

V_{DSS}	20V
$R_{DS(on)}$ (Max.)	2.0Ω
I_D	150mA
P_D	100mW

●Features

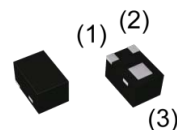
- 1) Ultra Small Package (0.6×0.4×0.36mm)
- 2) Low voltage drive (1.2V) makes this device ideal for portable equipment.
- 3) Drive circuits can be simple.
- 4) Built-in ESD Protection Diode.

●Application

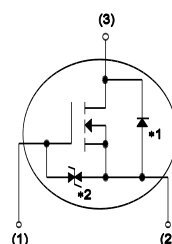
Switching

●Outline

VML0604



●Inner circuit



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

*1 BODY DIODE
*2 ESD PROTECTION DIODE

●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	180
	Tape width (mm)	8
	Basic ordering unit (pcs)	8,000
	Taping code	T2CL
	Marking	RY

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

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	20	V
Continuous drain current	I_D^{*1}	±150	mA
Pulsed drain current	$I_{D,pulse}^{*2}$	±600	mA
Gate - Source voltage	V_{GSS}	±10	V
Power dissipation	P_D^{*3}	100	mW
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}	-	-	1250	°C/W

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	20	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 20V, V_{GS} = 0V$	-	-	1	μA
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 8V, V_{DS} = 0V$	-	-	± 10	μA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 100\mu A$	0.3	-	1.0	V
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS}=4.5V, I_D=150mA$	-	1.4	2.0	Ω
		$V_{GS}=2.5V, I_D=150mA$	-	1.7	2.6	
		$V_{GS}=1.8V, I_D=150mA$	-	2.2	3.4	
		$V_{GS}=1.5V, I_D=20mA$	-	2.7	5.4	
		$V_{GS}=1.2V, I_D=10mA$	-	3.8	11.4	
		$V_{GS}=4.5V, I_D=150mA, T_j=125^\circ C$	-	2.3	4.6	
Transconductance	g_{fs}^{*4}	$V_{DS}=10V, I_D=150mA$	110	-	-	mS

*1 Limited only by maximum temperature allowed.

*2 $P_w \leq 10\mu s$, Duty cycle $\leq 1\%$

*3 Each terminal mounted on a recommended land

*4 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	12	-	pF
Output capacitance	C_{oss}	$V_{DS} = 10V$	-	5	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	3	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx 10V, V_{GS} = 4.5V$	-	3	-	ns
Rise time	t_r^{*4}	$I_D = 75\text{mA}$	-	4	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 133\Omega$	-	12	-	
Fall time	t_f^{*4}	$R_G = 10\Omega$	-	25	-	

●Body diode electrical characteristics (Source-Drain)($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous source current	I_S^{*1}	$T_a = 25^\circ\text{C}$	-	-	80	mA
Pulsed source current	I_{SM}^{*2}		-	-	600	mA
Forward voltage	V_{SD}^{*4}	$V_{GS} = 0V, I_S = 150\text{mA}$	-	-	1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

