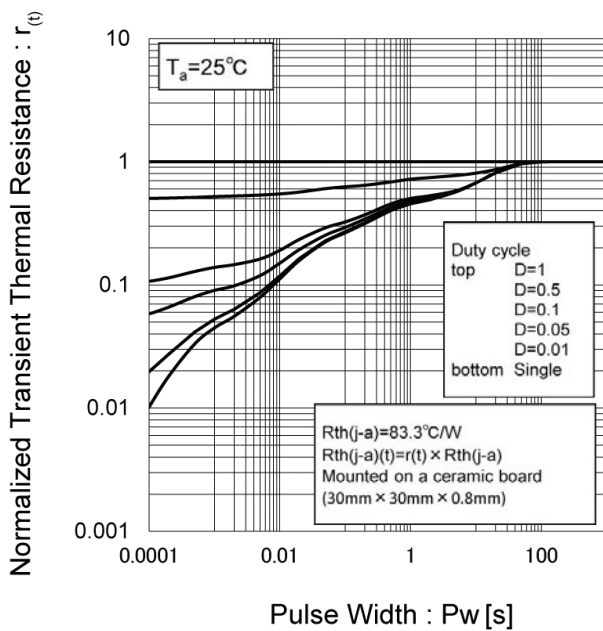
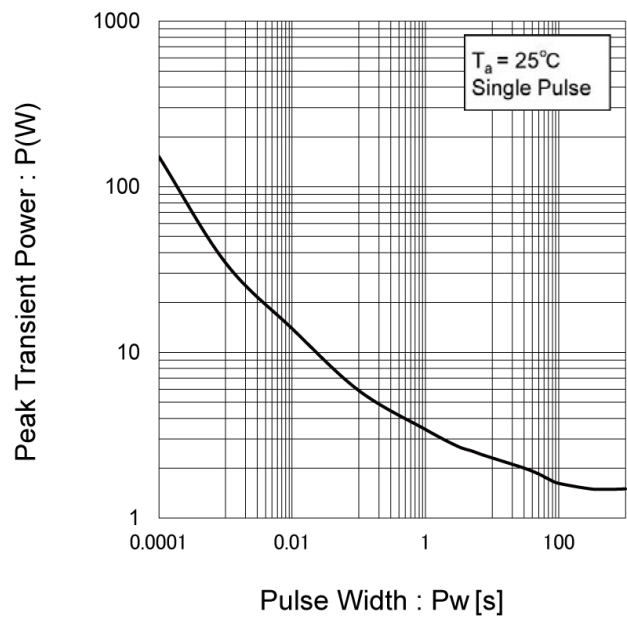


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

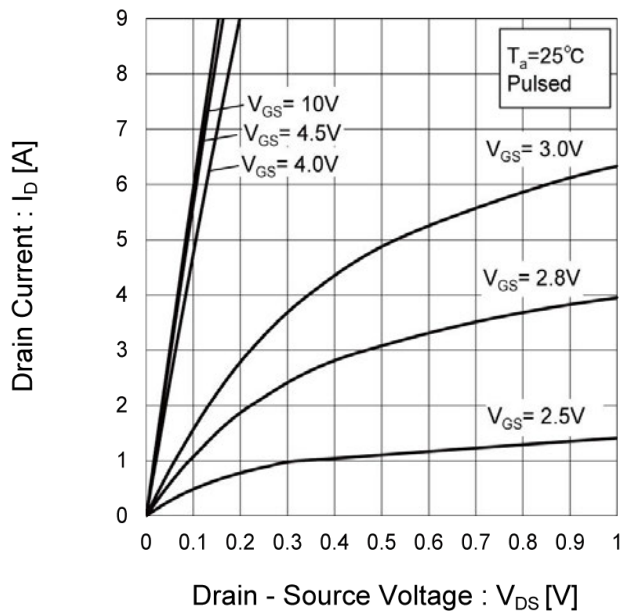


Fig.6 Typical Output Characteristics(II)

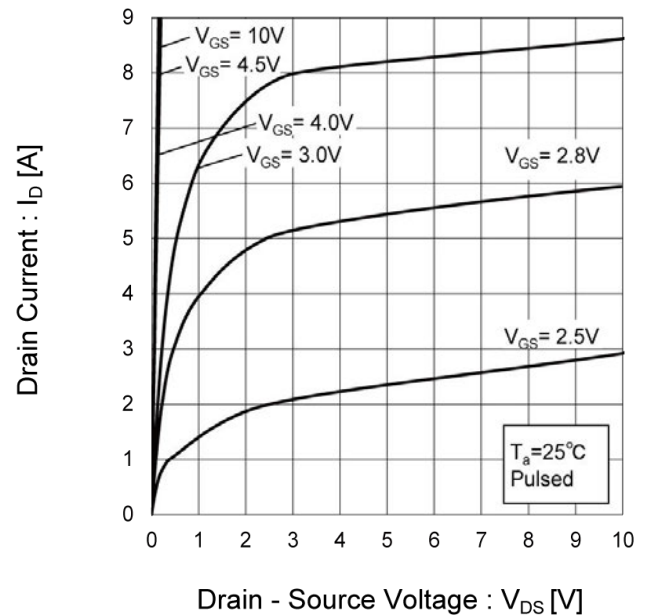
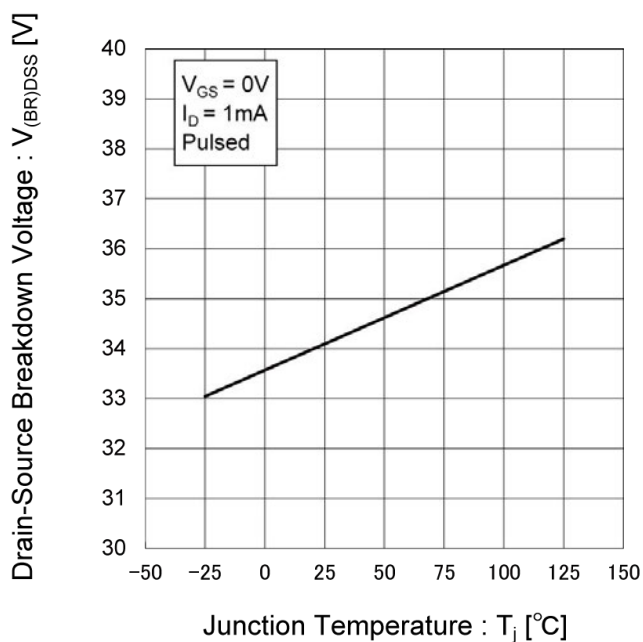


