

$V_{DSS}$	20V
$R_{DS(on)(Max.)}$	470mΩ
$I_D$	±1.0A
$P_D$	400mW

### ●Features

- 1) Low on - resistance.
- 2) High Power small mold Package (VML1006).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.
- 5) ESD protection up to 200V (MM).  
up to 2kV (HBM).

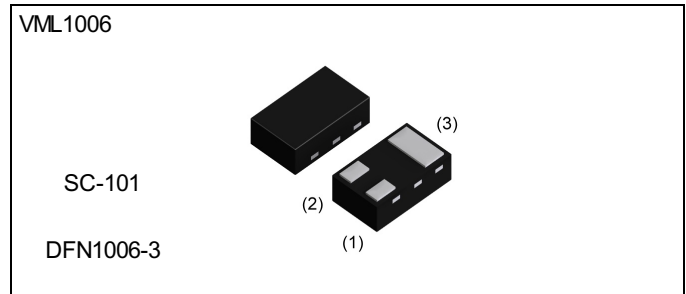
### ●Application

Switching

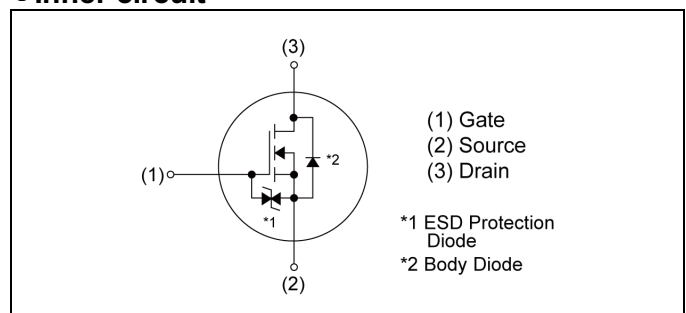
### ●Absolute maximum ratings ( $T_a = 25^{\circ}C$ )

Parameter	Symbol	Value	Unit
Drain - Source voltage	$V_{DSS}$	20	V
Continuous drain current	$I_D$	±1.0	A
Pulsed drain current	$I_{D,pulse}^{*1}$	±2.0	A
Gate - Source voltage	$V_{GSS}$	±8	V
Power dissipation	$P_D^{*2}$	400	mW
Junction temperature	$T_j$	150	°C
Range of storage temperature	$T_{stg}$	-55 to +150	°C

### ●Outline



### ●Inner circuit



### ●Packaging specifications

Type	Packing	Embossed Tape
	Reel size (mm)	180
	Tape width (mm)	8
	Basic ordering unit (pcs)	8000
	Taping code	T2L
	Marking	TJ

## ● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	$R_{thJA}^{*2}$	-	312.5	-	°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
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	$I_D = 1mA$ referenced to $25^\circ\text{C}$	-	29	-	mV/°C
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 20V, V_{GS} = 0V$	-	-	1	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 8V, V_{DS} = 0V$	-	-	$\pm 10$	$\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	0.3	-	1.0	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	$I_D = 1mA$ referenced to $25^\circ\text{C}$	-	-1.6	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*3}$	$V_{GS} = 4.5V, I_D = 500mA$	-	340	470	m $\Omega$
		$V_{GS} = 2.5V, I_D = 500mA$	-	400	560	
		$V_{GS} = 1.8V, I_D = 250mA$	-	470	650	
		$V_{GS} = 1.5V, I_D = 100mA$	-	540	810	
		$V_{GS} = 1.2V, I_D = 50mA$	-	700	1050	
Transconductance	$g_{fs}^{*3}$	$V_{DS} = 10V, I_D = 100mA$	0.4	-	-	S

\*1  $P_w \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$ \*2 EACH TERMINAL MOUNTED ON A REFERENCE LAND,  $P_w \leq 1\text{s}$ 

\*3 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	$C_{iss}$	$V_{GS} = 0V$	-	40	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 10V$	-	15	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	8	-	
Turn - on delay time	$t_{d(on)}^{*3}$	$V_{DD} \approx 10V, V_{GS} = 4.0V$	-	5	-	ns
Rise time	$t_r^{*3}$	$I_D = 250\text{mA}$	-	15	-	
Turn - off delay time	$t_{d(off)}^{*3}$	$R_L \approx 40\Omega$	-	15	-	
Fall time	$t_f^{*3}$	$R_G = 10\Omega$	-	10	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous forward current	$I_S$	$T_a = 25^\circ\text{C}$	-	-	0.1	A
Body diode pulse current	$I_{SP}^{*1}$		-	-	2.0	A
Forward voltage	$V_{SD}^{*3}$	$V_{GS} = 0V, I_S = 100\text{mA}$	-	-	1.2	V

