

# SSM6J507NU

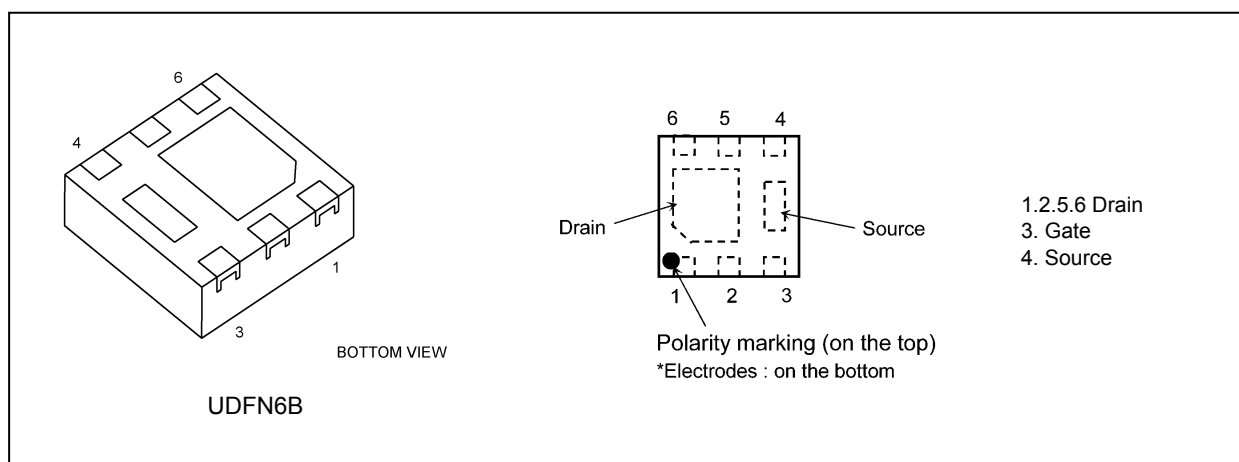
## 1. Applications

- Power Management Switches

## 2. Features

- (1) 4 V gate drive voltage.
- (2) Low drain-source on-resistance
  - :  $R_{DS(ON)} = 20 \text{ m}\Omega$  (max) (@ $V_{GS} = -10 \text{ V}$ )
  - $R_{DS(ON)} = 28 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.5 \text{ V}$ )
  - $R_{DS(ON)} = 32 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.0 \text{ V}$ )

## 3. Packaging and Pin Assignment



#### 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$ )

| Characteristics                                     | Symbol    | Rating     | Unit               |
|-----------------------------------------------------|-----------|------------|--------------------|
| Drain-source voltage                                | $V_{DS}$  | -30        | V                  |
| Gate-source voltage                                 | $V_{GS}$  | -25 / +20  |                    |
| Drain current (DC) (Note 1)                         | $I_D$     | -10        | A                  |
| Drain current (pulsed) (Note 1), (Note 2)           | $I_{DP}$  | -30        |                    |
| Power dissipation (Note 3)                          | $P_D$     | 1.25       | W                  |
| Power dissipation ( $t \leq 10\text{ s}$ ) (Note 3) | $P_D$     | 2.5        | W                  |
| Channel temperature                                 | $T_{ch}$  | 150        | $^{\circ}\text{C}$ |
| Storage temperature                                 | $T_{stg}$ | -55 to 150 |                    |

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

Note 2: Repetitive rating; pulse width limited by maximum channel temperature.

Note 3: Device mounted on a FR4 board. ( $25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$ , Cu pad:  $645\text{ mm}^2$ )

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

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 (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$ )

