

# 74AHC1G66-Q100; 74AHCT1G66-Q100

Single-pole single-throw analog switch

Rev. 1 — 27 January 2015

Product data sheet

## 1. General description

74AHC1G66-Q100 and 74AHCT1G66-Q100 are high-speed Si-gate CMOS devices. They are single-pole single-throw analog switches. The switch has two input/output pins (Y and Z) and an active HIGH enable input pin (E). When pin E is LOW, the analog switch is turned off.

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  $-40\text{ °C}$  to  $+85\text{ °C}$  and from  $-40\text{ °C}$  to  $+125\text{ °C}$
- Very low ON resistance:
  - ◆  $26\ \Omega$  (typ.) at  $V_{CC} = 3.0\text{ V}$
  - ◆  $16\ \Omega$  (typ.) at  $V_{CC} = 4.5\text{ V}$
  - ◆  $14\ \Omega$  (typ.) at  $V_{CC} = 5.5\text{ V}$
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\ \Omega$ )

## 3. Ordering information

Table 1. Ordering information

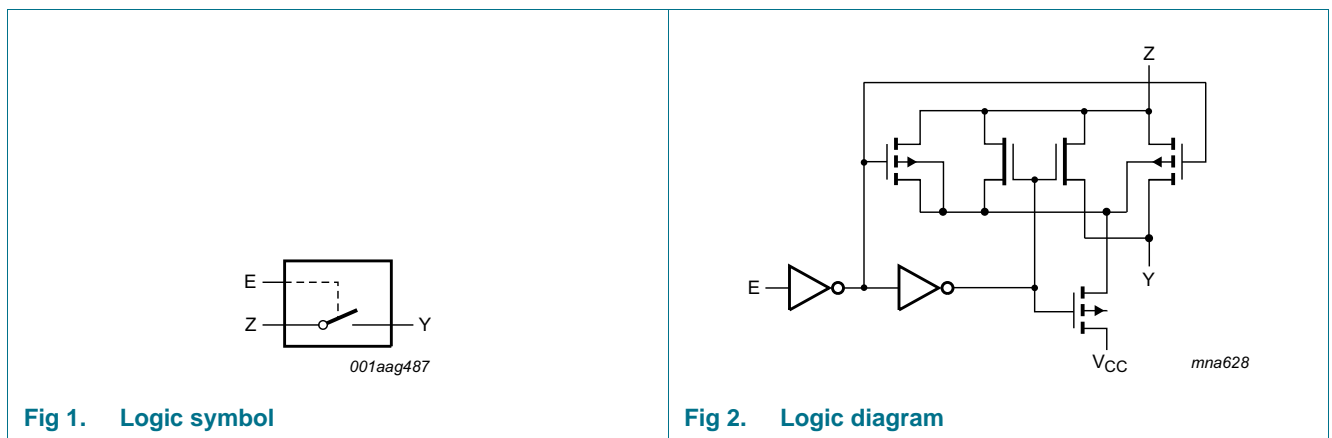
Type number	Package			Version
	Temperature range	Name	Description	
74AHC1G66GW-Q100	$-40\text{ °C}$ to $+125\text{ °C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHCT1G66GW-Q100				
74AHC1G66GV-Q100	$-40\text{ °C}$ to $+125\text{ °C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74AHCT1G66GV-Q100				

## 4. Marking

Table 2. Marking codes

Type number	Marking
74AHC1G66GW-Q100	AL
74AHCT1G66GW-Q100	CL
74AHC1G66GV-Q100	A66
74AHCT1G66GV-Q100	C66

