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Symbol	Tr1:Nch	Tr2:Pch
$V_{DSS}$	100V	-100V
$R_{DS(on)(Max.)}$	325mΩ	470mΩ
$I_D$	±2A	±1.5A
$P_D$	1.5W	

### ●Features

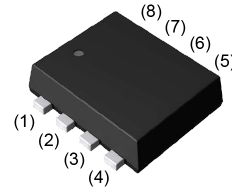
- 1) Low on - resistance.
- 2) Low voltage drive (4V drive).
- 3) Small Surface Mount Package (TSMT8).

### ●Application

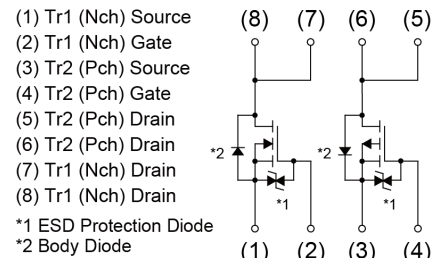
Switching

### ●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	M51	

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

Parameter	Symbol	Value		Unit
		Tr1:Nch	Tr2:Pch	
Drain - Source voltage	$V_{DSS}$	100	-100	V
Continuous drain current	$I_D$	±2	±1.5	A
Pulsed drain current	$I_{D,pulse}^{*1}$	±6	±6	A
Gate - Source voltage	$V_{GSS}$	±20	±20	V
Power dissipation	total	$P_D^{*2}$	1.5	W
		$P_D^{*3}$	0.7	
	element	$P_D^{*2}$	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	total	$R_{thJA}^{*2}$	-	-	83.3	°C/W
	element		-	-	100	
	total	$R_{thJA}^{*3}$	-	-	178	

● 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	$V_{GS} = 0V, I_D = 1mA$	100	-	-	V
		Tr2	$V_{GS} = 0V, I_D = -1mA$	-100	-	-	
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	Tr1	$I_D = 1mA$ , referenced to $25^\circ\text{C}$	-	116.9	-	mV/°C
		Tr2	$I_D = -1mA$ , referenced to $25^\circ\text{C}$	-	-91.3	-	
Zero gate voltage drain current	$I_{DSS}$	Tr1	$V_{DS} = 100V, V_{GS} = 0V$	-	-	1	μA
		Tr2	$V_{DS} = -100V, V_{GS} = 0V$	-	-	-1	
Gate - Source leakage current	$I_{GSS}$	Tr1	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	±10	μA
		Tr2	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	±10	
Gate threshold voltage	$V_{GS(th)}$	Tr1	$V_{DS} = 10V, I_D = 1mA$	1.0	-	2.5	V
		Tr2	$V_{DS} = -10V, I_D = -1mA$	-1.0	-	-2.5	
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	Tr1	$I_D = 1mA$ , referenced to $25^\circ\text{C}$	-	-3.6	-	mV/°C
		Tr2	$I_D = -1mA$ , referenced to $25^\circ\text{C}$	-	3.0	-	
Static drain - source on - state resistance	$R_{DS(on)}^{*3}$	Tr1	$V_{GS} = 10V, I_D = 2A$	-	240	325	mΩ
			$V_{GS} = 4.5V, I_D = 2A$	-	250	340	
			$V_{GS} = 4.0V, I_D = 2A$	-	260	355	
		Tr2	$V_{GS} = -10V, I_D = -1.5A$	-	350	470	
			$V_{GS} = -4.5V, I_D = -0.75A$	-	380	510	
			$V_{GS} = -4.0V, I_D = -0.75A$	-	400	540	
Forward Transfer Admittance	$ Y_{fs} ^{*3}$	Tr1	$V_{DS} = 10V, I_D = 2A$	1.9	-	-	S
		Tr2	$V_{DS} = -10V, I_D = -1.5A$	1.5	-	-	

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

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

\*3 Mounted on a FR4 (12×20×0.8mm)

\*4 Pulsed

● Electrical characteristics (T<sub>a</sub> = 25°C)

<Tr1>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	290	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 25V	-	30	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	20	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*3</sup>	V <sub>DD</sub> ≈ 50V, V <sub>GS</sub> = 10V	-	10	-	ns
Rise time	t <sub>r</sub> <sup>*3</sup>	I <sub>D</sub> = 1A	-	10	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*3</sup>	R <sub>L</sub> = 50Ω	-	30	-	
Fall time	t <sub>f</sub> <sup>*3</sup>	R <sub>G</sub> = 10Ω	-	15	-	

<Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	950	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = -25V	-	45	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	20	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*3</sup>	V <sub>DD</sub> ≈ -50V, V <sub>GS</sub> = -10V	-	10	-	ns
Rise time	t <sub>r</sub> <sup>*3</sup>	I <sub>D</sub> = -0.75A	-	15	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*3</sup>	R <sub>L</sub> = 66Ω	-	60	-	
Fall time	t <sub>f</sub> <sup>*3</sup>	R <sub>G</sub> = 10Ω	-	10	-	

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

<Tr1>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*3}$	$V_{DD} \approx 50\text{V}, I_D = 2\text{A}$ $V_{GS} = 5\text{V}$	-	4.7	-	nC
Gate - Source charge	$Q_{gs}^{*3}$		-	1.2	-	
Gate - Drain charge	$Q_{gd}^{*3}$		-	1.8	-	

<Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*3}$	$V_{DD} \approx -50\text{V}, I_D = -1.5\text{A}$ $V_{GS} = -5\text{V}$	-	17.0	-	nC
Gate - Source charge	$Q_{gs}^{*3}$		-	4.5	-	
Gate - Drain charge	$Q_{gd}^{*3}$		-	5.0	-	

● 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	$I_{SP}^{*1}$		-	-	6	
Forward voltage	$V_{SD}^{*3}$	$V_{GS} = 0\text{V}, I_S = 2\text{A}$	-	-	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	$I_{SP}^{*1}$		-	-	-6	
Forward voltage	$V_{SD}^{*3}$	$V_{GS} = 0\text{V}, I_S = -0.75\text{A}$	-	-	-1.2	V

