

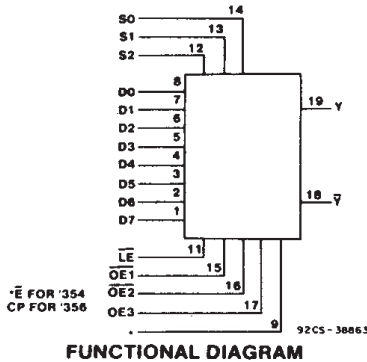
CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356

File Number 1690



Data sheet acquired from Harris Semiconductor
SCHS277

High-Speed CMOS Logic



8-Input Multiplexer/Register, 3-State

CD54/74HC/HCT354 — Transparent Data & Select Latches
CD54/74HC/HCT356 — Edge-Triggered Data Flip-Flops
Transparent Select Latches

Type Features:

- Buffered inputs
- 3-State Complementary Outputs
- Bus Line Driving Capability
- Typical propagation delay: $V_{CC} = 5V, C_L = 15 pF, T_A = 25^\circ C$
Data to Output (354) = 18 ns
Clock to Output (356) = 22 ns

The RCA-CD54/74HC/HCT354 and CD54/74HC/HCT356 are data selectors/multiplexers that select one of eight sources. In both the HC/HCT354 and HC/HCT356 the data select bits S0, S1, and S2 are stored in transparent latches that are enabled by a low latch enable input, LE.

In the HC/HCT354 the data enable input, \bar{E} , controls transparent latches that pass data to the outputs when \bar{E} is high and latches in new data when \bar{E} is low.

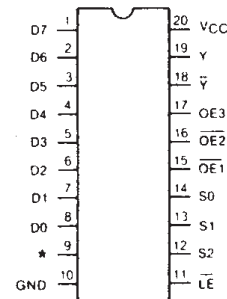
In the HC/HCT356 the data is stored in edge-triggered flip-flops that are triggered by a low-to-high clock transition.

In both types the three-state outputs are controlled by three output-enable inputs OE1, OE2, and OE3.

The CD54HC/HCT354/356 are supplied in 20-lead ceramic dual-in-line packages (F suffix). The CD74HC/HCT354/356 are supplied in 20-lead plastic dual-in-line plastic packages (E suffix). The CD54/74HC/HCT354/356 are also supplied in chip form (H suffix). The CD74HC/HCT354/356 are also available in plastic surface mounted packages (M suffix).

Family Features:

- Fanout (Over Temperature Range):
Standard Outputs - 10 LSTTL Loads
Bus Driver Outputs - 15 LSTTL Loads
- Wide Operating Temperature Range:
CD74HC/HCT: -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:
 $N_{IL} = 30\%, N_{IH} = 30\% \text{ of } V_{CC}; @ V_{CC} = 5 V$
- CD54HCT/CD74HCT Types:
4.5 to 5.5 V Operation
Direct LSTTL Input Logic Compatibility
 $V_{IL} = 0.8 V \text{ Max.}, V_{IH} = 2 V \text{ Min.}$
CMOS Input Compatibility
 $I_i \leq 1 \mu A @ V_{OL}, V_{OH}$

