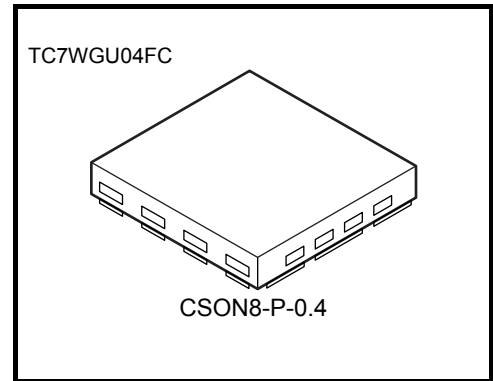


# TC7WGU04FC

## Triple Inverter (Un-Buffer)

### Features

- High-level output current:  $I_{OH}/I_{OL} = \pm 8 \text{ mA (min)}$   
at  $V_{CC} = 3 \text{ V}$
- High-speed operation:  $t_{pd} = 1.9 \text{ ns (typ.)}$   
at  $V_{CC} = 3.3 \text{ V}, 15\text{pF}$
- Operating voltage range:  $V_{CC} = 0.9\sim 3.6 \text{ V}$
- 3.6-V tolerant inputs



Weight: 0.002 g (typ.)

### Absolute Maximum Ratings (Ta = 25°C)

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

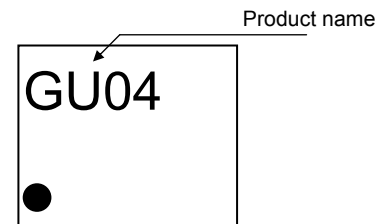
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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:  $V_{OUT} < GND, V_{OUT} > V_{CC}$

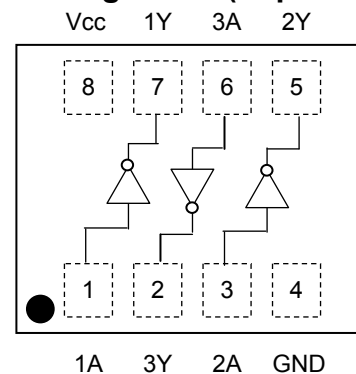
Note 2: Mounted on an FR4 board.

(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 11.56 mm<sup>2</sup>)

### Marking



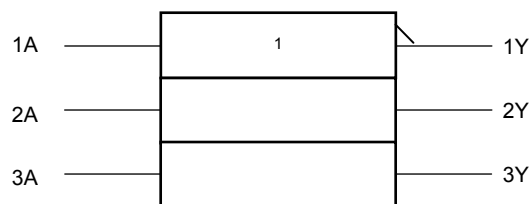
### Pin Assignment ( top view )



## Truth Table

A	Y
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	$V_{IN}$	0~3.6	V
Output voltage	$V_{OUT}$	0~ $V_{CC}$	V
Output Current	$I_{OH}/I_{OL}$	±8.0 (Note 3)	mA
		±4.0 (Note 4)	
		±3.0 (Note 5)	
		±1.7 (Note 6)	
		±0.3 (Note 7)	
		±0.02 (Note 8)	
Operating temperature	$T_{opr}$	-40~85	°C

Note 3:  $V_{CC} = 3.0\sim 3.6$  V

Note 4:  $V_{CC} = 2.3\sim 2.7$  V

Note 5:  $V_{CC} = 1.65\sim 1.95$  V

Note 6:  $V_{CC} = 1.4\sim 1.6$  V

Note 7:  $V_{CC} = 1.1\sim 1.3$  V

Note 8:  $V_{CC} = 0.9$  V

## Electrical Characteristics

### DC Electrical Characteristics

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

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Propagation delay time	$t_{pLH}$ $t_{pHL}$	$C_L = 10$ pF, $R_L = 1$ M $\Omega$	0.9	—	15.0	—	—	ns	
			1.1~1.3	—	6.0	18.4	1.0		34.2
			1.4~1.6	—	3.2	8.5	1.0		10.0
			1.65~1.95	—	2.6	6.2	1.0		6.7
			2.3~2.7	—	2.0	3.9	1.0		4.4
			3.0~3.6	—	1.7	3.1	1.0		3.7
		$C_L = 15$ pF, $R_L = 1$ M $\Omega$	0.9	—	18.8	—	—		—
			1.1~1.3	—	7.0	21.5	1.0		37.2
			1.4~1.6	—	3.5	9.3	1.0		11.2
			1.65~1.95	—	3.0	6.9	1.0		7.1
			2.3~2.7	—	2.3	4.4	1.0		5.0
		$C_L = 30$ pF, $R_L = 1$ M $\Omega$	3.0~3.6	—	1.9	3.4	1.0		3.9
			0.9	—	33.0	—	—		—
			1.1~1.3	—	12.0	30.4	1.0		58.0
			1.4~1.6	—	6.0	13.1	1.0		15.9
			1.65~1.95	—	4.5	9.2	1.0		9.6
			2.3~2.7	—	3.2	5.7	1.0		6.1
		Input capacitance	C <sub>IN</sub>	—	3.6	—	3		—
Power dissipation capacitance	C <sub>PD</sub>				(Note 9)	0.9 ~ 3.6	—	10	—

Note 9: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

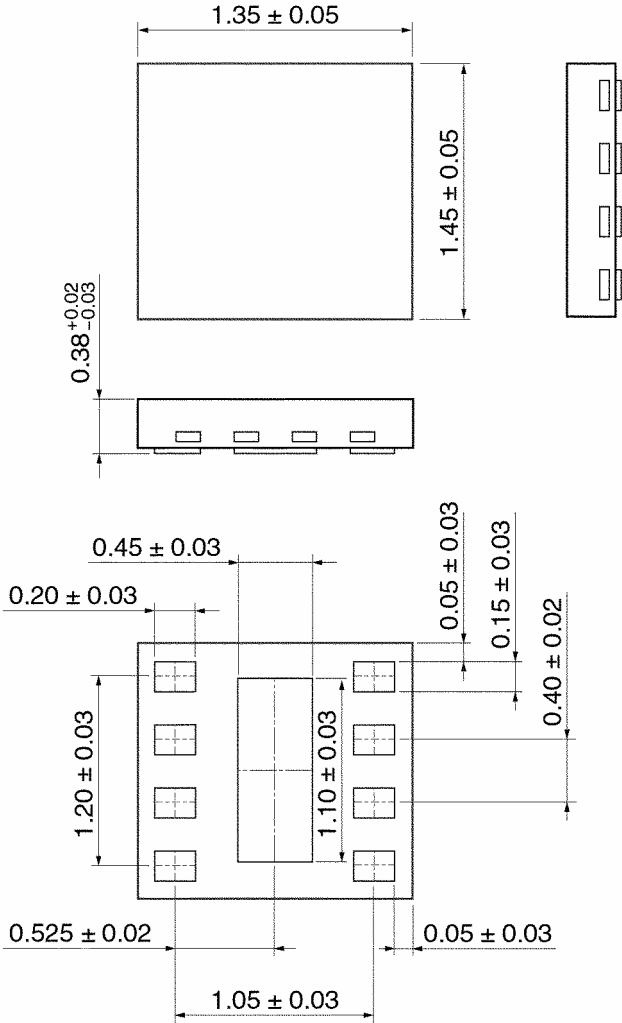
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3$$

Package Dimensions

CSON8-P-0.4

Unit: mm



Weight: 0.002 g (typ.)

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20070701-EN GENERAL

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