

1-of-8 Decoder/Demultiplexer with Address Latch

High-Performance Silicon-Gate CMOS

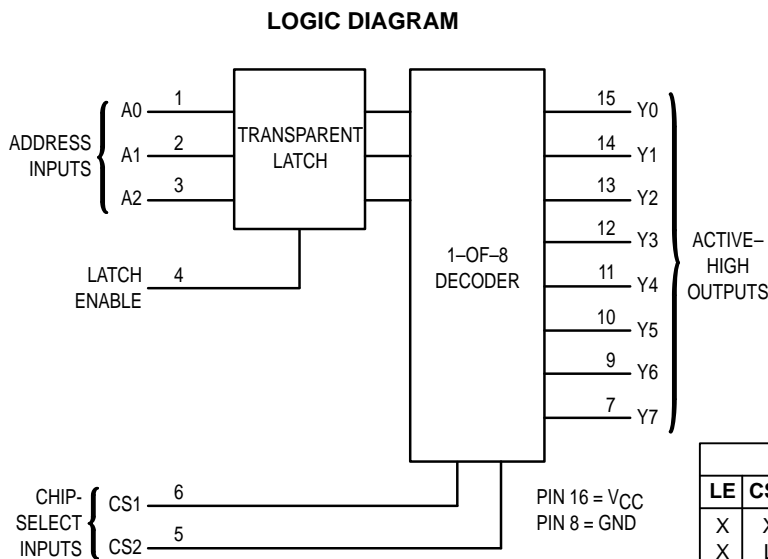
The MC74HC237 is identical in pinout to the LS137, but has noninverting outputs. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The HC237 decodes a three-bit Address to one-of-eight active-high outputs. The device has a transparent latch for storage of the Address. Two Chip Selects, one active-low and one active-high, are provided to facilitate the demultiplexing, cascading, and chip-selecting functions.

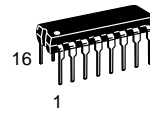
The demultiplexing function is accomplished by using the Address inputs to select the desired device output, and then by using one of the Chip Selects as a data input while holding the other one active.

The HC237 is the noninverting version of the HC137.

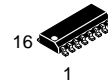
- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No 7A
- Chip Complexity: 156 FETs or 39 Equivalent Gates



MC74HC237



N SUFFIX
PLASTIC PACKAGE
CASE 648-08

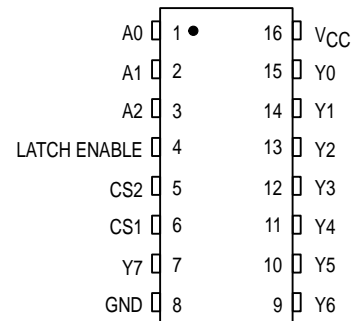


D SUFFIX
SOIC PACKAGE
CASE 751B-05

ORDERING INFORMATION

MC74HCXXXN Plastic
MC74HCXXXD SOIC

PIN ASSIGNMENT



FUNCTION TABLE

Inputs						Outputs							
LE	CS1	CS2	A2	A1	A0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	H	X	X	X	L	L	L	L	L	L	L	L
X	L	X	X	X	X	L	L	L	L	L	L	L	L
L	H	L	L	L	L	H	L	L	L	L	L	L	L
L	H	L	L	L	H	L	H	L	L	L	L	L	L
L	H	L	L	H	L	L	L	H	L	L	L	L	L
L	H	L	L	H	H	L	L	L	L	H	L	L	L
L	H	L	H	L	L	L	L	L	L	L	H	L	L
L	H	L	H	H	L	L	L	L	L	L	L	H	L
L	H	L	H	H	H	L	L	L	L	L	L	L	H
H	H	L	X	X	X	*							

* = Depends upon the Address previously applied while LE was at a low level.



MC74HC237

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit	
V_{CC}	DC Supply Voltage (Referenced to GND)	- 0.5 to + 7.0	V	
V_{in}	DC Input Voltage (Referenced to GND)	- 1.5 to $V_{CC} + 1.5$	V	
V_{out}	DC Output Voltage (Referenced to GND)	- 0.5 to $V_{CC} + 0.5$	V	
I_{in}	DC Input Current, per Pin	± 20	mA	
I_{out}	DC Output Current, per Pin	± 25	mA	
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 50	mA	
P_D	Power Dissipation in Still Air	Plastic DIP†	750	mW
		SOIC Package†	500	
T_{stg}	Storage Temperature	- 65 to + 150	$^{\circ}C$	
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	$^{\circ}C$	

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 $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$. 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.

