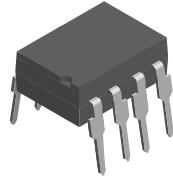
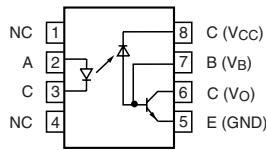


# High Speed Optocoupler, 1 MBd, Photodiode with Transistor Output



I179081



## DESCRIPTION

The 6N135 and 6N136 are optocouplers with a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector which consists of a photo diode and a high-speed transistor in a DIP-8 plastic package.

Signals can be transmitted between two electrically separated circuits up to frequencies of 2.0 MHz. The potential difference between the circuits to be coupled should not exceed the maximum permissible reference voltages.

## FEATURES

- Isolation test voltages: 5300 V<sub>RMS</sub>
- TTL compatible
- High bit rates: 1.0 Mbit/s
- High common-mode interference immunity
- Bandwidth 2.0 MHz
- Open-collector output
- External base wiring possible
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



e3

RoHS  
COMPLIANT

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 available with option 1
- CSA 93751

## ORDER INFORMATION

PART	REMARKS
6N135	CTR ≥ 7 %, DIP-8
6N136	CTR ≥ 19 %, DIP-8
6N135-X007	CTR ≥ 7 %, SMD-8 (option 7)
6N136-X006	CTR ≥ 19 %, DIP-8 400 mil (option 6)
6N136-X007	CTR ≥ 19 %, SMD-8 (option 7)
6N136-X009	CTR ≥ 19 %, SMD-8 (option 9)

### Note

For additional information on the available options refer to option information.

## ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	5.0	V
Forward current		I <sub>F</sub>	25	mA
Peak forward current	t = 1.0 ms, duty cycle 50 %	I <sub>FSM</sub>	50	mA
Maximum surge forward current	t ≤ 1.0 μs, 300 pulses/s		1.0	A
Thermal resistance		R <sub>th</sub>	700	K/W
Power dissipation	T <sub>amb</sub> = 70 °C	P <sub>diss</sub>	45	mW
<b>OUTPUT</b>				
Supply voltage		V <sub>S</sub>	- 0.5 to 15	V
Output voltage		V <sub>O</sub>	- 0.5 to 15	V
Emitter base voltage		V <sub>EBO</sub>	5.0	V
Output current		I <sub>O</sub>	8.0	mA
Maximum Output current			16	mA
Base current		I <sub>B</sub>	5.0	mA
Thermal resistance			300	K/W
Power dissipation	T <sub>amb</sub> = 70 °C	P <sub>diss</sub>	100	mW



ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>COUPLER</b>				
Isolation test voltage (between emitter and detector climate per DIN 50014 part 2, Nov. 74)	t = 1.0 s	V <sub>ISO</sub>	5300	V <sub>RMS</sub>
Pollution degree (DIN VDE 0109)			2.0	
Isolation resistance	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C	R <sub>IO</sub>	≥ 10 <sup>11</sup>	Ω
Storage temperature range		T <sub>stg</sub>	- 55 to + 125	°C
Ambient temperature range		T <sub>amb</sub>	- 55 to + 100	°C
Soldering temperature <sup>(2)</sup>	max. ≤ 10 s, dip soldering ≥ 0.5 mm from case bottom	T <sub>sld</sub>	260	°C

