

# SSM3H137TU

## 1. Applications

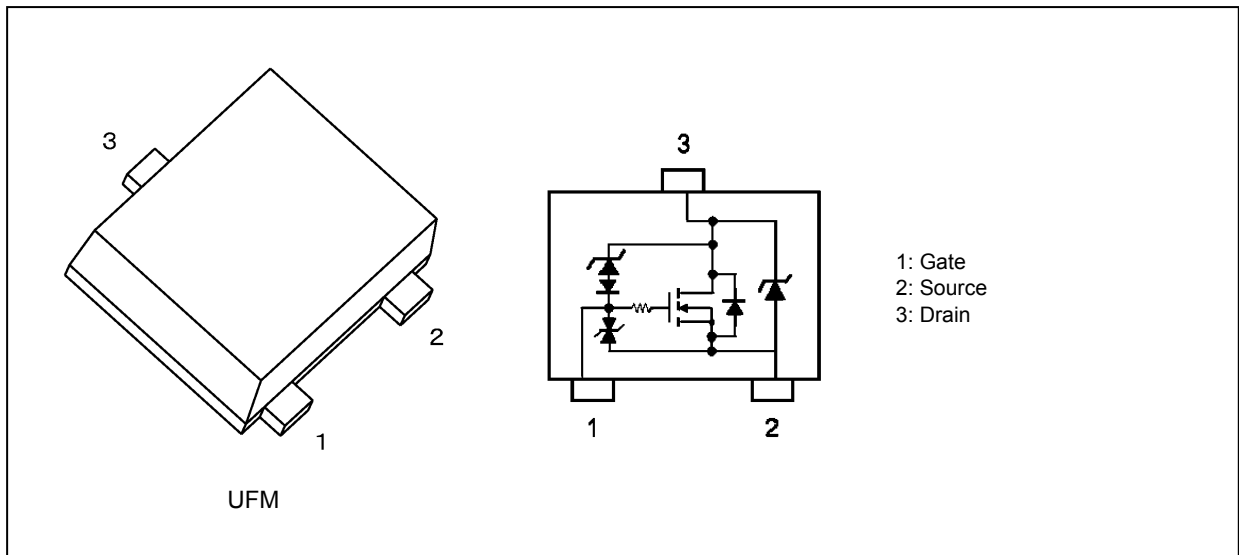
- Relay Drivers

## 2. Features

- (1) AEC-Q101 (Rev. D) qualified. (Note 1)
- (2) 4.0-V gate drive voltage.
- (3) Low drain-source on-resistance
  - :  $R_{DS(ON)} = 295 \text{ m}\Omega$  (max) (@ $V_{GS} = 4.0 \text{ V}$ ,  $I_D = 0.5 \text{ A}$ )
  - $R_{DS(ON)} = 280 \text{ m}\Omega$  (max) (@ $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )
  - $R_{DS(ON)} = 240 \text{ m}\Omega$  (max) (@ $V_{GS} = 10 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )

Note 1: For detail information, Please contact to our sales.

## 3. Packaging and Pin Assignment



Start of commercial production

2016-03

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	34	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)	$P_D$	800	mW
Power dissipation (t = 1 s) (Note 3)		1000	
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Single-pulse avalanche energy (Note 4)	$E_{AS}$	3.5	mJ
Avalanche current	$I_{AR}$	2.0	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  $150\text{ }^\circ\text{C}$ .

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

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

Note 4:  $V_{DD} = 25\text{ V}$ , Starting  $T_{ch} = 25\text{ }^\circ\text{C}$ , L = 0.5 mH

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 1\text{ mA}$ , $V_{GS} = 0\text{ V}$	34	—	37	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = 30.4\text{ V}$ , $V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}$ , $V_{DS} = 0\text{ V}$	—	—	$\pm 10$	
Gate threshold voltage (Note 1)	$V_{th}$	$V_{DS} = 10\text{ V}$ , $I_D = 1\text{ mA}$	0.7	—	1.7	V
Drain-source on-resistance (Note 2)	$R_{DS(ON)}$	$V_{GS} = 4.0\text{ V}$ , $I_D = 0.5\text{ A}$	—	230	295	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 1.0\text{ A}$	—	220	280	
		$V_{GS} = 10\text{ V}$ , $I_D = 1.0\text{ A}$	—	200	240	
Forward transfer admittance (Note 2)	$ Y_{fs} $	$V_{DS} = 10\text{ V}$ , $I_D = 0.5\text{ A}$	—	2.2	—	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	$C_{iss}$	$V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$	—	119	—	pF
Reverse transfer capacitance	$C_{rss}$		—	8	—	
Output capacitance	$C_{oss}$		—	40	—	
Switching time (turn-on time)	$t_{on}$	$V_{DD} = 20\text{ V}$ , $I_D = 0.5\text{ A}$ , $V_{GS} = 0\text{ to } 4.5\text{ V}$ , $R_G = 10\text{ }\Omega$ Duty $\leq 1\%$ , $V_{IN}$ : $t_r$ , $t_f < 5\text{ ns}$ , Common source, See Chapter 5.3.	—	320	—	ns
Switching time (turn-off time)	$t_{off}$		—	800	—	

