

TLC555M, TLC555I, TLC555C LinCMOS™ TIMERS

02784, SEPTEMBER 1983—REVISED OCTOBER 1988

- Very Low Power Consumption . . . 1 mW
Typ at $V_{DD} = 5\text{ V}$
- Capable of Operation in Astable Mode
- CMOS Output Capable of Swinging Rail to Rail
- High Output-Current Capability
. . . Sink 100 mA Typ
. . . Source 10 mA Typ
- Output Fully Compatible with CMOS, TTL,
and MOS
- Low Supply Current Reduces Spikes During
Output Transitions
- High-Impedance Inputs . . . $10^{12}\ \Omega$ Typ
- Single-Supply Operation from 2 V to 18 V
- Functionally Interchangeable with the
NE555; Has Same Pinout

description

The TLC555 is a monolithic timing circuit fabricated using TI's LinCMOS™ process, which provides full compatibility with CMOS, TTL, and MOS logic and operation at frequencies up to 2 MHz. Accurate time delays and oscillations are possible with smaller, less-expensive timing capacitors than the NE555 because of the high input impedance. Power consumption is low across the full range of power supply voltage.

Like the NE555, the TLC555 has a trigger level approximately one-third of the supply voltage and a threshold level approximately two-thirds of the supply voltage. These levels can be altered by use of the control voltage terminal. When the trigger input falls below the 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. If the reset input is low, the flip-flop is reset and the output is low. Whenever the output is low, a low-impedance path is provided between the discharge terminal and ground.

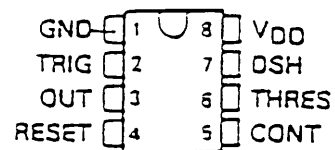
While the CMOS output is capable of sinking over 100 mA and sourcing over 10 mA, the TLC555 exhibits greatly reduced supply-current spikes during output transitions. This minimizes the need for the large decoupling capacitors required by the NE555.

These devices have internal electrostatic discharge (ESD) protection circuits that will prevent catastrophic failures at voltages up to 2000 V as tested under MIL-STD-883C, Method 3015. However, care should be exercised in handling these devices, as exposure to ESD may result in degradation of the device parametric performance.

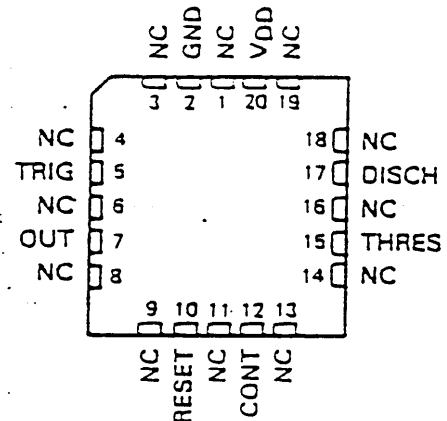
All unused inputs should be tied to an appropriate logic level to prevent false triggering.

The TLC555M is characterized for operation over the full military temperature range of $-55\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$. The TLC555I is characterized for operation from $-40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$. The TLC555C is characterized for operation from $0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$.

TLC555M . . . JG PACKAGE
TLC555I, TLC555C . . . D OR P PACKAGE
(TOP VIEW)



TLC555M . . . FK PACKAGE
(TOP VIEW)



NC—No internal connection

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TEXAS
INSTRUMENTS

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AVAILABLE OPTIONS

T _A RANGE	V _{CC} RANGE	PACKAGE			
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)---	PLASTIC DIP (P)
0°C to 70°C	2 V to 18 V	TLC555CD			TLC555CP
-40°C to 85°C	3 V to 18 V	TLC555ID			TLC555IP
-55°C to 125°C	5 V to 18 V		TLC555MFK	TLC555MJG	

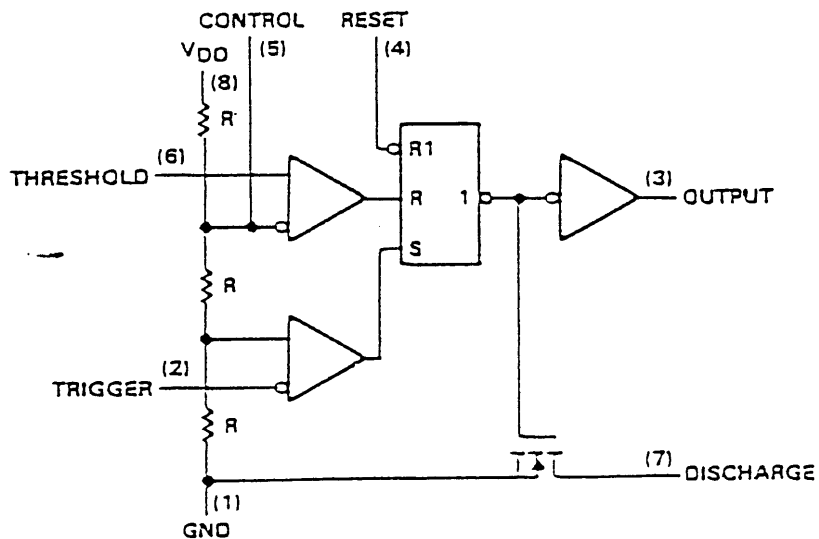
The D package is available taped and reeled. Add the suffix R to the device type (e.g., TLC555CDR).

