

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT182**

### Look-ahead carry generator

Product specification  
File under Integrated Circuits, IC06

December 1990

# Look-ahead carry generator

# 74HC/HCT182

## FEATURES

- Provides carry look-ahead across a group of four ALU's
- Multi-level look-ahead for high-speed arithmetic operation over long word length
- Output capability: standard
- I<sub>CC</sub> category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT182 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT182 carry look-ahead generators accept 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 ( $C_n$ ). The devices provide

anticipated active HIGH carries ( $C_{n+x}, C_{n+y}, C_{n+z}$ ) across four groups of binary adders.

The "182" also has active LOW carry propagate ( $\overline{P}$ ) and carry generate ( $\overline{G}$ ) outputs which may be used for further levels of look-ahead.

The logic equations provided at the outputs are:

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

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

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

$$\overline{G} = \overline{G}_3 + \overline{P}_3 \overline{G}_2 + \overline{P}_3 \overline{P}_2 \overline{G}_1 + \overline{P}_3 \overline{P}_2 \overline{P}_1 \overline{G}_0$$

$$\overline{P} = \overline{P}_3 \overline{P}_2 \overline{P}_1 \overline{P}_0$$

The "182" 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.

## QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

| SYMBOL                              | PARAMETER  | CONDITIONS                                    | TYPICAL |     | UNIT |
|-------------------------------------|--|---|---------|-----|------|
|                                     |  |   | HC      | HCT |      |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay                                  | C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V |         |     |      |
|                                     | $\overline{P}_n$ to $\overline{P}$                 |   | 11      | 14  | ns   |
|                                     | C <sub>n</sub> to any output                       |   | 17      | 21  | ns   |
|                                     | $\overline{P}_n$ or $\overline{G}_n$ to any output |   | 14      | 17  | ns   |
| C <sub>I</sub>                      | input capacitance                                  |   | 3.5     | 3.5 | pF   |
| C <sub>PD</sub>                     | power dissipation capacitance per package          | notes 1 and 2                                 | 50      | 50  | pF   |

## Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>

For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> - 1.5 V

## ORDERING INFORMATION

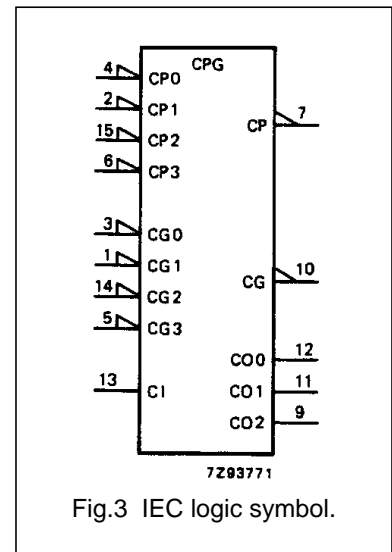
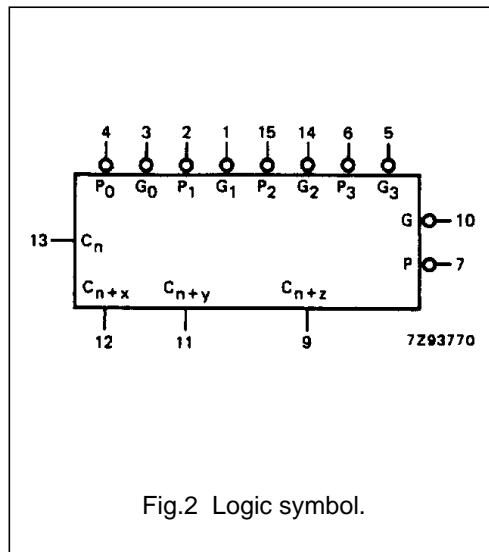
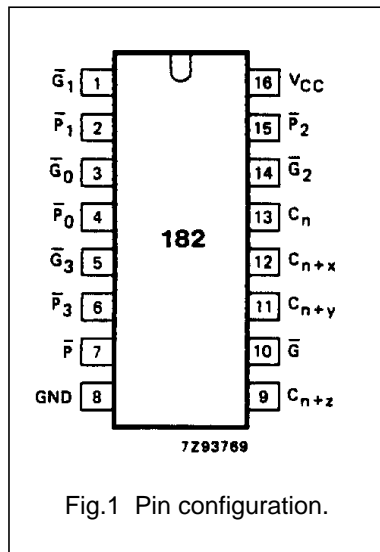
See "74HC/HCT/HCU/HCMOS Logic Package Information".

