

# 4V Drive Nch + Pch MOSFET

## QS8M13

### ● Structure

Silicon N-channel MOSFET/  
 Silicon P-channel MOSFET

### ● Features

- 1) Low on-resistance.
- 2) High power package(TSMT8).
- 3) Low voltage drive(4V drive).

### ● Application

Switching

### ● Packaging specifications

| Type   | Package                      | Taping |
|--------|------------------------------|--------|
|        | Code                         | TCR    |
|        | Basic ordering unit (pieces) | 3000   |
| QS8M13 |                              | ○      |

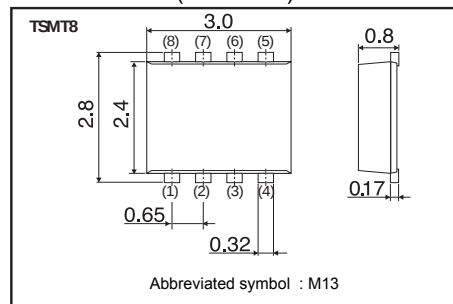
### ● Absolute maximum ratings (Ta = 25°C)

| Parameter                      |            | Symbol      | Limits      |            | Unit        |
|--------------------------------|------------|-------------|-------------|------------|-------------|
|                                |            |             | Tr1 : N-ch  | Tr2 : P-ch |             |
| Drain-source voltage           |            | $V_{DSS}$   | 30          | -30        | V           |
| Gate-source voltage            |            | $V_{GSS}$   | ±20         | ±20        | V           |
| Drain current                  | Continuous | $I_D$       | ±6          | ±5         | A           |
|                                | Pulsed     | $I_{DP}$ *1 | ±18         | ±18        | A           |
| Source current<br>(Body Diode) | Continuous | $I_S$       | 1.0         | -1.0       | A           |
|                                | Pulsed     | $I_{SP}$ *1 | 18          | -18        | A           |
| Power dissipation              |            | $P_D$ *2    | 1.5         |            | W / TOTAL   |
|                                |            |             | 1.25        |            | W / ELEMENT |
| Channel temperature            |            | $T_{ch}$    | 150         |            | °C          |
| Range of storage temperature   |            | $T_{stg}$   | -55 to +150 |            | °C          |

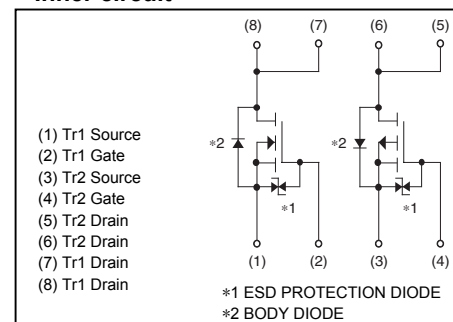
\*1  $P_w \leq 10\mu s$ , Duty cycle  $\leq 1\%$

\*2 Mounted on a ceramic board.

### ● Dimensions (Unit : mm)



### ● Inner circuit



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

<Tr1(Nch)>

| Parameter                               | Symbol         | Min. | Typ. | Max.     | Unit      | Conditions                         |
|-----------------------------------------|----------------|------|------|----------|-----------|------------------------------------|
| Gate-source leakage                     | $I_{GSS}$      | -    | -    | $\pm 10$ | $\mu A$   | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$ |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$  | 30   | -    | -        | V         | $I_D = 1mA$ , $V_{GS} = 0V$        |
| Zero gate voltage drain current         | $I_{DSS}$      | -    | -    | 1        | $\mu A$   | $V_{DS} = 30V$ , $V_{GS} = 0V$     |
| Gate threshold voltage                  | $V_{GS(th)}$   | 1.0  | -    | 2.5      | V         | $V_{DS} = 10V$ , $I_D = 1mA$       |
| Static drain-source on-state resistance | $R_{DS(on)}^*$ | -    | 20   | 28       | $m\Omega$ | $I_D = 6A$ , $V_{GS} = 10V$        |
|                                         |                | -    | 25   | 35       |           | $I_D = 6A$ , $V_{GS} = 4.5V$       |
|                                         |                | -    | 28   | 39       |           | $I_D = 6A$ , $V_{GS} = 4.0V$       |
| Forward transfer admittance             | $ Y_{fs} ^*$   | 3.0  | -    | -        | S         | $V_{DS} = 10V$ , $I_D = 6A$        |
| Input capacitance                       | $C_{iss}$      | -    | 390  | -        | pF        | $V_{DS} = 10V$                     |
| Output capacitance                      | $C_{oss}$      | -    | 150  | -        | pF        | $V_{GS} = 0V$                      |
| Reverse transfer capacitance            | $C_{rss}$      | -    | 70   | -        | pF        | $f = 1MHz$                         |
| Turn-on delay time                      | $t_{d(on)}^*$  | -    | 8    | -        | ns        | $I_D = 3A$ , $V_{DD} \approx 15V$  |
| Rise time                               | $t_r^*$        | -    | 40   | -        | ns        | $V_{GS} = 10V$                     |
| Turn-off delay time                     | $t_{d(off)}^*$ | -    | 35   | -        | ns        | $R_L = 5\Omega$                    |
| Fall time                               | $t_f^*$        | -    | 7    | -        | ns        | $R_G = 10\Omega$                   |
| Total gate charge                       | $Q_g^*$        | -    | 5.5  | -        | nC        | $I_D = 6A$ , $V_{DD} \approx 15V$  |
| Gate-source charge                      | $Q_{gs}^*$     | -    | 1.5  | -        | nC        | $V_{GS} = 5V$                      |
| Gate-drain charge                       | $Q_{gd}^*$     | -    | 2.1  | -        | nC        |                                    |

