# EMIPAK 1B PressFit Power Module
# 650 V HF Output Rectification, Flexible Configuration, 20 A

**EMIPAK 1B**
**(package example)**

## FEATURES

- FRED Pt® diode technology
- Exposed $Al_2O_3$ substrate with low thermal resistance
- Ultra soft reverse recovery
- Low internal inductances
- Qualified using AQG324 guideline as reference
- PressFit pins locking technology
  PATENT(S): www.vishay.com/patents
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

## DESCRIPTION

The EMIPAK 1B package is easy to use thanks to the PressFit pins. The exposed substrate provides improved thermal performance.
The optimized layout also helps to minimize stray parameters, allowing for better EMI performance.

| PRIMARY CHARACTERISTICS | |
|---|---|
| D1 - D12 | |
| $V_{RRM}$ | 650 V |
| $V_{FM}$ typical at 20 A | 1.70 V |
| $I_O$ at $T_{SINK}$ = 99 °C | 20 A |
| $t_{rr}$ typical at 20 A | 65 ns |
| Package | EMIPAK 1B |
| Circuit configuration | 6 x independent ultrafast rectifiers legs for output rectification |
| Type | Modules - diode, FRED Pt® |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
|---|---|---|---|---|
| Operating junction temperature | $T_J$ | | 175 | °C |
| Storage temperature range | $T_{Stg}$ | | -40 to +150 | |
| RMS isolation voltage | $V_{ISOL}$ | $T_J$ = 25 °C, all terminals shorted, f = 50 Hz, t = 1 s | 3500 | V |
| **D1 - D12** | | | | |
| Maximum average forward current (per diode) | $I_{F(AV)}$ | $T_{SINK}$ = 25 °C | 31 | A |
| | | $T_{SINK}$ = 80 °C | 23 | |
| Power dissipation | $P_D$ | $T_{SINK}$ = 25 °C | 68 | W |
| | | $T_{SINK}$ = 80 °C | 43 | |
| Maximum peak one cycle forward non-repetitive surge current | $I_{FSM}$ | 10 ms sine or 6 ms rectangular pulse, $T_J$ = 25 °C, no voltage reapplied | 160 | A |
| | | 8.3 ms sine, $T_J$ = 25 °C, no voltage reapplied | 167 | A |
| Maximum $I^2t$ capability for fusing | $I^2t$ | No voltage reapplied, t = 10 ms | 128 | $A^2s$ |
| | | No voltage reapplied, t = 8.3 ms | 117 | |
| Maximum $I^2\sqrt{t}$ capability for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied | 1281 | $A^2\sqrt{s}$ |
| Repetitive peak reverse voltage | $V_{RRM}$ | | 650 | V |
| Low level value of threshold voltage | $V_{F(TO)1}$ | (16.7 % x $I_{F(AV)}$ < I < x $I_{F(AV)}$), $T_J$ = $T_J$ maximum | 1.03 | V |
| High level value of threshold voltage | $V_{F(TO)2}$ | (I > x $I_{F(AV)}$), $T_J$ = $T_J$ maximum | 1.37 | |
| Low level value of forward slope resistance | $r_{f1}$ | (16.7 % x $I_{F(AV)}$ < I < x $I_{F(AV)}$), $T_J$ = $T_J$ maximum | 39.6 | mΩ |
| High level value of forward slope resistance | $r_{f2}$ | (I > x $I_{F(AV)}$), $T_J$ = $T_J$ maximum | 38.3 | |

**PATENT(S): www.vishay.com/patents**
**This Vishay product is protected by one or more United States and international patents.**

| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| **D1 - D12** | | | | | | |
| Forward voltage drop | $V_{FM}$ | $I_F$ = 20 A | - | 1.70 | 2.10 | V |
| | | $I_F$ = 20 A, $T_J$ = 175 °C | - | 1.33 | - | |
| Breakdown voltage | $V_{BR}$ | $I_R$ = 100 µA | 650 | - | - | V |
| Reverse leakage current | $I_{RM}$ | $V_R$ = 650 V | - | 0.3 | 10 | µA |
| | | $V_R$ = 650 V, $T_J$ = 175 °C | - | 90 | - | |

