

## Medium Power Thyristors (Stud Version), 16 A



TO-208AA (TO-48)

### FEATURES

- Improved glass passivation for high reliability and exceptional stability at high temperature
- High  $di/dt$  and  $dV/dt$  capabilities
- Standard package
- Low thermal resistance
- Metric threads version available
- Types up to 1200 V  $V_{DRM}/V_{RRM}$
- RoHS compliant
- Designed and qualified for industrial and consumer level



### PRODUCT SUMMARY

|             |      |
|-------------|------|
| $I_{T(AV)}$ | 16 A |
|-------------|------|

### TYPICAL APPLICATIONS

- Medium power switching
- Phase control applications
- Can be supplied to meet stringent military, aerospace and other high reliability requirements

### MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS | VALUES      | UNITS            |
|-------------------|-----------------|-------------|------------------|
| $I_{T(AV)}$       |                 | 16          | A                |
|                   | $T_C$           | 85          | °C               |
| $I_{T(RMS)}$      |                 | 35          | A                |
| $I_{TSM}$         | 50 Hz           | 340         | A                |
|                   | 60 Hz           | 360         |                  |
| $I^2t$            | 50 Hz           | 574         | A <sup>2</sup> s |
|                   | 60 Hz           | 524         |                  |
| $V_{DRM}/V_{RRM}$ |                 | 100 to 1200 | V                |
| $t_q$             | Typical         | 110         | µs               |
| $T_J$             |                 | - 65 to 125 | °C               |

## ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS |              |                                                                                       |                                                                     |                                                        |
|-----------------|--------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|
| TYPE NUMBER     | VOLTAGE CODE | $V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE <sup>(1)</sup><br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE <sup>(2)</sup><br>V | $I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM<br>mA |
| 16RIA           | 10           | 100                                                                                   | 150                                                                 | 20                                                     |
|                 | 20           | 200                                                                                   | 300                                                                 | 10                                                     |
|                 | 40           | 400                                                                                   | 500                                                                 |                                                        |
|                 | 60           | 600                                                                                   | 700                                                                 |                                                        |
|                 | 80           | 800                                                                                   | 900                                                                 |                                                        |
|                 | 100          | 1000                                                                                  | 1100                                                                |                                                        |
|                 | 120          | 1200                                                                                  | 1300                                                                |                                                        |

### Notes

<sup>(1)</sup> Units may be broken over non-repetitively in the off-state direction without damage, if  $di/dt$  does not exceed 20 A/ $\mu$ s

<sup>(2)</sup> For voltage pulses with  $t_p \leq 5$  ms

| ABSOLUTE MAXIMUM RATINGS                             |                     |                                                                                                          |                                  |                                                                       |        |                   |  |
|------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|--------|-------------------|--|
| PARAMETER                                            | SYMBOL              | TEST CONDITIONS                                                                                          |                                  |                                                                       | VALUES | UNITS             |  |
| Maximum average on-state current at case temperature | I <sub>T(AV)</sub>  | 180° sinusoidal conduction                                                                               |                                  |                                                                       | 16     | A                 |  |
|                                                      |                     |                                                                                                          |                                  |                                                                       | 85     | °C                |  |
| Maximum RMS on-state current                         | I <sub>T(RMS)</sub> |                                                                                                          |                                  |                                                                       | 35     | A                 |  |
| Maximum peak, one-cycle non-repetitive surge current | I <sub>TSM</sub>    | t = 10 ms                                                                                                | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum | 340    | A                 |  |
|                                                      |                     | t = 8.3 ms                                                                                               |                                  |                                                                       | 360    |                   |  |
|                                                      |                     | t = 10 ms                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                                       | 285    |                   |  |
|                                                      |                     | t = 8.3 ms                                                                                               |                                  |                                                                       | 300    |                   |  |
| Maximum I <sup>2</sup> t for fusing                  | I <sup>2</sup> t    | t = 10 ms                                                                                                | No voltage reapplied             |                                                                       | 574    | A <sup>2</sup> s  |  |
|                                                      |                     | t = 8.3 ms                                                                                               |                                  |                                                                       | 524    |                   |  |
|                                                      |                     | t = 10 ms                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                                       | 405    |                   |  |
|                                                      |                     | t = 8.3 ms                                                                                               |                                  |                                                                       | 375    |                   |  |
| Maximum I <sup>2</sup> √t for fusing                 | I <sup>2</sup> √t   | t = 0.1 to 10 ms, no voltage reapplied, T <sub>J</sub> = T <sub>J</sub> maximum                          |                                  |                                                                       | 5740   | A <sup>2</sup> √s |  |
| Low level value of threshold voltage                 | V <sub>T(TO)1</sub> | (16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                                       | 0.97   | V                 |  |
| High level value of threshold voltage                | V <sub>T(TO)2</sub> | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                   |                                  |                                                                       | 1.24   |                   |  |
| Low level value of on-state slope resistance         | r <sub>t1</sub>     | (16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                                       | 17.9   | mΩ                |  |
| High level value of on-state slope resistance        | r <sub>t2</sub>     | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                   |                                  |                                                                       | 13.6   |                   |  |
| Maximum on-state voltage                             | V <sub>TM</sub>     | I <sub>pk</sub> = 50 A, T <sub>J</sub> = 25 °C                                                           |                                  |                                                                       | 1.75   | V                 |  |
| Maximum holding current                              | I <sub>H</sub>      | T <sub>J</sub> = 25 °C, anode supply 6 V, resistive load                                                 |                                  |                                                                       | 130    | mA                |  |
| Latching current                                     | I <sub>L</sub>      |                                                                                                          |                                  |                                                                       | 200    |                   |  |

