

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

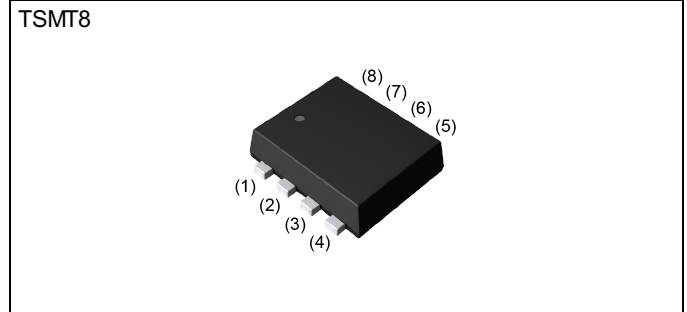
### ●Features

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

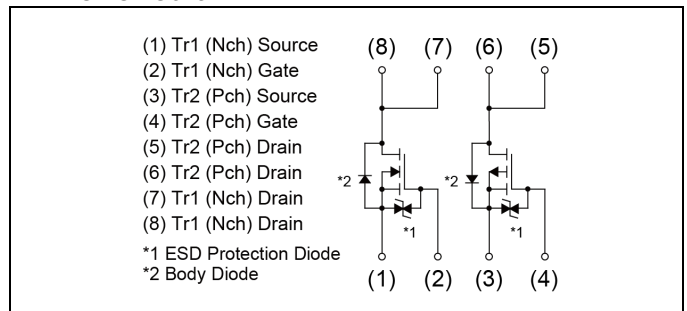
### ●Application

Switching

### ●Outline



### ●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

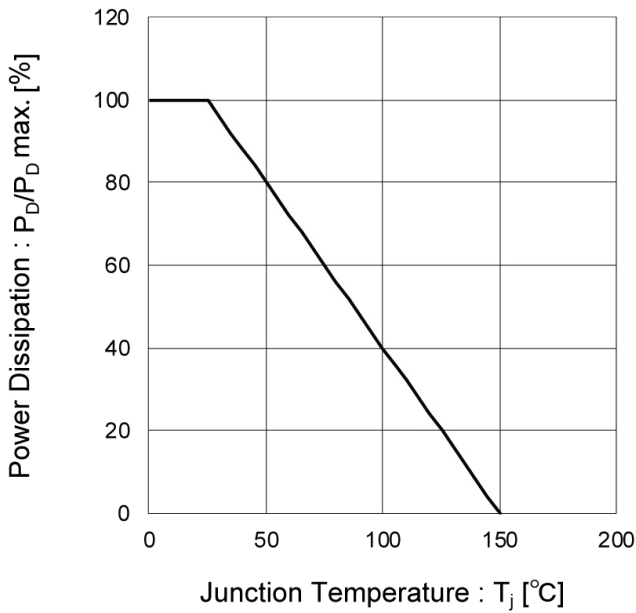


Fig.2 Maximum Safe Operating Area

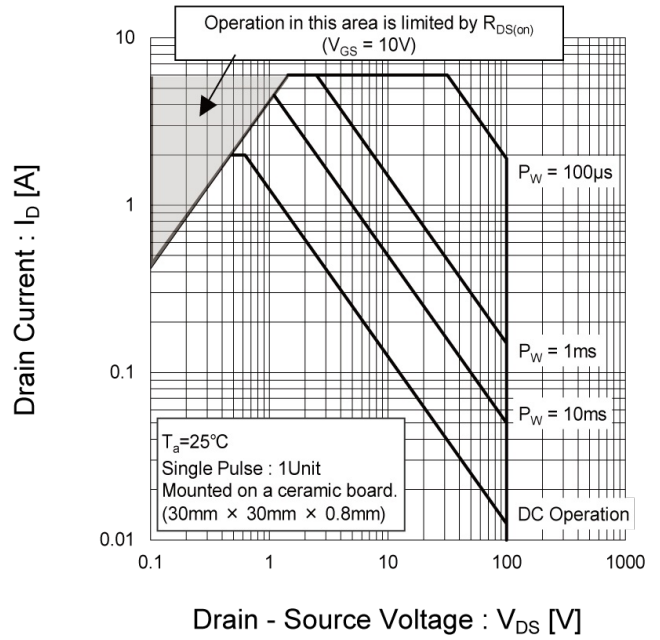


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

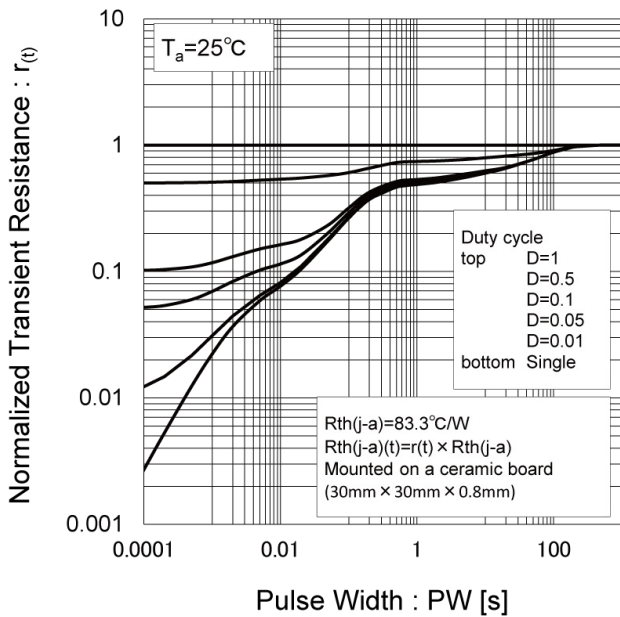
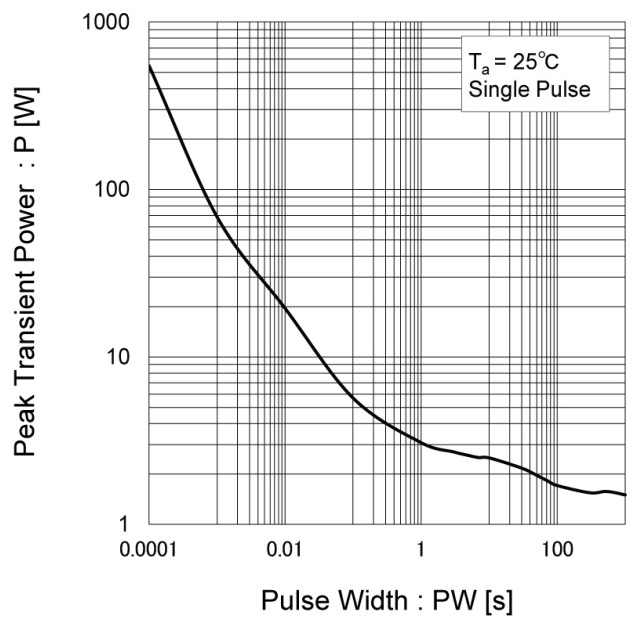


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

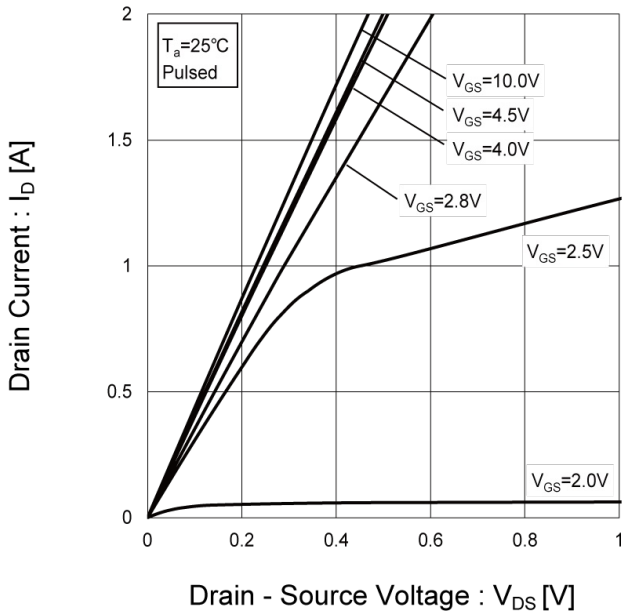


Fig.6 Typical Output Characteristics(II)

