MN74HC107/MN74HC107S

Dual J-K Flip-Flops with Clear

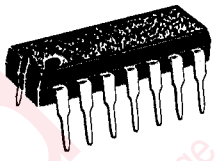
■ Outline

The MN74HC107/MN74HC107S consists of J-K flip-flops with clear inputs, and has two built-in circuits in one chip. The respective flip-flop has independent J input, K input, clock input, clear input, and complementary outputs Q and $\overline{Q}$. Each input data is transmitted to the output at the falling edge of the clock pulse. The clear input is independent of the clock input, and its active level is "L".

Owing to the silicon gate CMOS process, these flip-flop have 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. The MN74HC107/MN74HC107S can directly drive ten LS TTL inputs.

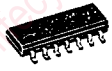
To protect the input and output against electrostaic breakdown, a resistor and a diode are used for the V_{CC} and the GND. The pin configuration and the function are the same as those of the standard 54LS/74LS logic family.

P-1



14-pin plastic DIL package

P-2



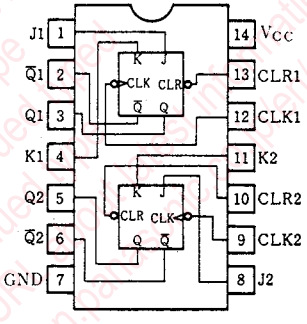
14-pin PANAFLAT package (SO-14D)

■ Truth Table

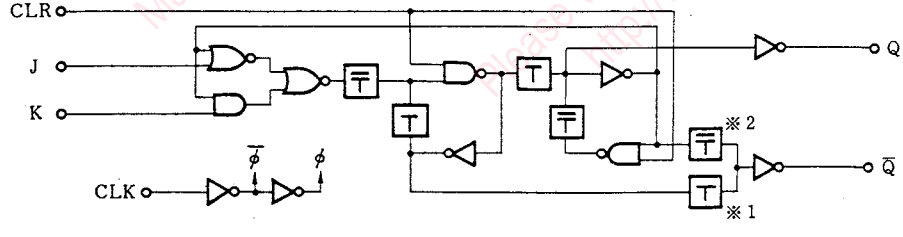
Input				Output	
CLR	CLK	J	K	Q	$\overline{Q}$
L	×	×	×	L	H
H	↘	L	L	Qo	$\overline{Q}$o
H	↘	H	L	H	L
H	↘	L	H	L	H
H	↘	H	H	Toggle	
H	H	×	×	Qo	$\overline{Q}$o

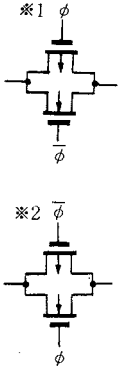
Note) 1. ↘ : Data input is transferred to output in leading of clock from "L" to "H".
2. × : "H" or "L" either will do
3. Qo ($\overline{Q}$o) : Level of Q ($\overline{Q}$) before input conditions in table are not confirmed.
5. Toggle : Each output becomes complement of previous sate by change of ↘.

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	MN74HC107	Ta=−40~+60°C	P_D	400	mW
		Ta=+60~+85°C		Decrease to 200mW at the rate of 8mW/°C	
	MN74HC107S	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 Ta=25°C			Temperature Ta=−40~+85°C		Unit
			V_I	V_O	Unit	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

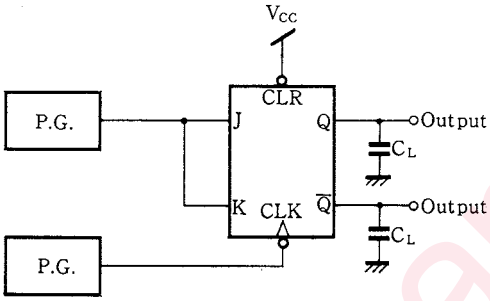
■ AC Characteristics (GND=0V, Input transition time≦6ns, C_L=50pF)

