

74HC1G66-Q100; 74HCT1G66-Q100

Single-pole single-throw analog switch

Rev. 1 — 16 September 2013

Product data sheet

1. General description

The 74HC1G66-Q100; 74HCT1G66-Q100 is a single-pole, single-throw analog switch with two input/output terminals (nY and nZ) and a digital enable input (nE). When nE is LOW, the analog switch is turned off. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

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 °C to $+85\text{ °C}$ and from -40 °C to $+125\text{ °C}$
- Wide supply voltage range from 2.0 V to 10.0 V for the 74HC1G66-Q100
- Very low ON resistance:
 - ◆ $45\ \Omega$ (typ.) at $V_{CC} = 4.5\text{ V}$
 - ◆ $30\ \Omega$ (typ.) at $V_{CC} = 6.0\text{ V}$
 - ◆ $25\ \Omega$ (typ.) at $V_{CC} = 9.0\text{ V}$
- High noise immunity
- Low power dissipation
- 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			
	Temperature range	Name	Description	Version
74HC1G66GW-Q100 74HCT1G66GW-Q100	-40 °C to $+125\text{ °C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HC1G66GV-Q100 74HCT1G66GV-Q100	-40 °C to $+125\text{ °C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking codes

Type number	Marking
74HC1G66GW-Q100	HL
74HCT1G66GW-Q100	TL
74HC1G66GV-Q100	H66
74HCT1G66GV-Q100	T66

5. Functional diagram

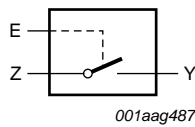


Fig 1. Logic symbol

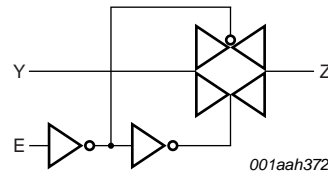


Fig 2. Logic diagram

6. Pinning information

6.1 Pinning

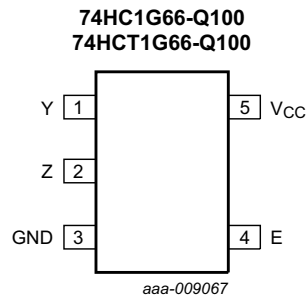


Fig 3. Pin configuration SOT353-1 and SOT753

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 _{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-Q100			74HCT1G66-Q100			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 from 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 flows from terminal Y. In this case, the voltage drop across the switch is unlimited, 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-Q100								
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-Q100								
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

