



## Standard Recovery Diodes, 250 A to 320 A (MAGN-A-PAK Power Modules)



MAGN-A-PAK

### FEATURES

- High voltage
- Electrically isolated base plate
- 3000 V<sub>RMS</sub> isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- 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)


**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

|                    |                               |
|--------------------|-------------------------------|
| I <sub>F(AV)</sub> | 250 A to 320 A                |
| Type               | Modules - Diode, High Voltage |
| Package            | MAGN-A-PAK                    |
| Circuit            | Two SCRs doubler circuit      |

### DESCRIPTION

This new VS-VSK series of MAGN-A-PAKs uses high voltage power diodes in two basic configurations. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges and the single diode module can be used in conjunction with the thyristor modules as a freewheel diode. These modules are intended for general purpose applications such as battery chargers, welders and plating equipment and where high voltage and high current are required (motor drives, etc.).

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL              | CHARACTERISTICS | VSK.250..   | VSK.270.. | VSK.320.. | UNITS              |
|---------------------|-----------------|-------------|-----------|-----------|--------------------|
| I <sub>F(AV)</sub>  |                 | 250         | 270       | 320       | A                  |
|                     | T <sub>C</sub>  | 100         | 100       | 100       | °C                 |
| I <sub>F(RMS)</sub> |                 | 393         | 424       | 502       | A                  |
| I <sub>FSM</sub>    | 50 Hz           | 7015        | 8920      | 10 110    |                    |
|                     | 60 Hz           | 7345        | 9430      | 10 580    |                    |
| I <sup>2</sup> t    | 50 Hz           | 246         | 398       | 511       | kA <sup>2</sup> s  |
|                     | 60 Hz           | 225         | 363       | 466       |                    |
| I <sup>2</sup> √t   |                 | 2460        | 3980      | 5110      | kA <sup>2</sup> √s |
| V <sub>RRM</sub>    |                 | 400 to 3000 |           |           | V                  |
| T <sub>J</sub>      |                 | - 40 to 150 |           |           | °C                 |



## ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS                        |              |                                                          |                                                              |                                   |
|----------------------------------------|--------------|----------------------------------------------------------|--------------------------------------------------------------|-----------------------------------|
| TYPE NUMBER                            | VOLTAGE CODE | $V_{RRM}$ , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$ MAXIMUM AT 150 °C<br>mA |
| VS-VSK.250<br>VS-VSK.270<br>VS-VSK.320 | 04           | 400                                                      | 500                                                          | 50                                |
|                                        | 08           | 800                                                      | 900                                                          |                                   |
|                                        | 12           | 1200                                                     | 1300                                                         |                                   |
|                                        | 16           | 1600                                                     | 1700                                                         |                                   |
|                                        | 20           | 2000                                                     | 2100                                                         |                                   |
| VS-VSK.270                             | 30           | 3000                                                     | 3100                                                         |                                   |

| FORWARD CONDUCTION                                            |                     |                                                                                                                                                                                                                        |                                  |                                                                       |         |         |         |                    |
|---------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|---------|---------|---------|--------------------|
| PARAMETER                                                     | SYMBOL              | TEST CONDITIONS                                                                                                                                                                                                        |                                  |                                                                       | VSK.250 | VSK.270 | VSK.320 | UNITS              |
| Maximum average forward current at case temperature           | I <sub>F(AV)</sub>  | 180° conduction, half sine wave                                                                                                                                                                                        |                                  |                                                                       | 250     | 270     | 320     | A                  |
|                                                               |                     |                                                                                                                                                                                                                        |                                  |                                                                       | 100     | 100     | 100     | °C                 |
| Maximum RMS forward current                                   | I <sub>F(RMS)</sub> | As AC switch                                                                                                                                                                                                           |                                  |                                                                       | 393     | 424     | 502     | A                  |
| Maximum peak, one-cycle forward, non-repetitive surge current | I <sub>FSM</sub>    | t = 10 ms                                                                                                                                                                                                              | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J maximum</sub> | 7015    | 8920    | 10 110  |                    |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                             |                                  |                                                                       | 7345    | 9340    | 10 580  |                    |
|                                                               |                     | t = 10 ms                                                                                                                                                                                                              | 100 % V <sub>RRM</sub> reapplied |                                                                       | 5900    | 7500    | 8500    |                    |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                             |                                  |                                                                       | 6180    | 7850    | 8900    |                    |
| Maximum I <sup>2</sup> t for fusing                           | I <sup>2</sup> t    | t = 10 ms                                                                                                                                                                                                              | No voltage reapplied             |                                                                       | 246     | 398     | 511     | kA <sup>2</sup> s  |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                             |                                  | 225                                                                   | 363     | 466     |         |                    |
|                                                               |                     | t = 10 ms                                                                                                                                                                                                              | 100 % V <sub>RRM</sub> reapplied | 174                                                                   | 281     | 361     |         |                    |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                             |                                  | 159                                                                   | 257     | 330     |         |                    |
| Maximum I <sup>2</sup> √t for fusing                          | I <sup>2</sup> √t   | t = 0.1 ms to 10 ms, no voltage reapplied                                                                                                                                                                              |                                  |                                                                       | 2460    | 3980    | 5110    | 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 maximum</sub>                                                                                                               |                                  |                                                                       | 0.79    | 0.74    | 0.69    | 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 maximum</sub>                                                                                                                                                 |                                  |                                                                       | 0.92    | 0.87    | 0.86    |                    |
| Low level 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 maximum</sub>                                                                                                               |                                  |                                                                       | 0.63    | 0.94    | 0.59    | mΩ                 |
| High level forward slope resistance                           | r <sub>f2</sub>     | (I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J maximum</sub>                                                                                                                                                 |                                  |                                                                       | 0.49    | 0.81    | 0.44    |                    |
| Maximum forward voltage drop                                  | V <sub>FM</sub>     | I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = T <sub>J maximum</sub> , 180° conduction<br>Average power = V <sub>F(TO)</sub> × I <sub>F(AV)</sub> + r <sub>f</sub> × (I <sub>F(RMS)</sub> ) <sup>2</sup> |                                  |                                                                       | 1.29    | 1.48    | 1.28    | V                  |

