TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

SYNCHRONOUS PRESETTABLE 4-BIT COUNTER

TC40H160 DECADE. ASYNCHRONOUS CLEAR.
TC40H161 BINARY. ASYNCHRONOUS CLEAR.
TC40H162 DECADE. SYNCHRONOUS CLEAR.
TC40H163 BINARY. SYNCHRONOUS CLEAR.

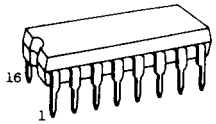
The TC40H160/161/162/163 are synchronous type presettable 4-bit counters.

The TC40H160/162 are DECADE counters.

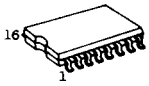
The TC40H161/163 are BINARY counters.

The CLEAR and LOAD of each counter are active at "L" level.

The CLEAR functions of the TC40H160/161 are asynchronous, but those of the TC40H162/163 synchronize with the rising edge of clock pulse.

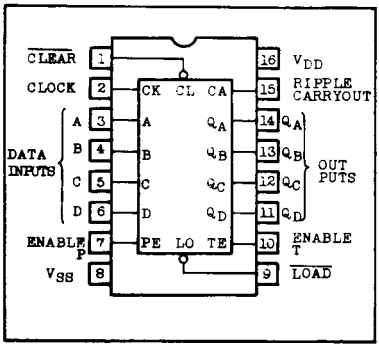


DIP16(3D16A-P)



MFP16(F16GC-P)

PIN CONNECTION



MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	V_{SS}-0.5 ∿ V_{SS}+10	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
Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300(DIP)/180(MFP)	mW
Storage Temperature	T_{stg}	-65 ∿ 150	°C
Lead Temp./Time	T_{sol}	260°C • 10 sec	

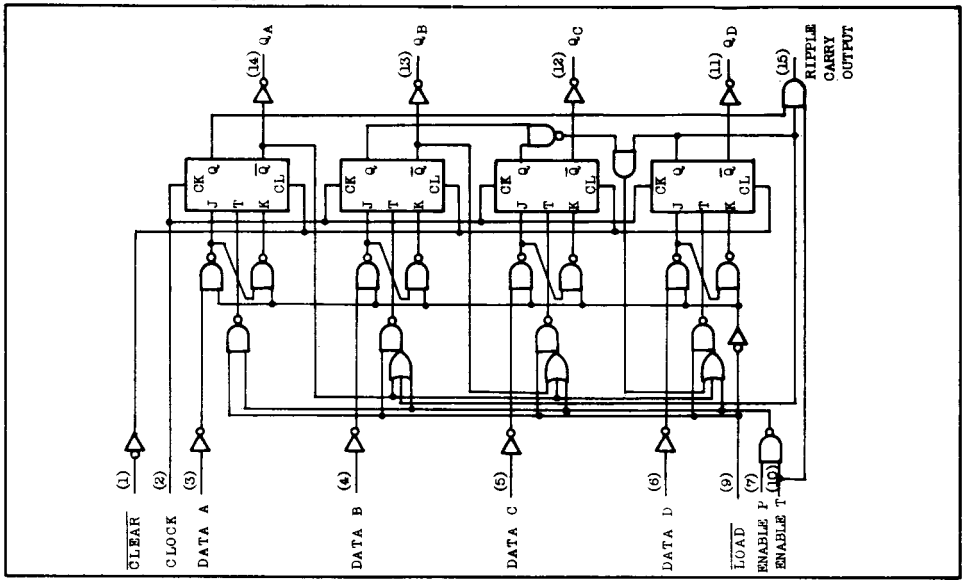
TRUTH TABLE

INPUTS									OUTPUTS				
CLEAR	ENABLE		LOAD	CLOCK	DATA INPUTS				DATA OUTPUTS				RIPPLE CARRY OUT
	PE	TE			A	B	C	D	Q_A	Q_B	Q_C	Q_D	
✱	✱	L	✱	↓	Don't Care				No change				L
✱	✱	H	✱	↓	Don't Care				No change				Able
L	✱	✱	✱	◇	Don't Care				All Reset				L
H	✱	L	L	↑	Program Data				Program Output				L
H	✱	H	L	↑	Program Data				Program Output				Able
H	✱	L	H	↑	Don't Care				No count				L
H	L	H	H	↑	Don't Care				No count				Able
H	H	H	H	↑	Don't Care				Count up				Able

