

$V_{DSS}$	250V
$R_{DS(on)}$ (Max.)	8.8Ω
$I_D$	0.5A
$P_D$	1.0W

#### ●Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Drive circuits can be simple.
- 4) Parallel use is easy.
- 5) Pb-free lead plating ; RoHS compliant

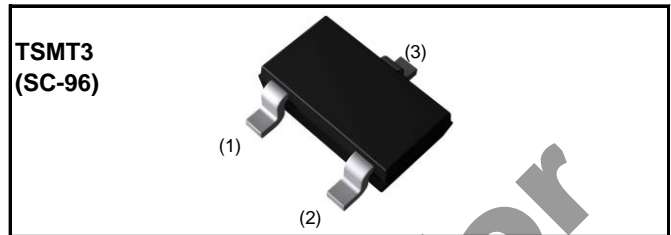
#### ●Application

Switching Power Supply  
 Automotive Motor Drive  
 Automotive Solenoid Drive

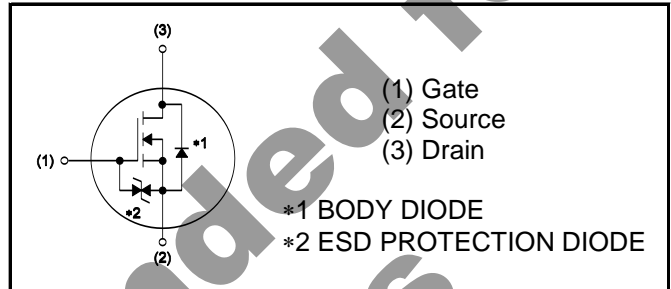
#### ●Absolute maximum ratings ( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Value	Unit	
Drain - Source voltage	$V_{DSS}$	250	V	
Continuous drain current	$T_c = 25^\circ\text{C}$	$I_D^{*1}$	±0.5	A
	$T_c = 100^\circ\text{C}$	$I_D^{*1}$	±0.27	A
Pulsed drain current	$I_{D,pulse}^{*2}$	±2.0	A	
Gate - Source voltage	$V_{GSS}$	±20	V	
Power dissipation	$P_D^{*3}$	1.0	W	
	$P_D^{*4}$	0.54	W	
Junction temperature	$T_j$	150	°C	
Range of storage temperature	$T_{stg}$	-55 to +150	°C	

#### ●Outline



#### ●Inner circuit



#### ●Packaging specifications

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

## ● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	$R_{thJA}^{*3}$	-	-	125	°C/W
	$R_{thJA}^{*4}$	-	-	232	°C/W

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	250	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 250V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	-	25	$\mu\text{A}$
		$V_{DS} = 250V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 10$	$\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	1.0	-	3.0	V
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 10V, I_D = 0.25A$	-	6.8	8.8	$\Omega$
		$V_{GS} = 4.5V, I_D = 0.25A$	-	7.2	9.4	
		$V_{GS} = 4V, I_D = 0.25A$	-	7.4	9.6	
		$V_{GS} = 10V, I_D = 0.25A$ $T_j = 125^\circ\text{C}$	-	12.8	18.0	
Forward transfer admittance	$g_{fs}$	$V_{DS} = 10V, I_D = 0.25A$	0.21	0.42	-	S

**●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	-	70	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 25V	-	10	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	3	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*5</sup>	V <sub>DD</sub> ≈ 125V, V <sub>GS</sub> = 10V	-	6	-	ns
Rise time	t <sub>r</sub> <sup>*5</sup>	I <sub>D</sub> = 0.25A	-	10	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*5</sup>	R <sub>L</sub> = 500Ω	-	21	-	
Fall time	t <sub>f</sub> <sup>*5</sup>	R <sub>G</sub> = 10Ω	-	90	-	

**●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>*5</sup>	V <sub>DD</sub> ≈ 125V	-	3.5	-	nC
Gate - Source charge	Q <sub>gs</sub> <sup>*5</sup>	I <sub>D</sub> = 0.5A	-	0.55	-	
Gate - Drain charge	Q <sub>gd</sub> <sup>*5</sup>	V <sub>GS</sub> = 10V	-	1.0	-	
Gate plateau voltage	V <sub>(plateau)</sub>	V <sub>DD</sub> ≈ 125V, I <sub>D</sub> = 0.5A	-	3.0	-	V

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous source current	I <sub>s</sub> <sup>*1</sup>	T <sub>c</sub> = 25°C	-	-	0.5	A
Pulsed source current	I <sub>SM</sub> <sup>*2</sup>		-	-	2.0	A
Forward voltage	V <sub>SD</sub> <sup>*5</sup>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 0.5A	-	-	1.2	V
Reverse recovery time	t <sub>rr</sub> <sup>*5</sup>	I <sub>S</sub> = 0.25A	-	60	-	ns
Reverse recovery charge	Q <sub>rr</sub> <sup>*5</sup>	di/dt = 100A/μs	-	60	-	nC

\*1 Limited only by maximum temperature allowed.

