

$V_{DSS}$	30V
$R_{DS(on)}(Max.)$	37mΩ
$I_D$	±4.0A
$P_D$	1W

### ●Features

- 1) Low on - resistance.
- 2) High Power Package (TSMT3).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

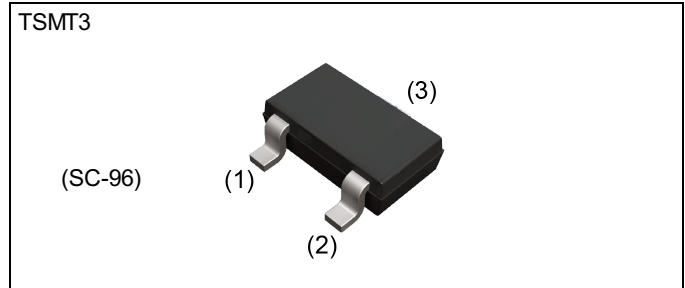
### ●Application

Switching

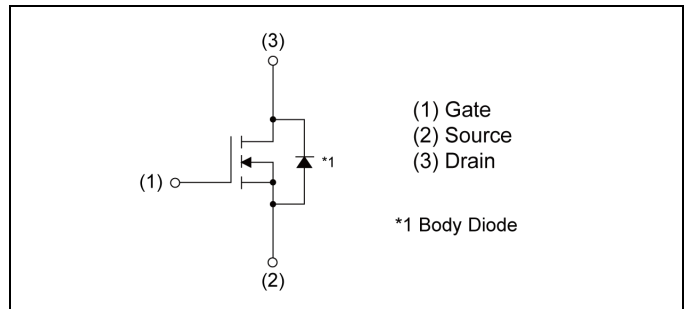
### ●Absolute maximum ratings ( $T_a = 25^{\circ}C$ )

Parameter	Symbol	Value	Unit
Drain - Source voltage	$V_{DSS}$	30	V
Continuous drain current	$I_D$	±4.0	A
Pulsed drain current	$I_{D,pulse}^{*1}$	±16	A
Gate - Source voltage	$V_{GSS}$	±12	V
Avalanche energy, single pulse	$E_{AS}^{*2}$	1.2	mJ
Avalanche current	$I_{AS}^{*2}$	4.0	A
Power dissipation	$P_D^{*3}$	1	W
Junction temperature	$T_j$	150	°C
Range of storage temperature	$T_{stg}$	-55 to +150	°C

### ●Outline



### ●Inner circuit



### ●Packaging specifications

Type	Packing	Embossed Tape
	Reel size (mm)	180
	Tape width (mm)	8
	Basic ordering unit (pcs)	3000
	Taping code	TCL
	Marking	FK

## ● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	$R_{thJA}^{*3}$	-	-	125	°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 $25^\circ\text{C}$	-	18	-	mV/°C
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 12V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 1mA$	0.5	-	1.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	$I_D = 1mA$ referenced to $25^\circ\text{C}$	-	-2.0	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS} = 4.5V, I_D = 4.0A$	-	27	37	m $\Omega$
		$V_{GS} = 2.5V, I_D = 4.0A$	-	39	54	
Gate input resistance	$R_G$	f=1MHz, open drain	-	2.5	-	$\Omega$
Forward Transfer Admittance	$ Y_{fs} ^{*4}$	$V_{DS} = 5V, I_D = 4A$	4.2	-	-	S

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

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

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

\*4 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	480	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 15V	-	55	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	40	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*4</sup>	V <sub>DD</sub> ≈ 15V, V <sub>GS</sub> = 4.5V	-	8.8	-	ns
Rise time	t <sub>r</sub> <sup>*4</sup>	I <sub>D</sub> = 2.0A	-	5.9	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*4</sup>	R <sub>L</sub> ≈ 7.5Ω	-	26	-	
Fall time	t <sub>f</sub> <sup>*4</sup>	R <sub>G</sub> = 10Ω	-	5.7	-	

**●Gate charge characteristics (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q <sub>g</sub> <sup>*4</sup>	V <sub>DD</sub> ≈ 15V, I <sub>D</sub> = 4.0A, V <sub>GS</sub> = 4.5V	-	4.3	-	nC
Gate - Source charge	Q <sub>gs</sub> <sup>*4</sup>		-	1.1	-	
Gate - Drain charge	Q <sub>gd</sub> <sup>*4</sup>		-	1.1	-	

