RT1E040RP

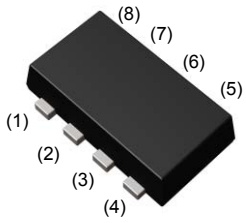
Pch -30V -4A Power MOSFET

Datasheet

V_{DSS}	−30V
$R_{DS(on)}$ (Max.)	45mΩ
I_D	−4A
P_D	1.25W

●Outline

TSST8



●Features

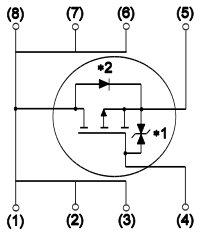
1) Low on - resistance.

2) Built-in G-S Protection Diode.

3) Small Surface Mount Package (TSST8).

4) Pb-free lead plating ; RoHS compliant

●Inner circuit



(1) Drain (5) Source
(2) Drain (6) Drain
(3) Drain (7) Drain
(4) Gate (8) Drain

∗1 ESD PROTECTION DIODE
∗2 BODY DIODE

●Application

DC/DC converters

●Packaging specifications

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

●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	A
Pulsed drain current	$I_{D,pulse}$ *2	±16	A
Gate - Source voltage	V_{GSS}	±20	V
Power dissipation	P_D *3	1.25	W
	P_D *4	0.55	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	-	-	227	°C/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°C	-	−25	-	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	-	−2.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{(GS)th}}{\Delta T_j}$	I_D= −1mA referenced to 25°C	-	3.9	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}$ *5	V_{GS}= −10V, I_D= −4A	-	32	45	mΩ
		V_{GS}= −4.5V, I_D= −2A	-	45	63	
		V_{GS}= −4.0V, I_D= −2A	-	52	72	
		V_{GS}= −10V, I_D= −4A, T_j=125°C	-	47	66	
Gate input resistannce	R_G	f = 1MHz, open drain	-	13	-	Ω
Transconductance	g_{fs} *5	V_{DS}= −10V, I_D= −4A	2.7	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 (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	-	150	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	130	-	
Turn - on delay time	$t_{d(on)}$ *5	$V_{DD} \simeq$ −15V, V_{GS} = −10V	-	15	-	ns
Rise time	t_r *5	I_D = −2A	-	30	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 7.5Ω	-	85	-	
Fall time	t_f *5	R_G = 10Ω	-	45	-	

●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= −9A V_{GS} = −5V	-	10.5	-	nC
		$V_{DD} \simeq$ −15V, I_D= −4A V_{GS} = −10V	-	20	-	
Gate - Source charge	Q_{gs} *5	$V_{DD} \simeq$ −15V, I_D= −4A V_{GS} = −5V	-	3.0	-	
Gate - Drain charge	Q_{gd} *5		-	3.3	-	

●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 = −4A	-	-	−1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

