

# TC74VHC157F, TC74VHC157FN, TC74VHC157FS, TC74VHC157FT

## QUAD 2-CHANNEL MULTIPLEXER

The TC74VHC157 is an advanced high speed CMOS QUAD 2-CHANNEL MULTIPLEXER fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

It consists of four 2-input digital multiplexers with common select and strobe inputs.

When the STROBE input is held "H" level, selection of data is inhibited and all the outputs become "L" level.

The SELECT decoding determines whether the A or B inputs get routed to their corresponding Y outputs.

An Input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and on two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

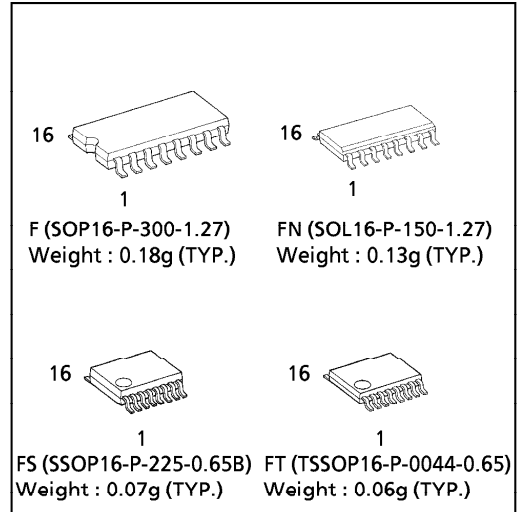
### FEATURES :

- High Speed..... $t_{pd} = 4.1\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range.... $V_{CC} (\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Low Noise ..... $V_{OLP} = 0.8\text{V} (\text{Max.})$
- Pin and Function Compatible with 74ALS157

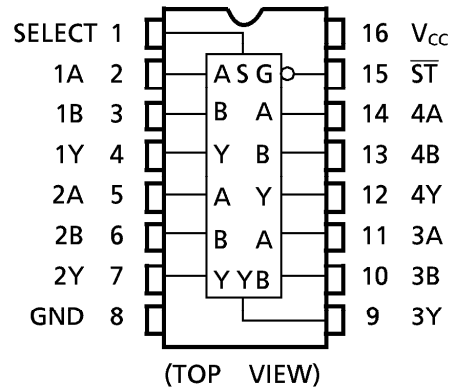
### TRUTH TABLE

| INPUTS          |        |   |   | OUTPUT |
|-----------------|--------|---|---|--------|
| $\overline{ST}$ | SELECT | A | B |        |
| H               | X      | X | X | L      |
| L               | L      | L | X | L      |
| L               | L      | H | X | H      |
| L               | H      | X | L | L      |
| L               | H      | X | H | H      |

