

# DATA SHEET

## **74LV4060**

14-stage binary ripple counter with  
oscillator

Product specification

1998 Jun 23

## 14-stage binary ripple counter with oscillator

74LV4060

## FEATURES

- Wide operating voltage: 1.0 to 5.5 V
- Optimized for Low Voltage applications: 1.0 to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Typical  $V_{OLP}$  (output ground bounce) < 0.8 V at  $V_{CC} = 3.3$  V,  $T_{amb} = 25^{\circ}\text{C}$ .
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot) > 2 V at  $V_{CC} = 3.3$  V,  $T_{amb} = 25^{\circ}\text{C}$ .
- All active components on chip
- RC or crystal oscillator configuration
- Output capability: standard (except for  $R_{TC}$  and  $C_{TC}$ )
- $I_{CC}$  category: MSI

## APPLICATIONS

- Control Counters
- Timers
- Frequency Dividers
- Time-delay circuits

## DESCRIPTION

The 74LV4060 is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC/HCT4060.

The 74LV4060 is a 14-stage ripple-carry counter/divider and oscillator with three oscillator terminals (RS,  $R_{TC}$  and  $C_{TC}$ ), ten buffered outputs ( $Q_3$  to  $Q_9$  and  $Q_{11}$  to  $Q_{13}$ ) and an overriding asynchronous master reset (MR). The oscillator configuration allows design of either RC or crystal oscillator circuits. The oscillator may be replaced by an external clock signal at input RS. In this case, keep the oscillator pins ( $R_{TC}$  and  $C_{TC}$ ) floating.

The counter advances on the negative-going transition of RS. A HIGH level on MR resets the counter ( $Q_3$  to  $Q_9$  and  $Q_{11}$  to  $Q_{13} = \text{LOW}$ ), independent of the other input conditions.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25^{\circ}\text{C}$ ;  $t_r = t_f \leq 2.5$  ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$ $t_{PHL}$	Propagation delay RS to $Q_3$	$C_L = 15$ pF $V_{CC} = 3.3$ V	29	ns
	$Q_n$ to $Q_{n+1}$		6	
	MR to $Q_n$		16	
$f_{max}$	Maximum clock frequency		99	MHz
$C_1$	Input capacitance		3.5	pF
$C_{PD}$	Power dissipation capacitance per package	Notes 1, 2 and 3	40	pF

## NOTES:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  $C_L$  = output load capacity in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.
2. The condition is  $V_1 = \text{GND}$  to  $V_{CC}$
3. For formula on dynamic power dissipation, see the following pages.

## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
16-Pin Plastic DIL	-40°C to +125°C	74LV4060 N	74LV4060 N	SOT38-4
16-Pin Plastic SO	-40°C to +125°C	74LV4060 D	74LV4060 D	SOT109-1
16-Pin Plastic SSOP Type II	-40°C to +125°C	74LV4060 DB	74LV4060 DB	SOT338-1
16-Pin Plastic TSSOP Type I	-40°C to +125°C	74LV4060 PW	74LV4060PW DH	SOT403-1

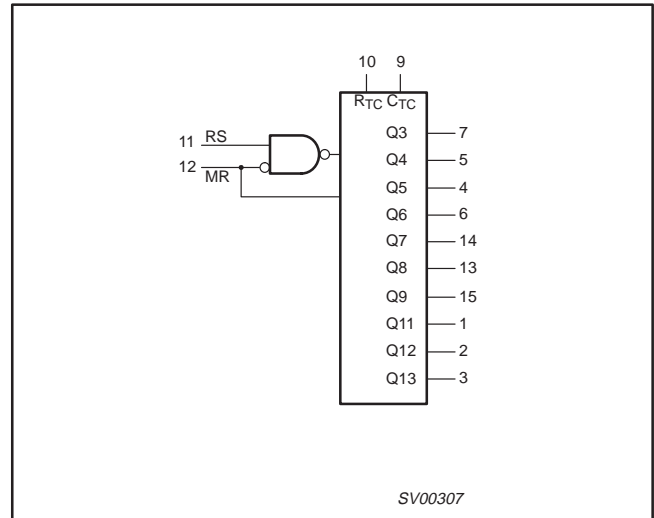
# 14-stage binary ripple counter with oscillator

# 74LV4060

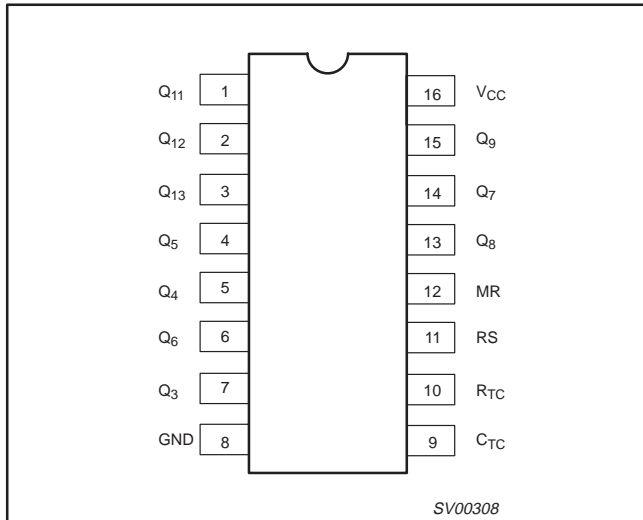
## PIN DESCRIPTION

PIN NO.	SYMBOL	FUNCTION
1, 2, 3	Q <sub>11</sub> to Q <sub>13</sub>	Counter outputs
7, 5, 4, 6, 15, 13, 15	Q <sub>3</sub> to Q <sub>9</sub>	Counter outputs
8	GND	Ground (0 V)
9	C <sub>TC</sub>	External capacitor connection
10	R <sub>TC</sub>	External resistor connection
11	RS	Clock input/oscillator pin
12	MR	Master reset
16	V <sub>CC</sub>	Positive supply voltage

