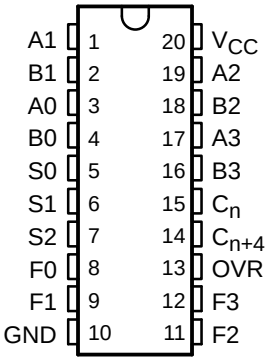
SDFS079A – D2932, MARCH 1987 – REVISED OCTOBER 1993

- **Fully Parallel 4-Bit ALU in 20-Pin Package**
- **Ideally Suited for HIgh-Density Economical Processors**
- **Ripple-Carry (C_{n+4}) and Overflow (OVR) Outputs**
- **Arithmetic and Logic Operations Selected Specifically to Simplify System Implementation:**
  - **A Minus B**
  - **B Minus A**
  - **A Plus B**
  - **Five Other Functions**
- **Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs**

DW OR N PACKAGE
(TOP VIEW)



description

The SN74F382 is an arithmetic logic unit (ALU)/function generator that performs 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 device provides a ripple-carry (C_{n+4}) output to ripple the carry to the C_n input of the next stage. It detects and indicates the two's complement overflow condition via the overflow (OVR) output. OVR is logically equivalent to $C_{n+3} \oplus C_{n+4}$. When the SN74F382 is cascaded to handle word lengths longer than four bits in length, only the most significant OVR is used.

The SN74F382 is characterized for operation from 0°C to 70°C.

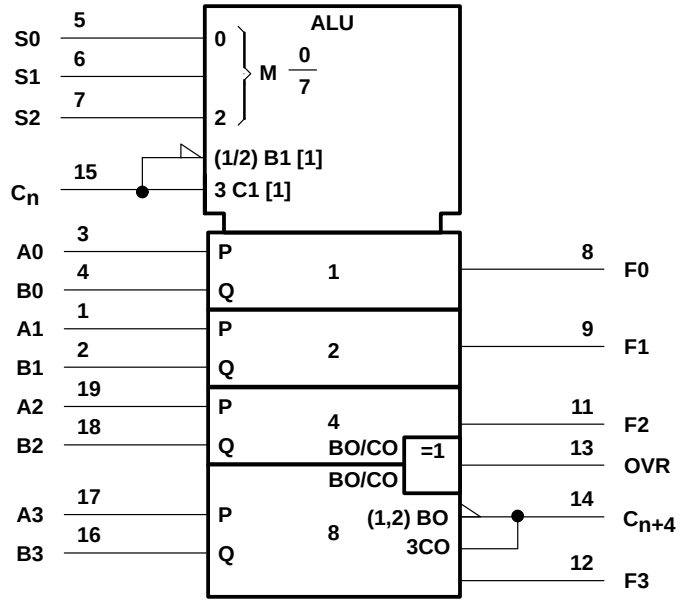
FUNCTION TABLE

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

PIN DESIGNATIONS

DESIGNATION	PIN NO.	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
C_{n+4}	14	Ripple-carry output
OVR	13	Overflow output
V_{CC}	20	Supply voltage
GND	10	Ground

