

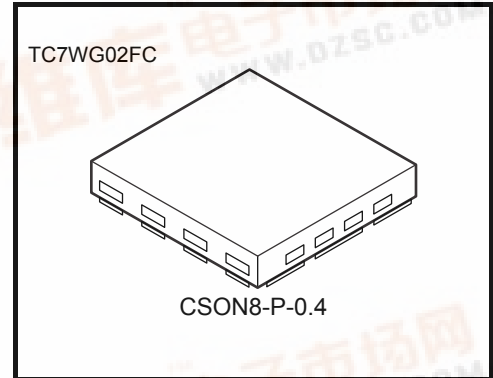
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7WG02FC

Dual 2-Input NOR Gate

Features

- High-level output current: $I_{OH}/I_{OL} = \pm 8 \text{ mA}$ (min)
at $V_{CC} = 3 \text{ V}$
- High-speed operation: $t_{pd} = 2.8 \text{ ns}$ (typ.)
at $V_{CC} = 3.3 \text{ V}, 15 \text{ pF}$
- Operating voltage range: $V_{CC} = 0.9 \sim 3.6 \text{ V}$
- 5.5-V tolerant inputs
- 3.6-V power down protection outputs



Weight: 0.002 g (typ.)

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

Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	$-0.5 \sim 4.6$	V
DC input voltage	V_{IN}	$-0.5 \sim 7.0$	V
DC output voltage	V_{OUT}	$-0.5 \sim 4.6$ (Note 1)	V
		$-0.5 \sim V_{CC} + 0.5$ (Note 2)	
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	-20 (Note 3)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC}/GND current	I_{CC}	± 50	mA
Power dissipation	P_D	150 (Note 4)	mW
Storage temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$

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 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: $V_{CC} = 0 \text{ V}$

Note 2: High or Low State.

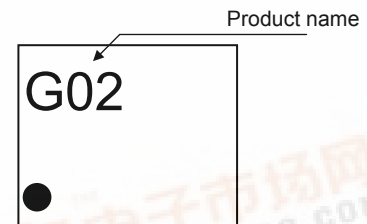
I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < \text{GND}$

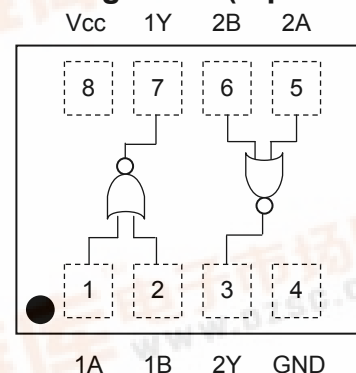
Note 4: Mounted on an FR4 board.

(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 11.56 mm²)

Marking



Pin Assignment (top view)



Truth Table

Inputs		Outputs
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

IEC Logic Symbol



Operating Ranges

Characteristics	Symbol	Value	Unit
Power supply voltage	V _{CC}	0.9~3.6	V
Input voltage	V _{IN}	0~5.5	V
Output voltage	V _{OUT}	0~3.6 (Note 5)	V
		0~V _{CC} (Note 6)	
Output Current	I _{OH} /I _{OL}	±8.0 (Note 7)	mA
		±4.0 (Note 8)	
		±3.0 (Note 9)	
		±1.7 (Note 10)	
		±0.3 (Note 11)	
		±0.02 (Note 12)	
Operating temperature	T _{opr}	-40~85	°C
Input rise and fall time	dt/dV	0~10 (Note 13)	ns/V

- Note 5: V_{CC} = 0V
- Note 6: High or Low state.
- Note 7: V_{CC} = 3.0~3.6 V
- Note 8: V_{CC} = 2.3~2.7 V
- Note 9: V_{CC} = 1.65~1.95 V
- Note 10: V_{CC} = 1.4~1.6 V
- Note 11: V_{CC} = 1.1~1.3 V
- Note 12: V_{CC} = 0.9 V
- Note 13: V_{IN} = 0.8~2.0 V, V_{CC} = 3.0 V

