

# 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  $\overline{OE}$ .

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.

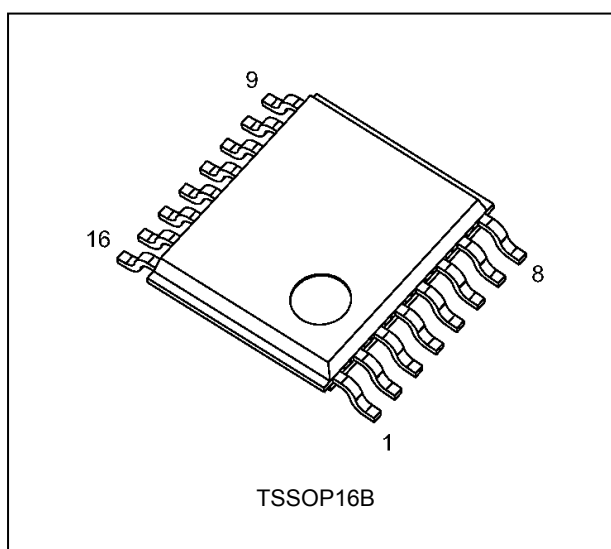
All inputs are equipped with protection circuits against static discharge.

## 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) ( $V_{CC} = 3.3 \pm 0.3$  V)
- (5) Output current:  $|I_{OH}|/I_{OL} = 24$  mA (min) ( $V_{CC} = 3.0$  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.

