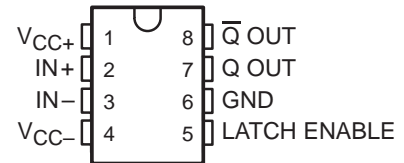


TL3016, TL3016Y ULTRA-FAST LOW-POWER PRECISION COMPARATORS

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- Ultrafast Operation . . . 7.6 ns (Typ)
- Low Positive Supply Current
10.6 mA (Typ)
- Operates From a Single 5-V Supply or From
a Split ± 5 -V Supply
- Complementary Outputs
- Low Offset Voltage
- No Minimum Slew Rate Requirement
- Output Latch Capability
- Functional Replacement to the LT1016

D AND PW PACKAGE
(TOP VIEW)

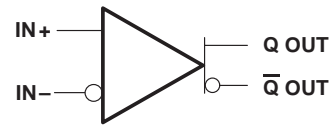


description

The TL3016 is an ultrafast comparator designed to interface directly to TTL logic while operating from either a single 5-V power supply or dual ± 5 -V supplies. It features extremely tight offset voltage and high gain for precision applications. It has complementary outputs that can be latched using the LATCH ENABLE terminal. Figure 1 shows the positive supply current of this comparator. The TL3016 only requires 10.6 mA (typical) to achieve a propagation delay of 7.6 ns.

The TL3016 is a pin-for-pin functional replacement for the LT1016 comparator, offering higher speed operation but consuming half the power.

symbol (each comparator)



POSITIVE SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

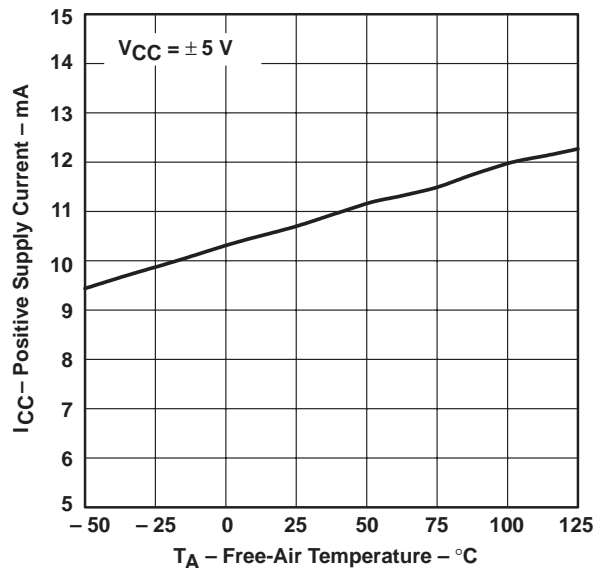


Figure 1

AVAILABLE OPTIONS

| T _A | PACKAGED DEVICES | | CHIP FORM [‡] (Y) |
|----------------|-----------------------------------|---------------|-------------------------------|
| | SMALL OUTLINE [†] (D) | TSSOP (PW) | |
| 0°C to 70°C | TL3016CD | TL3016CPWLE | TL3016Y |
| -40°C to 85°C | TL3016ID | TL3016IPWLE | — |

[†] The PW packages are available left-ended taped and reeled only.

[‡] Chip forms are tested at T_A = 25°C only.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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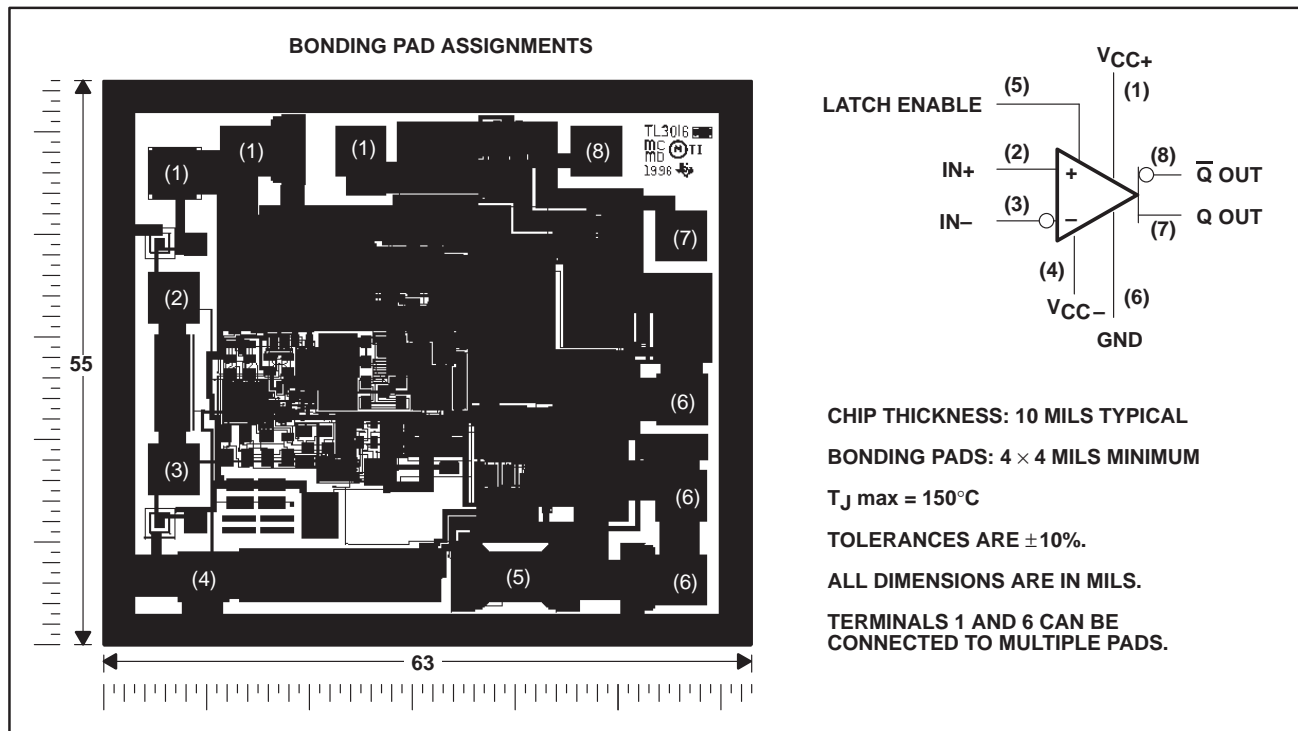
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TL3016, TL3016Y ULTRA-FAST LOW-POWER PRECISION COMPARATORS

