



**THE DATASHEET OF
RQ5E040AJTCL**



| | |
|--------------------|-------|
| V_{DSS} | 30V |
| $R_{DS(on)}(Max.)$ | 37mΩ |
| I_D | ±4.0A |
| P_D | 1W |

●Features

- 1) Low on - resistance.
- 2) High Power Package (TSMT3).
- 3) Pb-free lead plating ; RoHS compliant.
- 4) Halogen Free.

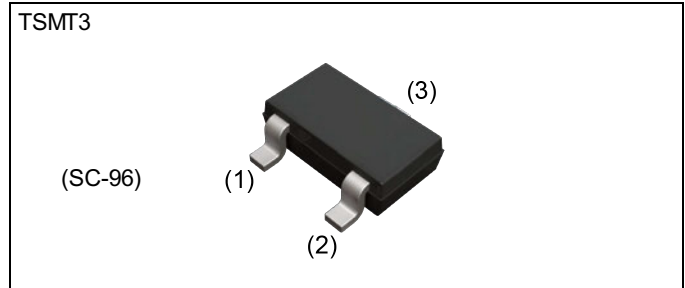
●Application

Switching

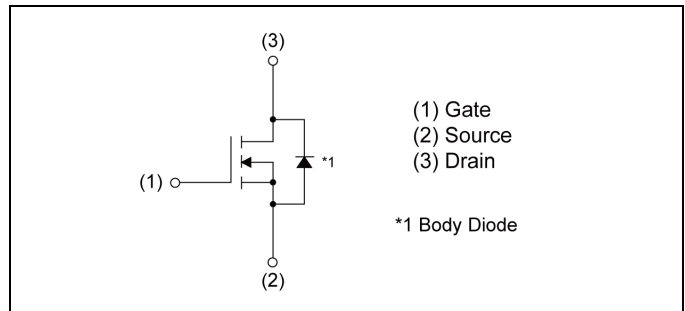
●Absolute maximum ratings ($T_a = 25^{\circ}C$)

| Parameter | Symbol | Value | Unit |
|--------------------------------|--------------------|-------------|------|
| Drain - Source voltage | V_{DSS} | 30 | V |
| Continuous drain current | I_D | ±4.0 | A |
| Pulsed drain current | $I_{D,pulse}^{*1}$ | ±16 | A |
| Gate - Source voltage | V_{GSS} | ±12 | V |
| Avalanche energy, single pulse | E_{AS}^{*2} | 1.2 | mJ |
| Avalanche current | I_{AS}^{*2} | 4.0 | A |
| Power dissipation | P_D^{*3} | 1 | W |
| Junction temperature | T_j | 150 | °C |
| Range of storage temperature | T_{stg} | -55 to +150 | °C |

●Outline



●Inner circuit



●Packaging specifications

| Type | Packing | Embossed Tape |
|------|---------------------------|---------------|
| | Reel size (mm) | 180 |
| | Tape width (mm) | 8 |
| | Basic ordering unit (pcs) | 3000 |
| | Taping code | TCL |
| | Marking | FK |

● Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|--|-----------------|--------|------|------|------|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - ambient | R_{thJA}^{*3} | - | - | 125 | °C/W |

● Electrical characteristics ($T_a = 25^\circ\text{C}$)

| 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 | - | 18 | - | mV/°C |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = 30V, V_{GS} = 0V$ | - | - | 1 | μA |
| Gate - Source leakage current | I_{GSS} | $V_{GS} = \pm 12V, V_{DS} = 0V$ | - | - | ±100 | nA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 1mA$ | 0.5 | - | 1.5 | V |
| Gate threshold voltage temperature coefficient | $\frac{\Delta V_{GS(th)}}{\Delta T_j}$ | $I_D = 1mA$ referenced to 25°C | - | -2.0 | - | mV/°C |
| Static drain - source on - state resistance | $R_{DS(on)}^{*4}$ | $V_{GS} = 4.5V, I_D = 4.0A$ | - | 27 | 37 | mΩ |
| | | $V_{GS} = 2.5V, I_D = 4.0A$ | - | 39 | 54 | |
| Gate input resistance | R_G | f=1MHz, open drain | - | 2.5 | - | Ω |
| Forward Transfer Admittance | $ Y_{fs} ^{*4}$ | $V_{DS} = 5V, I_D = 4A$ | 4.2 | - | - | S |

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

*2 $L \approx 0.1\text{mH}$, $V_{DD} = 15V$, $R_G = 25\Omega$, STARTING $T_{ch} = 25^\circ\text{C}$ Fig.3-1,3-2

*3 Mounted on a ceramic boad (30×30×0.8mm)

*4 Pulsed

●Electrical characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|------------------------------|-----------------------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Input capacitance | C _{iss} | V _{GS} = 0V | - | 480 | - | pF |
| Output capacitance | C _{oss} | V _{DS} = 15V | - | 55 | - | |
| Reverse transfer capacitance | C _{rss} | f = 1MHz | - | 40 | - | |
| Turn - on delay time | t _{d(on)} ^{*4} | V _{DD} ≈ 15V, V _{GS} = 4.5V | - | 8.8 | - | ns |
| Rise time | t _r ^{*4} | I _D = 2.0A | - | 5.9 | - | |
| Turn - off delay time | t _{d(off)} ^{*4} | R _L ≈ 7.5Ω | - | 26 | - | |
| Fall time | t _f ^{*4} | R _G = 10Ω | - | 5.7 | - | |

