

# SSM3J338R

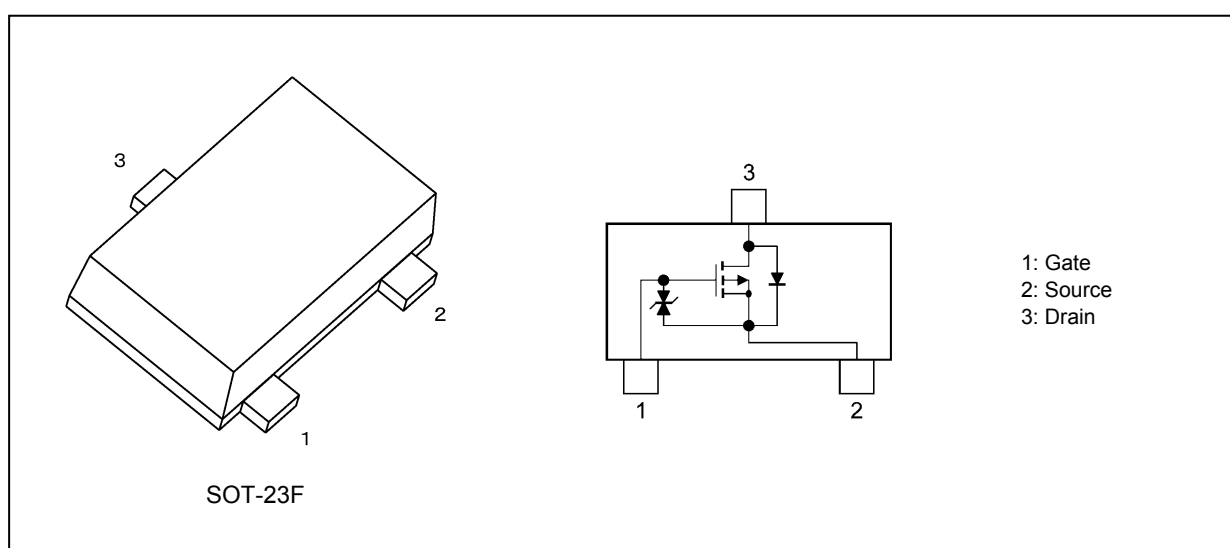
## 1. Applications

- Power Management Switches

## 2. Features

- (1) 1.8 V gate drive voltage.
- (2) Low drain-source on-resistance  
:  $R_{DS(ON)} = 26.3 \text{ m}\Omega$  (typ.) (@ $V_{GS} = -1.8 \text{ V}$ )  
 $R_{DS(ON)} = 20.1 \text{ m}\Omega$  (typ.) (@ $V_{GS} = -2.5 \text{ V}$ )  
 $R_{DS(ON)} = 15.9 \text{ m}\Omega$  (typ.) (@ $V_{GS} = -4.5 \text{ V}$ )

## 3. Packaging and Pin Assignment



Start of commercial production

2015-08

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

| Characteristics                                | Symbol    | Rating     | Unit               |
|------------------------------------------------|-----------|------------|--------------------|
| Drain-source voltage                           | $V_{DS}$  | -12        | V                  |
| Gate-source voltage                            | $V_{GS}$  | $\pm 10$   |                    |
| Drain current (Note 1)                         | $I_D$     | -6         | A                  |
| Drain current (pulsed) (Note 1), (Note 2)      | $I_{DP}$  | -14        | A                  |
| Power dissipation (Note 3)                     | $P_D$     | 1          | W                  |
| Power dissipation $t \leq 10\text{s}$ (Note 3) | $P_D$     | 2          | W                  |
| Channel temperature                            | $T_{ch}$  | 150        | $^{\circ}\text{C}$ |
| 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: Ensure that the channel temperature does not exceed  $150^{\circ}\text{C}$

