

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7WZ246FU, TC7WZ246FK

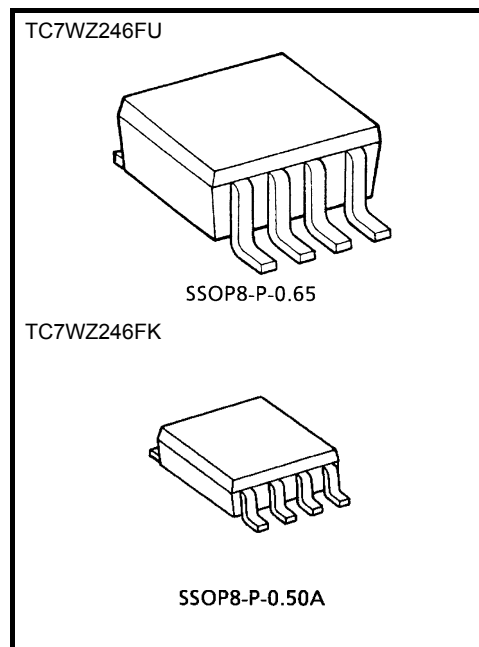
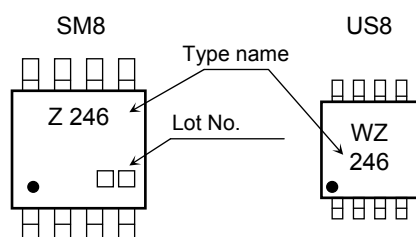
Dual Bus Transceiver  
Buffer And Buffer (Open Drain Outputs)

## Features

- High output drive :  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation :  $t_{pd} = 5.0$  ns(max)  
at  $V_{CC} = 5$  V, 50 pF
- Operation voltage range :  $V_{CC} (opr) = 1.65 \sim 5.5$  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  $V_{CC}$

Note: Do not apply a signal to any bus pins when it is in the output mode. Damage may result.

## Marking



Weight

SSOP8-P-0.65 : 0.02 g (typ.)

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

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

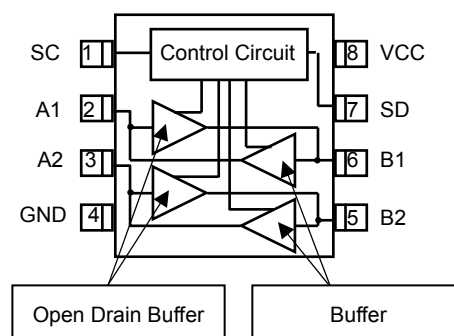
Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	$-0.5 \sim 6$	V
DC input voltage	$V_{IN}$	$-0.5 \sim 6$	V
DC output voltage	$V_{OUT}$	$-0.5 \sim 6$	V
Input diode current	$I_{IK}$	$-20$	mA
Output diode current	$I_{OK}$	$-20$	mA
DC output current	$I_{OUT}$	$\pm 50, +50$ (Note 1)	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8) 200 (US8)	mW
Storage temperature	$T_{stg}$	$-65 \sim 150$	$^\circ\text{C}$
Lead temperature (10 s)	$T_L$	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: Open Drain Buffer Output diode current.

## Pin Assignment (top view)



## Truth Table

INPUT		FUNCTION				OUTPUT
SC	SD	A1BUS	A2 BUS	B1 BUS	B2 BUS	
L	L	OUTPUT	OUTPUT	INPUT	INPUT	A1=B1,A2=B2
L	H	OUTPUT	INPUT	INPUT	OUTPUT*	A1=B1,B2=A2
H	L	INPUT	OUTPUT	OUTPUT*	INPUT	B1=A1,A2=B2
H	H	INPUT	INPUT	OUTPUT*	OUTPUT*	B1=A1,B2=A2

\* : High Impedance

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.65~5.5	V
		1.5~5.5 (Note 2)	
Input voltage	$V_{IN}$	0~5.5	V
Output voltage	$V_{OUT}$	0~5.5 (Note 3)	V
		0~ $V_{CC}$ (Note 4)	
Operating temperature	$T_{opr}$	-40~85	°C
Input rise and fall time	dt/dv	0~20 ( $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ , 2.5 V $\pm 0.2\text{ V}$ )	ns/V
		0~10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )	
		0~5 ( $V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$ )	

