RQ5E040AJ

Nch 30V 4A Middle Power MOSFET

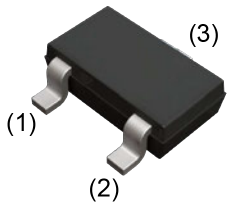
Datasheet

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

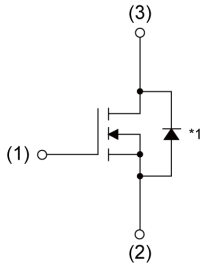
●Outline

TSMT3

(SC-96)



●Inner circuit



(1) Gate
(2) Source
(3) Drain

*1 Body Diode

●Features

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

●Packaging specifications

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

●Application

Switching

●Absolute maximum ratings (T_a = 25°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	℃
Range of storage temperature	T_{stg}	-55 to +150	℃

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●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJA} *3	-	-	125	℃/W

●Electrical characteristics (T_a = 25°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℃	-	18	-	mV/℃
Zero gate voltage drain current	I_{DSS}	V_{DS} = 30V, V_{GS} = 0V	-	-	1	μA
Gate - Source leakage current	I_{GSS}	V_{GS} = ±12V, V_{DS} = 0V	-	-	±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℃	-	-2.0	-	mV/℃
Static drain - source on - state resistance	$R_{DS(on)}$ *4	V_{GS} = 4.5V, I_D = 4.0A	-	27	37	mΩ
		V_{GS} = 2.5V, I_D = 4.0A	-	39	54	
Gate input resistance	R_G	f=1MHz, open drain	-	2.5	-	Ω
Forward Transfer Admittance	$\|Y_{fs}\|$ *4	V_{DS} = 5V, I_D = 4A	4.2	-	-	S

*1 Pw≦10μs , Duty cycle≦1%

*2 L ≃ 0.1mH, V_{DD} = 15V, R_G = 25Ω, STARTING T_{ch} = 25℃ Fig.3-1,3-2

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

*4 Pulsed

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●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	480	-	pF
Output capacitance	C_{oss}	V_{DS} = 15V	-	55	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	40	-	
Turn - on delay time	$t_{d(on)}$ *4	V_{DD} ≃ 15V, V_{GS} = 4.5V	-	8.8	-	ns
Rise time	t_r *4	I_D = 2.0A	-	5.9	-	
Turn - off delay time	$t_{d(off)}$ *4	R_L ≃ 7.5Ω	-	26	-	
Fall time	t_f *4	R_G = 10Ω	-	5.7	-	

●Gate charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *4	V_{DD} ≃ 15V, I_D = 4.0A, V_{GS} = 4.5V	-	4.3	-	nC
Gate - Source charge	Q_{gs} *4		-	1.1	-	
Gate - Drain charge	Q_{gd} *4		-	1.1	-	

●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} *1		-	-	16	A
Forward voltage	V_{SD} *4	V_{GS} = 0V, I_S = 0.8A	-	-	1.2	V

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●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

