

# SSM3K2615R

## 1. Applications

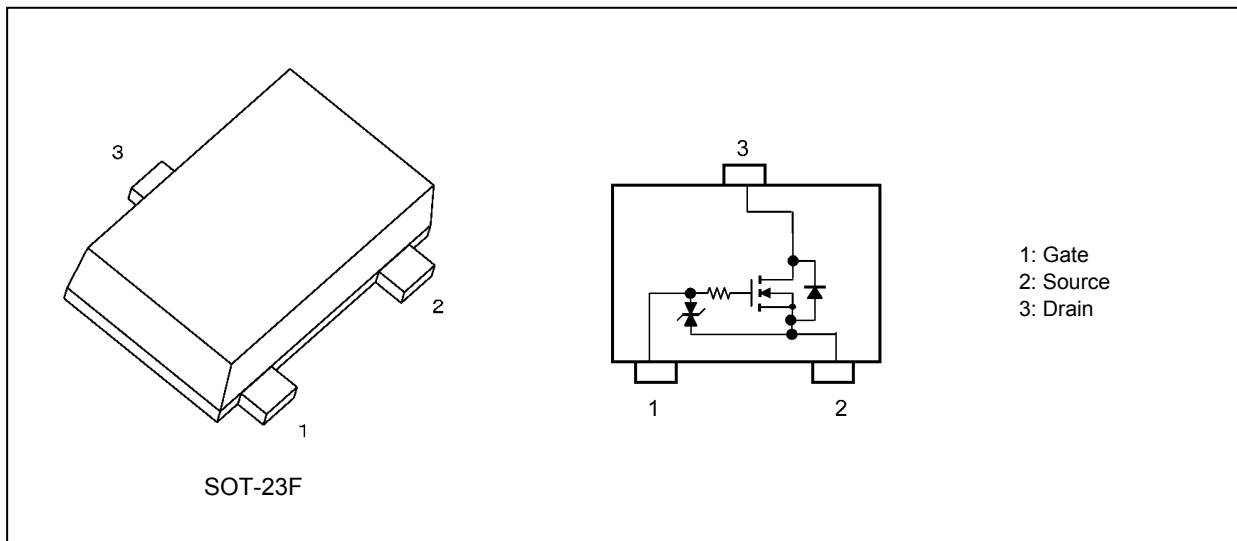
- Load Switches
- Motor Drivers

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

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 = 10 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
Avalanche current	$I_{AR}$	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  $^\circ\text{C}$ .

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

Note 3: Device mounted on an FR4 board. (25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu pad: 645 mm<sup>2</sup>)

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

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. 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	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
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.

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	150	—	$\text{pF}$
Reverse transfer capacitance	$C_{rss}$		—	25	—	
Output capacitance	$C_{oss}$		—	70	—	
Switching time (rise time)	$t_r$	$V_{DD} \approx 30\text{ V}, I_D = 1\text{ A}, V_{GS} = 0\text{ to }10\text{ V}, R_G = 50\text{ }\Omega$	—	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	—	

**5.3. Switching Time Test Circuit**

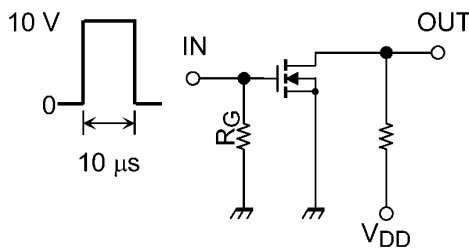


Fig. 5.3.1 Switching Time Test Circuit

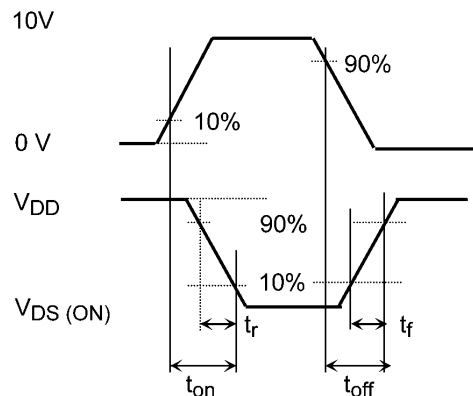


Fig. 5.3.2 Input Waveform/Output Waveform

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

**5.5. 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)	$V_{DSF}$	$I_D = -2.0\text{ A}, V_{GS} = 0\text{ V}$	—	-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.

