

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

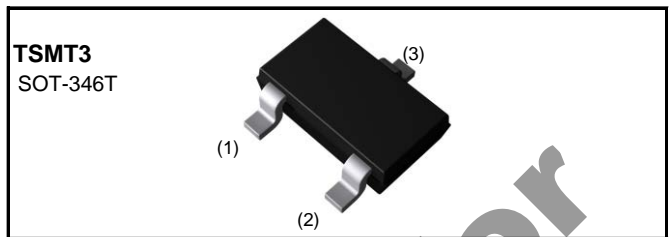
●Application

Switching Power Supply
 Automotive Motor Drive
 Automotive Solenoid Drive

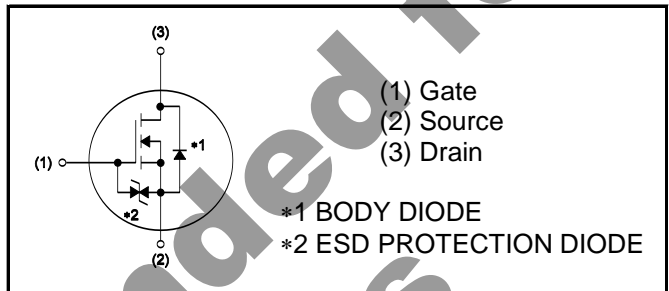
●Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

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	μA
		$V_{DS} = 250V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 10	μA
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	Ω
		$V_{GS} = 4.5V, I_D = 0.25A$	-	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_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C _{iss}	V _{GS} = 0V	-	70	-	pF
Output capacitance	C _{oss}	V _{DS} = 25V	-	10	-	
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	3	-	
Turn - on delay time	t _{d(on)} ^{*5}	V _{DD} ≈ 125V, V _{GS} = 10V	-	6	-	ns
Rise time	t _r ^{*5}	I _D = 0.25A	-	10	-	
Turn - off delay time	t _{d(off)} ^{*5}	R _L = 500Ω	-	21	-	
Fall time	t _f ^{*5}	R _G = 10Ω	-	90	-	

●Gate Charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q _g ^{*5}	V _{DD} ≈ 125V	-	3.5	-	nC
Gate - Source charge	Q _{gs} ^{*5}	I _D = 0.5A	-	0.55	-	
Gate - Drain charge	Q _{gd} ^{*5}	V _{GS} = 10V	-	1.0	-	
Gate plateau voltage	V _(plateau)	V _{DD} ≈ 125V, I _D = 0.5A	-	3.0	-	V

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous source current	I _s ^{*1}	T _c = 25°C	-	-	0.5	A
Pulsed source current	I _{SM} ^{*2}		-	-	2.0	A
Forward voltage	V _{SD} ^{*5}	V _{GS} = 0V, I _S = 0.5A	-	-	1.2	V
Reverse recovery time	t _{rr} ^{*5}	I _S = 0.25A	-	60	-	ns
Reverse recovery charge	Q _{rr} ^{*5}	di/dt = 100A/μs	-	60	-	nC

*1 Limited only by maximum temperature allowed.

