74ALVC14

Hex inverting Schmitt trigger

Rev. 03 — 15 February 2005 | Product data sheet

1. General description

The 74ALVC14 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

The 74ALVC14 provides six inverting buffers with Schmitt-trigger action. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

2. Features

- Wide supply voltage range from 1.65 V to 3.6 V
- 3.6 V tolerant inputs/outputs
- CMOS low power consumption
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Unlimited input rise and fall times
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options

3. Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PHL}, t_{PLH}	propagation delay nA to nY	V_{CC} = 1.8 V; C_L = 30 pF; R_L = 1 kΩ	-	2.9	-	ns
		V_{CC} = 2.5 V; C_L = 30 pF; R_L = 500 Ω	-	2.2	-	ns
		V_{CC} = 2.7 V; C_L = 50 pF; R_L = 500 Ω	-	2.8	-	ns
		V_{CC} = 3.3 V; C_L = 50 pF; R_L = 500 Ω	-	2.4	-	ns

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Table 1: Quality reference data *...continued*

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_I	input capacitance			-	3.5	-	pF
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 V	[1] [2]	-	25	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
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.

[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
74ALVC14D	–40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74ALVC14PW	–40 °C to +85 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74ALVC14BQ	–40 °C to +85 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1

5. Functional diagram

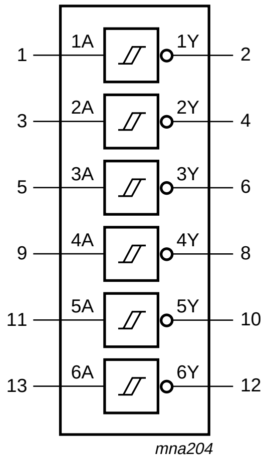


Fig 1. Logic symbol

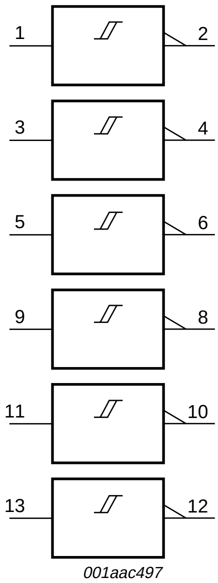


Fig 2. IEC logic symbol

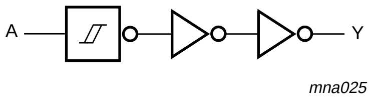


Fig 3. Logic diagram (one Schmitt trigger)

6. Pinning information

6.1 Pinning

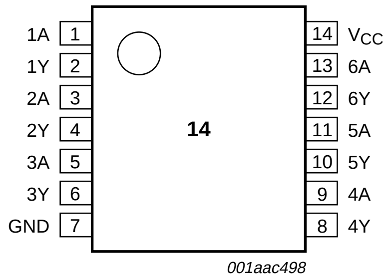
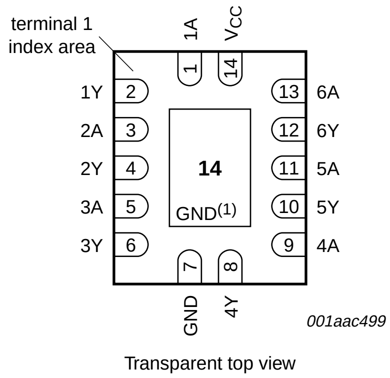


Fig 4. Pin configuration SO14 and TSSOP14



The die substrate is attached to the exposed die pad using conductive die attach material. It can not be used as a supply pin or input.

Fig 5. Pin configuration DHVQFN14

6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
1A	1	1 data input A
1Y	2	1 data output Y
2A	3	2 data input A
2Y	4	2 data output Y
3A	5	3 data input A
3Y	6	3 data output Y
GND	7	ground (0 V)
4Y	8	4 data output Y
4A	9	4 data input A
5Y	10	5 data output Y
5A	11	5 data input A
6Y	12	6 data output Y
6A	13	6 data input A
V_{CC}	14	supply voltage

7. Functional description

7.1 Function table

Table 4: Function table [1]

Input	Output
nA	nY
L	H
H	L

[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	+4.6	V
V_I	input voltage		[1]	–0.5	+4.6	V
V_O	output voltage	Active mode	[1]	–0.5	V_{CC} + 0.5	V
		Power-down mode	[2]	–0.5	+4.6	V
I_{IK}	input diode current	$V_I < 0$ V		-	–50	mA
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
I_O	output source or sink current	$V_O = 0$ V to V_{CC}		-	±50	mA
I_{CC}, I_{GND}	V_{CC} or GND current			-	±100	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –40 °C to +85 °C	[3]	-	500	mW

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

[2] When V_{CC} = 0 V (Power-down mode), the output voltage can be 3.6 V in normal operation.

