

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

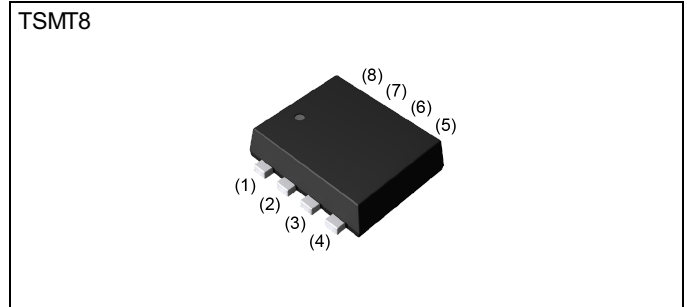
●Features

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

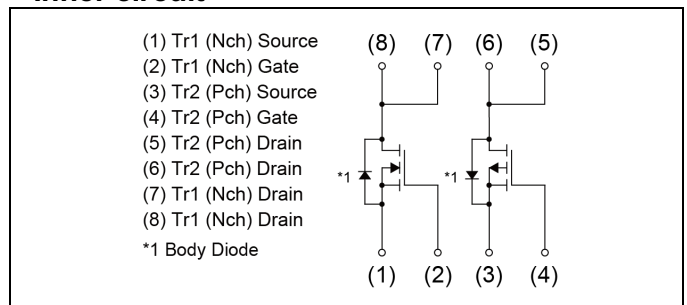
●Application

Switching

●Outline



●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 ($T_a = 25^\circ C$), 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}		W
		2.6		
	element	P_D^{*3}		
1.5				
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	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	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	Tr1	$I_D = 1mA$, referenced to 25°C	-	21	-	mV/°C
		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	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	Tr1	$I_D = 1mA$, referenced to 25°C	-	-3	-	mV/°C
		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}	$V_{DD} \approx 15\text{V}$ $I_D = 9\text{A}$	$V_{GS} = 10\text{V}$	-	15.5	-	nC
Gate - Source charge	Q_{gs}^{*5}		$V_{GS} = 4.5\text{V}$	-	7.9	-	
Gate - Drain charge	Q_{gd}^{*5}			-	2.8	-	

<Tr2>

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

● 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

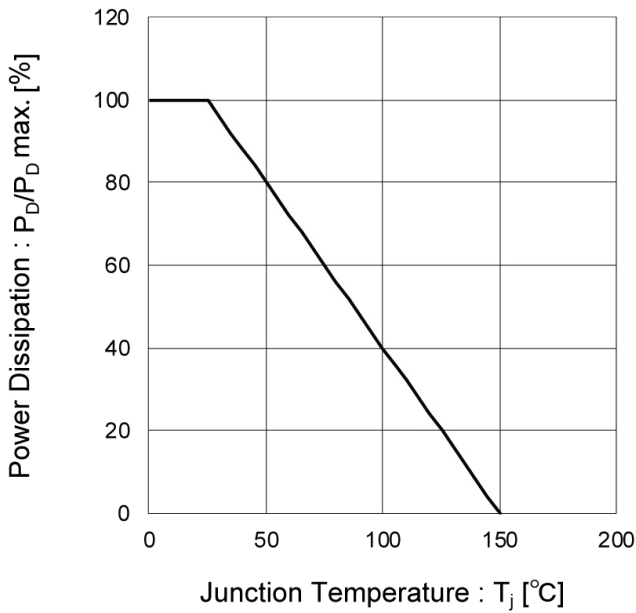


Fig.2 Maximum Safe Operating Area

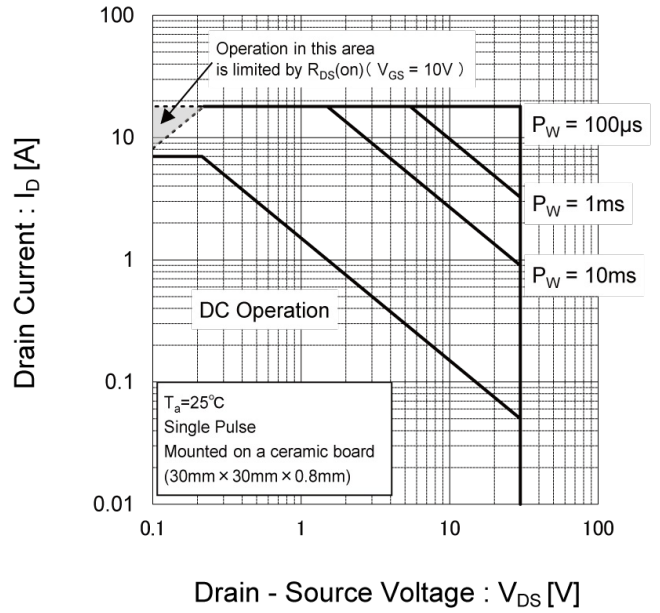


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

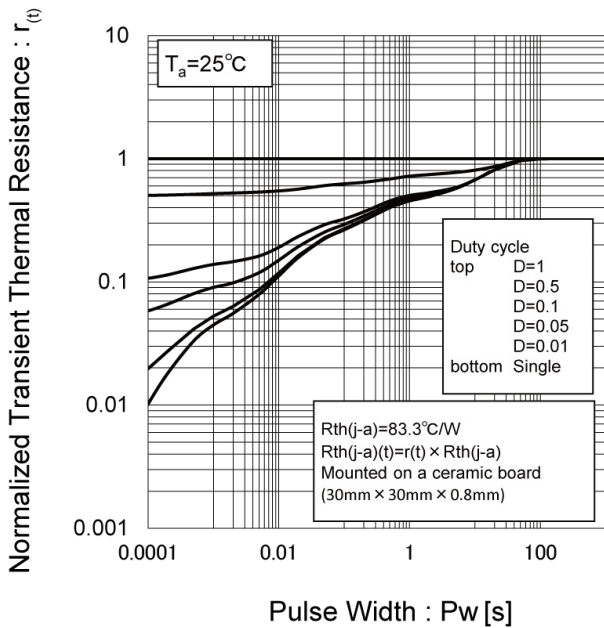
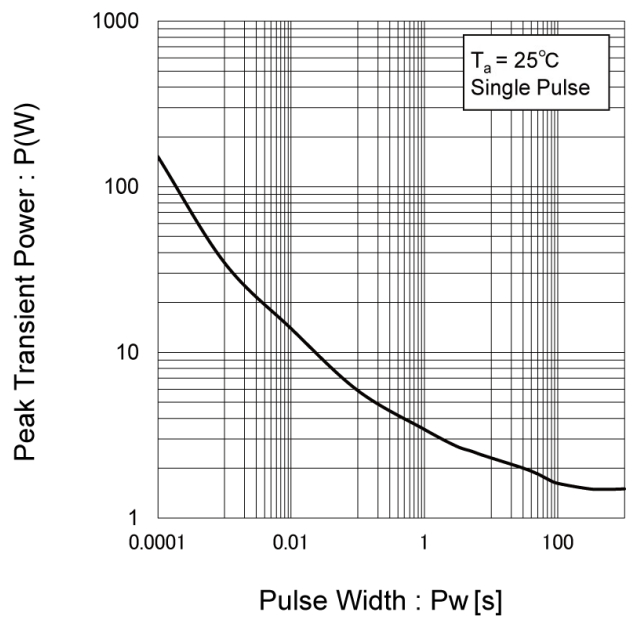


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

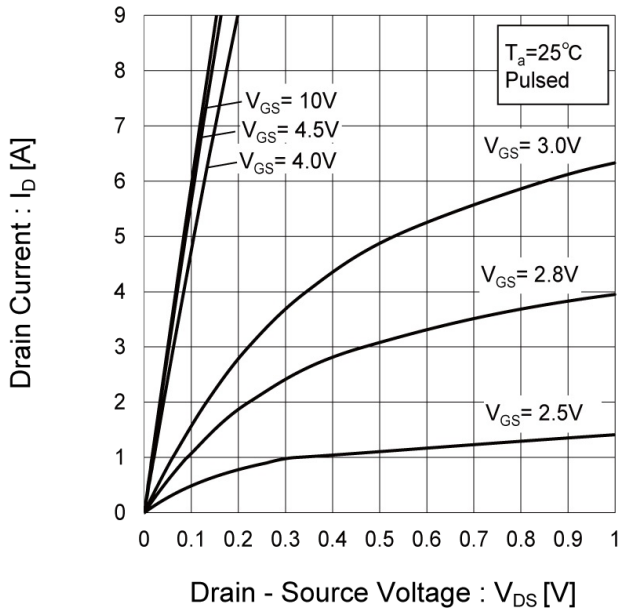


Fig.6 Typical Output Characteristics(II)

