RSQ045N03FRA

Nch 30V 4.5A Power MOSFET

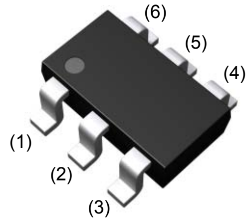
Datasheet

AEC-Q101 Qualified

V_{DSS}	30V
$R_{DS(on)}$ (Max.)	38mΩ
I_D	4.5A
P_D	1.25W

●Outline

TSMT6



●Features

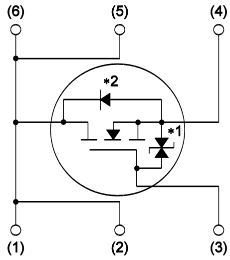
1) Low on - resistance.

2) Built-in G-S Protection Diode.

3) Small Surface Mount Package (TSMT6).

4) Pb-free lead plating ; RoHS compliant

●Inner circuit



(1) Drain
(2) Drain
(3) Gate
(4) Source
(5) Drain
(6) Drain

*1 ESD PROTECTION DIODE
*2 BODY DIODE

●Packaging specifications

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

●Application

DC/DC converters

●Absolute maximum ratings(T_a = 25°C)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	30	V
Continuous drain current	I_D *1	±4.5	A
Pulsed drain current	$I_{D,pulse}$ *2	±18	A
Gate - Source voltage	V_{GSS}	±20	V
Power dissipation	P_D *3	1.25	W
	P_D *4	0.6	W
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	R_{thJA} *3	-	-	100	°C/W
	R_{thJA} *4	-	-	208	°C/W

●Electrical characteristics(T_a = 25°C) ,unless otherwise specified

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	-	26	-	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} = 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	-	–2.8	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}$ *5	V_{GS}=10V, I_D=4.5A	-	27	38	mΩ
		V_{GS}=4.5V, I_D=4.5A	-	36	51	
		V_{GS}=4.0V, I_D=4.5A	-	40	56	
		V_{GS}=10V, I_D=4.5A, T_j=125°C	-	50	70	
Gate input resistannce	R_G	f = 1MHz, open drain	-	6	-	Ω
Transconductance	g_{fs} *5	V_{DS}=10V, I_D=4.5A	3.5	7.0	-	S

*1 Limited only by maximum temperature allowed.

*2 Pw ≤ 10μs, Duty cycle ≤ 1%

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

*4 Mounted on a FR4 (15×20×0.8mm)

*5 Pulsed

●**Electrical characteristics**(T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	520	-	pF
Output capacitance	C_{oss}	V_{DS} = 10V	-	150	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	95	-	
Turn - on delay time	$t_{d(on)}$ *5	$V_{DD} \simeq$ 15V, V_{GS} = 10V	-	12	-	ns
Rise time	t_r *5	I_D = 2.25A	-	19	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 6.67Ω	-	41	-	
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	$V_{DD} \simeq$ 15V, I_D=4.5A V_{GS} = 5V	-	6.8	9.5	nC
		$V_{DD} \simeq$ 15V, I_D=4.5A V_{GS} = 10V	-	13	-	
Gate - Source charge	Q_{gs} *5	$V_{DD} \simeq$ 15V, I_D=4.5A V_{GS} = 5V	-	1.6	-	
Gate - Drain charge	Q_{gd} *5		-	2.3	-	

●**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	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_s = 1.0A	-	-	1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