\*Pulsed

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

| Parameter       | Symbol     | Min. | Typ. | Max. | Unit | Conditions                 |
|-----------------|------------|------|------|------|------|----------------------------|
| Forward Voltage | $V_{SD}^*$ | -    | -    | 1.2  | V    | $I_s = 6A$ , $V_{GS} = 0V$ |

\*Pulsed

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

<Tr2(Pch)>

| Parameter                               | Symbol         | Min. | Typ. | Max.     | Unit       | Conditions                      |
|-----------------------------------------|----------------|------|------|----------|------------|---------------------------------|
| Gate-source leakage                     | $I_{GSS}$      | -    | -    | $\pm 10$ | $\mu A$    | $V_{GS} = \pm 20V, V_{DS} = 0V$ |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$  | -30  | -    | -        | V          | $I_D = -1mA, V_{GS} = 0V$       |
| Zero gate voltage drain current         | $I_{DSS}$      |      | -    | -1       | $\mu A$    | $V_{DS} = -30V, V_{GS} = 0V$    |
| Gate threshold voltage                  | $V_{GS(th)}$   | -1.0 | -    | -2.5     | V          | $V_{DS} = -10V, I_D = -1mA$     |
| Static drain-source on-state resistance | $R_{DS(on)}^*$ | -    | 28   | 39       | m $\Omega$ | $I_D = -5A, V_{GS} = -10V$      |
|                                         |                | -    | 40   | 56       |            | $I_D = -2.5A, V_{GS} = -4.5V$   |
|                                         |                | -    | 45   | 63       |            | $I_D = -2.5A, V_{GS} = -4.0V$   |
| Forward transfer admittance             | $ Y_{fs} ^*$   | 3    | -    | -        | S          | $V_{DS} = -10V, I_D = -5A$      |
| Input capacitance                       | $C_{iss}$      | -    | 1100 | -        | pF         | $V_{DS} = -10V$                 |
| Output capacitance                      | $C_{oss}$      | -    | 150  | -        | pF         | $V_{GS} = 0V$                   |
| Reverse transfer capacitance            | $C_{rss}$      | -    | 130  | -        | pF         | $f = 1MHz$                      |
| Turn-on delay time                      | $t_{d(on)}^*$  | -    | 9    | -        | ns         | $I_D = -2.5A, V_{DD} = -15V$    |
| Rise time                               | $t_r^*$        | -    | 40   | -        | ns         | $V_{GS} = -10V$                 |
| Turn-off delay time                     | $t_{d(off)}^*$ | -    | 90   | -        | ns         | $R_L = 6\Omega$                 |
| Fall time                               | $t_f^*$        | -    | 55   | -        | ns         | $R_G = 10\Omega$                |
| Total gate charge                       | $Q_g^*$        | -    | 10   | -        | nC         | $I_D = -5A, V_{DD} = -15V$      |
| Gate-source charge                      | $Q_{gs}^*$     | -    | 3.6  | -        | nC         | $V_{GS} = -5V$                  |
| Gate-drain charge                       | $Q_{gd}^*$     | -    | 3.0  | -        | nC         |                                 |

\*Pulsed

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

| Parameter       | Symbol     | Min. | Typ. | Max. | Unit | Conditions               |
|-----------------|------------|------|------|------|------|--------------------------|
| Forward Voltage | $V_{SD}^*$ | -    | -    | -1.2 | V    | $I_s = -5A, V_{GS} = 0V$ |

\*Pulsed

●Electrical characteristic curves (Ta=25°C)

〈Tr.1(Nch)〉

Fig.1 Typical Output Characteristics ( I )

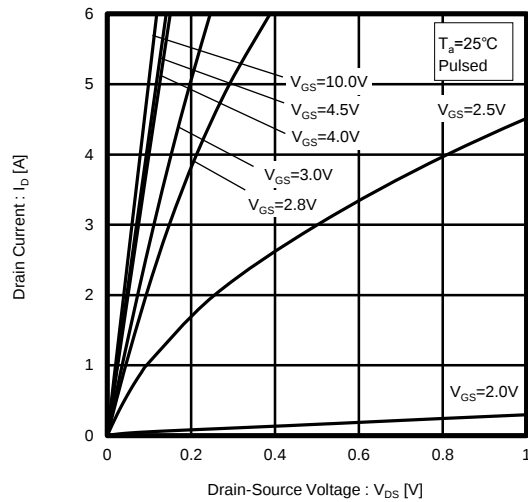


Fig.2 Typical Output Characteristics ( II )

