

# SN54AS882A, SN74AS882A 32-BIT LOOK-AHEAD CARRY GENERATORS

D2661, DECEMBER 1982 REVISED NOVEMBER 1985

- Directly Compatible with 'AS181B, 'AS1181, 'AS881B, and 'AS1881 ALUs
- Package Options Include Plastic "Small Outline" Packages, Both Plastic and Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Capable of Anticipating the Carry Across a Group of Eight 4-Bit Binary Adders
- Cascadable to Perform Look-Ahead Across n-Bit Adders
- Typical Carry Time,  $C_n$  to Any  $C_{n+i}$ , is Less Than 6 ns
- Dependable Texas Instruments Quality and Reliability

## description

The 'AS882A is a high-speed look-ahead carry generator capable of anticipating the carry across a group of eight 4-bit adders permitting the designer to implement look-ahead for a 32-bit ALU with a single package or, by cascading 'AS882A's, full look-ahead is possible across n-bit adders.

The SN54AS882A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74AS882A is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## 'AS882A LOGIC EQUATIONS

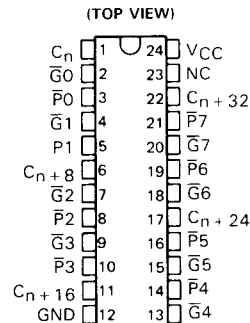
$$C_{n+8} = G_1 + P_1G_0 + P_1P_0C_n$$

$$C_{n+16} = G_3 + P_3G_2 + P_3P_2G_1 + P_3P_2P_1G_0 + P_3P_2P_1P_0C_n$$

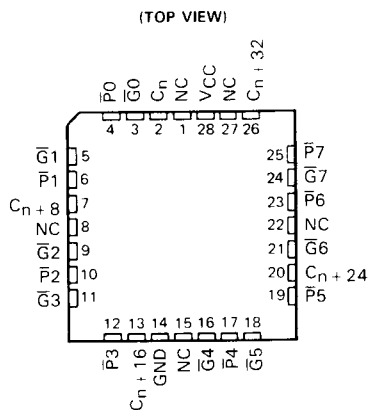
$$C_{n+24} = G_5 + P_5G_4 + P_5P_4G_3 + P_5P_4P_3G_2 + P_5P_4P_3P_2G_1 + P_5P_4P_3P_2P_1G_0 + P_5P_4P_3P_2P_1P_0C_n$$

$$C_{n+32} = G_7 + P_7G_6 + P_7P_6G_5 + P_7P_6P_5G_4 + P_7P_6P_5P_4G_3 + P_7P_6P_5P_4P_3G_2 + P_7P_6P_5P_4P_3P_2G_1 + P_7P_6P_5P_4P_3P_2P_1G_0 + P_7P_6P_5P_4P_3P_2P_1P_0C_n$$

SN54AS882A ... JT PACKAGE  
SN74AS882A ... DW OR NT PACKAGE



SN54AS882A ... FK PACKAGE  
SN74AS882A ... FN PACKAGE



NC No internal connection

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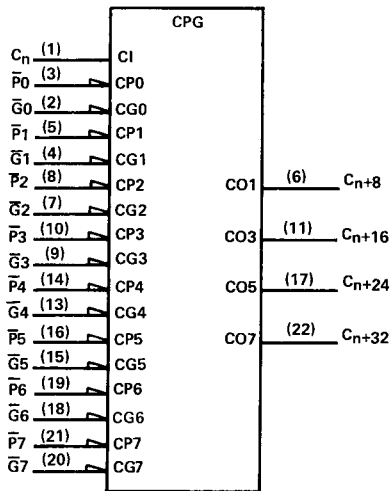


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**32-BIT LOOK-AHEAD CARRY GENERATORS**

logic symbol<sup>†</sup>



<sup>†</sup>This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
 Pin numbers shown are for DW, JT, and NT packages.

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**FUNCTION TABLE  
FOR  $C_{n+32}$  OUTPUT**