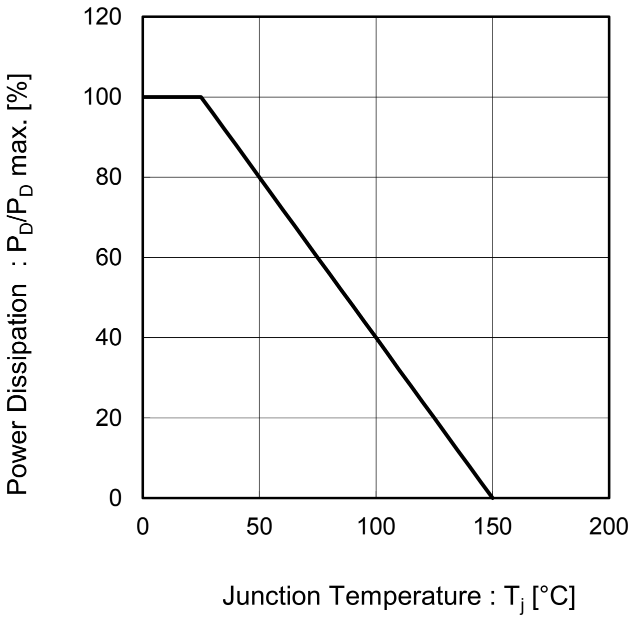


Fig.2 Maximum Safe Operating Area

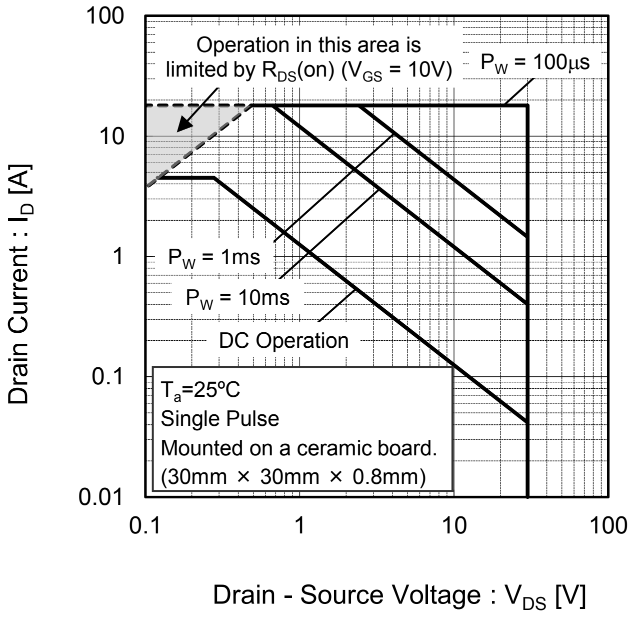


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

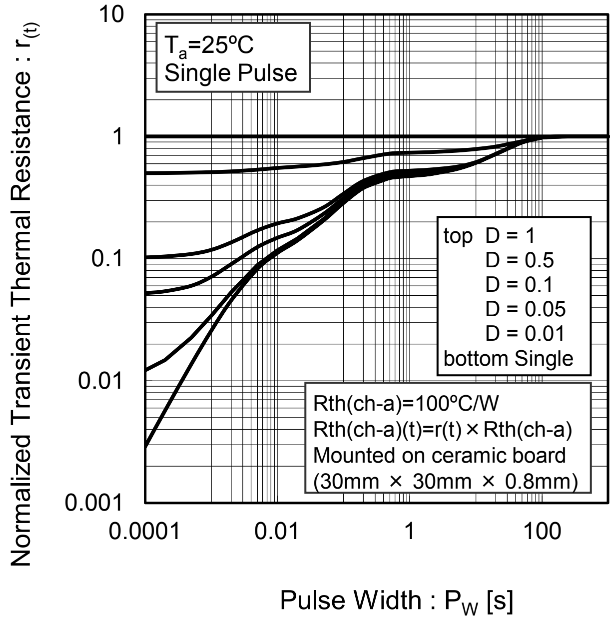
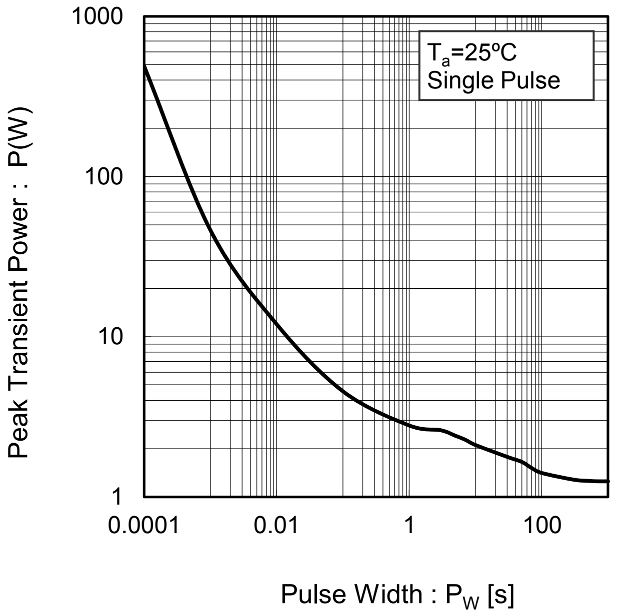