● Electrical characteristic curves <Tr1>

Fig.1 Power Dissipation Derating Curve

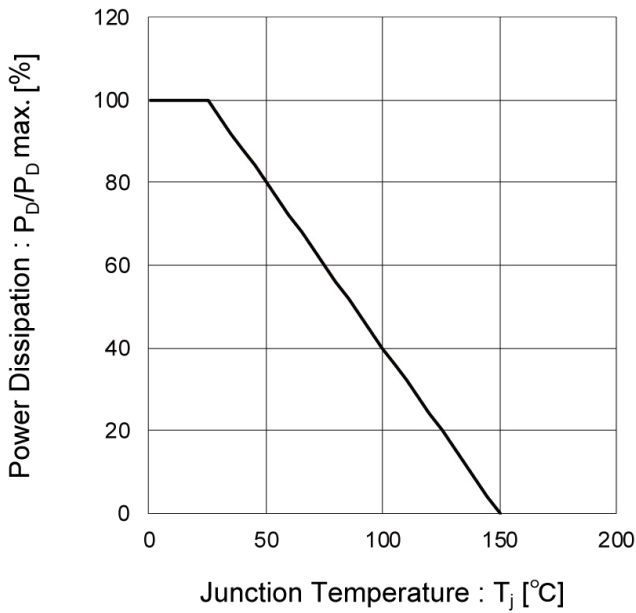


Fig.2 Maximum Safe Operating Area

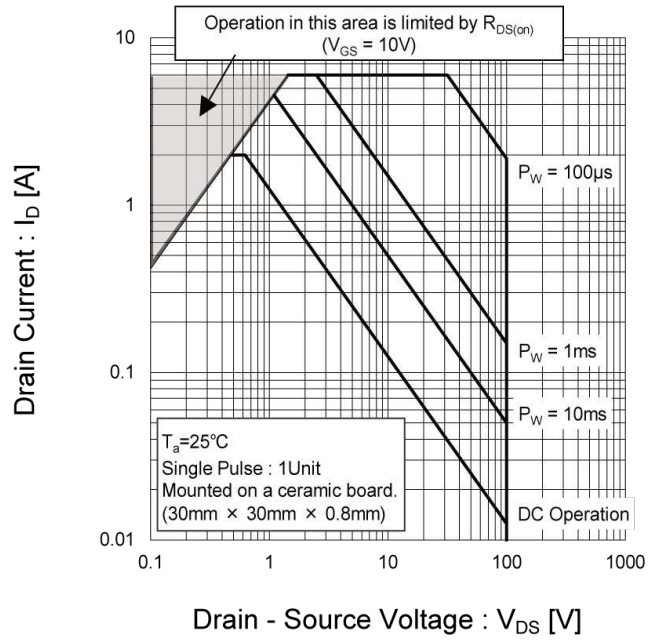


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

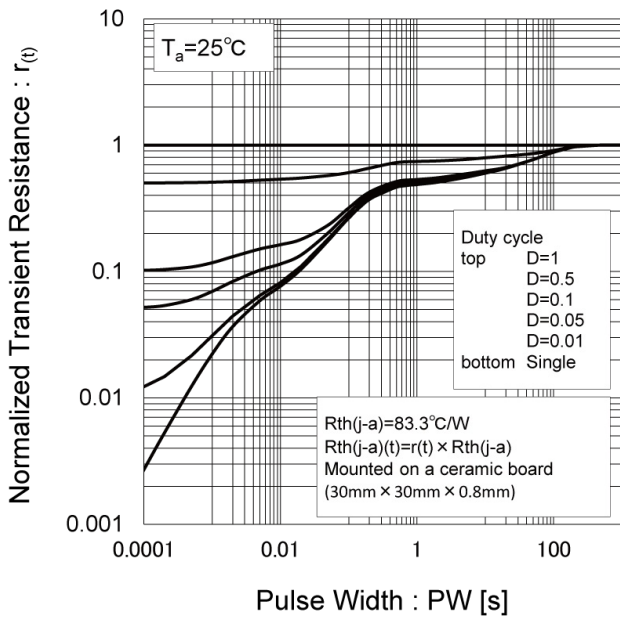
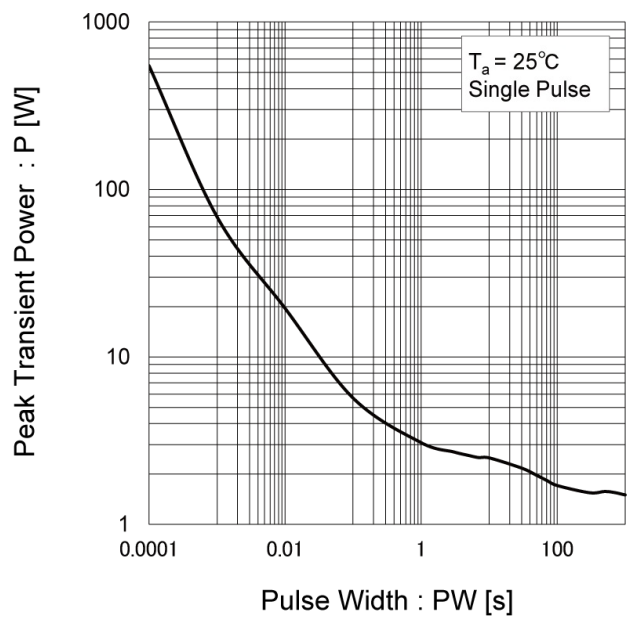


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

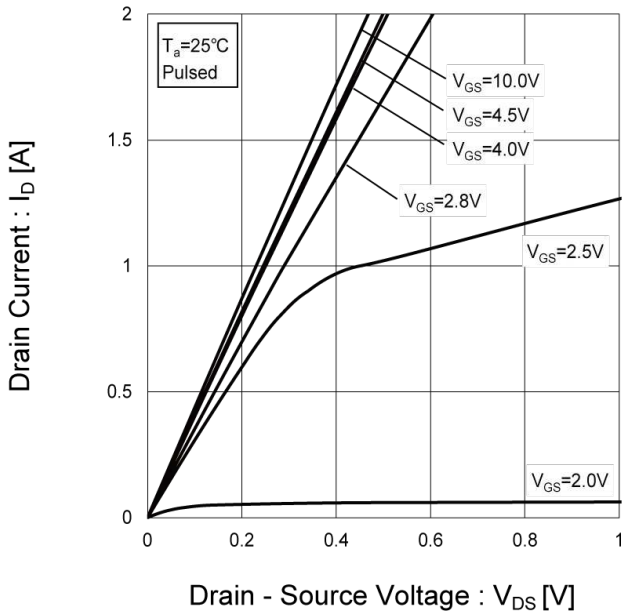


Fig.6 Typical Output Characteristics(II)

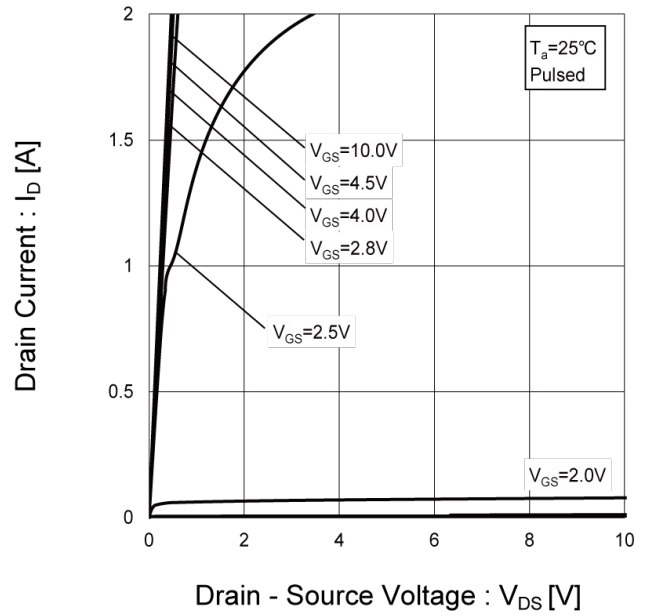


Fig.7 Breakdown Voltage vs. Junction Temperature

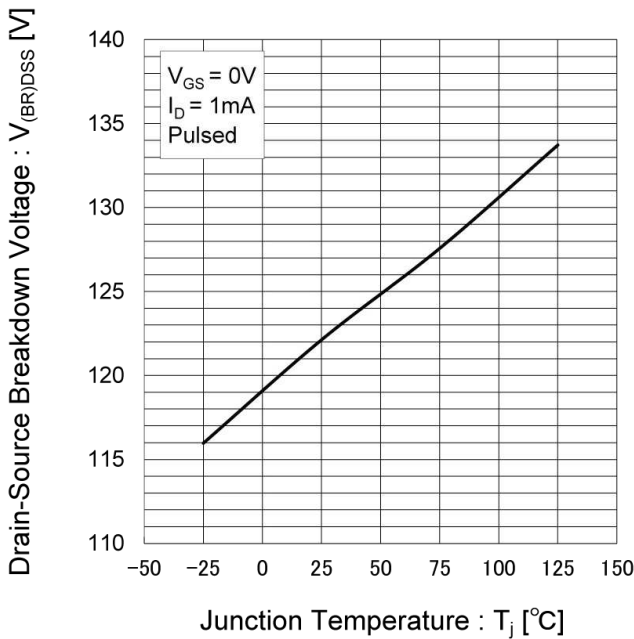
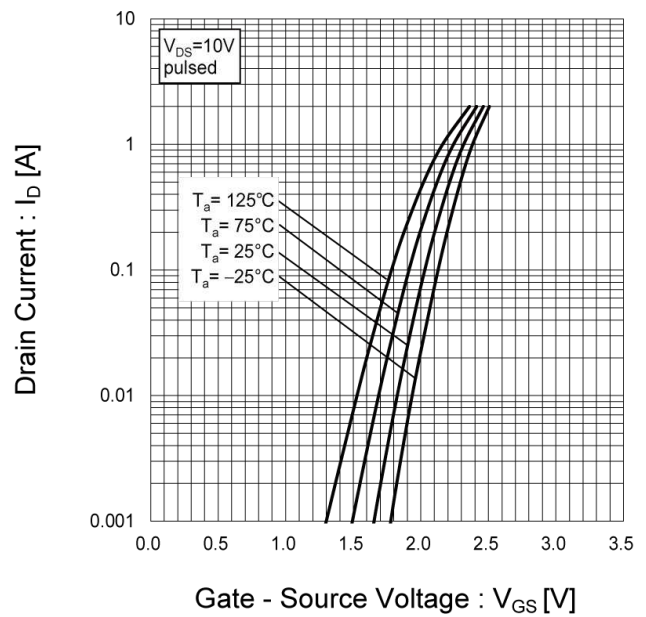


