

## Thyristor/Diode and Thyristor/Thyristor (SUPER MAGN-A-PAK Power Modules), 500 A



SUPER MAGN-A-PAK

### FEATURES

- High current capability
- High surge capability
- Industrial standard package
- 3000 V<sub>RMS</sub> isolating voltage with non-toxic substrate
- UL approved file E78996
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

$I_{T(AV)}$ ,  $I_{F(AV)}$

500 A

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL                    | CHARACTERISTICS | VALUES      | UNITS              |
|---------------------------|-----------------|-------------|--------------------|
| $I_{T(AV)}$ , $I_{F(AV)}$ | 82 °C           | 500         | A                  |
| $I_{T(RMS)}$              |                 | 785         | A                  |
|                           | $T_C$           | 82          | °C                 |
| $I_{TSM}$                 | 50 Hz           | 17.8        | kA                 |
|                           | 60 Hz           | 18.7        |                    |
| $I^2t$                    | 50 Hz           | 1591        | kA <sup>2</sup> s  |
|                           | 60 Hz           | 1452        |                    |
| $I^2\sqrt{t}$             |                 | 15 910      | kA <sup>2</sup> √s |
| $V_{RRM}$                 | Range           | 800 to 1600 | V                  |
| $T_{Stg}$                 | Range           | - 40 to 150 | °C                 |
| $T_J$                     | Range           | - 40 to 130 |                    |

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

| TYPE NUMBER | VOLTAGE CODE | $V_{RRM}/V_{DRM}$ , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}/I_{DRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM<br>mA |
|-------------|--------------|--|--|--|
| VSK.500     | 08           | 800  | 900  | 100  |
|             | 12           | 1200   | 1300   |  |
|             | 14           | 1400   | 1500   |  |
|             | 16           | 1600   | 1700   |  |

| ON-STATE CONDUCTION  |                              |   |                            |   |                    |
|--|------------------------------|---|----------------------------|---|--------------------|
| PARAMETER  | SYMBOL                       | TEST CONDITIONS   |                            | VALUES  | UNITS              |
| Maximum average on-state current at case temperature           | $I_{T(AV)}$ ,<br>$I_{F(AV)}$ | 180° conduction, half sine wave   |                            | 500   | A                  |
|  |                              |   |                            | 82  | °C                 |
| Maximum RMS on-state current                                   | $I_{T(RMS)}$                 | 180° conduction, half sine wave at $T_C = 82\text{ °C}$                                 |                            | 785   | A                  |
| Maximum peak, one-cycle, non-repetitive on-state surge current | $I_{TSM}$ ,<br>$I_{FSM}$     | t = 10 ms   | No voltage reappplied      | Sinusoidal half wave, initial $T_J = T_J$ maximum | kA                 |
|  |                              | t = 8.3 ms  |                            |   |                    |
|  |                              | t = 10 ms   | 100 % $V_{RRM}$ reappplied |   |                    |
|  |                              | t = 8.3 ms  |                            |   |                    |
| Maximum $I^2t$ for fusing                                      | $I^2t$                       | t = 10 ms   | No voltage reappplied      | 1591  | kA <sup>2</sup> s  |
|  |                              | t = 8.3 ms  |                            |   |                    |
|  |                              | t = 10 ms   | 100 % $V_{RRM}$ reappplied | 1452  |                    |
|  |                              | t = 8.3 ms  |                            | 1125  |                    |
| Maximum $I^2\sqrt{t}$ for fusing                               | $I^2\sqrt{t}$                | t = 0.1 ms to 10 ms, no voltage reappplied  |                            | 1027  | kA <sup>2</sup> √s |
| Low level value or threshold voltage                           | $V_{T(TO)1}$                 | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum) |                            | 15910   | V                  |
| High level value of threshold voltage                          | $V_{T(TO)2}$                 | (I $> \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)                                      |                            | 0.85  |                    |
| Low level value on-state slope resistance                      | $r_{t1}$                     | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum) |                            | 0.93  | mΩ                 |
| High level value on-state slope resistance                     | $r_{t2}$                     | (I $> \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)                                      |                            | 0.36  |                    |
| Maximum on-state voltage drop                                  | $V_{TM}$                     | $I_{pk} = 1500\text{ A}$ , $T_J = 25\text{ °C}$ , $t_p = 10\text{ ms}$ sine pulse       |                            | 0.32  | V                  |
| Maximum forward voltage drop                                   | $V_{FM}$                     | $I_{pk} = 1500\text{ A}$ , $T_J = 25\text{ °C}$ , $t_p = 10\text{ ms}$ sine pulse       |                            | 1.50  | V                  |
| Maximum holding current  | $I_H$                        | $T_J = 25\text{ °C}$ , anode supply 12 V resistive load                                 |                            | 500   | mA                 |
| Maximum latching current                                       | $I_L$                        |   |                            | 1000  |                    |

