

Fast Thyristor/Diode and Thyristor/Thyristor (MAGN-A-PAK Power Modules), 200 A


MAGN-A-PAK
FEATURES

- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS
COMPLIANT**
PRODUCT SUMMARY

| | |
|-------------|---------------------------|
| $I_{T(AV)}$ | 200 A |
| Type | Modules - Thyristor, Fast |

DESCRIPTION

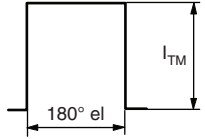
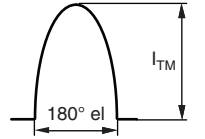
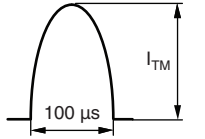
This series of MAGN-A-PAK modules are intended for applications such as self-commutated inverters, DC choppers, electronic welders, induction heating and others where fast switching characteristics are required.

MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
|-------------------|-----------------|-------------|--------------------|
| $I_{T(AV)}$ | | 200 | A |
| | T_C | 85 | °C |
| $I_{T(RMS)}$ | | 444 | A |
| I_{TSM} | 50 Hz | 7600 | |
| | 60 Hz | 8000 | |
| I^2t | 50 Hz | 290 | kA ² s |
| | 60 Hz | 265 | |
| $I^2\sqrt{t}$ | | 2900 | kA ² √s |
| t_q | | 20/25 | μs |
| t_{rr} | | 2 | |
| V_{DRM}/V_{RRM} | | 800/1200 | V |
| T_J | Range | - 40 to 125 | °C |

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 $T_J = 125^\circ\text{C}$ mA |
|-------------|--------------|---|--|--|
| VSK.F200- | 08 | 800 | 800 | 50 |
| | 12 | 1200 | 1200 | |

| CURRENT CARRYING CAPABILITY | | | | | | | |
|----------------------------------|---|-----|--|------|---|------|-------|
| FREQUENCY |  | |  | |  | | UNITS |
| 50 Hz | 380 | 560 | 630 | 850 | 2460 | 3180 | A |
| 400 Hz | 460 | 690 | 710 | 1060 | 1570 | 2080 | |
| 2500 Hz | 310 | 450 | 530 | 760 | 630 | 860 | |
| 5000 Hz | 250 | 360 | 410 | 560 | 410 | 560 | |
| 10 000 Hz | 180 | 280 | 300 | 410 | - | - | |
| Recovery voltage V_r | 50 | 50 | 50 | 50 | 50 | 50 | V |
| Voltage before turn-on V_d | 80 % V_{DRM} | | 80 % V_{DRM} | | 80 % V_{DRM} | | |
| Rise of on-state current di/dt | 50 | 50 | - | - | - | - | A/μs |
| Case temperature | 85 | 60 | 85 | 60 | 85 | 60 | °C |
| Equivalent values for RC circuit | 10/0.47 | | 10/0.47 | | 10/0.47 | | Ω/μF |

| ON-STATE CONDUCTION | | | | | |
|--|---------------|---|---------------------------|--------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 200 | A |
| | | | | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | As AC switch | | 444 | A |
| Maximum peak, one-cycle non-repetitive on-state, surge current | I_{TSM} | t = 10 ms | No voltage reapplied | 7600 | |
| | | t = 8.3 ms | | 8000 | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | 6400 | |
| | | t = 8.3 ms | | 6700 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reapplied | 290 | kA ² s |
| | | t = 8.3 ms | | 265 | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | 205 | |
| | | t = 8.3 ms | | 187 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied | | 2900 | 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) | | 1.18 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum) | | 1.25 | |
| 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) | | 0.74 | mΩ |
| High level value on-state slope resistance | r_{t2} | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum) | | 0.70 | |
| Maximum on-state voltage drop | V_{TM} | $I_{pk} = 600$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse | | 1.73 | V |
| Maximum holding current | I_H | $T_J = 25$ °C, $I_T > 30$ A | | 600 | mA |
| Maximum latching current | I_L | $T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_g = 1$ A | | 1000 | |



| SWITCHING | | | | | |
|-------------------------------------|----------|--|--------|----|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | | UNITS |
| | | | K | J | |
| Maximum non-repetitive rate of rise | di/dt | Gate drive 20 V, 20 Ω , $t_r \leq 1$ ms, $V_D = 80\%$ V_{DRM} , $T_J = 25$ °C | 800 | | A/ μ s |
| Maximum recovery time | t_{rr} | $I_{TM} = 350$ A, $di/dt = -25$ A/ μ s, $V_R = 50$ V, $T_J = 25$ °C | 2 | | μ s |
| Maximum turn-off time | t_q | $I_{TM} = 750$ A; $T_J = T_J$ maximum; $di/dt = -25$ A/ μ s; $V_R = 50$ V; $dV/dt = 400$ V/ μ s linear to 80 % V_{DRM} | 20 | 25 | |