Note 2: Pulse width (PW)  $\leq 10\text{ ms}$ , duty  $\leq 1\%$

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: 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, $T_a = 25^\circ\text{C}$ )

| Characteristics                         | Symbol        | Test Condition                                 | Min  | Typ. | Max     | Unit             |
|-----------------------------------------|---------------|------------------------------------------------|------|------|---------|------------------|
| Gate leakage current                    | $I_{GSS}$     | $V_{GS} = \pm 8\text{ V}, V_{DS} = 0\text{ V}$ | —    | —    | $\pm 1$ | $\mu\text{A}$    |
| Drain cut-off current                   | $I_{DSS}$     | $V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}$   | —    | —    | -1      | $\mu\text{A}$    |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$ | $I_D = -1\text{ mA}, V_{GS} = 0\text{ V}$      | -12  | —    | —       | V                |
| Drain-source breakdown voltage (Note 1) | $V_{(BR)DSX}$ | $I_D = -1\text{ mA}, V_{GS} = 5\text{ V}$      | -7   | —    | —       |                  |
| Gate threshold voltage (Note 2)         | $V_{th}$      | $V_{DS} = -3\text{ V}, I_D = -1\text{ mA}$     | -0.3 | —    | -1.0    |                  |
| Drain-source on-resistance (Note 3)     | $R_{DS(ON)}$  | $I_D = -6.0\text{ A}, V_{GS} = -8.0\text{ V}$  | —    | 13.9 | 17.6    | $\text{m}\Omega$ |
|                                         |               | $I_D = -6.0\text{ A}, V_{GS} = -4.5\text{ V}$  | —    | 15.9 | 20.2    |                  |
|                                         |               | $I_D = -6.0\text{ A}, V_{GS} = -3.6\text{ V}$  | —    | 17.0 | 21.9    |                  |
|                                         |               | $I_D = -6.0\text{ A}, V_{GS} = -2.5\text{ V}$  | —    | 20.1 | 27.9    |                  |
|                                         |               | $I_D = -4.5\text{ A}, V_{GS} = -1.8\text{ V}$  | —    | 26.3 | 45.3    |                  |
| Forward transfer admittance (Note 3)    | $ Y_{fs} $    | $V_{DS} = -3\text{ V}, I_D = -2\text{ A}$      | —    | 17   | —       | S                |

Note 1: If a reverse 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 be 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 (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

| Characteristics                | Symbol    | Test Condition                                                                                  | Min | Typ. | Max | Unit |
|--------------------------------|-----------|-------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = -6\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$                                   | —   | 1400 | —   | pF   |
| Reverse transfer capacitance   | $C_{rss}$ |                                                                                                 | —   | 225  | —   |      |
| Output capacitance             | $C_{oss}$ |                                                                                                 | —   | 250  | —   |      |
| Switching time (turn-on time)  | $t_{on}$  | $V_{DD} = -6\text{ V}, I_D = -6\text{ A}, V_{GS} = 0\text{ to }-4.5\text{ V}, R_G = 10\ \Omega$ | —   | 65   | —   | ns   |
| Switching time (turn-off time) | $t_{off}$ |                                                                                                 | —   | 383  | —   |      |

### 5.3. Switching Time Test Circuit

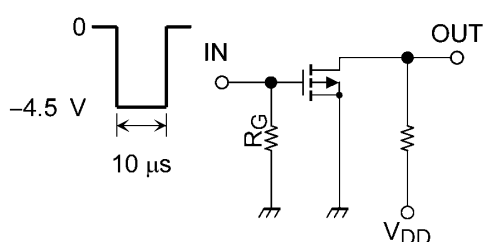


Fig. 5.3.1 Switching Time Test Circuit

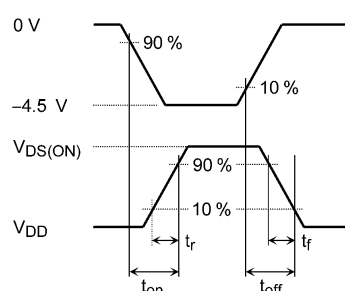


Fig. 5.3.2 Input Waveform/Output Waveform

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

| Characteristics                                 | Symbol    | Test Condition                                                    | Min | Typ. | Max | Unit |
|-------------------------------------------------|-----------|-------------------------------------------------------------------|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} = -6\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -6\text{ A}$ | —   | 19.5 | —   | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |                                                                   | —   | 1.4  | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |                                                                   | —   | 9.0  | —   |      |

5.5. Source-Drain Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

| Characteristics                | Symbol           | Test Condition                              | Min | Typ. | Max | Unit |
|--------------------------------|------------------|---------------------------------------------|-----|------|-----|------|
| Diode forward voltage (Note 1) | V <sub>DSF</sub> | I <sub>D</sub> = 6 A, V <sub>GS</sub> = 0 V | —   | 0.75 | 1.1 | V    |

Note 1: Pulse measurement.

