

74LV4060-Q100

14-stage binary ripple counter with oscillator

Rev. 1 — 25 July 2014

Product data sheet

1. General description

The 74LV4060-Q100 is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC4060-Q100; 74HCT4060-Q100.

The 74LV4060-Q100 is a 14-stage ripple-carry counter/divider and oscillator with three oscillator terminals (RS, RTC and CTC). It has ten buffered outputs (Q3 to Q9 and Q11 to Q13) and an overriding asynchronous master reset (MR). The oscillator configuration allows design of either RC or crystal oscillator circuits. The oscillator can be replaced by an external clock signal at input RS. In this case, keep the oscillator pins (RTC and CTC) floating.

The counter advances on the negative-going transition of RS. A HIGH-level on MR resets the counter (Q3 to Q9 and Q11 to Q13 = LOW), independent of the other input conditions.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - ◆ Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Wide operating voltage range from 1.0 V to 5.5 V
- Optimized for low voltage applications from 1.0 V to 3.6 V
- Accepts TTL input levels between $V_{CC} = 2.7\text{ V}$ and $V_{CC} = 3.6\text{ V}$
- Typical V_{OLP} (output ground bounce) $< 0.8\text{ V}$ at $V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$
- Typical V_{OHV} (output V_{OH} undershoot) $> 2\text{ V}$ at $V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$
- All active components on chip
- RC or crystal oscillator configuration
- Complies with JEDEC standard no. 7A
- ESD protection:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)

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-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LV4060PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

