# RRH090P03

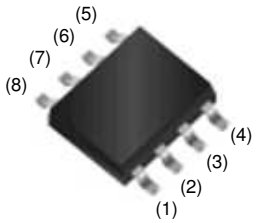
**Pch -30V -9A Power MOSFET**

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.

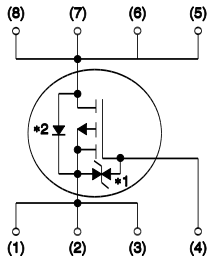
3) Small Surface Mount Package (SOP8).

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℃)

| 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 | ℃ |
| Range of storage temperature | $T_{stg}$ | −55 to +150 | ℃ |

## ●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - ambient | $R_{thJA}$ *4 | - | - | 62.5 | ℃/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ *5 | - | - | 192 | ℃/W |

## ●Electrical characteristics($T_a$ = 25℃)

| 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℃ | - | −25 | - | mV/℃ |
| 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℃ | - | 3.9 | - | mV/℃ |
| 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℃ | - | 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℃

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

*5 Mounted on a FR4 (20×20×0.8mm)

## ●Electrical characteristics($T_a$ = 25℃)

| 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℃)

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

## ●Body diode electrical characteristics (Source-Drain)($T_a$ = 25℃)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Inverse diode continuous, forward current | $I_S$ *1 | $T_a$ = 25℃ | - | - | −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<br>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

