

# 74LV4060

## 14-stage binary ripple counter with oscillator

Rev. 5 — 24 March 2021

Product data sheet

### 1. General description

The 74LV4060 is a 14-stage ripple-carry counter/divider and oscillator with three oscillator terminals (RS, R<sub>TC</sub> and C<sub>TC</sub>), ten buffered parallel outputs (Q<sub>3</sub> to Q<sub>9</sub> and Q<sub>11</sub> to Q<sub>13</sub>) 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<sub>TC</sub> and C<sub>TC</sub>) floating. The counter advances on the HIGH-to-LOW transition of RS. A HIGH level on MR clears all counter stages and forces all outputs LOW, independent of the other input conditions. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess V<sub>CC</sub>.

### 2. Features and benefits

- Wide supply voltage range from 1.0 V to 5.5 V
- Optimized for low voltage applications from 1.0 V to 3.6 V
- CMOS low power dissipation
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Accepts TTL input levels between V<sub>CC</sub> = 2.7 V and V<sub>CC</sub> = 3.6 V
- Typical V<sub>OLP</sub> (output ground bounce) < 0.8 V at V<sub>CC</sub> = 3.3 V; T<sub>amb</sub> = 25 °C
- Typical V<sub>OHV</sub> (output V<sub>OH</sub> undershoot) > 2 V at V<sub>CC</sub> = 3.3 V; T<sub>amb</sub> = 25 °C
- All active components on-chip
- RC or crystal oscillator configuration
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115A exceeds 200 V

### 3. Applications

- Control counters
- Timers
- Frequency dividers
- Time-delay circuits

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LV4060D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LV4060PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

