National Semiconductor

February 1995

LM556/LM556C Dual Timer

General Description

The LM556 Dual timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. The 556 is a dual 555. Timing is provided by an external resistor and capacitor for each timing function. The two timers operate independently of each other sharing only V_{CC} and ground. The circuits may be triggered and reset on falling waveforms. The output structures may sink or source 200 mA.

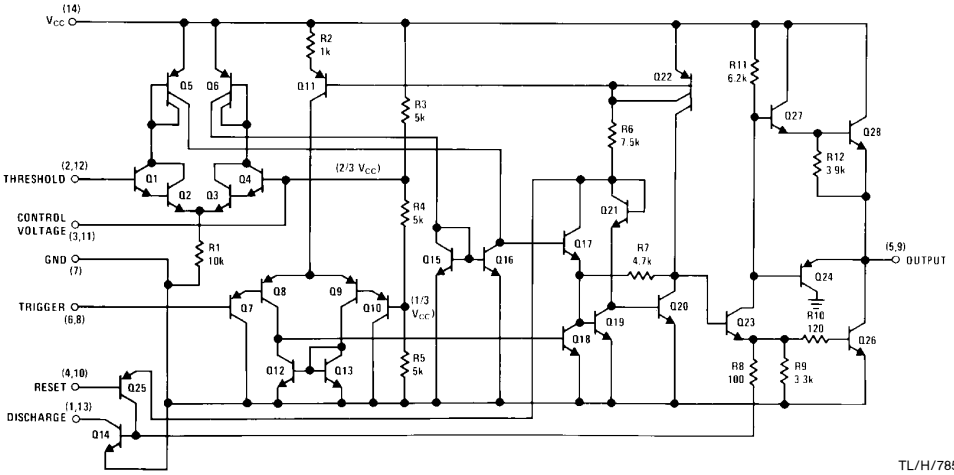
Features

- Direct replacement for SE556/NE556
- Timing from microseconds through hours
- Operates in both astable and monostable modes
- Replaces two 555 timers
- Adjustable duty cycle
- Output can source or sink 200 mA
- Output and supply TTL compatible
- Temperature stability better than 0.005% per °C
- Normally on and normally off output

Applications

- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation
- Pulse width modulation
- Pulse position modulation
- Linear ramp generator

Schematic Diagram



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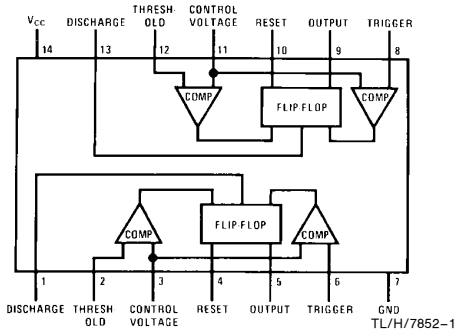
Connection Diagram

Dual-In-Line and Small Outline Packages



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Top View

Order Number LM556J or LM556CJ
See NS Package Number J14A

Order Number LM556CM
See NS Package Number M14A

Order Number LM556CN
See NS Package Number N14A

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Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	+18V
Power Dissipation (Note 1)	
LM556J, LM556CJ	1785 mW
LM556CN	1620 mW
Operating Temperature Ranges	
LM556C	0°C to +70°C
LM556	−55°C to +125°C
Storage Temperature Range	−65°C to +150°C
Soldering Information	
Dual-In-Line Package	
Soldering (10 seconds)	260°C
Small Outline Package	
Vapor phase (60 seconds)	215°C
Infrared (15 seconds)	220°C

See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Electrical Characteristics ($T_A = 25°C$, $V_{CC} = +5V$ to $+15V$, unless otherwise specified)

