

## LMC555 CMOS Timer

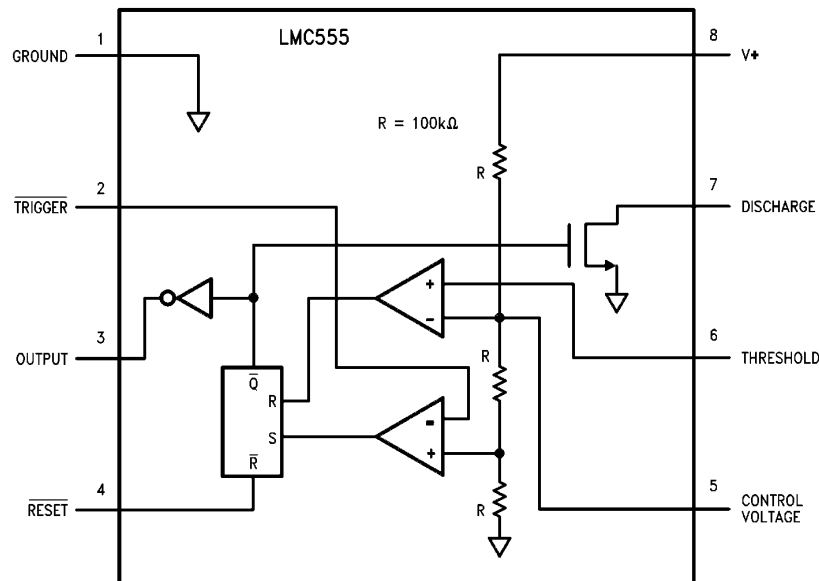
### General Description

The LMC555 is a CMOS version of the industry standard 555 series general purpose timers. It offers the same capability of generating accurate time delays and frequencies but with much lower power dissipation and supply current spikes. When operated as a one-shot, the time delay is precisely controlled by a single external resistor and capacitor. In the astable mode the oscillation frequency and duty cycle are accurately set by two external resistors and one capacitor. The use of National Semiconductor's LCMOS™ process extends both the frequency range and low supply capability.

### Features

- Less than 1 mW typical power dissipation at 5V supply
- 3 MHz astable frequency capability
- 1.5V supply operating voltage guaranteed
- Output fully compatible with TTL and CMOS logic at 5V supply
- Tested to -10 mA, +50 mA output current levels
- Reduced supply current spikes during output transitions
- Extremely low reset, trigger, and threshold currents
- Excellent temperature stability
- Pin-for-pin compatible with 555 series of timers
- Available in 8 pin MSOP Package

### Block and Connection Diagrams



DS008669-1

(Pinouts for Molded and Metal Can Packages are identical)

**Order Number LMC555CH, LMC555CM, LMC555CMM or LMC555CN**  
**See NS Package Number H08C, M08A, MUA08A, or N08E**

**Absolute Maximum Ratings** (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage, V <sub>S</sub>	15V
Input Voltages, V <sub>2</sub> , V <sub>4</sub> , V <sub>5</sub> , V <sub>6</sub>	−0.3V to V <sub>S</sub> + 0.3V
Output Voltages, V <sub>3</sub> , V <sub>7</sub>	15V
Output Current I <sub>3</sub> , I <sub>7</sub>	100 mA
Operating Temperature Range (Note 4)	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C

## Soldering Information

Dual-In-Line Package	
Soldering (10 seconds)	260°C
Small Outline Package (SOIC and MSOP)	
Vapor Phase (60 seconds)	215°C
Infrared (15 seconds)	220°C
See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.	

