

- Ultra-Fast Operation . . . 7.8 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

description

The TL3016 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. 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 7.8 ns.

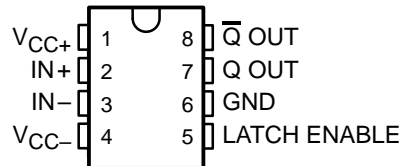
The TL3016 is a pin-for-pin functional replacement for the LT1016 comparator, offering higher speed operation but consuming half the power.

AVAILABLE OPTIONS

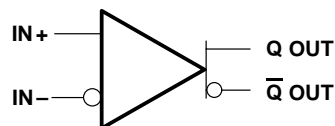
T_A	PACKAGED DEVICES		CHIP FORM [‡] (Y)
	SMALL OUTLINE [†] (D)	TSSOP (PW)	
0°C to 70°C	TL3016CD	TL3016CPWLE	TL3016Y
-40°C to 85°C	TL3016ID	TL3016IPWLE	—

[†] The PW packages are available left-ended taped and reeled only.
[‡] Chip forms are tested at $T_A = 25^\circ\text{C}$ only.

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



symbol (each comparator)



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

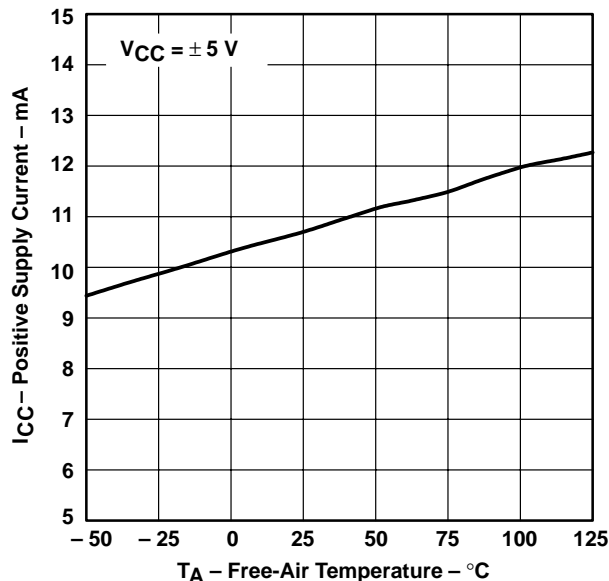


Figure 1



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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.

TL3016, TL3016Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS
 SLCS130B – MARCH 1997 – REVISED APRIL 1997

TL3016Y chip information

This chip, when properly assembled, 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.

BONDING PAD ASSIGNMENTS

CHIP THICKNESS: 10 MILS TYPICAL
BONDING PADS: 4 × 4 MILS MINIMUM
 $T_J \text{ max} = 150^\circ\text{C}$
TOLERANCES ARE $\pm 10\%$.
ALL DIMENSIONS ARE IN MILS.
TERMINALS 1 AND 6 CAN BE CONNECTED TO MULTIPLE PADS.

