



# Ultra-Fast Precision TTL Comparator

MXL1016

## General Description

The Maxim MXL1016 (10ns, typ) high-speed, complementary-output comparator is designed specifically to interface directly to TTL logic while operating from either a dual  $\pm 5V$  supply or a single +5V supply.

The MXL1016 remains stable with the outputs in the active region, which greatly reduces output instability common with slow-moving input signals. In addition, an output latch (LE) is provided.

For lower-power, higher-performance comparators, see the MAX912/MAX913 dual/single comparators data sheet. The MAX913 is an improved plug-in replacement for the MXL1016 and the MAX912 is the dual equivalent to the MAX913.

## Applications

High-Speed A/D Converters  
Zero-Crossing Detectors  
Current Sense for Switching Regulators  
High-Speed Sampling Circuits  
High-Speed Triggers  
Line Receivers  
Extended Range V/F Converters  
Fast Pulse Height/Width Discriminators

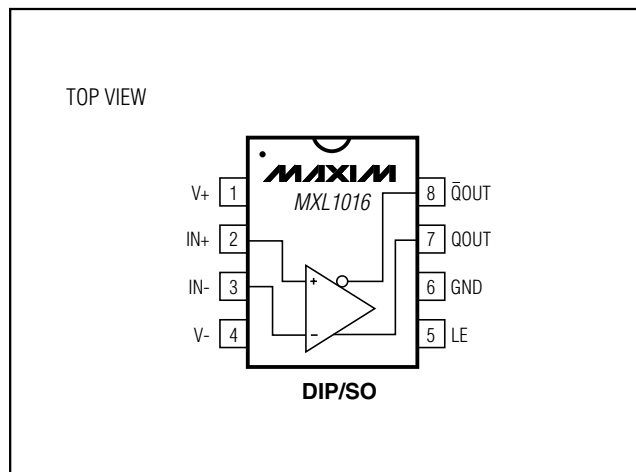
## Features

- ◆ Ultra Fast (10ns, typ)
- ◆ Single +5V or Dual  $\pm 5V$  Supply Operation
- ◆ Complementary TTL Outputs
- ◆ Low Offset Voltage: 1mV
- ◆ No Minimum Input Slew-Rate Requirement
- ◆ No Power-Supply Current Spiking
- ◆ Output Latch

## Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MXL1016CN8	0°C to +70°C	8 Plastic DIP
MXL1016CS8	0°C to +70°C	8 SO

## Pin Configuration



## Pin Description

PIN	NAME	FUNCTION
1	V+	Positive Power Supply +5V
2	IN+	Noninverting Input
3	IN-	Inverting Input
4	V-	Negative Power Supply, -5V for dual supply or GND for single supply
5	LE	Latch Enable. QOUT and $\bar{Q}$ OUT are latched when LE is high
6	GND	Ground
7	QOUT	TTL Output
8	$\bar{Q}$ OUT	Complementary TTL Output



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## ABSOLUTE MAXIMUM RATINGS

Positive Supply Voltage.....	7V	Output Current (continuous).....	±20mA
Negative Supply Voltage .....	-7V	Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )	
V+ to V- .....	13V	8-Pin Plastic DIP (derate 9.09mW/°C above +70°C) ...	727mW
Differential Input Voltage		8-Pin SO (derate 5.88mW/°C above +70°C).....	471mW
MXL1016.....	±5V	Operating Temperature Ranges:	
Input Voltage (either input)		MXL1016.....	0°C to +70°C
MXL1016.....	Equal to Supplies	Storage Temperature Range .....	-65°C to +150°C
Latch Pin Voltage .....	Equal to Supplies	Lead Temperature (soldering, 10s) .....	+300°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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

(V+ = 5V, V- = -5V, V<sub>OUT(Q)</sub> = 1.4V, V<sub>LE</sub> = 0V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 2)	V <sub>OS</sub>	R <sub>S</sub> ≤ 100Ω	T <sub>A</sub> = +25°C		1.0	±3	mV
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			3.5	
Input Offset-Voltage Drift	ΔV <sub>OS</sub> /ΔT	T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			4		μV/°C
Input Offset Current (Note 2)	I <sub>OS</sub>	T <sub>A</sub> = +25°C			0.3	1	μA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>				1.3	
Input Bias Current (Note 3)	I <sub>B</sub>	T <sub>A</sub> = +25°C			5	10	μA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>				13	
Input Voltage Range	V <sub>CM</sub>	Dual +5V and -5V supply		-3.75		+3.50	V
		Single 5V supply		+1.25		+3.50	
Common-Mode Rejection Ratio	CMRR	-3.75V ≤ V <sub>CM</sub> ≤ 3.5V		80	96		dB
Power-Supply Rejection Ratio	PSRR	Positive supply: 4.6V ≤ V+ ≤ 5.4V		60	75		dB
		Negative supply: -2V ≥ V- ≥ -7V		80	100		
Small-Signal Voltage Gain	A <sub>V</sub>	1V ≤ V <sub>OUT</sub> ≤ 2V, T <sub>A</sub> = +25°C		1400	3000		V/V
Output High Voltage	V <sub>OH</sub>	V+ ≥ 4.6V	I <sub>OUT</sub> = 1mA	2.7	3.4		V
			I <sub>OUT</sub> = 10mA	2.4	3.0		
Output Low Voltage	V <sub>OL</sub>	I <sub>SINK</sub> = 4mA			0.3	0.5	V
		I <sub>SINK</sub> = 10mA, T <sub>A</sub> = +25°C			0.4		
Positive Supply Current	I+	(Note 4)			25	35	mA
Negative Supply Current	I-	(Note 4)			3	5	mA

