



MOTOROLA

4-Bit Binary Counter

**ELECTRICALLY TESTED PER:
5962-8759001**

The 10H416 is a high-speed synchronous, presettable, cascadable 4-bit binary counter. It is useful for a large number of conversion, counting and digital integration applications.

- Counting Frequency, 200 MHz Minimum
- Improved Noise Margin 150 mV (Over Operating Voltage and Temperature Range)
- Voltage Compensated
- MECL 10K-Compatible

PIN ASSIGNMENTS

FUNCTION	DIL	FLATS	LCC	BURN-IN (CONDITION C)
V _{CC1}	1	5	2	GND
Q ₁	2	6	3	51 Ω to V _{TT}
Q ₀	3	7	4	51 Ω to V _{TT}
\overline{TC}	4	8	5	51 Ω to V _{TT}
\overline{PE}	5	9	7	OPEN
\overline{CE}	6	10	8	OPEN
P ₀	7	11	9	GND
V _{EE}	8	12	10	V _{EE}
P ₁	9	13	12	GND
P ₂	10	14	13	GND
P ₃	11	15	14	GND
MR	12	16	15	OPEN
CP	13	1	17	CP1
Q ₃	14	2	18	51 Ω to V _{TT}
Q ₂	15	3	19	51 Ω to V _{TT}
V _{CC2}	16	4	20	GND

BURN - IN CONDITIONS:

V_{TT} = - 2.0 V MAX/ - 2.2 V MIN

V_{EE} = - 5.7 V MAX/ - 5.2 V MIN

PIN NAMES

NAME	FUNCTION
\overline{PE}	Parallel Load Enable (Active Low)
P _n	Parallel Inputs
CP	Clock Inputs (Clocks on Positive Transition)
\overline{CE}	Count Enable (Low to Count)
MR	Master Reset (High forces all Q Outputs Low)
TC	Terminal Count (10010, Low at HLLH; 10016 Low at HHHH)
Q _n	Counter Outputs

Military 10H416

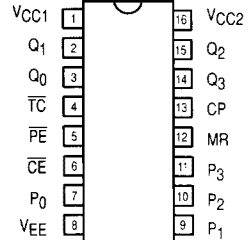


AVAILABLE AS

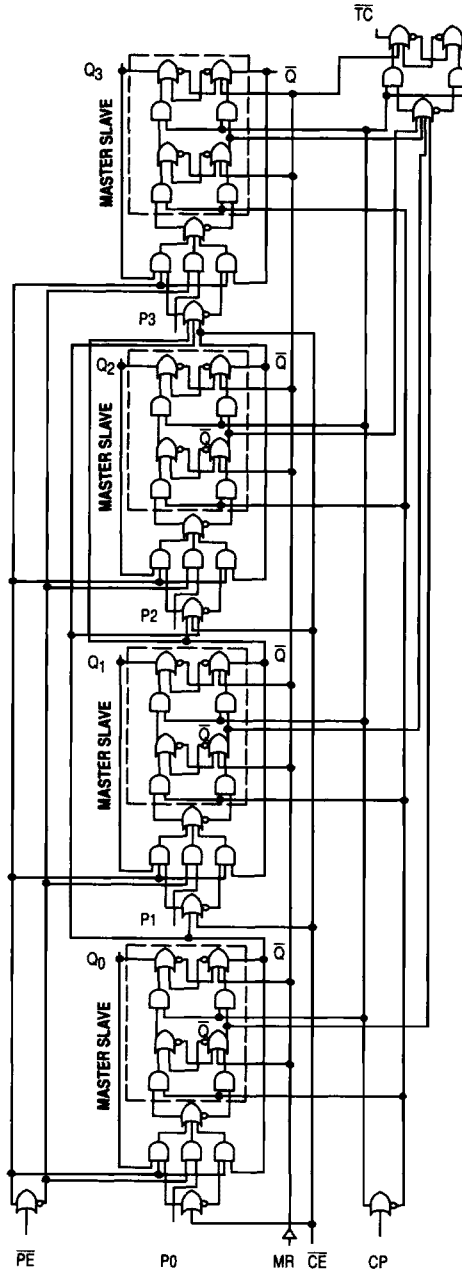
- 1) JAN: N/A
 - 2) SMD: 5962-8759001
 - 3) 883: 10H416/BXAJC
- X = CASE OUTLINE AS FOLLOWS:

PACKAGE: CERDIP: E
CERFLAT: F
LCC: 2

The letter "M" appears before the slash on LCC.



