FAIRCHILD

SEMICONDUCTOR ™

October 1987
Revised April 2002

CD4511BC
BCD-to-7 Segment Latch/Decoder/Driver

General Description

The CD4511BC BCD-to-seven segment latch/decoder/driver is constructed with complementary MOS (CMOS) enhancement mode devices and NPN bipolar output drivers in a single monolithic structure. The circuit provides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and an output drive capability. Lamp test (LT), blanking (BI), and latch enable (LE) inputs are used to test the display, to turn-off or pulse modulate the brightness of the display, and to store a BCD code, respectively. It can be used with seven-segment light emitting diodes (LED), incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly.

Applications include instrument (e.g., counter, DVM, etc.) display driver, computer/calculator display driver, cockpit display driver, and various clock, watch, and timer uses.

Features

■ Low logic circuit power dissipation
■ High current sourcing outputs (up to 25 mA)
■ Latch storage of code
■ Blanking input
■ Lamp test provision
■ Readout blanking on all illegal input combinations
■ Lamp intensity modulation capability
■ Time share (multiplexing) facility
■ Equivalent to Motorola MC14511

Ordering Code:

Order Number	Package Number	Package Description
CD4511BCWM	M16B	16-Lead Small Outline Intergrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
CD4511BCN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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

Connection Diagrams

Top View
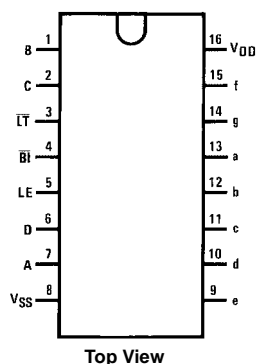
Segment Identification

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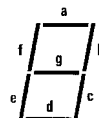
Truth Table

Inputs							Outputs							
LE	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	B
X	0	1	X	X	X	X	0	0	0	0	0	0	0	
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	
0	1	1	1	0	1	1	0	0	0	0	0	0	0	
0	1	1	1	1	0	0	0	0	0	0	0	0	0	
0	1	1	1	1	0	1	0	0	0	0	0	0	0	
0	1	1	1	1	1	0	0	0	0	0	0	0	0	
0	1	1	1	1	1	1	0	0	0	0	0	0	0	
1	1	1	X	X	X	X				*				*

X = Don't Care
*Depends upon the BCD code applied during the 0 to 1 transition of LE.

Display

0 1 2 3 4 5 6 7 8 9
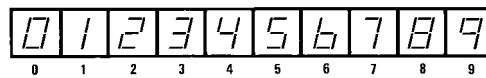
Absolute Maximum Ratings(Note 1)

DC Supply Voltage (V_{DD})	−0.5V to +18V
Input Voltage (V_{IN})	−0.5V to V_{DD} +0.5V
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

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

Note 1: Devices should not be connected with power on.