**Notes**

(1) T<sub>amb</sub> = 25 °C, unless otherwise specified. Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS <sup>(1)</sup>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	I <sub>F</sub> = 1.6 mA		V <sub>F</sub>		1.6	1.9	V
Breakdown voltage	I <sub>R</sub> = 10 μA		V <sub>BR</sub>	5.0			V
Reverse current	V <sub>R</sub> = 5.0 V		I <sub>R</sub>		0.5	10	μA
Capacitance	V <sub>R</sub> = 0 V, f = 1.0 MHz		C <sub>O</sub>		125		pF
Temperature coefficient, forward voltage	I <sub>F</sub> = 1.6 mA		ΔV <sub>F</sub> /ΔT <sub>A</sub>		- 1.7		mV/°C
<b>OUTPUT</b>							
Logic low supply current	I <sub>F</sub> = 1.6 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 15 V		I <sub>CCL</sub>		150		μA
Logic high supply current	I <sub>F</sub> = 0 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 15 V		I <sub>CCH</sub>		0.01	1	μA
Output voltage, output low	I <sub>F</sub> = 16 mA, I <sub>O</sub> = 1.1 mA, V <sub>CC</sub> = 4.5 V	6N135	V <sub>OL</sub>		0.1	0.4	V
	I <sub>F</sub> = 16 mA, I <sub>O</sub> = 2.4 mA, V <sub>CC</sub> = 4.5 V	6N136	V <sub>OL</sub>		0.1	0.4	V
Output current, output high	I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 5.5 V		I <sub>OH</sub>		3.0	500	nA
	I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 15 V		I <sub>OH</sub>		0.01	1	μA
<b>COUPLER</b>							
Capacitance (input to output)	f = 1.0 MHz		C <sub>IO</sub>		0.6		pF

**Note**

T<sub>amb</sub> = 25 °C, unless otherwise specified. Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

# 6N135/6N136

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## CURRENT TRANSFER RATIO

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio	$I_F = 16 \text{ mA}, V_O = 0.4 \text{ V}, V_{CC} = 4.5 \text{ V}$	6N135	CTR	7	16		%
		6N136	CTR	19	35		%
	$I_F = 16 \text{ mA}, V_O = 0.5 \text{ V}, V_{CC} = 4.5 \text{ V}$	6N135	CTR	5			%
		6N136	CTR	15			%

## SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High to low	$I_F = 16 \text{ mA}, V_{CC} = 5.0 \text{ V}, R_L = 4.1 \text{ k}\Omega$	6N135	$t_{PHL}$		0.3	1.5	$\mu\text{s}$
	$I_F = 16 \text{ mA}, V_{CC} = 5.0 \text{ V}, R_L = 1.9 \text{ k}\Omega$	6N136	$t_{PHL}$		0.2	0.8	$\mu\text{s}$
Low to high	$I_F = 16 \text{ mA}, V_{CC} = 5.0 \text{ V}, R_L = 4.1 \text{ k}\Omega$	6N135	$t_{PLH}$		0.3	1.5	$\mu\text{s}$
	$I_F = 16 \text{ mA}, V_{CC} = 5.0 \text{ V}, R_L = 1.9 \text{ k}\Omega$	6N136	$t_{PLH}$		0.2	0.8	$\mu\text{s}$

## COMMON MODE TRANSIENT IMMUNITY

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High	$I_F = 0 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, V_{CC} = 5.0 \text{ V}, R_L = 4.1 \text{ k}\Omega$	6N135	$ CM_H $		1000		$V/\mu\text{s}$
	$I_F = 0 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, V_{CC} = 5.0 \text{ V}, R_L = 1.9 \text{ k}\Omega$	6N136	$ CM_H $		1000		$V/\mu\text{s}$
Low	$I_F = 16 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, V_{CC} = 5.0 \text{ V}, R_L = 4.1 \text{ k}\Omega$	6N135	$ CM_L $		1000		$V/\mu\text{s}$
	$I_F = 16 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, V_{CC} = 5.0 \text{ V}, R_L = 1.9 \text{ k}\Omega$	6N136	$ CM_L $		1000		$V/\mu\text{s}$

## SAFETY AND INSULATION RATINGS

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (according to IEC 68 part 1)				55/100/21		
Comparative tracking index		CTI	175		399	
$V_{IOTM}$			8000			V
$V_{IORM}$			890			V
$P_{SO}$					500	mW
$I_{SI}$					300	mA
$T_{SI}$					175	$^{\circ}\text{C}$
Creepage distance	standard DIP-8		7			mm
Clearance distance	standard DIP-8		7			mm
Creepage distance	400 mil DIP-8		8			mm
Clearance distance	400 mil DIP-8		8			mm

