

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74LCX125F, TC74LCX125FN, TC74LCX125FT**LOW VOLTAGE QUAD BUS BUFFER
WITH 5V TOLERANT INPUTS AND OUTPUTS**

The TC74LCX125 is a high performance CMOS QUAD BUS BUFFERS. 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 inputs.

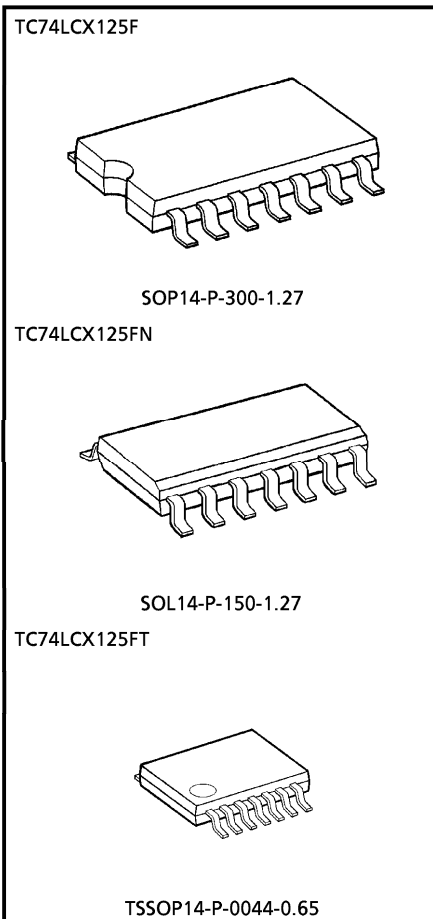
This device requires the 3-state control input \overline{OE} to be set high to place the output into the high impedance state.

All inputs are equipped with protection circuits against static discharge.

FEATURES

- Low voltage operation : $V_{CC} = 2.0 \sim 3.6V$
- High speed operation : $t_{pd} = 6.0ns$ (Max.)
($V_{CC} = 3.0 \sim 3.6V$)
- Output current : $|I_{OH}| / I_{OL} = 24mA$ (Min.)
($V_{CC} = 3.0V$)
- Latch-up performance : $\pm 500mA$
- Available in JEDEC SOP, EIAJ SOP and TSSOP
- Power down protection is provided on all inputs and outputs.
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 125 type.

(Note) The JEDEC SOP (FN) is not available in Japan.

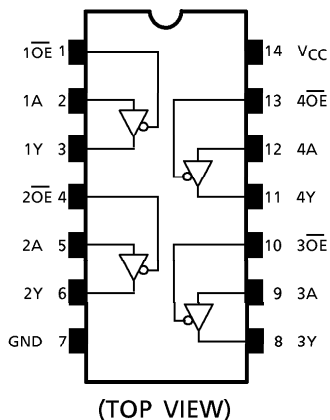
**Weight**

SOP14-P-300-1.27 : 0.18g (Typ.)
SOL14-P-150-1.27 : 0.12g (Typ.)
TSSOP14-P-0044-0.65 : 0.06g (Typ.)

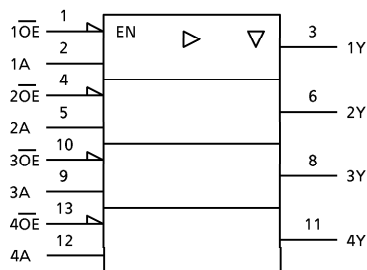
961001EBA2

● 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.

PIN ASSIGNMENT



IEC LOGIC SYMBOL



TRUTH TABLE

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

X : Don't Care
Z : High Impedance

MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|-----------------------------|------------------|--------------------------------|-------------|
| Supply Voltage Range | V_{CC} | - 0.5~7.0 | V |
| DC Input Voltage | V_{IN} | - 0.5~7.0 | V |
| DC 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 | 180 | mW |
| DC V_{CC} /Ground Current | I_{CC}/I_{GND} | ± 100 | mA |
| Storage Temperature | T_{stg} | - 65~150 | $^{\circ}C$ |

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

961001EBA2

● The products described in this document are subject to foreign exchange and foreign trade control 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.

