

SSM6G18NU

1. Applications

- Power Management Switches

2. Features

- (1) Combined a P-channel MOSFET and a Schottky barrier diode in one package.

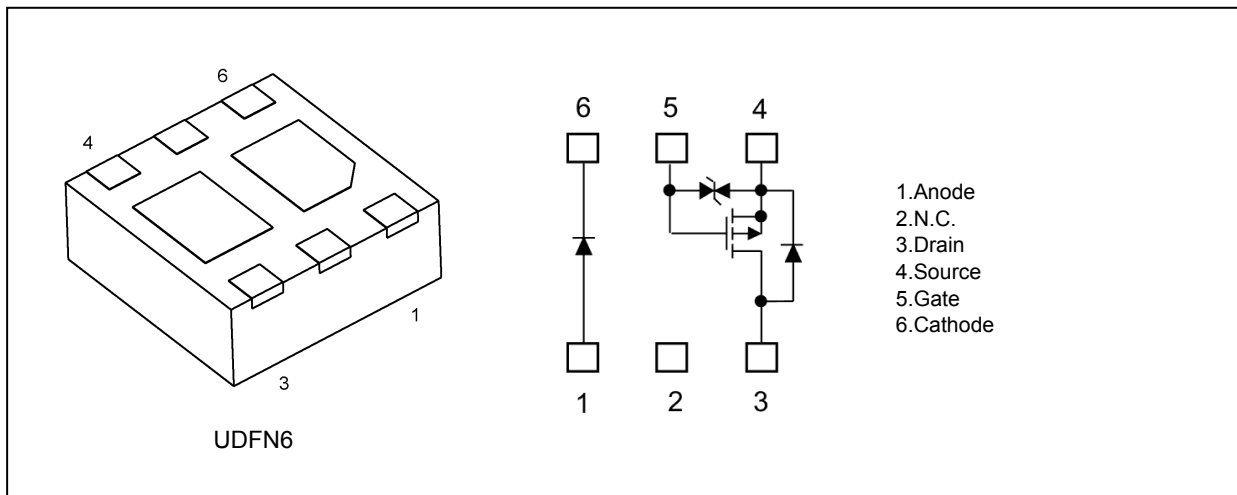
2.1. MOSFET Features

- (1) Low drain-source on-resistance
 - : $R_{DS(ON)} = 261 \text{ m}\Omega$ (max) ($V_{GS} = -1.5 \text{ V}$)
 - $R_{DS(ON)} = 185 \text{ m}\Omega$ (max) ($V_{GS} = -1.8 \text{ V}$)
 - $R_{DS(ON)} = 143 \text{ m}\Omega$ (max) ($V_{GS} = -2.5 \text{ V}$)
 - $R_{DS(ON)} = 112 \text{ m}\Omega$ (max) ($V_{GS} = -4.5 \text{ V}$)

2.2. Diode Features

- (1) Low forward voltage: $V_F = 0.48 \text{ V}$ (typ.) (@ $I_F = 1000 \text{ mA}$)

3. Packaging and Internal Circuit



Start of commercial production
2010-11

4. Absolute Maximum Ratings (Note)

4.1. Absolute Maximum Ratings of the MOSFET (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---------------------------------|-----------|---------|------------------|
| Drain-source voltage | V_{DSS} | -20 | V |
| Gate-source voltage | V_{GSS} | ± 8 | V |
| Drain current (DC) (Note 1) | I_D | -2.0 | A |
| Drain current (pulsed) (Note 1) | I_{DP} | -4.0 | |
| Channel temperature | T_{ch} | 150 | $^\circ\text{C}$ |

Note 1: Ensure that the channel temperature does not exceed $150\text{ }^\circ\text{C}$.

4.2. Absolute Maximum Ratings of the Diode (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|--|-----------|--------|------------------|
| Reverse voltage | V_R | 30 | V |
| Average rectified current | I_O | 1.0 | A |
| Non-repetitive peak forward surge current ($t = 10\text{ ms}$) | I_{FSM} | 5.0 | A |
| Junction temperature | T_j | 150 | $^\circ\text{C}$ |

4.3. Absolute Maximum Ratings of the Common Section (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---|-----------|------------|------------------|
| Power dissipation | P_D | 1 | W |
| Power dissipation ($t = 10\text{ s}$) | P_D | 2 | |
| Storage temperature | T_{stg} | -55 to 150 | $^\circ\text{C}$ |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Device mounted on an $25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$ FR4 glass epoxy board (Cu pad: 645 mm^2)