*2 P_w ≤ 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

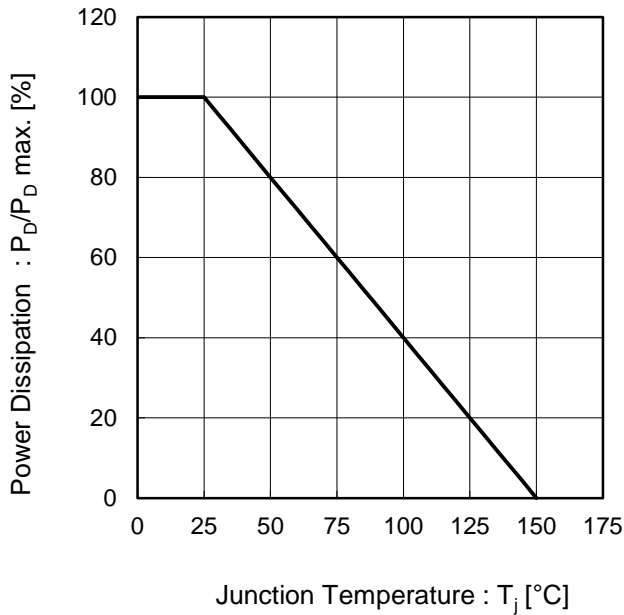
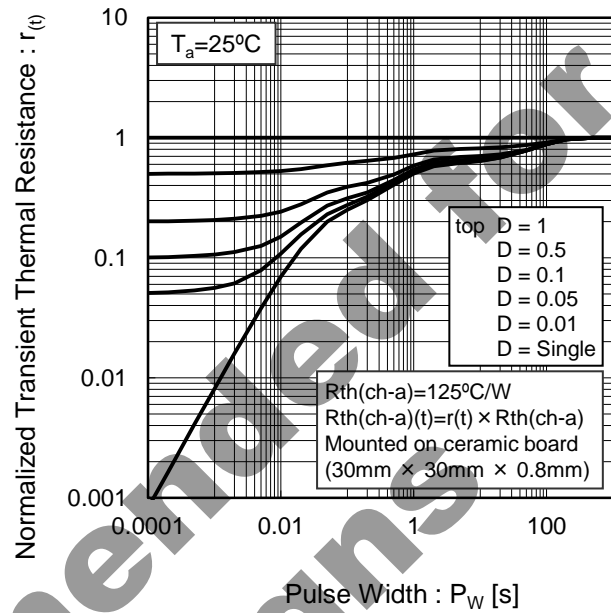


Fig.2 Normalized Transient Thermal Resistance vs. Pulse Width



Not Recommended for New Designs

●Electrical characteristic curves

Fig.3 Typical Output Characteristics(I)

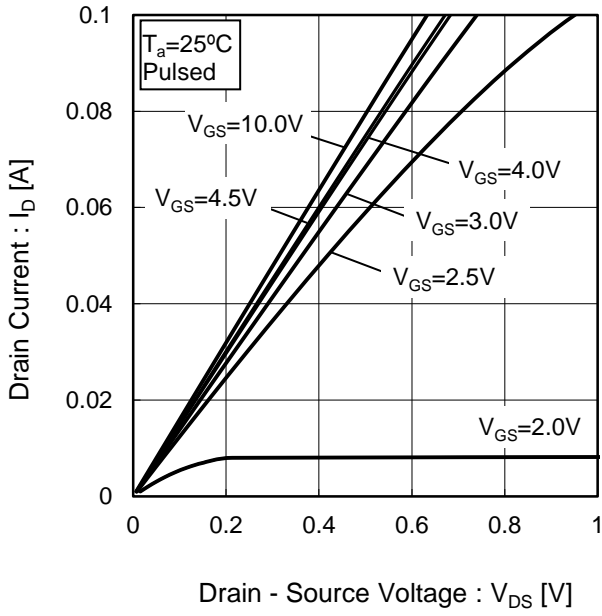
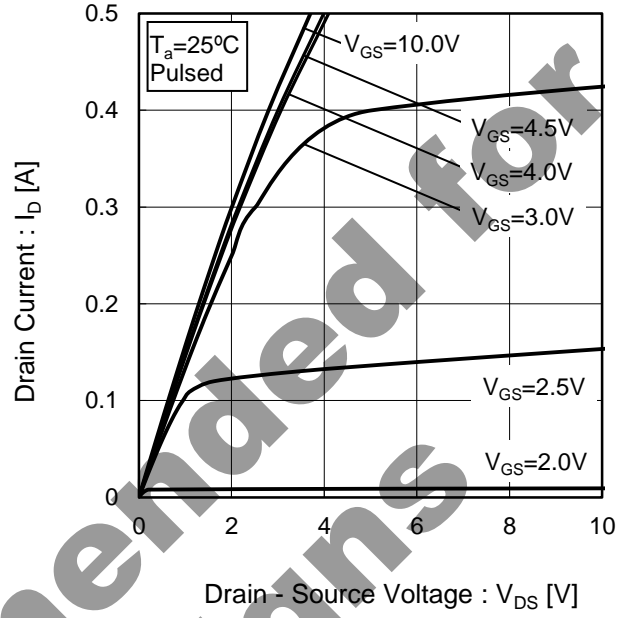


Fig.4 Typical Output Characteristics(II)