| SWITCHING                                 |         |   |  |        |       |
|---|---------|---|--|--------|-------|
| PARAMETER                                 | SYMBOL  | TEST CONDITIONS   |  | VALUES | UNITS |
| Maximum rate of rise of turned-on current | $di/dt$ | $T_J = T_J$ maximum, $I_{TM} = 400\text{ A}$ , $V_{DRM}$ applied  |  | 1000   | A/μs  |
| Typical delay time                        | $t_d$   | Gate current 1 A, $di_g/dt = 1\text{ A}/\mu\text{s}$<br>$V_d = 0.67\% V_{DRM}$ , $T_J = 25\text{ °C}$   |  | 2.0    | μs    |
| Typical turn-off time                     | $t_q$   | $I_{TM} = 750\text{ A}$ ; $T_J = T_J$ maximum, $di/dt = -60\text{ A}/\mu\text{s}$ ,<br>$V_R = 50\text{ V}$ , $dV/dt = 20\text{ V}/\mu\text{s}$ , gate 0 V 100 Ω |  | 200    |       |

| BLOCKING   |                          |  |  |        |       |
|--|--------------------------|--|--|--------|-------|
| PARAMETER  | SYMBOL                   | TEST CONDITIONS  |  | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage | $dV/dt$                  | $T_J = 130\text{ °C}$ , linear to $V_D = 80\% V_{DRM}$ |  | 1000   | V/μs  |
| RMS insulation voltage                             | $V_{INS}$                | t = 1 s  |  | 3000   | V     |
| Maximum peak reverse and off-state leakage current | $I_{RRM}$ ,<br>$I_{DRM}$ | $T_J = T_J$ maximum, rated $V_{DRM}/V_{RRM}$ applied   |  | 100    | mA    |



# VSKT500-..PbF, VSKH500-..PbF, VSKL500-..PbF

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| TRIGGERING                                  |             |  |        |       |
|---|-------------|--|--------|-------|
| PARAMETER                                   | SYMBOL      | TEST CONDITIONS                              | VALUES | UNITS |
| Maximum peak gate power                     | $P_{GM}$    | $T_J = T_J$ maximum, $t_p \leq 5$ ms         | 10     | W     |
| Maximum peak average gate power             | $P_{G(AV)}$ | $T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$ | 2.0    |       |
| Maximum peak positive gate current          | $+I_{GM}$   | $T_J = T_J$ maximum, $t_p \leq 5$ ms         | 3.0    | A     |
| Maximum peak positive gate voltage          | $+V_{GM}$   |  | 20     | V     |
| Maximum peak negative gate voltage          | $-V_{GM}$   |  | 5.0    |       |
| Maximum DC gate current required to trigger | $I_{GT}$    | $T_J = 25$ °C, $V_{ak} 12$ V                 | 200    | mA    |
| DC gate voltage required to trigger         | $V_{GT}$    |  | 3.0    | V     |
| DC gate current not to trigger              | $I_{GD}$    | $T_J = T_J$ maximum                          | 10     | mA    |
| DC gate voltage not to trigger              | $V_{GD}$    |  | 0.25   | V     |

| THERMAL AND MECHANICAL SPECIFICATIONS                     |                                    |  |                  |       |
|---|------------------------------------|--|------------------|-------|
| PARAMETER   | SYMBOL                             | TEST CONDITIONS  | VALUES           | UNITS |
| Maximum junction operating temperature range              | $T_J$                              |  | - 40 to 130      | °C    |
| Maximum storage temperature range                         | $T_{Stg}$                          |  | - 40 to 150      |       |
| Maximum thermal resistance, junction to case per junction | $R_{thJC}$                         | DC operation   | 0.065            | K/W   |
| Maximum thermal resistance, case to heatsink              | $R_{thC-hs}$                       |  | 0.02             |       |
| Mounting torque $\pm 10$ %                                | SMAP to heatsink<br>busbar to SMAP | 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. | 6 to 8           | Nm    |
|   |                                    |  | 12 to 15         |       |
| Approximate weight  |                                    |  | 1500             | g     |
| Case style  |                                    | See dimensions - link at the end of datasheet  | SUPER MAGN-A-PAK |       |

| $\Delta R_{thJC}$ CONDUCTION |                       |                        |                     |       |
|------------------------------|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE             | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS     | UNITS |
| 180°                         | 0.009                 | 0.006                  | $T_J = T_J$ maximum | K/W   |
| 120°                         | 0.011                 | 0.011                  |                     |       |
| 90°                          | 0.014                 | 0.015                  |                     |       |
| 60°                          | 0.021                 | 0.022                  |                     |       |
| 30°                          | 0.037                 | 0.038                  |                     |       |