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve



Fig.2 Maximum Safe Operating Area

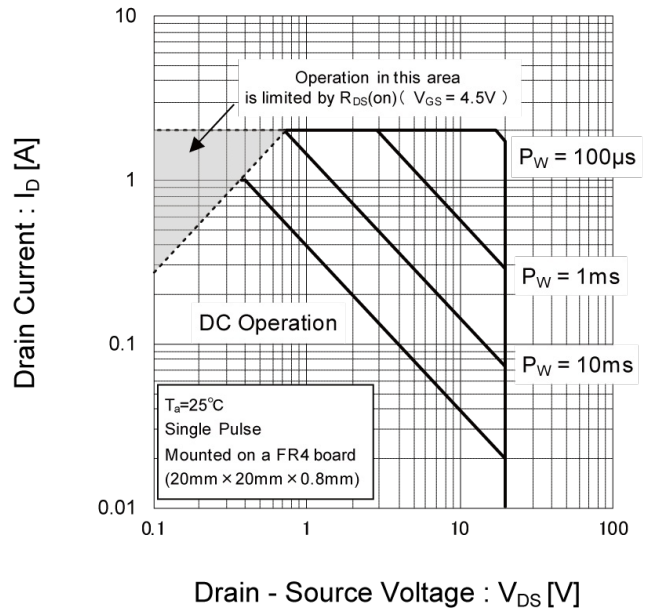


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

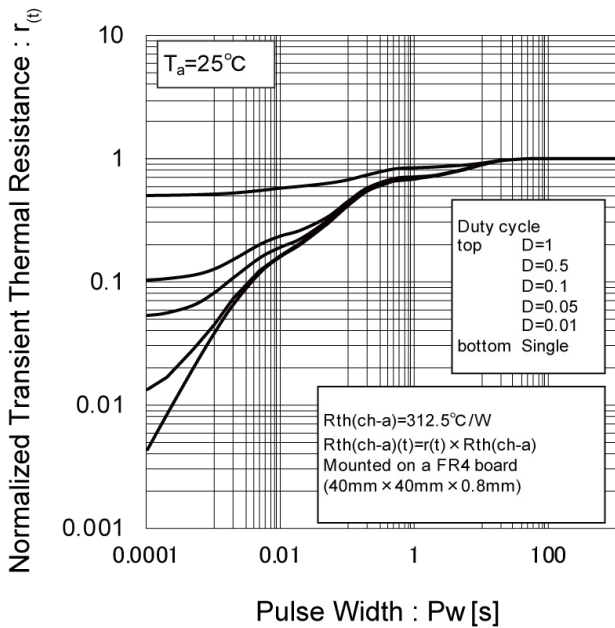
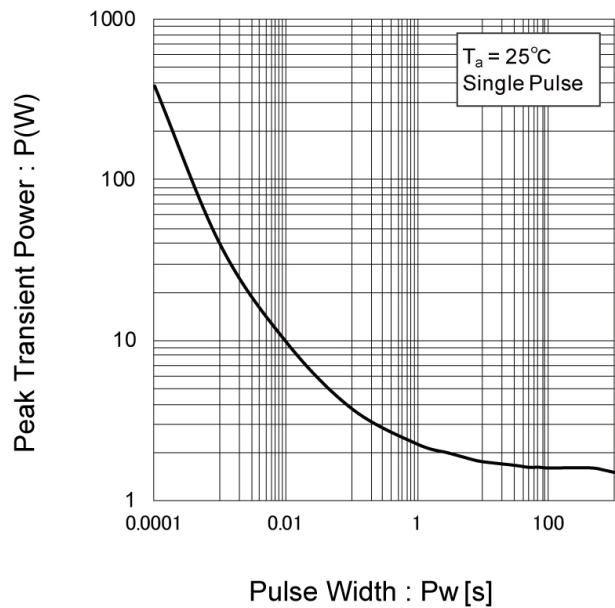


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

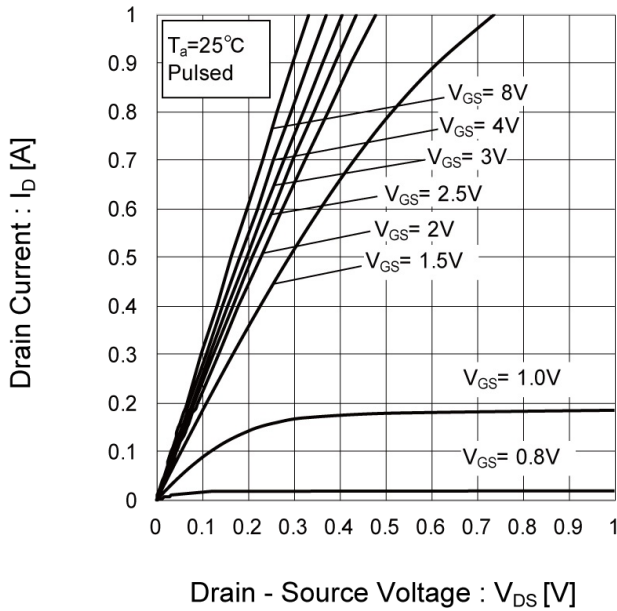


Fig.6 Typical Output Characteristics(II)

