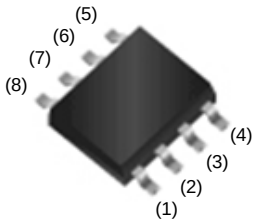
RRH090P03

Pch -30V -9A Power MOSFET Datasheet

V_{DSS}	−30V
$R_{DS(on)}$ (Max.)	15.4mΩ
I_D	−9A
P_D	2.0W

●Outline

SOP8



●Features

1) Low on - resistance.

2) Built-in G-S Protection Diode.

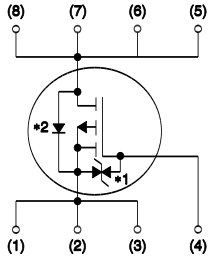
3) Small Surface Mount Package (SOP8).

4) Pb-free lead plating ; RoHS compliant

●Inner circuit

(1) Source (5) Drain
(2) Source (6) Drain
(3) Source (7) Drain
(4) Gate (8) Drain

∗1 ESD PROTECTION DIODE
∗2 BODY DIODE



●Application

DC/DC Converter

●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	330
	Tape width (mm)	12
	Basic ordering unit (pcs)	2,500
	Taping code	TB
	Marking	RRH090P03

●Absolute maximum ratings(T_a = 25°C)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	−30	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
Avalanche energy, single pulse	E_{AS} *3	0.6	mJ
Power dissipation	P_D *4	2.0	W
	P_D *5	0.65	W
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} *4	-	-	62.5	°C/W
Thermal resistance, junction - ambient	R_{thJA} *5	-	-	192	°C/W

●Electrical characteristics(T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = −1mA	−30	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	I_D = −1mA referenced to 25°C	-	−25	-	mV/°C
Zero gate voltage drain current	I_{DSS}	V_{DS} = −30V, V_{GS} = 0V	-	-	−1	μA
Gate - Source leakage current	I_{GSS}	V_{GS} = ±20V, V_{DS} = 0V	-	-	±10	μA
Gate threshold voltage	$V_{GS\ (th)}$	V_{DS} = −10V, I_D = −1mA	−1	-	−2.5	V
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{(GS)th}}{\Delta T_j}$	I_D = −1mA referenced to 25°C	-	3.9	-	mV/°C
Static drain - source on - state resistance	$R_{DS(on)}$ *6	V_{GS}= −10V, I_D= −9A	-	11.0	15.4	mΩ
		V_{GS}= −4.5V, I_D= −4.5A	-	15.0	21.0	
		V_{GS}= −4.0V, I_D= −4.5A	-	17.0	24.0	
		V_{GS}= −10V, I_D= −9A, T_j=125°C	-	17.0	24.0	
Gate input resistannce	R_G	f = 1MHz, open drain	-	3.0	-	Ω
Transconductance	g_{fs} *6	V_{DS} = −10V, I_D = −9A	10	20	-	S

*1 Limited only by maximum temperature allowed.

*2 Pw ≤ 10μs, Duty cycle ≤ 1%

*3 L ≃ 10μH, V_{DD} = −15V, Rg = 25Ω, starting T_j = 25°C

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

*5 Mounted on a FR4 (20×20×0.8mm)

●**Electrical characteristics**(T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	3000	-	pF
Output capacitance	C_{oss}	V_{DS} = −10V	-	360	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	360	-	
Turn - on delay time	$t_{d(on)}$ *6	$V_{DD} \simeq$ −15V, V_{GS} = −10V	-	20	-	ns
Rise time	t_r *6	I_D = −4.5A	-	30	-	
Turn - off delay time	$t_{d(off)}$ *6	R_L = 3.3Ω	-	135	-	
Fall time	t_f *6	R_G = 10Ω	-	80	-	

●**Gate Charge characteristics**(T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *6	$V_{DD} \simeq$ −15V, I_D = −9A V_{GS} = −5V	-	30	-	nC
		$V_{DD} \simeq$ −15V, I_D = −9A V_{GS} = −10V	-	56	-	
Gate - Source charge	Q_{gs} *6	$V_{DD} \simeq$ −15V, I_D = −9A V_{GS} = −5V	-	7	-	
Gate - Drain charge	Q_{gd} *6		-	11	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	T_a = 25°C	-	-	−1.6	A
Forward voltage	V_{SD} *6	V_{GS} = 0V, I_s = −9A	-	-	−1.2	V
Reverse recovery time	t_{rr} *6	I_S = −9A di/dt = 100A / μs	-	35	70	ns
Reverse recovery charge	Q_{rr} *6		-	30	60	μC