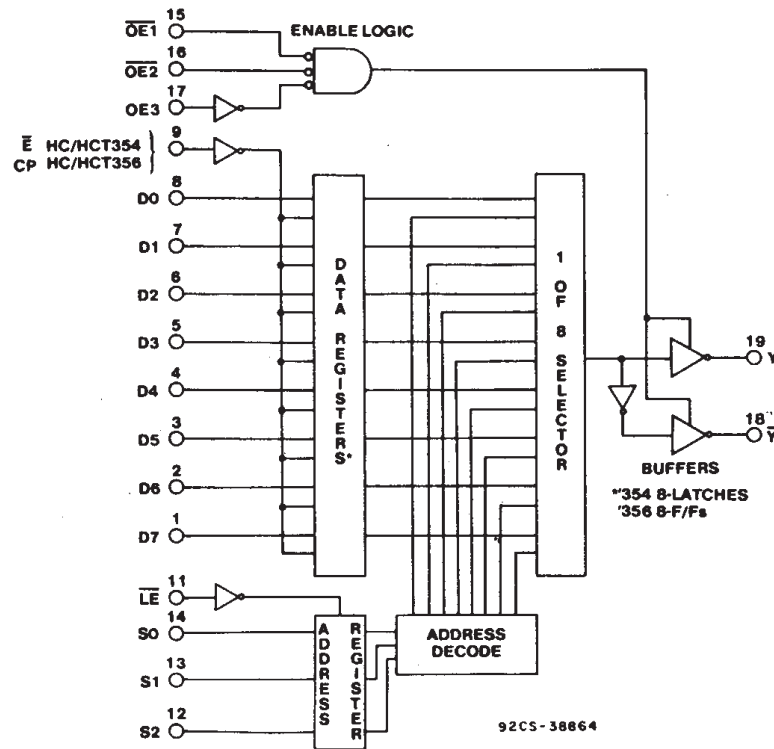


* \bar{E} for 354
CP for 356

TERMINAL ASSIGNMENT

This data sheet is applicable to the CD54HC354 and CD74HCT356. The CD54HCT354, CD54HCT356, CD74HC356, and CD54HCT356 were not acquired from Harris Semiconductor. See SCHS179 for information on the CD74HC354 and CD74HCT354.

