



October 1987
Revised January 1999

CD4027BC

Dual J-K Master/Slave Flip-Flop with Set and Reset

General Description

The CD4027BC dual J-K flip-flops are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. Each flip-flop has independent J, K, set, reset, and clock inputs and buffered Q and \bar{Q} outputs. These flip-flops are edge sensitive to the clock input and change state on the positive-going transition of the clock pulses. Set or reset is independent of the clock and is accomplished by a high level on the respective input.

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

Features

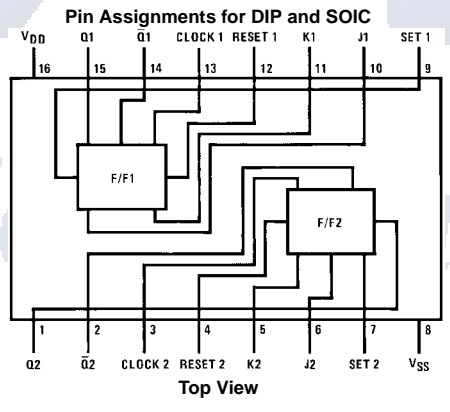
- Wide supply voltage range: 3.0V to 15V
- High noise immunity: $0.45 V_{DD}$ (typ.)
- Low power TTL compatibility: Fan out of 2 driving 74L or 1 driving 74LS
- Low power: 50 nW (typ.)
- Medium speed operation: 12 MHz (typ.) with 10V supply

Ordering Code:

Order Number	Package Number	Package Description
CD4027BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
CD4027BCN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Truth Table

CL (Note 3)	Inputs t_{n-1} (Note 1)					Outputs t_n (Note 2)	
	J	K	S	R	Q	Q	\bar{Q}
↘	1	X	0	0	0	1	0
↘	X	0	0	0	1	1	0
↘	0	X	0	0	0	0	1
↘	X	1	0	0	1	0	1
↘	X	X	0	0	X	(No Change)	(No Change)
X	X	X	1	0	X	1	0
X	X	X	0	1	X	0	1
X	X	X	1	1	X	1	1

1 = HIGH Level
0 = LOW Level
X = Don't Care
↘ = LOW-to-HIGH
↙ = HIGH-to-LOW

Note 1: t_{n-1} refers to the time interval prior to the positive clock pulse transition

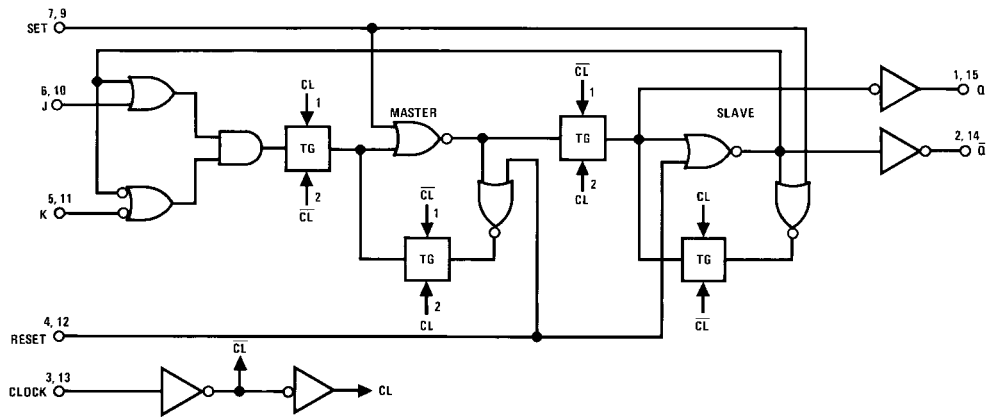
Note 2: t_n refers to the time intervals after the positive clock pulse transition