\*2 P<sub>w</sub> ≤ 10μs, Duty cycle ≤ 1%

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

\*4 Mounted on a FR4 (12×20×0.8mm)

\*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

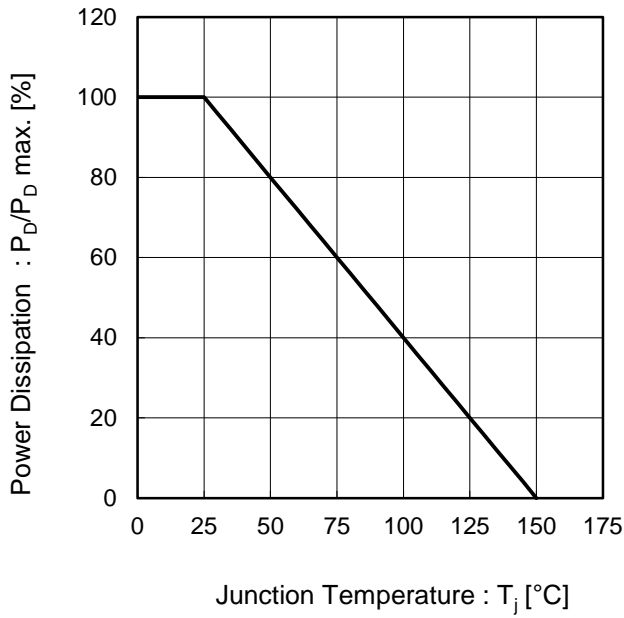
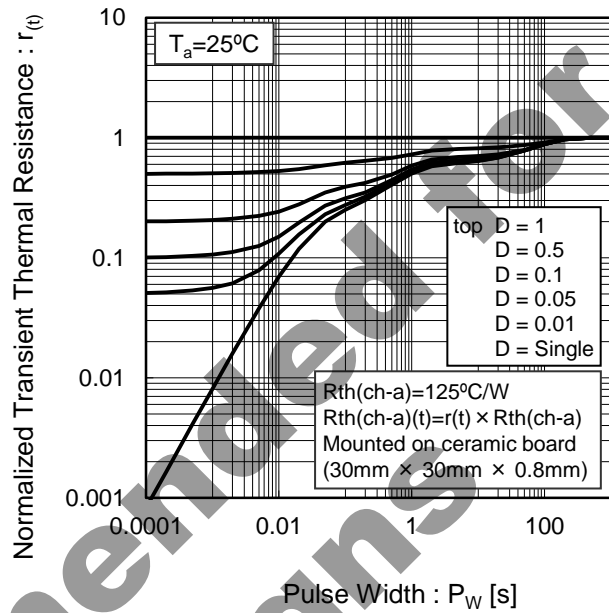


Fig.2 Normalized Transient Thermal Resistance vs. Pulse Width



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●Electrical characteristic curves

Fig.3 Typical Output Characteristics(I)

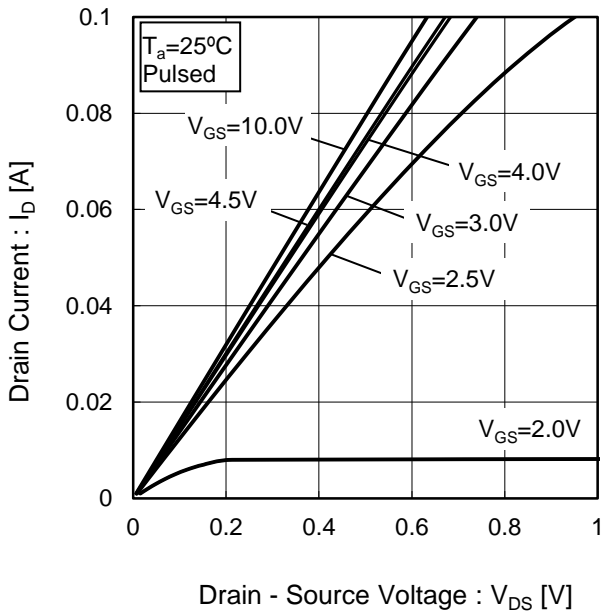
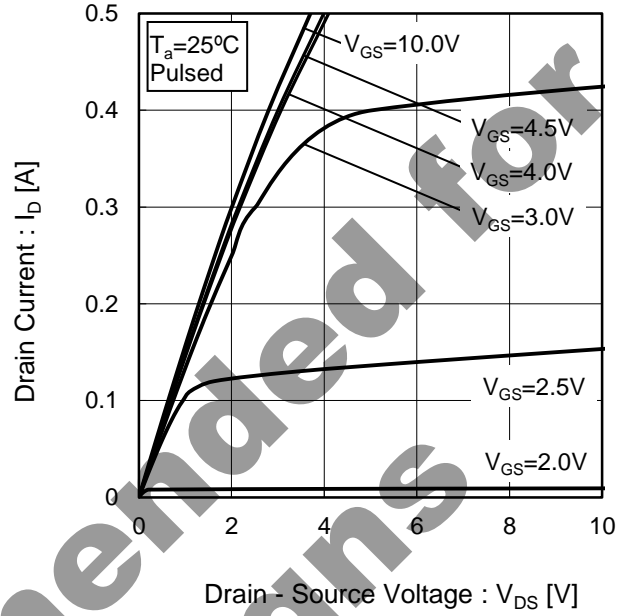


