



August 1986
Revised April 2000

DM74LS123

Dual Retriggerable One-Shot with Clear and Complementary Outputs

General Description

The DM74LS123 is a dual retriggerable monostable multi-vibrator capable of generating output pulses from a few nano-seconds to extremely long duration up to 100% duty cycle. Each device has three inputs permitting the choice of either leading edge or trailing edge triggering. Pin (A) is an active-LOW transition trigger input and pin (B) is an active-HIGH transition trigger input. The clear (CLR) input terminates the output pulse at a predetermined time independent of the timing components. The clear input also serves as a trigger input when it is pulsed with a low level pulse transition (\neg). To obtain the best trouble free operation from this device please read the operating rules as well as the Fairchild Semiconductor one-shot application notes carefully and observe recommendations.

Features

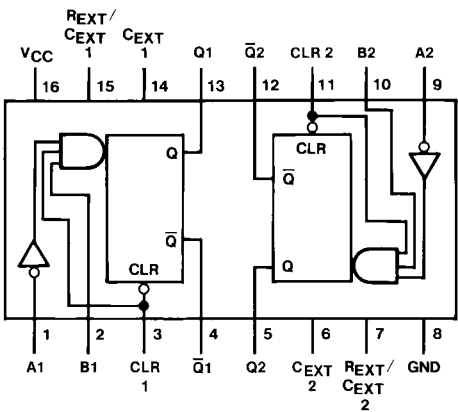
- DC triggered from active-HIGH transition or active-LOW transition inputs
- Retriggerable to 100% duty cycle
- Compensated for V_{CC} and temperature variations
- Triggerable from CLEAR input
- DTL, TTL compatible
- Input clamp diodes

Ordering Code:

Order Number	Package Number	Package Description
DM74LS123M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS123SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS123N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

Inputs			Outputs	
CLEAR	A	B	Q	\bar{Q}
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	\uparrow	\neg	\neg
H	\downarrow	H	\neg	\neg
\uparrow	L	H	\neg	\neg

H = HIGH Logic Level
L = LOW Logic Level
X = Can Be Either LOW or HIGH
 \uparrow = Positive Going Transition
 \downarrow = Negative Going Transition
 \neg = A Positive Pulse
 \neg = A Negative Pulse

DM74LS123 Dual Retriggerable One-Shot with Clear and Complementary Outputs

Functional Description

The basic output pulse width is determined by selection of an external resistor (R_X) and capacitor (C_X). Once triggered, the basic pulse width may be extended by retriggering the gated active-LOW transition or active-HIGH transition inputs or be reduced by use of the active-LOW or

CLEAR input. Retriggering to 100% duty cycle is possible by application of an input pulse train whose cycle time is shorter than the output cycle time such that a continuous "HIGH" logic state is maintained at the "Q" output.

Operating Rules

1. An external resistor (R_X) and an external capacitor (C_X) are required for proper operation. The value of C_X may vary from 0 to any necessary value. For small time constants high-grade mica, glass, polypropylene, polycarbonate, or polystyrene material capacitors may be used. For large time constants use tantalum or special aluminum capacitors. If the timing capacitors have leakages approaching 100 nA or if stray capacitance from either terminal to ground is greater than 50 pF the timing equations may not represent the pulse width the device generates.
2. When an electrolytic capacitor is used for C_X a switching diode is often required for standard TTL one-shots to prevent high inverse leakage current. This switching diode is not needed for the DM74LS123 one-shot and should not be used. In general the use of the switching diode is not recommended with retriggerable operation. Furthermore, if a polarized timing capacitor is used on the DM74LS123 the negative terminal of the capacitor should be connected to the "C_{EXT}" pin of the device (Figure 1).

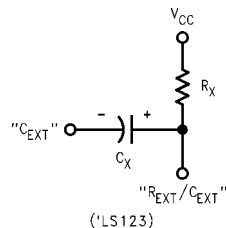


FIGURE 1.

