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100179

Carry Lookahead Generator

Not Intended For New Designs

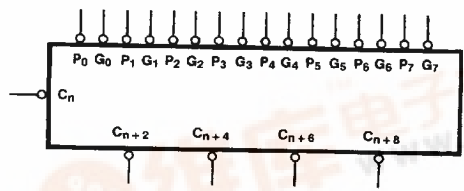
T-45-07

General Description

The 100179 is a high-speed Carry Lookahead Generator intended for use with the 100180 6-bit fast Adder and the 100181 4-bit ALU. All inputs have 50 kΩ pulldown resistors.

Ordering Code: See Section 6

Logic Symbol

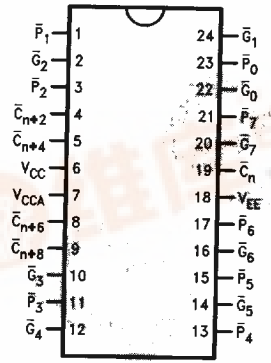


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Pin Names	Description
\bar{C}_n	Carry Input (Active LOW)
$\bar{P}_0 - \bar{P}_7$	Carry Propagate Inputs (Active LOW)
$\bar{G}_0 - \bar{G}_7$	Carry Generate Inputs (Active LOW)
$\bar{C}_{n+2}, \bar{C}_{n+4}$ $\bar{C}_{n+6}, \bar{C}_{n+8}$	Carry Outputs

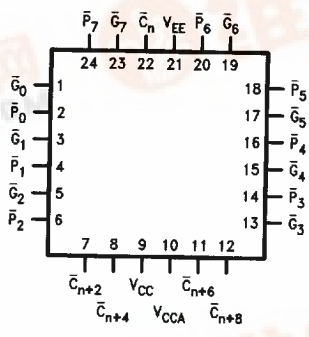
Connection Diagrams

24-Pin DIP



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24-Pin Quad Cerpak

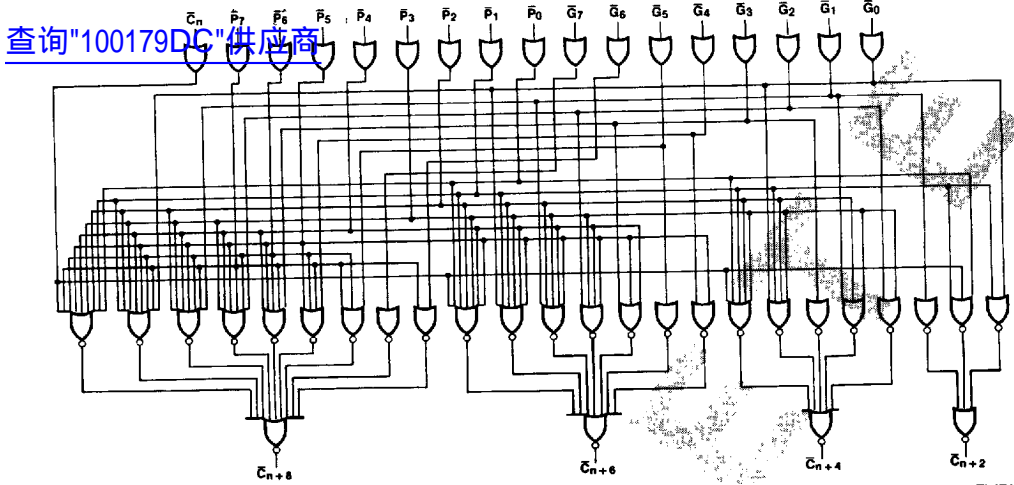


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Logic Diagram



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Truth Tables

C_{n+2} Output

Inputs					Output
C _n	G ₀	P ₀	G ₁	P ₁	C _{n+2}
X	X	X	L	X	L
X	L	X	X	L	L
L	X	L	X	L	L
All other combinations					H

$$C_{n+2} = G_1 \cdot (P_1 + G_0) \cdot (P_1 + P_0 + C_n)$$

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care

C_{n+4} Output

Inputs									Output
C _n	G ₀	P ₀	G ₁	P ₁	G ₂	P ₂	G ₃	P ₃	C _{n+4}
X	X	X	X	X	X	X	L	X	L
X	X	X	X	X	L	X	X	L	L
X	X	X	L	X	X	L	X	L	L
X	L	X	X	L	X	L	X	L	L
L	X	L	X	L	X	L	X	L	L
All other combinations									H

$$C_{n+4} = G_3 \cdot (P_3 + G_2) \cdot (P_3 + P_2 + G_1) \cdot (P_3 + P_2 + P_1 + G_0) \cdot (P_3 + P_2 + P_1 + P_0 + C_n)$$