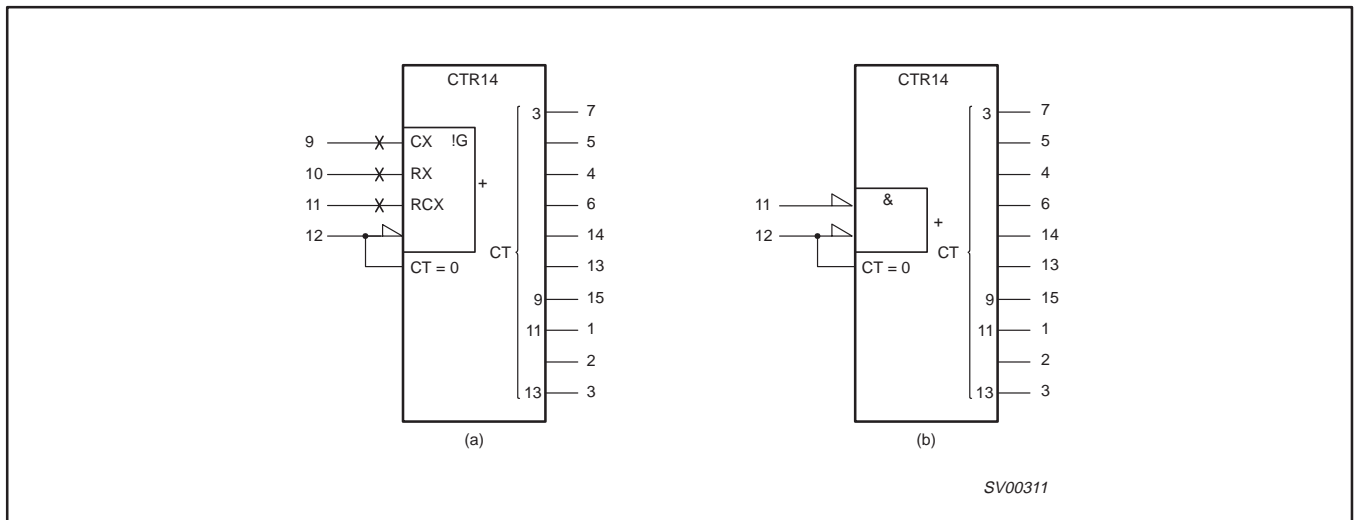
## LOGIC SYMBOL



## PIN CONFIGURATION



## LOGIC SYMBOL (IEEE/IEC)



# 14-stage binary ripple counter with oscillator

74LV4060

## DYNAMIC POWER DISSIPATION

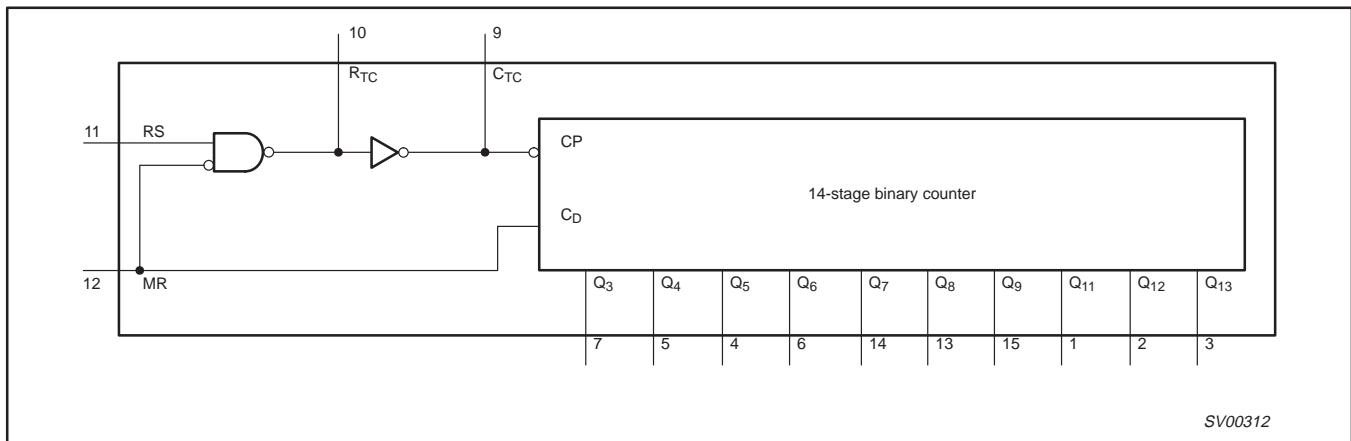
GND = 0 V; T<sub>amb</sub> = 25 °C

PARAMETER	V <sub>CC</sub> (V)	TYPICAL FORMULA FOR P <sub>D</sub> (μW) <sup>1</sup>
Total dynamic power dissipation when using the on-chip oscillator (P <sub>D</sub> )	1.2	$C_{PD} \times f_{osc} \times V_{CC}^2 + \sum (C_L \times V_{CC}^2 \times f_o) + 2C_t \times V_{CC}^2 \times f_{osc} + 16 \times V_{CC}$
	2.0	$C_{PD} \times f_{osc} \times V_{CC}^2 + \sum (C_L \times V_{CC}^2 \times f_o) + 2C_t \times V_{CC}^2 \times f_{osc} + 460 \times V_{CC}$
	3.0	$C_{PD} \times f_{osc} \times V_{CC}^2 + \sum (C_L \times V_{CC}^2 \times f_o) + 2C_t \times V_{CC}^2 \times f_{osc} + 1000 \times V_{CC}$

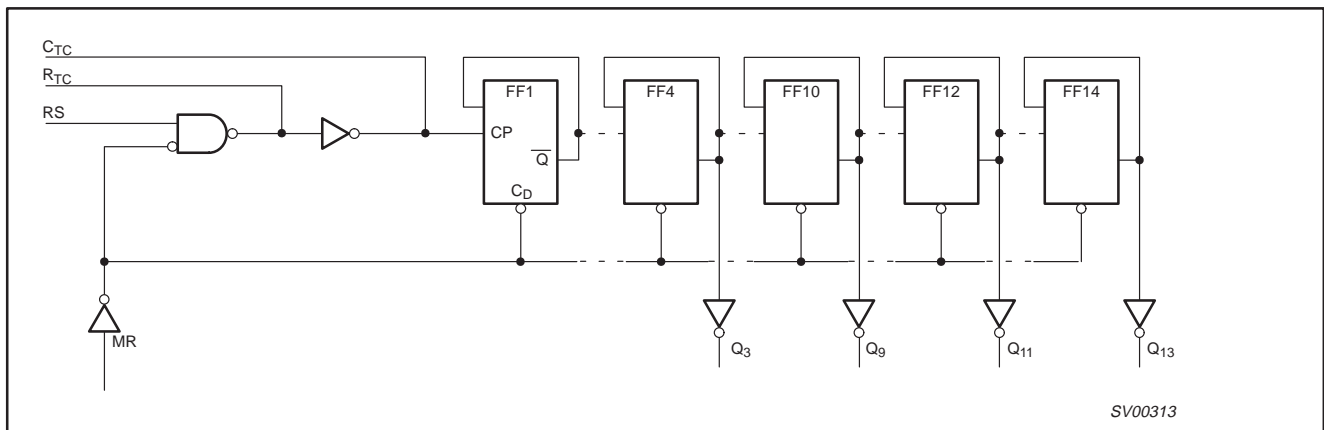
**NOTE:**

- Where: f<sub>o</sub> = output frequency in MHz; f<sub>osc</sub> = oscillator frequency in MHz;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs; C<sub>L</sub> = output load capacitance in pF;  
 C<sub>t</sub> = timing capacitance in pF; V<sub>CC</sub> = supply voltage in V.