| SWITCHING CHARACTERISTICS ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| **D1 - D12** | | | | | | |
| Diode reverse recovery time | $t_{rr}$ | $V_R$ = 400 V, $I_F$ = 20 A, dI/dt = 500 A/µs | - | 65 | - | ns |
| Diode reverse recovery current | $I_{rr}$ | | - | 8.5 | - | A |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 275 | - | nC |
| Diode reverse recovery time | $t_{rr}$ | $V_R$ = 400 V, $I_F$ = 20 A, dI/dt = 500 A/µs, $T_J$ = 125 °C | - | 111 | - | ns |
| Diode reverse recovery current | $I_{rr}$ | | - | 14.8 | - | A |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 821 | - | nC |

| INTERNAL NTC - THERMISTOR SPECIFICATIONS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **VALUE** | **UNITS** |
| Resistance | $R_{25}$ | $T_C$ = 25 °C | 5000 | Ω |
| | $R_{100}$ | $T_C$ = 100 °C | 493 ± 5 % | |
| B-value | $B_{25/50}$ | $R_2 = R_{25}$ exp. [$B_{25/50}$(1/T2 - 1/(298.15K))] | 3375 ± 5 % | K |
| Maximum operating temperature | | | 220 | °C |
| Dissipation constant | | | 2 | mW/°C |
| Thermal time constant | | | 8 | s |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| D1 - D12 - thermal resistance junction to sink (per diode) (1) | $R_{thJS}$ | - | 1.83 | - | °C/W |
| Case to sink thermal resistance (per module) (1) | | - | 0.1 | - | |
| Mounting torque (M4) | | 2 | - | 3 | Nm |
| Weight | | - | 28 | - | g |

**Note**

(1) Mounting surface flat, smooth, and greased, $\lambda_{grease}$ = 0.67 W/mK

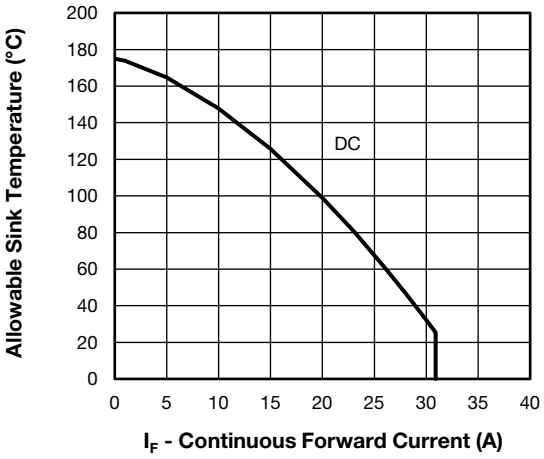



Fig. 1 - Allowable Sink Temperature vs. Continuous Forward Current
(Forward Current vs. Sink Temperature)

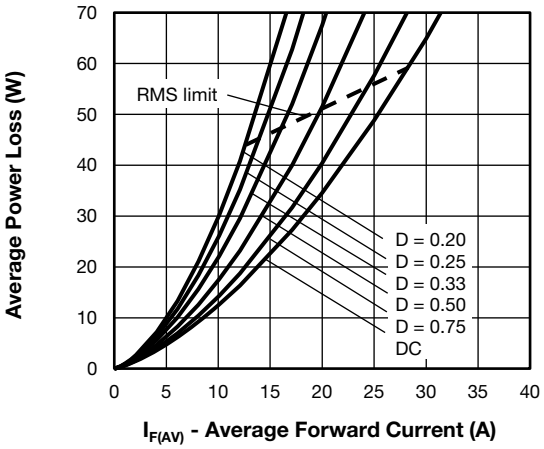



Fig. 2 - Average Power Loss vs. Average Forward Current
(Forward Power Loss Characteristics)

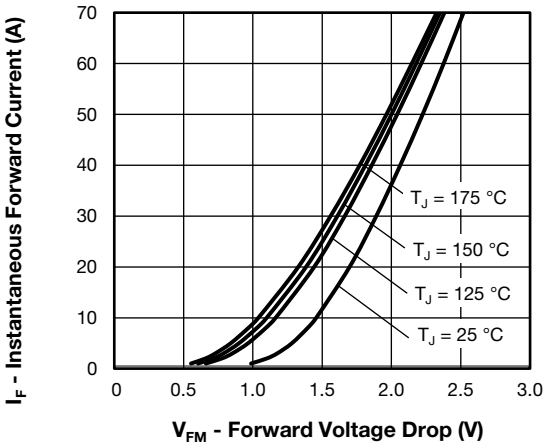



Fig. 3 - Typical Forward Voltage Drop vs. Instantaneous Forward
Current (Per Diode)