| Characteristics                      | Symbol        | Test Condition                                          | Min  | Typ. | Max     | Unit             |
|--------------------------------------|---------------|---------------------------------------------------------|------|------|---------|------------------|
| Gate leakage current                 | $I_{GSS}$     | $V_{GS} = \pm 16\text{ V}$ , $V_{DS} = 0\text{ V}$      | —    | —    | $\pm 1$ | $\mu\text{A}$    |
| Drain cut-off current                | $I_{DSS}$     | $V_{DS} = -30\text{ V}$ , $V_{GS} = 0\text{ V}$         | —    | —    | -1      |                  |
| Drain-source breakdown voltage       | $V_{(BR)DSS}$ | $I_D = -250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$ | -30  | —    | —       | V                |
| Gate threshold voltage (Note 1)      | $V_{th}$      | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$     | -1.0 | —    | -2.2    |                  |
| Drain-source on-resistance (Note 2)  | $R_{DS(ON)}$  | $I_D = -4.0\text{ A}$ , $V_{GS} = -10\text{ V}$         | —    | 14   | 20      | $\text{m}\Omega$ |
|                                      |               | $I_D = -4.0\text{ A}$ , $V_{GS} = -4.5\text{ V}$        | —    | 19   | 28      |                  |
|                                      |               | $I_D = -4.0\text{ A}$ , $V_{GS} = -4.0\text{ V}$        | —    | 21   | 32      |                  |
| Forward transfer admittance (Note 2) | $ Y_{fs} $    | $V_{DS} = -10\text{ V}$ , $I_D = -2.0\text{ A}$         | —    | 14   | —       | S                |

Note 1: Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to below ( $-250\text{ }\mu\text{A}$  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 2: Pulse measurement.

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

| Characteristics                | Symbol    | Test Condition                                                                                                                                                                                                         | Min | Typ. | Max | Unit        |
|--------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = -15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$                                                                                                                                                | —   | 1150 | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |                                                                                                                                                                                                                        | —   | 185  | —   |             |
| Output capacitance             | $C_{oss}$ |                                                                                                                                                                                                                        | —   | 210  | —   |             |
| Switching time (turn-on time)  | $t_{on}$  | $V_{DD} = -15\text{ V}$ , $I_D = -2.0\text{ A}$<br>$V_{GS} = 0\text{ to } -4.5\text{ V}$ , $R_G = 10\text{ }\Omega$ ,<br>Duty $\leq 1\%$ , $V_{IN}$ : $t_r$ , $t_f < 5\text{ ns}$ ,<br>Common source, See Chapter 5.3. | —   | 55   | —   | ns          |
| Switching time (turn-off time) | $t_{off}$ |                                                                                                                                                                                                                        | —   | 170  | —   |             |

### 5.3. Switching Time Test Circuit

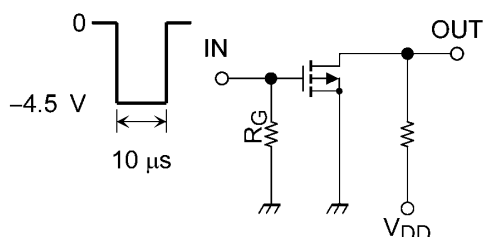


Fig. 5.3.1 Switching Time Test Circuit

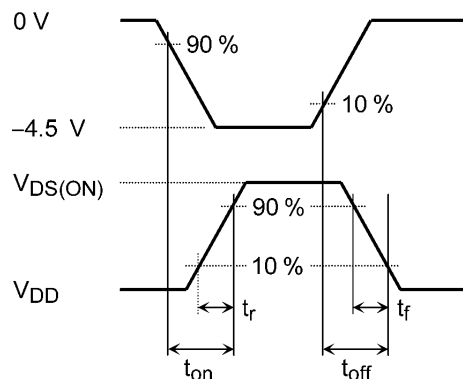


Fig. 5.3.2 Input Waveform/Output Waveform

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

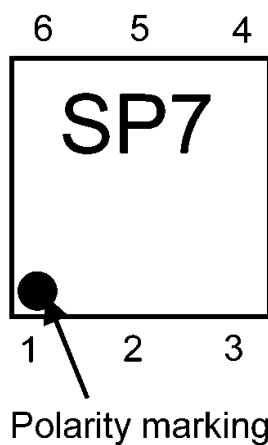
| Characteristics                                 | Symbol    | Test Condition                                                               | Min | Typ. | Max  | Unit |
|-------------------------------------------------|-----------|------------------------------------------------------------------------------|-----|------|------|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} = -15\text{ V}$ , $V_{GS} = -4.5\text{ V}$ ,<br>$I_D = -10\text{ A}$ | —   | 13.6 | 20.4 | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |                                                                              | —   | 2.6  | —    |      |
| Gate-drain charge                               | $Q_{gd}$  |                                                                              | —   | 5.8  | —    |      |

