

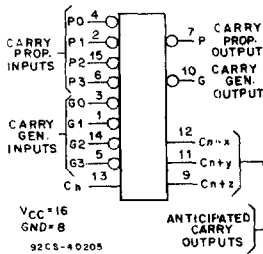
CD54/74HC182 CD54/74HCT182

High-Speed CMOS Logic

Look-Ahead Carry Generator

Type Features:

- Provides carry look-ahead across a group of four ALU s
- Multi-level look-ahead for high-speed arithmetic operation over long word length



FUNCTIONAL DIAGRAM

The RCA-CD54/74HC182 and CD54/74HCT182 carry look-ahead generators are high-speed silicon-gate CMOS devices and are pin compatible with low-power Schottky TTL (LSTTL).

The CD54/74HC/HCT182 accept up to four pairs of active LOW carry propagate ($\overline{P}_0, \overline{P}_1, \overline{P}_2, \overline{P}_3$) and carry generate ($\overline{G}_0, \overline{G}_1, \overline{G}_2, \overline{G}_3$) signals and an active HIGH carry input (C_n). The devices provide anticipated active HIGH carries ($C_{n+x}, C_{n+y}, C_{n+z}$) across four groups of binary adders. The HC/HCT182 also has active LOW carry propagate (\overline{P}) and carry generate (\overline{G}) outputs which may be used for further levels of look ahead.

The logic equations provided at the outputs are:

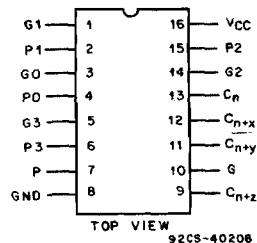
$$\begin{aligned}
 C_{n+x} &= P_0 C_n \\
 C_{n+y} &= G_1 + P_1 G_0 + P_1 P_0 C_n \\
 C_{n+z} &= G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 C_n \\
 \overline{G} &= \overline{G}_3 + P_3 \overline{G}_2 + P_3 P_2 \overline{G}_1 + P_3 P_2 P_1 \overline{G}_0 \\
 \overline{P} &= P_3 P_2 P_1 P_0
 \end{aligned}$$

The CD54/74HC/HCT182 can also be used with binary ALUs in an active LOW or active HIGH input operand mode. The connections to and from the ALU to the carry look-ahead generator are identical in both cases.

The CD54HC182 and CD54HCT182 are supplied in 16-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC182 and CD74HCT182 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).

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: $N_{IL} = 30\%, N_{IH} = 30\%$ 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
 $I_I \leq 1 \mu A @ V_{OL}, V_{OH}$



TERMINAL ASSIGNMENT

CD54/74HC182 CD54/74HCT182

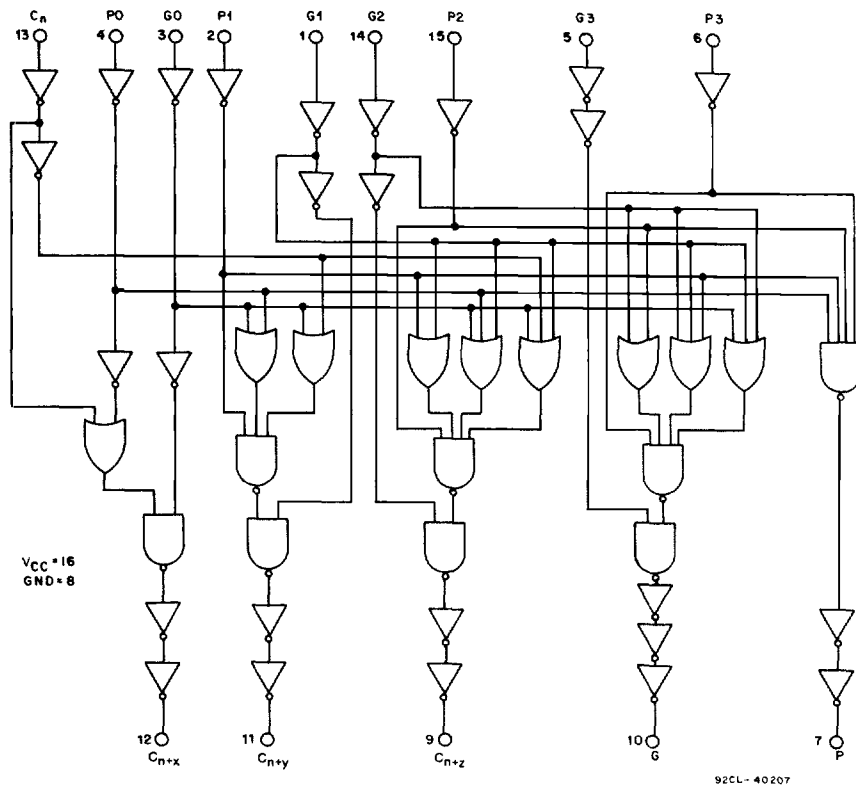


Fig. 1 - Logic diagram.

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 $V_i < -0.5$ 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)	± 20 mA
DC DRAIN CURRENT, PER OUTPUT (I_o) (FOR -0.5 V $< V_o < V_{cc} + 0.5$ V)	± 25 mA
DC V_{cc} OR GROUND CURRENT (I_{cc})	± 50 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

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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.

