

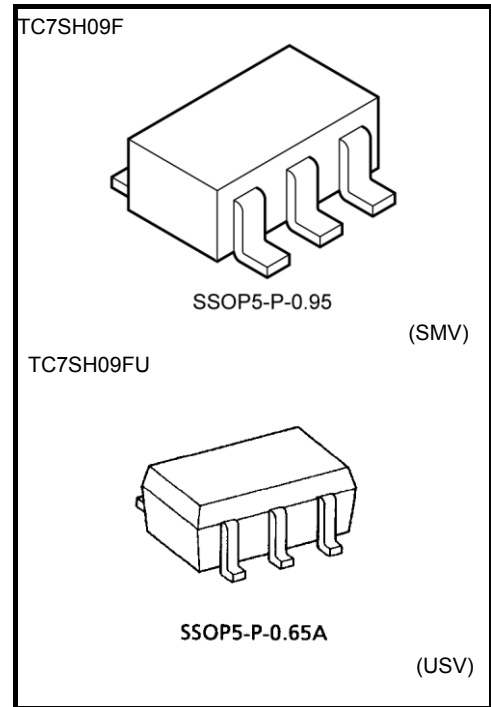
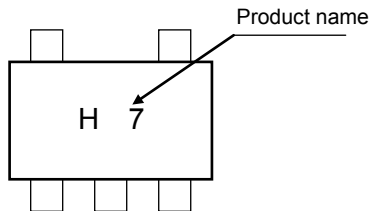
TC7SH09F, TC7SH09FU

2-Input AND Gate (Open Drain Output)

Features

- High speed operation : $t_{pLZ} = 3.2\text{ns}$ (typ.) at $V_{CC} = 5\text{V}$, 15pF
- Low power dissipation : $I_{CC} = 2\mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- Wide operating voltage range : $V_{CC} = 2$ to 5.5V
- 5.5-V tolerant inputs
- 5.5 V power down protection output

Marking



Weight
 SSOP5-P-0.95 : 0.016 g (typ.)
 SSOP5-P-0.65A : 0.006 g (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	- 0.5 to 7	V
DC input voltage	V_{IN}	- 0.5 to 7	V
DC output voltage	V_{OUT}	-0.5 to 7 (Note 1)	V
Input diode current	I_{IK}	- 20	mA
Output diode current	I_{OK}	- 20 (Note 1)	mA
DC output current	I_{OUT}	+ 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	- 65 to 150	$^\circ\text{C}$
Lead temperature (10s)	T_L	260	$^\circ\text{C}$

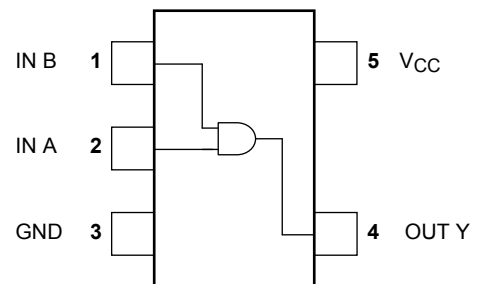
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings 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).

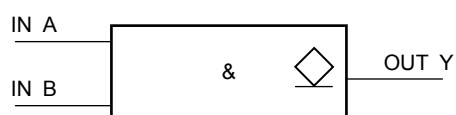
Note 1: Do not exceed I_{OUT} of absolute maximum ratings.

Note 2: $V_{OUT} < \text{GND}$

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

A	B	Y
L	L	L
L	H	L
H	L	L
H	H	Z

Z: High-impedance

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 3)	V
		0 to V_{CC} (Note 4)	
Operating temperature	T_{opr}	- 40 to 85	°C
Input rise and fall time	dt/dv	0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V)	ns/V
		0 to 20 ($V_{CC} = 5.0 \pm 0.5$ V)	

Note 3: High-Impedance State

Note 4: Low State

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit	
					V _{CC} (V)	Min	Typ.	Max	Min		Max
Input voltage	High level	V _{IH}	—		2.0	1.5	—	—	1.5	—	V
					3.0 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
	Low level	V _{IL}	—		2.0	—	—	0.5	—	0.5	
					3.0 to 5.5	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3	
Output voltage	Low level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	—	0	0.1	—	0.1	V
				I _{OL} = 4 mA	3.0	—	0	0.1	—	0.1	
					4.5	—	0	0.1	—	0.1	
					I _{OL} = 8 mA	3.0	—	—	0.36	—	
				4.5		—	—	0.36	—	0.44	
Input leakage current		I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Output Z level leakage current		I _{LKG}	V _{IN} = V _{IH}		0 to 5.5	—	—	±0.25	—	±2.5	μA
Power off leakage current		I _{OFF}	V _{IN} = 5.5V or V _{OUT} = 0 to 5.5V		0.0	—	—	1.0	—	10.0	μA
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	2.0	—	20.0	μA

