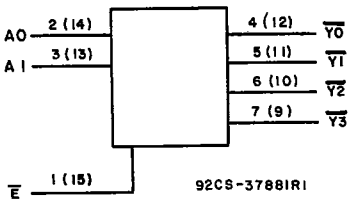
CD54/74HC139, CD54/74HCT139

FUNCTIONAL DIAGRAM



Dual 2-to-4 Line Decoder/Demultiplexer

Type Features:

- *Multifunction Capability*
  Binary to 1-of-4 Decoders or
  1-to-4 Line Demultiplexer
- *Active Low Mutually Exclusive Outputs*

Applications:

- *Memory Decoding*
- *Data Routing*
- *Code Conversion*

The RCA-CD54/74HC139 and CD54/74HCT139 contain two independent binary to one-of-four decoders each with a single active low enable input ($\overline{1E}$, or $\overline{2E}$). Data on the select inputs (1A0 and 1A1 or 2A0 and 2A1) cause one of the four normally high outputs to go low.

If the enable input is high all four outputs remain high. For demultiplexer operation the enable input is the data input. The enable input also functions as a chip select when these devices are cascaded. This device is functionally the same as the CD4556B and is pin compatible with it.

The outputs of these devices can drive 10 low power Schottky TTL equivalent loads. The 54/74HCT logic family is functionally as well as pin equivalent to the 54/74LS logic family.

The CD54HC139 and CD54HCT139 are supplied in 16-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC139 and CD74HCT139 are supplied in 16-lead dual-in-line plastic packages (E suffix) and in 16-lead dual-in-line surface-mount plastic packages (M suffix). Both types are also available in chip form (H suffix).

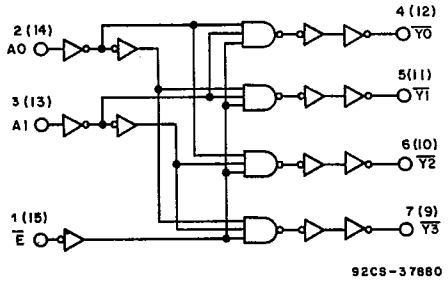


Fig. 1 - Logic diagram for the CD54/74HC/HCT139.

Family Features:

- *Fanout (Over Temperature Range):*
  Standard Outputs - 10 LSTTL Loads
  Bus Driver Outputs - 15 LSTTL Loads
- *Wide Operating Temperature Range:*
  CD74HC/HCT/HCU: -40 to +85° C
- *Balanced Propagation Delay and Transition Times*
- *Significant Power Reduction Compared to LSTTL Logic ICs*
- *Alternate Source is Philips/Signetics*
- *CD54HC/CD74HC Types:*
  2 to 6 V Operation
  High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} @ V_{CC} = 5 V
- *CD54HCT/CD74HCT Types:*
  4.5 to 5.5 V Operation
  Direct LSTTL Input Logic Compatibility
  V_{IL} = 0.8 V Max., V_{IH} = 2 V Min.
  CMOS Input Compatibility
  $I_I \leq 1\ \mu A$ @ V_{OL}, V_{OH}

TRUTH TABLE

Inputs Enable Select			Outputs			
$\overline{E}$	A1	A0	$\overline{Y3}$	$\overline{Y2}$	$\overline{Y1}$	$\overline{Y0}$
0	0	0	1	1	1	0
0	0	1	1	1	0	1
0	1	0	1	0	1	1
0	1	1	0	1	1	1
1	X	X	1	1	1	1

X = Don't Care

Logic 1 = High
Logic 0 = Low

CD54/74HC139, CD54/74HCT139

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MAXIMUM RATINGS, *Absolute-Maximum Values:*

