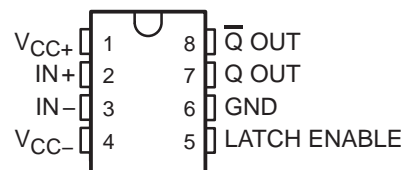


- Ultra-Fast Operation . . . 10 ns (typ)
- Low Positive Supply Current
12.7 mA (Typ)
- Operates From a Single 5-V Supply or From a Split ± 5 -V Supply
- Complementary Outputs
- Input Common-Mode Voltage Includes Negative Rail
- Low Offset Voltage
- No Minimum Slew Rate Requirement
- Output Latch Capability
- Functional Replacement to the LT1116

D AND PW PACKAGE
(TOP VIEW)

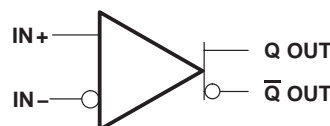


description

The TL3116 is an ultra-fast comparator designed to interface directly to TTL logic while operating from either a single 5-V power supply or dual ± 5 -V supplies. The input common-mode voltage extends to the negative rail for ground sensing applications. 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 the comparator. The TL3116 only requires 12.7 mA (typical) to achieve a propagation delay of 10 ns.

The TL3116 is a pin-for-pin functional replacement for the LT1116 comparator, offering high-speed operation but consuming much less power.

symbol (each comparator)



POSITIVE SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

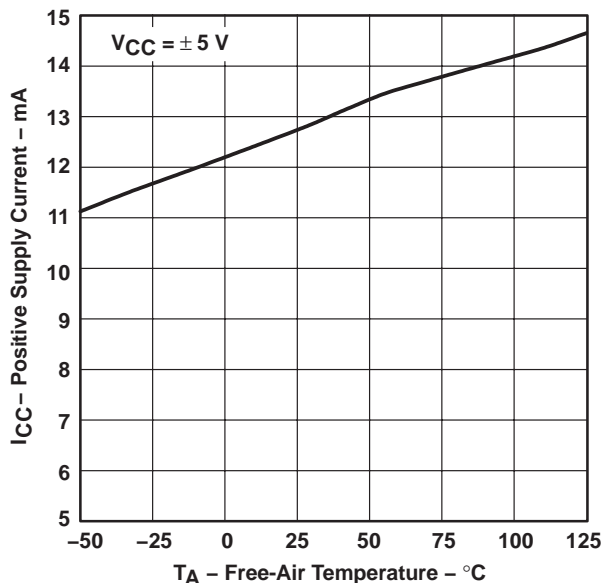


Figure 1

AVAILABLE OPTIONS

| T _A | PACKAGED DEVICES | | CHIP FORM [‡] (Y) |
|----------------|--------------------------------|-------------|----------------------------|
| | SMALL OUTLINE [†] (D) | TSSOP (PW) | |
| 0°C to 70°C | TL3116CD | TL3116CPWLE | TL3116Y |
| -40°C to 85°C | TL3116ID | TL3116IPWLE | — |

[†] 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.

