

- 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  $\pm 5$ -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

### 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  $\pm 5$ -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.

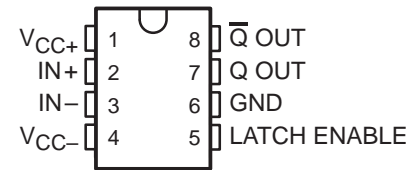
#### AVAILABLE OPTIONS

$T_A$	PACKAGED DEVICES		CHIP FORM <sup>‡</sup> (Y)
	SMALL OUTLINE <sup>†</sup> (D)	TSSOP (PW)	
0°C to 70°C	TL3116CD	TL3116CPWLE	TL3116Y
-40°C to 85°C	TL3116ID	TL3116IPWLE	—

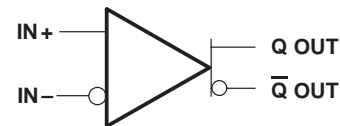
<sup>†</sup> The PW packages are available left-ended taped and reeled only.

<sup>‡</sup> Chip forms are tested at  $T_A = 25^\circ\text{C}$  only.

#### D AND PW PACKAGE (TOP VIEW)



#### symbol (each comparator)



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

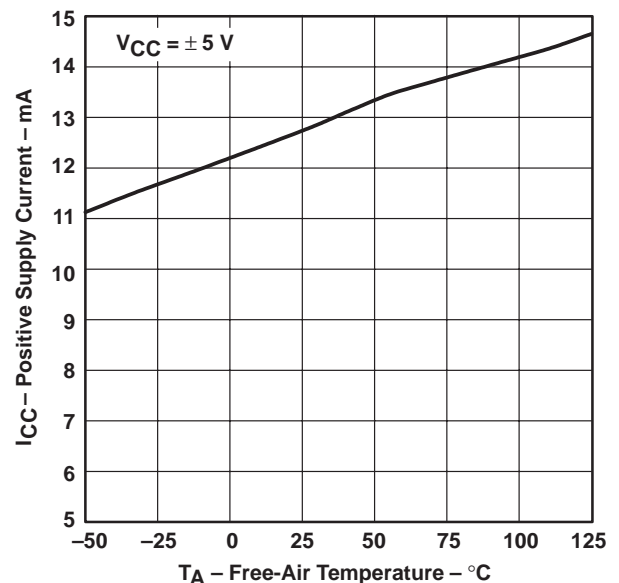


Figure 1



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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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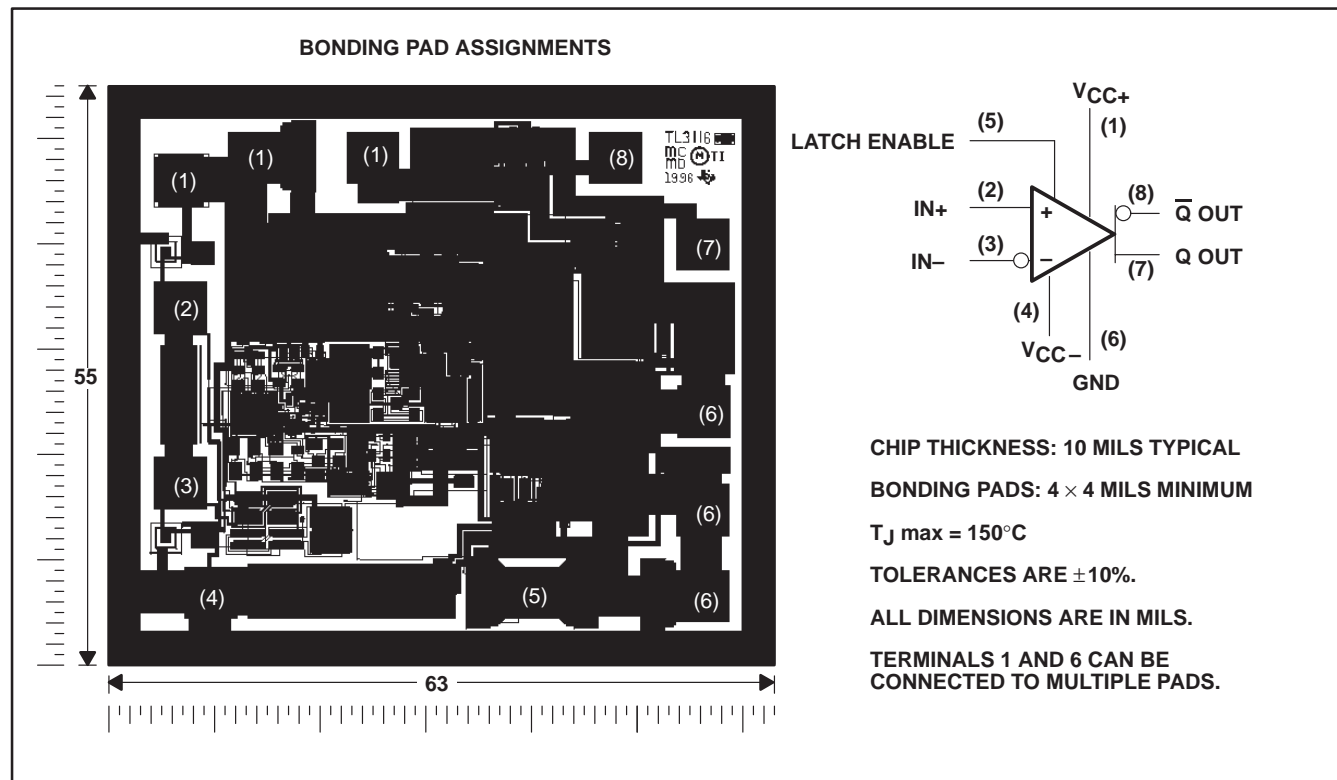
# TL3116, TL3116Y

