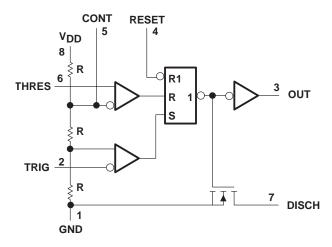
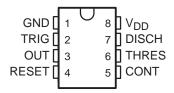


- Very Low Power Consumption
   1 mW Typ at V<sub>DD</sub> = 5 V
- Capable of Operation in Astable Mode
- CMOS Output Capable of Swinging Rail to Rail
- High Output-Current Capability
   Sink 100 mA Typ
   Source 10 mA Typ
- Output Fully Compatible With CMOS, TTL, and MOS
- Low Supply Current Reduces Spikes During Output Transitions
- Single-Supply Operation From 1 V to 15 V

#### functional block diagram



RESET can override TRIG, which can override THRES.



#### description

The XL551 is a monolithic timing circuit fabricated using LinCMOS™process. The

timer is fully compatible with CMOS, TTL, and MOS logic and operates at frequencies up to 2 MHz. Compared to the XL555 timer, this device uses smaller timing capacitors because of its high input impedance. As a result, more accurate time delays and oscillations are possible. Power consumption is low across the full range of power supply voltage.

Like the XL555, the XL551 has a trigger level equal to approximately one-third of the supply voltage and a threshold level equal to approximately two-thirds of the supply voltage. These levels can be altered by use of the control voltage terminal (CONT). When the trigger input (TRIG) falls below the trigger level, the flip-flop is set and the output goes high. If TRIG is above the trigger level and the threshold input (THRES) is above the threshold level, the flip-flop is reset and the output is low. The reset input (RESET) can override all other inputs and can be used to initiate a new timing cycle. If RESET is low, the flip-flop is reset and the output is low. Whenever the output is low, a low-impedance path is provided between DISCH and GND. All unused inputs should be tied to an appropriate logic level to prevent false triggering.

While the CMOS output is capable of sinking over 100 mA and sourcing over 10 mA, the XL551 exhibits greatly reduced supply-current spikes during output transitions. This minimizes the need for the large decoupling capacitors required by the XL555.

The XL551C is characterized for operation from 0 °C to 70°C.

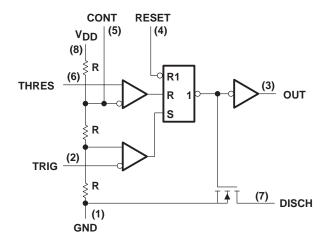
#### **FUNCTION TABLE**

RESET VOLTAGE†	TRIGGER VOLTAGE†	THRESHOLD VOLTAGE†	OUTPUT	DISCHARGE SWITCH		
<min< td=""><td>Irrelevant</td><td>Irrelevant</td><td>Low</td><td>On</td></min<>	Irrelevant	Irrelevant	Low	On		
>MAX	<min< td=""><td>Irrelevant</td><td>High</td><td>Off</td></min<>	Irrelevant	High	Off		
>MAX	>MAX	>MAX	Low	On		
>MAX	>MAX	<min< td=""><td colspan="4">As previously established</td></min<>	As previously established			

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

# XL551 chip information

This chip, when properly assembled, displays characteristics similar to the XL551. Thermal compression or ultrasonic bonding may be used on the doped aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



RESET can override TRIG, which can override THRES.

# equivalent schematic - THRES CONT -\\\\- RESET

XL5

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

Supply voltage, V <sub>DD</sub> (see Note 1)	18 V
Input voltage range, V <sub>I</sub> (any input)	0.3 to V <sub>DD</sub>
Sink current, discharge or output	150 mA
Source current, output, IO	15 mA
Continuous total power dissipation	See Dissipation Rating Table
Continuous total power dissipation  Operating free-air temperature range	
	0°C to 70°C

<sup>†</sup> 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.