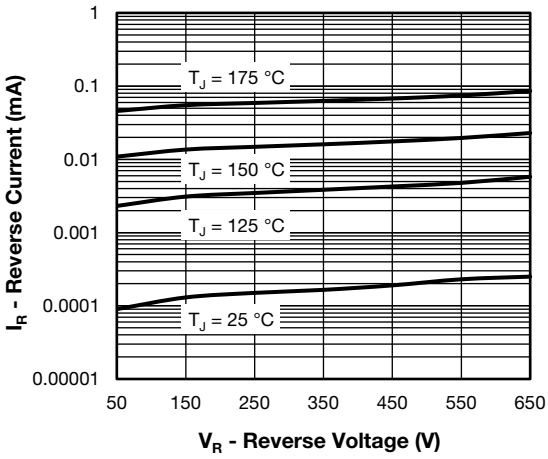



Fig. 4 - Typical Reverse Current vs. Reverse Voltage
(Per Diode)

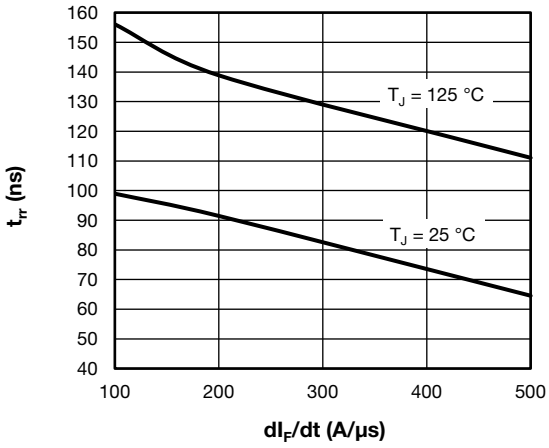



Fig. 5 - Typical Reverse Recovery Time vs. $dI_F/dt$ (Per Diode)
$V_{rr}$ = 400 V, $I_F$ = 20 A

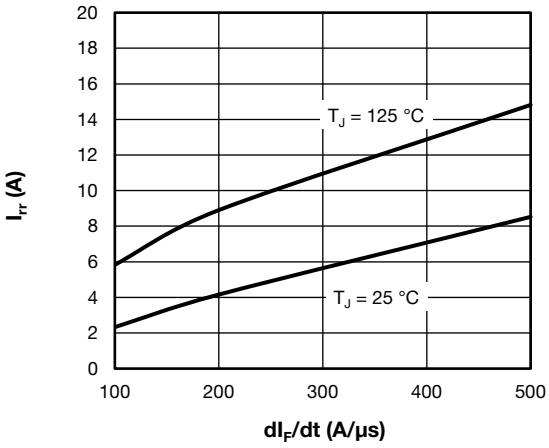



Fig. 6 - Typical Reverse Recovery Current vs. $dI_F/dt$ (Per Diode)
$V_{rr}$ = 400 V, $I_F$ = 20 A

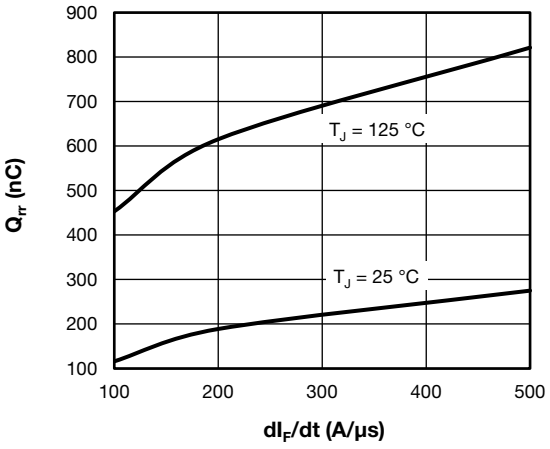



Fig. 7 - Typical Reverse Recovery Charge vs. $dI_F/dt$ (Per Diode)
$V_{rr}$ = 400 V, $I_F$ = 20 A

