

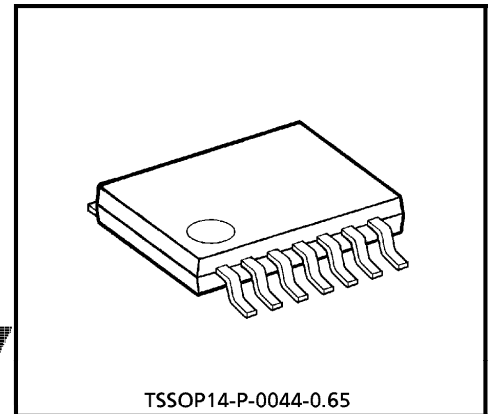
TC74VCX125FT

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

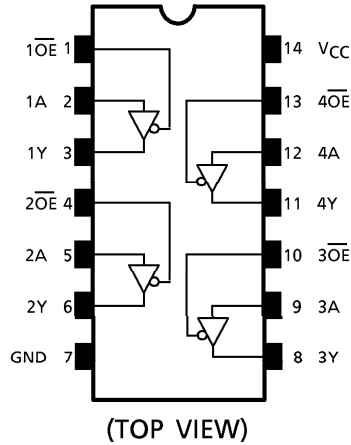
- Low Voltage Operation: $V_{CC} = 1.8 \sim 3.6V$
- High Speed Operation : $t_{pd} = TBD$ (max.) at $V_{CC} = 3.0 \sim 3.6V$
 $t_{pd} = TBD$ (max.) at $V_{CC} = 2.3 \sim 2.7V$
 $t_{pd} = TBD$ (max.) at $V_{CC} = 1.8V$
- 3.6V Tolerant inputs and outputs.
- Output Current : $I_{OH}/I_{OL} = \pm 24mA$ (min.) 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.

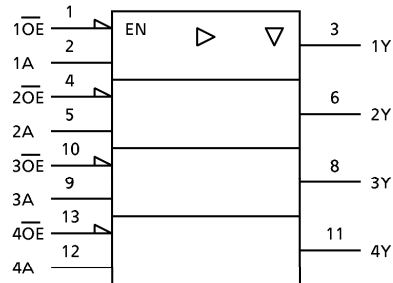
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PIN ASSIGNMENT



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}	± 50 (Note 3)	mA
DC Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	180	mW
DC V_{CC} /Ground Current	I_{CC}/I_{GND}	± 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_{CC}	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input Voltage	V_{IN}	-0.3~3.6	V
Output Voltage	V_{OUT}	0~3.6 (Note 5)	V
		0~ V_{CC} (Note 6)	
Output Current	I_{OH}/I_{OL}	± 24 (Note 7)	mA
		± 18 (Note 8)	
		± 6 (Note 9)	
Operating Temperature	T_{opr}	-40~85	$^{\circ}\text{C}$
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) $V_{CC} = 3.0\sim 3.6\text{V}$ (Note 8) $V_{CC} = 2.3\sim 2.7\text{V}$ (Note 9) $V_{CC} = 1.8\text{V}$ (Note 10) $V_{IN} = 0.8\sim 2.0\text{V}$, $V_{CC} = 3.0\text{V}$ **PRELIMINARY**

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40\sim 85^{\circ}\text{C}$, $2.7\text{V} < V_{CC} \leq 3.6\text{V}$)

