



# 3003

## LOOK-AHEAD CARRY GENERATOR

The INTEL® 3003 Look-Ahead Carry Generator (LCG) is a high speed circuit capable of anticipating a carry across a full 16-bit 3002 Central Processing Element (CPE) array. When used with a larger 3002 CP array multiple 3003 carry generators provide high speed carry look-ahead capability for any word length.

The LCG accepts eight pairs of active high cascade inputs (X,Y) and an active low carry input and generates active low carries for up to eight groups of binary adders.

High Performance – 10 ns typical propagation delay

Compatible with INTEL 3001 MCU and 3002 CPE

DTL and TTL compatible

Full look-ahead across 8 adders

Low voltage diode input clamp

Expandable

28-pin DIP

### PACKAGE CONFIGURATION

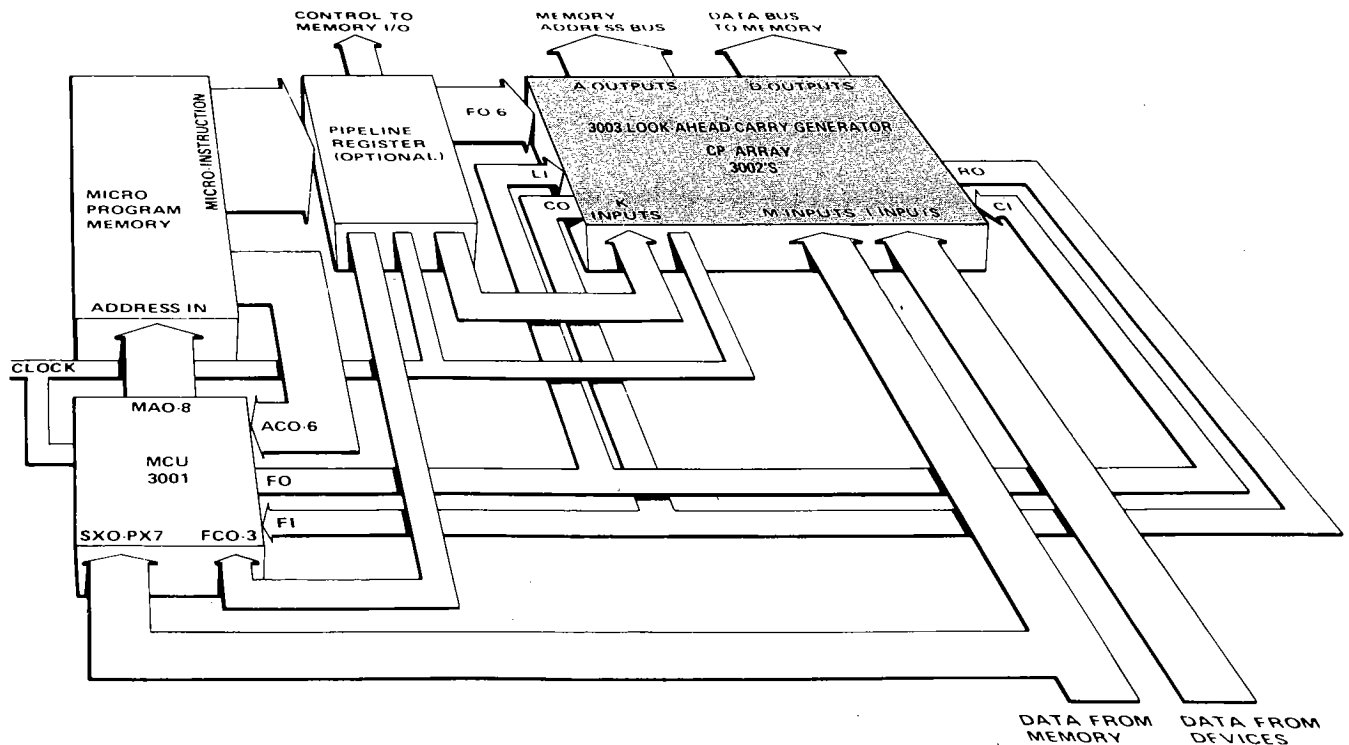
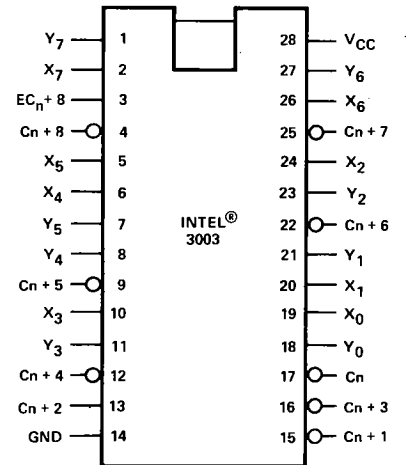
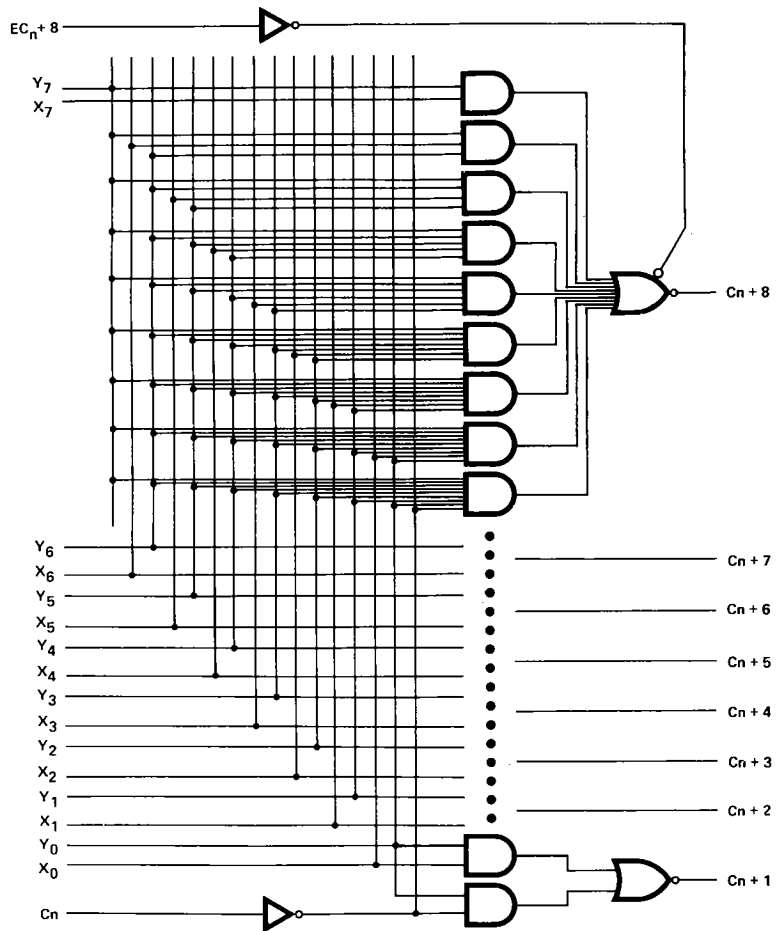