Parameter	Conditions	LM556			LM556C			Units
		Min	Typ	Max	Min	Typ	Max	
Supply Voltage		4.5		18	4.5		16	V
Supply Current	$V_{CC} = 5V$, $R_L = \infty$		3	5		3	6	mA
(Each Timer Section)	$V_{CC} = 15V$, $R_L = \infty$		10	11		10	14	mA
	(Low State) (Note 2)							
Timing Error, Monostable								
Initial Accuracy			0.5			0.75		%
Drift with Temperature	$R_A = 1k$ to $100 k\Omega$, $C = 0.1 \mu F$,		30			50		ppm/°C
	(Note 3)							
Accuracy over Temperature			1.5			1.5		%
Drift with Supply			0.05			0.1		%/V
Timing Error, Astable								
Initial Accuracy			1.5			2.25		%
Drift with Temperature	$R_A, R_B = 1k$ to $100 k\Omega$,		90			150		ppm/°C
Accuracy over Temperature	$C = 0.1 \mu F$, (Note 3)		2.5			3.0		%
Drift with Supply			0.15			0.30		%/V
Trigger Voltage	$V_{CC} = 15V$	4.8	5	5.2	4.5	5	5.5	V
	$V_{CC} = 5V$	1.45	1.67	1.9	1.25	1.67	2.0	V
Trigger Current			0.1	0.5		0.2	1.0	μA
Reset Voltage	(Note 4)	0.4	0.5	1	0.4	0.5	1	V
Reset Current			0.1	0.4		0.1	0.6	mA
Threshold Current	V_{TH} = V-Control (Note 5)		0.03	0.1		0.03	0.1	μA
	$V_{TH} = 11.2V$			250			250	nA
Control Voltage Level and	$V_{CC} = 15V$	9.6	10	10.4	9	10	11	V
Threshold Voltage	$V_{CC} = 5V$	2.9	3.33	3.8	2.6	3.33	4	V
Pin 1, 13 Leakage Output High			1	100		1	100	nA
Pin 1, 13 Sat	(Note 6)							
Output Low	$V_{CC} = 15V$, I = 15 mA		150	240		180	300	mV
Output Low	$V_{CC} = 4.5V$, I = 4.5 mA		70	100		80	200	mV

Electrical Characteristics (T_A = 25°C, V_{CC} = +5V to +15V, unless otherwise specified) (Continued)

Parameter	Conditions	LM556			LM556C			Units
		Min	Typ	Max	Min	Typ	Max	
Output Voltage Drop (Low)	V_{CC} = 15V							
	I_{SINK} = 10 mA		0.1	0.15		0.1	0.25	V
	I_{SINK} = 50 mA		0.4	0.5		0.4	0.75	V
	I_{SINK} = 100 mA		2	2.25		2	2.75	V
	I_{SINK} = 200 mA		2.5			2.5		V
	V_{CC} = 5V							
	I_{SINK} = 8 mA		0.1	0.25				V
	I_{SINK} = 5 mA					0.25	0.35	V
Output Voltage Drop (High)	I_{SOURCE} = 200 mA, V_{CC} = 15V		12.5			12.5		V
	I_{SOURCE} = 100 mA, V_{CC} = 15V	13	13.3		12.75	13.3		V
	V_{CC} = 5V	3	3.3		2.75	3.3		V
Rise Time of Output			100			100		ns
Fall Time of Output			100			100		ns
Matching Characteristics	(Note 7)							
Initial Timing Accuracy			0.05	0.2		0.1	2.0	%
Timing Drift with Temperature			±10			±10		ppm/°C
Drift with Supply Voltage			0.1	0.2		0.2	0.5	%/V

Note 1: For operating at elevated temperatures the device must be derated based on a +150°C maximum junction temperature and a thermal resistance of 70°C/W (Ceramic), 77°C/W (Plastic DIP) and 110°C/W (SO-14 Narrow).

Note 2: Supply current when output high typically 1 mA less at V_{CC} = 5V.

Note 3: Tested at V_{CC} = 5V and V_{CC} = 15V.

Note 4: As reset voltage lowers, timing is inhibited and then the output goes low.

Note 5: This will determine the maximum value of $R_A + R_B$ for 15V operation. The maximum total ($R_A + R_B$) is 20 MΩ.

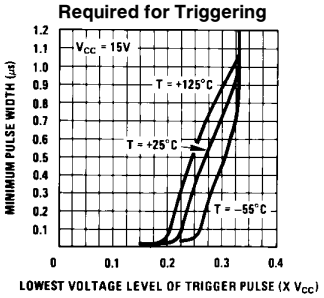
Note 6: No protection against excessive pin 1, 13 current is necessary providing the package dissipation rating will not be exceeded.

