

CD4528BM/CD4528BC Dual Monostable Multivibrator

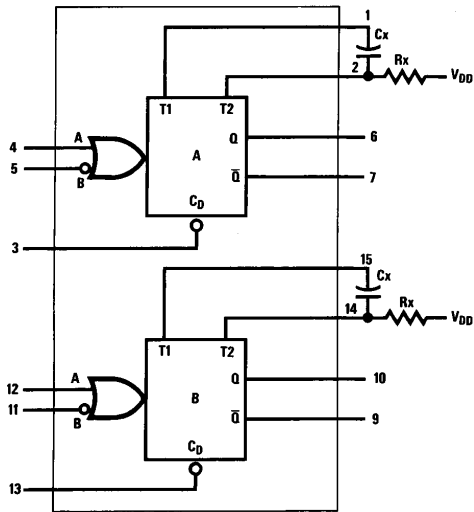
General Description

The CD4528B is a dual monostable multivibrator. Each device is retriggerable and resettable. Triggering can occur from either the rising or falling edge of an input pulse, resulting in an output pulse over a wide range of widths. Pulse duration and accuracy are determined by external timing components Rx and Cx.

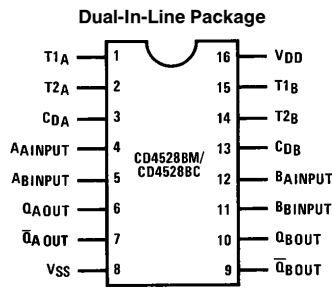
Features

- Wide supply voltage range 3.0V to 18V
- Separate reset available
- Quiescent current = 5.0 nA/package (typ.) at 5.0 V_{DC}
- Diode protection on all inputs
- Triggerable from leading or trailing edge pulse
- Capable of driving two low-power TTL loads or one low-power Schottky TTL load over the rated temperature range

Connection Diagrams



TL/F/5998-1



TL/F/5998-2

Top View
Order Number CD4528B

Truth Table

| Clear | Inputs | | Outputs | |
|-------|--------|---|---------|---|
| | A | B | Q | Q |
| L | X | X | L | H |
| X | H | X | L | H |
| X | X | L | L | H |
| H | L | ↓ | ⌊ | ⌋ |
| H | ↑ | H | ⌊ | ⌋ |

- H = High Level
- L = Low Level
- ↑ = Transition from Low to High
- ↓ = Transition from High to Low
- ⌊ = One High Level Pulse
- ⌋ = One Low Level Pulse
- X = Irrelevant

Absolute Maximum Ratings (Notes 1 & 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}) | $-0.5 V_{DC}$ to $+18 V_{DC}$ |
| Input Voltage, All Inputs (V_{IN}) | $-0.5 V_{DC}$ to $V_{DD} + 0.5 V_{DC}$ |
| Storage Temperature Range (T_S) | -65°C to $+150^{\circ}\text{C}$ |
| 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}) | 3V to 15V |
| Input Voltage (V_{IN}) | 0V to $V_{DD} V_{DC}$ |
| Operating Temperature Range (T_A) | |
| CD4528BM | -55°C to $+125^{\circ}\text{C}$ |
| CD4528BC | -40°C to $+85^{\circ}\text{C}$ |

DC Electrical Characteristics CD4528BM (Note 2)

