National Semiconductor

September 1996

LMC555 CMOS Timer

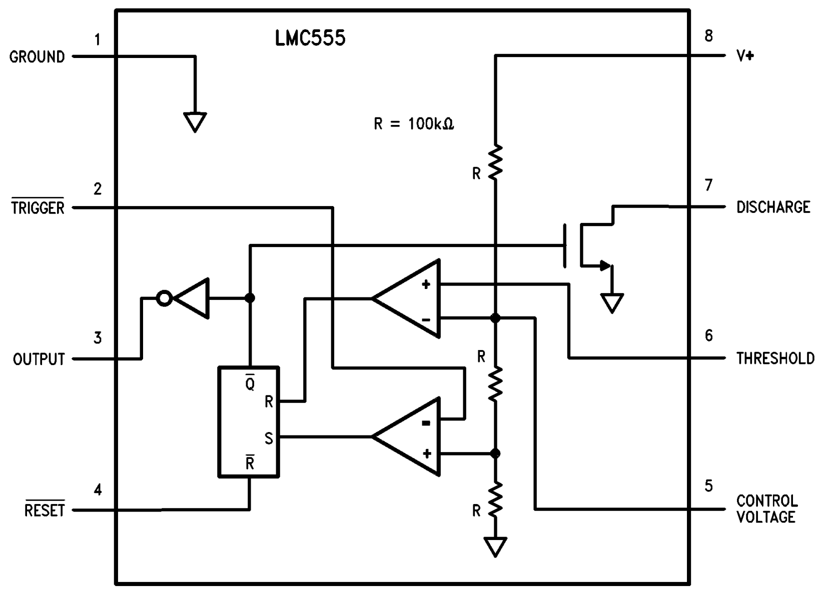
General Description

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 LMCMOS™ 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

Block and Connection Diagrams



TL/H/8669–1

(Pinouts for Molded and Metal Can Packages are identical)

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

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RRD-B30M96/Printed in U. S. A.

Absolute Maximum Ratings

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

Supply Voltage, V8	15V
Input Voltages, V2, V4, V5, V6	$-0.3V$ to $V_S + 0.3V$
Output Voltages, V3, V7	15V
Output Current I3, I7	100 mA
Operating Temperature Range (Note 1)	−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	
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

Test Circuit, T = 25°C, all switches open, $\overline{RESET}$ to V_S unless otherwise noted

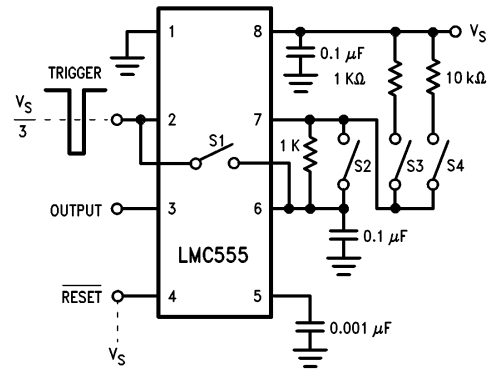
Symbol	Parameter	Conditions	Min	Typ	Max	Units (Limits)
I8	Supply Current	V_S = 1.5V V_S = 5V V_S = 12V		50 100 150	150 250 400	μA
V5	Control Voltage	V_S = 1.5V V_S = 5V V_S = 12V	0.8 2.9 7.4	1.0 3.3 8.0	1.2 3.8 8.6	V
V7	Discharge Saturation Voltage	V_S = 1.5V, I_7 = 1 mA V_S = 5V, I_7 = 10 mA		75 150	150 300	mV
$V3_L$	Output Voltage (Low)	V_S = 1.5V, I_3 = 1 mA V_S = 5V, I_3 = 8 mA V_S = 12V, I_3 = 50 mA		0.2 0.3 1.0	0.4 0.6 2.0	V
$V3_H$	Output Voltage (High)	V_S = 1.5V, I_3 = −0.25 mA V_S = 5V, I_3 = −2 mA V_S = 12V, I_3 = −10 mA	1.0 4.4 10.5	1.25 4.7 11.3		V
V2	Trigger Voltage	V_S = 1.5V V_S = 12V	0.4 3.7	0.5 4.0	0.6 4.3	V
I2	Trigger Current	V_S = 5V		10		pA
V4	Reset Voltage	V_S = 1.5V (Note 2) V_S = 12V	0.4 0.4	0.7 0.75	1.0 1.1	V
I4	Reset Current	V_S = 5V		10		pA
I6	Threshold Current	V_S = 5V		10		pA
I7	Discharge Leakage	V_S = 12V		1.0	100	nA
t	Timing Accuracy	SW 2, 4 Closed V_S = 1.5V V_S = 5V V_S = 12V	 0.9 1.0 1.0	 1.1 1.1 1.1	 1.25 1.20 1.25	ms
Δt/ΔVs	Timing Shift with Supply	V_S = 5V ±1V		0.3		%/V
Δt/ΔT	Timing Shift with Temperature	V_S = 5V −40°C ≤ T ≤ +85°C		75		ppm/°C
f_A	Astable Frequency	SW 1, 3 Closed V_S = 12V	4.0	4.8	5.6	kHz
f_{MAX}	Maximum Frequency	Max. Freq. Test Circuit, V_S = 5V		3.0		MHz
t_R, t_F	Output Rise and Fall Times	Max. Freq. Test Circuit V_S = 5V, C_L = 10 pF		15		ns
t_{PD}	Trigger Propagation Delay	V_S = 5V, Measure Delay from Trigger to Output		100		ns

