

# 10V Drive Nch MOSFET

**R5009ANJ**

## ●Structure

Silicon N-channel MOSFET

## ●Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Wide SOA (safe operating area).
- 4) Gate-source voltage ( $V_{GS}$ ) guaranteed to be  $\pm 30V$ .
- 5) Drive circuits can be simple.
- 6) Parallel use is easy.

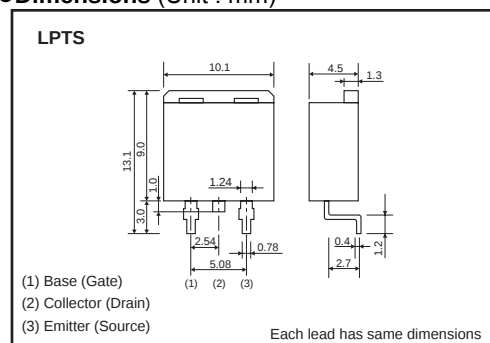
## ●Applications

Switching

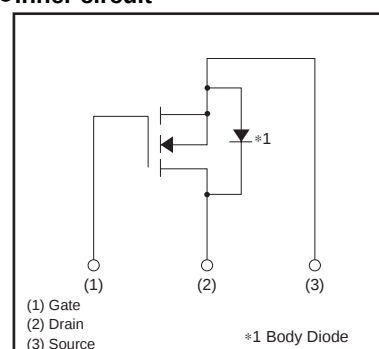
## ●Packaging specifications

|          |                              |        |
|----------|------------------------------|--------|
| Type     | Package                      | Taping |
|          | Code                         | TL     |
|          | Basic ordering unit (pieces) | 1000   |
| R5009ANJ |                              | ○      |

## ●Dimensions (Unit : mm)



## ●Inner circuit



## ●Absolute maximum ratings (Ta=25°C)

| Parameter                         | Symbol      | Limits      | Unit |
|-----------------------------------|-------------|-------------|------|
| Drain-source voltage              | $V_{DS}$    | 500         | V    |
| Gate-source voltage               | $V_{GS}$    | 30          | V    |
| Drain current                     | Continuous  | $I_D$ *3    | A    |
|                                   | Pulsed      | $I_{DP}$ *1 | A    |
| Source current (Body Diode)       | Continuous  | $I_S$       | A    |
|                                   | Pulsed      | $I_{SP}$ *1 | A    |
| Avalanche Current                 | $I_{AS}$ *2 | 4.5         | A    |
| Avalanche Energy                  | $E_{AS}$ *2 | 5.4         | mJ   |
| Total power dissipation (Tc=25°C) | $P_D$       | 50          | W    |
| Channel temperature               | $T_{ch}$    | 150         | °C   |
| Range of storage temperature      | $T_{stg}$   | -55 to +150 | °C   |

 \*1  $P_{ws} \leq 10\mu s$ , Duty cycle  $\leq 1\%$ 

 \*2  $L = 500\mu H$ ,  $V_{DS} = 50V$ ,  $R_G = 25\Omega$ , Starting,  $T_{ch} = 25^\circ C$ 

\*3 Limited only by maximum temperature allowed

## ●Thermal resistance

| Parameter       | Symbol         | Limits | Unit |
|-----------------|----------------|--------|------|
| Channel to case | $R_{th(ch-c)}$ | 2.5    | °C/W |

## ●Electrical characteristics (Ta=25°C)

| Parameter                               | Symbol         | Min. | Typ. | Max. | Unit | Conditions                                        |
|-----------------------------------------|----------------|------|------|------|------|---------------------------------------------------|
| Gate-source leakage                     | $I_{GSS}$      | —    | —    | ±100 | nA   | $V_{GS}=\pm 30V$ , $V_{DS}=0V$                    |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$  | 500  | —    | —    | V    | $I_D=1mA$ , $V_{GS}=0V$                           |
| Zero gate voltage drain current         | $I_{DSS}$      | —    | —    | 100  | μA   | $V_{DS}=500V$ , $V_{GS}=0V$                       |
| Gate threshold voltage                  | $V_{GS(th)}$   | 2.5  | —    | 4.5  | V    | $V_{DS}=10V$ , $I_D=1mA$                          |
| Static drain-source on-state resistance | $R_{DS(on)}^*$ | —    | 0.55 | 0.72 | Ω    | $I_D=4.5A$ , $V_{GS}=10V$                         |
| Forward transfer admittance             | $ Y_{fs} ^*$   | 2.5  | —    | —    | S    | $I_D=4.5A$ , $V_{DS}=10V$                         |
| Input capacitance                       | $C_{iss}$      | —    | 650  | —    | pF   | $V_{DS}=25V$                                      |
| Output capacitance                      | $C_{oss}$      | —    | 400  | —    | pF   | $V_{GS}=0V$                                       |
| Reverse transfer capacitance            | $C_{rss}$      | —    | 30   | —    | pF   | $f=1MHz$                                          |
| Turn-on delay time                      | $t_{d(on)}^*$  | —    | 30   | —    | ns   | $I_D=4.5A$ , $V_{DD}=250V$                        |
| Rise time                               | $t_r^*$        | —    | 20   | —    | ns   | $V_{GS}=10V$                                      |
| Turn-off delay time                     | $t_{d(off)}^*$ | —    | 62   | —    | ns   | $R_L=55.6\Omega$                                  |
| Fall time                               | $t_f^*$        | —    | 28   | —    | ns   | $R_G=10\Omega$                                    |
| Total gate charge                       | $Q_g^*$        | —    | 21   | —    | nC   | $V_{DD}=250V$                                     |
| Gate-source charge                      | $Q_{gs}^*$     | —    | 5    | —    | nC   | $I_D=9A$                                          |
| Gate-drain charge                       | $Q_{gd}^*$     | —    | 9    | —    | nC   | $V_{GS}=10V$<br>$R_L=27.8\Omega$ / $R_G=10\Omega$ |