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NOTE: This diagram is provided for understanding of logic operation only. It should not be used for evaluation of propagation delays as many gate functions are achieved internally without incurring a full gate delay.

Figure 1. 4-Bit Binary Counter Logic Diagram

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TRUTH TABLE

CE	PE	MR	CP	FUNCTION
L	L	L	Z	Load Parallel (P_n to Q_n)
H	L	L	Z	Load Parallel (P_n to Q_n)
L	H	L	Z	Count
H	H	L	Z	Hold
X	X	L	ZZ	Master Respond; Slave Hold
X	X	H	X	Reset ($Q_n = \text{Low}$, $\overline{TC} = \text{High}$)

L = Low

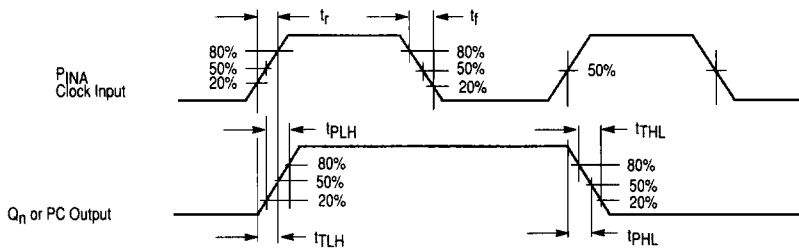
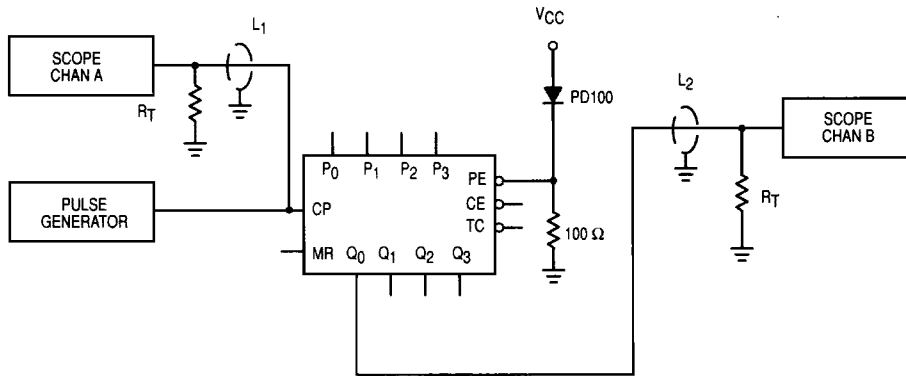
H = High Voltage Level

X = Don't Care

Z = Clock Pulse (Low to High)

ZZ = Clock Pulse (High to Low)

Features include assertion inputs and outputs on each of the four master/slave counting flip-flops. Terminal count is generated internally in a manner that allows synchronous loading at nearly the speed of the basic counter.