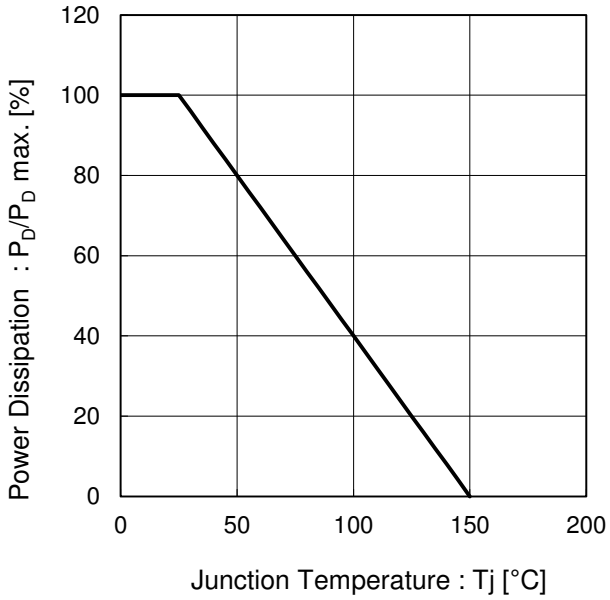



Fig.2 Maximum Safe Operating Area

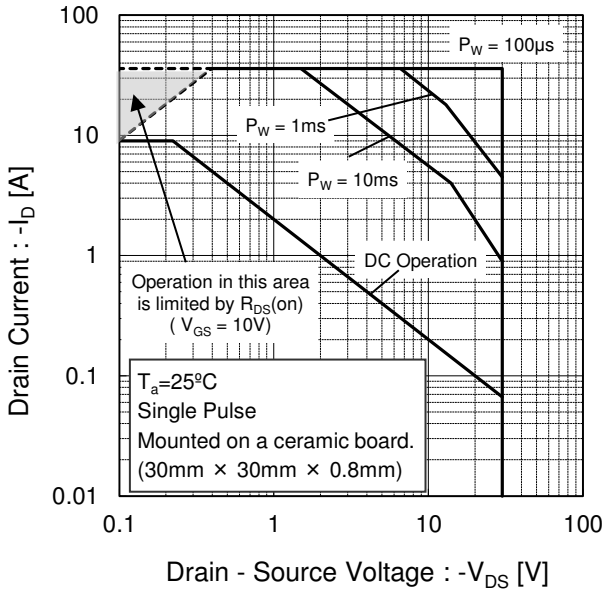



Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

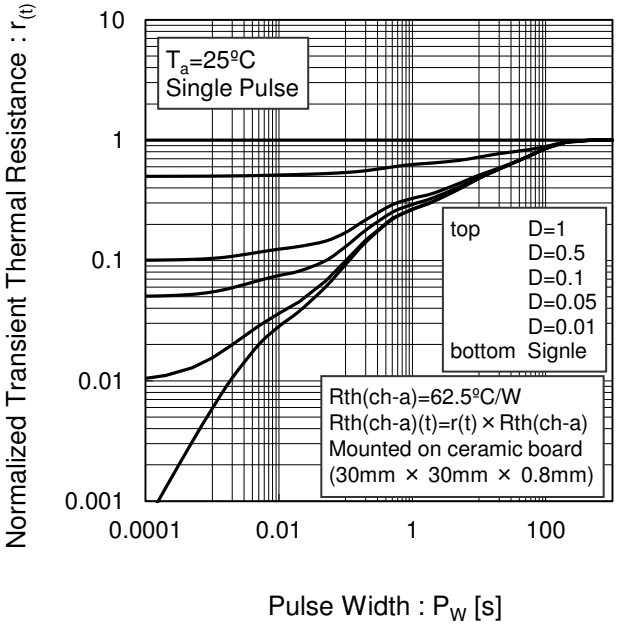
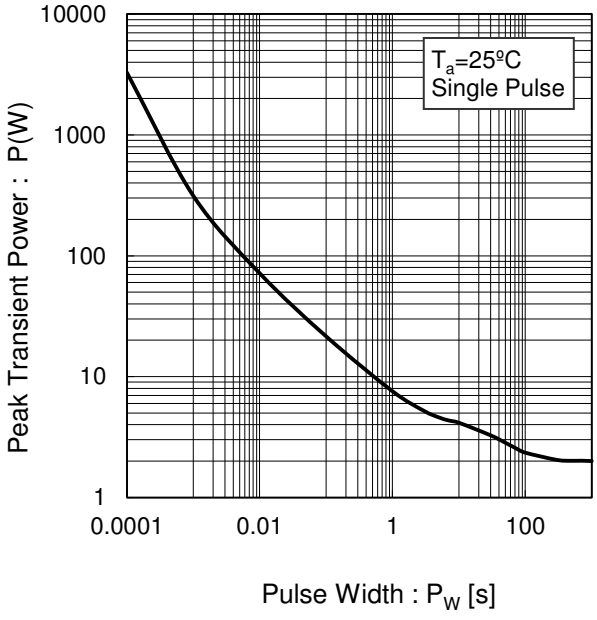



Fig.4 Single Pulse Maxmum Power dissipation



## ●Electrical characteristic curves

Fig.5 Avalanche Current vs Inductive Load

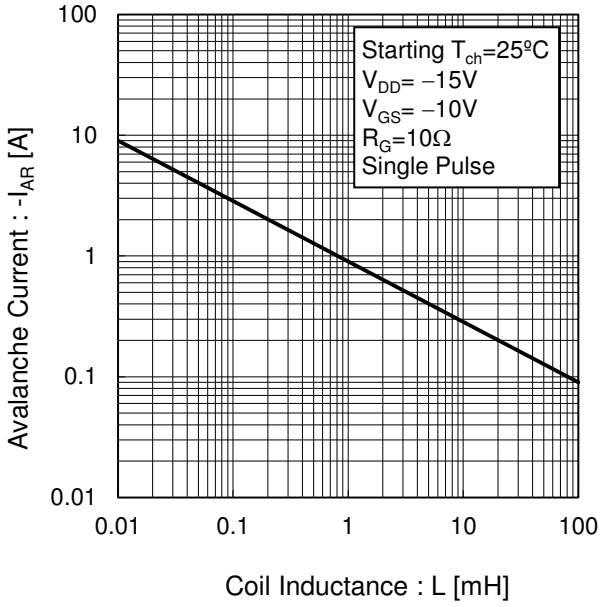



Fig.6 Avalanche Energy Derating Curve vs Junction Temperature

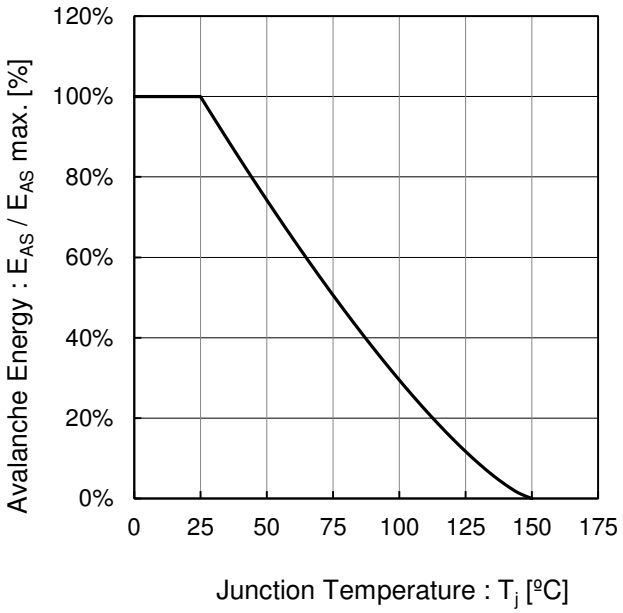



Fig.7 Typical Output Characteristics(I)