**5.3. Switching Time Test Circuit**

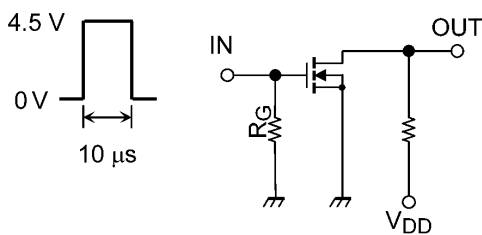


Fig. 5.3.1 Switching Time Test Circuit

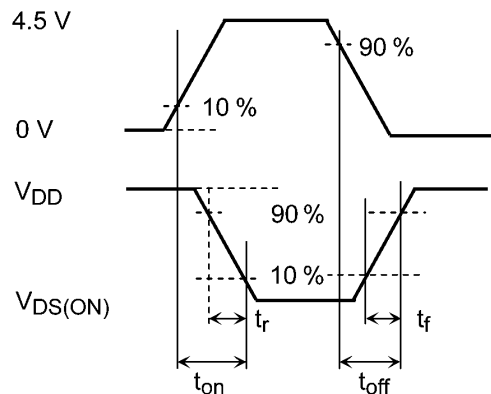


Fig. 5.3.2 Input Waveform/Output Waveform

**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)	$Q_g$	$V_{DD} = 20\text{ V}$ , $I_D = 1.0\text{ A}$ , $V_{GS} = 10\text{ V}$	—	3.0	—	nC
Gate-source charge 1	$Q_{gs1}$		—	0.8	—	
Gate-drain charge	$Q_{gd}$		—	0.4	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	$V_{DSF}$	$I_D = -2.0\text{ A}, V_{GS} = 0\text{ V}$	—	-0.82	-1.2	V

Note 1: Pulse measurement.

**6. Marking**

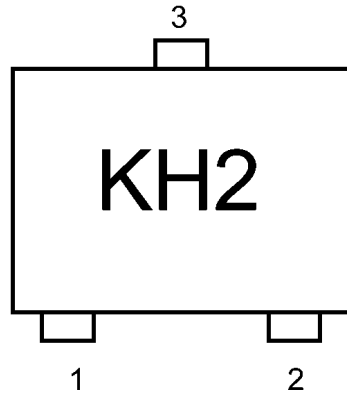
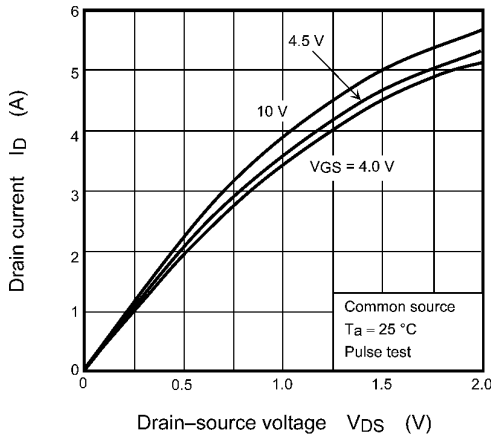
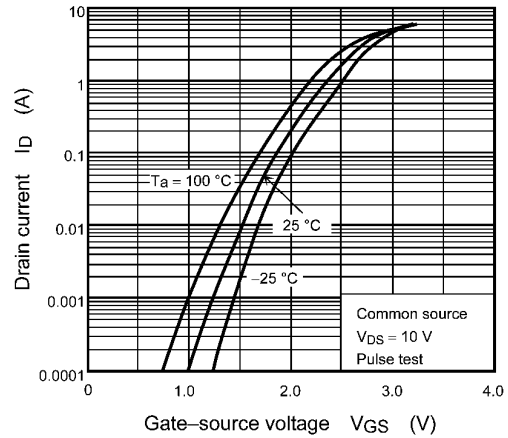


