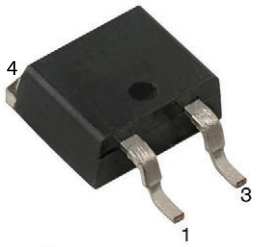
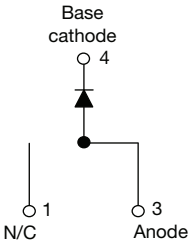
# Hyperfast Rectifier, 15 A FRED Pt® G5




D²PAK 2L (TO-263AB 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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified according to JEDEC®-JESD 47
- 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 | SPICE Models

## PRIMARY CHARACTERISTICS

| | |
|---|---|
| $I_{F(AV)}$ | 15 A |
| $V_R$ | 1200 V |
| $V_F$ at $I_F$ at 125 °C | 2.1 V |
| $t_{rr}$ | 29 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 | $I_{F(AV)}$ | $T_C$ = 98 °C, D = 0.50 | 15 | A |
| Repetitive peak forward current | $I_{FRM}$ | $T_C$ = 98 °C, D = 0.50, f = 20 kHz | 30 | |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_C$ = 45 °C, $t_p$ = 10 ms, sine wave | 110 | |
| 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 | $V_F$ | $I_F$ = 15 A | - | 2.5 | 3.3 | |
| | | $I_F$ = 15 A, $T_J$ = 125 °C | - | 2.1 | - | |
| 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 | - | 10 | - | 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 | | - | 29 | - | ns |
| | | $T_J$ = 25 °C | $I_F$ = 10 A<br>$dI_F/dt$ = 600 A/µs<br>$V_R$ = 400 V | - | 96 | - | |
| | | $T_J$ = 125 °C | | - | 137 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 11.5 | - | A |
| | | $T_J$ = 125 °C | | - | 16 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 375 | - | nC |
| | | $T_J$ = 125 °C | | - | 900 | - | |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C | $I_F$ = 15 A<br>$dI_F/dt$ = 1000 A/µs<br>$V_R$ = 800 V | - | 77.5 | - | ns |
| | | $T_J$ = 125 °C | | - | 106 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 21 | - | A |
| | | $T_J$ = 125 °C | | - | 29 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 680 | - | nC |
| | | $T_J$ = 125 °C | | - | 1600 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Thermal resistance, junction-to-case | $R_{thJC}$ | | - | - | 1.7 | °C/W |
| Weight | | | - | 2.0 | - | g |
| Mounting torque | | | 6.0<br>(5.0) | - | 12<br>(10) | kgf · cm<br>(lbf · in) |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -55 | - | 175 | °C |
| Marking device | | Case style $D^2PAK$ 2L (TO-263AB 2L) | E5TX1512S | | | |

