

1.5V Drive Nch+Pch MOSFET

US6M11

●Structure

Silicon N-channel MOSFET /
Silicon P-channel MOSFET

●Features

- 1) Nch MOSFET and Pch MOSFET are put in TUMT6 package.
- 2) Low on-resistance.
- 3) Low voltage drive (1.5V drive).
- 4) Built-in G-S Protection Diode.

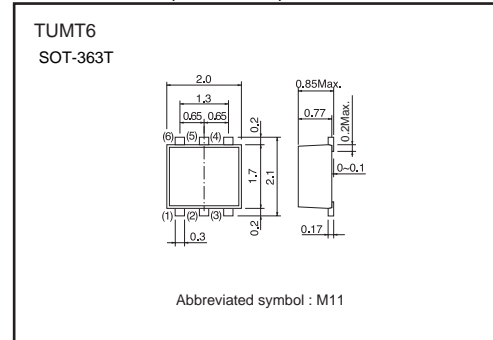
●Applications

Switching

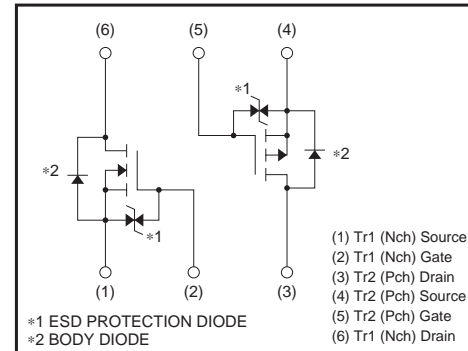
●Packaging specifications

| Type | Package | Taping |
|--------|------------------------------|--------|
| | Code | TR |
| | Basic ordering unit (pieces) | 3000 |
| US6M11 | | ○ |

●Dimensions (Unit : mm)



●Inner circuit



●Absolute maximum ratings (Ta=25°C)

| Parameter | Symbol | Limits | | Unit | |
|------------------------------|-------------------|--------------------|----------------|-------------|---|
| | | Tr1 : Nchannel | Tr2 : Pchannel | | |
| Drain-source voltage | V _{DSS} | 20 | -12 | V | |
| Gate-source voltage | V _{GSS} | ±10 | ±10 | V | |
| Drain current | Continuous | I _D | ±1.5 | ±1.3 | A |
| | Pulsed | I _{DP} *1 | ±6 | ±5.2 | A |
| Source current (Body diode) | Continuous | I _S | 0.5 | -0.5 | A |
| | Pulsed | I _{SP} *1 | 6 | -5.2 | A |
| Power dissipation | P _D *2 | 1.0 | | W / TOTAL | |
| | | 0.7 | | W / ELEMENT | |
| Channel temperature | T _{ch} | 150 | | °C | |
| Range of storage temperature | T _{stg} | -55 to +150 | | °C | |

*1 P_w≤10μs, Duty cycle≤1%

*2 Mounted on a ceramic board.

●Thermal resistance

| Parameter | Symbol | Limits | Unit |
|--------------------|------------------------------|--------|----------------|
| Channel to ambient | R _{th(ch-a)} * * | 125 | °C/W / TOTAL |
| | | 179 | °C/W / ELEMENT |

