CD54HC181/3A
CD54HCT181/3A

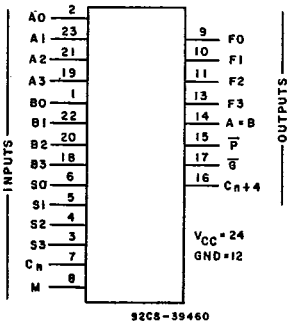
T-49-11

4-Bit Arithmetic Logic Unit (ALU)

The RCA CD54HC181 and CD54HCT181 are low-power four-bit parallel arithmetic logic units (ALU) capable off providing 16 binary arithmetic operations on two four-bit words and 16 logical functions of two Boolean variables. The mode control input M selects logical (M=High) or arithmetic (M=Low) operation. The four select inputs (S0, S1, S2, and S3) select the desired logical or arithmetic functions, which include AND, OR, NAND, NOR, and exclusive-OR and -NOR in the logic mode, and addition, subtraction, decrement, left-shift and straight transfer in the arithmetic mode. The HC/HCT181 operation may be interpreted with either active-low or active-high data at the A and B word inputs and the function outputs.

The HC/HCT181 contains logic for full look-ahead carry operation for fast-carry generation using the carry-generate and carry-propagate outputs $\overline{G}$ and $\overline{P}$ for the four bits of the HC/HCT181. Use of the HC/HCT182 look-ahead carry generator in conjunction with multiple HC/HCT181s permits high-speed arithmetic operations on long words. A ripple-carry output C_{n+4} is available for use in systems where speed is not of primary importance.

Also included in these devices is a comparator output A=B, which assumes a high level whenever the two four-bit input words A and B are equal and the device is in the subtract mode. A-B is an open-drain output that can be wire-AND connected to give a comparison for more than four bits. In addition, relative magnitude information may be derived from the carry-in input C_n and ripple carry-out output C_{n+4} by placing the unit in the subtract mode and externally decoding.



FUNCTIONAL DIAGRAM

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Package Specifications
See Section 11, Fig. 15

Static Electrical Characteristics (Limits with black dots (•) are tested 100%)

CHARACTERISTICS		TEST CONDITIONS HC/HCT V_{DD}	V_O	I_O	V_{CC} or GND	V_{IN} HC V_{IL} or V_{IH}	V_{IN} HCT V_{IL} or V_{IH}	LIMITS MIN.	LIMITS MAX.	UNITS
Quiescent Device Current I_{CC}	25°C	6	—	—	6, 0	—	—	—	8•	μA
	-55°C / +125°C	6	—	—	6, 0	—	—	—	160•	μA

The complete static electrical test specification consists of the above by-type static tests combined with the standard static tests in the beginning of this section.

HCT INPUT LOADING TABLE

INPUT	UNIT LOAD*
S0-S3	1
All A and B (Data)	0.75
M, C_n	0.5

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

CD54HC181/3A
CD54HCT181/3A

Switching Speed (Limits with black dots (•) are tested 100%.)

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS V_{CC} V	LIMITS 25°C HC Min.	HC Max.	HCT Min.	HCT Max.	-55°C to +125°C 54HC Min.	54HC Max.	54HCT Min.	54HCT Max.	UNITS
Propagation Delay SUM Mode A_n or B_n to C_{n+4}	t_{PLH} t_{PHL}	2	—	225	—	—	—	345	—	—	ns
		4.5	—	45•	—	53•	—	69•	—	80•	
		6	—	38	—	—	—	59	—	—	
A_n or B_n to G		2	—	210	—	—	—	315	—	—	
		4.5	—	42•	—	54•	—	63•	—	63•	
		6	—	36	—	—	—	54	—	—	
A_n or B_n to P		2	—	170	—	—	—	255	—	—	
		4.5	—	34	—	41	—	51	—	62	
		6	—	29	—	—	—	43	—	—	
A_n or B_n to F_n		2	—	230	—	—	—	345	—	—	
		4.5	—	46	—	58	—	69	—	69	
		6	—	39	—	—	—	59	—	—	
Propagation Delay, DIFFERENCE Mode A_n or B_n to C_{n+4}	t_{PHL} t_{PLH}	2	—	235	—	—	—	355	—	—	
		4.5	—	47	—	55	—	71	—	83	
		6	—	40	—	—	—	60	—	—	
A_n or B_n to G		2	—	215	—	—	—	325	—	—	
		4.5	—	43	—	54	—	65	—	65	
		6	—	37	—	—	—	55	—	—	
A_n or B_n to P		2	—	170	—	—	—	255	—	—	
		4.5	—	34	—	40	—	51	—	60	
		6	—	29	—	—	—	43	—	—	
A_n or B_n to F_n		2	—	235	—	—	—	355	—	—	
		4.5	—	47	—	57	—	71	—	86	
		6	—	40	—	—	—	60	—	—	
A_n or B_n to A=B		2	—	245	—	—	—	370	—	—	
		4.5	—	49•	—	60•	—	74•	—	90•	
		6	—	42	—	—	—	63	—	—	
Propagation Delay, LOGIC Mode A_n or B_n to F_n	t_{PHL} t_{PLH}	2	—	230	—	—	—	345	—	—	
		4.5	—	46	—	54	—	69	—	81	
		6	—	39	—	—	—	59	—	—	
Propagation Delay, SUM & DIFF. Modes C_n to C_{n+4}	t_{PHL} t_{PLH}	2	—	165	—	—	—	250	—	—	
		4.5	—	33	—	42	—	50	—	63	
		6	—	28	—	—	—	43	—	—	
C_n to F_n		2	—	200	—	—	—	300	—	—	
		4.5	—	40	—	48	—	60	—	68	
		6	—	34	—	—	—	51	—	—	
Output Transition Time	t_{THL} t_{TLH}	2	—	75	—	—	—	110	—	—	
		4.5	—	15	—	15	—	22	—	22	
		6	—	13	—	—	—	19	—	—	
Input Capacitance	C_I	—	—	10	—	10	—	10	—	10	pF

Burn-In Test-Circuit Connections (Use Static II for /3A burn-in and Dynamic for Life Test.)

Static	STATIC BURN-IN I OPEN	GROUND	V_{CC} (6V)	STATIC BURN-IN II OPEN	GROUND	V_{CC} (6V)
CD54HC/HCT181	9-11,13-17	1-8,12,18-23	24	9-11,13-17	12	1-8,18-24
Dynamic	**OPEN**	**GROUND**	**1/2 V_{CC} (3V)**	**V_{CC} (6V)**	**OSCILLATOR 50 kHz**	**25 kHz**
CD54HC/HCT181	—	4-6,8,12	9-11,13-17	3,24	1,2,18-23	7

NOTE: Each pin except V_{CC} and Gnd will have a resistor of 2k-47k ohms.