**Electrical Characteristics** (Notes 1, 2)

Test Circuit, T = 25°C, all switches open, RESET to V<sub>S</sub> unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units (Limits)
I <sub>8</sub>	Supply Current	V <sub>S</sub> = 1.5V V <sub>S</sub> = 5V V <sub>S</sub> = 12V		50 100 150	150 250 400	μA
V <sub>5</sub>	Control Voltage	V <sub>S</sub> = 1.5V V <sub>S</sub> = 5V V <sub>S</sub> = 12V	0.8 2.9 7.4	1.0 3.3 8.0	1.2 3.8 8.6	V
V <sub>7</sub>	Discharge Saturation Voltage	V <sub>S</sub> = 1.5V, I <sub>7</sub> = 1 mA V <sub>S</sub> = 5V, I <sub>7</sub> = 10 mA		75 150	150 300	mV
V <sub>3L</sub>	Output Voltage (Low)	V <sub>S</sub> = 1.5V, I <sub>3</sub> = 1 mA V <sub>S</sub> = 5V, I <sub>3</sub> = 8 mA V <sub>S</sub> = 12V, I <sub>3</sub> = 50 mA		0.2 0.3 1.0	0.4 0.6 2.0	V
V <sub>3H</sub>	Output Voltage (High)	V <sub>S</sub> = 1.5V, I <sub>3</sub> = −0.25 mA V <sub>S</sub> = 5V, I <sub>3</sub> = −2 mA V <sub>S</sub> = 12V, I <sub>3</sub> = −10 mA	1.0 4.4 10.5	1.25 4.7 11.3		V
V <sub>2</sub>	Trigger Voltage	V <sub>S</sub> = 1.5V V <sub>S</sub> = 12V	0.4 3.7	0.5 4.0	0.6 4.3	V
I <sub>2</sub>	Trigger Current	V <sub>S</sub> = 5V		10		pA
V <sub>4</sub>	Reset Voltage	V <sub>S</sub> = 1.5V (Note 5) V <sub>S</sub> = 12V	0.4 0.4	0.7 0.75	1.0 1.1	V
I <sub>4</sub>	Reset Current	V <sub>S</sub> = 5V		10		pA
I <sub>6</sub>	Threshold Current	V <sub>S</sub> = 5V		10		pA
I <sub>7</sub>	Discharge Leakage	V <sub>S</sub> = 12V		1.0	100	nA
t	Timing Accuracy	SW 2, 4 Closed V <sub>S</sub> = 1.5V V <sub>S</sub> = 5V V <sub>S</sub> = 12V	0.9 1.0 1.0	1.1 1.1 1.1	1.25 1.20 1.25	ms
Δt/ΔV <sub>S</sub>	Timing Shift with Supply	V <sub>S</sub> = 5V ±1V		0.3		%/V
Δt/ΔT	Timing Shift with Temperature	V <sub>S</sub> = 5V −40°C ≤ T ≤ +85°C		75		ppm/°C
f <sub>A</sub>	Astable Frequency	SW 1, 3 Closed V <sub>S</sub> = 12V	4.0	4.8	5.6	kHz
f <sub>MAX</sub>	Maximum Frequency	Max. Freq. Test Circuit, V <sub>S</sub> = 5V		3.0		MHz
t <sub>R</sub> , t <sub>F</sub>	Output Rise and Fall Times	Max. Freq. Test Circuit V <sub>S</sub> = 5V, C <sub>L</sub> = 10 pF		15		ns

## Electrical Characteristics (Notes 1, 2)

Test Circuit,  $T = 25^{\circ}\text{C}$ , all switches open,  $\overline{\text{RESET}}$  to  $V_S$  unless otherwise noted (Continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units (Limits)
$t_{PD}$	Trigger Propagation Delay	$V_S = 5\text{V}$ , Measure Delay from Trigger to Output		100		ns

