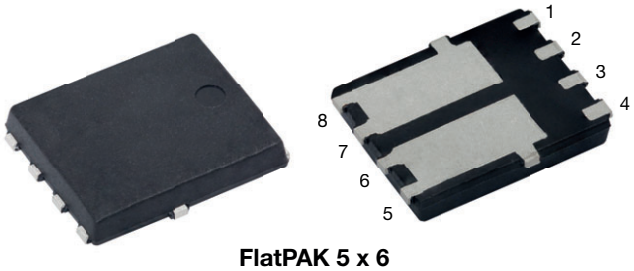
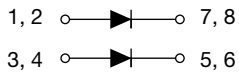
# Hyper Fast Rectifier, 2 x 3 A FRED Pt®




FlatPAK 5 x 6




## 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

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
Base P/N-M3 - halogen-free, RoHS-compliant
M3 suffix meets JESD 201 class 2 whisker test

| PRODUCT SUMMARY | |
|---|---|
| Package | FlatPAK 5 x 6 |
| $I_{F(AV)}$ | 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 |
| Diode variation | Separated cathode |

| 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 °C, DC | 3 | |
| | | | $T_{Solderpad}$ = 169 °C, D = 0.5 | | |
| Non-repetitive peak surge current | per device | $I_{FSM}$ | $T_J$ = 25 °C, 10 ms sinusoidal pulse | 147 | A |
| | per diode | | | 70 | |

| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Breakdown voltage, blocking voltage | $V_{BR}$, $V_R$ | $I_R$ = 100 µA | 200 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 3 A | - | 0.88 | 0.94 | |
| | | $I_F$ = 3 A, $T_J$ = 150 °C | - | 0.71 | 0.74 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | - | 2 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 6 | 40 | |
| Junction capacitance | $C_T$ | $V_R$ = 200 V | - | 14 | - | pF |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 50 A/µs, $V_R$ = 30 V | | - | 26 | - | ns |
| | | $I_F$ = 0.5 A, $I_R$ = 1 A, $I_{rr}$ = 0.25 A | | - | - | 25 | |
| | | $T_J$ = 25 °C | $I_F$ = 3 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 160 V | - | 15 | - | |
| | | $T_J$ = 125 °C | | - | 25 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 2 | - | A |
| | | $T_J$ = 125 °C | | - | 3 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 12 | - | nC |
| | | $T_J$ = 125 °C | | - | 40 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -65 | - | 175 | °C |
| Thermal resistance, junction to ambient | $R_{thJA}$ (1)(2) | | - | 90 | 103 | |
| Thermal resistance, junction to case | $R_{thJC}$ (3) | | - | 2.3 | 2.6 | °C/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

