

74HC1G66; 74HCT1G66

Single-pole single-throw analog switch

Rev. 04 — 19 December 2008

Product data sheet

1. General description

74HC1G66 and 74HCT1G66 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.

The non-standard output currents are equal to those of the 74HC4066 and 74HCT4066.

2. Features

- Wide supply voltage range from 2.0 V to 10.0 V for the 74HC1G66
- Very low ON resistance:
 - ◆ 45 Ω (typ.) at $V_{CC} = 4.5$ V
 - ◆ 30 Ω (typ.) at $V_{CC} = 6.0$ V
 - ◆ 25 Ω (typ.) at $V_{CC} = 9.0$ V
- High noise immunity
- Low power dissipation
- Multiple package options
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC1G66GW 74HCT1G66GW	-40 °C to $+125$ °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HC1G66GV 74HCT1G66GV	-40 °C to $+125$ °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking codes

Type number	Marking
74HC1G66GW	HL
74HCT1G66GW	TL
74HC1G66GV	H66
74HCT1G66GV	T66

5. Functional diagram

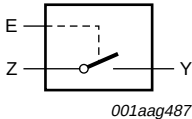


Fig 1. Logic symbol

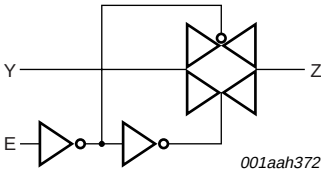


Fig 2. Logic diagram

6. Pinning information

6.1 Pinning

74HC1G66
74HCT1G66

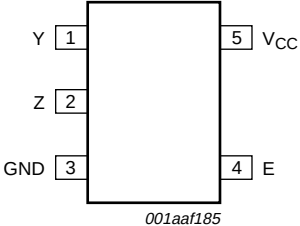


Fig 3. Pin configuration SOT353-1 and SOT753

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 _{CC}	5	supply voltage

7. Functional description

Table 4. Function table^[1]

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_{CC}	supply voltage		-0.5	+11.0	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_{SK}	switch clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	^[1] -	±20	mA
I_{SW}	switch current	$V_{SW} > -0.5\text{ V}$ or $V_{SW} < V_{CC} + 0.5\text{ V}$	-	±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 $+125\text{ °C}$	^[2] -	250	mW

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

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

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).^[1]

Symbol	Parameter	Conditions	74HC1G66			74HCT1G66			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	10.0	4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	0	-	V_{CC}	V
V_{SW}	switch voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V
		$V_{CC} = 10.0\text{ V}$	-	-	35	-	-	-	ns/V

[1] To avoid drawing V_{CC} current out of pin Z, when switch current flows in pin Y, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into pin Z, no V_{CC} current will flow out of terminal Y. In this case there is no limit for the voltage drop across the switch, but the voltage at pins Y and Z may not exceed V_{CC} or GND.

10. Static characteristics

Table 7. Static characteristics

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	
74HC1G66								
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	V
		V _{CC} = 9.0 V	6.3	4.7	-	6.3	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	V
		V _{CC} = 9.0 V	-	4.3	2.7	-	2.7	V
I _I	input leakage current	E; V _I = V _{CC} or GND						
		V _{CC} = 6.0 V	-	0.1	1.0	-	1.0	μA
		V _{CC} = 10.0 V	-	0.2	2.0	-	2.0	μA
I _{S(OFF)}	OFF-state leakage current	Y or Z; V _{CC} = 10 V; see Figure 4	-	0.1	1.0	-	1.0	μA
I _{S(ON)}	ON-state leakage current	Y or Z; V _{CC} = 10 V; see Figure 5	-	0.1	1.0	-	1.0	μA
I _{CC}	supply current	E, Y or Z; V _I = V _{CC} or GND; V _{SW} = GND or V _{CC}						
		V _{CC} = 6.0 V	-	1.0	10	-	20	μA
		V _{CC} = 10.0 V	-	2.0	20	-	40	μA
C _I	input capacitance		-	1.5	-	-	-	pF
C _{S(ON)}	ON-state capacitance		-	8	-	-	-	pF

Table 7. Static characteristics ...continued
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	
74HCT1G66								
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	0.1	1.2	0.8	-	0.8	V
I _I	input leakage current	E; V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	0.1	1.0	-	1.0	μA
I _{S(OFF)}	OFF-state leakage current	Y or Z; V _{CC} = 5.5 V; see Figure 4	-	0.1	1.0	-	1.0	μA
I _{S(ON)}	ON-state leakage current	Y or Z; V _{CC} = 5.5 V; see Figure 5	-	0.1	1.0	-	1.0	μA
I _{CC}	supply current	E, Y or Z; V _I = V _{CC} or GND; V _{SW} = GND or V _{CC} ; V _{CC} = 4.5 V to 5.5 V	-	1	10	-	20	μA
ΔI _{CC}	additional supply current	V _I = V _{CC} − 2.1 V; V _{CC} = 4.5 V to 5.5 V; I _O = 0 A	-	-	500	-	850	μA
C _I	input capacitance		-	1.5	-	-	-	pF
C _{S(ON)}	ON-state capacitance		-	8	-	-	-	pF

