

TC40175BP/BF

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

TC40175BP/TC40175BF QUAD D-TYPE FLIP-FLOP

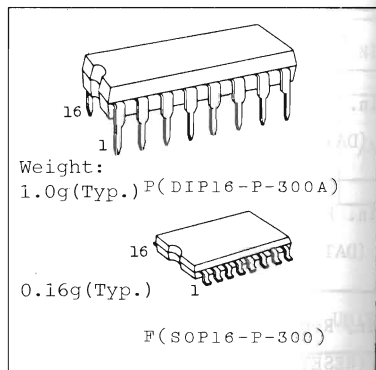
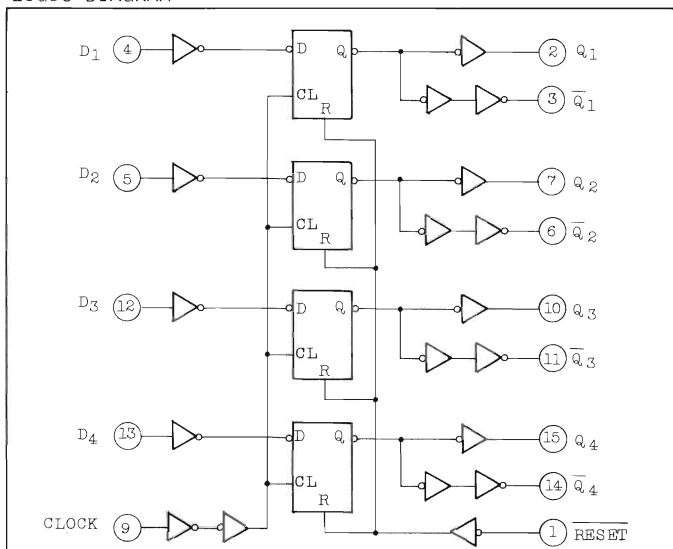
TC40175BP/TC40175BF contains four circuits of D type flip-flop having common clock terminal and clear terminal. The logical input applied to D_n input is transferred to Q_n output by the rising edge of CLOCK input.

RESET input is active with "L" level. This has the same functions as TTL 54175/74175 and the pin assignment is also same.

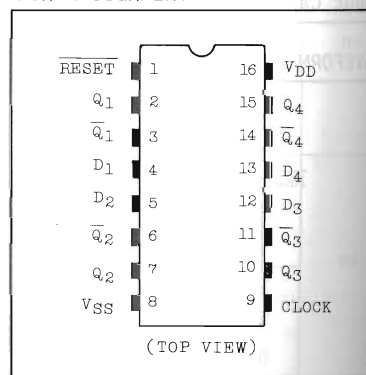
MAXIMUM RATINGS

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

LOGIC DIAGRAM



PIN ASSIGNMENT



TRUTH TABLE

INPUTS			OUTPUTS	
CLOCK△	D _n	RESET	Q _{n+1}	Q _{n+1}
┐	H	H	H	L
┐	L	H	L	H
┐	*	H	Q _n	Q _n
*	*	L	L	H

△ : Level change

· : No change

* : Don't care

RECOMMENDED OPERATING CONDITIONS ($V_{SS}=0V$)

CHARACTERISTIC	SYMBOL		MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V_{DD}		3	-	18	V
Input Voltage	V_{IN}		0	-	V_{DD}	V