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

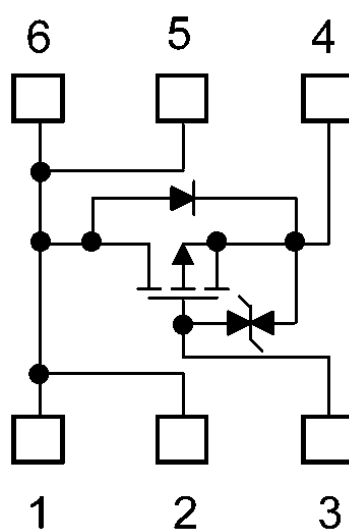
| Characteristics                | Symbol    | Test Condition                             | Min | Typ. | Max | Unit |
|--------------------------------|-----------|--------------------------------------------|-----|------|-----|------|
| Diode forward voltage (Note 1) | $V_{DSF}$ | $I_D = 4\text{ A}$ , $V_{GS} = 0\text{ V}$ | —   | 0.78 | 1.0 | V    |

Note 1: Pulse measurement.

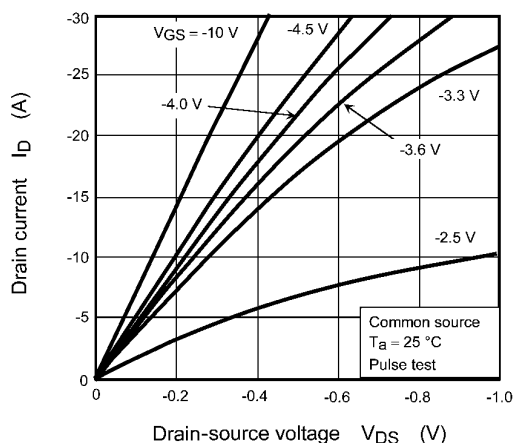
### 6. Marking



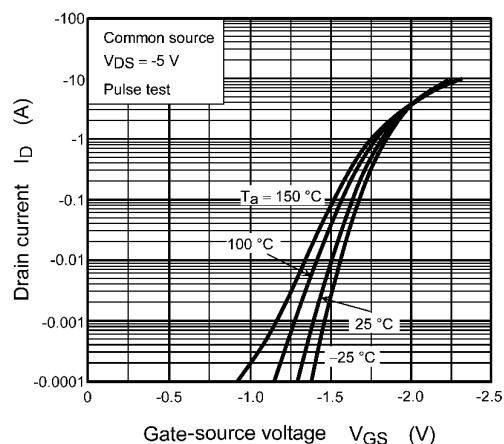
### 7. Internal Equivalent Circuit



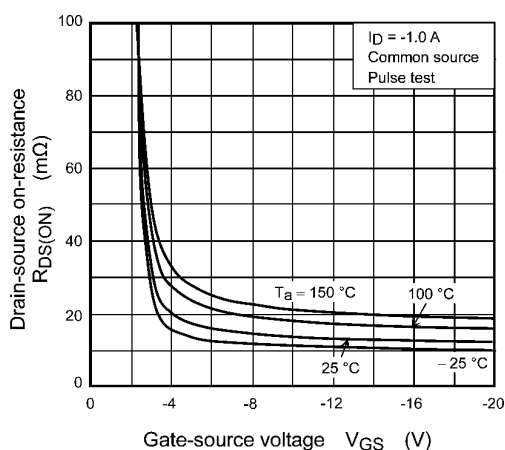
# 8. Characteristics Curves (Note)



