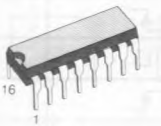
SGS-THOMSON MICROELECTRONICS

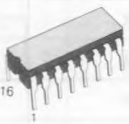
M54/74HC4518
M54/74HC4520

HC4518 DUAL DECADE COUNTER
HC4520 DUAL 4 BIT BINARY COUNTER

- LOW POWER DISSIPATION
  I_{CC} = 4 μA (MAX.) at T_A = 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} = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  t_{PLH} = t_{PHL}
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE
  WITH 4520B/4518B



B1N
Plastic Package



F1
Ceramic Frit Seal Package

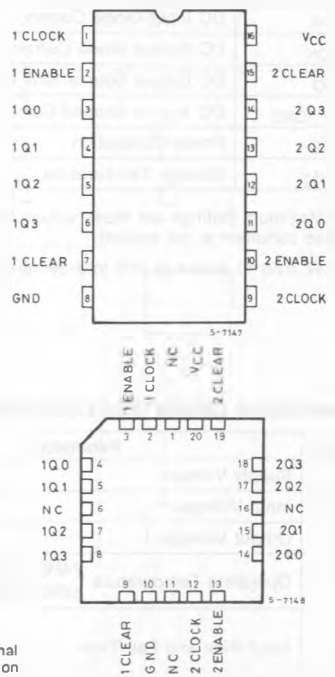
M1
Micro Package

C1
Plastic Chip Carrier

ORDERING NUMBERS:

M54HCXXXX F1
M74HCXXXX B1N
M74HCXXXX F1
M74HCXXXX C1
M74HCXXXX M1

PIN CONNECTIONS (top view)



NC =
No Internal
Connection

DESCRIPTION

The M54/74HC4518/4520 are a high speed CMOS DUAL 4 BIT BINARY COUNTERS fabricated in silicon gate C²MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption.
They consists of two identical internally synchronous 4-stage counters. The counter stages are D-type flip-flops having interchangeable Clock and ENABLE inputs for incrementing on either the positive-going or negative-going transition.
For single-unit operation the ENABLE input is maintained «high» and the counter advances on each positive-going transition of the CLOCK. The counters are cleared by high levels on their clear lines. The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the clock input of the latter is held permanently low.
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

TRUTH TABLE

INPUTS			FUNCTION
CLOCK	ENABLE	CLEAR	
↑	H	L	INCREMENT COUNTER
L	↓	L	INCREMENT COUNTER
↓	X	L	NO CHANGE
X	↑	L	NO CHANGE
↑	L	L	NO CHANGE
H	↓	L	NO CHANGE
X	X	H	Q0 THRU Q3 = L

X: DON'T CARE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	−0.5 to 7	V
V_I	DC Input Voltage	−0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	−0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500 (*)	mW
T_{stg}	Storage Temperature	−65 to 150	°C

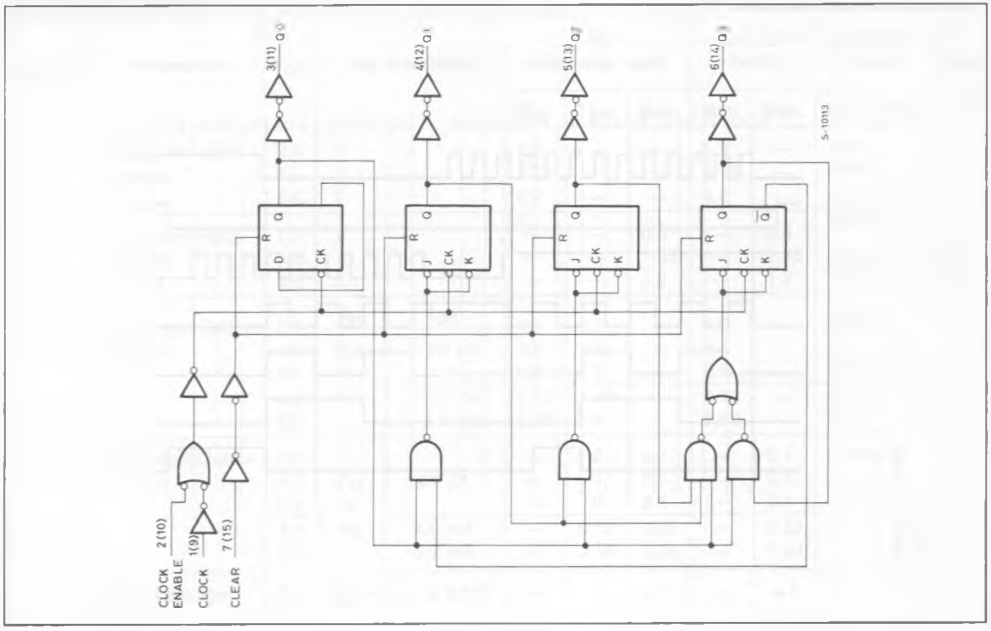
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: ≅ 65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C

