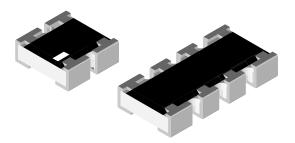


www.vishay.com

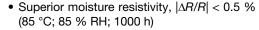
Vishay Beyschlag

# Precision Thin Film Chip Resistor Array Superior Moisture Resistivity



ACAS 0606 AT and ACAS 0612 AT precision automotive grade thin film chip resistor arrays with convex terminations combine the proven reliability of discrete chip resistors with the advantages of chip resistor arrays. Defined relative tolerance (matching) and relative TCR (tracking) make this product perfectly suited for applications with outstanding requirements towards stable fixed resistor ratios. The ACAS AT is available with equal or different resistor values. Find out more about Vishay's automotive grade product requirements at: <a href="https://www.vishay.com/applications">www.vishay.com/applications</a>

#### **FEATURES**





- Rated dissipation P<sub>70</sub> up to 125 mW per resistor
- ESD stability 1000 V, human body model
- Relative TCR down to ± 5 ppm/K (tracking)
- Relative tolerance down to ± 0.05 % (matching)
- AEC-Q200 qualified
- Material categorization: For definitions of compliance please see <a href="https://www.vishay.com/doc?99912">www.vishay.com/doc?99912</a>

#### **APPLICATIONS**

- · Precision analogue circuits
- Voltage divider
- · Feedback circuits
- · Signal conditioning

DESCRIPTION	ACAS 0606 AT	ACAS 0612 A		
EIA size	0606	0612		
Metric size	RR1616M	RR1632M		
Configuration, isolated	2 x 0603	4 x 0603		
Design:				
All equal values (AE)	AE	AE		
Two pairs of values (TP)		TP		
Different values (DF)	DF			
Resistance values	47 Ω to	150 kΩ <sup>(1)</sup>		
Absolute tolerance	± 0.1 %			
Relative tolerance	± 0.05 %			
Absolute temperature coefficient	± 25 ppm/K; ± 15 p	opm/K; ± 10 ppm/K		
Relative temperature coefficient	± 15 ppm/K; ± 10	ppm/K; ± 5 ppm/K		
Max. resistance ratio $R_{\text{min.}}/R_{\text{max.}}$	1:	20		
Rated dissipation: P <sub>70</sub>				
Element	0.125 W	0.125 W		
Package	0.2 W	0.4 W		
Operating voltage, U <sub>max</sub> . AC/DC	75	5 V		
Operating temperature range	- 55 °C to 155 °C			
Permissible film temperature	155 °C			
Insulation voltage ( <i>U</i> <sub>ins</sub> ) against ambient and between integrated resistors, continuous	75 V			

#### Notes

- The relative figures of tolerance, TCR and drift are related to a medial axis between the maximum and minimum permissable deviation of
  the resistor array. For detailed information please refer to the application note: Increasing Accuracy in Feedback Circuits and Voltage
  Dividers with Thin Film Chip Resistor Arrays (<a href="https://www.vishay.com/doc?28194">www.vishay.com/doc?28194</a>)
- (1) Resistance values to be selected from E24; E192.

Vishay Beyschlag

#### **APPLICATION INFORMATION**

The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded. These resistors do not feature a limited lifetime when operated within the permissible limits.

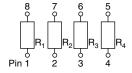
MAXIMUM RESISTANCE CHANGE AT RATED POWER (1)								
DESCRIPTION		ACAS 0	606 AT	ACAS 0612 AT				
Configuration, isolated		2 x 0	603	4 x (	0603			
Operation mode		Standard	Power	Standard	Power			
Rated power per element, P <sub>70</sub>	0.1 W	0.125 W	0.1 W	0.125 W				
Rated power per package, P <sub>70</sub>		0.15 W	0.2 W	0.3 W	0.4 W			
Film temperature		125 °C	155 °C	125 °C	155 °C			
Max. resistance change at P <sub>70</sub>								
$\Delta R/R$ max., after:	1000 h	± 0.1	± 0.25	± 0.1	± 0.25			
	8000 h	± 0.25	± 0.5	± 0.25	± 0.5			
Max. relative resistance change (relative drift) at P <sub>70</sub>								
Δ <i>R</i> / <i>R</i> max., after: 1000 h		± 0.05	± 0.125	± 0.05	± 0.125			
	8000 h	± 0.125	± 0.25	± 0.125	± 0.25			