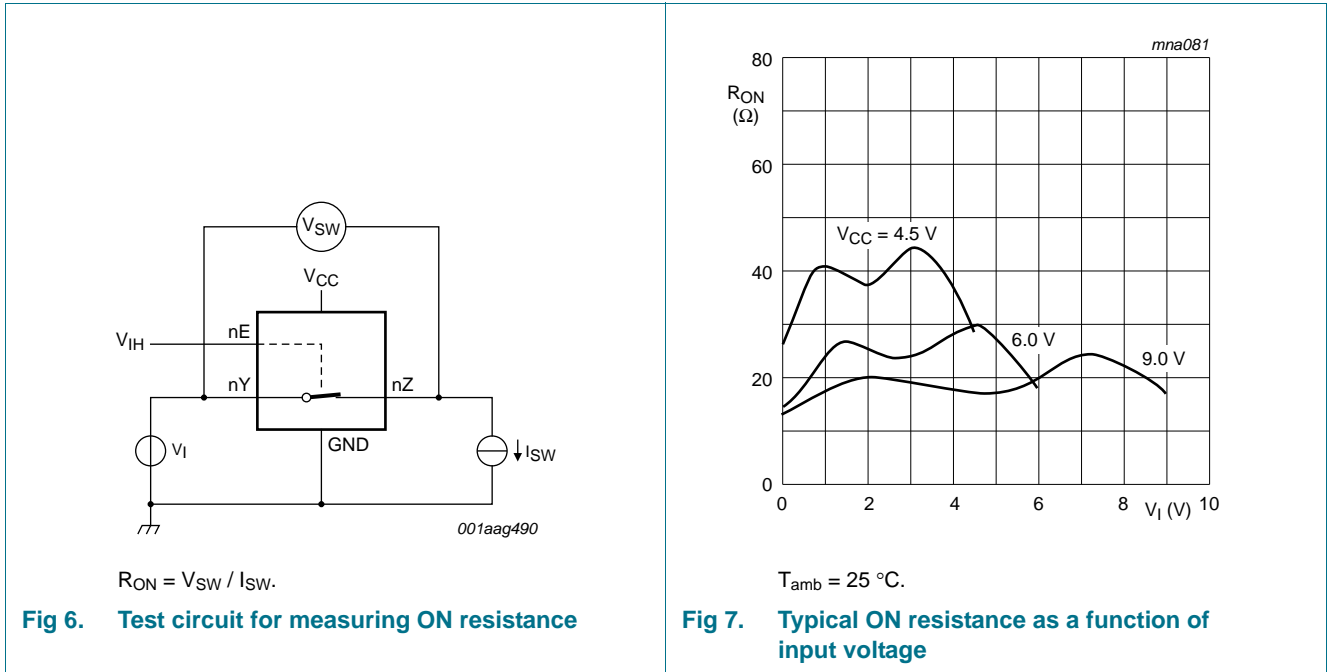
At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graph see [Figure 7](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit	
			Min	Typ ^[2]	Max	Min	Max		
74HC1G66-Q100^[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-Q100									
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-Q100								
t_{pd}	propagation delay	Y to Z or Z to Y; $R_L = \infty\ \Omega$; see Figure 8		[2]				
		$V_{CC} = 2.0\text{ V}$	-	8	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	3	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	2	13	-	15	ns
		$V_{CC} = 9.0\text{ V}$	-	1	10	-	12	ns
t_{en}	enable time	E to Y or Z; see Figure 9		[2]				
		$V_{CC} = 2.0\text{ V}$	-	50	125	-	150	ns
		$V_{CC} = 4.5\text{ V}$	-	16	25	-	30	ns
		$V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	11	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	13	21	-	26	ns
		$V_{CC} = 9.0\text{ V}$	-	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	$V_I = \text{GND to } V_{CC}$ ^[3]	-	9	-	-	-	pF
74HCT1G66-Q100								
t_{pd}	propagation delay	Y to Z or Z to Y; $R_L = \infty$ 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	$V_I = \text{GND to } V_{CC} - 1.5$ 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).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

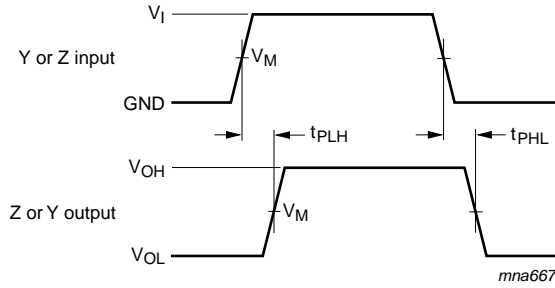
C_L = output load capacitance in pF;

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.

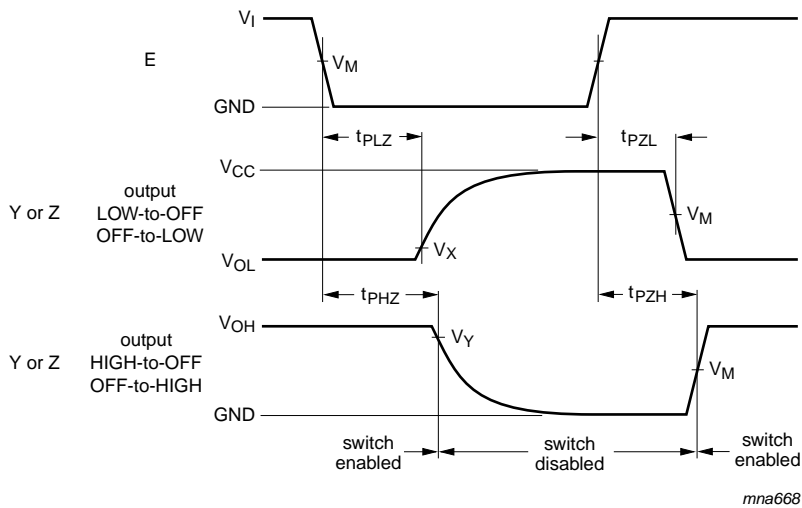
11.1 Waveforms and test circuit



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
74HC1G66-Q100	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 10\%$	$V_{OH} - 10\%$
74HCT1G66-Q100	1.3 V	1.3 V	$V_{OL} + 10\%$	$V_{OH} - 10\%$

