



V_{DSS}	30V
$R_{DS(on)}$ (Max.)	10.5m Ω
I_D	10A
P_D	1.5W

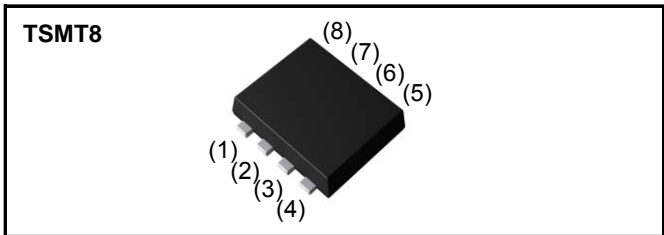
●Features

- 1) Low on - resistance.
- 2) Built-in G-S Protection Diode.
- 3) Small Surface Mount Package (TSMT8).
- 4) Pb-free lead plating ; RoHS compliant

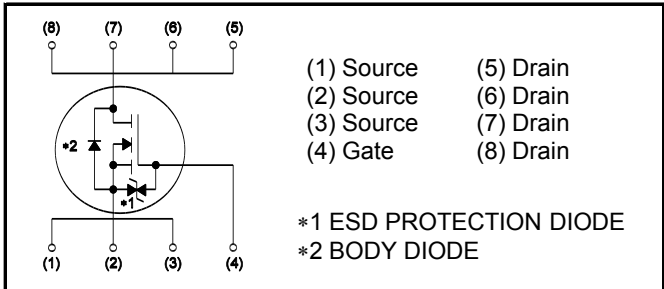
●Application

DC/DC converters

●Outline



●Inner circuit



●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	180
	Tape width (mm)	8
	Basic ordering unit (pcs)	3,000
	Taping code	TR
	Marking	XS

●Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	30	V
Continuous drain current	I_D *1	± 10	A
Pulsed drain current	$I_{D,pulse}$ *2	± 36	A
Gate - Source voltage	V_{GSS}	± 20	V
Power dissipation	P_D *3	1.5	W
	P_D *4	0.55	W
Junction temperature	T_j	150	$^\circ\text{C}$
Range of storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJA}^{*3}	-	-	83.3	°C/W
Thermal resistance, junction - ambient	R_{thJA}^{*4}	-	-	227	°C/W

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

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°C	-	35	-	mV/°C
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	μA
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	±10	μA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	1.0	-	2.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{(GS)th}}{\Delta T_j}$	$I_D = 1mA$ referenced to 25°C	-	-3.7	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS}=10V, I_D=10A$	-	7.5	10.5	mΩ
		$V_{GS}=4.5V, I_D=10A$	-	9.5	13.3	
		$V_{GS}=4.0V, I_D=10A$	-	10.0	14.0	
		$V_{GS}=10V, I_D=10A, T_j=125^\circ\text{C}$	-	12	17	
Gate input resistance	R_G	$f = 1MHz, \text{open drain}$	-	2	-	Ω
Transconductance	g_{fs}^{*5}	$V_{DS} = 10V, I_D = 10A$	4.9	15	-	S

*1 Limited only by maximum temperature allowed.

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

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

*4 Mounted on a FR4 (20×20×0.8mm)

*5 Pulsed

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C _{iss}	V _{GS} = 0V	-	1000	-	pF
Output capacitance	C _{oss}	V _{DS} = 10V	-	340	-	
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	170	-	
Turn - on delay time	t _{d(on)} ^{*5}	V _{DD} ≈ 15V, V _{GS} = 10V	-	12	-	ns
Rise time	t _r ^{*5}	I _D = 5A	-	33	-	
Turn - off delay time	t _{d(off)} ^{*5}	R _L = 3Ω	-	50	-	
Fall time	t _f ^{*5}	R _G = 10Ω	-	14	-	

●Gate Charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q _g ^{*5}	V _{DD} ≈ 15V, I _D = 10A V _{GS} = 5V	-	12.7	-	nC
		V _{DD} ≈ 15V, I _D = 9A V _{GS} = 10V	-	24	-	
Gate - Source charge	Q _{gs} ^{*5}	V _{DD} ≈ 15V, I _D = 10A	-	2.6	-	
Gate - Drain charge	Q _{gd} ^{*5}	V _{GS} = 5V	-	6.0	-	

●Body diode electrical characteristics (Source-Drain)(T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I _s ^{*1}	T _a = 25°C	-	-	1.25	A
Forward voltage	V _{SD} ^{*5}	V _{GS} = 0V, I _s = 10A	-	-	1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

