

MN4013B / MN4013BS

Dual D-Type Flip-Flops

■ Description

The MN4013B/S are dual D flip-flop. Each flip-flop has independent data, set, clear and clock inputs and complementary outputs (0, $\bar{0}$) only on the positive going edge of the clock.

Logic states are retained either High or Low according to the clock level.

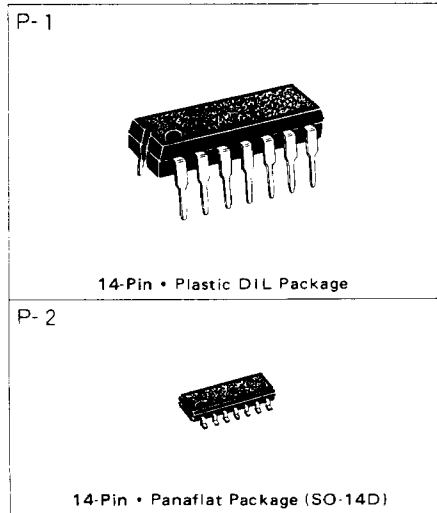
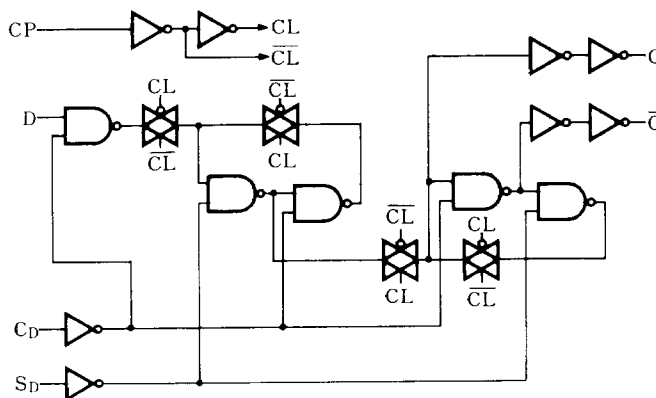
The MN4013B/S are equivalent to MOTOROLA MC14013B and RCA CD4013B.

■ Truth Table

Input				Output	
S _D	C _D	CP	D	O _{n-1}	\bar{O}_{n-1}
H	L	×	×	H	L
L	H	×	×	L	H
H	H	×	×	H	H
L	L		×	O _n	\bar{O}_n
L	L		L	L	H
L	L		H	H	L

Note) X : don't care

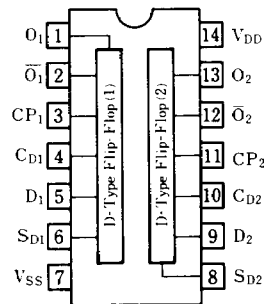
■ Logic Diagram (1/2)



14-Pin • Plastic DIL Package

14-Pin • Panafiat Package (SO-14D)

Pin Configuration



Pin Explanation

- S_D : Data-set input
- C_D : Data-clear input
- D : Data input
- CP : Clock input
- O, \bar{O} : Output (complementary)

■ Maximum Ratings (Ta=25°C)

Item	Symbol	Ratings	Unit
Supply Voltage	V _{DD}	-0.5 ~ +18	V
Input Voltage	V _I	-0.5 ~ V _{DD} +0.5*	V
Output Voltage	V _O	-0.5 ~ V _{DD} +0.5*	V
Peak Input · Output Current	±I _I	max. 10	mA
Power Dissipation (per package)	P _D	Ta=-40 ~ +60°C	max. 400
		Ta=+60 ~ +85°C	Decrease up to 200mW rating at 8mW/°C
Power Dissipation (per output terminal)	P _D	max. 100	mW
Operating Ambient Temperature	T _{opr}	-40 ~ +85	°C
Storage Temperature	T _{stg}	-65 ~ +150	°C

* V_{DD} + 0.5V should be under 18V

■ DC Characteristics (V_{SS}=0V)

