

MOSFETs Silicon N-Channel MOS

# SSM3K2615R

## 1. Applications

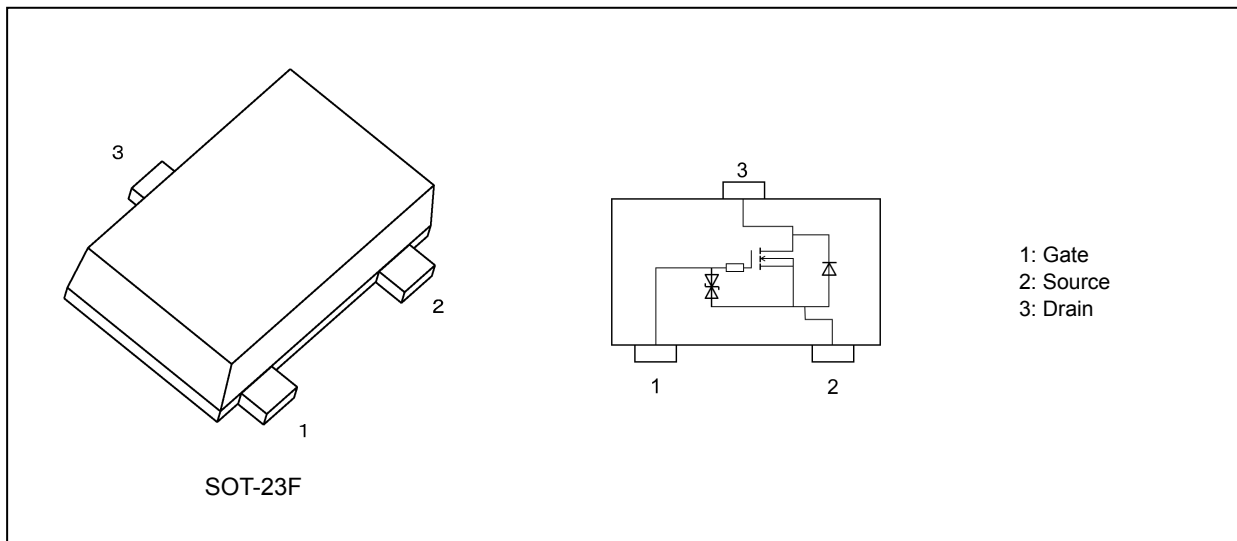
- Load Switches
- Motor Drivers

## 2. Features

- (1) AEC-Q101 Qualified (Note1).
- (2) 3.3-V gate drive voltage.
- (3) Low drain-source on-resistance
  - :  $R_{DS(ON)} = 380 \text{ m}\Omega$  (typ.) (@ $V_{GS} = 3.3 \text{ V}$ ,  $I_D = 0.5 \text{ A}$ )
  - $R_{DS(ON)} = 330 \text{ m}\Omega$  (typ.) (@ $V_{GS} = 4.0 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )
  - $R_{DS(ON)} = 230 \text{ m}\Omega$  (typ.) (@ $V_{GS} = 10 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )

Note1: For detail information, please contact to our sales.

## 3. Packaging and Pin Assignment



Start of commercial production  
2014-10

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	60	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	
Drain current (DC) (Note 1)	$I_D$	2	A
Drain current (pulsed) (Note 1), (Note 2)	$I_{DP}$	6	
Power dissipation (Note 3)	$P_D$	1	W
Power dissipation ( $t \leq 10\text{ s}$ ) (Note 3)	$P_D$	2	
Channel temperature	$T_{ch}$	150	$^{\circ}\text{C}$
Single-pulse avalanche energy (Note 4)	$E_{AS}$	52.9	mJ
Single-pulse avalanche current (Note 4)	$I_{AS}$	2	A
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  $150\text{ °C}$ .