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

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

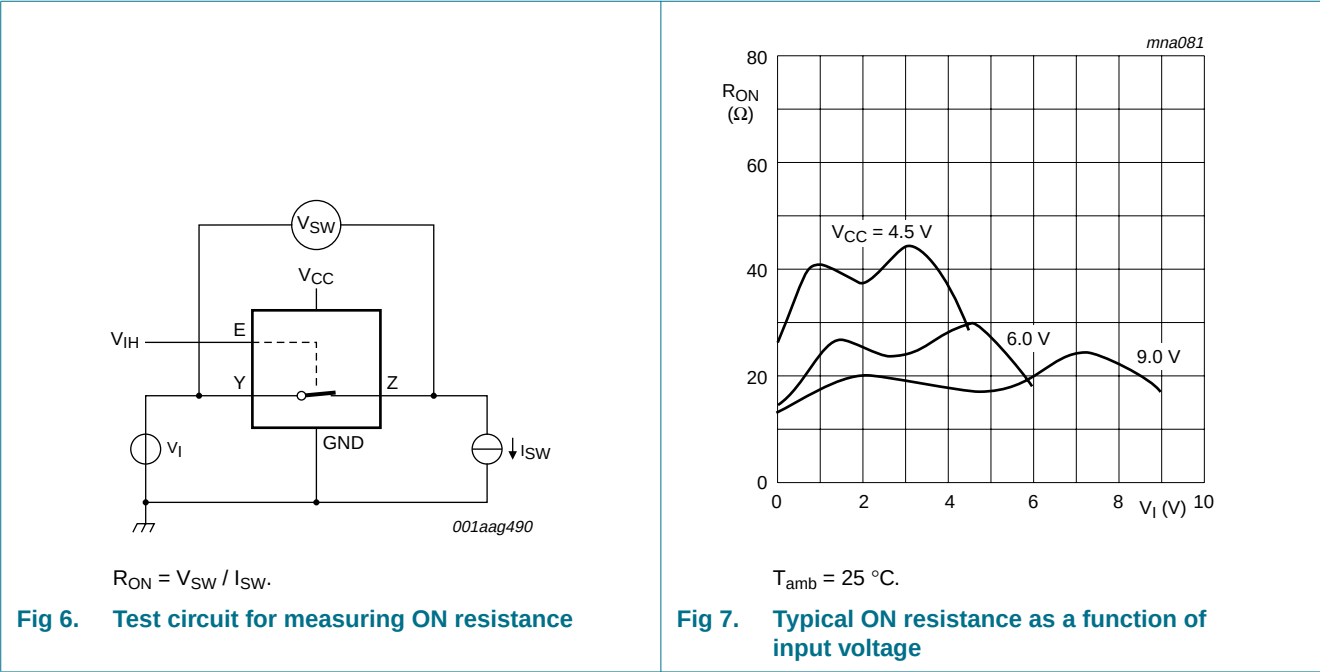
At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graph see [Figure 7](#).

Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ ^[2]	Max	Min	Max	
74HC1G66 ^[1]								
R _{ON(peak)}	ON resistance (peak)	V _I = GND to V _{CC} ; see Figure 6						
		I _{SW} = 0.1 mA; V _{CC} = 2.0 V	-	-	-	-	-	Ω
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	42	118	-	142	Ω
		I _{SW} = 1 mA; V _{CC} = 6.0 V	-	31	105	-	126	Ω
		I _{SW} = 1 mA; V _{CC} = 9.0 V	-	23	88	-	105	Ω
R _{ON(rail)}	ON resistance (rail)	V _I = GND; see Figure 6						
		I _{SW} = 0.1 mA; V _{CC} = 2.0 V	-	75	-	-	-	Ω
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	29	95	-	115	Ω
		I _{SW} = 1 mA; V _{CC} = 6.0 V	-	23	82	-	100	Ω
		I _{SW} = 1 mA; V _{CC} = 9.0 V	-	18	70	-	80	Ω
		V _I = V _{CC} ; see Figure 6						
		I _{SW} = 0.1 mA; V _{CC} = 2.0 V	-	75	-	-	-	Ω
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	35	106	-	128	Ω
		I _{SW} = 1 mA; V _{CC} = 6.0 V	-	27	94	-	113	Ω
		I _{SW} = 1 mA; V _{CC} = 9.0 V	-	21	78	-	95	Ω
74HCT1G66								
R _{ON(peak)}	ON resistance (peak)	V _I = GND to V _{CC} ; see Figure 6						
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	42	118	-	142	Ω
R _{ON(rail)}	ON resistance (rail)	V _I = GND; see Figure 6						
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	29	95	-	115	Ω
		V _I = V _{CC} ; see Figure 6						
		I _{SW} = 1 mA; V _{CC} = 4.5 V	-	35	106	-	128	Ω

[1] At supply voltages approaching 2 V, the 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.