[3] For SO14 packages: P_{tot} derates linearly with 8 mW/K above 70 °C.
For TSSOP14 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN14 packages: P_{tot} derates linearly with 4.5 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		1.65	-	3.6	V
V_I	input voltage		0	-	3.6	V
V_O	output voltage	V_{CC} = 1.65 V to 3.6 V	0	-	V_{CC}	V
		Power-down mode; V_{CC} = 0 V	0	-	3.6	V
T_{amb}	ambient temperature		–40	-	+85	°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} = –40 °C to +85 °C [1]						
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_O = 100 μA; V_{CC} = 1.65 V to 3.6 V	-	-	0.2	V
		I_O = 6 mA; V_{CC} = 1.65 V	-	0.11	0.3	V
		I_O = 12 mA; V_{CC} = 2.3 V	-	0.17	0.4	V
		I_O = 18 mA; V_{CC} = 2.3 V	-	0.25	0.6	V
		I_O = 12 mA; V_{CC} = 2.7 V;	-	0.16	0.4	V
		I_O = 18 mA; V_{CC} = 3.0 V	-	0.23	0.4	V
		I_O = 24 mA; V_{CC} = 3.0 V	-	0.30	0.55	V
V_{OH}	HIGH-level voltage output	$V_I = V_{IH}$ or V_{IL}				
		I_O = –100 μA; V_{CC} = 1.65 V to 3.6 V	V_{CC} – 0.2	-	-	V
		I_O = –6 mA; V_{CC} = 1.65 V	1.25	1.51	-	V
		I_O = –12 mA; V_{CC} = 2.3 V	1.8	2.10	-	V
		I_O = –18 mA; V_{CC} = 2.3 V	1.7	2.01	-	V
		I_O = –12 mA; V_{CC} = 2.7 V;	2.2	2.53	-	V
		I_O = –18 mA; V_{CC} = 3.0 V	2.4	2.76	-	V
		I_O = –24 mA; V_{CC} = 3.0 V	2.2	2.68	-	V
I_{LI}	input leakage current	V_{CC} = 3.6 V; V_I = 3.6 V or GND	-	±0.1	±5	μA
I_{off}	power-off leakage current	V_{CC} = 0 V; V_I or V_O = 3.6 V	-	±0.1	±10	μA
I_{CC}	quiescent supply current	V_{CC} = 3.6 V; $V_I = V_{CC}$ or GND; I_O = 0 A	-	0.2	10	μA
ΔI_{CC}	additional quiescent supply current per input pin	V_{CC} = 3.0 V to 3.6 V; $V_I = V_{CC}$ – 0.6 V; I_O = 0 A	-	5	750	μA
C_I	input capacitance		-	3.5	-	pF

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

11. Dynamic characteristics

Table 8: Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

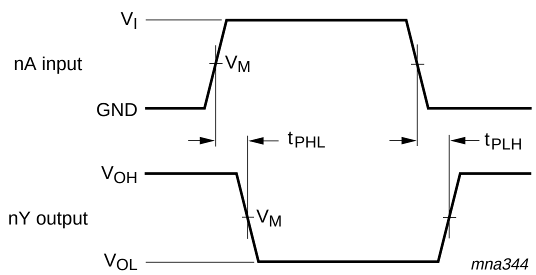
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]							
t_{PHL}, t_{PLH}	propagation delay nA to nY	see Figure 6					
		V_{CC} = 1.65 V to 1.95 V		1.0	2.9	4.4	ns
		V_{CC} = 1.95 V to 2.7 V		1.0	2.2	3.7	ns
		V_{CC} = 2.7 V		1.0	2.8	3.9	ns
		V_{CC} = 3.0 V to 3.6 V		1.0	2.4	3.4	ns
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 V	[2] [3]	-	25	-	pF

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

[2] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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.