## FUNCTIONAL DIAGRAM



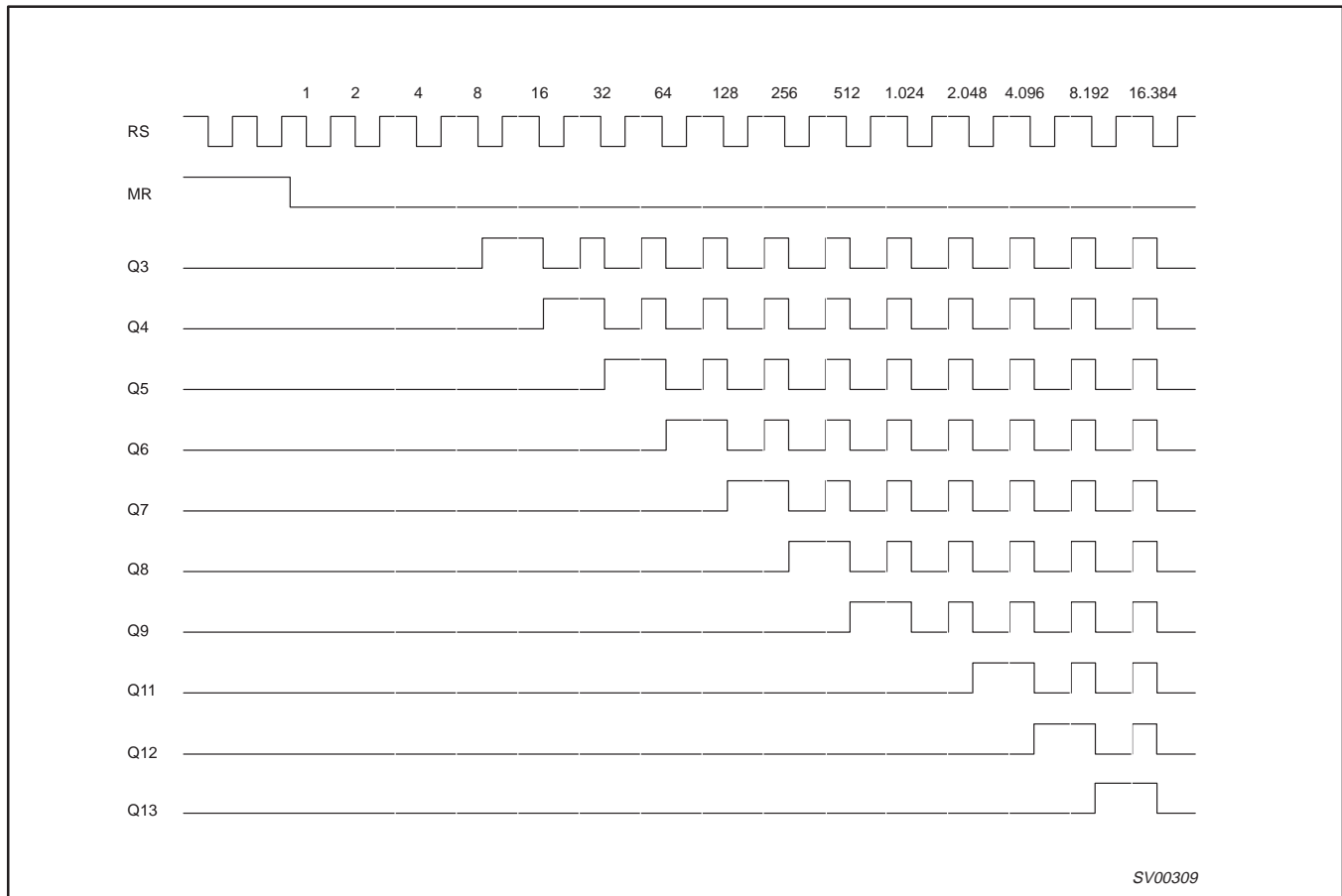
## LOGIC DIAGRAM



# 14-stage binary ripple counter with oscillator

74LV4060

## TIMING DIAGRAM



## ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

In accordance with the Absolute Maximum Rating System (IEC 134)  
 Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +7.0	V
$\pm I_{IK}$	DC input diode current	$V_I < -0.5$ or $V_I > V_{CC} + 0.5V$	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < -0.5$ or $V_O > V_{CC} + 0.5V$	50	mA
$\pm I_O$	DC output source or sink current - standard outputs	$-0.5V < V_O < V_{CC} + 0.5V$	25	mA
$\pm I_{GND},$ $\pm I_{CC}$	DC $V_{CC}$ or GND current for types with -standard outputs		50	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package -plastic DIL -plastic mini-pack (SO) -plastic shrink mini-pack (SSOP and TSSOP)	for temperature range: -40 to +125°C above +70°C derate linearly with 12mW/K above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	750 500 400	mW

### NOTES:

1. Stresses beyond those listed 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.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 14-stage binary ripple counter with oscillator

74LV4060

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT
$V_{CC}$	DC supply voltage	See Note <sup>1</sup>	1.0	3.3	5.5	V
$V_I$	Input voltage		0	–	$V_{CC}$	V
$V_O$	Output voltage		0	–	$V_{CC}$	V
$T_{amb}$	Operating ambient temperature range in free air	See DC and AC characteristics	–40 –40		+85 +125	°C
$t_r, t_f$	Input rise and fall times	$V_{CC} = 1.0V$ to $2.0V$ $V_{CC} = 2.0V$ to $2.7V$ $V_{CC} = 2.7V$ to $3.6V$ $V_{CC} = 3.6V$ to $5.5V$	– – – –	– – – –	500 200 100 50	ns/V

## NOTES:

1. The LV is guaranteed to function down to  $V_{CC} = 1.0V$  (input levels GND or  $V_{CC}$ ); DC characteristics are guaranteed from  $V_{CC} = 1.2V$  to  $V_{CC} = 5.5V$ .