[2] Typical values are measured at T_{amb} = 25 °C.

10.3 ON resistance test circuit and graphs



11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); $C_L = 50\text{ pF}$; $R_L = 1\text{ k}\Omega$, unless otherwise specified;
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	
74HC1G66								
t _{pd}	propagation delay	Y to Z or Z to Y; R _L = ∞ Ω; see Figure 8	[2]					
		V _{CC} = 2.0 V	-	8	75	-	90	ns
		V _{CC} = 4.5 V	-	3	15	-	18	ns
		V _{CC} = 6.0 V	-	2	13	-	15	ns
		V _{CC} = 9.0 V	-	1	10	-	12	ns
t _{en}	enable time	E to Y or Z; see Figure 9	[2]					
		V _{CC} = 2.0 V	-	50	125	-	150	ns
		V _{CC} = 4.5 V	-	16	25	-	30	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	11	-	-	-	ns
		V _{CC} = 6.0 V	-	13	21	-	26	ns
		V _{CC} = 9.0 V	-	9	16	-	20	ns

Table 9. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); $C_L = 50$ pF; $R_L = 1$ k Ω , unless otherwise specified;

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 _{dis}	disable time	E to Y or Z; see Figure 9 ^[2]						
		V _{CC} = 2.0 V	-	27	190	-	225	ns
		V _{CC} = 4.5 V	-	16	38	-	45	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	11	-	-	-	ns
		V _{CC} = 6.0 V	-	14	33	-	38	ns
		V _{CC} = 9.0 V	-	12	16	-	20	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ^[3]	-	9	-	-	-	pF
74HCT1G66								
t _{pd}	propagation delay	Y to Z or Z to Y; R _L = ∞ Ω; see Figure 8 ^[2]						
		V _{CC} = 4.5 V	-	3	15	-	18	ns
t _{en}	enable time	E to Y or Z; see Figure 9 ^[2]						
		V _{CC} = 4.5 V	-	15	30	-	36	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	12	-	-	-	ns
t _{dis}	disable time	E to Y or Z; see Figure 9 ^[2]						
		V _{CC} = 4.5 V	-	13	44	-	53	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	12	-	-	-	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} − 1.5 V ^[3]	-	9	-	-	-	pF

[1] All typical values are measured at $T_{amb} = 25$ °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 (μ 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