Fig.8 Typical Transfer Characteristics



● Electrical characteristic curves <Tr1>

Fig.9 Gate Threshold Voltage vs. Junction Temperature

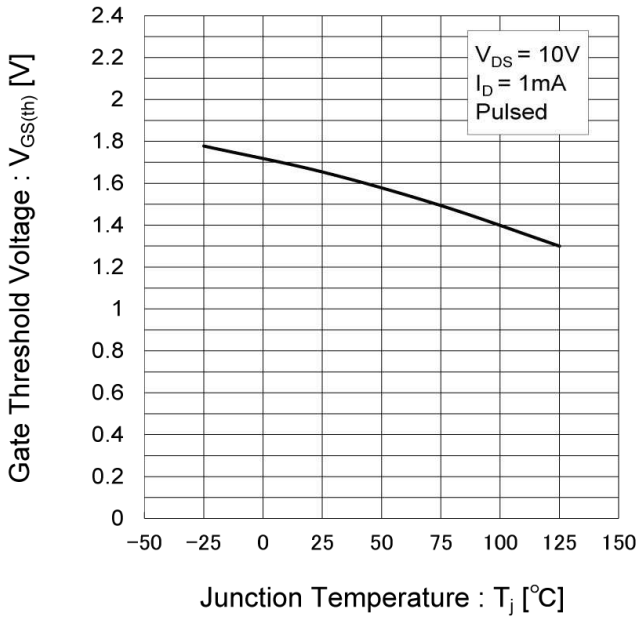


Fig.10 Forward Transfer Admittance vs. Drain Current

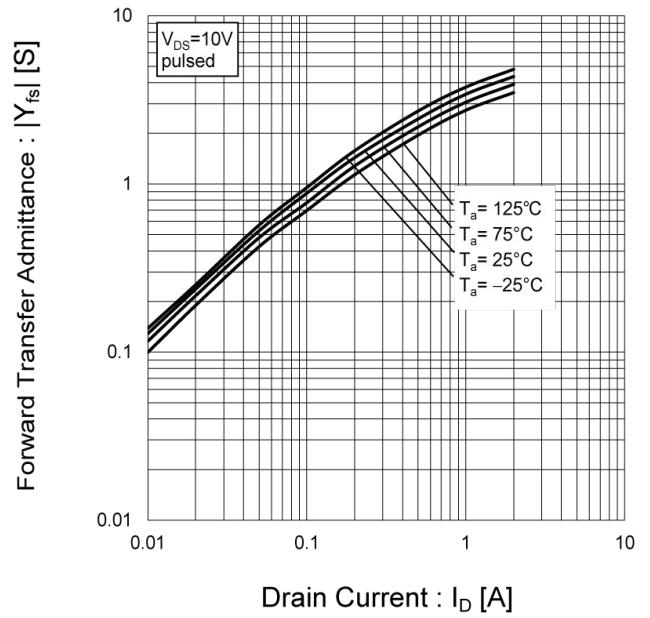


Fig.11 Drain Current Derating Curve

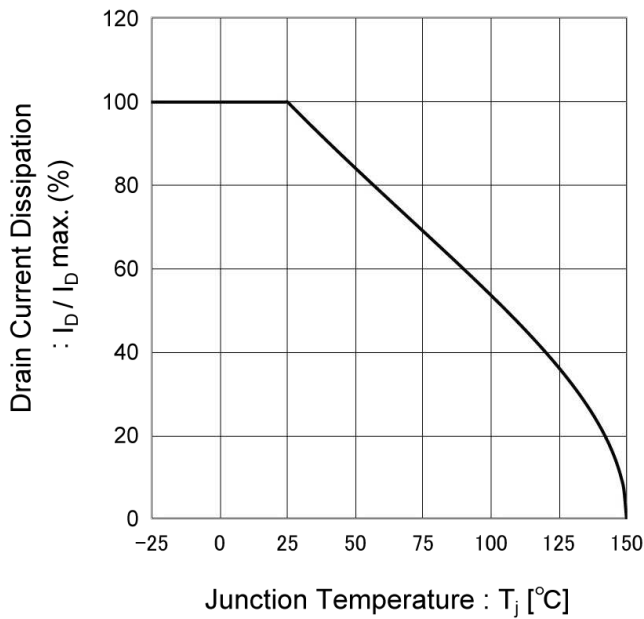
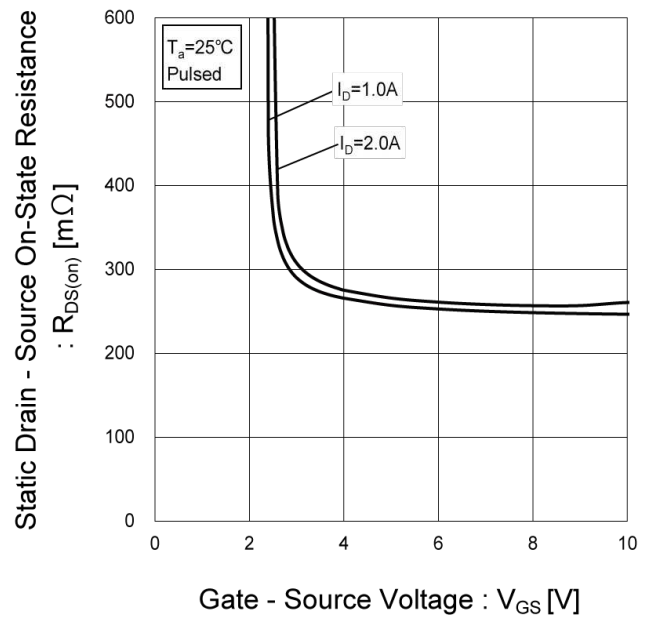


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage





● Electrical characteristic curves <Tr1>

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

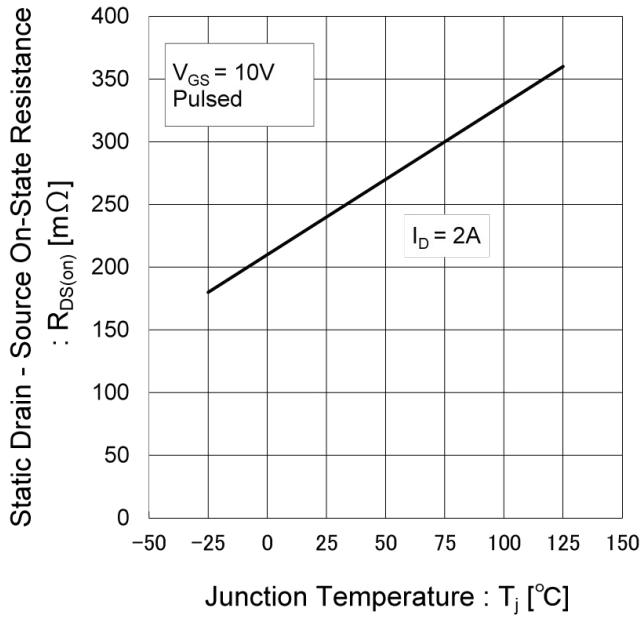
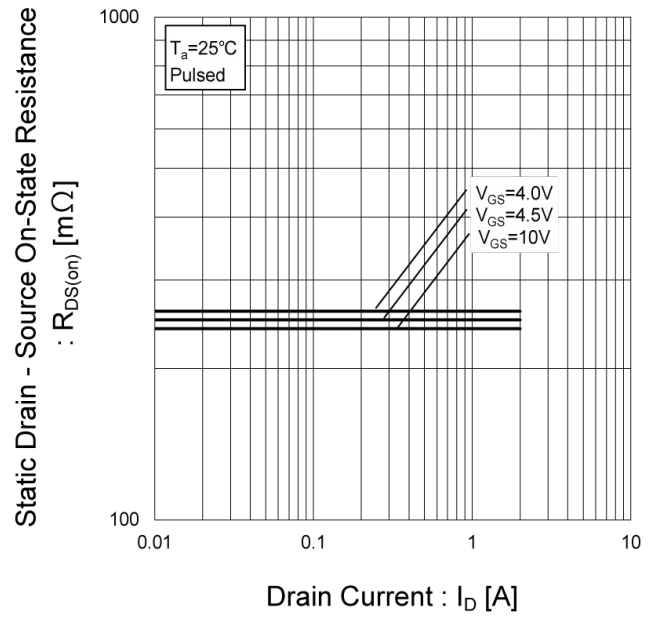


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (I)