*6 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

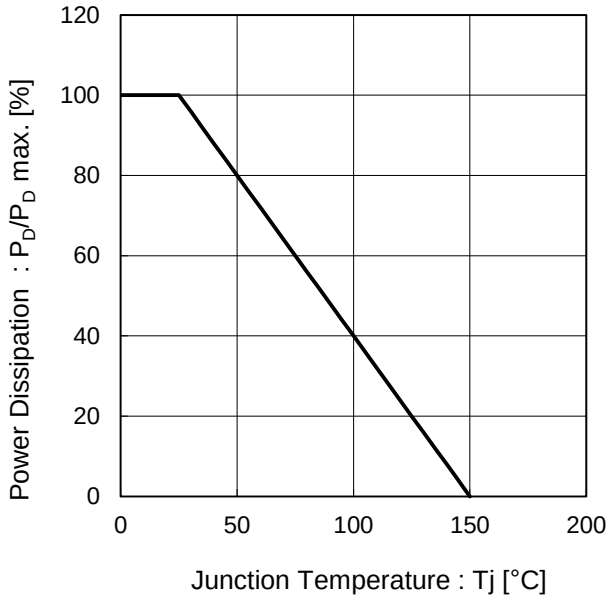


Fig.2 Maximum Safe Operating Area

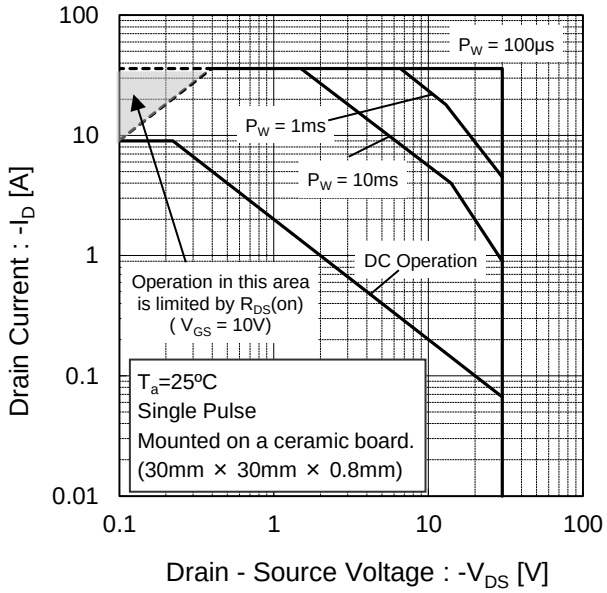


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

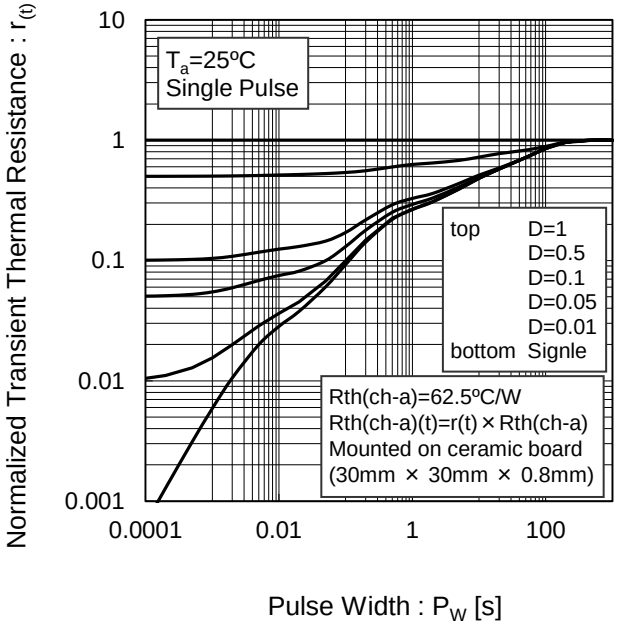
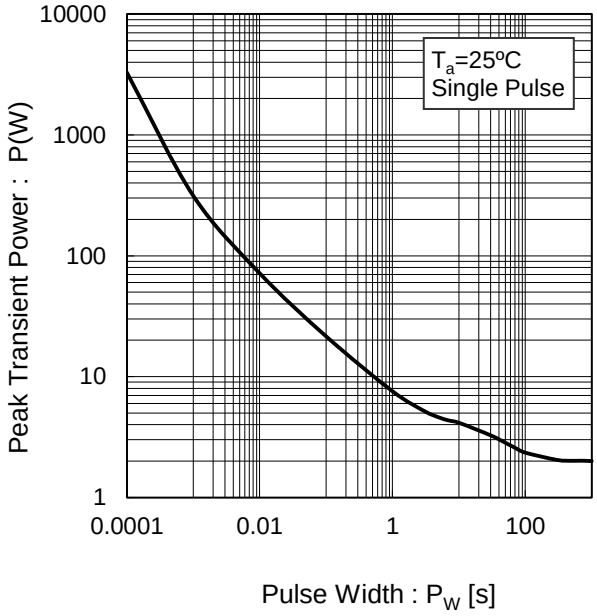


