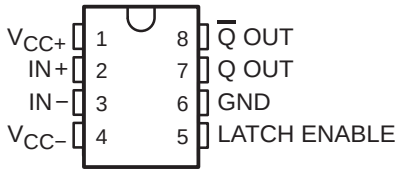
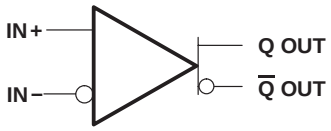
- **Ultra-Fast Operation . . . 10 ns (typ)**
- **Low Positive Supply Current 12.7 mA (Typ)**
- **Operates From a Single 5-V Supply or From a Split ±5-V Supply**
- **Complementary Outputs**
- **Input Common-Mode Voltage Includes Negative Rail**
- **Low Offset Voltage**
- **No Minimum Slew Rate Requirement**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

D AND PW PACKAGE
(TOP VIEW)



symbol (each comparator)



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.

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.

POSITIVE SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

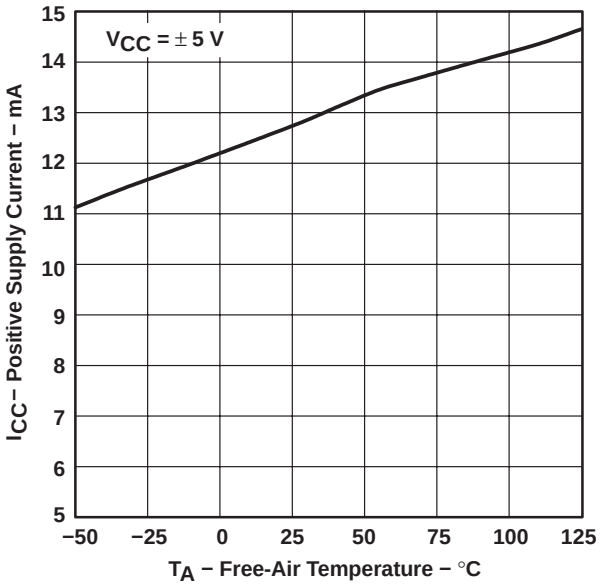
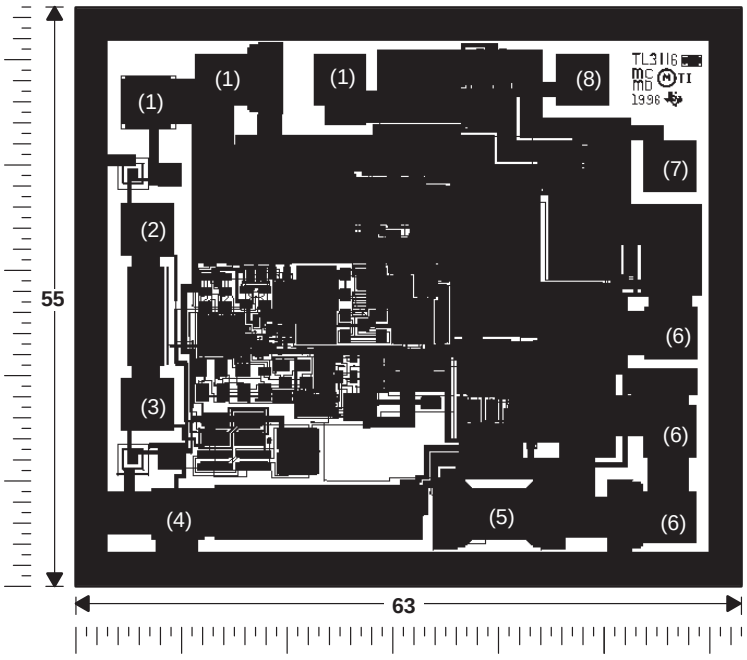


