MOSFETs Silicon P-Channel MOS (U-MOSⅥ)

SSM3J351R

1. Applications

- Power Management Switches

2. Features

(1) 4 V drive

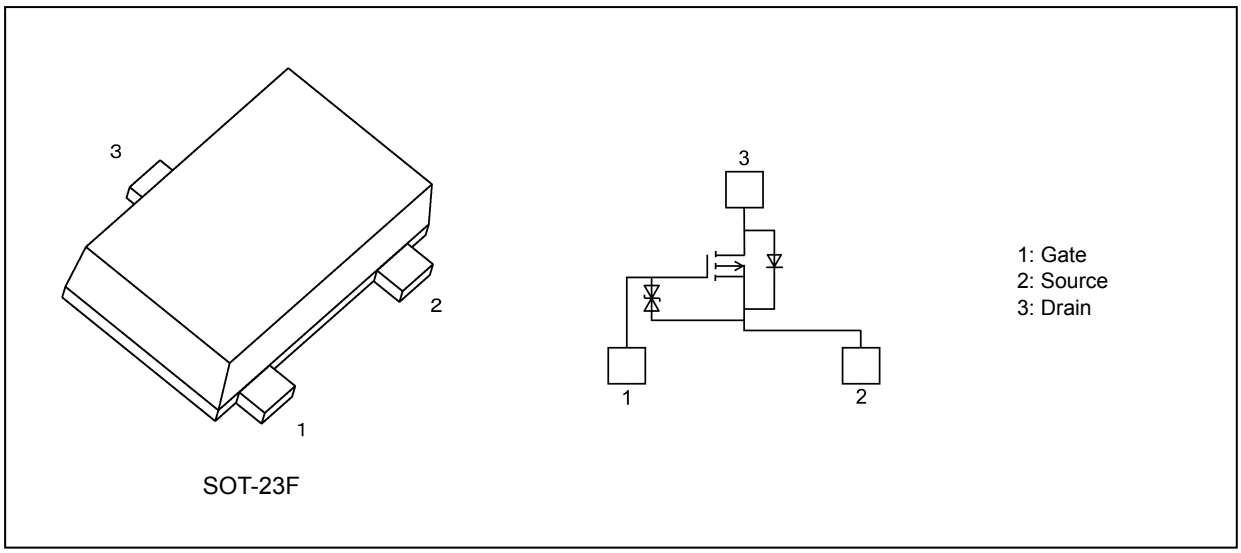
(2) Low drain-source on-resistance

: $R_{DS(ON)}$ = 107 mΩ (typ.) (V_{GS} = -10 V)

$R_{DS(ON)}$ = 122 mΩ (typ.) (V_{GS} = -4.5 V)

$R_{DS(ON)}$ = 129 mΩ (typ.) (V_{GS} = -4.0 V)

3. Packaging and Internal Circuit



Start of commercial production
2016-07

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4. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics			Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	-60	V
Gate-source voltage			V_{GSS}	-20/+10	
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	W
Power dissipation	(t ≤ 10 s)	(Note 3)	P_D	2	
Single-pulse avalanche energy		(Note 4)	E_{AS}	8.9	mJ
Avalanche current			I_{AR}	3.5	A
Channel temperature			T_{ch}	150	°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 °C.

Note 2: Pulse width (PW) ≤ 1 ms, duty ≤ 1 %

Note 3: Device mounted on a 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm^2)

Note 4: V_{DD} = 25 V, T_{ch} = 25 °C (Initial state), L = 1 mH, R_G = 25 Ω

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, $R_{th(ch\text{-}a)}$, 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)	$R_{th(ch\text{-}a)}$	125	°C/W

Note 1: Device mounted on an 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm^2)

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6. Electrical Characteristics

6.1. Static Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{DS} = 0 V, V_{GS} = -16 V/+10 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = -60 V, V_{GS} = 0 V	—	—	-10	
Drain-source breakdown voltage		$V_{(BR)DSS}$	I_D = -1 mA, V_{GS} = 0 V	-60	—	—	V
Drain-source breakdown voltage	(Note 1)	$V_{(BR)DSX}$	I_D = -1 mA, V_{GS} = 10 V	-50	—	—	
Gate threshold voltage		V_{th}	V_{DS} = -10 V, I_D = -1 mA	-0.8	—	-2.0	
Drain-source on-resistance	(Note 2)	$R_{DS(ON)}$	I_D = -1.0 A, V_{GS} = -4.0 V	—	129	184	mΩ
			I_D = -1.0 A, V_{GS} = -4.5 V	—	122	164	
			I_D = -1.0 A, V_{GS} = -10 V	—	107	134	
Forward transfer admittance	(Note 2)	$\|Y_{fs}\|$	V_{DS} = -10 V, I_D = -1.0 A	—	6.4	—	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: Pulse measurement.