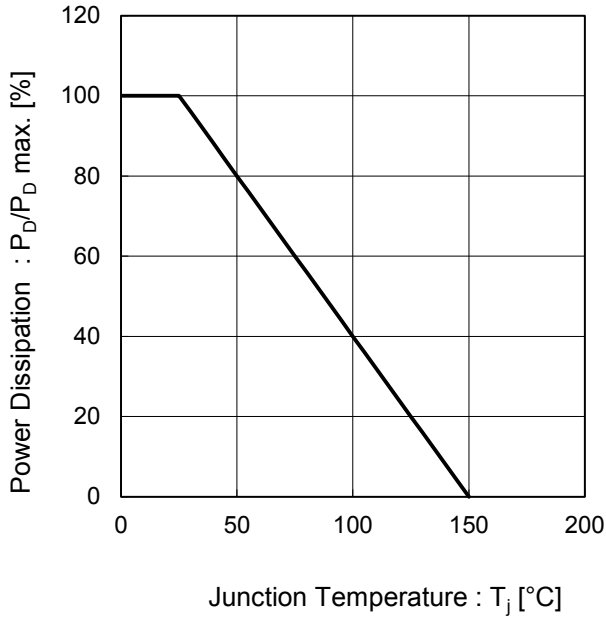


Fig.2 Maximum Safe Operating Area

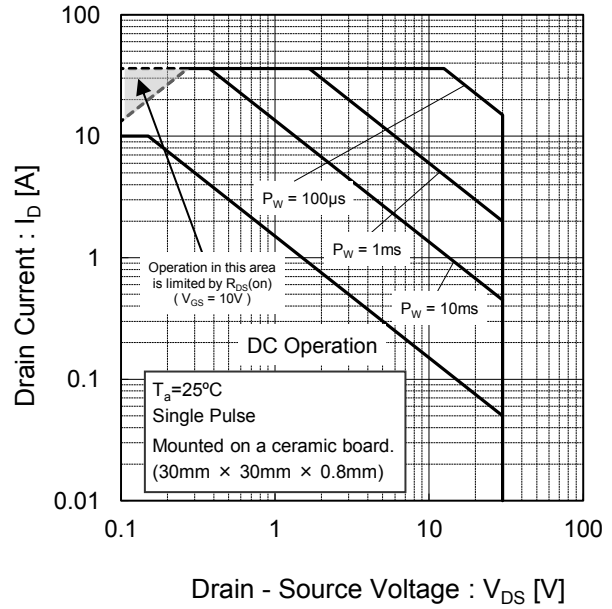


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

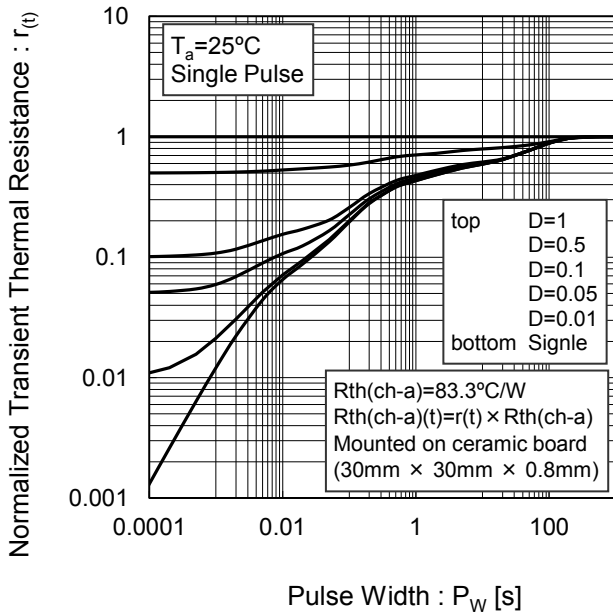
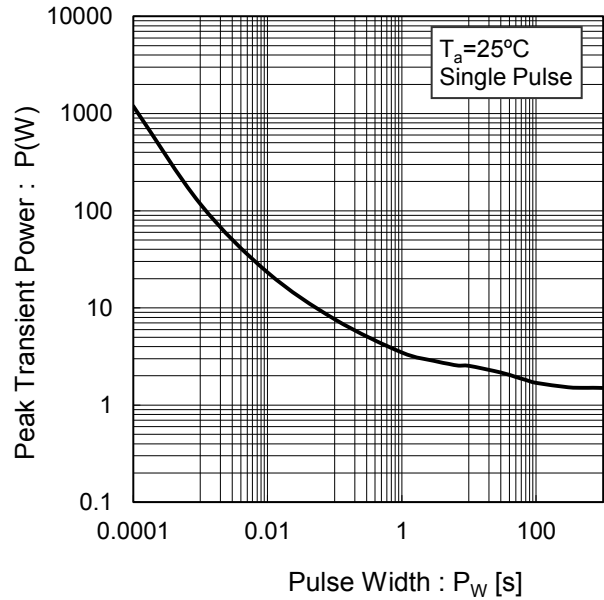