RECOMMENDED OPERATING CONDITIONS

| 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 | $^{\circ}\text{C}$ |
| Input Rise And Fall Time | dt/dv | 0~10 (Note 9) | ns/V |

(Note 4) Data Retention Only

(Note 5) Output in Off-State

(Note 6) High or Low State

(Note 7) $V_{CC} = 3.0\sim 3.6\text{V}$ (Note 8) $V_{CC} = 2.7\sim 3.0\text{V}$ (Note 9) $V_{IN} = 0.8\sim 2.0\text{V}$, $V_{CC} = 3.0\text{V}$

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS ($T_a = -40\sim 85^{\circ}\text{C}$)

| 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 | | |
| 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 | |
| | | | | $I_{OL} = 16\text{mA}$ | 3.0 | — | 0.4 | |
| | | | $I_{OL} = 24\text{mA}$ | 3.0 | — | 0.55 | | |
| Input Leakage Current | | I_{IN} | $V_{IN} = 0\sim 5.5\text{V}$ | 2.7~3.6 | — | ± 5.0 | μA | |
| 3-State Output Off-State Current | | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0\sim 5.5\text{V}$ | 2.7~3.6 | — | ± 5.0 | μA | |
| Power Off Leakage Current | | I_{OFF} | $V_{IN}/V_{OUT} = 5.5\text{V}$ | 0 | — | 10.0 | μA | |
| Quiescent Supply Current | | I_{CC} | $V_{IN} = V_{CC}$ or GND | 2.7~3.6 | — | 10.0 | μA | |
| | | | $V_{IN}/V_{OUT} = 3.6\sim 5.5\text{V}$ | 2.7~3.6 | — | ± 10.0 | | |
| Increase In I_{CC} Per Input | | ΔI_{CC} | $V_{IH} = V_{CC} - 0.6\text{V}$ | 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 | t _{pLH} | (Fig.1, 2) | 2.7 | — | 6.5 | ns |
| | t _{pHL} | | 3.3 ± 0.3 | 1.5 | 6.0 | |
| Output Enable Time | t _{pZL} | (Fig.1, 3) | 2.7 | — | 8.0 | ns |
| | t _{pZH} | | 3.3 ± 0.3 | 1.5 | 7.0 | |
| Output Disable Time | t _{pLZ} | (Fig.1, 3) | 2.7 | — | 7.0 | ns |
| | t _{pHZ} | | 3.3 ± 0.3 | 1.5 | 6.0 | |
| Output To Output Skew | t _{osLH} | (Note 10) | 2.7 | — | — | ns |
| | t _{osHL} | | 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_f = 2.5ns, C_L = 50pF, R_L = 500Ω)

| 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 |

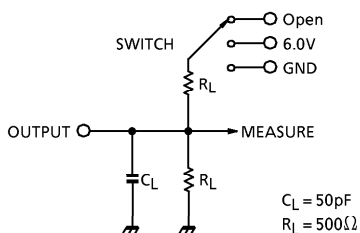
(Note 11) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