5. Functional diagram

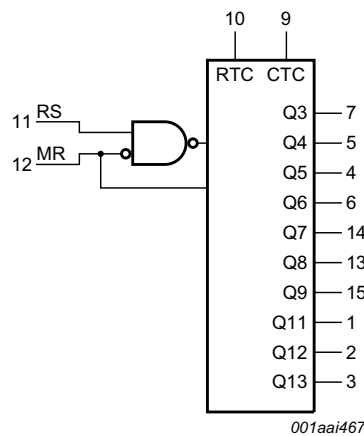


Fig 1. Logic symbol

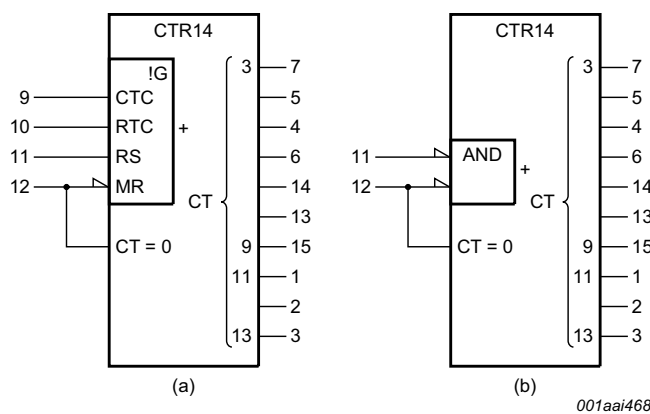


Fig 2. IEC logic symbol

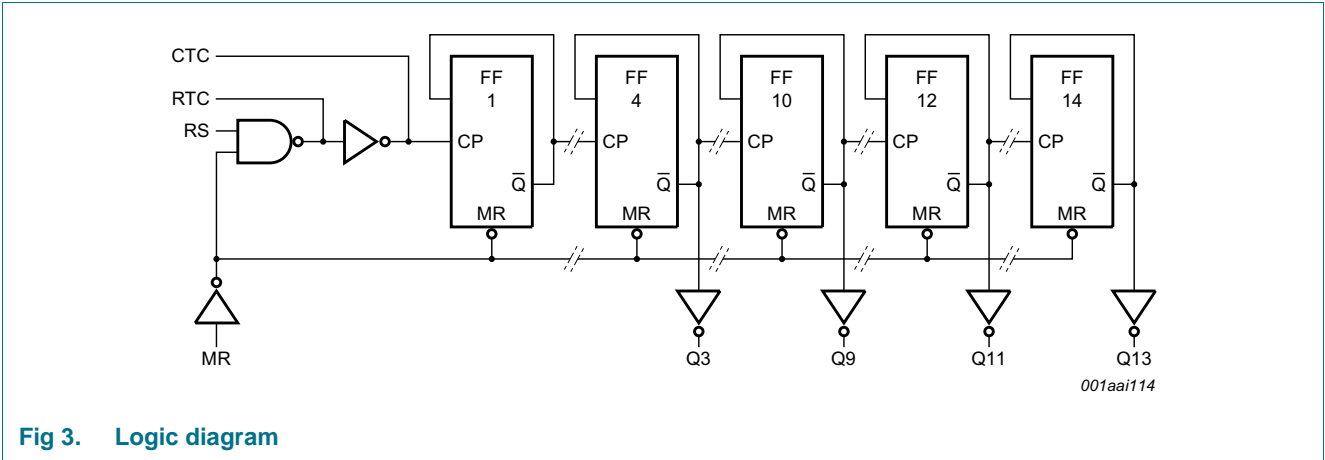


Fig 3. Logic diagram

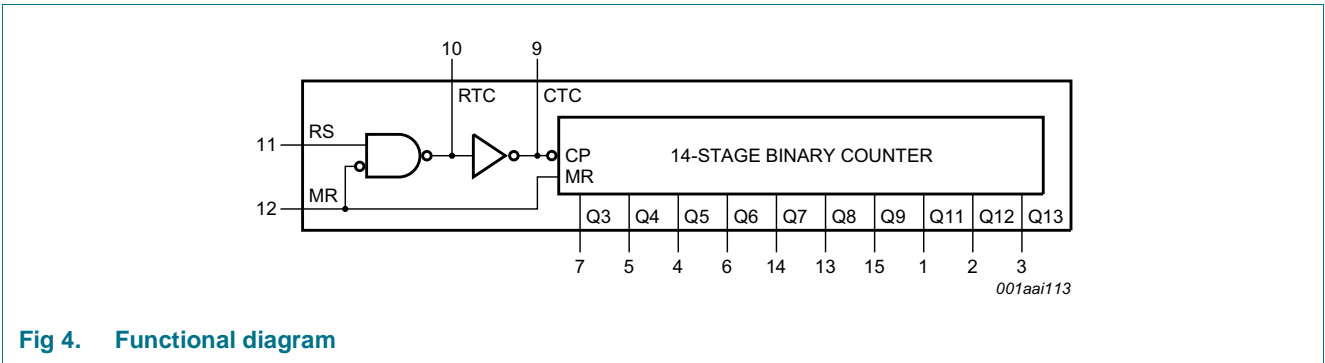


Fig 4. Functional diagram

6. Pinning information

6.1 Pinning

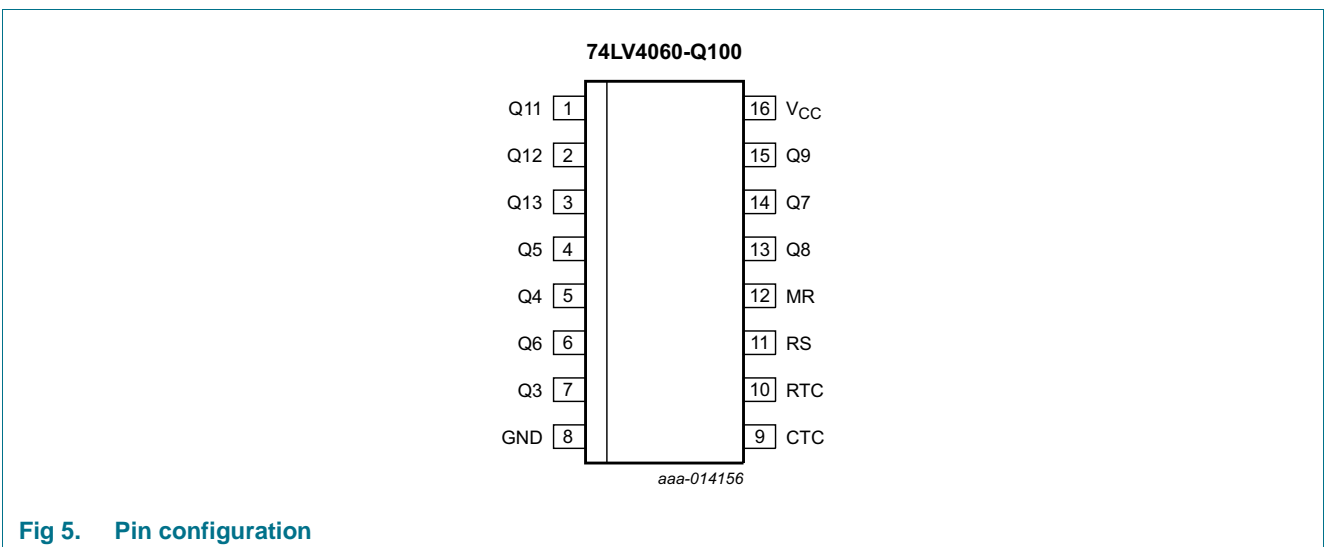


Fig 5. Pin configuration

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 _{CC}	16	supply voltage

7. Functional description

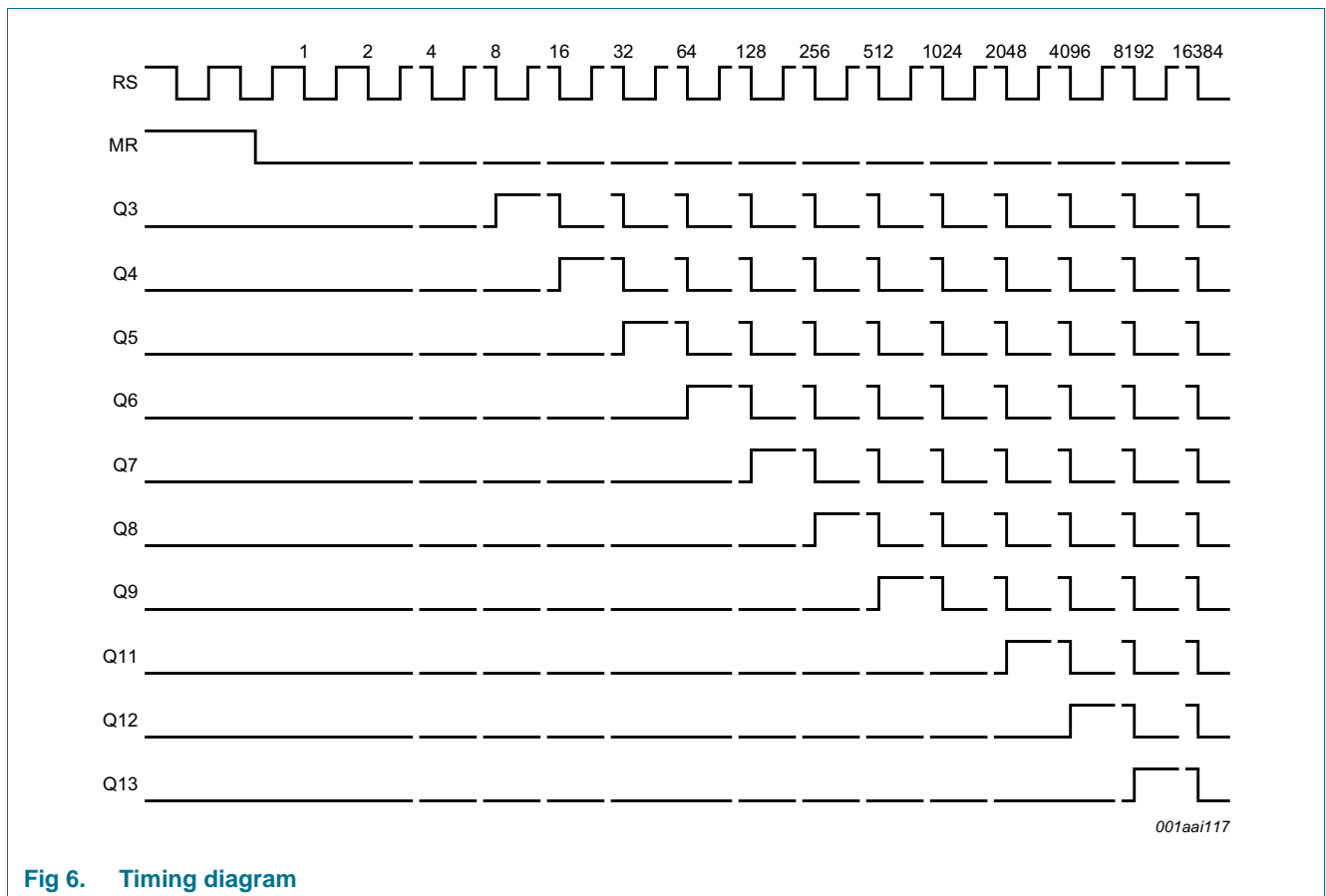


Fig 6. Timing diagram

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]	-	±20	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	±50	mA
I_O	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	±25	mA
I_{CC}	supply current		-	50	mA
I_{GND}	ground current		-50	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$			
		SO16 package [2]	-	500	mW
		TSSOP16 package [3]	-	400	mW

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

[2] P_{tot} derates linearly with 8 mW/K above 70 °C.

[3] P_{tot} derates linearly with 5.5 mW/K above 60 °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 V	-	-	500	ns/V
		$V_{CC} = 2.0\text{ V}$ to 2.7 V	-	-	200	ns/V
		$V_{CC} = 2.7\text{ V}$ to 3.6 V	-	-	100	ns/V
		$V_{CC} = 3.6\text{ V}$ to 5.5 V	-	-	50	ns/V

[1] The 74LV4060-Q100 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 V	0.9	-	-	0.9	-	V
