CMOS Digital Integrated Circuits Silicon Monolithic

74LCX245FT

1. Functional Description

· Low-Voltage Octal Bus Transceiver with 5-V Tolerant Inputs and Outputs

2. General

The 74LCX245FT is a high-performance CMOS octal bus transceiver. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage $(3.3 \text{ V}) V_{CC}$ applications, but it could be used to interface to 5-V supply environment for both inputs and outputs.

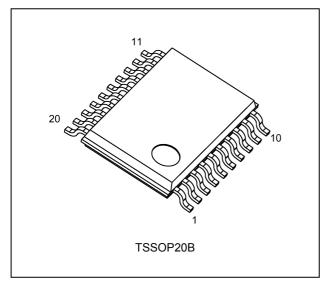
The direction of data transmission is determined by the level of the DIR input. The enable input (\overline{OE}) can be used to disable the device so that the busses are effectively isolated.

All inputs are equipped with protection circuits against static discharge.

3. Features (Note)

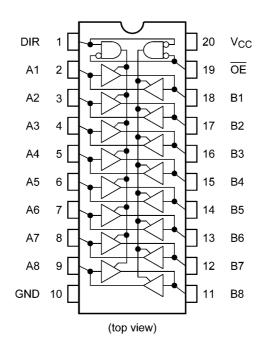
- (1) Low-voltage operation: V_{CC} = 1.65 to 3.6 V
- (2) High-speed operation: $t_{pd} = 7.0 \text{ ns} (\text{max}) (V_{CC} = 3.0 \text{ to } 3.6 \text{ V})$
- (3) Output current: $|I_{OH}|/I_{OL} = 24 \text{ mA} (\text{min}) (V_{CC} = 3.0 \text{ V})$
- (4) Bidirectional interface between 5.0 V and 3.3 V signals
- (5) Power-down protection provided on all inputs and outputs
- (6) Pin and function compatible with the 74 series(74LVC/ALVC/ etc.) 245 type
- Note: Do not apply a signal to any bus pins when it is in the output mode. Damage may result. All floating (high impedance) bus pins must have their input levels fixed by means of pull-up or pull-down resistors.

4. Packaging

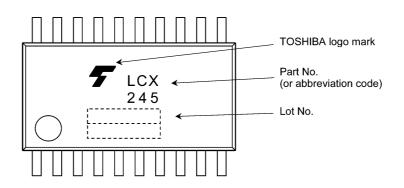


5. Pin Assignment

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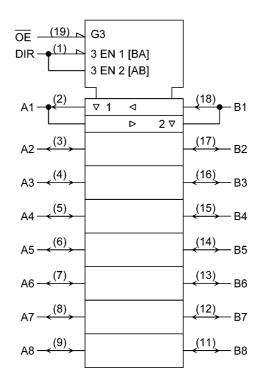


6. Marking



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7. IEC Logic Symbol



8. Truth Table

Input OE	Input DIR	Outputs	Function A-Bus	Function B-Bus
L	L	A = B	Output	Input
L	Н	B = A	Input	Output
н	Х	Z	Z	Z

X: Don't care

Z: High impedance

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V _{CC}		-0.5 to 6.5	V
Input voltage (DIR, OE)	V _{IN}		-0.5 to 6.5	V
Bus I/O voltage	V _{I/O}	(Note 1)	-0.5 to 6.5	V
		(Note 2)	-0.5 to V _{CC} + 0.5	
Input diode current	I _{IK}		-50	mA
Output diode current	I _{OK}	(Note 3)	±50	mA
Output current	I _{OUT}		±50	mA
Power dissipation	PD		180	mW
V _{CC} /ground current	I _{CC} /I _{GND}		±100	mA
Storage temperature	T _{stg}		-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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: Output in OFF state.

Note 2: High (H) or Low (L) state. I_{OUT} absolute maximum rating must be observed.

Note 3: V_{OUT} < GND, V_{OUT} > V_{CC}

10. Operating Ranges (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V _{CC}		1.65 to 3.6	V
		(Note 1)	1.5 to 3.6	
Input voltage (DIR, OE)	V _{IN}		0 to 5.5	V
Bus I/O voltage	V _{I/O}	(Note 2)	0 to 5.5	V
		(Note 3)	0 to V _{CC}	
Output current	I _{OH} ,I _{OL}	(Note 4)	±24	mA
		(Note 5)	±12	
Operating temperature	T _{opr}		-40 to 85	°C
Input rise and fall times	dt/dv	(Note 6)	0 to 10	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device.