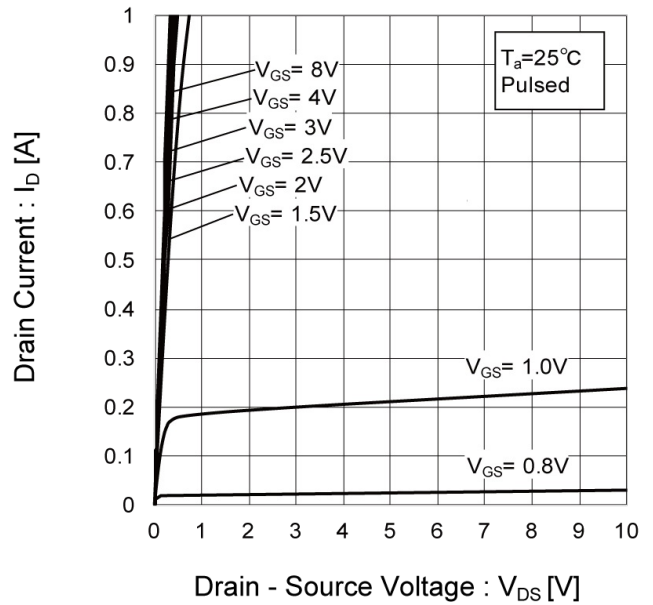


Fig.7 Breakdown Voltage vs. Junction Temperature

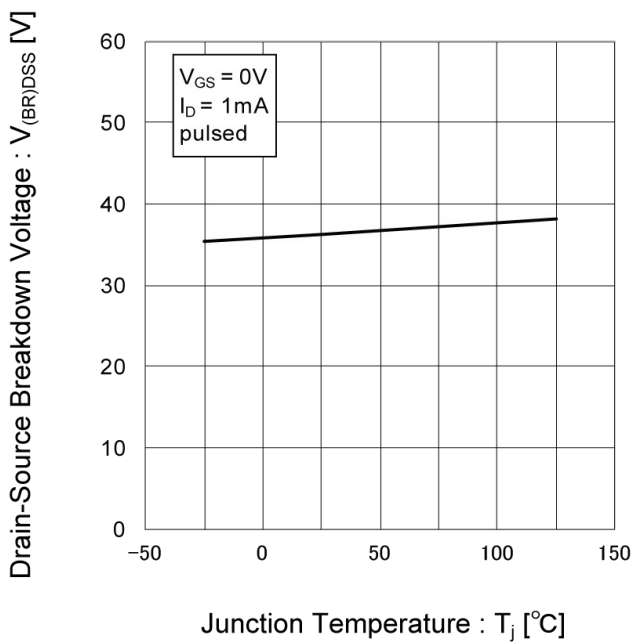
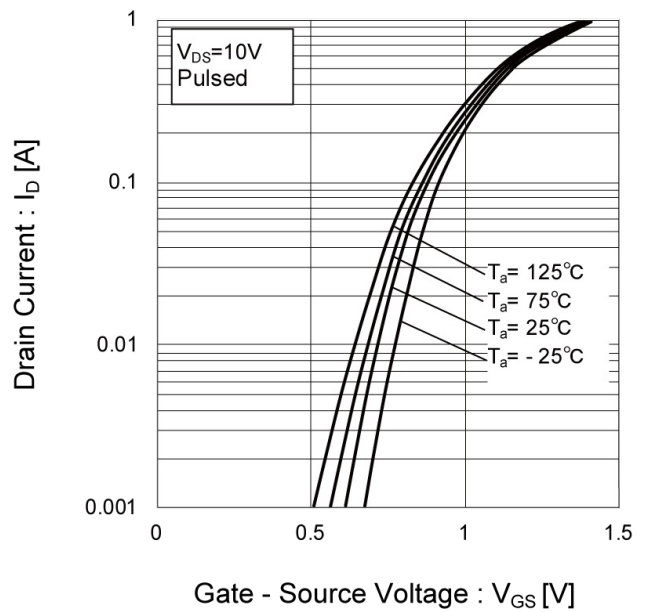


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage vs. Junction Temperature