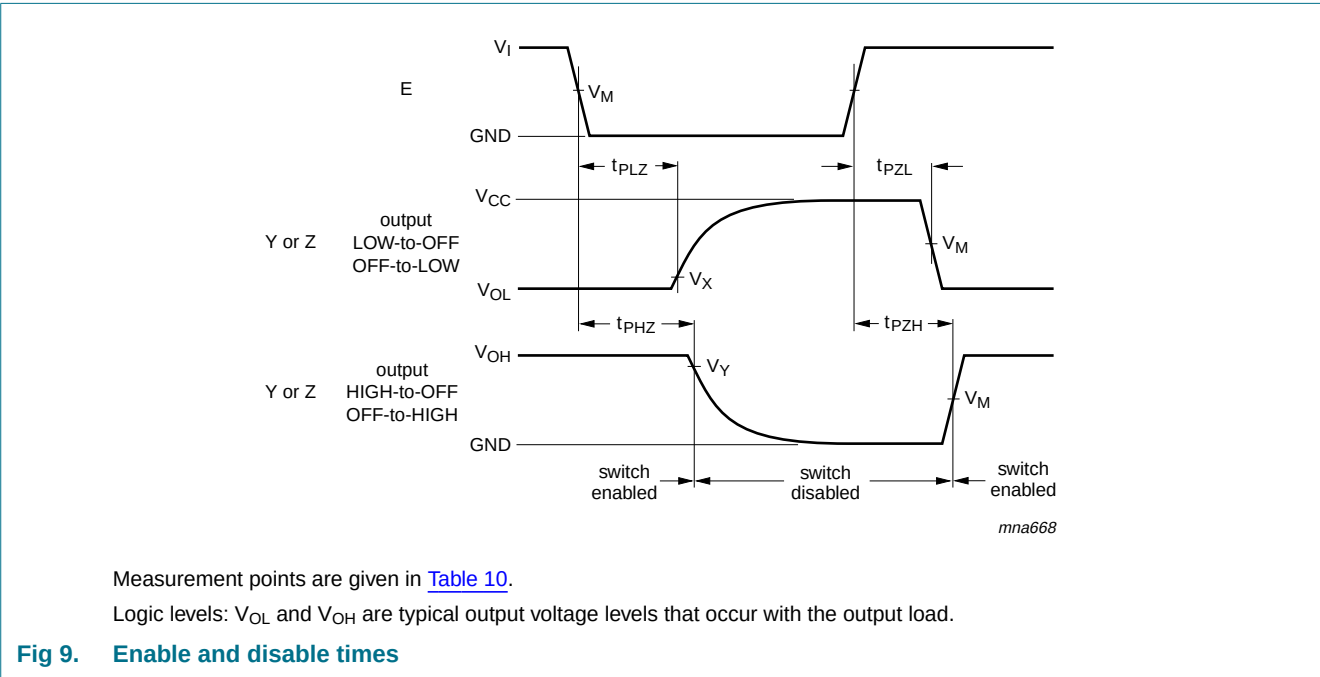
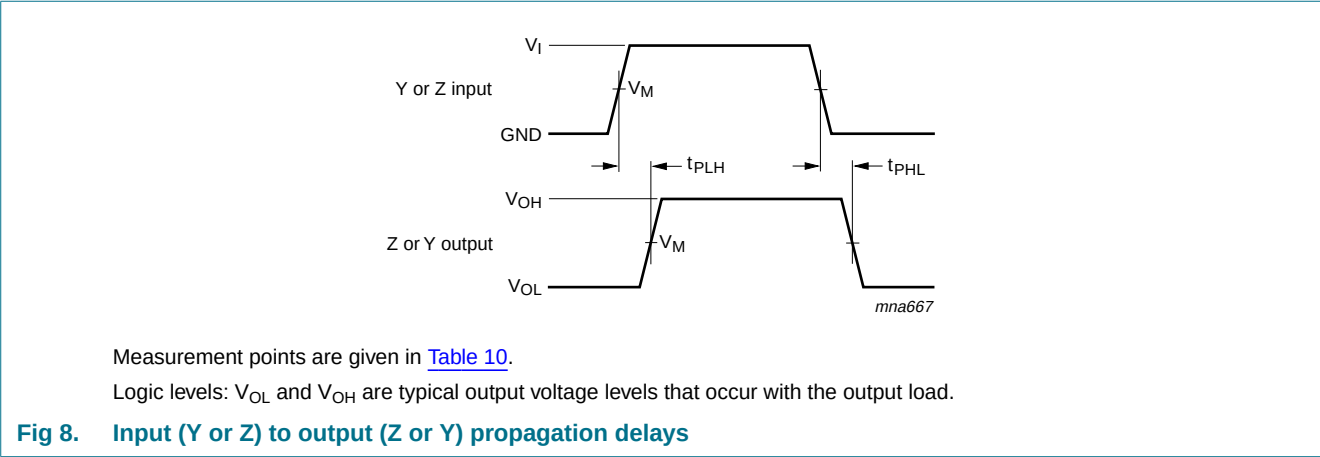
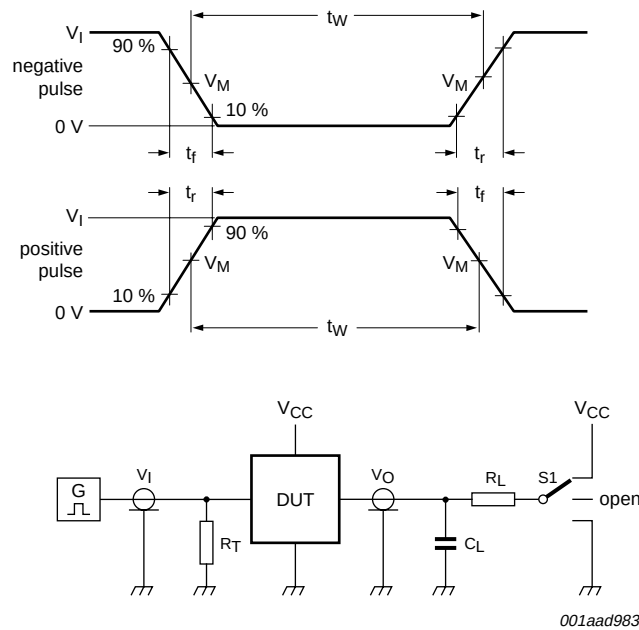


Table 10. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC1G66	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 10\%$	$V_{OH} - 10\%$
74HCT1G66	1.3 V	1.3 V	$V_{OL} + 10\%$	$V_{OH} - 10\%$



Test data is given in [Table 11](#).

Definitions for 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.

S1 = Test selection switch.

Fig 10. Test circuit for measuring switching times

Table 11. Test data

Type	Input		Load		S1 position		
	V_I	t_r, t_f ^[1]	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC1G66	GND to V_{CC}	6 ns	50 pF, 15 pF	1 k Ω , $\infty \Omega$	open	GND	V_{CC}
74HCT1G66	GND to 3 V	6 ns	50 pF, 15 pF	1 k Ω , $\infty \Omega$	open	GND	V_{CC}

[1] There is no constraint on t_r, t_f with a 50% duty factor when measuring f_{max} .