Not Recommended for New Designs

●Electrical characteristic curves

Fig.5 Breakdown Voltage vs. Junction Temperature

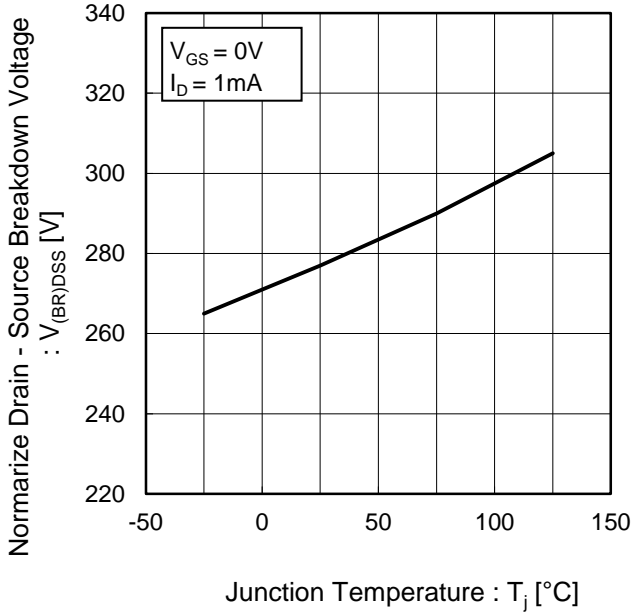


Fig.6 Typical Transfer Characteristics

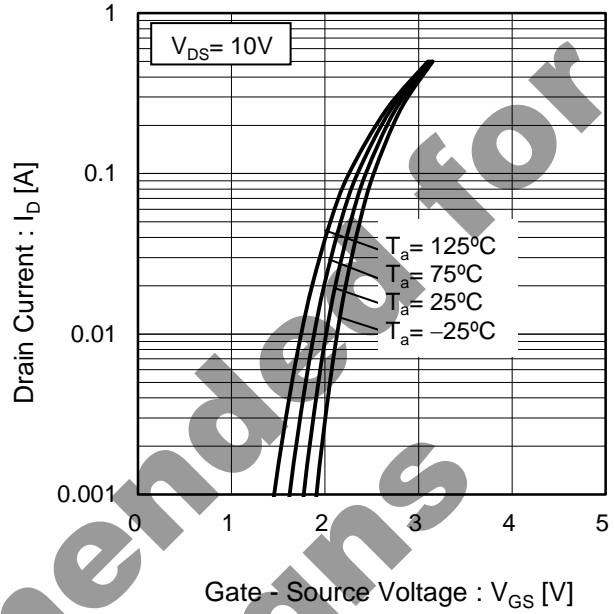


Fig.7 Gate Threshold Voltage vs. Junction Temperature

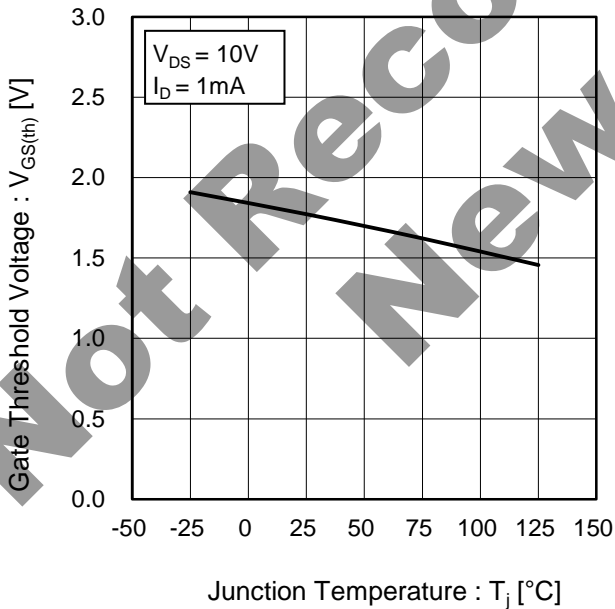
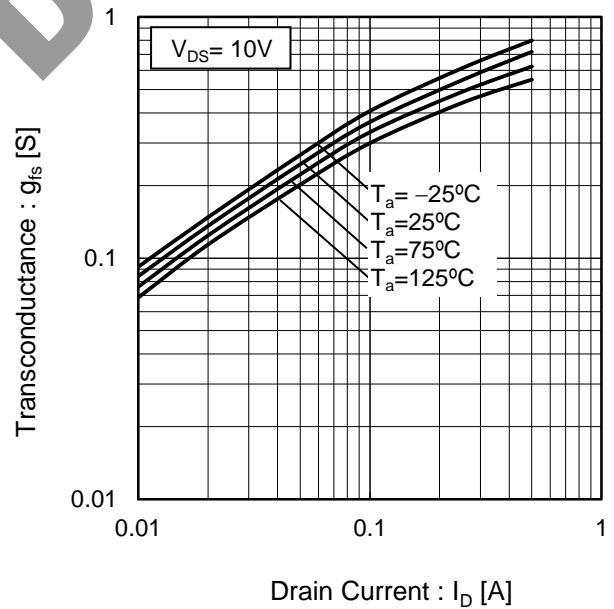