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

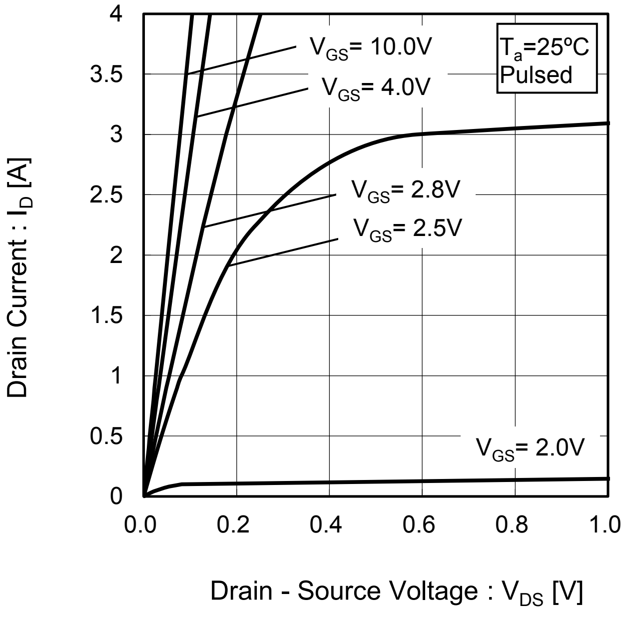


Fig.6 Typical Output Characteristics(II)

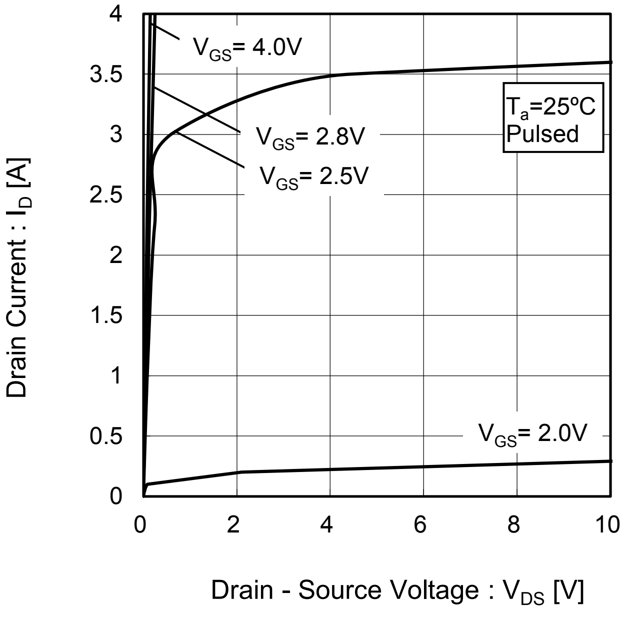


Fig.7 Breakdown Voltage vs. Junction Temperature

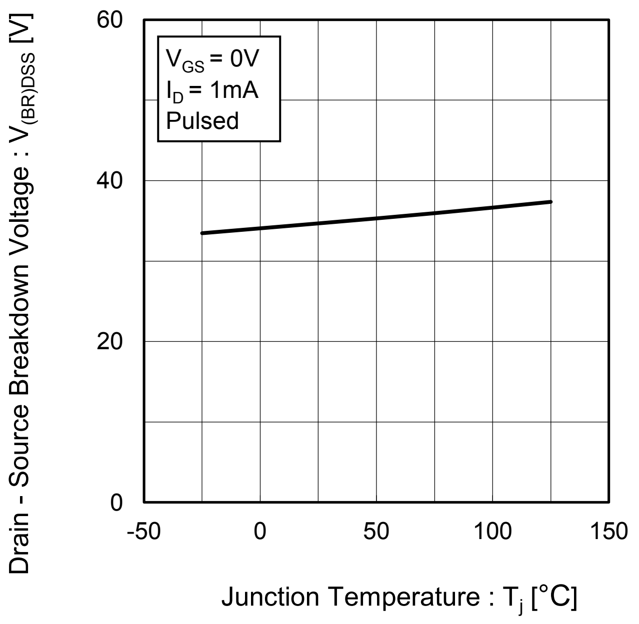
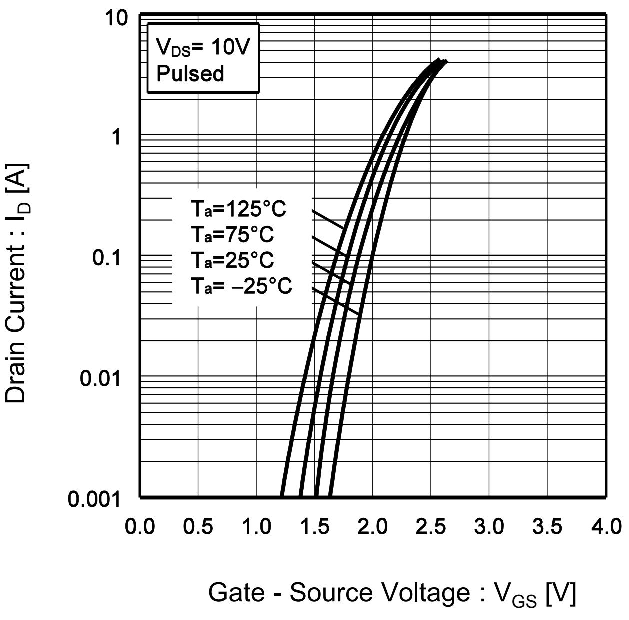