11.2 Additional dynamic characteristics

Table 12. Additional dynamic characteristics for 74HC1G66 and 74HCT1G66

$GND = 0 V$; $t_r = t_f = 6.0 ns$; $C_L = 50 pF$; 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 Figure 11				%
		$V_{CC} = 4.5 V$; $V_I = 4.0 V$ (p-p)	-	0.04	-	%
		$V_{CC} = 9.0 V$; $V_I = 8.0 V$ (p-p)	-	0.02	-	%
		$f_i = 10 kHz$; $R_L = 10 k\Omega$; see Figure 11				
		$V_{CC} = 4.5 V$; $V_I = 4.0 V$ (p-p)	-	0.12	-	%
		$V_{CC} = 9.0 V$; $V_I = 8.0 V$ (p-p)	-	0.06	-	%

Table 12. Additional dynamic characteristics for 74HC1G66 and 74HCT1G66 ...continued
GND = 0 V; $t_r = t_f = 6.0\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified. All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$f_{(-3\text{dB})}$	–3 dB frequency response	$R_L = 50\text{ }\Omega$; $C_L = 10\text{ pF}$; see Figure 12 and 13				
		$V_{CC} = 4.5\text{ V}$	-	180	-	MHz
		$V_{CC} = 9.0\text{ V}$	-	200	-	MHz
α_{iso}	isolation (OFF-state)	$R_L = 600\text{ }\Omega$; $f_i = 1\text{ MHz}$; see Figure 14 and 15				
		$V_{CC} = 4.5\text{ V}$	-	–50	-	dB
		$V_{CC} = 9.0\text{ V}$	-	–50	-	dB

