

## 28 Volt input, 7 Amp M-Grade EMI Filter Module

### Product Description

The **MQPI-18** attenuates conducted common-mode (CM) and differential mode (DM) noise for DC-DC converters including the ViChip MIL PRM to comply with MIL-STD-461F EMI requirements for conducted noise measurements. The filter operates within the full input operating range of a 28 V MIL PRM and supports 7 A loads up to 85°C (TA) without derating.

### Features

- 50V<sub>in</sub> max input
- Compatible to most industry standard DC-DC converters including ViChip MIL PRM
- MIL-STD-461F compliant\* CE101, CE102, CS101, CS106, CS114, CS115, and CS116
- 100 Vdc surge, 100 ms
- 1500 Vdc hi-pot hold off to shield plane
- 7 A rating
- 12.9 x 25.3 x 5.0 mm Lidded SiP (System-in-Package)
- 12.4 x 24.9 x 3.4 mm Open-frame SiP
- Low profile LGA package
- -55° to +125°C PCB temperature (see Figure 4)
- Efficiency >99%
- Pb solder construction

### Applications

- Rugged Environment
- Displays
- Wireless Communications

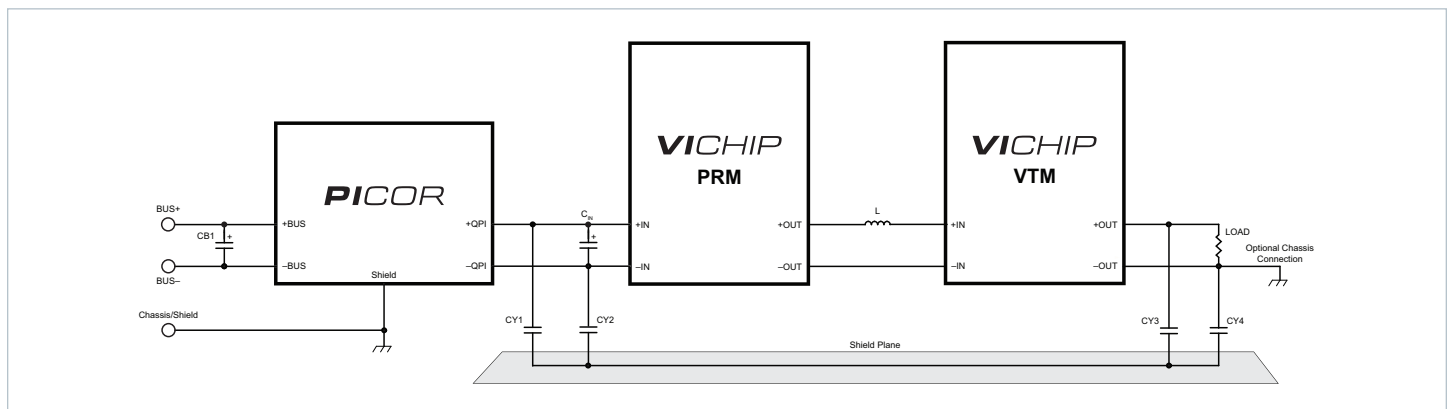
### Assembly Process Compatibility

- Designed for Pb solder SMT assembly
- Compatible with typical aqueous cleaning processes (MQPI-18LP-01, open-frame only)
- Compatible with most conformal coating compounds (MQPI-18LP-01, open-frame only, after re-flow)



MQPI-18LP (~1/2 in<sup>2</sup> area)

### Typical Application



**Figure 1** — Typical MQPI-18 application schematic with Vicor's MP028 PRM and MV036 VTM modules. <sup>[1]</sup>

<sup>[1]</sup> CB1 capacitor, referenced in all schematics, is a 47uF electrolytic; United Chemi-Con EMVE101ARA470MKE0S or equivalent.  
CY1 to CY4, referenced in all schematics, are 4.7nF hi-voltage safety capacitors; Vishay VY1472M63Y5UQ63V0 or equivalent.

## Order Information

Part Number	Description
MQPI-18LP	MQPI-18 LGA Package, RoHS Compliant
MQPI-18LP-01	MQPI-18 LGA Package, RoHS Compliant, Open Frame Package
<b>Also Available</b>	
MQPI-18-CB1	A MQPI-18LP mounted on a carrier board that can be paired with PRM/VTM and Cool-Power evaluation boards available from Vicor.

