

# LT1016

## ULTRA-FAST PRECISION LATCHED COMPARATOR

D3242, MAY 1988—REVISED MARCH 1989

- Ultra-Fast . . . 10 ns Typ  $t_{pd}$
- Operates from Single 5-V or Dual  $\pm 5$ -V Supply
- Complementary TTL Outputs
- Low Input Offset Voltage . . . 0.8 mV or 1 mV Typ
- No Minimum Input Slew Rate Requirement
- No Supply Current Spiking
- Output Latch

### description

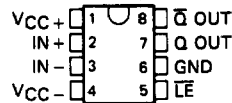
The LT1016 is an ultra-fast comparator specifically designed to interface directly to TTL logic while operating from either a dual  $\pm 5$ -V supply or a single 5-V supply. The LT1016 offers tight offset voltage specifications and high gain for precision applications. Matched complementary outputs further extend the versatility of the LT1016.

The LT1016 features a unique output stage that provides active drive in both directions for maximum speed into TTL-logic or passive loads yet does not exhibit the large current spikes normally found in totem-pole output stages. This eliminates the need for a minimum input slew rate typical of other fast comparators. The LT1016's ability to remain stable with the outputs in the active region greatly reduces the problem of output "glitching" when the input signal is slow moving or is at a low level.

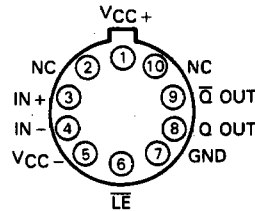
The LT1016 has a true latch for retaining input data at the outputs. The outputs remain latched as long as the latch enable input  $\overline{LE}$  is high. Quiescent negative supply current is only 3 mA, about ten times lower than competitive units. This feature reduces die temperature and allows the negative supply pin to be driven from virtually any supply voltage with a simple resistive divider. Device performance is not affected by variations in negative supply voltage.

The LT1016M is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The LT1016C is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

D, JG, OR P PACKAGE  
(TOP VIEW)



L PACKAGE  
(TOP VIEW)



NC—No internal connection.

All leads of the L package are electrically insulated from the case.

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Voltage Comparators

### AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGE			
	SMALL OUTLINE (D)	CERAMIC DIP (JG)	METAL CAN (L)	PLASTIC DIP (P)
0°C to 70°C	LT1016CD	LT1016CJG	LT1016CL	LT1016CP
-55°C to 125°C		LT1016MJG	LT1016ML	

The D package is available taped and reeled. Add the suffix R to the device type (e.g., LT1016CDR).

**PRODUCTION DATA** documents contain information 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.



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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC+}$ (see Note 1)	7 V
Supply voltage, $V_{CC-}$	-7 V
Differential input voltage (see Note 2)	$\pm 5$ V
Input voltage (either input)	$V_{CC\pm}$
Latch enable input voltage	$V_{CC\pm}$
Output current, $I_O$	$\pm 20$ mA
Operating free-air temperature range: LT1016M	-55°C to 125°C
LT1016C	0°C to 70°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: JG package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: L package	300°C

- NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .  
 2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.  
 3. The output may be shorted to ground or to either power supply.

## recommended operating conditions

		LT1016M			LT1016C			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC+}$				5		5	V	
Supply voltage, $V_{CC-}$				-5		-5	V	
Input voltage, $V_I$	$V_{CC\pm} = \pm 15$ V	-3.75	3.5	-3.75	3.5		V	
	$V_{CC+} = 5$ V, $V_{CC-} = 0$	1.25	3.5	1.25	1.25			
Operating free-air temperature, $T_A$		-55	125	0	70		°C	

