




## AAP Gen 7 (TO-240AA) Power Modules Standard Diodes, 60 A

**ADD-A-PAK****RoHS  
COMPLIANT****FEATURES**

- High voltage
- Industrial standard package
- Low thermal resistance
- UL approved file E78996 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

**BENEFITS**

- Excellent thermal performances obtained by the usage of exposed direct bonded copper substrate
- Up to 1600 V
- High surge capability
- Easy mounting on heat sink

**ELECTRICAL DESCRIPTION**

These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery charger.

**PRIMARY CHARACTERISTICS**

|                       |  |
|-----------------------|--|
| $I_{F(AV)}$           | 60 A   |
| Type                  | Modules - diode, high voltage  |
| Package               | AAP Gen 7 (TO-240AA)   |
| Circuit configuration | Two diodes doubler circuit, two diodes common cathode, two diodes common anode, single diode |

**MECHANICAL DESCRIPTION**

The AAP Gen 7 (TO-240AA), new generation of AAP module, combines the excellent thermal performances obtained by the usage of exposed direct bonded copper substrate, with advanced compact simple package solution and simplified internal structure with minimized number of interfaces.

**MAJOR RATINGS AND CHARACTERISTICS**

| SYMBOL        | CHARACTERISTICS | VALUES      | UNITS              |
|---------------|-----------------|-------------|--------------------|
| $I_{F(AV)}$   |                 | 60          | A                  |
|               | $T_C$           | 114         | °C                 |
| $I_{F(RMS)}$  |                 | 94          | A                  |
| $I_{FSM}$     | 50 Hz           | 1300        |                    |
|               | 60 Hz           | 1360        |                    |
| $I^2t$        | 50 Hz           | 8.44        | kA <sup>2</sup> s  |
|               | 60 Hz           | 7.68        |                    |
| $I^2\sqrt{t}$ |                 | 84.5        | kA <sup>2</sup> √s |
| $V_{RRM}$     | Range           | 400 to 1600 | V                  |
| $T_{Stg}$     |                 | -40 to +150 | °C                 |
| $T_J$         |                 | -40 to +150 | °C                 |



**ELECTRICAL SPECIFICATIONS**

| <b>VOLTAGE RATINGS</b> |              |   |   |   |
|------------------------|--------------|---|---|---|
| TYPE NUMBER            | VOLTAGE CODE | V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE<br>V | V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | I <sub>RRM</sub> MAXIMUM AT T <sub>J</sub> = 150 °C<br>mA |
| VS-VSK.56              | 04           | 400   | 500   | 10  |
|                        | 06           | 600   | 700   |   |
|                        | 08           | 800   | 900   |   |
|                        | 10           | 1000  | 1100  |   |
|                        | 12           | 1200  | 1300  |   |
|                        | 14           | 1400  | 1500  |   |
|                        | 16           | 1600  | 1700  |   |

| <b>FORWARD CONDUCTION</b>                                     |                     |  |                                   |        |                    |
|---|---------------------|--|-----------------------------------|--------|--------------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS  |                                   | VALUES | UNITS              |
| Maximum average forward current at case temperature           | I <sub>F(AV)</sub>  | 180° conduction, half sine wave  |                                   | 60     | A                  |
|   |                     |  |                                   | 114    | °C                 |
| Maximum RMS forward current                                   | I <sub>F(RMS)</sub> |  |                                   | 94     | A                  |
| Maximum peak, one-cycle forward, non-repetitive surge current | I <sub>FSM</sub>    | t = 10 ms  | No voltage reappplied             | 1300   |                    |
|   |                     | t = 8.3 ms   | No voltage reappplied             | 1360   |                    |
|   |                     | t = 10 ms  | 100 % V <sub>RRM</sub> reappplied | 1090   |                    |
|   |                     | t = 8.3 ms   | 100 % V <sub>RRM</sub> reappplied | 1140   |                    |
| Maximum I <sup>2</sup> t for fusing                           | I <sup>2</sup> t    | t = 10 ms  | No voltage reappplied             | 8.44   | kA <sup>2</sup> s  |
|   |                     | t = 8.3 ms   | No voltage reappplied             | 7.68   |                    |
|   |                     | t = 10 ms  | 100 % V <sub>RRM</sub> reappplied | 5.97   |                    |
|   |                     | t = 8.3 ms   | 100 % V <sub>RRM</sub> reappplied | 5.43   |                    |
| Maximum I <sup>2</sup> √t for fusing                          | I <sup>2</sup> √t   | t = 0.1 ms to 10 ms, no voltage reappplied   |                                   | 84.5   | kA <sup>2</sup> √s |
| Low level value of threshold voltage                          | V <sub>F(TO)1</sub> | (16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                   | 0.74   | V                  |
| High level value of threshold voltage                         | V <sub>F(TO)2</sub> | (I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                   |                                   | 0.86   |                    |
| Low level value of forward slope resistance                   | r <sub>f1</sub>     | (16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                   | 3.94   | mΩ                 |
| High level value of forward slope resistance                  | r <sub>f2</sub>     | (I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                   |                                   | 3.43   |                    |
| Maximum forward voltage drop                                  | V <sub>FM</sub>     | I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = 25 °C, t <sub>p</sub> = 400 μs square wave   |                                   | 1.6    | V                  |