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			
Output Voltage	"H" Level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100\mu\text{A}$	2.7~3.6	$V_{CC} - 0.2$	—	V
				$I_{OH} = -12\text{mA}$	2.7	2.2	—	
				$I_{OH} = -18\text{mA}$	3.0	2.4	—	
				$I_{OH} = -24\text{mA}$	3.0	2.2	—	
	"L" Level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100\mu\text{A}$	2.7~3.6	—	0.2	
				$I_{OL} = 12\text{mA}$	2.7	—	0.4	
				$I_{OL} = 18\text{mA}$	3.0	—	0.4	
				$I_{OL} = 24\text{mA}$	3.0	—	0.55	
Input Leakage Current	I_{IN}	$V_{IN} = 0\sim 3.6\text{V}$	2.7~3.6	—	± 5.0	μA		
3-State Output Off-State Current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0\sim 3.6\text{V}$	2.7~3.6	—	± 10.0	μA		
Power Off Leakage Current	I_{OFF}	$V_{IN}, V_{OUT} = 0\sim 3.6\text{V}$	0	—	10.0	μA		
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND	2.7~3.6	—	20.0	μA		
		$V_{CC} \leq (V_{IN}, V_{OUT}) \leq 3.6\text{V}$	2.7~3.6	—	± 20.0			
Increase In I_{CC} Per Input	ΔI_{CC}	$V_{IH} = V_{CC} - 0.6\text{V}$	2.7~3.6	—	750	μA		

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = -40~85°C, 2.3V ≤ VCC ≤ 2.7V)

PARAMETER		SYMBOL	TEST CONDITION	VCC (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} = -100μA	2.3~2.7	V _{CC} - 0.2	V
				I _{OH} = -6mA	2.3	2.0	
				I _{OH} = -12mA	2.3	1.8	
				I _{OH} = -18mA	2.3	1.7	
	"L" Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100μA	2.3~2.7	—	0.2
				I _{OL} = 12mA	2.3	—	0.4
I _{OL} = 18mA				2.3	—	0.6	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6V	2.3~2.7	—	± 5.0	μA
3-State Output Off-State Current		I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0~3.6V	2.3~2.7	—	± 10.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6V	0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND	2.3~2.7	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6V _{CC}	2.3~2.7	—	± 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
Input Voltage	"H" Level	V _{IH}			1.8~2.3	0.7 × V _{CC}	—	V
	"L" Level	V _{IL}			1.8~2.3	—	0.2 × V _{CC}	
Output Voltage	"H" Level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -100 μA	1.8	V _{CC} - 0.2	—	V
				I _{OH} = -6 mA	1.8	1.4	—	
	"L" Level	V _{OL}	V _N = V _{IH} or V _{IL}	I _{OL} = 100 μA	1.8	—	0.2	
				I _{OL} = 6 mA	1.8	—	0.3	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6V		1.8	—	± 5.0	μA
3-State Output Off-State Current		I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0~3.6V		1.8	—	± 10.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		1.8	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6V		1.8	—	± 20.0	

AC characteristics (Ta = -40~85°C, Input t_r = t_f = 2.0ns, C_L = 30pF, R_L = 500Ω)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	MIN.	MAX.	UNIT
Propagation Delay Time	t _{pLH} t _{pHL}	(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 _{pZL} t _{pZH}	(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 _{pLZ} t _{pHZ}	(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 _{osLH} t _{osHL}	(Note 11)	1.8	—	TBD	ns
			2.5 ± 0.2	—	TBD	
			3.3 ± 0.3	—	TBD	

For C_L = 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	pF

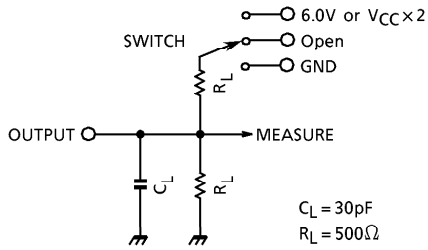
(Note 13) CpD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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	@ $V_{CC} = 3.3 + 0.3V$
	$V_{CC} \times 2$	@ $V_{CC} = 2.5 + 0.2V$
		@ $V_{CC} = 1.8V$
t_{pHZ}, t_{pZH}	GND	