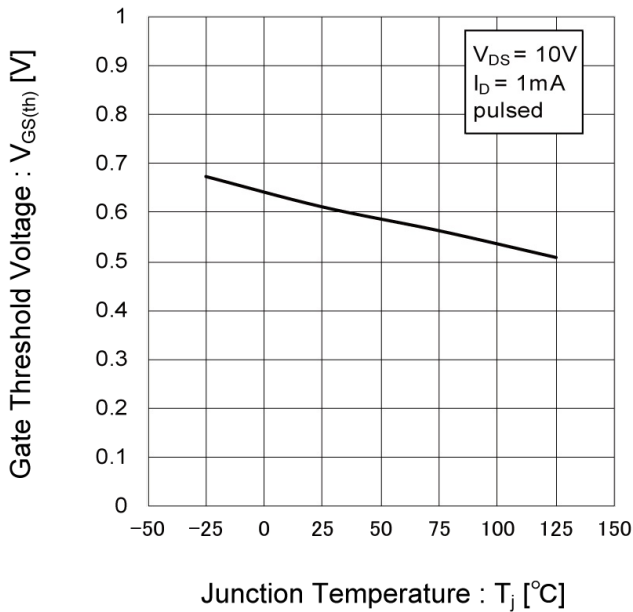


Fig.10 Transconductance vs. Drain Current

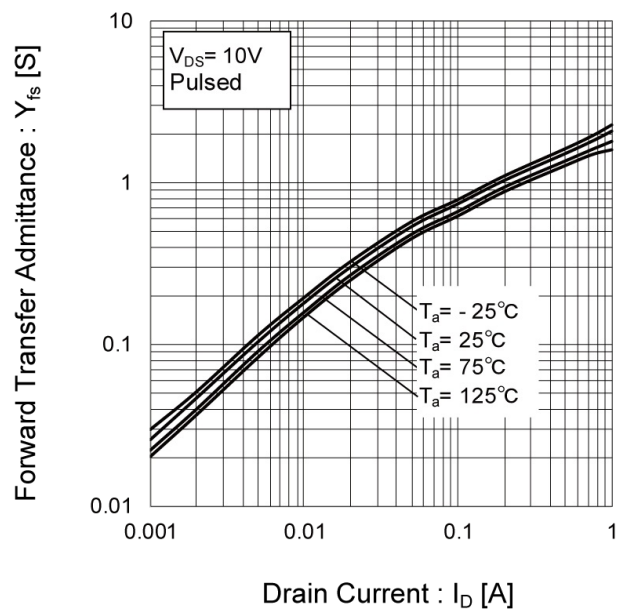


Fig.11 Drain Current Derating Curve

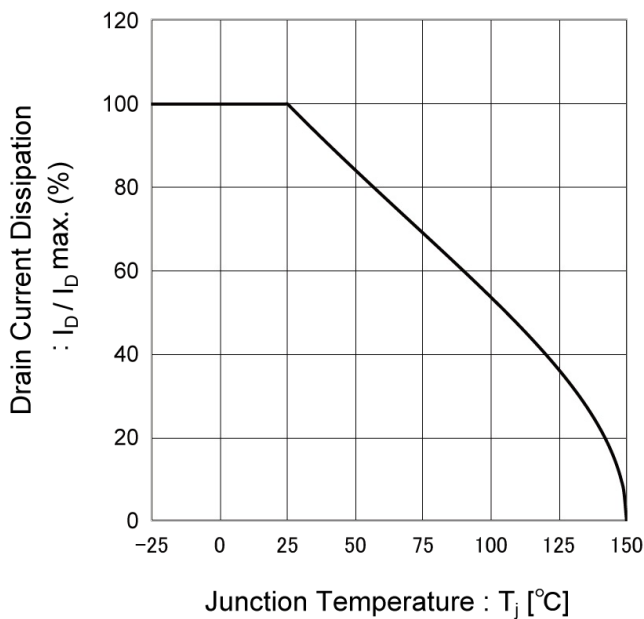
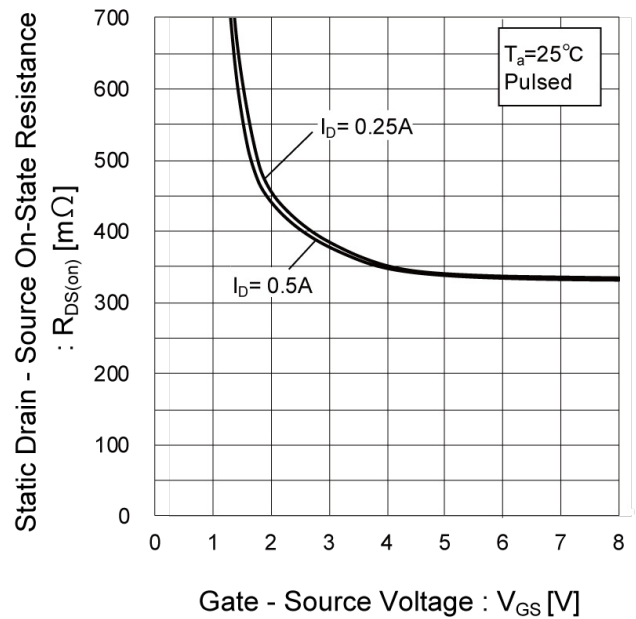