\* Pulsed

## ●Body diode characteristics (Source-drain) (Ta=25°C)

| Parameter       | Symbol     | Min. | Typ. | Max. | Unit | Conditions             |
|-----------------|------------|------|------|------|------|------------------------|
| Forward voltage | $V_{SD}^*$ | —    | —    | 1.5  | V    | $I_S=9A$ , $V_{GS}=0V$ |

\* Pulsed

## ●Electrical characteristics curves

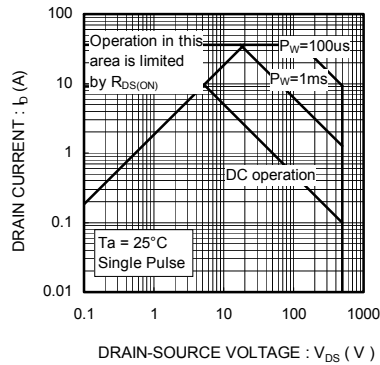


Fig.1 Maximum Safe Operating Area

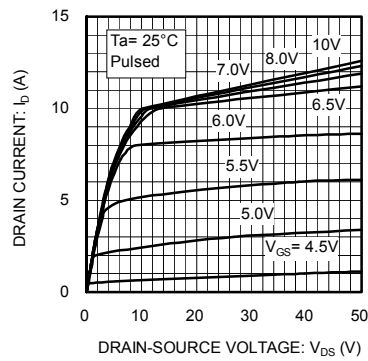


Fig.2 Typical Output Characteristics(I)

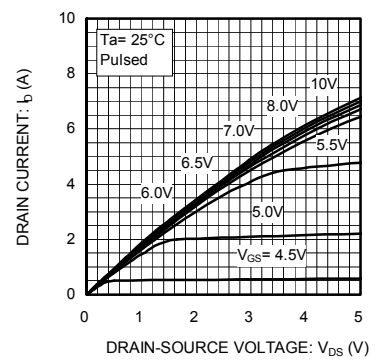


Fig.3 Typical Output Characteristics(II)