| <b>BLOCKING</b>                      |                  |                         |  |                            |       |
|--------------------------------------|------------------|-------------------------|--|----------------------------|-------|
| PARAMETER                            | SYMBOL           | TEST CONDITIONS         |  | VALUES                     | UNITS |
| Maximum peak reverse leakage current | I <sub>RRM</sub> | T <sub>J</sub> = 150 °C |  | 10                         | mA    |
| Maximum RMS insulation voltage       | V <sub>INS</sub> | 50 Hz                   |  | 3000 (1 min)<br>3600 (1 s) | V     |



| <b>THERMAL AND MECHANICAL SPECIFICATIONS</b>                  |                |  |                      |       |
|---|----------------|--|----------------------|-------|
| PARAMETER   | SYMBOL         | TEST CONDITIONS  | VALUES               | UNITS |
| Junction and storage temperature range                        | $T_J, T_{Stg}$ |  | -40 to +150          | °C    |
| Maximum internal thermal resistance, junction to case per leg | $R_{thJC}$     | DC operation   | 0.33                 | °C/W  |
| Typical thermal resistance, case to heat sink per module      | $R_{thCS}$     | Mounting surface flat, smooth and greased  | 0.1                  |       |
| Mounting torque $\pm 10\%$                                    | to heatsink    | A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound. | 4                    | Nm    |
|   | busbar         |  | 3                    |       |
| Approximate weight  |                |  | 75                   | g     |
|   |                |  | 2.7                  | oz.   |
| Case style  |                | JEDEC®   | AAP Gen 7 (TO-240AA) |       |

| <b><math>\Delta R</math> CONDUCTION PER JUNCTION</b> |                           |       |       |       |       |                             |       |       |       |       |       |
|--|---------------------------|-------|-------|-------|-------|-----------------------------|-------|-------|-------|-------|-------|
| DEVICES  | SINE HALF WAVE CONDUCTION |       |       |       |       | RECTANGULAR WAVE CONDUCTION |       |       |       |       | UNITS |
|  | 180°                      | 120°  | 90°   | 60°   | 30°   | 180°                        | 120°  | 90°   | 60°   | 30°   |       |
| VSK.56   | 0.115                     | 0.136 | 0.173 | 0.236 | 0.346 | 0.09                        | 0.145 | 0.185 | 0.243 | 0.349 | °C/W  |