### Note

As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

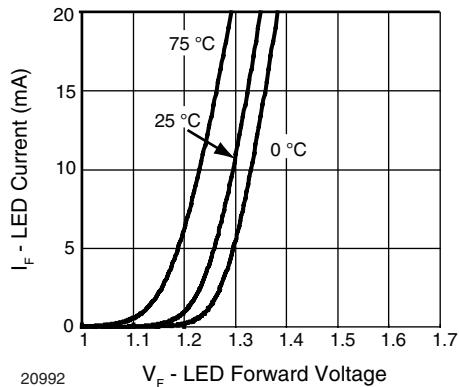
**TYPICAL CHARACTERISTICS**
 $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified


Fig. 1 - LED Forward Current vs. Forward Voltage

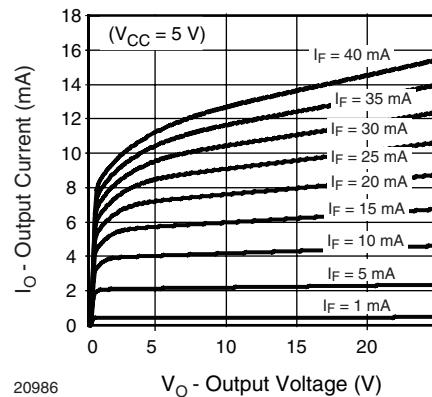


Fig. 4 - Output Current vs. Output Voltage

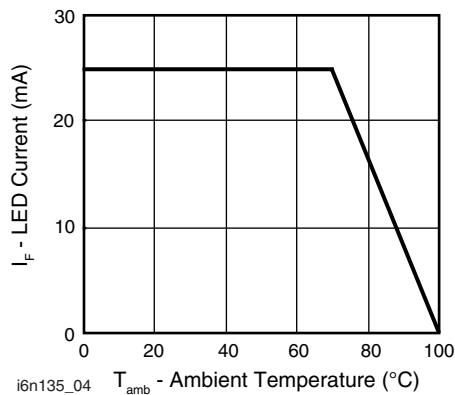


Fig. 2 - Permissible Forward LED Current vs. Temperature

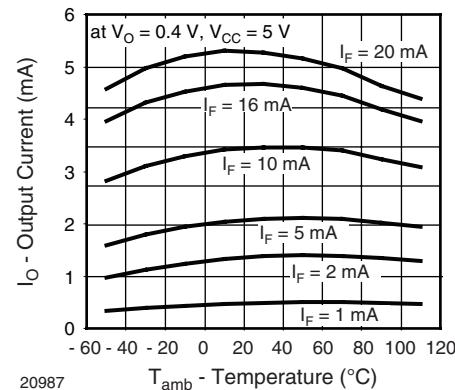


Fig. 5 - Output Current vs. Temperature

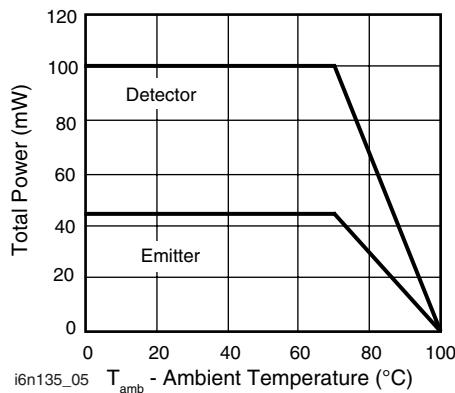


