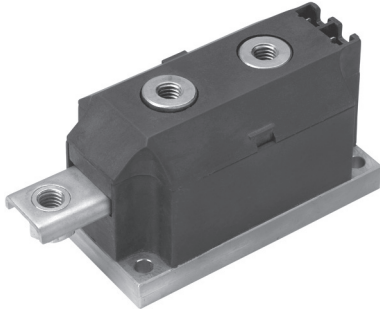


## Fast Thyristor/Diode and Thyristor/Thyristor (MAGN-A-PAK Power Modules), 200 A



MAGN-A-PAK

### FEATURES

- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3500 V<sub>RMS</sub> 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.

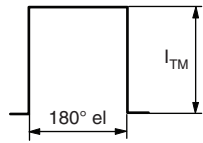
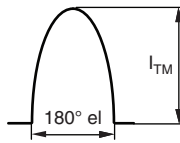
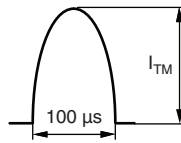
### MAJOR RATINGS AND CHARACTERISTICS

| 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 <sup>2</sup> s  |
|                   | 60 Hz           | 265         |                    |
| $I^2\sqrt{t}$     |                 | 2900        | kA <sup>2</sup> √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<br>PEAK REVERSE AND OFF-STATE<br>BLOCKING VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE<br>PEAK REVERSE VOLTAGE<br>V | $I_{RRM}/I_{DRM}$<br>AT $T_J = 125^\circ\text{C}$<br>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 <sub>T(AV)</sub>  | 180° conduction, half sine wave                                                                          |                                  |                                                       | 200    | A                  |                   |
|                                                                |                     |                                                                                                          |                                  |                                                       | 85     | °C                 |                   |
| Maximum RMS on-state current                                   | I <sub>T(RMS)</sub> | As AC switch                                                                                             |                                  |                                                       | 444    | A                  |                   |
| Maximum peak, one-cycle non-repetitive on-state, surge current | I <sub>TSM</sub>    | t = 10 ms                                                                                                | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = 125 °C | 7600   |                    |                   |
|                                                                |                     | t = 8.3 ms                                                                                               |                                  |                                                       | 8000   |                    |                   |
|                                                                |                     | t = 10 ms                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                       | 6400   |                    |                   |
|                                                                |                     | t = 8.3 ms                                                                                               |                                  |                                                       | 6700   |                    |                   |
| Maximum I <sup>2</sup> t for fusing                            | I <sup>2</sup> t    | t = 10 ms                                                                                                | No voltage reapplied             |                                                       | 290    |                    | kA <sup>2</sup> s |
|                                                                |                     | t = 8.3 ms                                                                                               |                                  |                                                       | 265    |                    |                   |
|                                                                |                     | t = 10 ms                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                       | 205    |                    |                   |
|                                                                |                     | t = 8.3 ms                                                                                               |                                  |                                                       | 187    |                    |                   |
| Maximum I <sup>2</sup> √t for fusing                           | I <sup>2</sup> √t   | t = 0.1 ms to 10 ms, no voltage reapplied                                                                |                                  |                                                       | 2900   | kA <sup>2</sup> √s |                   |
| Low level value or threshold voltage                           | V <sub>T(TO)1</sub> | (16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                       | 1.18   | V                  |                   |
| High level value of threshold voltage                          | V <sub>T(TO)2</sub> | (I > π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum      |                                  |                                                       | 1.25   |                    |                   |
| Low level value on-state slope resistance                      | r <sub>t1</sub>     | (16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                       | 0.74   | mΩ                 |                   |
| High level value on-state slope resistance                     | r <sub>t2</sub>     | (I > π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum      |                                  |                                                       | 0.70   |                    |                   |
| Maximum on-state voltage drop                                  | V <sub>TM</sub>     | I <sub>pk</sub> = 600 A, T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> = 10 ms sine pulse      |                                  |                                                       | 1.73   | V                  |                   |
| Maximum holding current                                        | I <sub>H</sub>      | T <sub>J</sub> = 25 °C, I <sub>T</sub> > 30 A                                                            |                                  |                                                       | 600    | mA                 |                   |
| Maximum latching current                                       | I <sub>L</sub>      | T <sub>J</sub> = 25 °C, V <sub>A</sub> = 12 V, R <sub>a</sub> = 6 Ω, I <sub>q</sub> = 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 $\Omega$ , $t_r \leq 1$ ms, $V_D = 80\% V_{DRM}$ , $T_J = 25^\circ\text{C}$                                               | 800    |    | A/ $\mu\text{s}$ |
| Maximum recovery time               | $t_{rr}$ | $I_{TM} = 350$ A, $di/dt = -25$ A/ $\mu\text{s}$ , $V_R = 50$ V, $T_J = 25^\circ\text{C}$                                                     | 2      |    | $\mu\text{s}$    |
| Maximum turn-off time               | $t_q$    | $I_{TM} = 750$ A; $T_J = T_J$ maximum; $di/dt = -25$ A/ $\mu\text{s}$ ; $V_R = 50$ V; $dV/dt = 400$ V/ $\mu\text{s}$ linear to $80\% V_{DRM}$ | 20     | 25 |                  |