| BLOCKING | | | | |
|--|--------------------------|--|--------|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage | dV/dt | $T_J = 125$ °C, exponential to 67 % V_{DRM} | 1000 | V/ μ s |
| RMS insulation voltage | V_{INS} | 50 Hz, circuit to base, $T_J = 25$ °C, $t = 1$ s | 3000 | V |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = 125$ °C, rated V_{DRM}/V_{RRM} applied | 50 | mA |

| TRIGGERING | | | | |
|---|-------------|---|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $f = 50$ Hz, $d\% = 50$ | 60 | W |
| Maximum peak average gate power | $P_{G(AV)}$ | $T_J = 125$ °C, $f = 50$ Hz, $d\% = 50$ | 10 | |
| Maximum peak positive gate current | I_{GM} | $T_J = 125$ °C, $t_p \leq 5$ ms | 10 | A |
| Maximum peak negative gate voltage | $-V_{GT}$ | | 5 | V |
| Maximum DC gate current required to trigger | I_{GT} | $T_J = 25$ °C, $V_{ak} 12$ V, $R_a = 6$ | 200 | mA |
| DC gate voltage required to trigger | V_{GT} | | 3 | V |
| DC gate current not to trigger | I_{GD} | $T_J = 125$ °C, rated V_{DRM} applied | 20 | 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 125 | °C |
| Storage temperature range | T_{Stg} | | - 40 to 150 | |
| Maximum thermal resistance, junction to case per junction | R_{thJC} | DC operation | 0.125 | K/W |
| Maximum thermal resistance, case to heatsink per module | R_{thC-hs} | Mounting surface flat, smooth and greased | 0.025 | |
| Mounting torque $\pm 10\%$ | MAP to heatsink | A mounting compound is recommended. The torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Use of cable lugs is not recommended, busbar should be used and restrained during tightening. Threads must be lubricated with a compound. | 4 to 6 | N · m (lb · in) |
| | busbar to MAP | | (35 to 53) | |
| Approximate weight | | | 500 | g |
| | | | 17.8 | oz. |
| Case style | | | MAGN-A-PAK | |

| ΔR_{thJC} CONDUCTION | | | |
|------------------------------|-----------------------|------------------------|-------|
| CONDUCTIONS ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | UNITS |
| 180° | 0.009 | 0.006 | K/W |
| 120° | 0.10 | 0.011 | |
| 90° | 0.014 | 0.015 | |
| 60° | 0.020 | 0.020 | |
| 30° | 0.32 | 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

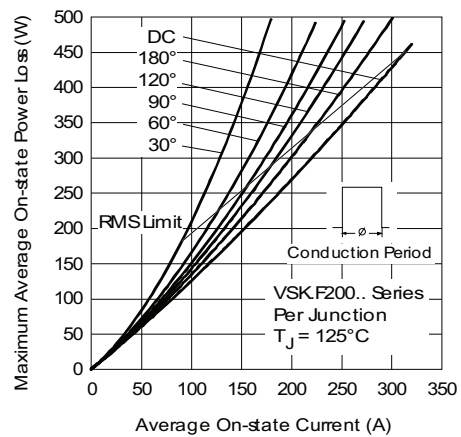


Fig. 4 - On-State Power Loss Characteristics



Fig. 5 - Maximum Non-Repetitive Surge Current



Fig. 8 - Thermal Impedance Z_{thJC} Characteristics



Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 9 - Reverse Recovery Charge Characteristics

