

## 28V<sub>IN</sub>, 7A 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 VI Chip® 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 28V MIL PRM and supports 7A loads up to 85°C (T<sub>A</sub>) without de-rating.



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

### Assembly Process Compatibility

- Designed for Pb solder SMT assembly
- ENIG (electroless nickel immersion gold) pad termination finish
- 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 reflow)

### Features & Benefits

- 50V<sub>IN</sub> max input
- Compatible to most industry-standard DC-DC converters, including VI Chip MIL PRM
- MIL-STD-461F compliant <sup>[a]</sup> CE101, CE102, CS101, CS106, CS114, CS115, and CS116
- 100V<sub>DC</sub> surge, 100ms
- 1,500V<sub>DC</sub> hipot hold-off to shield plane
- 7A rating
- ~1/2in<sup>2</sup> area
- -55 to +125°C PCB temperature (see Figure 3)
- Efficiency >99%
- Pb solder construction

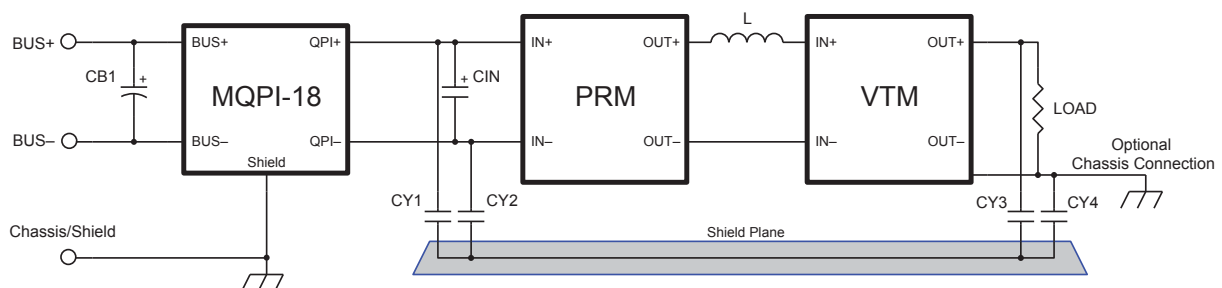
### Applications

- Rugged Environment
- Displays
- Wireless Communications

### Package Information

- 12.9 x 25.3 x 5.0mm, lidded SiP (System-in-Package)
- 12.4 x 24.9 x 4.2mm, open-frame

### Typical Applications



Typical MQPI-18 application schematic with Vicor MP028 PRM and MV036 VTM modules <sup>[a]</sup>

<sup>[a]</sup> When combined with MP028 PRM™ and MV036 VTM™.

<sup>[b]</sup> CB1 capacitor, referenced in all schematics, is a 47µF electrolytic; United Chemi-Con EMVE101ARA470MKE05 or equivalent.

CY1 to CY4, referenced in all schematics, are 4.7nF high-voltage safety capacitors; Vishay VY1472M63Y5UQ63V0 or equivalent.

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## Order Information

| Product                  | Description                             |
|--------------------------|-----------------------------------------|
| MQPI-18LP <sup>[c]</sup> | MQPI-18 LGA package                     |
| MQPI-18LP-01             | MQPI-18 LGA package, open-frame package |

<sup>[c]</sup> QPI-18LP is a non-hermetically sealed package. Please read the "Post-Solder Cleaning" section on page 10.