**6. Marking**

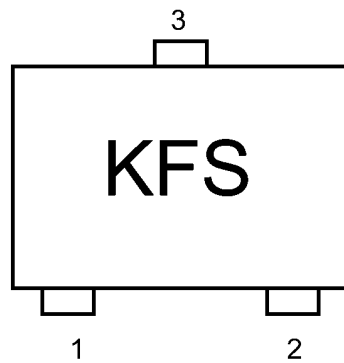
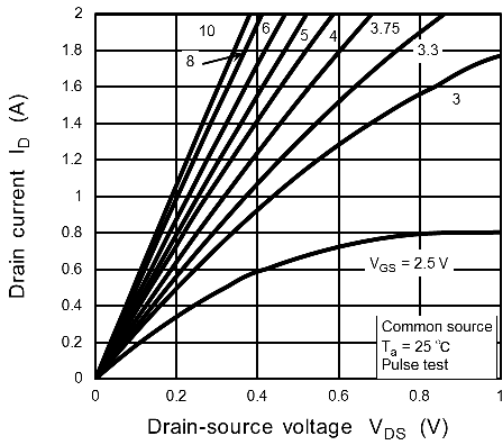
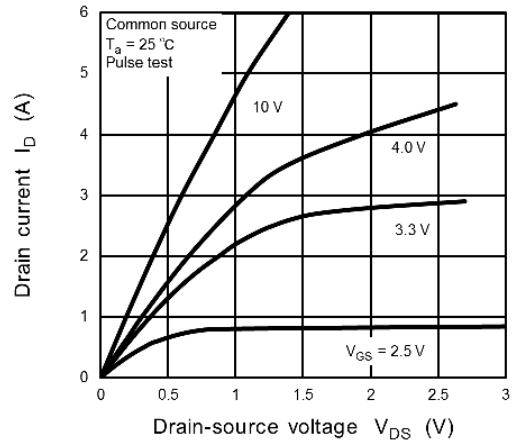


