

MOSFETs Silicon N-channel MOS (U-MOS<sup>Ⅷ</sup>-H)

# SSM3K361R

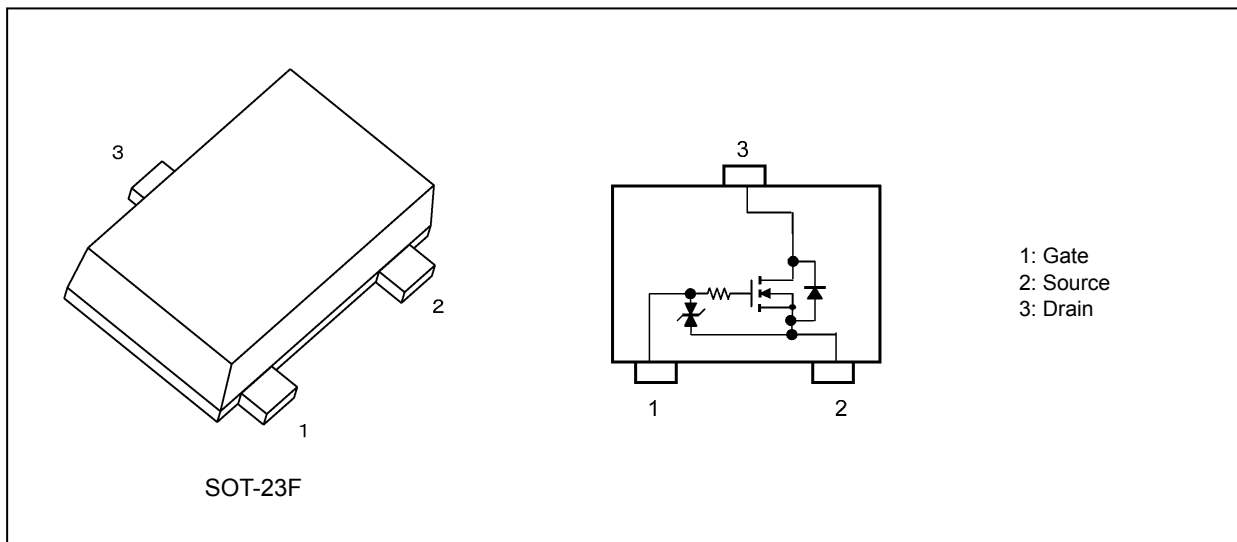
### 1. Applications

- Power Management Switches
- DC-DC Converters

### 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) 175 °C MOSFET
- (3) 4.5 V drive
- (4) Low drain-source on-resistance  
 :  $R_{DS(ON)} = 65 \text{ m}\Omega$  (typ.) (@ $V_{GS} = 4.5 \text{ V}$ )  
 $R_{DS(ON)} = 51 \text{ m}\Omega$  (typ.) (@ $V_{GS} = 10 \text{ V}$ )

### 3. Packaging and Pin Assignment



### 4. Orderable part number

| Orderable part number | AEC-Q101     | Note                    |
|-----------------------|--------------|-------------------------|
| SSM3K361R,LF          | —            | General Use             |
| SSM3K361R,LXGF        | YES (Note 1) | Unintended Use (Note 1) |
| SSM3K361R,LXHF        | YES          | Automotive Use          |

Note 1: For more information, please contact our sales or use the inquiry form on our website.

Start of commercial production  
2016-02

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

| Characteristics                           | Symbol    | Rating     | Unit             |
|---|-----------|------------|------------------|
| Drain-source voltage                      | $V_{DSS}$ | 100        | V                |
| Gate-source voltage                       | $V_{GSS}$ | $\pm 20$   |                  |
| Drain current (DC) (Note 1)               | $I_D$     | 3.5        | A                |
| Drain current (pulsed) (Note 1), (Note 2) | $I_{DP}$  | 14         |                  |
| Power dissipation (Note 3)                | $P_D$     | 1.2        | W                |
| Power dissipation (t = 10 s) (Note 3)     | $P_D$     | 2.4        |                  |
| Single-pulse avalanche energy (Note 4)    | $E_{AS}$  | 9.1        | mJ               |
| Avalanche current                         | $I_{AR}$  | 3.5        | A                |
| Channel temperature (Note 5)              | $T_{ch}$  | 175        | $^\circ\text{C}$ |
| Storage temperature (Note 5)              | $T_{stg}$ | -55 to 175 |                  |

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  $175\text{ }^\circ\text{C}$ .

