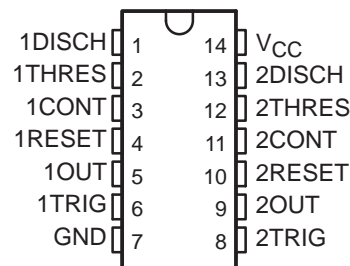


NE556, SA556, SE556 DUAL PRECISION TIMERS

SLFS023E – APRIL 1978 – REVISED OCTOBER 2000

- 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 normally are 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 also is available taped and reeled. Add the suffix R to the device type (e.g., NE556DR).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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.

 **TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2000, 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

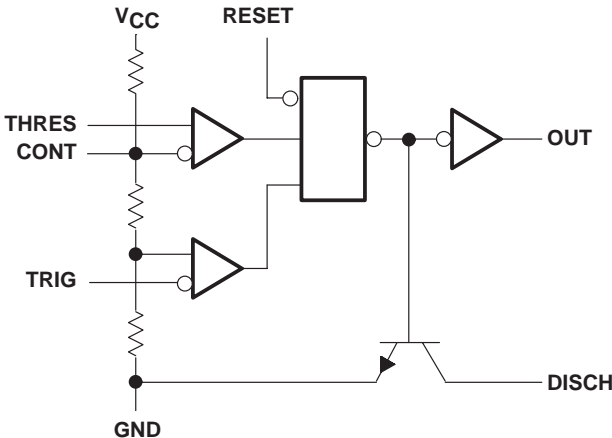
SLFS023E – APRIL 1978 – REVISED OCTOBER 2000

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	±225 mA
Continuous total dissipation	See Dissipation Rating Table
Package thermal impedance, θ _{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 51-7.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING	T _A = 85°C POWER RATING	T _A = 125°C POWER RATING
J	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW



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		± 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 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
			$T_A = -55^\circ\text{C}$ to 125°C				3		6	
		$V_{CC} = 5\text{ V}$		1.1	1.67	2.2	1.45	1.67	1.9	
			$T_A = -55^\circ\text{C}$ to 125°C						1.9	
I_{TRIG}	Trigger current	TRIG at 0 V			0.5	2		0.5	0.9	μA
V_{RESET}	Reset voltage level			0.3	0.7	1	0.3	0.7	1	V
		$T_A = -55^\circ\text{C}$ to 125°C							1.1	
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
			$T_A = -55^\circ\text{C}$ to 125°C				9.6		10.4	
		$V_{CC} = 5\text{ V}$		2.6	3.3	4	2.9	3.3	3.8	
			$T_A = -55^\circ\text{C}$ to 125°C				2.9		3.8	

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 $R = R_A + R_B \approx 3.4\text{ M}\Omega$, and for $V_{CC} = 15\text{ V}$, the maximum value is $\approx 10\text{ M}\Omega$.

NE556, SA556, SE556

DUAL PRECISION TIMERS

SLFS023E – APRIL 1978 – REVISED OCTOBER 2000

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

PARAMETER	TEST CONDITIONS		NE556 SA556			SE556			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OL} Low-level output voltage	$V_{CC} = 15\text{ V}$, $I_{OL} = 10\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.1	0.25		0.1	0.15		V
								0.2	
	$V_{CC} = 15\text{ V}$, $I_{OL} = 50\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.4	0.75		0.4	0.5		
								1	
	$V_{CC} = 15\text{ V}$, $I_{OL} = 100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	2	2.5		2	2.2		
								2.7	
	$V_{CC} = 15\text{ V}$, $I_{OL} = 200\text{ mA}$		2.5			2.5			
V_{OH} High-level output voltage	$V_{CC} = 5\text{ V}$, $I_{OL} = 3.5\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$						0.35	V
	$V_{CC} = 5\text{ V}$, $I_{OL} = 5\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.1	0.25		0.1	0.15		
								0.8	
	$V_{CC} = 5\text{ V}$, $I_{OL} = 8\text{ mA}$		0.15	0.3		0.15	0.25		
V_{OH} High-level output voltage	$V_{CC} = 15\text{ V}$, $I_{OH} = -100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	12.75	13.3		13	13.3		V
								12	
	$V_{CC} = 15\text{ V}$, $I_{OH} = -200\text{ mA}$		12.5			12.5			
	$V_{CC} = 5\text{ V}$, $I_{OH} = -100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	2.75	3.3		3	3.3		
								2	
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		
		$V_{CC} = 5\text{ V}$	4	10		4	8		

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

PARAMETER		TEST CONDITION†	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		±1			±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		±10			±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		±0.2			±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		$C_L = 15\text{ pF}$, $T_A = 25^\circ\text{C}$	100	300		100	200*		ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

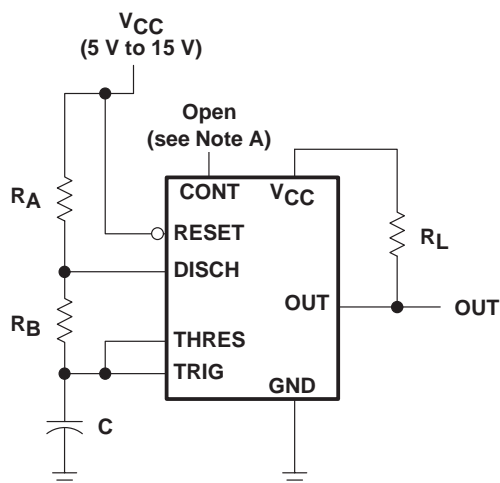
‡ Timing-interval error is defined as the difference between the measured value and the average value of a random sample from each process run.

§ Values specified are for a device in a monostable circuit similar to Figure 2, with the following component values: $R_A = 2\text{ k}\Omega$ 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 the following component values: $R_A = 1\text{ k}\Omega$ 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 might improve operation. This should be evaluated for individual applications.

Figure 1. Circuit for Astable Operation

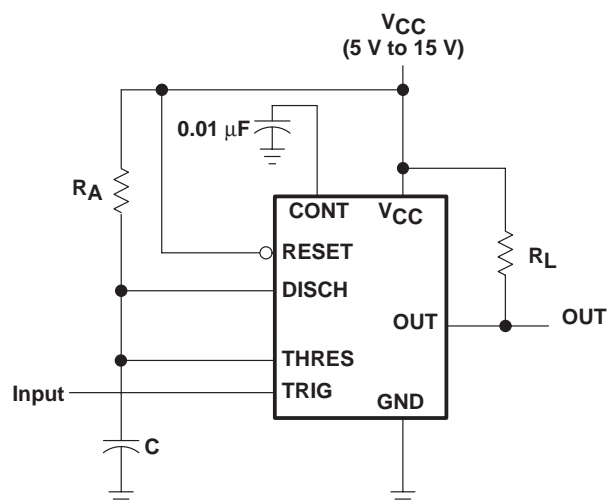


Figure 2. Circuit for Monostable Operation

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 acknowledgment, 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.

Customers are responsible for their applications using TI components.

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.