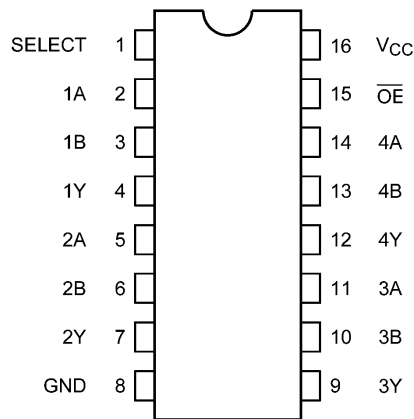
## 4. Packaging



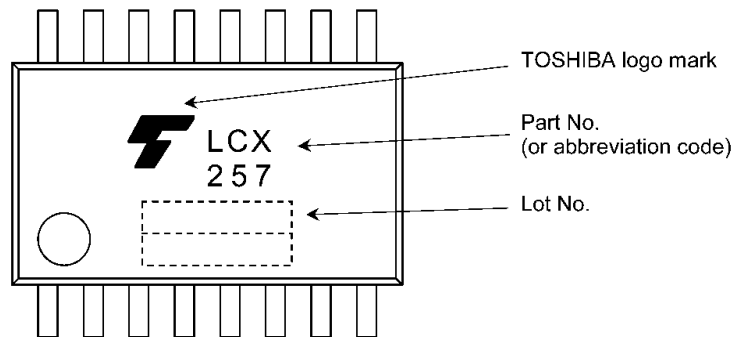
Start of commercial production

2014-11

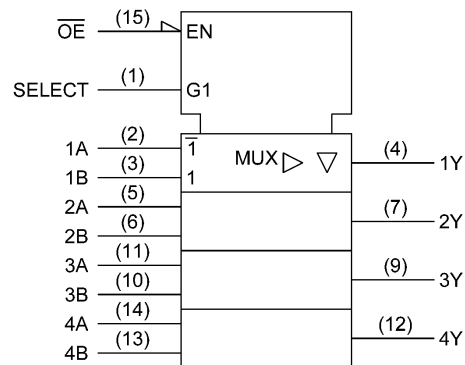
**5. Pin Assignment**



**6. Marking**



**7. IEC Logic Symbol**

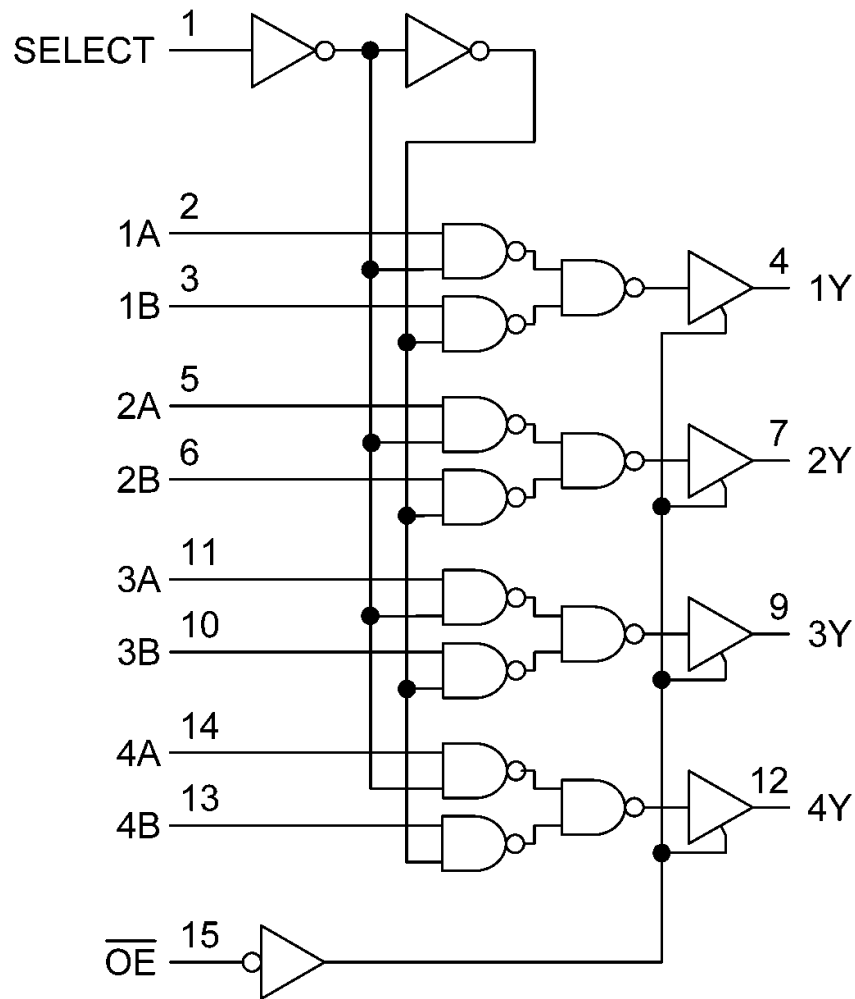


**8. Truth Table**

Input OE	Input SELECT	Inputs A	Inputs B	Outputs Y
H	X	X	X	Z
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

X: Don't care  
Z: High impedance

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)	$\pm 50$	mA
Output current	$I_{OUT}$		$\pm 50$	mA
Power dissipation	$P_D$	(Note 4)	180	mW
$V_{CC}$ /ground current	$I_{CC}/I_{GND}$		$\pm 100$	mA
Storage temperature	$T_{stg}$		-65 to 150	$^{\circ}C$

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  $85^{\circ}C$ . From  $T_a = 85$  to  $125^{\circ}C$  a derating factor of  $-3.25$  mW/ $^{\circ}C$  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)	$\pm 24$	mA
		(Note 5)	$\pm 12$	
Operating temperature	$T_{opr}$		-40 to 125	$^{\circ}C$
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

**12. Electrical Characteristics**

**12.1. DC Characteristics (Unless otherwise specified,  $T_a = -40$  to  $85\text{ }^\circ\text{C}$ )**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Max	Unit	
High-level input voltage	$V_{IH}$	—	1.65 to 2.3	$V_{CC} \times 0.9$	—	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 $V_{IL}$	$I_{OH} = -100\text{ }\mu\text{A}$	1.65 to 3.6	$V_{CC} - 0.2$	—	V
			$I_{OH} = -4\text{ mA}$	1.65	1.05	—	
			$I_{OH} = -8\text{ mA}$	2.3	1.7	—	
			$I_{OH} = -12\text{ mA}$	2.7	2.2	—	
			$I_{OH} = -18\text{ mA}$	3.0	2.4	—	
			$I_{OH} = -24\text{ mA}$	3.0	2.2	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 100\text{ }\mu\text{A}$	1.65 to 3.6	—	0.2	V
			$I_{OL} = 4\text{ mA}$	1.65	—	0.45	
			$I_{OL} = 8\text{ mA}$	2.3	—	0.7	
			$I_{OL} = 12\text{ mA}$	2.7	—	0.4	
			$I_{OL} = 16\text{ mA}$	3.0	—	0.4	
			$I_{OL} = 24\text{ mA}$	3.0	—	0.55	
Input leakage current	$I_{IN}$	$V_{IN} = 0$ to $5.5\text{ V}$	1.65 to 3.6	—	$\pm 5.0$	$\mu\text{A}$	
3-state output OFF-state leakage current	$I_{OZ}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0$ to $5.5\text{ V}$	1.65 to 3.6	—	$\pm 5.0$	$\mu\text{A}$	
Power-OFF leakage current	$I_{OFF}$	$V_{IN}/V_{OUT} = 5.5\text{ V}$	0	—	10.0	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	1.65 to 3.6	—	10.0	$\mu\text{A}$	
		$V_{IN}/V_{OUT} = 3.6$ to $5.5\text{ V}$	1.65 to 3.6	—	$\pm 10.0$		
Quiescent supply current	$\Delta I_{CC}$	$V_{IH} = V_{CC} - 0.6\text{ V}$ (per 1 input)	2.7 to 3.6	—	500	$\mu\text{A}$	