* Mounted on a ceramic board

<N-ch>

●Electrical characteristics (Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|----------------------|------|------|------|------|---|
| Gate-source leakage | I _{GSS} | – | – | ±10 | μA | V _{GS} = ±10V, V _{DS} =0V |
| Drain-source breakdown voltage | V _{(BR)DSS} | 20 | – | – | V | I _D = 1mA, V _{GS} =0V |
| Zero gate voltage drain current | I _{DSS} | – | – | 1 | μA | V _{DS} = 20V, V _{GS} =0V |
| Gate threshold voltage | V _{GS(th)} | 0.3 | – | 1.0 | V | V _{DS} = 10V, I _D = 1mA |
| Static drain-source on-state resistance | R _{DS(on)*} | – | 130 | 180 | mΩ | I _D = 1.5A, V _{GS} = 4.5V |
| | | – | 170 | 240 | mΩ | I _D = 1.5A, V _{GS} = 2.5V |
| | | – | 220 | 310 | mΩ | I _D = 0.8A, V _{GS} = 1.8V |
| | | – | 300 | 600 | mΩ | I _D = 0.3A, V _{GS} = 1.5V |
| Forward transfer admittance | Y _{fs} * | 1.6 | – | – | S | V _{DS} = 10V, I _D = 1.5A |
| Input capacitance | C _{iss} | – | 110 | – | pF | V _{DS} = 10V |
| Output capacitance | C _{oss} | – | 18 | – | pF | V _{GS} =0V |
| Reverse transfer capacitance | C _{rss} | – | 15 | – | pF | f=1MHz |
| Turn-on delay time | t _{d(on)*} | – | 5 | – | ns | V _{DD} ≐ 10V |
| Rise time | t _r * | – | 5 | – | ns | I _D = 1A |
| Turn-off delay time | t _{d(off)*} | – | 20 | – | ns | V _{GS} = 4.5V |
| Fall time | t _f * | – | 3 | – | ns | R _L ≐ 10Ω |
| Total gate charge | Q _g * | – | 1.8 | – | nC | V _{DD} ≐ 10V, V _{GS} = 4.5V |
| Gate-source charge | Q _{gs} * | – | 0.3 | – | nC | I _D = 1.5A |
| Gate-drain charge | Q _{gd} * | – | 0.3 | – | nC | R _L ≐ 6.7Ω, R _G = 10Ω |

*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 = 1.5A, V _{GS} =0V |

*Pulsed

<P-ch>

●Electrical characteristics (Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|----------------------|------|------|------|------|---|
| Gate-source leakage | I _{GSS} | – | – | ±10 | μA | V _{GS} = ±10V, V _{DS} =0V |
| Drain-source breakdown voltage | V _{(BR)DSS} | –12 | – | – | V | I _D = –1mA, V _{GS} =0V |
| Zero gate voltage drain current | I _{DSS} | – | – | –1 | μA | V _{DS} = –12V, V _{GS} =0V |
| Gate threshold voltage | V _{GS(th)} | –0.3 | – | –1.0 | V | V _{DS} = –6V, I _D = –1mA |
| Static drain-source on-state resistance | R _{DS(on)*} | – | 190 | 260 | mΩ | I _D = –1.3A, V _{GS} = –4.5V |
| | | – | 280 | 390 | mΩ | I _D = –0.6A, V _{GS} = –2.5V |
| | | – | 400 | 600 | mΩ | I _D = –0.6A, V _{GS} = –1.8V |
| | | – | 530 | 1060 | mΩ | I _D = –0.2A, V _{GS} = –1.5V |
| Forward transfer admittance | Y _{fs} * | 1.4 | – | – | S | V _{DS} = –6V, I _D = –1.3A |
| Input capacitance | C _{iss} | – | 290 | – | pF | V _{DS} = –6V |
| Output capacitance | C _{oss} | – | 28 | – | pF | V _{GS} = 0V |
| Reverse transfer capacitance | C _{rss} | – | 21 | – | pF | f=1MHz |
| Turn-on delay time | t _{d(on)*} | – | 8 | – | ns | V _{DD} ≐ –6V |
| Rise time | t _r * | – | 10 | – | ns | I _D = –0.6A |
| Turn-off delay time | t _{d(off)*} | – | 30 | – | ns | V _{GS} = –4.5V |
| Fall time | t _f * | – | 9 | – | ns | R _L ≐ 10Ω |
| Total gate charge | Q _g * | – | 2.4 | – | nC | V _{DD} ≐ –6V, V _{GS} = –4.5V |
| Gate-source charge | Q _{gs} * | – | 0.6 | – | nC | I _D = –1.3A |
| Gate-drain charge | Q _{gd} * | – | 0.4 | – | nC | R _L ≐ 4.6Ω, R _G = 10Ω |

*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 = –1.3A, V _{GS} =0V |

*Pulsed

●Electrical characteristic curves

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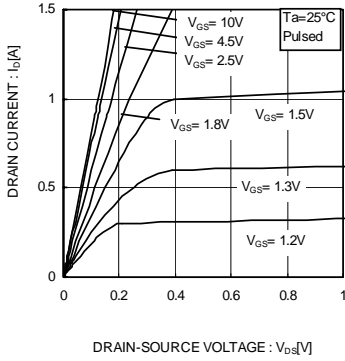


