

# Am2902A

High-Speed Look-Ahead Carry Generator

Am2902A

## DISTINCTIVE CHARACTERISTICS

- Provides look-ahead carries across a group of four Am2901 or Am2903 microprocessor ALU's
- Capability of multi-level look-ahead for high-speed arithmetic operation over large word lengths
- Typical carry propagation delay of 4.5ns

## GENERAL DESCRIPTION

The Am2902A is a high-speed, look-ahead carry generator which accepts up to four pairs of carry propagate and carry generate signals and a carry input and provides anticipated carries across four groups of binary ALU's. The device also has carry propagate and carry generate outputs which may be used for further levels of look-ahead.

The Am2902A is generally used with the Am2901 bipolar microprocessor unit to provide look-ahead over word lengths of more than four bits. The look-ahead carry generator can be used with binary ALU's in an active LOW

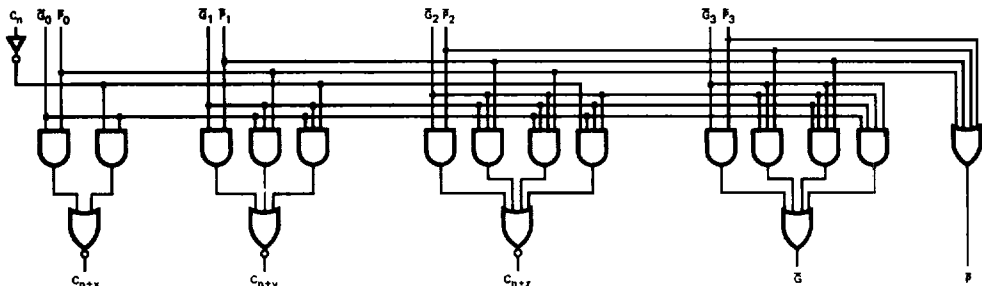
or active HIGH input operand mode by reinterpreting the carry functions. The connections to and from the ALU to the look-ahead carry generator are identical in both cases.

The logic equations provided at the outputs are:

$$\begin{aligned} C_n + x &= G_0 + P_0 C_n \\ C_n + y &= G_1 + P_1 G_0 + P_1 P_0 C_n \\ C_n + z &= G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 C_n \\ G &= G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0 \\ P &= P_3 P_2 P_1 P_0 \end{aligned}$$

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## BLOCK DIAGRAM



BD001680

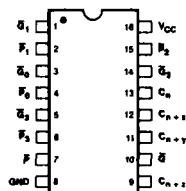
## RELATED PRODUCTS

| Part No. | Description                   |
|----------|-------------------------------|
| Am2901   | 4-Bit Microprocessor Slice    |
| Am2903   | 4-Bit Microprocessor Slice    |
| Am29203  | Improved 2903                 |
| Am29501  | Multiport Pipelined Processor |

03595B

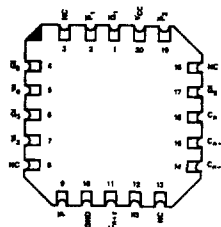
## CONNECTION DIAGRAM Top View

P-16, D-16



CD004010

L-20-1

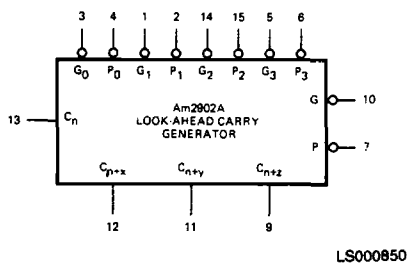


CD004000

F-16 pin configuration identical to D-16, P-16.

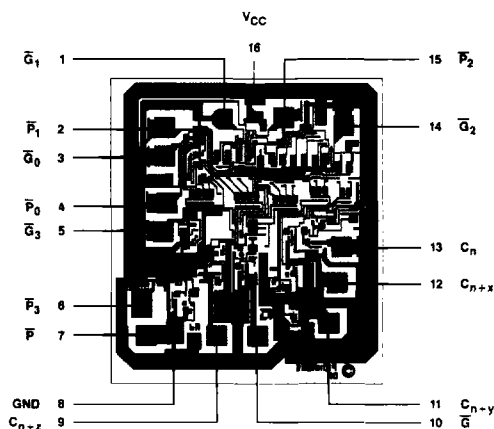
Note: Pin 1 is marked for orientation

### LOGIC SYMBOL



LS000850

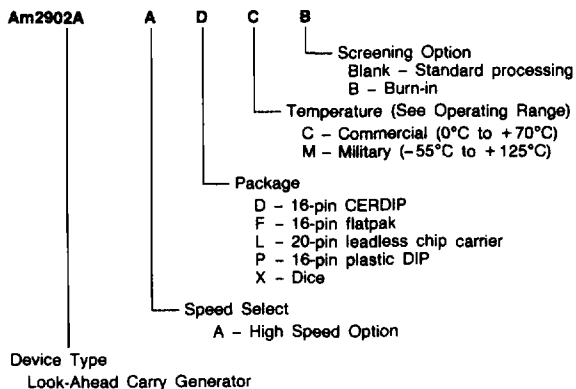
### METALLIZATION AND PAD LAYOUT



DIE SIZE 0.062" x 0.067"

### ORDERING INFORMATION

AMD products are available in several packages and operating ranges. The order number is formed by a combination of the following: Device number, speed option (if applicable), package type, operating range and screening option (if desired).



