

| | |
|---------------------|------|
| V_{DSS} | 750V |
| $R_{DS(on)}$ (Typ.) | 20mΩ |
| I_D^{*1} | 69A |
| P_D | 208W |

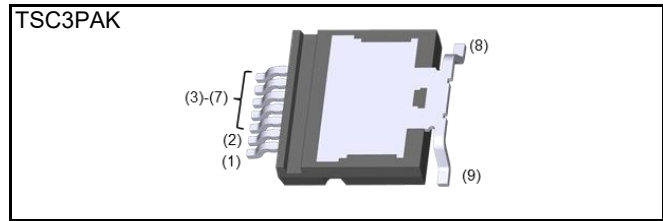
● Features

- 1) Qualified to AEC-Q101
- 2) Wide creepage distance = min.6.66mm
- 3) Low on-resistance
- 4) Fast switching speed
- 5) Fast reverse recovery
- 6) Easy to parallel
- 7) Simple to drive
- 8) Pb-free lead plating ; RoHS compliant

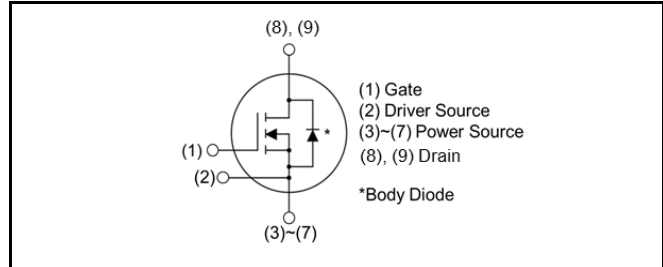
● Application

- Automobile
- Switch mode power supplies

● Outline



● Inner circuit



Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

● Packaging specifications

| Type | Packing | Embossed tape |
|------|---------------------------|---------------|
| | Reel size (mm) | 330 |
| | Tape width (mm) | 32 |
| | Basic ordering unit (pcs) | 600 |
| | Taping code | TCR |
| | Marking | SCT4020DTW |

● Absolute maximum ratings ($T_{vj} = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | | Symbol | Value | Unit | |
|--|--|-----------------------|---------------------------|------------------|---|
| Drain - source voltage | | V_{DSS} | 750 | V | |
| Continuous drain and source current | $V_{GS} = V_{GS_{on}}$ | I_D, I_S^{*1} | $T_c = 25^\circ\text{C}$ | 69 | A |
| | | | $T_c = 100^\circ\text{C}$ | 49 | A |
| Pulsed drain current | $V_{GS} = V_{GS_{on}}$ | $I_{D,pulse}^{*2}$ | 163 | A | |
| Body diode pulsed forward current | $T_c = 25^\circ\text{C}$ $V_{GS} = 0\text{V}$ | $I_{S,pulse}^{*1,*3}$ | 69 | A | |
| Body diode surge forward current | | $I_{S,pulse}^{*1,*4}$ | 163 | A | |
| Gate - source voltage (DC) | | V_{GSS_DC} | -4 to +21 | V | |
| Gate - source surge voltage ($t_{surge} < 300\text{ns}$) | | $V_{GSS_surge}^{*5}$ | -4 to +23 | V | |
| Recommended turn-on gate - source drive voltage | | $V_{GS_{on}}^{*6}$ | +15 to +18 | V | |
| Recommended turn-off gate - source drive voltage | | $V_{GS_{off}}$ | 0 | V | |
| Virtual junction temperature | | T_{vj} | 175 | $^\circ\text{C}$ | |
| Range of storage temperature | | T_{stg} | -40 to +175 | $^\circ\text{C}$ | |

● **Electrical characteristics** ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|-------------------|--|--------|--------------|-----------|------------------|
| | | | Min. | Typ. | Max. | |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 12.4\text{mA}$ $T_{vj} = 25^{\circ}\text{C}$ | 750 | - | - | V |
| Zero Gate voltage Drain current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 750\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | - | 1 10 | 80 - | μA |
| Gate - Source leakage current | I_{GSS+} | $V_{GS} = +21\text{ V}, V_{DS} = 0\text{V}$ | - | - | 100 | nA |
| Gate - Source leakage current | I_{GSS-} | $V_{GS} = -4\text{ V}, V_{DS} = 0\text{V}$ | - | - | -100 | nA |
| Gate threshold voltage | $V_{GS(th)}^{*7}$ | $V_{DS} = 10\text{V}, I_D = 20\text{mA}$ | 2.8 | - | 4.8 | V |
| Static Drain - Source on - state resistance | $R_{DS(on)}^{*8}$ | $V_{GS} = 18\text{V}, I_D = 38\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | - | 20.0 34.2 | 26.0 - | $\text{m}\Omega$ |
| Gate input resistance | R_G | $f = 1\text{MHz}, \text{open drain}$ | - | 1 | - | Ω |

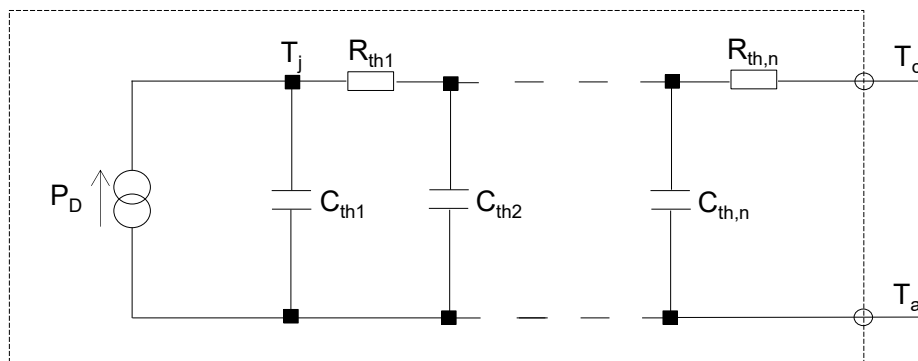
● **Thermal resistance**

| Parameter | Symbol | Values | | | Unit |
|-------------------------------------|-----------------|--------|------|------|------|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | R_{thJC}^{*9} | - | 0.55 | 0.72 | K/W |

Important note: The thermal resistance of the entire thermal stack is a critical factor for correct T_j estimation. Relying solely on the datasheet R_{thJC} value and assuming a constant case temperature when comparing different devices can lead to misleading results. For more information, please refer to "[application note 68AN036E](#)".