## Absolute Maximum Ratings

Exceeding these parameters may result in permanent damage to the product.

Name	Rating
Input Voltage, BUS+ to BUS-, continuous	-50 to 50 Vdc
Input Voltage, BUS+ to BUS-, 100ms transient	-100 to 100 Vdc
BUS+/- BUS- to Shield pads, hi-pot	-750 to 750 Vdc
Input to output current, continuous @ 25°C T <sub>A</sub>	7 Adc
Power dissipation, @ 85°C T <sub>A</sub> , 7 A <sup>[2]</sup>	1.85 W
Operating temperature - T <sub>A</sub>	-55 to 125°C
Thermal resistance <sup>(2)</sup> - R <sub>θJA</sub> , using PCB layout in Figure 12	30°C/W
Thermal resistance <sup>(2)</sup> - R <sub>θJPCB</sub>	18°C/W
Storage temperature, JEDEC Standard J-STD-033B	-55 to 125°C
Reflow temperature, 20 s exposure	245°C
ESD, Human body model (HBM)	-2000 to 2000 V

<sup>[2]</sup> See Figure 4 for the current de-rating curve.

## Electrical Characteristics

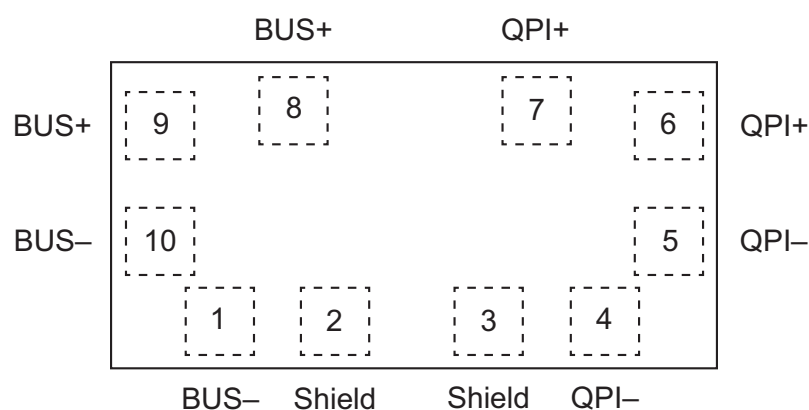
Parameter limits apply over the operating temp. range, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Range	BUS+ to BUS-	Measured at 7 A, 85°C ambient temperature <sup>[2]</sup>			50	Vdc
Voltage Drop	BUS+ to QPI+	Measured at 7 A, 85°C ambient temperature <sup>[2]</sup>			130	mVdc
Voltage Drop	BUS- to QPI-	Measured at 7 A, 85°C ambient temperature <sup>[2]</sup>			130	mVdc
Common mode attenuation		VBUS = 28 V, Frequency = 1.0 MHz, line impedance = 50Ω	45			dB
Differential mode attenuation		VBUS = 28 V, Frequency = 1.0 MHz, line impedance = 50Ω	75			dB
Input bias current at 50 V		Input current from BUS+ to BUS-			10	uA

<sup>[2]</sup> See Figure 4 for the current de-rating curve.

## Pad Descriptions

Pin Name	Name	Description
8, 9	BUS+	Positive bus potential
1, 10	BUS-	Negative bus potential
6, 7	QPI+	Positive input to the converter
4, 5	QPI-	Negative input to the converter
2, 3	Shield	Shield connects to the system chassis or to a safety ground



**LGA Pattern (Top View)**

## Applications Information

The MQPI-18 was designed specifically to work with Vicor's MIL PRM (MP028) and VTM (MV036) series of VICHIP® Factorized Power Architecture™ (FPA™) converters to achieve compliance with the MIL-STD 461F standard.

MIL_STD 461F Test Results		
CS101	Conducted Susceptibility, Power	Leads Passed
CS106	Conducted Susceptibility, Transients, Power Leads	Passed
CS114	Bulk Cable Injection, Radio Frequency	Passed, 100% load (Curve 4)
CS114	Bulk Cable Injection, Radio Frequency	Passed, 78% load (Curve 5)
CS115	Bulk Cable Injection, Radio Frequency	Passed
CS116	Damped Sinusoid Transients	Passed
CS116	Damped Sinusoid Transients	Passed