**Medium Power Thyristors Vishay High Power Products  
(Stud Version), 16 A**

| <b>SWITCHING</b>                          |                 |                                                                                                                                                                                                                                    |        |       |
|-------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| PARAMETER                                 | SYMBOL          | TEST CONDITIONS                                                                                                                                                                                                                    | VALUES | UNITS |
| Maximum rate of rise of turned-on current | di/dt           | T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DM</sub> = Rated V <sub>DRM</sub><br>Gate pulse = 20 V, 15 Ω, t <sub>p</sub> = 6 μs, t <sub>r</sub> = 0.1 μs maximum<br>I <sub>TM</sub> = (2 x rated di/dt) A                      | 200    | A/μs  |
|                                           |                 |                                                                                                                                                                                                                                    | 180    |       |
|                                           |                 |                                                                                                                                                                                                                                    | 160    |       |
|                                           |                 |                                                                                                                                                                                                                                    | 150    |       |
| Typical turn-on time                      | t <sub>gt</sub> | T <sub>J</sub> = 25 °C,<br>at rated V <sub>DRM</sub> /V <sub>RRM</sub> , T <sub>J</sub> = 125 °C                                                                                                                                   | 0.9    | μs    |
| Typical reverse recovery time             | t <sub>rr</sub> | T <sub>J</sub> = T <sub>J</sub> maximum,<br>I <sub>TM</sub> = I <sub>T(AV)</sub> , t <sub>p</sub> > 200 μs, di/dt = - 10 A/μs                                                                                                      | 4      |       |
| Typical turn-off time                     | t <sub>q</sub>  | T <sub>J</sub> = T <sub>J</sub> maximum, I <sub>TM</sub> = I <sub>T(AV)</sub> , t <sub>p</sub> > 200 μs, V <sub>R</sub> = 100 V,<br>di/dt = - 10 A/μs, dV/dt = 20 V/μs linear to 67 % V <sub>DRM</sub> ,<br>gate bias 0 V to 100 W | 110    |       |

**Note**

- t<sub>q</sub> = 10 μs up to 600 V, t<sub>q</sub> = 30 μs up to 1600 V available on special request

| <b>BLOCKING</b>                                    |        |                                                                                |                    |       |
|----------------------------------------------------|--------|--------------------------------------------------------------------------------|--------------------|-------|
| PARAMETER                                          | SYMBOL | TEST CONDITIONS                                                                | VALUES             | UNITS |
| Maximum critical rate of rise of off-state voltage | dV/dt  | T <sub>J</sub> = T <sub>J</sub> maximum linear to 100 % rated V <sub>DRM</sub> | 100                | V/μs  |
|                                                    |        | T <sub>J</sub> = T <sub>J</sub> maximum linear to 67 % rated V <sub>DRM</sub>  | 300 <sup>(1)</sup> |       |