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

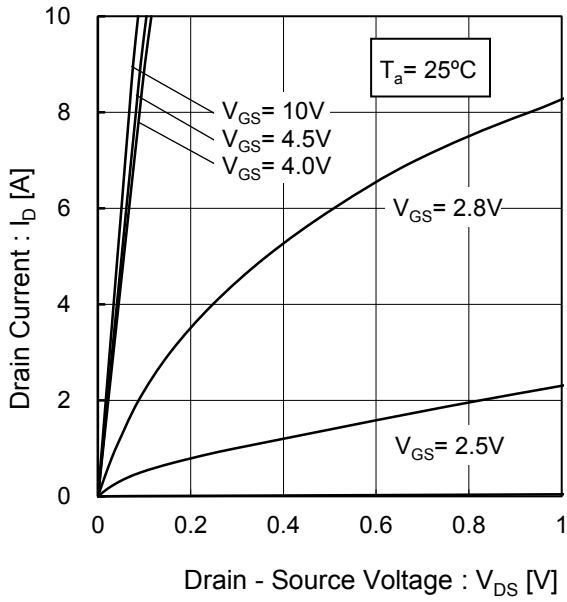
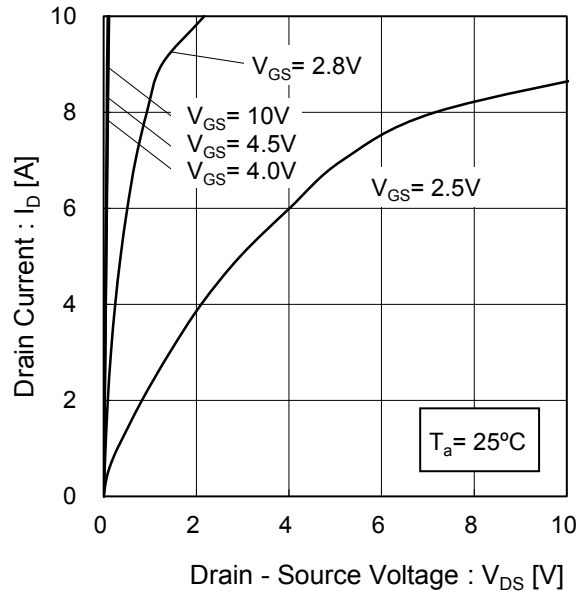


Fig.6 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.7 Breakdown Voltage vs. Junction Temperature

