



Ultra-Fast Precision TTL Comparators

General Description

The Maxim LT1016 (10ns typ) and LT1116 (12ns typ) high-speed, complementary-output comparators are designed specifically to interface directly to TTL logic while operating from either a dual $\pm 5V$ supply or a single +5V supply.

The LT1016/LT1116 remain 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 comparator data sheet. The MAX913 is an improved, plug-in replacement for the LT1016 and LT1116, 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
- ♦ Input Common-Mode Extends to Negative Supply (LT1116)
- ♦ Inputs Can Exceed the Positive Supply Up to +15V (LT1116) Without Damage
- ♦ Complementary TTL Outputs
- ♦ Low Offset Voltage: 1mV
- ♦ No Minimum Input Slew-Rate Requirement
- ♦ No Power-Supply Current Spiking
- ♦ Output Latch

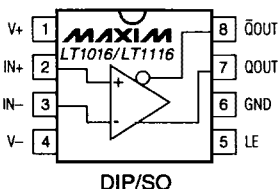
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
LT1016CN8	0°C to +70°C	8 Plastic DIP
LT1016CS8	0°C to +70°C	8 SO
LT1016MJ8	-55°C to +125°C	8 CERDIP*
LT1116CN8	0°C to +70°C	8 Plastic DIP
LT1116CS8	0°C to +70°C	8 SO

* Contact factory for availability and processing to MIL-STD-883.

Pin Configuration

TOP VIEW



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ABSOLUTE MAXIMUM RATINGS

Positive Supply Voltage.....	7V
Negative Supply Voltage.....	-7V
Differential Input Voltage	
LT1016	±5V
LT1116	±15V
Input Voltage (either input)	
LT1016	Equal to Supplies
LT1116	(V ₋ - 0.3V) to 15V
Latch Pin Voltage	Equal to Supplies

Output Current (continuous).....	±20mA
Continuous Power Dissipation (T _A = +70°C)	
Plastic DIP (derate 9.09mW/°C above +70°C)	727mW
SO (derate 5.88mW/°C above +70°C).....	471mW
CERDIP (derate 8.00mW/°C above +70°C).....	640mW
Operating Temperature Ranges:	
LT1016C/LT1116C	0°C to +70°C
LT1016MJ	-55°C to +125°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10sec)	+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 – LT1016

(V₊ = 5V, V₋ = -5V, V_{OUT} (Q) = 1.4V, V_{LE} = 0V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		LT1016M			LT1016C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage (Note 1)	V _{OS}	R _S ≤ 100Ω	T _A = +25°C	0.8	±2		1.0	±3	mV	
Input Offset-Voltage Drift	ΔV _{OS} /ΔT			4			4			μV/°C
Input Offset Current (Note 1)	I _{OS}	T _A = +25°C		0.3	1		0.3	1	μA	
Input Bias Current (Note 2)	I _B	T _A = +25°C		5 10			5 10			μA
				13			13			
Input Voltage Range	V _{CM}	Single 5V supply		-3.75		+3.5	-3.75		+3.5	V
				+1.25		+3.5	+1.25		+3.5	
Common-Mode Rejection Ratio	CMRR	-3.75V ≤ V _{CM} ≤ 3.5		80	96		80	96	dB	
Power-Supply Rejection Ratio	PSRR	Positive supply: 4.6V ≤ V ₊ ≤ 5.4V		60	75		60	75	dB	
		Negative supply: -2V ≥ V ₋ ≥ -7V		80	100		80	100		
Small-Signal Voltage Gain	A _V	1V ≤ V _{OUT} ≤ 2V, T _A = +25°C		1400	3000		1400	3000	V/V	
Output High Voltage	V _{OH}	V ₊ ≥ 4.6V	I _{OUT} = 1mA	2.7	3.4		2.7	3.4	V	
			I _{OUT} = 10mA	2.4	3.0		2.4	3.0		
Output Low Voltage	V _{OL}		I _{SINK} = 4mA		0.3	0.5		0.3	0.5	V
			I _{SINK} = 10mA, T _A = +25°C		0.4			0.4		
Positive Supply Current	I ₊			25	35		25	35	mA	
Negative Supply Current	I ₋			3	5		3	5	mA	
Latch Pin High Input Voltage	V _{IH}			2.0			2.0			V
Latch Pin Low Input Voltage	V _{IL}			0.8			0.8			V
Latch Pin Current	I _{IL}	V _{LE} = 0V		-500			-500			μA
Propagation Delay (Note 3)	t _{PD}	ΔV _{IN} = 100mV, OD = 5mV	T _A = +25°C	10	14		10	14	ns	
				16			16			
		ΔV _{IN} = 100mV, OD = 20mV	T _A = +25°C	9	12		9	12		
				15			15			
Differential Propagation Delay (Note 3)	Δt _{PD}	ΔV _{IN} = 100mV, OD = 5mV, T _A = +25°C		3			3			ns
Latch Setup Time	t _{SU}	(Note 4)		2			2			ns