Fig.8 Transconductance vs. Drain Current



●Electrical characteristic curves

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

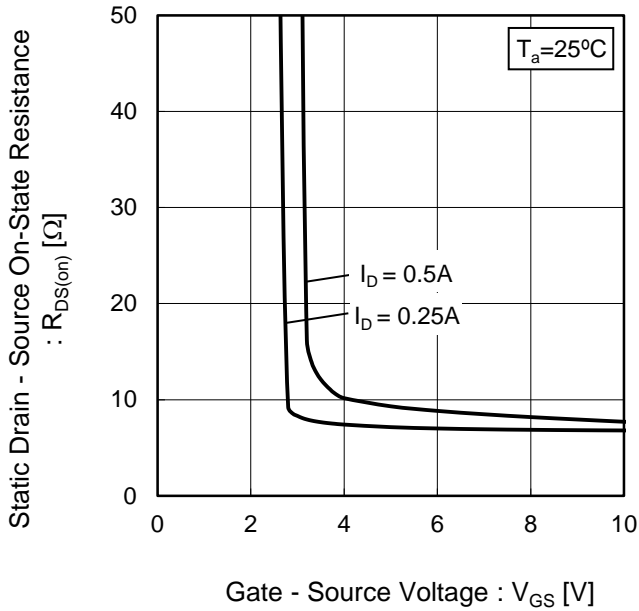


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current(I)

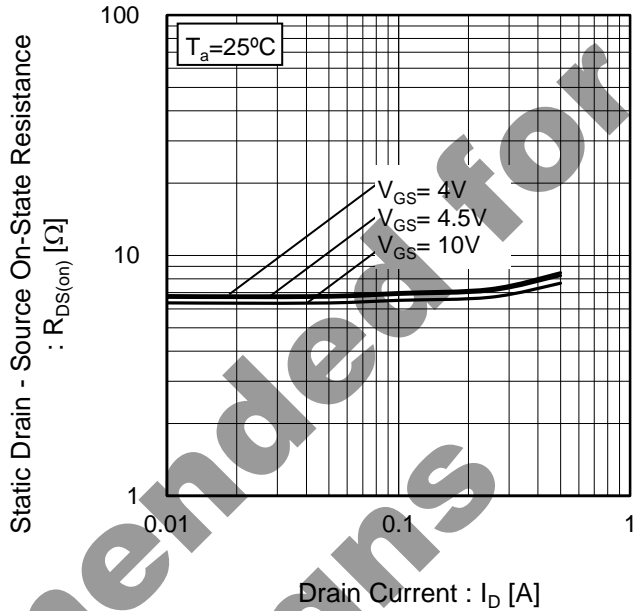
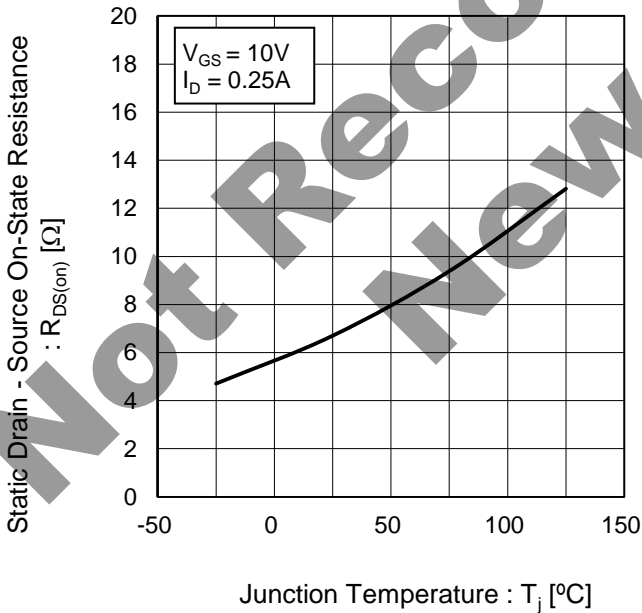