● Electrical characteristic curves <Tr1>

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

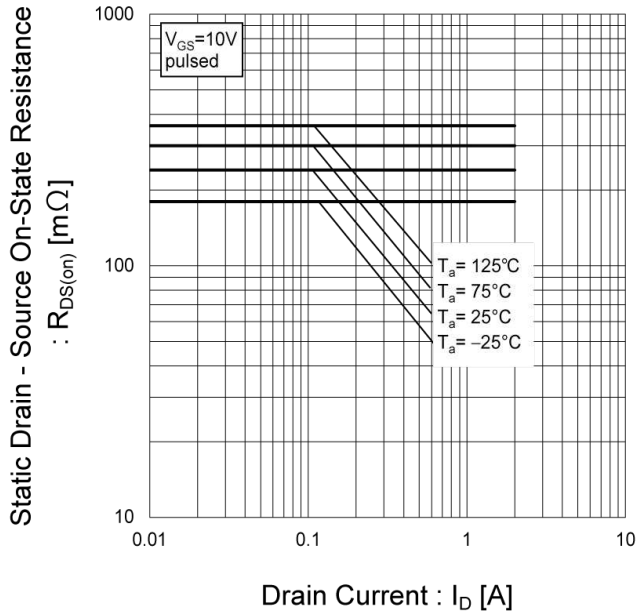


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

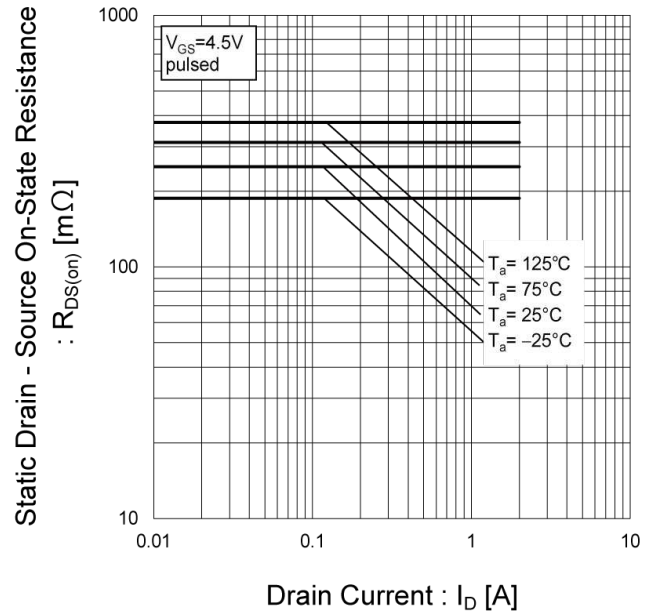
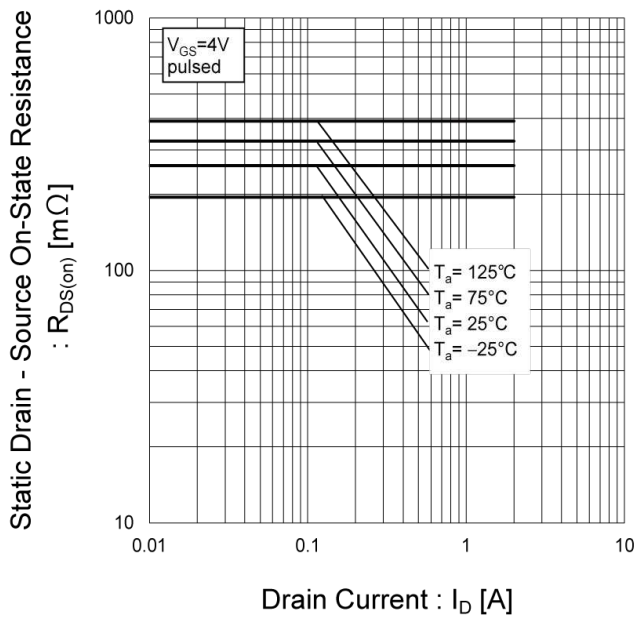


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current (IV)



●Electrical characteristic curves <Tr1>

Fig.18 Typical Capacitance vs. Drain - Source Voltage

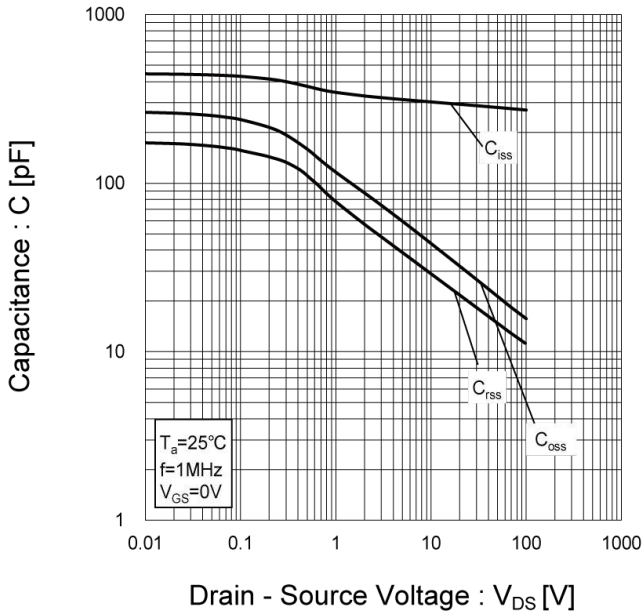


Fig.19 Switching Characteristics

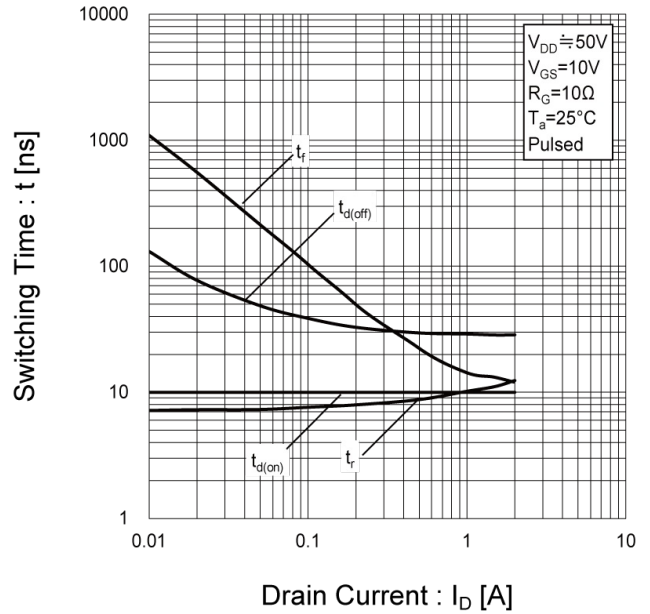


Fig.20 Dynamic Input Characteristics

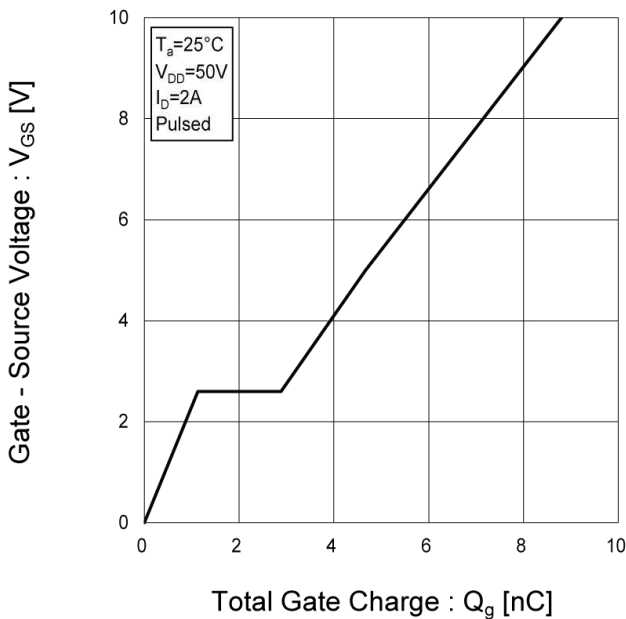
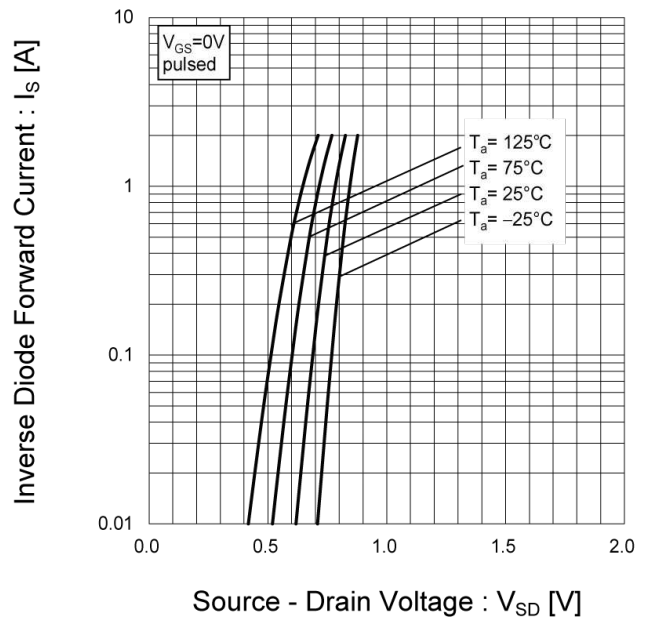


