74HC86; 74HCT86

Quad 2-input EXCLUSIVE-OR gate Rev. 4 — 4 December 2015

Product data sheet

General description 1.

The 74HC86; 74HCT86 is a quad 2-input EXCLUSIVE-OR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

Features and benefits 2.

Input levels:

◆ For 74HC86: CMOS level ◆ For 74HCT86: TTL level

- Complies with JEDEC standard no. 7A
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ♦ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

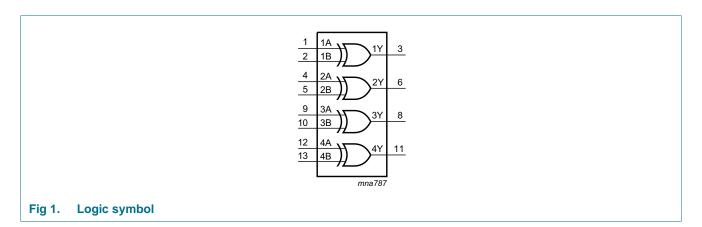
Ordering information 3.

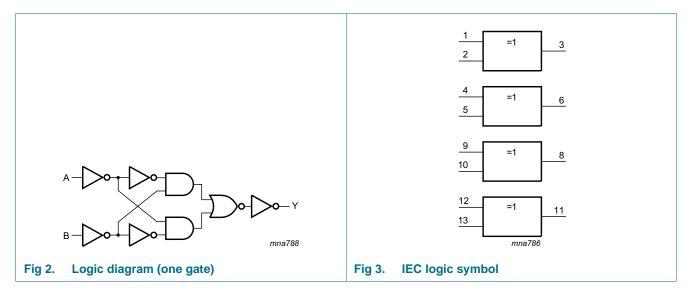
Table 1. **Ordering information**

Type number	Package								
	Temperature range	Name	Description	Version					
74HC86D	−40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width	SOT108-1					
74HCT86D	-		3.9 mm						
74HC86DB	−40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body	SOT337-1					
74HCT86DB	-		width 5.3 mm						
74HC86PW	-40 °C to +125 °C TSSOP14		plastic thin shrink small outline package; 14 leads;	SOT402-1					
74HCT86PW	-		body width 4.4 mm						



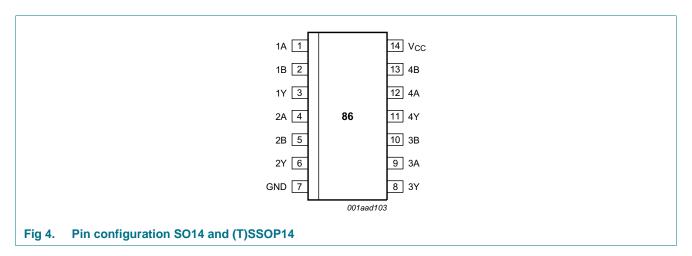
4. Functional diagram





5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table[1]

Input nA	Input nB	Output nY
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

^[1] H = HIGH voltage level;

L = LOW voltage level.

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	V
I _{IK}	input clamping current	$V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$	<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	mA
Io	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±25	mA
I _{CC}	supply current			-	50	mA
I _{GND}	ground current			-50	-	mA
T _{stg}	storage temperature			- 65	+150	°C
P _{tot}	total power dissipation	SO14, and (T)SSOP14 packages	[2]	-	500	mW

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

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions		74HC86			74HCT86		
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	Vcc	V
Vo	output voltage		0	-	V _{CC}	0	-	Vcc	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5 \text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0 \text{ V}$	-	-	83	-	-	-	ns/V

^[2] For SO14 package: P_{tot} derates linearly with 8 mW/K above 70 °C. For (T)SSOP14 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

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 t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC86							I			
V _{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = -20 \mu A$; $V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20 \mu A$; $V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20 \mu A; V_{CC} = 6.0 V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = 20 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 6.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		$I_O = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1	-	±1	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
Cı	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT8	6						1			
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	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 = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}$	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = 20 μA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 5.2 mA	-	0.15	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1	-	±1	μΑ

 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 to +125 °C		Unit	
			Min	Тур	Max	Min	Max	Min	Max	
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; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	100	360	-	450	-	490	μА
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

