National Semiconductor

CD4528BM/CD4528BC Dual Monostable Multivibrator

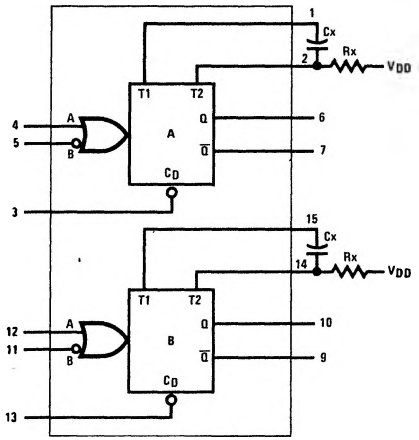
General Description

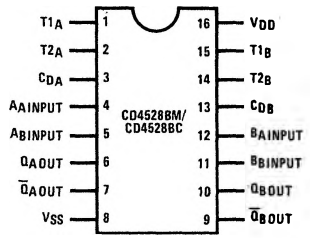
The CD4528B is a dual monostable multivibrator. Each device is retriggerable and resettable. Triggering can occur from either the rising or falling edge of an input pulse, resulting in an output pulse over a wide range of widths. Pulse duration and accuracy are determined by external timing components R_X and C_X.

Features

- Wide supply voltage range 3.0V to 18V
- Separate reset available
- Quiescent current = 5.0 nA/package (typ.) at 5.0 V_{DC}
- Diode protection on all inputs
- Triggerable from leading or trailing edge pulse
- Capable of driving two low-power TTL loads or one low-power Schottky TTL load over the rated temperature range

Connection Diagrams





Truth Tables

Inputs			Outputs	
Clear	A	B	Q	Q
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↓	⎍	⎎
H	↑	H	⎍	⎎

H = High Level
L = Low Level
↑ = Transition from Low to High
↓ = Transition from High to Low
⎍ = One High Level Pulse
⎎ = One Low Level Pulse
X = Irrelevant

Absolute Maximum Ratings (Notes 1 and 2)

V_{DD}, DC Supply Voltage −0.5VDC to +18VDC
V_{IN}, Input Voltage, All Inputs −0.5VDC to V_{DD} +0.5VDC
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}, DC Supply Voltage 3V to 15V
V_{IN}, Input Voltage 0V to V_{DD} V_{DC}
T_A, Operating Temperature Range
CD4528BM −55°C to +125°C
CD4528BC −40°C to +85°C

DC Electrical Characteristics CD4528BM (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	0.005		5		150	μA
	V_{DD} = 10V		10	0.010		10		300	μA
	V_{DD} = 15V		20	0.015		20		600	μA
V_{OL} Low Level Output Voltage	V_{DD} = 5V		0.05			0.05		0.05	V
	V_{DD} = 10V		0.05			0.05		0.05	V
	V_{DD} = 15V		0.05			0.05		0.05	V
V_{OH} High Level Output Voltage	V_{DD} = 5V	4.95		4.95	5.0		4.95		V
	V_{DD} = 10V	9.95		9.95	10.0		9.95		V
	V_{DD} = 15V	14.95		14.95	15.0		14.95		V
V_{IL} Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
	V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
	V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V_{IH} High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	2.75		3.5		V
	V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
	V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I_{OL} Low Level Output Current	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_{DD} = 5V, V_O = 4.6V	−0.25		−0.2	−0.36		−0.14		mA
	V_{DD} = 10V, V_O = 9.5V	−0.62		−0.5	−0.9		−0.35		mA
	V_{DD} = 15V, V_O = 13.5V	−1.8		−1.5	−3.5		−1.1		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 CD4528BC (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		0.005	20		150	μA
	V_{DD} = 10V		40		0.010	40		300	μA
	V_{DD} = 15V		80		0.015	80		600	μA
V_{OL} Low Level Output Voltage	V_{DD} = 5V		0.05			0.05		0.05	V
	V_{DD} = 10V		0.05			0.05		0.05	V
	V_{DD} = 15V		0.05			0.05		0.05	V
V_{OH} High Level Output Voltage	V_{DD} = 5V	4.95		4.95	5.0		4.95		V
	V_{DD} = 10V	9.95		9.95	10.0		9.95		V
	V_{DD} = 15V	14.95		14.95	15.0		14.95		V
V_{IL} Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
	V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
	V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V_{IH} High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	2.75		3.5		V
	V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
	V_{DD} = 15V, V_O = 0.5V or 4.5V	11.0		11.0	8.25		11.0		V
I_{OL} Low Level Output Current	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_{DD} = 5V, V_O = 4.6V	−0.2		−0.16	−0.36		−0.12		mA
	V_{DD} = 10V, V_O = 9.5V	−0.5		−0.4	−0.9		−0.3		mA
	V_{DD} = 15V, V_O = 13.5V	−1.4		−1.2	−3.5		−1.0		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