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**electrical characteristics,  $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = -5\text{ V}$ ,  $V_{O(Q)} = 1.4\text{ V}$ ,  $\overline{\text{LE}}$  at 0 V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	LT1016M			LT1016C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage (see Note 4)	$R_S \leq 100\ \Omega$	25°C	0.8			1			mV
		Full range				3.5			
$\alpha V_{IO}$ Average temperature coefficient of input offset voltage		Full range	4			4			$\mu\text{V}/^\circ\text{C}$
$I_{IO}$ Input offset current (see Note 4)		25°C	0.3			0.3			$\mu\text{A}$
		Full range				1.3			
$I_{IB}$ Input bias current (see Note 5)	$V_O = 1.4\text{ V}$	25°C	5			5			$\mu\text{A}$
		Full range				13			
$V_{ICR}$ Common-mode input voltage range	Dual supply	Full range	-3.75 to 3.5			-3.75 to 3.5			V
	Single supply	Full range	1.25 to 3.5			1.25 to 3.5			
$V_I$ Input voltage	$\overline{\text{LE}}$ high	Full range	2			2			V
	$\overline{\text{LE}}$ low	Full range				0.8			
$V_{OH}$ High-level output voltage	$V_{CC+} \leq 4.6\text{ V}$ , $I_O = 1\text{ mA}$	Full range	2.7			2.7			V
	$V_{CC+} \leq 4.6\text{ V}$ , $I_O = 10\text{ mA}$		2.4			2.4			
$V_{OL}$ Low-level output voltage	$I_O = 4\text{ mA}$	Full range	0.5			0.5			V
	$I_O = 10\text{ mA}$		25°C			0.4			
$A_{VD}$ Small-signal differential voltage amplification	$V_O = 1\text{ V to }2\text{ V}$	25°C	1400 3000			1400 3000			V/V
CMRR Common-mode rejection ratio	$V_{IC} = -3.75\text{ V to }3.5\text{ V}$	Full range	80			80			dB
$k_{SVR}$ Supply voltage rejection ratio	Positive supply, $V_{CC+} = 4.6\text{ V to }5.4\text{ V}$	Full range	60			60			dB
	Negative supply, $V_{CC-} = 2\text{ V to }7\text{ V}$		80			80			
$I_{CC+}$ Supply current from $V_{CC+}$		Full range	35			35			mA
$I_{CC-}$ Supply current from $V_{CC-}$		Full range	5			5			mA
$I_l$ Latch pin input current		Full range	500			500			$\mu\text{A}$

$^\dagger$ Full range is  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  for the LT1016M. Full range is  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for the LT1016C.

NOTES: 4. Input offset voltage is defined as the average of the two voltages measured by forcing first one output and then the other to 1.4 V. Input offset current is defined in an analogous way.

5. Input bias current is defined as the average of the two input currents.

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Voltage Comparators

**LT1016**  
**ULTRA-FAST PRECISION LATCHED COMPARATOR**

switching characteristics,  $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = -5\text{ V}$ ,  $\overline{LE}$  at 0 V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$ †	MIN	TYP	MAX	UNIT
$t_{pd}$ Propagation delay time	$\Delta V_I = 100\text{ mV}$ , 5-mV overdrive, See Note 6	25°C		10	14	ns
		Full range			16	
	$\Delta V_I = 100\text{ mV}$ , 20-mV overdrive, See Note 6	25°C		10	14	
		Full range			16	
$\Delta t_{pd}$ Differential propagation delay	$\Delta V_I = 100\text{ mV}$ , 5-mV overdrive, See Note 6	25°C			3	ns
		Latch minimum setup time	25°C		2	ns

†Full range is -55°C to 125°C for the LT1016M. Full range is 0°C to 70°C for the LT1016C.

NOTE 6:  $t_{pd}$  and  $\Delta t_{pd}$  cannot be measured in automatic-handling test equipment with low values of overdrive. The LT1016 is tested with a 1-V step and 500-mV overdrive. Correlation testing indicates that  $t_{pd}$  and  $\Delta t_{pd}$  limits shown can be met with this test. For low overdrive conditions,  $V_{IO}$  is added to the overdrive.



Voltage Comparators