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356



Block Diagram

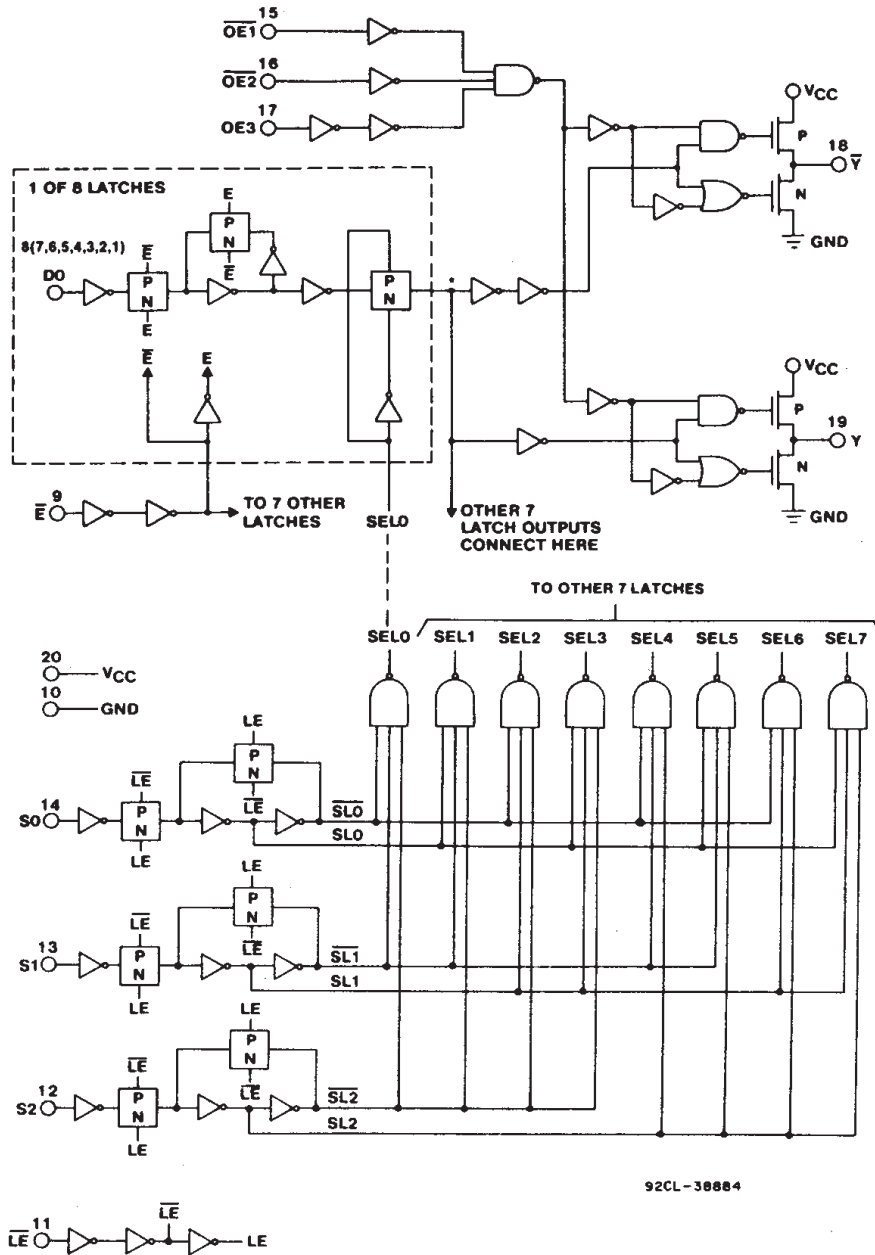
TRUTH TABLE

Inputs					Outputs	
Select #	Enable Data 'HC354 'HCT354	Clock 'HC356 'HCT356	Output Enables	Outputs		
S2 S1 S0	E	CP	OE1 OE2 OE3	Y	Y	
X X X	X	X	H X X	Z	Z	
X X X	X	X	X H X	Z	Z	
X X X	X	X	X X L	Z	Z	
L L L	L	↗	L L H	$\overline{D_0}$	D0	
L L L	H	H or L	L L H	$\overline{D_{0n}}$	D0 _n	
L L H	L	↗	L L H	$\overline{D_1}$	D1	
L L H	H	H or L	L L H	$\overline{D_{1n}}$	D1 _n	
L H L	L	↗	L L H	$\overline{D_2}$	D2	
L H L	H	H or L	L L H	$\overline{D_{2n}}$	D2 _n	
L H H	L	↗	L L H	$\overline{D_3}$	D3	
L H H	H	H or L	L L H	$\overline{D_{3n}}$	D3 _n	
H L L	L	↗	L L H	$\overline{D_4}$	D4	
H L L	H	H or L	L L H	$\overline{D_{4n}}$	D4 _n	
H L H	L	↗	L L H	$\overline{D_5}$	D5	
H L H	H	H or L	L L H	$\overline{D_{5n}}$	D5 _n	
H H L	L	↗	L L H	$\overline{D_6}$	D6	
H H L	H	H or L	L L H	$\overline{D_{6n}}$	D6 _n	
H H H	L	↗	L L H	$\overline{D_7}$	D7	
H H H	H	H or L	L L H	$\overline{D_{7n}}$	D7 _n	