**BLOCKING**

| PARAMETER                                          | SYMBOL                   | TEST CONDITIONS                                              | VALUES | UNITS            |
|----------------------------------------------------|--------------------------|--------------------------------------------------------------|--------|------------------|
| Maximum critical rate of rise of off-state voltage | $dV/dt$                  | $T_J = 125^\circ\text{C}$ , exponential to $67\% V_{DRM}$    | 1000   | V/ $\mu\text{s}$ |
| RMS insulation voltage                             | $V_{INS}$                | 50 Hz, circuit to base, $T_J = 25^\circ\text{C}$ , $t = 1$ s | 3000   | V                |
| Maximum peak reverse and off-state leakage current | $I_{RRM}$ ,<br>$I_{DRM}$ | $T_J = 125^\circ\text{C}$ , 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             | $P_{G(AV)}$ | $T_J = 125^\circ\text{C}$ , $f = 50$ Hz, $d\% = 50$ | 10     |       |
| Maximum peak positive gate current          | $I_{GM}$    | $T_J = 125^\circ\text{C}$ , $t_p \leq 5$ ms         | 10     | A     |
| Maximum peak negative gate voltage          | $-V_{GT}$   |                                                     | 5      | V     |
| Maximum DC gate current required to trigger | $I_{GT}$    | $T_J = 25^\circ\text{C}$ , $V_{ak} 12$ V, $R_a = 6$ | 200    | mA    |
| DC gate voltage required to trigger         | $V_{GT}$    |                                                     | 3      | V     |
| DC gate current not to trigger              | $I_{GD}$    | $T_J = 125^\circ\text{C}$ , 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          | $^\circ\text{C}$                |
| 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 $\pm 10\%$<br>MAP to heatsink<br>busbar to MAP |              | 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<br>(35 to 53) | N $\cdot$ m<br>(lbf $\cdot$ in) |
| Approximate weight                                             |              |                                                                                                                                                                                                                                                                                 | 500                  | g                               |
|                                                                |              |                                                                                                                                                                                                                                                                                 | 17.8                 | oz.                             |
| Case style                                                     |              |                                                                                                                                                                                                                                                                                 | MAGN-A-PAK           |                                 |

