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	

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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, λ_{grease} = 0.67 W/mK

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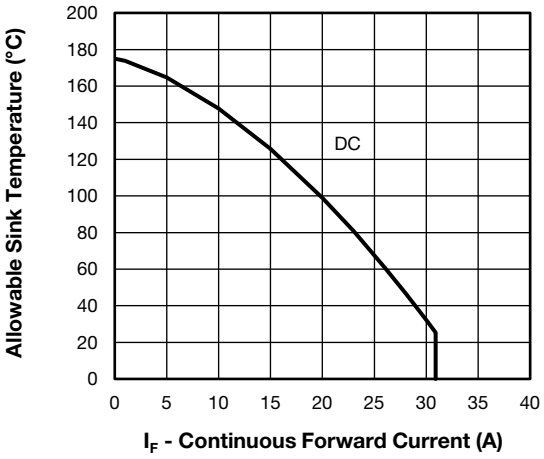


Fig. 1 - Allowable Sink Temperature vs. Continuous Forward Current
(Forward Current vs. Sink Temperature)

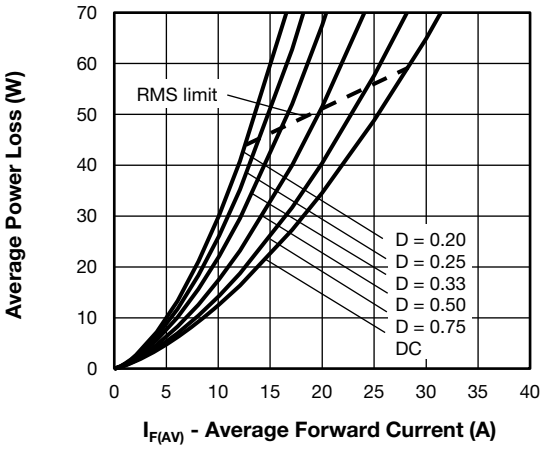


Fig. 2 - Average Power Loss vs. Average Forward Current
(Forward Power Loss Characteristics)

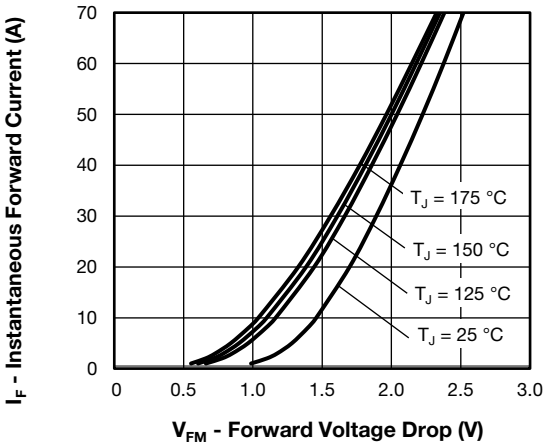


Fig. 3 - Typical Forward Voltage Drop vs. Instantaneous Forward
Current (Per Diode)

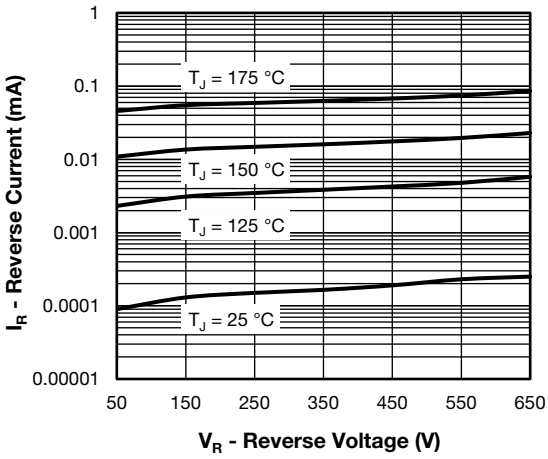


Fig. 4 - Typical Reverse Current vs. Reverse Voltage
(Per Diode)