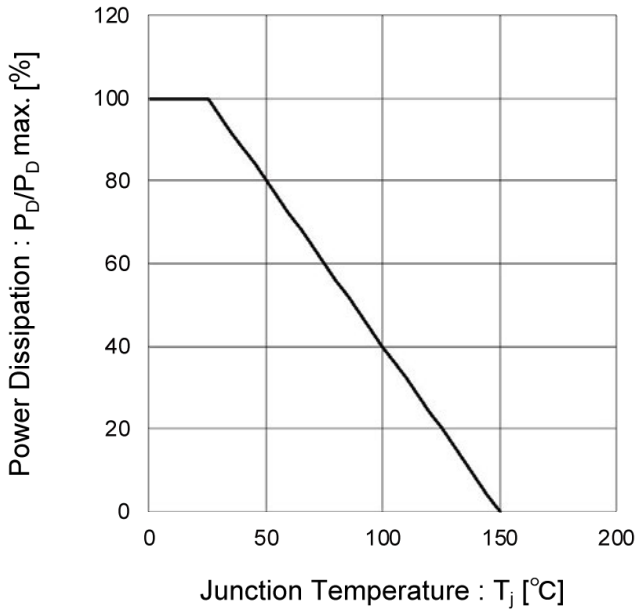


Fig.2 Maximum Safe Operating Area

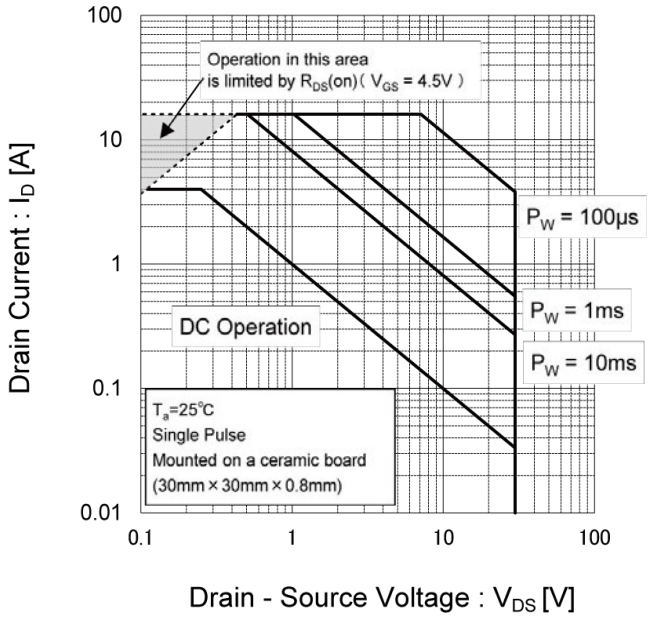


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

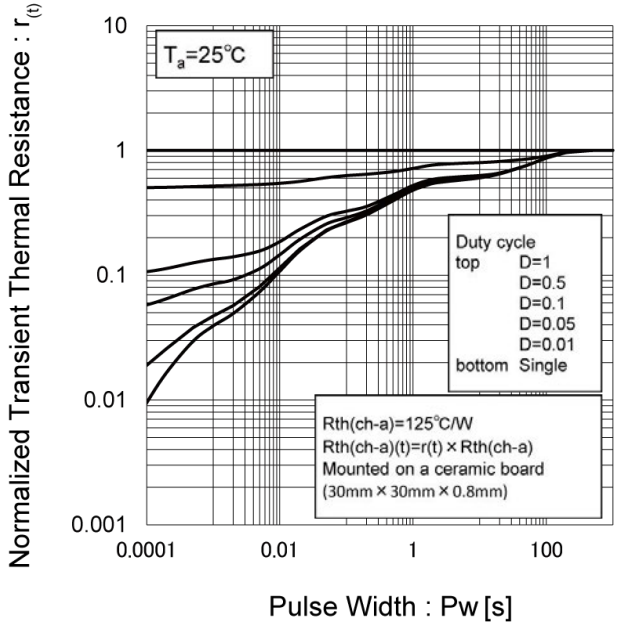
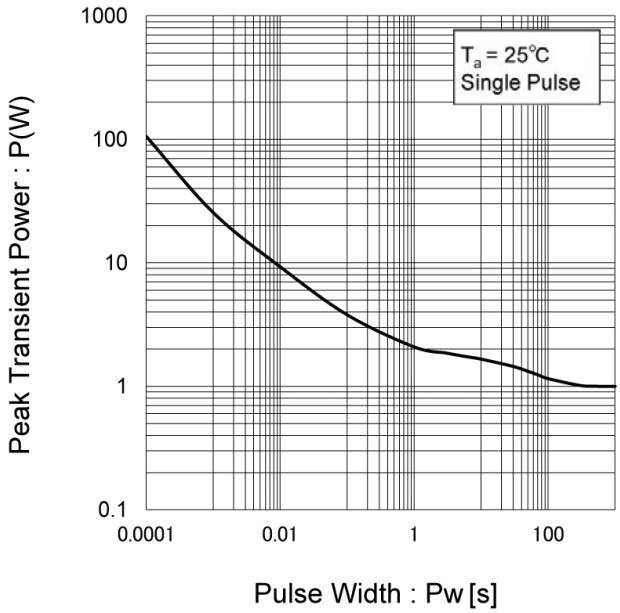


Fig.4 Single Pulse Maximum Power dissipation



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●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

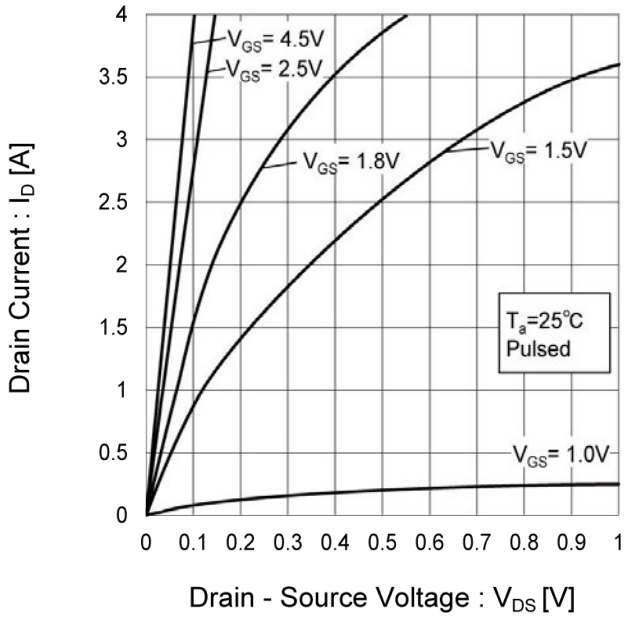


Fig.6 Typical Output Characteristics(II)