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

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

Note 4:  $V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (Initial state),  $L = 20\text{ mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 2\text{ A}$

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

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. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-ambient thermal resistance (Note 1)	$R_{th(ch-a)}$	125	$^{\circ}\text{C}/\text{W}$

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

### 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	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	1	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	60	—	—	V
Gate threshold voltage (Note 1)	$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	0.8	—	2.0	V
Drain-source on-resistance (Note 2)	$R_{DS(ON)}$	$I_D = 0.5\text{ A}, V_{GS} = 3.3\text{ V}$	—	0.38	0.58	$\Omega$
		$I_D = 1.0\text{ A}, V_{GS} = 4.0\text{ V}$	—	0.33	0.44	
		$I_D = 1.0\text{ A}, V_{GS} = 10\text{ V}$	—	0.23	0.3	
Forward transfer admittance (Note 2)	$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 1.0\text{ A}$	1.0	2.0	—	S

Note 1: 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 2: 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	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	—	150	—	$\text{pF}$
Reverse transfer capacitance	$C_{rss}$		—	25	—	
Output capacitance	$C_{oss}$		—	70	—	
Switching time (rise time)	$t_r$	$V_{DD} \approx 30\text{ V}, I_D = 1\text{ A}$ $V_{GS} = 0\text{ to }10\text{ V}, R_{GS} = 50\text{ }\Omega$	—	25	—	ns
Switching time (turn-on time)	$t_{on}$		—	30	—	
Switching time (fall time)	$t_f$		—	50	—	
Switching time (turn-off time)	$t_{off}$		—	150	—	

#### 6.3. Switching Time Test Circuit

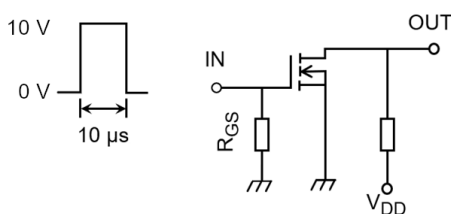


Fig. 6.3.1 Switching Time Test Circuit

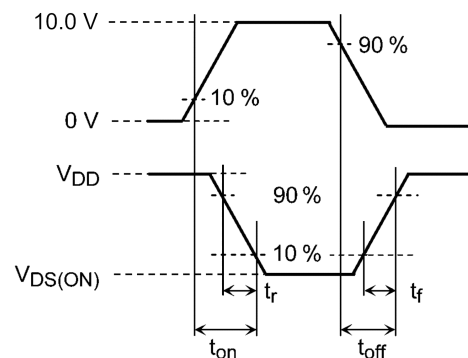


Fig. 6.3.2 Input Waveform/Output Waveform

#### 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)	$Q_g$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V},$ $I_D = 2.0\text{ A}$	—	6.0	—	nC
Gate-source charge	$Q_{gs}$		—	4.6	—	
Gate-drain charge	$Q_{gd}$		—	1.4	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (DC) (Note 1)	$I_{DR}$	—	—	—	2	A
Reverse drain current (pulsed) (Note 1)	$I_{DRP}$	—	—	—	6	A
Diode forward voltage (Note 2)	$V_{DSF}$	$I_{DR} = 2.0\text{ A}, V_{GS} = 0\text{ V}$	—	0.9	1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 2\text{ A}, V_{GS} = 0\text{ V},$ $dI_{DR} / dt = 50\text{ A} / \mu\text{s}$	—	100	—	ns
Reverse recovery charge	$Q_{rr}$		—	40	—	nC

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

Note 2: Pulse measurement.