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning

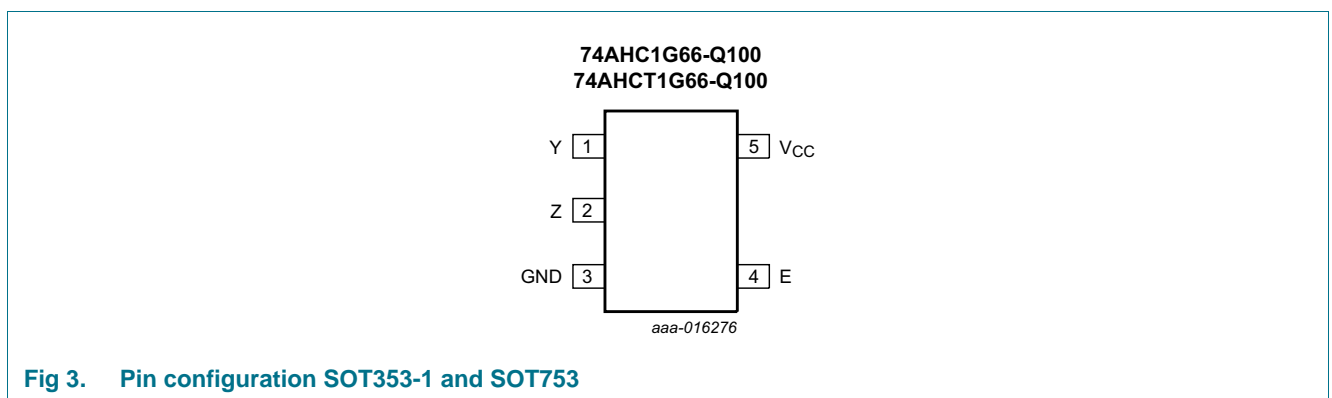


Fig 3. Pin configuration SOT353-1 and SOT753

## 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
Y	1	independent input or output
Z	2	independent input or output
GND	3	ground (0 V)
E	4	enable input (active HIGH)
V <sub>CC</sub>	5	supply voltage

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

Input E	Switch
L	OFF
H	ON

[1] H = HIGH voltage level; L = LOW voltage level.

## 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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V <sup>[1]</sup>	-20	-	mA
I <sub>SK</sub>	switch clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V <sup>[1]</sup>	-	±20	mA
I <sub>SW</sub>	switch current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
I <sub>GND</sub>	ground current		-75	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C <sup>[2]</sup>	-	250	mW

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

[2] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K.

## 9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).<sup>[1]</sup>

Symbol	Parameter	Conditions	74AHC1G66-Q100			74AHCT1G66-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	0	-	5.5	V
V <sub>SW</sub>	switch voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V

**Table 6. Recommended operating conditions ...continued**Voltages are referenced to GND (ground = 0 V).<sup>[1]</sup>

Symbol	Parameter	Conditions	74AHC1G66-Q100			74AHCT1G66-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 3.3 ± 0.3 V <sup>[2]</sup>	-	-	100	-	-	-	ns/V
		V <sub>CC</sub> = 5.0 ± 0.5 V <sup>[2]</sup>	-	-	20	-	-	20	ns/V

[1] To avoid drawing V<sub>CC</sub> current from pin Z, when switch-current flows in pin Y, the voltage drop across the bidirectional switch must not exceed 0.4 V. If switch-current flows into pin Z, no V<sub>CC</sub> current flows out of terminal Y. In this case, there is no limit for the voltage drop across the switch. However, the voltage at pins Y and Z may not exceed V<sub>CC</sub> or GND.

[2] Applies to control signal levels.

## 10. Static characteristics

**Table 7. Static characteristics**

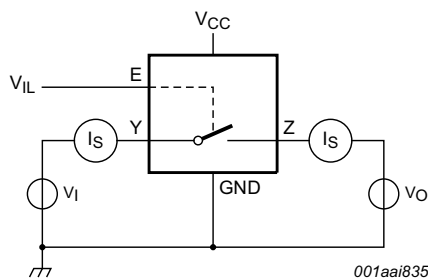
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74AHC1G66-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I <sub>S(OFF)</sub>	OFF-state leakage current	Y or Z; V <sub>CC</sub> = 5.5 V; see <a href="#">Figure 4</a>	-	-	0.1	-	1.0	-	4.0	μA
I <sub>S(ON)</sub>	ON-state leakage current	Y or Z; V <sub>CC</sub> = 5.5 V; see <a href="#">Figure 5</a>	-	-	0.1	-	1.0	-	4.0	μA
I <sub>CC</sub>	supply current	E, Y or Z = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	10	-	40	μA
C <sub>I</sub>	input capacitance	E input	-	2.0	10	-	10	-	10	pF
C <sub>S(ON)</sub>	ON-state capacitance	Y or Z input or output	-	4.0	10	-	10	-	10	pF
<b>74AHCT1G66-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 5.5 V	-	-	0.1	-	1.0	-	2.0	μA

**Table 7. Static characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V).

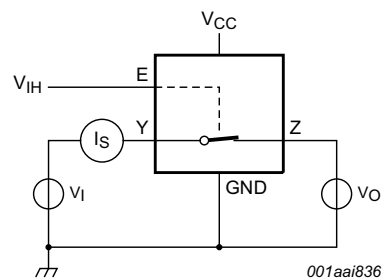
Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$I_{S(OFF)}$	OFF-state leakage current	Y or Z; $V_{CC} = 5.5$ V; see <a href="#">Figure 4</a>	-	-	0.1	-	1.0	-	4.0	$\mu$ A
$I_{S(ON)}$	ON-state leakage current	Y or Z; $V_{CC} = 5.5$ V; see <a href="#">Figure 5</a>	-	-	0.1	-	1.0	-	4.0	$\mu$ A
$I_{CC}$	supply current	E, Y or Z = $V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	1.0	-	10	-	40	$\mu$ A
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = 3.4$ V; other inputs at $V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	1.35	-	1.5	-	1.5	mA
$C_I$	input capacitance	E input	-	2.0	10	-	10	-	10	pF
$C_{S(ON)}$	ON-state capacitance	Y or Z input or output	-	4.0	10	-	10	-	10	pF

## 10.1 Test circuits



$V_I = V_{CC}$  or GND and  $V_O =$  GND or  $V_{CC}$ .

