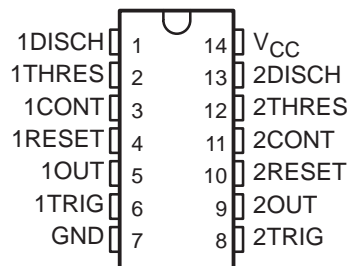


# NE556, SA556, SE556 DUAL PRECISION TIMERS

SLFS023C – APRIL 1978 – REVISED DECEMBER 1999

- Two Precision Timing Circuits per Package
- Astable or Monostable Operation
- TTL-Compatible Output Can Sink or Source Up to 150 mA
- Active Pullup or Pulldown
- Designed to be Interchangeable With Signetics NE556, SA556, and SE556
- Applications Include:
  - Precision Timers From Microseconds to Hours
  - Pulse-Shaping Circuits
  - Missing-Pulse Detectors
  - Tone-Burst Generators
  - Pulse-Width Modulators
  - Pulse-Position Modulators
  - Sequential Timers
  - Pulse Generators
  - Frequency Dividers
  - Application Timers
  - Industrial Controls
  - Touch-Tone Encoders

NE556, SA556 . . . D, OR N PACKAGE  
SE556 . . . J PACKAGE  
(TOP VIEW)



## description

These devices provide two independent timing circuits of the NE555, SA555, or SE555 type in each package. These circuits can be operated in the astable or the monostable mode with external resistor-capacitor (RC) timing control. The basic timing provided by the RC time constant can be controlled actively by modulating the bias of the control-voltage input.

The threshold (THRES) and trigger (TRIG) levels are normally two-thirds and one-third, respectively, of  $V_{CC}$ . These levels can be altered by using the control-voltage (CONT) terminal. When the trigger input falls below trigger level, the flip-flop is set and the output goes high. If the trigger input is above the trigger level and the threshold input is above the threshold level, the flip-flop is reset and the output is low. The reset (RESET) input can override all other inputs and can be used to initiate a new timing cycle. When the reset input goes low, the flip-flop is reset and the output goes low. When the output is low, a low-impedance path is provided between the discharge (DISCH) terminal and ground (GND).

The NE556 is characterized for operation from 0°C to 70°C. The SA556 is characterized for operation from -40°C to 85°C, and the SE556 is characterized for operation over the full military range of -55°C to 125°C.

### AVAILABLE OPTIONS

$T_A$	$V_T$ (MAX) $V_{CC} = 15\text{ V}$	PACKAGED DEVICES		
		SMALL OUTLINE (D)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	11.2 V	NE556D	–	NE556N
-40°C to 85°C	11.2 V	SA556D	–	SA556N
-55°C to 125°C	10.6 V	–	SE556J	–

The D package is available taped and reeled. Add the suffix R to the device type (e.g., NE556DR).

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1999, Texas Instruments Incorporated  
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# NE556, SA556, SE556 DUAL PRECISION TIMERS

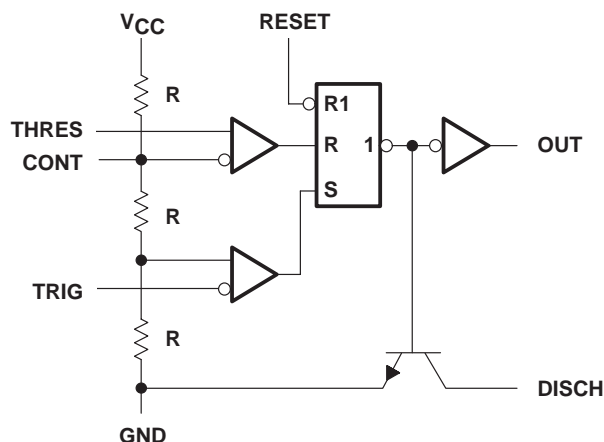
SLFS023C – APRIL 1978 – REVISED DECEMBER 1999

**FUNCTION TABLE**  
(each timer)

RESET	TRIGGER VOLTAGE†	THRESHOLD VOLTAGE†	OUTPUT	DISCHARGE SWITCH
Low	Irrelevant	Irrelevant	Low	On
High	$< 1/3 V_{DD}$	Irrelevant	High	Off
High	$> 1/3 V_{DD}$	$> 2/3 V_{DD}$	Low	On
High	$> 1/3 V_{DD}$	$> 2/3 V_{DD}$	As previously established	

† Voltage levels shown are nominal.