		V _{CC} = 2.0 V	1.4	-	-	1.4	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V _{CC} = 4.5 V to 5.5 V	0.7V _{CC}	-	-	0.7V _{CC}	-	V
		RS input						
		V _{CC} = 1.2 V	1.0	-	-	1.0	-	V
		V _{CC} = 2.0 V	1.6	-	-	1.6	-	V
		V _{CC} = 2.7 V to 3.6 V	2.4	-	-	2.4	-	V
V _{CC} = 4.5 V to 5.5 V	0.8V _{CC}	-	-	0.8V _{CC}	-	V		
V _{IL}	LOW-level input voltage	MR input						
		V _{CC} = 1.2 V	-	-	0.3	-	0.3	V
		V _{CC} = 2.0 V	-	-	0.6	-	0.6	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	0.3V _{CC}	-	0.3V _{CC}	V
		RS input						
		V _{CC} = 1.2 V	-	-	0.2	-	0.2	V
		V _{CC} = 2.0 V	-	-	0.4	-	0.4	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.5	-	0.5	V
V _{CC} = 4.5 V to 5.5 V	-	-	0.2V _{CC}	-	0.2V _{CC}	V		
V _{OH}	HIGH-level output voltage	RTC output; RS = MR = GND						
		V _{CC} = 1.2 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 2.0 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 2.7 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -3.4 mA	2.40	2.82	-	2.20	-	V
		V _{CC} = 4.5 V; I _O = -3.4 mA	-	-	-	-	-	V
		RTC output; RS = MR = V _{CC}						
		V _{CC} = 1.2 V; I _O = -0.8 mA	-	-	-	-	-	V
		V _{CC} = 2.0 V; I _O = -0.8 mA	-	-	-	-	-	V
		V _{CC} = 2.7 V; I _O = -0.8 mA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -0.8 mA	2.40	2.82	-	2.20	-	V
		V _{CC} = 4.5 V; I _O = -0.8 mA	-	-	-	-	-	V