Fig.4 Typical Output Characteristics(II)



Not Recommended for New Designs

●Electrical characteristic curves

Fig.5 Breakdown Voltage vs. Junction Temperature

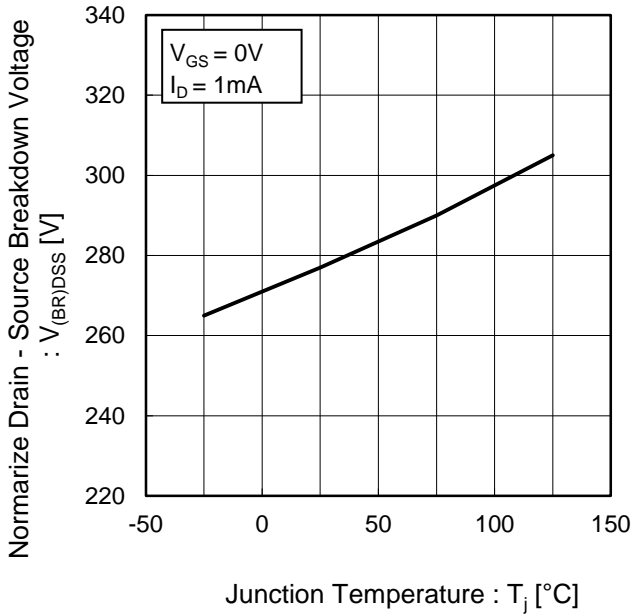


Fig.6 Typical Transfer Characteristics

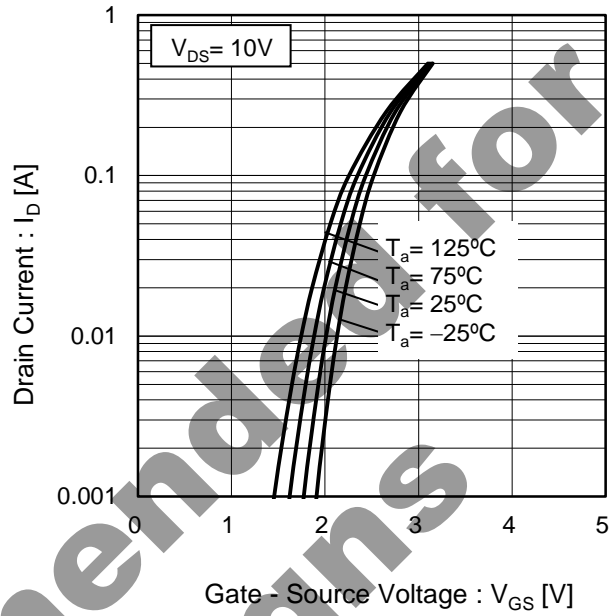


Fig.7 Gate Threshold Voltage vs. Junction Temperature