6.2. Dynamic Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	—	660	—	pF
Reverse transfer capacitance	C_{rss}		—	50	—	
Output capacitance	C_{oss}		—	70	—	
Switching time (turn-on time)	t_{on}	V_{DD} = -30 V, I_D = -1.0 A, V_{GS} = 0 to -4.5 V, R_{GS} = 10 Ω, Duty ≤ 1 %, V_{IN}: t_r, t_f < 5 ns, Common source, See Chapter 6.3.	—	32	—	ns
Switching time (turn-off time)	t_{off}		—	100	—	

6.3. Switching Time Test Circuit

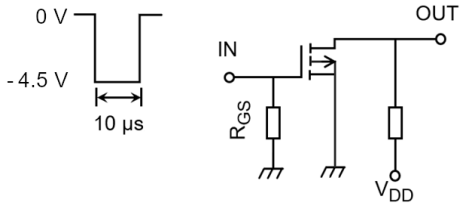

Fig. 6.3.1 Switching Time Test Circuit

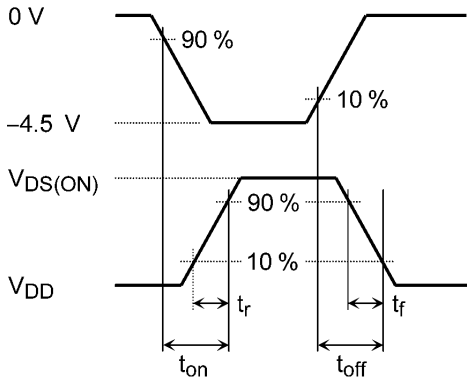

Fig. 6.3.2 Input Waveform/Output Waveform

6.4. Gate Charge Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	V_{DD} = -48 V, I_D = -3.5 A, V_{GS} = -10 V	—	15.1	—	nC
Gate-source charge 1	Q_{gs1}		—	0.6	—	
Gate-drain charge	Q_{gd}		—	3	—	

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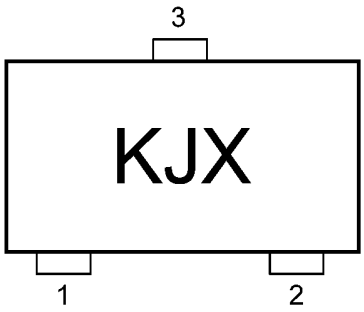
6.5. Source-Drain Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	V_{DSF}	I_{DR} = 3.5 A, V_{GS} = 0 V	—	0.85	1.2	V

Note 1: Pulse measurement.

7. Marking



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8. Characteristics Curves (Note)