### 5. Functional diagram

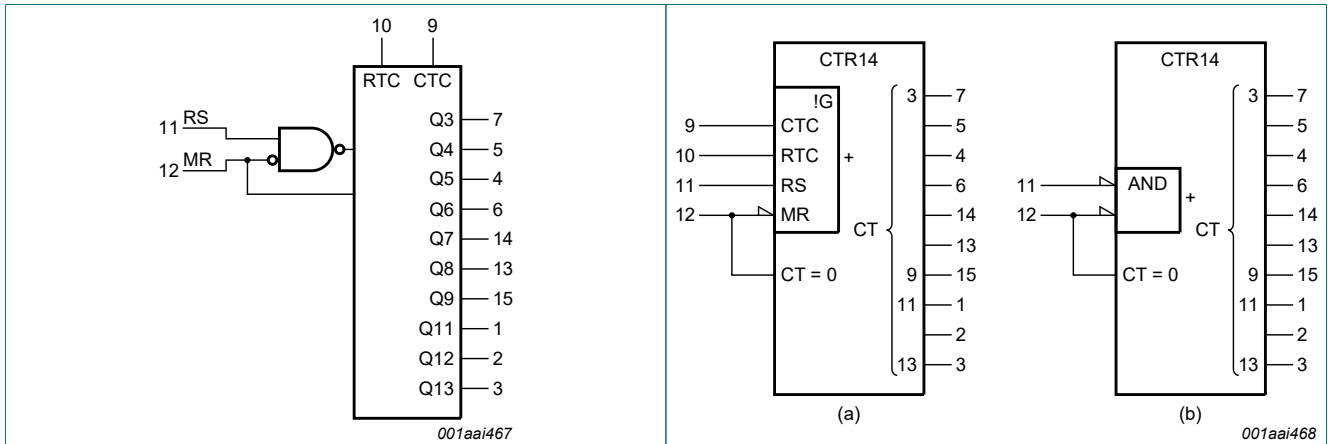


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

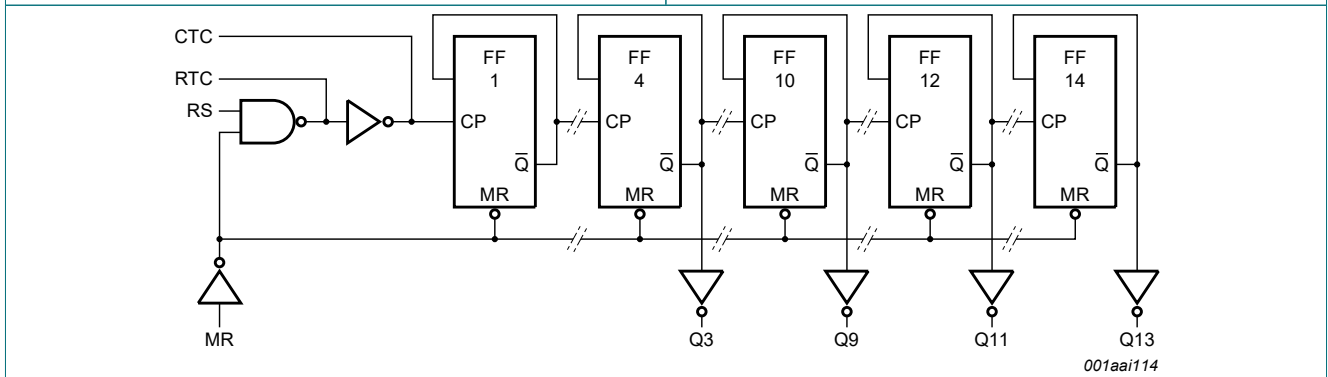


Fig. 3. Logic diagram

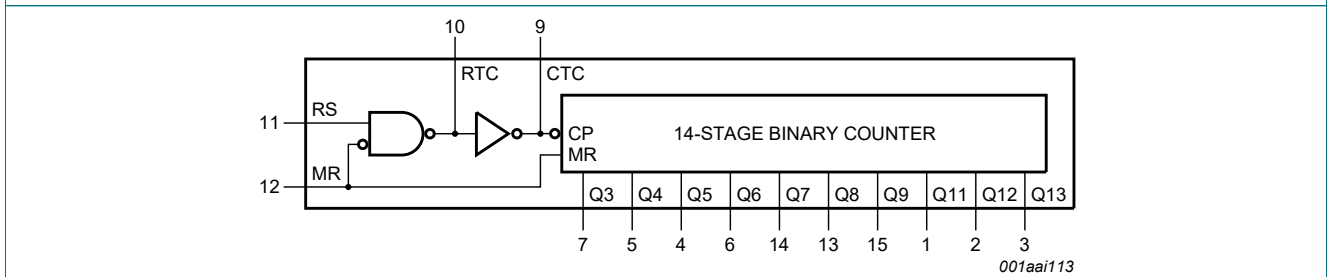
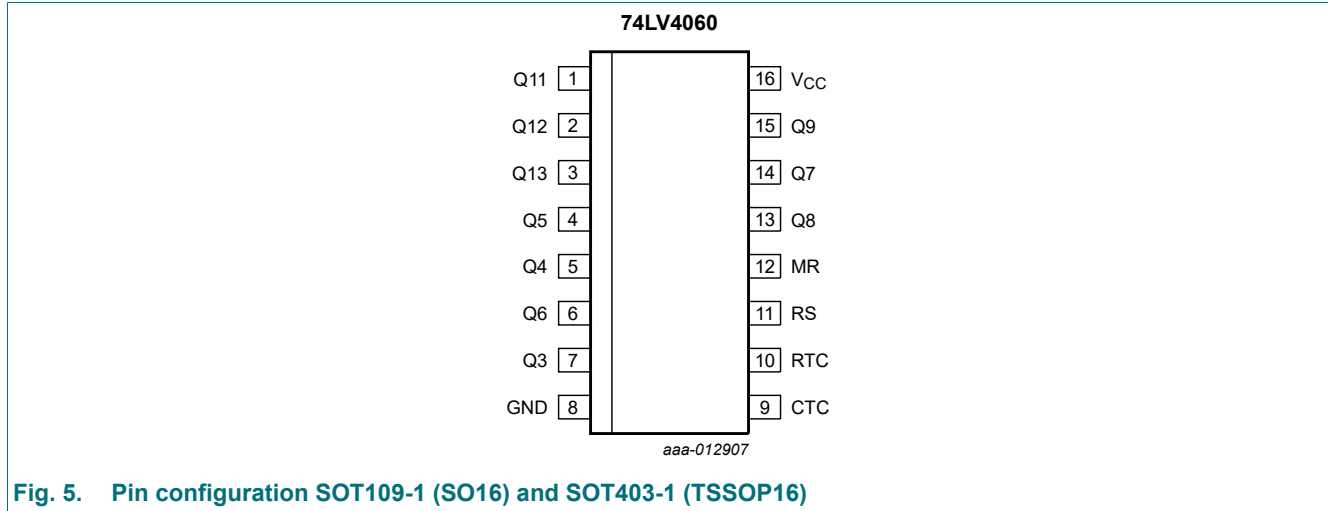


Fig. 4. Functional diagram

## 6. Pinning information

### 6.1. Pinning



### 6.2. Pin description

**Table 2. Pin description**

Symbol	Pin	Description
Q11 to Q13	1, 2, 3	counter output
Q3 to Q9	7, 5, 4, 6, 14, 13, 15	counter output
GND	8	ground (0 V)
CTC	9	external capacitor connection
RTC	10	external resistor connection
RS	11	clock input/oscillator pin
MR	12	master reset
V <sub>CC</sub>	16	supply voltage