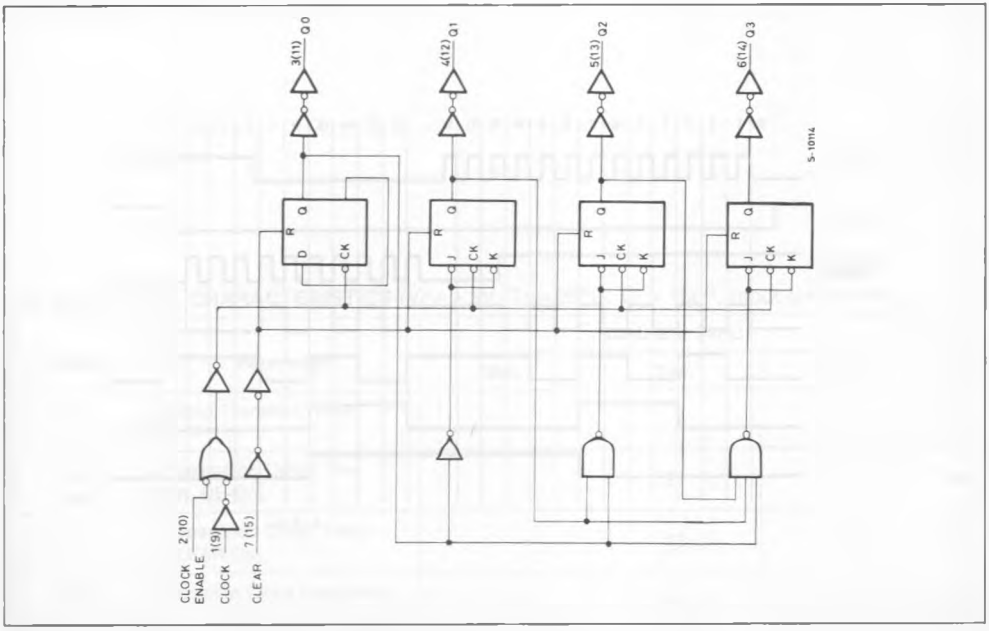
RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value		Unit
V_{CC}	Supply Voltage	2 to 6		V
V_I	Input Voltage	0 to V_{CC}		V
V_O	Output Voltage	0 to V_{CC}		V
T_A	Operating Temperature 74HC Series 54HC Series	− 40 to 85 −55 to 125		°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2 V	0 to 1000	ns
		V_{CC} = 4.5V	0 to 500	
		V_{CC} = 6 V	0 to 400	

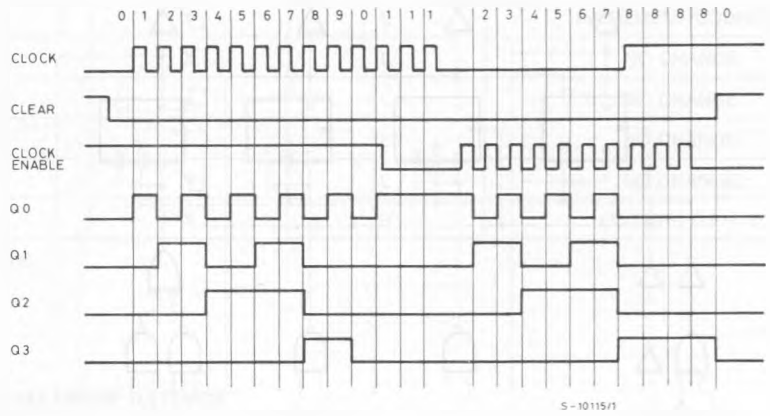
LOGIC DIAGRAM (1/2 HC4518)