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TL3016Y chip information

This chip displays characteristics similar to the TL3016C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



| COMPONENT COUNT | |
|-----------------|----|
| Bipolars | 53 |
| MOSFETs | 49 |
| Resistors | 46 |
| Capacitors | 14 |

TL3016, TL3016Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

| | |
|--|------------------------------|
| Supply voltage, V_{DD} (see Note 1) | – 7 V to 7 V |
| Differential input voltage, V_{ID} (see Note 2) | 7 V |
| Input voltage range, V_I | 7 V |
| Input voltage, V_I (LATCH ENABLE) | 7 V |
| Output current, I_O | ± 20 mA |
| Continuous total power dissipation | See Dissipation Rating Table |
| Operating free-air temperature range, T_A | –40°C to 85°C |
| Storage temperature range, T_{stg} | – 65°C to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, except differential voltages, are with respect to network ground.
 2. Differential voltages are at $IN+$ with respect to $IN-$.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$ POWER RATING |
|---------|---|---|--|
| D | 725 mW | 5.8 mW/°C | 464 mW |
| PW | 525 mW | 4.2 mW/°C | 336 mW |



TL3016, TL3016Y ULTRA-FAST LOW-POWER PRECISION COMPARATORS

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electrical characteristics at specified operating free-air temperature, $V_{DD} = \pm 5\text{ V}$, $V_{LE} = 0$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS† | TL3016C | | | TL3016I | | | UNIT |
|--|---|---------------------------|------|------|---------|------|------|------------------------------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V_{IO} Input offset voltage | $T_A = 25^\circ\text{C}$ | 0.5 | | 3 | 0.5 | | 3 | mV |
| | $T_A = \text{full range}$ | | | 3.5 | | | 3.5 | |
| α_{VIO} Temperature coefficient of input offset voltage | | -4.8 | | | -4.5 | | | $\mu\text{V}/^\circ\text{C}$ |
| I_{IO} Input offset current | $T_A = 25^\circ\text{C}$ | 0.1 | | 0.6 | 0.1 | | 0.6 | μA |
| | $T_A = \text{full range}$ | | | 0.9 | | | 1.3 | |
| I_{IB} Input bias current | $T_A = 25^\circ\text{C}$ | 6 | | 10 | 6 | | 10 | μA |
| | $T_A = \text{full range}$ | | | 10 | | | 10 | |
| V_{ICR} Common-mode input voltage range | $V_{DD} = \pm 5\text{ V}$ | -3.75 | | 3.5 | -3.75 | | 3.5 | V |
| | $V_{DD} = 5\text{ V}$ | 1.25 | | 3.5 | 1.25 | | 3.5 | |
| CMRR Common-mode rejection ratio | $-3.75 \leq V_{IC} \leq 3.5\text{ V}$, $T_A = 25^\circ\text{C}$ | 80 | 97 | | 80 | 97 | | dB |
| k_{SVR} Supply-voltage rejection ratio | Positive supply: $4.6\text{ V} \leq +V_{DD} \leq 5.4\text{ V}$, $T_A = 25^\circ\text{C}$ | 60 | 72 | | 60 | 72 | | dB |
| | Negative supply: $-7\text{ V} \leq -V_{DD} \leq -2\text{ V}$, $T_A = 25^\circ\text{C}$ | 80 | 100 | | 80 | 100 | | |
| V_{OL} Low-level output voltage | $I_{(\text{sink})} = 4\text{ mA}$, $V_+ \leq 4.6\text{ V}$, $T_A = 25^\circ\text{C}$ | 500 | 600 | | 500 | 600 | | mV |
| | $I_{(\text{sink})} = 10\text{ mA}$, $V_+ \leq 4.6\text{ V}$, $T_A = 25^\circ\text{C}$ | 750 | | | 750 | | | |
| V_{OH} High-level output voltage | $V_+ \leq 4.6\text{ V}$, $T_A = 25^\circ\text{C}$, $I_O = 1\text{ mA}$ | 3.6 | 3.9 | | 3.6 | 3.9 | | V |
| | $V_+ \leq 4.6\text{ V}$, $T_A = 25^\circ\text{C}$, $I_O = 10\text{ mA}$ | 3.4 | 3.7 | | 3.4 | 3.7 | | |
| I_{DD} | Positive supply current | | 10.6 | 12.5 | | 10.6 | 12.5 | mA |
| | Negative supply current | $T_A = \text{full range}$ | -1.8 | -1.3 | | -2.4 | -1.3 | |
| V_{IL} Low-level input voltage (LATCH ENABLE) | | | | 0.8 | | | 0.8 | V |
| V_{IH} High-level input voltage (LATCH ENABLE) | | 2 | | | 2 | | | V |
| I_{IL} Low-level input current (LATCH ENABLE) | $V_{LE} = 0$ | 0 | 1 | | 0 | 1 | | μA |
| | $V_{LE} = 2\text{ V}$ | 24 | 39 | | 24 | 45 | | |