**Fig 4. Test circuit for measuring OFF-state leakage current**



$V_I = V_{CC}$  or GND and  $V_O =$  open circuit.

**Fig 5. Test circuit for measuring ON-state leakage current**

## 10.2 ON resistance

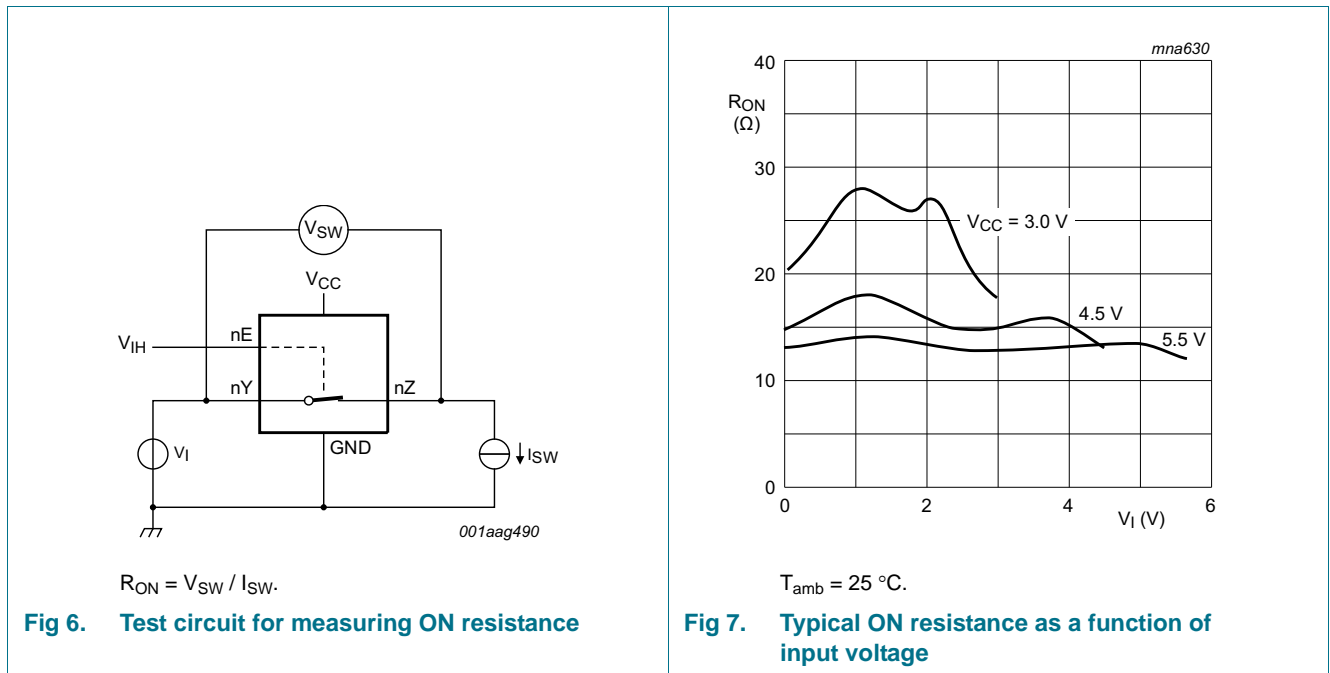
**Table 8. ON resistance**

At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graph see [Figure 7 \[1\]](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	max	Max	Max	
<b>74AHC1G66-Q100 and 74AHCT1G66-Q100</b>							
R <sub>ON(peak)</sub>	ON resistance (peak)	V <sub>I</sub> = V <sub>CC</sub> to GND; see <a href="#">Figure 6</a>					
		I <sub>SW</sub> = 1.0 mA; V <sub>CC</sub> = 2.0 V	148[1]	-	-	-	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 3.0 V to 3.6 V	28	50	70	110	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 4.5 V to 5.5 V	15	30	40	60	Ω
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>I</sub> = GND; see <a href="#">Figure 6</a>					
		I <sub>SW</sub> = 1.0 mA; V <sub>CC</sub> = 2.0 V	30	-	-	-	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 3.0 V to 3.6 V	20	50	65	90	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 4.5 V to 5.5 V	15	22	26	40	Ω
		V <sub>I</sub> = V <sub>CC</sub> ; see <a href="#">Figure 6</a>					
		I <sub>SW</sub> = 1.0 mA; V <sub>CC</sub> = 2.0 V	28	-	-	-	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 3.0 V to 3.6 V	18	50	65	90	Ω
		I <sub>SW</sub> = 10 mA; V <sub>CC</sub> = 4.5 V to 5.5 V	13	22	26	40	Ω

[1] At supply voltages approaching 2 V, the analog switch ON resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using this supply voltage.