STATIC ELECTRICAL CHARACTERISTICS ($V_{SS}=0V$)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V_{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Output Voltage	V_{OH}	$ I_{OUT} < 1\mu A$ $V_{IN}=V_{SS}, V_{DD}$	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_{OL}	$ I_{OUT} < 1\mu A$ $V_{IN}=V_{SS}, V_{DD}$	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_{OH}	$V_{OH}=4.6V$	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA
		$V_{OH}=2.5V$	5	-2.5	-	-2.1	-4.0	-	-1.7	-	
		$V_{OH}=9.5V$	10	-1.5	-	-1.3	-2.2	-	-1.1	-	
		$V_{OH}=13.5V$	15	-4.0	-	-3.4	-9.0	-	-2.8	-	
		$V_{IN}=V_{SS}, V_{DD}$									
Output Low Current	I_{OL}	$V_{OL}=0.4V$	5	0.61	-	0.51	1.5	-	0.42	-	mA
		$V_{OL}=0.5V$	10	1.5	-	1.3	3.8	-	1.1	-	
		$V_{OL}=1.5V$	15	4.0	-	3.4	15.0	-	2.8	-	
		$V_{IN}=V_{SS}, V_{DD}$									
Input High Voltage	V_{IH}	$V_{OUT}=0.5V, 4.5V$	5	3.5	-	3.5	2.75	-	3.5	-	V
		$V_{OUT}=1.0V, 9.0V$	10	7.0	-	7.0	5.5	-	7.0	-	
		$V_{OUT}=1.5V, 13.5V$	15	11.0	-	11.0	8.25	-	11.0	-	
		$ I_{OUT} < 1\mu A$									
Input Low Voltage	V_{IL}	$V_{OUT}=0.5V, 4.5V$	5	-	1.5	-	2.25	1.5	-	1.5	V
		$V_{OUT}=1.0V, 9.0V$	10	-	3.0	-	4.5	3.0	-	3.0	
		$V_{OUT}=1.5V, 13.5V$	15	-	4.0	-	6.75	4.0	-	4.0	
		$ I_{OUT} < 1\mu A$									
Input Current	"H" Level	I_{IH} $V_{IH}=18V$	18	-	0.1	-	10^{-5}	0.1	-	1.0	μA
	"L" Level	I_{IL} $V_{IL}=0V$	18	-	-0.1	-	-10^{-5}	-0.1	-	-1.0	

STATIC ELECTRICAL CHARACTERISTICS ($V_{SS}=0V$)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V_{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
Quiescent Device Current	I_{DD}	$V_{IN}=V_{SS}, V_{DD}$ *	5	-	1	-	0.005	1	-	30	A
			10	-	2	-	0.010	2	-	60	
			15	-	4	-	0.015	4	-	120	

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS ($T_a=25^\circ C$, $V_{SS}=0V$, $C_L=50pF$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t_{TLH}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Output Transition Time (High to Low)	t_{THL}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Propagation Delay Time (CLOCK - Q, $\bar{Q}$)	t_{pLH} t_{pHL}		5	-	170	340	ns
			10	-	70	140	
			15	-	50	100	
Propagation Delay Time ($\overline{RESET}$ - Q, $\bar{Q}$)	t_{pLH} t_{pHL}		5	-	190	380	ns
			10	-	80	160	
			15	-	55	110	
Min. Clock Pulse Width	t_w		5	-	55	130	ns
			10	-	20	60	
			15	-	15	40	
Min. Pulse Width ($\overline{RESET}$)	t_{WL}		5	-	40	100	ns
			10	-	20	50	
			15	-	15	40	
Max. Clock Frequency	f_{CL}		5	3.5	9	-	MHz
			10	6	25	-	
			15	8	34	-	
Max. Clock Input Rise Time. Max. Clock Input Fall Time.	t_{rCL} t_{fCL}		5	20	-	-	μs
			10	15	-	-	
			15	15	-	-	

DYNAMIC ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, $V_{SS}=0\text{V}$, $C_L=50\text{pF}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	$V_{DD}(\text{V})$	MIN.	TYP.	MAX.	UNIT
Min. Set-up Time (DATA - CLOCK)	t_{SU}		5	-	30	60	ns
			10	-	15	30	
			15	-	10	20	
Min. Hold Time (DATA - CLOCK)	t_{H}		5	-	-5	80	ns
			10	-	0	40	
			15	-	3	30	
Min. Removal Time ($\overline{\text{RESET}}$ - CLOCK)	t_{rem}		5	-	7	40	ns
			10	-	4	20	
			15	-	3	15	
Input Capacitance	C_{IN}			-	5	7.5	pF

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

