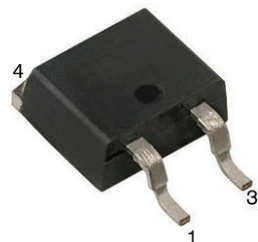


Hyperfast Rectifier, 20 A FRED Pt® G5


D²PAK 2L (TO-263AB 2L)


FEATURES

- Minimum creepage and clearance distances are 5.2 mm and 5.4 mm respectively
- Hyperfast and optimized Q_{rr}
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- AEC-Q101 qualified meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS | |
|--------------------------|------------------------|
| $I_{F(AV)}$ | 20 A |
| V_R | 1200 V |
| V_F at I_F at 125 °C | 1.88 V |
| t_{rr} | 37 ns |
| T_J max. | 175 °C |
| Package | D²PAK 2L (TO-263AB 2L) |
| Circuit configuration | Single |

DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for high frequency converters, both soft switched / resonant. Specifically designed to improve efficiency of PFC and output rectification stages of EV / HEV battery charging stations, booster stage of solar inverters and UPS applications, these devices are perfectly matched to operate with MOSFETs or high speed IGBTs.

MECHANICAL DATA

Case: D²PAK 2L (TO-263AB 2L)

Molding compound meets UL 94 V-0 flammability rating

Terminals: matte tin plated leads, solderable per J-STD-002

| ABSOLUTE MAXIMUM RATINGS | | | | |
|--|----------------|--|-------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Repetitive peak reverse voltage | V_{RRM} | | 1200 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C = 103\text{ °C}$ | 20 | A |
| Repetitive peak forward current | I_{FRM} | $T_C = 103\text{ °C}$, $D = 0.50$, $f = 20\text{ kHz}$ | 32 | |
| Non-repetitive peak surge current | I_{FSM} | $T_C = 45\text{ °C}$, $t_p = 10\text{ ms}$, sine wave | 125 | |
| Operating junction and storage temperature | T_J, T_{Stg} | | -55 to +175 | °C |

| 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 | $I_R = 100\text{ }\mu\text{A}$ | 1200 | - | - | V |
| Forward voltage | V_F | $I_F = 20\text{ A}$ | - | 2.04 | 2.66 | |
| | | $I_F = 20\text{ A}$, $T_J = 125\text{ °C}$ | - | 1.88 | - | |
| Reverse leakage current | I_R | $V_R = V_R$ rated | - | - | 50 | μA |
| | | $T_J = 125\text{ °C}$, $V_R = V_R$ rated | - | - | 500 | |
| Junction capacitance | C_T | $V_R = 200\text{ V}$ | - | 10 | - | pF |
| Series inductance | L_S | Measured to lead 5 mm from package body | - | 8 | - | nH |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) | | | | | | |
|--|-----------|---|------|------|------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | t_{rr} | $I_F = 1.0\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 37 | - | ns |
| | | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 125 | - | |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 188 | - | |
| Peak recovery current | I_{RRM} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 14 | - | A |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 19 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 670 | - | nC |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 1450 | - | |
| Reverse recovery time | t_{rr} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 90 | - | ns |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 107 | - | |
| Peak recovery current | I_{RRM} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 28 | - | A |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 48 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 1450 | - | nC |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 2930 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|--|----------------|--|------------|------|------|-----------------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction-to-case | R_{thJC} | | - | - | 1.7 | $^{\circ}\text{C}/\text{W}$ |
| Weight | | | - | 2.0 | - | g |
| Maximum junction and storage temperature range | T_J, T_{Stg} | | -55 | - | 175 | $^{\circ}\text{C}$ |
| Marking device | | Case style D ² PAK 2L (TO-263AB 2L) | E5TH2112SH | | | |