## functional block diagram, each timer



RESET can override TRIG, which can override THRES.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage, $V_{CC}$ (see Note 1)	18 V
Input voltage (CONT, RESET, THRES, and TRIG)	$V_{CC}$
Output current	$\pm 225$ mA
Continuous total dissipation	See Dissipation Rating Table
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
D package	86°C/W
N package	80°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package	260°C
Storage temperature range, $T_{stg}$	-65°C to 150°C

‡ Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values are with respect to network ground terminal.  
2. The package thermal impedance is calculated in accordance with JESD 51.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
J	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

# NE556, SA556, SE556 DUAL PRECISION TIMERS

SLFS023C – APRIL 1978 – REVISED DECEMBER 1999

## recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, $V_{CC}$	NE556, SA556	4.5	16	V
	SE556	4.5	18	
Input voltage (CONT, RESET, THRES, and TRIG), $V_I$		$V_{CC}$		V
Output current, $I_O$		$\pm 200$		mA
Operating free-air temperature, $T_A$	NE556	0	70	°C
	SA556	-40	85	
	SE556	-55	125	

## electrical characteristics, $V_{CC} = 5\text{ V to }15\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	NE556, SA556			SE556			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX		
$V_T$ Threshold voltage level	$V_{CC} = 15\text{ V}$	8.8	10	11.2	9.4	10	10.6	V	
	$V_{CC} = 5\text{ V}$	2.4	3.3	4.2	2.7	3.3	4		
$I_T$ Threshold current (see Note 3)			30	250		30	250	nA	
$V_{TRIG}$ Trigger voltage level	$V_{CC} = 15\text{ V}$	4.5	5	5.6	4.8	5	5.2	V	
	$V_{CC} = 5\text{ V}$	1.1	1.67	2.2	1.45	1.67	1.9		
$I_{TRIG}$ Trigger current	TRIG at 0 V		0.5	2		0.5	0.9	$\mu\text{A}$	
$V_{RESET}$ Reset voltage level		0.3	0.7	1	0.3	0.7	1	V	
$I_{RESET}$ Reset current	RESET at $V_{CC}$		0.1	0.4		0.1	0.4	mA	
	RESET at 0 V		-0.4	1.5		-0.4	-1		
$I_{DISCH}$ Discharge switch off-state current			20	100		20	100	nA	
$V_{CONT}$ Control voltage (open circuit)	$V_{CC} = 15\text{ V}$	9	10	11	9.6	10	10.4	V	
	$V_{CC} = 5\text{ V}$	2.6	3.3	4	2.9	3.3	3.8		
$V_{OL}$ Low-level output voltage	$V_{CC} = 15\text{ V}$	$I_{OL} = 10\text{ mA}$		0.1	0.25		0.1	0.15	V
		$I_{OL} = 50\text{ mA}$		0.4	0.75		0.4	0.5	
		$I_{OL} = 100\text{ mA}$		2	2.5		2	2.2	
		$I_{OL} = 200\text{ mA}$		2.5			2.5		
	$V_{CC} = 5\text{ V}$	$I_{OL} = 5\text{ mA}$		0.1	0.25		0.1	0.15	
		$I_{OL} = 8\text{ mA}$		0.15	0.3		0.15	0.25	
$V_{OH}$ High-level output voltage	$V_{CC} = 15\text{ V}$	$I_{OH} = -100\text{ mA}$	12.75	13.3		13	13.3	V	
		$I_{OH} = -200\text{ mA}$		12.5			12.5		
	$V_{CC} = 5\text{ V}$	$I_{OH} = -100\text{ mA}$	2.75	3.3		3	3.3		
$I_{CC}$ Supply current	Output low, No Load	$V_{CC} = 15\text{ V}$		20	30		20	24	mA
		$V_{CC} = 5\text{ V}$		6	12		6	10	
	Output high, No load	$V_{CC} = 15\text{ V}$		18	26		18	20	nA
		$V_{CC} = 5\text{ V}$		4	10		4	8	

NOTE 3: This parameter influences the maximum value of the timing resistors  $R_A$  and  $R_B$  in the circuit of Figure 1. For example, when  $V_{CC} = 5\text{ V}$ , the maximum value is  $R = R_A + R_B = 3.4\text{ M}\Omega$ , and for  $V_{CC} = 15\text{ V}$ , the maximum value is  $\approx 10\text{ M}\Omega$ .