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage
vs. Junction Temperature

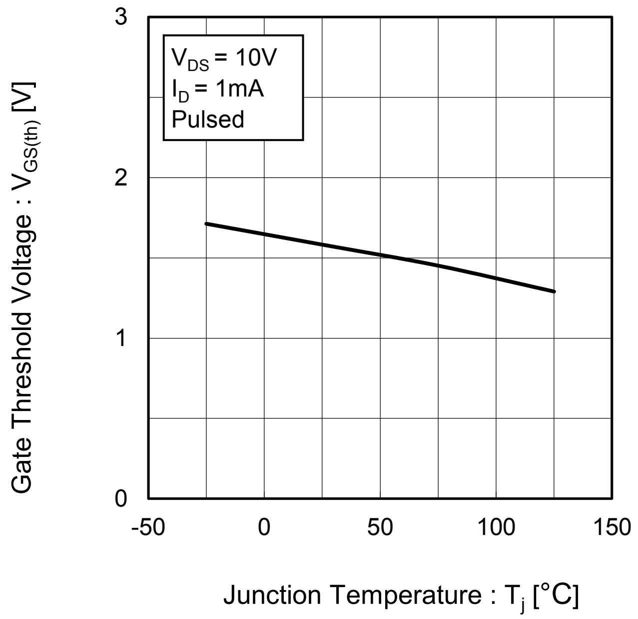


Fig.10 Transconductance vs. Drain Current

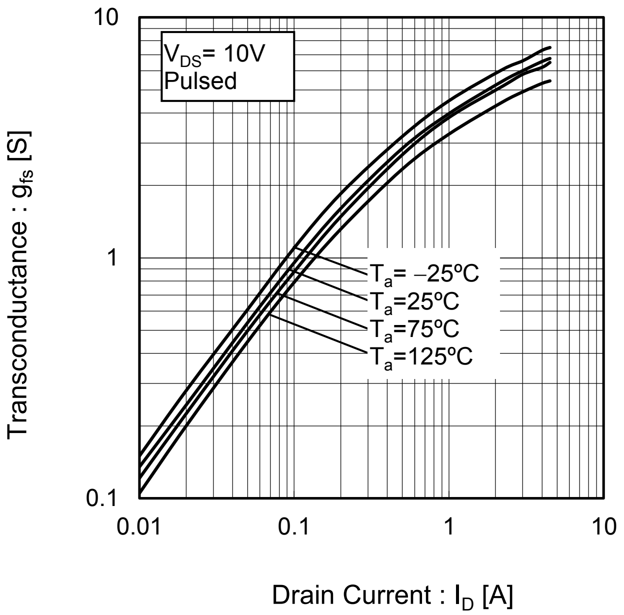


Fig.11 Drain CurrentDerating Curve

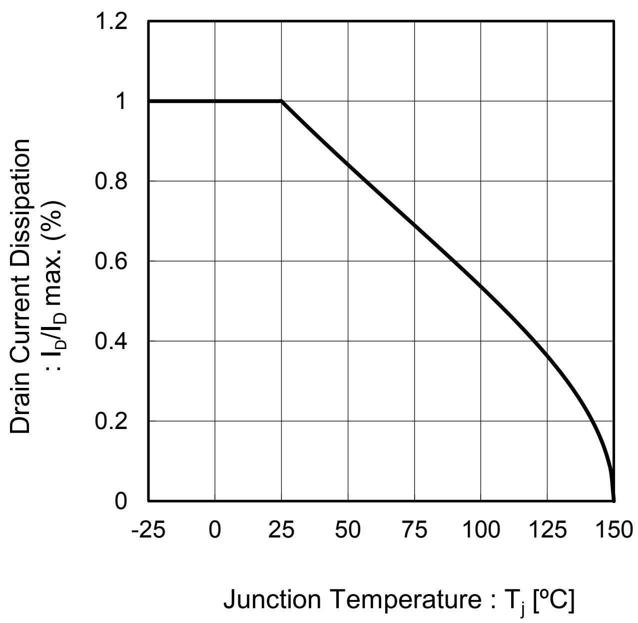
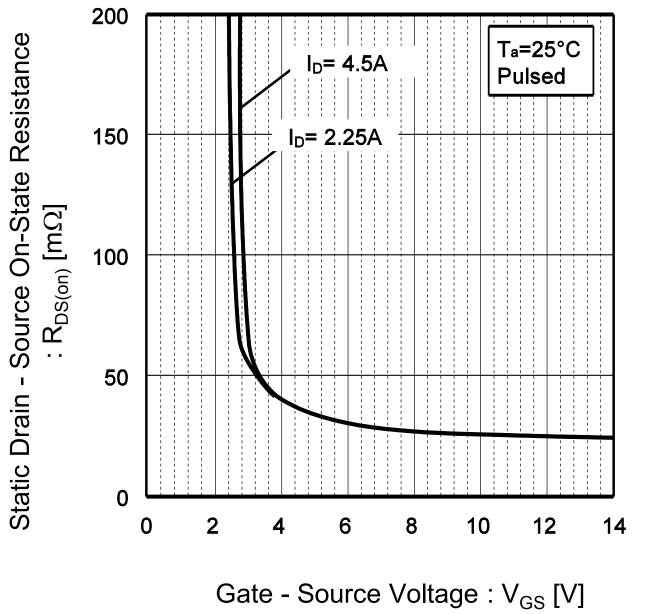


