

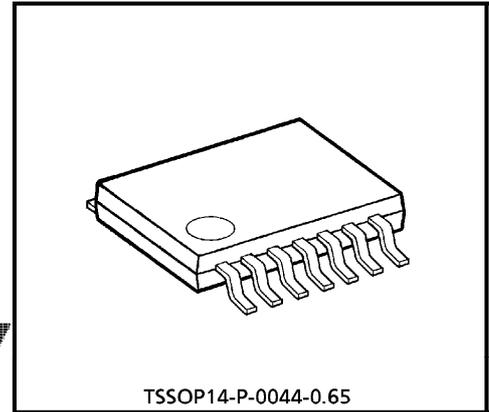
# TC74VCX125FT

## LOW-VOLTAGE QUAD BUS BUFFER WITH 3.6V TOLERANT INPUTS AND OUTPUTS

The TC74VCX125FT is a high performance CMOS QUAD BUS BUFFER. Designed for use in 1.8, 2.5 or 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation. It is also designed with over voltage tolerant inputs and outputs up to 3.6V.

This device requires the 3-state control input  $\overline{OE}$  to be set high to place the output into the high impedance state.

All inputs are equipped with protection circuits against static discharge.



Weight : 0.06g (Typ.)

### FEATURES

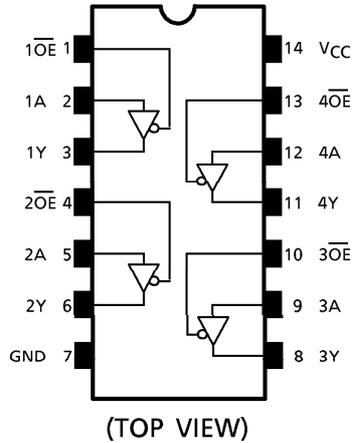
- Low Voltage Operation:  $V_{CC} = 1.8 \sim 3.6V$
- High Speed Operation :  $t_{pd} = TBD$  (max.) at  $V_{CC} = 3.0 \sim 3.6V$   
 $t_{pd} = TBD$  (max.) at  $V_{CC} = 2.3 \sim 2.7V$   
 $t_{pd} = TBD$  (max.) at  $V_{CC} = 1.8V$
- 3.6V Tolerant inputs and outputs.
- Output Current :  $I_{OH}/I_{OL} = \pm 24mA$  (min.) at  $V_{CC} = 3.0V$   
 $I_{OH}/I_{OL} = \pm 18mA$  (min.) at  $V_{CC} = 2.3V$   
 $I_{OH}/I_{OL} = \pm 6mA$  (min.) at  $V_{CC} = 1.8V$
- Latch-up Performance :  $\pm 300mA$
- ESD Performance : Human Body Model  $> \pm 2000V$   
Machine Model  $> \pm 200V$
- Package : TSSOP  
(Thin Shrink Small Outline Package)
- Power Down Protection is provided on all inputs and outputs.
- Supports live insertion / withdrawal (Note 1)

(Note 1) To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

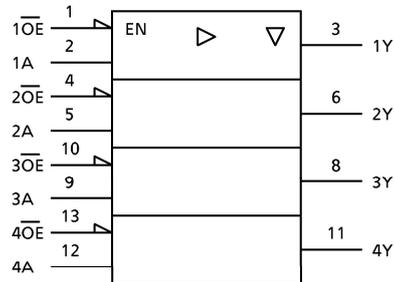
980508EBA1

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The products described in this document are subject to foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



**TRUTH TABLE**

INPUTS		OUTPUTS
$\overline{OE}$	A	Y
H	X	Z
L	L	L
L	H	H

**PRELIMINARY**

X : Don't Care  
Z : High Impedance

**MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	$V_{CC}$	-0.5~4.6	V
DC Input Voltage	$V_{IN}$	-0.5~4.6	V
DC Output Voltage	$V_{OUT}$	-0.5~4.6 (Note 1)	V
		-0.5~ $V_{CC} + 0.5$ (Note 2)	
Input Diode Current	$I_{IK}$	-50	mA
Output Diode Current	$I_{OK}$	$\pm 50$ (Note 3)	mA
DC Output Current	$I_{OUT}$	$\pm 50$	mA
Power Dissipation	$P_D$	180	mW
DC $V_{CC}$ /Ground Current	$I_{CC}/I_{GND}$	$\pm 100$	mA
Storage Temperature	$T_{stg}$	-65~150	$^{\circ}C$