● **Typical Transient Thermal Characteristics**

| Symbol | Value | Unit | Symbol | Value | Unit |
|-----------|----------------------|------|-----------|----------------------|------|
| R_{th1} | 8.0×10^{-2} | K/W | C_{th1} | 7.8×10^{-4} | Ws/K |
| R_{th2} | 2.1×10^{-1} | | C_{th2} | 4.0×10^{-3} | |
| R_{th3} | 2.5×10^{-1} | | C_{th3} | 2.9×10^{-2} | |



●Electrical characteristics ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit | |
|--|----------------------------|---|---|------|------|---------------|---------------|
| | | | Min. | Typ. | Max. | | |
| Transconductance | g_{fs}^{*8} | $V_{DS} = 10\text{V}, I_D = 38\text{A}$ | - | 19 | - | S | |
| Input capacitance | C_{iss} | $V_{GS} = 0\text{V}$ | - | 3174 | - | pF | |
| Output capacitance | C_{oss} | $V_{DS} = 500\text{V}$ | - | 155 | - | | |
| Reverse transfer capacitance | C_{rss} | $f = 1\text{MHz}$ | - | 8 | - | | |
| Effective output capacitance, energy related | $C_{o(er)}$ | $V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 500\text{V}$ | - | 203 | - | pF | |
| Total Gate charge | Q_g^{*8} | $V_{DS} = 500\text{V}$ $I_D = 38\text{A}$ | - | 123 | - | nC | |
| Gate - Source charge | Q_{gs}^{*8} | $V_{GS} = 18\text{V}$ | - | 29 | - | | |
| Gate - Drain charge | Q_{gd}^{*8} | See Fig. 1-1, 1-2. | - | 43 | - | | |
| Turn - on delay time | $t_{d(on)}^{*8}$ | $V_{DS} = 500\text{V}$ $I_D = 38\text{A}$ | - | 14 | - | ns | |
| Rise time | t_r^{*8} | $V_{GS} = +18\text{V} / 0\text{V}$ | - | 26 | - | | |
| Turn - off delay time | $t_{d(off)}^{*8}$ | $R_G = 6.8\Omega, L = 250\mu\text{H}$ E_{on} includes diode reverse recovery | - | 53 | - | | |
| Fall time | t_f^{*8} | $L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ | - | 14 | - | | |
| Turn - on switching loss | E_{on}^{*8} | See Fig. 2-1, 2-2, 2-3. | - | 550 | - | μJ | |
| Turn - off switching loss | E_{off}^{*8} | | - | 82 | - | | |
| Short-circuit withstand time | $V_{GS(on)} = +15\text{V}$ | t_{sc}^{*10} | $V_{DS} \leq 400\text{V}$ | - | 12.0 | - | μs |
| | $V_{GS(on)} = +18\text{V}$ | | $V_{DS,peak} \leq 750\text{V}$ $T_{vj(start)} = 25^{\circ}\text{C}$ $R_G = 2.2\Omega$ | - | 11.5 | - | μs |

● **Body diode electrical characteristics** (Source-Drain) ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|-------------------------------|----------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Forward voltage | V_{SD}^{*8} | $V_{GS} = 0\text{V}, I_S = 38\text{A}$ | - | 3.3 | - | V |
| Reverse recovery time | t_{rr}^{*8} | $I_F = 38\text{A}$ $V_R = 500\text{V}$ | - | 15 | - | ns |
| Reverse recovery charge | Q_{rr}^{*8} | $di/dt = 2600\text{A}/\mu\text{s}$ | - | 210 | - | nC |
| Peak reverse recovery current | I_{rrm}^{*8} | $L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ See Fig. 3-1, 3-2. | - | 28 | - | A |

*1 Limited by maximum T_{vj} and for Max. R_{thJC} .

*2 Pulse width and duty cycle are limited by $T_{vj,max}$.

*3 Only for body-diode, Repetitive pulse, $PW \leq 1.5\mu\text{s}$, Duty cycle $\leq 5\%$

*4 When used as a protective function, $PW \leq 10\mu\text{s}$

*5 Example of acceptable V_{GS} waveform



*6 Please be advised not to use SiC-MOSFETs with V_{GS} below 10V as doing so may cause thermal runaway.

*7 Tested after applying $V_{GS} = 21\text{V}$ for 100ms.

*8 Pulsed

*9 Measured conformable to JESD51-14.

See the application note "rthjc_measurement_and_usage_an-e.pdf". [Link](#)

URL: https://fscdn.rohm.com/en/products/databook/applnote/discrete/common/rthjc_measurement_and_usage_an-e.pdf

*10 The value is based on TO-247 package. Single Pulsed.