## 10.3 ON resistance test circuit and graphs



## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V);  $C_L = 50$  pF; unless otherwise specified; For test circuit, see [Figure 10](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ <sup>[1]</sup>	max	Max	Max	
<b>74AHC1G66-Q100</b>							
$t_{pd}$	propagation delay	Y to Z or Z to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>					
		$V_{CC} = 2.0$ V	2.2	5.0	6.0	7.0	ns
		$V_{CC} = 3.0$ V to 3.6 V	1.0	2.0	3.0	4.0	ns
		$V_{CC} = 4.5$ V to 5.5 V	0.6	1.0	2.0	3.0	ns
$t_{en}$	enable time	E to Y or Z; see <a href="#">Figure 9</a> <sup>[2]</sup>					
		$V_{CC} = 2.0$ V; $C_L = 15$ pF	7.0	25.0	33.0	40.0	ns
		$V_{CC} = 2.0$ V	11.0	35.0	46.0	57.0	ns
		$V_{CC} = 3.0$ V to 3.6 V; $C_L = 15$ pF	4.0	11.0	14.0	18.0	ns
		$V_{CC} = 3.0$ V to 3.6 V	5.8	15.0	20.0	25.0	ns
		$V_{CC} = 4.5$ V to 5.5 V; $C_L = 15$ pF	3.0	8.0	10.0	13.0	ns
		$V_{CC} = 4.5$ V to 5.5 V	4.0	11.0	13.0	17.0	ns
$t_{dis}$	disable time	E to Y or Z; see <a href="#">Figure 9</a> <sup>[2]</sup>					
		$V_{CC} = 2.0$ V; $C_L = 15$ pF	9.0	25.0	33.0	40.0	ns
		$V_{CC} = 2.0$ V	13.0	35.0	46.0	57.0	ns
		$V_{CC} = 3.0$ V to 3.6 V; $C_L = 15$ pF	6.0	11.0	14.0	18.0	ns
		$V_{CC} = 3.0$ V to 3.6 V	8.4	15.0	20.0	25.0	ns
		$V_{CC} = 4.5$ V to 5.5 V; $C_L = 15$ pF	5.0	8.0	10.0	13.0	ns
		$V_{CC} = 4.5$ V to 5.5 V	6.1	11.0	13.0	17.0	ns
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC}$ <sup>[3]</sup>	13	-	-	-	pF
<b>74AHCT1G66-Q100</b>							
$t_{pd}$	propagation delay	Y to Z or Z to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>					
		$V_{CC} = 4.5$ V to 5.5 V	0.7	1.0	2.0	3.0	ns
$t_{en}$	enable time	E to Y or Z; see <a href="#">Figure 9</a> <sup>[2]</sup>					
		$V_{CC} = 4.5$ V to 5.5 V; $C_L = 15$ pF	3.0	7.0	10.0	13.0	ns
		$V_{CC} = 4.5$ V to 5.5 V	4.7	10.0	13.0	17.0	ns
$t_{dis}$	disable time	E to Y or Z; see <a href="#">Figure 9</a> <sup>[2]</sup>					
		$V_{CC} = 4.5$ V to 5.5 V; $C_L = 15$ pF	5.0	8.0	10.0	13.0	ns
		$V_{CC} = 4.5$ V to 5.5 V	6.5	11.0	13.0	17.0	ns

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V);  $C_L = 50$  pF; unless otherwise specified; For test circuit, see [Figure 10](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ <sup>[1]</sup>	max	Max	Max	
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC}$	15	-	-	-	pF

[1] All typical values are measured at  $V_{CC} = 2.0$  V,  $V_{CC} = 3.3$  V,  $V_{CC} = 5.0$  V and  $T_{amb} = 25$  °C.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

$t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

$t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu$ W).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

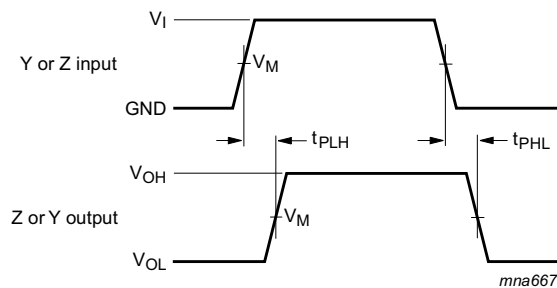
$C_L$  = output load capacitance in pF;

$C_{SW}$  = maximum switch capacitance in pF (see [Table 7](#));

$V_{CC}$  = supply voltage in Volt;

