

V_{DSS}	-20V
$R_{DS(on)(Max.)}$	59mΩ
I_D	±3.5A
P_D	1W

●Features

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

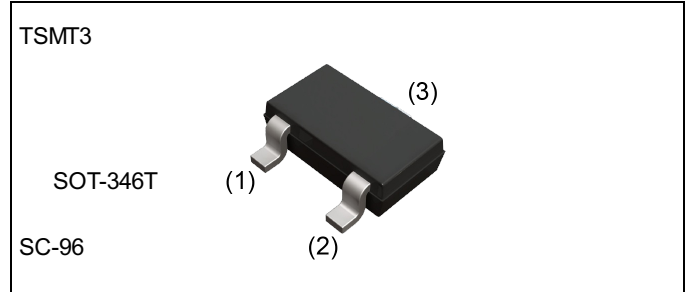
●Application

- Switching
- Load switch

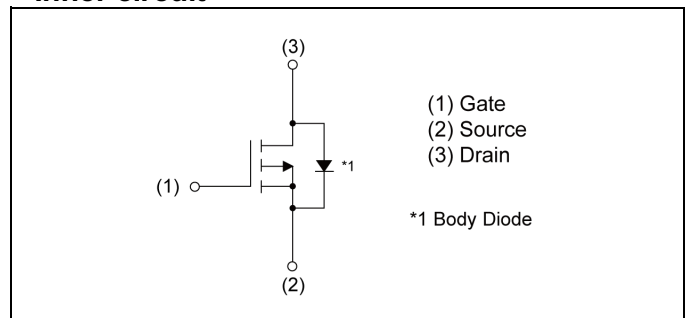
●Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	-20	V
Continuous drain current	I_D^{*1}	±3.5	A
Pulsed drain current	$I_{D,pulse}^{*2}$	±12	A
Gate - Source voltage	V_{GSS}	±8	V
Avalanche energy, single pulse	E_{AS}^{*3}	9.3	mJ
Avalanche current	I_{AS}^{*3}	-3.5	A
Power dissipation	P_D^{*4}	1	W
	P_D^{*5}	0.55	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	JJ

● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJA}^{*4}	-	-	125	°C/W
	R_{thJA}^{*5}	-	-	227	°C/W

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -1mA$	-20	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	$I_D = -1mA$ referenced to 25°C	-	-10.3	-	mV/°C
Zero gate voltage drain current	I_{DSS}	$V_{DS} = -20V, V_{GS} = 0V$	-	-	-1	μA
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 8V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -1mA$	-0.5	-	-1.2	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	$I_D = -1mA$ referenced to 25°C	-	1.7	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*6}$	$V_{GS} = -4.5V, I_D = -3.5A$	-	42	59	m Ω
		$V_{GS} = -2.5V, I_D = -3.5A$	-	54	76	
		$V_{GS} = -1.8V, I_D = -0.9A$	-	84	135	
Gate input resistance	R_G	$f = 1MHz, \text{open drain}$	-	9.5	-	Ω
Forward Transfer Admittance	$ Y_{fs} ^{*6}$	$V_{DS} = -5V, I_D = -3.5A$	4.3	-	-	S

*1 $V_{GS} \geq 2.5V$

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

*3 $L \approx 1mH, V_{DD} = -10V, R_G = 25\Omega$, STARTING $T_j = 25^\circ\text{C}$ Fig.3-1,3-2

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

*5 Mounted on a FR4 (12×20×0.8mm)

*6 Pulsed

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C _{iss}	V _{GS} = 0V	-	460	-	pF
Output capacitance	C _{oss}	V _{DS} = -10V	-	90	-	
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	80	-	
Turn - on delay time	t _{d(on)} ^{*6}	V _{DD} ≈ -10V, V _{GS} = -4.5V	-	9	-	ns
Rise time	t _r ^{*6}	I _D = -1.75A	-	30	-	
Turn - off delay time	t _{d(off)} ^{*6}	R _L ≈ 5.7Ω	-	50	-	
Fall time	t _f ^{*6}	R _G = 10Ω	-	30	-	

●Gate charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q _g ^{*6}	V _{DD} ≈ -10V, I _D = -3.5A, V _{GS} = -4.5V	-	6.5	-	nC
Gate - Source charge	Q _{gs} ^{*6}		-	0.9	-	
Gate - Drain charge	Q _{gd} ^{*6}		-	2.2	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous forward current	I _S	T _a = 25°C	-	-	-0.8	A
Body diode pulse current	I _{SP} ^{*2}		-	-	-12	A
Forward voltage	V _{SD} ^{*6}	V _{GS} = 0V, I _S = -0.8A	-	-	-1.2	V