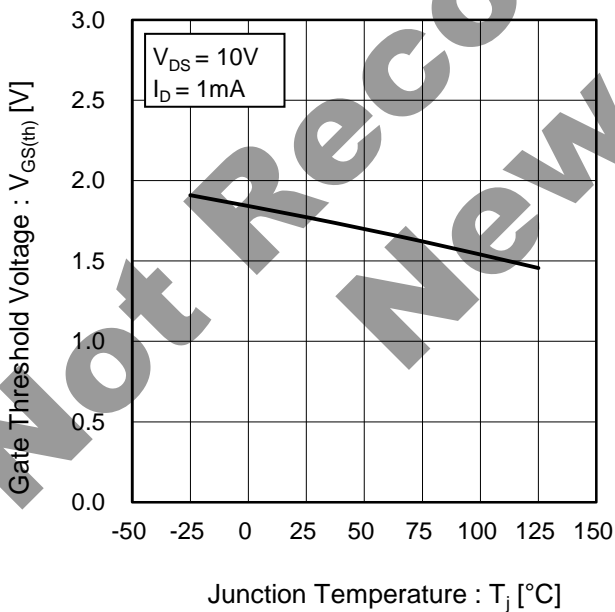
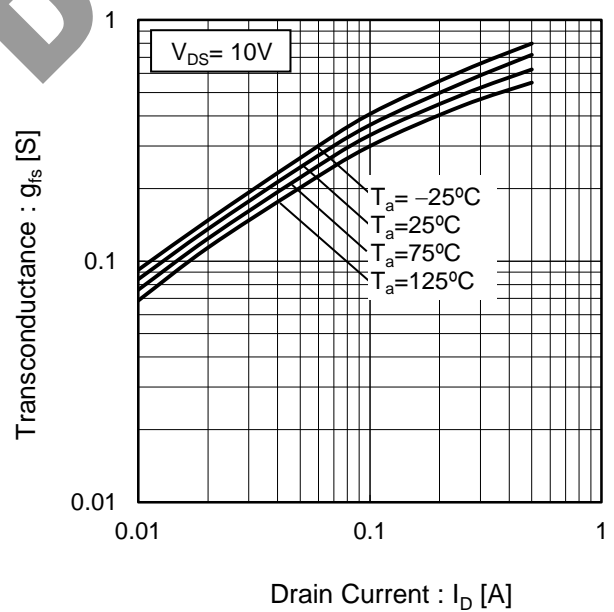


Fig.8 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.9 Static Drain - Source On - State Resistance vs. Gate Source Voltage

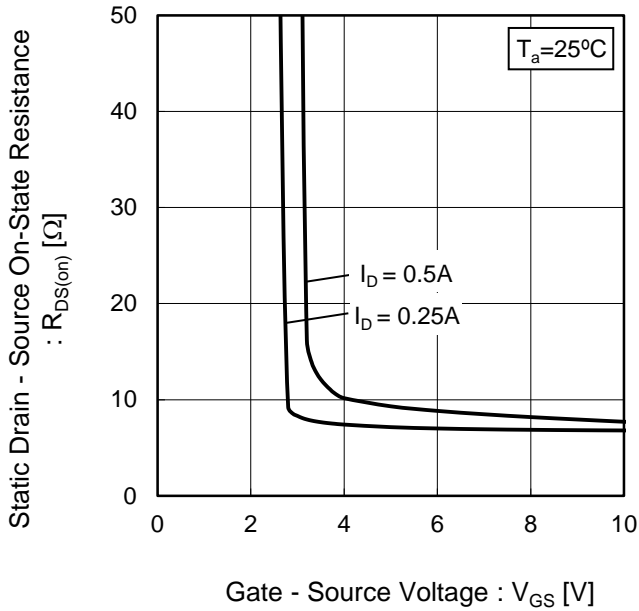


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current(I)