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

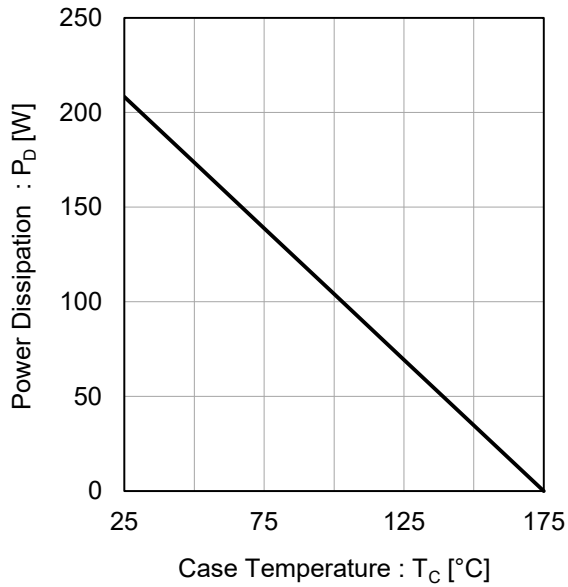


Fig.2 Maximum Safe Operating Area

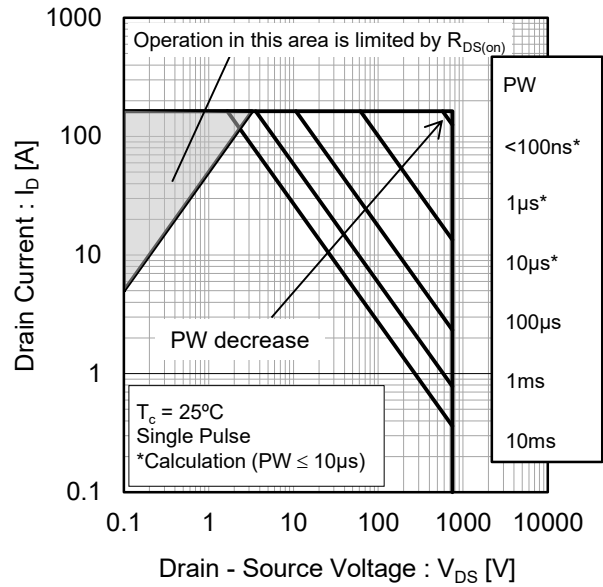
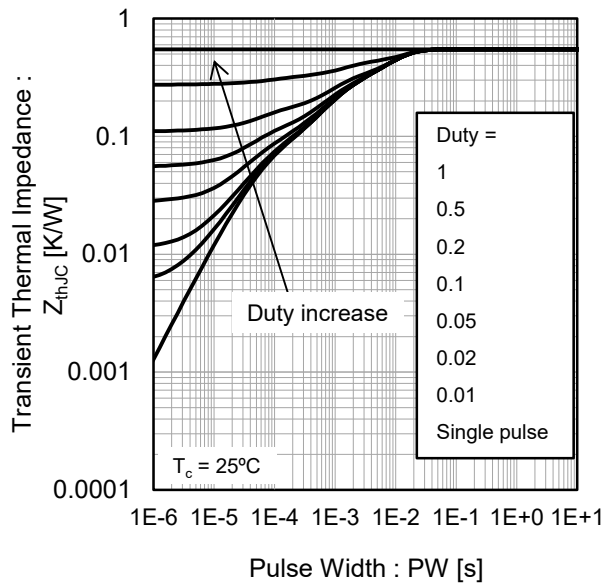


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

Fig.4 $T_{vj} = 25^{\circ}\text{C}$ Typical Output Characteristics

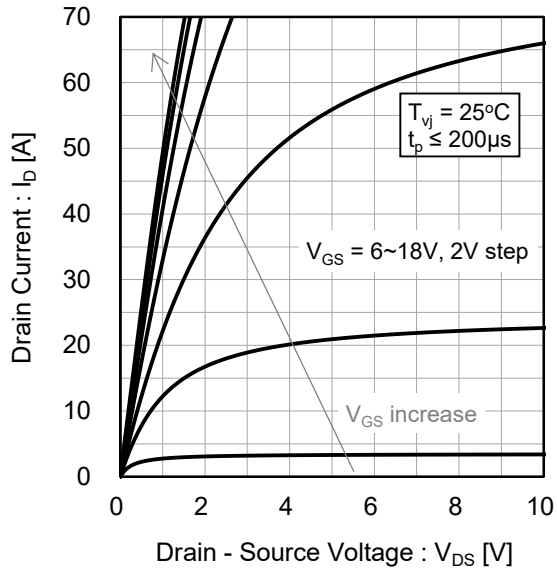
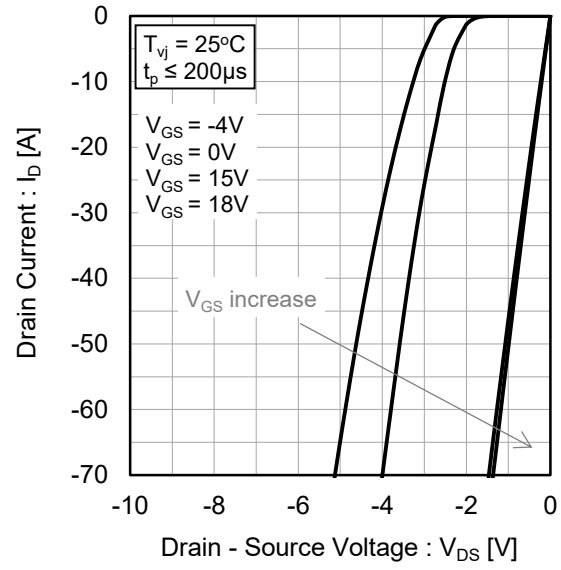


