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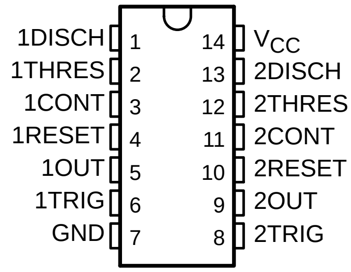
- **Two Precision Timing Circuits Per Package**
- **Astable or Monostable Operation**
- **TTL-Compatible Output Can Sink or Source Up To 150 mA**
- **Active Pullup or Pulldown**
- **Designed to Be Interchangeable With Signetics NE556, SA556, and SE556**
- **Applications Include:**
  - **Precision Timers 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 . . . D, N, OR NS PACKAGE
SA556 . . . D OR N PACKAGE
SE556 . . . J PACKAGE
(TOP VIEW)



description/ordering information

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 RESET 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).

ORDERING INFORMATION

T_A	V_T (MAX) V_{CC} = 15 V	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	11.2 V	PDIP (N)	Tube of 25	NE556N	NE556N
		SOIC (D)	Tube of 50	NE556D	NE556
			Reel of 2500	NE556DR	
		SOP (NS)	Reel of 2000	NE556NSR	NE556
–40°C to 85°C	11.2 V	PDIP (N)	Tube of 25	SA556N	SA556N
–55°C to 125°C	10.6 V	CDIP (J)	Tube of 25	SE556J	SE556J
				SE556JB	SE556JB

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

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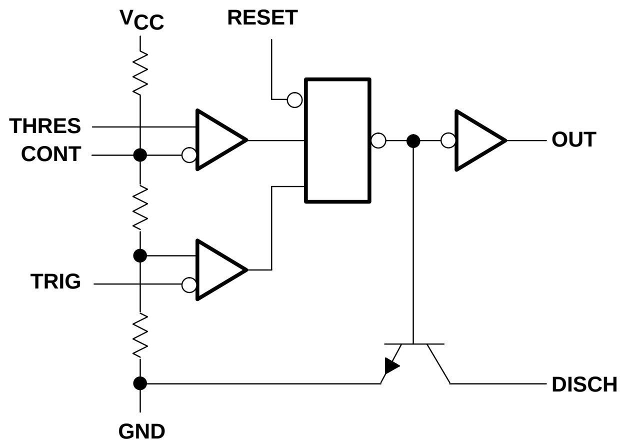
FUNCTION TABLE
(each timer)

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
Package thermal impedance, θ_{JA} (see Notes 2 and 3): D package . . . 86°C/W
N package . . . 80°C/W
NS package . . . 76°C/W
Package thermal impedance, θ_{JC} (see Notes 4 and 5): J package . . . 15.05°C/W
Operating virtual junction temperature, T_J . . . 150°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, N, or NS 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. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.
4. Maximum power dissipation is a function of T_J(max), θ_{JC}, and T_C. The maximum allowable power dissipation at any allowable case temperature is $P_D = (T_J(max) – T_C)/\theta_{JC}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with MIL-STD-883.

recommended operating conditions

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

electrical characteristics, V_{CC} = 5 V to 15 V, T_A = 25°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 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 6)				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
			T_A = –55°C to 125°C				3		6	
		V_{CC} = 5 V		1.1	1.67	2.2	1.45	1.67	1.9	
			T_A = –55°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°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 V		9	10	11	9.6	10	10.4	V
			T_A = –55°C to 125°C				9.6		10.4	
		V_{CC} = 5 V		2.6	3.3	4	2.9	3.3	3.8	
			T_A = –55°C to 125°C				2.9		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
			T_A = –55°C to 125°C						0.2	
		V_{CC} = 15 V, I_{OL} = 50 mA			0.4	0.75		0.4	0.5	
			T_A = –55°C to 125°C						1	
		V_{CC} = 15 V, I_{OL} = 100 mA			2	2.5		2	2.2	
			T_A = –55°C to 125°C						2.7	
		V_{CC} = 15 V,	I_{OL} = 200 mA		2.5			2.5		
		V_{CC} = 5 V, I_{OL} = 3.5 mA	T_A = –55°C to 125°C						0.35	
		V_{CC} = 5 V, I_{OL} = 5 mA			0.1	0.25		0.1	0.15	
			T_A = –55°C to 125°C						0.8	
		V_{CC} = 5 V,	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
			T_A = –55°C to 125°C				12			
		V_{CC} = 15 V,	I_{OH} = –200 mA		12.5			12.5		
		V_{CC} = 5 V, I_{OH} = –100 mA		2.75	3.3		3	3.3		
			T_A = –55°C to 125°C				2			
I_{CC}	Supply current	Output low, No load	V_{CC} = 15 V		20	30		20	24	mA
			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	

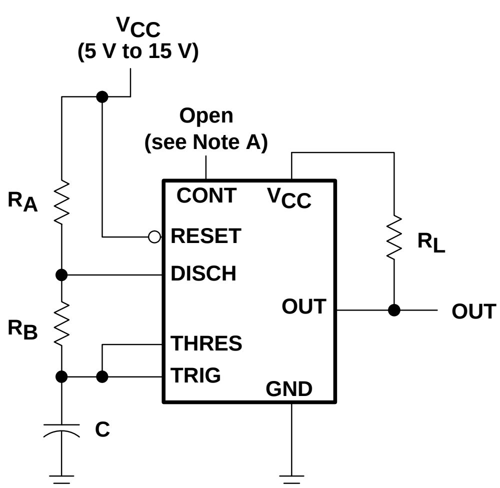
NOTE 6: This parameter influences the maximum value of the timing resistors R_A and R_B in the circuit of Figure 1. For example, when V_{CC} = 5 V, the maximum value is $R = R_A + R_B \approx 3.4\ M\Omega$, and for V_{CC} = 15 V, the maximum value is ≈ 10 MΩ.

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

PARAMETER		TEST CONDITIONS†	NE556 SA556 MIN	NE556 SA556 TYP	NE556 SA556 MAX	SE556 MIN	SE556 TYP	SE556 MAX	UNIT
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		C_L = 15 pF, T_A = 25°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 kΩ to 100 kΩ, C = 0.1 µF.
¶ Values specified are for a device in an astable circuit similar to Figure 1, with the following component values: R_A = 1 kΩ to 100 kΩ, C = 0.1 µF.

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

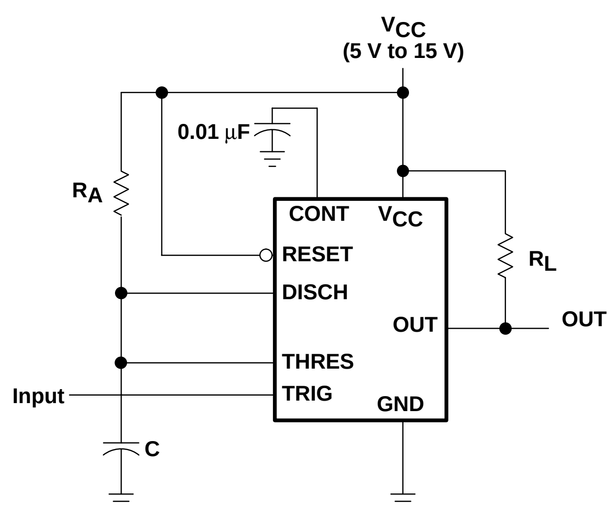


Figure 2. Circuit for Monostable Operation

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