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

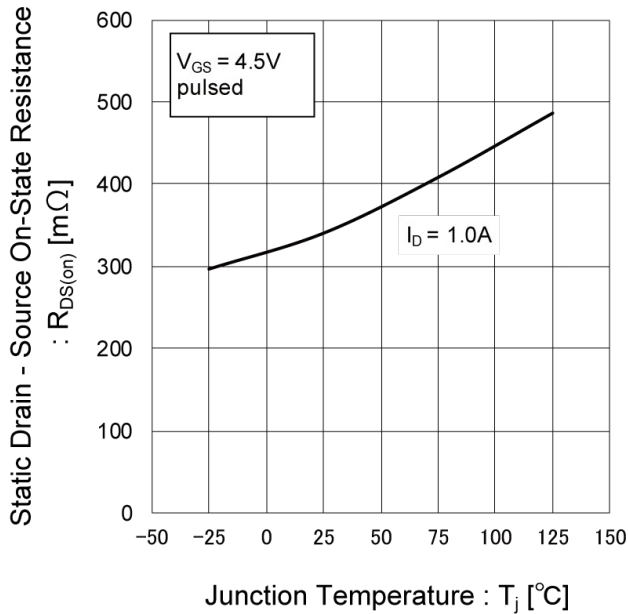


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

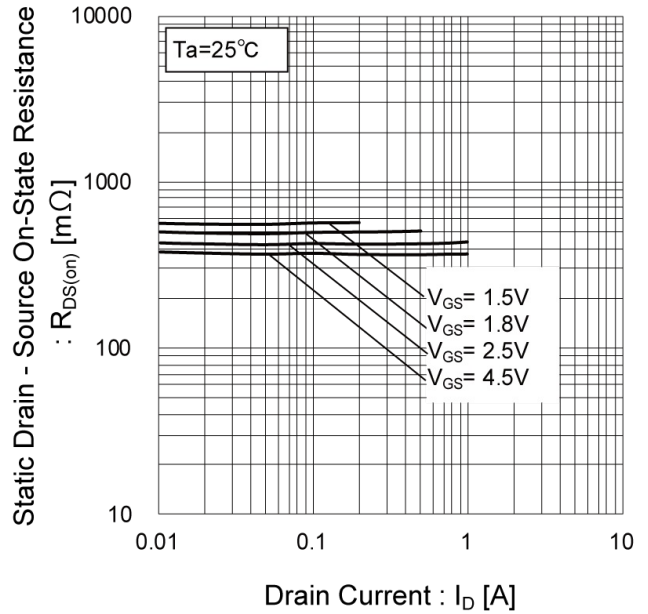


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

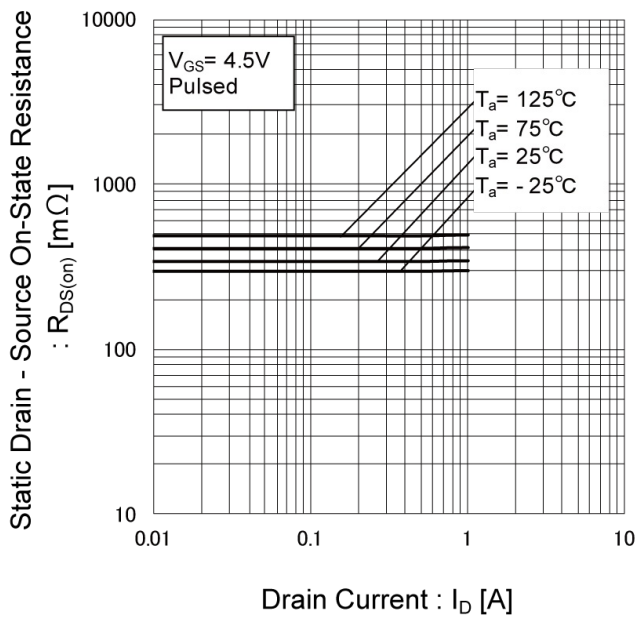
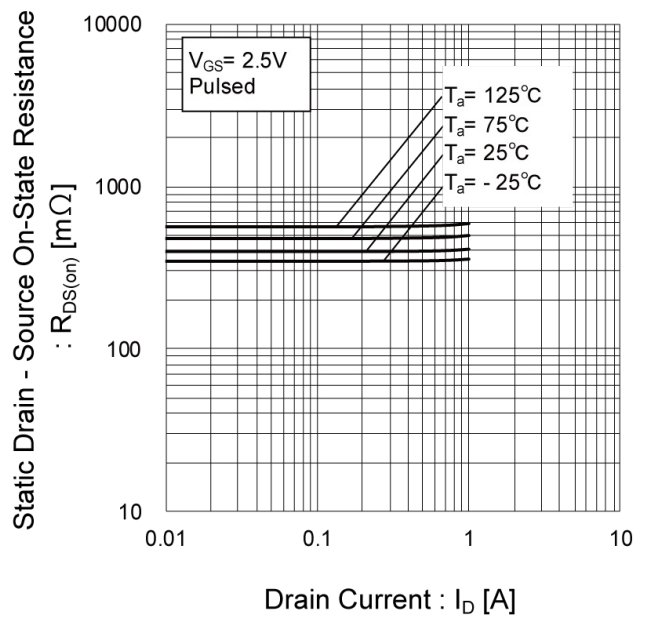


