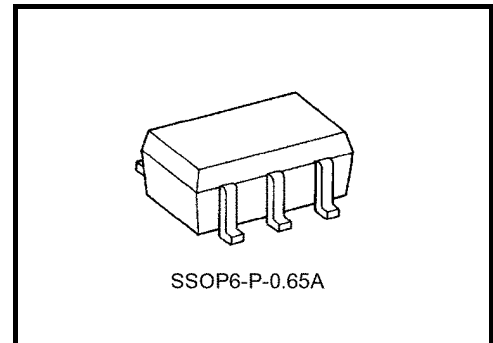


TC7PA17FU

Dual Schmitt Buffer

Features

- Operating voltage range: $V_{CC} = 1.8\sim 3.6\text{ V}$
- High-speed operation: $t_{pd} = 4.0\text{ ns (max) at } V_{CC} = 3.0\sim 3.6\text{ V}$
 $t_{pd} = 4.3\text{ ns (max) at } V_{CC} = 2.3\sim 2.7\text{ V}$
 $t_{pd} = 8.6\text{ ns (max) at } V_{CC} = 1.8\text{ V}$
- High-level output current:
 $I_{OH}/I_{OL} = \pm 24\text{ mA (min) at } V_{CC} = 3.0\text{ V}$
 $I_{OH}/I_{OL} = \pm 18\text{ mA (min) at } V_{CC} = 2.3\text{ V}$
 $I_{OH}/I_{OL} = \pm 6\text{ mA (min) at } V_{CC} = 1.8\text{ V}$
- 3.6-V tolerant inputs
- 3.6-V power down protection outputs



Weight: 0.0068 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Value | 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 | 200 | mW |
| DC V_{CC} /ground current | I_{CC} | ± 100 | mA |
| Storage temperature | T_{stg} | -65~150 | °C |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

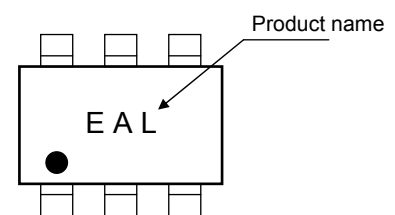
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: $V_{CC} = 0\text{ V}$

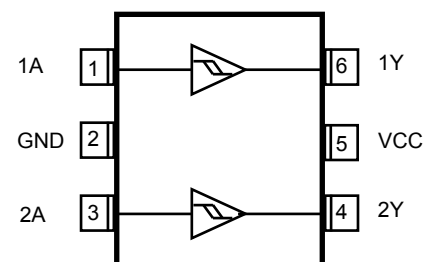
Note 2: High or Low state. I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < GND$

Marking



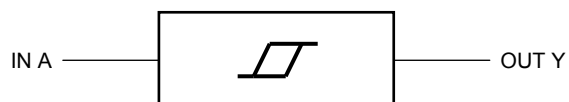
Pin Assignment (top view)



Truth Table

| | |
|---|---|
| A | Y |
| L | L |
| H | H |

IEC Logic Symbol



Operating Ranges

| Characteristics | Symbol | Value | Unit |
|-----------------------|-----------------|----------------------|-------------|
| Power 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 | $^{\circ}C$ |

Note 4: Data retention only

Note 5: $V_{CC} = 0\text{ V}$

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: $V_{CC} = 1.8\text{ V}$

DC Electrical Characteristics (Ta = -40~85°C, 2.7 V < VCC ≤ 3.6 V)

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|---------------------------|------------|------------------|---------------------------|---------------|---------|-----------|-------|------|
| | | | | | | | | |
| Threshold voltage | High level | VP | — | | 3.6 | - | 2.2 | V |
| | | | | | 3.0 | - | 2.0 | |
| | Low level | VN | — | | 3.6 | 0.8 | - | V |
| | | | | | 3.0 | 0.7 | - | |
| Hysteresys Voltage | | VH | — | | 3.6 | 0.3 | 1.2 | V |
| | | | | | 3.0 | 0.3 | 1.2 | |
| High-Level Output Voltage | | VOH | VIN = VIH | IOH = -100 μA | 2.7~3.6 | VCC - 0.2 | — | V |
| | | | | IOH = -12 mA | 2.7 | 2.2 | — | |
| | | | | IOH = -18 mA | 3.0 | 2.4 | — | |
| | | | | IOH = -24 mA | 3.0 | 2.2 | — | |
| Low-Level Output Voltage | | VOL | VIN = VIL | IOL = 100 μA | 2.7~3.6 | — | 0.2 | V |
| | | | | IOL = 12 mA | 2.7 | — | 0.4 | |
| | | | | IOL = 18 mA | 3.0 | — | 0.4 | |
| | | | | IOL = 24 mA | 3.0 | — | 0.55 | |
| Input Leakage Current | | IIN | VIN = 0~3.6 V | | 2.7~3.6 | — | ±5.0 | μA |
| Power-off Leakage Current | | I _{OFF} | VIN, VOUT = 0~3.6 V | | 0 | — | 10.0 | μA |
| Quiescent Supply Current | | ICC | VIN = VCC or GND | | 2.7~3.6 | — | 20.0 | μA |
| | | | VCC ≤ (VIN, VOUT) ≤ 3.6 V | | 2.7~3.6 | — | ±20.0 | |
| Increase in ICC per Input | | ΔICC | VIH = VCC - 0.6 V | | 2.7~3.6 | — | 750 | |

