

**NE/SA/SE556/NE556-1**

## PIN CONFIGURATION

### D, F, N Packages

| Pin | Function        |
|-----|-----------------|
| 1   | DISCHARGE       |
| 2   | THRESHOLD       |
| 3   | CONTROL VOLTAGE |
| 4   | RESET           |
| 5   | OUTPUT          |
| 6   | TRIGGER         |
| 7   | GND             |
| 8   | TRIGGER         |
| 9   | OUTPUT          |
| 10  | RESET           |
| 11  | CONTROL VOLTAGE |
| 12  | THRESHOLD       |
| 13  | DISCHARGE       |
| 14  | VCC             |

- Pulse generator
- Missing pulse detector
- Tone burst generator
- Pulse width modulation
- Time delay generator
- Frequency division
- Touch-Tone® encoder
- Industrial controls
- Pulse position modulation
- Appliance timing
- Traffic light control

- Turn-off time less than  $2\mu\text{s}$  (556-1)
- Maximum operating frequency  $>500\text{kHz}$  (556-1)
- Timing from microseconds to hours
- Replaces two 555 timers
- Operates in both astable and monostable modes
- High output current
- Adjustable duty cycle
- TTL compatible
- Temperature stability of  $0.005\%/^{\circ}\text{C}$
- SE556-1 compliant to MIL-STD or JAN

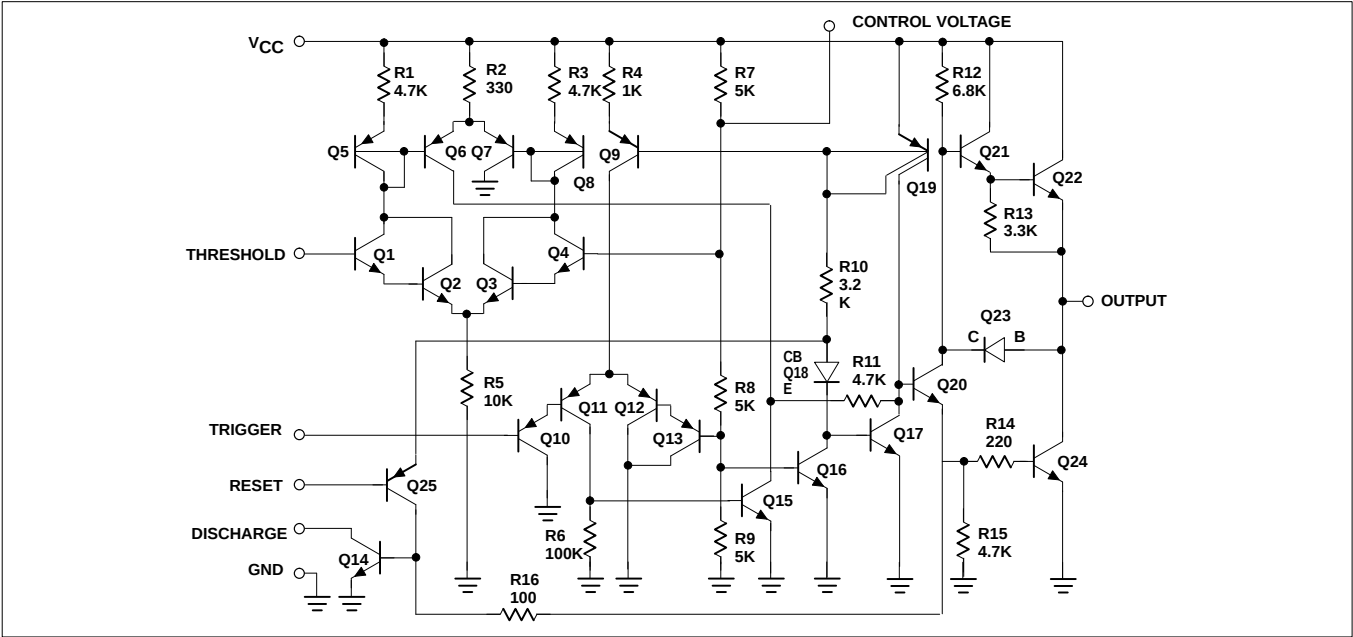
- Precision timing
- Sequential timing
- Pulse shaping