Fig.12 Static Drain - Source On - State
Resistance vs. Gate Source Voltage



●Electrical characteristic curves

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

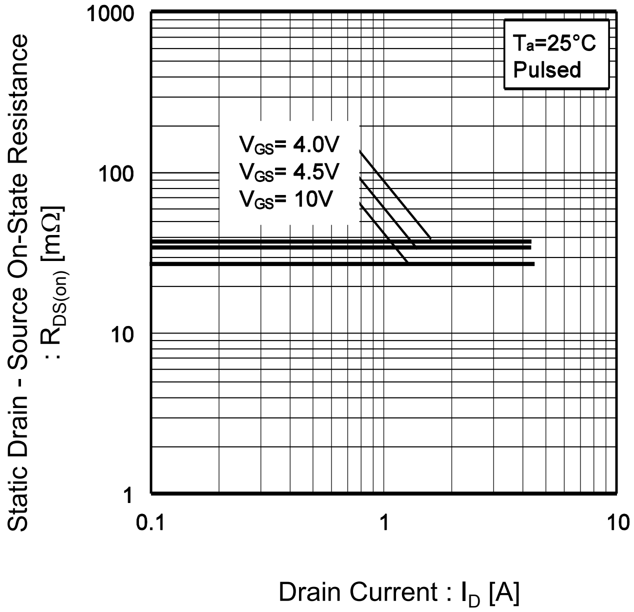


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature

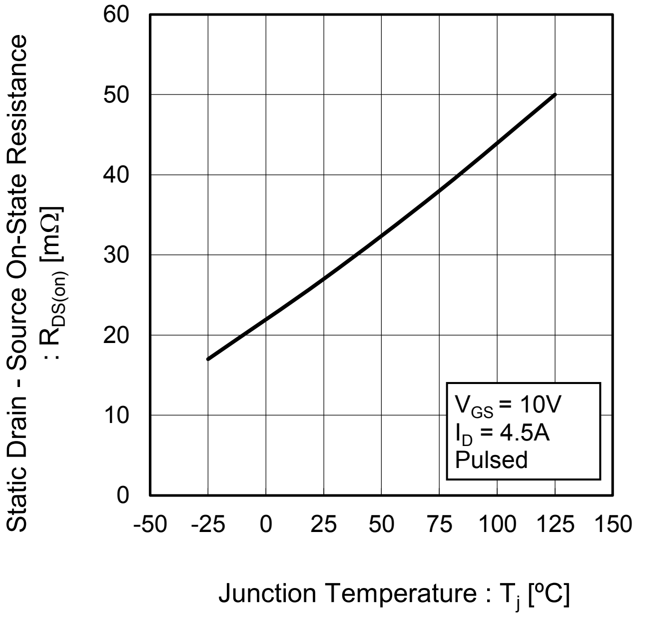


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

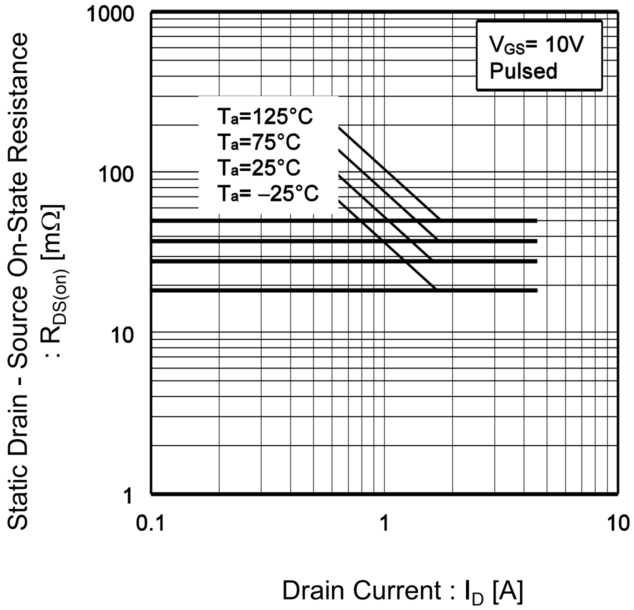
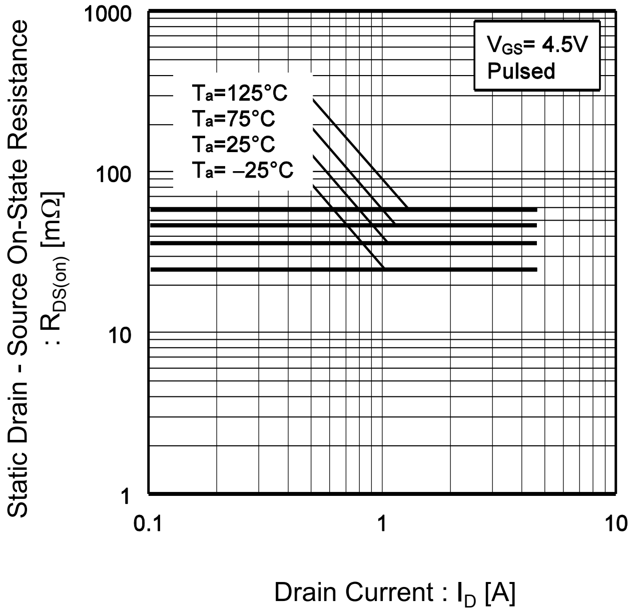


Fig.16 Static Drain-Source On-State Resistance vs. Drain Current(III)



