End of Life

TPM™ in a VIA™ Package

TPM1714xE3MG5K7yzz

Three-Phase AC Input Module

Features & Benefits

- Three-phase input
- 170 – 530V_{AC} (line to line)
- 47 – 840Hz
- Chassis-Mount or PCB-Mount Form Factor
- Small robust package
- Low profile
- EMI filtering
- Meets EN61000-4-5 Class 3 surge protection at V_{IN} = 208V_{AC} when used with external surge trap and fuse, paired with Vicor BCM4414 VIA high-voltage products

Typical Applications

- 3-Phase AC-DC Power Converters
- Test and Measurement Equipment
- Industrial Power Systems

Product Ratings	
V_{IN} = 170 – 530V (L – L)	P_{OUT} = up to 1650W
V_{OUT} = Rectified AC	I_{OUT} = 2.3A

Product Description

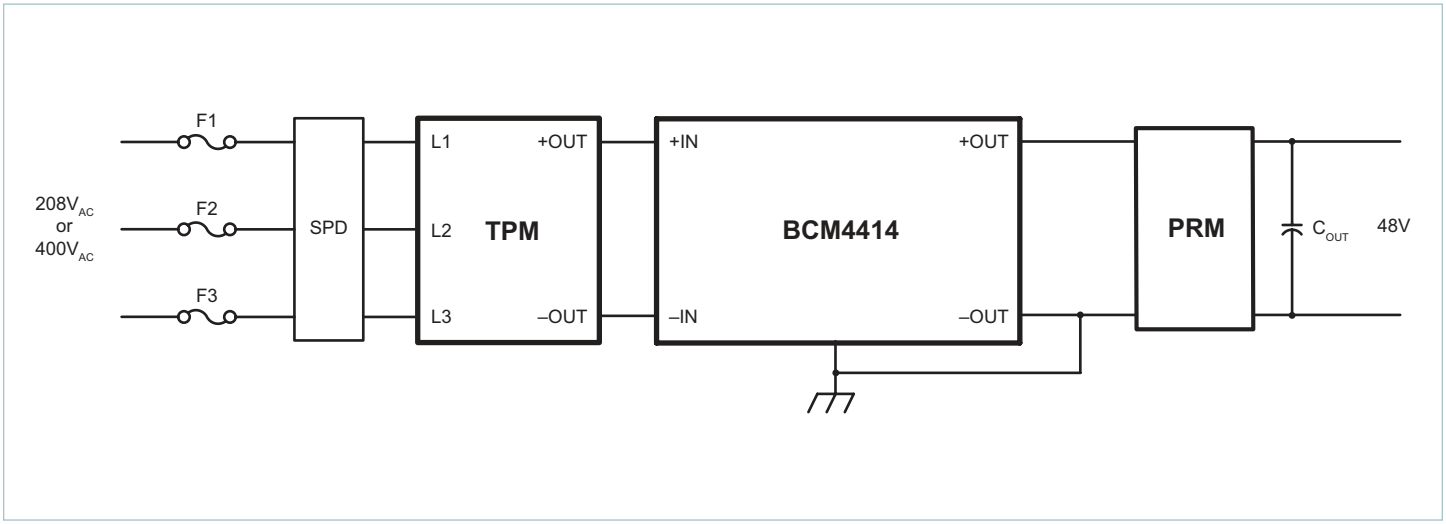
The TPM in a VIA Package (Three-Phase Module) is a front-end module designed to interface with worldwide three-phase AC mains and provide a rectified AC input to the Vicor family of BCM4414 VIA high-voltage and ultra-high-voltage products. The TPM combines a full-wave bridge rectifier, EMI filter and surge-protection circuitry in an easy-to-use VIA plastic housing. The TPM can be used with other power components (such as the ultra-high-voltage BCM® to create a low-profile, efficient, simple and cost-effective AC-DC solution for a broad range of end applications.

Size:
1.76 x 1.40 x 0.37in
[44.6 x 35.5 x 9.3mm]

Part Ordering Information

Part Number	Package Type	Product Grade	Option Field
TPM1714**B**E3MG5K7**C04**	**B** = Board VIA	**C** = –20 to 100°C	**04** = Short Pin/Always On
TPM1714**B**E3MG5K7**C08**			**08** = Long Pin/Always On
TPM1714**B**E3MG5K7**T04**		**T** = –40 to 100°C	**04** = Short Pin/Always On
TPM1714**B**E3MG5K7**T08**			**08** = Long Pin/Always On
TPM1714**B**E3MG5K7**M04**		**M** = –55 to 100°C	**04** = Short Pin/Always On
TPM1714**B**E3MG5K7**M08**			**08** = Long Pin/Always On
TPM1714**V**E3MG5K7**C00**	**V** = Chassis VIA	**C** = –20 to 100°C	**00** = Chassis/Always On
TPM1714**V**E3MG5K7**T00**		**T** = –40 to 100°C	
TPM1714**V**E3MG5K7**M00**		**M** = –55 to 100°C	

