

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

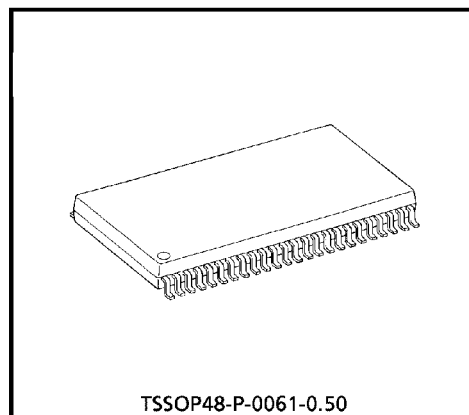
# TC74LCX16240AFT

## LOW-VOLTAGE 16-BIT BUS BUFFER (INVERTED) WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX16240AFT is a high performance CMOS 16bit BUS BUFFER. 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 device is inverting 3-state buffer having four active-low output enables. It can be used as four 4-bit buffers two 8-bit buffers or one 16-bit buffer. When the  $\overline{OE}$  input is high, the outputs are in a high impedance state. This device is designed to be used with 3-state memory address drivers, etc.

All inputs are equipped with protection circuits against static discharge.



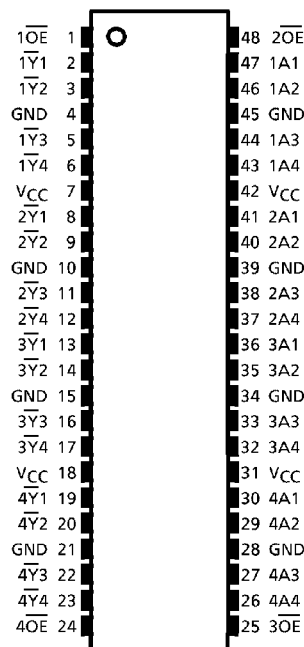
TSSOP48-P-0061-0.50

Weight : 0.25g (Typ.)

### FEATURES

- Low Voltage Operation :  $V_{CC} = 2.0 \sim 3.6V$
- High Speed Operation :  $t_{pd} = 4.9ns$  (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



(TOP VIEW)

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TRUTH TABLE

INPUTS		OUTPUTS
$\overline{1OE}$	1A1-1A4	$\overline{1Y1-1Y4}$
L	L	H
L	H	L
H	X	Z

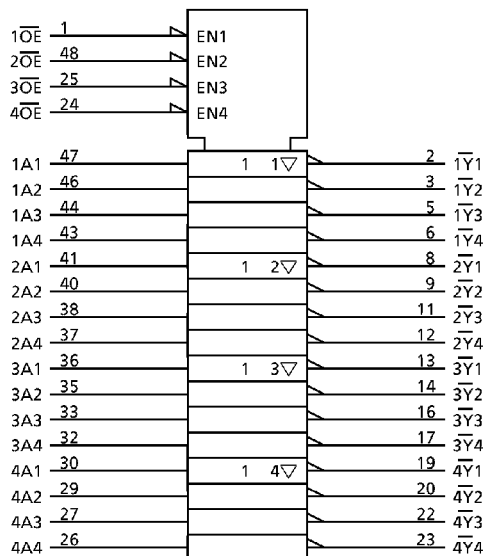
INPUTS		OUTPUTS
$\overline{2OE}$	2A1-2A4	$\overline{2Y1-2Y4}$
L	L	H
L	H	L
H	X	Z

INPUTS		OUTPUTS
$\overline{3OE}$	3A1-3A4	$\overline{3Y1-3Y4}$
L	L	H
L	H	L
H	X	Z

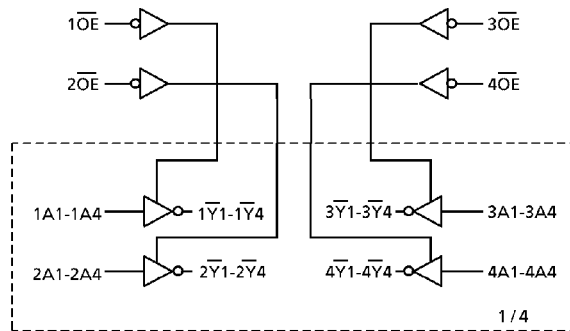
INPUTS		OUTPUTS
$\overline{4OE}$	4A1-4A4	$\overline{4Y1-4Y4}$
L	L	H
L	H	L
H	X	Z