### 7. Marking

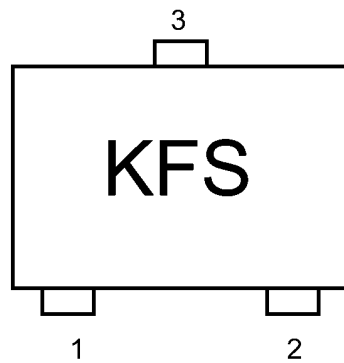


Fig. 7.1 Marking

## 8. Characteristics Curves (Note)

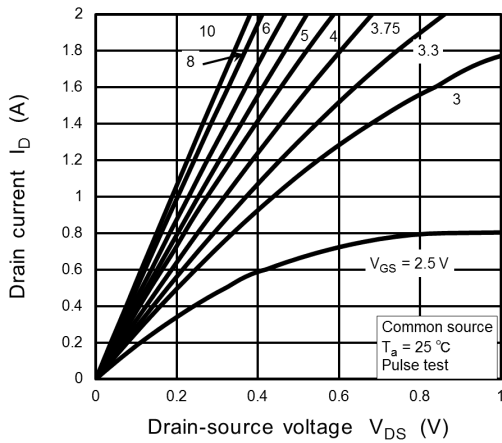


Fig. 8.1  $I_D - V_{DS}$

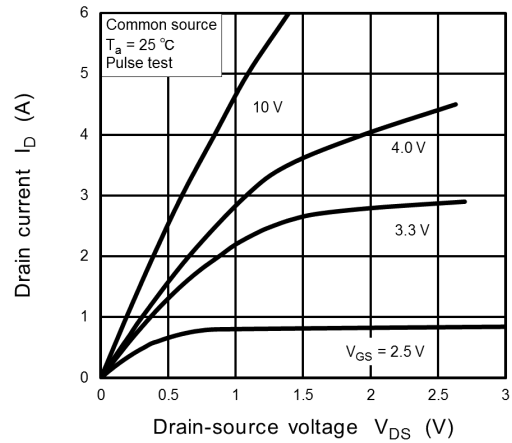


Fig. 8.2  $I_D - V_{DS}$

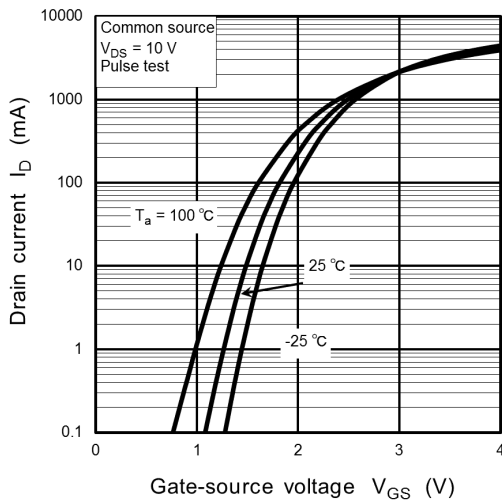


Fig. 8.3  $I_D - V_{GS}$

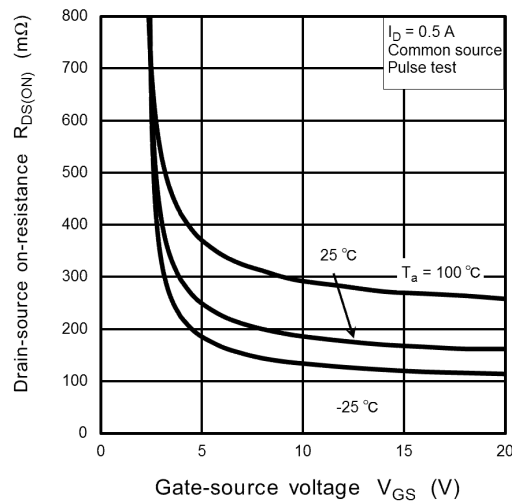