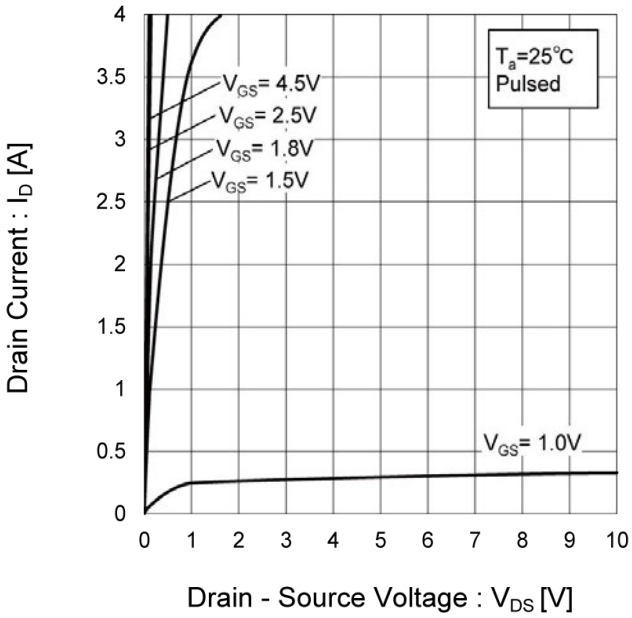
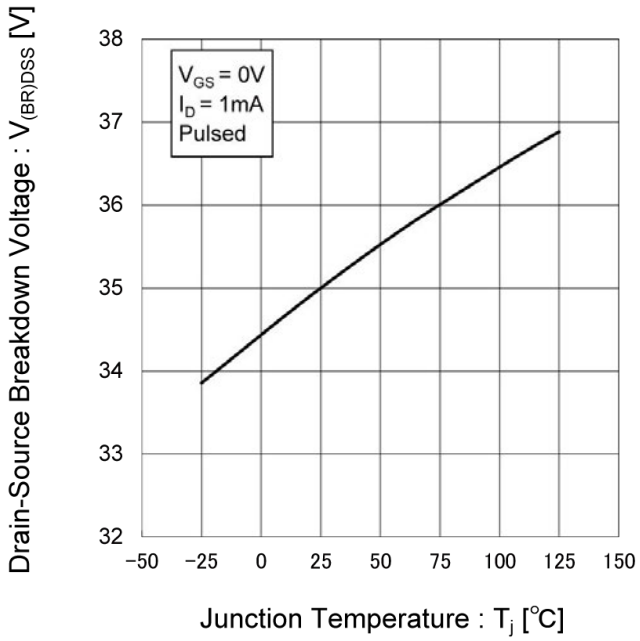


Fig.7 Breakdown Voltage vs. Junction Temperature



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●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