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

TL3016, TL3016Y
ULTRA-FAST LOW-POWER
PRECISION COMPARATORS

SLCS130B – 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†	TL3016C			TL3016I			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IO}	Input offset voltage	T _A = 25°C	0.5		3	0.5		3	mV
		T _A = full range			3.5			3.5	
αV _{IO}	Temperature coefficient of input offset voltage		-4.8			-4.5			μV/°C
I _{IO}	Input offset current	T _A = 25°C	0.1		0.6	0.1		0.6	μA
		T _A = full range			0.9			1.3	
I _{IB}	Input bias current	T _A = 25°C	0.6		7.5	0.6		7.5	μA
		T _A = full range			8			10	
V _{ICR}	Common-mode input voltage range	V _{DD} = ±5 V	-3.75		3.5	-3.75		3.5	V
		V _{DD} = 5 V	1.25		3.5	1.25		3.5	
CMRR	Common-mode rejection ratio	-3.75 ≤ V _{IC} ≤ 3.5 V, T _A = 25°C	80		97	80		97	dB
k _{SVR}	Supply-voltage rejection ratio	Positive supply: 4.6 V ≤ +V _{DD} ≤ 5.4 V, T _A = 25°C	60		72	60		72	dB
		Negative supply: -7 V ≤ -V _{DD} ≤ -2 V, T _A = 25°C	80		100	80		100	
V _{OL}	Low-level output voltage	I _(sink) = 4 mA, V ₊ ≤ 4.6 V, T _A = 25°C	500		600	500		600	mV
		I _(sink) = 10 mA, V ₊ ≤ 4.6 V, T _A = 25°C			750			750	
V _{OH}	High-level output voltage	V ₊ ≤ 4.6 V, T _A = 25°C, I _O = 1 mA	3.6		3.9	3.6		3.9	V
		V ₊ ≤ 4.6 V, T _A = 25°C, I _O = 10 mA	3.4		3.7	3.4		3.7	
I _{DD}	Positive supply current	T _A = full range	10.6		12.5	10.6		12.5	mA
	Negative supply current		-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 V	24		39	24		45	

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

‡ All typical values are measures with T_A = 25°C.



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

PARAMETER		TEST CONDITION†		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	8.8		7.8	8.8	ns	
			$T_A = \text{full range}$	7.8	10.4		7.8	11.4		
		$\Delta V_I = 100\text{ mV}$, $V_{OD} = 20\text{ mV}$	$T_A = 25^\circ\text{C}$	7.6	8.6		7.6	8.6		
			$T_A = \text{full range}$	7.6	10.2		7.6	11.2		
$t_{sk(p)}$	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			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
	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