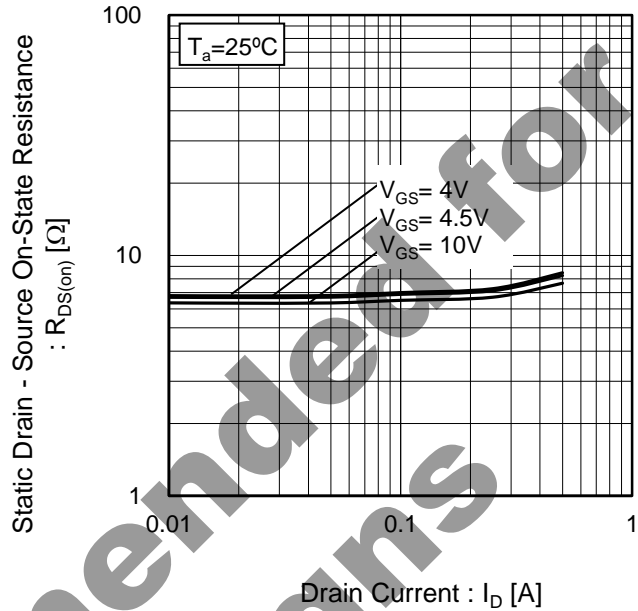
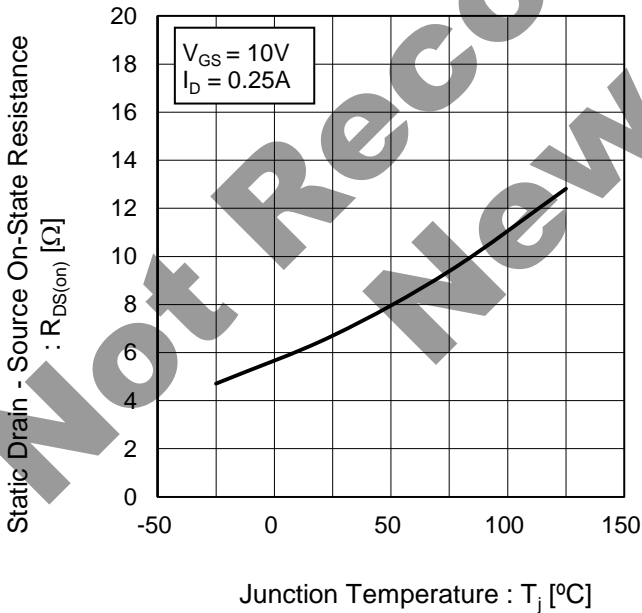


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

Fig.12 Static Drain - Source On - State Resistance vs. Drain Current(I)

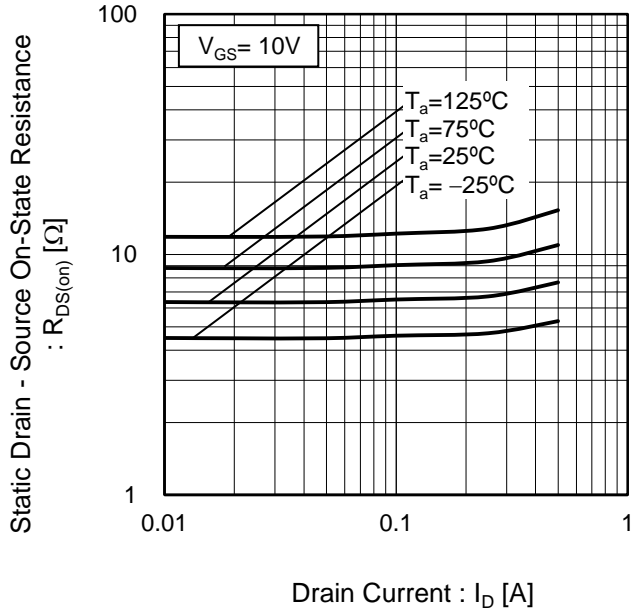


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(II)

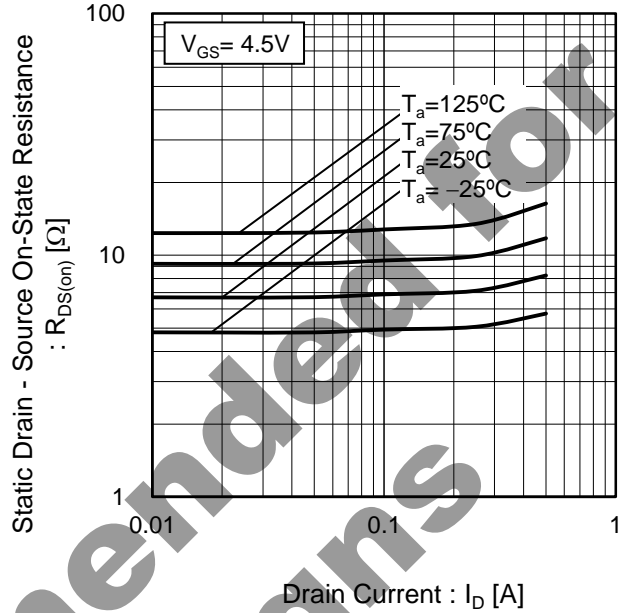


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(III)