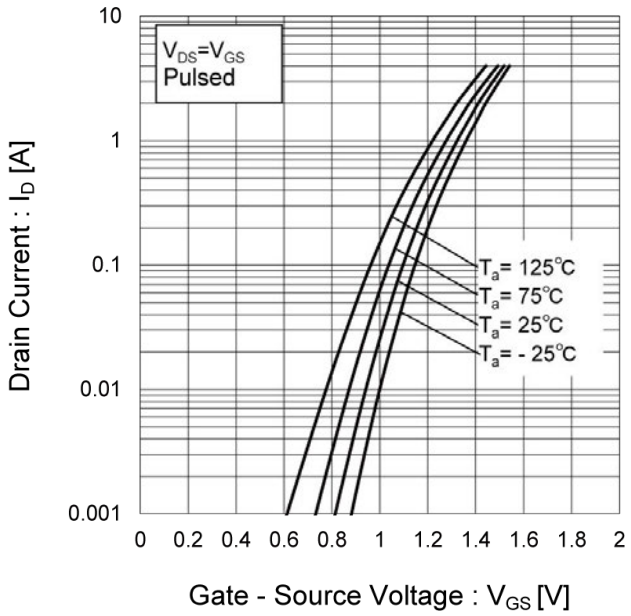


Fig.9 Gate Threshold Voltage vs. Junction Temperature

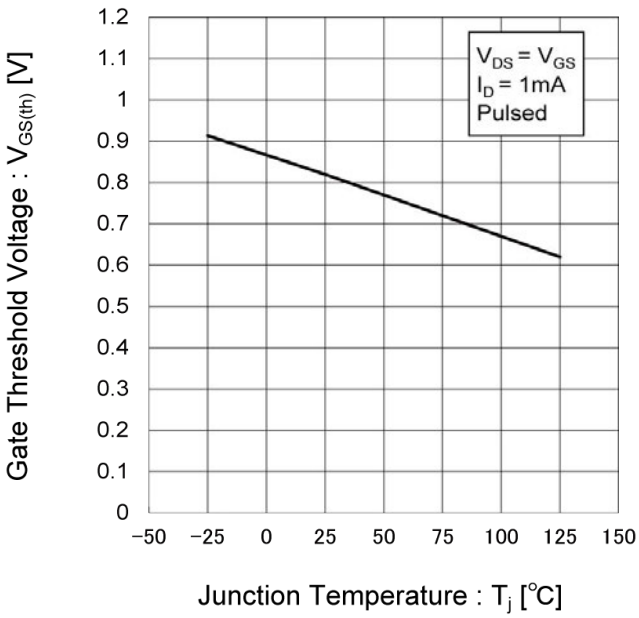
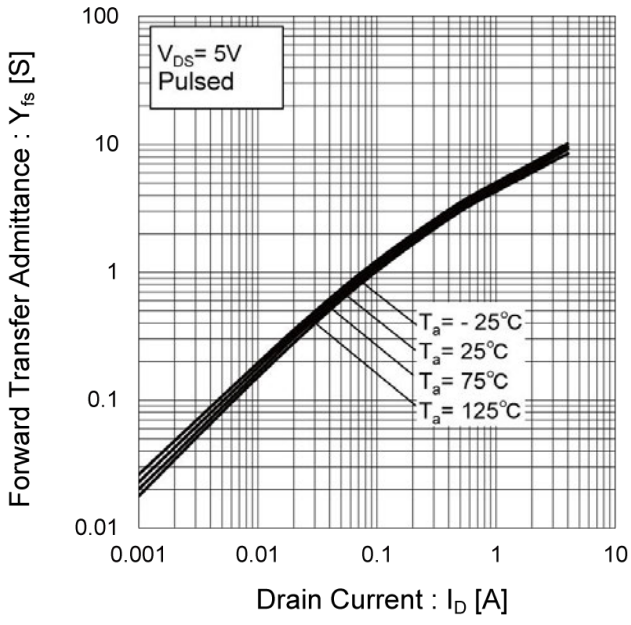


Fig.10 Tranceconductance vs. Drain Current



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Fig.11 Drain Current Derating Curve