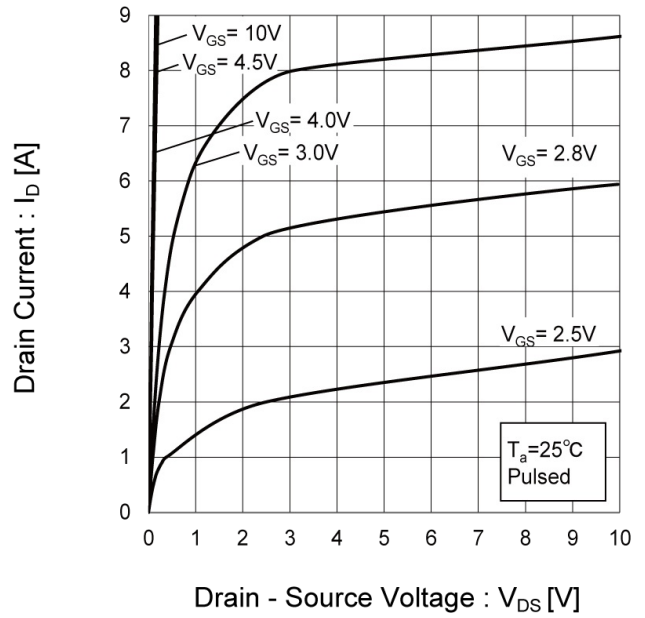
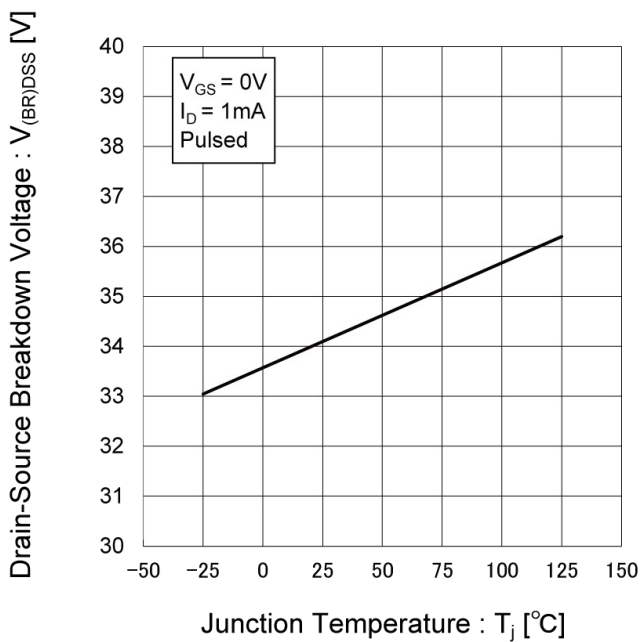


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr1>

Fig.8 Typical Transfer Characteristics

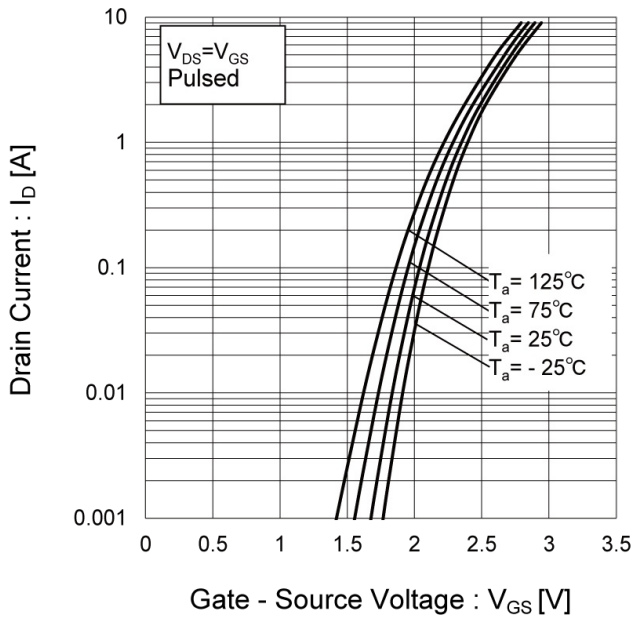


Fig.9 Gate Threshold Voltage vs. Junction Temperature

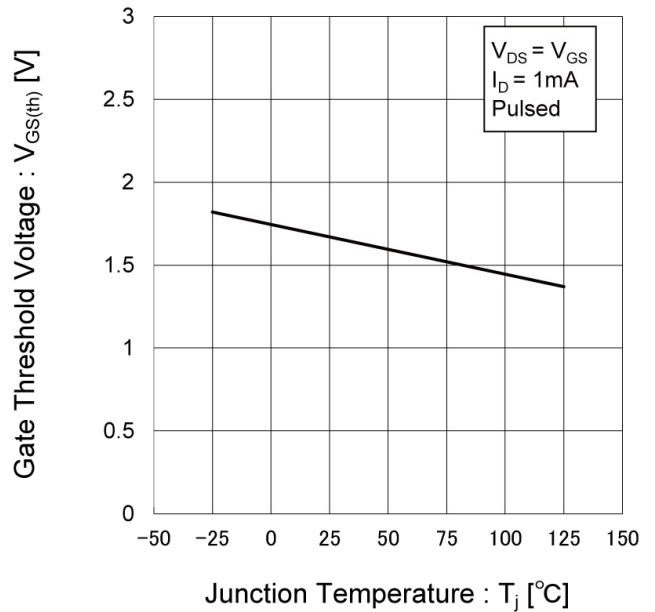
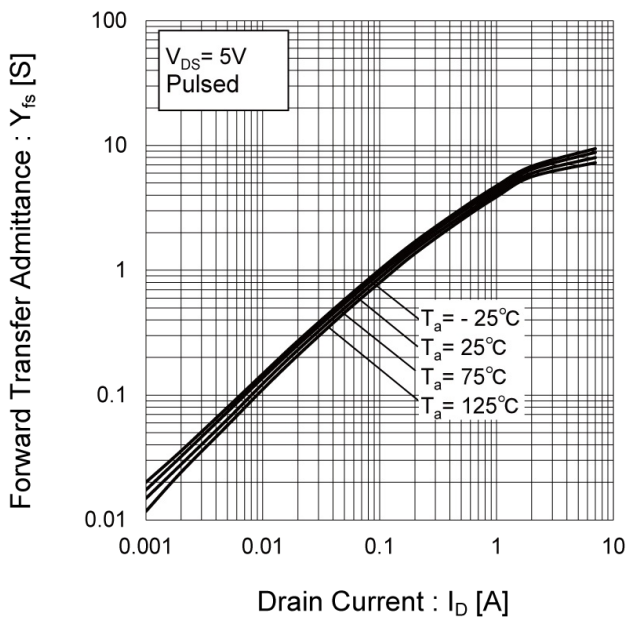