| BLOCKING                             |           |                                                        |        |       |
|--------------------------------------|-----------|--------------------------------------------------------|--------|-------|
| PARAMETER                            | SYMBOL    | TEST CONDITIONS                                        | VALUES | UNITS |
| Maximum peak reverse leakage current | $I_{RRM}$ | $T_J = 150\text{ °C}$                                  | 50     | mA    |
| RMS insulation voltage               | $V_{INS}$ | 50 Hz, circuit to base, all terminals shorted, t = 1 s | 3000   | V     |



| THERMAL AND MECHANICAL SPECIFICATIONS                     |                 |                                   |                                                                                                                                                |             |         |         |       |
|-----------------------------------------------------------|-----------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|---------|-------|
| PARAMETER                                                 |                 | SYMBOL                            | TEST CONDITIONS                                                                                                                                | VALUES      |         |         | UNITS |
|                                                           |                 |                                   |                                                                                                                                                | VSK.250     | VSK.270 | VSK.320 |       |
| Maximum junction operating and storage temperature range  |                 | T <sub>J</sub> , T <sub>Stg</sub> |                                                                                                                                                | - 40 to 150 |         |         | °C    |
| Maximum thermal resistance, junction to case per junction |                 | R <sub>thJC</sub>                 | DC operation                                                                                                                                   | 0.16        | 0.125   |         | K/W   |
| Maximum resistance, case to heatsink per module           |                 | R <sub>thCS</sub>                 | Mounting surface flat, smooth and greased                                                                                                      | 0.035       |         |         |       |
| Mounting torque<br>± 10 %                                 | MAP to heatsink |                                   | A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound. | 4 to 6      |         |         | Nm    |
|                                                           | busbar to MAP   |                                   |                                                                                                                                                | 8 to 10     |         |         |       |
| Approximate weight                                        |                 |                                   |                                                                                                                                                | 800         |         |         | g     |
|                                                           |                 |                                   |                                                                                                                                                | 30          |         |         | oz.   |
| Case style                                                |                 |                                   |                                                                                                                                                | MAGN-A-PAK  |         |         |       |

| ΔR CONDUCTION PER JUNCTION |                                                    |       |       |       |       |                                                     |       |       |       |       |       |
|----------------------------|----------------------------------------------------|-------|-------|-------|-------|-----------------------------------------------------|-------|-------|-------|-------|-------|
| DEVICE                     | SINUSOIDAL CONDUCTION<br>AT T <sub>J</sub> MAXIMUM |       |       |       |       | RECTANGULAR CONDUCTION<br>AT T <sub>J</sub> MAXIMUM |       |       |       |       | UNITS |
|                            | 180°                                               | 120°  | 90°   | 60°   | 30°   | 180°                                                | 120°  | 90°   | 60°   | 30°   |       |
| VSK.250                    | 0.009                                              | 0.010 | 0.014 | 0.020 | 0.032 | 0.007                                               | 0.011 | 0.015 | 0.021 | 0.033 | K/W   |
| VSK.270                    | 0.008                                              | 0.012 | 0.014 | 0.020 | 0.032 | 0.007                                               | 0.011 | 0.015 | 0.020 | 0.033 |       |
| VSK.320                    | 0.008                                              | 0.010 | 0.013 | 0.020 | 0.032 | 0.007                                               | 0.011 | 0.015 | 0.020 | 0.033 |       |

