

V_{DSS}	40V
$R_{DS(on)}$ at 10V (Max.)	17.5m Ω
$R_{DS(on)}$ at 4.5V (Max.)	23.1m Ω
I_D	9A
P_D	2.0W

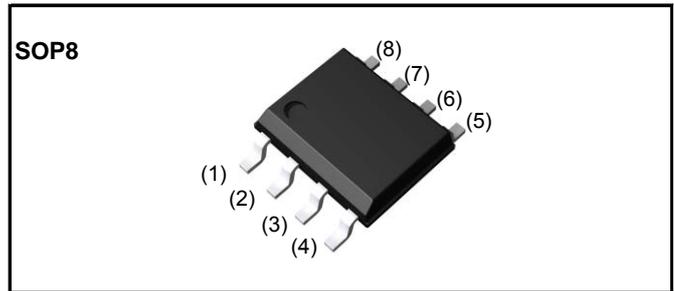
●Features

- 1) Low on - resistance.
- 2) High Power Small Mold Package (SOP8).
- 3) Pb-free lead plating ; RoHS compliant
- 4) Halogen Free
- 5) 100% UIS Tested

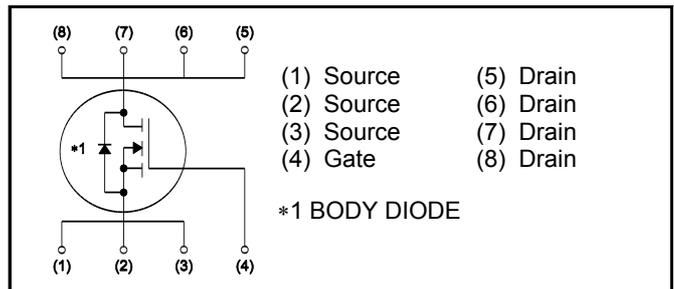
●Application

DC/DC converters

●Outline



●Inner circuit



●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	330
	Tape width (mm)	12
	Basic ordering unit (pcs)	2,500
	Taping code	TB
	Marking	RMH090N04

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

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	40	V
Continuous drain current	I_D^{*1}	± 9	A
Pulsed drain current	$I_{D,pulse}^{*2}$	± 36	A
Gate - Source voltage	V_{GSS}	± 20	V
Power dissipation	P_D^{*3}	2.0	W
Junction temperature	T_j	150	$^\circ\text{C}$
Range of storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJA}^{*4}	-	-	62.5	°C/W
	R_{thJC}	-	-	-	°C/W

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	40	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	$I_D = 1mA$ referenced to 25°C	-	39.4	-	mV/°C
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 40V, V_{GS} = 0V$	-	-	1	μA
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	1.0	-	2.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{(GS)th}}{\Delta T_j}$	$I_D = 1mA$ referenced to 25°C	-	-4.7	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS} = 10V, I_D = 9A$	-	12.5	17.5	mΩ
		$V_{GS} = 4.5V, I_D = 9A$	-	16.5	23.1	
Gate input resistance	R_G	$f = 1MHz, \text{open drain}$	-	2.9	-	Ω
Transconductance	g_{fs}^{*4}	$V_{DS} = 10V, I_D = 9A$	3.5	-	-	S

*1 Limited only by maximum temperature allowed.

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

*3 Mounted on a CERAMIC board

*4 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	600	-	pF
Output capacitance	C_{oss}	$V_{DS} = 20V$	-	135	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	34	-	
Turn - on delay time	$t_{d(on)}^{*4}$	$V_{DD} \approx 20V, V_{GS} = 10V$	-	10.6	-	ns
Rise time	t_r^{*4}	$I_D = 4.5A$	-	4.6	-	
Turn - off delay time	$t_{d(off)}^{*4}$	$R_L = 4.4\Omega$	-	26.3	-	
Fall time	t_f^{*4}	$R_G = 10\Omega$	-	3.4	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*4}	$V_{DD} \approx 20V, I_D=9A$ $V_{GS} = 10V$	-	10.4	-	nC
		$V_{DD} \approx 20V, I_D=9A$ $V_{GS} = 4.5V$	-	5.0	-	
Gate - Source charge	Q_{gs}^{*4}	$V_{GS} = 4.5V$	-	2.6	-	
Gate - Drain charge	Q_{gd}^{*4}		-	1.4	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S^{*1}	$T_a = 25^\circ\text{C}$	-	-	1.67	A
Forward voltage	V_{SD}^{*4}	$V_{GS} = 0V, I_S = 1.67A$	-	-	1.2	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