●Electrical characteristic curves

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

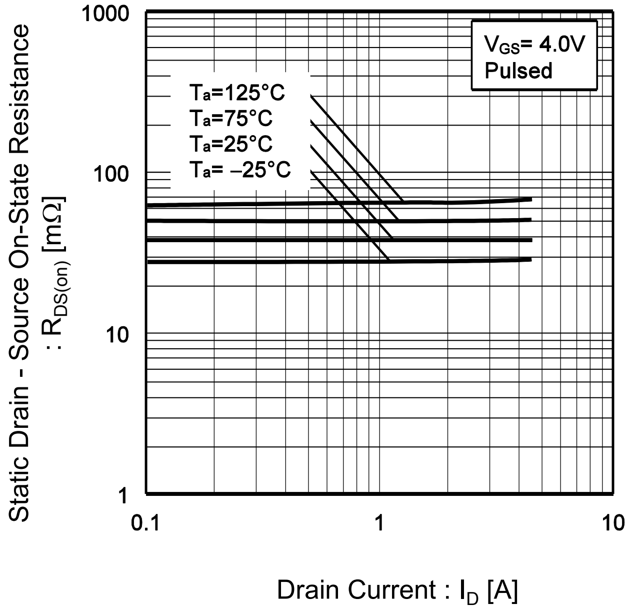


Fig.18 Typical Capacitance vs. Drain - Source Voltage

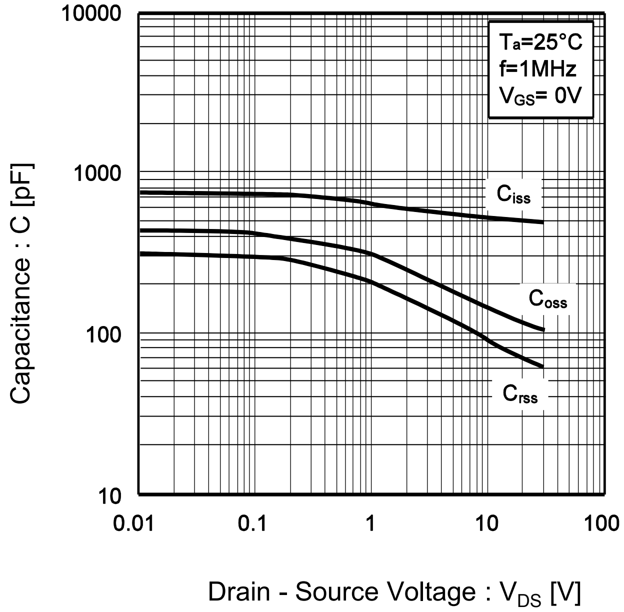


Fig.19 Switching Characteristics

