

# 74F38

## Quad 2-input NAND buffer (open collector)

Rev. 3 — 10 January 2014

Product data sheet

### 1. General description

The 74F38 provides four 2-input NAND functions with open-collector outputs.

### 2. Features and benefits

- Industrial temperature range available (–40 °C to +85 °C)

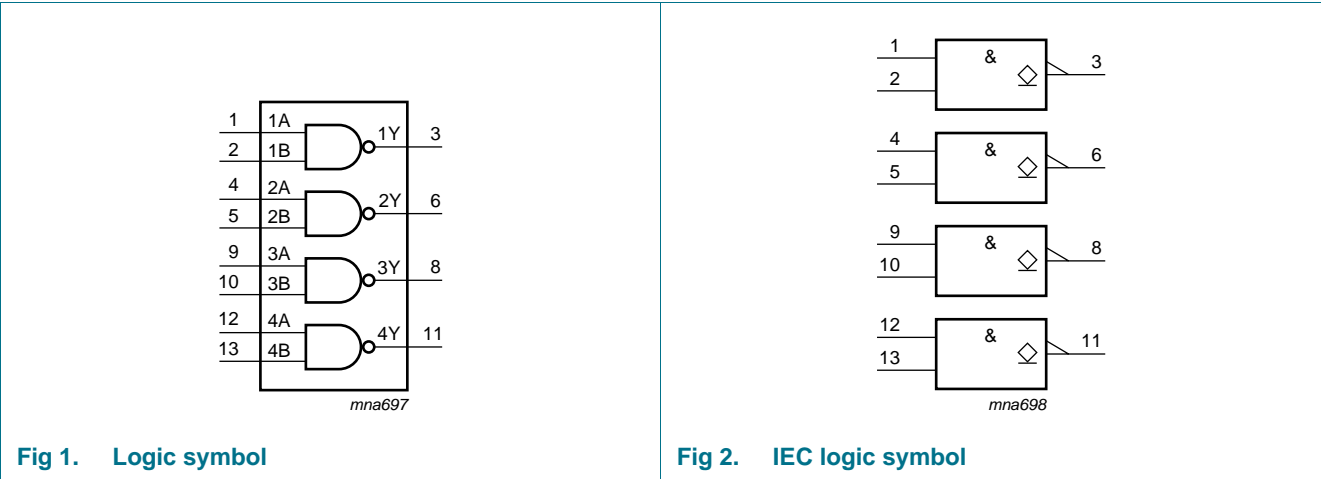
### 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
N74F38N	0 °C to +70 °C	DIP14	plastic dual in-line package; 14 leads (300 mil)	SOT27-1
I74F38N	–40 °C to +85 °C			
N74F38D	0 °C to +70 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
I74F38D	–40 °C to +85 °C			