DC Electrical Characteristics

Symbol	Parameter	Conditions	−55°C Min	−55°C Max	+25°C Min	+25°C Typ	+25°C Max	+125°C Min	+125°C Max	Units
I_{DD}	Quiescent	V_{DD} = 5V		5			5		150	
	Supply Current	V_{DD} = 10V		10			10		300	μA
		V_{DD} = 15V		20			20		600	
V_{OL}	Output Voltage	V_{DD} = 5V		0.01		0	0.01		0.05	
	Logical "0"	V_{DD} = 10V		0.01		0	0.01		0.05	V
	Level	V_{DD} = 15V		0.01		0	0.01		0.05	
V_{OH}	Output Voltage	V_{DD} = 5V	4.1		4.1	4.57		4.1		
	Logical "1"	V_{DD} = 10V	9.1		9.1	9.58		9.1		V
	Level	V_{DD} = 15V	14.1		14.1	14.59		14.1		
V_{IL}	LOW Level	V_{DD} = 5V, V_{OUT} = 3.8V or 0.5V		1.5		2	1.5		1.5	
	Input Voltage	V_{DD} = 10V, V_{OUT} = 8.8V or 1.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_{OUT} = 13.8V or 1.5V		4.0		6	4.0		4.0	
V_{IH}	HIGH Level	V_{DD} = 5V, V_{OUT} = 0.5V or 3.8V	3.5		3.5	3		3.5		
	Input Voltage	V_{DD} = 10V, V_{OUT} = 1.0V or 8.8V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_{OUT} = 1.5V or 13.8V	11.0		11.0	9		11.0		
V_{OH}	Output	V_{DD} = 5V, I_{OH} = 0 mA	4.1		4.1	4.57		4.1		
	(Source) Drive	V_{DD} = 5V, I_{OH} = 5 mA				4.24				
	Voltage	V_{DD} = 5V, I_{OH} = 10 mA	3.9		3.9	4.12		3.5		V
		V_{DD} = 5V, I_{OH} = 15 mA				3.94				
		V_{DD} = 5V, I_{OH} = 20 mA	3.4		3.4	3.75		3.0		
		V_{DD} = 5V, I_{OH} = 25 mA				3.54				
		V_{DD} = 10V, I_{OH} = 0 mA	9.1		9.1	9.58		9.1		
		V_{DD} = 10V, I_{OH} = 5 mA				9.26				
		V_{DD} = 10V, I_{OH} = 10 mA	9.0		9.0	9.17		8.6		V
		V_{DD} = 10V, I_{OH} = 15 mA				9.04				
		V_{DD} = 10V, I_{OH} = 20 mA	8.6		8.6	8.9		8.2		
		V_{DD} = 10V, I_{OH} = 25 mA				8.75				
		V_{DD} = 15V, I_{OH} = 0 mA	14.1		14.1	9.58		14.1		
		V_{DD} = 15V, I_{OH} = 5 mA				14.27				
		V_{DD} = 15V, I_{OH} = 10 mA	14.0		14.0	14.17		13.6		V
		V_{DD} = 15V, I_{OH} = 15 mA				14.07				
		V_{DD} = 15V, I_{OH} = 20 mA	13.6		13.6	13.95		13.2		
		V_{DD} = 15V, I_{OH} = 25 mA				13.80				
I_{OL}	LOW Level	V_{DD} = 5V, V_{OL} = 0.4V	0.64		0.51	0.88		0.36		
	Output Current	V_{DD} = 10V, V_{OL} = 0.5V	1.6		1.3	2.25		0.9		mA
		V_{DD} = 15V, V_{OL} = 1.5V	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	

AC Electrical Characteristics (Note 2)

$T_A = 25°C$ and $C_L = 50$ pF, typical temperature coefficient for all values of $V_{DD} = 0.3\%/°C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
C_{IN}	Input Capacitance	$V_{IN} = 0$		5.0	7.5	pF
t_r	Output Rise Time (Figure 1**a**)	$V_{DD} = 5V$		40	80	ns
		$V_{DD} = 10V$		30	60	
		$V_{DD} = 15V$		25	50	
t_f	Output Fall Time (Figure 1**a**)	$V_{DD} = 5V$		125	250	ns
		$V_{DD} = 10V$		75	150	
		$V_{DD} = 15V$		65	130	
t_{PLH}	Turn-Off Delay Time (Data) (Figure 1**a**)	$V_{DD} = 5V$		640	1280	ns
		$V_{DD} = 10V$		250	500	
		$V_{DD} = 15V$		175	350	
t_{PHL}	Turn-On Delay Time (Data) (Figure 1**a**)	$V_{DD} = 5V$		720	1440	ns
		$V_{DD} = 10V$		290	580	
		$V_{DD} = 15V$		195	400	
t_{PLH}	Turn-Off Delay Time (Blank) (Figure 1**a**)	$V_{DD} = 5V$		320	640	ns
		$V_{DD} = 10V$		130	260	
		$V_{DD} = 15V$		100	200	
t_{PHL}	Turn-On Delay Time (Blank) (Figure 1**a**)	$V_{DD} = 5V$		485	970	ns
		$V_{DD} = 10V$		200	400	
		$V_{DD} = 15V$		160	320	
t_{PLH}	Turn-Off Delay Time (Lamp Test) (Figure 1**a**)	$V_{DD} = 5V$		313	625	ns
		$V_{DD} = 10V$		125	250	
		$V_{DD} = 15V$		90	180	
t_{PHL}	Turn-On Delay Time (Lamp Test) (Figure 1 **a**)	$V_{DD} = 5V$		313	625	ns
		$V_{DD} = 10V$		125	250	
		$V_{DD} = 15V$		90	180	
t_{SETUP}	Setup Time (Figure 1**b**)	$V_{DD} = 5V$	180	90		ns
		$V_{DD} = 10V$	76	38		
		$V_{DD} = 15V$	40	20		
t_{HOLD}	Hold Time (Figure 1**b**)	$V_{DD} = 5V$	0	−90		ns
		$V_{DD} = 10V$	0	−38		
		$V_{DD} = 15V$	0	−20		
PW_{LE}	Minimum Latch Enable Pulse Width (Figure 1 **c**)	$V_{DD} = 5V$	520	260		ns
		$V_{DD} = 10V$	220	110		
		$V_{DD} = 15V$	130	65		