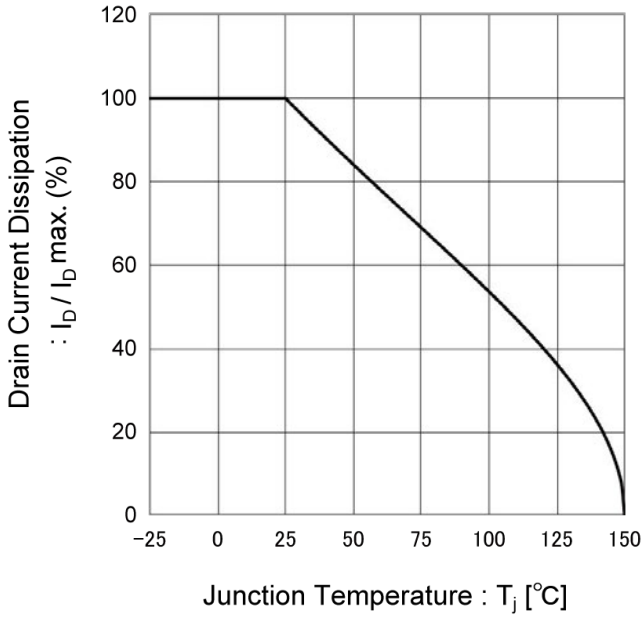


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

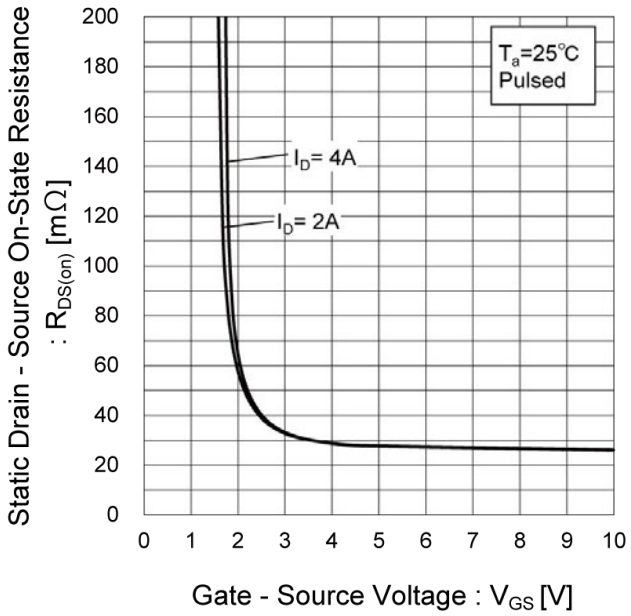
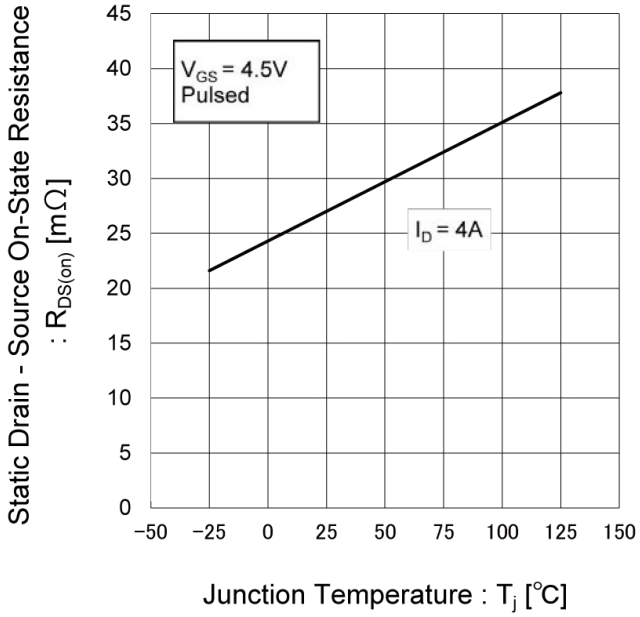


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



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●Electrical characteristic curves