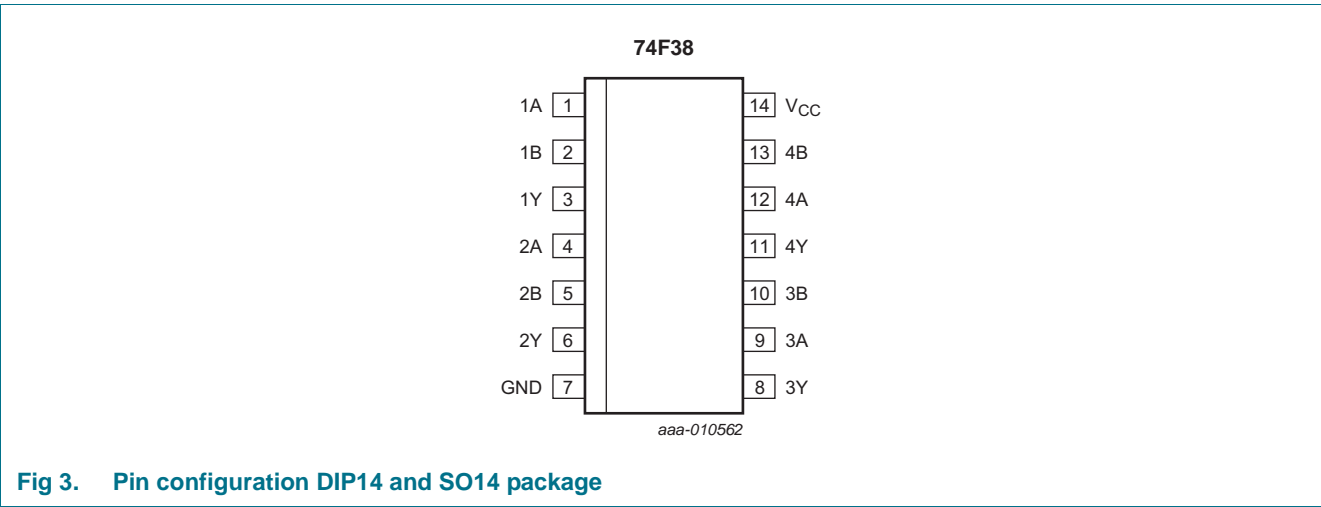


4. Functional diagram



5. Pinning information

5.1 Pinning



## 5.2 Pin description

**Table 2.** Pin description

Symbol	Pin	Description	Unit load HIGH/LOW	Load value <sup>[1][2]</sup> HIGH/LOW
1A, 2A, 3A, 4A	1, 4, 9, 12	data input	1.0/2.0	20 $\mu$ A/1.2 mA
1B, 2B, 3B, 4B	2, 5, 10, 13	data input	1.0/2.0	20 $\mu$ A/1.2 mA
1Y, 2Y, 3Y, 4Y	3, 6, 8, 11	data output	OC/106.7	OC/64 mA
GND	7	ground (0 V)	-	-
V <sub>CC</sub>	14	supply voltage	-	-

[1] One FAST Unit Load (UL) is defined as 20  $\mu$ A in HIGH state, 0.6 mA in LOW state.

[2] OC = open collector.

## 6. Functional description

**Table 3.** Function table<sup>[1]</sup>

Input		Output
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
V <sub>I</sub>	input voltage		<sup>[1]</sup> -0.5	+7.0	V
V <sub>O</sub>	output voltage	output in HIGH-state	<sup>[1]</sup> -0.5	V <sub>CC</sub>	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-30	+5	mA
I <sub>O</sub>	output current	output in LOW-state	-	128	mA
T <sub>amb</sub>	ambient temperature	in free-air	<sup>[2]</sup>		
		commercial	0	70	°C
		industrial	-40	+85	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$V_{OH}$	HIGH-level output voltage		-	-	4.5	V
$I_{IK}$	input clamping current		-18	-	-	mA
$I_{OL}$	LOW-level output current		-	-	64	mA

## 9. Static characteristics

**Table 6. Static characteristics**

Symbol	Parameter	Conditions	25 °C			0 °C to +70 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$V_{IK}$	input clamping voltage	$V_{CC} = 4.5\text{ V}$ ; $I_{IK} = -18\text{ mA}$	-1.2	-0.73	-	-1.2	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 4.5\text{ V}$ ; $V_{IL} = 0.8\text{ V}$ ; $V_{IH} = 2.0\text{ V}$ $I_{OL} = 64\text{ mA}$						
		$V_{CC} = \pm 10\%$	-	-	-	-	0.55	V
		$V_{CC} = \pm 5\%$	-	0.42	-	-	0.55	V
$I_I$	input leakage current	$V_{CC} = 0\text{ V}$ ; $V_I = 7.0\text{ V}$	-	-	-	-	100	$\mu\text{A}$
$I_{IH}$	HIGH-level input current	$V_{CC} = 5.5\text{ V}$ ; $V_I = 2.7\text{ V}$	-	-	-	-	20	$\mu\text{A}$
$I_{IL}$	LOW-level input current	$V_{CC} = 5.5\text{ V}$ ; $V_I = 0.5\text{ V}$	-	-	-	-20	-	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 5.5\text{ V}$						
		$V_I = \text{GND}$	-	4	-	-	7	mA
		$V_I = 4.5\text{ V}$	-	22	-	-	30	mA

[1] All typical values are measured at  $V_{CC} = 5\text{ V}$ .

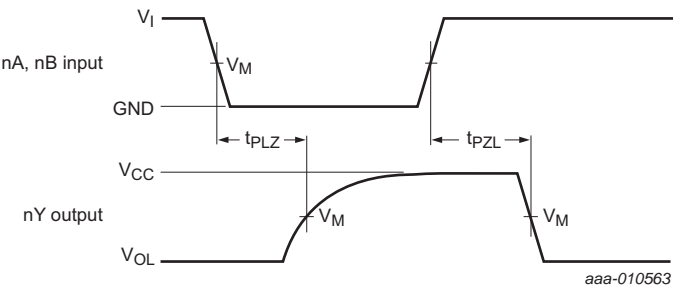
## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ . Test circuit is shown in [Figure 6](#).