Typical Application

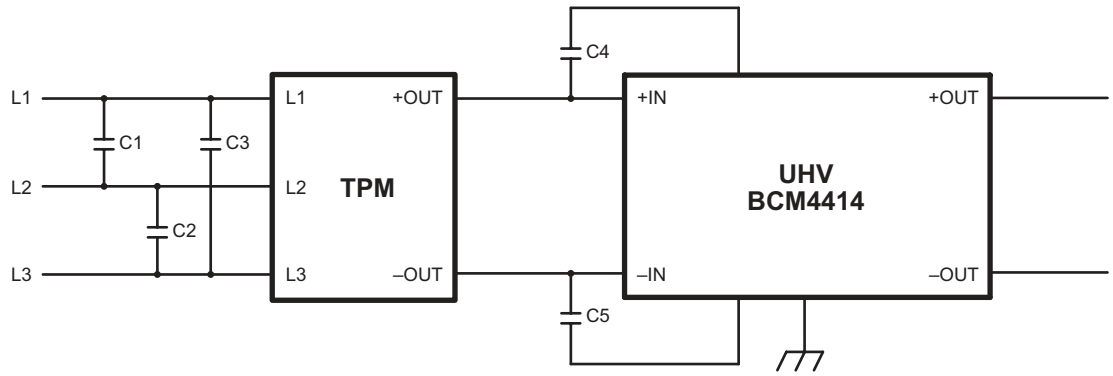


Typical Application: The PCB terminal option allows mounting on an industry standard printed circuit board, with two different pin lengths.

Parts List for Typical PCB-Mount Applications	
F1, F2, F3	**Eaton/Bussman** 5A/600V$_{AC}$, Class CC, KTK-R-5
SPD	**Mersen** Surge-Trap Model ST2083PYG rated 120/208V$_{AC}$ or ST4803PYG rated 277/480V$_{AC}$
TPM	**Vicor TPM** TPM1714xE3MG5K7yzz
BCM	**Vicor BCM®** BCM4414xD1E5135yzz, or BCM4414xD1E13A3yzz, BCM4414xD1E2663yzz or BCM4414xG0F4440yzz [a]
PRM	Downstream PRM™ regulator (optional)
C$_{OUT}$	Output hold-up capacitor (optional): must be located after regulator to avoid harmonics degradation

[a] Surge testing with BCM4414xG0F4440yzz has not been verified.

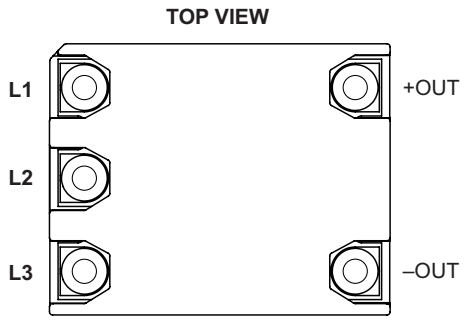
Typical Applications (Cont.)



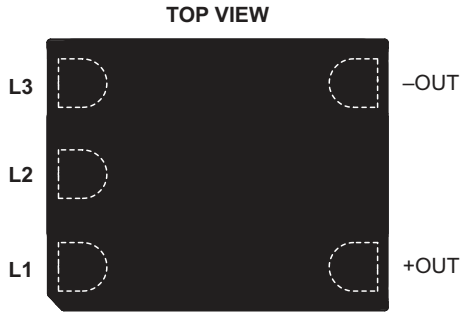
Typical Application: TPM configuration and external components used for conducted-emission scan shown in Figure 2

Parts List for Conducted-Emissions Scan	
C1, C2, C3	X1 capacitors, 0.1µF, Kemet PHE844, rated 440V~ (ENEC) / 480V~ (UL/CSA)
C4, C5	Y1 capacitors, Vishay VY1472M61Y5UC63V0, rated 4.7nF/Y5U/500V_{AC}
TPM	TPM1714xE3MG5K7yzz
BCM	Ultra-High-Voltage BCM® BCM4414xG0F4440yzz

Pin Configuration



TPM1714 VIA – Chassis Mount – Terminals Up



TPM1714 VIA – PCB Mount – Pins Down

Please note that these pin drawings are not to scale.

Pin Descriptions

Signal Name	Type	Function
L1	INPUT POWER	AC Line 1 input
L2	INPUT POWER	AC Line 2 input
L3	INPUT POWER	AC Line 3 input
–OUT	OUTPUT POWER RETURN	Negative output power terminal
+OUT	OUTPUT POWER	Positive output power terminal

Absolute Maximum Ratings

The absolute maximum ratings below are stress ratings only. Operation at or beyond these maximum ratings can cause permanent damage to the device.

Parameter	Comments	Min	Max	Unit
Peak Voltage at Input Terminals, 1ms Max	Limits refer to TPM only. System limits (TPM + BCM4414) will vary based on absolute maximum ratings of BCM model selected	0	800	V_{PK}
Input Voltage (AC RMS) Continuous		0	530	V_{RMS}
Output Current (Continuous)		0	2.3	A_{RMS}
Operating Internal Temperature	C-Grade	–20	125	°C
	T-Grade	–40	125	
	M-Grade	–55	125	
Storage Temperature		–65	125	°C
Input / Output Pin Torque and Mounting Torque			4 [0.45]	in·lbs [N·m]

Electrical Specifications

Specifications apply over all line and load conditions, 50Hz and 60Hz line frequencies, T_{CASE} = 25°C, unless otherwise noted.
Boldface specifications apply over the temperature range of the specified product grade.

