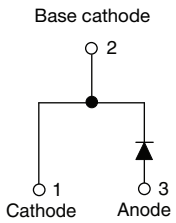
# Hyperfast Rectifier, 30 A FRED Pt® G5


2L TO-220AC




## 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

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 30 A |
| $V_R$ | 1200 V |
| $V_F$ at $I_F$ at 125 °C | 1.7 V |
| $t_{rr}$ | 32 ns |
| $T_J$ max. | 175 °C |
| Package | 2L TO-220AC |
| 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:** 2L TO-220AC
Molding compound meets UL 94 V-0 flammability rating

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

**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 | $I_{F(AV)}$ | $T_C$ = 96 °C, D = 0.50 | 30 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_C$ = 96 °C, $t_p$ = 10 ms, sine wave | 240 | |
| Repetitive peak forward current | $I_{FRM}$ | $T_C$ = 45 °C, D = 0.50, f = 20 kHz | 60 | |
| Operating junction and storage temperature | $T_J$, $T_{Stg}$ | | -55 to +175 | °C |

| 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 | 1200 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 30 A | - | 1.9 | 2.5 | |
| | | $I_F$ = 30 A, $T_J$ = 125 °C | - | 1.7 | - | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | - | 50 | µA |
| | | $T_J$ = 125 °C, $V_R$ = $V_R$ rated | - | - | 500 | |
| Junction capacitance | $C_T$ | $V_R$ = 200 V | - | 17 | - | pF |
| Series inductance | $L_S$ | Measured to lead 5 mm from package body | - | 8 | - | nH |

| 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, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 32 | 58 | ns |
| | | $T_J$ = 25 °C | $I_F$ = 20 A<br>$dI_F/dt$ = 600 A/µs<br>$V_R$ = 400 V | - | 113 | - | |
| | | $T_J$ = 125 °C | | - | 175 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 17 | - | A |
| | | $T_J$ = 125 °C | | - | 24 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 850 | - | nC |
| | | $T_J$ = 125 °C | | - | 2150 | - | |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C | $I_F$ = 30 A<br>$dI_F/dt$ = 1000 A/µs<br>$V_R$ = 800 V | - | 85 | - | ns |
| | | $T_J$ = 125 °C | | - | 132 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 30 | - | A |
| | | $T_J$ = 125 °C | | - | 43 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 1350 | - | nC |
| | | $T_J$ = 125 °C | | - | 3215 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction-to-case | $R_{thJC}$ | | - | - | 1.1 | °C/W |
| Weight | | | - | 2.0 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -55 | - | 175 | °C |
| Marking device | | Case style 2L TO-220AC | E5TH3012 | | | |