#### Note

#### **CIRCUITS**



ACAS 0606 AT



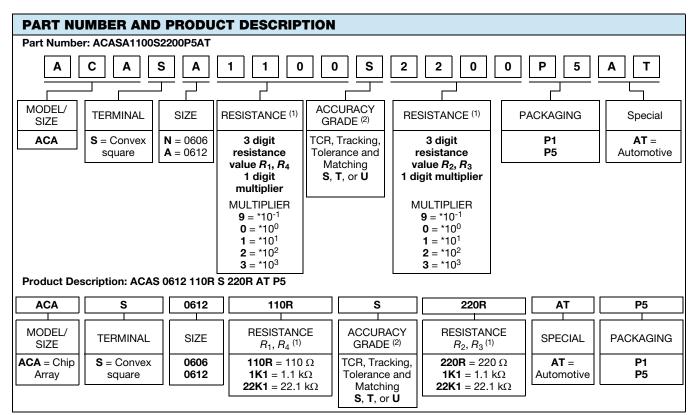
ACAS 0612 AT

Marking on ACAS 0606 AT: For types with different resistor values pin 1 is marked.

DESIGN						
	ACAS 0606 AT	ACAS 0612 AT				
AE	$R_1 = R_2$	$R_1 = R_2 = R_3 = R_4$				
TP		$R_1 = R_4 < R_2 = R_3$				
DF	$R_1 < R_2$					

<sup>(1)</sup> Figures are given for arrays with equal values, design type AE.

Vishay Beyschlag



#### **Notes**

- Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.
- (1)  $R_1 = R_4 \le R_2 = R_3$ .
- (2) For historical temperature coefficient and resistance ranges please refer to the end of the data sheet.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE									
TYPE	ACCURACY	ABSO	LUTE	RELA	RESISTANCE				
ITPE	GRADE	TCR	TOLERANCE	TCR	TOLERANCE	VALUE			
	S	± 25 ppm/K	± 0.1 %	± 15 ppm/K	± 0.05 %	47 $\Omega$ to 150 k $\Omega$			
ACAS 0606 AT ACAS 0612 AT	Т	± 15 ppm/K	± 0.1 %	± 10 ppm/K	± 0.05 %	47 $\Omega$ to 150 k $\Omega$			
	U	± 10 ppm/K	± 0.1 %	± 5 ppm/K	± 0.05 %	47 $\Omega$ to 100 k $\Omega$			

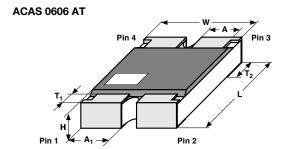
#### Notes

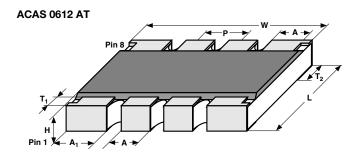
- For historical temperature coefficent and resistance range please refer to the end of the data sheet.
- Relative TCR (tracking) down to ± 2.5 ppm/K on request.

# Vishay Beyschlag

PACKAGING								
TYPE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	REEL DIAMETER		
ACAS 0606 AT ACAS 0612 AT	P1	1000	Tape and reel cardboard tape	0	4 200	100/7"		
	P5	5000	acc. IEC 60286-3 Type I	8 mm	4 mm	180 mm/7"		

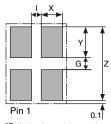
#### **DIMENSIONS**

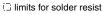


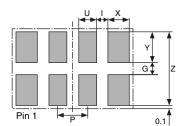


DIMENSION AND MASS									
TYPE	L (mm)	W (mm)	H (mm)	P (mm)	A <sub>1</sub> (mm)	A (mm)	T <sub>1</sub> (mm)	T <sub>2</sub> (mm)	MASS (mg)
ACAS 0606 AT	1.5 ± 0.15	1.6 ± 0.15	0.45 ± 0.1	-	0.6 ± 0.1	0.4 ± 0.1	0.3 ± 0.15	0.4 ± 0.15	3.6
ACAS 0612 AT	1.5 ± 0.15	3.2 ± 0.15	0.45 ± 0.1	0.8 ± 0.1	0.6 ± 0.1	0.4 ± 0.1	0.3 ± 0.15	0.4 ± 0.15	6.8

#### **PATTERN STYLES FOR CHIP RESISTOR ARRAYS**







 $\ \square$  limits for solder resist

Dimensions in mm

RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE         G (mm)         Y (mm)         X (mm)         U (mm)         Z (mm)         I (mm)         P (mm)							P (mm)	
ACAS 0606 AT	0.7	0.7	0.64	-	2.1	0.3	0.8	
ACAS 0612 AT	0.7	0.7	0.64	0.5	2.1	0.3	0.8	



Vishay Beyschlag

#### **DESCRIPTION**

The production of the components is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade (Al $_2$ O $_3$ ) ceramic substrate using a mask to separate the adjacent resistors and conditioned to achieve the desired temperature coefficient. Specially designed inner contacts are realized on both sides. A special laser is used to achieve the target value by smoothly cutting a meander groove in the resistive layer without damaging the ceramics.