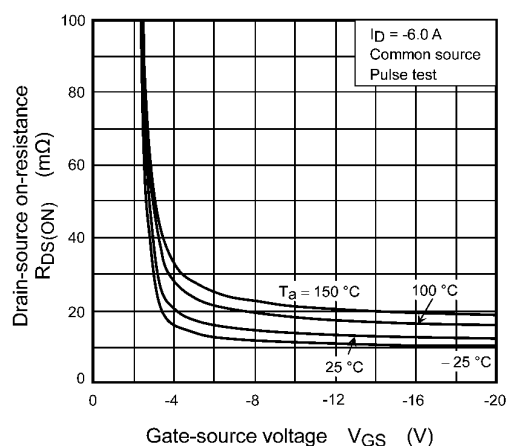
**Fig. 8.1  $I_D - V_{DS}$**



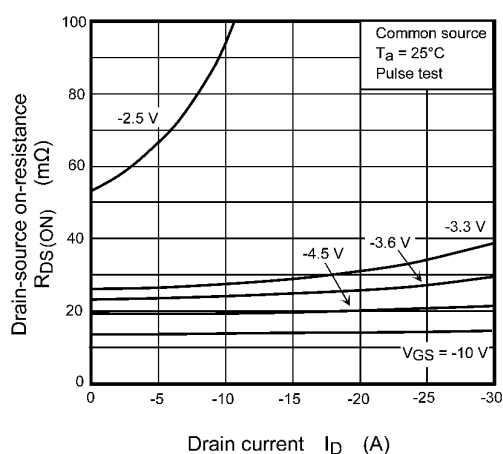
**Fig. 8.2  $I_D - V_{GS}$**



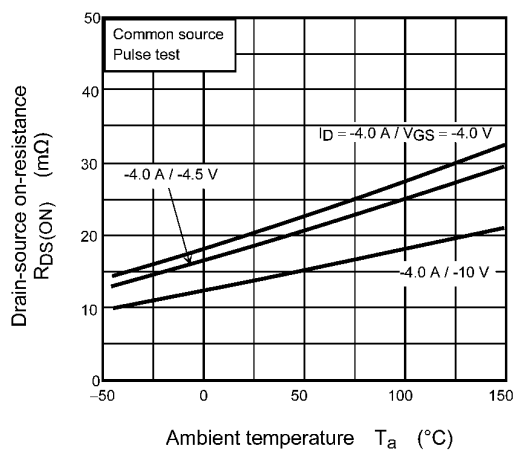
**Fig. 8.3  $R_{DS(ON)} - V_{GS}$**



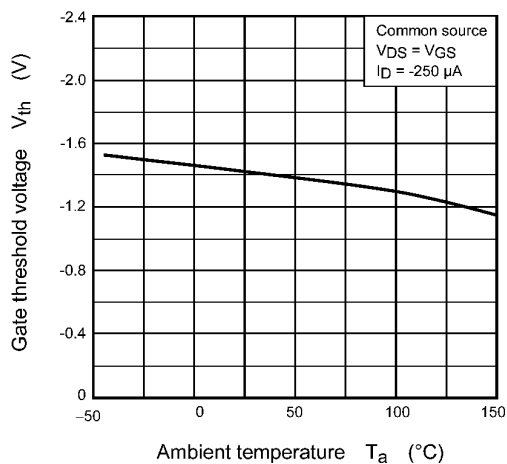
**Fig. 8.4  $R_{DS(ON)} - V_{GS}$**



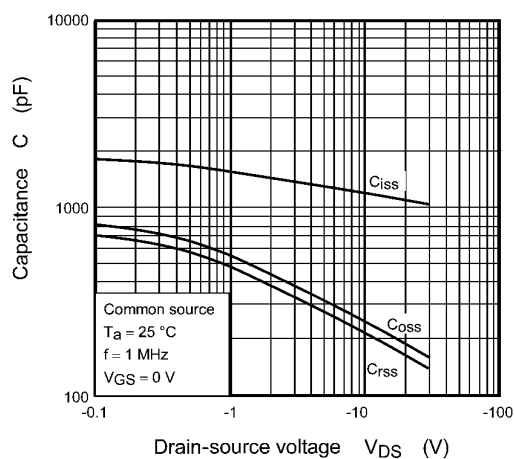