Fig.10 Transconductance vs. Drain Current



●Electrical characteristic curves <Tr1>

Fig.11 Drain Current Derating Curve

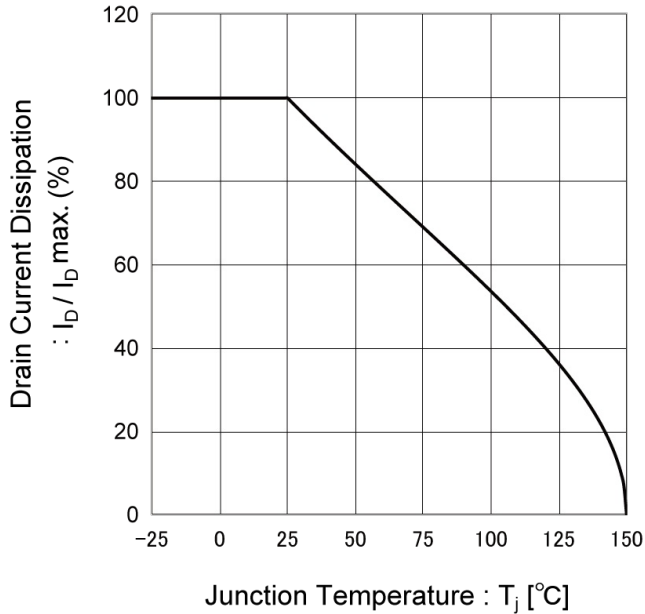


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

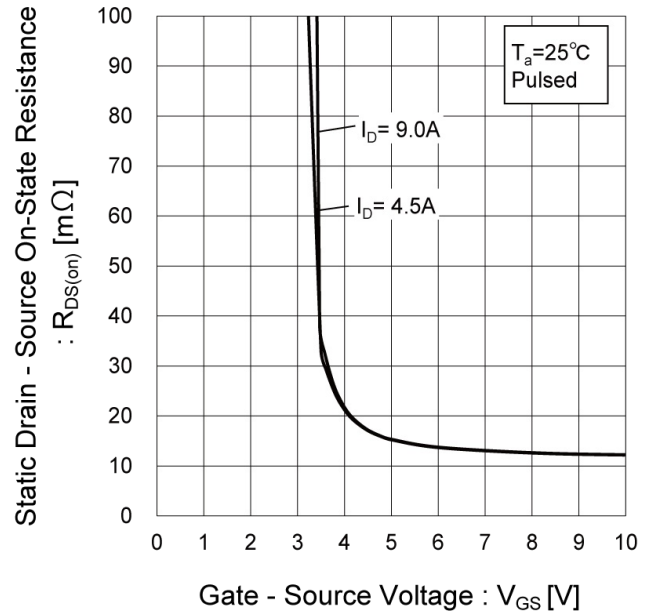
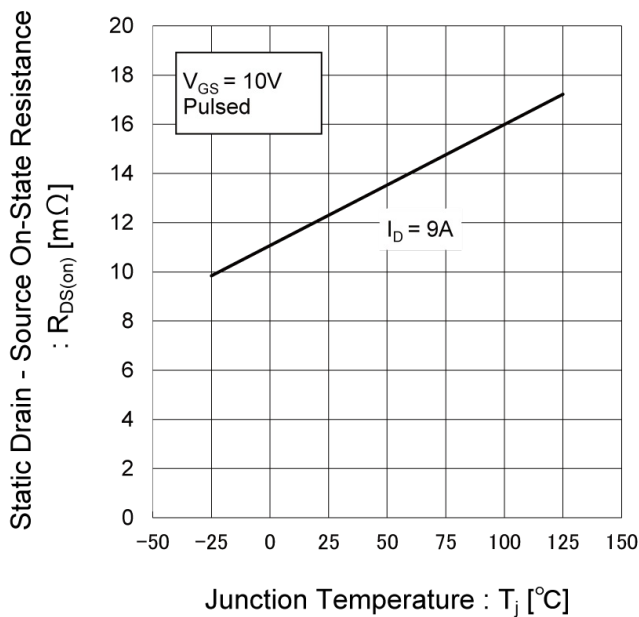


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves <Tr1>

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

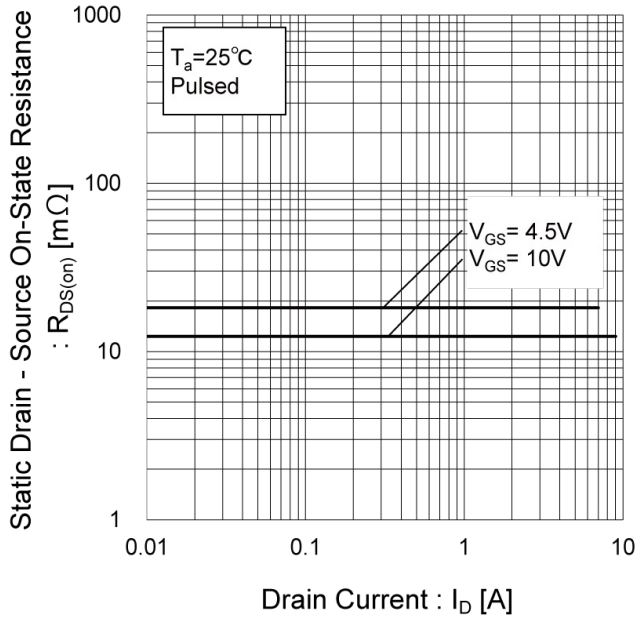


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

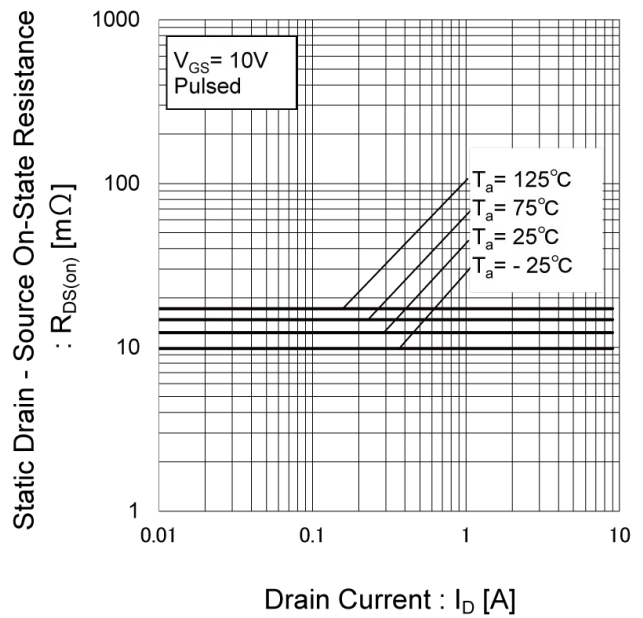
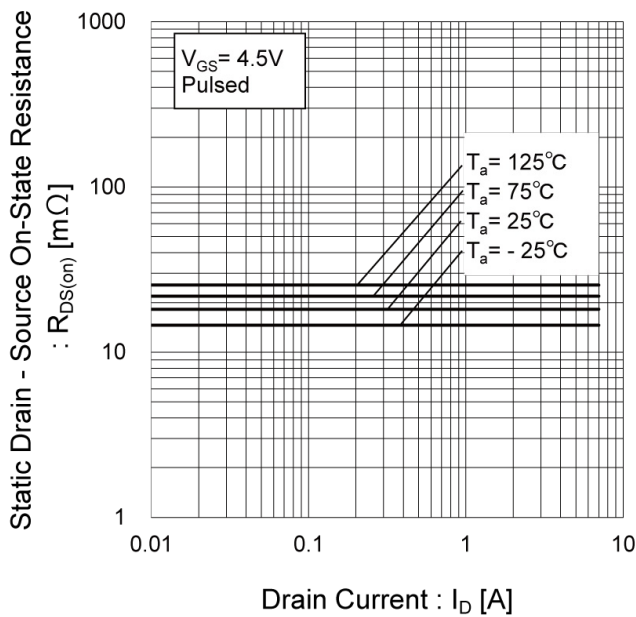


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr1>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

