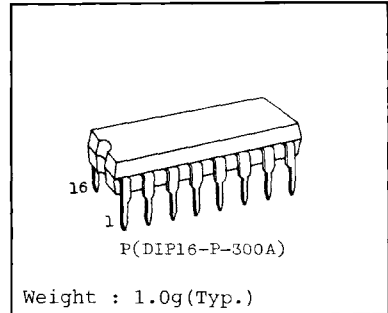


TC4560BP NBCD ADDER

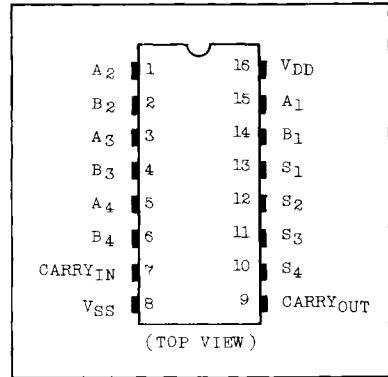
TC4560BP is NBCD (natural BCD) adder which adds two binary coded decimal numbers (BCD code). The sum of BCD inputs applied to four data input lines (A₁ through A₄) and another set of four data input lines (B₁ through B₄) and carry input C_{IN} from the lower order digit is output to S₁ through S₄ in the same BCD code. When the sum is 10 or larger, "H" level is output to carry output C_{OUT}. When the sum is smaller than 10, C_{OUT} is kept at "L" level. By connecting with TC4561BP (9's complementer), the add/subtract circuit can be easily obtained.



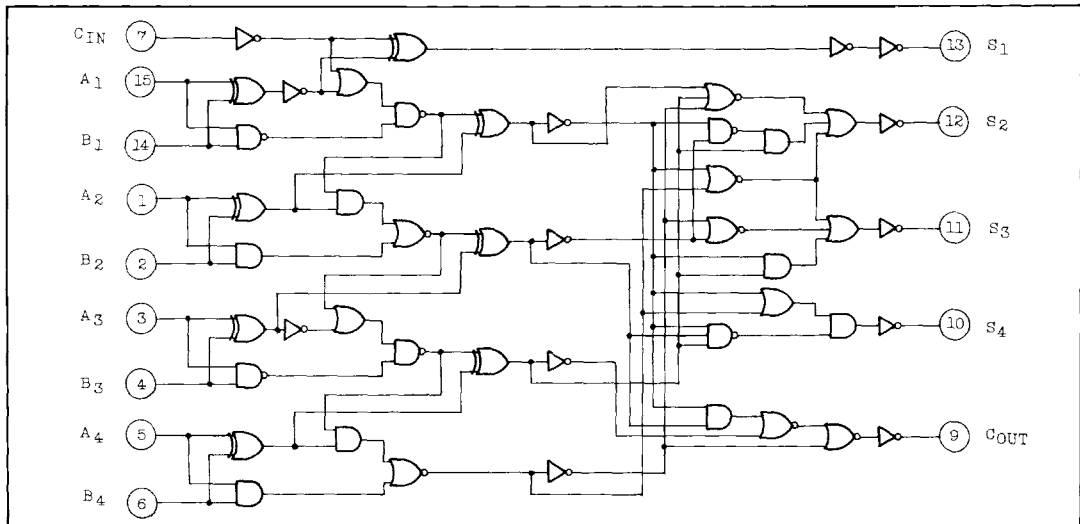
ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V _{DD}	V _{SS} -0.5 ~ V _{SS} +20	V
Input Voltage	V _{IN}	V _{SS} -0.5 ~ V _{DD} +0.5	V
Output Voltage	V _{OUT}	V _{SS} -0.5 ~ V _{DD} +0.5	V
DC Input Current	I _{IN}	±10	mA
Power Dissipation	P _D	300	mW
Operating Temperature Range	T _A	-40 ~ 85	°C
Storage Temperature Range	T _{stg}	-65 ~ 150	°C
Lead Temp./Time	T _{sol}	260°C · 10sec	