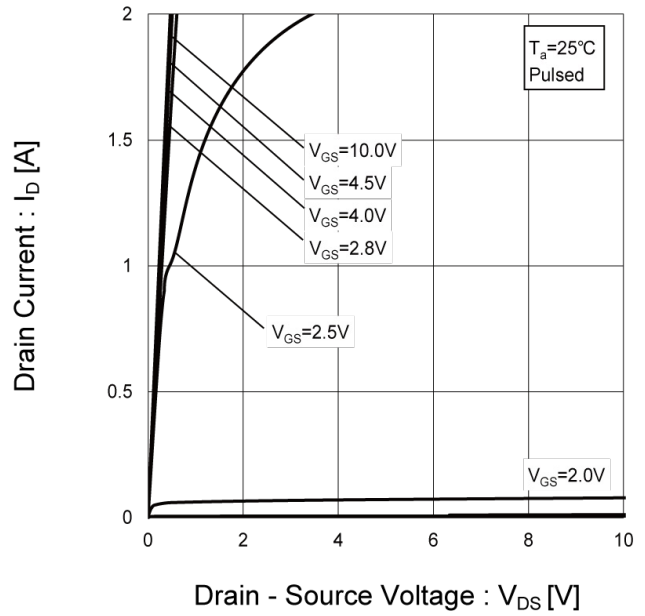


Fig.7 Breakdown Voltage vs. Junction Temperature

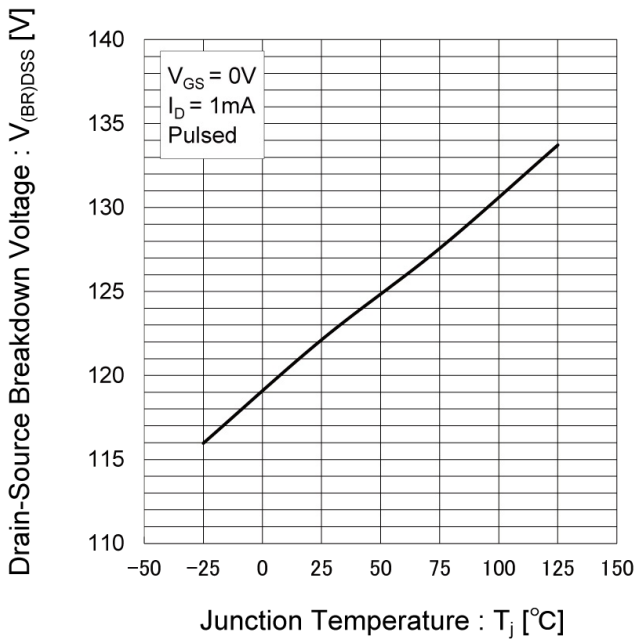
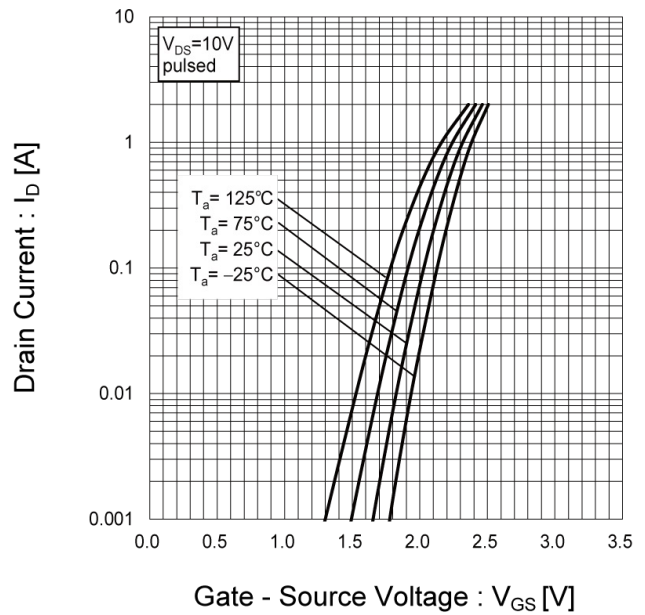


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves <Tr1>

Fig.9 Gate Threshold Voltage vs. Junction Temperature

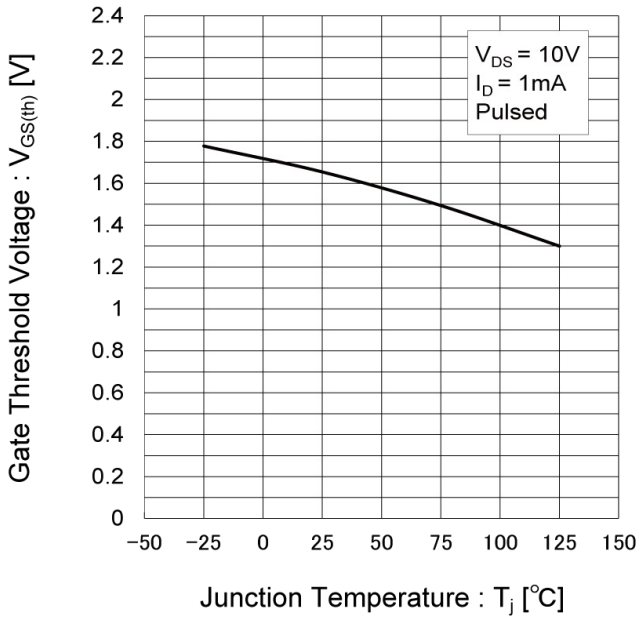


Fig.10 Forward Transfer Admittance vs. Drain Current

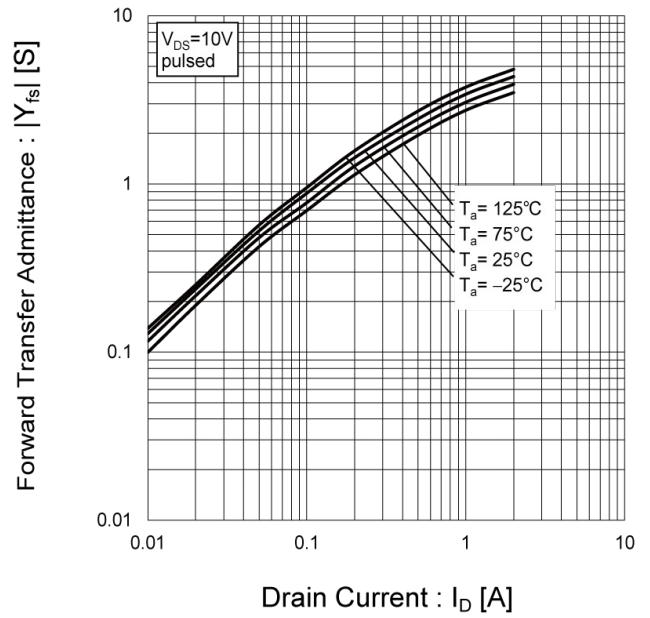


Fig.11 Drain Current Derating Curve

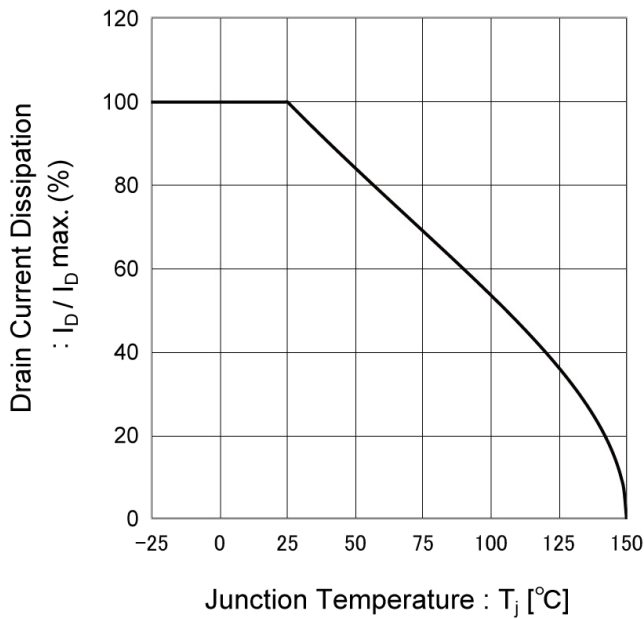
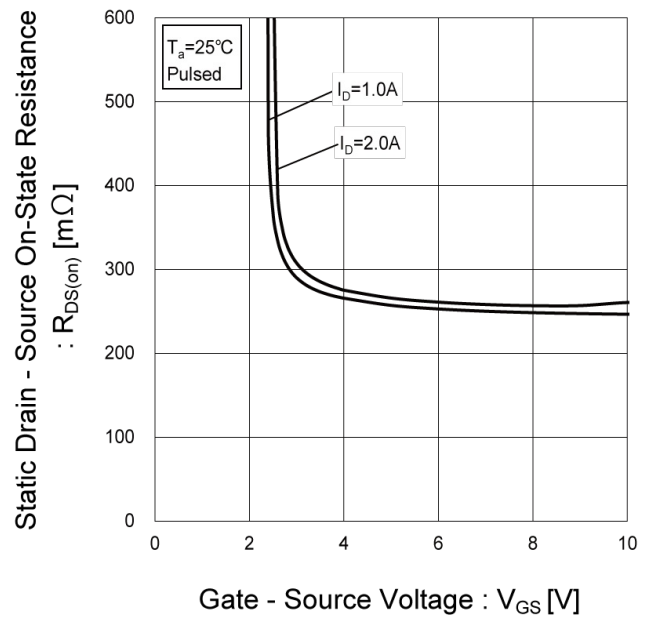