Unused inputs and bus inputs must be tied to either V_{CC} or GND. Please connect both bus inputs and the bus outputs with V_{CC} or GND when the I/O of the bus terminal changes by the function. In this case, please note that the output is not short-circuited.

Note 1: Data retention only.

Note 2: Output in OFF state.

Note 3: High or low state

Note 4: V_{CC} = 3.0 to 3.6 V

Note 5: V_{CC} = 2.7 to 3.0 V

Note 6: V_{IN} =0.8 to 2.0 V , V_{CC} = 3.0 V

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, $T_a = -40$ to 85°C)

Characteristics	Symbol	Test Condition		V _{CC} (V)	Min	Max	Unit
High-level input voltage	VIH	—		1.65 to 2.3	$V_{CC} imes 0.9$	_	V
				2.3 to 2.7	1.7	_	
				2.7 to 3.6	2.0	_	
Low-level input voltage	VIL	—		1.65 to 2.3	_	$V_{CC} \times 0.1$	V
				2.3 to 2.7	_	0.7	
				2.7 to 3.6	_	0.8	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -100 μA	1.65 to 3.6	V _{CC} - 0.2		V
			I _{OH} = -4 mA	1.65	1.05	_	
			I _{OH} = -8 mA	2.3	1.7		
			I _{OH} = -12 mA	2.7	2.2		
			I _{OH} = -18 mA	3.0	2.4		
			I _{OH} = -24 mA	3.0	2.2	_	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	1.65 to 3.6	_	0.2	V
			I _{OL} = 4 mA	1.65	—	0.45	
			I _{OL} = 8 mA	2.3	—	0.7	
			I _{OL} = 12 mA	2.7	—	0.4	
			I _{OL} = 16 mA	3.0	—	0.4	
			I _{OL} = 24 mA	3.0	—	0.55	
Input leakage current	I _{IN}	V _{IN} = 0 to 5.5 V		1.65 to 3.6	_	±5.0	μA
3-state output OFF-state leakage current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0 to 5.5 V		1.65 to 3.6	—	±5.0	μA
Power-OFF leakage current	I _{OFF}	V _{IN} /V _{OUT} = 5.5 V		0	—	10.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		1.65 to 3.6	_	10.0	μA
		V_{IN}/V_{OUT} = 3.6 to 5.5 V		1.65 to 3.6	_	±10.0	
Quiescent supply current	Δl _{CC}	V _{IH} = V _{CC} - 0.6 V (per input)		2.7 to 3.6	—	500	μA

11.2. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 85°C)

Characteristics	Symbol	Note	Test Condition	V _{CC} (V)	Min	Max	Unit
Propagation delay time	t _{PLH} ,t _{PHL}		See 11.5 AC Test Circuit,	1.8 ± 0.15	_	25.0	ns
			Table 11.5.1,	2.5 ± 0.2	_	9.0	
			Fig. 11.6.1, Table 11.6.1	2.7	_	8.0	
				3.3 ± 0.3	1.5	7.0	
3-state output enable time	t _{PZL} ,t _{PZH}		See 11.5 AC Test Circuit,	1.8 ± 0.15	_	34.0	ns
		Table 11.5.1, Fig. 11.6.2, Table 11.6.1		2.5 ± 0.2	_	17.0	
			2.7	_	9.5		
				3.3 ± 0.3	1.5	8.5	
3-state output disable time	t _{PLZ} ,t _{PHZ}		See 11.5 AC Test Circuit,	1.8 ± 0.15	_	32.0	ns
			Table 11.5.1, Fig. 11.6.2, Table 11.6.1	2.5 ± 0.2	_	16.0	
				2.7	_	8.5	
				3.3 ± 0.3	1.5	7.5	
Output skew	t _{osLH} ,t _{osHL}	(Note 1)	—	2.7	_	_	ns
				3.3 ± 0.3	_	1.0	

Note 1: Parameter guaranteed by design. ($t_{osLH} = |t_{PLH}m-t_{PLH}n|$, $t_{osHL} = |t_{PHL}m-t_{PHL}n|$)

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11.3. Dynamic Switching Characteristics (Unless otherwise specified, $T_a = 25^{\circ}$ C, Input: tr = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Тур.	Unit
Quiet output maximum dynamic V_{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V_{OL}	V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

11.4. Capacitive Characteristics (Unless otherwise specified, $T_a = 25^{\circ}C$)

Characteristics	Symbol	Note	Test Condition	V _{CC} (V)	Тур.	Unit
Input capacitance	C _{IN}		DIR, OE	3.3	7	pF
Bus I/O capacitance	C _{I/O}		An, Bn	3.3	8	pF
Power dissipation capacitance	C _{PD}	(Note 1)	f _{IN} = 10 MHz	3.3	25	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.

