

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

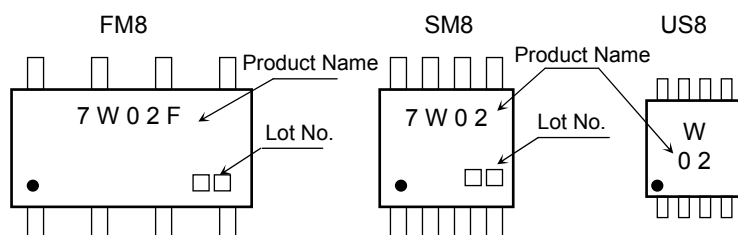
TC7W02F, TC7W02FU, TC7W02FK

Dual 2-Input NOR Gate

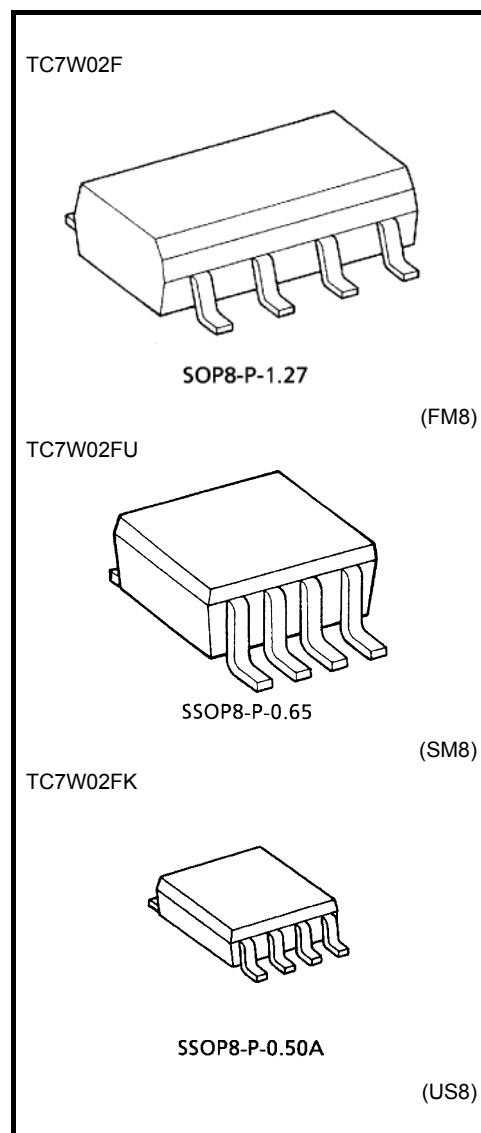
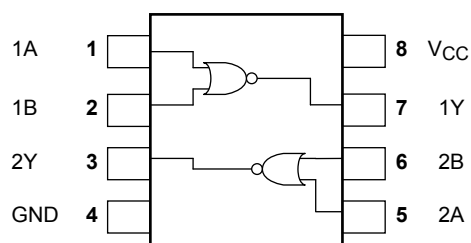
Features

- High Speed : $t_{pd} = 6\text{ns}$ (typ.) at $V_{CC} = 5\text{V}$
- Low power dissipation : $I_{CC} = 1\mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity : $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output drive capability : 10 LSTTL Loads
- Symmetrical Output Impedance : $|I_{OH}| = I_{OL} = 4\text{mA}$ (min)
- Balanced propagation delays : $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range : $V_{CC} = 2$ to 6V

Marking



Pin Assignment (top view)



Weight	
SOP8-P-1.27	: 0.05 g (typ.)
SSOP8-P-0.65	: 0.02 g (typ.)
SSOP8-P-0.50A	: 0.01 g (typ.)

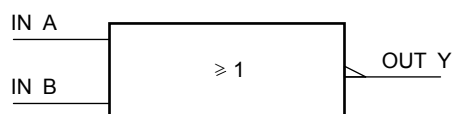
Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{CC}	−0.5 to 7.0	V
DC input voltage	V _{IN}	−0.5 to V _{CC} + 0.5	V
DC output voltage	V _{OUT}	−0.5 to V _{CC} + 0.5	V
Input diode current	I _{IK}	±20	mA
Output diode current	I _{OK}	±20	mA
DC output current	I _{OUT}	±25	mA
DC V _{CC} /ground current	I _{CC}	±25	mA
Power dissipation	P _D	300 (FM8, SM8)	mW
		200 (US8)	
Storage temperature	T _{stg}	−65 to 150	°C
Lead temperature (10 s)	T _L	260	°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).