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: The channel-to-ambient thermal resistance, $R_{th(ch-a)}$, and the drain power dissipation, P_D , vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

5. Electrical Characteristics

5.1. Static Characteristics of the MOSFET (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|--|------|------|---------|---------------|
| Gate leakage current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$ | — | — | ± 1 | μA |
| Drain cut-off current | I_{DSS} | $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$ | — | — | -1 | μA |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = -1\text{ mA}, V_{GS} = 0\text{ V}$ | -20 | — | — | V |
| Drain-source breakdown voltage (Note 1) | $V_{(BR)DSX}$ | $I_D = -1\text{ mA}, V_{GS} = 5\text{ V}$ | -15 | — | — | V |
| Gate threshold voltage (Note 2) | V_{th} | $V_{DS} = -3\text{ V}, I_D = -1\text{ mA}$ | -0.3 | — | -1.0 | V |
| Drain-source on-resistance (Note 3) | $R_{DS(ON)}$ | $I_D = -1.0\text{ A}, V_{GS} = -4.5\text{ V}$ | — | 89 | 112 | m Ω |
| | | $I_D = -0.6\text{ A}, V_{GS} = -2.5\text{ V}$ | — | 107 | 143 | |
| | | $I_D = -0.4\text{ A}, V_{GS} = -1.8\text{ V}$ | — | 128 | 185 | |
| | | $I_D = -0.2\text{ A}, V_{GS} = -1.5\text{ V}$ | — | 148 | 261 | |
| Forward transfer admittance (Note 3) | $ Y_{fs} $ | $V_{DS} = -3\text{ V}, I_D = -1.0\text{ A}$ | 2.7 | 5.4 | — | S |

Note 1: If a forward bias is applied between gate and source, this device enters $V_{(BR)DSX}$ mode. Note that the drain-source breakdown voltage is lowered in this mode.

Note 2: Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (-1 mA for this device). Then, for normal switching operation, $V_{GS(ON)}$ must be higher than V_{th} , and $V_{GS(OFF)}$ must be lower than V_{th} . This relationship can be expressed as: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$. Take this into consideration when using the device.

Note 3: Pulse measurement.

5.2. Dynamic Characteristics of the MOSFET (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|-----------|--|-----|------|-----|------|
| Input capacitance | C_{iss} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$ | — | 270 | — | pF |
| Reverse transfer capacitance | C_{rss} | | — | 32 | — | |
| Output capacitance | C_{oss} | | — | 40 | — | |
| Switching time (turn-on time) | t_{on} | $V_{DD} = -10\text{ V}, I_D = -1.0\text{ A},$ $V_{GS} = 0\text{ to }-2.5\text{ V}, R_G = 4.7\text{ }\Omega$ Duty $\leq 1\%$, Input: $t_r, t_f < 5\text{ ns}$ Common source | — | 17 | — | ns |
| Switching time (turn-off time) | t_{off} | | — | 43 | — | |

5.3. Switching Time Test Circuit

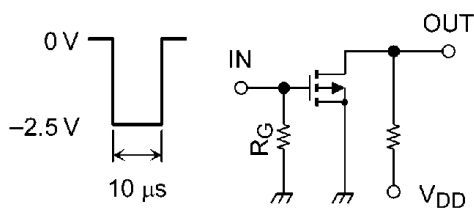


Fig. 5.3.1 Switching Time Test Circuit

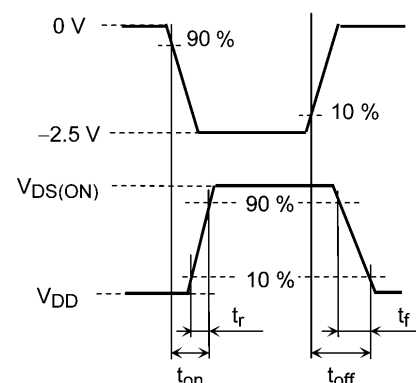


Fig. 5.3.2 Input Waveform/Output Waveform

5.4. Gate Charge Characteristics of the MOSFET (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | Q_g | $V_{DD} = -10\text{ V}$, $I_D = -2.0\text{ A}$, $V_{GS} = -4.5\text{ V}$ | — | 4.6 | — | nC |
| Gate-source charge 1 | Q_{gs1} | | — | 0.4 | — | |
| Gate-drain charge | Q_{gd} | | — | 0.9 | — | |

5.5. Source-Drain Characteristics of the MOSFET (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|-----------|--|-----|------|-----|------|
| Diode forward voltage (Note 1) | V_{DSF} | $I_D = 2.0\text{ A}$, $V_{GS} = 0\text{ V}$ | — | 0.86 | 1.2 | V |

Note 1: Pulse measurement.