Fig.1 Typical Output Characteristics(I)

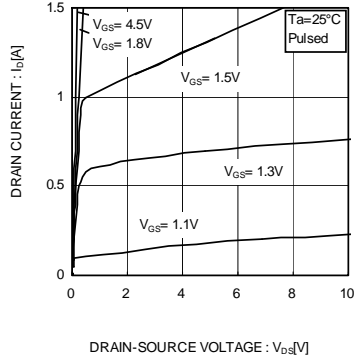


Fig.2 Typical Output Characteristics(II)

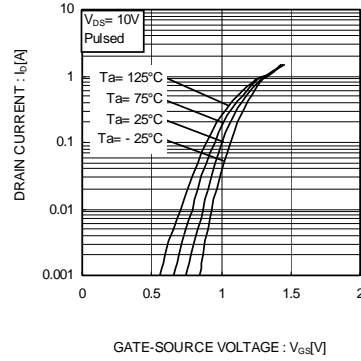


Fig.3 Typical Transfer Characteristics

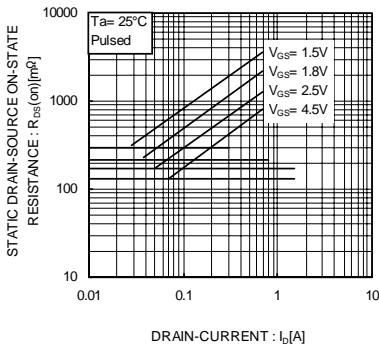


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current(I)

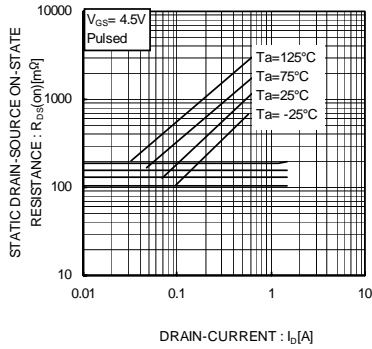


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current(II)

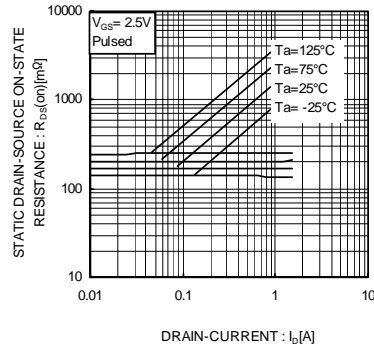


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current(III)

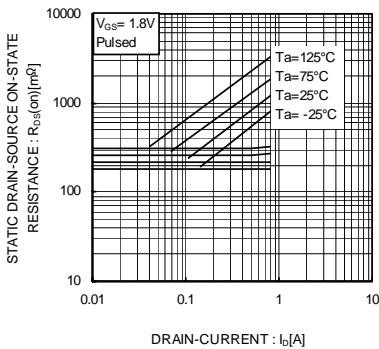


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current(IV)

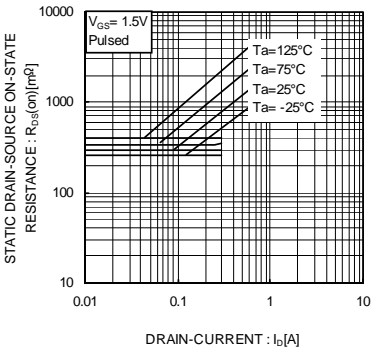


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current(V)