Fig.4 Single Pulse Maxmum Power dissipation



●Electrical characteristic curves

Fig.5 Avalanche Current vs Inductive Load

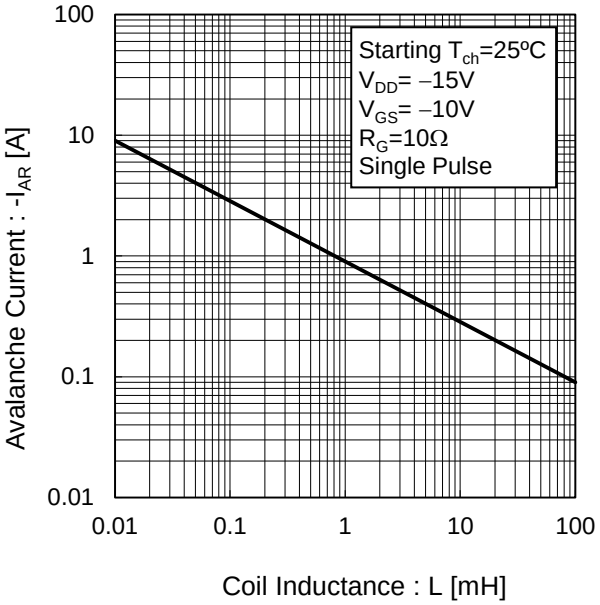


Fig.6 Avalanche Energy Derating Curve vs Junction Temperature

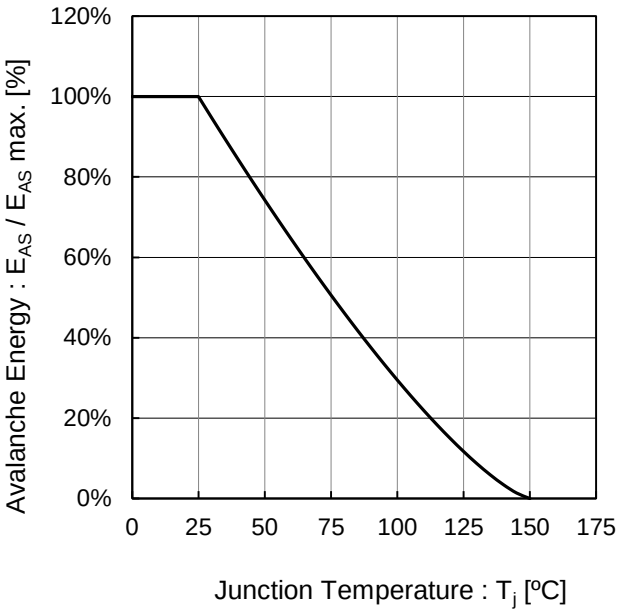


Fig.7 Typical Output Characteristics(I)

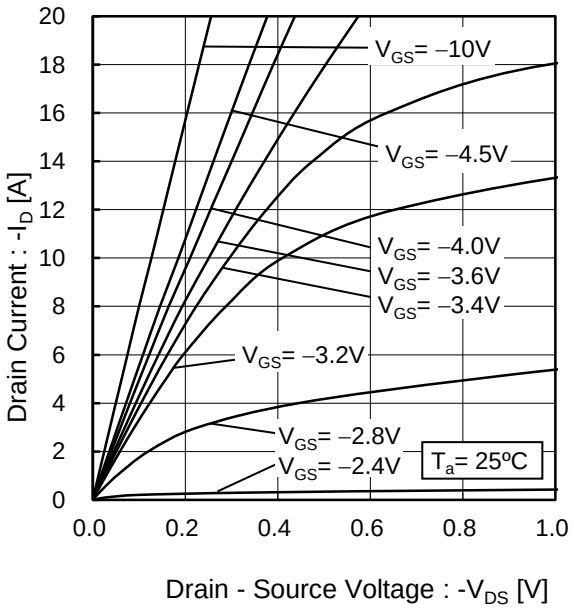
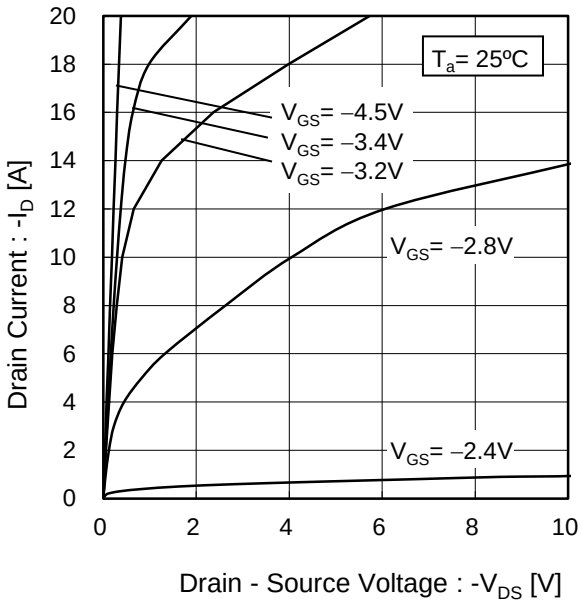


Fig.8 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.9 Breakdown Voltage vs. Junction Temperature