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

Note 1: For operation at elevated temperatures, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 111°C/W for the LMC555CN, 167°C/W for the LMC555CH, and 169°C/W for the LMC555CM. Maximum allowable dissipation at 25°C is 1126 mW for the LMC555CN, 755 mW for the LMC555CH, and 740 mW for the LMC555CM.

Note 2: If the $\overline{RESET}$ pin is to be used at temperatures of −20°C and below V_S is required to be 2.0V or greater.

Test Circuit



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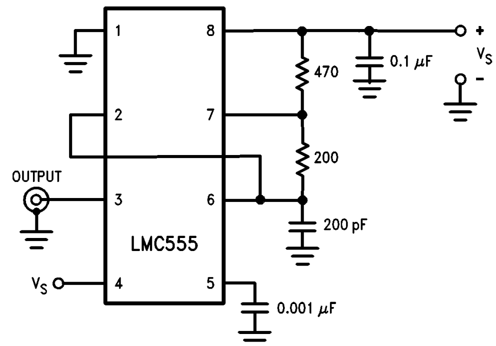
Maximum Frequency Test Circuit



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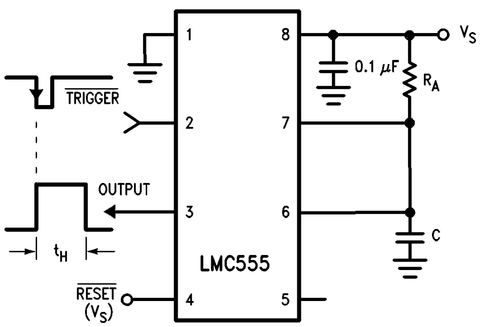
Typical Applications

Monostable (One-Shot)



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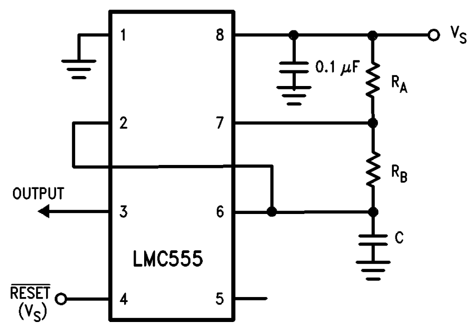
$t_H = 1.1\ R_AC$ (Gives time that output is high following trigger)

$\overline{\text{RESET}}$ overrides $\overline{\text{TRIGGER}}$, which can override 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.

Variable Duty Cycle Oscillator



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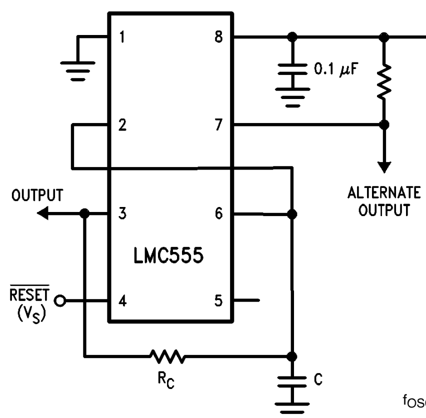
$$f_{OSC.} = \frac{1.44}{(R_A + 2R_B)C}$$

$$\text{Duty Cycle} = \frac{R_B}{R_A + 2R_B}$$ (Gives fraction of total period that output is low)