# Look-ahead carry generator

# 74HC/HCT182

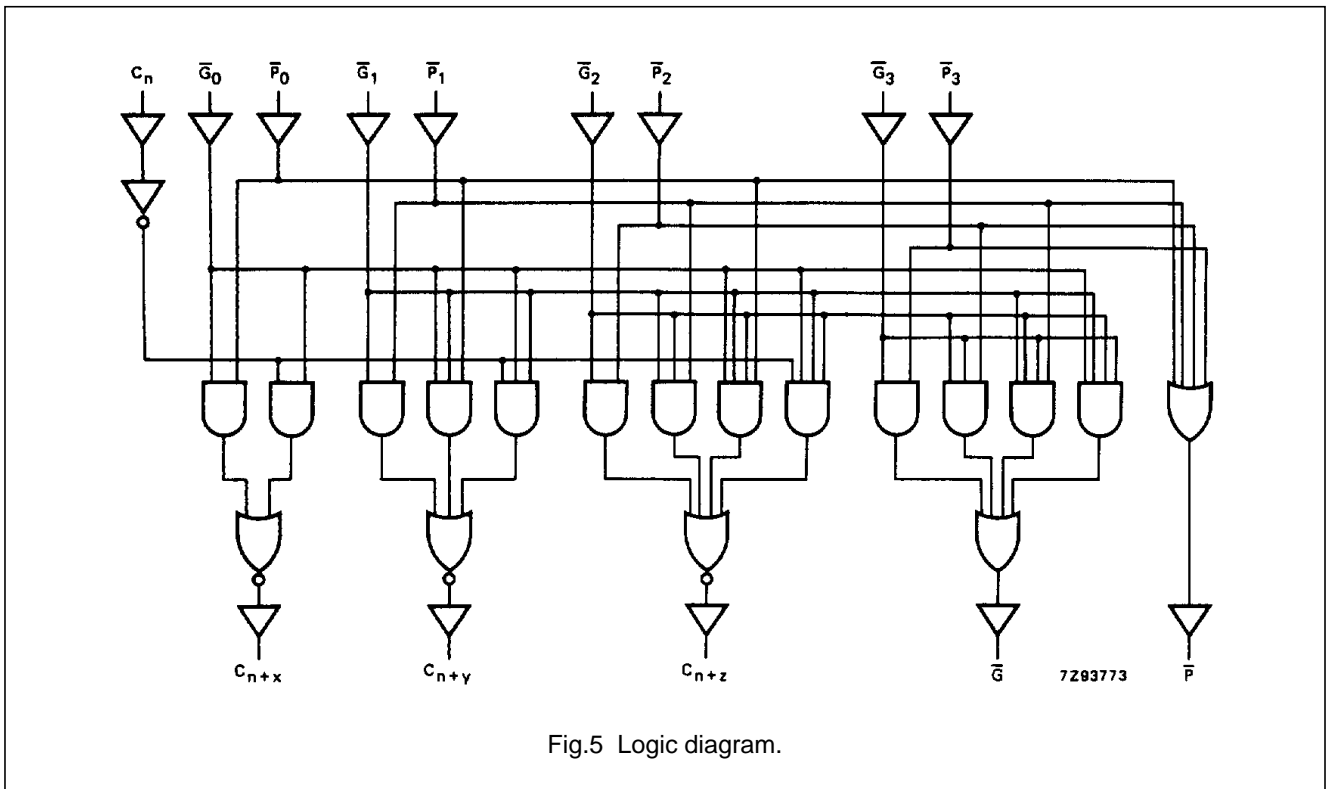
