FAIRCHILD SEMICONDUCTOR™

October 1987
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CD40106BC
Hex Schmitt Trigger

General Description

The CD40106BC Hex Schmitt Trigger is a monolithic complementary MOS (CMOS) integrated circuit constructed with N and P-channel enhancement transistors. The positive and negative-going threshold voltages, V_{T+} and V_{T-}, show low variation with respect to temperature (typ 0.0005V/°C at V_{DD} = 10V), and hysteresis, $V_{T+} - V_{T-} \geq 0.2$ V_{DD} is guaranteed.

All inputs are protected from damage due to static discharge by diode clamps to V_{DD} and V_{SS}.

Features

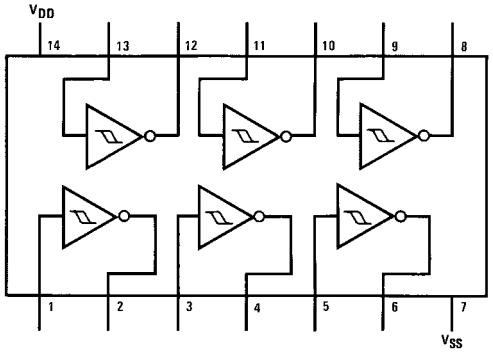
- Wide supply voltage range: 3V to 15V
- High noise immunity: 0.7 V_{DD} (typ.)
- Low power TTL compatibility:
  Fan out of 2 driving 74L or 1 driving 74LS
- Hysteresis: 0.4 V_{DD} (typ.),
  0.2 V_{DD} guaranteed
- Equivalent to MM74C14

Ordering Code:

Order Number	Package Number	Package Description
CD40106BCM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD40106BCN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

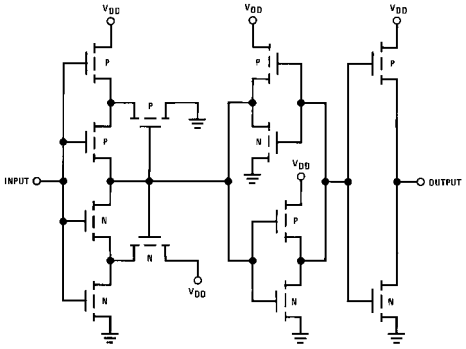
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Top View

Schematic Diagram



Absolute Maximum Ratings (Note 1)

(Note 2)

DC Supply Voltage (V_{DD})	−0.5 to +18 V_{DC}
Input Voltage (V_{IN})	−0.5 to V_{DD} +0.5 V_{DC}
Storage Temperature Range (T_S)	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C

Recommended Operating Conditions (Note 2)

DC Supply Voltage (V_{DD})	3 to 15 V_{DC}
Input Voltage (V_{IN})	0 to V_{DD} V_{DC}
Operating Temperature Range (T_A)	−55°C to +125°C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

Note 2: V_{SS} = 0V unless otherwise specified.

DC Electrical Characteristics (Note 3)

Symbol	Parameter	Conditions	−55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V		1.0			1.0		30	
		V_{DD} = 10V		2.0			2.0		60	µA
		V_{DD} = 15V		4.0			4.0		120	
V_{OL}	LOW Level Output	$\|I_O\|$ < 1 µA								
	Voltage	V_{DD} = 5V		0.05			0.05		0.05	V
		V_{DD} = 10V		0.05			0.05		0.05	
		V_{DD} = 15V		0.05			0.05		0.05	
V_{OH}	HIGH Level Output	$\|I_O\|$ < 1 µA								
	Voltage	V_{DD} = 5V	4.95		4.95	5		4.95		V
		V_{DD} = 10V	9.95		9.95	10		0.95		
		V_{DD} = 15V	14.95		14.95	15		14.95		
V_{T-}	Negative-Going Threshold	V_{DD} = 5V, V_O = 4.5V	0.7	2.0	0.7	1.4	2.0	0.7	2.0	
	Voltage	V_{DD} = 10V, V_O = 9V	1.4	4.0	1.4	3.2	4.0	1.4	4.0	V
		V_{DD} = 15V, V_O = 13.5V	2.1	6.0	2.1	5.0	6.0	2.1	6.0	
V_{T+}	Positive-Going Threshold	V_{DD} = 5V, V_O = 0.5V	3.0	4.3	3.0	3.6	4.3	3.0	4.3	
	Voltage	V_{DD} = 10V, V_O = 1V	6.0	8.6	6.0	6.8	8.6	6.0	8.6	V
		V_{DD} = 15V, V_O = 1.5V	9.0	12.9	9.0	10.0	12.9	9.0	12.9	
V_H	Hysteresis ($V_{T+} - V_{T-}$)	V_{DD} = 5V	1.0	3.6	1.0	2.2	3.6	1.0	3.6	
	Voltage	V_{DD} = 10V	2.0	7.2	2.0	3.6	7.2	2.0	7.2	V
		V_{DD} = 15V	3.0	10.8	3.0	5.0	10.8	3.0	10.8	
I_{OL}	LOW Level Output	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		
	Current (Note 3)	V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.25		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	8.8		2.4		
I_{OH}	HIGH Level Output	V_{DD} = 5V, V_O = 4.6V	−0.64		−0.51	−0.88		−0.36		
	Current (Note 3)	V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.25		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−8.8		−2.4		
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.1		-10^{-5}	−0.1		−1.0	µA
		V_{DD} = 15V, V_{IN} = 15V		0.1		10^{-5}	0.1		1.0	