Diagram of a Typical System

## PIN DESCRIPTION

PIN	SYMBOL	NAME AND FUNCTION	TYPE
1,7,8,11 18,21,23 27	$Y_0$ - $Y_7$	Standard carry look-ahead inputs	Active HIGH
2,5,6,10 19,20,24 26	$X_0$ - $X_7$	Standard carry look-ahead inputs	Active HIGH
17	$C_n$	Carry input	Active LOW
4,9,12 13,15,16	$C_{n+1}$ - $C_{n+8}$	Carry outputs	Active LOW
3	$EC_{n+8}$	$C_{n+8}$ carry output enable	Active HIGH
28	$V_{CC}$	+5 volt supply	
14	GND	Ground	

## LOGIC DIAGRAM



## 3003 LOGIC EQUATIONS

The 3003 Look-Ahead Generator is implemented in a compatible form for direct connection to the 3001 MCU and 3002 CPE. Logic equations for the 3003 are:

$$\overline{C_{n+1}} = Y_0 X_0 + Y_0 \overline{C_n}$$

$$\overline{C_{n+2}} = Y_1 X_1 + Y_1 Y_0 X_0 + Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+3}} = Y_2 X_2 + Y_2 Y_1 X_1 + Y_2 Y_1 Y_0 X_0 + Y_2 Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+4}} = Y_3 X_3 + Y_3 Y_2 X_2 + Y_3 Y_2 Y_1 X_1 + Y_3 Y_2 Y_1 Y_0 X_0 + Y_3 Y_2 Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+5}} = Y_4 X_4 + Y_4 Y_3 X_3 + Y_4 Y_3 Y_2 X_2 + Y_4 Y_3 Y_2 Y_1 X_1 + Y_4 Y_3 Y_2 Y_1 Y_0 X_0 + Y_4 Y_3 Y_2 Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+6}} = Y_5 X_5 + Y_5 Y_4 X_4 + Y_5 Y_4 Y_3 X_3 + Y_5 Y_4 Y_3 Y_2 X_2 + Y_5 Y_4 Y_3 Y_2 Y_1 X_1 + Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 X_0 + Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+7}} = Y_6 X_6 + Y_6 Y_5 X_5 + Y_6 Y_5 Y_4 X_4 + Y_6 Y_5 Y_4 Y_3 X_3 + Y_6 Y_5 Y_4 Y_3 Y_2 X_2 + Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 X_1 + Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 X_0 + Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 \overline{C_n}$$