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr1>

Fig.8 Typical Transfer Characteristics

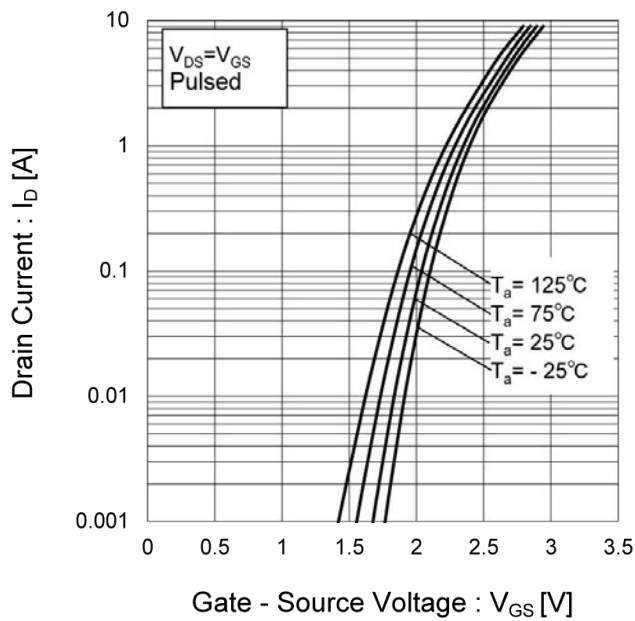


Fig.9 Gate Threshold Voltage vs. Junction Temperature

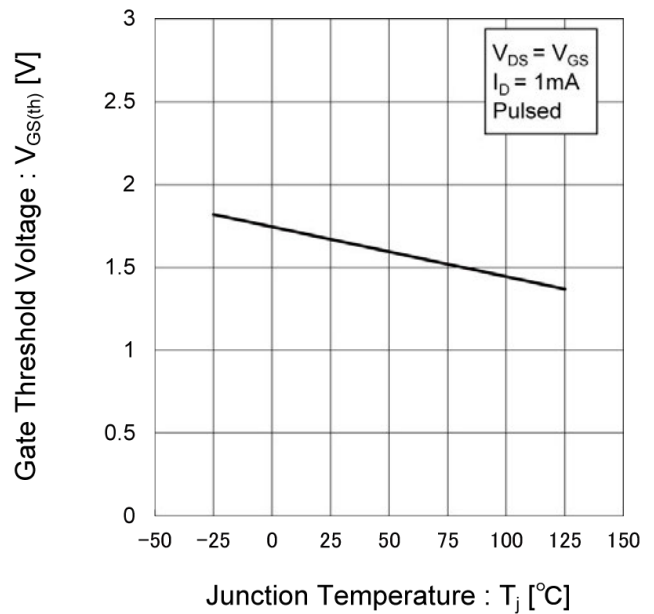
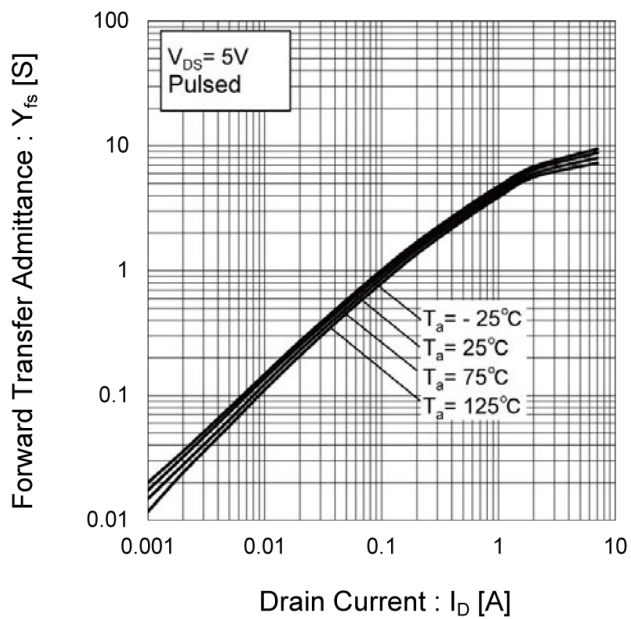


Fig.10 Transconductance vs. Drain Current



●Electrical characteristic curves <Tr1>

Fig.11 Drain Current Derating Curve

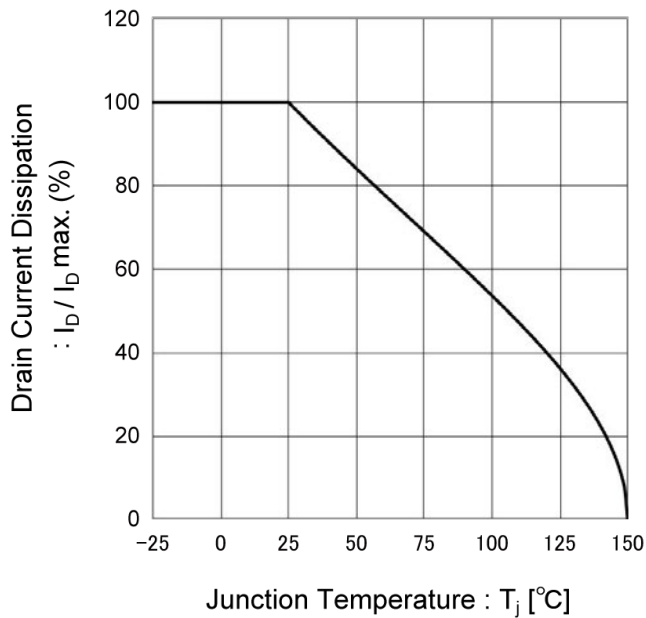


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

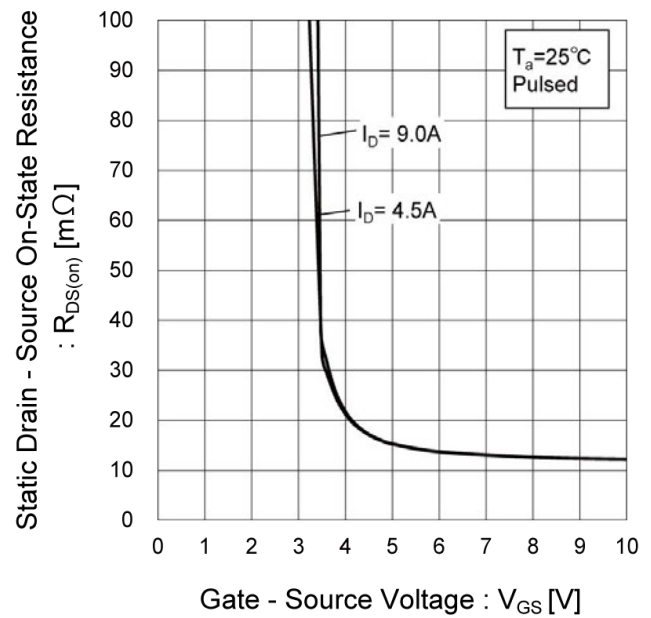
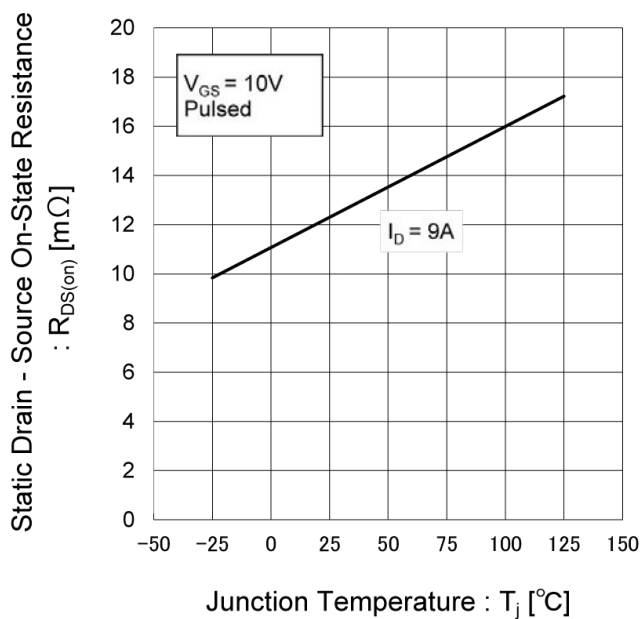