| Symbol | Parameter | Conditions | -55°C | | $+25^{\circ}\text{C}$ | | | $+125^{\circ}\text{C}$ | | Units |
|----------|------------------------------------|--|-----------------------|--------|-----------------------|------------|--------|------------------------|--------|---------------|
| | | | Min | Max | Min | Typ | Max | Min | Max | |
| I_{DD} | Quiescent Device Current | $V_{DD} = 5\text{V}$ | | 5 | 0.005 | | 5 | | 150 | μA |
| | | $V_{DD} = 10\text{V}$ | | 10 | 0.010 | | 10 | | 300 | μA |
| | | $V_{DD} = 15\text{V}$ | | 20 | 0.015 | | 20 | | 600 | μA |
| V_{OL} | Low Level Output Voltage | $V_{DD} = 5\text{V}$ | | 0.05 | | | 0.05 | | 0.05 | V |
| | | $V_{DD} = 10\text{V}$ | | 0.05 | | | 0.05 | | 0.05 | V |
| | | $V_{DD} = 15\text{V}$ | | 0.05 | | | 0.05 | | 0.05 | V |
| V_{OH} | High Level Output Voltage | $V_{DD} = 5\text{V}$ | 4.95 | | 4.95 | 5.0 | | 4.95 | | V |
| | | $V_{DD} = 10\text{V}$ | 9.95 | | 9.95 | 10.0 | | 9.95 | | V |
| | | $V_{DD} = 15\text{V}$ | 14.95 | | 14.95 | 15.0 | | 14.95 | | V |
| V_{IL} | Low Level Input Voltage | $V_{DD} = 5\text{V}, V_O = 0.5\text{V}$ or 4.5V | | 1.5 | | 2.25 | 1.5 | | 1.5 | V |
| | | $V_{DD} = 10\text{V}, V_O = 1\text{V}$ or 9V | | 3.0 | | 4.50 | 3.0 | | 3.0 | V |
| | | $V_{DD} = 15\text{V}, V_O = 1.5\text{V}$ or 13.5V | | 4.0 | | 6.75 | 4.0 | | 4.0 | V |
| V_{IH} | High Level Input Voltage | $V_{DD} = 5\text{V}, V_O = 0.5\text{V}$ or 4.5V | 3.5 | | 3.5 | 2.75 | | 3.5 | | V |
| | | $V_{DD} = 10\text{V}, V_O = 1\text{V}$ or 9V | 7.0 | | 7.0 | 5.50 | | 7.0 | | V |
| | | $V_{DD} = 15\text{V}, V_O = 1.5\text{V}$ or 13.5V | 11.0 | | 11.0 | 8.25 | | 11.0 | | V |
| I_{OL} | Low Level Output Current (Note 3) | $V_{DD} = 5\text{V}, V_O = 0.4\text{V}$ | 0.64 | | 0.51 | 0.88 | | 0.36 | | mA |
| | | $V_{DD} = 10\text{V}, V_O = 0.5\text{V}$ | 1.6 | | 1.3 | 2.25 | | 0.9 | | mA |
| | | $V_{DD} = 15\text{V}, V_O = 1.5\text{V}$ | 4.2 | | 3.4 | 8.8 | | 2.4 | | mA |
| I_{OH} | High Level Output Current (Note 3) | $V_{DD} = 5\text{V}, V_O = 4.6\text{V}$ | -0.25 | | -0.2 | -0.36 | | -0.14 | | mA |
| | | $V_{DD} = 10\text{V}, V_O = 9.5\text{V}$ | -0.62 | | -0.5 | -0.9 | | -0.35 | | mA |
| | | $V_{DD} = 15\text{V}, V_O = 13.5\text{V}$ | -1.8 | | -1.5 | -3.5 | | -1.1 | | mA |
| I_{IN} | Input Current | $V_{DD} = 15\text{V}, V_{IN} = 0\text{V}$ | | -0.1 | | -10^{-5} | -0.1 | | -1.0 | μA |
| | | $V_{DD} = 15\text{V}, V_{IN} = 15\text{V}$ | | 0.1 | | 10^{-5} | 0.1 | | 1.0 | μA |

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range", they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

