

74HC590

8-bit binary counter with output register; 3-state

Rev. 01 — 30 March 2005

Product data sheet

1. General description

The 74HC590 is a high-speed Si-gate CMOS device and is pin compatible with Low power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard no. 7A.

The 74HC590 is an 8-bit binary counter with a storage register and 3-state outputs. The storage register has parallel (Q0 to Q7) outputs. The binary counter features a master reset counter ($\overline{\text{MRC}}$) and count enable ($\overline{\text{CE}}$) inputs. The counter and storage register have separate positive edge triggered clock (CPC and CPR) inputs. If both clocks are connected together, the counter state always is one count ahead of the register. Internal circuitry prevents clocking from the clock enable. A ripple carry output ($\overline{\text{RCO}}$) is provided for cascading. Cascading is accomplished by connecting $\overline{\text{RCO}}$ of the first stage to $\overline{\text{CE}}$ of the second stage. Cascading for larger count chains can be accomplished by connecting $\overline{\text{RCO}}$ of each stage to the counter clock (CPC) input of the following stage. If both clocks are connected together, the counter state always is one count ahead of the register.

2. Features

- Counter and register have independent clock inputs
- Counter has master reset
- Complies with JEDEC standard no. 7A
- Multiple package options
- ESD protection:
 - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
 - ◆ MM EIA/JESD22-A115-A exceeds 200 V
 - ◆ CDM EIA/JESD22-C101C exceeds 2000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Quick reference data

Table 1: Quick reference data
 $GND = 0\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_r = t_f = 6\text{ ns}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PHL} , t_{PLH}	propagation delay CPC to $\overline{\text{RCO}}$	$C_L = 50\text{ pF}$; $V_{\text{CC}} = 4.5\text{ V}$	-	19	-	ns
	propagation delay CPR to Qn	$C_L = 50\text{ pF}$; $V_{\text{CC}} = 4.5\text{ V}$	-	17	-	ns
t_{PLH}	propagation delay $\overline{\text{MRC}}$ to RCO	$C_L = 50\text{ pF}$; $V_{\text{CC}} = 4.5\text{ V}$	-	18	-	ns
t_{PZH} , t_{PZL}	3-state output enable time $\overline{\text{OE}}$ to Qn	$C_L = 50\text{ pF}$; $V_{\text{CC}} = 4.5\text{ V}$	-	13	-	ns

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Table 1: Quick reference data ...continued $GND = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; $t_r = t_f = 6\text{ ns}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PHZ} , t_{PLZ}	3-state output disable time \overline{OE} to Q_n	$C_L = 50\text{ pF}$; $V_{CC} = 4.5\text{ V}$	-	13	-	ns
C_I	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance		[1] [2]	44	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

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;

$\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

[2] The condition is $V_I = GND$ to V_{CC} .

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC590D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC590PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HC590BQ	-40 °C to +125 °C	DHVQFN16	plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