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

#### **DISSIPATION RATING TABLE**

$\begin{array}{cc} & & & T_{\mbox{\scriptsize A}} \leq 25^{\circ}\mbox{\scriptsize C} \\ & & & \mbox{\scriptsize POWER RATING} \end{array}$		DERATING FACTOR ABOVE T <sub>A</sub> = 25°C	T <sub>A</sub> = 70°C POWER RATING
D	725 mW	5.8 mW/°C	464 mW

### recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V <sub>DD</sub>	1	15	V
Operating free-air temperature range, TA	0	70	°C

# electrical characteristics at specified free-air temperature, $V_{\mbox{\scriptsize DD}}$ = 1 V

	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	UNIT
\/. <del>-</del>	Threshold voltage		25°C	0.475	0.67	0.85	V
VIT	Tillesilolu voltage		Full range	0.45		0.875	l
lт	Threshold current		25°C		10		pА
111	Threshold current		70°C		75		PΛ
VI(TDIC)	Trigger voltage		25°C	0.15	0.33	0.425	V
VI(TRIG)	Trigger voltage		Full range	0.1		0.45	v
l/TDIO)	Trigger current		25°C		10		pА
l(TRIG)	rngger current		70°C		75		PΛ
V <sub>V</sub> DEOET)	Reset voltage		25°C	0.4	0.7	1	1 V
VI(RESET)	Neset Voltage		Full range	0.3		1	
lypeoet)	Reset current		25°C		10		pА
I(RESET)			70°C		75		
	Control voltage (open circuit) as a percentage of supply voltage		70°C		66.7%		
	Discharge quitab en ataga valtage	100	25°C		0.02	0.15	V
	Discharge switch on-stage voltage	I <sub>OL</sub> = 100 μA	Full range			0.2	V
	Discharge switch off-stage voltage		25°C		0.1		nA
	Discharge switch oil-stage voltage		70°C		0.5		IIA
V	High-level output voltage	10 u A	25°C	0.6	0.98		V
VOH	nigri-level output voltage	I <sub>OH</sub> = -10 μA	Full range	0.6			v
	Low level output voltage	los - 100 uA	25°C		0.03	0.2	V
VOL	Low-level output voltage	I <sub>OL</sub> = 100 μA	Full range			0.25	
loo	Supply current	See Note 2	25°C		15	100	
IDD	очрру синен	See Note 2	Full range			150	μΑ

† Full range is 0°C to 70°C.

NOTE 2: These values apply for the expected operating configurations in which THRES is connected directly to DISCH or to TRIG.

# electrical characteristics at specified free-air temperature, $V_{\mbox{DD}}$ = 2 V

	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	UNIT
V-	Threshold voltage		25°C	0.95	1.33	1.65	V
VIT	Threshold voltage		Full range	0.85		1.75	V
lт	Threshold current		25°C		10		pА
111	The should current		70°C		75		PΛ
V((TDIO)	Trigger voltage		25°C	0.4	0.67	0.95	V
VI(TRIG)	rrigger voltage		Full range	0.3		1.65 1.75 0.95 1.05 1.5 1.8	V
lumnio)	Trigger current		25°C		10		pА
l(TRIG)	rrigger current		70°C		75		PΑ
\/	Reset voltage		25°C	0.4	1.1	1.5 V	\/
VI(RESET)	Neset voltage		Full range	0.3		1.8	V
luneaer)	Reset current		25°C		10		рА
l(RESET)			70°C		75		
	Control voltage (open circuit) as a percentage of supply voltage		70°C		66.7%		
	Discharge switch on stage voltage	la. 1 m A	25°C		0.03	0.2	V
	Discharge switch on-stage voltage	I <sub>OL</sub> = 1 mA	Full range			0.25	V
	Discharge switch off-stage voltage		25°C		0.1		- ^
	Discharge switch on-stage voltage		70°C		0.5		nA
V	High-level output voltage	I <sub>OH</sub> = -300 μA	25°C	1.5	1.9		V
VOH	r ligh-level output voltage	10Η = -300 μΑ	Full range	1.5			V
1/	Low lovel output voltage	loι = 1 mΛ	25°C		0.07	0.3	V
VOL	Low-level output voltage	I <sub>OL</sub> = 1 mA	Full range			0.35	
loo	Supply current	See Note 2	25°C		65	250	μА
IDD	очрріў очітепі	Jee Note 2	Full range			400	μΛ

† Full range is 0°C to 70°C.

NOTE 2: These values apply for the expected operating configurations in which THRES is connected directly to DISCH or to TRIG.