INPUTS															OUTPUT		
$\bar{G}_7$	$\bar{G}_6$	$\bar{G}_5$	$\bar{G}_4$	$\bar{G}_3$	$\bar{G}_2$	$\bar{G}_1$	$\bar{G}_0$	$\bar{P}_7$	$\bar{P}_6$	$\bar{P}_5$	$\bar{P}_4$	$\bar{P}_3$	$\bar{P}_2$	$\bar{P}_1$	$\bar{P}_0$	$C_n$	$C_{n+32}$
L	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	H
X	L	X	X	X	X	X	X	L	X	X	X	X	X	X	X	X	H
X	X	L	X	X	X	X	X	L	L	X	X	X	X	X	X	X	H
X	X	X	L	X	X	X	X	L	L	L	X	X	X	X	X	X	H
X	X	X	X	L	X	X	X	L	L	L	L	X	X	X	X	X	H
X	X	X	X	X	L	X	X	L	L	L	L	L	X	X	X	X	H
X	X	X	X	X	X	L	X	L	L	L	L	L	L	X	X	X	H
X	X	X	X	X	X	X	L	L	L	L	L	L	L	L	X	X	H
X	X	X	X	X	X	X	X	L	L	L	L	L	L	L	L	X	H
X	X	X	X	X	X	X	X	L	L	L	L	L	L	L	L	H	H
X	X	X	X	X	X	X	X	L	L	L	L	L	L	L	L	H	H
X	X	X	X	X	X	X	X	L	L	L	L	L	L	L	L	H	L
All other combinations																	L

**FUNCTION TABLE  
FOR  $C_{n+24}$  OUTPUT**

INPUTS													OUTPUT
$\bar{G}_5$	$\bar{G}_4$	$\bar{G}_3$	$\bar{G}_2$	$\bar{G}_1$	$\bar{G}_0$	$\bar{P}_5$	$\bar{P}_4$	$\bar{P}_3$	$\bar{P}_2$	$\bar{P}_1$	$\bar{P}_0$	$C_n$	$C_{n+24}$
L	X	X	X	X	X	X	X	X	X	X	X	X	H
X	L	X	X	X	X	L	X	X	X	X	X	X	H
X	X	L	X	X	X	L	L	X	X	X	X	X	H
X	X	X	L	X	X	L	L	L	X	X	X	X	H
X	X	X	X	L	X	L	L	L	L	X	X	X	H
X	X	X	X	X	L	L	L	L	L	L	X	X	H
X	X	X	X	X	X	L	L	L	L	L	X	X	H
X	X	X	X	X	X	X	L	L	L	L	L	H	H
X	X	X	X	X	X	X	L	L	L	L	L	H	H
All other combinations													L

**FUNCTION TABLE  
FOR  $C_{n+16}$  OUTPUT**

INPUTS								OUTPUT	
$\bar{G}_3$	$\bar{G}_2$	$\bar{G}_1$	$\bar{G}_0$	$\bar{P}_3$	$\bar{P}_2$	$\bar{P}_1$	$\bar{P}_0$	$C_n$	$C_{n+16}$
L	X	X	X	X	X	X	X	X	H
X	L	X	X	L	X	X	X	X	H
X	X	L	X	L	L	X	X	X	H
X	X	X	L	L	L	L	X	X	H
X	X	X	X	L	L	L	L	H	H
All other combinations									L

**FUNCTION TABLE  
FOR  $C_{n+8}$  OUTPUT**

INPUTS				OUTPUT	
$\bar{G}_1$	$\bar{G}_0$	$\bar{P}_1$	$\bar{P}_0$	$C_n$	$C_{n+8}$
L	X	X	X	X	H
X	L	L	X	X	H
X	X	L	L	H	H
All other combinations					L

Any inputs not shown in a given table are irrelevant with respect to that output.