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

12. Waveforms

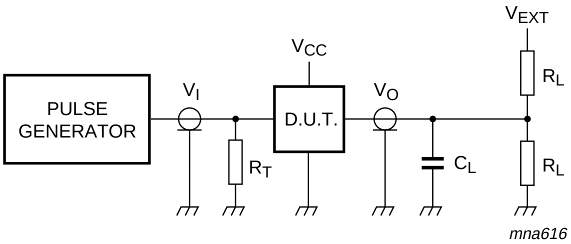


V_{OL} and V_{OH} are typical output voltage drop that occur with the output load.

Fig 6. Propagation delay input (nA) to output (nY)

Table 9: Measurement points

Supply	Input	Output
V_{CC}	V_M	V_M
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.7 V	1.5 V	1.5 V
3.0 V to 3.6 V	1.5 V	1.5 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 resistor.

V_{EXT} = Test voltage for switching times.

Fig 7. Load circuitry for switching times

Table 10: Test data

Supply	Input		Load		V_{EXT}
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open

13. Transfer characteristics

Table 11: Transfer characteristics

The V_{IH} and V_{IL} from the family static characteristics are superseded by the V_{T+} and V_{T-}. Voltages are referenced to GND (ground = 0 V); see Figure 8.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]							
V_{T+}	positive-going threshold	V_{CC} = 1.65 V		0.7	0.98	1.24	V
		V_{CC} = 1.95 V		0.75	1.12	1.46	V
		V_{CC} = 2.3 V		0.9	1.27	1.7	V
		V_{CC} = 2.7 V		1.0	1.43	2.0	V
		V_{CC} = 3.0 V	[2]	1.1	1.56	2.0	V
		V_{CC} = 3.6 V		1.1	1.81	2.0	V
V_{T-}	negative-going threshold	V_{CC} = 1.65 V		0.41	0.64	0.9	V
		V_{CC} = 1.95 V		0.49	0.76	1.1	V
		V_{CC} = 2.3 V		0.6	0.90	1.3	V
		V_{CC} = 2.7 V		0.7	1.06	1.4	V
		V_{CC} = 3.0 V	[2]	0.8	1.19	1.5	V
		V_{CC} = 3.6 V		0.8	1.42	1.7	V

Table 11: Transfer characteristics *…continued*

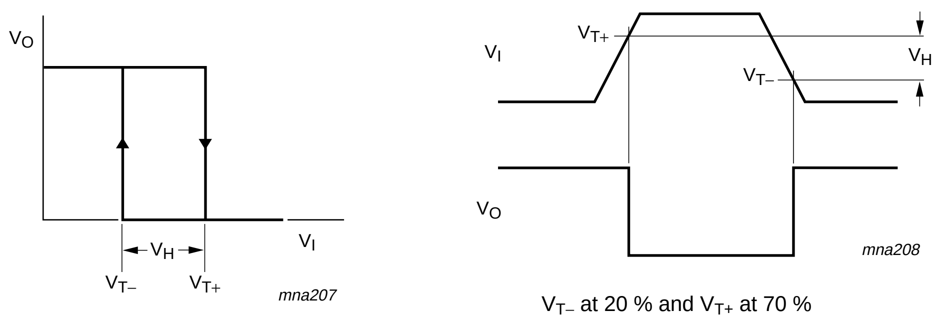
The V_{IH} and V_{IL} from the family static characteristics are superseded by the V_{T+} and V_{T-}.
Voltages are referenced to GND (ground = 0 V); see Figure 8.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_H	hysteresis ($V_{T+} - V_{T-}$)	V_{CC} = 1.65 V		0.25	0.34	0.62	V
		V_{CC} = 1.95 V		0.25	0.36	0.62	V
		V_{CC} = 2.3 V		0.3	0.36	1.0	V
		V_{CC} = 2.7 V		0.3	0.38	1.1	V
		V_{CC} = 3.0 V	[2]	0.3	0.37	1.2	V
		V_{CC} = 3.6 V		0.3	0.40	1.2	V

