

TC7WB66CFK,TC7WB66CL8X TC7WB67CFK,TC7WB67CL8X

1. Functional Description

- Dual SPST Bus Switch

2. General

The TC7WB66CFK/L8X and TC7WB67CFK/L8X are low ON-resistance, high-speed CMOS 2-bit bus switches. These bus switches allow connections or disconnections to be made with minimal propagation delay while maintaining Low power dissipation which is the feature of CMOS.

TC7WB66CFK/L8X requires the output enable (OE) input to be set low to place the output into the high impedance state, whereas the TC7WB67CFK/L8X requires the output enable ($\overline{\text{OE}}$) input to be set high to place the output into the high impedance.

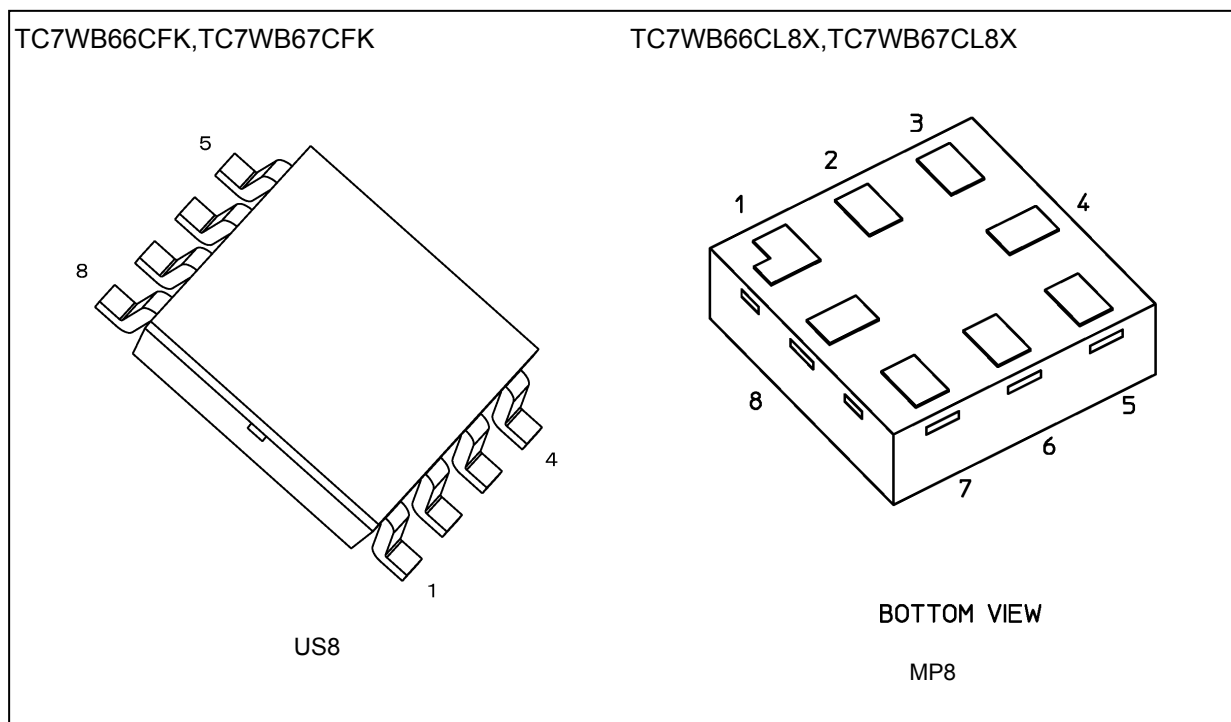
These Bus switches consist of P-MOS and N-MOS structure, meaning these devices are suitable for analog signal transmission.

All inputs are equipped with protector circuits to protect the device from static discharge.

