

MM54HC137/MM74HC137 3-to-8 Line Decoder With Address Latches (Inverted Output)

General Description

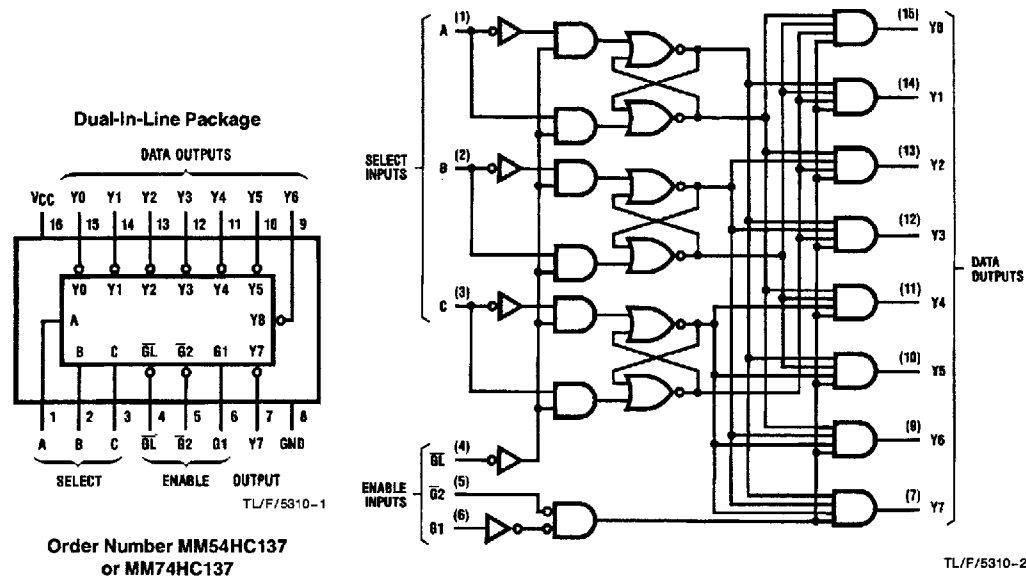
This device utilizes advanced silicon-gate CMOS technology, to implement a three-to-eight line decoder with latches on the three address inputs. When $\overline{G1}$ goes from low to high, the address present at the select inputs (A, B and C) is stored in the latches. As long as $\overline{G1}$ remains high no address changes will be recognized. Output enable controls, $G1$ and $\overline{G2}$, control the state of the outputs independently of the select or latch-enable inputs. All of the outputs are high unless $G1$ is high and $\overline{G2}$ is low. The HC137 is ideally suited for the implementation of glitch-free decoders in stored-address applications in bus oriented systems.

The 54HC/74HC logic family is speed, function and pin-out compatible with the standard 54LS/74LS logic family. All inputs are protected from damage due to static discharge by diodes to V_{CC} and ground.

Features

- Typical propagation delay: 20 ns
- Wide supply range: 2-6V
- Latched inputs for easy interfacing.
- Fanout of 10 LS-TTL loads.

Connection and Functional Block Diagrams



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Absolute Maximum Ratings (Notes 1 & 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}	$T_A = 25^\circ C$			Units	
				Typ	74HC $T_A = -40$ to $85^\circ C$	54HC $T_A = -55$ to $125^\circ C$		
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} $ I_{OUT} \leq 20 \mu A$	2.0V	2.0	1.9	1.9	V	
			4.5V	4.5	4.4	4.4	V	
			6.0V	6.0	5.9	5.9	V	
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V		3.98	3.84	3.7	V
			6.0V		5.48	5.34	5.2	V
V_{OL}	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu A$	2.0V	0	0.1	0.1	V	
			4.5V	0	0.1	0.1	V	
			6.0V	0	0.1	0.1	V	
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V		0.26	0.33	0.4	V
			6.0V		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: Absolute 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 $V_{CC}=5V, T_A=25^{\circ}C, C_L=15\text{ pF}, t_r=t_f=6\text{ ns}$