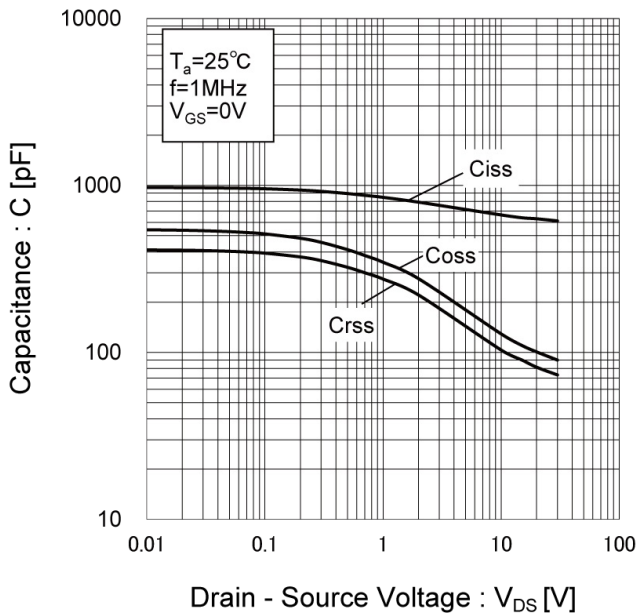


Fig.18 Switching Characteristics

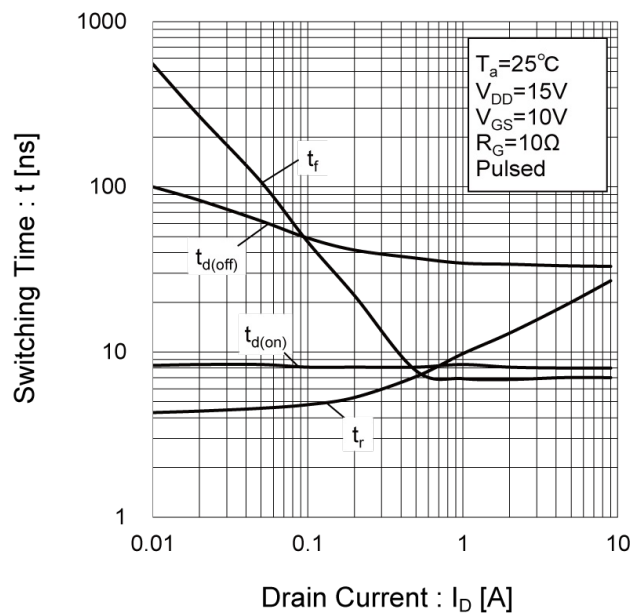


Fig.19 Dynamic Input Characteristics

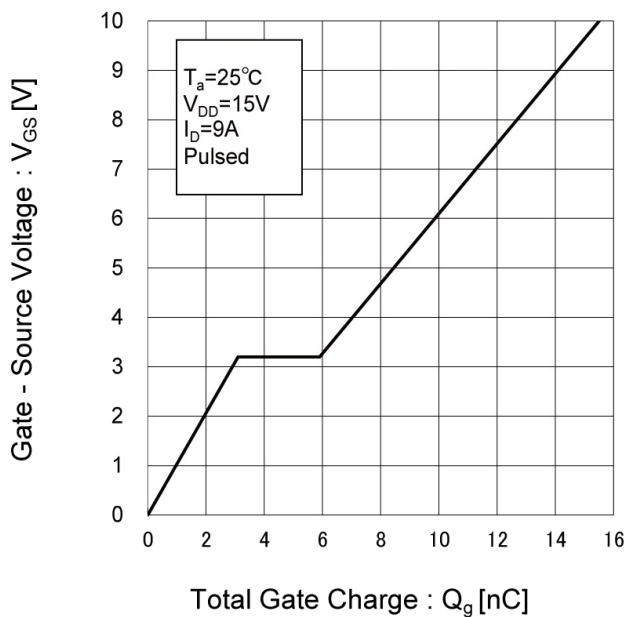
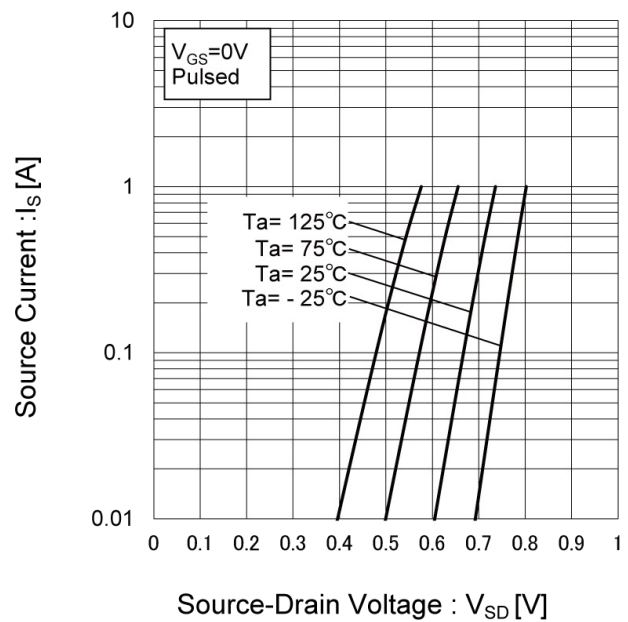


Fig.20 Source Current vs. Source Drain Voltage



●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

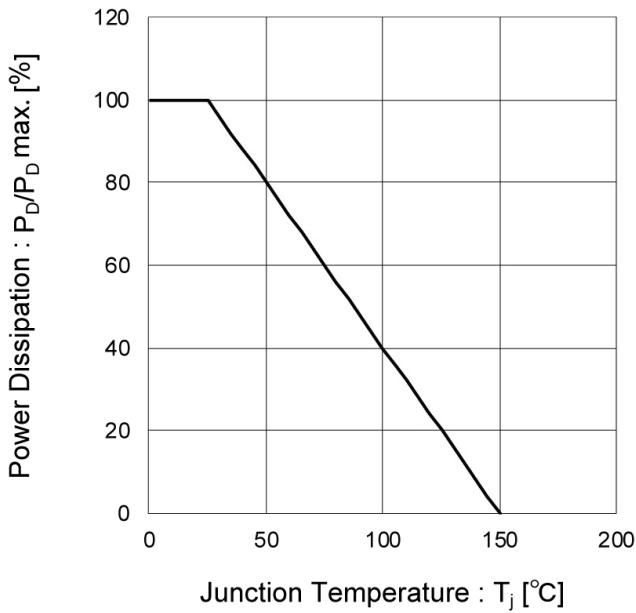


Fig.2 Maximum Safe Operating Area

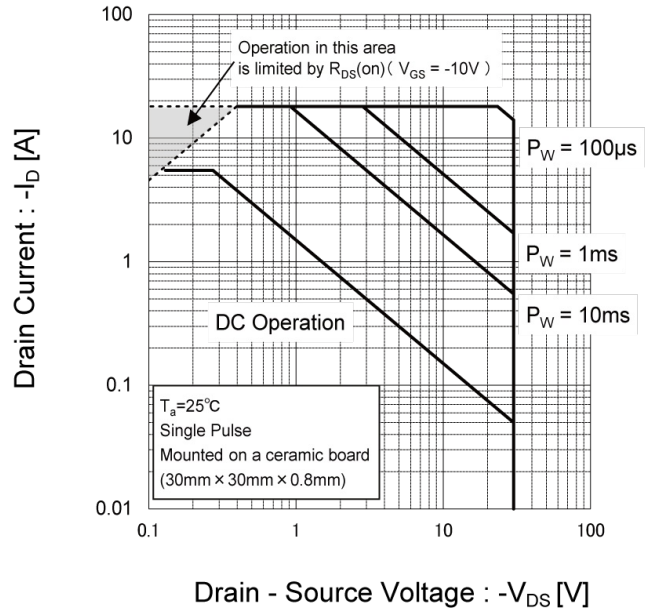


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

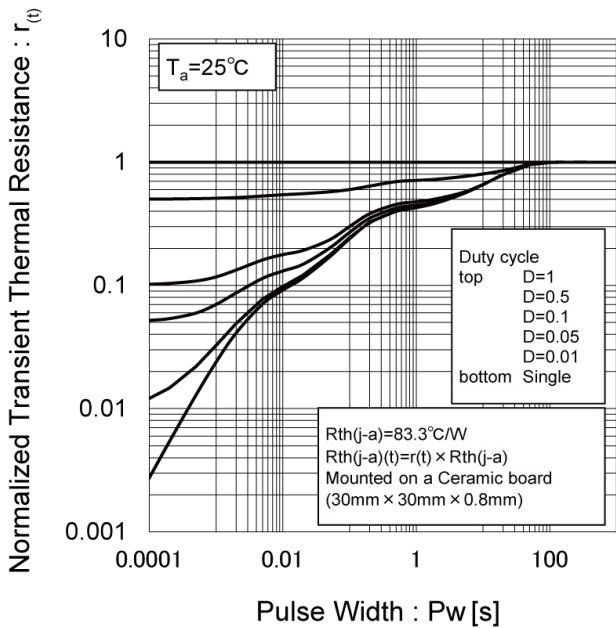
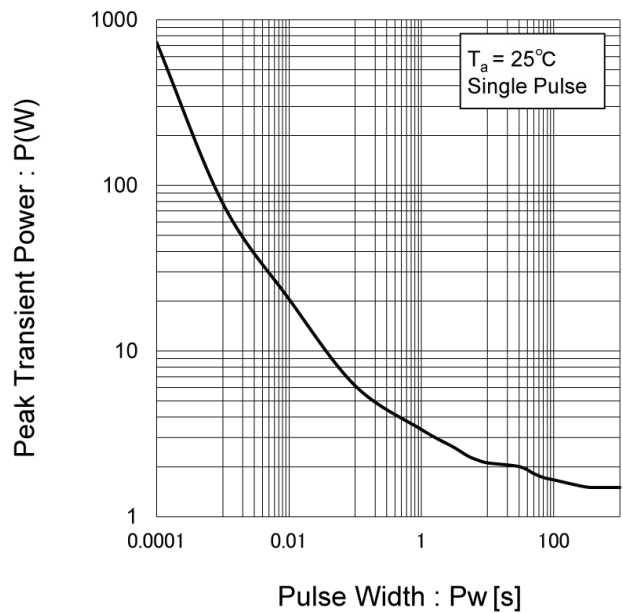


