National Semiconductor

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MM54HC4514/MM74HC4514 4-to-16 Line Decoder with Latch

General Description

This utilizes advanced silicon-gate CMOS technology, which is well suited to memory address decoding or data routing application. It possesses high noise immunity and low power dissipation usually associated with CMOS circuitry, yet speeds comparable to low power Schottky TTL circuits. It can drive up to 10 LS-TTL loads.

The MM54HC4514/MM74HC4514 contain a 4-to-16 line decoder and a 4-bit latch. The latch can store the data on the select inputs, thus allowing a selected output to remain high even though the select data has changed. When the LATCH ENABLE input to the latches is high the outputs will change with the inputs. When LATCH ENABLE goes low the data on the select inputs is stored in the latches. The four select inputs determine which output will go high provided the INHIBIT input is low. If the INHIBIT input is high all outputs are held low thus disabling the decoder.

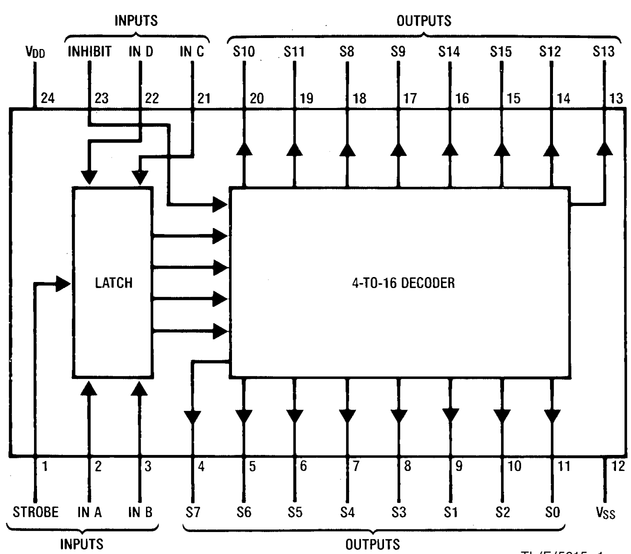
The MM54HC4514/MM74HC4514 is functionally and pinout equivalent to the CD4514BM/CD4514BC and the MC1451BA/MC1451BC. All inputs are protected against damage due to static discharge diodes from V_{CC} and ground.

Features

- Typical propagation delay: 18 ns
- Low quiescent power: 80 μA maximum (74HC Series)
- Low input current: 1 μA maximum
- Fanout of 10 LS-TTL loads (74HC Series)

Connection Diagram

Dual-In-Line Package



TL/F/5215–1

Top View

Order Number MM54HC4514 or MM74HC4514

Truth Table

LE	Inhibit	Data Inputs D	C	B	A	Selected Output High
H	L	L	L	L	L	S0
H	L	L	L	L	H	S1
H	L	L	L	H	L	S2
H	L	L	L	H	H	S3
H	L	L	H	L	L	S4
H	L	L	H	L	H	S5
H	L	L	H	H	L	S6
H	L	L	H	H	H	S7
H	L	H	L	L	L	S8
H	L	H	L	L	H	S9
H	L	H	L	H	L	S10
H	L	H	L	H	H	S11
H	L	H	H	L	L	S12
H	L	H	H	L	H	S13
H	L	H	H	H	L	S14
H	L	H	H	H	H	S15
X	H	X	X	X	X	All Outputs = 0
L	L	X	X	X	X	Latched Data

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Notes 1 and 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage (V_{IN})	−1.5 to V_{CC}+1.5V
DC Output Voltage (V_{OUT})	−0.5 to V_{CC}+0.5V
Clamp Diode Current (I_{IK}, I_{OK})	±20 mA
DC Output Current, per pin (I_{OUT})	±25 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±50 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D)	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature (T_L)	
(Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HC	−40	+85	°C
MM54HC	−55	+125	°C
Input Rise or Fall Times			
(t_r, t_f) V_{CC}=2.0V		1000	ns
V_{CC}=4.5V		500	ns
V_{CC}=6.0V		400	ns