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ELECTRICAL CHARACTERISTICS – LT1116

(V+ = 5V, V- = -5V, V_{OUT} (Q) = 1.4V, V_{LE} = 0V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Specifications for V_{OS}, I_B, CMRR and A_V are valid for single-supply operation, V+ = 5V, V- = 0V.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 1)	V _{OS}	R _S ≤ 100Ω	T _A = +25°C		1.0	±3	mV
						3.5	
Input Offset-Voltage Drift	ΔV _{OS} /ΔT				5		μV/°C
Input Offset Current (Note 1)	I _{OS}				0.5	2	μA
Input Bias Current, Sourcing (Note 2)	I _B				10	20	μA
Input Voltage Range	V _{CM}			V-		(V+ - 2.5)	V
		Single 5V supply		0		2.5	
Common-Mode Rejection Ratio	CMRR	-5V ≤ V _{CM} ≤ 2.5V		75	90		dB
		0V ≤ V _{CM} ≤ 2.5V, V _S = +5V, 0V		65	90		
Power-Supply Rejection Ratio	PSRR	Positive Supply: 4.6V ≤ V+ ≤ 5.4V		60	75		dB
		Negative Supply: -7V ≤ V- ≤ -2V		80	100		
Small-Signal Voltage Gain	A _V	1V ≤ V _{OUT} ≤ 2V, T _A = +25°C		1400	3000		V/V
Output High Voltage	V _{OH}	I _{SOURCE} = 1mA		2.7	3.4		V
		I _{SOURCE} = 10mA		2.4	3.0		
Output Low Voltage	V _{OL}	I _{SINK} = 4mA			0.3	0.5	V
		I _{SINK} = 10mA, T _A = +25°C			0.4		
Positive Supply Current	I+				27	38	mA
Negative Supply Current	I-				5	7	mA
Latch Pin High Input Voltage	V _{IH}			2.0			V
Latch Pin Low Input Voltage	V _{IL}					0.8	V
Latch Input Current	I _{IL}	V _{LE} = 0V			-20	-500	μA
Propagation Delay (Note 3)	t _{PD}	ΔV _{IN} = 100mV, OD = 5mV	T _A = +25°C		12	16	ns
		ΔV _{IN} = 100mV, OD = 20mV	T _A = +25°C		10	14	
						16	
Differential Propagation Delay (Note 3)	Δt _{PD}	ΔV _{IN} = 100mV, OD = 5mV, T _A = +25°C				3	ns
Latch Setup Time (Note 4)	t _{SU}				2		ns
Latch Hold Time (Note 4)	t _H				2		ns

Note 1: 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 2: Input bias current (I_B) is defined as the average of the two input currents.

Note 3: t_{PD} and Δt_{PD} cannot be measured in automatic handling equipment with low values of overdrive. The LT1016/LT1116 are sample tested to 0.1% AQL with a 1V step and 500mV overdrive at +25°C only. Correlation tests have shown that t_{PD} and Δt_{PD} limits shown can be guaranteed with this test, if additional DC tests are performed to guarantee that all internal bias conditions are correct. For low overdrive conditions, V_{OS} is added to overdrive.

Note 4: 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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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