●Gate charge characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|----------------------|-------------------------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Total gate charge | Q _g ^{*4} | V _{DD} ≈ 15V, I _D = 4.0A, V _{GS} = 4.5V | - | 4.3 | - | nC |
| Gate - Source charge | Q _{gs} ^{*4} | | - | 1.1 | - | |
| Gate - Drain charge | Q _{gd} ^{*4} | | - | 1.1 | - | |

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

| Parameter | Symbol | Conditions | Values | | | Unit |
|---------------------------------------|-------------------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Body diode continuous forward current | I _S | T _a = 25°C | - | - | 0.8 | A |
| Body diode pulse current | I _{SP} ^{*1} | | - | - | 16 | A |
| Forward voltage | V _{SD} ^{*4} | V _{GS} = 0V, I _S = 0.8A | - | - | 1.2 | V |

● Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

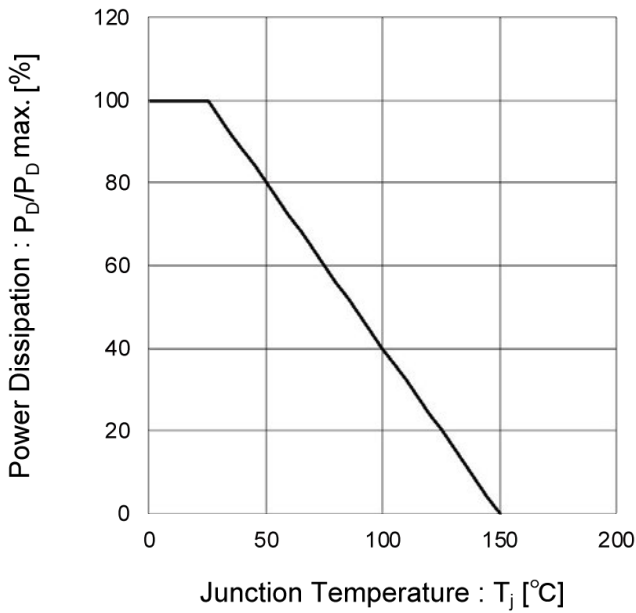


Fig.2 Maximum Safe Operating Area

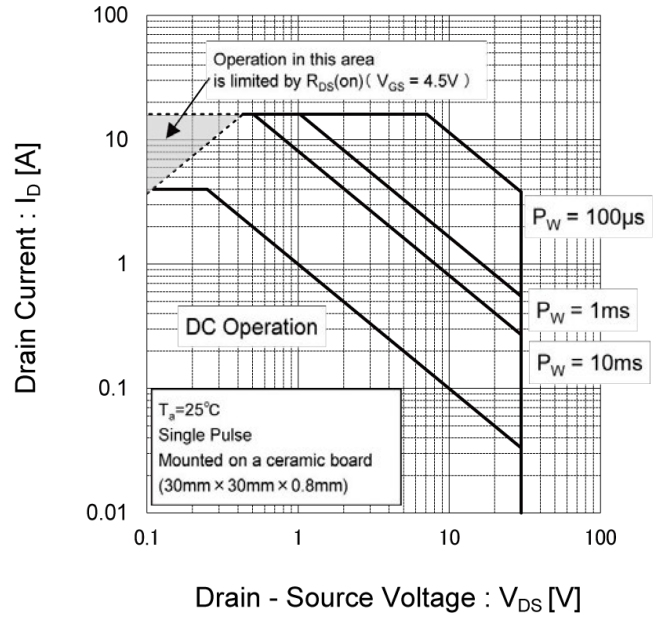


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

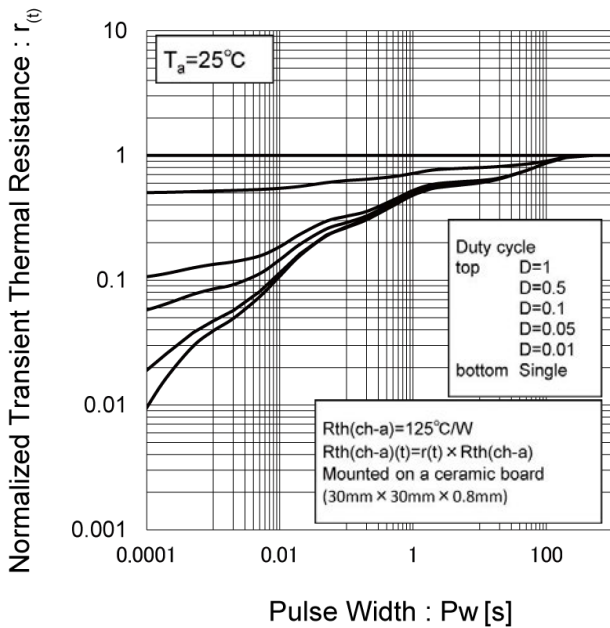
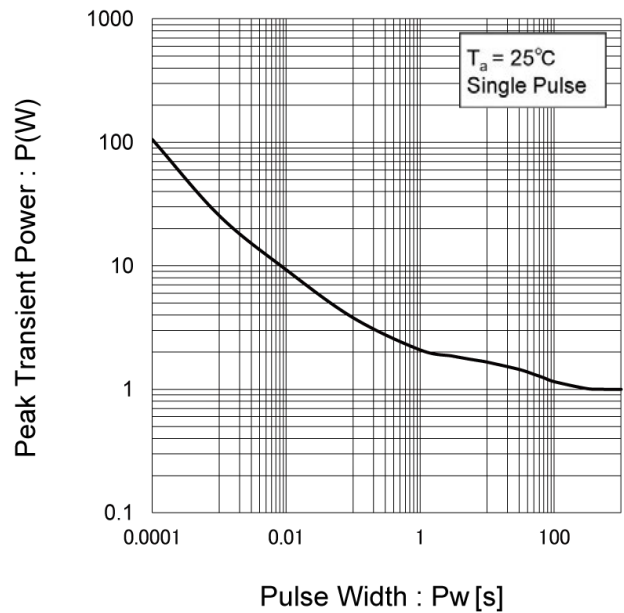


Fig.4 Single Pulse Maximum Power dissipation



● Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

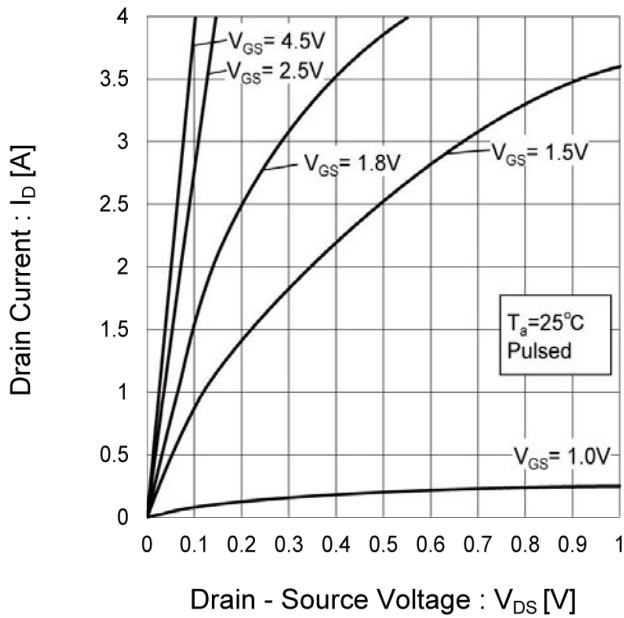


Fig.6 Typical Output Characteristics(II)

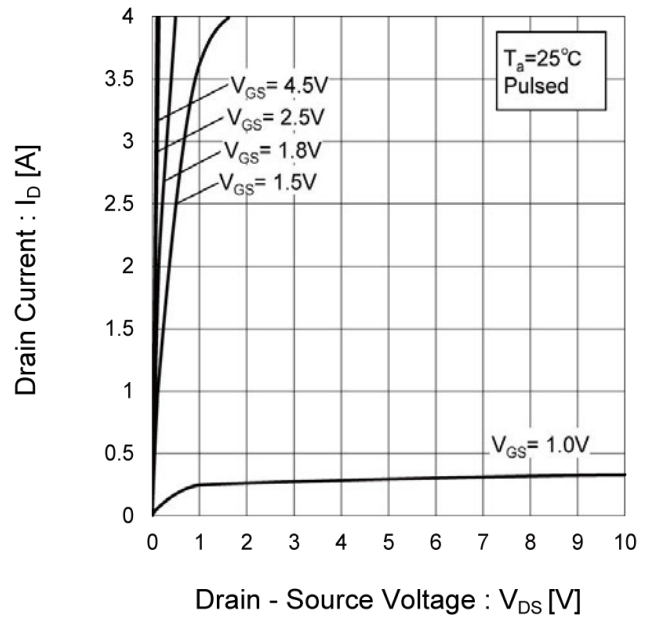
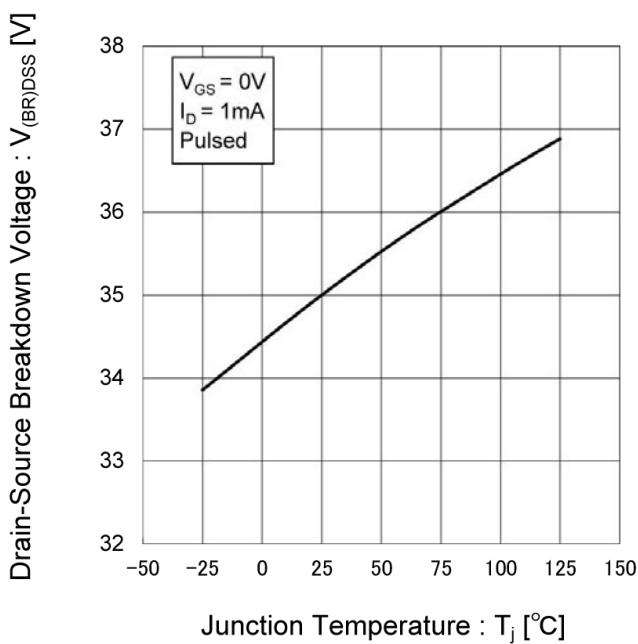