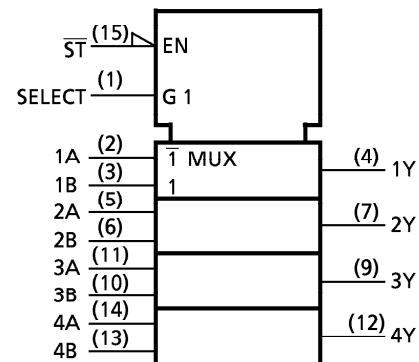
X : Don't Care



### PIN ASSIGNMENT



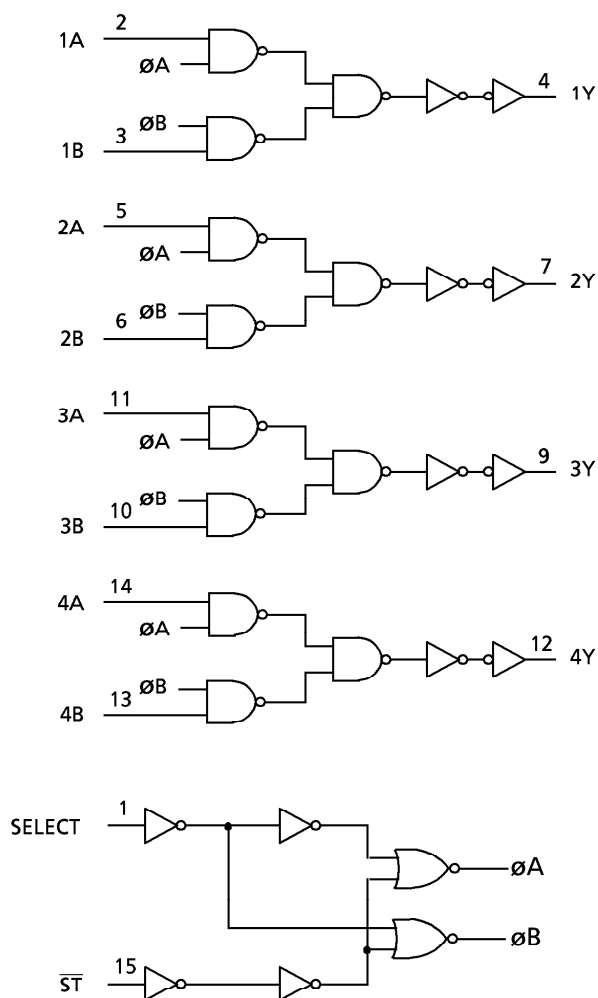
### IEC LOGIC SYMBOL



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.

## SYSTEM DIAGRAM



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.

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                    | UNIT               |
|-----------------------------|-----------|--------------------------|--------------------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7.0$          | V                  |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim 7.0$          | V                  |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V                  |
| Input Diode Current         | $I_{IK}$  | $-20$                    | mA                 |
| Output Diode Current        | $I_{OK}$  | $\pm 20$                 | mA                 |
| DC Output Current           | $I_{OUT}$ | $\pm 25$                 | mA                 |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 50$                 | mA                 |
| Power Dissipation           | $P_D$     | 180                      | mW                 |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$           | $^{\circ}\text{C}$ |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE                                                                                           | UNIT               |
|--------------------------|-----------|-------------------------------------------------------------------------------------------------|--------------------|
| Supply Voltage           | $V_{CC}$  | $2.0 \sim 5.5$                                                                                  | V                  |
| Input Voltage            | $V_{IN}$  | $0 \sim 5.5$                                                                                    | V                  |
| Output Voltage           | $V_{OUT}$ | $0 \sim V_{CC}$                                                                                 | V                  |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                                                   | $^{\circ}\text{C}$ |
| Input Rise and Fall Time | $dt/dv$   | $0 \sim 100$ ( $V_{CC} = 3.3 \pm 0.3\text{V}$ )<br>$0 \sim 20$ ( $V_{CC} = 5 \pm 0.5\text{V}$ ) | ns/V               |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL   | TEST CONDITION                     | $V_{CC}$<br>(V)                                  | $T_a = 25^{\circ}\text{C}$  |                   |                             | $T_a = -40 \sim 85^{\circ}\text{C}$ |                             | UNIT          |
|-----------------------------|----------|------------------------------------|--------------------------------------------------|-----------------------------|-------------------|-----------------------------|-------------------------------------|-----------------------------|---------------|
|                             |          |                                    |                                                  | MIN.                        | TYP.              | MAX.                        | MIN.                                | MAX.                        |               |
| High - Level Input Voltage  | $V_{IH}$ |                                    | 2.0<br>3.0~5.5                                   | 1.50<br>$V_{CC} \times 0.7$ | —<br>—            | —<br>—                      | 1.50<br>$V_{CC} \times 0.7$         | —<br>—                      | V             |
| Low - Level Input Voltage   | $V_{IL}$ |                                    | 2.0<br>3.0~5.5                                   | —<br>—                      | —<br>—            | 0.50<br>$V_{CC} \times 0.3$ | —<br>$V_{CC} \times 0.3$            | 0.50<br>$V_{CC} \times 0.3$ | V             |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} =$<br>$V_{IH}$ or $V_{IL}$ | $I_{OH} = -50\mu\text{A}$                        | 2.0<br>3.0<br>4.5           | 1.9<br>2.9<br>4.4 | 2.0<br>3.0<br>4.5           | —<br>—<br>—                         | 1.9<br>2.9<br>4.4           | V             |
|                             |          |                                    | $I_{OH} = -4\text{mA}$<br>$I_{OH} = -8\text{mA}$ | 3.0<br>4.5                  | 2.58<br>3.94      | —<br>—                      | 2.48<br>3.80                        | —<br>—                      |               |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} =$<br>$V_{IH}$ or $V_{IL}$ | $I_{OL} = 50\mu\text{A}$                         | 2.0<br>3.0<br>4.5           | —<br>—<br>—       | 0.0<br>0.0<br>0.0           | —<br>—<br>—                         | 0.1<br>0.1<br>0.1           | V             |
|                             |          |                                    | $I_{OL} = 4\text{mA}$<br>$I_{OL} = 8\text{mA}$   | 3.0<br>4.5                  | —<br>—            | 0.36<br>0.36                | —<br>—                              | 0.44<br>0.44                |               |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = 5.5\text{V}$ or GND      | 0~5.5                                            | —                           | —                 | $\pm 0.1$                   | —                                   | $\pm 1.0$                   | $\mu\text{A}$ |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND           | 5.5                                              | —                           | —                 | 4.0                         | —                                   | 40.0                        |               |

