

February 1988

CD4006BM/CD4006BC 18-Stage Static Shift Register

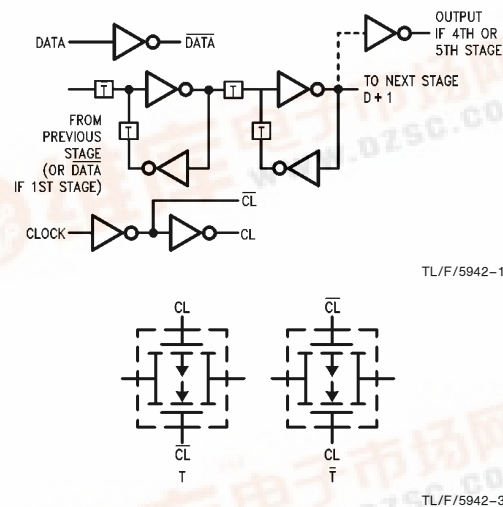
General Description

The CD4006BM/CD4006BC 18-stage static shift register is comprised of four separate shift register sections, two sections of four stages and two sections of five stages. Each section has an independent data input. Outputs are available at the fourth stage and the fifth stage of each section. A common clock signal is used for all stages. Data is shifted to the next stage on the negative-going transition of the clock. Through appropriate connections of inputs and outputs, multiple register sections of 4, 5, 8, and 9 stages, or single register sections of 10, 12, 13, 14, 16, 17, and 18 stages can be implemented using one package.

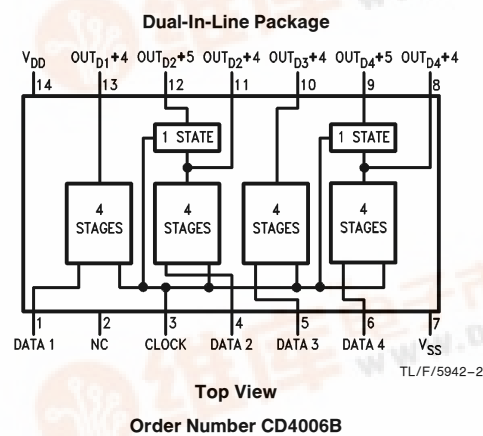
Features

- 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 74LS or 1 driving 74LS
- Low clock input capacitance 6 pF (typ.)
- Medium speed 10 MHz (typ.) (with V_{DD} = 10V)
- Low power
- Fully static operation

Logic Diagrams



Connection Diagram



Truth Table

D	CL ^Δ	D + 1
0		0
1		1
X		NC

TL/F/5942-4

X = Don't care
Δ = Level change
NC = No change



Absolute Maximum Ratings (Notes 1 and 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 to +18 V_{DC}
Input Voltage (V_{IN})	−0.5 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})	+3.0V to +15V
Input Voltage (V_{IN})	0V to V_{DD} V_{DC}
Operating Temperature Range (T_A)	
CD4006BM	−55°C to +125°C
CD4006BC	−40°C to +85°C

DC Electrical Characteristics CD4006BM (Note 2)

Symbol	Parameter	Conditions	−55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	$V_{DD} = 5.0V, V_{IN} = V_{DD}$ or V_{SS}		5.0		0.005	5.0		150	μA
		$V_{DD} = 10V, V_{IN} = V_{DD}$ or V_{SS}		10		0.010	10		300	μA
		$V_{DD} = 15V, V_{IN} = V_{DD}$ or V_{SS}		20		0.015	20		600	μA
V_{OL}	Low Level Output Voltage	$V_{DD} = 5.0V$		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	$V_{DD} = 5.0V$	4.95		4.95	5.0		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	$V_{DD} = 5.0V, V_O = 0.5V$ 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	$V_{DD} = 5.0V, V_O = 0.5V$ 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 (Note 3)	$V_{DD} = 5.0V, V_O = 0.4V$	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)	$V_{DD} = 5.0V, V_O = 4.6V$	−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		−0.1	-10^{-5}		−1.0		μA
		$V_{DD} = 15V, V_{IN} = 15V$		0.1		10^{-5}	0.1		1.0	μA

DC Electrical Characteristics CD4006BC (Note 2)

Symbol	Parameter	Conditions	−40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	$V_{DD} = 5.0V, V_{IN} = V_{DD}$ or V_{SS}		20		0.005	20		150	μA
		$V_{DD} = 10V, V_{IN} = V_{DD}$ or V_{SS}		40		0.010	40		300	μA
		$V_{DD} = 15V, V_{IN} = V_{DD}$ or V_{SS}		80		0.015	80		600	μA
V_{OL}	Low Level Output Voltage	$V_{DD} = 5.0V$		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	$V_{DD} = 5.0V$	4.95		4.95	5.0		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 CD4006BC (Note 2) (Continued)