Fig.7 Breakdown Voltage vs. Junction Temperature



● Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

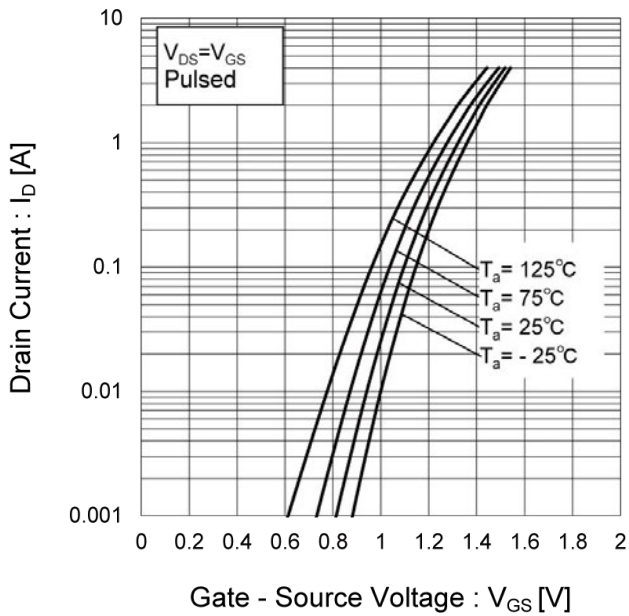


Fig.9 Gate Threshold Voltage vs. Junction Temperature

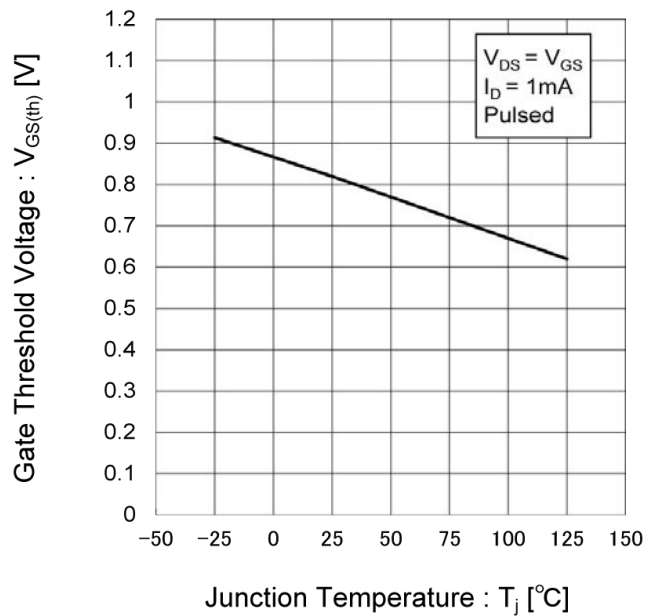
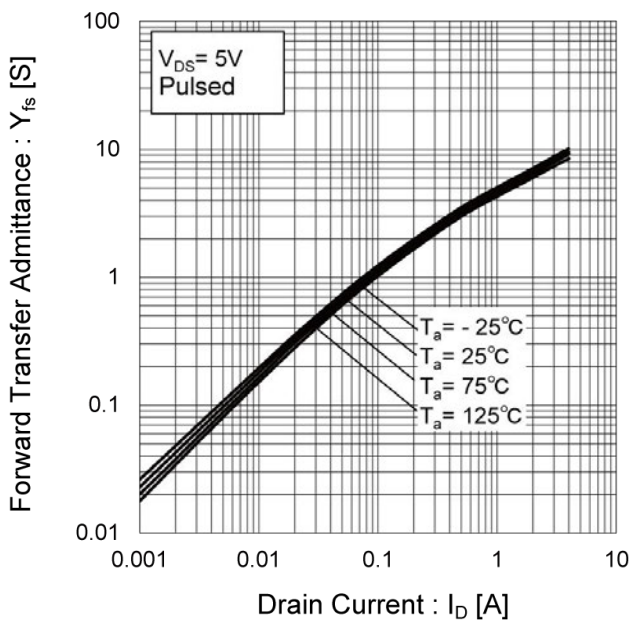