Fig. 8.4  $R_{DS(ON)} - V_{GS}$

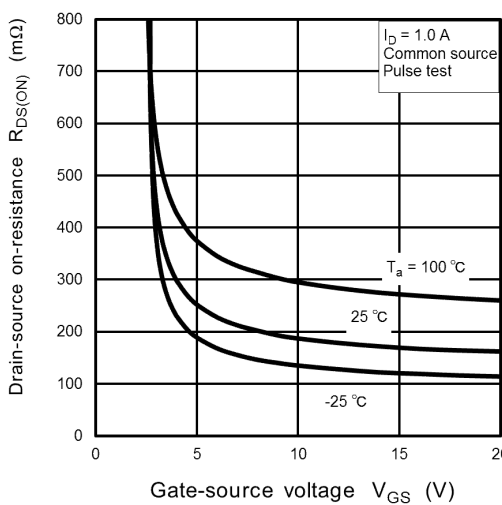


Fig. 8.5  $R_{DS(ON)} - V_{GS}$

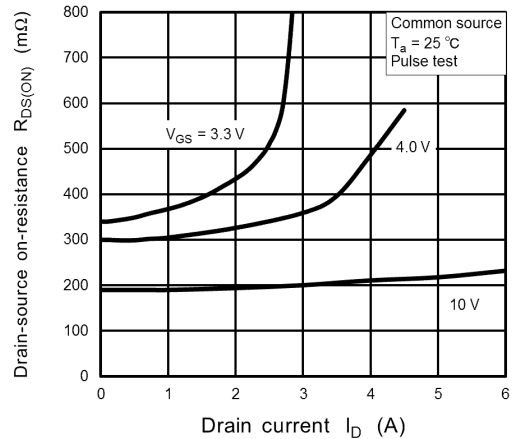


Fig. 8.6  $R_{DS(ON)} - I_D$

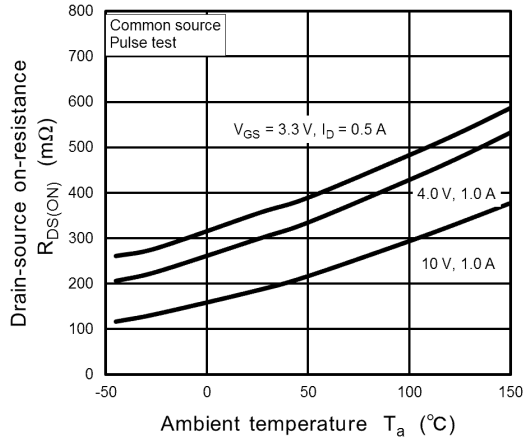


Fig. 8.7  $R_{DS(ON)} - T_a$

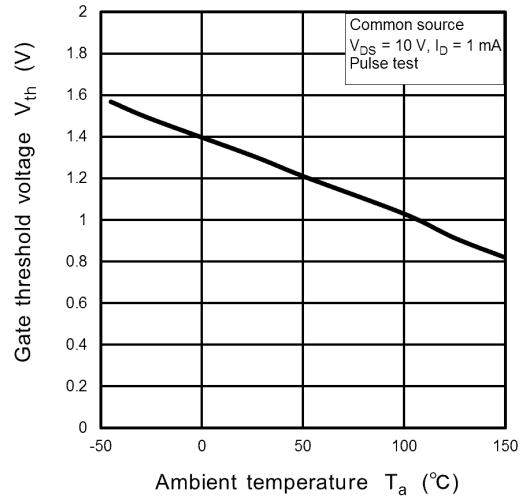


Fig. 8.8  $V_{th} - T_a$

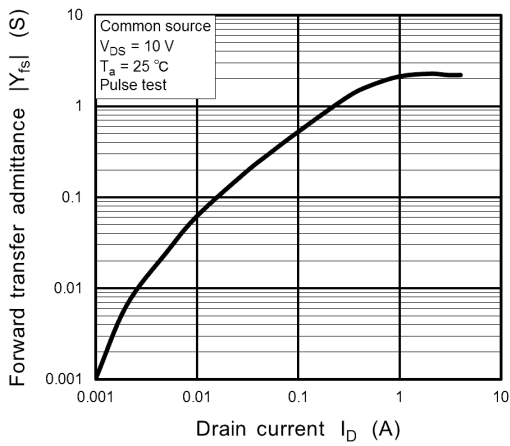