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	T_A=25°C Typ	T_A=25°C	74HC T_A=−40 to 85°C	54HC T_A=−55 to 125°C	Units
				Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V_{IL}	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V_{OH}	Minimum High Level Output Voltage	$V_{IN}=V_{IH}$ or V_{IL} $\lvert I_{OUT}\rvert \leq 20\ \mu A$	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		$V_{IN}=V_{IH}$ or V_{IL} $\lvert I_{OUT}\rvert \leq 4.0$ mA	4.5V	4.2	3.98	3.84	3.7	V
		$\lvert I_{OUT}\rvert \leq 5.2$ mA	6.0V	5.7	5.48	5.34	5.2	V
V_{OL}	Maximum Low Level Output Voltage	$V_{IN}=V_{IH}$ or V_{IL} $\lvert I_{OUT}\rvert \leq 20\ \mu A$	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		$V_{IN}=V_{IH}$ or V_{IL} $\lvert I_{OUT}\rvert \leq 4.0$ mA	4.5V	0.2	0.26	0.33	0.4	V
		$\lvert I_{OUT}\rvert \leq 5.2$ mA	6.0V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	$V_{IN}=V_{CC}$ or GND	6.0V		±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN}=V_{CC}$ or GND $I_{OUT}=0\ \mu A$	6.0V		8.0	80	160	μA

Note 1: Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C; ceramic "J" package: −12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of 5V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC}=5.5V and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

**V_{IL} limits are currently tested at 20% of V_{CC}. The above V_{IL} specification (30% of V_{CC}) will be implemented no later than Q1, CY'89.

AC Electrical Characteristics $V_{CC} = 5V$, $T_A = 25°C$, $C_L = 15$ pF, $t_r = t_f = 6$ ns

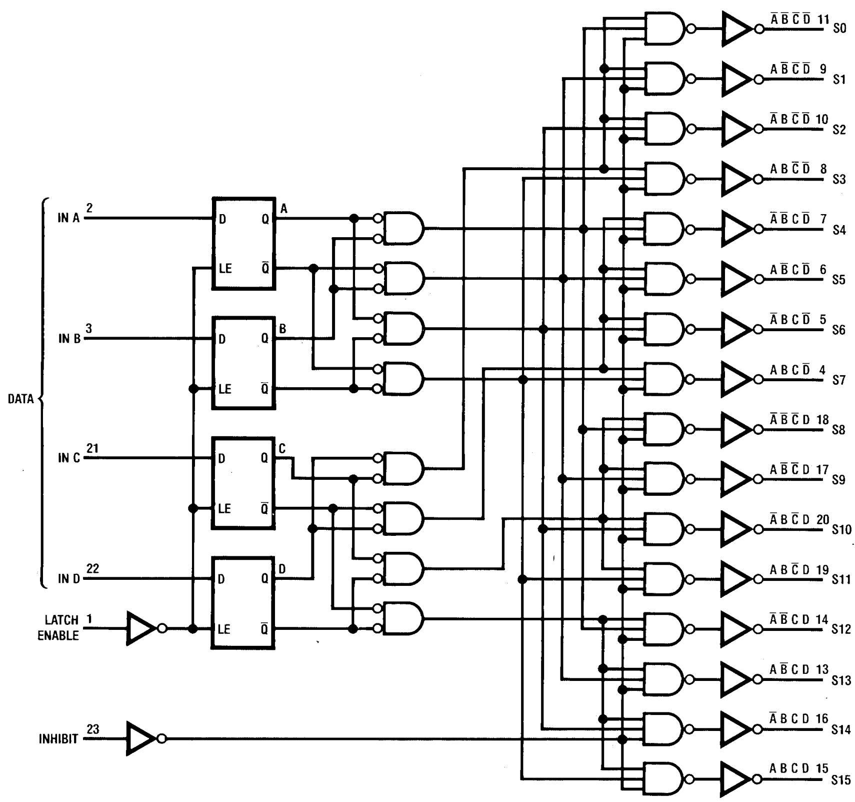
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay Data to Output		18	30	ns
t_{PHL}	Maximum Propagation Delay LE to Output		18	30	ns
t_{PLH}	Maximum Propagation Delay LE to Output		24	40	ns
t_{PHL}	Maximum Propagation Delay Inhibit to Output		16	30	ns
t_{PLH}	Maximum Propagation Delay Inhibit to Output		24	40	ns
t_s	Minimum Setup Time, Date to LE			20	ns
t_H	Minimum Hold Time, LE to Data			5	ns
t_W	Minimum Pulse Width, Latch Enable			16	ns