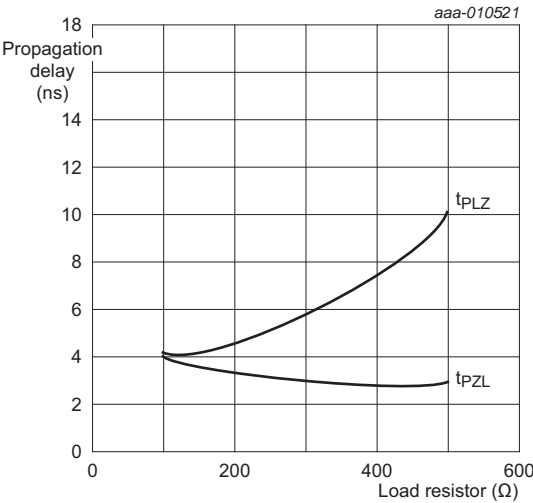
Symbol	Parameter	Conditions	25 °C; $V_{CC} = 5.0\text{ V}$			0 °C to +70 °C; $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$		-40 °C to +85 °C; $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_{PZL}$	OFF-state to LOW propagation delay	nA, nB to nY; see <a href="#">Figure 4</a>	1.5	3.0	5.0	1.5	5.5	1.5	6.0	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	nA, nB to nY; see <a href="#">Figure 4</a>	7.5	10.0	12.5	7.5	13.0	7.5	14.5	ns

11. Waveforms



$V_M = 1.5\text{ V}$   
 $V_{OL}$  is a typical output voltage level that occurs with the output load.

Fig 4. Propagation delay for inverting outputs



When using open collector parts, the value of the pull-up resistor greatly affects the value of the  $t_{PLZ}$ . For example, changing the specified pull-up resistor value from 500  $\Omega$  to 100  $\Omega$  improves the  $t_{PLZ}$  up to 50% with only a slight increase in the  $t_{PZL}$ . However, if the value of the pull-up resistor is changed, the user must ensure that the total  $I_{OL}$  current through the resistor and the total  $I_{IL}$  of the receivers, does not exceed the  $I_{OL}$  minimum specification.

