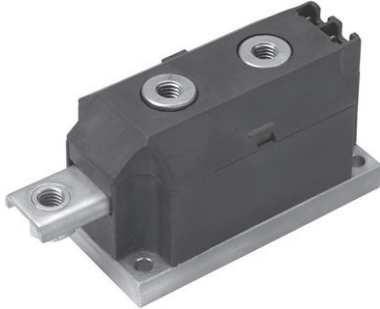



SCR/SCR and SCR/Diode (MAGN-A-PAK Power Modules), 170 A/250 A



MAGN-A-PAK

FEATURES

- High voltage
- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



RoHS
COMPLIANT

PRODUCT SUMMARY

| | |
|-------------|-------------|
| $I_{T(AV)}$ | 170 A/250 A |
|-------------|-------------|

DESCRIPTION

This new VSK series of MAGN-A-PAK modules uses high voltage power thyristor/thyristor and thyristor/diode in seven 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 or as AC-switches when modules are connected in anti-parallel mode. These modules are intended for general purpose applications such as battery chargers, welders, motor drives, UPS, etc.

MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL | CHARACTERISTICS | VSK.170.. | VSK.250.. | UNITS |
|-------------------|-----------------|-------------|------------|--------------------|
| $I_{T(AV)}$ | 85 °C | 170 | 250 | A |
| $I_{T(RMS)}$ | | 377 | 555 | |
| I_{TSM} | 50 Hz | 5100 | 8500 | |
| | 60 Hz | 5350 | 8900 | |
| I^2t | 50 Hz | 131 | 361 | kA ² s |
| | 60 Hz | 119 | 330 | |
| $I^2\sqrt{t}$ | | 1310 | 3610 | kA ² √s |
| V_{DRM}/V_{RRM} | | Up to 1600 | Up to 2000 | V |
| T_J | Range | - 40 to 130 | | °C |

VSK.170PbF, VSK.250PbF Series



Vishay Semiconductors

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|-----------------|--------------|---|--|---|
| TYPE NUMBER | VOLTAGE CODE | V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE AND OFF-STATE BLOCKING VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM}/I_{DRM} AT 130 °C MAXIMUM mA |
| VSK.170- | 04 | 400 | 500 | 50 |
| | 08 | 800 | 900 | |
| | 10 | 1000 | 1100 | |
| | 12 | 1200 | 1300 | |
| | 14 | 1400 | 1500 | |
| | 16 | 1600 | 1700 | |
| VSK.250- | 04 | 400 | 500 | 50 |
| | 08 | 800 | 900 | |
| | 10 | 1000 | 1100 | |
| | 12 | 1200 | 1300 | |
| | 14 | 1400 | 1500 | |
| | 16 | 1600 | 1700 | |
| | 18 | 1800 | 1900 | |
| | 20 | 2000 | 2100 | 60 |

| ON-STATE CONDUCTION | | | | | | |
|--|---------------|--|----------------------------|---------|---------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VSK.170 | VSK.250 | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 170 | 250 | A |
| | | | | 85 | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | As AC switch | | 377 | 555 | A |
| Maximum peak, one-cycle on-state non-repetitive, surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 5100 | 8500 | |
| | | t = 8.3 ms | | 5350 | 8900 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 4300 | 7150 | |
| | | t = 8.3 ms | | 4500 | 7500 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 131 | 361 | kA ² s |
| | | t = 8.3 ms | | 119 | 330 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 92.5 | 255 | |
| | | t = 8.3 ms | | 84.4 | 233 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 1310 | 3610 | kA ² √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) | | 0.89 | 0.97 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.12 | 1.00 | |
| 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) | | 1.34 | 0.60 | mΩ |
| High level value on-state slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 0.96 | 0.57 | |
| Maximum on-state voltage drop | V_{TM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = T_J$ maximum, 180° conduction, average power = $V_{T(TO)} \times I_{T(AV)} + r_f \times (I_{T(RMS)})^2$ | | 1.60 | 1.44 | V |
| Maximum holding current | I_H | Anode supply = 12 V, initial $I_T = 30$ A, $T_J = 25$ °C | | 500 | 500 | mA |
| Maximum latching current | I_L | Anode supply = 12 V, resistive load = 1 Ω, gate pulse: 10 V, 100 μs, $T_J = 25$ °C | | 1000 | 1000 | |