6. Marking

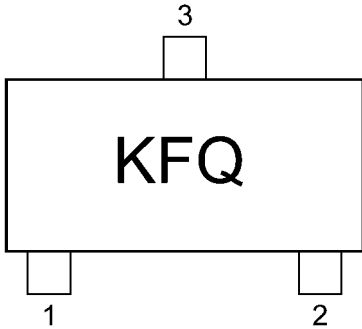
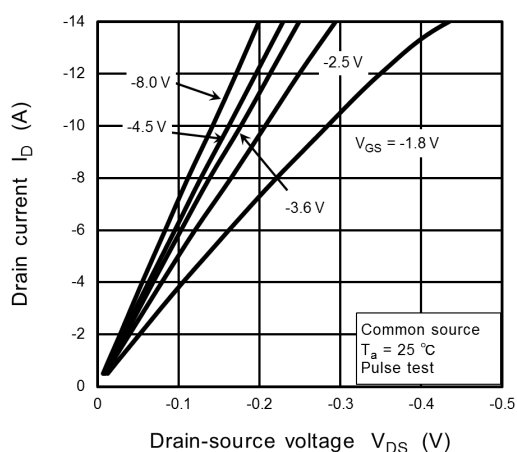
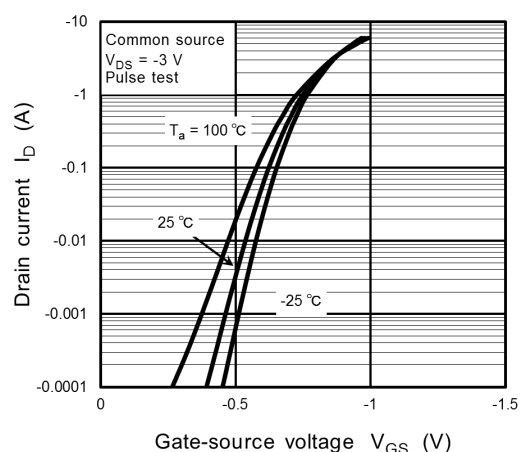


Fig. 6.1 Marking

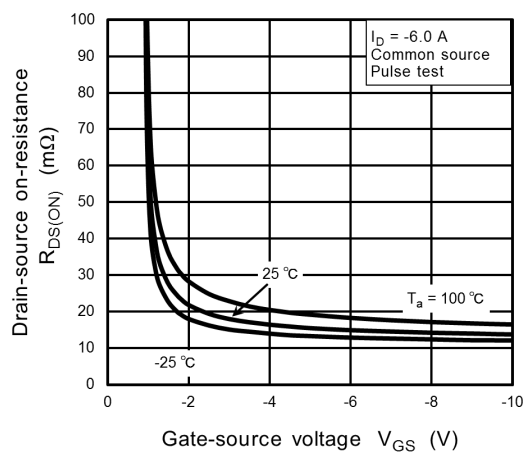
# 7. Characteristics Curves (Note)