<sup>®</sup> Touch-Tone is a registered trademark of AT&T

Dual timer

NE/SA/SE556/NE556-1

EQUIVALENT SCHEMATIC (Shown for one circuit only)



ORDERING INFORMATION

| DESCRIPTION                                  | TEMPERATURE RANGE | ORDER CODE | DWG # |
|----------------------------------------------|-------------------|------------|-------|
| 14-Pin Plastic Small Outline (SO) Package    | 0 to +70°C        | NE556D     | 0175D |
| 14-Pin Ceramic Dual In-Line Package (CERDIP) | 0 to +70°C        | NE556F     | 0581B |
| 14-Pin Plastic Dual In-Line Package (DIP)    | 0 to +70°C        | NE556N     | 0405B |
| 14-Pin Ceramic Dual In-Line Package (CERDIP) | 0 to +70°C        | NE556-1F   | 0581B |
| 14-Pin Plastic Dual In-Line Package (DIP)    | 0 to +70°C        | NE556-1N   | 0405B |
| 14-Pin Plastic Dual In-Line Package (DIP)    | -40°C to +85°C    | SA556N     | 0405B |
| 14-Pin Ceramic Dual In-Line Package (CERDIP) | -55°C to +125°C   | SE556F     | 0581B |
| 14-Pin Plastic Dual In-Line Package (DIP)    | -55°C to +125°C   | SE556N     | 0405B |

ABSOLUTE MAXIMUM RATINGS

| SYMBOL            | PARAMETER                                                       | RATING                                | UNIT           |
|-------------------|-----------------------------------------------------------------|---------------------------------------|----------------|
| V <sub>CC</sub>   | Supply voltage<br>NE/SA556, NE556-1<br>SE556                    | +16<br>+18                            | V<br>V         |
| P <sub>D</sub>    | Maximum allowable power dissipation <sup>1</sup>                | 800                                   | mW             |
| T <sub>A</sub>    | Operating temperature range<br>NE556-1, NE556<br>SA556<br>SE556 | 0 to +70<br>-40 to +85<br>-55 to +125 | °C<br>°C<br>°C |
| T <sub>STG</sub>  | Storage temperature range                                       | -65 to +150                           | °C             |
| T <sub>SOLD</sub> | Lead soldering temperature (10sec max)                          | +300                                  | °C             |

NOTES:

- The junction temperature must be kept below 125°C for the D package and below 150°C for the N and F packages. At ambient temperatures above 25°C, where this limit would be exceeded, the Maximum Allowable Power Dissipation must be derated by the following:  
D package 115°C/W  
N package 80°C/W  
F package 100°C/W