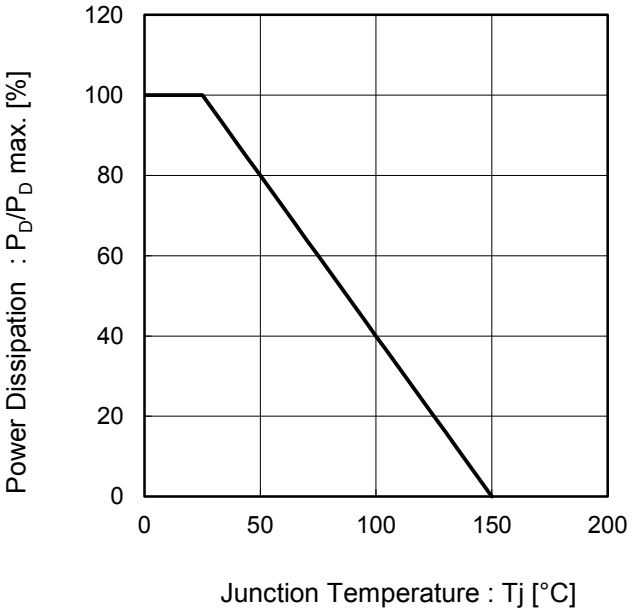


Fig.2 Maximum Safe Operating Area

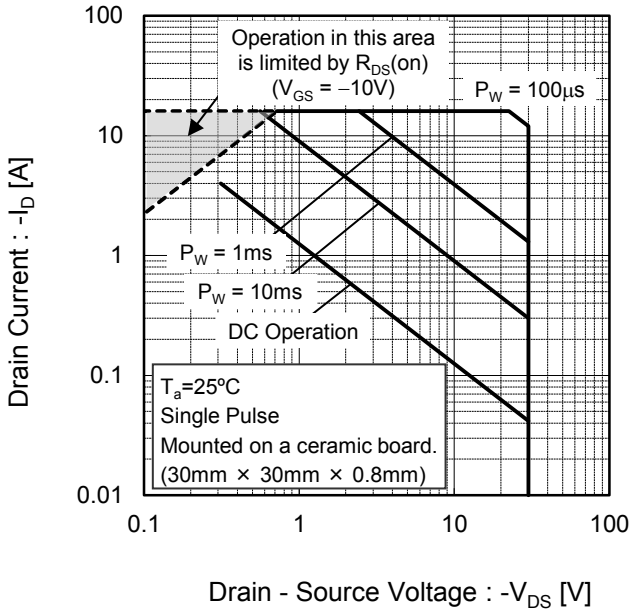


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

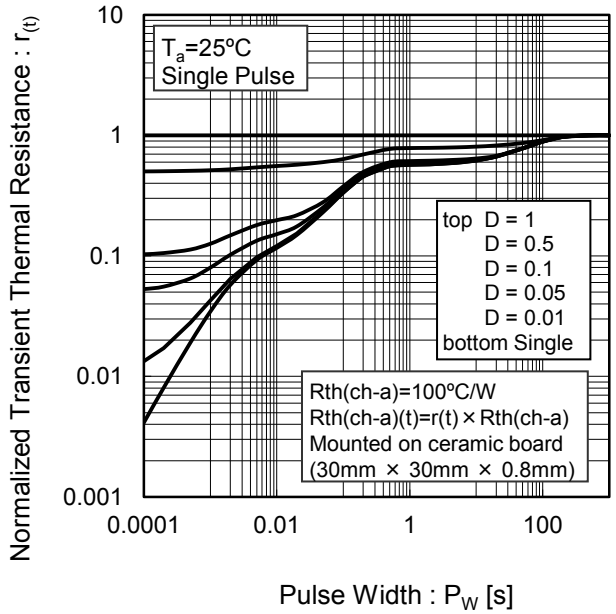
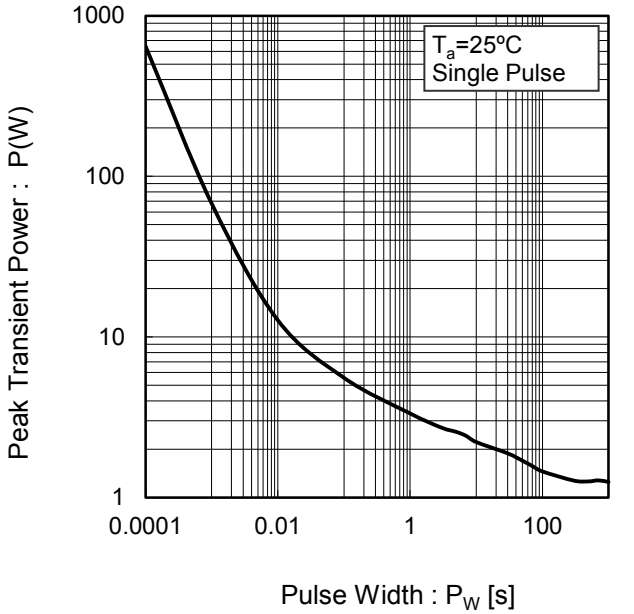


Fig.4 Single Pulse Maxmum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

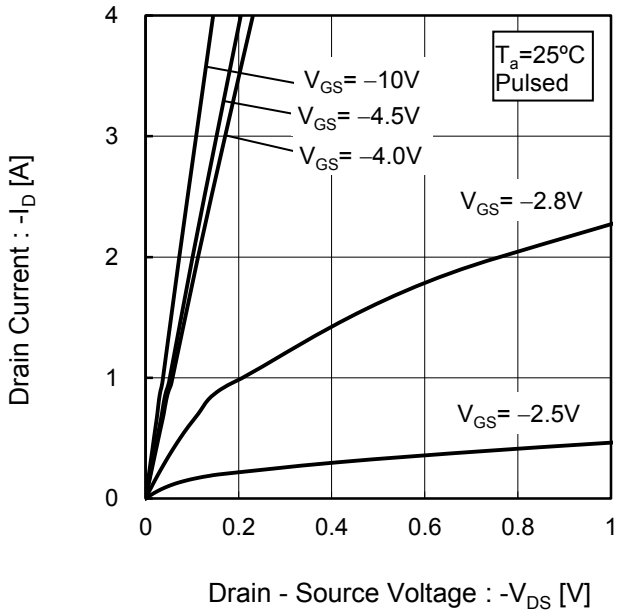


Fig.6 Typical Output Characteristics(II)

