TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT   SILICON MONOLITHIC

TC74LCX16373AFT

LOW-VOLTAGE 16-BIT D-TYPE LATCH
WITH 5V TOLERANT INPUTS AND OUTPUTS

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

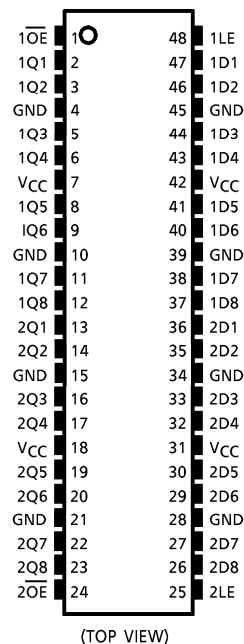All inputs are equipped with protection circuits against static discharge.

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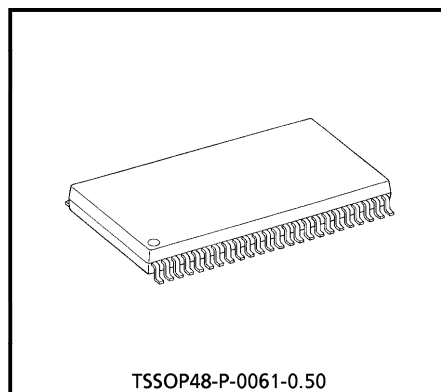
Weight : 0.25 g (Typ.)

FEATURES

● Low Voltage Operation : $V_{CC} = 2.0 \sim 3.6V$

● High Speed Operation : $t_{pd} = 7.0\,ns\,(max.)$ at $V_{CC} = 3.0 \sim 3.6V$

● Output Current : $|I_{OH}| / I_{OL} = 24mA\,(min.)$ at $V_{CC} = 3.0V$

● Latch-up Performance : $\pm 500mA$

● Package : TSSOP
   (Thin Shrink Small Outline Package)

● Power Down Protection is provided on all inputs and outputs.

PIN CONNECTION

1$\overline{OE}$	1	48 1LE
1Q1	2	47 1D1
1Q2	3	46 1D2
GND	4	45 GND
1Q3	5	44 1D3
1Q4	6	43 1D4
V_{CC}	7	42 V_{CC}
1Q5	8	41 1D5
IQ6	9	40 1D6
GND	10	39 GND
1Q7	11	38 1D7
1Q8	12	37 1D8
2Q1	13	36 2D1
2Q2	14	35 2D2
GND	15	34 GND
2Q3	16	33 2D3
2Q4	17	32 2D4
V_{CC}	18	31 V_{CC}
2Q5	19	30 2D5
2Q6	20	29 2D6
GND	21	28 GND
2Q7	22	27 2D7
2Q8	23	26 2D8
2$\overline{OE}$	24	25 2LE

(TOP VIEW)

961001EBA2

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

IEC LOGIC SYMBOL
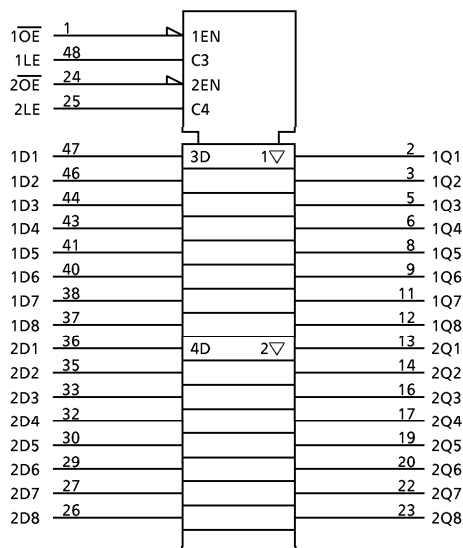
SYSTEM DIAGRAM
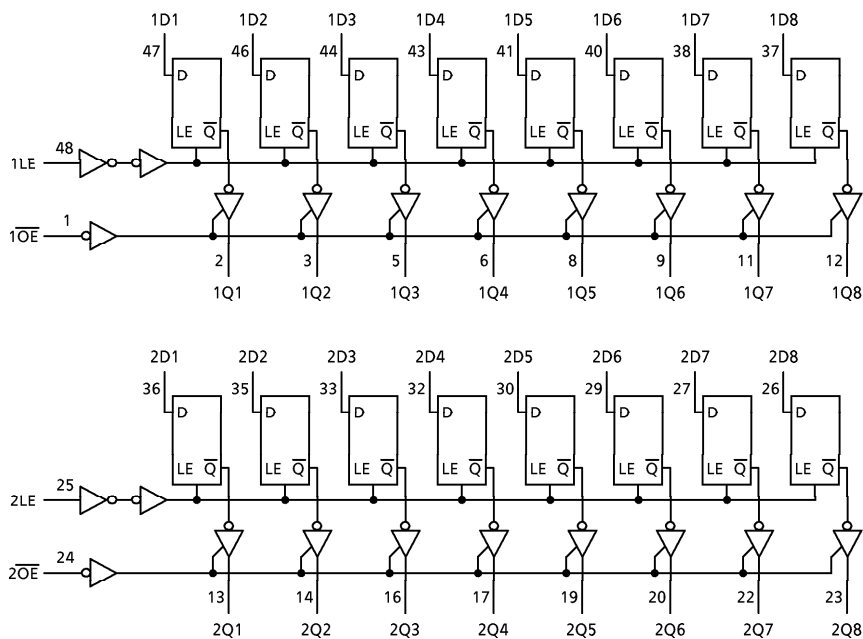
MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	$-0.5\sim7.0$	V
Input Voltage	V_{IN}	$-0.5\sim7.0$	V
Output Voltage	V_{OUT}	$-0.5\sim7.0$ (Note 1)	V
		$-0.5\sim V_{CC}+0.5$ (Note 2)	
Input Diode Current	I_{IK}	-50	mA
Output Diode Current	I_{OK}	±50 (Note 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}	$-65\sim150$	°C

