High Speed CMOS Logic – 74HC154

Dual 1-of-16 Decoder / Demultiplexer in bare die form

Rev 1.0
30/05/22

Description

The 74HC154 is fabricated using a 2.5µm 5V CMOS process and has the same high speed performance of LSTTL combined with CMOS low power consumption. The device consists of x4 active-high binary address inputs, x16 active-low outputs & x2 active-low chip-selects. The x2 active-low chip-selects can be used to strobe & eliminate normal decoding 'glitches' on the outputs, or can be used to expand the decoder. Both chip-selects must be low to enable the outputs. The demultiplexing function is executed by use of one chip-select input as multiplexed data input. When the other chip-select input is low, the addressed output will follow the state of the applied data.

Features:

- Output Drive Capability: 10 LSTTL Loads
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2 V to 6V
- CMOS High Noise Immunity
- Function compatible with 74LS154.

Ordering Information

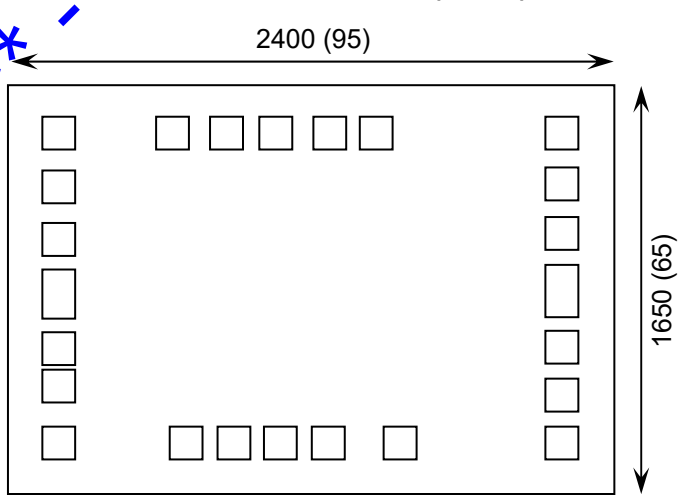
The following part suffixes apply:

- No suffix - MIL-STD-883 /2010B Visual Inspection

For High Reliability versions of this product please see

54HC154

Die Dimensions in µm (mils)



Supply Formats:

- Default – Die in Waffle Pack (100 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	2400 x 1650 95 x 65	µm mils
Minimum Bond Pad Size	120 x 120 4.72 x 4.72	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

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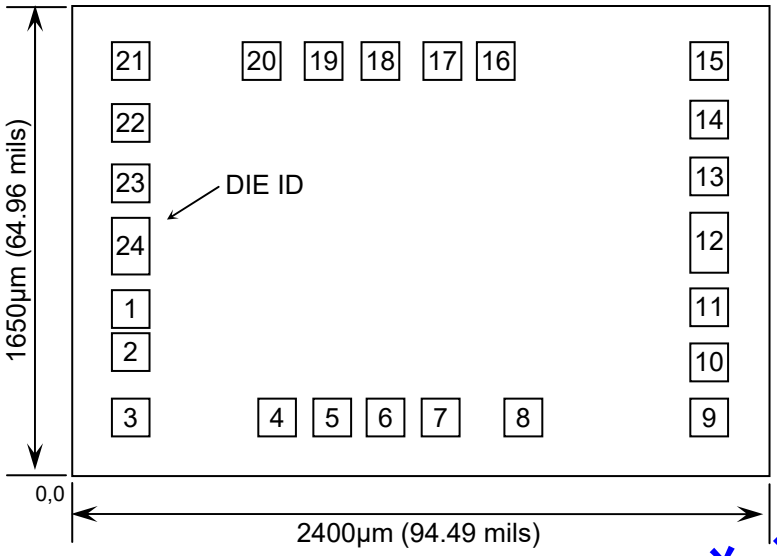
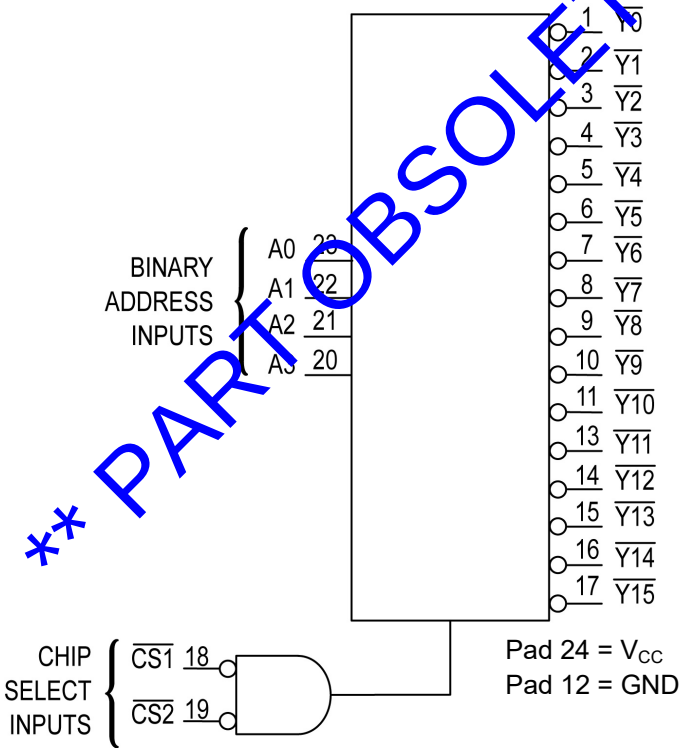
Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	$\overline{Y0}$	0.140	0.522
2	$\overline{Y1}$	0.140	0.377
3	$\overline{Y2}$	0.140	0.142
4	$\overline{Y3}$	0.645	0.132
5	$\overline{Y4}$	0.833	0.132
6	$\overline{Y5}$	1.021	0.132
7	$\overline{Y6}$	1.210	0.132
8	$\overline{Y7}$	1.490	0.132
9	$\overline{Y8}$	2.138	0.142
10	$\overline{Y9}$	2.138	0.342
11	$\overline{Y10}$	2.138	0.537
12	GND	2.138	0.724
13	$\overline{Y11}$	2.138	0.992
14	$\overline{Y12}$	2.138	1.187
15	$\overline{Y13}$	2.138	1.387
16	$\overline{Y14}$	1.397	1.490
17	$\overline{Y15}$	1.210	1.397
18	$\overline{CS1}$	1.005	1.397
19	$\overline{CS2}$	0.795	1.397
20	A3	0.590	1.397
21	A2	0.140	1.387
22	A1	0.140	1.179
23	A0	0.140	0.971
24	V_{CC}	0.140	0.707
CONNECT CHIP BACK TO V_{CC} OR FLOAT			