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves <Tr1>

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

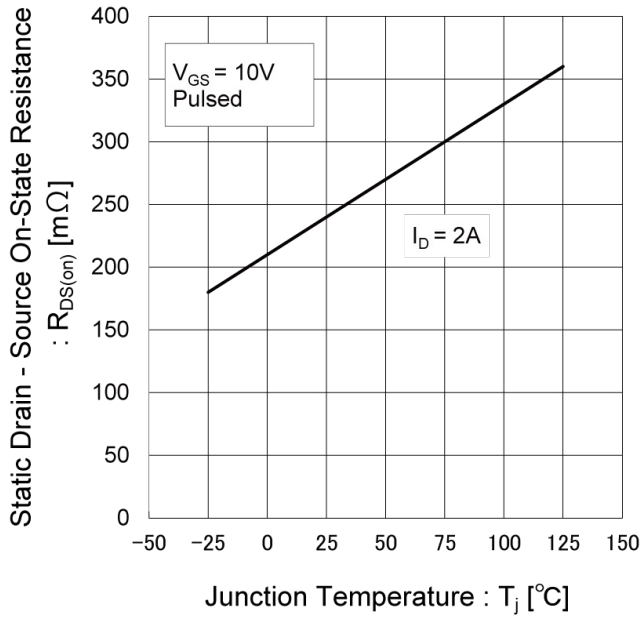
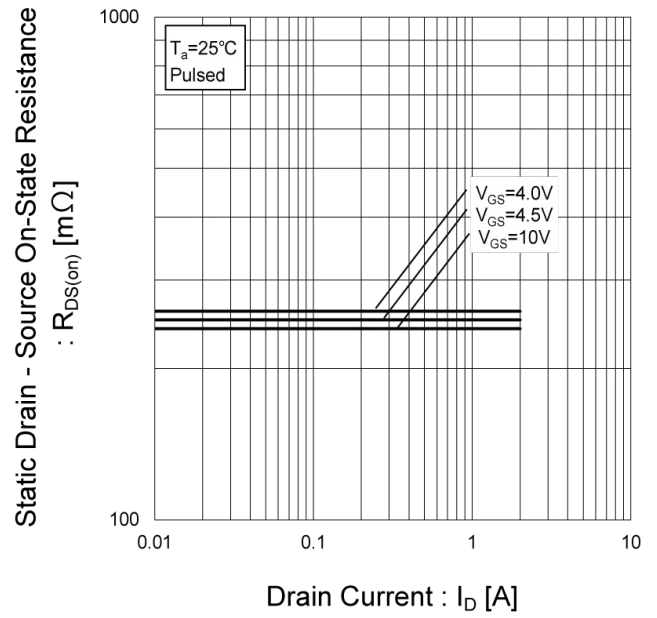


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (I)





● Electrical characteristic curves <Tr1>

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

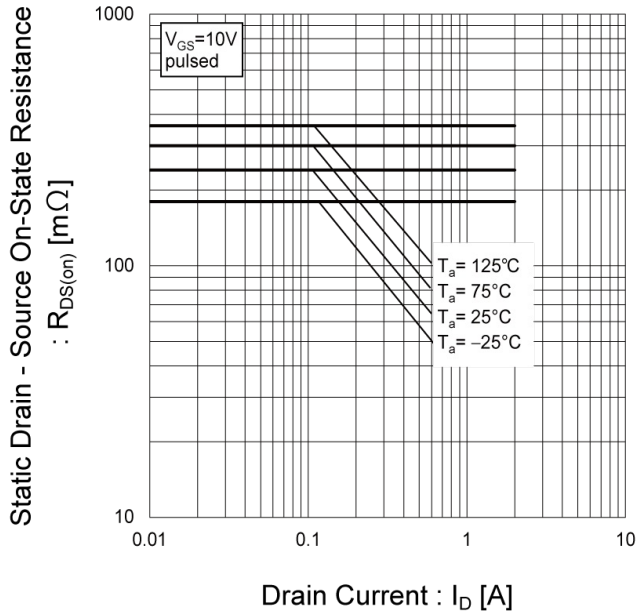


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

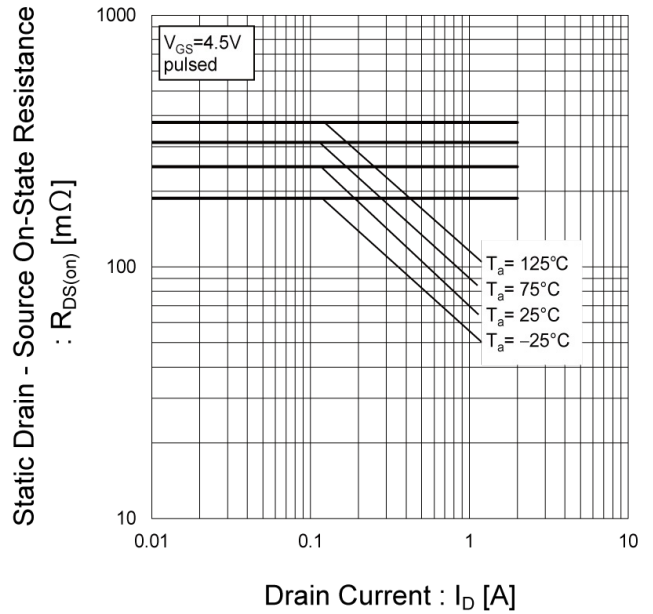
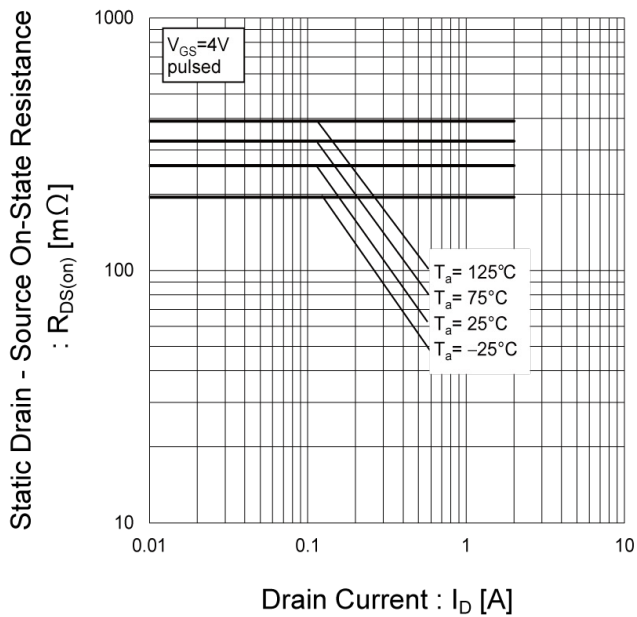


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current (IV)