**Note**

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

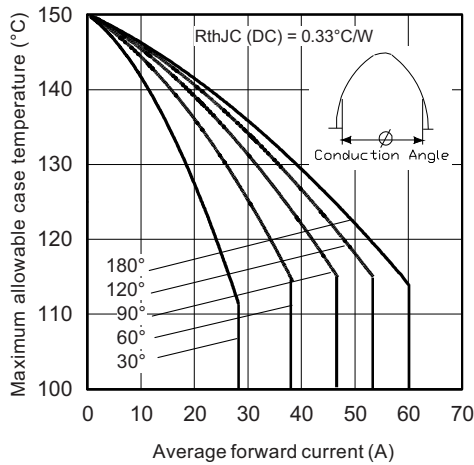


Fig. 1 - Current Ratings Characteristics

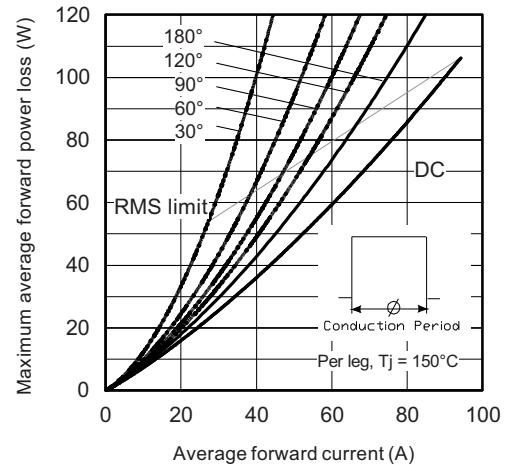


Fig. 4 - Forward Power Loss Characteristics

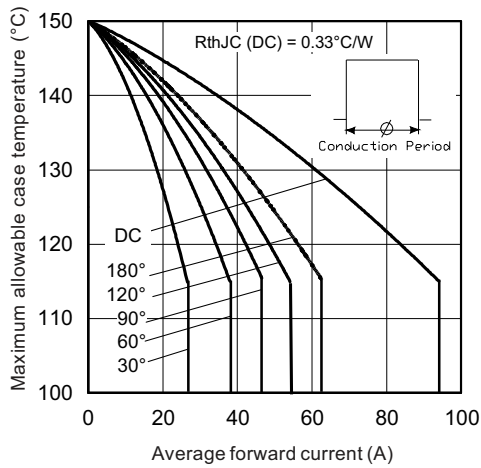


Fig. 2 - Current Ratings Characteristics

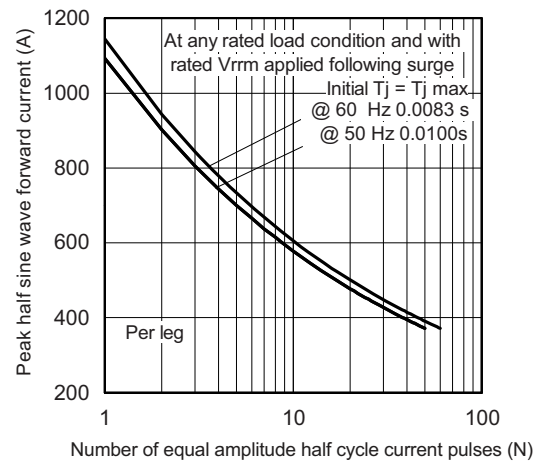


Fig. 5 - Maximum Non-Repetitive Surge Current

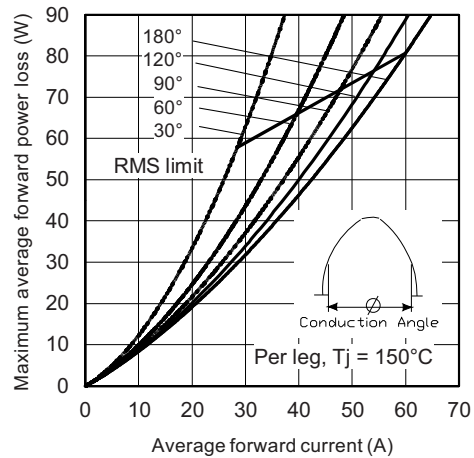


Fig. 3 - Forward Power Loss Characteristics

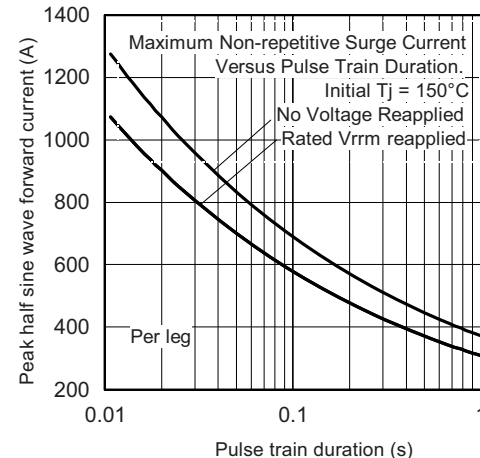


Fig. 6 - Maximum Non-Repetitive Surge Current

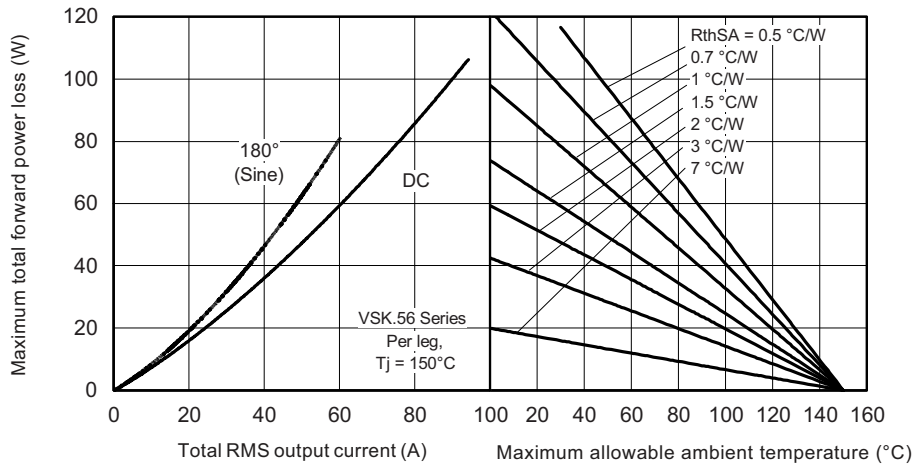


Fig. 7 - Forward Power Loss Characteristics

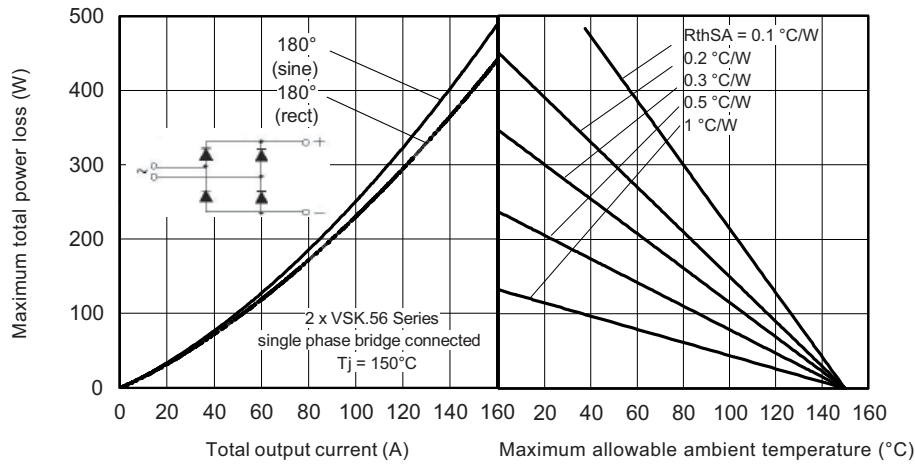


Fig. 8 - Forward Power Loss Characteristics

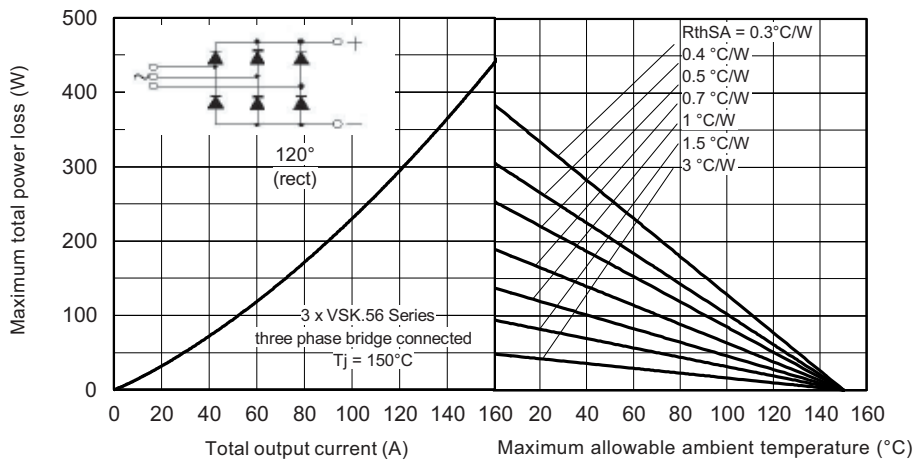


Fig. 9 - Forward Power Loss Characteristics

