



Programmable Decade Counter

**ELECTRICALLY TESTED PER:
MPG54LS716**

These monolithic devices are programmable, cascadable, modulo-N-counters. The 54LS716 can be programmed to divide by any number (N) from 0 through 9, the 54LS718 from 0 through 15.

The parallel enable (PE) input enables the parallel data inputs D₀ through D₃. All zeros are entered into the counter by applying a logic "0" level to the master reset (MR) and PE inputs. This causes the counter to stop counting (count = 0). All data inputs are independent of the logic level of the Clock.

Modulo-N counters are useful in frequency synthesizers, in phase-locked loops, and in other applications where a simple method for frequency division is needed.

All Types:

Input Loading Factor:

Clock, PE = 2

D₀, D₁, D₂, D₃ Gate = 1

MR = 4

Output Loading Factor = 8

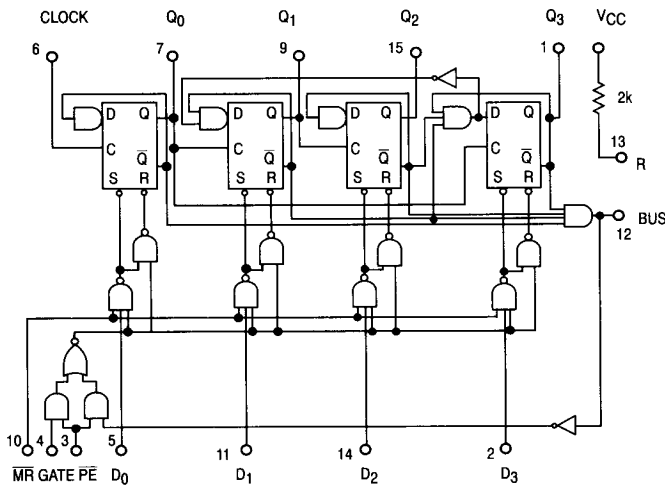
Total Power Dissipation =
85 mW typ/pkg

Propagation Delay Time:

Clock to Q₃ = 50 ns typ

Clock to Bus = 35 ns typ

LOGIC DIAGRAM



Military 54LS716



AVAILABLE AS:

- 1) JAN: N/A
- 2) SMD: N/A
- 3) 883: 54LS716/BXAJC

X = CASE OUTLINE AS FOLLOWS:

PACKAGE: CERDIP: E
CERFLAT: F
LCC: 2

**THE LETTER "M" APPEARS
BEFORE THE / ON LCC.**

PIN ASSIGNMENTS

FUNCT.	DIL 620-09	FLATS 650-05	LCC 756A-02	BURN-IN (COND. A)
Q ₃	1	1	2	VCC
D ₃	2	2	3	VCC
PE	3	3	4	GND
GATE	4	4	5	VCC
D ₀	5	5	7	VCC
CLK	6	6	8	VCC
Q ₀	7	7	9	VCC
GND	8	8	10	GND
Q ₁	9	9	12	VCC
MR	10	10	13	GND
D ₁	11	11	14	VCC
BUS	12	12	15	PN17
R	13	13	17	PN15
D ₂	14	14	18	VCC
Q ₂	15	15	19	VCC
VCC	16	16	20	VCC

BURN-IN CONDITIONS:
VCC = 5.0 V MIN/6.0 V MAX

TRUTH TABLE

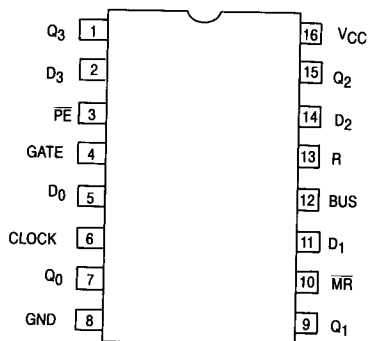
Count	Outputs			
	Q ₃	Q ₂	Q ₁	Q ₀
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

MOTOROLA MILITARY FAST/LS/TTL DATA

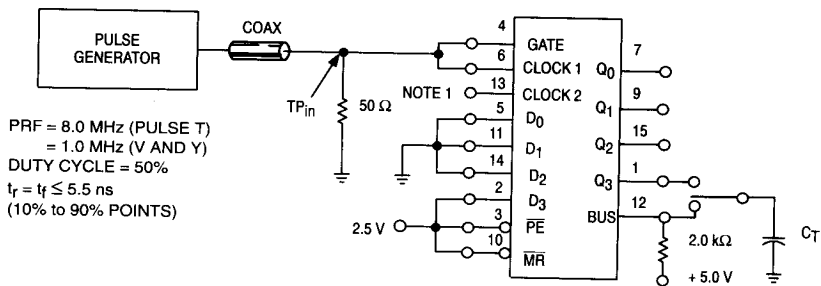
5-424

54LS716

CONNECTION DIAGRAM



FUNCTIONAL SWITCHING TIME CIRCUIT

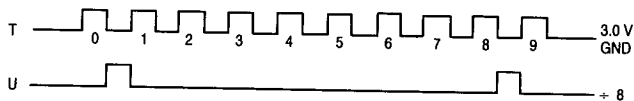


$C_T = 50$ pF = TOTAL PARASITIC CAPACITANCE, WHICH INCLUDES PROBE, WIRING, AND LOAD CAPACITANCE.