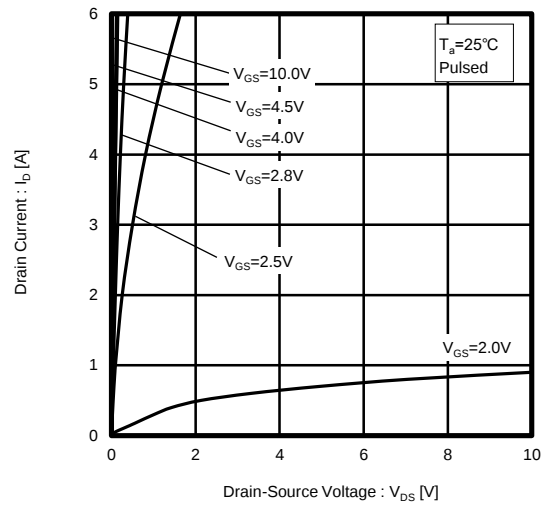


Fig.3 Static Drain-Source On-State Resistance vs. Drain Current

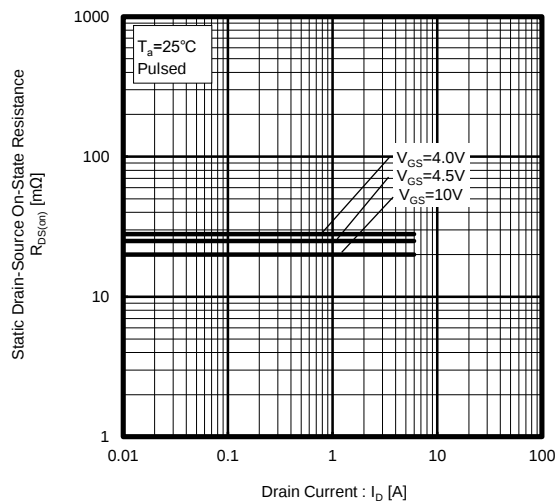


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current

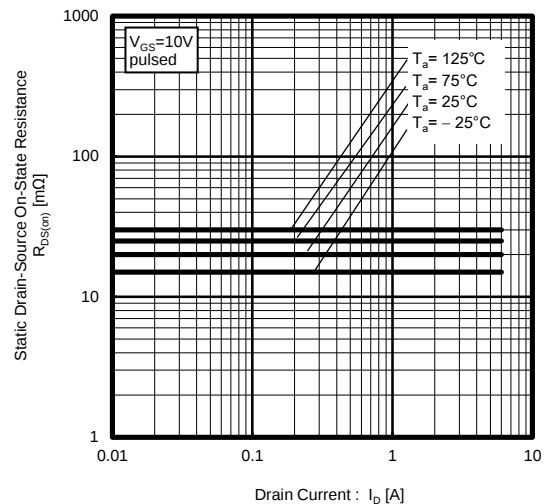


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current

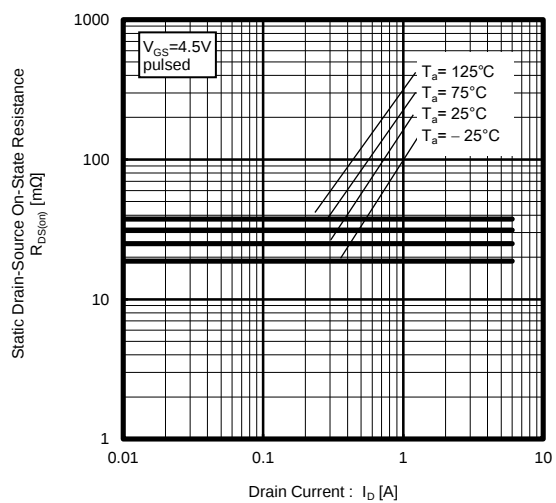


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

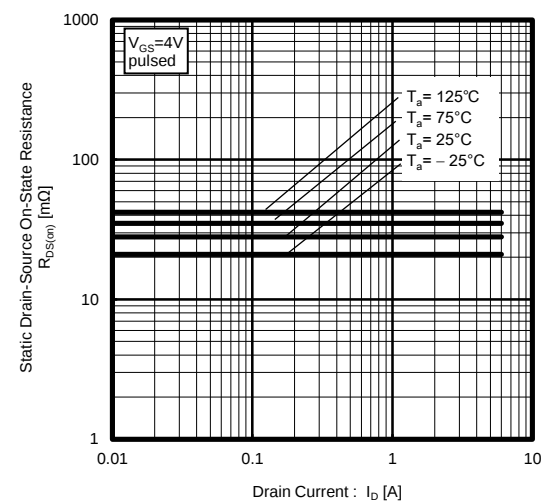


