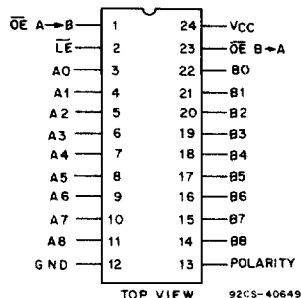


CD54/74HC7038 CD54/74HCT7038

File Number 1872

High-Speed CMOS Logic



TERMINAL ASSIGNMENT

9-Bit Bus Transceiver With Latch

Type Features:

- 48 mA sink current
- Inverting and non-inverting data paths
- Open drain outputs
- Interface compatible with SCSI, multibus, and VME bus specifications

The RCA-CD54/74HC7038 and the CD54/74HCT7038 are high-speed CMOS 9-bit bidirectional transceivers with input data latch and data polarity selection capability. These data-bus interface products are intended for two-way asynchronous communications between data buses. The 48 mA output sink current meets the drive requirements for the SCSI/Q-02, multibus, and VME bus specifications. The HC/HCT7038 devices feature the low power consumption of standard CMOS circuits and the speed and drive capabilities of LSTTL and TTL circuits.

The CD54/74HC7038 and CD54/74HCT7038 allow transmission and internal latch storage of 9 bits of positive or negative logic data from the "A" bus to the "B" bus. A low level on the Latch Enable input (\overline{LE}) stores "A" bus data in a 9 bit latch. When \overline{LE} is a high level, the latch is transparent and data flows from "A" to "B". The "B" bus output data drivers are open drain N-MOS transistors that allow the "B" bus high logic state level to be set by the B bus termination network which may be the SCSI/Q-02 (220/330 ohm) or

multibus/VME (dual 330/470 ohm) terminations. B-bus data may be transferred to the A-bus via appropriate \overline{OE} control levels as shown in the Function Table.

Data polarity may be reversed in either direction as shown in the Function Table.

For the HC types, A-bus ports and control are compatible with CMOS logic levels. For the HCT types, the A-bus ports and control are compatible with CMOS or TTL logic levels. For both types, the B-bus ports are compatible with only TTL levels; the TTL high-logic-level must be set by the external bus termination network.

The CD54HC7038 and CD54HCT7038 are supplied in 24-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC7038 and CD74HCT7038 are supplied in 24-lead dual-in-line narrow body plastic packages (EN suffix) and in 24-lead dual-in-line surface-mount plastic packages (M suffix). Both types are also available in chip form (H suffix).

FUNCTION TABLE

CONTROL INPUTS			OPERATION
$\overline{OE} A \rightarrow B$	$\overline{OE} B \rightarrow A$	POLARITY	
L	H	H	A_n to \overline{B}_n
L	H	L	A_n to B_n
H	L	H	B Data to \overline{A}
H	L	L	B Data to \overline{A}
H	H	X	Isolation

When $\overline{LE} = L$ "A" data is latched
 When $\overline{LE} = H$ latch is transparent
 H = High Level; L = Low Level; X = Irrelevant

CD54/74HC7038

CD54/74HCT7038

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE, (V_{CC}):		
(Voltages referenced to ground)	.....	-0.5 to +7 V
DC INPUT DIODE CURRENT, I_{IK} (for $V_i < 0$ V or $V_i > V_{CC} + 0.5$ V)	± 20 mA
DC INPUT VOLTAGE, V_i	.....	-0.5 to $V_{CC} + 0.5$ V
DC OUTPUT DIODE CURRENT, I_{OK} (for $V_o < 0$ V or $V_o > V_{CC} + 0.5$ V)	± 20 mA
DC OUTPUT VOLTAGE, V_o	.....	-0.5 to $V_{CC} + 0.5$ V
DC DRAIN CURRENT, PER OUTPUT, I_o , A SIDE	± 35 mA
B SIDE	± 50 mA
DC VCC CURRENT, I_{CC}	.....	+200 mA
DC GROUND CURRENT, I_{GND}	.....	-450 mA
STORAGE TEMPERATURE (T_{stg})	.....	-65 to +150°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°C
Unit inserted into a PC Board (min. thickness $1/16$ in., 1.59 mm)	.....
with solder contacting lead tips only	.....	-300°C

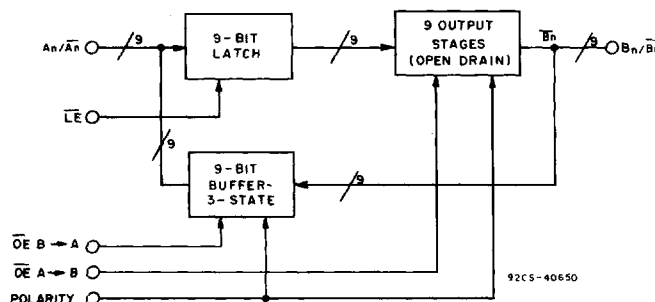


Fig. 1 - Logic block diagram.

