

✓ TC74HC182AP/AF

LOOK AHEAD CARRY LOGIC

The TC74HC182A is a high speed CMOS FUNCTION LOOK AHEAD CARRY GENERATOR fabricated with silicon gate C² MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

These circuits are capable of anticipating a carry across four binary adders or group of adders. They are cascadable to perform full look-ahead across n-bit adders. Carry, generate-carry, and propagate-carry functions are provided as shown in the pin designation table.

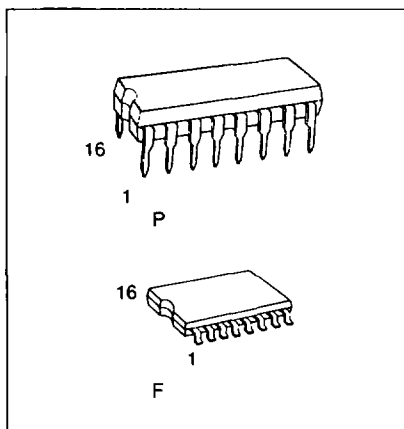
When used in conjunction with the HC181A arithmetic logic unit, these generators provide high-speed carry look-ahead capability for any word length. Each HC182A generates the look-ahead (anticipated carry) across a group of four ALU's and, in addition, other carry look-ahead circuits may be employed to anticipate carry across sections of four look-ahead packages up to n-bits. The method of cascading circuits to perform multi-level look-ahead is illustrated under typical application data.

Carry input and output of the ALU's are in their true form, and the carry propagate (P) and carry generate (G) are in negated form; therefore, the carry functions (inputs, output, generate, and propagate) of the look-ahead generators are implemented in the compatible forms for direct connection to the ALU. Reinterpretation of carry functions as explained on the HC181A data sheet are also applicable to and compatible with the look-ahead generator.

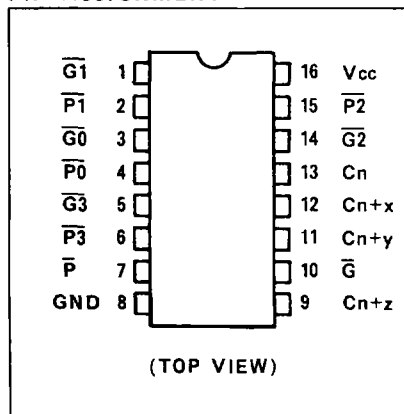
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed $t_{pd} = 14\text{ns}$ (Typ.) at $V_{CC} = 5\text{V}$
- Low Power Dissipation $I_{CC} = 4\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Output Drive Capability 10 LSTTL Loads
- Symmetrical Output Impedance $|I_{OH}| = |I_{OL}| = 4\text{mA}$ (Min.)
- Balanced Propagation Delays $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range V_{CC} (opr.) = 2V ~ 6V
- Pin and Function Compatible with 74LS182



PIN ASSIGNMENT



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Pin Designation

Active "L"	Active "H"	Pin No.	Function
G ₀ , G ₁ , G ₂ , G ₃	G ₀ , G ₁ , G ₂ , G ₃	3, 1, 14, 6	Carry Generate Inputs
P ₀ , P ₁ , P ₂ , P ₃	P ₀ , P ₁ , P ₂ , P ₃	4, 2, 15, 8	Carry Propagate Inputs
C _n	C _n	13	Carry Input
C _{n+z} , C _{n+y} C _{n+z}	C _{n+x} , C _{n+y} C _{n+z}	12, 11, 9	Carry Outputs
G	Y	10	Carry Generate Output
P	X	7	Carry Propagate Output
V _{cc}		16	Supply Voltage
GND		8	Ground

TRUTH TABLE

FOR G OUTPUT

INPUTS							OUTPUT
G ₃	G ₂	G ₁	G ₀	P ₃	P ₂	P ₁	G
L	X	X	X	X	X	X	L
X	L	X	X	L	X	X	L
X	X	L	X	L	L	X	L
X	X	X	L	L	L	L	L
All other combinations							H

FOR P OUTPUT

INPUTS				OUTPUT
P ₃	P ₂	P ₁	P ₀	P
L	L	L	L	L
All other combinations				H

FOR C_{n+z} OUTPUT

INPUTS							OUTPUT
G ₂	G ₁	G ₀	P ₂	P ₁	P ₀	C _n	C _{n+z}
L	X	X	X	X	X	X	H
X	L	X	L	X	X	X	H
X	X	L	L	L	X	X	H
X	X	X	L	L	L	H	H
All other combinations							L

FOR C_{n+x} OUTPUT

INPUTS			OUTPUT
G ₀	P ₀	C _n	C _{n+x}
L	X	X	H
X	L	H	H
All other combinations			L

FOR C_{n+y} OUTPUT

INPUTS					OUTPUT
G ₁	G ₀	P ₁	P ₀	C _n	C _{n+y}
L	X	X	X	X	H
X	L	L	X	X	H
X	X	L	L	H	H
All other combinations					L