#### Valid Combinations

|         |              |
|---------|--------------|
| Am2902A | PC           |
|         | DC, DCB, DM, |
|         | DMB          |
|         | FM, FMB      |
|         | LC, LCB, LM, |
|         | LMB          |
|         | XC, XM       |

#### Valid Combinations

Consult the AMD sales office in your area to determine if a device is currently available in the combination you wish.

## PIN DESCRIPTION

| Pin No.     | Name                   | I/O | Description                                                                                                                                                                      |
|-------------|------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13          | $C_n$                  | I   | Carry-in. The carry-in input to the look-ahead generator. Also the carry-in input to the nth Am2901 microprocessor ALU input.                                                    |
| 12, 11, 9   | $C_{n+j}$              | O   | Carry-out. ( $j = x, y, z$ ). The carry-out output to be used at the carry-in inputs of the $n+1$ , $n+2$ and $n+3$ microprocessor ALU slices.                                   |
| 1-6, 14, 15 | $\bar{G}_i, \bar{P}_i$ | I   | Generate and propagate inputs respectively ( $i = 0, 1, 2, 3$ ). The carry generate and carry propagate inputs from the $n$ , $n+1$ , $n+2$ and $n+3$ microprocessor ALU slices. |
| 10, 7       | $\bar{G}, \bar{P}$     | O   | Generate and propagate outputs respectively. The carry generate and carry propagate outputs that can be used with the next higher level of carry look-ahead if used.             |

## TRUTH TABLE

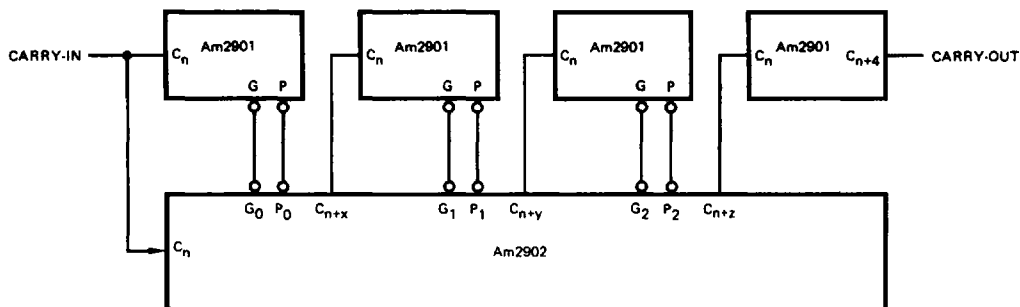
| Inputs |             |             |             |             |             |             |             | Outputs     |           |           |           |           |           |
|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------|-----------|-----------|-----------|-----------|
| $C_n$  | $\bar{G}_0$ | $\bar{P}_0$ | $\bar{G}_1$ | $\bar{P}_1$ | $\bar{G}_2$ | $\bar{P}_2$ | $\bar{G}_3$ | $\bar{P}_3$ | $C_{n+x}$ | $C_{n+y}$ | $C_{n+z}$ | $\bar{G}$ | $\bar{P}$ |
| X      | H           | H           |             |             |             |             |             |             | L         |           |           |           |           |
| L      | H           | X           |             |             |             |             |             |             | L         |           |           |           |           |
| X      | L           | X           |             |             |             |             |             |             | L         |           |           |           |           |
| 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           | X           | H           | X           | H           | X           |             |           |           |           | L         |           |
| X      | X           | X           | X           | X           | X           | L           | X           |             |           |           |           | L         |           |
| X      | X           | X           | L           | X           | X           | L           | L           |             |           |           |           | L         |           |
| X      | L           | X           | X           | X           | L           | X           | L           |             |           |           |           | L         |           |
| L      | X           | L           | X           | L           | X           | L           | L           |             |           |           |           | L         |           |
| H      | X           | X           | X           | X           |             |             |             |             |           |           |           |           | H         |
| X      | X           | X           | X           | X           |             |             |             |             |           |           |           |           | H         |
| X      | X           | X           | H           | X           |             |             |             |             |           |           |           |           | H         |
| X      | X           | X           | X           | X           | H           |             |             |             |           |           |           |           | H         |
| L      | L           | L           | L           | L           |             |             |             |             |           |           |           |           | L         |

