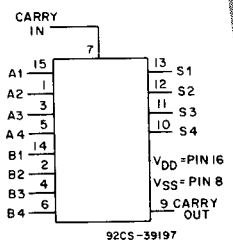
NOT RECOMMENDED FOR NEW DESIGNS

CD4560B Types

CMOS NBCD Adder

High-Voltage Types (20-Volt Rating)



FUNCTIONAL DIAGRAM

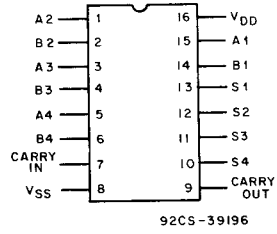
Features:

- *Four sum outputs plus carry out*
- *Standardized symmetrical output characteristics*
- *Maximum input current of 1 μA at 18-V over full package-temperature range: 100nA at 18-V and 25°C*
- *100% tested for quiescent current at 20-V*
- *5-V, 10-V, and 15-V parametric ratings*
- *Noise margin (over full package-temperature range):*
  1-V at V_{DD} = 5-V
  2-V at V_{DD} = 10-V
  2.5-V at V_{DD} = 15-V
- *Meets all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"*

■ CD4560B Types are designed for use in adding two 4-bit natural-binary-coded-decimal (NBCD) numbers. CD4560B inputs include two sets of 4-bit NBCD number inputs (A1 to A4 and B1 to B4) and a "Carry In" bit from a previous section. Outputs include the NBCD number outputs (S1 to S4) and the "Carry Out" which may be utilized at a succeeding CD4560B section.

Decoded outputs are valid when input sums do not exceed 19. When input sums exceed 19 the output sums are not valid, but are consistent and reproducible. (Refer to the output truth table.)

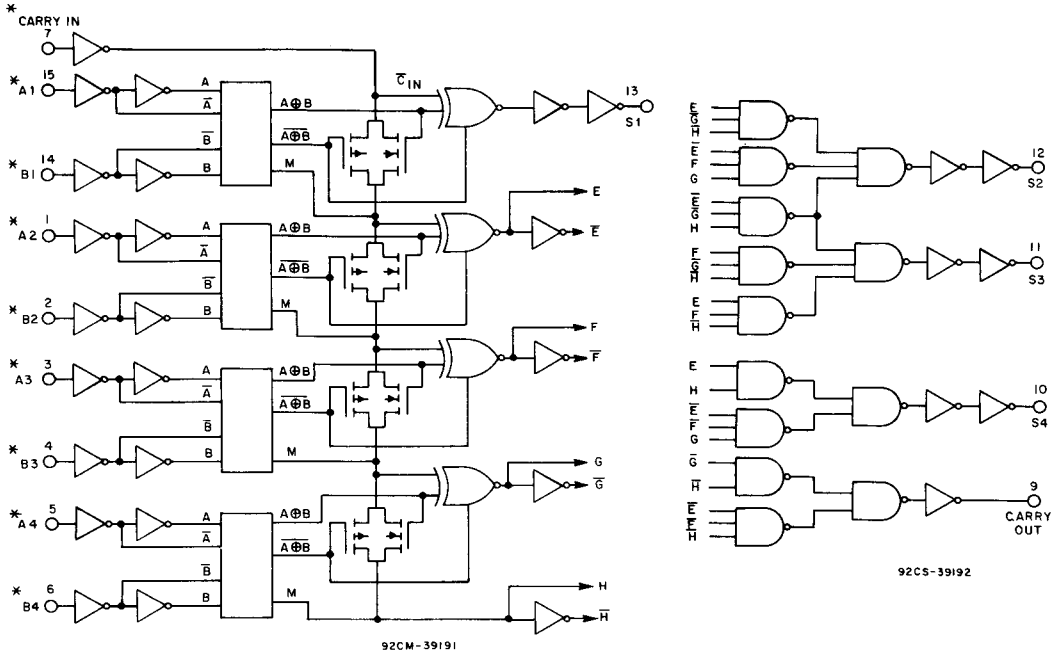
The CD4560B types are supplied in 16-lead dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

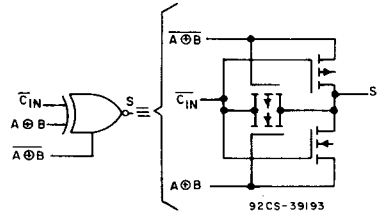


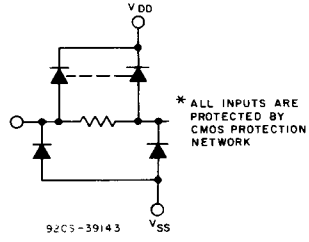
TERMINAL ASSIGNMENT

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, (V_{DD})
(Voltages referenced to V_{SS} Terminal) ..... -0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -55°C to +100°C 500mW
For T_A = +100°C to +125°C ..... Derate Linearity at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW
OPERATING-TEMPERATURE RANGE (T_A) ..... -55°C to +125°C
STORAGE TEMPERATURE RANGE (T_{stg}) ..... -65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max ..... +265°C