Fig.10 Transconductance vs. Drain Current



● Electrical characteristic curves

Fig.11 Drain Current Derating Curve

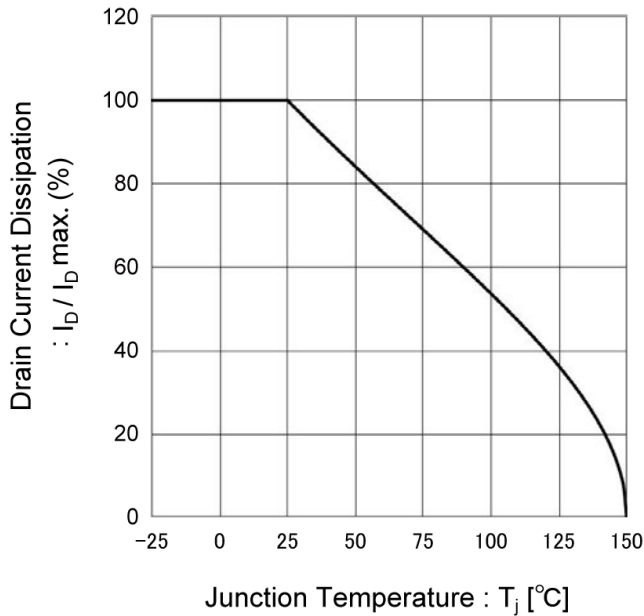


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

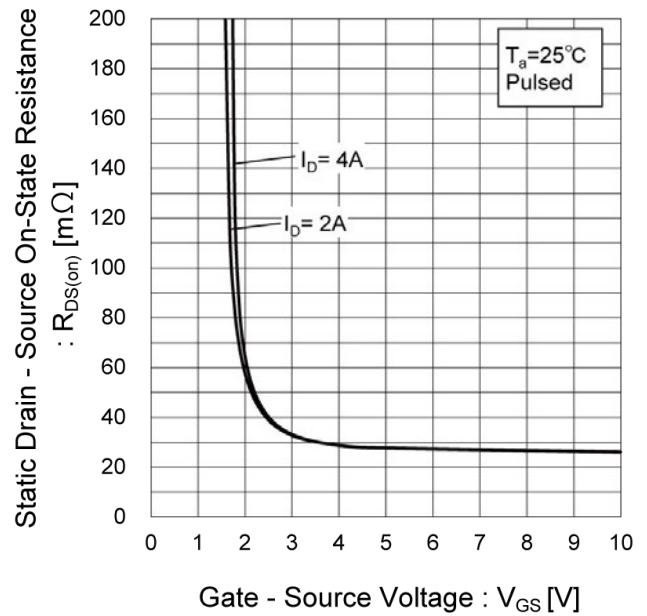
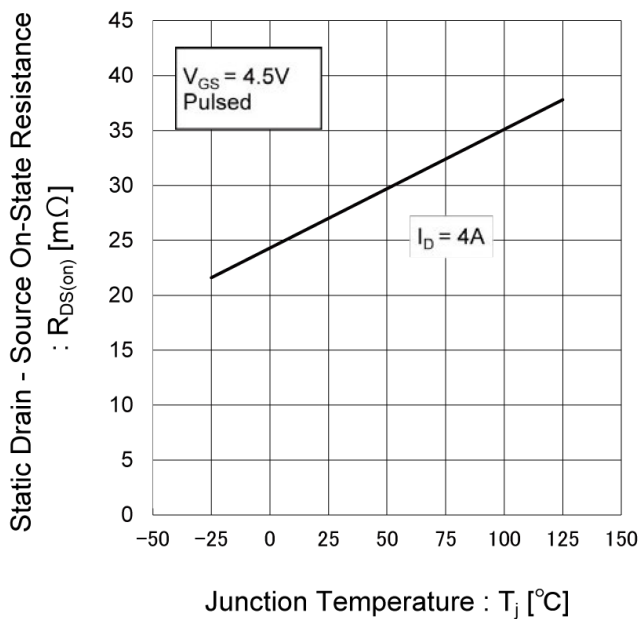