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

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|---------------------------|------------|------------------|---------------------------|---------------|---------|-----------|-------|------|
| | | | | | | | | |
| Threshold voltage | High level | VP | — | | 2.3 | - | 1.8 | V |
| | Low level | VN | — | | 2.3 | 0.5 | - | |
| Hysteresys Voltage | | VH | — | | 2.3 | 0.3 | 1.0 | V |
| | | | | | | | | |
| High-Level Output Voltage | | VOH | VIN = VIH | IOH = -100 μA | 2.3~2.7 | VCC - 0.2 | — | V |
| | | | | IOH = -6 mA | 2.3 | 2.0 | — | |
| | | | | IOH = -12 mA | 2.3 | 1.8 | — | |
| | | | | IOH = -18 mA | 2.3 | 1.7 | — | |
| Low-Level Output Voltage | | VOL | VIN = VIL | IOL = 100 μA | 2.3~2.7 | — | 0.2 | V |
| | | | | IOL = 12 mA | 2.3 | — | 0.4 | |
| | | | | IOL = 18 mA | 2.3 | — | 0.6 | |
| Input Leakage Current | | IIN | VIN = 0~3.6 V | | 2.3~2.7 | — | ±5.0 | μA |
| Power-off Leakage Current | | I _{OFF} | VIN, VOUT = 0~3.6 V | | 0 | — | 10.0 | μA |
| Quiescent Supply Current | | ICC | VIN = VCC or GND | | 2.3~2.7 | — | 20.0 | μA |
| | | | VCC ≤ (VIN, VOUT) ≤ 3.6 V | | 2.3~2.7 | — | ±20.0 | |

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

| Characteristics | Symbol | Test Condition | VCC (V) | Min | Max | Unit | |
|---------------------------|------------------|---|---------------------------|-----|-----------------------|------|---|
| | | | | | | | |
| Threshold voltage | High level | VP | — | 1.8 | - | 1.4 | V |
| | Low level | VN | — | 1.8 | 0.25 | - | |
| Hysteresys Voltage | VH | — | 1.8 | 0.2 | 0.95 | V | |
| High-Level Output Voltage | VOH | VIN = VIH | I _{OH} = -100 μA | 1.8 | V _{CC} - 0.2 | — | V |
| | | | I _{OH} = -6 mA | 1.8 | 1.4 | — | |
| Low-Level Output Voltage | VOL | VIN = VIL | I _{OL} = 100 μA | 1.8 | — | 0.2 | |
| | | | I _{OL} = 6 mA | 1.8 | — | 0.3 | |
| Input Leakage Current | I _{IN} | V _{IN} = 0~3.6 V | 1.8 | — | ±5.0 | μA | |
| Power-off Leakage Current | I _{OFF} | V _{IN} , V _{OUT} = 0~3.6 V | 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}) ≤ 3.6 V | 1.8 | — | ±20.0 | | |

AC Electrical Characteristics (Ta = -40~85°C, input tr = tf = 2.0 ns, CL = 30 pF, RL = 500 Ω)

| Characteristics | Symbol | Test Condition | VCC (V) | Min | Max | Unit |
|------------------------|--------------------------------------|------------------|-----------|-----|-----|------|
| | | | | | | |
| Propagation delay time | t _{PLH} t _{pHL} | (Figure 1 and 2) | 1.8 | 1.0 | 8.6 | ns |
| | | | 2.5 ± 0.2 | 0.8 | 4.3 | |
| | | | 3.3 ± 0.3 | 0.6 | 4.0 | |

For C_L = 50 pF, add approximately 300 ps to the AC maximum specification.

Dynamic Switching Characteristics (Ta = 25°C, input: tr = tf = 2.0 ns, CL = 30 pF)

| Characteristics | Symbol | Test Condition | | Typ. | Unit | |
|----------------------------------|--------|------------------------|-----------|------|-------|----|
| | | | VCC (V) | | | |
| Quiet output maximum dynamic VOL | VOLP | VIN = 1.8 V, VIL = 0 V | (Note 10) | 1.8 | 0.25 | ns |
| | | VIN = 2.5 V, VIL = 0 V | (Note 10) | 2.5 | 0.6 | |
| | | VIN = 3.3 V, VIL = 0 V | (Note 10) | 3.3 | 0.8 | |
| Quiet output minimum dynamic VOL | VOLV | VIN = 1.8 V, VIL = 0 V | (Note 10) | 1.8 | -0.25 | ns |
| | | VIN = 2.5 V, VIL = 0 V | (Note 10) | 2.5 | -0.6 | |
| | | VIN = 3.3 V, VIL = 0 V | (Note 10) | 3.3 | -0.8 | |
| Quiet output minimum dynamic VOH | VOHV | VIN = 1.8 V, VIL = 0 V | (Note 10) | 1.8 | 1.5 | ns |
| | | VIN = 2.5 V, VIL = 0 V | (Note 10) | 2.5 | 1.9 | |
| | | VIN = 3.3 V, VIL = 0 V | (Note 10) | 3.3 | 2.2 | |