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves <Tr1>

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

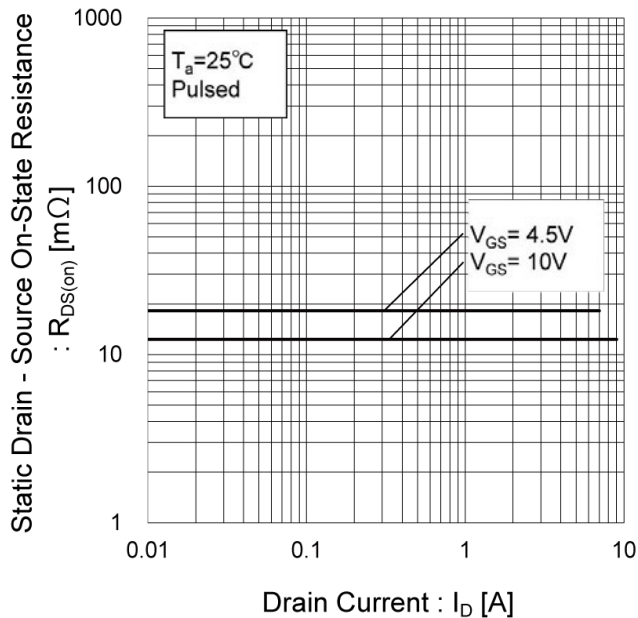


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

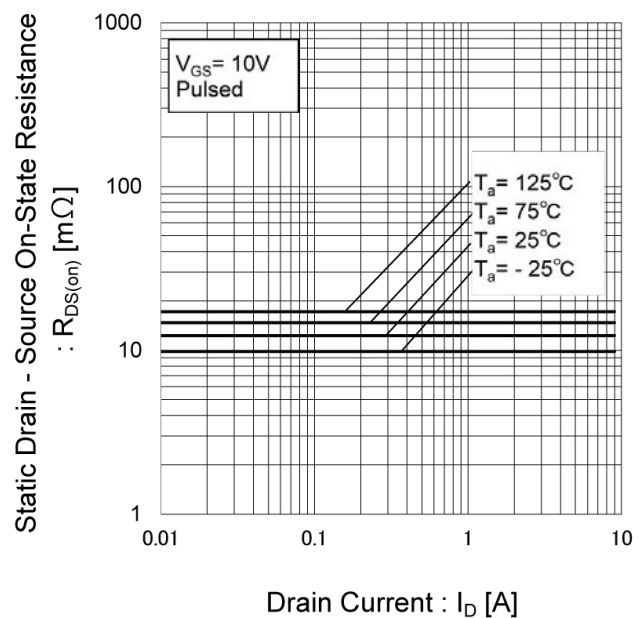
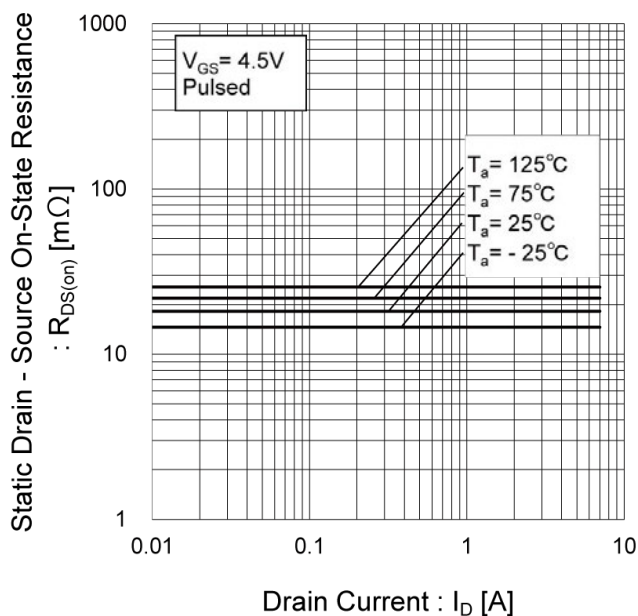


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr1>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

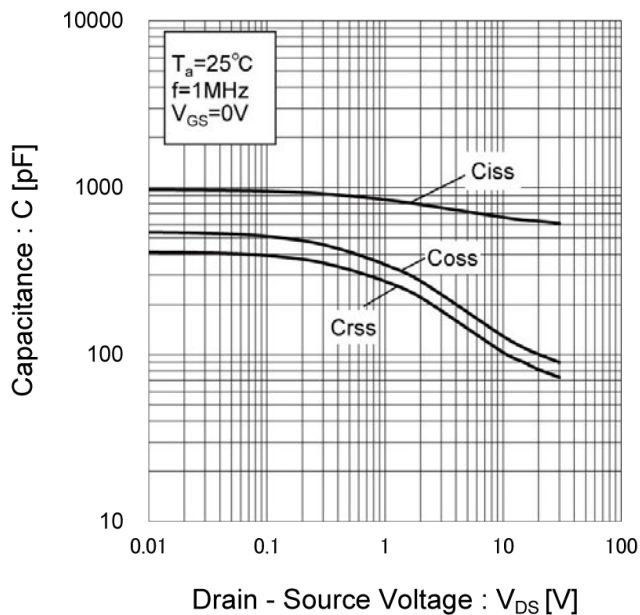


Fig.18 Switching Characteristics

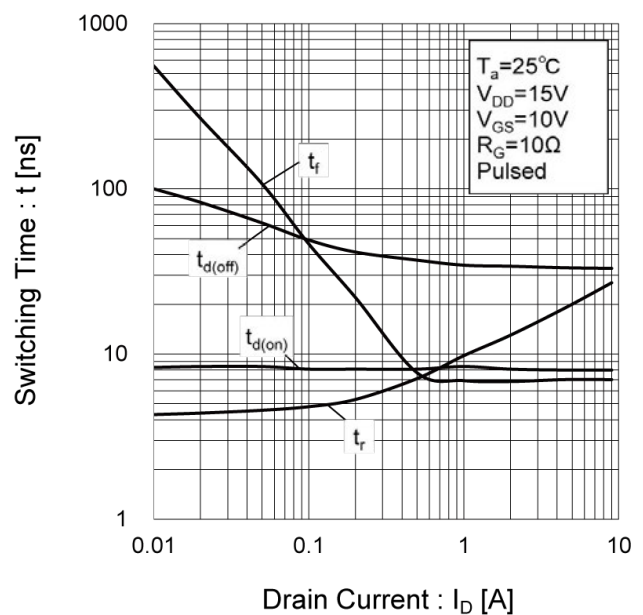


Fig.19 Dynamic Input Characteristics

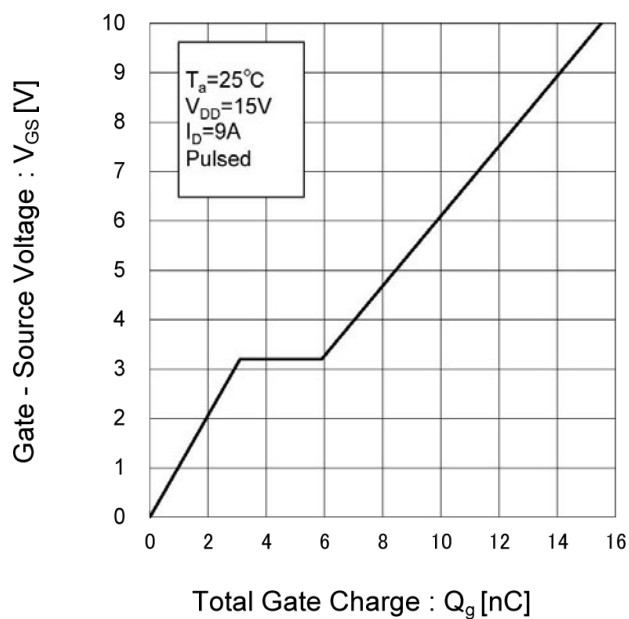
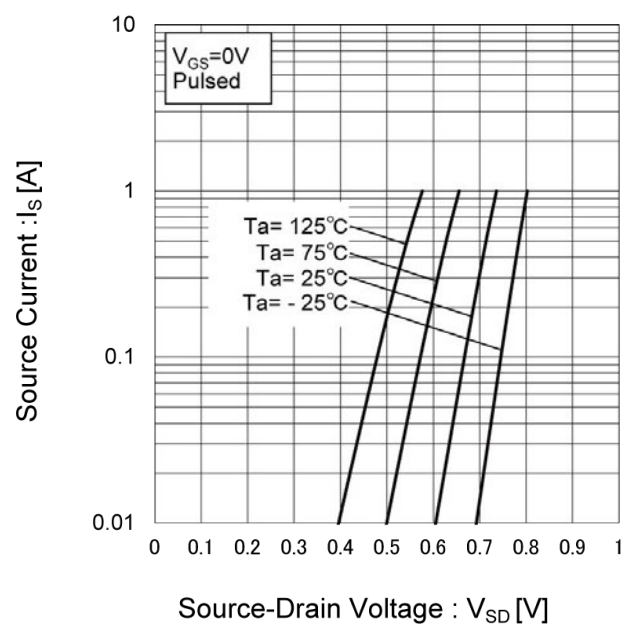


