Innovative Service Around the Globe YAGEO

# DATA SHEET

## ANTI-SULFURATED CHIP RESISTORS AUTOMOTIVE GRADE

AA series

±5%, ±1%, ±0.5%

**sizes 0201/0402/0603/0805/1206/ 1210/1218/2010/2512**

**RoHS compliant & Halogen free**

YAGEO Phycomp

Product specification – December 08, 2015 V.3

## SCOPE

This specification describes AA0201 to AA2512 chip resistors with lead-free terminations made by thick film process.

## APPLICATIONS

- Car electronics
- Engine control unit
- Body control system
- Safety devices

## FEATURES

- Superior resistance against sulfur containing atmosphere
- AEC-Q200 qualified
- Moisture sensitivity level: MSL1
- AA series soldering is compliant with J-STD-020D
- Halogen free epoxy
- RoHS compliant
- Reduce environmentally hazardous waste
- High component and equipment reliability
- The resistors are 100% performed by automatic optical inspection

## ORDERING INFORMATION - GLOBAL PART NUMBER

Part number is identified by the series name, size, tolerance, packaging type, temperature coefficient, taping reel and resistance value.

### GLOBAL PART NUMBER

| AA | XXXX | X | X | X | XX | XXXX | L |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |

(1) SIZE

0201 / 0402 / 0603 / 0805 / 1206 / 1210 / 1218 / 2010 / 2512

(2) TOLERANCE

D = ±0.5%

F = ±1%

J = ±5% (for Jumper ordering, use code of J)

(3) PACKAGING TYPE

R = Paper/PE taping reel

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

(6) RESISTANCE VALUE

1Ω to 10 MΩ

There are 2~4 digits indicated the resistance value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g.1K2, not 1K20.

(7) DEFAULT CODE

Letter L is the system default code for ordering only. (Note)

Resistance rule of global part number

| Resistance coding rule | Example |
|---|---|
| XRXX (1 to 9.76 Ω) | 1R = 1 Ω<br>1R5 = 1.5 Ω<br>9R76 = 9.76 Ω |
| XXRX (10 to 97.6 Ω) | 10R = 10 Ω<br>97R6 = 97.6 Ω |
| XXXR (100 to 976 Ω) | 100R = 100 Ω<br>976R = 976 Ω |
| XKXX (1 to 9.76 KΩ) | 1K = 1,000 Ω<br>9K76 = 9760 Ω |
| XMXX (1 to 9.76 MΩ) | 1M = 1,000,000 Ω<br>9M76= 9,760,000 Ω |
| XXMX (10 MΩ) | 10M = 10,000,000 Ω |

### ORDERING EXAMPLE

The ordering code for an AA0402 chip resistor, value 100 KΩ with ±1% tolerance, supplied in 7-inch tape reel is: AA0402FR-07100KL

### NOTE

1. All our R-Chip products are RoHS compliant and Halogen free. "LFP" of the internal 2D reel label states "Lead-Free Process".
2. On customized label, "LFP" or specific symbol can be printed.

## MARKING

AA0201 / AA0402

Fig. 1

No marking

AA0603 / AA0805 / AA1206 / AA1210 / AA2010 / AA2512

Fig. 2 Value=10 KΩ

E-24 series: 3 digits, ±5%
First two digits for significant figure and 3rd digit for number of zeros

AA0603

Fig. 3 Value = 24 Ω

E-24 series: 3 digits, ±1%
One short bar under marking letter

Fig. 4 Value = 12.4 KΩ

E-96 series: 3 digits, ±1%
First two digits for E-96 marking rule and 3rd letter for number of zeros

AA0805 / AA1206 / AA1210 / AA2010 / AA2512

Fig. 5 Value = 10 KΩ

Both E-24 and E-96 series: 4 digits, ±1%
First three digits for significant figure and 4th digit for number of zeros

AA1218

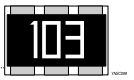



Fig. 6 Value = 10 KΩ

E-24 series: 3 digits, ±5%
First two digits for significant figure and 3rd digit for number of zeros

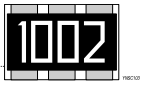



Fig. 7 Value = 10 KΩ

Both E-24 and E-96 series: 4 digits, ±1%
First three digits for significant figure and 4th digit for number of zeros

**NOTE**

For further marking information, please refer to data sheet "Chip resistors marking". Marking of AA series is the same as RC series.