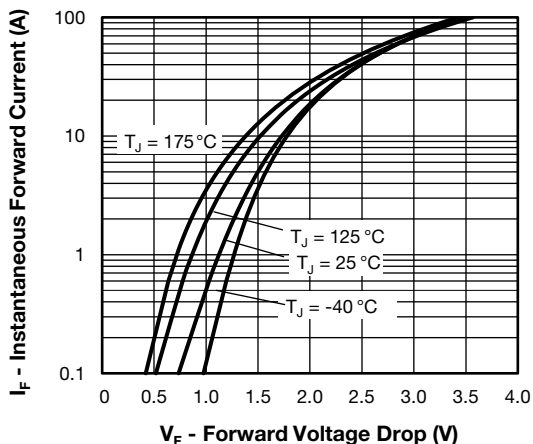


Fig. 1 - Forward Voltage Drop Characteristics

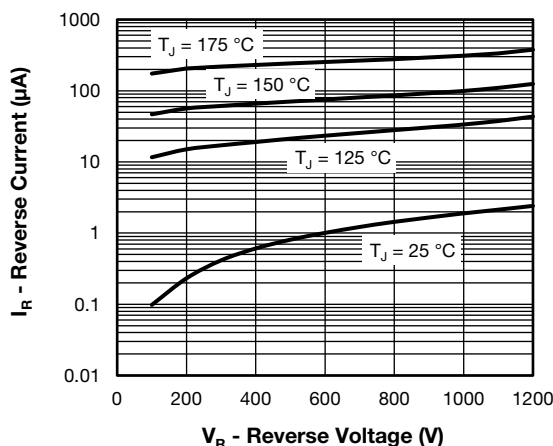


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

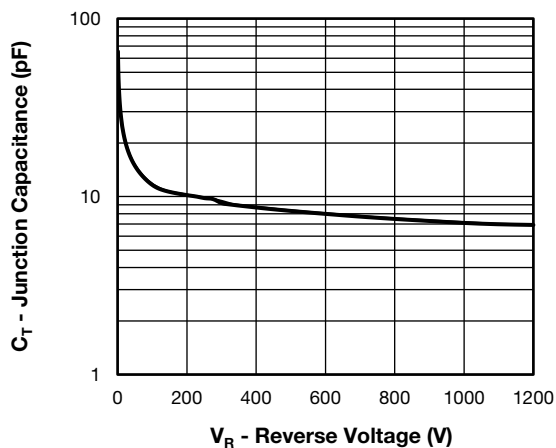


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

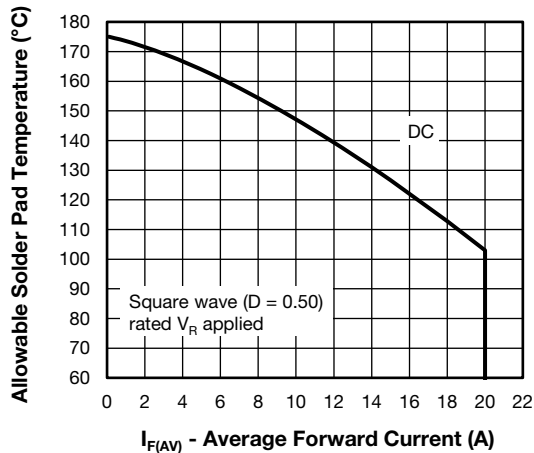