PIN ASSIGNMENT



LOGIC DIAGRAM



TC4560BP

TRUTH TABLE

INPUTS									OUTPUTS				
A ₄	A ₃	A ₂	A ₁	B ₄	B ₃	B ₂	B ₁	C _{IN}	S ₄	S ₃	S ₂	S ₁	C _{OUT}
L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	H	L	L	L	H	L
L	H	L	H	L	L	H	L	L	L	H	H	H	L
L	H	L	L	L	L	H	H	H	H	L	L	L	L
L	H	H	L	L	H	L	H	L	L	L	L	H	H
L	L	H	H	H	L	L	L	H	L	L	H	L	H
H	L	L	H	L	H	L	L	L	L	L	H	H	H
L	H	L	H	H	L	L	L	H	L	H	L	L	H
H	L	L	H	H	L	L	H	H	H	L	L	H	H

RECOMMENDED OPERATING CONDITIONS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V _{DD}	3	-	18	V
Input Voltage	V _{IN}	0	-	V _{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Output Voltage	V _{OH}	I _{OUT} < 1μA V _{IN} =V _{SS} , V _{DD}	5	4.95	-	4.95	5.00	-	4.95	-	V
			10	9.95	-	9.95	10.00	-	9.95	-	
			15	14.95	-	14.95	15.00	-	14.95	-	
Low-Level Output Voltage	V _{OL}	I _{OUT} < 1μA V _{IN} =V _{SS} , V _{DD}	5	-	0.05	-	0.00	0.05	-	0.05	V
			10	-	0.05	-	0.00	0.05	-	0.05	
			15	-	0.05	-	0.00	0.05	-	0.05	
Output High Current	I _{OH}	V _{OH} =4.6V V _{OH} =2.5V V _{OH} =9.5V V _{OH} =13.5V V _{IN} =V _{SS} , V _{DD}	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA
			5	-2.5	-	-2.1	-4.0	-	-1.7	-	
			10	-1.5	-	-1.3	-2.2	-	-1.1	-	
			15	-4.0	-	-3.4	-9.0	-	-2.8	-	
			5	0.61	-	0.51	1.5	-	0.42	-	
Output Low Current	I _{OL}	V _{OL} =0.4V V _{OL} =0.5V V _{OL} =1.5V V _{IN} =V _{SS} , V _{DD}	5	0.61	-	0.51	1.5	-	0.42	-	mA
			10	1.5	-	1.3	3.8	-	1.1	-	
			15	4.0	-	3.4	15.0	-	2.8	-	
			5	0.61	-	0.51	1.5	-	0.42	-	

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT	
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
Input High Voltage	V _{IH}	V _{OUT} =0.5V, 4.5V	5	3.5	-	3.5	2.75	-	3.5	-	V	
		V _{OUT} =1.0V, 9.0V	10	7.0	-	7.0	5.5	-	7.0	-		
		V _{OUT} =1.5V, 13.5V	15	11.0	-	11.0	8.25	-	11.0	-		
		I _{OUT} < 1μA										
Input Low Voltage	V _{IL}	V _{OUT} =0.5V, 4.5V	5	-	1.5	-	2.25	1.5	-	1.5	V	
		V _{OUT} =1.0V, 9.0V	10	-	3.0	-	4.5	3.0	-	3.0		
		V _{OUT} =1.5V, 13.5V	15	-	4.0	-	6.75	4.0	-	4.0		
		I _{OUT} < 1μA										
Input Current	"H" Level	I _{IH}	V _{IH} =18V	18	-	0.1	-	10 ⁻⁵	0.1	-	1.0	μA
	"L" Level	I _{IL}	V _{IL} =0V	18	-	-0.1	-	-10 ⁻⁵	-0.1	-	-1.0	
Quiescent Device Current	I _{DD}	V _{IN} =V _{SS} , V _{DD} *	5	-	5	-	0.005	5	-	150	μA	
			10	-	10	-	0.010	10	-	300		
			15	-	20	-	0.015	20	-	600		

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (T_a=25°C, V_{SS}=0V, C_L=50pF)