X: Don't care

$$C_{n+x} = G_0 + P_0 C_n$$

$$C_{n+y} = G_1 + P_1 G_0 + P_1 P_0 C_n$$

$$C_{n+z} = G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 C_n$$

$$G = G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0$$

$$P = P_3 P_2 P_1 P_0$$

or

$$C_{n+x} = Y_0 (X_0 + C_n)$$

$$C_{n+y} = Y_1 [X_1 + Y_0 (X_0 + C_n)]$$

$$C_{n+z} = Y_2 [X_2 + Y_1 [X_1 + Y_0 (X_0 + C_n)]]$$

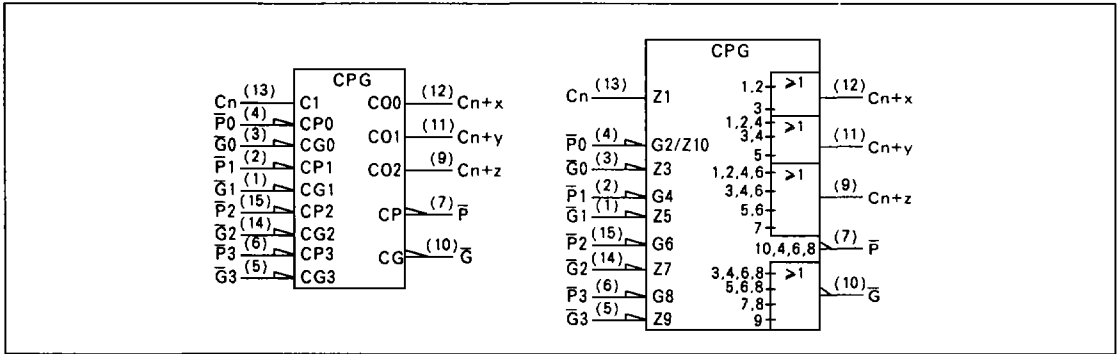
$$Y = Y_3 (X_3 + Y_2) (X_3 + X_2 + Y_1) (X_3 + X_2 + X_1 + Y_0)$$

$$X = X_3 + X_2 + X_1 + X_0$$

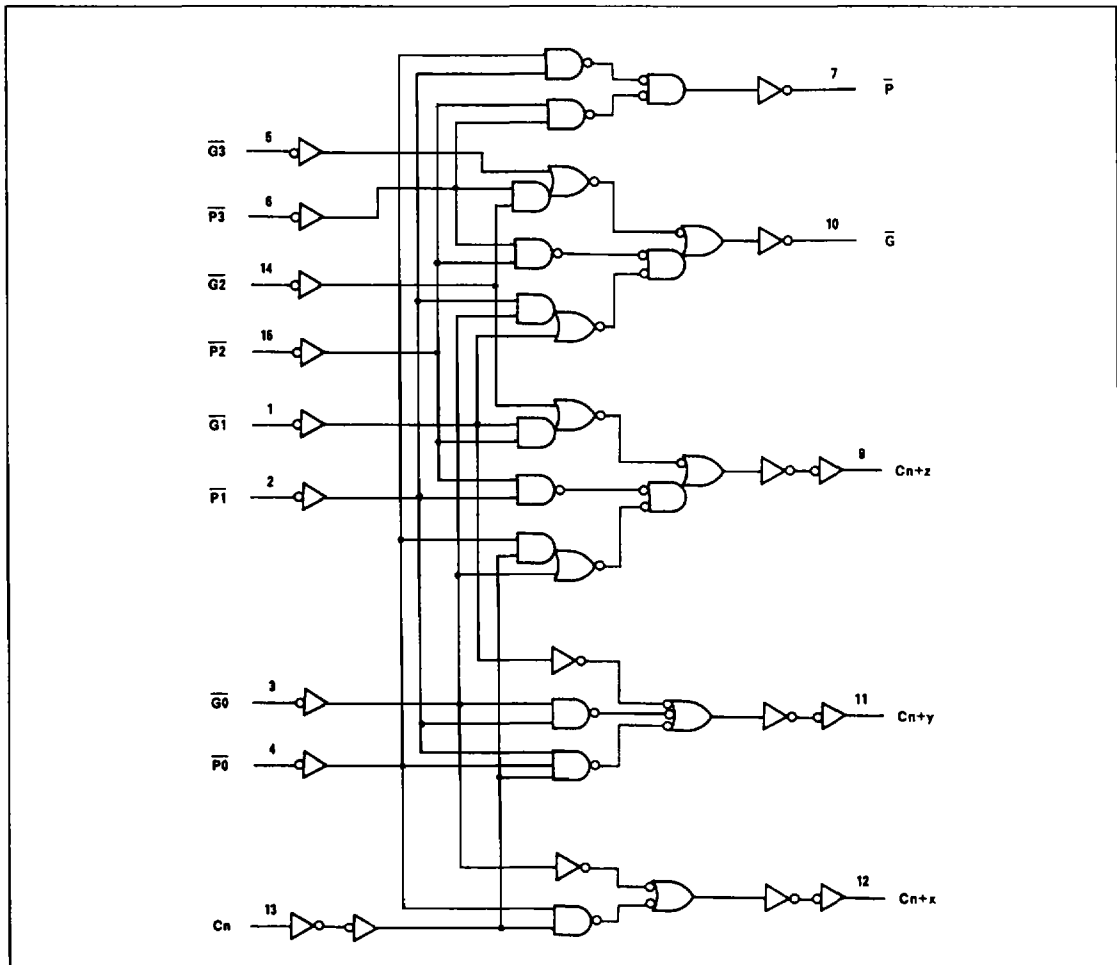
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IEC LOGIC SYMBOL