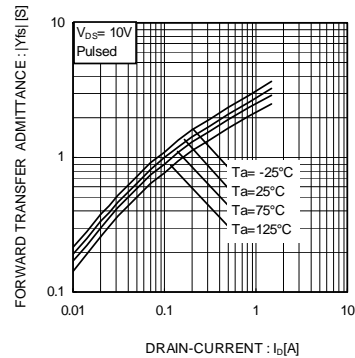


Fig.9 Forward Transfer Admittance vs. Drain Current

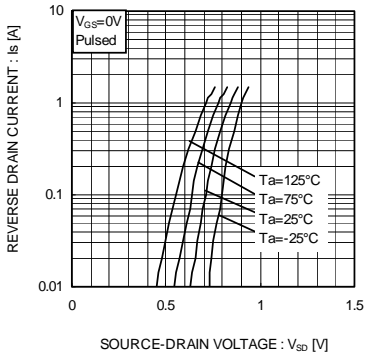


Fig.10 Reverse Drain Current vs. Source-Drain Voltage

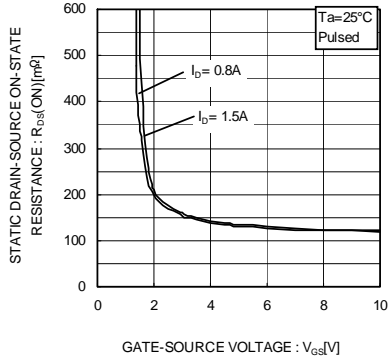


Fig.11 Static Drain-Source On-State Resistance vs. Gate Source Voltage

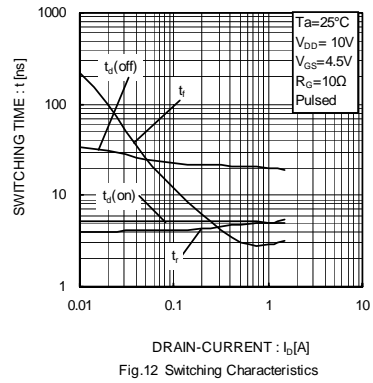


Fig.12 Switching Characteristics

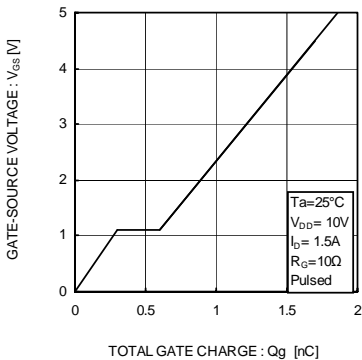


Fig.13 Dynamic Input Characteristics

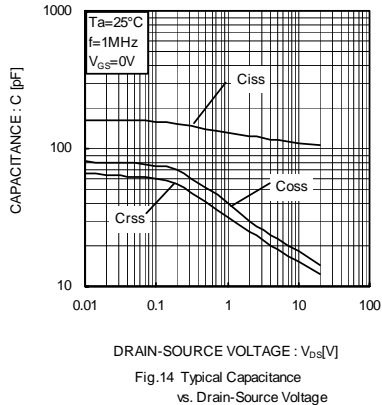


Fig.14 Typical Capacitance vs. Drain-Source Voltage

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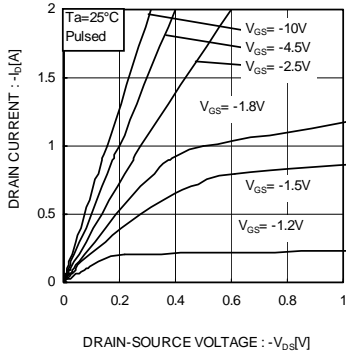


Fig.1 Typical output characteristics (I)

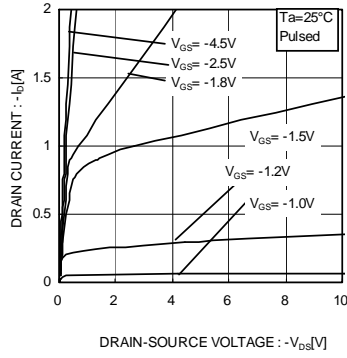


Fig.2 Typical output characteristics (II)

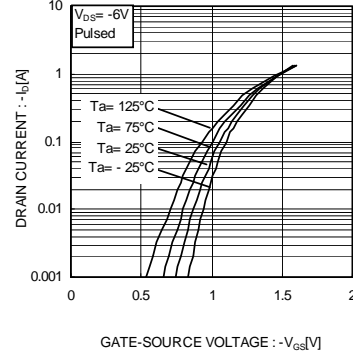


Fig.3 Typical Transfer Characteristics

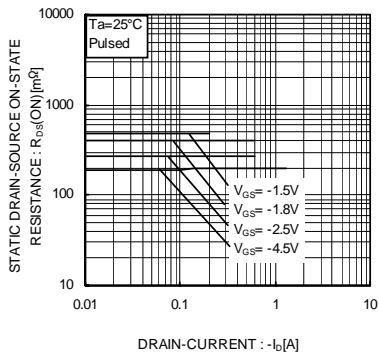


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current (I)