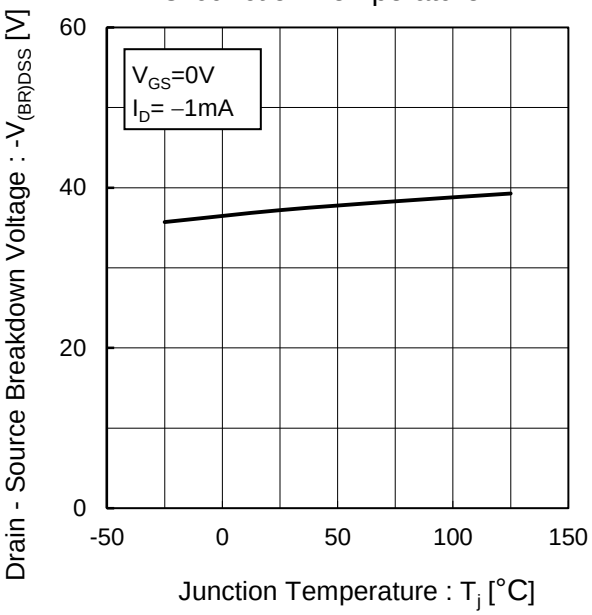


Fig.10 Typical Transfer Characteristics

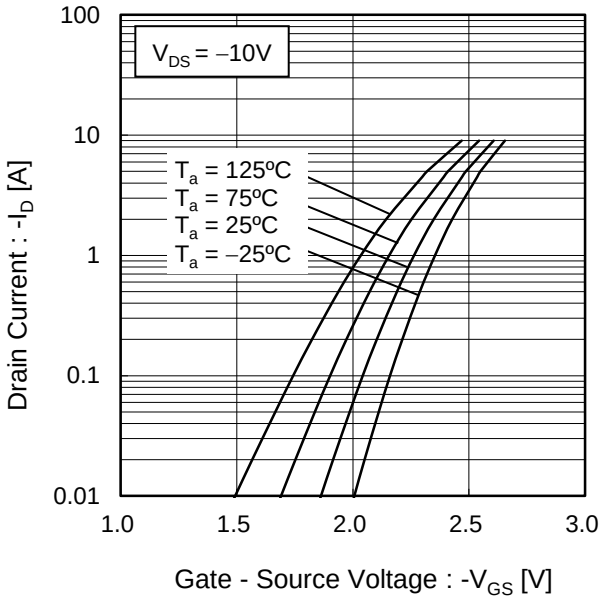


Fig.11 Gate Threshold Voltage vs. Junction Temperature

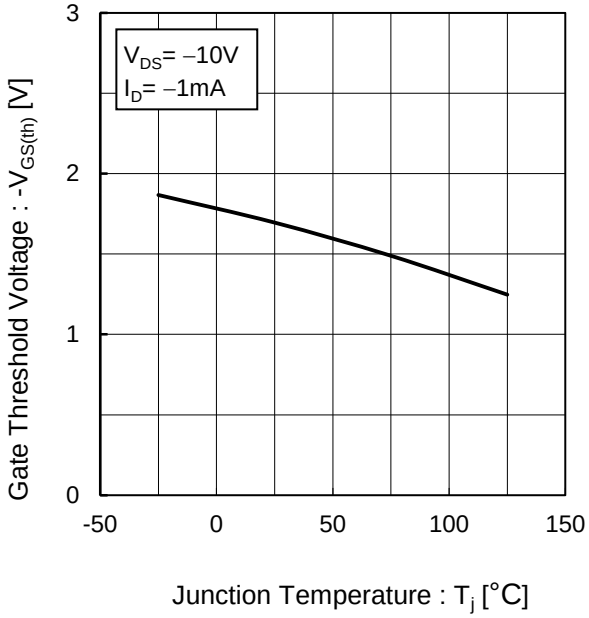
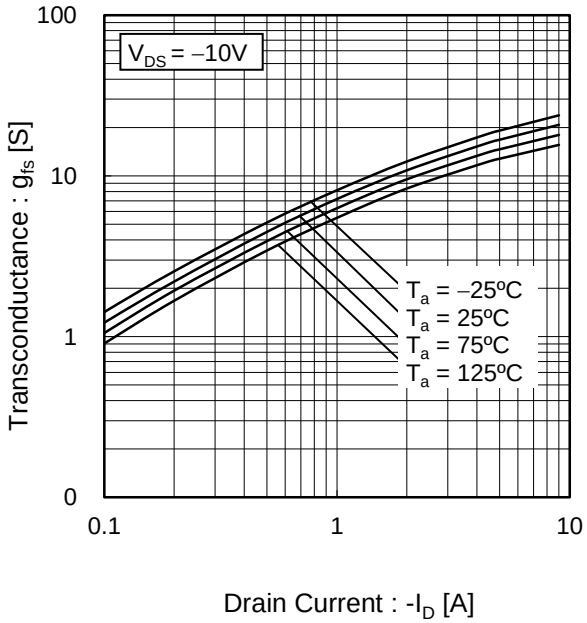


Fig.12 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.13 Drain Current Derating Curve