3. For $C_X \gg 1000$ pF the output pulse width (t_W) is defined as follows:

$$t_W = K R_X C_X$$

where [R_X is in k Ω]

[C_X is in pF]

[t_W is in ns]

$$K \approx 0.37$$

4. The multiplicative factor K is plotted as a function of C_X below for design considerations:

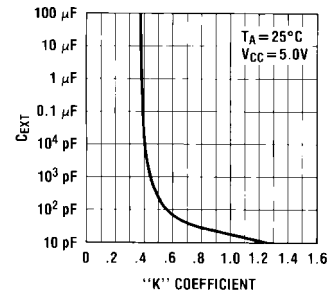


FIGURE 2.

5. For $C_X < 1000$ pF see Figure 3 for t_W vs. C_X family curves with R_X as a parameter:

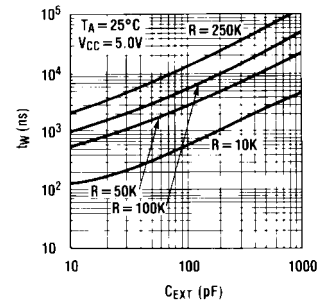


FIGURE 3.

6. To obtain variable pulse widths by remote trimming, the following circuit is recommended:

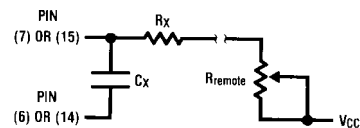


FIGURE 4.

"R_{remote}" should be as close to the device pin as possible.

7. The retriggerable pulse width is calculated as shown below:

$$T = t_W + t_{PLH} = K \times R_X \times C_X + t_{PLH}$$

The retriggered pulse width is equal to the pulse width plus a delay time period (Figure 5).

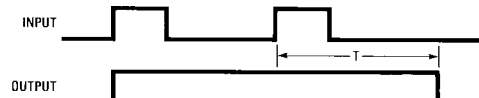
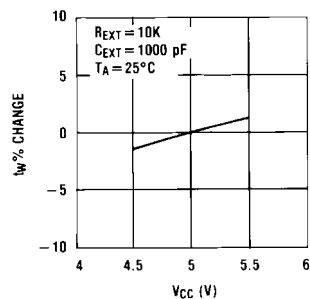
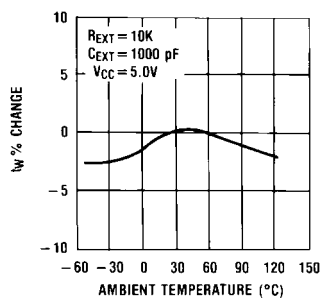


FIGURE 5.

Operating Rules (Continued)

8. Output pulse width variation versus V_{CC} and temperatures: Figure 6 depicts the relationship between pulse width variation versus V_{CC} , and Figure 7 depicts pulse width variation versus temperatures.

**FIGURE 6.****FIGURE 7.**

9. Under any operating condition C_X and R_X must be kept as close to the one-shot device pins as possible to minimize stray capacitance, to reduce noise pick-up, and to reduce $I \cdot R$ and $L \cdot di/dt$ voltage developed along their connecting paths. If the lead length from C_X to pins (6) and (7) or pins (14) and (15) is greater than 3 cm, for example, the output pulse width might be quite different from values predicted from the appropriate equations. A non-inductive and low capacitive path is necessary to ensure complete discharge of C_X in each cycle of its operation so that the output pulse width will be accurate.
10. The C_{EXT} pins of this device are internally connected to the internal ground. For optimum system performance they should be hard wired to the system's return ground plane.
11. V_{CC} and ground wiring should conform to good high-frequency standards and practices so that switching transients on the V_{CC} and ground return leads do not cause interaction between one-shots. A 0.01 μF to 0.10 μF bypass capacitor (disk ceramic or monolithic type) from V_{CC} to ground is necessary on each device. Furthermore, the bypass capacitor should be located as close to the V_{CC} -pin as space permits.

Note: For further detailed device characteristics and output performance please refer to the Fairchild Semiconductor one-shot application note AN-372.

Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature	−65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			−0.4	mA
I _{OL}	LOW Level Output Current			8	mA
t _W	Pulse Width (Note 2)	A or B HIGH	40		ns
		A or B LOW	40		
		Clear LOW	40		
R _{EXT}	External Timing Resistor	5		260	kΩ
C _{EXT}	External Timing Capacitance	No Restriction			μF
C _{WIRE}	Wiring Capacitance at R _{EXT} /C _{EXT} Terminal			50	pF
T _A	Free Air Operating Temperature	0		70	°C

Note 2: T_A = 25°C and V_{CC} = 5V.

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 3)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = −18 mA			−1.5	V
V _{OH}	HIGH Level Output Voltage	V _{CC} = Min, I _{OH} = Max V _{IL} = Max, V _{IH} = Min	2.7	3.4		V
V _{OL}	LOW Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IL} = Max, V _{IH} = Min I _{OL} = 4 mA, V _{CC} = Min		0.35 0.25	0.5 0.4	V
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 7V			0.1	mA
I _{IH}	HIGH Level Input Current	V _{CC} = Max, V _I = 2.7V			20	μA
I _{IL}	LOW Level Input Current	V _{CC} = Max, V _I = 0.4V			−0.4	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 4)	−20		−100	mA
I _{CC}	Supply Current	V _{CC} = Max (Note 5)(Note 6)(Note 7)		12	20	mA

Note 3: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 4: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 5: Quiescent I_{CC} is measured (after clearing) with 2.4V applied to all clear and A inputs, B inputs grounded, all outputs OPEN, C_{EXT} = 0.02 μF, and R_{EXT} = 25 kΩ.

Note 6: I_{CC} is measured in the triggered state with 2.4V applied to all clear and B inputs, A inputs grounded, all outputs OPEN, C_{EXT} = 0.02 μF, and R_{EXT} = 25 kΩ.

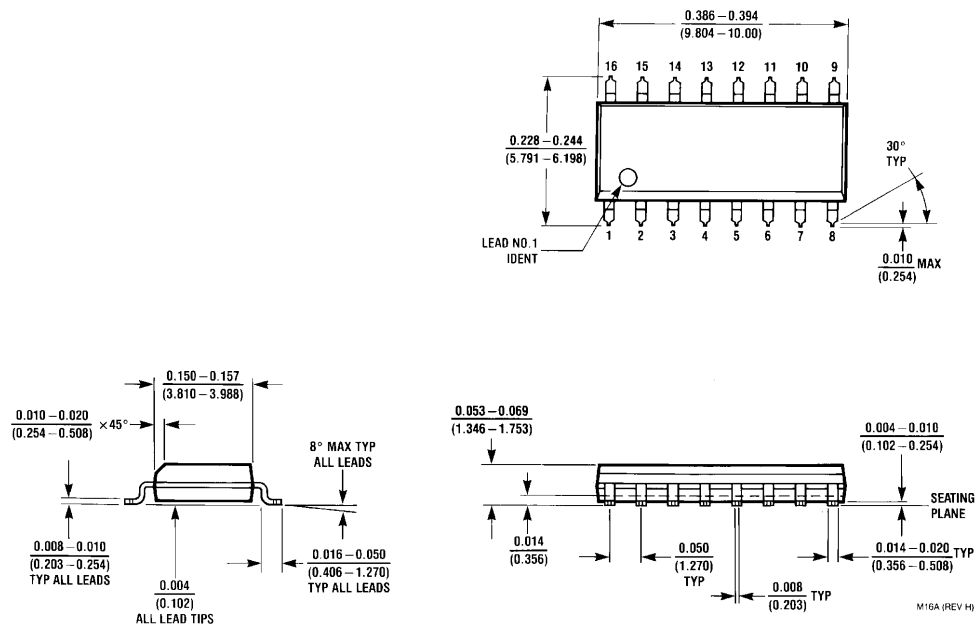
Note 7: With all outputs OPEN and 4.5V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5V is applied to the clock.