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

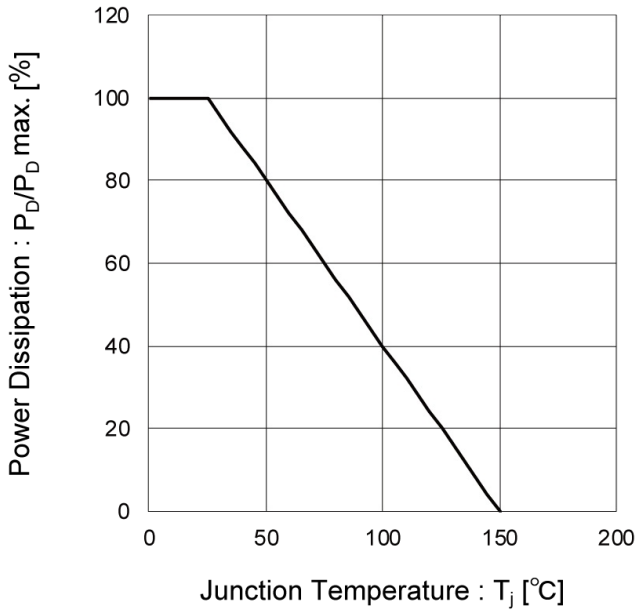


Fig.2 Maximum Safe Operating Area

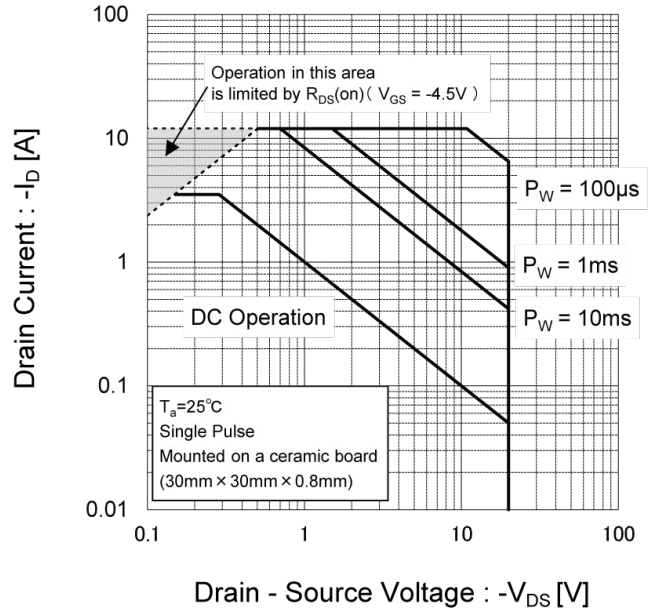


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

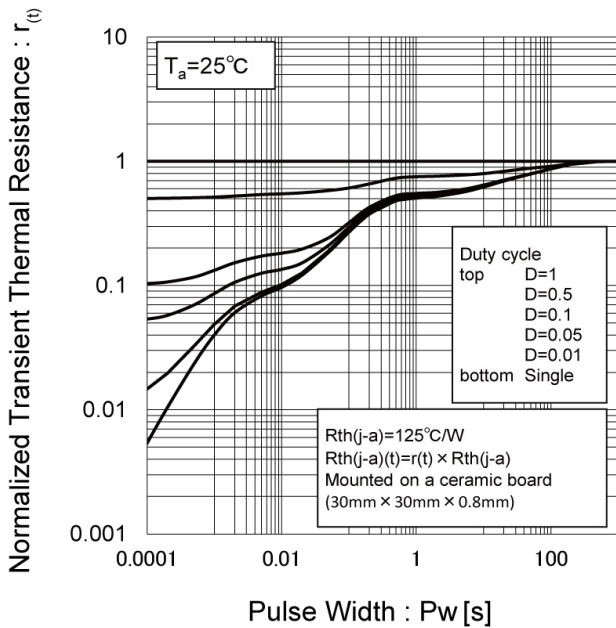
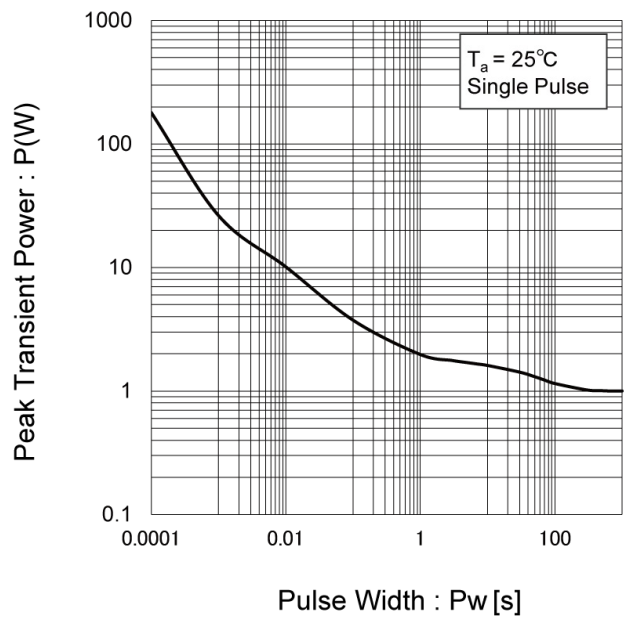


