TOSHIBA

TC74LCX16373AFT

Low Voltage 16-Bit D-TYPE LATCH with 5V Tolerant Inputs and Outputs

The TC74LCX16373AFT is a high performance CMOS 16-bit D-TYPE LATCH. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaning the CMOS low power dissipation.

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

This 16-bit D-type latch is controlled by a latch enable input (LE) and an output enable input ($\overline{OE}$) which are common to each byte. It can be used as two 8-bit latches or one 16-bit latch. When the $\overline{OE}$ input is high, the outputs are in a high impedance state.

All inputs are equipped with protection circuits against static discharge.
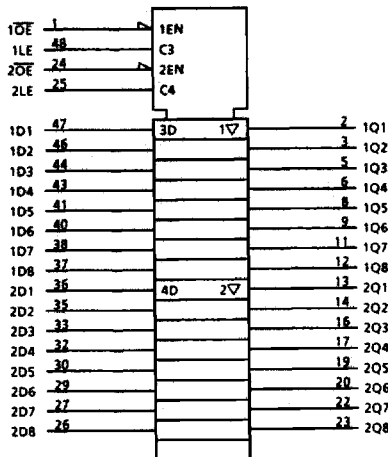
Features
- Low Voltage Operation: $V_{CC} = 2.0 \sim 3.6V$
- High Speed: $t_{pd} = 7.0ns$ (Max.) at $V_{CC} = 3.0 \sim 3.6V$
- Output Current: $I_{OH}/I_{OL} = 24mA$ (Min.) $V_{CC} = 3.0V$
- Latch up Performance: ±500mA
- Package: TSSOP (Thin Shrink Small Outline Package)
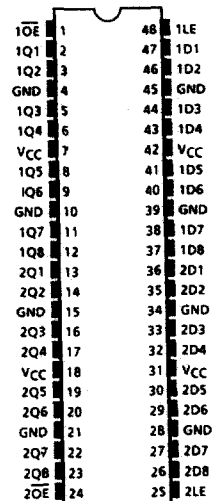- Power down protection is provided on all inputs and outputs.
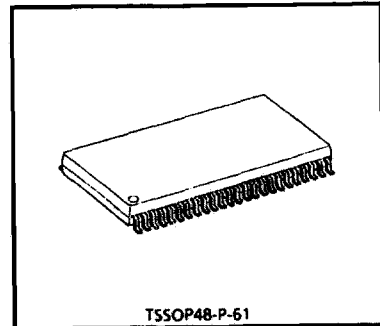
TSSOP48-P-61

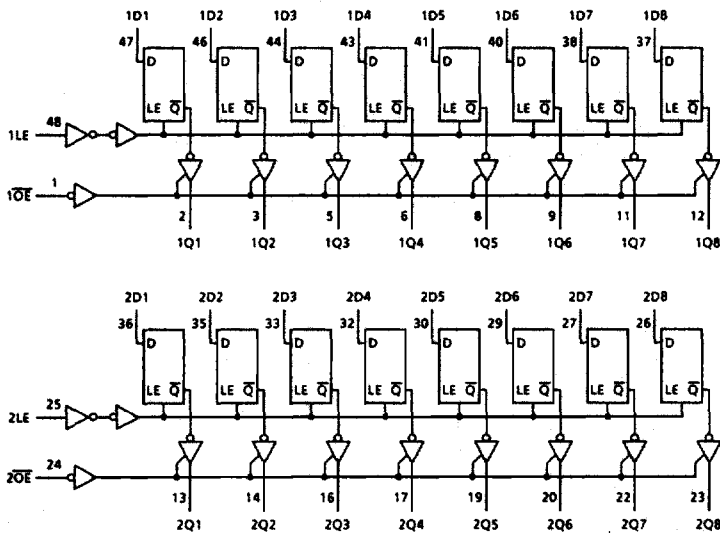Weight : 0.25 g (Typ.)

