

MOSFETs Silicon N-Channel MOS

# SSM3K72CTC

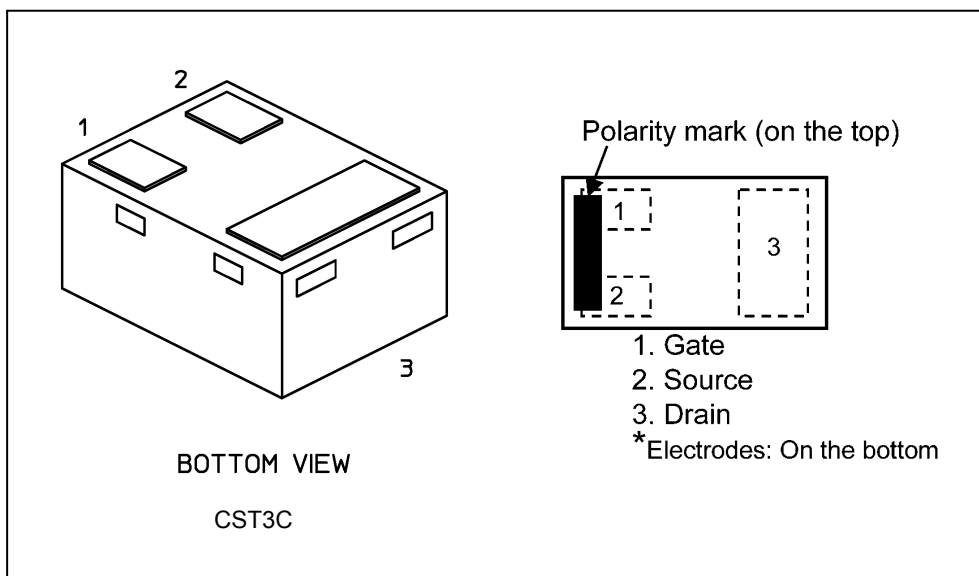
## 1. Applications

- High-Speed Switching

## 2. Features

- (1) ESD protected gate
- (2) Low drain-source on-resistance
  - :  $R_{DS(ON)} = 2.8 \Omega$  (typ.) (@ $V_{GS} = 10 V$ )
  - $R_{DS(ON)} = 3.1 \Omega$  (typ.) (@ $V_{GS} = 5.0 V$ )
  - $R_{DS(ON)} = 3.2 \Omega$  (typ.) (@ $V_{GS} = 4.5 V$ )

## 3. Packaging and Pin Assignment



Start of commercial production  
2015-01

### 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)	$I_D$	150	mA
Drain current (pulsed) (Note 1), (Note 2)	$I_{DP}$	600	
Power dissipation (Note 3)	$P_D$	500	mW
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
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  $150\text{ }^\circ\text{C}$ .

Note 2: Repetitive rating; pulse width limited by maximum channel temperature.  
pulse width  $\leq 10\text{ }\mu\text{s}$ , Duty  $\leq 1\%$

Note 3: Device mounted on a  $25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$  FR-4 glass epoxy board (Cu pad:  $645\text{ mm}^2$ )

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.

### 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	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 2$	$\mu\text{A}$
		$V_{GS} = \pm 10\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 0.5$	
		$V_{GS} = \pm 5\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 0.1$	
Drain cut-off current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	1	$\mu\text{A}$
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_{ch} = 150\text{ }^\circ\text{C}$	—	—	200	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	60	—	—	V
Gate threshold voltage	$V_{th}$	$I_D = 250\text{ }\mu\text{A}, V_{DS} = V_{GS}$	1.1	—	2.1	
Drain-source on-resistance (Note 1)	$R_{DS(ON)}$	$I_D = 100\text{ mA}, V_{GS} = 10\text{ V}$	—	2.8	3.9	$\Omega$
		$I_D = 100\text{ mA}, V_{GS} = 10\text{ V}, T_{ch} = 150\text{ }^\circ\text{C}$	—	5.4	8.1	
		$I_D = 100\text{ mA}, V_{GS} = 5.0\text{ V}$	—	3.1	4.4	
		$I_D = 100\text{ mA}, V_{GS} = 4.5\text{ V}$	—	3.2	4.7	
		$I_D = 5\text{ mA}, V_{GS} = 2.5\text{ V}$	—	5.7	—	
Forward transfer admittance (Note 1)	$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	—	450	—	mS