# electrical characteristics at specified free-air temperature, $V_{DD} = 5 \text{ V}$

	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	UNIT
\/	Threshold voltage		25°C	2.8	3.3	3.8	V
VIT	Threshold voltage		Full range	2.7		3.9	V
l	Threshold current		25°C		10		pА
ΙΤ	Threshold current		70°C		75		PΑ
V(TDIO)	Trigger voltage		25°C	1.36	1.66	1.96	V
VI(TRIG)	mgger voltage		Full range	1.26		2.06	v
li/TDIC)	Trigger current		25°C		10		pА
l(TRIG)	rngger current		70°C		75		PΛ
VI(RESET)	Reset voltage		25°C	0.4	1.1	1.5	V
VI(RESET)	Neset voltage		Full range	0.3		1.8	v
l(RESET)	Reset current		25°C		10		pΑ
"I(KESET)	Noot outline		70°C		75		P'
	Control voltage (open circuit) as a percentage of supply voltage		70°C		66.7%		
	Discharge quitab on stage voltage	lo 10 m/	25°C		0.14	0.5	V
	Discharge switch on-stage voltage	I <sub>OL</sub> = 10 mA	Full range			0.6	V
	Discharge switch off-stage voltage		25°C		0.1		nA
	Discharge switch oil-stage voltage		70°C		0.5		
Vон	High-level output voltage	I <sub>OH</sub> = -1 mA	25°C	4.1	4.8		V
VOH	riigii-ievei output voitage	IOH = TIMA	Full range	4.1			V
		I <sub>OL</sub> = 8 mA	25°C		0.21	0.4	
		IOL = 0 IIIA	Full range			0.5	
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 5 mA	25°C		0.13	0.3	V
VOL	Low-level output voltage	IOL = 3 IIIA	Full range			0.4	
		I <sub>OL</sub> = 3.2 mA	25°C		0.08	0.3	
		10L = 3.2 IIIA	Full range			0.35	
Inn	Supply current	See Note 2	25°C		170	350	μΑ
IDD	очрру синен	Jee Note 2	Full range			500	μΛ

<sup>†</sup> Full range is 0°C to 70°C.

NOTE 2: These values apply for the expected operating configurations in which THRES is connected directly to DISCH or to TRIG.

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

	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	UNIT
\/	Threshold voltage		25°C	9.45		10.55	V
VIT	Threshold voltage		Full range	9.35		10.65	V
1.—	Threshold current		25°C		10		- A
ΙΙΤ	Threshold current		70°C		75		pА
V((TD10)	Trigger voltage		25°C	4.65	5	5.35	V
VI(TRIG)	rrigger voltage		Full range	4.55		5.45	V
lumnio)	Trigger current		25°C		10		pА
l(TRIG)	rrigger current		70°C		75		PΑ
\/\(\n=0=\)	Reset voltage		25°C	0.4	1.1	1.5	V
VI(RESET)	Reset voltage		Full range	0.3		1.8	V
L	Ponet gurrent		25°C		10		n ^
I(RESET)	Reset current		70°C		75		pА
	Control voltage (open circuit) as a percentage of supply voltage		70°C		66.7%		
	Discharge quitab en etage valtage	la. 100 mA	25°C		0.77	1.7	V
	Discharge switch on-stage voltage	I <sub>OL</sub> = 100 mA	Full range			1.8	
	Discharge quitab off stage valtage		25°C		0.1		nA
	Discharge switch off-stage voltage		70°C		0.5		TIA
		I <sub>OH</sub> = -10 mA	25°C	12.5	14.2		V
			Full range	12.5			
Vон	High-level output voltage	1 5 mm A	25°C	13.5	14.6		
VОН	riigii-level output voitage	I <sub>OH</sub> = -5 mA	Full range	13.5			V
		lou - 1 mA	25°C	14.2	14.9		
		I <sub>OH</sub> = −1 mA	Full range	14.2			
		lo 100 mA	25°C		1.28	3.2	
		I <sub>OL</sub> = 100 mA	Full range			3.6	
Vai	Low-level output voltage	I <sub>OL</sub> = 50 mA	25°C		0.63	1	V
VOL	Low-level output voltage	IOL = 30 IIIA	Full range			1.3	V
		I <sub>OL</sub> = 10 mA	25°C		0.12	0.3	
		IOL = 10 IIIA	Full range			0.4	
Inn	Supply current	See Note 2	25°C		360	600	μΑ
IDD	очрру синен	See Note 2	Full range			800	μΛ

<sup>†</sup> Full range is 0°C to 70°C.

NOTE 2: These values apply for the expected operating configurations in which THRES is connected directly to DISCH or to TRIG.