† Full range for the TL3016C is $T_A = 0^\circ\text{C}$ to 70°C . Full range for the TL3016I is $T_A = -40^\circ\text{C}$ to 85°C .

‡ All typical values are measures with $T_A = 25^\circ\text{C}$.



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TL3016, TL3016Y
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PRECISION COMPARATORS

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switching characteristics, $V_{DD} = \pm 5\text{ V}$, $V_{LE} = 0$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS† | | TL3016C | | | TL3016I | | | UNIT |
|-------------|------------------------------------|--|---------------------------|---------|------|-----|---------|------|-----|------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| t_{pd1} | Propagation delay time‡ | $\Delta V_I = 100\text{ mV}$, $V_{OD} = 5\text{ mV}$ | $T_A = 25^\circ\text{C}$ | 7.8 | 10 | | 7.8 | 10 | ns | |
| | | | $T_A = \text{full range}$ | 7.8 | 11.2 | | 7.8 | 12.2 | | |
| | | $\Delta V_I = 100\text{ mV}$, $V_{OD} = 20\text{ mV}$ | $T_A = 25^\circ\text{C}$ | 7.6 | 10 | | 7.6 | 10 | | |
| | | | $T_A = \text{full range}$ | 7.6 | 11.2 | | 7.6 | 12.2 | | |
| $t_{sk(p)}$ | Pulse skew ($t_{pd+} - t_{pd-}$) | $\Delta V_I = 100\text{ mV}$, $T_A = 25^\circ\text{C}$ | $V_{OD} = 5\text{ mV}$ | 0.5 | | 0.5 | | ns | | |
| t_{su} | Setup time, LATCH ENABLE | | | 2.5 | | 2.5 | | ns | | |

† Full range for the TL3016C is 0°C to 70°C . Full range for the TL3016I is -40°C to 85°C .

‡ t_{pd1} cannot be measured in automatic handling equipment with low values of overdrive. The TL3016 is 100% tested with a 1-V step and 500-mV overdrive at $T_A = 25^\circ\text{C}$ only. Correlation tests have shown that t_{pd1} limits given can be ensured with this test, if additional dc tests are performed to ensure that all internal bias conditions are correct. For low overdrive conditions, V_{OS} is added to the overdrive.

TYPICAL CHARACTERISTICS

Table of Graphs

| | | FIGURE | |
|----------|--|--------------------------|----|
| I_{CC} | Positive supply current | vs Input voltage | 2 |
| | | vs Frequency | 3 |
| | | vs Free-air temperature | 4 |
| I_{CC} | Negative supply current | vs Free-air temperature | 5 |
| t_{pd} | Propagation delay time | vs Overdrive voltage | 6 |
| | | vs Supply voltage | 7 |
| | | vs Input impedance | 8 |
| | | vs Load capacitance | 9 |
| | | vs Free-air temperature | 10 |
| V_{IC} | Common-mode input voltage | vs Free-air temperature | 11 |
| | Input threshold voltage (LATCH ENABLE) | vs Free-air temperature | 12 |
| V_O | Output voltage | vs Output source current | 13 |
| | | vs Output sink current | 14 |
| I_I | Input current (LATCH ENABLE) | vs Input voltage | 15 |