Note 2: Pulse width  $\leq 10\text{ ms}$ , Duty  $\leq 1\%$

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

Note 4:  $V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25\text{ }^\circ\text{C}$  (Initial state),  $L = 1\text{ mH}$ ,  $R_G = 25\ \Omega$

Note 5: The definitions of the absolute maximum channel and storage temperatures are qualified per AEC-Q101.

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.

### 6. Electrical Characteristics

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

| Characteristics                         | Symbol        | Test Condition                                  | Min | Typ. | Max      | Unit             |
|---|---------------|---|-----|------|----------|------------------|
| Gate leakage current                    | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 16\text{ V}$ | —   | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain cut-off current                   | $I_{DSS}$     | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$    | —   | —    | 10       |                  |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$       | 100 | —    | —        | V                |
| Drain-source breakdown voltage (Note 1) | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$     | 80  | —    | —        |                  |
| Gate threshold voltage (Note 2)         | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 0.1\text{ mA}$     | 1.5 | —    | 2.5      | V                |
| Drain-source on-resistance (Note 3)     | $R_{DS(ON)}$  | $I_D = 1\text{ A}, V_{GS} = 4.5\text{ V}$       | —   | 65   | 92       | $\text{m}\Omega$ |
|   |               | $I_D = 2\text{ A}, V_{GS} = 10\text{ V}$        | —   | 51   | 69       |                  |

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 below (0.1 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.

#### 6.2. 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>$f = 1\text{ MHz}$  | —   | 430  | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |   | —   | 22   | —   |             |
| Output capacitance             | $C_{oss}$ |   | —   | 160  | —   |             |
| Switching time (rise time)     | $t_r$     | $V_{DD} = 30\text{ V}, I_D = 1.0\text{ A},$<br>$V_{GS} = 0\text{ to }4.5\text{ V}, R_G = 50\ \Omega$<br>Duty $\leq 1\%$ , Input: $t_r, t_f < 5\text{ ns}$ ,<br>Common source,<br>See Chapter 5.3. | —   | 9    | —   | ns          |
| Switching time (turn-on time)  | $t_{on}$  |   | —   | 21   | —   |             |
| Switching time (fall time)     | $t_f$     |   | —   | 7    | —   |             |
| Switching time (turn-off time) | $t_{off}$ |   | —   | 16   | —   |             |

#### 6.3. Switching Time Test Circuit

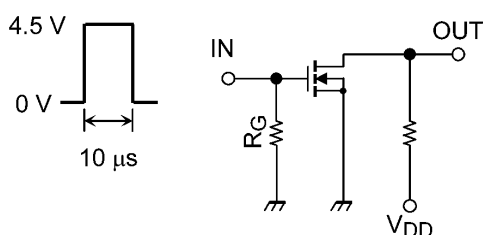


Fig. 6.3.1 Switching Time Test Circuit

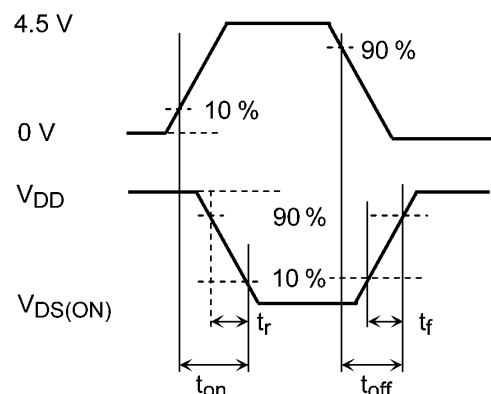


Fig. 6.3.2 Input Waveform/Output Waveform

#### 6.4. 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) | $Q_g$     | $V_{DD} = 50\text{ V}, I_D = 2.0\text{ A},$<br>$V_{GS} = 4.5\text{ V}$ | —   | 3.2  | —   | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |  | —   | 1.1  | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |  | —   | 1.5  | —   |      |