3. Features

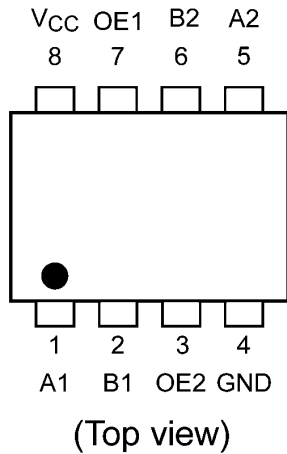
- (1) Operating voltage: $V_{CC} = 1.65$ to 5.5 V
- (2) ON capacitance: $C_{IO} = 10$ pF Switch On (typ.) @ $V_{CC} = 5.0$ V
- (3) ON resistance: $R_{ON} = 4 \Omega$ (typ.) @ $V_{CC} = 4.5$ V, $V_{IS} = 0$ V
- (4) ESD performance: Machine model $\geq \pm 200$ V, Human body model $\geq \pm 2000$ V
- (5) Package: US8, MP8

4. Packaging

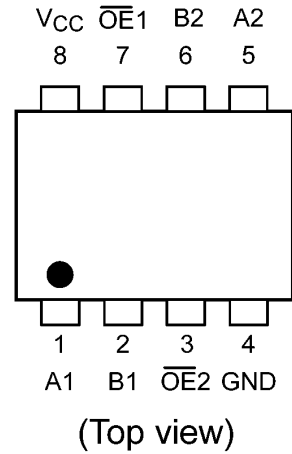


5. Pin Assignment

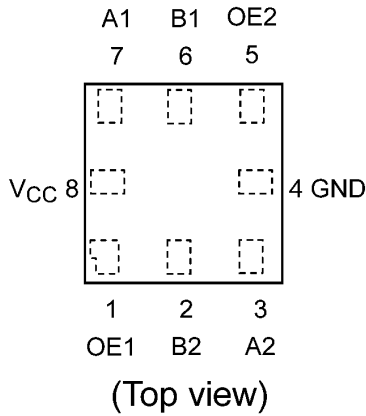
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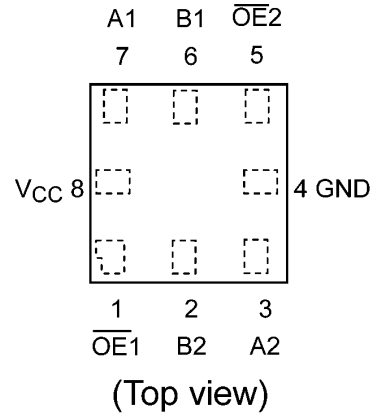
TC7WB67CFK