## Current De-Rating

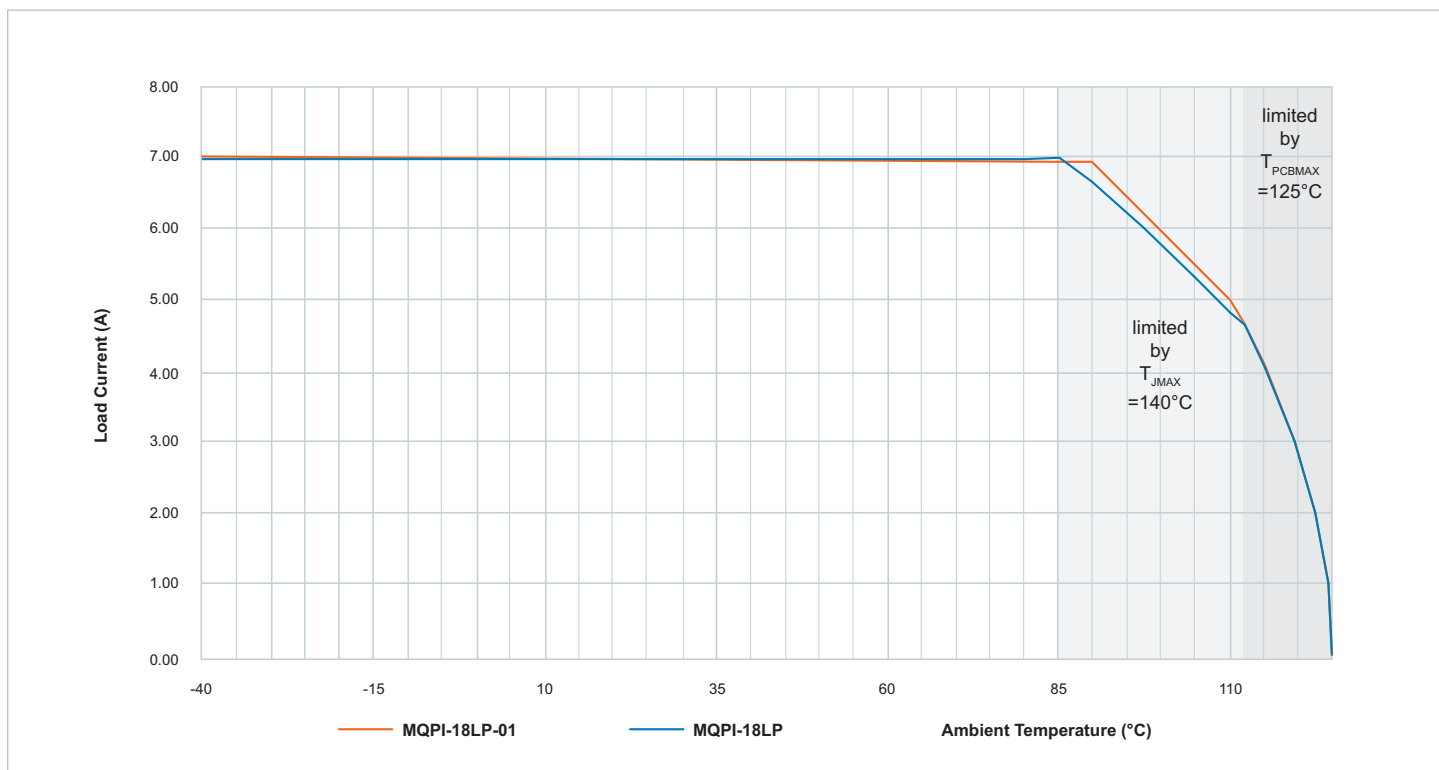


Figure 4 — Current de-rating over