5. Functional diagram

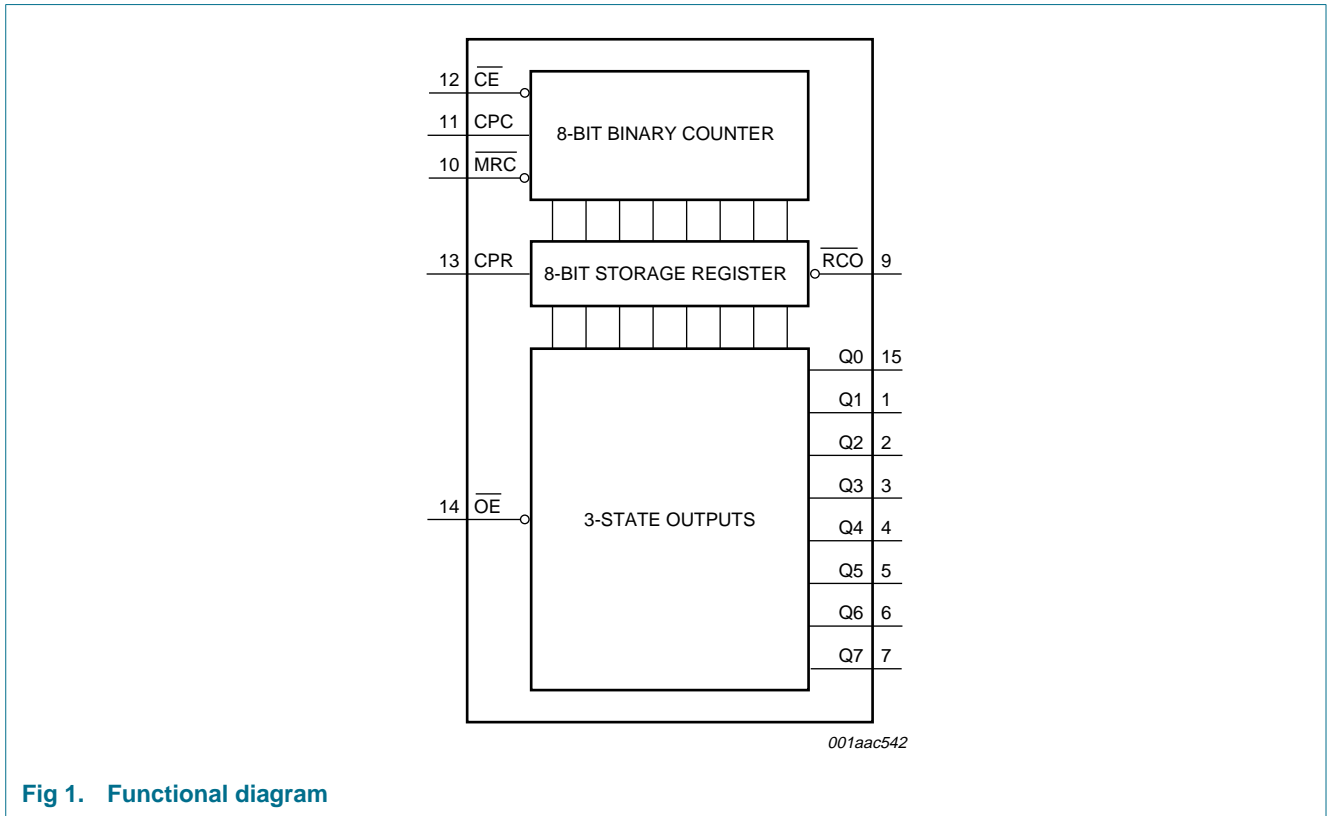


Fig 1. Functional diagram

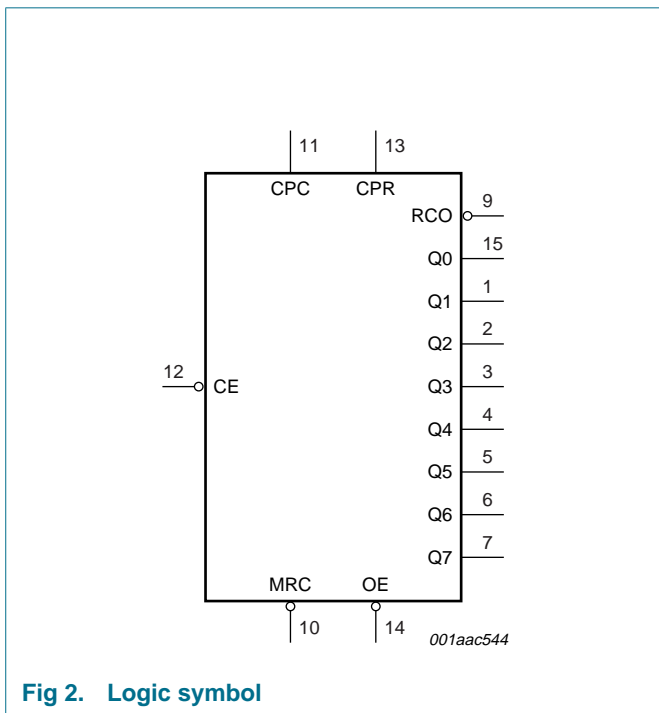


Fig 2. Logic symbol

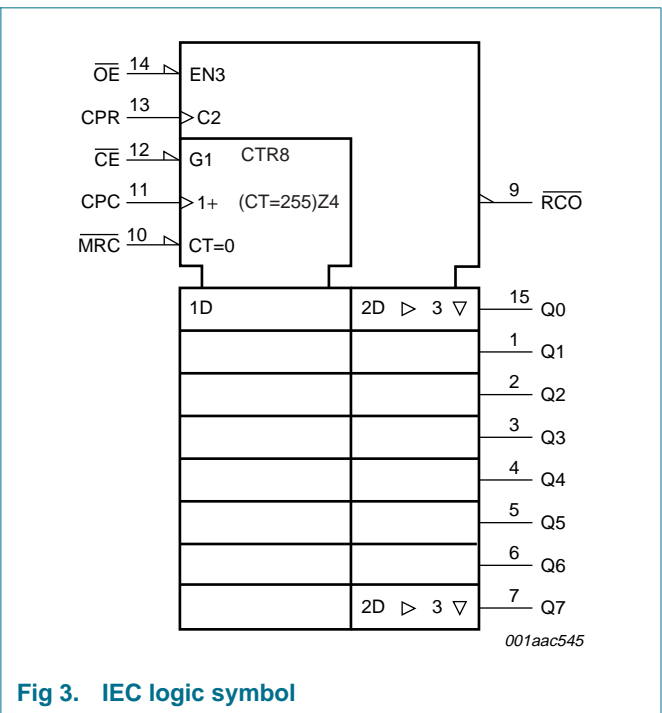


Fig 3. IEC logic symbol

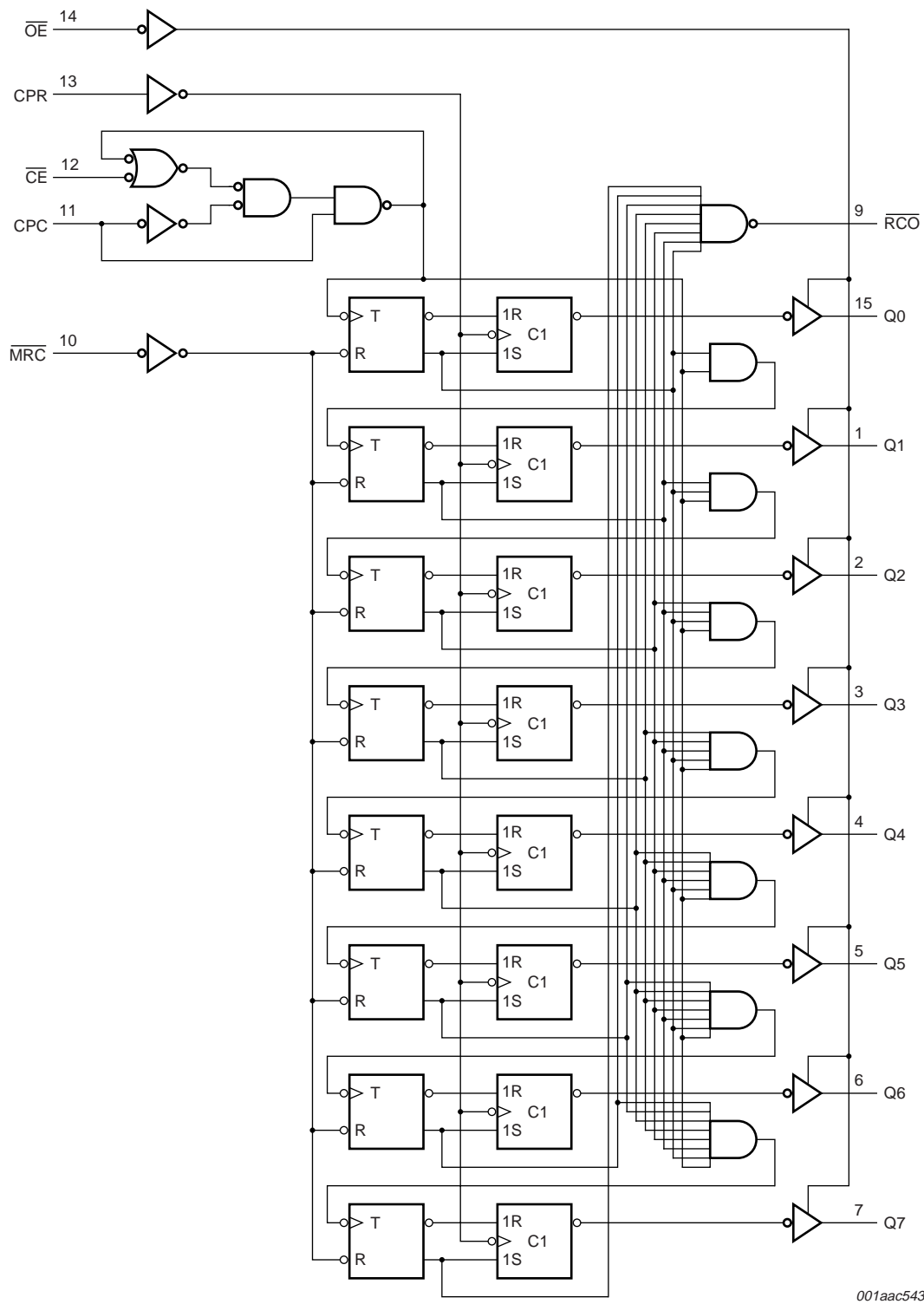
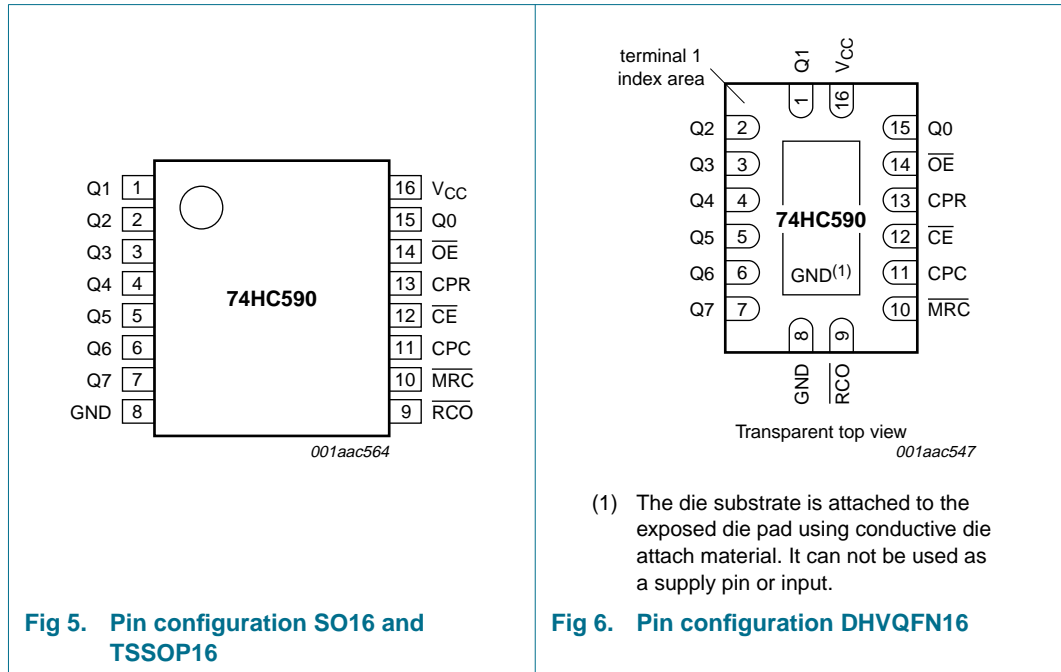