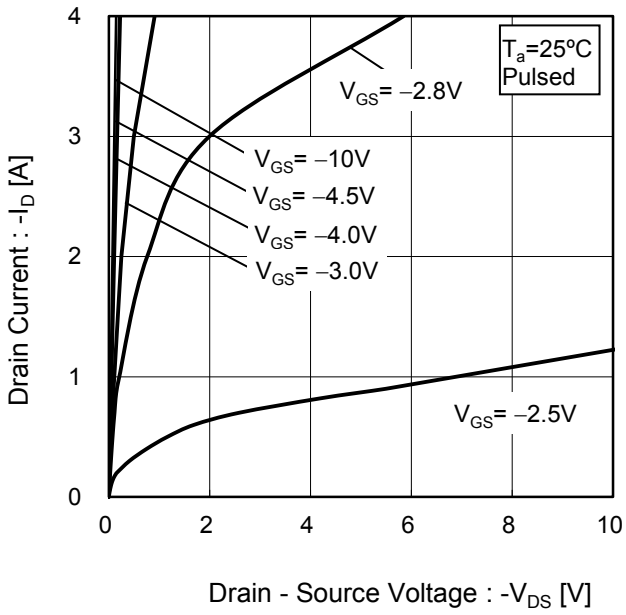


Fig.7 Breakdown Voltage vs. Junction Temperature

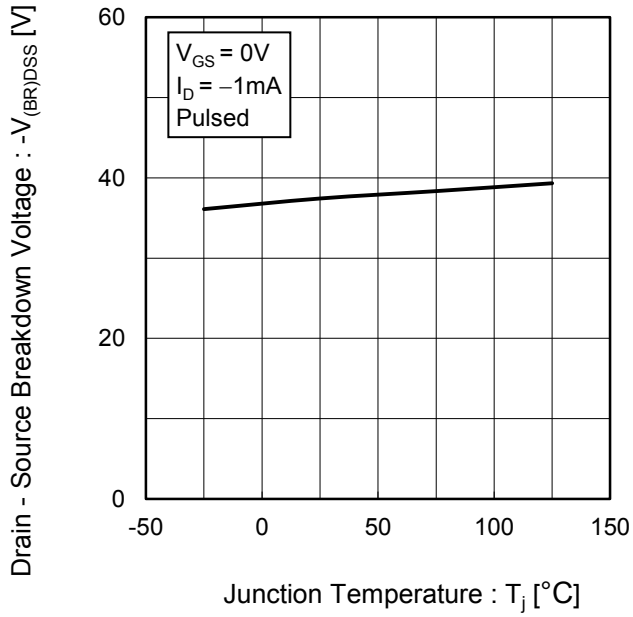
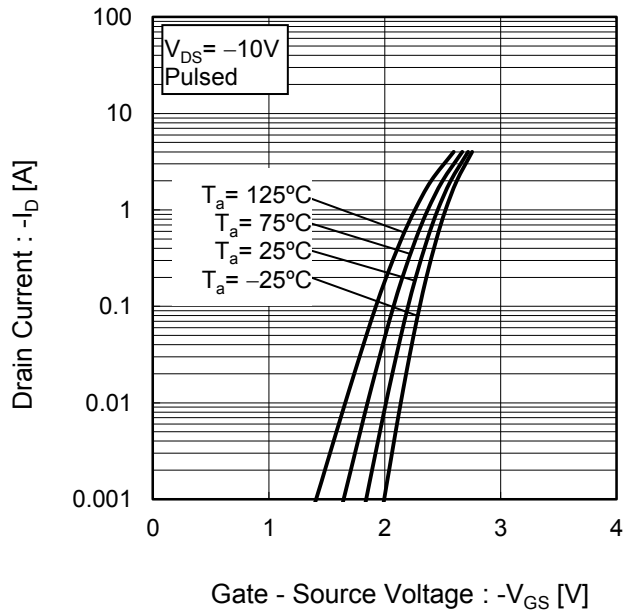


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage vs. Junction Temperature