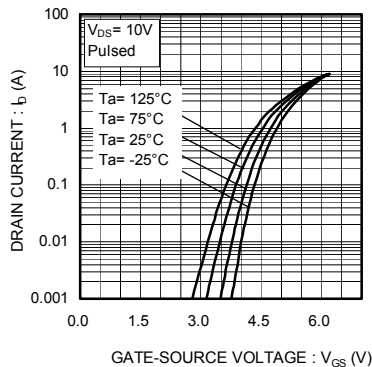


Fig.4 Typical Transfer Characteristics

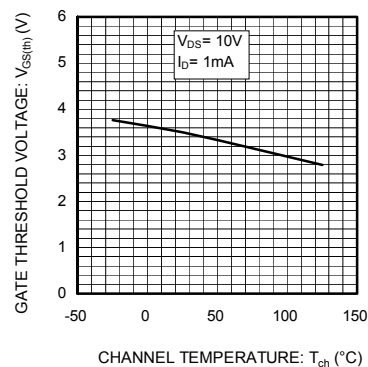


Fig.5 Gate Threshold Voltage vs. Channel Temperature

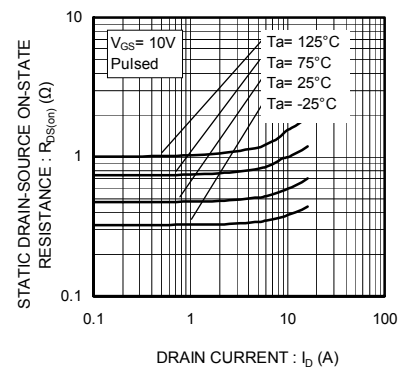


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

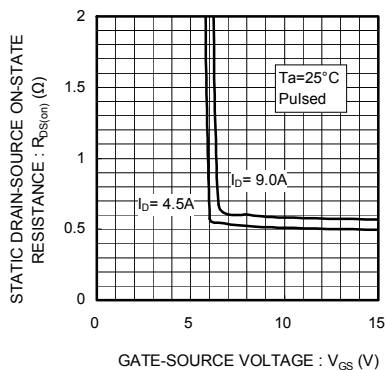


Fig.7 Static Drain-Source On-State Resistance vs. Gate Source Voltage

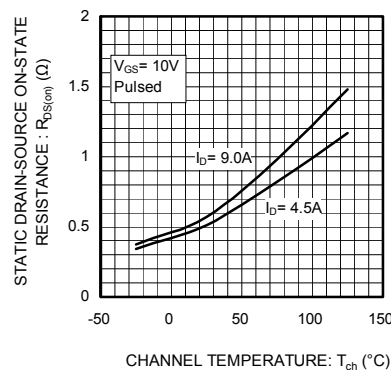


Fig.8 Static Drain-Source On-State Resistance vs. Channel Temperature

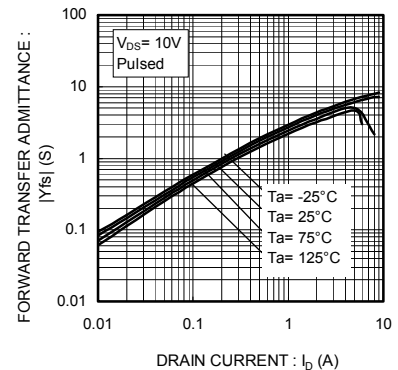


Fig.9 Forward Transfer Admittance vs. Drain Current

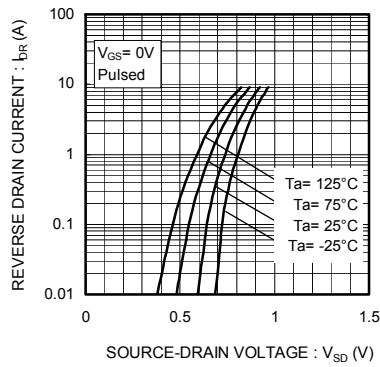


Fig.10 Reverse Drain Current vs. Source-Drain Voltage

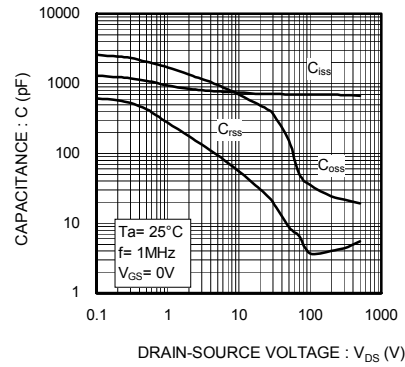


Fig.11 Typical Capacitance vs. Drain-Source Voltage

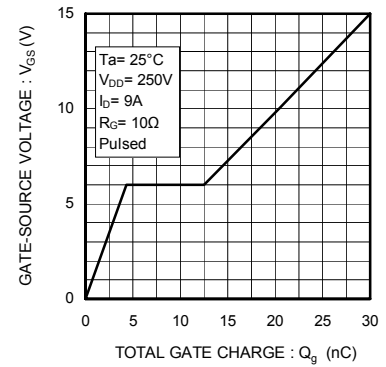


Fig.12 Dynamic Input Characteristics