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t _{pZL}	R _L = 1kΩ	3.3 ± 0.3	15	—	4.6	7.5	1.0	8.5	ns
				50	—	6.5	11.0	1.5	12.0	
			5.0 ± 0.5	15	—	3.2	5.5	1.0	6.5	
				50	—	4.6	7.5	1.5	8.0	
	t _{pLZ}	R _L = 1kΩ	3.3 ± 0.3	15	—	4.6	7.5	1.0	8.5	
				50	—	6.5	11.0	1.5	12.0	
			5.0 ± 0.5	15	—	3.2	5.5	1.0	6.5	
				50	—	4.6	7.5	1.5	8.0	
Input capacitance	C _{IN}	—			—	1.5	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note 5)			—	5	—	—	—	pF

Note 5: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

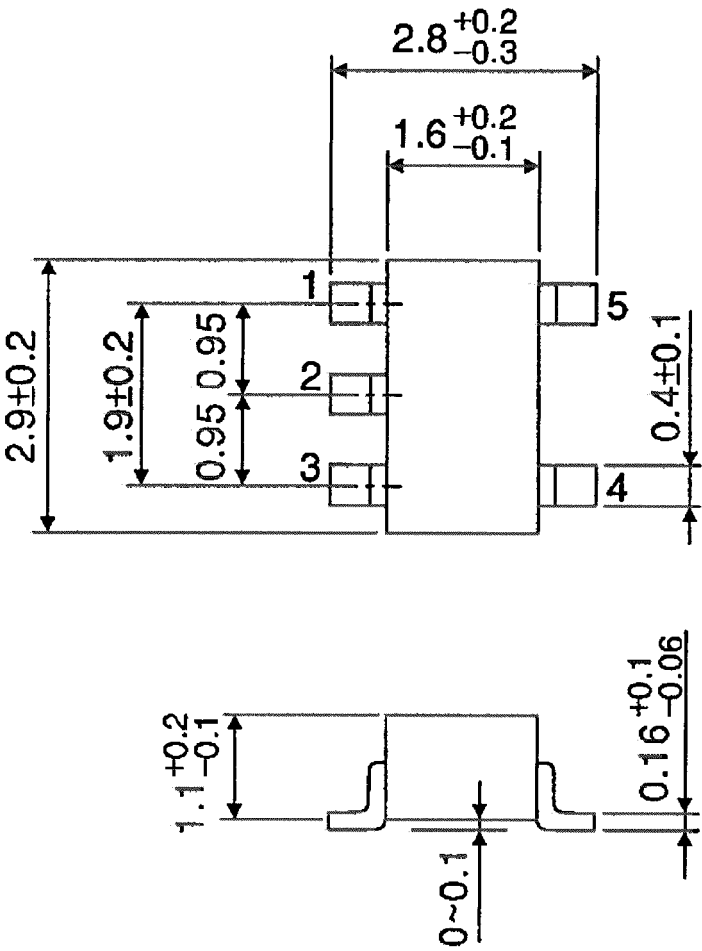
Average operating current can be obtained by the equation:

$$I_{CC} (\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

Package Dimensions

SSOP5-P-0.95

Unit : mm

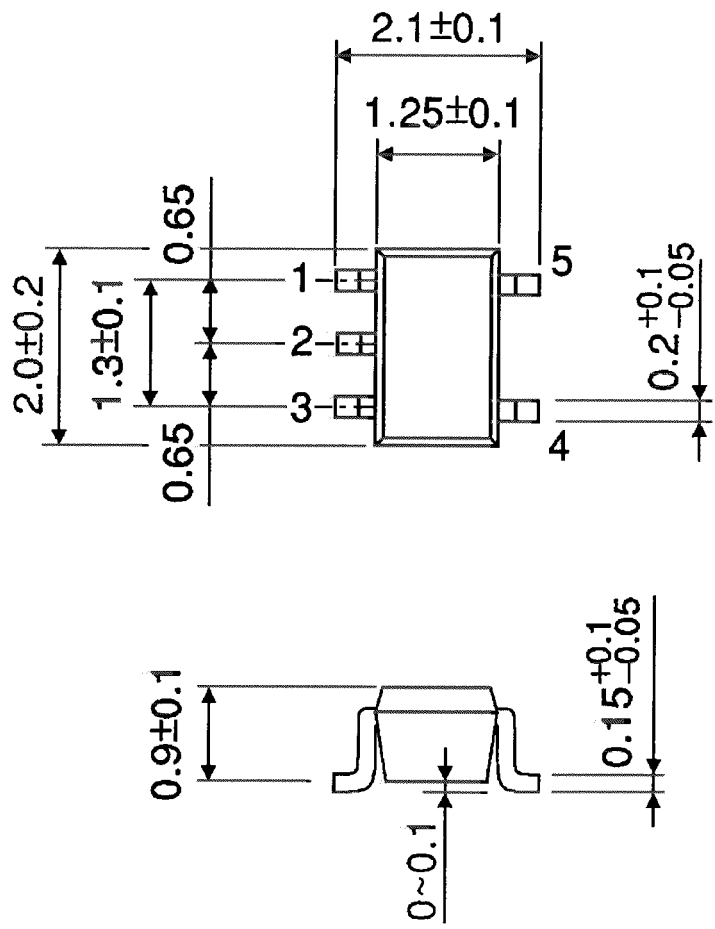


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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