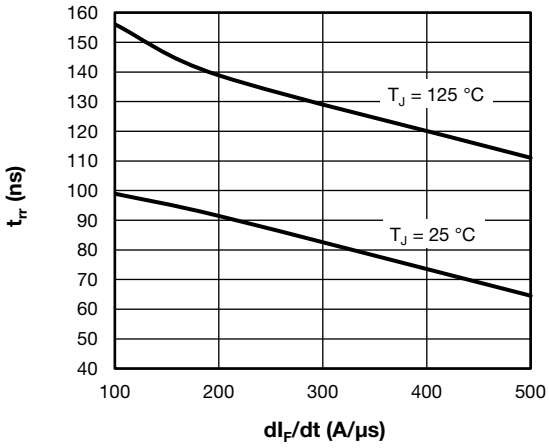


Fig. 5 - Typical Reverse Recovery Time vs. dI_F/dt (Per Diode)
V_{rr} = 400 V, I_F = 20 A

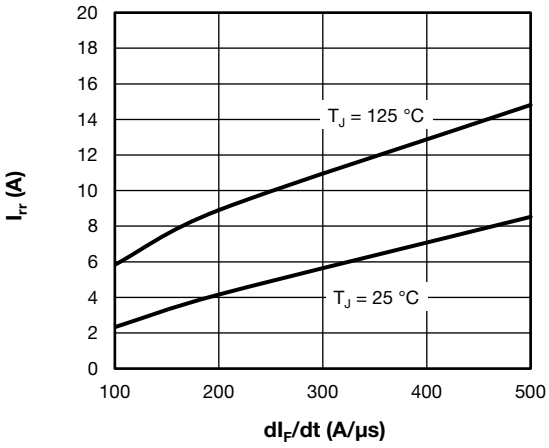


Fig. 6 - Typical Reverse Recovery Current vs. dI_F/dt (Per Diode)
V_{rr} = 400 V, I_F = 20 A

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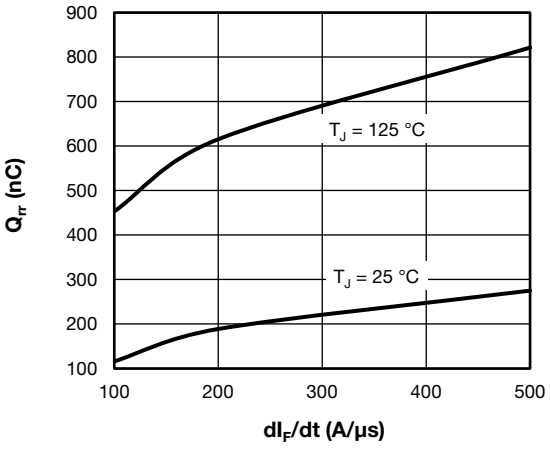


Fig. 7 - Typical Reverse Recovery Charge vs. dI_F/dt (Per Diode)
V_{rr} = 400 V, I_F = 20 A

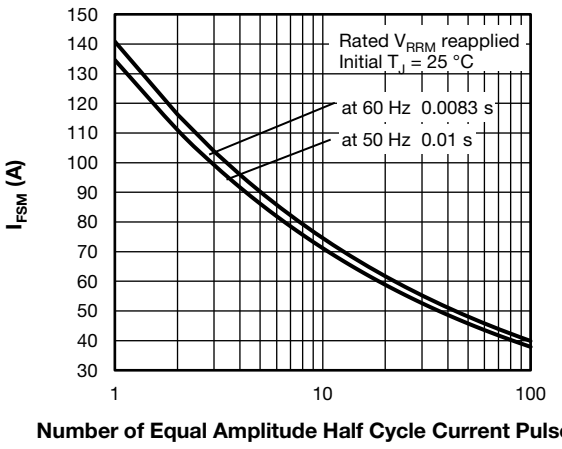


Fig. 8 - I_{FSM} vs. N
(Non-Repetitive Peak Forward Surge Current vs. Number Pulses)