FUNCTION TABLE

INPUTS									OUTPUTS				
C_n	G_0	P_0	G_1	P_1	G_2	P_2	G_3	P_3	C_{n+2}	C_{n+1}	C_{n+2}	G	P
X L X H	H L L X	H X X L							L L H H				
X X L X X H	X H X L X	X H X X L	H H L X X	H X X L L						L L L H H			
X X X L X X X H	X X H H	X X H X	X H H H	X H X X	H H H H	H X X X					L L L L H H H H		
	X X X H X X X L		X X H H	X X H X	X H H H	X H X X	H H H H	H X X X				H H H H L L L L	
		H X X X L		X H X X L		X X H X L		X X H X L					H H H L

H = HIGH voltage level

L = LOW voltage level

X = don't care

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STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC182/CD54HC182										CD74HCT182/CD54HCT182								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	2	—	—	2	—	2	—	V	
			4.5	3.15	—	—	3.15	—	3.15	—	—	5.5										
			6	4.2	—	—	4.2	—	4.2	—												
Low-Level Input Voltage	V _{IL}		2	—	—	0.5	—	0.5	—	0.5	—	4.5	to	—	—	0.8	—	0.8	—	0.8	V	
			4.5	—	—	1.35	—	1.35	—	1.35	—	5.5										
			6	—	—	1.8	—	1.8	—	1.8	—											
High-Level Output Voltage	V _{OH}	V _{IL} or -0.02	2	1.9	—	—	1.9	—	1.9	—	V _{IL} or V _{IH}	4.5	4.4	—	—	4.4	—	4.4	—	4.4	V	
CMOS Loads			4.5	4.4	—	—	4.4	—	4.4	—												
			6	5.9	—	—	5.9	—	5.9	—												
TTL Loads		V _{IL} or -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}	V _{IL} or 0.02	2	—	—	0.1	—	0.1	—	0.1	V _{IL} or V _{IH}	4.5	—	—	0.1	—	0.1	—	0.1	—	0.1	V
CMOS Loads			4.5	—	—	0.1	—	0.1	—	0.1												
			6	—	—	0.1	—	0.1	—	0.1												
TTL Loads		V _{IL} or 4	4.5	—	—	0.26	—	0.33	—	0.4	V _{IL} or V _{IH}	4.5	—	—	0.26	—	0.33	—	0.4	—	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	—	±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	—	100	360	—	450	—	490	μA
													5.5									

*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 *
P ₀ , P ₁ , P ₂ , G ₀ , G ₁	1.5
P ₃ , G ₂ , C _n	1.25
G ₃	0.3

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

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

CHARACTERISTIC	C_L (pF)	TYPICAL VALUES		UNITS	
		HC	HCT		
Propagation Delay Time:					
P_n to P	t_{PHL}, t_{PLH}	15	9	11	ns
C_n to any output	t_{PHL}, t_{PLH}	15	12	17	
P_n to any output	t_{PHL}, t_{PLH}	15	12	13	
G_n to any output	t_{PHL}, t_{PLH}	15	11	13	
Power Dissipation Capacitance *	C_{PD}	—	66	72	pF

* C_{PD} is used to determine the dynamic power consumption, per package.

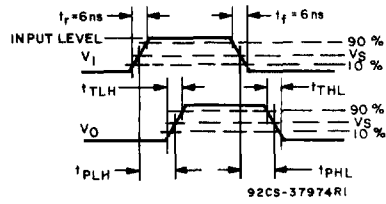
$$P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L V_{CC}^2 f_o)$$

where: f_i = input frequency
 f_o = output frequency
 C_L = output load capacitance
 V_{CC} = supply voltage

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

CHARACTERISTIC	TEST CONDITIONS	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.		
Propagation Delay, t_{PLH}	t_{PLH}	—	120	—	—	—	150	—	—	—	180	—	—	ns	
	t_{PHL}	—	24	—	28	—	30	—	35	—	36	—	42		
	P_n to P	6	—	20	—	—	—	26	—	—	—	31	—		—
C_n to any output	t_{PLH}	2	—	150	—	—	—	190	—	—	—	225	—		—
	t_{PHL}	4.5	—	30	—	40	—	38	—	50	—	45	—		60
	P_n to any output	6	—	26	—	—	—	33	—	—	—	38	—		—
P_n to any output	t_{PLH}	2	—	145	—	—	—	180	—	—	—	220	—		—
	t_{PHL}	4.5	—	29	—	33	—	36	—	41	—	36	—		50
	G_n to any output	6	—	25	—	—	—	31	—	—	—	31	—		—
G_n to any output	t_{PLH}	2	—	135	—	—	—	170	—	—	—	205	—		—
	t_{PHL}	4.5	—	27	—	32	—	34	—	40	—	41	—		48
	P_n to any output	6	—	23	—	—	—	29	—	—	—	35	—		—
Transition Time	t_{TLH}	2	—	75	—	—	—	95	—	—	—	110	—	—	
	t_{THL}	4.5	—	15	—	15	—	19	—	19	—	22	—	22	
	P_n to any output	6	—	13	—	—	—	16	—	—	—	19	—	—	
Input Capacitance	C_i	—	10	—	10	—	10	—	10	—	10	—	10	pF	

CD54/74HC182
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	54/74HC	54/74HCT
Input Level	V_{CC}	3 V
Switching Voltage, V_s	50% V_{CC}	1.3 V

Fig. 2 - Transition times and propagation delay times.