PRELIMINARY

AC WAVEFORM

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

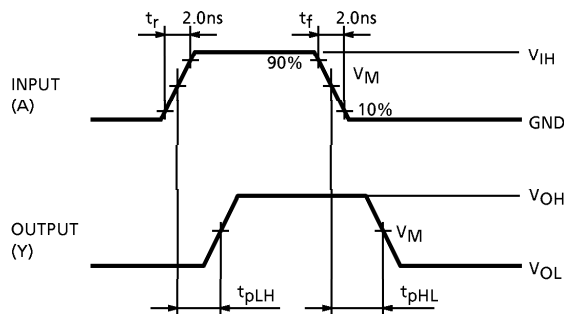
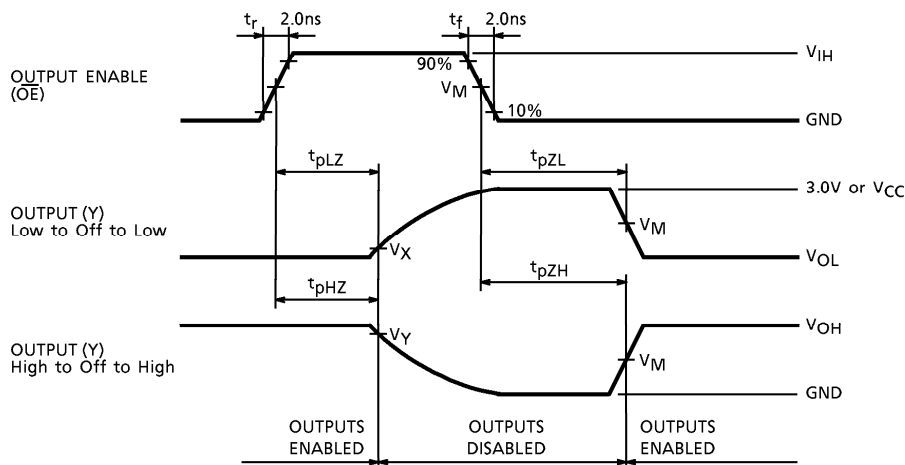


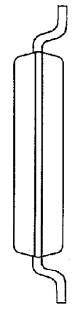
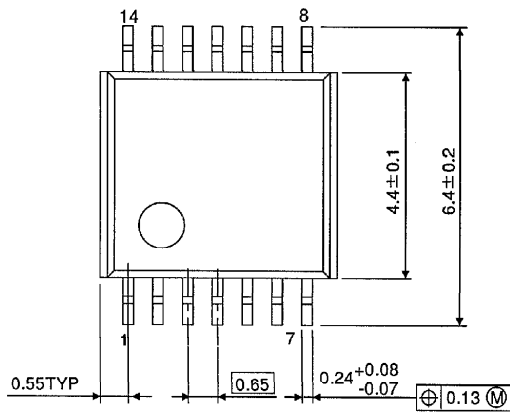
Fig.3 $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$



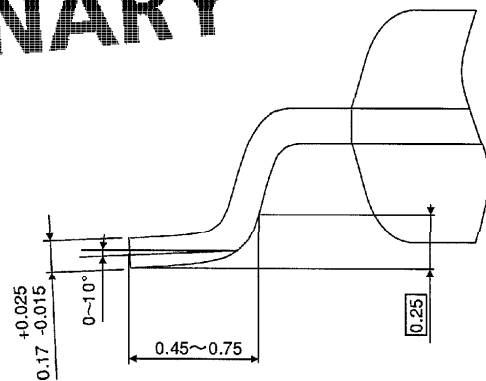
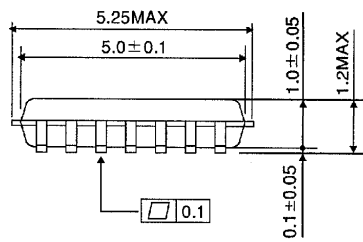
SYMBOL	V_{CC}		
	$3.3 \pm 0.3V$	$2.5 \pm 0.2V$	1.8V
V_{IH}	2.7V	V_{CC}	V_{CC}
V_M	1.5V	$V_{CC} / 2$	$V_{CC} / 2$
V_X	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$	$V_{OL} + 0.15V$
V_Y	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$	$V_{OH} - 0.15V$

OUTLINE DRAWING
TSSOP14-P-0044-0.65

Unit : mm



PRELIMINARY



Weight : 0.06g (Typ.)