National Semiconductor

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# LM556/LM556C Dual Timer

## General Description

The LM556 Dual timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. The 556 is a dual 555. Timing is provided by an external resistor and capacitor for each timing function. The two timers operate independently of each other sharing only $V_{CC}$ and ground. The circuits may be triggered and reset on falling waveforms. The output structures may sink or source 200 mA.

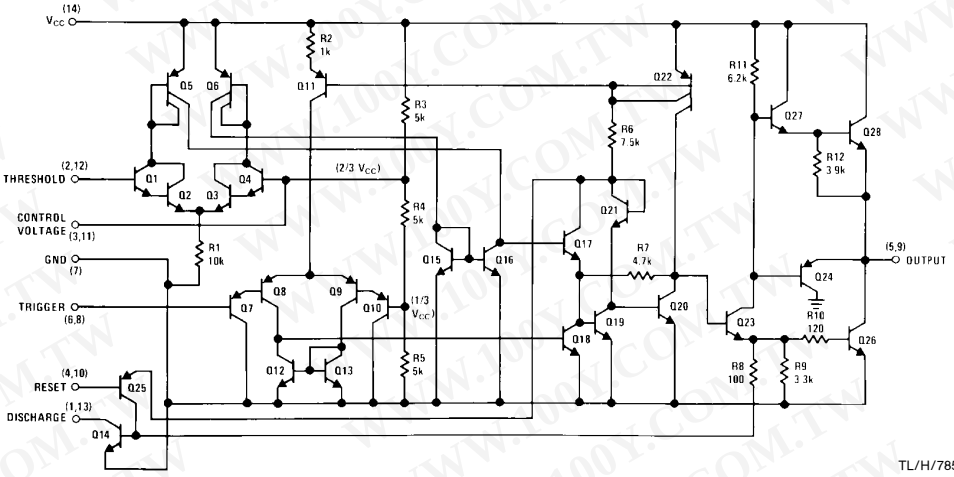
## Features

- Direct replacement for SE556/NE556
- Timing from microseconds through hours
- Operates in both astable and monostable modes
- Replaces two 555 timers
- Adjustable duty cycle
- Output can source or sink 200 mA
- Output and supply TTL compatible
- Temperature stability better than 0.005% per °C
- Normally on and normally off output

## Applications

- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation
- Pulse width modulation
- Pulse position modulation
- Linear ramp generator

## Schematic Diagram

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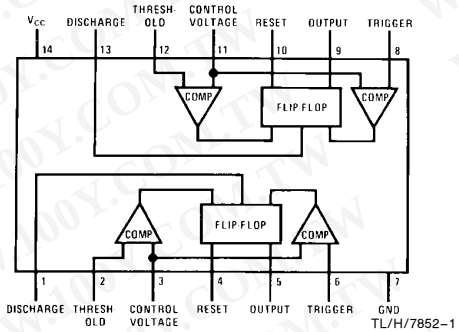
## Connection Diagram

**Dual-In-Line and Small Outline Packages**

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**Top View**

**Order Number LM556J or LM556CJ**
**See NS Package Number J14A**

**Order Number LM556CM**
**See NS Package Number M14A**

**Order Number LM556CN**
**See NS Package Number N14A**



RRD-B30M115/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 +18V

Power Dissipation (Note 1)
- LM556J, LM556CJ 1785 mW
- LM556CN 1620 mW

Operating Temperature Ranges
- LM556C 0°C to +70°C
- LM556 −55°C to +125°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 ($T_A$ = 25°C, $V_{CC}$ = +5V to +15V, unless otherwise specified)