Attribute	Symbol	Conditions / Notes	Min	Typ	Max	Unit
Input Specifications						
Input Voltage Range, Continuous Operation	V_{IN}	Line-to-line voltage	**170**		**530**	V_{RMS}
Input Voltage Range, Transient, Non-Operational (Peak), 30s Minimum Interval	V_{IN}				800	V_{PK}
Source Line Frequency Range	f_{LINE}		**47**		**840**	Hz
Power Factor	PF	Full load, no external capacitance		0.95		-
Output Specifications						
Output Power	P_{OUT}				**1650**	W
Output Current (Continuous)	I_{OUT}				**2.3**	A
Full-Load Efficiency	η	V_{IN} = 400V_{AC}		99.4		%
		Over line and temperature		**98.7**		
Full-Load Efficiency, 800Hz	η_{800}	V_{IN} = 400V_{AC}		97.3		%
		Over line and temperature		**97.0**		

Application Characteristics

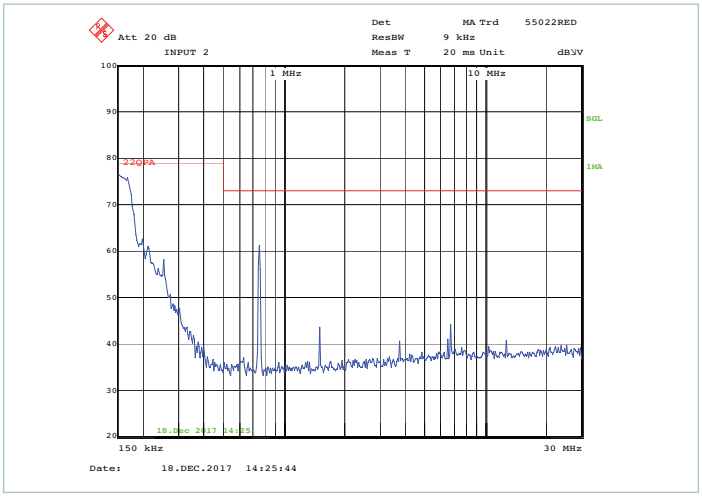


Figure 1 — *Typical conducted emissions, peak scan, with BCM4414VG0F4440T02 VIA, 400V_{AC}, 90% load, no external components*

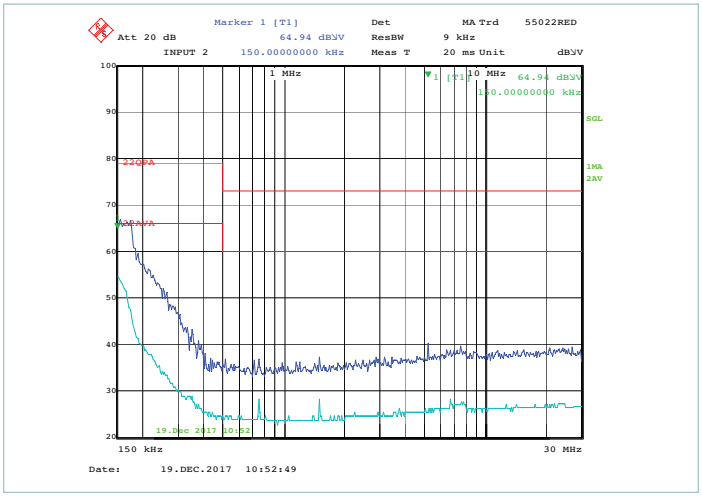


Figure 2 — *Typical conducted emissions, peak and average scan, with BCM4414VG0F4440T02 VIA, 400V_{AC}, 90% load, with external components as shown in typical application on page 3*

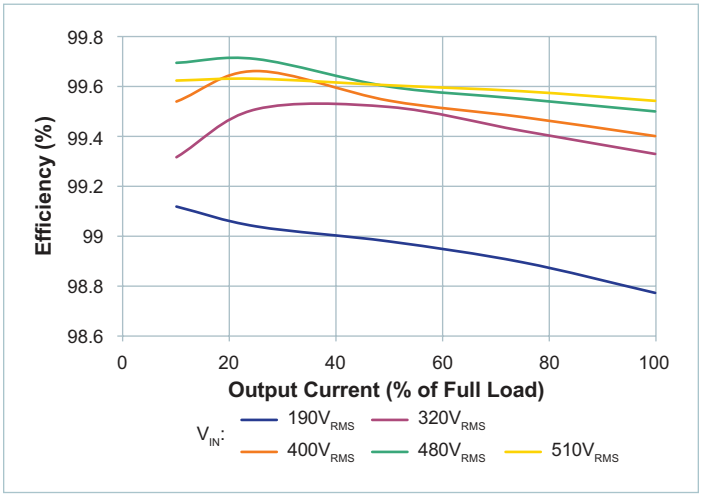


Figure 3 — *V_{IN} to V_{OUT} efficiency vs. V_{IN} (line to line) and I_{OUT}, T_{CASE} = 25°C*