Fig. 3 - Permissible Power Dissipation vs. Temperature

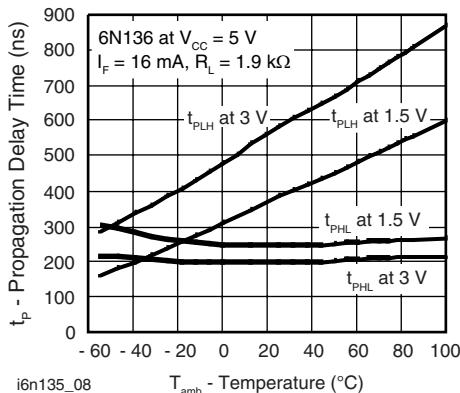


Fig. 6 - Propagation Delay vs. Ambient Temperature

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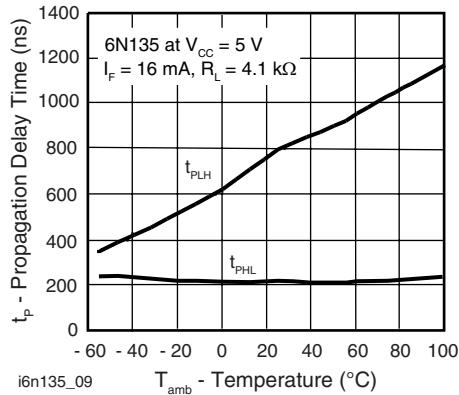


Fig. 7 - Propagation Delay vs. Ambient Temperature

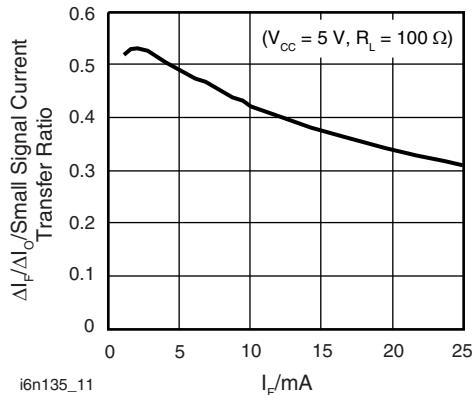


Fig. 9 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

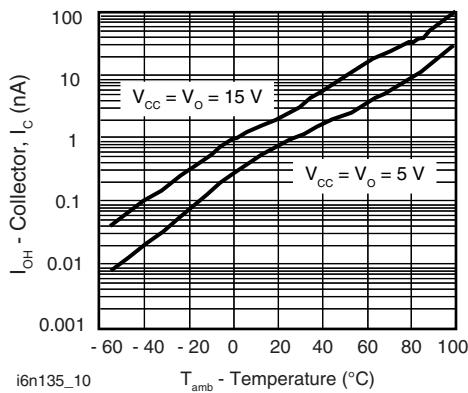


Fig. 8 - Logic High Output Current vs. Temperature

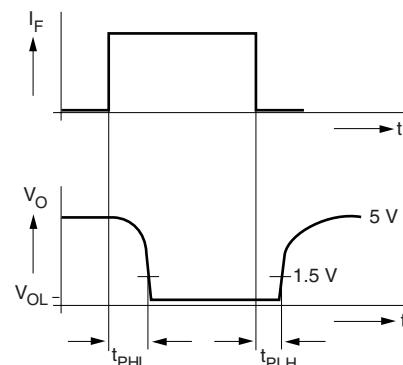
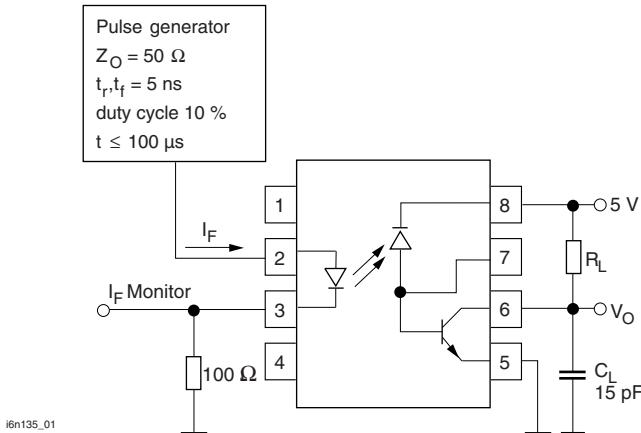