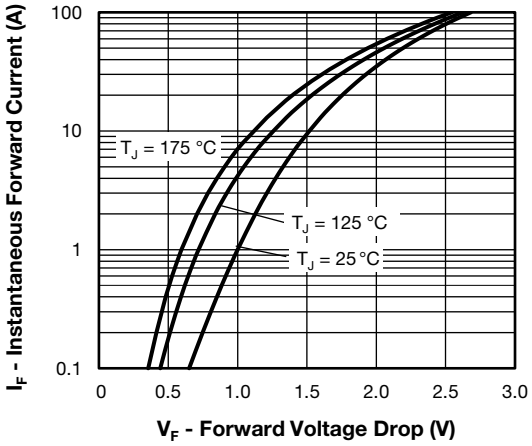



Fig. 1 - Typical Forward Voltage Drop Characteristics

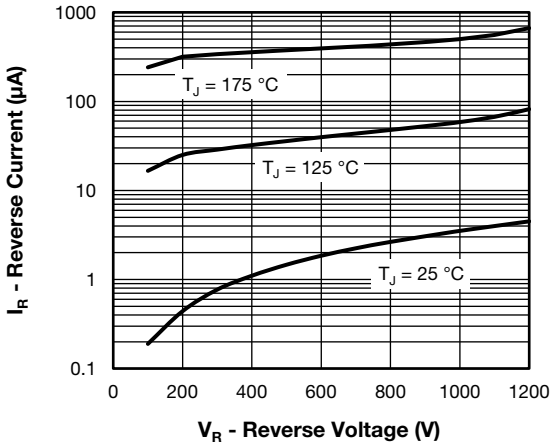



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

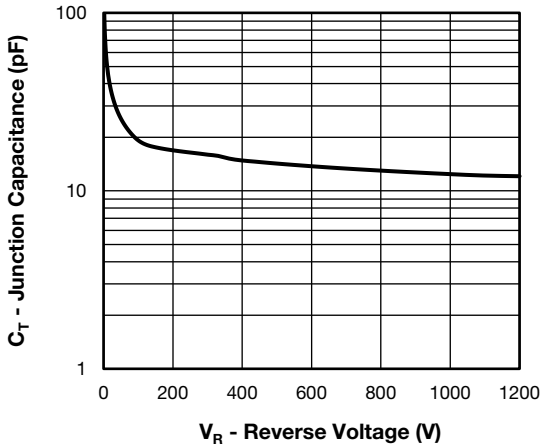



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

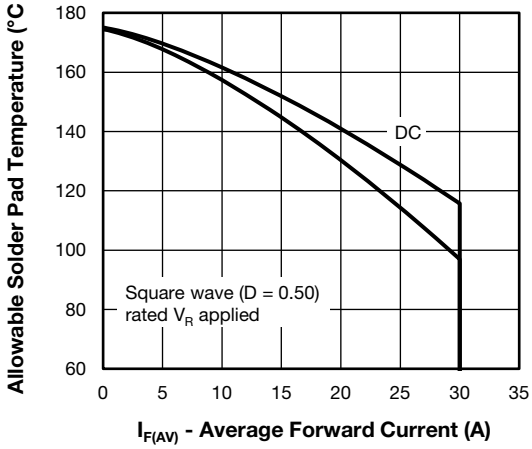



Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

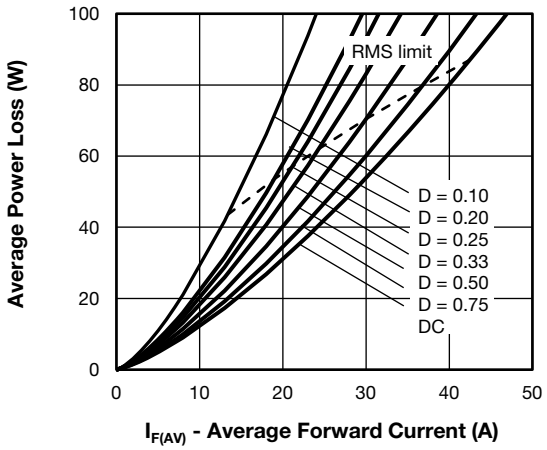



Fig. 5 - Forward Power Loss Characteristics

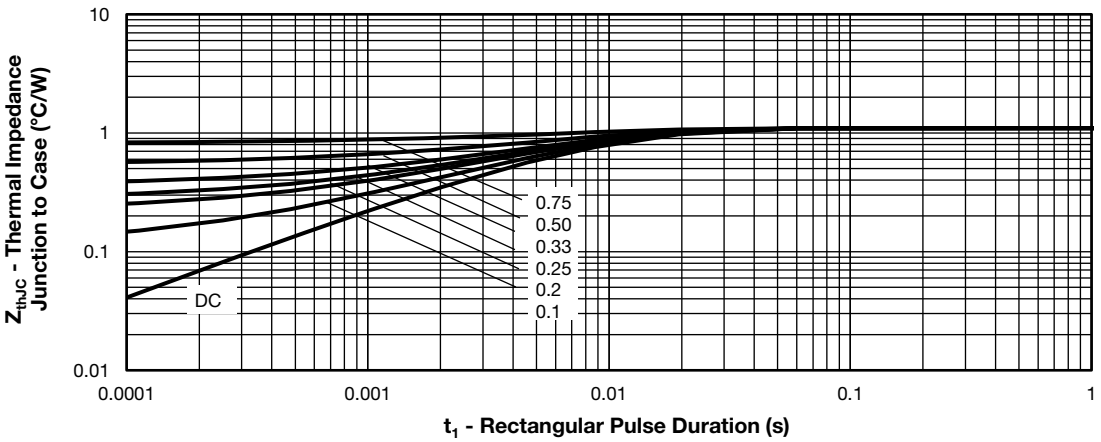