VSK.170PbF, VSK.250PbF Series

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

Vishay Semiconductors

| SWITCHING | | | | | |
|-----------------------|--------|--|-----------|---------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VSK.170 | VSK.250 | UNITS |
| Typical delay time | t_d | $T_J = 25\text{ }^\circ\text{C}$, gate current = 1 A $dI_g/dt = 1\text{ A}/\mu\text{s}$ $V_d = 0.67\% V_{DRM}$ | 1.0 | | μs |
| Typical rise time | t_r | | 2.0 | | |
| Typical turn-off time | t_q | $I_{TM} = 300\text{ A}$; $dI/dt = 15\text{ A}/\mu\text{s}$; $T_J = T_J$ maximum; $V_R = 50\text{ V}$; $dV/dt = 20\text{ V}/\mu\text{s}$; gate 0 V, 100 Ω | 50 to 150 | | |

| BLOCKING | | | | | |
|--|--------------------------|--|---------|---------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VSK.170 | VSK.250 | UNITS |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = T_J$ maximum | 50 | 60 | mA |
| RMS insulation voltage | V_{INS} | 50 Hz, circuit to base, all terminals shorted, 25 $^\circ\text{C}$, 1 s | 3000 | | V |
| Critical rate of rise of off-state voltage | dV/dt | $T_J = T_J$ maximum, exponential to 67 % rated V_{DRM} | 1000 | | V/ μs |

| TRIGGERING | | | | | |
|---|-------------|---|---------|---------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VSK.170 | VSK.250 | UNITS |
| Maximum peak gate power | P_{GM} | $t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum | 10.0 | | W |
| Maximum average gate power | $P_{G(AV)}$ | $f = 50\text{ Hz}$, $T_J = T_J$ maximum | 2.0 | | |
| Maximum peak gate current | + I_{GM} | $t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum | 3.0 | | A |
| Maximum peak negative gate voltage | - V_{GT} | $t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum | 5.0 | | V |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | 4.0 | | |
| | | $T_J = 25\text{ }^\circ\text{C}$ | 3.0 | | |
| | | $T_J = T_J$ maximum | 2.0 | | |
| Maximum required DC gate current to trigger | I_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | 350 | | mA |
| | | $T_J = 25\text{ }^\circ\text{C}$ | 200 | | |
| | | $T_J = T_J$ maximum | 100 | | |
| Maximum gate voltage that will not trigger | V_{GD} | $T_J = T_J$ maximum, rated V_{DRM} applied | 0.25 | | V |
| Maximum gate current that will not trigger | I_{GD} | $T_J = T_J$ maximum, rated V_{DRM} applied | 10.0 | | mA |
| Maximum rate of rise of turned-on current | dI/dt | $T_J = T_J$ maximum, $I_{TM} = 400\text{ A}$, rated V_{DRM} applied | 500 | | A/ μs |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|----------------------------------|--|-------------|---------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VSK.170 | VSK.250 | UNITS |
| Junction operating and storage temperature range | T_J , T_{Stg} | | - 40 to 130 | | $^\circ\text{C}$ |
| Maximum thermal resistance, junction to case per junction | R_{thJC} | DC operation | 0.17 | 0.125 | K/W |
| Typical thermal resistance, case to heatsink per module | R_{thCS} | Mounting surface flat, smooth and greased | 0.02 | 0.02 | |
| Mounting torque $\pm 10\%$ | MAP to heatsink busbar to MAP | 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 |
| Approximate weight | | | 500 | | g |
| | | | 17.8 | | oz. |
| Case style | | | MAGN-A-PAK | | |