**●Body diode electrical characteristics (Source-Drain) (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous forward current	I <sub>S</sub>	T <sub>a</sub> = 25°C	-	-	0.8	A
Body diode pulse current	I <sub>SP</sub> <sup>*1</sup>		-	-	16	A
Forward voltage	V <sub>SD</sub> <sup>*4</sup>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 0.8A	-	-	1.2	V

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve



Fig.2 Maximum Safe Operating Area

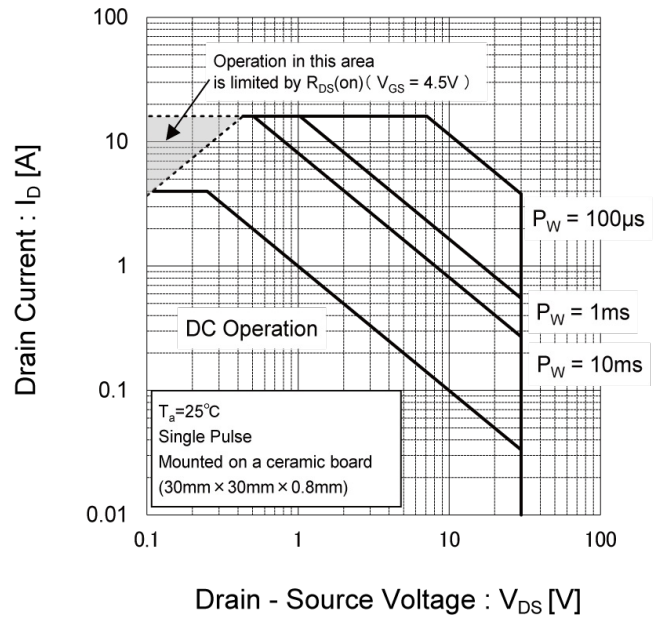


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

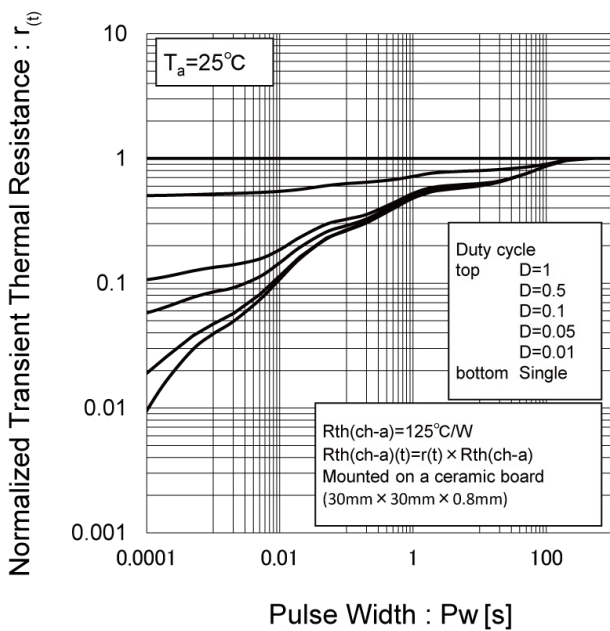
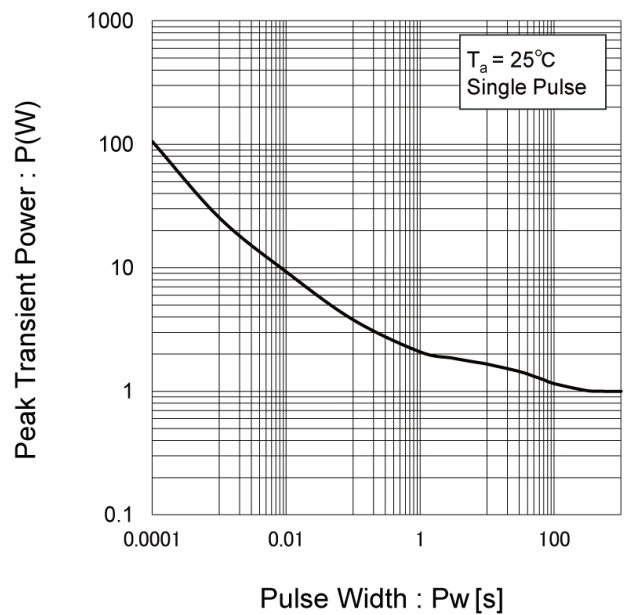