11.3 Test circuits and graphs

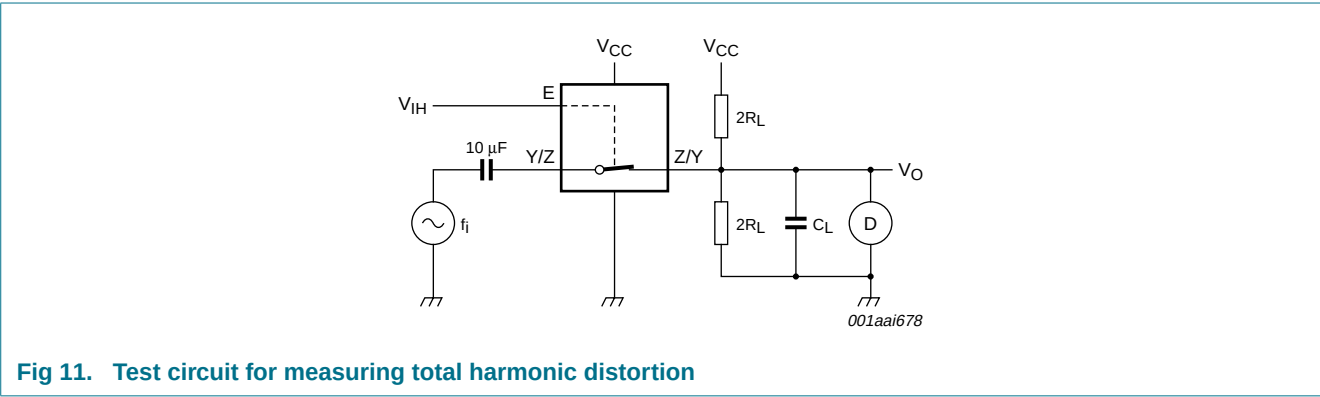


Fig 11. Test circuit for measuring total harmonic distortion

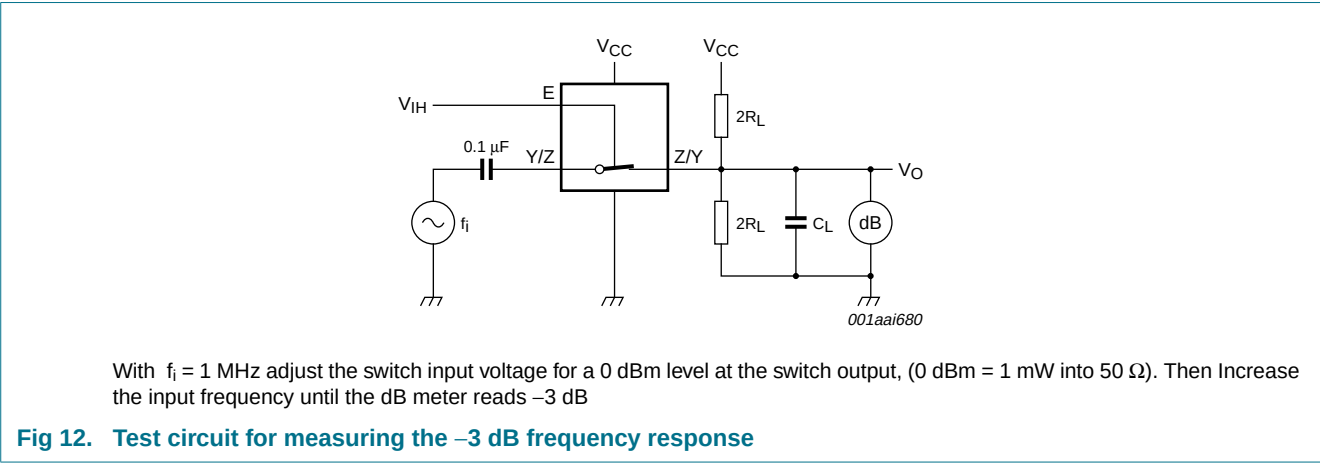
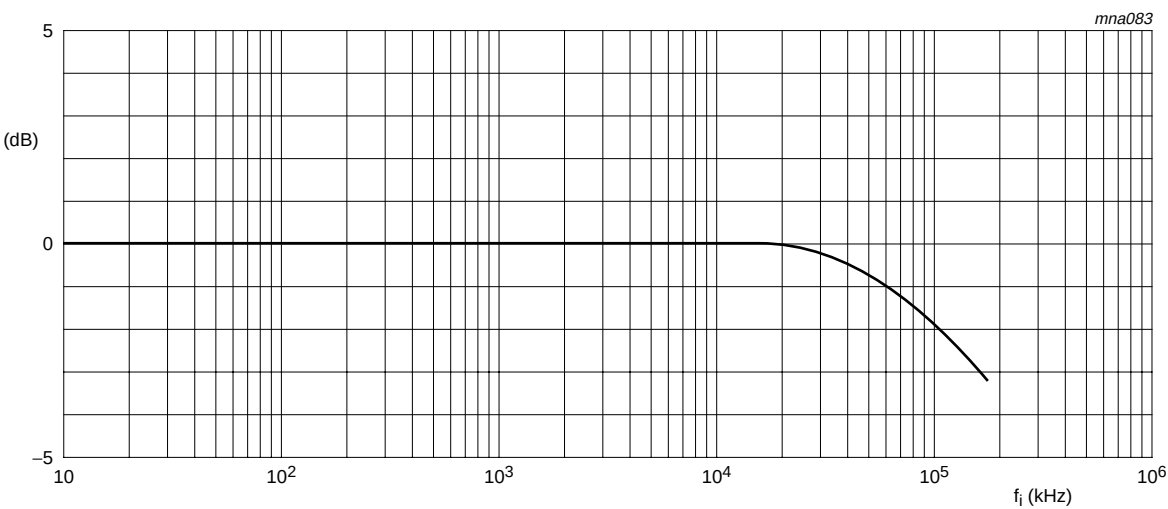
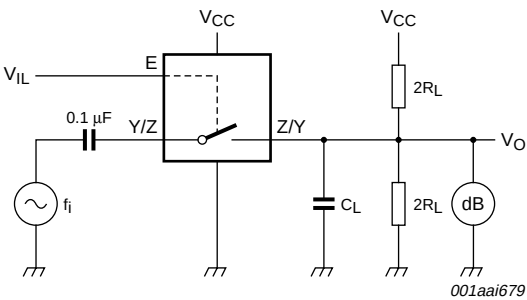


Fig 12. Test circuit for measuring the –3 dB frequency response



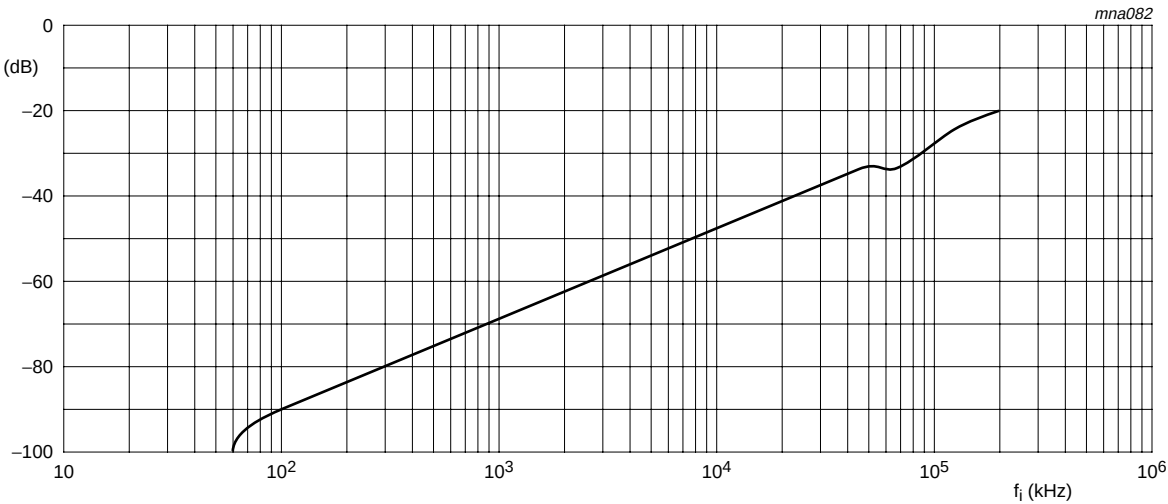
Test conditions: $V_{CC} = 4.5\text{ V}$; $GND = 0\text{ V}$; $R_L = 50\text{ }\Omega$; $R_{SOURCE} = 1\text{ k}\Omega$.