# operating characteristics, $V_{DD}$ = 5 V, $T_A$ = 25°C (unless otherwise noted)

PARAMETER TEST CONDITIONS		MIN	TYP	MAX	UNIT		
	Initial error of timing interval‡	$V_{DD} = 5 \text{ V to } 15 \text{ V},$	5 V, $R_A = R_B = 1 \text{ k}\Omega \text{ to } 100 \text{ k}\Omega$ ,		1%	3%	
	Supply voltage sensitivity of timing interval	$C_T = 0.1 \mu F$ ,	See Note 3		0.1	0.5	%/V
t <sub>r</sub>	Rise time, output pulse	$R_{I} = 10 M\Omega$	C <sub>I</sub> = 10 pF		20	75	no
tf	Fall time, output pulse	K[ = 10 lvis2,	CL = 10 pr		15	60	ns
f <sub>max</sub>	Maximum frequency in astable mode	$R_A = 470 \Omega,$ $C_T = 200 pF$	$R_B = 200 \Omega$ , See Note 3	1.2	1.8	·	MHz

<sup>‡</sup> 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 3.

# electrical characteristics at $V_{DD}$ = 5 V, $T_A$ = 25°C

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
VIT	Threshold voltage		2.8	3.3	3.8	V
I <sub>IT</sub>	Threshold current			10		pА
V <sub>I</sub> (TRIG)	Trigger voltage		1.36	1.66	1.96	V
l <sub>(TRIG)</sub>	Trigger current			10		pА
V <sub>I</sub> (RESET)	Reset voltage		0.4	1.1	1.5	V
I(RESET)	Reset current			10		pА
	Control voltage (open circuit) as a percentage of supply voltage			66.7%		
	Discharge switch on-state voltage	$I_{OL} = 10 \text{ mA}$		0.14	0.5	V
	Discharge switch off-state current			0.1		nA
Vон	High-level output voltage	I <sub>OH</sub> = – 1 mA	4.1	4.8		V
		$I_{OL} = 8 \text{ mA}$		0.21	0.4	
VOL	Low-level output voltage	$I_{OL} = 5 \text{ mA}$		0.13	0.3	V
		$I_{OL} = 3.2 \text{ mA}$		0.08	3.8 1.96 1.5 0.5	
$I_{DD}$	Supply current	See Note 2		170	350	μΑ

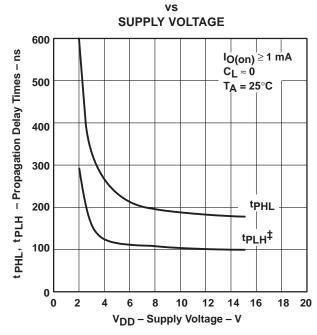
NOTE 2: These values apply for the expected operating configurations in which THRES is connected directly to DISCH or to TRIG.

# **TYPICAL CHARACTERISTICS**

# **DISCHARGE SWITCH ON-STATE RESISTANCE** FREE-AIR TEMPERATURE 100 70 $V_{DD} = 2 V$ , $I_{O} = 1 mA$ Discharge Switch On-State Resistance – 40 $V_{DD} = 5 \text{ V}, I_{O} = 10 \text{ mA}$ 20 10 7 $V_{DD} = 15 \text{ V, I}_{O} = 100 \text{ mA}$ 4 2 1 25 50 75 100 0 $T_A$ – Free-Air Temperature – $^{\circ}$ C

#### Figure 1

# PROPAGATION DELAY TIMES (TO DISCHARGE OUTPUT FROM TRIGGER AND THRESHOLD SHORTED TOGETHER)



<sup>&</sup>lt;sup>‡</sup>The effects of the load resistance on these values must be taken into account separately.

Figure 2

#### **APPLICATION INFORMATION**

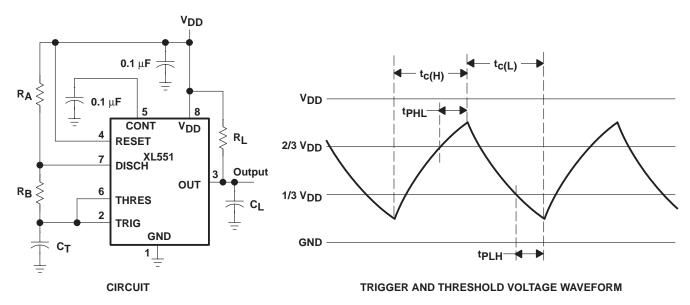


Figure 3. Astable Operation

Connecting TRIG to THRES, as shown in Figure 3, causes the timer to run as a multivibrator. The capacitor  $C_T$  charges through  $R_A$  and  $R_B$  to the threshold voltage level (approximately 0.67  $V_{DD}$ ) and then discharges through  $R_B$  only to the value of the trigger voltage level (approximately 0.33  $V_{DD}$ ). The output is high during the charging cycle ( $t_{C(L)}$ ) and low during the discharge cycle ( $t_{C(L)}$ ). The duty cycle is controlled by the values of  $R_A$ , and  $R_B$ , and  $C_T$ , as shown in the equations below.