| Parameter | Conditions | LM556 | | | LM556C | | | Units |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Supply Voltage | | 4.5 | | 18 | 4.5 | | 16 | V |
| Supply Current | $V_{CC}$ = 5V, $R_L$ = ∞ | | 3 | 5 | | 3 | 6 | mA |
| (Each Timer Section) | $V_{CC}$ = 15V, $R_L$ = ∞ | | 10 | 11 | | 10 | 14 | mA |
| | (Low State) (Note 2) | | | | | | | |
| Timing Error, Monostable | | | | | | | | |
| Initial Accuracy | | | 0.5 | | | 0.75 | | % |
| Drift with Temperature | $R_A$ = 1k to 100 kΩ, C = 0.1 μF, | | 30 | | | 50 | | ppm/°C |
| | (Note 3) | | | | | | | |
| Accuracy over Temperature | | | 1.5 | | | 1.5 | | % |
| Drift with Supply | | | 0.05 | | | 0.1 | | %/V |
| Timing Error, Astable | | | | | | | | |
| Initial Accuracy | | | 1.5 | | | 2.25 | | % |
| Drift with Temperature | $R_A$, $R_B$ = 1k to 100 kΩ, | | 90 | | | 150 | | ppm/°C |
| Accuracy over Temperature | C = 0.1 μF, (Note 3) | | 2.5 | | | 3.0 | | % |
| Drift with Supply | | | 0.15 | | | 0.30 | | %/V |
| Trigger Voltage | $V_{CC}$ = 15V | 4.8 | 5 | 5.2 | 4.5 | 5 | 5.5 | V |
| | $V_{CC}$ = 5V | 1.45 | 1.67 | 1.9 | 1.25 | 1.67 | 2.0 | V |
| Trigger Current | | | 0.1 | 0.5 | | 0.2 | 1.0 | μA |
| Reset Voltage | (Note 4) | 0.4 | 0.5 | 1 | 0.4 | 0.5 | 1 | V |
| Reset Current | | | 0.1 | 0.4 | | 0.1 | 0.6 | mA |
| Threshold Current | $V_{TH}$ = V-Control (Note 5) | | 0.03 | 0.1 | | 0.03 | 0.1 | μA |
| | $V_{TH}$ = 11.2V | | | 250 | | | 250 | nA |
| Control Voltage Level and | $V_{CC}$ = 15V | 9.6 | 10 | 10.4 | 9 | 10 | 11 | V |
| Threshold Voltage | $V_{CC}$ = 5V | 2.9 | 3.33 | 3.8 | 2.6 | 3.33 | 4 | V |
| Pin 1, 13 Leakage Output High | | | 1 | 100 | | 1 | 100 | nA |
| Pin 1, 13 Sat | (Note 6) | | | | | | | |
| Output Low | $V_{CC}$ = 15V, I = 15 mA | | 150 | 240 | | 180 | 300 | mV |
| Output Low | $V_{CC}$ = 4.5V, I = 4.5 mA | | 70 | 100 | | 80 | 200 | mV |

## Electrical Characteristics ($T_A$ = 25°C, $V_{CC}$ = +5V to +15V, unless otherwise specified) (Continued)

| Parameter | Conditions | LM556 | | | LM556C | | | Units |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage Drop (Low) | $V_{CC}$ = 15V | | | | | | | |
| | $I_{SINK}$ = 10 mA | | 0.1 | 0.15 | | 0.1 | 0.25 | V |
| | $I_{SINK}$ = 50 mA | | 0.4 | 0.5 | | 0.4 | 0.75 | V |
| | $I_{SINK}$ = 100 mA | | 2 | 2.25 | | 2 | 2.75 | V |
| | $I_{SINK}$ = 200 mA | | 2.5 | | | 2.5 | | V |
| | $V_{CC}$ = 5V | | | | | | | |
| | $I_{SINK}$ = 8 mA | | 0.1 | 0.25 | | | | V |
| | $I_{SINK}$ = 5 mA | | | | | 0.25 | 0.35 | V |
| Output Voltage Drop (High) | $I_{SOURCE}$ = 200 mA, $V_{CC}$ = 15V | | 12.5 | | | 12.5 | | V |
| | $I_{SOURCE}$ = 100 mA, $V_{CC}$ = 15V | 13 | 13.3 | | 12.75 | 13.3 | | V |
| | $V_{CC}$ = 5V | 3 | 3.3 | | 2.75 | 3.3 | | V |
| Rise Time of Output | | | 100 | | | 100 | | ns |
| Fall Time of Output | | | 100 | | | 100 | | ns |
| Matching Characteristics | (Note 7) | | | | | | | |
| Initial Timing Accuracy | | | 0.05 | 0.2 | | 0.1 | 2.0 | % |
| Timing Drift with Temperature | | | ±10 | | | ±10 | | ppm/°C |
| Drift with Supply Voltage | | | 0.1 | 0.2 | | 0.2 | 0.5 | %/V |

**Note 1:** For operating at elevated temperatures the device must be derated based on a +150°C maximum junction temperature and a thermal resistance of 70°C/W (Ceramic), 77°C/W (Plastic DIP) and 110°C/W (SO-14 Narrow).

**Note 2:** Supply current when output high typically 1 mA less at $V_{CC}$ = 5V.

**Note 3:** Tested at $V_{CC}$ = 5V and $V_{CC}$ = 15V.

**Note 4:** As reset voltage lowers, timing is inhibited and then the output goes low.

**Note 5:** This will determine the maximum value of $R_A + R_B$ for 15V operation. The maximum total ($R_A + R_B$) is 20 MΩ.