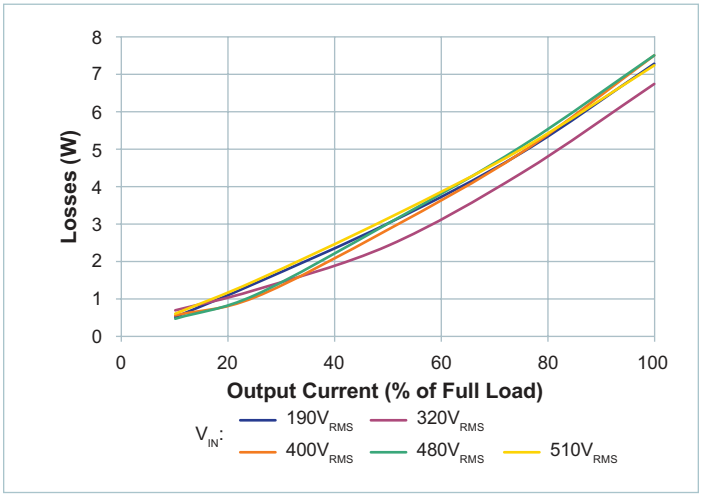


Figure 4 — *V_{IN} to V_{OUT} power dissipation vs. V_{IN} (line to line) and I_{OUT}, T_{CASE} = 25°C*

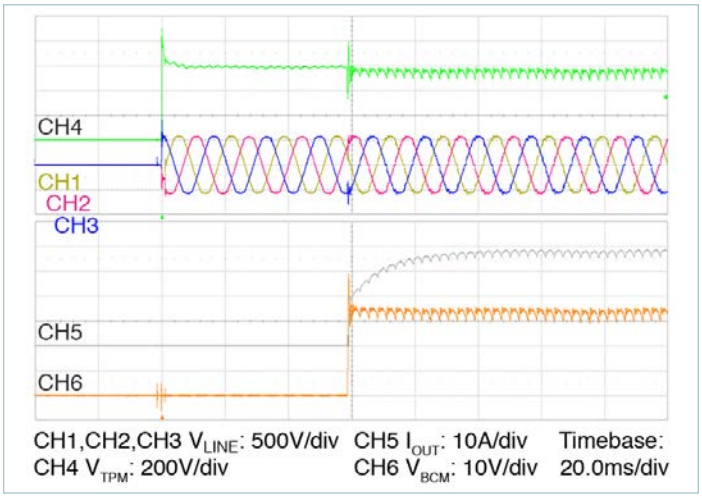


Figure 5 — *Start up from V_{IN}*

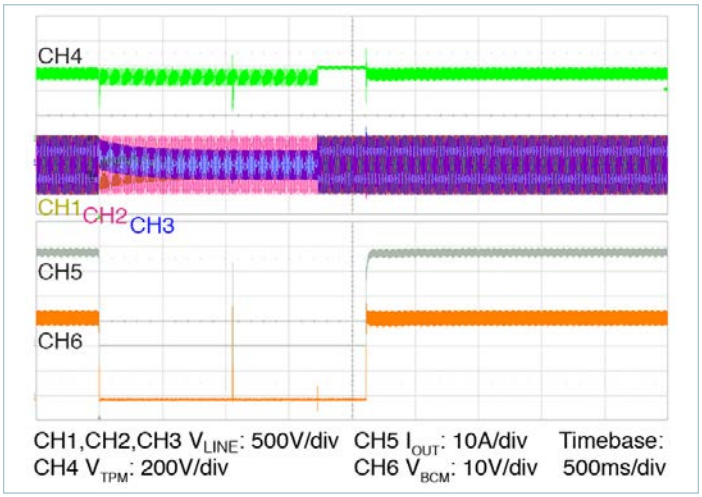


Figure 6 — *Input line drop and recovery*

General Characteristics

Specifications apply over all line and load conditions, 50Hz and 60Hz line frequencies, T_{CASE} = 25°C, unless otherwise noted.
Boldface specifications apply over the temperature range of the specified Product Grade.