Note 1: 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	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	11	17	$\text{pF}$
Reverse transfer capacitance	$C_{rss}$		—	0.7	—	
Output capacitance	$C_{oss}$		—	3	—	
Switching time (rise time)	$t_r$	$V_{DD} = 40\text{ V}, I_D = 160\text{ mA}, V_{GS} = 0\text{ to }10\text{ V}, R_G = 50\text{ }\Omega, \text{Duty} \leq 1\%, V_{IN}: t_r, t_f < 5\text{ ns}, \text{Common source, See Chapter 5.3.}$	—	3	—	ns
Switching time (turn-on delay time)	$t_{d(on)}$		—	2	4	
Switching time (fall time)	$t_f$		—	24	—	
Switching time (turn-off delay time)	$t_{d(off)}$		—	7	14	

#### 5.3. Switching Time Test Circuit

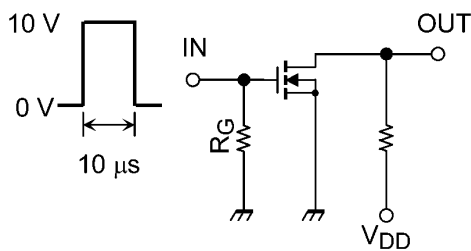


Fig. 5.3.1 Switching Time Test Circuit

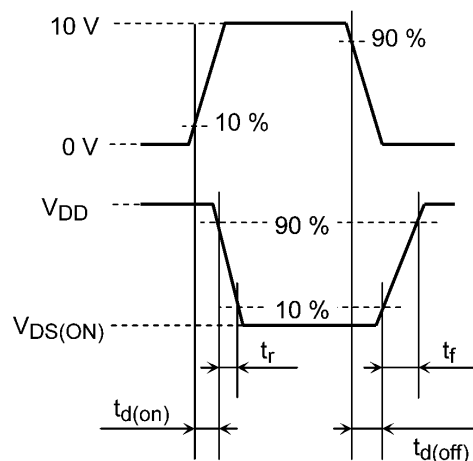


Fig. 5.3.2 Input Waveform/Output Waveform

### 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)	$Q_g$	$V_{DD} = 30\text{ V}, V_{GS} = 4.5\text{ V},$ $I_D = 200\text{ mA}$	—	0.27	0.35	nC
Gate-source charge	$Q_{gs}$		—	0.08	—	
Gate-drain charge	$Q_{gd}$		—	0.08	—	

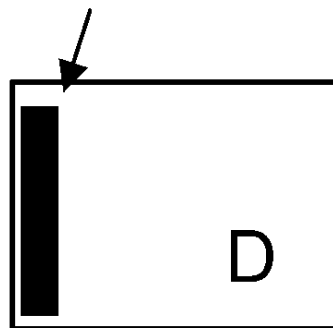
### 5.5. Source-Drain Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	$V_{DSF}$	$I_D = -115\text{ mA}, V_{GS} = 0\text{ V}$	—	0.87	-1.2	V

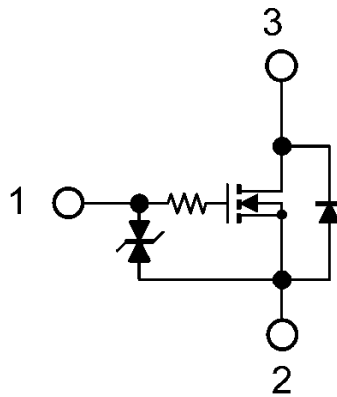
Note 1: Pulse measurement.