TEST CIRCUIT

Fig.1



| 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}

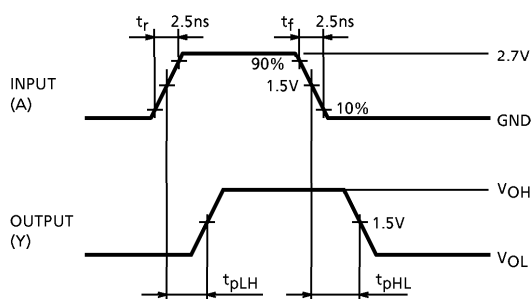
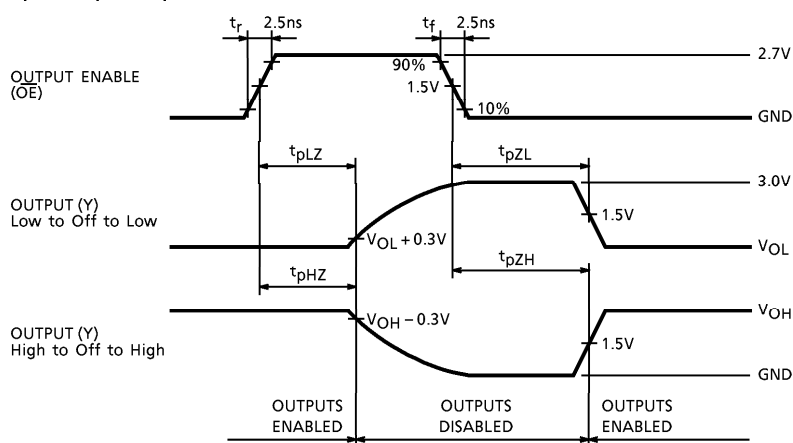
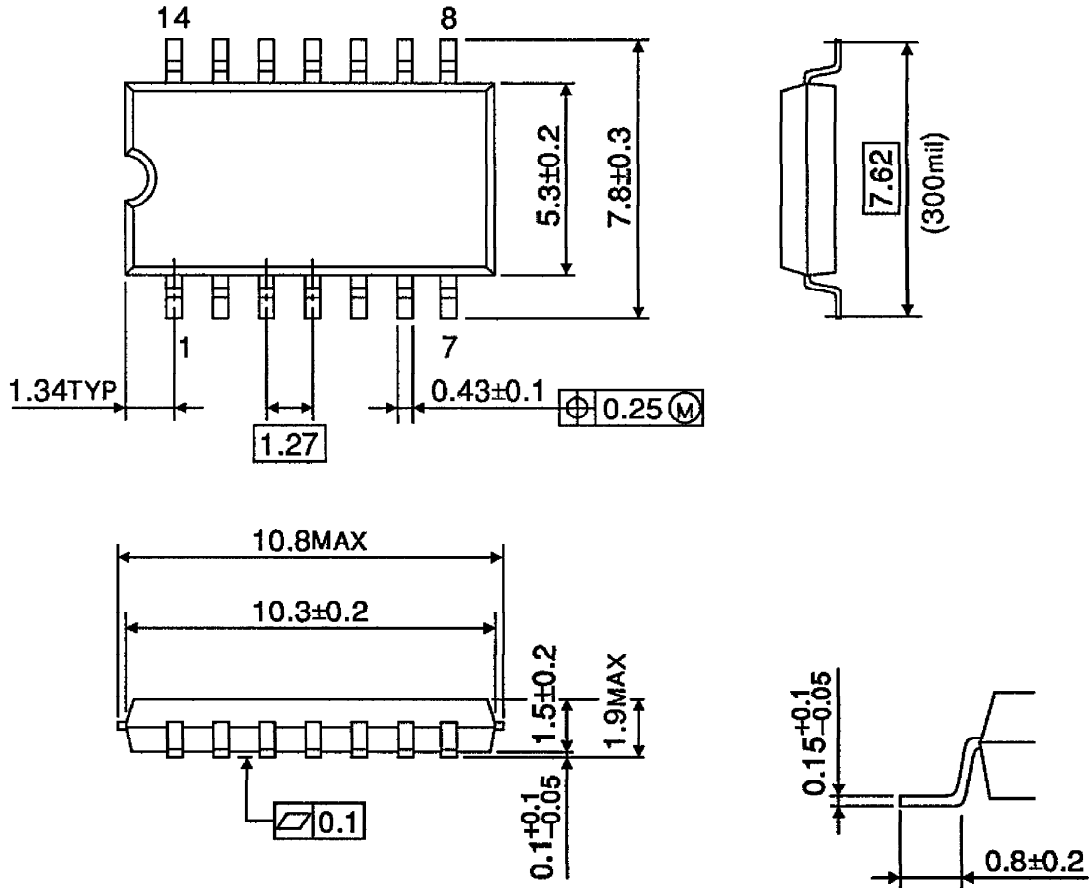