Symbol	Parameter	Conditions	− 40°C		+ 25°C			+ 85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
V _{IL}	Low Level Input Voltage	V _{DD} = 5.0V, 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		4.5	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} = 5.0V, 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	5.5		7.0		V
		V _{DD} = 15V, V _O = 1.5V or 13.5V	11		11	8.25		11		V
I _{OL}	Low Level Output Current (Note 3)	V _{DD} = 5.0V, 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 _{IL} = 0V, V _{IH} = V _{DD}								
		V _{DD} = 5.0V, 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* CD4006BM/CD4006BC T_A = 25°C, C_L = 50 pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t _{PLH} , t _{PHL}	Propagation Delay Time (t _{PLH} = t _{PHL})	V _{DD} = 5.0V		200	400	ns
		V _{DD} = 10V		100	200	ns
		V _{DD} = 15V		80	150	ns
t _{TLH} , t _{THL}	Transition Time (t _{TLH} = t _{THL})	V _{DD} = 5.0V		100	200	ns
		V _{DD} = 10V		50	100	ns
		V _{DD} = 15V		40	80	ns
t _{WL} , t _{WH}	Minimum Clock Pulse Width (t _{WL} = t _{WH})	V _{DD} = 5.0V		100	200	ns
		V _{DD} = 10V		45	100	ns
		V _{DD} = 15V		35	70	ns
t _{RCL} , t _{FCL}	Clock Rise and Fall Time (t _{RCL} = t _{FCL})	V _{DD} = 5.0V			15	μs
		V _{DD} = 10V			15	μs
		V _{DD} = 15V			15	μs
t _{SU}	Minimum Set-Up Time	V _{DD} = 5.0V		50	100	ns
		V _{DD} = 10V		25	50	ns
		V _{DD} = 15V		20	40	ns
t _H	Minimum Hold Time	V _{DD} = 5.0V		55	110	ns
		V _{DD} = 10V		35	70	ns
		V _{DD} = 15V		30	60	ns
f _{CL}	Maximum Clock Frequency	V _{DD} = 5.0V	2.5	5.0		MHz
		V _{DD} = 10V	5.0	12		MHz
		V _{DD} = 15V	7.0	16		MHz
C _L	Input Capacitance	Data Input		5.0		pF
		CLK Input		7.5		pF

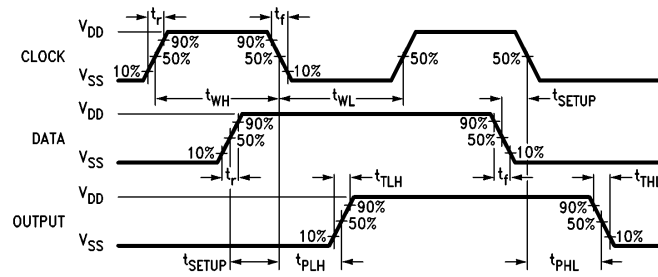
*AC Parameters are guaranteed by DC correlated testing.

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

Switching Time Waveforms



TL/F/5942-5

Physical Dimensions

inches (millimeters)

The diagram shows three views of the package: a top view, a side view, and a front view. The top view shows a rectangular package with pins 1 through 14. The side view shows the package height and pin dimensions. The front view shows the package width and pin dimensions. Dimensions are given in inches and millimeters.

Top View Dimensions:

- Overall width: 0.785 (19.939) MAX
- Pin pitch: 0.025 (0.635) RAD
- Pin 1 location: 0.220-0.310 (5.588-7.874)

Side View Dimensions:

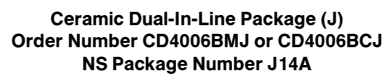
- Package height: 0.180 (4.572) MAX
- Pin height: 0.290-0.320 (7.366-8.128)
- Pin angle: 95° ± 5°
- Pin width: 0.310-0.410 (7.874-10.41)
- Pin spacing: 0.008-0.012 (0.203-0.305)
- Pin width: 0.098 (2.489)
- Pin angle: 86°-94° TYP
- Pin width: 0.005 (0.127) MIN
- Pin width: 0.060 ± 0.005 (1.524 ± 0.127)
- Pin width: 0.200 (5.080) MAX
- Pin width: 0.020-0.060 (0.508-1.524)
- Pin width: 0.018 ± 0.003 (0.457 ± 0.076)
- Pin width: 0.100 ± 0.010 (2.540 ± 0.254)
- Pin width: 0.125-0.200 (3.175-5.080)
- Pin width: 0.150 (3.81) MIN

Front View Dimensions:

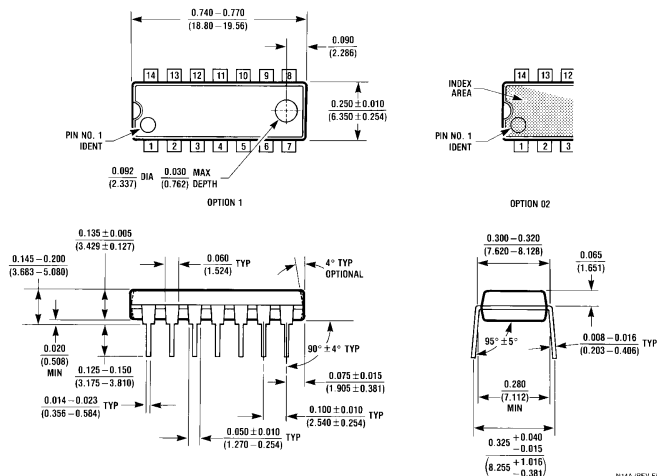
- Package width: 0.290-0.320 (7.366-8.128)
- Pin pitch: 0.008-0.012 (0.203-0.305)
- Pin width: 0.098 (2.489)
- Pin angle: 86°-94° TYP
- Pin width: 0.005 (0.127) MIN
- Pin width: 0.060 ± 0.005 (1.524 ± 0.127)
- Pin width: 0.200 (5.080) MAX
- Pin width: 0.020-0.060 (0.508-1.524)
- Pin width: 0.018 ± 0.003 (0.457 ± 0.076)
- Pin width: 0.100 ± 0.010 (2.540 ± 0.254)
- Pin width: 0.125-0.200 (3.175-5.080)
- Pin width: 0.150 (3.81) MIN

Order Number CD4006BMJ or CD4006BCJ
NS Package Number J14A

J14A (REV G)



Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number CD4006BMN or CD4006BCN
NS Package Number N14A

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