## Absolute Maximum Ratings

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

| Name                                                                                 | Rating                     |
|--------------------------------------------------------------------------------------|----------------------------|
| Input Voltage, BUS+ to BUS–, Continuous                                              | –50 to 50V <sub>DC</sub>   |
| Input Voltage, BUS+ to BUS–, 100ms Transient                                         | –100 to 100V <sub>DC</sub> |
| BUS+ / BUS– to Shield Pads, Hipot                                                    | –750 to 750V <sub>DC</sub> |
| Input to Output Current, Continuous at 25°C (T <sub>A</sub> )                        | 7A <sub>DC</sub>           |
| Power Dissipation at 85°C (T <sub>A</sub> ), 7A <sup>[d]</sup>                       | 1.85W                      |
| Operating Temperature - T <sub>A</sub>                                               | –55 to 125°C               |
| Thermal Resistance <sup>[d]</sup> - R <sub>θJA</sub> , using PCB layout in Figure 11 | 30°C/W                     |
| Thermal Resistance <sup>[d]</sup> - R <sub>θJ-PCB</sub>                              | 18°C/W                     |
| Storage Temperature, JEDEC Standard J-STD-033B                                       | –55 to 125°C               |
| Reflow Temperature, 20s Exposure                                                     | 245°C                      |
| ESD, Human Body Model (HBM)                                                          | –2000 to 2000V             |

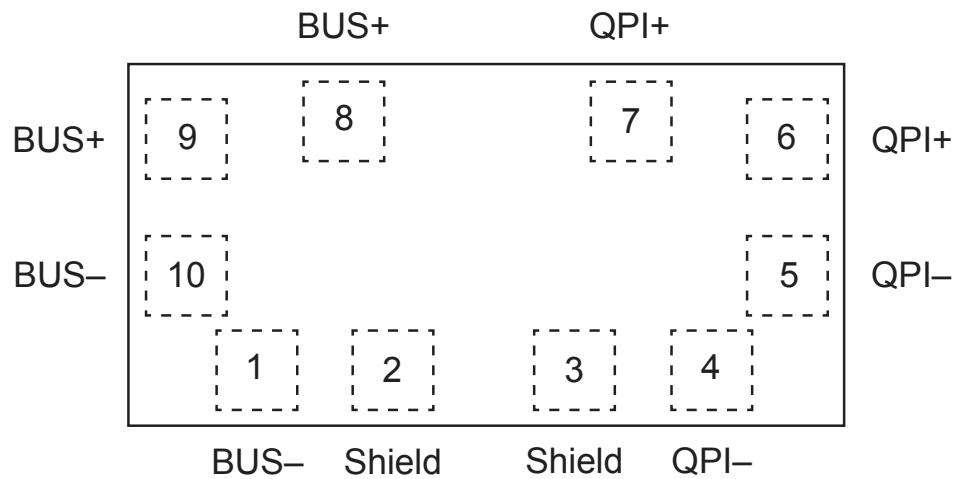
## Electrical Characteristics

Parameter limits apply over the operating temperature range unless otherwise noted.

| Parameter                     | Conditions                                                       | Min | Typ | Max | Unit             |
|-------------------------------|------------------------------------------------------------------|-----|-----|-----|------------------|
| BUS+ to BUS– Input Range      | Measured at 7A, 85°C ambient temperature <sup>[d]</sup>          |     |     | 50  | V <sub>DC</sub>  |
| BUS+ to QPI+ Voltage Drop     | Measured at 7A, 85°C ambient temperature <sup>[d]</sup>          |     |     | 130 | mV <sub>DC</sub> |
| BUS– to QPI– Voltage Drop     | Measured at 7A, 85°C ambient temperature <sup>[d]</sup>          |     |     | 130 | mV <sub>DC</sub> |
| Common-Mode Attenuation       | V <sub>BUS</sub> = 28V, frequency = 1.0MHz, line impedance = 50Ω | 45  |     |     | dB               |
| Differential-Mode Attenuation | V <sub>BUS</sub> = 28V, frequency = 1.0MHz, line impedance = 50Ω | 75  |     |     | dB               |
| Input Bias Current at 50V     | Input current from BUS+ to BUS–                                  |     |     | 10  | μA               |

<sup>[d]</sup> See Figure 3 for the current de-rating curve.