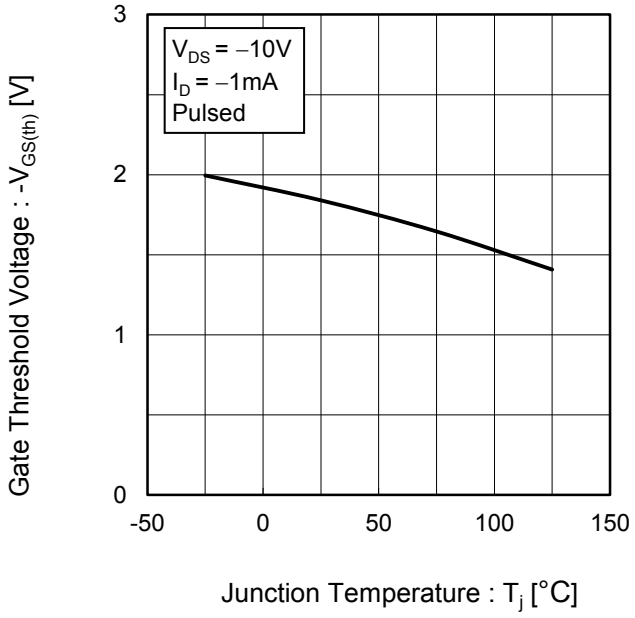


Fig.10 Transconductance vs. Drain Current

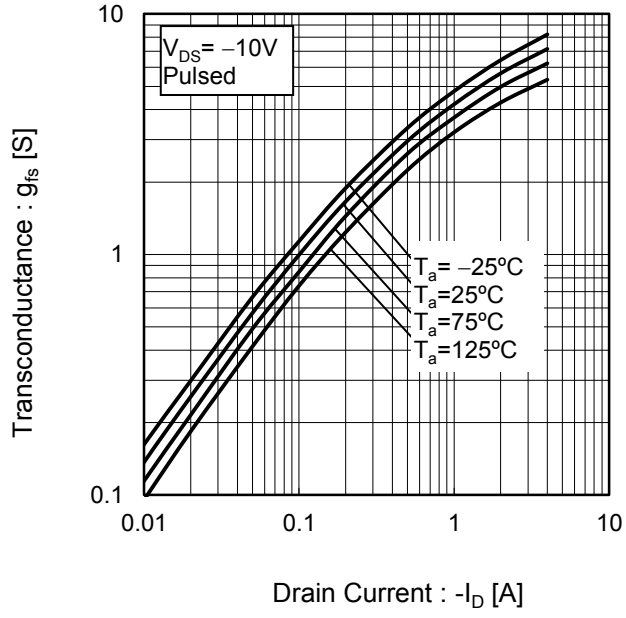


Fig.11 Drain CurrentDerating Curve

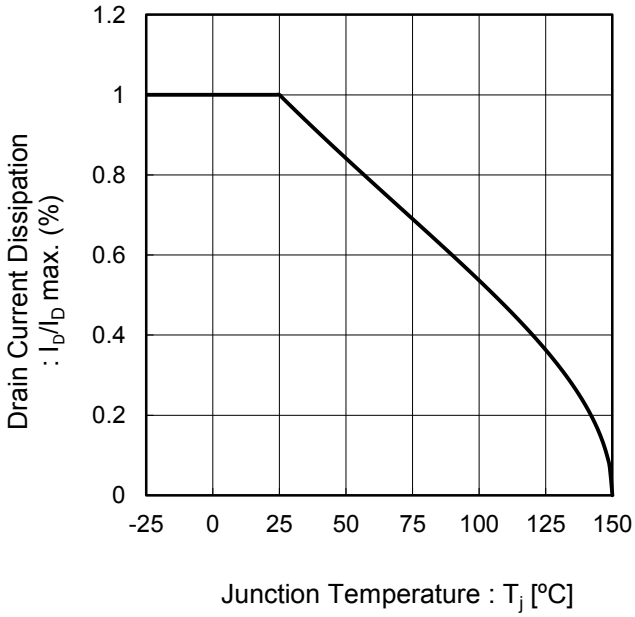
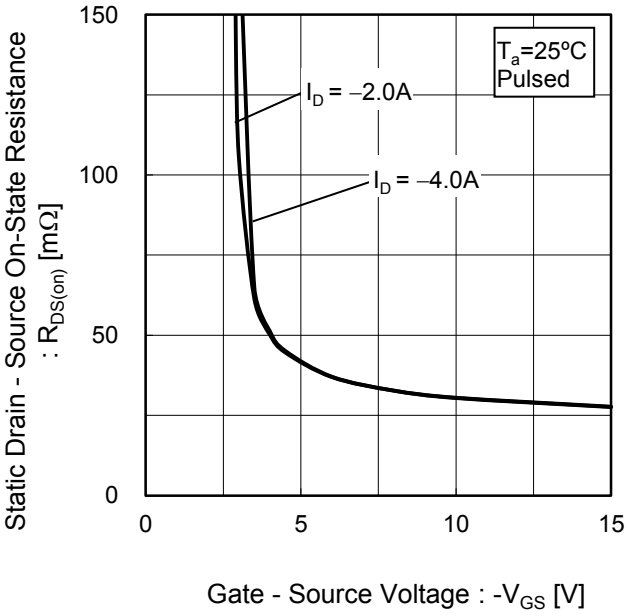