(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 <sub>CC</sub>	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input Voltage	V <sub>IN</sub>	-0.3~3.6	V
Output Voltage	V <sub>OUT</sub>	0~3.6 (Note 5)	V
		0~V <sub>CC</sub> (Note 6)	
Output Current	I <sub>OH</sub> / I <sub>OL</sub>	±24 (Note 7)	mA
		±18 (Note 8)	
		±6 (Note 9)	
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Input Rise And Fall Time	dt/dv	0~10 (Note 10)	ns/V

(Note 4) Data Retention Only

(Note 5) Off-State

(Note 6) High or Low State

(Note 7) V<sub>CC</sub> = 3.0~3.6V

(Note 8) V<sub>CC</sub> = 2.3~2.7V

(Note 9) V<sub>CC</sub> = 1.8V

(Note 10) V<sub>IN</sub> = 0.8~2.0V, V<sub>CC</sub> = 3.0V

**PRELIMINARY**

**ELECTRICAL CHARACTERISTICS**

DC characteristics (Ta = -40~85°C, 2.7V < V<sub>CC</sub> ≤ 3.6V)

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	MIN.	MAX.	UNIT		
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			
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> = -12mA	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	
				I <sub>OL</sub> = 12mA	2.7	—	0.4	
				I <sub>OL</sub> = 18mA	3.0	—	0.4	
				I <sub>OL</sub> = 24mA	3.0	—	0.55	
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 0~3.6V	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> = 0~3.6V	2.7~3.6	—	±10.0	μA		
Power Off Leakage Current	I <sub>OFF</sub>	V <sub>IN</sub> , V <sub>OUT</sub> = 0~3.6V	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>CC</sub> ≤ (V <sub>IN</sub> , V <sub>OUT</sub> ) ≤ 3.6V	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	—	750	μA		

## ELECTRICAL CHARACTERISTICS

DC characteristics ( $T_a = -40 \sim 85^\circ\text{C}$ ,  $2.3\text{V} \leq V_{CC} \leq 2.7\text{V}$ )

PARAMETER		SYMBOL	TEST CONDITION	$V_{CC}$ (V)	MIN.	MAX.	UNIT
Input Voltage	"H" Level	$V_{IH}$		2.3~2.7	1.6	—	V
	"L" Level	$V_{IL}$		2.3~2.7	—	0.7	
Output Voltage	"H" Level	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -100\mu\text{A}$	2.3~2.7	$V_{CC} - 0.2$	V
				$I_{OH} = -6\text{mA}$	2.3	2.0	
				$I_{OH} = -12\text{mA}$	2.3	1.8	
				$I_{OH} = -18\text{mA}$	2.3	1.7	
	"L" Level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 100\mu\text{A}$	2.3~2.7	—	0.2
				$I_{OL} = 12\text{mA}$	2.3	—	0.4
$I_{OL} = 18\text{mA}$				2.3	—	0.6	
Input Leakage Current		$I_{IN}$	$V_{IN} = 0 \sim 3.6\text{V}$	2.3~2.7	—	$\pm 5.0$	$\mu\text{A}$
3-State Output Off-State Current		$I_{OZ}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0 \sim 3.6\text{V}$	2.3~2.7	—	$\pm 10.0$	$\mu\text{A}$
Power Off Leakage Current		$I_{OFF}$	$V_{IN}, V_{OUT} = 0 \sim 3.6\text{V}$	0	—	10.0	$\mu\text{A}$
Quiescent Supply Current		$I_{CC}$	$V_{IN} = V_{CC}$ or GND	2.3~2.7	—	20.0	$\mu\text{A}$
			$V_{CC} \leq (V_{IN}, V_{OUT}) \leq 3.6V_{CC}$	2.3~2.7	—	$\pm 20.0$	

PRELIMINARY

**ELECTRICAL CHARACTERISTICS**

DC characteristics (Ta = -40~85°C, 1.8V ≤ VCC < 2.3V)

PARAMETER		SYMBOL	TEST CONDITION		VCC (V)	MIN.	MAX.	UNIT
					1.8~2.3			
Input Voltage	"H" Level	V <sub>IH</sub>			1.8~2.3	0.7 × V <sub>CC</sub>	—	V
	"L" Level	V <sub>IL</sub>			1.8~2.3	—	0.2 × V <sub>CC</sub>	
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> = -100 μA	1.8	V <sub>CC</sub> - 0.2	—	V
				I <sub>OH</sub> = -6 mA	1.8	1.4	—	
	"L" Level	V <sub>OL</sub>	V <sub>N</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.8	—	0.2	
				I <sub>OL</sub> = 6 mA	1.8	—	0.3	
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~3.6V		1.8	—	± 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> = 0~3.6V		1.8	—	± 10.0	μA
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> , V <sub>OUT</sub> = 0~3.6V		0	—	10.0	μA
Quiescent Supply Current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		1.8	—	20.0	μA
			V <sub>CC</sub> ≤ (V <sub>IN</sub> , V <sub>OUT</sub> ) ≤ 3.6V		1.8	—	± 20.0	