X : Don't Care  
Z : High impedance

IEC LOGIC SYMBOL



SYSTEM DIAGRAM



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## MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	$V_{CC}$	-0.5~7.0	V
Input Voltage	$V_{IN}$	-0.5~7.0	V
Output Voltage	$V_{OUT}$	-0.5~7.0 (Note 1)	V
		-0.5~ $V_{CC}$ +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	$T_{stg}$	-65~150	°C

(Note 1) 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	$V_{CC}$	2.0~3.6	V
		1.5~3.6 (Note 4)	
Input Voltage	$V_{IN}$	0~5.5	V
Output Voltage	$V_{OUT}$	0~5.5 (Note 5)	V
		0~ $V_{CC}$ (Note 6)	
Output Current	$I_{OH}/I_{OL}$	±24 (Note 7)	mA
		±12 (Note 8)	
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise And Fall Time	$dt/dv$	0~10 (Note 9)	ns/V

(Note 4) Data Retention Only

(Note 5) Off-State

(Note 6) High or Low State

(Note 7)  $V_{CC} = 3.0\sim 3.6V$

(Note 8)  $V_{CC} = 2.7\sim 3.0V$

(Note 9)  $V_{IN} = 0.8\sim 2.0V$ ,  $V_{CC} = 3.0V$

**ELECTRICAL CHARACTERISTICS**

DC characteristics (Ta = -40~85°C)

PARAMETER		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT	
				V <sub>CC</sub> (V)				
Input Voltage	"H" Level	V <sub>IH</sub>		2.7~3.6	2.0	—	V	
	"L" Level	V <sub>IL</sub>		2.7~3.6	—	0.8	V	
Output Voltage	"H" Level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100μA	2.7~3.6	V <sub>CC</sub> - 0.2	—	V
				I <sub>OH</sub> = -12μA	2.7	2.2	—	
				I <sub>OH</sub> = -18mA	3.0	2.4	—	
				I <sub>OH</sub> = -24mA	3.0	2.2	—	
	"L" Level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100μA	2.7~3.6	—	0.2	V
				I <sub>OL</sub> = 12mA	2.7	—	0.4	
				I <sub>OL</sub> = 16mA	3.0	—	0.4	
				I <sub>OL</sub> = 24mA	3.0	—	0.55	
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~5.5V	2.7~3.6	—	±5.0	μA	
3-State Output Off-State Current		I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = 0~5.5V	2.7~3.6	—	±5.0	μA	
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> / V <sub>OUT</sub> = 5.5V	0	—	10.0	μA	
Quiescent Supply Current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	2.7~3.6	—	20.0	μA	
			V <sub>IN</sub> / V <sub>OUT</sub> = 3.6~5.5V	2.7~3.6	—	±20.0		
Increase In I <sub>CC</sub> Per Input		ΔI <sub>CC</sub>	V <sub>IH</sub> = V <sub>CC</sub> - 0.6V	2.7~3.6	—	500	μA	

AC characteristics (Ta = -40~85°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	MIN.	MAX.	UNIT
Propagation Delay Time	t <sub>pLH</sub>	(Fig.1, 2)	2.7	—	5.9	ns
	t <sub>pHL</sub>		3.3 ± 0.3	1.5	4.9	
3-State Output Enable Time	t <sub>pZL</sub>	(Fig.1, 3)	2.7	—	7.5	ns
	t <sub>pZH</sub>		3.3 ± 0.3	1.5	6.5	
3-State Output Disable Time	t <sub>pLZ</sub>	(Fig.1, 3)	2.7	—	6.5	ns
	t <sub>pHZ</sub>		3.3 ± 0.3	1.5	5.5	
Output To Output Skew	t <sub>osLH</sub>	(Note 10)	2.7	—	—	ns
	t <sub>osHL</sub>		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<sub>r</sub> = t<sub>f</sub> = 2.5ns, C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω)

CHARACTERISTIC	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> = 3.3V, V <sub>IL</sub> = 0V	3.3	0.8	V
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V	3.3	0.8	V

Capacitive characteristics (Ta = 25°C)

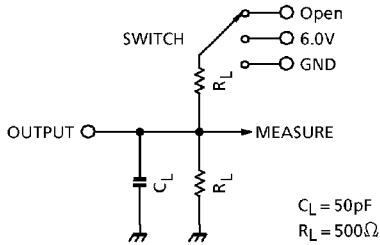
CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	TYP	UNIT
Input Capacitance	C <sub>IN</sub>	—	3.3	7	pF
Output Capacitance	C <sub>OUT</sub>		3.3	8	pF
Power Dissipation Capacitance	C <sub>PD</sub>	f <sub>IN</sub> = 10MHz (Note 11)	3.3	25	pF