**Fig. 8.5  $R_{DS(ON)} - I_D$**



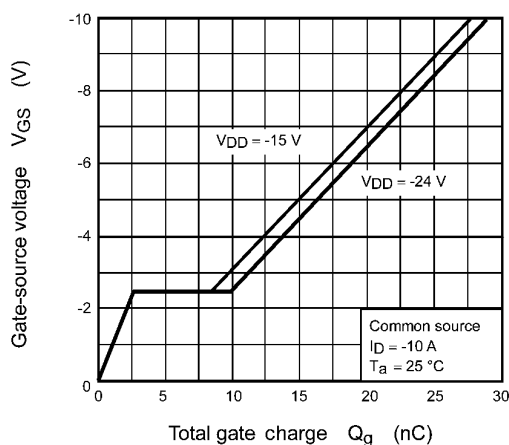
**Fig. 8.6  $R_{DS(ON)} - T_a$**



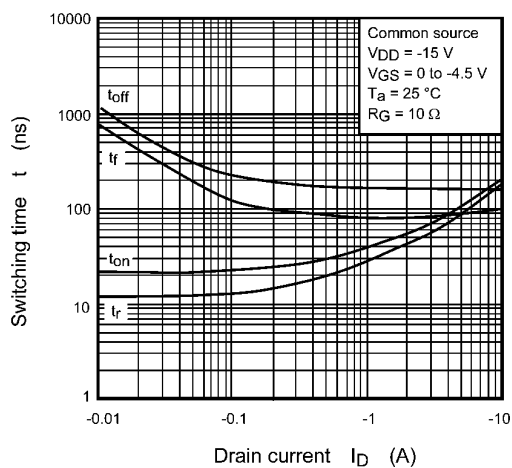
**Fig. 8.7  $V_{th} - T_a$**



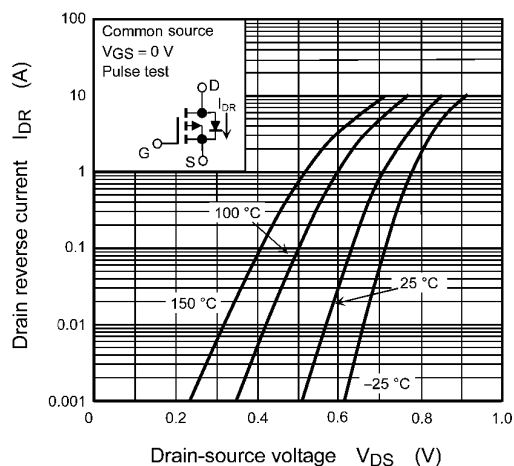
**Fig. 8.8  $C - V_{DS}$**



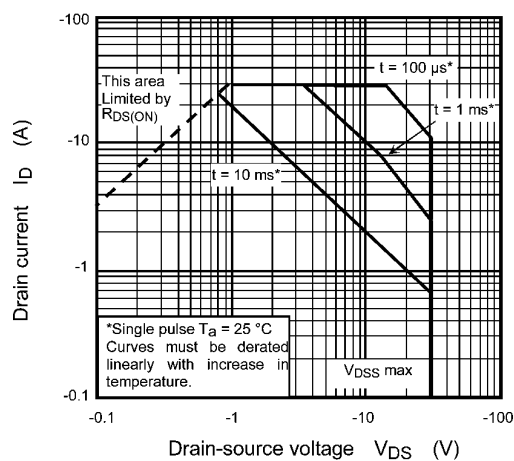
**Fig. 8.9 Dynamic Input Characteristics**