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

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

DC Electrical Characteristics CD4528BC (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} = 5V | | 20 | | 0.005 | 20 | | 150 | μA |
| | | V _{DD} = 10V | | 40 | | 0.010 | 40 | | 300 | μA |
| | | V _{DD} = 15V | | 80 | | 0.015 | 80 | | 600 | μA |
| V _{OL} | Low Level Output Voltage | V _{DD} = 5V | | 0.05 | | | 0.05 | | 0.05 | V |
| | | V _{DD} = 10V | | 0.05 | | | 0.05 | | 0.05 | V |
| | | V _{DD} = 15V | | 0.05 | | | 0.05 | | 0.05 | V |
| V _{OH} | High Level Output Voltage | V _{DD} = 5V | 4.95 | | 4.95 | 5.0 | | 4.95 | | V |
| | | V _{DD} = 10V | 9.95 | | 9.95 | 10.0 | | 9.95 | | V |
| | | V _{DD} = 15V | 14.95 | | 14.95 | 15.0 | | 14.95 | | V |
| V _{IL} | Low Level Input Voltage | V _{DD} = 5V, V _O = 0.5V or 4.5V | | 1.5 | | 2.25 | 1.5 | | 1.5 | V |
| | | V _{DD} = 10V, V _O = 1V or 9V | | 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} = 5V, V _O = 0.5V or 4.5V | 3.5 | | 3.5 | 2.75 | | 3.5 | | V |
| | | V _{DD} = 10V, V _O = 1V or 9V | 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} = 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 3) | 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. Except for "Operating Temperature Range", they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

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

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

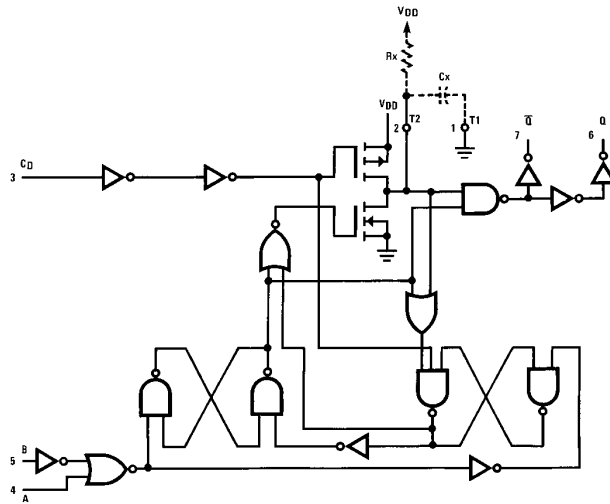
AC Electrical Characteristics* CD4528BM

$T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, Input $t_r = t_f = 20\text{ ns}$, unless otherwise specified