Fig 5. Typical propagation delays versus load for open collector outputs

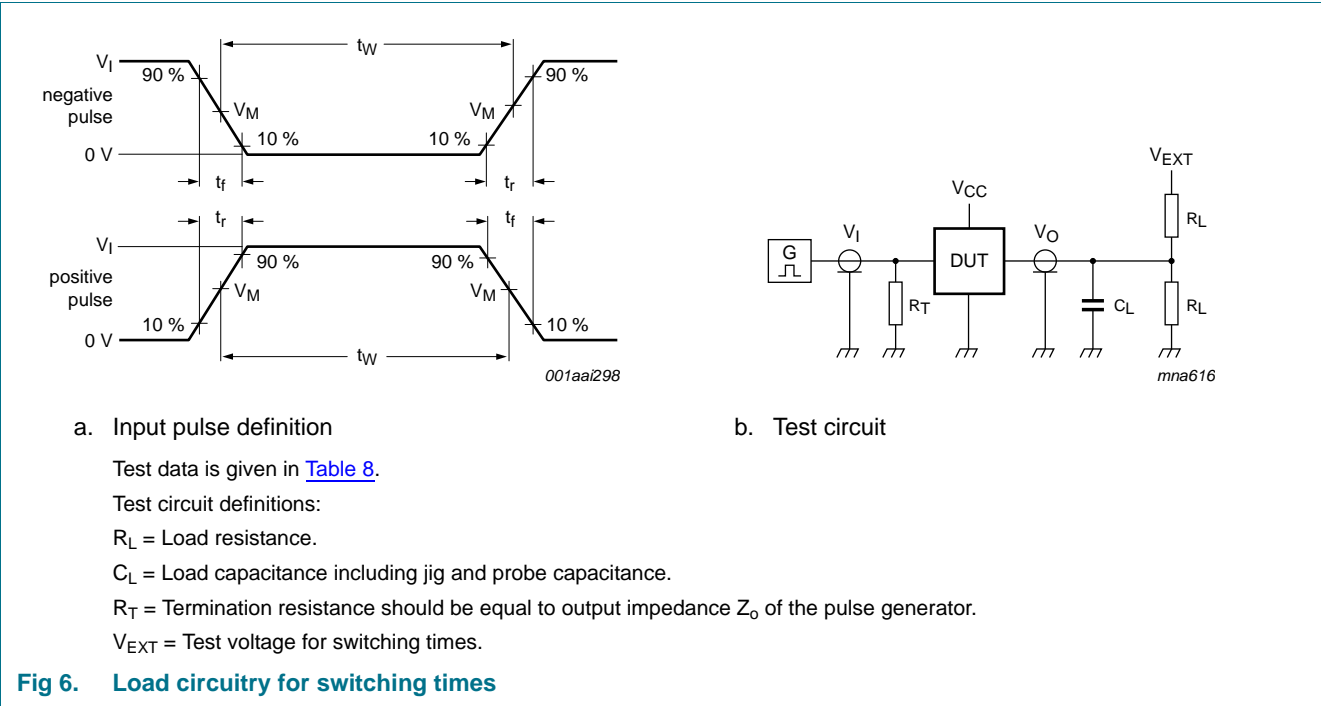


Fig 6. Load circuitry for switching times

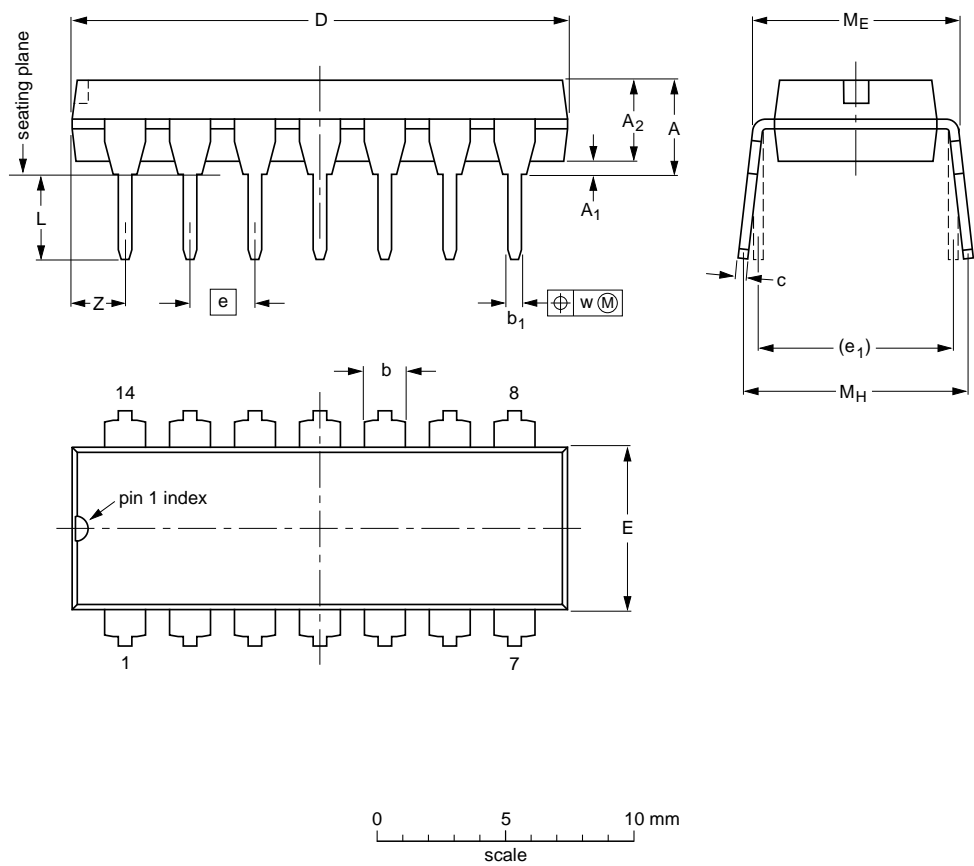
Table 8. Test data

Input				Load		$V_{EXT}$
$V_I$	$f_i$	$t_W$	$t_r, t_f$	$C_L$	$R_L$	$t_{PZL}, t_{PLZ}$
3.0 V	1 MHz	500 ns	$\leq 2.5$ ns	50 pF	500 $\Omega$	7.0 V

12. Package outline

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1



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

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.02	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