H = HIGH Voltage Level

L = LOW Voltage Level

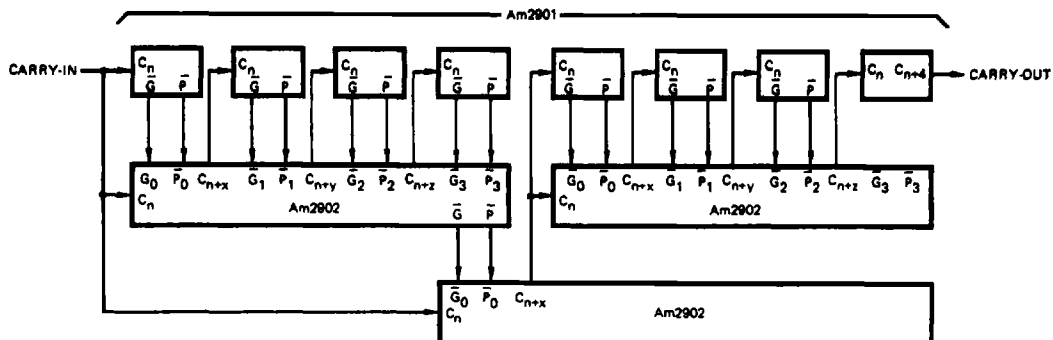
X = Don't Care

## APPLICATIONS



AF001331

16-BIT CARRY LOOK-AHEAD CONNECTION.



AF001321

32-BIT ALU, THREE LEVEL CARRY LOOK-AHEAD.

**ABSOLUTE MAXIMUM RATINGS**

Storage Temperature ..... -65°C to +150°C  
 (Ambient) Temperature with  
 Applied Powers ..... -55°C to +125°C  
 Supply Voltage to Ground Potential  
 Continuous ..... -0.5V to +7.0V  
 DC Voltage Applied to Outputs For  
 High Output State ..... -0.5V to +V<sub>CC</sub> max  
 DC Input Voltage ..... -0.5V to +5.5V  
 DC Output Current, Into Outputs ..... 30mA  
 DC Input Current ..... -30mA to +5.0mA

*Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.*

**OPERATING RANGES****Commercial (C) Devices**

Temperature ..... 0°C to +70°C  
 Supply Voltage ..... +4.75V to +5.25V

**Military (M) Devices**

Temperature ..... -55°C to +125°C  
 Supply Voltage ..... +4.5V to +5.5V  
*Operating ranges define those limits over which the functionality of the device is guaranteed.*

**DC CHARACTERISTICS** over operating range unless otherwise specified

| Parameters      | Description                      | Test Conditions (Note 2)                                                                              |                                                  | Min        | Typ<br>(Note 1) | Max  | Units |
|-----------------|----------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------|-----------------|------|-------|
| V <sub>OH</sub> | Output HIGH Voltage              | V <sub>CC</sub> = MIN, I <sub>OH</sub> = -1mA<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | MIL<br>COM                                       | 2.5<br>2.7 | 3.4<br>3.4      |      | Volts |
| V <sub>OL</sub> | Output LOW Voltage               | V <sub>CC</sub> = MIN, I <sub>OL</sub> = 20mA<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> |                                                  |            |                 | 0.5  | Volts |
| V <sub>IH</sub> | Input HIGH Level                 | Guaranteed input logical HIGH voltage for all inputs                                                  |                                                  | 2.0        |                 |      | Volts |
| V <sub>IL</sub> | Input LOW Level                  | Guaranteed input logical LOW voltage for all inputs                                                   |                                                  |            |                 | 0.8  | Volts |
| V <sub>I</sub>  | Input Clamp Voltage              | V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18mA                                                        |                                                  |            |                 | -1.2 | Volts |
| I <sub>IL</sub> | Input LOW Current                | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.5V                                                         | C <sub>n</sub>                                   |            |                 | -2   | mA    |
|                 |                                  |                                                                                                       | P <sub>3</sub>                                   |            |                 | -4   |       |
|                 |                                  |                                                                                                       | P <sub>2</sub>                                   |            |                 | -6   |       |
|                 |                                  |                                                                                                       | P <sub>0</sub> , P <sub>1</sub> , G <sub>3</sub> |            |                 | -8   |       |
|                 |                                  |                                                                                                       | G <sub>0</sub> , G <sub>2</sub>                  |            |                 | -14  |       |
|                 |                                  |                                                                                                       | G <sub>1</sub>                                   |            |                 | -16  |       |
| I <sub>IH</sub> | Input HIGH Current               | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7V                                                         | C <sub>n</sub>                                   |            |                 | 50   | μA    |
|                 |                                  |                                                                                                       | P <sub>3</sub>                                   |            |                 | 100  |       |
|                 |                                  |                                                                                                       | P <sub>2</sub>                                   |            |                 | 150  |       |
|                 |                                  |                                                                                                       | P <sub>0</sub> , P <sub>1</sub> , G <sub>3</sub> |            |                 | 200  |       |
|                 |                                  |                                                                                                       | G <sub>0</sub> , G <sub>2</sub>                  |            |                 | 350  |       |
|                 |                                  |                                                                                                       | G <sub>1</sub>                                   |            |                 | 400  |       |
| I <sub>I</sub>  | Input HIGH Current               | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 5.5V                                                         |                                                  |            |                 | 1.0  | mA    |
| I <sub>SC</sub> | Output Short Circuit<br>(Note 3) | V <sub>CC</sub> = MAX, V <sub>OUT</sub> = 0.0V                                                        |                                                  | -40        |                 | -100 | mA    |
| I <sub>CC</sub> | Power Supply Current             | V <sub>CC</sub> = MAX<br>All Outputs LOW                                                              | MIL                                              |            | 69              | 99   | mA    |
|                 |                                  |                                                                                                       | COM'L                                            |            | 69              | 109  |       |
|                 |                                  | V <sub>CC</sub> = MAX<br>All Outputs HIGH                                                             | MIL                                              |            | 35              |      | mA    |
|                 |                                  |                                                                                                       | COM'L                                            |            | 35              |      |       |

