

CD4518BM/CD4518BC, CD4520BM/CD4520BC

Dual Synchronous Up Counters

General Description

The CD4518BM/CD4518BC dual BCD counter and the CD4520BM/CD4520BC dual binary counter are implemented with complementary MOS (CMOS) circuits constructed with N- and P-channel enhancement mode transistors.

Each counter consists of two identical, independent, synchronous, 4-stage counters. The counter stages are toggle flip-flops which increment on either the positive-edge of CLOCK or negative-edge of ENABLE, simplifying cascading of multiple stages. Each counter can be asynchronously cleared by a high level on the RESET

line. All inputs are protected against static discharge by diode clamps to both V_{DD} and V_{SS} .

Features

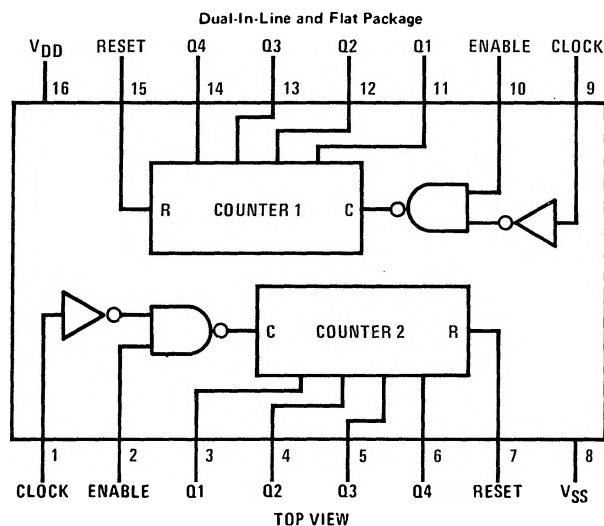
- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45 V_{DD} (typ.)
- Low power TTL compatibility fan out of 2 driving 74L or 1 driving 74LS
- 6MHz counting rate (typ.) at $V_{DD} = 10V$

Truth Table

CLOCK	ENABLE	RESET	ACTION
	1	0	Increment counter
0		0	Increment counter
	X	0	No change
X		0	No change
	0	0	No change
1		0	No change
X	X	1	Q1 thru Q4 = 0

X = Don't Care

Connection Diagram



Absolute Maximum Ratings

(Notes 1 and 2)

V_{DD} Supply Voltage	-0.5V to +18V
V_{IN} Input Voltage	-0.5V to $V_{DD} + 0.5V$
T_S Storage Temperature Range	-65°C to +150°C
P_D Package Dissipation	500 mW
T_L Lead Temperature (Soldering, 10 seconds)	300°C

Recommended Operating Conditions

(Note 2)

V_{DD} Supply Voltage	3V to 15V
V_{IN} Input Voltage	0V to V_{DD}
T_A Operating Temperature Range	-55°C to +125°C
CD4518BM, CD4520BM	-55°C to +125°C
CD4518BC, CD4520BC	-40°C to +85°C

DC Electrical Characteristics CD4518BM/CD4520BM (Note 2)

PARAMETER	CONDITIONS	-55°C		25°C			125°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		5		0.01	5		150	μA
	$V_{DD} = 10V$		10		0.01	10		300	μA
	$V_{DD} = 15V$		20		0.01	20		600	μA
V_{OL} Low Level Output Voltage	$ I_{OL} < 1 \mu A, V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
	$V_{DD} = 15V$		0.05		0	0.05		0.05	V
V_{OH} High Level Output Voltage	$ I_{OL} < 1 \mu A, V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V$	4.95		4.95	5		4.95		V
	$V_{DD} = 10V$	9.95		9.95	10		9.95		V
	$V_{DD} = 15V$	14.95		14.95	15		14.95		V
V_{IL} Low Level Input Voltage	$ I_{OI} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$		1.5		2.25	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1V \text{ or } 9V$		3.0		4.5	3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$		4.0		6.75	4.0		4.0	V
V_{IH} High Level Input Voltage	$ I_{OI} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$	3.5		3.5	2.75		3.5		V
	$V_{DD} = 10V, V_O = 1V \text{ or } 9V$	7.0		7.0	5.5		7.0		V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$	11.0		11.0	8.25		11.0		V
I_{OL} Low Level Output Current	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 0.4V$	0.64		0.51	0.88		0.36		mA
	$V_{DD} = 10V, V_O = 0.5V$	1.6		1.3	2.25		0.9		mA
	$V_{DD} = 15V, V_O = 1.5V$	4.2		3.4	8.8		2.4		mA
I_{OH} High Level Output Current	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 4.6V$	-0.64		-0.51	-0.88		-0.36		mA
	$V_{DD} = 10V, V_O = 9.5V$	-1.6		-1.3	-2.25		-0.9		mA
	$V_{DD} = 15V, V_O = 13.5V$	-4.2		-3.4	-8.8		-2.4		mA
I_{IN} Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.1		-10^{-5}	-0.1		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.1		10^{-5}	0.1		1.0	μA