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



● Electrical characteristic curves

Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

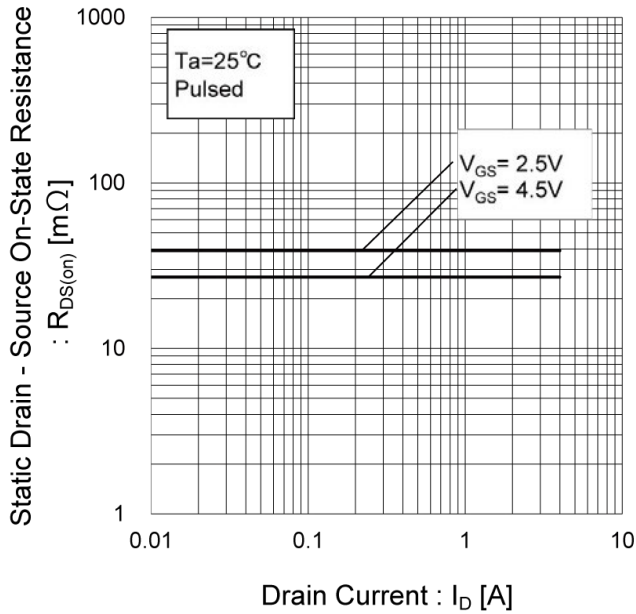


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

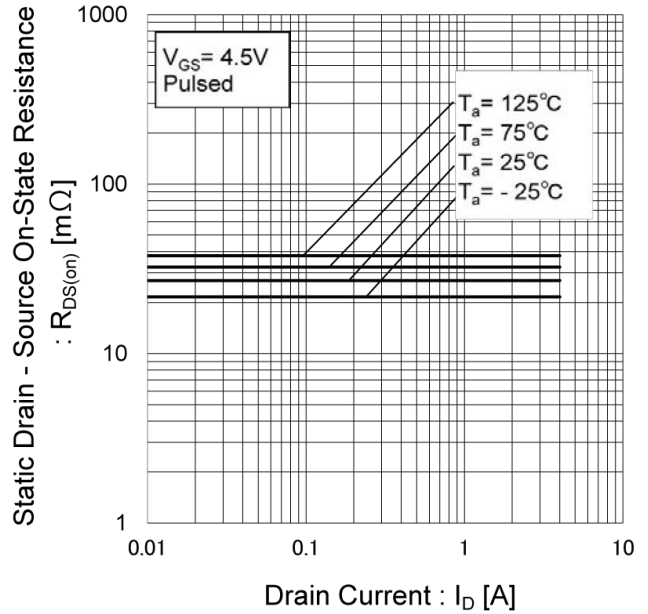
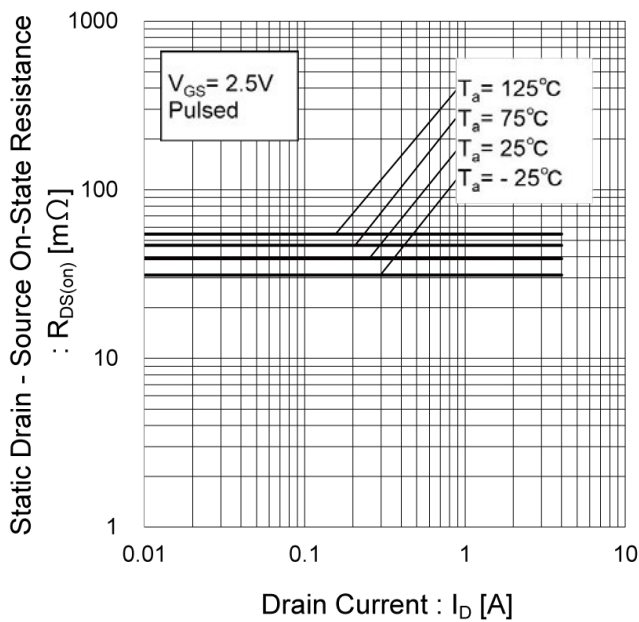