## ULTRA-FAST LOW-POWER PRECISION COMPARATORS

SLCS132B – MARCH 1997 – REVISED APRIL 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, $I_O$	$\pm 20$ 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

SLCS132B – MARCH 1997 – REVISED APRIL 1997

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

PARAMETER		TEST CONDITIONS†	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	
$\alpha_{VIO}$	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	$\mu\text{A}$
		$T_A = \text{full range}$			0.3			0.35	
$I_{IB}$	Input bias current	$T_A = 25^\circ\text{C}$		0.7	1.1		0.7	1.1	$\mu\text{A}$
		$T_A = \text{full range}$			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	$I_{(\text{sink})} = 4\text{ mA}$ , $V_+ \leq 4.6\text{ V}$ , $T_A = 25^\circ\text{C}$		400	600		400	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	3.8		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	$\mu\text{A}$
		$V_{LE} = 2\text{ V}$		24	39		24	45	$\mu\text{A}$

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

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



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

PARAMETER	TEST CONDITIONS†		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-} $ )	$\Delta V_I = 100\text{ mV}$ , $V_{OD} = 5\text{ mV}$ , $T_A = 25^\circ\text{C}$			0.5			0.5		ns
$t_{su}$ Setup time, LATCH ENABLE				3.4			3.4		ns