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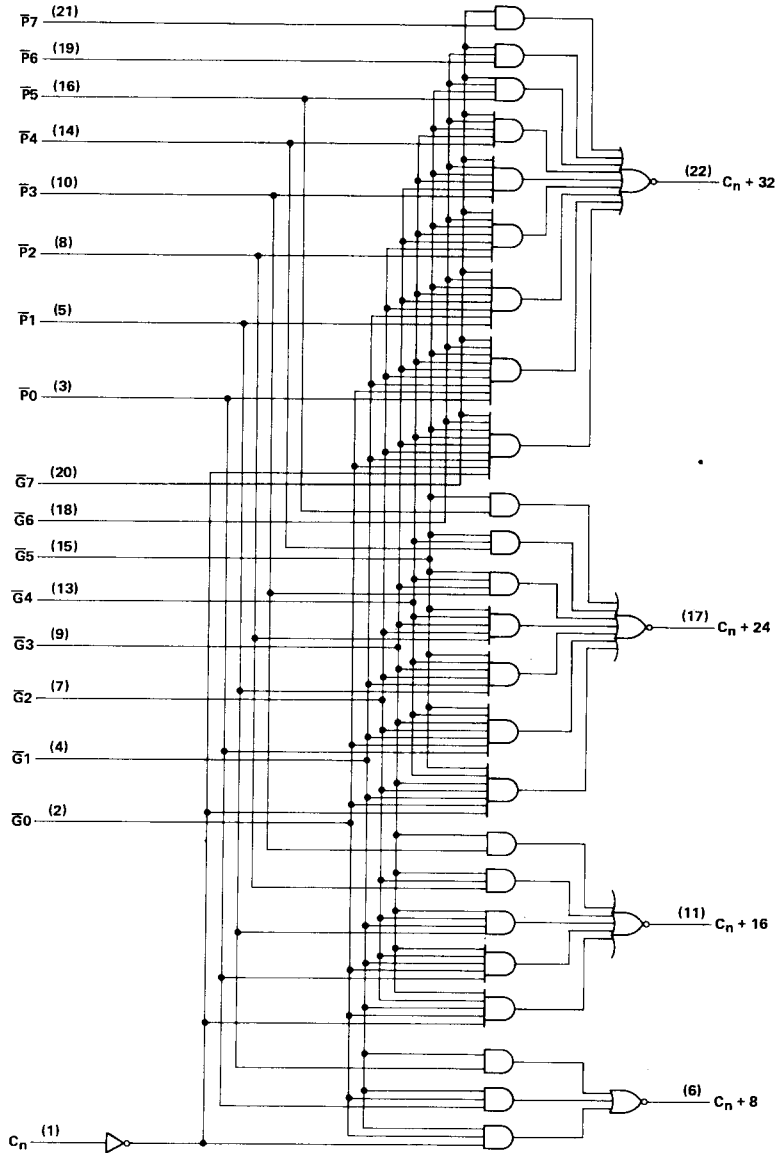
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**SN54AS882A, SN74AS882A**  
**32-BIT LOOK-AHEAD CARRY GENERATORS**

logic diagram (positive logic)

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Pin numbers shown are for DW, JT, and NT packages.

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**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	7 V
Operating free-air temperature range: SN54AS882A .....	-55°C to 125°C
SN74AS822A .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

**recommended operating conditions**

	SN54AS882A			SN74AS882A			UNIT	
	MIN	NOM	MAX	MIN	NOM	MAX		
$V_{CC}$ Supply voltage	4.5	5	5.5	4.5	5	5.5	V	
$V_{IH}$ High-level input voltage	2			2			V	
$V_{IL}$ Low-level input voltage	0.8			0.8			V	
$I_{OH}$ High-level output current	-2			-2			mA	
$I_{OL}$ Low-level output current	20			20			mA	
$T_A$ Operating free-air temperature	-55			0			70	°C

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**32-BIT LOOK-AHEAD CARRY GENERATORS**

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	SN54AS882A		SN74AS882A		UNIT		
		MIN	TYP†	MAX	MIN		TYP†	MAX
$V_{IK}$	$V_{CC} = 4.5 \text{ V}$ , $I_I = -18 \text{ mA}$			-1.2			V	
$V_{OH}$	$V_{CC} = 4.5 \text{ V}$ , to $5.5 \text{ V}$ , $I_{OH} = -2 \text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$		V	
$V_{OL}$	$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 20 \text{ mA}$	0.3	0.5		0.3	0.5	V	
$I_I$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ ,	$V_I = 7 \text{ V}$				mA	
	$\bar{G}0, \bar{G}6$				0.4	0.4		
	$\bar{G}1, \bar{G}2, \bar{G}4$				0.8	0.8		
	$\bar{G}3, \bar{G}5$				1.2	1.2		
	$\bar{G}7$				1.5	1.5		
	$\bar{P}2, \bar{P}3$				0.9	0.9		
	$\bar{P}4, \bar{P}5$				0.3	0.3		
	$\bar{P}6, \bar{P}7$				0.2	0.2		
$I_{IH}$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ ,	$V_I = 2.7 \text{ V}$				$\mu\text{A}$	
	$\bar{G}0, \bar{G}6$				80	80		
	$\bar{G}1, \bar{G}2, \bar{G}4$				160	160		
	$\bar{G}3, \bar{G}5$				240	240		
	$\bar{G}7$				300	300		
	$\bar{P}2, \bar{P}3$				180	180		
	$\bar{P}4, \bar{P}5$				60	60		
	$\bar{P}6, \bar{P}7$				40	40		
$I_{IL}$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ ,	$V_I = 0.4 \text{ V}$				mA	
	$\bar{G}0, \bar{G}6$				-2	-2		
	$\bar{G}1, \bar{G}2, \bar{G}4$				-4	-4		
	$\bar{G}3, \bar{G}5$				-6	-6		
	$\bar{G}7$				-7.5	-7.5		
	$\bar{P}2, \bar{P}3$				-4.5	-4.5		
	$\bar{P}4, \bar{P}5$				-1.5	-1.5		
	$\bar{P}6, \bar{P}7$				-1	-1		
$I_{O}^\ddagger$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.25 \text{ V}$	-30	-130		-30	-130	mA	
$I_{CC}$	$V_{CC} = 5.5 \text{ V}$		44	70		44	70	mA