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

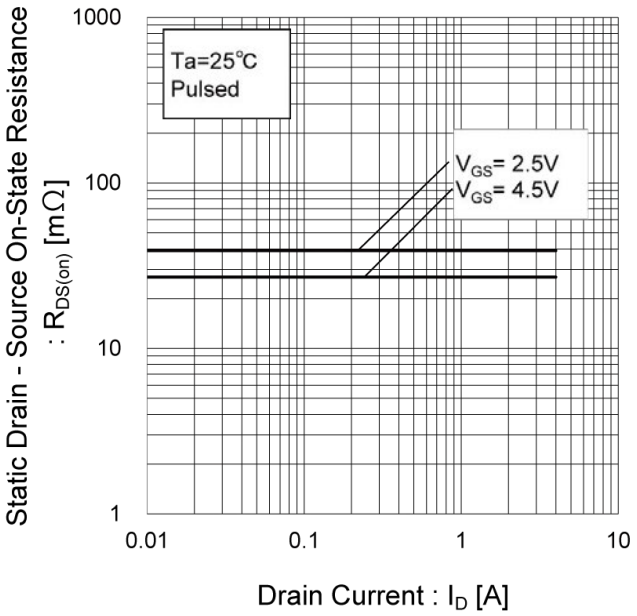


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

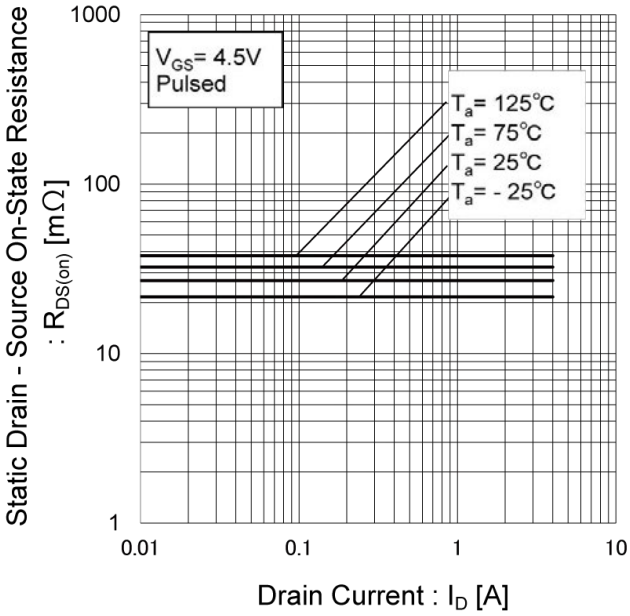
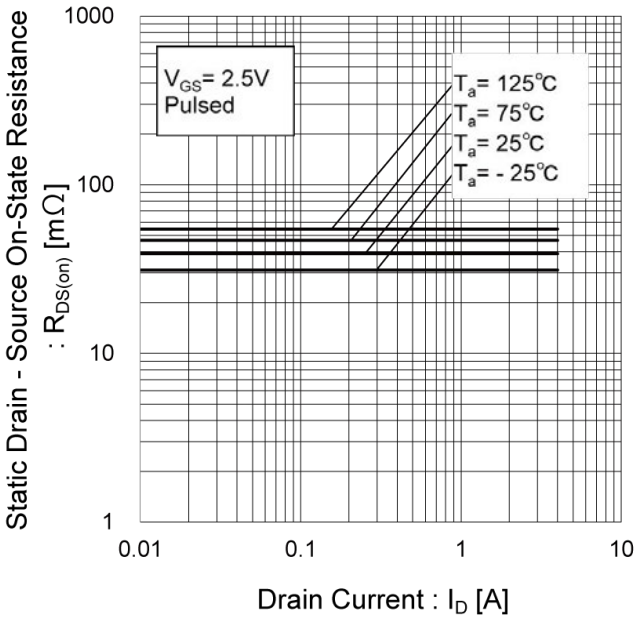


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



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●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