Table 5. Static characteristics ...continued

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 _{OH}	HIGH-level output voltage	RTC output; RS = MR = GND						
		V _{CC} = 1.2 V; I _O = -100 μA	1.0	1.2	-	1.0	-	V
		V _{CC} = 2.0 V; I _O = -100 μA	1.8	2.0	-	1.8	-	V
		V _{CC} = 2.7 V; I _O = -100 μA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -100 μA	2.8	3.0	-	2.8	-	V
		V _{CC} = 4.5 V; I _O = -100 μA	-	-	-	-	-	V
		RTC output; RS = MR = V _{CC}						
		V _{CC} = 1.2 V; I _O = -100 μA	1.0	1.2	-	1.0	-	V
		V _{CC} = 2.0 V; I _O = -100 μA	1.8	2.0	-	1.8	-	V
		V _{CC} = 2.7 V; I _O = -100 μA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -100 μA	2.8	3.0	-	2.8	-	V
		V _{CC} = 4.5 V; I _O = -100 μA	-	-	-	-	-	V
		CTC output; RS = V _{IH} and MR = V _{IL}						
		V _{CC} = 1.2 V; I _O = -3.8 mA	-	1.2	-	-	-	V
		V _{CC} = 2.0 V; I _O = -3.8 mA	-	-	-	-	-	V
		V _{CC} = 2.7 V; I _O = -3.8 mA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -3.8 mA	2.40	2.82	-	2.20	-	V
		V _{CC} = 4.5 V; I _O = -3.8 mA	-	-	-	-	-	V
		except RTC output; V _I = V _{IH} or V _{IL}						
		V _{CC} = 1.2 V; I _O = -100 μA	1.0	1.2	-	1.0	-	V
		V _{CC} = 2.0 V; I _O = -100 μA	1.8	2.0	-	1.8	-	V
		V _{CC} = 2.7 V; I _O = -100 μA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -100 μA	2.8	3.0	-	2.8	-	V
		V _{CC} = 4.5 V; I _O = -100 μA	-	-	-	-	-	V
		except RTC and CTC outputs; V _I = V _{IH} or V _{IL}						
		V _{CC} = 1.2 V; I _O = -6 mA	-	-	-	-	-	V
V _{CC} = 2.0 V; I _O = -6 mA	-	-	-	-	-	V		
V _{CC} = 2.7 V; I _O = -6 mA	-	-	-	-	-	V		
V _{CC} = 3.0 V; I _O = -6 mA	2.40	2.82	-	2.20	-	V		
V _{CC} = 4.5 V; I _O = -6 mA	-	-	-	-	-	V		
V _{OL}	LOW-level output voltage	RTC output; RS = V _{CC} and MR = GND						
		V _{CC} = 1.2 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 2.0 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 2.7 V; I _O = -3.4 mA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -3.4 mA	-	0.25	0.40	-	0.50	V
		V _{CC} = 4.5 V; I _O = -3.4 mA	-	-	-	-	-	V

Table 5. Static characteristics ...continued

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 _{OL}	LOW-level output voltage	RTC output; RS = V _{CC} and MR = GND						
		V _{CC} = 1.2 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 2.0 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 2.7 V; I _O = -100 μA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 4.5 V; I _O = -100 μA	-	-	-	-	-	V
		CTC output; RS = V _{IH} and MR = V _{IL}						
		V _{CC} = 1.2 V; I _O = -3.8 mA	-	-	-	-	-	V
		V _{CC} = 2.0 V; I _O = -3.8 mA	-	-	-	-	-	V
		V _{CC} = 2.7 V; I _O = -3.8 mA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -3.8 mA	-	0.25	-	0.40	0.50	V
		V _{CC} = 4.5 V; I _O = -3.8 mA	-	-	-	-	-	V
		except RTC output; V _I = V _{IH} or V _{IL}						
		V _{CC} = 1.2 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 2.0 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 2.7 V; I _O = -100 μA	-	-	-	-	-	V
		V _{CC} = 3.0 V; I _O = -100 μA	-	0	0.2	-	0.2	V
		V _{CC} = 4.5 V; I _O = -100 μA	-	-	-	-	-	V
		except RTC and CTC output; V _I = V _{IH} or V _{IL}						
		V _{CC} = 1.2 V; I _O = -6 mA	-	-	-	-	-	V
V _{CC} = 2.0 V; I _O = -6 mA	-	-	-	-	-	V		
V _{CC} = 2.7 V; I _O = -6 mA	-	0.25	0.40	-	0.50	V		
V _{CC} = 3.0 V; I _O = -6 mA	-	-	-	-	-	V		
V _{CC} = 4.5 V; I _O = -6 mA	-	-	-	-	-	V		
I _I	input leakage current	V _{CC} = 5.5 V; V _I = V _{CC} or GND	-	-	1.0	-	1.0	μA
I _{CC}	supply current	V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	-	20	-	160	μA
		V _{CC} = 5.5 V; V _I = V _{CC} or GND; I _O = 0 A	-	-	-	-	80	μA
ΔI _{CC}	additional supply current	V _{CC} = 2.7 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 A	-	-	500	-	850	μA
C _I	input capacitance		-	3.5	-	-	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

11. Dynamic characteristics

Table 6. Dynamic characteristics

$GND = 0\text{ V}$; for test circuit, see [Figure 10](#).

