

TC40H393P/F

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

TC40H393 DUAL 4-BIT BINARY COUNTER

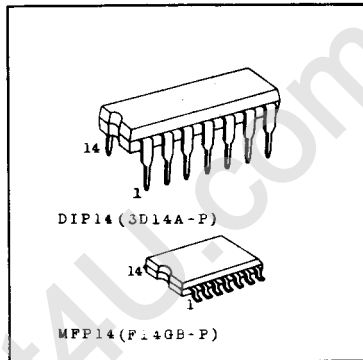
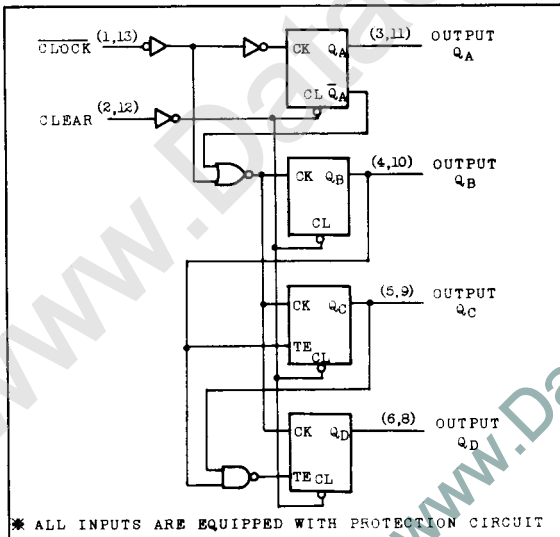
The TC40H393 is a dual binary counter with CLEAR function.

When CLEAR input is set to "H" level, the contents of each flip-flop are cleared, and all the outputs go to "L" level. The TC40H393 is triggered at the falling edge of CLOCK input.

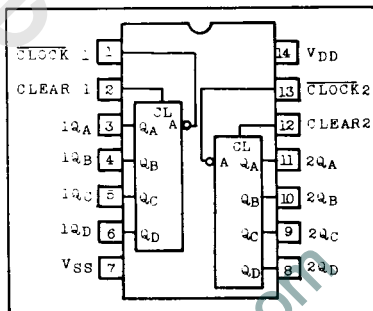
MAXIMUM RATINGS

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	

BLOCK DIAGRAM



TRUTH TABLE



COUNT SEQUENCE

COUNT	OUTPUT			
	Q _A	Q _B	Q _C	Q _D
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H
10	L	H	L	H
11	H	H	L	H
12	L	L	H	H
13	H	L	H	H
14	L	H	H	H
15	H	H	H	H

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RECOMMENDED OPERATING CONDITIONS ($V_{SS}=0.0V$)

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} (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$ $V_{IN}=V_{DD}$	5	4.95	-	4.95	5.0	-	4.95	-	V
Low Level Output Voltage	V_{OL}	$ I_{OUT} < 1\mu A$ $V_{IN}=V_{SS}, V_{DD}$	5	-	0.05	-	0.0	0.05	-	0.05	V
High Level Output Current	I_{OH}	$V_{OH}=4.6V$ $V_{IN}=V_{DD}$	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} < 1\mu A$ $V_{OUT}=0.5V$ $V_{OUT}=4.5V$	5	4.0	-	4.0	-	-	4.0	-	V
	"L" Level V_{IL}		5	-	1.0	-	-	1.0	-	1.0	
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	
Quiescent Supply Current	I_{DD}	$*V_{IN}=V_{SS}, V_{DD}$	5	-	12.5	-	10^{-3}	12.5	-	75	μA