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



●Electrical characteristic curves

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

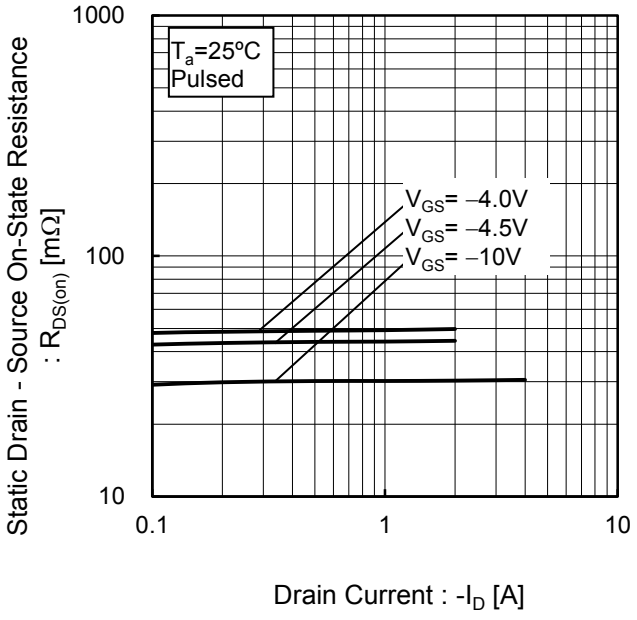


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature

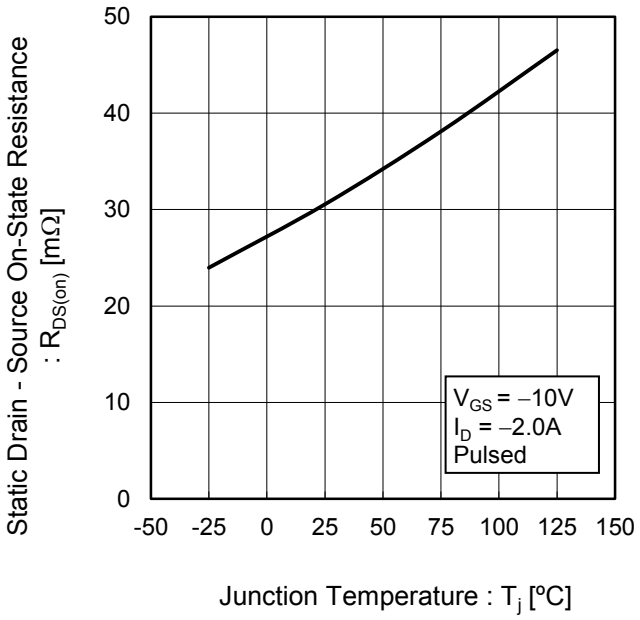


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

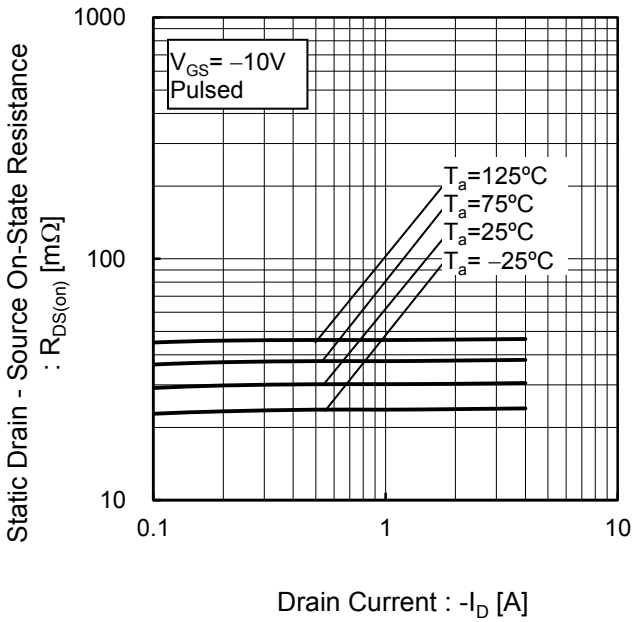
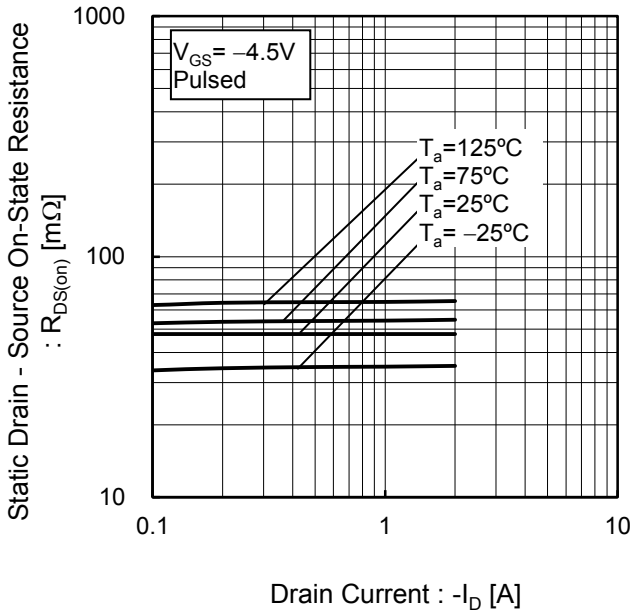