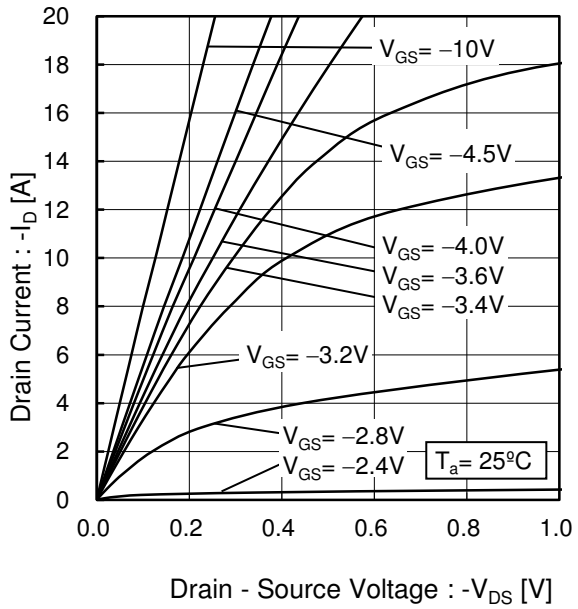
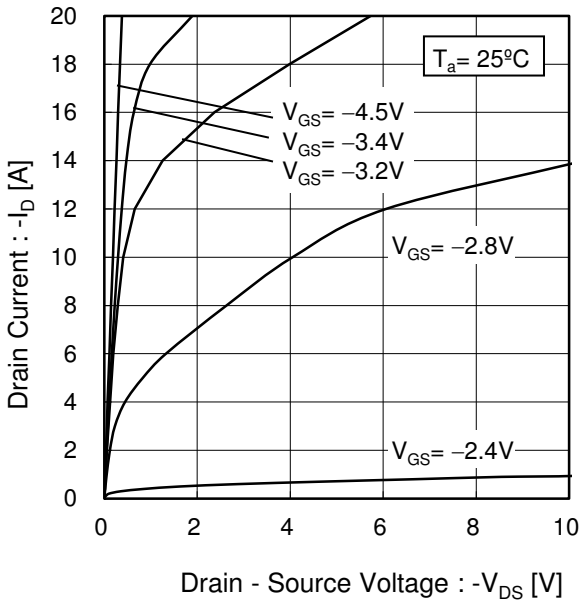



Fig.8 Typical Output Characteristics(II)



