National Semiconductor

2900 Family/
Bipolar Microprocessor

IDM2902 Look-Ahead Carry Generator

General Description

This circuit is a high-speed, look-ahead carry generator, capable of anticipating a carry across four binary adders or groups of adders. It is 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 IDM2901A arithmetic logic units, this generator provides high-speed carry look-ahead capability for any word length. The IDM2902 generates the look-ahead (anticipated carry) across a group of four ALUs 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 ALUs are in their true form, and the carry propagate (P) and carry generate (G) are in negated form; therefore, the carry functions (inputs, outputs, generate, and propagate) of the look-ahead generators are implemented in the compatible forms for direct connection to the ALU. Reinterpretations of carry functions, as explained on the IDM2901A data sheet, are also applicable to and compatible with the look-ahead generator. Positive logic equations for the 2902 parts are:

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

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

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

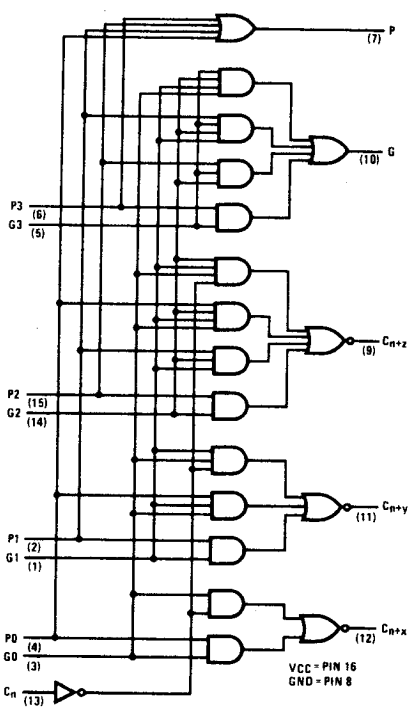
$$G = G_3 (P_3 + G_2)(P_3 + P_2 + G_1)(P_3 + P_2 + P_1 + G_0)$$

$$P = P_3 P_2 P_1 P_0$$

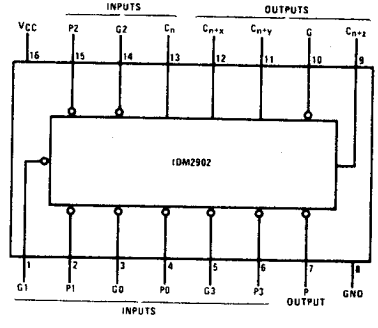
Features and Benefits

Type	Typical Propagation Delay Time	Typical Power Dissipation
IDM2902	7 ns	260 mW

Logic and Connection Diagram



Connection Diagram



Pin Designations

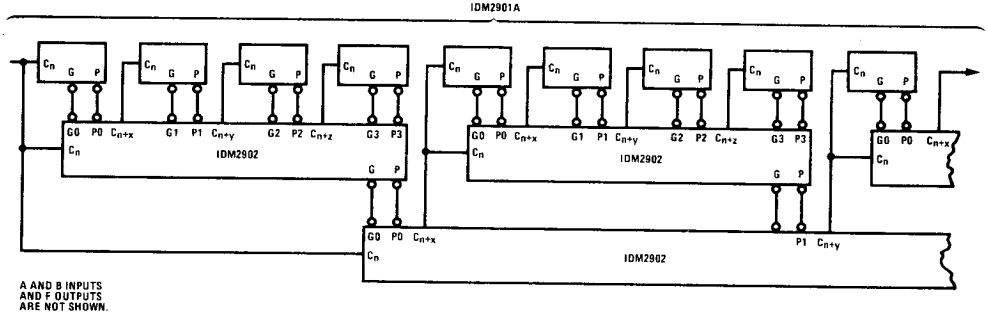
Designation	Pin Nos.	Function
G_0, G_1, G_2, G_3	3, 1, 14, 5	Active Low Carry Generate Inputs
P_0, P_1, P_2, P_3	4, 2, 15, 6	Active Low Carry Propagate Inputs
C_n	13	Carry Input
$C_{n+x}, C_{n+y}, C_{n+z}$	12, 11, 9	Carry Outputs
G	10	Active Low Carry Generate Output
P	7	Active Low Carry Propagate Output
V_{CC}	16	Supply Voltage
GND	8	Ground

Switching Characteristics $V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15pF$, $R_L = 400\Omega$

Parameter	From (Input)	To (Output)	Test Conditions	Min.	Typ.	Max.	Units
t_{PLH}	C_n	C_{n+j}	$P_0 = P_1 = P_2 = 0V$ $G_0 = G_1 = G_2 = 4.5V$		9.0	12	ns
t_{PHL}					9.0	12	
t_{PLH}	P_i	C_{n+j}	$P_i = 0V$ $(j > i)$ $C_n = G_0 = G_1 = G_2 = 4.5V$		6.0	8.0	ns
t_{PHL}					6.0	8.0	
t_{PLH}	G_i	C_{n+j}	$G_i = 0V$ $(j > i)$ $C_n = P_0 = P_1 = P_2 = 4.5V$		7.0	10	ns
t_{PHL}					7.0	10	
t_{PLH}	P_i	G or P	$P_i = 0V$ $(j > i)$ $C_n = G_0 = G_1 = G_2 = 4.5V$		6.0	10	ns
t_{PHL}					6.0	10	
t_{PLH}	G_i	G or P	$G_i = 0V$ $(j > i)$ $C_n = P_0 = P_1 = P_2 = 4.5V$		7.0	10	ns
t_{PHL}					7.0	10	

Typical Application

64-Bit ALU with Full Look-Ahead Carry in Three Levels



Ordering Information

Package Type	Package Number	Temperature Range	Order Number
Molded DIP	N16A	0°C to +70°C	IDM2902NC/DM74S182N
Hermetic DIP	J16A (D16C)	0°C to +70°C	IDM2902JC/DM74S182J
Hermetic DIP	J16A (D16C)	−55°C to +125°C	IDM2902JM/DM54S182J
Hermetic DIP	J16A (D16C)	−55°C to +125°C	IDM2902JM/883/DM54S182J/883