Fig.16 Static Drain-Source On-State Resistance vs. Drain Current(III)



●Electrical characteristic curves

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

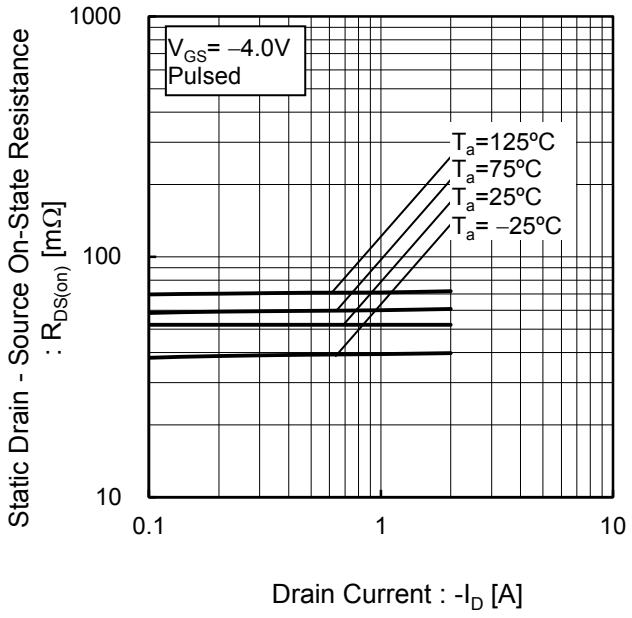


Fig.18 Typical Capacitance vs. Drain - Source Voltage

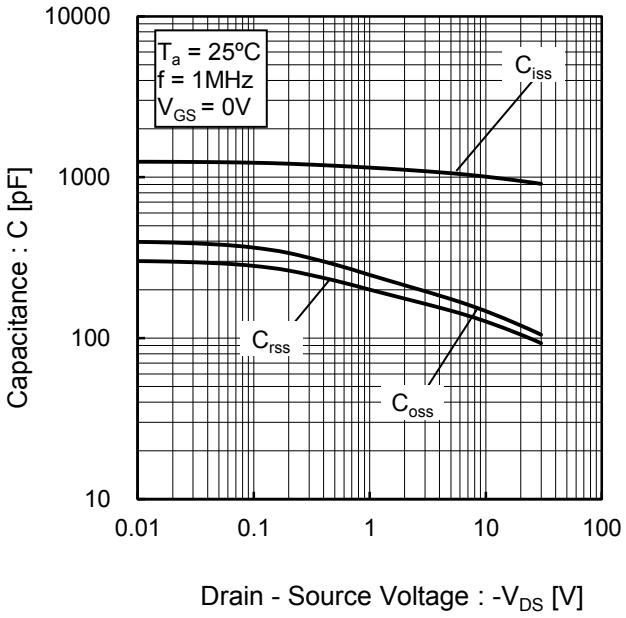