## ●Electrical characteristic curves

Fig.9 Breakdown Voltage vs. Junction Temperature

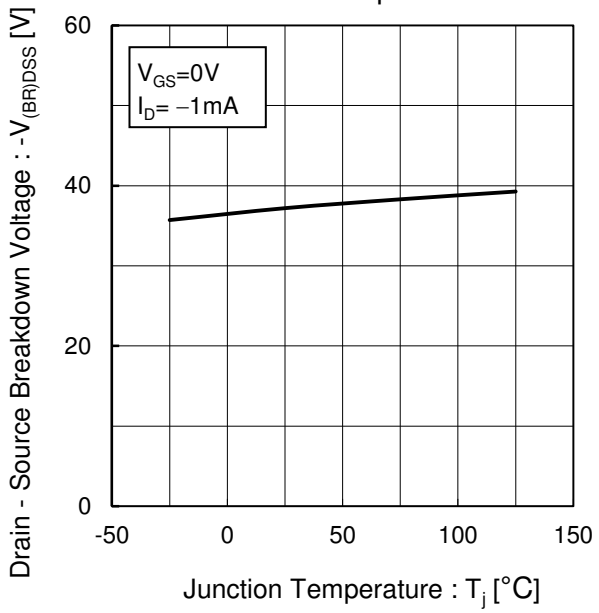



Fig.10 Typical Transfer Characteristics

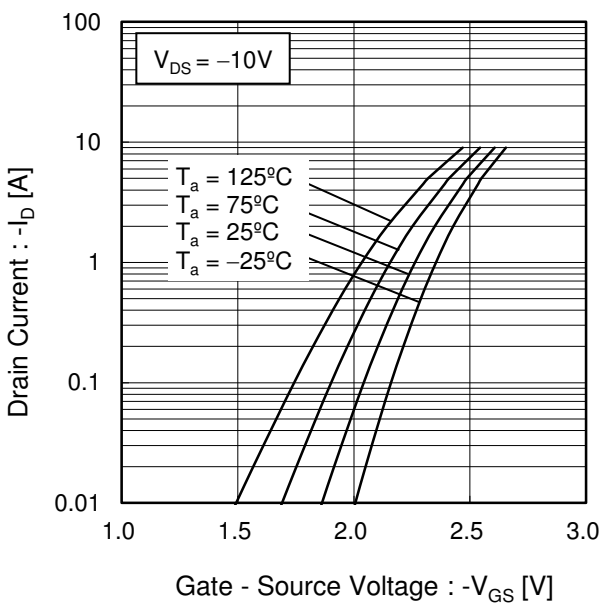



Fig.11 Gate Threshold Voltage vs. Junction Temperature

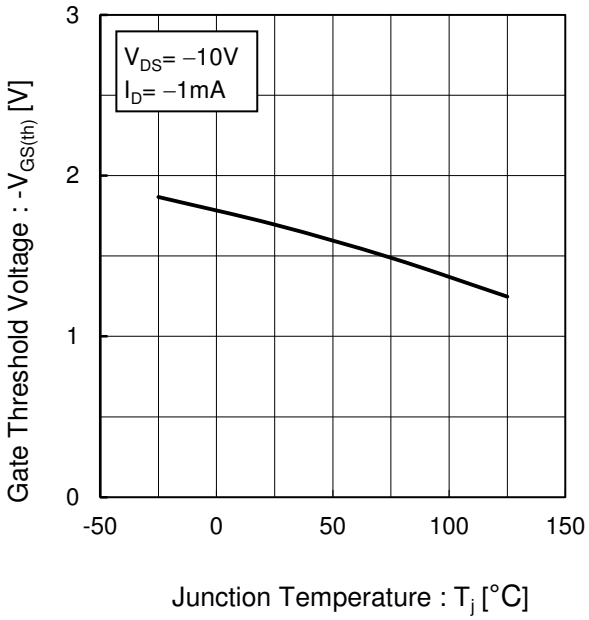
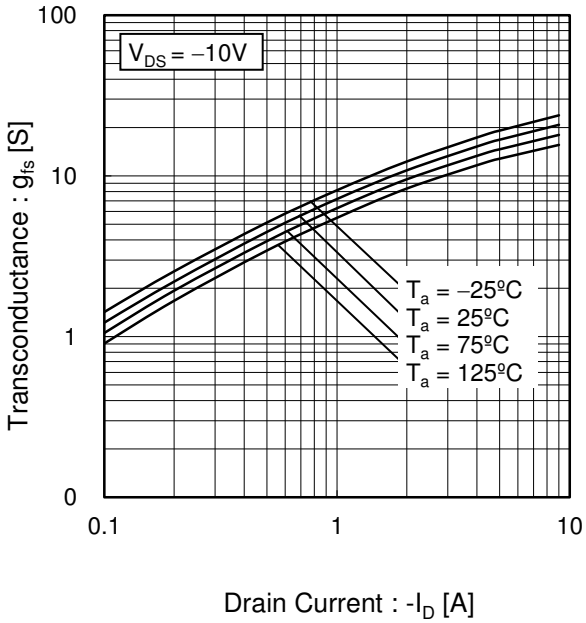



Fig.12 Transconductance vs. Drain Current



## ●Electrical characteristic curves

Fig.13 Drain Current Derating Curve

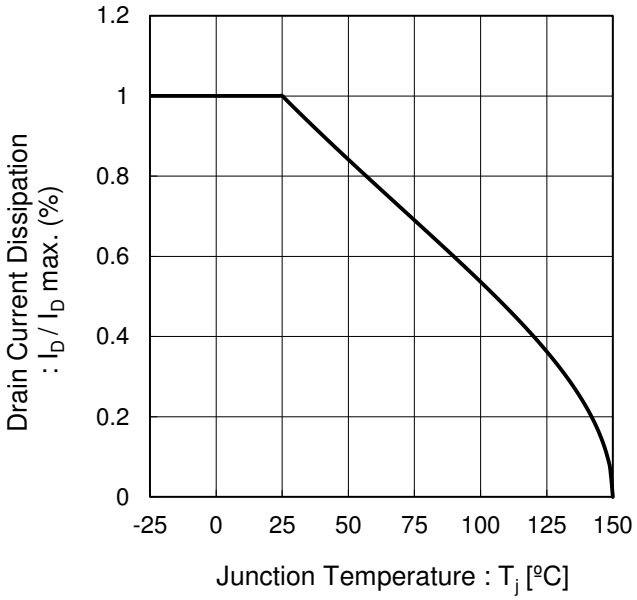



Fig.14 Static Drain - Source On - State Resistance vs. Gate Source Voltage

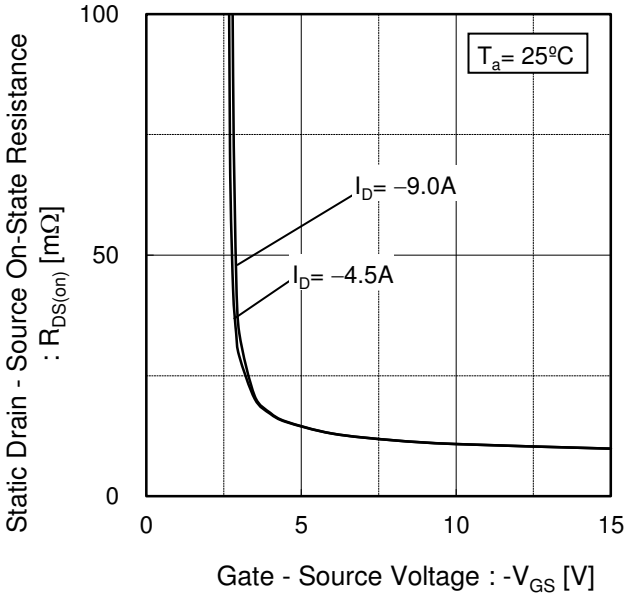



Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(I)

