

CD4035BM/CD4035BC 4-Bit Parallel-In/Parallel-Out Shift Register

General Description

The CD4035B 4-bit parallel-in/parallel-out shift register is a monolithic complementary MOS (CMOS) integrated circuit constructed with P- and N-channel enhancement mode transistors. This shift register is a 4-stage clocked serial register having provisions for synchronous parallel inputs to each stage and serial inputs to the first stage via JK logic. Register stages 2, 3, and 4 are coupled in a serial "D" flip-flop configuration when the register is in the serial mode (parallel/serial control low).

Parallel entry via the "D" line of each register stage is permitted only when the parallel/serial control is "high".

In the parallel or serial mode, information is transferred on positive clock transitions.

When the true/complement control is "high", the true contents of the register are available at the output terminals. When the true/complement control is "low", the outputs are the complements of the data in the register. The true/complement control functions asynchronously with respect to the clock signal.

\overline{JK} input logic is provided on the first stage serial input to minimize logic requirements particularly in counting and sequence-generation applications. With \overline{JK} inputs connected together, the first stage becomes a "D" flip-flop. An asynchronous common reset is also provided.

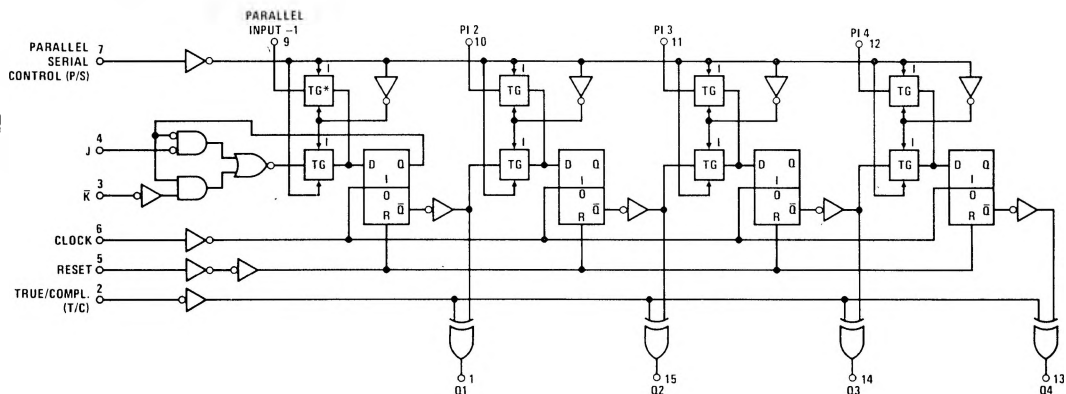
Features

- 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
- 4-stage clocked operation
- Synchronous parallel entry on all 4 stages
- \overline{JK} inputs on first stage
- Asynchronous true/complement control on all outputs
- Reset Control
- Static flip-flop operation; master/slave configuration
- Buffered outputs
- Low power dissipation 5 μ W (typ.) (ceramic)
- High speed to 5MHz

Applications

- | | |
|-----------------------|-----------------------|
| ■ Automotive | ■ Alarm systems |
| ■ Data terminals | ■ Industrial controls |
| ■ Instrumentation | ■ Remote metering |
| ■ Medical electronics | ■ Computers |

Logic Diagram



P/S = 0 = serial mode

T/C = 1 = true outputs

*TG = transmission gate



Input to output is:

a) A bidirectional low impedance when control input 1 is low and control input 2 is high.

b) An open circuit when control input 1 is high and control input 2 is low.

Absolute Maximum Ratings (Notes 1 and 2)

V _{DD} dc Supply Voltage	-0.5 to +18V
V _{IN} Input Voltage	-0.5 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

Operating Conditions (Note 2)

V _{DD} dc Supply Voltage	3 to 15V
V _{IN} Input Voltage	0 to V _{DD} V
T _A Operating Temperature Range	-55°C to +125°C
CD4035BM	-40°C to +85°C
CD4035BC	

DC Electrical Characteristics CD4035BM (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		0.3	5		150	μA
	V _{DD} = 10V		10		0.5	10		300	μA
	V _{DD} = 15V		20		1.0	20		600	μA
V _{OL} Low Level Output Voltage	I _O < 1.0 μA								
	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 _O < 1.0 μA								
	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 _O < 1.0 μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1.0V or 9.0V		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 Input Voltage	I _O < 1.0 μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1.0V or 9.0V	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	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
	V _{DD} = 15V, V _{IN} = 0V		-0.1		10 ⁻⁵	-0.1		-1.0	μA
I _{IN} Input Current	V _{DD} = 15V, V _{IN} = 15V		0.1		10 ⁻⁵	0.1		1.0	μA