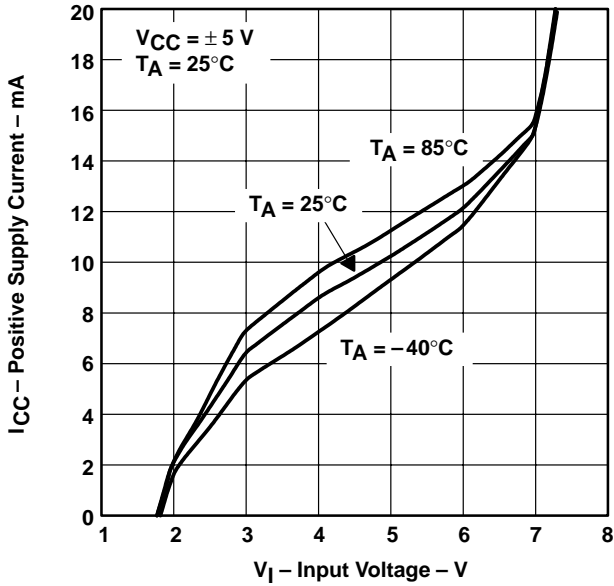


Figure 2

POSITIVE SUPPLY CURRENT
 VS
 FREQUENCY

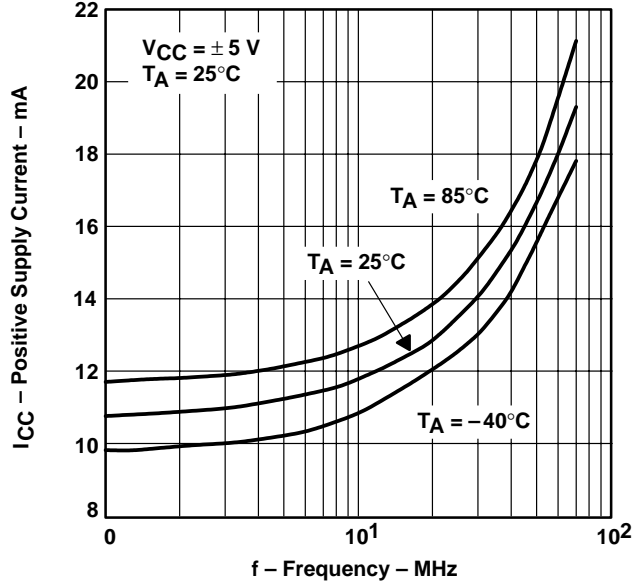


Figure 3

POSITIVE SUPPLY CURRENT
 VS
 FREE-AIR TEMPERATURE

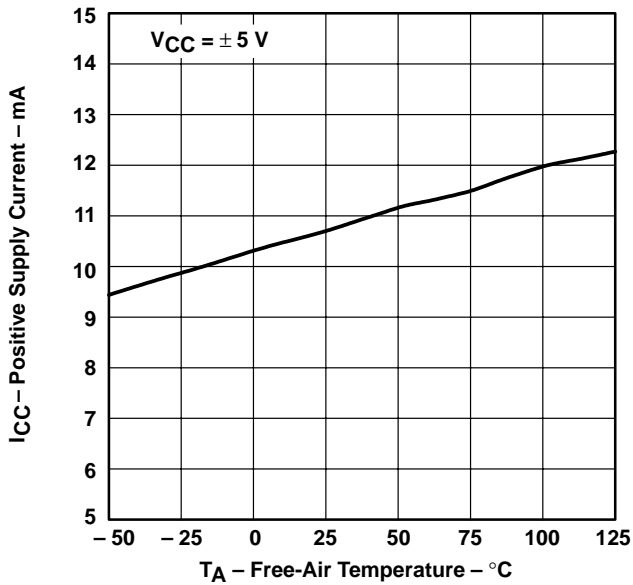


Figure 4

NEGATIVE SUPPLY CURRENT
 VS
 FREE-AIR TEMPERATURE

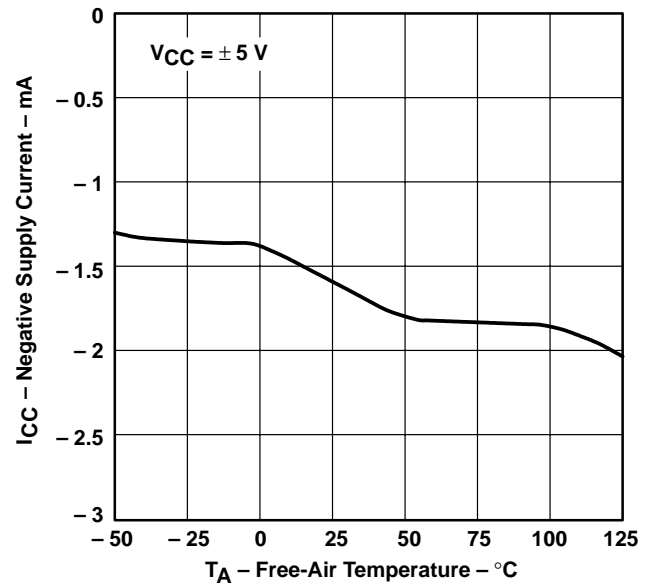


Figure 5

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME
 VS
 OVERDRIVE VOLTAGE