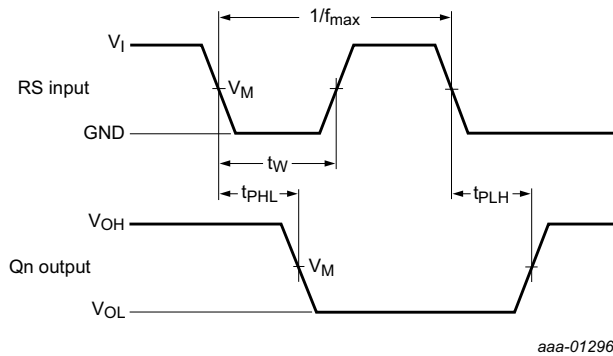
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	RS to Q3; see Figure 7 and Figure 9 ^[2]						
		$V_{CC} = 1.2\text{ V}$	-	180	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	52	84	-	105	ns
		$V_{CC} = 2.7\text{ V}$	-	42	66	-	83	ns
		$V_{CC} = 3.3\text{ V}$; $C_L = 15\text{ pF}$	-	29	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	33	53	-	66	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ^[4]	-	24	39	-	49	ns
		Qn to Qn+1; see Figure 8 and Figure 9						
		$V_{CC} = 1.2\text{ V}$	-	40	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	14	23	-	29	ns
		$V_{CC} = 2.7\text{ V}$	-	10	16	-	20	ns
		$V_{CC} = 3.3\text{ V}$; $C_L = 15\text{ pF}$	-	6	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	8	13	-	16	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ^[4]	-	6	9	-	11	ns
t_{PHL}	HIGH to LOW propagation delay	MR to Qn; see Figure 8 and Figure 9						
		$V_{CC} = 1.2\text{ V}$	-	100	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	29	46	-	58	ns
		$V_{CC} = 2.7\text{ V}$	-	24	39	-	49	ns
		$V_{CC} = 3.3\text{ V}$; $C_L = 15\text{ pF}$	-	16	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	19	31	-	39	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ^[4]	-	14	23	-	29	ns
t_w	pulse width	RS HIGH or LOW; see Figure 7						
		$V_{CC} = 2.0\text{ V}$	34	9	-	38	-	ns
		$V_{CC} = 2.7\text{ V}$	25	6	-	30	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	20	5	-	24	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ^[4]	16	4	-	20	-	ns
		MR HIGH; see Figure 9						
		$V_{CC} = 2.0\text{ V}$	34	10	-	38	-	ns
		$V_{CC} = 2.7\text{ V}$	25	8	-	30	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	20	6	-	24	-	ns
$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ^[4]	16	4	-	20	-	ns		

Table 6. Dynamic characteristics
GND = 0 V; for test circuit, see [Figure 10](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{rec}	recovery time	MR to RS; see Figure 9						
		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
f _{max}	maximum frequency	RS; see Figure 7						
		V _{CC} = 2.0 V	14	40	-	9	-	MHz
		V _{CC} = 2.7 V	19	70	-	12	-	MHz
		V _{CC} = 3.3 V; C _L = 15 pF	-	99	-	-	-	MHz
		V _{CC} = 3.0 V to 3.6 V ^[3]	24	90	-	15	-	MHz
		V _{CC} = 4.5 V to 5.5 V ^[4]	30	100	-	19	-	MHz
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ^[5]	-	40	-	-	-	pF

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

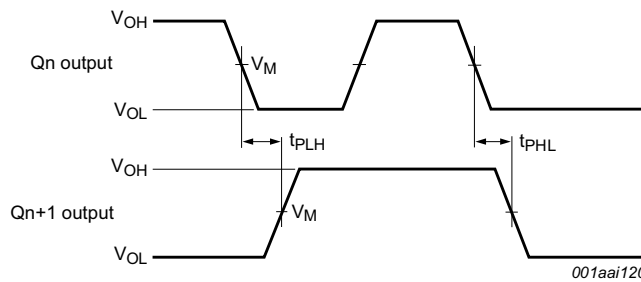
12. Waveforms



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

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

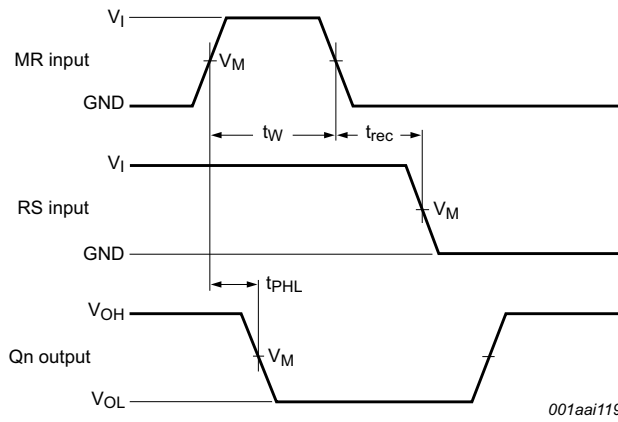
Fig 7. Waveforms showing the clock (RS) to output (Q_n) propagation delays, the clock pulse width, the output transition times and the maximum frequency



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

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

Fig 8. Waveforms showing the output Q_n to output Q_{n+1} propagation delays



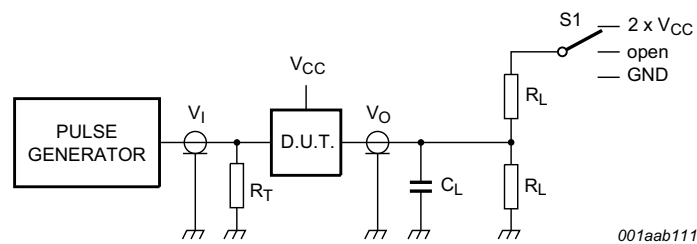
Measurement points are given in [Table 7](#).