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

## 11.1 Waveforms and test circuit

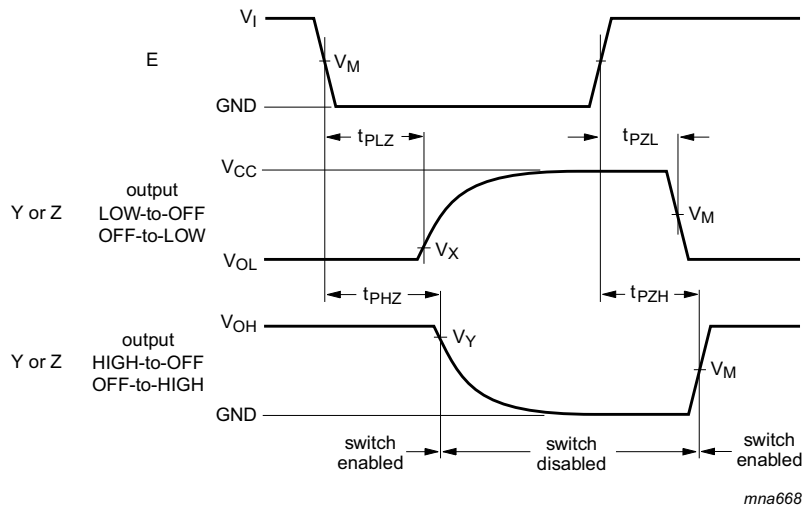


Measurement points are given in [Table 10](#).

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

**Fig 8. Input (Y or Z) to output (Z or Y) propagation delays**





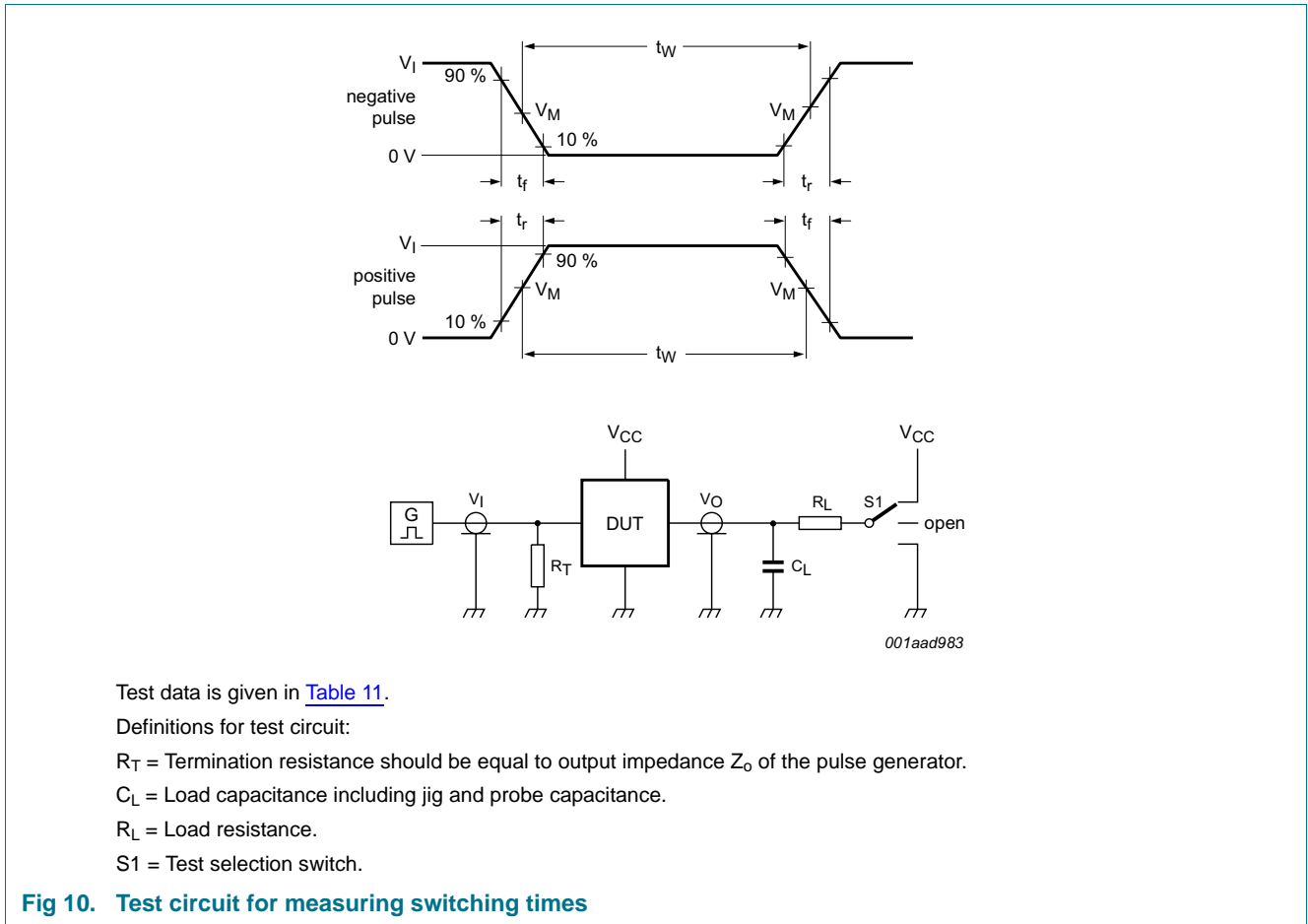
Measurement points are given in [Table 10](#).