Fig. 6.1 Marking

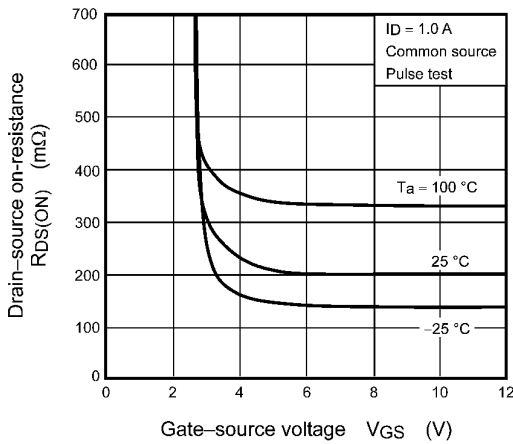
**7. Characteristics Curves (Note)**



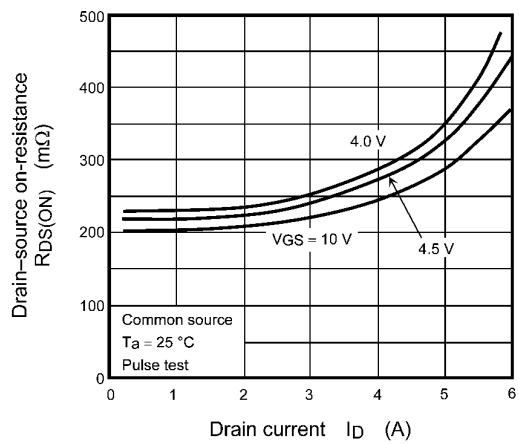
**Fig. 7.1  $I_D - V_{DS}$**



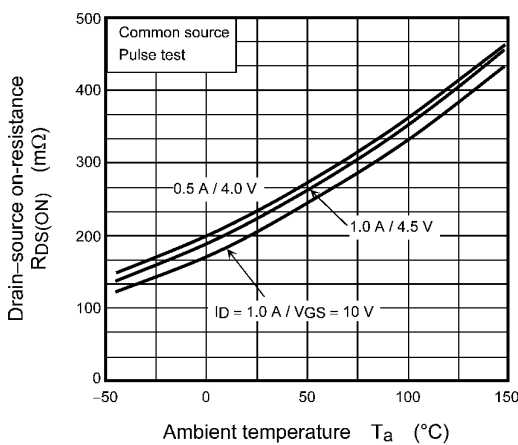
**Fig. 7.2  $I_D - V_{GS}$**



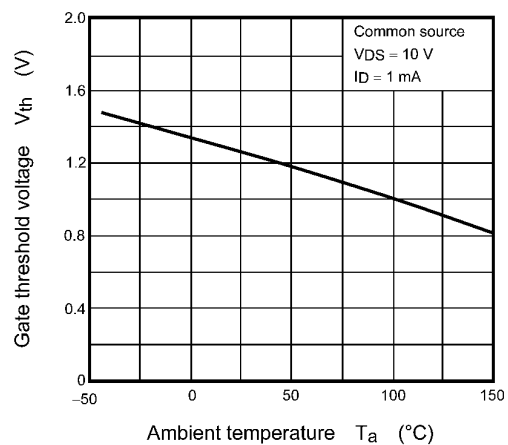
**Fig. 7.3  $R_{DS(ON)} - V_{GS}$**



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



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



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