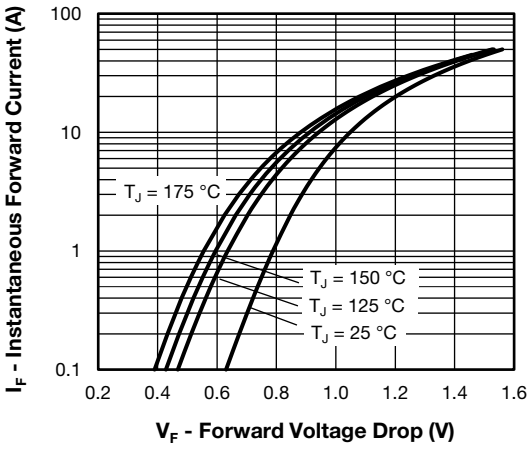



Fig. 1 - Typical Forward Voltage Drop Characteristics

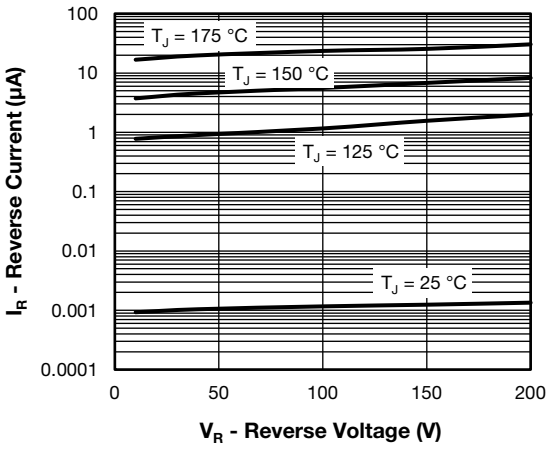



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

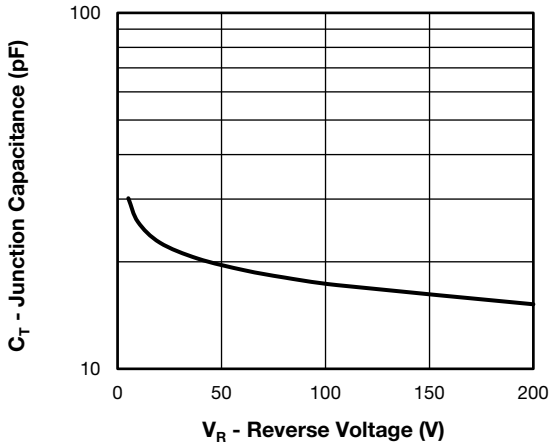



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

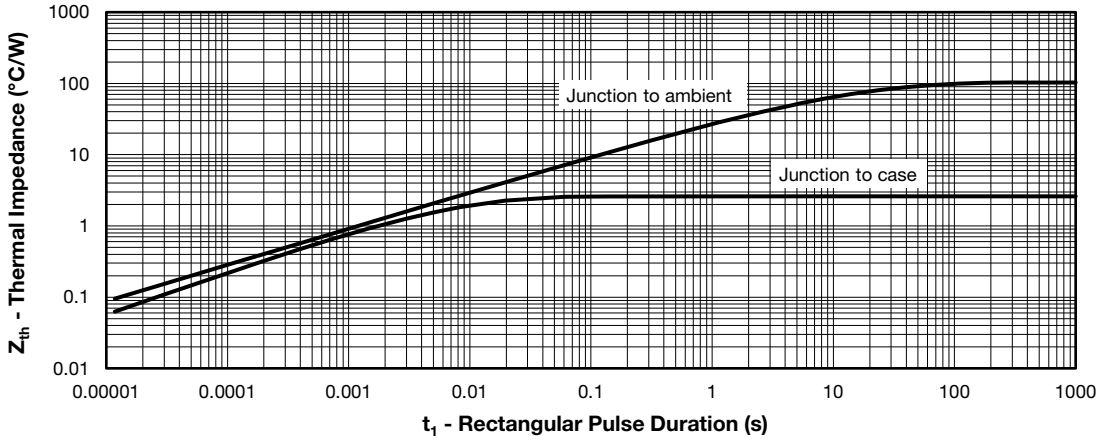



Fig. 4 - Maximum Thermal Impedance $Z_{th}$ Characteristics

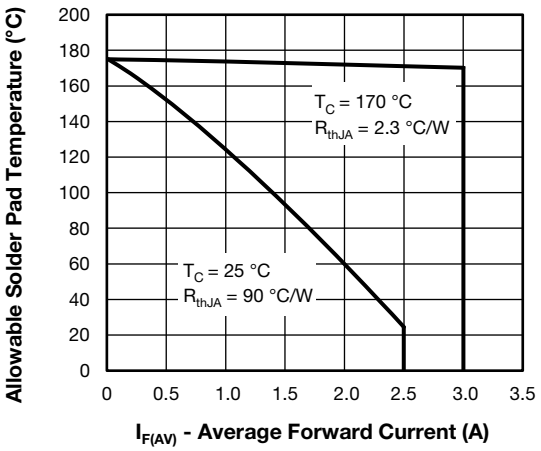



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

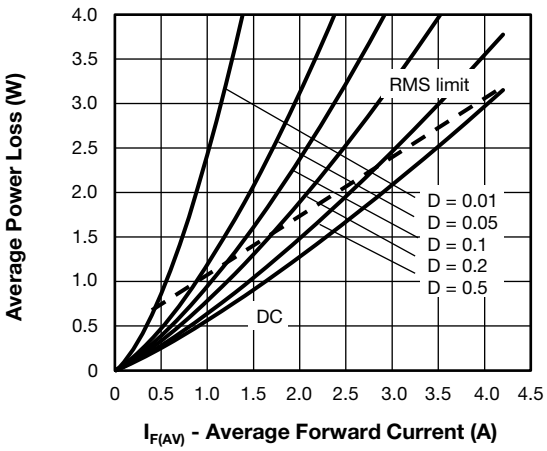



Fig. 6 - Forward Power Loss Characteristics

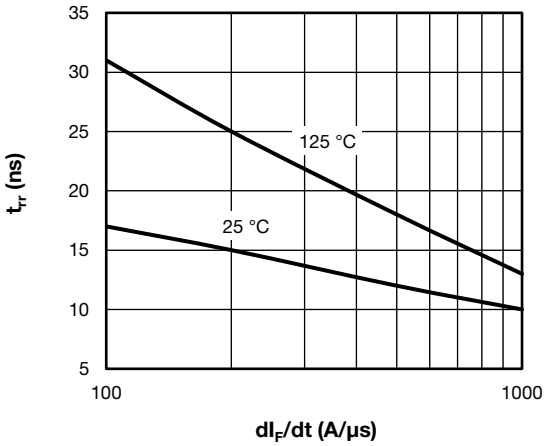



Fig. 7 - Typical Reverse Recovery vs. $dI_F/dt$

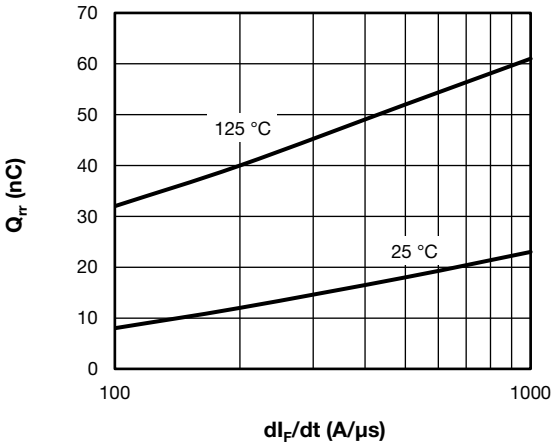
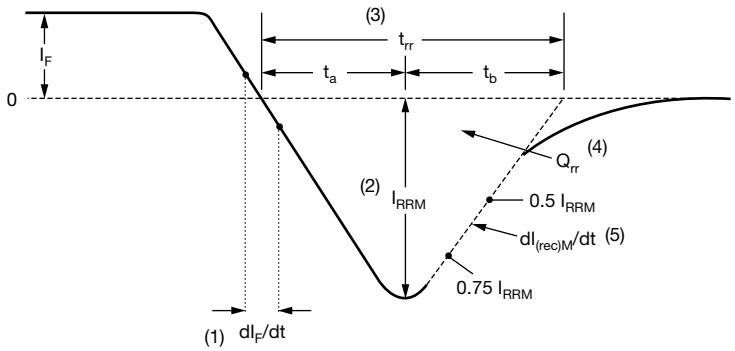



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

**Note**

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




(1) $dI_F/dt$ - rate of change of current through zero crossing

(2) $I_{RRM}$ - peak reverse recovery current

(3) $t_{rr}$ - reverse recovery time measured from zero crossing point of negative going $I_F$ to point where a line passing through 0.75 $I_{RRM}$ and 0.50 $I_{RRM}$ extrapolated to zero current.

(4) $Q_{rr}$ - area under curve defined by $t_{rr}$ and $I_{RRM}$

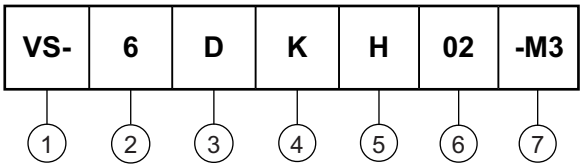
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during $t_b$ portion of $t_{rr}$

Fig. 9 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

Device code




1 - Vishay Semiconductors product
2 - Current rating (6 = 6 A)
3 - Circuit configuration:
D = separated cathode
4 - K = FlatPAK package
5 - Process type:
H = hyperfast recovery
6 - Voltage code (02 = 200 V)
7 - -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 | www.vishay.com/doc?96056 |
| Part marking information | www.vishay.com/doc?96059 |
| Packaging information | www.vishay.com/doc?88869 |

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