at $V_{CC} = 5V$ and $T_A = 25^\circ C$

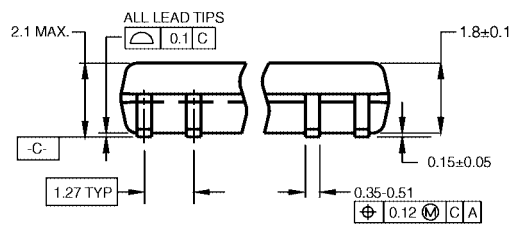
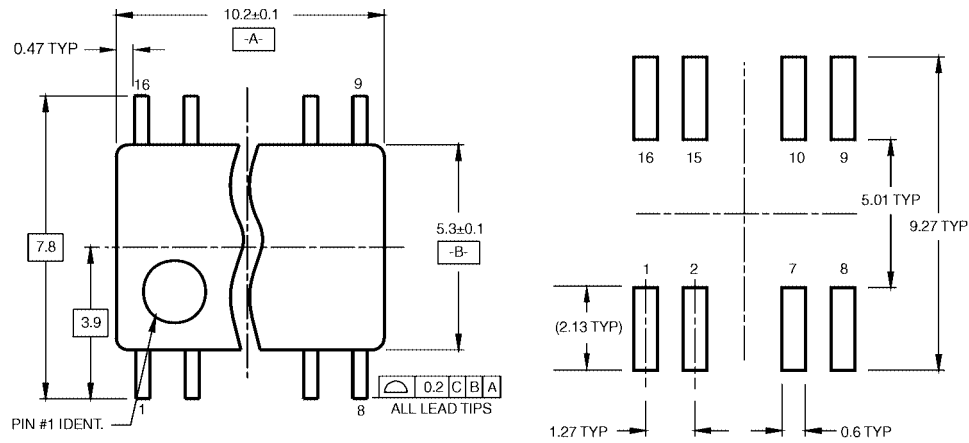
Case No.	Case Name	Case Type	Case Status	Case Date	Case Location	Case Description	Case Details	Case Notes	Case Attachments
1	John Doe	Case 1	Open	2023-01-01	New York	Case 1 Description	Case 1 Details	Case 1 Notes	Case 1 Attachments
2	Jane Smith	Case 2	Closed	2023-01-02	California	Case 2 Description	Case 2 Details	Case 2 Notes	Case 2 Attachments
3	Bob Johnson	Case 3	Pending	2023-01-03	Texas	Case 3 Description	Case 3 Details	Case 3 Notes	Case 3 Attachments
4	Alice Brown	Case 4	Open	2023-01-04	Florida	Case 4 Description	Case 4 Details	Case 4 Notes	Case 4 Attachments
5	Charlie Davis	Case 5	Closed	2023-01-05	Illinois	Case 5 Description	Case 5 Details	Case 5 Notes	Case 5 Attachments
6	Diana Prince	Case 6	Pending	2023-01-06	Ohio	Case 6 Description	Case 6 Details	Case 6 Notes	Case 6 Attachments
7	Frank Miller	Case 7	Open	2023-01-07	Georgia	Case 7 Description	Case 7 Details	Case 7 Notes	Case 7 Attachments
8	Grace Wilson	Case 8	Closed	2023-01-08	Arizona	Case 8 Description	Case 8 Details	Case 8 Notes	Case 8 Attachments
9	Henry Taylor	Case 9	Pending	2023-01-09	Colorado	Case 9 Description	Case 9 Details	Case 9 Notes	Case 9 Attachments
10	Ivy White	Case 10	Open	2023-01-10	Connecticut	Case 10 Description	Case 10 Details	Case 10 Notes	Case 10 Attachments
11	Jack Black	Case 11	Closed	2023-01-11	Delaware	Case 11 Description	Case 11 Details	Case 11 Notes	Case 11 Attachments
12	Karen Green	Case 12	Pending	2023-01-12	Idaho	Case 12 Description	Case 12 Details	Case 12 Notes	Case 12 Attachments
13	Liam King	Case 13	Open	2023-01-13	Indiana	Case 13 Description	Case 13 Details	Case 13 Notes	Case 13 Attachments
14	Mia Lee	Case 14	Closed	2023-01-14	Iowa	Case 14 Description	Case 14 Details	Case 14 Notes	Case 14 Attachments
15	Noah Scott	Case 15	Pending	2023-01-15	Kansas	Case 15 Description	Case 15 Details	Case 15 Notes	Case 15 Attachments
16	Olivia Hall	Case 16	Open	2023-01-16	Kentucky	Case 16 Description	Case 16 Details	Case 16 Notes	Case 16 Attachments
17	Peter Young	Case 17	Closed	2023-01-17	Louisiana	Case 17 Description	Case 17 Details	Case 17 Notes	Case 17 Attachments
18	Quinn Adams	Case 18	Pending	2023-01-18	Maine	Case 18 Description	Case 18 Details	Case 18 Notes	Case 18 Attachments
19	Rachel Baker	Case 19	Open	2023-01-19	Maryland	Case 19 Description	Case 19 Details	Case 19 Notes	Case 19 Attachments
20	Samuel Clark	Case 20	Closed	2023-01-20	Massachusetts	Case 20 Description	Case 20 Details	Case 20 Notes	Case 20 Attachments