IEC Logic Symbol



Truth Table

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

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{CC}	2.0 to 6.0	V
Input voltage	V _{IN}	0 to V _{CC}	V
Output voltage	V _{OUT}	0 to V _{CC}	V
Operating temperature	T _{opr}	−40 to 85	°C
Input rise and fall time	t _r , t _f	0 to 1000 (V _{CC} = 2.0 V)	ns
		0 to 500 (V _{CC} = 4.5 V)	
		0 to 400 (V _{CC} = 6.0 V)	

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
High-level input voltage	V _{IH}	—		2.0	1.5	—	—	1.5	—
				4.5	3.15	—	—	3.15	—
				6.0	4.2	—	—	4.2	—
Low-level input voltage	V _{IL}	—		2.0	—	—	0.5	—	0.5
				4.5	—	—	1.35	—	1.35
				6.0	—	—	1.8	—	1.8
High-level output voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -20 μA	2.0	1.9	2.0	—	1.9	—
				4.5	4.4	4.5	—	4.4	—
				6.0	5.9	6.0	—	5.9	—
			I _{OH} = -4 mA	4.5	4.18	4.31	—	4.13	—
			I _{OH} = -5.2 mA	6.0	5.68	5.80	—	5.63	—
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 μA	2.0	—	0.0	0.1	—	0.1
				4.5	—	0.0	0.1	—	0.1
				6.0	—	0.0	0.1	—	0.1
			I _{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33
			I _{OL} = 5.2 mA	6.0	—	0.18	0.26	—	0.33
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND		6.0	—	—	±0.1	—	±1.0
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		6.0	—	—	1.0	—	10.0

AC Characteristics ($C_L = 15\text{pF}$, $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			Unit
			Min	Typ.	Max	
Output Transition Time	t_{TLH} t_{THL}	—	—	4	8	ns
Propagation Delay Time	t_{pLH} t_{pHL}	—	—	6	12	ns

AC Characteristics ($C_L = 50\text{pF}$, Input: $t_r = t_f = 6\text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = -40 to 85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Output Transition Time	tTLH	—	2.0	—	25	75	—	95	ns
	tTHL		4.5	—	7	15	—	19	
			6.0	—	6	13	—	16	
Propagation delay time	tPLH	—	2.0	—	25	75	—	95	ns
			4.5	—	9	15	—	19	
	tPHL		6.0	—	8	13	—	16	
Input capacitance	CIN	—		—	5	10	—	10	pF
Power dissipation capacitance	CPD	(Note 1)		—	21	—	—	—	pF

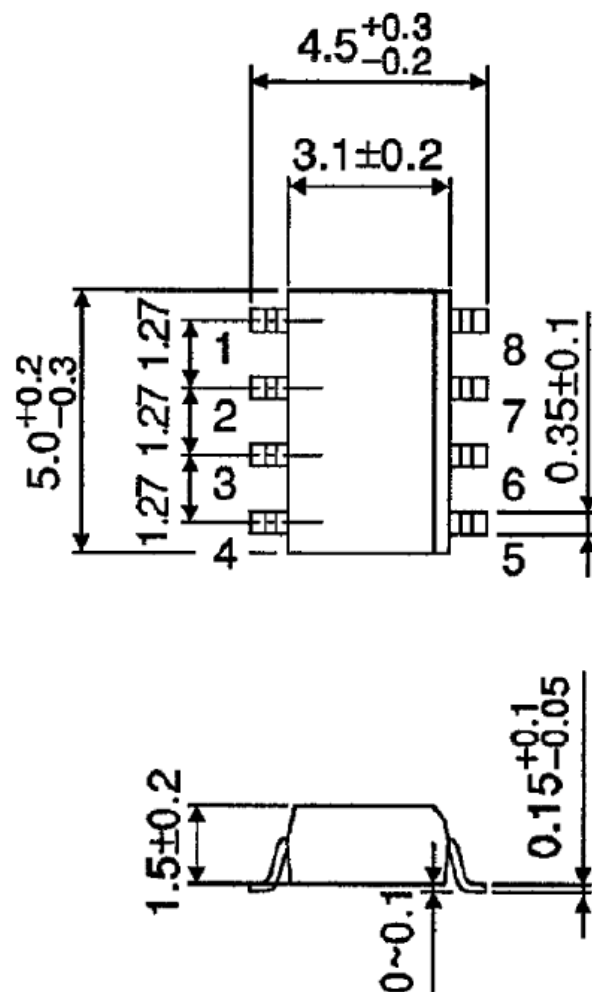
Note 1: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