(Note 1) Output in Off-State

(Note 2) High or Low State. I_{OUT} absolute maximum rating must be observed.

(Note 3) $V_{OUT}<GND$, $V_{OUT}>V_{CC}$

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	$2.0\sim3.6$	V
		$1.5\sim3.6$ (Note 4)	
Input Voltage	V_{IN}	$0\sim5.5$	V
Output Voltage	V_{OUT}	$0\sim5.5$ (Note 5)	V
		$0\sim V_{CC}$ (Note 6)	
Output Current	I_{OH}/I_{OL}	±24 (Note 7)	mA
		±12 (Note 8)	
Operating Temperature	T_{opr}	$-40\sim85$	°C
Input Rise And Fall Time	dt/dv	$0\sim10$ (Note 9)	ns/V

(Note 4) Data Retention Only

(Note 5) Output in Off-State

(Note 6) High or Low State

(Note 7) $V_{CC}=3.0\sim3.6V$

(Note 8) $V_{CC}=2.7\sim3.0V$

(Note 9) $V_{IN}=0.8\sim2.0V$, $V_{CC}=3.0V$

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
				$I_{OH} = -12\mu A$	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
				$I_{OL} = 12mA$	2.7	—	0.4	
				$I_{OL} = 16mA$	3.0	—	0.4	
				$I_{OL} = 24mA$	3.0	—	0.55	
Input Leakage Current		I_{IN}	$V_{IN} = 0∼5.5V$		2.7∼3.6	—	±5.0	μA
3-State Output Off-State Current		I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0∼5.5V$		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
			$V_{IN} / V_{OUT} = 3.6∼5.5V$		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 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	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Propagation Delay Time (LE-Q)	t_{pLH} t_{pHL}	(Fig.1, 2)	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
3-State Output Enable Time	t_{pZL} t_{pZH}	(Fig.1, 3)	2.7	—	8.2	ns
			3.3 ± 0.3	1.5	7.2	
3-State Output Disable Time	t_{pLZ} t_{pHZ}	(Fig.1, 3)	2.7	—	8.2	ns
			3.3 ± 0.3	1.5	7.2	
Minimum Pulse Width (LE)	$t_W(H)$	(Fig.1, 2)	2.7	4.0	—	ns
			3.3 ± 0.3	3.0	—	
Minimum Set-up Time	t_s	(Fig.1, 2)	2.7	2.5	—	ns
			3.3 ± 0.3	2.5	—	
Minimum Hold Time	t_h	(Fig.1, 2)	2.7	1.5	—	ns
			3.3 ± 0.3	1.5	—	
Output To Output Skew	t_{osLH} t_{osHL}	(Note 10)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

(Note 10) Parameter guaranteed by design.
$(t_{osLH} = |t_{pLHm} − t_{pLHn}|, t_{osHL} = |t_{pHLm} − t_{pHLn}|)$

Dynamic switching characteristics
(Ta = 25°C, Input $t_r = t_r = 2.5ns$, $C_L = 50pF$, $R_L = 500\Omega$)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	TYP	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)	TYP	UNIT
Input Capacitance	C_{IN}	—	3.3	7	pF
Output Capacitance	C_{OUT}		3.3	8	pF
Power Dissipation Capacitance	C_{PD}	$f_{IN} = 10MHz$ (Note 11)	3.3	25	pF

(Note 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.) $= C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 16$. (Per bit)

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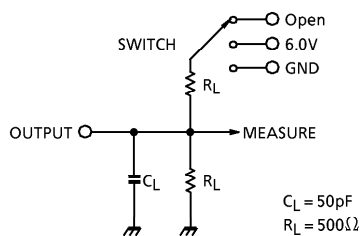
PARAMETER	SWITCH
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	6.0V
t_{pHZ}, t_{pZH}	GND
t_W, t_S, t_h	Open