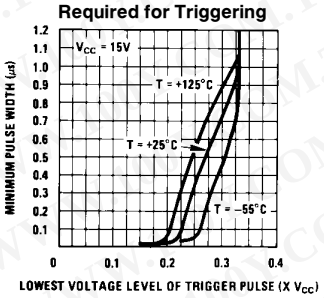
**Note 6:** No protection against excessive pin 1, 13 current is necessary providing the package dissipation rating will not be exceeded.

**Note 7:** Matching characteristics refer to the difference between performance characteristics of each timer section.

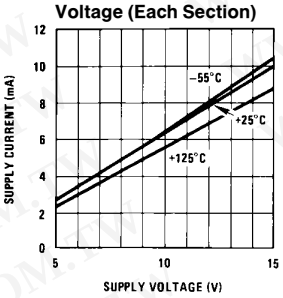
**Note 8:** Refer to RETS556X drawing for specifications of military LM556J version.

## Typical Performance Characteristics

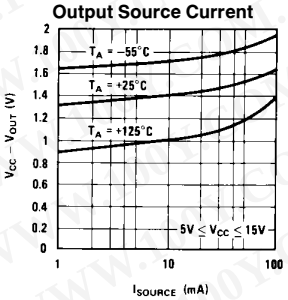
**Minimum Pulse Width Required for Triggering**