IEC Logic Symbol

Pin Assignment

(TOP VIEW)

Truth Table

Input			Output
1$\overline{OE}$	1LE	1D1 - 1D8	1Q1 - 1Q8
H	X	X	Z
L	L	X	Qn
L	H	L	L
L	H	H	H

Input			Output
2$\overline{OE}$	2LE	2D1 - 2D8	2Q1 - 2Q8
H	X	X	Z
L	L	X	Qn
L	H	L	L
L	H	H	H

X : Don't Care
Z : High Impedance
Qn : No Change

System Diagram

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Power Supply Voltage	V_{CC}	-0.5 ~ 7.0	V
DC Input Voltage	V_{IN}	-0.5 ~ 7.0	V
DC Bus I/O Voltage	$V_{I/O}$	-0.5 ~ 7.0 (*1)	V
		-0.5 ~ V_{CC} + 0.5 (*2)	
Input Diode Current	I_{IK}	-50	mA
Output Diode Current	I_{OK}	±50 (*3)	mA
DC Output Current	I_{OUT}	±50	mA
Power Dissipation	P_D	400	mW
DC V_{CC}/Ground Current Per Supply Pin	I_{CC}/I_{GND}	±100	mA
Storage Temperature	T_{stg}	-65 ~ 150	°C

(*1) Off-State
(*2) High or Low State. I_{OUT} absolute maximum rating must be observed
(*3) V_{OUT} < GND, V_{OUT} > V_{CC}

Recommended Operating Range

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	2.0 ~ 3.6	V
		1.5 ~ 3.6 (*4)	
Input Voltage	V_{IN}	0 ~ 5.5	V
Bus I/O Voltage	$V_{I/O}$	0 ~ 5.5 (*5)	V
		0 ~ V_{CC} (*6)	
Output Current	I_{OH}/I_{OL}	±24 (*7)	mA
		±12 (*8)	
Operating Temperature	T_{opr}	-40 ~ 85	°C
Input Rise and Fall Time	dt/dv	0 ~ 10 (*9)	ns/V

(*4) Data Retension Only
(*5) Off-State
(*6) High or Low State
(*7) V_{CC} = 3.0 ~ 3.6V
(*8) V_{CC} = 2.7 ~ 3.0V
(*9) V_{IN} = 0.8 ~ 2.0V, V_{CC} = 3.0V

Electrical Characteristics
DC Characteristics (Ta = –40 ~ 85°C)

Parameter		Symbol	Test Condition		V_{CC} (V)	Min.	Max.	Unit
Input Voltage	"H" Level	V_{IH}			2.7 ~ 3.6	2.0	–	V
	"L" Level	V_{IL}			2.7 ~ 3.6	–	0.8	V
Output Voltage	"H" Level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100\mu A$	2.7 ~ 3.6	$V_{CC} - 0.2$	–	V
				$I_{OH} = -12mA$	2.7	2.2	–	
				$I_{OH} = -18mA$	3.0	2.4	–	
				$I_{OH} = -24mA$	3.0	2.2	–	
	"L" Level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100\mu A$	2.7 ~ 3.6	–	0.2	V
				$I_{OL} = 16mA$	3.0	–	0.4	
				$I_{OL} = 12mA$	2.7	–	0.4	
				$I_{OH} = 24mA$	3.0	–	0.55	
Input Leakage Current		I_{IN}	$V_{IN} = 0 \sim 5.5V$		2.7 ~ 3.6	–	±5.0	μA
3-State Output Off-State Current		I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0 \sim 5.5V$		2.7 ~ 3.6	–	±5.0	μA
Power Off Leakage Current		I_{OFF}	$V_{IN}/V_{OUT} = 5.5V$		0	–	10.0	μA
Quiescent Supply Current		I_{CC}	$V_{IN} = V_{CC}$ or GND		2.7 ~ 3.6	–	20.0	μA
			$V_{IN}/V_{OUT} = 3.6 \sim 5.5V$		2.7 ~ 3.6	–	±20.0	
Increase in I_{CC} per Input		ΔI_{CC}	$V_{IH} = V_{CC} - 0.6V$		2.7 ~ 3.6	–	500	μA

AC Electrical Characteristics (Ta = -40 ~85°C)

Parameter	Symbol	Test Condition	V_{CC} (V)	Min.	Max.	Unit
Propagation Delay Time (D - Q)	t_{pLH} t_{pHL}	(Fig. 1, 2)	2.7 3.3 ±0.3	– 1.5	8.0 7.0	ns
Propagation Delay Time (LE - Q)	t_{pLH} t_{pHL}	(Fig. 1, 2)	2.7 3.3 ±0.3	– 1.5	8.0 7.0	ns
3-State Output Enable Time	t_{pZL} t_{pZH}	(Fig. 1, 3)	2.7 3.3 ±0.3	– 1.5	8.2 7.2	ns
3-State Output Disable Time	t_{pLZ} t_{pHZ}	(Fig. 1, 3)	2.7 3.3 ±0.3	– 1.5	8.2 7.2	ns
Minimum Pulse Width (LE)	$t_w(H)$ $t_w(H$	(Fig. 1, 2)	2.7 3.3 ±0.3	3.0 3.0	– –	ns
Minimum Setup Time	t_s	(Fig. 1, 2)	2.7 3.3 ±0.3	2.5 2.5	– –	ns
Minimum Hold Time	t_h	(Fig. 1, 2)	2.7 3.3 ±0.3	1.5 1.5	– –	ns
Output to Output Skew	t_{osLH} t_{osHL}	(*10)	2.7 3.3 ±0.3	– –	– 1.0	ns