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

‡  $t_{pd1}$  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

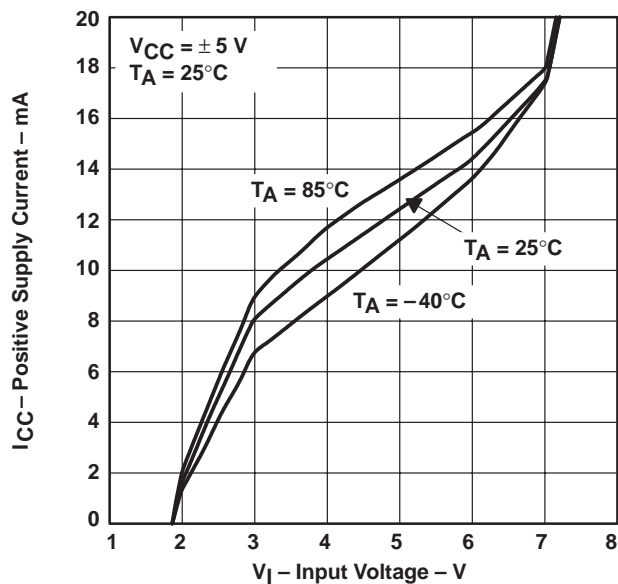


Figure 2

POSITIVE SUPPLY CURRENT  
 vs  
 FREQUENCY

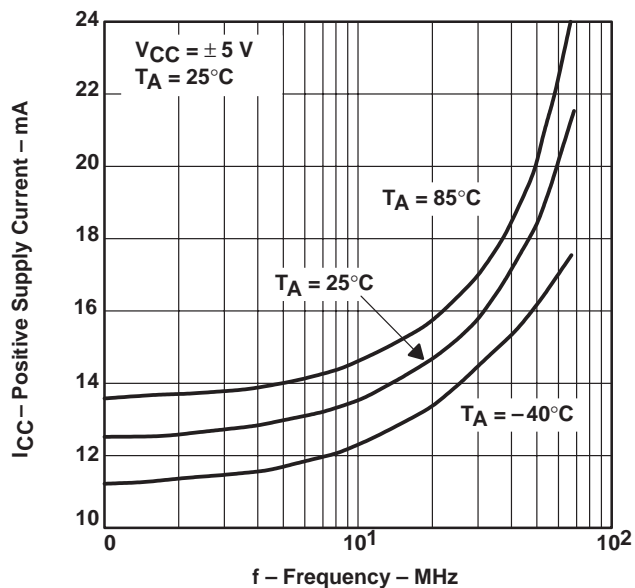


Figure 3

POSITIVE SUPPLY CURRENT  