## 6. Marking

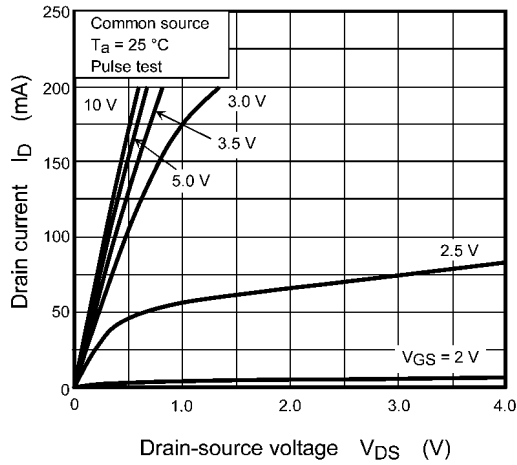
Polarity mark



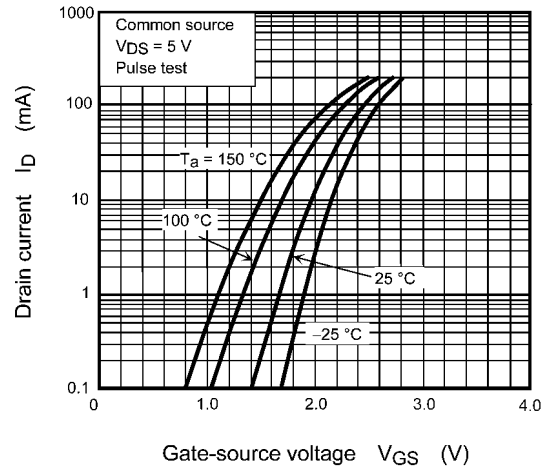
## 7. Equivalent Circuit



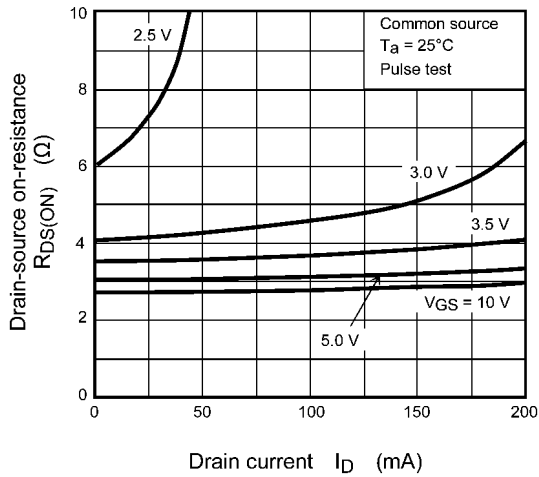
### 8. Characteristics Curves (Note)