## CONSTRUCTION

The resistors are constructed on top of an automotive grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a lead-free glass. The composition of the glaze is adjusted to give the approximately required resistance value and laser trimming of this resistive glaze achieves the value within tolerance. The whole element is covered by a protective overcoat. Size 0603 and bigger is marked with the resistance value on top. Finally, the two external terminations (Ni / matte tin) are added, as shown in Fig.8.

## OUTLINES

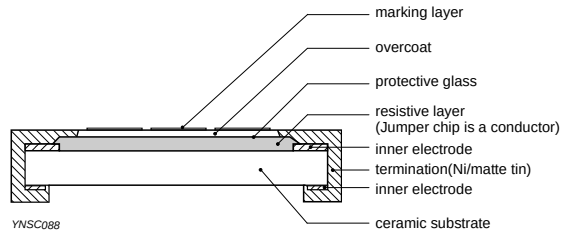



**Fig. 8** Chip resistor outlines

## DIMENSIONS

**Table 1** For outlines, please refer to Fig. 9

| TYPE | L (mm) | W (mm) | H (mm) | $I_1$ (mm) | $I_2$ (mm) |
|---|---|---|---|---|---|
| AA0201 | 0.60 ±0.03 | 0.30 ±0.03 | 0.23 ±0.03 | 0.12 ±0.05 | 0.15 ±0.05 |
| AA0402 | 1.00 ±0.05 | 0.50 ±0.05 | 0.32 ±0.05 | 0.20 ±0.10 | 0.25 ±0.10 |
| AA0603 | 1.60 ±0.10 | 0.80 ±0.10 | 0.45 ±0.10 | 0.25 ±0.15 | 0.25 ±0.15 |
| AA0805 | 2.00 ±0.10 | 1.25 ±0.10 | 0.50 ±0.10 | 0.35 ±0.20 | 0.35 ±0.20 |
| AA1206 | 3.10 ±0.10 | 1.60 ±0.10 | 0.55 ±0.10 | 0.45 ±0.20 | 0.40 ±0.20 |
| AA1210 | 3.10 ±0.10 | 2.60 ±0.15 | 0.50 ±0.10 | 0.45 ±0.15 | 0.50 ±0.20 |
| AA1218 | 3.10 ±0.10 | 4.60 ±0.10 | 0.55 ±0.10 | 0.45 ±0.20 | 0.40 ±0.20 |
| AA2010 | 5.00 ±0.10 | 2.50 ±0.15 | 0.55 ±0.10 | 0.55 ±0.15 | 0.50 ±0.20 |
| AA2512 | 6.35 ±0.10 | 3.10 ±0.15 | 0.55 ±0.10 | 0.60 ±0.20 | 0.50 ±0.20 |

