

DATA SHEET

74F86

Quad 2-input exclusive-OR gate

Product specification

1990 Feb 09

IC15 Data Handbook

Quad 2-input Exclusive-OR gate

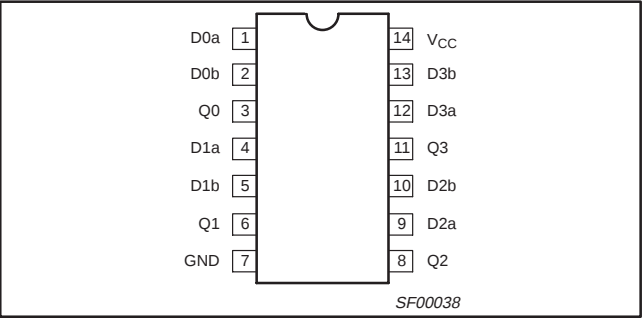
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FEATURE

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

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F86	4.3ns	16.5mA

PIN CONFIGURATION



ORDERING INFORMATION

DESCRIPTION	ORDER CODE		PKG DWG #
	COMMERCIAL RANGE V _{CC} = 5V ±10%, T _{amb} = 0°C to +70°C	INDUSTRIAL RANGE V _{CC} = 5V ±10%, T _{amb} = −40°C to +85°C	
14-pin plastic DIP	N74F86N	I74F86N	SOT27-1
14-pin plastic SO	N74F86D	I74F86D	SOT108-1

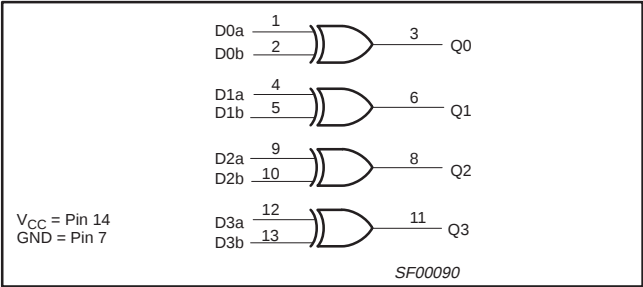
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
Dna, Dnb	Data inputs	1.0/1.0	20µA/0.6mA
Qn	Data output	50/33	1.0mA/20mA

NOTE:

- One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

LOGIC DIAGRAM



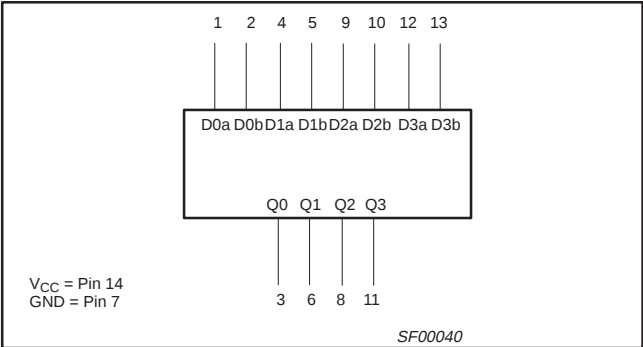
FUNCTION TABLE

INPUTS		OUTPUT
Dna	Dnb	Qn
L	L	L
L	H	H
H	L	H
H	H	L

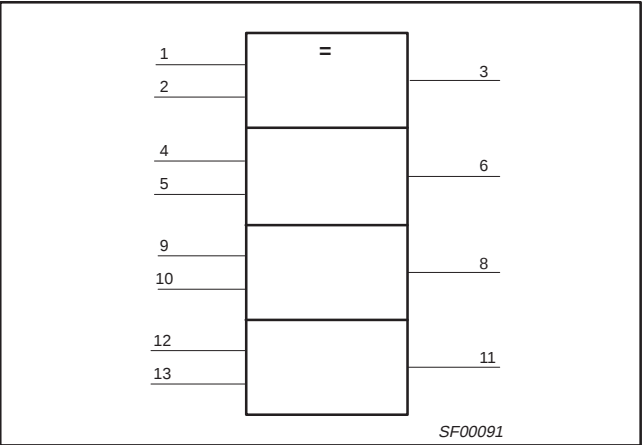
NOTES:

- H = High voltage level
L = Low voltage level

LOGIC SYMBOL



IEC/IEEE SYMBOL



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ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER		RATING	UNIT
V_{CC}	Supply voltage		-0.5 to +7.0	V
V_{IN}	Input voltage		-0.5 to +7.0	V
I_{IN}	Input current		-30 to +5	mA
V_{OUT}	Voltage applied to output in High output state		-0.5 to V_{CC}	V
I_{OUT}	Current applied to output in Low output state		40	mA
T_{amb}	Operating free-air temperature range	Commercial range	0 to +70	°C
		Industrial range	-40 to +85	°C
T_{stg}	Storage temperature range		-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
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
I_{IK}	Input clamp current			-18	mA
I_{OH}	High-level output current			-1	mA
I_{OL}	Low-level output current			20	mA
T_{amb}	Operating free-air temperature range	Commercial range	0	+70	°C
		Industrial range	-40	+85	°C

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS ¹		LIMITS			UNIT
				MIN	TYP ²	MAX	
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$	$\pm 10\%V_{CC}$	2.5			V
		$V_{IH} = \text{MIN}, I_{OH} = \text{MAX}$	$\pm 5\%V_{CC}$	2.7	3.4		V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$	$\pm 10\%V_{CC}$		0.30	0.50	V
		$V_{IH} = \text{MIN}, I_{OL} = \text{MAX}$	$\pm 5\%V_{CC}$		0.30	0.50	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = I_{IK}$			-0.73	-1.2	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7.0\text{V}$				100	μA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7\text{V}$				20	μA
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.5\text{V}$				-0.6	mA
I_{OS}	Short-circuit output current ³	$V_{CC} = \text{MAX}$		-60		-150	mA
I_{CC}	Supply current (total)	I_{CCH} $V_{CC} = \text{MAX}$	D0a = GND, D0b = 4.5V		15	23	mA
		I_{CCL} $V_{CC} = \text{MAX}$	$V_{IN} = 4.5\text{V}$		18	28	mA

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at $V_{CC} = 5\text{V}$, $T_{amb} = 25^\circ\text{C}$.
- Not more than one output should be shorted at a time. For testing I_{OS} , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

Quad 2-input Exclusive-OR gate

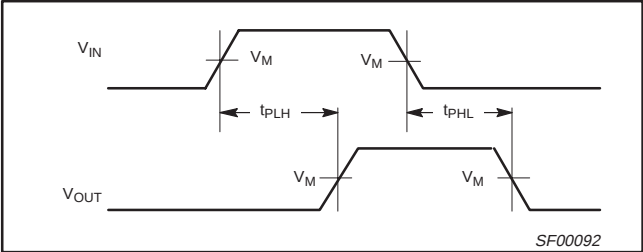
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AC ELECTRICAL CHARACTERISTICS

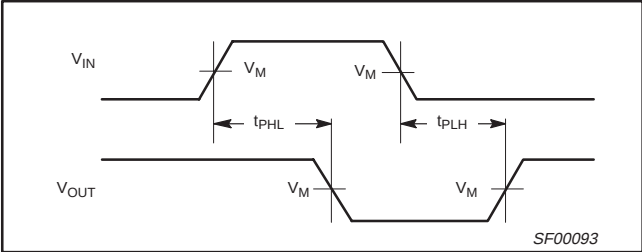
SYMBOL	PARAMETER	TEST CONDITION	LIMITS							UNIT
			V _{CC} = +5.0V T _{amb} = +25°C C _L = 50pF R _L = 500Ω			V _{CC} = +5.0V ± 10% T _{amb} = 0°C to +70°C C _L = 50pF R _L = 500Ω		V _{CC} = +5.0V ± 10% T _{amb} = -40°C to +85°C C _L = 50pF R _L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH} t _{PHL}	Propagation delay Dna or Dnb to Qn (other input Low)	Waveform 1	3.0 3.0	4.0 4.2	5.5 5.5	3.0 3.0	6.5 6.5	3.0 2.5	7.0 8.0	ns
t _{PLH} t _{PHL}	Propagation delay Dna or Dnb to Qn (other input High)	Waveform 2	3.5 3.0	5.3 4.7	7.0 6.5	3.5 3.0	8.0 7.5	3.5 3.0	10.0 8.0	ns

AC WAVEFORMS

For all waveforms, $V_M = 1.5V$.



Waveform 1. Propagation Delay for Non-Inverting Outputs



Waveform 2. Propagation Delay for Inverting Outputs

TEST CIRCUIT AND WAVEFORMS

Test Circuit for Totem-Pole Outputs

Input Pulse Definition

DEFINITIONS:

R_L = Load resistor;
see AC ELECTRICAL CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance;
see AC ELECTRICAL CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of
pulse generators.

family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

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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	0.020	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	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 maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT27-1	050G04	MO-001AA				92-11-17 95-03-11

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

SOT108-1



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NOTES

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Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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