## 7. Functional description

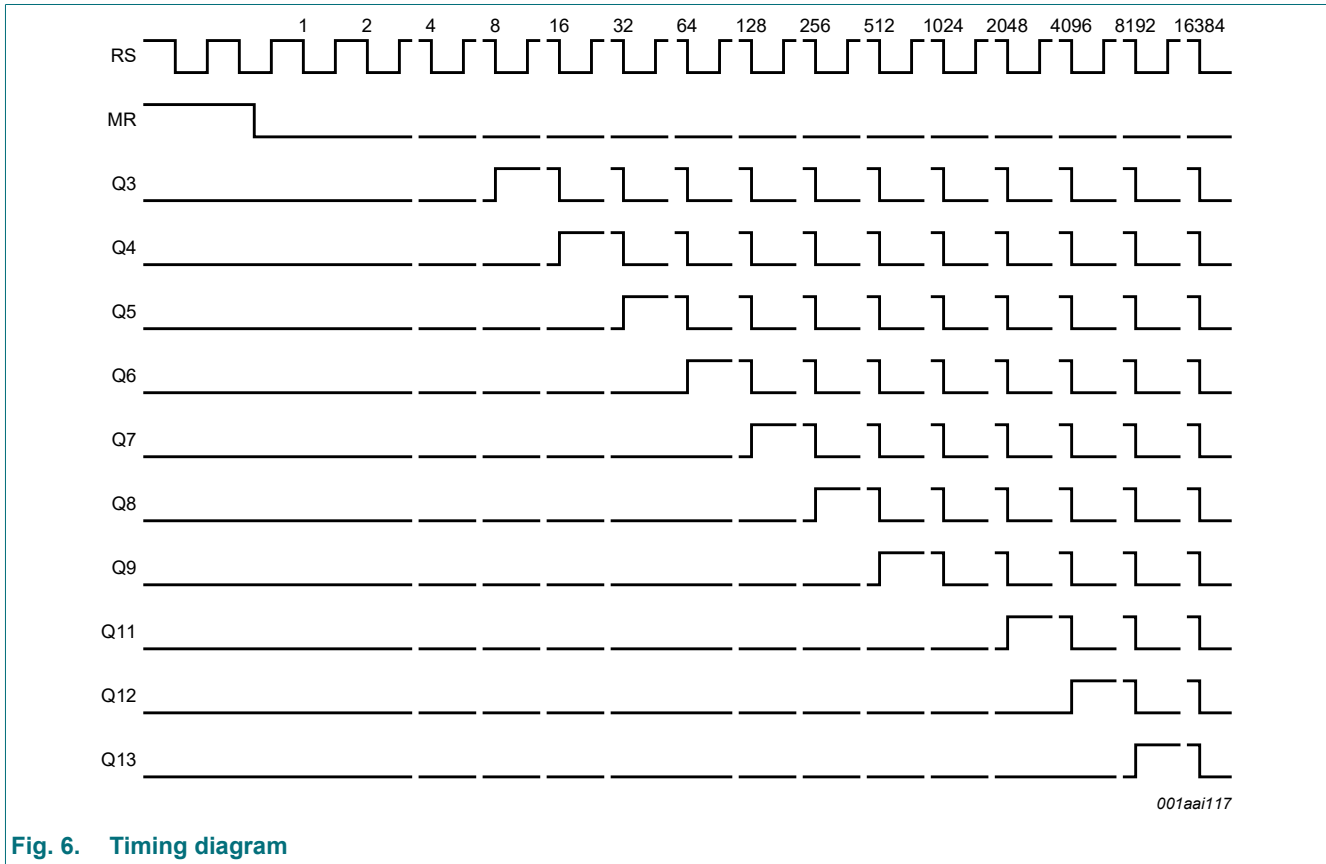


Fig. 6. Timing diagram

## 8. Limiting values

Table 3. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 50$	mA
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	$\pm 25$	mA
$I_{CC}$	supply current		-	+50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	$^{\circ}\text{C}$
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ [2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110  $^{\circ}\text{C}$ .

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91  $^{\circ}\text{C}$ .

## 9. Recommended operating conditions

Table 4. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	[1]	1.0	3.3	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature	in free air	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.0\text{ V to }2.0\text{ V}$	-	-	500	ns/V
		$V_{CC} = 2.0\text{ V to }2.7\text{ V}$	-	-	200	ns/V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	100	ns/V
		$V_{CC} = 3.6\text{ V to }5.5\text{ V}$	-	-	50	ns/V

[1] The 74LV4060 is guaranteed to function down to  $V_{CC} = 1.0\text{ V}$  (input levels GND or  $V_{CC}$ ); DC characteristics are guaranteed from  $V_{CC} = 1.2\text{ V to }V_{CC} = 5.5\text{ V}$ .

## 10. Static characteristics

Table 5. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	MR input						
		$V_{CC} = 1.2\text{ V}$	0.9	-	-	0.9	-	V
		$V_{CC} = 2.0\text{ V}$	1.4	-	-	1.4	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	2.0	-	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	V
		RS input						
		$V_{CC} = 1.2\text{ V}$	1.0	-	-	1.0	-	V
		$V_{CC} = 2.0\text{ V}$	1.6	-	-	1.6	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.4	-	-	2.4	-	V
$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.8V_{CC}$	-	-	$0.8V_{CC}$	-	V		
$V_{IL}$	LOW-level input voltage	MR input						
		$V_{CC} = 1.2\text{ V}$	-	-	0.3	-	0.3	V
		$V_{CC} = 2.0\text{ V}$	-	-	0.6	-	0.6	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	-	0.8	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
		RS input						
		$V_{CC} = 1.2\text{ V}$	-	-	0.2	-	0.2	V
		$V_{CC} = 2.0\text{ V}$	-	-	0.4	-	0.4	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.5	-	0.5	V
$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	$0.2V_{CC}$	-	$0.2V_{CC}$	V		