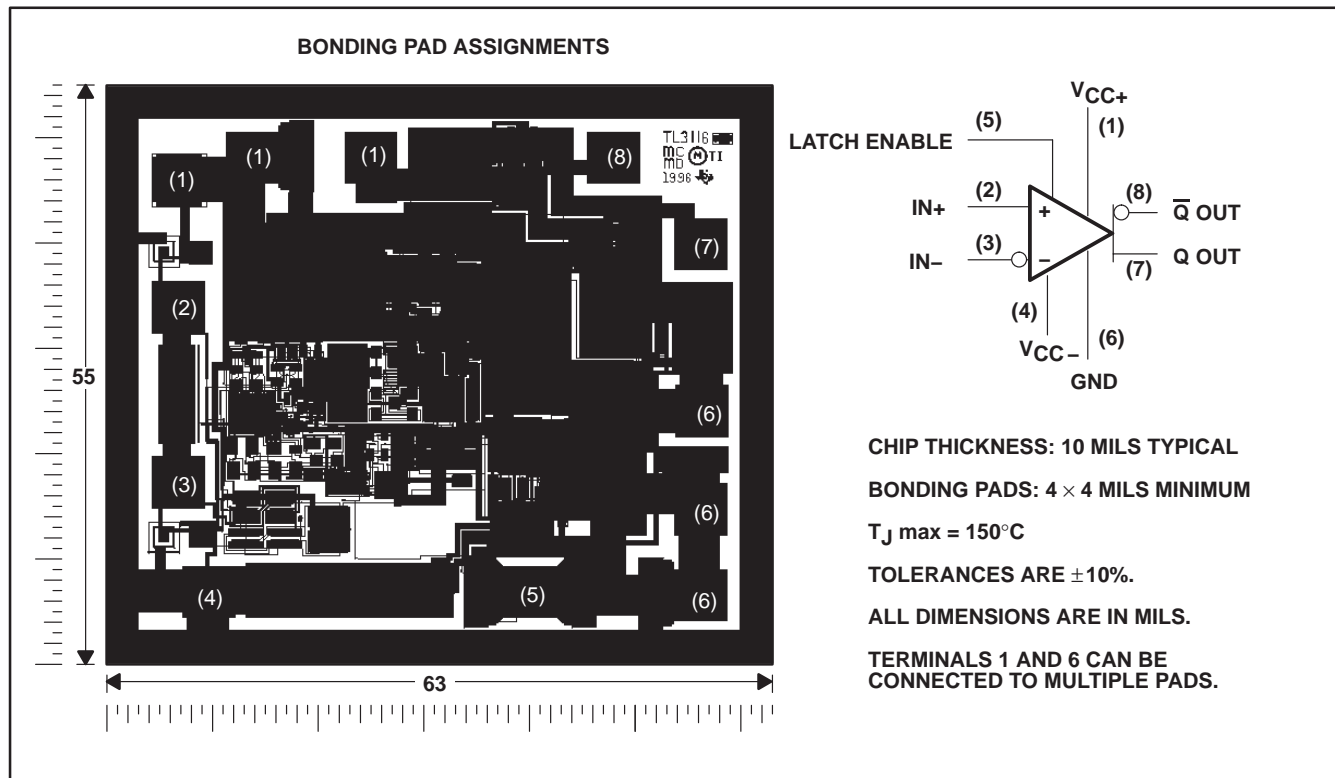


TL3116, TL3116Y ULTRA-FAST LOW-POWER PRECISION COMPARATORS

SLCS132C – MARCH 1997 – REVISED MAY 1997

TL3116Y chip information

This chip, when properly assembled, displays characteristics similar to the TL3116C. 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 |

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 |

TL3116, TL3116Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS

SLCS132C – MARCH 1997 – REVISED MAY 1997

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

| PARAMETER | | TEST CONDITION† | TL3116C | | | TL3116I | | | 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 | | | -2.5 | | | -2.8 | $\mu\text{V}/^\circ\text{C}$ | |
| I_{IO} | Input offset current | $T_A = 25^\circ\text{C}$ | | 0.1 | 0.2 | | 0.1 | 0.2 | μA |
| | | $T_A = \text{full range}$ | | | 0.3 | | | 0.35 | |
| I_{IB} | Input bias current | $T_A = 25^\circ\text{C}$ | | 0.7 | 1.1 | | 0.7 | 1.1 | μA |
| | | $T_A = \text{full range}$ | | | 1.2 | | | 1.5 | |
| V_{ICR} | Common-mode input voltage range | $V_{DD} = \pm 5\text{ V}$ | -5 | | 2.5 | -5 | | 2.5 | V |
| | | $V_{DD} = 5\text{ V}$ | 0 | | 2.5 | 0 | | 2.5 | |
| CMRR | Common-mode rejection ratio | $-5 \leq V_{IC} \leq 2.5\text{ V}$ | 75 | 100 | | 75 | 100 | 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 | 80 | | 60 | 80 | 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 | $I_{(\text{sink})} = 4\text{ mA}$, $T_A = 25^\circ\text{C}$, $V_+ \leq 4.6\text{ V}$ | | 400 | 600 | | 400 | 600 | mV |
| | | $I_{(\text{sink})} = 10\text{ mA}$, $T_A = 25^\circ\text{C}$, $V_+ \leq 4.6\text{ V}$ | | 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 | 3.8 | | 3.4 | 3.8 | | |
| I_{CC} | Positive supply current | $T_A = \text{full range}$ | | 12.7 | 14.7 | | 12.7 | 15 | mA |
| | Negative supply current | | | -2.6 | | | -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 | μA |

† Full range for the TL3116C is $T_A = 0^\circ\text{C}$ to 70°C . Full range for the TL3116I is $T_A = -40^\circ\text{C}$ to 85°C .

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



switching characteristics, $V_{DD} = \pm 5\text{ V}$, $V_{LE} = 0$

| PARAMETER | TEST CONDITION† | | TL3116C | | | TL3116I | | | UNIT |
|------------------------------------------------|------------------------------------------------------------|---------------------------|---------|------|-----|---------|------|-----|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| t_{pd1} Propagation delay time‡ | $\Delta V_I = 100\text{ mV}$, $V_{OD} = 5\text{ mV}$ | $T_A = 25^\circ\text{C}$ | 9.9 | 12 | | 9.9 | 12 | ns | |
| | | $T_A = \text{full range}$ | 9.9 | 14 | | 9.9 | 15 | | |
| | $\Delta V_I = 100\text{ mV}$, $V_{OD} = 20\text{ mV}$ | $T_A = 25^\circ\text{C}$ | 8.2 | 10.3 | | 8.2 | 10.3 | | |
| | | $T_A = \text{full range}$ | 8.2 | 12.7 | | 8.2 | 13.7 | | |
| $t_{sk(p)}$ 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 | | | 3.4 | | | 3.4 | ns | | |

† Full range for the TL3116C is 0°C to 70°C . Full range for the TL3116I is -40°C to 85°C .