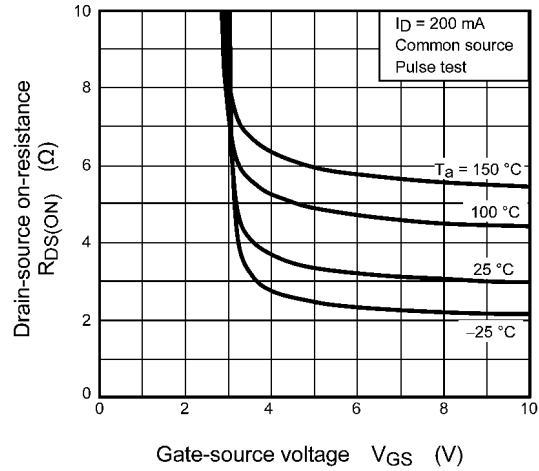
**Fig. 8.1**  $I_D - V_{DS}$



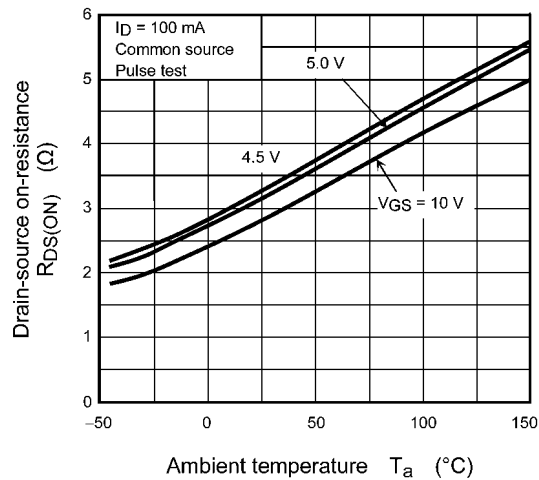
**Fig. 8.2**  $I_D - V_{GS}$



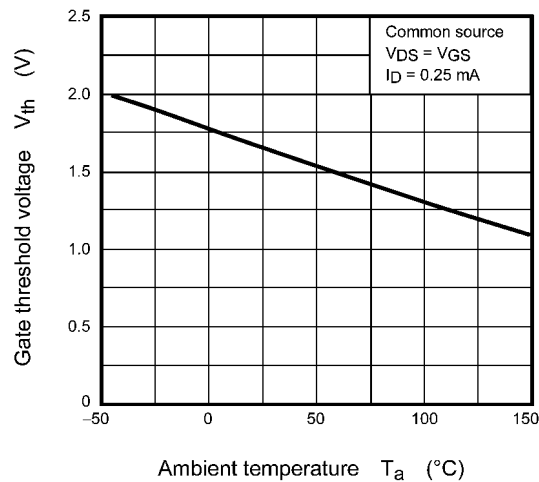
**Fig. 8.3**  $R_{DS(ON)} - I_D$



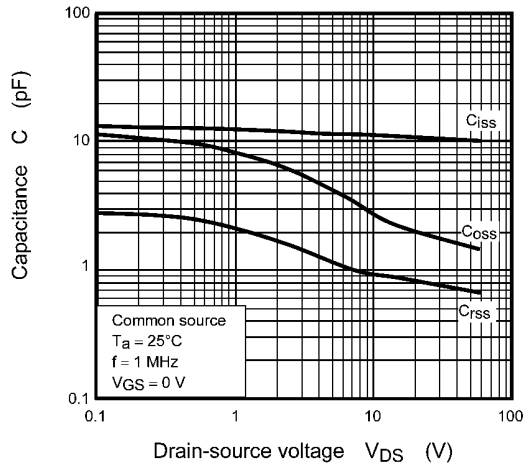
**Fig. 8.4**  $R_{DS(ON)} - V_{GS}$



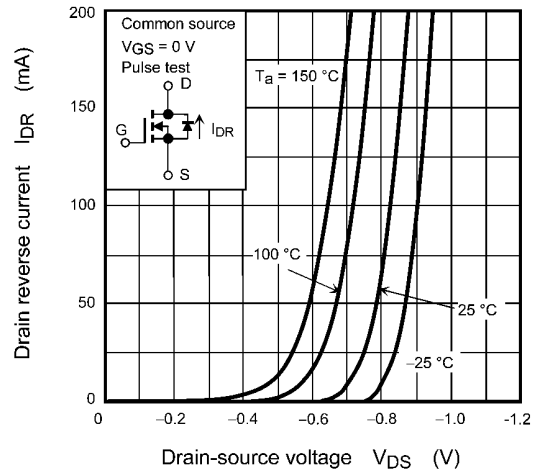