## Package Pinout

**LGA Pattern (Top View)**

| Pad Number | 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 |

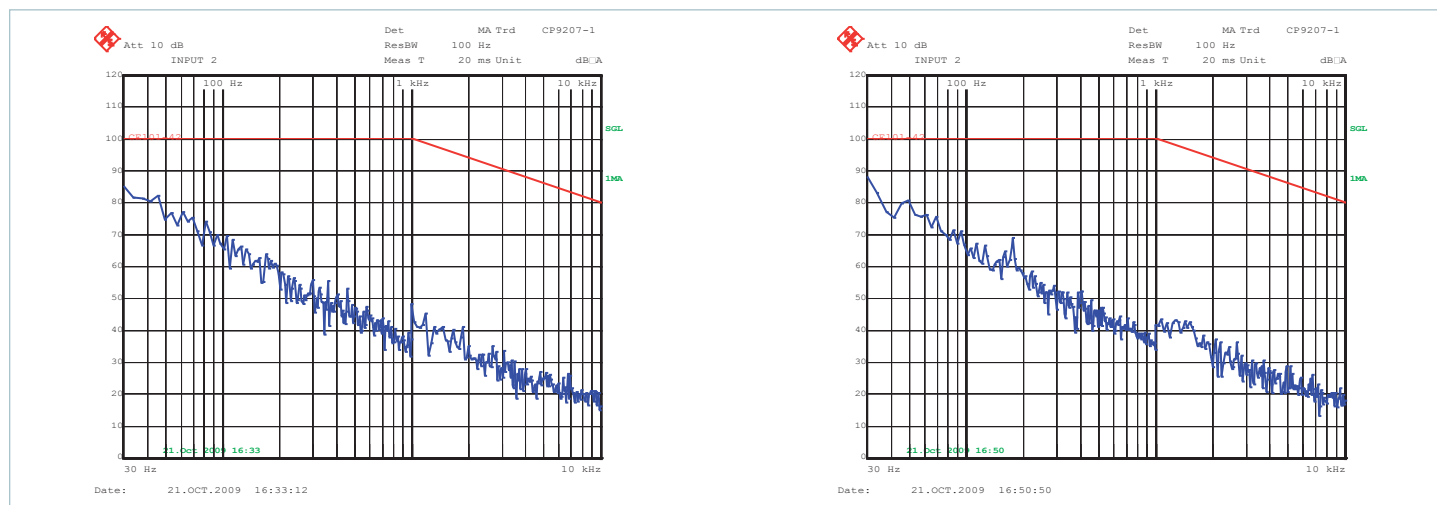
## Applications Information

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

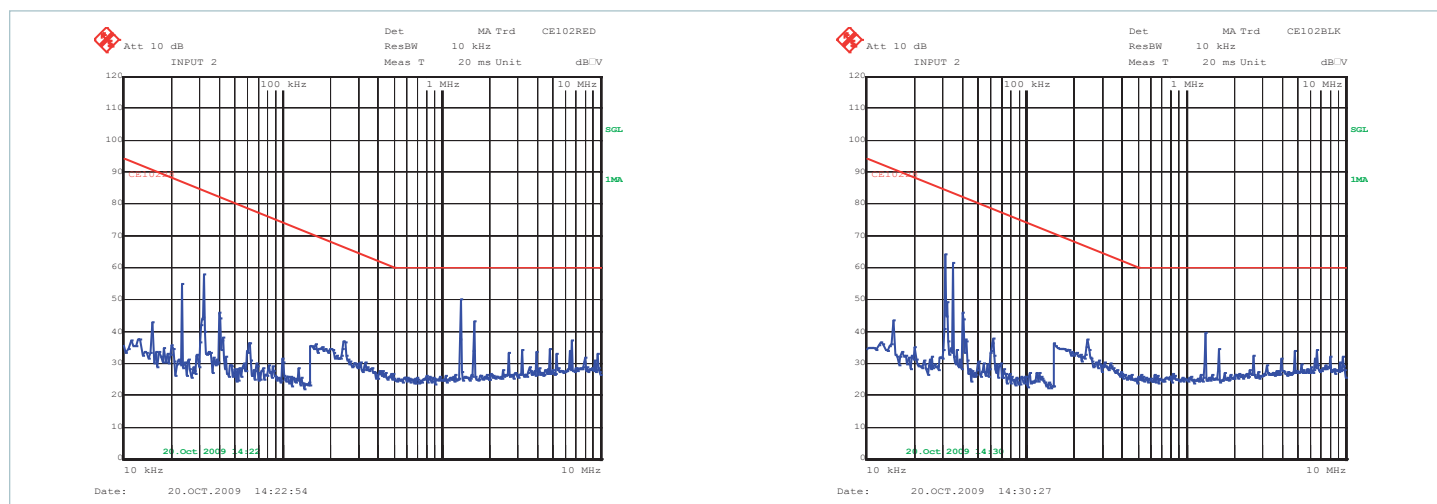
| MIL-STD 461F Test Results |                                                   |                              |
|---------------------------|---------------------------------------------------|------------------------------|
| CS101                     | Conducted susceptibility, power                   | Leads Passed                 |
| CS106                     | Conducted susceptibility, transients, power leads | Passed                       |
| CS114                     | Bulk cable injection, radio frequency             | Passed, 100% load (Figure 3) |
| CS114                     | Bulk cable injection, radio frequency             | Passed, 78% load (Figure 4)  |
| CS115                     | Bulk cable injection, radio frequency             | Passed                       |
| CS116                     | Damped sinusoid transients                        | Passed                       |
| CS116                     | Damped sinusoid transients                        | Passed                       |