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

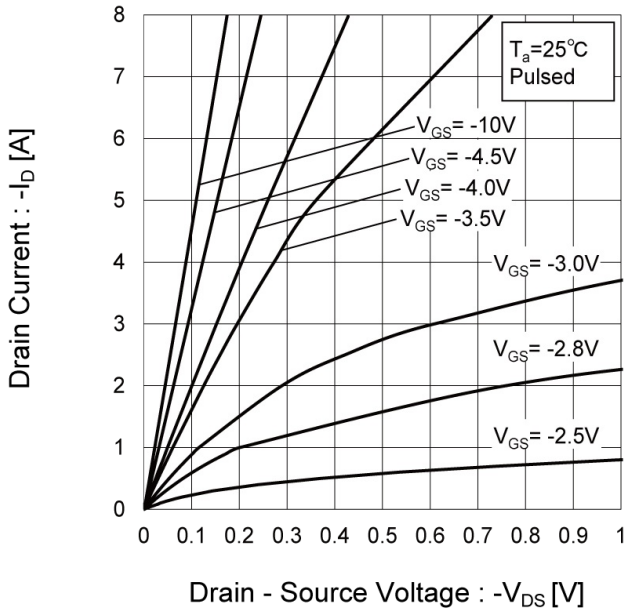


Fig.6 Typical Output Characteristics(II)

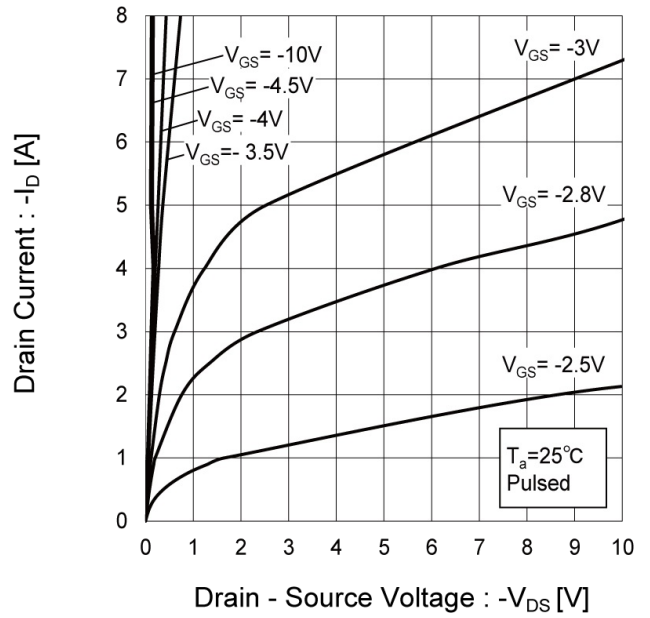
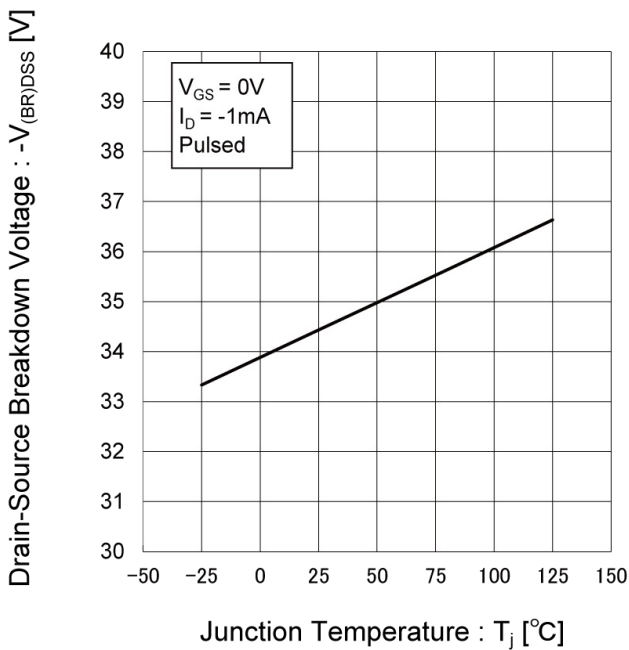


Fig.7 Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr2>

Fig.8 Typical Transfer Characteristics

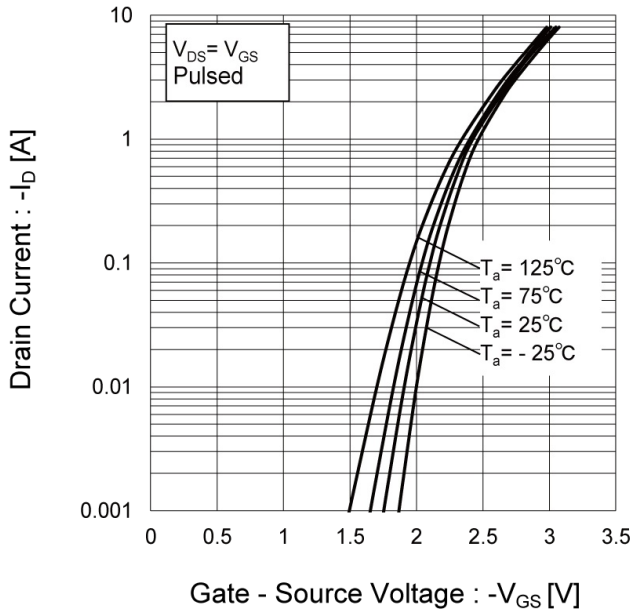


Fig.9 Gate Threshold Voltage vs. Junction Temperature

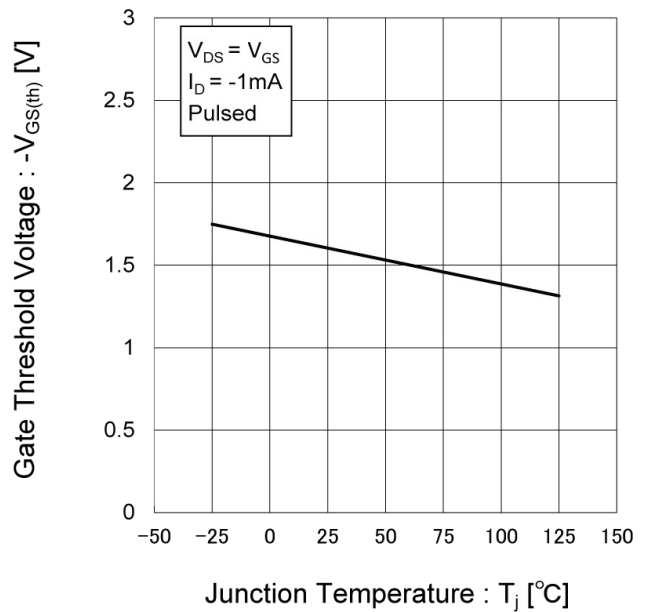
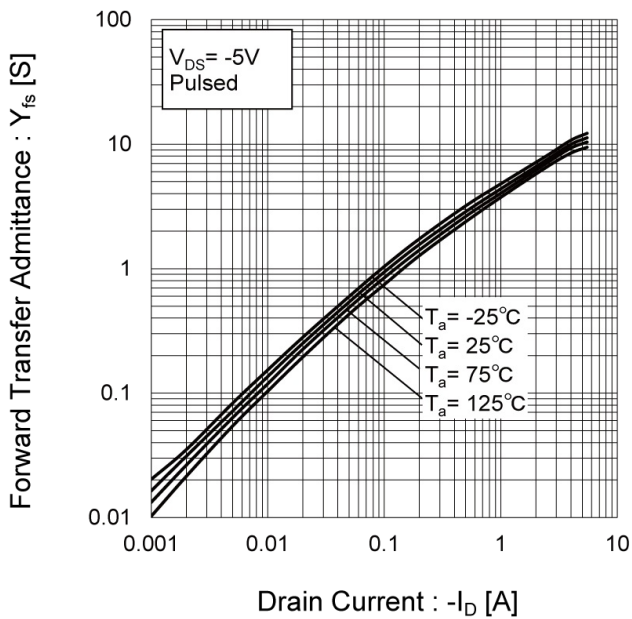