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

† Derating — Plastic DIP: - 10 mW/ $^{\circ}C$ from 65 $^{\circ}$ to 125 $^{\circ}C$
SOIC Package: - 7 mW/ $^{\circ}C$ from 65 $^{\circ}$ to 125 $^{\circ}C$

For high frequency or heavy load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit	
V_{CC}	DC Supply Voltage (Referenced to GND)	2.0	6.0	V	
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V_{CC}	V	
T_A	Operating Temperature, All Package Types	- 55	+ 125	$^{\circ}C$	
t_r, t_f	Input Rise and Fall Time (Figure 2)	$V_{CC} = 2.0$ V	0	1000	ns
		$V_{CC} = 4.5$ V	0	500	
		$V_{CC} = 6.0$ V	0	400	

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				- 55 to 25 $^{\circ}C$	$\leq 85^{\circ}C$	$\leq 125^{\circ}C$	
V_{IH}	Minimum High-Level Input Voltage	$V_{out} = 0.1$ V or $V_{CC} - 0.1$ V $ I_{out} \leq 20$ μA	2.0	1.5	1.5	1.5	V
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V_{IL}	Maximum Low-Level Input Voltage	$V_{out} = 0.1$ V or $V_{CC} - 0.1$ V $ I_{out} \leq 20$ μA	2.0	0.3	0.3	0.3	V
			4.5	0.9	0.9	0.9	
			6.0	1.2	1.2	1.2	
V_{OH}	Minimum High-Level Output Voltage	$V_{in} = V_{IH}$ or V_{IL} $ I_{out} \leq 20$ μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
			6.0	5.9	5.9	5.9	
			$V_{in} = V_{IH}$ or V_{IL} $ I_{out} \leq 4.0$ mA $ I_{out} \leq 5.2$ mA	4.5	3.98	3.84	
6.0	5.48	5.34	5.20				
V_{OL}	Maximum Low-Level Output Voltage	$V_{in} = V_{IH}$ or V_{IL} $ I_{out} \leq 20$ μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
			6.0	0.1	0.1	0.1	
			$V_{in} = V_{IH}$ or V_{IL} $ I_{out} \leq 4.0$ mA $ I_{out} \leq 5.2$ mA	4.5	0.26	0.33	
6.0	0.26	0.33	0.40				
I_{in}	Maximum Input Leakage Current	$V_{in} = V_{CC}$ or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND $I_{out} = 0$ μA	6.0	8	80	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

AC ELECTRICAL CHARACTERISTICS ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t _{PLH}	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 6)	2.0	235	295	355	ns
		4.5	47	59	71	
		6.0	40	50	60	
t _{PHL}		2.0	185	230	280	
		4.5	37	46	56	
		6.0	31	39	48	
t _{PLH}	Maximum Propagation Delay, CS2 to Output Y (Figures 2 and 6)	2.0	200	250	300	ns
		4.5	40	50	60	
		6.0	34	43	51	
t _{PHL}		2.0	145	180	220	
		4.5	29	36	44	
		6.0	25	31	38	
t _{PLH}	Maximum Propagation Delay, CS1 to Output Y (Figures 3 and 6)	2.0	200	250	300	ns
		4.5	40	50	60	
		6.0	34	43	51	
t _{PHL}		2.0	160	200	240	
		4.5	32	40	48	
		6.0	27	34	41	
t _{PLH}	Maximum Propagation Delay, Latch Enable to Output Y (Figures 4 and 6)	2.0	250	315	375	ns
		4.5	50	63	75	
		6.0	43	54	64	
t _{PHL}		2.0	190	240	285	
		4.5	38	48	57	
		6.0	32	41	48	
t _{TLH} , t _{THL}	Maximum Output Transition Time, Any Output (Figures 2 and 6)	2.0	75	95	110	ns
		4.5	15	19	22	
		6.0	13	16	19	
C _{in}	Maximum Input Capacitance	—	10	10	10	pF

NOTES:

- For propagation delays with loads other than 50 pF, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).
- Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

C _{PD}	Power Dissipation Capacitance (Per Package)*	Typical @ 25°C, V _{CC} = 5.0 V			pF
		100			

* Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$. For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

TIMING REQUIREMENTS (Input $t_r = t_f = 6$ ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t _{su}	Minimum Setup Time, Input A to Latch Enable (Figure 5)	2.0	100	125	150	ns
		4.5	20	25	30	
		6.0	17	21	26	
t _h	Minimum Hold Time, Latch Enable to Input A (Figure 5)	2.0	50	65	75	ns
		4.5	10	13	15	
		6.0	9	11	13	
t _w	Minimum Pulse Width, Latch Enable (Figure 4)	2.0	80	100	120	ns
		4.5	16	20	24	
		6.0	14	17	20	
t _r , t _f	Maximum Input Rise and Fall Times (Figure 2)	2.0	1000	1000	1000	ns
		4.5	500	500	500	
		6.0	400	400	400	

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

PIN DESCRIPTIONS

ADDRESS INPUTS

A0, A1, A2 (Pins 1, 2, 3)

Address inputs. These inputs, when the chip is enabled, determine which of the eight outputs is selected.

CONTROL INPUTS

CS1, CS2 (Pins 6, 5)

Chip select inputs. For CS1 at a high level and CS2 at a low level, the chip is enabled and the outputs follow the data inputs (Latch Enable = L). For any other combination of CS1 and CS2, the outputs are at a low level.

Latch Enable (Pin 4)

Latch Enable input. A high level at this input latches the Address. A low level at this input allows the outputs to follow the Address (CS1 = H and CS2 = L).

OUTPUTS

Y0–Y7 (Pins 15, 14, 13, 12, 11, 10, 9, 7)

Active-high outputs. One of these eight outputs is selected when the chip is enabled (CS1 = H and CS2 = L) and the Address inputs correspond to that particular output. The selected output is at a high level while all others remain at a low level.

SWITCHING WAVEFORMS

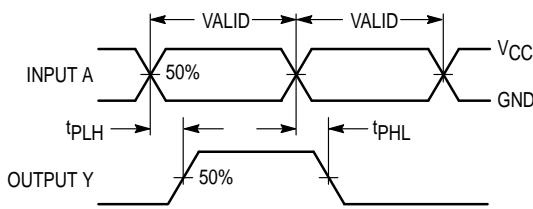


Figure 1.

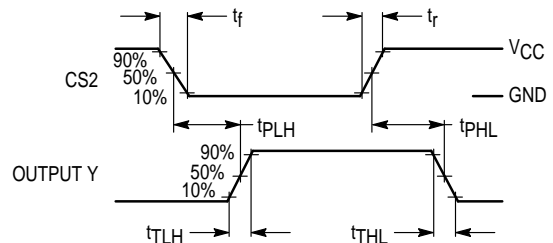


Figure 2.

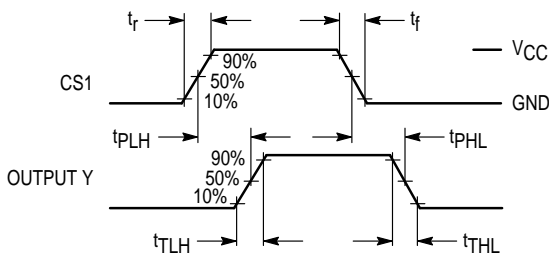


Figure 3.

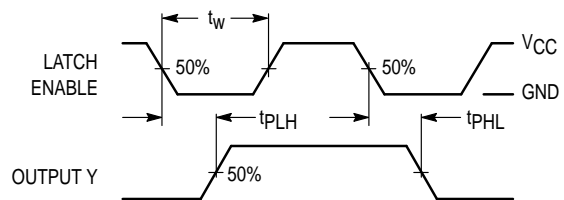


Figure 4.

