Signetics

FAST Products

FAST 74F182

Look-Ahead Carry Generator

Product Specification

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F182	5.0ns	21mA

FEATURES

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

DESCRIPTION

The 74F182 is a high speed carry look-ahead generator. It accepts 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) and provides anticipated active-High carries (C_{n+x}, C_{n+y}, C_{n+z}) across four groups of binary adders. The 'F182 also has active-Low Carry Propagate ($\overline{P}$) Carry Generate ($\overline{G}$) outputs which may be used for further levels of look-ahead.

The logic equations provided at the outputs are:

$$C_{n+x} = G_0 + P_0C_n$$

$$C_{n+y} = G_1 + P_1G_0 + P_1P_0C_n$$

$$C_{n+z} = G_2 + P_2G_1 + P_2P_1G_0 + P_2P_1P_0C_n$$

$$\overline{G} = \overline{G_3 + P_3G_2 + P_3P_2G_1 + P_3P_2P_1G_0}$$

$$\overline{P} = \overline{P_3P_2P_1P_0}$$

The 'F182 can also be used with binary ALU's 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.

ORDERING INFORMATION

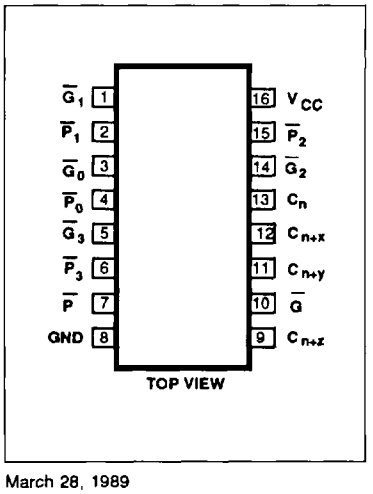
PACKAGES	COMMERCIAL RANGE V_{CC} = 5V±10%; T_A = 0°C to +70°C
16-Pin Plastic DIP	N74F182N
16-Pin Plastic SO	N74F182D

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

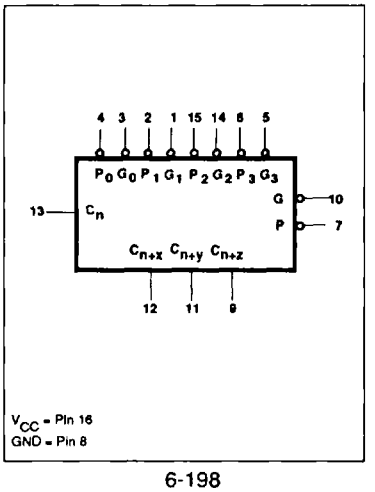
PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
C_n	Carry input	1.0/2.0	20µA/1.2mA
$\overline{G}_0$, $\overline{G}_2$	Carry generate inputs (active-Low)	1.0/14.0	20µA/8.4mA
$\overline{G}_1$	Carry generate input (active-Low)	1.0/16.0	20µA/9.6mA
$\overline{G}_3$	Carry generate input (active-Low)	1.0/8.0	20µA/4.8mA
$\overline{P}_0$, $\overline{P}_1$	Carry propagate inputs (active-Low)	1.0/8.0	20µA/4.8mA
$\overline{P}_2$	Carry propagate input (active-Low)	1.0/6.0	20µA/3.6mA
$\overline{P}_3$	Carry propagate input (active-Low)	1.0/4.0	20µA/2.4mA
C_{n+x} - C_{n+z}	Carry outputs	50/33	1.0mA/20mA
$\overline{G}$	Carry generate output (active-Low)	50/33	1.0mA/20mA
$\overline{P}$	Carry propagate output (active-Low)	50/33	1.0mA/20mA

NOTE: One (1.0) FAST Unit Load is defined as: 20µA in the High state and 0.6mA in the Low state.