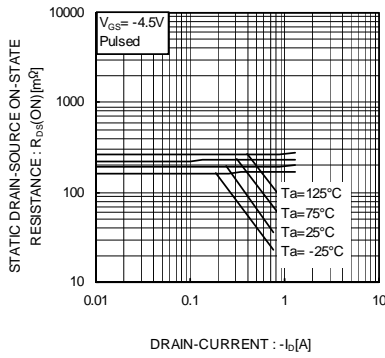


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current (II)

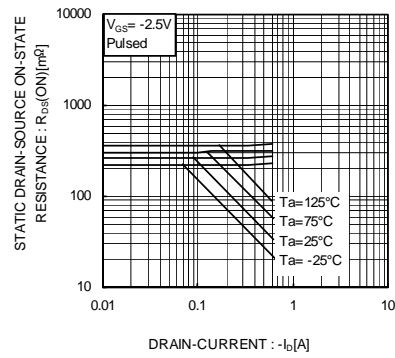


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current (III)

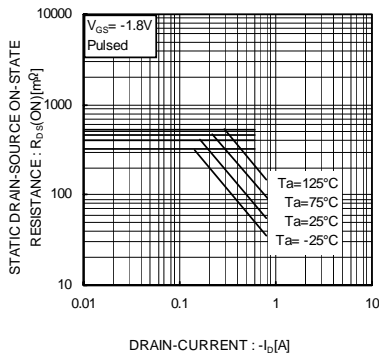


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (IV)

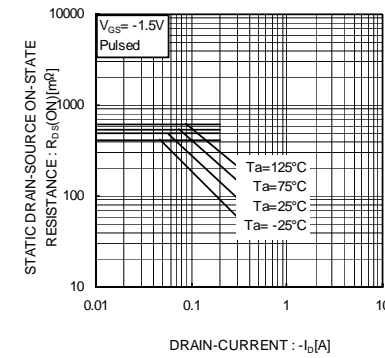


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (IV)

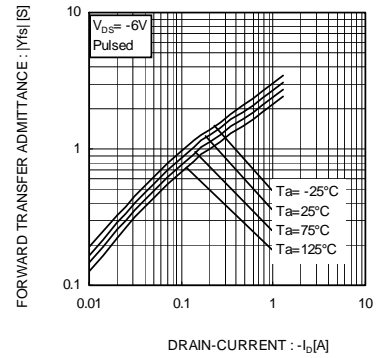
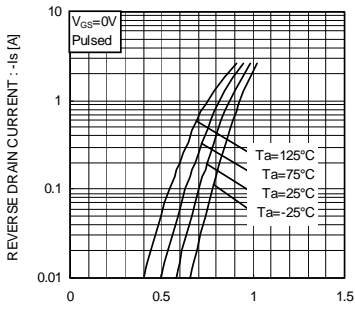
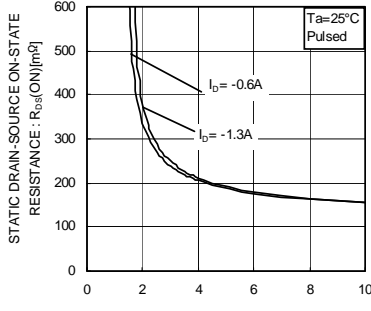


Fig.9 Forward Transfer Admittance vs. Drain Current



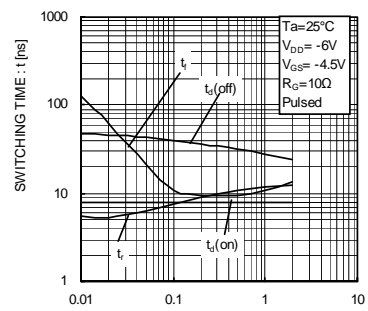
SOURCE-DRAIN VOLTAGE : $-V_{sd}$ [V]

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



GATE-SOURCE VOLTAGE : $-V_{gs}$ [V]

