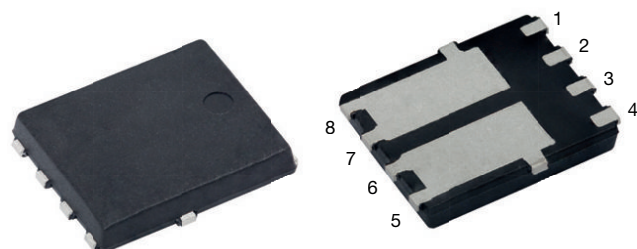
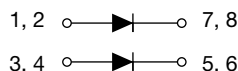


# Hyperfast Rectifier, 2 x 3 A FRED Pt®



FlatPAK 5 x 6



## LINKS TO ADDITIONAL RESOURCES



### PRIMARY CHARACTERISTICS

|                       |                   |
|-----------------------|-------------------|
| $I_{F(AV)}$           | 2 x 3 A           |
| $V_R$                 | 200 V             |
| $V_F$ at $I_F$        | 0.71 V            |
| $t_{rr}$              | 25 ns             |
| $T_J$ max.            | 175 °C            |
| Package               | FlatPAK 5 x 6     |
| Circuit configuration | Separated cathode |

## FEATURES

- Hyper fast recovery time, reduced  $Q_{rr}$ , and soft recovery
- 175 °C maximum operating junction temperature
- Low forward voltage drop
- Low leakage current
- Specific for output and snubber operation
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## DESCRIPTION / APPLICATIONS

State of the art hyper fast recovery rectifiers specifically designed with optimized performance of forward voltage drop and hyper fast recovery time.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in snubber, boost, lighting, as high frequency rectifiers and freewheeling diodes.

The extremely optimized stored charge and low recovery current minimize the switching losses and reduce power dissipation in the switching element.

## MECHANICAL DATA

**Case:** FlatPAK 5 x 6

Molding compound meets UL 94 V-0 flammability rating  
Halogen-free, RoHS-compliant

**Terminals:** matte tin plated leads, solderable per J-STD-002, meets JESD 201 class 2 whisker test

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                    | SYMBOL      | TEST CONDITIONS                                                                   | VALUES | UNITS |
|----------------------------------------------|-------------|-----------------------------------------------------------------------------------|--------|-------|
| Peak repetitive reverse voltage              | $V_{RRM}$   |                                                                                   | 200    | V     |
| Average rectified forward current per device | $I_{F(AV)}$ | $T_{Solderpad} = 170\text{ °C}$ , DC<br>$T_{Solderpad} = 169\text{ °C}$ , D = 0.5 | 3      |       |
| Non-repetitive peak surge current per device | $I_{FSM}$   | $T_J = 25\text{ °C}$ , 10 ms sinusoidal pulse                                     | 147    | A     |
| per diode                                    |             |                                                                                   | 70     |       |

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified)

| PARAMETER                           | SYMBOL           | TEST CONDITIONS                            | MIN. | TYP. | MAX. | UNITS         |
|-------------------------------------|------------------|--------------------------------------------|------|------|------|---------------|
| Breakdown voltage, blocking voltage | $V_{BR}$ , $V_R$ | $I_R = 100\text{ }\mu\text{A}$             | 200  | -    | -    | V             |
| Forward voltage                     | $V_F$            | $I_F = 3\text{ A}$                         | -    | 0.88 | 0.94 |               |
|                                     |                  | $I_F = 3\text{ A}$ , $T_J = 150\text{ °C}$ | -    | 0.71 | 0.74 |               |
| Reverse leakage current             | $I_R$            | $V_R = V_R$ rated                          | -    | -    | 2    | $\mu\text{A}$ |
|                                     |                  | $T_J = 150\text{ °C}$ , $V_R = V_R$ rated  | -    | 6    | 40   |               |
| Junction capacitance                | $C_T$            | $V_R = 200\text{ V}$                       | -    | 14   | -    | pF            |

| <b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |           |                                                                                  |      |      |      |       |
|----------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------|------|------|------|-------|
| PARAMETER                                                                                                | SYMBOL    | TEST CONDITIONS                                                                  | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time                                                                                    | $t_{rr}$  | $I_F = 1.0\text{ A}$ , $dI_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 26   | -    | ns    |
|                                                                                                          |           | $I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$             | -    | -    | 25   |       |
|                                                                                                          |           | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 15   | -    |       |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 25   | -    |       |
| Peak recovery current                                                                                    | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 2    | -    | A     |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 3    | -    |       |
| Reverse recovery charge                                                                                  | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 12   | -    | nC    |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 40   | -    |       |