Note 10: Parameter guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | | TYP. | Unit |
|-------------------------------|--------|----------------|-----------|---------------|-------|
| | | | VCC (V) | | |
| Input Capacitance | CIN | — | | 4 | pF |
| Power Dissipation Capacitance | CPD | fIN = 10 MHz | (Note 11) | 1.8, 2.5, 3.3 | 27 pF |

Note 11: 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:

$$I_{CC (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

AC Test Circuit

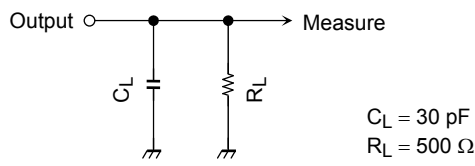
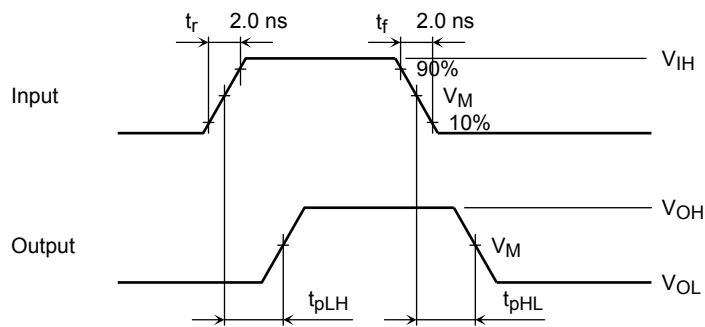


Figure 1

AC Waveforms



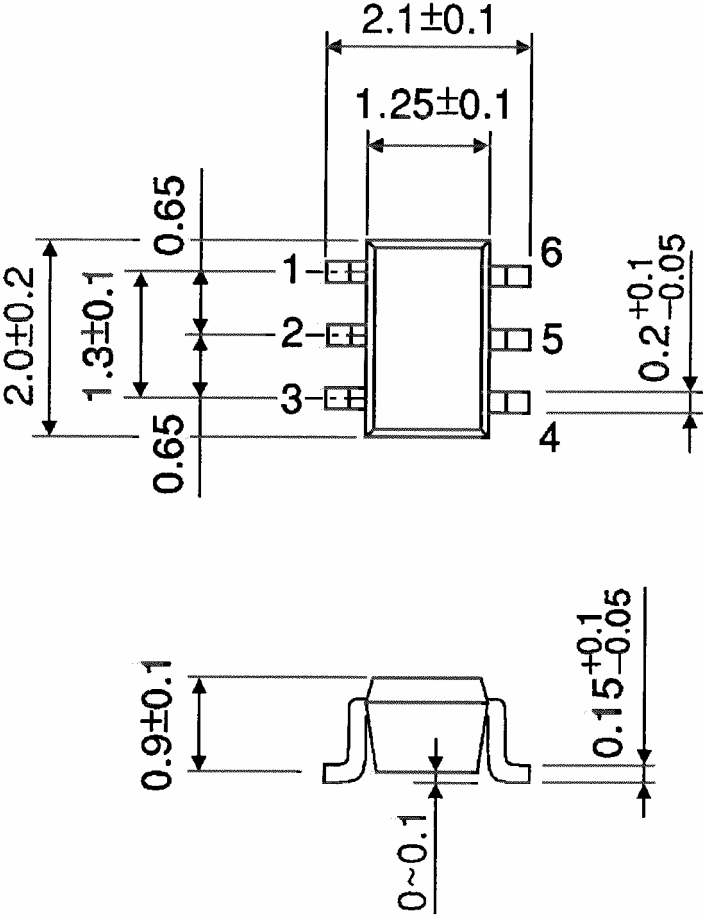
| Symbol | V_{CC} | | |
|----------|-------------------------|-------------------------|-----------------|
| | $3.3 \pm 0.3 \text{ V}$ | $2.5 \pm 0.2 \text{ V}$ | 1.8 V |
| V_{IH} | 2.7 V | V_{CC} | V_{CC} |
| V_M | 1.5 V | $V_{CC}/2$ | $V_{CC}/2$ |

Figure 2 t_{pLH} , t_{pHL}

Package Dimensions

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and 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 comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products 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 TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.