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

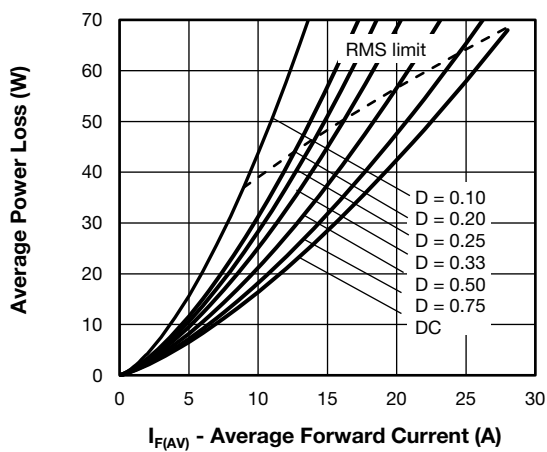


Fig. 5 - Forward Power Loss Characteristics

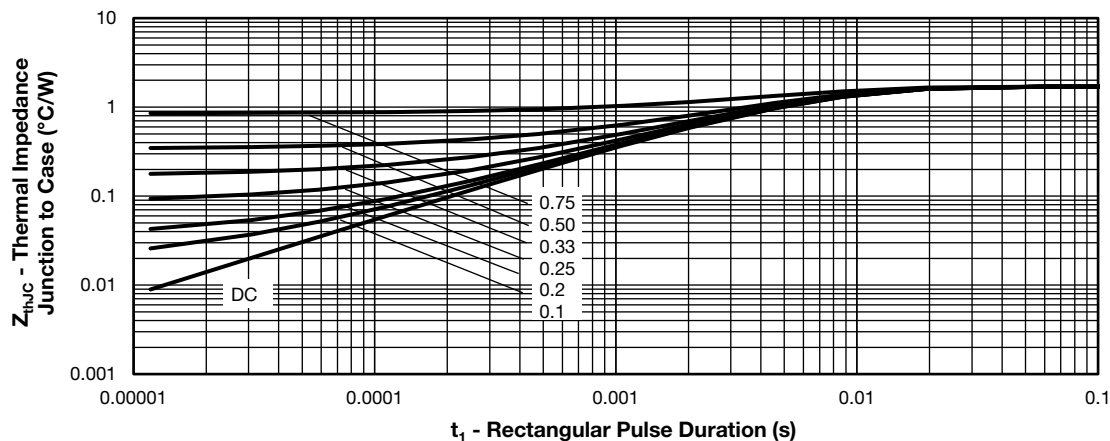
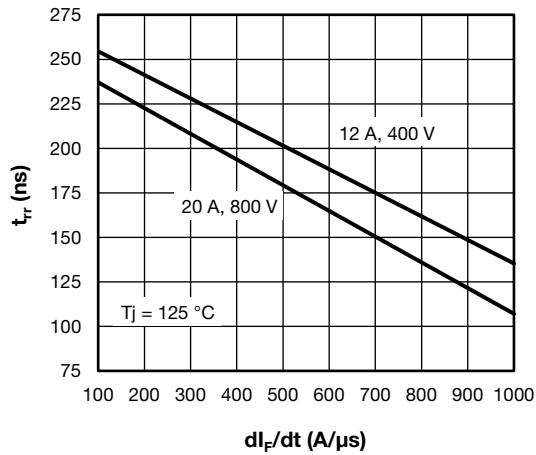
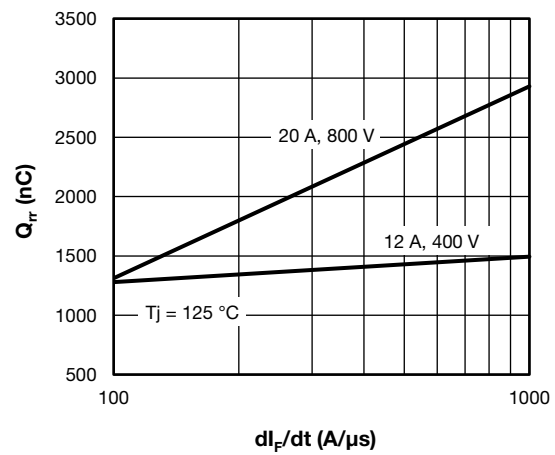
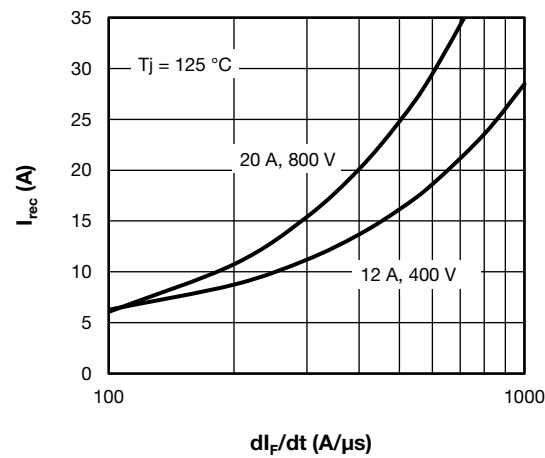