Fig.11 Static Drain-Source On-State Resistance vs. Gate Source Voltage



DRAIN-CURRENT : $-I_b$ [A]

Fig.12 Switching Characteristics

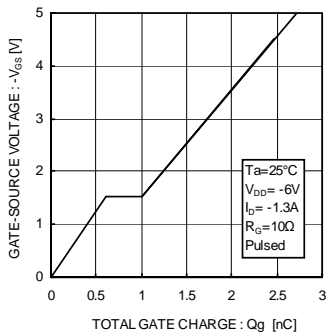


Fig.13 Dynamic Input Characteristics

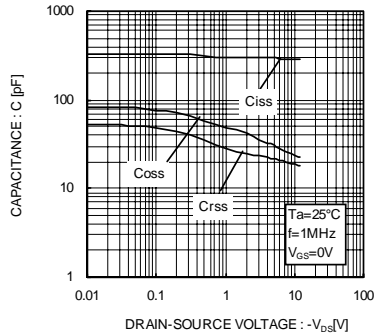


Fig.14 Typical Capacitance vs. Drain-Source Voltage

●Measurement circuit

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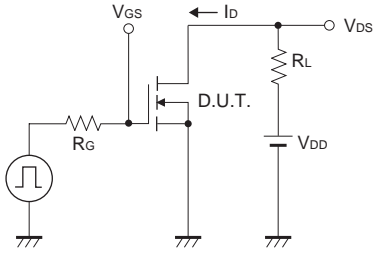


Fig.1-1 Switching Time Measurement Circuit

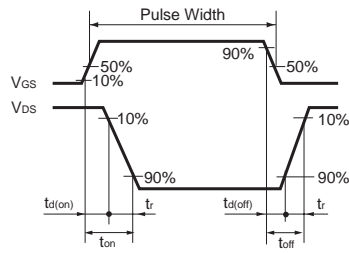


Fig.1-2 Switching Waveforms

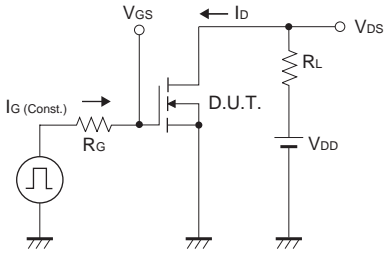


Fig.2-1 Gate Charge Measurement Circuit

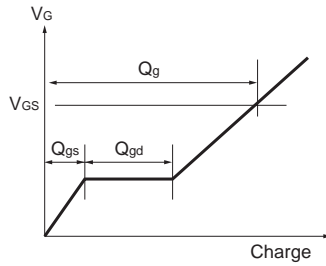


Fig.2-2 Gate Charge Waveform

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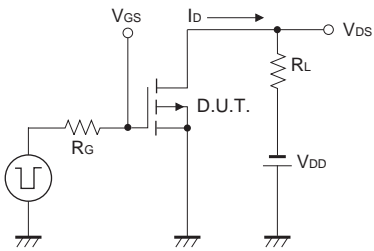


Fig.3-1 Switching Time Measurement Circuit

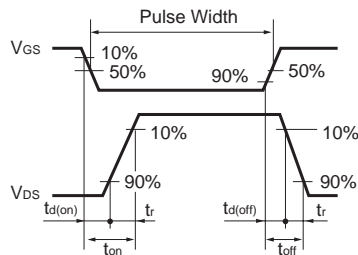


Fig.3-2 Switching Waveforms

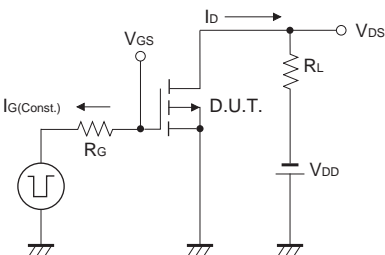


Fig.4-1 Gate Charge Measurement Circuit

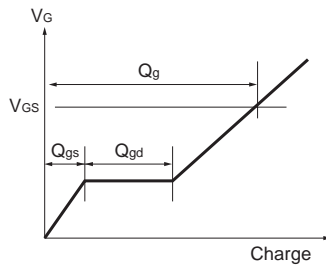


Fig.4-2 Gate Charge Waveform

●Notice

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

Notes

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