74VHC126-Q100; 74VHCT126-Q100

Quad buffer/line driver; 3-state

Rev. 1 — 15 November 2013

Product data sheet

1. General description

The 74VHC126-Q100; 74VHCT126-Q100 are high-speed Si-gate CMOS devices and are pin compatible with Low-power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard No. 7-A.

The 74VHC126-Q100; 74VHCT126-Q100 provide four non-inverting buffer/line drivers with 3-state outputs. The output enable input (nOE) controls the 3-state outputs (nY). A LOW-level at pin nOE causes the outputs to assume a high-impedance OFF-state.

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 °C and from -40 °C to +125 °C
- Balanced propagation delays
- All inputs have Schmitt-trigger action
- Inputs accept voltages higher than V_{CC}
- Input levels:
 - ◆ The 74VHC126-Q100 operates with CMOS input level
 - ◆ The 74VHCT126-Q100 operates with TTL input level
- 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 pf, R = 0 Ω)
- Multiple package options

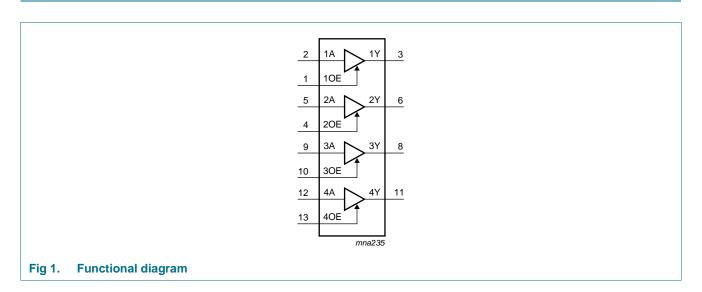


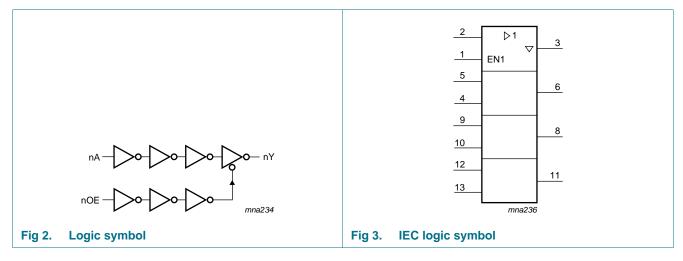
3. Ordering information

Table 1. Ordering information

Type number	Package											
	Temperature range	Name	Description	Version								
74VHC126D-Q100	–40 °C to +125 °C	SO14	plastic small outline package; 14 leads;	SOT108-1								
74VHCT126D-Q100			body width 3.9 mm									
74VHC126PW-Q100	–40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package;	SOT402-1								
74VHCT126PW-Q100			14 leads; body width 4.4 mm									
74VHC126BQ-Q100	$-40~^{\circ}\text{C}$ to +125 $^{\circ}\text{C}$	DHVQFN14	plastic dual in-line compatible thermal enhanced	SOT762-1								
74VHCT126BQ-Q100			very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85$ mm									

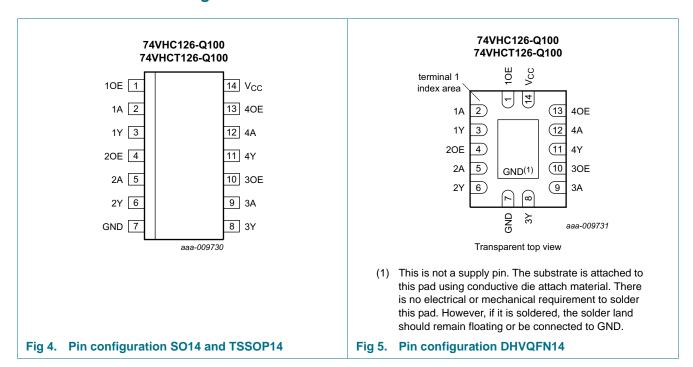
4. Functional diagram





5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Tubic 2.	i ili description	
Symbol	Pin	Description
10E	1	output enable input 1 (active HIGH)
1A	2	data input 1
1Y	3	data output 1
20E	4	output enable input 2 (active HIGH)
2A	5	data input 2
2Y	6	data output 2
GND	7	ground (0 V)
3Y	8	data output 3
3A	9	data input 3
3OE	10	output enable input 3 (active HIGH)
4Y	11	data output 4
4A	12	data input 4
40E	13	output enable input 4 (active HIGH)
V_{CC}	14	supply voltage

6. Functional description

Table 3. Function table[1]

Control	Input	Output
nOE	nA	nY
Н	L	L
Н	Н	Н
L	X	Z

^[1] H = HIGH voltage state;

L = LOW voltage state;

X = don't care;

Z = high-impedance OFF-state.