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

| Characteristics                | Symbol    | Test Condition                             | Min | Typ. | Max  | Unit |
|--------------------------------|-----------|--|-----|------|------|------|
| Diode forward voltage (Note 1) | $V_{DSF}$ | $I_D = -3.5\text{ A}, V_{GS} = 0\text{ V}$ | —   | -0.9 | -1.5 | V    |

Note 1: Pulse measurement.

## 7. Marking

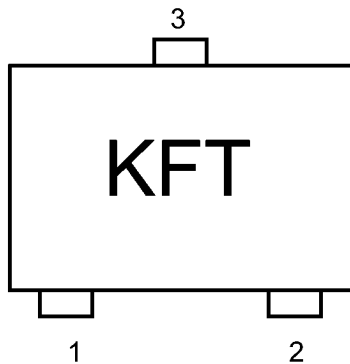


Fig. 7.1 Marking

## 8. Characteristics Curves (Note)

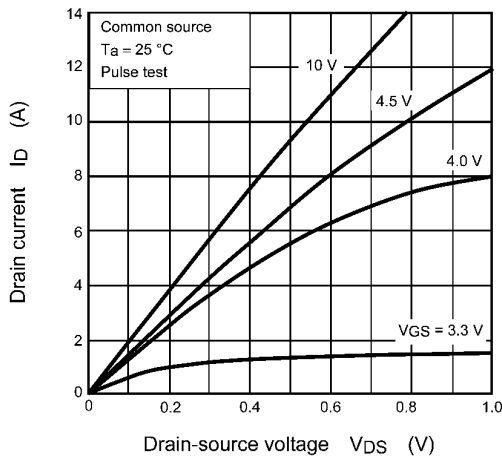


Fig. 8.1  $I_D - V_{DS}$

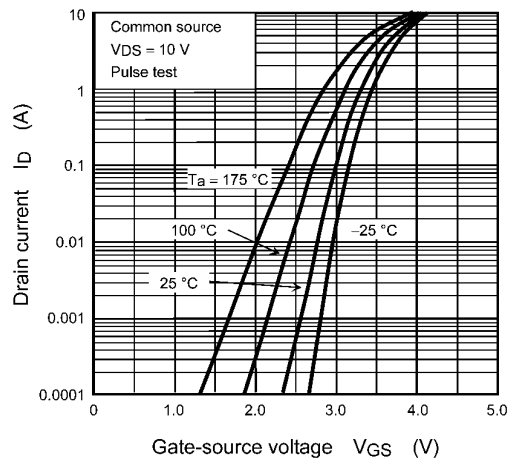


Fig. 8.2  $I_D - V_{GS}$

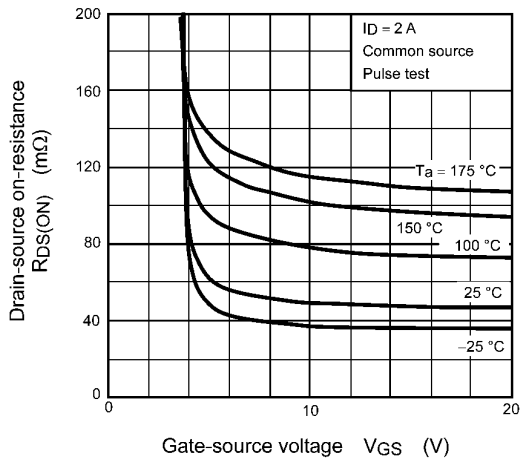


Fig. 8.3  $R_{DS(ON)} - V_{GS}$

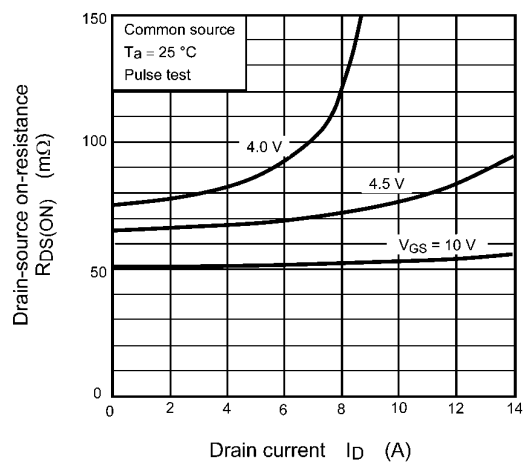