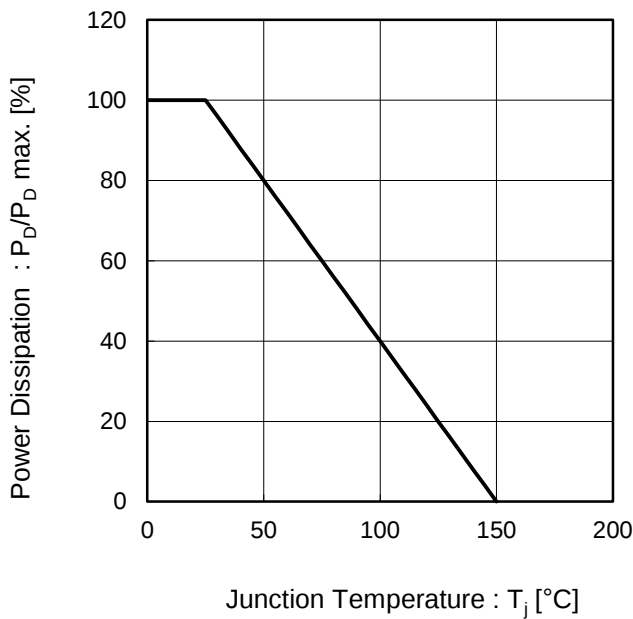


Fig.2 Drain Current Derating Curve

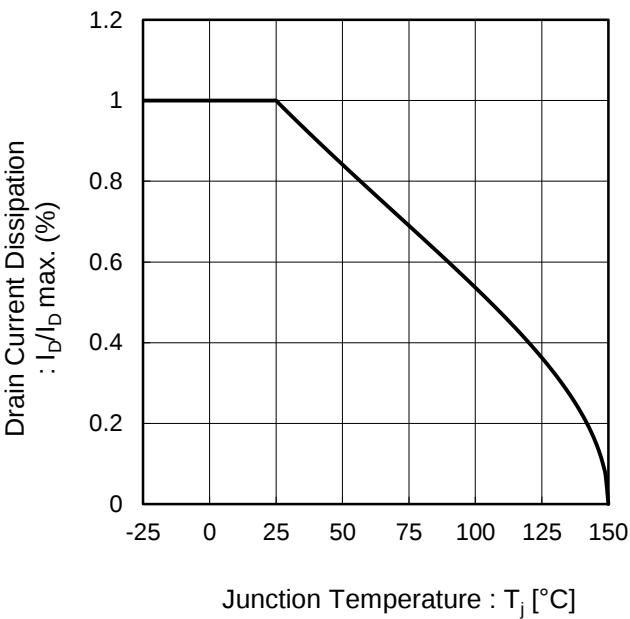


Fig.3 Typical Output Characteristics(I)