$$\overline{C_{n+8}} = \text{High Impedance State when } EC_{n+8} \text{ Low}$$

$$\overline{C_{n+8}} = Y_7 X_7 + Y_7 Y_6 X_6 + Y_7 Y_6 Y_5 X_5 + Y_7 Y_6 Y_5 Y_4 X_4 + Y_7 Y_6 Y_5 Y_4 Y_3 X_3 + Y_7 Y_6 Y_5 Y_4 Y_3 Y_2 X_2 + Y_7 Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 X_1 + Y_7 Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 X_0 + Y_7 Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 Y_0 \overline{C_n} \text{ when } EC_{n+8} \text{ high}$$

**D.C. AND OPERATING CHARACTERISTICS****ABSOLUTE MAXIMUM RATINGS\***

Temperature Under Bias . . . . .	-55°C to +125°C
Storage Temperature . . . . .	-65°C to +160°C
All Input and Supply Voltages . . . . .	-0.5V to +7V
All Input Voltages . . . . .	-1.0V to +5.5V
Output Currents . . . . .	100 mA

\**COMMENT:* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

$T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$ .

SYMBOL	PARAMETER	MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT	CONDITIONS
$V_C$	Input Clamp Voltage (All Input Pins)		-0.8	-1.2	V	$I_C = -5\text{ mA}$
$I_F$	Input Load Current: X <sub>6</sub> , X <sub>7</sub> , C <sub>n</sub> , EC <sub>n+8</sub> Y <sub>7</sub> , X <sub>0</sub> -X <sub>5</sub> , Y <sub>0</sub> -Y <sub>6</sub>		-0.07 -0.200 -0.6	-0.25 -0.500 -1.5	mA mA mA	$V_F = 0.45\text{V}$
$I_R$	Input Leakage Current: C <sub>n</sub> and EC <sub>n + 8</sub> All Other Inputs			40 100	μA μA	$V_{CC} = 5.25\text{V}$ , $V_R = 5.5\text{V}$
$V_{IL}$	Input Low Voltage			0.8	V	$V_{CC} = 5.0\text{V}$
$V_{IH}$	Input High Voltage	2.1			V	$V_{CC} = 5.0\text{V}$
$I_{CC}$	Power Supply Current		80	130	mA	All Y and EC <sub>n + 8</sub> high, All X and C <sub>n</sub> low
$V_{OL}$	Output Low Voltage (All Output Pins)		0.35	0.45	V	$I_{OL} = 4\text{ mA}$
$V_{OH}$	Output High Voltage (All Output Pins)	2.4	3		V	$I_{OH} = -1\text{ mA}$
$I_{OS}$	Short Circuit Output Current (All Output Pins)	-15	-40	-65	mA	$V_{CC} = 5\text{V}$
$I_{O(off)}$	Off-State Output Current (C <sub>n</sub> + 8)			-100 +100	μA μA	$V_O = 0.45\text{V}$ $V_O = 5.5\text{V}$

NOTE:

(1) Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

**A.C. CHARACTERISTICS**

$T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_{CC} = +5.0\text{V} \pm 10\%$

SYMBOL	PARAMETER	MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
$t_{XC}$	X, Y to Outputs	3	10	25	ns
$t_{CC}$	Carry In to Outputs		13	40	ns
$t_{EN}$	Enable Time, C <sub>n</sub> + 8		20	50	ns

NOTE:

(1) Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

## D.C. AND OPERATING CHARACTERISTICS

## ABSOLUTE MAXIMUM RATINGS\*

Temperature Under Bias . . . . .	0°C to 70°C
Storage Temperature . . . . .	-65°C to +160°C
All Output and Supply Voltages . . . . .	-0.5V to +7V
All Input Voltages . . . . .	-1.0V to +5.5V
Output Currents . . . . .	100 mA

\*COMMENT: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

$T_A = 0^\circ\text{C to } +70^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 5\%$