VSK.170PbF, VSK.250PbF Series



Vishay Semiconductors

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

| ΔR CONDUCTION PER JUNCTION | | | | | | | | | | | |
|-----------------------------------|---|-------|-------|-------|-------|--|-------|-------|-------|-------|-------|
| DEVICES | SINUSOIDAL CONDUCTION AT T _J MAXIMUM | | | | | RECTANGULAR CONDUCTION AT T _J MAXIMUM | | | | | UNITS |
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| VSK.170- | 0.009 | 0.010 | 0.010 | 0.020 | 0.032 | 0.007 | 0.011 | 0.015 | 0.020 | 0.033 | K/W |
| VSK.250- | 0.009 | 0.010 | 0.014 | 0.020 | 0.032 | 0.007 | 0.011 | 0.015 | 0.020 | 0.033 | |

Note

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

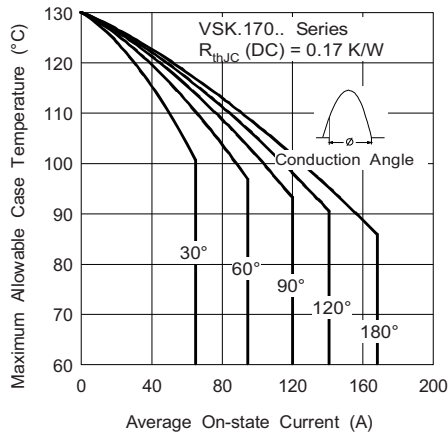


Fig. 1 - Current Ratings Characteristics

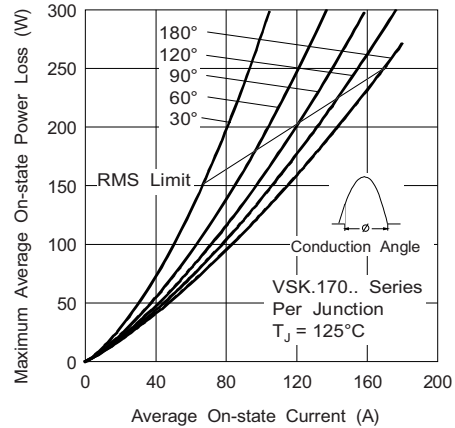


Fig. 3 - On-State Power Loss Characteristics

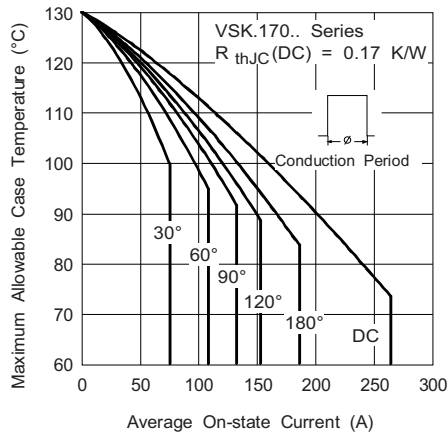


Fig. 2 - Current Ratings Characteristics

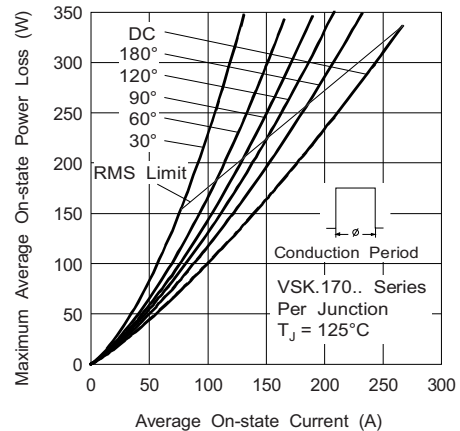


Fig. 4 - On-State Power Loss Characteristics



VSK.170PbF, VSK.250PbF Series

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

Vishay Semiconductors

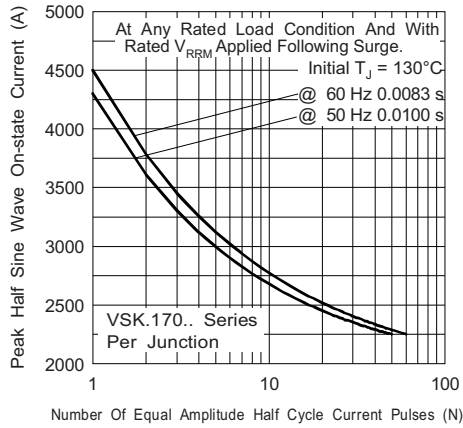


Fig. 5 - Maximum Non-Repetitive Surge Current

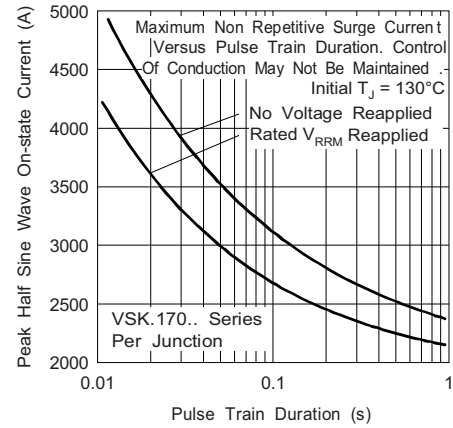


Fig. 6 - Maximum Non-Repetitive Surge Current

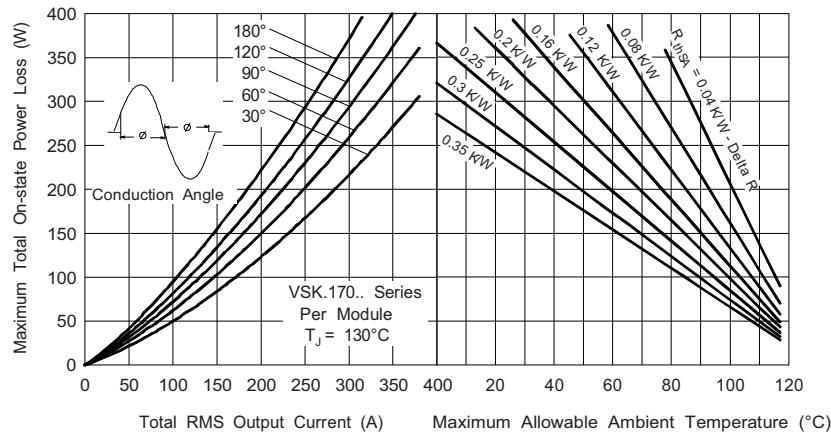


Fig. 7 - On-State Power Loss Characteristics