AC ELECTRICAL CHARACTERISTICS ( Input  $t_r = t_f = 3\text{ns}$  )

| PARAMETER                                        | SYMBOL                 | TEST CONDITION      |         | Ta = 25°C |      |      | Ta = -40~85°C |      | UNIT |
|--------------------------------------------------|------------------------|---------------------|---------|-----------|------|------|---------------|------|------|
|                                                  |                        | V <sub>CC</sub> (V) | CL (pF) | MIN.      | TYP. | MAX. | MIN.          | MAX. |      |
| Propagation Delay Time<br>(A, B - Y)             | $t_{pLH}$<br>$t_{pHL}$ | $3.3 \pm 0.3$       | 15      | —         | 6.2  | 9.7  | 1.0           | 11.5 | ns   |
|                                                  |                        |                     | 50      | —         | 8.7  | 13.2 | 1.0           | 15.0 |      |
|                                                  |                        | $5.0 \pm 0.5$       | 15      | —         | 4.1  | 6.4  | 1.0           | 7.5  |      |
|                                                  |                        |                     | 50      | —         | 5.6  | 8.4  | 1.0           | 9.5  |      |
| Propagation Delay Time<br>(SELECT - Y)           | $t_{pLH}$<br>$t_{pHL}$ | $3.3 \pm 0.3$       | 15      | —         | 8.4  | 13.2 | 1.0           | 15.5 |      |
|                                                  |                        |                     | 50      | —         | 10.9 | 16.7 | 1.0           | 19.0 |      |
|                                                  |                        | $5.0 \pm 0.5$       | 15      | —         | 5.3  | 8.1  | 1.0           | 9.5  |      |
|                                                  |                        |                     | 50      | —         | 6.8  | 10.1 | 1.0           | 11.5 |      |
| Propagation Delay Time<br>( $\overline{ST}$ - Y) | $t_{pLH}$<br>$t_{pHL}$ | $3.3 \pm 0.3$       | 15      | —         | 8.7  | 13.6 | 1.0           | 16.0 | ns   |
|                                                  |                        |                     | 50      | —         | 11.2 | 17.1 | 1.0           | 19.5 |      |
|                                                  |                        | $5.0 \pm 0.5$       | 15      | —         | 5.6  | 8.6  | 1.0           | 10.0 |      |
|                                                  |                        |                     | 50      | —         | 7.1  | 10.6 | 1.0           | 12.0 |      |
| Input Capacitance                                | C <sub>IN</sub>        |                     |         | —         | 4    | 10   | —             | 10   | pF   |
| Power Dissipation Capacitance                    | C <sub>PD</sub>        | (Note 1)            |         | —         | 20   | —    | —             | —    |      |

Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

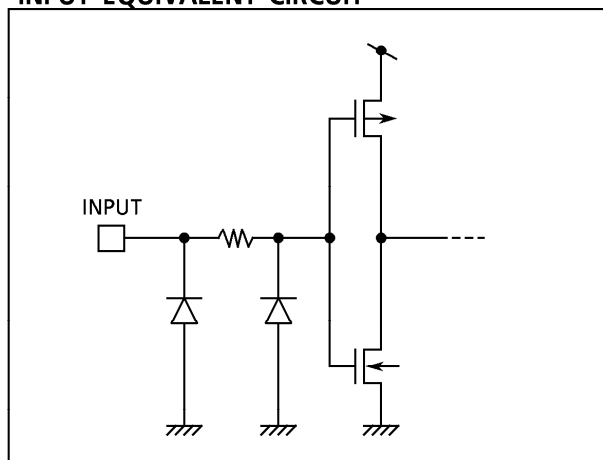
Average operating current can be obtained by the equation :