Fig. 6.1 Marking

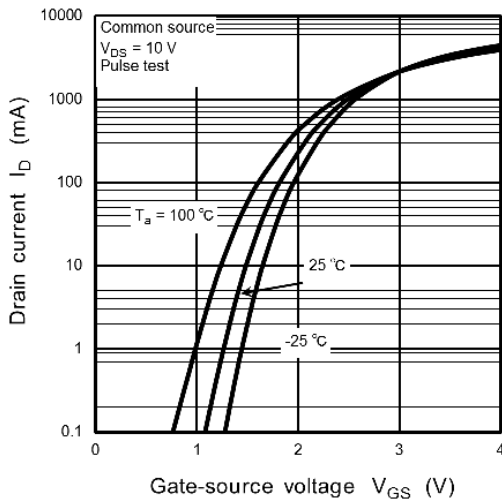
**7. Characteristics Curves (Note)**



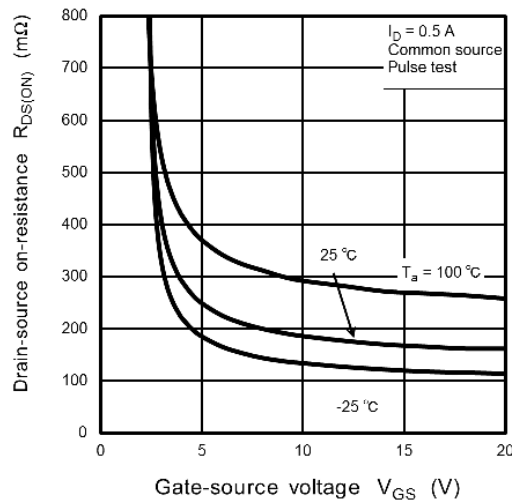
**Fig. 7.1  $I_D - V_{DS}$**



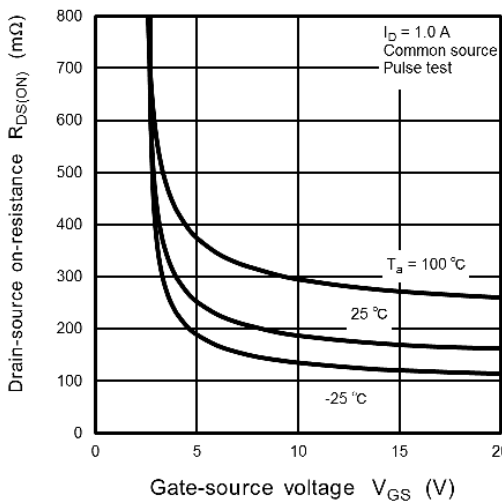
**Fig. 7.2  $I_D - V_{DS}$**



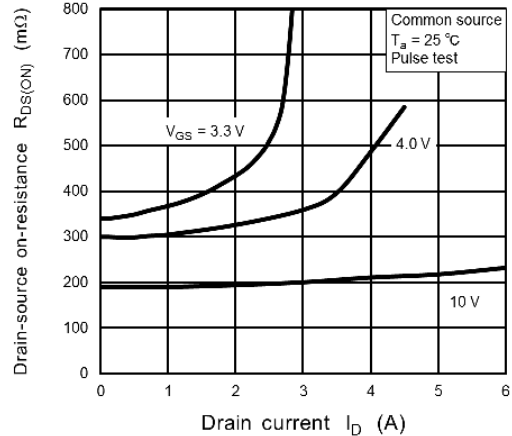
**Fig. 7.3  $I_D - V_{GS}$**



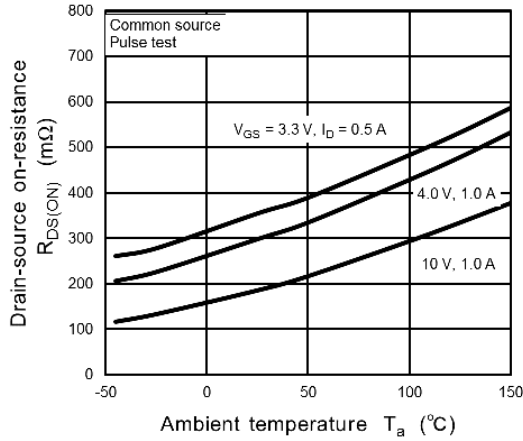
**Fig. 7.4  $R_{DS(ON)} - V_{GS}$**



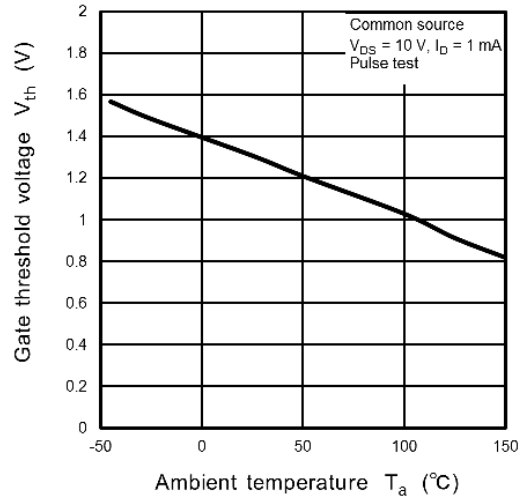
**Fig. 7.5  $R_{DS(ON)} - V_{GS}$**



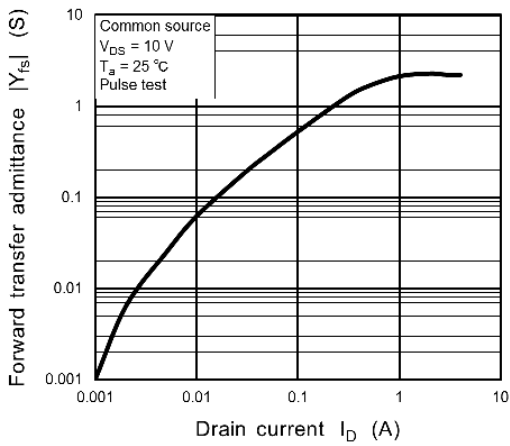