FUNCTION TABLE

RESET VOLTAGE†	TRIGGER VOLTAGE†	THRESHOLD VOLTAGE†	OUTPUT	DISCHARGE SWITCH
<MIN	Irrelevant	Irrelevant	Low	On
>MAX	<MIN	Irrelevant	High	Off
>MAX	>MAX	>MAX	Low	On
>MAX	>MAX	<MIN	As previously established	

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

functional block diagram



Pin numbers are for all packages except FK.
 Reset can override Trigger, which can override Threshold.

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

	TLC555M	TLC555L	TLC555C	UNIT
Supply voltage (see Note 1)	18	18	18	V
Input voltage:	-0.3 to V _{DD}	-0.3 to V _{DD}	-0.3 to V _{DD}	V
Sink current, discharge or output	150	150	150	mA
Source current, output	15	15	15	mA
Continuous total power dissipation	See Dissipation Rating Table			
Operating free-air temperature range	-55 to 125	-40 to 85	0 to 70	°C
Storage temperature range	-85 to 150	-85 to 150	-85 to 150	°C
Case temperature for 60 seconds	FK package	260		
Lead temperature 1.8 mm (1/16 inch) from case for 60 seconds	JG package	300		°C
Lead temperature 1.8 mm (1/16 inch) from case for 10 seconds	D or P package		260	280

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

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C	DERATING FACTOR	T _A = 70°C	T _A = 85°C	T _A = 125°C
	POWER RATING	ABOVE T _A = 25°C	POWER RATING	POWER RATING	POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	N/A
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
JG	1050 mW	8.4 mW/°C	872 mW	546 mW	210 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW	N/A

TLC555I, TLC555C
 LinCMOS™ TIMERS

electrical characteristics at specified free-air temperature, VDD = 3 V for TLC555I, VDD = 2 V for TLC555C

PARAMETER	TEST CONDITIONS†	TLC555I			TLC555C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Threshold voltage level	25°C	1.3		2.4	0.95	1.33	1.85	V
	Full range	1.5		2.5	0.85		1.75	
Threshold current	25°C		10			10		µA
	MAX		150			75		
Trigger voltage level	25°C	0.71	1.0	1.29	0.4	0.87	0.95	V
	Full range	0.81		1.39	0.3		1.05	
Trigger current	25°C		10			10		µA
	MAX		150			75		
Reset voltage level	25°C	0.4	1.1	1.5	0.4	1.1	1.5	V
	Full range	0.3		1.8	0.3		2	
Reset current	25°C		10			10		µA
	MAX		150			75		
Control voltage (open-circuit) as a percentage of supply voltage	MAX		66.7%			66.7%		
Discharge switch on-state voltage	25°C		0.03	0.2		0.03	0.2	V
	Full range			0.375			0.25	
Discharge switch off-state current	25°C		0.1			0.1		nA
	MAX		120			0.5		
Low-level output voltage	25°C		0.07	0.3		0.07	0.3	V
	Full range			0.4			0.35	
High-level output voltage	25°C	1.5	1.9		1.5	1.9		V
	Full range	2.5			1.5			
Supply current	25°C			250			250	µA
	Full range			500			400	

† Full range (MIN to MAX) is -40°C to 85°C for TLC555I and 0°C to 70°C for TLC555C.

NOTE 2: These values apply for the expected operating configurations in which the Threshold terminal is connected directly to the Discharge terminal or to the Trigger terminal.