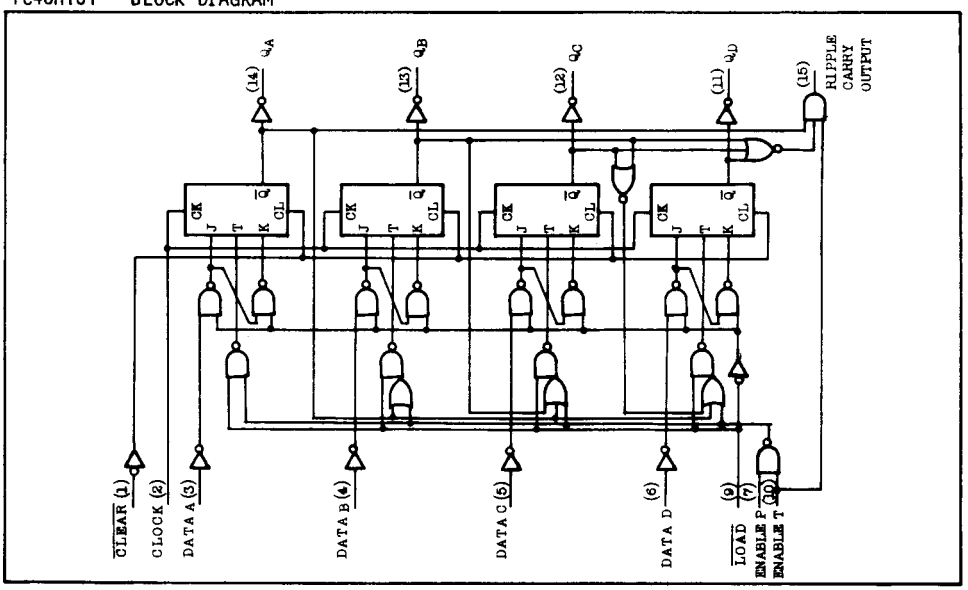
✱ Don't care
◇ { TC40H160/163 Don't Care
TC40H162/163 Synchronise with the rising edge of clock.

TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

TC40H160 BLOCK DIAGRAM

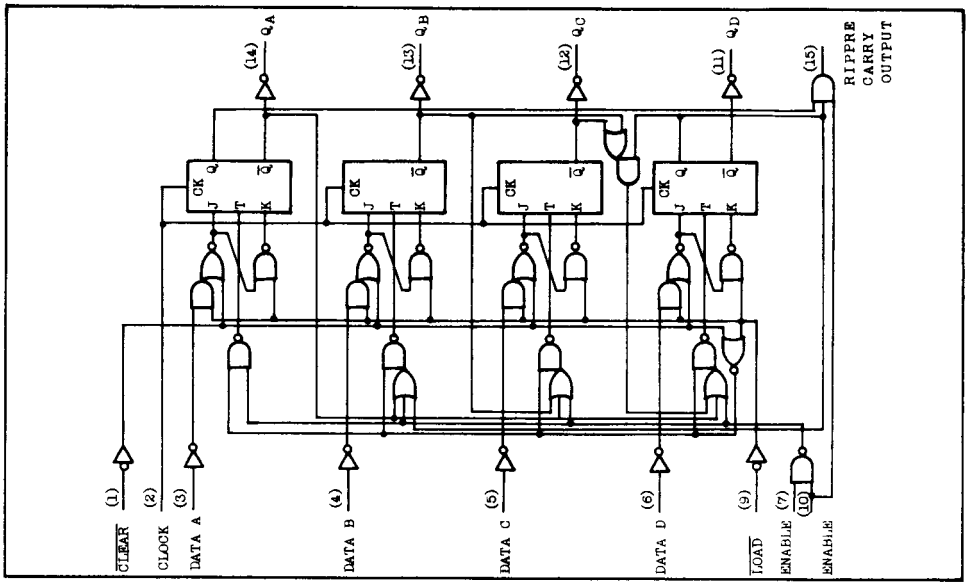


TC40H161 BLOCK DIAGRAM

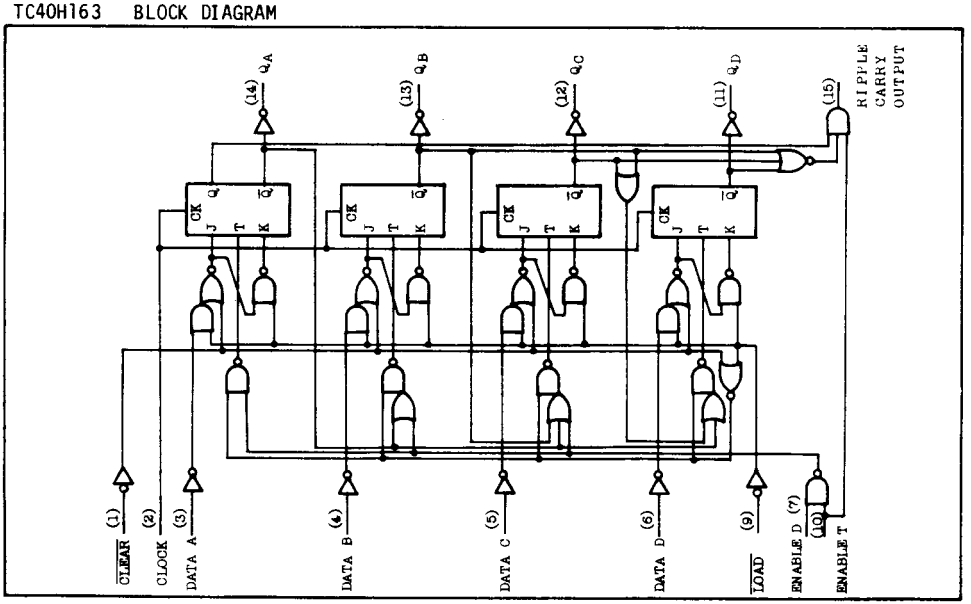


TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

TC40H162 BLOCK DIAGRAM

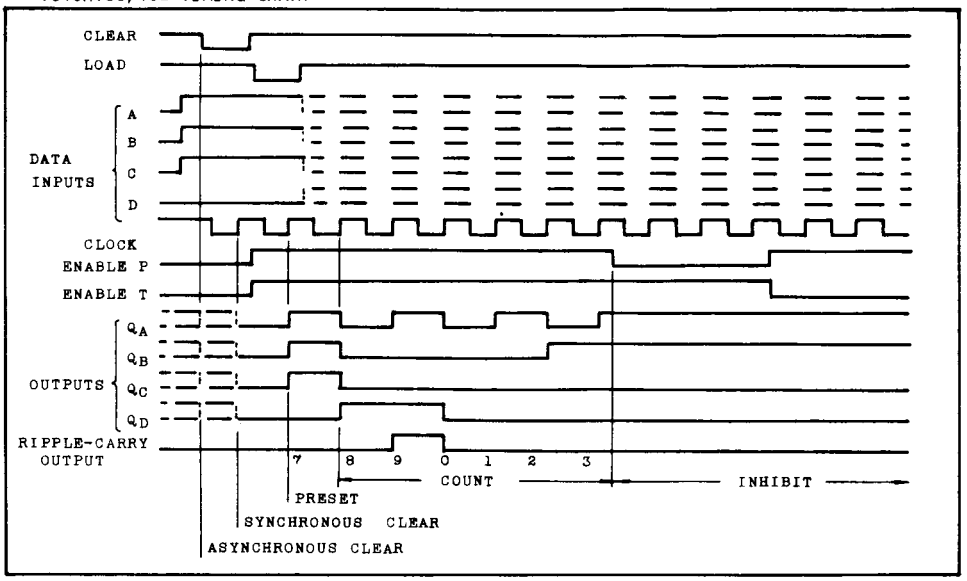


TC40H163 BLOCK DIAGRAM

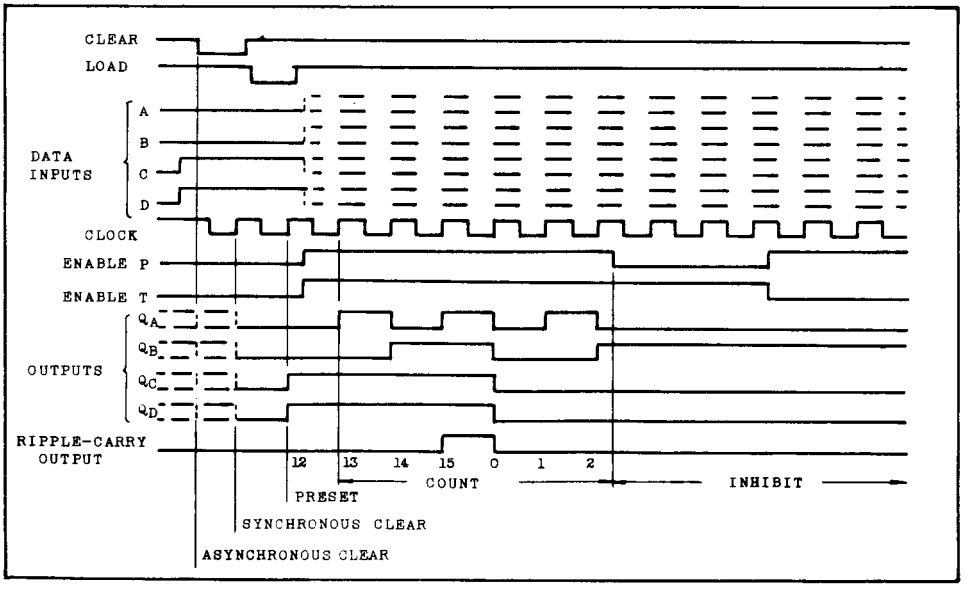


TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

TC40H160/162 TIMING CHART



TC40H161/163 TIMING CHART



TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{DD}	-	2.0	-	8.0	V
Input Voltage	V_{IN}	-	0	-	V_{DD}	V
Operating Temperature	T_{opr}	-	-40	-	85	°C

ELECTRICAL CHARACTERISTICS (V_{SS}=0.0V)

CHARACTERISTIC		SYMBOL	TEST CONDITION	V_{DD} (B)	-40°C		25°C			85°C		UNIT
					MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High Level Output Voltage		V_{OH}	$\|I_{OUT}\|$<1μA $V_{IN}=V_{SS},V_{DD}$	5	4.95	-	4.95	5.0	-	4.95	-	V
Low Level Output Voltage		V_{OL}	$\|I_{OUT}\|$<1μA $V_{IN}=V_{SS},V_{DD}$	5	-	0.05	-	0.0	0.05		0.05	V
High Level Output Current		I_{OH}	V_{OH}=4.6V $V_{IN}=V_{SS},V_{DD}$	5	-0.52	-	-0.44		-	-0.36	-	mA
Low Level Output Current		I_{OL}	V_{OL}=0.4V $V_{IN}=V_{SS},V_{DD}$	5	1.4	-	1.1		-	0.8	-	mA
Input Voltage	"H" Level	V_{IH}	$\|I_{OUT}\|$<1μA V_{OUT}=0.5V	5	4.0	-	4.0		-	4.0	-	V
	"L" Level	V_{IL}	V_{OUT}=4.5V	5	-	1.0	-		1.0	-	1.0	V
Input Current	"H" Level	I_{IH}	V_{IH}=8.0V	8	-	0.3	-	10^{-5}	0.3	-	1.0	μA
	"L" Level	I_{IL}	V_{IL}=0.0V	8	-	-0.3	-	-10^{-5}	-0.3	-	-1.0	μA
Quiescent Supply Current		I_{DD}	*$V_{IN}=V_{SS},V_{DD}$	5	-	12.5	-	10^{-3}	12.5	-	75	μA

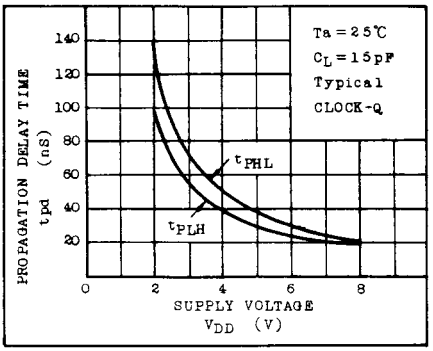
* All valid input combinations.