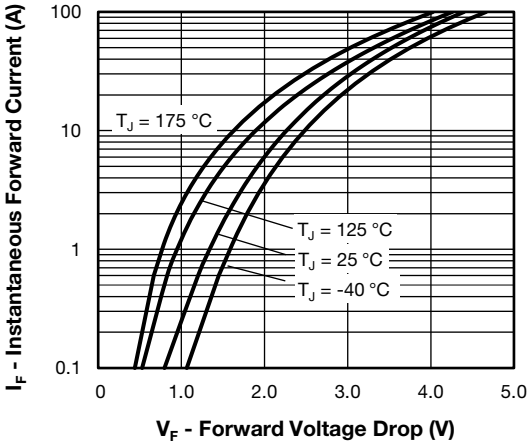



Fig. 1 - Forward Voltage Drop Characteristics

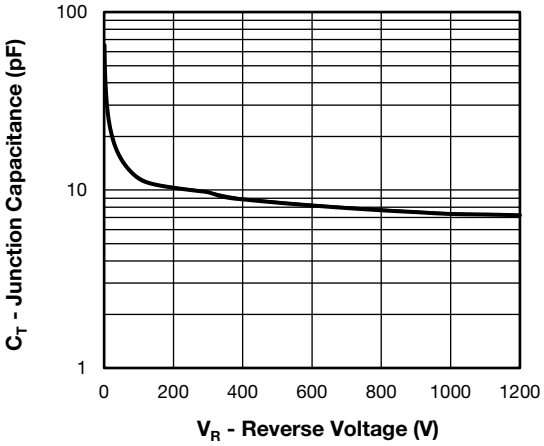



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

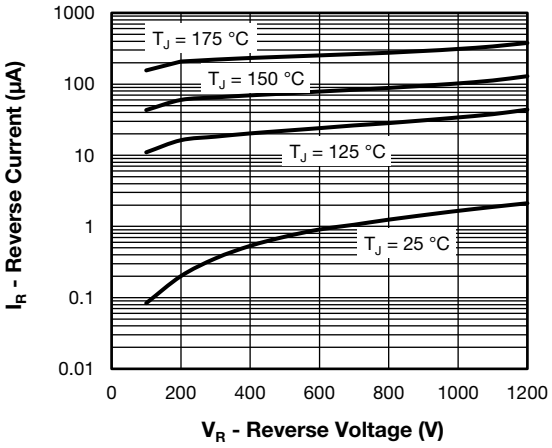



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

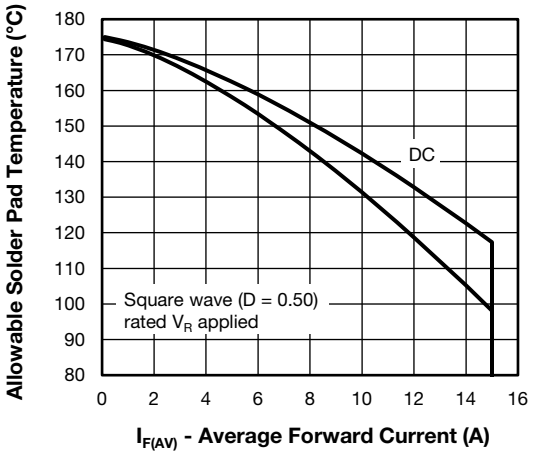



Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

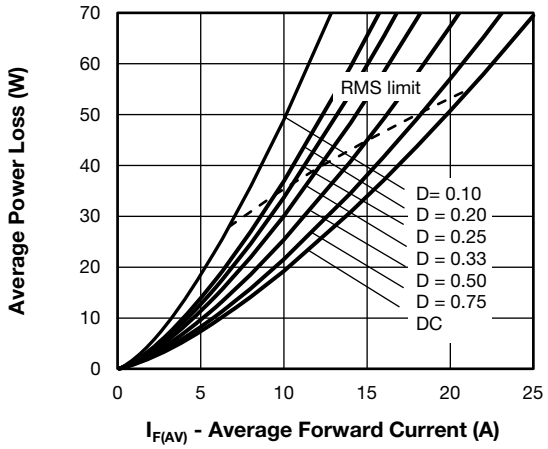



Fig. 5 - Forward Power Loss Characteristics

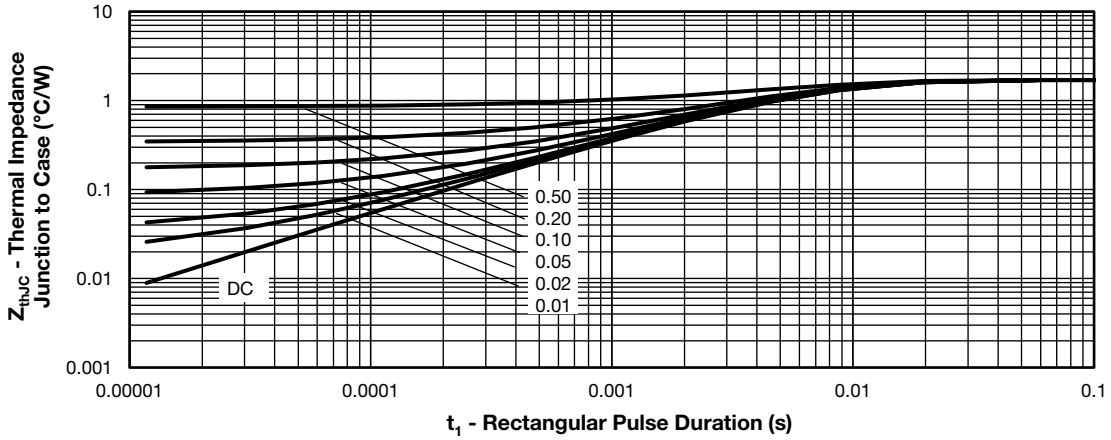



Fig. 6 - Transient Thermal Impedance, Junction to Case

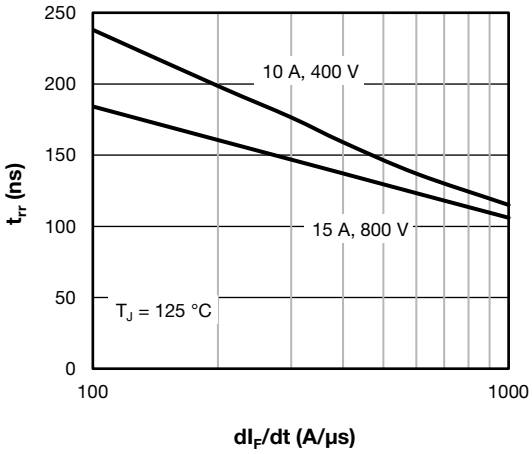



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

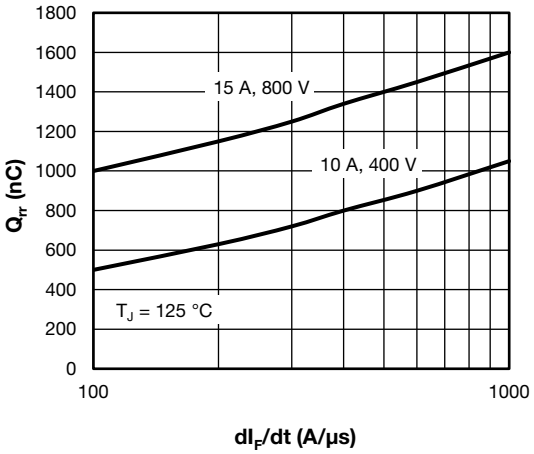



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

