

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

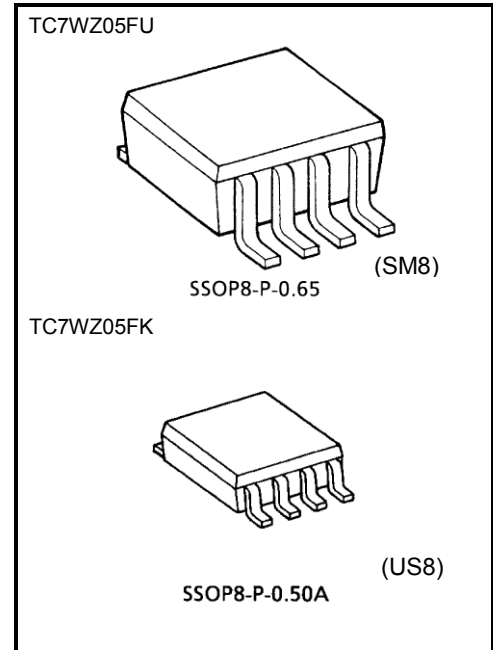
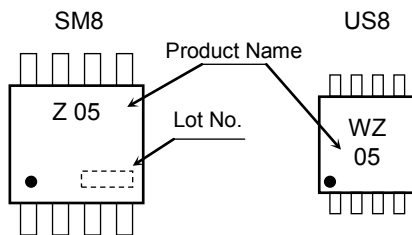
## TC7WZ05FU, TC7WZ05FK

Triple Inverter (Open Drain)

### Features

- High output current:  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation:  $t_{pZL} = 2.3$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operation voltage range:  $V_{CC(opr)} = 1.65$  to 5.5 V
- 5.5-V tolerant inputs
- 5.5-V power down protection outputs
- Matches the performance of TC74LCX series when operated at 3.3-V  $V_{CC}$

### Marking



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

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

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	-0.5 to 6	V
DC input voltage	$V_{IN}$	-0.5 to 6	V
DC output voltage	$V_{OUT}$	-0.5 to 6 (Note1)	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note2)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8) 200 (US8)	mW
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$
Lead temperature (10s)	$T_L$	260	$^\circ\text{C}$

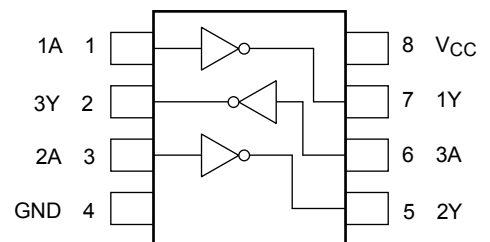
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

### Pin Assignment (top view)



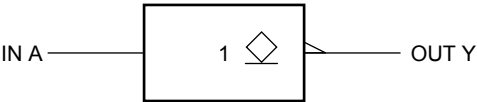
Start of commercial production  
 2000-08

Truth Table

A	Y
L	Z
H	L

Z: High Impedance

IEC Logic Symbol



Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.65 to 5.5	V
		1.5 to 5.5 (Note 3)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 4)	V
		0 to $V_{CC}$ (Note 5)	
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 ( $V_{CC} = 1.80\text{ V} \pm 0.15\text{ V}$ , 2.5 V $\pm 0.2\text{ V}$ )	ns/V
		0 to 10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )	
		0 to 5 ( $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ )	

Note 3: Data retention only

Note 4:  $V_{CC} = 0\text{ V}$  or high impedance condition.

Note 5: Low state

## Electrical Characteristics

## DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Input voltage	High level	V <sub>IH</sub>	—	1.65 to 1.95	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
				2.3 to 5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
	Low level	V <sub>IL</sub>	—	1.65 to 1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25		
				2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
Output voltage	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	1.65	—	0	0.1	—	0.1	V
					2.3	—	0	0.1	—	0.1	
					3.0	—	0	0.1	—	0.1	
					4.5	—	0	0.1	—	0.1	
				I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—	0.24	
				I <sub>OL</sub> = 8 mA	2.3	—	0.1	0.3	—	0.3	
				I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4	—	0.4	
				I <sub>OL</sub> = 24 mA	3.0	—	0.22	0.55	—	0.55	
				I <sub>OL</sub> = 32 mA	4.5	—	0.22	0.55	—	0.55	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA	
Off-state current		I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IL</sub> , V <sub>OUT</sub> = V <sub>CC</sub> or GND	5.5	—	—	±5	—	±10	μA	
Power off leakage current		I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	—	—	1	—	10	μA	

## AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

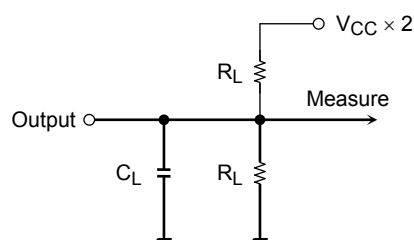
Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = −40 to 85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	tpZL	CL = 50 pF, RL = 500 Ω	1.8 ± 0.15	1.8	5.5	9.5	1.8	10.5	ns
			2.5 ± 0.2	1.2	3.7	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.9	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	2.3	3.5	0.5	3.9	
	tpLZ	CL = 50 pF, RL = 500 Ω	1.8 ± 0.15	1.8	4.3	9.5	1.8	10.5	
			2.5 ± 0.2	1.2	2.8	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.1	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	1.4	3.5	0.5	3.9	
Input capacitance	CIN	—	0 to 5.5	—	3.0	—	—	pF	
Output capacitance	COUT	—	0 to 5.5	—	3.0	—	—	pF	
Power dissipation capacitance	CPD	(Note 6)	3.3	—	5.2	—	—	—	pF
			5.5	—	8.5	—	—	—	

Note 6: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

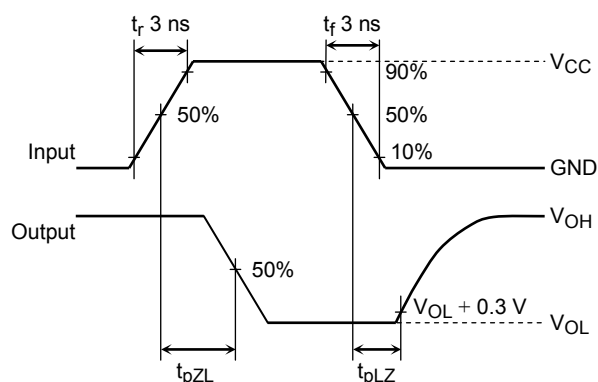
Average operating current can be obtained by the equation:

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

### Test Circuit



### AC Waveform

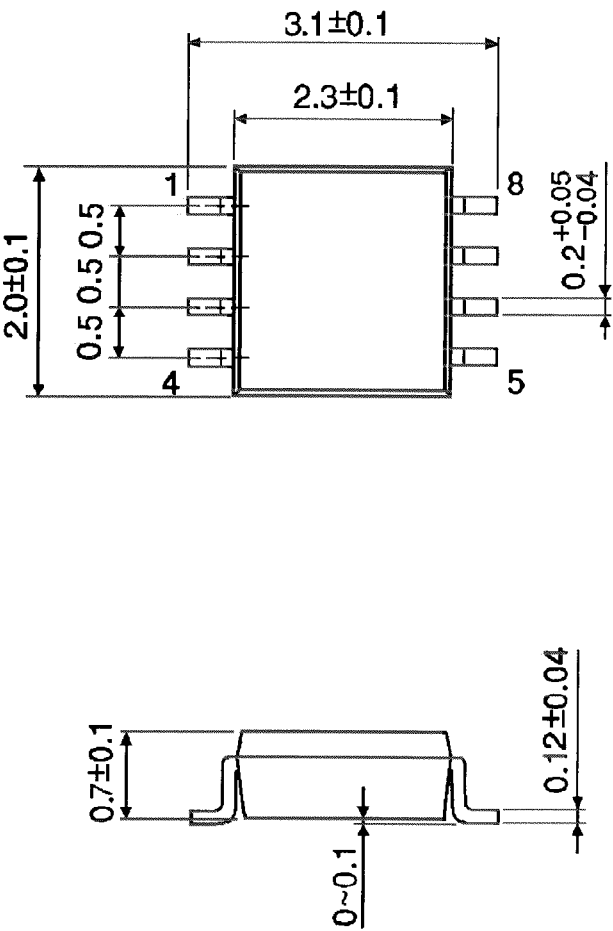




Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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