Fig.5 $T_{vj} = 25^{\circ}\text{C}$ 3rd Quadrant Characteristics



●Electrical characteristic curves

Fig.6 $T_{vj} = 150^{\circ}\text{C}$ Typical Output Characteristics

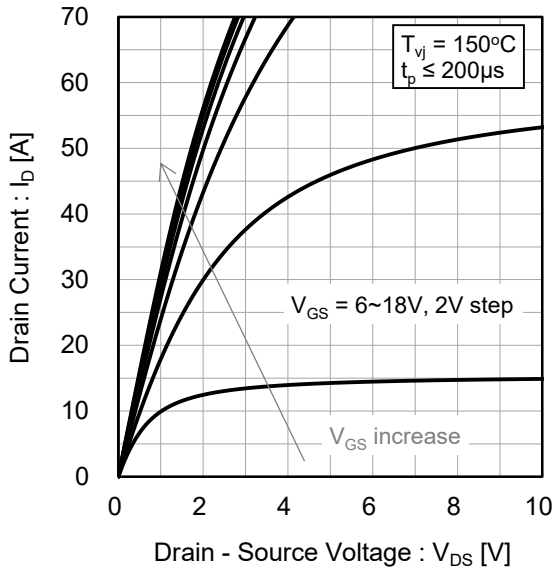


Fig.7 $T_{vj} = 150^{\circ}\text{C}$ 3rd Quadrant Characteristics

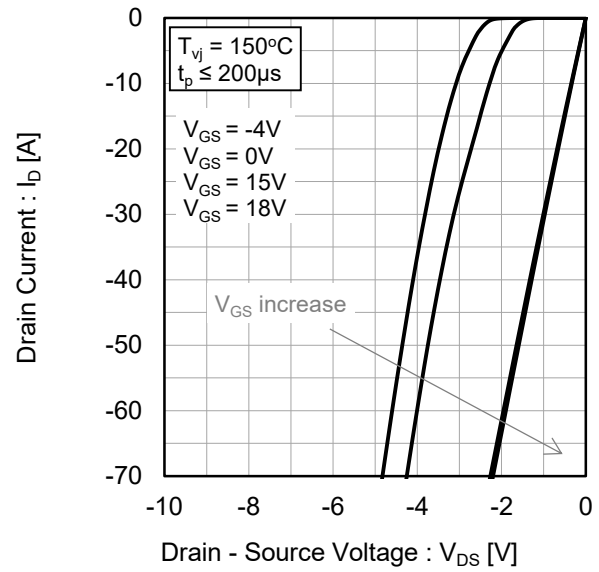
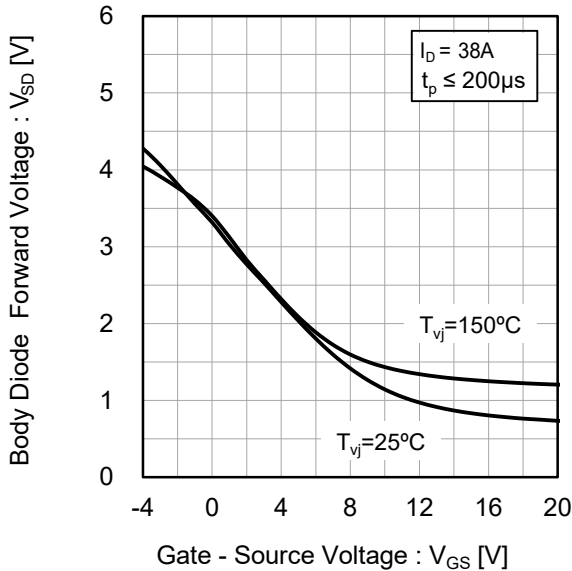


Fig.8 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.9 Typical Transfer Characteristics (I)

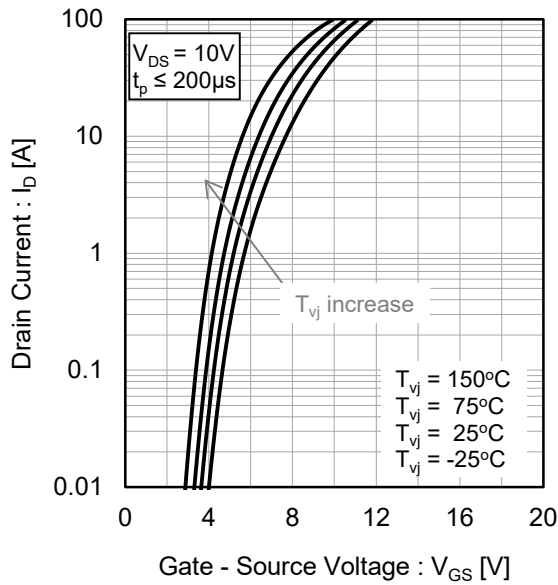


Fig.10 Typical Transfer Characteristics (II)

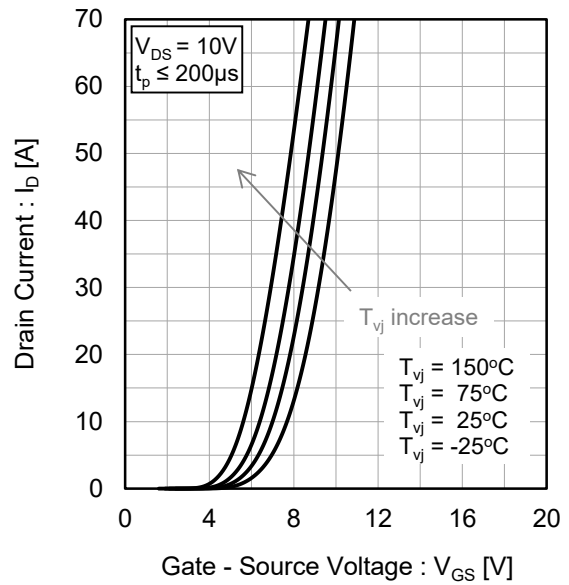


Fig.11 Gate Threshold Voltage vs. Virtual Junction Temperature

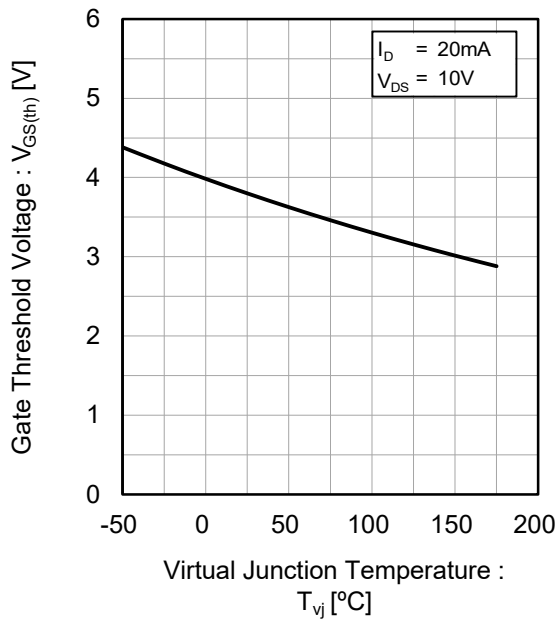
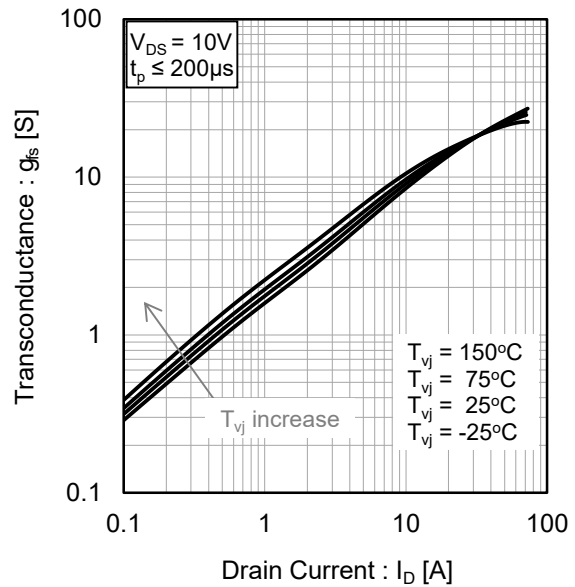