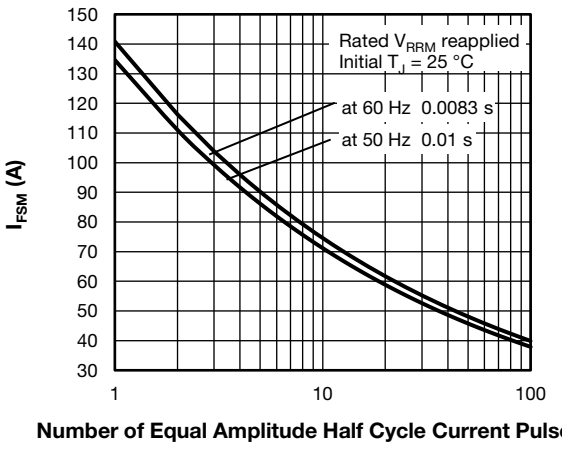



Fig. 8 - $I_{FSM}$ vs. N
(Non-Repetitive Peak Forward Surge Current vs. Number Pulses)

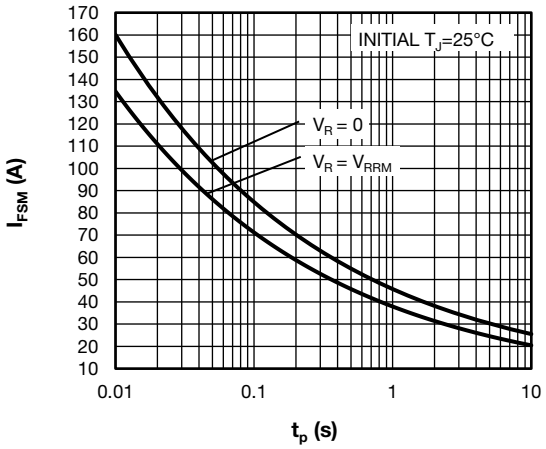



Fig. 9 - $I_{FSM}$ vs. $t_p$
(Non-Repetitive Peak Forward Surge Current vs Pulse Duration)