## Dual timer

## NE/SA/SE556/NE556-1

**ELECTRICAL CHARACTERISTICS**T<sub>A</sub>=25°C, V<sub>CC</sub>=+5V to +15V, unless otherwise specified.

| SYMBOL                           | PARAMETER                               | TEST CONDITIONS                                 | SE556 |      |      | NE/SA556<br>NE556-1 |      |      | UNIT   |
|----------------------------------|-----------------------------------------|-------------------------------------------------|-------|------|------|---------------------|------|------|--------|
|                                  |                                         |                                                 | Min   | Typ  | Max  | Min                 | Typ  | Max  |        |
| V <sub>CC</sub>                  | Supply voltage                          |                                                 | 4.5   |      | 18   | 4.5                 |      | 16   | V      |
| I <sub>CC</sub>                  | Supply current (low state) <sup>1</sup> | V <sub>CC</sub> =5V, R <sub>L</sub> =∞          |       | 6    | 10   |                     | 6    | 12   | mA     |
|                                  |                                         | V <sub>CC</sub> =15V, R <sub>L</sub> =∞         |       | 20   | 24   |                     | 20   | 30   | mA     |
| t <sub>M</sub>                   | Timing error (monostable)               | R <sub>A</sub> =2kΩ to 100kΩ                    |       |      |      |                     |      |      |        |
| Δt <sub>M</sub> /ΔT              | Initial accuracy <sup>2</sup>           | C=0.1μF                                         |       | 0.5  | 2.0  |                     | 0.75 | 3.0  | %      |
| Δt <sub>M</sub> /ΔV <sub>S</sub> | Drift with temperature                  | T=1.1 RC                                        |       | 30   | 100  |                     | 50   | 150  | ppm/°C |
|                                  | Drift with supply voltage               |                                                 |       | 0.05 | 0.2  |                     | 0.1  | 0.5  | %/V    |
| t <sub>A</sub>                   | Timing error (astable)                  | R <sub>A</sub> , R <sub>B</sub> =1kΩ to 100kΩ   |       |      |      |                     |      |      |        |
| Δt <sub>A</sub> /ΔT              | Initial accuracy <sup>2</sup>           | C=0.μF                                          |       | 4    | 6    |                     | 5    | 13   | %      |
| Δt <sub>A</sub> /ΔV <sub>S</sub> | Drift with temperature                  | V <sub>CC</sub> =15V                            |       | 400  | 500  |                     | 400  | 500  | ppm/°C |
|                                  | Drift with supply voltage               |                                                 |       | 0.15 | 0.6  |                     | 0.3  | 1    | %/V    |
| V <sub>C</sub>                   | Control voltage level                   | V <sub>CC</sub> =15V                            | 9.6   | 10.0 | 10.4 | 9.0                 | 10.0 | 11.0 | V      |
|                                  |                                         | V <sub>CC</sub> =5V                             | 2.9   | 3.33 | 3.8  | 2.6                 | 3.33 | 4.0  | V      |
| V <sub>TH</sub>                  | Threshold voltage                       | V <sub>CC</sub> =15V                            | 9.4   | 10.0 | 10.6 | 8.8                 | 10.0 | 11.2 | V      |
|                                  |                                         | V <sub>CC</sub> =5V                             | 2.7   | 3.33 | 4.0  | 2.4                 | 3.33 | 4.2  | V      |
| I <sub>TH</sub>                  | Threshold current <sup>3</sup>          | V <sub>CC</sub> = 15V, V <sub>TH</sub> = 10.5V  |       | 30   | 250  |                     | 30   | 250  | nA     |
| V <sub>TRIG</sub>                | Trigger voltage                         | V <sub>CC</sub> =15V                            | 4.8   | 5.0  | 5.2  | 4.5                 | 5.0  | 5.6  | V      |
|                                  |                                         | V <sub>CC</sub> =5V                             | 1.45  | 1.67 | 1.9  | 1.1                 | 1.67 | 2.2  | V      |
