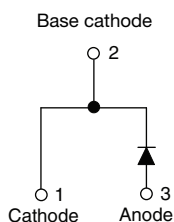


Hyperfast Rectifier, 15 A FRED Pt® G5



TO-220AC 2L



FEATURES

- 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
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

| PRIMARY CHARACTERISTICS | |
|--------------------------|-------------|
| $I_{F(AV)}$ | 15 A |
| V_R | 1200 V |
| V_F at I_F at 125 °C | 1.7 V |
| t_{rr} | 37 ns |
| T_J max. | 175 °C |
| Package | TO-220AC 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: TO-220AC 2L

Molding compound meets UL 94 V-0 flammability rating

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

Polarity: as per marking device details

| ABSOLUTE MAXIMUM RATINGS | | | | |
|--|-------------------|--|-------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Repetitive peak reverse voltage | V_{RRM} | | 1200 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C = 110\text{ °C}$, $D = 0.50$ | 15 | A |
| Repetitive peak forward current | I_{FRM} | $T_C = 110\text{ °C}$, $D = 0.50$, $f = 20\text{ kHz}$ | 30 | |
| 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 | $I_F = 15\text{ A}$ | - | 1.9 | 2.5 | |
| | | $I_F = 15\text{ A}$, $T_J = 125\text{ °C}$ | - | 1.7 | - | |
| 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 | 50 | ns |
| | | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 95 | - | |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 146 | - | |
| 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} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 545 | - | nC |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 1200 | - | |
| Reverse recovery time | t_{rr} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 75.5 | - | ns |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 100 | - | |
| Peak recovery current | I_{RRM} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 23 | - | A |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 35 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25\text{ }^{\circ}\text{C}$ | - | 935 | - | nC |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | - | 1985 | - | |

| 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 |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Maximum junction and storage temperature range | T_J , T_{Stg} | | -55 | - | 175 | $^{\circ}\text{C}$ |
| Marking device | | Case style TO-220AC 2L | E5TH1512 | | | |