 vs  
 FREE-AIR TEMPERATURE

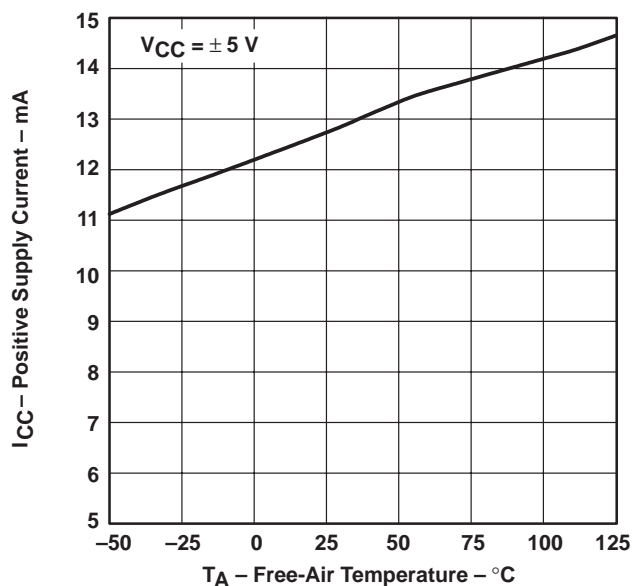


Figure 4

NEGATIVE SUPPLY CURRENT  
 vs  
 FREE-AIR TEMPERATURE

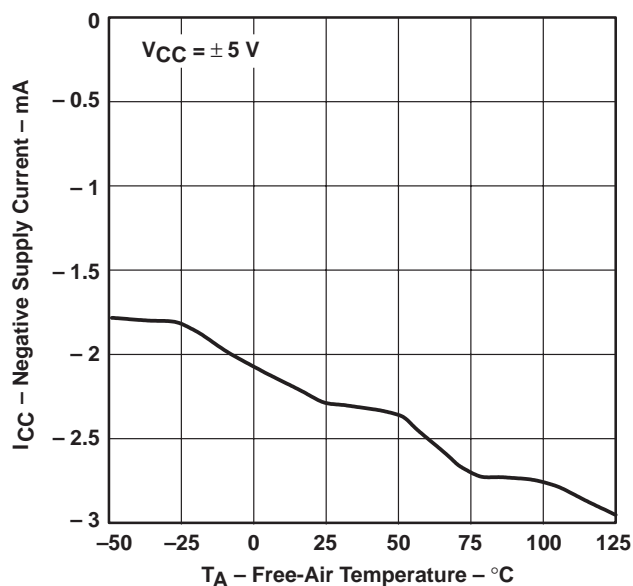


Figure 5

## TYPICAL CHARACTERISTICS

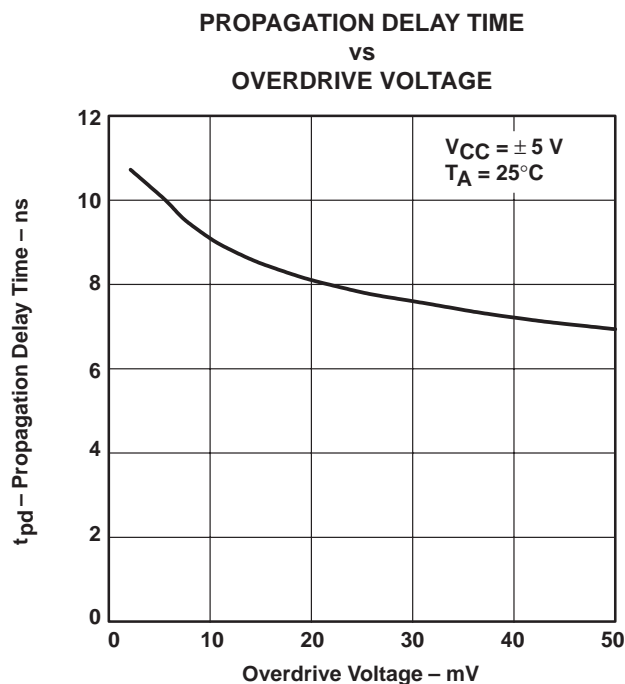


Figure 6