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
≥ 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

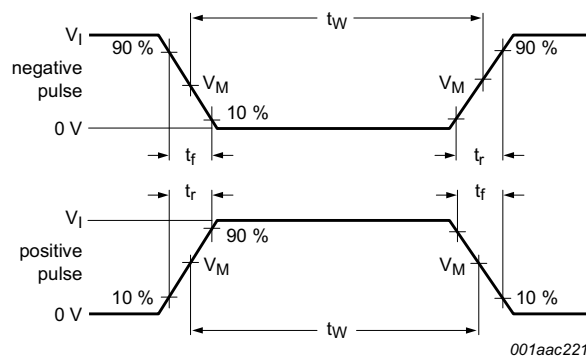
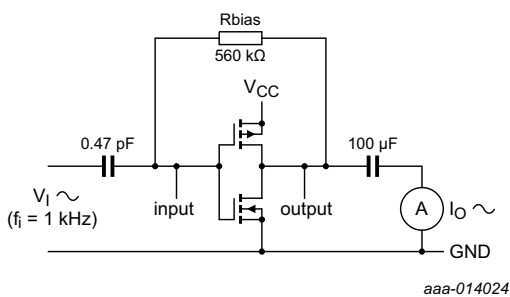


Fig 11. Input pulse definition

Table 8. Test data

Supply voltage	Input		Load		S1
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}
< 2.7 V	V_{CC}	2.5 ns	50 pF	1 k Ω	open
2.7 V to 3.6 V	2.7 V	2.5 ns	15 pF, 50 pF	1 k Ω	open
≥ 4.5 V	V_{CC}	2.5 ns	50 pF	1 k Ω	open

13. Typical forward transconductance



$g_{fs} = \Delta I_O / \Delta V_I$ at V_O is constant; MR = LOW.

See [Figure 13](#).

Fig 12. Test setup for measuring forward transconductance

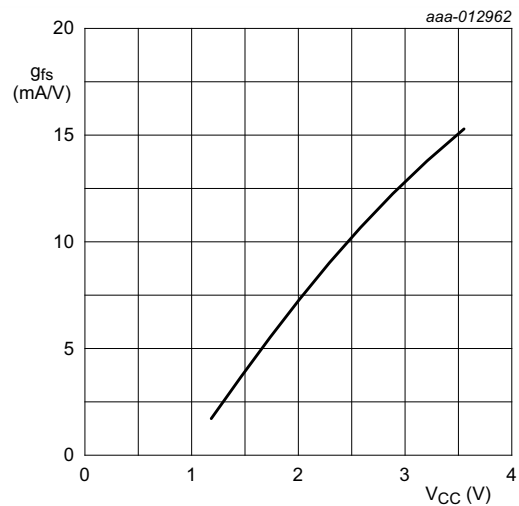
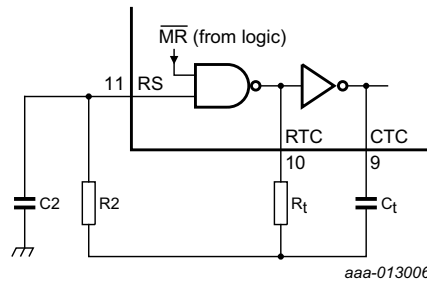


Fig 13. Typical forward transconductance as function of the supply voltage

14. RC oscillator

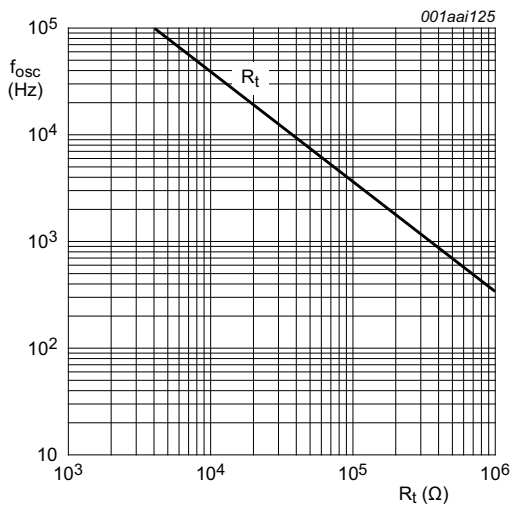
14.1 Timing component limitations

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 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 k $\Omega < R_t < 1$ M Ω . In order to avoid start-up problems, $R_t \geq 1$ k Ω .



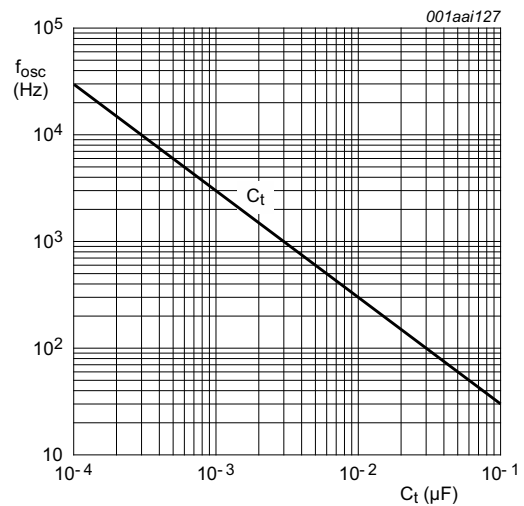
Typical formula for oscillator frequency:
$$f_{osc} = \frac{1}{2.5 \times R_t \times C_t}$$