ambient temperature range

## MQPI-18 Insertion Loss Measurements

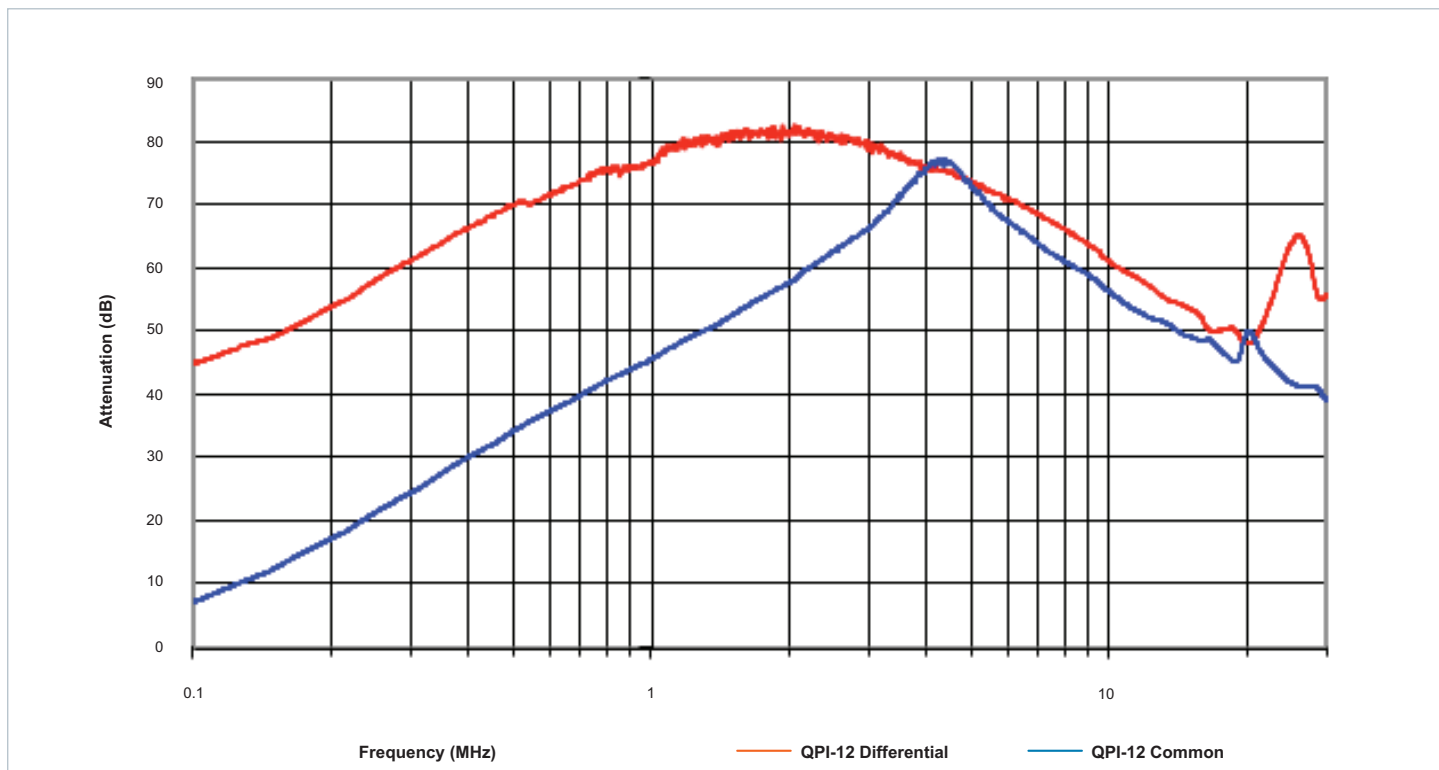