**Fig. 8.5**  $R_{DS(ON)} - T_a$



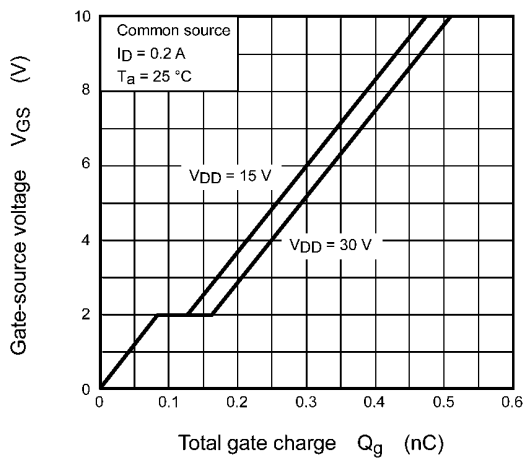
**Fig. 8.6**  $V_{th} - T_a$



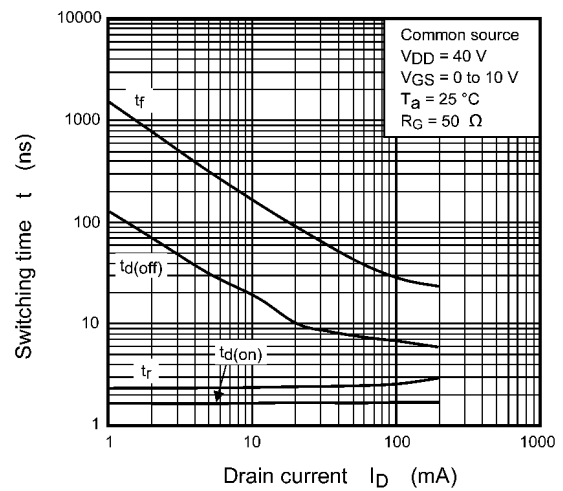
**Fig. 8.7 C -  $V_{DS}$**



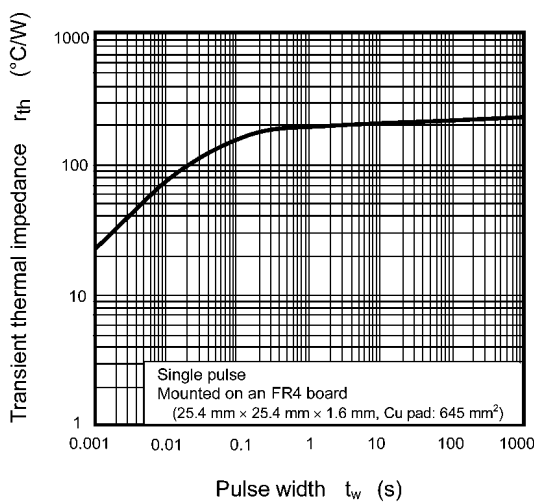
**Fig. 8.8  $I_{DR} - V_{DS}$**



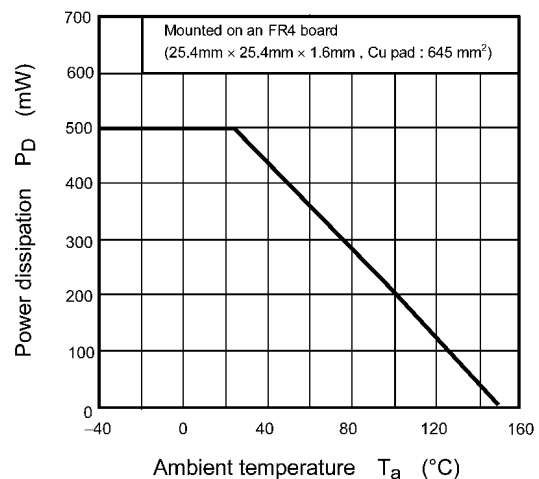
**Fig. 8.9 Dynamic Input Characteristics**