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

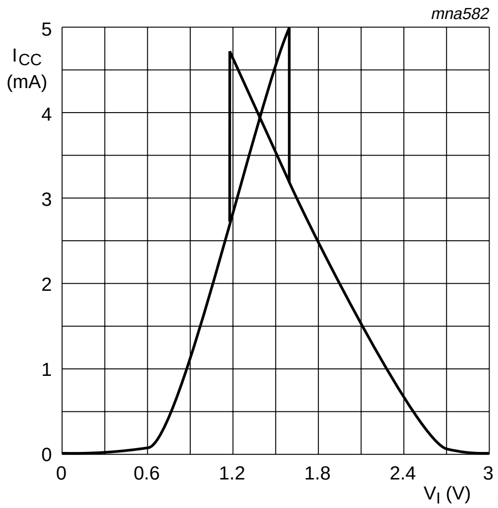
[2] The typical transfer characteristic is displayed in Figure 9.

14. Waveforms transfer characteristics



V_{T-} at 20 % and V_{T+} at 70 %

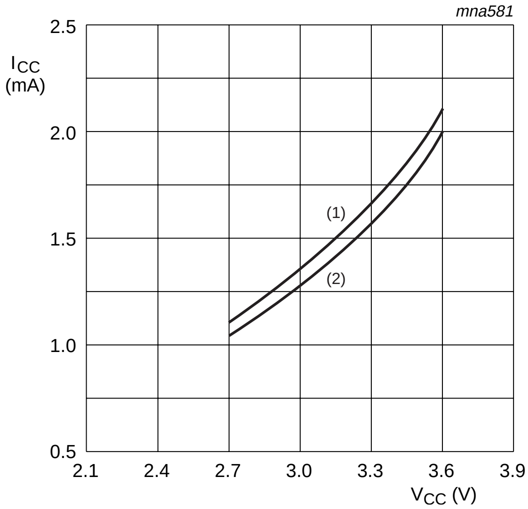
Fig 8. Definition of V_{T+}, V_{T-} and V_H



V_{CC} = 3.0 V.

Fig 9. Typical transfer characteristic

15. Application information



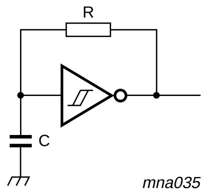
(1) Positive-going edge.

(2) Negative going-edge.

Linear change of V_I between 0.8 V to 2.0 V.

All values given are typical unless otherwise specified.