# NE556, SA556, SE556 DUAL PRECISION TIMERS

SLFS023C – APRIL 1978 – REVISED DECEMBER 1999

## operating characteristics, $V_{CC} = 5\text{ V}$ and $15\text{ V}$

PARAMETER		TEST CONDITIONS†	NE556, SA556			SE556			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Initial error of timing interval‡	Each timer, monostable§	$T_A = 25^\circ\text{C}$	1	3		0.5	1.5		
	Each timer, astable¶		2.25%			1.5%			
	Timer 1 — Timer 2		$\pm 1$			$\pm 0.5$			
Temperature coefficient of timing interval	Each timer, monostable§	$T_A = \text{MIN to MAX}$	50			30	100	ppm/°C	
	Each timer, astable¶		150			90			
	Timer 1 — Timer 2		$\pm 10$			$\pm 10$			
Supply voltage sensitivity of timing interval	Each timer, monostable§	$T_A = 25^\circ\text{C}$	0.1	0.5		0.05	0.2	% / V	
	Each timer, astable¶		0.3			0.15			
	Timer 1 — Timer 2		$\pm 0.2$			$\pm 0.1$			
Output pulse rise time		$C_L = 15\text{ pF}$ , $T_A = 25^\circ\text{C}$	100	300		100	200	ns	
Output pulse fall time			100	300		100	200		

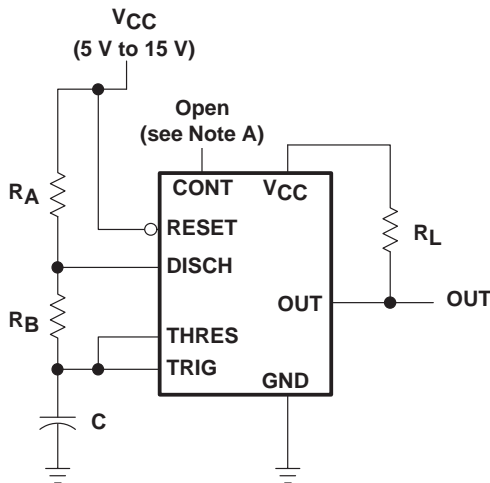
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ Timing interval error is defined as the difference between the measured value and the average value of a random sample from each process run.

§ Values specified are for a device in a monostable circuit similar to Figure 2, with component values as follow:  $R_A = 2\text{ k}\Omega$  to  $100\text{ k}\Omega$ ,  $C = 0.1\text{ }\mu\text{F}$ .

¶ Values specified are for a device in an astable circuit similar to Figure 1, with component values as follow:  $R_A = 1\text{ k}\Omega$  to  $100\text{ k}\Omega$ ,  $C = 0.1\text{ }\mu\text{F}$ .

## APPLICATION INFORMATION



NOTE A: Bypassing the control-voltage input to ground with a capacitor may improve operation. This should be evaluated for individual applications.

Figure 1. Circuit for Astable Operation

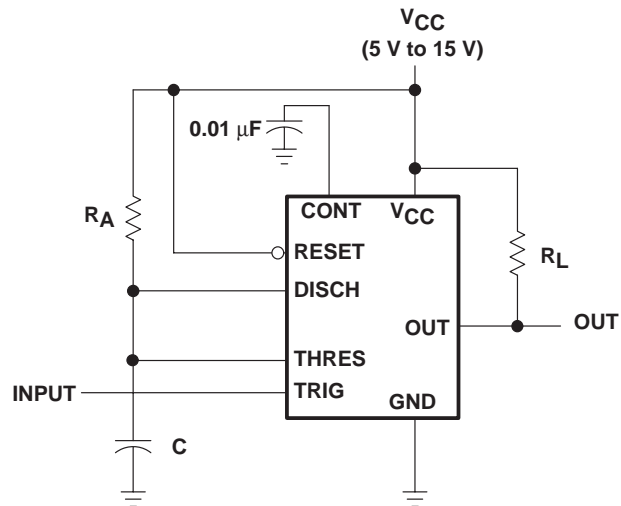


Figure 2. Circuit for Monostable Operation

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.