●Electrical characteristic curves <Tr1>

Fig.18 Typical Capacitance vs. Drain - Source Voltage

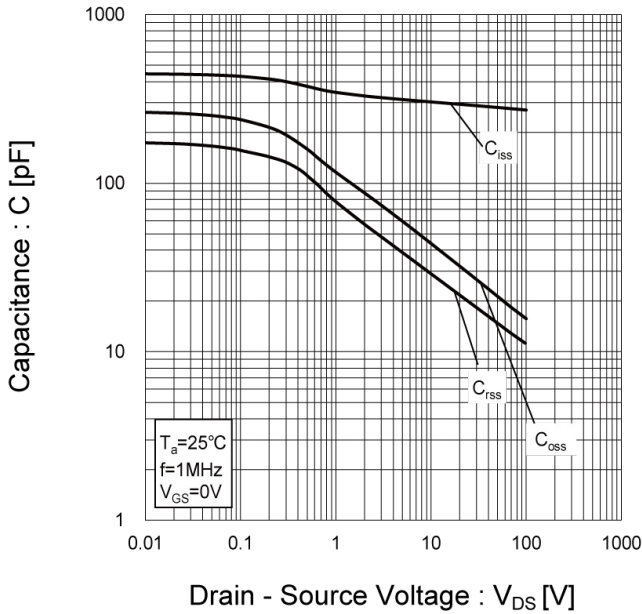


Fig.19 Switching Characteristics

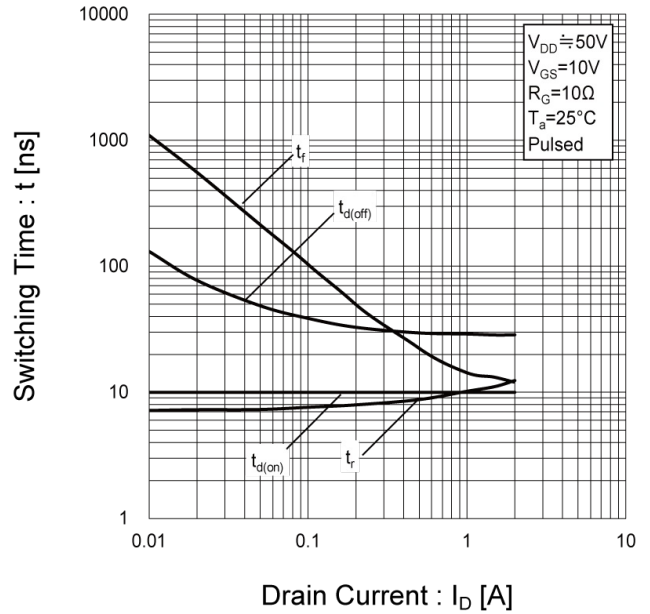


Fig.20 Dynamic Input Characteristics

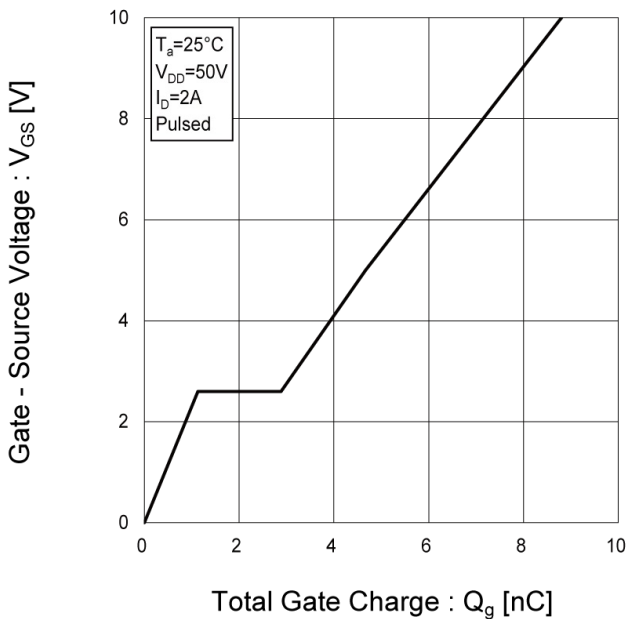
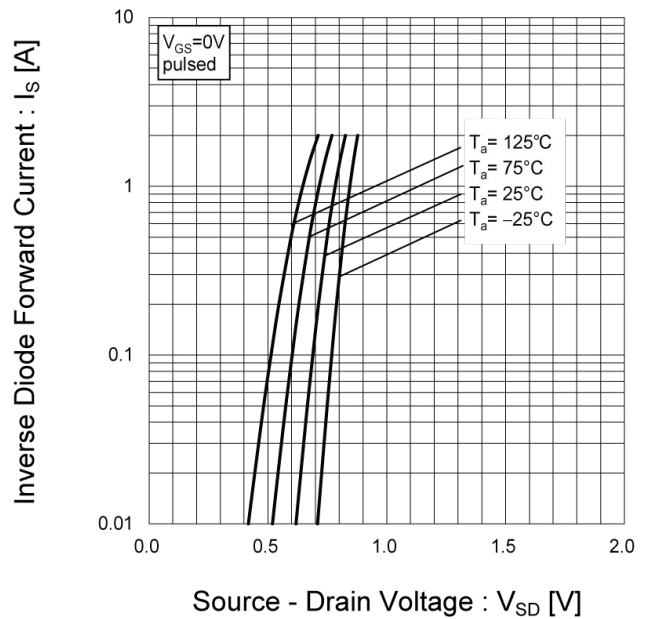