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

**Fig 9. Enable and disable times**

**Table 10. Measurement points**

Type	Input	Output		
	$V_M$	$V_M$	$V_X$	$V_Y$
74AHC1G66-Q100	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$
74AHCT1G66-Q100	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



**Table 11. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74AHC1G66-Q100	GND to $V_{CC}$	3 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74AHCT1G66-Q100	GND to 3 V	3 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

## 11.2 Additional dynamic characteristics

**Table 12. Additional dynamic characteristics for 74AHC1G66-Q100 and 74AHCT1G66-Q100**

$GND = 0 V$ ;  $t_r = t_f = 3.0 ns$ ;  $C_L = 50 pF$ ; unless otherwise specified. All typical values are measured at  $T_{amb} = 25 ^\circ C$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
THD	total harmonic distortion	$f_i = 1 kHz$ ; $R_L = 10 k\Omega$ ; see <a href="#">Figure 11</a>					
		$V_{CC} = 3.0 V$ to $3.6 V$	-	0.025	-	%	
		$V_{CC} = 4.5 V$ to $5.5 V$	-	0.015	-	%	
		$f_i = 10 kHz$ ; $R_L = 10 k\Omega$ ; see <a href="#">Figure 11</a>					
		$V_{CC} = 3.0 V$ to $3.6 V$ ; $V_I = 2.5 V$	-	0.025	-	%	
		$V_{CC} = 4.5 V$ to $5.5 V$ ; $V_I = 4.0 V$	-	0.015	-	%	

**Table 12. Additional dynamic characteristics for 74AHC1G66-Q100 and 74AHCT1G66-Q100 ...continued**  
*GND = 0 V;  $t_r = t_f = 3.0$  ns;  $C_L = 50$  pF; unless otherwise specified. All typical values are measured at  $T_{amb} = 25$  °C.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$f_{(-3dB)}$	-3 dB frequency response	$R_L = 50 \Omega$ ; $C_L = 10$ pF; see <a href="#">Figure 12</a> and <a href="#">13</a>				
		$V_{CC} = 3.0$ V to $3.6$ V	-	230	-	MHz
		$V_{CC} = 4.5$ V to $5.5$ V	-	280	-	MHz
$\alpha_{iso}$	isolation (OFF-state)	$R_L = 600 \Omega$ ; $f_i = 1$ MHz; see <a href="#">Figure 14</a> <a href="#">[1]</a>				
		$V_{CC} = 3.0$ V to $3.6$ V; $V_I = 2.5$ V	-	-50	-	dB
		$V_{CC} = 4.5$ V to $5.5$ V; $V_I = 4.0$ V	-	-50	-	dB

[1] Adjust input voltage  $V_I$  to 0 dBm level (0 dBm = 1 mW into 50  $\Omega$ ).

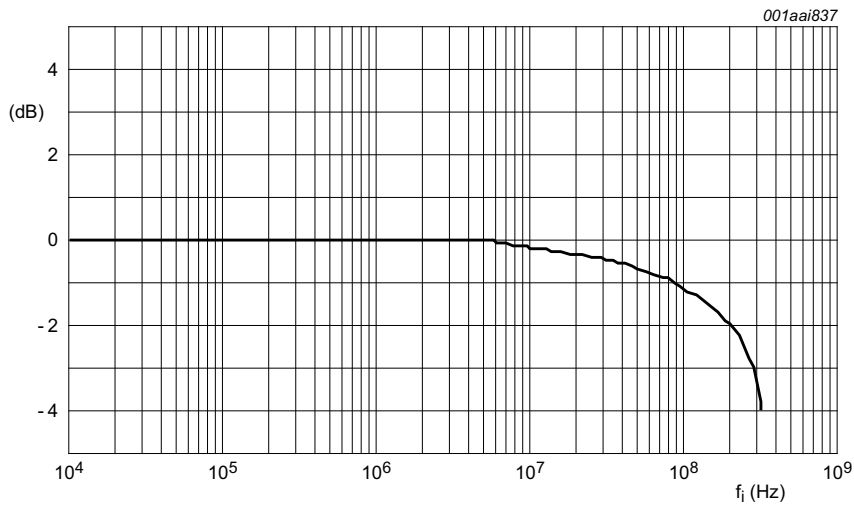
### 11.3 Test circuits and graphs

**Test conditions:**  
 $V_{CC} = 3.0$  V to  $3.6$  V;  $V_I = 2.5$  V (p-p).  
 $V_{CC} = 4.5$  V to  $5.5$  V;  $V_I = 4.0$  V (p-p).