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

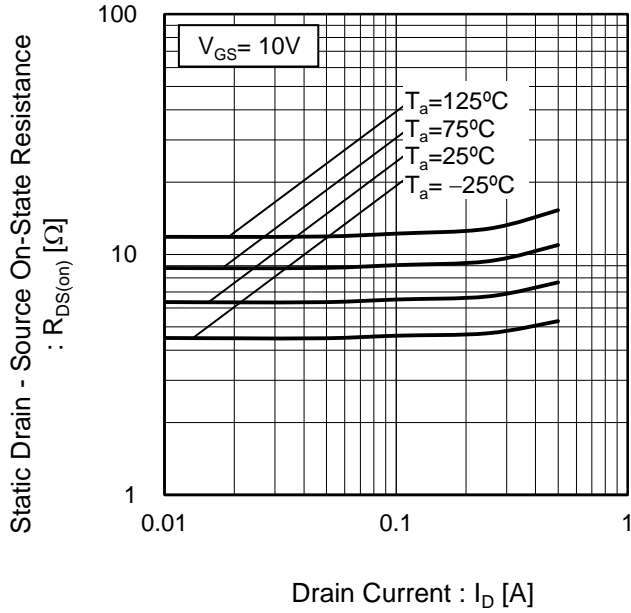


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(II)

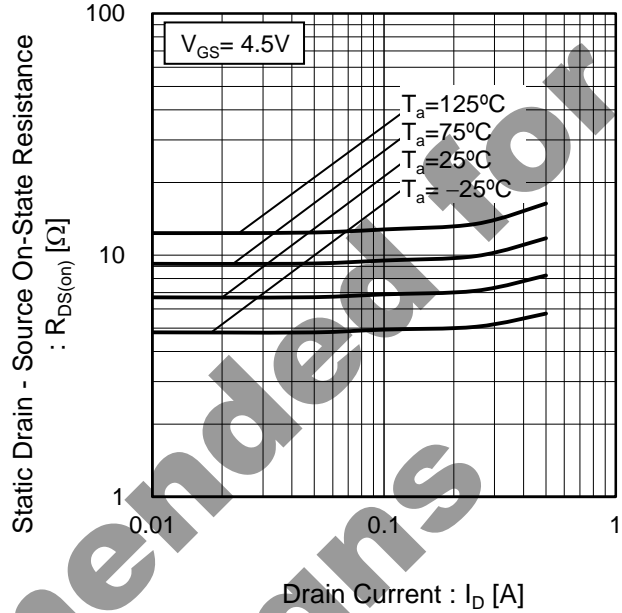


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(III)

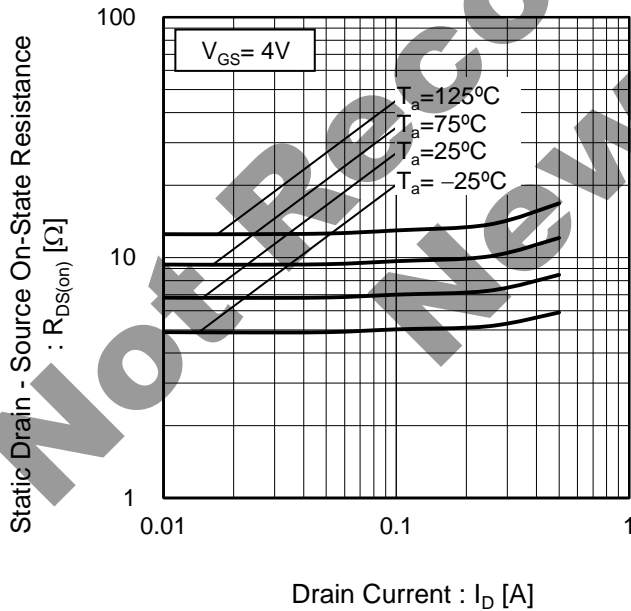
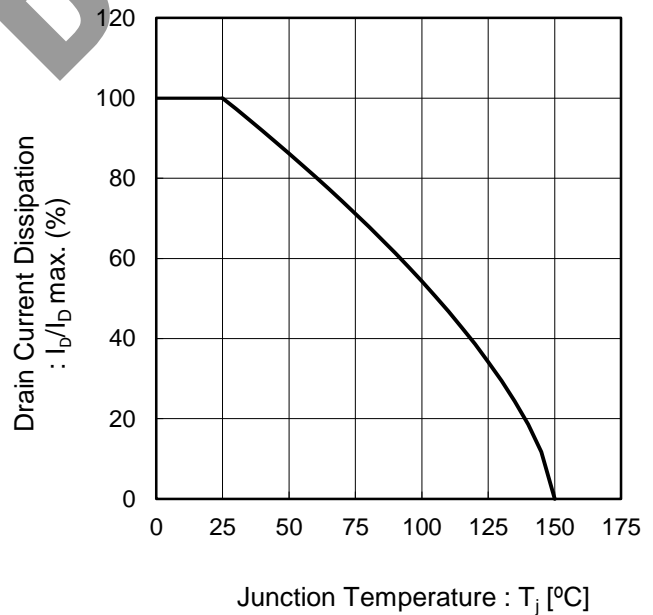


