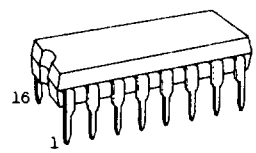
TC74HC4017P/F DECADE COUNTER/DIVIDER

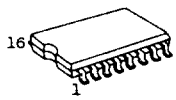
The TC74HC 4017 is a high speed CMOS DECADE JOHNSON COUNTER fabricated with silicon C^2MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. It contains 5-stage divided-by-10 Johnson counter with 10 decoded output (Q0 - Q10) and carry-out bit.
This counter is advanced on the positive edge of clock signal when $\overline{CE}$ input is held low, or it is advanced on the negative edge of the clock enable signal ($\overline{CE}$) when CLOCK input is held high, and selected one of ten outputs goes high. Holding high the CLEAR input, this counter is cleared to its zero state without regard to the other input conditions.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed ..... f_{MAX}=45MHz(Typ.) at V_{CC}=5V
- Low Power Dissipation ..... I_{CC}=4μA(Max.) at Ta=25°C
- High Noise Immunity ..... $V_{NIH}=V_{NIL}$=28% V_{CC}(Min.)
- Output Drive Capability .....10 LSTTL Loads
- Symmetrical Output Impedance .....$|I_{OH}|=I_{OL}$=4mA(Min.)
- Balanced Propagation Delays ..... $t_{pLH}\fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ..... $V_{CC(opr.)}$=2V∿6V
- Pin and Function Compatible with 4017B



DIP16(3D16A-P)



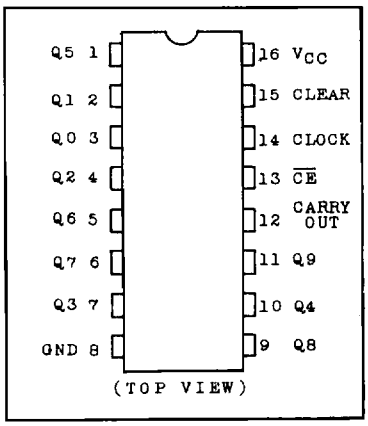
MFP16(F16GC-P)

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	-0.5∿7	V
DC Input Voltage	V_{IN}	-0.5∿V_{CC}+0.5	V
DC Output Voltage	V_{OUT}	-0.5∿V_{CC}+0.5	V
Input Diode Current	I_{IK}	±20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current	I_{OUT}	±25	mA
DC V_{CC}/Ground Current	I_{CC}	±50	mA
Power Dissipation	P_D	500(DIP)* 180(MFP)	mW
Storage Temperature	T_{stg}	-65∿150	°C
Lead Temperature 10sec	T_L	300	°C

* 500mW in the range of Ta=-40°∿65°C and from Ta=65°C up to 85°C derating factor of -10mW/°C shall be applied until 300mW.