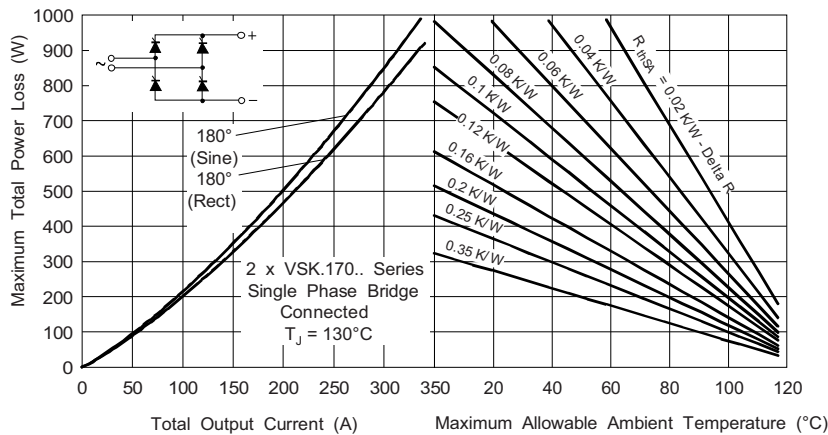


Fig. 8 - On-State Power Loss Characteristics

VSK.170PbF, VSK.250PbF Series



Vishay Semiconductors

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

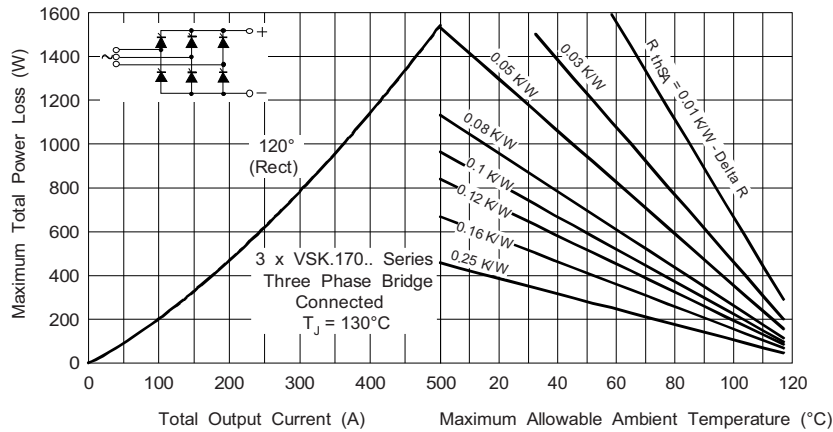


Fig. 9 - On-State Power Loss Characteristics

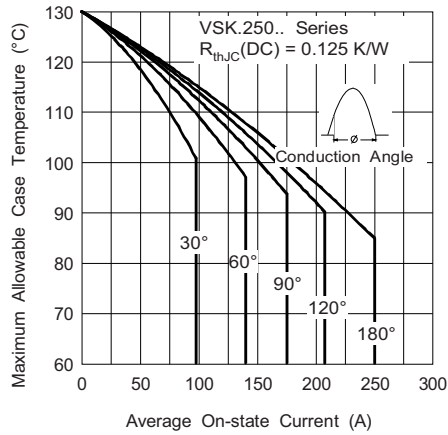


Fig. 10 - Current Ratings Characteristics

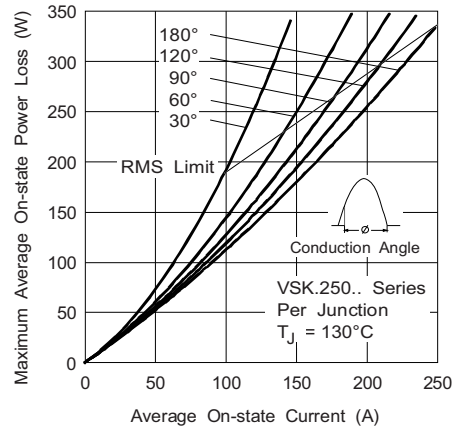


Fig. 12 - On-State Power Loss Characteristics

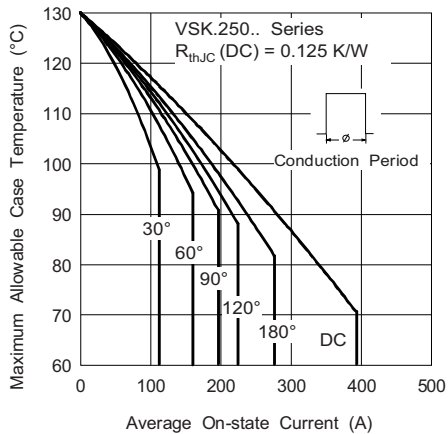


Fig. 11 - Current Ratings Characteristics

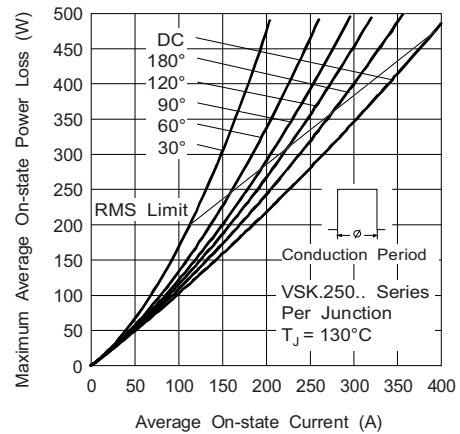


Fig. 13 - On-State Power Loss Characteristics

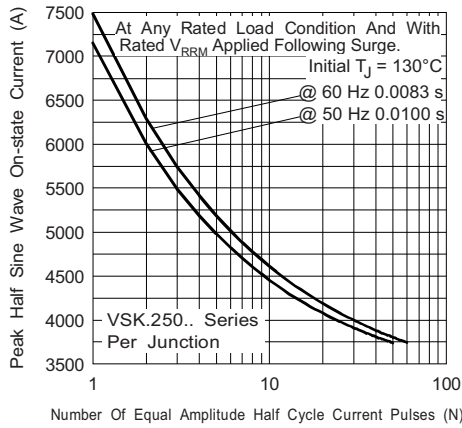


Fig. 14 - Maximum Non-Repetitive Surge Current