| <b>THERMAL - MECHANICAL SPECIFICATIONS</b>     |                     |                 |      |      |      |                             |
|------------------------------------------------|---------------------|-----------------|------|------|------|-----------------------------|
| PARAMETER                                      | SYMBOL              | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS                       |
| Maximum junction and storage temperature range | $T_J, T_{Stg}$      |                 | -55  | -    | 175  | $^{\circ}\text{C}$          |
| Thermal resistance, junction to ambient        | $R_{thJA}^{(1)(2)}$ |                 | -    | 90   | 103  |                             |
| Thermal resistance, junction to mount          | $R_{thJM}^{(3)}$    |                 | -    | 2.3  | 2.6  | $^{\circ}\text{C}/\text{W}$ |

**Notes**

- (1) The heat generated must be less than thermal conductivity from junction to ambient;  $dP_D/dT_J < 1 \times R_{thJA}$
- (2) Free air, mounted or recommended copper pad area; thermal resistance  $R_{thJA}$  - junction to ambient
- (3) Mounted on infinite heatsink

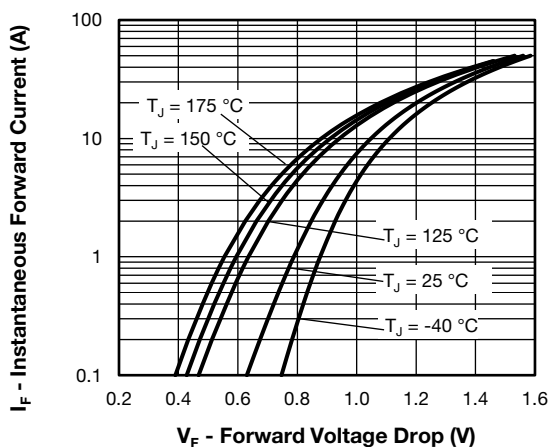


Fig. 1 - Typical Forward Voltage Drop Characteristics

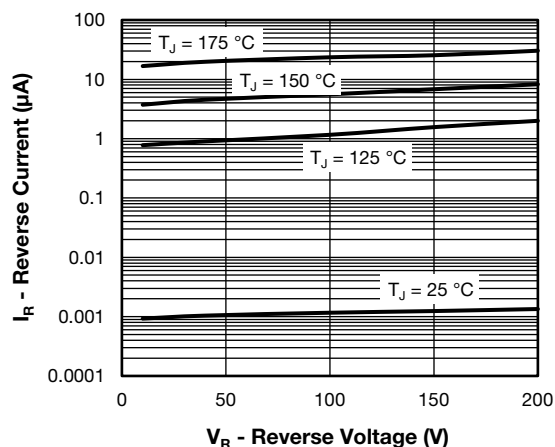


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

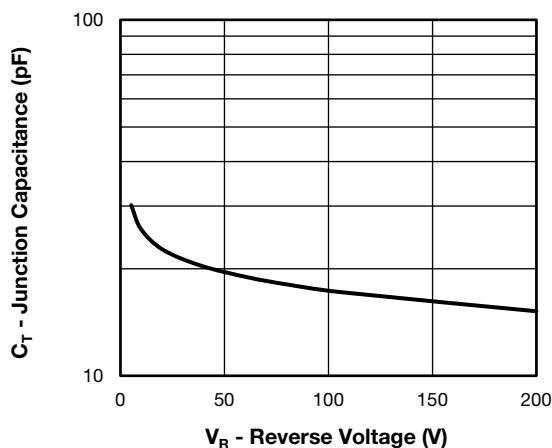


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

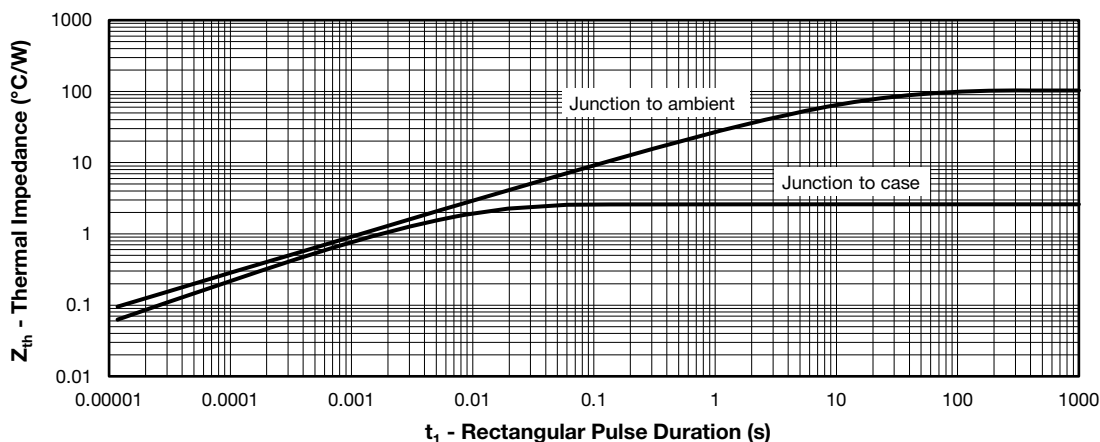
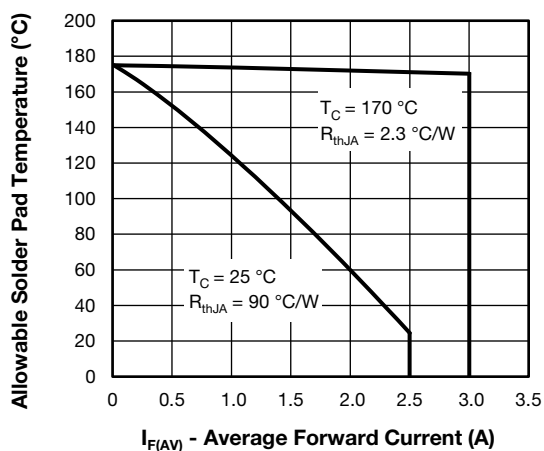

Fig. 4 - Maximum Thermal Impedance  $Z_{th}$  Characteristics


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

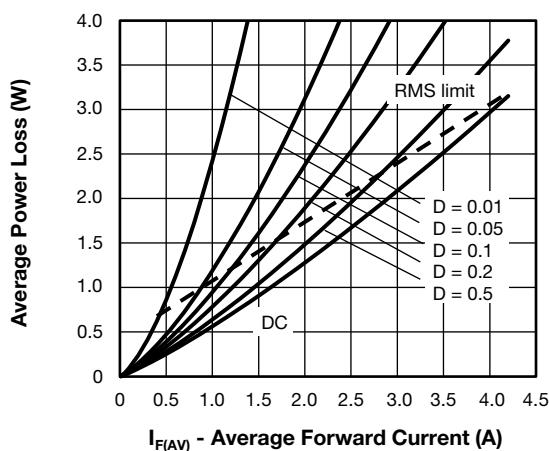


Fig. 6 - Forward Power Loss Characteristics

#### Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see Fig. 6);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = rated  $V_R$