## DC CHARACTERISTICS

Over operating conditions, voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			–40°C to +85°C			–40°C to +125°C		
			MIN	TYP <sup>1</sup>	MAX	MIN	MAX	
$V_{IH}$	HIGH level Input voltage MR input	$V_{CC} = 1.2V$	0.9	–	–	0.9	–	V
		$V_{CC} = 2.0V$	1.4	–	–	1.4	–	
		$V_{CC} = 2.7$ to $3.6V$	2.0	–	–	2.0	–	
		$V_{CC} = 4.5$ to $5.5V$	$0.7 * V_{CC}$	–	–	$0.7 * V_{CC}$	–	
$V_{IL}$	LOW level Input voltage MR input	$V_{CC} = 1.2V$	–	–	0.3	–	0.3	V
		$V_{CC} = 2.0V$	–	–	0.6	–	0.6	
		$V_{CC} = 2.7$ to $3.6V$	–	–	0.8	–	0.8	
		$V_{CC} = 4.5$ to $5.5$	–	–	$0.3 * V_{CC}$	–	$0.3 * V_{CC}$	
$V_{IH}$	HIGH level Input voltage RS input	$V_{CC} = 1.2V$	1.0	–	–	1.0	–	V
		$V_{CC} = 2.0V$	1.6	–	–	1.6	–	
		$V_{CC} = 2.7$ to $3.6V$	2.4	–	–	2.4	–	
		$V_{CC} = 4.5$ to $5.5V$	$0.8 * V_{CC}$	–	–	$0.8 * V_{CC}$	–	
$V_{IL}$	LOW level Input voltage RS input	$V_{CC} = 1.2V$	–	–	0.2	–	0.2	V
		$V_{CC} = 2.0V$	–	–	0.4	–	0.4	
		$V_{CC} = 2.7$ to $3.6V$	–	–	0.5	–	0.5	
		$V_{CC} = 4.5$ to $5.5$	–	–	$0.2 * V_{CC}$	–	$0.2 * V_{CC}$	
$V_{OH}$	HIGH level output voltage; $R_{TC}$ output	$V_{CC} = 1.2V$ ; RS = GND and MR = GND; $-I_O = 3.4mA$	–	–	–	–	–	V
		$V_{CC} = 2.0V$ ; RS = GND and MR = GND; $-I_O = 3.4mA$	–	–	–	–	–	
		$V_{CC} = 2.7V$ ; RS = GND and MR = GND; $-I_O = 3.4mA$	–	–	–	–	–	
		$V_{CC} = 3.0V$ ; RS = GND and MR = GND; $-I_O = 3.4mA$	2.40	2.82	–	2.20	–	
		$V_{CC} = 4.5V$ ; RS = GND and MR = GND; $-I_O = 3.4mA$	–	–	–	–	–	

## 14-stage binary ripple counter with oscillator

74LV4060

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
V <sub>OH</sub>	HIGH level output voltage; R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 0.8mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 0.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 0.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 0.8mA	2.40	2.82	-	2.20	-	
		V <sub>CC</sub> = 4.5V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 0.8mA	-	-	-	-	-	
V <sub>OH</sub>	HIGH level output voltage; R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = GND and MR = GND; -I <sub>O</sub> = 100µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0V; RS = GND and MR = GND; -I <sub>O</sub> = 100µA	1.8	2.0	-	1.8	-	
		V <sub>CC</sub> = 2.7V; RS = GND and MR = GND; -I <sub>O</sub> = 100µA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = GND and MR = GND; -I <sub>O</sub> = 100µA	2.8	3.0	-	2.8	-	
		V <sub>CC</sub> = 4.5V; RS = GND and MR = GND; -I <sub>O</sub> = 100µA	-	-	-	-	-	
V <sub>OH</sub>	HIGH level output voltage; R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 100µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 100µA	1.8	2.0	-	1.8	-	
		V <sub>CC</sub> = 2.7V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 100µA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 100µA	2.8	3.0	-	2.8	-	
		V <sub>CC</sub> = 4.5V; RS = V <sub>CC</sub> and MR = V <sub>CC</sub> ; -I <sub>O</sub> = 100µA	-	-	-	-	-	
V <sub>OH</sub>	HIGH level output voltage; C <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	1.2	-	-	-	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	2.40	2.82	-	2.20	-	
		V <sub>CC</sub> = 4.5V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
V <sub>OH</sub>	HIGH level output voltage; except R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	1.8	2.0	-	1.8	-	
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	2.8	3.0	-	2.8	-	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	-	-	-	-	-	

## 14-stage binary ripple counter with oscillator

74LV4060

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
V <sub>OH</sub>	HIGH level output voltage; except R <sub>TC</sub> and C <sub>TC</sub> outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	2.40	2.82	-	2.20	-	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
V <sub>OL</sub>	LOW level output voltage; R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 3.4mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 3.4mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 3.4mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 3.4mA	-	0.25	0.40	-	0.50	
		V <sub>CC</sub> = 4.5V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 3.4mA	-	-	-	-	-	
V <sub>OL</sub>	LOW level output voltage; R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	
		V <sub>CC</sub> = 2.7V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 100μA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	
		V <sub>CC</sub> = 4.5V; RS = V <sub>CC</sub> and MR = GND; -I <sub>O</sub> = 100μA	-	-	-	-	-	
V <sub>OL</sub>	LOW level output voltage; C <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	0.25	0.40	-	0.50	
		V <sub>CC</sub> = 4.5V; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ; -I <sub>O</sub> = 3.8mA	-	-	-	-	-	
V <sub>OL</sub>	LOW level output voltage; except R <sub>TC</sub> output	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100μA	-	-	-	-	-	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100μA	-	0	0.2	-	0.2	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 100μA	-	-	-	-	-	



# 14-stage binary ripple counter with oscillator

# 74LV4060

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
V <sub>OL</sub>	HIGH level output voltage; except R <sub>TC</sub> and C <sub>TC</sub> outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	0.25	0.40	-	0.50	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
		V <sub>CC</sub> = 4.5V; V <sub>I</sub> = V <sub>IH</sub> and V <sub>I</sub> = V <sub>IL</sub> ; -I <sub>O</sub> = 6mA	-	-	-	-	-	
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	1.0	-	1.0	μA
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	-	-	20	-	160	μA
	Quiescent supply current	V <sub>CC</sub> = 5.5V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	-	-	-	-	80	
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0	-	-	500	-	850	μA

**NOTE:**

1. All typical values are measured at T<sub>amb</sub> = 25°C.

**AC CHARACTERISTICS**

GND = 0V; t<sub>r</sub> = t<sub>f</sub> = 2.5ns; C<sub>L</sub> = 50pF; R<sub>L</sub> = 500Ω

SYMBOL	PARAMETER	WAVEFORM	CONDITION V <sub>CC</sub> (V)	LIMITS -40 to +85 °C			LIMITS -40 to +125 °C		UNIT
				MIN	TYP <sup>1</sup>	MAX	MIN	MAX	
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay RS to Q <sub>3</sub>	Figures 6, 8	1.2	-	180	-	-	-	ns
			2.0	-	52	84	-	105	
			2.7	-	42	66	-	83	
			3.0 to 3.6	-	33 <sup>2</sup>	53	-	66	
			4.5 to 5.5	-	24	39	-	49	
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay Q <sub>n</sub> to Q <sub>n+1</sub>	Figures 7, 8	1.2	-	40	-	-	-	ns
			2.0	-	14	23	-	29	
			2.7	-	10	16	-	20	
			3.0 to 3.6	-	8 <sup>2</sup>	13	-	16	
			4.5 to 5.5	-	6	9	-	11	
t <sub>PHL</sub>	Propagation delay MR to Q <sub>n</sub>	Figures 7, 8	1.2	-	100	-	-	-	ns
			2.0	-	29	46	-	58	
			2.7	-	24	39	-	49	
			3.0 to 3.6	-	19 <sup>2</sup>	31	-	39	
			4.5 to 5.5	-	14	23	-	29	
t <sub>w</sub>	Clock pulse width RS; HIGH or LOW	Figure 6	2.0	34	9	-	38	-	ns
			2.7	25	6	-	30	-	
			3.0 to 3.6	20	5	-	24	-	
			4.5 to 5.5	16	4	-	20	-	
t <sub>w</sub>	Master reset pulse width MR; HIGH	Figure 7	2.0	34	10	-	38	-	ns
			2.7	25	8	-	30	-	
			3.0 to 3.6	20	6	-	24	-	
			4.5 to 5.5	16	4	-	20	-	