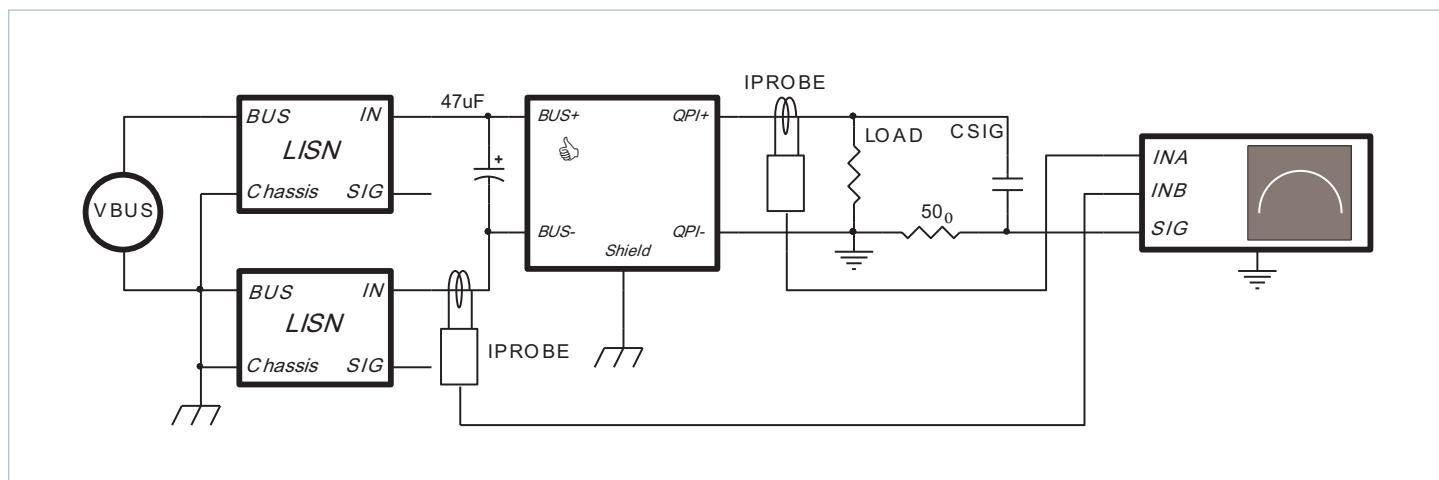
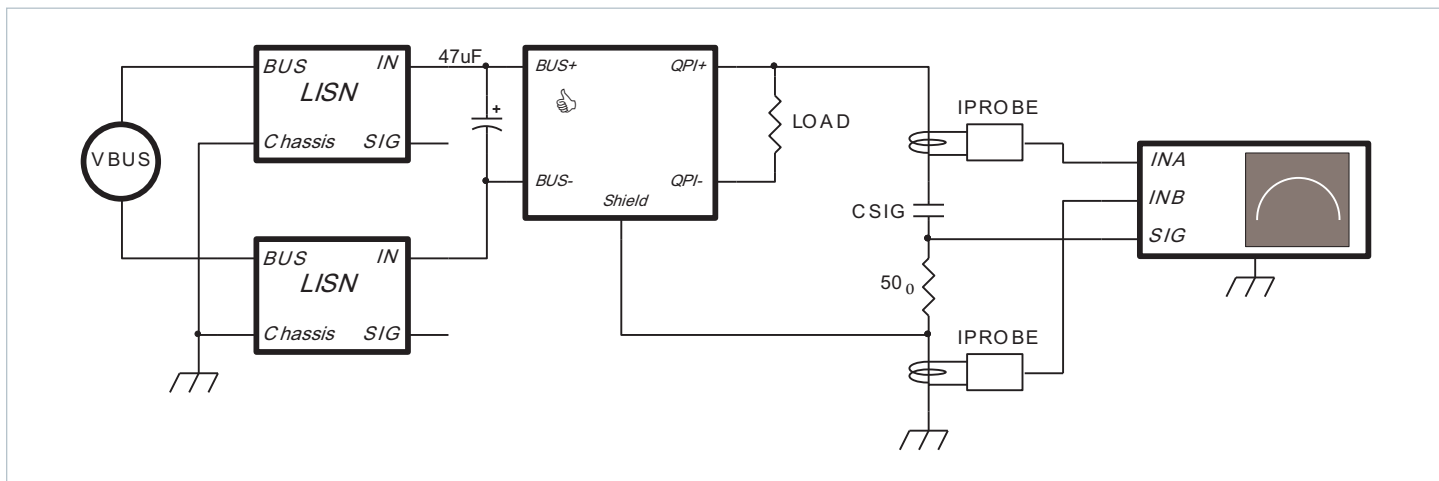