**Note**

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

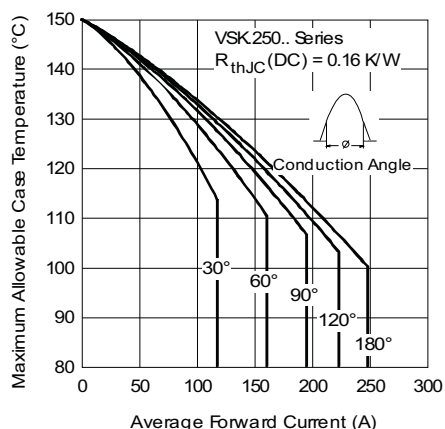


Fig. 1 - Current Ratings Characteristics

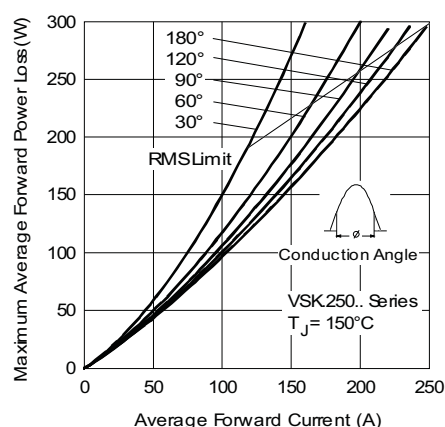


Fig. 3 - Forward Power Loss Characteristics

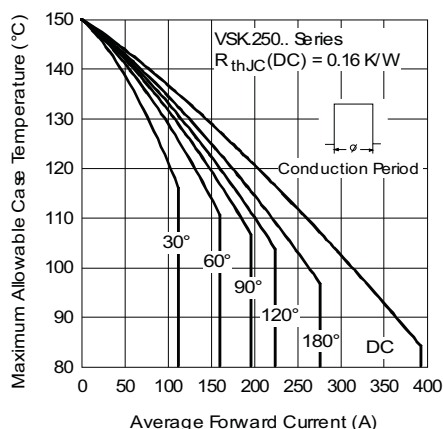


Fig. 2 - Current Ratings Characteristics

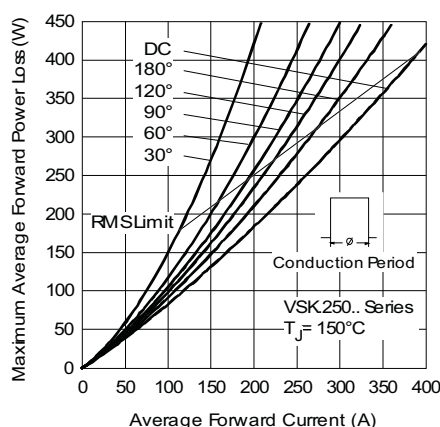


Fig. 4 - Forward Power Loss Characteristics

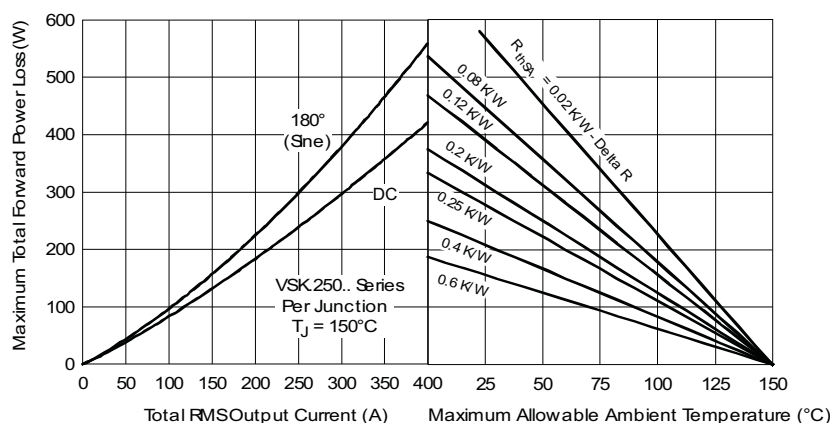


Fig. 5 - Forward Power Loss Characteristics

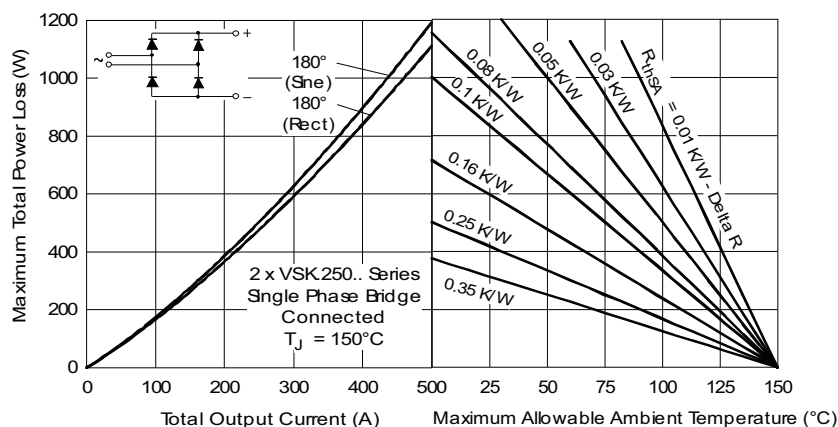


Fig. 6 - Forward Power Loss Characteristics

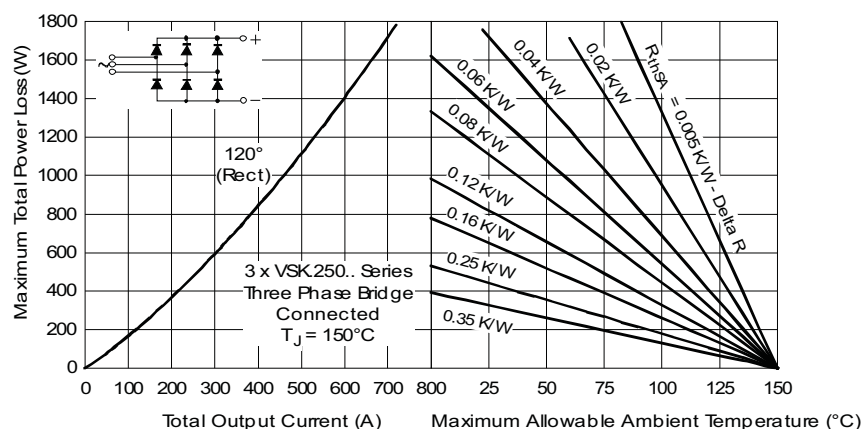


Fig. 7 - Forward Power Loss Characteristics

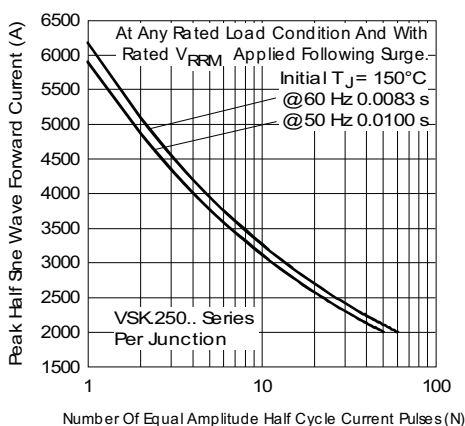


Fig. 8 - Maximum Non-Repetitive Surge Current

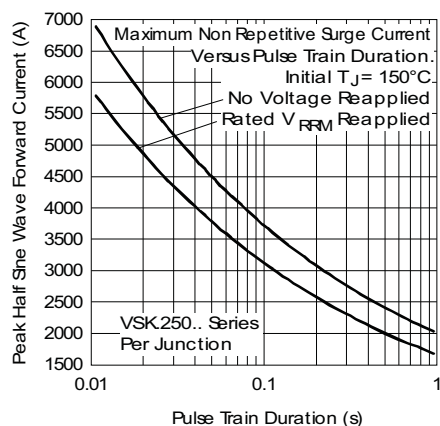


Fig. 9 - Maximum Non-Repetitive Surge Current