# 14-stage binary ripple counter with oscillator

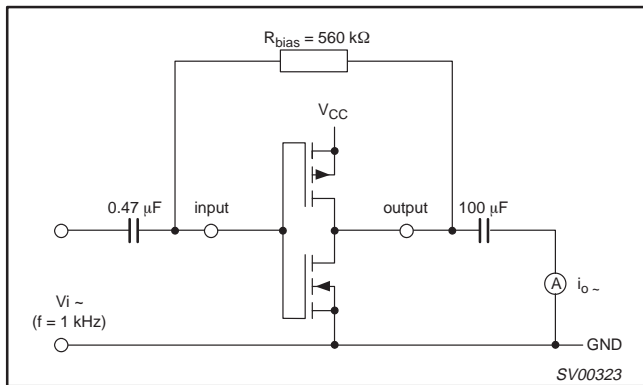
# 74LV4060

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS -40 to +85 °C			LIMITS -40 to +125 °C		UNIT
			V <sub>CC</sub> (V)	MIN	TYP <sup>1</sup>	MAX	MIN	MAX	
t <sub>rem</sub>	Removal time MR to RS	Figure 7	2.0	29	18	–	37	–	ns
			2.7	26	16	–	32	–	
			3.0 to 3.6	18	11	–	23	–	
			4.5 to 5.5	12	7	–	15	–	
f <sub>max</sub>	Maximum clock pulse frequency	Figure 6	2.0	14	40	–	9	–	MHz
			2.7	19	70	–	12	–	
			3.0 to 3.6	24	90	–	15	–	
			4.5 to 5.5	30	100	–	19	–	

**NOTE:**

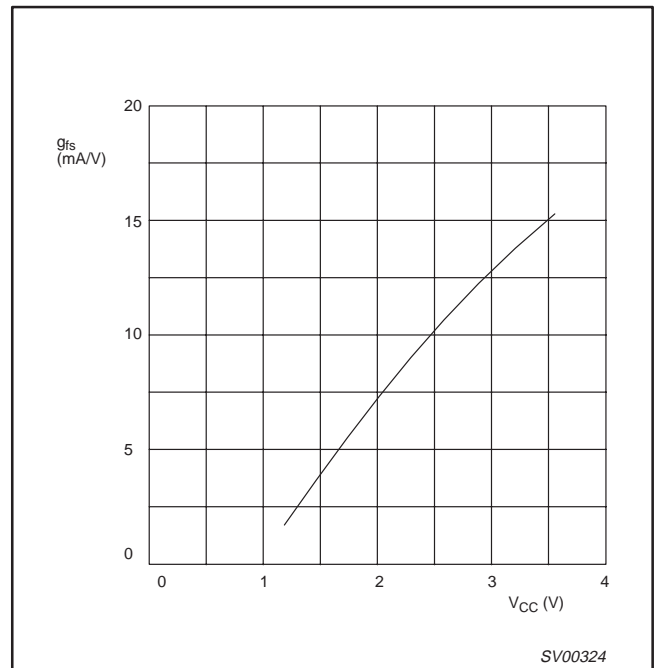
Unless otherwise stated, all typical values are at T<sub>amb</sub> = 25°C.

1. Typical value measured at V<sub>CC</sub> = 3.3V.
2. Typical value measured at V<sub>CC</sub> = 5.0V.



**Figure 1.**

Test set-up for measuring forward transconductance  $g_{fs} = di_o/dv_i$  at  $v_o$  is constant (see also graph Figure 2); MR = LOW.

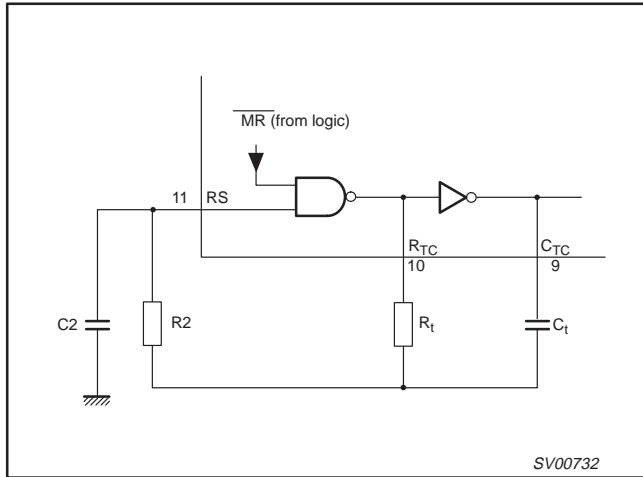


**Figure 2.**

Typical forward transconductance  $g_{fs}$  as a function of the supply voltage V<sub>CC</sub> at T<sub>amb</sub> = 25°C.

# 14-stage binary ripple counter with oscillator

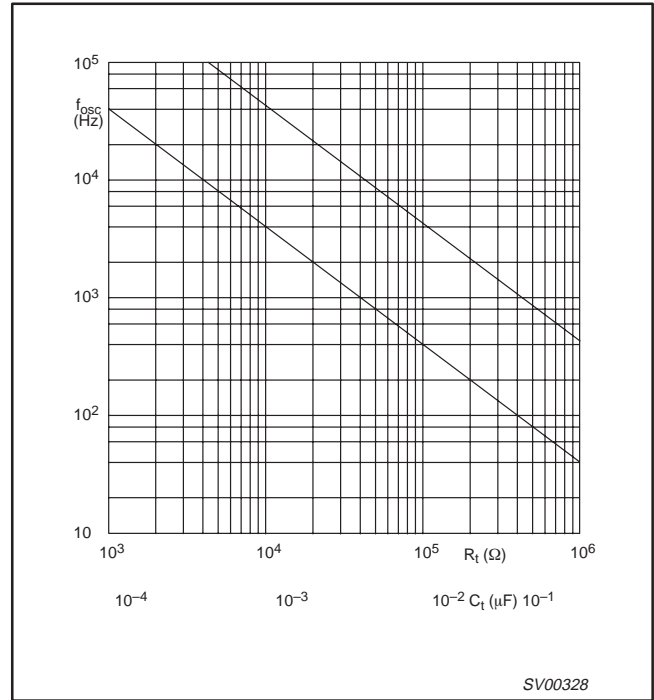
74LV4060



**Figure 3.**

Example of an RC oscillator. Typical formula for oscillator frequency:

$$f_{OSC} = \frac{1}{2.5 \times R_t \times C_t}$$



**Figure 4.**

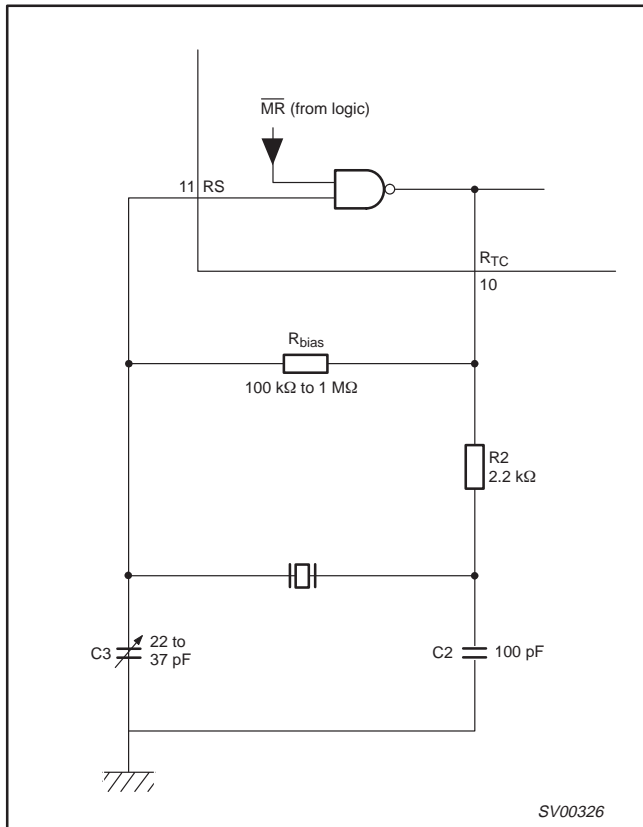
RC oscillator frequency as a function of  $R_t$  and  $C_t$  at  $V_{CC} = 1.2$  to  $3.6$  V;  $T_{amb} = 25^\circ\text{C}$ .  
 $C_t$  curve at  $R_t = 100$  kΩ;  $R_2 = 200$  kΩ.  
 $R_t$  curve at  $C_t = 1$  nF;  $R_2 = 2 \times R_t$ .

### TIMING COMPONENTS LIMITATIONS

The oscillator frequency is mainly determined by  $R_t \cdot C_t$ , provided  $R_2 \approx 2R_t$  and  $R_2 \cdot C_2 \ll R_t \cdot C_t$ . The function of  $R_2$  is to minimize the influence of the forward voltage across the input protection diodes on the frequency. The stray capacitance  $C_2$  should be kept as small as possible. In consideration of accuracy,  $C_t$  must be larger than the inherent stray capacitance.  $R_t$  must be larger than the 'ON' resistance in series with it, which typically is 280 Ω at  $V_{CC} = 1.2$  V, 130 Ω at  $V_{CC} = 2.0$  V and 100 Ω at  $V_{CC} = 3.0$  V. The recommended values for these components to maintain agreement with the typical oscillation formula are:  $C_t > 50$  pF, up to any practical value,  $10$  kΩ  $< R_t < 1$  MΩ. In order to avoid start-up problems,  $R_t \geq 1$  kΩ.

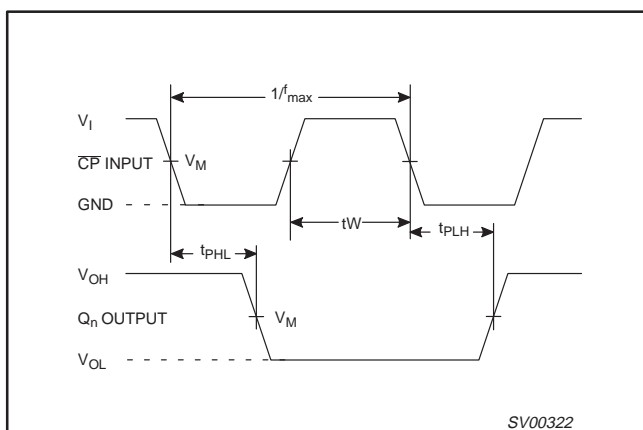
# 14-stage binary ripple counter with oscillator

## 74LV4060



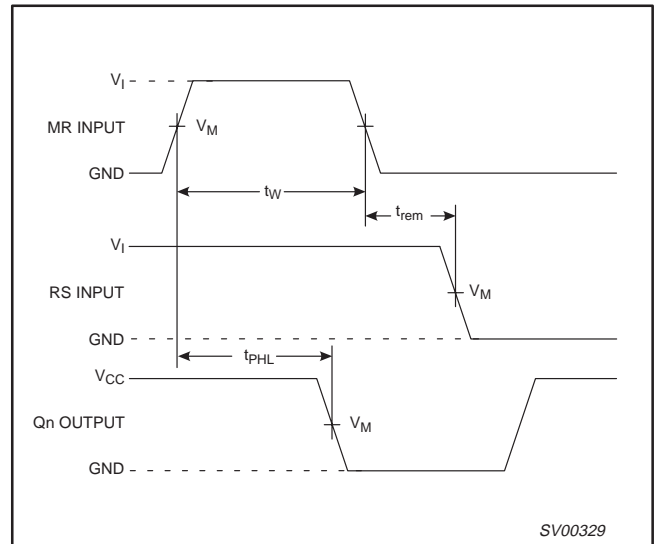
**Figure 5. External components connection for a typical crystal oscillator**

R2 is the power limiting resistor. For starting and maintaining oscillation, a minimum transconductance is necessary, so R2 should not be too large. A practical value for R2 is 2.2 kΩ.



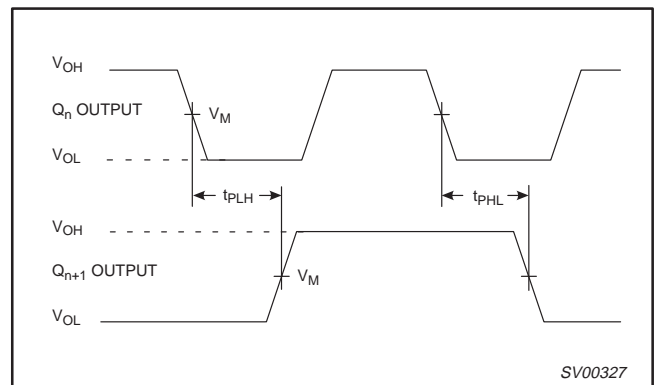
**Figure 6.**

Waveforms showing the clock (RS) to output ( $Q_3$ ) propagation delays, the clock pulse width, the output transition times and the maximum clock frequency.



**Figure 7.**

Waveforms showing the master reset (MR) pulse width, the master reset to output ( $Q_n$ ) propagation delays and the master reset to clock (RS) removal time.



**Figure 8.**

Waveforms showing the output  $Q_n$  to output  $n + 1$  propagation delays.