The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating.

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100 % of the individual chip resistors. Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3** <sup>(3)</sup>.

#### **ASSEMBLY**

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using reflow or vapour phase as shown in **IEC 61760-1** <sup>(3)</sup>. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system. The resistors are RoHS compliant; the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. The permitted storage time is 20 years, whereas the solderability is specified for 2 years after production or requalification. The immunity of the plating against tin whisker growth has been proven under extensive testing.

All products comply with the **GADSL** <sup>(1)</sup> and the **CEFIC-EECA-EICTA** <sup>(2)</sup> list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV) and Annex II (ELV II)
- 2011/65/EC Restriction of the use of Hazardous Substances directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

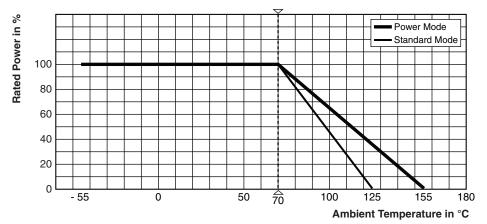
#### **APPROVALS**

The chip resistor array is AEC-Q200 qualified. Where applicable, the resistors are tested in accordance with **EN 140401-801** which refers to **EN 60115-1** and **EN 140400**.

#### Notes

- (1) Global Automotive Declarable Substance List, see <u>www.gadsl.org</u>.
- (2) CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see <a href="www.eicta.org">www.eicta.org</a> → policy → environmental policy group → chemicals → jig → Joint Industry Guide (JIG-101 Ed 2.0).
- (3) The quoted IEC standards are also released as EN standards with the same number and identical contents.

#### **FUNCTIONAL PERFORMANCE**



For permissible resistance change please refer to table MAXIMUM RESISTANCE CHANGE AT RATED POWER, above **Derating** 



Vishay Beyschlag

#### **TESTS AND REQUIREMENTS**

Essentially all tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 140400, sectional specification

EN 140401-801, detail specification

The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are are carried out under standard atmospheric conditions according to **IEC 60068-1** <sup>(1)</sup>, 5.3. Climatic category LCT/UCT/56 (rated temperature range:

Lower category temperature, upper category temperature; damp heat, long term, 56 days) is valid (LCT = -55 °C/UCT = 125 °C).

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

The requirements stated in the "Test Procedures and Requirements" table are based on the required tests and permitted limits of EN 140401-801 where applicable.

TEST PROCEDURES AND REQUIREMENTS								
EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE $^{(2)}$ ( $\Delta R$ )				
			Stability for product types:					
			ACAS 0606 AT ACAS 0612 AT	47 $\Omega$ to 150 k $\Omega$ 47 $\Omega$ to 150 k $\Omega$				
4.5	-	Resistance	-	± 0.1 %				
4.8.4.2	-	Temperature coefficient	At (20/- 55/ 20) °C and (20/125/20) °C	$\pm$ 25 ppm/K; $\pm$ 15 ppm/K; $\pm$ 10 ppm/K				
			$U = \sqrt{P_{70} \times R}$ or $U = U_{\text{max.}}$ ; 1.5 h on; 0.5 h off; whichever is the less severe;					
		Endurance at 70 °C: Standard operation mode	1000 h: Absolute Relative	$\pm$ (0.1 % R + 0.05 Ω) $\pm$ (0.05 % R + 0.05 Ω)				
4 25 1			8000 h: Absolute Relative	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ ) $\pm$ (0.125 % $R$ + 0.05 $\Omega$ )				
4.25.1 -	-		$U = \sqrt{P_{70} \times R}$ or $U = U_{\text{max.}}$ ; 1.5 h on; 0.5 h off; whichever is the less severe;					
		Endurance at 70 °C: Power operation mode	1000 h: Absolute Relative	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ ) $\pm$ (0.125 % $R$ + 0.05 $\Omega$ )				
			8000 h: Absolute Relative	$\pm$ (0.5 % R + 0.05 Ω) $\pm$ (0.25 % R + 0.05 Ω)				
			125 °C; 1000 h: Absolute Relative	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ ) $\pm$ (0.125 % $R$ + 0.05 $\Omega$ )				
4.25.3	-	Endurance at upper category temperature	125 °C; 8000 h: Absolute Relative	$\pm$ (0.5 % R + 0.05 Ω) $\pm$ (0.25 % R + 0.05 Ω)				
			155 °C; 1000 h: Absolute Relative	$\pm$ (0.4 % R + 0.05 Ω) $\pm$ (0.2 % R + 0.05 Ω)				
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.25 % R + 0.05 Ω)				
4.39	67 (Cy)	Damp heat, steady state, accelerated	$(85 \pm 2) ^{\circ}C$ $(85 \pm 5) ^{\circ}RH$ $U = \sqrt{0.1 \times P_{70} \times R};$ $U \le 0.3 \times U_{\text{max.}};$ $1000 \text{ h}$	± (0.5 % R + 0.05 Ω)				