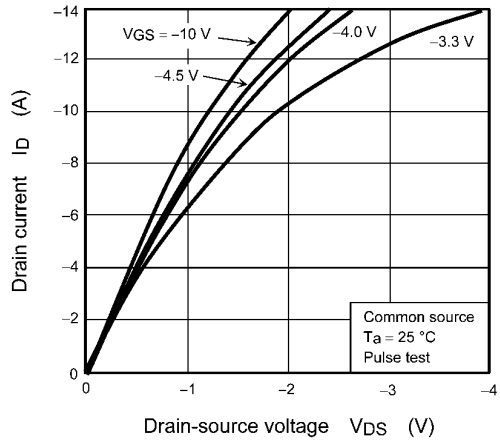

Fig. 8.1 I_D - V_{DS}

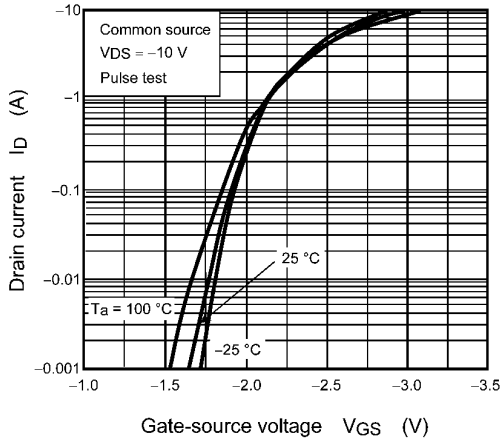

Fig. 8.2 I_D - V_{GS}

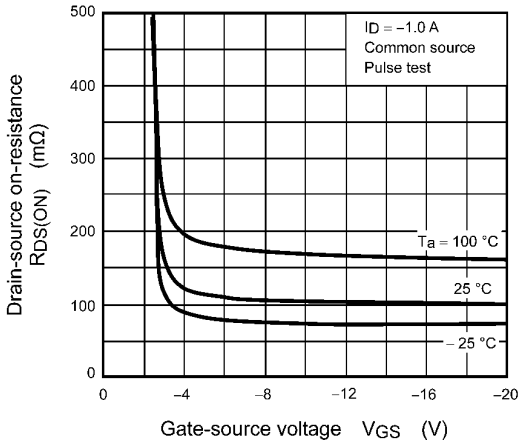

Fig. 8.3 $R_{DS(ON)}$ - V_{GS}

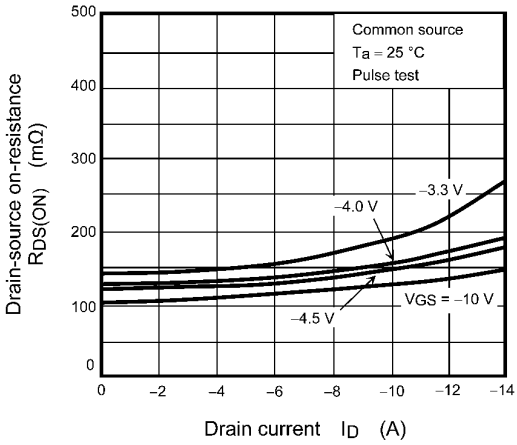

Fig. 8.4 $R_{DS(ON)}$ - I_D

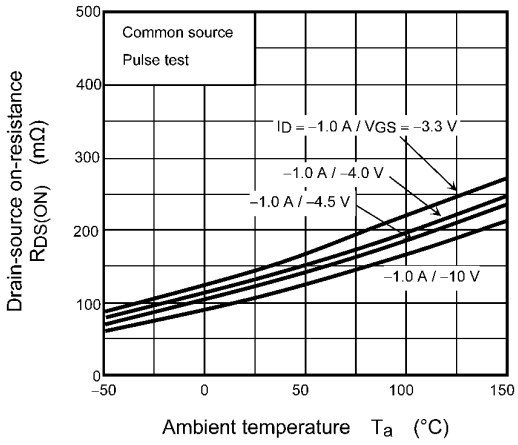

Fig. 8.5 $R_{DS(ON)}$ - T_a

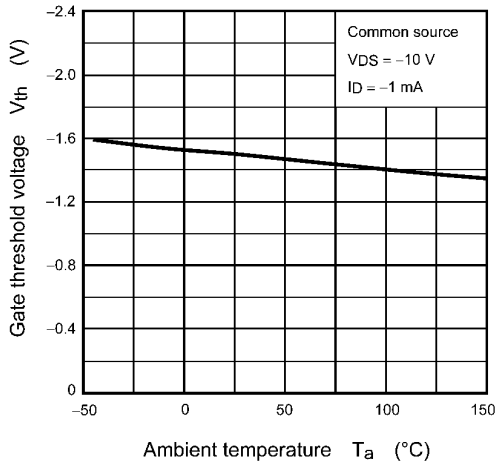

Fig. 8.6 V_{th} - T_a

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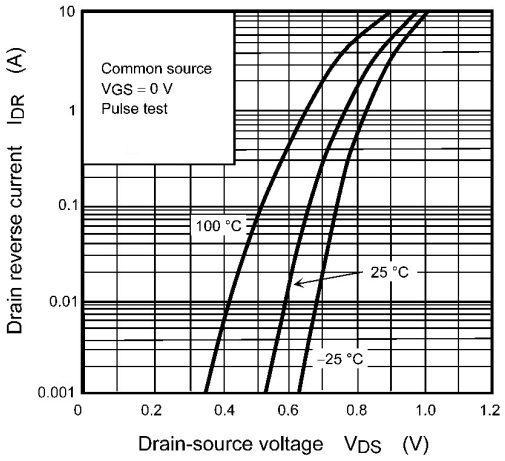