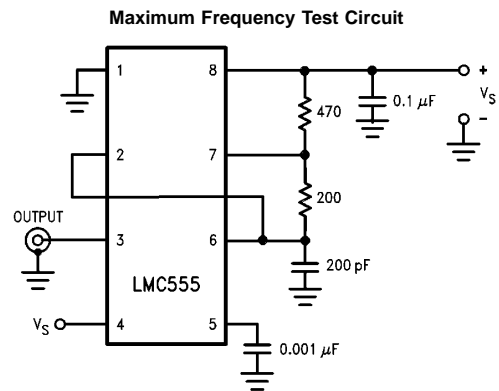
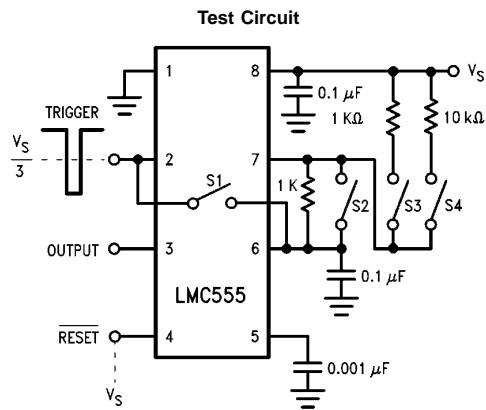
**Note 1:** All voltages are measured with respect to the ground pin, unless otherwise specified.

**Note 2:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

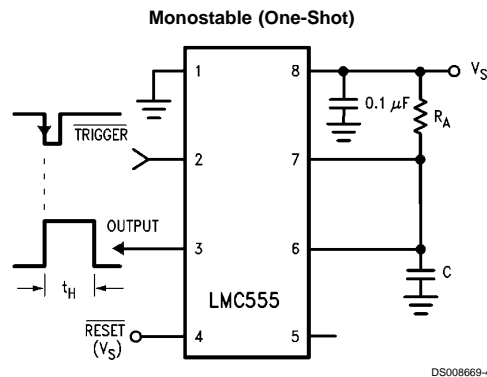
**Note 3:** Refer to RETSC555X drawing for specifications of military LMC555H version.

**Note 4:** For operation at elevated temperatures, the device must be derated based on a  $150^{\circ}\text{C}$  maximum junction temperature and a thermal resistance of  $111^{\circ}\text{C/W}$  for the LMC555CN,  $167^{\circ}\text{C/W}$  for the LMC555CH,  $169^{\circ}\text{C/W}$  for the LMC555CM, and  $225^{\circ}\text{C/W}$  for the LMC555MM. Maximum allowable dissipation at  $25^{\circ}\text{C}$  is 1126 mW for the LMC555CN, 755 mW for the LMC555CH, 740 mW for the LMC555CM and 555 mW for the LMC555MM.

**Note 5:** If the  $\overline{\text{RESET}}$  pin is to be used at temperatures of  $-20^{\circ}\text{C}$  and below  $V_S$  is required to be 2.0V or greater.



## Typical Applications



$t_H = 1.1 R_A C$  (Gives time that output is high following trigger)

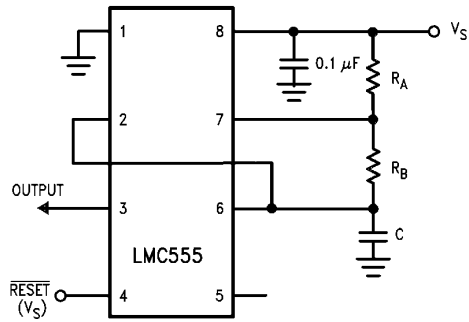
$\overline{\text{RESET}}$  overrides  $\overline{\text{TRIGGER}}$ , which can override  $\overline{\text{THRESHOLD}}$ . Therefore, the trigger pulse must be shorter than the desired  $t_H$ .

The minimum trigger pulse width is 20 ns.

The minimum reset pulse width is 400 ns.