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

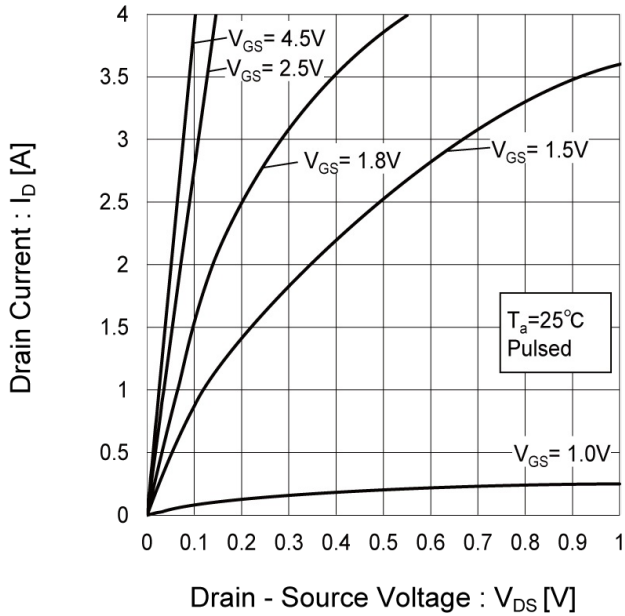


Fig.6 Typical Output Characteristics(II)

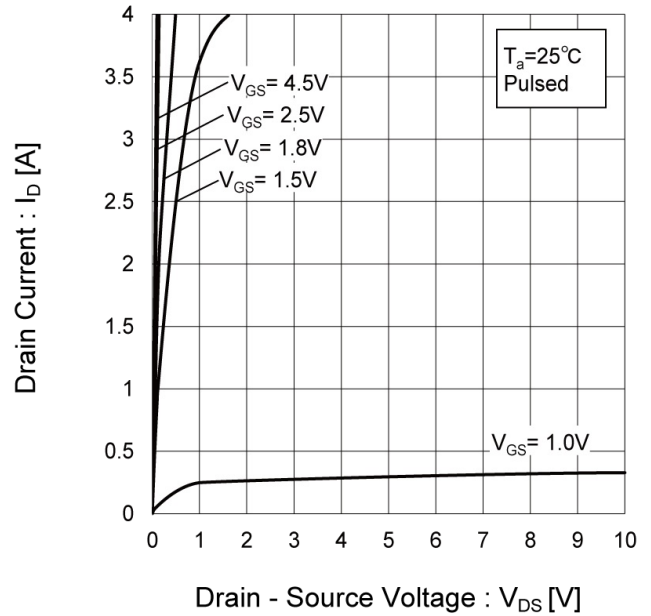
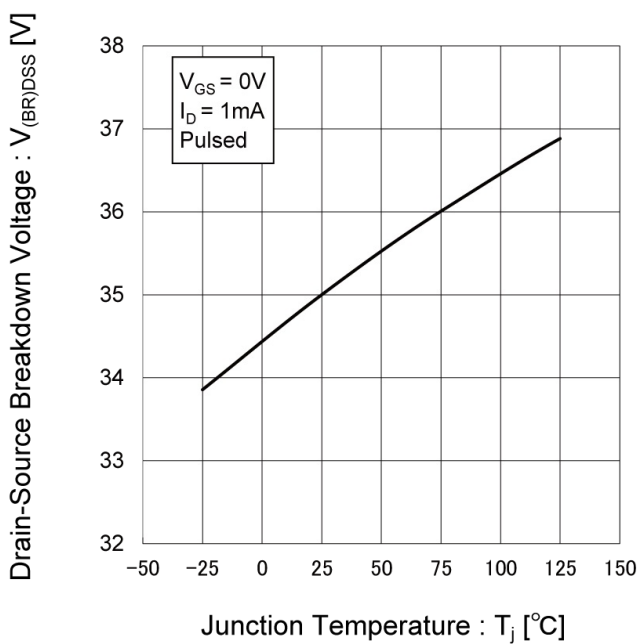