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+7.0	V
VI	input voltage		-0.5	+7.0	V
I _{IK}	input clamping current	$V_1 < -0.5 V$	<u>[1]</u> –20	-	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	<u>[1]</u> –20	+20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$	-25	+25	mA
I _{CC}	supply current		-	+75	mA
I_{GND}	ground current		-75	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	[2] -	500	mW

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

^[2] For SO14 packages: above 70 °C the value of P_{tot} derates linearly at 8 mW/K.
For TSSOP14 packages: above 60 °C the value of P_{tot} derates linearly at 5.5 mW/K.
For DHVQFN14 packages: above 60 °C the value of P_{tot} derates linearly at 4.5 mW/K.

8. Recommended operating conditions

Table 5. Operating conditions

	•					
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
74VHC126-Q100						
V _{CC}	supply voltage		2.0	5.0	5.5	V
V _I	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V_{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	-	-	100	ns/V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	20	ns/V
74VHCT126-Q100						
V _{CC}	supply voltage		4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V_{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	–40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74VHC1	26-Q100				•			'	'	
V_{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V _{OH} HIGH-level		$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = -50 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu A; V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.80	-	3.70	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = 50 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 3.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		I_{O} = 8.0 mA; V_{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V

74VHC_VHCT126_Q100

 Table 6.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	–40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
I _I	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to 5.5 V}$	-	-	0.1	-	1.0	-	2.0	μА
I _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±10.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
Cı	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
C _O	output capacitance		-	4	-	-	-	-	-	pF
74VHCT	126-Q100									
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		$I_0 = -8.0 \text{ mA}$	3.94	-	-	3.80	-	3.70	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 8.0 \text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
I _I	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	1.0	-	2.0	μΑ
l _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	±0.25	-	±2.5	-	±10.0	μА
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
Δl _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}$; other pins at V_{CC} or GND; $I_O = 0 \text{ A}$; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
Cı	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Figure 8.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C	to +125 °C	Unit
				Min	Typ[1]	Max	Min	Max	Min	Max	
74VHC1	26-Q100					1					1
t _{pd}	propagation	nA to nY; see Figure 6	[2]								
	delay	V _{CC} = 3.0 V to 3.6 V									
		C _L = 15 pF		-	4.7	8.0	1.0	9.5	1.0	10.0	ns
		$C_{L} = 50 \text{ pF}$		-	6.7	11.5	1.0	13.0	1.0	14.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$									
		C _L = 15 pF		-	3.3	5.5	1.0	6.5	1.0	7.0	ns
		$C_L = 50 pF$		-	4.7	7.5	1.0	8.5	1.0	9.5	ns
t _{en}	enable time	nOE to nY; see Figure 7	[3]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$									
		C _L = 15 pF		-	5.3	8.0	1.0	9.5	1.0	10.0	ns
		$C_L = 50 pF$		-	7.6	11.5	1.0	13.0	1.0	14.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$									
		C _L = 15 pF		-	3.6	5.3	1.0	6.1	1.0	7.0	ns
		$C_L = 50 pF$		-	5.1	7.6	1.0	8.7	1.0	9.5	ns
t _{dis}	disable time	nOE to nY; see Figure 7	<u>[4]</u>								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$									
		C _L = 15 pF		-	6.6	9.7	1.0	11.5	1.0	12.5	ns
		$C_L = 50 pF$		-	9.4	13.2	1.0	15.0	1.0	16.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$									
		C _L = 15 pF		-	4.7	6.8	1.0	8.0	1.0	8.5	ns
		$C_L = 50 pF$		-	6.7	8.8	1.0	10.0	1.0	11.0	ns
C _{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	<u>[5]</u>	-	10	-	-	-	-	-	pF
74VHCT	126-Q100; V _C	_C = 4.5 V to 5.5 V									
t_{pd}		nA to nY; see Figure 6	[2]								
	delay	$C_L = 15 pF$		-	3.0	5.5	1.0	6.5	1.0	7.0	ns
		$C_L = 50 pF$		-	4.3	7.5	1.0	8.5	1.0	9.5	ns
t _{en}	enable time	nOE to nY; see Figure 7	[3]								
		$C_L = 15 pF$		-	3.3	5.1	1.0	6.0	1.0	6.5	ns
		$C_L = 50 pF$		-	4.7	7.1	1.0	8.0	1.0	9.0	ns
t_{dis}	disable time	nOE to nY; see Figure 7	<u>[4]</u>								
		$C_L = 15 pF$		-	4.8	6.8	1.0	8.0	1.0	8.5	ns
		$C_L = 50 pF$		-	6.9	8.9	1.0	10.0	1.0	11.5	ns
C_{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	[5]	-	12	-	-	-	-	-	pF