TC7WB66CL8X

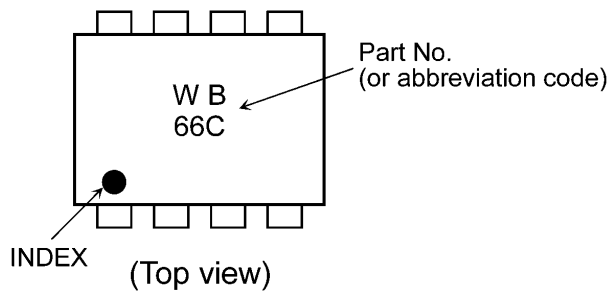


TC7WB67CL8X

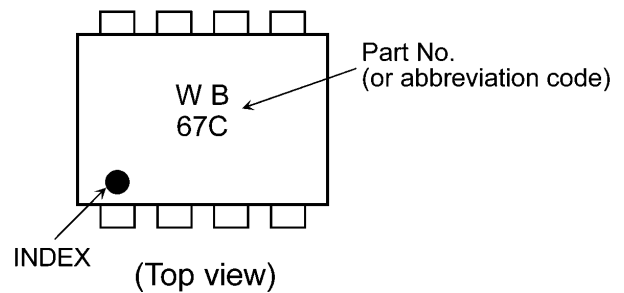


6. Marking

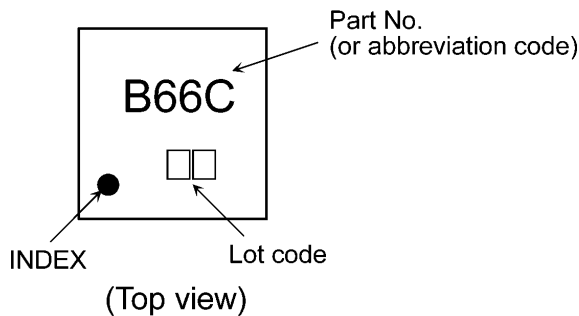
TC7WB66CFK



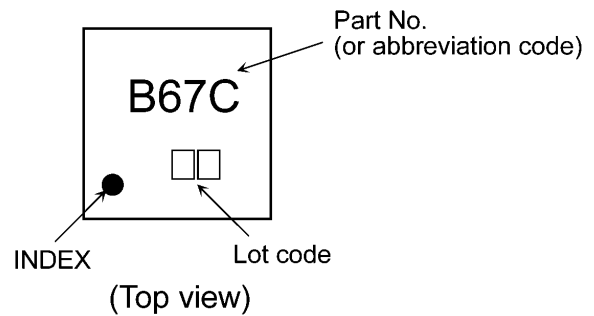
TC7WB67CFK



TC7WB66CL8X

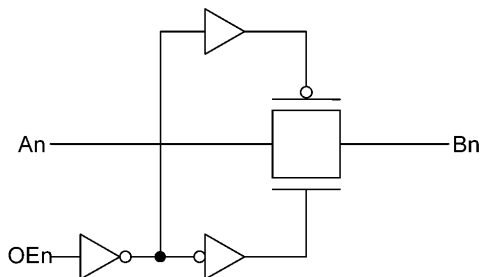


TC7WB67CL8X

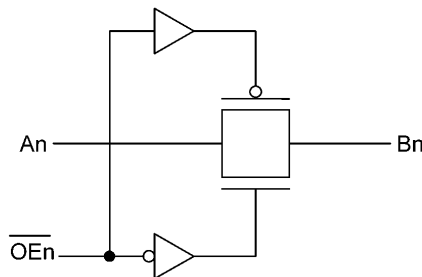


7. Block Diagram

TC7WB66CFK, TC7WB66CL8X



TC7WB67CFK, TC7WB67CL8X



8. Principle of Operation

8.1. Truth Table

Inputs OE (TC7WB66CFK/L8X)	Inputs \overline{OE} (TC7WB67CFK/L8X)	Function
H	L	A port = B port
L	H	Disconnect

9. Absolute Maximum Ratings (Note)

Characteristics	Part Number	Symbol	Note	Rating	Unit
Supply voltage		V_{CC}		-0.5 to 7.0	V
Input voltage (OE, \overline{OE})		V_{IN}		-0.5 to 7.0	
Switch I/O voltage		V_S		-0.5 to $V_{CC} + 0.5$	
Clamp diode current		I_{IK}		-50	mA
Switch I/O current		I_S		50	
Power dissipation	TC7WB66CFK, TC7WB67CFK	P_D		200	mW
	TC7WB66CL8X, TC7WB67CL8X		(Note 1)	300	
V_{CC} /ground current		I_{CC}/I_{GND}		± 100	mA
Storage temperature		T_{stg}		-65 to 150	$^{\circ}C$

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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 and the operating ranges.

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: Mounted on an FR4 board

10. Operating Ranges (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		1.65 to 5.5	V
Input voltage (OE, \overline{OE})	V_{IN}		0 to 5.5	
Switch I/O voltage	V_S		0 to V_{CC}	
Operating temperature	T_{opr}		-40 to 85	$^{\circ}C$
Input rise time	dt/dv		0 to 10	ns/V
Input fall time	dt/dv		0 to 10	

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused control inputs must be tied to either V_{CC} or GND.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, $T_a = -40$ to 85 °C)

Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage (OE, \overline{OE})		V_{IH}		—	1.65 to 1.95	$0.8 \times V_{CC}$	—	—	V
					2.3 to 5.5	$0.7 \times V_{CC}$	—	—	
Low-level input voltage (OE, \overline{OE})		V_{IL}		—	1.65 to 1.95	—	—	$0.2 \times V_{CC}$	V
					2.3 to 5.5	—	—	$0.3 \times V_{CC}$	
Input leakage current (OE, \overline{OE})		I_{IN}		$V_{IN} = 0$ to 5.5 V	1.65 to 5.5	—	—	± 1.0	μA
Switch OFF-state leakage current	TC7WB66-CFK/L8X	I_{SZ}		A, B = 0 to V_{CC} , OE = GND	1.65 to 5.5	—	—	± 10	μA
	TC7WB67-CFK/L8X			A, B = 0 to V_{CC} , $\overline{OE} = V_{CC}$	1.65 to 5.5	—	—	± 10	
ON-resistance		R_{ON}	(Note 1), (Note 2)	$V_{IS} = 0$ V, $I_{IS} = 30$ mA	4.5	—	4	7	Ω
				$V_{IS} = 2.4$ V, $I_{IS} = 30$ mA	4.5	—	5	12	
				$V_{IS} = 4.5$ V, $I_{IS} = 30$ mA	4.5	—	6	10	
				$V_{IS} = 0$ V, $I_{IS} = 24$ mA	3.0	—	5	9	
				$V_{IS} = 3.0$ V, $I_{IS} = 24$ mA	3.0	—	7	14	
				$V_{IS} = 0$ V, $I_{IS} = 8$ mA	2.3	—	6	12	
				$V_{IS} = 2.3$ V, $I_{IS} = 8$ mA	2.3	—	9	18	
				$V_{IS} = 0$ V, $I_{IS} = 4$ mA	1.65	—	8	20	
				$V_{IS} = 1.65$ V, $I_{IS} = 4$ mA	1.65	—	15	30	
				Quiescent supply current		I_{CC}		$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$ A	
ΔI_{CC}		$V_{IN} = V_{CC} - 0.6$ V	5.5			—	—	50	

Note 1: All typical values are at $T_a = 25$ °C.

Note 2: Measured by the voltage drop between A and B pins at the indicated current through the switch. On-resistance is determined by the lower of the voltages on the two (A or B) pins.

11.2. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 85 °C)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Max	Unit
3-state output enable time	t_{PZL}/t_{PZH}		See Fig. 11.2.1, 11.2.2, Table 11.2.1	5.0 ± 0.5	—	4	ns
				3.3 ± 0.3	—	6	
				2.5 ± 0.2	—	9	
				1.8 ± 0.15	—	18	
3-state output disable time	t_{PLZ}/t_{PHZ}		See Fig. 11.2.1, 11.2.2, Table 11.2.1	5.0 ± 0.5	—	4.5	ns
				3.3 ± 0.3	—	7	
				2.5 ± 0.2	—	9	
				1.8 ± 0.15	—	18	

11.3. Capacitive Characteristics (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	Typ.	Unit
Input capacitance (OE, $\overline{\text{OE}}$)		C_{IN}		$V_{IN} = 0\text{ V}$	5.0	4	pF
Switch terminal OFF-capacitance	TC7WB66CFK/L8X	$C_{I/O}$		OE = GND, $V_{I/O} = 0\text{ V}$	5.0	5	
	TC7WB67CFK/L8X			$\overline{\text{OE}} = V_{CC}$, $V_{I/O} = 0\text{ V}$	5.0	5	
Switch terminal ON-capacitance	TC7WB66CFK/L8X	$C_{I/O}$		OE = V_{CC} , $V_{I/O} = 0\text{ V}$	5.0	10	
	TC7WB67CFK/L8X			$\overline{\text{OE}} = \text{GND}$, $V_{I/O} = 0\text{ V}$	5.0	10	

Note: Parameter guaranteed by design.