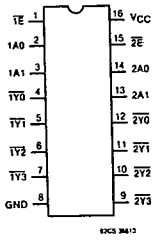
DC SUPPLY-VOLTAGE, (V_{CC}): -0.5 to +7 V
(Voltages referenced to ground) ±20 mA
DC INPUT DIODE CURRENT, I_{IK} (FOR $V_I < -0.5$ V OR $V_I > V_{CC}$ +0.5 V) ±20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (FOR $V_o < -0.5$ V OR $V_o > V_{CC}$ +0.5 V) ±25 mA
DC DRAIN CURRENT, PER OUTPUT (I_O) (FOR -0.5 V < V_o < V_{CC} +0.5 V) ±50 mA
DC V_{CC} OR GROUND CURRENT, (I_{CC}): ±50 mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -40 to +60°C (PACKAGE TYPE E) 500 mW
For T_A = +60 to +85°C (PACKAGE TYPE E) Derate Linearly at 8 mW/°C to 300 mW
For T_A = -55 to +100°C (PACKAGE TYPE F, H) 500 mW
For T_A = +100 to +125°C (PACKAGE TYPE F, H) Derate Linearly at 8 mW/°C to 300 mW
For T_A = -40 to +60°C (PACKAGE TYPE M) 300 mW
For T_A = +60 to +85°C (PACKAGE TYPE M) Derate Linearly at 5 mW/°C to 175 mW
OPERATING-TEMPERATURE RANGE (T_A):
PACKAGE TYPE F, H -55 to +125°C
PACKAGE TYPE E, M -40 to +85°C
STORAGE TEMPERATURE (T_{stg}) -65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING) +265°C
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max.
Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm) +300°C
with solder contacting lead tips only

RECOMMENDED OPERATING CONDITIONS:

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range (For T_A = Full Package Temperature Range) V_{CC}:*			
CD54/74HC Types	2	6	V
CD54/74HCT Types	4.5	5.5	V
DC Input or Output Voltage V_I, V_O	0	V_{CC}	V
Operating Temperature T_A:			
CD74 Types	-40	+85	°C
CD54 Types	-55	+125	°C
Input Rise and Fall Times, t_r, t_f			
at 2 V	0	1000	ns
at 4.5 V	0	500	ns
at 6 V	0	400	ns

*Unless otherwise specified, all voltages are referenced to Ground.



TERMINAL ASSIGNMENT

CD54/74HC139, CD54/74HCT139

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC139/CD54HC139										CD74HCT139/CD54HCT139									UNITS
	TEST CONDITIONS			74HC/54HC TYPES			74HC TYPES		54HC TYPES		TEST CONDITIONS		74HCT/54HCT TYPES			74HCT TYPES		54HCT TYPES		
	V_I V	I_O mA	V_{CC} V	+25°C			-40/ +85°C		-55/ +125°C		V_I V	V_{CC} V	+25°C			-40/ +85°C		-55/ +125°C		
				Min	Typ	Max	Min	Max	Min	Max			Min	Typ	Max	Min	Max	Min	Max	
High-Level Input Voltage V_{IH}			2	1.5	—	—	1.5	—	1.5	—	—	4.5 to 5.5	2	—	—	2	—	2	—	V
			4.5	3.15	—	—	3.15	—	3.15	—										
			6	4.2	—	—	4.2	—	4.2	—										
Low-Level Input Voltage V_{IL}			2	—	—	0.5	—	0.5	—	0.5	—	4.5 to 5.5	—	—	0.8	—	0.8	—	0.8	V
			4.5	—	—	1.35	—	1.35	—	1.35										
			6	—	—	1.8	—	1.8	—	1.8										
High-Level Output Voltage V_{OH} CMOS Loads	V_{IL} or V_{IH}	-0.02	2	1.9	—	—	1.9	—	1.9	—	V_{IL} or V_{IH}	4.5	4.4	—	—	4.4	—	4.4	—	V
			4.5	4.4	—	—	4.4	—	4.4	—										
			6	5.9	—	—	5.9	—	5.9	—										
TTL Loads (Standard Output)	V_{IL} or V_{IH}	-4	4.5	3.98	—	—	3.84	—	3.7	—	V_{IL} or V_{IH}	4.5	3.98	—	—	3.84	—	3.7	—	V
		-5.2	6	5.48	—	—	5.34	—	5.2	—										
Low-Level Output Voltage V_{OL} CMOS Loads	V_{IL} or V_{IH}	0.02	2	—	—	0.1	—	0.1	—	0.1	V_{IL} or V_{IH}	4.5	—	—	0.1	—	0.1	—	0.1	V
			4.5	—	—	0.1	—	0.1	—	0.1										
			6	—	—	0.1	—	0.1	—	0.1										
TTL Loads (Standard Output)	V_{IL} or V_{IH}	4	4.5	—	—	0.26	—	0.33	—	0.4	V_{IL} or V_{IH}	4.5	—	—	0.26	—	0.33	—	0.4	V
		5.2	6	—	—	0.26	—	0.33	—	0.4										
Input Leakage Current I_I	V_{CC} or Gnd		6	—	—	±0.1	—	±1	—	±1	Any Voltage Between V_{CC} & Gnd	5.5	—	—	±0.1	—	±1	—	±1	μA
Quiescent Device Current I_{CC}	V_{CC} or Gnd	0	6	—	—	8	—	80	—	160	V_{CC} or Gnd	5.5	—	—	8	—	80	—	160	μA
Additional Quiescent Device Current per input pin: 1 unit load ΔI_{CC}*											V_{CC}-2.1	4.5 to 5.5	—	100	360	—	450	—	490	μA