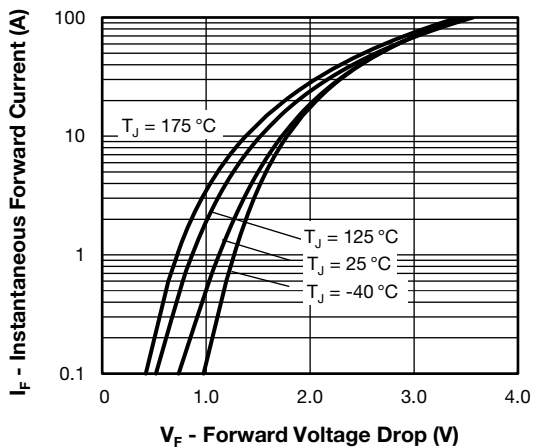


Fig. 1 - Forward Voltage Drop Characteristics

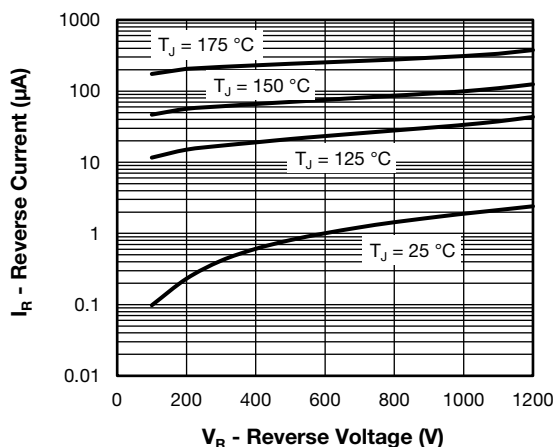


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

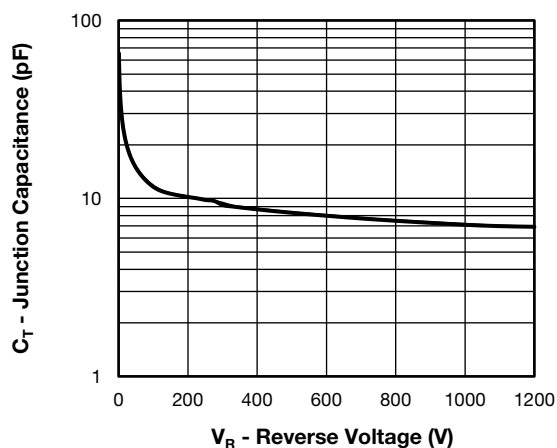


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

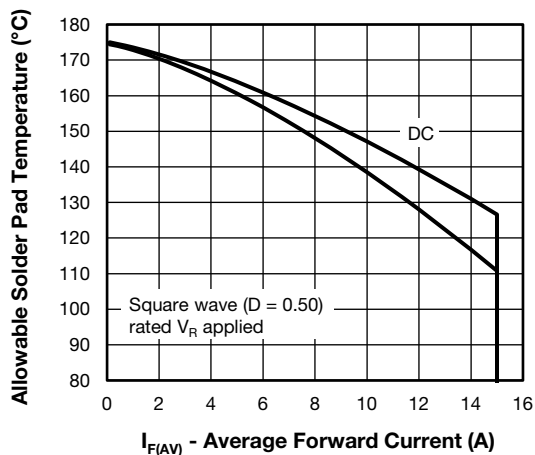


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

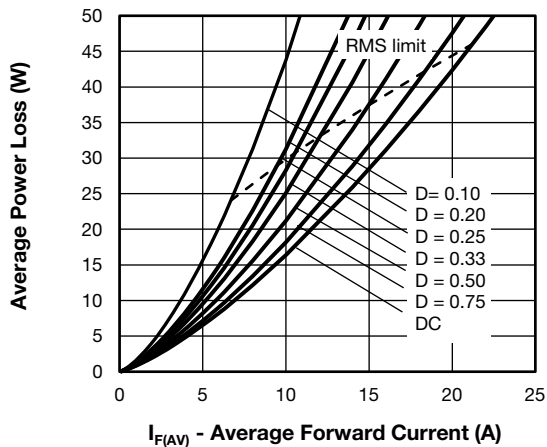


Fig. 5 - Forward Power Loss Characteristics

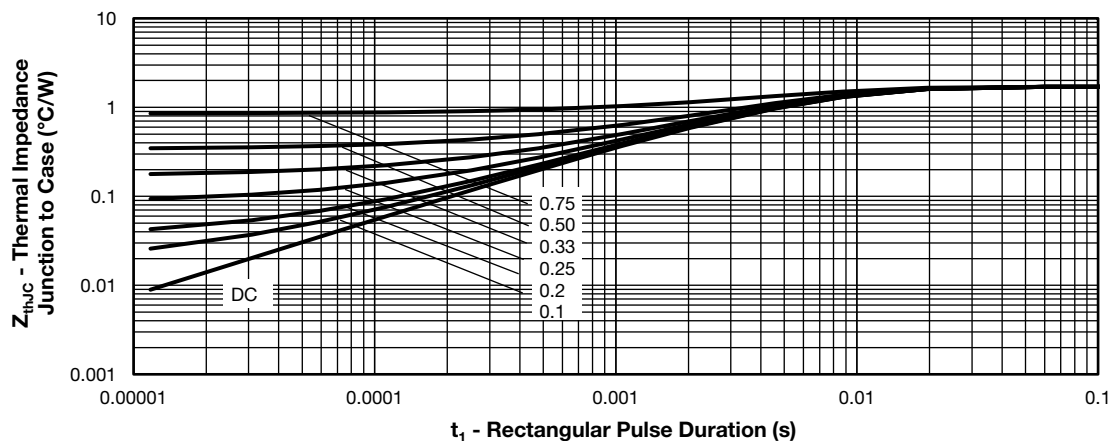
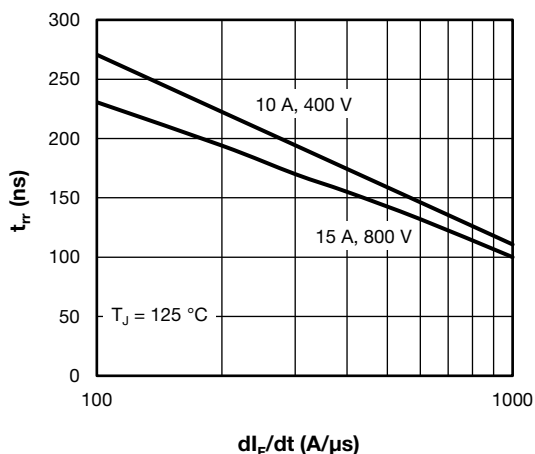
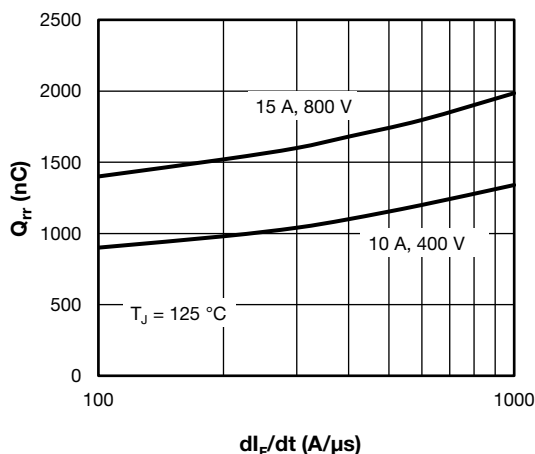
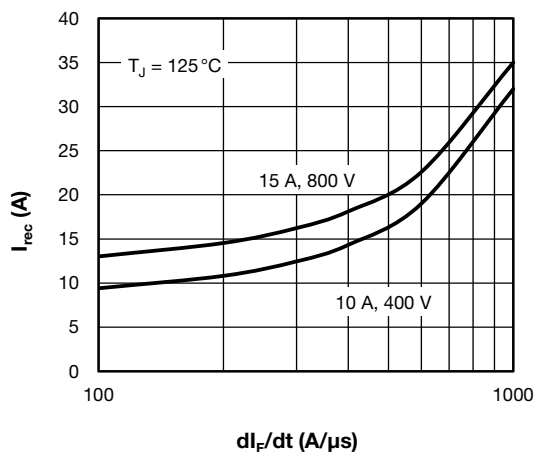