Notes

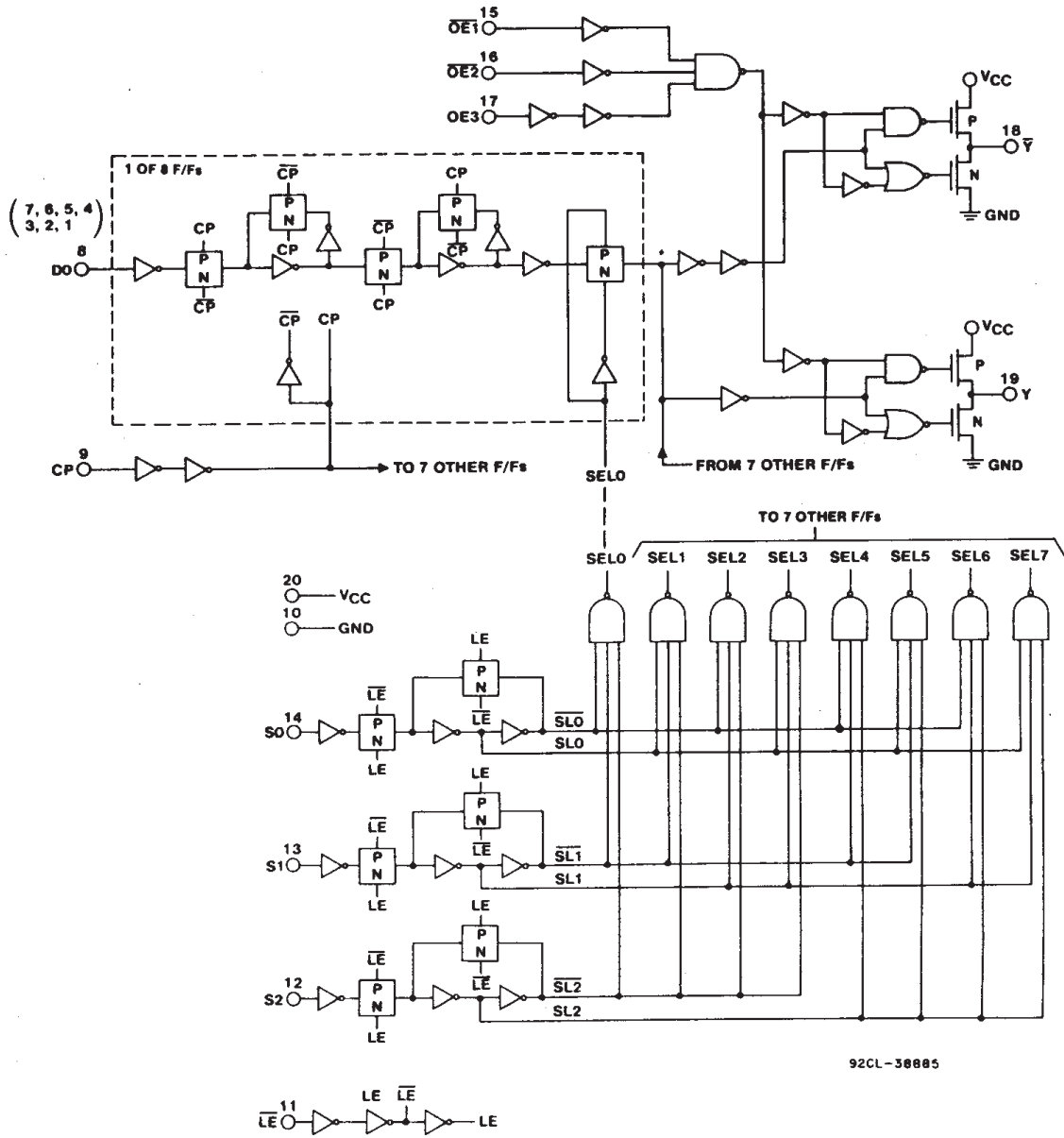
- H = high level (steady state)
- L = low level (steady state)
- X = irrelevant (any input, including transitions)
- Z = high-impedance state (off state)
- ↗ = transition from low to high level
- D0 ... D7 = the level of steady-state inputs at inputs D0 through D7, respectively, at the time of the low-to-high clock transition in the case of HC356
- D0_n ... D7_n = the level of steady state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control or clock
- # This column shows the input address setup with \overline{LE} low