Fig.7 Forward Transfer Admittance vs. Drain Current

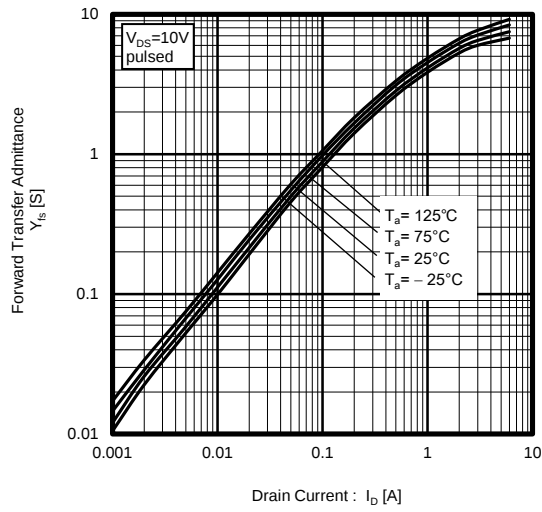


Fig.8 Typical Transfer Characteristics

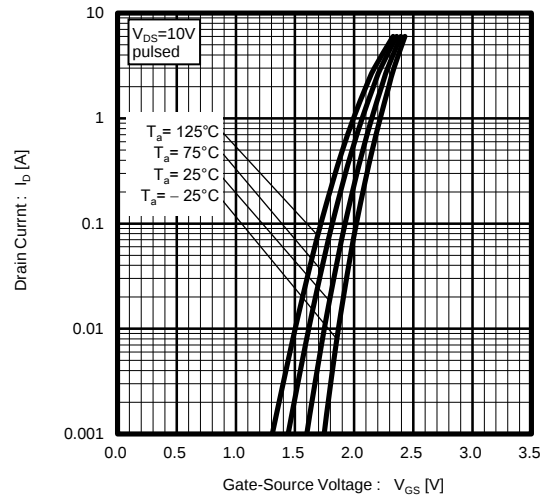


Fig.9 Source Current vs. Source-Drain Voltage

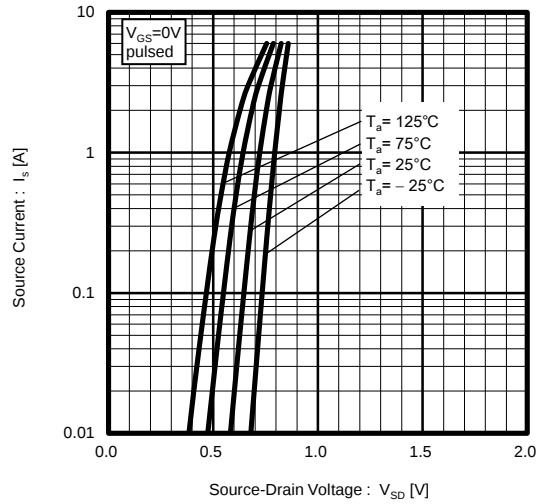


Fig.10 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

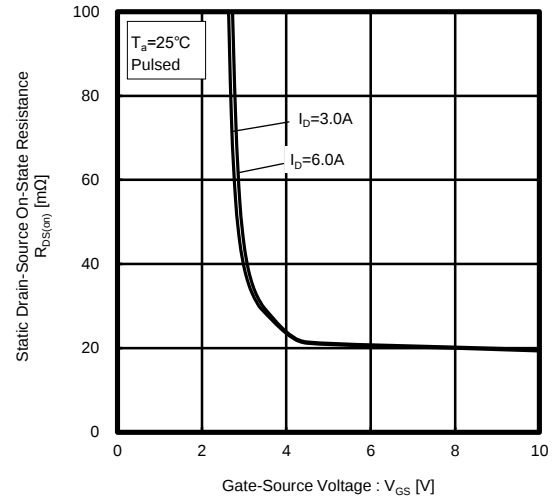


Fig.11 Switching Characteristics

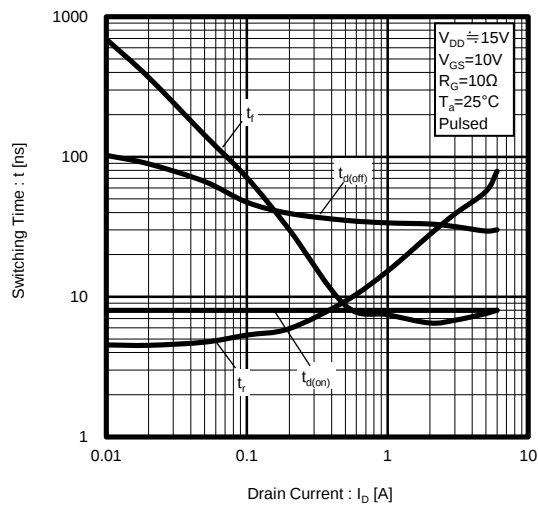


Fig.12 Dynamic Input Characteristics