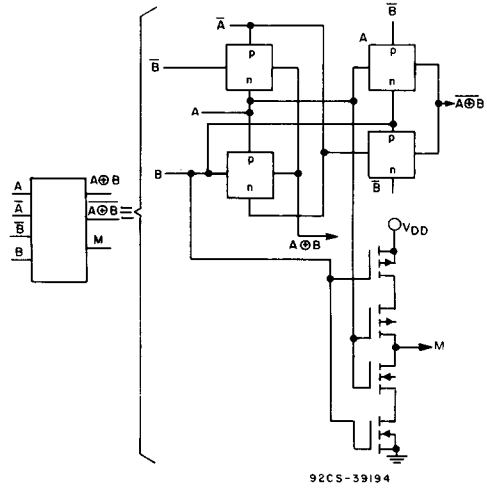


Fig. 1 — Logic diagram for CD4560B

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
								+25			
	V_O (V)	V_{IN} (V)	V_{DD} (V)	-55	-40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I_{DD} Max.	—	0, 5	5	5	5	150	150	—	0.04	5	μA
	—	0, 10	10	10	10	300	300	—	0.04	10	
	—	0, 15	15	20	20	600	600	—	0.04	20	
	—	0, 20	20	100	100	3000	3000	—	0.08	100	
Output Low (Sink) Current, I_{OL} Min.	0.4	0, 5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA
	0.5	0, 10	10	1.6	1.5	1.1	0.9	1.3	2.6	—	
	1.5	0, 15	15	4.2	4	2.8	2.4	3.4	6.8	—	
Output High (Source) Current, I_{OH} Min.	4.6	0, 5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	
	2.5	0, 5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—	
	9.5	0, 10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—	
	13.5	0, 15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—	
Output Voltage: Low-Level, V_{OL} Max.	—	0, 5	5	0.05				—	0	0.05	V
	—	0, 10	10	0.05				—	0	0.05	
	—	0, 15	15	0.05				—	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	—	0, 5	5	4.95				4.95	5	—	
	—	0, 10	10	9.95				9.95	10	—	
	—	0, 15	15	14.95				14.95	15	—	
Input Low Voltage, V_{IL} Max.	0.5, 4.5	—	5	1.5				—	—	1.5	V
	1, 9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V_{IH} Min.	0.5, 4.5	—	5	3.5				3.5	—	—	
	1, 9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current I_{IN} Max.	—	0, 18	18	±0.1	±0.1	±1	±1	—	±10⁻⁵	±0.1	μA

RECOMMENDED OPERATING CONDITIONS at T_A = 25°C, except as noted
For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	Min.	Max.	
Supply-Voltage Range (For T_A = Full Package-Temperature Range)	3	18	V

PARTIAL TRUTH TABLE

INPUT									OUTPUT				
A4	A3	A2	A1	B4	B3	B2	B1	CARRY IN	CARRY OUT	S4	S3	S2	S1
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	1
0	1	0	0	0	0	1	1	0	0	0	1	1	1
0	1	0	0	0	0	1	1	1	0	1	0	0	0
0	1	1	1	0	1	0	0	0	1	0	0	0	1
0	1	1	1	0	1	0	0	1	1	0	0	1	0
1	0	0	0	0	1	0	1	0	1	0	0	1	1
0	1	1	0	1	0	0	0	0	1	0	1	0	0
1	0	0	1	1	0	0	1	1	1	1	0	0	1

OUTPUT TRUTH TABLE

Sum of Inputs	Carry Out	S4	S3	S2	S1	Decoded Output
0	0	0	0	0	0	0
1	0	0	0	0	1	1
2	0	0	0	1	0	2
3	0	0	0	1	1	3
4	0	0	1	0	0	4
5	0	0	1	0	1	5
6	0	0	1	1	0	6
7	0	0	1	1	1	7
8	0	1	0	0	0	8
9	0	1	0	0	1	9
10	1	0	0	0	0	10
11	1	0	0	0	1	11
12	1	0	0	1	0	12
13	1	0	0	1	1	13
14	1	0	1	0	0	14
15	1	0	1	0	1	15
16	1	0	1	1	0	16
17	1	0	1	1	1	17
18	1	1	0	0	0	18
19	1	1	0	0	1	19
20	1	0	1	1	0	16*
21	1	0	1	1	1	17*
22	1	1	0	0	0	18*
23	1	1	0	0	1	19*
24	1	1	0	0	0	18*
25	1	1	0	0	1	19*
26	1	1	0	0	0	18*
27	1	1	0	0	1	19*
28	1	0	0	1	0	12*
29	1	0	0	1	1	13*
30	1	1	0	0	0	18*
31	1	1	0	0	1	19*

*Invalid output valve

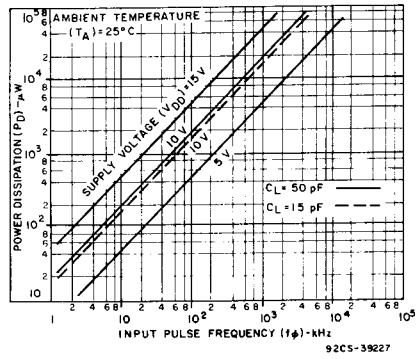


Fig. 2 — Typical dissipation characteristics.

