National Semiconductor

February 1988

CD4006BM/CD4006BC 18-Stage Static Shift Register

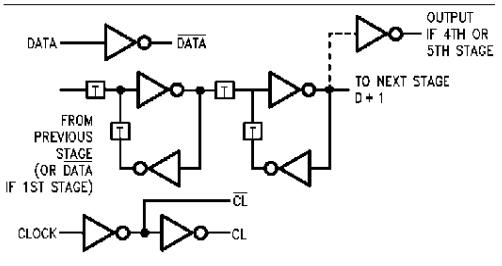
General Description

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.

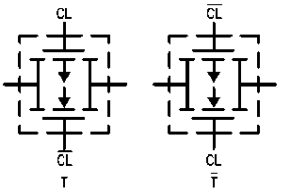
Features

- 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 74L 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



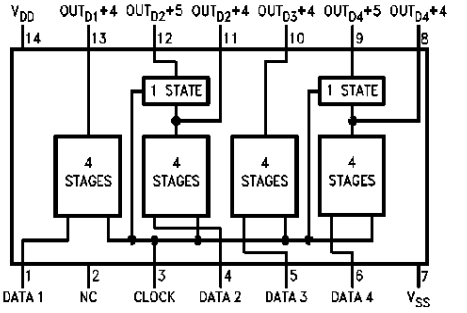
TL/F/5942–1



TL/F/5942–3

Connection Diagram

Dual-In-Line Package



TL/F/5942–2

Top View

Order Number CD4006B

Truth Table

D	CL$^{\Delta}$	D + 1
0	⌐⌐	0
1	⌐⌐	1
X	⌐⌐	NC

TL/F/5942–4

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

RRD-B30M105/Printed in U. S. A.

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

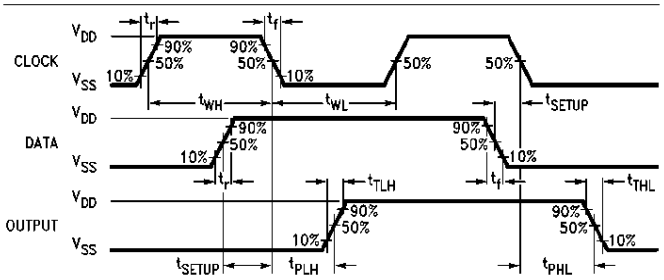
*AC Parameters are guaranteed by DC correlated testing.

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.

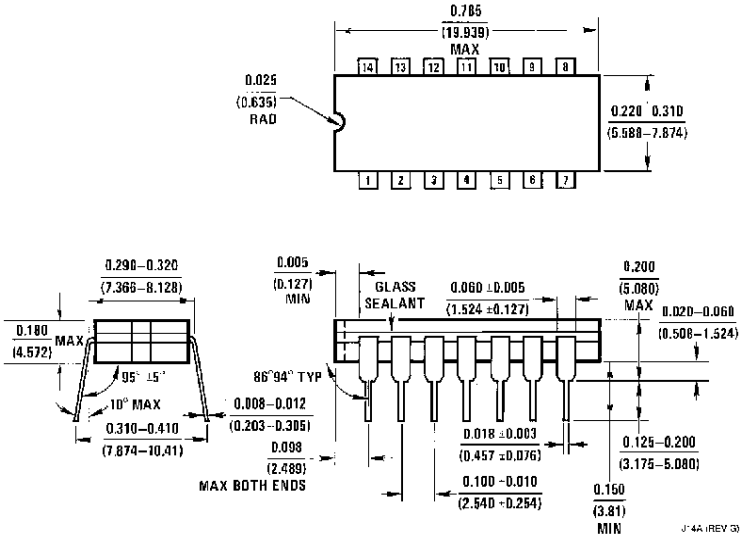
Note 3: I_{OL} and I_{OH} are tested one output at a time.

Switching Time Waveforms



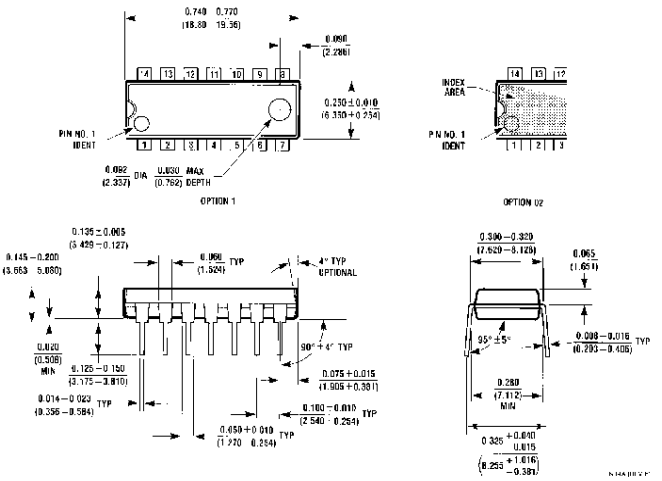
TL/F/5942–5

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4006BMJ or CD4006BCJ
NS Package Number J14A

Physical Dimensions inches (millimeters) (Continued)



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

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