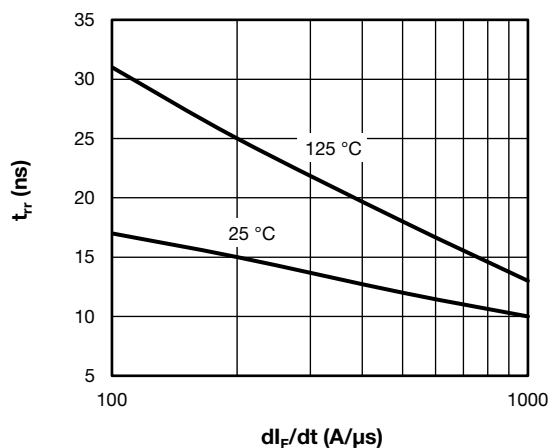
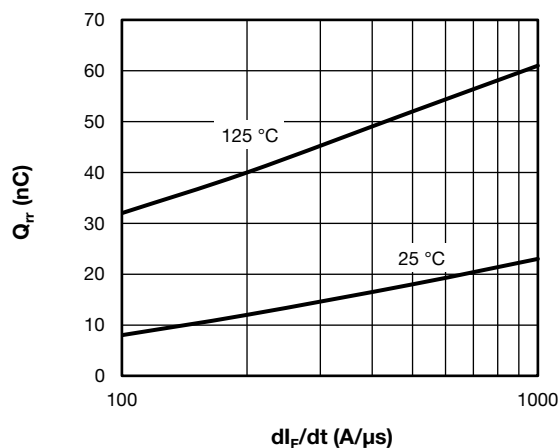
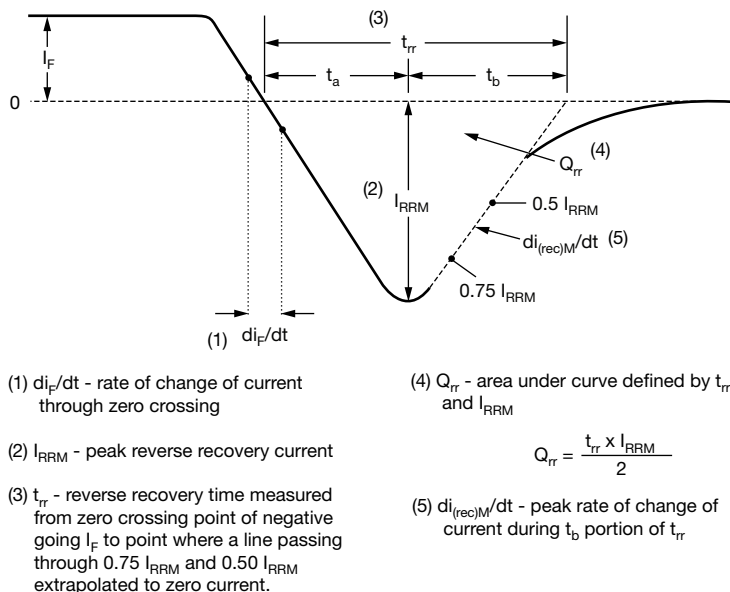

Fig. 7 - Typical Reverse Recovery vs.  $dI_F/dt$ 

Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$ 


Fig. 9 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

|             |            |          |          |          |          |           |            |
|-------------|------------|----------|----------|----------|----------|-----------|------------|
| Device code | <b>VS-</b> | <b>6</b> | <b>D</b> | <b>K</b> | <b>H</b> | <b>02</b> | <b>-M3</b> |
|             | ①          | ②        | ③        | ④        | ⑤        | ⑥         | ⑦          |

- |          |                                                                       |
|----------|-----------------------------------------------------------------------|
| <b>1</b> | - Vishay Semiconductors product                                       |
| <b>2</b> | - Current rating (6 = 6 A)                                            |
| <b>3</b> | - Circuit configuration:<br>D = separated cathode                     |
| <b>4</b> | - K = FlatPAK package                                                 |
| <b>5</b> | - Process type:<br>H = hyperfast recovery                             |
| <b>6</b> | - Voltage code (02 = 200 V)                                           |
| <b>7</b> | - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free |

**ORDERING INFORMATION** (Example)

| PREFERRED P/N  | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | PACKAGING DESCRIPTION              |
|----------------|-----------------|------------------------|---------------|------------------------------------|
| VS-6DKH02-M3/H | 0.10            | H                      | 1500          | 7" diameter plastic tape and reel  |
| VS-6DKH02-M3/I | 0.10            | I                      | 6000          | 13" diameter plastic tape and reel |