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

NOISE CHARACTERISTICS ( Input  $t_r = t_f = 3\text{ns}$  )

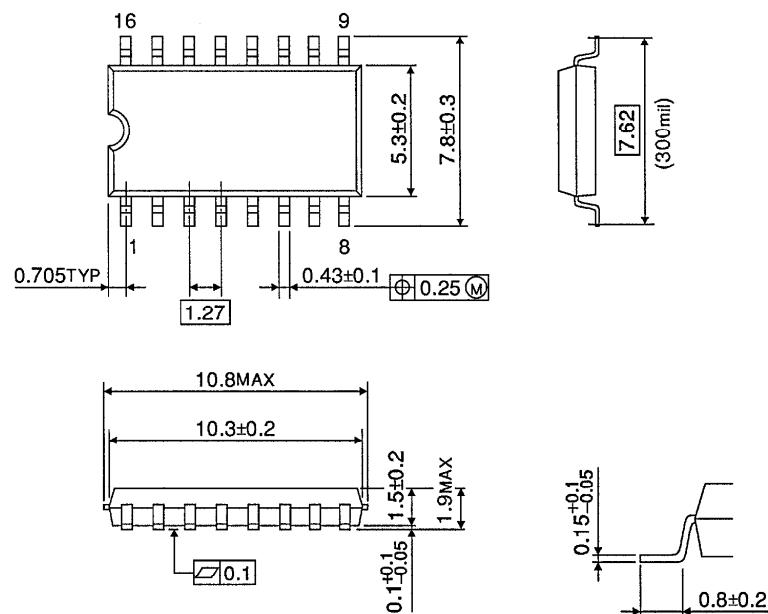
| PARAMETER                       | SYMBOL           | TEST CONDITION        |     | Ta = 25°C |       | UNIT |
|---------------------------------|------------------|-----------------------|-----|-----------|-------|------|
|                                 |                  | V <sub>CC</sub> (V)   |     | TYP.      | LIMIT |      |
| Quiet Output                    | V <sub>OLP</sub> | C <sub>L</sub> = 50pF | 5.0 | 0.3       | 0.8   | V    |
| Maximum Dynamic V <sub>OL</sub> | V <sub>OLP</sub> | C <sub>L</sub> = 50pF | 5.0 | 0.3       | 0.8   | V    |
| Quiet Output                    | V <sub>OLV</sub> | C <sub>L</sub> = 50pF | 5.0 | —0.3      | —0.8  | V    |
| Minimum Dynamic V <sub>OL</sub> | V <sub>OLV</sub> | C <sub>L</sub> = 50pF | 5.0 | —0.3      | —0.8  | V    |
| Minimum High Level              | V <sub>IHD</sub> | C <sub>L</sub> = 50pF | 5.0 | —         | 3.5   | V    |
| Dynamic Input Voltage           | V <sub>IHD</sub> | C <sub>L</sub> = 50pF | 5.0 | —         | 3.5   | V    |
| Maximum Low Level               | V <sub>ILD</sub> | C <sub>L</sub> = 50pF | 5.0 | —         | 1.5   | V    |
| Dynamic Input Voltage           | V <sub>ILD</sub> | C <sub>L</sub> = 50pF | 5.0 | —         | 1.5   | V    |

## INPUT EQUIVALENT CIRCUIT



SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)