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

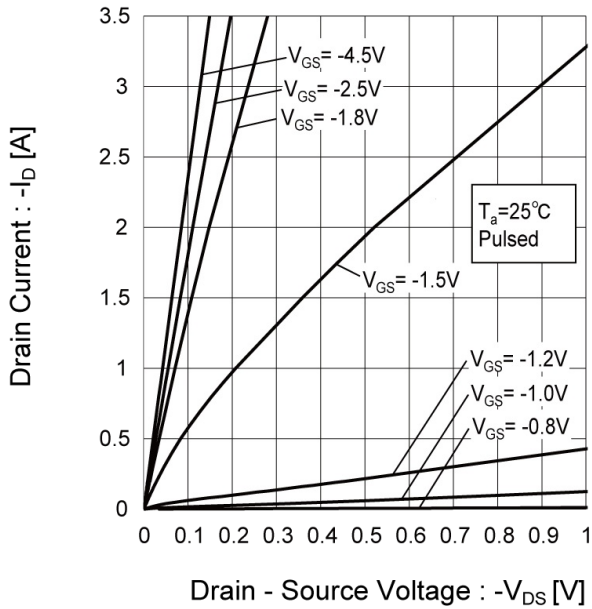


Fig.6 Typical Output Characteristics(II)

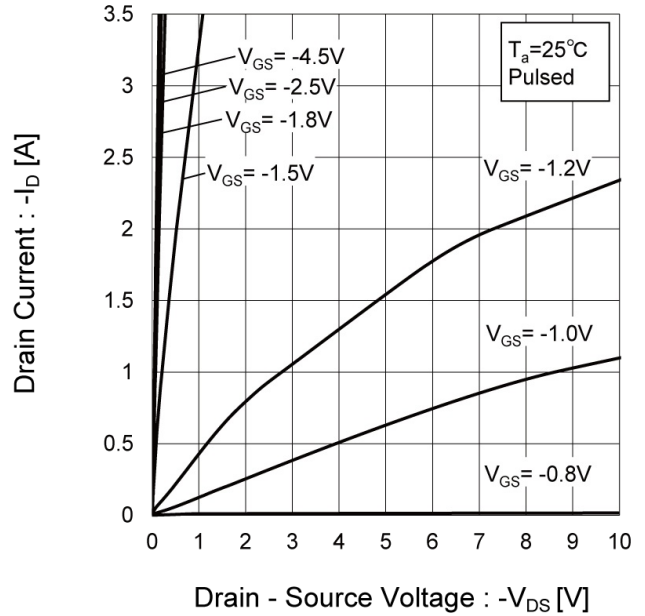
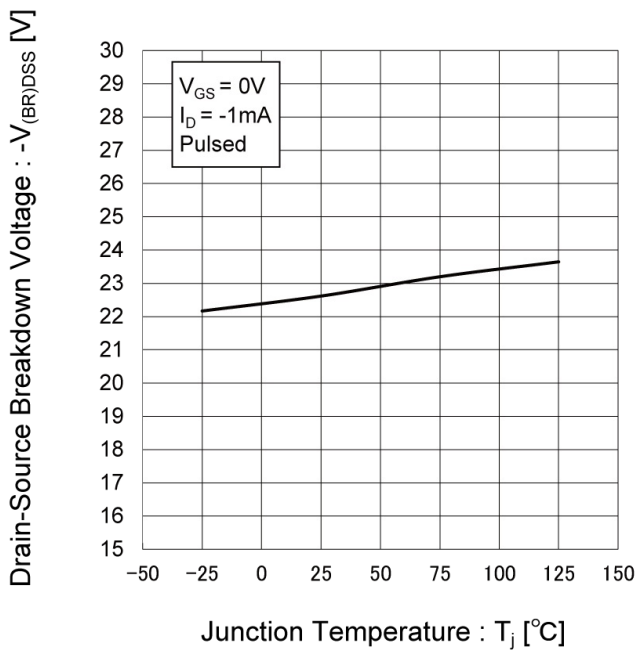