Fig. 6 - Transient Thermal Impedance, Junction to Case


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

Fig. 8 - Typical Stored Charge vs. di_F/dt

Fig. 9 - Typical Stored Charge vs. di_F/dt

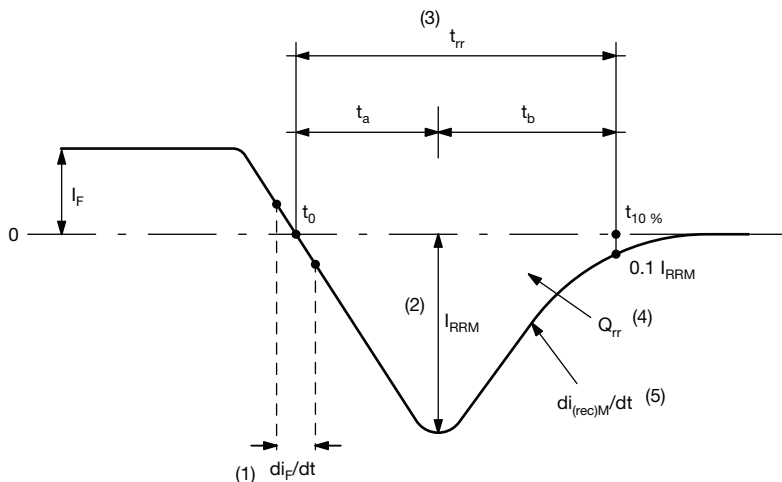


Fig. 10 - Reverse Recovery Waveform and Definitions

Notes

- (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 t_0 , crossing point of negative going I_F , to point $t_{10\%}$, $0.1 I_{RRM}$
- (4) Q_{rr} - area under curve defined by t_0 and $t_{10\%}$

$$Q_{rr} = \int_{t_0}^{t_{10\%}} I(t) dt$$

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

**ORDERING INFORMATION TABLE**

| Device code | VS- | E | 5 | T | H | 21 | 12 | S2 | L | H | M3 |
|-------------|---|---|---|---|---|----|----|----|---|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1 | - Vishay Semiconductors product | | | | | | | | | | |
| 2 | - E = single diode | | | | | | | | | | |
| 3 | - 5 = FRED generation 5 | | | | | | | | | | |
| 4 | - Package: T = TO-263 / D ² PAK package | | | | | | | | | | |
| 5 | - H = hyperfast recovery | | | | | | | | | | |
| 6 | - Current rating (21 = 20 A) | | | | | | | | | | |
| 7 | - Voltage rating (12 = 1200 V) | | | | | | | | | | |
| 8 | - S2 = true 2 pin D ² PAK | | | | | | | | | | |
| 9 | - None = tube (50 pieces) • L = tape and reel (left oriented, for D ² PAK package) If needed different orientation/packaging, please contact factory | | | | | | | | | | |
| 10 | - H = AEC-Q101 qualified | | | | | | | | | | |
| 11 | - Environmental digit: M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free | | | | | | | | | | |

ORDERING INFORMATION (Example)

| PREFERRED P/N | BASE QUANTITY | PACKAGING DESCRIPTION |
|-------------------|---------------|-----------------------|
| VS-E5TH2112S2LHM3 | 800 | 13" diameter reel |

LINKS TO RELATED DOCUMENTS

| | |
|--------------------------|--|
| Dimensions | www.vishay.com/doc?96683 |
| Part marking information | www.vishay.com/doc?96693 |
| Packaging information | www.vishay.com/doc?95032 |

D²PAK 2L (TO-263AB 2L)

DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D²PAK (SMD-220)



| SYMBOL | MILLIMETERS | | INCHES | | NOTES | | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|--|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | | MIN. | MAX. | | | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | | | D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | | | E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| b | 0.51 | 0.99 | 0.020 | 0.039 | | | E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 | | e | 2.54 BSC | | 0.100 BSC | | |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | | | H | 14.61 | 15.88 | 0.575 | 0.625 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | | L | 1.78 | 2.79 | 0.070 | 0.110 | |
| c | 0.38 | 0.74 | 0.015 | 0.029 | | | L1 | - | 1.65 | - | 0.066 | 3 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 | | L3 | 0.25 BSC | | 0.010 BSC | | |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | | | L4 | 4.78 | 5.28 | 0.188 | 0.208 | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 | | | | | | | |

Notes

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inch
- (7) Outline conforms to JEDEC® outline TO-263AB



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