**Fig. 8.10  $t - I_D$**



**Fig. 8.11  $r_{th} - t_w$**

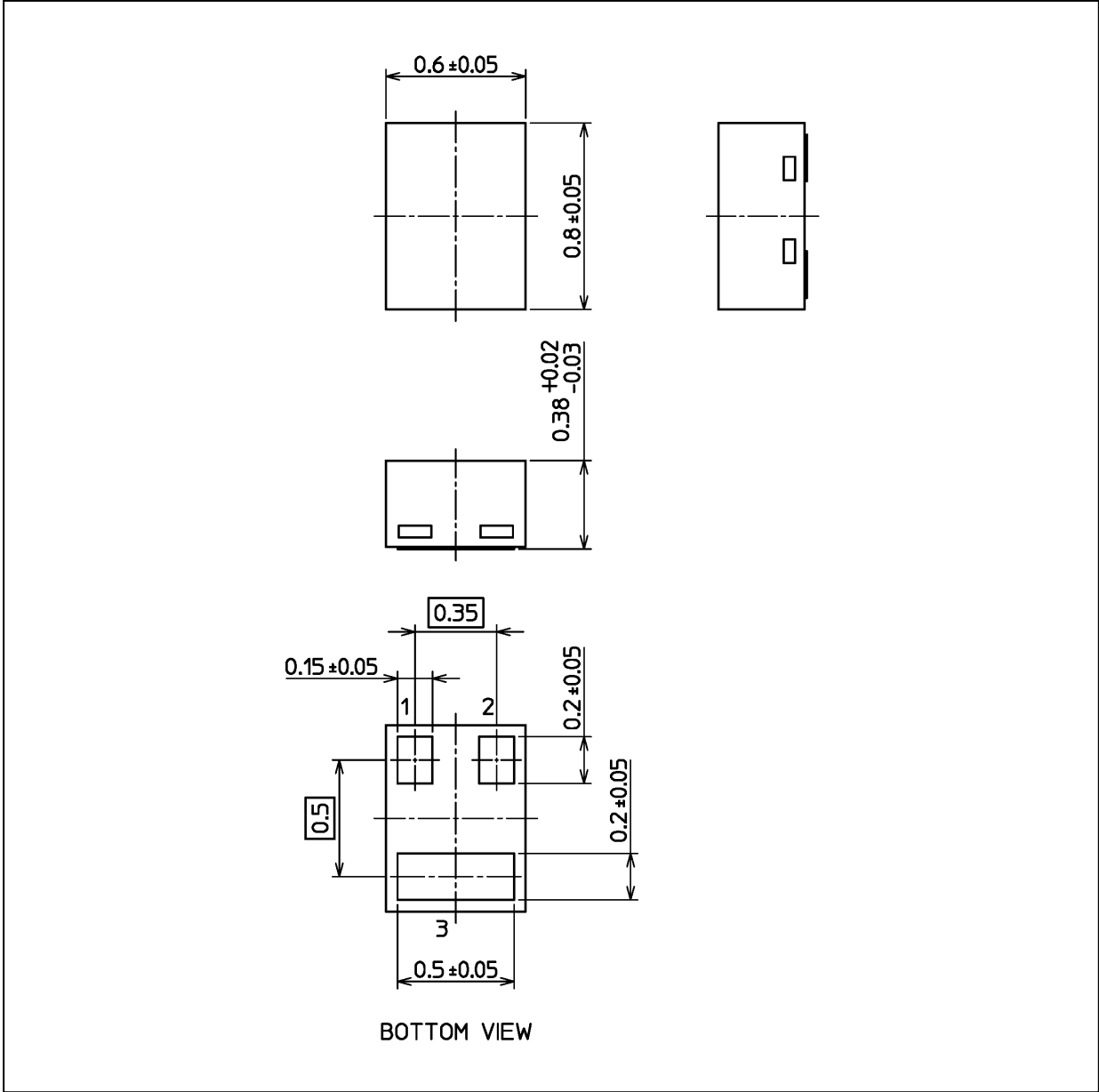


**Fig. 8.12  $P_D - T_a$**

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

Package Dimensions

Unit: mm



Weight: 0.55 mg (typ.)

Package Name(s)
Nickname: CST3C

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