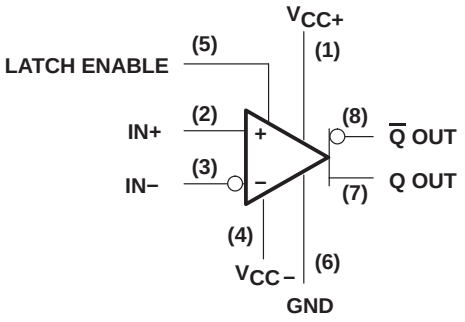
Figure 1

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.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS: 10 MILS TYPICAL

BONDING PADS: 4 × 4 MILS MINIMUM

T_J max = 150°C

TOLERANCES ARE ±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	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW
PW	525 mW	4.2 mW/°C	336 mW

electrical characteristics at specified operating free-air temperature, V_{DD} = ±5 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°C		0.5	3		0.5	3	mV
		T_A = full range			3.5			3.5	
α_{VIO}	Temperature coefficient of input offset voltage			−2.5			−2.8		µV/°C
I_{IO}	Input offset current	T_A = 25°C		0.1	0.2		0.1	0.2	µA
		T_A = full range			0.3			0.35	
I_{IB}	Input bias current	T_A = 25°C		0.7	1.1		0.7	1.1	µA
		T_A = full range			1.2			1.5	
V_{ICR}	Common-mode input voltage range	V_{DD} = ±5 V	−5		2.5	−5		2.5	V
		V_{DD} = 5 V	0		2.5	0		2.5	
CMRR	Common-mode rejection ratio	− 5 ≤ V_{IC} ≤ 2.5 V	75	100		75	100		dB
k_{SVR}	Supply-voltage rejection ratio	Positive supply: 4.6 V ≤ +V_{DD} ≤ 5.4 V, T_A = 25°C	60	80		60	80		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		400	600		400	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, I_O = 1 mA, T_A = 25°C	3.6	3.9		3.6	3.9		V
		V+ ≤ 4.6 V, I_O = 10 mA, T_A = 25°C	3.4	3.8		3.4	3.8		
I_{CC}	Positive supply current	T_A = 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 V		24	39		24	45	µA

† Full range for the TL3116C is T_A = 0°C to 70°C. Full range for the TL3116I is T_A = −40°C to 85°C.
‡ All typical values are measures with T_A = 25°C.

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

PARAMETER		TEST CONDITIONS†		TL3116C			TL3116I			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd1}	Propagation delay time‡	ΔV_I = 100 mV, V_{OD} = 5 mV	T_A = 25°C		9.9	12		9.9	12	ns
			T_A = full range		9.9	14		9.9	15	
		ΔV_I = 100 mV, V_{OD} = 20 mV	T_A = 25°C		8.2	10.3		8.2	10.3	
			T_A = full range		8.2	12.7		8.2	13.7	
$t_{sk(p)}$	Pulse skew ($\lvert t_{pd+} - t_{pd-} \rvert$)	ΔV_I = 100 mV, T_A = 25°C	V_{OD} = 5 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°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