SWITCHING CHARACTERISTICS (Ta=25°C, V_{SS}=0V, V_{DD}=5V, C_L=15pF)

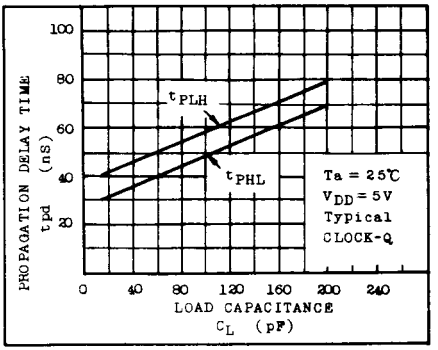
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Rise Time		t_{or}		-	20	35	ns
Output Fall Time		t_{of}		-	15	30	
Propergation Delay Time	(Low-High)	t_{pLH}	CLOCK - Q	-	30	45	ns
	(High-Low)	t_{pHL}		-	40	60	
Propergation Delay Time	(Low-High)	t_{pLH}	CLOCK - RIPPLE CARRY OUTPUT	-	50	75	ns
	(High-Low)	t_{pHL}		-	42	63	
Propergation Delay Time	(Low-High)	t_{pLH}	ENABLE TE or PE - RIPPLE CARRY OUTPUT	-	26	39	ns
	(High-Low)	t_{pHL}		-	34	51	
	(High-Low)	t_{pHL}	CLEAR - Q	-	45	68	ns
Setup Time		t_{set-up}	DATA, ENABLE LOAD, CLEAR - CLOCK	-	40	60	ns
Min. Clock Clear Pulse Width		t_W	CLOCK, CLEAR	-	17	26	ns
Max. Clock	Rise Time	$t_{r\phi}$		1.0	20	-	ns
	Fall Time	$t_{f\phi}$					
Max. Clock Frequency		f_{MAX}		10	17	-	MHz

TC40H160P/F • TC40H162P/F
TC40H161P/F • TC40H163P/F

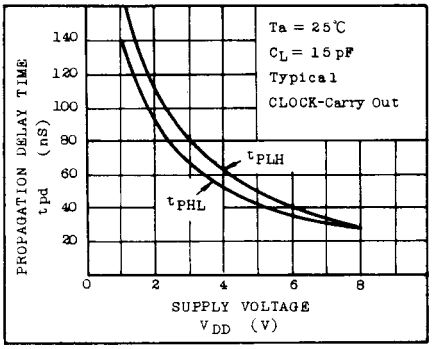
t_{pd} - V_{DD}



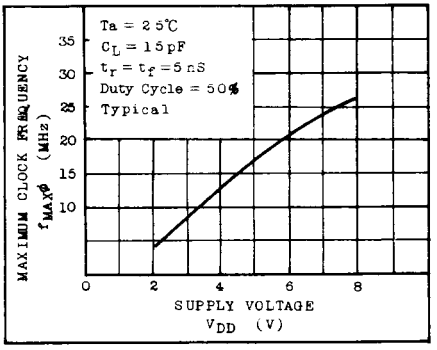
t_{pd} - C_L



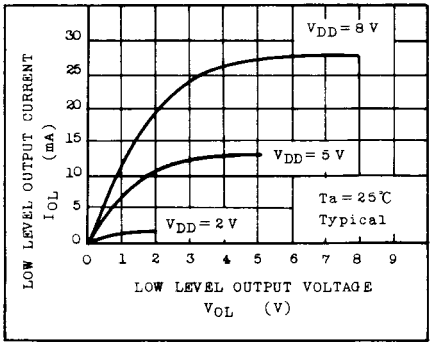
t_{pd} - V_{DD}



$f_{max\phi}$ - V_{DD}



I_{OL} - V_{OL}



I_{OH} - (V_{DD}-V_{OH})