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



● Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

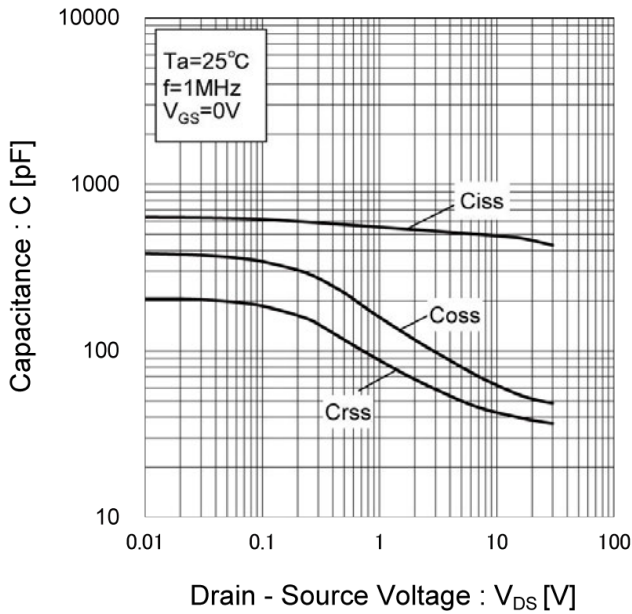


Fig.18 Switching Characteristics

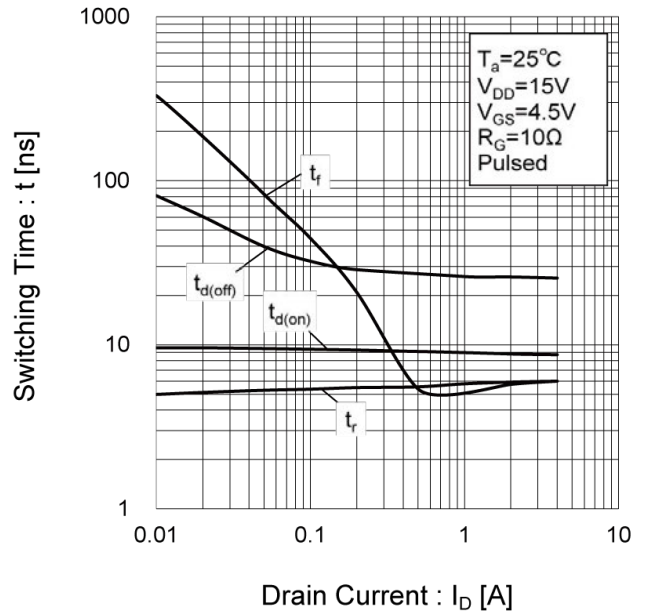


Fig.19 Dynamic Input Characteristics

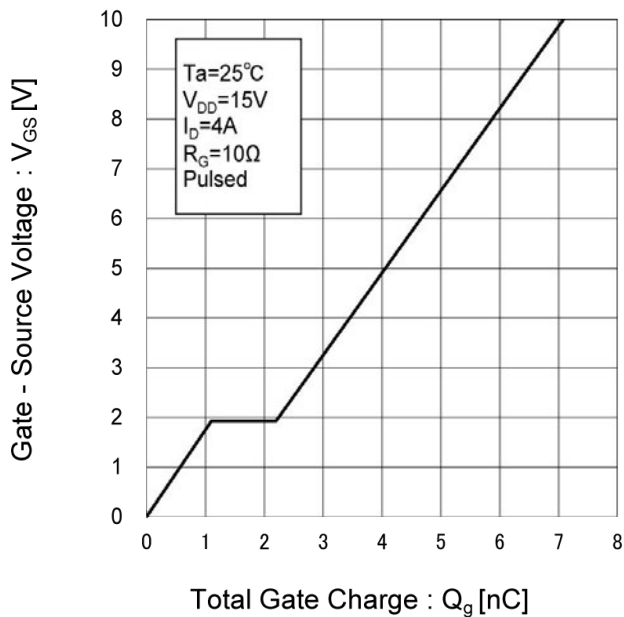
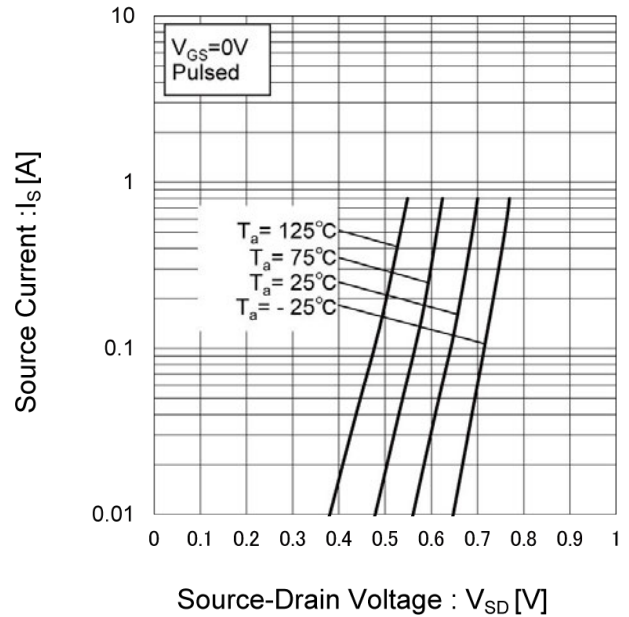


Fig.20 Source Current vs. Source Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