Fig.7 Breakdown Voltage vs. Junction Temperature



● Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

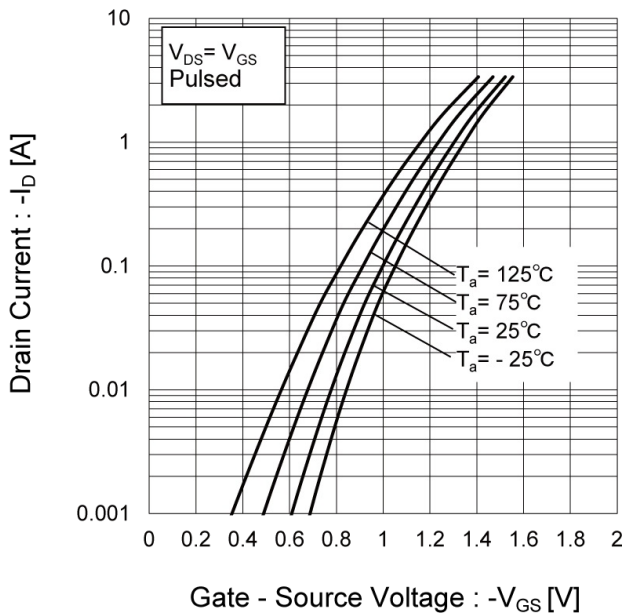


Fig.9 Gate Threshold Voltage vs. Junction Temperature

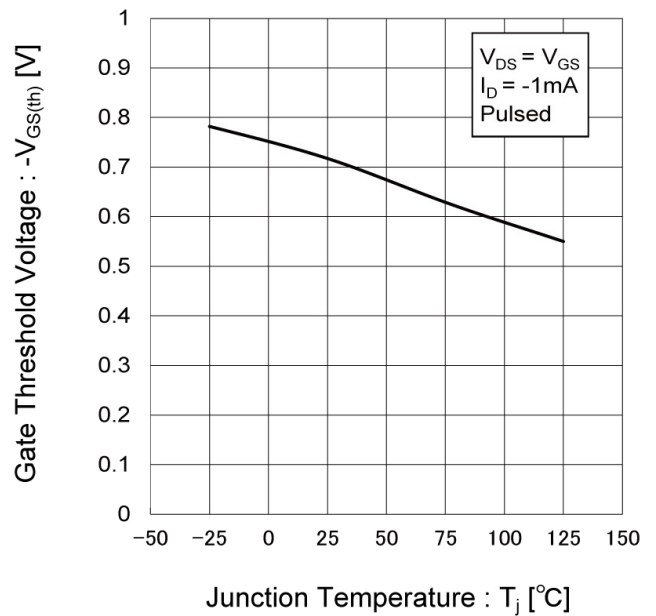
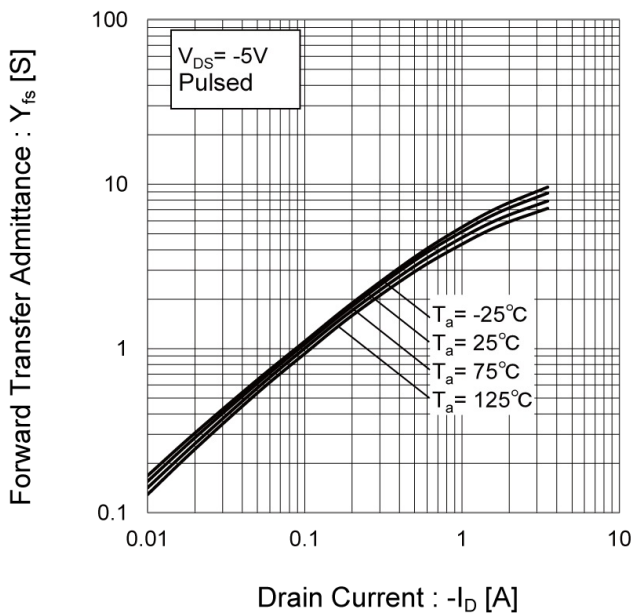