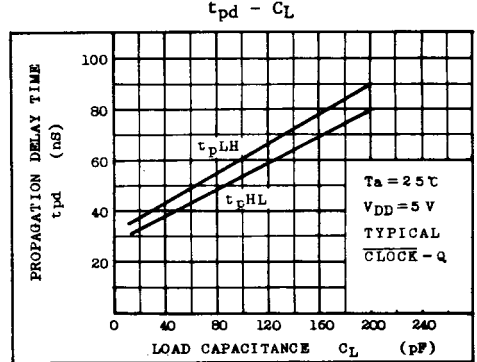
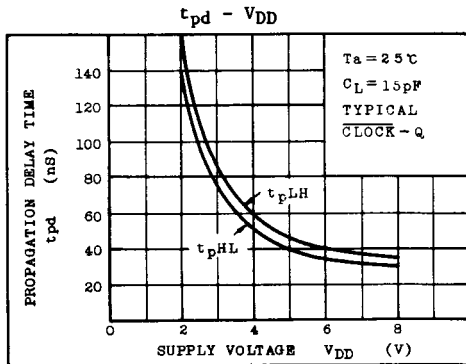
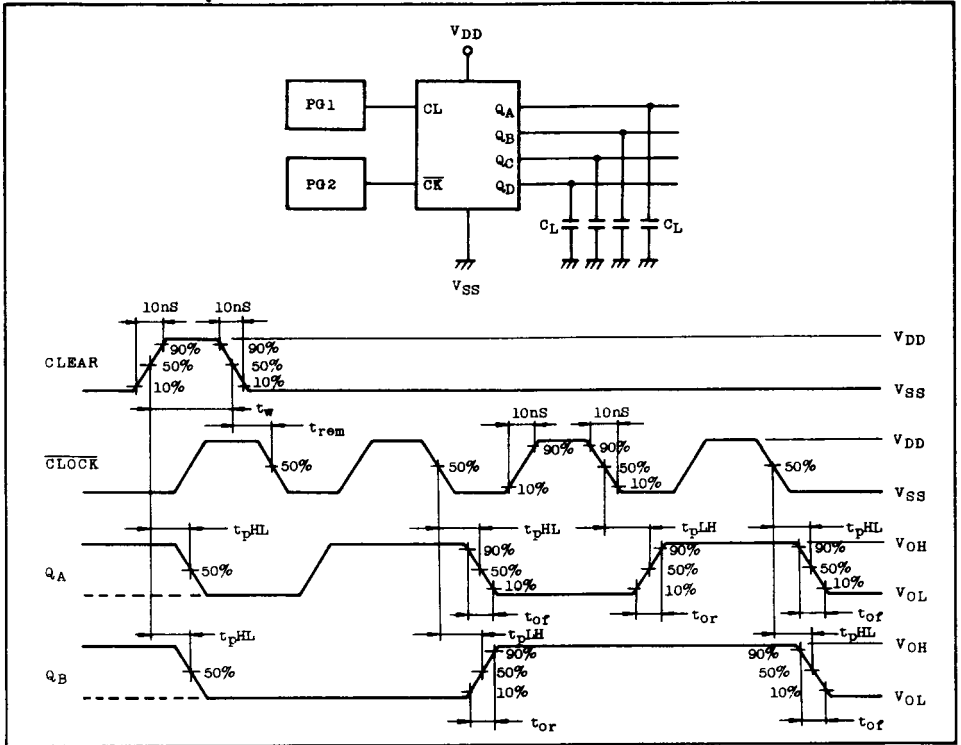
* All valid input combinations.

SWITCHING CHARACTERISTICS ($T_a=25^\circ C$, $V_{SS}=0V$, $V_{DD}=5V$, $C_L=15pF$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Rise Time	t_{or}	CLOCK - Q	-	18	35	ns
Output Fall Time	t_{of}		-	15	30	
Propagation Delay Time	Low-High t_{pLH}	CLOCK - Q	-	45	68	ns
	High-Low t_{pHL}		-	40	60	
Propagation Delay Time High-Low	t_{pHL}	CLEAR - Q	-	36	54	ns
Maximum Clock Input Rise/Fall Time	$t_{r\phi}$ $t_{f\phi}$		1.0	100	-	μs
Minimum Clear Pulse Width	t_w		-	20	35	ns
Minimum Clear Removal Time	t_{rem}		-	10	20	ns
Maximum Clock Frequency	f_{MAX}		15	30	-	MHz
Input Capacitance	C_{IN}		-	5	-	pF

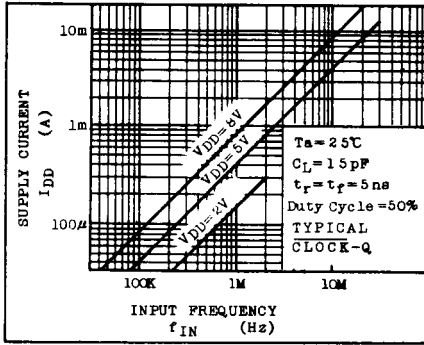
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SWITCHING TIME TEST CIRCUIT AND WAVEFORM

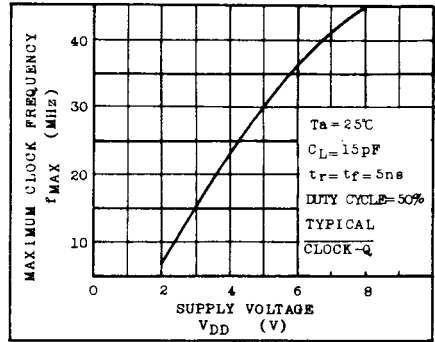


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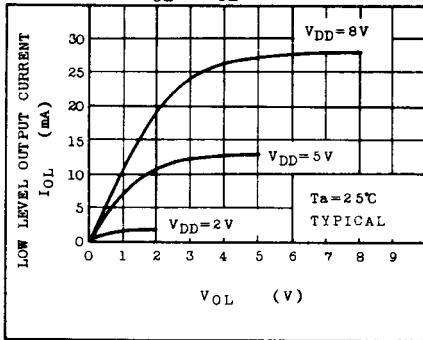
$I_{DD} - f_{IN}$



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



$I_{OL} - V_{OL}$



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