AC characteristics (Ta = -40~85°C, Input t<sub>r</sub> = t<sub>f</sub> = 2.0ns, C<sub>L</sub> = 30pF, R<sub>L</sub> = 500Ω)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	MIN.	MAX.	UNIT
			1.8			
Propagation Delay Time	t <sub>pLH</sub> t <sub>pHL</sub>	(Fig.1, 2)	1.8	1.5	TBD	ns
			2.5 ± 0.2	1.0	TBD	
			3.3 ± 0.3	0.8	TBD	
3-State Output Enable Time	t <sub>pZL</sub> t <sub>pZH</sub>	(Fig.1, 3)	1.8	1.5	TBD	ns
			2.5 ± 0.2	1.0	TBD	
			3.3 ± 0.3	0.8	TBD	
3-State Output Disable Time	t <sub>pLZ</sub> t <sub>pHZ</sub>	(Fig.1, 3)	1.8	1.5	TBD	ns
			2.5 ± 0.2	1.0	TBD	
			3.3 ± 0.3	0.8	TBD	
Output To Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 11)	1.8	—	TBD	ns
			2.5 ± 0.2	—	TBD	
			3.3 ± 0.3	—	TBD	

For C<sub>L</sub> = 50pF, add approximately 300ps to the AC maximum specification.

(Note 11) Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

Dynamic switching characteristics (Ta = 25°C, Input tr = tf = 2.0ns, CL = 30pF)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	TYP.	UNIT
Quiet Output Maximum Dynamic VOL	VOLP	VIH = 1.8V, VIL = 0V (Note 12)	1.8	TBD	V
		VIH = 2.5V, VIL = 0V (Note 12)	2.5	TBD	
		VIH = 3.3V, VIL = 0V (Note 12)	3.3	TBD	
Quiet Output Minimum Dynamic VOL	VOLV	VIH = 1.8V, VIL = 0V (Note 12)	1.8	TBD	V
		VIH = 2.5V, VIL = 0V (Note 12)	2.5	TBD	
		VIH = 3.3V, VIL = 0V (Note 12)	3.3	TBD	
Quiet Output Minimum Dynamic VOH	VOHV	VIH = 1.8V, VIL = 0V (Note 12)	1.8	TBD	V
		VIH = 2.5V, VIL = 0V (Note 12)	2.5	TBD	
		VIH = 3.3V, VIL = 0V (Note 12)	3.3	TBD	

(Note 12) Parameter guaranteed by design.

Capacitive characteristics (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	TYP.	UNIT
Input Capacitance	CIN	—	1.8, 2.5, 3.3	TBD	pF
Output Capacitance	COU		1.8, 2.5, 3.3	TBD	pF
Power Dissipation Capacitance	CpD		fIN = 10MHz (Note 13)	1.8, 2.5, 3.3	TBD

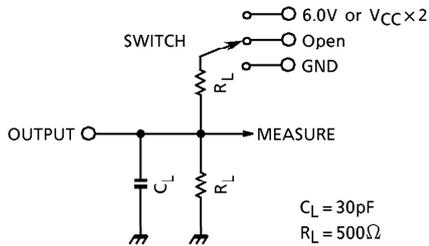
(Note 13) CpD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC(opr.)} = C_{pD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (per gate)}$$

**PRELIMINARY**

Fig.1 Test Circuit



PARAMETER	SWITCH
$t_{pLH}, t_{pHL}$	Open
$t_{pLZ}, t_{pZL}$	6.0V $V_{CC} \times 2$ @ $V_{CC} = 3.3 + 0.3\text{V}$ @ $V_{CC} = 2.5 + 0.2\text{V}$ @ $V_{CC} = 1.8\text{V}$
$t_{pHZ}, t_{pZH}$	GND