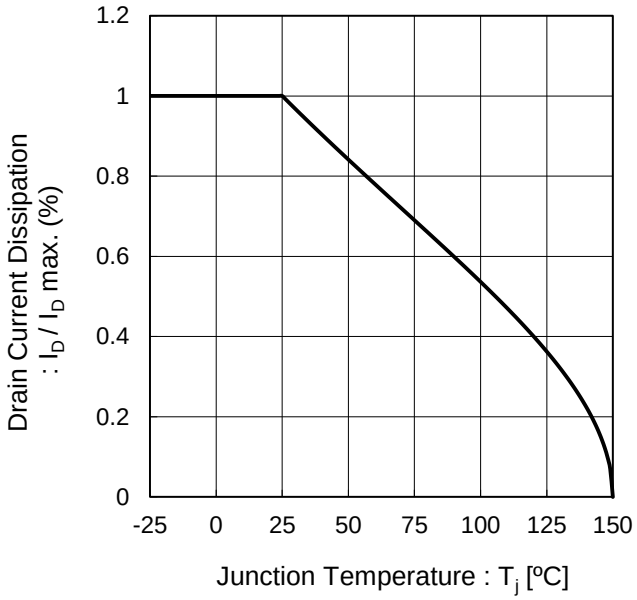


Fig.14 Static Drain - Source On - State Resistance vs. Gate Source Voltage

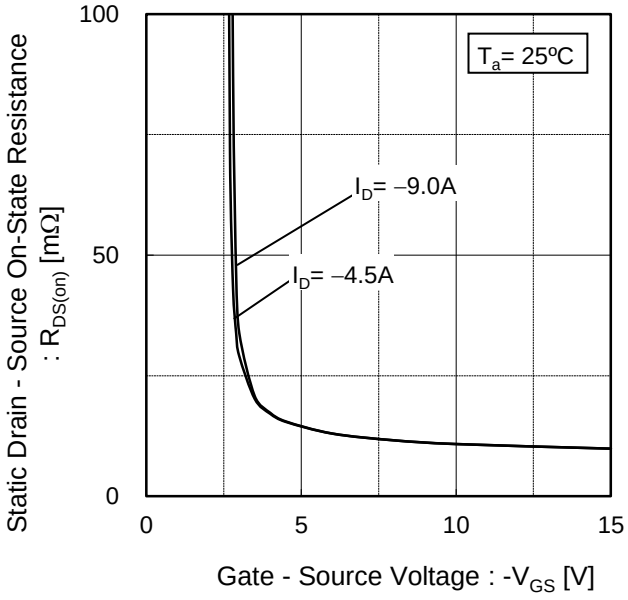


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(I)

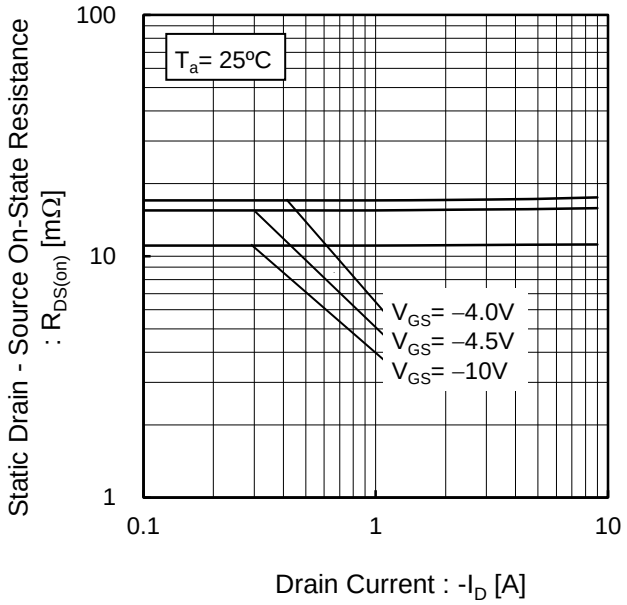
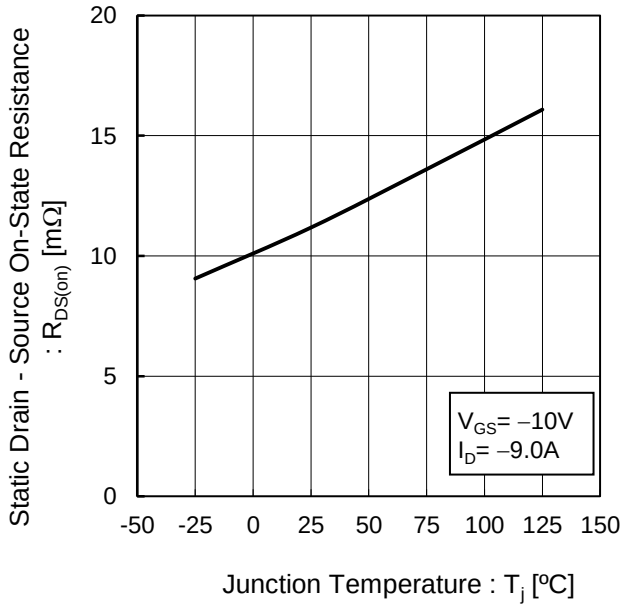