Note 3: I_{OH} and I_{OL} are tested one output at a time.

AC Electrical Characteristics (Note 4)

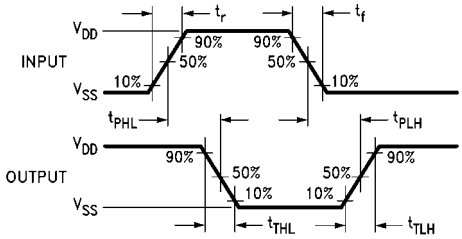
$T_A = 25°C$, $C_L = 50$ pF, $R_L = 200$k, t_r and $t_f = 20$ ns, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL} or t_{PLH}	Propagation Delay Time from Input to Output	$V_{DD} = 5V$		220	400	ns
		$V_{DD} = 10V$		80	200	
		$V_{DD} = 15V$		70	160	
t_{THL} or t_{TLH}	Transition Time	$V_{DD} = 5V$		100	200	ns
		$V_{DD} = 10V$		50	100	
		$V_{DD} = 15V$		40	80	
C_{IN}	Average Input Capacitance	Any Input		5	7.5	pF
C_{PD}	Power Dissipation Capacity	Any Gate (Note 5)		14		pF

Note 4: AC Parameters are guaranteed by DC correlated testing.

Note 5: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation see 74C Family Characteristics Application Note, AN-90.

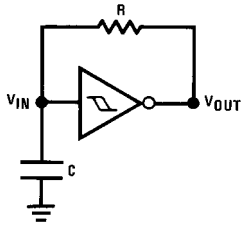
Switching Time Waveforms



$t_r = t_f = 20$ ns

Typical Applications

Low Power Oscillator



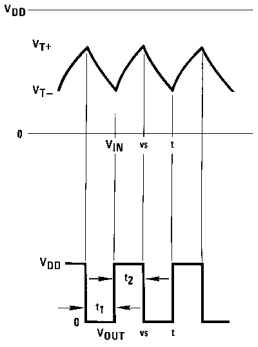
$$t_1 \approx RC\,\ell n\frac{V_{T+}}{V_{T-}}$$

$$t_2 \approx RC\,\ell n\frac{V_{DD} - V_{T-}}{V_{DD} - V_{T+}}$$

$$f \approx \frac{1}{RC\,\ell n\frac{V_T \cdot (V_{DD} - V_T)}{V_{T-}(V_{DD} - V_{T+})}}$$

