

TC4011BP/TC4011BF QUAD 2 INPUT NAND GATE  
TC4012BP/TC4012BF DUAL 4 INPUT NAND GATE  
TC4023BP/TC4023BF TRIPLE 3 INPUT NAND GATE

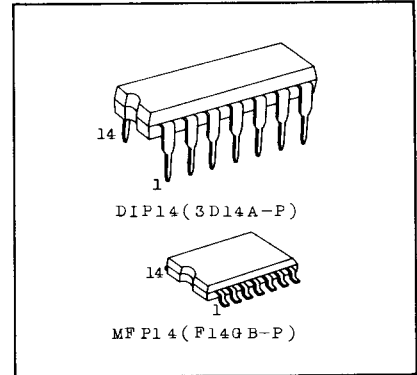
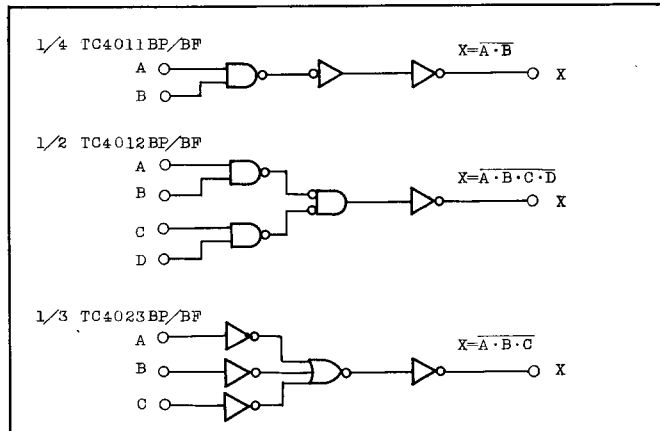
The TC4011BP/BF, TC4023BP/BF, and TC4012BP/BF are 2-input, 3-input, and 4-input positive logic NAND gates respectively.

Since all the outputs of these gates are provided with the inverters as buffers, the input/output characteristics have been improved and the variation of propagation delay time due to the increase in load capacity is kept down to the minimum.

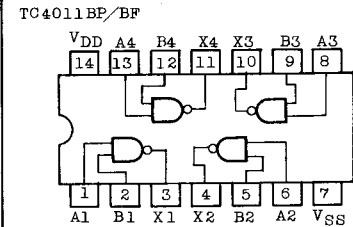
ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V <sub>DD</sub>	V <sub>SS</sub> -0.5 ~ V <sub>SS</sub> +20	V
Input Voltage	V <sub>IN</sub>	V <sub>SS</sub> -0.5 ~ V <sub>DD</sub> +0.5	V
Output Voltage	V <sub>OUT</sub>	V <sub>SS</sub> -0.5 ~ V <sub>DD</sub> +0.5	V
DC Input Current	I <sub>IN</sub>	±10	mA
Power Dissipation	P <sub>D</sub>	300(DIP)/180(MFP)	mW
Operating Temperature Range	T <sub>A</sub>	-40 ~ 85	°C
Storage Temperature Range	T <sub>stg</sub>	-65 ~ 150	°C
Lead Temp./Time	T <sub>sol</sub>	260°C • 10 sec	

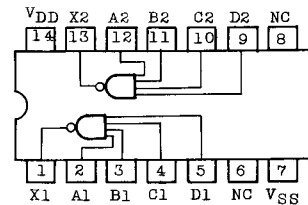
LOGIC DIAGRAM



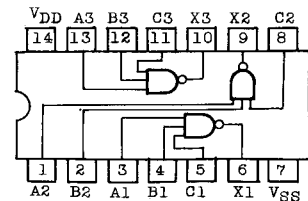
PIN ASSIGNMENT (TOP VIEW)



TC4012BP/BF



TC4023BP/BF



# TC4011BP/BF, TC4012BP/BF, TC4023BP/BF

## RECOMMENDED OPERATING CONDITIONS (V<sub>SS</sub>=0V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS
DC Supply Voltage	V <sub>DD</sub>	3	-	18	V
Input Voltage	V <sub>IN</sub>	0	-	V <sub>DD</sub>	V