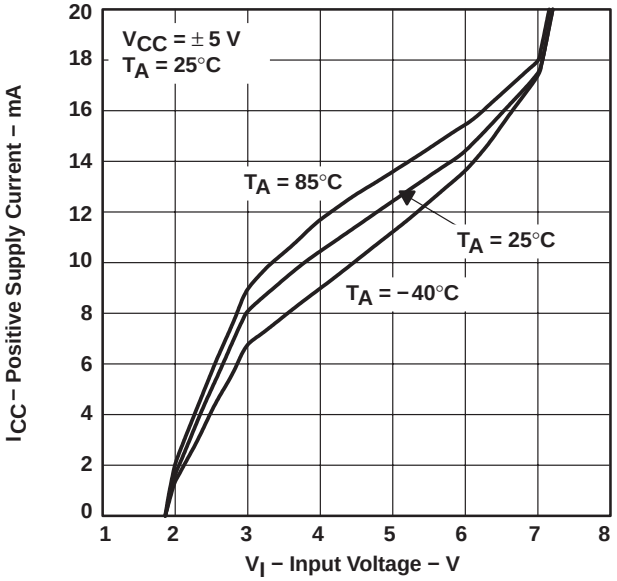


Figure 2

POSITIVE SUPPLY CURRENT vs FREQUENCY

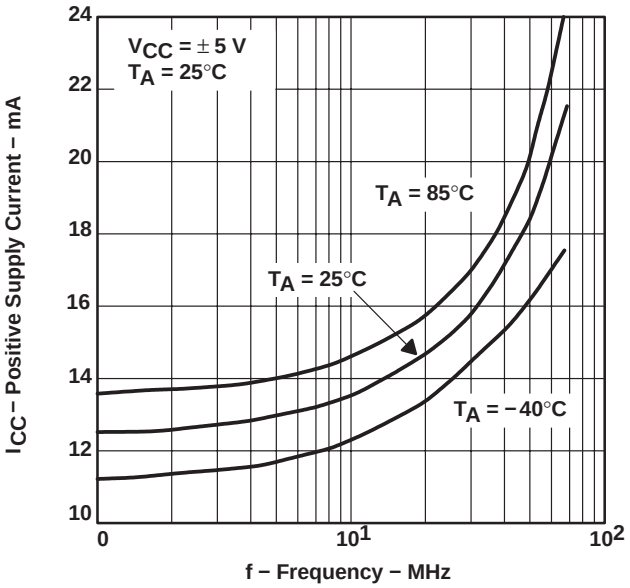


Figure 3

POSITIVE SUPPLY CURRENT vs FREE-AIR TEMPERATURE

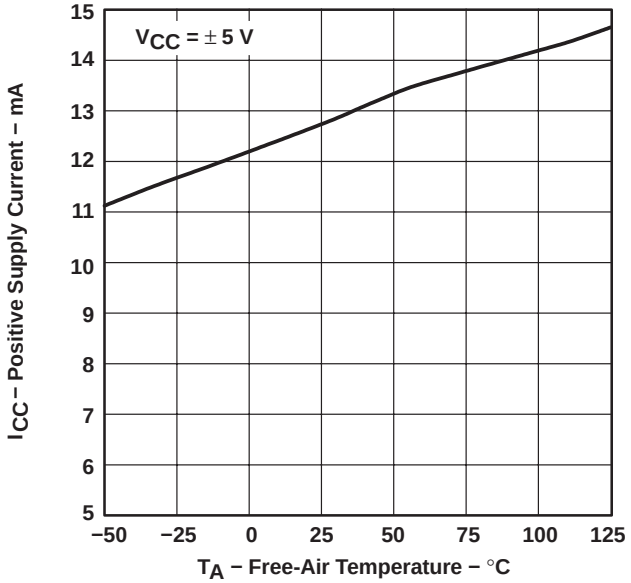


Figure 4

NEGATIVE SUPPLY CURRENT vs FREE-AIR TEMPERATURE

