FAIRCHILD SEMICONDUCTOR™

October 1987
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CD4514BC • CD4515BC
4-Bit Latched/4-to-16 Line Decoders

General Description

The CD4514BC and CD4515BC are 4-to-16 line decoders with latched inputs implemented with complementary MOS (CMOS) circuits constructed with N- and P-channel enhancement mode transistors. These circuits are primarily used in decoding applications where low power dissipation and/or high noise immunity is required.

The CD4514BC (output active high option) presents a logical "1" at the selected output, whereas the CD4515BC presents a logical "0" at the selected output. The input latches are R–S type flip-flops, which hold the last input data presented prior to the strobe transition from "1" to "0". This input data is decoded and the corresponding output is activated. An output inhibit line is also available.

Features

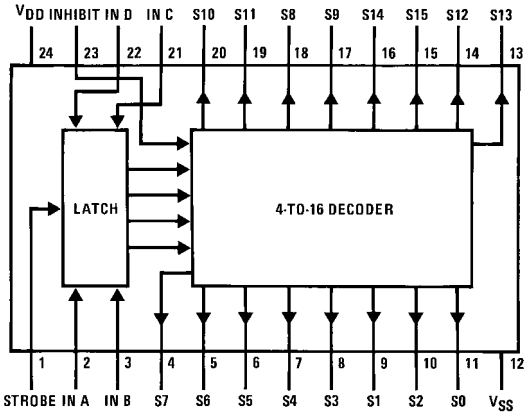
- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 V_{DD} (typ.)
- Low power TTL: fan out of 2
  compatibility: driving 74L
- Low quiescent power dissipation:
  0.025 µW/package @ 5.0 V_{DC}
- Single supply operation
- Input impedance = $10^{12}\Omega$ typically
- Plug-in replacement for MC14514, MC14515

Ordering Code:

Order Number	Package Number	Package Diagram
CD4514BCWM	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
CD4514BCN	N24A	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-011, 0.600" Wide
CD4515BCWM (Note 1)	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
CD4515BCN	N24A	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-011, 0.600" Wide

Note 1: Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Connection Diagram



Top View

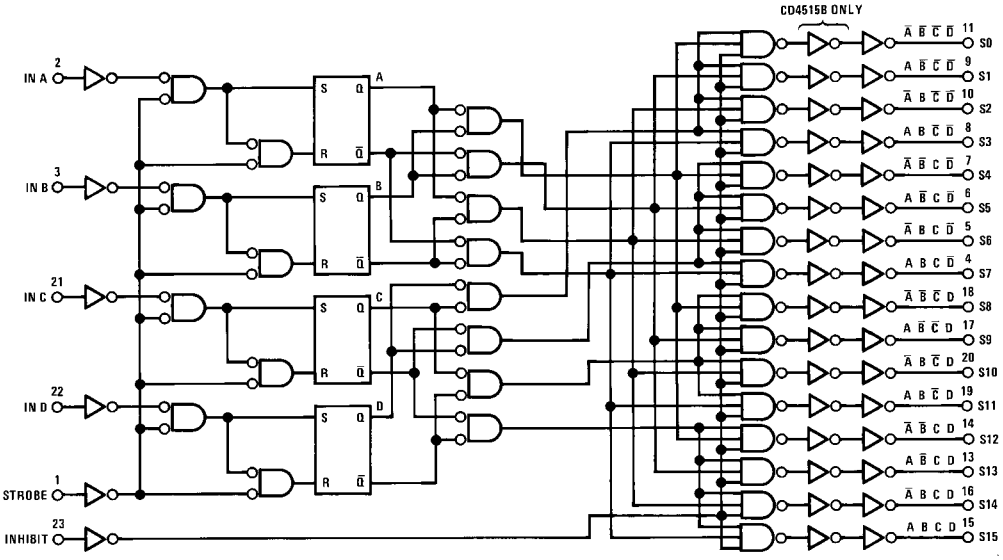
Truth Table

Decode Truth Table (Strobe = 1)

Inhibit	Data Inputs				Selected Output CD4514 = Logic "1" CD4515 = Logic "0"
	D	C	B	A	
0	0	0	0	0	S0
0	0	0	0	1	S1
0	0	0	1	0	S2
0	0	0	1	1	S3
0	0	1	0	0	S4
0	0	1	0	1	S5
0	0	1	1	0	S6
0	0	1	1	1	S7
0	1	0	0	0	S8
0	1	0	0	1	S9
0	1	0	1	0	S10
0	1	0	1	1	S11
0	1	1	0	0	S12
0	1	1	0	1	S13
0	1	1	1	0	S14
0	1	1	1	1	S15
1	X	X	X	X	All Outputs = 0, CD4514 All Outputs = 1, CD4515