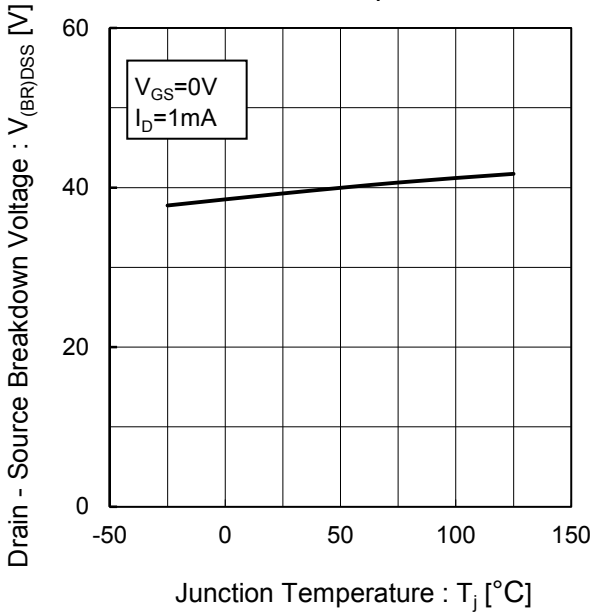


Fig.8 Typical Transfer Characteristics

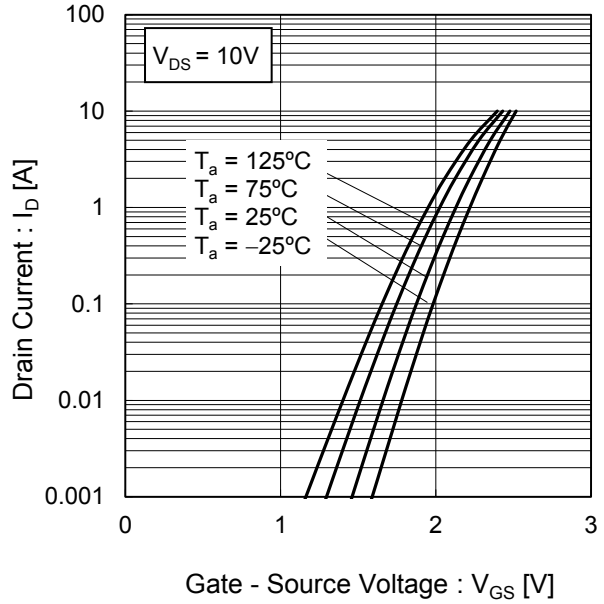


Fig.9 Gate Threshold Voltage vs. Junction Temperature

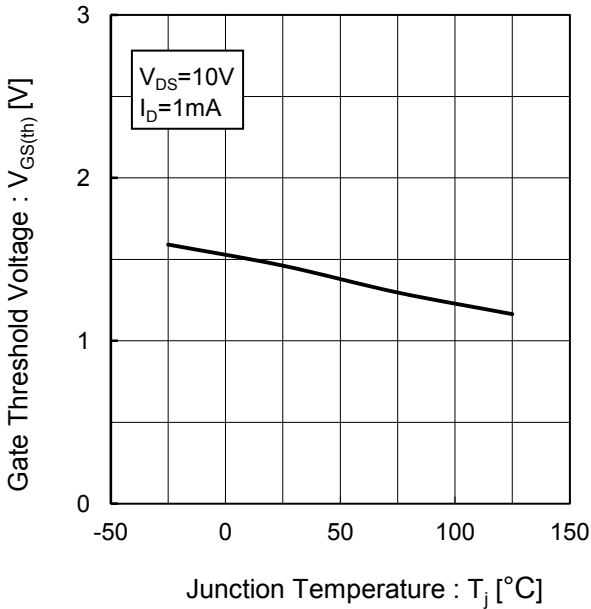
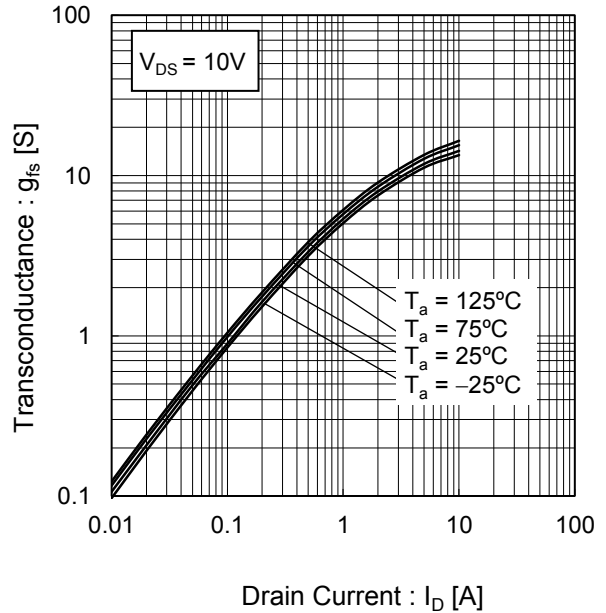


Fig.10 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.11 Drain Current Derating Curve

