

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74AC521P, TC74AC521F

8-Bit Equality Comparator

The TC74AC521 is an advanced high speed CMOS 8-BIT DIGITAL COMPARATOR fabricated with silicon gate and double-layer metal wiring C²MOS technology.

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

It compares two 8-bit binary or BCD words applied inputs P₀~P₇, and inputs Q₀~Q₇, and indicates whether or not they are equal.

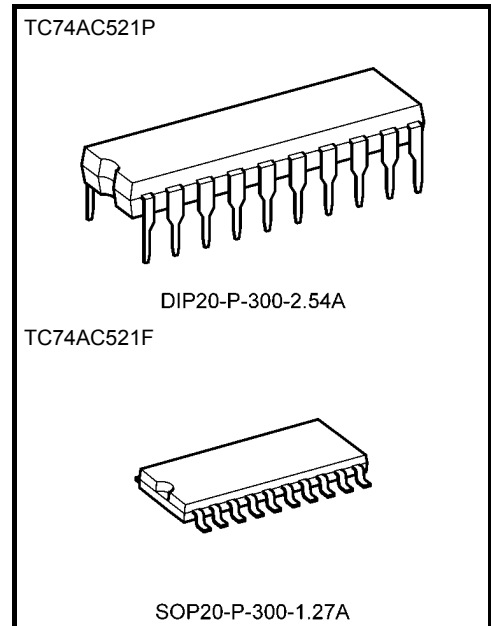
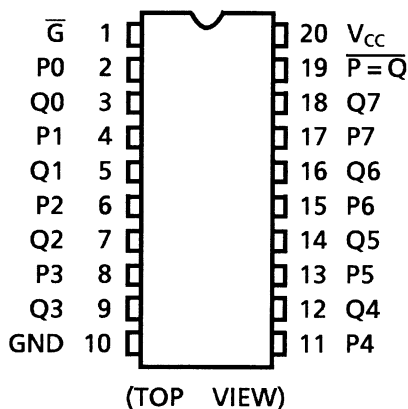
A signal active low enable is provided to facilitate cascading of several packages to compare of words greater than 8 bits.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

Features

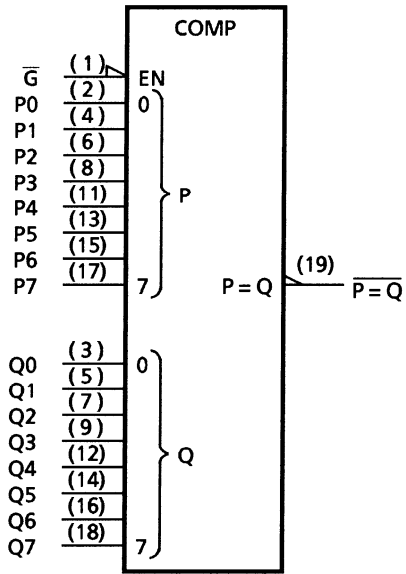
- High speed: $t_{pd} = 6.4 \text{ ns (typ.) at } V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 8 \mu\text{A (max) at } T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$
Capability of driving 50Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Pin and function compatible with 74F521

Pin Assignment



| | |
|-------------------|-----------------|
| Weight | |
| DIP20-P-300-2.54A | : 1.30 g (typ.) |
| SOP20-P-300-1.27A | : 0.22 g (typ.) |