Fig.15 Drain Current Derating Curve



●Electrical characteristic curves

Fig.16 Typical Capacitance vs. Drain - Source Voltage

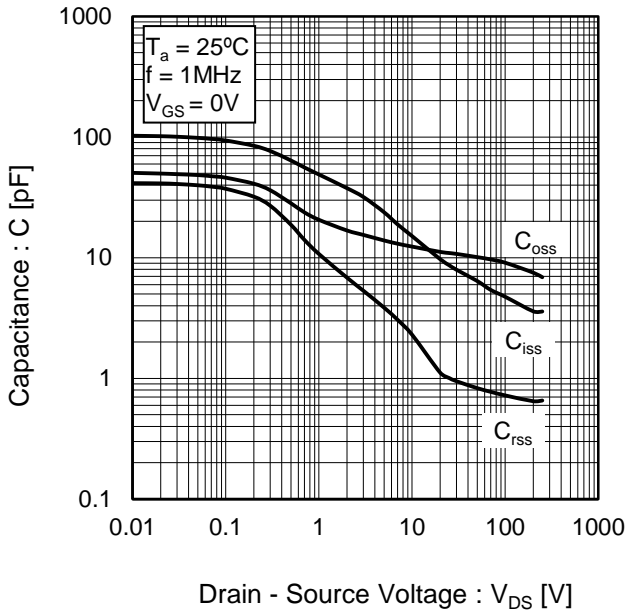


Fig.17 Switching Characteristics

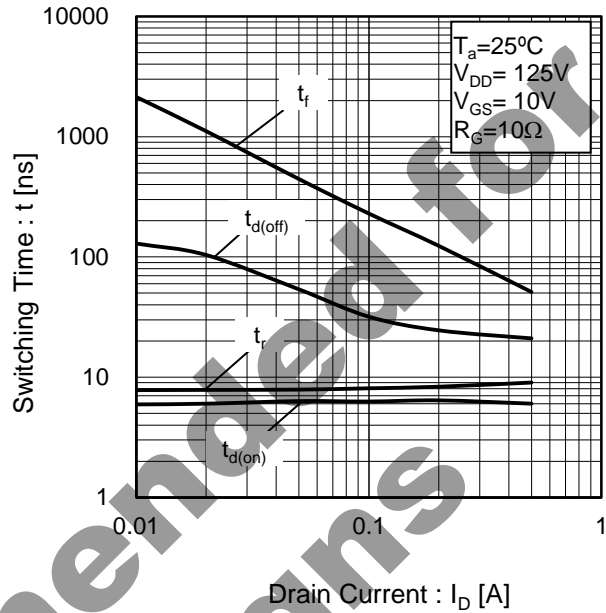
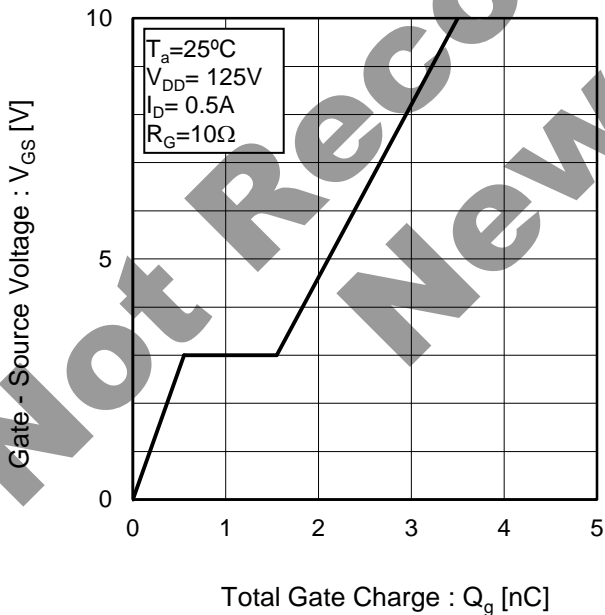