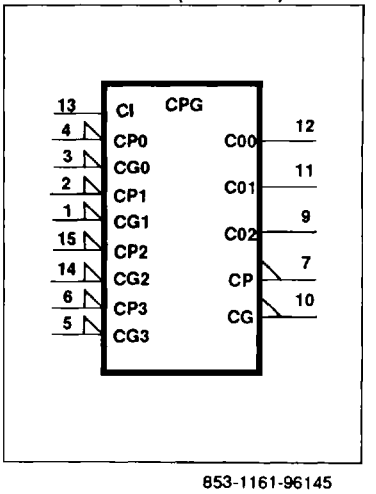
PIN CONFIGURATION



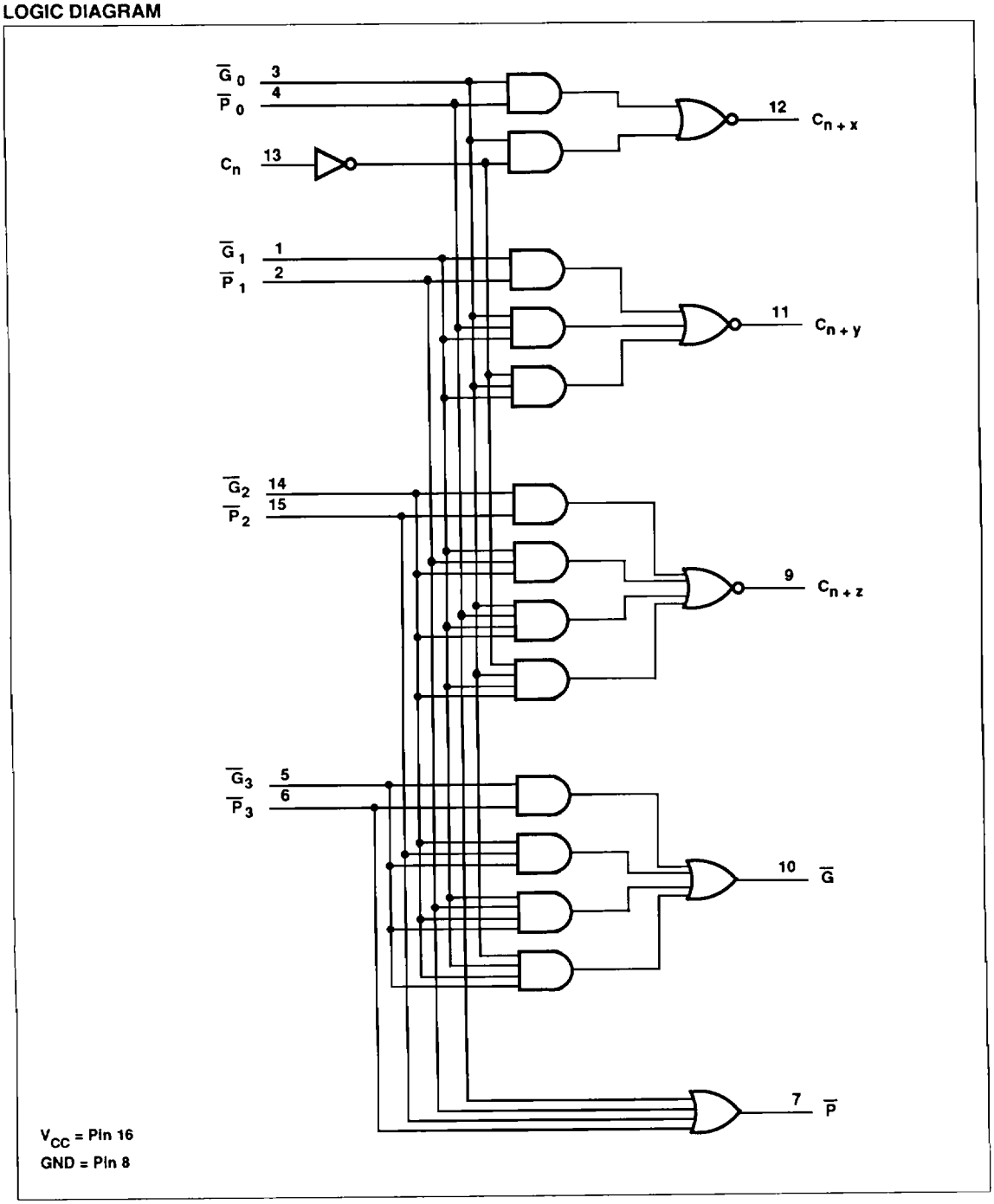
LOGIC SYMBOL



LOGIC SYMBOL(IEEE/IEC)