Fig.21 Source Current vs. Source Drain Voltage



●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

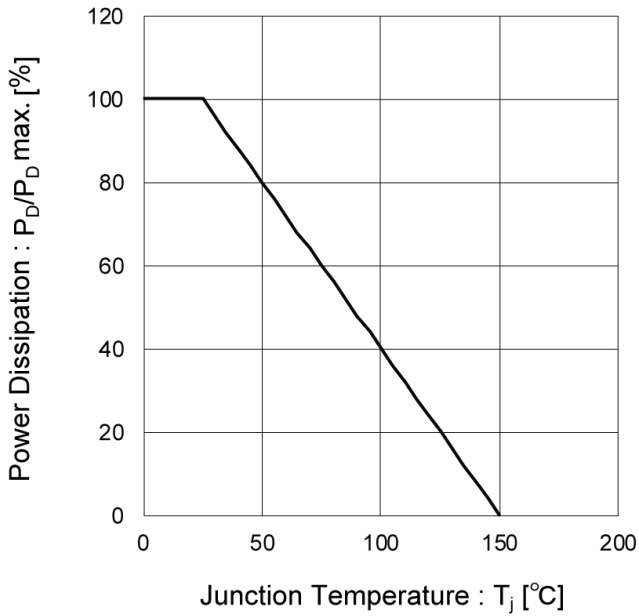


Fig.2 Maximum Safe Operating Area

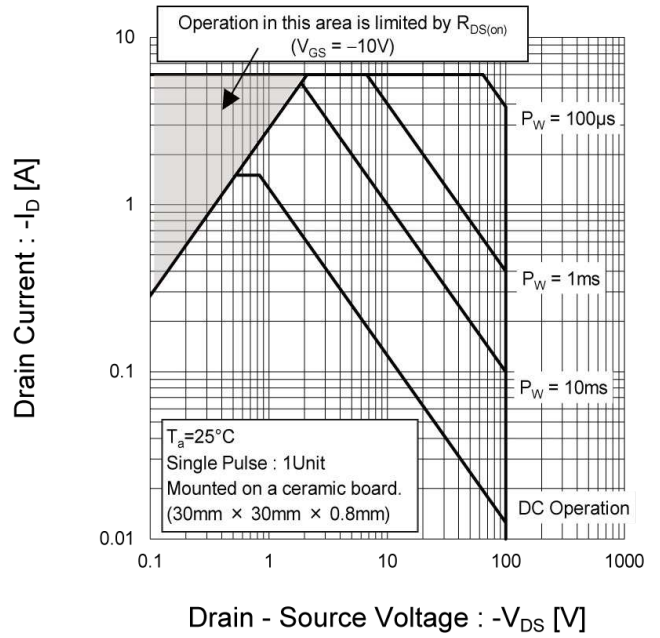


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

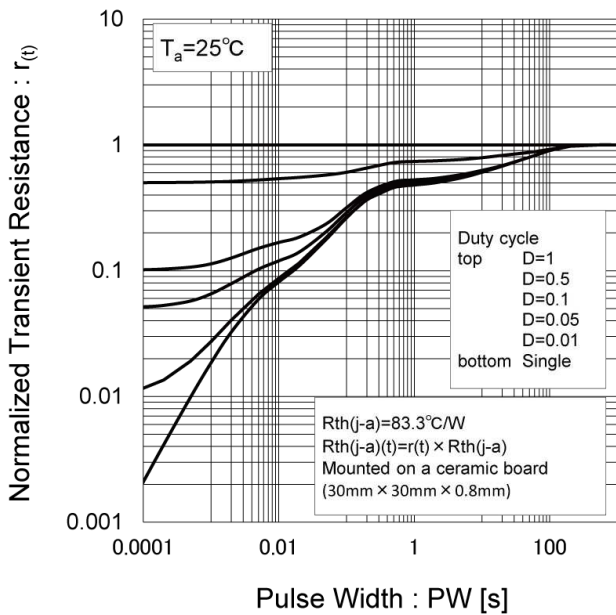
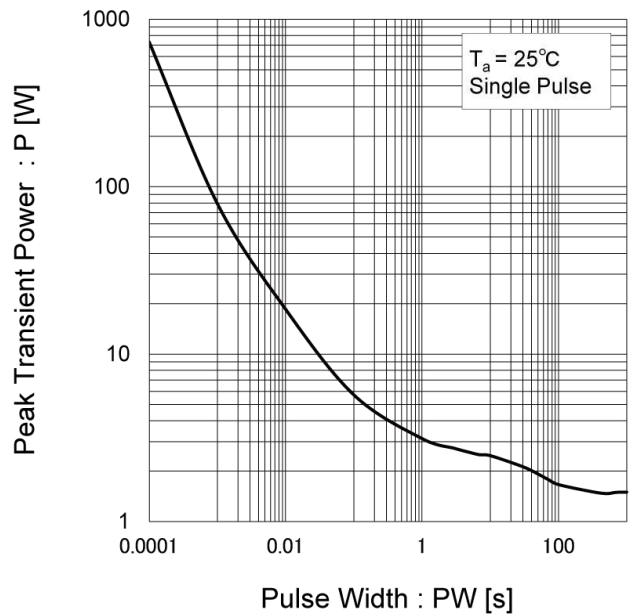


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

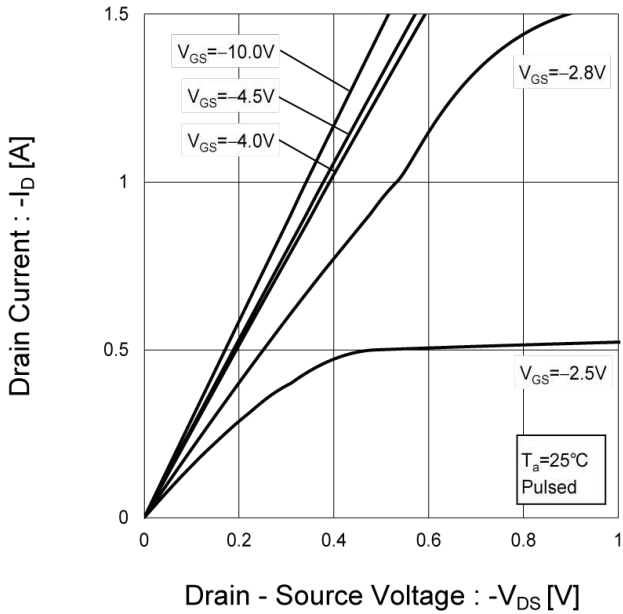


Fig.6 Typical Output Characteristics(II)

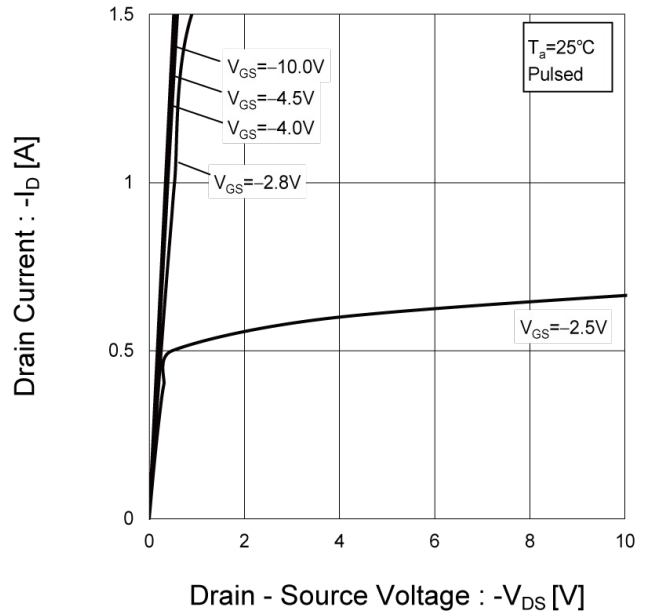


Fig.7 Breakdown Voltage vs. Junction Temperature

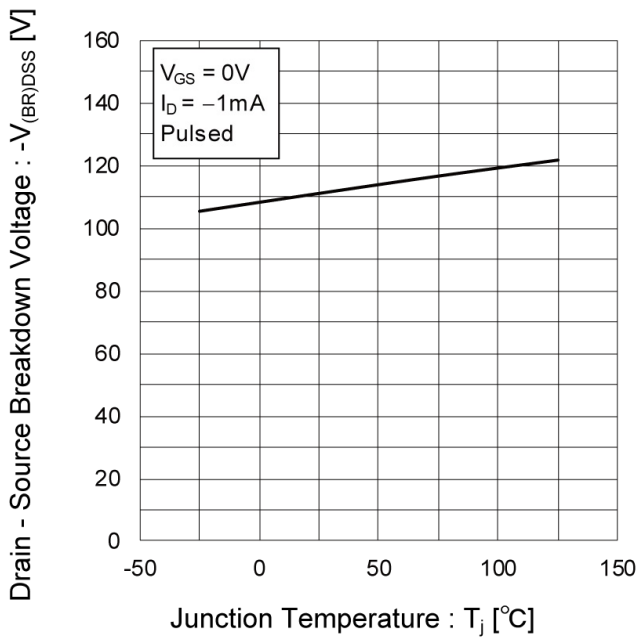
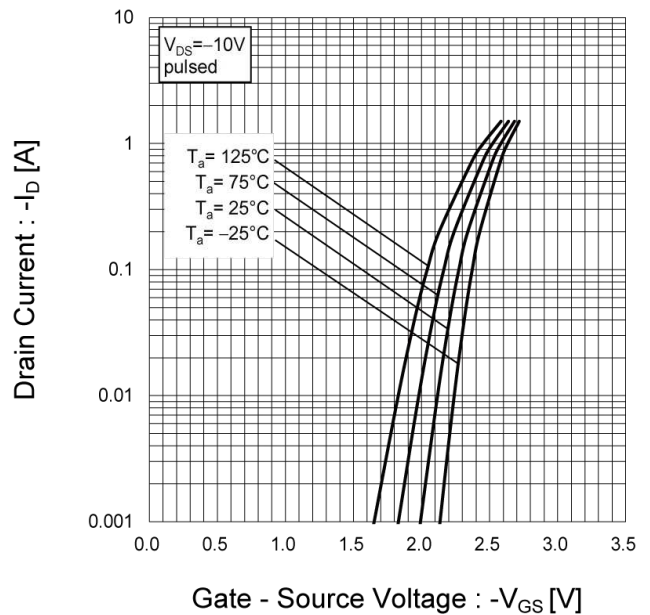