5.6. Characteristics of the Diode (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------|------------|---|-----|------|------|---------------|
| Forward voltage | $V_{F(1)}$ | $I_F = 100\text{ mA}$ | — | 0.31 | — | V |
| | $V_{F(2)}$ | $I_F = 200\text{ mA}$ | — | 0.36 | — | |
| | $V_{F(3)}$ | $I_F = 500\text{ mA}$ | — | 0.38 | 0.45 | |
| | $V_{F(4)}$ | $I_F = 1000\text{ mA}$ | — | 0.48 | 0.58 | |
| Reverse current | I_R | $V_R = 30\text{ V}$ | — | 5 | 50 | μA |
| Total capacitance | C_t | $V_R = 0\text{ V}$, $f = 1\text{ MHz}$ | — | 120 | — | pF |

6. Marking

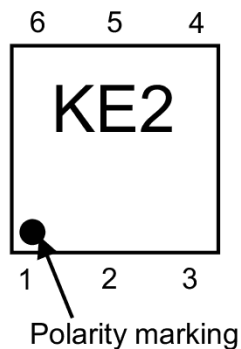


Fig. 6.1 Marking

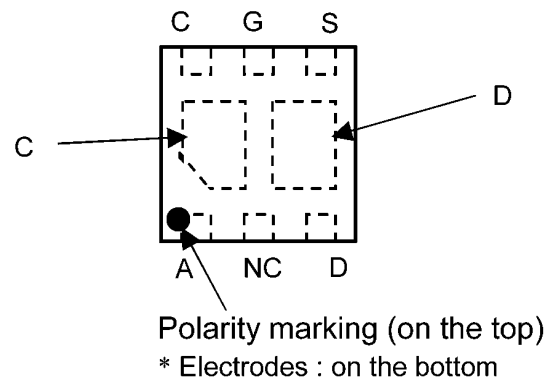


Fig. 6.2 Pin Condition(Top View)

- The Schottky barrier diode in this device has large reverse current leakage compared to typical switching diodes. Thus, excessive operating temperature or voltage may cause thermal runaway. To avoid this problem, be sure to take both forward and reverse loss into consideration.