$$\begin{array}{l} t_{c(H)} \approx C_T \; (R_A \, + \, R_B) \; \text{ln 2} \quad (\text{ln 2} = 0.693) \\ t_{c(L)} \approx C_T \; R_B \; \text{ln 2} \\ \text{Period} = t_{c(H)} \, + \, t_{c(L)} \approx C_T \; (R_A \, + \, 2R_B) \; \text{ln 2} \\ \text{Output driver duty cycle} = \frac{t_{c(L)}}{t_{c(H)} \, + \, t_{c(L)}} \approx 1 - \frac{R_B}{R_A \, + \, 2R_B} \\ \text{Output waveform duty cycle} = \frac{t_{c(H)}}{t_{c(H)} \, + \, t_{c(L)}} \approx \frac{R_B}{R_A \, + \, 2R_B} \end{array}$$

The 0.1-μF capacitor at CONT in Figure 3 decreases the period by about 10%.

The formulas shown above do not allow for any propagation delay times from TRIG and THRES to DISCH. These delay times add directly to the period and create differences between calculated and actual values that increase with frequency. In addition, the internal on-state resistance  $r_{on}$  during discharge adds to  $R_{B}$  to provide another source of timing error in the calculation when  $R_{B}$  is very low or  $r_{on}$  is very high.

#### **APPLICATION INFORMATION**

The equations below provide better agreement with measured values.

$$t_{c(H)} = C_{T} (R_{A} + R_{B}) \ln \left[ 3 - \exp\left(\frac{-t_{PLH}}{C_{T} (R_{B} + r_{on})}\right) \right] + t_{PHL}$$

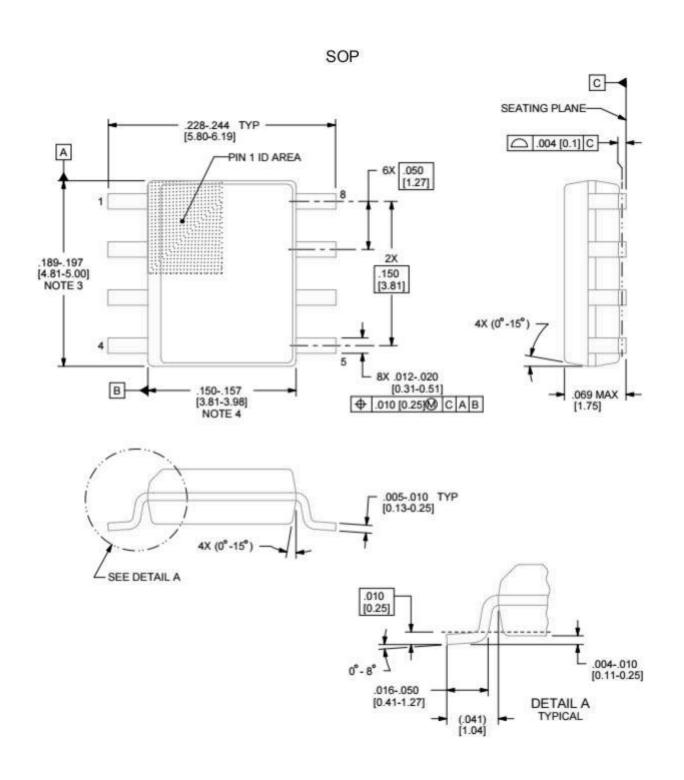
$$t_{c(L)} = C_{T} (R_{B} + r_{on}) \ln \left[ 3 - \exp\left(\frac{-t_{PHL}}{C_{T} (R_{A} + R_{B})}\right) \right] + t_{PLH}$$

These equations and those given earlier are similar in that a time constant is multiplied by the logarithm of a number or function. The limit values of the logarithmic terms must be between In 2 at low frequencies and In 3 at extremely high frequencies. For a duty cycle close to 50%, an appropriate constant for the logarithmic terms can be substituted

with good results. Duty cycles less than 50%  $\frac{{}^t c(H)}{{}^t c(H) + {}^t c(L)}$  require that  $\frac{{}^t c(H)}{{}^t c(L)}$  <1 and possibly  $R_A \le r_{on}$ . These

conditions can be difficult to obtain.

In monostable applications, the trip point of the trigger input can be set by a voltage applied to CONT. An input voltage between 10% and 80% of the supply voltage from a resistor divider with at least 500-µA bias provides good results.



以上信息仅供参考. 如需帮助联系客服人员。谢谢 XINLUDA

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