## Typical Applications (Continued)

### Variable Duty Cycle Oscillator

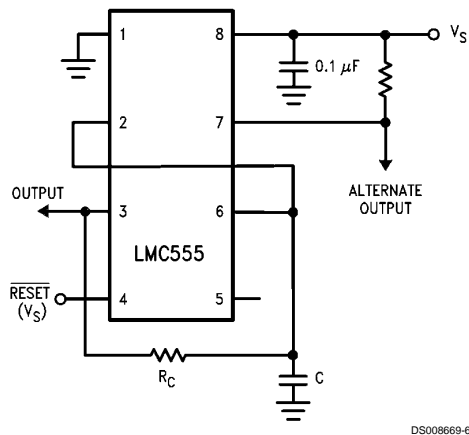


(Gives fraction of total period that output is low)

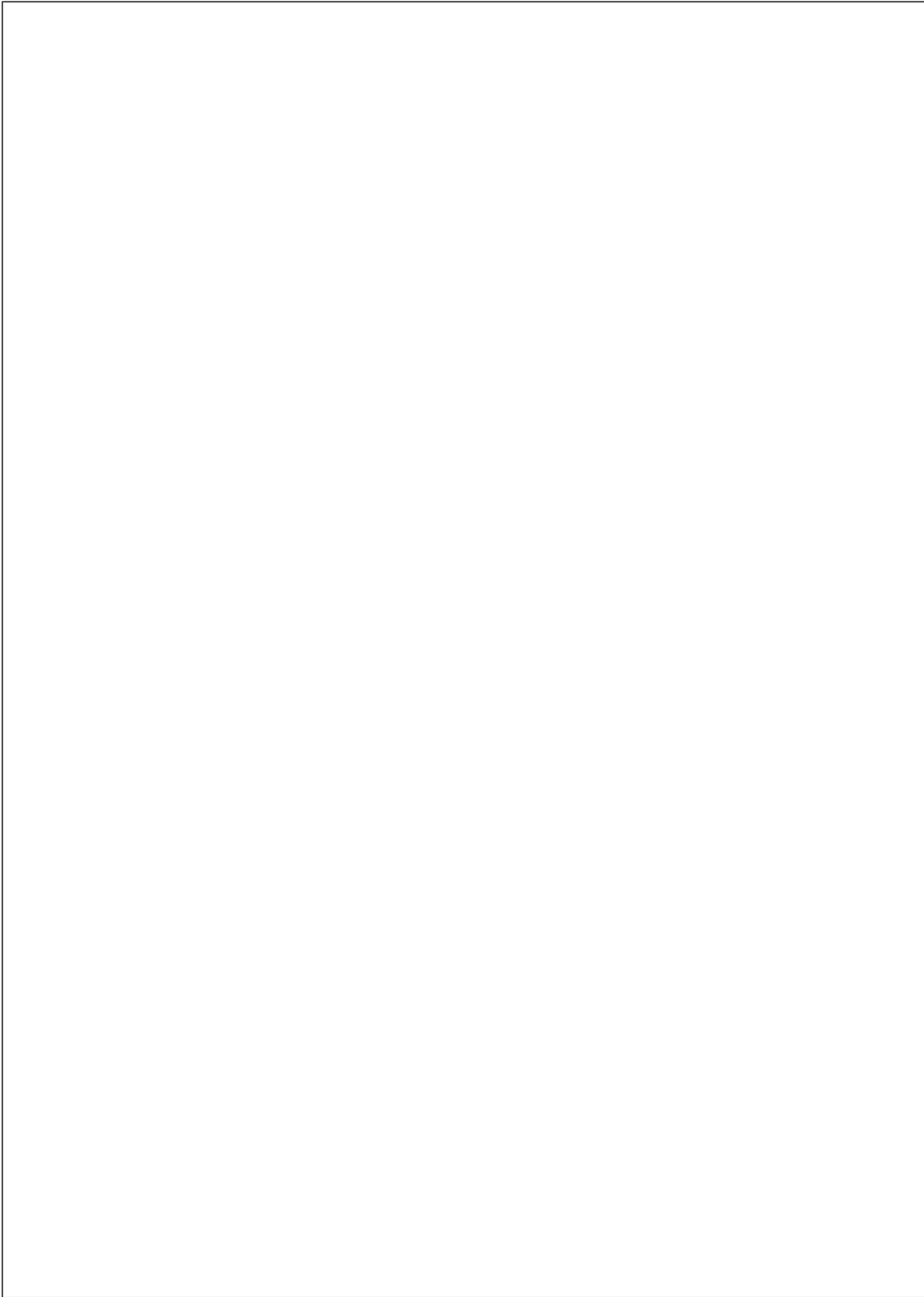
$$f_{\text{OSC}} = \frac{1.44}{(R_A + 2R_B)C}$$