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves <Tr2>

Fig.9 Gate Threshold Voltage vs. Junction Temperature

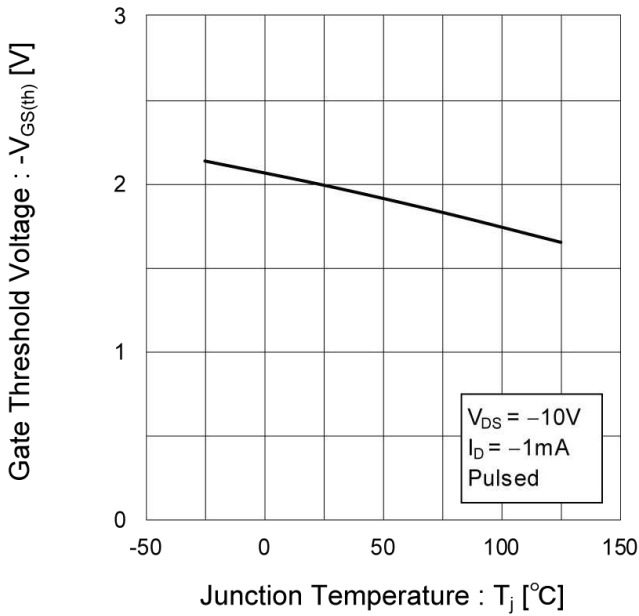


Fig.10 Forward Transfer Admittance vs. Drain Current

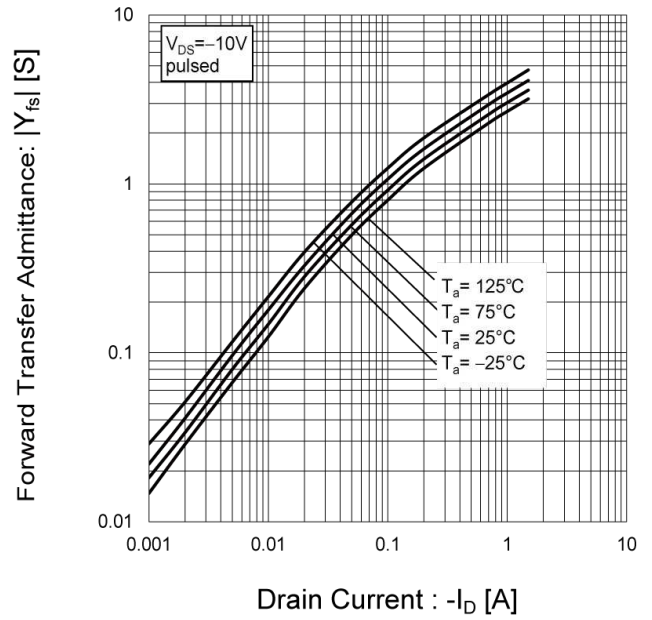


Fig.11 Drain Current Derating Curve

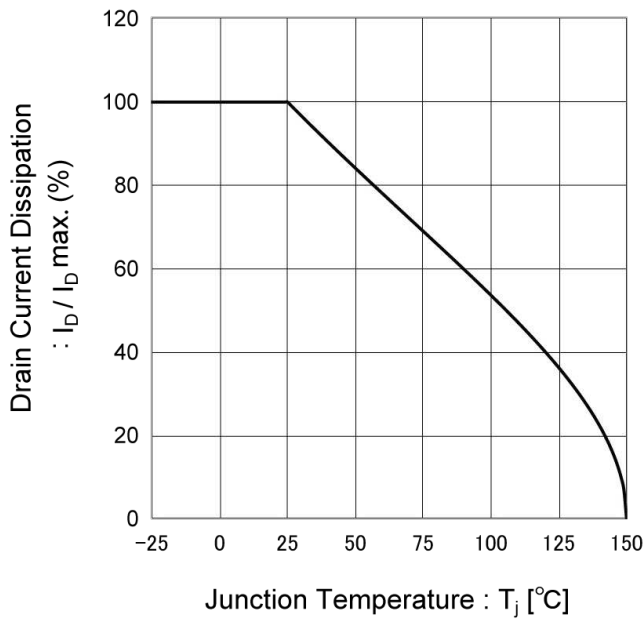
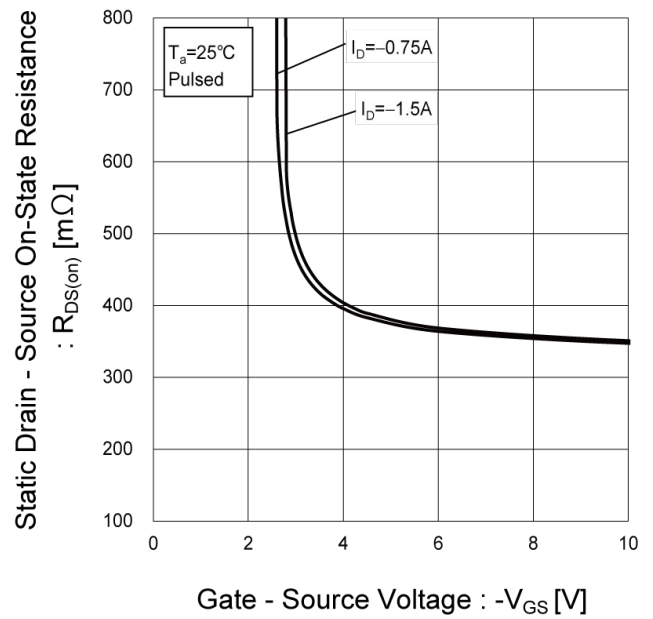


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves <Tr2>

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

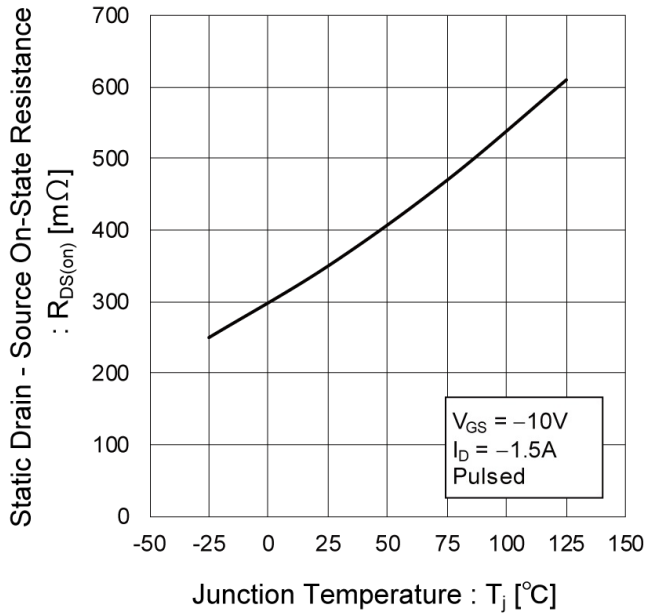
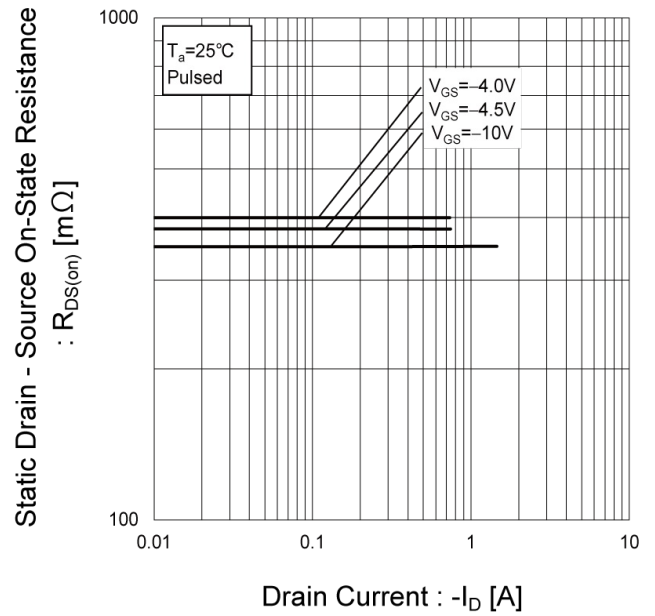


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (I)



