MN74HC4024/MN74HC4024S

7-Stage Binary Counter

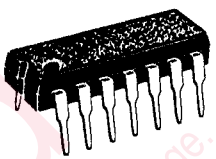
■ Outline

The MN74HC4024/MN74HC4024S is a 7-stage high speed ripple carry counter. This counter advances at the falling edge of the clock input. When the level is "H", the clear input clears the counter irrespectively of the clock input, and the levels of all the outputs (Q1~Q7) become "L".

Owing to the silicon gate CMOS process, this counter has realized low power consumption and high noise immunity equivalent to those of a standard CMOS and the operation speed as high as of an LS TTL, and can directly drive ten LS TTL inputs.

To protect the input and output against electrostatic breakdown, a resistor and a diode are used for the V_{CC} and the GND. The pin configuration and the function are the same as those of the standard CMOS logic 4000 family.

P-1



14-pin plastic DIL package

P-2

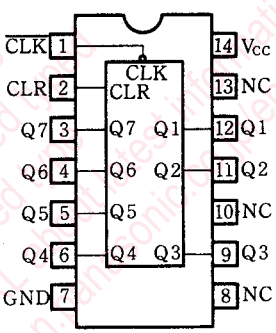
14-pin PANAFLAT package (SO-14D)

■ Truth Table

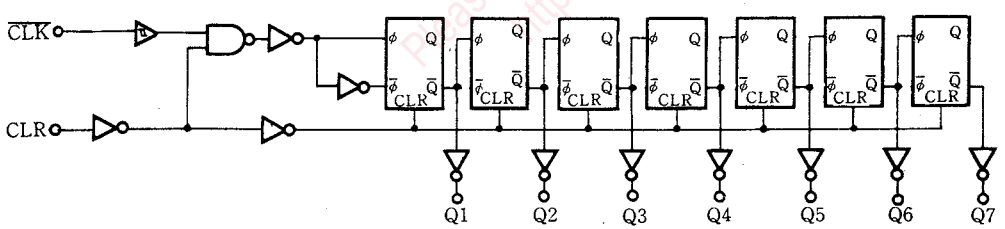
$\overline{CLK}$	CLR	Mode
×	H	All Outputs are low
↓	L	No Change
↘	L	Counter Advances

Note) 1. × : "H" or "L" either will do
2. ↘ : Leading of clock from "L" to "H".
3. ↓ : Leading of clock from "H" to "L"

Pin Configuration



■ Logic Diagram



■ Absolute Maximum Ratings

Item			Symbol	Rating	Unit
Supply voltage			V_{CC}	−0.5~+7.0	V
Input output voltage			V_I, V_O	−0.5~V_{CC}+0.5	V
Input protective diode current			I_{IK}	±20	mA
Output parasitic diode current			I_{OK}	±20	mA
Output current			I_O	±25	mA
Supply current			I_{CC}, I_{GND}	±50	mA
Storage temperature			T_{stg}	−65~+150	°C
Power dissipation	MN74HC4024	Ta=−40~+60°C	P_D	400	mW
		Ta=+60~+85°C		Decrease to 200mW at the rate of 8mW/°C	
	MN74HC4024S	Ta=−40~+60°C	P_D	275	mW
		Ta=+60~+85°C		Decrease to 200mW at the rate of 3.8mW/°C	

■ Recommended Operating Conditions

Item	Symbol	V_{CC}(V)	Rating	Unit
Operating power supply voltage	V_{CC}		1.4~6.0	V
Input output voltage	V_I, V_O		0~V_{CC}	V
Operating temperature	T_A		−40~+85	°C
Input rise, fall time	t_r, t_f	2.0	0~1000	ns
		4.5	0~500	ns
		6.0	0~400	ns

■ DC Characteristics (GND=0V)