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356



HC/HCT354 Logic Diagram

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356



HC/HCT356 Logic Diagram

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE, (V_{cc}) (Voltages referenced to ground)	-0.5 to +7V
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 $V_i < -0.5$ V OR $V_i > 0.5$ V + V_{cc})	± 20 mA
DC DRAIN CURRENT, PER OUTPUT (I_O) (FOR -0.5 V $< V_O < V_{cc} + 0.5$ V)	± 35 mA
DC V_{cc} OR GROUND CURRENT (I_{cc})	± 70 mA
POWER DISSIPATION PER PACKAGE (P_D):	
For $T_A = -40$ to $+60^\circ$ C (PACKAGE TYPE E)	500 mW
For $T_A = +60$ to $+85^\circ$ C (PACKAGE TYPE E)	Derate Linearly at 8 mW/ $^\circ$ C to 300 mW
For $T_A = -55$ to $+100^\circ$ C (PACKAGE TYPE F, H)	500 mW
For $T_A = +100$ to $+125^\circ$ C (PACKAGE TYPE F, H)	Derate Linearly at 8 mW/ $^\circ$ C to 300 mW
For $T_A = -40$ to $+70^\circ$ C (PACKAGE TYPE M)	400 mW
For $T_A = +70$ to $+125^\circ$ C (PACKAGE TYPE M)	Derate Linearly at 6 mW/ $^\circ$ C to 70 mW
OPERATING-TEMPERATURE RANGE (T_A):	
PACKAGE TYPE F, H	-55 to $+125^\circ$ C
PACKAGE TYPE E, M	-40 to $+85^\circ$ C
STORAGE TEMPERATURE (T_{stg})	-65 to $+150^\circ$ C
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ in. (1.59 ± 0.79 mm) from case for 10 s max.	$+265^\circ$ C
Unit inserted into a PC Board (min. thickness $1/16$ in., 1.59 mm) with solder contacting lead tips only	$+300^\circ$ C

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) CD54/74HC Types CD54/74HCT Types	2 4.5	6 5.5	V
DC Input or Output Voltage V_i, V_O	0	V_{cc}	V
Operating Temperature T_A : CD74 Types CD54 Types	-40 -55	+85 +125	$^\circ$ C
Input Rise and Fall Times t_r, t_f at 2 V at 4.5 V at 6 V	0 0 0	1000 500 400	ns

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

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356

HCT354 Input Loading Table

Input	Unit Loads*
D0-D7	0.50
S0, S1, S3	0.70
$\overline{OE}1, \overline{OE}2$	0.80
OE3	0.25
\overline{LE}	0.25
\overline{E}	0.60

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

HCT356 Input Loading Table

Input	Unit Loads*
D0-D7	0.50
S0, S1, S3	0.70
$\overline{OE}1, \overline{OE}2$	0.80
OE3	0.25
\overline{LE}	0.25
CP	0.60

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

SWITCHING CHARACTERISTICS ($V_{CC} = 5 V, T_A = 25^\circ C$, Input $t_r, t_f = 6 ns$) — HC/HCT354

CHARACTERISTIC	C_L (pF)	SYMBOL	TYPICAL		UNITS
			54/74HC	54/74HCT	
Propagation Delay $D_n \rightarrow Y, \overline{Y}$	15	t_{PLH}, t_{PHL}	18	20	ns
$\overline{E} \rightarrow Y, \overline{Y}$	15	t_{PLH}, t_{PHL}	21	23	ns
$S_n \rightarrow Y, \overline{Y}$	15	t_{PLH}, t_{PHL}	22	25	ns
$\overline{LE} \rightarrow Y, \overline{Y}$	15	t_{PLH}, t_{PHL}	24	25	ns
Output Disabling Time	15	t_{PLZ}, t_{PHZ}	13	13, 16	ns
Output Enabling Time	15	t_{PZL}, t_{PZH}	12, 13	14	ns
Power Dissipation Capacitance*	—	C_{PD}	90	92	pF