DC Electrical Characteristics CD4518BC/CD4520BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		20		0.01	20		150	μA
	$V_{DD} = 10V$		40		0.01	40		300	μA
	$V_{DD} = 15V$		80		0.01	80		600	μA
V_{OL} Low Level Output Voltage	$ I_{OL} < 1 \mu A, V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
	$V_{DD} = 15V$		0.05		0	0.05		0.05	V
V_{OH} High Level Output Voltage	$ I_{OL} < 1 \mu A, V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V$	4.95		4.95	5		4.95		V
	$V_{DD} = 10V$	9.95		9.95	10		9.95		V
	$V_{DD} = 15V$	14.95		14.95	15		14.95		V

DC Electrical Characteristics (Cont'd.) CD4518BC/CD4520BC (Note 2)

PARAMETER	CONDITIONS	-40 °C		25 °C			85 °C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
V_{IL} Low Level Input Voltage	$ I_{O1} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$		1.5		2.25	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1V \text{ or } 9V$		3.0		4.5	3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$		4.0		6.75	4.0		4.0	V
V_{IH} High Level Input Voltage	$ I_{O1} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$	3.5		3.5	2.75		3.5		V
	$V_{DD} = 10V, V_O = 1V \text{ or } 9V$	7.0		7.0	5.5		7.0		V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$	11.0		11.0	8.25		11.0		V
I_{OL} Low Level Output Current	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 0.4V$	0.52		0.44	0.88		0.36		mA
	$V_{DD} = 10V, V_O = 0.5V$	1.3		1.1	2.25		0.9		mA
	$V_{DD} = 15V, V_O = 1.5V$	3.6		3.0	8.8		2.4		mA
I_{OH} High Level Output Current	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 4.6V$	-0.52		-0.44	-0.88		-0.36		mA
	$V_{DD} = 10V, V_O = 9.5V$	-1.3		-1.1	-2.25		-0.9		mA
	$V_{DD} = 15V, V_O = 13.5V$	-3.6		-3.0	-8.8		-2.4		mA
I_{IN} Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.3		-10^{-5}	-0.3		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.3		10^{-5}	0.3		1.0	μA

AC Electrical Characteristics $T_A = 25^\circ C$, $C_L = 50 \text{ pF}$, $R_L = 200 \text{ k}\Omega$, $t_r = t_f = 20 \text{ ns}$, unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL}, t_{PLH} Propagation Delay Time, Clock $\rightarrow$ Q	$V_{DD} = 5V$		325	650	ns
	$V_{DD} = 10V$		110	225	ns
	$V_{DD} = 15V$		85	170	ns
t_{PHL} Propagation Delay Time Reset $\rightarrow$ Q	$V_{DD} = 5V$		220	560	ns
	$V_{DD} = 10V$		90	230	ns
	$V_{DD} = 15V$		65	160	ns
t_{THL}, t_{TLH} Transition Time	$V_{DD} = 5V$		100	200	ns
	$V_{DD} = 10V$		50	100	ns
	$V_{DD} = 15V$		40	80	ns
f_{CL} Maximum Clock Input Frequency	$V_{DD} = 5V$	1.5	3		MHz
	$V_{DD} = 10V$	3.0	6		MHz
	$V_{DD} = 15V$	4.0	8		MHz
t_{WL}, t_{WH} Minimum Clock Pulse Width	$V_{DD} = 5V$		100	200	ns
	$V_{DD} = 10V$		50	100	ns
	$V_{DD} = 15V$		35	70	ns
t_{RCL}, t_{FC} Maximum Clock or Enable Rise and Fall Time	$V_{DD} = 5V$	15			μs
	$V_{DD} = 10V$	10			μs
	$V_{DD} = 15V$	5			μs
t_{WH}, t_{WL} Minimum Enable Pulse Width	$V_{DD} = 5V$		125	250	ns
	$V_{DD} = 10V$		55	110	ns
	$V_{DD} = 15V$		40	80	ns
t_{WH} Minimum Reset Pulse Width	$V_{DD} = 5V$		180	375	ns
	$V_{DD} = 10V$		80	160	ns
	$V_{DD} = 15V$		65	130	ns
C_{IN} Input Capacitance	Any Input		5	7.5	pF
C_{PD} Power Dissipation Capacity	Either Counter, (Note 3)		50		pF