**PRELIMINARY**

**AC WAVEFORM**

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

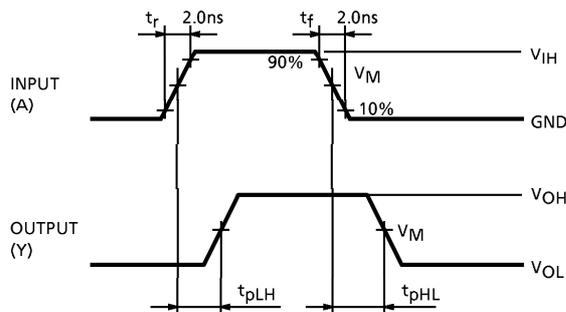
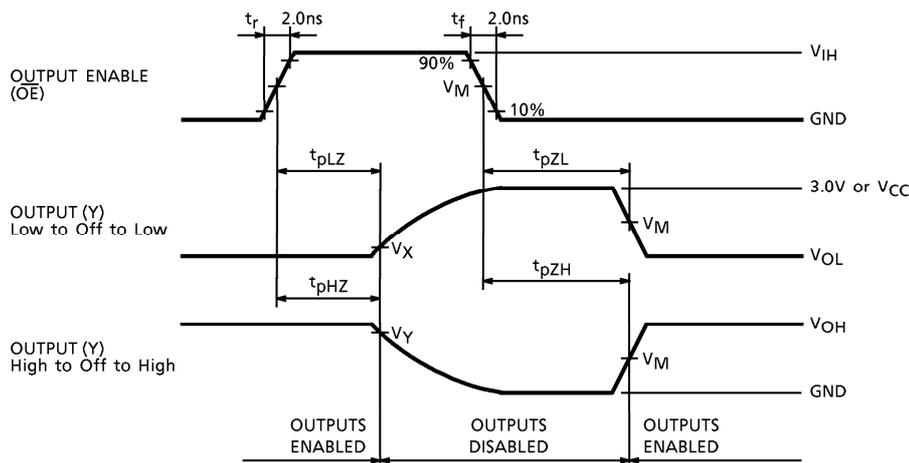


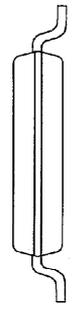
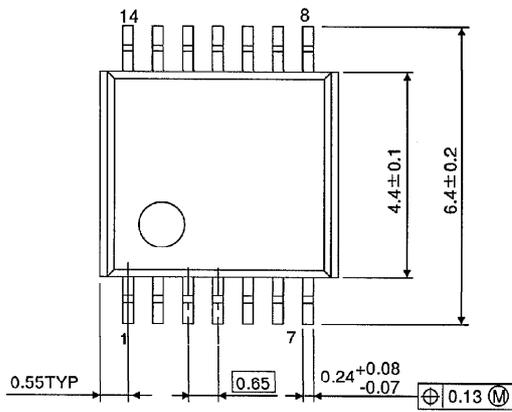
Fig.3  $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$



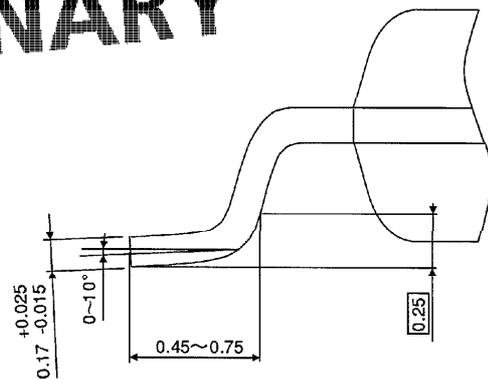
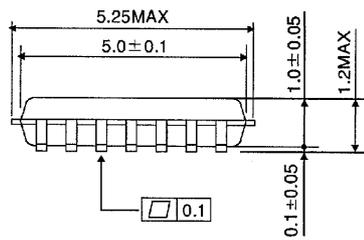
SYMBOL	$V_{CC}$		
	$3.3 \pm 0.3\text{V}$	$2.5 \pm 0.2\text{V}$	1.8V
$V_{IH}$	2.7V	$V_{CC}$	$V_{CC}$
$V_M$	1.5V	$V_{CC}/2$	$V_{CC}/2$
$V_X$	$V_{OL} + 0.3\text{V}$	$V_{OL} + 0.15\text{V}$	$V_{OL} + 0.15\text{V}$
$V_Y$	$V_{OH} - 0.3\text{V}$	$V_{OH} - 0.15\text{V}$	$V_{OH} - 0.15\text{V}$

**OUTLINE DRAWING**  
TSSOP14-P-0044-0.65

Unit : mm



**PRELIMINARY**



Weight : 0.06g (Typ.)

Copyright Each Manufacturing Company.

All Datasheets cannot be modified without permission.

This datasheet has been download from :

[www.AllDataSheet.com](http://www.AllDataSheet.com)

100% Free DataSheet Search Site.

Free Download.

No Register.

Fast Search System.

[www.AllDataSheet.com](http://www.AllDataSheet.com)