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|-----|-----|-----|---------------|
| Output Rise Time | $t_r = (3.0\text{ ns/pF}) C_L + 30\text{ ns}$, $V_{DD} = 5.0\text{V}$ | | 180 | 400 | ns |
| | $t_r = (1.5\text{ ns/pF}) C_L + 15\text{ ns}$, $V_{DD} = 10.0\text{V}$ | | 90 | 200 | ns |
| | $t_r = (1.1\text{ ns/pF}) C_L + 10\text{ ns}$, $V_{DD} = 15.0\text{V}$ | | 65 | 160 | ns |
| Output Fall Time | $t_f = (1.5\text{ ns/pF}) C_L + 25\text{ ns}$, $V_{DD} = 5.0\text{V}$ | | 100 | 200 | ns |
| | $t_f = (0.75\text{ ns/pF}) C_L + 12.5\text{ ns}$, $V_{DD} = 10\text{V}$ | | 50 | 100 | ns |
| | $t_f = (0.55\text{ ns/pF}) C_L + 9.5\text{ ns}$, $V_{DD} = 15.0\text{V}$ | | 35 | 80 | ns |
| Turn-Off, Turn-On Delay A or B to Q or \bar{Q} $C_x = 15\text{ pF}$, $R_x = 5.0\text{ k}\Omega$ | t_{PLH} , $t_{PHL} = (1.7\text{ ns/pF}) C_L + 240\text{ ns}$, $V_{DD} = 5.0\text{V}$ | | 230 | 500 | ns |
| | t_{PLH} , $t_{PHL} = (0.66\text{ ns/pF}) C_L + 8\text{ ns}$, $V_{DD} = 10.0\text{V}$ | | 100 | 250 | ns |
| | t_{PLH} , $t_{PHL} = (0.5\text{ ns/pF}) C_L + 65\text{ ns}$, $V_{DD} = 15.0\text{V}$ | | 65 | 150 | ns |
| Turn-Off, Turn-On Delay A or B to Q or \bar{Q} $C_x = 100\text{ pF}$, $R_x = 10\text{ k}\Omega$ | t_{PLH} , $t_{PHL} = (1.7\text{ ns/pF}) C_L + 620\text{ ns}$, $V_{DD} = 5.0\text{V}$ | | 230 | 500 | ns |
| | t_{PLH} , $t_{PHL} = (0.66\text{ ns/pF}) C_L + 257\text{ ns}$, $V_{DD} = 10.0\text{V}$ | | 100 | 250 | ns |
| | t_{PLH} , $t_{PHL} = (0.5\text{ ns/pF}) C_L + 185\text{ ns}$, $V_{DD} = 15.0\text{V}$ | | 65 | 150 | ns |
| Minimum Input Pulse Width A or B $C_x = 15\text{ pF}$, $R_x = 5.0\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 60 | 150 | ns |
| | $V_{DD} = 10.0\text{V}$ | | 20 | 50 | ns |
| | $V_{DD} = 15\text{V}$ | | 20 | 50 | ns |
| $C_x = 1000\text{ pF}$, $R_x = 10\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 60 | 150 | ns |
| | $V_{DD} = 10.0\text{V}$ | | 20 | 50 | ns |
| | $V_{DD} = 15.0\text{V}$ | | 20 | 50 | ns |
| Output Pulse Width Q or \bar{Q} For $C_x < 0.01\text{ }\mu\text{F}$ (See Graph for Appropriate V_{DD} Level) $C_x = 15\text{ pF}$, $R_x = 5.0\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 550 | | ns |
| | $V_{DD} = 10.0\text{V}$ | | 350 | | ns |
| | $V_{DD} = 15.0\text{V}$ | | 300 | | ns |
| For $C_x > 0.01\text{ }\mu\text{F}$ Use $PW_{out} = 0.2 R_x C_x \ln [V_{DD} - V_{SS}]$ $C_x = 10,000\text{ pF}$, $R_x = 10\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | 15 | 29 | 45 | μs |
| | $V_{DD} = 10.0\text{V}$ | 10 | 37 | 90 | μs |
| | $V_{DD} = 15.0\text{V}$ | 15 | 42 | 95 | μs |
| Pulse Width Match between Circuits in the Same Package $C_x = 10,000\text{ pF}$, $R_x = 10\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 6 | 25 | % |
| | $V_{DD} = 10.0\text{V}$ | | 8 | 35 | % |
| | $V_{DD} = 15.0\text{V}$ | | 8 | 35 | % |
| Reset Propagation Delay, t_{PLH} , t_{PHL} $C_x = 15\text{ pF}$, $R_x = 5.0\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 325 | 600 | ns |
| | $V_{DD} = 10.0\text{V}$ | | 90 | 225 | ns |
| | $V_{DD} = 15.0\text{V}$ | | 60 | 170 | ns |
| $C_x = 1000\text{ pF}$, $R_x = 10\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 7.0 | | μs |
| | $V_{DD} = 10.0\text{V}$ | | 6.7 | | μs |
| | $V_{DD} = 15.0\text{V}$ | | 6.7 | | μs |
| Minimum Retrigger Time $C_x = 15\text{ pF}$, $R_x = 5.0\text{ k}\Omega$ $C_x = 1000\text{ pF}$, $R_x = 10\text{ k}\Omega$ | $V_{DD} = 5.0\text{V}$ | | 0 | | ns |
| | $V_{DD} = 10.0\text{V}$ | | 0 | | ns |
| | $V_{DD} = 15.0\text{V}$ | | 0 | | ns |
| | $V_{DD} = 5.0\text{V}$ | | 0 | | ns |
| | $V_{DD} = 10.0\text{V}$ | | 0 | | ns |
| | $V_{DD} = 15.0\text{V}$ | | 0 | | ns |

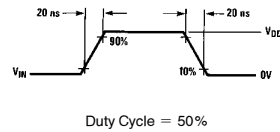
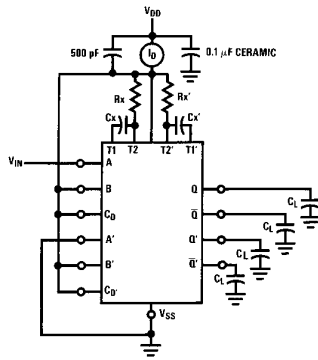
*AC parameters are guaranteed by DC correlated testing.