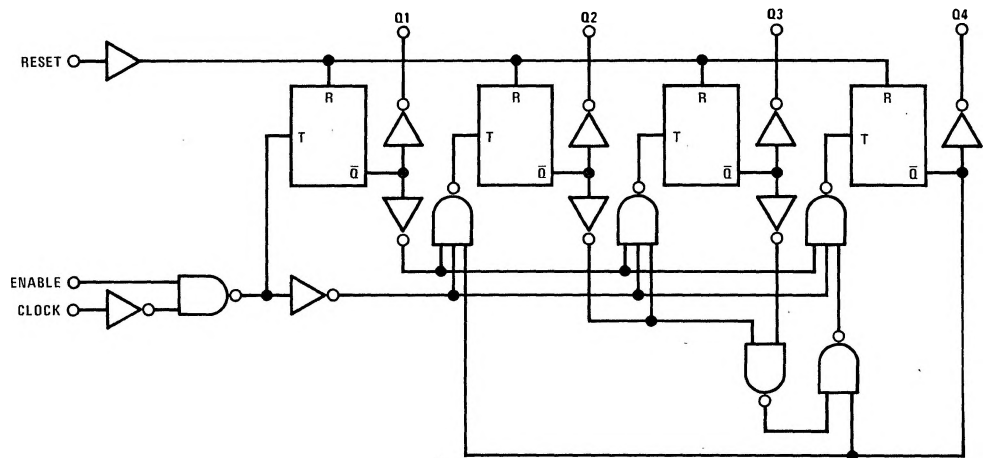
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

Note 2: $V_{SS} = 0V$ unless otherwise specified.

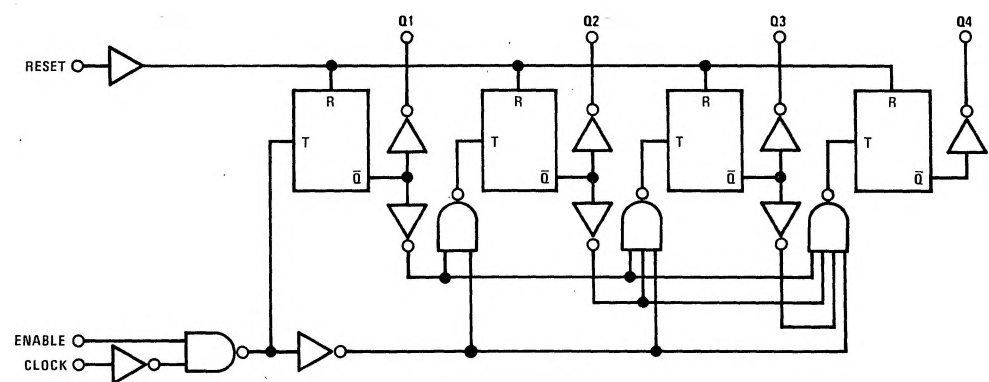
Note 3: C_{PD} determines the no load ac power consumption of a CMOS device. For a complete explanation, see "54C/74C Family Characteristics," application note AN-90.

Logic Diagrams

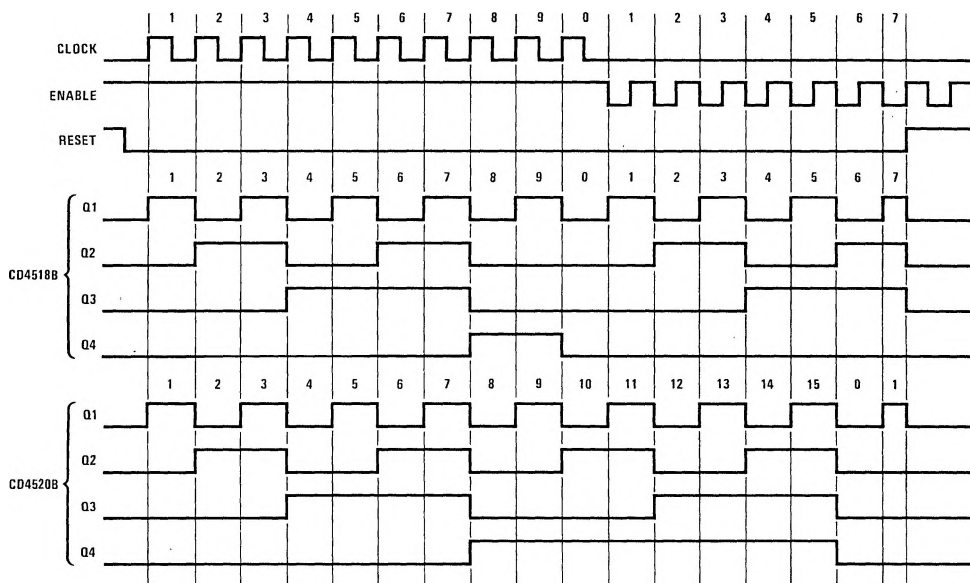
Decade Counter (CD4518B) 1/2 Device Shown



Binary Counter (CD4520B) 1/2 Device Shown



Timing Diagrams



Switching Time Waveforms