PIN ASSIGNMENT

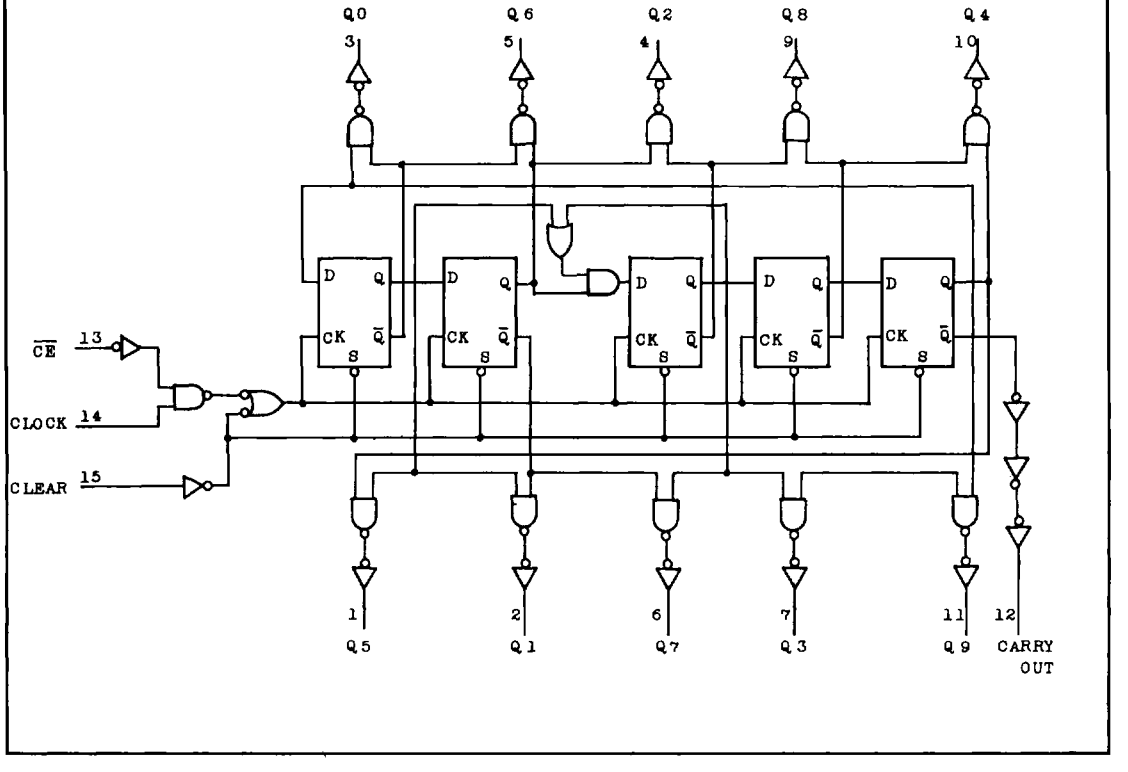


TRUTH TABLE

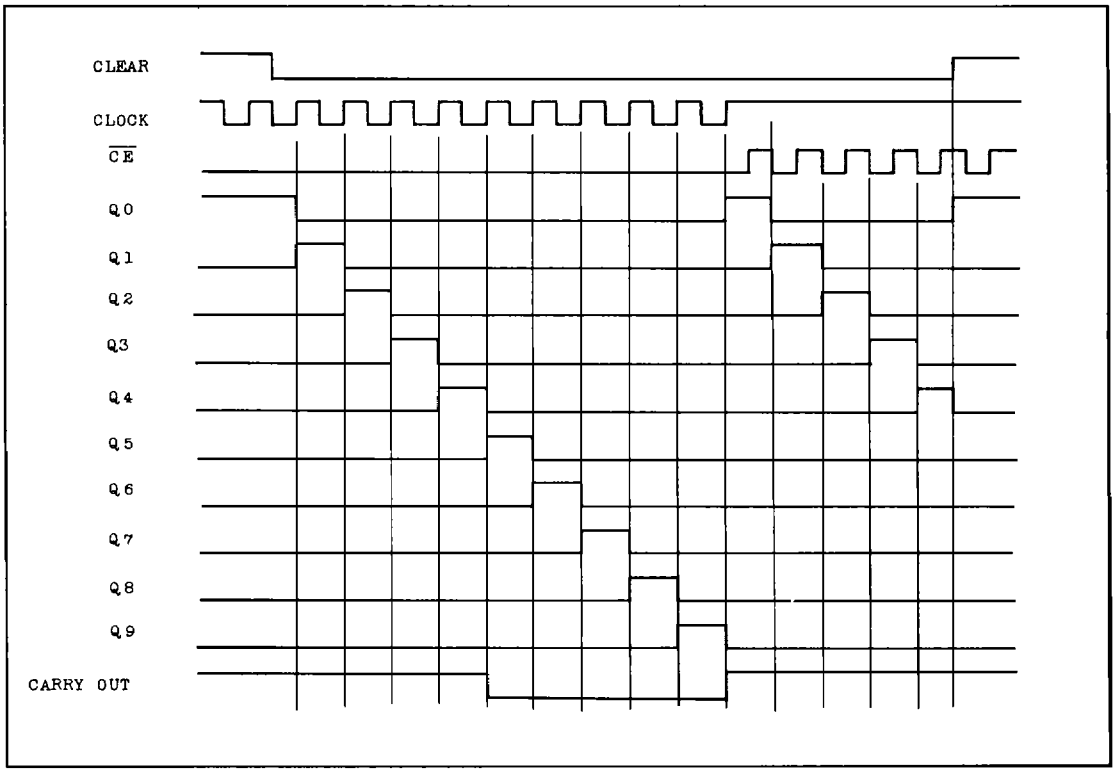
CLOCK	$\overline{CE}$	CLEAR	DECODE OUTPUT (H)
X	X	H	Q0
L	X	L	Qn
X	H	L	Qn
↓	L	L	Qn+1
↑	L	L	Qn
H	↓	L	Qn
H	↑	L	Qn+1