Fig.7 Breakdown Voltage vs. Junction Temperature



● Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

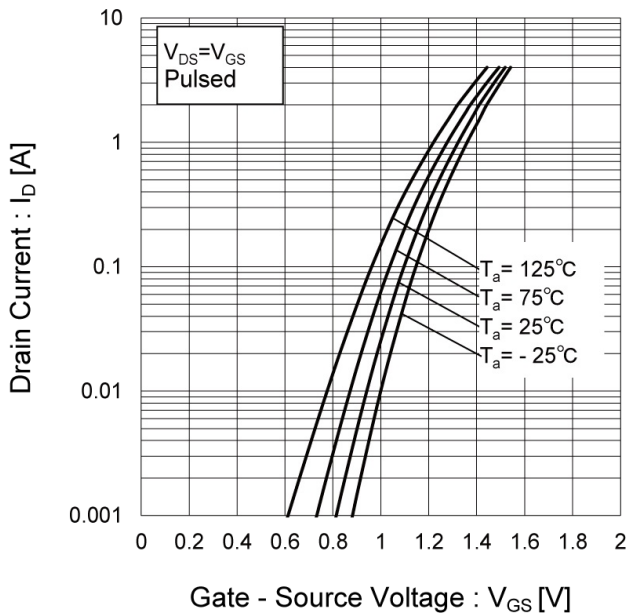


Fig.9 Gate Threshold Voltage vs. Junction Temperature

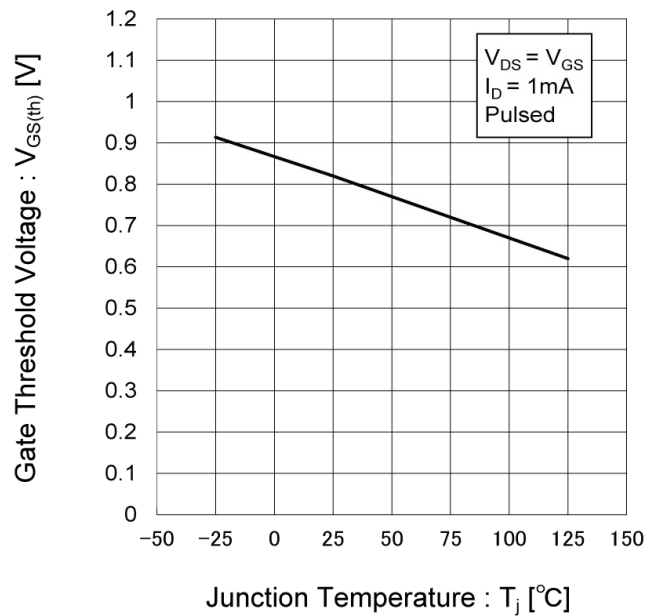
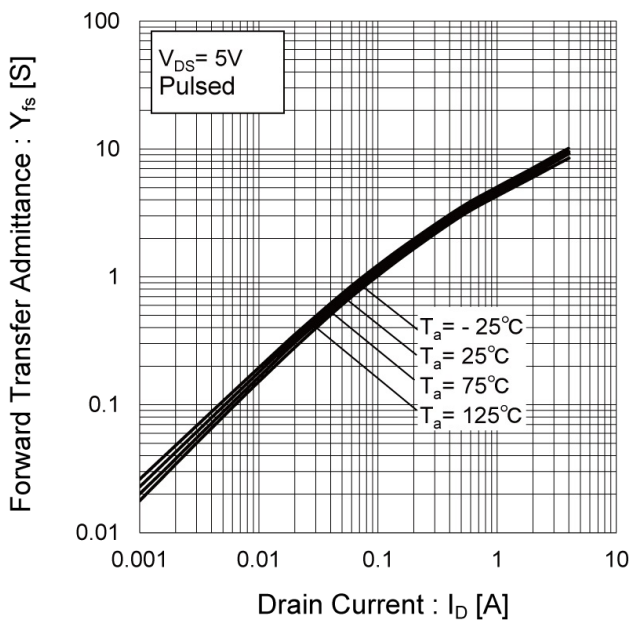