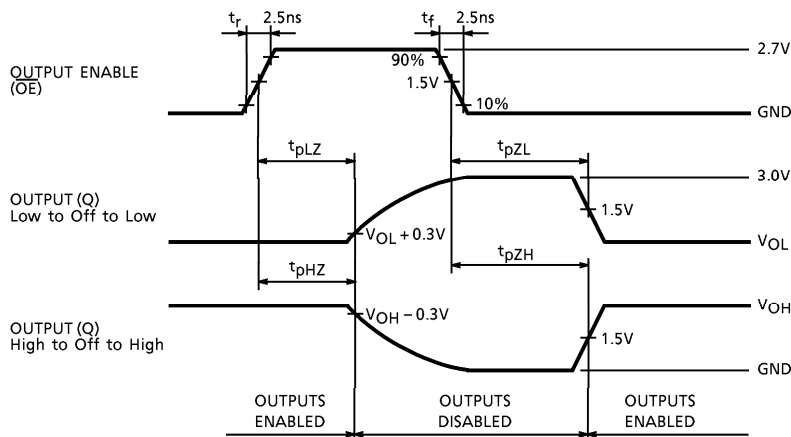## AC WAVEFORM

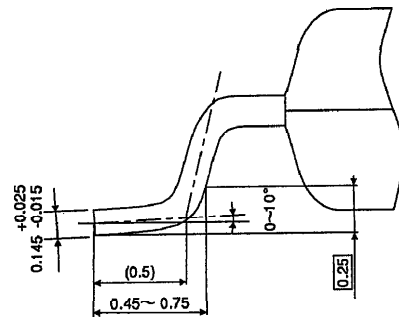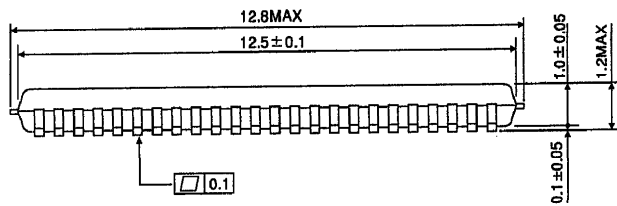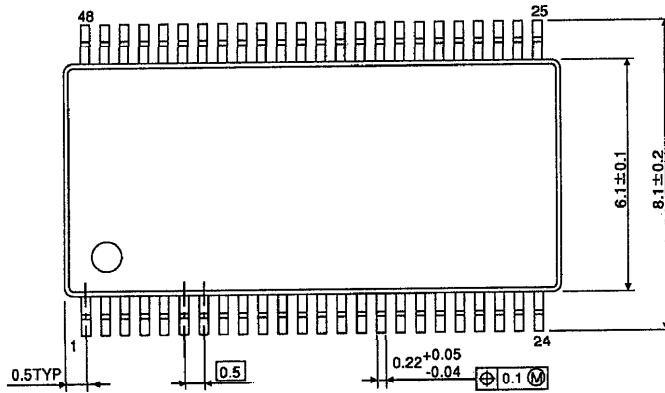Fig.2 t_{pLH}、t_{pHL}、t_W、t_S、t_h
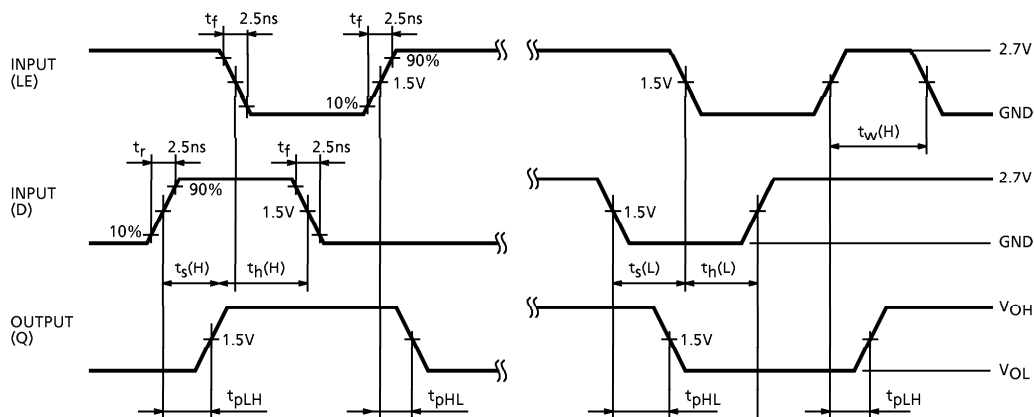
Fig.3 t_{pLZ}、t_{pHZ}、t_{pZL}、t_{pZH}

OUTLINE DRAWING

TSSOP48-P-0061-0.50   Unit : mm

Weight : 0.25g (Typ.)