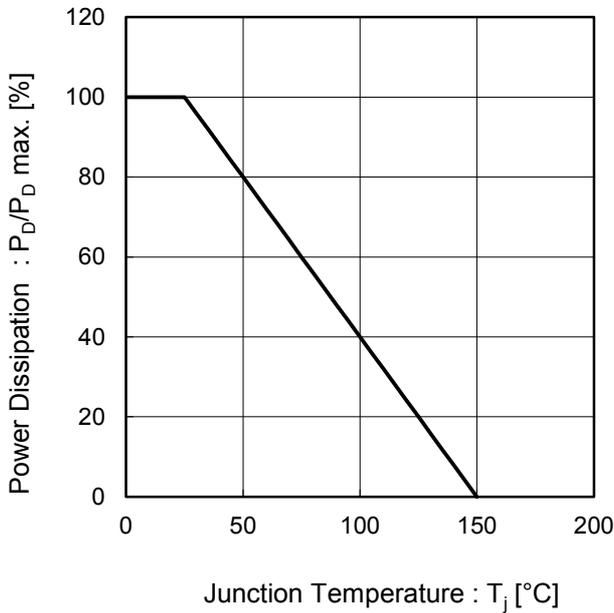


Fig.2 Maximum Safe Operating Area

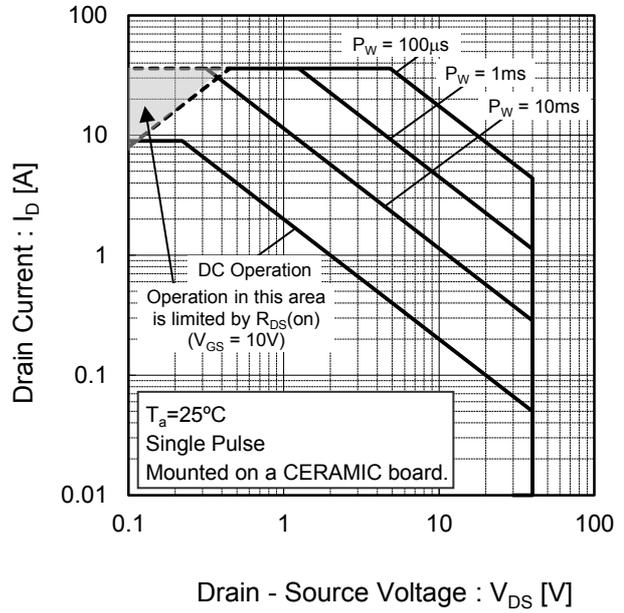


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

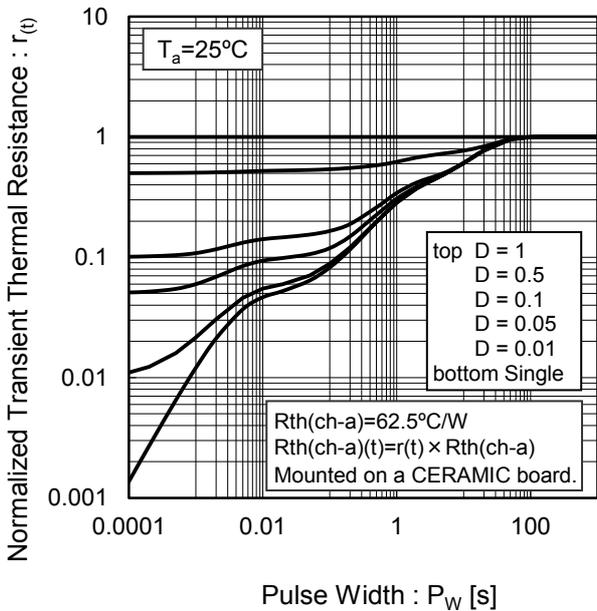
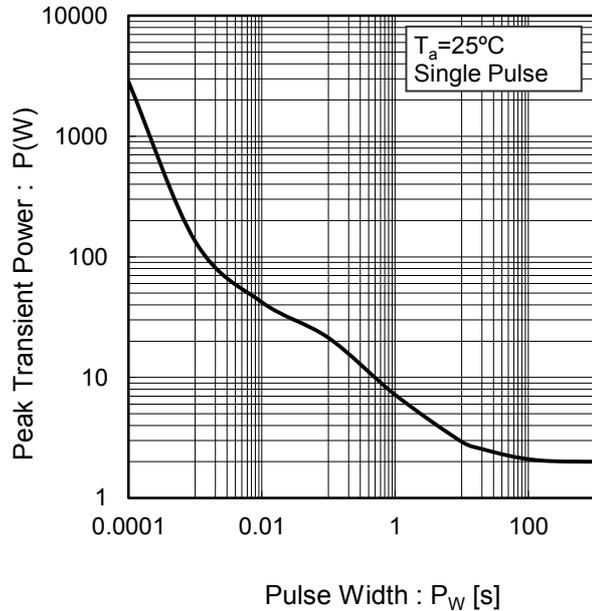