Fig.10 Forward Transfer Admittance vs. Drain Current



● Electrical characteristic curves

Fig.11 Drain Current Derating Curve



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

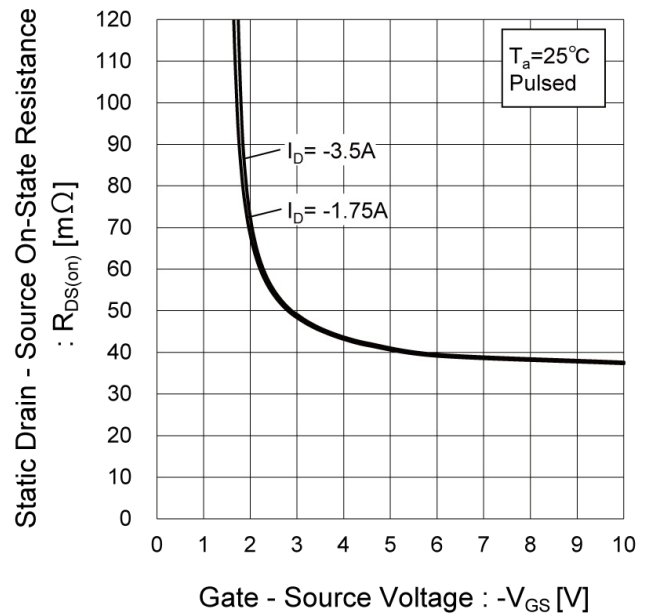
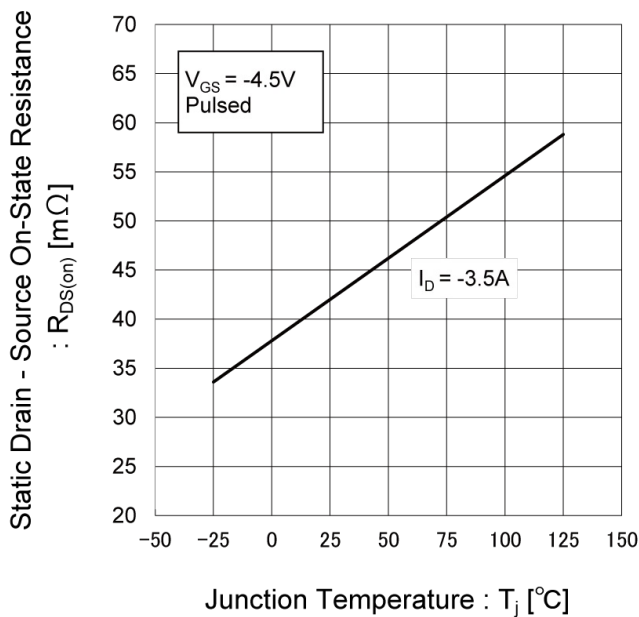