Figure 5 — Attenuation curves into a 50Ω line impedance, bias from a 48 V bus

## MQPI Insertion Loss Test Circuits

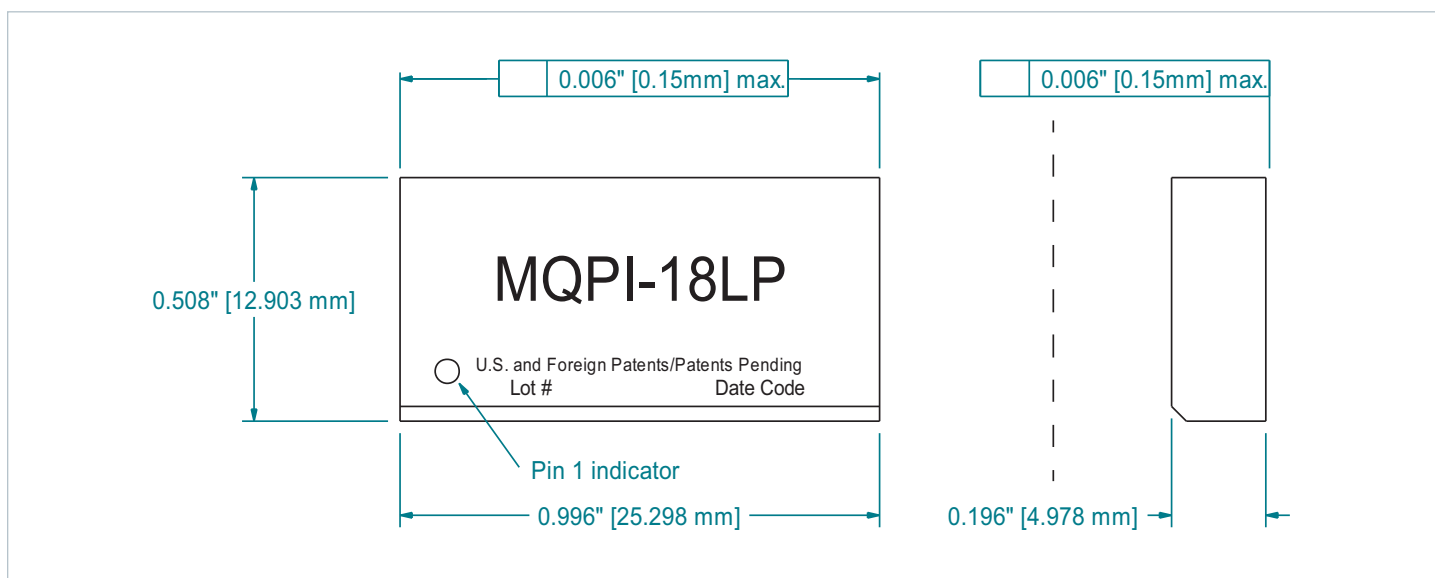


**Figure 6** — Test Set-up to measure Differential Mode EMI currents in Figure 4

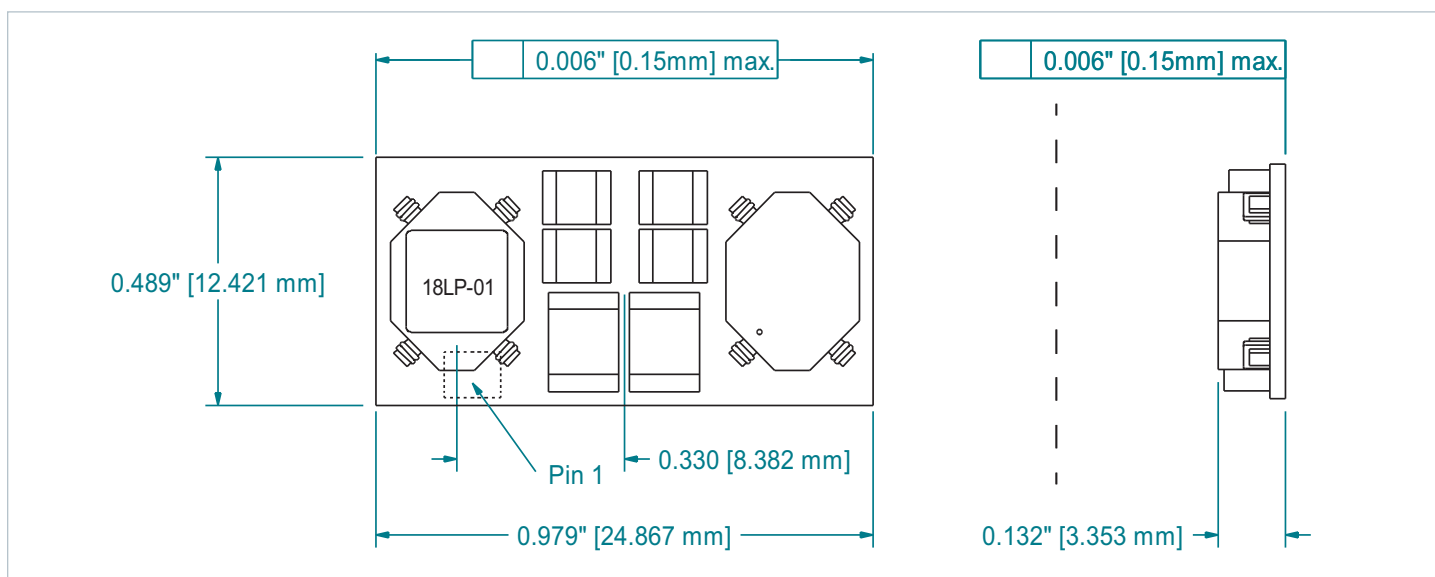


**Figure 7** — Test Set-up to measure Common Mode EMI currents in Figure 4

## Mechanical Package Drawings



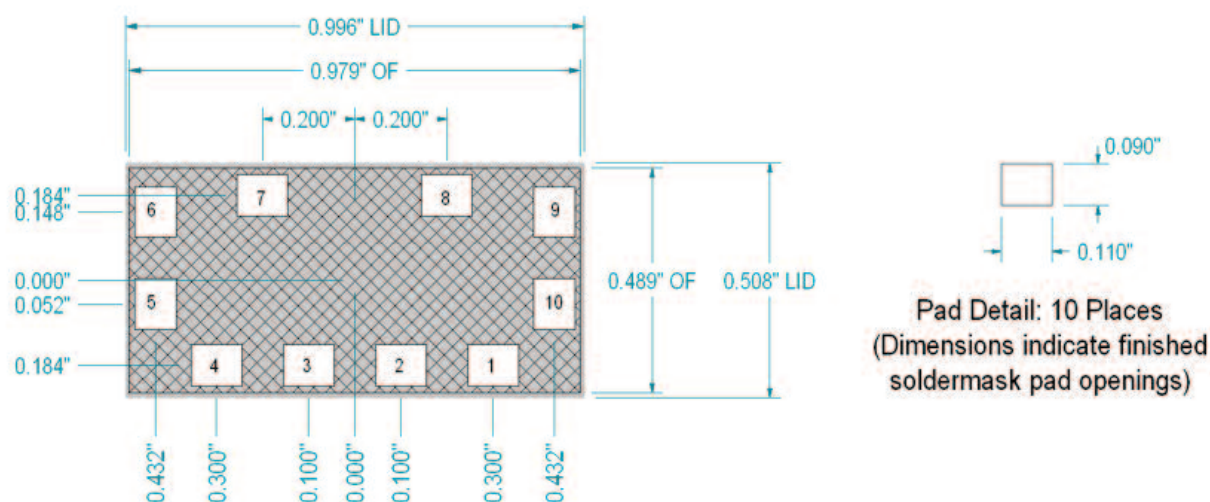