IEC Logic Symbol

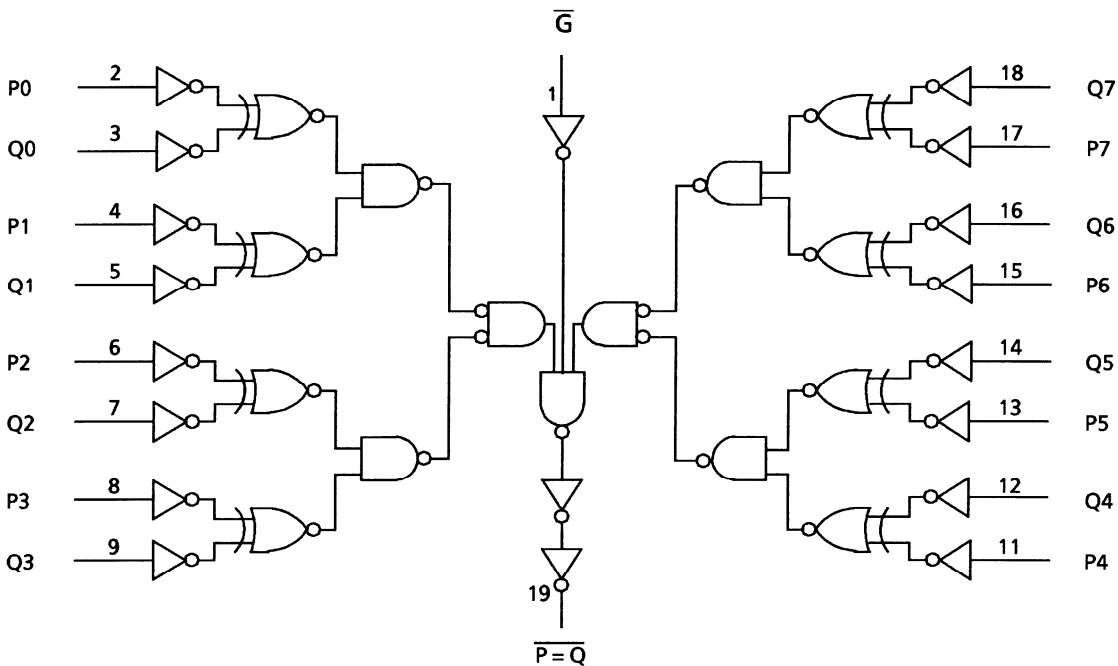


Truth Table

| Inputs | | Output |
|--------|-----------|------------------|
| P, Q | \bar{G} | $\overline{P=Q}$ |
| P = Q | L | L |
| P ≠ Q | L | H |
| X | H | H |

X: Don't care

System Diagram



Absolute Maximum Ratings (Note 1)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|------------------------------|--------------------|
| Supply voltage range | V_{CC} | -0.5 to 7.0 | V |
| DC input voltage | V_{IN} | -0.5 to $V_{CC} + 0.5$ | V |
| DC output voltage | V_{OUT} | -0.5 to $V_{CC} + 0.5$ | V |
| Input diode current | I_{IK} | ± 20 | mA |
| Output diode current | I_{OK} | ± 50 | mA |
| DC output current | I_{OUT} | ± 50 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 100 | mA |
| Power dissipation | P_D | 500 (DIP) (Note 2)/180 (SOP) | mW |
| Storage temperature | T_{stg} | -65 to 150 | $^{\circ}\text{C}$ |

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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 2: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of -10 mW/ $^{\circ}\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|---|--------------------|
| Supply voltage | V_{CC} | 2.0 to 5.5 | V |
| Input voltage | V_{IN} | 0 to V_{CC} | V |
| Output voltage | V_{OUT} | 0 to V_{CC} | V |
| Operating temperature | T_{opr} | -40 to 85 | $^{\circ}\text{C}$ |
| Input rise and fall time | dt/dV | 0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V) | ns/V |

