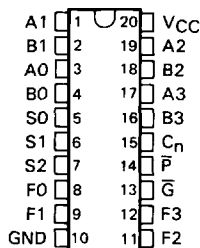


- Fully Parallel 4-Bit ALUs in 20-Pin Package
- Ideally Suited for High-Density Economical Processors
- \bar{G} and \bar{P} Outputs for Look-Ahead Carry Cascading
- Arithmetic and Logic Operations Selected Specifically to Simplify System Implementation:
 - A Minus B
 - B Minus A
 - A Plus B
 - and Five Other Functions
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

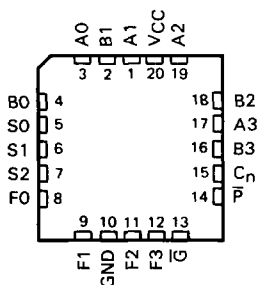
PIN DESIGNATIONS

DESIGNATION	PIN NOS.	FUNCTION
A3, A2, A1, A0	17, 19, 1, 3	WORD A INPUTS
B3, B2, B1, B0	16, 18, 2, 4	WORD B INPUTS
S2, S1, S0	7, 6, 5	FUNCTION-SELECT INPUTS
C_n	15	CARRY INPUT FOR ADDITION, INVERTED CARRY INPUT FOR SUBTRACTION
F3, F2, F1, F0	12, 11, 9, 8	FUNCTION OUTPUTS
\bar{P}	14	ACTIVE-LOW CARRY PROPAGATE OUTPUT
\bar{G}	13	ACTIVE-LOW CARRY GENERATE OUTPUT
V_{CC}	20	SUPPLY VOLTAGE
GND	10	GROUND

SN54F381 . . . J PACKAGE
SN74F381 . . . DW OR N PACKAGE
(TOP VIEW)



SN54F381 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE

SELECTION			ARITHMETIC/LOGIC OPERATION
S2	S1	S0	
L	L	L	CLEAR
L	L	H	B MINUS A
L	H	L	A MINUS B
L	H	H	A PLUS B
H	L	L	A ⊕ B
H	L	H	A + B
H	H	L	AB
H	H	H	PRESET

H = high level, L = low level

Description

The SN54F381 and SN74F381 are arithmetic logic units (ALU)/function generators that perform eight binary arithmetic/logic operations on two 4-bit words as shown in the function table. The exclusive-OR, AND, and OR functions of the two Boolean variables are provided without the use of external circuits. In addition, the outputs can be cleared (low) or preset (high) as desired. The 'F381 provides two cascade outputs (\bar{P} and \bar{G}) for expansion utilizing 'AS182 look-ahead carry generators.

The SN54F381 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74F381 is characterized for operation from 0°C to 70°C .

function table

Certain differences exist in the \bar{G} and \bar{P} function table compared with similar parts from other technologies. No differences exist in the arithmetic modes (B minus A, A minus B, and A plus B), where these outputs perform valuable cascade functions. There are slight differences in the other modes (CLEAR, A + B, $A \oplus B$, AB, and PRESET), in which these outputs are strictly "don't care." There are no functional differences between 'F381 parts built by Texas Instruments and Fairchild.