LOGIC DIAGRAM



TC74HC182AP/AF-3

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	-0.5 ~ 7	V
DC Input Voltage	V_{IN}	-0.5 ~ $V_{CC} + 0.5$	V
DC Output Voltage	V_{OLT}	-0.5 ~ $V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	±20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current	I_{OLT}	±25	mA
DC V_{CC} /Ground Current	I_{CC}	±50	mA
Power Dissipation	P_D	500(DIP)* / 180(SOIC)	mW
Storage Temperature	T_{stg}	-65 ~ 150	°C
Lead Temperature 10sec	T_l	300	°C

*500mW in the range of $T_a = -40^\circ\text{C} \sim 65^\circ\text{C}$. From $T_a = 65^\circ\text{C}$ to 85°C a derating factor of $-10\text{mW}/^\circ\text{C}$ shall be applied until 300mW

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	2 ~ 6	V
Input Voltage	V_{IN}	0 ~ V_{CC}	V
Output Voltage	V_{OLT}	0 ~ V_{CC}	V
Operating Temperature	T_{opr}	-40 ~ 85	°C
Input Rise and Fall Time	t_r, t_f	0 ~ 1000 ($V_{CC}=2.0\text{V}$)	ns
		0 ~ 500 ($V_{CC}=4.5\text{V}$)	
		0 ~ 400 ($V_{CC}=6.0\text{V}$)	

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	$T_a = 25^\circ\text{C}$			$T_a = -40 \sim 85^\circ\text{C}$		UNIT		
			V_{CC}	MIN.	TYP.	MAX.	MIN.		MAX.	
High-Level Input Voltage	V_{IH}		2.0	1.5	-	-	1.5	-	V	
			4.5	3.15	-	-	3.15	-		
			6.0	4.2	-	-	4.2	-		
Low-Level Input Voltage	V_{IL}		2.0	-	-	0.5	-	0.5	V	
			4.5	-	-	1.35	-	1.35		
			6.0	-	-	1.8	-	1.8		
High-Level Output Voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu\text{A}$	2.0	1.9	2.0	-	1.9	-	V
				4.5	4.4	4.5	-	4.4	-	
				6.0	5.9	6.0	-	5.9	-	
			$I_{OH} = -4 \text{ mA}$	4.5	4.18	4.31	-	4.13	-	
				6.0	5.68	5.80	-	5.63	-	
				$I_{OH} = -5.2 \text{ mA}$	2.0	-	0.0	0.1	-	
4.5	-	0.0	0.1		-	0.1				
6.0	-	0.0	0.1		-	0.1				
Low-Level Output Voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu\text{A}$	2.0	-	0.0	0.1	-	0.1	V
				4.5	-	0.0	0.1	-	0.1	
				6.0	-	0.0	0.1	-	0.1	
			$I_{OL} = 4 \text{ mA}$	4.5	-	0.17	0.26	-	0.33	
				6.0	-	0.18	0.26	-	0.33	
				$I_{OL} = 5.2 \text{ mA}$	2.0	-	-	-	-	
4.5	-	-	-		-	-				
6.0	-	-	-		-	-				
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC} \text{ or } \text{GND}$	6.0	-	-	±0.1	-	±1.0	μA	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC} \text{ or } \text{GND}$	6.0	-	-	4.0	-	40.0		