Fig 10. Average supply current as a function of supply voltage

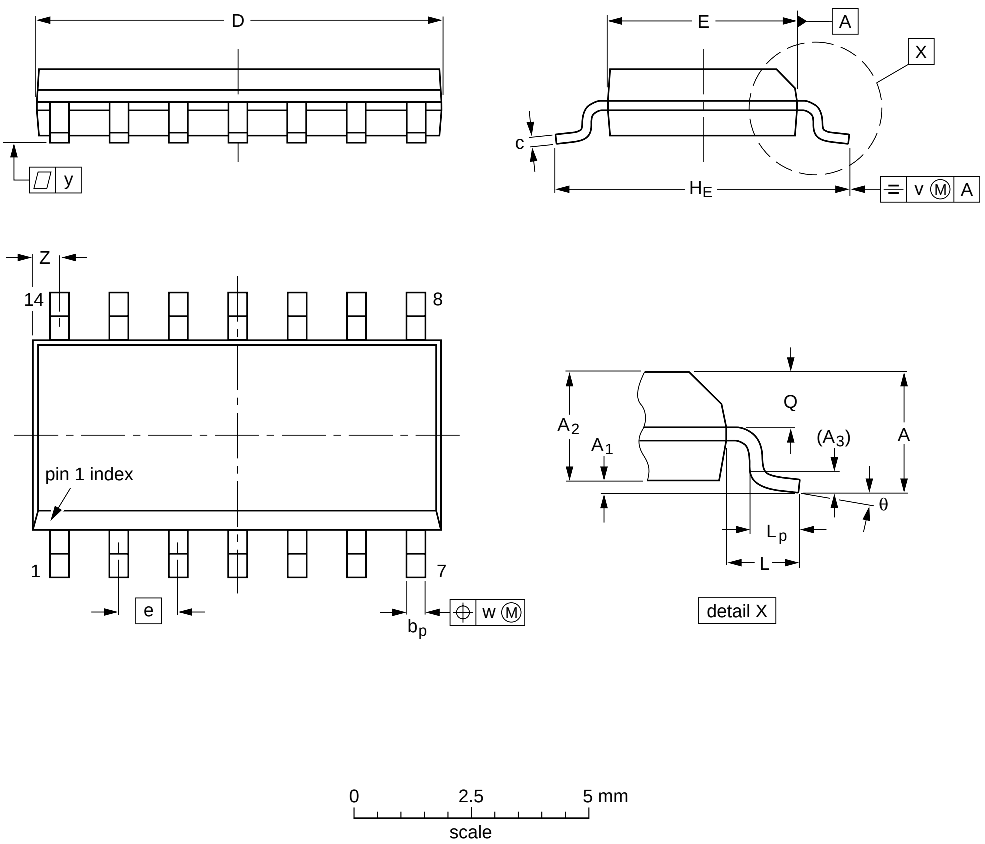


$$f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$$ at V_{CC} = 3.0 V.

Fig 11. Relaxation oscillator

16. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm **SOT108-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(1)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

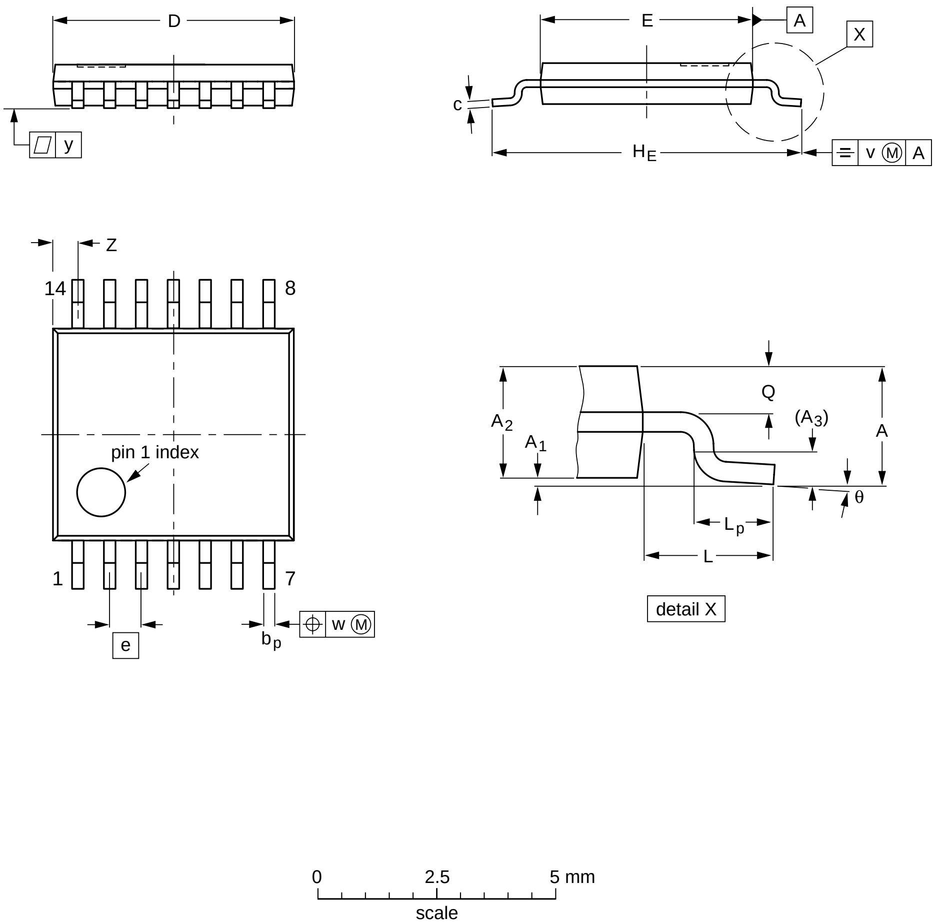
Note

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

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

Fig 12. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm **SOT402-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	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°