X : DON'T CARE
Qn : NO CHANGE

LOGIC DIAGRAM



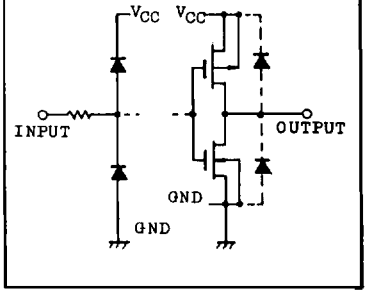
TIMING DIAGRAM



RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	LIMIT	UNIT
Supply Voltage	V_{CC}	2 ∿ 6	V
Input Voltage	V_{IN}	0 ∿ V_{CC}	V
Output Voltage	V_{OUT}	0 ∿ V_{CC}	V
Operating Temperature	T_{opr}	-40 ∿ 85	°C
Input Rise and Fall Time	t_r, t_f	0 ∿ 1000 (V_{CC}=2.0V) 0 ∿ 500 (V_{CC}=4.5V) 0 ∿ 400 (V_{CC}=6.0V)	ns

INPUT and OUTPUT
EQUIVALENT CIRCUIT



DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V_{CC}	Ta=25°C MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=-40∼85°C MIN.	Ta=-40∼85°C MAX.	UNIT
High-Level Input Voltage	V_{IH}			2.0	1.5	-	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	
				6.0	4.2	-	-	4.2	-	
Low-Level Input Voltage	V_{IL}			2.0	-	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	
				6.0	-	-	1.8	-	1.8	
High-Level Output Voltage	V_{OH}	$V_{IN}=V_{IH}$ or V_{IL}	I_{OH}=-20μA	2.0	1.9	2.0	-	1.9	-	V
				4.5	4.4	4.5	-	4.4	-	
				6.0	5.9	6.0	-	5.9	-	
			I_{OH}=-4mA	4.5	4.18	4.31	-	4.13	-	
			I_{OH}=-5.2mA	6.0	5.68	5.80	-	5.63	-	
Low-Level Output Voltage	V_{OL}	$V_{IN}=V_{IH}$ or V_{IL}	I_{OL}=20μA	2.0	-	0.0	0.1	-	0.1	V
				4.5	-	0.0	0.1	-	0.1	
				6.0	-	0.0	0.1	-	0.1	
			I_{OL}=4mA	4.5	-	0.17	0.26	-	0.33	
			I_{OL}=5.2mA	6.0	-	0.18	0.26	-	0.33	
Input Leakage Current	I_{IN}	$V_{IN}=V_{CC}$ or GND		6.0	-	-	±0.1	-	±1.0	μA
Quiescent Supply Current	I_{CC}	$V_{IN}=V_{CC}$ or GND		6.0	-	-	4.0	-	40.0	

AC ELECTRICAL CHARACTERISTICS (C_L=50pF, INPUT $t_r=t_f$=6ns)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25°C MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=-40∼85°C MIN.	Ta=-40∼85°C MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Propagation Delay Time (CLOCK, $\overline{CE}$ - Q, CARRY)	t_{pLH} t_{pHL}		2.0	-	100	195	-	245	
			4.5	-	25	39	-	49	
			6.0	-	21	33	-	42	
Propagation Delay Time (CLEAR - Q, CARRY)	t_{pLH} t_{pHL}		2.0	-	100	195	-	245	
			4.5	-	25	39	-	49	
			6.0	-	21	33	-	42	

