CMOS Digital Integrated Circuits Silicon Monolithic

74LCX257FT

1. Functional Description

Low-Voltage Quad 2-Channel Multiplexer (3-state) with 5-V Tolerant Inputs and Outputs

2. General

The 74LCX257FT is a high-performance CMOS multiplexer. 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 V) V_{CC} applications, but it could be used to interface to 5 V supply environment for inputs.

It is composed of four independent 2-channel multiplexers with common select and $\overline{\mathrm{OE}}$.

If \overline{OE} is set high, the outputs are held in a high-impedance state. When SELECT is set low, "A" data inputs are enabled. Conversely, when SELECT is high, "B" data inputs are enabled.

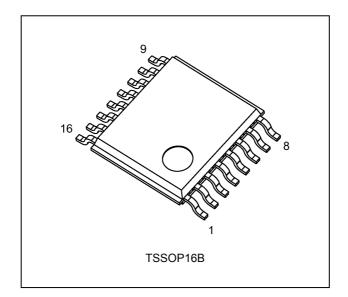
All inputs are equipped with protection circuits against static discharge.

3. Features

- (1) AEC-Q100 (Rev. H) (Note 1)
- (2) Wide operating temperature range: $T_{opr} = -40$ to 125 °C
- (3) Low-voltage operation: V_{CC} = 1.65 to 3.6 V
- (4) High-speed operation: t_{pd} = 7.0 ns (max) (V_{CC} = 3.3 ± 0.3 V)
- (5) Output current: $|I_{OH}|/I_{OL} = 24 \text{ mA} \text{ (min)} (V_{CC} = 3.0 \text{ V})$
- (6) Power-down protection provided on all inputs and outputs
- (7) Pin and function compatible with the 74 series(74LVC/ALVC/ etc.) 257 type

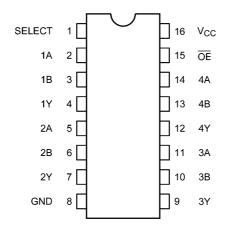
Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

4. Packaging

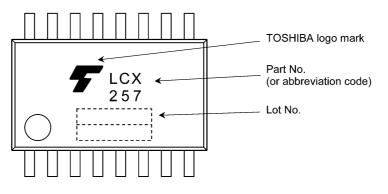


5. Pin Assignment

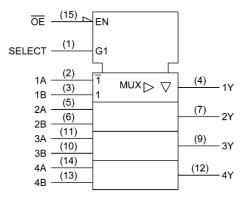
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6. Marking



7. IEC Logic Symbol



8. Truth Table

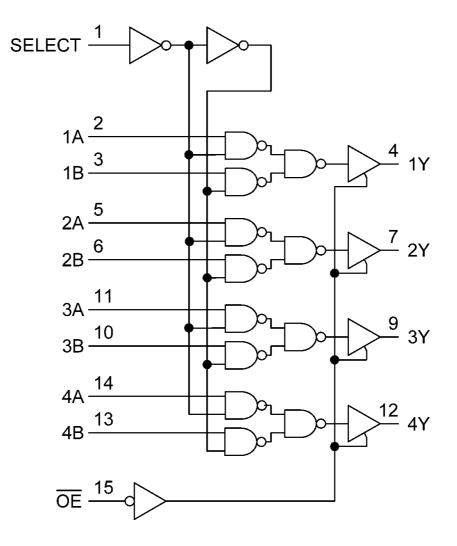
Input OE	Input SELECT	Inputs A	Inputs B	Outputs Y
Н	х	Х	Х	Z
L	L	L	Х	L
L	L	Н	Х	Н
L	Н	Х	L	L
L	Н	Х	Н	Н

X: Don't care

Z: High impedance

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9. System Diagram



10. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V _{CC}		-0.5 to 6.5	V
Input voltage	V _{IN}		-0.5 to 6.5	V
Output voltage	V _{OUT}	(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	(Note 4)	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 or Low state. I_{OUT} absolute maximum rating must be observed.

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

Note 4: 180 mW in the range of $T_a = -40$ to 85 °C. From $T_a = 85$ to 125 °C a derating factor of -3.25 mW/°C shall be applied until 50 mW.

11. 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	V _{IN}		0 to 5.5	V
Output voltage	V _{OUT}	(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 125	°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 must be tied to either V_{CC} or GND.

