

CD4006BM/CD4006BC 18-Stage Static Shift Register

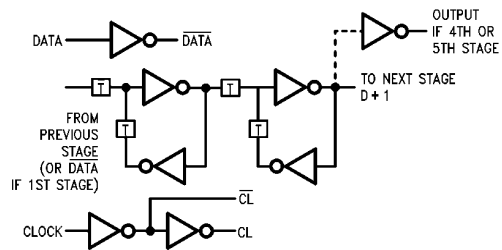
General Description

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.

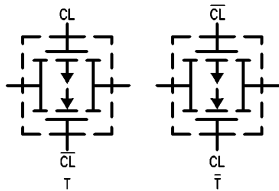
Features

- 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

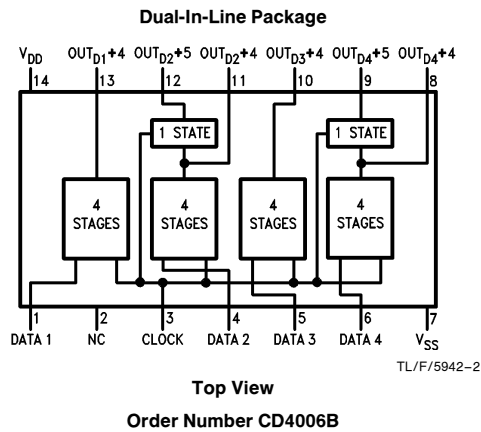


TL/F/5942-1



TL/F/5942-3

Connection Diagram



TL/F/5942-2

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 |

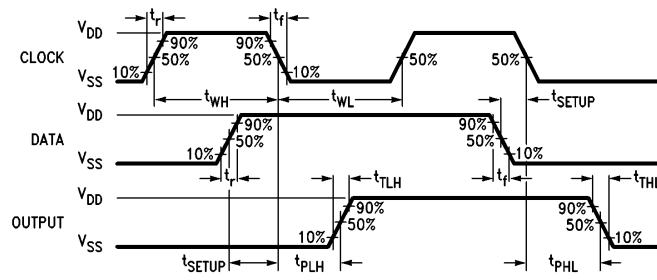
*AC Parameters are guaranteed by DC correlated testing.

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.

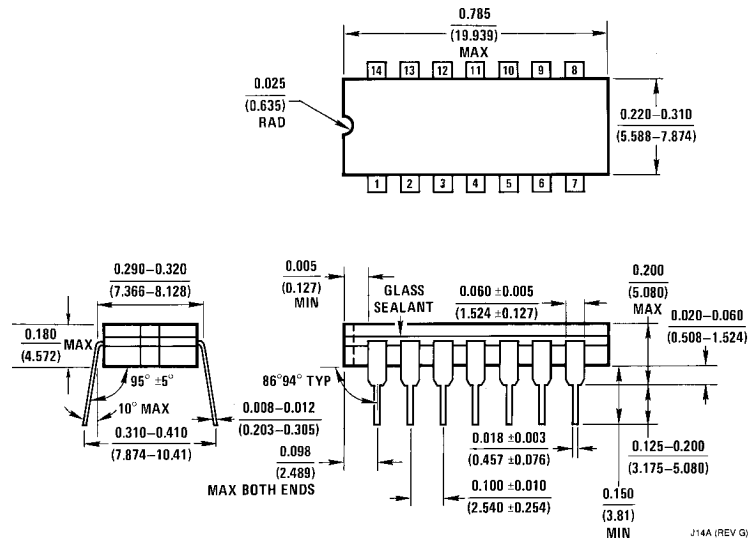
Note 3: I_{OL} and I_{OH} are tested one output at a time.

Switching Time Waveforms



TL/F/5942-5

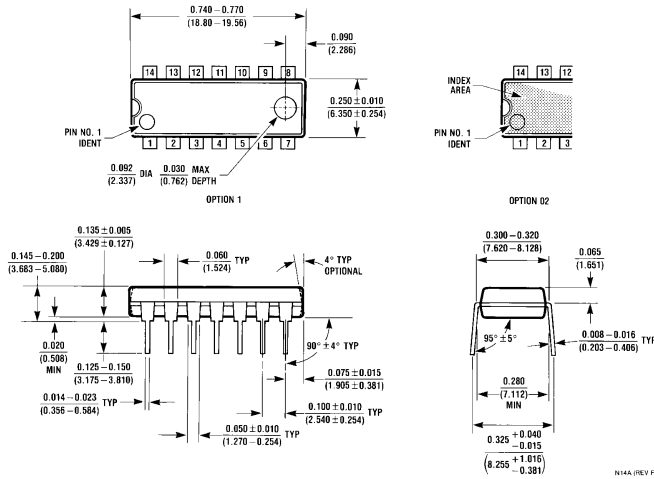
Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
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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