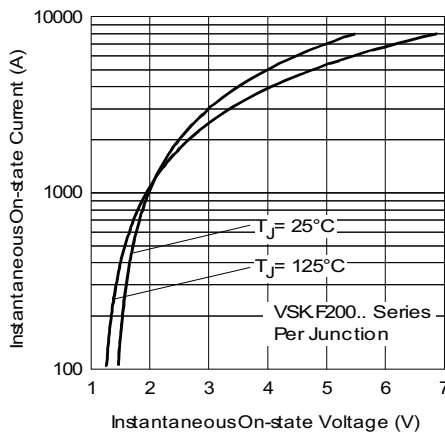


Fig. 7 - On-State Voltage Drop Characteristics



Fig. 10 - Reverse Recovery Current Characteristics

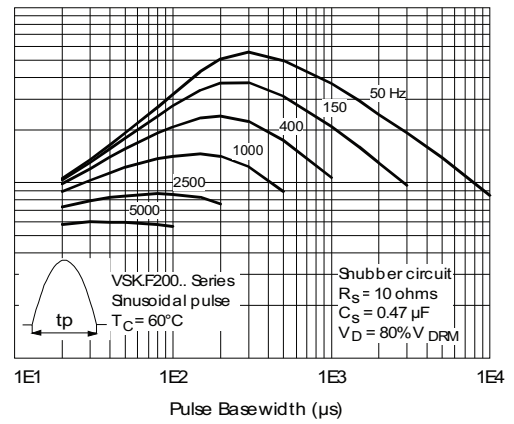
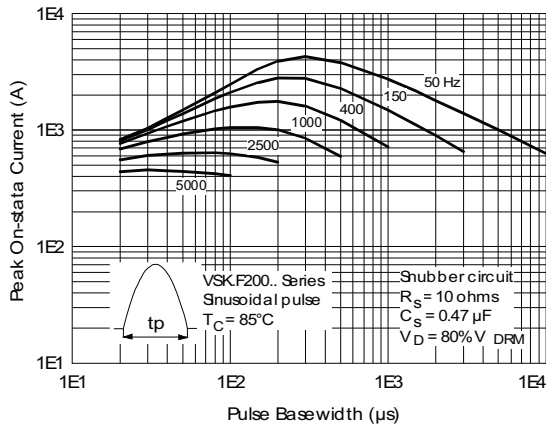


Fig. 11 - Frequency Characteristics

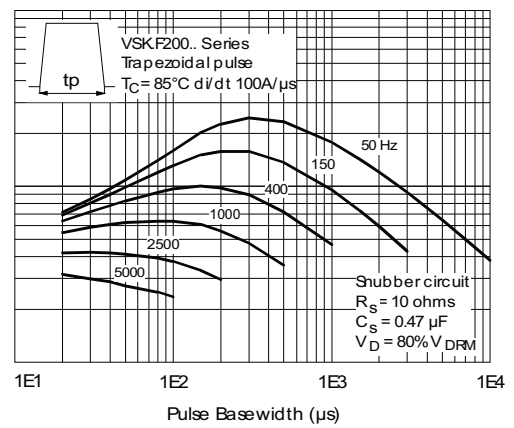
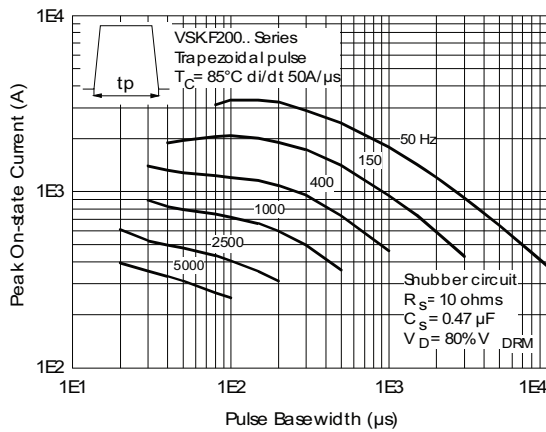