Fig.21 Source Current vs. Source Drain Voltage



●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

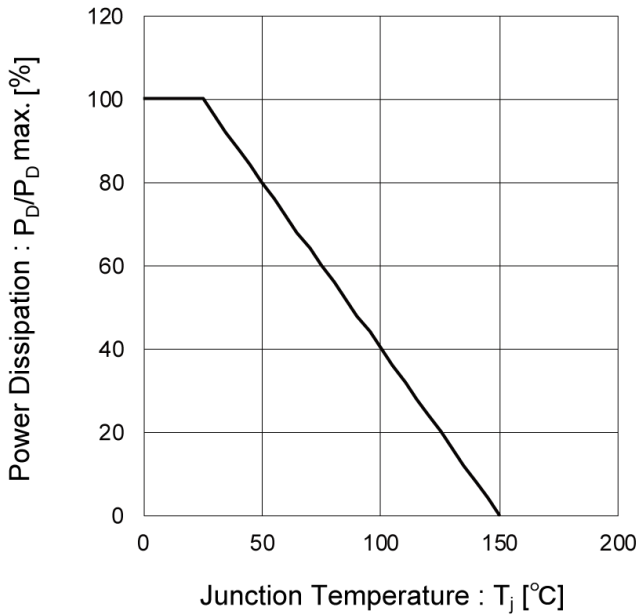


Fig.2 Maximum Safe Operating Area

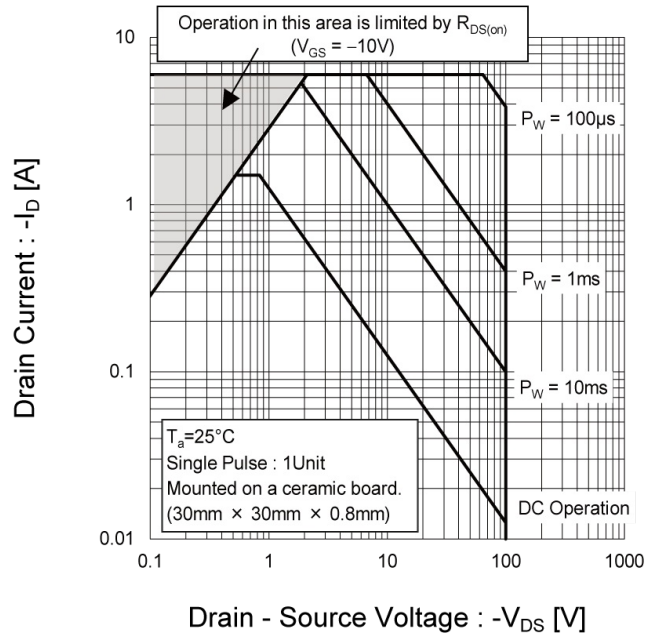


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

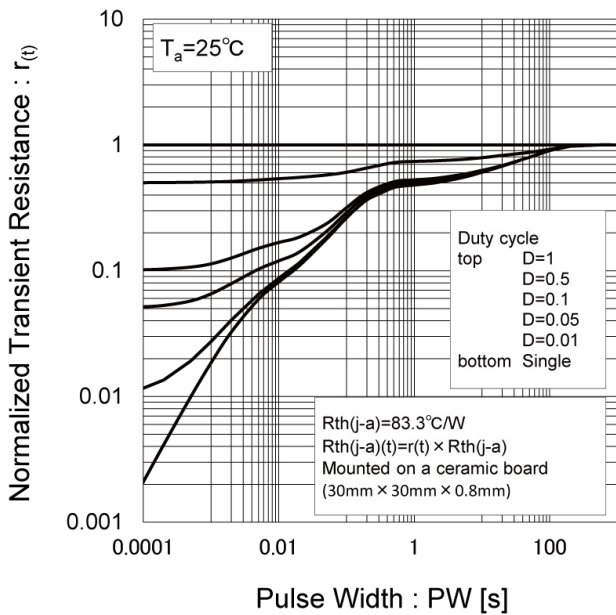
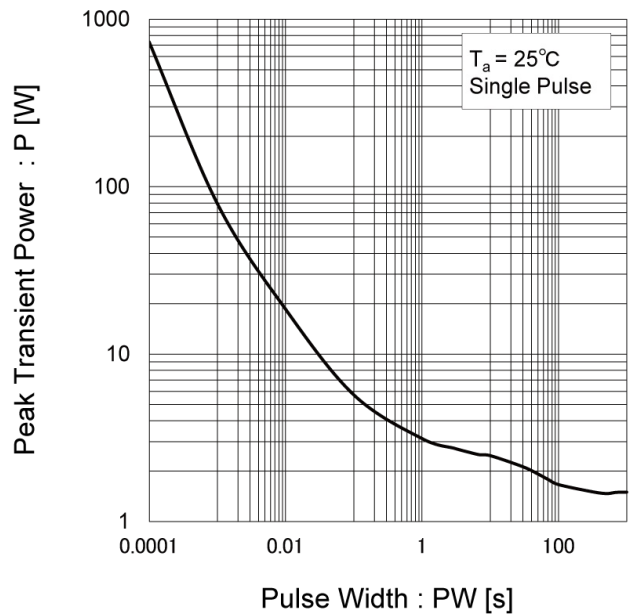


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

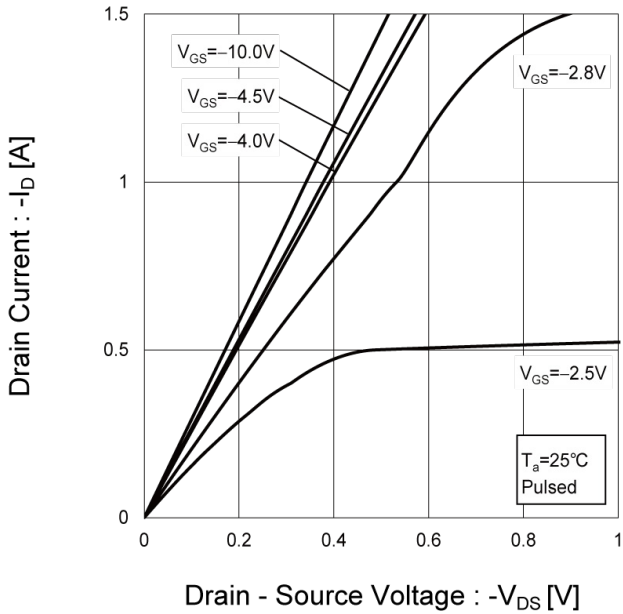


Fig.6 Typical Output Characteristics(II)

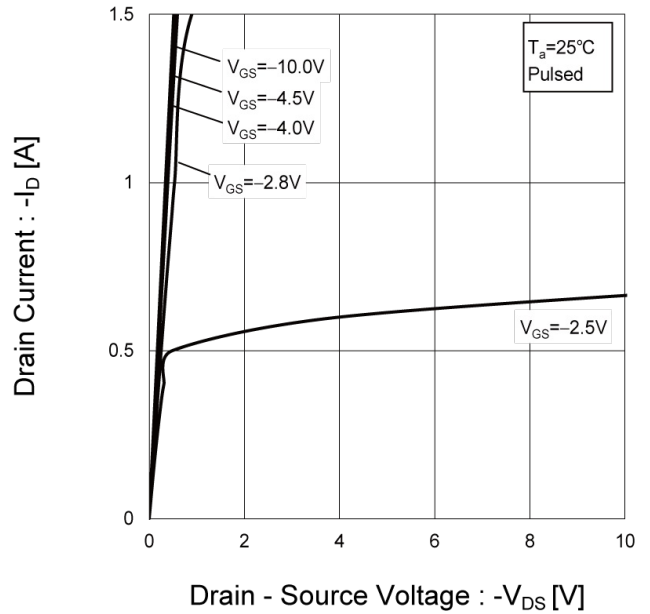


Fig.7 Breakdown Voltage vs. Junction Temperature

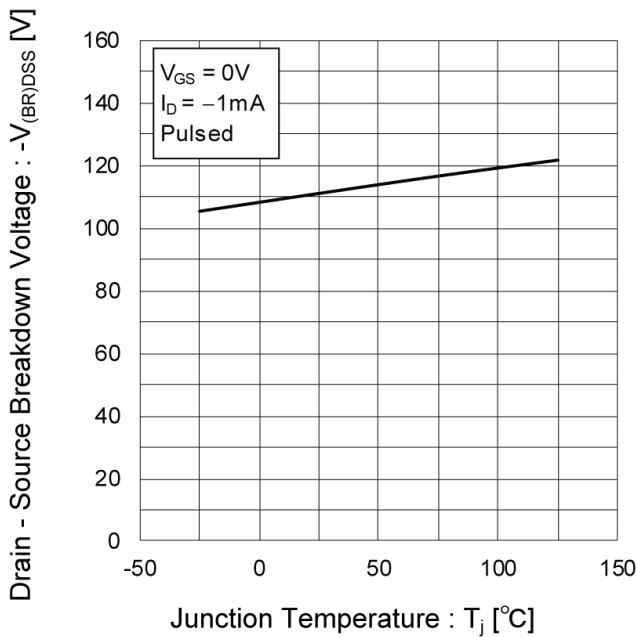
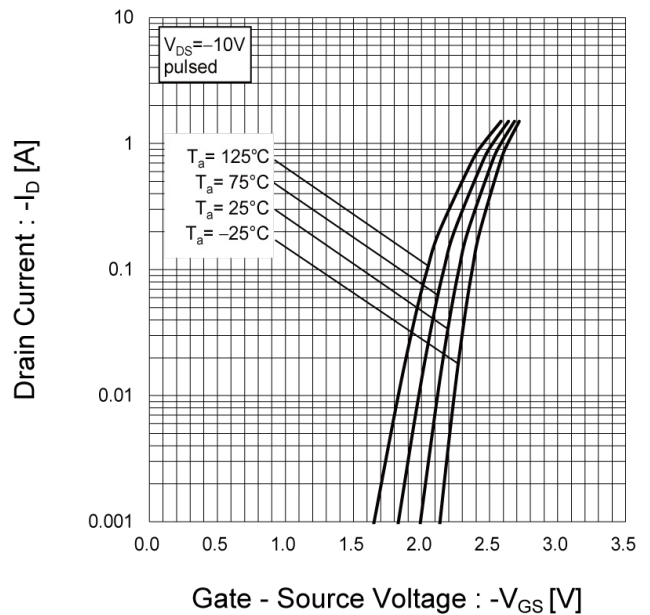