TYPICAL CHARACTERISTICS

POSITIVE SUPPLY CURRENT
 vs
 INPUT VOLTAGE

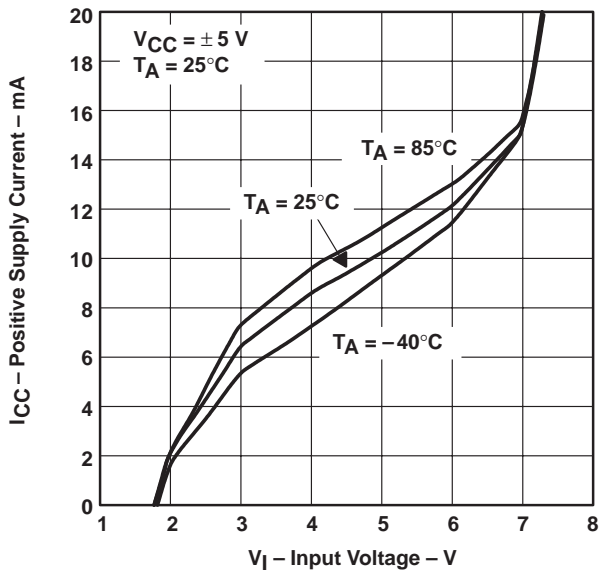


Figure 2

POSITIVE SUPPLY CURRENT
 vs
 FREQUENCY

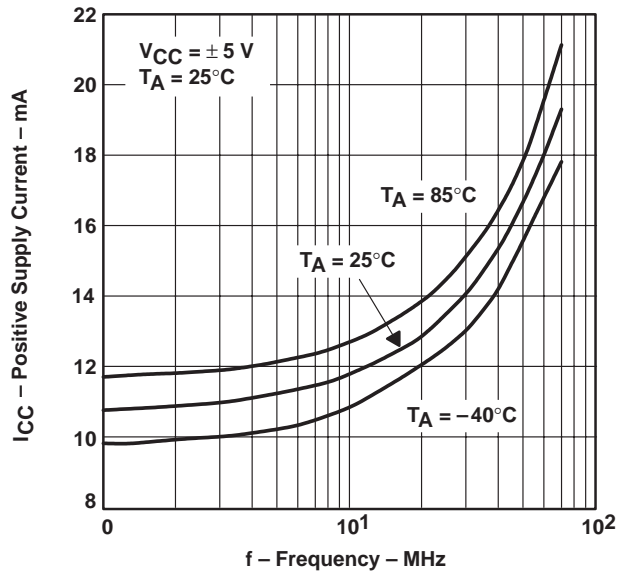


Figure 3

POSITIVE SUPPLY CURRENT
 vs
 FREE-AIR TEMPERATURE

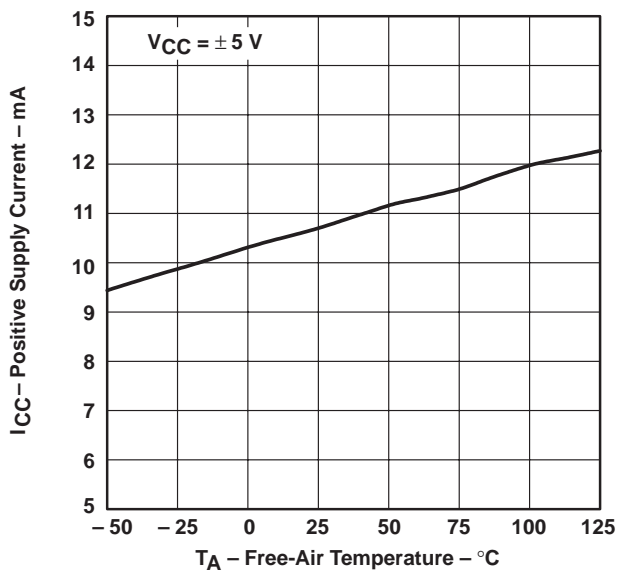


Figure 4

NEGATIVE SUPPLY CURRENT
 vs
 FREE-AIR TEMPERATURE

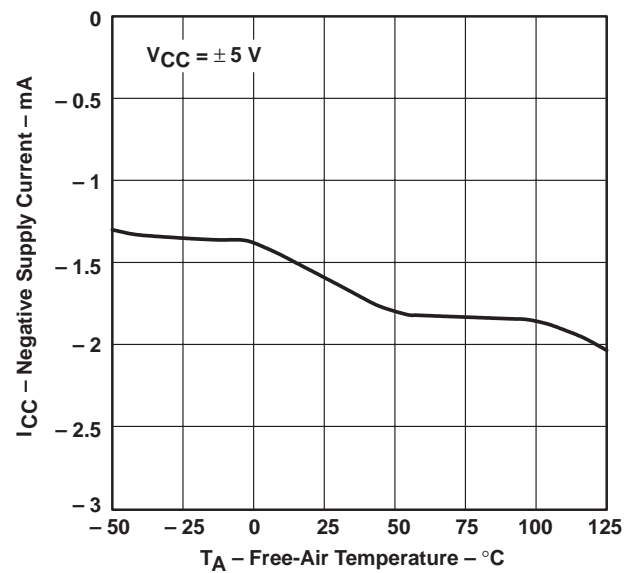


Figure 5

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME
 vs
 OVERDRIVE VOLTAGE

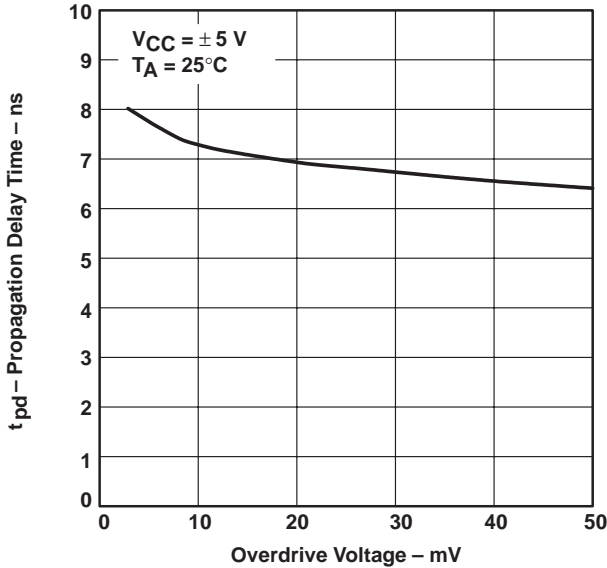


Figure 6

PROPAGATION DELAY TIME
 vs
 SUPPLY VOLTAGE

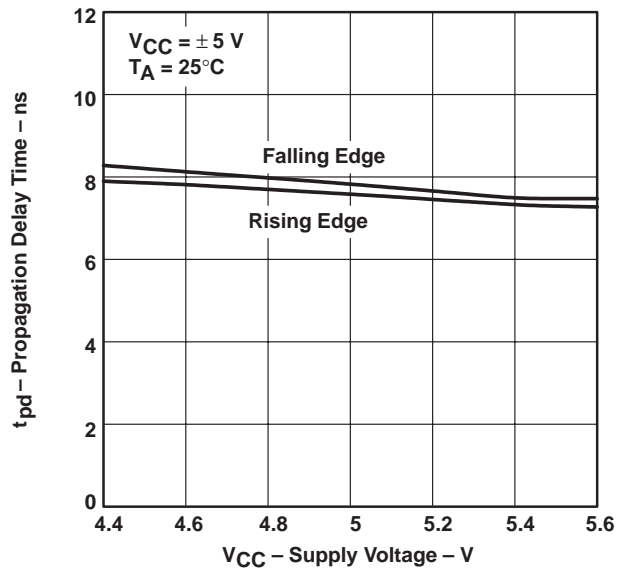


Figure 7

PROPAGATION DELAY TIME
 vs
 INPUT IMPEDANCE

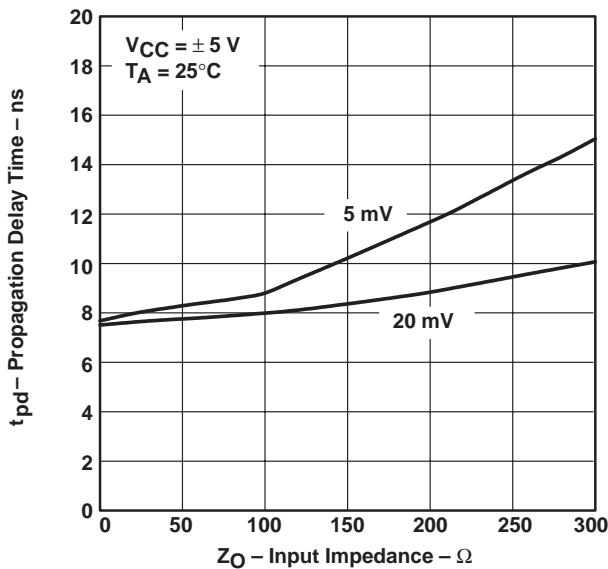


Figure 8

PROPAGATION DELAY TIME
 vs
 LOAD CAPACITANCE

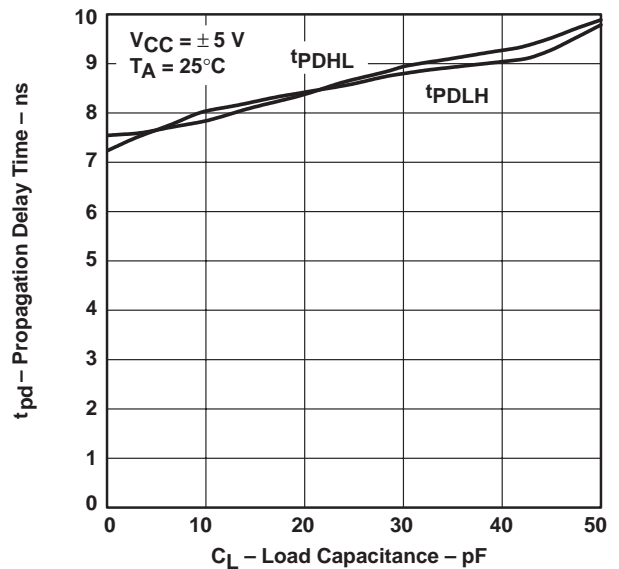


Figure 9

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME
 vs
 FREE-AIR TEMPERATURE