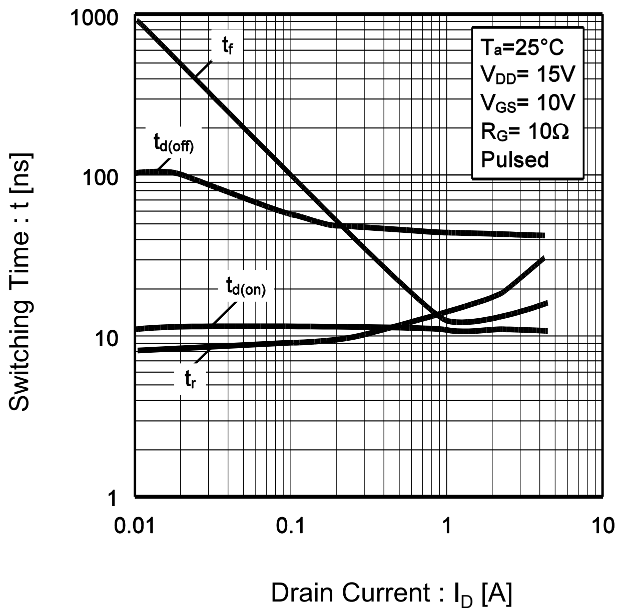
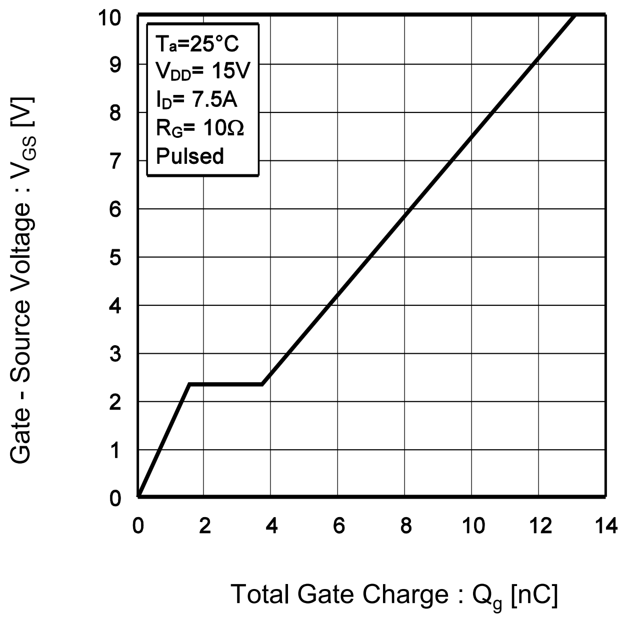
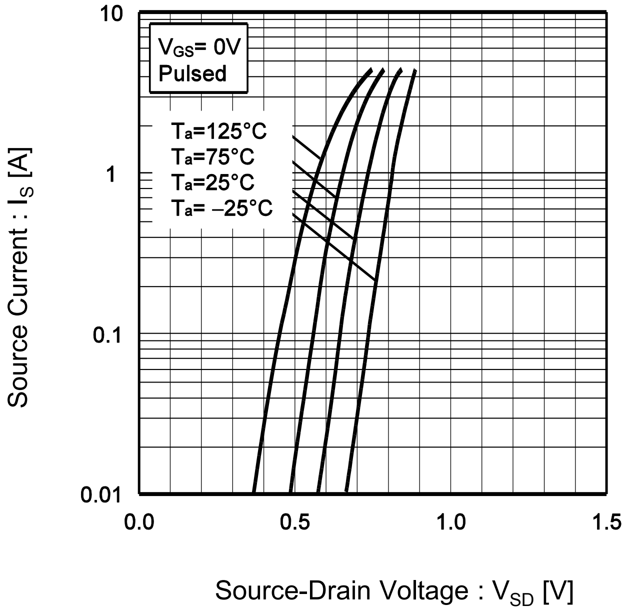


Fig.20 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.21 Source Current
vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