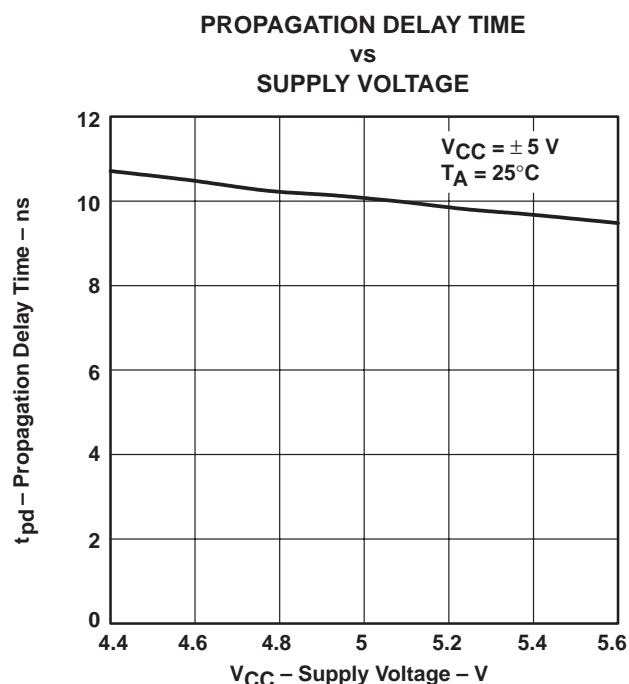


Figure 7

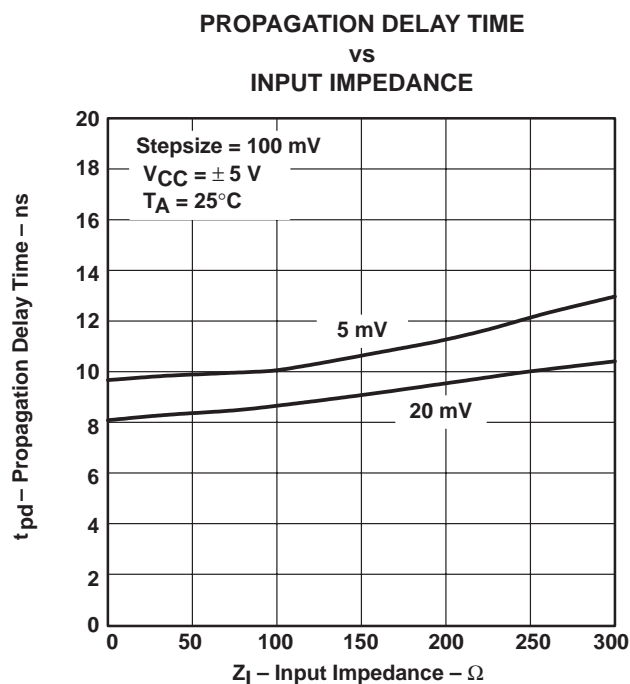


Figure 8

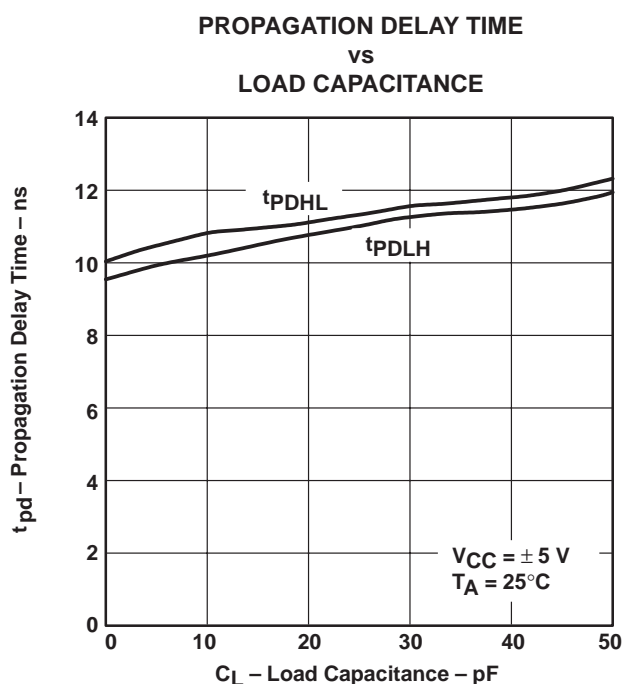


Figure 9

## TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME  
 vs  
 FREE-AIR TEMPERATURE

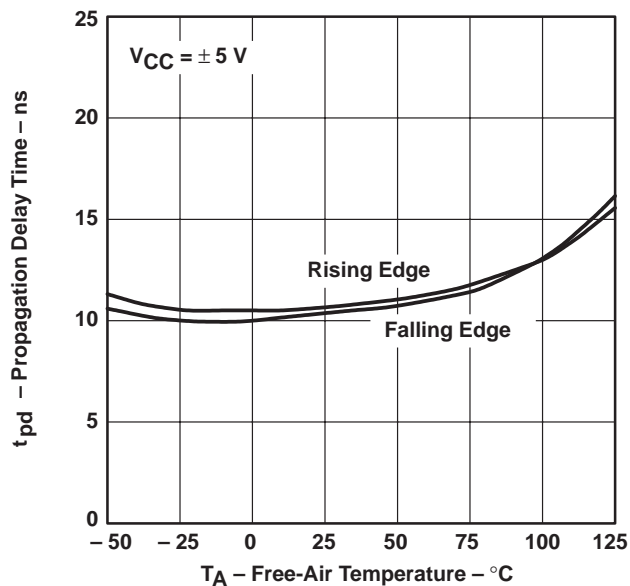


Figure 10