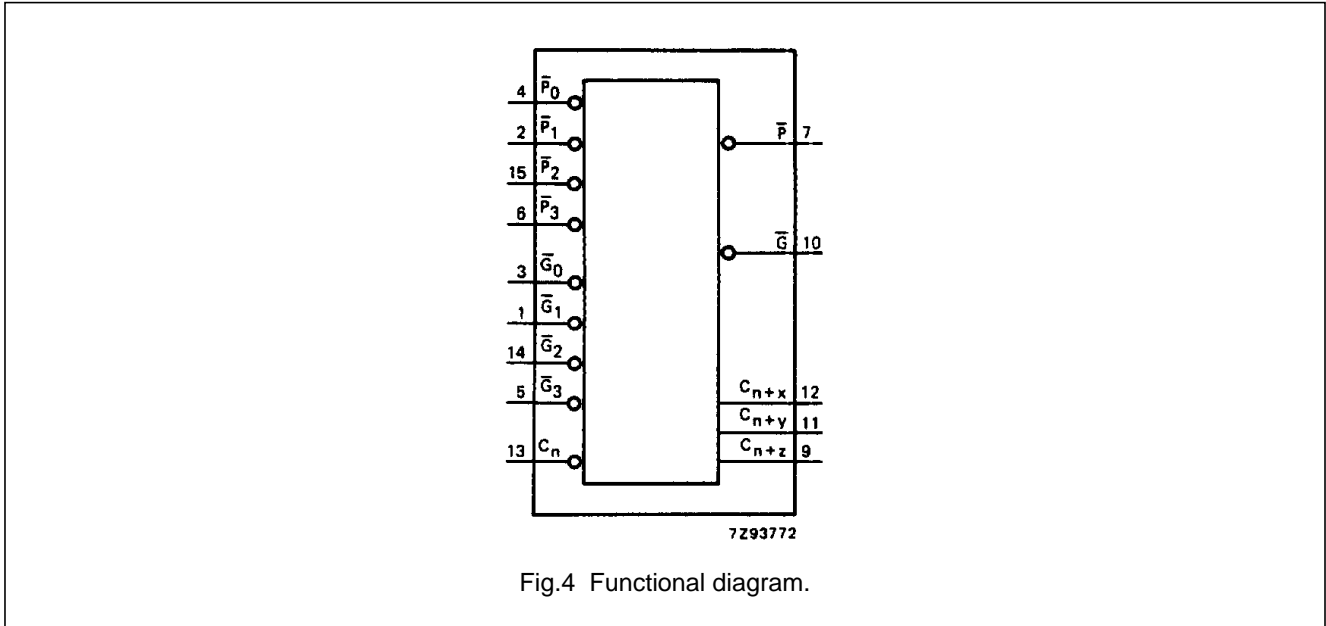
## PIN DESCRIPTION