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves

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

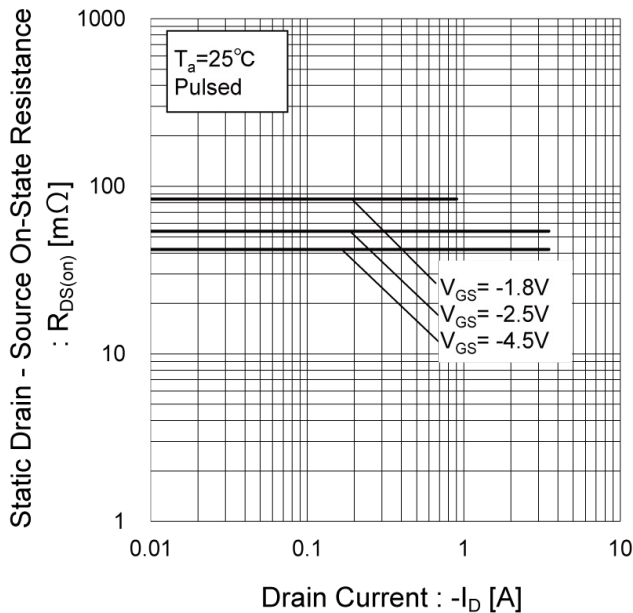


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

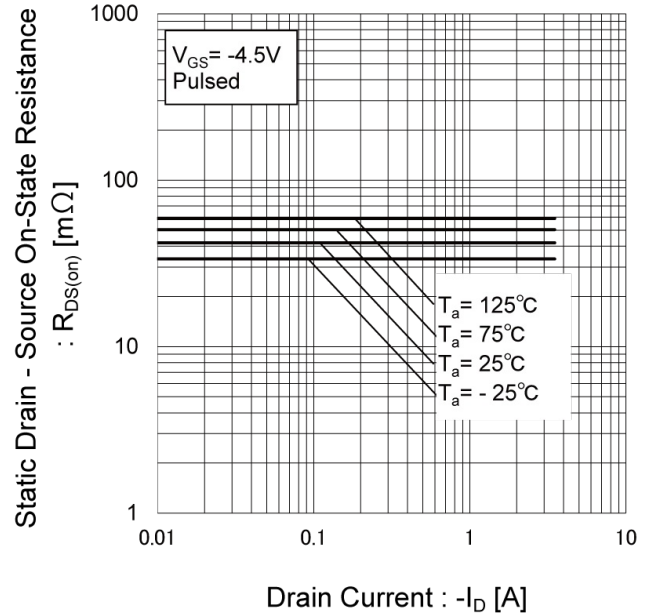


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

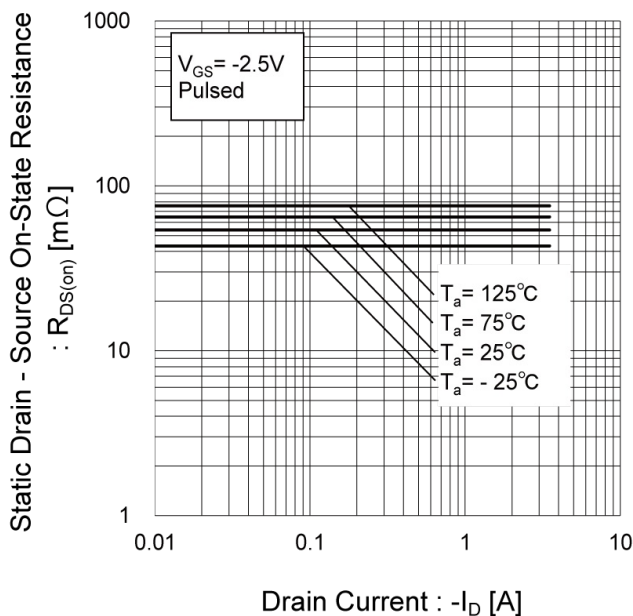
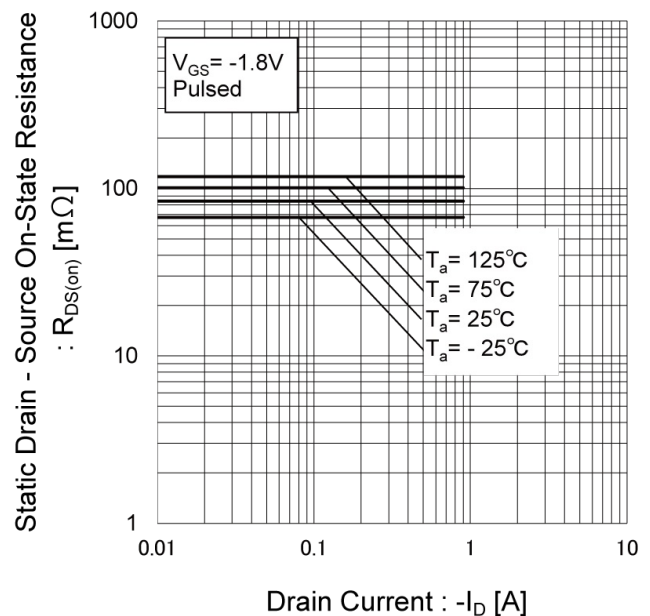


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)



● Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

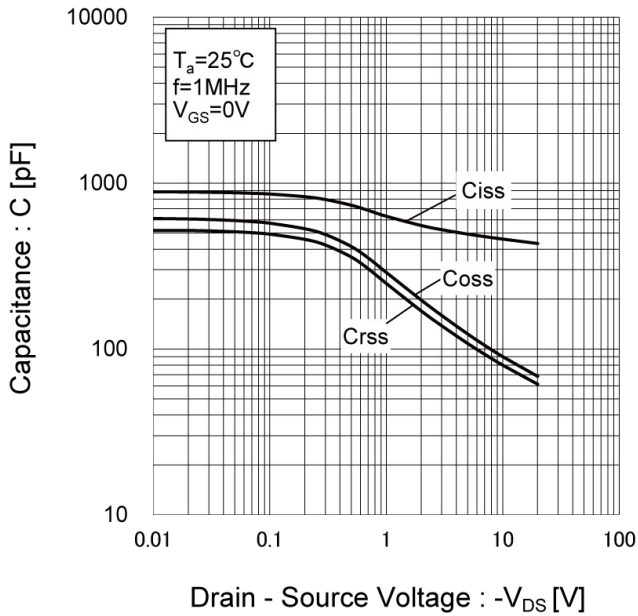


Fig.19 Switching Characteristics

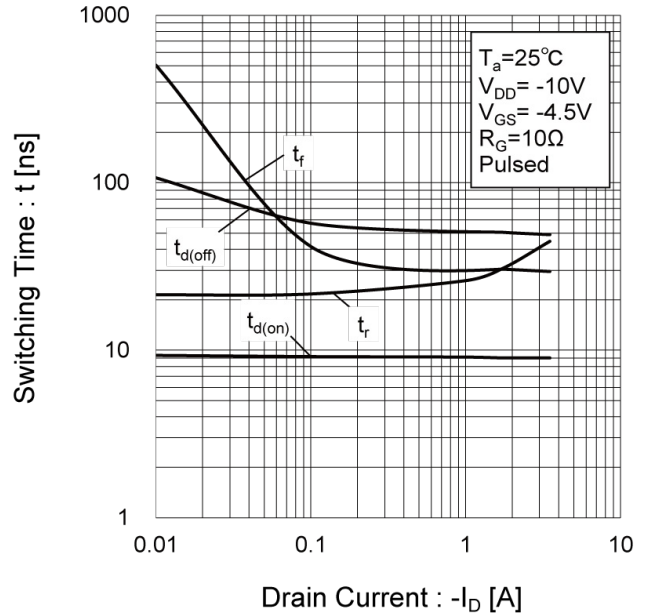


Fig.20 Dynamic Input Characteristics

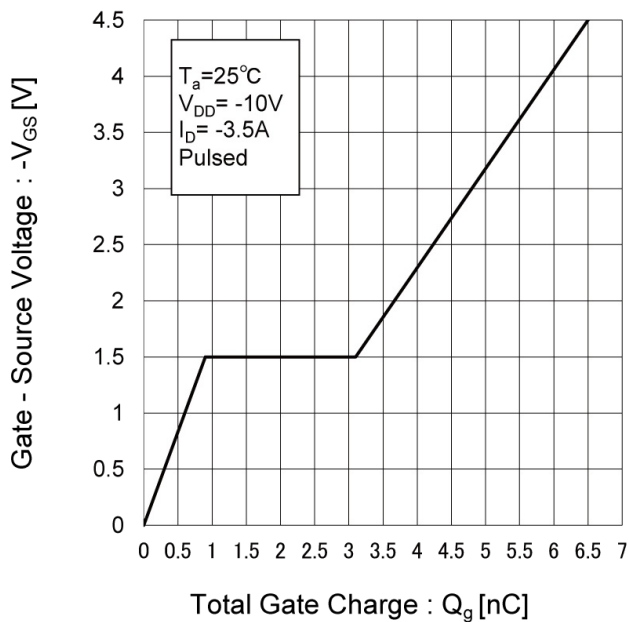
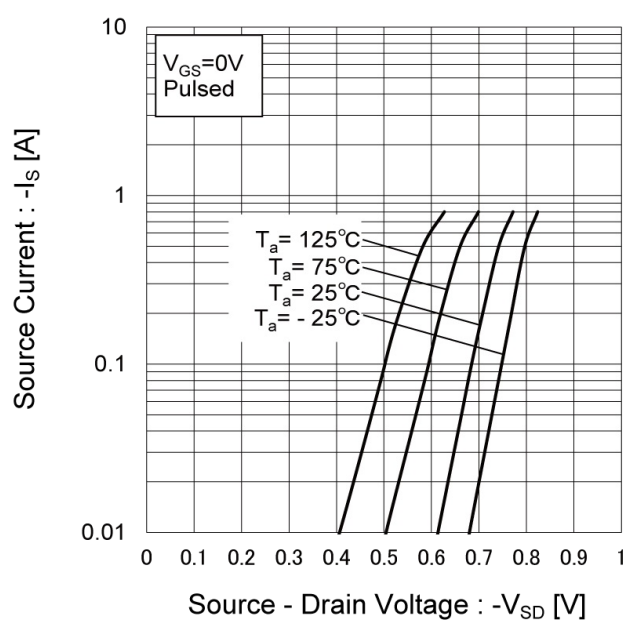