21	Tina Evans	Case 21	Pending	2023-01-21	Michigan	Case 21 Description	Case 21 Details	Case 21 Notes	Case 21 Attachments
22	Uma Frost	Case 22	Open	2023-01-22	Minnesota	Case 22 Description	Case 22 Details	Case 22 Notes	Case 22 Attachments
23	Victor Gray	Case 23	Closed	2023-01-23	Mississippi	Case 23 Description	Case 23 Details	Case 23 Notes	Case 23 Attachments
24	Wendy Harris	Case 24	Pending	2023-01-24	Montana	Case 24 Description	Case 24 Details	Case 24 Notes	Case 24 Attachments
25	Xavier King	Case 25	Open	2023-01-25	Nebraska	Case 25 Description	Case 25 Details	Case 25 Notes	Case 25 Attachments
26	Yara Lee	Case 26	Closed	2023-01-26	Nevada	Case 26 Description	Case 26 Details	Case 26 Notes	Case 26 Attachments
27	Zoe Miller	Case 27	Pending	2023-01-27	New Hampshire	Case 27 Description	Case 27 Details	Case 27 Notes	Case 27 Attachments
28	Adam White	Case 28	Open	2023-01-28	New Jersey	Case 28 Description	Case 28 Details	Case 28 Notes	Case 28 Attachments
29	Bella Black	Case 29	Closed	2023-01-29	New Mexico	Case 29 Description	Case 29 Details	Case 29 Notes	Case 29 Attachments
30	Chris Green	Case 30	Pending	2023-01-30	New York	Case 30 Description	Case 30 Details	Case 30 Notes	Case 30 Attachments
31	Diana King	Case 31	Open	2023-01-31	North Carolina	Case 31 Description	Case 31 Details	Case 31 Notes	Case 31 Attachments
32	Ethan Lee	Case 32	Closed	2023-02-01	North Dakota	Case 32 Description	Case 32 Details	Case 32 Notes	Case 32 Attachments
33	Fiona Scott	Case 33	Pending	2023-02-02	Ohio	Case 33 Description	Case 33 Details	Case 33 Notes	Case 33 Attachments
34	Gavin Hall	Case 34	Open	2023-02-03	Oklahoma	Case 34 Description	Case 34 Details	Case 34 Notes	Case 34 Attachments
35	Hannah Young	Case 35	Closed	2023-02-04	Oregon	Case 35 Description	Case 35 Details	Case 35 Notes	Case 35 Attachments
36	Ian Adams	Case 36	Pending	2023-02-05	Pennsylvania	Case 36 Description	Case 36 Details	Case 36 Notes	Case 36 Attachments
37	Jasmine Baker	Case 37	Open	2023-02-06	Rhode Island	Case 37 Description	Case 37 Details	Case 37 Notes	Case 37 Attachments
38	Kyle Clark	Case 38	Closed	2023-02-07	South Carolina	Case 38 Description	Case 38 Details	Case 38 Notes	Case 38 Attachments
39	Laura Evans	Case 39	Pending	2023-02-08	South Dakota	Case 39 Description	Case 39 Details	Case 39 Notes	Case 39 Attachments
40	Mason Frost	Case 40	Open	2023-02-09	Tennessee	Case 40 Description	Case 40 Details	Case 40 Notes	Case 40 Attachments
41	Nora Gray	Case 41	Closed	2023-02-10	Texas	Case 41 Description	Case 41 Details	Case 41 Notes	Case 41 Attachments
42	Oliver Harris	Case 42	Pending	2023-02-11	Utah	Case 42 Description	Case 42 Details	Case 42 Notes	Case 42 Attachments
43	Peter King	Case							