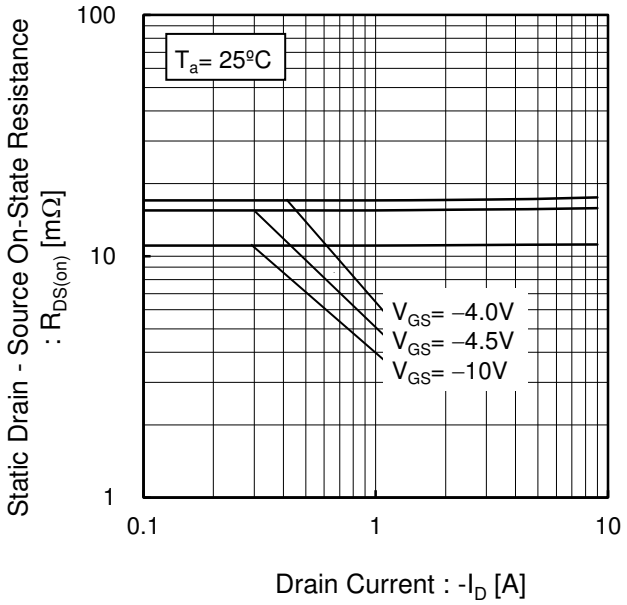
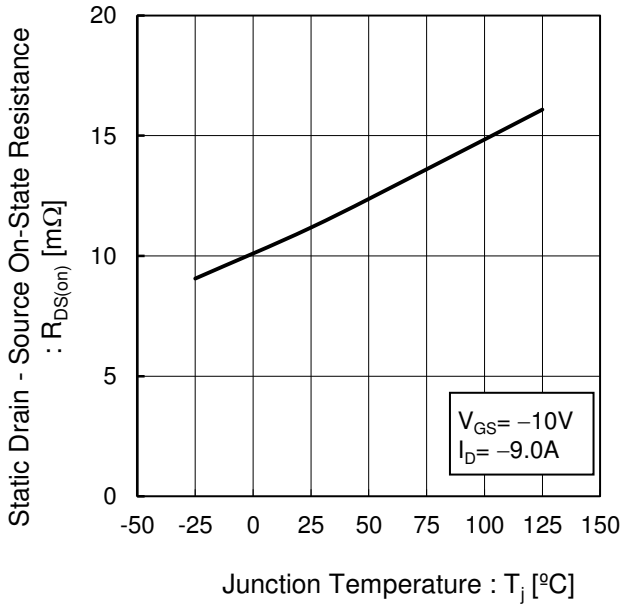



Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature



## ●Electrical characteristic curves

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

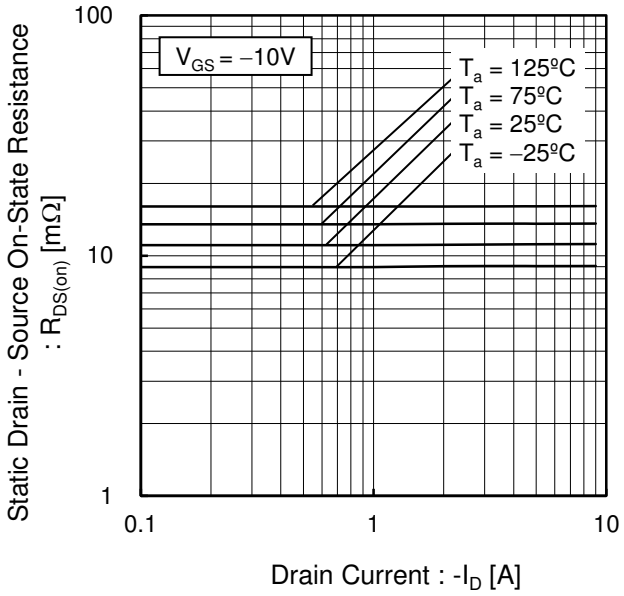



Fig.18 Static Drain - Source On - State Resistance vs. Drain Current(III)