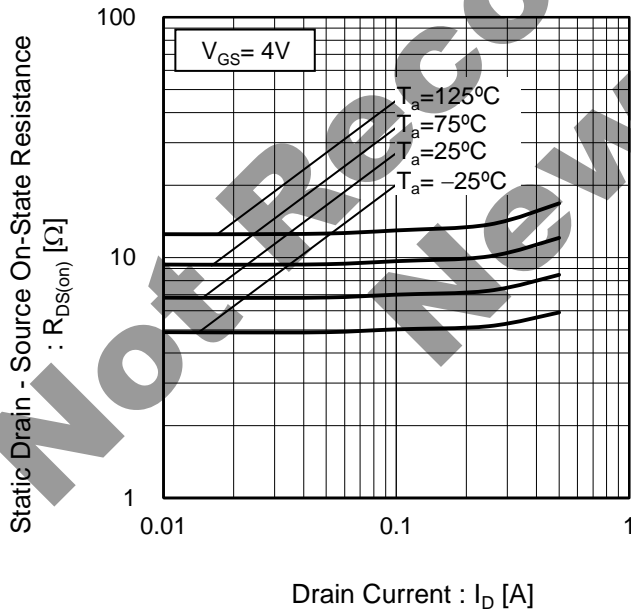
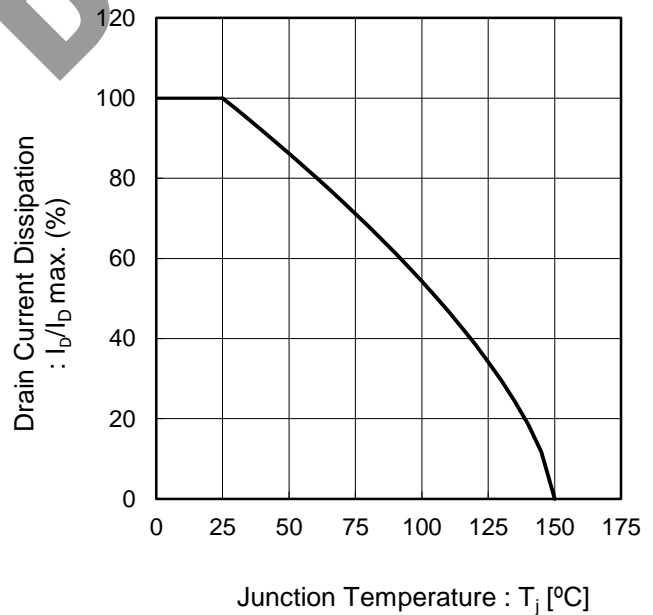