Note 7: Matching characteristics refer to the difference between performance characteristics of each timer section.

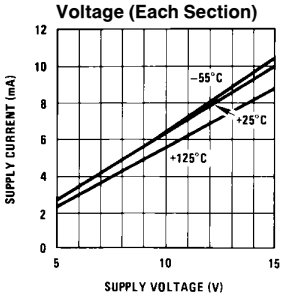
Note 8: Refer to RETS556X drawing for specifications of military LM556J version.

Typical Performance Characteristics

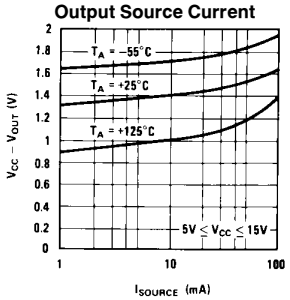
Minimum Pulse Width Required for Triggering



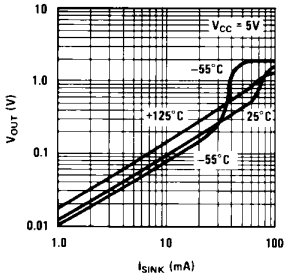
Supply Current vs Supply Voltage (Each Section)



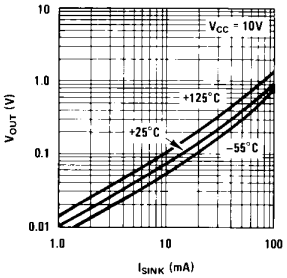
High Output Voltage vs Output Source Current



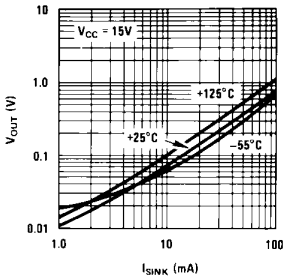
Low Output Voltage vs Output Sink Current



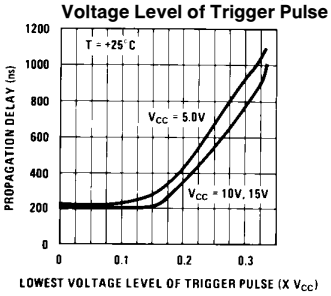
Low Output Voltage vs Output Sink Current



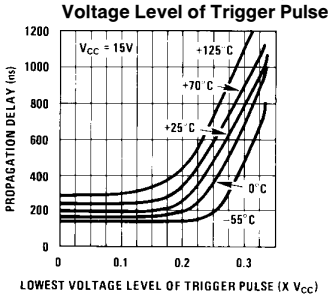
Low Output Voltage vs Output Sink Current



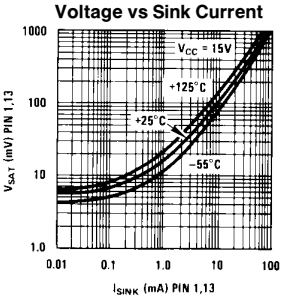
Output Propagation Delay vs Voltage Level of Trigger Pulse



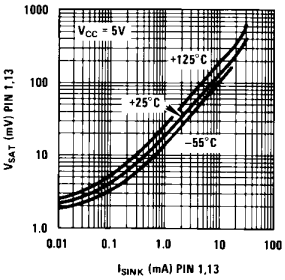
Output Propagation Delay vs Voltage Level of Trigger Pulse