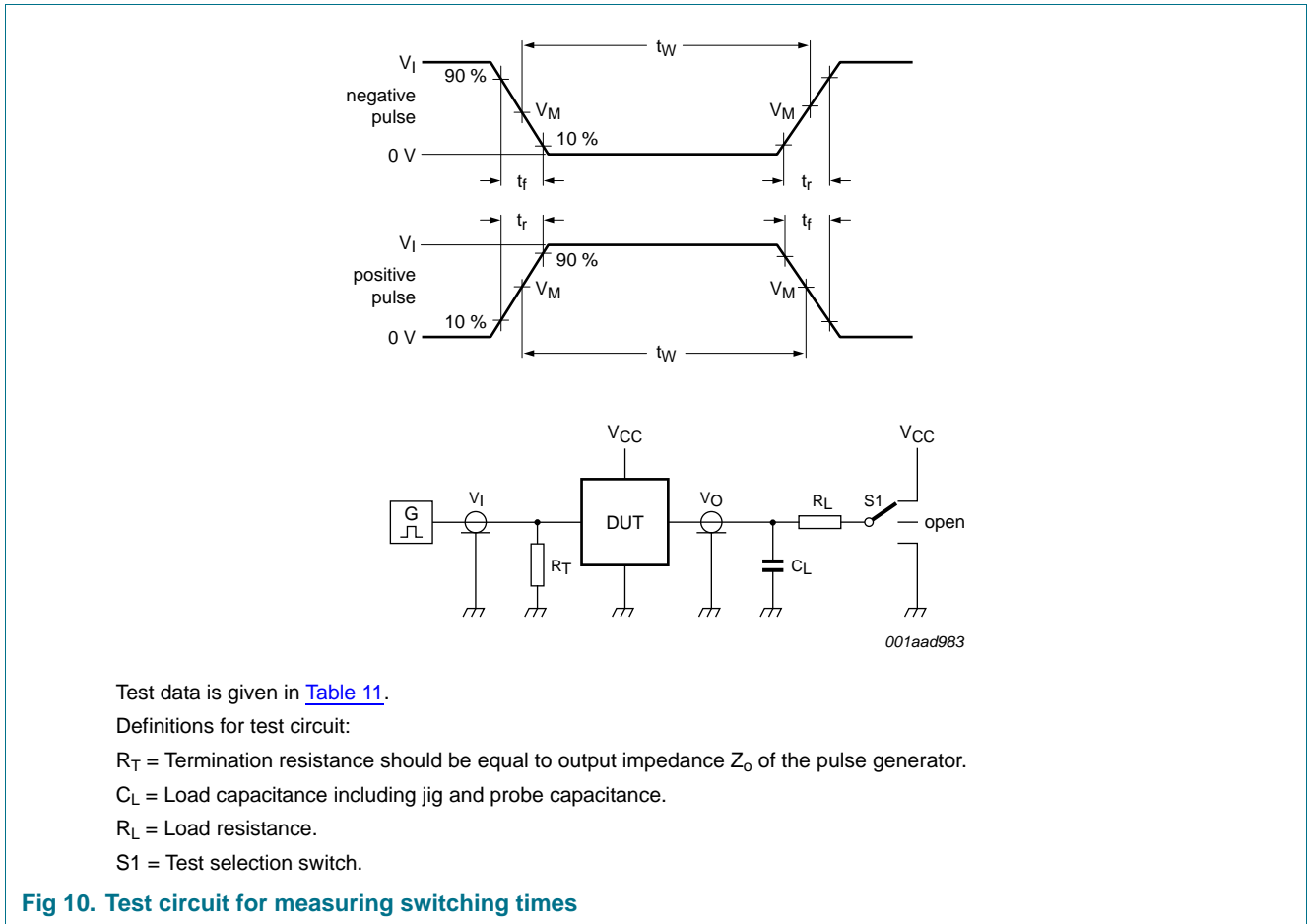


Table 11. Test data

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-Q100	GND to V_{CC}	6 ns	50 pF, 15 pF	1 k Ω , $\infty \Omega$	open	GND	V_{CC}
74HCT1G66-Q100	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-Q100 and 74HCT1G66-Q100