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Special Functions

electrical characteristics at specified free-air temperature, VDD = 5 V

PARAMETER	TEST CONDITIONS†	TLC555M			TLC555I			TLC555C			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
Threshold voltage level	25°C	2.8	3.3	3.8	2.8	3.3	3.8	2.8	3.3	3.8	V	
	Full range	2.7		3.9	2.7		3.9	2.7		3.9		
Threshold current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Trigger voltage level	25°C	1.38	1.88	1.98	1.38	1.88	1.98	1.38	1.88	1.98	V	
	Full range	1.28		2.08	1.25		2.08	1.28		2.08		
Trigger current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Reset voltage level	25°C	0.4	1.1	1.5	0.4	1.1	1.5	0.4	1.1	1.5	V	
	Full range	0.3		1.8	0.3		1.8	0.3		1.8		
Reset current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Control voltage (open-circuit as a percentage of supply voltage)	MAX	88.7%			88.7%			88.7%				
Discharge switch on-state voltage	I _{OL} = 10 mA	25°C	0.14	0.5		0.14	0.5		0.14	0.5	V	
	Full range			0.8			0.8			0.8		
Discharge switch off-state current		25°C	0.1			0.1			0.1		µA	
	MAX		120			120			0.5			
Low-level output voltage	I _{OL} = 8 mA	25°C	0.21	0.4		0.21	0.4		0.21	0.4	V	
		Full range			0.8			0.5		0.5		
	I _{OL} = 5 mA	25°C	0.13	0.3		0.13	0.3		0.13	0.3		
		Full range			0.45			0.4		0.4		
	I _{OL} = 3.2 mA	25°C	0.08	0.3		0.08	0.3		0.08	0.3		
		Full range			0.4			0.35		0.35		
High-level output voltage	I _{OH} = -1 mA	25°C	4.1	4.8		4.1	4.8		4.1	4.8	V	
		Full range	4.1			4.1			4.1			
Supply current	See Note 2	25°C		170	350		170	350		170	350	µA
		Full range			700			600			500	

†Full range (MIN to MAX) is -55°C to 125°C for TLC555M, -40°C to 85°C for TLC555I, and 0°C to 70°C for TLC555C.

NOTE 2: These values apply for the expected operating configurations in which the Threshold terminal is connected directly to the Discharge terminal or to the Trigger terminal.

TLC555M, TLC555I, TLC555C
 LinCMOS™ TIMERS

electrical characteristics at specified free-air temperature, $V_{DD} = 15\text{ V}$

PARAMETER	TEST CONDITIONS†	TLC555M			TLC555I			TLC555C			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
Threshold voltage level	25°C	9.45	10	10.55	9.45	10	10.55	9.45	10	10.55	V	
	Full range	9.35		10.65	9.35		10.65	9.35		10.65		
Threshold current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Trigger voltage level	25°C	4.85	5	5.35	4.85	5	5.35	4.85	5	5.35	V	
	Full range	4.55		5.45	4.55		5.45	4.55		5.45		
Trigger current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Reset voltage level	25°C	0.4	1.1	1.5	0.4	1.1	1.5	0.4	1.1	1.5	V	
	Full range	0.3		1.8	0.3		1.8	0.3		1.8		
Reset current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Control voltage (open-circuit) as a percentage of supply voltage	MAX	88.7%			88.7%			88.7%				
Discharge switch on-state voltage	$I_{OL} = 100\text{ mA}$	25°C		0.77	1.7		0.77	1.7		0.77	1.7	V
		Full range			1.8			1.8			1.8	
Discharge switch off-state current		25°C		0.1			0.1			0.1		nA
		MAX		120			120			0.5		
Low-level output voltage	$I_{OL} = 100\text{ mA}$	25°C		1.28	3.2		1.28	3.2		1.28	3.2	V
		Full range			3.8			3.7			3.8	
	$I_{OL} = 50\text{ mA}$	25°C		0.63	1		0.63	1		0.63	1	
		Full range			1.5			1.4			1.3	
	$I_{OL} = 10\text{ mA}$	25°C		0.12	0.3		0.12	0.3		0.12	0.3	
		Full range			0.45			0.4			0.4	
High-level output voltage	$I_{OH} = -10\text{ mA}$	25°C	12.5	14.2		12.5	14.2		12.5	14.2	V	
		Full range	12.5			12.5			12.5			
	$I_{OH} = -5\text{ mA}$	25°C	13.5	14.6		13.5	14.6		13.5	14.6		
		Full range	13.5			13.5			13.5			
	$I_{OH} = -1\text{ mA}$	25°C	14.2	14.9		14.2	14.9		14.2	14.9		
		Full range	14.2			14.2			14.2			
Supply current	See Note 2	25°C		360	600		360	600		360	600	µA
		Full range			1000			900			800	

† Full range (MIN to MAX) is -55°C to 125°C for TLC555M, -40°C to 85°C for TLC555I, and 0°C to 70°C for TLC555C.

NOTE 2: These values apply for the expected operating configurations in which the Threshold terminal is connected directly to the Discharge terminal or to the Trigger terminal.