Fig.4 Single Pulse Maximum Power dissipation



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

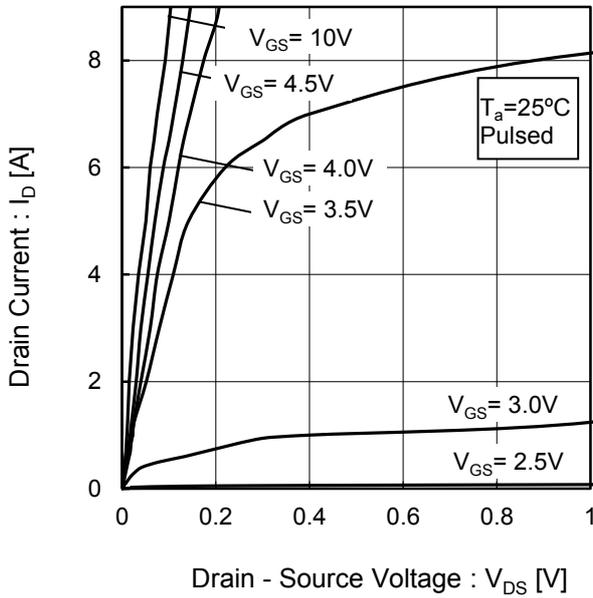


Fig.6 Typical Output Characteristics(II)