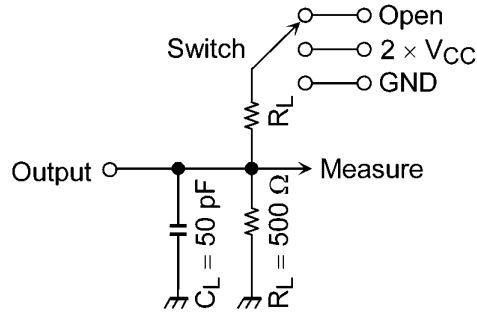


Fig. 11.2.1 AC Test Circuit

Table 11.2.1 Parameter for AC Test Circuit

Parameter	Switch
t_{PLZ} , t_{PZL}	$2 \times V_{CC}$
t_{PHZ} , t_{PZH}	GND

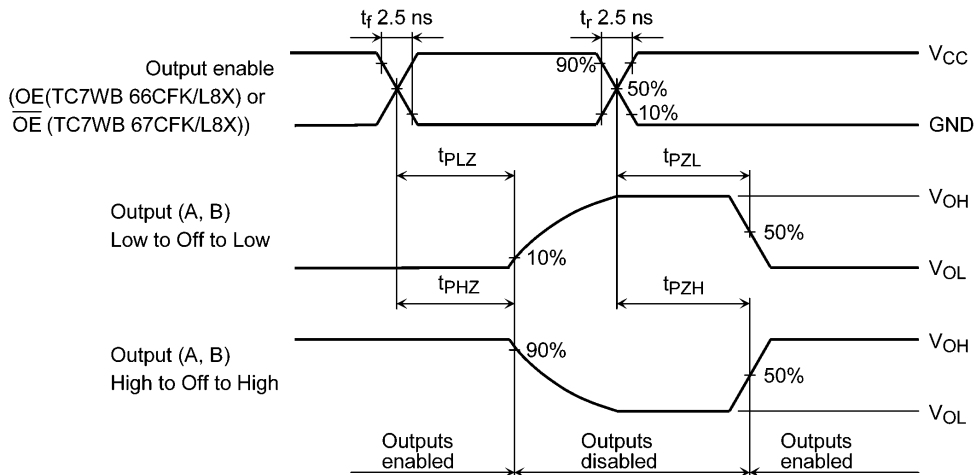


Fig. 11.2.2 AC Waveform t_{PLZ} , t_{PHZ} , t_{PZL} , t_{PZH}

12. Rise and Fall Time (t_r/t_f)

The t_{r(out)} and t_{f(out)} values of the output signals are affected by the CR time constant of the input, which consists of the switch terminal capacitance (C_{I/O}) and the on-resistance (R_{ON}) of the input.

In practice, the t_{r(out)} and t_{f(out)} values are also affected by the circuit's capacitance and resistance components other than the capacitance of TC7WB66CFK/L8X, TC7WB67CFK/L8X

The t_r/t_{f(out)} values can be approximated as follows.

(Figure 12.1, Table 12.1 shows the test circuit.)

$$t_r/t_{f(out)} \text{ (approx)} = - (C_{I/O} + C_L) \cdot (R_{DRIVE} + R_{ON}) \cdot \ln (((V_{OH} - V_{OL}) \cdot V_M) / (V_{OH} - V_{OL}))$$

Where, R_{DRIVE} is the output impedance of the previous-stage circuit.

Calculation example:

$$t_{r(out)} \text{ (approx)} = - (10 + 15) \text{ E} \cdot 12 \cdot (120 + 4) \cdot \ln (((4.5 - 0) \cdot 2.25) / (4.5 - 0)) = \approx 2.1 \text{ ns}$$

Calculation conditions:

V_{CC} = 4.5 V, C_L = 15 pF, R_{DRIVE} = 120 Ω (output impedance of the previous IC), V_M = 2.25 V (V_{CC}/2)

Output of the previous IC = digital (i.e., high-level voltage = V_{CC}, low-level voltage = GND)