DYNAMIC ELECTRICAL CHARACTERISTICS AT T_A = 25°C, Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 kΩ

CHARACTERISTIC	TEST CONDITIONS	LIMITS			UNITS
	V_{DD} (V)	Min.	Typ.	Max.	
Propagation Delay Time (t_{PHL}, t_{PLH}): A or B to S	5	—	500	1000	ns
	10	—	200	400	
	15	—	150	300	
A or B to Carry Out	5	—	450	900	ns
	10	—	175	350	
	15	—	125	250	
Carry In to Carry Out	5	—	375	750	ns
	10	—	150	300	
	15	—	100	200	
Turn-Off Delay Time (t_{PLH}): Carry In to S	5	—	350	700	ns
	10	—	150	300	
	15	—	100	200	
Turn-On Delay Time (t_{PHL}): Carry In to S	5	—	350	700	ns
	10	—	150	300	
	15	—	100	200	
Transition Time (t_{THL}, t_{TLH}):	5	—	100	200	ns
	10	—	50	100	
	15	—	40	80	
Input Capacitance (C_{IN}):	Any Input	—	5	7.5	pF

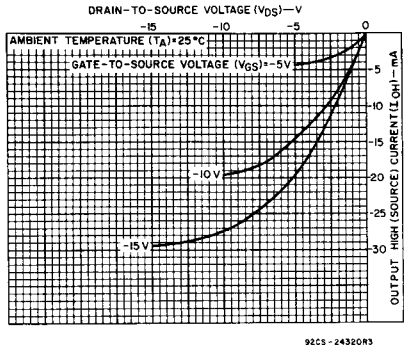


Fig. 3 — Typical output high (source) current characteristics.

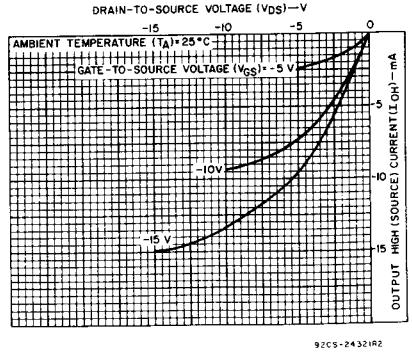


Fig. 4 — Minimum output high (source) current characteristics.

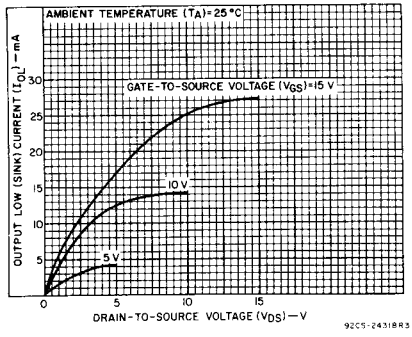


Fig. 5 — Typical output low (sink) current characteristics.

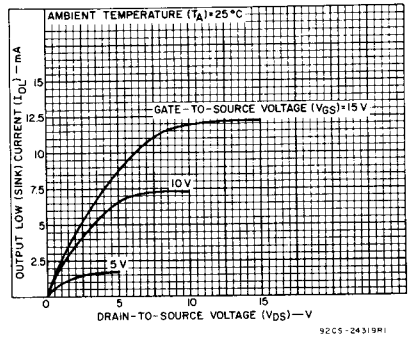


Fig. 6 — Minimum output low (sink) current characteristics.

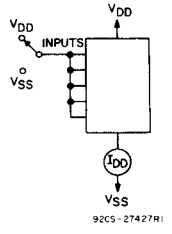


Fig. 7 — Quiescent-device-current test circuit.

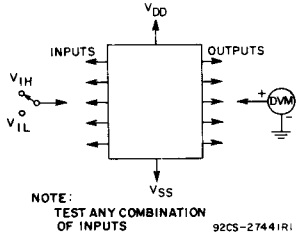


Fig. 8 — Input-voltage test circuit.

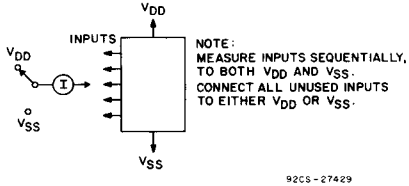
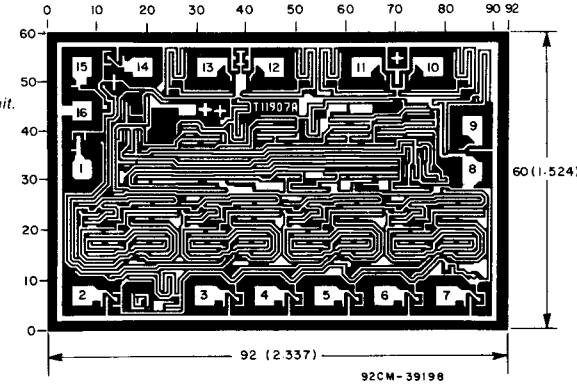


Fig. 9 — Input current test circuit.



Dimensions and pad layout for CD4560BH

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).