Fig.3 t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}



OUTLINE DRAWING
SOP14-P-300-1.27

Unit : mm

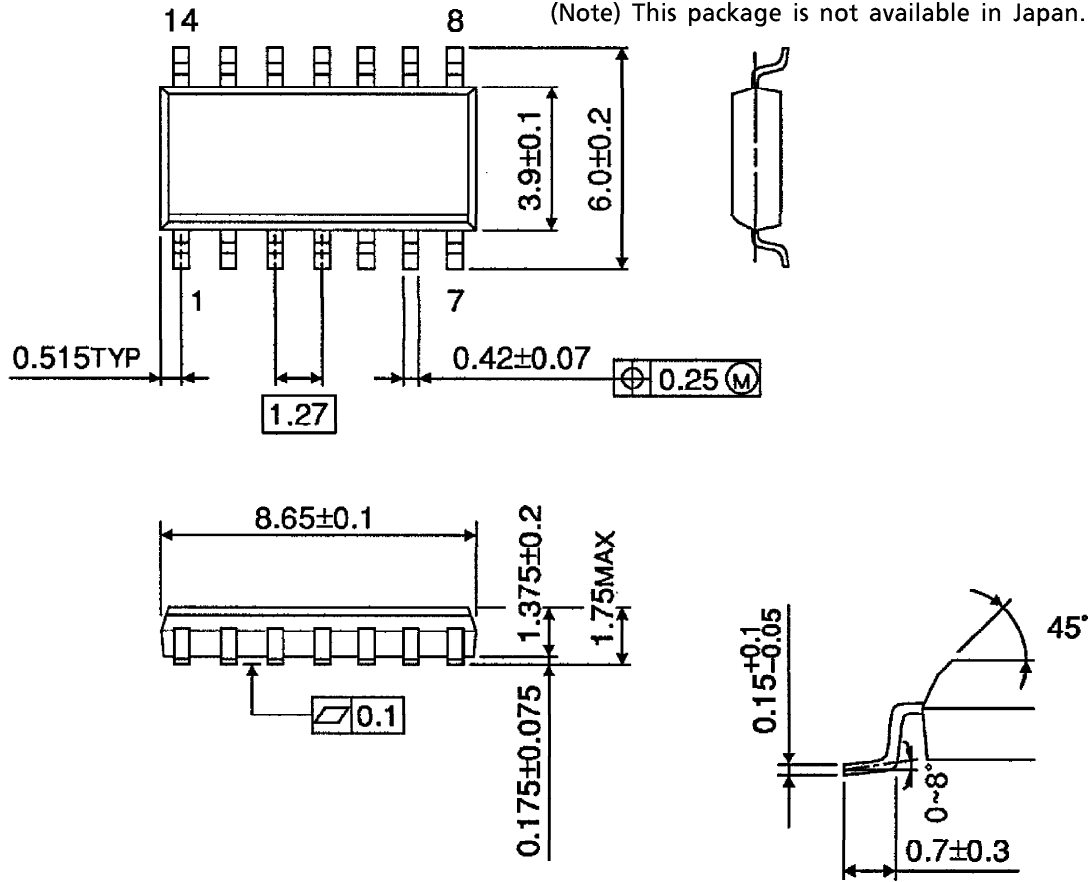


Weight : 0.18g (Typ.)

OUTLINE DRAWING
SOL14-P-150-1.27

Unit : mm

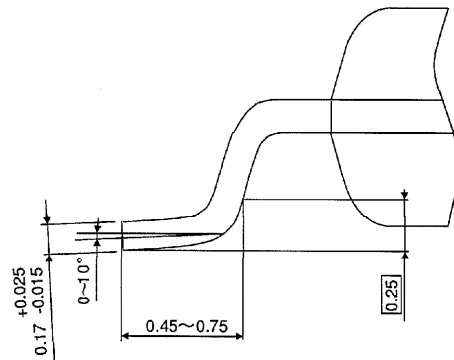
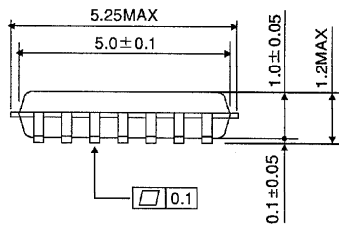
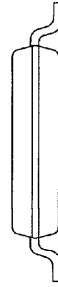
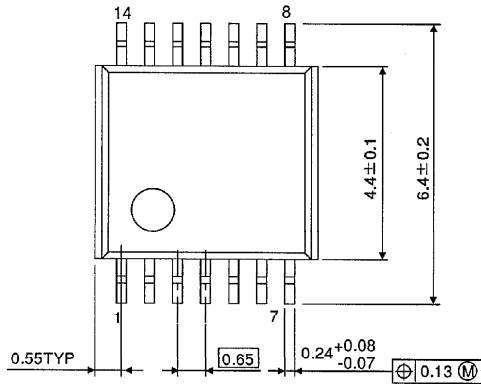
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

OUTLINE DRAWING
TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)