7. Characteristics Curves (Note)

7.1. Characteristics Curves of the MOSFET

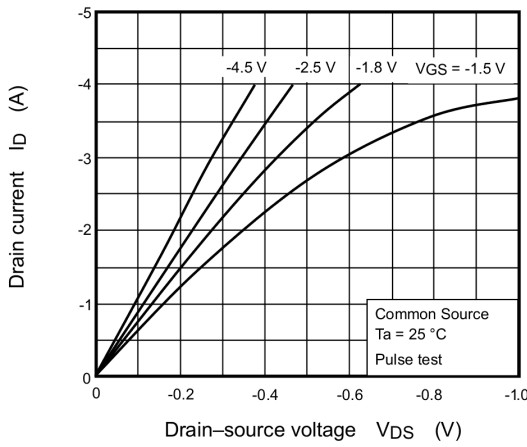


Fig. 7.1.1 $I_D - V_{DS}$

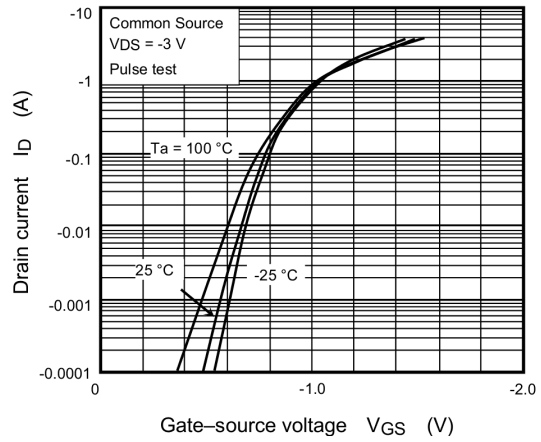


Fig. 7.1.2 $I_D - V_{GS}$

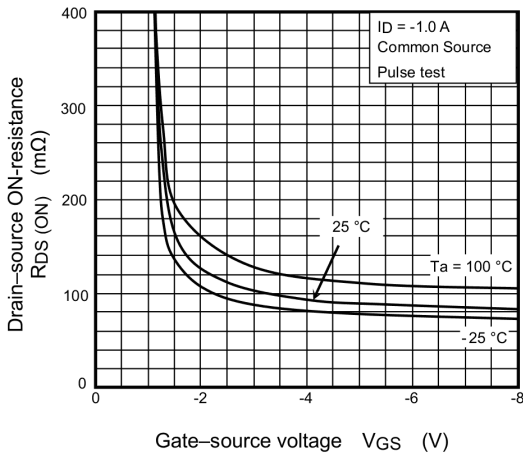


Fig. 7.1.3 $R_{DS(ON)} - V_{GS}$

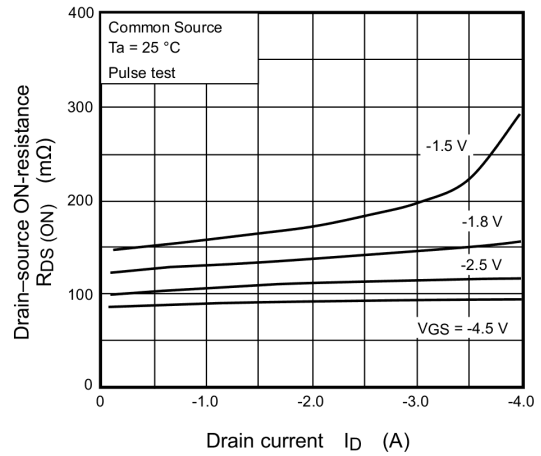


Fig. 7.1.4 $R_{DS(ON)} - I_D$

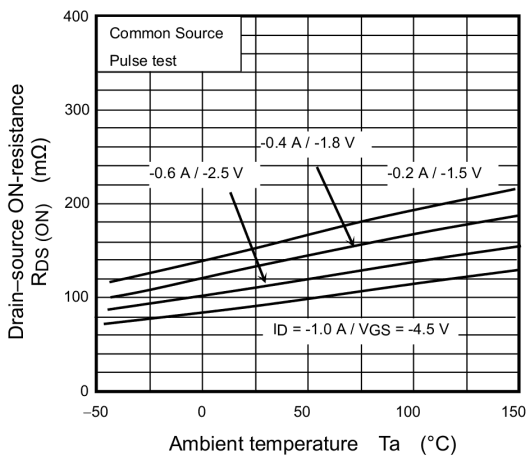