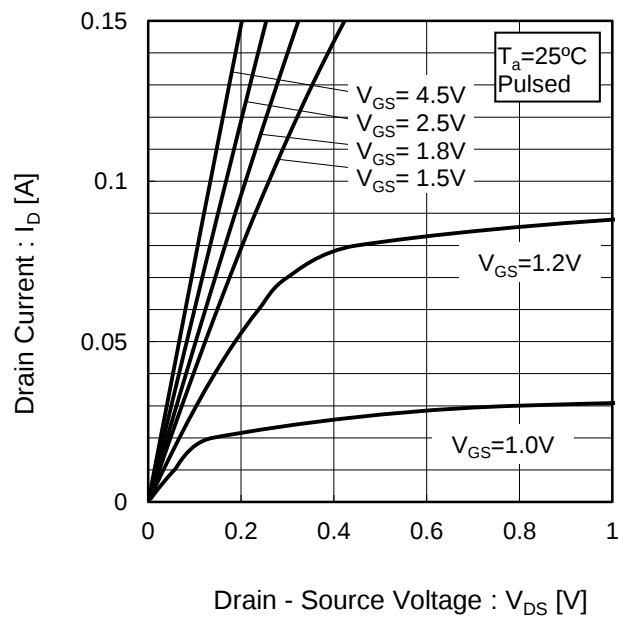
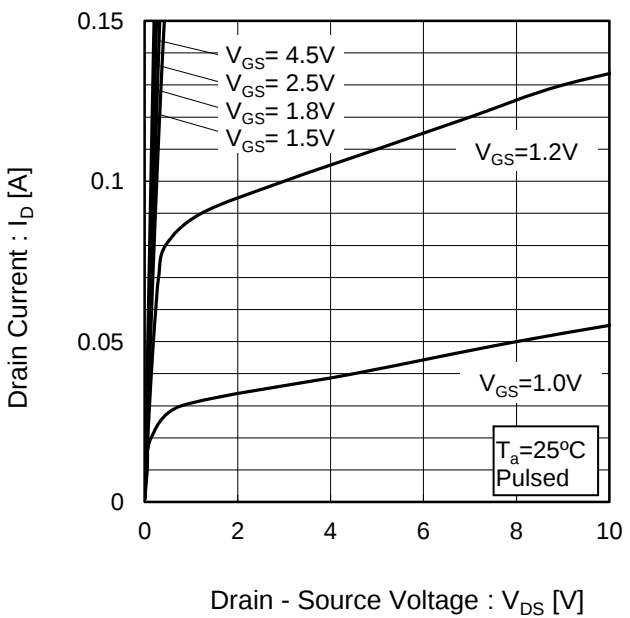
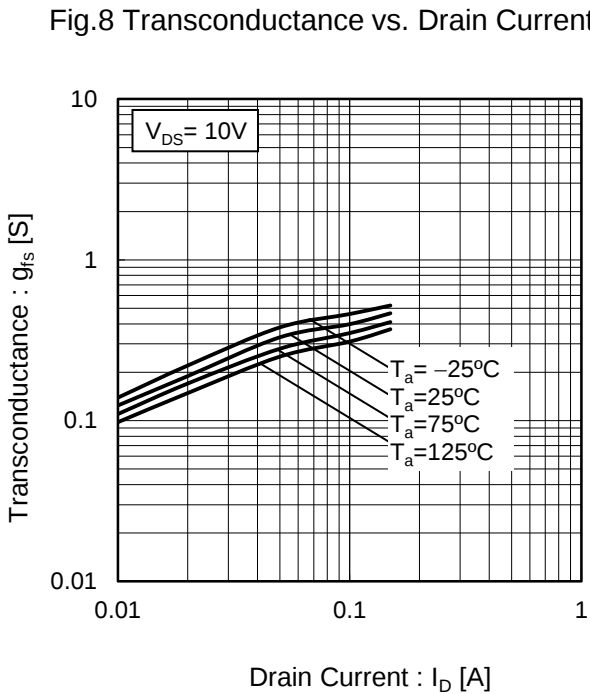
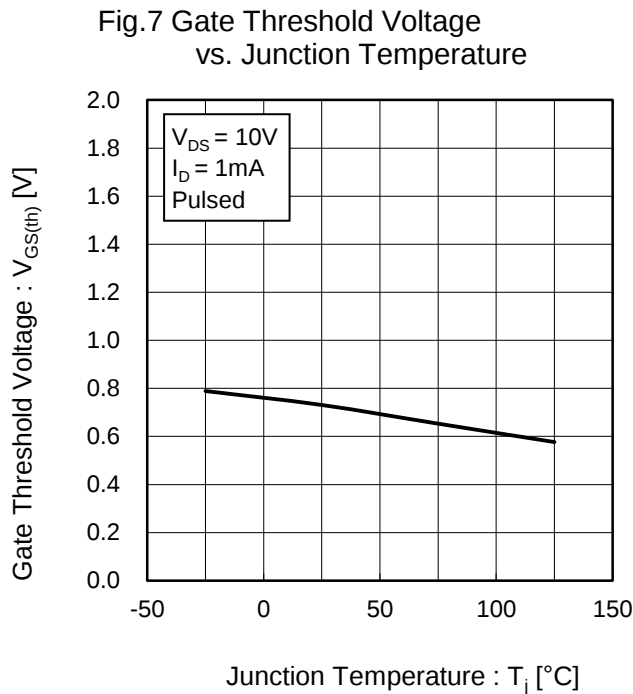
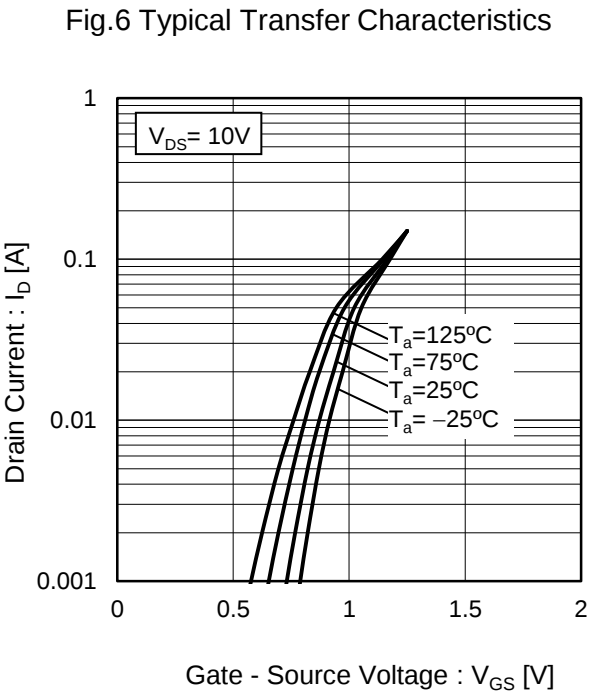
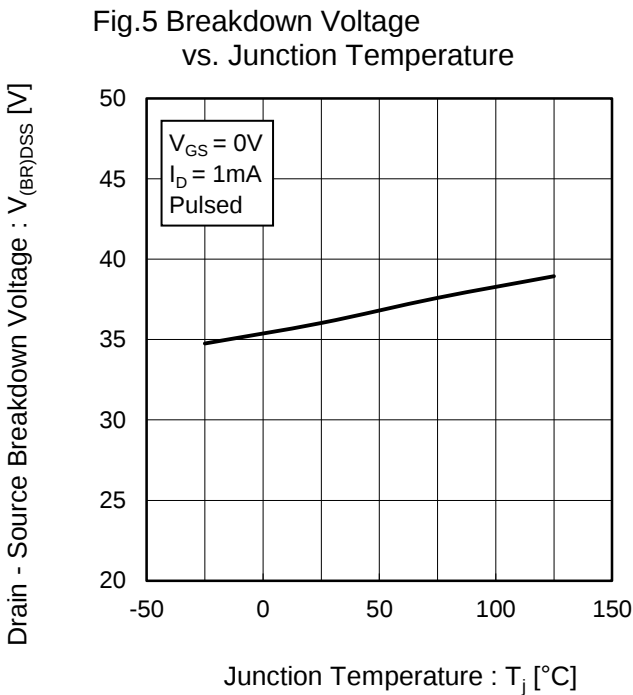