Fig.10 Transconductance vs. Drain Current



●Electrical characteristic curves <Tr2>

Fig.11 Drain Current Derating Curve

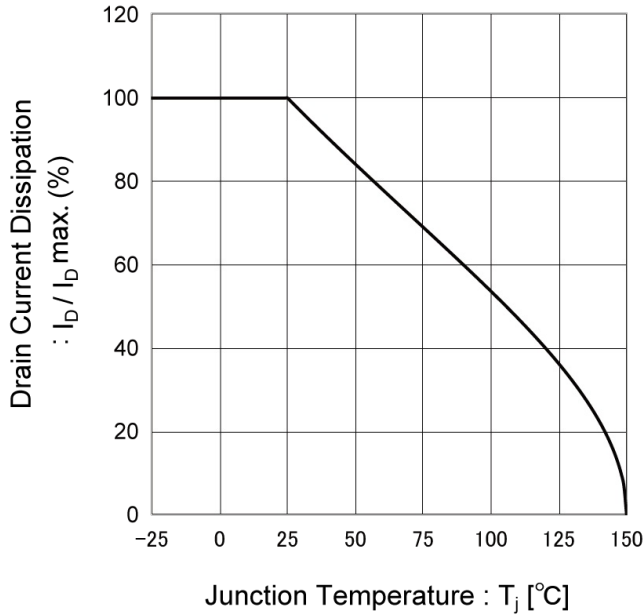


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

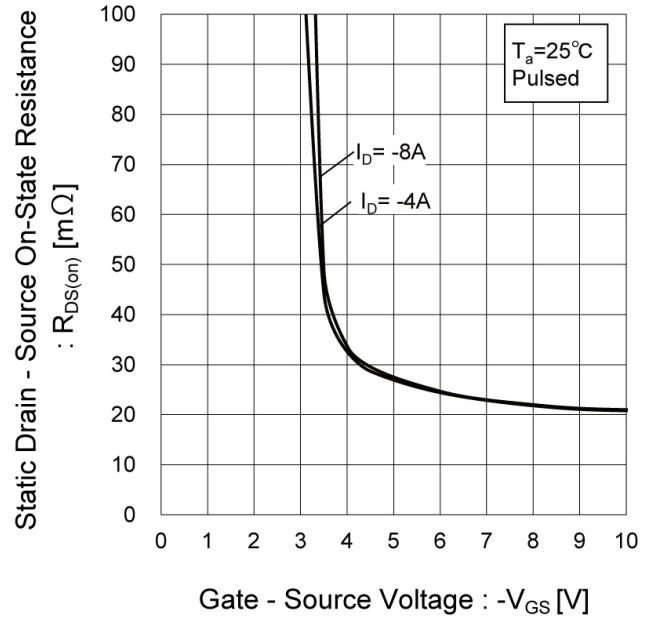
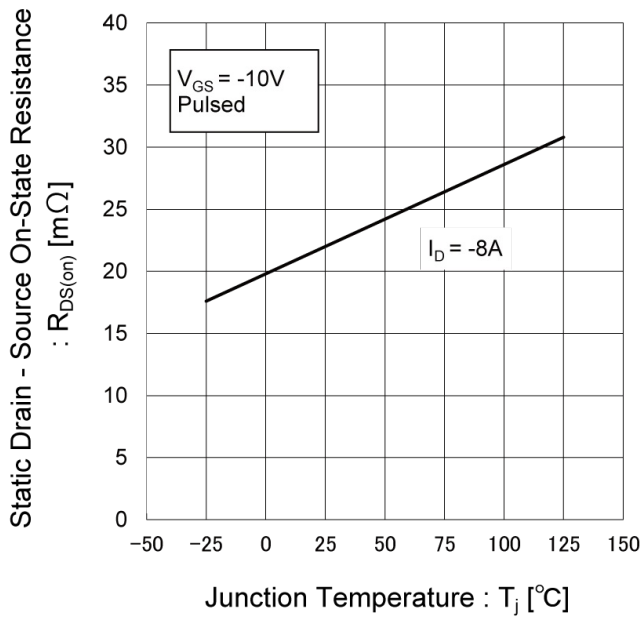


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves <Tr2>

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

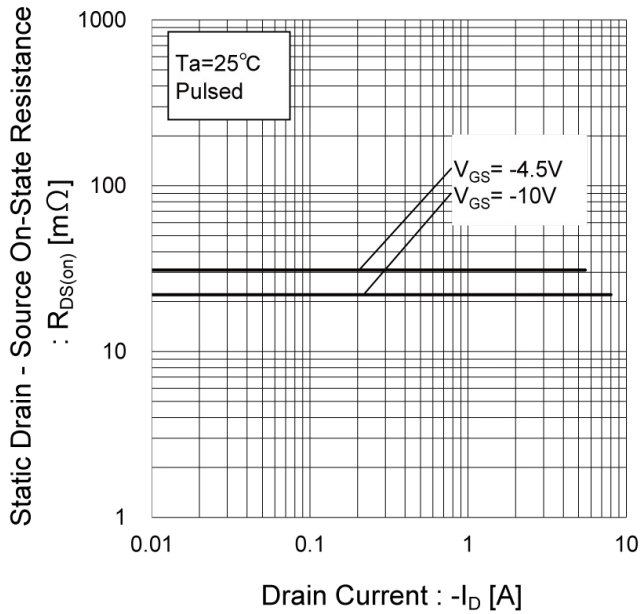


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

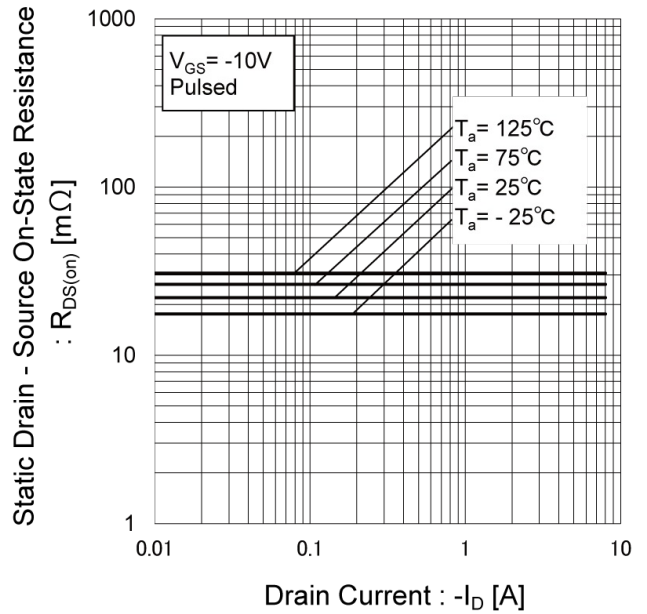
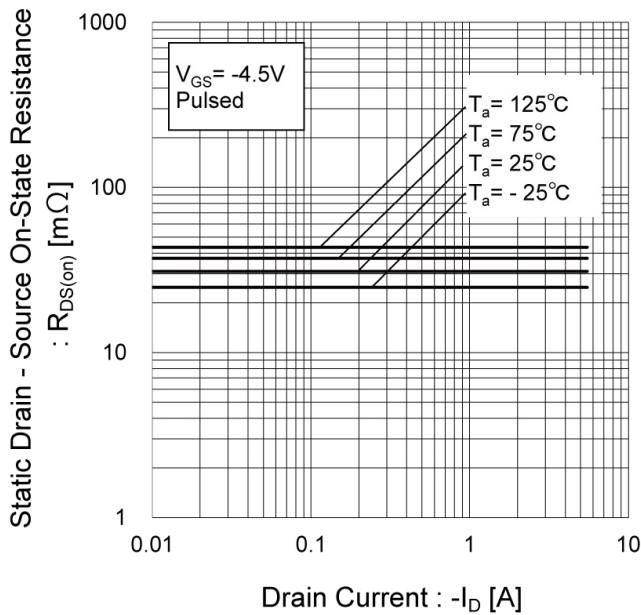


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr2>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