$GND = 0 V$; $t_r = t_f = 6.0 ns$; $C_L = 50 pF$; unless otherwise specified. All typical values are measured at $T_{amb} = 25 \text{ }^\circ\text{C}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
THD	total harmonic distortion	$f_i = 1 \text{ kHz}$; $R_L = 10 \text{ k}\Omega$; see Figure 11				%	
		$V_{CC} = 4.5 \text{ V}$; $V_I = 4.0 \text{ V (p-p)}$	-	0.04	-	%	
		$V_{CC} = 9.0 \text{ V}$; $V_I = 8.0 \text{ V (p-p)}$	-	0.02	-	%	
		$f_i = 10 \text{ kHz}$; $R_L = 10 \text{ k}\Omega$; see Figure 11					
		$V_{CC} = 4.5 \text{ V}$; $V_I = 4.0 \text{ V (p-p)}$	-	0.12	-	%	
		$V_{CC} = 9.0 \text{ V}$; $V_I = 8.0 \text{ V (p-p)}$	-	0.06	-	%	

Table 12. Additional dynamic characteristics for 74HC1G66-Q100 and 74HCT1G66-Q100 ...continued
GND = 0 V; $t_r = t_f = 6.0$ ns; $C_L = 50$ pF; unless otherwise specified. All typical values are measured at $T_{amb} = 25$ °C.

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

11.3 Test circuits and graphs

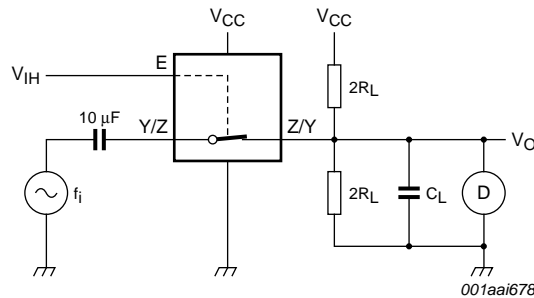
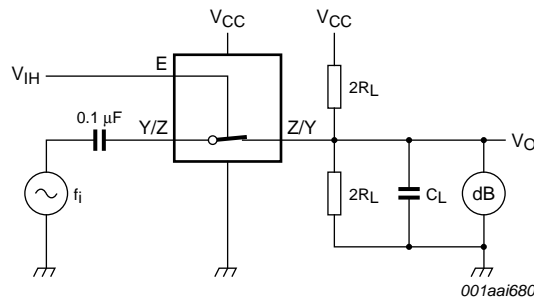
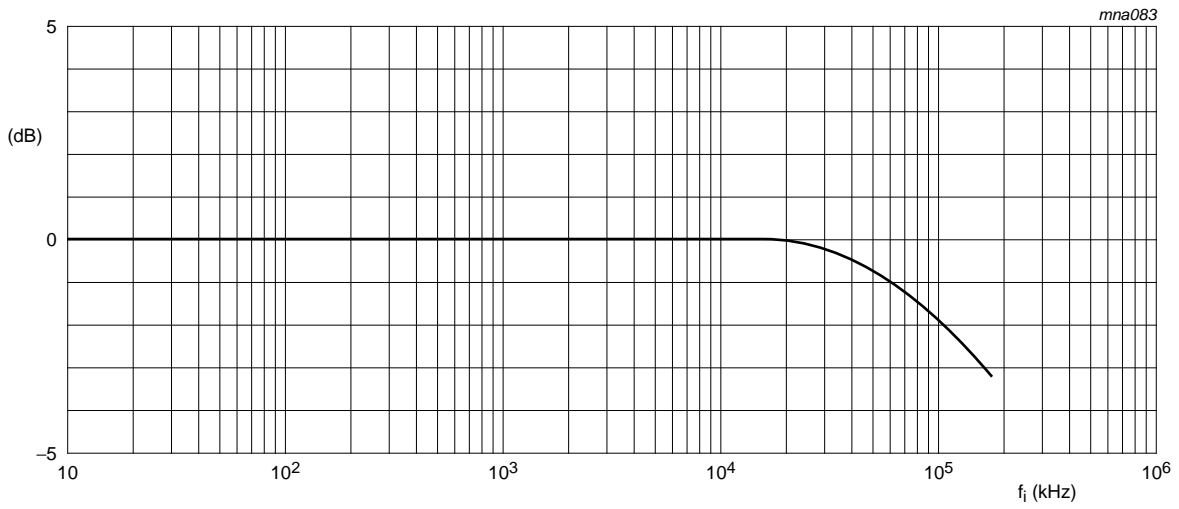