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

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12. Electrical Characteristics

12.1. 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	V _{IH}	—		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 1 input)		2.7 to 3.6	—	500	μΑ

12.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to 125 °C)

Characteristics	Symbol	Test Conditior	ı	V _{CC} (V)	Min	Max	Unit
High-level input voltage	V _{IH}	—		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	V _{IL}	—		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	0.9	—	
			I _{OH} = -8 mA	2.3	1.55	—	
			I _{OH} = -12 mA	2.7	2.0	—	
			I _{OH} = -18 mA	3.0	2.2	—	
			I _{OH} = -24 mA	3.0	2.0	—	
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	—	0.65	
			I _{OL} = 8 mA	2.3	—	0.9	
			I _{OL} = 12 mA	2.7	—	0.6	
			I _{OL} = 16 mA	3.0	—	0.6	
			I _{OL} = 24 mA	3.0	—	0.75	
Input leakage current	I _{IN}	V _{IN} = 0 to 5.5 V		1.65 to 3.6	—	±20.0	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	—	±20.0	μA
Power-OFF leakage current	I _{OFF}	V _{IN} /V _{OUT} = 5.5 V		0	_	40.0	μA
Quiescent supply current	I _{CC}	$V_{IN} = V_{CC}$ or GND		1.65 to 3.6	_	40.0	μA
		V_{IN}/V_{OUT} = 3.6 to 5.5 V		1.65 to 3.6	_	±40.0	
Quiescent supply current	Δl _{CC}	V _{IH} = V _{CC} - 0.6 V (per 1 input)		2.7 to 3.6	_	5.0	mA

12.3. 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 12.7 AC Test Circuit,	1.8 ± 0.15	—	20.0	ns		
(A,B - Y)			Table 12.7.1 Fig. 12.8.1, Table 12.8.1	2.5 ± 0.2	_	7.5			
			1 lg. 12.0.1, Table 12.0.1	2.7	_	6.5			
				$\textbf{3.3}\pm\textbf{0.3}$	1.5	6.0			
Propagation delay time	t _{PLH} ,t _{PHL}		See 12.7 AC Test Circuit,	1.8 ± 0.15	_	25.0	ns		
(SELECT - Y)			Table 12.7.1	2.5 ± 0.2	_	9.5			
			Fig. 12.8.1, Table 12.8.1	2.7	_	8.5			
				3.3 ± 0.3	1.5	7.0			
Output enable time	t _{PZL} ,t _{PZH}		See 12.7 AC Test Circuit,		_	30.0	ns		
				Table 12.7.1	Table 12.7.1 Fig. 12.8.2, Table 12.8.1	2.5 ± 0.2	_	15.0	
			1 lg. 12.0.2, Table 12.0.1	2.7	_	8.5			
				$\textbf{3.3}\pm\textbf{0.3}$	1.5	7.0			
Output disable time	t _{PLZ} ,t _{PHZ}		See 12.7 AC Test Circuit,	1.8 ± 0.15	_	30.0	ns		
			Table 12.7.1 Fig. 12.8.2, Table 12.8.1	2.5 ± 0.2	_	15.0			
			1 lg. 12.0.2, Table 12.0.1	2.7	_	6.0			
				$\textbf{3.3}\pm\textbf{0.3}$	1.5	5.5			
Output skew	t _{osLH} ,t _{osHL}	(Note 1)	—	2.7	_	_	ns		
				$\textbf{3.3}\pm\textbf{0.3}$		1.0			

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

12.4. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 125 °C)