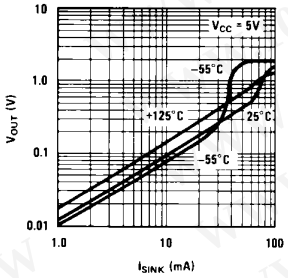

**Supply Current vs Supply Voltage (Each Section)**



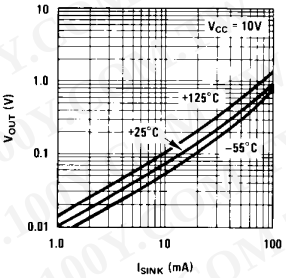

**High Output Voltage vs Output Source Current**



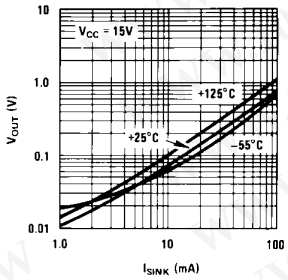

**Low Output Voltage vs Output Sink Current**



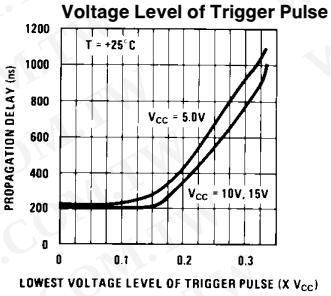

**Low Output Voltage vs Output Sink Current**



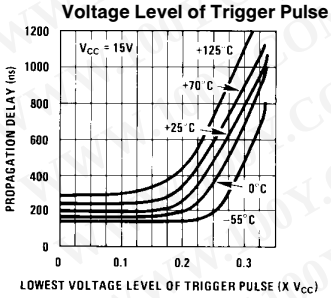

**Low Output Voltage vs Output Sink Current**



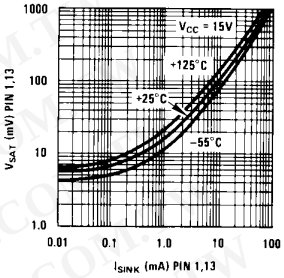

**Output Propagation Delay vs Voltage Level of Trigger Pulse**



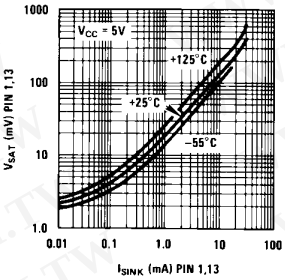

**Output Propagation Delay vs Voltage Level of Trigger Pulse**




**Discharge Transistor (Pin 1, 13) Voltage vs Sink Current**




**Discharge Transistor (Pin 1, 13) Voltage vs Sink Current**

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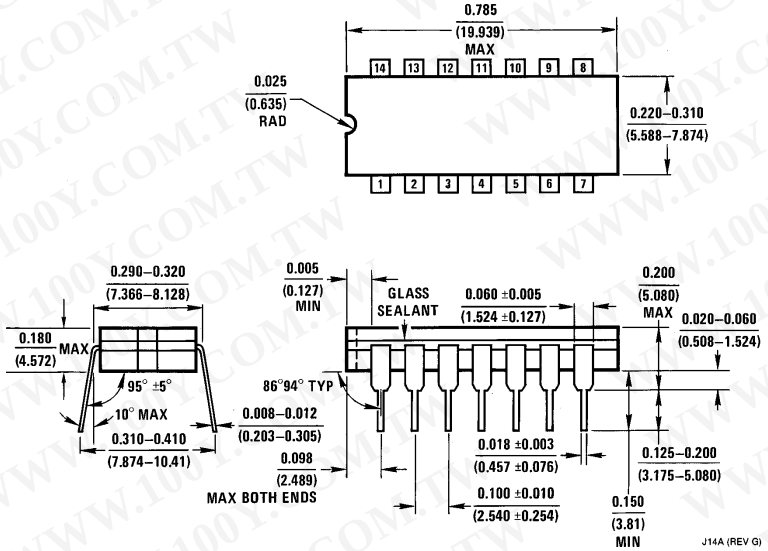
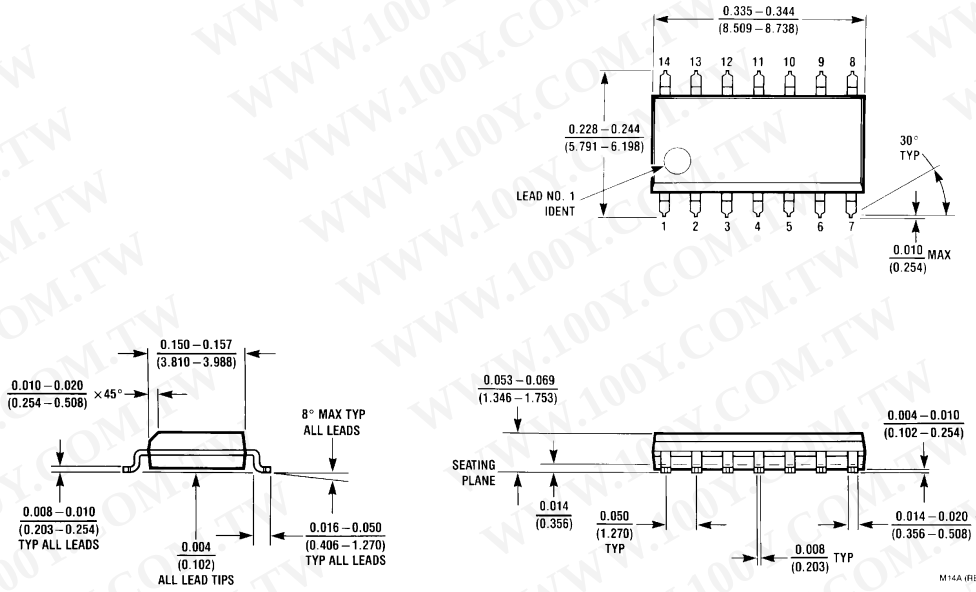
## Physical Dimensions inches (millimeters)

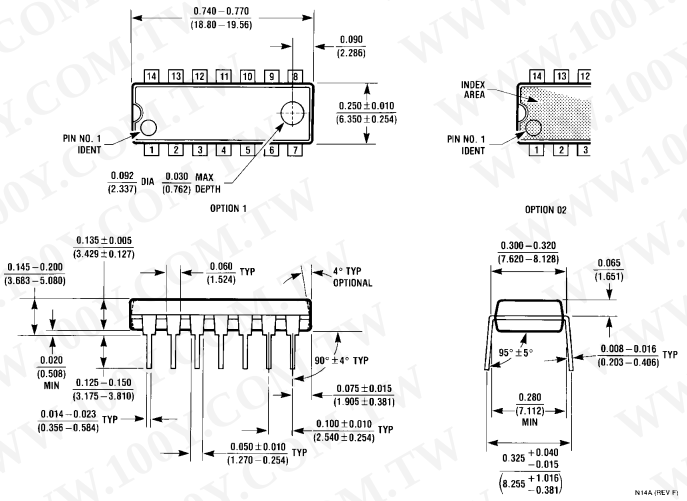



**Ceramic Dual-In-Line Package (J)**
**Order Number LM556J or LM556CJ**
**NS Package Number J14A**




**S.O. Molded Package (M)**
**Order Number LM556CM**
**NS Package Number M14A**

## Physical Dimensions inches (millimeters) (Continued)




**Molded Dual-In-Line Package (N)**
**Order Number LM556CN**
**NS Package Number N14A**

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**National Semiconductor Corporation**
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

**National Semiconductor Europe**
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

**National Semiconductor Japan Ltd.**
Tel: 81-043-299-2309
Fax: 81-043-299-2408