**Fig 11. Test circuit for measuring total harmonic distortion**

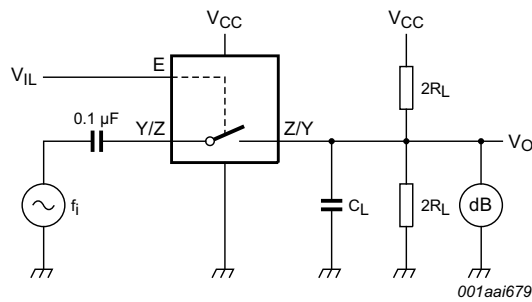
With  $f_i = 1$  MHz, adjust the switch input voltage for a 0 dBm level at the switch output (0 dBm = 1 mW into 50  $\Omega$ ). Then increase the input  $f_i$  frequency until the dB meter reads -3 dB.

**Fig 12. Test circuit for measuring the -3 dB frequency response**



Test conditions:  $V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $R_L = 50\ \Omega$ ;  $R_{SOURCE} = 1\text{ k}\Omega$ .

**Fig 13. Typical -3 dB frequency response**



Adjust the switch input voltage for a 0 dBm level (0 dBm = 1 mW into 600  $\Omega$ ).

**Fig 14. Test circuit for measuring isolation (OFF-state)**

12. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

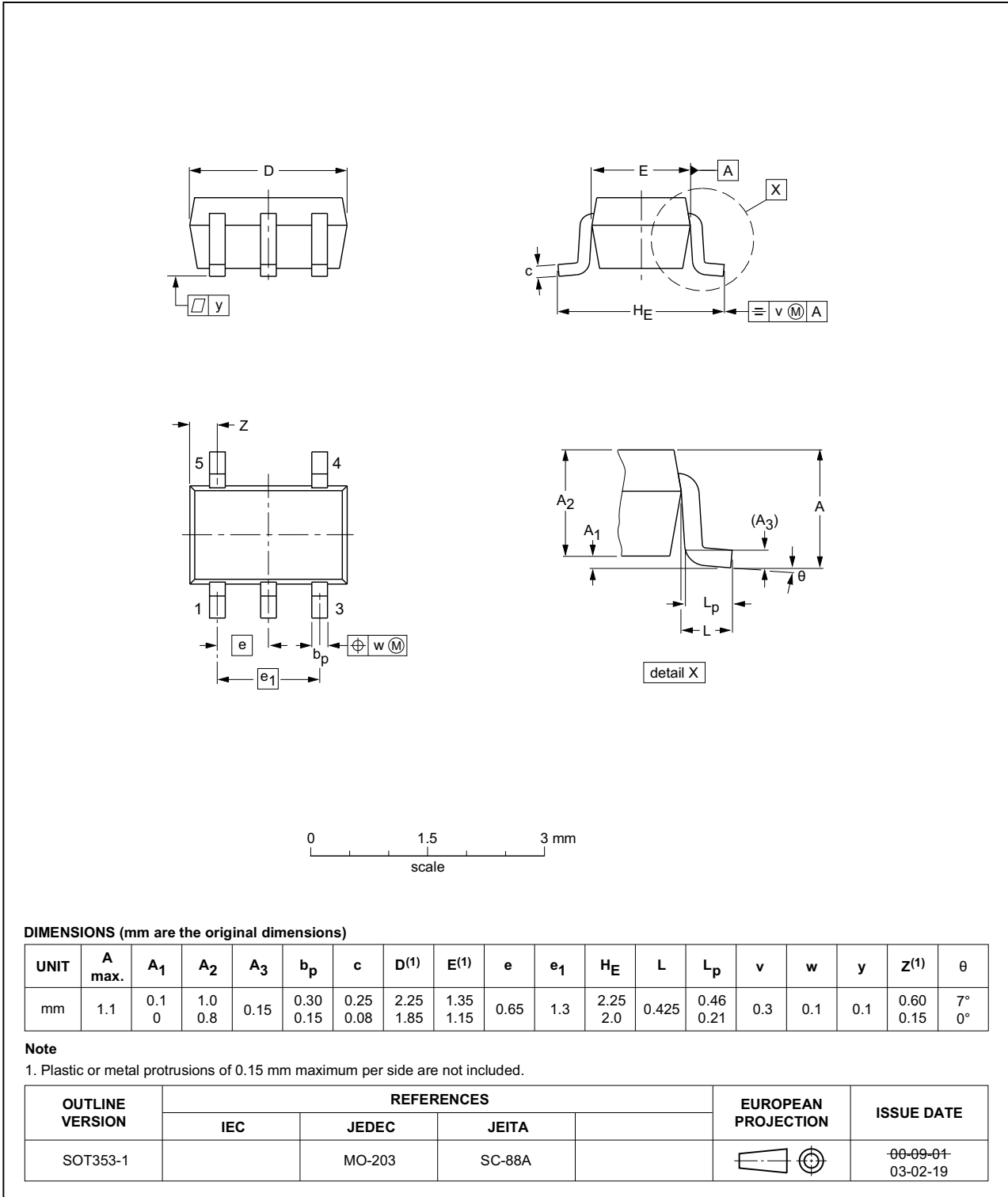


Fig 15. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

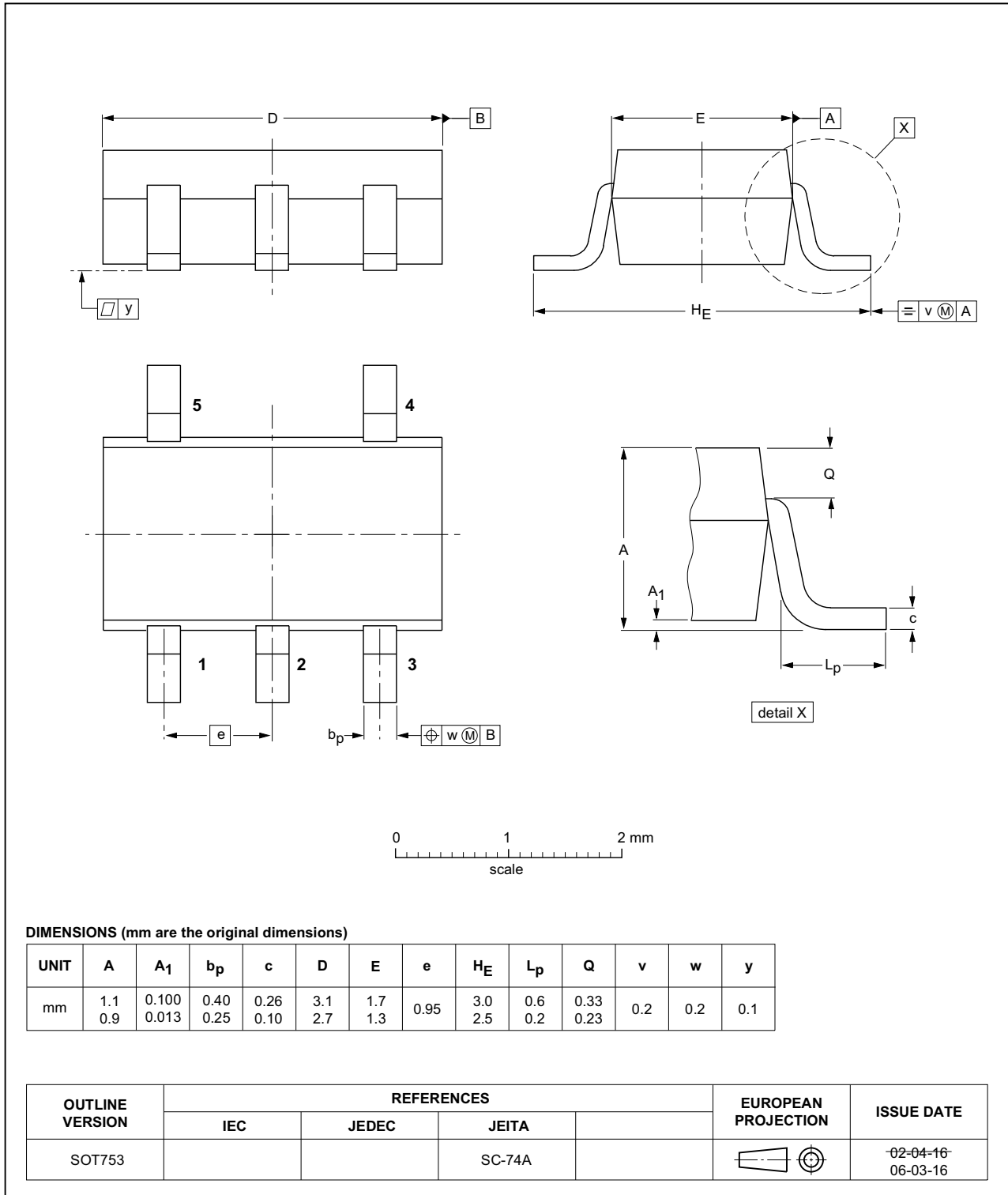


Fig 16. Package outline SOT753 (SC-74A)

## 13. Abbreviations

Table 13. Abbreviations

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

## 14. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G66_Q100 v.1	20150127	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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>.

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