



Ultra-Fast Precision TTL Comparators

General Description

The Maxim MXL1016 (10ns typ) and MXL1116 (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.

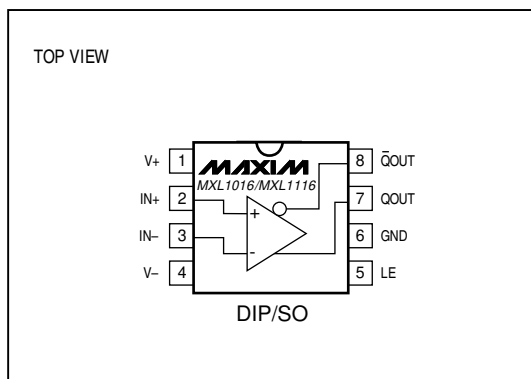
The MXL1016/MXL1116 remain stable with the outputs in the active region, which greatly reduces output instability common with slow-moving input signals. In addition, an output latch (LE) is provided.

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 MXL1016 and MXL1116, 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

Pin Configuration



Features

- ♦ Ultra Fast (10ns typ)
- ♦ Single +5V or Dual $\pm 5V$ Supply Operation
- ♦ Input Common-Mode Extends to Negative Supply (MXL1116)
- ♦ Inputs Can Exceed the Positive Supply Up to +15V (MXL1116) 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
MXL1016CN8	0°C to +70°C	8 Plastic DIP
MXL1016CS8	0°C to +70°C	8 SO
MXL1016MJ8	-55°C to +125°C	8 CERDIP
MXL1116CN8	0°C to +70°C	8 Plastic DIP
MXL1116CS8	0°C to +70°C	8 SO

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

MXL1016/MXL1116

Ultra-Fast Precision TTL Comparators

ABSOLUTE MAXIMUM RATINGS

Positive Supply Voltage.....	7V	Output Current (continuous).....	±20mA
Negative Supply Voltage.....	-7V	Continuous Power Dissipation (T _A = +70°C)	
Differential Input Voltage		Plastic DIP (derate 9.09mW/°C above +70°C)	727mW
MXL1016.....	±5V	SO (derate 5.88mW/°C above +70°C).....	471mW
MXL1116.....	±15V	CERDIP (derate 8.00mW/°C above +70°C).....	640mW
Input Voltage (either input)		Operating Temperature Ranges:	
MXL1016.....	Equal to Supplies	MXL1016C/MXL1116C	0°C to +70°C
MXL1116.....	(V ₋ - 0.3V) to 15V	MXL1016MJ	-55°C to +125°C
Latch Pin Voltage	Equal to Supplies	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 – MXL1016

(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	MXL1016M			MXL1016C			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
						3			3.5	
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
						1.3			1.3	
Input Bias Current (Note 2)	I _B		T _A = +25°C			5	10	5	10	μA
						13			13	
Input Voltage Range	V _{CM}		-3.75	+3.5		-3.75	+3.5			V
		Single 5V supply	+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	

Ultra-Fast Precision TTL Comparators

ELECTRICAL CHARACTERISTICS – MXL1116

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

MXL1016/MXL1116

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 1)	V_{OS}	$R_S \leq 100\Omega$	$T_A = +25^\circ\text{C}$	1.0	± 3		mV
						3.5	
Input Offset-Voltage Drift	$\Delta V_{OS}/\Delta T$				5		$\mu\text{V}/^\circ\text{C}$
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	$-5V \leq V_{CM} \leq 2.5V$		75	90		dB
		$0V \leq V_{CM} \leq 2.5V$, $V_S = +5V$, $0V$		65	90		
Power-Supply Rejection Ratio	PSRR	Positive Supply: $4.6V \leq V_+ \leq 5.4V$		60	75		dB
		Negative Supply: $-7V \leq V_- \leq -2V$		80	100		
Small-Signal Voltage Gain	A_V	$1V \leq V_{OUT} \leq 2V$, $T_A = +25^\circ\text{C}$		1400	3000		V/V
Output High Voltage	V_{OH}	$I_{SOURCE} = 1\text{mA}$		2.7	3.4		V
		$I_{SOURCE} = 10\text{mA}$		2.4	3.0		
Output Low Voltage	V_{OL}	$I_{SINK} = 4\text{mA}$			0.3	0.5	V
		$I_{SINK} = 10\text{mA}$, $T_A = +25^\circ\text{C}$			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}	$\Delta V_{IN} = 100\text{mV}$, $OD = 5\text{mV}$	$T_A = +25^\circ\text{C}$		12	16	ns
						18	
		$\Delta V_{IN} = 100\text{mV}$, $OD = 20\text{mV}$	$T_A = +25^\circ\text{C}$		10	14	
						16	
Differential Propagation Delay (Note 3)	Δt_{PD}	$\Delta V_{IN} = 100\text{mV}$, $OD = 5\text{mV}$, $T_A = +25^\circ\text{C}$				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. Correlation tests have shown that t_{PD} and Δt_{PD} limits shown can be guaranteed by design, 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.

Ultra-Fast Precision TTL Comparators

Package Information

**Plastic DIP
PLASTIC
DUAL-IN-LINE
PACKAGE
(0.300 in.)**

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
A1	0.015	—	0.38	—
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.016	0.022	0.41	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100	—	2.54	—
eA	0.300	—	7.62	—
eB	—	0.400	—	10.16
L	0.115	0.150	2.92	3.81

PKG.	DIM	PINS	INCHES		MILLIMETERS	
			MIN	MAX	MIN	MAX
P	D	8	0.348	0.390	8.84	9.91
P	D	14	0.735	0.765	18.67	19.43
P	D	16	0.745	0.765	18.92	19.43
P	D	18	0.885	0.915	22.48	23.24
P	D	20	1.015	1.045	25.78	26.54
N	D	24	1.14	1.265	28.96	32.13

21-0043A

**Narrow SO
SMALL-OUTLINE
PACKAGE
(0.150 in.)**

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
E	0.150	0.157	3.80	4.00
e	0.050		1.27	
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	0.189	0.197	4.80	5.00
D	14	0.337	0.344	8.55	8.75
D	16	0.386	0.394	9.80	10.00

21-0041A

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

4 _____ Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 (408) 737-7600