Fig.4 Typical Output Characteristics(II)



●Electrical characteristic curves



●Electrical characteristic curves

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

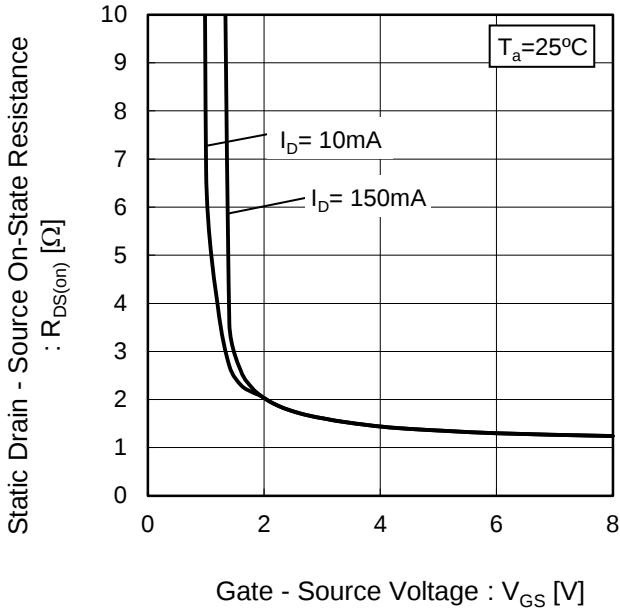


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current(I)