| I <sub>TRIG</sub>                | Trigger current                         | V <sub>TRIG</sub> =0V                           |       | 0.5  | 0.9  |                     | 0.5  | 2.0  | μA     |
| V <sub>RESET</sub>               | Reset voltage <sup>5</sup>              |                                                 | 0.4   | 0.7  | 1.0  | 0.4                 | 0.7  | 1.0  | V      |
|                                  | Reset current                           | V <sub>RESET</sub> =0.4V                        | 0.4   | 0.1  | 0.4  | 0.4                 | 0.1  | 0.6  | mA     |
| I <sub>RESET</sub>               | Reset current                           | V <sub>RESET</sub> =0V                          |       | 0.4  | 1.0  |                     | 0.4  | 1.5  | mA     |
| V <sub>OL</sub>                  | Output voltage (low)                    | V <sub>CC</sub> =15V<br>I <sub>SINK</sub> =10mA |       | 0.1  | 0.15 |                     | 0.1  | 0.25 | V      |
|                                  |                                         | I <sub>SINK</sub> =50mA                         |       | 0.4  | 0.5  |                     | 0.4  | 0.75 |        |
|                                  | SE556<br>NE/SA556<br>NE556-1            | I <sub>SINK</sub> =100mA                        |       | 2.0  | 2.25 |                     | 2.0  | 3.2  | V      |
|                                  |                                         |                                                 |       |      |      |                     | 2.0  | 2.5  |        |
| V <sub>OH</sub>                  | Output voltage (low)                    | I <sub>SINK</sub> =200mA                        |       | 2.5  |      |                     | 2.5  |      | V      |
|                                  |                                         | V <sub>CC</sub> =5V                             |       |      |      |                     |      |      |        |
|                                  |                                         | I <sub>SINK</sub> =8mA                          |       | 0.1  | 0.2  |                     | 0.25 | 0.3  | V      |
|                                  |                                         | I <sub>SINK</sub> =5mA                          |       | 0.05 | 0.15 |                     | 0.15 | 0.25 |        |
| V <sub>OH</sub>                  | Output voltage (high)                   | V <sub>CC</sub> =15V                            |       |      |      |                     |      |      | V      |
|                                  |                                         | I <sub>SOURCE</sub> =200mA                      |       | 12.5 |      |                     | 12.5 |      |        |
|                                  |                                         | I <sub>SOURCE</sub> =100mA                      | 13.0  | 13.3 |      | 12.75               | 13.3 |      | V      |
|                                  |                                         | V <sub>CC</sub> =5V                             |       |      |      |                     |      |      |        |
|                                  |                                         | I <sub>SOURCE</sub> =100mA                      | 3.0   | 3.3  |      | 2.75                | 3.3  |      |        |
| t <sub>OFF</sub>                 | Turn-off time <sup>6</sup>              | V <sub>RESET</sub> =V <sub>CC</sub>             |       | 0.5  | 2.0  |                     | 0.5  |      | μs     |
| t <sub>R</sub>                   | Rise time of output                     |                                                 |       | 100  | 200  |                     | 100  | 300  | ns     |
| t <sub>F</sub>                   | Fall time of output                     |                                                 |       | 100  | 200  |                     | 100  | 300  | ns     |
|                                  | Discharge leakage current               |                                                 |       | 20   | 100  |                     | 20   | 100  | nA     |