Logic Diagram



Truth Table

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Absolute Maximum Ratings[1]

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage (Referenced to GND)	V_{CC}	-0.5 to +7.0	V
DC Input Voltage (Referenced to GND)	V_{IN}	-1.5 to V_{CC} +1.5	V
DC Output Voltage (Referenced to GND)	V_{OUT}	-0.5 to V_{CC} +0.5	V
DC Input Current, per pin	I_{IN}	±20	mA
DC Output Current, per pin	I_{OUT}	±25	mA
DC V_{CC} or GND Current, per pin	I_{CC}	±50	mA
Power Dissipation in Still Air[2]	P_D	750	mW
Storage Temperature Range	T_{STG}	-65 to 150	°C

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. **2.** Measured in plastic DIP package, results in die form are dependent on die attach and assembly method.

Recommended Operating Conditions[3] (Voltages referenced to GND)

PARAMETER		SYMBOL	MIN	MAX	UNITS
DC Supply Voltage		V_{CC}	2	6	V
DC Input or Output Voltage		V_{IN} ,V_{OUT}	0	V_{CC}	V
Operating Temperature Range		T_J	-40	+85	°C
Input Rise and Fall Time	V_{CC} = 2.0V	t_r, t_f	0	1000	ns
	V_{CC} = 4.5V		0	500	
	V_{CC} = 6.0V		0	400	

3. This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND ≤ (V_{IN} or V_{OUT}) ≤ V_{CC}. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC Electrical Characteristics (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Input Voltage	V_{IH}	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	1.5	1.5	1.5	V
		4.5V		3.15	3.15	3.15	
		6.0V		4.2	4.2	4.2	
Maximum Low-Level Input Voltage	V_{IL}	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	0.3	0.3	0.3	V
		4.5V		0.9	0.9	0.9	
		6.0V		1.2	1.2	1.2	

4. -40˚C ≤ T_J ≤ +85˚C

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DC Electrical Characteristics (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Output Voltage	V_{OH}	2.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 20\mu A$	1.9	1.9	1.9	V
		4.5V		4.4	4.4	4.4	
		6.0V		5.9	5.9	5.9	
		4.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 4.0mA$	3.98	3.84	3.84	
		6.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 5.2mA$	5.48	5.34	5.34	
Maximum Low-Level Output Voltage	V_{OL}	2.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 20\mu A$	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		6.0V		0.1	0.1	0.1	
		4.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 4.0mA$	0.26	0.33	0.33	
		6.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq 5.2mA$	0.26	0.33	0.33	
Maximum Input Leakage Current	I_{IN}	6.0V	$V_{IN} = V_{CC}$ or GND	±0.1	±1.0	±1.0	µA
Maximum Quiescent Supply Current	I_{CC}	6.0V	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0\mu A$	8	80	80	µA