Characteristics	Symbol	Note	Test Condition	V _{CC} (V)	Min	Max	Unit	
Propagation delay time	t _{PLH} ,t _{PHL}		See 12.7 AC Test Circuit,	1.8 ± 0.15	_	22.0	ns	
(A,B - Y)			Table 12.7.1 Fig. 12.8.1, Table 12.8.1	2.5 ± 0.2		8.5		
			Fig. 12.0.1, Table 12.0.1	2.7	_	7.5		
				3.3 ± 0.3	1.5	7.0		
Propagation delay time	t _{PLH} ,t _{PHL}		See 12.7 AC Test Circuit,	1.8 ± 0.15	_	27.5	ns	
(SELECT - Y)			Table 12.7.1 Fig. 12.8.1, Table 12.8.1	2.5 ± 0.2	_	10.5		
			Fig. 12.0.1, Table 12.0.1	2.7		9.5		
				3.3 ± 0.3	1.5	8.0		
Output enable time	t _{PZL} ,t _{PZH}		See 12.7 AC Test Circuit,	1.8 ± 0.15	_	33.0	ns	
				Table 12.7.1 Fig. 12.8.2, Table 12.8.1	2.5 ± 0.2	_	16.5	
			1 lg. 12.0.2, Table 12.0.1	2.7	_	9.5		
				3.3 ± 0.3	1.5	8.0		
Output disable time	t _{PLZ} ,t _{PHZ}		See 12.7 AC Test Circuit,	1.8 ± 0.15		33.0	ns	
			Table 12.7.1	2.5 ± 0.2	_	16.5		
			Fig. 12.8.2, Table 12.8.1	2.7	_	7.0		
				3.3 ± 0.3	1.5	6.0		
Output skew	t _{osLH} ,t _{osHL}	(Note 1)	_	2.7		_	ns	
				3.3 ± 0.3		1.0	ns	

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

12.5. Dynamic Switching Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_r = t_f = 2.5$ ns, $C_L = 50$ pF, $R_L = 500 \Omega$)

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

12.6. Capacitive Characteristics (Unless otherwise specified, $T_a = 25$ °C)

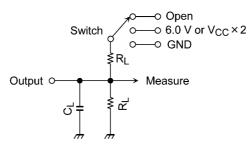
Characteristics	Symbol	Note	Test Condition	V _{CC} (V)	Тур.	Unit
Input capacitance	C _{IN}		_	3.3	7	pF
Output capacitance	C _{OUT}		_	3.3	8	pF
Power dissipation capacitance	C _{PD}	(Note 1)	f _{IN} = 10 MHz	3.3	25	pF

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.

 $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per 1 circuit)

12.7. AC Test Circuit

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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	

12.8. AC Waveform

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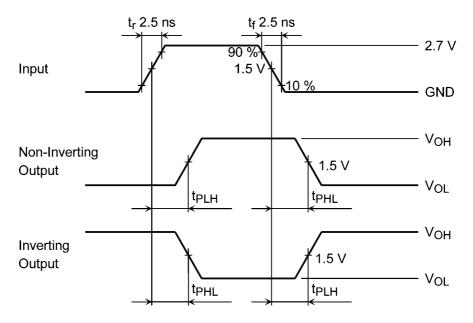
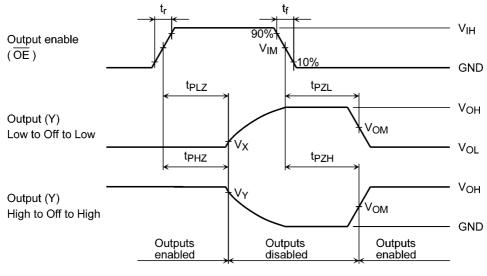


Fig. 12.8.1 t_{PLH}, t_{PHL}





			,	
	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

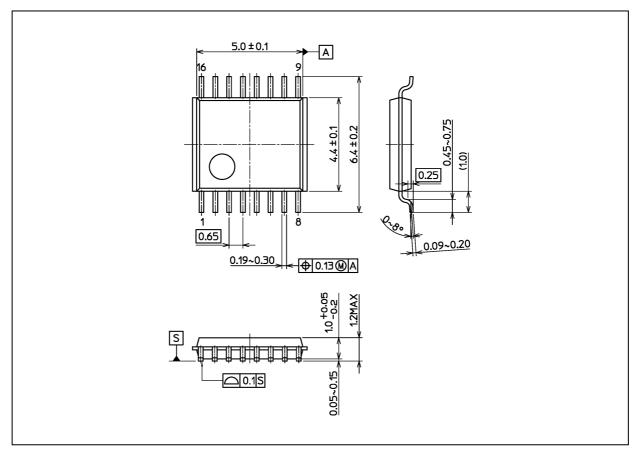
Table 12.8.1 AC Waveform Symbols



74LCX257FT

Package Dimensions

Unit: mm



Weight: 0.055 g (typ.)

	Package Name(s)
Nickname: TSSOP16B	

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