**Note**

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

# VSKT500-..PbF, VSKH500-..PbF, VSKL500-..PbF



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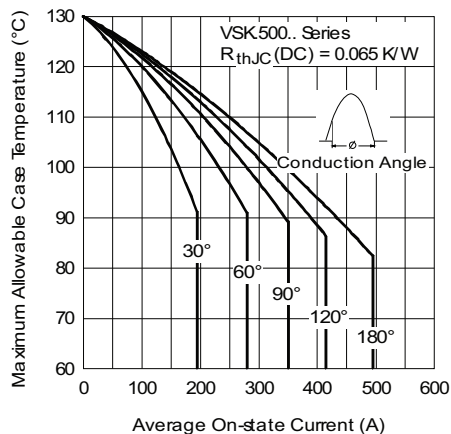


Fig. 1 - Current Ratings Characteristics



Fig. 4 - On-State Power Loss Characteristics

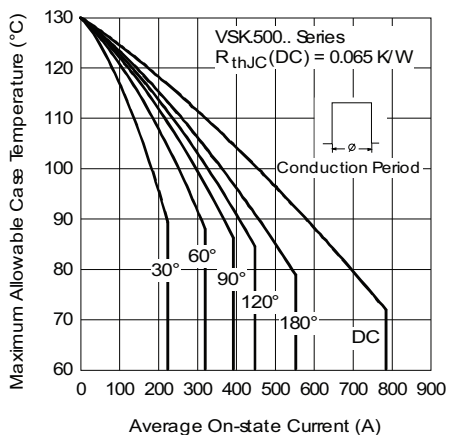


Fig. 2 - Current Ratings Characteristics



Fig. 5 - Maximum Non-Repetitive Surge Current

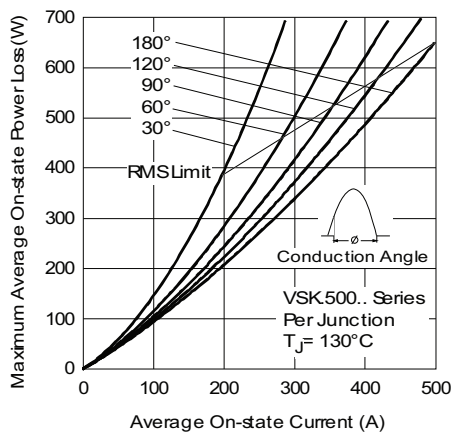


Fig. 3 - On-State Power Loss Characteristics

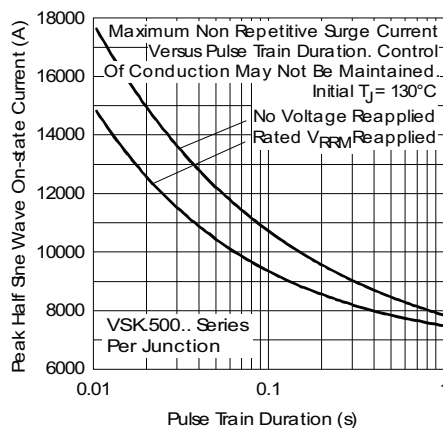


Fig. 6 - Maximum Non-Repetitive Surge Current



# VSKT500-..PbF, VSKH500-..PbF, VSKL500-..PbF

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Fig. 7 - On-State Power Loss Characteristics