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} : *	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	
Input Rise and Fall Times, t_r , t_f :	0	500	ns

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

CD54/74HC7038 CD54/74HCT7038

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC7038/CD54HC7038									CD74HCT7038/CD54HCT7038									UNITS
	TEST CONDITIONS			74HC/54HC TYPE		74HC TYPE		54HC TYPE		TEST CONDITIONS		74HCT/54HCT TYPE			74HCT TYPE		54HCT TYPE		
	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.	Max.	Min.	Max.	Min.	Max.			Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
High-Level Input Voltage V _{IH}			4.5 to 5.5	0.7 V _{CC}	—	0.7 V _{CC}	—	0.7 V _{CC}	—	—	4.5 to 5.5	2	—	—	2	—	2	—	V
Low-Level Input Voltage V _{IL}			4.5 to 5.5	—	0.3 V _{CC}	—	0.3 V _{CC}	—	0.3 V _{CC}	—	4.5 to 5.5	—	—	0.8	—	0.8	—	0.8	V
High-Level Output Voltage or "A" Side V _{OH}	V _{IL} or V _{IH}	-0.02 -6	4.5 4.5	4.4 3.98	—	4.4 3.84	—	4.4 3.7	—	V _{IL} or V _{IH}	4.5 4.5	4.4 3.98	—	—	4.4 3.84	—	4.4 3.7	—	V
Low-Level Output Voltage or "A" Side V _{OL}	V _{IL} or V _{IH}	0.02 6	4.5 4.5	—	0.1 0.26	—	0.1 0.33	—	0.1 0.4	V _{IL} or V _{IH}	4.5 4.5	—	—	0.1 0.26	—	0.1 0.33	—	0.1 0.4	V
"B" Side	V _{IL} or V _{IH}	0.02 48	4.5 4.5	—	0.1 0.31	—	0.1 0.4	—	0.1 0.46	V _{IL} or V _{IH}	4.5 4.5	—	—	0.1 0.31	—	0.1 0.4	—	0.1 0.46	V
Input Leakage Current I _i	V _{I0} = V _{CC} or Gnd		5.5	—	±0.5	—	±5	—	±10	V _{I0} = V _{CC} or Gnd	5.5	—	—	±0.1	—	±1	—	±1	μA
Quiescent Device Current I _{CC}	V _{CC} or Gnd	0	5.5	—	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 _I =2.4V Other Inputs: at V _{CC} or Gnd I _O = 0	5.5	—	100	390	—	450	—	490	μA
3-State Leakage Current I _{OZ}	V _{IL} or V _{IH}		5.5	—	±0.5	—	±5	—	±10	V _{IL} or V _{IH}	5.5	—	—	±0.5	—	±5	—	±10	μA

HCT Input Loading Table

Input	Unit Loads
All	1

CD54/74HC7038

CD54/74HCT7038

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

CHARACTERISTIC		C_L (pF)	TYPICAL		UNITS
			HC	HCT	
Propagation Delay A → B	t_{PLZ}	15	18	18	ns
	t_{PZL}				
A → \bar{B}	t_{PLZ}		17	17	
	t_{PZL}		15	15	
B → A	t_{PLH}, t_{PHL}		11	14	
\bar{B} → A	t_{PLH}, t_{PHL}		9	10	

PRE-REQUISITE FOR SWITCHING FUNCTION

CHARACTERISTIC	TEST CONDITIONS	V_{CC} (V)	LIMITS												UNITS
			+25°C				-40°C to +85°C				-55°C to +125°C				
			HC		HCT		74HC		74HCT		54HC		54HCT		
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.				
\bar{LE} Pulse Width	t_w	2	60	—	—	—	75	—	—	—	90	—	—	—	ns
		4.5	12	—	12	—	15	—	15	—	18	—	18	—	
		6	10	—	—	—	13	—	—	—	15	—	—	—	
Set-up Time Data to \bar{LE}	t_{su}	2	35	—	—	—	45	—	—	—	55	—	—	—	ns
		4.5	7	—	7	—	9	—	9	—	11	—	11	—	
		6	6	—	—	—	8	—	—	—	9	—	—	—	
Hold Time Data to \bar{LE}	t_h	2	35	—	—	—	45	—	—	—	55	—	—	—	ns
		4.5	7	—	7	—	9	—	9	—	11	—	11	—	
		6	6	—	—	—	8	—	—	—	9	—	—	—	