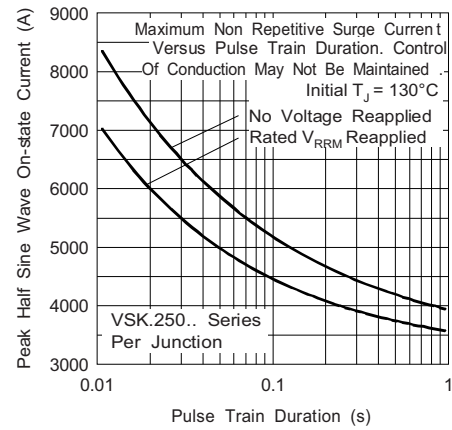


Fig. 15 - Maximum Non-Repetitive Surge Current

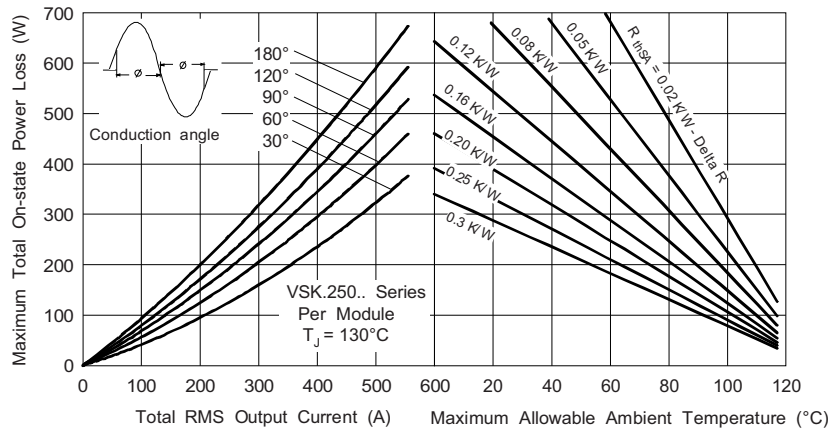


Fig. 16 - On-State Power Loss Characteristics

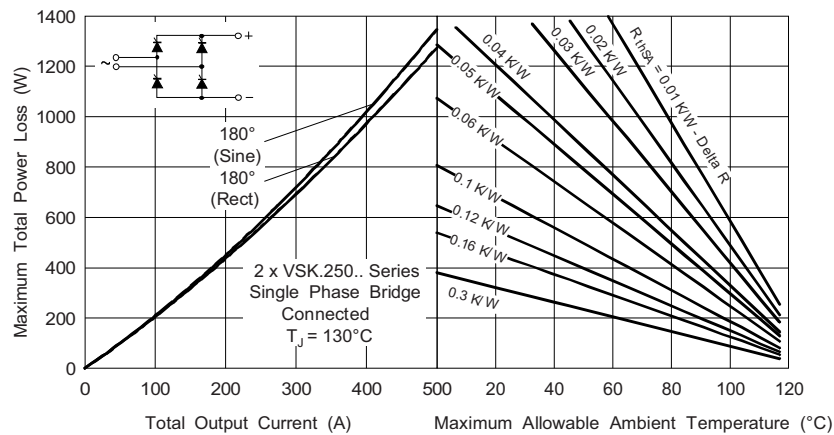


Fig. 17 - On-State Power Loss Characteristics

VSK.170PbF, VSK.250PbF Series



Vishay Semiconductors

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

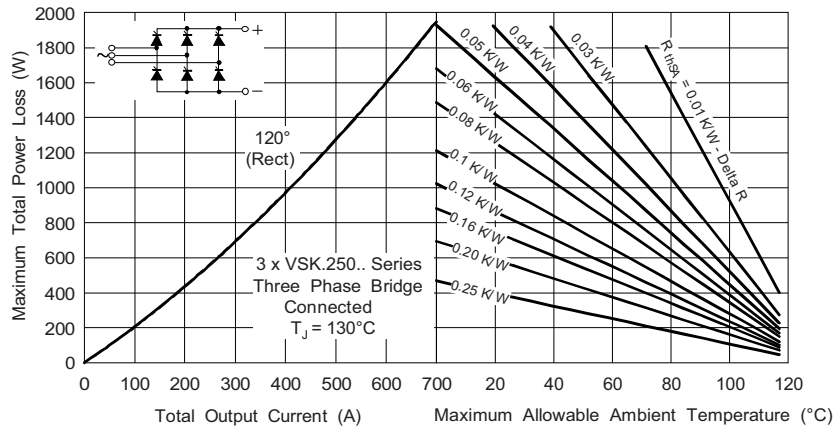


Fig. 18 - On-State Power Loss Characteristics

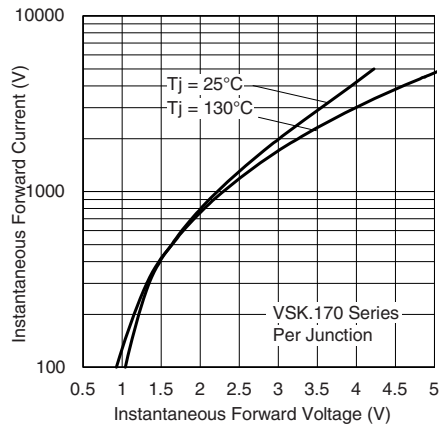


Fig. 19 - On-State Voltage Drop Characteristics

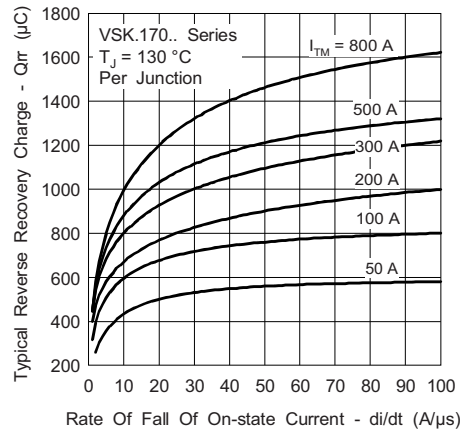


Fig. 21 - Reverse Recovery Charge Characteristics

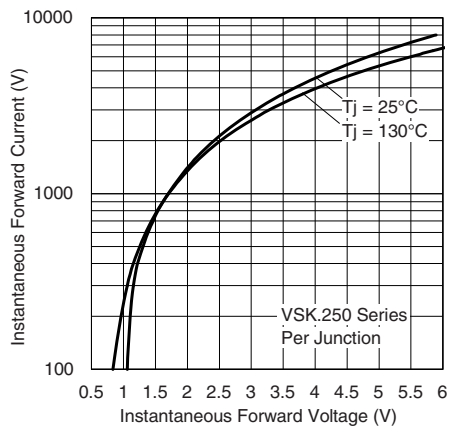