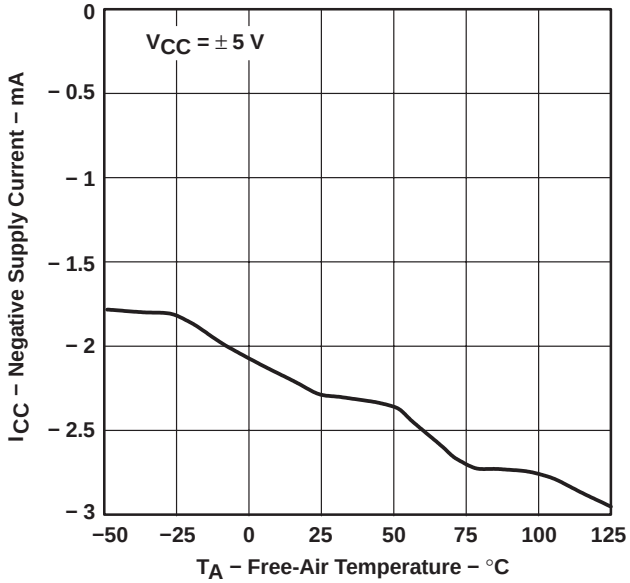


Figure 5

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME vs OVERDRIVE VOLTAGE

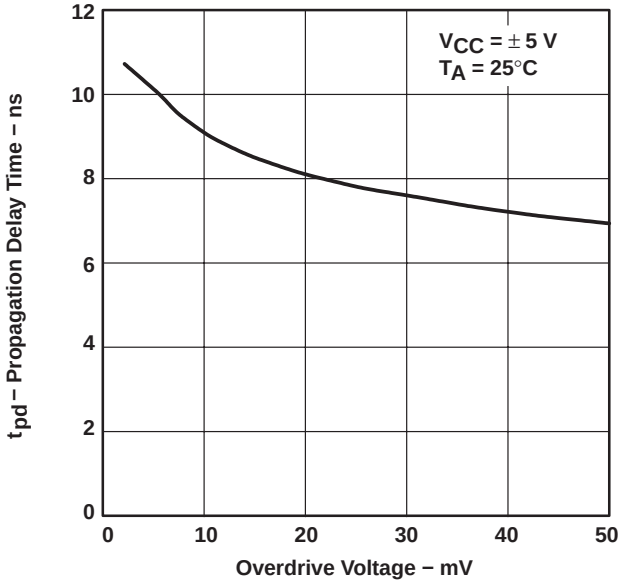


Figure 6

PROPAGATION DELAY TIME vs SUPPLY VOLTAGE

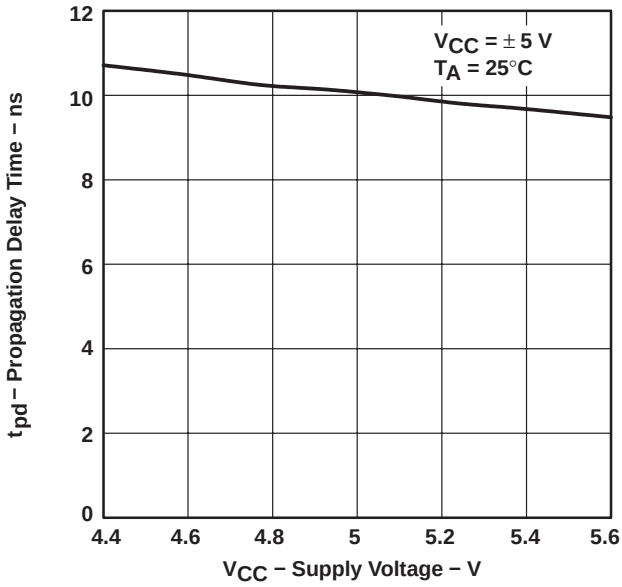


Figure 7