$$\text{Duty Cycle} = \frac{R_B}{R_A + 2R_B}$$

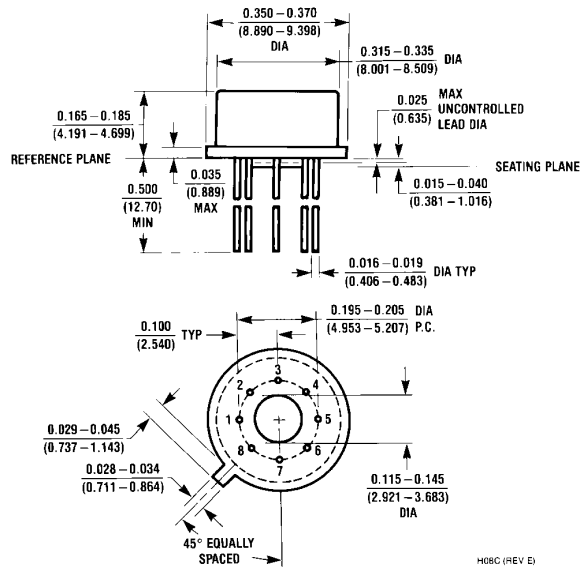
### 50% Duty Cycle Oscillator



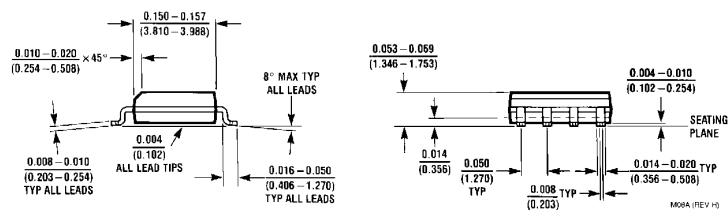
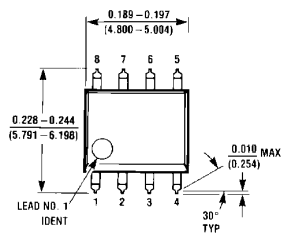
$$f_{\text{OSC}} = \frac{1}{1.4R_C C}$$