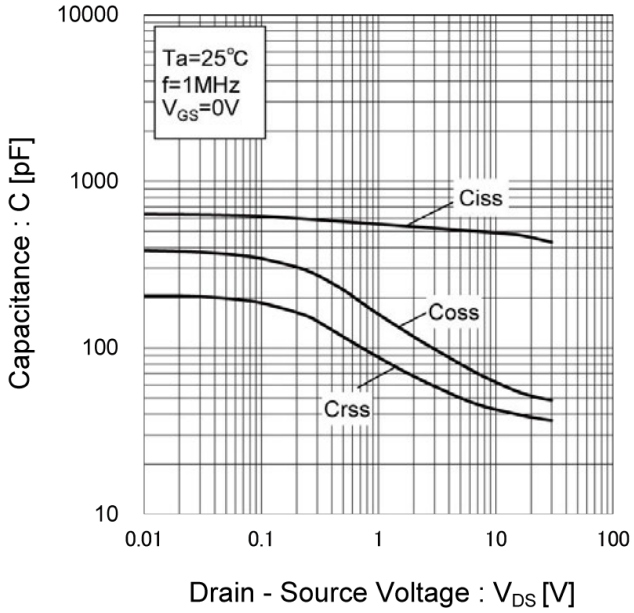


Fig.18 Switching Characteristics

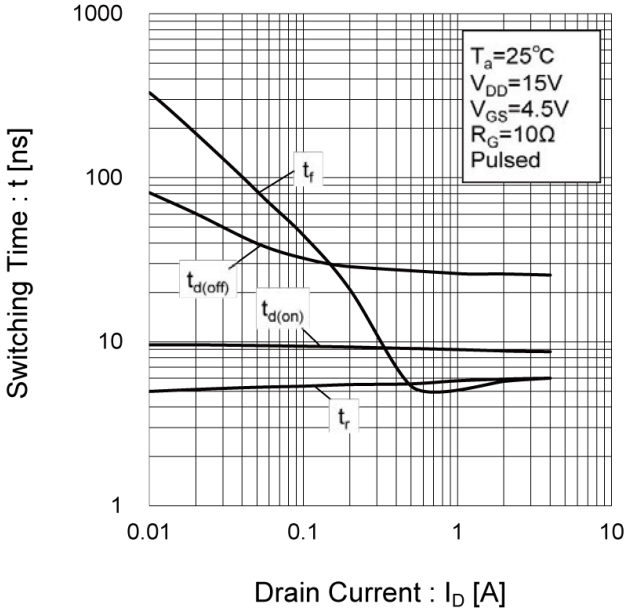


Fig.19 Dynamic Input Characteristics

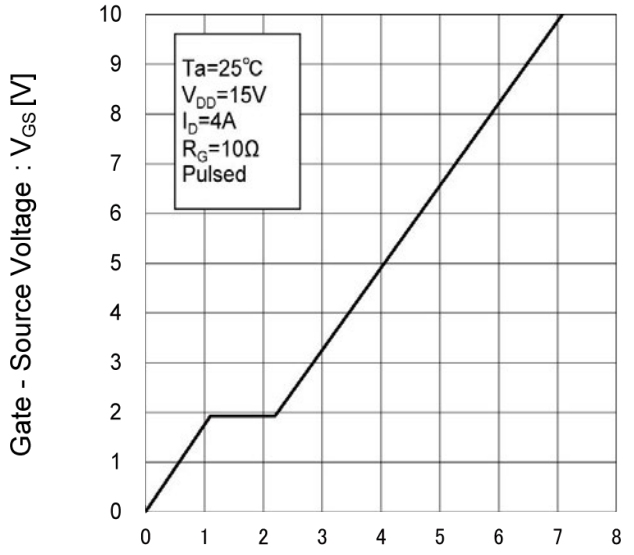
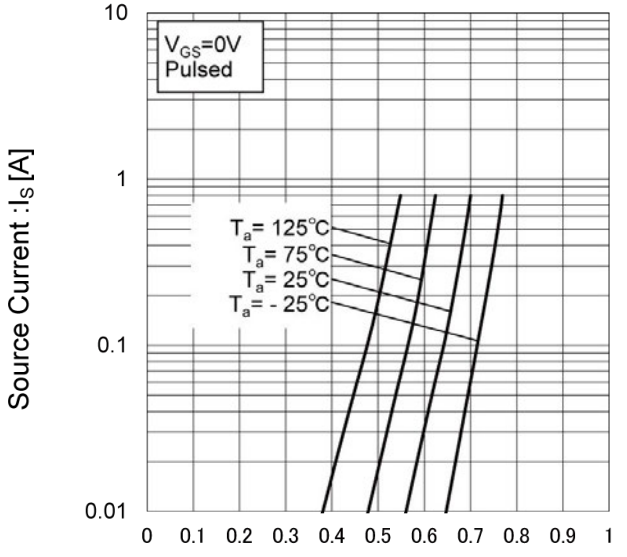


Fig.20 Source Current vs. Source Drain Voltage



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●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