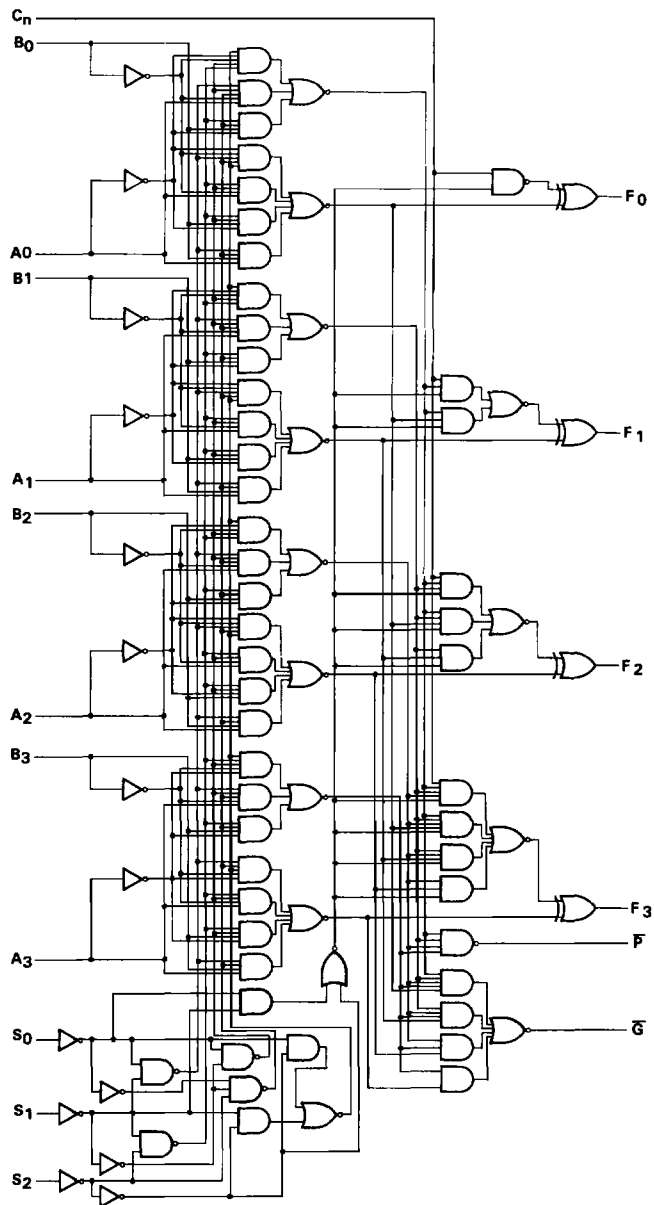
This function table is a condensed version and assumes for A_n that A0, A1, A2, and A3 inputs all agree and for B_n that B0, B1, B2, and B3 inputs all agree. This table is intended to point out the response of these \bar{G} and \bar{P} outputs in all modes of operation to facilitate incoming inspection.

FUNCTION TABLE

ARITHMETIC/LOGIC OPERATION	INPUTS						OUTPUTS				\bar{G}	\bar{P}			
	S2	S1	S0	C_n	A_n	B_n	F3	F2	F1	F0					
CLEAR	L	L	L	X	X	X	L	L	L	L	L	L	L		
B MINUS A	L	L	H	L	L	L	H	H	H	H	H	H	L		
				L	L	H	H	H	H	H	L	L	L	L	
				L	H	L	L	L	L	L	L	L	L	L	L
				L	H	H	H	H	H	H	H	H	H	H	L
				H	L	L	L	L	L	L	L	L	L	L	L
				H	L	H	H	H	H	H	H	H	H	H	L
				H	H	L	L	L	L	L	L	L	L	L	L
				H	H	H	L	L	L	L	L	L	L	L	L
A MINUS B	L	H	L	L	L	L	H	H	H	H	H	H	L		
				L	L	H	L	L	L	L	L	L	L	L	
				L	H	L	H	H	H	H	H	H	H	L	
				L	H	H	H	H	H	H	H	H	H	L	
				H	L	L	L	L	L	L	L	L	L	L	
				H	L	H	L	L	L	L	L	L	L	L	
				H	H	L	L	L	L	L	L	L	L	L	
				H	H	H	L	L	L	L	L	L	L	L	
A PLUS B	L	H	H	L	L	L	L	L	L	L	L	H	H		
				L	L	H	H	H	H	H	H	H	L		
				L	H	L	L	L	L	L	L	L	L		
				L	H	H	H	H	H	H	H	L	L		
				H	L	L	L	L	L	L	L	L	L		
				H	L	H	L	L	L	L	L	L	L		
				H	H	L	L	L	L	L	L	L	L		
				H	H	H	L	L	L	L	L	L	L		
$A \oplus B$	H	L	L	X	L	L	L	L	L	L	L	H	H		
				X	L	H	H	H	H	H	H	H	H		
				X	H	L	L	L	L	L	L	L	L		
				X	H	H	H	L	L	L	L	L	L		
A + B	H	L	H	X	L	L	L	L	L	L	L	H	H		
				X	L	H	H	H	H	H	H	H	H		
				X	H	L	L	L	L	L	L	L	L		
				X	H	H	H	H	H	H	H	H	L		
AB	H	H	L	X	L	L	L	L	L	L	L	L	L		
				X	L	H	H	L	L	L	L	L	L		
				X	H	L	L	L	L	L	L	L	L		
				X	H	H	H	H	H	H	H	H	L		
PRESET	H	H	H	X	L	L	H	H	H	H	H	H	H		
				X	L	H	H	H	H	H	H	H			
				X	H	L	H	H	H	H	H	H			
				X	H	H	H	H	H	H	H				