SYMBOL	PARAMETER	MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT	CONDITIONS
$V_C$	Input Clamp Voltage (All Input Pins)		-0.8	-1.0	V	$I_C = -5 \text{ mA}$
$I_F$	Input Load Current: X <sub>6</sub> , X <sub>7</sub> , C <sub>n</sub> , EC <sub>n</sub> + 8 Y <sub>7</sub> , X <sub>0</sub> -X <sub>5</sub> , Y <sub>0</sub> -Y <sub>6</sub>		-0.07	-0.25	mA	$V_F = 0.45\text{V}$
			-0.200	-0.500	mA	
			-0.6	-1.5	mA	
$I_R$	Input Leakage Current: C <sub>n</sub> and EC <sub>n</sub> + 8 All Other Inputs			40	μA	$V_R = 5.25\text{V}$
				100	μA	
$V_{IL}$	Input Low Voltage			0.8	V	$V_{CC} = 5.0\text{V}$
$V_{IH}$	Input High Voltage	2.0			V	$V_{CC} = 5.0\text{V}$
$I_{CC}$	Power Supply Current		80	130	mA	All Y and EC <sub>n</sub> + 8 high, All X and C <sub>n</sub> low
$V_{OL}$	Output Low Voltage (All Output Pins)		0.35	0.45	V	$I_{OL} = 4 \text{ mA}$
$V_{OH}$	Output High Voltage (All Output Pins)	2.4	3		V	$I_{OH} = -1 \text{ mA}$
$I_{OS}$	Short Circuit Output Current (All Output Pins)	-15	-40	-65	mA	$V_{CC} = 5\text{V}$
$I_{O(off)}$	Off-State Output Current (C <sub>n</sub> + 8)			-100	μA	$V_O = 0.45\text{V}$
				+100	μA	$V_O = 5.25\text{V}$

NOTE:

(1) Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

## A.C. CHARACTERISTICS

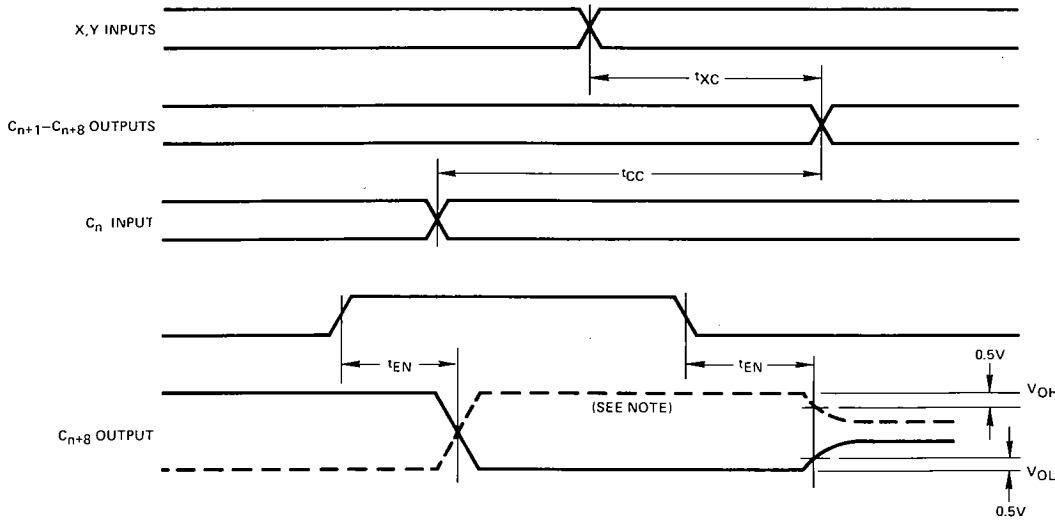
$T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{CC} = +5\text{V} \pm 5\%$

SYMBOL	PARAMETER	MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
$t_{XC}$	X, Y to Outputs	3	10	20	ns
$t_{CC}$	Carry In to Outputs		13	30	ns
$t_{EN}$	Enable Time, C <sub>n</sub> + 8		20	40	ns

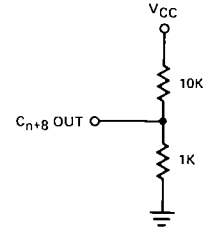
NOTE:

(1) Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

WAVEFORMS



NOTE: ALTERNATE TEST LOAD:



CAPACITANCE<sup>(2)</sup> T<sub>A</sub> = 25°C

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
C <sub>IN</sub>	Input Capacitance All inputs		12	20	pF
C <sub>OUT</sub>	Output Capacitance C <sub>n</sub> + 8		7	12	pF

NOTE:

(2) This parameter is periodically sampled and is not 100% tested. Condition of measurement is f = 1 MHz, V<sub>BIAS</sub> = 5.0V, V<sub>CC</sub> = 5.0V and T<sub>A</sub> = 25°C.

TEST CONDITIONS:

Input pulse amplitude of 2.5V.  
 Input rise and fall times of 5 ns between 1 and 2 volts.  
 Output loading is 5 mA and 30 pF.  
 Speed measurements are made at 1.5 volt levels.

TEST LOAD CIRCUIT:

