

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

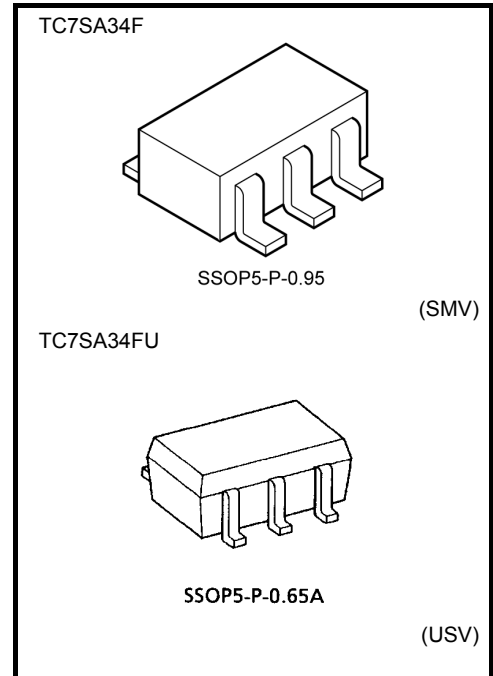
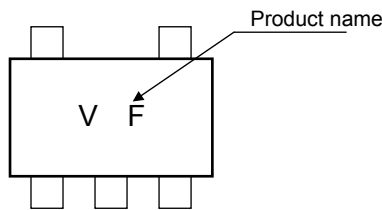
TC7SA34F, TC7SA34FU

Non-Inverter

Features

- Low voltage operation : $V_{CC} = 1.8$ to 3.6 V
- High speed operation : $t_{pd} = 2.8$ ns (max) ($V_{CC} = 3.0$ to 3.6 V)
 : $t_{pd} = 3.7$ ns (max) ($V_{CC} = 2.3$ to 2.7 V)
 : $t_{pd} = 7.4$ ns (max) ($V_{CC} = 1.8$ V)
- High output current : $I_{OH}/I_{OL} = \pm 24$ mA (min) ($V_{CC} = 3.0$ V)
 : $I_{OH}/I_{OL} = \pm 18$ mA (min) ($V_{CC} = 2.3$ V)
 : $I_{OH}/I_{OL} = \pm 6$ mA (min) ($V_{CC} = 1.8$ V)
- 3.6-V tolerant input.
- 3.6-V power down protection output.

Marking

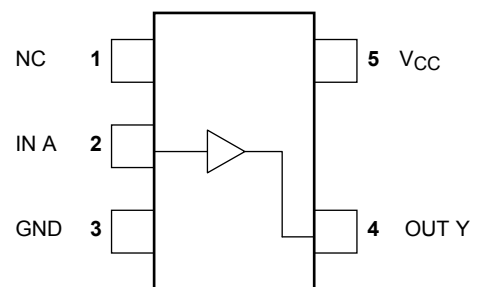


Weight
 SSOP5-P-0.95 : 0.016 g (typ.)
 SSOP5-P-0.65A : 0.006 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|-------------------------------|------|
| Supply voltage | V_{CC} | -0.5 to 4.6 | V |
| DC input voltage | V_{IN} | -0.5 to 4.6 | V |
| DC output voltage | V_{OUT} | -0.5 to 4.6 (Note 1) | V |
| | | -0.5 to $V_{CC}+0.5$ (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 range | T_{stg} | -65 to 150 | °C |

Pin Assignment (top view)



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: $V_{CC} = 0$ V

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

Note 3: $V_{OUT} < GND$

IEC Logic Symbol



Truth Table

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

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------------|------------------------|-------------|
| Supply voltage | V_{CC} | 1.8 to 3.6 | V |
| | | 1.2 to 3.6 (Note 4) | |
| Input voltage | V_{IN} | -0.3 to 3.6 | V |
| Output voltage | V_{OUT} | 0 to 3.6 (Note 5) | V |
| | | 0 to V_{CC} (Note 6) | |
| Output current | I_{OH}/I_{OL} | ± 24 (Note 7) | mA |
| | | ± 18 (Note 8) | |
| | | ± 6 (Note 9) | |
| Operating temperature range | T_{opr} | -40 to 85 | $^{\circ}C$ |
| Input rise and fall time | dt/dv | 0 to 10 (Note 10) | ns/V |