‡ t_{pd1} cannot be measured in automatic handling equipment with low values of overdrive. The TL3116 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 |
| V_{IT} | 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**

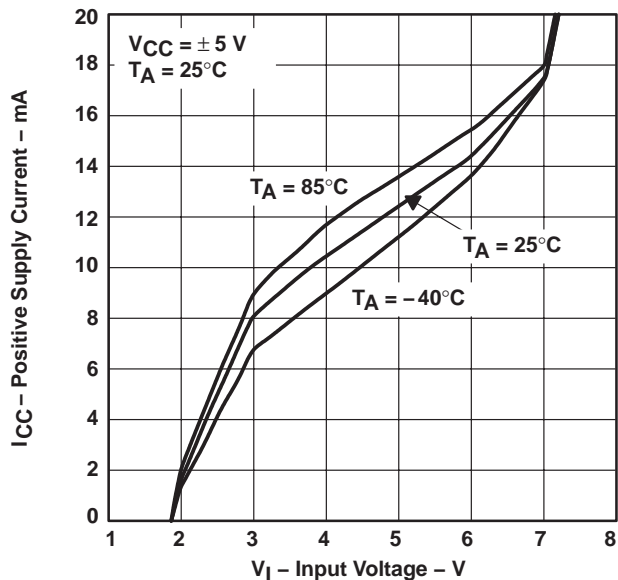


Figure 2

**POSITIVE SUPPLY CURRENT
 vs
 FREQUENCY**