**Fig. 7.6  $R_{DS(ON)} - I_D$**



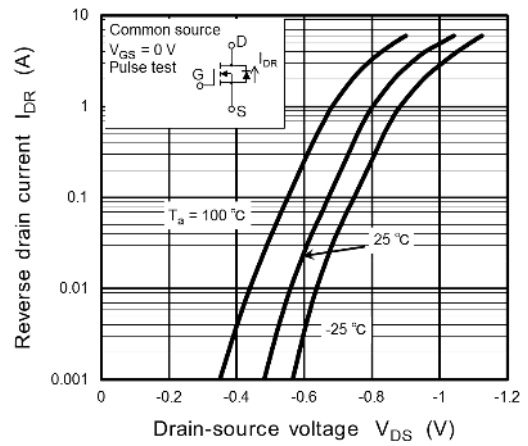
**Fig. 7.7  $R_{DS(ON)} - T_a$**



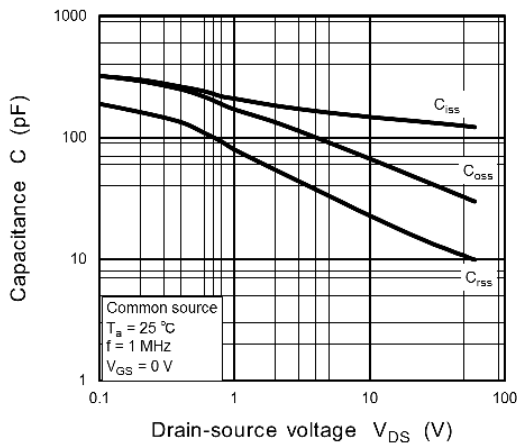
**Fig. 7.8  $V_{th} - T_a$**



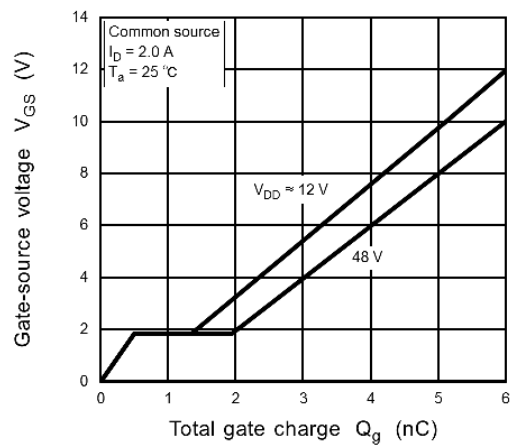
**Fig. 7.9  $|Y_{fs}| - I_D$**



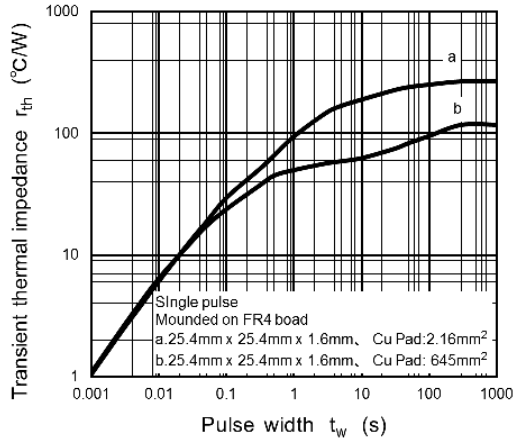
**Fig. 7.10  $I_{DR} - V_{DS}$**



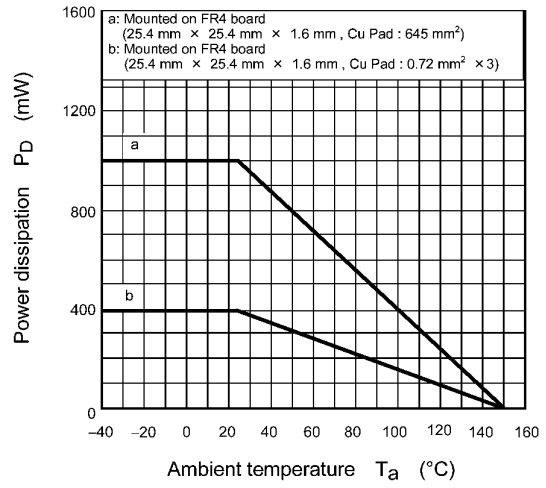
**Fig. 7.11 C -  $V_{DS}$**



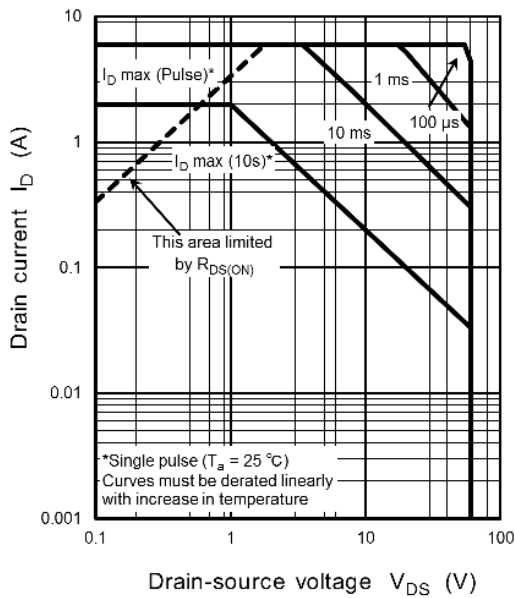
**Fig. 7.12 Dynamic Input Characteristics**