DC Electrical Characteristics CD4035BC (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		0.5	20		150	μA
	V _{DD} = 10V		40		1.0	40		300	μA
	V _{DD} = 15V		80		5.0	80		600	μA
V _{OL} Low Level Output Voltage	I _O < 1 μA								
	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 _O < 1 μA								
	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 _O < 1 μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1.0V or 9.0V		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 Input Voltage	I _O < 1 μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1.0V or 9.0V	7.0		7.0			7.0		V
	V _{DD} = 15V, V _O = 1.5V or 13.5V	11.0		11.0			11.0		V

DC Electrical Characteristics (Cont'd.) CD4035BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
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, 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.

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

AC Electrical Characteristics

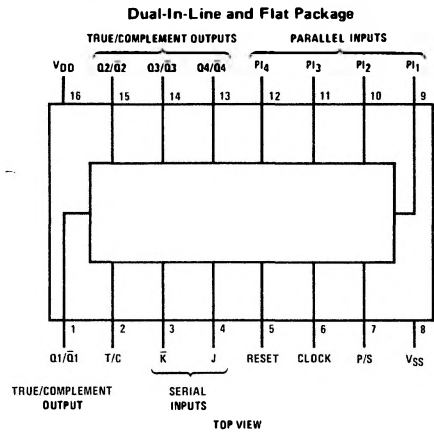
T_A = 25°C, C_L = 50 pF, R_L = 200k, t_r and t_f = 20 ns, unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
CLOCKED OPERATION					
t _{PHL} , t _{PLH} Propagation Delay Time	V _{DD} = 5V		250	500	ns
	V _{DD} = 10V		100	200	ns
	V _{DD} = 15V		75	150	ns
t _{THL} Transition Time High Low to High	V _{DD} = 5V		90	175	ns
	V _{DD} = 10V		50	75	ns
	V _{DD} = 15V		40	60	ns
t _{TLH} Transition Time Low to High	V _{DD} = 5V		135	270	ns
	V _{DD} = 10V		70	140	ns
	V _{DD} = 15V		60	120	ns
t _{WL} , t _{WH} Minimum Clock Pulse Width	V _{DD} = 5V	335	135		ns
	V _{DD} = 10V	165	50		ns
	V _{DD} = 15V	100	40		ns
t _{rCL} , t _{fCL} Clock Rise and Fall Time	V _{DD} = 5V			15	μs
	V _{DD} = 10V			10	μs
	V _{DD} = 15V			5	μs
t _S Minimum Set-up Time J/ \bar{K} Lines	V _{DD} = 5V		250	500	ns
	V _{DD} = 10V		100	200	ns
	V _{DD} = 15V		80	160	ns
t _S Parallel-In Lines	V _{DD} = 5V		250	500	ns
	V _{DD} = 10V		100	200	ns
	V _{DD} = 15V		80	160	ns
t _S P/S Control	V _{DD} = 5V		100	200	ns
	V _{DD} = 10V		40	80	ns
	V _{DD} = 15V		35	60	ns
f _{MAX} Maximum Clock Frequency	V _{DD} = 5V	1.5	2.5		MHz
	V _{DD} = 10V	3	6		MHz
	V _{DD} = 15V	5	9		MHz
C _{IN} Input Capacitance	Any Input		5	7.5	pF
RESET OPERATION					
t _{PHL} , t _{PLH} Propagation Delay Time	V _{DD} = 5V		300	500	ns
	V _{DD} = 10V		150	200	ns
	V _{DD} = 15V		85	150	ns
t _{WH} Minimum Reset Pulse Width	V _{DD} = 5V		75	250	ns
	V _{DD} = 10V		30	110	ns
	V _{DD} = 15V		25	80	ns

Truth Table

C_L	$t_n - 1$ (INPUTS)			t_n (OUTPUTS)	
	J	\bar{K}	R	Q_{n-1}	Q_n
	0	X	0	0	0
	1	X	0	0	1
	X	0	0	1	0
	1	0	0	Q_{n-1}	$\overline{Q_{n-1}}$ TOGGLE MODE
	X	1	0	1	1
	X	X	0	Q_{n-1}	Q_{n-1}
X	X	X	1	X	0

Connection Diagram



Switching Time Waveforms