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 Special Functions

electrical characteristics at specified free-air temperature, $V_{DD} = 18\text{ V}$

PARAMETER	TEST CONDITIONS†	TLC555M			TLC555I			TLC555C			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
Threshold voltage level	25°C	11.4	12	12.8	11.4	12	12.8	11.4	12	12.8	V	
	Full range	10.9		12.7	10.9		12.7	10.9		12.7		
Threshold current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Trigger voltage level	25°C	5.8	8	8.4	5.8	8	8.4	5.8	8	8.4	V	
	Full range	5.5		6.5	5.5		6.5	5.5		6.5		
Trigger current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Reset voltage level	25°C	0.4	1.1	1.5	0.4	1.1	1.5	0.4	1.1	1.5	V	
	Full range	0.3		1.8	0.3		1.8	0.3		1.8		
Reset current	25°C		10			10			10		µA	
	MAX		5000			150			75			
Control voltage (open-circuit) as a percentage of supply voltage	MAX		88.7%			88.7%			88.7%			
Discharge switch on-state voltage	$I_{OL} = 100\text{ mA}$	25°C		0.72	1.5		0.72	1.5		0.72	1.5	V
		Full range			1.8			1.8			1.8	
Discharge switch off-state current		25°C		0.1			0.1			0.1		nA
		MAX		120			120			0.5		
Low-level output voltage	$I_{OL} = 3.2\text{ mA}$	25°C		0.04	0.3		0.04	0.3		0.04	0.3	V
		Full range			0.4			0.35			0.35	
High-level output voltage	$I_{OH} = -1\text{ mA}$	25°C	17.3	17.9		17.3	17.9		17.3	17.9	V	
		Full range	17.3			17.3			17.3			
Supply current	See Note 2	25°C		600			600			600	µA	
		Full range		1000			900			800		

† Full range (MIN to MAX) is -55°C to 125°C for TLC555M, -40°C to 85°C for TLC555I, and 0°C to 70°C for TLC555C.

NOTE 2: These values apply for the expected operating configuration in which the Threshold terminal is connected directly to the Discharge terminal or to the Trigger terminal.

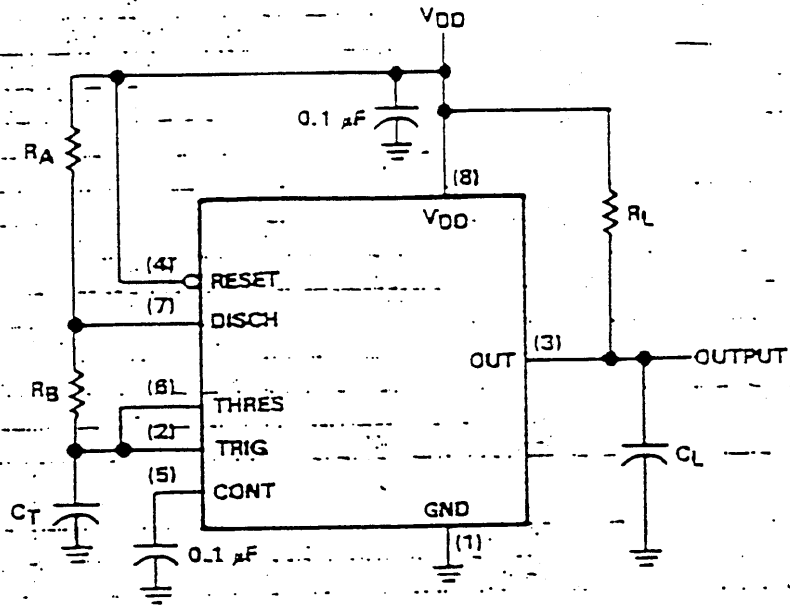
operating characteristics, $V_{DD} = 5\text{ V}$, $T_A = 25^{\circ}\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Initial error of timing interval ²	$V_{DD} = 5\text{ V to }15\text{ V}$,		1%	3%	
Supply voltage sensitivity of timing interval	$R_A = R_B = 1\text{ k}\Omega$ to $100\text{ k}\Omega$, $C_T = 0.1\text{ }\mu\text{F}$. See Note 3		0.1	0.5	%/V
Output pulse rise time	$R_L = 10\text{ M}\Omega$, $C_L = 10\text{ pF}$		20	75	ns
Output pulse fall time			15	60	
Maximum frequency in astable mode	$R_A = 470\text{ }\Omega$, $R_B = 200\text{ }\Omega$, $C_T = 200\text{ pF}$. See Note 3	1.2	2.1		MHz

² Timing interval error is defined as the difference between the measured value and the average value of a random sample from each process run.

NOTE 3: R_A , R_B , and C_T are as defined in Figure 1.

8.2. TYPICAL APPLICATION DATA



Pin numbers are for all packages except FK.

FIGURE 1. CIRCUIT FOR ASTABLE OPERATION