● Electrical characteristic curves <Tr2>

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

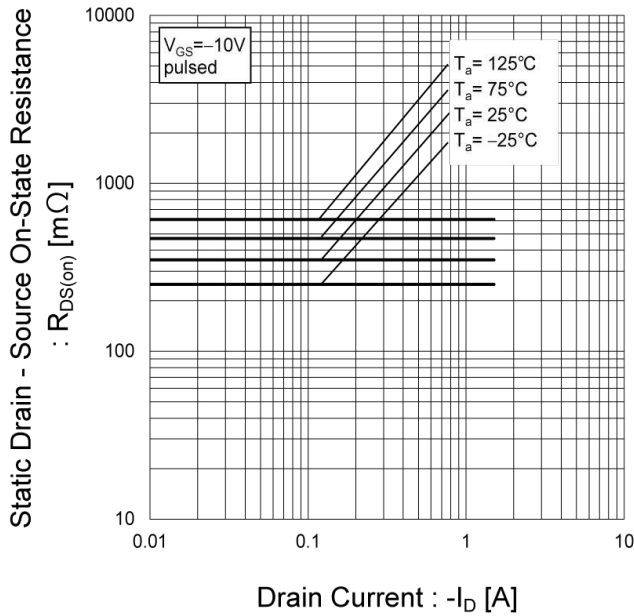


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

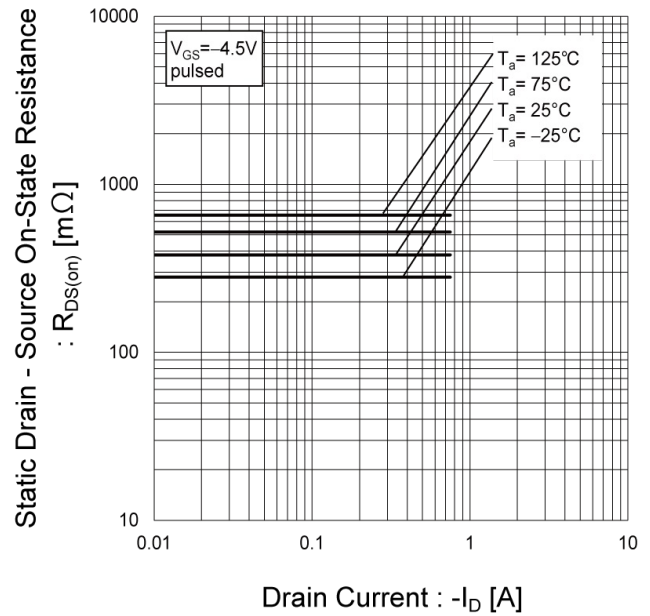
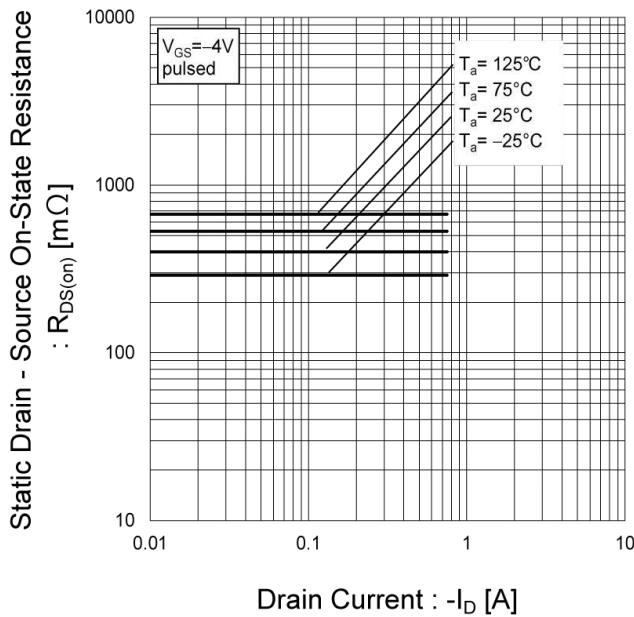


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current (IV)





●Electrical characteristic curves <Tr2>

Fig.18 Typical Capacitance vs. Drain - Source Voltage

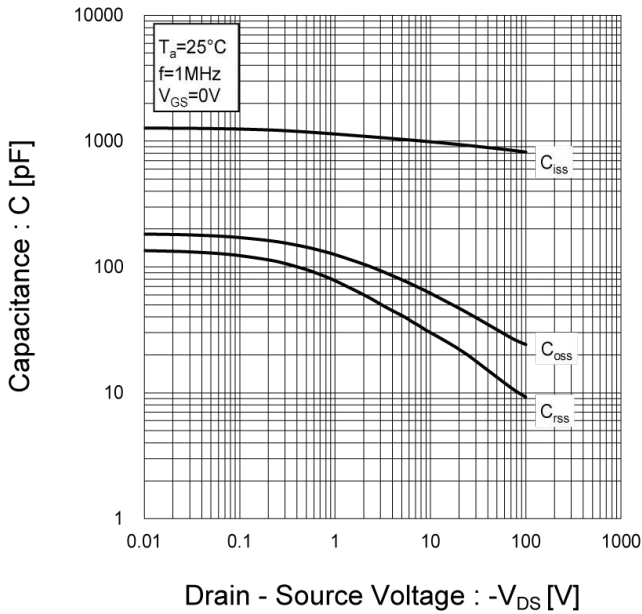


Fig.19 Switching Characteristics

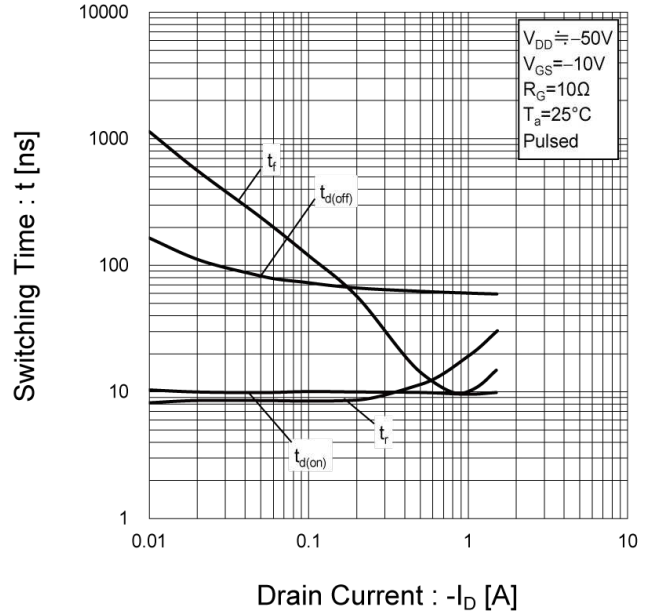


Fig.20 Dynamic Input Characteristics

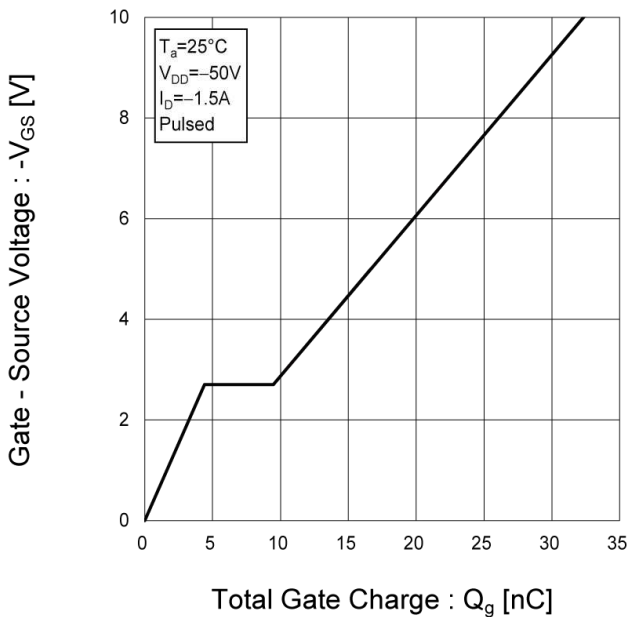
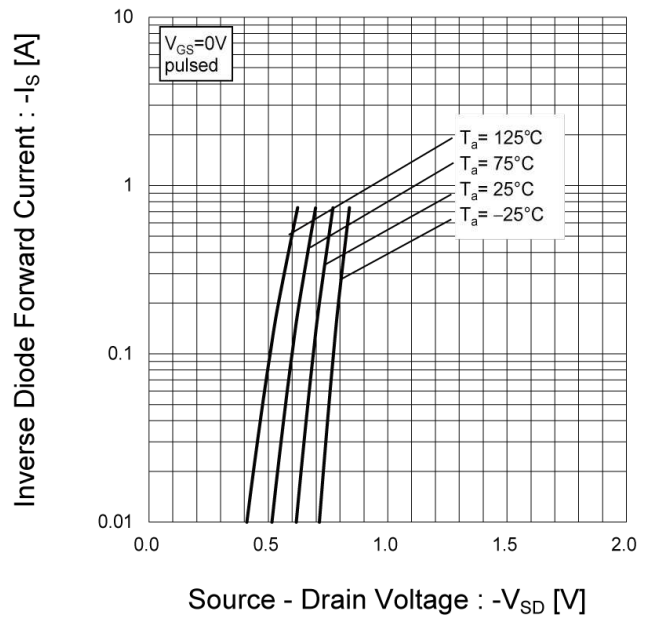
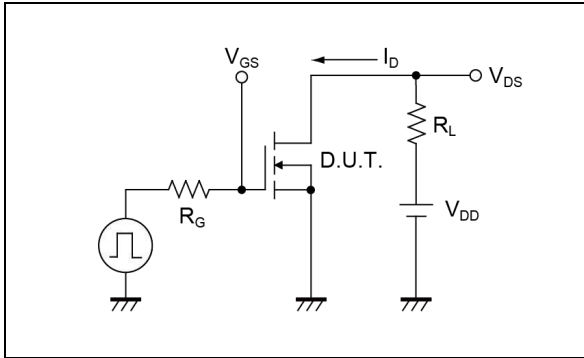