Note 2: AC Parameters are guaranteed by DC correlated testing.

Switching Time Waveforms
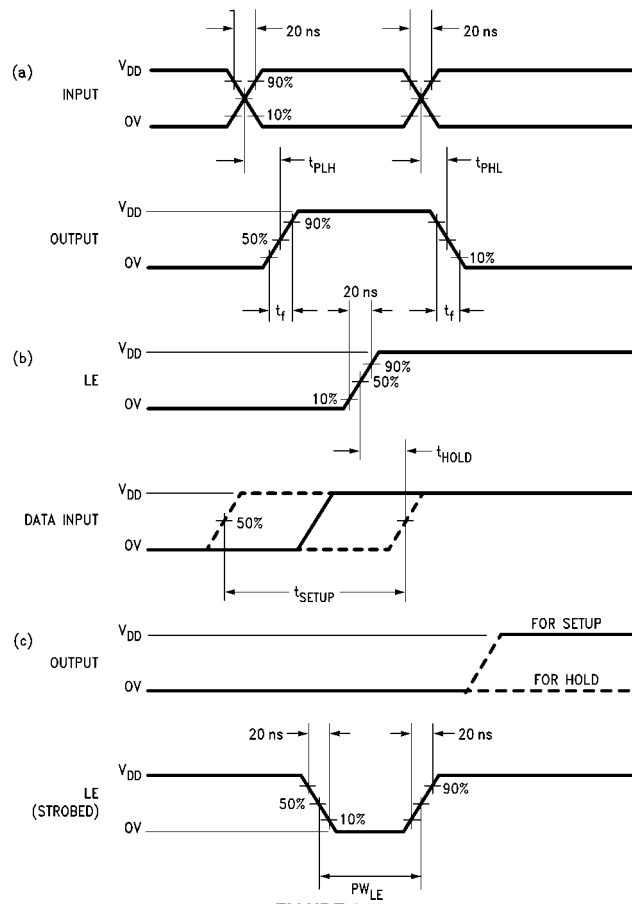
FIGURE 1.

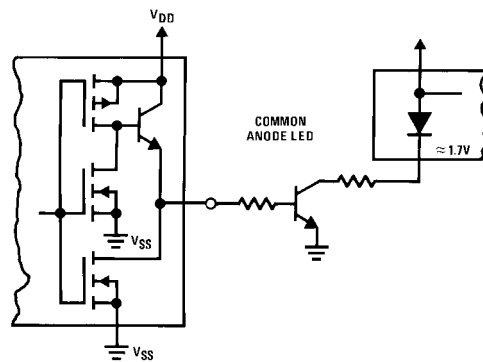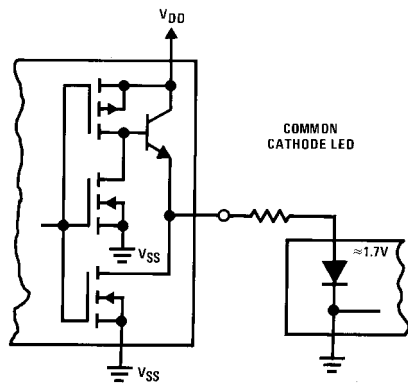# Typical Applications