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

Electrical Characteristics

DC Characteristics

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---------------------------------|-----------------|--|--------------------------|---------------------|------|------|------------------|------|------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| High-level input voltage | V _{IH} | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 3.0 | 2.10 | — | — | 2.10 | — | |
| | | | | 5.5 | 3.85 | — | — | 3.85 | — | |
| Low-level input voltage | V _{IL} | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 3.0 | — | — | 0.90 | — | 0.90 | |
| | | | | 5.5 | — | — | 1.65 | — | 1.65 | |
| High-level output voltage | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | |
| | | | I _{OH} = -4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | | 4.5 | 3.94 | — | — | 3.80 | — | |
| I _{OH} = -24 mA | 4.5 | 3.94 | — | — | 3.80 | — | | | | |
| I _{OH} = -75 mA (Note) | 5.5 | — | — | — | 3.85 | — | | | | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50 μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | |
| | | | I _{OL} = 12 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | | 4.5 | — | — | 0.36 | — | 0.44 | |
| I _{OL} = 24 mA | 4.5 | — | — | 0.36 | — | 0.44 | | | | |
| I _{OL} = 75 mA (Note) | 5.5 | — | — | — | — | 1.65 | | | | |
| Input leakage current | I _{IN} | V _{IN} = V _{CC} or GND | | 5.5 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | I _{CC} | V _{IN} = V _{CC} or GND | | 5.5 | — | — | 8.0 | — | 80.0 | μA |

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

AC Characteristics (C_L = 50 pF, R_L = 500 Ω, input: t_r = t_f = 3 ns)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---|---------------------------|----------------|--|---------------------|-----|------|------------------|-----|------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| Propagation delay time (P _n , Q _n - $\overline{P=Q}$) | t _{pLH} | — | | 3.3 ± 0.3 | — | 10.5 | 17.5 | 1.0 | 20.0 | ns |
| | t _{pHL} | | | 5.0 ± 0.5 | — | 7.2 | 11.0 | 1.0 | 12.5 | |
| Propagation delay time ($\overline{G} - \overline{P=Q}$) | t _{pLH} | — | | 3.3 ± 0.3 | — | 7.2 | 11.5 | 1.0 | 13.0 | ns |
| | t _{pHL} | | | 5.0 ± 0.5 | — | 4.8 | 7.0 | 1.0 | 8.0 | |
| Input capacitance | C _{IN} | — | | — | 5 | 10 | — | 10 | pF | |
| Power dissipation capacitance | C _{PD} (Note) | — | | — | 34 | — | — | — | pF | |

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

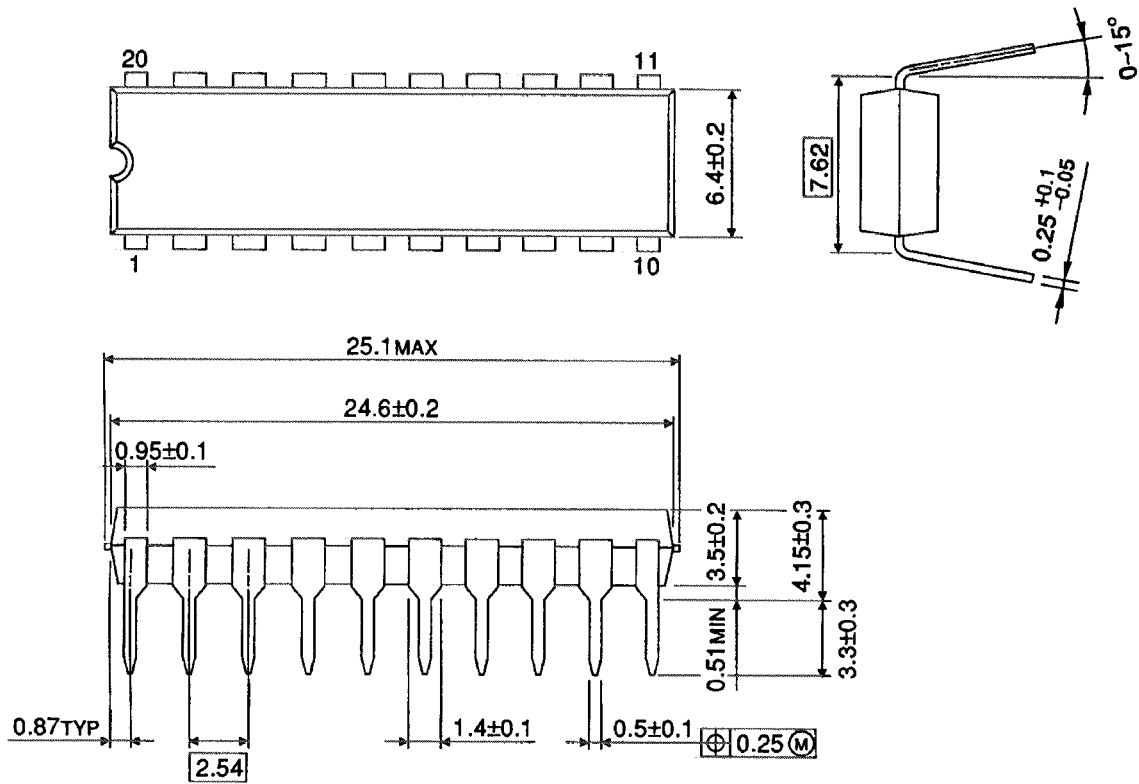
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