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves <Tr2>

Fig.9 Gate Threshold Voltage vs. Junction Temperature

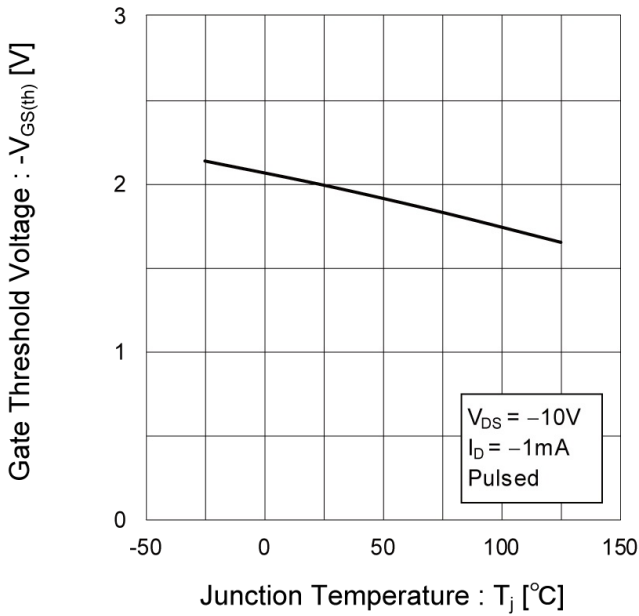


Fig.10 Forward Transfer Admittance vs. Drain Current

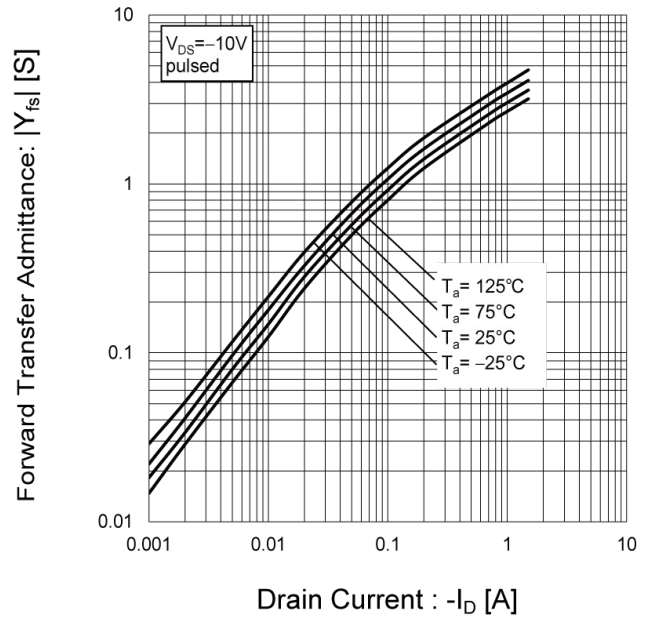


Fig.11 Drain Current Derating Curve

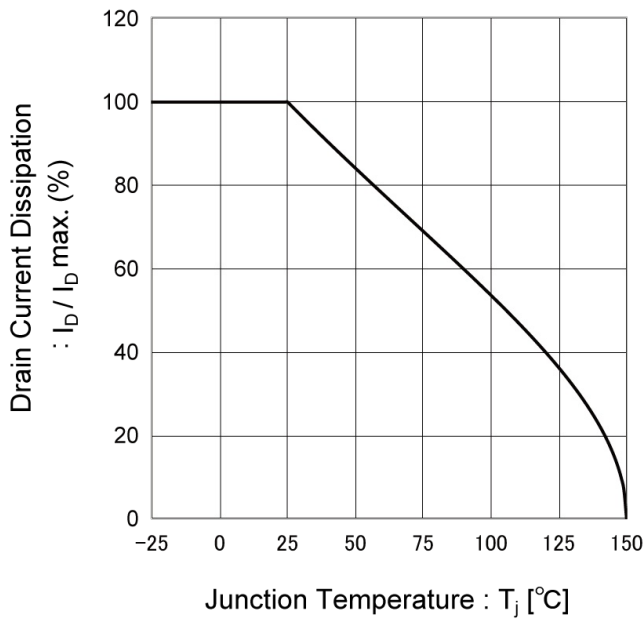
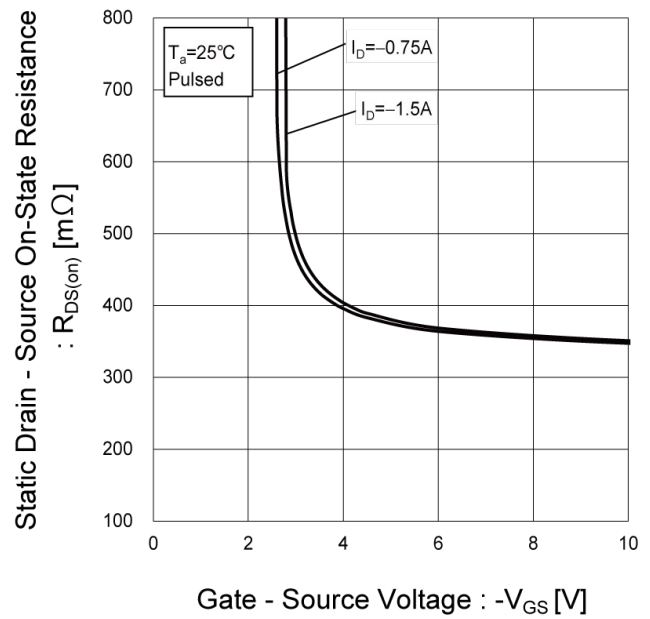


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves <Tr2>

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

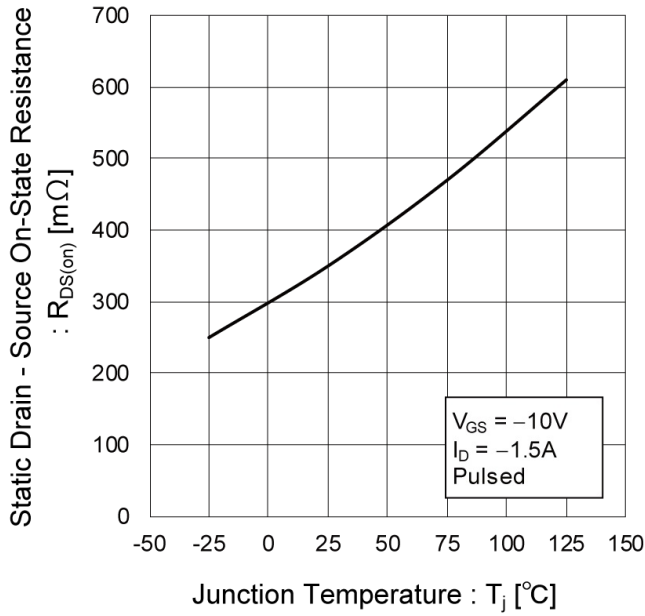
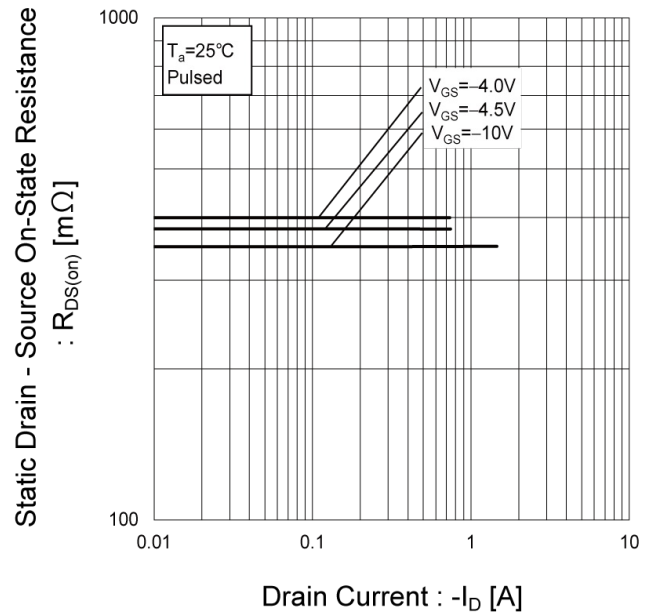


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (I)