Light Emitting Diode (LED) Readout

COMMON CATHODE LED

$\approx 1.7V$

COMMON ANODE LED

$\approx 1.7V$

Gas Discharge Readout

APPROPRIATE VOLTAGE

Liquid Crystal (LC) Readout

EXCITATION (SQUARE WAVE, V_{SS} TO V_{DD})

MM74C86
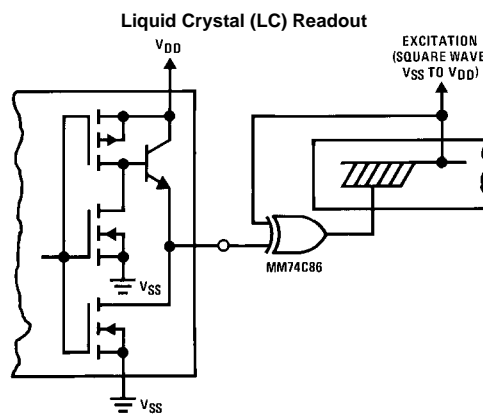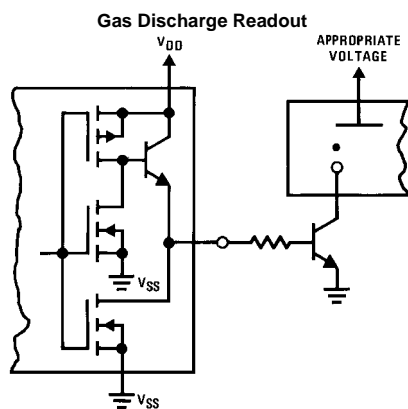
Direct DC drive of LC's not recommended for life of LC readouts.

Incandescent Readout

V_{DD}

**
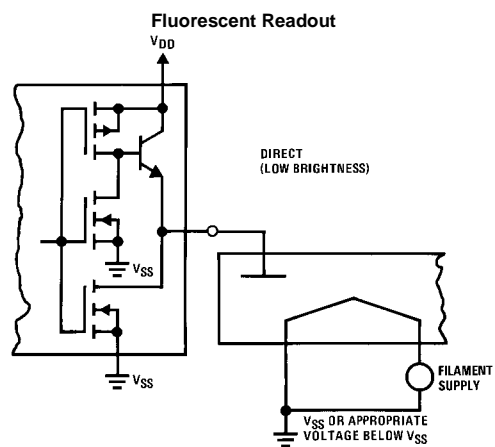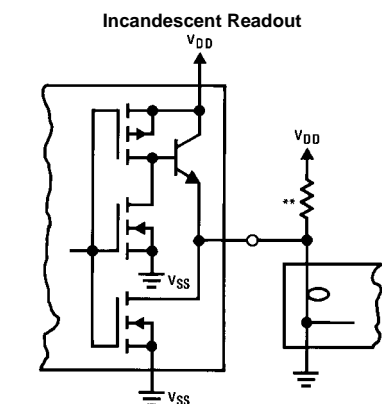
**A filament pre-warm resistor is recommended to reduce filament thermal shock and increase the effective cold resistance of the filament.

Fluorescent Readout

DIRECT (LOW BRIGHTNESS)