Dual timer

NE/SA/SE556/NE556-1

ELECTRICAL CHARACTERISTICS (Continued)

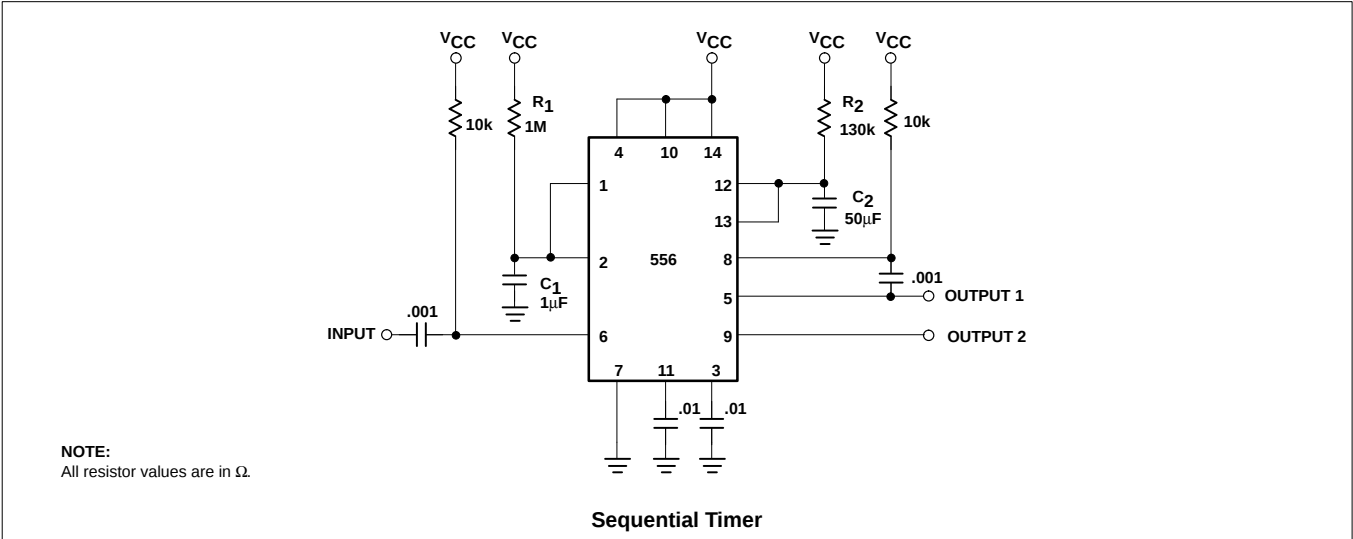
| SYMBOL | PARAMETER                             | TEST CONDITIONS | SE556/556-1 |     |     | NE/SA556/SE556C<br>NE556-1/SE556-1C |     |     | UNIT   |
|--------|---------------------------------------|-----------------|-------------|-----|-----|-------------------------------------|-----|-----|--------|
|        |                                       |                 | Min         | Typ | Max | Min                                 | Typ | Max |        |
|        | Matching characteristics <sup>4</sup> |                 |             |     |     |                                     |     |     |        |
|        | Initial accuracy <sup>2</sup>         |                 |             | 0.5 | 1.0 |                                     | 1.0 | 2.0 | %      |
|        | Drift with temperature                |                 |             | 10  |     |                                     | ±10 |     | ppm/°C |
|        | Drift with supply voltage             |                 |             | 0.1 | 0.2 |                                     | 0.2 | 0.5 | %/V    |