**NOTES:**

1.  $V_M = 1.5 \text{ V}$  at  $V_{CC} \geq 2.7 \text{ V}$  and  $\leq 3.6 \text{ V}$   
 $V_M = 0.5 \cdot V_{CC}$  at  $V_{CC} < 2.7 \text{ V}$  and  $\geq 4.5 \text{ V}$ .
2.  $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

# 14-stage binary ripple counter with oscillator

74LV4060

## TEST CIRCUIT

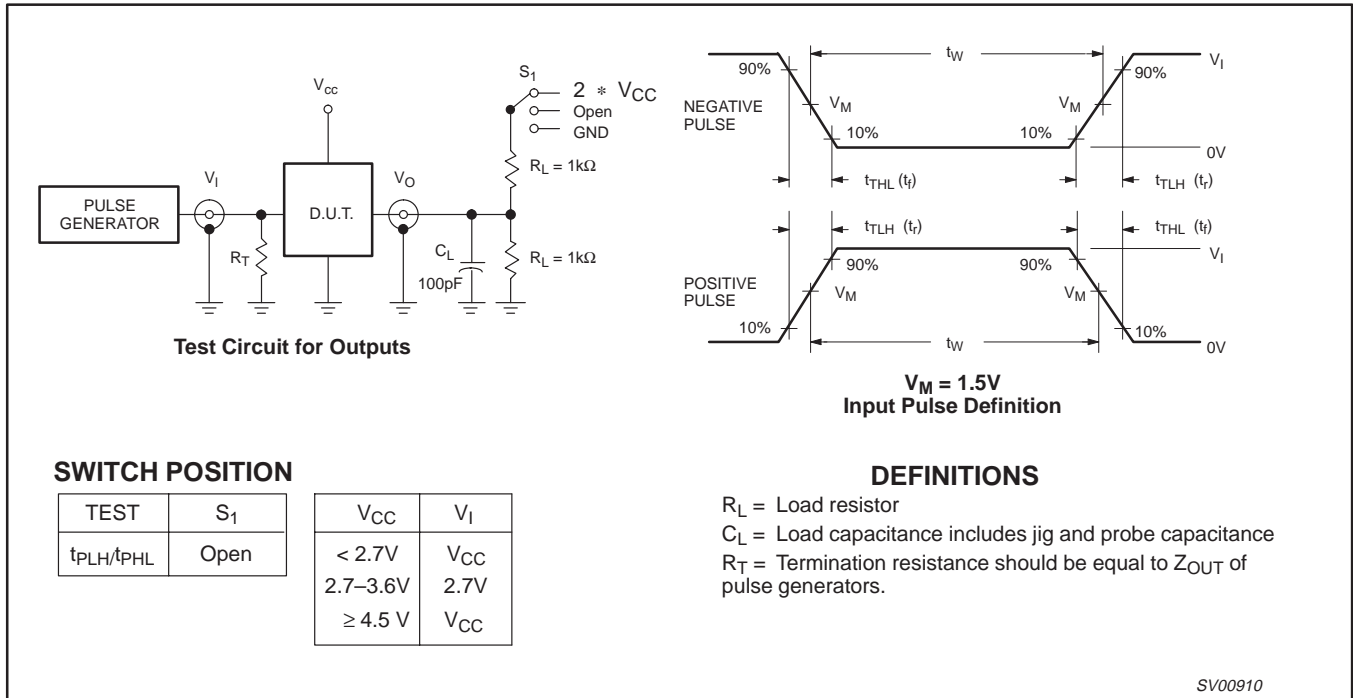


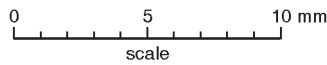
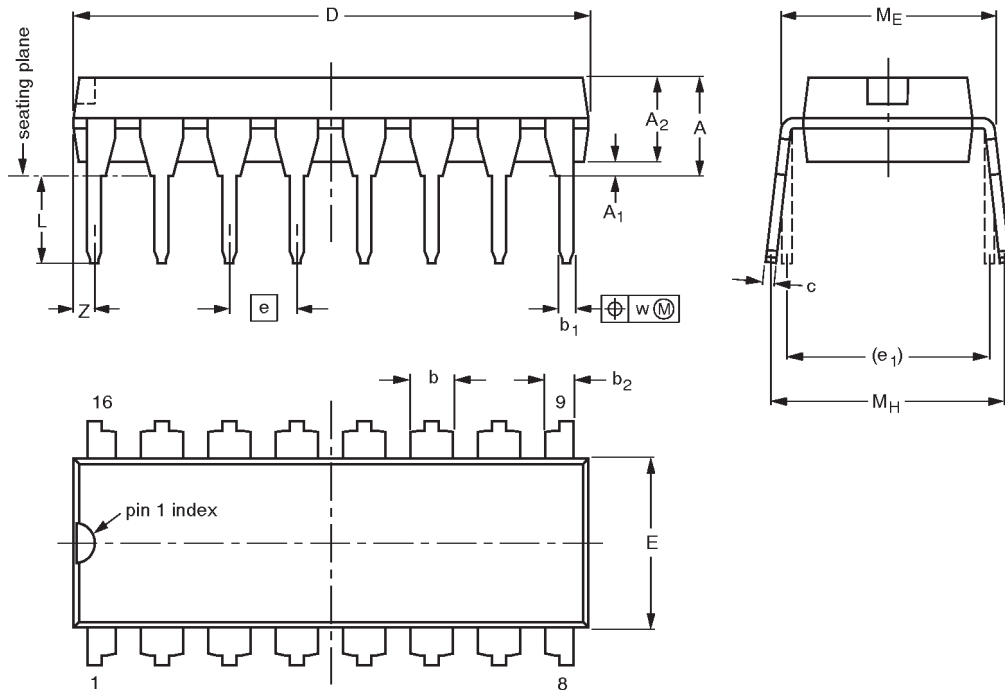
Figure 9. Load circuitry for switching times.