Fig.10 Transconductance vs. Drain Current



● Electrical characteristic curves

Fig.11 Drain Current Derating Curve

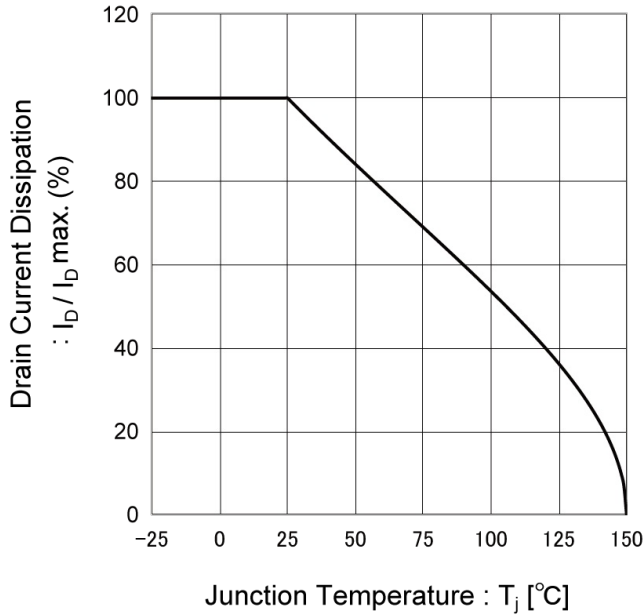


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

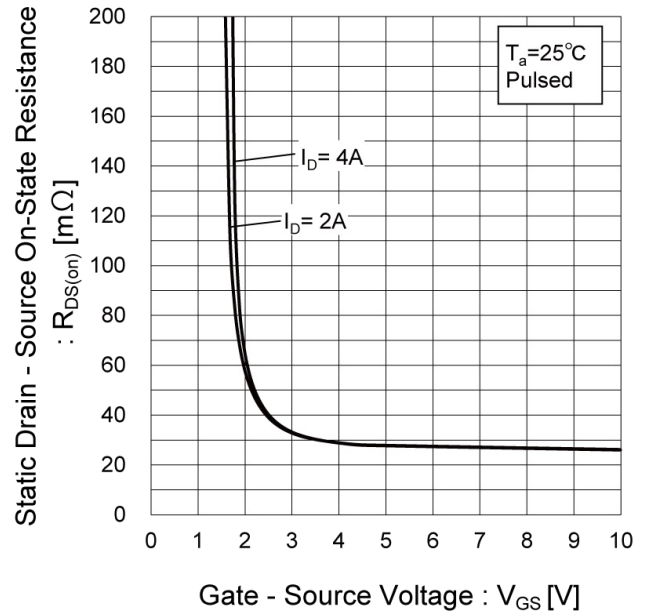
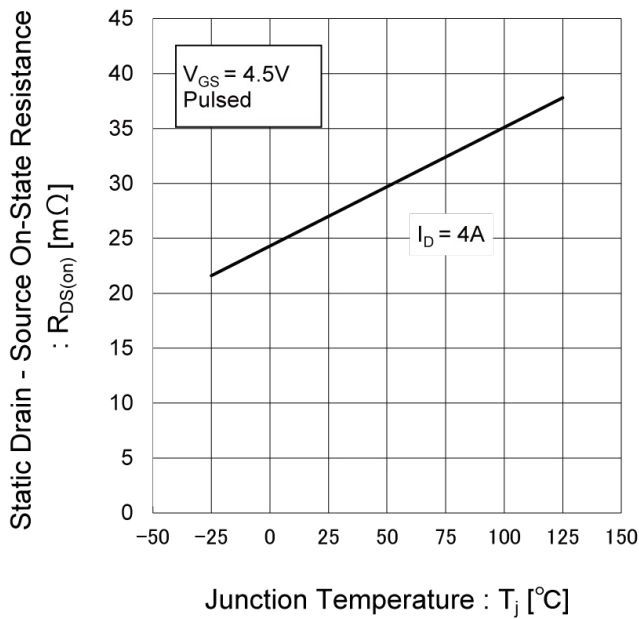