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AC ELECTRICAL CHARACTERISTICS (C_L = 15pF, V_{CC} = 5V, T_a = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		-	4	8	ns
Propagation Delay Time ($\overline{G0}, \overline{G1}, \overline{G2}$ - C _{n+x} , C _{n+y}) ($\overline{P0}, \overline{P1}, \overline{P2}$ - C _{n+z})	t_{PLH} t_{PHL}		-	14	24	
Propagation Delay Time ($\overline{G0}, \overline{G1}, \overline{G2}, \overline{G3}$ - \overline{G}) ($\overline{P1}, \overline{P2}, \overline{P3}$)	t_{PLH} t_{PHL}		-	16	27	
Propagation Delay Time ($\overline{P0}, \overline{P1}, \overline{P2}, \overline{P3}$ - \overline{P})	t_{PLH} t_{PHL}		-	14	24	
Propagation Delay Time (C _n - C _{n+x} , C _{n+y} , C _{n+z})	t_{PLH} t_{PHL}		-	14	24	

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

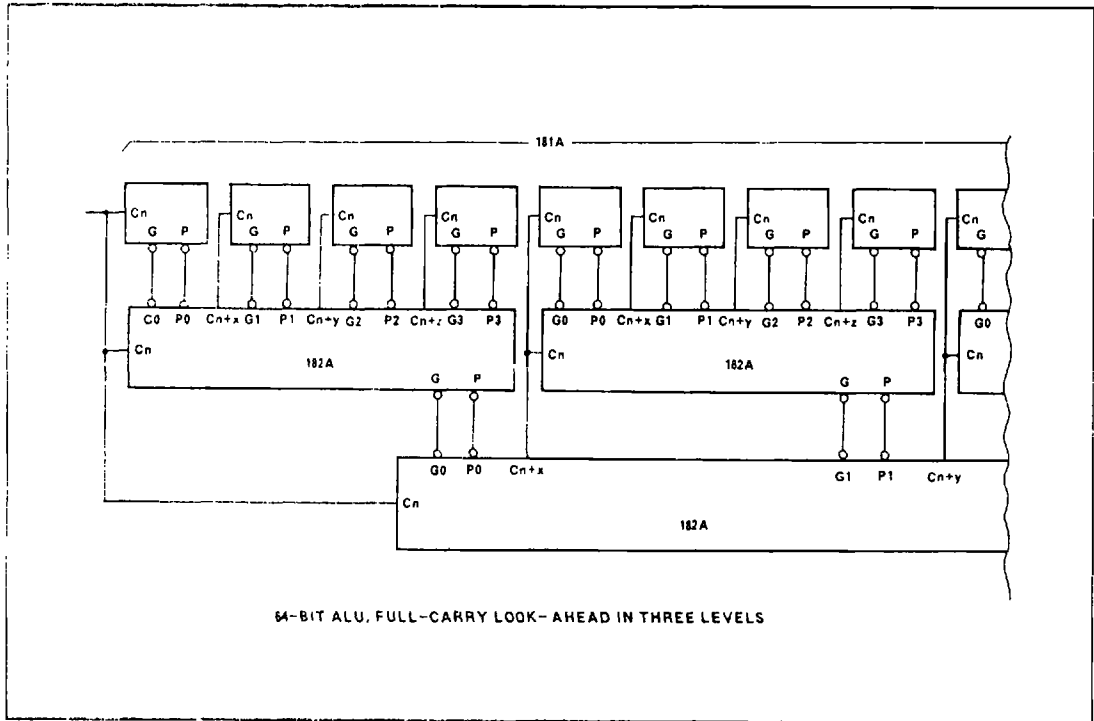
PARAMETER	SYMBOL	TEST CONDITION	V _{CC}	T _a = 25°C			T _a = -40 ~ 85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t_{TLH} t_{THL}		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Propagation Delay Time ($\overline{G0}, \overline{G1}, \overline{G2}$ - C _{n+x} , C _{n+y}) ($\overline{P0}, \overline{P1}, \overline{P2}$ - C _{n+z})	t_{PLH} t_{PHL}		2.0	-	62	135	-	170	
			4.5	-	17	27	-	34	
			6.0	-	13	23	-	29	
Propagation Delay Time ($\overline{G0}, \overline{G1}, \overline{G2}, \overline{G3}$ - \overline{G}) ($\overline{P1}, \overline{P2}, \overline{P3}$)	t_{PLH} t_{PHL}		2.0	-	72	150	-	190	
			4.5	-	19	30	-	38	
			6.0	-	14	26	-	33	
Propagation Delay Time ($\overline{P0}, \overline{P1}, \overline{P2}, \overline{P3}$ - \overline{P})	t_{PLH} t_{PHL}		2.0	-	62	135	-	170	
			4.5	-	17	27	-	34	
			6.0	-	13	23	-	29	
Propagation Delay Time (C _n - C _{n+x} , C _{n+y} , C _{n+z})	t_{PLH} t_{PHL}		2.0	-	62	135	-	170	
			4.5	-	17	27	-	34	
			6.0	-	13	23	-	29	
Input Capacitance	C _{IN}			-	5	10	-	10	pF
Power Dissipation Capacitance	C _{PD(1)}			-	61	-	-	-	

Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

$$I_{CC(1)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

TYPICAL APPLICATION



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