DM74LS123

Physical Dimensions inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
Package Number M16A**

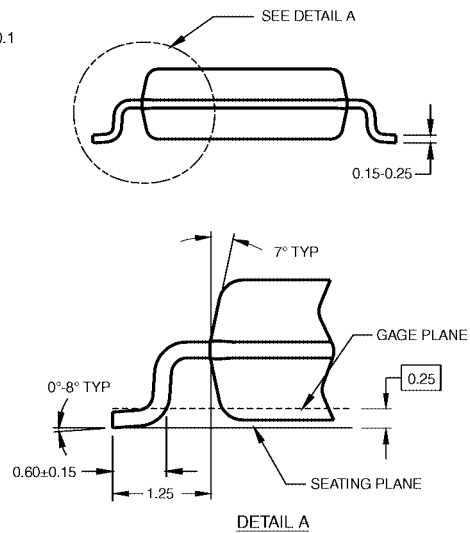
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

DIMENSIONS ARE IN MILLIMETERS

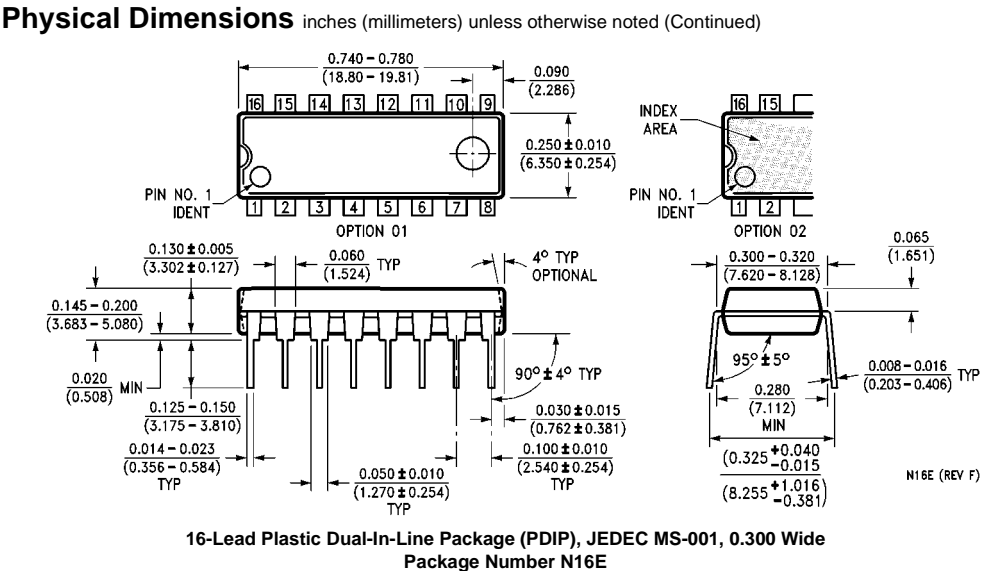
NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1



16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D



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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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