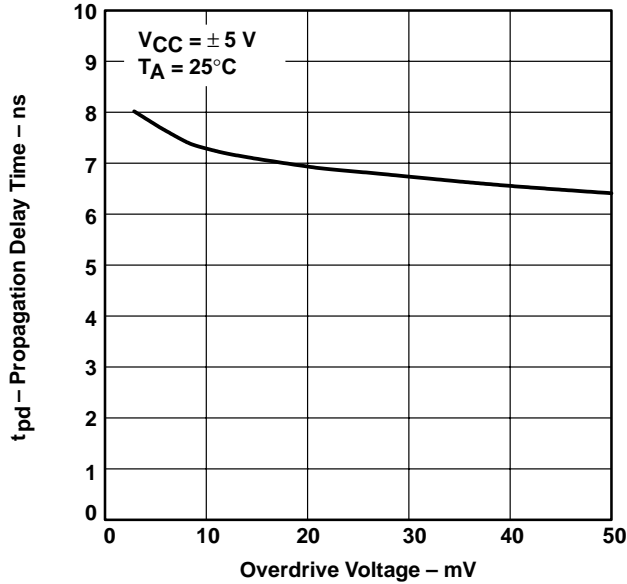


Figure 6

PROPAGATION DELAY TIME
 VS
 SUPPLY VOLTAGE

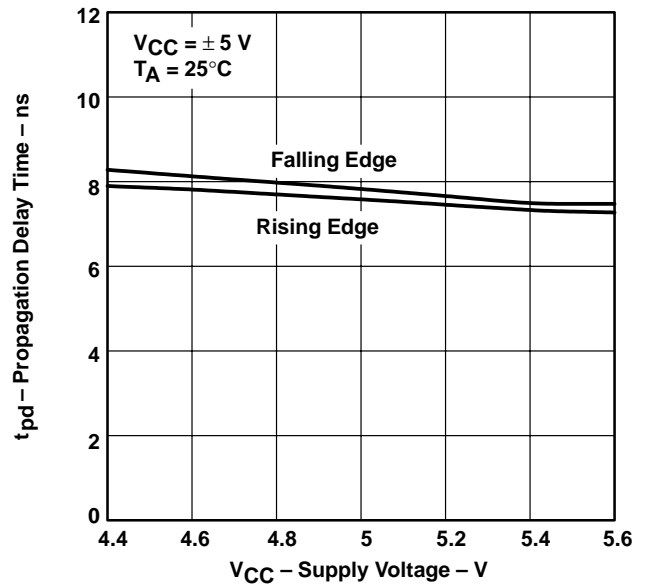


Figure 7

PROPAGATION DELAY TIME
 VS
 INPUT IMPEDANCE

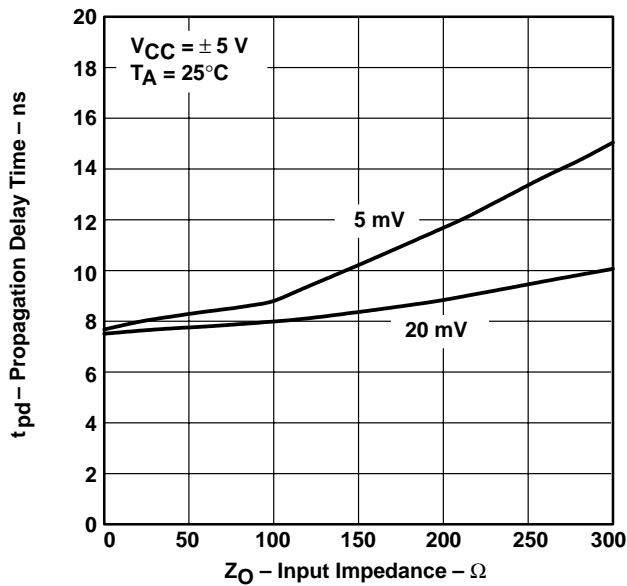


Figure 8

PROPAGATION DELAY TIME
 VS
 LOAD CAPACITANCE

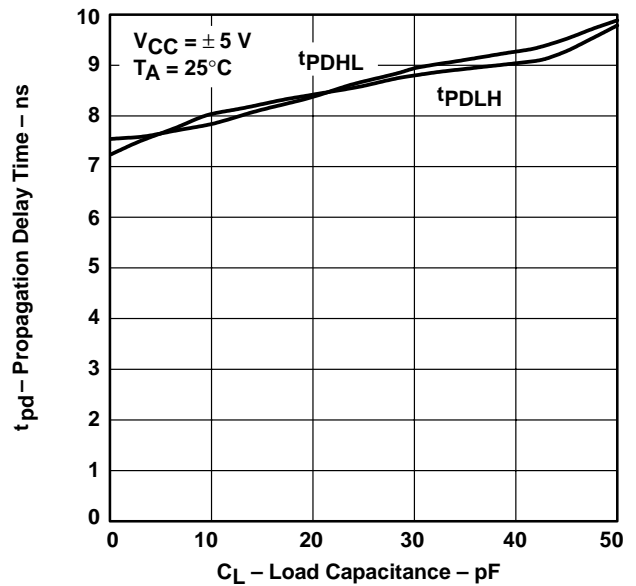


Figure 9

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME
 vs
 FREE-AIR TEMPERATURE