Vishay Beyschlag

TEST PROCEDURES AND REQUIREMENTS								
EN 60115-1 CLAUSE	IEC 60068-2 <sup>(1)</sup> TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE <sup>(2)</sup> (Δ <i>R</i> )				
			Stability for product types:					
			ACAS 0606 AT ACAS 0612 AT	47 $\Omega$ to 150 k $\Omega$ 47 $\Omega$ to 150 k $\Omega$				
4.13	-	Short time overload <sup>(3)</sup> Standard operation mode	$U = 2.5 \times \sqrt{P_{70}} \times R$ or $U = 2 \times U_{\text{max.}}$ ; 5 s	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage				
4.40	-	Electrostatic discharge (human body model) (3)	IEC 61340-3-1; 3 pos. + 3 neg. (equivalent to MIL-STD-883, Method 3015); 1000 V	± (0.5 % R + 0.05 Ω)				
4.19	14 (Na)	Rapid change of temperature	30 min at - 55 °C and 30 min at 125 °C; 1000 cycles	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ ) no visible damage				
4.18.2	58 (Td)	Resistance to soldering heat	Reflow method 2 (IR/forced gas convection); (260 $\pm$ 5) °C; (10 $\pm$ 1) s	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage				
4.17.0	F0 /T-1\	Caldanah ilih	Solder bath method; SnPb; non-activated flux accelerated aging 4 h/155 °C (215 ± 3) °C; (3 ± 0.3) s	Good tinning (≥ 95 % covered);				
4.17.2	58 (Td)	Solderability	Solder bath method; SnAgCu; non-activated flux accelerated aging 4 h/155 °C (235 ± 3) °C; (2 ± 0.2) s	no visible damage				
4.32	21 (Ue <sub>3</sub> )	Shear (adhesion)	45 N	No visible damage				
4.33	21 (Ue <sub>1</sub> )	Substrate bending	Depth 2 mm, 3 times	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage; no open circuit in bent position				
4.35	-	Flammability	IEC 60695-11-5, needle flame test; 10 s	No burning after 30 s				
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s²; 7.5 h	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage				
4.7	-	Voltage proof	$U_{\rm RMS} = U_{\rm ins}$ 60 s ± 5 s; against ambient, between adjacent resistors	No flashover or breakdown				

#### Notes

<sup>(3)</sup> For a single element.

HISTORICAL TEMPERATURE COEFFICIENT AND RESISTANCE RANGES								
	RESISTANCE VALUE							
ACCURACY GRADE	ABSOLUTE TCR	TCR TRACKING	ABSOLUTE TOLERANCE	TOLERANCE MATCHING	ACAS 0606 AT ACAS 0612 AT			
Α	± 25 ppm/K	10 ppm/K	± 0.25 %	0.1 %	47 $\Omega$ to 150 k $\Omega$			
В	± 25 ppm/K	10 ppm/K	± 0.5 %	0.25 %	47 $\Omega$ to 150 k $\Omega$			
Е	± 25 ppm/K	15 ppm/K	± 0.25 %	0.1 %	47 $\Omega$ to 150 k $\Omega$			
F	± 25 ppm/K	15 ppm/K	± 0.5 %	0.25 %	47 $\Omega$ to 150 k $\Omega$			
J	± 25 ppm/K	25 ppm/K	± 0.25 %	0.1 %	47 $\Omega$ to 150 k $\Omega$			
K	± 25 ppm/K	25 ppm/K	± 0.5 %	0.25 %	47 $\Omega$ to 150 k $\Omega$			
N	± 50 ppm/K	25 ppm/K	± 0.5 %	0.5 %	47 $\Omega$ to 150 k $\Omega$			
Р	± 50 ppm/K	50 ppm/K	± 0.5 %	0.5 %	47 $\Omega$ to 150 k $\Omega$			

#### Note

<sup>(1)</sup> The quoted IEC standards are also released as EN standards with the same number and identical contents.

<sup>(2)</sup> Figures are given for arrays with equal values, design type AE.

Special temperature coefficent and resistance combinations remain available. For optimized availability please refer to the table TEMPERATURE COEFFICENT AND RESISTANCE.



# **Legal Disclaimer Notice**

Vishay

### **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

# **Material Category Policy**

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.

Revision: 02-Oct-12 Document Number: 91000

### **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

# Данный компонент на территории Российской Федерации Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

### http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru 4 moschip.ru 9