Fig. 12 - Frequency Characteristics

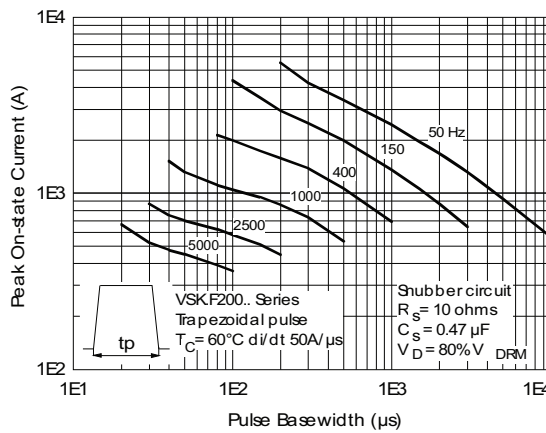


Fig. 13 - Frequency Characteristics

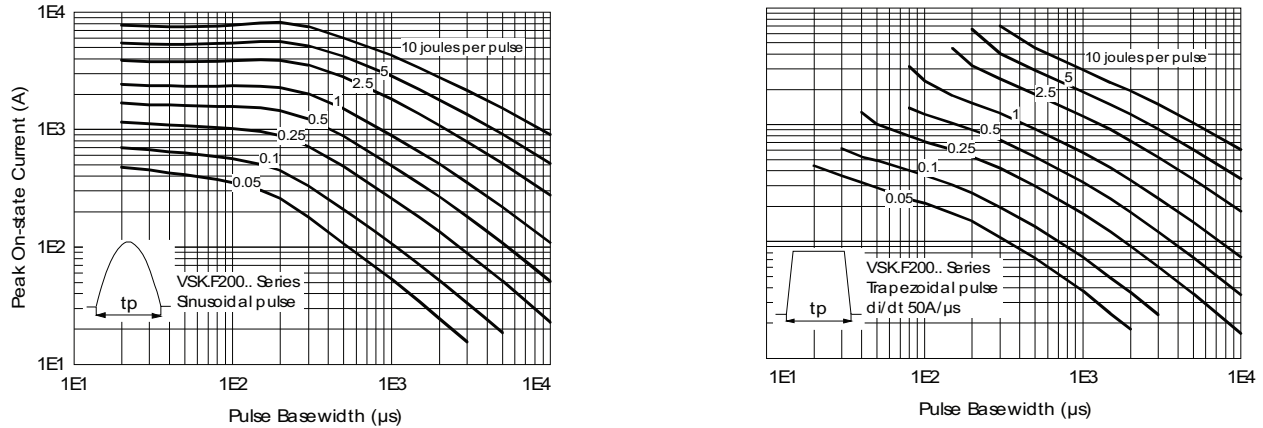


Fig. 14 - Maximum On-State Energy Power Loss Characteristics



Fig. 15 - Gate Characteristics

VSK.F200..P Series



Vishay Semiconductors Fast Thyristor/Diode and Thyristor/Thyristor
(MAGN-A-PAK Power Modules), 200 A

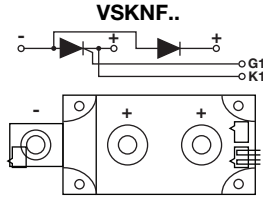
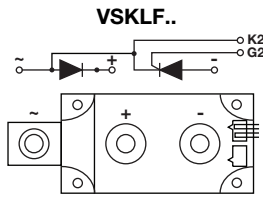
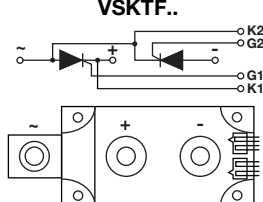
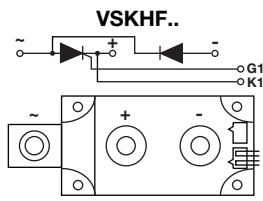
ORDERING INFORMATION TABLE

| | | | | | | | | | |
|-------------|------------|----------|---|------------|----------|-----------|----------|----------|----------|
| Device code | VSK | T | F | 200 | - | 12 | H | K | P |
| | ① | ② | ③ | ④ | | ⑤ | ⑥ | ⑦ | ⑧ |
| | 1 | - | Module type | | | | | | |
| | 2 | - | Circuit configuration (see circuit configuration table) | | | | | | |
| | 3 | - | Fast SCR | | | | | | |
| | 4 | - | Current rating: $I_{T(AV)} \times 10$ rounded | | | | | | |
| | 5 | - | Voltage code $\times 100 = V_{RRM}$ (see Voltage Ratings table) | | | | | | |
| | 6 | - | dV/dt code: $H \leq 400 \text{ V}/\mu\text{s}$ | | | | | | |
| | 7 | - | t_q code: $K \leq 20 \mu\text{s}$ $J \leq 25 \mu\text{s}$ | | | | | | |
| | 8 | - | Lead (Pb)-free | | | | | | |

Note

- To order the optional hardware go to www.vishay.com/doc?95172

| CIRCUIT CONFIGURATION | | |
|---------------------------|----------------------------|-----------------------|
| CIRCUIT DESCRIPTION | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Two SCRs common cathodes | U | <p>VSKUF..</p> |
| SCR/diode common cathodes | K | <p>VSKKF..</p> |
| Two SCRs common anodes | V | <p>VSKVF..</p> |

| CIRCUIT CONFIGURATION | | |
|---|-----------------------------------|---|
| CIRCUIT DESCRIPTION | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| SCR/diode common anodes | N |  <p>VSKNF..</p> |
| SCR/diode doubler circuit, negative control | L |  <p>VSKLF..</p> |
| Two SCRs doubler circuit | T |  <p>VSKTF..</p> |
| SCR/diode doubler circuit, positive control | H |  <p>VSKHF..</p> |

| 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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- Защита от снятия компонента с производства.



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