Fig. 7.1.5 $R_{DS(ON)} - T_a$

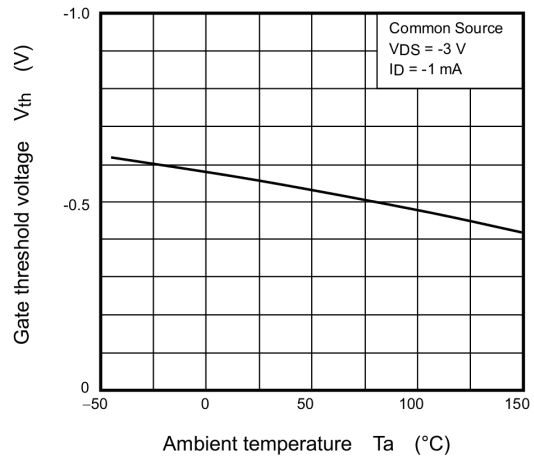


Fig. 7.1.6 $V_{th} - T_a$

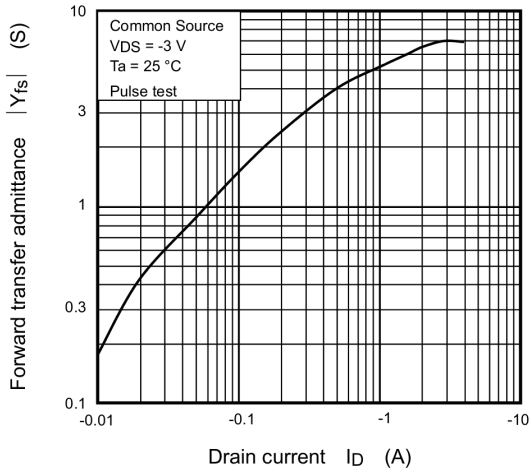


Fig. 7.1.7 $|Y_{fs}| - I_D$

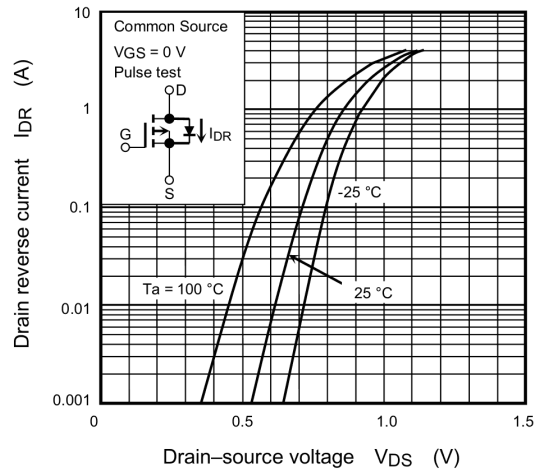


Fig. 7.1.8 $I_{DR} - V_{DS}$

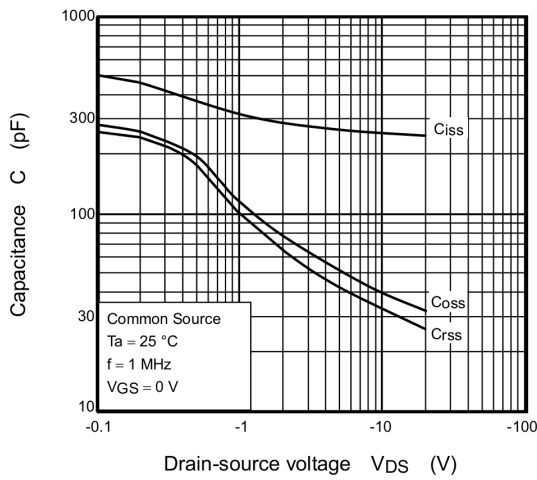


Fig. 7.1.9 $C - V_{DS}$

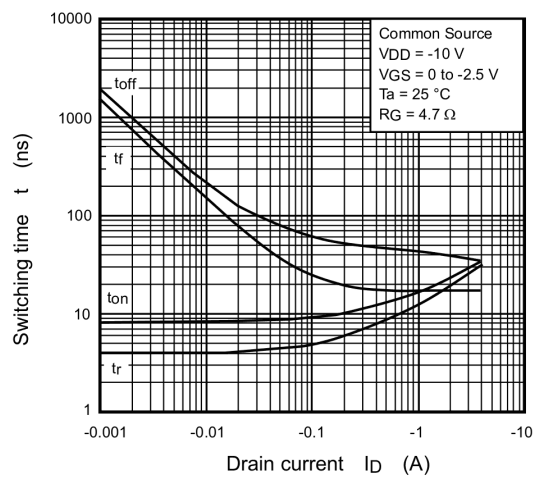


Fig. 7.1.10 $t - I_D$

