

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

SDAS235 – 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

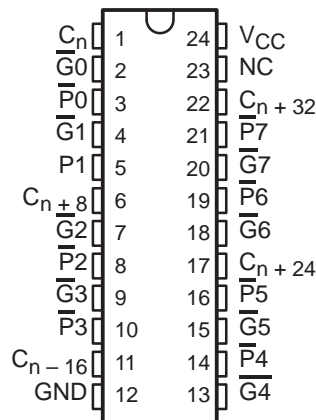
The 'AS882A is a high-speed look-ahead carry generator capable of anticipating the carry across a group of eight 4-bit adders permitting the designer to implement look-ahead for a 32-bit ALU with a single package or, by cascading 'AS882As, full look-ahead is possible across n-bit adders.

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  $70^{\circ}\text{C}$ .

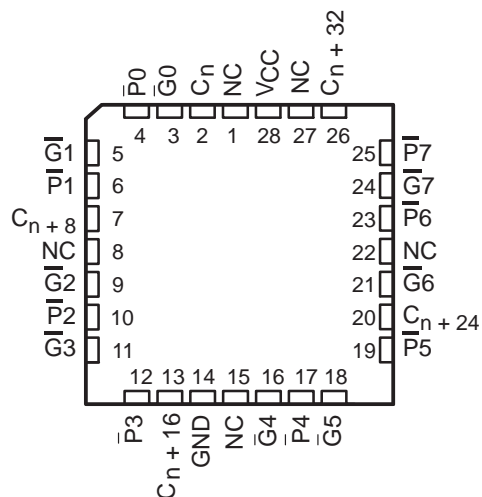
## 'AS882A LOGIC EQUATIONS

$$\begin{aligned} C_{n+8} &= G1 + P1G0 + P1P0C_n \\ C_{n+16} &= G3 + P3G2 + P3P2G1 + P3P2P1G0 \\ &\quad + P3P2P1P0C_n \\ C_{n+24} &= G5 + P5G4 + P5P4G3 + P5P4P3G2 \\ &\quad + P5P4P3P2G1 + P5P4P3P2P1G0 \\ &\quad + P5P4P3P2P1P0C_n \\ C_{n+32} &= G7 + P7G6 + P7P6G5 + P7P6P5G4 \\ &\quad + P7P6P5P4G3 + P7P6P5P4P3G2 \\ &\quad + P7P6P5P4P3P2G1 + P7P6P5P4P3P2P1G0 \\ &\quad + P7P6P5P4P3P2P1P0C_n \end{aligned}$$

SN54AS882A . . . JT PACKAGE  
SN74AS882A . . . DW OR NT PACKAGE  
(TOP VIEW)



SN54AS882A . . . FK PACKAGE  
SN74AS882A . . . DW OR NT PACKAGE  
(TOP VIEW)



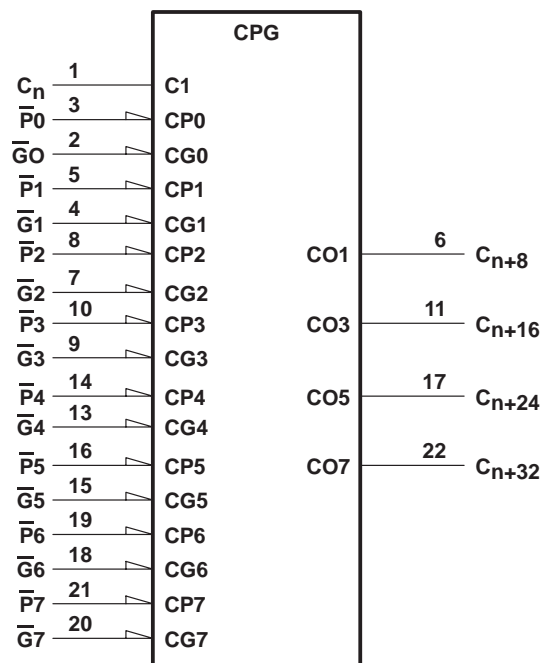
NC – No internal connection

# SN54AS882A, SN74AS882A

## 32-BIT LOOK-AHEAD CARRY GENERATORS

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logic symbol†



† 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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## 32-BIT LOOK-AHEAD CARRY GENERATORS

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FUNCTION TABLE  
FOR  $C_n + 32$  OUTPUT