logic symbol†



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

function table

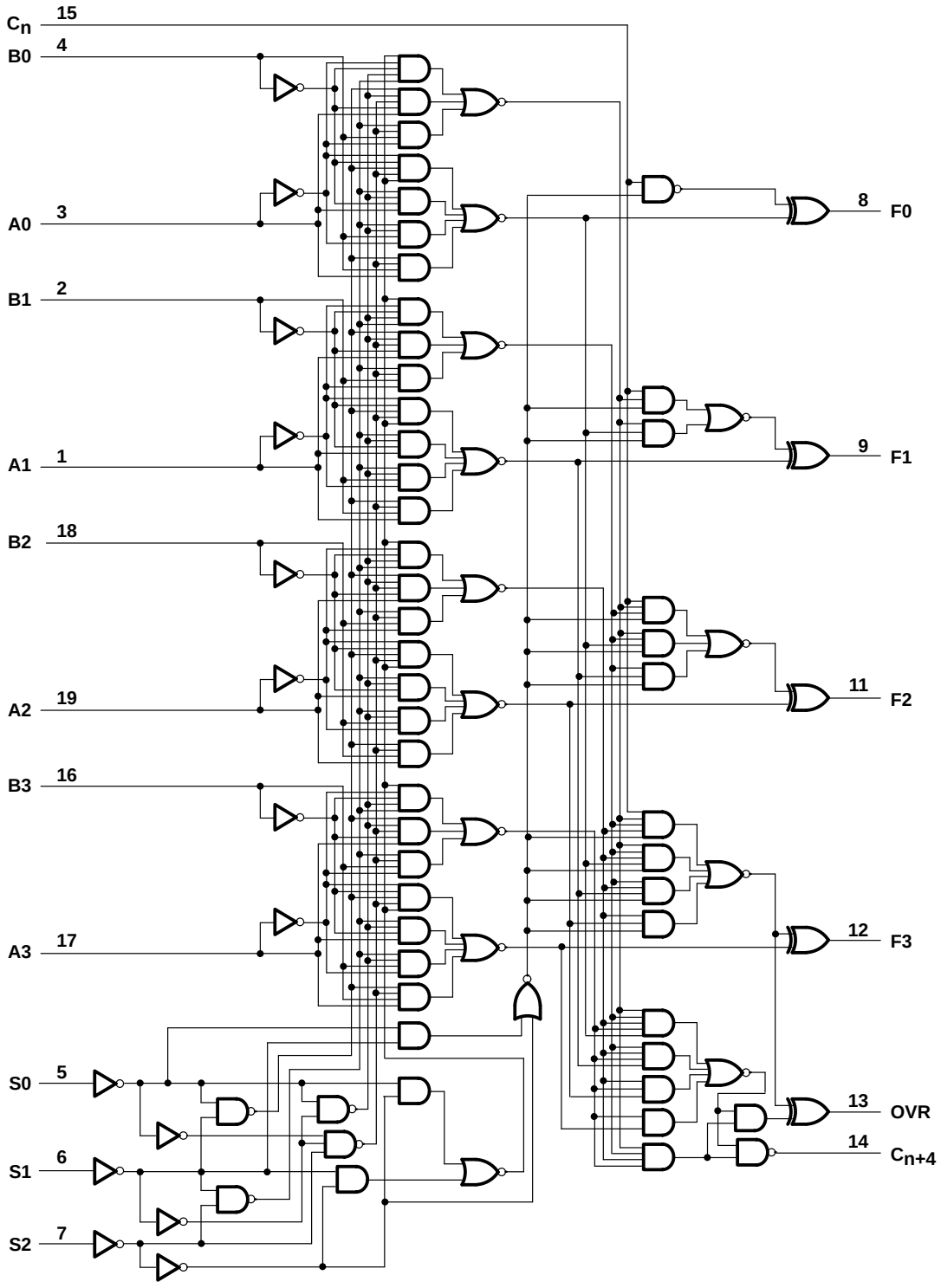
Certain differences exist in the OVR and C_{n+4} function table compared with similar parts from other technologies and other vendors. No differences exist in the arithmetic modes (B minus A, A minus B, and A plus B) where these outputs perform valuable cascade functions. There are slight differences in the other modes (clear, A + B, A ⊕ B, AB, and preset), in which these outputs strictly *don't care*.

The following 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 OVR and C_{n+4} outputs in all modes of operation to facilitate incoming inspection.

FUNCTION TABLE

ARITHMETIC/LOGIC OPERATION	INPUTS						OUTPUTS				OVR	C_{n+4}
	S2	S1	S0	C_n	A_n	B_n	F3	F2	F1	F0		
Clear	L	L	L	X	X	X	L	L	L	L	H	H
B minus A	L	L	H	L	L	L	H	H	H	H	L	L
				L	L	H	H	H	H	L	L	H
				L	H	L	L	L	L	L	L	L
				L	H	H	H	H	H	H	L	L
				H	L	L	L	L	L	L	L	H
				H	L	H	H	H	H	H	L	H
				H	H	L	L	L	L	H	L	L
				H	H	H	L	L	L	L	L	H
A minus B	L	H	L	L	L	L	H	H	H	H	L	L
				L	L	H	L	L	L	L	L	L
				L	H	L	H	H	H	L	L	H
				L	H	H	H	H	H	H	L	L
				H	L	L	L	L	L	L	L	H
				H	L	H	L	L	L	H	L	L
				H	H	L	H	H	H	H	L	H
				H	H	H	L	L	L	L	L	H
A plus B	L	H	H	L	L	L	L	L	L	L	L	L
				L	L	H	H	H	H	H	L	L
				L	H	L	H	H	H	H	L	L
				L	H	H	H	H	H	L	L	H
				H	L	L	L	L	L	H	L	L
				H	L	H	L	L	L	L	L	H
				H	H	L	L	L	L	L	L	H
				H	H	H	H	H	H	H	L	H
A ⊕ B	H	L	L	X	L	L	L	L	L	L	L	L
				X	L	H	H	H	H	H	L	L
				L	H	L	H	H	H	H	L	L
				H	H	L	H	H	H	H	H	H
				X	H	H	L	L	L	L	H	H
A + B	H	L	H	X	L	L	L	L	L	L	L	L
				X	L	H	H	H	H	H	L	L
				X	H	L	H	H	H	H	L	L
				L	H	H	H	H	H	H	L	L
				H	H	H	H	H	H	H	H	H
AB	H	H	L	X	L	L	L	L	L	L	H	H
				X	L	H	L	L	L	L	L	L
				X	H	L	L	L	L	L	H	H
				L	H	H	H	H	H	H	L	L
				H	H	H	H	H	H	H	H	H
Preset	H	H	H	X	L	L	H	H	H	H	L	L
				X	L	H	H	H	H	H	L	L
				X	H	L	H	H	H	H	L	L
				L	H	H	H	H	H	H	L	L
				H	H	H	H	H	H	H	H	H