Fig 14. Example of an RC oscillator



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

Fig 15. RC oscillator frequency as a function of R_t

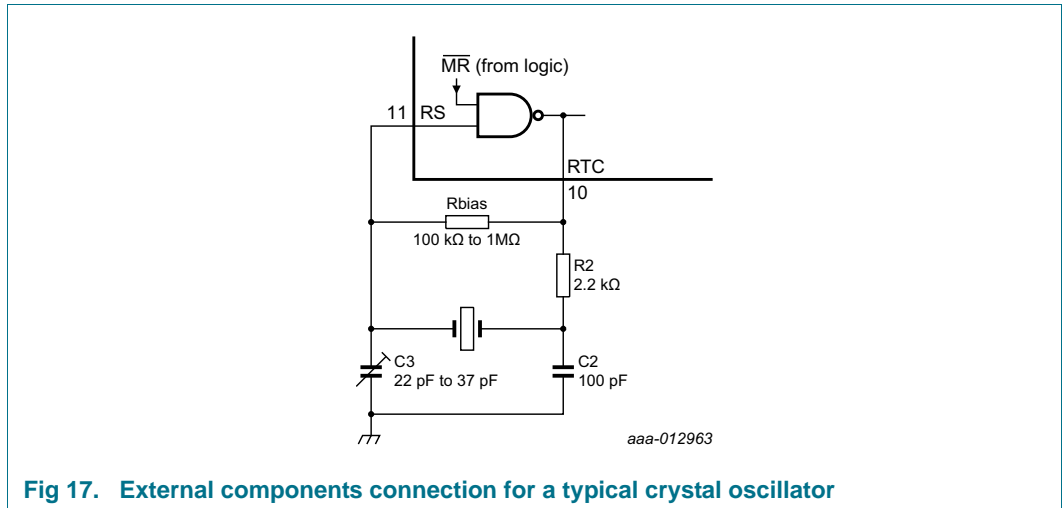


$V_{CC} = 1.2$ V to 3.6 V; $T_{amb} = 25$ °C
 C_t curve: $R_t = 100$ k Ω ; $R_2 = 200$ k Ω

Fig 16. RC oscillator frequency as a function of C_t

14.2 Typical crystal oscillator circuit

In [Figure 17](#), R2 is the power limiting resistor. For starting and maintaining oscillation, a minimum transconductance is necessary, so R2 must not be too large. A practical value for R2 is 2.2 k Ω .



15. Package outline

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

SOT109-1

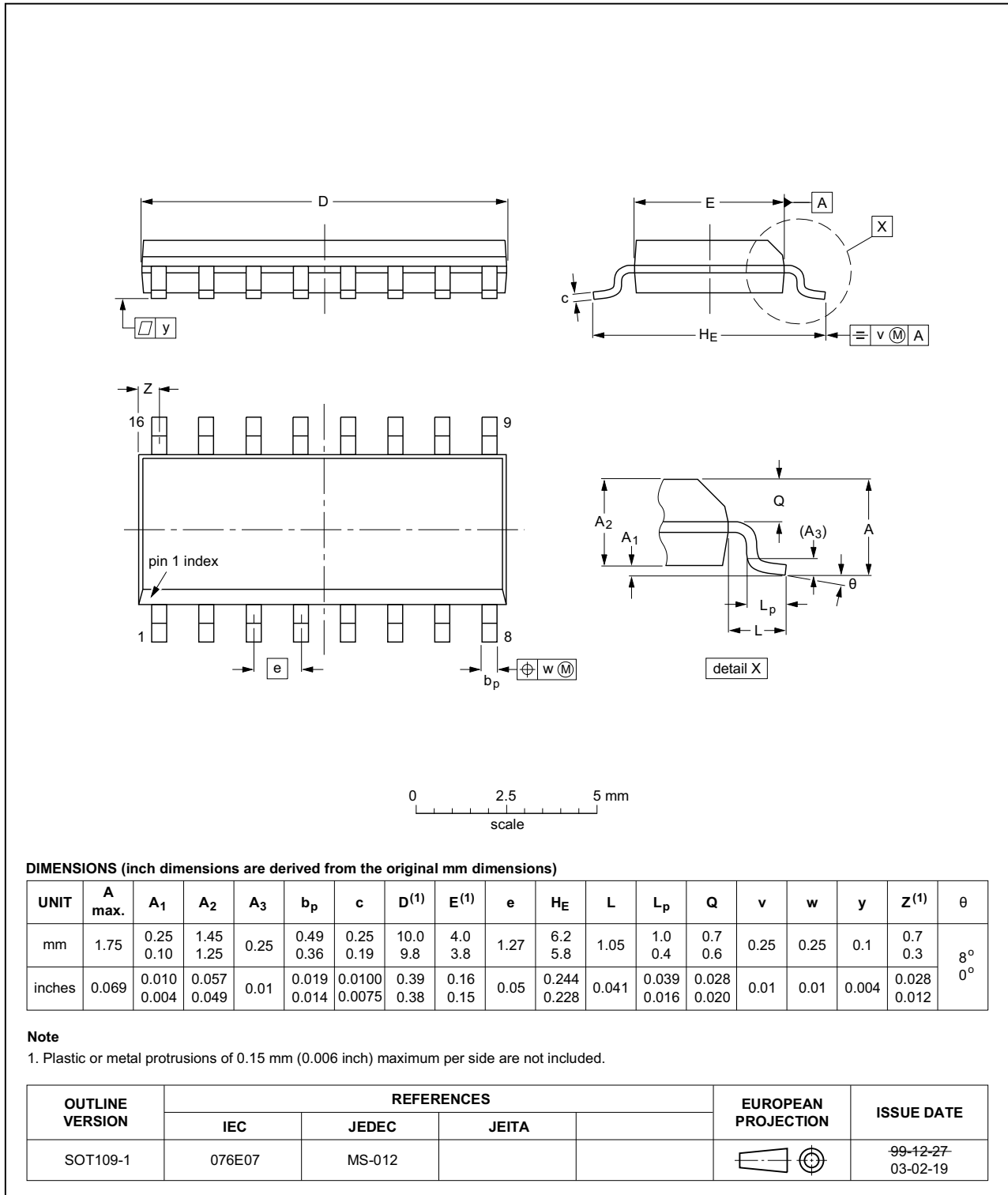


Fig 18. Package outline SOT109-1 (SO16)