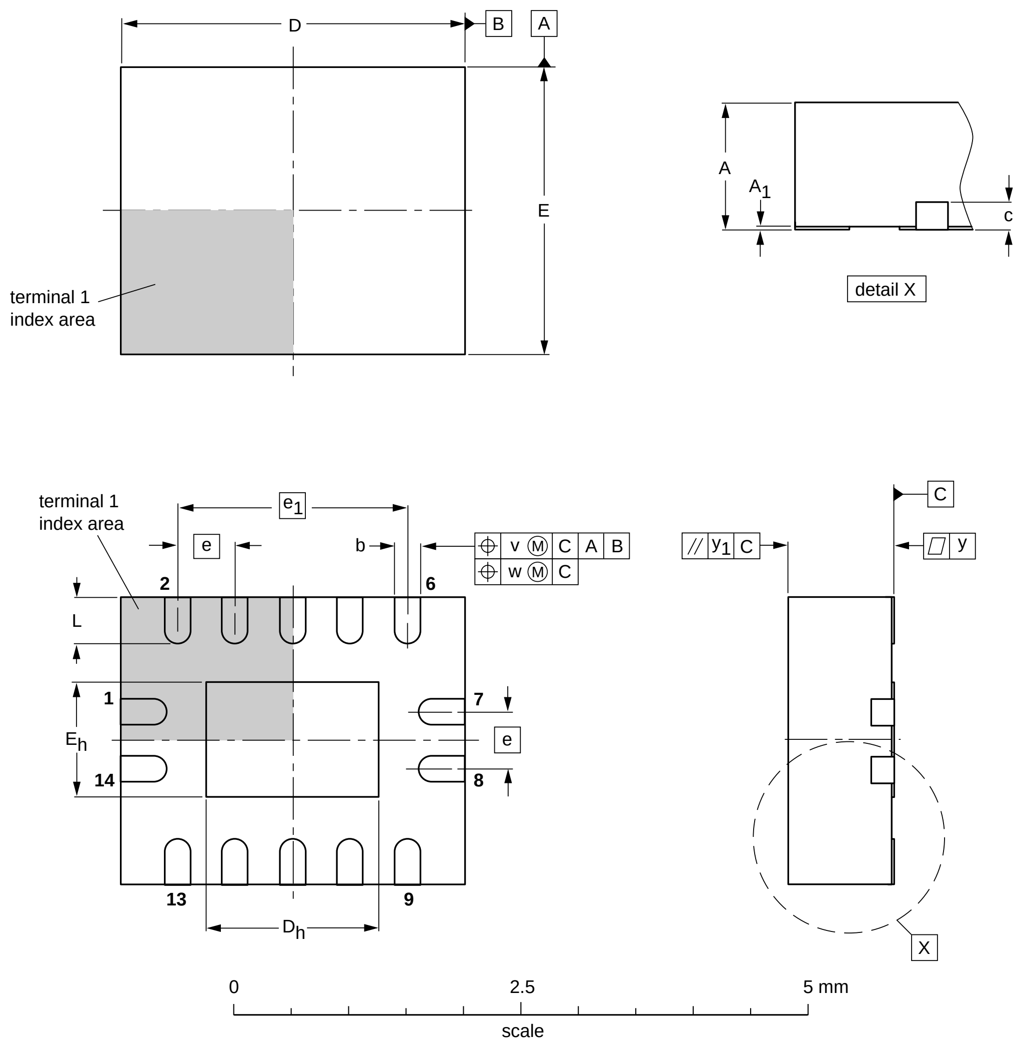
Notes

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 PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				~~99-12-27~~ 03-02-18

Fig 13. Package outline SOT402-1 (TSSOP14)

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max.	A_1	b	c	D(1)	D_h	E(1)	E_h	e	e_1	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	3.1 2.9	1.65 1.35	2.6 2.4	1.15 0.85	0.5	2	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

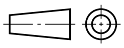
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT762-1	- - -	MO-241	- - -			~~02-10-17~~ 03-01-27

Fig 14. Package outline SOT762-1 (DHVQFN14)

17. Revision history

Table 12: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74ALVC14_3	20050215	Product data sheet	-	9397 750 14592	74ALVC14_2
Modifications:	• The format of this data sheet is redesigned to comply with the current presentation and information standard of Philips Semiconductors. • General text updates.				
74ALVC14_2	20030514	Product specification	-	9397 750 11257	74ALVC14_1
74ALVC14_1	20030203	Product specification	-	9397 750 10452	-

18. 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.

19. Definitions

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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21. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

22. Contents

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