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves

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

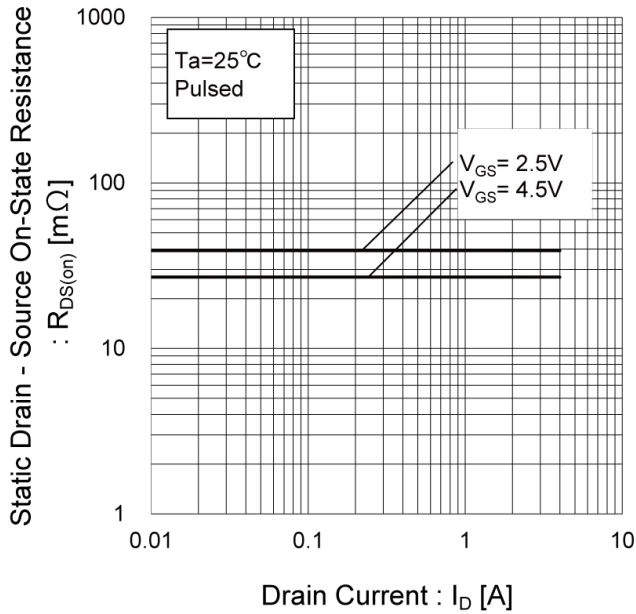


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

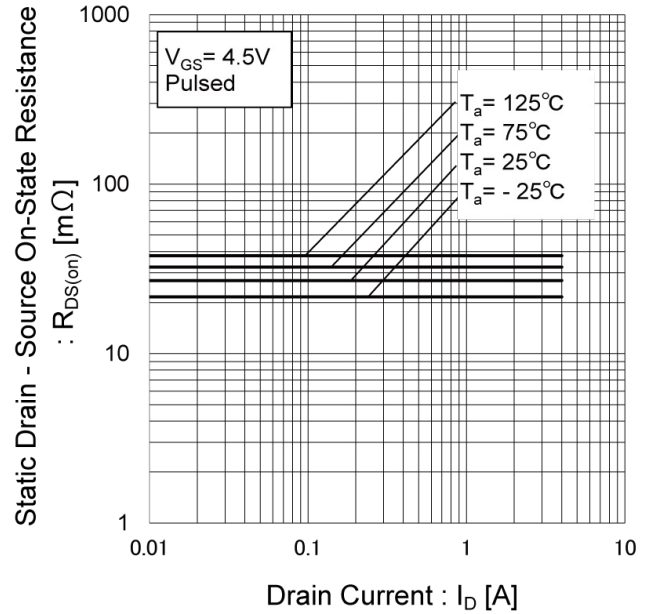
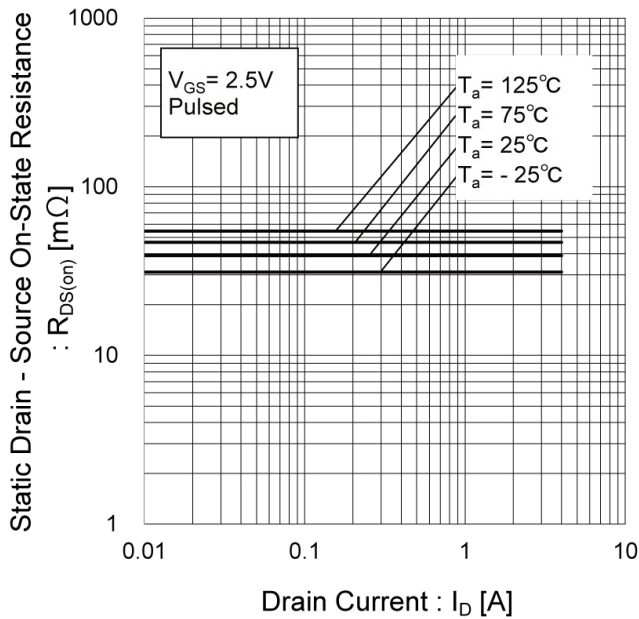


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)