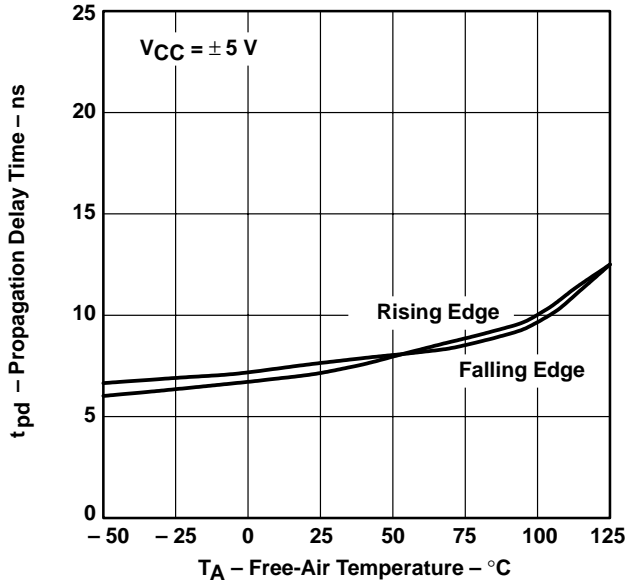


Figure 10

COMMON-MODE INPUT VOLTAGE
 vs
 FREE-AIR TEMPERATURE

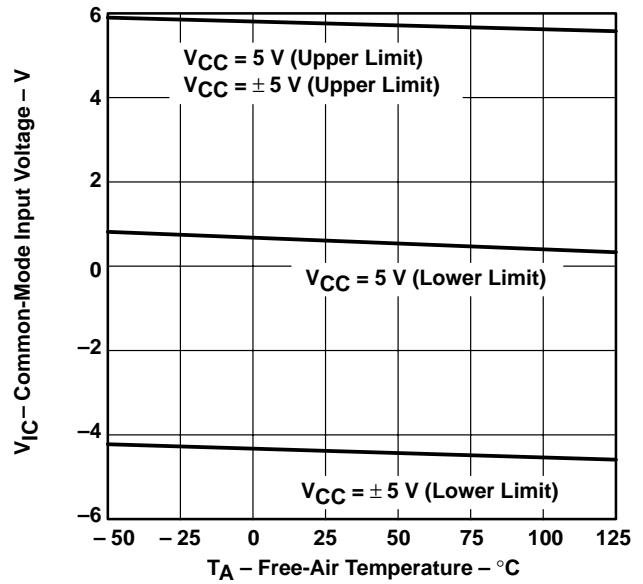


Figure 11

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