Fig 13. Typical -3 dB frequency response



Adjust the switch input voltage for a 0 dBm level, (0 dBm = 1 mW into 600 Ω)

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



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

Fig 15. Typical isolation (OFF-state) as a function of frequency

12. Package outline

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

SOT353-1

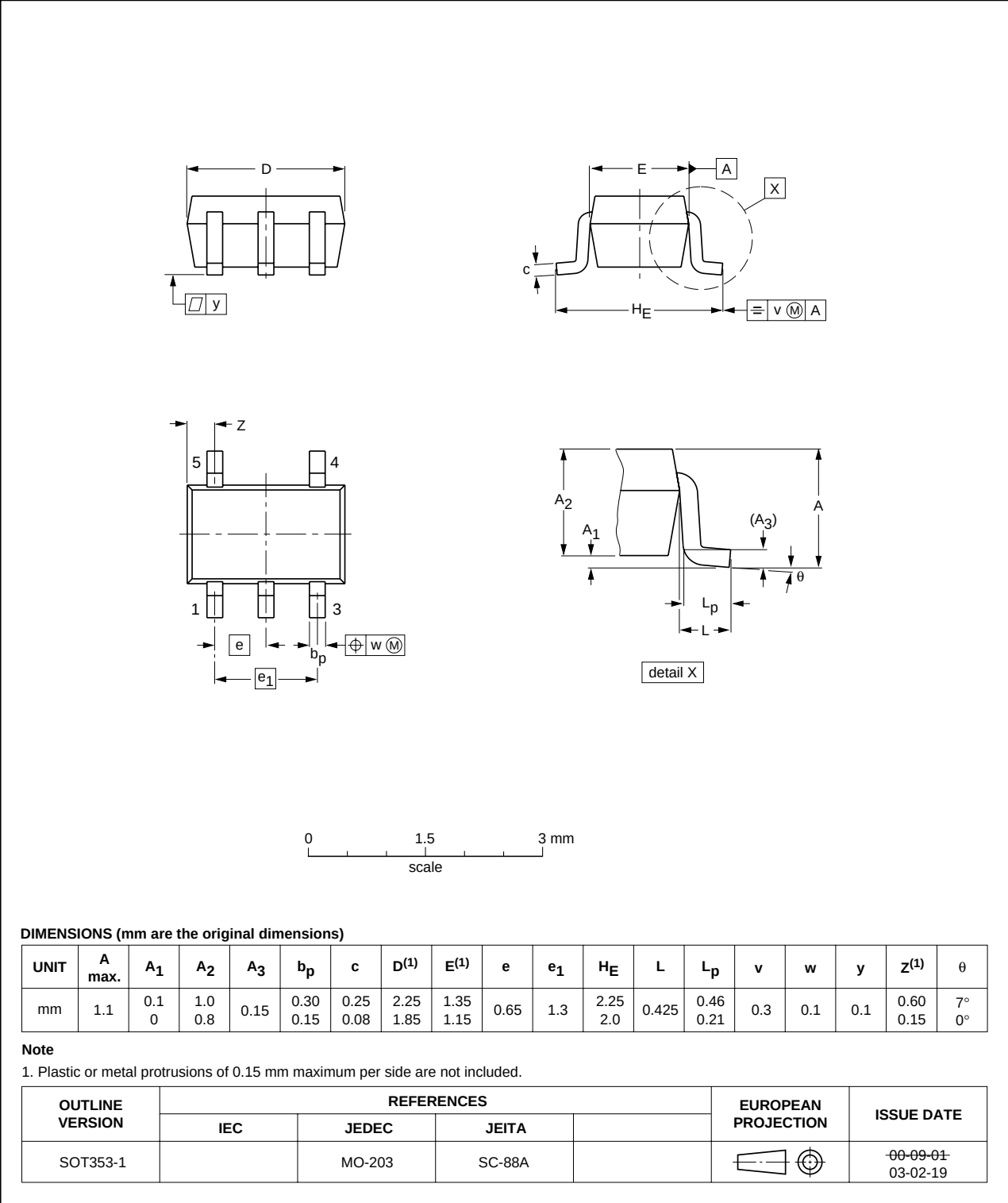


Fig 16. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

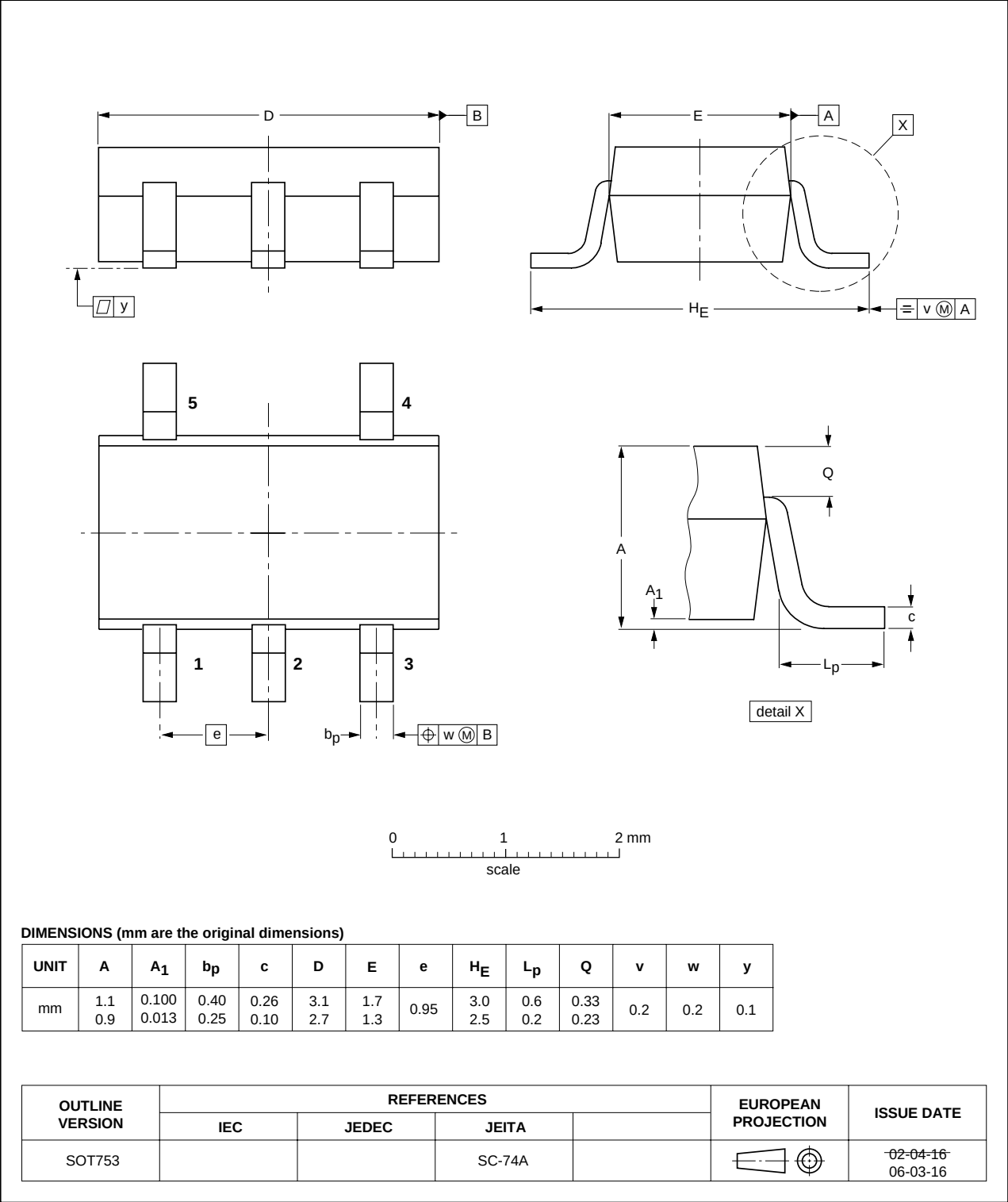


Fig 17. Package outline SOT753 (SC-74A)

13. Abbreviations

Table 13. Abbreviations

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

14. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G66_4	20081219	Product data sheet	-	74HC_HCT1G66_3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package SOT353 changed to SOT353-1 in Table 1 and Figure 16. • Quick Reference Data and Soldering sections removed. • Section 2 "Features" updated.			
74HC_HCT1G66_3	20020515	Product specification	-	74HC_HCT1G66_2
74HC_HCT1G66_2	20010302	Product specification	-	74HC_HCT1G66_1
74HC_HCT1G66_1	19980803	Product specification	-	-

15. Legal information

15.1 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.nxp.com>.

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