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Truth Tables (Continued)

\bar{C}_{n+6} Output

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\bar{C}_n	Inputs										Output \bar{C}_{n+6}		
	\bar{G}_0	\bar{P}_0	\bar{G}_1	\bar{P}_1	\bar{G}_2	\bar{P}_2	\bar{G}_3	\bar{P}_3	\bar{G}_4	\bar{P}_4		\bar{G}_5	\bar{P}_5
X	X	X	X	X	X	X	X	X	X	X	L	X	L
X	X	X	X	X	X	X	X	X	X	L	X	L	L
X	X	X	X	X	X	X	X	L	X	X	L	L	L
X	X	X	X	X	L	X	X	X	L	X	L	L	L
X	X	X	L	X	X	L	X	L	X	L	X	L	L
X	L	X	X	L	X	L	X	L	X	L	X	L	L
L	X	L	X	L	X	L	X	L	X	L	X	L	L

All other combinations

H

$$\bar{C}_{n+6} = \bar{G}_5 \cdot (\bar{P}_5 + \bar{G}_4) \cdot (\bar{P}_5 + \bar{P}_4 + \bar{G}_3) \cdot (\bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{G}_2)$$

- $\cdot (\bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{G}_1) \cdot (\bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{P}_1 + \bar{G}_0)$
- $\cdot (\bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{P}_1 + \bar{P}_0 + \bar{C}_n)$

\bar{C}_{n+8} Output

\bar{C}_n	Inputs														Output \bar{C}_{n+8}		
	\bar{G}_0	\bar{P}_0	\bar{G}_1	\bar{P}_1	\bar{G}_2	\bar{P}_2	\bar{G}_3	\bar{P}_3	\bar{G}_4	\bar{P}_4	\bar{G}_5	\bar{P}_5	\bar{G}_6	\bar{P}_6		\bar{G}_7	\bar{P}_7
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	L	X	L
X	X	X	X	X	X	X	X	X	X	X	X	X	L	X	X	L	L
X	X	X	X	X	X	X	X	X	X	L	X	X	X	L	X	L	L
X	X	X	X	X	X	X	X	L	X	X	L	X	L	X	L	L	L
X	X	X	X	X	L	X	X	X	L	X	L	X	L	X	L	L	L
X	X	X	L	X	X	L	X	L	X	L	X	L	X	L	X	L	L
X	L	X	X	L	X	L	X	L	X	L	X	L	X	L	X	L	L
L	X	L	X	L	X	L	X	L	X	L	X	L	X	L	X	L	L

All other combinations

H

$$\bar{C}_{n+8} = \bar{G}_7 \cdot (\bar{P}_7 + \bar{G}_6) \cdot (\bar{P}_7 + \bar{P}_6 + \bar{G}_5) \cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{G}_4)$$

- $\cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{P}_4 + \bar{G}_3) \cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{G}_2)$
- $\cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{G}_1)$
- $\cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{P}_1 + \bar{G}_0)$
- $\cdot (\bar{P}_7 + \bar{P}_6 + \bar{P}_5 + \bar{P}_4 + \bar{P}_3 + \bar{P}_2 + \bar{P}_1 + \bar{P}_0 + \bar{C}_n)$

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care

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Absolute Maximum Ratings

Above which the useful life may be impaired. (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature -65°C to +150°C
Maximum Junction Temperature (T_J) +150°C

Case Temperature under Bias (T_C) 0°C to +85°C
V_{EE} Pin Potential to Ground Pin -7.0V to +0.5V
Input Voltage (DC) V_{EE} to +0.5V
Output Current (DC Output HIGH) -50 mA
Operating Range (Note 2) -5.7V to -4.2V