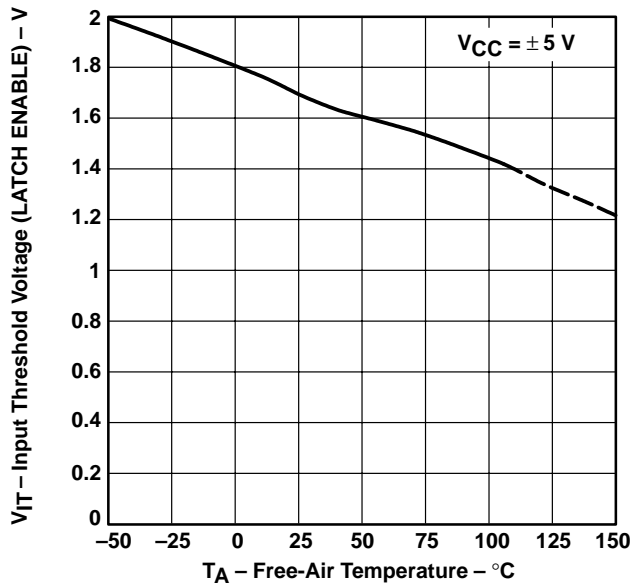


Figure 12

OUTPUT VOLTAGE
 vs
 OUTPUT SOURCE CURRENT

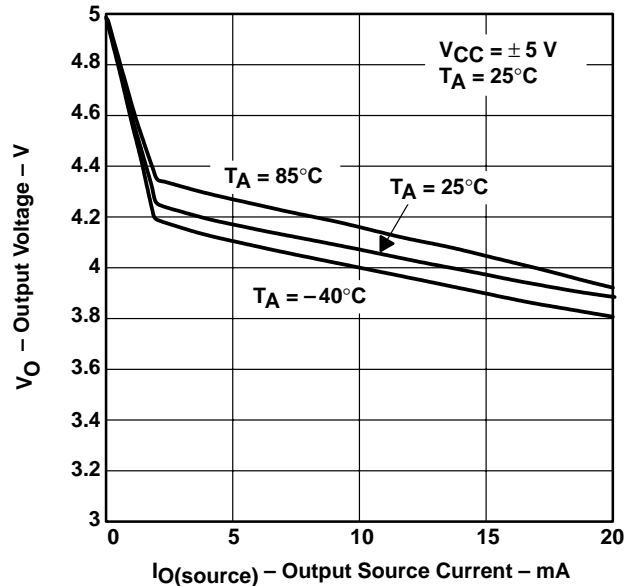


Figure 13

TYPICAL CHARACTERISTICS