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## ELECTRICAL CHARACTERISTICS (continued)

( $V_+ = 5V$ ,  $V_- = -5V$ ,  $V_{OUT(Q)} = 1.4V$ ,  $V_{LE} = 0V$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ C$ .) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Latch Pin High Input Voltage	$V_{IH}$		2.0			V
Latch Pin Low Input Voltage	$V_{IL}$				0.8	V
Latch Pin Current	$I_{IL}$	$V_{LE} = 0V$			-500	$\mu A$
Propagation Delay (Note 5)	$t_{PD}$	$\Delta V_{IN} = 100mV$ , $OD = 5mV$		10	14	ns
		$T_A = +25^\circ C$			16	
		$\Delta V_{IN} = 100mV$ , $OD = 20mV$		9	12	
		$T_A = +25^\circ C$			15	
Differential Propagation Delay (Note 5)	$\Delta t_{PD}$	$\Delta V_{IN} = 100mV$ , $OD = 5mV$ , $T_A = +25^\circ C$			4	ns
Latch Setup Time	$t_{SU}$	(Note 6)		2		ns
Latch Hold Time	$t_H$	(Note 6)		2		ns

**Note 1:** All specifications are 100% tested at  $T_A = +25^\circ C$ , unless otherwise noted. Specification limits over temperature ( $T_A = T_{MIN}$  to  $T_{MAX}$ ) are guaranteed by design.

**Note 2:** Input offset voltage is defined as the average of the two input offset voltages, measured by forcing first one output, then the other to 1.4V. Input offset current is defined in the same way.

**Note 3:** Input bias current ( $I_B$ ) is defined as the average of the two input currents.

**Note 4:** Supply currents are measured with  $V_{OUT(Q)}$  driven to both  $V_{OH}$  and  $V_{OL}$  (not 1.4V).

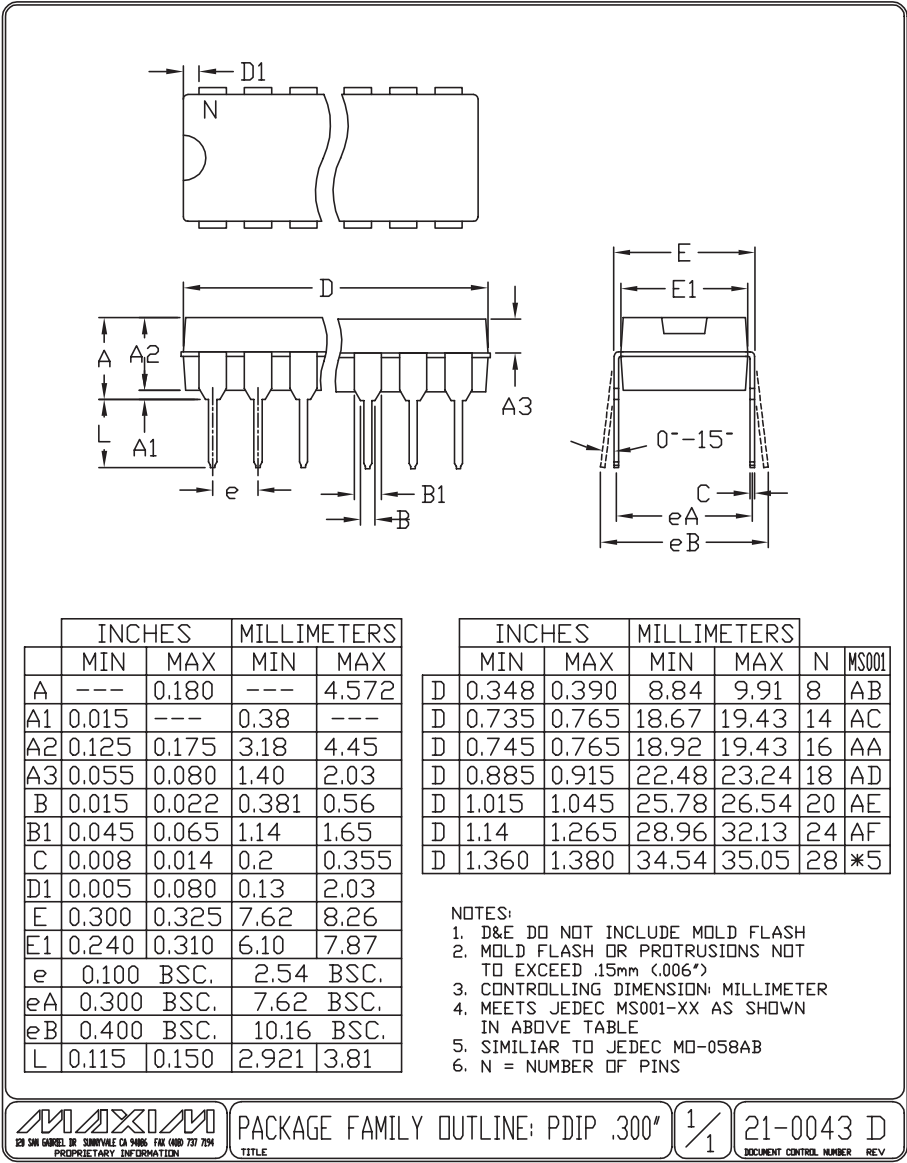
**Note 5:**  $t_{PD}$  and  $\Delta t_{PD}$  cannot be measured in automatic handling equipment with low values of overdrive. Characterization and correlation tests have shown that  $t_{PD}$  and  $\Delta t_{PD}$  limits can be guaranteed by design. Electrical Characteristic DC tests are performed to guarantee that all internal bias conditions are correct. For low overdrive conditions,  $V_{OS}$  is added to overdrive.