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



● Electrical characteristic curves

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

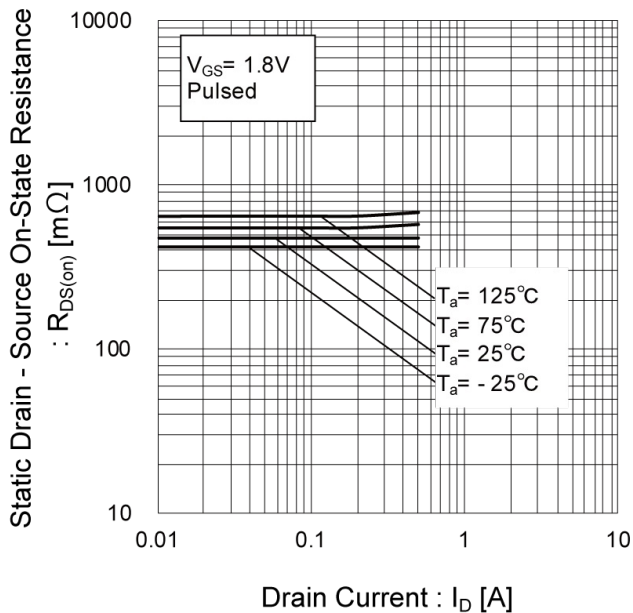


Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(V)

