National Semiconductor

February 1988

CD4528BM/CD4528BC Dual Monostable Multivibrator

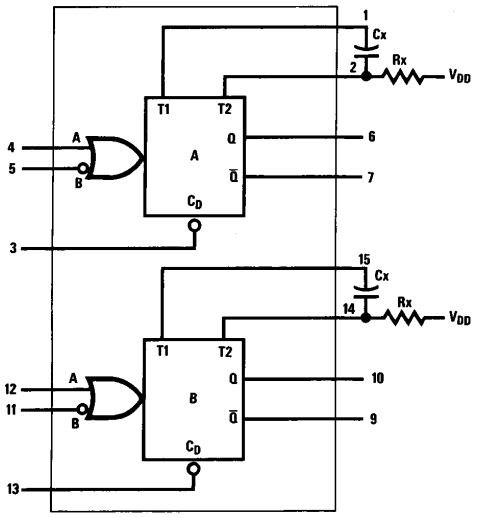
General Description

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 Rx and Cx.

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



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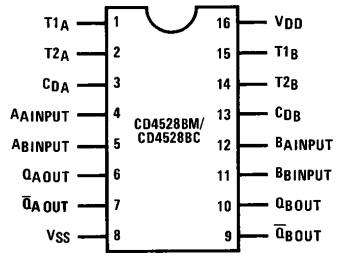
Dual-In-Line Package



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Top View

Order Number CD4528B

Truth Table

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 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

DC Supply Voltage (V_{DD})	$-0.5\ V_{DC}$ to $+18\ V_{DC}$
Input Voltage, All Inputs (V_{IN})	$-0.5\ V_{DC}$ to $V_{DD} + 0.5\ V_{DC}$
Storage Temperature Range (T_S)	$-65°C$ to $+150°C$
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature (T_L) (Soldering, 10 seconds)	260°C

Recommended Operating Conditions (Note 2)

DC Supply Voltage (V_{DD})	3V to 15V
Input Voltage (V_{IN})	0V to $V_{DD}\ V_{DC}$
Operating Temperature Range (T_A)	
CD4528BM	$-55°C$ to $+125°C$
CD4528BC	$-40°C$ to $+85°C$

DC Electrical Characteristics CD4528BM (Note 2)

Symbol	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
		$V_{DD} = 10V$, $V_O = 1V$ or 9V		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
		$V_{DD} = 10V$, $V_O = 1V$ or 9V	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 (Note 3)	$V_{DD} = 5V$, $V_O = 0.4V$	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 (Note 3)	$V_{DD} = 5V$, $V_O = 4.6V$	−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

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.

Note 3: I_{OH} and I_{OL} are tested one output at a time.

DC Electrical Characteristics CD4528BC (Note 2)

Symbol	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 = 1V or 9V		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 = 1V or 9V	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 (Note 3)	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 (Note 3)	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.

Note 3: I_{OH} and I_{OL} are tested one output at a time.

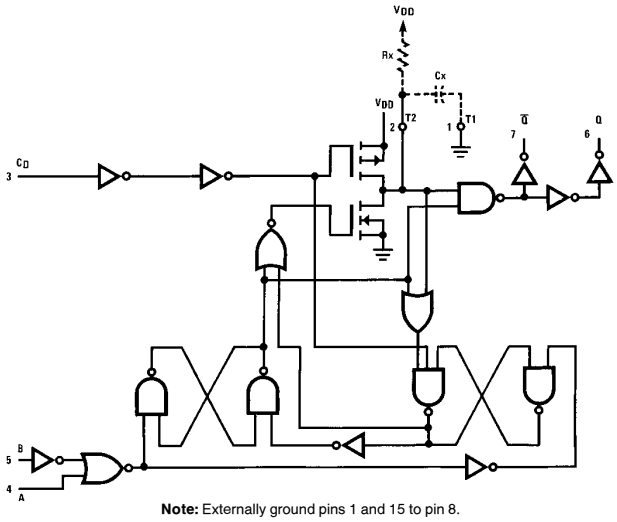
AC Electrical Characteristics* CD4528BM

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

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

*AC parameters are guaranteed by DC correlated testing.

Logic Diagrams (1/2 of Device Shown)



Note: Externally ground pins 1 and 15 to pin 8.

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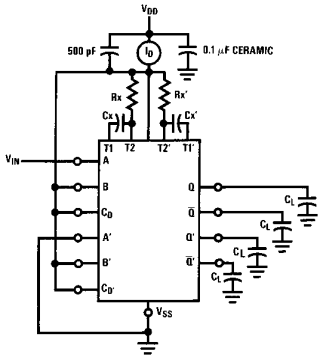
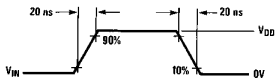


TL/F/5998–4



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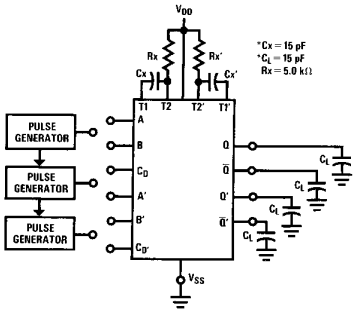
Duty Cycle = 50%

FIGURE 1. Power Dissipation Test Circuit and Waveforms



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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.