Fig.19 Switching Characteristics

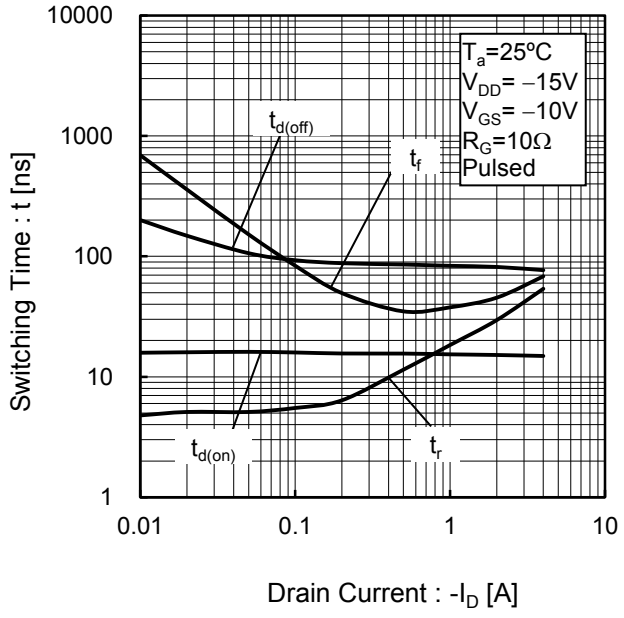
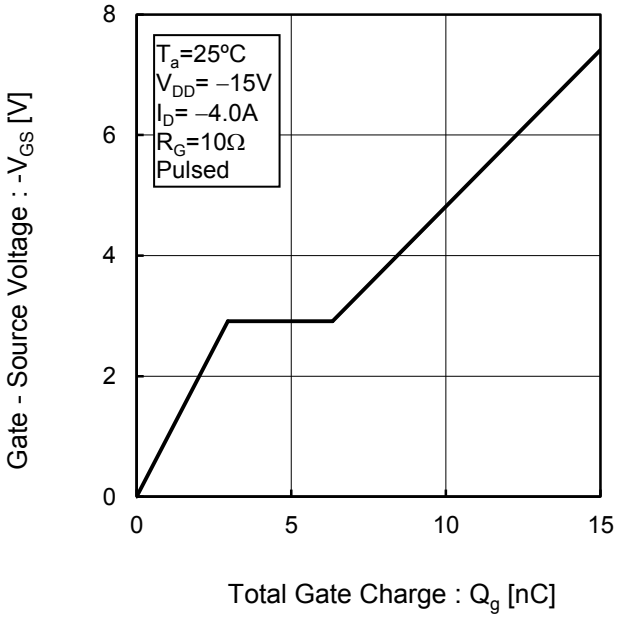
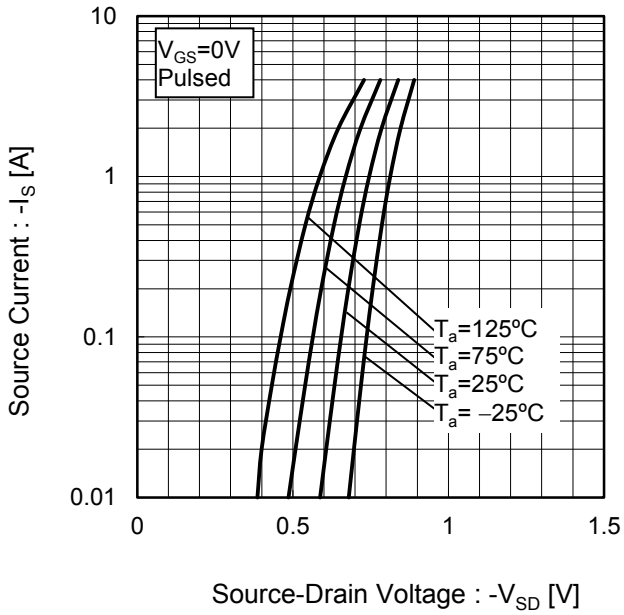


Fig.20 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.21 Source Current
vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

