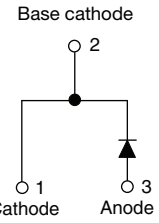
# Hyperfast Rectifier, 30 A FRED Pt®


TO-220AC 2L




## FEATURES

- Hyper fast and soft recovery
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- True 2 pin package
- Designed and qualified according to JEDEC®-JESD 47
- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE Available

## LINKS TO ADDITIONAL RESOURCES

3D Models

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 30 A |
| $V_R$ | 650 V |
| $V_F$ at $I_F$ | 1.4 V |
| $t_{rr}$ typ. | 33 ns |
| $T_J$ max. | 175 °C |
| Package | TO-220AC 2L |
| Circuit configuration | Single |

## DESCRIPTION / APPLICATIONS

Ultra low $V_F$, soft-switching hyper fast rectifiers optimized for discontinuous (critical) mode (DCM) power factor correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimized the switching losses and reduce over dissipation in the switching element and snubbers.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

## 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

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **VALUES** | **UNITS** |
| Repetitive peak reverse voltage | $V_{RRM}$ | | 650 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C$ = 120 °C | 30 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C | 210 | |
| Operating junction and storage temperatures | $T_J$, $T_{Stg}$ | | -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 | 650 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 30 A | - | 1.8 | 2.1 | |
| | | $I_F$ = 30 A, $T_J$ = 150 °C | - | 1.4 | 1.6 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.02 | 30 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 50 | 300 | |
| Junction capacitance | $C_T$ | $V_R$ = 650 V | - | 22 | - | pF |
| Series inductance | $L_S$ | Measured lead 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 | $t_{rr}$ | $T_J$ = 25 °C | $I_F$ = 1 A<br>$dI_F/dt$ = 100 A/µs<br>$V_R$ = 30 V | - | 37 | - | ns |
| | | $T_J$ = 25 °C | $I_F$ = 30 A<br>$dI_F/dt$ = 1000 A/µs<br>$V_R$ = 400 V | - | 33 | - | |
| | | $T_J$ = 125 °C | | - | 88 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 18 | - | A |
| | | $T_J$ = 125 °C | | - | 30 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 450 | - | nC |
| | | $T_J$ = 125 °C | | - | 1350 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -55 | - | 175 | °C |
| Thermal resistance, junction to case | $R_{thJC}$ | | - | 1.0 | 1.3 | °C/W |
| Thermal resistance, junction to ambient | $R_{thJA}$ | Typical socket mount | - | - | 70 | |
| Thermal resistance, case to heatsink | $R_{thCS}$ | Mounting surface, flat, smooth, and greased | - | - | 0.5 | |
| Weight | | | - | 2.0 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | Case style: 2L TO-220AC | ETH3007TH | | | |