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

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Max	Unit	
High-level input voltage	$V_{IH}$	—	1.65 to 2.3	$V_{CC} \times 0.9$	—	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 $V_{IL}$	$I_{OH} = -100 \mu A$	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 $V_{IL}$	$I_{OL} = 100 \mu A$	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	—	$\pm 20.0$	$\mu A$	
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	—	$\pm 20.0$	$\mu A$	
Power-OFF leakage current	$I_{OFF}$	$V_{IN}/V_{OUT} = 5.5$ V	0	—	40.0	$\mu A$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	1.65 to 3.6	—	40.0	$\mu A$	
		$V_{IN}/V_{OUT} = 3.6$ to $5.5$ V	1.65 to 3.6	—	$\pm 40.0$		
Quiescent supply current	$\Delta I_{CC}$	$V_{IH} = V_{CC} - 0.6$ 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 (A,B - Y)	$t_{PLH}, t_{PHL}$		See 12.7 AC Test Circuit, Table 12.7.1 Fig. 12.8.1, Table 12.8.1	$1.8 \pm 0.15$	—	20.0	ns
				$2.5 \pm 0.2$	—	7.5	
				2.7	—	6.5	
				$3.3 \pm 0.3$	1.5	6.0	
Propagation delay time (SELECT - Y)	$t_{PLH}, t_{PHL}$		See 12.7 AC Test Circuit, Table 12.7.1 Fig. 12.8.1, Table 12.8.1	$1.8 \pm 0.15$	—	25.0	ns
				$2.5 \pm 0.2$	—	9.5	
				2.7	—	8.5	
				$3.3 \pm 0.3$	1.5	7.0	
Output enable time	$t_{PZL}, t_{PZH}$		See 12.7 AC Test Circuit, Table 12.7.1 Fig. 12.8.2, Table 12.8.1	$1.8 \pm 0.15$	—	30.0	ns
				$2.5 \pm 0.2$	—	15.0	
				2.7	—	8.5	
				$3.3 \pm 0.3$	1.5	7.0	
Output disable time	$t_{PLZ}, t_{PHZ}$		See 12.7 AC Test Circuit, Table 12.7.1 Fig. 12.8.2, Table 12.8.1	$1.8 \pm 0.15$	—	30.0	ns
				$2.5 \pm 0.2$	—	15.0	
				2.7	—	6.0	
				$3.3 \pm 0.3$	1.5	5.5	
Output skew	$t_{oS LH}, t_{oS HL}$	(Note 1)	—	2.7	—	—	ns
				$3.3 \pm 0.3$	—	1.0	

Note 1: Parameter guaranteed by design. ( $t_{oS LH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{oS HL} = |t_{PHLm} - t_{PHLn}|$ )

**12.4. AC Characteristics (Unless otherwise specified, T<sub>a</sub> = -40 to 125 °C)**

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

Note 1: Parameter guaranteed by design. (t<sub>osLH</sub> = |t<sub>PLHM</sub> - t<sub>PLHN</sub>|, t<sub>osHL</sub> = |t<sub>PHLM</sub> - t<sub>PHLN</sub>|)

**12.5. Dynamic Switching Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C, Input: t<sub>r</sub> = t<sub>f</sub> = 2.5 ns, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω)**

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>OLP</sub>	V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	0.8	V
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>OLV</sub>	V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	0.8	V

**12.6. Capacitive Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)**

Characteristics	Symbol	Note	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Input capacitance	C <sub>IN</sub>		—	3.3	7	pF
Output capacitance	C <sub>OUT</sub>		—	3.3	8	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 1)	f <sub>IN</sub> = 10 MHz	3.3	25	pF

Note 1: 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.