| $\Delta R_{thJC}$ 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

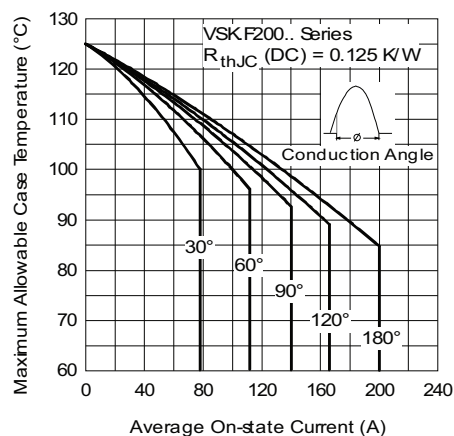


Fig. 1 - Current Ratings Characteristics

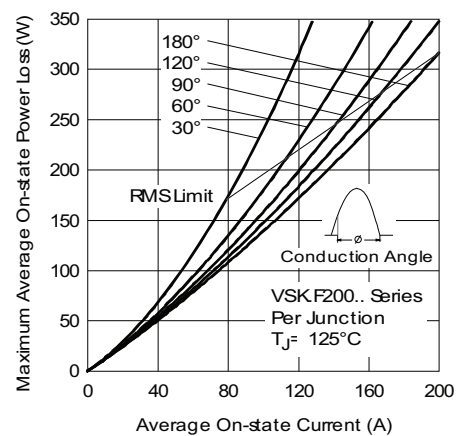


Fig. 3 - On-State Power Loss Characteristics

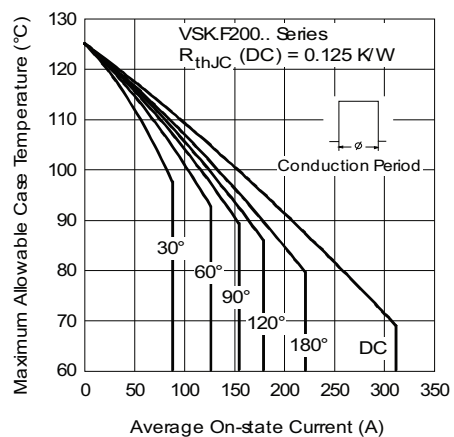


Fig. 2 - Current Ratings Characteristics

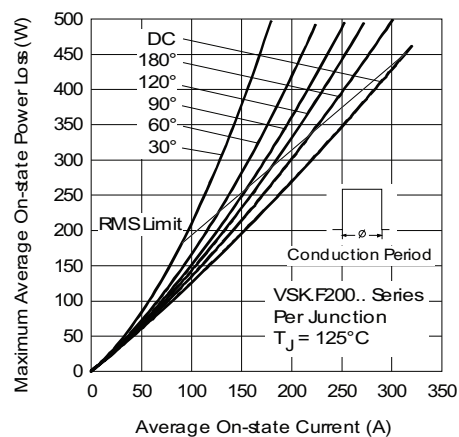


Fig. 4 - On-State Power Loss Characteristics

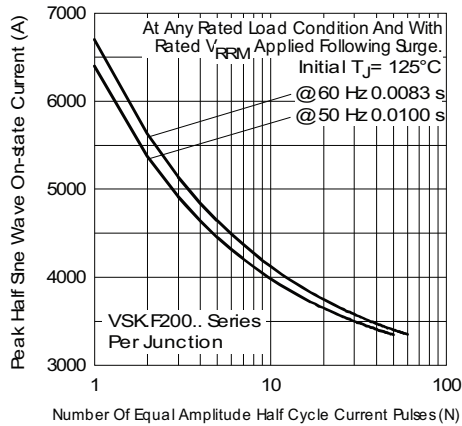


Fig. 5 - Maximum Non-Repetitive Surge Current