Fig. 8.4  $R_{DS(ON)} - I_D$

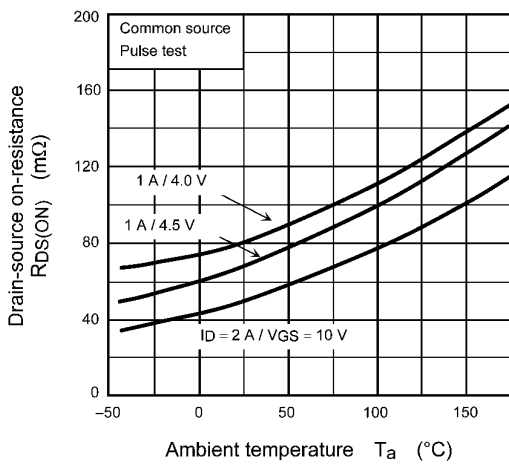


Fig. 8.5  $R_{DS(ON)} - T_a$

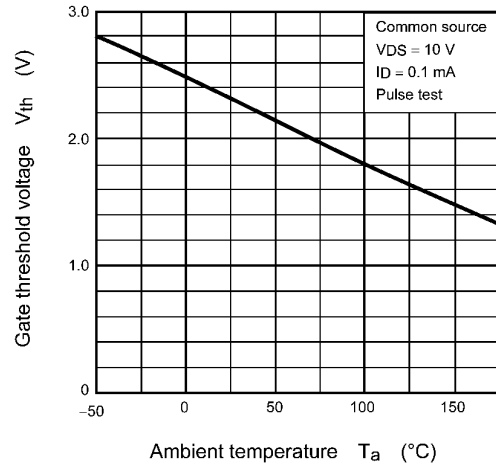
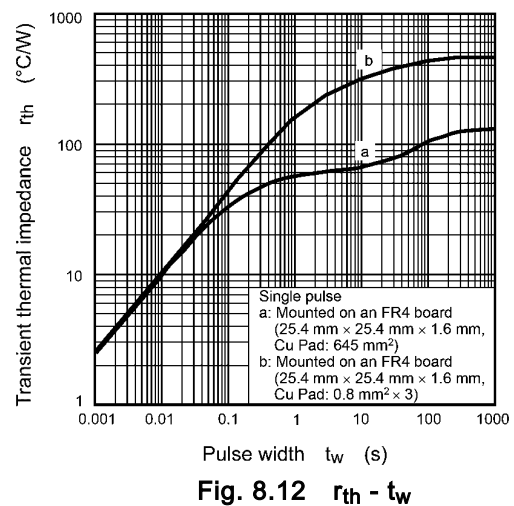
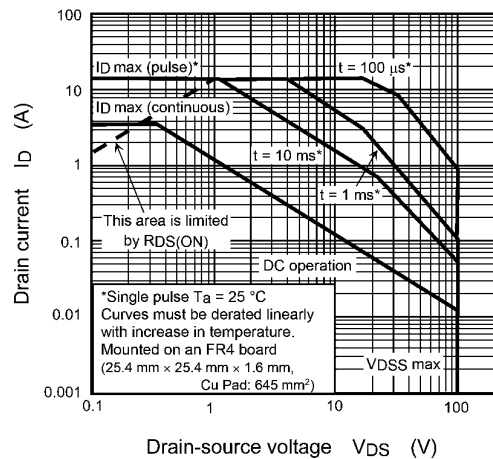
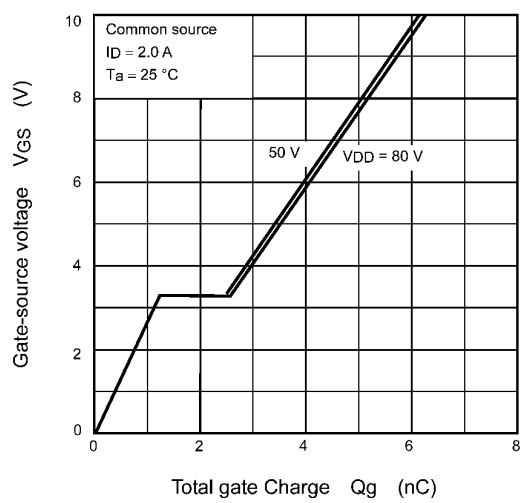
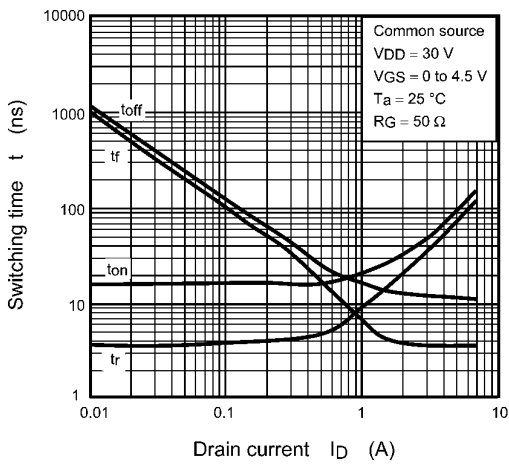
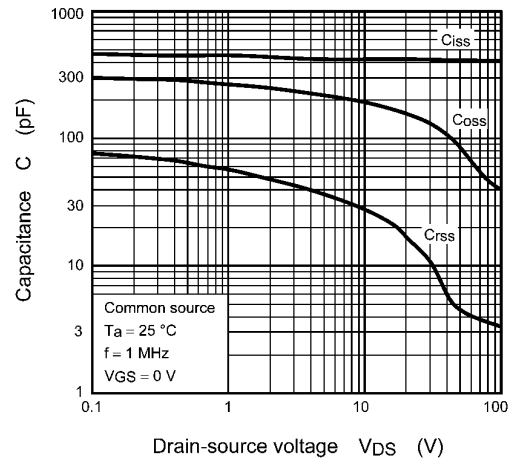
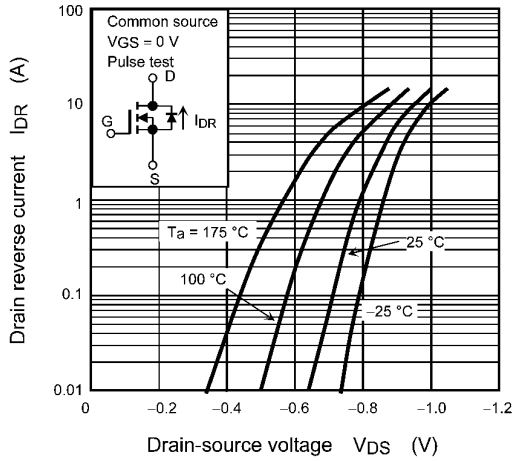