Fig.20 Source Current vs. Source Drain Voltage



●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

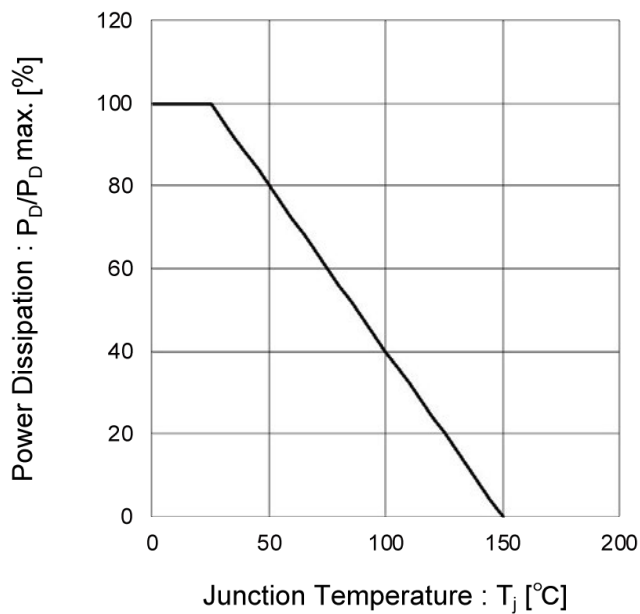


Fig.2 Maximum Safe Operating Area

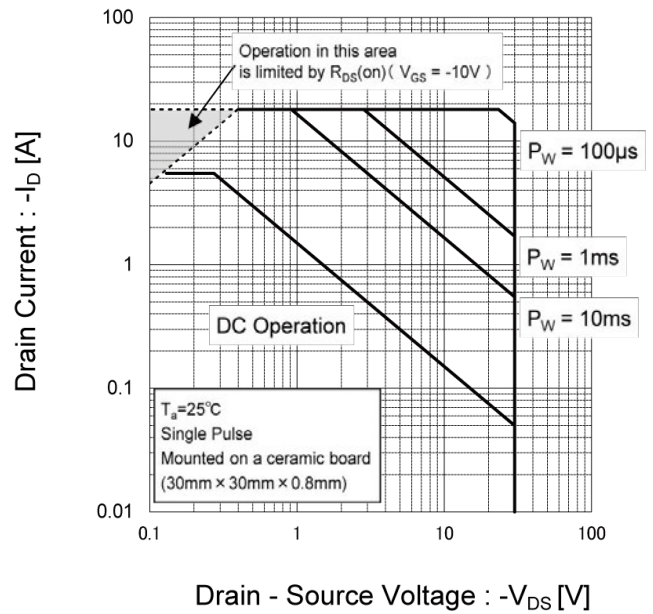


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

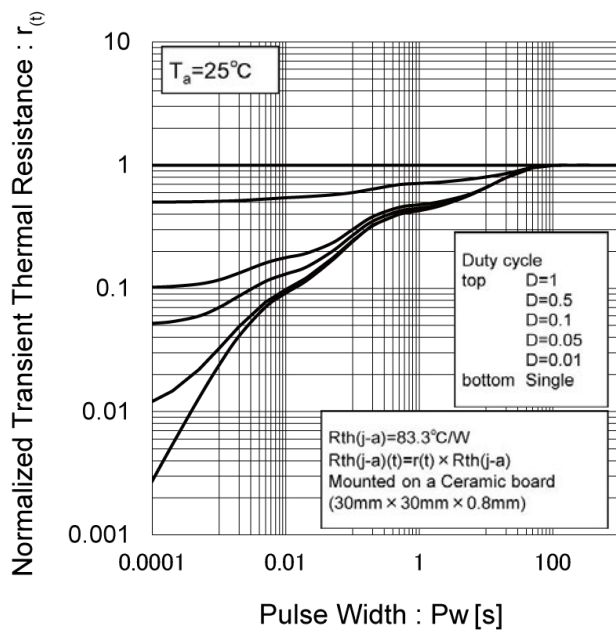
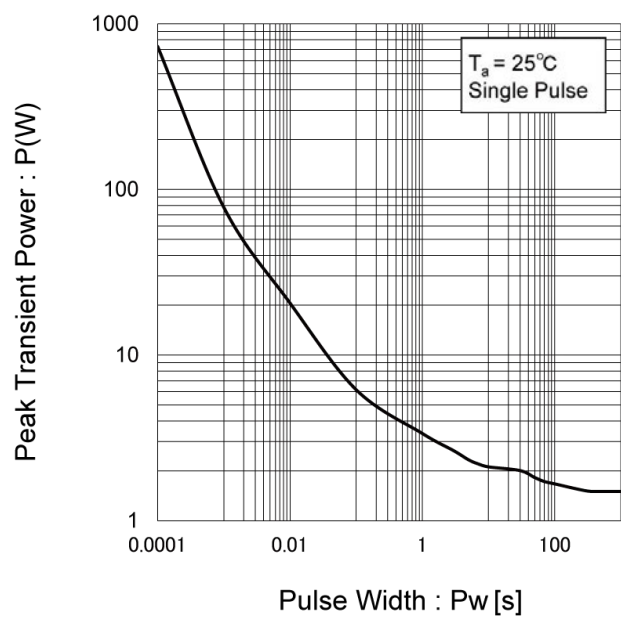


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

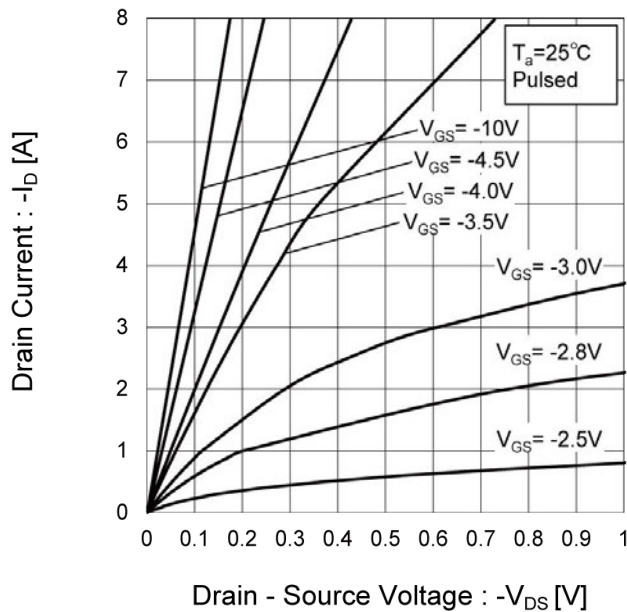


Fig.6 Typical Output Characteristics(II)