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

PREREQUISITE FOR SWITCHING FUNCTION — HC/HCT354

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.	
\overline{E} pulse width	t_{PLH} t_{PHL}	2	80	—	—	—	100	—	—	—	120	—	—	—	ns
		4.5	16	—	16	—	20	—	20	—	24	—	24	—	
		6	14	—	—	—	17	—	—	—	20	—	—	—	
\overline{LE} pulse width	t_{PLH} t_{PHL}	2	80	—	—	—	100	—	—	—	120	—	—	—	ns
		4.5	16	—	16	—	20	—	20	—	24	—	24	—	
		6	14	—	—	—	17	—	—	—	20	—	—	—	
Set Up Times $D_n \rightarrow \overline{E}$	t_{SU}	2	50	—	—	—	65	—	—	—	75	—	—	—	ns
		4.5	10	—	10	—	13	—	13	—	15	—	15	—	
		6	9	—	—	—	11	—	—	—	13	—	—	—	
$S_n \rightarrow \overline{LE}$	t_{SU}	2	50	—	—	—	65	—	—	—	75	—	—	—	ns
		4.5	10	—	10	—	13	—	13	—	15	—	15	—	
		6	9	—	—	—	11	—	—	—	13	—	—	—	
Hold Times $D_n \rightarrow \overline{E}$	t_H	2	45	—	—	—	55	—	—	—	70	—	—	—	ns
		4.5	9	—	9	—	11	—	11	—	14	—	14	—	
		6	8	—	—	—	9	—	—	—	12	—	—	—	
$S_n \rightarrow \overline{LE}$	t_H	2	45	—	—	—	55	—	—	—	70	—	—	—	ns
		4.5	9	—	9	—	11	—	11	—	14	—	14	—	
		6	8	—	—	—	9	—	—	—	12	—	—	—	

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356

SWITCHING CHARACTERISTICS ($C_L = 50 \text{ pF}$, Input $t_r, t_f = 6 \text{ ns}$) — HC/HCT354

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, $D_n \rightarrow Y, \bar{Y}$	t_{PLH} t_{PHL}	2	—	210	—	—	—	265	—	—	—	315	—	—	ns
		4.5	—	42	—	47	—	53	—	59	—	63	—	71	
		6	—	36	—	—	—	45	—	—	—	54	—	—	
$\bar{E} \rightarrow Y, \bar{Y}$	t_{PLH} t_{PHL}	2	—	250	—	—	—	315	—	—	—	375	—	—	ns
		4.5	—	50	—	54	—	63	—	68	—	75	—	81	
		6	—	43	—	—	—	54	—	—	—	64	—	—	
$S_n \rightarrow Y, \bar{Y}$	t_{PLH} t_{PHL}	2	—	260	—	—	—	325	—	—	—	390	—	—	ns
		4.5	—	52	—	59	—	65	—	74	—	78	—	89	
		6	—	44	—	—	—	55	—	—	—	66	—	—	
$\bar{L}\bar{E} \rightarrow Y, \bar{Y}$	t_{PLH} t_{PHL}	2	—	290	—	—	—	365	—	—	—	435	—	—	ns
		4.5	—	58	—	63	—	73	—	79	—	87	—	94	
		6	—	49	—	—	—	62	—	—	—	74	—	—	
Output Disabling Time $\bar{O}E_n \rightarrow Y, \bar{Y}$	t_{PLZ} t_{PHZ}	2	—	155	—	—	—	195	—	—	—	235	—	—	ns
		4.5	—	31	—	33	—	39	—	41	—	47	—	50	
		6	—	26	—	—	—	33	—	—	—	40	—	—	
OE3 to Y, \bar{Y}	t_{PLZ} t_{PHZ}	2	—	155	—	—	—	195	—	—	—	235	—	—	ns
		4.5	—	31	—	39	—	39	—	49	—	47	—	59	
		6	—	26	—	—	—	33	—	—	—	40	—	—	
Output Enabling Time $\bar{O}E_n \rightarrow Y, \bar{Y}$	t_{PZL} t_{PZH}	2	—	150	—	—	—	190	—	—	—	225	—	—	ns
		4.5	—	30	—	34	—	38	—	43	—	45	—	51	
		6	—	26	—	—	—	33	—	—	—	38	—	—	
OE3 to Y, \bar{Y}	t_{PZL} t_{PZH}	2	—	160	—	—	—	200	—	—	—	240	—	—	ns
		4.5	—	32	—	34	—	40	—	43	—	48	—	51	
		6	—	27	—	—	—	34	—	—	—	41	—	—	
Output Transition Time	t_{TLH} t_{THL}	2	—	60	—	—	—	75	—	—	—	90	—	—	ns
		4.5	—	12	—	12	—	15	—	15	—	18	—	18	
		6	—	10	—	—	—	13	—	—	—	15	—	—	
Input Capacitance	C_i		—	10	—	10	—	10	—	10	—	10	—	10	pF
3-state Output Capacitance	C_o		—	20	—	20	—	20	—	20	—	20	—	20	pF