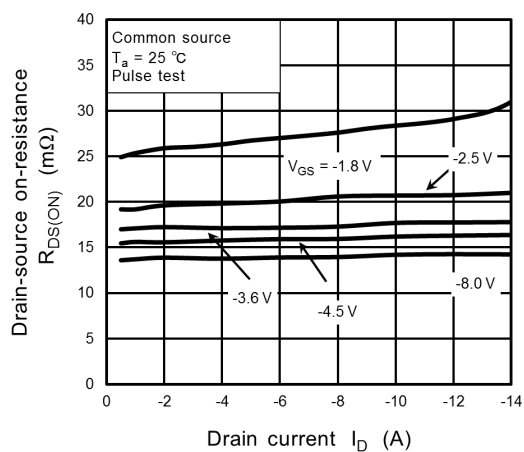
**Fig. 7.1  $I_D - V_{DS}$**



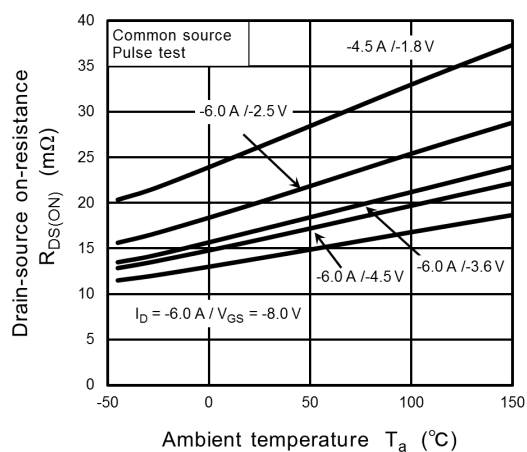
**Fig. 7.2  $I_D - V_{GS}$**



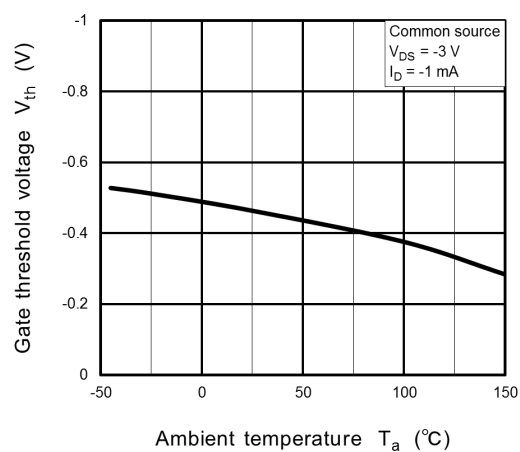
**Fig. 7.3  $R_{DS(ON)} - V_{GS}$**



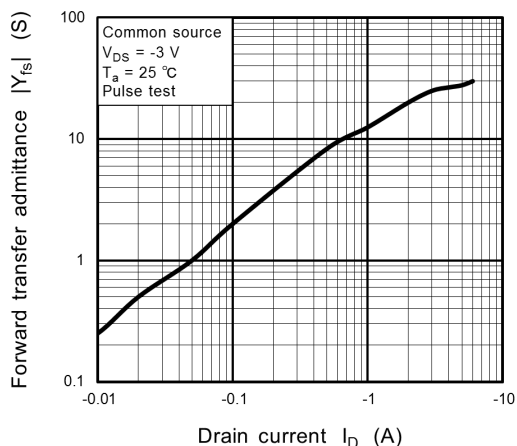
**Fig. 7.4  $R_{DS(ON)} - I_D$**



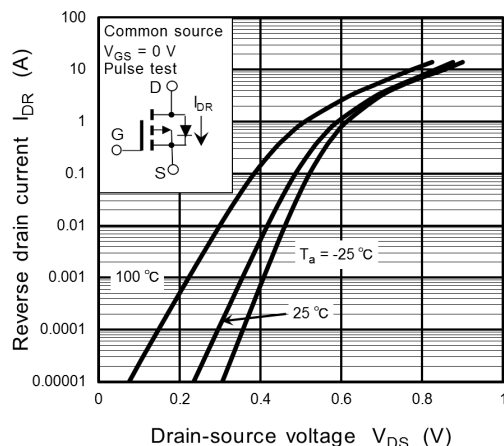