**Note**

- <sup>(1)</sup> Available with: dV/dt = 1000 V/μs, to complete code add S90 i.e. 16RIA120S90

| <b>TRIGGERING</b>                   |                    |                                                                            |        |       |
|-------------------------------------|--------------------|----------------------------------------------------------------------------|--------|-------|
| PARAMETER                           | SYMBOL             | TEST CONDITIONS                                                            | VALUES | UNITS |
| Maximum peak gate power             | P <sub>GM</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum                                    | 8.0    | W     |
| Maximum average gate power          | P <sub>G(AV)</sub> |                                                                            | 2.0    |       |
| Maximum peak positive gate current  | I <sub>GM</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum                                    | 1.5    | A     |
| Maximum peak negative gate voltage  | -V <sub>GM</sub>   | T <sub>J</sub> = T <sub>J</sub> maximum                                    | 10     | V     |
| DC gate current required to trigger | I <sub>GT</sub>    | T <sub>J</sub> = - 65 °C                                                   | 90     | mA    |
|                                     |                    | T <sub>J</sub> = 25 °C                                                     | 60     |       |
|                                     |                    | T <sub>J</sub> = 125 °C                                                    | 35     |       |
| DC gate voltage required to trigger | V <sub>GT</sub>    | T <sub>J</sub> = - 65 °C                                                   | 3.0    | V     |
|                                     |                    | T <sub>J</sub> = 25 °C                                                     | 2.0    |       |
|                                     |                    | T <sub>J</sub> = 125 °C                                                    | 1.0    |       |
| DC gate current not to trigger      | I <sub>GD</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated value    | 2.0    | mA    |
| DC gate voltage not to trigger      | V <sub>GD</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum,<br>V <sub>DRM</sub> = Rated value | 0.2    | V     |

| THERMAL AND MECHANICAL SPECIFICATIONS                    |                |                                                |                  |           |
|----------------------------------------------------------|----------------|------------------------------------------------|------------------|-----------|
| PARAMETER                                                | SYMBOL         | TEST CONDITIONS                                | VALUES           | UNITS     |
| Maximum operating junction and storage temperature range | $T_J, T_{Stg}$ |                                                | - 65 to 125      | °C        |
| Maximum thermal resistance, junction to case             | $R_{thJC}$     | DC operation                                   | 0.86             | K/W       |
| Maximum thermal resistance, case to heatsink             | $R_{thCS}$     | Mounting surface, smooth, flat and greased     | 0.35             |           |
|                                                          |                |                                                | TO NUT           | TO DEVICE |
| Mounting torque                                          |                | Lubricated threads<br>(Non-lubricated threads) | 20 (27.5)        | 25        |
|                                                          |                |                                                | 0.23 (0.32)      | 0.29      |
|                                                          |                |                                                | 2.3 (3.1)        | 2.8       |
| Approximate weight                                       |                |                                                | 14               | g         |
|                                                          |                |                                                | 0.49             | oz.       |
| Case style                                               |                | See dimensions - link at the end of datasheet  | TO-208AA (TO-48) |           |

| $\Delta R_{thJC}$ CONDUCTION |                       |                        |                             |       |
|------------------------------|-----------------------|------------------------|-----------------------------|-------|
| CONDUCTION ANGLE             | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS             | UNITS |
| 180°                         | 0.21                  | 0.15                   | $T_J = T_J \text{ maximum}$ | K/W   |
| 120°                         | 0.25                  | 0.25                   |                             |       |
| 90°                          | 0.31                  | 0.34                   |                             |       |
| 60°                          | 0.45                  | 0.47                   |                             |       |
| 30°                          | 0.76                  | 0.76                   |                             |       |