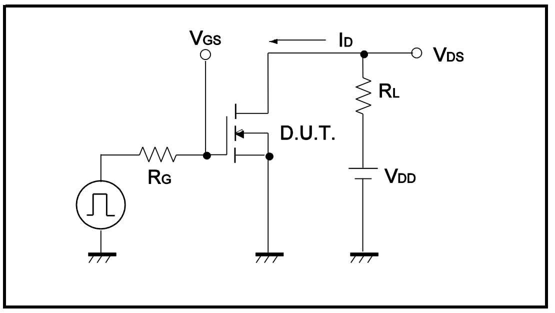


Fig.1-2 Switching Waveforms

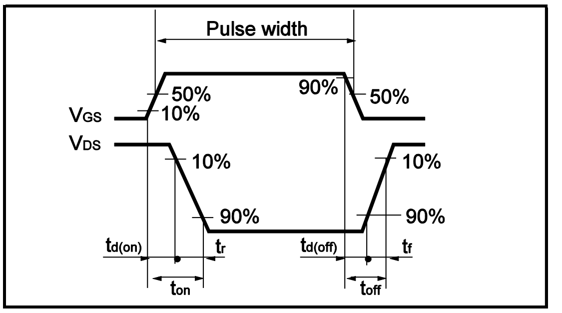


Fig.2-1 Gate Charge Measurement Circuit

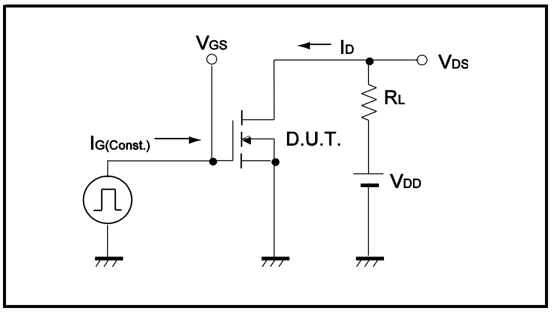
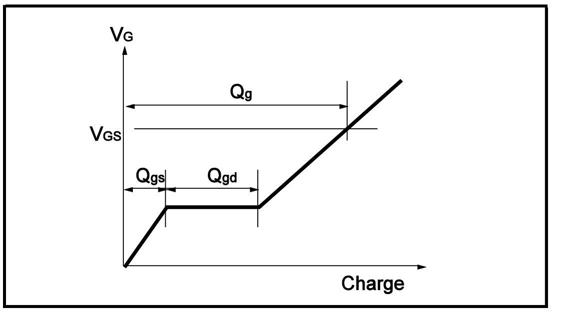
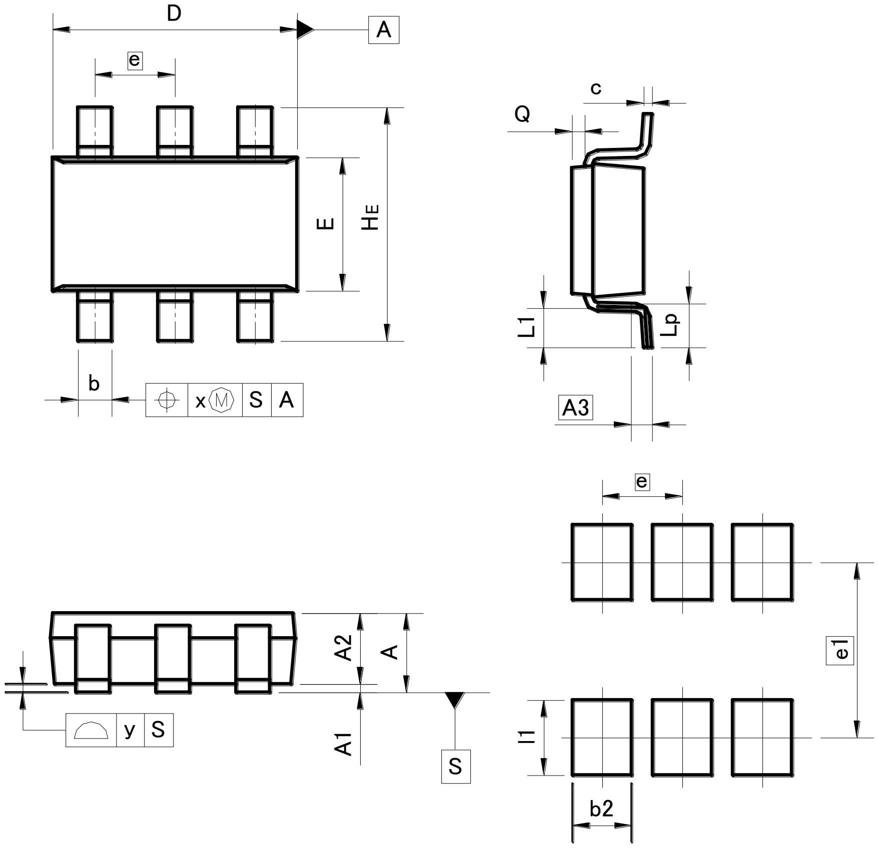


Fig.2-2 Gate Charge Waveform



●Dimensions (Unit : mm)

TSMT6



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
y	–	0.10	–	0.004

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

Notice

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1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

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JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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QR code printed on ROHM Products label is for ROHM's internal use only.

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