## STATIC ELECTRICAL CHARACTERISTICS (V<sub>SS</sub>=0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	-40°C		25°C			85°C		UNITS	
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
High-Level Output Voltage	V <sub>OH</sub>	I <sub>OUT</sub>   < 1μA V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>	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 <sub>OL</sub>	I <sub>OUT</sub>   < 1μA V <sub>IN</sub> =V <sub>DD</sub>	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 <sub>OH</sub>	V <sub>OH</sub> =4.6V V <sub>OH</sub> =2.5V V <sub>OH</sub> =9.5V V <sub>OH</sub> =13.5V V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>	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	1.2	-	0.42	-		
Output Low Current	I <sub>OL</sub>	V <sub>OL</sub> =0.4V V <sub>OL</sub> =0.5V V <sub>OL</sub> =1.5V V <sub>IN</sub> =V <sub>DD</sub>	5	0.61	-	0.51	1.2	-	0.42	-	mA	
			10	1.5	-	1.3	3.2	-	1.1	-		
			15	4.0	-	3.4	12.0	-	2.8	-		
			5	3.5	-	3.5	2.75	-	3.5	-		
Input High Voltage	V <sub>IH</sub>	V <sub>OUT</sub> =0.5V, 4.5V V <sub>OUT</sub> =1.0V, 9.0V V <sub>OUT</sub> =1.5V, 13.5V  I <sub>OUT</sub>   < 1μA	5	3.5	-	3.5	2.75	-	3.5	-	V	
			10	7.0	-	7.0	5.5	-	7.0	-		
			15	11.0	-	11.0	8.25	-	11.0	-		
Input Low Voltage	V <sub>IL</sub>	V <sub>OUT</sub> =4.5V V <sub>OUT</sub> =9.0V V <sub>OUT</sub> =13.5V  I <sub>OUT</sub>   < 1μA	5	-	1.5	-	2.25	1.5	-	1.5	V	
			10	-	3.0	-	4.5	3.0	-	3.0		
			15	-	4.0	-	6.75	4.0	-	4.0		
			5	-	0.1	-	10 <sup>-5</sup>	0.1	-	1.0		
Input Current	"H" Level	I <sub>IH</sub>	V <sub>IH</sub> =18V	18	-	0.1	-	10 <sup>-5</sup>	0.1	-	1.0	μA
	"L" Level	I <sub>IL</sub>	V <sub>IL</sub> =0V	18	-	-0.1	-	-10 <sup>-5</sup>	-0.1	-	-1.0	
Quiescent Device Current	I <sub>DD</sub>	V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> *	5	-	0.25	-	0.001	0.25	-	7.5	μA	
			10	-	0.5	-	0.001	0.5	-	15		
			15	-	1.0	-	0.002	1.0	-	30		

\* All valid input combinations.

# TC4011BP/BF, TC4012BP/BF, TC4023BP/BF

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNITS
Output Transition Time (TC4012BP/BF)	t <sub>TLH</sub>		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Output Transition Time (TC4012BP/BF)	t <sub>THL</sub>		5	-	80	200	
			10	-	50	100	
			15	-	40	80	
Output Transition Time (TC4011BP/BF) (TC4023BP/BF)	t <sub>TLH</sub>		5	-	70	200	
			10	-	35	100	
			15	-	30	80	
Output Transition Time (TC4011BP/BF) (TC4023BP/BF)	t <sub>THL</sub>		5	-	70	200	
			10	-	35	100	
			15	-	30	80	
Propagation Delay Time (TC4011BP/BF)	t <sub>pLH</sub>		5	-	65	200	
			10	-	30	100	
			15	-	25	80	
Propagation Delay Time (TC4011BP/BF)	t <sub>pHL</sub>		5	-	65	200	
			10	-	30	100	
			15	-	25	80	
Propagation Delay Time (TC4012BP/BF)	t <sub>pLH</sub>		5	-	95	250	
			10	-	45	120	
			15	-	30	90	
Propagation Delay Time (TC4012BP/BF)	t <sub>pHL</sub>		5	-	95	250	
			10	-	45	120	
			15	-	30	90	
Propagation Delay Time (TC4023BP/BF)	t <sub>pLH</sub>		5	-	90	250	
			10	-	45	100	
			15	-	35	80	
Propagation Delay Time (TC4023BP/BF)	t <sub>pHL</sub>		5	-	90	250	
			10	-	45	100	
			15	-	35	80	
Input Capacitance	C <sub>IN</sub>			-	5	7.5	pF

## CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