Fig.12 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

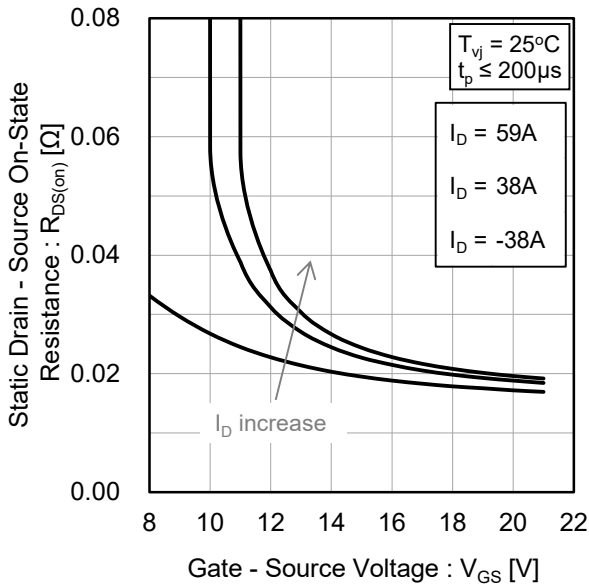


Fig.14 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

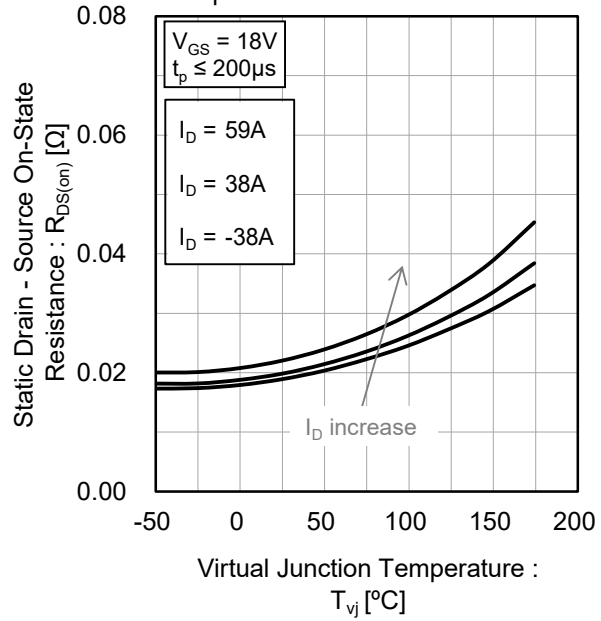


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current

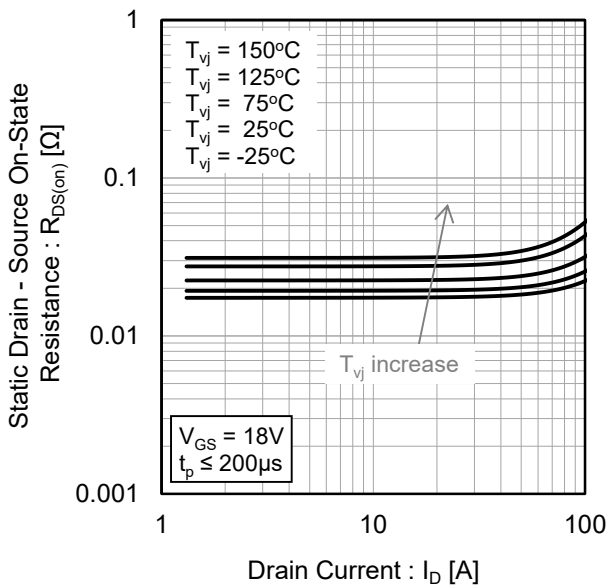
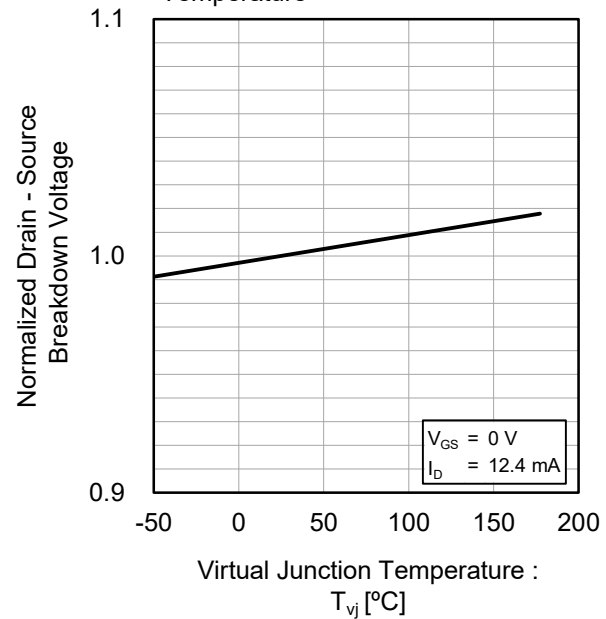