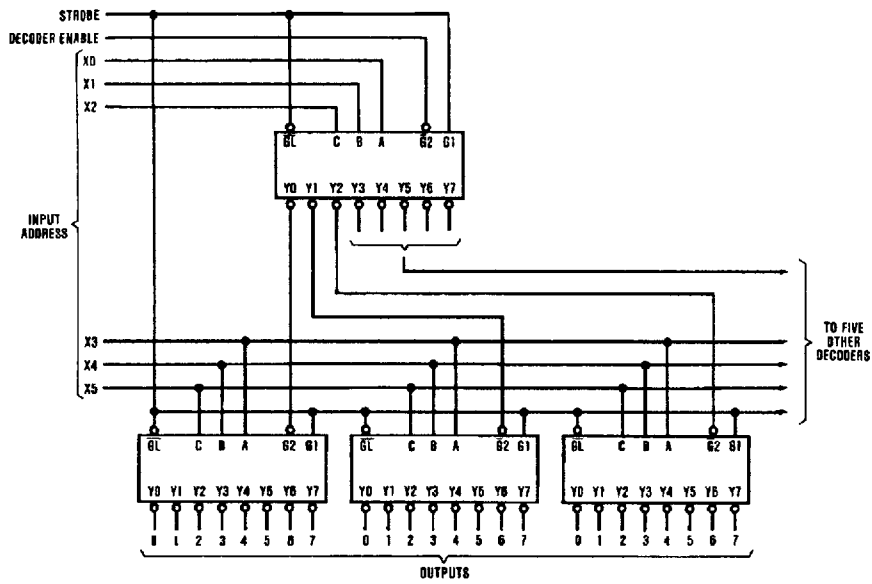
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PLH}	Maximum Propagation Delay, A, B or C to any Y Output		14	29	ns
t_{PHL}	Maximum Propagation Delay, A, B or C to any Y Output		20	42	ns
t_{PLH}	Maximum Propagation Delay $\overline{G2}$ to any Y Output		12	22	ns
t_{PHL}	Maximum Propagation Delay $\overline{G2}$ to any Y Output		15	34	ns
t_{PLH}	Maximum Propagation Delay G1 to any Output		13	25	ns
t_{PHL}	Maximum Propagation Delay GL to any Output		17	34	ns
t_{PLH}	Maximum Propagation Delay GL to Output		15	30	ns
t_{PHL}	Maximum Propagation Delay GL to Output		22	34	ns
t_S	Minimum Setup Time at A, B and C Inputs			20	ns
t_H	Minimum Hold Time at A, B and C Inputs			0	ns
t_W	Minimum Pulse Width of Enabling Pulse at \overline{GL}			16	ns

AC Electrical Characteristics $C_L=50\text{ pF}, t_r=t_f=6\text{ ns}$ (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A=25^{\circ}C$		74HC	54HC	Units
				Typ		$T_A=-40\text{ to }85^{\circ}C$	$T_A=-55\text{ to }125^{\circ}C$	
				Guaranteed Limits				
t_{PLH}	Maximum Propagation Delay A, B or C to any Y Output		2.0V	85	170	214	253	ns
			4.5V	17	34	43	51	ns
			6.0V	14	29	36	43	ns
t_{PHL}	Maximum Propagation Delay A, B or C to any Y Output		2.0V	120	240	302	358	ns
			4.5V	24	48	60	72	ns
			6.0V	20	41	51	61	ns
t_{PLH}	Maximum Propagation Delay $\overline{G2}$ to any Y Output		2.0V	65	130	164	194	ns
			4.5V	13	26	33	39	ns
			6.0V	11	22	28	33	ns
t_{PLH}	Maximum Propagation Delay G1 to Output		2.0V	75	150	189	224	ns
			4.5V	15	30	38	45	ns
			6.0V	13	26	32	38	ns
t_{PHL}	Maximum Propagation Delay G1 to Output		2.0V	98	195	246	291	ns
			4.5V	20	39	49	58	ns
			6.0V	17	33	42	49	ns
t_{PLH}	Maximum Propagation Delay GL to Output		2.0V	88	175	221	261	ns
			4.5V	18	35	44	52	ns
			6.0V	15	30	37	44	ns
t_{PHL}	Maximum Propagation Delay GL to Output		2.0V	125	250	315	373	ns
			4.5V	25	50	63	75	ns
			6.0V	21	43	54	63	ns
t_{PHL}	Maximum Propagation Delay $\overline{G2}$, to any Y Output		2.0V	98	195	246	291	ns
			4.5V	20	39	49	58	ns
			6.0V	17	33	42	49	ns
t_S	Minimum Setup Time at A, B and C inputs		2.0V		100	125	150	ns
			4.5V		20	25	30	ns
			6.0V		17	21	25	ns
t_H	Minimum Hold Time at A, B and C inputs		2.0V		50	63	75	ns
			4.5V		10	13	15	ns
			6.0V		8	11	13	ns
t_{TLH}, t_{THL}	Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
t_W	Minimum Pulse Width of Enabling Pulse at \overline{GL}		2.0V		80	100	120	ns
			4.5V		16	20	24	ns
			6.0V		14	18	21	ns
C_{PD}	Power Dissipation Capacitance (Note 5)			75				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, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Typical Application