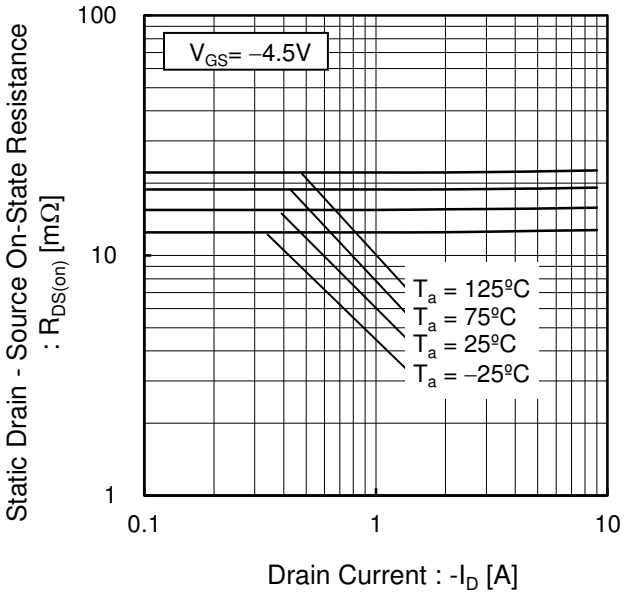
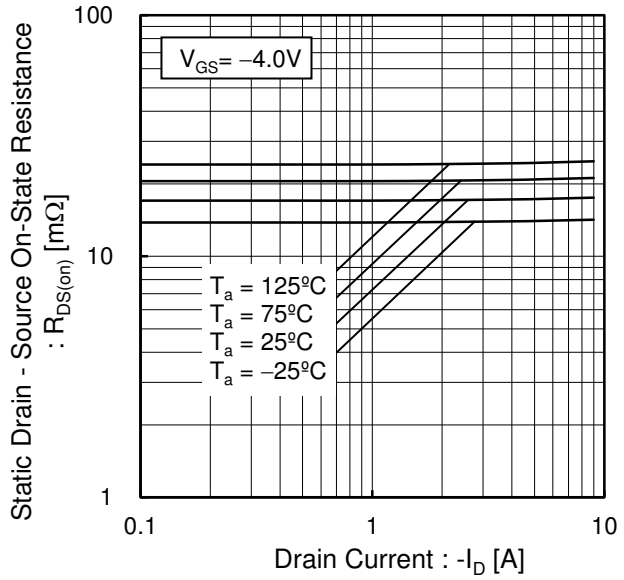



Fig.19 Static Drain - Source On - State Resistance vs. Drain Current(IV)



