

HD14013B

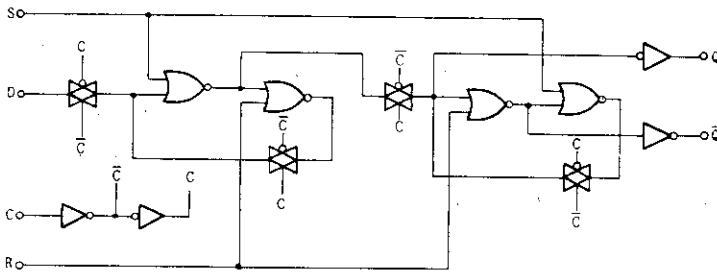
Dual D-type Flip Flop

The HD14013B dual type D flip-flop has independent Data, (D), Direct Set, (S), Direct Reset, (R), and Clock (C) inputs and complementary outputs (Q and \bar{Q}). These devices may be used as shift register elements or as type T flip-flops for counter and toggle Applications

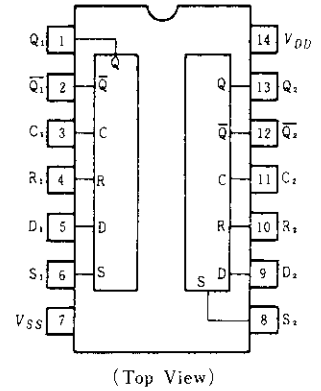
FEATURES

- Static Operation
- Quiescent Current = 2nA/pkg typ @5V
- Supply Voltage Range = 3 to 18V
- Toggle Rate = 4MHz typ @5V
- Logic Edge-triggered Flip-Flop Design ... Logic state is retained indefinitely with clock level either high or low; information is transferred to the output only on the positive-going edge of the clock pulse.
- Pin-for-pin Replacement for CD4013B and MC14013B

LOGIC DIAGRAM (1/2)



PIN ARRANGEMENT



TRUTH TABLE

Inputs				Outputs	
Clock*	Data	Reset	Set	Q	\bar{Q}
—	0	0	0	0	1
—	1	0	0	1	0
—	x	0	0	Q	\bar{Q}
x	x	1	0	0	1
x	x	0	1	1	0
x	x	1	1	1	1

x : Don't Care
* : Level Change

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	$V_{DD}(V)$	Test Conditions	-40°C		25°C			85°C		Unit
				min	max	min	typ	max	min	max	
Output Voltage	V_{OL}	5.0	$V_{in} = V_{DD}$ or 0	-	0.05	-	0	0.05	-	0.05	V
		10		-	0.05	-	0	0.05	-	0.05	
		15		-	0.05	-	0	0.05	-	0.05	
	V_{OH}	5.0	$V_{in} = 0$ or V_{DD}	4.95	-	4.95	5.0	-	4.95	-	V
		10		9.95	-	9.95	10	-	9.95	-	
		15		14.95	-	14.95	15	-	14.95	-	
Input Voltage	V_{IL}	5.0	$V_{out} = 4.5$ or $0.5V$	-	1.5	-	2.25	1.5	-	1.5	V
		10	$V_{out} = 9.0$ or $1.0V$	-	3.0	-	4.50	3.0	-	3.0	
		15	$V_{out} = 13.5$ or $1.5V$	-	4.0	-	6.75	4.0	-	4.0	
	V_{IH}	5.0	$V_{out} = 0.5$ or $4.5V$	3.5	-	3.5	2.75	-	3.5	-	V
		10	$V_{out} = 1.0$ or $9.0V$	7.0	-	7.0	5.50	-	7.0	-	
		15	$V_{out} = 1.5$ or $13.5V$	11.0	-	11.0	8.25	-	11.0	-	
Output Drive Current	I_{OH}	5.0	$V_{OH} = 2.5V$	-1.0	-	-0.8	-1.7	-	-0.6	-	mA
		5.0	$V_{OH} = 4.6V$	-0.2	-	-0.16	-0.36	-	-0.12	-	
		10	$V_{OH} = 9.5V$	-0.5	-	-0.4	-0.9	-	-0.3	-	
		15	$V_{OH} = 13.5V$	-1.4	-	-1.2	-3.5	-	-1.0	-	
	I_{OL}	5.0	$V_{OL} = 0.4V$	0.52	-	0.44	0.88	-	0.36	-	mA
		10	$V_{OL} = 0.5V$	1.3	-	1.1	2.25	-	0.9	-	
15		$V_{OL} = 1.5V$	3.6	-	3.0	8.8	-	2.4	-		
Input Current	I_{in}	15		-	± 0.1	-	± 0.0001	± 0.3	-	± 1.0	μA
Input Capacitance	C_{in}		$V_{in} = 0$	-	-	-	5.0	7.5	-	-	pF
Quiescent Current	I_{DD}	5.0	Zero Signal, per Package	-	4.0	-	0.002	4.0	-	30	μA
		10		-	8.0	-	0.004	8.0	-	60	
		15		-	16	-	0.006	16	-	120	
Total Supply Current*	I_T	5.0	Dynamic + I_{DD} , per Gate, $C_L = 50pF, f = 1kHz$	-	-	-	0.75	-	-	-	μA
		10		-	-	-	1.5	-	-	-	
		15		-	-	-	2.3	-	-	-	

* To calculate total supply current at frequency other than 1kHz.