PROPAGATION DELAY TIME vs INPUT IMPEDANCE

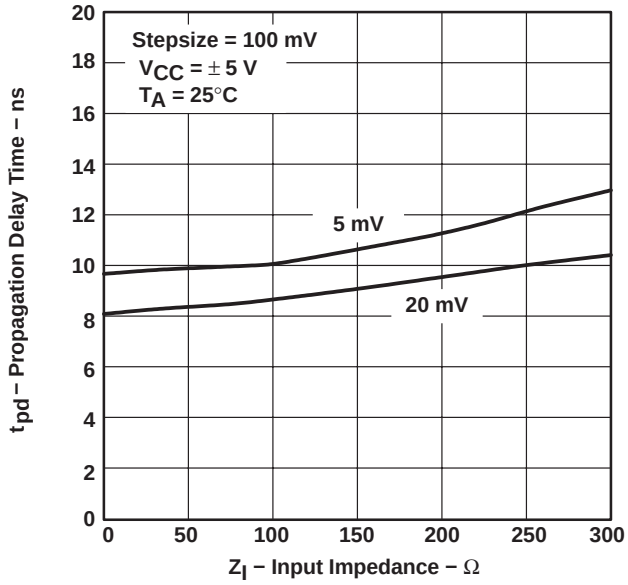


Figure 8

PROPAGATION DELAY TIME vs LOAD CAPACITANCE

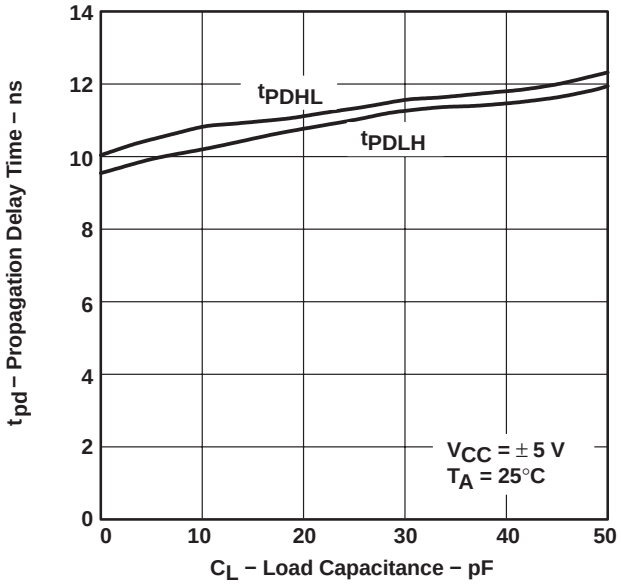


Figure 9

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME vs FREE-AIR TEMPERATURE

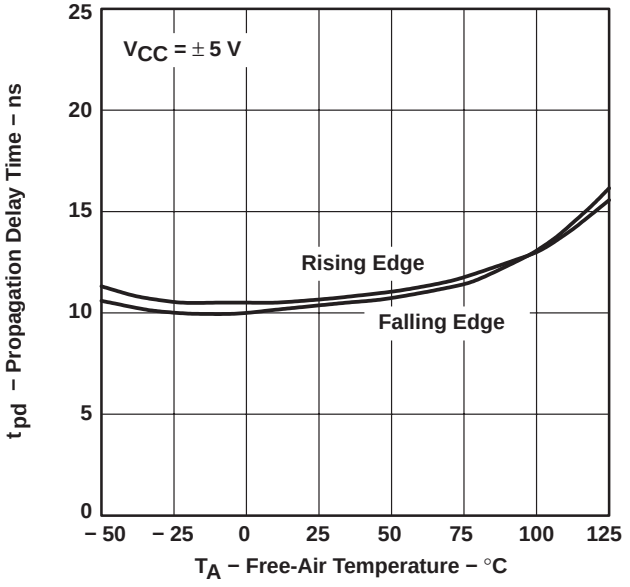