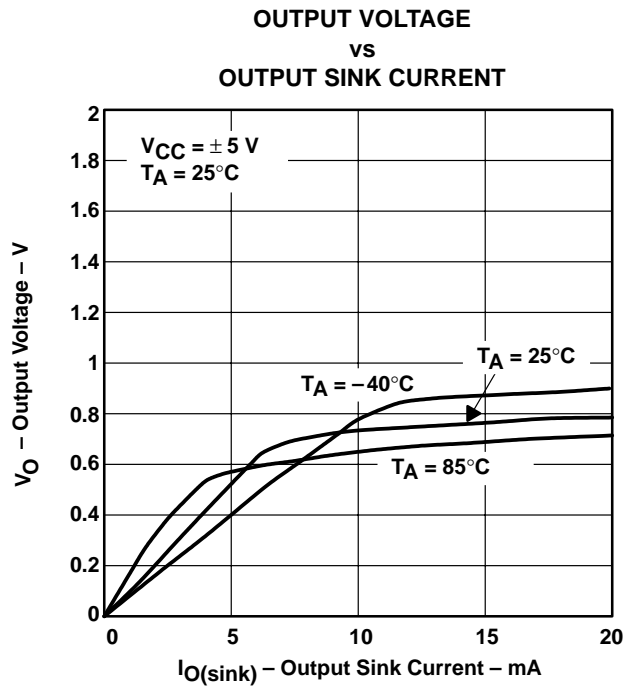


Figure 14

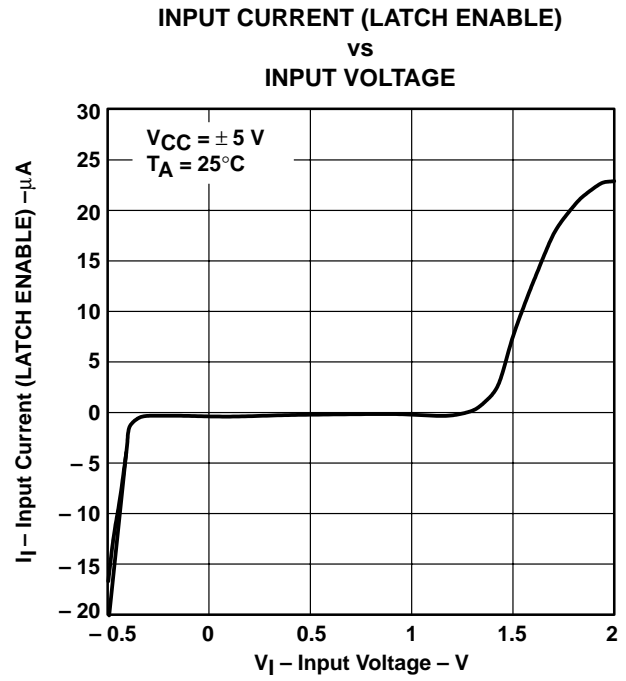


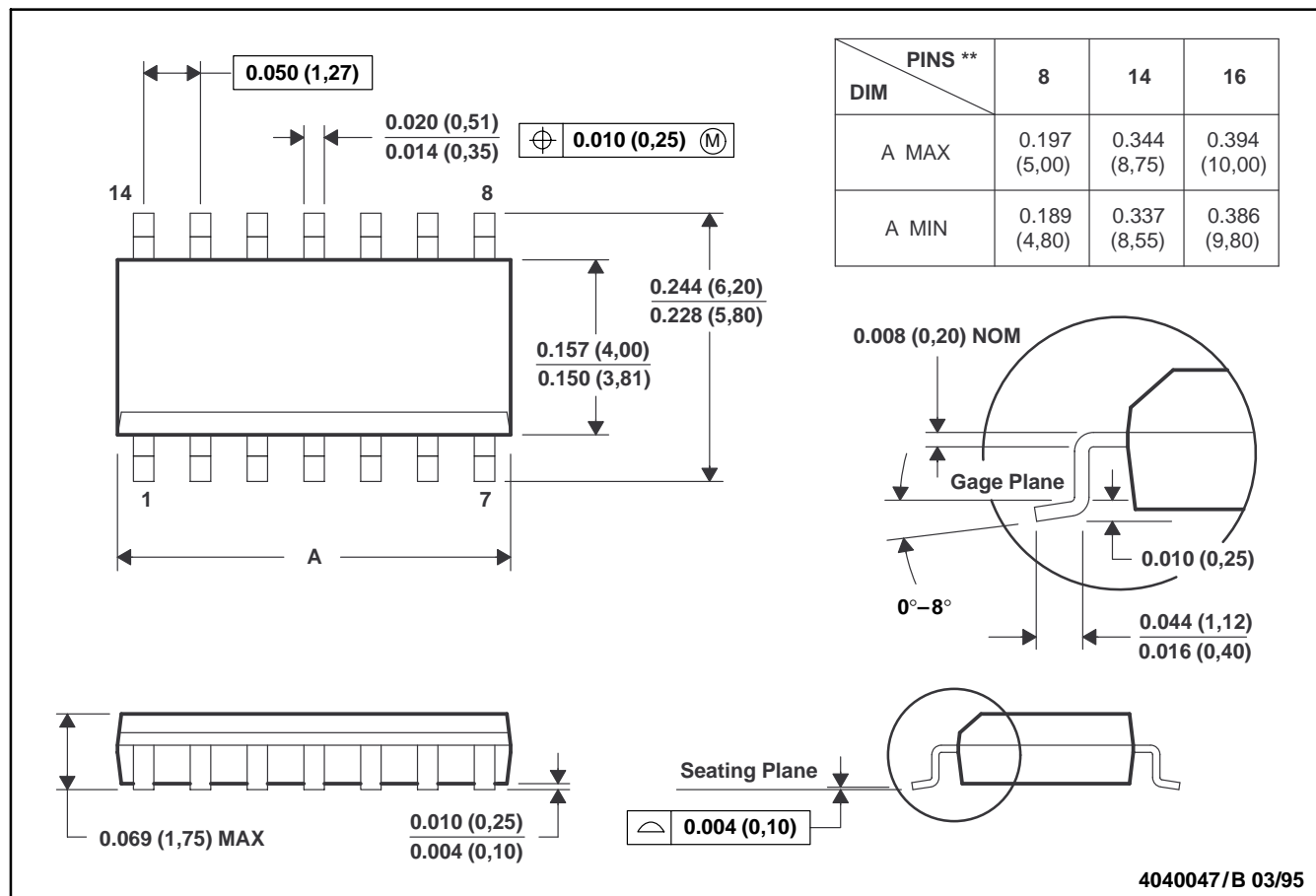
Figure 15

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