Fig 4. Logic diagram

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
Q1	1	parallel data output 1
Q2	2	parallel data output 2
Q3	3	parallel data output 3
Q4	4	parallel data output 4
Q5	5	parallel data output 5
Q6	6	parallel data output 6
Q7	7	parallel data output 7
GND	8	ground (0 V)
\overline{RCO}	9	ripple carry output (active LOW)
\overline{MRC}	10	master reset counter input (active LOW)
CPC	11	counter clock input (active HIGH)
\overline{CE}	12	count enable input (active LOW)
CPR	13	register clock input (active HIGH)
\overline{OE}	14	output enable input (active LOW)
Q0	15	parallel data output 0
V _{CC}	16	supply voltage

7. Functional description

7.1 Function table

Table 4: Function table [\[1\]](#) [\[2\]](#)

Inputs					Description
OE	CPR	MRC	CE	CPC	
H	X	X	X	X	Q outputs disable
L	X	X	X	X	Q outputs enable
X	↑	X	X	X	counter data stored into register
X	↓	X	X	X	register stage is not changed
X	X	L	X	X	counter clear
X	X	H	L	↑	advance one count
X	X	H	L	↓	no count
X	X	H	H	X	no count

- [1] H = HIGH voltage level
 L = LOW voltage level
 X = don't care
 ↑ = LOW-to-HIGH transition
 ↓ = HIGH-to-LOW transition

- [2] $\overline{RCO} = Q_0' \cdot Q_1' \cdot Q_2' \cdot Q_3' \cdot Q_4' \cdot Q_5' \cdot Q_6' \cdot Q_7'$ (Q0' to Q7' are internal outputs of the counter)

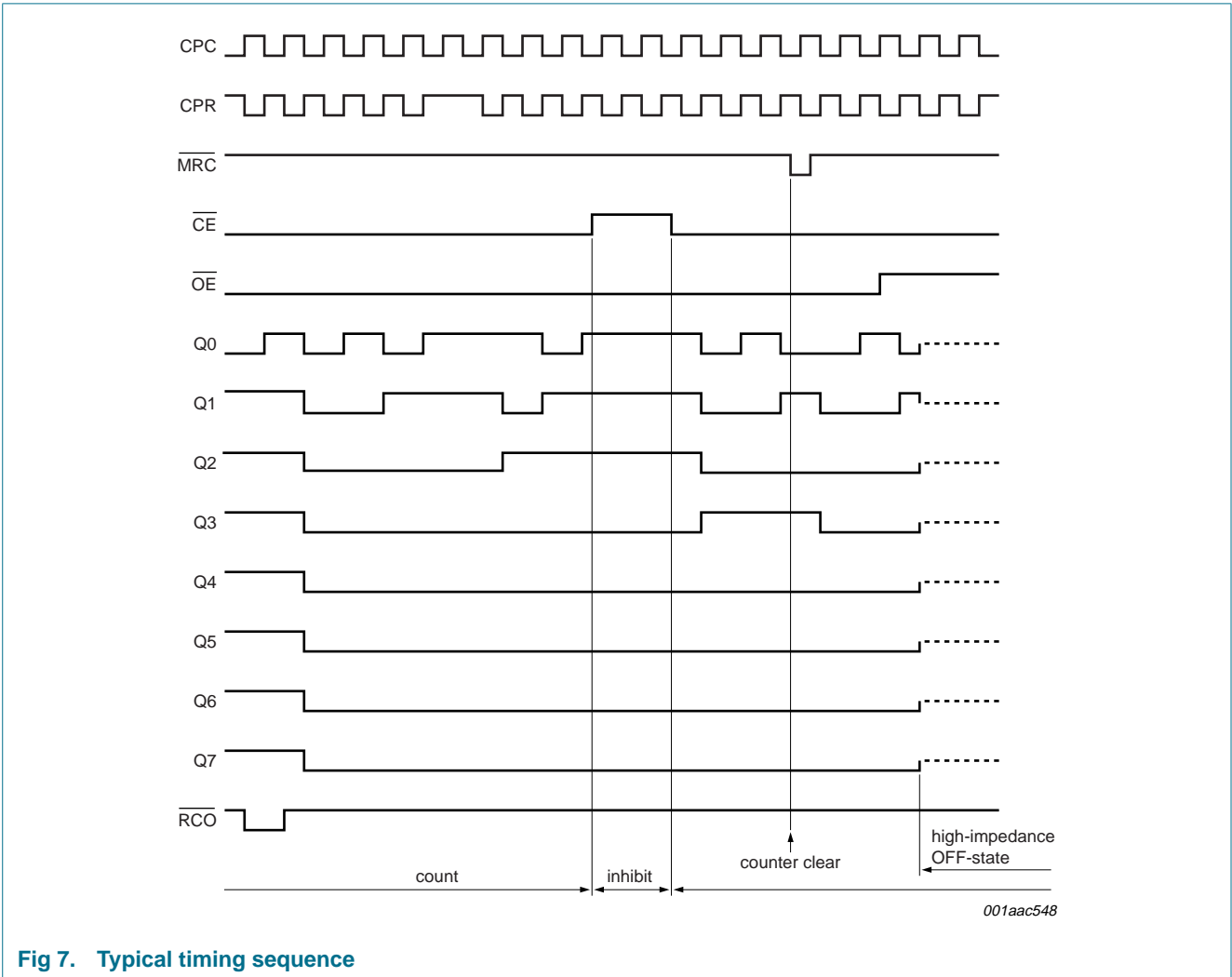


Fig 7. Typical timing sequence

8. Limiting values

Table 5: 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	V
I_{IK}	input diode current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_{OK}	output diode current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_O	source or sink output current	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$			
	RCO standard output		-	± 25	mA
	Qn bus driver output		-	± 35	mA
I_{CC}, I_{GND}	V_{CC} or GND current		-	± 70	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation		[1]	500	mW

- [1] For SO16 packages: P_{tot} derates linearly with 8 mW/K above 70 °C.
 For TSSOP16 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.
 For DHVQFN16 packages: P_{tot} derates linearly with 8 mW/K above 60 °C.

9. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
t_r, t_f	input rise and fall times	$V_{CC} = 2.0\text{ V}$	-	-	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	-	400	ns
T_{amb}	ambient temperature		-40	-	+125	°C

10. Static characteristics

Table 7: Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	V
V _{OH}	HIGH-level output voltage all outputs	V _I = V _{IH} or V _{IL} I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	V
	RCO standard output	I _O = -4 mA; V _{CC} = 4.5 V	4.18	4.31	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.68	5.80	-	V
	Qn bus driver output	I _O = -6 mA; V _{CC} = 4.5 V	4.18	4.31	-	V
I _O = -7.8 mA; V _{CC} = 6.0 V		5.68	5.80	-	V	
V _{OL}	LOW-level output voltage all outputs	V _I = V _{IH} or V _{IL} I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	V
	RCO standard output	I _O = 4 mA; V _{CC} = 4.5 V	-	0.17	0.26	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.18	0.26	V
	Qn bus driver output	I _O = 6 mA; V _{CC} = 4.5 V	-	0.17	0.26	V
I _O = 7.8 mA; V _{CC} = 6.0 V		-	0.18	0.26	V	
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	μA
I _{OZ}	3-state output OFF-state current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.5	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	4.0	μA
C _I	input capacitance		-	3.5	-	pF

Table 7: Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V
V_{OH}	HIGH-level output voltage all outputs	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	1.9	-	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	-	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	5.9	-	-	V
	$\overline{\text{RCO}}$ standard output	$I_O = -4\text{ mA}; V_{CC} = 4.5\text{ V}$	4.13	-	-	V
		$I_O = -5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	5.63	-	-	V
	Qn bus driver output	$I_O = -6\text{ mA}; V_{CC} = 4.5\text{ V}$	4.13	-	-	V
		$I_O = -7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	5.63	-	-	V
	V_{OL}	LOW-level output voltage all outputs	$V_I = V_{IH}$ or V_{IL}			
$I_O = 20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$			-	-	0.1	V
$I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$			-	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	-	-	0.1	V
$\overline{\text{RCO}}$ standard output		$I_O = 4\text{ mA}; V_{CC} = 4.5\text{ V}$	-	-	0.33	V
		$I_O = 5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	-	-	0.33	V
Qn bus driver output		$I_O = 6\text{ mA}; V_{CC} = 4.5\text{ V}$	-	-	0.33	V
		$I_O = 7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	-	-	0.33	V
I_{LI}		input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	± 1.0
I_{OZ}	3-state output OFF-state current	$V_I = V_{IH}$ or $V_{IL}; V_O = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	± 5.0	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A};$ $V_{CC} = 6.0\text{ V}$	-	-	40	μA

Table 7: Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = -40 °C to +125 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-level output voltage all outputs	V _I = V _{IH} or V _{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	-	-	V
	RCO standard output	I _O = -4 mA; V _{CC} = 4.5 V	4.1	-	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.6	-	-	V
	Qn bus driver output	I _O = -6 mA; V _{CC} = 4.5 V	4.1	-	-	V
		I _O = -7.8 mA; V _{CC} = 6.0 V	5.6	-	-	V
	V _{OL}	LOW-level output voltage all outputs	V _I = V _{IH} or V _{IL}			
I _O = 20 μA; V _{CC} = 2.0 V			-	-	0.1	V
I _O = 20 μA; V _{CC} = 4.5 V			-	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	-	0.1	V
RCO standard output		I _O = 4 mA; V _{CC} = 4.5 V	-	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.4	V
Qn bus driver output		I _O = 6 mA; V _{CC} = 4.5 V	-	-	0.4	V
		I _O = 7.8 mA; V _{CC} = 6.0 V	-	-	0.4	V
I _{LI}		input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0
I _{OZ}	3-state output OFF-state current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±10.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	80	μA

11. Dynamic characteristics

Table 8: Dynamic characteristics

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified; see [Figure 14](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$T_{amb} = 25\text{ °C}$							
t_{PHL} , t_{PLH}	propagation delay CPC to RCO	see Figure 8					
		$V_{CC} = 2.0\text{ V}$	-	52	150	ns	
		$V_{CC} = 4.5\text{ V}$	-	19	30	ns	
	propagation delay CPR to Qn	see Figure 9					
		$V_{CC} = 2.0\text{ V}$	-	50	140	ns	
		$V_{CC} = 4.5\text{ V}$	-	17	28	ns	
t_{PLH}	propagation delay $\overline{\text{MRC}}$ to RCO	see Figure 10					
		$V_{CC} = 2.0\text{ V}$	-	53	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	18	26	ns	
	3-state output enable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	28	105	ns	
		$V_{CC} = 4.5\text{ V}$	-	13	21	ns	
t_{PHZ} , t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	11	18	ns	
		$V_{CC} = 4.5\text{ V}$	-	11	18	ns	
	t_W	CPC and CPR clock pulse width HIGH or LOW	see Figure 8 and Figure 9				
			$V_{CC} = 2.0\text{ V}$	100	24	-	ns
			$V_{CC} = 4.5\text{ V}$	20	9	-	ns
$\overline{\text{MRC}}$ reset pulse width LOW		see Figure 10					
		$V_{CC} = 2.0\text{ V}$	75	28	-	ns	
		$V_{CC} = 4.5\text{ V}$	15	8	-	ns	
t_{su}	set-up time CPC to CPR	see Figure 13					
		$V_{CC} = 2.0\text{ V}$	100	46	-	ns	
		$V_{CC} = 4.5\text{ V}$	20	14	-	ns	
	set-up time $\overline{\text{CE}}$ to CPC	see Figure 12					
		$V_{CC} = 2.0\text{ V}$	100	44	-	ns	
		$V_{CC} = 4.5\text{ V}$	20	11	-	ns	
		$V_{CC} = 6.0\text{ V}$	17	9	-	ns	

Table 8: Dynamic characteristics ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified; see [Figure 14](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
t_h	hold time \overline{CE} to CPC	see Figure 12					
		$V_{CC} = 2.0\text{ V}$	0	-	-	ns	
		$V_{CC} = 4.5\text{ V}$	0	-	-	ns	
		$V_{CC} = 6.0\text{ V}$	0	-	-	ns	
t_{rem}	removal time \overline{MRC} to CPC	see Figure 10					
		$V_{CC} = 2.0\text{ V}$	75	28	-	ns	
		$V_{CC} = 4.5\text{ V}$	15	7	-	ns	
		$V_{CC} = 6.0\text{ V}$	13	6	-	ns	
f_{max}	maximum clock pulse frequency CPC or CPR	see Figure 8 and Figure 9					
		$V_{CC} = 2.0\text{ V}$	6.6	16	-	MHz	
		$V_{CC} = 4.5\text{ V}$	33	52	-	MHz	
		$V_{CC} = 6.0\text{ V}$	39	61	-	MHz	
C_{PD}	power dissipation capacitance		[1] [2]	44	-	pF	
$T_{amb} = -40\text{ °C to }+85\text{ °C}$							
t_{PHL}, t_{PLH}	propagation delay CPC to RCO	see Figure 8					
		$V_{CC} = 2.0\text{ V}$	-	-	190	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	38	ns	
	propagation delay CPR to Qn	see Figure 9					
		$V_{CC} = 2.0\text{ V}$	-	-	175	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	35	ns	
	t_{PLH}	propagation delay \overline{MRC} to RCO	see Figure 10				
			$V_{CC} = 2.0\text{ V}$	-	-	165	ns
			$V_{CC} = 4.5\text{ V}$	-	-	33	ns
t_{PZH}, t_{PZL}	3-state output enable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	
t_{PHZ}, t_{PLZ}	3-state output disable time OE to Qn	see Figure 11					
		$V_{CC} = 2.0\text{ V}$	-	-	130	ns	
		$V_{CC} = 4.5\text{ V}$	-	-	26	ns	