Note 4: Data retention only

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

Note 6: High or low state

Note 7: $V_{CC} = 3.0\text{ to }3.6\text{ V}$

Note 8: $V_{CC} = 2.3\text{ to }2.7\text{ V}$

Note 9: $V_{CC} = 1.8\text{ V}$

Note 10: $V_{IN} = 0.8\text{ to }2.0\text{ V}$, $V_{CC} = 3.0\text{ V}$

Electrical Characteristics

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

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|---------------------------------------|------------|------------------|---|---------------------------|------------|-----------------------|-------|------|
| | | | | | | | | |
| Input voltage | High level | V _{IH} | — | | 2.7 to 3.6 | 2.0 | — | V |
| | Low level | V _{IL} | — | | 2.7 to 3.6 | — | 0.8 | |
| Output voltage | High level | V _{OH} | V _{IN} = V _{IH} | I _{OH} = -100 μA | 2.7 to 3.6 | V _{CC} - 0.2 | — | V |
| | | | | I _{OH} = -12 mA | 2.7 | 2.2 | — | |
| | | | | I _{OH} = -18 mA | 3.0 | 2.4 | — | |
| | | | | I _{OH} = -24 mA | 3.0 | 2.2 | — | |
| | Low level | V _{OL} | V _{IN} = V _{IL} | I _{OL} = 100 μA | 2.7 to 3.6 | — | 0.2 | |
| | | | | I _{OL} = 12 mA | 2.7 | — | 0.4 | |
| | | | | I _{OL} = 18 mA | 3.0 | — | 0.4 | |
| | | | | I _{OL} = 24 mA | 3.0 | — | 0.55 | |
| Input leakage current | | I _{IN} | V _{IN} = 0 to 3.6 V | | 2.7 to 3.6 | — | ±5.0 | μA |
| Power off leakage current | | I _{OFF} | V _{IN} , V _{OUT} = 0 to 3.6 V | | 0 | — | 10.0 | μA |
| Quiescent supply current | | I _{CC} | V _{IN} = V _{CC} or GND | | 2.7 to 3.6 | — | 20.0 | μA |
| | | | V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V | | 2.7 to 3.6 | — | ±20.0 | |
| Increase in I _{CC} per input | | ΔI _{CC} | V _{IH} = V _{CC} - 0.6 V | | 2.7 to 3.6 | — | 750 | |

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

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|---------------------------|------------|------------------|---|---------------------------|------------|-----------------------|------------------------------|------|
| | | | | | | | | |
| Input voltage | High level | V _{IH} | — | | 2.3 to 2.7 | 1.6 | — | V |
| | Low level | V _{IL} | — | | 2.3 to 2.7 | — | 0.7 | |
| Output voltage | High level | V _{OH} | V _{IN} = V _{IH} | I _{OH} = -100 μA | 2.3 to 2.7 | V _{CC} - 0.2 | — | V |
| | | | | I _{OH} = -6 mA | 2.3 | 2.0 | — | |
| | | | | I _{OH} = -12 mA | 2.3 | 1.8 | — | |
| | | | | I _{OH} = -18 mA | 2.3 | 1.7 | — | |
| | Low level | V _{OL} | V _{IN} = V _{IL} | I _{OL} = 100 μA | 2.3 to 2.7 | — | 0.2 | |
| | | | | I _{OL} = 12 mA | 2.3 | — | 0.4 | |
| | | | | I _{OL} = 18 mA | 2.3 | — | 0.6 | |
| | | | | Input leakage current | | I _{IN} | V _{IN} = 0 to 3.6 V | |
| Power off leakage current | | I _{OFF} | V _{IN} , V _{OUT} = 0 to 3.6 V | | 0 | — | 10.0 | μA |
| Quiescent supply current | | I _{CC} | V _{IN} = V _{CC} or GND | | 2.3 to 2.7 | — | 20.0 | μA |
| | | | V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V | | 2.3 to 2.7 | — | ±20.0 | |