AC Electrical Characteristics $V_{CC} = 2.0V-6.0V$, $C_L = 50$ pF, $t_r = t_f = 6$ ns (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25°C$		74HC $T_A = -40$ to 85°C	54HC $T_A = -55$ to 125°C	Units
				Typ	Guaranteed Limits			
t_{PHL}, t_{PLH}	Maximum Propagation Delay Data to Output		2.0V	80	175	220	263	ns
			4.5V	18	35	44	53	ns
			6.0V	16	30	38	45	ns
t_{PHL}	Maximum Propagation Delay LE to Output		2.0V	80	175	220	263	ns
			4.5V	19	35	44	53	ns
			6.0V	17	30	38	45	ns
t_{PLH}	Maximum Propagation Delay LE to Output		2.0V	120	230	290	343	ns
			4.5V	27	46	58	69	ns
			6.0V	22	39	49	58	ns
t_{PHL}	Maximum Propagation Delay Inhibit to Output		2.0V	70	175	220	263	ns
			4.5V	18	35	44	53	ns
			6.0V	16	30	38	45	ns
t_{PLH}	Maximum Propagation Delay Inhibit to Output		2.0V	120	230	290	343	ns
			4.5V	27	46	58	69	ns
			6.0V	22	39	49	58	ns
t_s	Minimum Setup Time, Data to LE		2.0V		100	125	150	ns
			4.5V		20	25	30	ns
			6.0V		17	21	25	ns
t_H	Minimum Hold Time, LE to Data		2.0V		5	5	5	ns
			4.5V		5	5	5	ns
			6.0V		5	5	5	ns
t_W	Minimum Pulse Width, Latch Enable		2.0V		80	100	120	ns
			4.5V		16	20	24	ns
			6.0V		14	17	20	ns
C_{PD}	Power Dissipation Capacitance			290				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Logic Diagram



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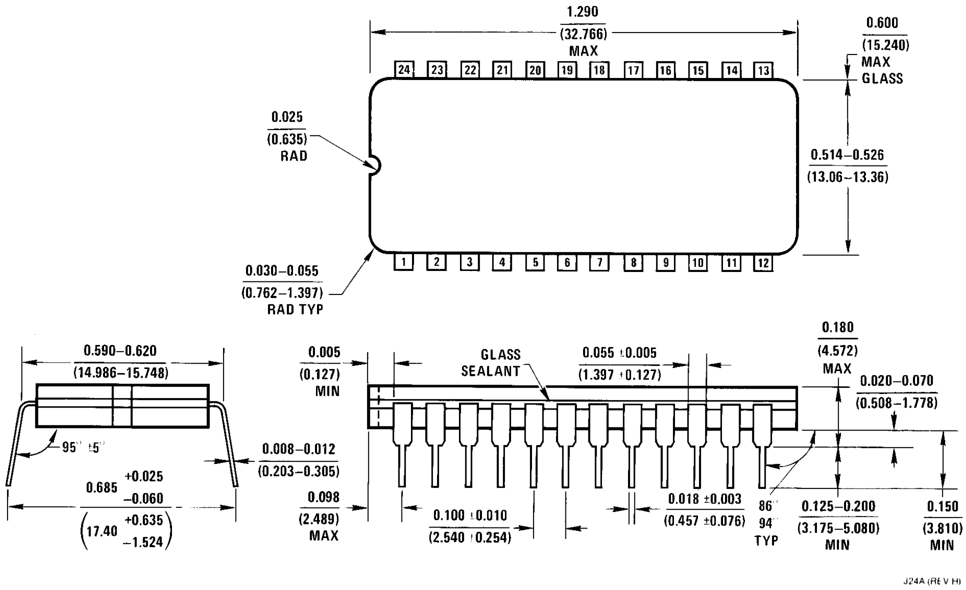
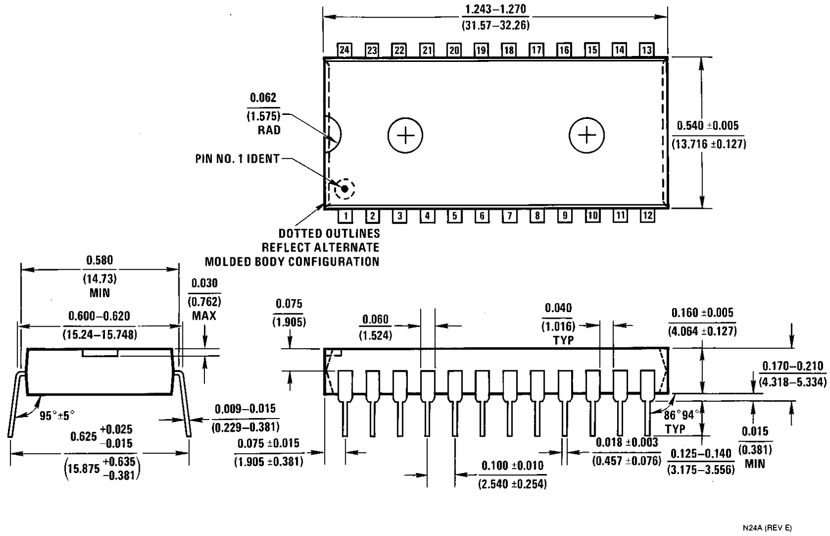
Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number MM54HC4514J or MM74HC4514J
NS Package Number J24A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number MM74HC4514N
NS Package Number N24A

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