Attribute	Symbol	Conditions / Notes	Min	Typ	Max	Unit
Mechanical						
Length	L			44.6 [1.76]		mm [in]
Width	W			35.5 [1.40]		mm [in]
Height	H			9.3 [0.37]		mm [in]
Volume	Vol	Without heat sink		14.5 [0.88]		cm^3 [in^3]
Mass (Weight)	M			35 [1.2]		g [oz]
Pin Material		C145 copper, half hard				
Underplate		Low-stress, ductile nickel	50		100	µin
Pin Finish		Palladium	0.8		6	µin
		Soft Gold	0.12		2	µin
Thermal						
Operating Case Temperature	T_{CASE}	C-Grade	–20		100	°C
		T-Grade	–40		100	°C
		M-Grade	–55		100	
Thermal Resistance, Internal to Case Non-Pin Side	$\theta_{INT\_NON\_PIN\_SIDE}$			2.2		°C/W
Thermal Design		See Thermal Considerations on Page 9				
Soldering						
Temperature		See: AN:401 PCB Mount VIA Soldering Guidelines				
Reliability						
MTBF		MIL-HDBK-217FN2 Parts Count - 25°C Ground Benign, Stationary, Indoors Computer		8.2		MHrs
		Telcordia Issue 2 - Method I Case III; 25°C		28.6		
		MIL-HDBK-217FN2 - 25°C Ground Benign, Stationary, Indoors Computer		7.4		
Safety						
Agency Approvals Standards		EN60950-1; CE marked for low voltage directive and RoHS recast directive, as applicable				
Dielectric Withstand (Hipot)		IN / OUT to Case	2200			V_{AC}
Leakage Current Touch Current		No Y capacitor connection of GND connection within package		Negligible		
EMI/EMC Compliance						
FCC Part 15, EN55032 : 2015, Conducted Emissions		Class A Limits				
EN61000-4-5: 2015, Level 3 Surge Immunity		Performance Criteria B 208V, V_{IN} = 208V_{AC} when used with external surge trap and fuse, paired with Vicor BCM4414 VIA high-voltage products (260 – 410V input); surge testing with higher voltage BCM4414 400 – 700V and (500 – 800V input) has not been verified				

Environmental Qualification

Testing Activity	Reference Standard	Test Details
High Temperature Operating Bias/Life (HTOB/HTOL)	JESD22-A108D	1000hrs, nominal full load at max operating temperature
Temperature Cycling Test (TCT)	IPC-9592B	125 to –40˚C, 700 cycles
Temperature Humidity Bias (THB)	JESD22-A101C	1000hrs, Nominal input voltage, minimal load 85˚C, 85% RH
High Temperature Storage (HTS)	JESD22-A103D	1000hrs, 125˚C
Low Temperature Storage (LTS)	JESD22–A119	1000hrs, –65˚C
Random Vibration	MIL-STD-810G	Method 514.6, Procedure I, Category 24, 20 – 2000Hz, @7.7g_{RMS}, 1hour /axis for 3 axis. Product mounted on an evaluation board, nominal line 50% load.
Mechanical Shock	MIL-STD-810G	Method 516.5, Procedure I, Functional shock 40G, total of 18 shocks. Product mounted on an evaluation board, nominal line 50% load.
Highly Accelerated Life Test (HALT)	Internal Vicor Procedure - DP-0265	Low and high temperature tests, rapid thermal cycling, random vibration testing, combined stress testing and destruct testing.
Res. Solvents	MIL-STD-202G	Method 215K, 3 minutes exposure
ESD Human Body Model	JEDEC JS-001-2012	Class 1C (HBM) minimum
ESD Charged Device Model	JESD22-C101E	Class II (CDM) minimum

Thermal Considerations

The TPM in a VIA package can be cooled using single side cooling from the non-pin side.

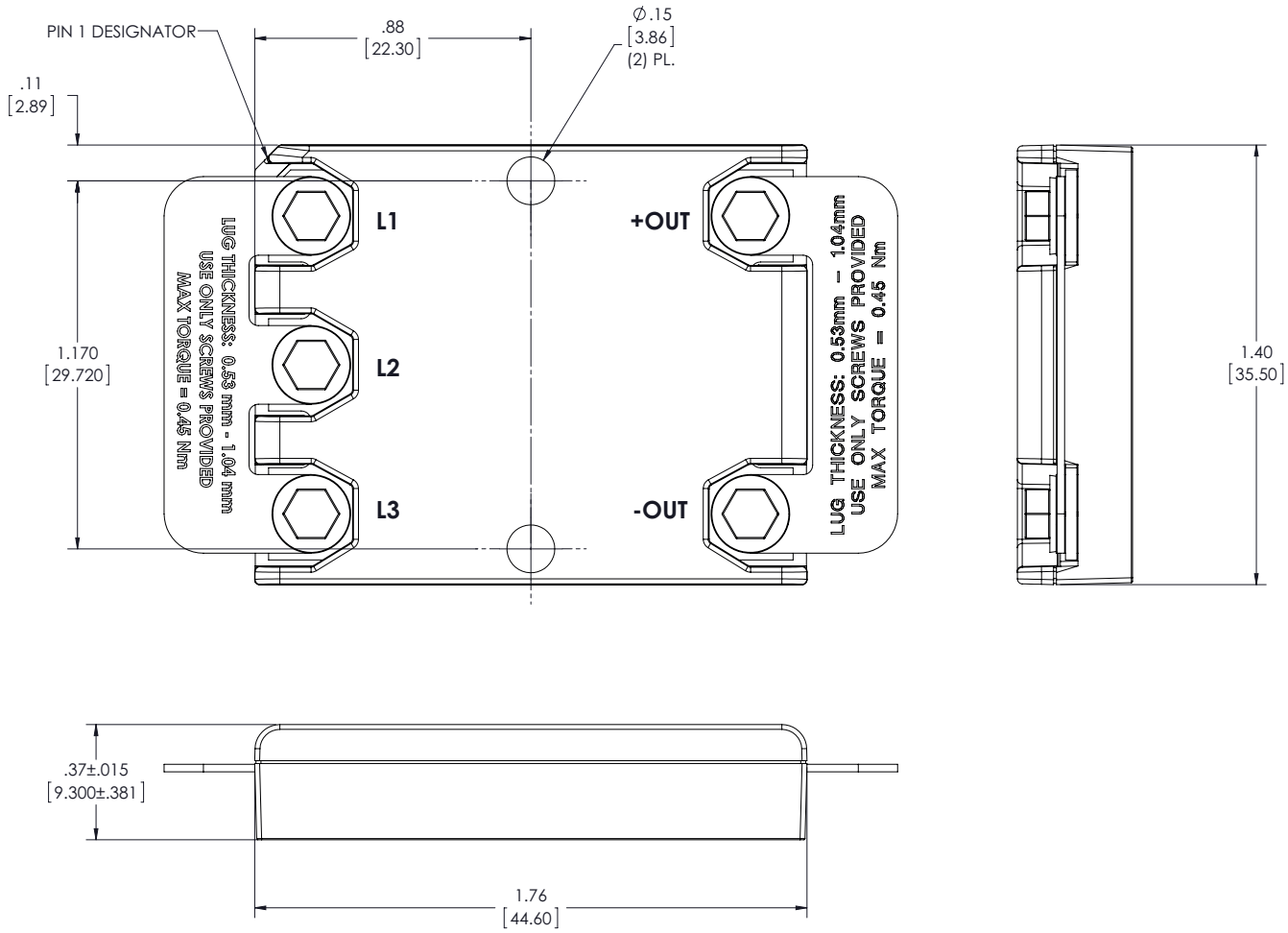
Internal operating temperatures will be kept to acceptable limits if the lower housing of the unit is mounted to a metal plate (coldplate or heatsink) with thermal grease that is kept to 100°C or less. If the unit is not mounted to a metal plate, then a thermocouple on the bottom housing located midway between the two mounting holes needs to be kept to 110°C or less.