Discharge Transistor (Pin 1, 13) Voltage vs Sink Current



Discharge Transistor (Pin 1, 13) Voltage vs Sink Current



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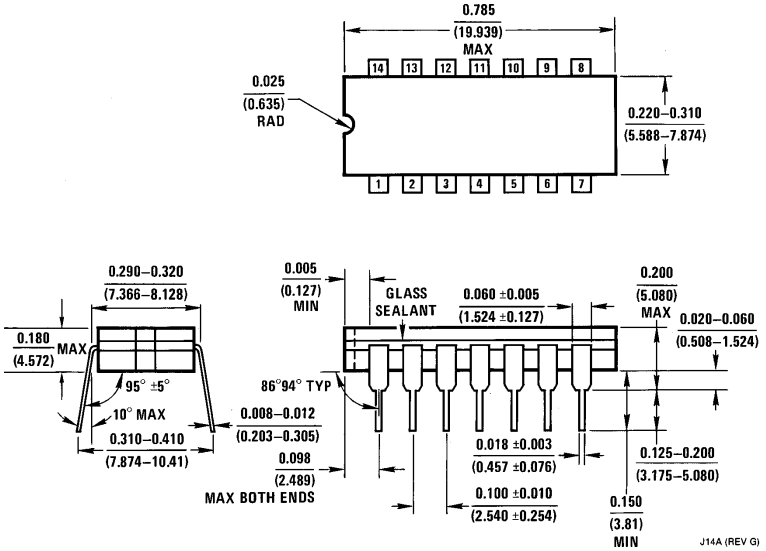
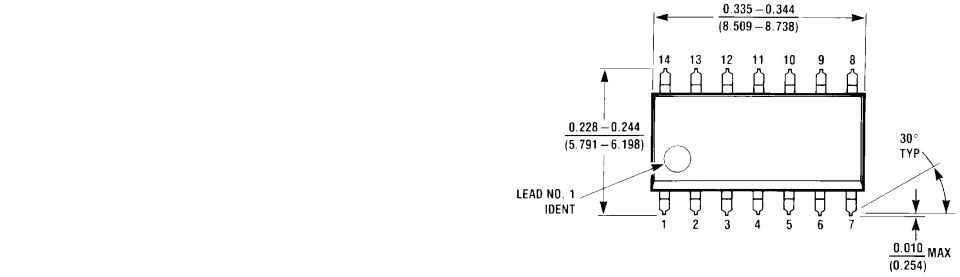
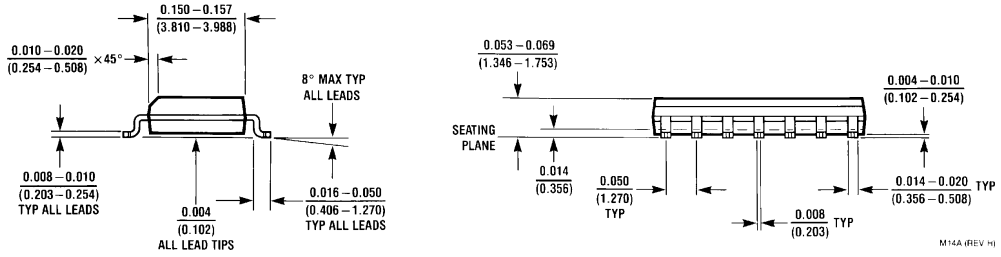
Physical Dimensions inches (millimeters)



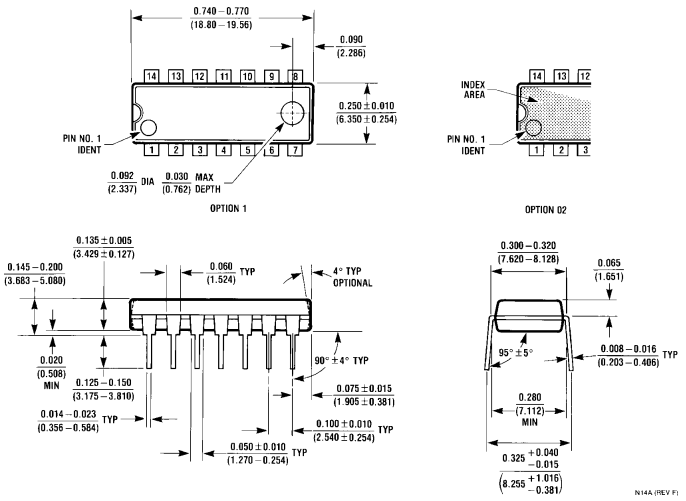
Ceramic Dual-In-Line Package (J)
Order Number LM556J or LM556CJ
NS Package Number J14A





S.O. Molded Package (M)
Order Number LM556CM
NS Package Number M14A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number LM556CN
NS Package Number N14A

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