## 14-stage binary ripple counter with oscillator

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>OH</sub>	HIGH-level output voltage	RTC output; RS = MR = GND						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -3.4 mA	2.40	2.82	-	2.20	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		RTC output; RS = MR = V <sub>CC</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -0.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -0.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -0.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -0.8 mA	2.40	2.82	-	2.20	-	V
V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -0.8 mA	-	-	-	-	-	V		
V <sub>OH</sub>	HIGH-level output voltage	RTC output; RS = MR = GND						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 µA	1.8	2.0	-	1.8	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 µA	2.8	3.0	-	2.8	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		RTC output; RS = MR = V <sub>CC</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 µA	1.8	2.0	-	1.8	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 µA	2.8	3.0	-	2.8	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		CTC output; RS = V <sub>IH</sub> and MR = V <sub>IL</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -3.8 mA	-	1.2	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -3.8 mA	2.40	2.82	-	2.20	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		except RTC output; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 µA	1.0	1.2	-	1.0	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 µA	1.8	2.0	-	1.8	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 µA	2.8	3.0	-	2.8	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -100 µA	-	-	-	-	-	V
		except RTC and CTC outputs; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -6 mA	2.40	2.82	-	2.20	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V

## 14-stage binary ripple counter with oscillator

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>OL</sub>	LOW-level output voltage	RTC output; RS = V <sub>CC</sub> and MR = GND						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -3.4 mA	-	0.25	0.40	-	0.50	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -3.4 mA	-	-	-	-	-	V
V <sub>OL</sub>	LOW-level output voltage	RTC output; RS = V <sub>CC</sub> and MR = GND;						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 μA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -100 μA	-	-	-	-	-	V
		CTC output; RS = V <sub>IH</sub> and MR = V <sub>IL</sub> ;						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -3.8 mA	-	0.25	-	0.40	0.50	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -3.8 mA	-	-	-	-	-	V
		except RTC output; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 μA	-	-	-	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 μA	-	0	0.2	-	0.2	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -100 μA	-	-	-	-	-	V
		except RTC and CTC output; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V
V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -6 mA	-	0.25	0.40	-	0.50	V		
V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V		
V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -6 mA	-	-	-	-	-	V		
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	1.0	-	1.0	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	20	-	160	μA
		V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	-	-	80	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	-	500	-	850	μA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	pF

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

## 11. Dynamic characteristics

**Table 6. Dynamic characteristics**

$GND = 0 V$ ; for test circuit, see [Fig. 10](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$t_{pd}$	propagation delay	RS to Q3; see <a href="#">Fig. 7</a> and <a href="#">Fig. 9</a> [2]						
		$V_{CC} = 1.2 V$	-	180	-	-	-	ns
		$V_{CC} = 2.0 V$	-	52	84	-	105	ns
		$V_{CC} = 2.7 V$	-	42	66	-	83	ns
		$V_{CC} = 3.3 V$ ; $C_L = 15 pF$	-	29	-	-	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	-	33	53	-	66	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	-	24	39	-	49	ns
		Qn to Qn+1; see <a href="#">Fig. 8</a> and <a href="#">Fig. 9</a>						
		$V_{CC} = 1.2 V$	-	40	-	-	-	ns
		$V_{CC} = 2.0 V$	-	14	23	-	29	ns
		$V_{CC} = 2.7 V$	-	10	16	-	20	ns
		$V_{CC} = 3.3 V$ ; $C_L = 15 pF$	-	6	-	-	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	-	8	13	-	16	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	-	6	9	-	11	ns
$t_{PHL}$	HIGH to LOW propagation delay	MR to Qn; see <a href="#">Fig. 8</a> and <a href="#">Fig. 9</a>						
		$V_{CC} = 1.2 V$	-	100	-	-	-	ns
		$V_{CC} = 2.0 V$	-	29	46	-	58	ns
		$V_{CC} = 2.7 V$	-	24	39	-	49	ns
		$V_{CC} = 3.3 V$ ; $C_L = 15 pF$	-	16	-	-	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	-	19	31	-	39	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	-	14	23	-	29	ns
$t_W$	pulse width	RS HIGH or LOW; see <a href="#">Fig. 7</a>						
		$V_{CC} = 2.0 V$	34	9	-	38	-	ns
		$V_{CC} = 2.7 V$	25	6	-	30	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	20	5	-	24	-	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	16	4	-	20	-	ns
		MR HIGH; see <a href="#">Fig. 9</a>						
		$V_{CC} = 2.0 V$	34	10	-	38	-	ns
		$V_{CC} = 2.7 V$	25	8	-	30	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	20	6	-	24	-	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	16	4	-	20	-	ns
$t_{rec}$	recovery time	MR to RS; see <a href="#">Fig. 9</a>						
		$V_{CC} = 2.0 V$	29	18	-	37	-	ns
		$V_{CC} = 2.7 V$	26	16	-	32	-	ns
		$V_{CC} = 3.0 V$ to $3.6 V$ [3]	18	11	-	23	-	ns
		$V_{CC} = 4.5 V$ to $5.5 V$ [4]	12	7	-	15	-	ns