Fig. 6 - Thermal Impedance $Z_{thJC}$ Characteristics

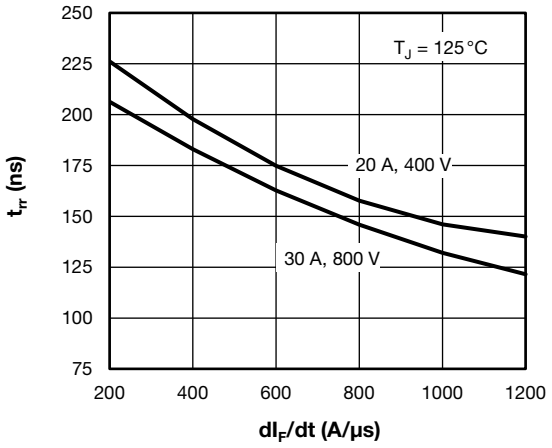



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

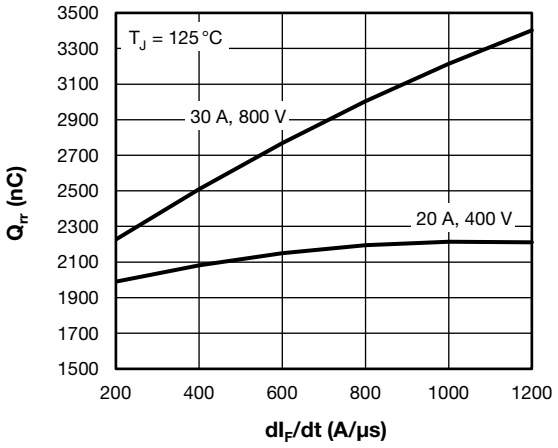



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

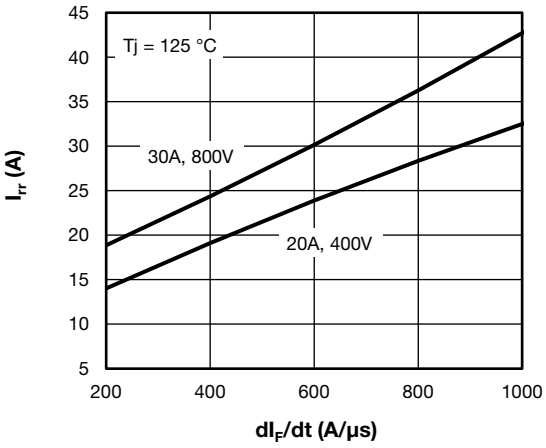



Fig. 9 - Typical Recovery Current vs. $dI_F/dt$

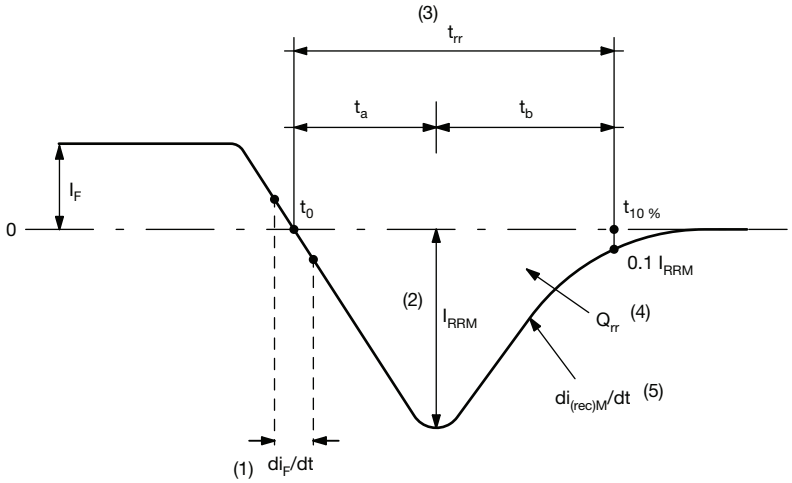



Fig. 10 - Reverse Recovery Waveform and Definitions

**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 | 30 | 12 | -M3 |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