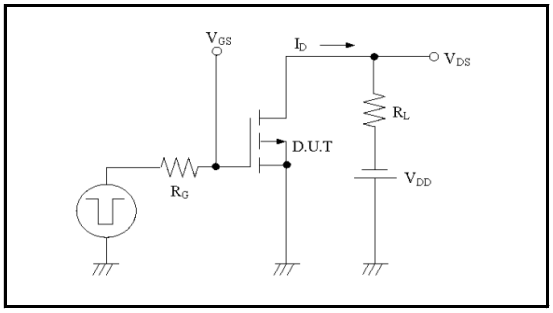


Fig.1-2 Switching Waveforms

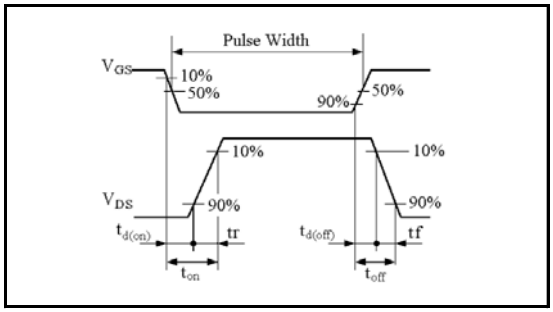


Fig.2-1 Gate Charge Measurement Circuit

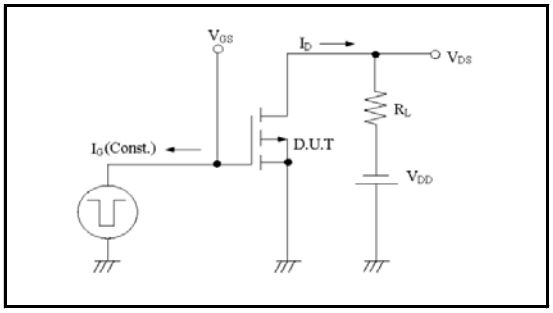
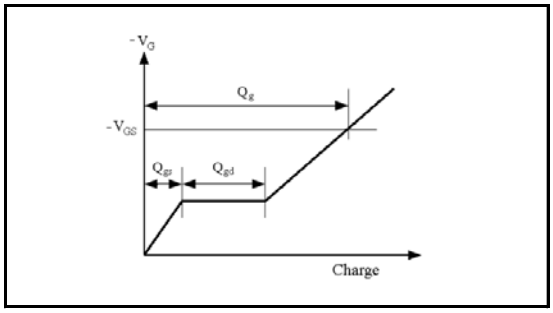
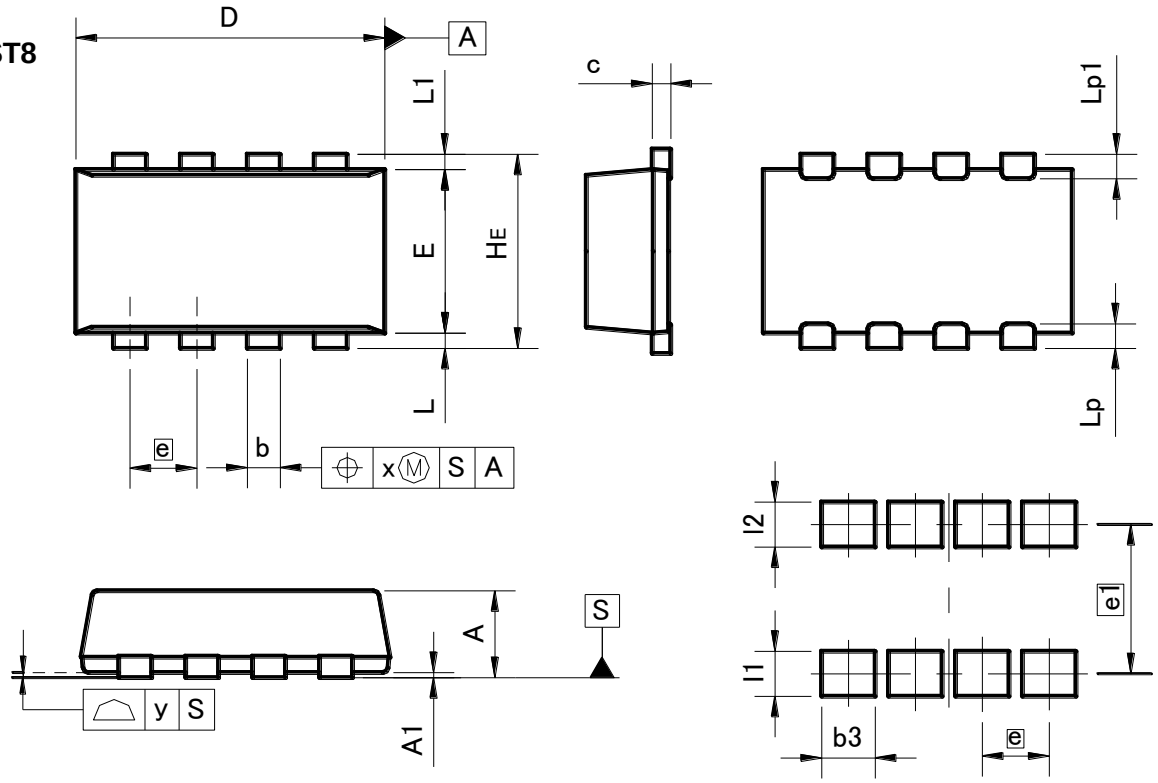


Fig.2-2 Gate Charge Waveform



●**Dimensions** (Unit : mm)

TSST8



Patterm of terminal position areas

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.75	0.85	0.03	0.033
A1	0.00	0.05	0	0.002
b	0.22	0.42	0.009	0.017
c	0.12	0.22	0.005	0.009
D	2.90	3.10	0.114	0.122
E	1.50	1.70	0.059	0.067
e	0.65		0.03	
HE	1.80	2.00	0.071	0.079
L	0.05	0.25	0.002	0.01
L1	0.05	0.25	0.002	0.01
Lp	0.15	0.34	0.006	0.013
Lp1	0.15	0.34	0.006	0.013
x	−	0.10	−	0.004
y	−	0.10	−	0.004

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
e1	1.46		0.06	
b3	−	0.52	−	0.02
l1	−	0.44	−	0.017
l2	−	0.44	−	0.017

Dimension in mm/inches

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