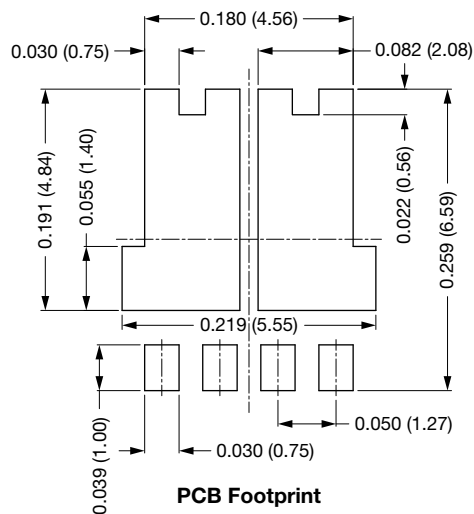
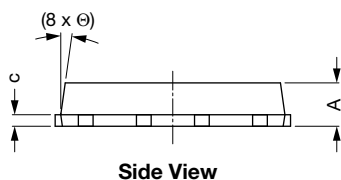
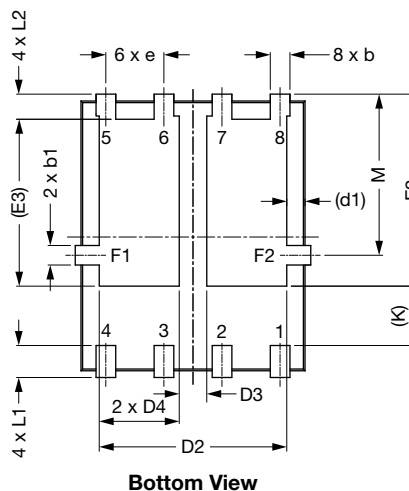
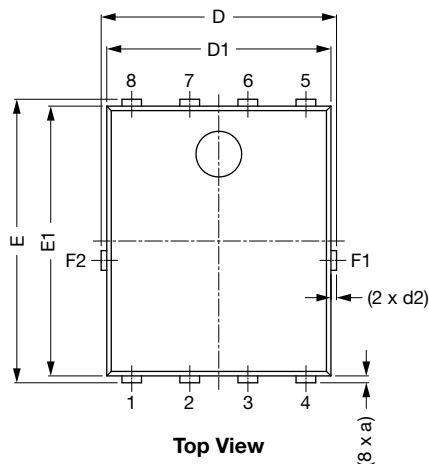
**LINKS TO RELATED DOCUMENTS**

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?96056">www.vishay.com/doc?96056</a> |
| Part marking information | <a href="http://www.vishay.com/doc?96059">www.vishay.com/doc?96059</a> |
| Packaging information    | <a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a> |
| SPICE model              | <a href="http://www.vishay.com/doc?96882">www.vishay.com/doc?96882</a> |



## FlatPAK 5 x 6 (Dual)

**DIMENSIONS** in inches (millimeters)



| DIM. | INCHES |       |       | MILLIMETERS |       |      |
|------|--------|-------|-------|-------------|-------|------|
|      | MIN.   | NOM.  | MAX.  | MIN.        | NOM.  | MAX. |
| A    | 0.035  | 0.039 | 0.043 | 0.89        | 0.99  | 1.09 |
| (a)  | -      | 0.006 | -     | -           | 0.15  | -    |
| b    | 0.013  | 0.017 | 0.020 | 0.32        | 0.43  | 0.52 |
| b1   | 0.013  | 0.017 | 0.020 | 0.32        | 0.43  | 0.52 |
| c    | 0.008  | -     | 0.014 | 0.20        | -     | 0.35 |
| D    | 0.197  | 0.203 | 0.209 | 5.00        | 5.15  | 5.30 |
| D1   | 0.189  | 0.193 | 0.197 | 4.80        | 4.90  | 5.00 |
| D2   | 0.154  | 0.161 | 0.169 | 3.90        | 4.10  | 4.30 |
| D3   | 0.020  | 0.024 | 0.031 | 0.50        | 0.60  | 0.80 |
| D4   | 0.063  | 0.069 | 0.075 | 1.60        | 1.75  | 1.90 |
| (d1) | -      | 0.016 | -     | -           | 0.40  | -    |
| (d2) | -      | 0.005 | -     | -           | 0.125 | -    |
| E    | 0.238  | 0.244 | 0.250 | 6.05        | 6.20  | 6.35 |



| DIM. | INCHES    |       |       | MILLIMETERS |      |      |
|------|-----------|-------|-------|-------------|------|------|
|      | MIN.      | NOM.  | MAX.  | MIN.        | NOM. | MAX. |
| E1   | 0.228     | 0.232 | 0.236 | 5.80        | 5.90 | 6.00 |
| E2   | 0.157     | 0.165 | 0.173 | 4.00        | 4.20 | 4.40 |
| (E3) | -         | 0.144 | -     | -           | 3.65 | -    |
| e    | 0.050 BSC |       |       | 1.27 BSC    |      |      |
| (K)  | 0.039     | -     | -     | 1.00        | -    | -    |
| L1   | 0.019     | -     | 0.043 | 0.48        | -    | 1.10 |
| L2   | 0.012     | -     | 0.031 | 0.30        | -    | 0.80 |
| M    | 0.128     | 0.138 | 0.148 | 3.25        | 3.50 | 3.75 |
| Θ    | 0°        | -     | 10°   | 0°          | -    | 10°  |

**Notes**

- Dimensioning and tolerancing per ASME Y14.5-2009
- Dimensions D1 and E1 do not include mold flash or gate burrs
- Dimension (XX) means reference only



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