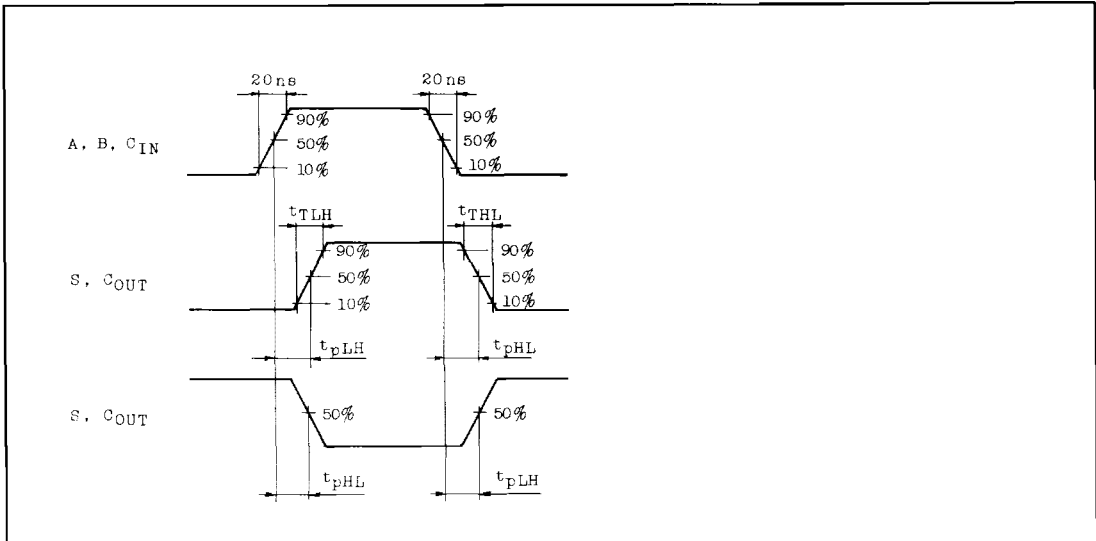
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t _{TLH}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Output Transition Time (High to Low)	t _{THL}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Propagation Delay Time (A, B - S)	t _{pLH} t _{pHL}		5	-	660	2100	ns
			10	-	250	900	
			15	-	170	675	
Propagation Delay Time (A, B - COUT)	t _{pLH} t _{pHL}		5	-	500	1800	ns
			10	-	190	600	
			15	-	130	450	

TC4560BP

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, VGS=0V, CL=50pF)

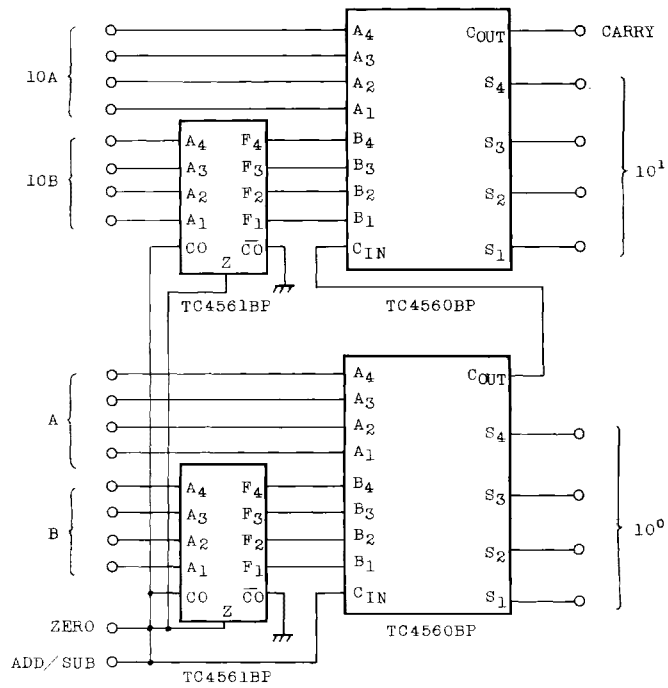
CHARACTERISTIC	SYMBOL	TEST CONDITION	VDD(V)	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (C _{IN} - C _{OUT})	t _{pLH}		5	-	430	1500	ns
	t _{pHL}		10	-	160	600	
			15	-	110	450	
Propagation Delay Time (C _{IN} - S)	t _{pLH}		5	-	550	1800	
	t _{pHL}		10	-	230	600	
			15	-	160	450	
Input Capacitance	C _{IN}			-	5	7.5	pF

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



APPLICATION CIRCUIT

• PARALLEL ADD/SUBTRACT CIRCUIT



FUNCTION TABLE

ZERO	ADD/SUB	RESULT
L	L	A + B
L	H	A - B
H	*	A