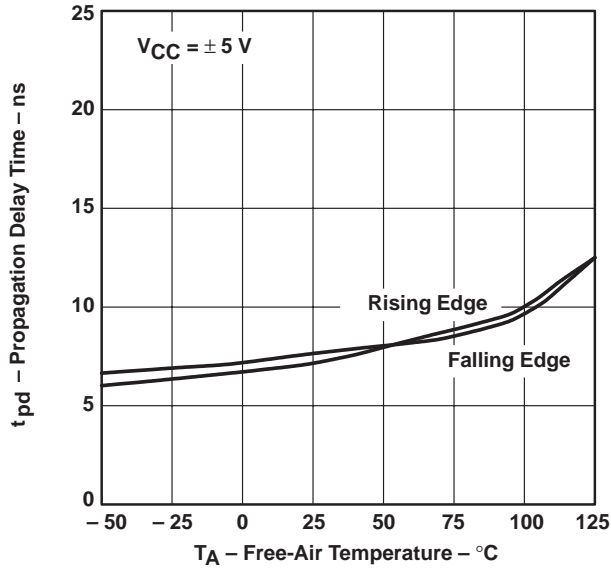


Figure 10

COMMON-MODE INPUT VOLTAGE
 vs
 FREE-AIR TEMPERATURE

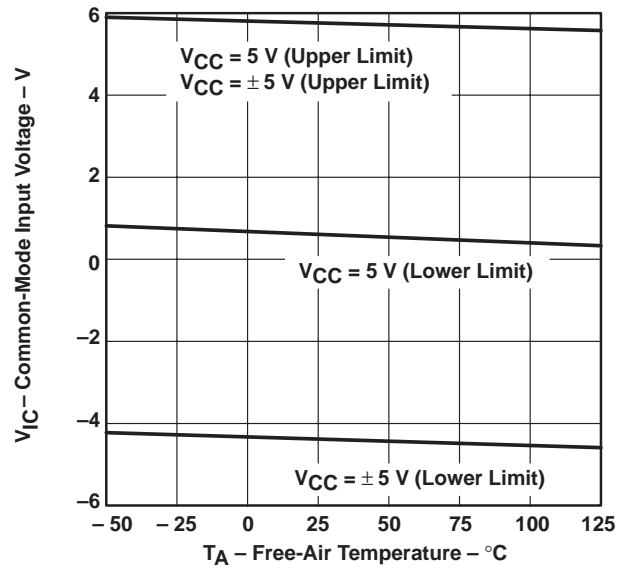


Figure 11

INPUT THRESHOLD VOLTAGE (LATCH ENABLE)
 vs
 FREE-AIR TEMPERATURE

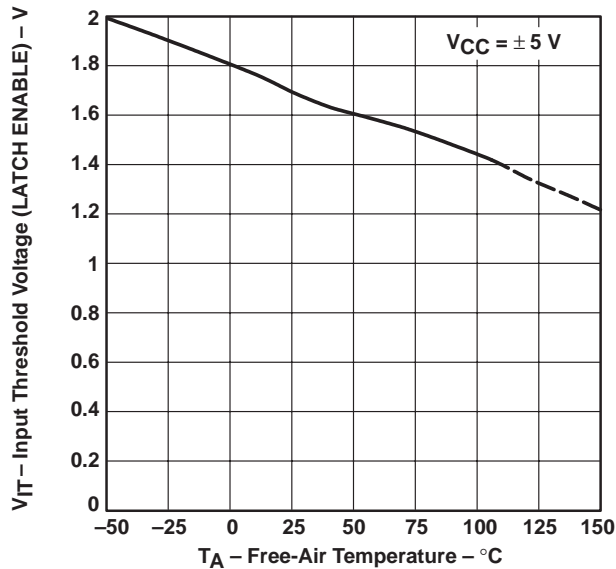


Figure 12

OUTPUT VOLTAGE
 vs
 OUTPUT SOURCE CURRENT

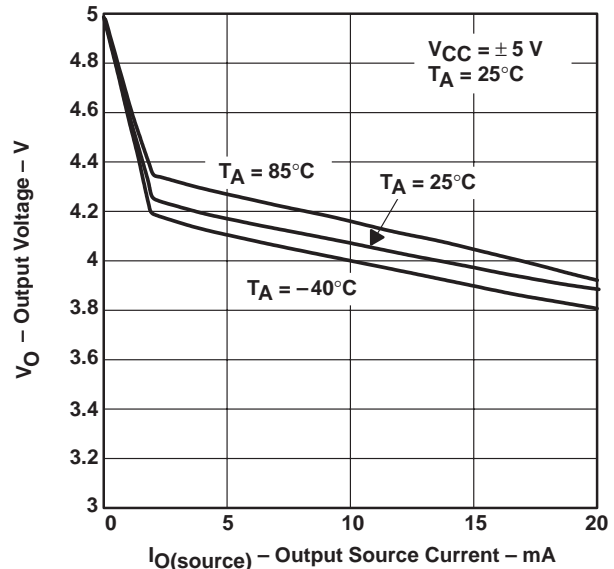