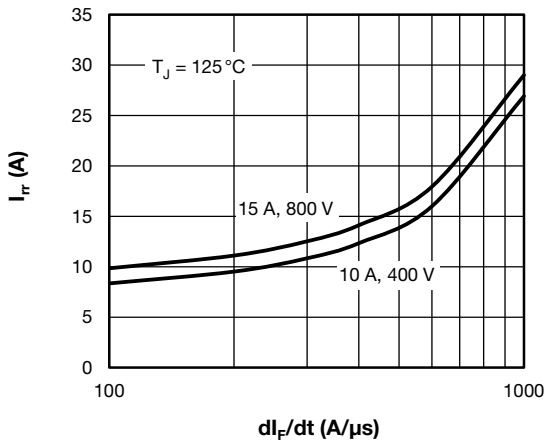



Fig. 9 - Typical Recovery Current vs. $dI_F/dt$

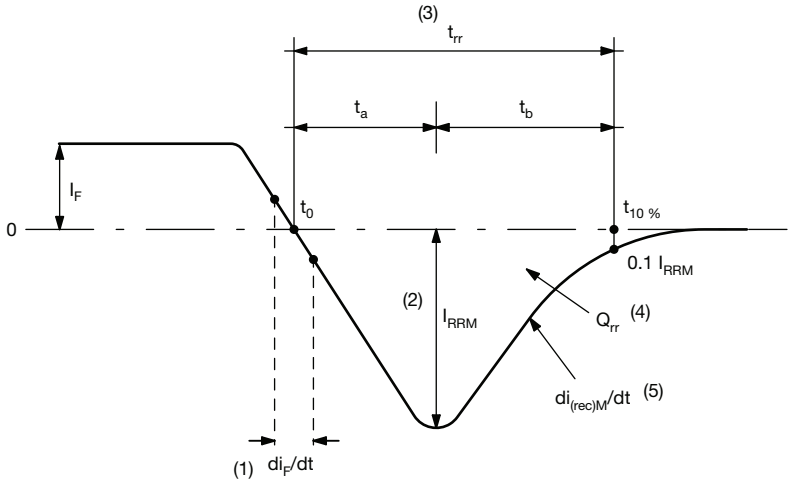



Fig. 10 - Reverse Recovery Waveform and Definitions

**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 | X | 15 | 12 | S2 | L | -M3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

1 - Vishay Semiconductors product

2 - E = single diode

3 - 5 = FRED generation 5

4 - Package:
T = $D^2PAK$ 2L (TO-263 2L) package

5 - X = hyperfast recovery

6 - Current rating (15 = 15 A)

7 - Voltage rating (12 = 1200 V)

8 - S2 = true 2 pin $D^2PAK$

9 - None = tube (50 pieces)
- L = tape and reel (left oriented, for $D^2PAK$ package)
If needed different orientation/packaging, please contact factory