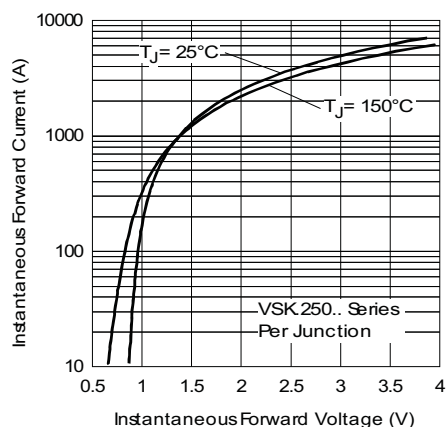


Fig. 10 - Forward Voltage Drop Characteristics

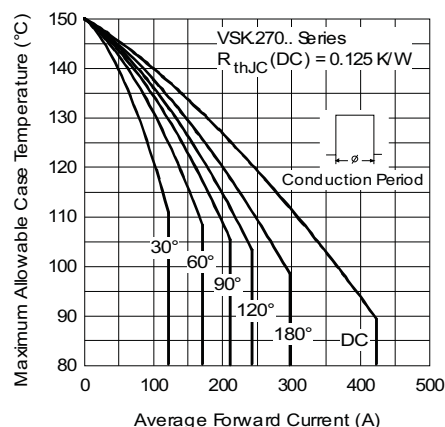


Fig. 13 - Current Ratings Characteristics

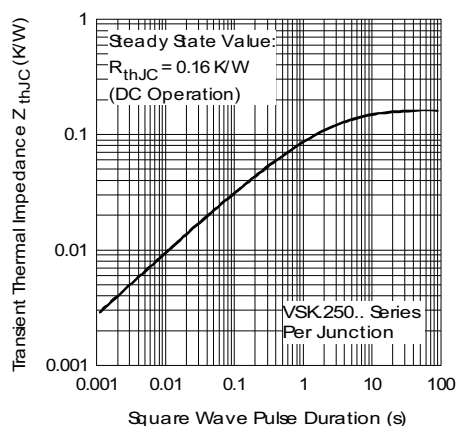


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

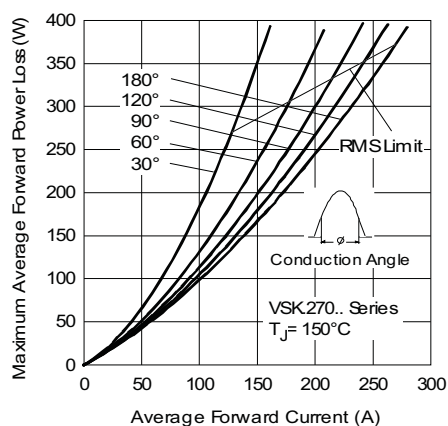


Fig. 14 - Forward Power Loss Characteristics

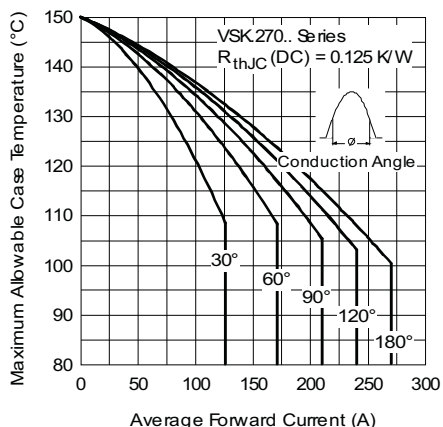


Fig. 12 - Current Ratings Characteristics

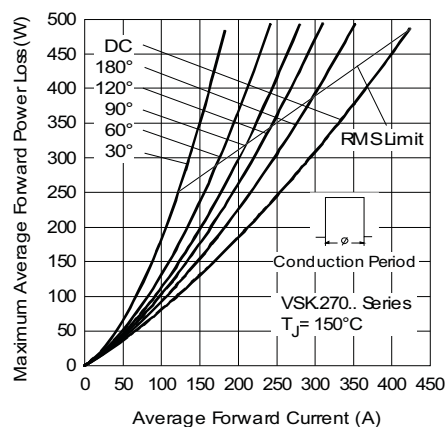


Fig. 15 - Forward Power Loss Characteristics

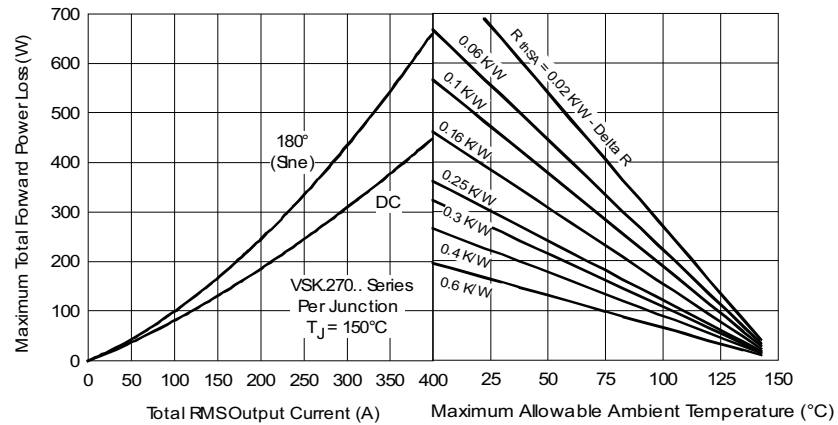


Fig. 16 - Forward Power Loss Characteristics

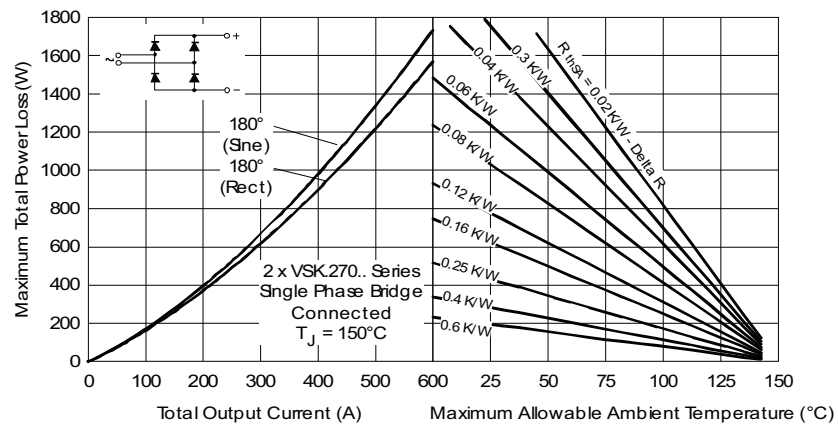


Fig. 17 - Forward Power Loss Characteristics

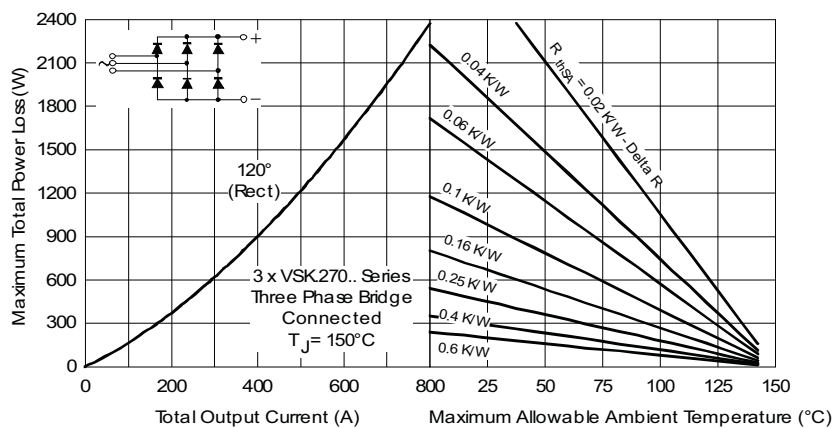


Fig. 18 - Forward Power Loss Characteristics

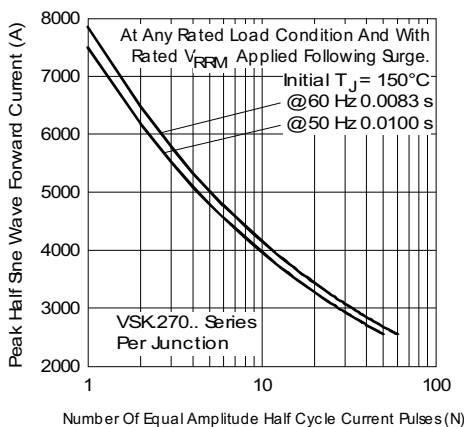