Figure 13

TYPICAL CHARACTERISTICS

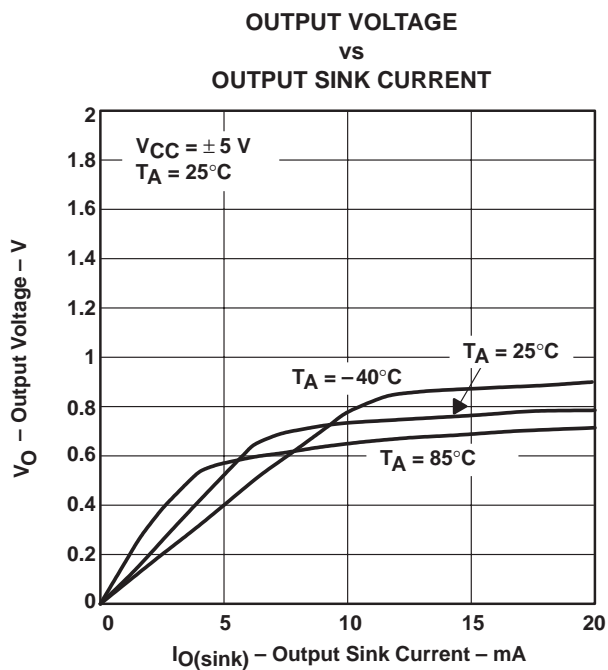


Figure 14

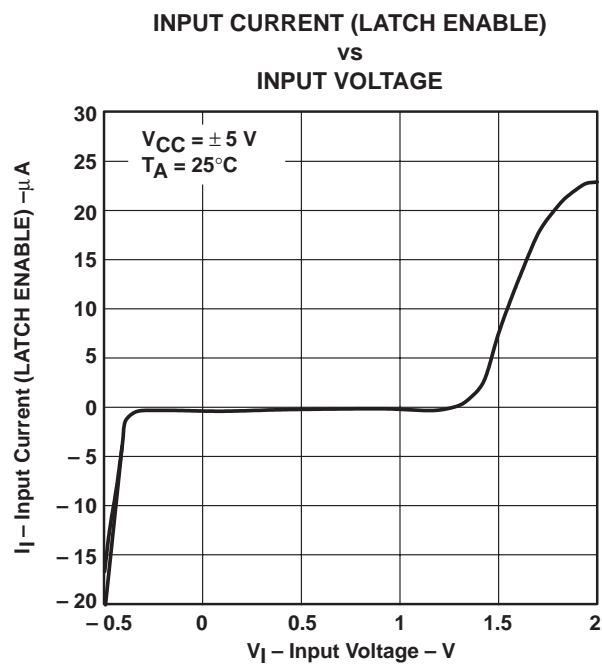


Figure 15

TL3016, TL3016Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS

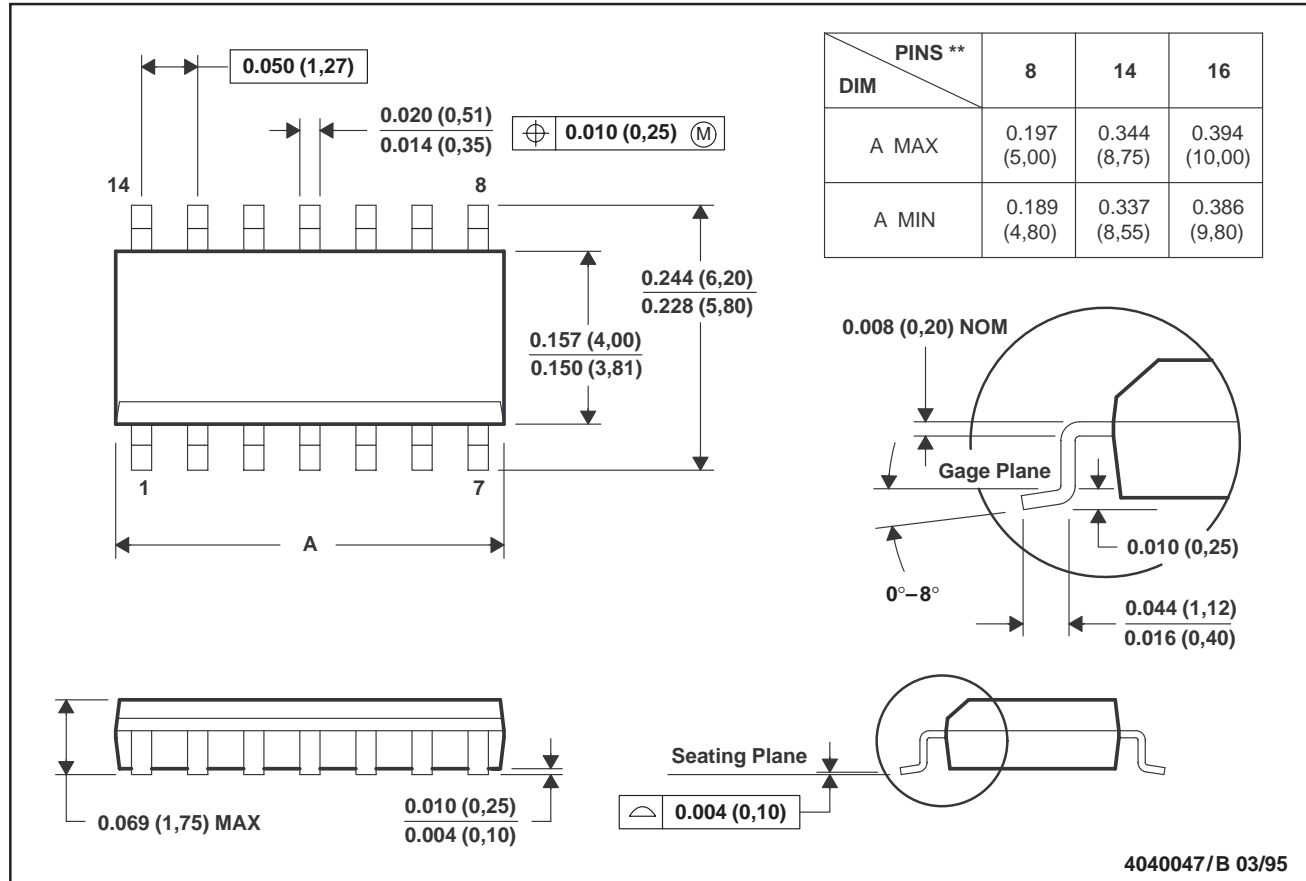
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MECHANICAL INFORMATION