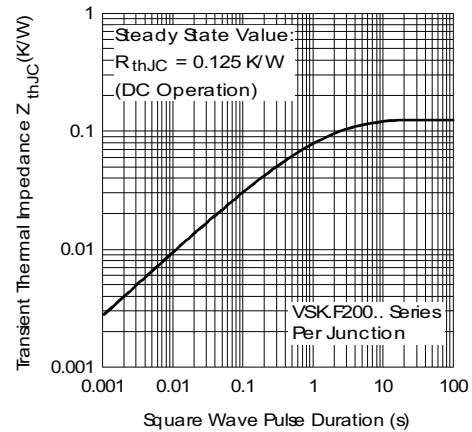


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

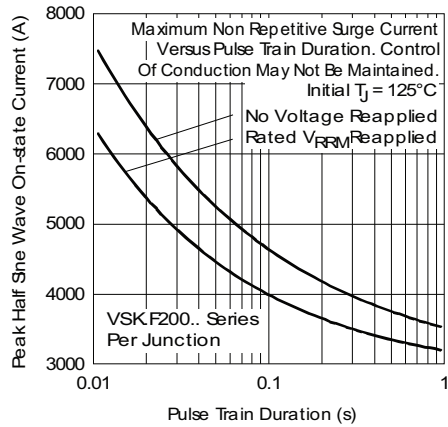


Fig. 6 - Maximum Non-Repetitive Surge Current

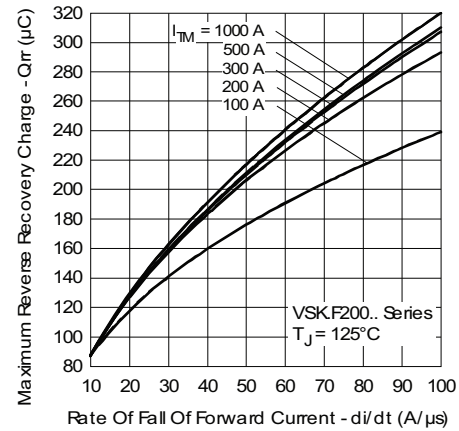


Fig. 9 - Reverse Recovery Charge Characteristics

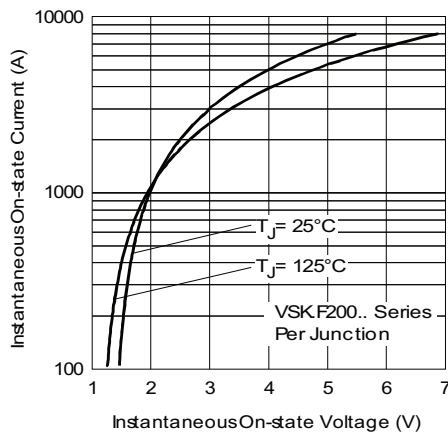


Fig. 7 - On-State Voltage Drop Characteristics

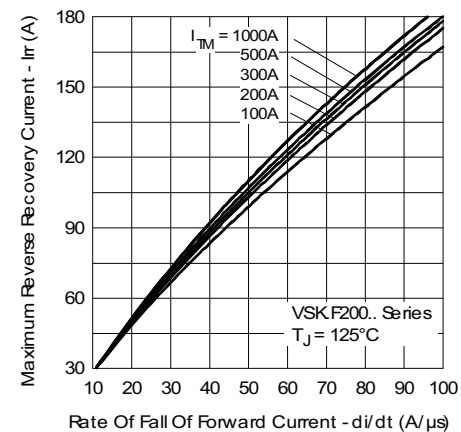


Fig. 10 - Reverse Recovery Current Characteristics

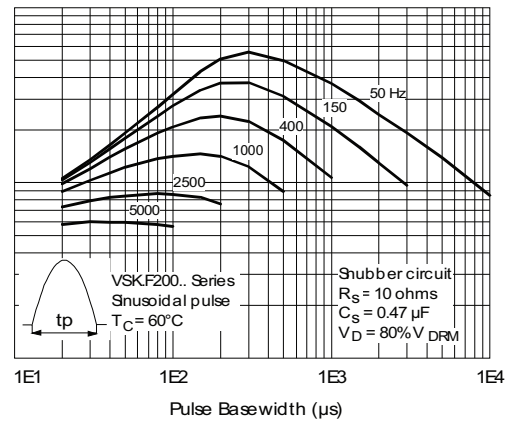
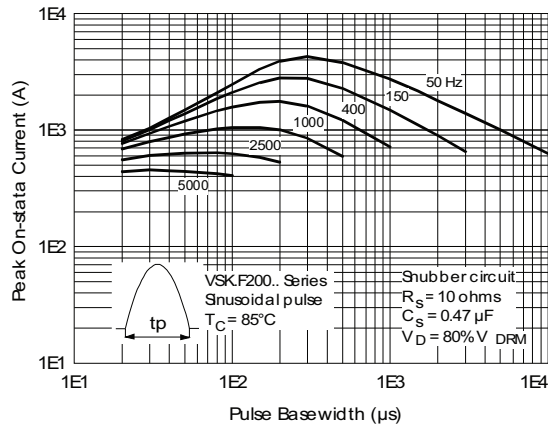