## Attenuation Plots

MQPI-18 with PRM™ MP028F036M12AL and VTM™ MV036F120M010 modules.



**Figure 1** — CE101 EMI plots of the MP028F036M12AL and MV036F120M010, filtered with the MQPI-18LP, +(RED) and -(BLK) leads



**Figure 2** — CE102 EMI plots of the MP028F036M12AL and MV036F120M010, filtered with the MQPI-18LP, +(RED) and -(BLK) leads

## Current De-Rating

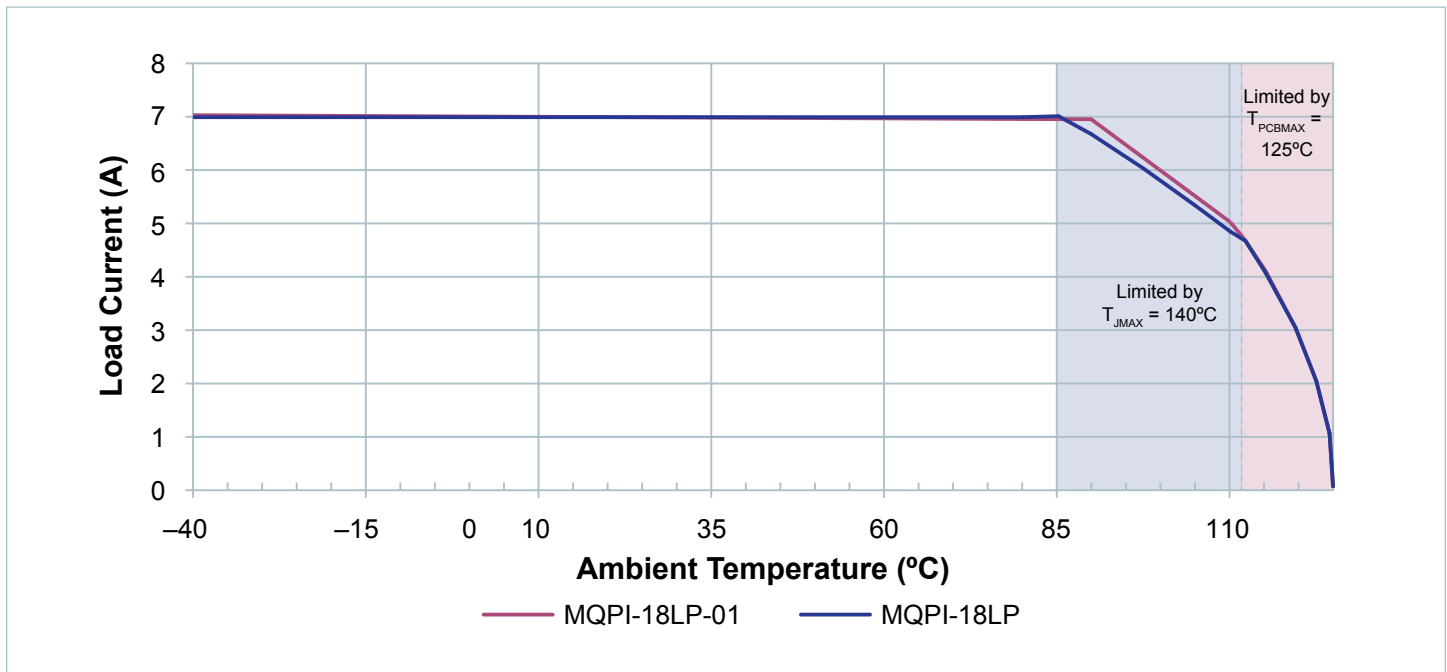
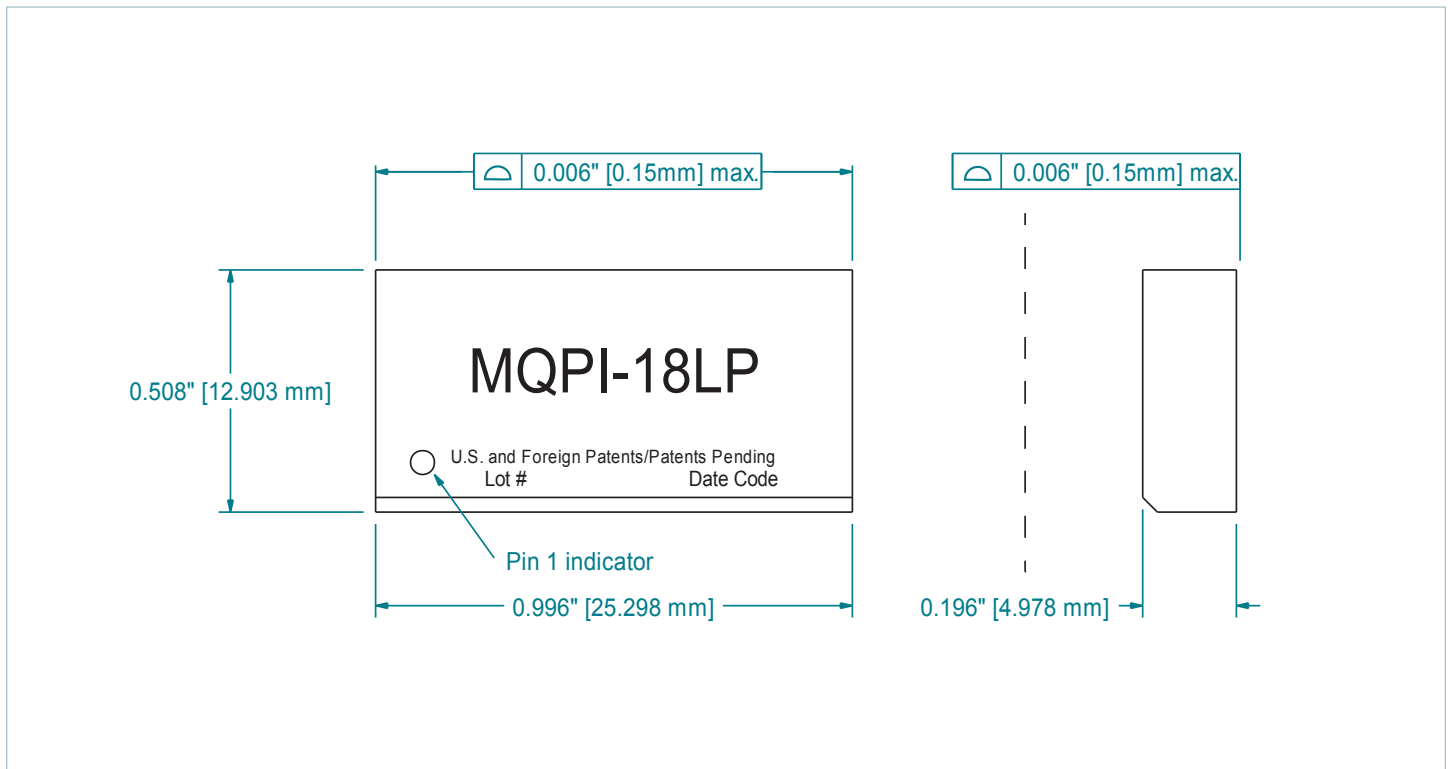