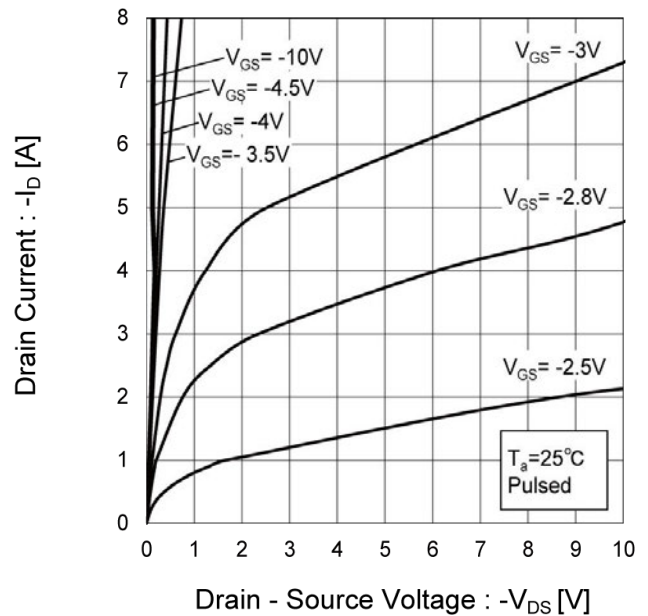
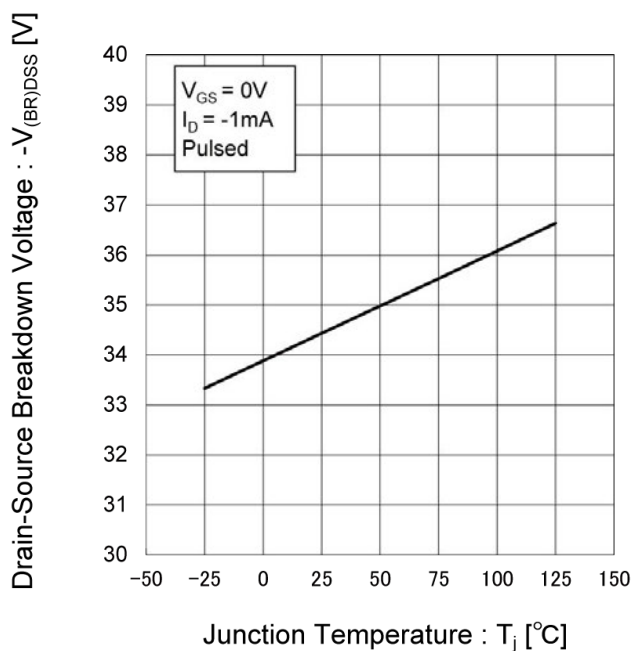


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr2>

Fig.8 Typical Transfer Characteristics

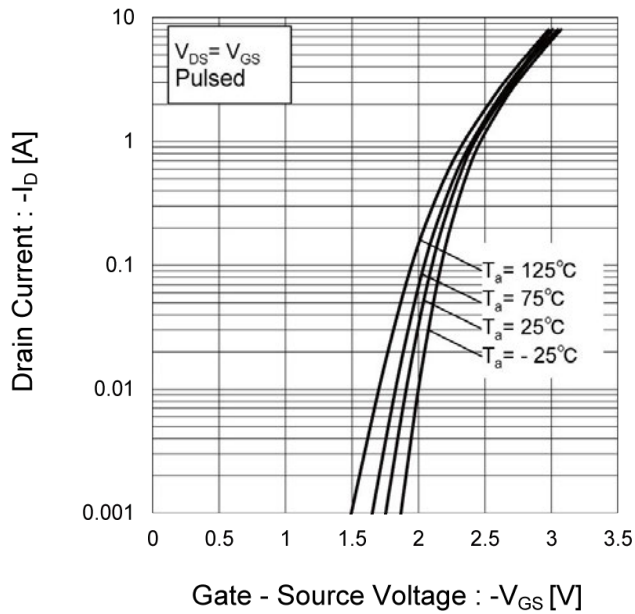


Fig.9 Gate Threshold Voltage vs. Junction Temperature

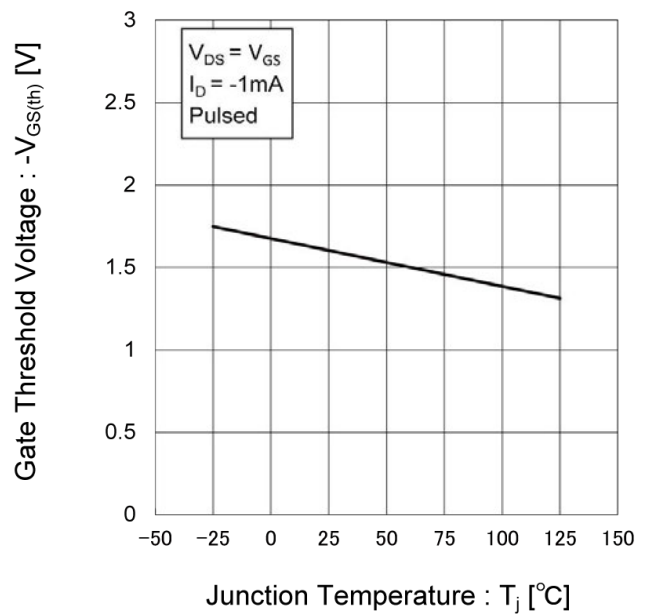
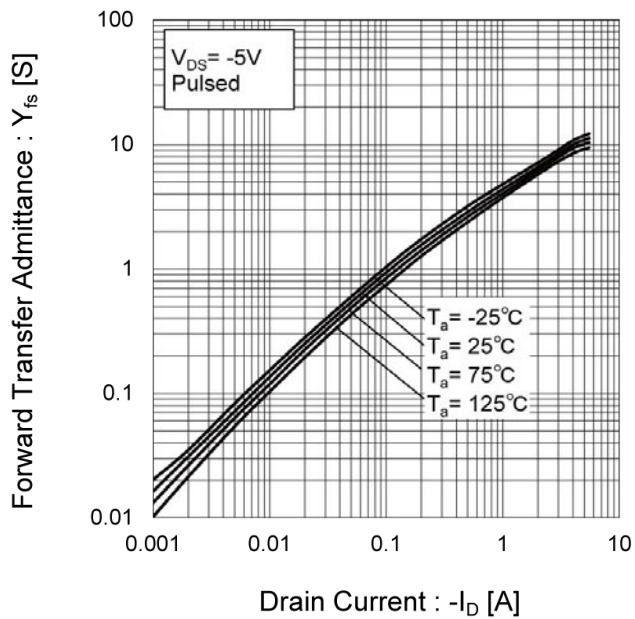