## ●Electrical characteristic curves

Fig.20 Typical Capacitance vs. Drain - Source Voltage

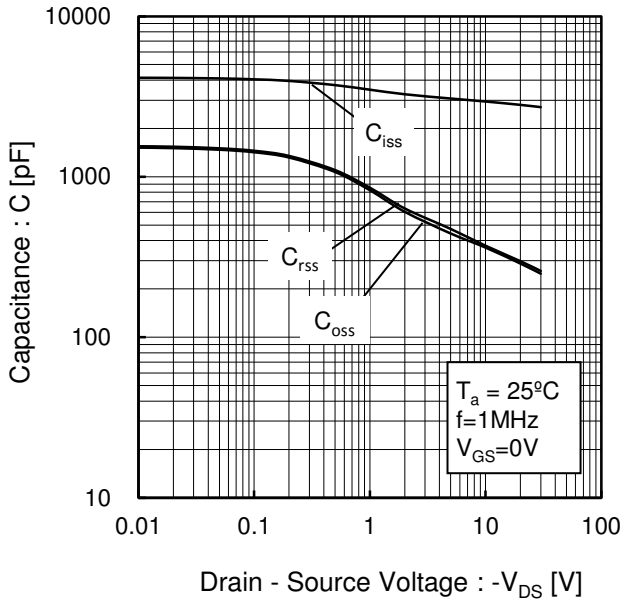



Fig.21 Switching Characteristics

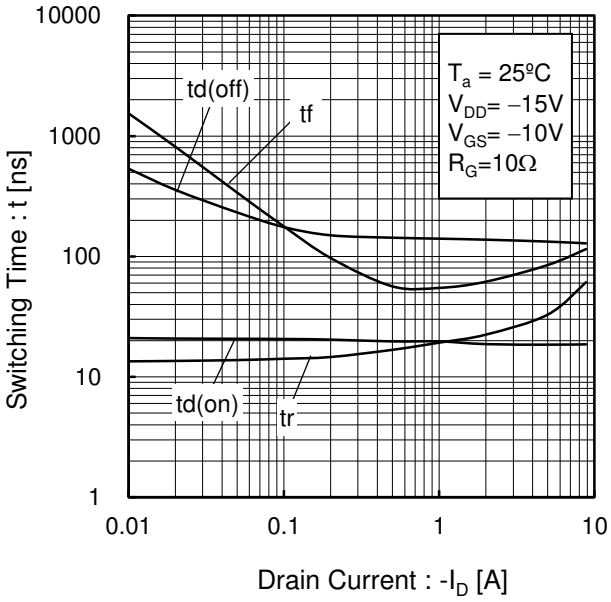



Fig.22 Dynamic Input Characteristics

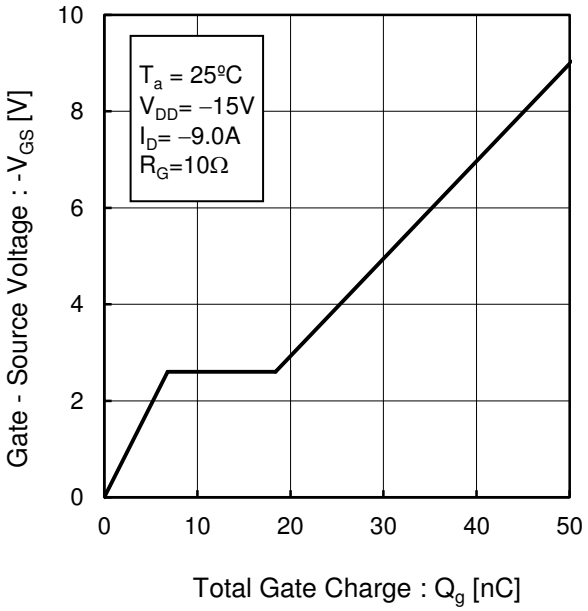
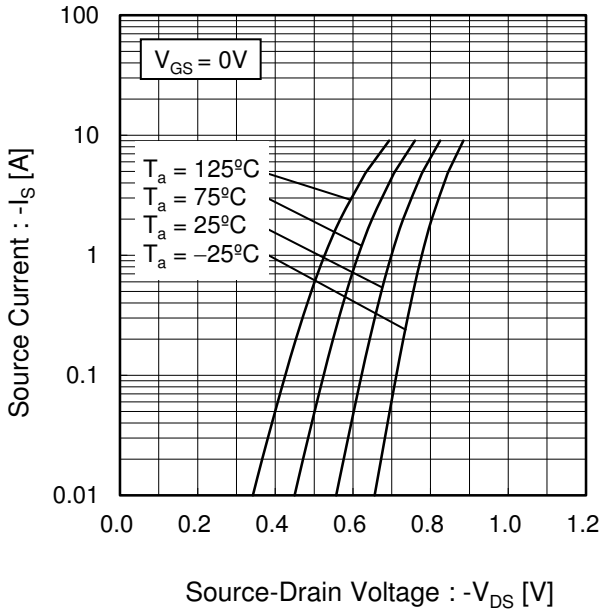