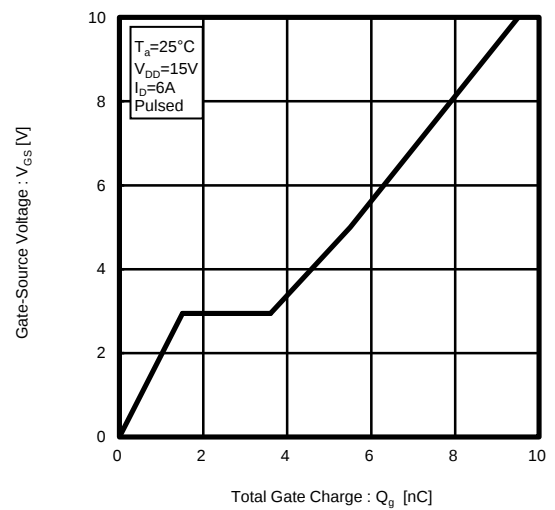


Fig.13 Typical Capacitance vs. Drain-Source Voltage

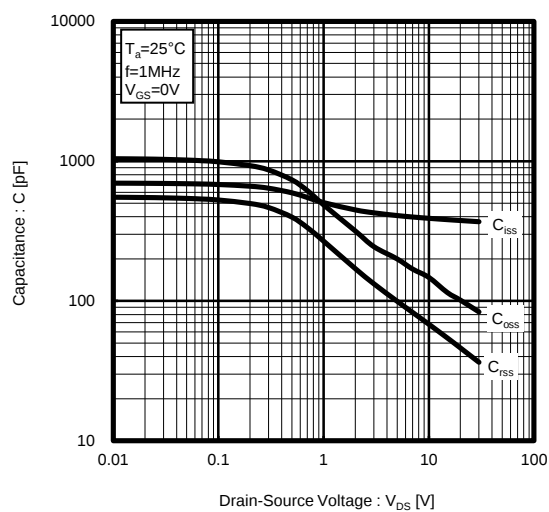


Fig.14 Maximum Safe Operating Area

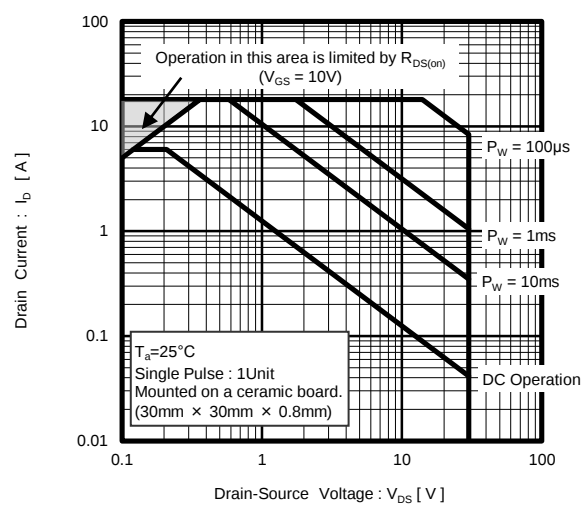
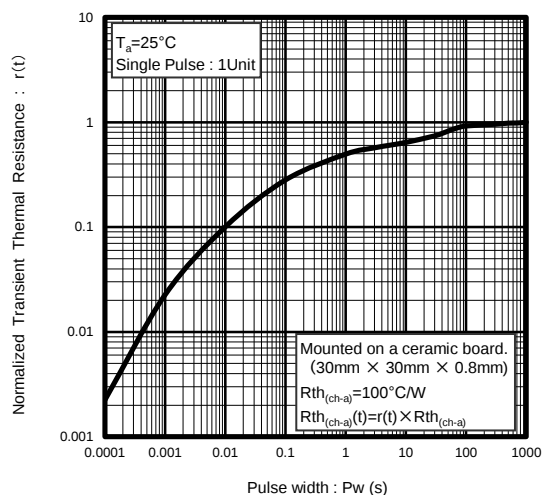


Fig.15 Normalized Transient Thermal Resistance v.s. Pulse Width



<Tr.2(Pch)>

Fig.1 Typical Output Characteristics ( I )

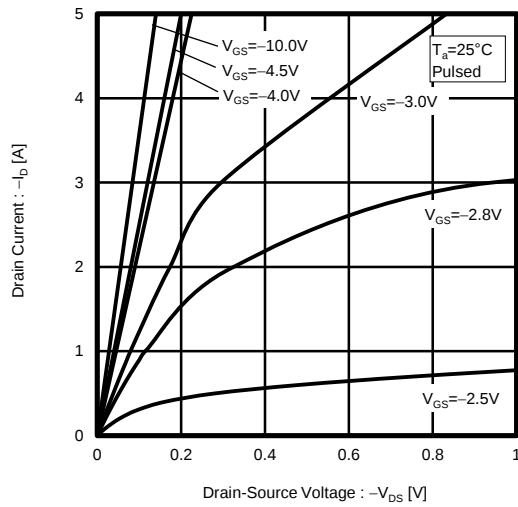


Fig.2 Typical Output Characteristics ( II )