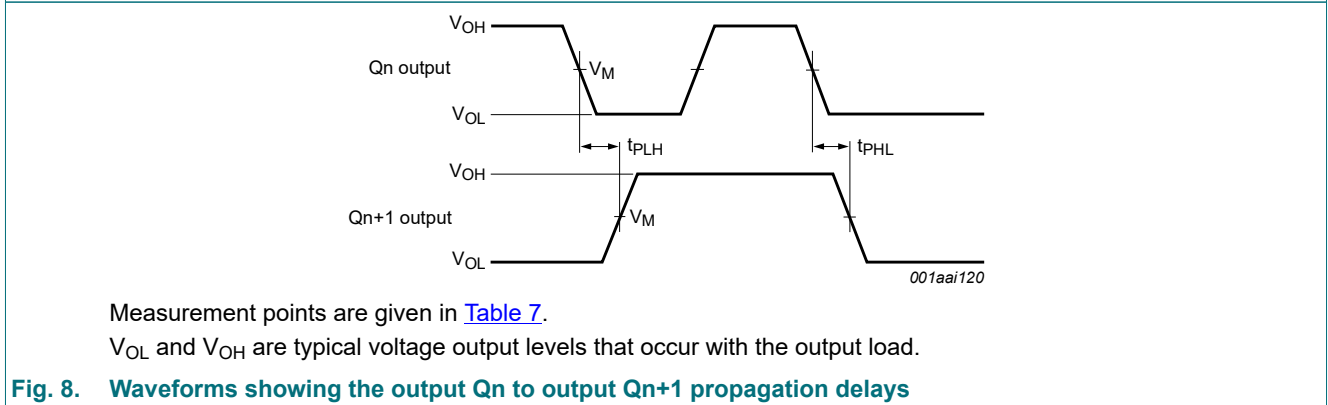
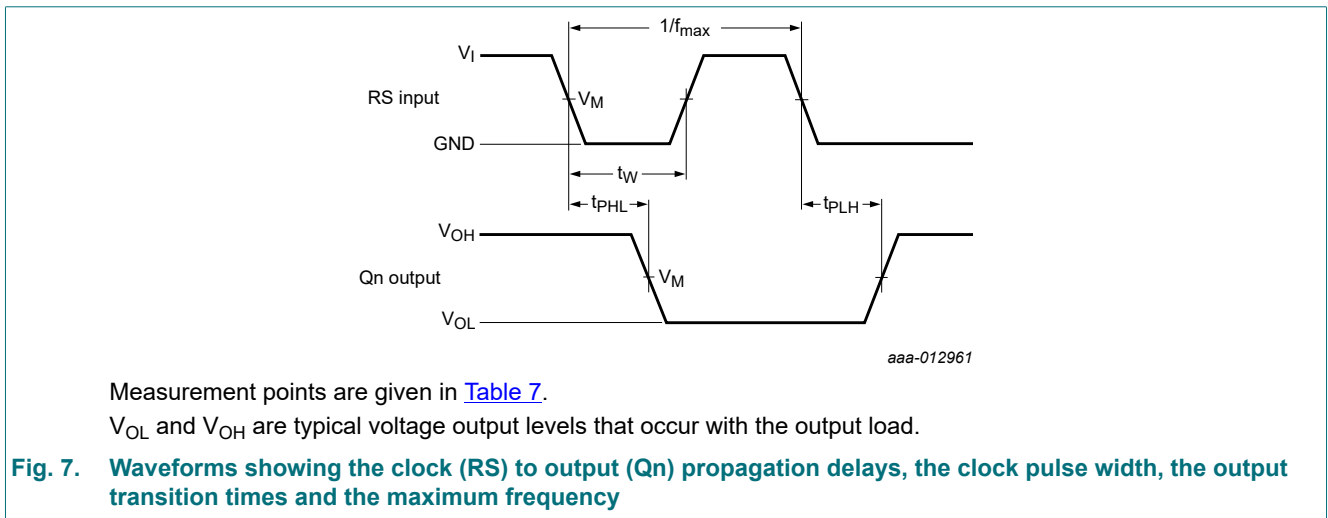


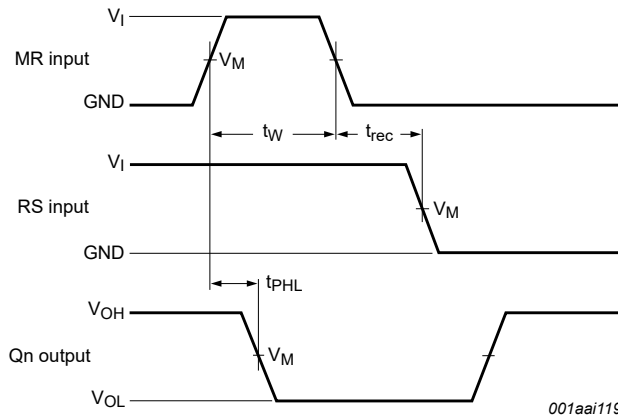
14-stage binary ripple counter with oscillator