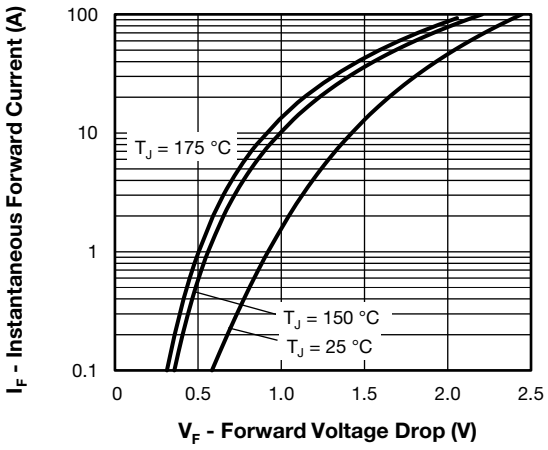



Fig. 1 - Typical Forward Voltage Drop Characteristics

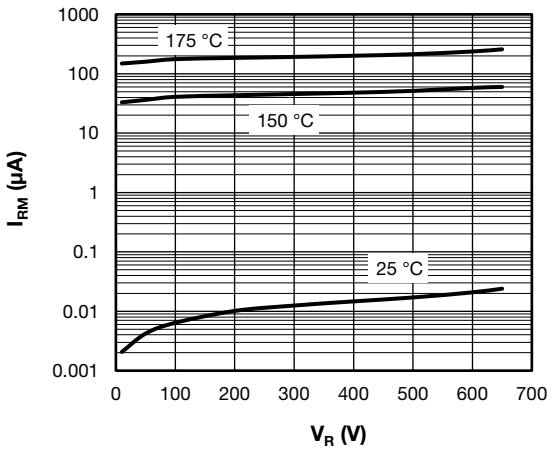



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

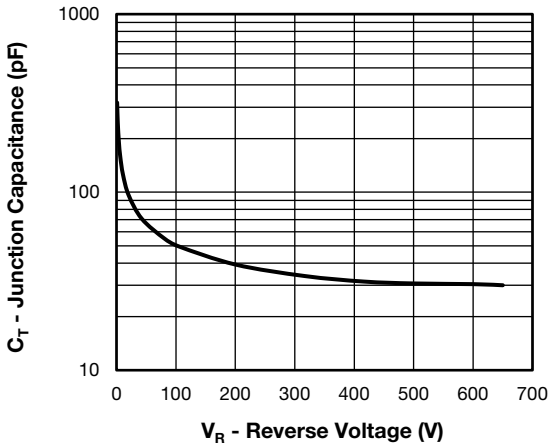



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

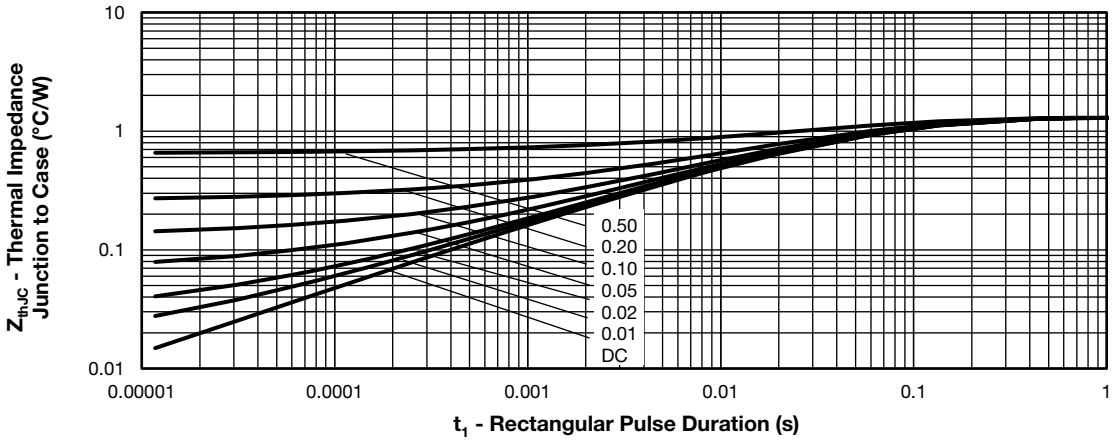



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

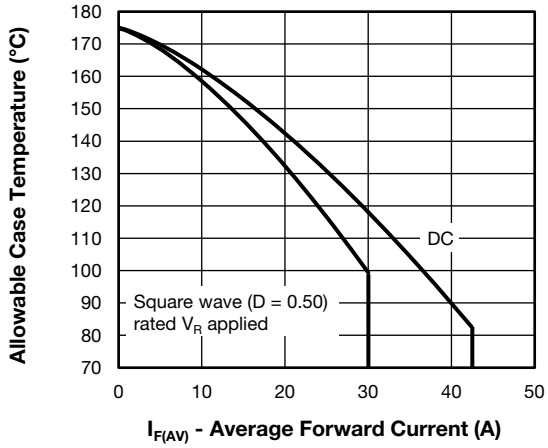



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

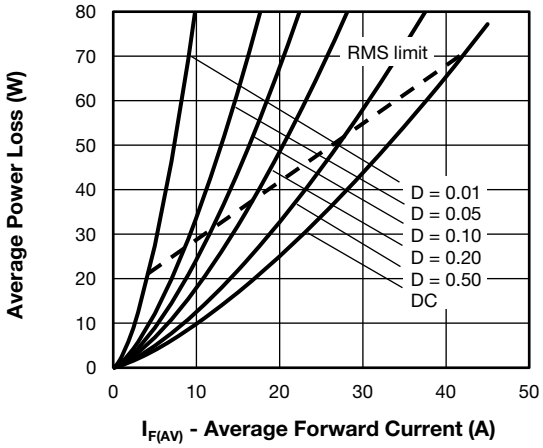



