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

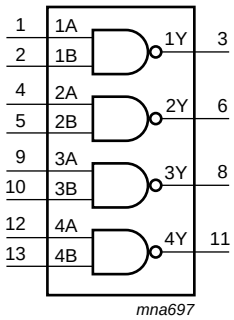


Fig 1. Logic symbol

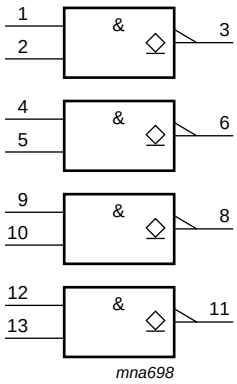


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning

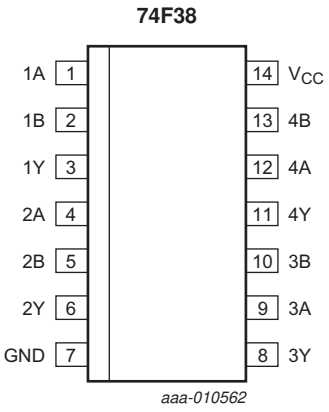


Fig 3. Pin configuration DIP14 and SO14 package

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description	Unit load HIGH/LOW	Load value[1][2] HIGH/LOW
1A, 2A, 3A, 4A	1, 4, 9, 12	data input	1.0/2.0	20 μA/1.2 mA
1B, 2B, 3B, 4B	2, 5, 10, 13	data input	1.0/2.0	20 μA/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_{CC}	14	supply voltage	-	-

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

[2] OC = open collector.

6. Functional description

Table 3. Function table[1]

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_{CC}	supply voltage			−0.5	+7.0	V
V_I	input voltage		[1]	−0.5	+7.0	V
V_O	output voltage	output in HIGH-state	[1]	−0.5	V_{CC}	V
I_{IK}	input clamping current	$V_I < 0$ V		−30	+5	mA
I_O	output current	output in LOW-state		-	128	mA
T_{amb}	ambient temperature	in free-air	[2]			
		commercial		0	70	°C
		industrial		−40	+85	°C
T_{stg}	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[1]	Max	Min	Max	
V_{IK}	input clamping voltage	V_{CC} = 4.5 V; I_{IK} = –18 mA	–1.2	–0.73	-	–1.2	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 4.5 V; V_{IL} = 0.8 V; V_{IH} = 2.0 V						
		I_{OL} = 64 mA						
		V_{CC} = ±10 %	-	-	-	-	0.55	V
		V_{CC} = ±5 %	-	0.42	-	-	0.55	V
I_I	input leakage current	V_{CC} = 0 V; V_I = 7.0 V	-	-	-	-	100	µA
I_{IH}	HIGH-level input current	V_{CC} = 5.5 V; V_I = 2.7 V	-	-	-	-	20	µA
I_{IL}	LOW-level input current	V_{CC} = 5.5 V; V_I = 0.5 V	-	-	-	–20	-	µA
I_{CC}	supply current	V_{CC} = 5.5 V						
		V_I = GND	-	4	-	-	7	mA
		V_I = 4.5 V	-	22	-	-	30	mA

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

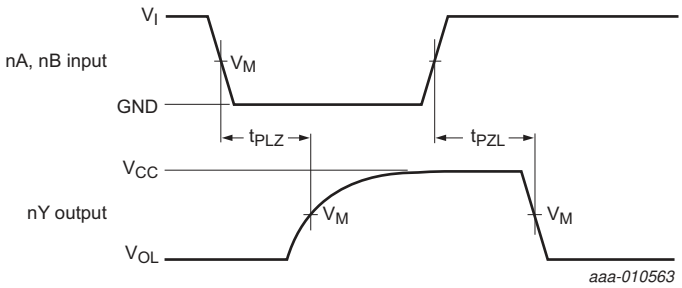
10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V. Test circuit is shown in Figure 6.