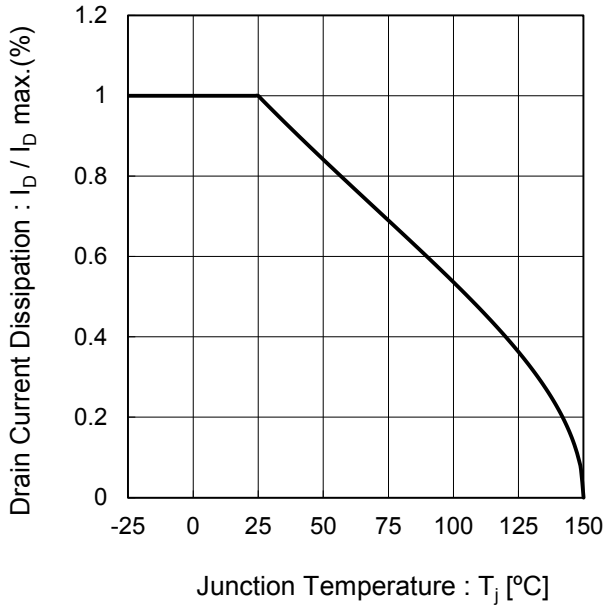


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

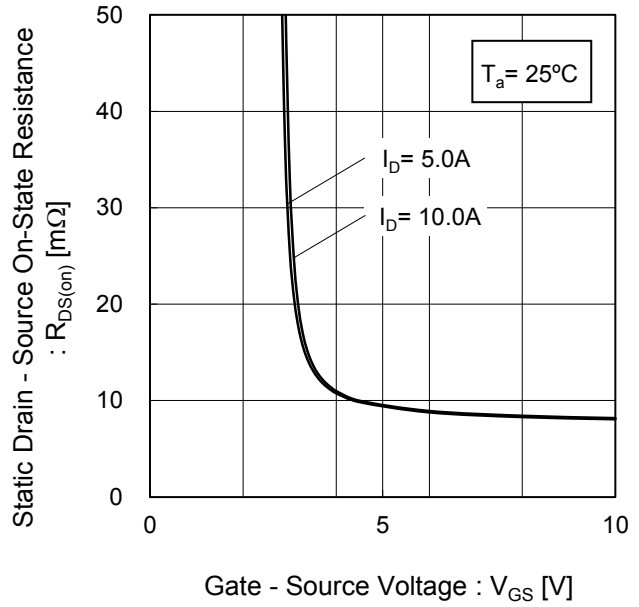


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

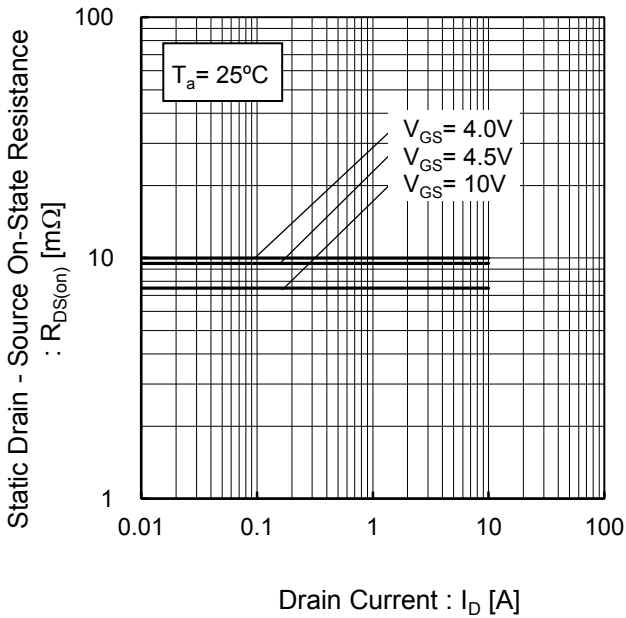
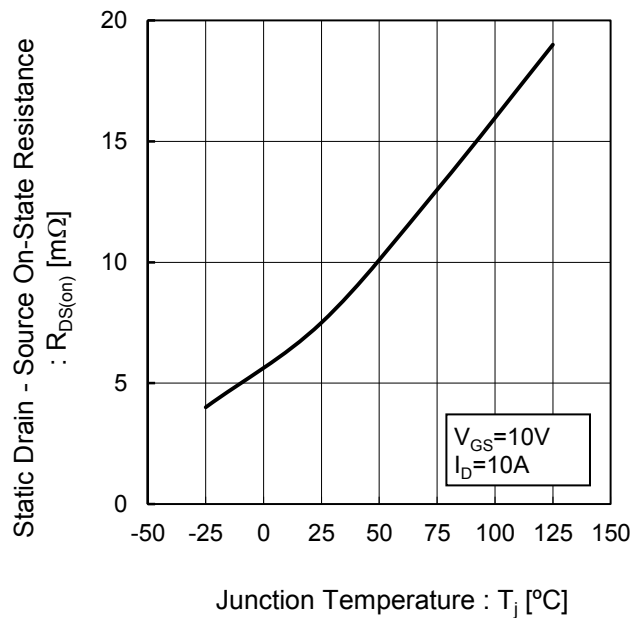