Fig.15 Drain Current Derating Curve



●Electrical characteristic curves

Fig.16 Typical Capacitance vs. Drain - Source Voltage

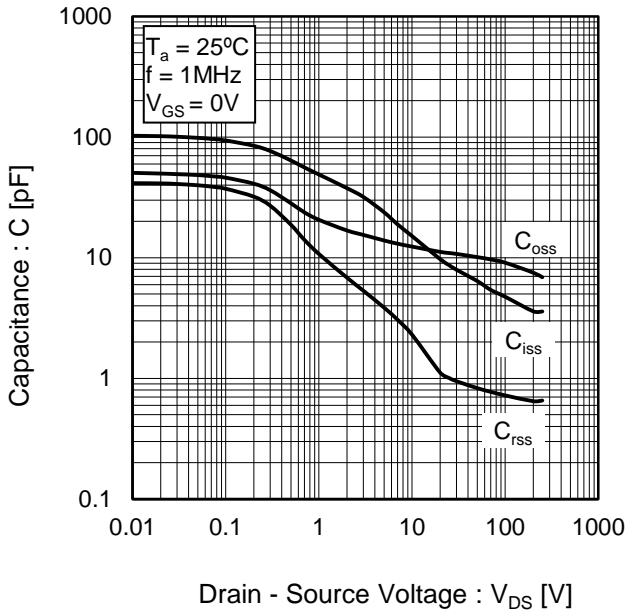


Fig.17 Switching Characteristics

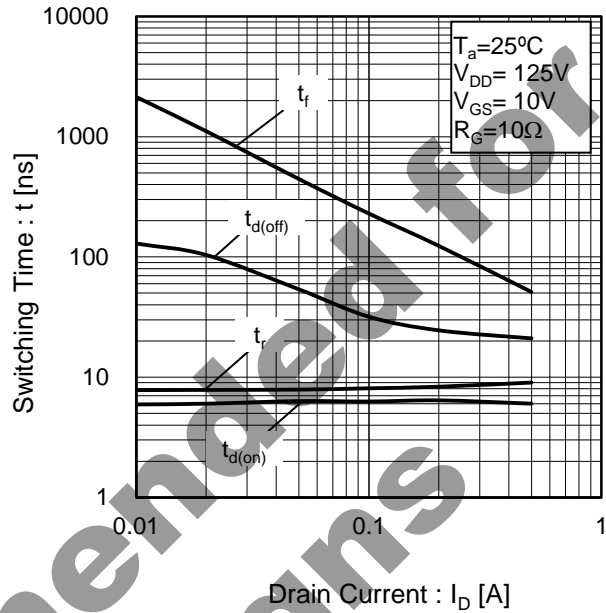
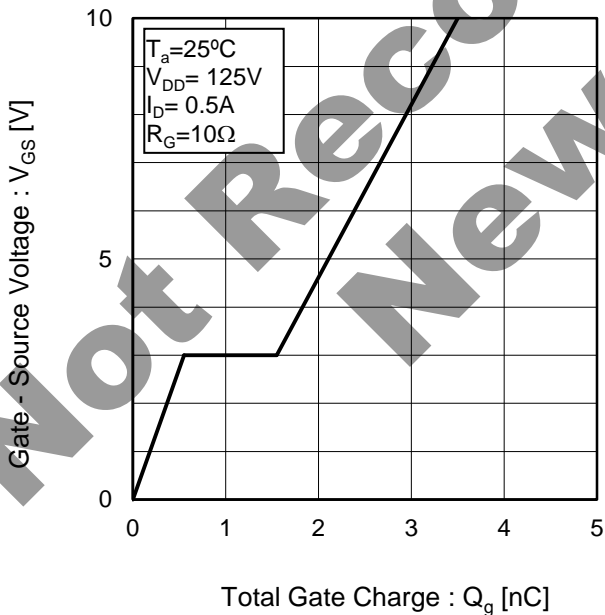


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.19 Source Current vs. Source - Drain Voltage

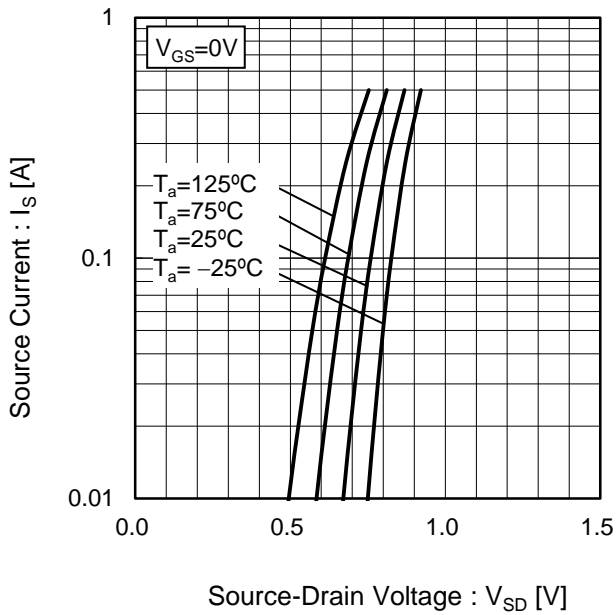
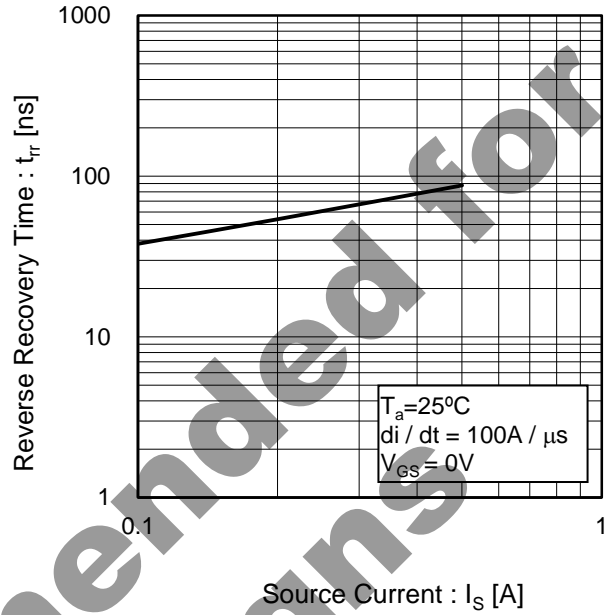