Creepage

In chassis-mount applications a Gap Pad TIM is necessary to meet the creepage requirements from the Input/Output terminals to chassis. If a heat sink is used then it will need to be insulated or sized appropriately to satisfy the creepage requirements from the Input/Output terminals to the heatsink. Vicor Part Number 47591 shown on page 13 can be used to meet the required creepage distances.

TPM in a VIA Package Chassis-Mount Package Mechanical Drawing

CHASSIS MNT 3 PHASE AIM
(Reference DWG # 44314 Rev 1)

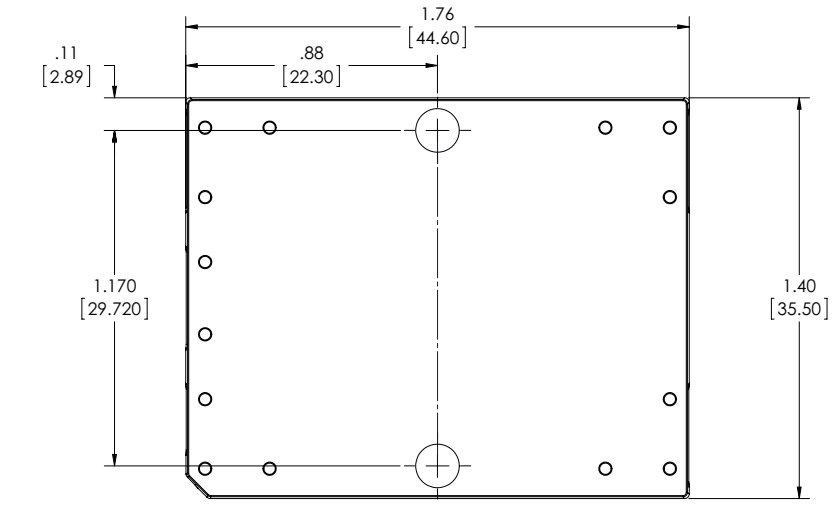


NOTES:
1- UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE MM [INCH]
2- TOLERANCES ARE:
DECIMALS
X.XX [X.XX] = ±0.25 [0.01]
X.XXX [X.XXX] = ±0.127 [0.005]
ANGLES = ±1°

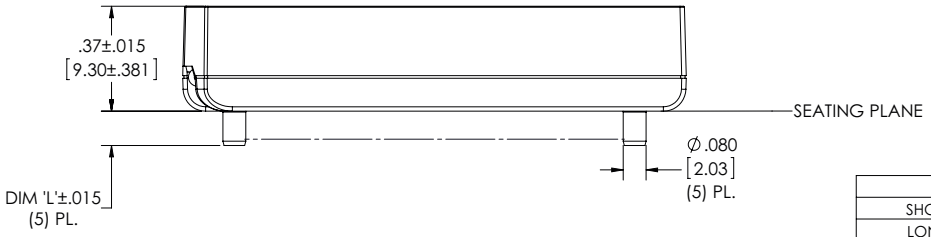
Product outline drawing; product outline drawings are available in .pdf and .dxf formats.
3D mechanical models are available in .pdf and .step formats.