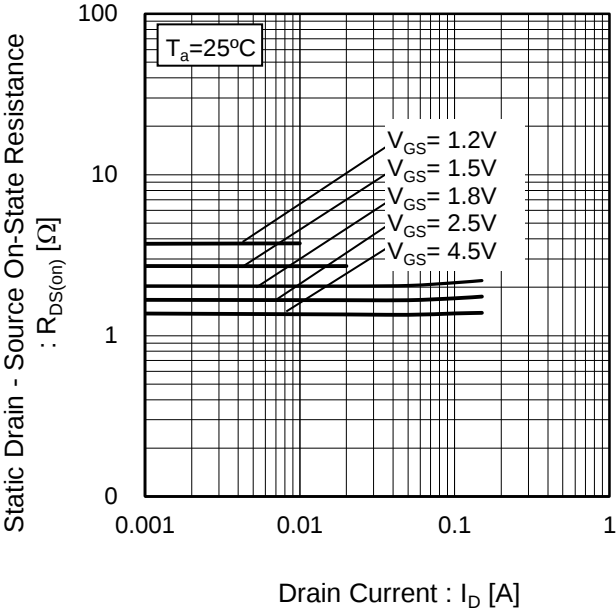


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature

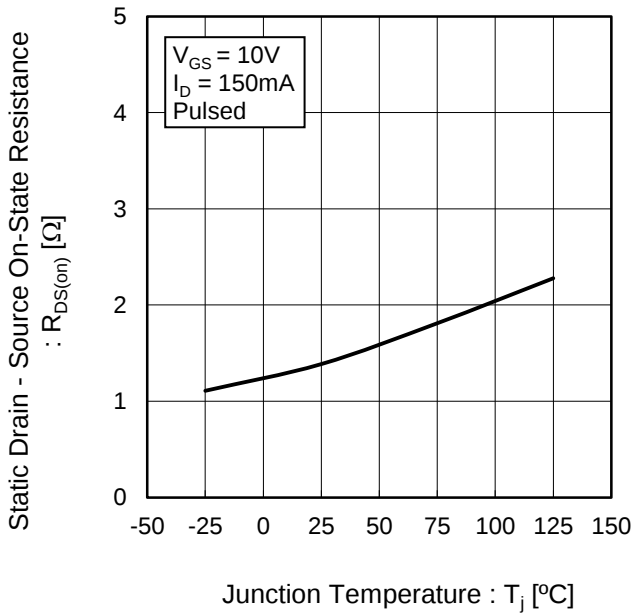
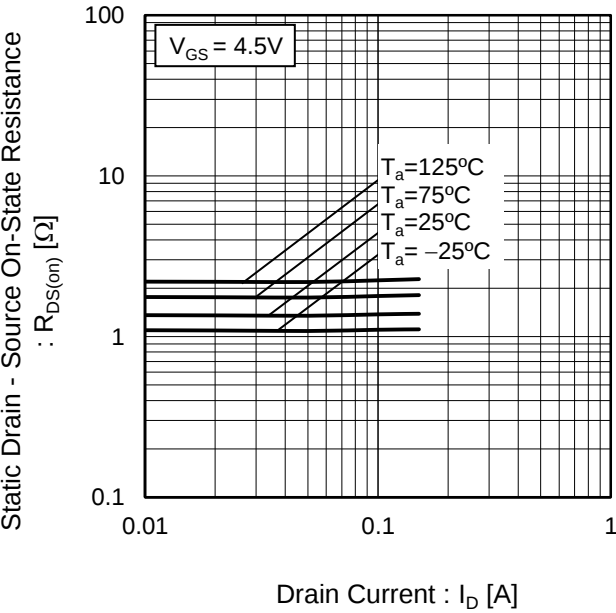


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current(II)



●Electrical characteristic curves

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

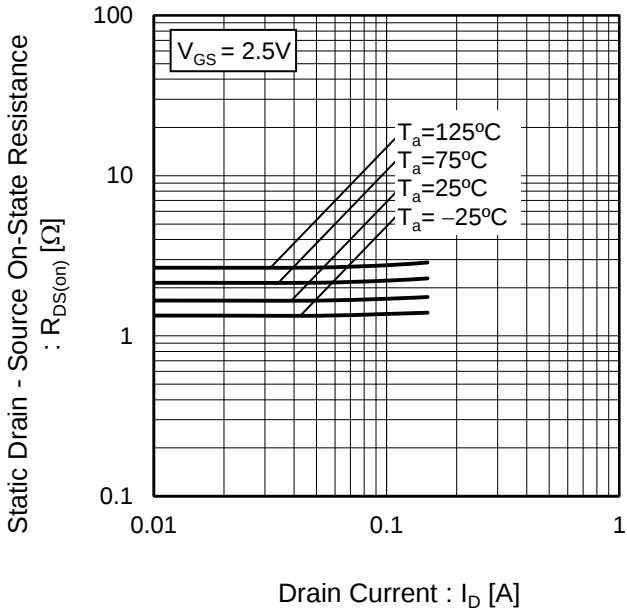


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(IV)