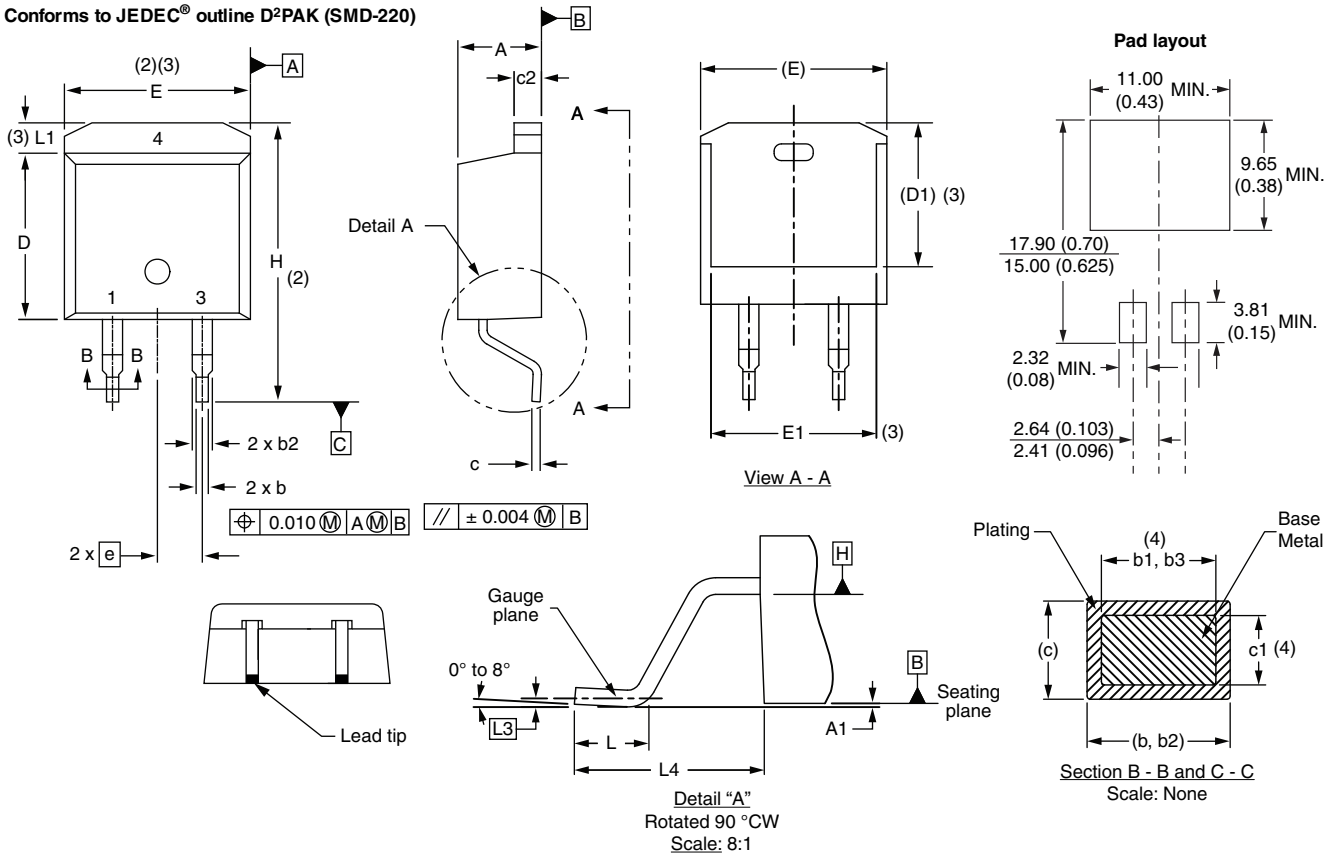
10 - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | |
|---|---|---|
| **PREFERRED P/N** | **BASE QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-E5TX1512S2L-M3 | 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 |
| SPICE Model | www.vishay.com/doc?97160 |

# D²PAK 2L (TO-263AB 2L)

**DIMENSIONS** in millimeters and inches




| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | |
| b | 0.51 | 0.99 | 0.020 | 0.039 | |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 |
| c | 0.38 | 0.74 | 0.015 | 0.029 | |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| e | 2.54 BSC | | 0.100 BSC | | |
| H | 14.61 | 15.88 | 0.575 | 0.625 | |
| L | 1.78 | 2.79 | 0.070 | 0.110 | |
| L1 | - | 1.65 | - | 0.066 | 3 |
| L3 | 0.25 BSC | | 0.010 BSC | | |
| L4 | 4.78 | 5.28 | 0.188 | 0.208 | |

**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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