Note 3: Level Change

CD4027BC Dual J-K Master/Slave Flip-Flop with Set and Reset

CD4027BC

Logic Diagram



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CD4027BC

Absolute Maximum Ratings (Note 4)			Recommended Operating Conditions (Note 5)							
(Note 5)										
DC Supply Voltage (V_{DD})		-0.5 V_{DC} to +18 V_{DC}	DC Supply Voltage (V_{DD})			3V to 15 V_{DC}				
Input Voltage (V_{IN})		-0.5V to V_{DD} +0.5 V_{DC}	Input Voltage (V_{IN})			0V to V_{DD} V_{DC}				
Storage Temperature Range (T_S)		-65°C to +150°C	Operating Temperature Range (T_A)			-40°C to +85°C				
Power Dissipation (P_D)			Note 4: "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 table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.							
Dual-In-Line		700 mW	Note 5: $V_{SS} = 0V$ unless otherwise specified.							
Small Outline		500 mW								
Lead Temperature (T_L)										
(Soldering, 10 seconds)		260°C								
DC Electrical Characteristics (Note 6)										
Symbol	Parameter	Conditions	-40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	$V_{DD} = 5V, V_{IN} = V_{DD}$ or V_{SS}		4			4		30	μA
		$V_{DD} = 10V, V_{IN} = V_{DD}$ or V_{SS}		8			8		60	μA
		$V_{DD} = 15V, V_{IN} = V_{DD}$ or V_{SS}		16			16		120	μA
V_{OL}	LOW Level	$ I_{OL} < 1 \mu A$								
	Output Voltage	$V_{DD} = 5V$		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	$ I_{OL} < 1 \mu A$								
	Output Voltage	$V_{DD} = 5V$	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	$V_{DD} = 5V, V_O = 0.5V$ or $4.5V$		1.5			1.5		1.5	V
	Input Voltage	$V_{DD} = 10V, V_O = 1V$ or $9V$		3.0			3.0		3.0	V
		$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$		4.0			4.0		4.0	V
V_{IH}	HIGH Level	$V_{DD} = 5V, V_O = 0.5V$ or $4.5V$	3.5		3.5			3.5		V
	Input Voltage	$V_{DD} = 10V, V_O = 1V$ or $9V$	7.0		7.0			7.0		V
		$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$	11.0		11.0			11.0		V
I_{OL}	LOW Level Output Current (Note 7)	$V_{DD} = 5V, V_O = 0.4V$	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 7)	$V_{DD} = 5V, V_O = 4.6V$	-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
Note 6: $V_{SS} = 0V$ unless otherwise specified.										
Note 7: I_{OH} and I_{OL} are tested one output at a time.										