Fig. 19 - Maximum Non-Repetitive Surge Current

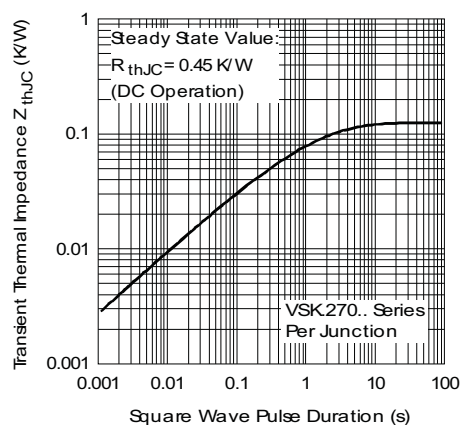


Fig. 22 - Thermal Impedance  $Z_{thJC}$  Characteristics

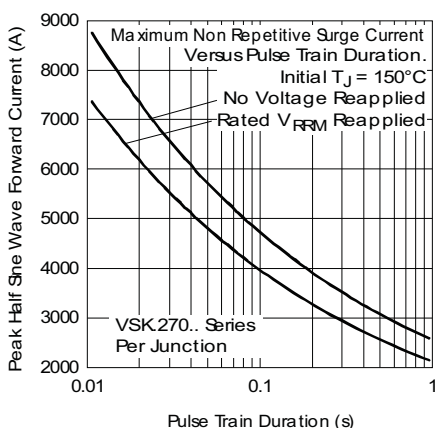


Fig. 20 - Maximum Non-Repetitive Surge Current

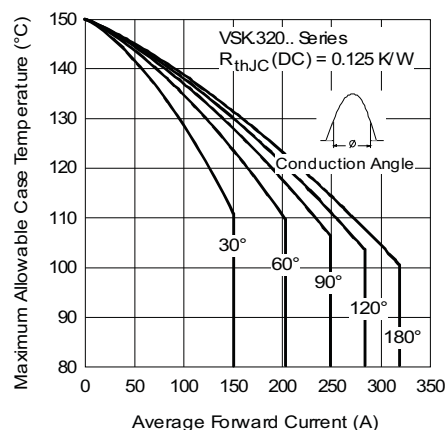


Fig. 23 - Current Ratings Characteristics

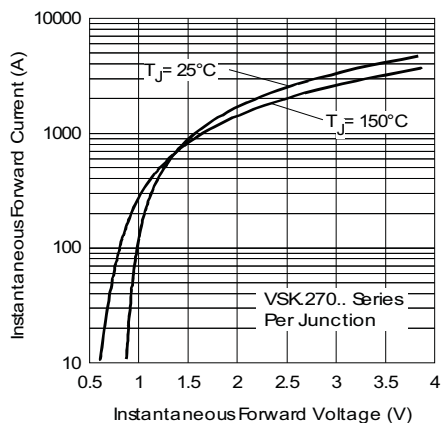


Fig. 21 - Forward Voltage Drop Characteristics

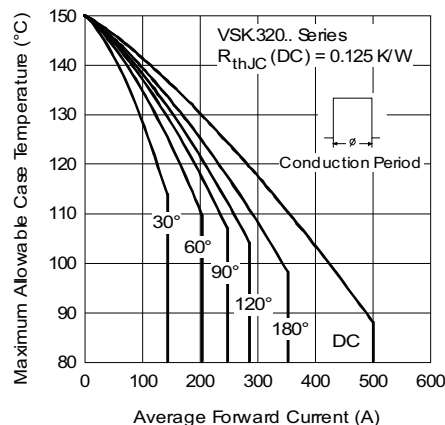


Fig. 24 - Current Ratings Characteristics

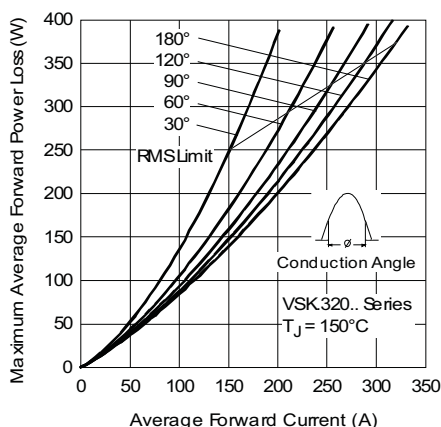


Fig. 25 - Forward Power Loss Characteristics

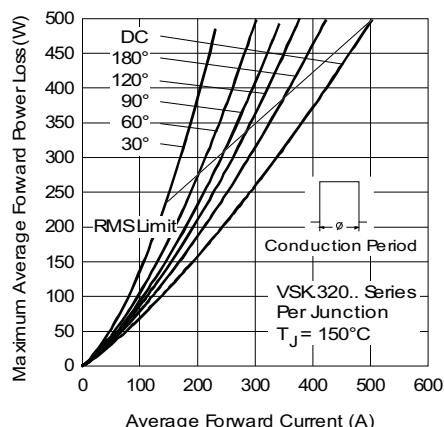


Fig. 26 - Forward Power Loss Characteristics

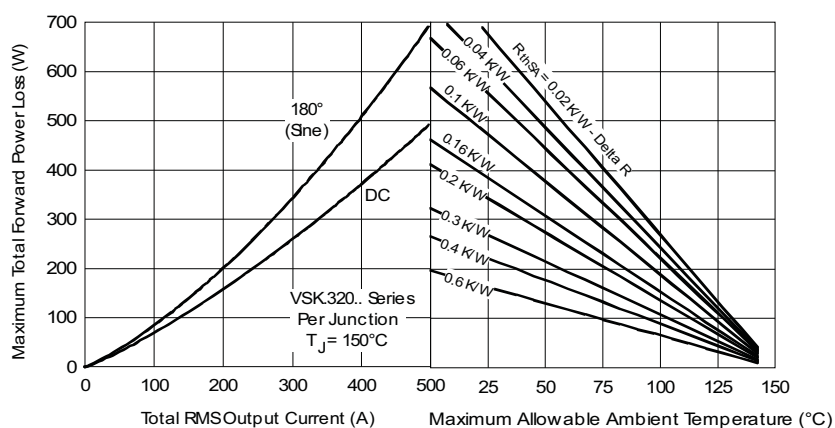


Fig. 27 - Forward Power Loss Characteristics

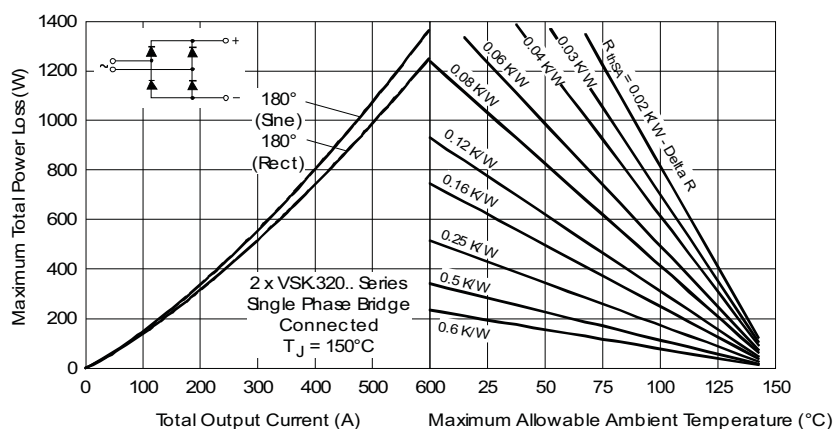


Fig. 28 - Forward Power Loss Characteristics