SOP8-P-1.27

Unit : mm

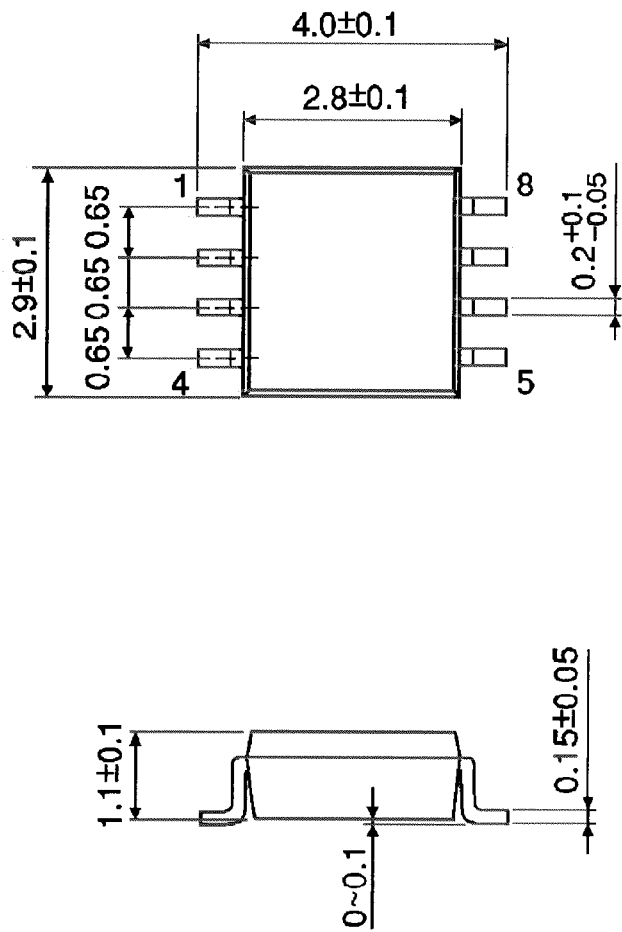


Weight: 0.05 g (typ.)

Package Dimensions

SSOP8-P-0.65

Unit : mm

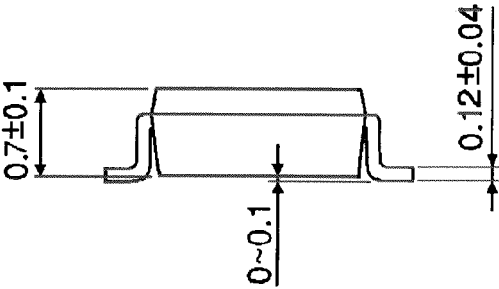
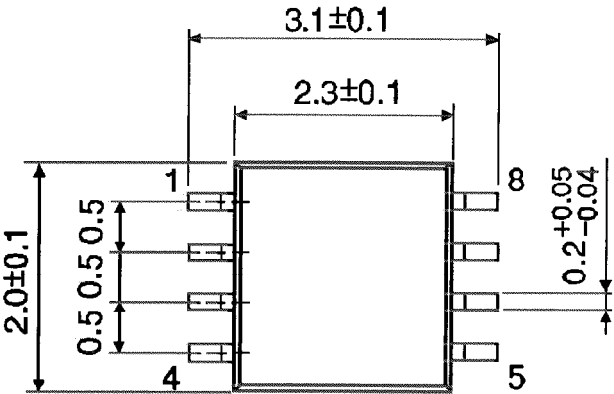


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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