Fig. 11 - Frequency Characteristics

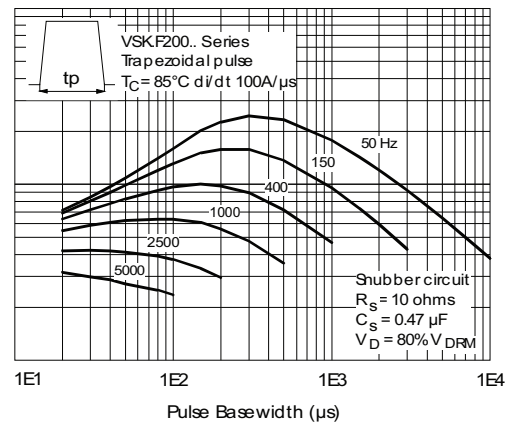
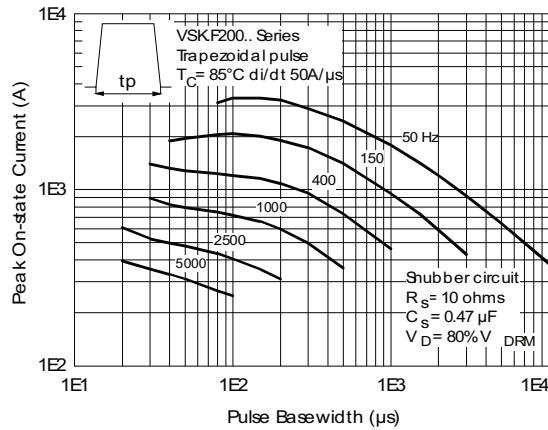


Fig. 12 - Frequency Characteristics

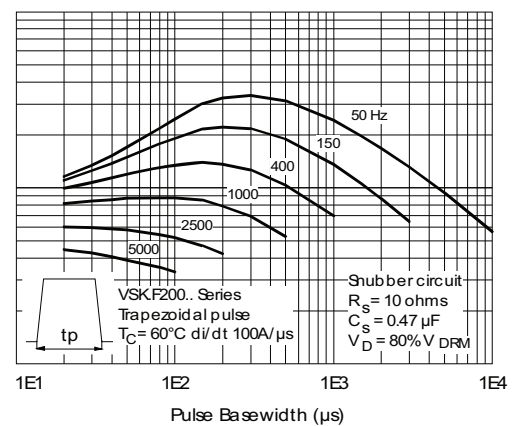
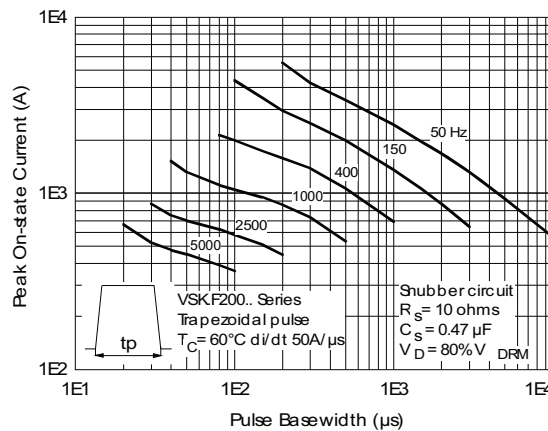