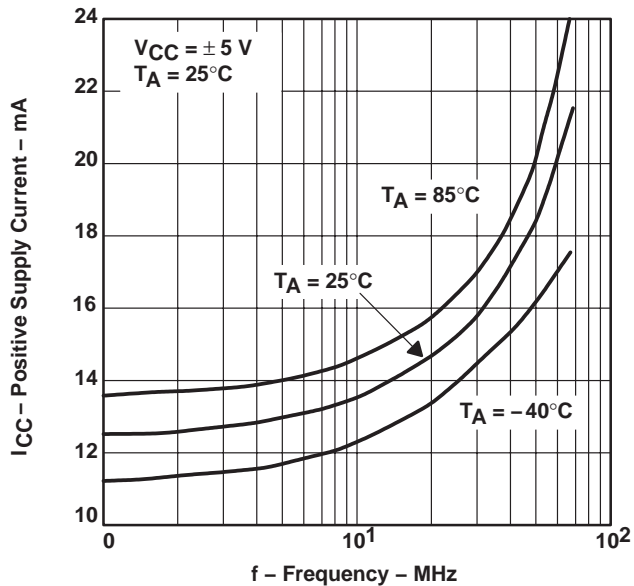


Figure 3

**POSITIVE SUPPLY CURRENT
 vs
 FREE-AIR TEMPERATURE**

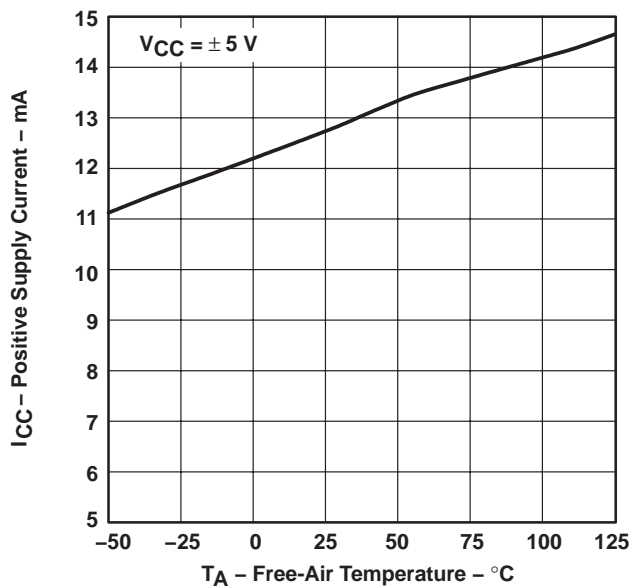


Figure 4

**NEGATIVE SUPPLY CURRENT
 vs
 FREE-AIR TEMPERATURE**

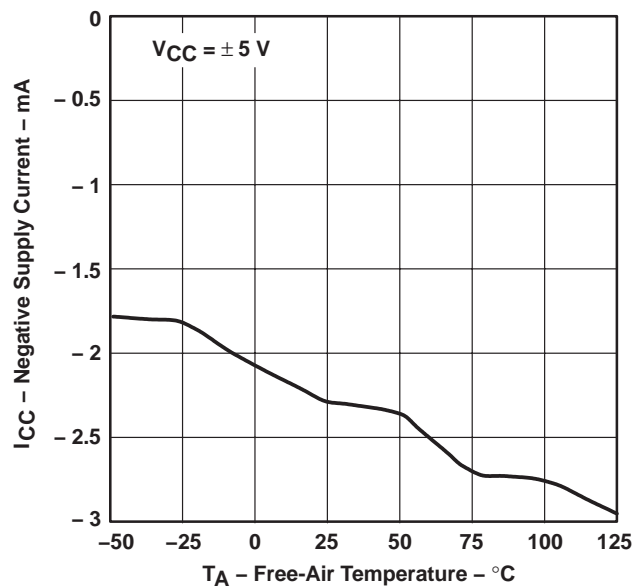


Figure 5

TYPICAL CHARACTERISTICS

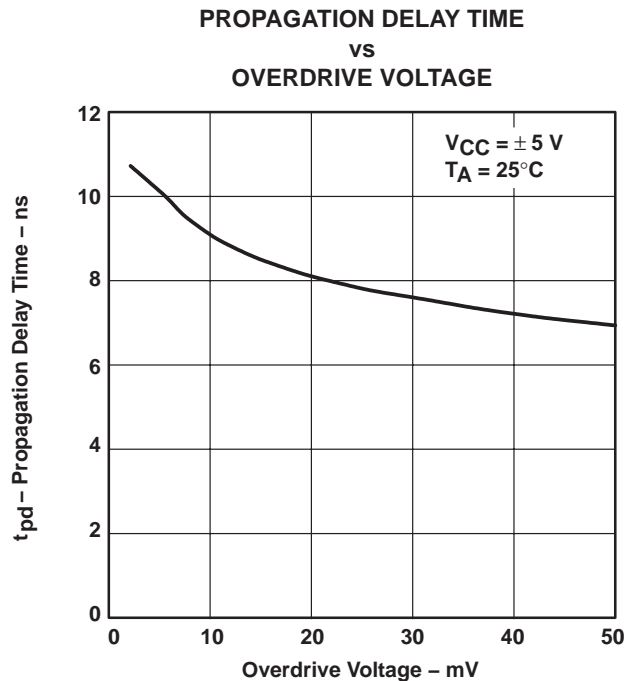