74VHC_VHCT126_Q100

- [1] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3 \text{ V}$ and $V_{CC} = 5.0 \text{ V}$).
- [2] t_{pd} is the same as t_{PLH} and t_{PHL} .
- [3] ten is the same as tPZL and tPZH.
- [4] t_{dis} is the same as t_{PLZ} and t_{PHZ} .
- [5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

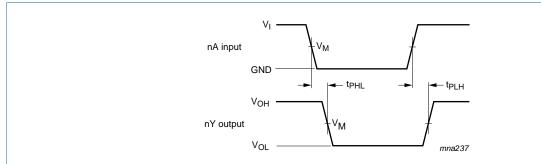
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

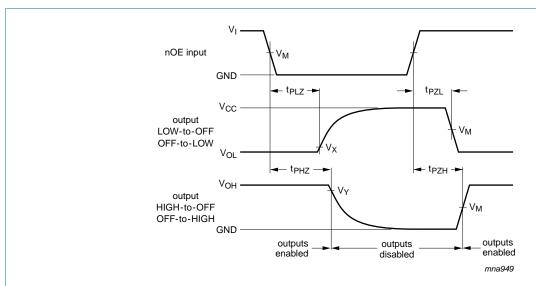
11. Waveforms



Measurement points are given in Table 8.

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

Fig 6. Input to output propagation delays



Measurement points are given in Table 8.

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

Fig 7. Enable and disable times

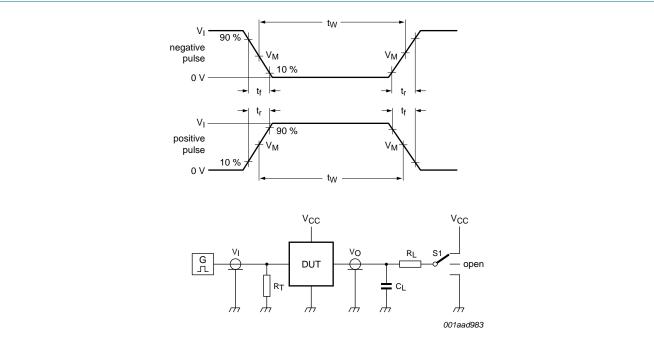
74VHC_VHCT126_Q100

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Table 8. Measurement points

Туре	Input	Output		
	V _M	V _M	V _X	V _Y
74VHC126-Q100	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.3 V	$V_{OH} - 0.3 V$
74VHCT126-Q100	1.5 V	0.5V _{CC}	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



Test data is given in Table 9.

Definitions test circuit:

 R_T = termination resistance should be equal to output impedance Z_o of the pulse generator.

 C_L = load capacitance including jig and probe capacitance.

 R_L = load resistance.

S1 = test selection switch.

Fig 8. Test circuitry for measuring switching times

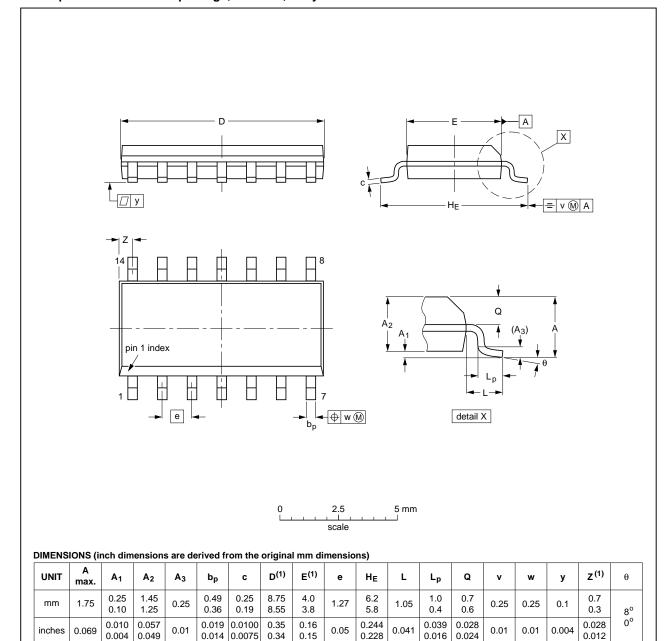
Table 9. Test data

Туре	Input		Load		S1 position				
	VI	t _r , t _f	CL	R _L	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}		
74VHC126-Q100	V_{CC}	\leq 3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}		
74VHCT126-Q100	3.0 V	\leq 3.0 ns	15 pF, 50 pF 1 kΩ		open	GND	V _{CC}		

12. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Fig 9. Package outline SOT108-1 (SO14)

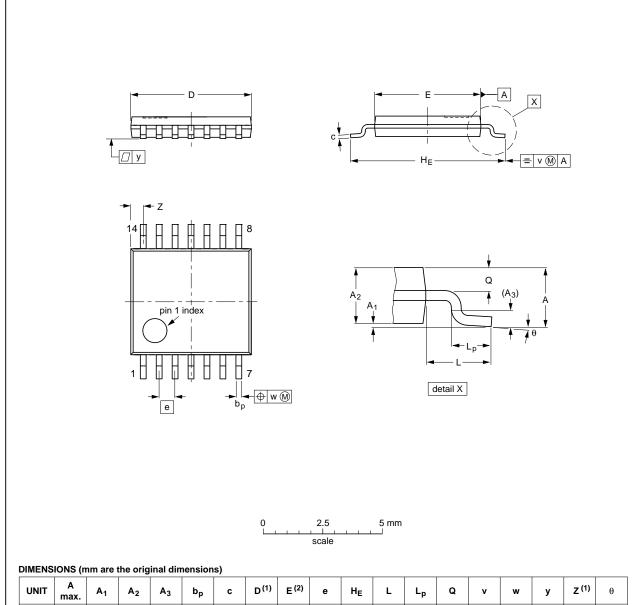
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TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

	OUTLINE VERSION	REFERENCES				EUROPEAN	ISSUE DATE
		IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
	SOT402-1		MO-153				-99-12-27 03-02-18

Fig 10. Package outline SOT402-1 (TSSOP14)

74VHC_VHCT126_Q100

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DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm SOT762-1

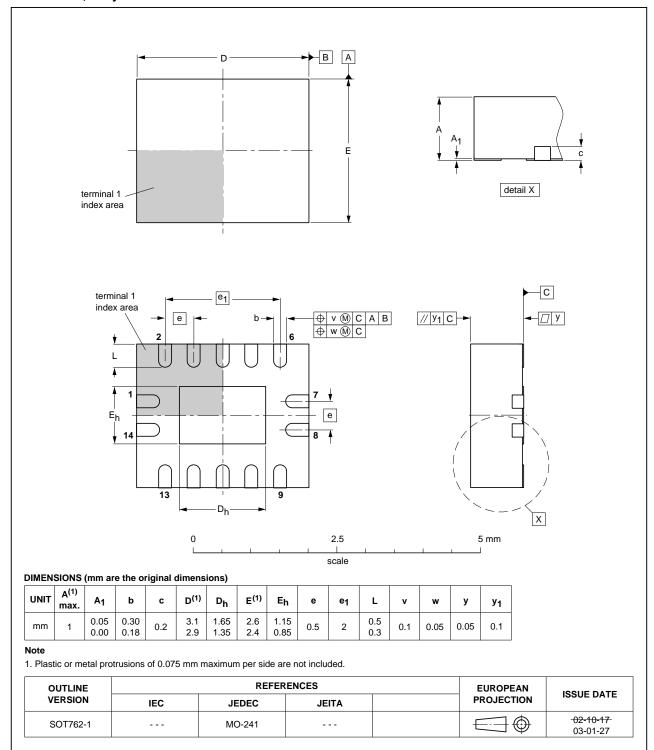


Fig 11. Package outline SOT762-1 (DHVQFN14)

74VHC_VHCT126_Q100

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13. Abbreviations

Table 10. Abbreviations

Acronym	Description	
CMOS	Complementary Metal-Oxide Semiconductor	
DUT	Device Under Test	
ESD	ElectroStatic Discharge	
НВМ	Human Body Model	
LSTTL	Low-power Schottky Transistor-Transistor Logic	
MIL	Military	
MM	Machine Model	

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74VHC_VHCT126_Q100 v.1	20131115	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.nxp.com.

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