Fig.10 Transconductance vs. Drain Current



●Electrical characteristic curves <Tr2>

Fig.11 Drain Current Derating Curve

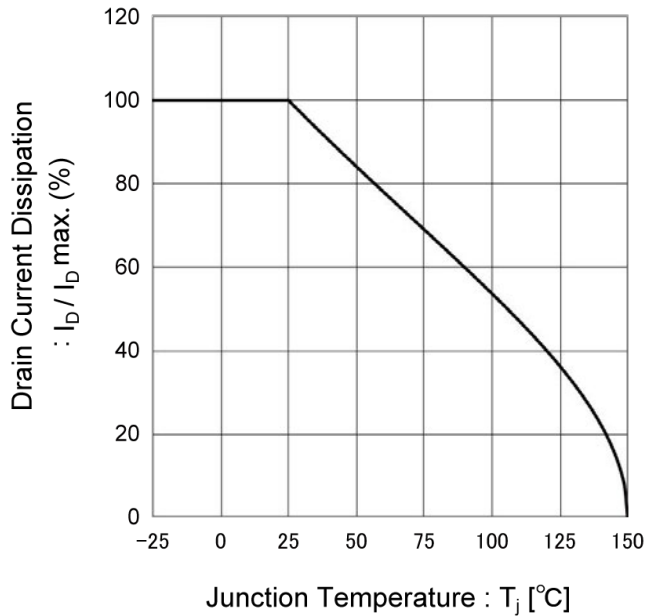


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

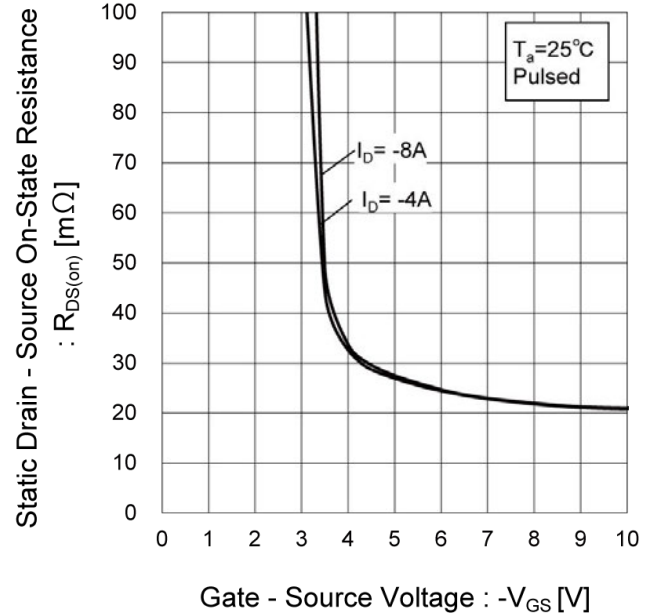
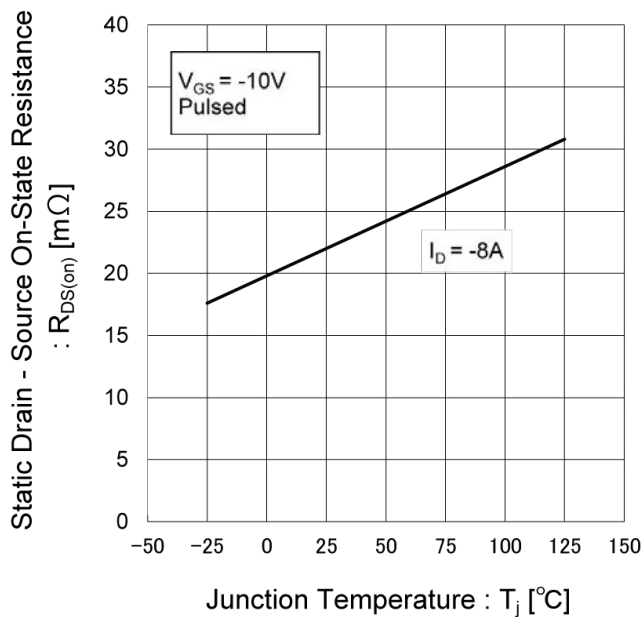


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves <Tr2>

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

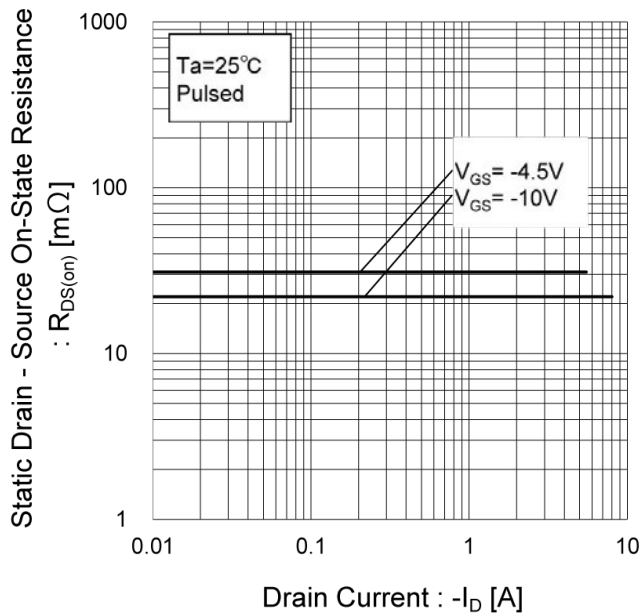


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

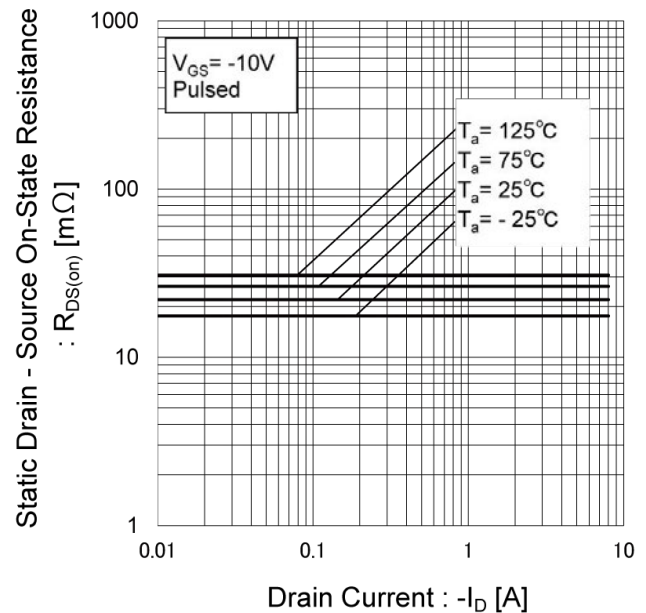
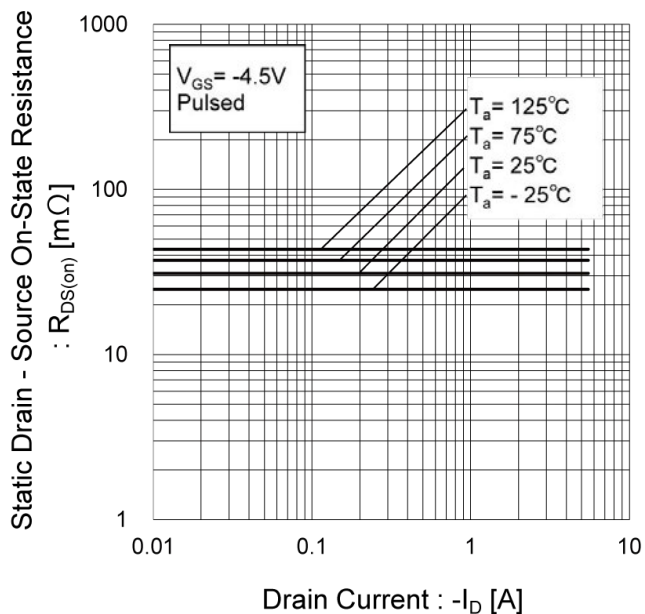


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr2>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