Figure 6

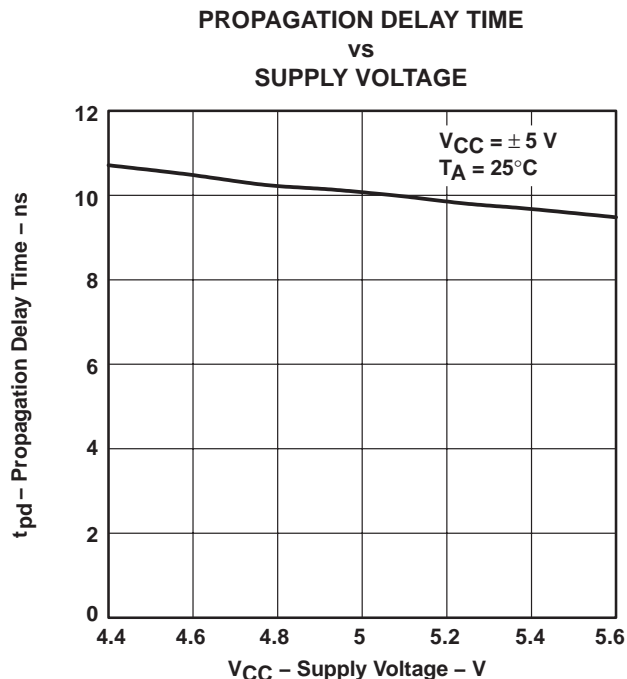


Figure 7

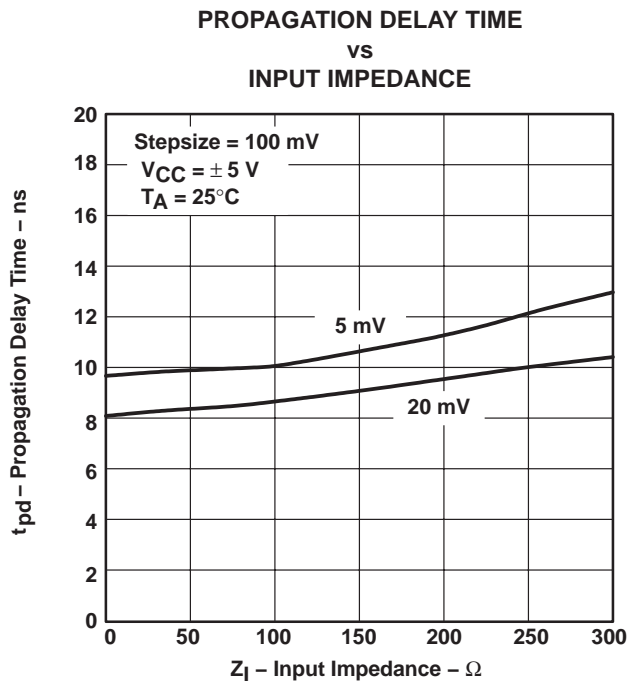


Figure 8

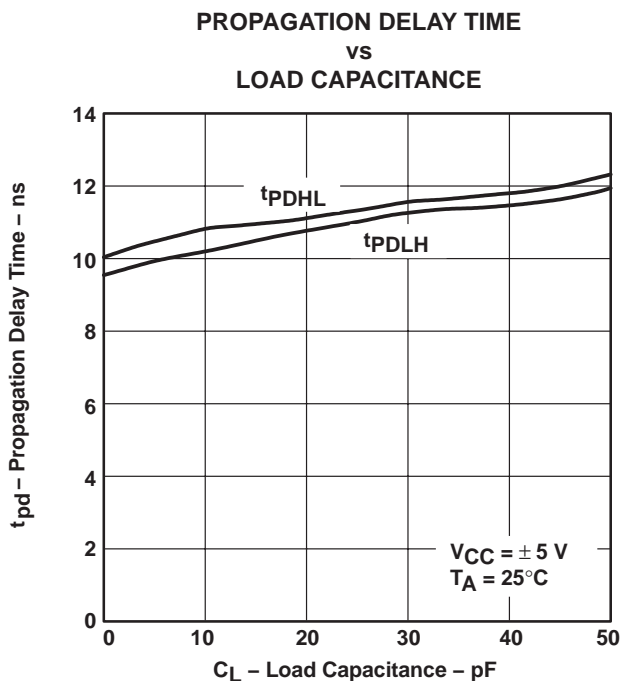


Figure 9

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME
vs
FREE-AIR TEMPERATURE

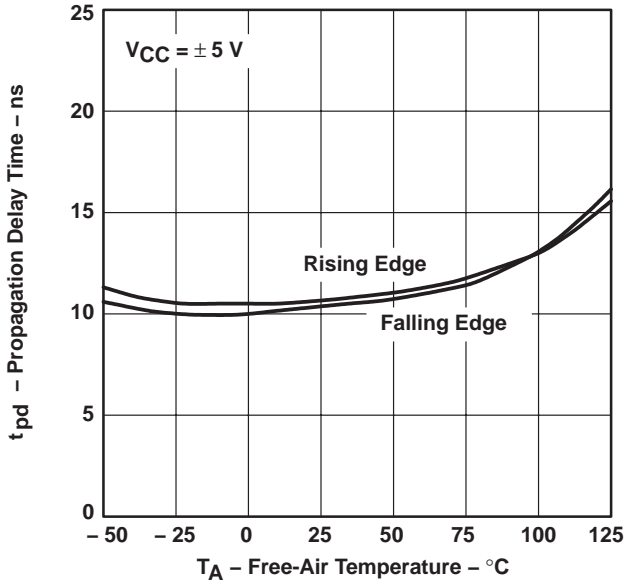


Figure 10