Fig. 20 - On-State Voltage Drop Characteristics

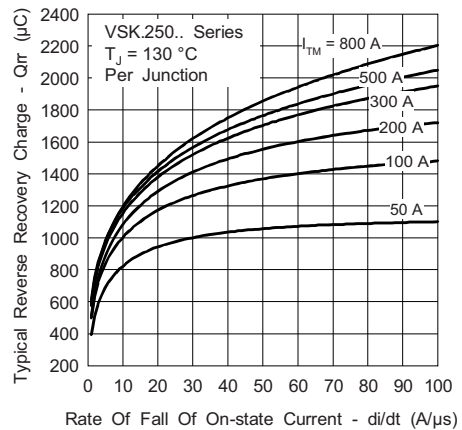


Fig. 22 - Reverse Recovery Charge Characteristics

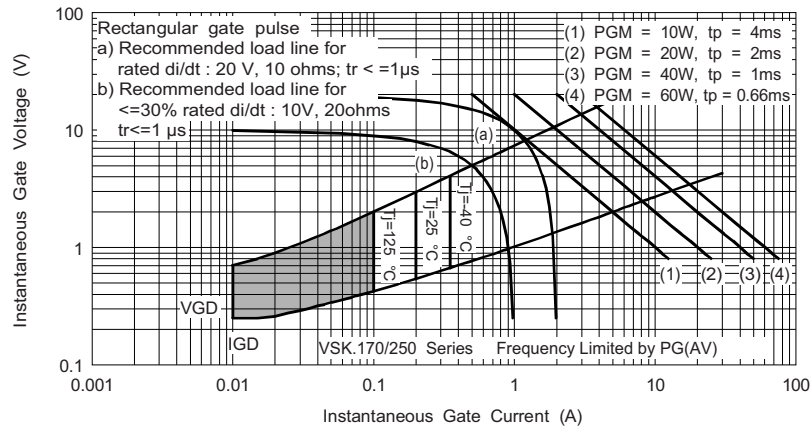


Fig. 23 - Gate Characteristics

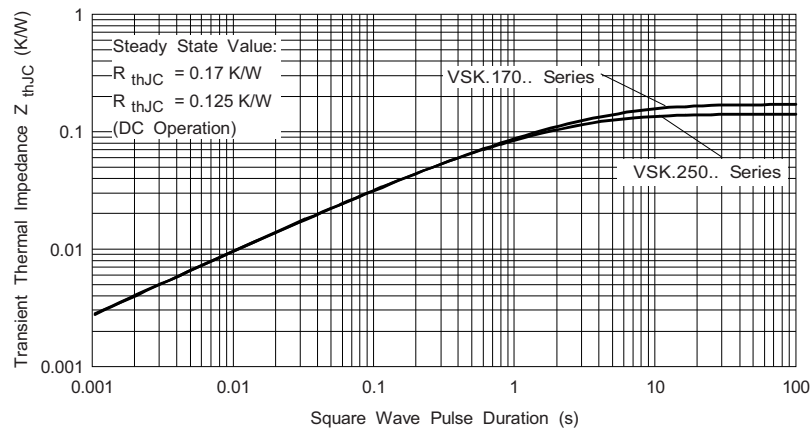


Fig. 24 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

| | | | | | | |
|-------------|-----|---|--|---|----|-----|
| Device code | VSK | T | 250 | - | 20 | PbF |
| | ① | ② | ③ | | ④ | ⑤ |
| | 1 | - | Module type | | | |
| | 2 | - | Circuit configuration (see dimensions - link at the end of datasheet) | | | |
| | 3 | - | Current rating | | | |
| | 4 | - | Voltage code x 100 = V_{RRM} (see Voltage Ratings table) | | | |