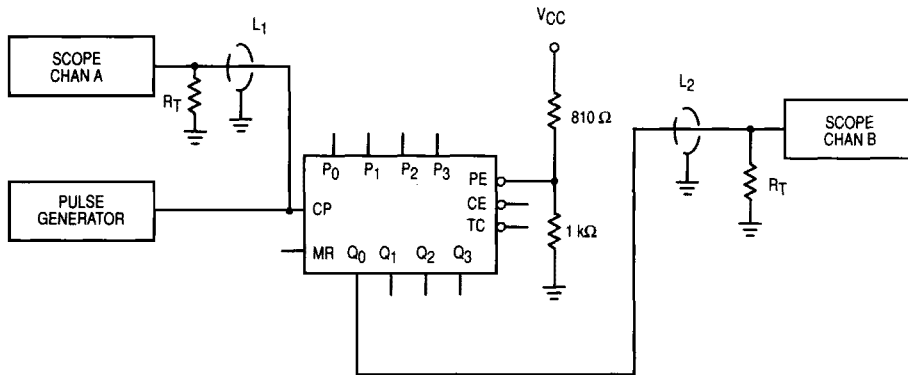


NOTES

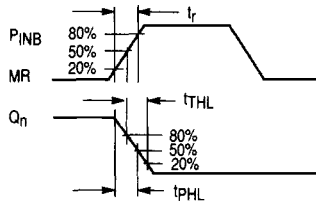
1. L_1 and L_2 = equal length of 50 Ω impedance line, < 5.0 pF.
2. R_T = 50 Ω termination of scope.
3. Decoupling 0.1 μ F from gnd to V_{EE} and V_{CC} .
4. $V_{CC1} = V_{CC2} = 2.0$ V.
5. $V_{EE} = -3.2$ V.

Figure 2. Test Circuit and Waveforms (Clock to Output)

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NOTES

1. L_1 and L_2 = equal length of 50Ω impedance line.
2. R_T = 50Ω termination of scope.
3. C_L = Jig and stray capacitance < 5.0 pF
3. Decoupling $0.1 \mu\text{F}$ from gnd to V_{EE} and V_{CC} .
4. $V_{CC1} = V_{CC2} = 2.0$ V.
5. $V_{EE} = -3.2$ V.

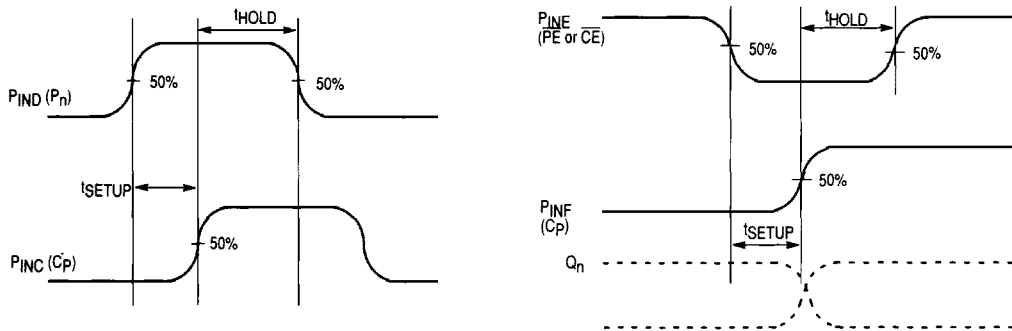


Figure 3. Test Circuit and Waveforms (Master Reset to Output)

10H416 QUIESCENT LIMIT TABLE *

* ELECTRICAL CHARACTERISTICS

Each MECL 10H series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are terminated through a 100 Ω resistor to - 2.0 volts.

Test Temperature	Test Voltage Values (Volts)									
	V _{IH1}	V _{IL1}	V _{IH2}	V _{IL2}	PS1	PS2	V _{EE1}	V _{EE2}	V _{EE1}	V _{EE2}
T _A = 25 °C	-0.78	-1.95	-1.11	-1.48	+1.11	+0.31	-5.46	-4.94	-5.46	-4.94
T _A = 125 °C	-0.65	-1.95	-0.96	-1.465	+1.24	+0.36	-5.46	-4.94	-5.46	-4.94
T _A = -55 °C	-0.84	-1.95	-1.16	-1.51	+1.01	+0.28	-5.46	-4.94	-5.46	-4.94