COMMON-MODE INPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

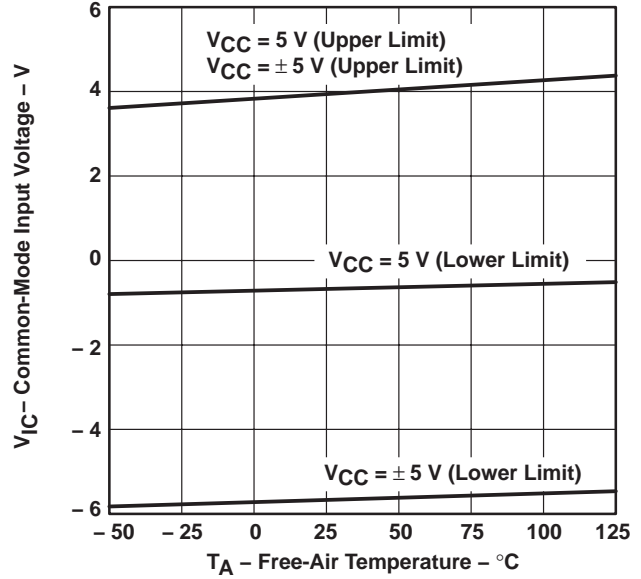


Figure 11

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

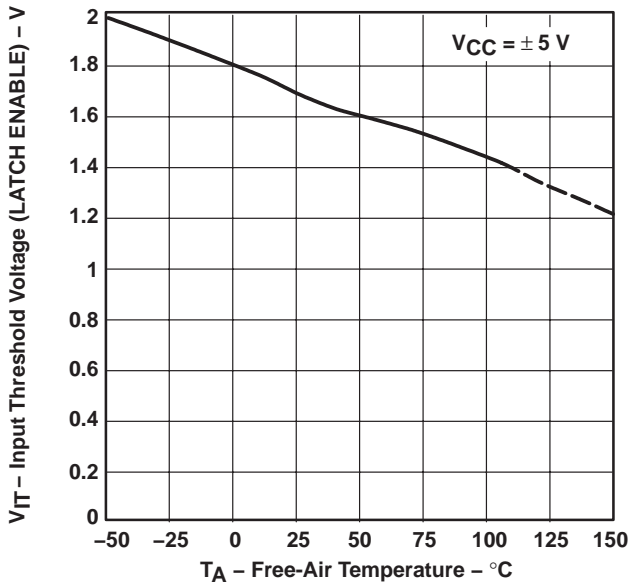


Figure 12

OUTPUT VOLTAGE
vs
OUTPUT SOURCE CURRENT

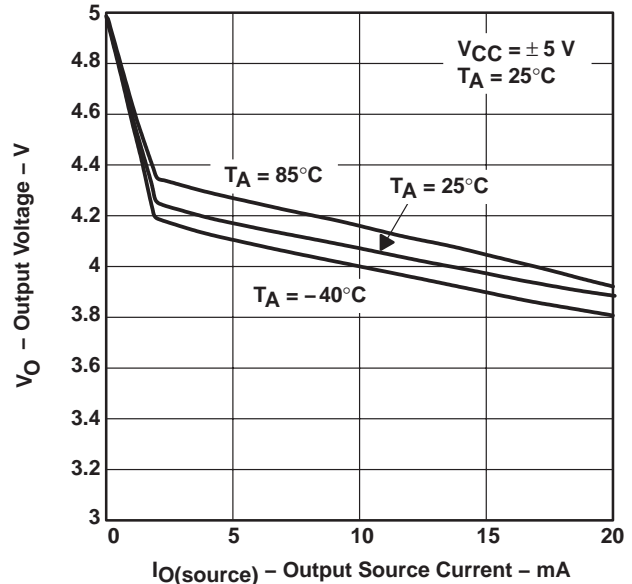


Figure 13