Fig. 6 - Forward Power Loss Characteristics

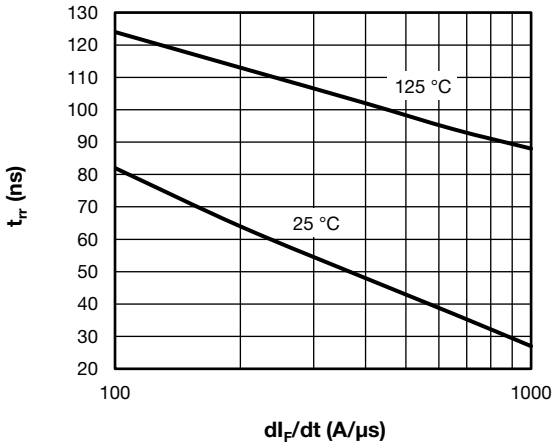



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

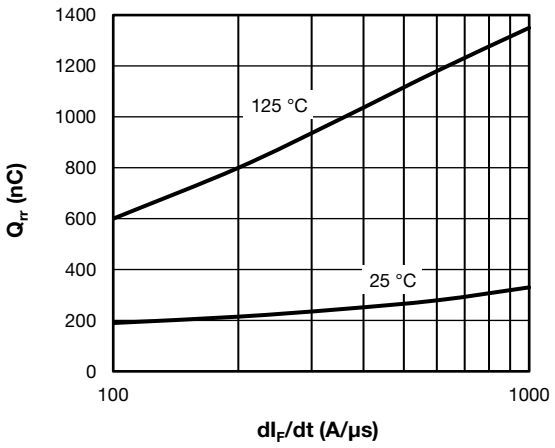
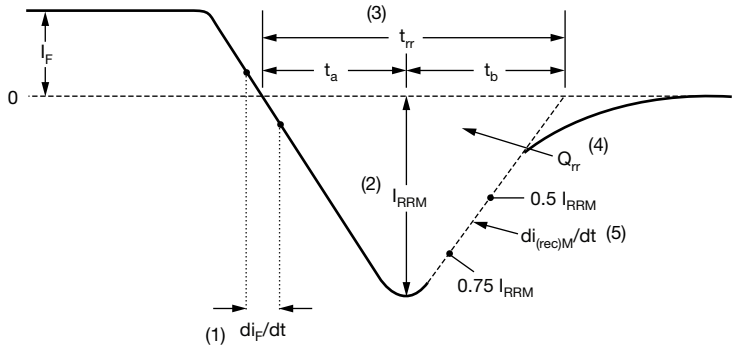



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

**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 $I_{RRM}$

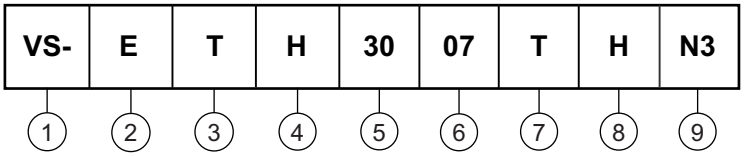
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(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