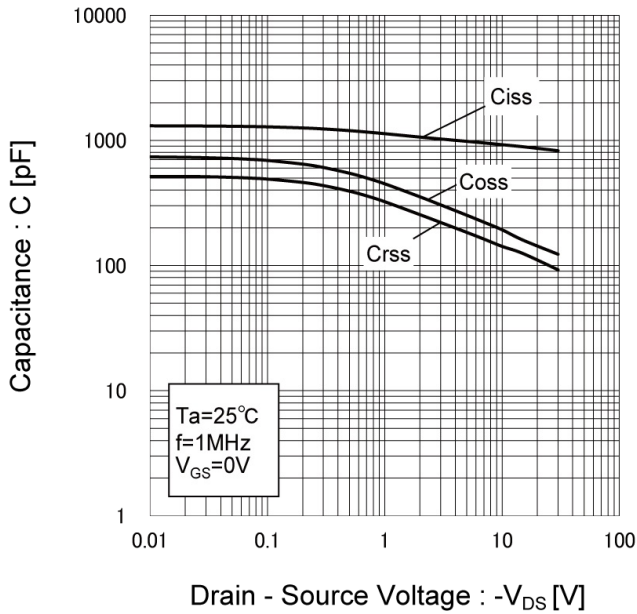


Fig.18 Switching Characteristics

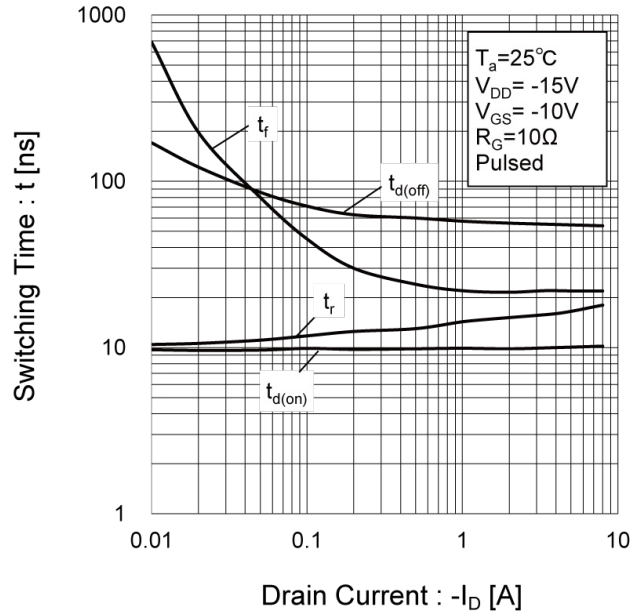


Fig.19 Dynamic Input Characteristics

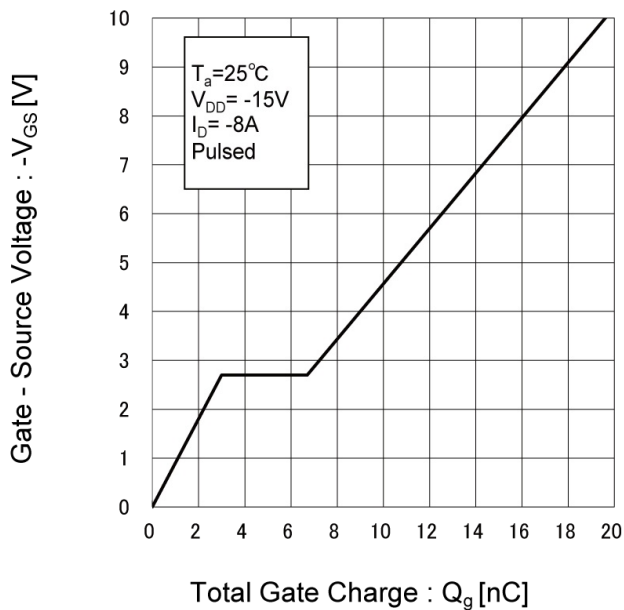
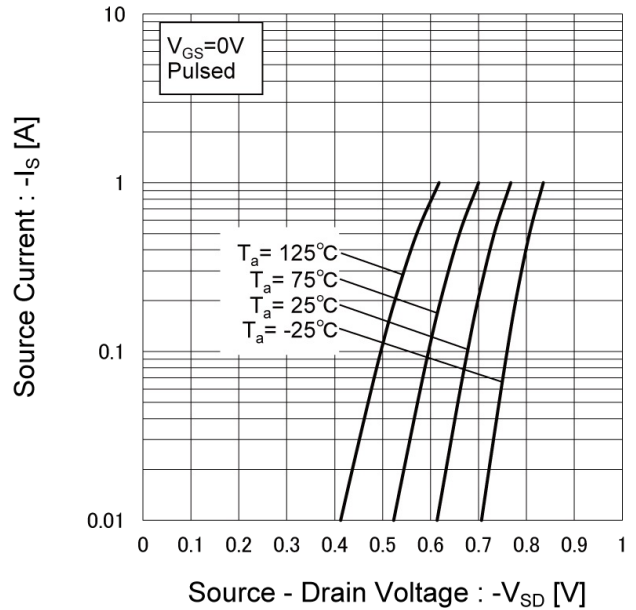


Fig.20 Source Current vs. Source Drain Voltage



● Measurement circuits <Tr1>

Fig.1-1 Switching Time Measurement Circuit

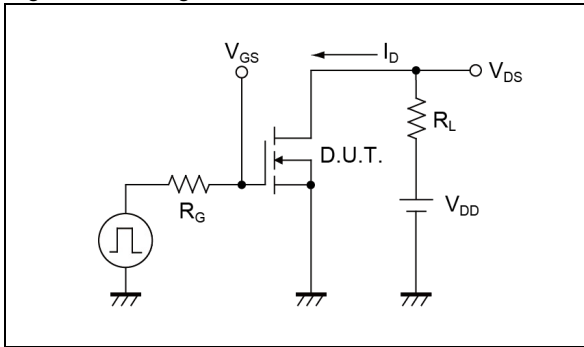


Fig.1-2 Switching Waveforms

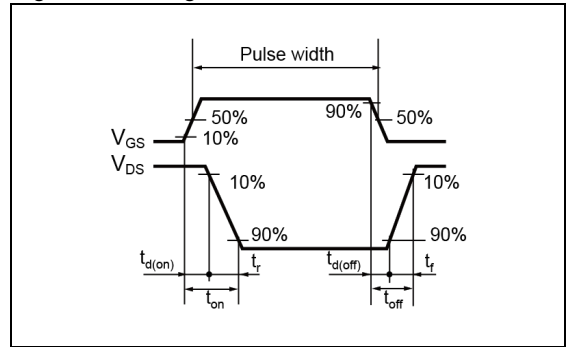


Fig.2-1 Gate Charge Measurement Circuit

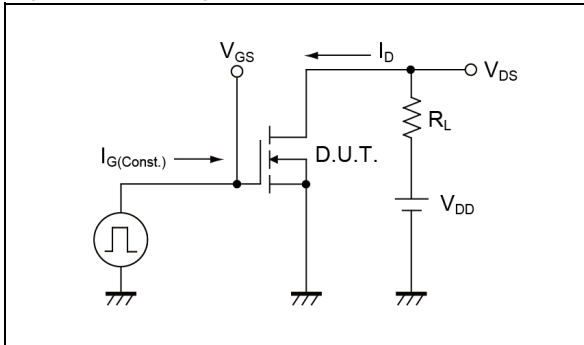


Fig.2-2 Gate Charge Waveform

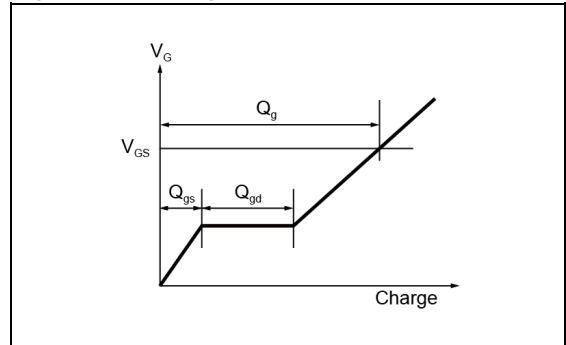


Fig.3-1 Avalanche Measurement Circuit

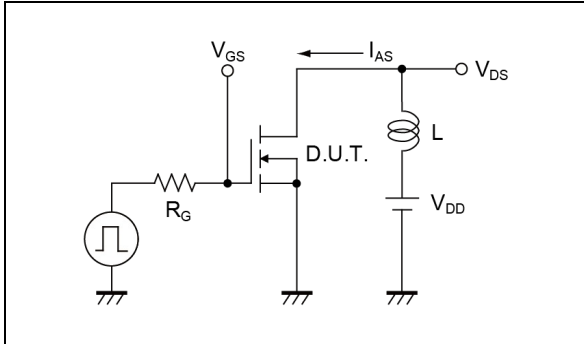
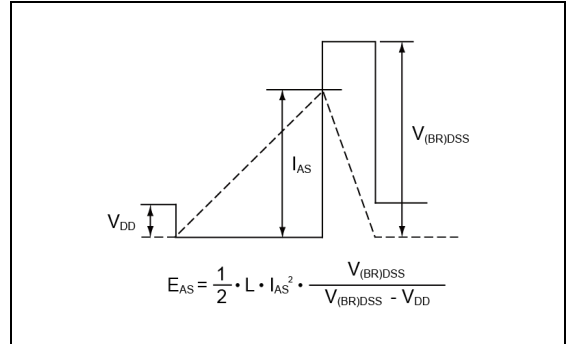