Note 2: Data retention only

Note 3:  $V_{CC} = 0\text{ V}$

Note 4: High or low state

## Electrical Characteristics

### DC 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>	—		1.65~1.95	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
				2.3~5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
Low-Level Input Voltage	V <sub>IL</sub>	—		1.65~1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25		
				2.3~5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.65	1.55	1.65	—	1.55	—	V	
				2.3	2.2	2.3	—	2.2	—		
				3.0	2.9	3.0	—	2.9	—		
				4.5	4.4	4.5	—	4.4	—		
			I <sub>OH</sub> = - 4 mA	1.65	1.29	1.52	—	1.29	—		
				I <sub>OH</sub> = - 8 mA	2.3	1.9	2.14	—	1.9		—
				I <sub>OH</sub> = - 16 mA	3.0	2.4	2.75	—	2.4		—
				I <sub>OH</sub> = - 24 mA	3.0	2.3	2.62	—	2.3		—
				I <sub>OH</sub> = - 32 mA	4.5	3.8	4.13	—	3.8		—
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</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	—	0.16	0.4	—		0.4
				I <sub>OL</sub> = 24 mA	3.0	—	0.24	0.55	—		0.55
				I <sub>OL</sub> = 32 mA	4.5	—	0.25	0.55	—		0.55
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0~5.5	—	—	±1	—	±10	μA		
3-State Output Off-State Current	I <sub>OZ</sub>	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> =V <sub>CC</sub> or GND	1.65~5.5	—	—	±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	1.65~5.5	—	—	1	—	10	μA		

## AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = -40~85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Propagation delay time ( Buffer output)	tpLH tpHL	CL = 15 pF, RL = 1 MΩ	1.8 ± 0.15	2.0	—	17.0	2.0	18.5	ns
			2.5 ± 0.2	1.0	—	7.5	1.0	8.0	
			3.3 ± 0.3	0.8	—	5.2	1.2	6.0	
			5.0 ± 0.5	0.5	—	4.5	0.8	5.5	
		CL = 50 pF, RL = 500 Ω	3.3 ± 0.3	1.5	—	6.7	1.5	7.0	
			5.0 ± 0.5	0.8	—	5.0	0.8	5.3	
Output to output skew	tosLH tosHL	(Note 5)	3.3 ± 0.3	—	—	1.0	—	1.0	ns
3-state output Disable time ( Open drain output)	tpLZ pLZ	CL = 50 pF, RL = 500 Ω	1.8 ± 0.15	1.8	—	9.5	1.8	10.5	ns
			2.5 ± 0.2	1.2	—	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	—	5.0	0.8	5.3	
			5.0 ± 0.5	0.5	—	4.2	0.5	4.5	
Input capacitance	CIN	—	0	—	7	—	—	—	pF
Bus input capacitance	CI / O	—	5.5	—	8	—	—	—	pF
Output capacitance	COUT	—	5.5	—	9	—	—	—	pF
Power dissipation capacitance	CPD	(Note 6)	3.3	—	29	—	—	—	pF
			5.5	—	33	—	—	—	
Minimum set-up time	STs	(Note 7)	2.5 ± 0.2	7.5	—	—	9.0	—	ns
			3.3 ± 0.3	7.0	—	—	8.2	—	
			5.0 ± 0.5	6.5	—	—	7.4	—	

Note 5 :Parameter guaranteed by design.  $t_{osLH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

Note 6 :  $C_{PD}$  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:

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

Note 7 :  $S_{ts}$  is the time which must be waited for an input signal when a bus signal direction is switched.

## AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$ , Bn = Pull Up ( $R_{\text{Pull Up}} = 500 \Omega$ , $V_{\text{Pull Up}} = 5 \text{ V}$ ) )

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit
				Min	Typ.	Max	Min	Max	
Propagation delay time ( An-Bn )	$t_{pZL}$ $t_{pLZ}$	Input = An = VIH or VIL  Output = Bn CL= 50 pF	$3.3 \pm 0.3$	1.0	—	9.0	1.0	11.0	ns
Propagation delay time ( Bn-An )	$t_{pLH}$ $t_{pHL}$	Input = Bn = 5 V or VIL  Output = An CL= 50 pF	$3.3 \pm 0.3$	1.0	—	6.5	1.0	7.0	ns
Output to output skew	$t_{oS LH}$ $t_{oS HL}$	(Note 8)	$3.3 \pm 0.3$	—	—	1.0	—	1.0	ns

Note 8 :Parameter guaranteed by design.  $t_{oS LH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{oS HL} = |t_{pHLm} - t_{pHLn}|$