**Fig. 7.5  $R_{DS(ON)} - T_a$**



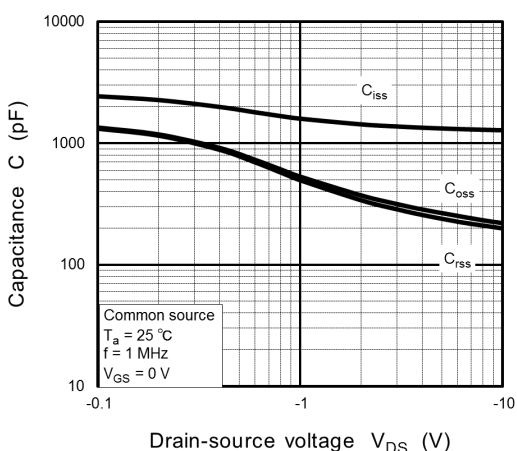
**Fig. 7.6  $V_{th} - T_a$**



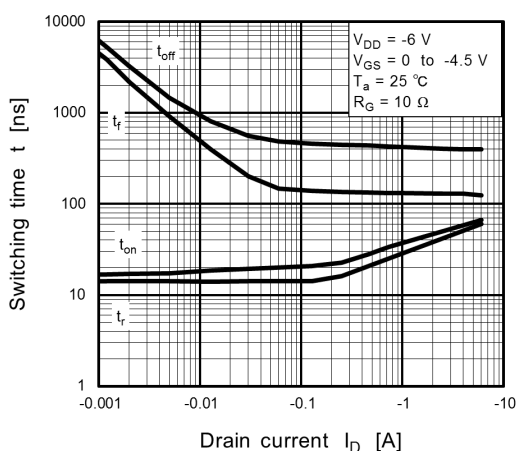
**Fig. 7.7**  $|Y_{fs}| - I_D$



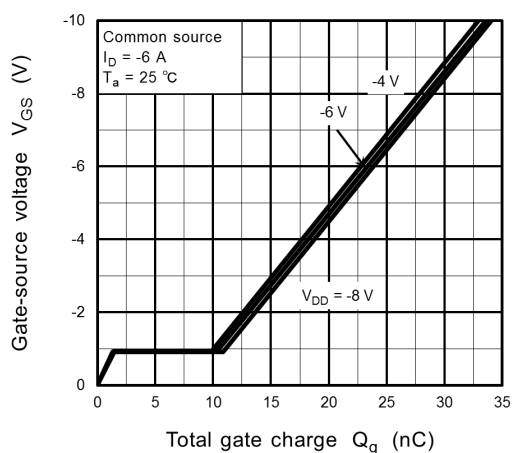
**Fig. 7.8**  $I_{DR} - V_{DS}$



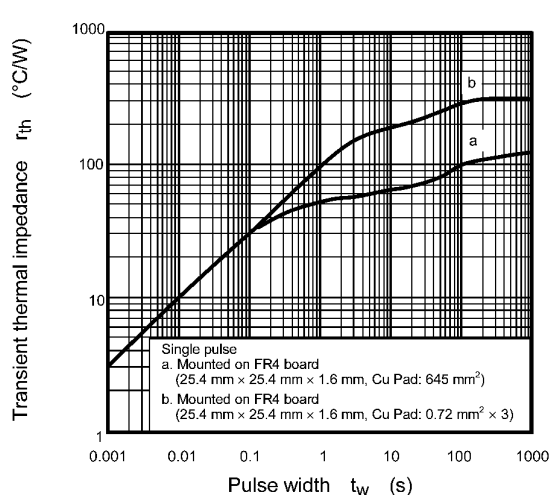
**Fig. 7.9**  $C - V_{DS}$



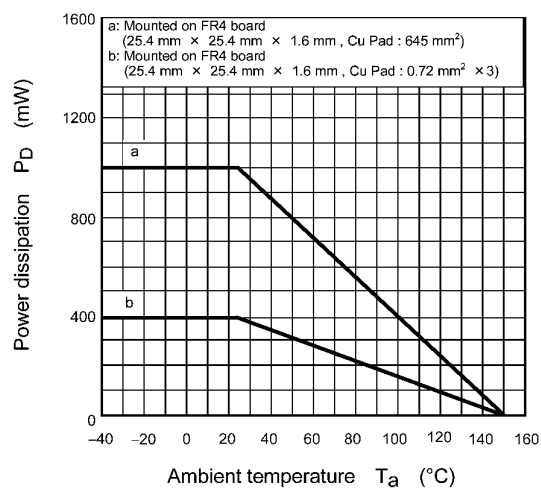