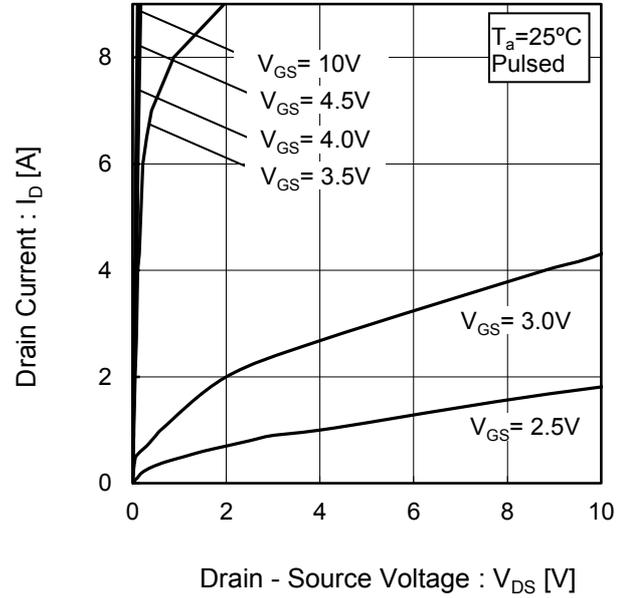


Fig.7 Breakdown Voltage vs. Junction Temperature

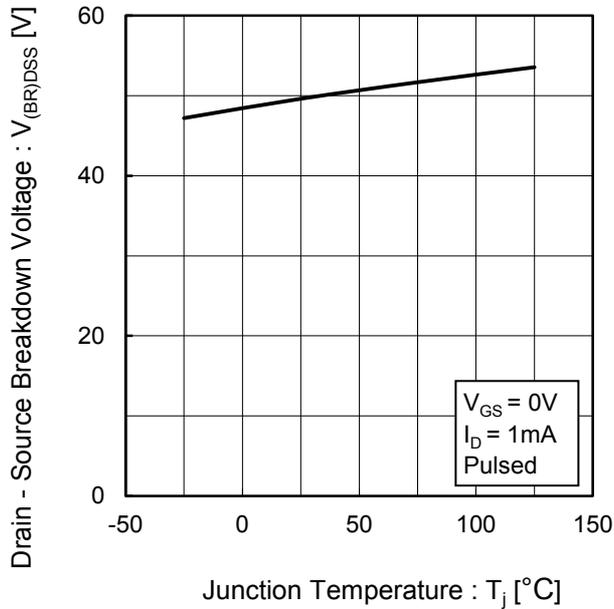
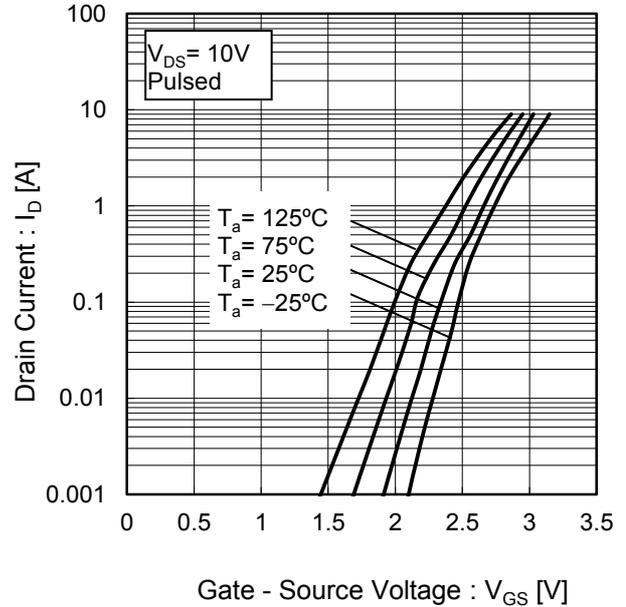


Fig.8 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.9 Gate Threshold Voltage vs. Junction Temperature