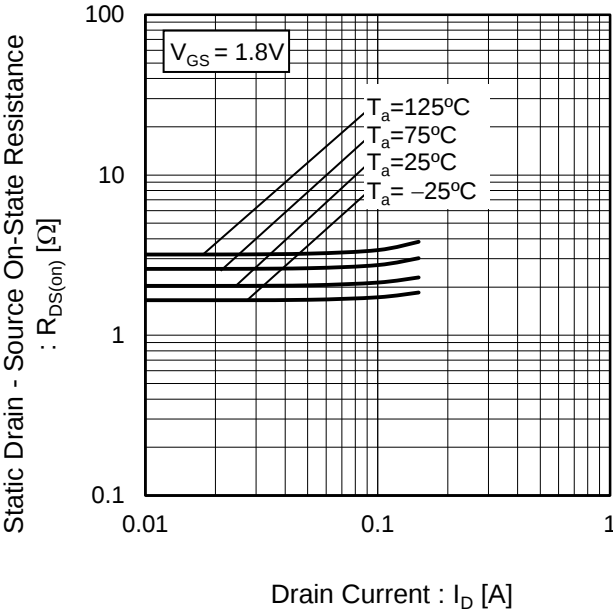


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(V)

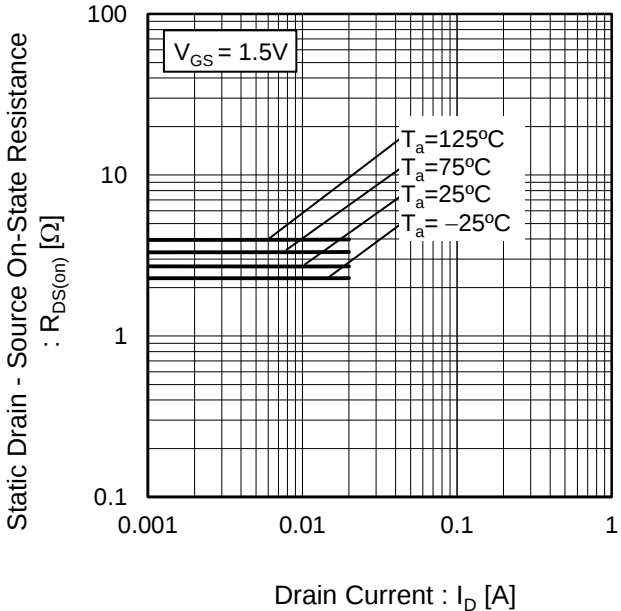
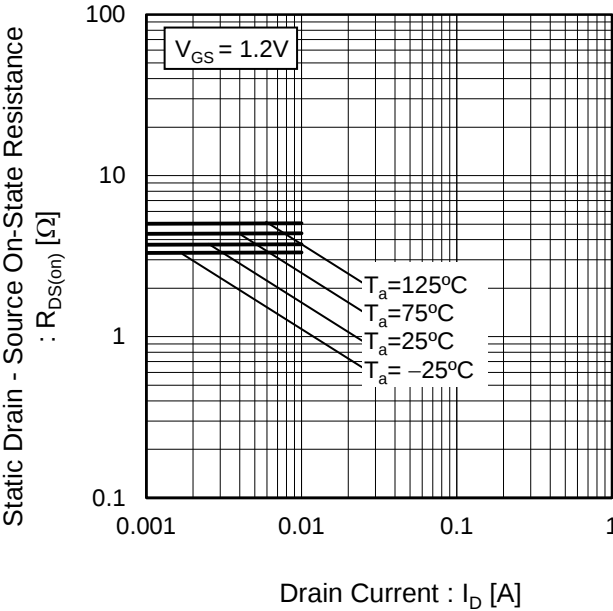


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(VI)