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			25	75		95	ns
		4.5			8	15		19	
		6.0			7	13		16	
Output fall time	t_{THL}	2.0			20	75		95	ns
		4.5			7	15		19	
		6.0			6	13		16	
Propagation time CLK→Q, $\overline{Q}$ (L→H)	t_{PLH}	2.0			34	125		155	ns
		4.5			14	25		31	
		6.0			11	21		26	
Propagation time CLK→Q, $\overline{Q}$ (H→L)	t_{PHL}	2.0			37	125		155	ns
		4.5			13	25		31	
		6.0			10	21		26	
Propagation time CLR→$\overline{Q}$ (L→H)	t_{PLH}	2.0			48	150		190	ns
		4.5			19	30		38	
		6.0			15	26		33	
Propagation time CLR→Q (H→L)	t_{PHL}	2.0			42	125		155	ns
		4.5			15	25		31	
		6.0			13	21		26	
Minimum set-up time	t_{su}	2.0			16	75		95	ns
		4.5			6	15		19	
		6.0			5	13		16	
Minimum hold time	t_h	2.0			—	0		0	ns
		4.5			—	0		0	
		6.0			—	0		0	
Minimum pulse width CLR	t_w	2.0			17	75		95	ns
		4.5			8	15		19	
		6.0			6	13		16	
Minimum recovery time	t_{rem}	2.0			15	75		95	ns
		4.5			4	15		19	
		6.0			2	13		16	
Maximum clock frequency	f_{max}	2.0		6	24		4		MHz
		4.5		30	64		24		
		6.0		35	83		28		

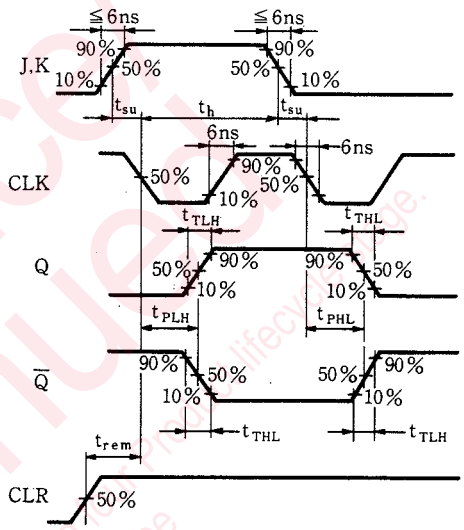
● Switching time measuring circuit and waveforms

(1) t_{TLH}, t_{THL}, t_{PLH}/t_{PHL} (CLK→Q Q), t_{rem}, t_h, t_{su}, t_{max}

1. Measuring circuit

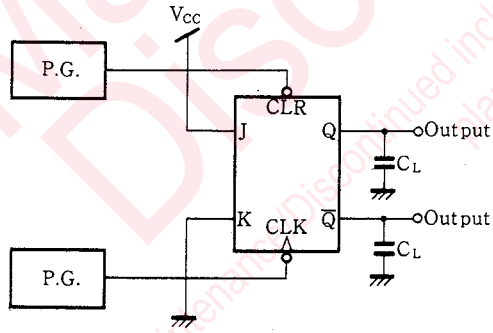


2. Switching waveforms

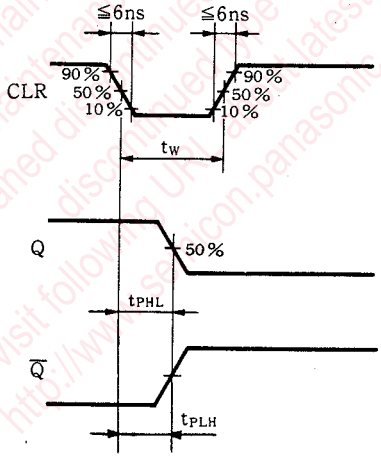


(2) t_{PLH}, t_{PHL} (CLR→Q, $\overline{Q}$), t_W (CLR)

1. Measuring circuit



2. Switching waveforms



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