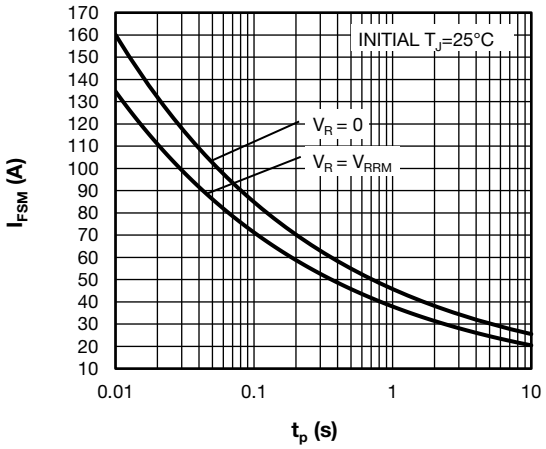


Fig. 9 - I_{FSM} vs. t_p
(Non-Repetitive Peak Forward Surge Current vs Pulse Duration)

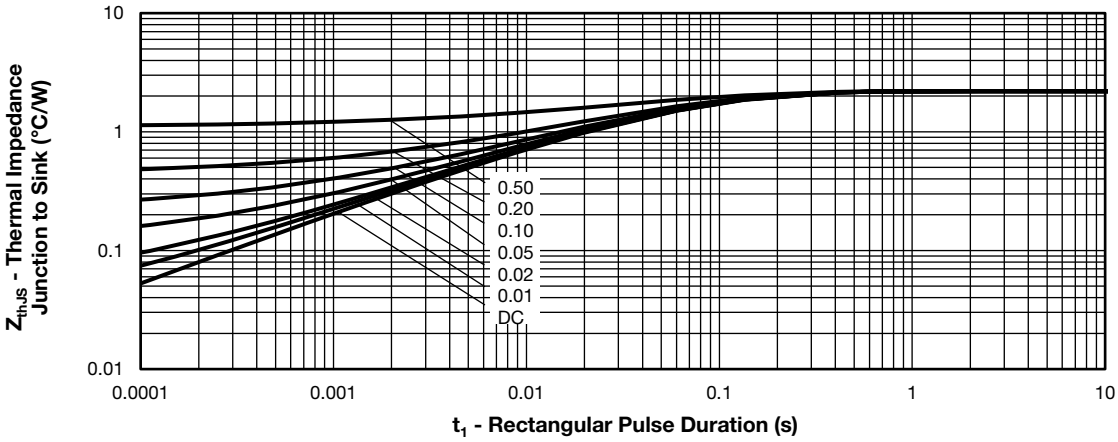
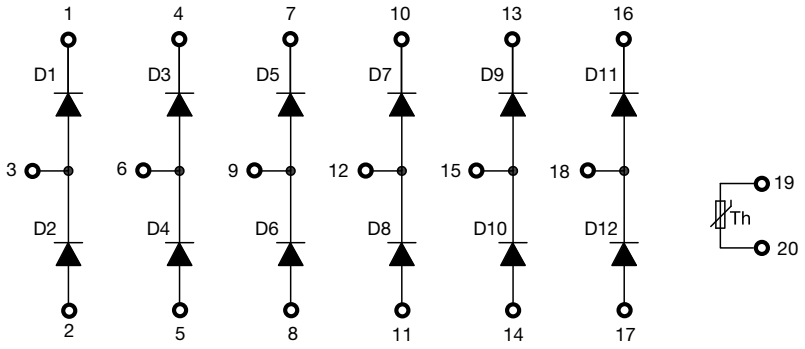
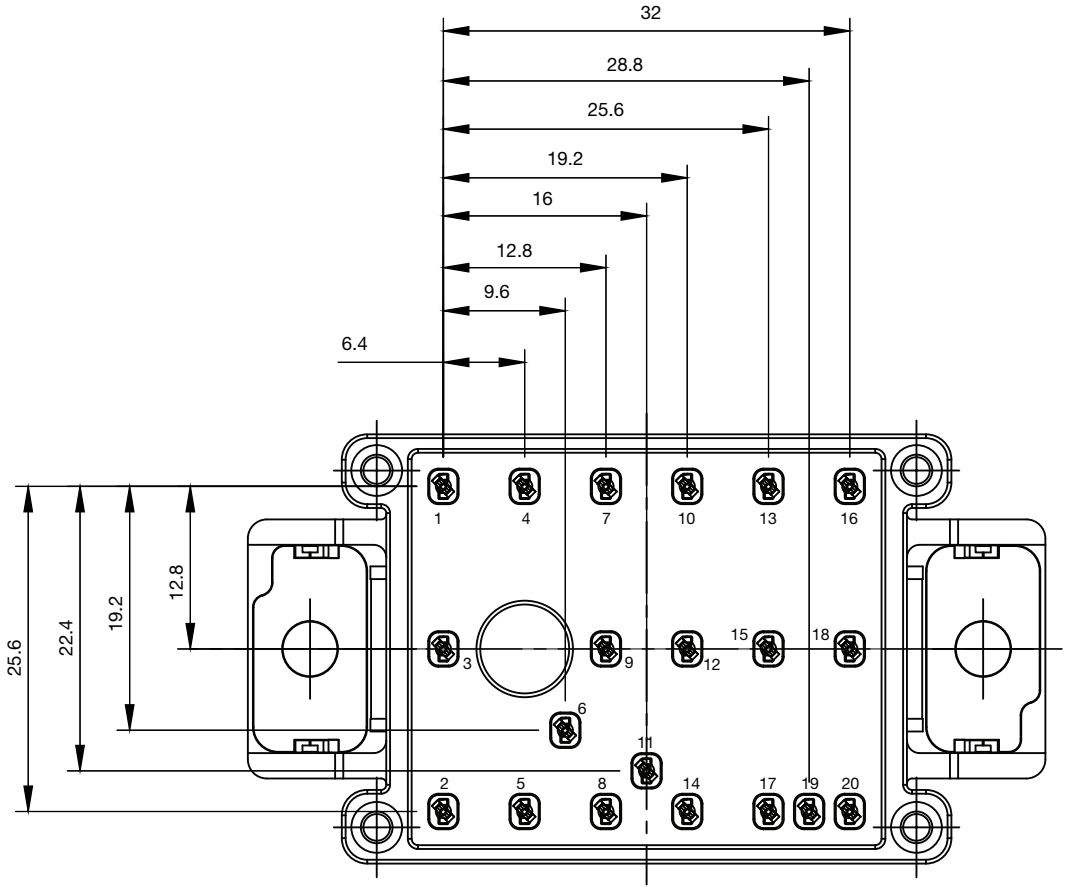