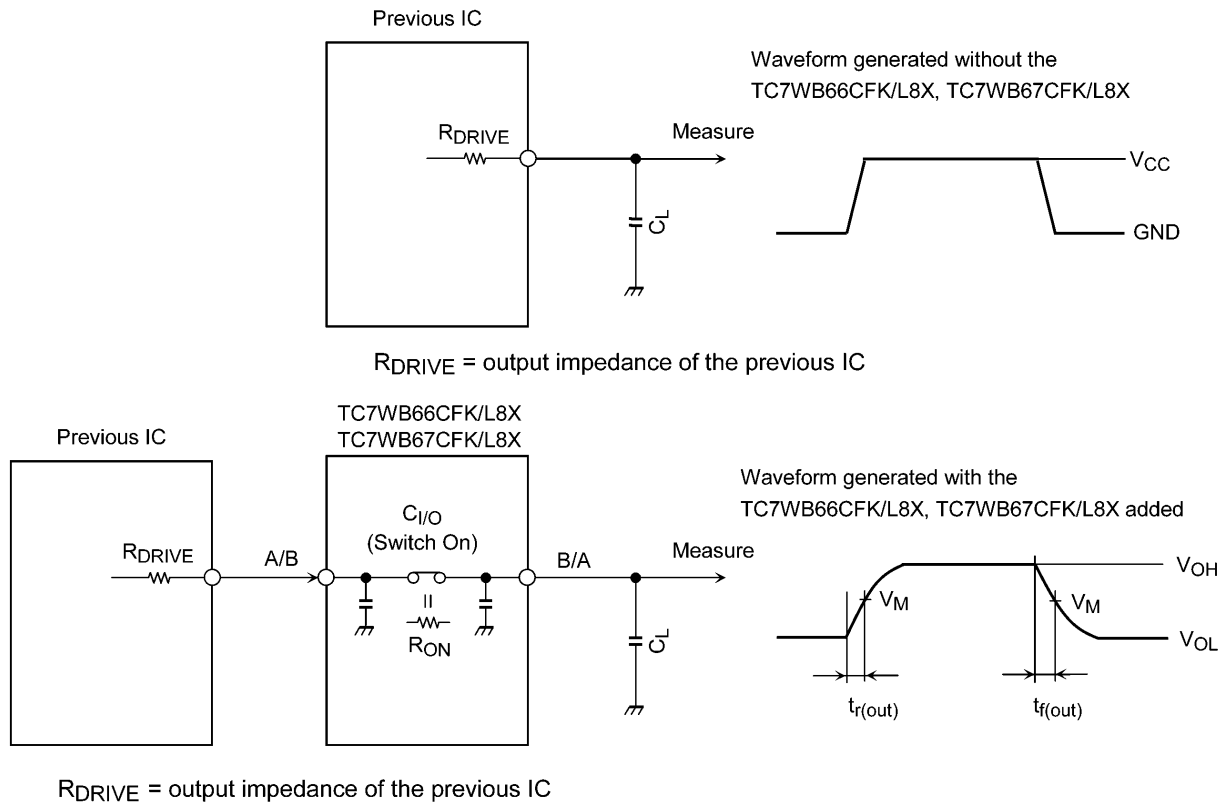


Fig. 12.1 Calculation Circuit

Table 12.1 Calculation Circuit

Characteristics	V _{CC} = 5.0 ± 0.5 V	V _{CC} = 3.3 ± 0.3 V	V _{CC} = 2.5 ± 0.2 V	V _{CC} = 1.8 ± 0.15 V
V _M	V _{CC} /2	V _{CC} /2	V _{CC} /2	V _{CC} /2