TYPICAL CHARACTERISTICS

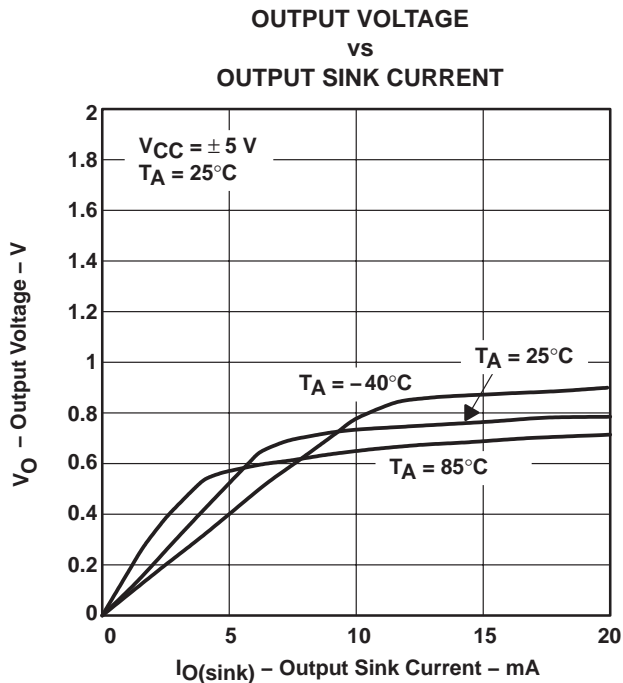


Figure 14

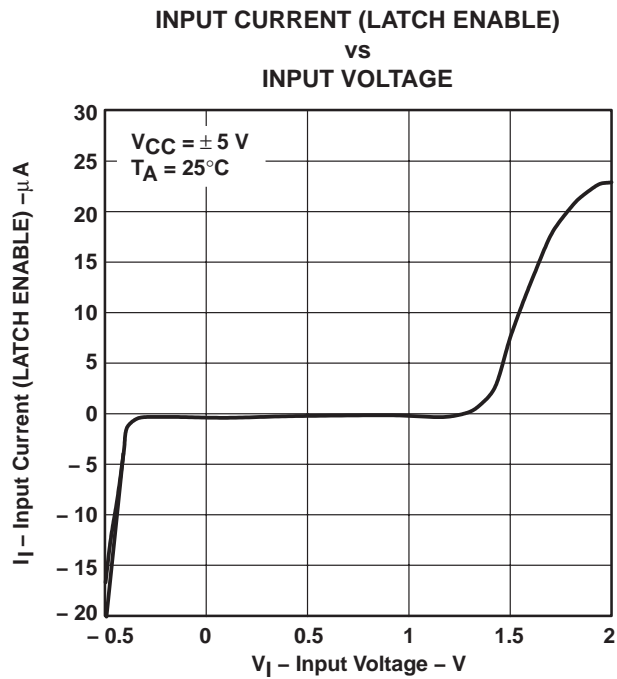


Figure 15

TL3116, TL3116Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS

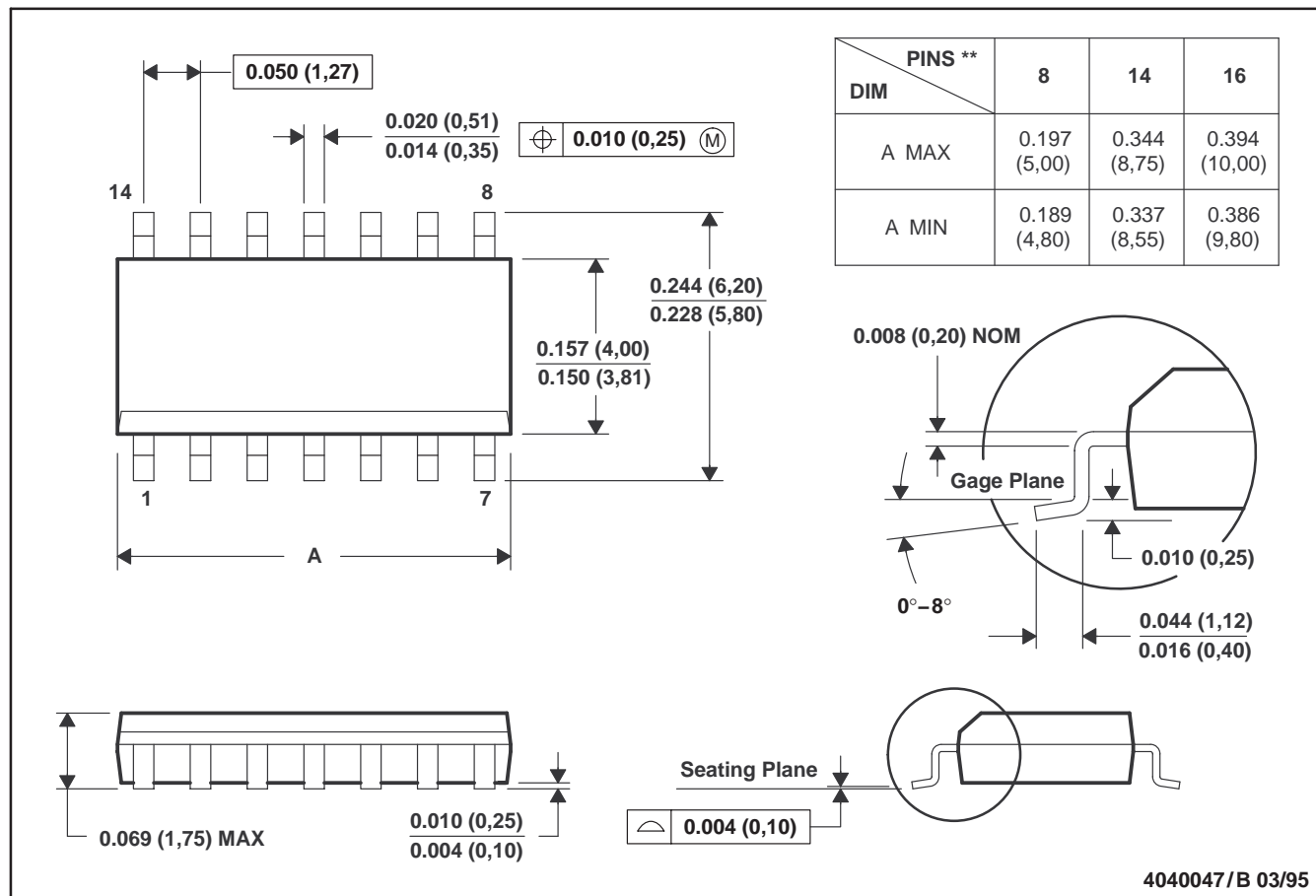
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MECHANICAL INFORMATION