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

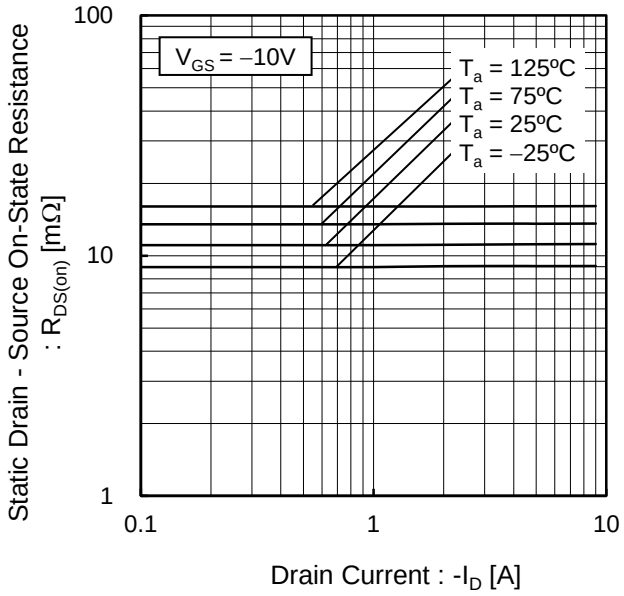


Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(III)

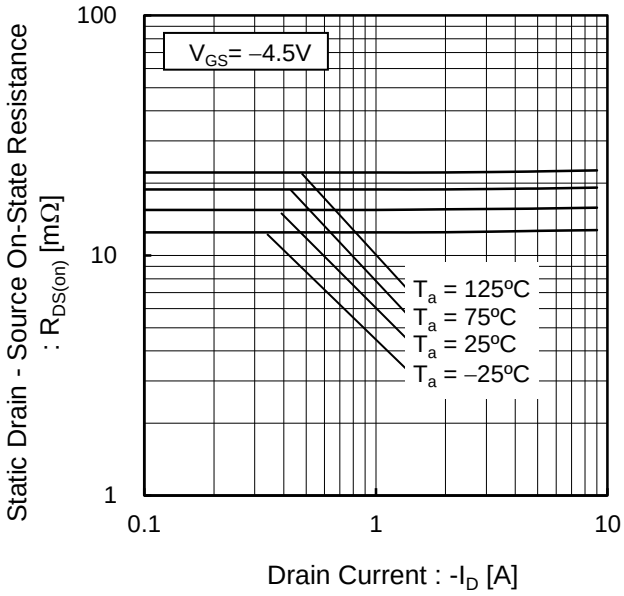
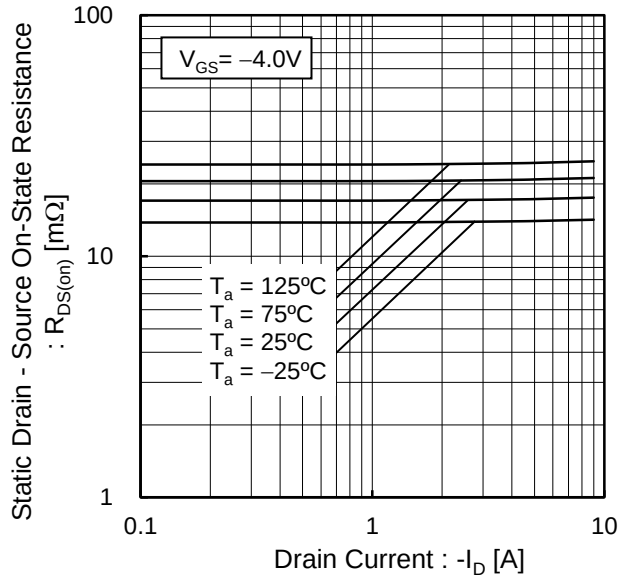


Fig.19 Static Drain - Source On - State Resistance vs. Drain Current(IV)