SWITCHING CHARACTERISTICS ($V_{CC} = 5 \text{ V}$, $T_A = 25^\circ \text{ C}$, Input $t_r, t_f = 6 \text{ ns}$) — HC/HCT356

CHARACTERISTIC	C_L (pF)	SYMBOL	TYPICAL		UNITS
			54/74HC	54/74HCT	
Propagation Delay $CP \rightarrow Y, \bar{Y}$	15	t_{PLH}, t_{PHL}	22	22	ns
$S_n \rightarrow Y, \bar{Y}$	15	t_{PLH}, t_{PHL}	22	25	ns
$\bar{L}\bar{E} \rightarrow Y, \bar{Y}$	15	t_{PLH}, t_{PHL}	24	25	ns
Output Disabling Time	15	t_{PLZ}, t_{PHZ}	13	13, 15	ns
Output Enabling Time	15	t_{PZL}, t_{PZH}	12, 13	14	ns
Power Dissipation Capacitance*	—	C_{PD}	51	52	pF

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

**CD54/74HC354, CD54/74HCT354
CD54/74HC356, CD54/74HCT356**

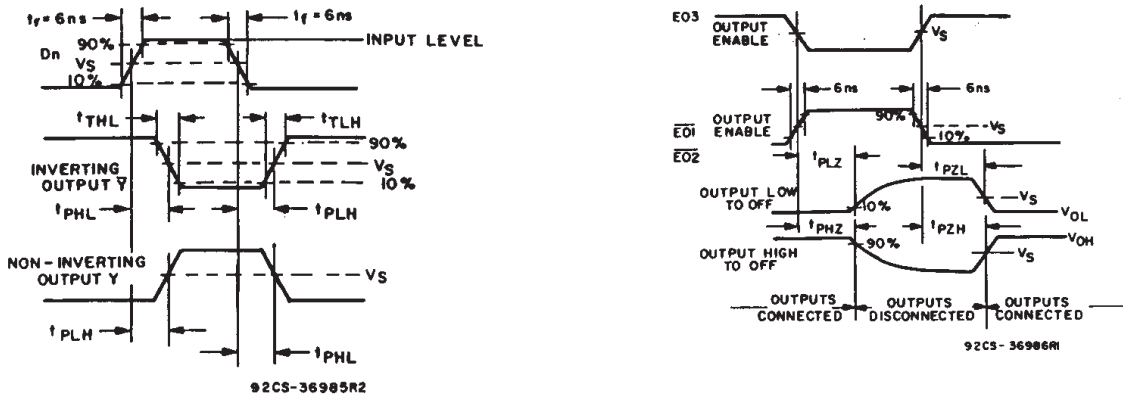
PREREQUISITE FOR SWITCHING FUNCTION — HC/HCT356

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.	
CP Pulse Width	t _{PLH} t _{PHL}	2	80	—	—	—	100	—	—	—	120	—	—	—	ns
		4.5	16	—	20	—	20	—	25	—	24	—	30	—	
		6	14	—	—	—	17	—	—	—	20	—	—	—	
LE Pulse Width	t _{PLH} t _{PHL}	2	80	—	—	—	100	—	—	—	120	—	—	—	ns
		4.5	16	—	20	—	20	—	25	—	24	—	30	—	
		6	14	—	—	—	17	—	—	—	20	—	—	—	
Set Up Times Dn → CP	t _{SU}	2	5	—	—	—	5	—	—	—	5	—	—	—	ns
		4.5	5	—	7	—	5	—	9	—	5	—	11	—	
		6	5	—	—	—	5	—	—	—	5	—	—	—	
Sn → LE	t _{SU}	2	5	—	—	—	5	—	—	—	5	—	—	—	ns
		4.5	5	—	7	—	5	—	9	—	5	—	11	—	
		6	5	—	—	—	5	—	—	—	5	—	—	—	
Hold Times Dn → CP	t _H	2	45	—	—	—	55	—	—	—	70	—	—	—	ns
		4.5	9	—	9	—	11	—	11	—	14	—	14	—	
		6	8	—	—	—	9	—	—	—	12	—	—	—	
Sn → LE	t _H	2	60	—	—	—	75	—	—	—	90	—	—	—	ns
		4.5	12	—	12	—	15	—	15	—	18	—	18	—	
