SLFS023A – D2440, APRIL 1978 – REVISED OCTOBER 1992

- **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 SE556, SE556C, SA556, NE556**

APPLICATIONS

Precision Timer From Microseconds to Hours	**Sequential Timer**
Pulse-Shaping CIrcuit	**Pulse Generator**
Missing-Pulse Detector	**Time-Delay Circuit**
Tone-Burst Generator	**Frequency Divider**
Pulse-Width Modulator	**Appliance Timer**
Pulse-Position Modulator	**Industrial Controls**
	Touch-Tone Encoder

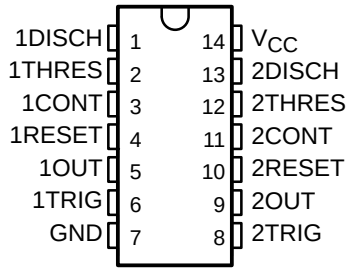
SE556C FROM TI IS NOT RECOMMENDED FOR NEW DESIGNS

description

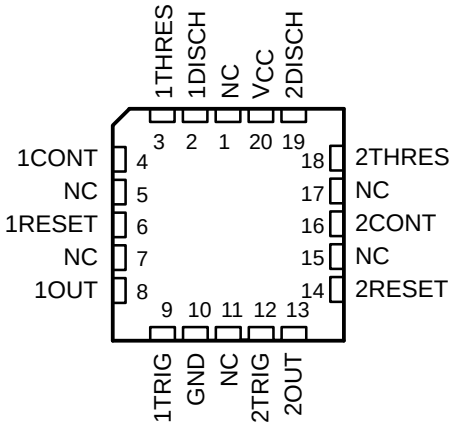
These devices provide two monolithic, independent timing circuits of the NE555, SA555, SE555, or SE555C type in each package. These circuits can be operated in the astable or the monostable mode with external resistor-capacitor timing control. The basic timing provided by the RC time constant may be actively controlled by modulating the bias of the control voltage input.

The threshold and trigger levels are normally two-thirds and one-third respectively of V_{CC}. These levels can be altered by use of the control voltage 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 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. Whenever the output is low, a low impedance path is provided between the discharge terminal and ground.

NE556, SA556 . . . D, J, OR N PACKAGE
SE556, SA556C . . . J PACKAGE
(TOP VIEW)

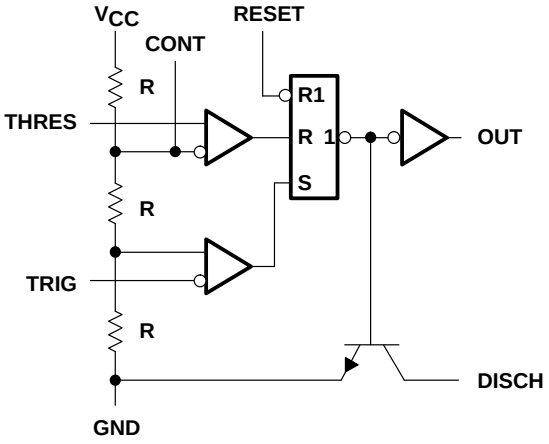


SE556, SE556C . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

functional block diagram (each timer)



RESET can override TRIG, which can override THRES.

description (continued)

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 and SE556C are characterized for operation over the full military range of – 55°C to 125°C.

AVAILABLE OPTIONS

T_A RANGE	V_{thres} max V_{CC} = 15 V	PACKAGE			
		SMALL OUTLINE (D)	CHIP OUTLINE (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	11.2 V	NE556D		NE556J	
– 40°C to 85°C	11.2 V	SA556D		SA556J	SA556N
– 55°C to 125°C	10.6 V 11.2 V		SE556FK SE556CFK		

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

FUNCTION TABLE

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.

absollute 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
Operating free-air temperature range: NE556 . . . . . 0°C to 70°C
SA556 . . . . . –40°C to 85°C
SE556, SE556C . . . . . –55°C to 125°C
Storage temperature range . . . . . –65°C to 150°C
Case temperature for 60 seconds: FK package . . . . . 260°C
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

† Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions beyond those indicated in the recommended operating conditions section of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ 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
D	950 mW	7.6 mW/°C	608 mW	494 mW	N/A
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
J (NE556, SA556)	1025 mW	8.2 mW/°C	656 mW	533 mW	N/A
J (SE556, SE556C)	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
N	1575 mW	12.6 mW/°C	1008 mW	891 mW	N/A

recommended operating conditions

		NE556		SA556		SE556		SE556C		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage	4.5	16	4.5	16	4.5	18	4.5	16	V
V_I	Input voltage (CONT, RESET, THRES, and TRIG)		V_{CC}		V_{CC}		V_{CC}		V_{CC}	V
I_O	Output current		±200		±200		±200		±200	mA
T_A	Operating free-air temperature	0	70	−40	85	−55	125	−55	125	°C

electrical characteristics, V_{CC} = 5 V to 15 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		NE556, SA556, SE556C			SE556			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_T	Threshold voltage level	V_{CC} = 15 V		8.8	10	11.2	9.4	10	10.6	V
		V_{CC} = 5 V		2.4	3.3	4.2	2.7	3.3	4	
I_T	Threshold current (see Note 2)				30	250		30	250	nA
V_{TRIG}	Trigger voltage level	V_{CC} = 15 V		4.5	5	5.6	4.8	5	5.2	V
		V_{CC} = 5 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	µA
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 V		9	10	11	9.6	10	10.4	V
		V_{CC} = 5 V		2.6	3.3	4	2.9	3.3	3.8	
V_{OL}	Low-level output voltage	V_{CC} = 15 V	I_{OL} = 10 mA		0.1	0.25		0.1	0.15	V
			I_{OL} = 50 mA		0.4	0.75		0.4	0.5	
			I_{OL} = 100 mA		2	2.5		2	2.2	
			I_{OL} = 200 mA		2.5			2.5		
		V_{CC} = 5 V	I_{OL} = 5 mA		0.1	0.25		0.1	0.15	
			I_{OL} = 8 mA		0.15	0.3		0.15	0.25	
V_{OH}	High-level output voltage	V_{CC} = 15 V	I_{OH} = −100 mA	12.75	13.3		13	13.3		V
			I_{OH} = −200 mA		12.5			12.5		
		V_{CC} = 5 V	I_{OH} = −100 mA	2.75	3.3		3	3.3		
I_{CC}	Supply current	Output high, No Load	V_{CC} = 15 V		20	30		20	24	nA
			V_{CC} = 5 V		6	12		6	10	
		Output high, No load	V_{CC} = 15 V		18	26		18	20	
			V_{CC} = 5 V		4	10		4	8	

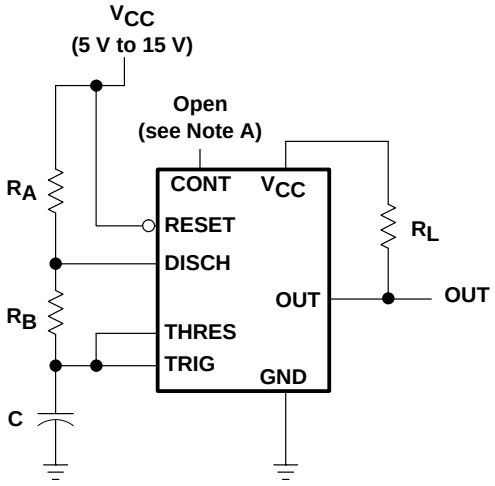
NOTE 2: This parameter influences the maximum value of the timing resistors R_A and R_B in the circuit of Figure 1. For example, when V_{CC} = 5 V, the maximum value is $R = R_A + R_B \approx 3.4$ MΩ, and for V_{CC} = 15 V, the maximum value is ≈ 10 MΩ.

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

PARAMETER		TEST CONDITIONS†	NE556, SA556, SE556C			SE556			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Initial error of timing interval‡	Each timer, monostable§	T_A = 25°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 = 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°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 pF, T_A = 25°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 kΩ to 100 kΩ, C = 0.1μF.
¶ Values specified are for a device in an astable circuit similar to Figure 1, with component values as follow: R_A = 1 kΩ to 100 kΩ, C = 0.1μF.

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

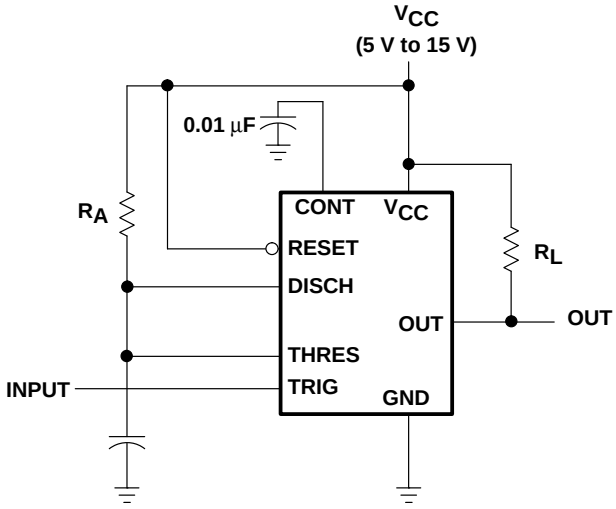


Figure 2. Circuit for Monostable Operation

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software 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, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

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

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI 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.