●Electrical characteristic curves

Fig.20 Typical Capacitance vs. Drain - Source Voltage

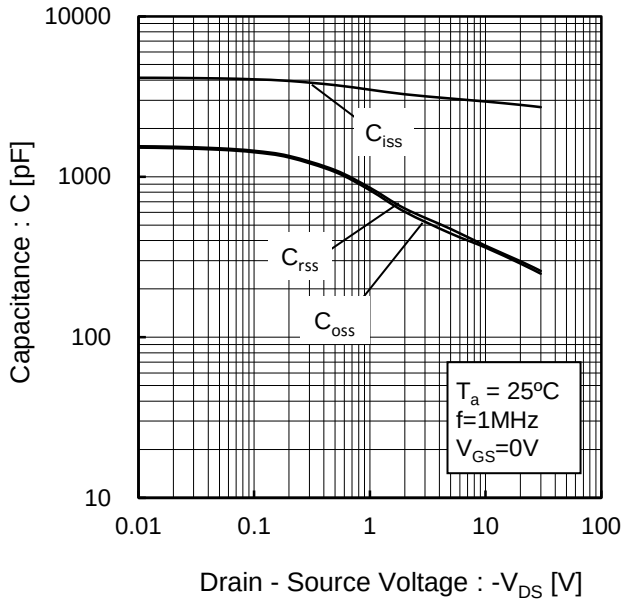


Fig.21 Switching Characteristics

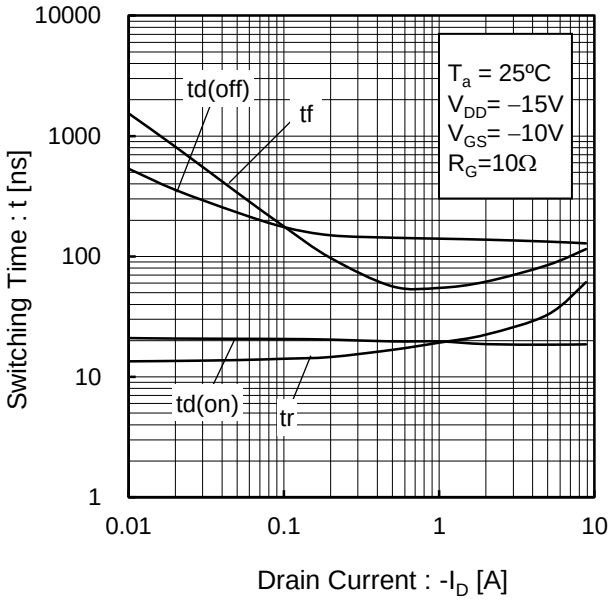


Fig.22 Dynamic Input Characteristics

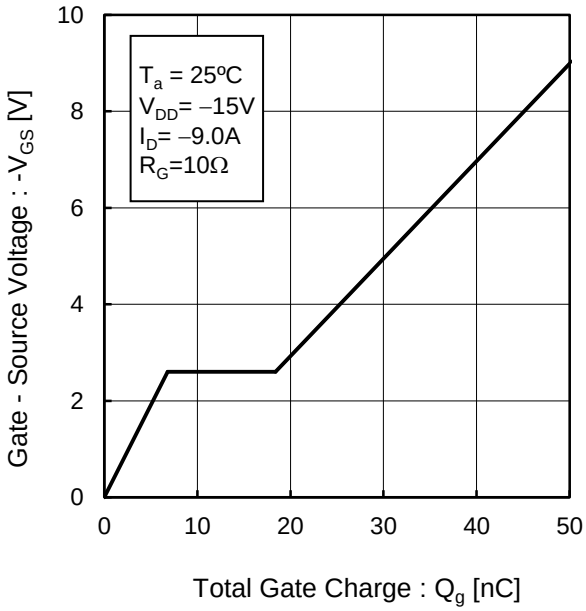
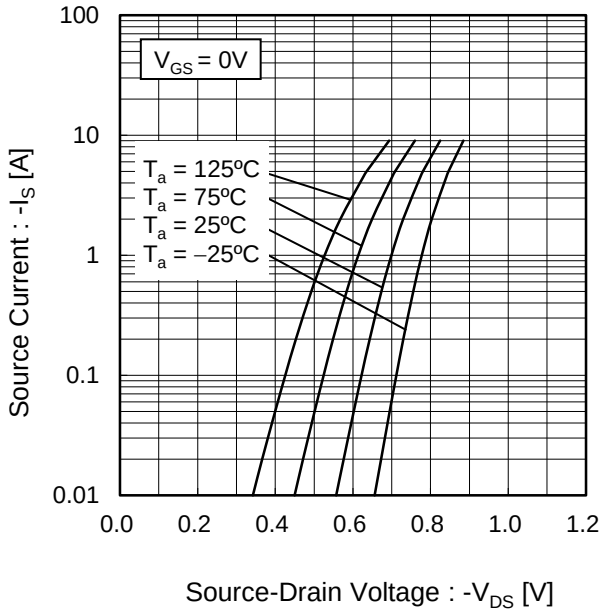


Fig.23 Source Current vs. Source Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