Fig. 6 - Transient Thermal Impedance, Junction to Case


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

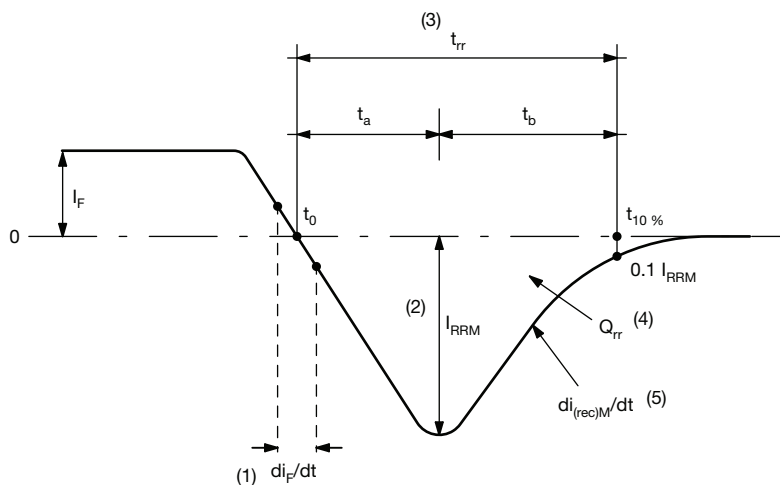


Fig. 10 - Reverse Recovery Waveform and Definitions

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 | 15 | 12 | -M3 |
|-------------|--|---|---|---|---|----|----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Vishay Semiconductors product | | | | | | | |
| 2 | E = single diode | | | | | | | |
| 3 | 5 = FRED generation 5 | | | | | | | |
| 4 | Package: T = TO-220AC 2L | | | | | | | |
| 5 | H = hyperfast recovery | | | | | | | |
| 6 | Current rating (15 = 15 A) | | | | | | | |
| 7 | Voltage rating (12 = 1200 V) | | | | | | | |
| 8 | Environmental digit: -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free | | | | | | | |

ORDERING INFORMATION (Example)

| PREFERRED P/N | BASE QUANTITY | PACKAGING DESCRIPTION |
|----------------|---------------|--------------------------|
| VS-E5TH1512-M3 | 50 | Antistatic plastic tubes |

LINKS TO RELATED DOCUMENTS

| | |
|--------------------------|--|
| Dimensions | www.vishay.com/doc?96156 |
| Part marking information | www.vishay.com/doc?95391 |



TO-220AB 3L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.25 | 4.65 | 0.167 | 0.183 | |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | |
| A2 | 2.50 | 2.92 | 0.098 | 0.115 | |
| b | 0.69 | 1.01 | 0.027 | 0.040 | |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 |
| c | 0.36 | 0.61 | 0.014 | 0.024 | |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 |
| D | 14.85 | 15.35 | 0.585 | 0.604 | 3 |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | |
| D2 | 11.68 | 13.30 | 0.460 | 0.524 | 6, 7 |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |
| E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| e | 2.41 | 2.67 | 0.095 | 0.105 | |
| e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| H1 | 6.09 | 6.48 | 0.240 | 0.255 | 6 |
| L | 13.52 | 14.02 | 0.532 | 0.552 | |
| L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| Ø P | 3.54 | 3.91 | 0.139 | 0.154 | |
| Q | 2.60 | 3.00 | 0.102 | 0.118 | |

Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1, 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 outermost extremes of the plastic body
- (4) Dimension b1, b3, and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2, and E1
- (7) Outline conforms to JEDEC® TO-220, except D2



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