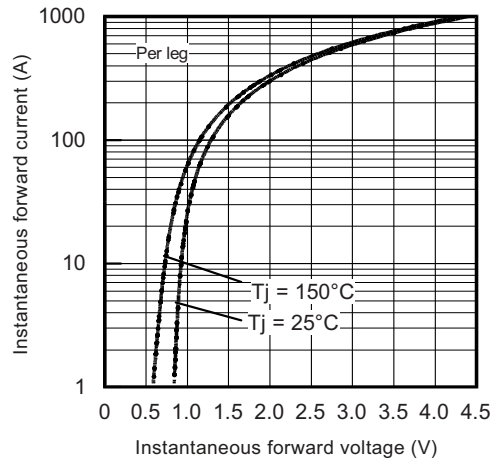


Fig. 10 - Forward Voltage Characteristics

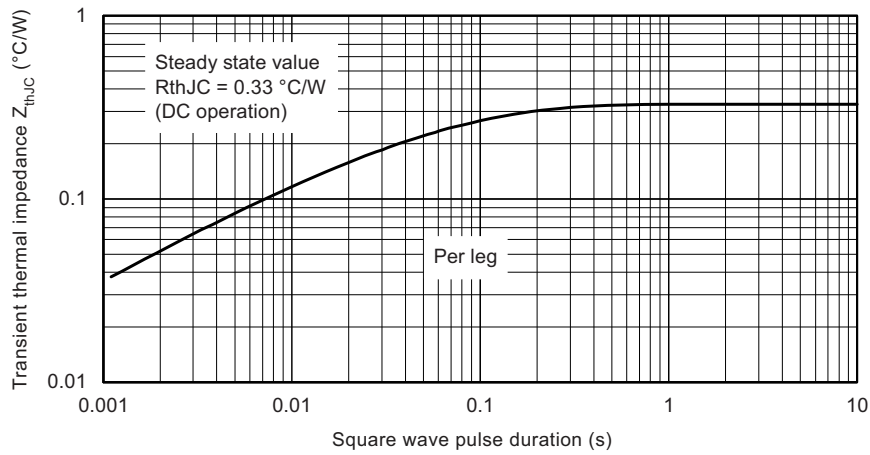


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

|             |              |          |          |           |          |           |
|-------------|--------------|----------|----------|-----------|----------|-----------|
| Device code | <b>VS-VS</b> | <b>K</b> | <b>D</b> | <b>56</b> | <b>/</b> | <b>16</b> |
|             | ①            | ②        | ③        | ④         |          | ⑤         |

- 1** - Vishay Semiconductors product
- 2** - Module type
- 3** - Circuit configuration (see Circuit Configuration table)
- 4** - Current code (60 A)
- 5** - Voltage code (see Voltage Ratings table)

**Note**

- To order the optional hardware go to [www.vishay.com/doc?95172](http://www.vishay.com/doc?95172)