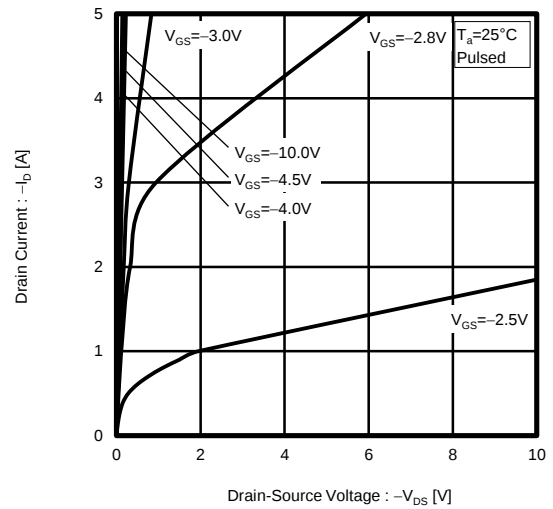


Fig.3 Static Drain-Source On-State Resistance vs. Drain Current

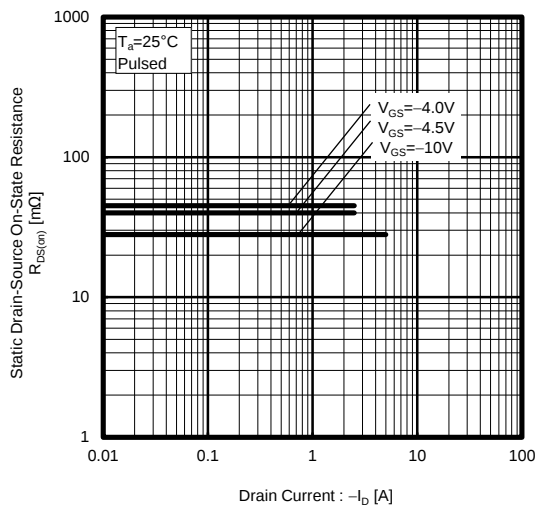


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current

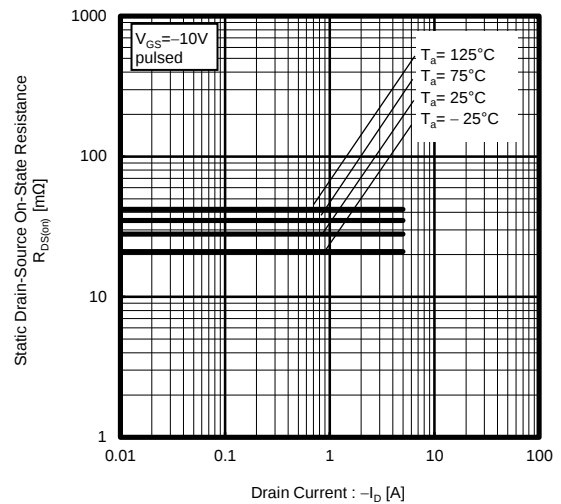


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current

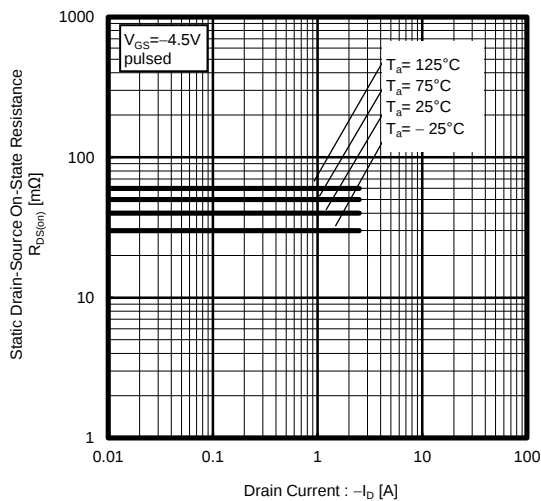


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

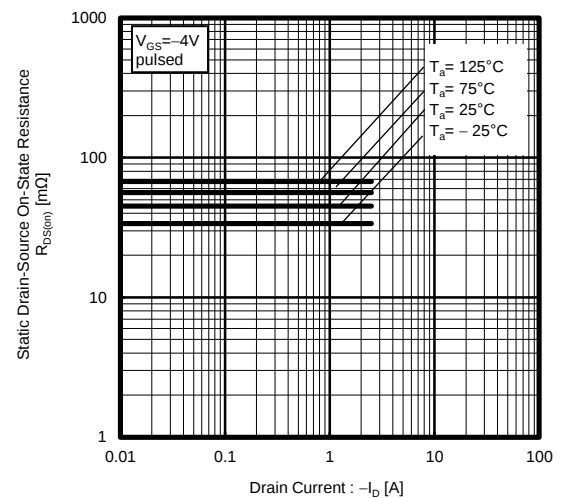


Fig.7 Forward Transfer Admittance vs. Drain Current

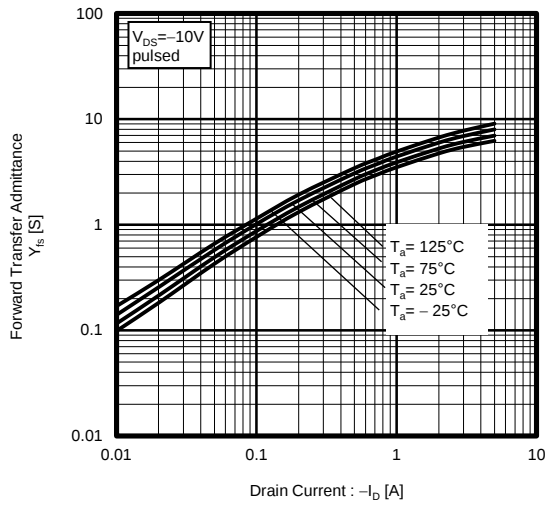


Fig.8 Typical Transfer Characteristics

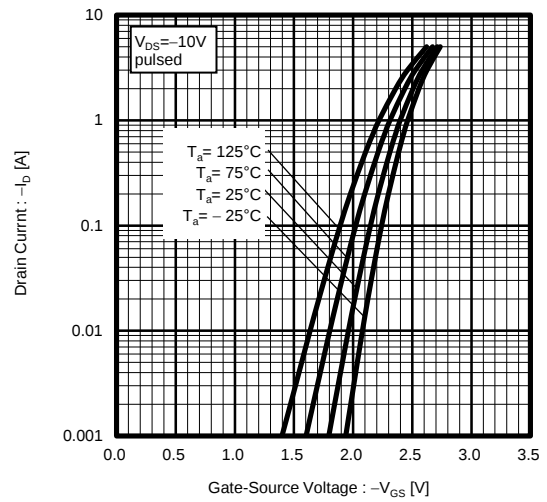


Fig.9 Source Current vs. Source-Drain Voltage