Fig. 8.9  $|Y_{fs}| - I_D$

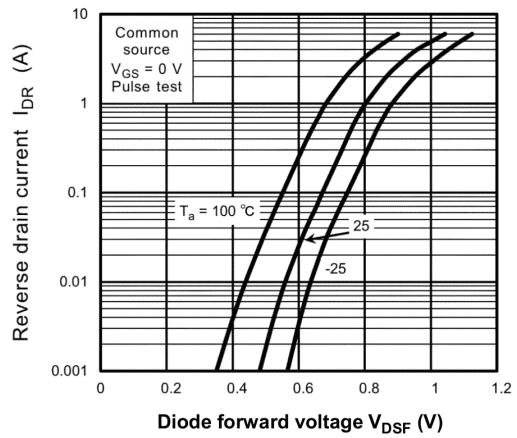


Fig. 8.10  $I_{DR} - V_{DSF}$

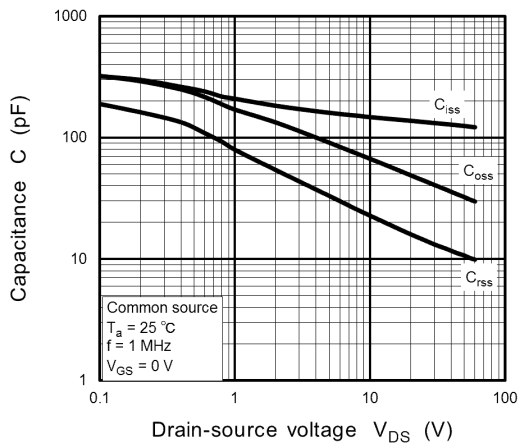


Fig. 8.11  $C - V_{DS}$

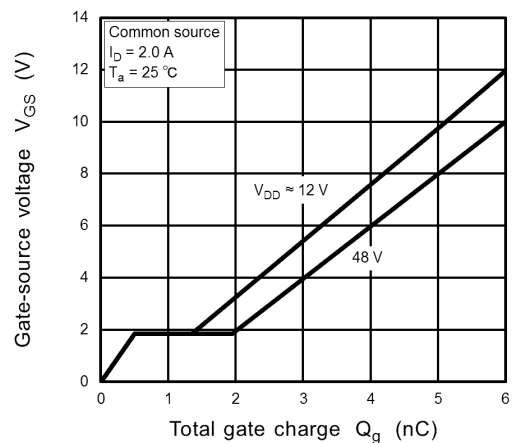


Fig. 8.12 Dynamic Input Characteristics

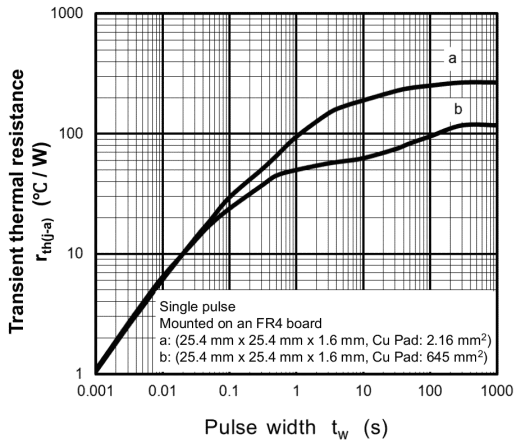


Fig. 8.13  $r_{th(j-a)} - t_w$