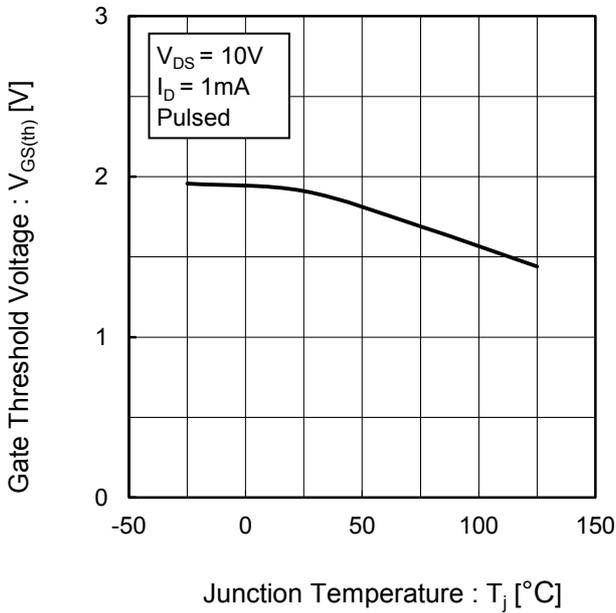


Fig.10 Transconductance vs. Drain Current

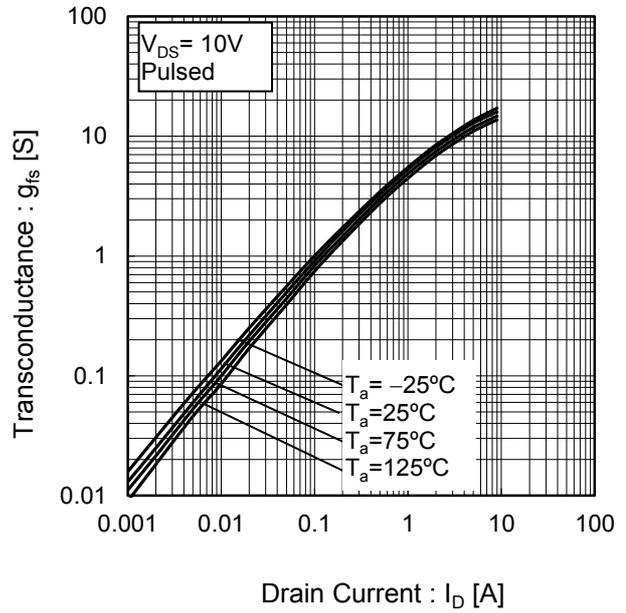


Fig.11 Drain Current Derating Curve

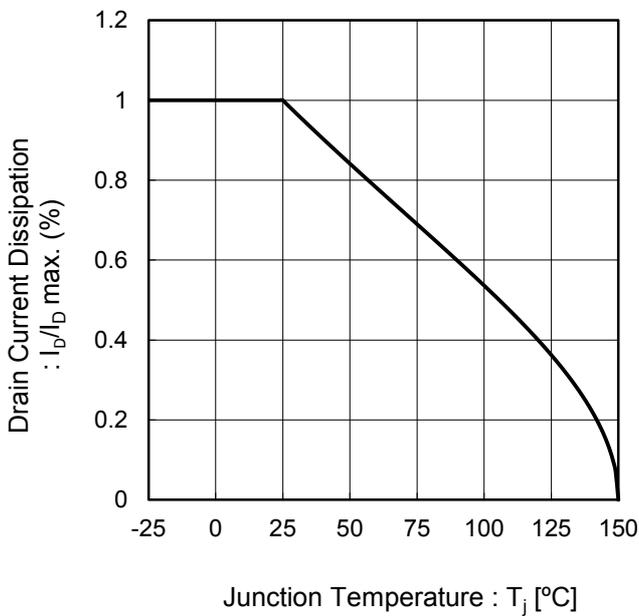
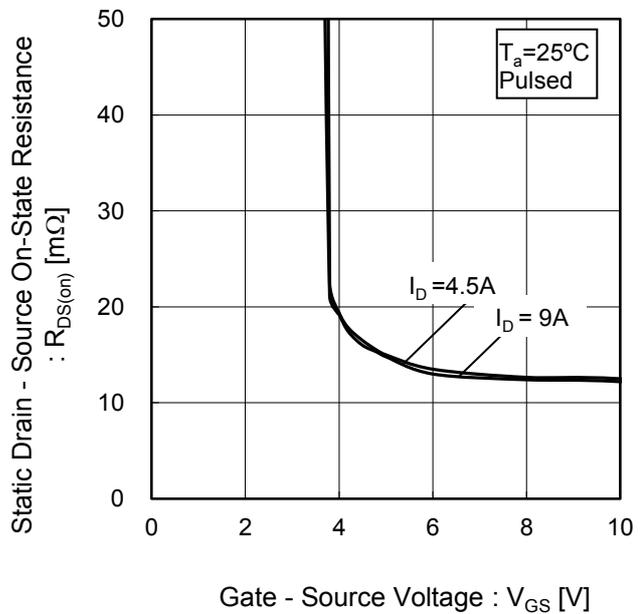