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
f <sub>max</sub>	maximum frequency	see Fig. 7						
		V <sub>CC</sub> = 2.0 V	14	40	-	9	-	MHz
		V <sub>CC</sub> = 2.7 V	19	70	-	12	-	MHz
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 15 pF	-	99	-	-	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V [3]	24	90	-	15	-	MHz
	V <sub>CC</sub> = 4.5 V to 5.5 V [4]	30	100	-	19	-	MHz	
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> [5]	-	40	-	-	-	pF

- [1] All typical values are measured at T<sub>amb</sub> = 25 °C.
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [3] Typical value measured at V<sub>CC</sub> = 3.3 V.
- [4] Typical value measured at V<sub>CC</sub> = 5.0 V.
- [5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

11.1. Waveforms and test circuit





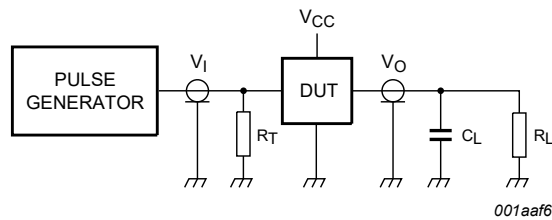
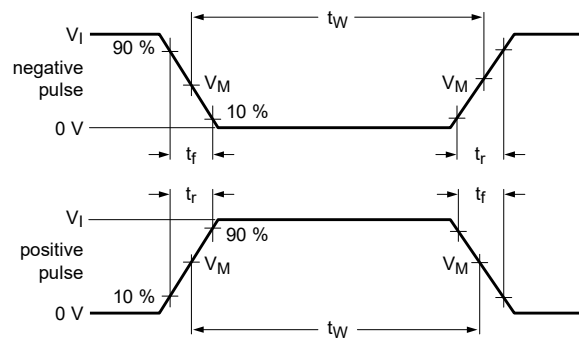
Measurement points are given in [Table 7](#).

$V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig. 9. Waveforms showing the master reset (MR) pulse width, the master reset to output (Qn) propagation delays and the master reset to clock (RS) recovery time**

**Table 7. Measurement points**

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
< 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
2.7 V to 3.6 V	1.5 V	1.5 V
$\geq 4.5$ V	$0.5V_{CC}$	$0.5V_{CC}$



Test data is given in [Table 8](#).

Definitions test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$C_L$  = Load capacitance including jig and probe capacitance.

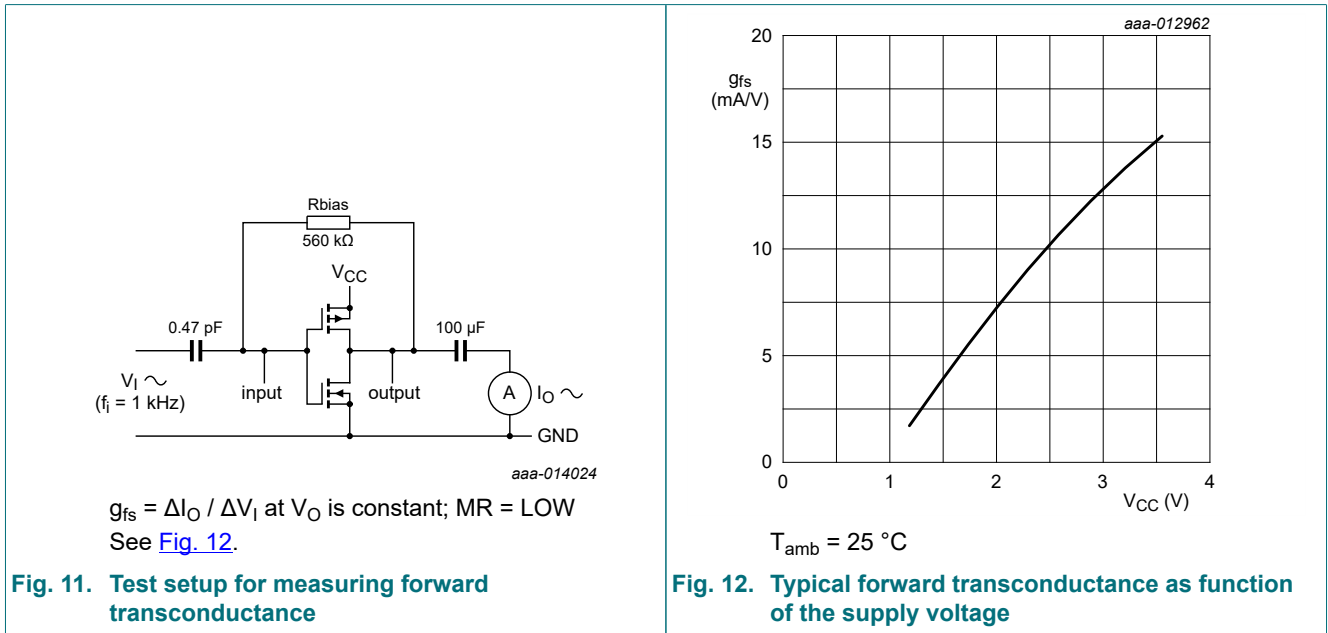
$R_L$  = Load resistance.