 $GND = 0 \ V; \ C_L = 50 \ pF;$ for test circuit see <u>Figure 6</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C to	+125 °C	Unit
				Min	Тур	Max	Max (85 °C)	Max (125 °C)	
74HC86									
t _{pd}	propagation delay	nA, nB to nY; see Figure 5	<u>[1]</u>						
	V _{CC} = 2.0 V		-	39	120	150	180	ns	
		V _{CC} = 4.5 V		-	14	24	30	36	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	11	-	-	-	ns
		V _{CC} = 6.0 V		-	11	20	26	31	ns
t _t	transition time	see Figure 5	[2]						
		V _{CC} = 2.0 V		-	19	75	95	110	ns
		V _{CC} = 4.5 V		-	7	15	19	22	ns
		V _{CC} = 6.0 V		-	6	13	16	19	ns
C _{PD}	power dissipation capacitance	per package; $V_I = GND$ to V_{CC}	[3]	-	30	-	-	-	pF

Table 7. Dynamic characteristics ...continued GND = 0 V; $C_L = 50$ pF; for test circuit see Figure 6.

Symbol	Parameter	Conditions			25 °C		-40 °C to	-40 °C to +125 °C		
				Min	Тур	Max	Max (85 °C)	Max (125 °C)		
74HCT86	6									
t _{pd} propagation del	propagation delay	nA, nB to nY; see Figure 5	<u>[1]</u>							
		V _{CC} = 4.5 V		-	17	32	40	48	ns	
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	14	-	-	-	ns	
t _t	transition time	V _{CC} = 4.5 V; see Figure 5	[2]	-	7	15	19	22	ns	
C _{PD}	power dissipation capacitance	per package; V _I = GND to V _{CC} – 1.5 V	<u>[3]</u>	-	30	-	-	-	pF	

- [1] t_{pd} is the same as t_{PHL} and t_{PLH} .
- [2] t_t is the same as t_{THL} and t_{TLH} .
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

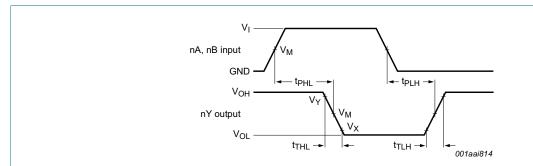
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11. Waveforms



Measurement points are given in Table 9.

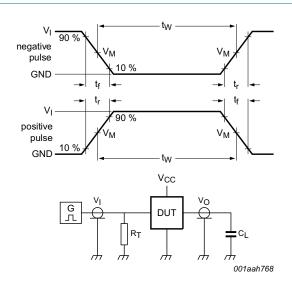
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 5. Input to output propagation delays

Table 8. Measurement points

Туре	Input	Output					
	V _M	V _M	V _X	V _Y			
74HC86	0.5V _{CC}	0.5V _{CC}	0.1V _{CC}	0.9V _{CC}			
74HCT86	1.3 V	1.3 V	0.1V _{CC}	0.9V _{CC}			

74HC_HCT86



Test data is given in Table 9.

Definitions test circuit:

 R_T = termination resistance should be equal to output impedance Z_0 of the pulse generator.

 C_L = load capacitance including jig and probe capacitance.