NOTE:

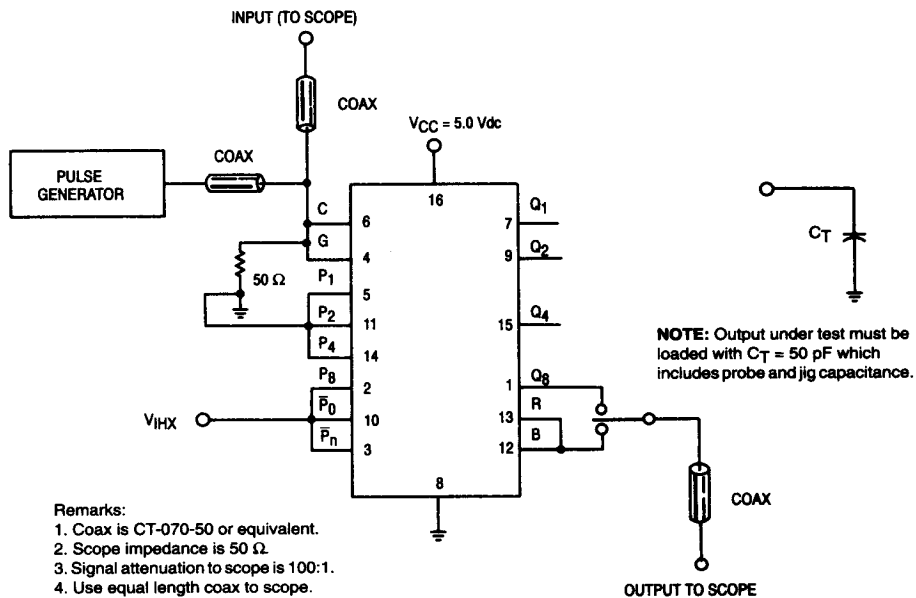
- Counter programmed for +8 operation, Pin 13 is the resistor pin, and left open.

PRF = 8.0 MHz AT 25°C
PRF = 6.5 MHz AT -55°C AND 125°C

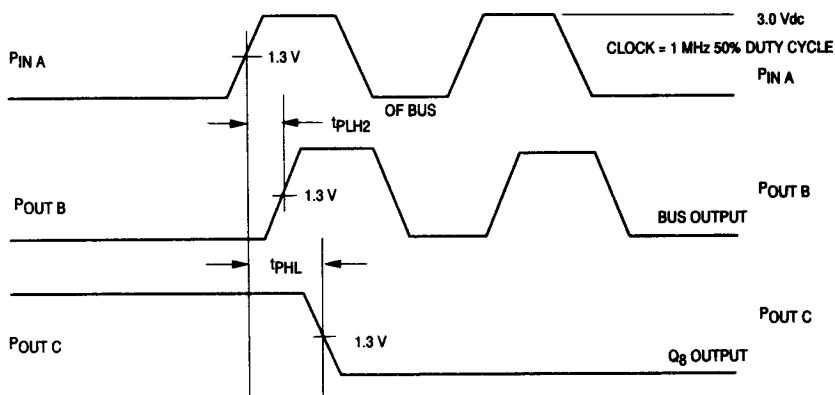


54LS716

SWITCHING CIRCUIT AND WAVEFORMS



PULSE GENERATOR REQUIREMENTS:
 $V_{GEN} = 3.0$ Vdc, $t_+ = t_- \leq 6.0$ ns, PRR = 1 MHz,
 Duty Cycle = 50%.

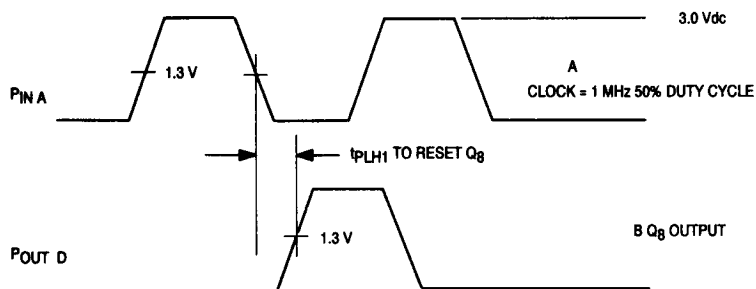


MOTOROLA MILITARY FAST/LS/TTL DATA

5-426

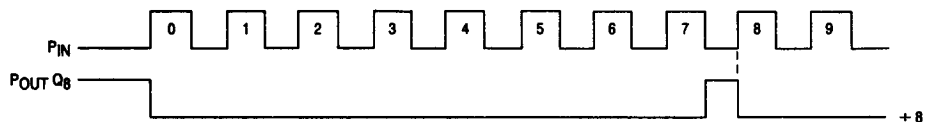
54LS716

SWITCHING CIRCUIT WAVEFORM



NOTE:

Check output waveform as shown below prior to measuring propagation delay.