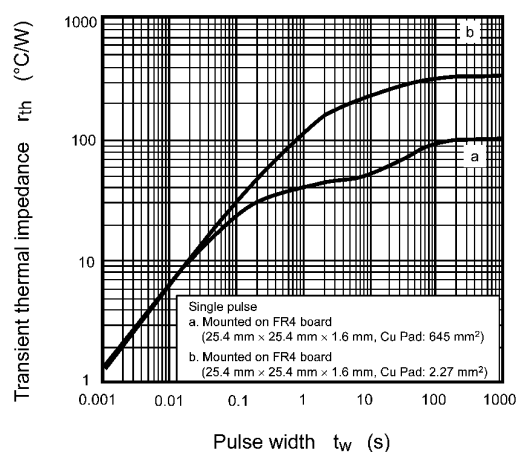
**Fig. 8.10  $t - I_D$**



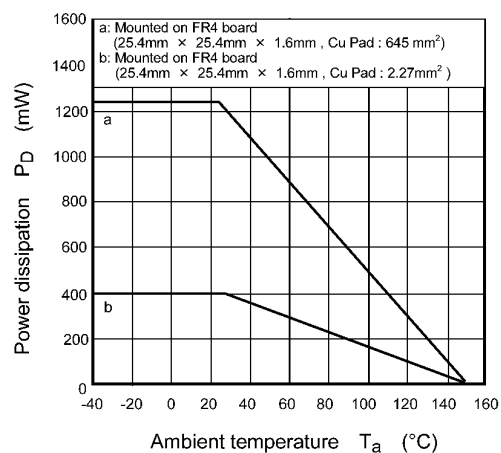
**Fig. 8.11  $I_{DR} - V_{DS}$**



**Fig. 8.12 Safe Operating Area**



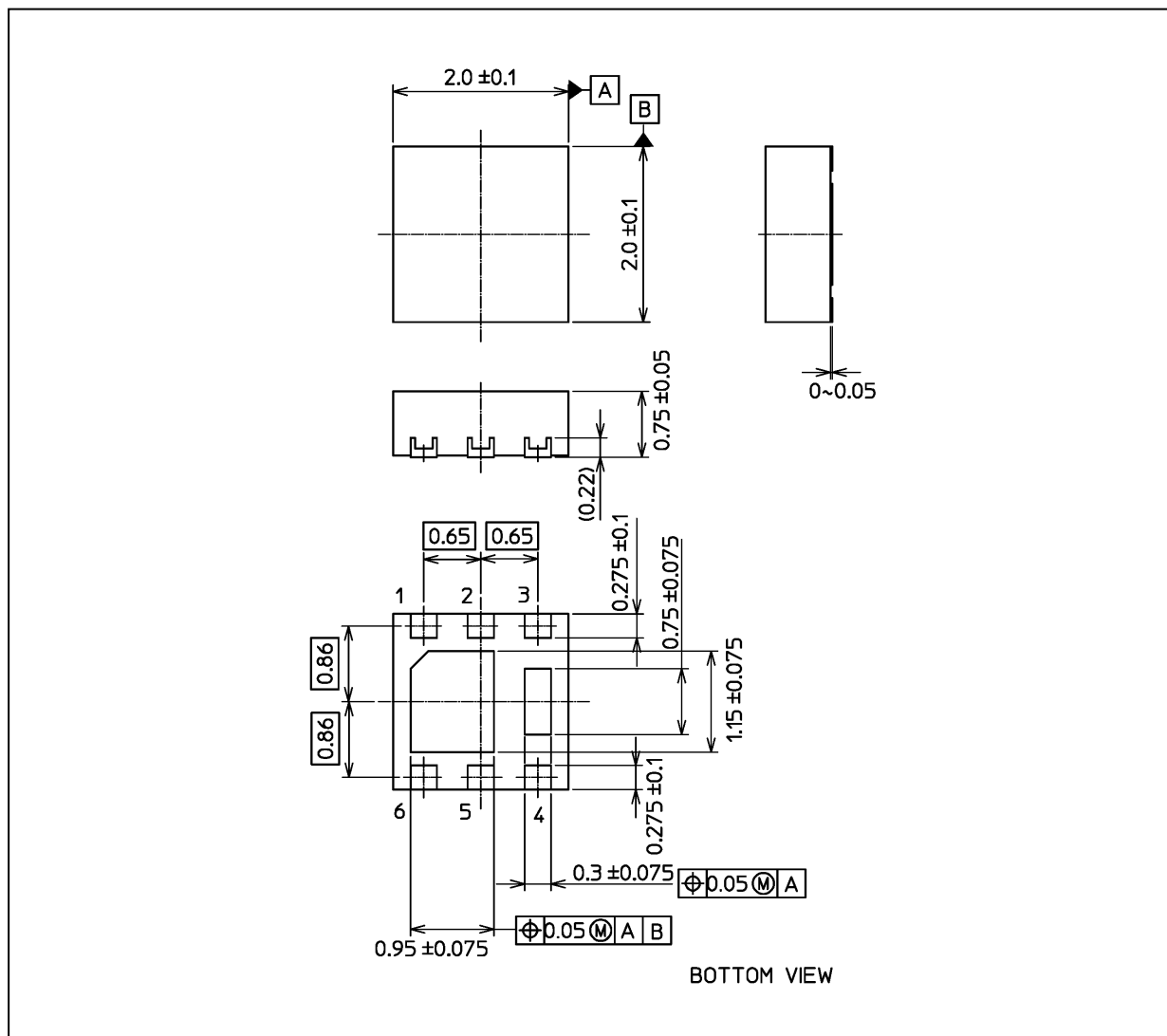
**Fig. 8.13**  $r_{th} - t_w$



**Fig. 8.14**  $P_D - T_a$

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

Unit: mm



Weight: 8.5 mg (typ.)

| Package Name(s)  |
|------------------|
| TOSHIBA: 2-2AA1A |
| Nickname: UDFN6B |

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