Fig.3-2 Avalanche Waveform



● Measurement circuits <Tr2>

Fig.4-1 Switching Time Measurement Circuit

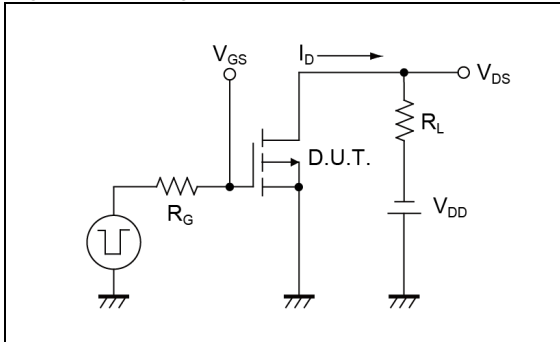


Fig.4-2 Switching Waveforms

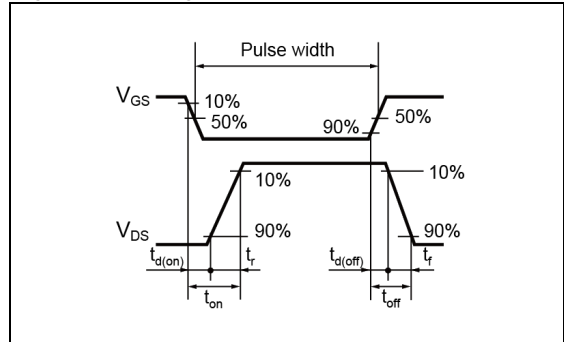


Fig.5-1 Gate Charge Measurement Circuit

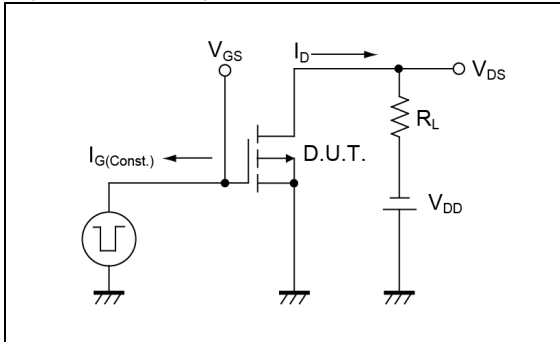


Fig.5-2 Gate Charge Waveform

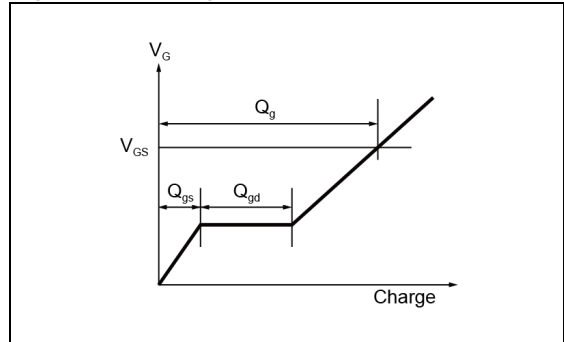


Fig.6-1 Avalanche Measurement Circuit

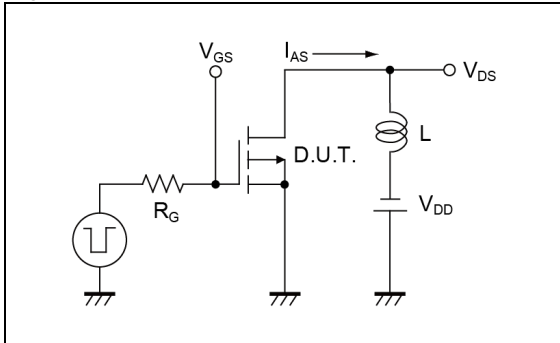
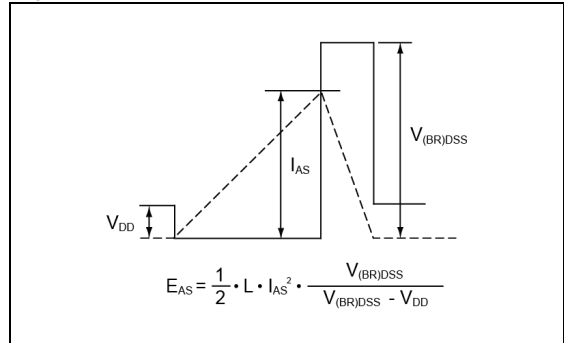


Fig.6-2 Avalanche Waveform

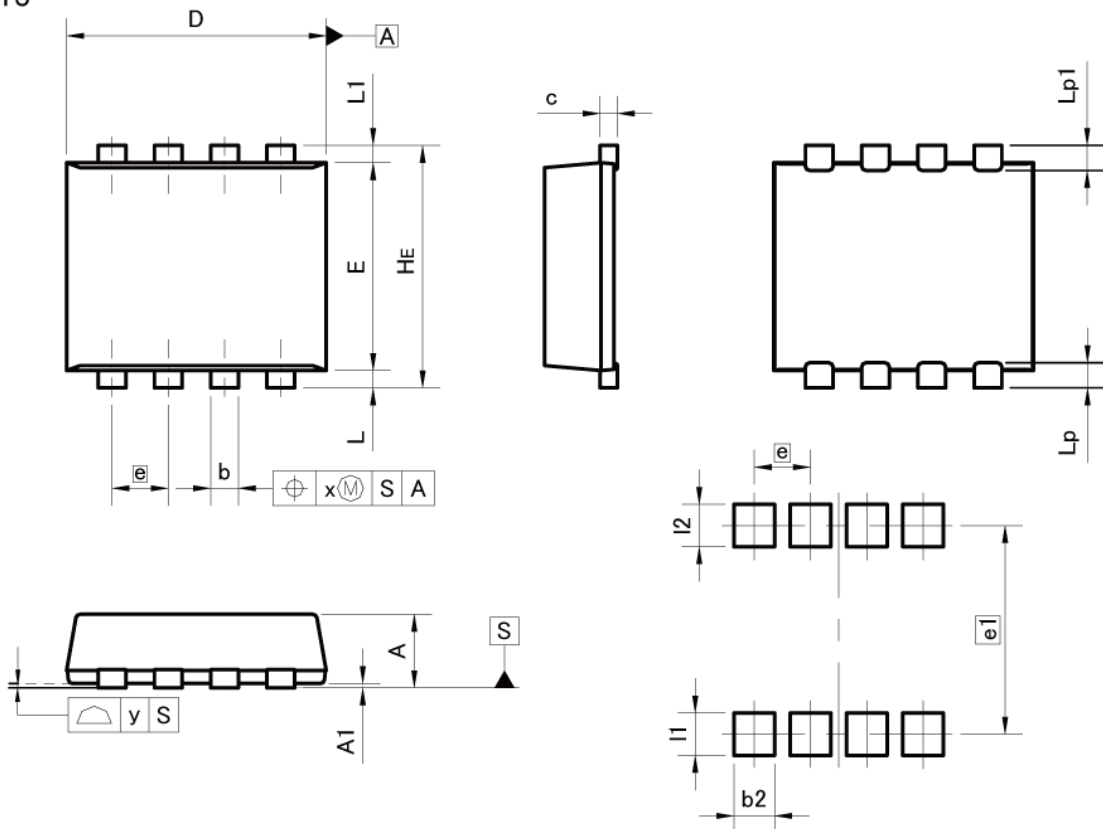


● Notice

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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- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors. Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
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