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

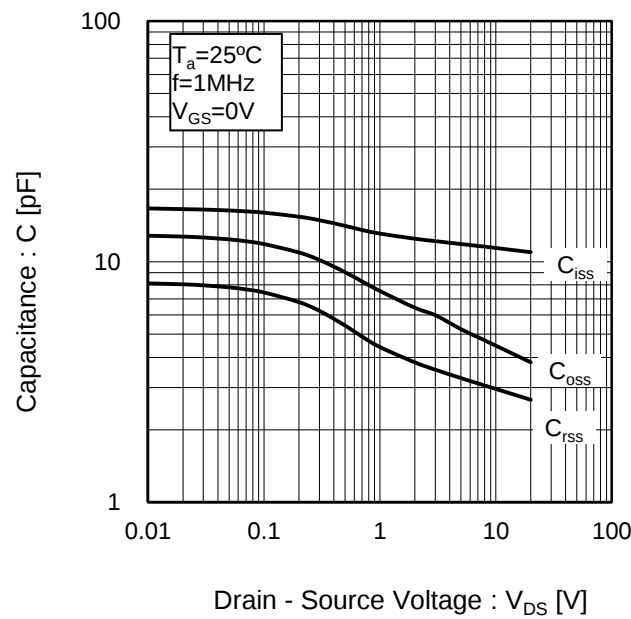


Fig.18 Switching Characteristics

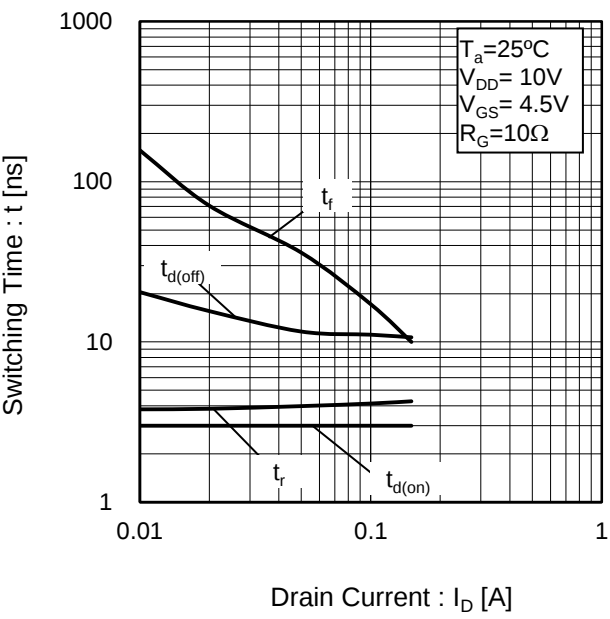
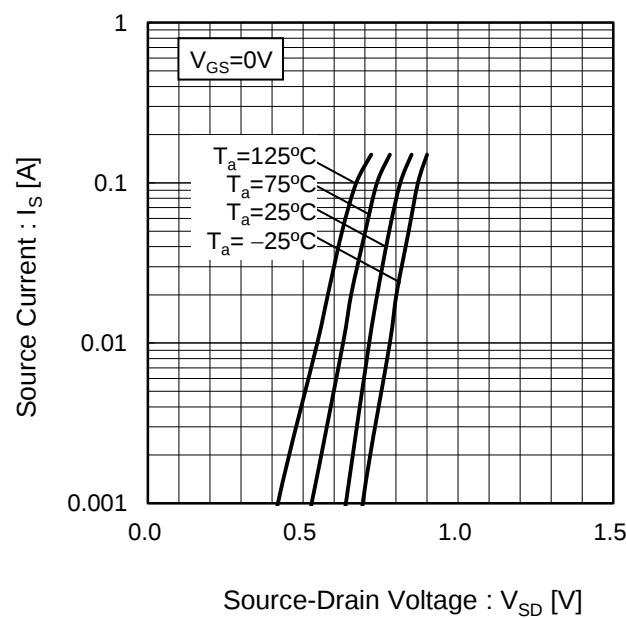


Fig.19 Source Current vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

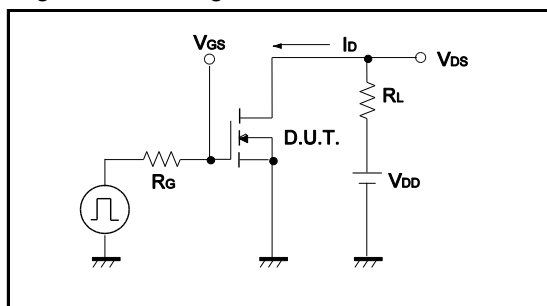
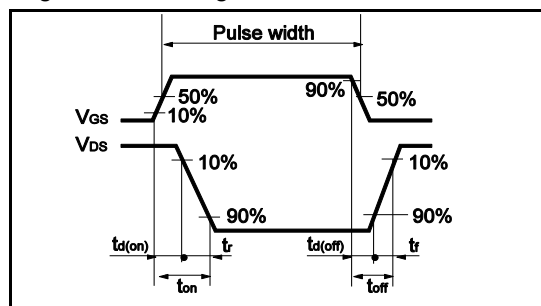