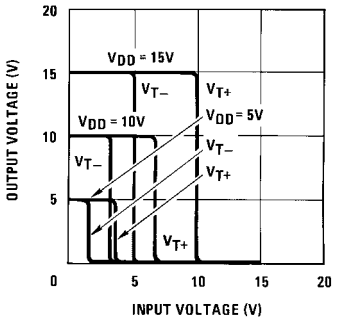
Note: The equations assume

$t_1 + t_2 >> t_{PHL} + t_{PLH}$

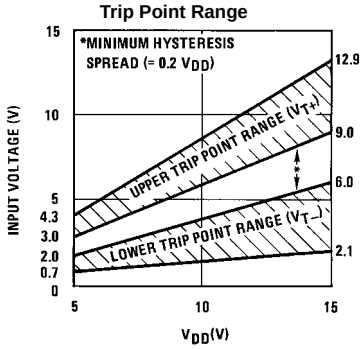


Typical Performance Characteristics

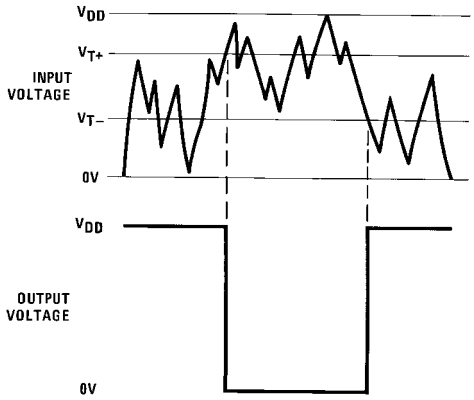
Typical Transfer Characteristics



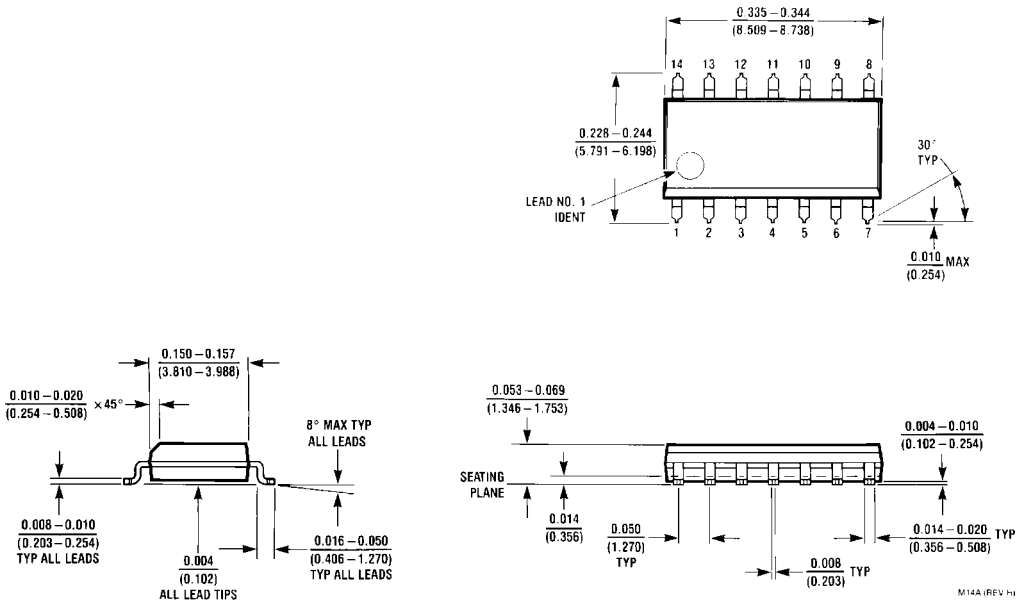
Guaranteed Trip Point Range



Guaranteed

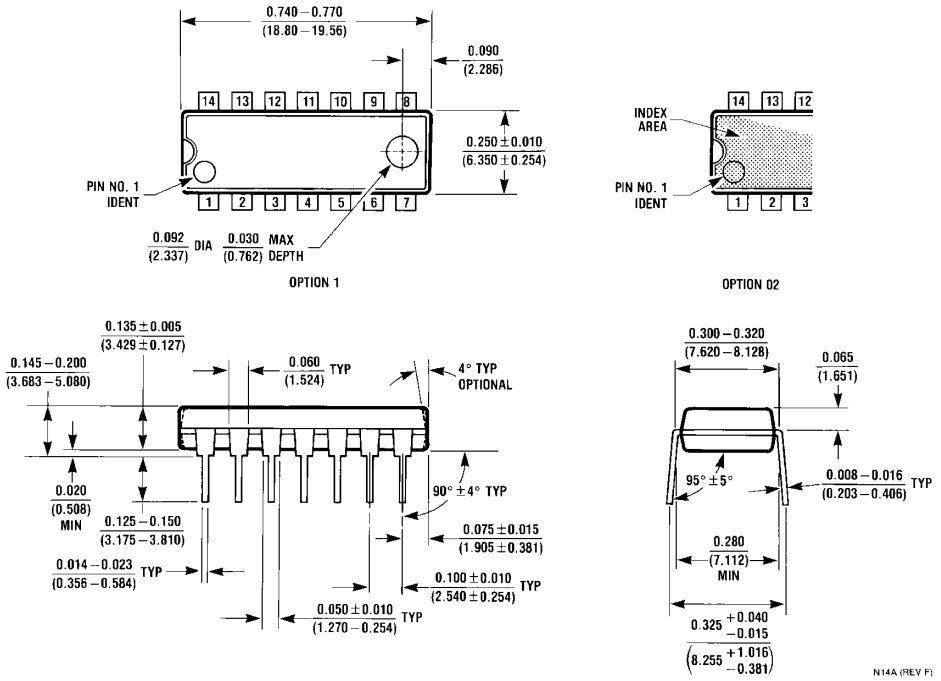


Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N14A

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