**Fig. 7.10**  $t - I_D$



**Fig. 7.11** Dynamic Input Characteristics



**Fig. 7.12**  $r_{th} - t_w$

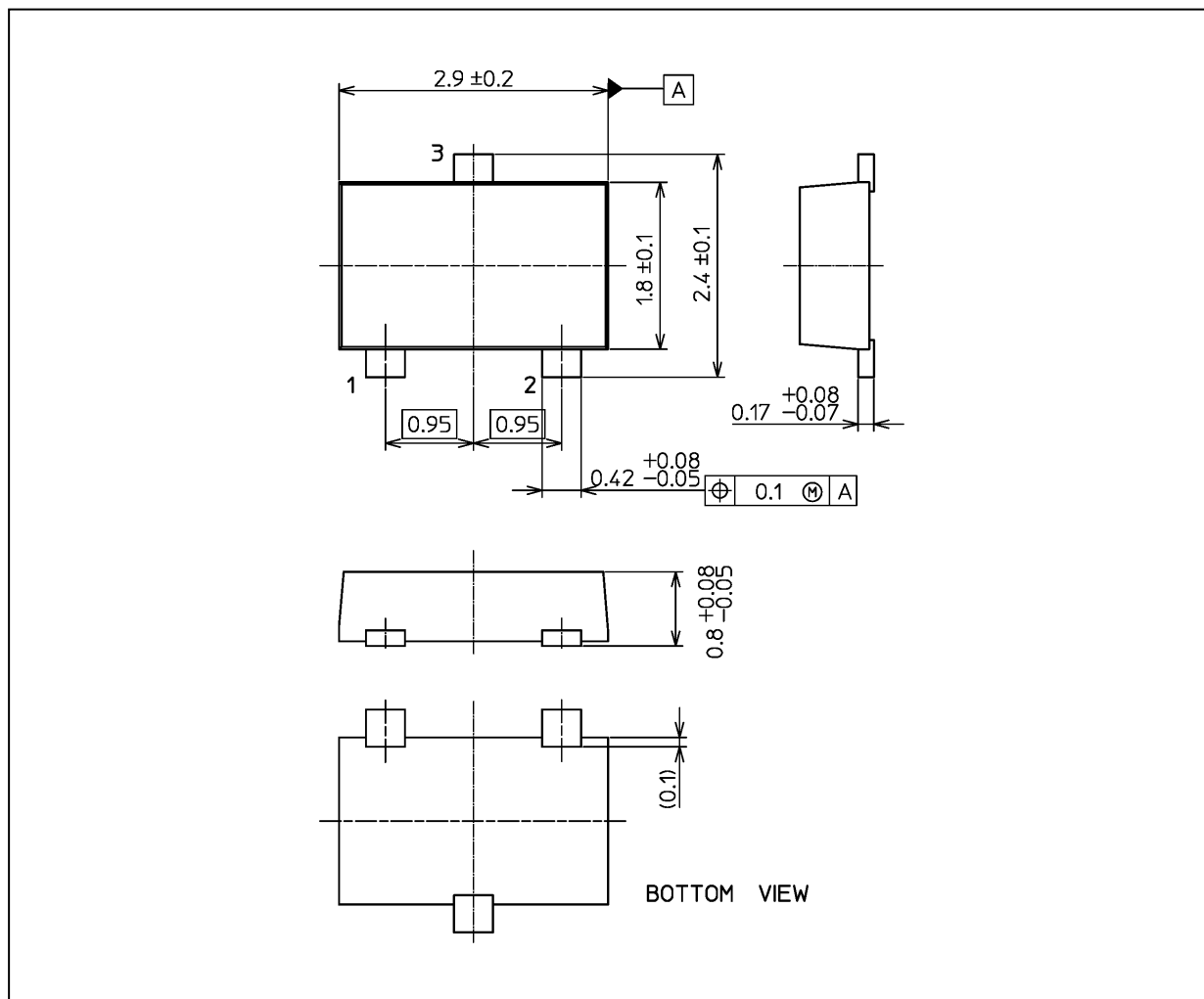


**Fig. 7.13  $P_D - T_a$**

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

## Package Dimensions

Unit: mm



Weight: 0.011 g (typ.)

| Package Name(s)   |
|-------------------|
| Nickname: SOT-23F |

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