FILAMENT SUPPLY

V_{SS} OR APPROPRIATE VOLTAGE BELOW V_{SS}

Physical Dimensions inches (millimeters) unless otherwise noted

-B-

0.3977–0.4133
─────────────
10.10–10.50

16 15 14 13 12 11 10 9

LEAD NO 1
IDENTIFICATION

0.2914–0.2992
─────────────
7.4–7.6

-C-

0.3940–0.4190
─────────────
10.00–10.65

1   2   3   4   5   6   7   8

0.050
─────
1.27

0.0138–0.0200
───────────── TYP
0.350–0.508

⊕ | 0.010 / 0.25 Ⓜ | A | C Ⓢ | B

0.0926–0.1043
─────────────
2.35–2.65

0.0040–0.0118
─────────────
0.1–0.3

-A-

SEATING
PLANE

0.014
─────
0.35

45° X 0.010–0.029
       ───────────
       0.25–0.75

0.0091–0.0125
───────────── TYP ALL LEADS
0.23–0.32

▱ | 0.004 / 0.1
ALL LEAD TIPS

0.0160–0.0500
───────────── TYP ALL LEADS
0.40–1.27

B MAX TYP
ALL LEADS

M16B (REV F)
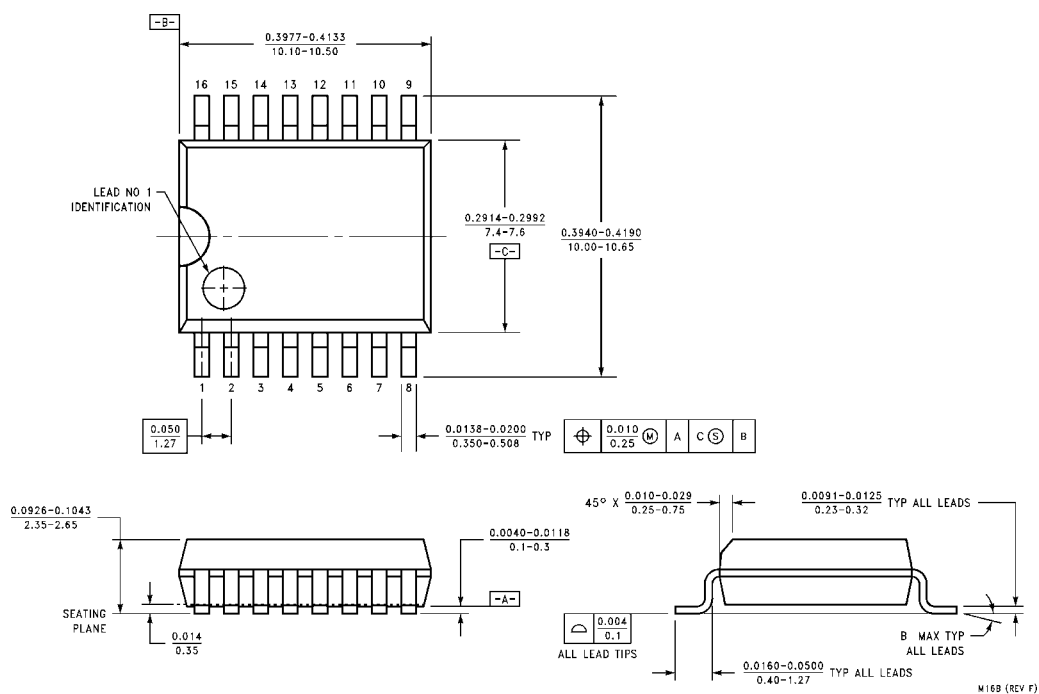
16-Lead Small Outline Intergrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M16B

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)
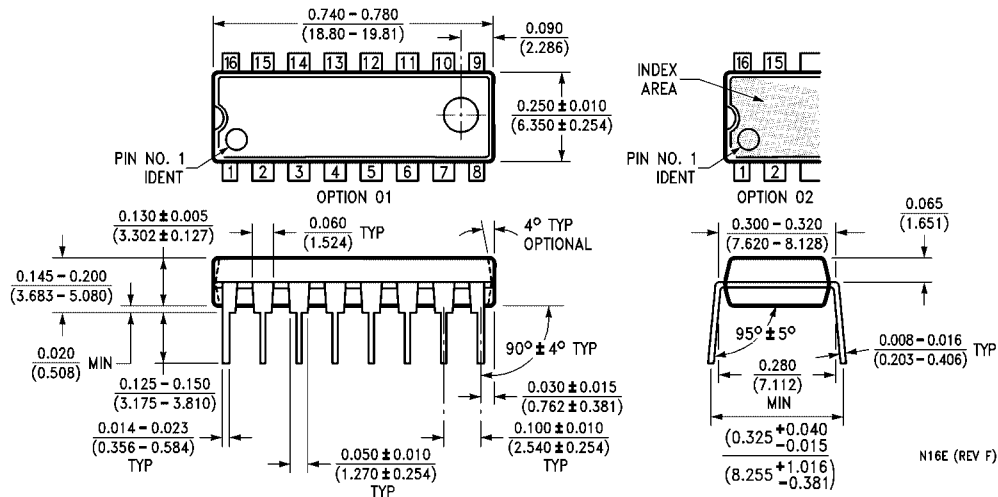
**16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N16E**

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