**Fig. 10. Test circuit for measuring switching times**

Table 8. Test data

Supply voltage	Input		Load	
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$	$R_L$
$V_{CC} < 2.7\text{ V}$	$V_{CC}$	2.5 ns	50 pF	1 k $\Omega$
$2.7\text{ V} < V_{CC} < 3.6\text{ V}$	2.7 V	2.5 ns	15 pF, 50 pF	1 k $\Omega$
$V_{CC} \geq 4.5\text{ V}$	$V_{CC}$	2.5 ns	50 pF	1 k $\Omega$

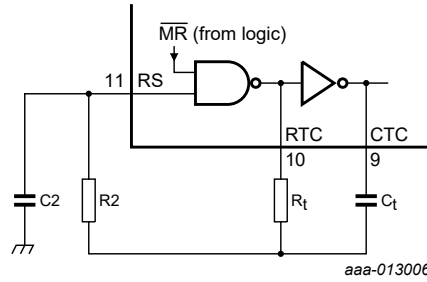
## 12. Typical forward transconductance



## 13. RC oscillator

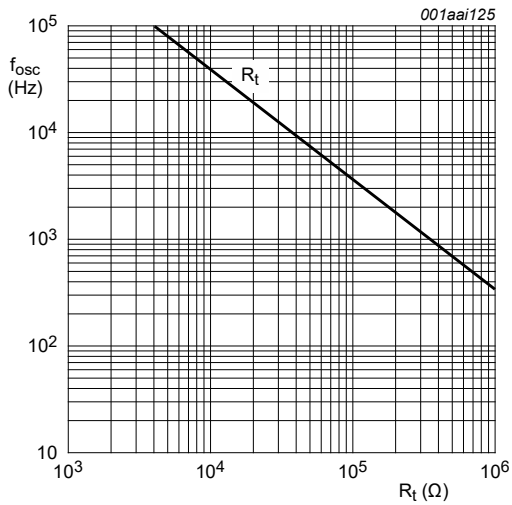
### 13.1. Timing component limitations

The oscillator frequency is mainly determined by  $R_t \times C_t$ , provided  $R_2 \approx 2R_t$  and  $R_2 \times C_2$  is much less than  $R_t \times C_t$ . 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  $\Omega$  at  $V_{CC} = 1.2\text{ V}$ , 130  $\Omega$  at  $V_{CC} = 2.0\text{ V}$  and 100  $\Omega$  at  $V_{CC} = 3.0\text{ V}$ . The recommended values for these components to maintain agreement with the typical oscillation formula are:  $C_t > 50\text{ pF}$ , up to any practical value,  $10\text{ k}\Omega < R_t < 1\text{ M}\Omega$ . In order to avoid start-up problems,  $R_t \geq 1\text{ k}\Omega$ .



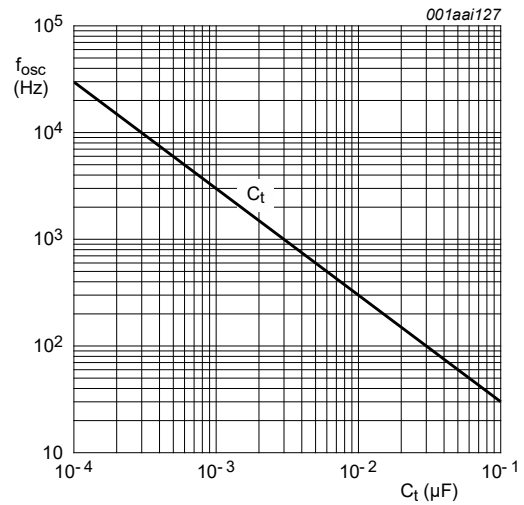
Typical formula for oscillator frequency:  $f_{osc} = \frac{1}{2.5 \times R_t \times C_t}$

Fig. 13. Example of an RC oscillator



$V_{CC} = 1.2 \text{ V to } 3.6 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$   
 $R_t$  curve:  $C_t = 1 \text{ nF}; R_2 = 2 \times R_t$

Fig. 14. RC oscillator frequency as a function of  $R_t$



$V_{CC} = 1.2 \text{ V to } 3.6 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$   
 $C_t$  curve:  $R_t = 100 \text{ k}\Omega; R_2 = 200 \text{ k}\Omega$

Fig. 15. RC oscillator frequency as a function of  $C_t$

### 13.2. Typical crystal oscillator circuit

In Fig. 16,  $R_2$  is the power limiting resistor. For starting and maintaining oscillation, a minimum transconductance is necessary, so  $R_2$  must not be too large. A practical value for  $R_2$  is 2.2 kΩ.