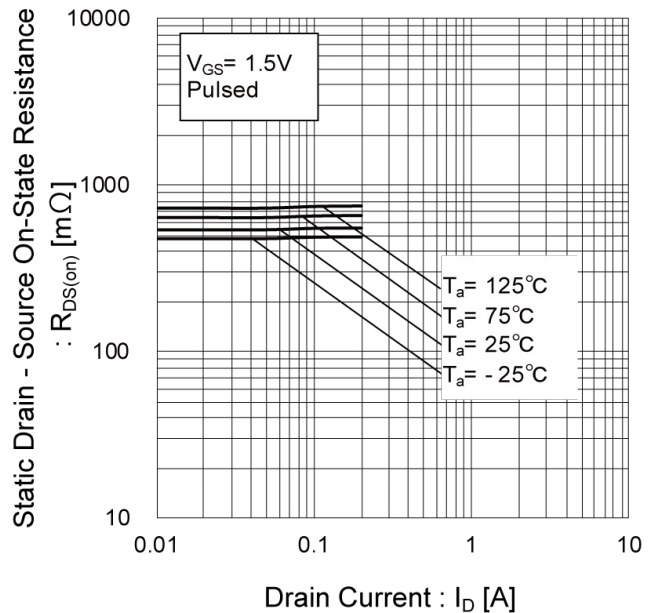


Fig.19 Typical Capacitance vs. Drain - Source Voltage

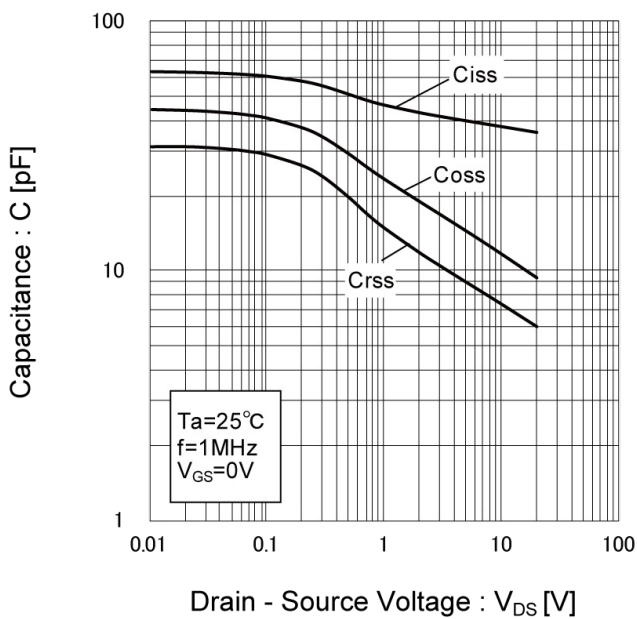
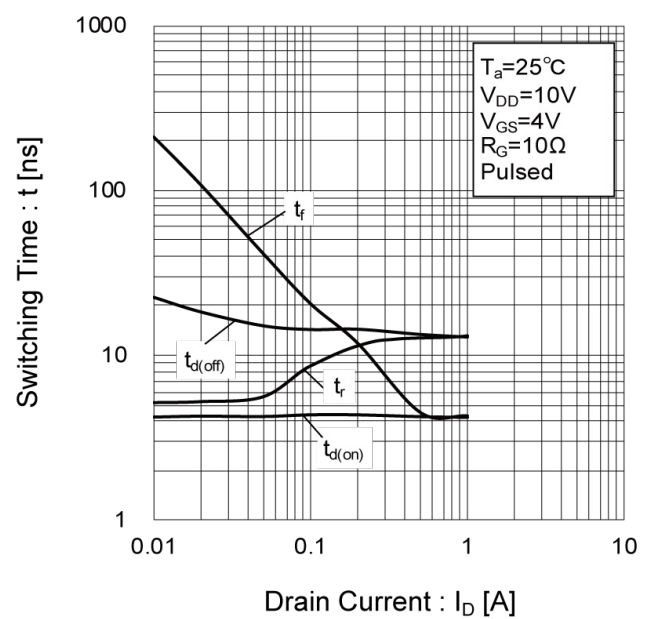


Fig.20 Switching Characteristics





● Electrical characteristic curves

Fig.21 Dynamic Input Characteristics

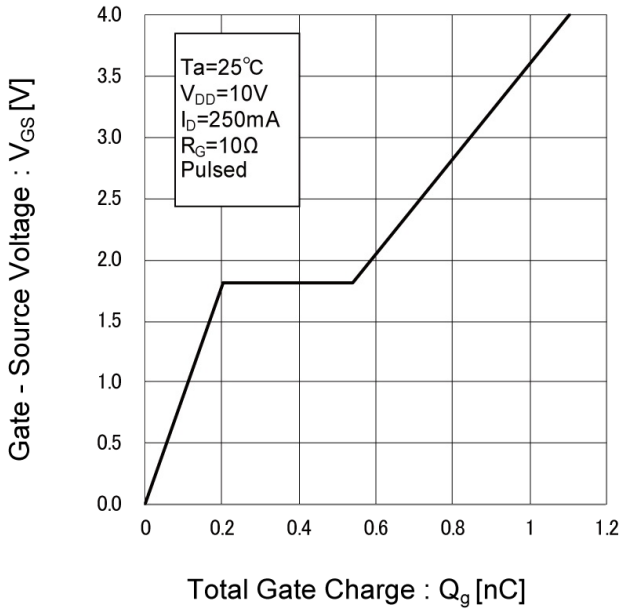
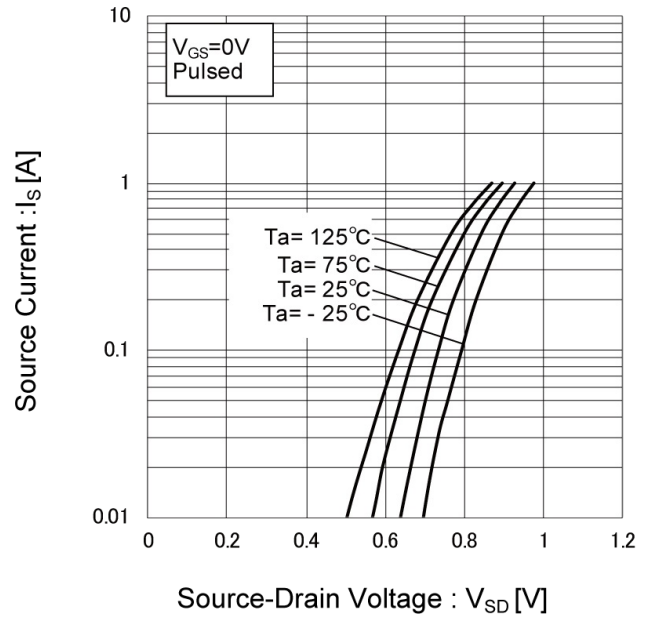