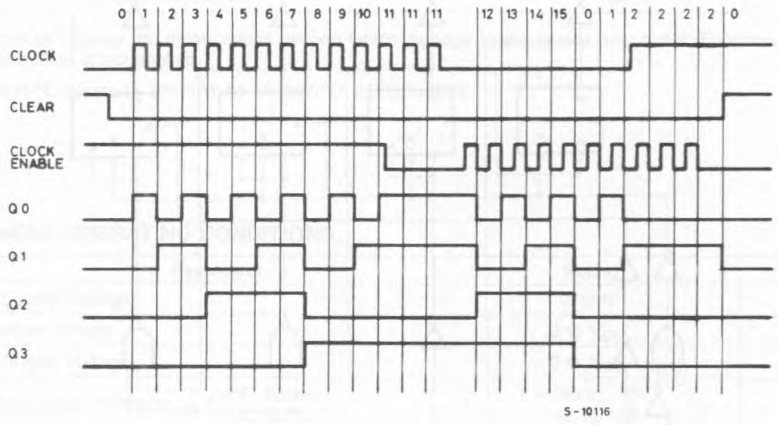
LOGIC DIAGRAM (1/2 HC4520)



TIMING CHART (HC4518)



TIMING CHART (HC4520)



DC SPECIFICATIONS

Symbol	Parameter	V_{CC}	Test Condition		$T_A = 25°C$ 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0 4.5 6.0			1.5 3.15 4.2	— — —	— — —	1.5 3.15 4.2	— — —	1.5 3.15 4.2	— — —	V
V_{IL}	Low Level Input Voltage	2.0 4.5 6.0			— — —	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	V
V_{OH}	High Level Output Voltage	2.0 4.5 6.0	V_{IN} V_{IH} or	I_{OH} −20 μA	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	— — —	1.9 4.4 5.9	— — —	V
		4.5 6.0	V_{IL}	−4.0 mA −5.2 mA	4.18 5.68	4.31 5.8	— —	4.13 5.63	— —	4.10 5.60	— —	
V_{OL}	Low Level Output Voltage	2.0 4.5 6.0	V_{IH} or	20 μA	— — —	0 0 0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
		4.5 6.0	V_{IL}	4.0 mA 5.2 mA	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	— —	0.40 0.40	
I_{IN}	Input Leakage Current	6.0	$V_{IN} = V_{CC}$ or GND		—	—	±0.1	—	±1	—	±1	
I_{CC}	Quiescent Supply Current	6.0	$V_{IN} = V_{CC}$ or GND		—	—	4.0	—	40.0	—	80.0	

AC ELECTRICAL CHARACTERISTICS ($V_{CC} = 5V$, $T_A = 25°C$, $C_L = 15pF$, Input $t_r = t_f = 6ns$)

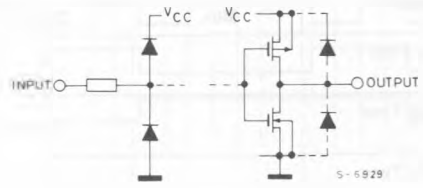
Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t_{TLH} t_{THL}	Output Transition Time		4	8	ns
t_{PLH} t_{PHL}	Propagation Delay Time (CK, CE-Qn)		21	33	ns
t_{PLH}	Propagation Delay Time (CLEAR-Qn)		23	36	ns
f_{MAX}	Maximum Clock Frequency		53	28	MHz