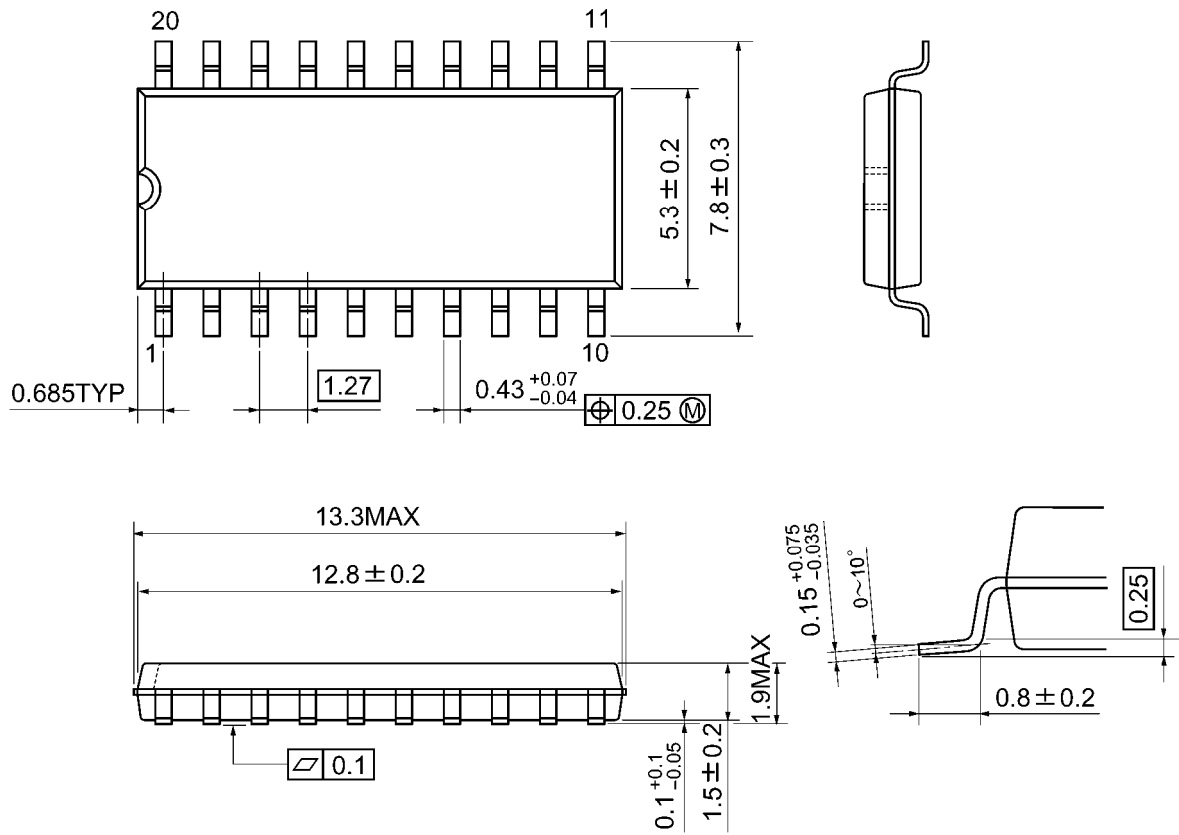


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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