Table 8: Dynamic characteristics ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified; see [Figure 14](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{w}	CPC and CPR clock pulse width HIGH or LOW	see Figure 8 and Figure 9				
		$V_{CC} = 2.0\text{ V}$	125	-	-	ns
		$V_{CC} = 4.5\text{ V}$	25	-	-	ns
		$V_{CC} = 6.0\text{ V}$	21	-	-	ns
	MRC reset pulse width LOW	see Figure 10				
		$V_{CC} = 2.0\text{ V}$	95	-	-	ns
$V_{CC} = 4.5\text{ V}$		19	-	-	ns	
	$V_{CC} = 6.0\text{ V}$	16	-	-	ns	
t_{su}	set-up time CPC to CPR	see Figure 13				
		$V_{CC} = 2.0\text{ V}$	125	-	-	ns
		$V_{CC} = 4.5\text{ V}$	25	-	-	ns
		$V_{CC} = 6.0\text{ V}$	21	-	-	ns
	set-up time \overline{CE} to CPC	see Figure 12				
		$V_{CC} = 2.0\text{ V}$	125	-	-	ns
$V_{CC} = 4.5\text{ V}$		25	-	-	ns	
	$V_{CC} = 6.0\text{ V}$	21	-	-	ns	
t_h	hold time \overline{CE} to CPC	see Figure 12				
		$V_{CC} = 2.0\text{ V}$	0	-	-	ns
		$V_{CC} = 4.5\text{ V}$	0	-	-	ns
	$V_{CC} = 6.0\text{ V}$	0	-	-	ns	
t_{rem}	removal time MRC to CPC	see Figure 10				
		$V_{CC} = 2.0\text{ V}$	95	-	-	ns
		$V_{CC} = 4.5\text{ V}$	19	-	-	ns
	$V_{CC} = 6.0\text{ V}$	16	-	-	ns	
f_{max}	maximum clock pulse frequency CPC or CPR	see Figure 8 and Figure 9				
		$V_{CC} = 2.0\text{ V}$	5.2	-	-	MHz
		$V_{CC} = 4.5\text{ V}$	26	-	-	MHz
	$V_{CC} = 6.0\text{ V}$	31	-	-	MHz	

Table 8: Dynamic characteristics ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified; see [Figure 14](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}$							
$t_{\text{PHL}}, t_{\text{PLH}}$	propagation delay CPC to $\overline{\text{RCO}}$	see Figure 8					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	230	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	45	ns	
		$V_{\text{CC}} = 6.0\text{ V}$	-	-	40	ns	
	propagation delay CPR to Q_n	see Figure 9					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	210	ns	
$V_{\text{CC}} = 4.5\text{ V}$		-	-	42	ns		
	$V_{\text{CC}} = 6.0\text{ V}$	-	-	36	ns		
t_{PLH}	propagation delay $\overline{\text{MRC}}$ to $\overline{\text{RCO}}$	see Figure 10					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	200	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	40	ns	
	$V_{\text{CC}} = 6.0\text{ V}$	-	-	34	ns		
$t_{\text{PZH}}, t_{\text{PZL}}$	3-state output enable time $\overline{\text{OE}}$ to Q_n	see Figure 11					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	160	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	32	ns	
	$V_{\text{CC}} = 6.0\text{ V}$	-	-	27	ns		
$t_{\text{PHZ}}, t_{\text{PLZ}}$	3-state output disable time $\overline{\text{OE}}$ to Q_n	see Figure 11					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	160	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	32	ns	
	$V_{\text{CC}} = 6.0\text{ V}$	-	-	27	ns		
t_w	CPC and CPR clock pulse width HIGH or LOW	see Figure 8 and Figure 9					
		$V_{\text{CC}} = 2.0\text{ V}$	145	-	-	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	29	-	-	ns	
		$V_{\text{CC}} = 6.0\text{ V}$	25	-	-	ns	
		$\overline{\text{MRC}}$ reset pulse width LOW	see Figure 10				
			$V_{\text{CC}} = 2.0\text{ V}$	110	-	-	ns
	$V_{\text{CC}} = 4.5\text{ V}$		22	-	-	ns	
		$V_{\text{CC}} = 6.0\text{ V}$	19	-	-	ns	
	t_{su}	set-up time CPC to CPR	see Figure 13				
$V_{\text{CC}} = 2.0\text{ V}$			150	-	-	ns	
$V_{\text{CC}} = 4.5\text{ V}$			30	-	-	ns	
		$V_{\text{CC}} = 6.0\text{ V}$	26	-	-	ns	
set-up time $\overline{\text{CE}}$ to CPC		see Figure 12					
		$V_{\text{CC}} = 2.0\text{ V}$	150	-	-	ns	
	$V_{\text{CC}} = 4.5\text{ V}$	30	-	-	ns		
	$V_{\text{CC}} = 6.0\text{ V}$	26	-	-	ns		

Table 8: Dynamic characteristics ...continued
GND = 0 V; $t_r = t_f = 6 \text{ ns}$; $C_L = 50 \text{ pF}$; unless otherwise specified; see [Figure 14](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_h	hold time \overline{CE} to CPC	see Figure 12				
		$V_{CC} = 2.0 \text{ V}$	0	-	-	ns
		$V_{CC} = 4.5 \text{ V}$	0	-	-	ns
		$V_{CC} = 6.0 \text{ V}$	0	-	-	ns
t_{rem}	removal time \overline{MRC} to CPC	see Figure 10				
		$V_{CC} = 2.0 \text{ V}$	110	-	-	ns
		$V_{CC} = 4.5 \text{ V}$	22	-	-	ns
		$V_{CC} = 6.0 \text{ V}$	19	-	-	ns
f_{max}	maximum clock pulse frequency CPC or CPR	see Figure 8 and Figure 9				
		$V_{CC} = 2.0 \text{ V}$	4.4	-	-	MHz
		$V_{CC} = 4.5 \text{ V}$	22	-	-	MHz
		$V_{CC} = 6.0 \text{ V}$	26	-	-	MHz

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

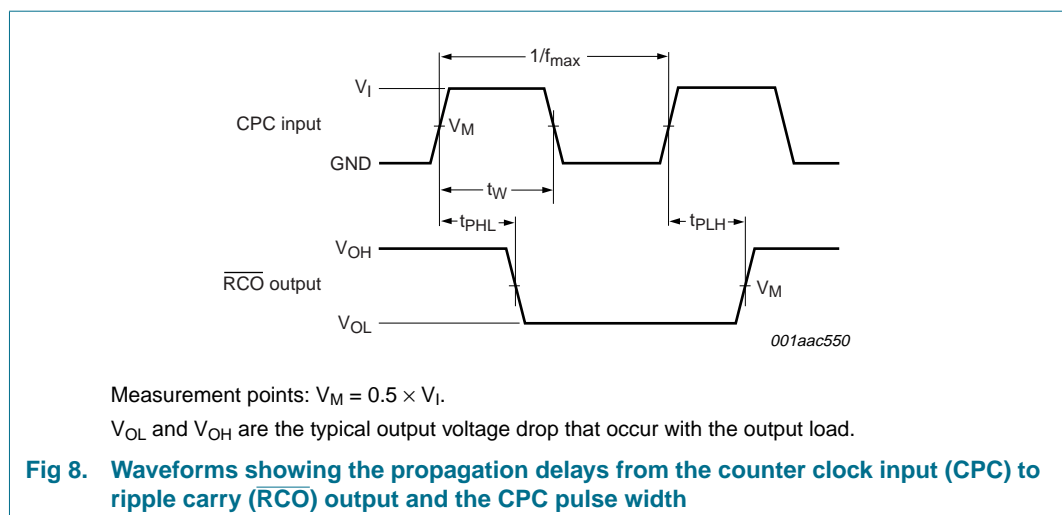
V_{CC} = supply voltage in V;