(*10)   Parameter guaranteed by design. (t_{osLH} = I t_{pLHm}- t_{pLHn} I, t_{osHL} = I t_{pHLm} - t_{pHLn} I)

## Dynamic Switching Characteristics (Ta = 25°C, Input t_r = t_f = 2.5ns, C_L = 50pF, R_L = 500Ω)

Parameter	Symbol	Test Condition	V_{CC} (V)	Typical	Unit
Quiet Output Maximum Dynamic V_{OL}	V_{OLP}	V_{IH} = 3.3V, V_{IL} = 0V	3.3	0.8	V
Quiet Output Minimum Dynamic V_{OL}	$|V_{OLV}|$	V_{IH} = 3.3V, V_{IL} = 0V	3.3	0.8	V

Capacitive Characteristics (Ta = 25°C)

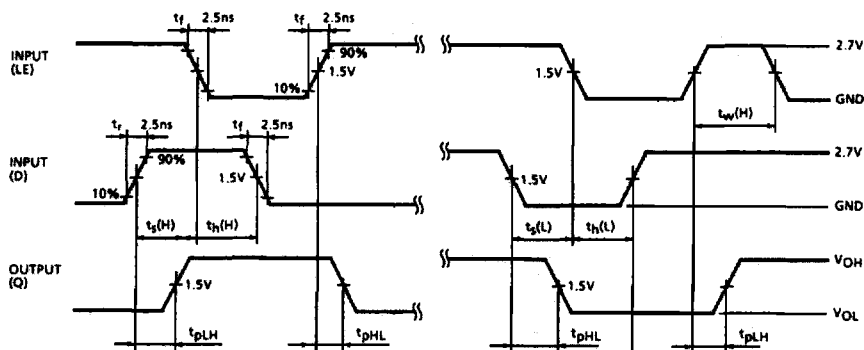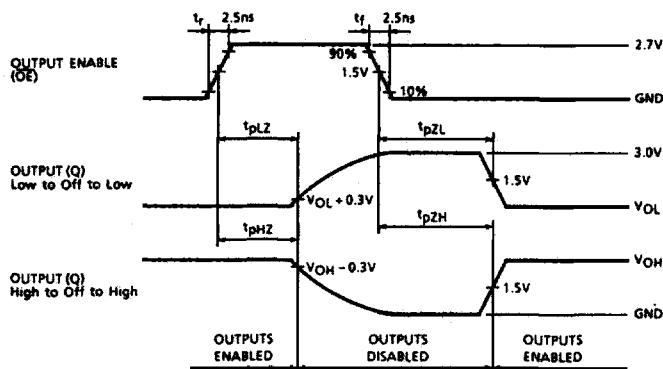| Parameter	Symbol	Test Condition	V_{CC} (V)	Typical	Unit
Input Capacitance	C_{IN}	–	3.3	7	pF
Bus Input Capacitance	C_{OUT}		3.3	8	pF
Power Dissipation Capacitance	C_{PD}	f_{IN} = 10MHz (*11)	3.3	25	pF

(*11) 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} • V_{CC} • f_{IN} + I_{CC}/16 (per latch)

Fig.1   Test circuit
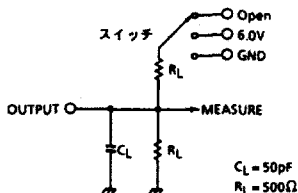
Parameter	Switch
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	6.0V
t_{pHZ}, t_{pZH}	GND
t_W, t_S, t_h	Open

$C_L = 50pF$
$R_L = 500\Omega$

AC wave form

Fig.2 t_{pLH}、t_{pHL}、t_W、t_S、t_h

Fig.3 t_{pLZ}、t_{pHZ}、t_{pZL}、t_{pZH}