| | 5 | - | <ul style="list-style-type: none"> None = Standard production PbF = Lead (Pb)-free | | | |

Note

- To order the optional hardware go to www.vishay.com/doc/295172

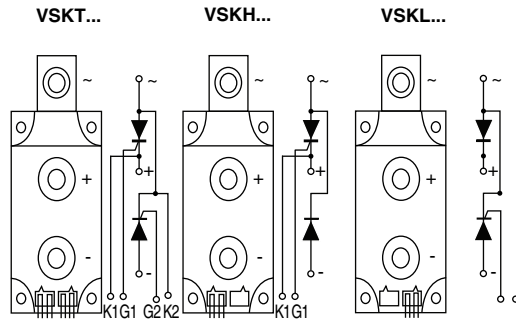
VSK.170PbF, VSK.250PbF Series



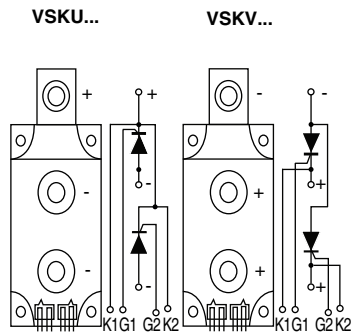
Vishay Semiconductors

SCR/SCR and SCR/Diode
(MAGN-A-PAK Power Modules), 170 A/250 A

CIRCUIT CONFIGURATION



Available from 400 V to 1600 V for VSK.170PbF Series,
available from 400 V to 2000 V for VSK.250PbF Series



Available up to 1200 V,
contact factory for different requirement

LINKS TO RELATED DOCUMENTS

Dimensions

www.vishay.com/doc?95086

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



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