●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

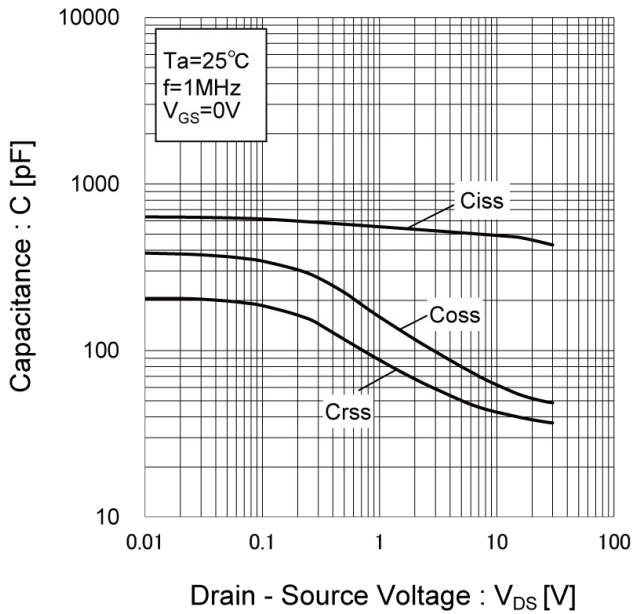


Fig.18 Switching Characteristics

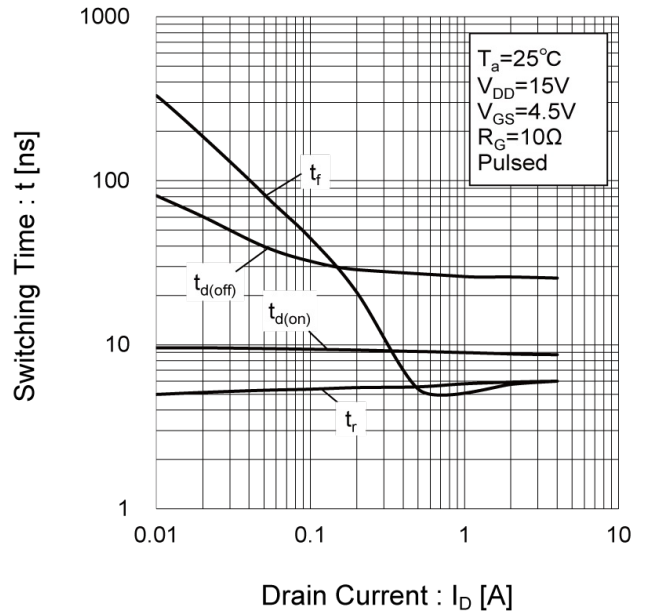


Fig.19 Dynamic Input Characteristics

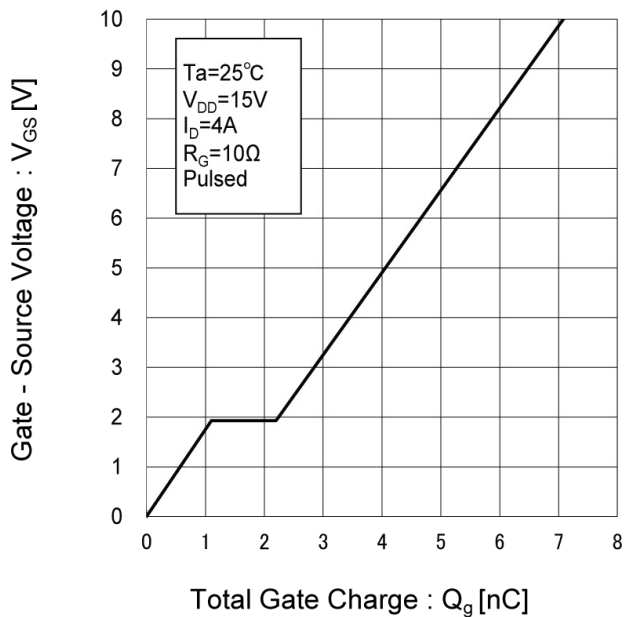
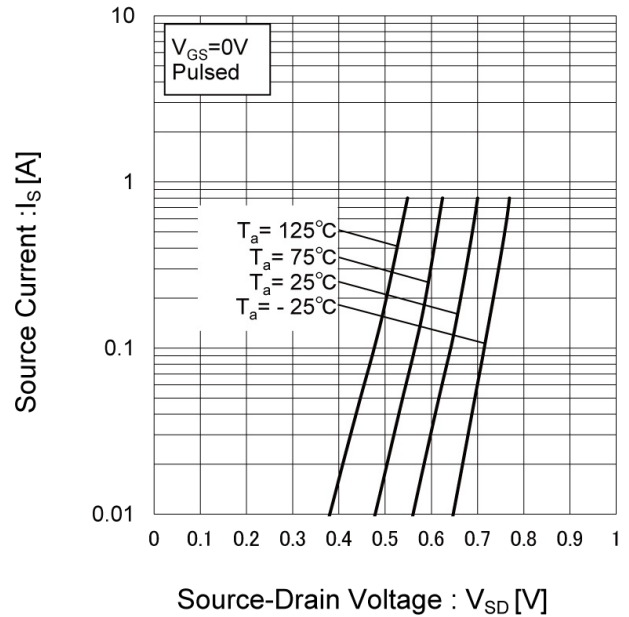