Symbol	Parameter	Limits						Units	TEST VOLTAGE APPLIED TO PINS BELOW							
		+ 25 °C		+ 125 °C		- 55 °C			Pinouts referenced are for DIL package, check Pin Assignments V _{CC} = 0 V, Output Load = 100 Ω to - 2.0 V							
		Subgroup 1		Subgroup 2		Subgroup 3			V _{IH1}	V _{IL1}	V _{EE1}	V _{EE2}	V _{CC}	P.U.T.		
V _{OH}	High Output Voltage	Min	Max	Min	Max	Min	Max	V	9 - 11, 7, 13	13	8		1, 16	2 - 4, 14, 15		
V _{OL}	Low Output Voltage	- 1.95	- 1.58	- 1.95	- 1.565	- 1.95	- 1.61	V	12, 13	13	8		1, 16	2 - 4, 14, 15		
V _{OHA}	High Output Voltage	- 1.01	- 0.78	- 0.65	- 0.65	- 1.06	- 0.84	V			8	8	1, 16	2 - 4, 14, 15		
V _{OLA}	Low Output Voltage	- 1.95	- 1.58	- 1.95	- 1.565	- 1.95	- 1.61	V			8	8	1, 16	2 - 4, 14, 15		
I _{EE}	Power Supply Current	- 115		- 126		- 126		mA			8		1, 16	8		
I _{IH}	Input Current High		265		450		450	μ A	5 - 7, 9 - 11		8		1, 16	5 - 7, 9 - 11		
I _{IH1}	Input Current High		700		1190		1190	μ A	912		8		1, 16	12		
I _{IL}	Input Current Low	0.5		0.3		0.5		μ A	5 - 7, 9 - 13		8		1, 16	5 - 7, 9 - 13		

10H416 QUIESCENT LIMIT TABLE *

* ELECTRICAL CHARACTERISTICS

Each MECL 10H series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are terminated through a 100 Ω resistor to 0.0 volts.

Test Temperature	Test Voltage Values (Volts)									
	V _{IH1}	V _{IL1}	V _{IH2}	V _{IL2}	PS1	PS2	VEE1	VEE2	VEEL	VEEL
T _A = 25 °C	-0.780	-1.950	-1.11	-1.48	+1.11	+0.31	-5.46	-4.94	-2.94	-2.94
T _A = 125 °C	-0.650	-1.950	-0.96	-1.465	+1.24	+0.36	-5.46	-4.94	-2.94	-2.94
T _A = -55 °C	-0.840	-1.950	-1.16	-1.51	+1.01	+0.28	-5.46	-4.94	-2.94	-2.94

Symbol	Parameter	Limits						Units	TEST VOLTAGE APPLIED TO PINS BELOW							
		+ 25 °C		+ 125 °C		- 55 °C			Pinouts referenced are for DIL package, check Pin Assignments V _{CC} = 2.0 V, Output Load = 100 Ω to GND							
		Subgroup 9	Subgroup 10	Subgroup 11	Subgroup 9	Subgroup 10	Subgroup 11		V _{IN}	V _{OUT}	PS1	PS2	V _{CC}	VEEL	Clk	P.U.T.
t _{RLH}	Rise Time	0.5	2.1	0.5	2.2	0.5	2.0	ns	5 - 13	4	9 - 11	7	1, 16	8	2, 3, 14, 15	
t _{FHL}	Fall Time	0.5	2.1	0.5	2.2	0.5	2.0	ns	5 - 13	4	9 - 11	7	1, 16	8	2, 3, 14, 15	
t _{pd}	Propagation Delay															
	Clk to Q	1.0	2.6	1.0	2.9	1.0	2.5	ns	12, 13	14	7, 9 - 11	7	1, 16	8	2 - 4, 15	
	Clk to TC	0.7	2.6	0.7	2.9	0.7	2.5	ns	12, 13	14	7, 9 - 11	7	1, 16	8	2 - 4, 15	
	MR to Q	0.7	2.6	0.7	2.9	0.7	2.5	ns	12, 13	14	7, 9 - 11	7	1, 16	8	2 - 4, 15	
t _{SET}	Setup Time															
	P _n to Clk	2.0		2.0		2.0		ns	5 - 7	3, 14	5, 7, 9 - 11		1, 16	8	13	
	CE or PE to Clk	2.5		2.5		2.5		ns	5 - 7	3, 14	5, 7, 9 - 11		1, 16	8	13	
t _{HOLD}	Hold Time															
	Clk to P _n	1.0		1.0		1.0		ns	5 - 7	3, 14	5, 7, 9 - 11		1, 16	8	13	
	Clk to PE or CE	0.5		0.5		0.5		ns	5 - 7	3, 14	5, 7, 9 - 11		1, 16	8	13	
f _{Count}	Count Frequency	200		200		200		MHZ	13	3	9		1, 16	8	2, 4, 14, 15	