Fig.16 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

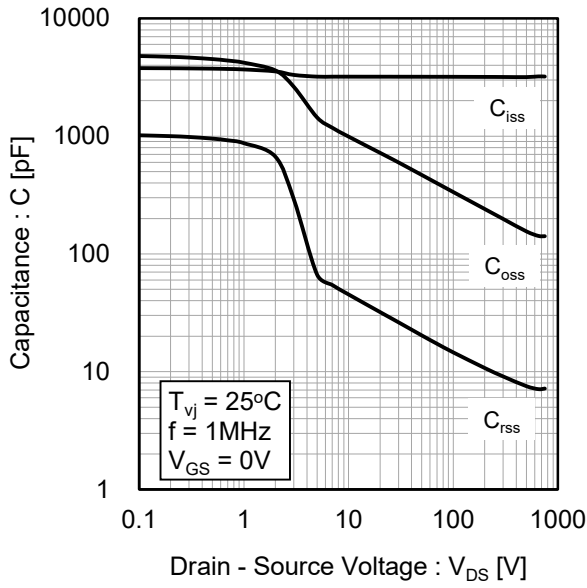


Fig.18 C_{oss} Stored Energy vs. Drain - Source Voltage

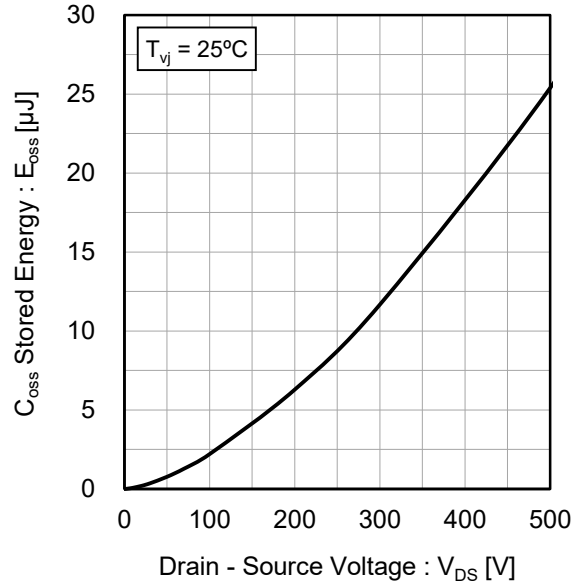
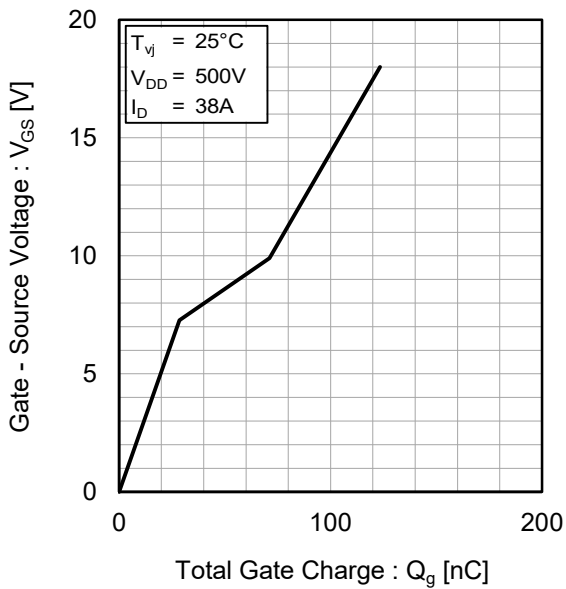


Fig.19 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.20 Typical Switching Time vs. External Gate Resistance

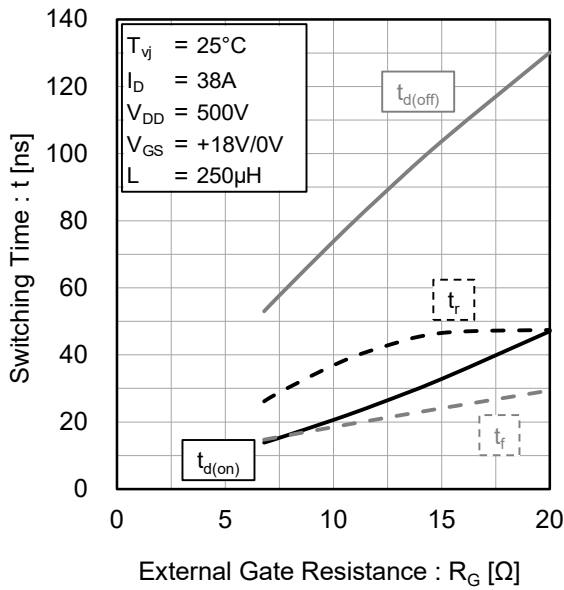


Fig.21 Typical Switching Loss vs. Drain - Source Voltage

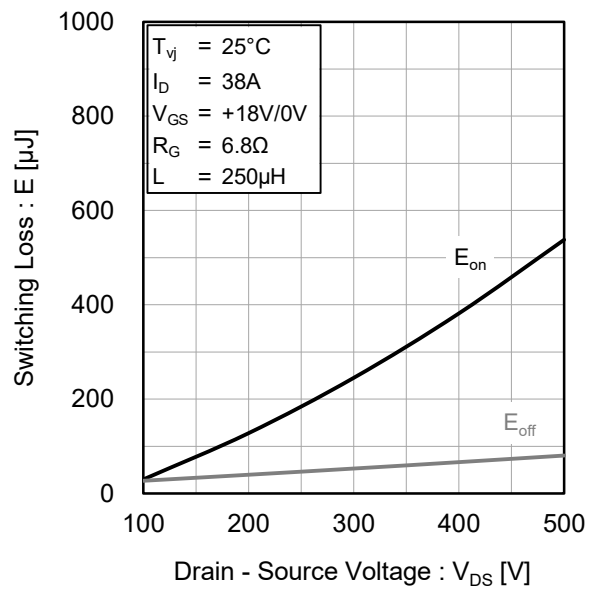


Fig.22 Typical Switching Loss vs. Drain Current

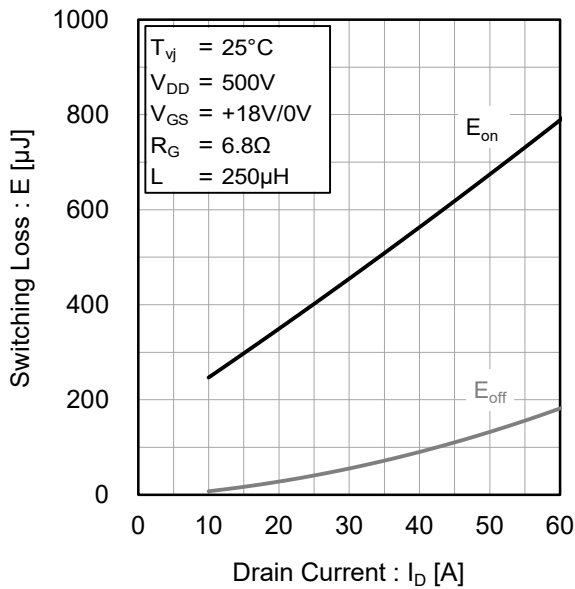
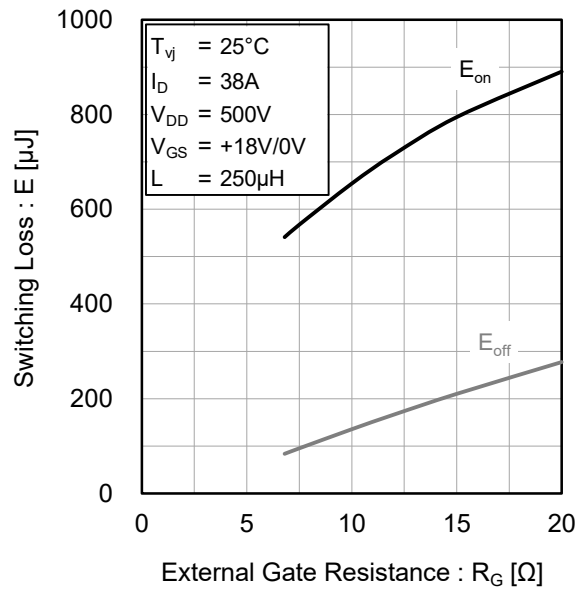