Logic Diagrams (1/2 of Device Shown)



Note: Externally ground pins 1 and 15 to pin 8.

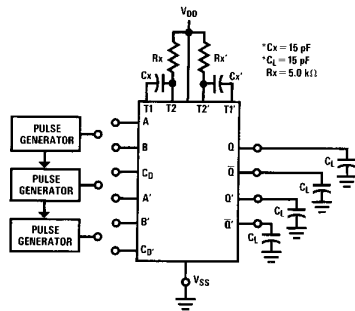
TL/F/5998-3



TL/F/5998-10

TL/F/5998-4

FIGURE 1. Power Dissipation Test Circuit and Waveforms



TL/F/5998-5

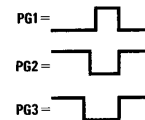
FIGURE 2. AC Test Circuit

Input Connections

| Characteristics | C_D | A | B |
|---|----------|----------|----------|
| t_{PLH} , t_{PHL} , t_r , t_f , PW_{out} , PW_{in} | V_{DD} | PG1 | V_{DD} |
| t_{PLH} , t_{PHL} , t_r , t_f , PW_{out} , PW_{in} | V_{DD} | V_{SS} | PG2 |
| $t_{PLH(R)}$, $t_{PHL(R)}$, PW_{in} | PG3 | PG1 | PG2 |

*Includes capacitance of probes, wiring, and fixture parasitic.

Note: AC test waveforms for PG1, PG2, and PG3 on next page.



TL/F/5998-6

Logic Diagrams (1/2 of Device Shown) (Continued)

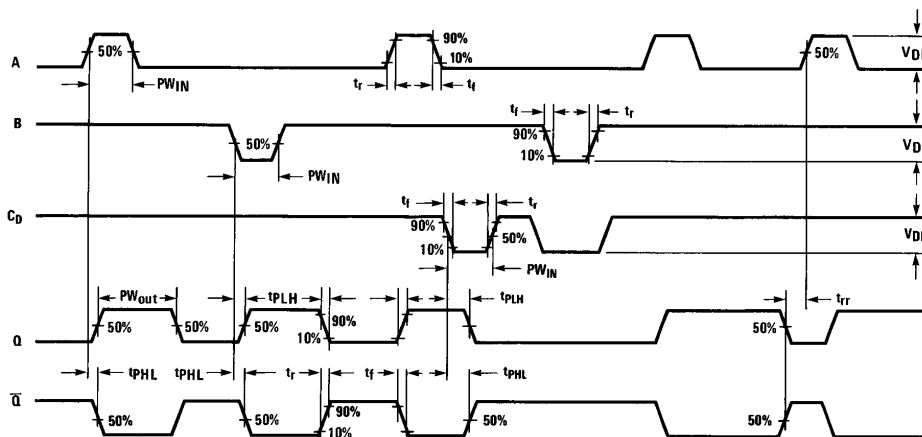


FIGURE 3. AC Test Waveforms

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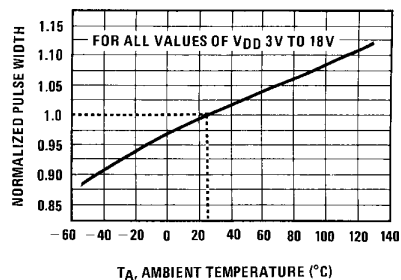