X = Don't Care

Logic Diagram



Absolute Maximum Ratings(Note 2)

(Note 3)

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 (Note 3)

DC Supply Voltage (V_{DD})	3V to 15V
Input Voltage (V_{IN})	0V to V_{DD}
Operating Temperature Range (T_A)	
CD4514BC, CD4515BC	−55°C to +125°C

Note 2: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

Note 3: V_{SS} = 0V unless otherwise specified.

DC Electrical Characteristics (Note 3)

CD4514BC, CD4515BC

Symbol	Parameter	Conditions	−55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS}		5		0.005	5		150	
	Current	V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		10		0.010	10		300	µA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		20		0.015	20		600	
V_{OL}	LOW Level	V_{IL} = 0V, V_{IH} = V_{DD},								
	Output Voltage	$\|I_O\|$ < 1 µA								
		V_{DD} = 5V		0.05		0	0.05		0.05	
		V_{DD} = 10V		0.05		0	0.05		0.05	V
		V_{DD} = 15V		0.05		0	0.05		0.05	
V_{OH}	HIGH Level	V_{IL} = 0V, V_{IH} = V_{DD},								
	Output Voltage	$\|I_O\|$ < 1 µA								
		V_{DD} = 5V	4.95		4.95	5.0		4.95		
		V_{DD} = 10V	9.95		9.95	10.0		9.95		V
		V_{DD} = 15V	14.95		14.95	15.0		14.95		
V_{IL}	LOW Level	$\|I_O\|$ < 1 µA								
	Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	
V_{IH}	HIGH Level	$\|I_O\|$ < 1 µA								
	Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	2.75		3.5		
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	8.25		11.0		
I_{OL}	LOW Level Output	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		
	Current (Note 4)	V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.25		0.90		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 4)	V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.25		−0.90		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 4: I_{OH} and I_{OL} are tested one output at a time.

AC Electrical Characteristics (Note 5)

All types C_L = 50 pF, T_A = 25°C, $t_r = t_f$ = 20 ns unless otherwise specified

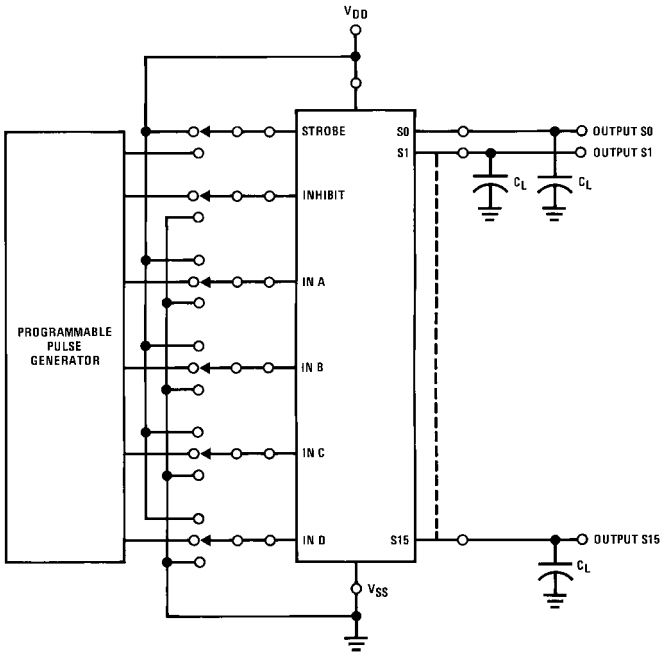
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{THL}, t_{TLH}	Transition Times	V_{DD} = 5V		100	200	
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		40	80	
t_{PLH}, t_{PHL}	Propagation Delay Times	V_{DD} = 5V		550	1100	
		V_{DD} = 10V		225	450	ns
		V_{DD} = 15V		150	300	
t_{PLH}, t_{PHL}	Inhibit Propagation	V_{DD} = 5V		400	800	
	Delay Times	V_{DD} = 10V		150	300	ns
		V_{DD} = 15V		100	200	
t_{SU}	Setup Time	V_{DD} = 5V		125	250	
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		38	75	
t_{WH}	Strobe Pulse Width	V_{DD} = 5V		175	350	
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		38	75	
C_{PD}	Power Dissipation Capacitance	Per Package (Note 6)		150		pF
C_{IN}	Input Capacitance	Any Input (Note 7)		5	7.5	pF

Note 5: AC Parameters are guaranteed by DC correlated testing.