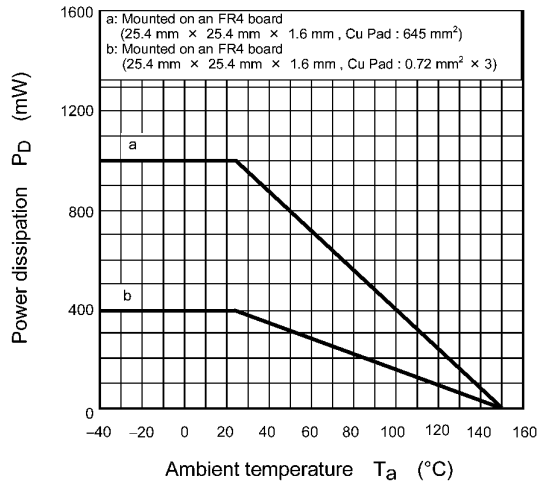


Fig. 8.14  $P_D - T_a$

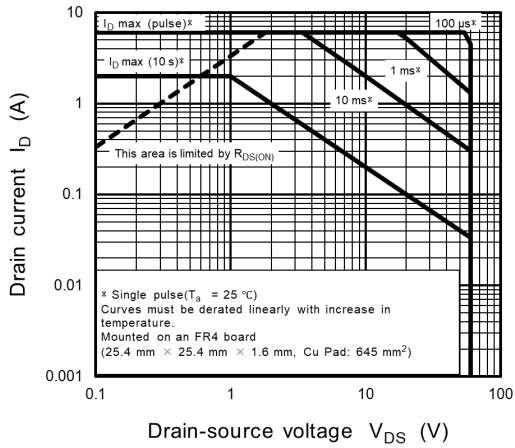
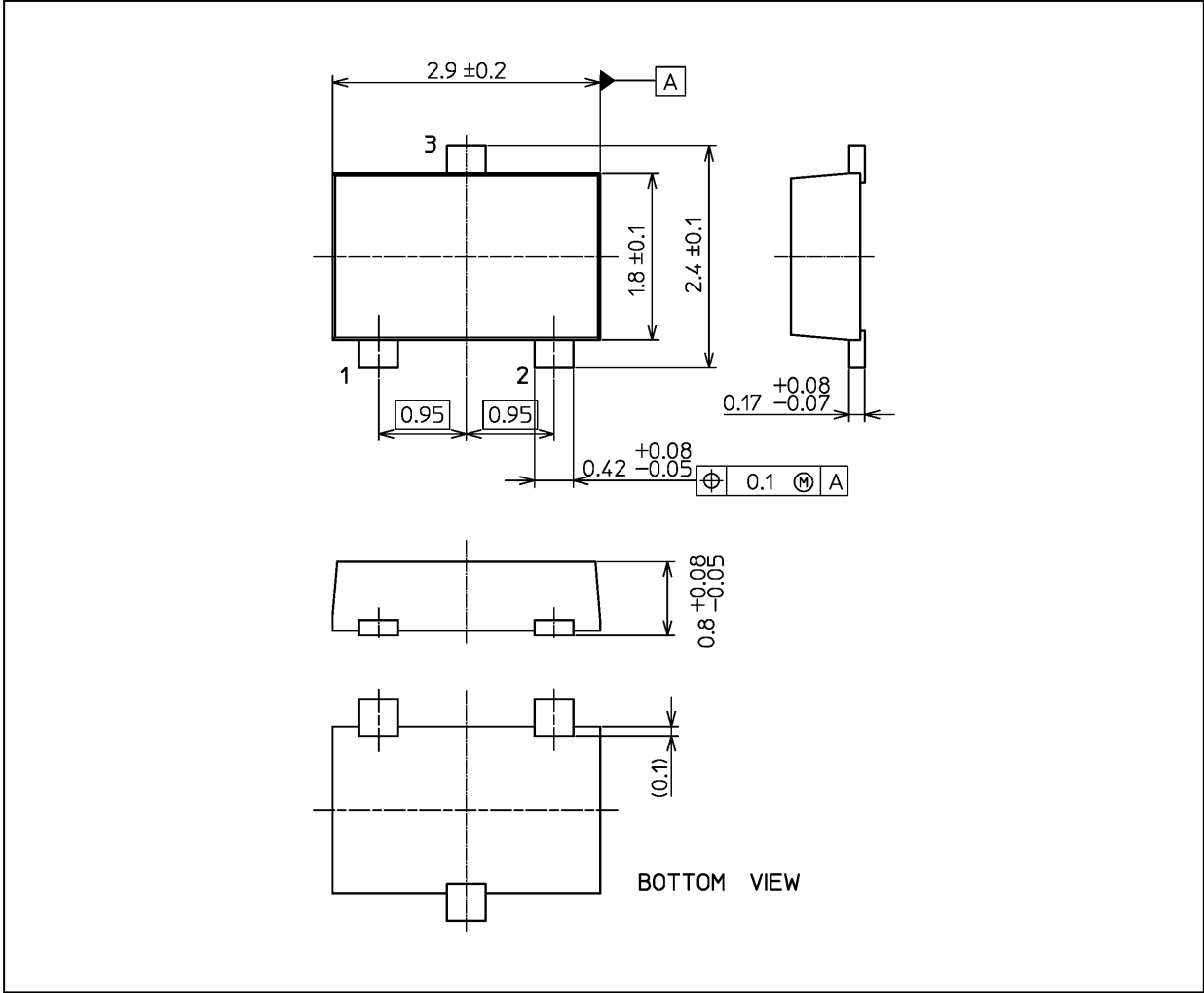


Fig. 8.15 Safe Operating Area

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

Package Dimensions

Unit: mm



Weight: 0.011 g (typ.)

Package Name(s)
Nickname: SOT-23F

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