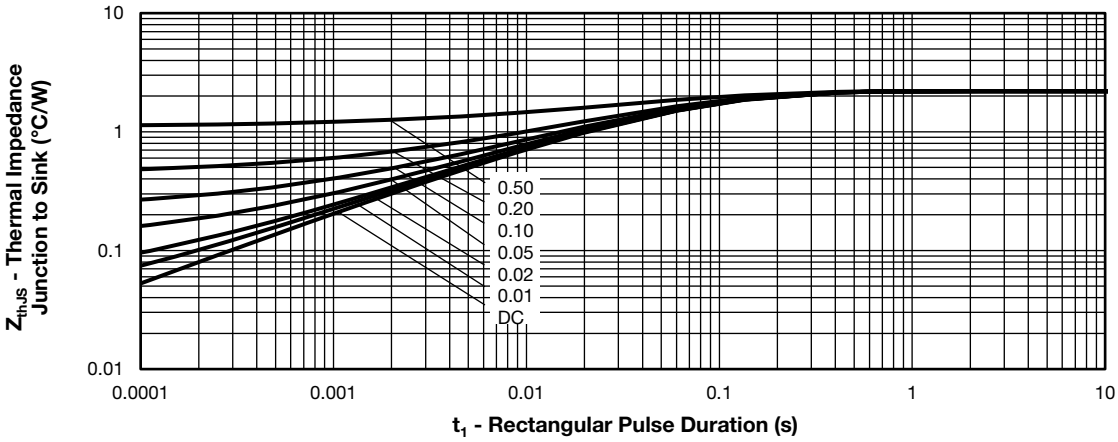
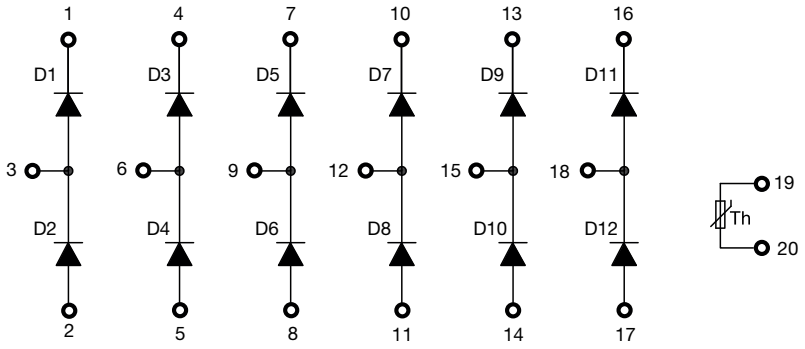
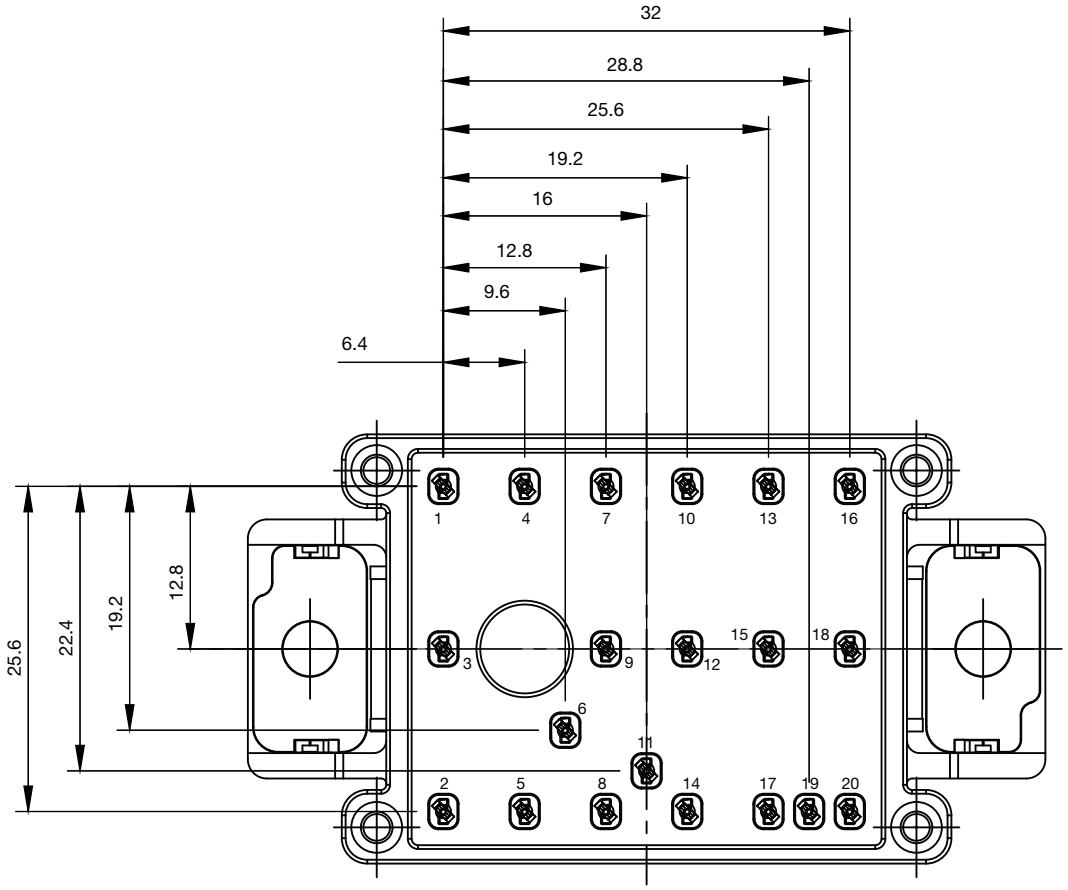



Fig. 10 - $Z_{thJS}$ Thermal Impedance Junction to Sink vs. t1 Rectangular Pulse Duration
(Maximum Thermal Impedance $Z_{thJS}$ Characteristics Per Diode)

| CIRCUIT CONFIGURATION | | |
|---|---|---|
| **CIRCUIT** | **CIRCUIT CONFIGURATION CODE** | **CIRCUIT DRAWING** |
| 6 x independent ultrafast rectifiers legs for output rectification | V |  |