† All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

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switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_L = 500 \Omega,$ $T_A = \text{MIN to MAX}$				UNIT	
			SN54AS822A		SN74AS882A			
			MIN	MAX	MIN	MAX		
			$t_{PLH}$	$C_n$	Any output	2		10
$t_{PHL}$			3	15	3	5	14	✓
$t_{PLH}$	$\bar{P}$ or $\bar{C}$	$C_{n+8}$	2	8	2	3	7	✓
$t_{PHL}$			2	8	2	7	7	✓
$t_{PLH}$	$\bar{P}$ or $\bar{C}$	$C_{n+16}$	2	8	2	7	7	✓
$t_{PHL}$			2	8	2	7	7	ns
$t_{PLH}$	$\bar{P}$ or $\bar{C}$	$C_{n+24}$	2	8	2	7	7	✓
$t_{PHL}$			2	11	2	10	10	✓
$t_{PLH}$	$\bar{P}$ or $\bar{C}$	$C_{n+32}$	1.5	9	2	8	8	✓
$t_{PHL}$			2	13	2	12	12	✓

NOTE 1: Load circuits and voltage waveforms are shown in Section 1.

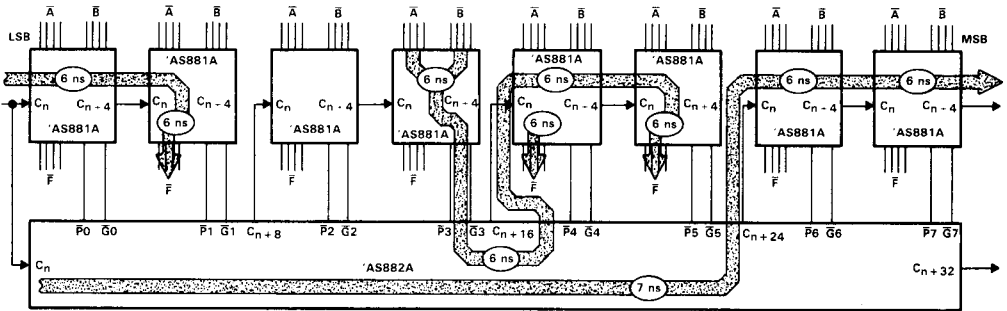
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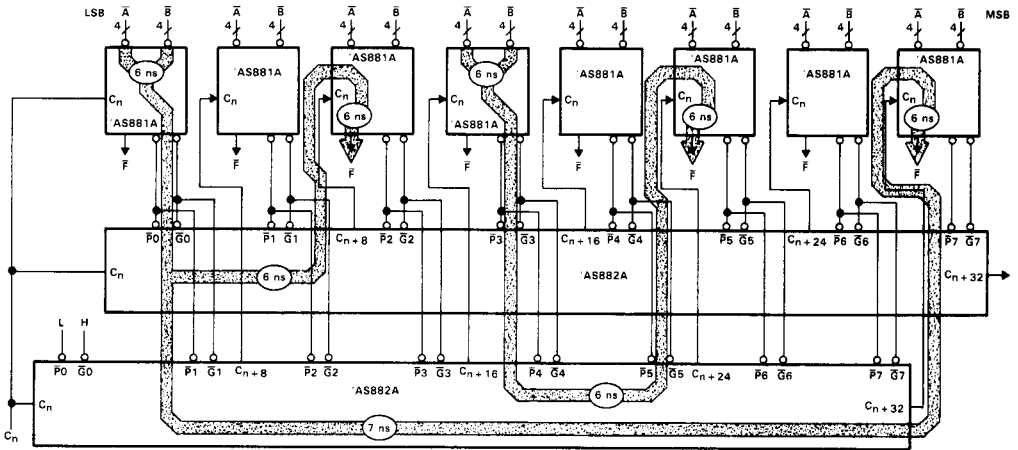
**TYPICAL APPLICATION DATA**

The application given in Figure 1 illustrates how the 'AS882A can implement look-ahead carry for a 32-bit ALU (in this case, the popular 'AS881A) with a single package. Typical carry times shown are derived using the standard Advanced Schottky load circuit.



**FIGURE 1**

Likewise, Figure 2 illustrates the same 32-bit ALU using two 'AS882s. This shows the worst-case delay from LSB to MSB to be 19 ns as opposed to 25 ns in Figure 1.



**FIGURE 2**

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