13. Characteristics Curves (Note)

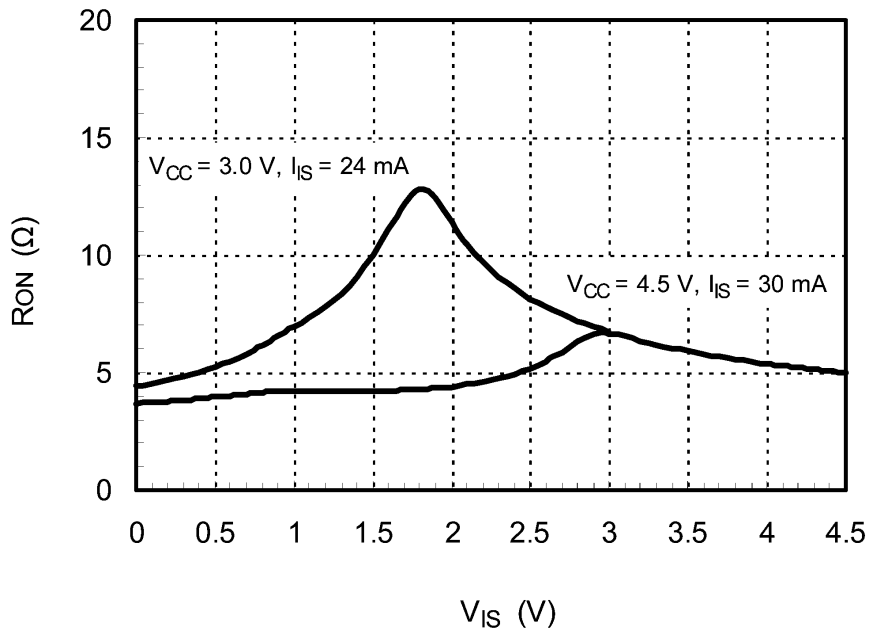
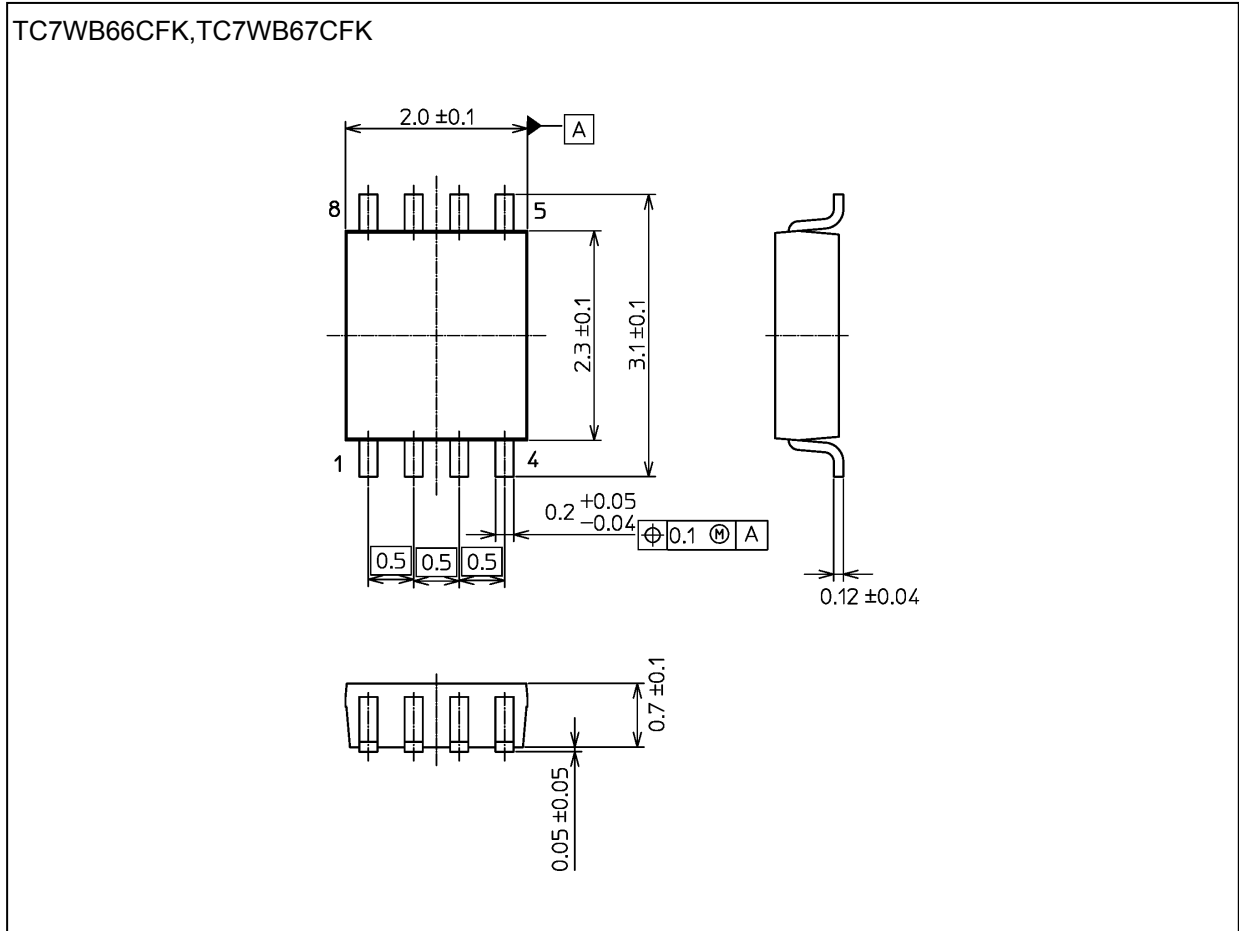


Fig. 13.1 RON - VIS

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

Package Dimensions

Unit: mm

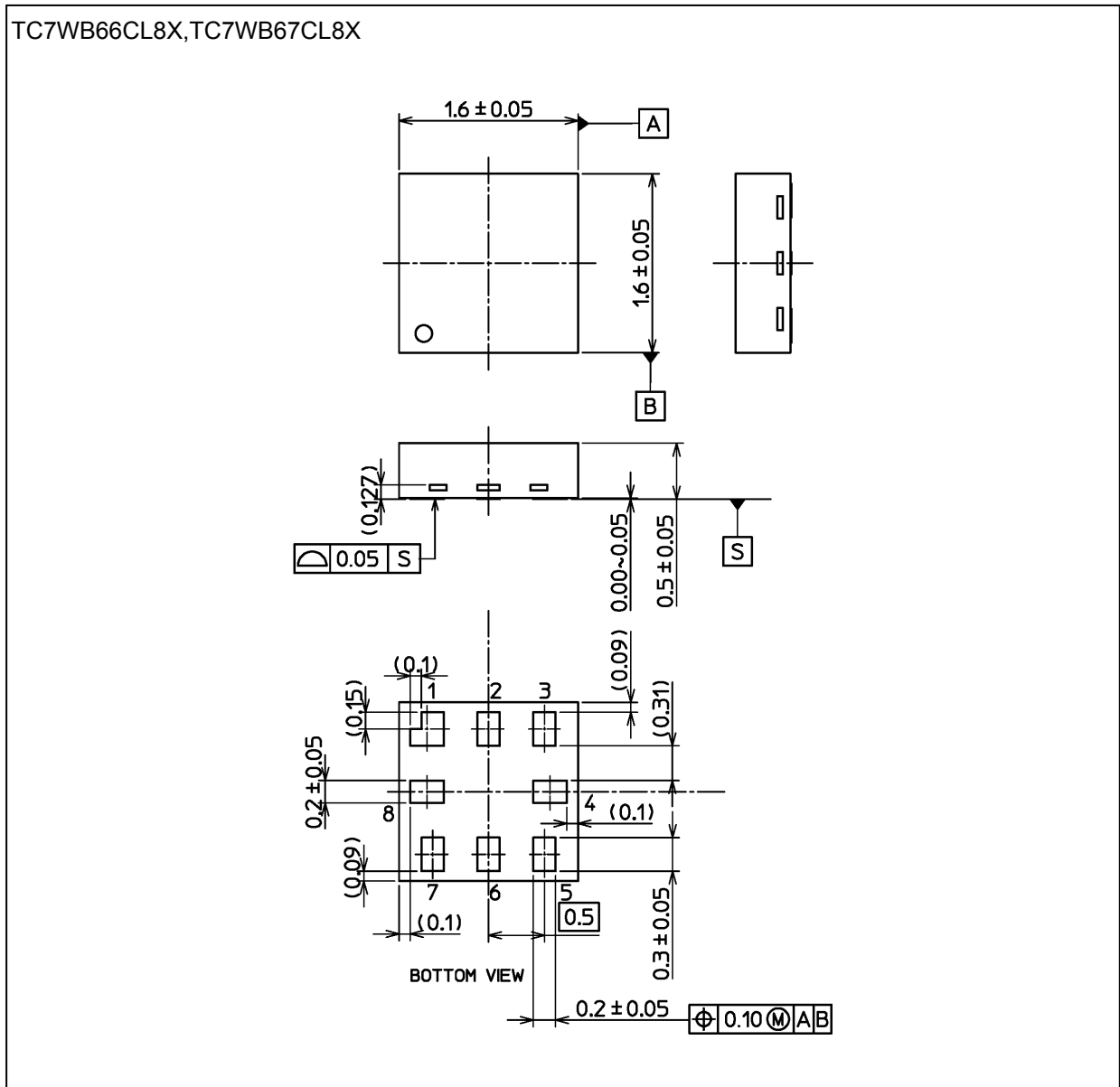


Weight: 0.01 g (typ.)

Package Name(s)
TOSHIBA: SSOP8-P-0.50S
Nickname: US8

Package Dimensions

Unit: mm



Weight: 0.0039 g (typ.)

Package Name(s)
TOSHIBA: P-UFLGA8-0202-0.50-002
Nickname: MP8

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