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.19 Source Current vs. Source - Drain Voltage

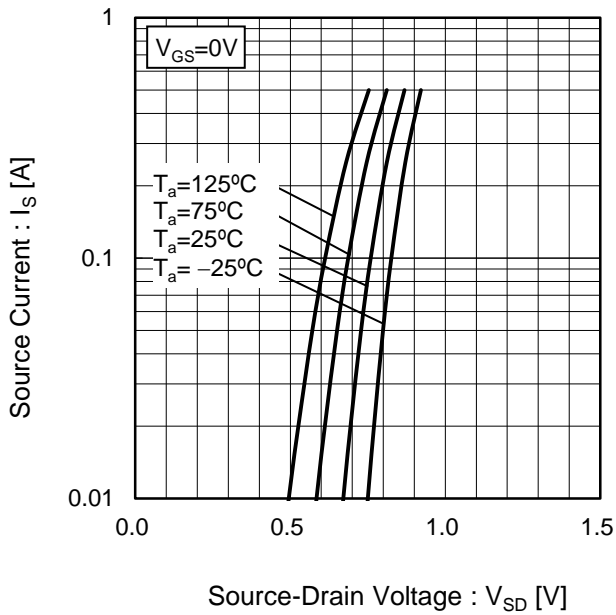
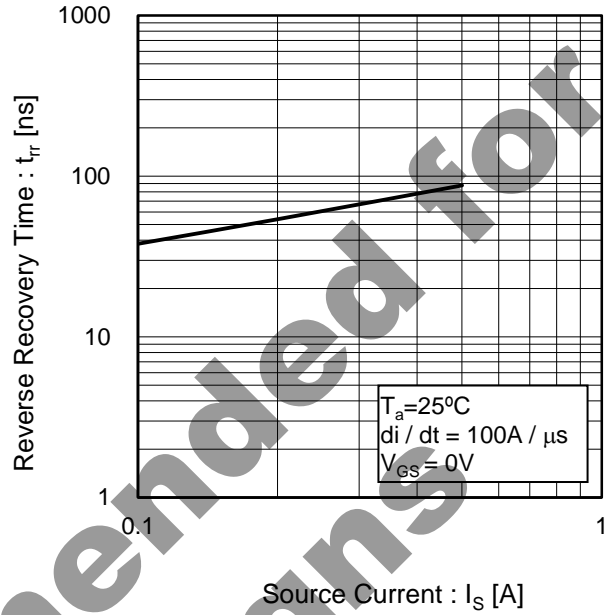