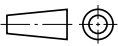
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT27-1	050G04	MO-001	SC-501-14			99-12-27 03-02-13

Fig 7. Package outline SOT27-1 (DIP14)

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

SOT108-1

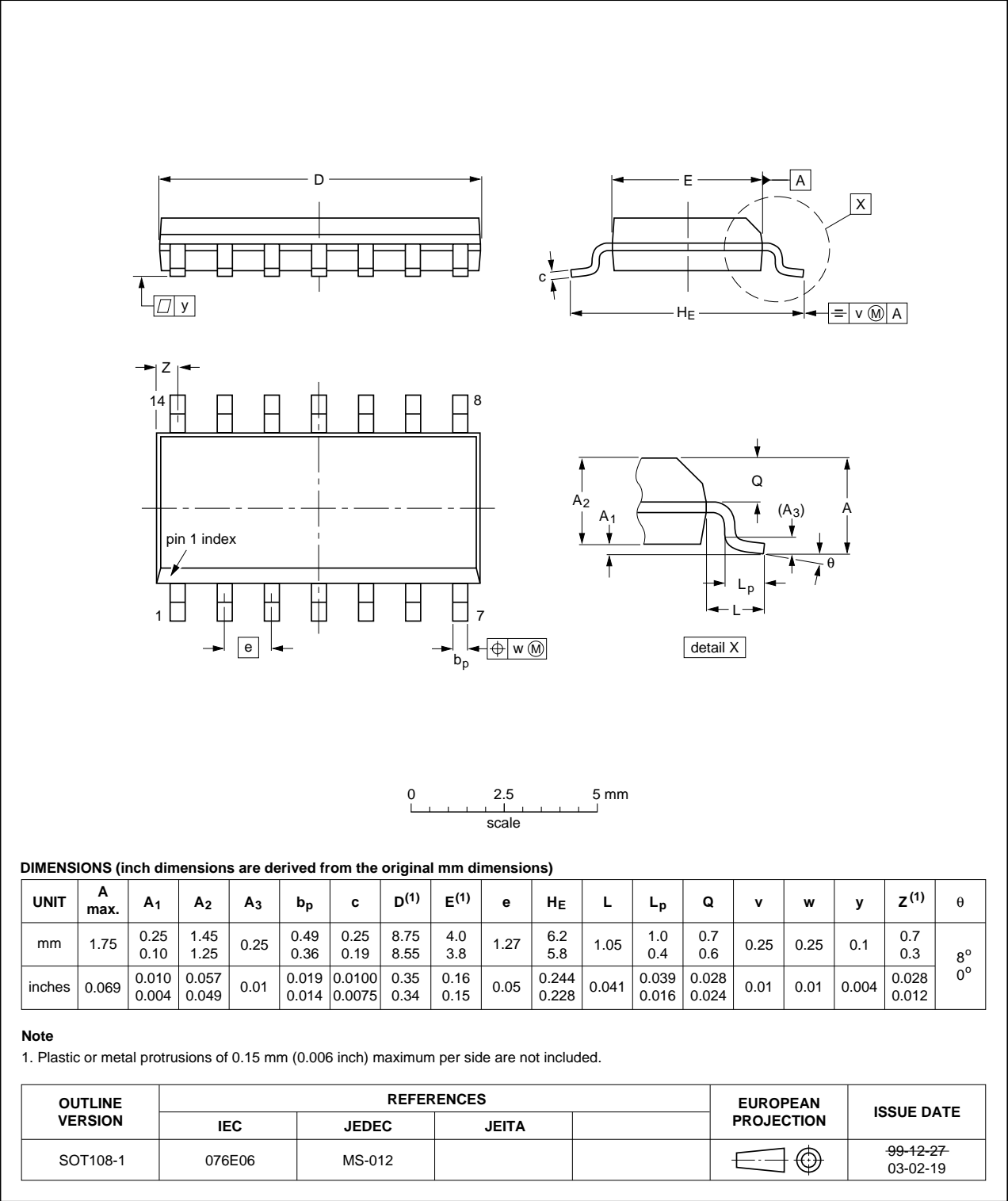


Fig 8. Package outline SOT108-1 (SO14)



## 13. Abbreviations

Table 9. Abbreviations

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

## 14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74F38 v.3	20140110	Product data sheet	-	74F38 v.2
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• General update of values</li></ul>			
74F38 v.2	19901004	Product specification	-	-

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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".

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