### Note

- The table above shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC

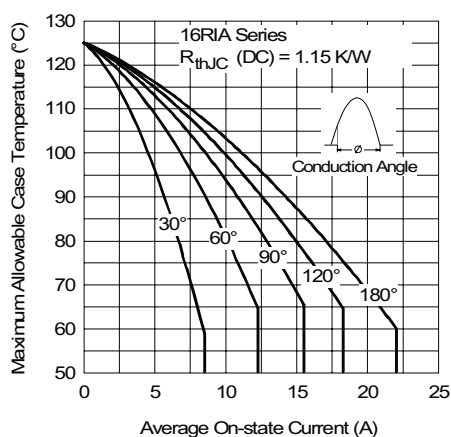


Fig. 1 - Current Ratings Characteristics

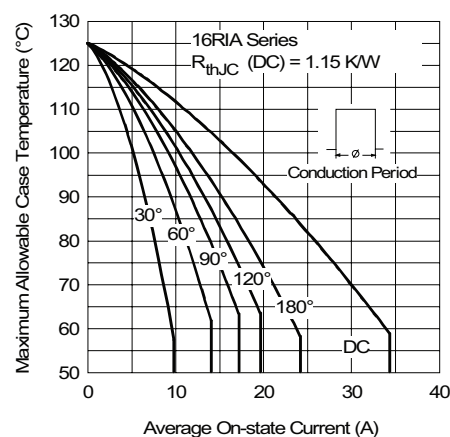


Fig. 2 - Current Ratings Characteristics

## Medium Power Thyristors Vishay High Power Products (Stud Version), 16 A

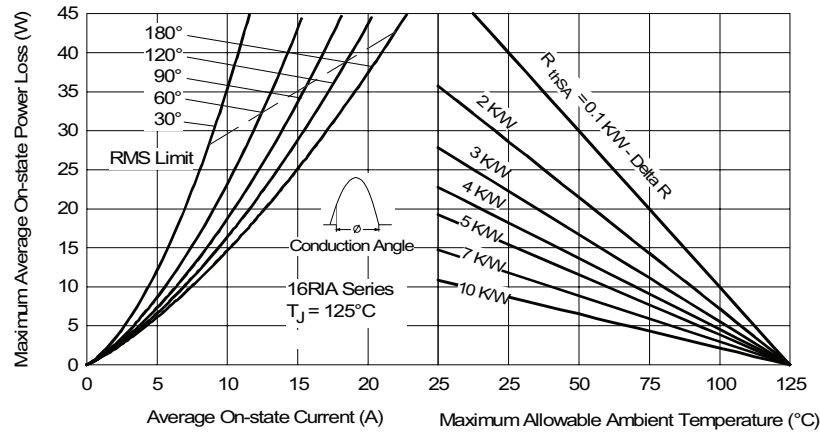


Fig. 3 - On-State Power Loss Characteristics

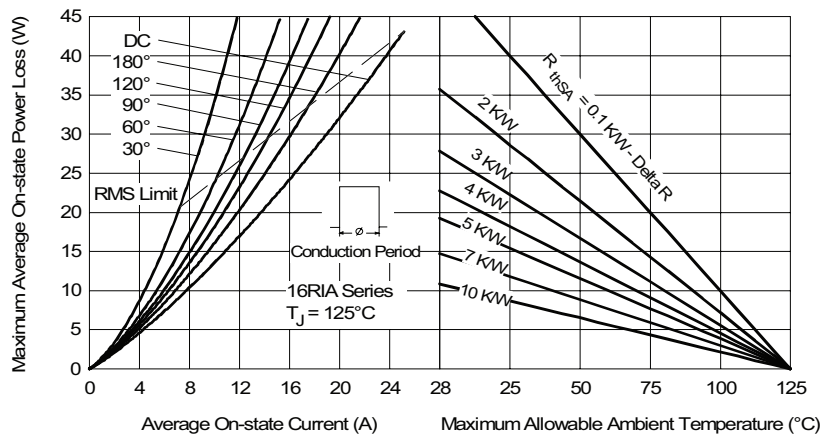


Fig. 4 - On-State Power Loss Characteristics

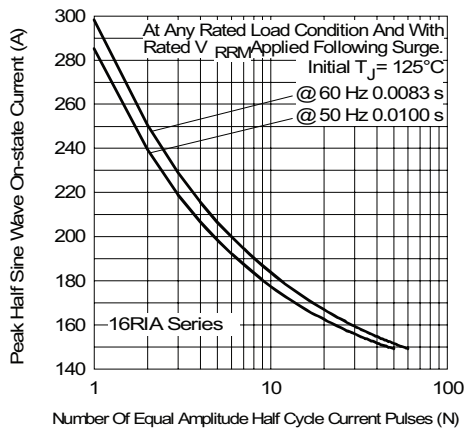


Fig. 5 - Maximum Non-Repetitive Surge Current

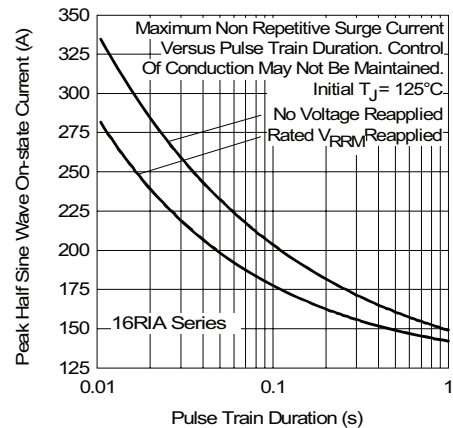


Fig. 6 - Maximum Non-Repetitive Surge Current

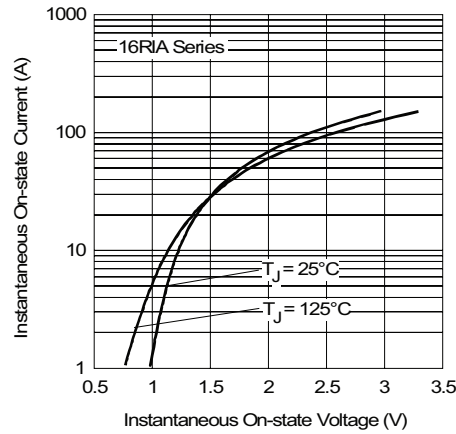


Fig. 7 - Forward Voltage Drop Characteristics

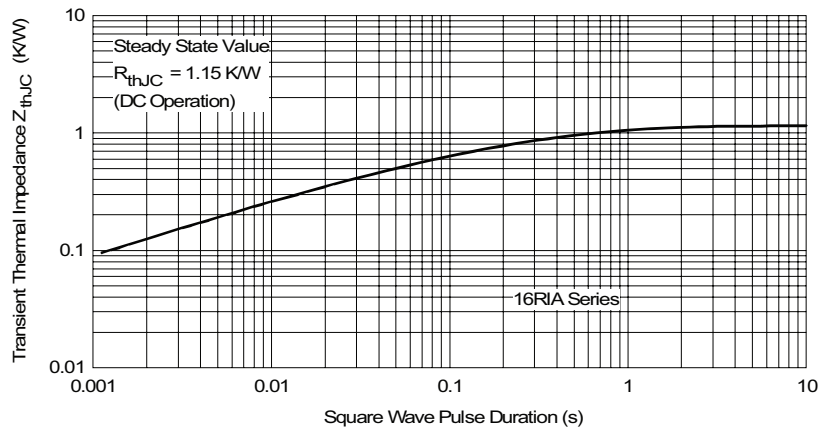


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

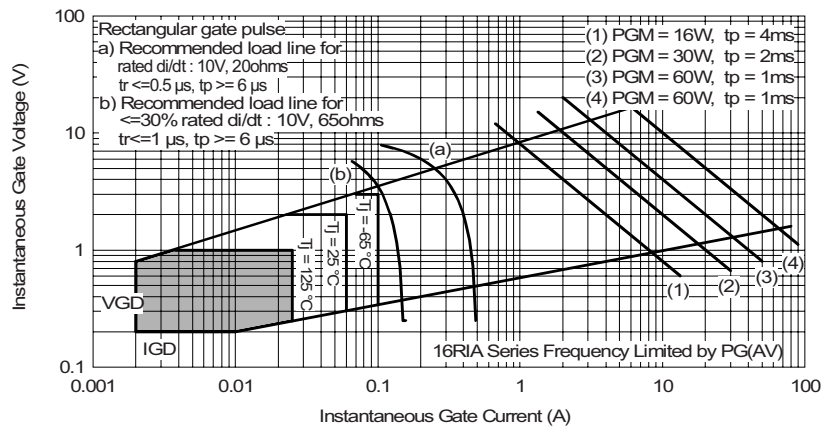


Fig. 9 - Gate Characteristics



### ORDERING INFORMATION TABLE

|             |    |     |     |   |     |
|-------------|----|-----|-----|---|-----|
| Device code | 16 | RIA | 120 | M | S90 |
|             | 1  | 2   | 3   | 4 | 5   |

- 1** - Current code
- 2** - Essential part number
- 3** - Voltage code x 10 =  $V_{RRM}$  (see Voltage Ratings table)
- 4** - None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A  
M = Stud base TO-208AA (TO-48) M6 x 1
- 5** - Critical dV/dt:  
None = 300 V/ $\mu$ s (standard value)  
S90 = 1000 V/ $\mu$ s (special selection)

| LINKS TO RELATED DOCUMENTS |                                                                               |
|----------------------------|-------------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95333">http://www.vishay.com/doc?95333</a> |



### Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.



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](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.