- NOTES:**
- Supply current when output is high is typically 1.0mA less.
  - Tested at  $V_{CC}=5V$  and  $V_{CC}=15V$ .
  - This will determine maximum value of  $R_A+R_B$ . For 15V operation, the max total  $R=10M\Omega$ , and for 5V operation, the maximum total  $R=3.4M\Omega$ .
  - Matching characteristics refer to the difference between performance characteristics for each timer section in the monostable mode.
  - Specified with trigger input high. In order to guarantee reset the voltage at reset pin must be less than or equal to 0.4V. To disable reset function, the voltage at reset pin has to be greater than 1V.
  - Time measured from a positive-going input pulse from 0 to 0.4  $V_{CC}$  into the threshold to the drop from high to low of the output. Trigger is tied to threshold.

TYPICAL APPLICATIONS

One feature of the dual timer is that by utilizing both halves it is possible to obtain sequential timing. By connecting the output of the first half to the input of the second half via a  $0.001\mu F$  coupling capacitor sequential timing may be obtained. Delay  $t_1$  is determined by the first half and  $t_2$  by the second half delay.

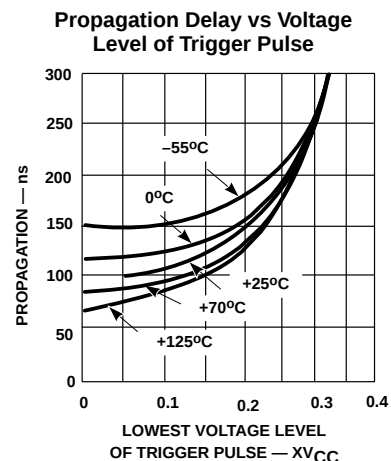
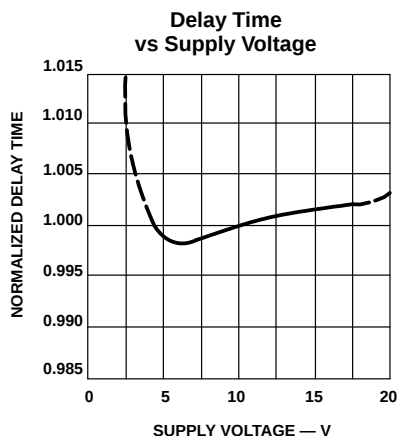
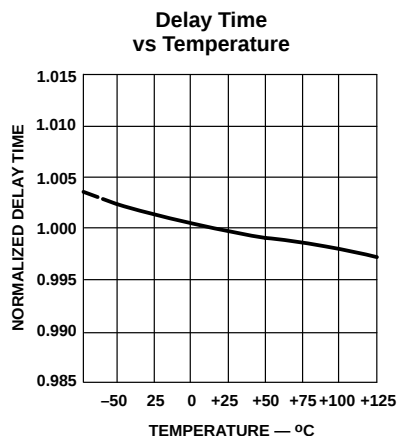
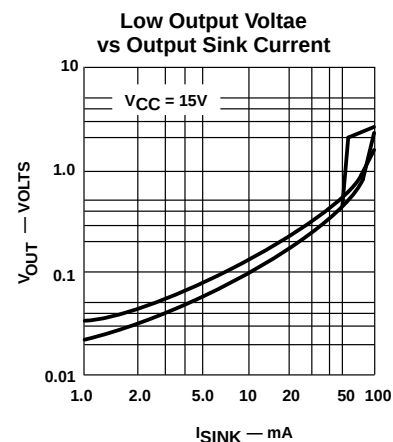
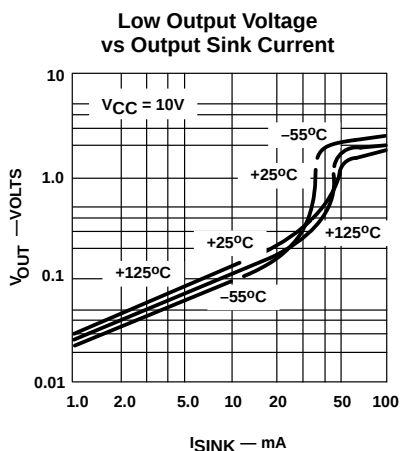
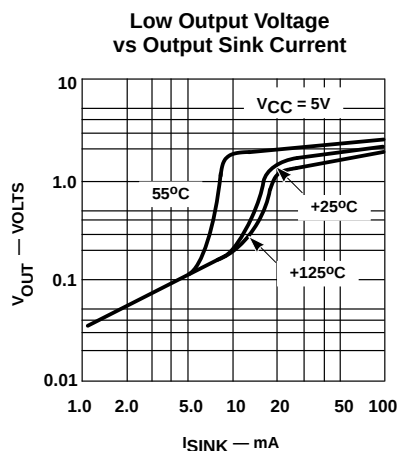
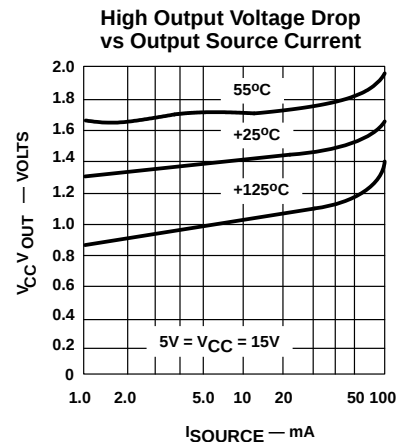
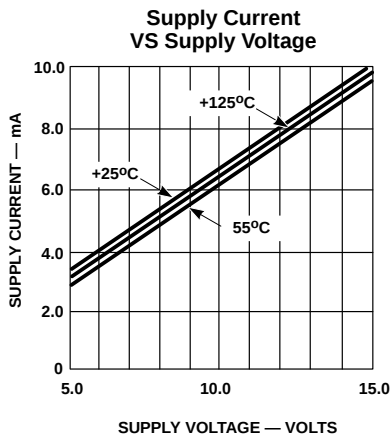
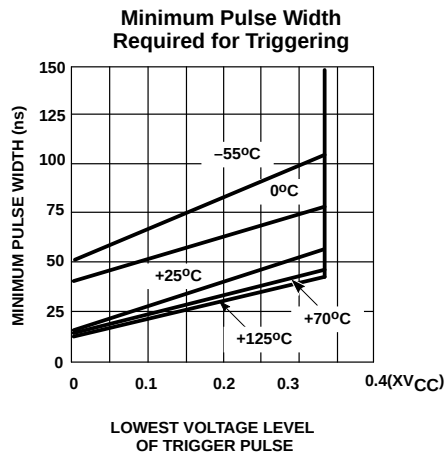
The first half of the timer is started by momentarily connecting Pin 6 to ground. When it is timed out (determined by  $1.1R_1C_1$ ) the second half begins. Its duration is determined by  $1.1R_2C_2$ .



## Dual timer

## NE/SA/SE556/NE556-1

## TYPICAL PERFORMANCE CHARACTERISTICS



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