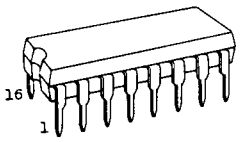
C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

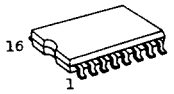
TC40175BP/BF

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.
$\overline{\text{RESET}}$ input is active with "L" level. This has the same functions as TTL 54175/74175 and the pin assignment is also same.



DIP 16(3D16A-P)

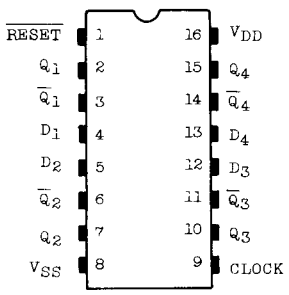


MFP 16(F16GC-P)

MAXIMUM RATINGS

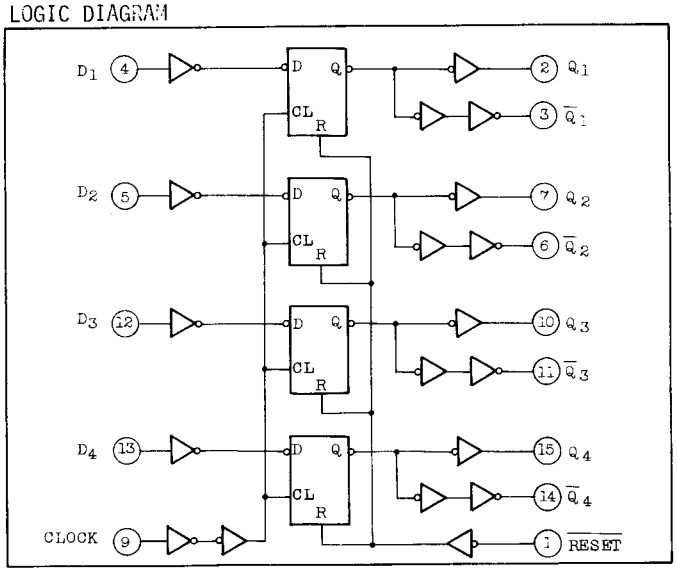
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	V_{SS}-0.5 ~ V_{SS}+20	V
Input Voltage	V_{IN}	V_{SS}-0.5 ~ V_{DD}+0.5	V
Output Voltage	V_{OUT}	V_{SS}-0.5 ~ V_{DD}+0.5	V
DC Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300(DIP)/180(MFP)	mW
Operating Temperature Range	T_A	-40 ~ 85	°C
Storage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

PIN ASSIGNMENT



(TOP VIEW)

LOGIC DIAGRAM



TRUTH TABLE

INPUTS			OUTPUTS	
CLOCK△	Dn	$\overline{\text{RESET}}$	Qn+1	$\overline{\text{Qn+1}}$
↑	H	H	H	L
↑	L	H	L	H
↓	*	H	Qn·	$\overline{\text{Qn}}$·
*	*	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	SYMBOL	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}	$\|I_{OUT}\|<1\mu A$	5	4.95	-	4.95	5.00	-	4.95	-	V
		$V_{IN}=V_{SS},V_{DD}$	10	9.95	-	9.95	10.00	-	9.95	-	
			15	14.95	-	14.95	15.00	-	14.95	-	
Low-Level Output Voltage	V_{OL}	$\|I_{OUT}\|<1\mu A$	5	-	0.05	-	0.00	0.05	-	0.05	
		$V_{IN}=V_{SS},V_{DD}$	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	-	
		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_{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
Input Current "L" Level	I_{IL}	V_{IL}=0V	18	-	-0.1	-	-10^{-5}	-0.1	-	-1.0	

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

CHARACTERISTIC	SYMBOL	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 (Ta=25°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	
			10	-	50	100	
			15	-	40	80	
Propagation Delay Time (CLOCK - Q, $\overline{Q}$)	t_{pLH} t_{pHL}		5	-	170	340	ns
			10	-	70	140	
			15	-	50	100	
Propagation Delay Time ($\overline{RESET}$ - Q, $\overline{Q}$)	t_{pLH} t_{pHL}		5	-	190	380	
			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	
			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 (Ta=25°C, V_{SS}=0V, C_L=50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD}(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 ($\overline{RESET}$ - 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