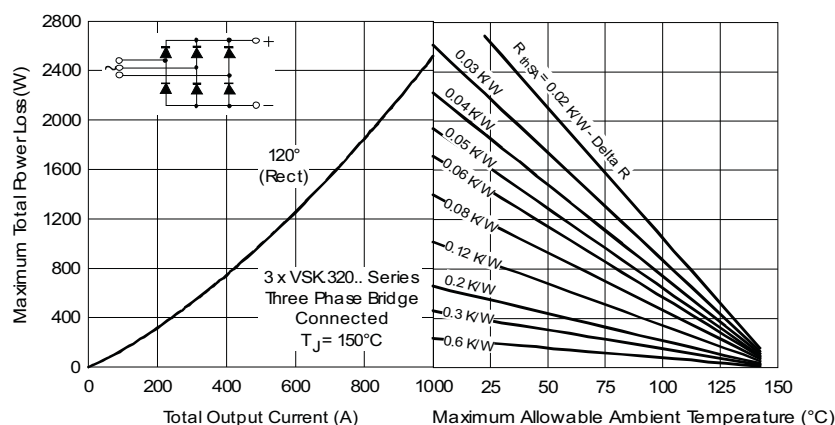


Fig. 29 - Forward Power Loss Characteristics

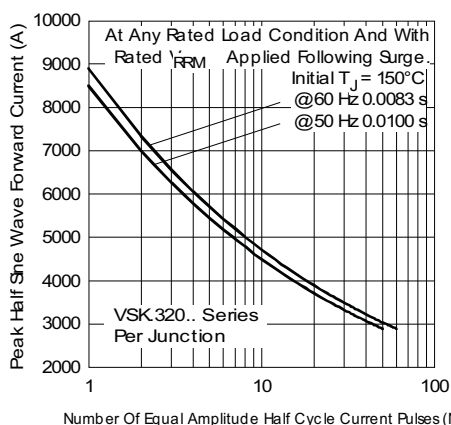


Fig. 30 - Maximum Non-Repetitive Surge Current

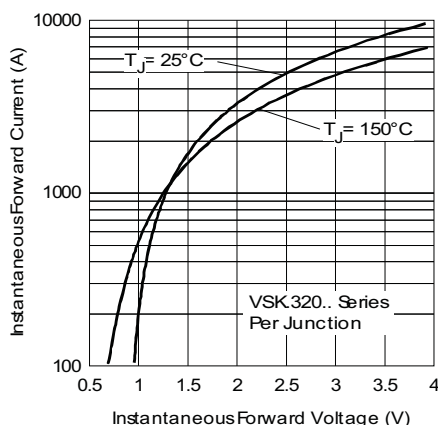


Fig. 32 - Forward Voltage Drop Characteristics

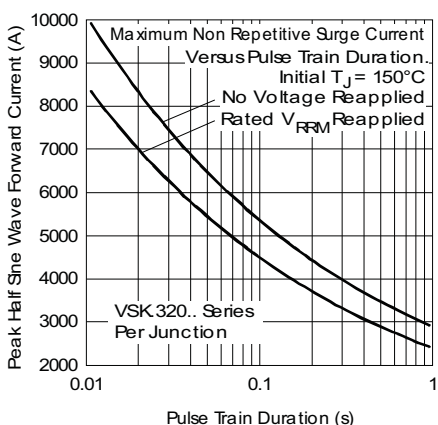


Fig. 31 - Maximum Non-Repetitive Surge Current

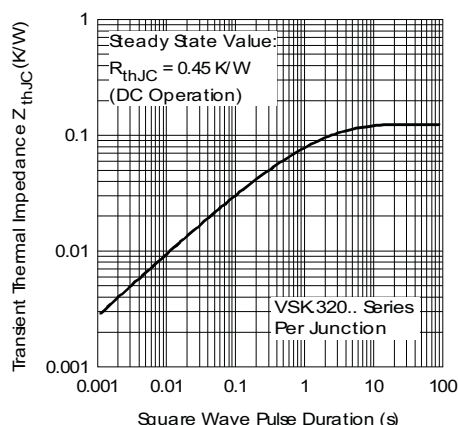


Fig. 33 - Thermal Impedance  $Z_{thJC}$  Characteristics



## ORDERING INFORMATION TABLE

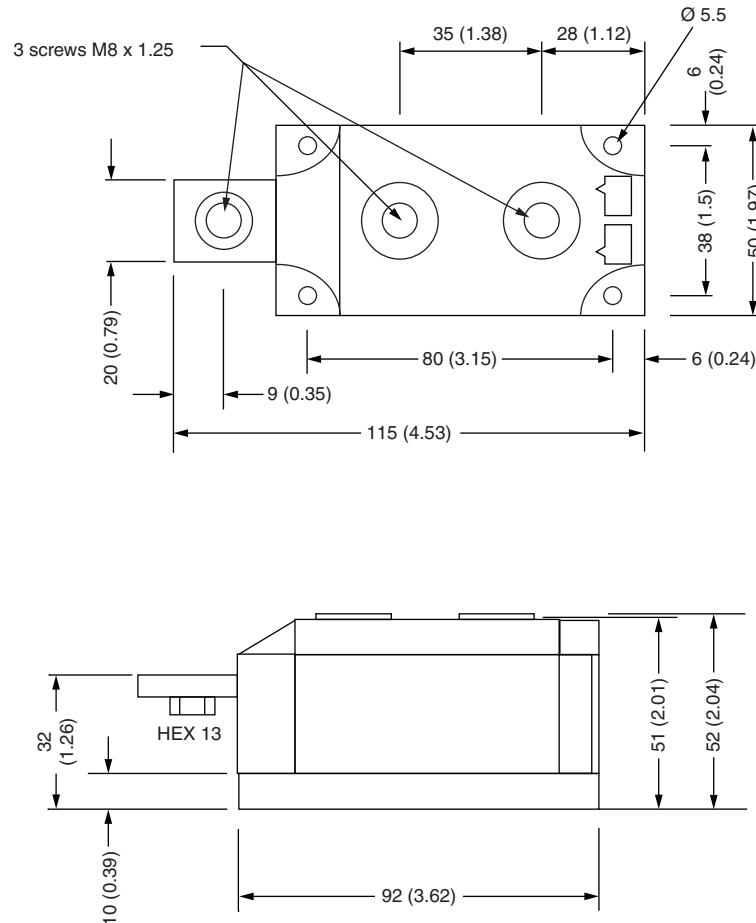
| Device code | VS-                                                        | VSK | D | 320 | - | 24 | PbF |
|-------------|------------------------------------------------------------|-----|---|-----|---|----|-----|
|             | 1                                                          | 2   | 3 | 4   |   | 5  | 6   |
| 1           | Vishay Semiconductors product                              |     |   |     |   |    |     |
| 2           | Module type                                                |     |   |     |   |    |     |
| 3           | Circuit configuration (see Circuit Configuration table)    |     |   |     |   |    |     |
| 4           | Current rating: $I_{F(AV)}$ rounded                        |     |   |     |   |    |     |
| 5           | Voltage code x 100 = $V_{RRM}$ (see Voltage Ratings table) |     |   |     |   |    |     |
| 6           | Lead (Pb)-free                                             |     |   |     |   |    |     |

| CIRCUIT CONFIGURATION      |                            |                       |
|----------------------------|----------------------------|-----------------------|
| CIRCUIT DESCRIPTION        | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING       |
| Two diodes doubler circuit | D                          | <p><b>VSKD...</b></p> |
| Two diodes common cathodes | C                          | <p><b>VSKC...</b></p> |
| Two diodes common anodes   | 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?95086">www.vishay.com/doc?95086</a> |

## MAGN-A-PAK

**DIMENSIONS** in millimeters (inches)



### Notes

- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for gate and cathode wire: UL 1385
- UL identification number for package: UL 94 V-0



## Disclaimer

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**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.**



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Электрон  
Связь**

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