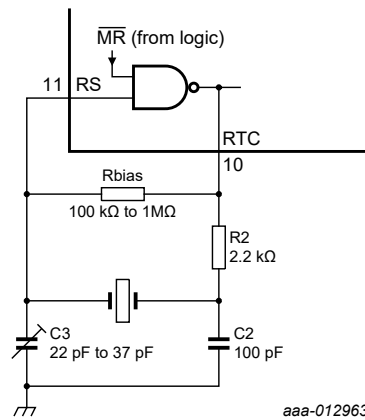


Fig. 16. External components connection for a typical crystal oscillator

14. Package outline

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

SOT109-1



Fig. 17. Package outline SOT109-1 (SO16)

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

SOT403-1

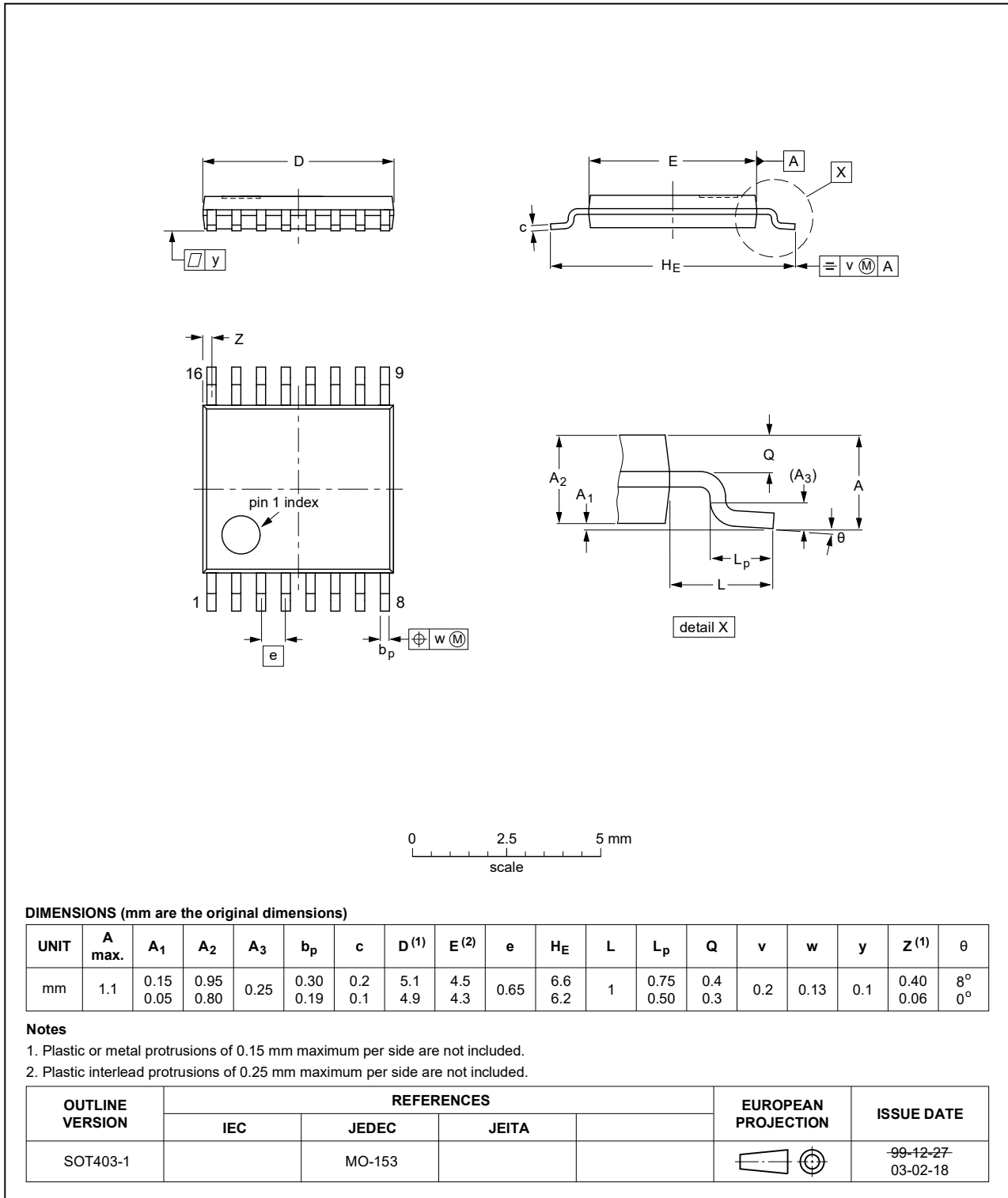


Fig. 18. Package outline SOT403-1 (TSSOP16)

## 15. Abbreviations

Table 9. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 16. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV4060 v.5	20210324	Product data sheet	-	74LV4060 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Section 8</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li>Type number 74LV4060DB (SOT338-1/SSOP16) removed.</li> </ul>			
74LV4060 v.4	20160317	Product data sheet	-	74LV4060 v.3
Modifications:	<ul style="list-style-type: none"> <li>Type number 74LV4060N (SOT38-4) removed.</li> </ul>			
74LV4060 v.3	20140728	Product data sheet	-	74LV4060 v.2
Modifications:	<ul style="list-style-type: none"> <li>Minimum value <math>V_{OH}</math> and <math>V_{OL}</math> corrected (errata).</li> </ul>			
74LV4060 v.2	20140703	Product data sheet	-	74LV4060 v.1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74LV4060 v.1	19980623	Product specification	-	-

## 17. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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