D (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



4040047/B 03/95

- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Four center pins are connected to die mount pad.
 E. Falls within JEDEC MS-012



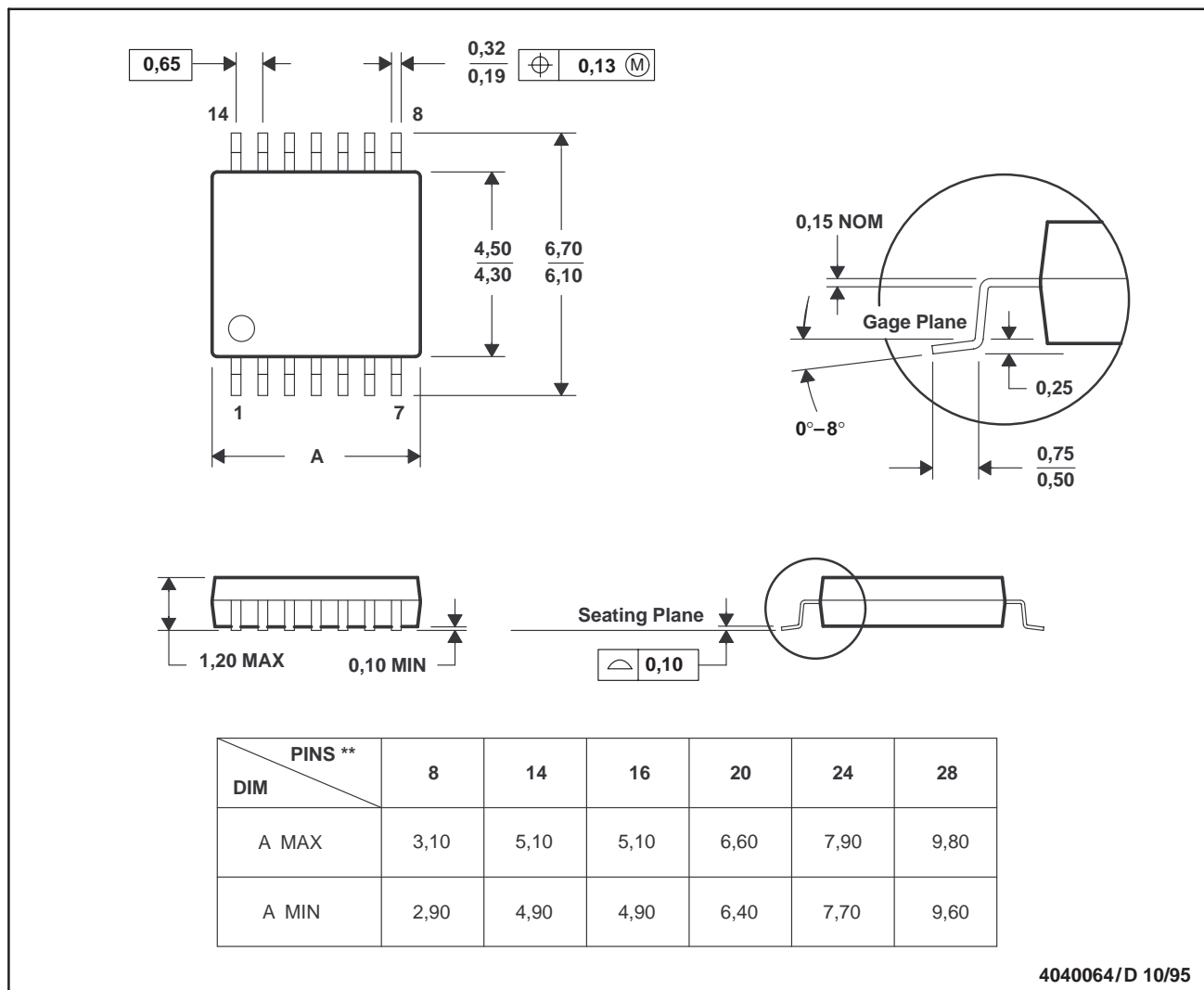
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MECHANICAL INFORMATION

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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