*For dual-supply systems theoretical worst case (V_I = 2.4 V, V_{CC} = 5.5 V) specification is 1.8 mA.

HCT Input Loading Table

Input	Unit Loads *
All	0.7

*Unit Load is ΔI_{CC} limit specified in Static Characteristic Chart, e.g., 360 μA max. @ 25°C.

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SWITCHING CHARACTERISTICS (V_{CC} = 5 V, T_A = 25°C, Input t_r, t_f = 6 ns)

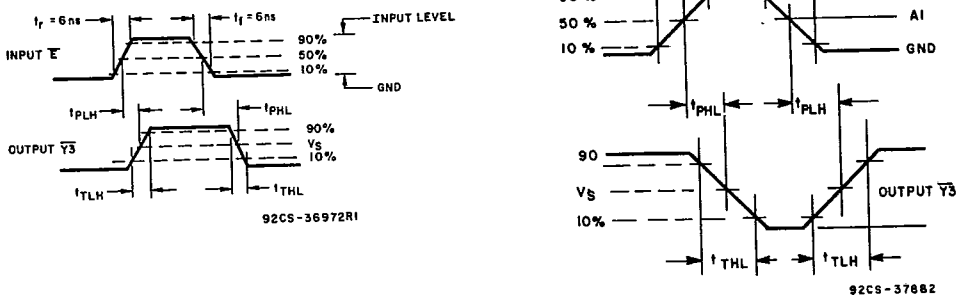
CHARACTERISTIC	SYMBOL	Typical		UNITS
		54/74HC	54/74HCT	
Propagation Delay	t_{PHL}			
Select to Output (C_L = 15 pF)	t_{PLH}	13	14	ns
Enable to Output (C_L = 15 pF)		13	14	ns
Power Dissipation Capacitance*	C_{PD}	55	59	pF

*C_{PD} is used to determine the dynamic power consumption, per decoder/demux.
$P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where:
f_i = input frequency
C_L = output load capacitance.
V_{CC} = supply voltage.

SWITCHING CHARACTERISTICS (C_L = 50 pF, Input t_r, t_f = 6 ns)

CHARACTERISTIC	SYMBOL	V_{CC}	25°C				-40°C to +85°C				-55°C to +125°C				UNITS
			HC		HCT		74HC		74HCT		54HC		54HCT		
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Propagation Delay A0, A1 to Outputs	t_{PLH}	2	—	160	—	—	—	200	—	—	—	240	—	—	ns
	t_{PHL}	4.5	—	32	—	35	—	40	—	44	—	48	—	53	
		6	—	27	—	—	—	34	—	—	—	41	—	—	
$\overline{E}$ to Outputs	t_{PLH}	2	—	150	—	—	—	190	—	—	—	225	—	—	ns
	t_{PHL}	4.5	—	30	—	35	—	38	—	44	—	45	—	53	
		6	—	26	—	—	—	33	—	—	—	38	—	—	
Output Transition Time	t_{TLH}	2	—	75	—	—	—	95	—	—	—	110	—	—	ns
	t_{THL}	4.5	—	15	—	15	—	19	—	19	—	22	—	22	
		6	—	13	—	—	—	16	—	—	—	19	—	—	
Input Capacitance	C_{IN}		—	10	—	10	—	10	—	10	—	10	—	10	pF

CD54/74HC139, CD54/74HCT139



Transition times and propagation delay times.

	54/74HC	54/74HCT
Input Level	V_{CC}	3 V
Switching Voltage, V_s	50% V_{CC}	1.3 V