Fig. 10 - Switching Times

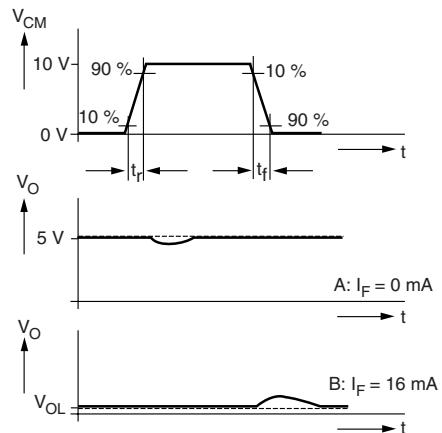
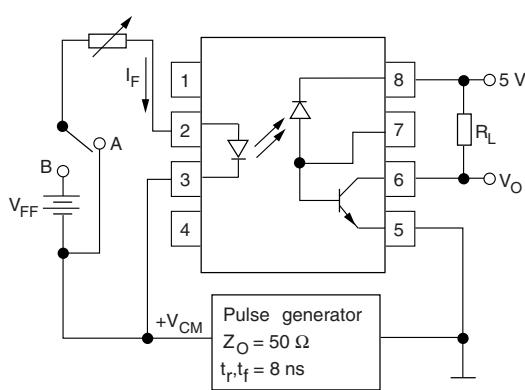
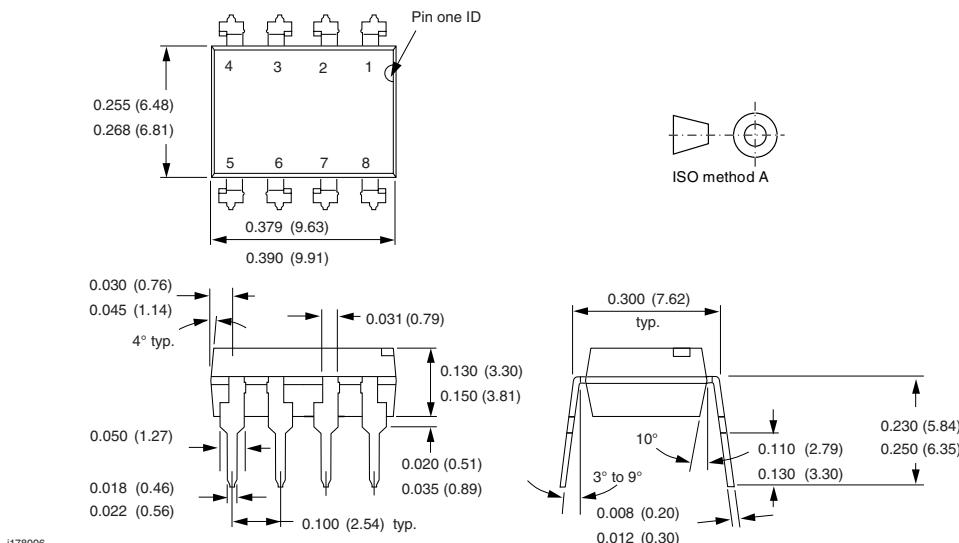
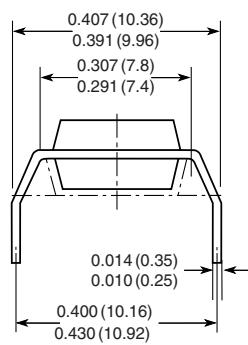


Fig. 11 - Common-Mode Interference Immunity

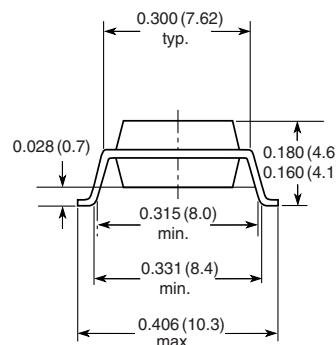
### PACKAGE DIMENSIONS in inches (millimeters)



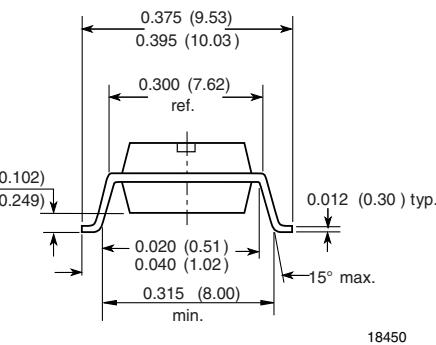
Option 6



Option 7



Option 9



**OZONE DEPLETING SUBSTANCES POLICY STATEMENT**

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

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- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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