Fig. 10 - Z_{thJS} Thermal Impedance Junction to Sink vs. t1 Rectangular Pulse Duration
(Maximum Thermal Impedance Z_{thJS} Characteristics Per Diode)

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

PACKAGE

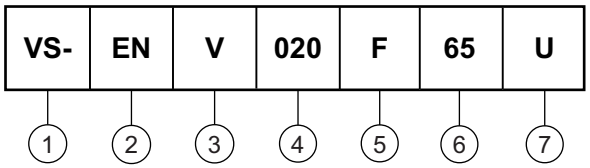


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ORDERING INFORMATION TABLE

Device code



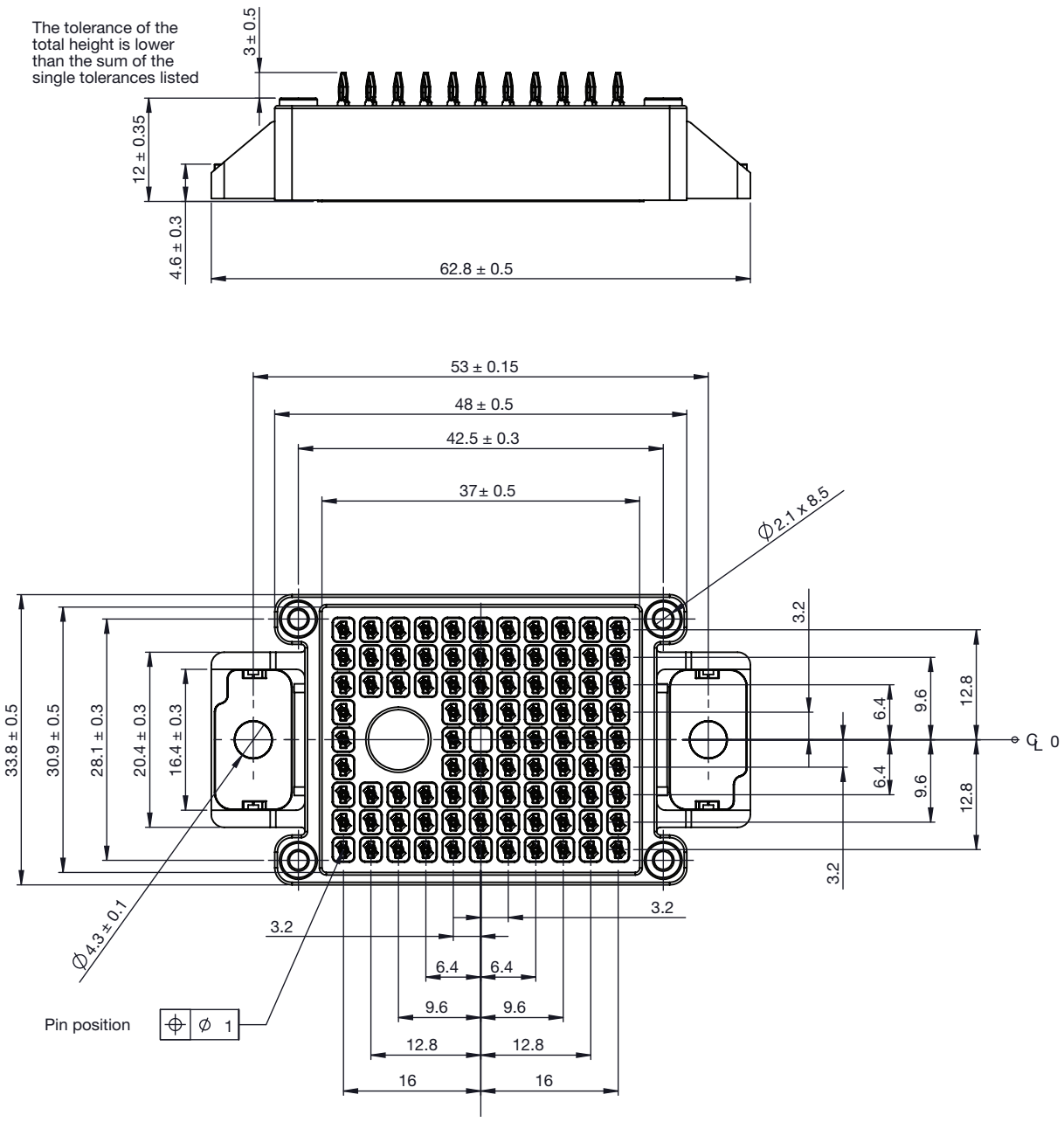
1 - Vishay Semiconductors product
2 - Package indicator (EN = EMIPAK 1B)
3 - Circuit configuration (V = 6 x independent ultrafast rectifiers legs for output rectification)
4 - Current rating (020 = 20 A)
5 - Switch die technology (F = FRED Pt® diode)
6 - Voltage rating (65 = 650 V)
7 - Diode die technology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

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EMIPAK 1B

DIMENSIONS in millimeters



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