Fig.1-2 Switching Waveforms

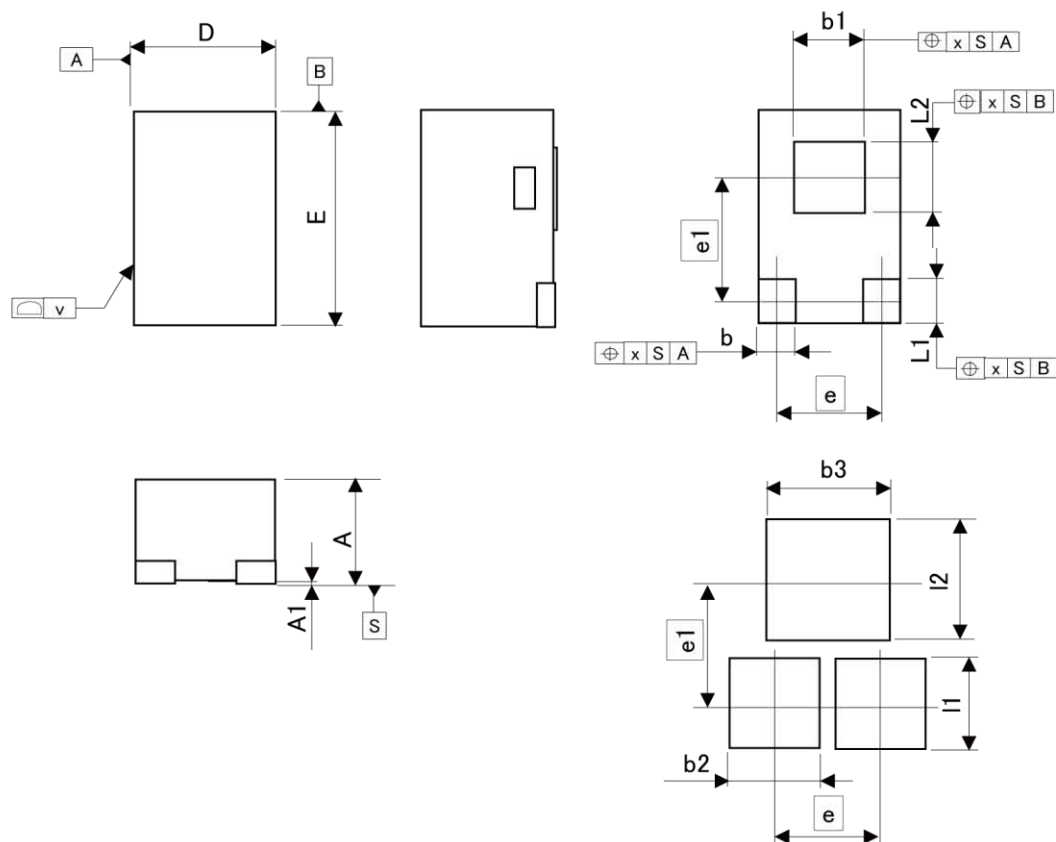


●Notice

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

●Dimensions (Unit : mm)

VML0604



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.33	0.39	0.013	0.015
A1	0.00	0.05	0.000	0.002
b	0.05	0.15	0.002	0.006
b1	0.15	0.25	0.006	0.010
D	0.35	0.45	0.014	0.018
E	0.55	0.65	0.022	0.026
e	0.30		0.012	
e1	0.35		0.014	
L1	0.07	0.17	0.003	0.007
L2	0.15	0.25	0.006	0.010
x	-	0.10	-	0.004
v	-	0.05	-	0.002

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	-	0.25	-	0.010
b3	-	0.35	-	0.014
l1	-	0.27	-	0.011
l2	-	0.35	-	0.014

Dimension in mm/inches

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