(Note 11) 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 :

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

Fig.1 Test circuit



PARAMETER	SWITCH
$t_{pLH}, t_{pHL}$	Open
$t_{pLZ}, t_{pZL}$	6.0V
$t_{pHZ}, t_{pZH}$	GND

**AC WAVEFORM**

Fig.2  $t_{pLH}, t_{pHL}$

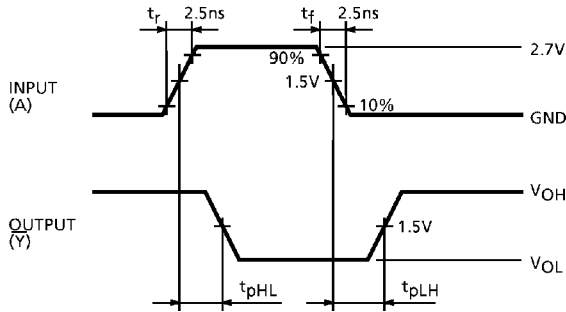
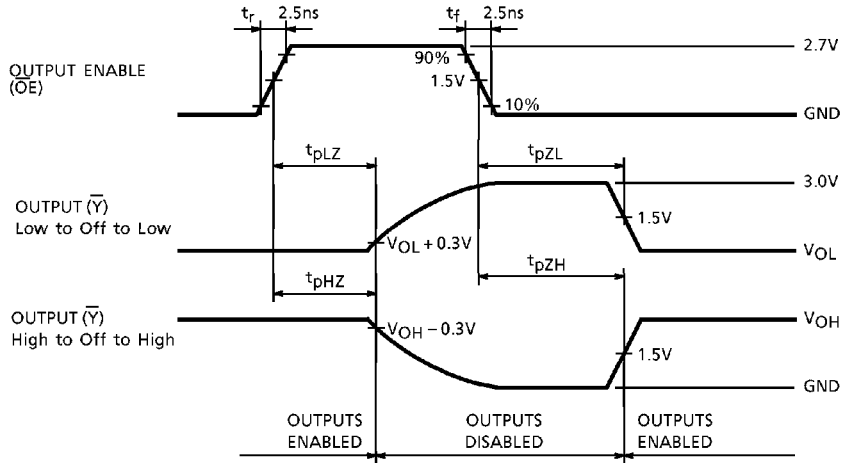
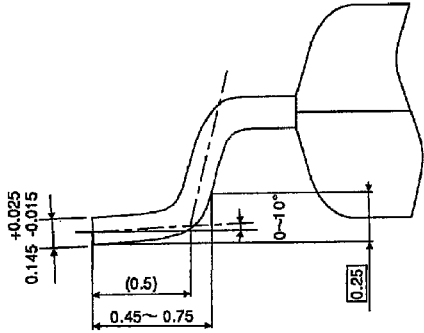
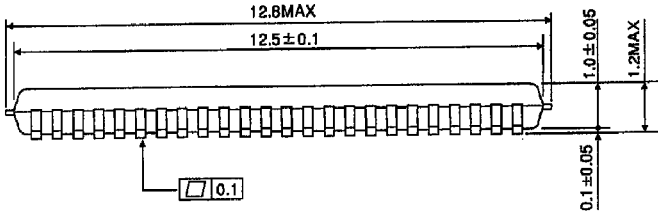
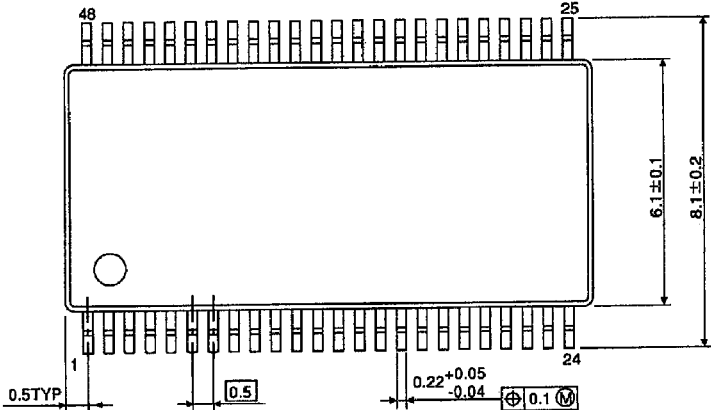


Fig.3  $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$



OUTLINE DRAWING  
TSSOP48-P-0061-0.50

Unit : mm



Weight : 0.25g (Typ.)