D (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



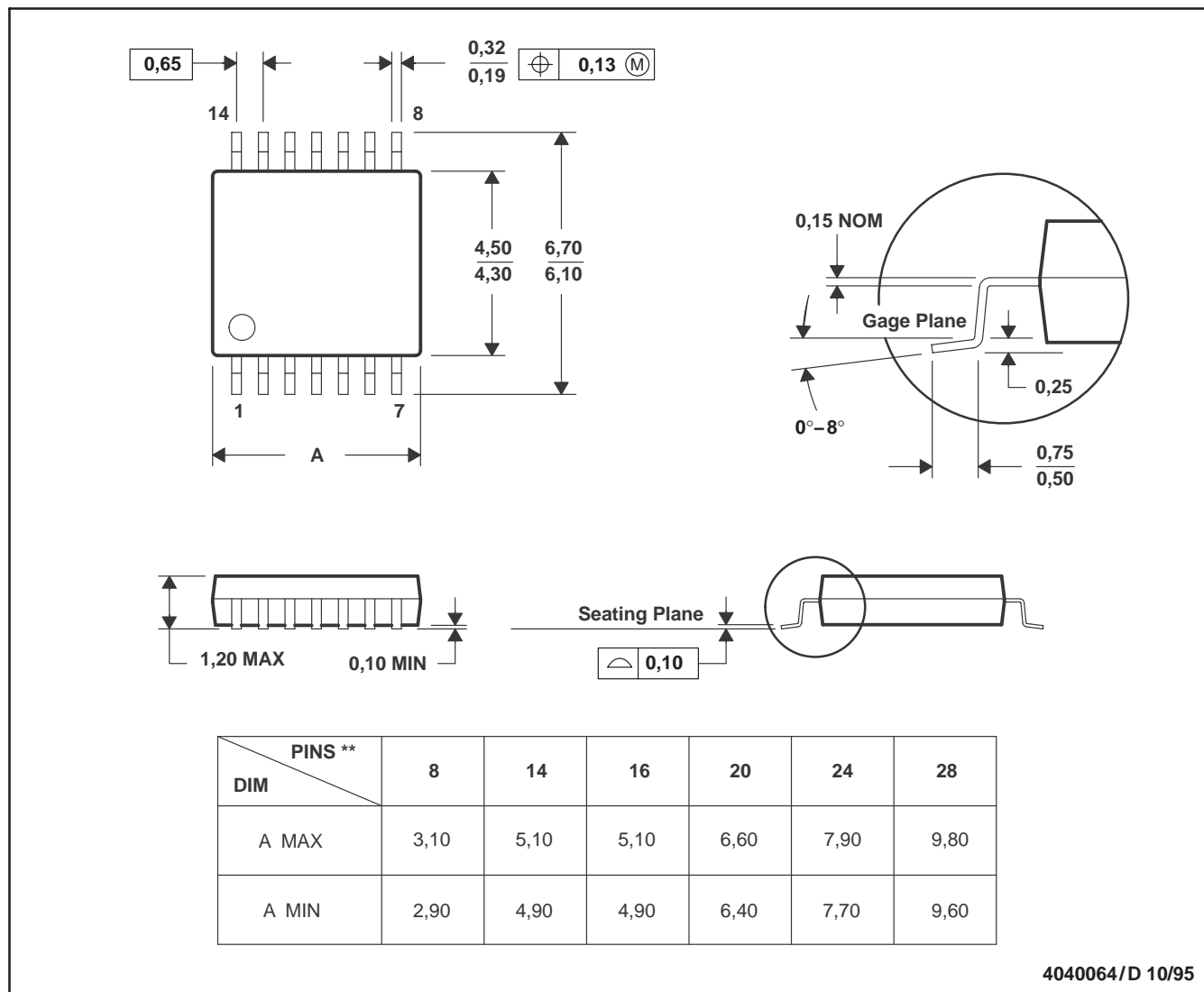
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Four center pins are connected to die mount pad.
 E. Falls within JEDEC MS-012

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

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|-------------------------------------------|
| TL3116CD | ACTIVE | SOIC | D | 8 | 75 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1YEAR/ Level-1-220C-UNLIM |
| TL3116CDR | ACTIVE | SOIC | D | 8 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1YEAR/ Level-1-220C-UNLIM |
| TL3116CPW | ACTIVE | TSSOP | PW | 8 | 150 | None | CU NIPDAU | Level-1-220C-UNLIM |
| TL3116CPWLE | OBSOLETE | TSSOP | PW | 8 | | None | Call TI | Call TI |
| TL3116CPWR | ACTIVE | TSSOP | PW | 8 | 2000 | None | CU NIPDAU | Level-1-220C-UNLIM |
| TL3116ID | ACTIVE | SOIC | D | 8 | 75 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1YEAR/ Level-1-220C-UNLIM |
| TL3116IDR | ACTIVE | SOIC | D | 8 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1YEAR/ Level-1-220C-UNLIM |
| TL3116IPW | ACTIVE | TSSOP | PW | 8 | 150 | None | CU NIPDAU | Level-1-220C-UNLIM |
| TL3116IPWLE | OBSOLETE | TSSOP | PW | 8 | | None | Call TI | Call TI |
| TL3116IPWR | ACTIVE | TSSOP | PW | 8 | 2000 | None | CU NIPDAU | Level-1-220C-UNLIM |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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