AC Electrical Characteristics[5]

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Propagation Delay, Select to Output Y (Figure 1, 3)	t_{PLH}, t_{PHL}	2.0V	$C_L = 50pF$, $t_r = t_f = 6ns$	190	240	240	ns
		4.5V		38	48	48	
		6.0V		32	41	41	
Maximum Propagation Delay, Input A to Output Y (Figure 2,3)	t_{PLH}, t_{PHL}	2.0V	$C_L = 50pF$, $t_r = t_f = 6ns$	175	220	220	ns
		4.5V		35	44	44	
		6.0V		30	37	37	
Maximum Output Transition Time, Any Output (Figure 1,3)	t_{TLH}, t_{THL}	2.0V	$C_L = 50pF$, $t_r = t_f = 6ns$	75	95	95	ns
		4.5V		15	19	19	
		6.0V		13	16	16	
Maximum Input Capacitance	C_{IN}	-	-	10	10	10	pF
Power Dissipation Capacitance[7]	C_{PD}	-	$T_J = 25°C$, $V_{CC} = 5.0V$	TYPICAL			
				80			pF

6. Not production tested in die form, characterized by chip design and tested in package.
7. Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

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Pad Description

ADDRESS INPUTS
A0, A1, A2, A3
(Pads 23, 22, 21, 20)
These inputs, when the 1-of-16 decoder is enabled, determine which of its sixteen active-low outputs is selected.

CONTROL INPUTS
$\overline{CS1}$, $\overline{CS2}$
(Pads 18, 19)
Active-low chip-select inputs. With a low level on both inputs, the outputs of the decoder follow the Address inputs. A high level on either input forces all outputs to a high level.

OUTPUTS
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8, Y9, Y10, Y11, Y12, Y13, Y14, Y15
(Pads 1-11, Pads 13-17)
Active-low outputs. These outputs assume a low level when addressed and both chip-select inputs are active. These outputs remain high when not addressed or when a chip-select input is high.

Truth Table

INPUTS						OUTPUTS														
CS1	CS2	A3	A2	A1	A0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = High Level, L = Low Level, X = Don't Care

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Switching Waveforms

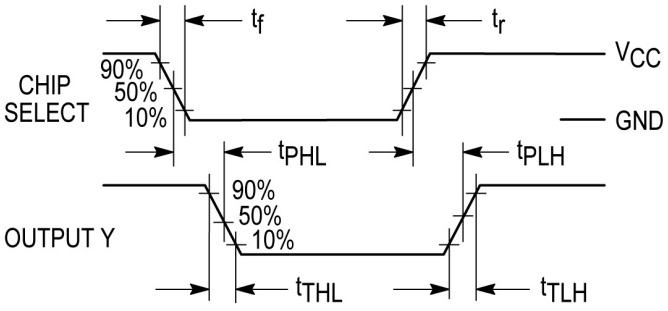


Figure 1

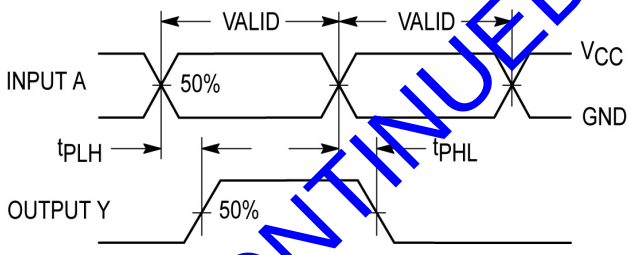
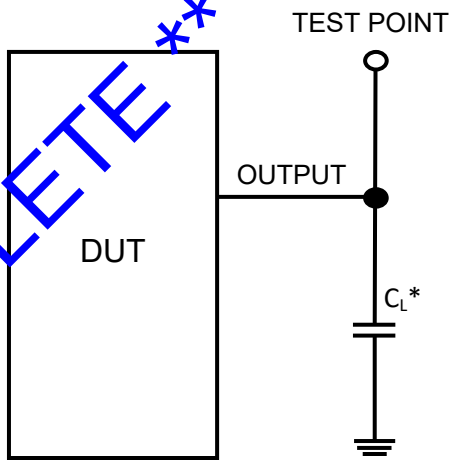


Figure 2

Test Circuit



* Includes all probe and jig capacitance

Figure 3