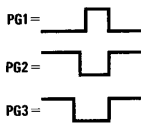

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FIGURE 2. AC Test Circuit

Logic Diagrams (½ of Device Shown) (Continued)

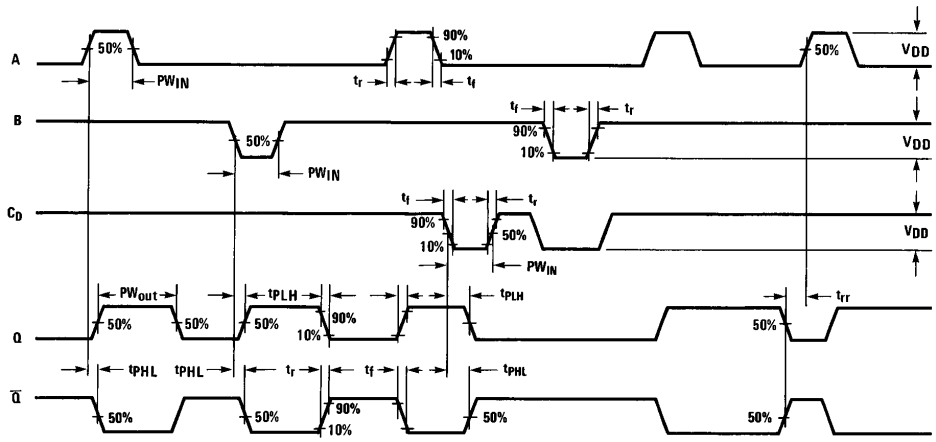

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FIGURE 3. AC Test Waveforms

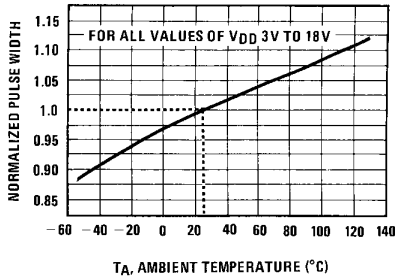

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FIGURE 4. Normalized Pulse Width vs Temperature

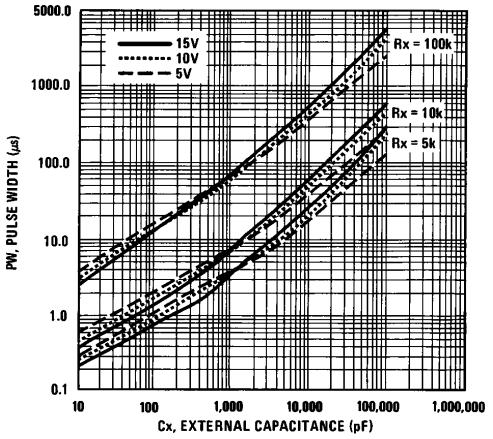

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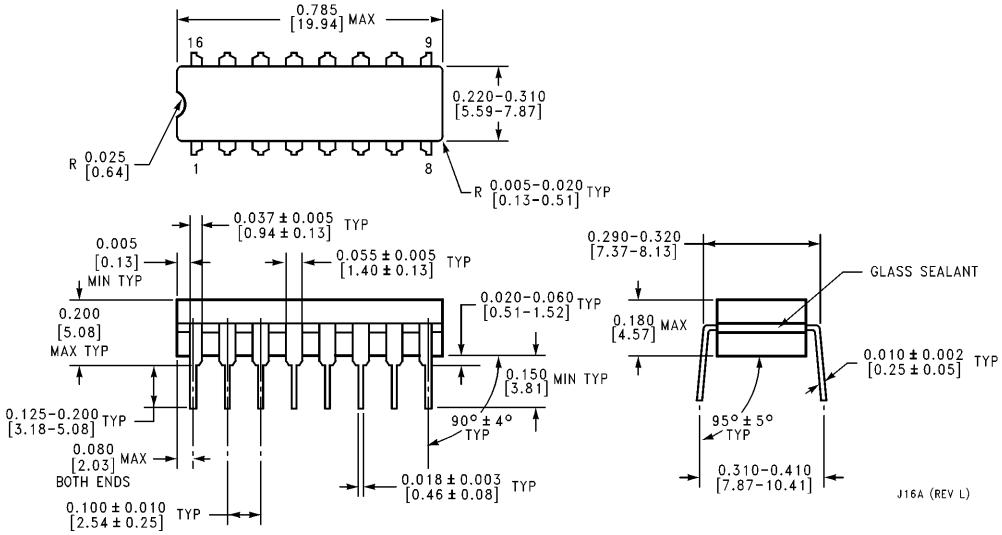
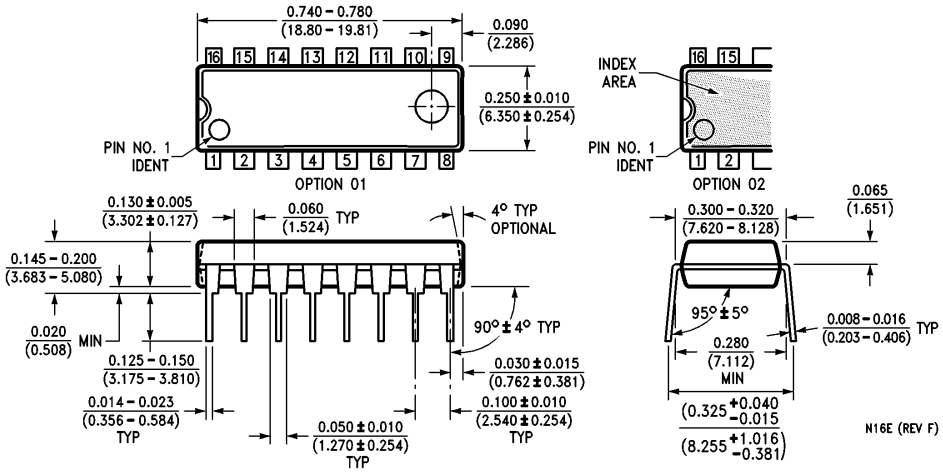
FIGURE 5. Pulse Width vs Cx

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4528BMJ or CD4528BCJ
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number CD4528BMN or CD4528BCN
NS Package Number N16E

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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