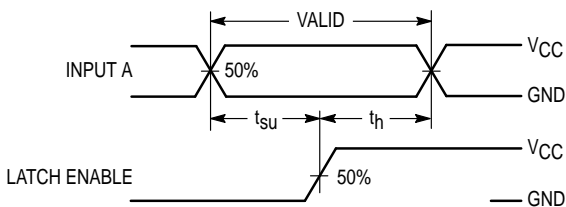
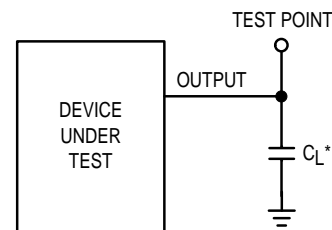


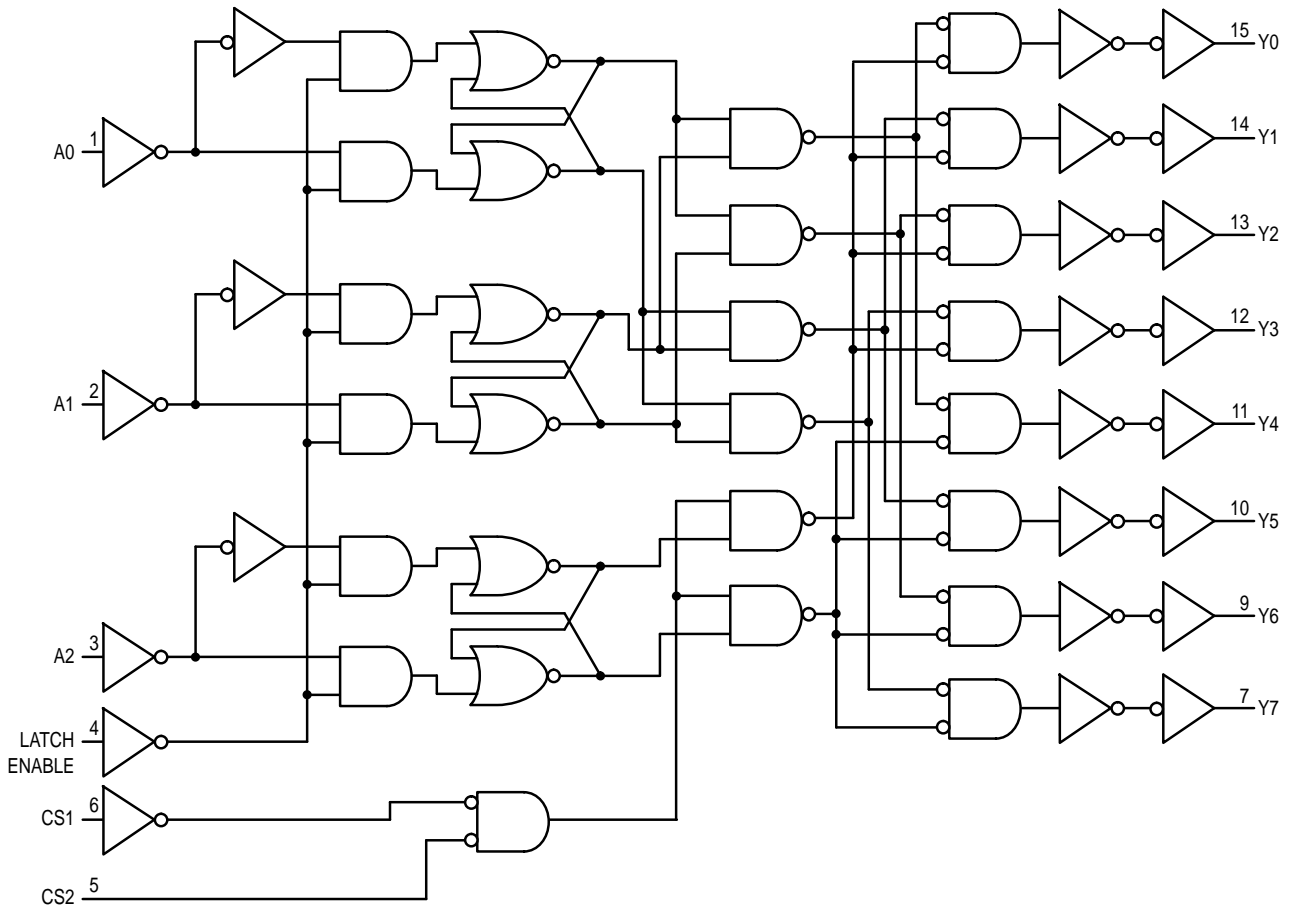
Figure 5.



* Includes all probe and jig capacitance

Figure 6. Test Circuit

EXPANDED LOGIC DIAGRAM



OUTLINE DIMENSIONS

**N SUFFIX
PLASTIC PACKAGE
CASE 648-08
ISSUE R**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.070	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

**D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B-05
ISSUE J**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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MC74HC237/D