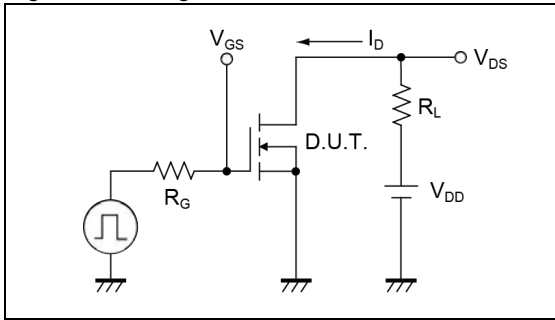


Fig.1-2 Switching Waveforms

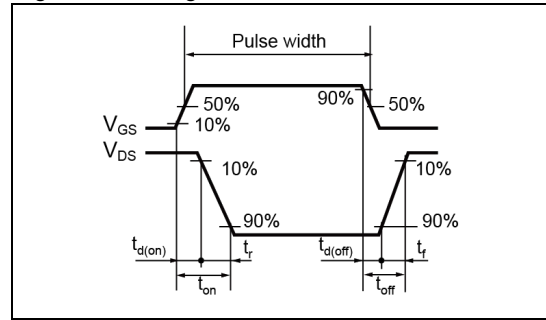


Fig.2-1 Gate Charge Measurement Circuit

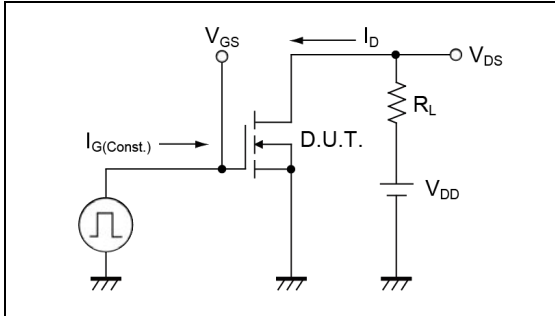


Fig.2-2 Gate Charge Waveform

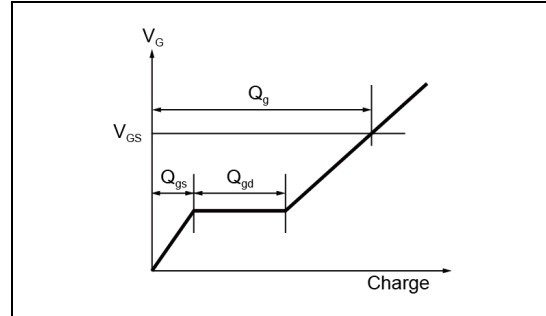


Fig.3-1 Avalanche Measurement Circuit

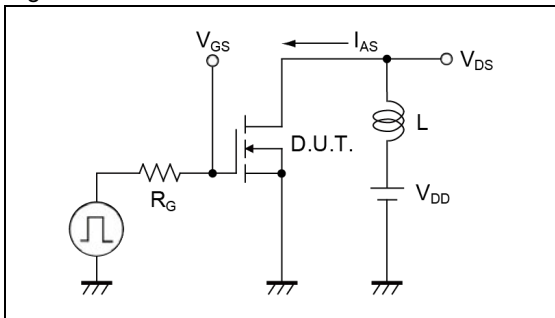
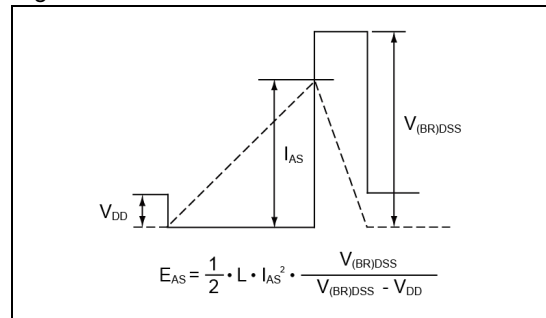


Fig.3-2 Avalanche Waveform

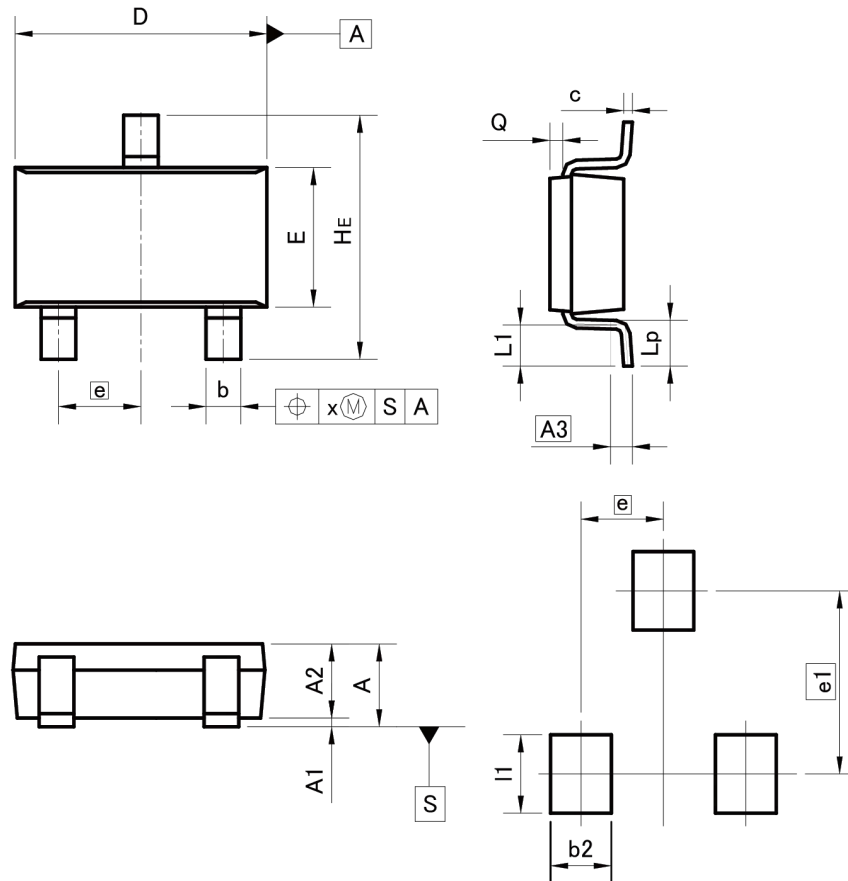


● Notice

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

●Dimensions

TSMT3



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | - | 1.00 | - | 0.039 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.75 | 0.95 | 0.030 | 0.037 |
| A3 | 0.25 | | 0.010 | |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.10 | 0.26 | 0.004 | 0.010 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 1.50 | 1.80 | 0.059 | 0.071 |
| e | 0.95 | | 0.037 | |
| HE | 2.60 | 3.00 | 0.102 | 0.118 |
| L1 | 0.30 | 0.60 | 0.012 | 0.024 |
| Lp | 0.40 | 0.70 | 0.016 | 0.028 |
| Q | 0.05 | 0.25 | 0.002 | 0.010 |
| x | - | 0.20 | - | 0.008 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.70 | - | 0.028 |
| e1 | 2.10 | | 0.083 | |
| l1 | - | 0.90 | - | 0.035 |

Dimension in mm/inches

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