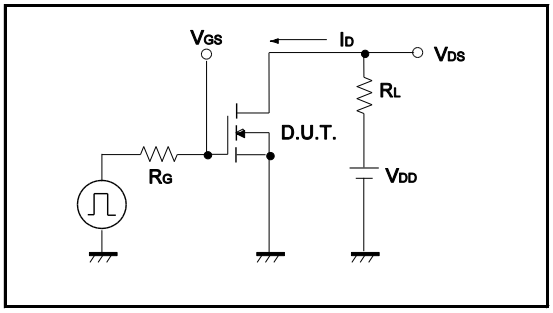


Fig.1-2 Switching Waveforms

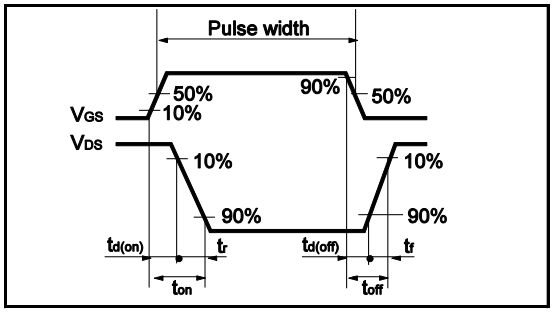


Fig.2-1 Gate Charge Measurement Circuit

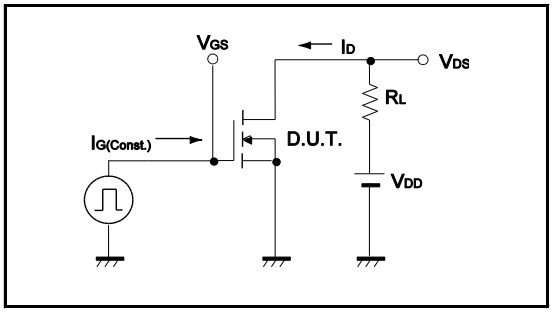


Fig.2-2 Gate Charge Waveform

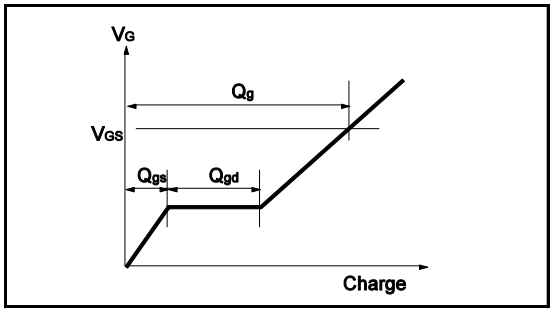


Fig.3-1 Avalanche Measurement Circuit

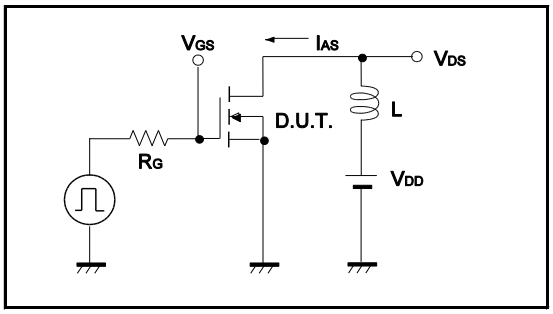
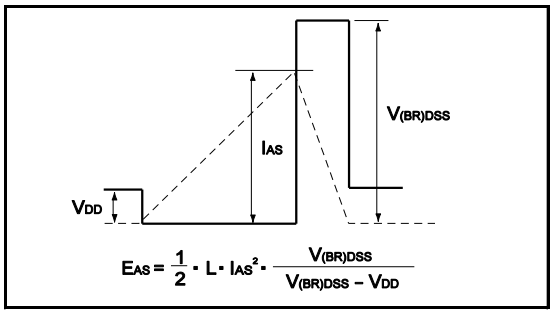
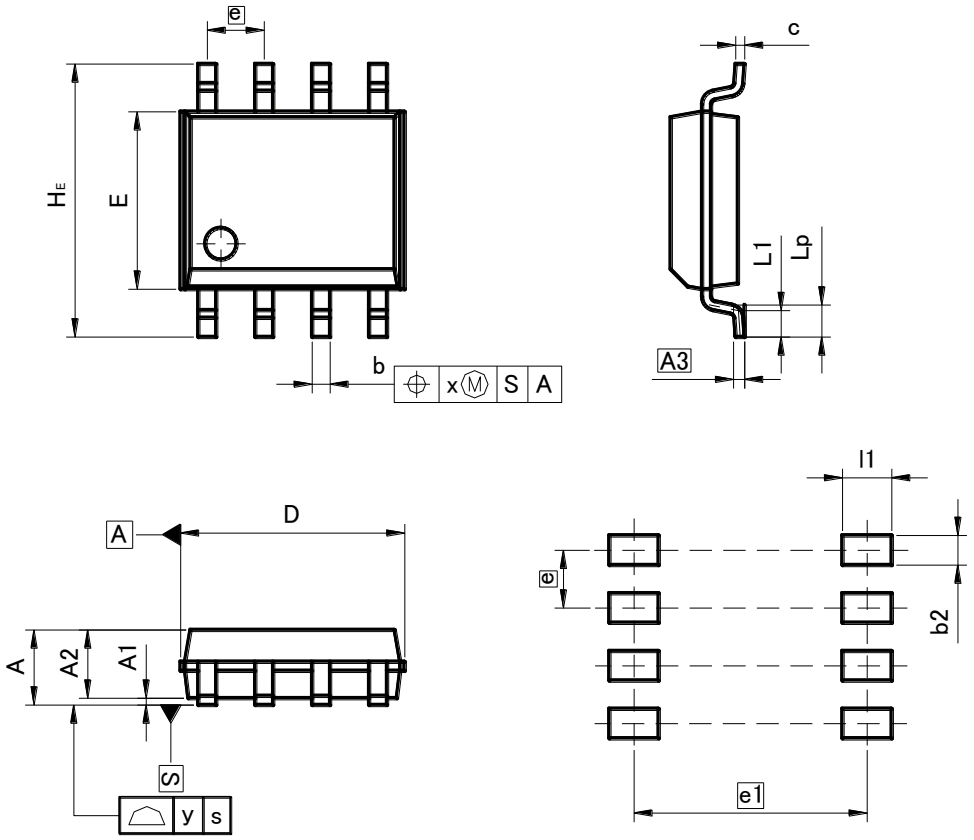


Fig.3-2 Avalanche Waveform



●**Dimensions** (Unit : mm)

SOP8



Patterm of terminal position areas

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		0.01	
b	0.30	0.50	0.012	0.02
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		0.05	
HE	5.70	6.30	0.224	0.248
L1	0.50	0.70	0.02	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

Notes

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