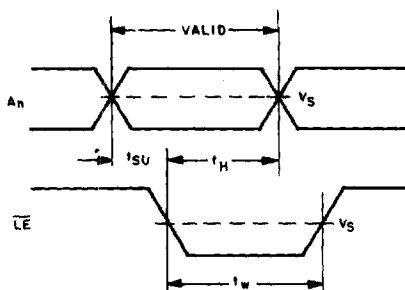
CD54/74HC7038

CD54/74HCT7038

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

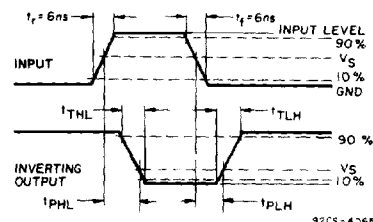
CHARACTERISTIC	TEST CONDITIONS V _{CC} (V)	LIMITS										UNITS			
		+25°C				-40°C to +85°C				-55°C to +125°C					
		HC		HCT		74HC		74HCT		54HC	54HCT				
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.				
Propagation Delay A to B	t _{PLZ}	2	—	220	—	—	—	275	—	—	—	330	—	—	ns
	t _{PZL}	4.5	—	44	—	44	—	55	—	55	—	66	—	66	
		6	—	37	—	—	—	47	—	—	—	56	—	—	
A to \bar{B}	t _{PLZ}	2	—	200	—	—	—	250	—	—	—	300	—	—	
		4.5	—	40	—	40	—	50	—	50	—	60	—	60	
		6	—	34	—	—	—	43	—	—	—	51	—	—	
$\bar{L}E$ to $\bar{B}n$	t _{PLZ}	2	—	180	—	—	—	225	—	—	—	270	—	—	
		4.5	—	36	—	36	—	45	—	45	—	54	—	54	
		6	—	31	—	—	—	38	—	—	—	46	—	—	
Polarity Low	t _{PZL}	2	—	260	—	—	—	325	—	—	—	390	—	—	
		4.5	—	52	—	52	—	65	—	65	—	78	—	78	
		6	—	44	—	—	—	55	—	—	—	66	—	—	
Polarity High	t _{PZL}	2	—	230	—	—	—	290	—	—	—	345	—	—	
		4.5	—	46	—	46	—	58	—	58	—	69	—	69	
		6	—	39	—	—	—	49	—	—	—	59	—	—	
$\bar{O}E$ A → B Disable	t _{PLZ}	2	—	230	—	—	—	290	—	—	—	345	—	—	
		4.5	—	46	—	46	—	58	—	58	—	69	—	69	
		6	—	39	—	—	—	49	—	—	—	59	—	—	
Enable	t _{PLZ}	2	—	170	—	—	—	215	—	—	—	255	—	—	
		4.5	—	34	—	34	—	43	—	43	—	51	—	51	
		6	—	29	—	—	—	37	—	—	—	43	—	—	
B to A	t _{PLH}	2	—	170	—	—	—	215	—	—	—	255	—	—	
		4.5	—	34	—	34	—	43	—	43	—	51	—	51	
		6	—	29	—	—	—	37	—	—	—	43	—	—	
B to \bar{A}	t _{PLH}	2	—	140	—	—	—	175	—	—	—	210	—	—	
		4.5	—	28	—	28	—	35	—	35	—	42	—	42	
		6	—	24	—	—	—	30	—	—	—	36	—	—	
$\bar{O}E$ B → A Disable	t _{PLH}	2	—	120	—	—	—	150	—	—	—	180	—	—	
		4.5	—	24	—	26	—	30	—	33	—	36	—	39	
		6	—	20	—	—	—	26	—	—	—	31	—	—	
Enable	t _{PZL}	2	—	185	—	—	—	230	—	—	—	280	—	—	
		4.5	—	37	—	37	—	46	—	46	—	56	—	56	
		6	—	31	—	—	—	39	—	—	—	48	—	—	
Enable	t _{PZH}	2	—	175	—	—	—	220	—	—	—	265	—	—	
		4.5	—	35	—	35	—	44	—	44	—	53	—	53	
		6	—	30	—	—	—	39	—	—	—	45	—	—	

CD54/74HC7038 CD54/74HCT7038



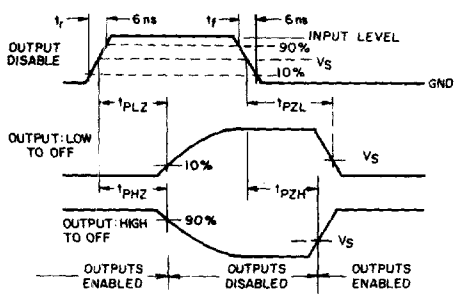
92CS-40652

Fig. 2 - Latch enable pulse width, setup and hold times.

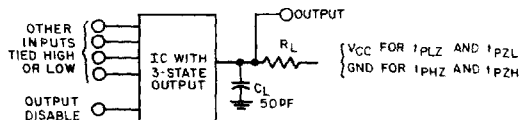


92CS-40654

Fig. 3 - Transition times and propagation delay times, combination logic.



92CS-40653

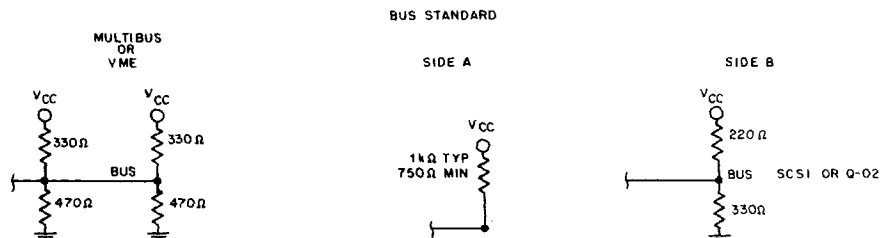


	V _{CC}	R _L
Side A	4.5 V	1k Ω
Side B	3 V	133 Ω

92CS-35129R2

Fig. 4 - Three-state propagation delay wave shapes and test circuit.

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



92CS-40651

Fig. 5 - Recommended bus terminations.