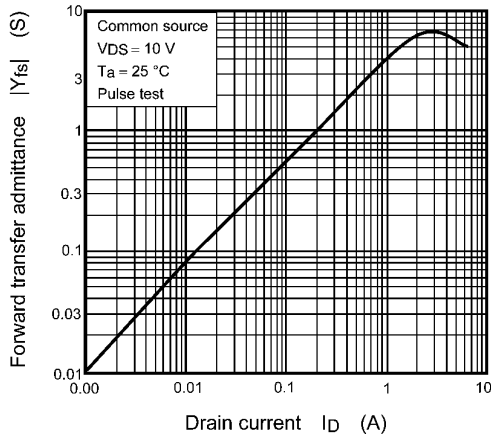


Fig. 7.7  $|Y_{fs}| - I_D$

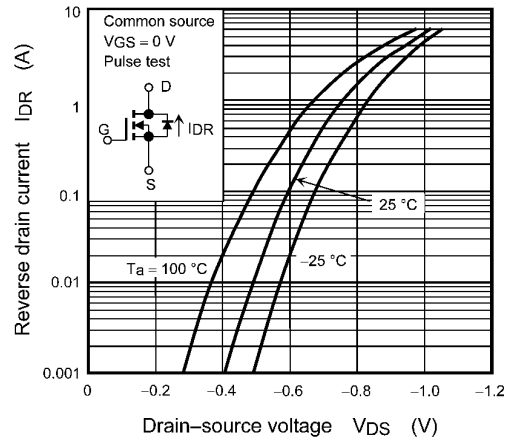


Fig. 7.8  $I_{DR} - V_{DS}$

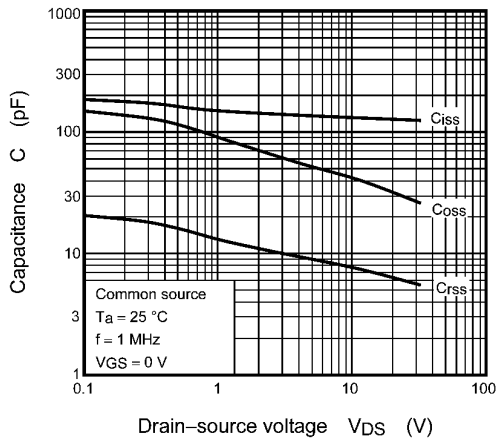


Fig. 7.9  $C - V_{DS}$

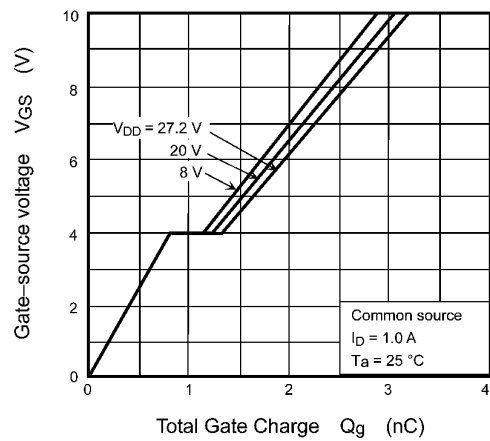


Fig. 7.10 Dynamic Input Characteristics

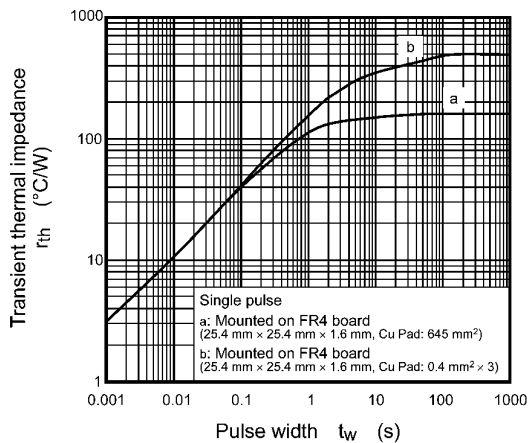


Fig. 7.11  $r_{th} - t_w$  (MOSFET)

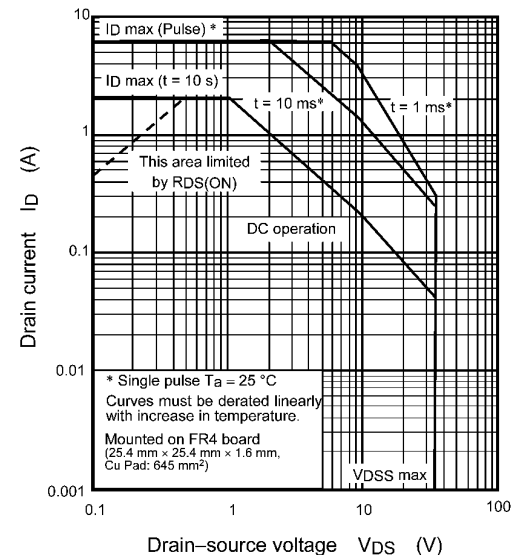
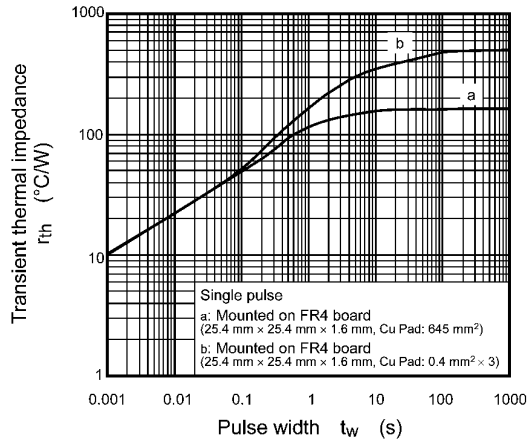
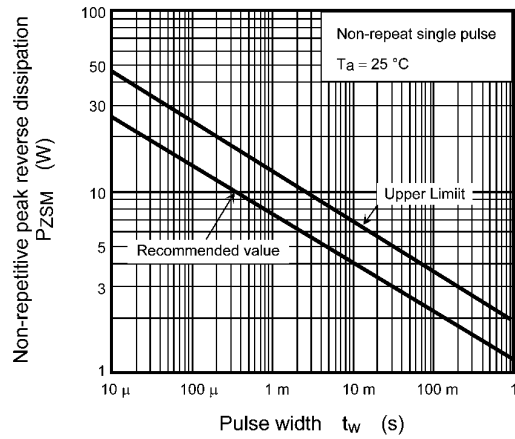