LOGIC DIAGRAM

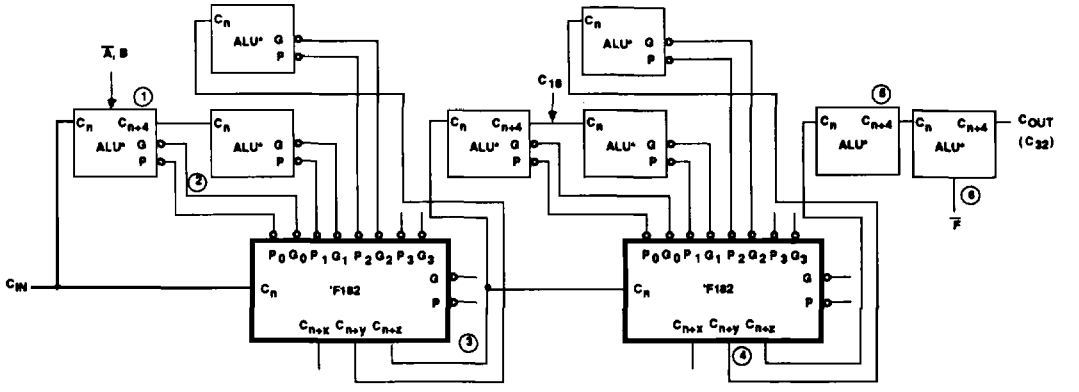


FUNCTION TABLE

INPUTS									OUTPUTS				
C_n	$\overline{G}_0$	$\overline{P}_0$	$\overline{G}_1$	$\overline{P}_1$	$\overline{G}_2$	$\overline{P}_2$	$\overline{G}_3$	$\overline{P}_3$	C_{n+x}	C_{n+y}	C_{n+z}	$\overline{G}$	P
X	H	H							L				
L	H	X							L				
X	L	X							H				
H	X	L							H				
X	X	X	H	H						L			
X	H	H	H	X						L			
L	H	X	H	X						L			
X	X	X	L	X						H			
X	L	X	X	L						H			
H	X	L	X	L						H			
X	X	X	X	X	H	H					L		
X	X	X	H	H	H	X					L		
X	H	H	H	X	H	X					L		
L	H	X	H	X	H	X					L		
X	X	X	X	X	L	X					H		
X	X	X	L	X	X	L					H		
X	L	X	X	L	X	L					H		
H	X	L	X	L	X	L					H		
	X		X	X	X	X	H	H				H	
	X		X	X	H	H	H	X				H	
	X		H	H	H	X	H	X				H	
	H		H	X	H	X	H	X				H	
	X		X	X	X	X	L	X				L	
	X		X	X	L	X	X	L				L	
	X		L	X	X	L	X	L				L	
	L		X	L	X	L	X	L				L	
		H		X		X		X					H
		X		H		X		X					H
		X		X		H		X					H
		X		X		X		H					H
		L		L		L		L					L

H = High voltage level
L = Low voltage level
X = Don't care

APPLICATION



32-Bit ALU With Ripple Carry Between 16-Bit Look-Ahead ALUs
(*ALU's may be either 'F181 or 'F381)

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	-0.5 to +7.0	V
V_{IN}	Input voltage	-0.5 to +7.0	V
I_{IN}	Input current	-30 to +5	mA
V_{OUT}	Voltage applied to output in High output state	-0.5 to +V_{CC}	V
I_{OUT}	Current applied to output in Low output state	40	mA
T_A	Operating free-air temperature range	0 to +70	°C
T_{STG}	Storage temperature	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Nom	Max	
V_{CC}	Supply voltage	4.5	5.0	5.5	V
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			-18	mA
I_{OH}	High-level output current			-1	mA
I_{OL}	Low-level output current			20	mA
T_A	Operating free-air temperature range	0		70	°C

DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

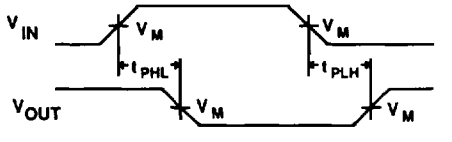
SYMBOL	PARAMETER		TEST CONDITIONS[1]			LIMITS			UNIT
						Min	Typ[2]	Max	
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN,	I_{OH}=MAX	±10%V_{CC}	2.5			V
					±5%V_{CC}	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OL}=MAX	±10%V_{CC}		0.30	0.50	V
					±5%V_{CC}		0.30	0.50	V
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = I_{IK}				-0.73	-1.2	V
I_I	Input current at maximum input voltage		V_{CC} =MAX, V_I = 7.0V					100	µA
I_{IH}	High-level input current		V_{CC} = MAX, V_I = 2.7V					20	µA
I_{IL}	Low-level input current	C_n	V_{CC} = MAX, V_I = 0.5V					-1.2	mA
		$\overline{G}_0$, $\overline{G}_2$						-8.4	mA
		$\overline{G}_1$						-9.6	mA
		$\overline{G}_3$, $\overline{P}_0$, $\overline{P}_1$						-4.8	mA
		$\overline{P}_2$						-3.6	mA
		$\overline{P}_3$						-2.4	mA
I_{OS}	Short-circuit output current[3]		V_{CC} = MAX			-60		-150	mA
I_{CC}	Supply current (total)	I_{CCH}	V_{CC} = MAX				18	28	mA
		I_{CCL}					24	36	mA

NOTES:
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_A = 25°C.
3. Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter test, I_{OS} tests should be performed last.

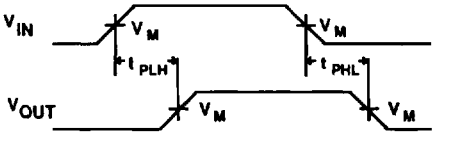
AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			T_A = +25°C, V_{CC} = 5V, C_L = 50pF, R_L = 500Ω			T_A = 0°C to +70°C, V_{CC} = 5V ±10%, C_L = 50pF, R_L = 500Ω		
			Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation delay C_n to C_{n+x}, C_{n+y}, C_{n+z}	Waveform 2	2.5 2.5	5.0 5.0	8.0 7.5	2.5 2.5	8.5 8.5	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}_0$, $\overline{P}_1$ or $\overline{P}_2$ to C_{n+x}, C_{n+y}, C_{n+z}	Waveform 1	2.0 1.5	5.0 3.5	7.0 5.0	1.5 1.5	8.0 6.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{G}_{0,1,2}$ to C_{n+x}, C_{n+y}, C_{n+z}	Waveform 1	1.5 1.5	4.0 3.0	7.5 5.0	1.5 1.5	8.5 5.5	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}_{1,2,3}$ to $\overline{G}$	Waveform 2	2.0 3.0	7.0 5.0	10.0 7.0	1.5 2.5	11.0 8.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{G}_n$ to $\overline{G}$	Waveform 2	1.5 3.0	5.0 5.0	7.0 7.0	1.5 2.5	7.5 8.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}_n$ or $\overline{P}$	Waveform 2	1.5 2.5	3.5 4.0	6.0 6.0	1.5 2.5	7.5 6.5	ns

AC WAVEFORMS



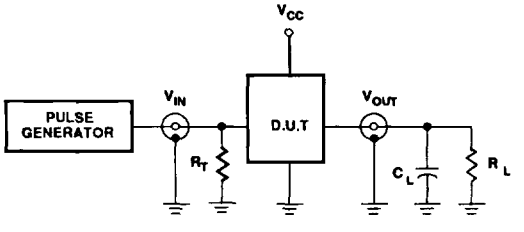
Waveform 1. Propagation Delay for Inverting Outputs



Waveform 2. Propagation Delay for Non-Inverting outputs

NOTE: For all waveforms, V_M = 1.5V

TEST CIRCUIT AND WAVEFORMS



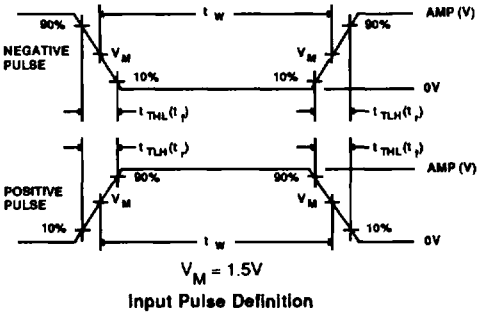
Test Circuit For Totem-Pole Outputs

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.



V_M = 1.5V

Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_{TLH}	t_{THL}
74F	3.0V	1MHz	500ns	2.5ns	2.5ns