Figure 10

COMMON-MODE INPUT VOLTAGE vs FREE-AIR TEMPERATURE

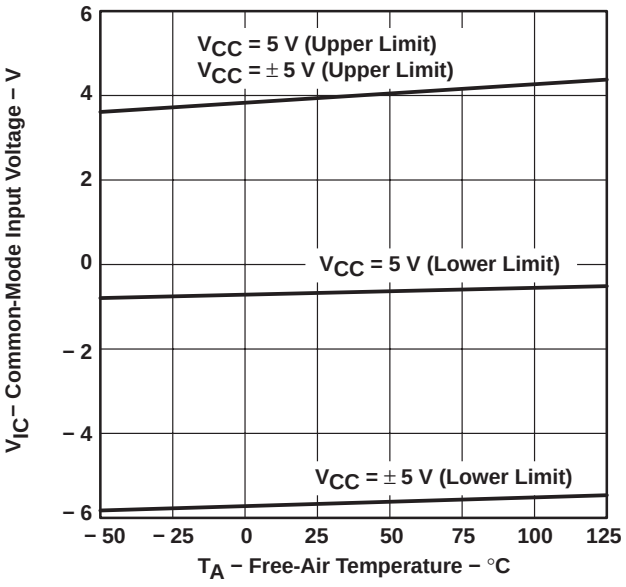


Figure 11

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

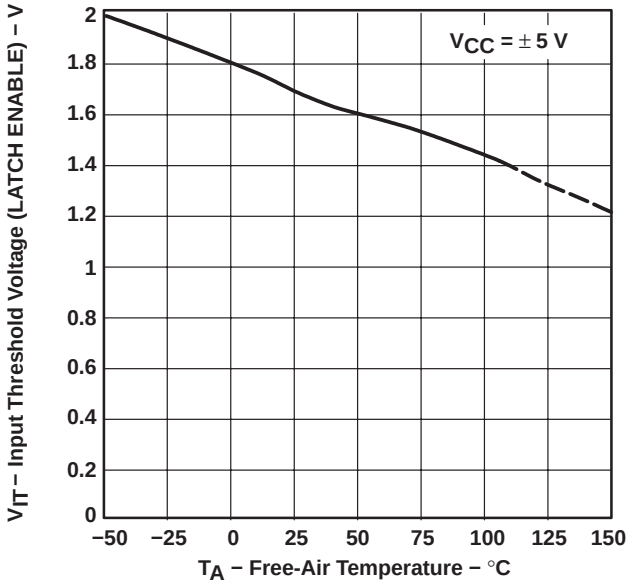


Figure 12

OUTPUT VOLTAGE vs OUTPUT SOURCE CURRENT