**Fig. 7.13**  $r_{th} - t_w$



**Fig. 7.14**  $P_D - T_a$

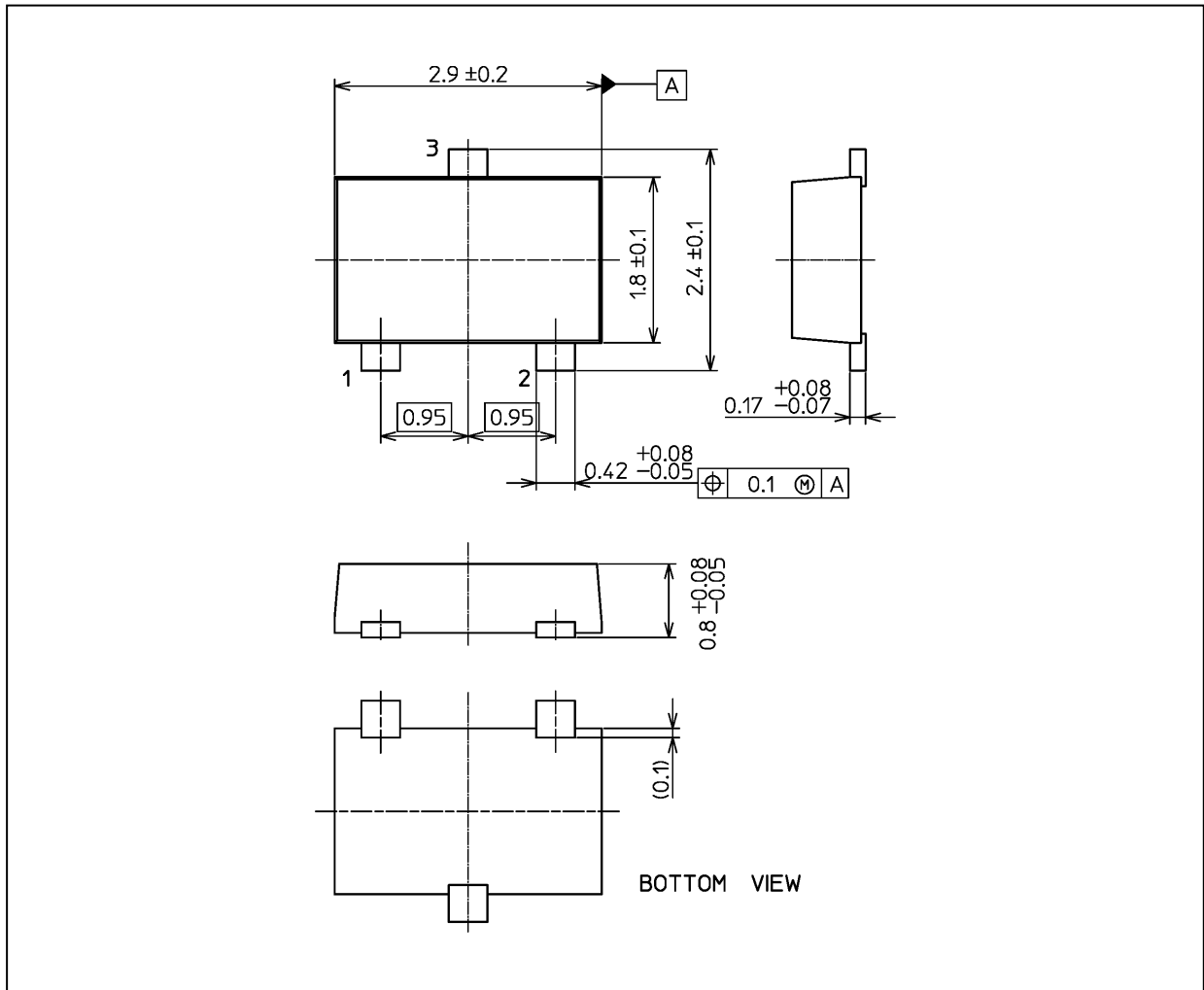


**Fig. 7.15** Safe Operating Area

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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