 $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8 \text{ (per bit)}$

11.5. AC Test Circuit

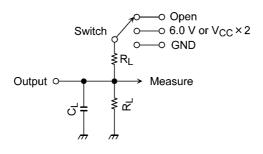
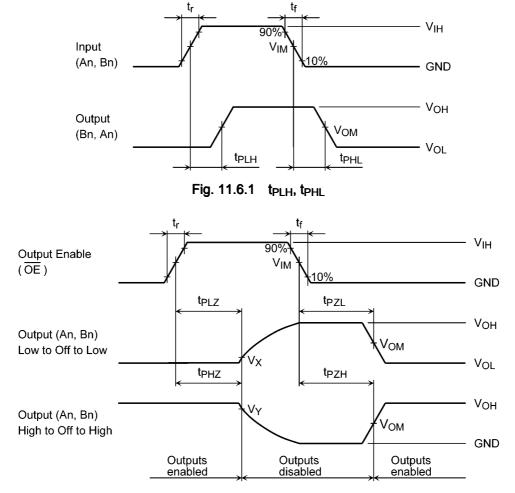


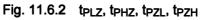
Table 11.5.1 Parameter for AC Test Circuit

Parameter	Switch	Test Condition
t _{PLH} , t _{PHL}	OPEN	_
t _{PLZ} , t _{PZL}	6.0 V	V_{CC} = 3.3 \pm 0.3 V
		V _{CC} = 2.7 V
	$V_{CC} \times 2$	V_{CC} = 2.5 \pm 0.2 V
		V_{CC} = 1.8 \pm 0.15 V
t _{PHZ} , t _{PZH}	GND	

11.6. AC Waveform

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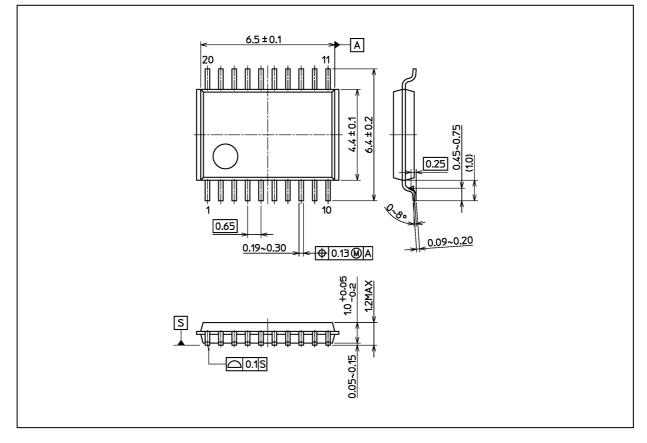
	Symbol	V_{CC} = 3.3 ± 0.3 V V_{CC} = 2.7 V	V_{CC} = 2.5 \pm 0.2 V	V_{CC} = 1.8 \pm 0.15 V
Input	V _{IH}	2.7 V	V _{CC}	V _{CC}
	V _{IM}	1.5 V	V _{CC} /2	V _{CC} /2
	t _r , t _f	2.5 ns	2.0 ns	2.0 ns
Output	V _{OM}	1.5 V	V _{OH} /2	V _{OH} /2
	V _X	V _{OL} + 0.3 V	V _{OL} + 0.15 V	V _{OL} + 0.15 V
	V _Y	V _{OH} - 0.3 V	V _{OH} - 0.15 V	V _{OH} - 0.15 V
Load	CL	50 pF	30 pF	30 pF
	RL	500 Ω	500 Ω	1 kΩ

Table 11.6.1 AC Waveform Symbols

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Package Dimensions

Unit: mm



Weight: 0.071 g (typ.)

	Package Name(s)
Nickname: TSSOP20B	

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