Fig.22 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 SWITCHING TIME MEASUREMENT CIRCUIT

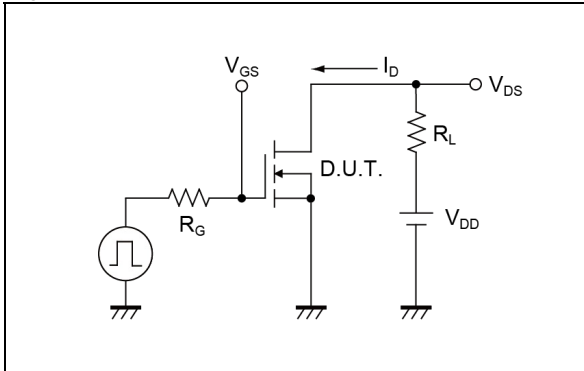
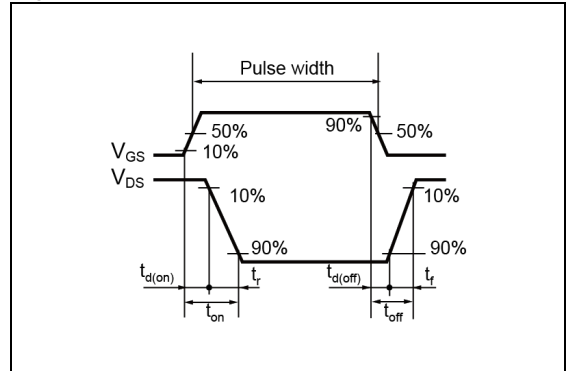
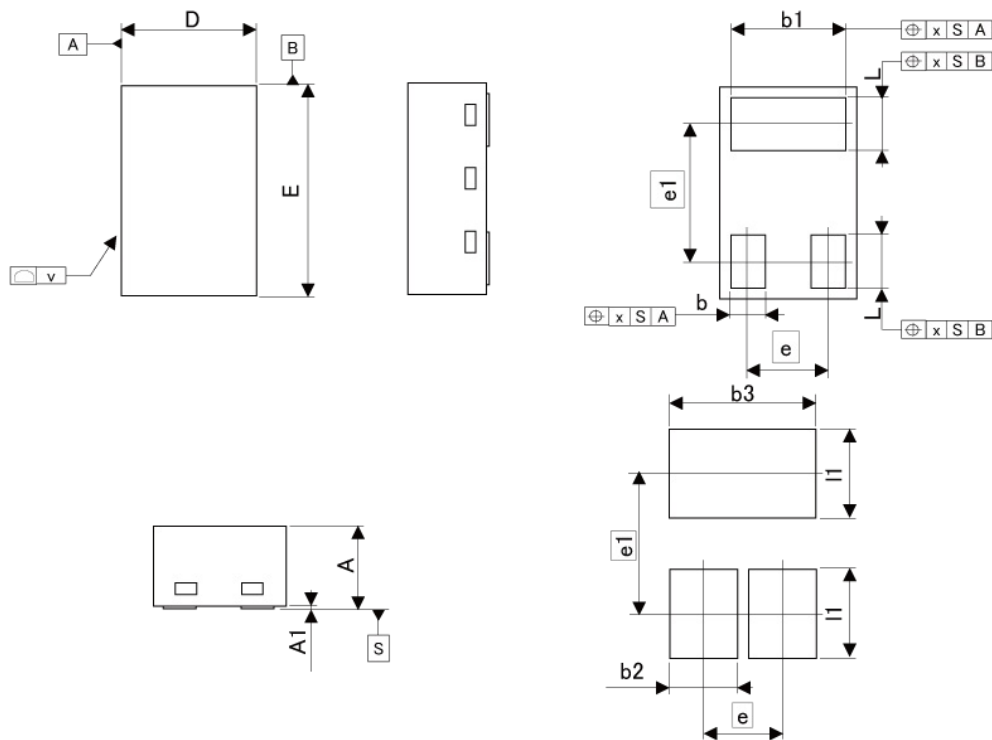


Fig.1-2 SWITCHING WAVEFORMS



●Dimensions

VML1006  
< DFN1006-3 >



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

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.34	0.40	0.013	0.016
A1	0.00	0.05	0.000	0.002
b	0.10	0.20	0.004	0.008
b1	0.45	0.55	0.018	0.022
D	0.55	0.65	0.022	0.026
E	0.95	1.05	0.037	0.041
e	0.35		0.014	
e1	0.65		0.026	
L	0.20	0.30	0.008	0.012
x	-	0.10	-	0.004
v	-	0.05	-	0.002

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	-	0.3	-	0.012
b3	-	0.65	-	0.026
l1	-	0.40	-	0.016

Dimension in mm/inches

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