● Electrical characteristic curves <Tr2>

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

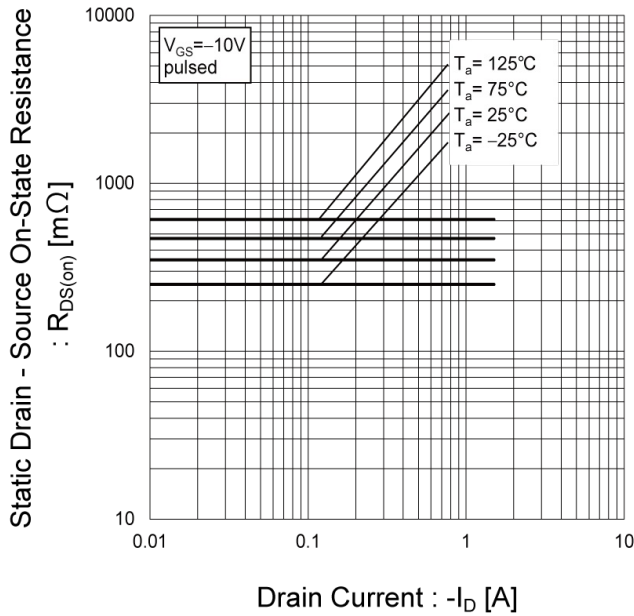


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

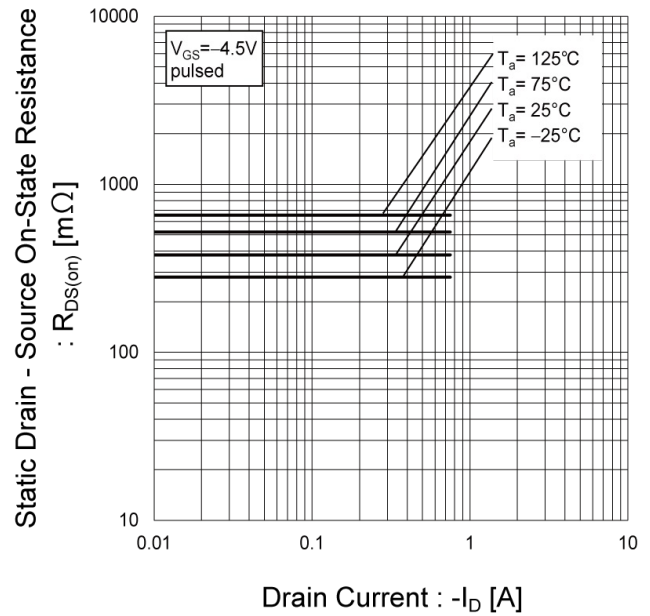
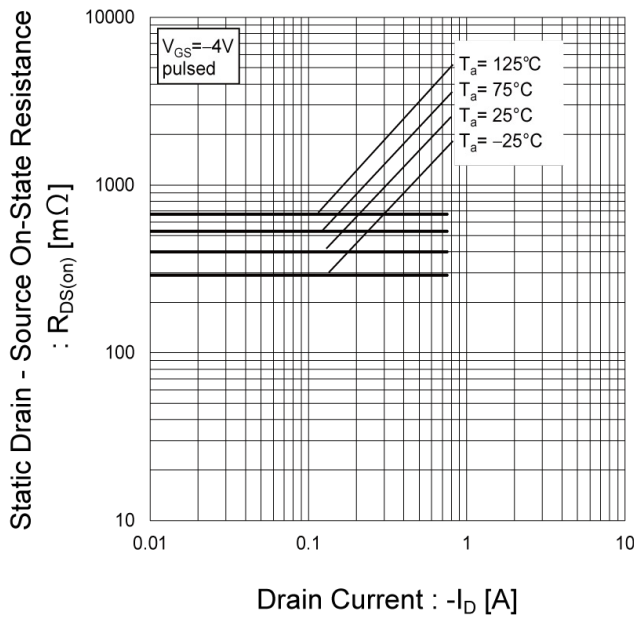


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current (IV)



●Electrical characteristic curves <Tr2>

Fig.18 Typical Capacitance vs. Drain - Source Voltage

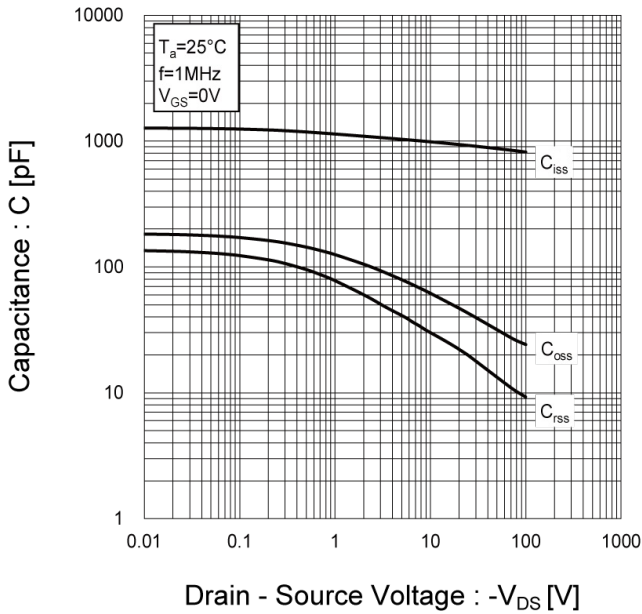


Fig.19 Switching Characteristics

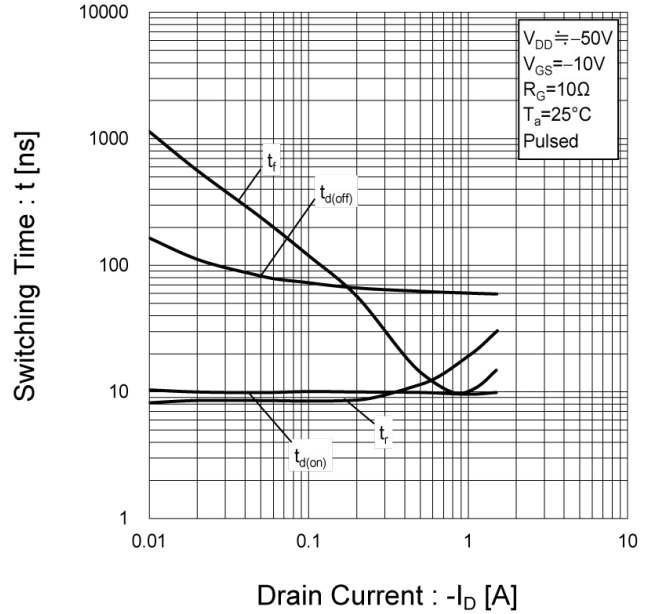


Fig.20 Dynamic Input Characteristics

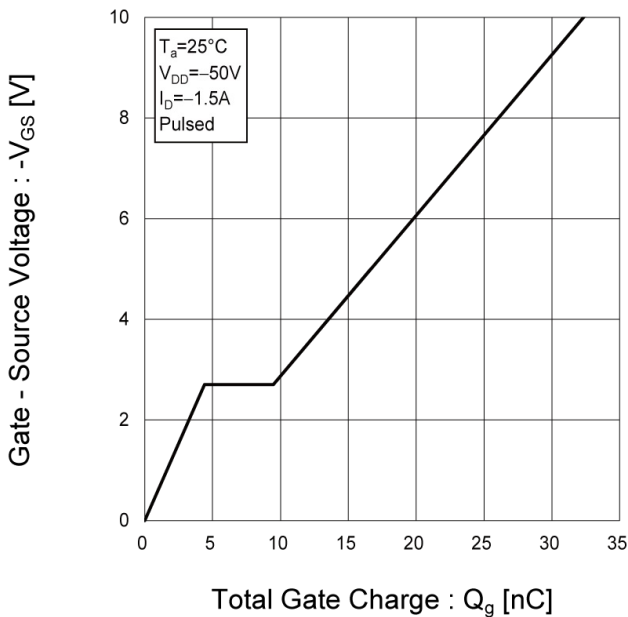
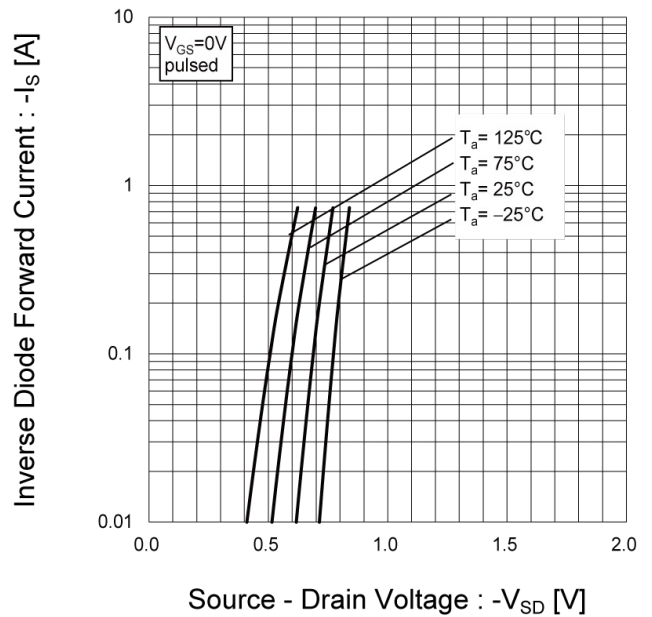


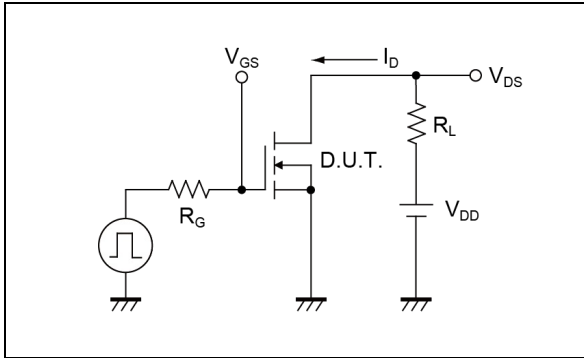
Fig.21 Source Current vs. Source Drain Voltage