| PIN NO.     | SYMBOL                               | NAME AND FUNCTION                   |
|-------------|--------------------------------------|-------------------------------------|
| 3, 1, 14, 5 | $\overline{G}_0$ to $\overline{G}_3$ | carry generate inputs (active LOW)  |
| 4, 2, 15, 6 | $\overline{P}_0$ to $\overline{P}_3$ | carry propagate inputs (active LOW) |
| 7           | $\overline{P}$                       | carry propagate output (active LOW) |
| 8           | GND                                  | ground (0 V)                        |
| 9           | $C_{n+z}$                            | function output                     |
| 10          | $\overline{G}$                       | carry generate output (active LOW)  |
| 11          | $C_{n+y}$                            | function output                     |
| 12          | $C_{n+x}$                            | function output                     |
| 13          | $C_n$                                | carry input (active HIGH)           |
| 16          | $V_{CC}$                             | positive supply voltage             |



Look-ahead carry generator

74HC/HCT182



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FUNCTION TABLE

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

## Notes

- H = HIGH voltage level  
L = LOW voltage level  
X = don't care

## Look-ahead carry generator

## 74HC/HCT182

**DC CHARACTERISTICS FOR 74HC**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

I<sub>CC</sub> category: MSI

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

| SYMBOL                              | PARAMETER   | T <sub>amb</sub> (°C) |                |                 |            |                 |             | UNIT            | TEST CONDITIONS        |                   |       |
|-------------------------------------|---|-----------------------|----------------|-----------------|------------|-----------------|-------------|-----------------|------------------------|-------------------|-------|
|                                     |   | 74HC                  |                |                 |            |                 |             |                 | V <sub>CC</sub><br>(V) | WAVEFORMS         |       |
|                                     |   | +25                   |                |                 | -40 to +85 |                 | -40 to +125 |                 |                        |                   |       |
|                                     |   | min.                  | typ.           | max.            | min.       | max.            | min.        |                 |                        |                   | max.  |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{P}_n$ to $\overline{P}$   |                       | 30<br>14<br>11 | 120<br>24<br>20 |            | 150<br>30<br>26 |             | 180<br>36<br>31 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>C <sub>n</sub> to any output         |                       | 55<br>20<br>16 | 170<br>34<br>29 |            | 215<br>43<br>37 |             | 255<br>51<br>43 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{P}_n$ to $\overline{G}$   |                       | 47<br>17<br>14 | 145<br>29<br>25 |            | 180<br>36<br>31 |             | 220<br>44<br>38 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{P}_n$ to C <sub>n+n</sub> |                       | 47<br>17<br>14 | 145<br>29<br>25 |            | 180<br>36<br>31 |             | 220<br>44<br>38 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{G}_n$ to C <sub>n+n</sub> |                       | 44<br>16<br>13 | 135<br>27<br>23 |            | 170<br>34<br>29 |             | 205<br>41<br>35 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{G}_n$ to $\overline{G}$   |                       | 41<br>15<br>12 | 135<br>27<br>23 |            | 170<br>34<br>29 |             | 205<br>41<br>35 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                    |                       | 19<br>7<br>6   | 75<br>15<br>13  |            | 95<br>19<br>16  |             | 110<br>22<br>19 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6 |

## Look-ahead carry generator

## 74HC/HCT182

**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

$I_{CC}$  category: MSI

**Note to HCT types**

The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given in the family specifications. To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

| INPUT  | UNIT LOAD COEFFICIENT |
|--|-----------------------|
| $\overline{G}_0, \overline{G}_1, \overline{P}_0, \overline{P}_1, \overline{P}_2$ | 1.50                  |
| $\overline{G}_3$   | 0.30                  |
| $\overline{G}_2, \overline{P}_3, C_n$  | 1.25                  |

**AC CHARACTERISTICS FOR 74HCT**

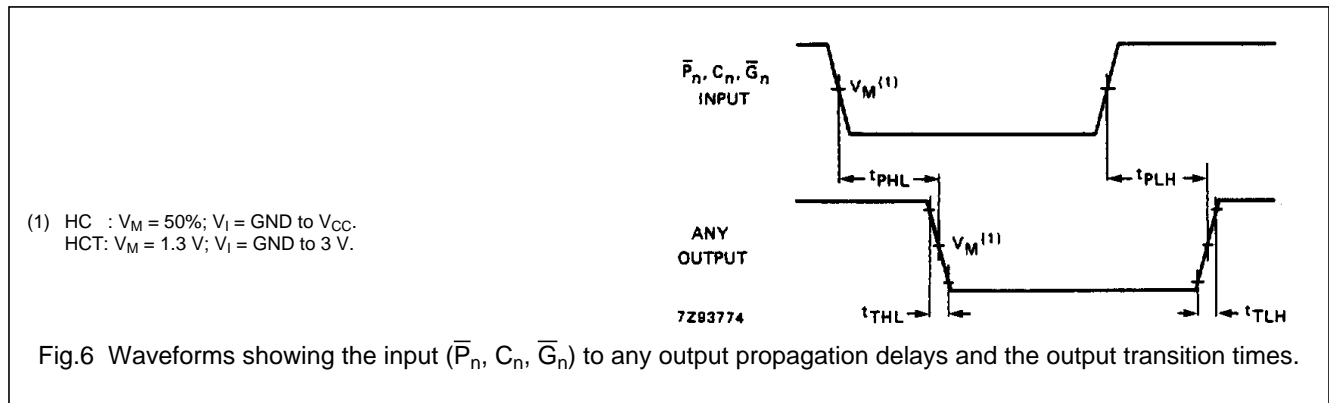
GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL              | PARAMETER  | $T_{amb}$ (°C) |      |      |            |      |             |      | UNIT | TEST CONDITIONS |           |
|---------------------|--|----------------|------|------|------------|------|-------------|------|------|-----------------|-----------|
|                     |  | 74HCT          |      |      |            |      |             |      |      | $V_{CC}$<br>(V) | WAVEFORMS |
|                     |  | +25            |      |      | -40 to +85 |      | -40 to +125 |      |      |                 |           |
|                     |  | min.           | typ. | max. | min.       | max. | min.        | max. |      |                 |           |
| $t_{PHL} / t_{PLH}$ | propagation delay<br>$\overline{P}_n$ to $\overline{P}$                              |                | 17   | 28   |            | 35   |             | 42   | ns   | 4.5             | Fig.6     |
| $t_{PHL} / t_{PLH}$ | propagation delay<br>$C_n$ to any output   |                | 26   | 43   |            | 54   |             | 65   | ns   | 4.5             | Fig.6     |
| $t_{PHL} / t_{PLH}$ | propagation delay<br>$\overline{P}_n$ to $\overline{G}$                              |                | 20   | 33   |            | 41   |             | 50   | ns   | 4.5             | Fig.6     |
| $t_{PHL} / t_{PLH}$ | propagation delay<br>$\overline{P}_n$ to $C_{n+n}$                                   |                | 20   | 33   |            | 41   |             | 50   | ns   | 4.5             | Fig.6     |
| $t_{PHL} / t_{PLH}$ | propagation delay<br>$\overline{G}_n$ to $C_{n+n}, \overline{G}_n$ to $\overline{G}$ |                | 18   | 32   |            | 40   |             | 48   | ns   | 4.5             | Fig.6     |
| $t_{THL} / t_{TLH}$ | output transition time   |                | 7    | 15   |            | 19   |             | 22   | ns   | 4.5             | Fig.6     |