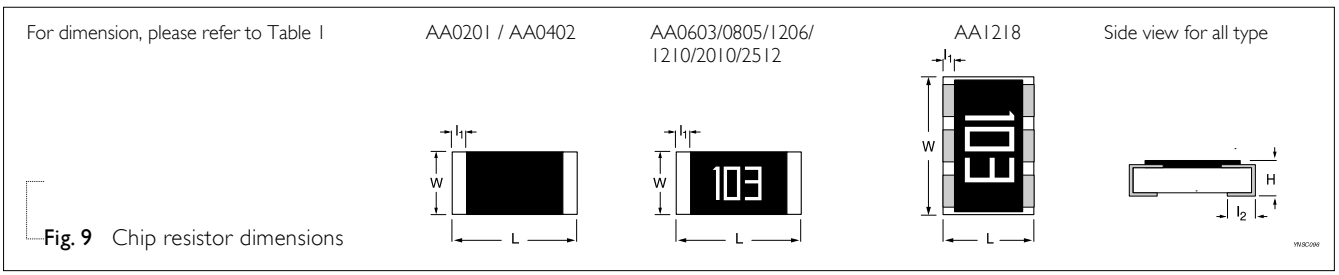



**Fig. 9** Chip resistor dimensions

## ELECTRICAL CHARACTERISTICS

Table 2

| TYPE | RESISTANCE RANGE | CHARACTERISTICS | | | | | |
|---|---|---|---|---|---|---|---|
| | | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | Temperature Coefficient of Resistance | Jumper Criteria |
| AA0201 | 5% (E24) 1Ω≤ R ≤ 22MΩ (0201: Max. 10MΩ. 1218: Max. 1MΩ) 0.5%, 1% (E24/E96) 1Ω≤ R ≤10MΩ (1218: Max. 1MΩ) Jumper < 50mΩ | –55 °C to +155 °C | 25V | 50V | 50V | 1Ω ≤ R ≤ 10Ω, -100/+400 ppm/°C<br>10Ω < R ≤ 10 MΩ, ±300 ppm/°C | Rated Current 0.5A<br>Max. Current 1.0A |
| AA0402 | | | 50 V | 100 V | 100 V | 1Ω ≤ R ≤ 10Ω, ±200 ppm/°C<br>10Ω < R ≤ 10 MΩ, ±150 ppm/°C<br>10 MΩ < R ≤ 22 MΩ, ±200 ppm/°C | Rated Current 1A<br>Max. Current 2A |
| AA0603 | | | 75V | 150 V | 150 V | | Rated Current 1A<br>Max. Current 2A |
| AA0805 | | | 150 V | 300 V | 300 V | | Rated Current 2A<br>Max. Current 5A |
| AA1206 | | | 200 V | 400 V | 500 V | | Rated Current 2A<br>Max. Current 10A |
| AA1210 | | | 200 V | 500 V | 500 V | | Rated Current 2A<br>Max. Current 10A |
| AA1218 | | | 200 V | 500 V | 500 V | | Rated Current 6A<br>Max. Current 10A |
| AA2010 | | | 200 V | 500 V | 500 V | | Rated Current 2A<br>Max. Current 10A |
| AA2512 | | | 200 V | 500 V | 500 V | | Rated Current 2A<br>Max. Current 10A |

## FOOTPRINT AND SOLDERING PROFILES

Recommended footprint and soldering profiles. Please refer to data sheet "Chip resistors mounting".

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

| PACKING STYLE | REEL DIMENSION | AA0201 | AA0402 | AA0603 | AA0805 | AA1206 | AA1210 | AA1218 | AA2010 | AA2512 |
|---|---|---|---|---|---|---|---|---|---|---|
| Paper/PE taping reel (R) | 7" (178 mm) | 10,000 | 10,000 | 5,000 | 5,000 | 5,000 | 5,000 | --- | --- | --- |
| | 13" (330 mm) | 50,000 | 50,000 | 20,000 | 20,000 | 20,000 | 20,000 | --- | --- | --- |
| Embossed taping reel (K) | 7" (178 mm) | --- | --- | --- | --- | --- | --- | 4,000 | 4,000 | 4,000 |

**NOTE**

1. For paper/PE/embossed tape and reel specifications/dimensions, please refer to data sheet "Chip resistors packing".

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

Range: -55°C to +155°C

### POWER RATING

Each type rated power at 70°C:
AA0201=1/20W (0.05W)
AA0402=1/16 W (0.0625W)
AA0603=1/10 W (0.1W)
AA0805=1/8 W (0.125W)
AA1206=1/4 W (0.25W)
AA1210=1/2 W (0.5W)
AA1218=1 W
AA2010=3/4 W (0.75W)
AA2512=1 W

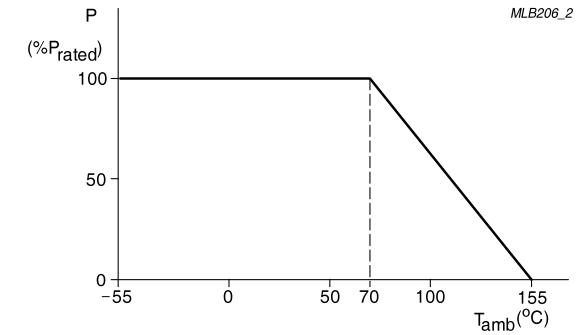



Fig. 10 Maximum dissipation ($P_{max}$) in percentage of rated power as a function of the operating ambient temperature ($T_{amb}$)

### RATED VOLTAGE

The DC or AA (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$V = \sqrt{(P \times R)}$

Or Maximum working voltage whichever is less

Where

V = Continuous rated DC or AA (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)

## TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|---|---|
| High Temperature Exposure | AEC-Q200 Test 3<br>MIL-STD-202 Method 108 | 1,000 hours at $T_A$ = 155 °C, unpowered | ±(1.0%+0.05Ω)<br><50 mΩ for Jumper |
| Moisture Resistance | AEC-Q200 Test 6<br>MIL-STD-202 Method 106 | Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered<br>Parts mounted on test-boards, without condensation on parts | ±(0.5%+0.05Ω) for D/F tol.<br>±(2.0%+0.05Ω) for J tol.<br><100 mΩ for Jumper |
| Biased Humidity | AEC-Q200 Test 7<br>MIL-STD-202 Method 103 | 1,000 hours; 85 °C / 85% RH<br>10% of operating power<br>Measurement at 24±4 hours after test conclusion. | ±(3.0%+0.05Ω)<br><100 mΩ for Jumper |
| Operational Life | AEC-Q200 Test 8<br>MIL-STD-202 Method 108 | 1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required | ±(1.0%+0.05Ω)<br><100 mΩ for Jumper |
| Resistance to Soldering Heat | AEC-Q200 Test 15<br>MIL-STD-202 Method 210 | Condition B, no pre-heat of samples<br>Lead-free solder, 260±5 °C, 10±1 seconds immersion time<br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol | ±(0.5%+0.05Ω) for D/F tol.<br>±(1.0%+0.05Ω) for J tol.<br><50 mΩ for Jumper<br>No visible damage |
| Thermal Shock | AEC-Q200 Test 16<br>MIL-STD-202 Method 107 | -55/+125 °C<br>Number of cycles is 300. Devices mounted<br>Maximum transfer time is 20 seconds.<br>Dwell time is 15 minutes. Air – Air | ±(1.0%+0.05Ω)<br><50 mΩ for Jumper |
| ESD | AEC-Q200 Test 17<br>AEC-Q200-002 | 1 pos. + 1 neg. discharges<br>0201: 500V<br>0402/0603: 1KV<br>0805 and above: 2KV | ±(3.0%+0.05Ω)<br><50 mΩ for Jumper |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|---|---|
| Solderability<br>- Wetting | AEC-Q200 Test 18<br>J-STD-002 | Electrical Test not required Magnification 50X<br>SMD conditions:<br>(a) Method B, aging 4 hours at 155 °C dry heat, dipping at 235±3 °C for 5±0.5 seconds.<br>(b) Method B, steam aging 8 hours, dipping at 215±3 °C for 5±0.5 seconds.<br>(c) Method D, steam aging 8 hours, dipping at 260±3 °C for 7±0.5 seconds. | Well tinned (≥95% covered)<br>No visible damage |
| Board Flex | AEC-Q200 Test 21<br>AEC-Q200-005 | Chips mounted on a 90mm glass epoxy resin PCB (FR4)<br>Bending for 0201/0402: 5 mm<br>0603/0805: 3 mm<br>1206 and above: 2 mm<br>Holding time: minimum 60 seconds | ±(1.0%+0.05Ω )<br><50 mΩ for Jumper |
| Temperature Coefficient of Resistance (T.C.R.) | IEC 60115-1 4.8<br>MIL-STD-202 Method 304 | At +25/–55 °C and +25/+125 °C<br>**Formula:**<br>$T.C.R=\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C)<br>Where<br>$t_1$=+25 °C or specified room temperature<br>$t_2$=–55 °C or +125 °C test temperature<br>$R_1$=resistance at reference temperature in ohms<br>$R_2$=resistance at test temperature in ohms | Refer to table 2 |
| Short Time Overload | IEC60115-1 4.13 | 2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature | ±(1.0%+0.05Ω )<br><50 mΩ for Jumper |
| FOS | ASTM-B-809-95 | - Sulfur (saturated vapor) 1000 hours, 90±2 °C unpowered | ±(1.0%+0.05Ω) |
| | ASTM-B-809-95*<br>*Modified | - Sulfur 750 hours, 105 °C. unpowered | ±(4.0%+0.05Ω) |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version 3 | Dec. 08, 2015 | - | - Update Dielectric Withstanding Voltage |
| Version 2 | Apr. 09, 2015 | - | - Modified FOS test procedure |
| Version 1 | Jan. 27, 2015 | - | - Dimensions update |
| Version 0 | Feb. 27, 2014 | - | - First issue of this specification |

## LEGAL DISCLAIMER

Yageo, its distributors and agents (collectively, "Yageo"), hereby disclaims any and all liabilities for any errors, inaccuracies or incompleteness contained in any product related information, including but not limited to product specifications, datasheets, pictures and/or graphics. Yageo may make changes, modifications and/or improvements to product related information at any time and without notice.