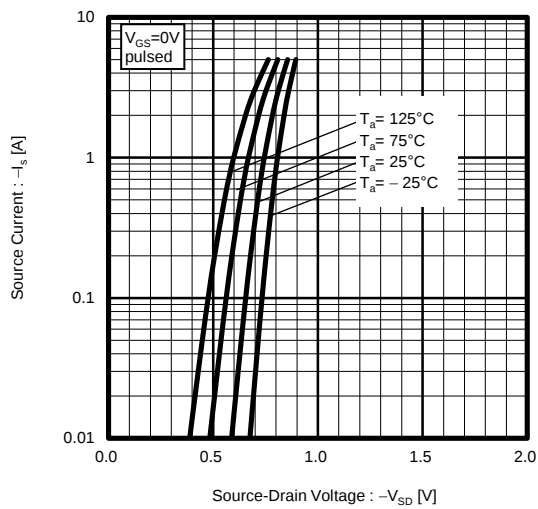


Fig.10 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

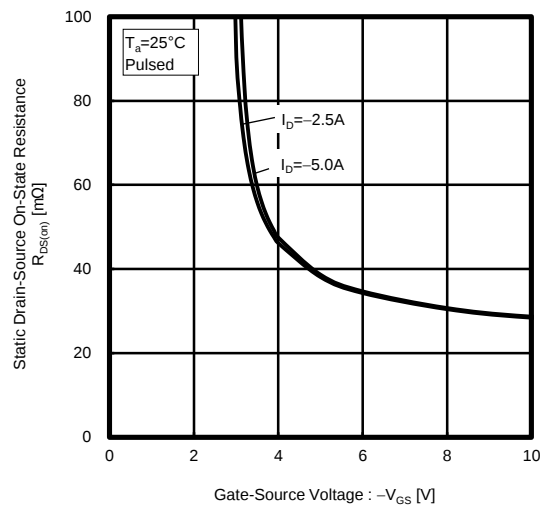


Fig.11 Switching Characteristics

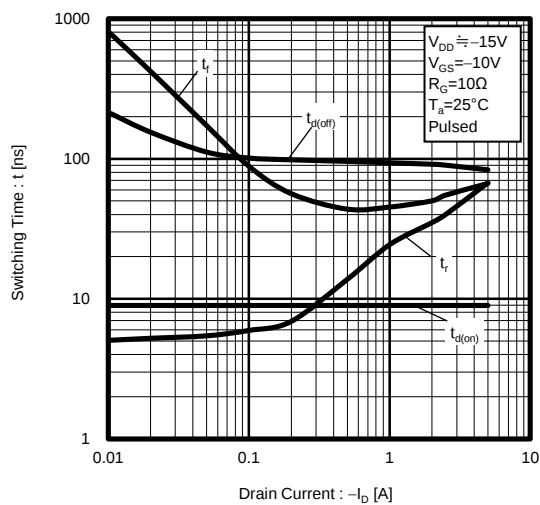


Fig.12 Dynamic Input Characteristics

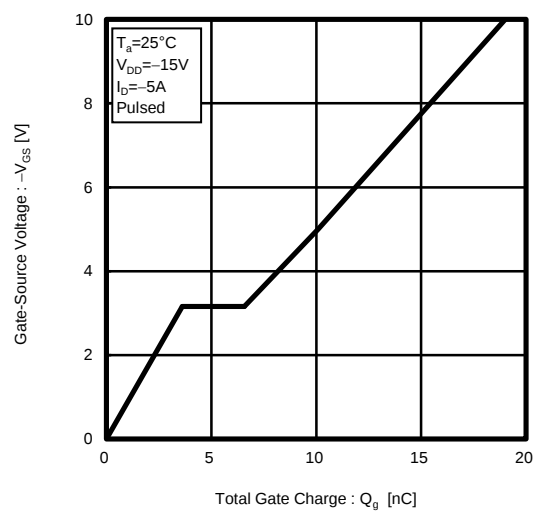


Fig.13 Typical Capacitance vs. Drain-Source Voltage

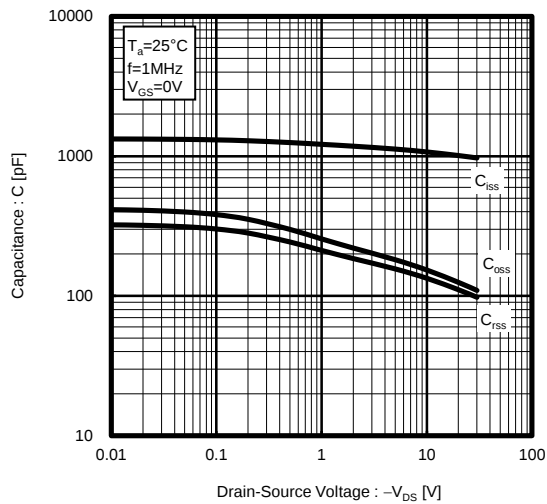


Fig.14 Maximum Safe Operating Area

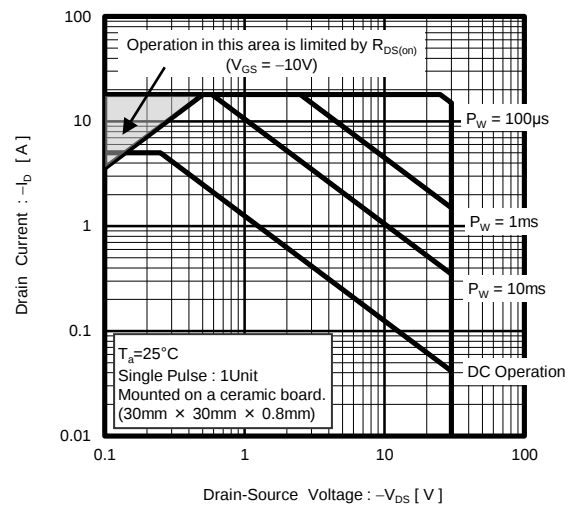
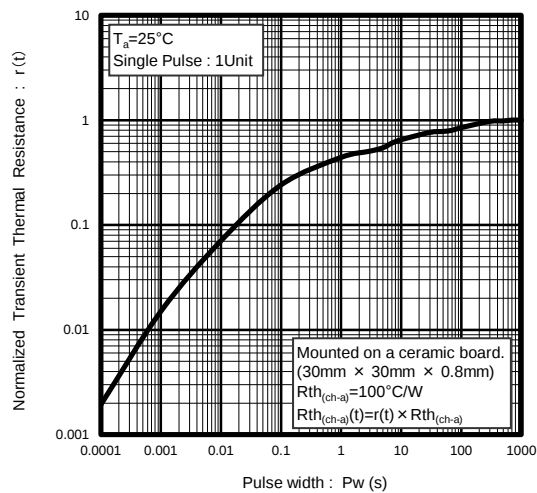


Fig.15 Normalized Transient Thermal Resistance v.s. Pulse Width



● Measurement circuits

<Tr1(Nch)>

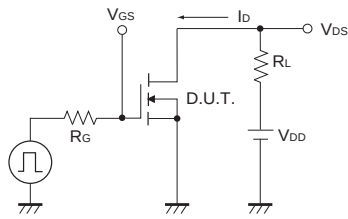


Fig.1-1 Switching Time Measurement Circuit