INPUTS																	OUTPUT
G7	G6	G5	G4	G3	G2	G1	G0	P7	P6	P5	P4	P3	P2	P1	P0	$C_n$	$C_n + 32$
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	H	H
All other combinations																	L

FUNCTION TABLE  
FOR  $C_n + 24$  OUTPUT

INPUTS													OUTPUT
G5	G4	G3	G2	G1	G0	P5	P4	P3	P2	P1	P0	$C_n$	$C_n + 24$
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	L	H	H
All other combinations													L

### Function Tables

FOR  $C_n + 16$  OUTPUT

INPUTS									OUTPUT
G3	G2	G1	G0	P3	P2	P1	P0	$C_n$	$C_n + 16$
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

FOR  $C_n + 8$  OUTPUT

INPUTS					OUTPUT
G1	G0	P1	P0	$C_n$	$C_n + 8$
L	X	X	X	X	H
X	L	L	X	X	H
X	X	L	L	H	H
All other combinations					L

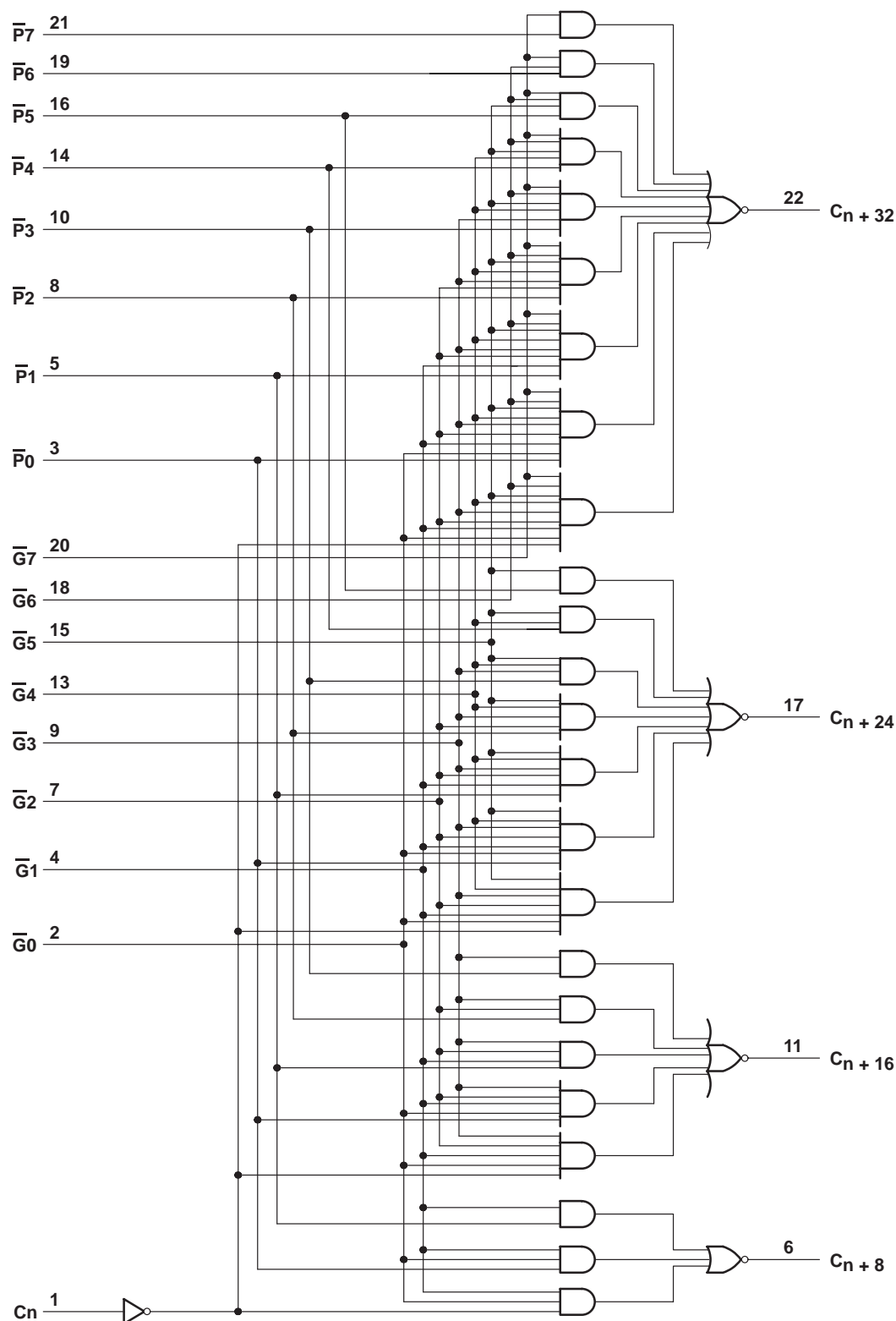
Any inputs not shown in a given table are irrelevant with respect to that output.