logic diagram (positive logic)



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

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I (see Note 1) . . . . . –1.2 V to 7 V
Input current range . . . . . –30 mA to 5 mA
Voltage range 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 . . . . . 0°C to 70°C
Storage temperature range . . . . . –65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			–18	mA
I_{OH}	High-level output current			– 1	mA
I_{OL}	Low-level output current			20	mA
T_A	Operating free-air temperature	0		70	°C

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

PARAMETER		TEST CONDITIONS		MIN	TYP‡	MAX	UNIT
V_{IK}		V_{CC} = 4.5 V,	I_I = –18 mA			–1.2	V
V_{OH}		V_{CC} = 4.5 V,	I_{OH} = – 1 mA	2.5	3.4		V
		V_{CC} = 4.75 V,	I_{OH} = – 1 mA	2.7			
V_{OL}		V_{CC} = 4.5 V,	I_{OL} = 20 mA		0.3	0.5	V
I_I		V_{CC} = 5.5 V,	V_I = 7 V			0.1	mA
I_{IH}		V_{CC} = 5.5 V,	V_I = 2.7 V			20	µA
I_{IL}	Any A or B	V_{CC} = 5.5 V,	V_I = 0.5 V			– 2.4	mA
	Any S					– 0.6	
	C_n					– 3	
I_{OS}§		V_{CC} = 5.5 V,	V_O = 0	–60		–150	mA
I_{CC}		V_{CC} = 5.5 V,	See Note 2		54	81	mA

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

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

NOTE 2: I_{CC} is measured with all outputs open, S0 and C_n inputs at 4.5 V, and all other inputs grounded.

switching characteristics (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 5 V, C_L = 50 pF, R_L = 500 Ω, T_A = 25°C			V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R_L = 500 Ω, T_A = MIN to MAX†		UNIT
			MIN	TYP	MAX	MIN	MAX	
t_{PLH}	C_n	Any F	2.3	5.3	11	2.3	12	ns
t_{PHL}			2.2	4.6	7.5	2.2	8.5	
t_{PLH}	Any A or B	Any F	2.7	6.9	12	2.4	13	ns
t_{PHL}			2.5	6.1	10	2.3	11	
t_{PLH}	S0, S1, S2	Any F	4.7	8.3	15	4.3	17	ns
t_{PHL}			3.3	7.5	14	3.3	15	
t_{PLH}	Any A or B	C_{n+4}	3.3	6.6	10	3.3	11	ns
t_{PHL}			3.4	6.3	10	3	10.5	
t_{PLH}	S0, S1, S2	OVR or C_{n+4}	3.6	9.8	16.5	3	17.5	ns
t_{PHL}			5	8.6	13	4.6	14	
t_{PLH}	C_n	C_{n+4}	2.2	3.9	5.5	2	6.5	ns
t_{PHL}			3	4.8	6.5	2.6	7.5	
t_{PLH}	C_n	OVR	3.3	7	11	3	12.5	ns
t_{PHL}			3	5	6.5	3	8	
t_{PLH}	Any A or B	OVR	5.1	8.8	13	4.7	15	ns
t_{PHL}			3.3	6.9	10.5	3.3	11.5	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 3: Load circuits and waveforms are shown in Section 1.

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