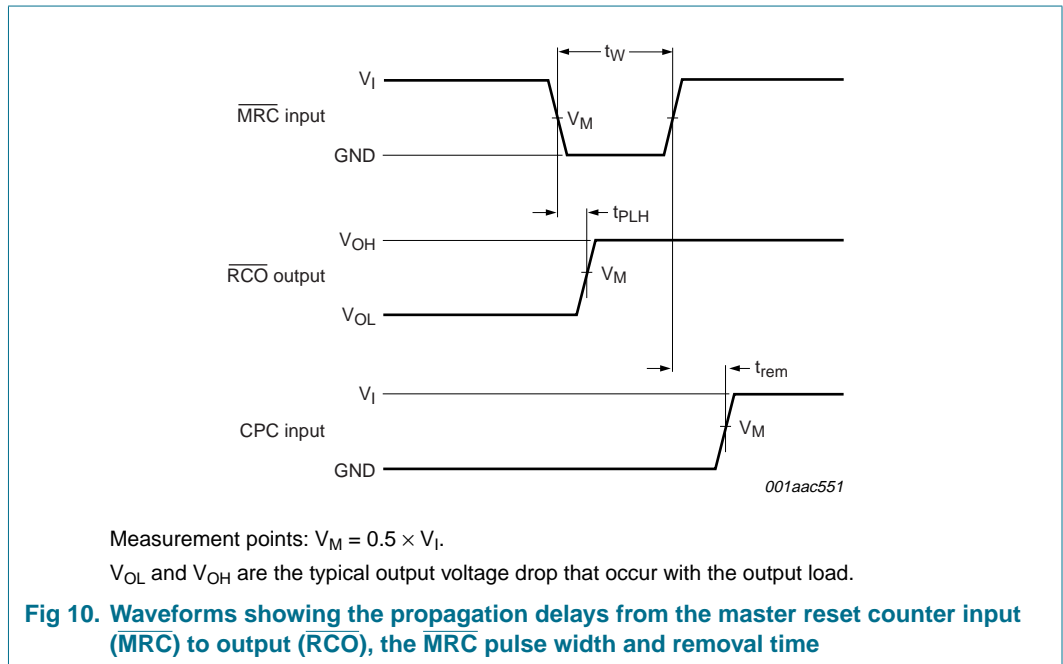
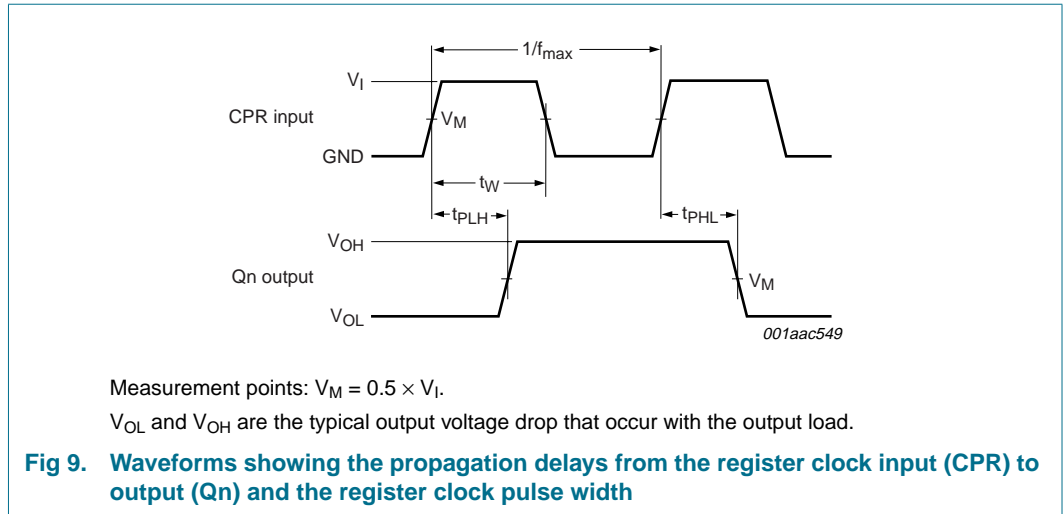
N = number of inputs switching;

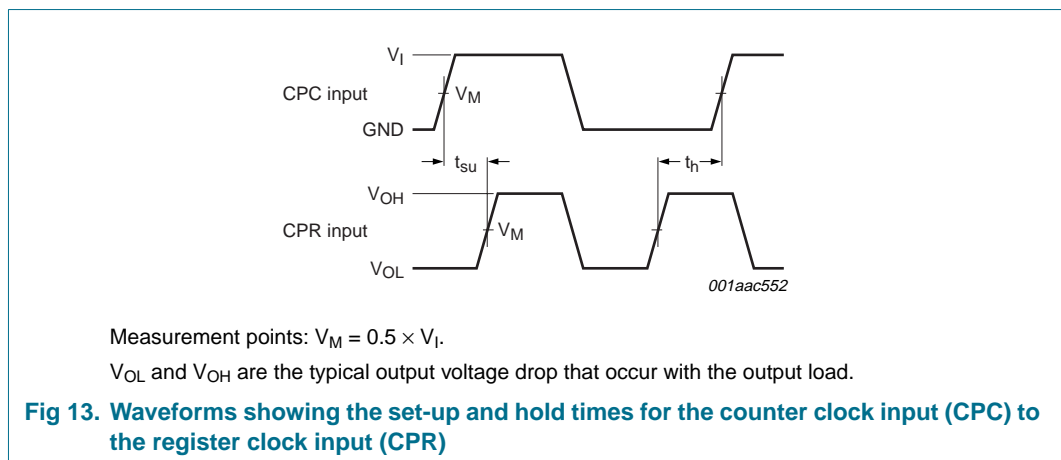
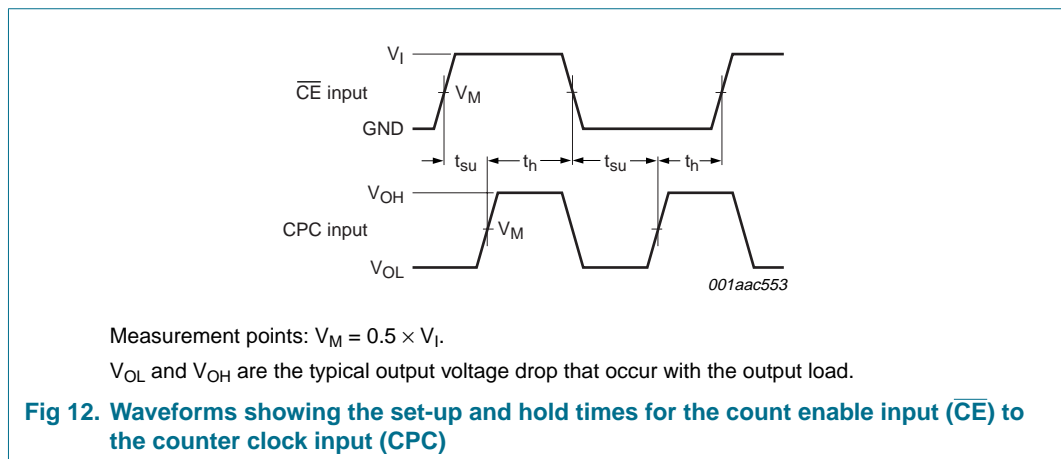
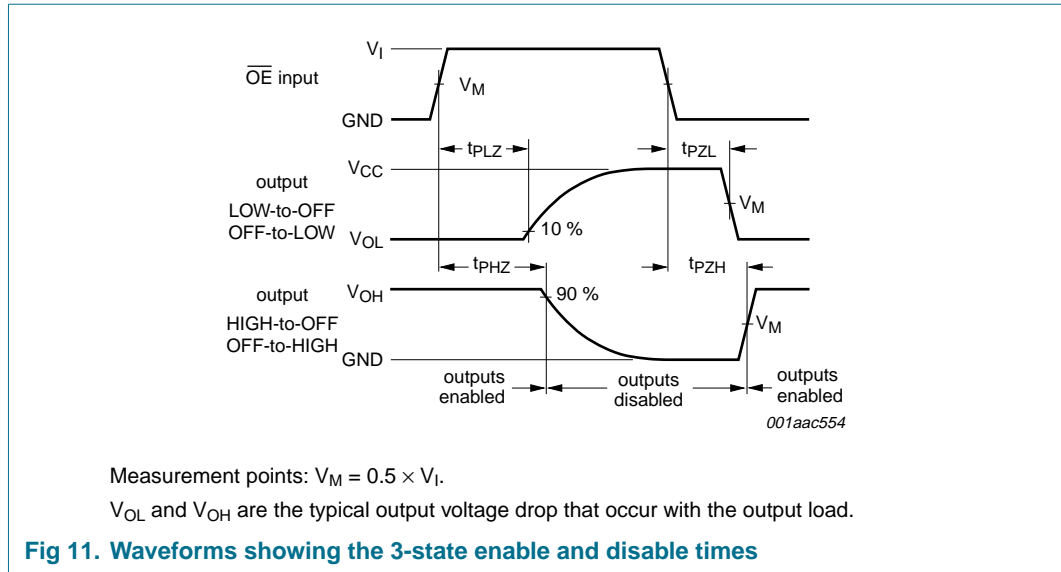
$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