Note 6: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation, see Family Characteristics application note, AN-90.

Note 7: Capacitance is guaranteed by periodic testing.

AC Test Circuit and Switching Time Waveforms



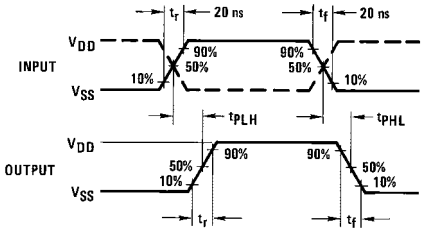


FIGURE 1.

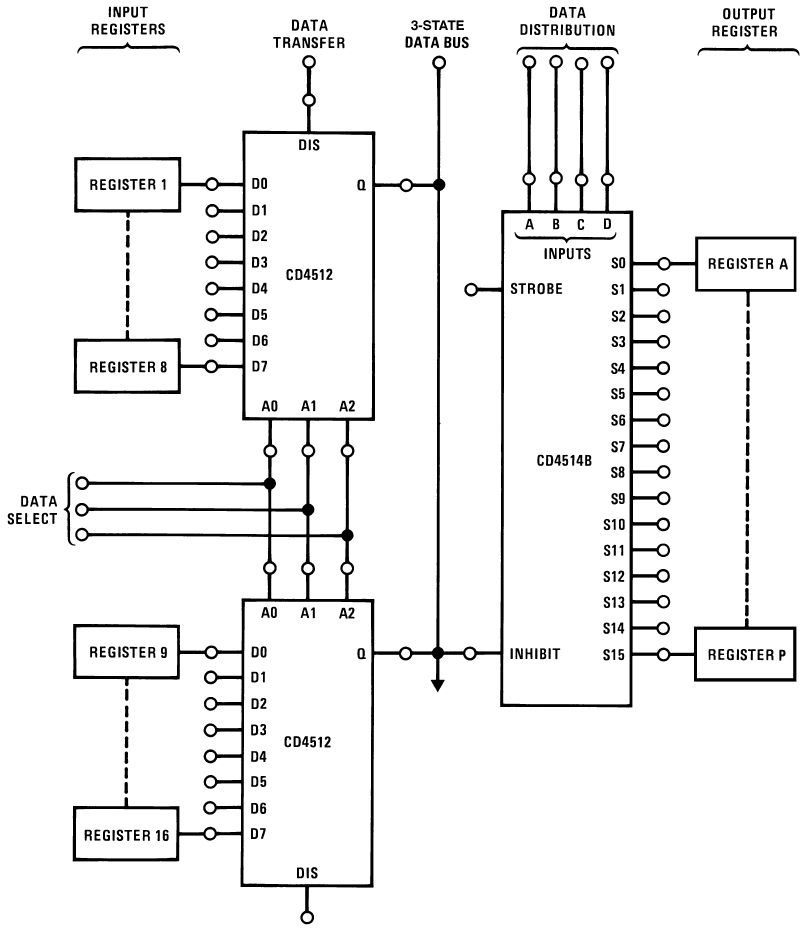
Applications

Two CD4512 8-channel data selectors are used here with the CD4514B 4-bit latch/decoder to effect a complex data routing system. A total of 16 inputs from data registers are selected and transferred via a 3-STATE data bus to a data distributor for rearrangement and entry into 16 output registers. In this way sequential data can be re-routed or intermixed according to patterns determined by data select and distribution inputs.