COMMON-MODE INPUT VOLTAGE  
 vs  
 FREE-AIR TEMPERATURE

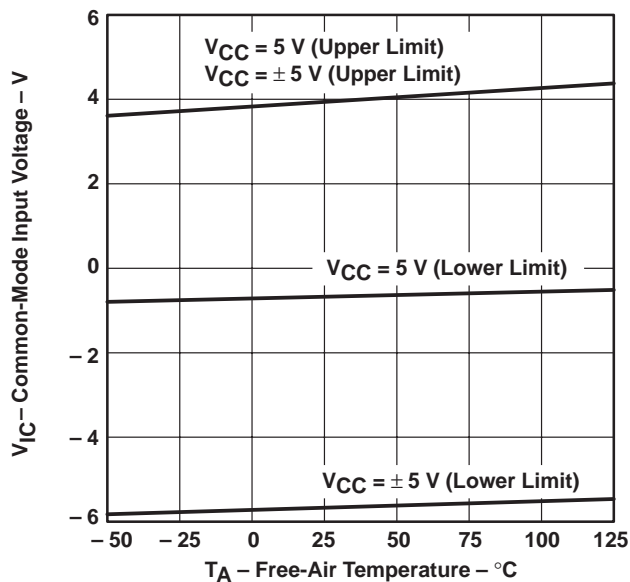


Figure 11

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

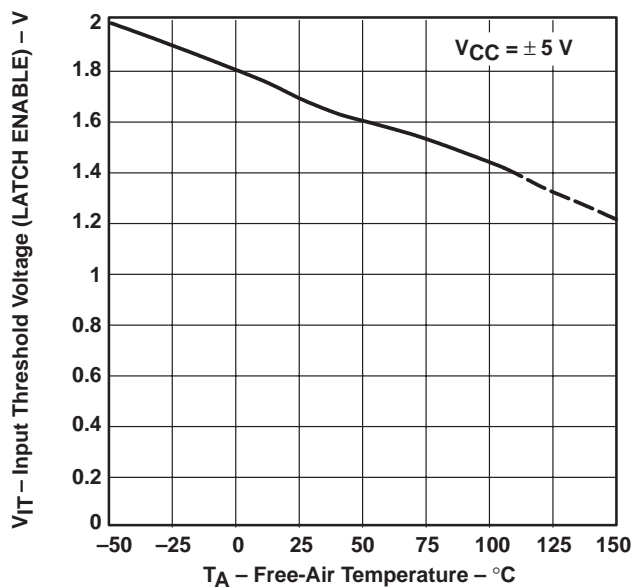


Figure 12

OUTPUT VOLTAGE  
 vs  
 OUTPUT SOURCE CURRENT

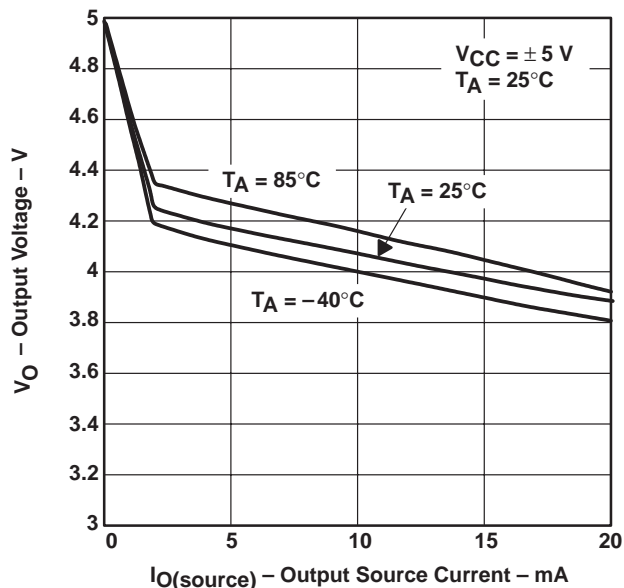