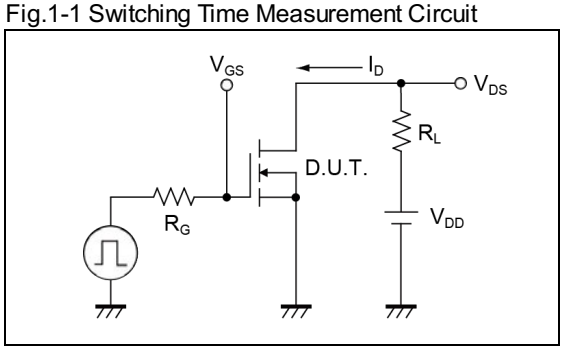


Fig.1-2 Switching Waveforms

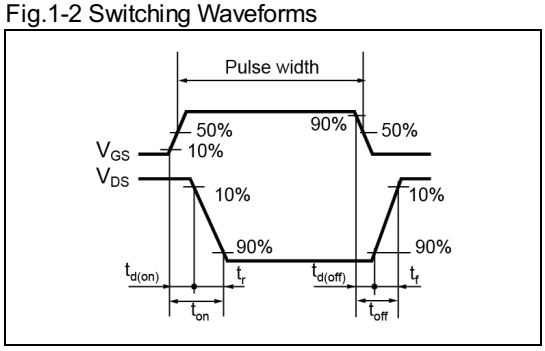


Fig.2-1 Gate Charge Measurement Circuit

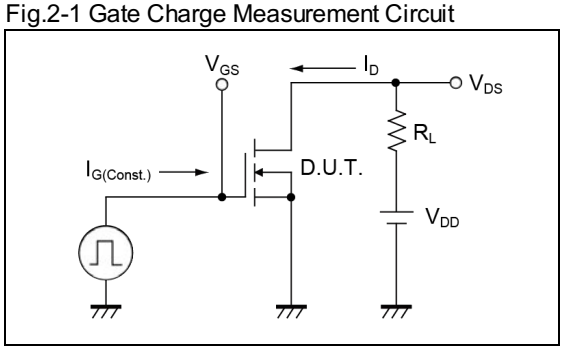


Fig.2-2 Gate Charge Waveform

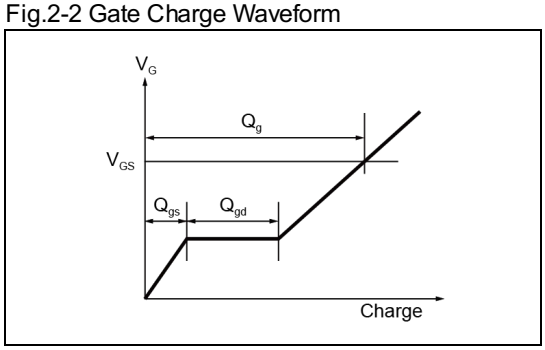


Fig.3-1 Avalanche Measurement Circuit

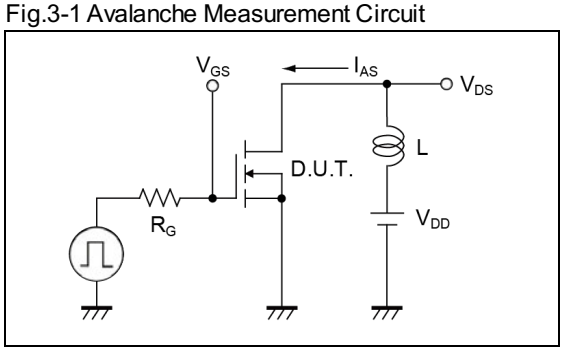
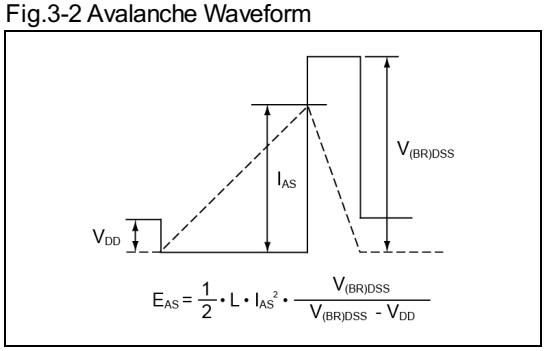


Fig.3-2 Avalanche Waveform



●Notice

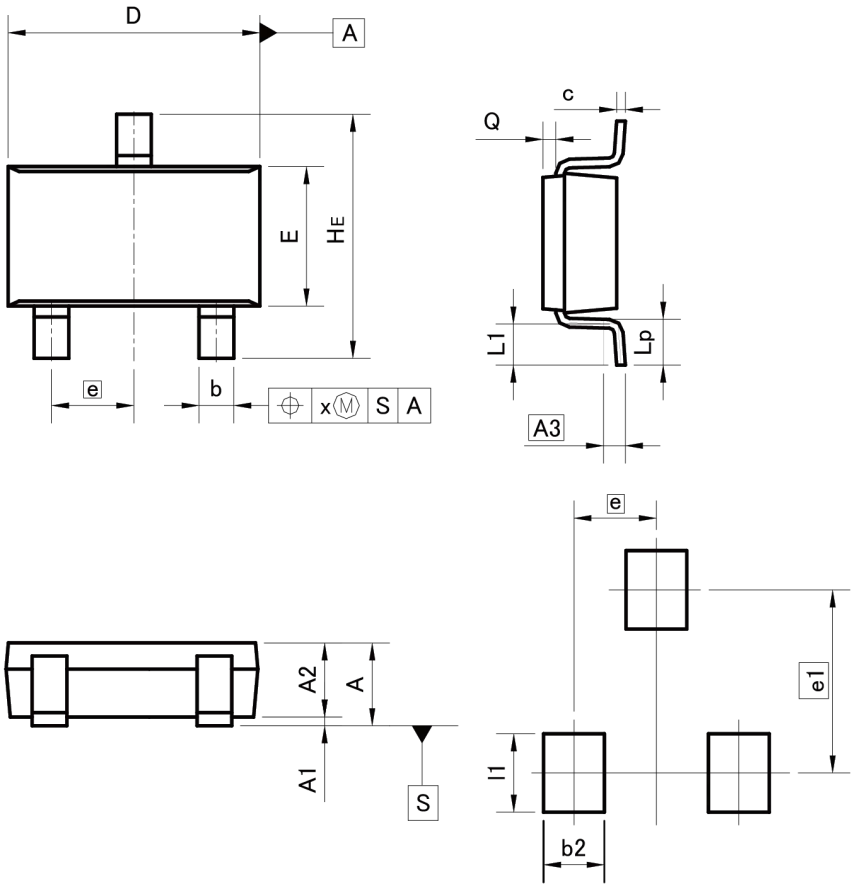
This product might cause chip aging and breakdown under the large electrified environment.
Please consider to design ESD protection circuit.

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●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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