Fig20 Reverse Recovery Time vs. Source Current



Not Recommended for New Designs

●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

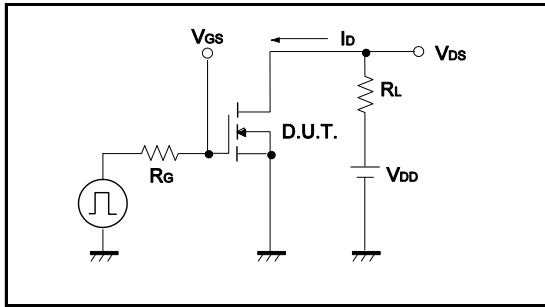


Fig.1-2 Switching Waveforms

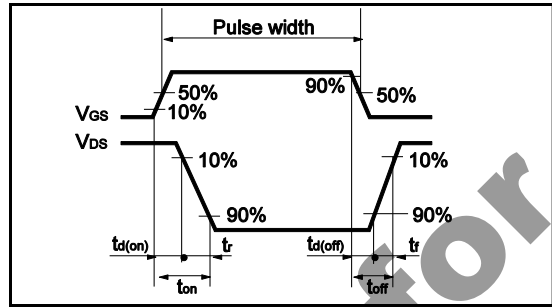


Fig.2-1 Gate Charge Measurement Circuit

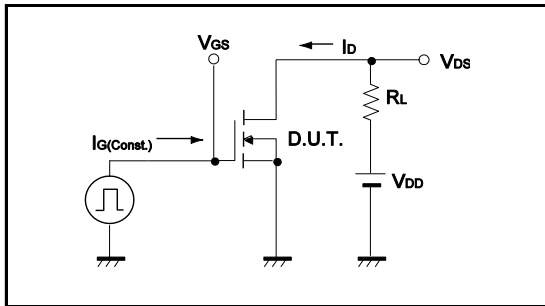
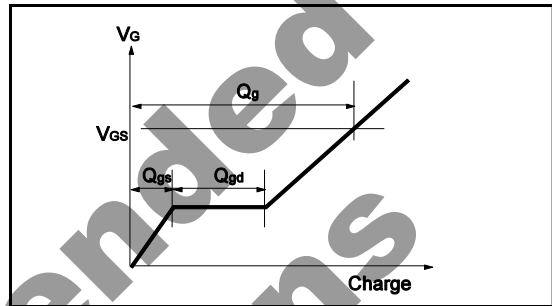


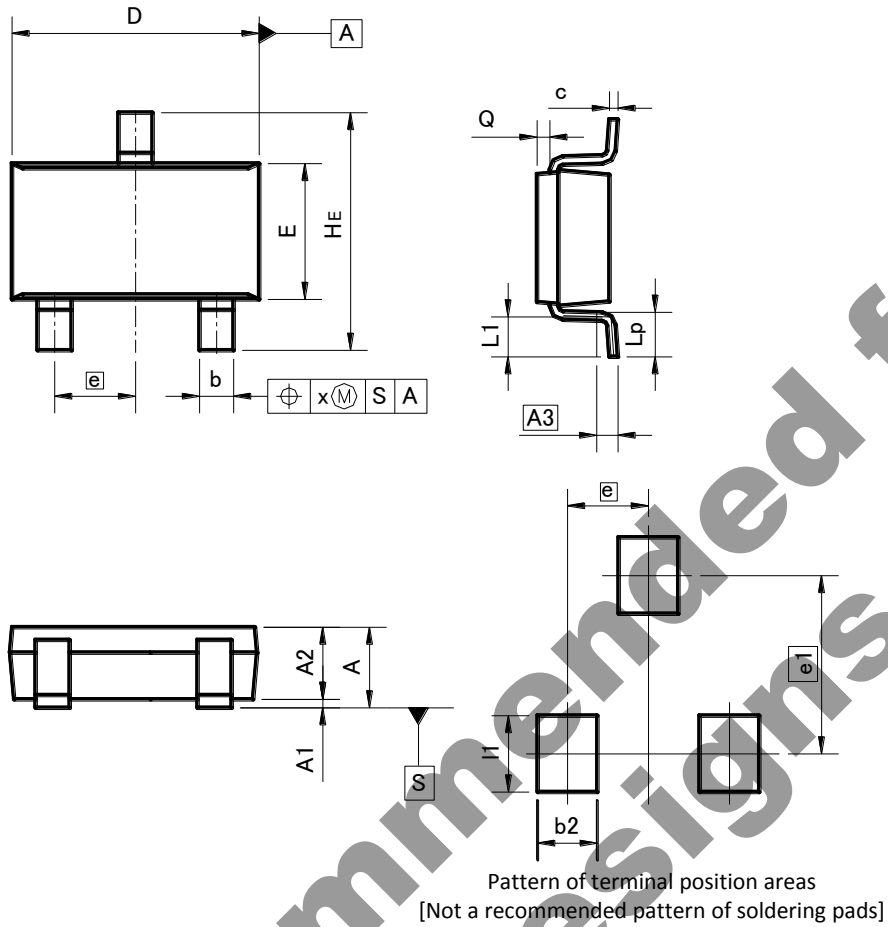
Fig.2-2 Gate Charge Waveform



Not Recommended for New Designs

●Dimensions (Unit : mm)

TSMT3



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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