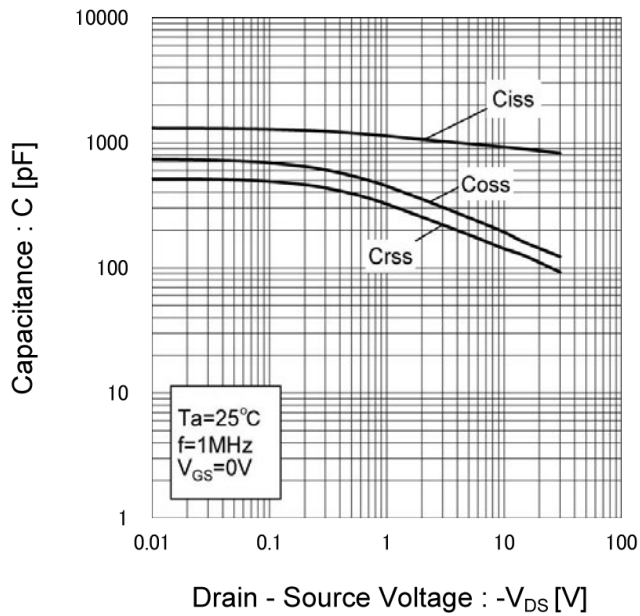


Fig.18 Switching Characteristics

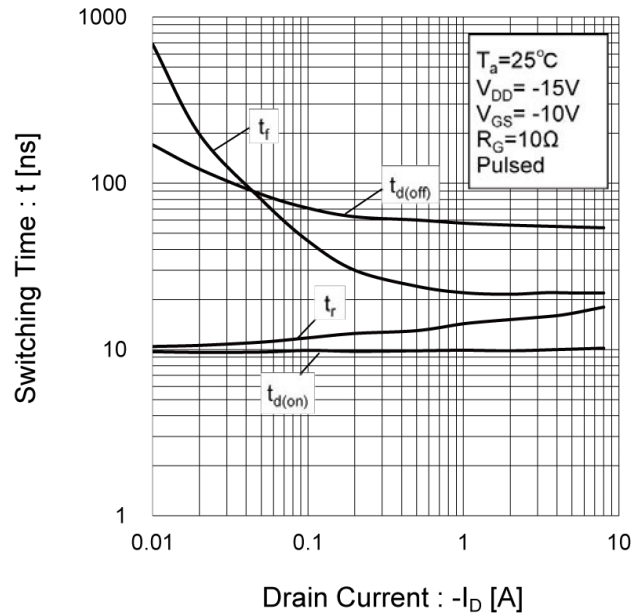


Fig.19 Dynamic Input Characteristics

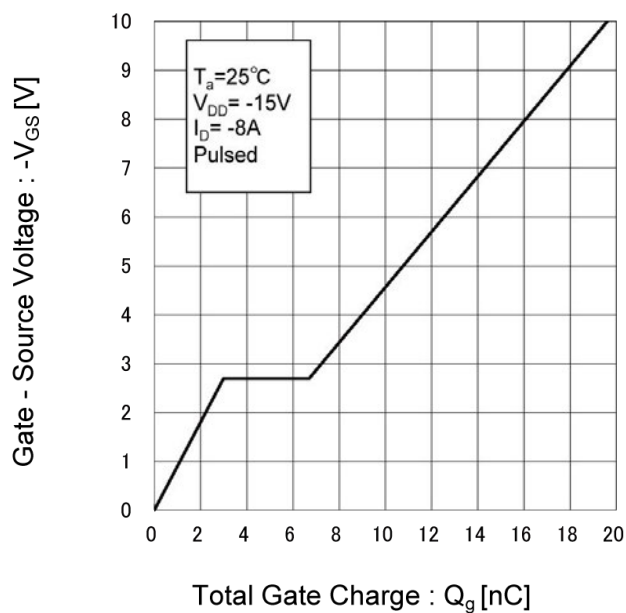
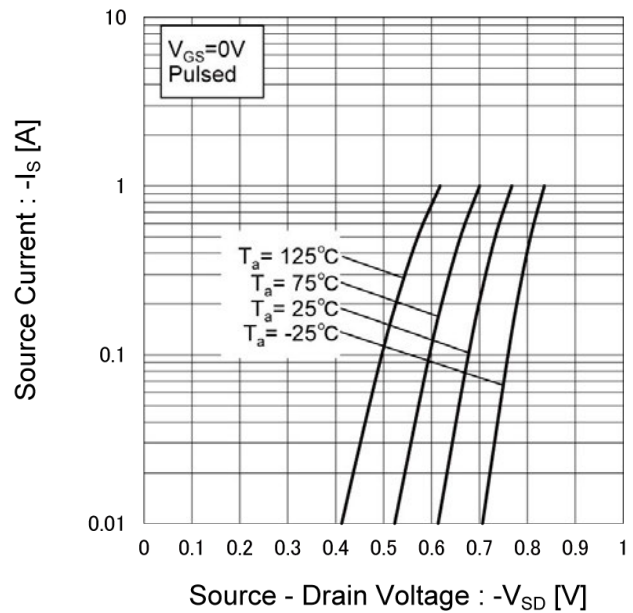


Fig.20 Source Current vs. Source Drain Voltage



● Measurement circuits <Tr1>

Fig.1-1 Switching Time Measurement Circuit

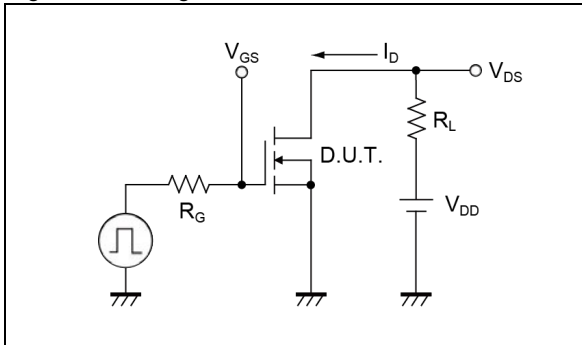


Fig.1-2 Switching Waveforms

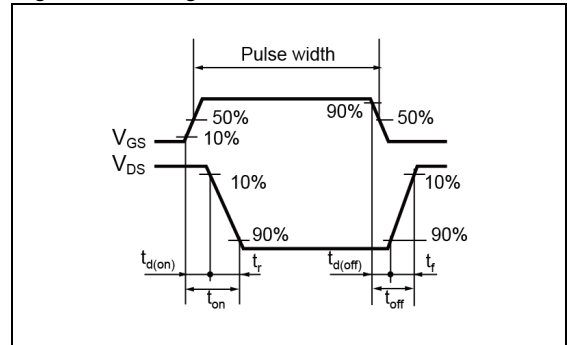


Fig.2-1 Gate Charge Measurement Circuit

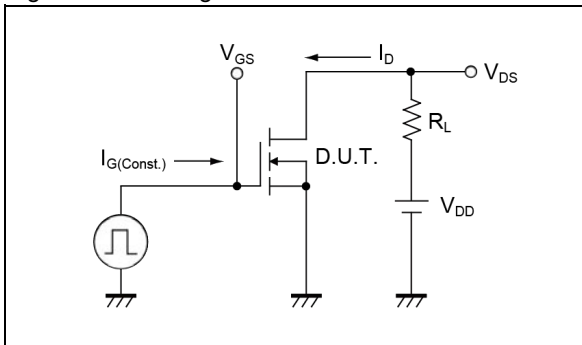


Fig.2-2 Gate Charge Waveform

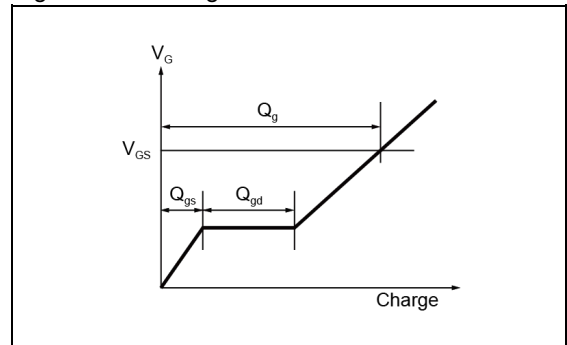


Fig.3-1 Avalanche Measurement Circuit

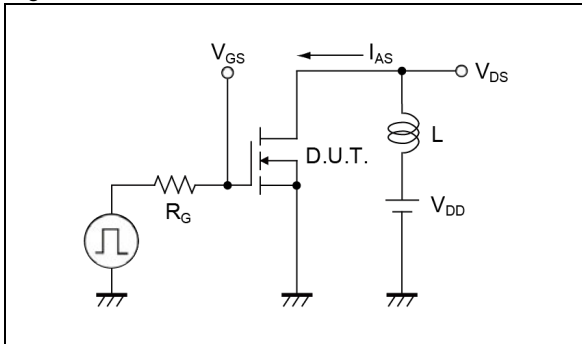
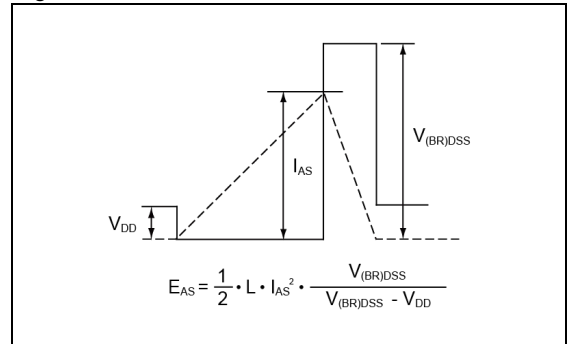