Fig.20 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

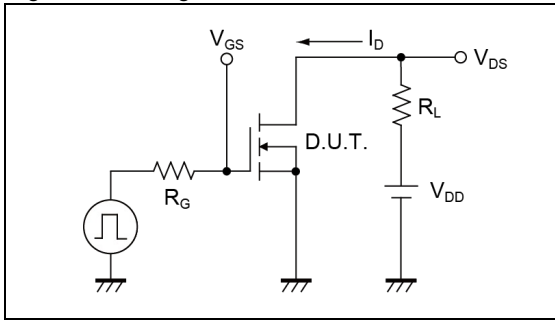


Fig.1-2 Switching Waveforms

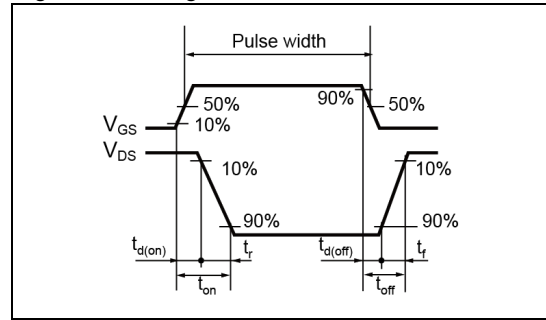


Fig.2-1 Gate Charge Measurement Circuit

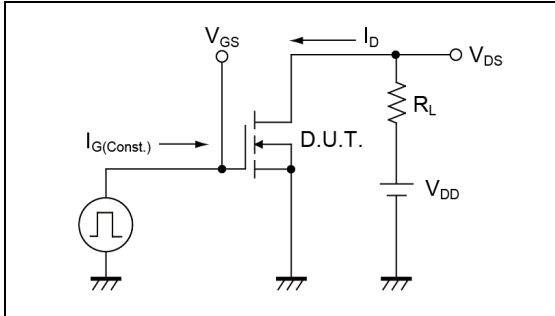


Fig.2-2 Gate Charge Waveform



Fig.3-1 Avalanche Measurement Circuit

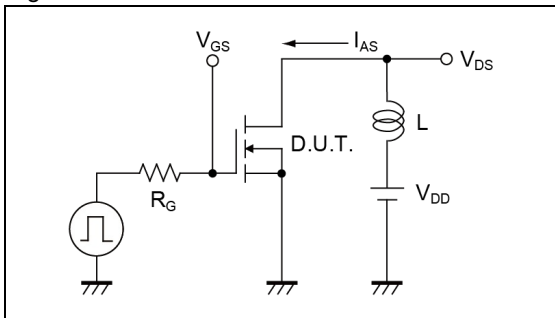


Fig.3-2 Avalanche Waveform

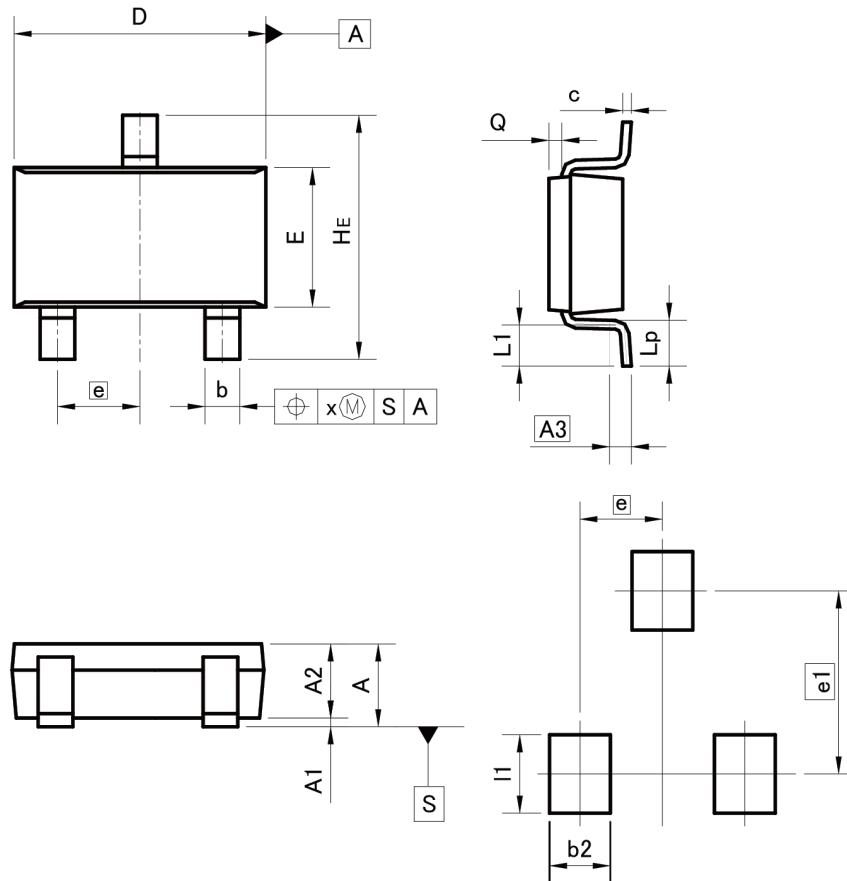


● Notice

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

●Dimensions

TSMT3



Pattern of terminal position areas  
[Not a recommended pattern of soldering pads]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	1.00	-	0.039
A1	0.00	0.10	0.000	0.004
A2	0.75	0.95	0.030	0.037
A3	0.25		0.010	
b	0.35	0.50	0.014	0.020
c	0.10	0.26	0.004	0.010
D	2.80	3.00	0.110	0.118
E	1.50	1.80	0.059	0.071
e	0.95		0.037	
HE	2.60	3.00	0.102	0.118
L1	0.30	0.60	0.012	0.024
Lp	0.40	0.70	0.016	0.028
Q	0.05	0.25	0.002	0.010
x	-	0.20	-	0.008

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	-	0.70	-	0.028
e1	2.10		0.083	
l1	-	0.90	-	0.035

Dimension in mm/inches

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