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

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|---------------------------|------------|------------------|---|---------------------------|------------|-----------------------|-----------------------|------|
| | | | | | | | | |
| Input voltage | High level | V _{IH} | — | | 1.8 to 2.3 | V _{CC} × 0.7 | — | V |
| | Low level | V _{IL} | — | | 1.8 to 2.3 | — | V _{CC} × 0.2 | |
| Output voltage | High level | V _{OH} | V _{IN} = V _{IH} | I _{OH} = -100 μA | 1.8 | V _{CC} - 0.2 | — | V |
| | | | | I _{OH} = -6 mA | 1.8 | 1.4 | — | |
| | Low level | V _{OL} | V _{IN} = 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 to 3.6 V | | 1.8 | — | ±5.0 | μA |
| Power off leakage current | | I _{OFF} | V _{IN} , V _{OUT} = 0 to 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 Characteristics (Ta = -40 to 85°C, input: t_r = t_f = 2.0 ns, C_L = 30 pF, R_L = 500 Ω)

| Characteristics | | Symbol | Test Condition | | VCC (V) | Min | Max | Unit |
|------------------------|--------------------------------------|--------------------|----------------|--|-----------|-----|-----|------|
| | | | | | | | | |
| Propagation delay time | t _{pLH} t _{pHL} | Figure 1, Figure 2 | | | 1.8 | 1.0 | 7.4 | ns |
| | | | | | 2.5 ± 0.2 | 0.8 | 3.7 | |
| | | | | | 3.3 ± 0.3 | 0.6 | 2.8 | |

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

Capacitive Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | | VCC (V) | Typ. | Unit |
|-------------------------------|--|-----------------|--------------------------|-----------|---------------|------|------|
| | | | | | | | |
| Input capacitance | | C _{IN} | — | | 1.8, 2.5, 3.3 | 4 | pF |
| Power dissipation capacitance | | C _{PD} | f _{IN} = 10 MHz | (Note 11) | 1.8, 2.5, 3.3 | 12 | 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.

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

AC Test Circuit

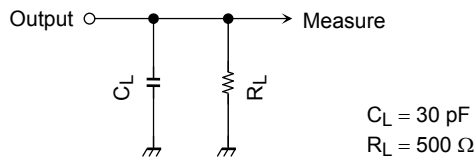
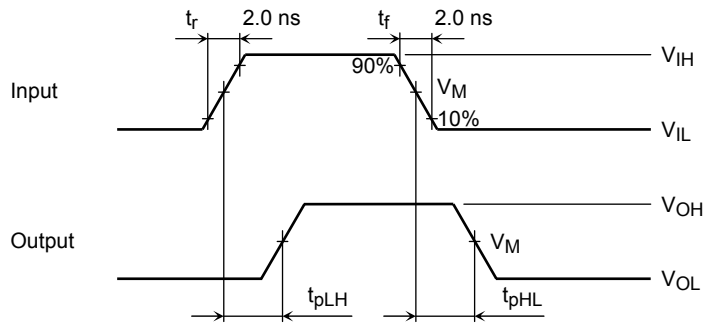