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



●Electrical characteristic curves

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

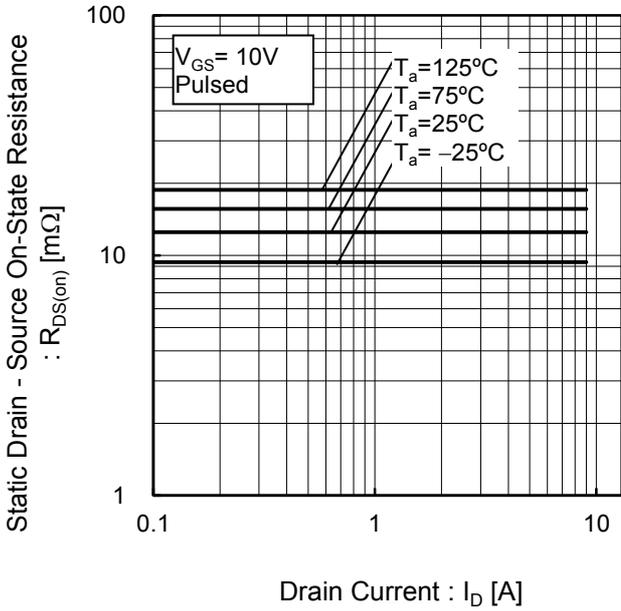


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature

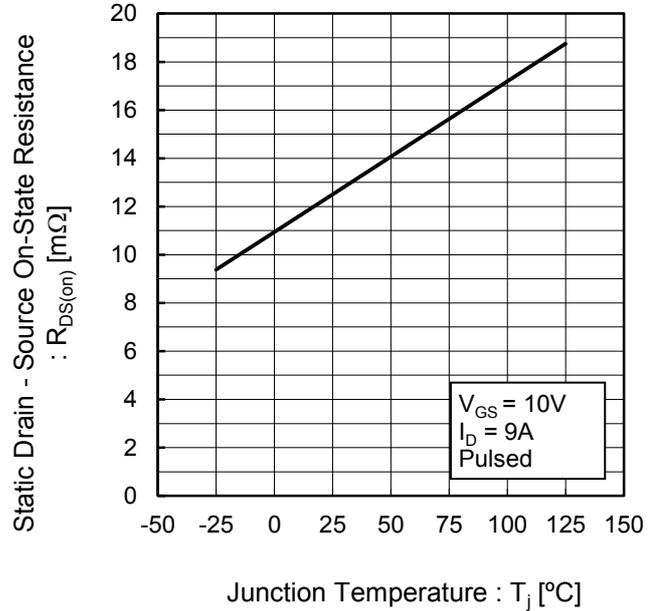
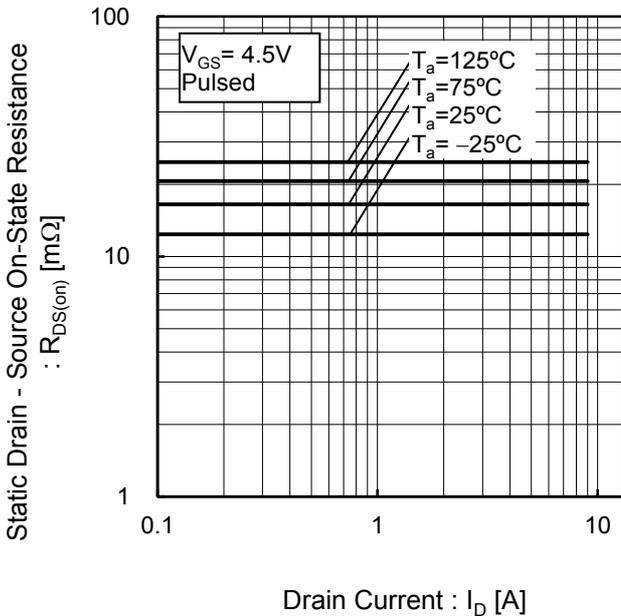


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)