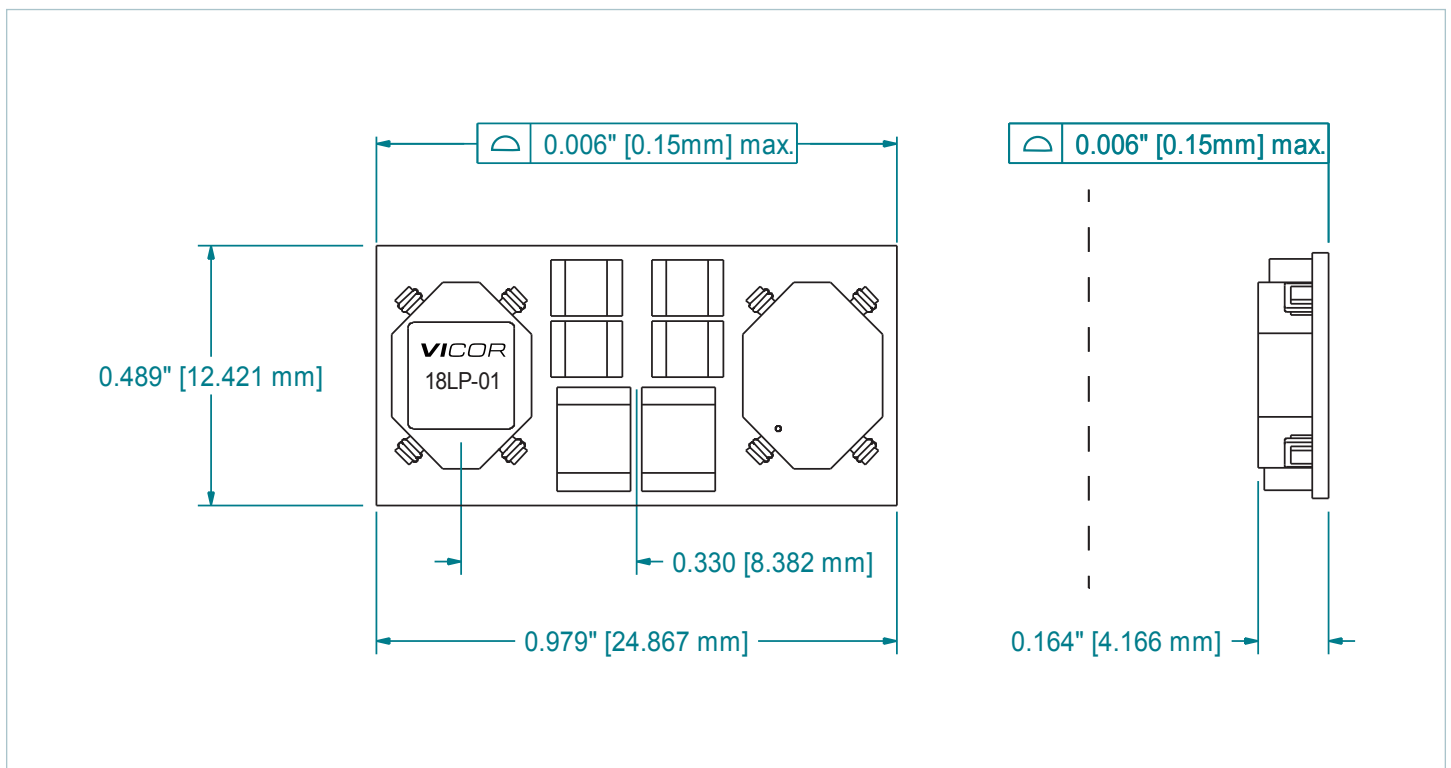
Figure 3 — Current de-rating over ambient temperature range