Fig. 8 - On-State Power Loss Characteristics

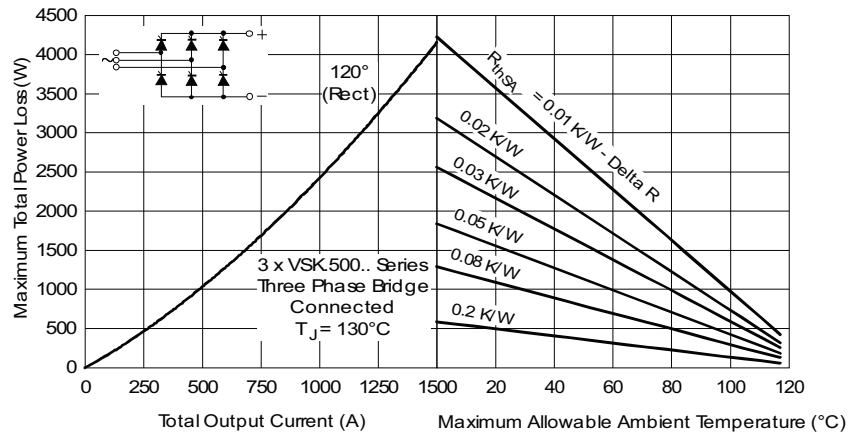


Fig. 9 - On-State Power Loss Characteristics

# VSKT500-..PbF, VSKH500-..PbF, VSKL500-..PbF



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Fig. 10 - On-State Voltage Drop Characteristics



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

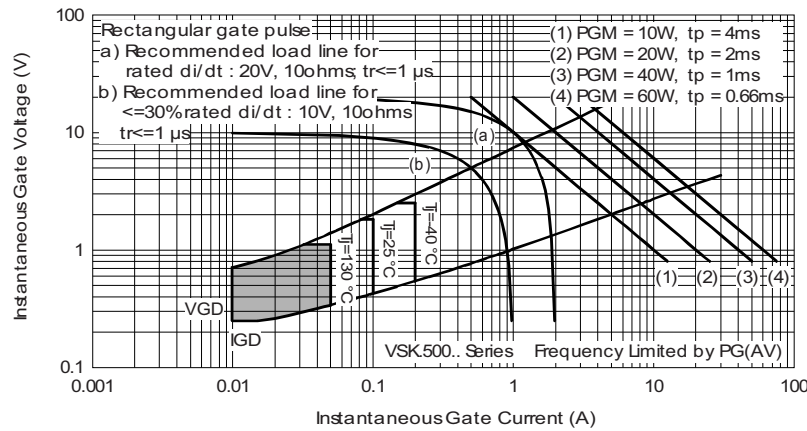


Fig. 12 - Gate Characteristics

## ORDERING INFORMATION TABLE

|             |            |          |  |          |           |            |
|-------------|------------|----------|--|----------|-----------|------------|
| Device code | <b>VSK</b> | <b>T</b> | <b>500</b>   | <b>-</b> | <b>16</b> | <b>PbF</b> |
|             | ①          | ②        | ③  |          | ④         | ⑤          |
|             | ①          | -        | Module type  |          |           |            |
|             | ②          | -        | Circuit configuration (see end of datasheet)               |          |           |            |
|             | ③          | -        | Current rating   |          |           |            |
|             | ④          | -        | Voltage code x 100 = $V_{RRM}$ (see Voltage Ratings table) |          |           |            |
|             | ⑤          | -        | Lead (Pb)-free   |          |           |            |

### Note

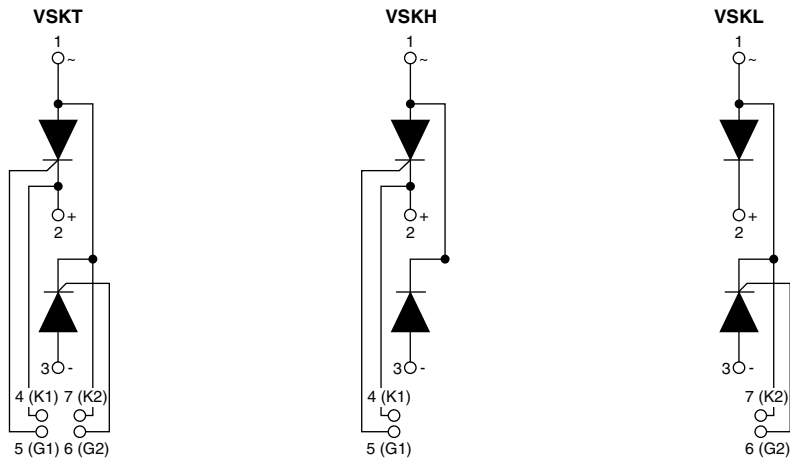
- To order the optional hardware go to [www.vishay.com/doc?95172](http://www.vishay.com/doc?95172)



# VSKT500-..PbF, VSKH500-..PbF, VSKL500-..PbF

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## CIRCUIT CONFIGURATION



### LINKS TO RELATED DOCUMENTS

Dimensions

[www.vishay.com/doc?95283](http://www.vishay.com/doc?95283)

## Super MAGN-A-PAK Thyristor/Diode

**DIMENSIONS** in millimeters (inches)







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