[2] The condition is $V_I = \text{GND}$ to V_{CC} .

12. Waveforms







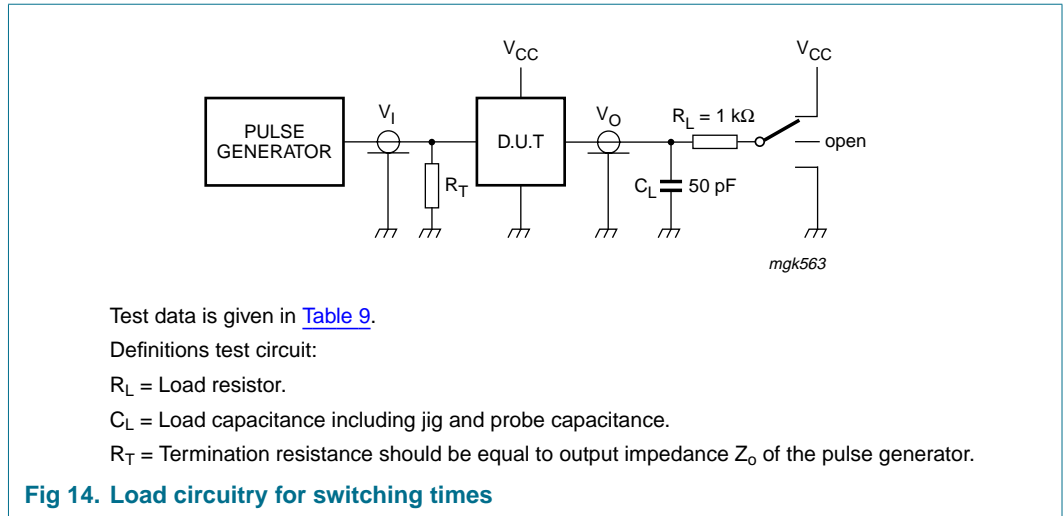


Table 9: Test data

Supply voltage	Input		Load		Switch position		
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZL}, t_{PLZ}	t_{PZH}, t_{PHZ}
2.0 V to 6.0 V	V_{CC}	6 ns	50 pF	1 kΩ	open	V_{CC}	GND

13. Package outline

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

SOT109-1

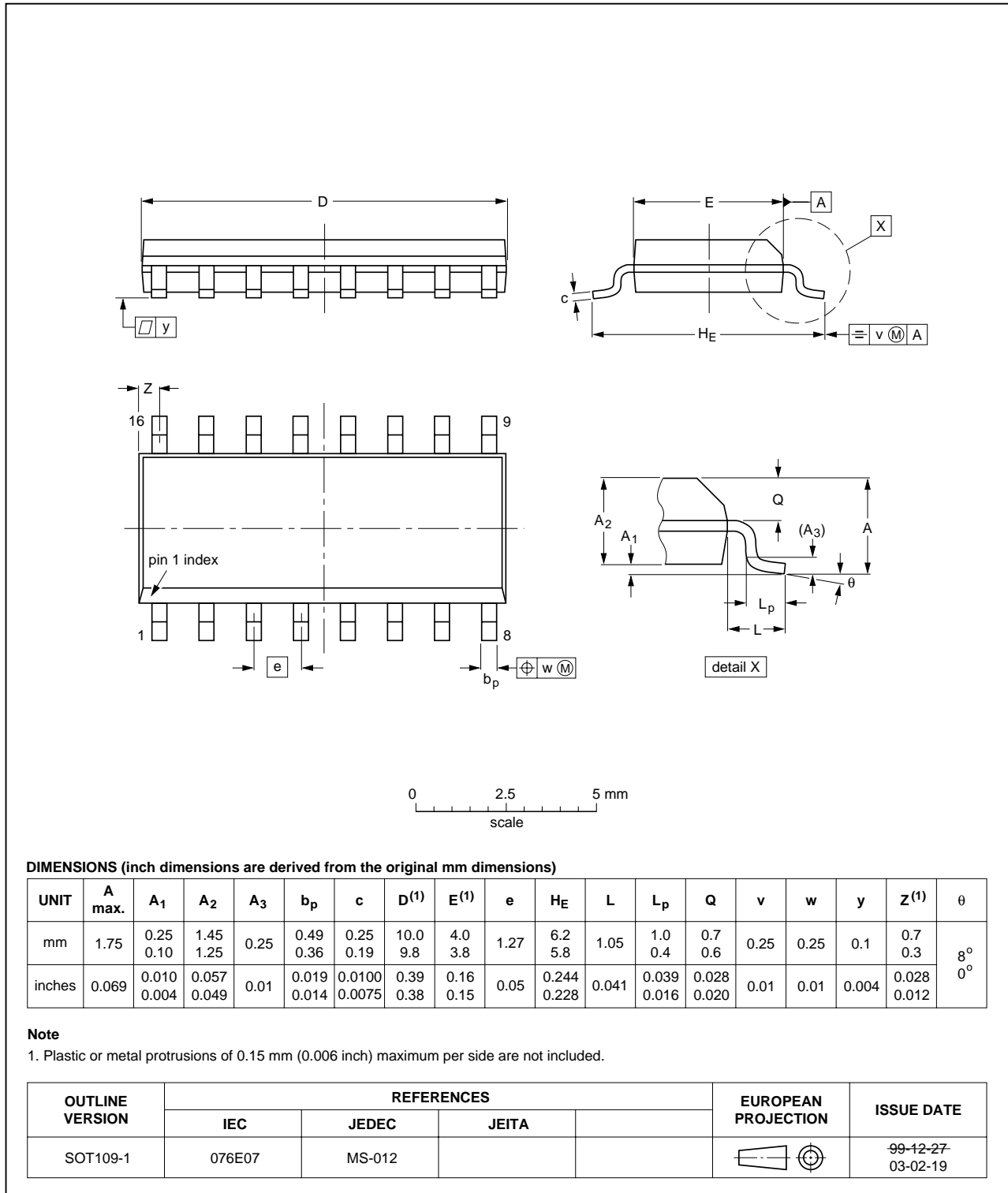


Fig 15. Package outline SOT109-1 (SO16)