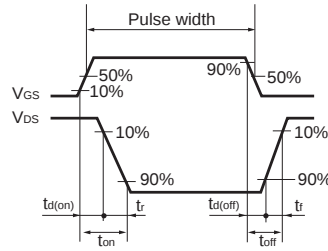


Fig.1-2 Switching Waveforms

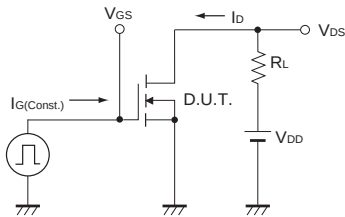


Fig.2-1 Gate Charge Measurement Circuit

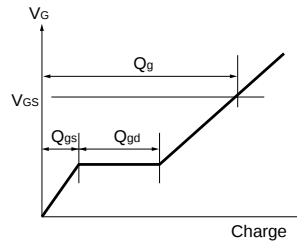


Fig.2-2 Gate Charge Waveform

<Tr2(Pch)>

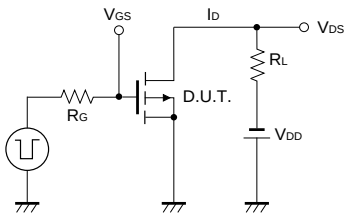


Fig.1-1 Switching Time Measurement Circuit

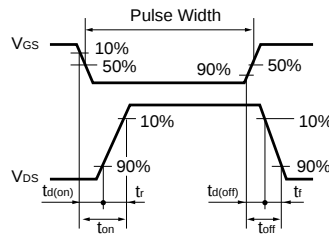


Fig.1-2 Switching Waveforms

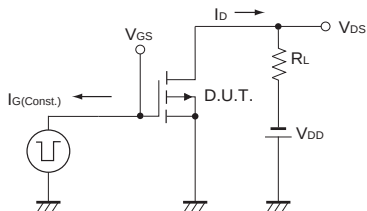


Fig.2-1 Gate Charge Measurement Circuit

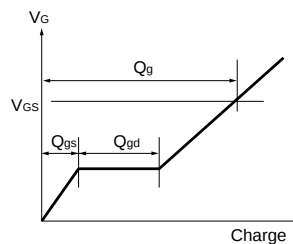


Fig.2-2 Gate Charge Waveform

● Notice

This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

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