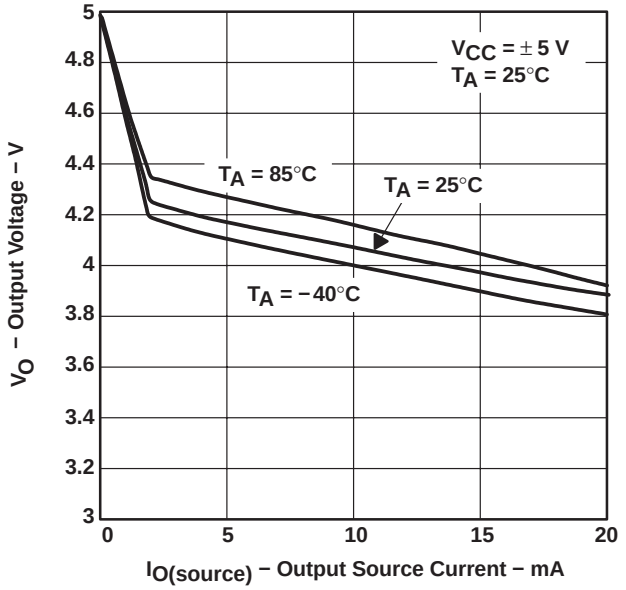


Figure 13

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs OUTPUT SINK CURRENT

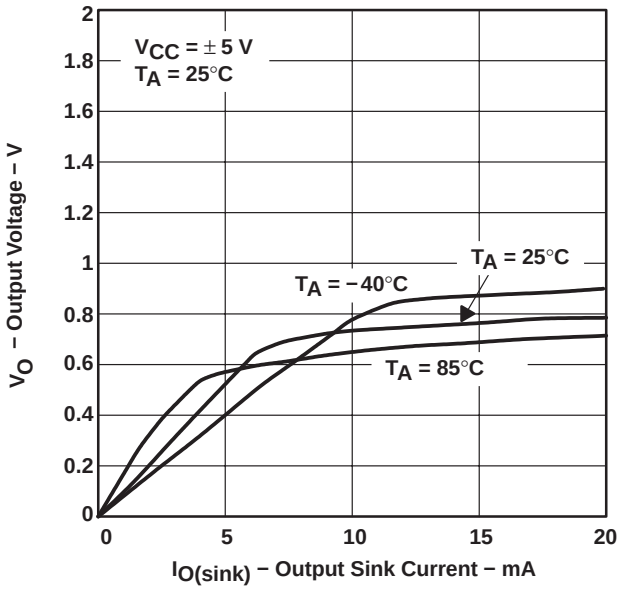


Figure 14

INPUT CURRENT (LATCH ENABLE) vs INPUT VOLTAGE

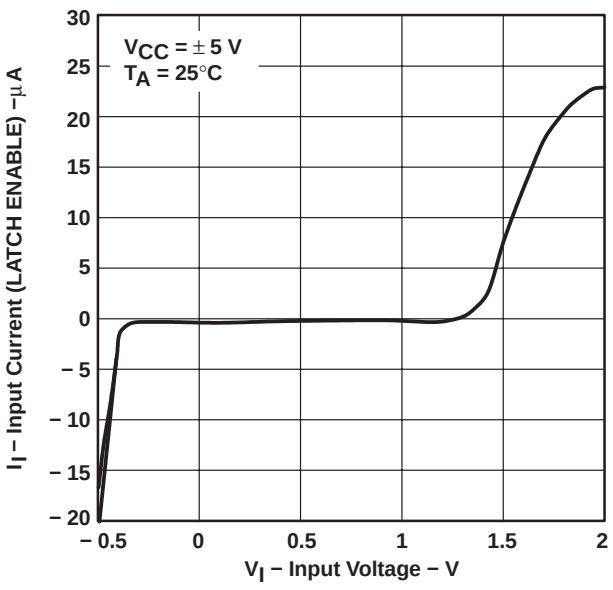
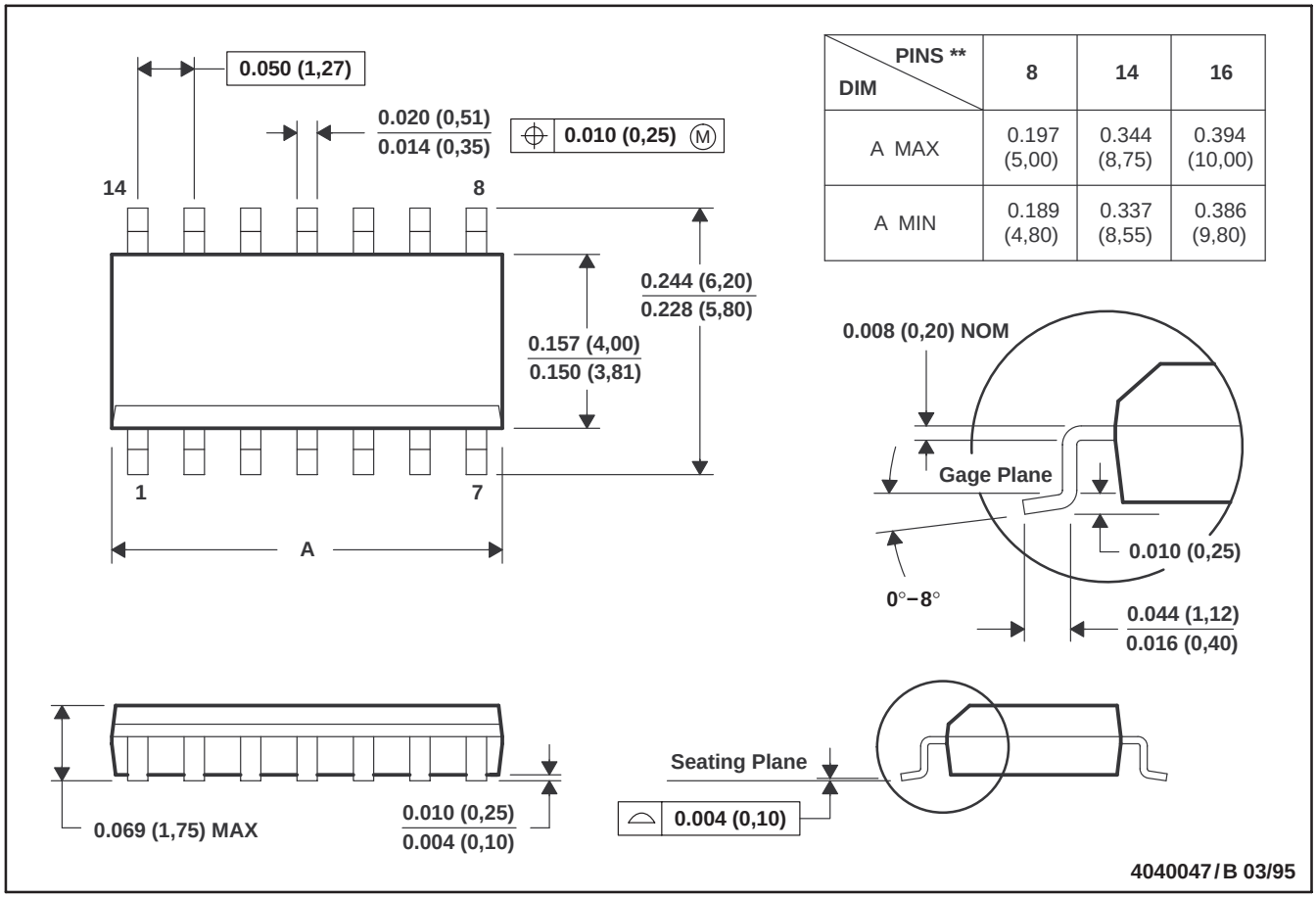