$$Insertion\ Loss = 20\log\left(\frac{I_{INA}}{I_{INR}}\right)$$


## Package Outline Drawings

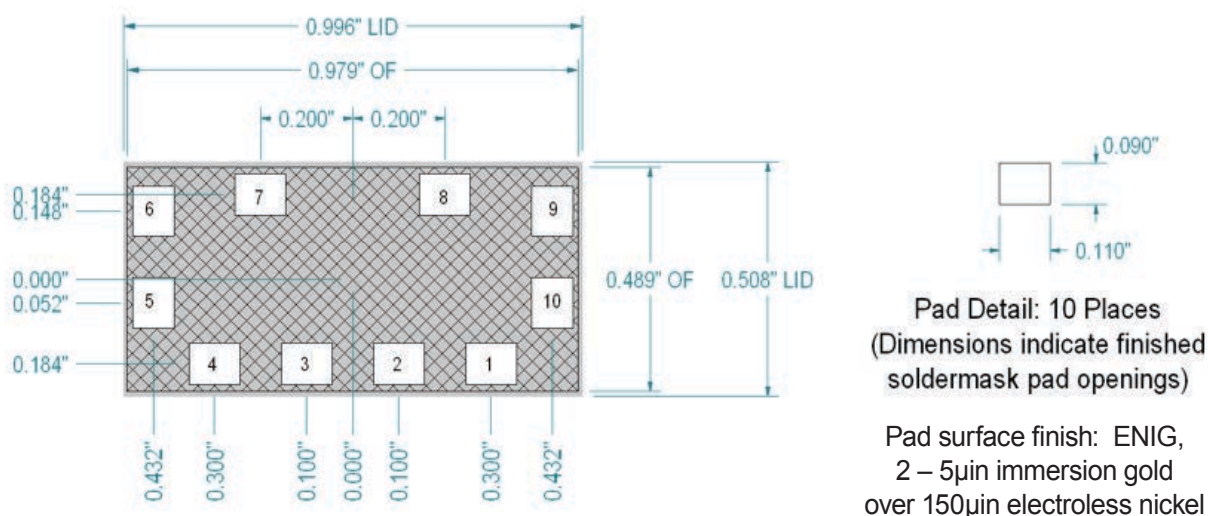


**Figure 7** — Lidded package dimensions, tolerance of  $\pm 0.004$ in

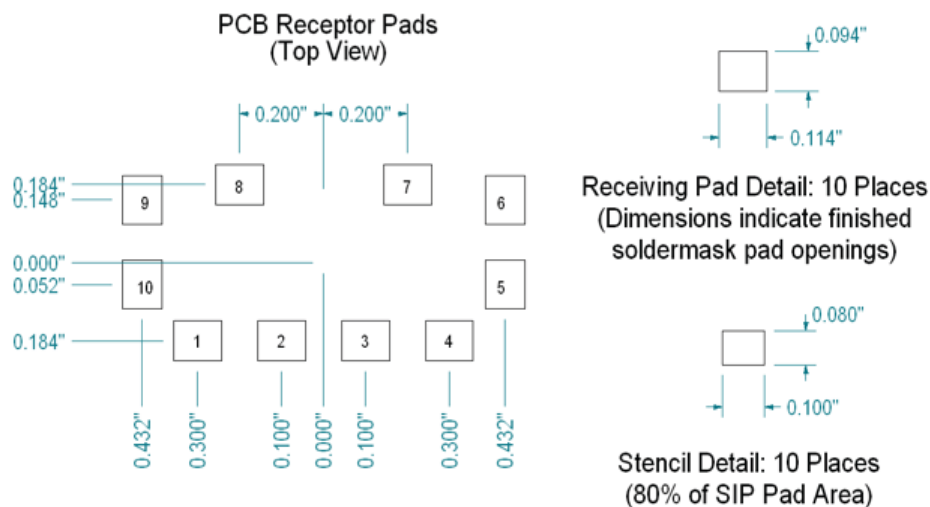


**Figure 8** — Open-frame package dimensions, tolerance of  $\pm 0.004$ in; pick-and-place from label center

## Pad and Stencil Definitions



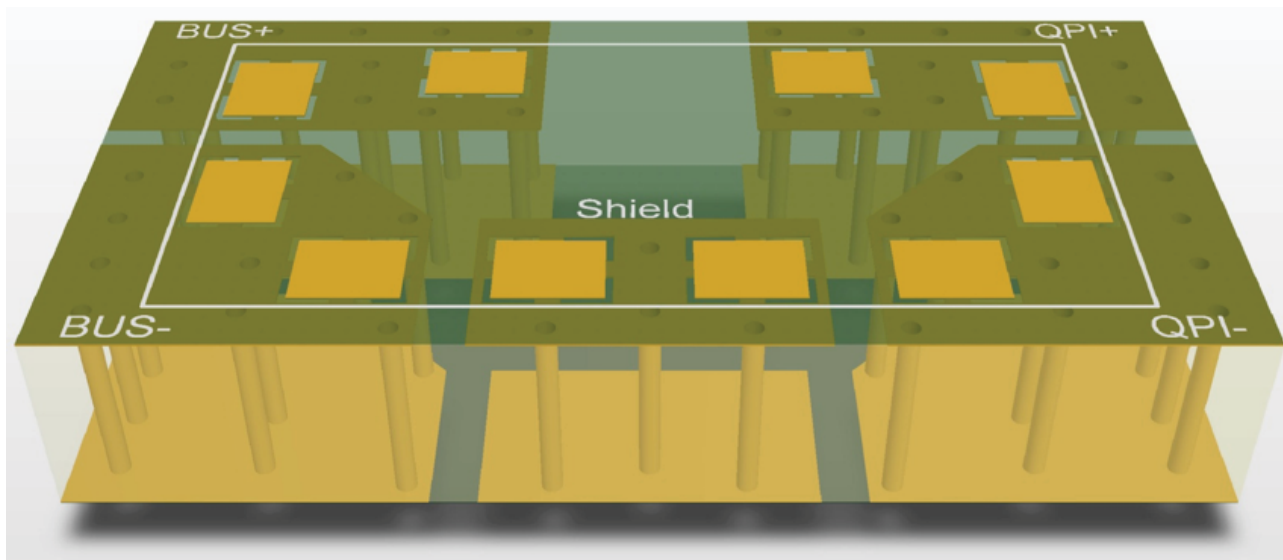
**Figure 9** — Bottom view of open-frame (OF) and lidded (LID) products (all dimensions are in inches)



**Figure 10** — Recommended receptor and stencil patterns (all dimensions are in inches)

**Note:** 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 QPI-18.

## PCB Layout Recommendations



**Figure 11** — 3D view of paralleling planes underneath the MQPI-18

### PCB Layout

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 one 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 bypassed together. Figure 11 shows the recommended PCB layout on a two-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

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, Vicor recommends using the MQPI-18LP-01, open-frame version of the EMI filter.

### MQPI-18 Mechanical Data

| Datum                   | Units               | MQPI-18LP | MQPI-18LP-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                        |

## Revision History

| Revision | Date     | Description                                        | Page Number(s) |
|----------|----------|----------------------------------------------------|----------------|
| 2.0      | 07/28/26 | Updated assembly process compatibility information | 1              |
|          |          | Updated order information                          | 3              |
|          |          | Updated branding and format                        | all            |
| 2.1      | 07/31/26 | Added pad finish specification                     | 9              |

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