Figure 13



## TYPICAL CHARACTERISTICS

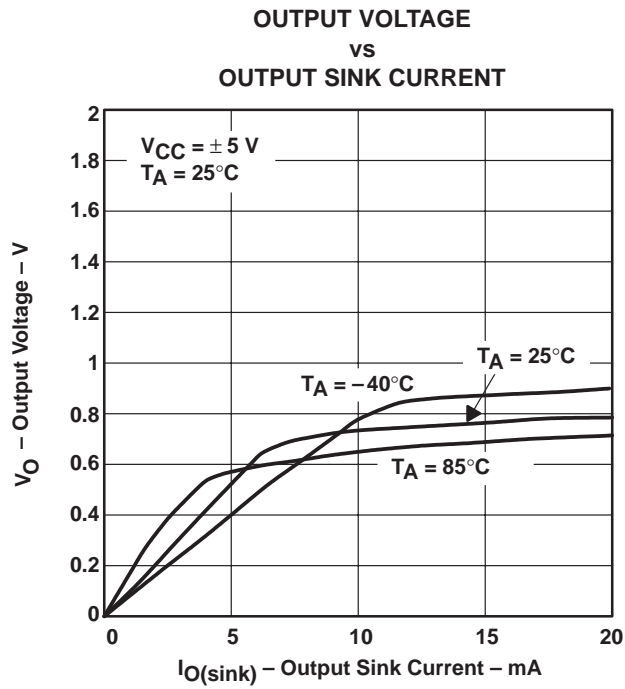


Figure 14

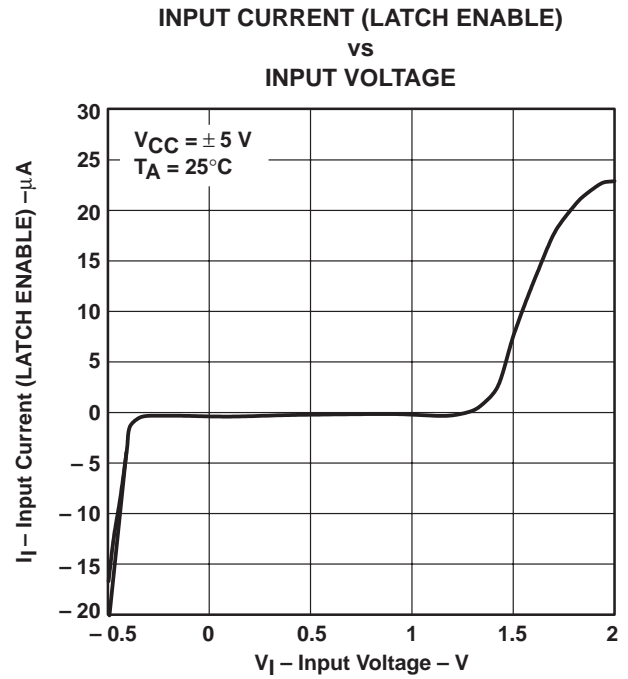


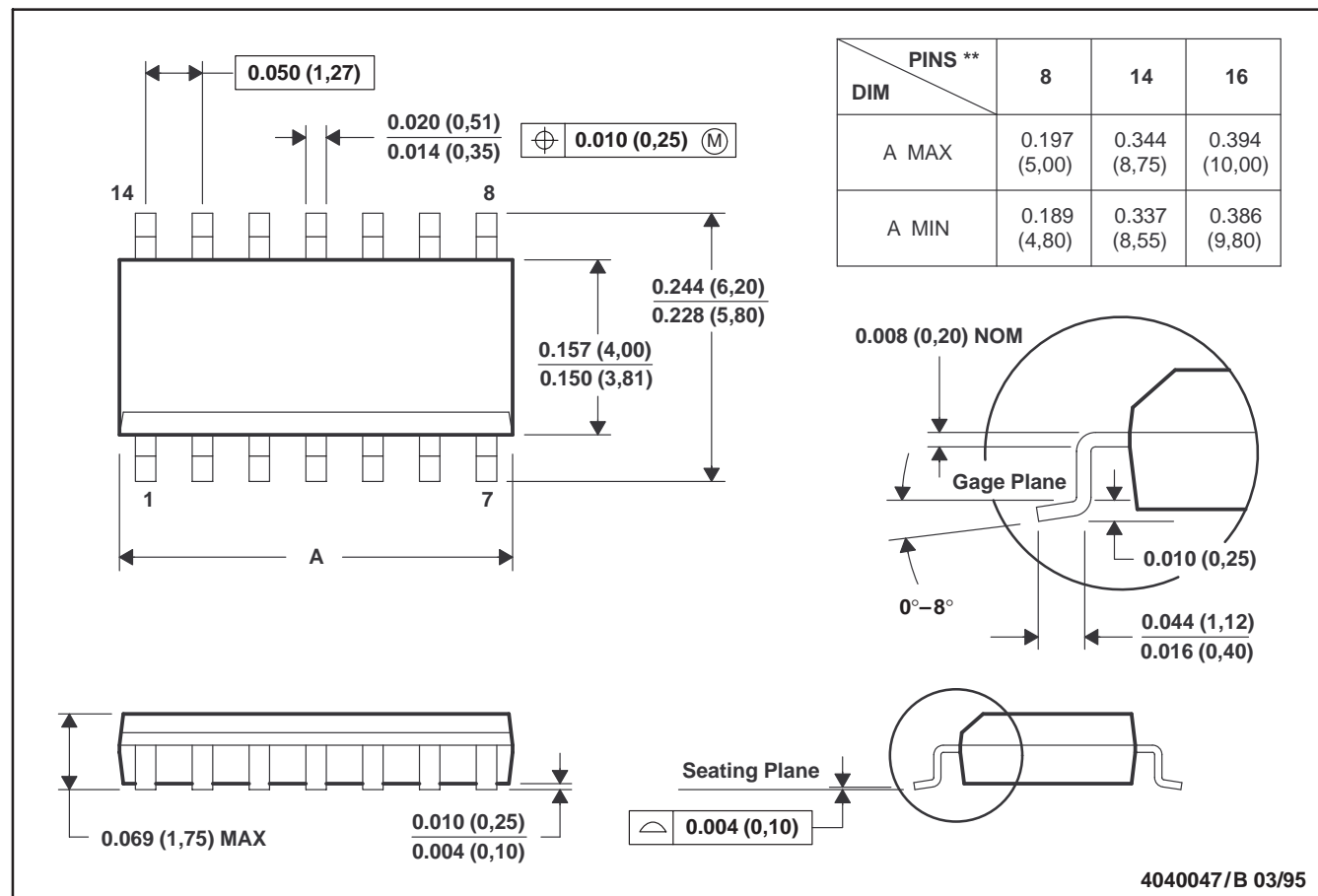
Figure 15

## MECHANICAL INFORMATION

D (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