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

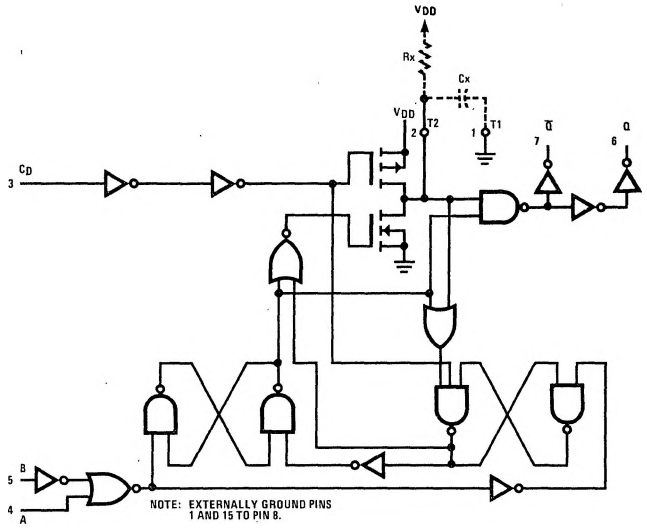
Note 2: V_{SS} = 0V unless otherwise specified.

AC Electrical Characteristics CD4528BM

$T_A = 25°C$, $C_L = 50\,pF$, $R_L = 200\,k\Omega$, Input $t_r = t_f = 20\,ns$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Units
Output Rise Time	$t_r = (3.0\,ns/pF)C_L + 30\,ns$, $V_{DD} = 5.0V$		180	400	ns
	$t_r = (1.5\,ns/pF)C_L + 15\,ns$, $V_{DD} = 10.0V$		90	200	ns
	$t_r = (1.1\,ns/pF)C_L + 10\,ns$, $V_{DD} = 15.0V$		65	160	ns
Output Fall Time	$t_f = (1.5\,ns/pF)C_L + 25\,ns$, $V_{DD} = 5.0V$		100	200	ns
	$t_f = (0.75\,ns/pF)C_L + 12.5\,ns$, $V_{DD} = 10.0V$		50	100	ns
	$t_f = (0.55\,ns/pF)C_L + 9.5\,ns$, $V_{DD} = 15.0V$		35	80	ns
Turn-Off, Turn-On Delay A or B to Q or $\overline{Q}$ Cx = 15 pF, Rx = 5.0 kΩ	$t_{PLH}, t_{PHL} = (1.7\,ns/pF)C_L + 240\,ns$, $V_{DD} = 5.0V$		230	500	ns
	$t_{PLH}, t_{PHL} = (0.66\,ns/pF)C_L + 8\,ns$, $V_{DD} = 10.0V$		100	250	ns
	$t_{PLH}, t_{PHL} = (0.5\,ns/pF)C_L + 65\,ns$, $V_{DD} = 15.0V$		65	150	ns
Turn-Off, Turn-On Delay A or B to Q or $\overline{Q}$ Cx = 100 pF, Rx = 10 kΩ	$t_{PLH}, t_{PHL} = 1.7\,ns/pF)C_L + 620\,ns$, $V_{DD} = 5.0V$		230	500	ns
	$t_{PLH}, t_{PHL} = 0.66\,ns/pF)C_L + 257\,ns$, $V_{DD} = 10.0V$		100	250	ns
	$t_{PLH}, t_{PHL} = (0.5\,ns/pF)C_L + 185\,ns$, $V_{DD} = 15.0V$		65	150	ns
Minimum Input Pulse Width A or B Cx = 15 pF, Rx = 5.0 kΩ	$V_{DD} = 5.0V$		60	150	ns
	$V_{DD} = 10.0V$		20	50	ns
	$V_{DD} = 15.0V$		20	50	ns
Cx = 1000 pF, Rx = 10 kΩ	$V_{DD} = 5.0V$		60	150	ns
	$V_{DD} = 10.0V$		20	50	ns
	$V_{DD} = 15.0V$		20	50	ns
Output Pulse Width Q or $\overline{Q}$ For Cx < 0.01 μF (see graph for appropriate V_{DD} level) Cx = 15 pF, Rx = 5.0 kΩ	$V_{DD} = 5.0V$		550		ns
	$V_{DD} = 10.0V$		350		ns
	$V_{DD} = 15.0V$		300		ns
For Cx > 0.01 μF use $PW_{out} = 0.2RxCx\ ln[V_{DD} - V_{SS}]$ Cx = 10,000 pF, Rx = 10 kΩ	$V_{DD} = 5.0V$	15	29	45	μs
	$V_{DD} = 10.0V$	10	37	90	μs
	$V_{DD} = 15.0V$	15	42	95	μs
Pulse Width Match Between Circuits in the Same Package Cx = 10,000 pF, Rx = 10 kΩ	$V_{DD} = 5.0V$		6	25	%
	$V_{DD} = 10.0V$		8	35	%
	$V_{DD} = 15.0V$		8	35	%
Reset Propagation Delay, t_{PLH}, t_{PHL} Cx = 15 pF, Rx = 5.0 kΩ	$V_{DD} = 5.0V$		325	600	ns
	$V_{DD} = 10.0V$		90	225	ns
	$V_{DD} = 15.0V$		60	170	ns
Cx = 1000 pF, Rx = 10 kΩ	$V_{DD} = 5.0V$		7.0		μs
	$V_{DD} = 10.0V$		6.7		μs
	$V_{DD} = 15.0V$		6.7		μs
Minimum Retrigger Time Cx = 15 pF, Rx = 5.0 kΩ	$V_{DD} = 5.0V$		0		
	$V_{DD} = 10.0V$		0		
	$V_{DD} = 15.0V$		0		
Cx = 1000 pF, Rx = 10 kΩ	$V_{DD} = 5.0V$		0		
	$V_{DD} = 10.0V$		0		
	$V_{DD} = 15.0V$		0		