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

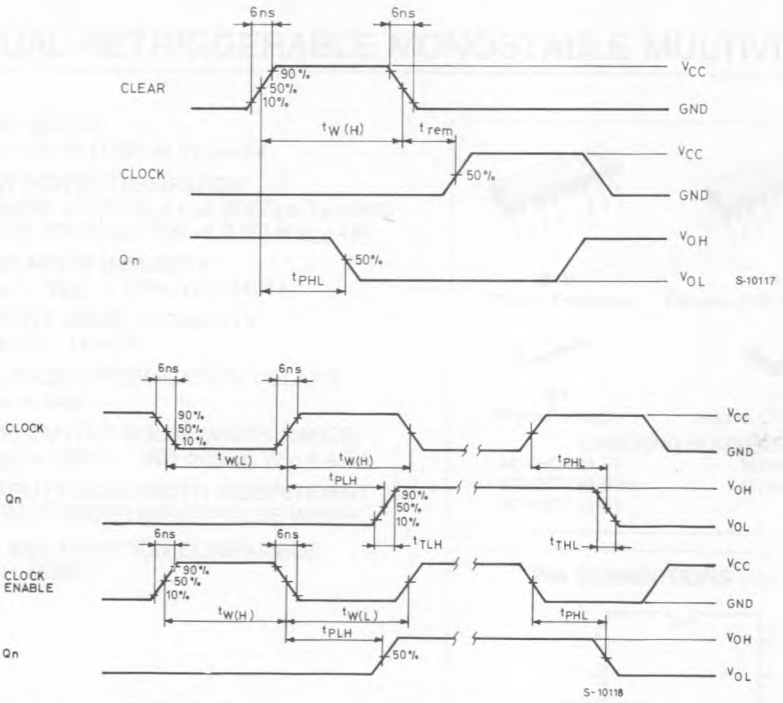
Symbol	Parameter	V_{CC}	Test Condition	T_A = 25°C 54HC and 74HC			– 40 to 85°C 74HC		– 55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} T_{THL}	Output Transition Time	2.0		—	30	75	—	95	—	110	ns
		4.5		—	8	15	—	19	—	22	
		6.0		—	7	13	—	16	—	19	
t_{PLH} t_{PHL}	Propagation Delay Time (CK, CE-Qn)	2.0		—	100	190	—	240	—	285	ns
		4.5		—	25	38	—	48	—	57	
		6.0		—	21	32	—	41	—	48	
t_{PHL}	Propagation Delay Time (CLEAR-Qn)	2.0		—	104	205	—	255	—	310	ns
		4.5		—	26	41	—	51	—	62	
		6.0		—	22	35	—	43	—	53	
f_{MAX}	Maximum Clock Frequency	2.0		5	12	—	4	—	3	—	MHz
		4.5		25	48	—	20	—	17	—	
		6.0		29	56	—	24	—	20	—	
$t_{W(H)}$ $t_{W(L)}$	Minimum Clock Pulse Width (CK, CE)	2.0		—	30	75	—	95	—	110	ns
		4.5		—	8	15	—	19	—	22	
		6.0		—	7	13	—	16	—	19	
$t_{W(H)}$	Minimum Pulse Width (CLEAR)	2.0		—	35	100	—	125	—	150	ns
		4.5		—	9	20	—	25	—	30	
		6.0		—	8	17	—	21	—	26	
t_{REM}	Minimum Removal Time (CLEAR)	2.0		—	—	0	—	0	—	0	ns
		4.5		—	—	0	—	0	—	0	
		6.0		—	—	0	—	0	—	0	
C_{IN}	Input Capacitance			—	5	10	—	10	—	10	pF
C_{PD} (*)	Power Dissipation Capacitance		HC4518	—	145	—	—	—	—	—	pF
			HC4520	—	145	—	—	—	—	—	

Note (*) 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 from the equation: $I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$ (per circuit)

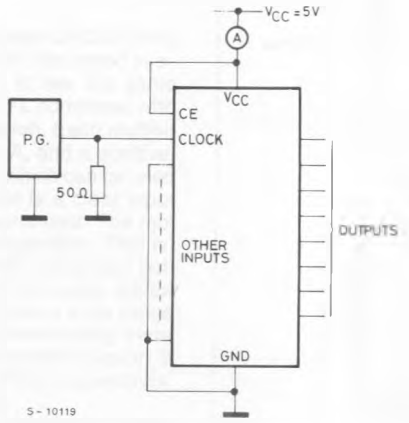
INPUT AND OUTPUT EQUIVALENT CIRCUIT



SWITCHING CHARACTERISTICS TEST WAVEFORMS



TEST CIRCUIT I_{CC} (Opr.)



INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TESTS