**Figure 8** — Bottom view of open-frame (OF) and lidded (LID) products. (All dimensions are in inches)



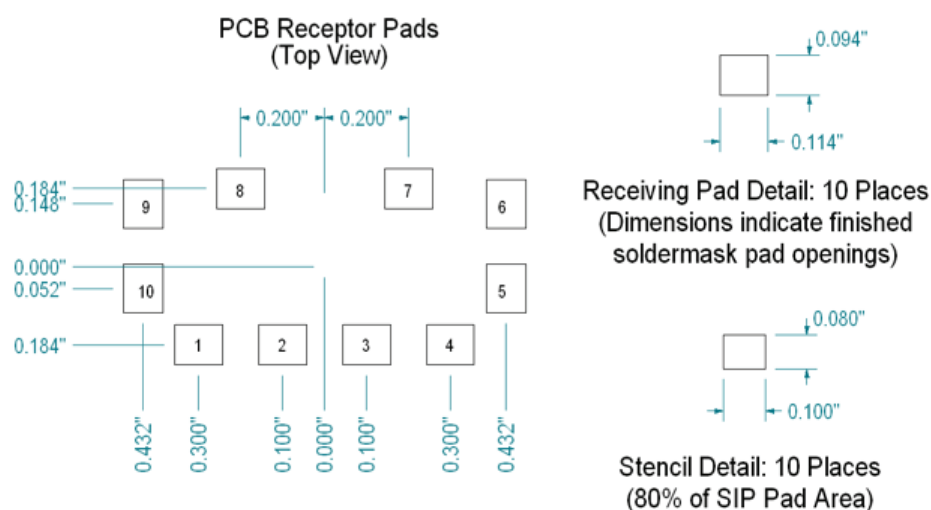
**Figure 9** — Recommended receptor and stencil patterns. (All dimensions are in inches)

Datum	Units	MQPI-18LP	MQPI-19LP-01	Notes
FITS	Failure/Billion Hrs.	16	16	FITS based on the BellCore Standard TR-332
MTBF	Million Hrs.	62.5	62.5	MTBFs based on the BellCore Standard TR-332
Weight	grams	2.4	2.075	
MSL		3	3	
Peak reflow Temperature	°C/20 seconds	245	245	IPC/JEDEC J-STD-020D