Fig.21 Source Current vs. Source Drain Voltage

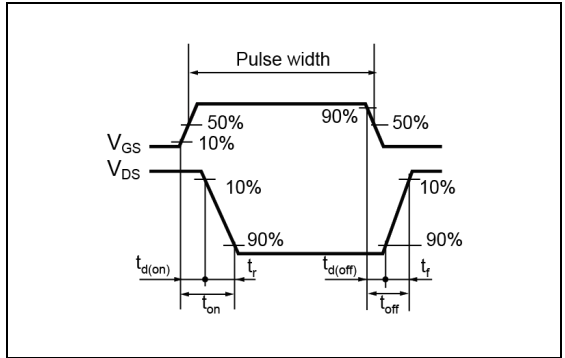


● Measurement circuits <Tr1>

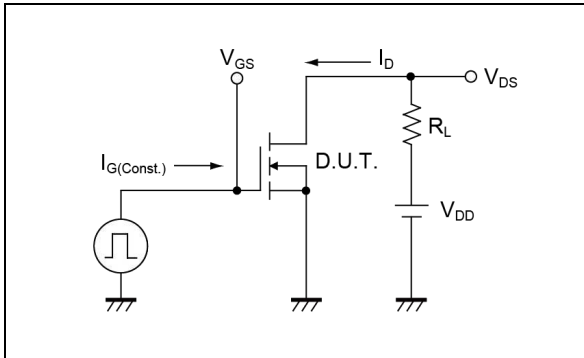
☒ 1-1 SWITCHING TIME MEASUREMENT CIRCUIT



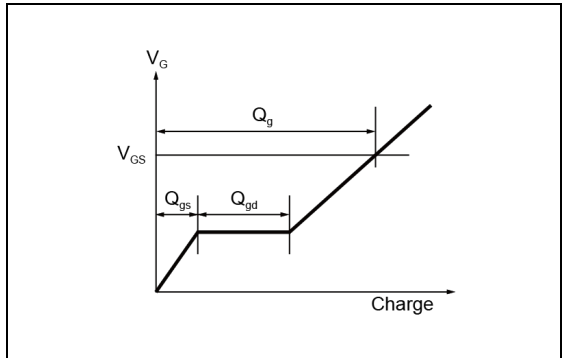
☒ 1-2 SWITCHING WAVEFORMS



☒ 2-1 GATE CHARGE MEASUREMENT CIRCUIT

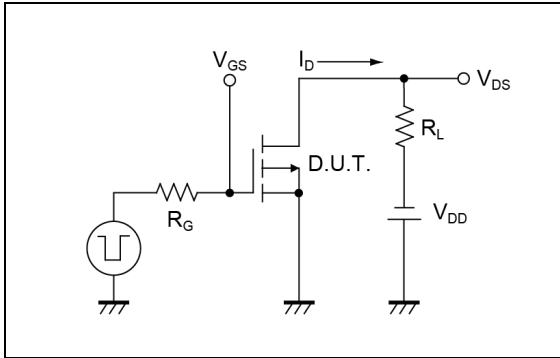


☒ 2-2 GATE CHARGE WAVEFORM

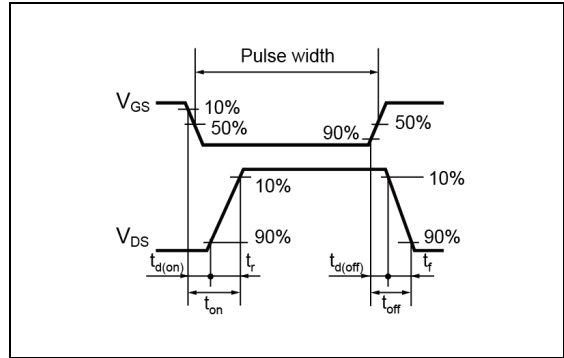


● Measurement circuits <Tr2>

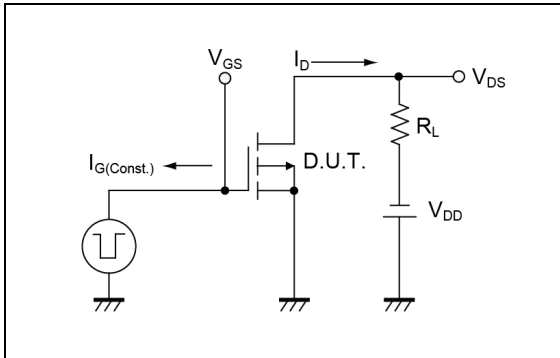
☒ 3-1 SWITCHING TIME MEASUREMENT CIRCUIT



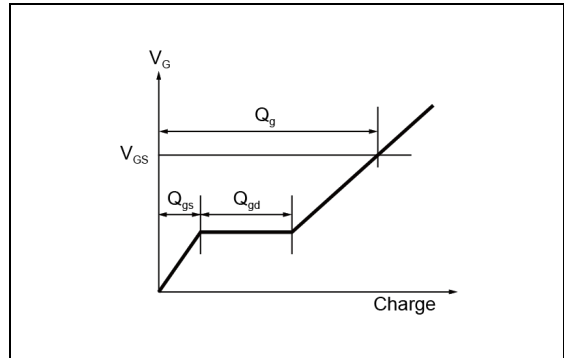
☒ 3-2 SWITCHING WAVEFORMS



☒ 4-1 GATE CHARGE MEASUREMENT CIRCUIT

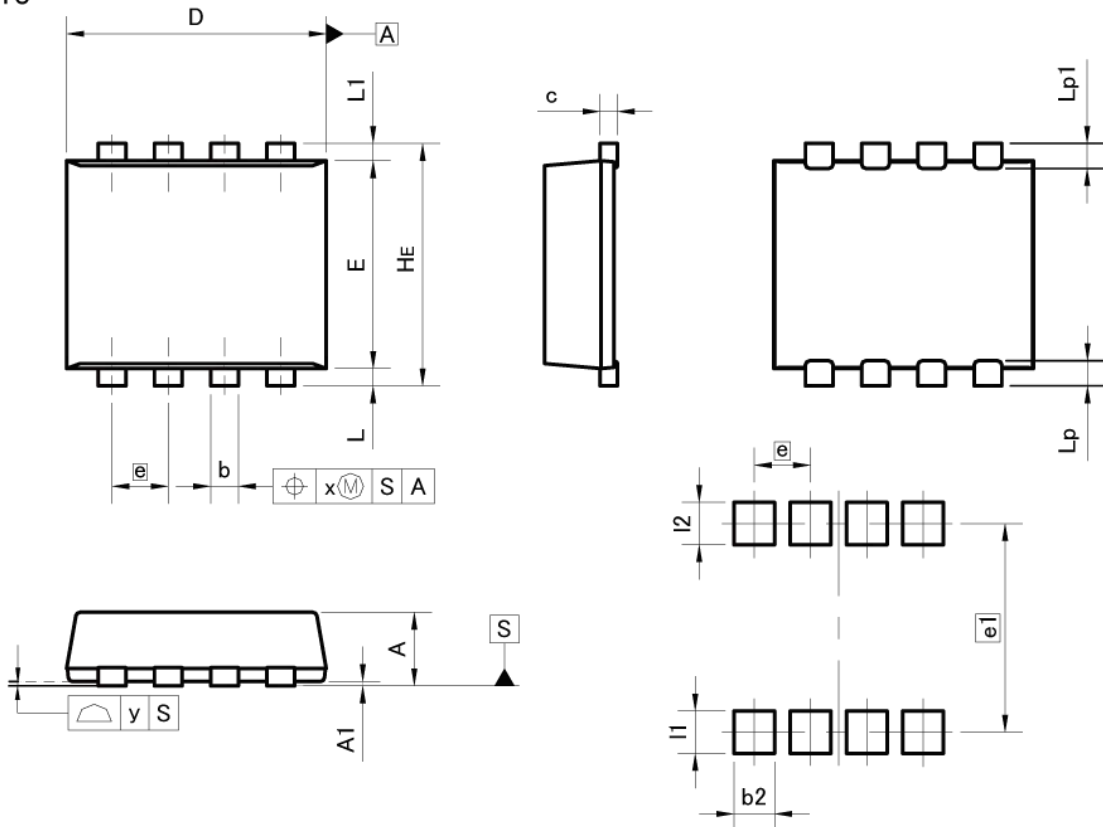


☒ 4-2 GATE CHARGE WAVEFORM



●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	
I1	-	0.49	-	0.019
I2	-	0.49	-	0.019

Dimension in mm/inches

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