Fig 11. Test circuit for measuring total harmonic distortion



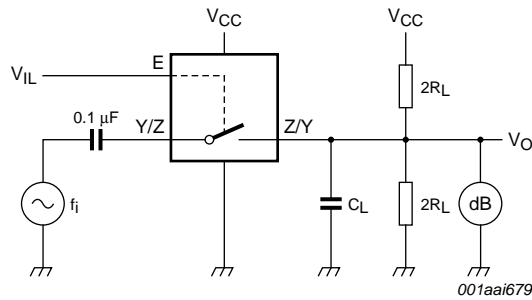
With $f_i = 1$ MHz, adjust the switch input voltage for a 0 dBm level at the switch output (0 dBm = 1 mW into 50 Ω). Then increase the input frequency until the dB meter reads -3 dB

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



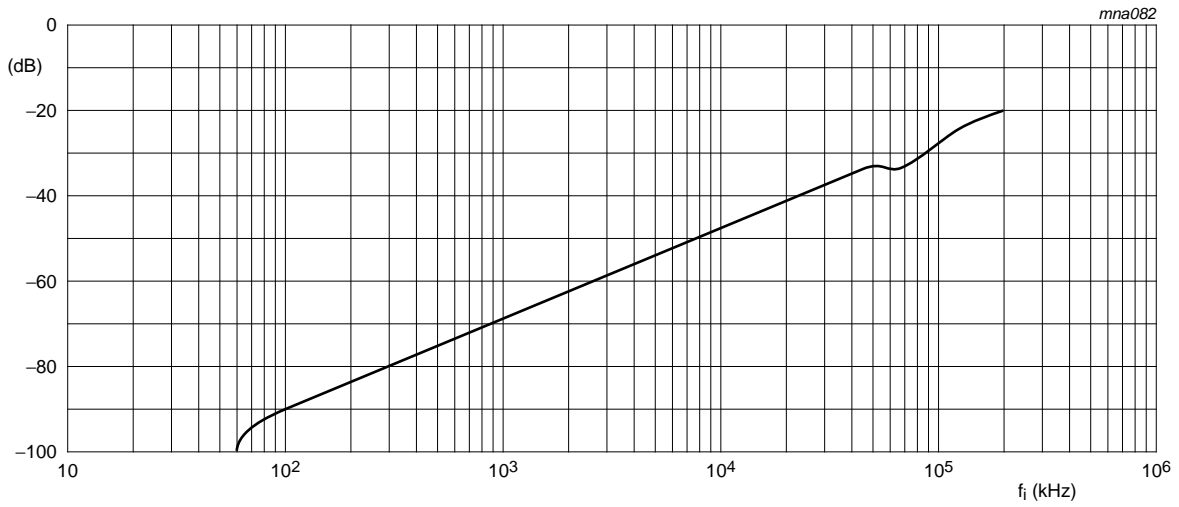
Test conditions: $V_{CC} = 4.5\text{ V}$; $GND = 0\text{ V}$; $R_L = 50\ \Omega$; $R_{SOURCE} = 1\text{ k}\Omega$.