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## 32-BIT LOOK-AHEAD CARRY GENERATORS

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### logic diagram (positive logic)



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

## SDAS235 – D2661, DECEMBER 1982 – REVISED NOVEMBER 1985

Supply voltage, $V_{CC}$	7 V
Input voltage	7 V
Operating free-air temperature range:	
SN54AS882A	–55°C to 125°C
SN74AS882A	0°C to 70°C
Storage temperature range	–65°C to 150°C

		SN54AS882A			SN74AS882A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	2			2			V
V <sub>IL</sub>	Low-level input voltage			0.8			0.8	V
I <sub>OH</sub>	High-level output current			−2			−2	mA
I <sub>OL</sub>	Low-level output current			20			20	mA
T <sub>A</sub>	Operating free-air temperature	−55		125	0		70	°C

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## 32-BIT LOOK-AHEAD CARRY GENERATORS

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**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			-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
$I_I$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 7 \text{ V}$			0.4			0.4	mA
	$\bar{G}0, \bar{G}6$				0.8			0.8	
	$\bar{G}1, \bar{G}2, \bar{G}4$				1.2			1.2	
	$\bar{G}3, \bar{G}5$				1.5			1.5	
	$\bar{G}7$				0.9			0.9	
	$\bar{P}2, \bar{P}3$				0.3			0.3	
	$\bar{P}4, \bar{P}5$				0.2			0.2	
	$\bar{P}6, \bar{P}7$				0.1			0.1	
$I_{IH}$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 2.7 \text{ V}$			80			80	$\mu\text{A}$
	$\bar{G}0, \bar{G}6$				160			160	
	$\bar{G}1, \bar{G}2, \bar{G}4$				240			240	
	$\bar{G}3, \bar{G}5$				300			300	
	$\bar{G}7$				180			180	
	$\bar{P}2, \bar{P}3$				60			60	
	$\bar{P}4, \bar{P}5$				40			40	
	$\bar{P}6, \bar{P}7$				20			20	
$I_{IL}$	$C_n, \bar{P}0, \bar{P}1$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 0.4 \text{ V}$			-2			-2	mA
	$\bar{G}0, \bar{G}6$				-4			-4	
	$\bar{G}1, \bar{G}2, \bar{G}4$				-6			-6	
	$\bar{G}3, \bar{G}5$				-7.5			-7.5	
	$\bar{G}7$				-4.5			-4.5	
	$\bar{P}2, \bar{P}3$				-1.5			-1.5	
	$\bar{P}4, \bar{P}5$				-1			-1	
	$\bar{P}6, \bar{P}7$				-0.5			-0.5	
$I_{O\ddagger}$		$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.25 \text{ V}$	-30		-130	-30		-30	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 <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX				UNIT
			SN54AS882A		SN74AS882A		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	C <sub>n</sub>	Any output	2	10	2	9	ns
t <sub>PHL</sub>			3	15	3	14	
t <sub>PLH</sub>	$\overline{\text{P}}$ or $\overline{\text{G}}$	C <sub>n</sub> + 8	2	8	2	7	
t <sub>PHL</sub>			2	8	2	7	
t <sub>PLH</sub>	$\overline{\text{P}}$ or $\overline{\text{G}}$	C <sub>n</sub> + 16	2	8	2	7	
t <sub>PHL</sub>			2	8	2	7	
t <sub>PLH</sub>	$\overline{\text{P}}$ or $\overline{\text{G}}$	C <sub>n</sub> + 24	2	8	2	7	
t <sub>PHL</sub>			2	11	2	10	
t <sub>PLH</sub>	$\overline{\text{P}}$ or $\overline{\text{G}}$	C <sub>n</sub> + 32	1.5	9	2	8	
t <sub>PHI</sub>			2	13	2	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.