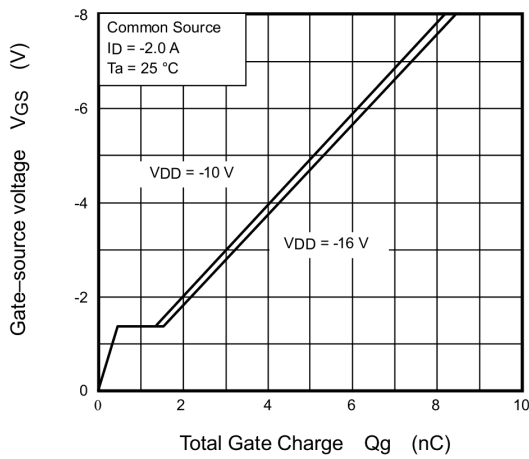


Fig. 7.1.11 Dynamic Input Characteristics

7.2. Characteristics Curves of the Diode

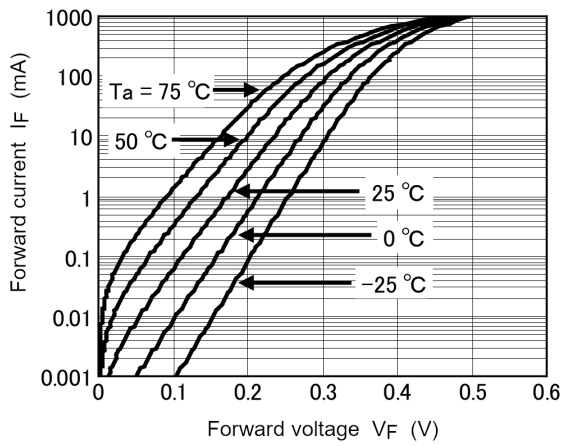


Fig. 7.2.1 $I_F - V_F$

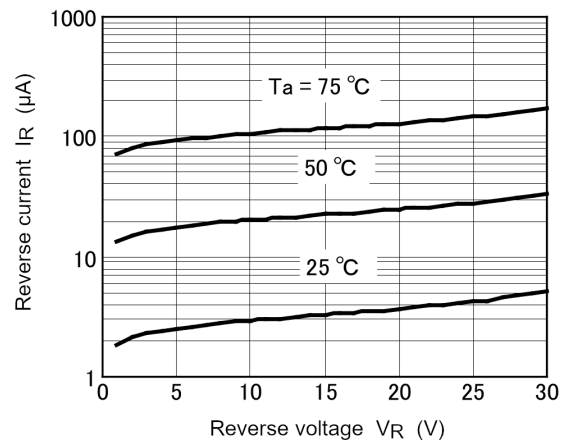


Fig. 7.2.2 $I_R - V_R$

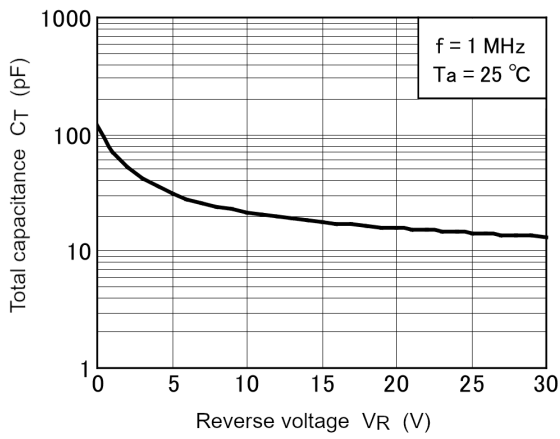


Fig. 7.2.3 $C_t - V_R$

7.3. Characteristics Curves of the MOSFET · Diodes Common

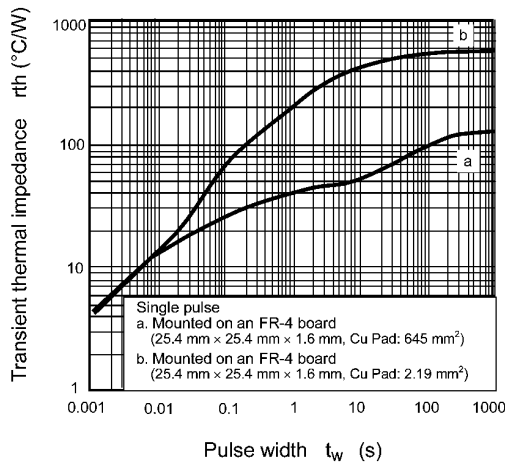