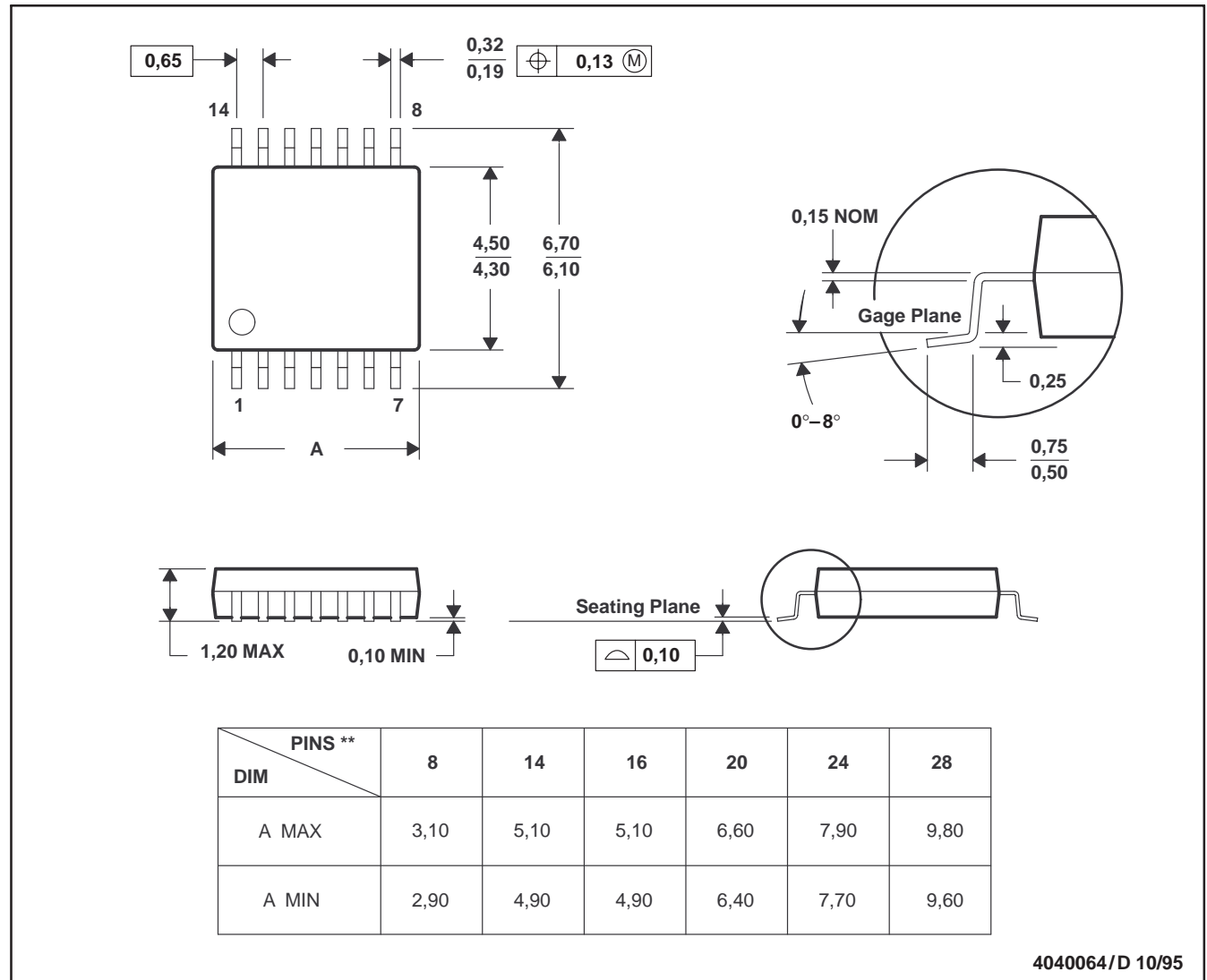
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Four center pins are connected to die mount pad.  
 E. Falls within JEDEC MS-012

## 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

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