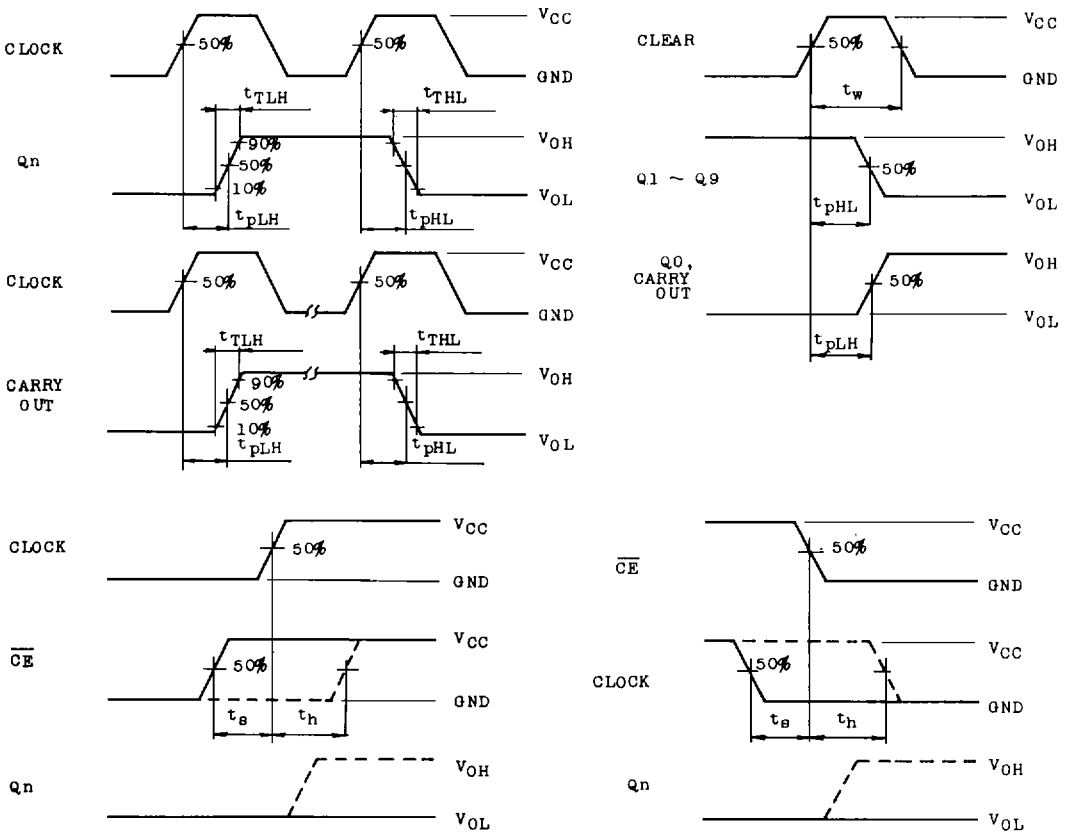
AC ELECTRICAL CAHRACTERISTICS (Continued)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25°C MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=-40~85°C MIN.	Ta=-40~85°C MAX.	UNIT
Maximum Clock Frequency	f_{MAX}		2.0	5	10	-	4	-	MHz
			4.5	25	41	-	20	-	
			6.0	29	48	-	24	-	
Minimum Pulse Width (CLOCK)	$t_{w(L)}$ $t_{w(H)}$		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Minimum Pulse Width (CLEAR)	$t_{w(H)}$		2.0	-	30	75	-	95	
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Minimum Set-up Time	t_s		2.0	-	-	0	-	0	
			4.5	-	-	0	-	0	
			6.0	-	-	0	-	0	
Minimum Hold Time	t_h		2.0	-	30	75	-	95	
			4.5	-	7	15	-	19	
			6.0	-	6	13	-	16	
Minimum Removal Time (CLEAR)	t_{rem}		2.0	-	25	75	-	95	
			4.5	-	6	15	-	19	
			6.0	-	5	13	-	16	
Input Capacitance	C_{IN}			-	5	10	-	10	pF
Power Dissipation Capacitance	C_{PD}(1)			-	74	-	-	-	

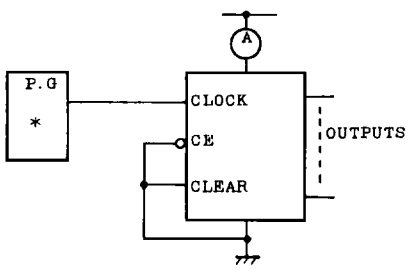
Note (1) C_{PD} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder.

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

SWITCHING CHARACTERISTICS TEST WAVEFORM



$I_{CC(opr.)}$ TEST CIRCUIT



* : INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.