**Note 6:** Input latch setup time,  $t_{SU}$ , is the interval in which the input signal must be stable prior to asserting the latch signal. The hold time,  $t_H$ , is the interval after the latch is asserted in which the input signal must be stable.

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## Package Information

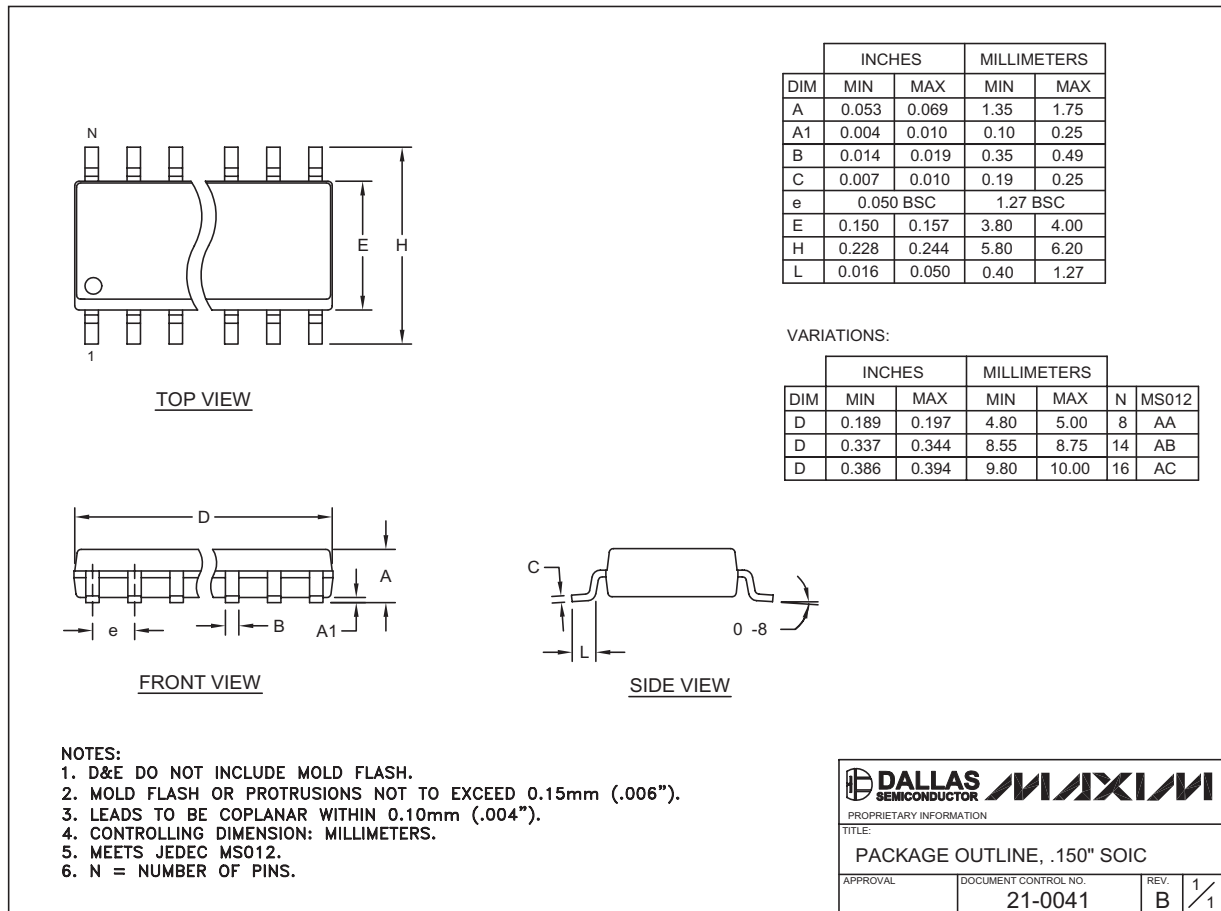
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



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## Package Information (continued)

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