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

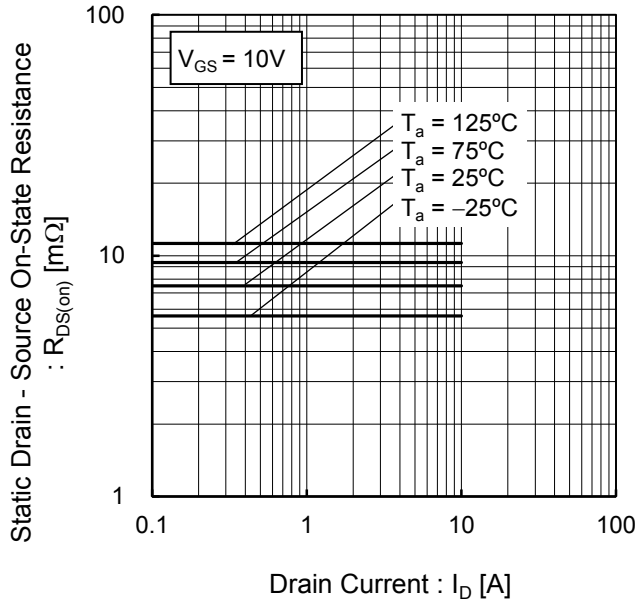


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

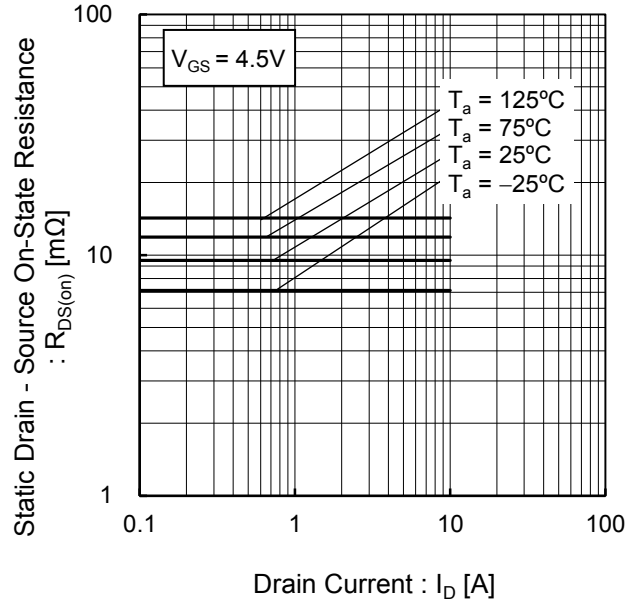
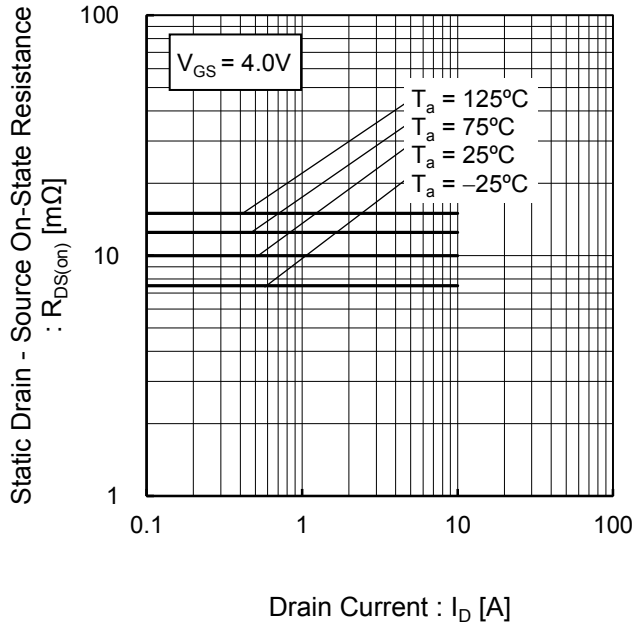


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)



●Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

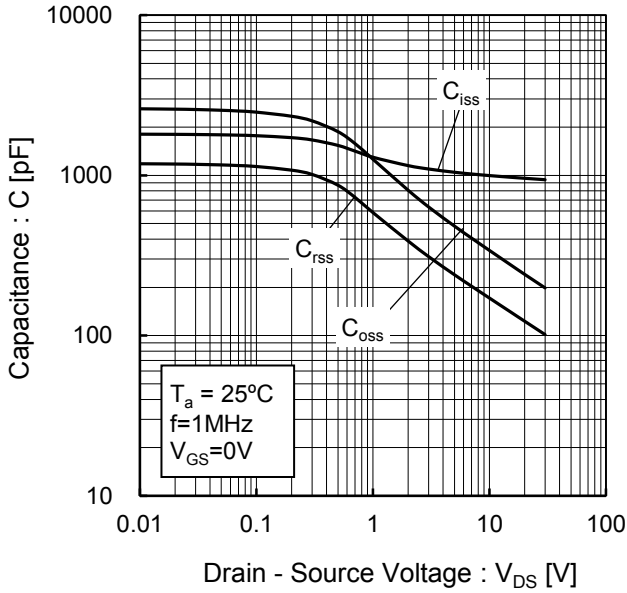


Fig.19 Switching Characteristics

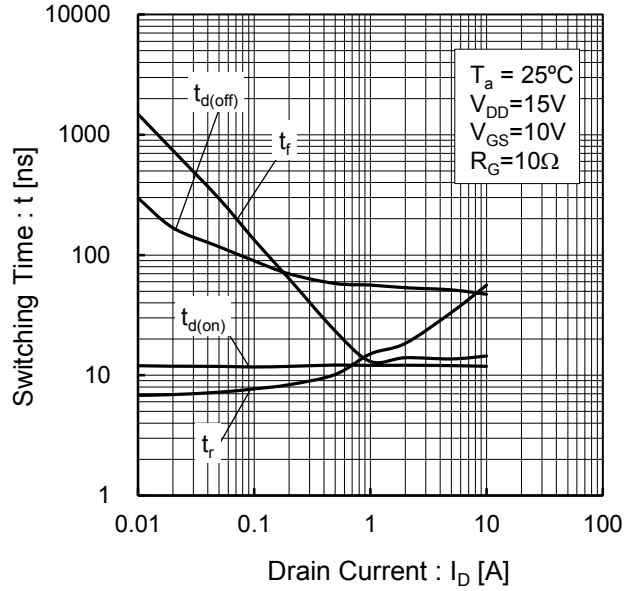


Fig.20 Dynamic Input Characteristics

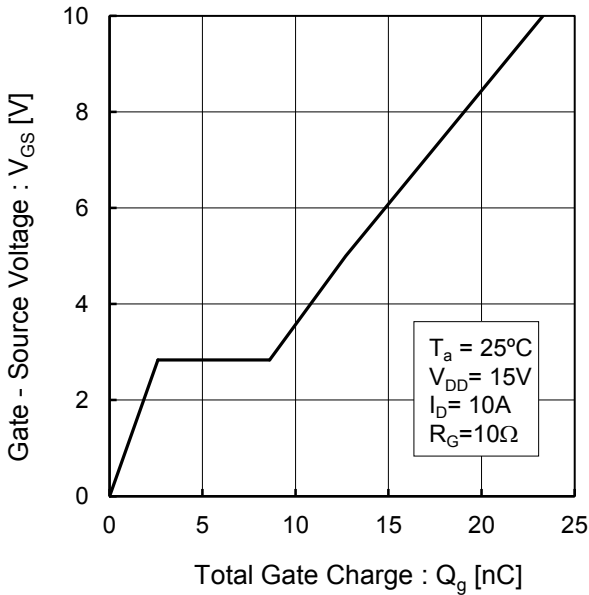
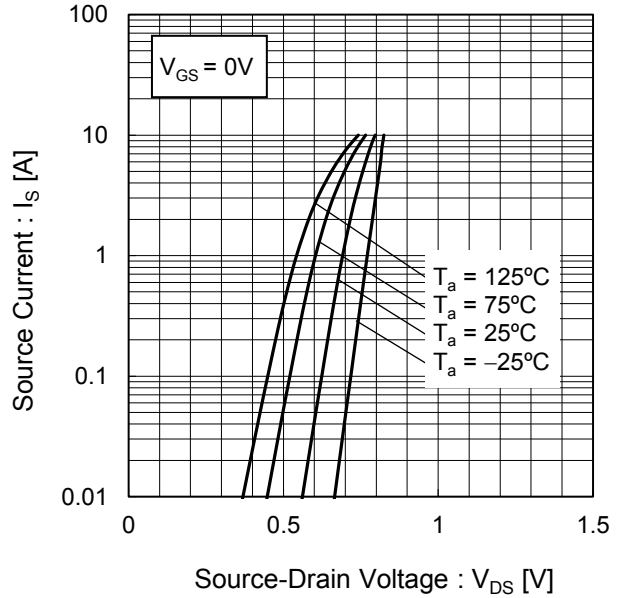