Fig.23 Typical Switching Loss vs. External Gate Resistance



● Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

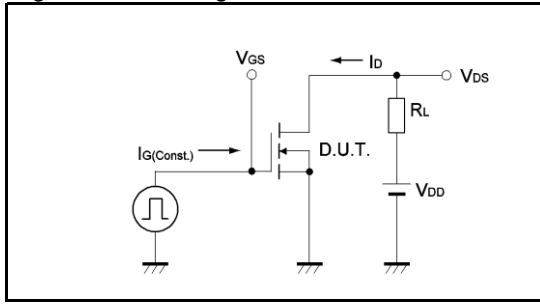


Fig.1-2 Gate Charge Waveform

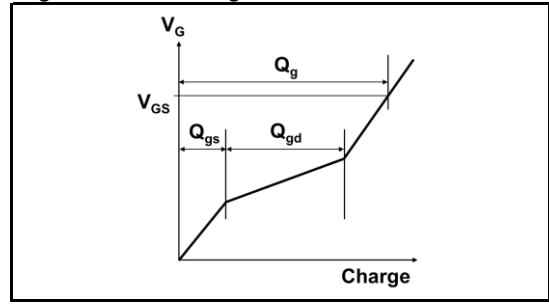


Fig.2-1 Switching Characteristics Measurement Circuit

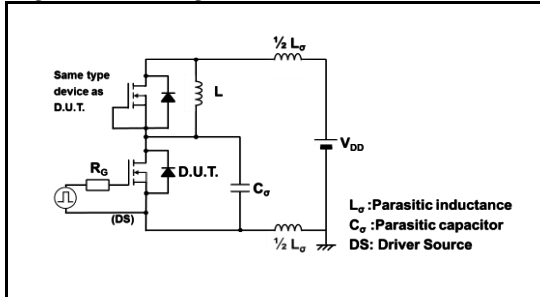


Fig.2-2 Waveforms for Switching Time

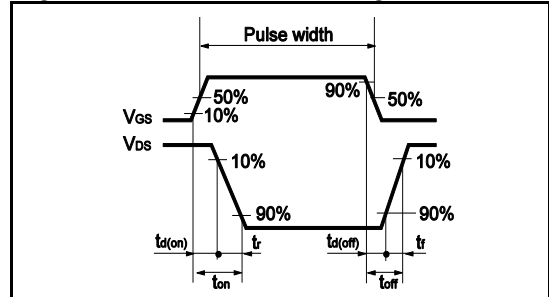


Fig.2-3 Waveforms for Switching Energy Loss

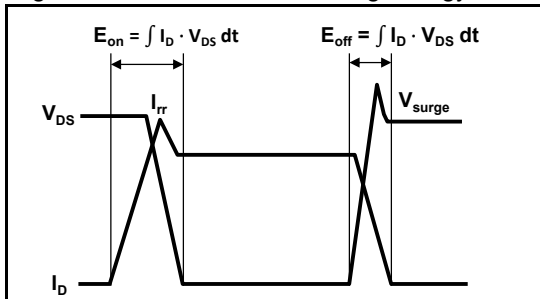


Fig.3-1 Reverse Recovery Time Measurement Circuit

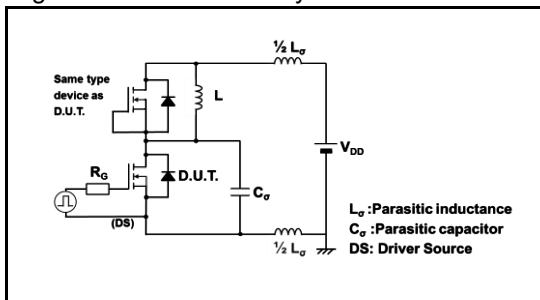
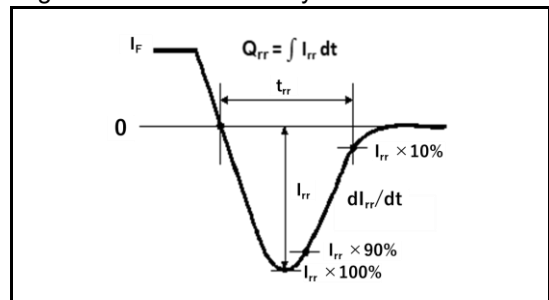
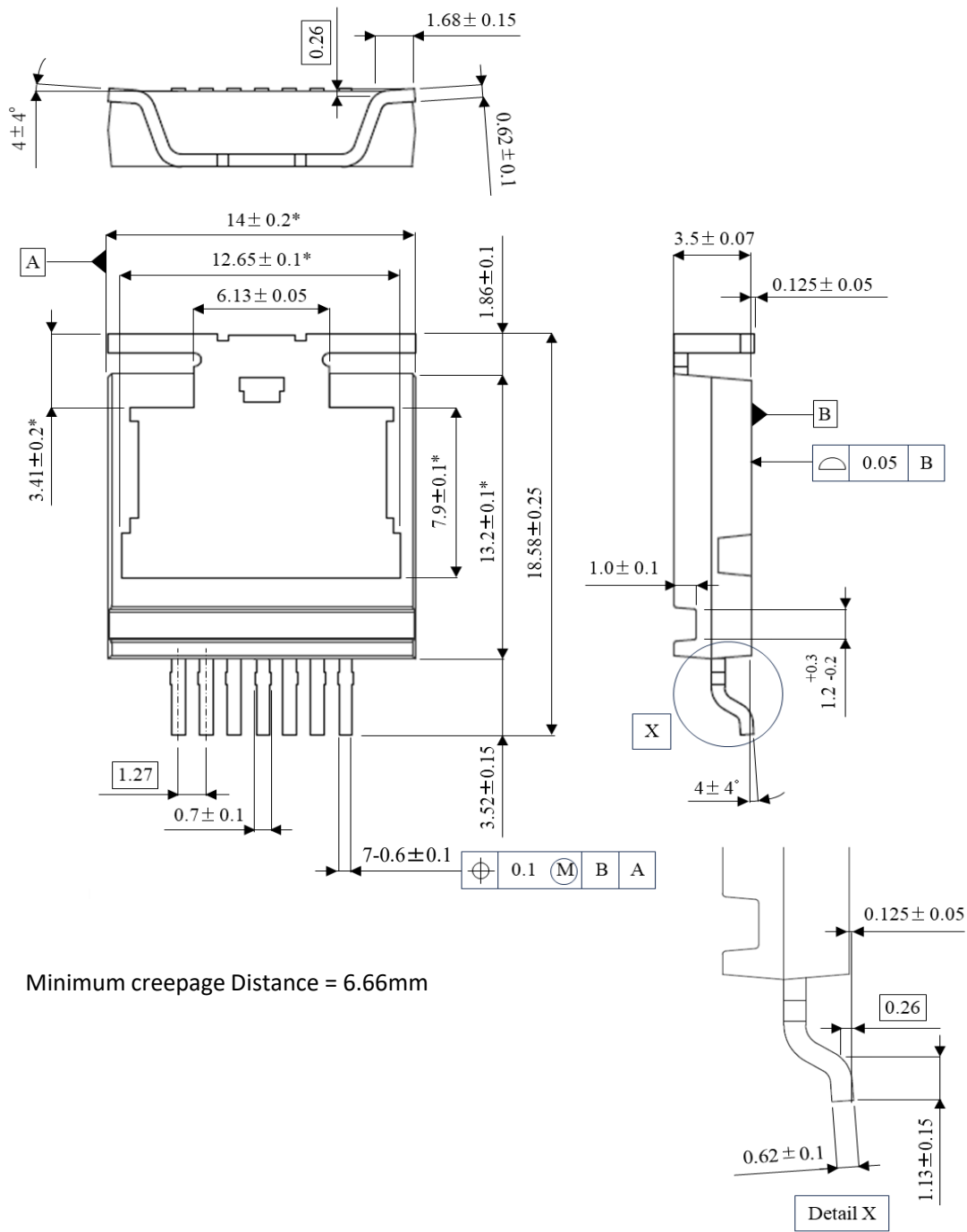