50% Duty Cycle Oscillator



$$f_{OSC} = \frac{1}{1.4R_CC}$$

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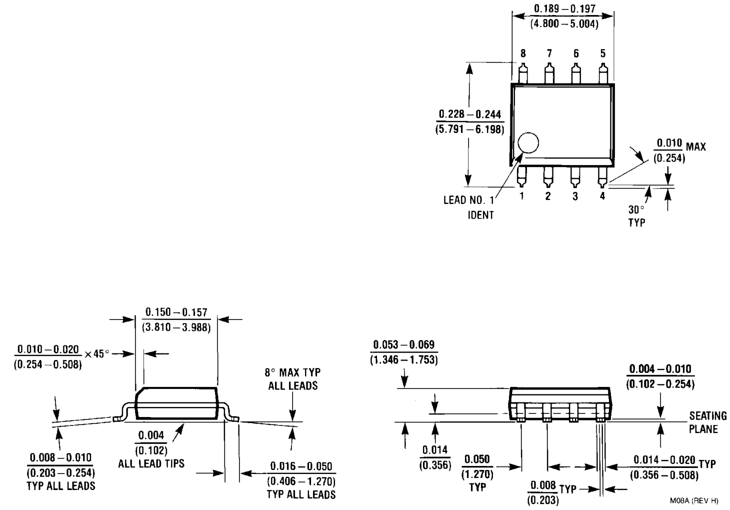
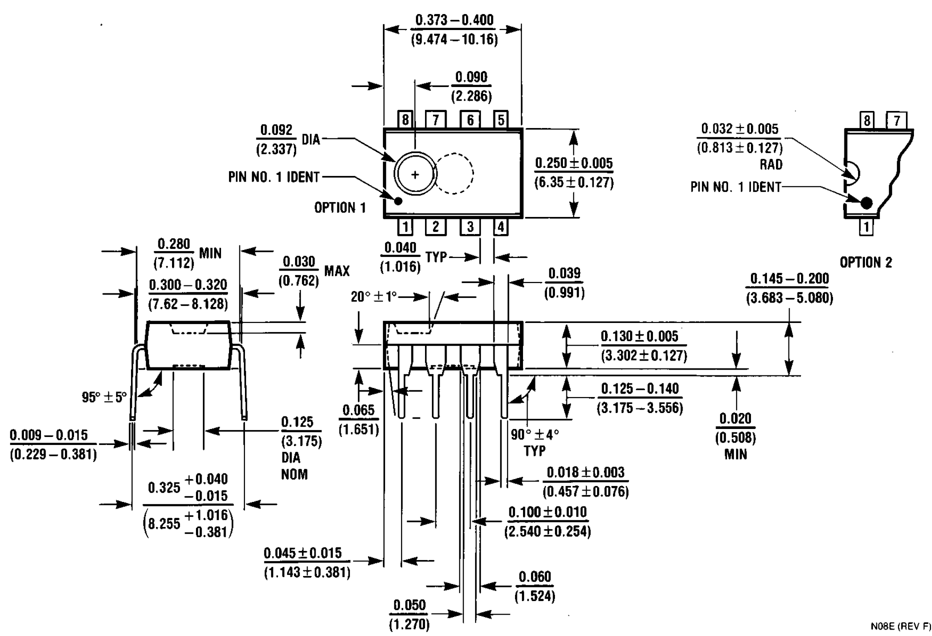
Physical Dimensions inches (millimeters) unless otherwise noted



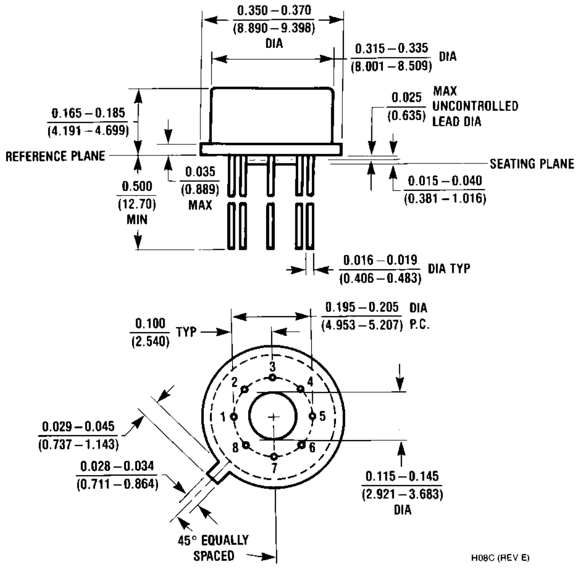
Molded Small Outline (SO) Package (M)
Order Number LMC555CM
NS Package Number M08A



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

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

Lit. # 108445



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

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