Item	V _{DD} (V)	Sym- bol	Conditions	Ta=-40°C		Ta=25°C		Ta=85°C		Unit	
				min.	max.	min.	max.	min.	max.		
Quiescent Power Supply Current	5	I _{DD}	V _I =V _{SS} or V _{IH}	—	4	—	4	—	30	μA	
	10			—	8	—	8	—	60		
	15			—	16	—	16	—	120		
Output Voltage Low Level	5	V _{OL}	V _I =V _{SS} or V _{IH} I _O < 1μA	—	0.05	—	0.05	—	0.05	V	
	10			—	0.05	—	0.05	—	0.05		
	15			—	0.05	—	0.05	—	0.05		
Output Voltage High Level	5	V _{OH}	V _I =V _{SS} or V _{IH} I _O < 1μA	4.95	—	4.95	—	4.95	—	V	
	10			9.95	—	9.95	—	9.95	—		
	15			14.95	—	14.95	—	14.95	—		
Input Voltage Low Level	5	V _{IL}	I _O < 1μA	V _O =0.5V or 4.5V	—	1.5	—	1.5	—	V	
	10			V _O =1V or 9V	—	3	—	3	—		3
	15			V _O =1.5V or 13.5V	—	4	—	4	—		4
Input Voltage High Level	5	V _{IH}	I _O < 1μA	V _O =0.5V or 4.5V	3.5	—	3.5	—	3.5	V	
	10			V _O =1V or 9V	7	—	7	—	7		
	15			V _O =1.5V or 13.5V	11	—	11	—	11		
Output Current Low Level	5	I _{OL}	V _O =0.4V, V _I =0V or 5V	0.52	—	0.44	—	0.36	—	mA	
	10		V _O =0.5V, V _I =0V or 10V	1.3	—	1.1	—	0.9	—		
	15		V _O =1.5V, V _I =0V or 15V	3.6	—	3	—	2.4	—		
Output Current High Level	5	-I _O H	V _O =4.6V, V _I =0V or 5V	0.52	—	0.44	—	0.36	—	mA	
	10		V _O =9.5V, V _I =0V or 10V	1.3	—	1.1	—	0.9	—		
	15		V _O =13.5V, V _I =0V or 15V	3.6	—	3	—	2.4	—		
Output Current High Level	5	-I _O H	V _O =2.5V, V _I =0V or 5V	1.7	—	1.4	—	1.1	—	mA	
Input Leakage Current	15	±I _I	V _I =0V or 15V	—	0.3	—	0.3	—	1	μA	

■ Switching Characteristics (Ta = 25°C, VSS = 0V, CL = 50pF)

Item	V _{DD} (V)	Symbol	min.	typ.	max.	Unit
Output Rise Time (Fig. 1)	5	t _{TLH}	—	60	180	ns
	10		—	30	90	
	15		—	20	60	
Output Fall Time (Fig. 2)	5	t _{THL}	—	60	180	ns
	10		—	30	90	
	15		—	20	60	
Minimum Data Set-up Time	5	t _{su}	—	30	90	ns
	10		—	10	30	
	15		—	10	30	
Maximum Clock Rise Time Maximum Clock Fall Time	5	tr _φ , tf _φ	20	—	—	μs
	10		2.5	—	—	
	15		1	—	—	
Maximum Clock Frequency	5	f _{max}	6	12	—	MHz
	10		12	25	—	
	15		18	36	—	
Propagation Delay Time (Fig. 1) (CP-O, \bar{O})	5	t _{PLH}	—	100	300	ns
	10		—	40	120	
	15		—	30	90	
Propagation Delay Time (Fig. 2) (CP-O, \bar{O})	5	t _{PHL}	—	110	330	ns
	10		—	45	135	
	15		—	30	90	
Propagation Delay Time (Fig. 1) (C _D , S _D -O, \bar{O})	5	t _{PLH}	—	135	405	ns
	10		—	50	150	
	15		—	35	105	
Propagation Delay Time (Fig. 2) (C _D , S _D -O, \bar{O})	5	t _{PHL}	—	100	300	ns
	10		—	40	120	
	15		—	30	90	
Minimum Clear Pulse Width (Fig. 2)	5	t _{wCD}	—	45	135	ns
	10		—	20	60	
Minimum Preset Pulse Width (Fig. 2)	5	t _{wSD}	—	45	135	ns
	10		—	20	60	
Input Capacitance		C _i	—	—	7.5	pF

● Dynamic Signal Waveforms

(Fig. 1) t_{TLH}, t_{THL}, t_{PLH}(CP-O, \bar{O}), t_{PHL}(CP-O, \bar{O}) (Fig. 2) t_{PLH}(S_D-O, C_D- \bar{O}), t_{PHL}(S_D-O, C_D- \bar{O}), t_{wCD}, t_{wSD}