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

12.7. AC Test Circuit

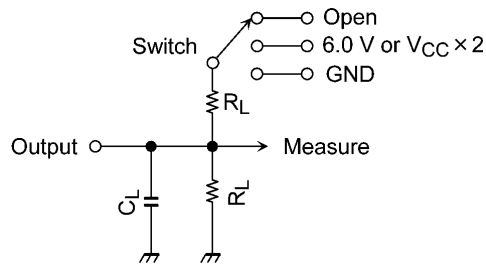


Table 12.7.1 Parameter for AC Test Circuit

Parameter	Switch	Test Condition
t <sub>PLH</sub> , t <sub>PHL</sub>	OPEN	—
t <sub>PLZ</sub> , t <sub>PZL</sub>	6.0 V	V <sub>CC</sub> = 3.3 ± 0.3 V
		V <sub>CC</sub> = 2.7 V
	V <sub>CC</sub> × 2	V <sub>CC</sub> = 2.5 ± 0.2 V
		V <sub>CC</sub> = 1.8 ± 0.15 V
t <sub>PHZ</sub> , t <sub>PZH</sub>	GND	—



12.8. AC Waveform

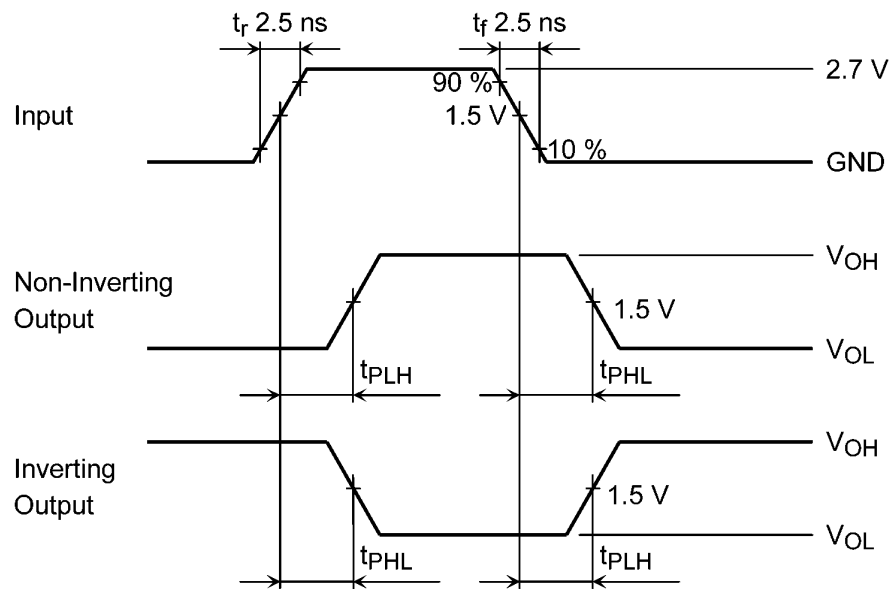


Fig. 12.8.1  $t_{PLH}$ ,  $t_{PHL}$

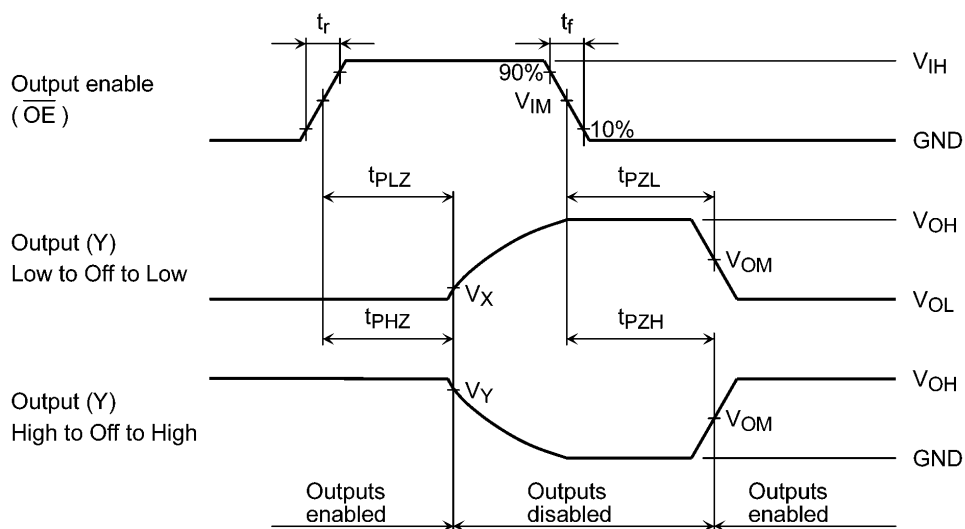


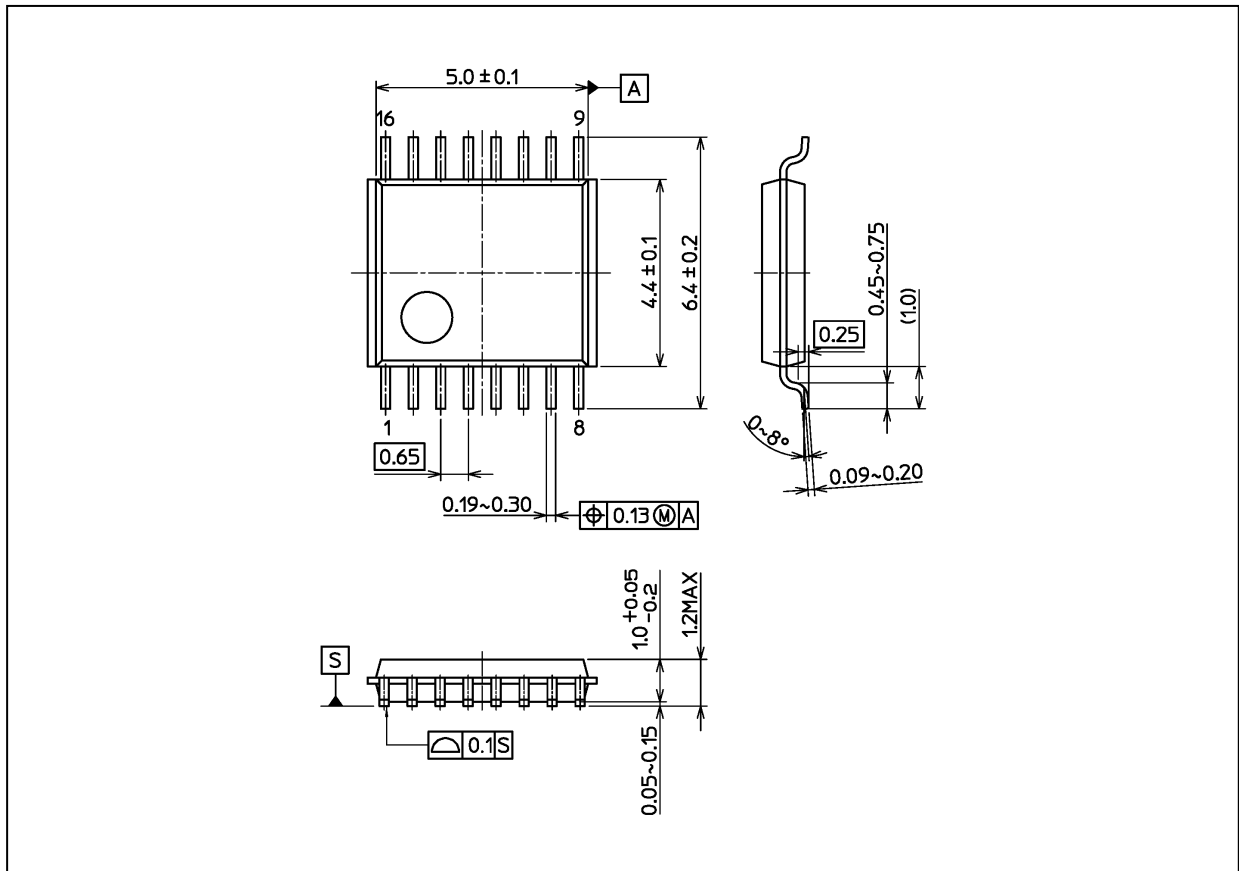
Fig. 12.8.2  $t_{PLZ}$ ,  $t_{PHZ}$ ,  $t_{PZL}$ ,  $t_{PZH}$

Table 12.8.1 AC Waveform Symbols

	Symbol	$V_{CC} = 3.3 \pm 0.3 \text{ V}$ $V_{CC} = 2.7 \text{ V}$	$V_{CC} = 2.5 \pm 0.2 \text{ V}$	$V_{CC} = 1.8 \pm 0.15 \text{ V}$
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	$V_{OH}/2$	$V_{OH}/2$
	$V_X$	$V_{OL} + 0.3 \text{ V}$	$V_{OL} + 0.15 \text{ V}$	$V_{OL} + 0.15 \text{ V}$
	$V_Y$	$V_{OH} - 0.3 \text{ V}$	$V_{OH} - 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
Load	$C_L$	50 pF	30 pF	30 pF
	$R_L$	500 $\Omega$	500 $\Omega$	1 k $\Omega$

Package Dimensions

Unit: mm



Weight: 0.055 g (typ.)

Package Name(s)
Nickname: TSSOP16B

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