54LS716

Symbol	Parameter	Limits						Unit	Test Condition (Unless Otherwise Specified)
	Static Parameters:	+ 25°C		+ 125°C		– 55°C			
		Subgroup 1		Subgroup 2		Subgroup 3			
		Min	Max	Min	Max	Min	Max		
V _{OH}	Logical "1" Output Voltage	2.4		2.4		2.4		V	V _{CC} = 4.5 V, I _{OH} = – 1.0 mA, V _{IH} = 2.0 V, V _{IL} = 0.7 V, other inputs are open.
V _{OL}	Logical "0" Output Voltage		0.4		0.4		0.4	V	V _{CC} = 4.5 V, I _{OL} = 12 mA, V _{IL} = 0.7 V, V _{IH} = 2.0 V, other inputs are open.
V _{IC}	Input Clamping Voltage		–1.5					V	V _{CC} = 4.5 V, I _{IN} = – 18 mA, other inputs are open.
I _{IH1}	Logical "1" Input Current		20		20		20	μA	V _{CC} = 5.5 V, V _{IH} = 2.7 V, other inputs are open.
I _{IHH1}	Logical "1" Input Current		100		100		100	μA	V _{CC} = 5.5 V, V _{IHH} = 5.5 V, other inputs are open.
I _{IH2}	Logical "1" Input Current		40		40		40	μA	V _{CC} = 5.5 V, V _{IH} (PE) = 2.7 V, other inputs are open, Gate = GND.
I _{IHH2}	Logical "1" Input Current		200		200		200	μA	V _{CC} = 5.5 V, V _{IHH} (PE) = 5.5 V, other inputs are open, Gate = GND.
I _{IH3}	Logical "1" Input Current		80		80		80	μA	V _{CC} = 5.5 V, V _{IH} ($\overline{\text{MR}}$) = 2.7 V, other inputs are open, D ₀ -D ₃ = GND.
I _{IHH3}	Logical "1" Input Current		400		400		400	μA	V _{CC} = 5.5 V, V _{IHH} ($\overline{\text{MR}}$) = 5.5 V, other inputs are open, D ₀ -D ₃ = GND.
I _{IL}	Logical "0" Input Current		–0.4		–0.4		–0.4	mA	V _{CC} = 5.5 V, V _{IL} = 0.4 V, other inputs are open.
I _{IL}	Logical "0" Input Current		–0.8		–0.8		–0.8	μA	V _{CC} = 5.5 V, V _{IL} (PE) = 0.4 V, other inputs are open, $\overline{\text{MR}}$ = 2.7 V.
I _{IL}	Logical "0" Input Current		–1.6		–1.6		–1.6	μA	V _{CC} = 5.5 V, V _{IL} ($\overline{\text{MR}}$) = 0.4 V, other inputs are open, D ₀ -D ₃ = 2.7 V.
I _{OS}	Output Short Circuit Current	–30	–130	–30	–130	–30	–130	mA	V _{CC} = 5.5 V, V _{IN} = 2.7 V, other inputs are open, PE = 0.7 V, V _{OUT} = GND.
I _{CC}	Power Supply Current Off		32		32		32	mA	V _{CC} = 5.5 V, V _{IN} = GND, other inputs are open.
V _{IH}	Logical "1" Input Voltage	2.0		2.0		2.0		V	V _{CC} = 4.5 V.
V _{IL}	Logical "0" Input Voltage		0.7		0.7		0.7	V	V _{CC} = 4.5 V.
	Functional Tests	Subgroup 7		Subgroup 8A		Subgroup 8B			per Truth Table with V _{CC} = 4.5 V, (Repeat at) V _{CC} = 5.5 V, V _{INL} = 0.4 V, and V _{INH} = 2.4 V.

54LS716

Symbol	Parameter	Limits						Unit	Test Condition (Unless Otherwise Specified)
	Switching Parameters:	+ 25°C		+ 125°C		– 55°C			
		Subgroup 9		Subgroup 10		Subgroup 11			
		Min	Max	Min	Max	Min	Max		
t _{PHL1} t _{PHL1}	Propagation Delay Clock to Q _n		78 45		90 85		90 85	ns	V _{CC} = 5.0 V, C _T = 50 pF, R _L = 50 Ω. V _{CC} = 5.0 V, C _T = 15 pF
t _{PLH1} t _{PLH1}	Propagation Delay Gate to Q _n		35 35		50 44		50 44	ns	V _{CC} = 5.0 V, C _T = 50 pF, R _L = 50 Ω. V _{CC} = 5.0 V, C _T = 15 pF.
t _{PHL2} t _{PHL2}	Propagation Delay Clock to Bus		80 65		95 90		95 90	ns	V _{CC} = 5.0 V, C _T = 50 pF, R _L = 50 Ω. V _{CC} = 5.0 V, C _T = 15 pF.
f _{tog} f _{tog}	Toggle Frequency	8.0 8.0		6.5 —		6.5 —		MHz	V _{CC} = 5.0 V, C _T = 50 pF, R _L = 50 Ω. V _{CC} = 5.0 V, C _T = 15 pF.

NOTE:

NOTE:

1. The limits specified for C_T = 15 pF is guaranteed but not tested.