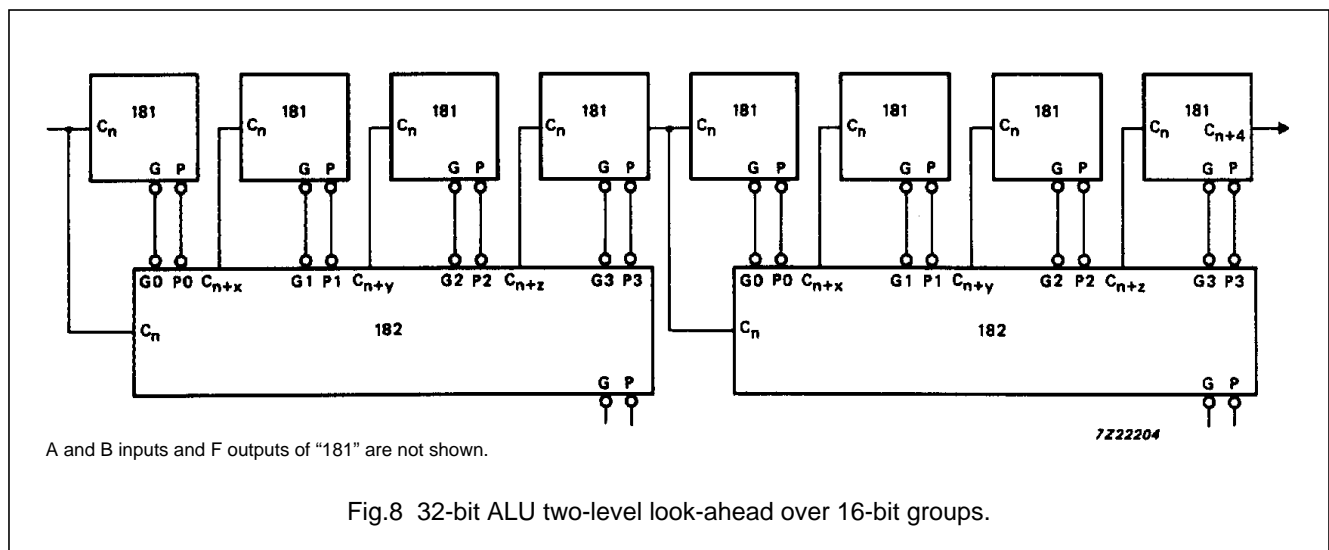
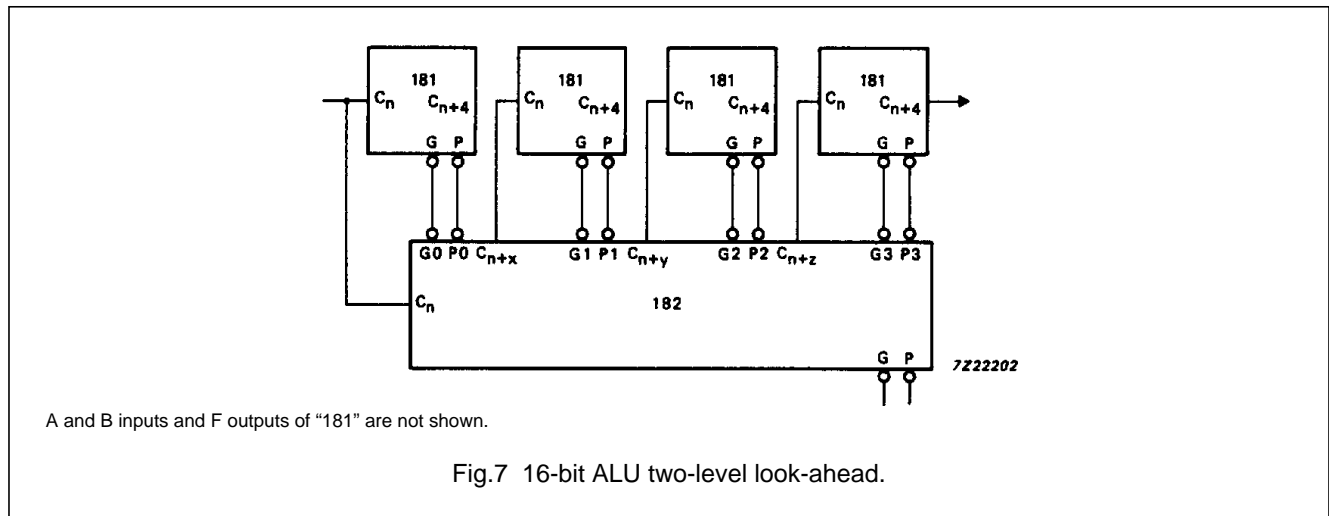
# Look-ahead carry generator