Logic Diagram (½ of Device Shown)



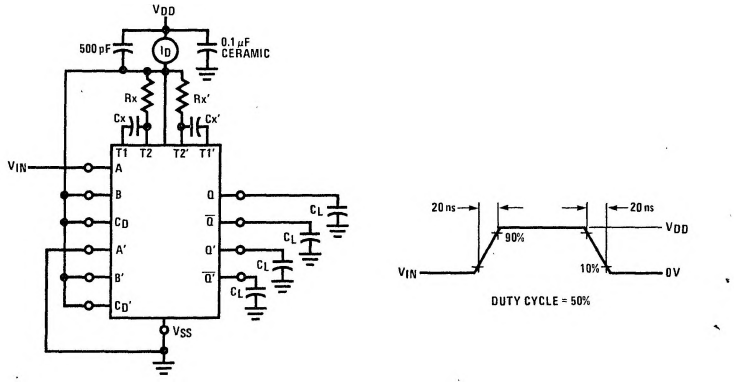
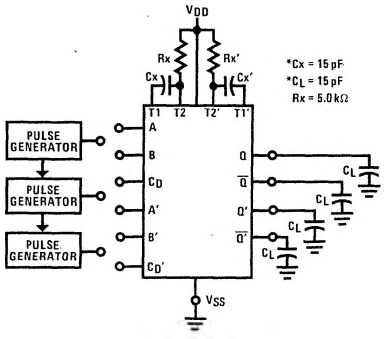


Figure 1. Power Dissipation Test Circuit and Waveforms



Input Connections

Characteristics	C_D	A	B
t_{PLH}, t_{PHL}, t_r, t_f, PW_{out}, PW_{in}	V_{DD}	PG1	V_{DD}
t_{PLH}, t_{PHL}, t_r, t_f, PW_{out}, PW_{in}	V_{DD}	V_{SS}	PG2
$t_{PLH(R)}$, $t_{PHL(R)}$, PW_{in}	PG3	PG1	PG2

*INCLUDES CAPACITANCE OF PROBES, WIRING, AND FIXTURE PARASITIC.

NOTE: AC TEST WAVEFORMS FOR PG1, PG2, AND PG3 ON NEXT PAGE.

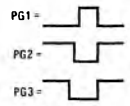


Figure 2. AC Test Circuit

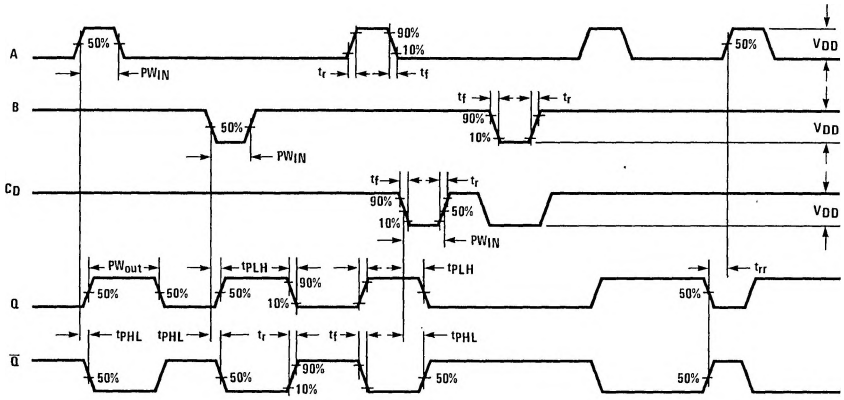


Figure 3. AC Test Waveforms

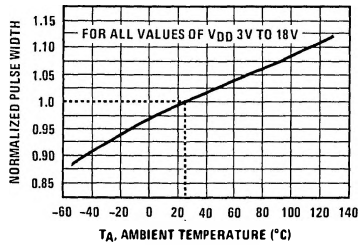


Figure 4. Normalized Pulse Width vs Temperature

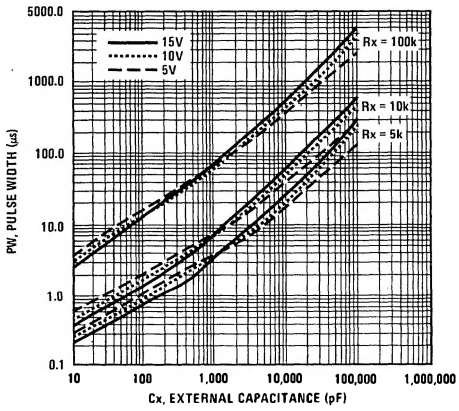


Figure 5. Pulse Width vs Cx