Fig.3-2 Avalanche Waveform



● Measurement circuits <Tr2>

Fig.4-1 Switching Time Measurement Circuit

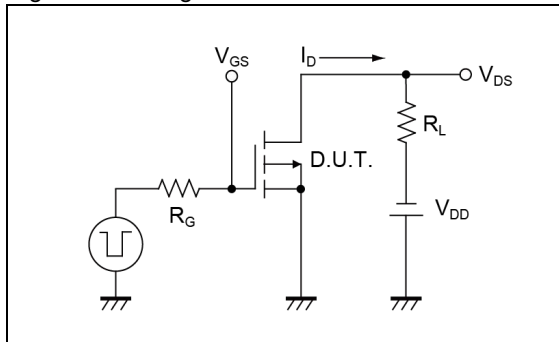


Fig.4-2 Switching Waveforms

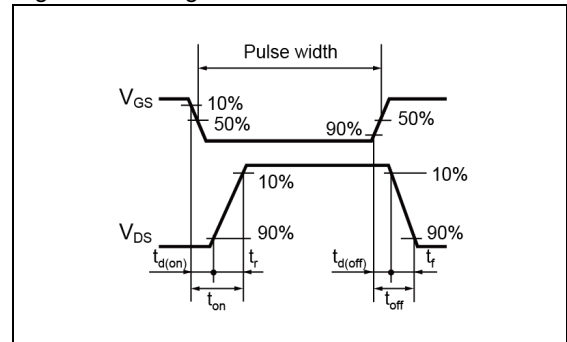


Fig.5-1 Gate Charge Measurement Circuit

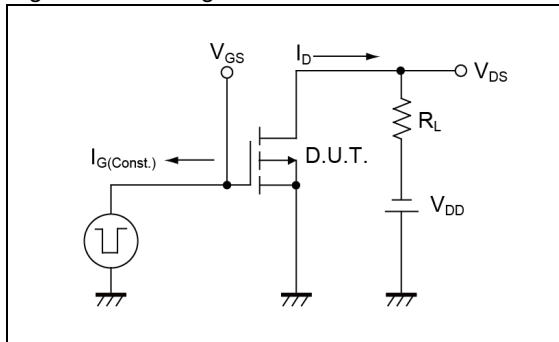


Fig.5-2 Gate Charge Waveform

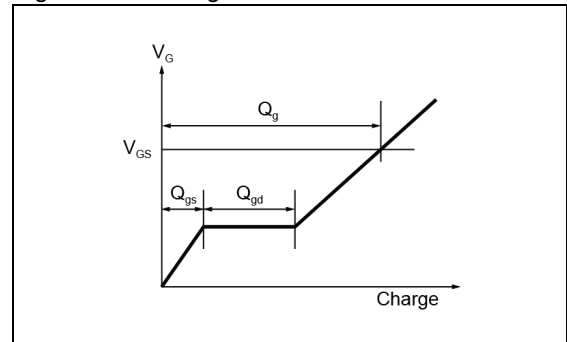


Fig.6-1 Avalanche Measurement Circuit

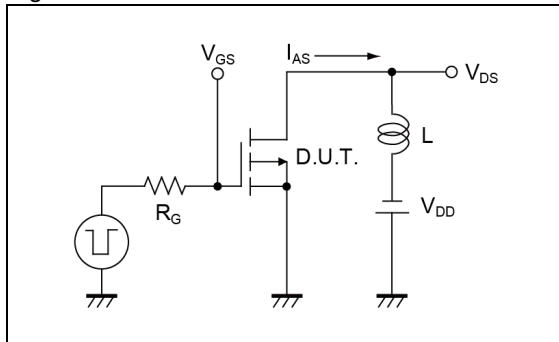
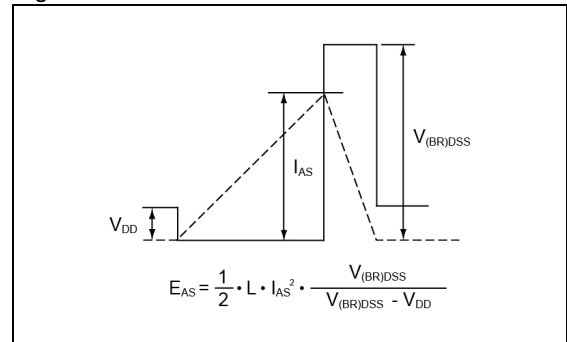


Fig.6-2 Avalanche Waveform

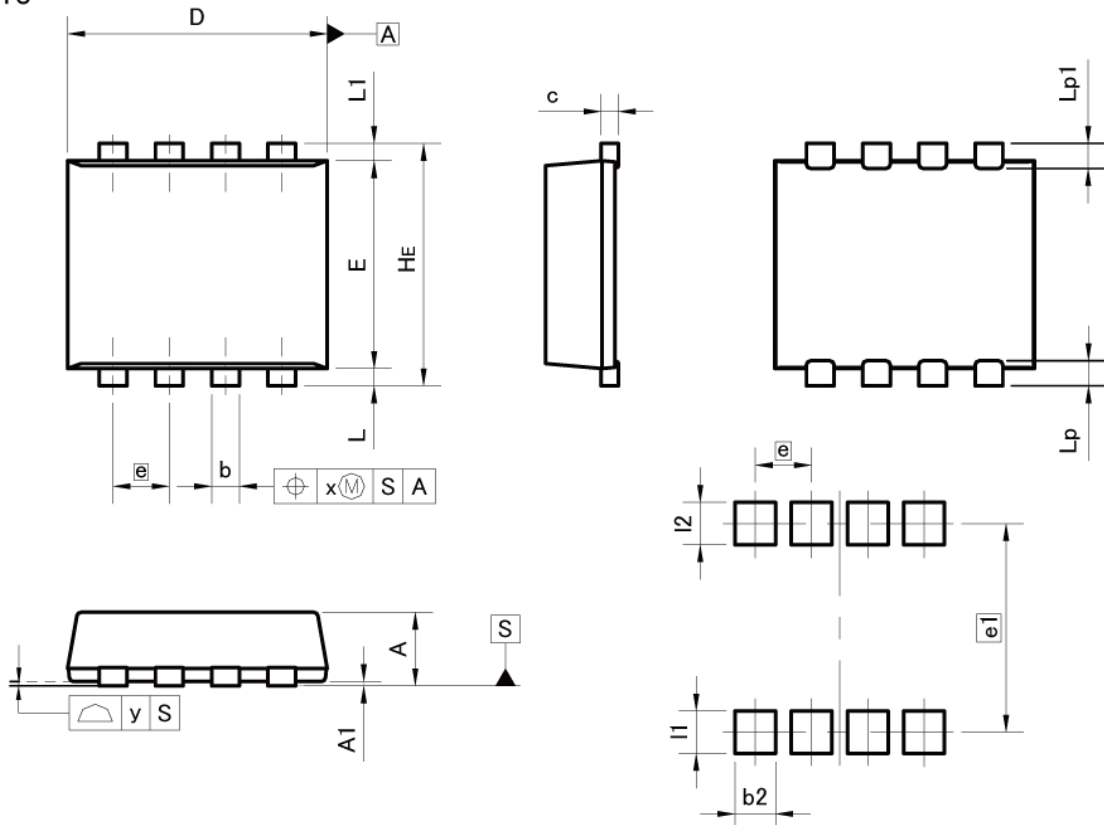


● Notice

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

●Dimensions

TSMT8



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	0.27	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

Notes

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- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
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