# 14-stage binary ripple counter with oscillator

## 74LV4060

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

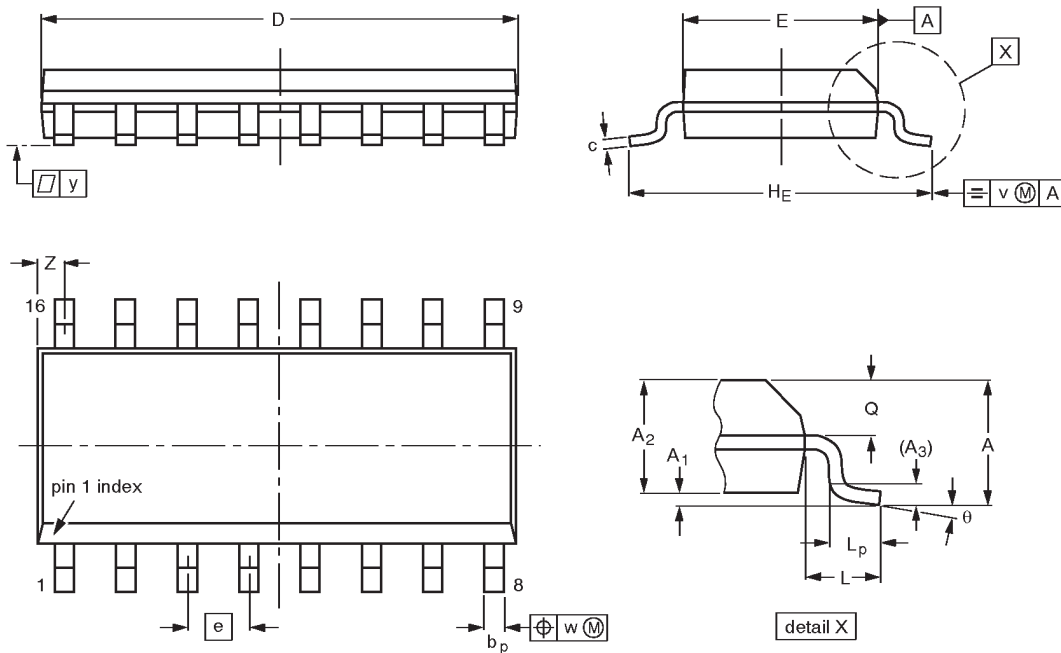
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						92-11-17 95-01-14

# 14-stage binary ripple counter with oscillator

# 74LV4060

**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

**SOT109-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.39 0.38	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

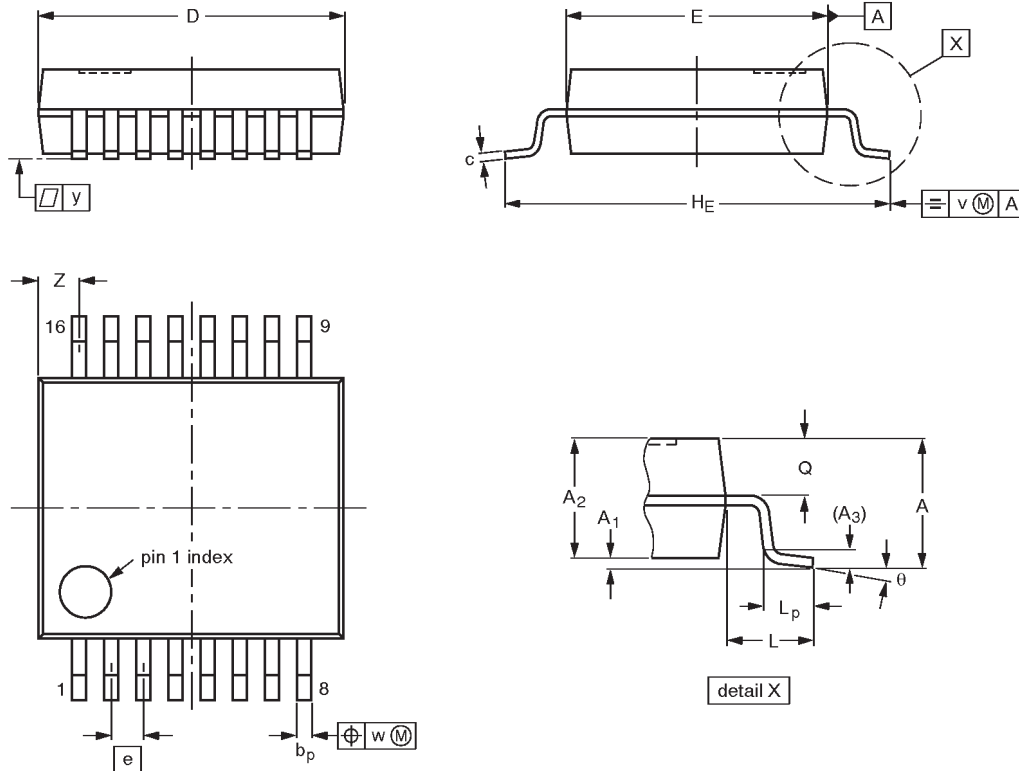
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				91-08-13 95-01-23

# 14-stage binary ripple counter with oscillator

# 74LV4060

**SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm**

**SOT338-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8° 0°

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT338-1		MO-150AC				94-01-14- 95-02-04

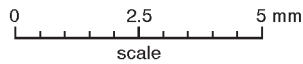
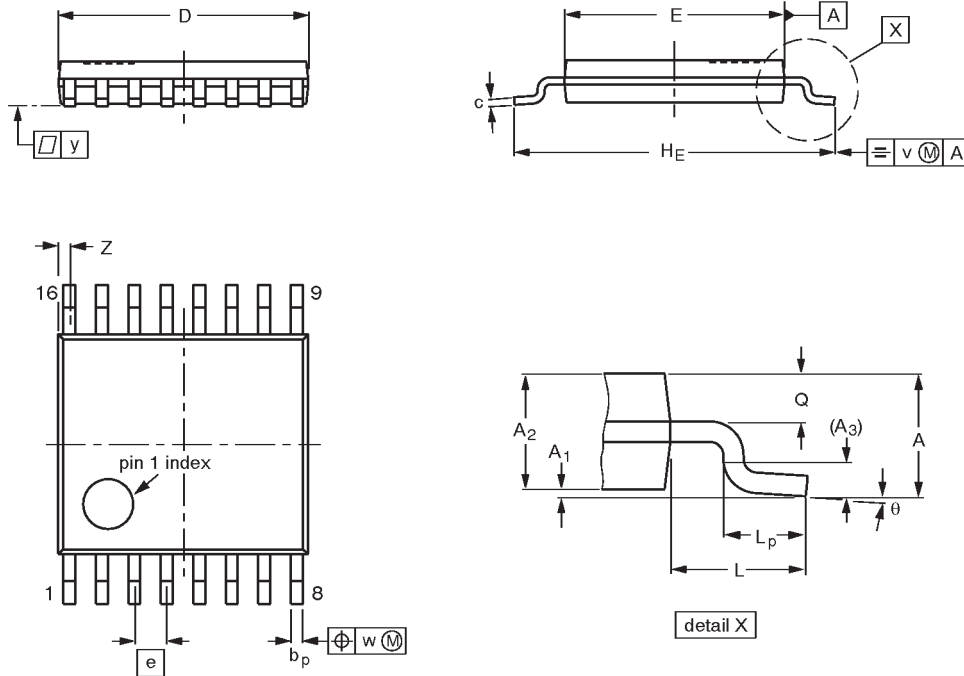


# 14-stage binary ripple counter with oscillator

# 74LV4060

**TSSOP16:** plastic thin shrink small outline package; 16 leads; body width 4.4 mm

**SOT403-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT403-1		MO-153				94-07-12 95-04-04

## 14-stage bunary ripple counter with oscillator

74LV4060

## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## Disclaimers

**Life support** — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors  
811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

© Copyright Philips Electronics North America Corporation 1998  
All rights reserved. Printed in U.S.A.

print code

Date of release: 08-98

Document order number:

9397-750-04658

*Let's make things better.*