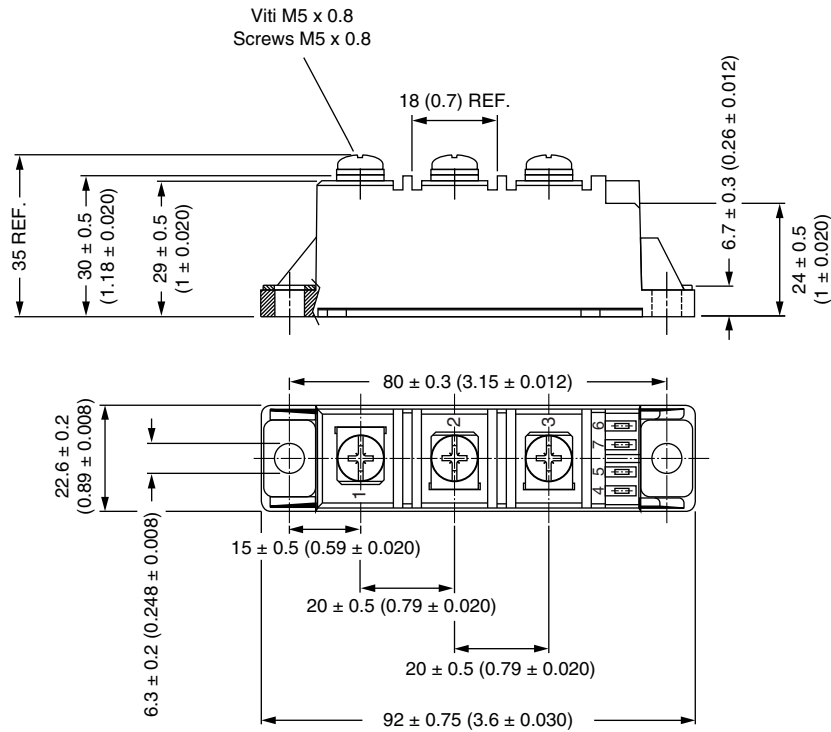


| CIRCUIT CONFIGURATION      |                            |                       |
|----------------------------|----------------------------|-----------------------|
| CIRCUIT DESCRIPTION        | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING       |
| Two diodes doubler circuit | D                          | <p><b>VSKD...</b></p> |
| Two diodes common cathode  | C                          | <p><b>VSKC...</b></p> |
| Two diodes common anode    | J                          | <p><b>VSKJ...</b></p> |
| Single diode               | E                          | <p><b>VSKE...</b></p> |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95369">www.vishay.com/doc?95369</a> |

## ADD-A-PAK Generation VII - Diode

**DIMENSIONS** in millimeters (inches)







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