TPM in a VIA Package PCB-Mount Package Mechanical Drawing

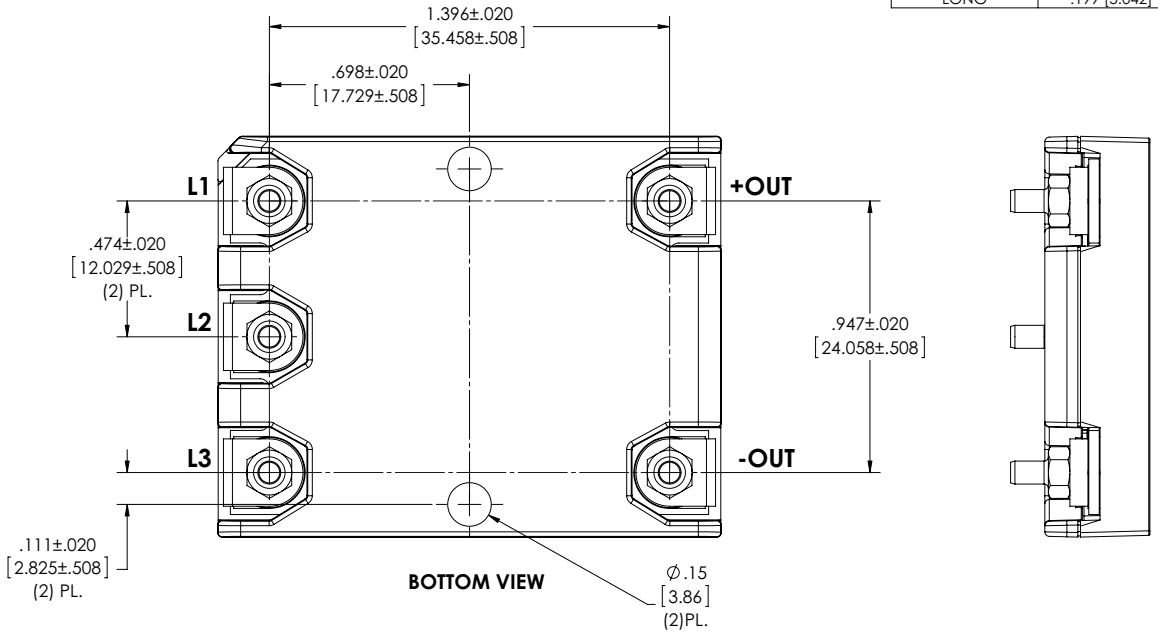
PCB MNT 3 PHASE AIM
(Reference DWG # 44316 Rev 2)



TOP VIEW
(COMPONENT SIDE)



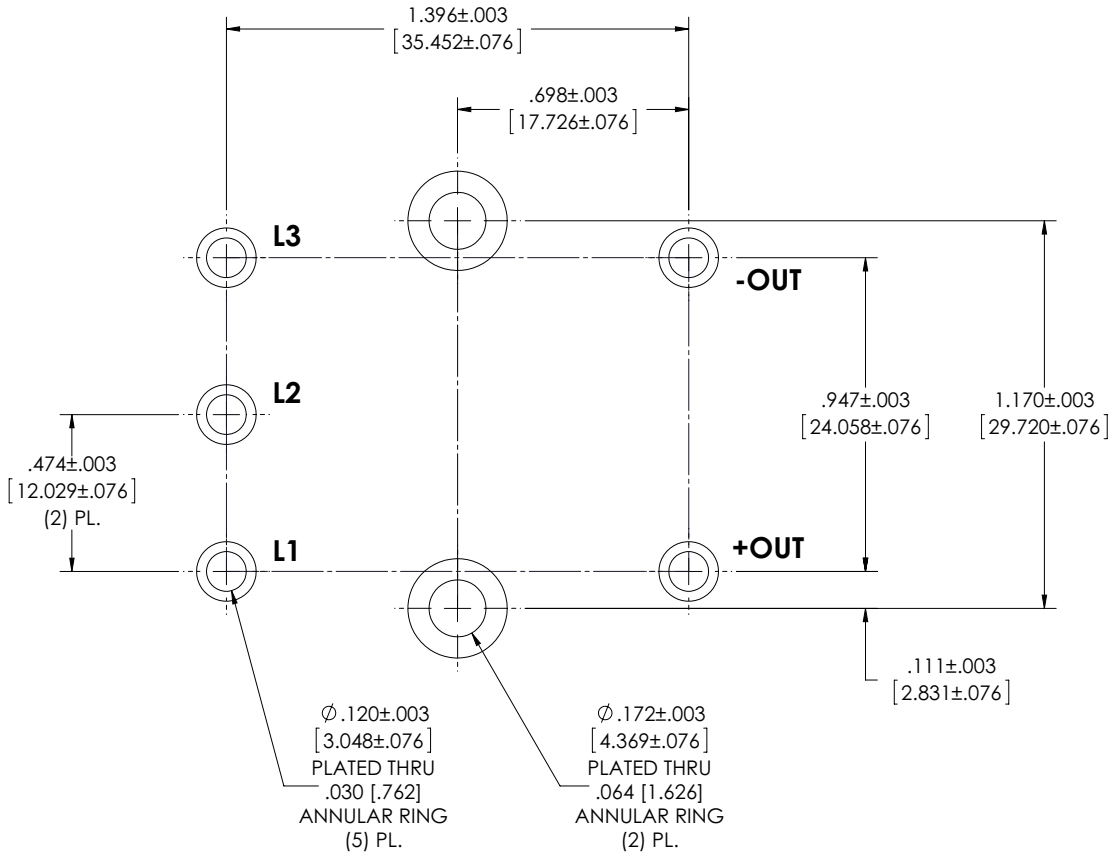
DIM 'L'	
SHORT	.120 [3.036]
LONG	.199 [5.042]