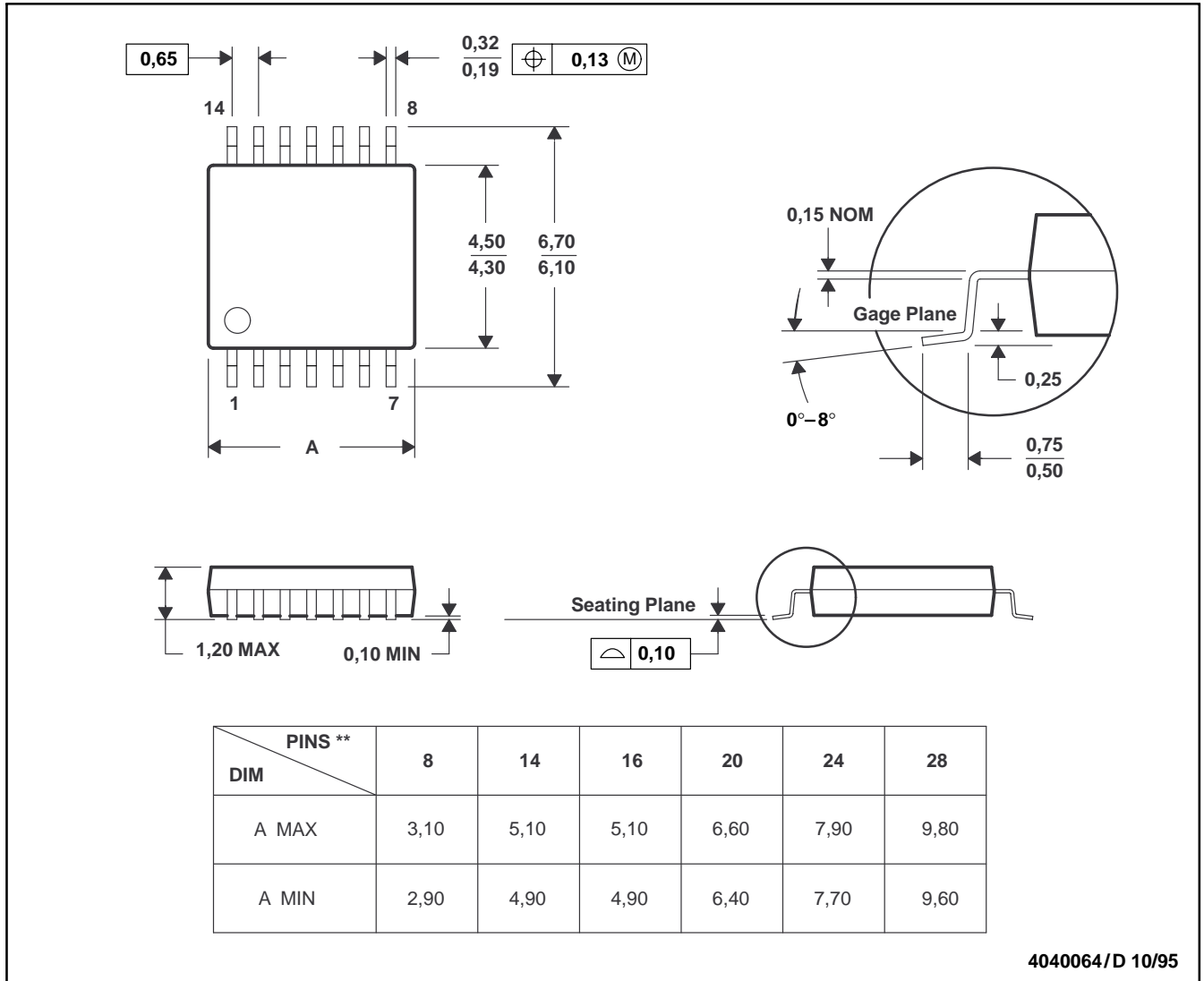
4040047/B 03/95

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

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.