DC Electrical Characteristics

V_{EE} = -4.5V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V _{OH}	Output HIGH Voltage	-1025	-955	-880	mV	V _{IN} = V _{IH} (Max) or V _{IL} (Min)	Loading with 50Ω to -2.0V
V _{OL}	Output LOW Voltage	-1810	-1705	-1620			
V _{OHC}	Output HIGH Voltage	-1035			mV	V _{IN} = V _{IH} (Min) or V _{IL} (Max)	Loading with 50Ω to -2.0V
V _{OLC}	Output LOW Voltage			-1610			
V _{IH}	Input HIGH Voltage	-1165		-880	mV	Guaranteed HIGH Signal for All Inputs	
V _{IL}	Input LOW Voltage	-1810		-1475	mV	Guaranteed LOW Signal for All Inputs	
I _{IL}	Input LOW Current	0.50			μA	V _{IN} = V _{IL} (Min)	

DC Electrical Characteristics

V_{EE} = -4.2V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V _{OH}	Output HIGH Voltage	-1020		-870	mV	V _{IN} = V _{IH} (Max) or V _{IL} (Min)	Loading with 50Ω to -2.0V
V _{OL}	Output LOW Voltage	-1810		-1605			
V _{OHC}	Output HIGH Voltage	-1030			mV	V _{IN} = V _{IH} (Min) or V _{IL} (Max)	Loading with 50Ω to -2.0V
V _{OLC}	Output LOW Voltage			-1595			
V _{IH}	Input HIGH Voltage	-1150		-870	mV	Guaranteed HIGH Signal for All Inputs	
V _{IL}	Input LOW Voltage	-1810		-1475	mV	Guaranteed LOW Signal for All Inputs	
I _{IL}	Input LOW Current	0.50			μA	V _{IN} = V _{IL} (Min)	

DC Electrical Characteristics

V_{EE} = -4.8V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V _{OH}	Output HIGH Voltage	-1035		-880	mV	V _{IN} = V _{IH} (Max) or V _{IL} (Min)	Loading with 50Ω to -2.0V
V _{OL}	Output LOW Voltage	-1830		-1620			
V _{OHC}	Output HIGH Voltage	-1045			mV	V _{IN} = V _{IH} (Min) or V _{IL} (Max)	Loading with 50Ω to -2.0V
V _{OLC}	Output LOW Voltage			-1610			
V _{IH}	Input HIGH Voltage	-1165		-880	mV	Guaranteed HIGH Signal for All Inputs	
V _{IL}	Input LOW Voltage	-1830		-1490	mV	Guaranteed LOW Signal for All Inputs	
I _{IL}	Input LOW Current	0.50			μA	V _{IN} = V _{IL} (Min)	

Note 1: Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Parametric values specified at -4.2V to -4.8V.

Note 3: The specified limits represent the "worst case" value for the parameter. Since these "worst case" values normally occur at the temperature extremes, additional noise immunity and guard banding can be achieved by decreasing the allowable system operating ranges.

Note 4: Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$ unless otherwise specified, $V_{CC} = V_{CCA} = GND$, $T_C = 0^\circ C$ to $+85^\circ C$

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{IH}	Input High Current C_n, G_0-G_7 P_0-P_7			250 340	μA	$V_{IN} = V_{IH} (Max)$
I_{EE}	Power Supply Current	-220	-150	-100	mA	Inputs Open

Ceramic Dual-In-Line Package AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay C_n, G_0-G_7, P_0-P_7 to C_{n+x}	1.10	2.90	1.10	2.90	1.10	3.00	ns	Figures 1 and 2
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.45	1.80	0.45	1.80	0.45	1.80	ns	

Cerpak AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay C_n, G_0-G_7, P_0-P_7 to C_{n+x}	1.10	2.70	1.10	2.70	1.10	2.80	ns	Figures 1 and 2
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.45	1.70	0.45	1.70	0.45	1.70	ns	