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

SOT403-1

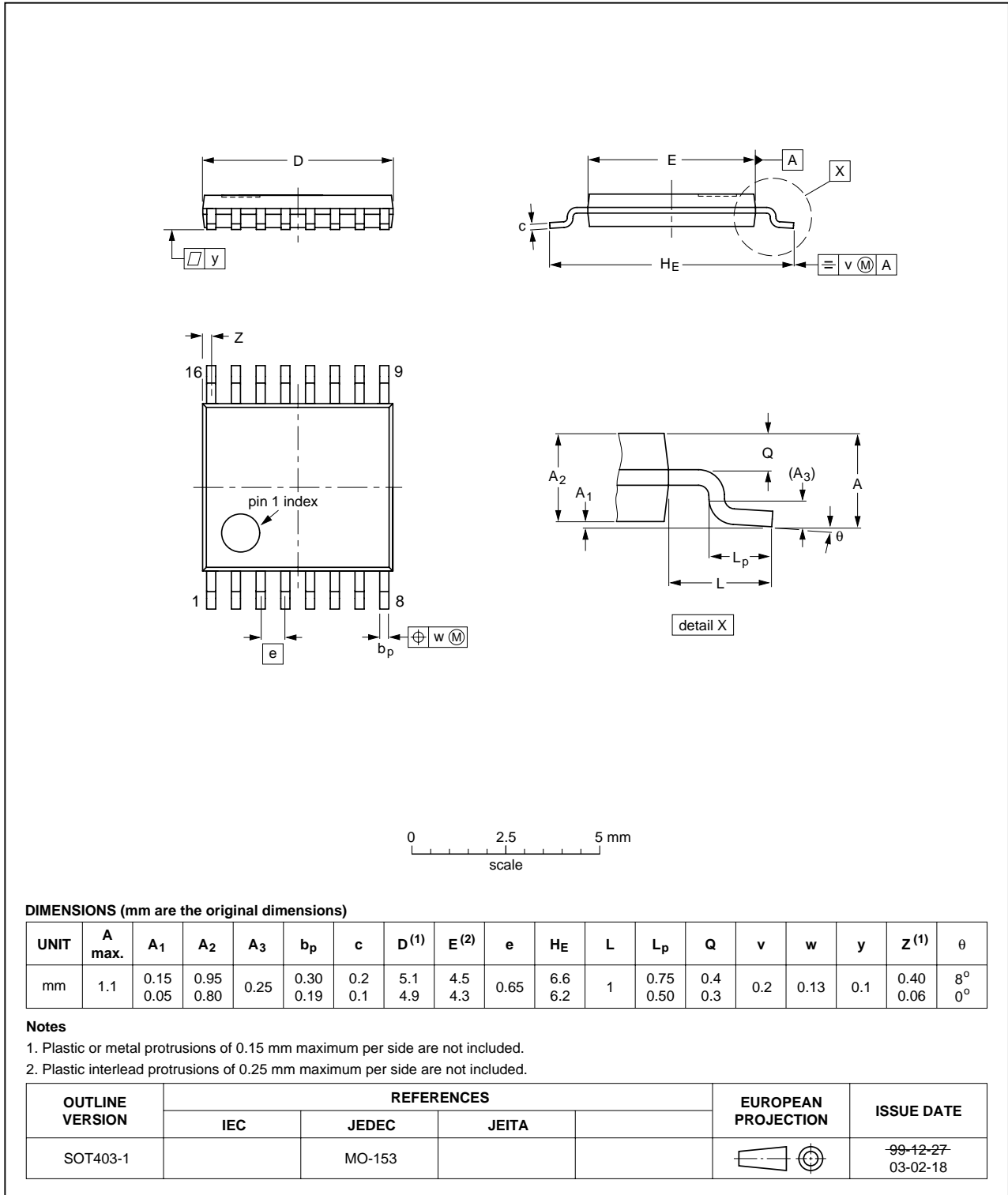


Fig 16. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

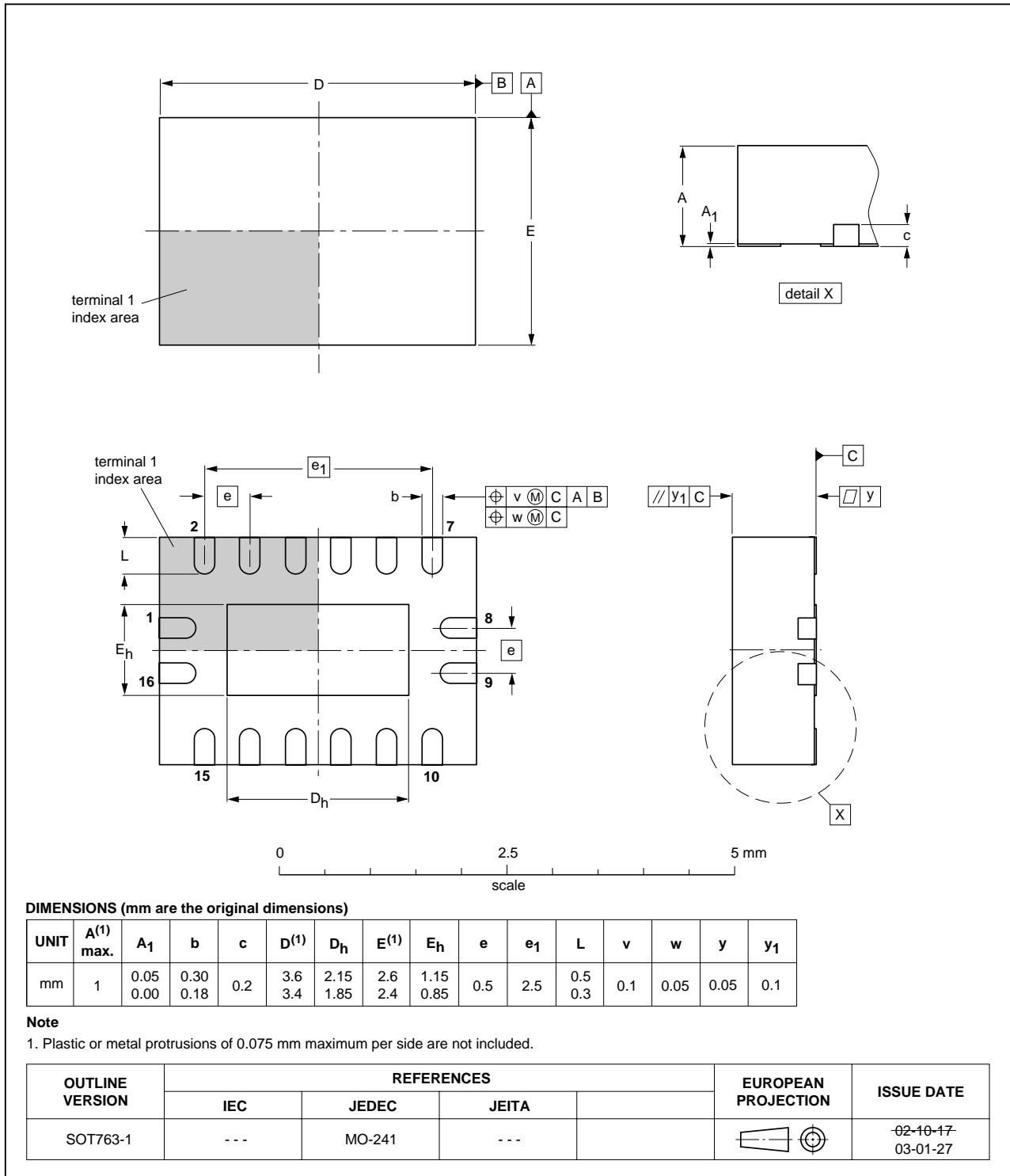


Fig 17. Package outline SOT763-1 (DHVQFN16)

14. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC590_1	20050330	Product data sheet	-	9397 750 14691	-

15. Data sheet status

Level	Data sheet status ^[1]	Product status ^[2] ^[3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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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 60134). 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.

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