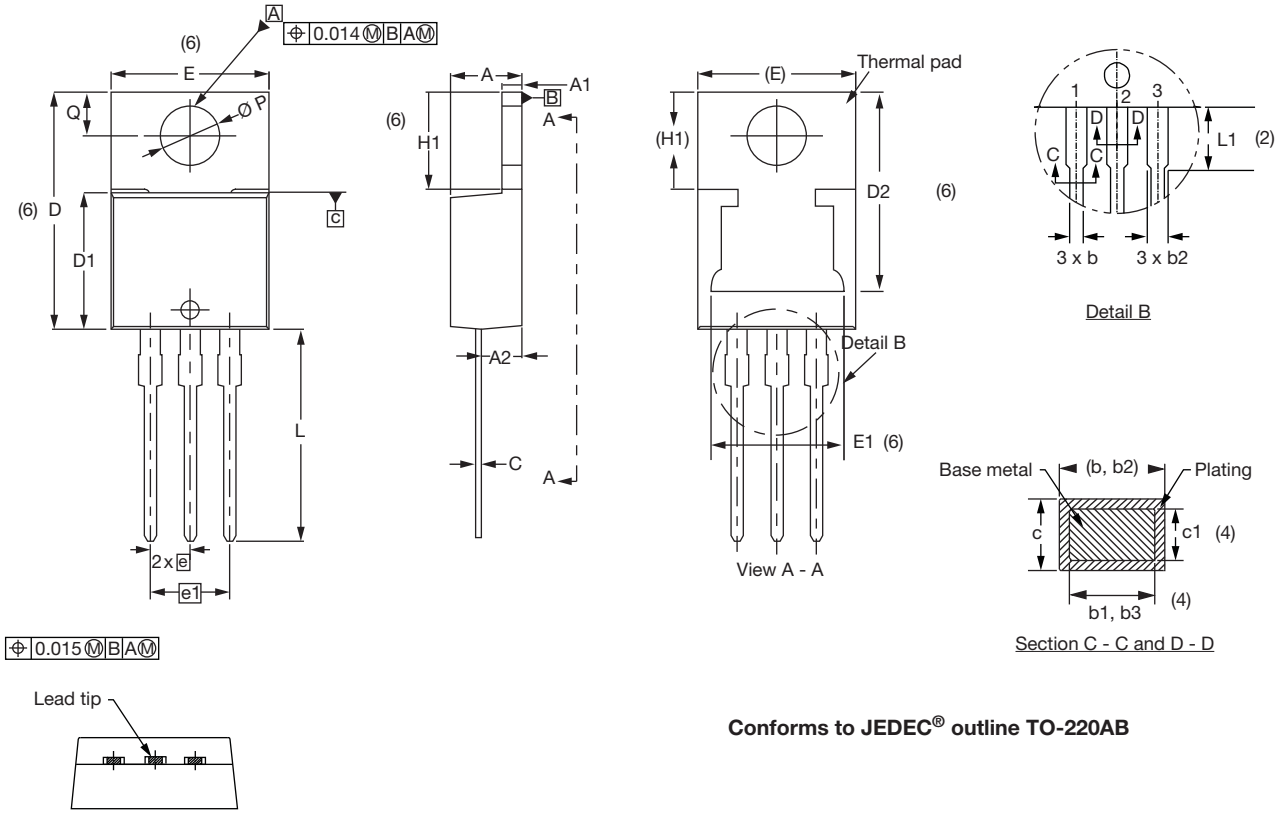
- 1 - Vishay Semiconductors product
- 2 - E = single diode
- 3 - 5 = FRED generation 5
- 4 - Package: T = 2L TO-220AC
- 5 - H = hyperfast recovery
- 6 - Current rating (30 = 30 A)
- 7 - Voltage rating (12 = 1200 V)
- 8 - Environmental digit:
  -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-E5TH3012-M3 | 50 | 1000 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96154 |
| Part marking information | www.vishay.com/doc?95391 |

## 3L TO-220AB

**DIMENSIONS** in millimeters and inches




**Conforms to JEDEC® outline TO-220AB**

| 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 | |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| 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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