		6	10	—	—	—	13	—	—	—	15	—	—	—	

SWITCHING CHARACTERISTICS (C_L = 50 pF, Input t_r, t_f = 6 ns) — HC/HCT356

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: CP → Y, Ȳ	t _{PLH} t _{PHL}	2	—	255	—	—	—	320	—	—	—	385	—	—	ns
		4.5	—	51	—	51	—	64	—	64	—	77	—	77	
		6	—	43	—	—	—	54	—	—	—	65	—	—	
Sn → Y, Ȳ	t _{PLH} t _{PHL}	2	—	260	—	—	—	325	—	—	—	390	—	—	ns
		4.5	—	52	—	59	—	65	—	74	—	78	—	89	
		6	—	44	—	—	—	55	—	—	—	66	—	—	
LE → Y, Ȳ	t _{PLH} t _{PHL}	2	—	290	—	—	—	365	—	—	—	435	—	—	ns
		4.5	—	58	—	63	—	73	—	79	—	87	—	94	
		6	—	49	—	—	—	62	—	—	—	74	—	—	
Output Disabling Time OE1, OE2 to Y, Ȳ OE3 to Y, Ȳ	t _{PLZ} t _{PHZ}	2	—	155	—	—	—	195	—	—	—	235	—	—	ns
		4.5	—	31	—	33	—	39	—	41	—	47	—	50	
		6	—	26	—	—	—	33	—	—	—	40	—	—	
Output Enabling Time OE1, OE2 to Y, Ȳ OE3 to Y, Ȳ	t _{PZL} t _{PZH}	2	—	150	—	—	—	190	—	—	—	225	—	—	ns
		4.5	—	30	—	34	—	38	—	43	—	45	—	51	
		6	—	26	—	—	—	33	—	—	—	38	—	—	
Output Transition Time	t _{TLH} t _{THL}	2	—	60	—	—	—	75	—	—	—	90	—	—	ns
		4.5	—	12	—	12	—	15	—	15	—	18	—	18	
		6	—	10	—	—	—	13	—	—	—	15	—	—	
Input Capacitance	C _i		—	10	—	10	—	10	—	10	—	10	—	10	pF
3-state Output Capacitance	C _o		—	20	—	20	—	20	—	20	—	20	—	20	pF

CD54/74HC354, CD54/74HCT354 CD54/74HC356, CD54/74HCT356



	54/74HC	54/74HCT
Input Level	V_{CC}	3 V
V_S	50% V_{CC}	1.3 V

Fig. 1 — Transition times and propagation delay times.

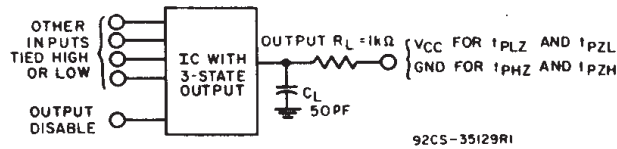


Fig. 2 — Three-state propagation delay test circuit.

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