Notes: 1. Typical limits are at V<sub>CC</sub> = 5.0V, 25°C ambient and maximum loading.

2. For conditions shown as MIN or MAX, use the appropriate value specified under Operating Ranges for the applicable device type.

3. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.

**SWITCHING CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ )

| Parameters       | Description                                                                                       | Test Conditions                                  | Min | Typ | Max  | Units |
|------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------|-----|-----|------|-------|
| t <sub>PLH</sub> | C <sub>n</sub> to C <sub>n</sub> + x, C <sub>n</sub> + y, or C <sub>n</sub> + z                   | C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 280 Ω |     | 6.5 | 10   | ns    |
| t <sub>PHL</sub> |                                                                                                   |                                                  |     | 7   | 10.5 |       |
| t <sub>PLH</sub> | P <sub>i</sub> or G <sub>i</sub> to C <sub>n</sub> + x, C <sub>n</sub> + y, or C <sub>n</sub> + z |                                                  |     | 4.5 | 7    | ns    |
| t <sub>PHL</sub> |                                                                                                   |                                                  |     | 4.5 | 7    |       |
| t <sub>PLH</sub> | P <sub>i</sub> or G <sub>i</sub> to G                                                             |                                                  |     | 5   | 7.5  | ns    |
| t <sub>PHL</sub> |                                                                                                   |                                                  |     | 7   | 10.5 |       |
| t <sub>PLH</sub> | P <sub>i</sub> to P                                                                               |                                                  |     | 4.5 | 6.5  | ns    |
| t <sub>PHL</sub> |                                                                                                   |                                                  |     | 6.5 | 10   |       |

**SWITCHING CHARACTERISTICS** over operating range unless otherwise specified\*

| Parameters | Description                                                                  | Test Conditions                             | COMMERCIAL |     | MILITARY |      | Units |  |
|------------|------------------------------------------------------------------------------|---------------------------------------------|------------|-----|----------|------|-------|--|
|            |                                                                              |                                             | Am2902A    |     | Am2902A  |      |       |  |
|            |                                                                              |                                             | Min        | Max | Min      | Max  |       |  |
| $t_{PLH}$  | $C_n$ to $C_n + x$ , $C_n + y$ or $C_n + z$                                  | $C_L = 50\text{ pF}$<br>$R_L = 280\ \Omega$ |            | 13  |          | 15   | ns    |  |
| $t_{PHL}$  |                                                                              |                                             |            | 14  |          | 16.5 | ns    |  |
| $t_{PLH}$  | $\overline{P}_i$ or $\overline{G}_i$ to $C_n + x$ , $C_n + y$ , or $C_n + z$ |                                             |            | 8   |          | 9.5  | ns    |  |
| $t_{PHL}$  |                                                                              |                                             |            | 9   |          | 11.5 | ns    |  |
| $t_{PLH}$  | $\overline{P}_i$ or $\overline{G}_i$ to $\overline{G}$                       |                                             |            | 12  |          | 16.5 | ns    |  |
| $t_{PHL}$  |                                                                              |                                             |            | 12  |          | 13.5 | ns    |  |
| $t_{PLH}$  | $\overline{P}_i$ to $\overline{P}$                                           |                                             |            | 9.5 |          | 11.5 | ns    |  |
| $t_{PHL}$  |                                                                              |                                             |            | 11  |          | 12   | ns    |  |

\*Switching Characteristics' performance over the operating temperature range is guaranteed by testing defined in Group A, Subgroup 9.