Fig. 7.12 Safe Operating Area



**Fig. 7.13  $r_{th} - t_w$  (Zener)**

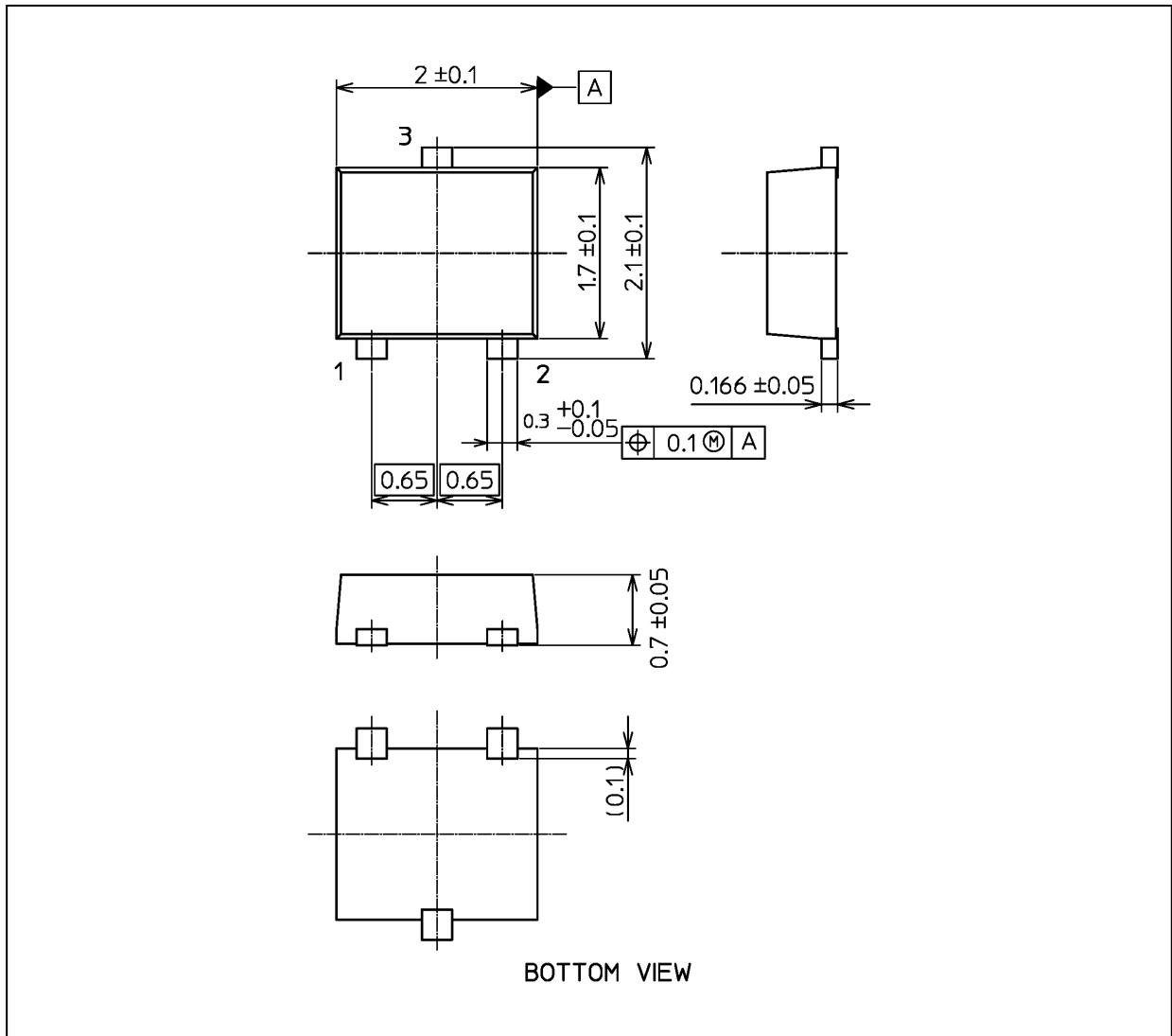


**Fig. 7.14  $P_{zsm} - t$**

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

Package Dimensions

Unit: mm



Weight: 6.6 mg (typ.)

Package Name(s)
Nickname: UFM



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