Symbol	Parameter	Conditions	25 °C; V_{CC} = 5.0 V			0 °C to +70 °C; V_{CC} = 5.0 V ± 0.5 V		–40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{PZL}	OFF-state to LOW propagation delay	nA, nB to nY; see Figure 4	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 Figure 4	7.5	10.0	12.5	7.5	13.0	7.5	14.5	ns

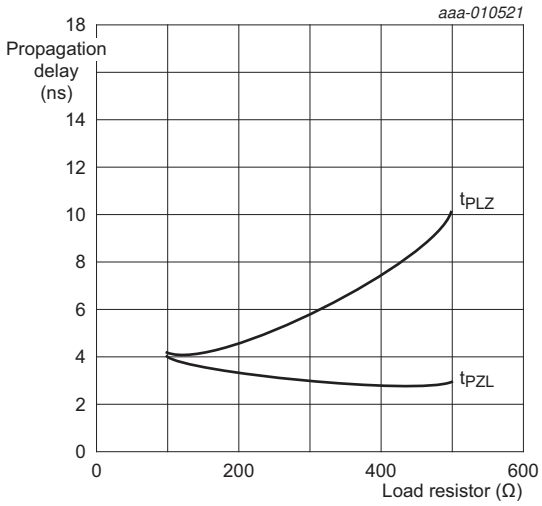
11. Waveforms



V_M = 1.5 V

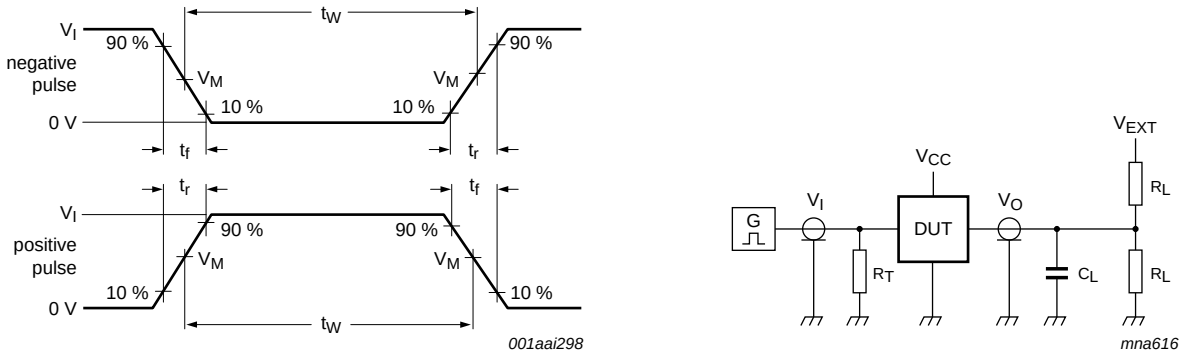
VOL is a typical output voltage level that occurs with the output load.

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 Ω to 100 Ω 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



a. Input pulse definition

b. Test circuit

Test data is given in Table 8.

Test circuit definitions:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

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

V_{EXT} = Test voltage for switching times.

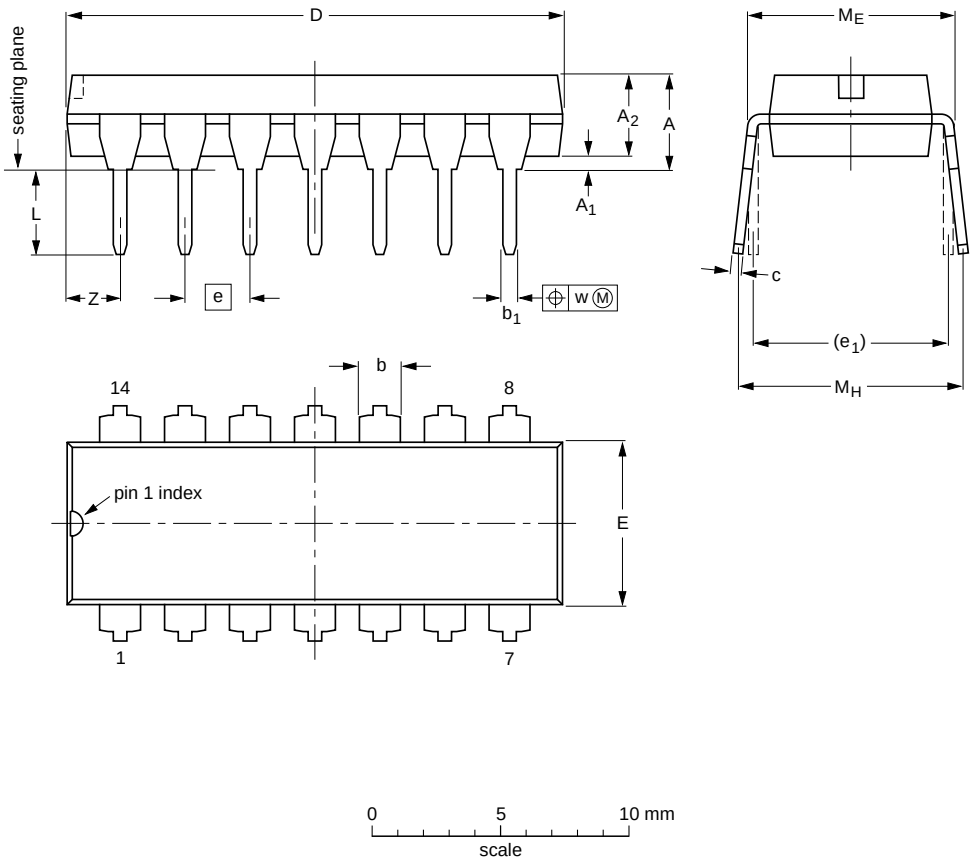
Fig 6. Load circuitry for switching times