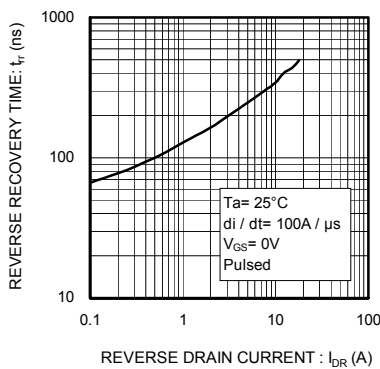


Fig.13 Reverse Recovery Time vs. Reverse Drain Current

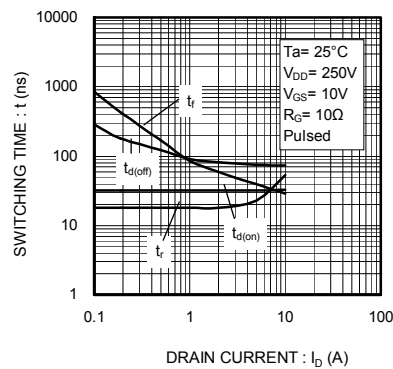


Fig.14 Switching Characteristics

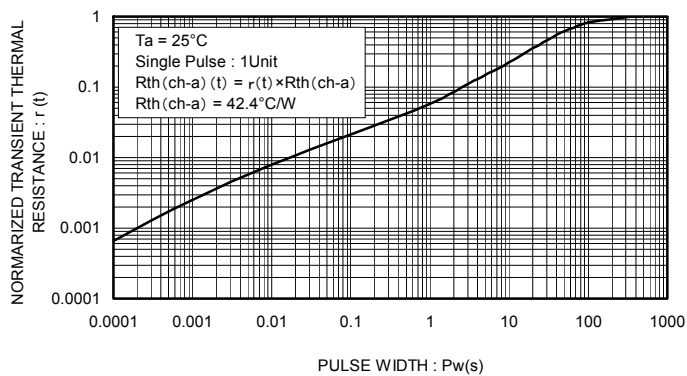


Fig.15 Normalized Transient Thermal Resistance vs. Pulse Width

# ●Switching characteristics measurement circuit

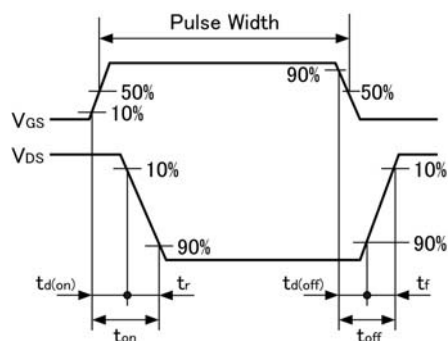


Fig.1-1 Switching time measurement circuit

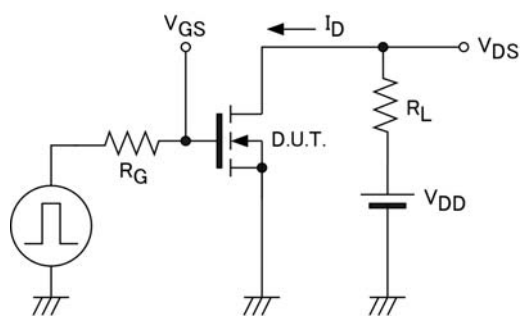


Fig.1-2 Switching waveforms

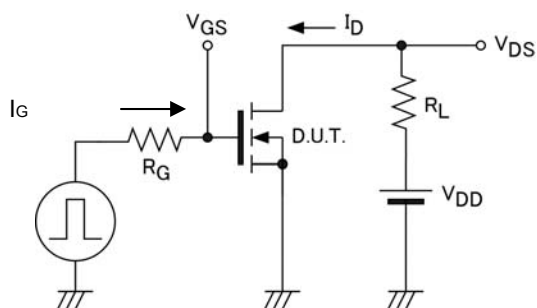


Fig.2-1 Gate charge measurement circuit

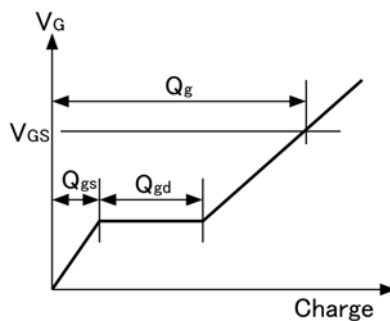


Fig.2-2 Gate charge waveform

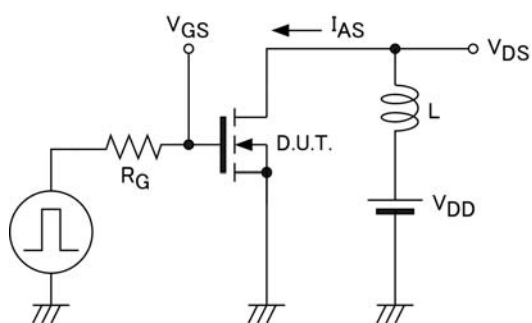


Fig.3-1 Avalanche measurement circuit

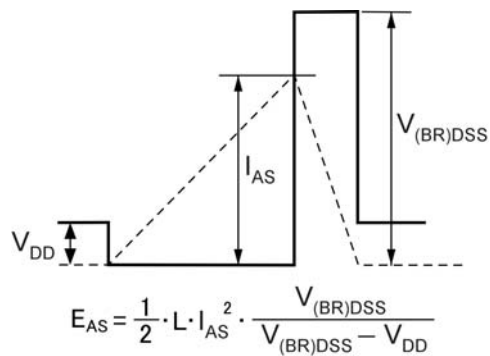


Fig.3-2 Avalanche waveform

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