FIGURE 4. Normalized Pulse Width vs Temperature

TL/F/5998-8

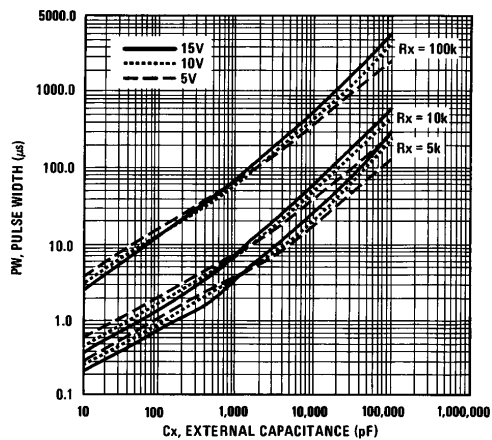
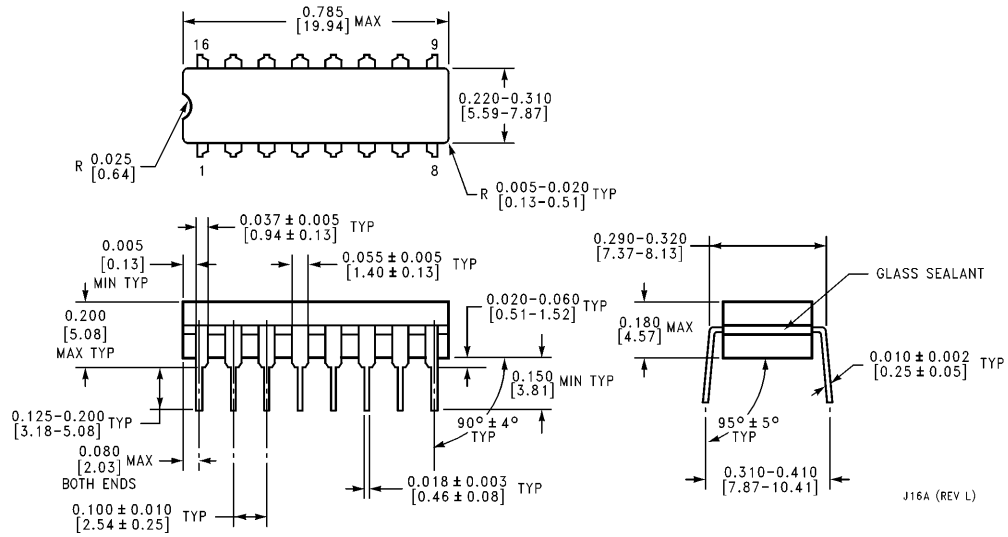


FIGURE 5. Pulse Width vs Cx

TL/F/5998-9

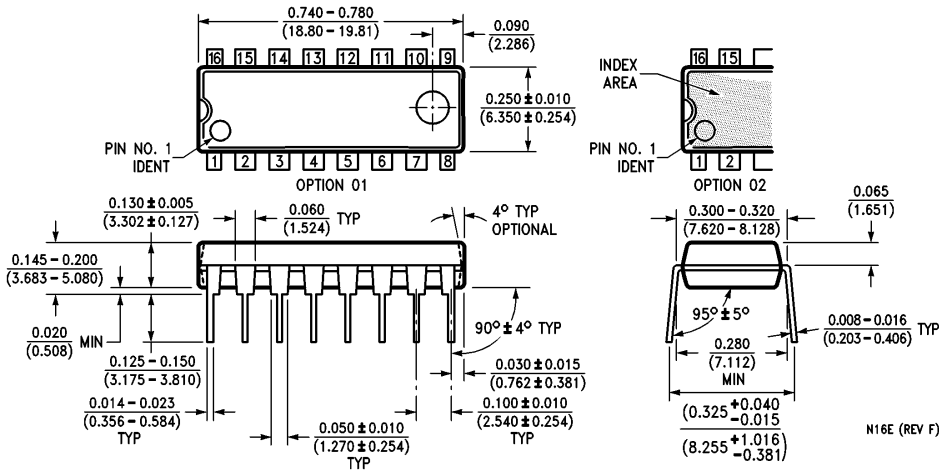
Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4528BMJ or CD4528BCJ
NS Package Number J16A

J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number CD4528BMN or CD4528BCN
NS Package Number N16E

N16E (REV F)

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