## Physical Dimensions inches (millimeters)

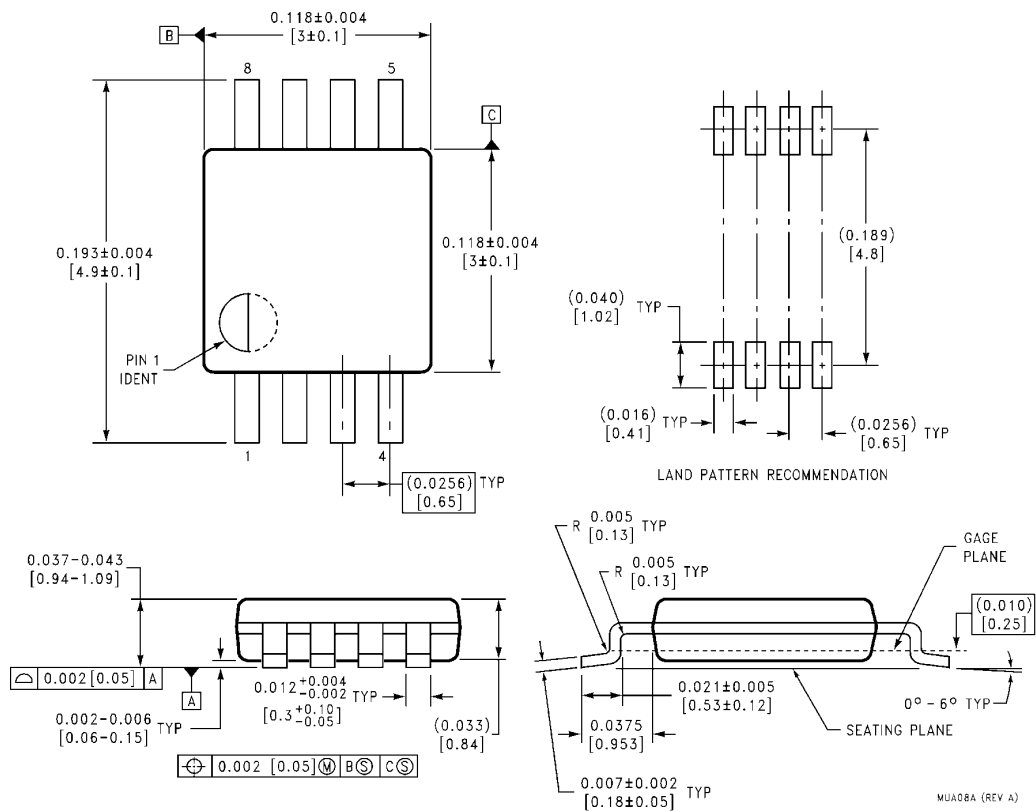


**8-Lead TO-5 Metal Can Package (H)**  
Order Number LMC555CH  
NS Package Number H08C



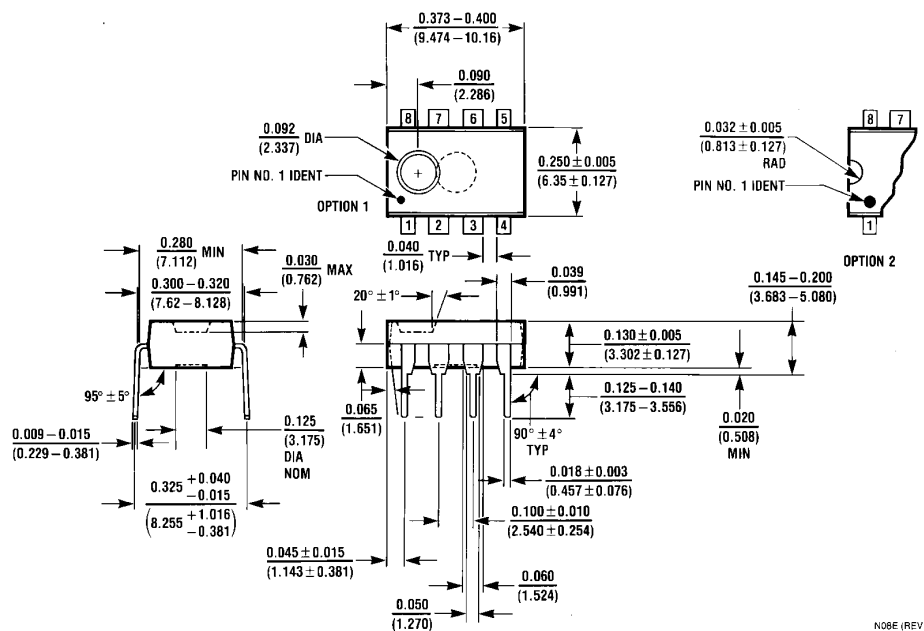
**Molded Small Outline (SO) Package (M)**  
Order Number LMC555CM  
NS Package Number M08A

# Physical Dimensions inches (millimeters) (Continued)



**8-Lead (0.118" Wide) Molded Mini Small Outline Package**  
**Order Number LMC555CMM**  
**NS Package Number MUA08A**

# Physical Dimensions inches (millimeters) (Continued)



Molded Dual-in-line Package (N)  
Order Number LMC555CN  
NS Package Number N08E

N08E (REV F)

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