Figure 15

MECHANICAL INFORMATION

D (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN



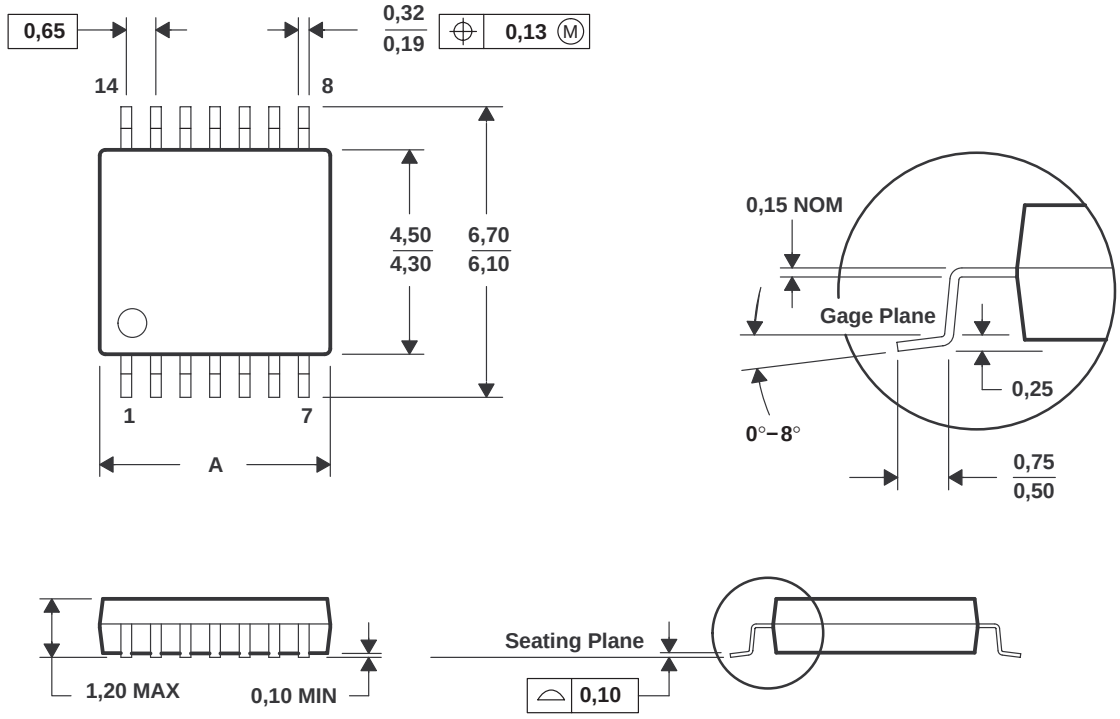
DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

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



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/D 10/95

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 Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265