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

SOT403-1

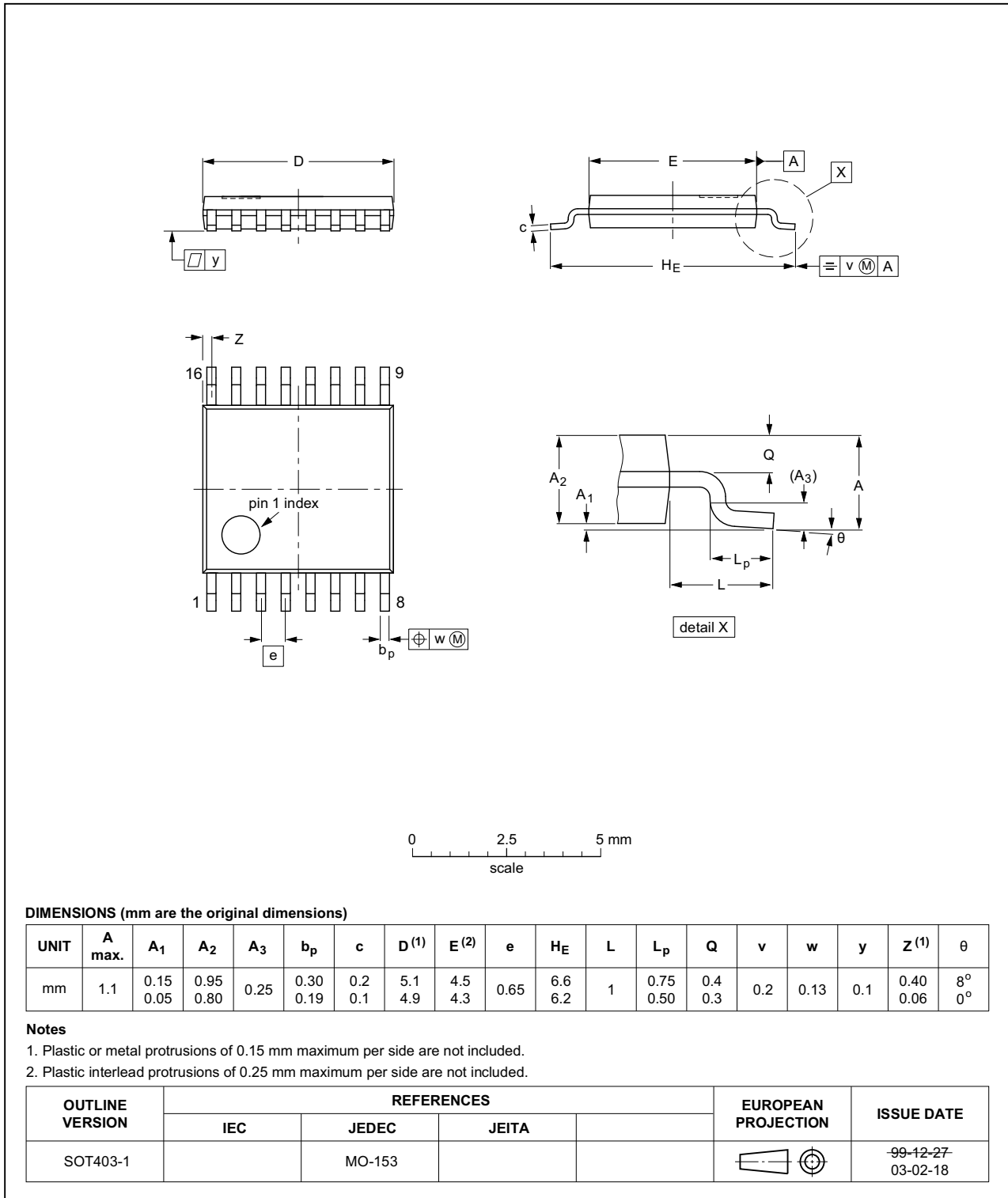


Fig 19. Package outline SOT403-1 (TSSOP16)

16. Abbreviations

Table 9. Abbreviations

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

17. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV4060_Q100 v.1	20140725	Product data sheet	-	-

18. Legal information

18.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

18.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

18.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This Nexperia product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

18.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

19. Contact information

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

20. Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
4	Ordering information	2
5	Functional diagram	2
6	Pinning information	3
6.1	Pinning	3
6.2	Pin description	4
7	Functional description	4
8	Limiting values	5
9	Recommended operating conditions	5
10	Static characteristics	6
11	Dynamic characteristics	9
12	Waveforms	11
13	Typical forward transconductance	13
14	RC oscillator	14
14.1	Timing component limitations	14
14.2	Typical crystal oscillator circuit	15
15	Package outline	16
16	Abbreviations	18
17	Revision history	18
18	Legal information	19
18.1	Data sheet status	19
18.2	Definitions	19
18.3	Disclaimers	19
18.4	Trademarks	20
19	Contact information	20
20	Contents	21