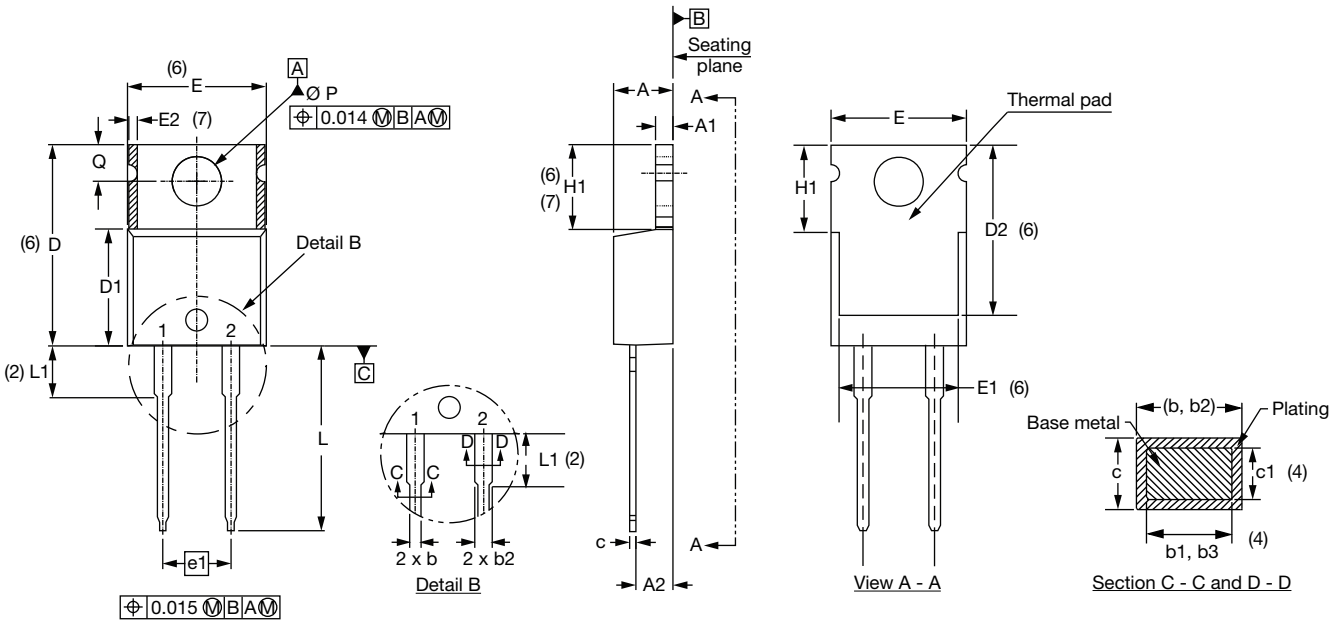

1 - Vishay Semiconductors product
2 - E = single diode
3 - Package:
T = TO-220AC
4 - H = hyper fast recovery
5 - Current rating (30 = 30 A)
6 - Voltage rating (07 = 650 V)
7 - True 2 pin TO-220
8 - H = AEC-Q101 qualified
9 - Environmental digit:
N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-ETH3007THN3 | 50 | 1000 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96069 |
| Part marking information | www.vishay.com/doc?95391 |
| SPICE model | www.vishay.com/doc?96531 |

# TO-220AC 2L

**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 | 2.56 | 2.92 | 0.101 | 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 | 15.25 | 0.585 | 0.600 | 3 |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | |
| D2 | 11.68 | 12.88 | 0.460 | 0.507 | 6 |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| E2 | - | 0.76 | - | 0.030 | 7 |
| e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| H1 | 5.84 | 6.86 | 0.230 | 0.270 | 6, 7 |
| L | 13.52 | 14.02 | 0.532 | 0.552 | |
| L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| Ø P | 3.54 | 3.73 | 0.139 | 0.147 | |
| 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 dimension: inches
(6) Thermal pad contour optional within dimensions E, H1, D2 and E1
(7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
(8) Outline conforms to JEDEC® TO-220, except D2, where JEDEC® minimum is 0.480"

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