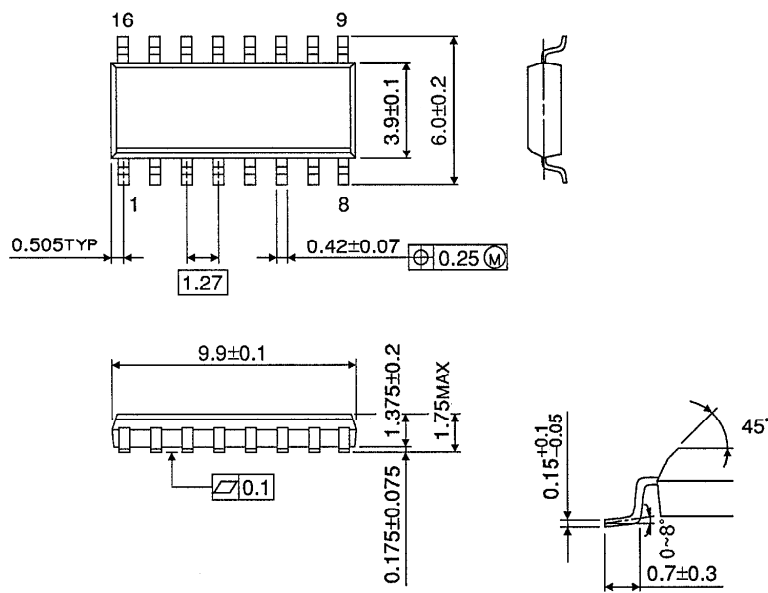
Unit in mm



Weight : 0.18g (TYP.)

SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOP16-P-150-1.27)

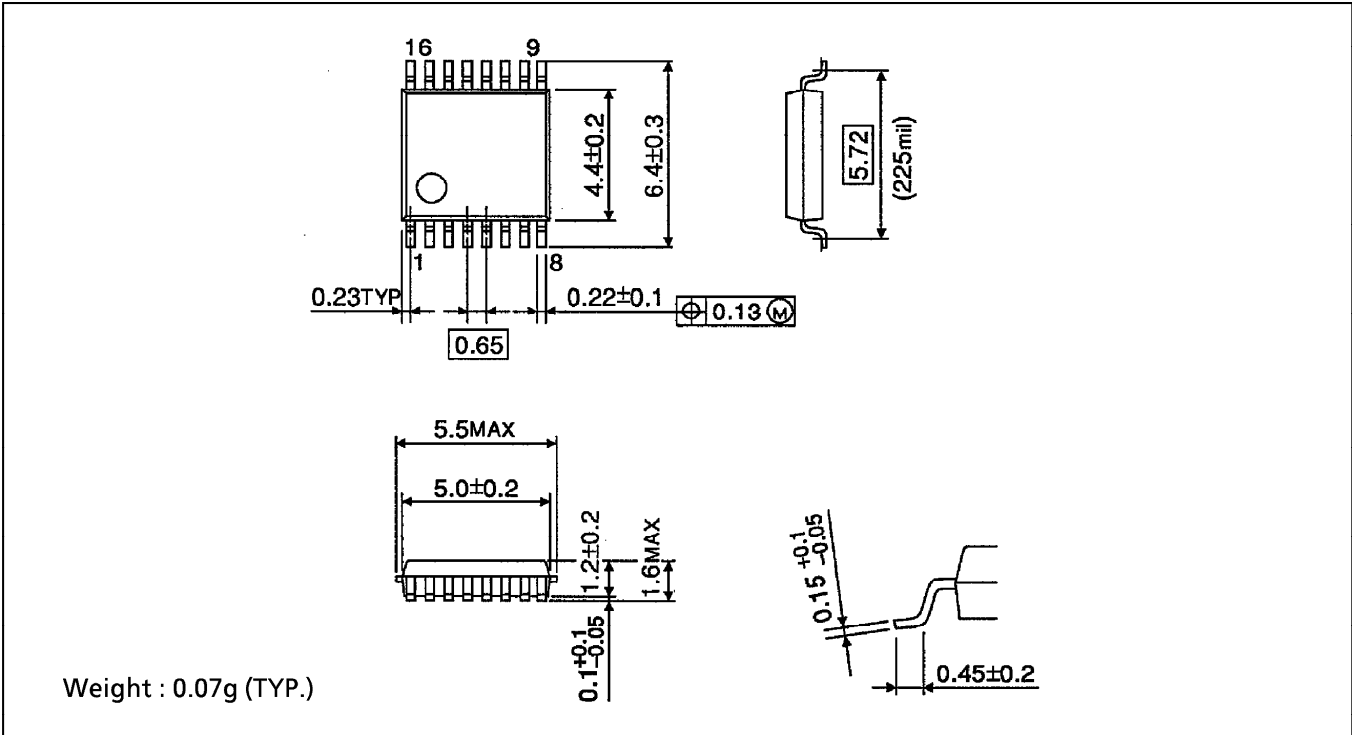
Unit in mm



Weight : 0.13g (TYP.)

SSOP 16PIN OUTLINE DRAWING (SSOP16-P-225-0.65B)

Unit in mm



TSSOP 16PIN OUTLINE DRAWING (TSSOP16-P-0044-0.65)

Unit in mm