●Electrical characteristic curves

Fig.16 Typical Capacitance vs. Drain - Source Voltage

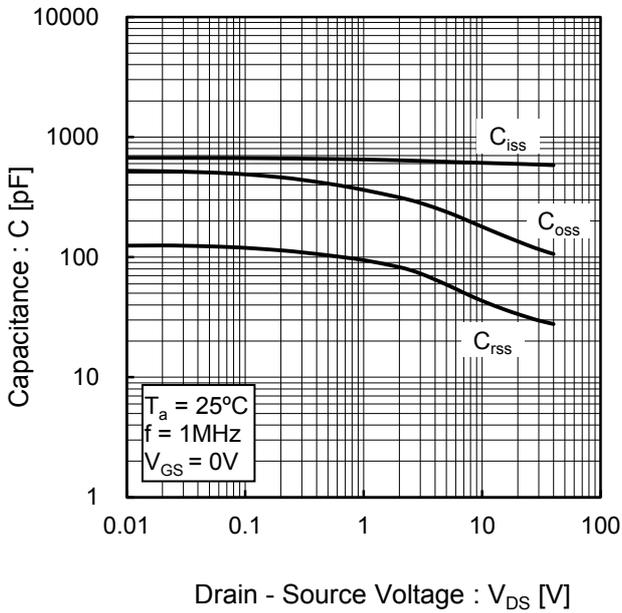


Fig.17 Switching Characteristics

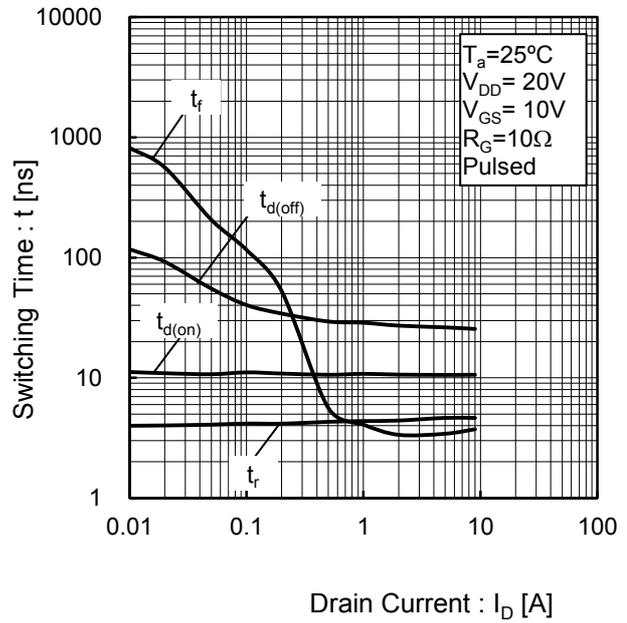


Fig.18 Dynamic Input Characteristics

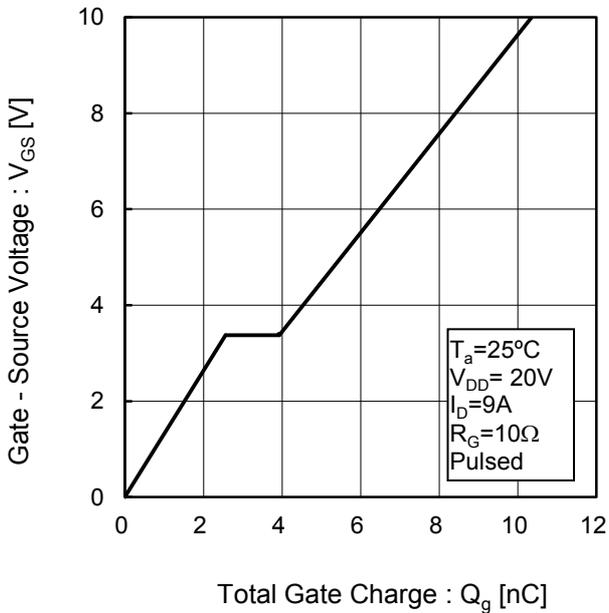
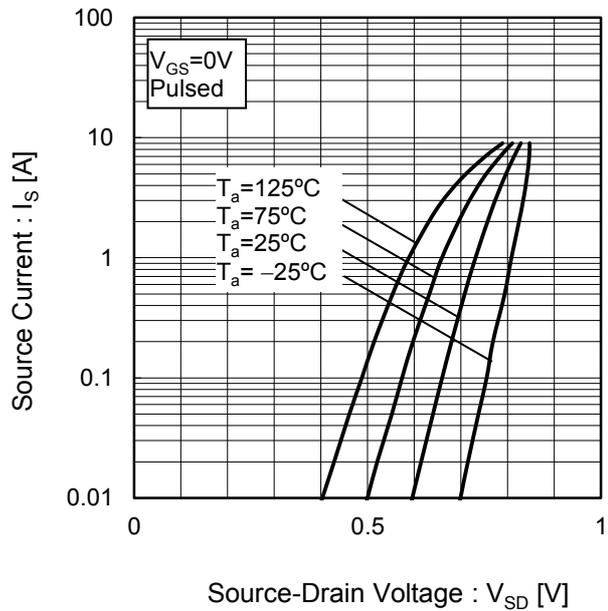