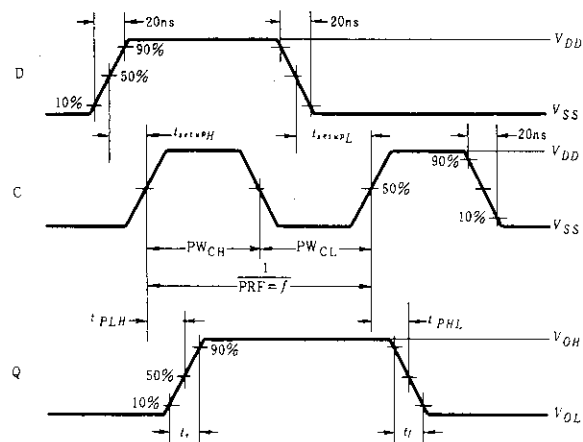
$\mu V_{DD} = 5.0V \quad I_T = (0.75\mu A/kHz)f + I_{DD}$ $\mu V_{DD} = 10V \quad I_T = (1.5\mu A/kHz)f + I_{DD}$ $\mu V_{DD} = 15V \quad I_T = (2.3\mu A/kHz)f + I_{DD}$

■ SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

Characteristic		Symbol	$V_{DD}(\text{V})$	min	typ	max	Unit
Output Rise Time		t_r	5.0	—	180	360	ns
			10	—	90	180	
			15	—	65	130	
Output Fall Time		t_f	5.0	—	180	250	ns
			10	—	70	150	
			15	—	60	100	
Propagation Delay Time	Clock	t_{PLH} , t_{PHL}	5.0	—	175	350	ns
			10	—	80	200	
			15	—	70	150	
	Set		5.0	—	250	450	
			10	—	115	200	
			15	—	75	150	
	Reset		5.0	—	350	450	
			10	—	100	200	
			15	—	75	150	
Setup Time		$t_{setup H}$ $t_{setup L}$	5.0	40	20	—	ns
			10	20	10	—	
			15	15	7.5	—	
Clock Pulse Width		PW_{CH} , PW_{CL}	5.0	250	125	—	ns
			10	100	50	—	
			15	70	35	—	
Clock Pulse Frequency		PRF	5.0	—	4.0	2.0	MHz
			10	—	10	5.0	
			15	—	14	7.0	
Clock Pulse Rise and Fall Time		t_r , t_f	5.0	—	—	15	μs
			10	—	—	5.0	
			15	—	—	4.0	
Set and Reset Pulse Width		PW_S , PW_R	5.0	250	125	—	ns
			10	100	50	—	
			15	70	35	—	

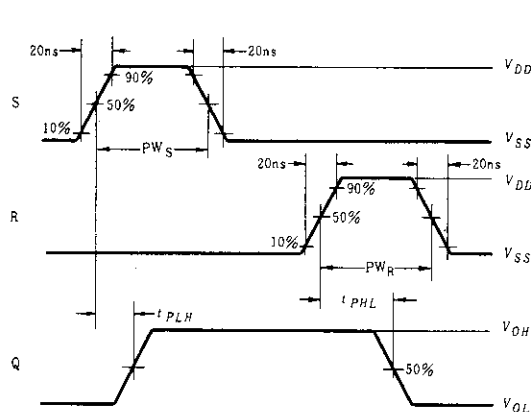
■ DYNAMIC SIGNAL WAVEFORMS

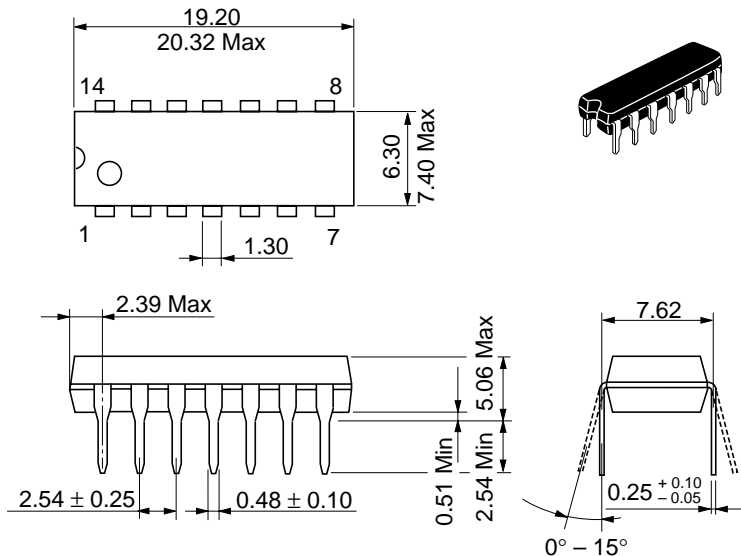
● Data, Clock, and Output



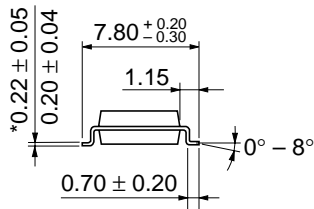
Note) Inputs R and S low.

● Set, Reset, and Output



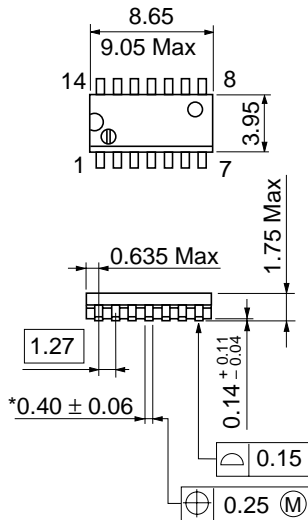


Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.97 g



Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

*Dimension including the plating thickness
Base material dimension



Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.13 g

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