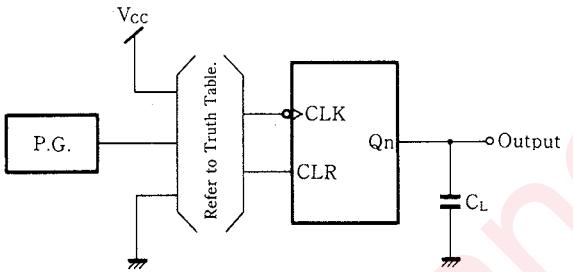
Item	Symbol	V_{CC} (V)	Test Condition			Temperature					Unit
			V_I	V_O	Unit	Ta=25°C			Ta=−40~+85°C		
						min.	typ.	max.	min.	max.	
Input voltage high level	V_{IH}	2.0				1.5			1.5		V
		4.5				3.15			3.15		
		6.0				4.2			4.2		
Input voltage low level	V_{IL}	2.0						0.3		0.3	V
		4.5						0.9		0.9	
		6.0						1.2		1.2	
Output voltage high level	V_{OH}	2.0	V_{IH} or V_{IL}	−20.0	μA	1.9	2.0		1.9		V
		4.5		−20.0	μA	4.4	4.5		4.4		
		6.0		−20.0	μA	5.9	6.0		5.9		
		4.5		−4.0	mA	3.92			3.84		
		6.0		−5.2	mA	5.48			5.34		
Output voltage low level	V_{OL}	2.0	V_{IH} or V_{IL}	20.0	μA		0.0	0.1		0.1	V
		4.5		20.0	μA		0.0	0.1		0.1	
		6.0		20.0	μA		0.0	0.1		0.1	
		4.5		4.0	mA			0.26		0.33	
		6.0		5.2	mA			0.26		0.33	
Input leakage current	I_I	6.0	V_I=V_{CC} or GND					±0.1		±1.0	μA
Static supply current	I_{CC}	6.0	V_I=V_{CC} or GND, I_O=0					8.0		80.0	μA

■ AC Characteristics (GND=0V, Input transition time≦6ns, C_L=50pF)

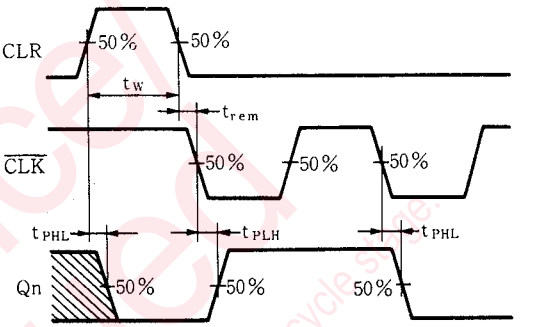
Item	Symbol	V_{CC} (V)	Test Condition	Temperature					Unit
				Ta=25°C			Ta=−40~+85°C		
				min.	typ.	max.	min.	max.	
Output rise time	t_{TLH}	2.0			26	75		95	ns
		4.5			8	15		19	
		6.0			7	13		16	
Output fall time	t_{THL}	2.0			22	75		95	ns
		4.5			6	15		19	
		6.0			5	13		16	
Propagation time $\overline{CLK}$→Q1 (L→H)	t_{PLH}	2.0			42	150		190	ns
		4.5			16	30		38	
		6.0			13	26		33	
Propagation time $\overline{CLK}$→Q1 (H→L)	t_{PHL}	2.0			41	150		190	ns
		4.5			15	30		38	
		6.0			12	26		33	
Propagation time $Qn \rightarrow Q_{n+1}$ (L→H)	t_{PLH}	2.0			14	75		95	ns
		4.5			5	15		19	
		6.0			4	13		16	
Propagation time $Qn \rightarrow Q_{n+1}$ (H→L)	t_{PHL}	2.0			20	75		95	ns
		4.5			7	15		19	
		6.0			6	13		16	
Propagation time CLR→Qn (H→L)	t_{PHL}	2.0			40	150		190	ns
		4.5			17	30		38	
		6.0			12	26		33	
Minimum pulse width CLR	t_w	2.0			15	125		155	ns
		4.5			7	25		31	
		6.0			6	21		26	
Minimum recovery time	t_{rem}	2.0			7	75		95	ns
		4.5			4	15		19	
		6.0			3	13		16	
Maximum clock frequency	f_{max}	2.0		6	30		4		MHz
		4.5		30	70		24		
		6.0		35	80		28		

• Switching time measuring circuit and waveforms

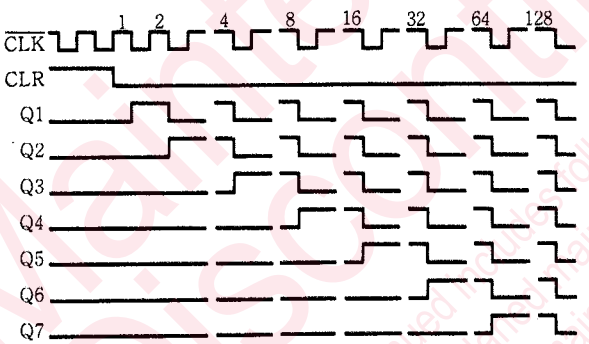
1. Measuring circuit



2. Switching waveforms



■ Typical Operating Condition



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