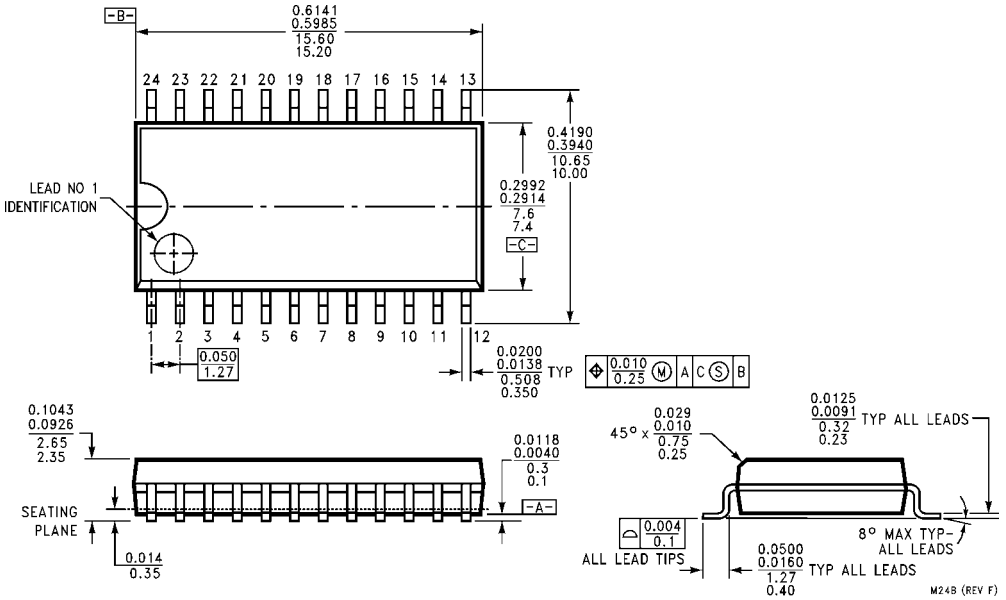
Data is placed into the routing scheme via the 8 inputs on both CD4512 data selectors. One register is assigned to each input. The signals on A0, A1 and A2 choose 1-of-8 inputs for transfer out to the 3-STATE data bus. A fourth signal, labelled Dis, disables one of the CD4512 selectors, assuring transfer of data from only one register.

In addition to a choice of input registers, 1–16, the rate of transfer of the sequential information can also be varied. That is, if the CD4512 were addressed at a rate that is 8 times faster than the shift frequency of the input registers, the most significant bit (MSB) from each register could be selected for transfer to the data bus. Therefore, all of the most significant bits from all of the registers can be transferred to the data bus before the next most significant bit is presented for transfer by the input registers.

Information from the 3-STATE bus is redistributed by the CD4514B 4-bit latch/decoder. Using the 4-bit address, INA–IND, the information on the inhibit line can be transferred to the addressed output line to the desired output registers, A–P. This distribution of data bits to the output registers can be made in many complex patterns. For example, all of the most significant bits from the input registers can be routed into output register A, all of the next most significant bits into register B, etc. In this way horizontal, vertical, or other methods of data slicing can be implemented.

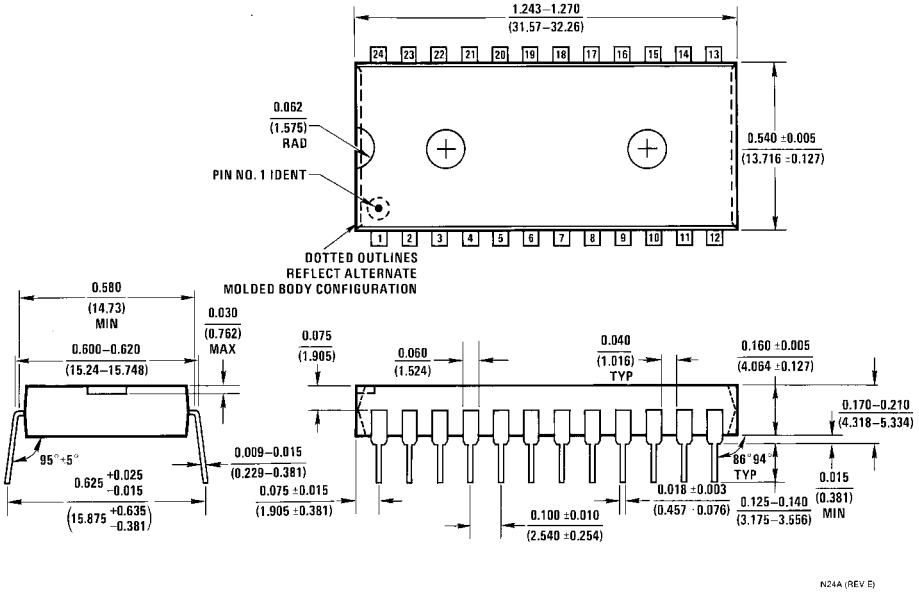


Physical Dimensions inches (millimeters) unless otherwise noted



24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M24B

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



24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-011, 0.600" Wide
Package Number N24A