Fig.3-2 Reverse Recovery Waveform



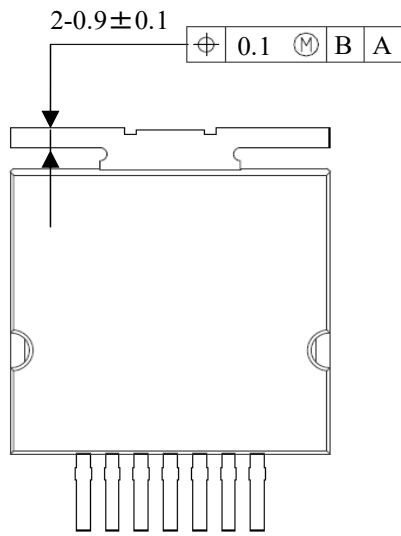
● Package Dimensions



Minimum creepage Distance = 6.66mm

*Does not include resin burrs

Unit: mm

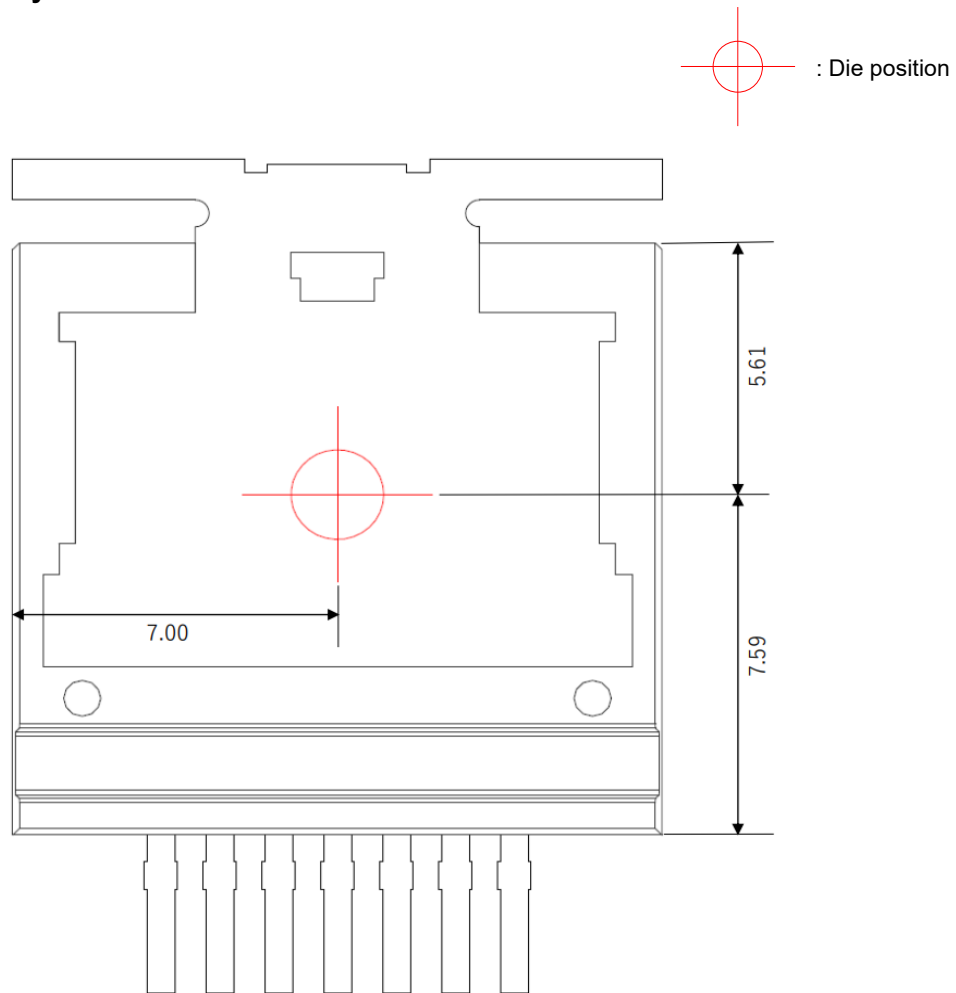


RECOMMENDED FOOTPRINT DIMENSIONS



Unit: mm

●Die Bonding Layout



- Front view of the packaging.
- Dimensions are design values.
- If the heat sink is to be installed, it should be in contact with the die bonding point.

Unit: mm

Notes

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