NOTES:
1- UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE MM [INCH]
2- TOLERANCES ARE:
DECIMALS
X.XX [X.XX] = ±0.25 [0.01]
X.XXX [X.XXX] = ±0.127 [0.005]
ANGLES = ±1°

TPM in a VIA Package PCB-Mount Recommended Hole Pattern

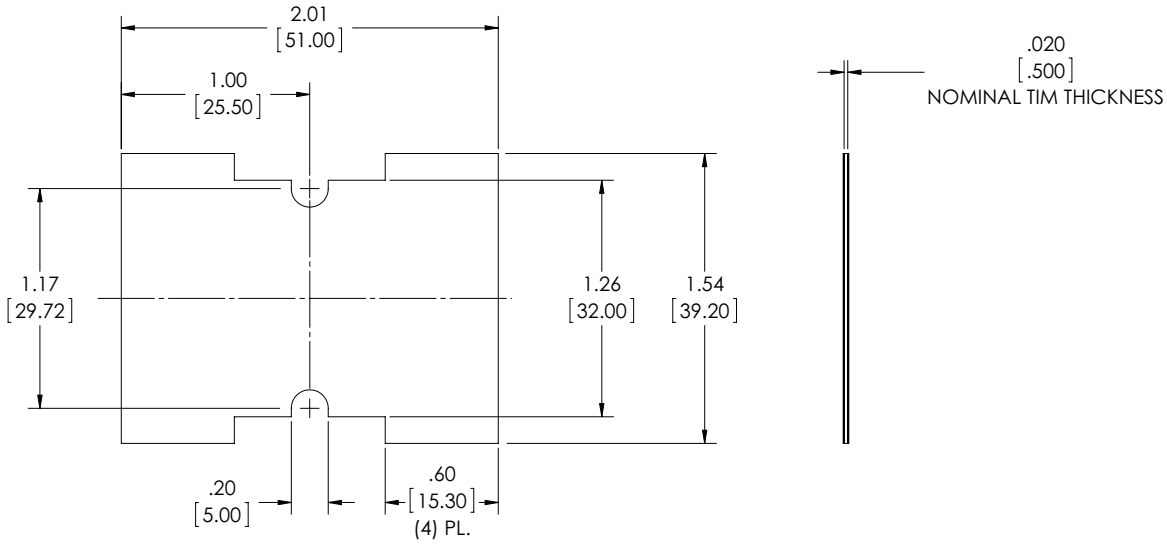
PCB MNT 3 PHASE AIM
(Reference DWG # 44316 Rev 2)



RECOMMENDED HOLE PATTERN
(COMPONENT SIDE)

TPM1714 Thermal Interface Material (TIM) Pad Mechanical Drawing

TIM PAD, VIA, 1714, TPM
(Reference DWG # 47591 Rev #1)



NOTES:
1- UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE MM [INCH]
2- TOLERANCES ARE:
DECIMALS
X.XX [X.XX] = ±0.25 [0.01]
X.XXX [X.XXX] = ±0.127 [0.005]
ANGLES = ±1°
3- MATERIAL: HENKEL BERGQUIST GAP PAD 5000 S35
4- NOMINAL THICKNESS .020 [.50] EXCLUSIVE OF LINER
5- PART IS KISS CUT AND SUPPLIED WITH A REMOVABLE PROTECTIVE LINER ON BOTH SIDES
6- LINEAR TOLERANCE ± 0.020 [0.50]

Revision History

Revision	Date	Description	Page Number(s)
1.0	07/10/18	Intitial release	n/a
1.1	07/12/18	Updated to include safe operating area	5, 6
1.2	10/11/18	Updated to remove SOA	5
1.3	02/25/19	Updated to include M-Grade version of part	1, 5, 7
1.4	01/14/22	Typo corrections Added note to BCM parts list Revised EMI/EMC compliance notes Revised chassis mount drawing, presentation format of all mechanical drawings	1 2 7 10 – 13

Note: page added in Rev 1.1, removed in Rev 1.2.

Vicor's comprehensive line of power solutions includes high density AC-DC and DC-DC modules and accessory components, fully configurable AC-DC and DC-DC power supplies, and complete custom power systems.

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10,398,040; and other patents pending.

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