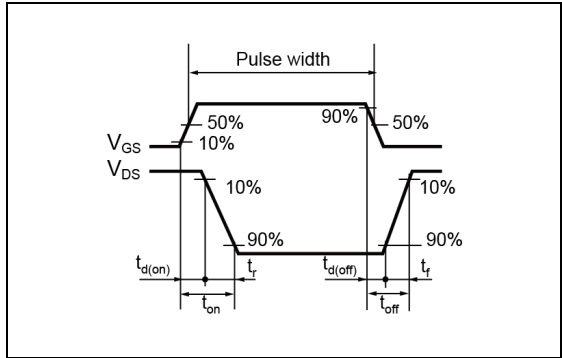


● Measurement circuits <Tr1>

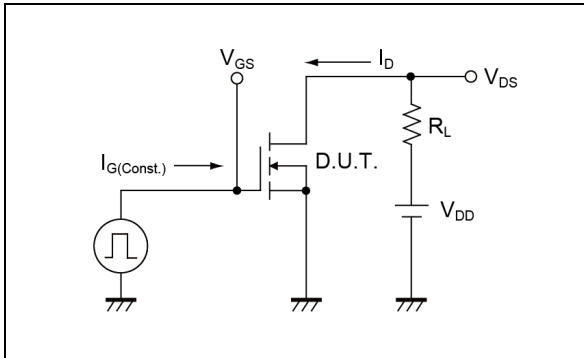
☒ 1-1 SWITCHING TIME MEASUREMENT CIRCUIT



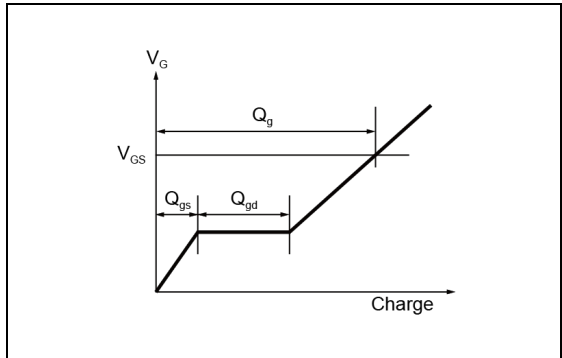
☒ 1-2 SWITCHING WAVEFORMS



☒ 2-1 GATE CHARGE MEASUREMENT CIRCUIT

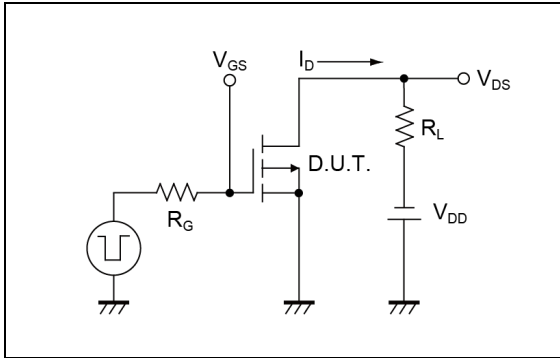


☒ 2-2 GATE CHARGE WAVEFORM

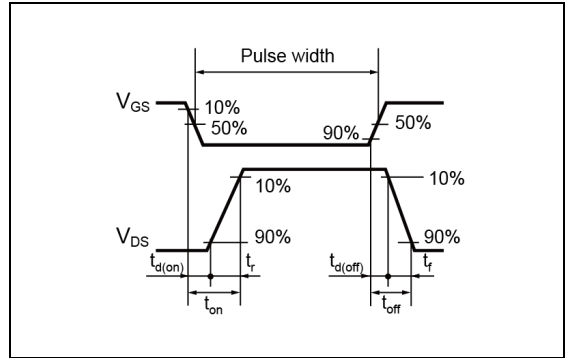


● Measurement circuits <Tr2>

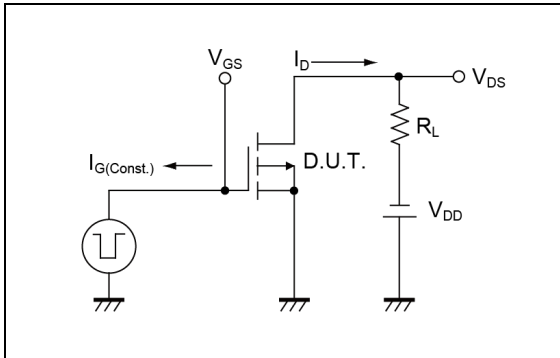
☒ 3-1 SWITCHING TIME MEASUREMENT CIRCUIT



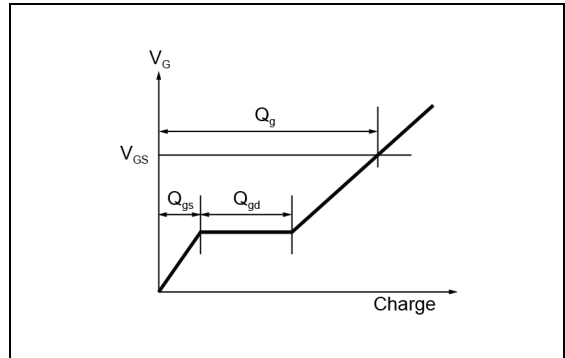
☒ 3-2 SWITCHING WAVEFORMS



☒ 4-1 GATE CHARGE MEASUREMENT CIRCUIT

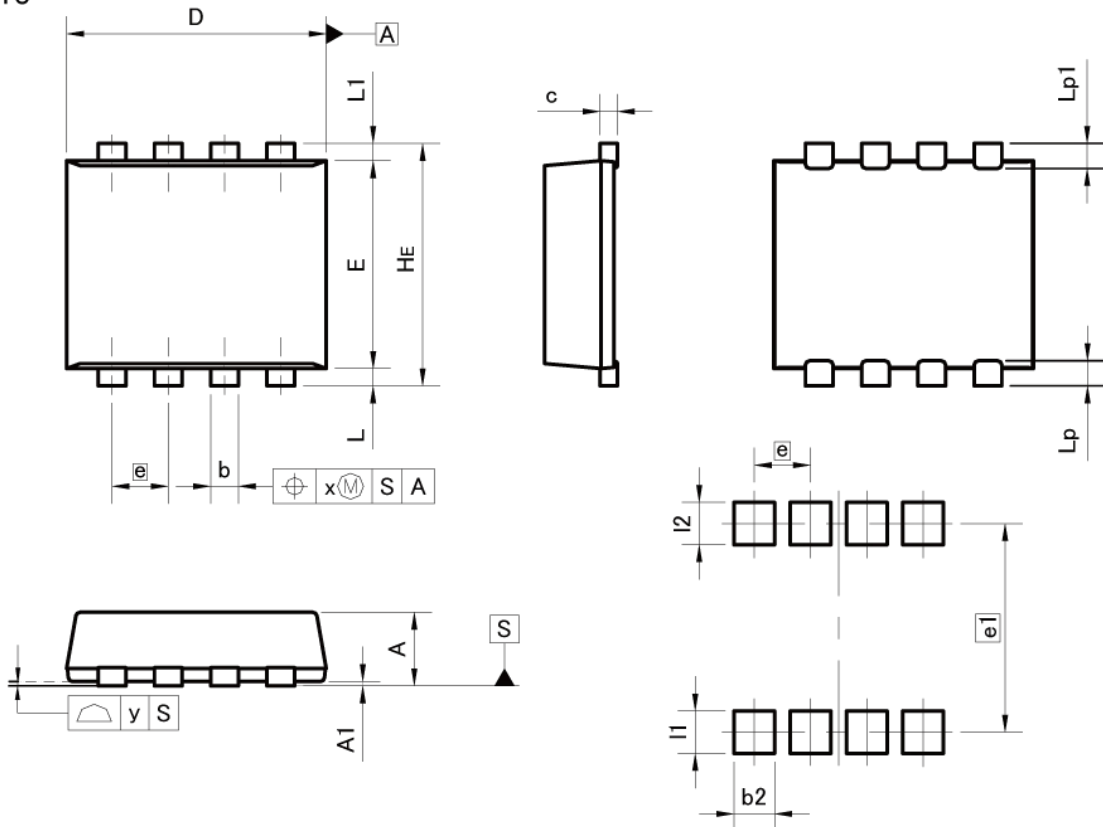


☒ 4-2 GATE CHARGE WAVEFORM



●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

## Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 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.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products are intended for use in general electronic equipment (i.e. AV/OA devices, communication, consumer systems, gaming/entertainment sets) as well as the applications indicated in this document.
- 7) The Products specified in this document are not designed to be radiation tolerant.
- 8) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 9) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 10) ROHM shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
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