Figure 1

AC Waveforms



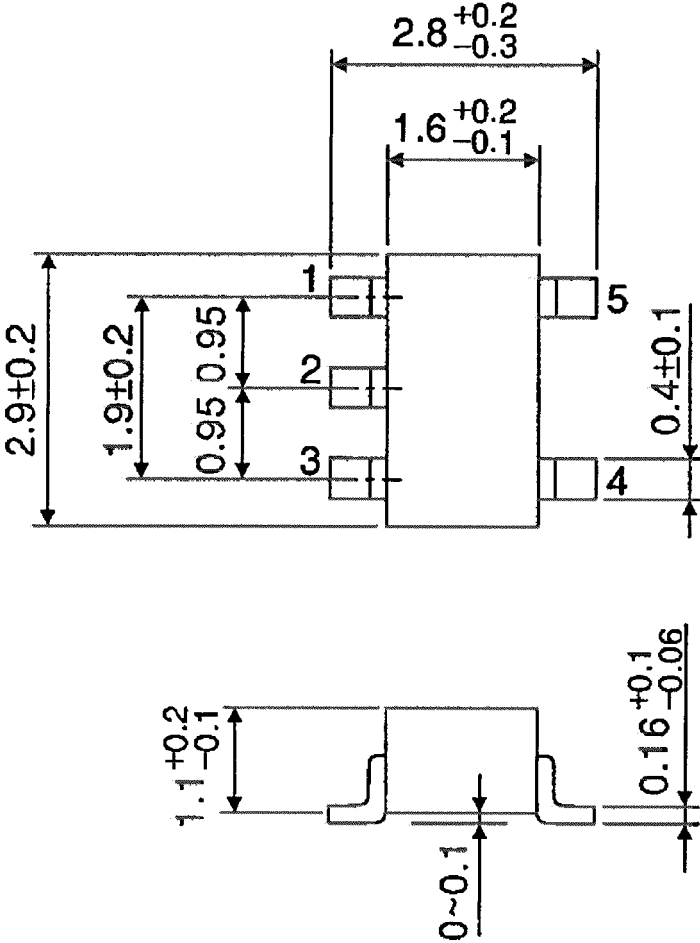
| Symbol | V_{CC} | | |
|----------|-------------------------|-------------------------|------------|
| | $3.3 \pm 0.3 \text{ V}$ | $2.5 \pm 0.2 \text{ V}$ | 1.8 V |
| V_{IH} | 2.7 V | V_{CC} | V_{CC} |
| V_M | 1.5 V | $V_{CC}/2$ | $V_{CC}/2$ |

Figure 2 t_{pLH} , t_{pHL}

Package Dimensions

SSOP5-P-0.95

Unit : mm

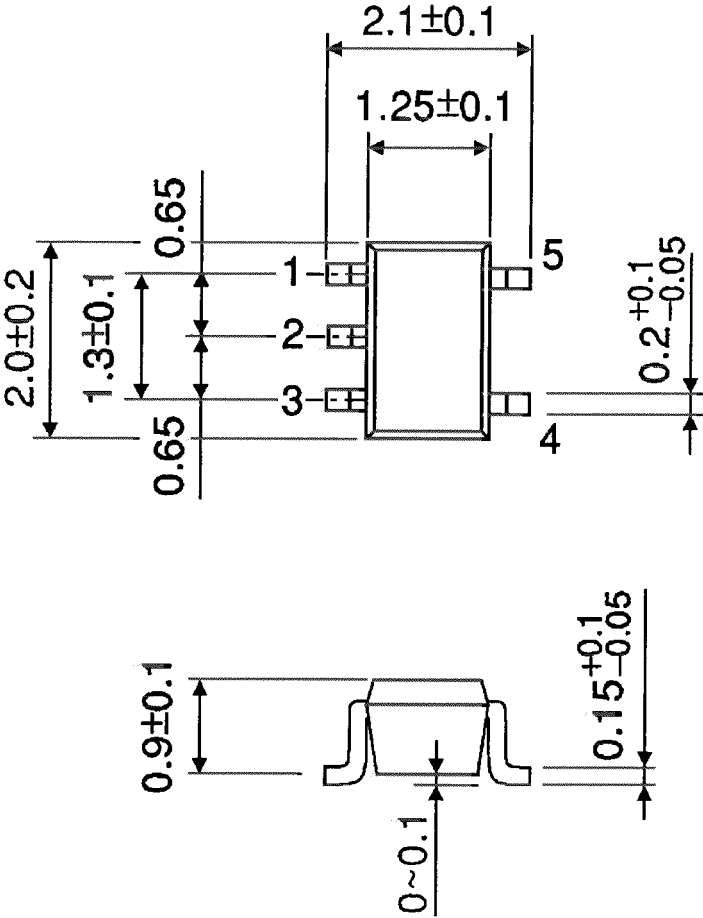


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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