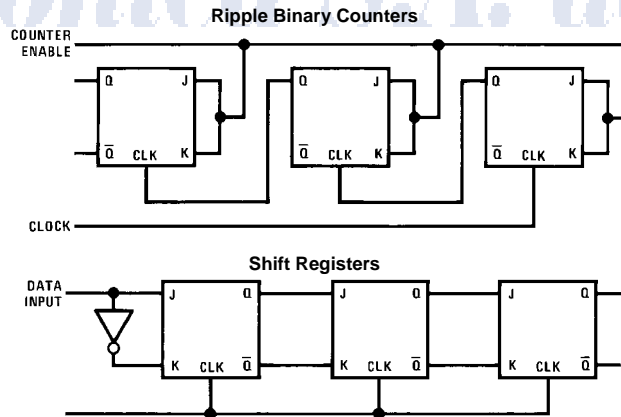
CD4027BC

AC Electrical Characteristics (Note 8)						
T _A = 25°C, C _L = 50 pF, t _{rCL} = t _{fCL} = 20 ns, unless otherwise specified						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t _{PHL} or t _{PLH}	Propagation Delay Time from Clock to Q or \bar{Q}	V _{DD} = 5V		200	400	ns
		V _{DD} = 10V		80	160	ns
		V _{DD} = 15V		65	130	ns
t _{PHL} or t _{PLH}	Propagation Delay Time from Set to \bar{Q} or Reset to Q	V _{DD} = 5V		170	340	ns
		V _{DD} = 10V		70	140	ns
		V _{DD} = 15V		55	110	ns
t _{PHL} or t _{PLH}	Propagation Delay Time from Set to Q or Reset to \bar{Q}	V _{DD} = 5V		110	220	ns
		V _{DD} = 10V		50	100	ns
		V _{DD} = 15V		40	80	ns
t _S	Minimum Data Setup Time	V _{DD} = 5V		135	270	ns
		V _{DD} = 10V		55	110	ns
		V _{DD} = 15V		45	90	ns
t _{THL} or 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 Frequency (Toggle Mode)	V _{DD} = 5V	2.5	5		MHz
		V _{DD} = 10V	6.2	12.5		MHz
		V _{DD} = 15V	7.6	15.5		MHz
t _{rCL} or t _{fCL}	Maximum Clock Rise and Fall Time	V _{DD} = 5V	15			μs
		V _{DD} = 10V	10			μs
		V _{DD} = 15V	5			μs
t _W	Minimum Clock Pulse Width (t _{WH} = t _{WL})	V _{DD} = 5V		100	200	ns
		V _{DD} = 10V		40	80	ns
		V _{DD} = 15V		32	65	ns
t _{WH}	Minimum Set and Reset Pulse Width	V _{DD} = 5V		80	160	ns
		V _{DD} = 10V		30	60	ns
		V _{DD} = 15V		25	50	ns
C _{IN}	Average Input Capacitance	Any Input		5	7.5	pF
C _{PD}	Power Dissipation Capacity	Per Flip-Flop (Note 9)		35		pF

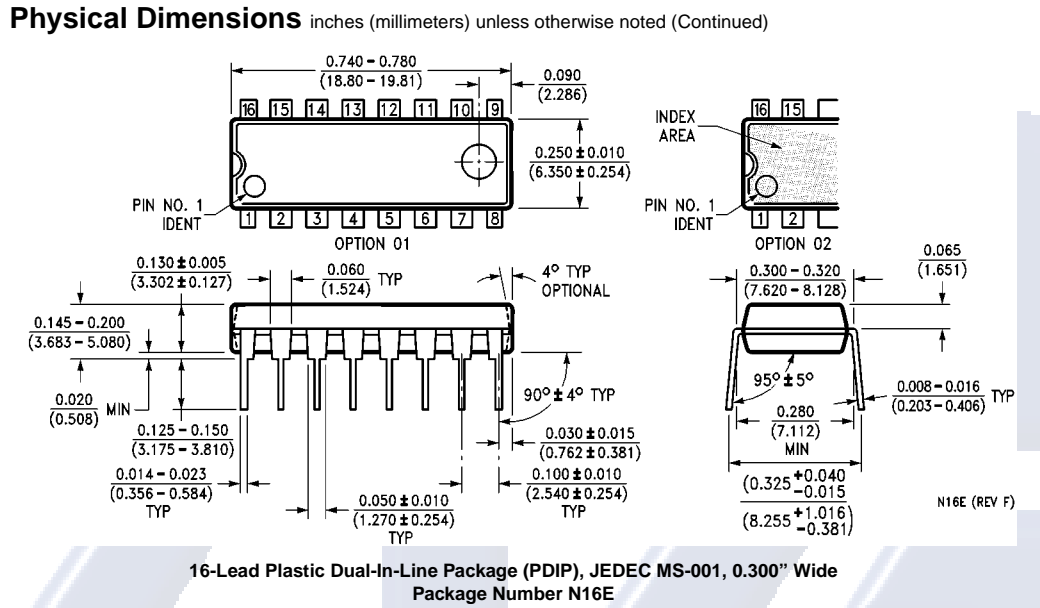
Note 8: AC Parameters are guaranteed by DC correlated testing.

Note 9: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation, see 74C Family Characteristics application note, AN-90.

Typical Applications



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