Yageo makes no representation, warranty, and/or guarantee about the fitness of its products for any particular purpose or the continuing production of any of its products. To the maximum extent permitted by law, Yageo disclaims (i) any and all liability arising out of the application or use of any Yageo 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 a particular purpose, non-infringement and merchantability.

Yageo statements regarding the suitability of products for certain types of applications are based on Yageo's knowledge of typical operating conditions for such types of applications in a generic nature. Such statements are neither binding statements of Yageo nor intended to constitute any warranty concerning the suitability for a specific customer application or use. They are intended for use only by customers with requisite knowledge and experience for determining whether Yageo products are the correct products for their application or use. In addition, unpredicatable and isolated cases of product failure may still occur, therefore, customer application or use of Yageo products which requires higher degree of reliability or safety, shall employ additional protective safeguard measures to ensure that product failure would not result in personal injury or property damage.

Yageo products are not designed for application or use in medical, life-saving, or life-sustaining devices or for any other application or use in which the failure of Yageo products could result in personal injury or death. Customers using or selling Yageo products not expressly indicated for above-mentioned purposes shall do so at their own risk and agree to fully indemnify Yageo and hold Yageo harmless.

Information provided here is intended to indicate product specifications only. Yageo reserves all the rights for revising this content without further notification, as long as products are unchanged. Any product change will be announced by PCN.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Yageo:

AA1206FR-07255RL AA1210JR-075R6L AA0603FR-071M78L AA0402FR-07909RL AA1206FR-07332KL AA1206FR-078K2L AA1206FR-07681KL AA1206FR-073ML AA0603FR-0716RL AA0402FR-07140RL AA0402FR-0736RL AA0805FR-074R12L AA0603FR-07309KL AA1206FR-0760R4L AA2010JK-071M2L AA0805FR-07215RL AA1206FR-076R8L AA1206FR-071M6L AA0805FR-0711K8L AA0402FR-0728R7L AA1206FR-0791KL AA1206FR-079R09L AA0402JR-0743RL AA0805JR-079K1L AA0603FR-0711K8L AA0603JR-07200KL AA0805FR-07210KL AA0805FR-0718RL AA0603FR-07249RL AA1210JR-0756RL AA0805FR-071K65L AA0402FR-079K1L AA0603FR-07590RL AA1206FR-072R74L AA0603FR-071K43L AA0402FR-074M3L AA0402JR-0715RL AA0805JR-07620RL AA0402JR-07120RL AA0603FR-071R8L AA1210JR-0782KL AA1206FR-071R4L AA0402FR-071M24L AA1206JR-07240KL AA0603FR-07487KL AA1210JR-07160KL AA0402FR-0715R4L AA0805FR-0736KL AA0805FR-076R04L AA0805JR-076M2L AA1206FR-0797R6L AA0402FR-071K4L AA0805FR-0728R7L AA0805JR-07200RL AA0805JR-07510RL AA0402FR-07390RL AA2512FK-07287RL AA1206FR-0711K3L AA0805FR-07422KL AA0603JR-0711KL AA0805FR-074K87L AA0603FR-077R68L AA0603FR-07510KL AA1206FR-072K61L AA0603FR-0733K2L AA0402FR-0771R5L AA1206FR-0712R1L AA1206FR-07383KL AA0805FR-07576KL AA2010JK-078M2L AA0603FR-0736RL AA1206JR-07300RL AA0805FR-0710R5L AA0402FR-07113KL AA0805FR-078K87L AA0603FR-0713RL AA0805FR-073M3L AA1206FR-07365KL AA0402FR-0714KL AA0805FR-073K74L AA1206FR-071ML AA0805FR-0786R6L AA1206FR-0710R7L AA1206JR-07510RL AA0603FR-071R58L AA1206FR-0719R6L AA0603FR-071M47L AA0603FR-074R02L AA0805FR-072K55L AA0805FR-07200RL AA0805FR-076M98L AA0805FR-072K74L AA1206FR-076M98L AA0805FR-079R09L AA1206FR-072K1L AA2010JK-072R4L AA2512FK-071R6L AA1206FR-0754K9L AA2512FK-07825RL AA2010JK-0727KL

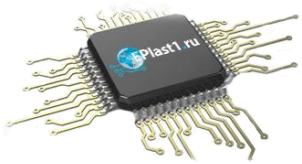
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- 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, помощь 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.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

**Телефон:** 8 (812) 309 58 32 (многоканальный)
**Факс:** 8 (812) 320-02-42
**Электронная почта:** org@eplast1.ru
**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.