Fig.21 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

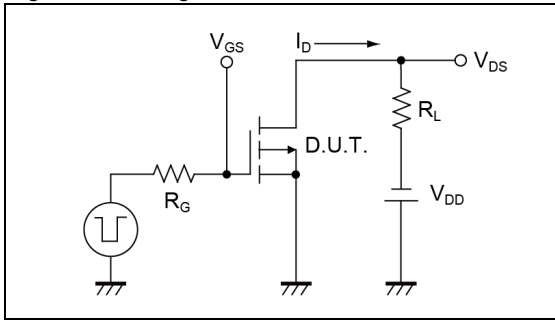


Fig.1-2 Switching Waveforms

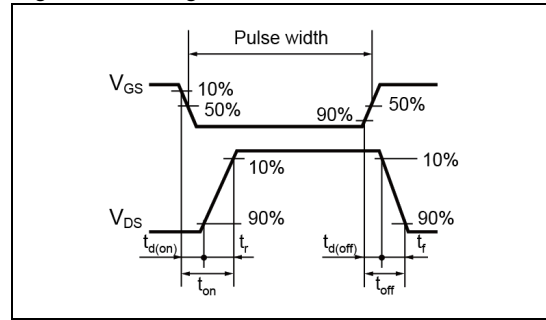


Fig.2-1 Gate Charge Measurement Circuit

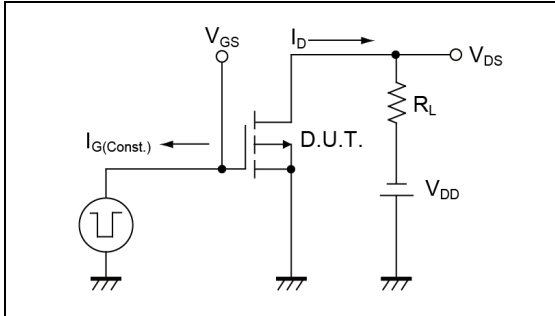


Fig.2-2 Gate Charge Waveform



Fig.3-1 Avalanche Measurement Circuit

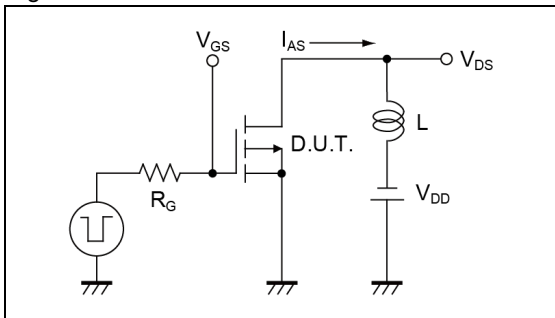


Fig.3-2 Avalanche Waveform

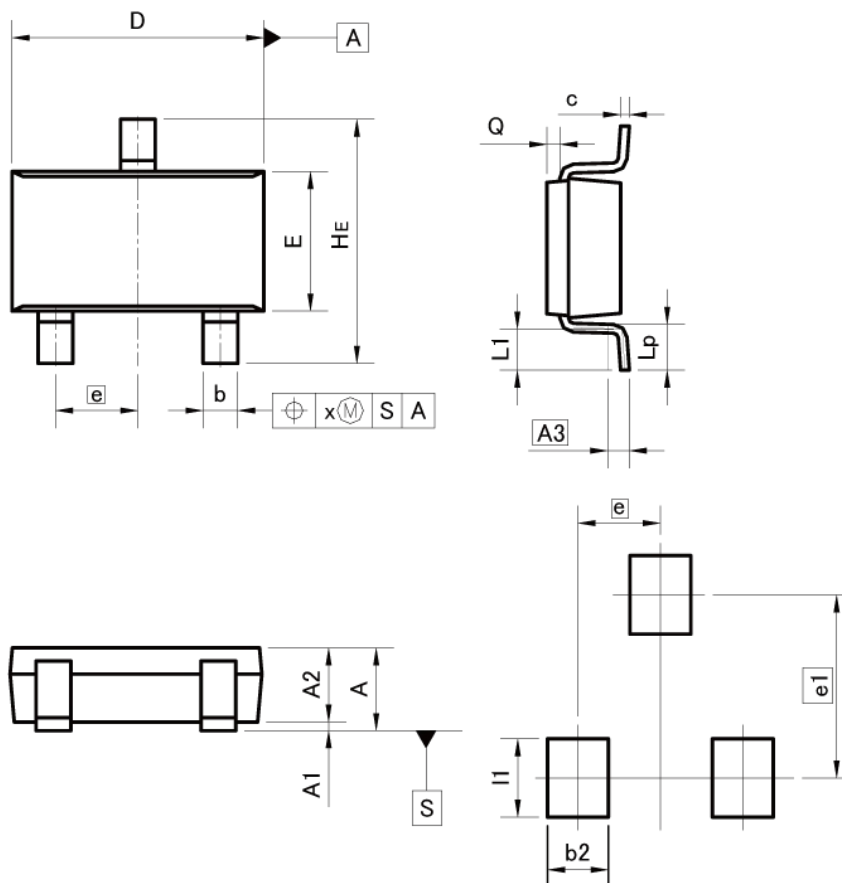


● Notice

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

●Dimensions

TSMT3
< SOT-346T >



Pattern of terminal position areas
[Not a 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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