2
Data Sheets

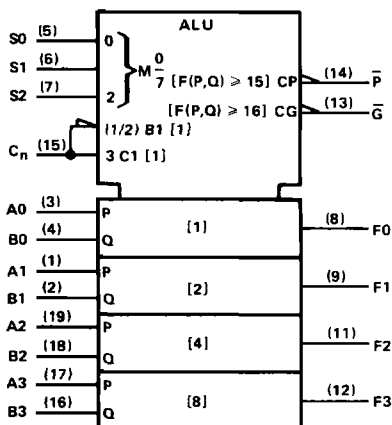
logic diagram (positive logic)



2

Data Sheets

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

Supply voltage, V _{CC}	-0.5 V to 7 V
Input voltage†	-1.2 V to 7 V
Input current	-30 mA to 5 mA
Voltage applied to any output in the high state	-0.5 V to V _{CC}
Current into any output in the low state	40 mA
Operating free-air temperature range: SN54F381	-55°C to 125°C
SN74F381	0°C to 70°C
Storage temperature range	-65°C to 150°C

†The input voltage ratings may be exceeded provided the input current ratings are observed.

recommended operating conditions

	SN54F381			SN74F381			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 _{IK} Input clamp current	-18			-18			mA
I _{OH} High-level output current	-1			-1			mA
I _{OL} Low-level output current	20			20			mA
T _A Operating free-air temperature	-55 125			0 70			°C

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

PARAMETER	TEST CONDITIONS	SN54F381			SN74F381			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}^{\dagger}	$V_{CC} = 4.5 \text{ V}$, $I_{OH} = -1 \text{ mA}$	2.5	3.4		2.5	3.4		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	$V_{CC} = 5.5 \text{ V}$, $V_I = 7 \text{ V}$			0.1			0.1	mA
I_{IH}	$V_{CC} = 5.5 \text{ V}$, $V_I = 2.7 \text{ V}$						20	μA
I_{IL}	$V_{CC} = 5.5 \text{ V}$, $V_I = 0.5 \text{ V}$	Any A or B		-2.4			-2.4	mA
		Any S		-0.6			-0.6	
		C_n		-2.4			-2.4	
I_{OS}^{\S}	$V_{CC} = 5.5 \text{ V}$, $V_O = 0$	-60		-150	-60		-150	mA
I_{CC}	$V_{CC} = 5.5 \text{ V}$, See Note 1		59	89		59	89	mA

switching characteristics (see Note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V}$, $C_L = 50 \text{ pF}$, $R_L = 500 \Omega$, $T_A = 25^\circ\text{C}$			$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$, $C_L = 50 \text{ pF}$, $R_L = 500 \Omega$, $T_A = \text{MIN to MAX}^{\dagger}$				UNIT
			F381			SN54F381		SN74F381		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	C_n	Any F	5.6							ns
t_{PHL}			4.1							
t_{PLH}	Any A or B	Any F	6.6							ns
t_{PHL}			5.6							
t_{PLH}	S0, S1, S2	Any F	8.6							ns
t_{PHL}			7.1							
t_{PLH}	Any A or B	\bar{G}	6.1							ns
t_{PHL}			5.6							
t_{PLH}	Any A or B	\bar{P}	5.1							ns
t_{PHL}			5.6							
t_{PLH}	S0, S1, S2	\bar{G} or \bar{P}	7.1							ns
t_{PHL}			8.1							

[†]For conditions shown as MIN or MAX, use the appropriate value specified under Recommended Operating Conditions.

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

[§]Not more than one output should be shorted at a time and the duration of the short circuit should not exceed one second.

[¶]For the SN74F381 at $V_{CC} = 4.75 \text{ V}$ and $I_{OH} = -1 \text{ mA}$, $V_{OH \text{ min}} = 2.7 \text{ V}$.

NOTES: 1. I_{CC} is measured with all outputs open, S0, S1 and S2 grounded, and all other inputs at 4.5V.

2. See General Information for load circuits and waveforms.