Fig. 7.3.1 $r_{th} - t_w$

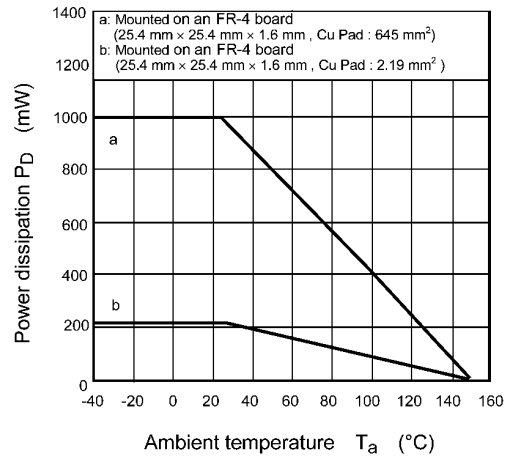


Fig. 7.3.2 $P_D - T_a$

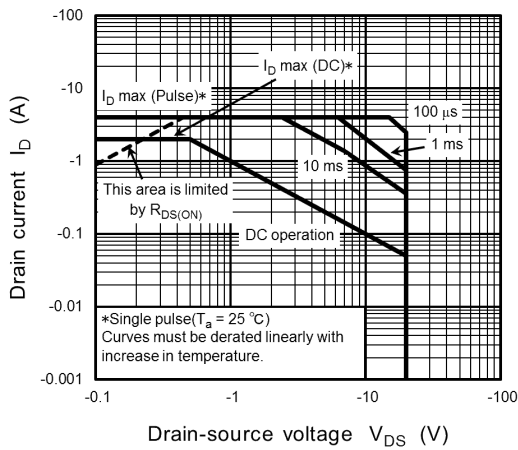
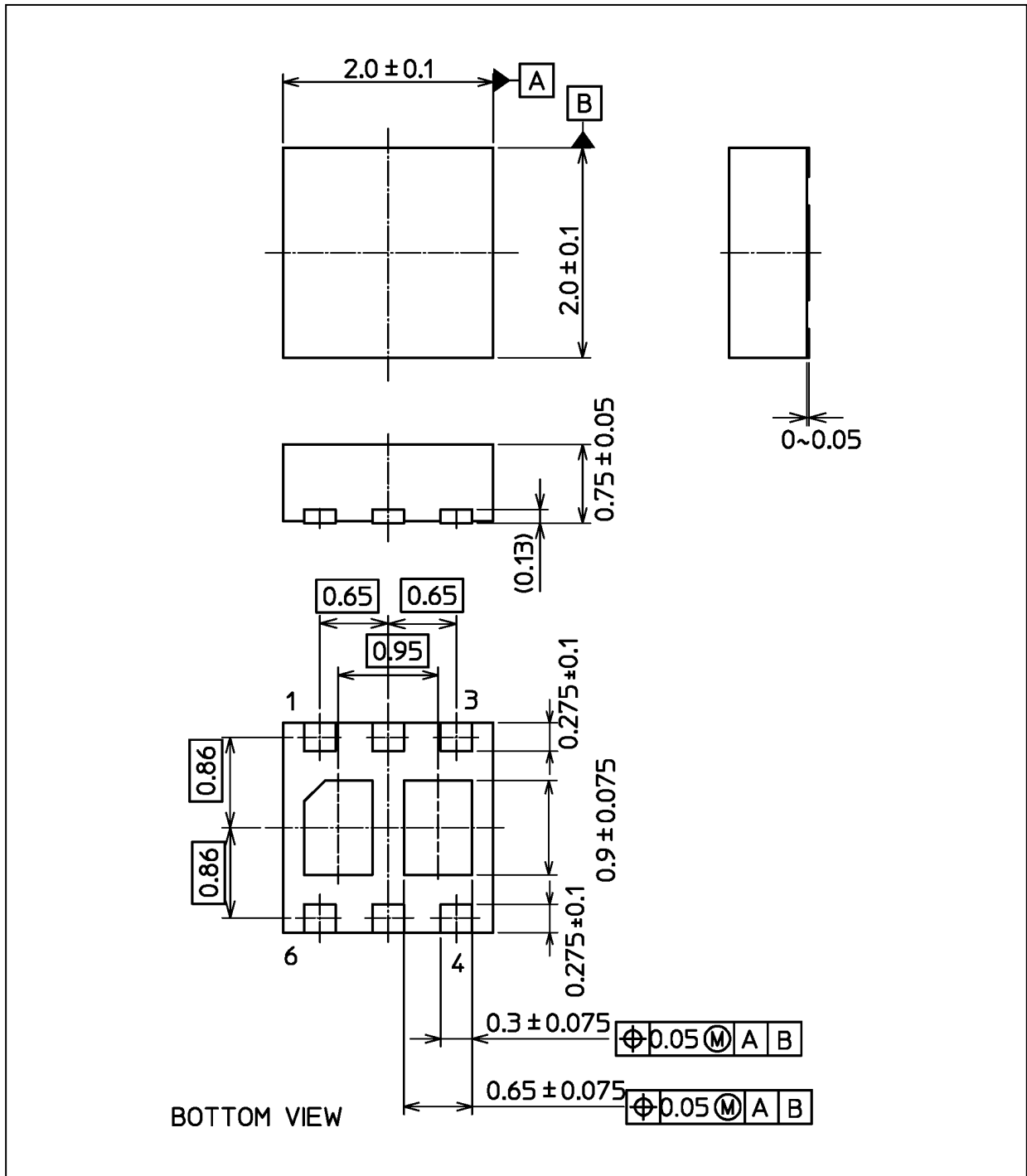


Fig. 7.3.3 Safe Operating Area

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 8.5 mg (typ.)

| |
|-----------------|
| Package Name(s) |
| Nickname: UDFN6 |

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