Fig. 8.7 I_{DR} - V_{DSF}

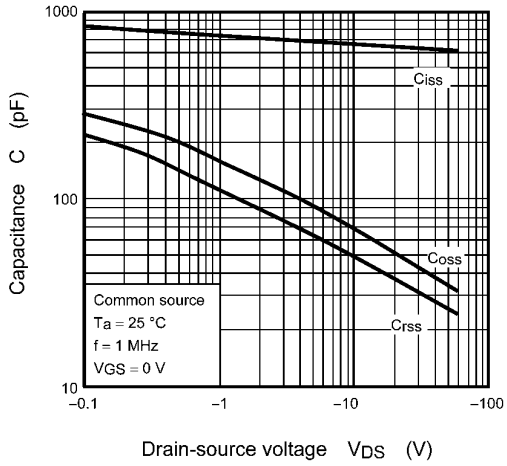

Fig. 8.8 C - V_{DS}

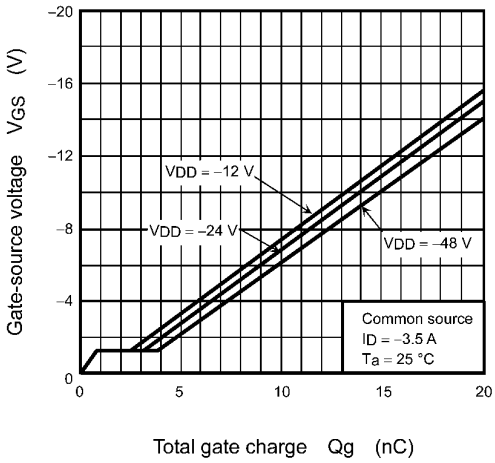

Fig. 8.9 Dynamic Input Characteristics

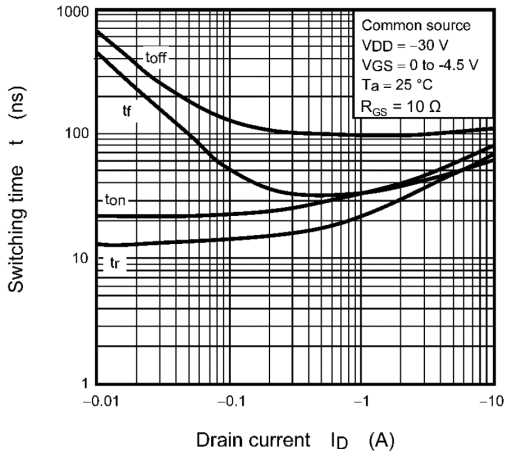

Fig. 8.10 t - I_D

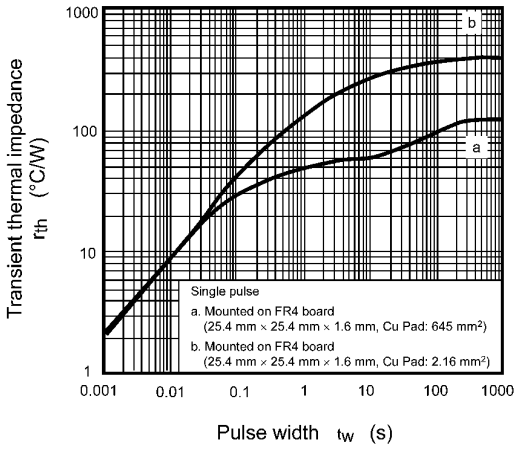

Fig. 8.11 r_{th} - t_w