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	≤ 2.5 ns	50 pF	500 Ω	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_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) 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

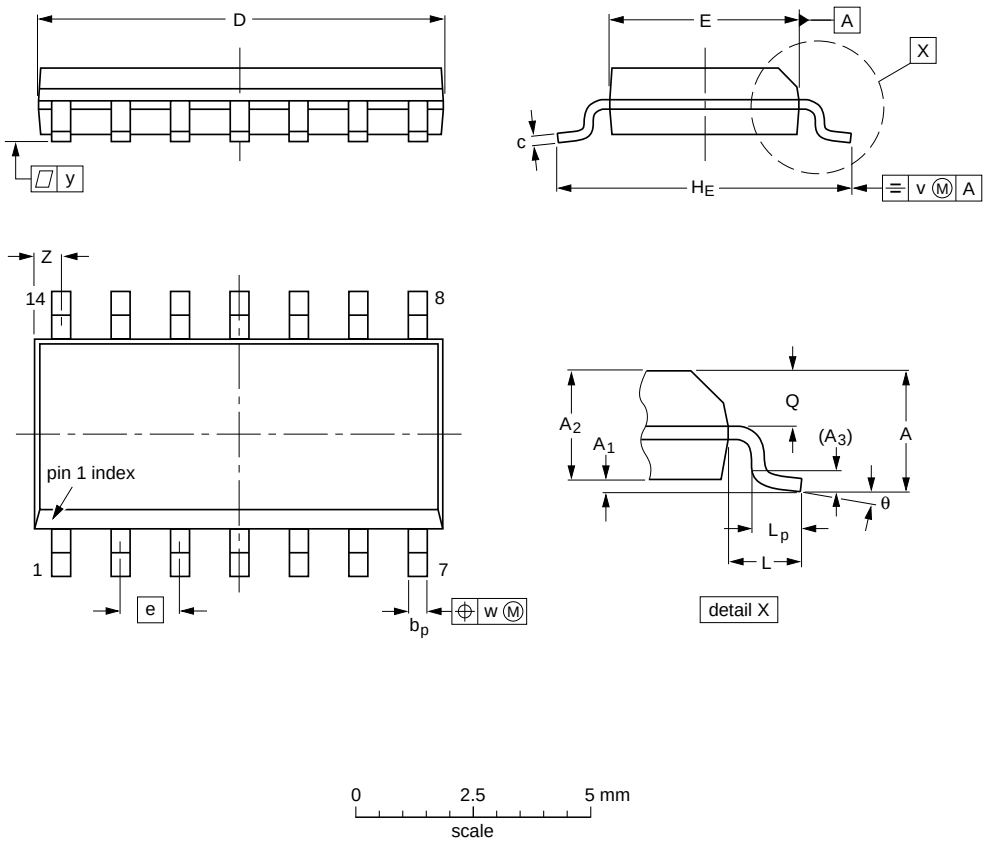
Note

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**



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^o 0^o
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 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:	• 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. • General update of values			
74F38 v.2	19901004	Product specification	-	-

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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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17. Contents

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