Fig.23 Source Current vs. Source Drain Voltage



## ●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

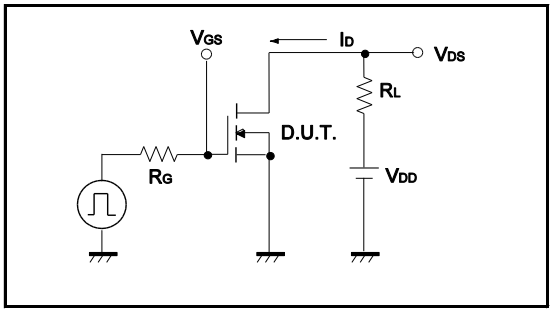



Fig.1-2 Switching Waveforms

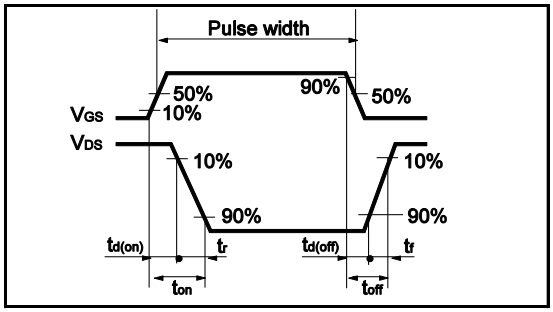



Fig.2-1 Gate Charge Measurement Circuit

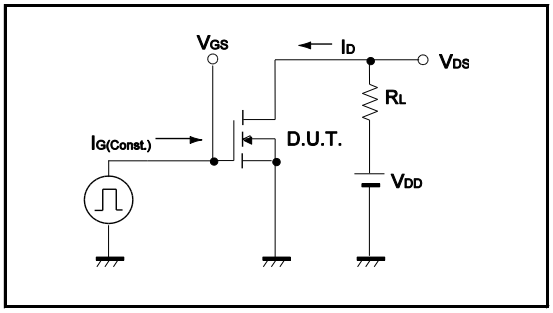



Fig.2-2 Gate Charge Waveform

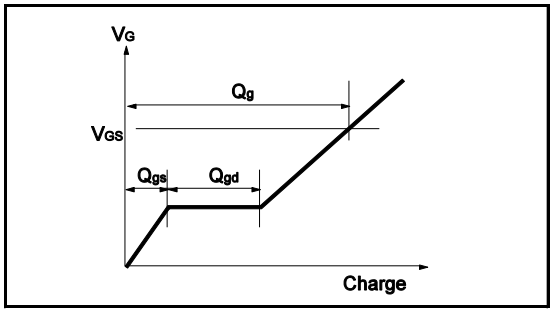



Fig.3-1 Avalanche Measurement Circuit

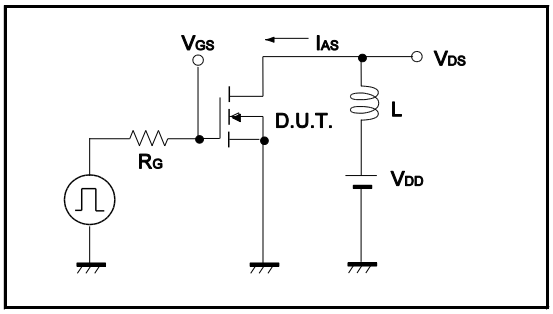
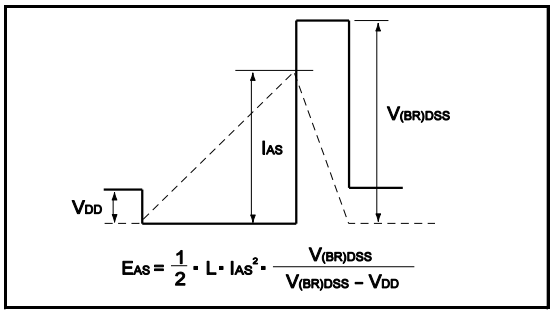
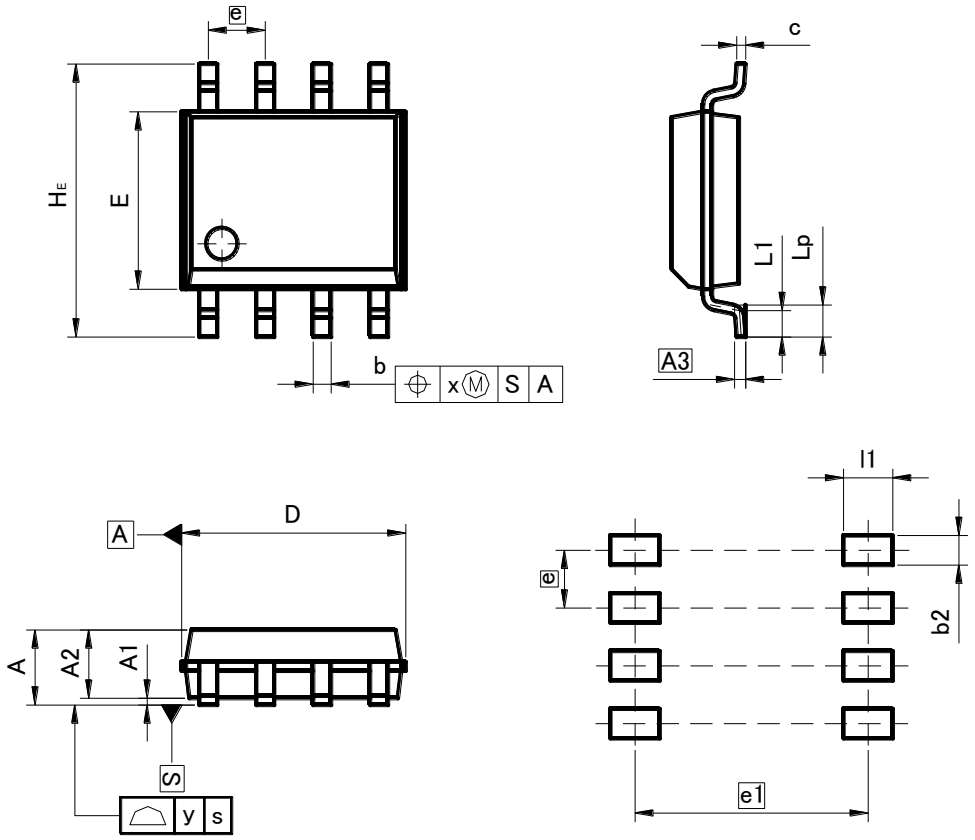



Fig.3-2 Avalanche Waveform



●**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

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