Fig 6. Test circuit for measuring switching times

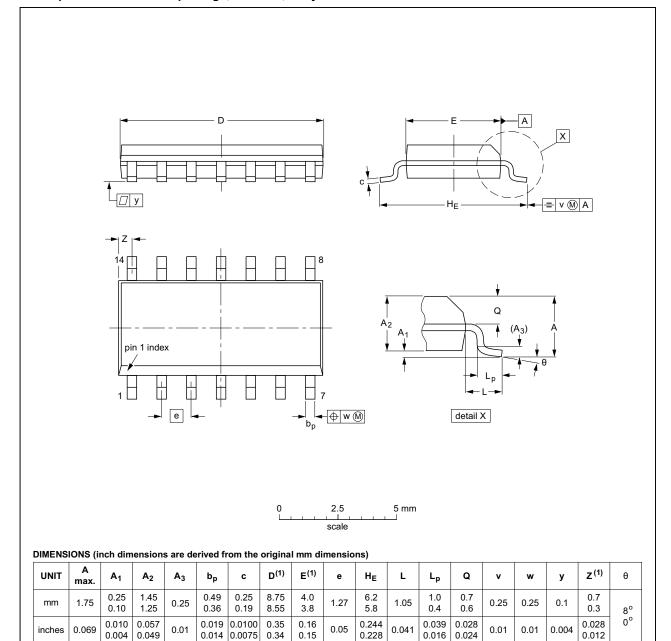
Table 9. Test data

Туре	Input		Load	Test
	VI	t _r , t _f	CL	
74HC86	V _{CC}	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}
74HCT86	3.0 V	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}

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

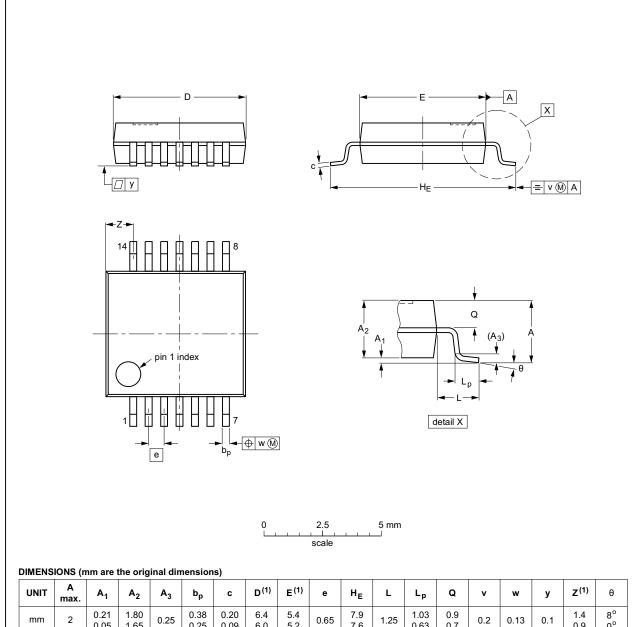
Fig 7. Package outline SOT108-1 (SO14)

74HC_HCT86

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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



-							-,												
	UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
	mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT337-1		MO-150				99-12-27 03-02-19

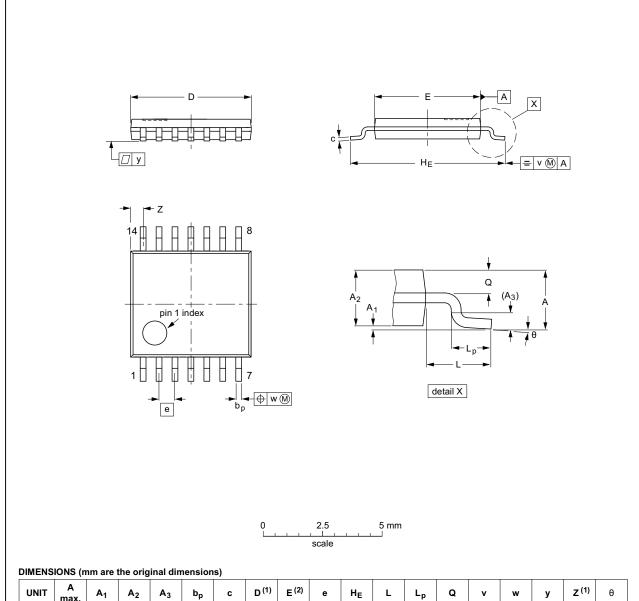
Package outline SOT337-1 (SSOP14)

74HC_HCT86

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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°

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

Fig 9. Package outline SOT402-1 (TSSOP14)

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13. Abbreviations

Table 10. Abbreviations

Acronym	Description
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 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74HC_HCT86 v.4	20151204	Product data sheet	-	74HC_HCT86 v.3			
Modifications:	Type numbers 74HC	86N and 74HCT86N (SO	T27-1) removed.				
74HC_HCT86 v.3	20120827	Product data sheet	-	74HC_HCT86_CNV 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. 						
74HC_HCT86_CNV v.2	19970918	Product specification	-	-			

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"
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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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