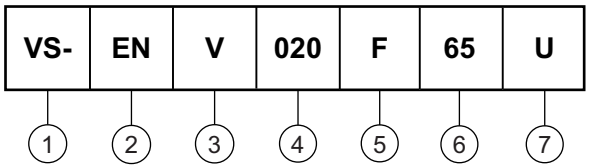


## PACKAGE



## ORDERING INFORMATION TABLE

**Device code**

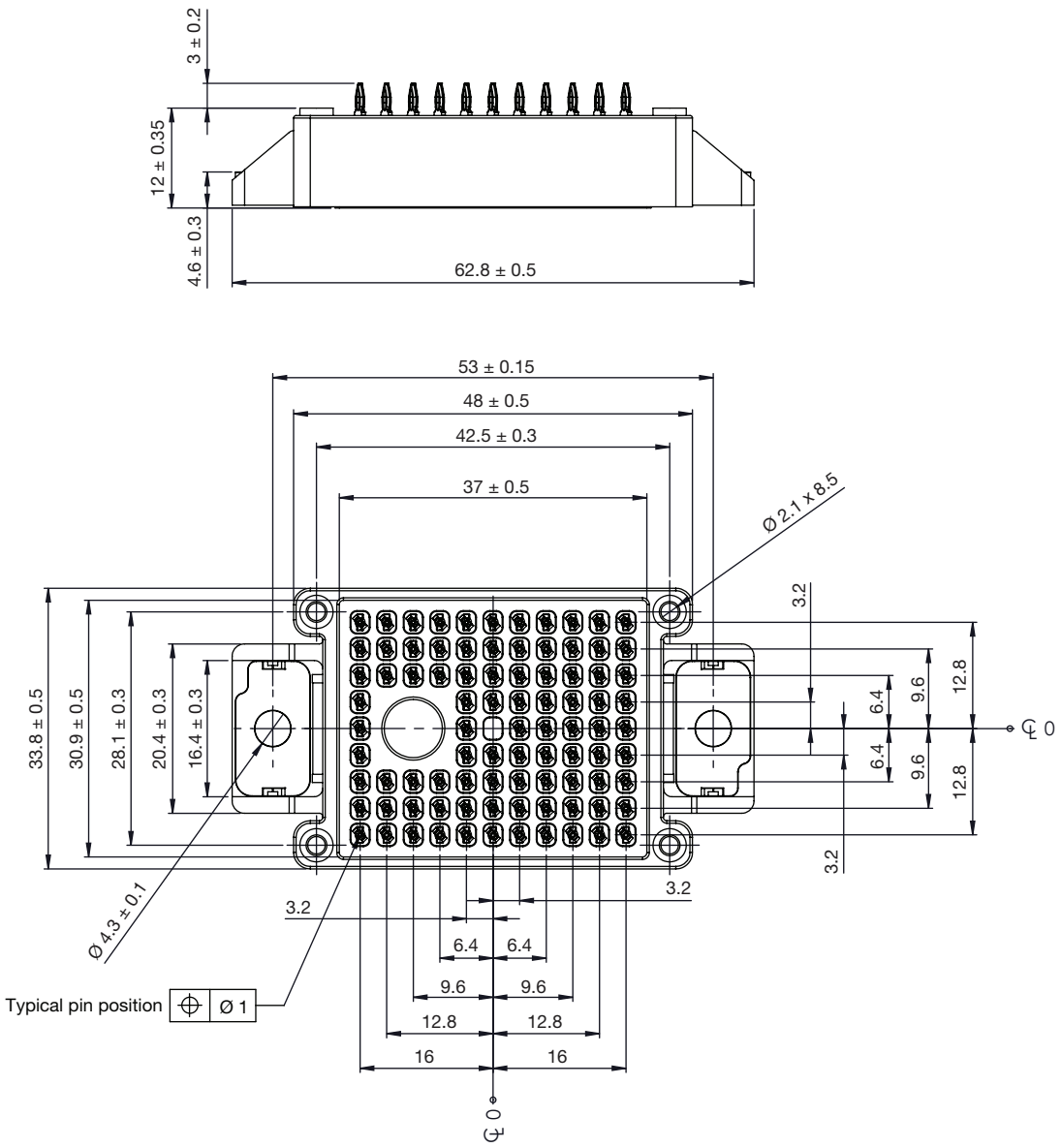



1 - Vishay Semiconductors product
2 - Package indicator (EN = EMIPAK 1B)
3 - Circuit configuration (V = 6 x independent ultrafast rectifiers legs for output rectification)
4 - Current rating (020 = 20 A)
5 - Switch die technology (F = FRED Pt® diode)
6 - Voltage rating (65 = 650 V)
7 - Diode die technology (U = FRED Pt diode with ultra soft reverse recovery)

| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95558 |
| Application Note | www.vishay.com/doc?95580 |

# EMIPAK-1B PressFit

**DIMENSIONS** in millimeters



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