## Pad and Stencil Definitions



**Figure 10** — Bottom view of open-frame (OF) and lidded (LID) products. (All dimensions are in inches)

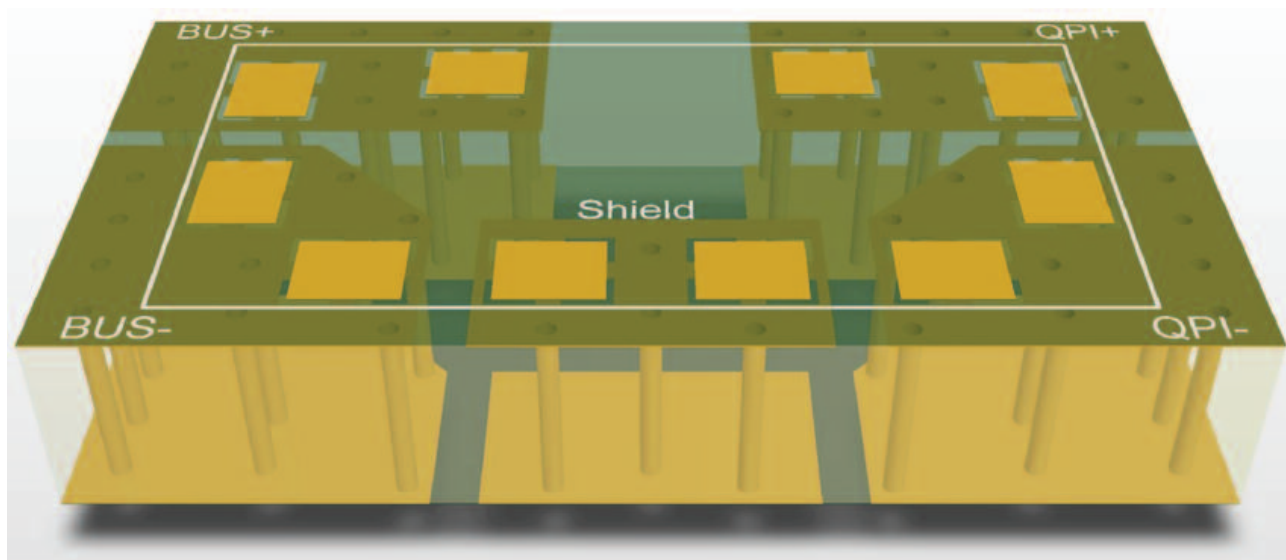


**Figure 11** — Recommended receptor and stencil patterns. (All dimensions are in inches)

Stencil definition is based on a 6mil stencil thickness, 80% of LGA pad area coverage. LGA Package dimensions are for both the Open-Frame and Lidded versions of the MQPI-18.



## MQPI-18 PCB Layout Recommendations



**Figure 12** — 3D view of paralleling planes underneath the MQPI-18

The filtering performance of the **MQPI-18** is sensitive to capacitive coupling between its input and output pins. Parasitic plane capacitance must be kept below 1 pico-Farad between inputs and outputs using the layout shown above and the recommendations described below to achieve maximum conducted EMI performance.

To avoid capacitive coupling between input and output pins, there should not be any planes or large traces that run under both input and output pins, such as a ground plane or power plane. For example, if there are two signal planes or large traces where one trace runs under the input pins, and the other under the output pins, and both planes overlap in another area, they will cause capacitive coupling between input and output pins. Also, planes that run under both input and outputs pins, but do not cross, can cause capacitive coupling if they are capacitively by-passed together. Figure 11 shows

the recommended pcb layout on a 2 layer board. Here, the top layer planes are duplicated on the bottom layer so that there can be no overlapping of input and output planes. This method can be used for boards of greater layer count.

### Post Solder Cleaning

Picor's MQPI-18LP SIPs are not hermetically sealed and must not be exposed to liquid, including but not limited to cleaning solvents, aqueous washing solutions or pressurized sprays. When soldering, it is recommended that no-clean flux solder be used, as this will ensure that potentially corrosive mobile ions will not remain on, around, or under the module following the soldering process. For applications where the end product must be cleaned in a liquid solvent, Picor recommends using the MQPI-18LP-01, open-frame version of the EMI filter.

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