Electrical Characteristics

DC Electrical Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max	
High-level input voltage	V _{IH}	—		0.9	V _{CC}	—	—	V _{CC}	—	V
				1.1~1.3	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
				1.4~1.6	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				1.65~1.95	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				2.3~2.7	1.7	—	—	1.7	—	
				3.0~3.6	2.0	—	—	2.0	—	
Low-level input voltage	V _{IL}	—		0.9	—	—	GND	—	GND	V
				1.1~1.3	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3	
				1.4~1.6	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				1.65~1.95	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				2.3~2.7	—	—	0.7	—	0.7	
				3.0~3.6	—	—	0.8	—	0.8	
High-level output voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -0.02 mA	0.9	0.75	—	—	0.75	—	V
			I _{OH} = -0.3 mA	1.1~1.3	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -1.7 mA	1.4~1.6	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -3.0 mA	1.65~1.95	V _{CC} -0.45	—	—	V _{CC} -0.45	—	
			I _{OH} = -4.0 mA	2.3~2.7	2.0	—	—	2.0	—	
			I _{OH} = -8.0 mA	3.0~3.6	2.48	—	—	2.48	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 0.02 mA	0.9	—	—	0.1	—	0.1	V
			I _{OL} = 0.3 mA	1.1~1.3	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 1.7 mA	1.4~1.6	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 3.0 mA	1.65~1.95	—	—	0.45	—	0.45	
			I _{OL} = 4.0 mA	2.3~2.7	—	—	0.4	—	0.4	
			I _{OL} = 8.0 mA	3.0~3.6	—	—	0.4	—	0.4	
Input leakage current	I _{IN}	V _{IN} = 0~5.5V		0~3.6	—	—	±0.1	—	±1.0	μA
Power off leakage current	I _{OFF}	V _{IN} = 0~5.5V V _{OUT} = 0~3.6V		0	—	—	1.0	—	10.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		3.6	—	—	1.0	—	10.0	μA

AC Electrical Characteristics (input $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		Unit
				Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	$C_L = 10$ pF, $R_L = 1$ M Ω	0.9	—	19.8	—	—	—	ns
			1.1~1.3	—	10.1	18.7	1.0	34.5	
			1.4~1.6	—	5.9	8.9	1.0	10.8	
			1.65~ 1.95	—	4.5	6.4	1.0	6.9	
			2.3~2.7	—	3.1	4.2	1.0	4.7	
			3.0~3.6	—	2.3	3.4	1.0	4.0	
		$C_L = 15$ pF, $R_L = 1$ M Ω	0.9	—	22.5	—	—	—	
			1.1~1.3	—	11.6	21.5	1.0	37.2	
			1.4~1.6	—	6.6	9.8	1.0	12.0	
			1.65~ 1.95	—	5.0	7.1	1.0	7.3	
			2.3~2.7	—	3.5	4.5	1.0	5.1	
			3.0~3.6	—	2.8	3.8	1.0	4.4	
		$C_L = 30$ pF, $R_L = 1$ M Ω	0.9	—	30.0	—	—	—	
			1.1~1.3	—	15.0	29.6	1.0	56.0	
			1.4~1.6	—	8.5	13.1	1.0	15.9	
			1.65~ 1.95	—	6.3	9.2	1.0	9.6	
			2.3~2.7	—	4.3	5.7	1.0	6.1	
			3.0~3.6	—	3.5	4.4	1.0	4.8	
Input capacitance	C_{IN}	—	3.6	—	3	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 14)	0.9 ~ 3.6	—	11	—	—	—	pF

Note 14: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

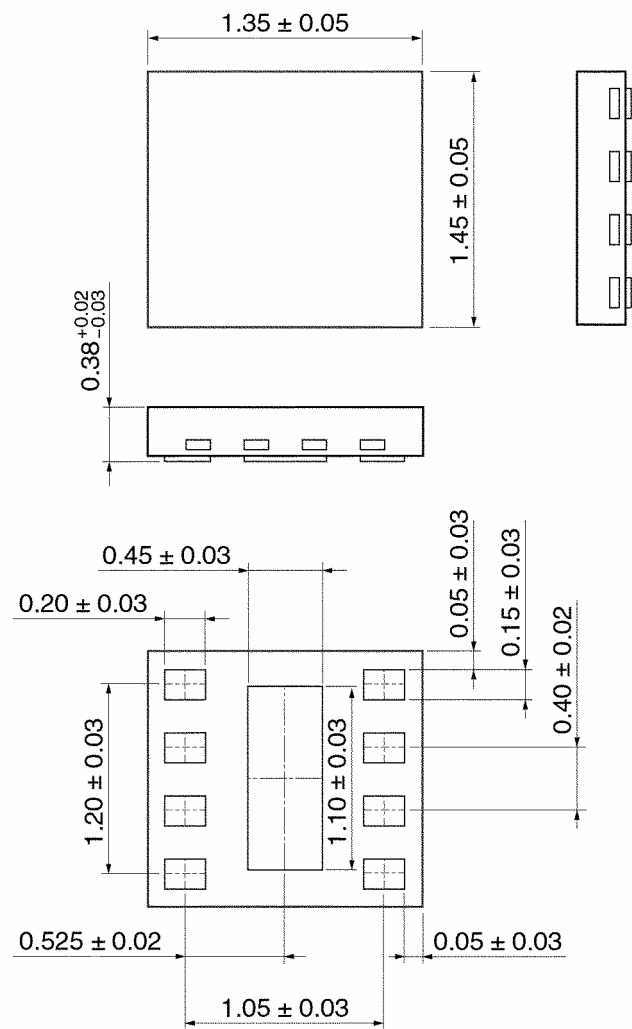
Average operating current can be obtained by the equation:

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

Package Dimensions

CSON8-P-0.4

Unit: mm



Weight: 0.002 g (typ.)

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20070701-EN GENERAL

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