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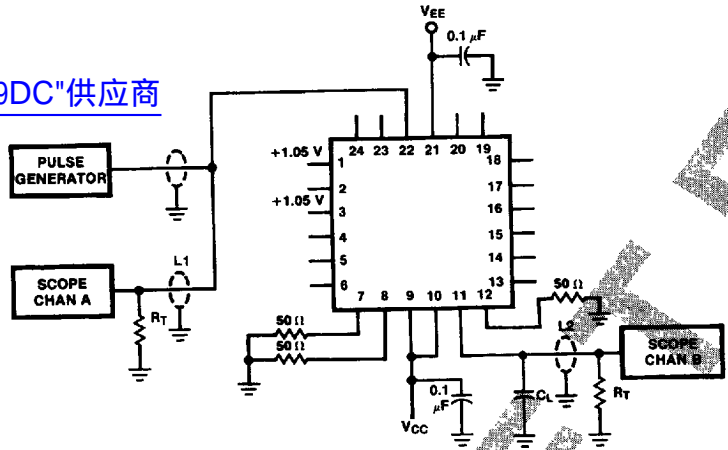


FIGURE 1. AC Test Circuit

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Notes:

- V_{CC}, V_{CCA} = +2V, V_{EE} = -2.5V
- L1 and L2 = equal length 50Ω impedance lines
- R_T = 50Ω terminator internal to scope
- Decoupling 0.1 μF from GND to V_{CC} and V_{EE}
- All unused outputs are loaded with 50Ω to GND
- C_L = Fixture and stray capacitance ≤ 3 pF
- Pin numbers shown are for flatpak; for DIP see logic symbol

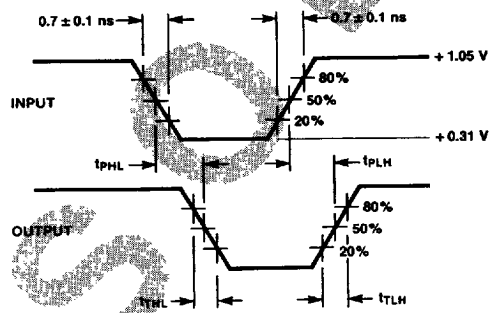


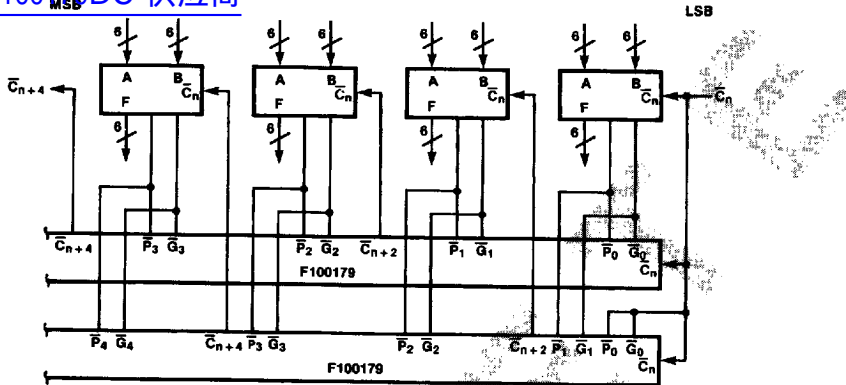
FIGURE 2. Propagation Delay and Transition Times

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Applications

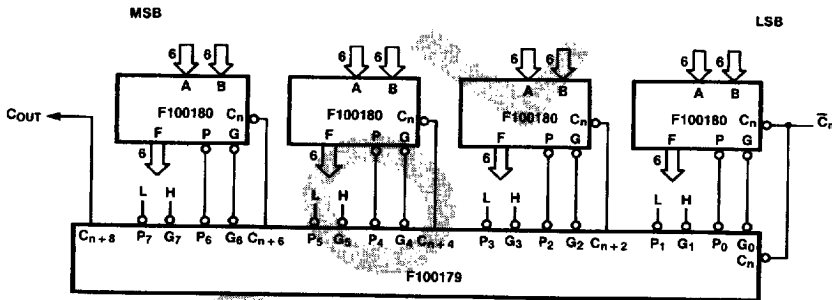
Fast Adder and Carry Lookahead

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24-Bit Adder Using One Carry Lookahead



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