6-Line to 64-Line Decoder with Input Address Storage

TL/F/6310-3

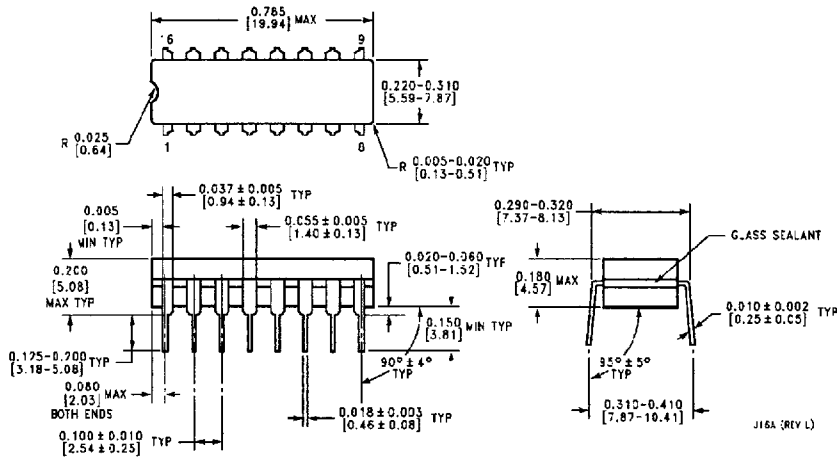
Truth Table

Inputs					Outputs								
Enable			Select										
$\overline{G1}$	G1	$\overline{G2}$	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	H	X	X	X	H	H	H	H	H	H	H	H
X	L	X	X	X	X	H	H	H	H	H	H	H	H
L	H	L	L	L	L	L	H	H	H	H	H	H	H
L	H	L	L	L	H	H	L	H	H	H	H	H	H
L	H	L	L	H	L	H	H	L	H	H	H	H	H
L	H	L	L	H	H	H	H	H	L	H	H	H	H
L	H	L	H	L	H	H	H	H	H	L	H	H	H
L	H	L	H	H	L	H	H	H	H	H	L	H	H
L	H	L	H	H	H	H	H	H	H	H	H	L	H
H	H	L	X	X	X	Output corresponding to stored address L; all others, H							

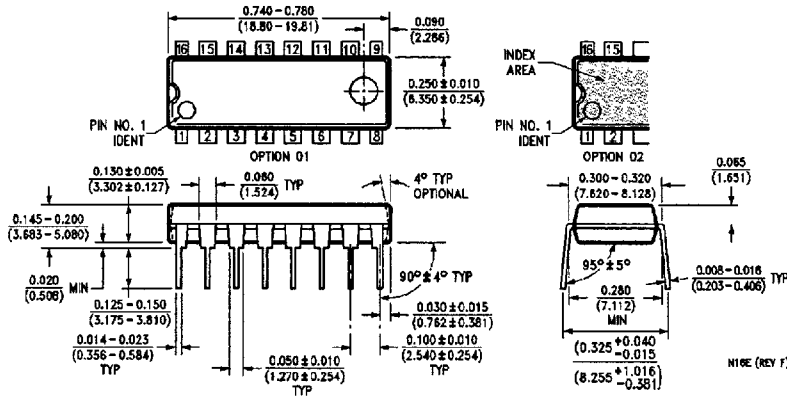
H = high level, L = low level, X = irrelevant

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Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number MM54HC137J or MM74HC137J
NS Package J16A



Molded Dual-In-Line Package (N)
Order Number MM74HC137N
NS Package N16E

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