Fig20 Reverse Recovery Time vs. Source Current



Not Recommended for New Designs

●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

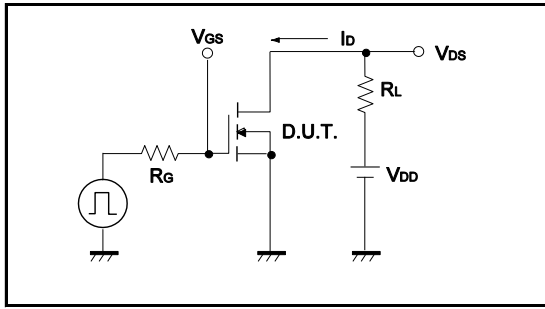


Fig.1-2 Switching Waveforms

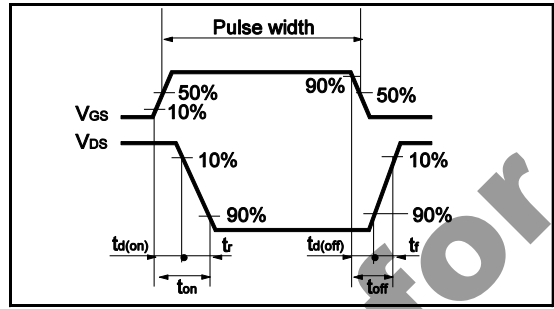


Fig.2-1 Gate Charge Measurement Circuit

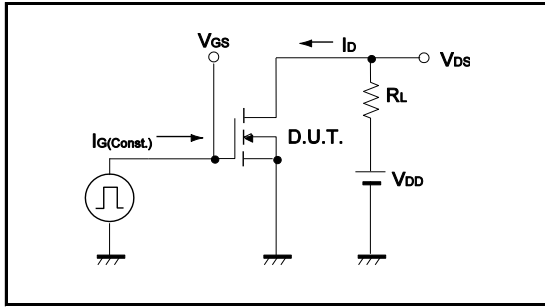
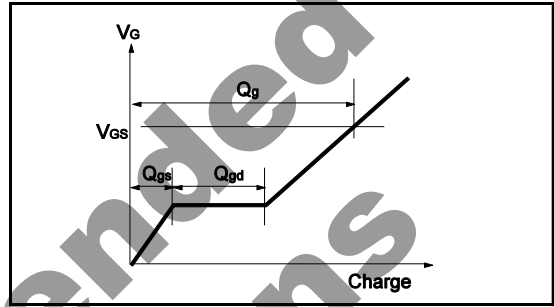


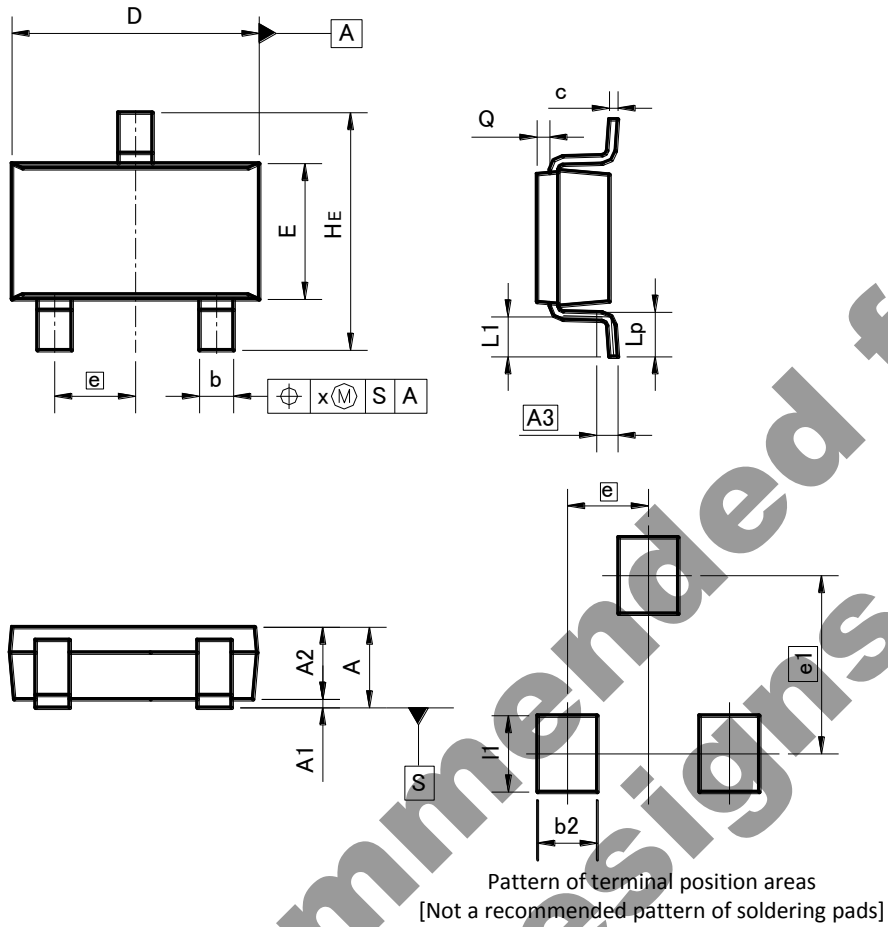
Fig.2-2 Gate Charge Waveform



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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