Fig 13. Typical -3 dB frequency response



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

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



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

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

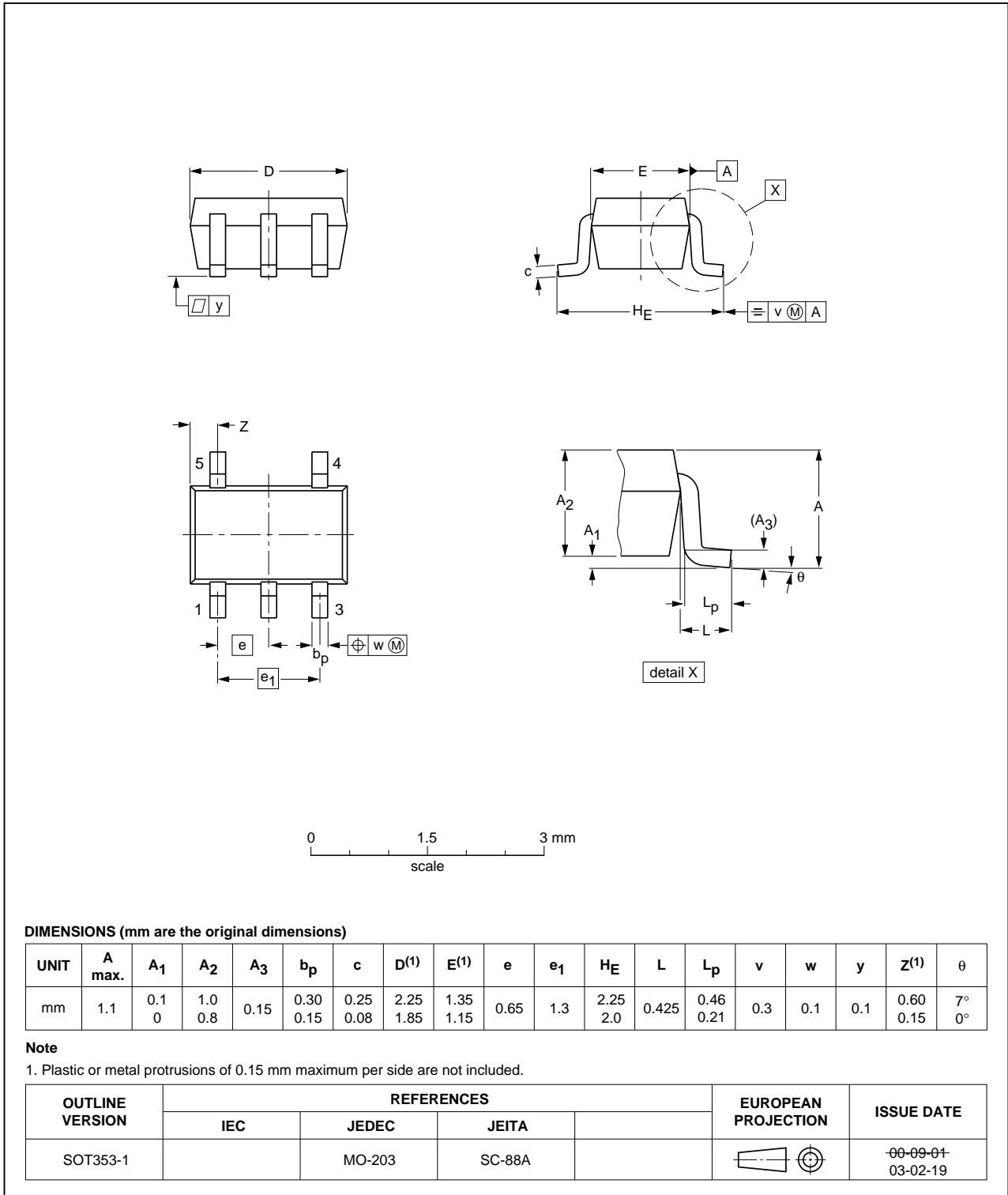


Fig 16. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

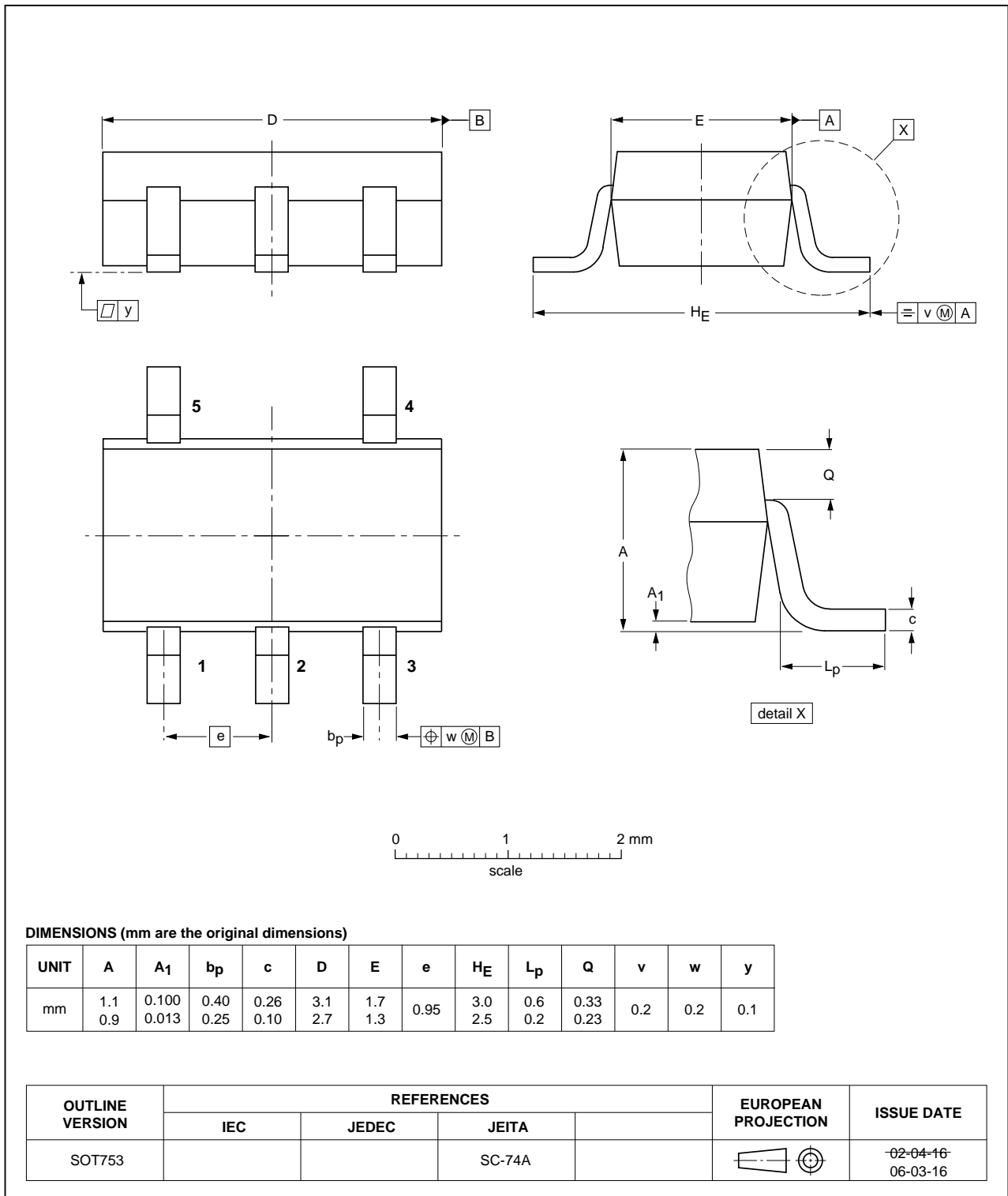


Fig 17. Package outline SOT753 (SC-74A)

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_Q100 v.1	20130916	Product data sheet	-	-

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.nexperia.com>.

15.2 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.

15.3 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.

15.4 Trademarks

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

16. Contact information

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

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

17. Contents

1	General description	1
2	Features and benefits	1
3	Ordering information	1
4	Marking	2
5	Functional diagram	2
6	Pinning information	2
6.1	Pinning	2
6.2	Pin description	2
7	Functional description	3
8	Limiting values	3
9	Recommended operating conditions	3
10	Static characteristics	4
10.1	Test circuits	5
10.2	ON resistance	6
10.3	ON resistance test circuit and graphs	7
11	Dynamic characteristics	7
11.1	Waveforms and test circuit	9
11.2	Additional dynamic characteristics	10
11.3	Test circuits and graphs	11
12	Package outline	14
13	Abbreviations	16
14	Revision history	16
15	Legal information	17
15.1	Data sheet status	17
15.2	Definitions	17
15.3	Disclaimers	17
15.4	Trademarks	18
16	Contact information	18
17	Contents	19