Fig. 13 - Frequency Characteristics

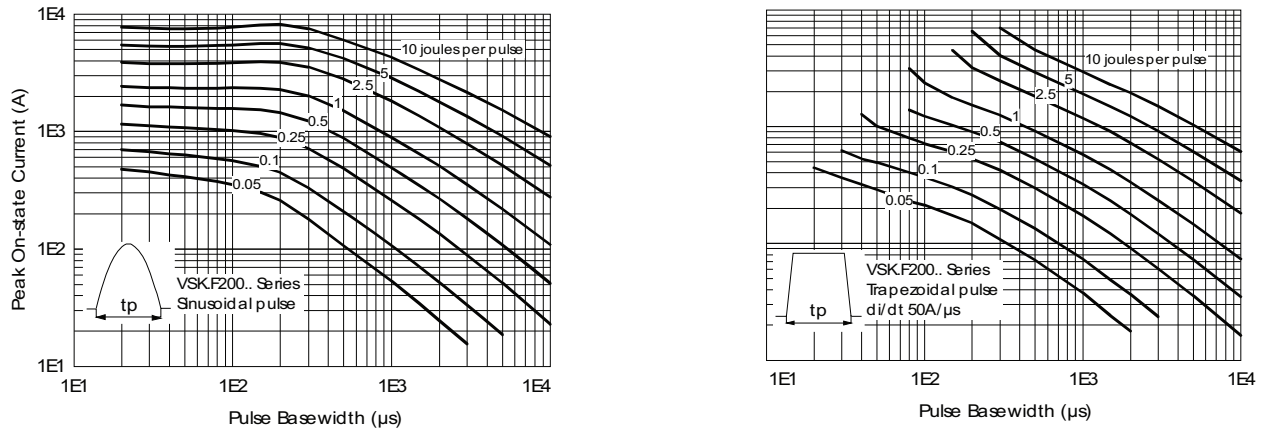


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

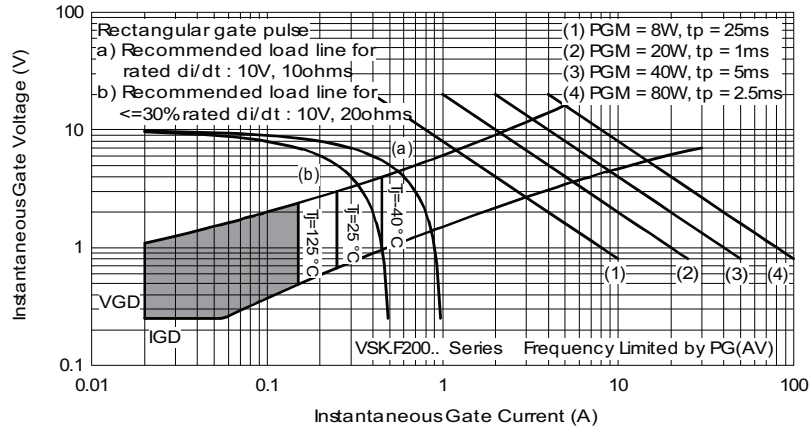


Fig. 15 - Gate Characteristics

# VSK.F200..P Series



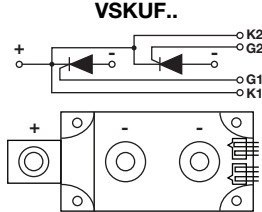
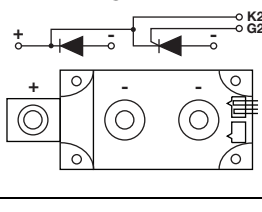
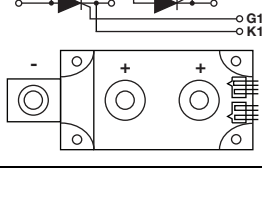
Vishay Semiconductors Fast Thyristor/Diode and Thyristor/Thyristor  
(MAGN-A-PAK Power Modules), 200 A