Fig.19 Source Current vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

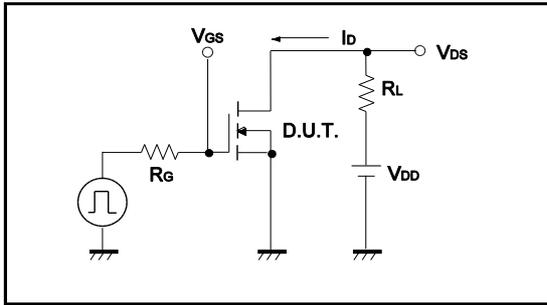


Fig.1-2 Switching Waveforms

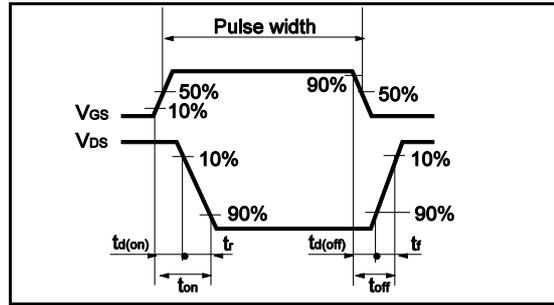


Fig.2-1 Gate Charge Measurement Circuit

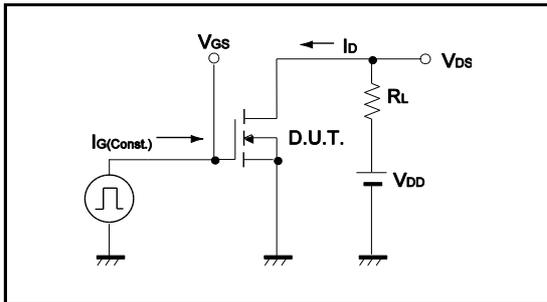
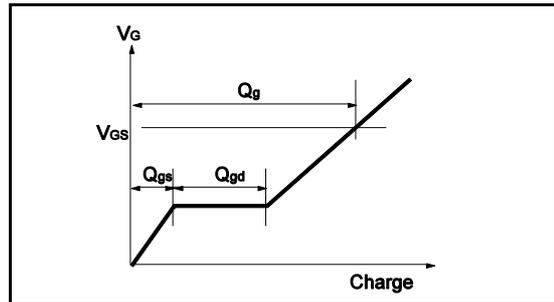
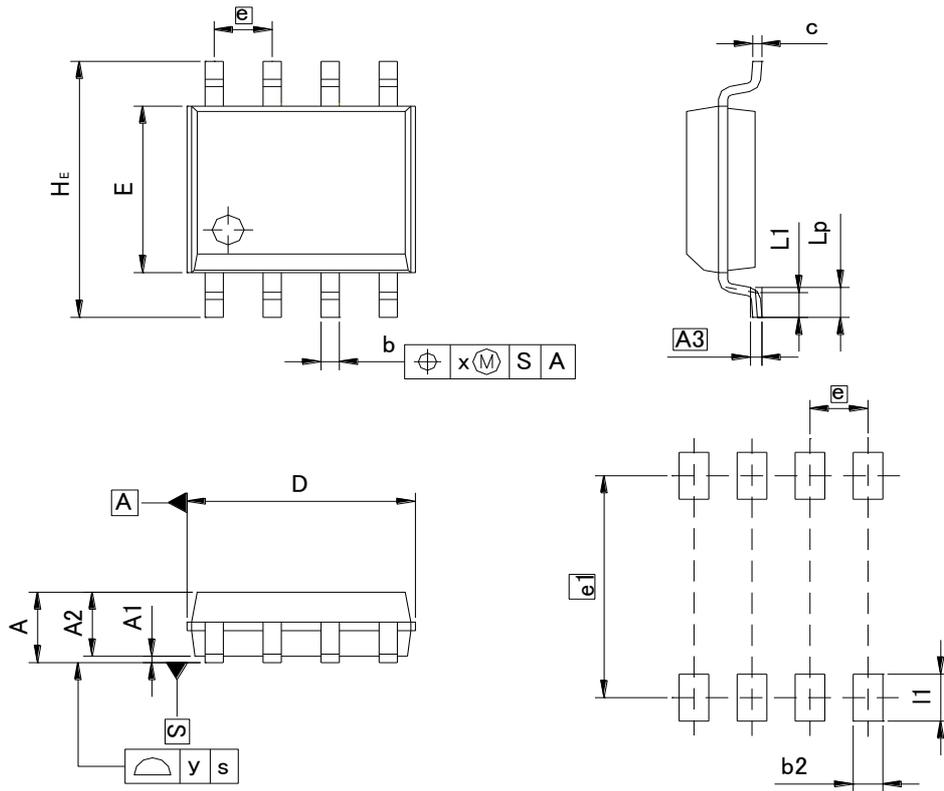


Fig.2-2 Gate Charge Waveform



●Dimensions (Unit : mm)

SOP8



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

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	1.75	-	0.069
A1	0.15		0.006	
A2	1.40	1.60	0.055	0.063
A3	0.25		0.010	
b	0.30	0.50	0.012	0.020
c	0.10	0.30	0.004	0.012
D	4.80	5.20	0.189	0.205
E	3.75	4.05	0.148	0.159
e	1.27		0.050	
HE	5.70	6.30	0.224	0.248
L1	0.50	0.70	0.020	0.028
Lp	0.65	0.85	0.026	0.033
x	0.15		0.006	
y	0.10		0.004	

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	-	0.65	-	0.026
e1	5.15		0.203	
l1	-	1.15	-	0.045

Dimension in mm / inches

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