Fig.21 Source Current vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

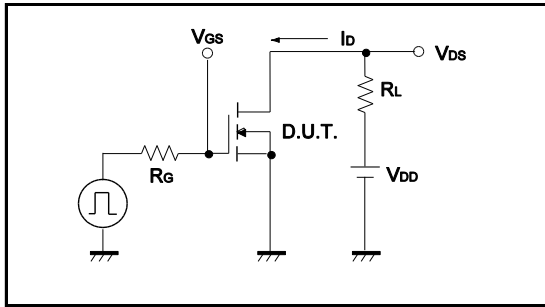


Fig.1-2 Switching Waveforms

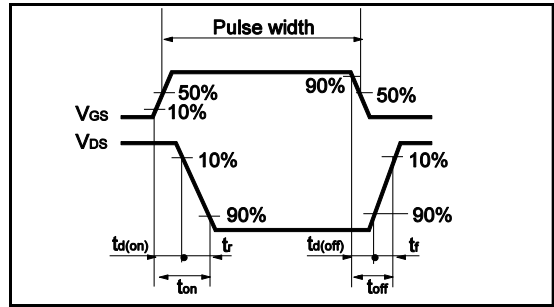


Fig.2-1 Gate Charge Measurement Circuit

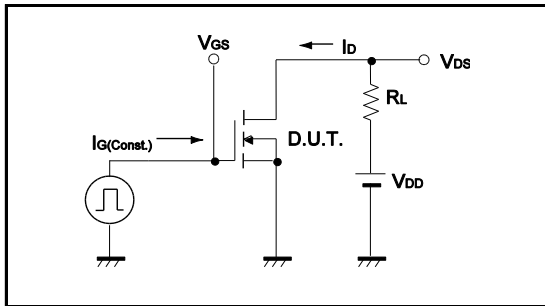
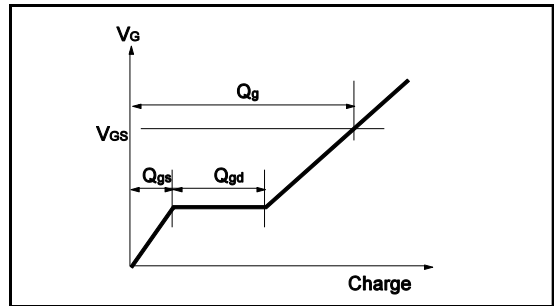
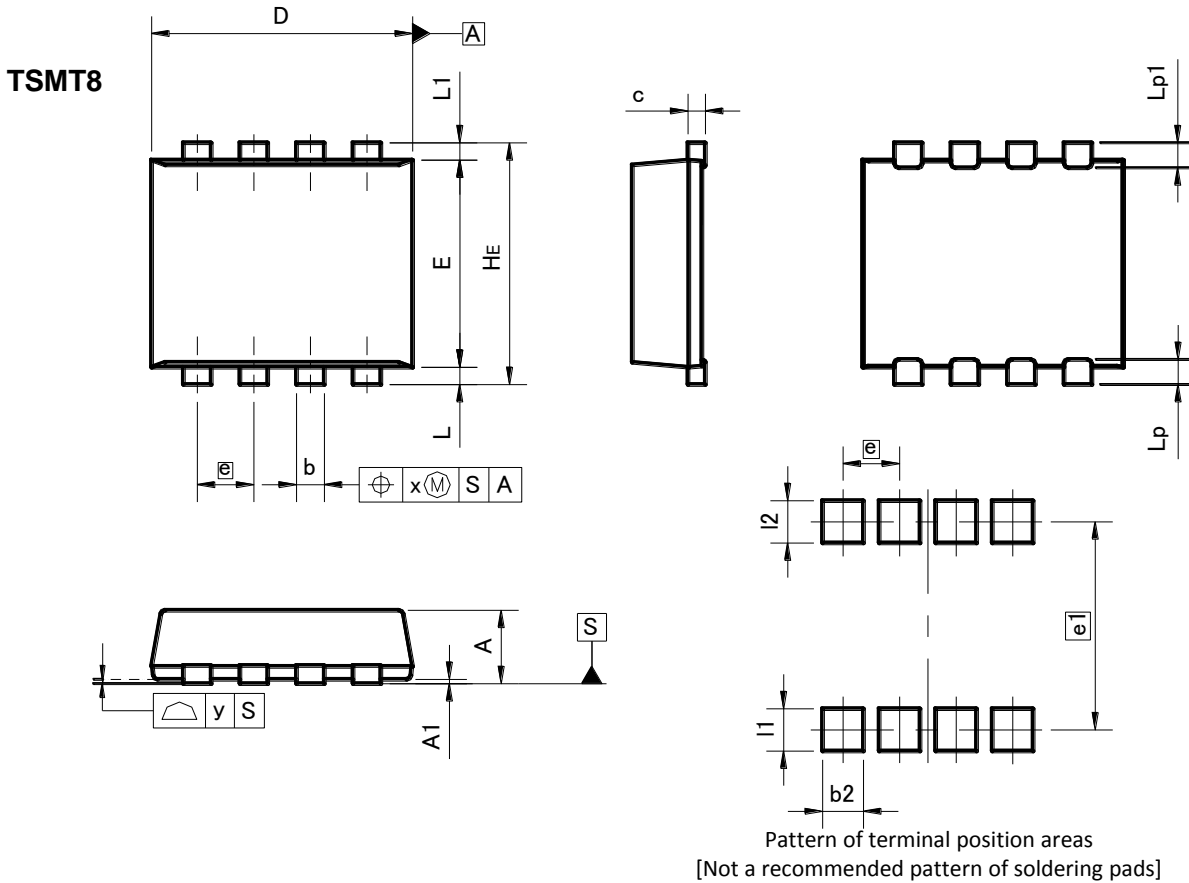


Fig.2-2 Gate Charge Waveform



●Dimensions (Unit : mm)



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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