## ORDERING INFORMATION TABLE

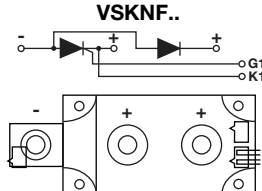
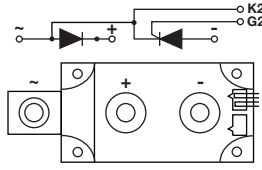
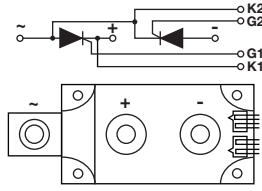
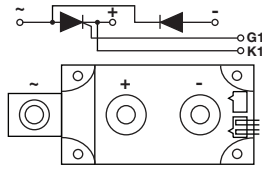
| Device code | VSK                                                               | T | F | 200 | - | 12 | H | K | P |
|-------------|-------------------------------------------------------------------|---|---|-----|---|----|---|---|---|
|             | 1                                                                 | 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: $K \leq 20 \mu\text{s}$<br>$J \leq 25 \mu\text{s}$  |   |   |     |   |    |   |   |   |
| 8           | - Lead (Pb)-free                                                  |   |   |     |   |    |   |   |   |

### 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 SCRs common cathodes  | U                          |  |
| SCR/diode common cathodes | K                          |  |
| Two SCRs common anodes    | V                          |  |

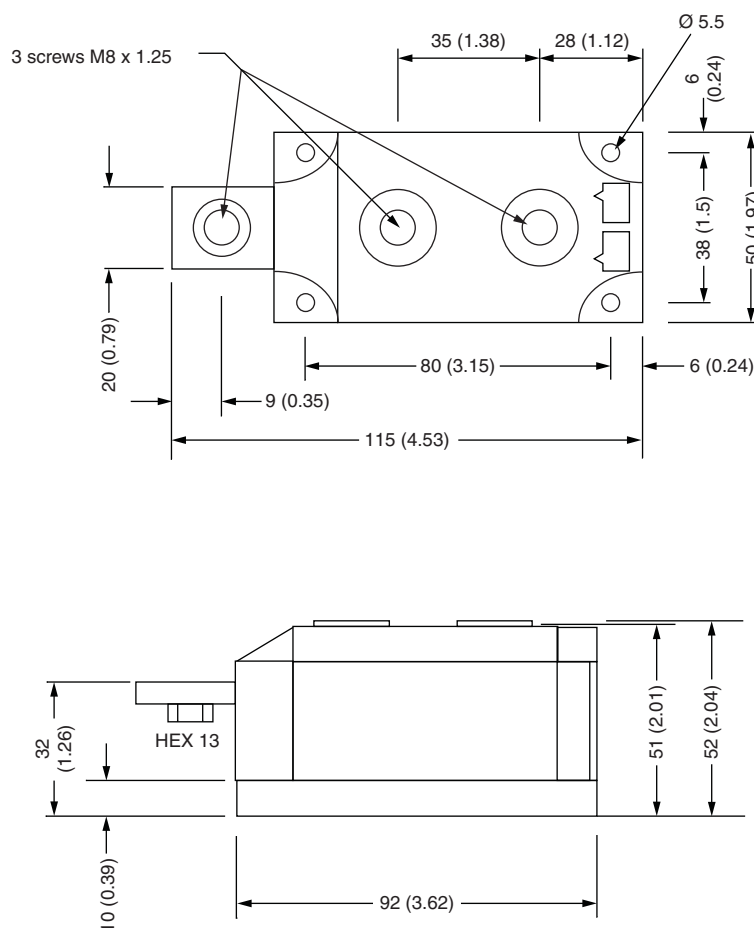


| CIRCUIT CONFIGURATION                       |                            |                                                                                       |
|---------------------------------------------|----------------------------|---------------------------------------------------------------------------------------|
| CIRCUIT DESCRIPTION                         | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING                                                                       |
| SCR/diode common anodes                     | N                          |    |
| SCR/diode doubler circuit, negative control | L                          |    |
| Two SCRs doubler circuit                    | T                          |   |
| SCR/diode doubler circuit, positive control | H                          |  |

| 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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