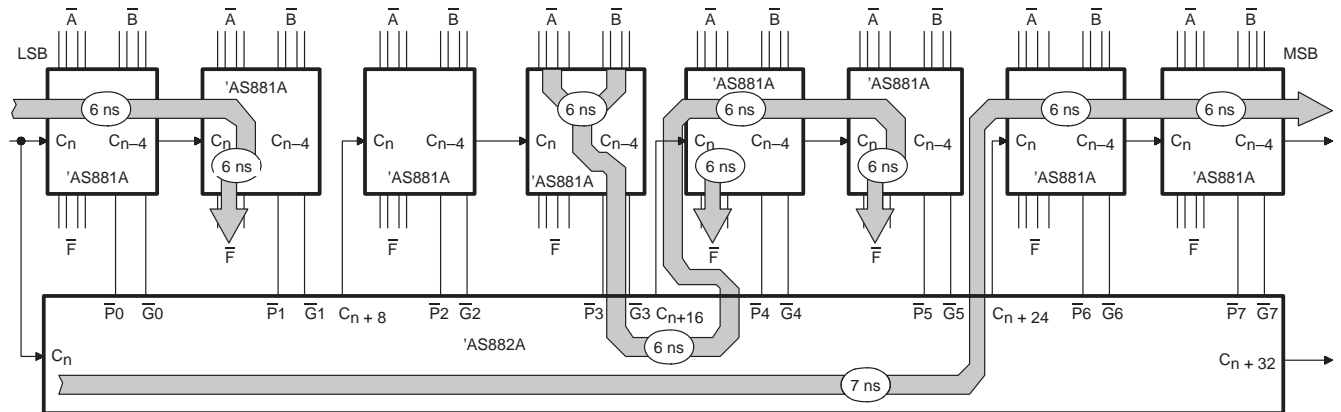


Figure 1

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.

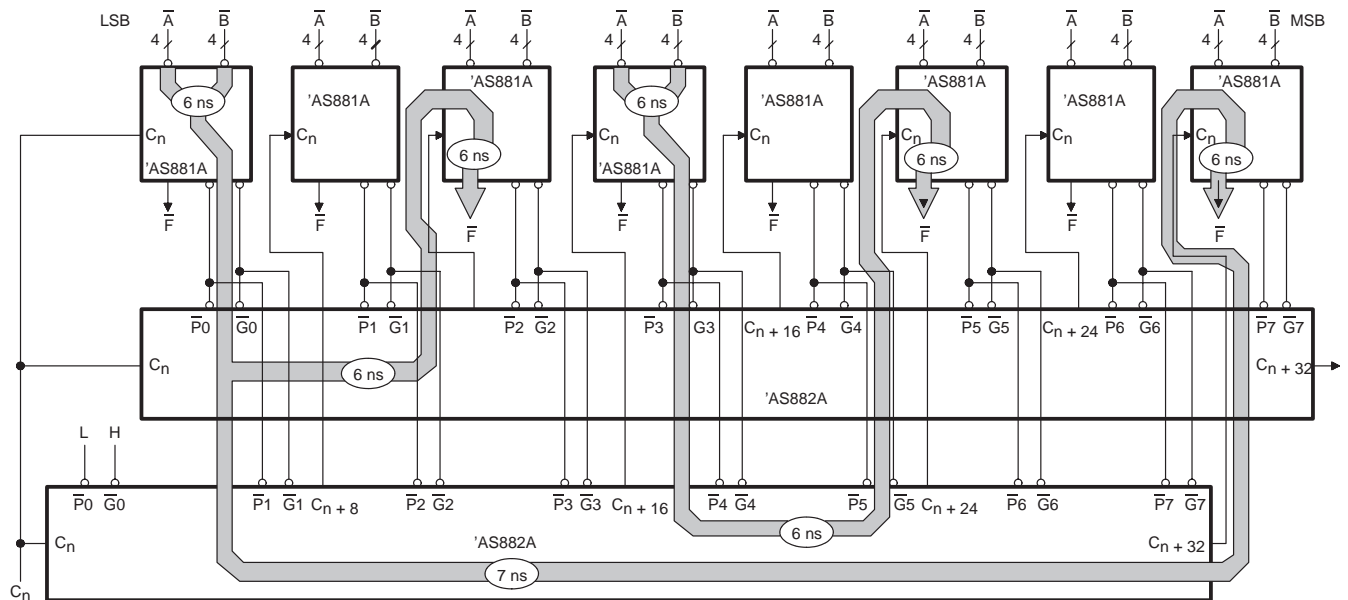


Figure 2



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