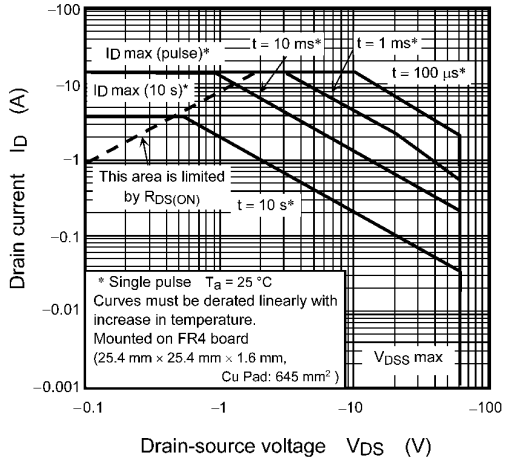

Fig. 8.12 Safe Operating Area

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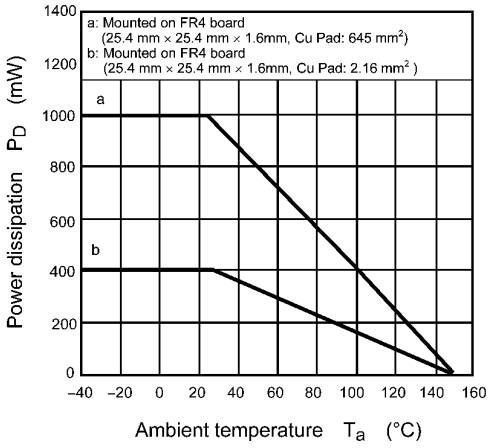
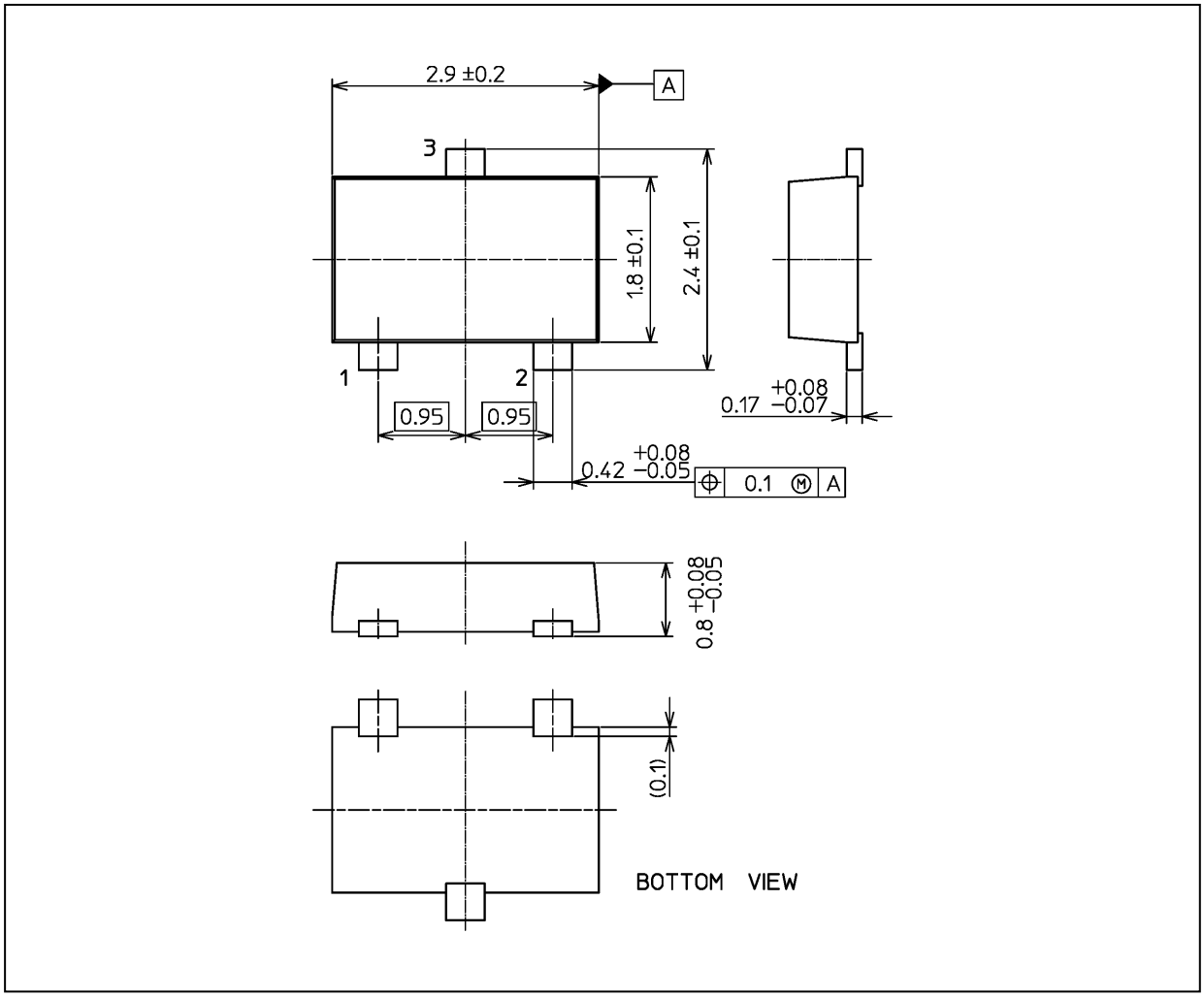


Fig. 8.13 P_D - T_a

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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