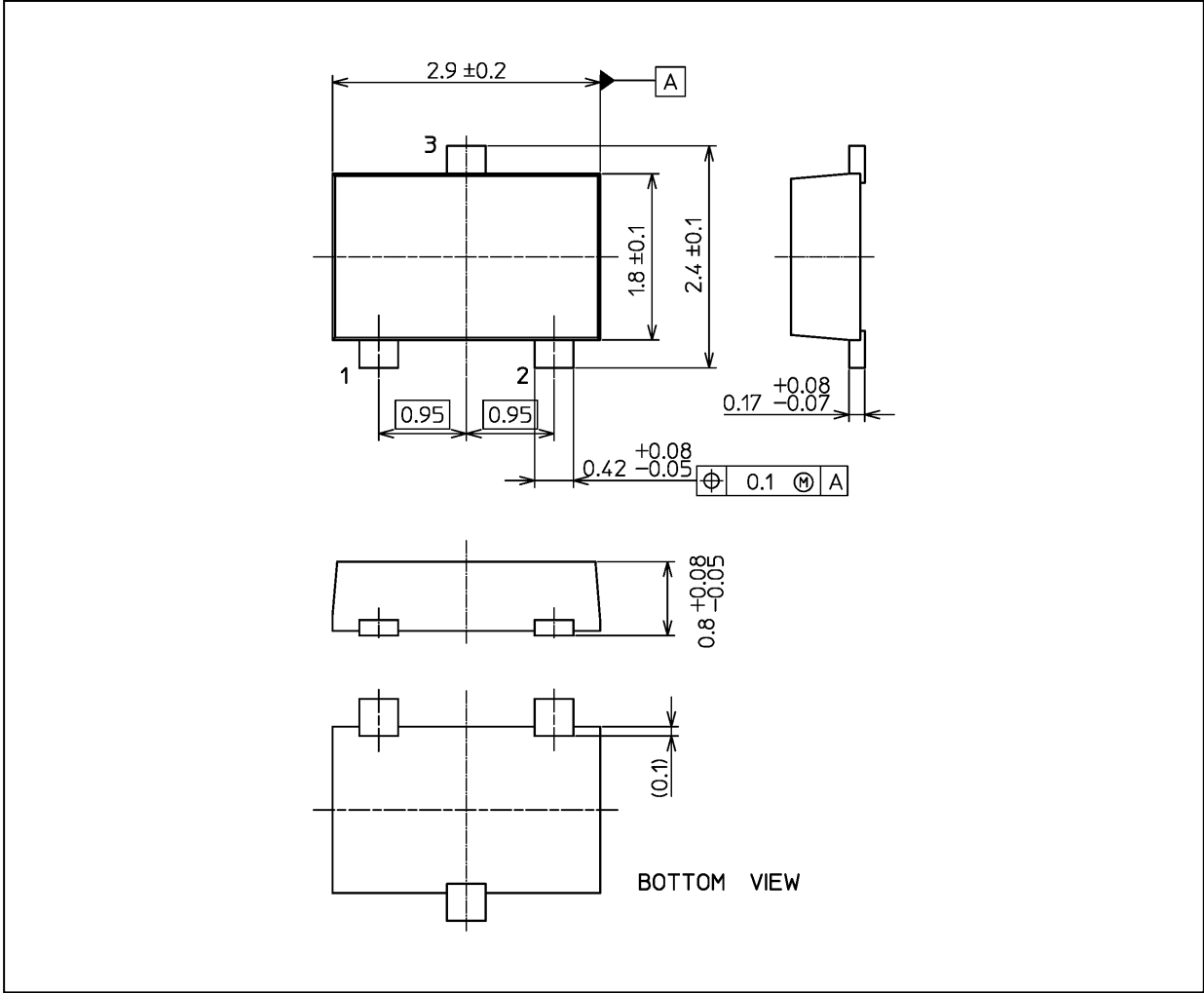
Fig. 8.6  $V_{th} - T_a$



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)   |
|-------------------|
| TOSHIBA: 2-3Z1S   |
| Nickname: SOT-23F |

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