# 74HC/HCT182

## AC WAVEFORMS



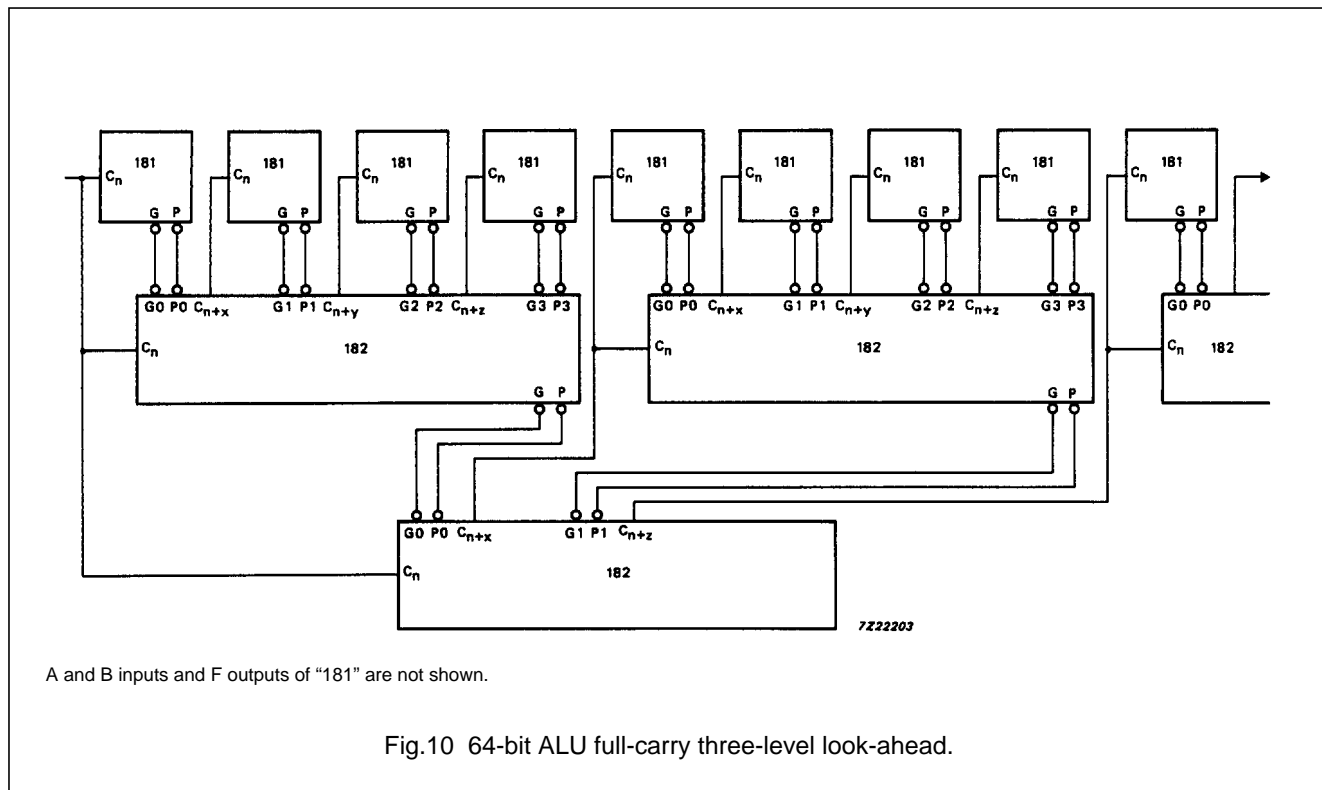
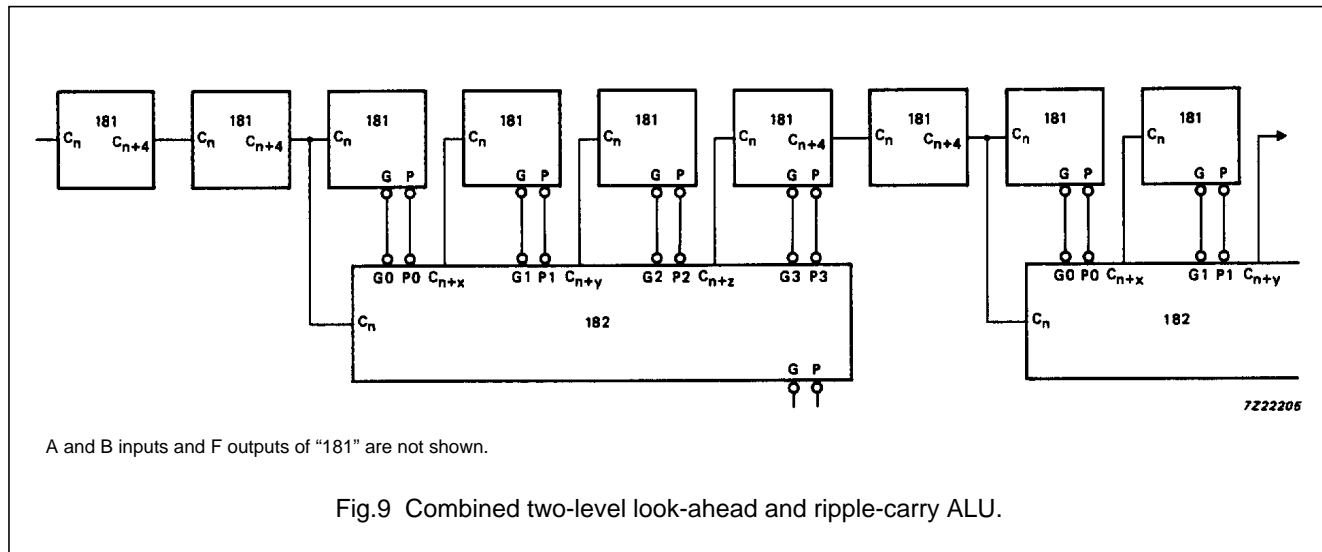
## APPLICATION INFORMATION





# Look-ahead carry generator

# 74HC/HCT182



## PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".