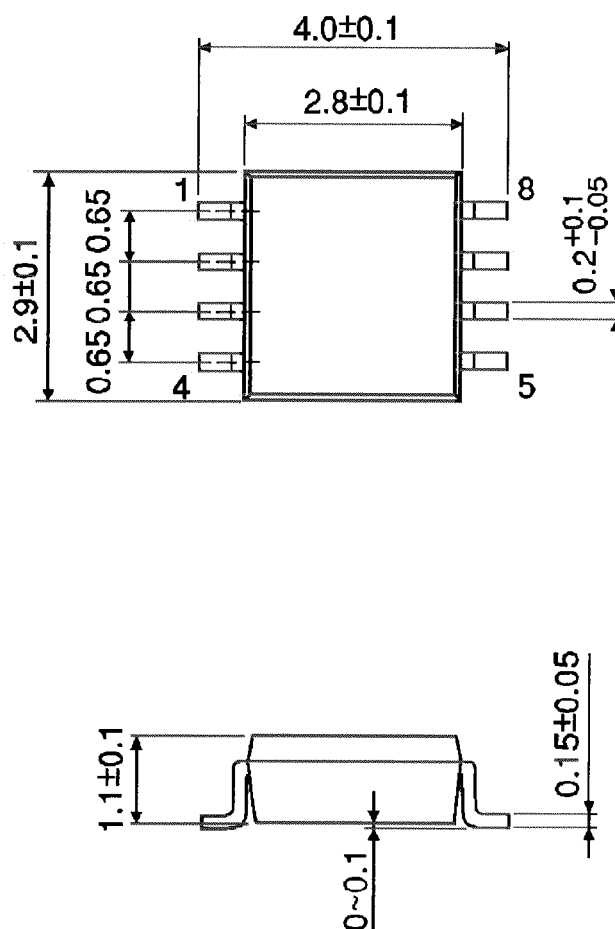
## AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$ , Bn = Pull Up ( $R_{\text{Pull Up}} = 10k \Omega$ , $V_{\text{Pull Up}} = 5 \text{ V}$ ) )

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit
				Min	Typ.	Max	Min	Max	
Propagation delay time ( An-Bn )	$t_{pZL}$	Input = An = VIH or VIL	$3.3 \pm 0.3$	1.0	—	6.7	1.0	7.3	ns
	$t_{pLZ}$	Output = Bn CL= 50 pF		—	—	70.0	—	90.0	
Propagation delay time ( Bn-An )	$t_{pLH}$ $t_{pHL}$	Input = Bn = 5 V or VIL  Output = An CL= 50 pF	$3.3 \pm 0.3$	1.0	—	6.3	1.0	7.0	ns
Output to output skew	$t_{oS LH}$ $t_{oS HL}$	(Note 9)	$3.3 \pm 0.3$	—	—	1.0	—	1.0	ns

Note 9 :Parameter guaranteed by design.  $t_{oS LH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{oS HL} = |t_{pHLm} - t_{pHLn}|$

## SSOP8-P-0.65

Unit : mm

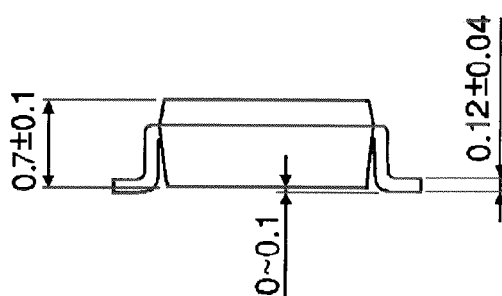
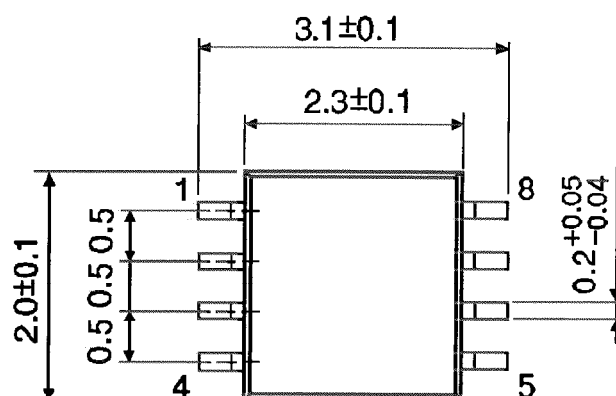


Weight: 0.02 g (typ.)

## Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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