

## PASSIVE EMI FILTER

**-40 to +40V**  
Input

**30A**  
Output Current

**20mΩ @ 100°C**  
Max DC Resistance

**>80dB @ 250kHz**  
Differential Attenuation

**FULL POWER OPERATION: -40°C TO +100°C**

The InQor series of EMI filters brings SynQor's field proven technology and manufacturing expertise to the industrial power applications marketplace. SynQor's innovative packaging approach ensures survivability in the most hostile environments. Compatible with the industry standard format, these filters have high differential-mode and common-mode attenuation, low DC resistance, and a stabilizing bulk capacitor resistor. They follow conservative component derating guidelines and they are designed and manufactured to the highest standards.

# InQor®

### Operational Features

- -40°C to +100°C Operation
- ±40V Input Voltage Range; ±50 Transient (1s)
- 30A output current
- Very low DC resistance
- >80dB @ 250kHz differential-mode attenuation
- >36dB @ 250kHz common-mode attenuation
- Stabilizing bulk capacitor and damping resistor included
- All capacitors are X7R multi-layer ceramic



*IQ040PFQTx30 Module*

### Mechanical Features

- Standard Size: 1.54" x 2.39" x 0.50" (39.0 x 60.6 x 12.7mm)
- Total weight: 3.53oz (100g)

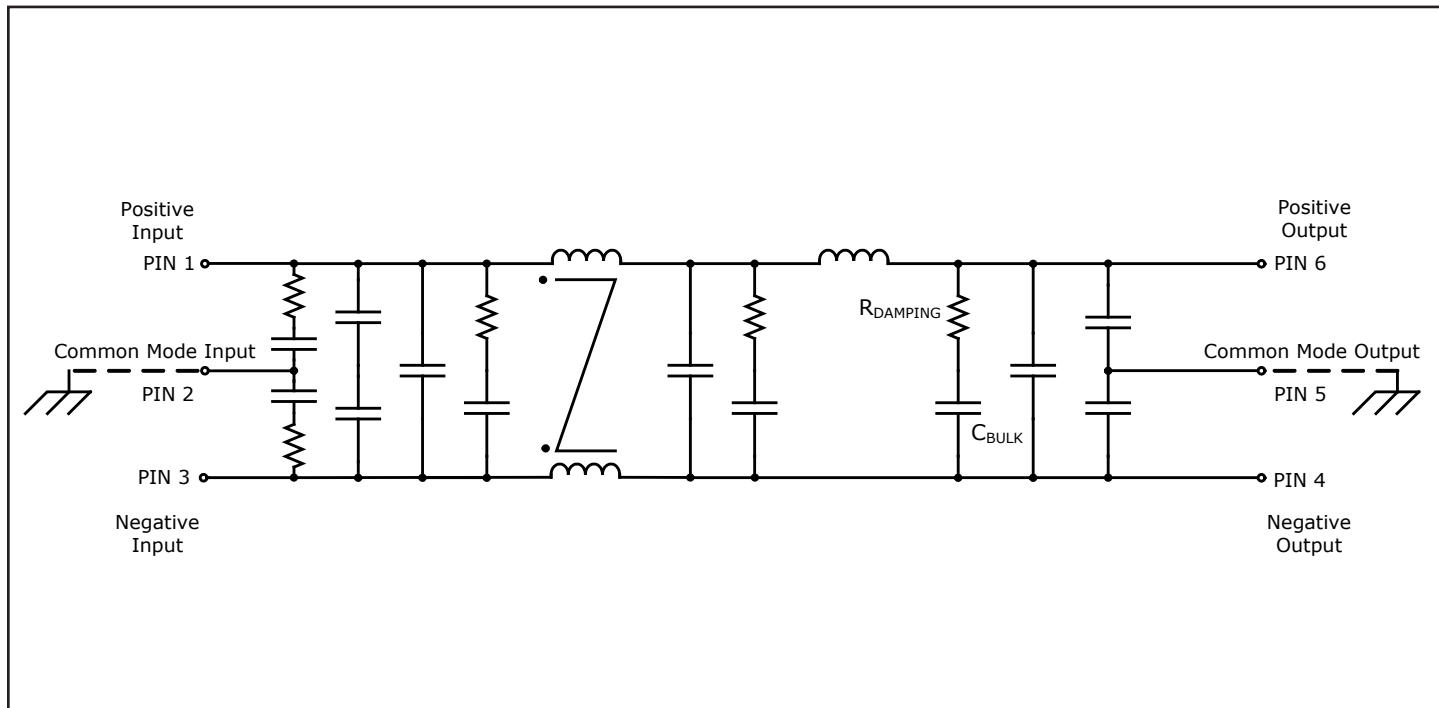
### In-Line Manufacturing Process

- AS9100 and ISO 9001:2000 certified facility
- Full component traceability

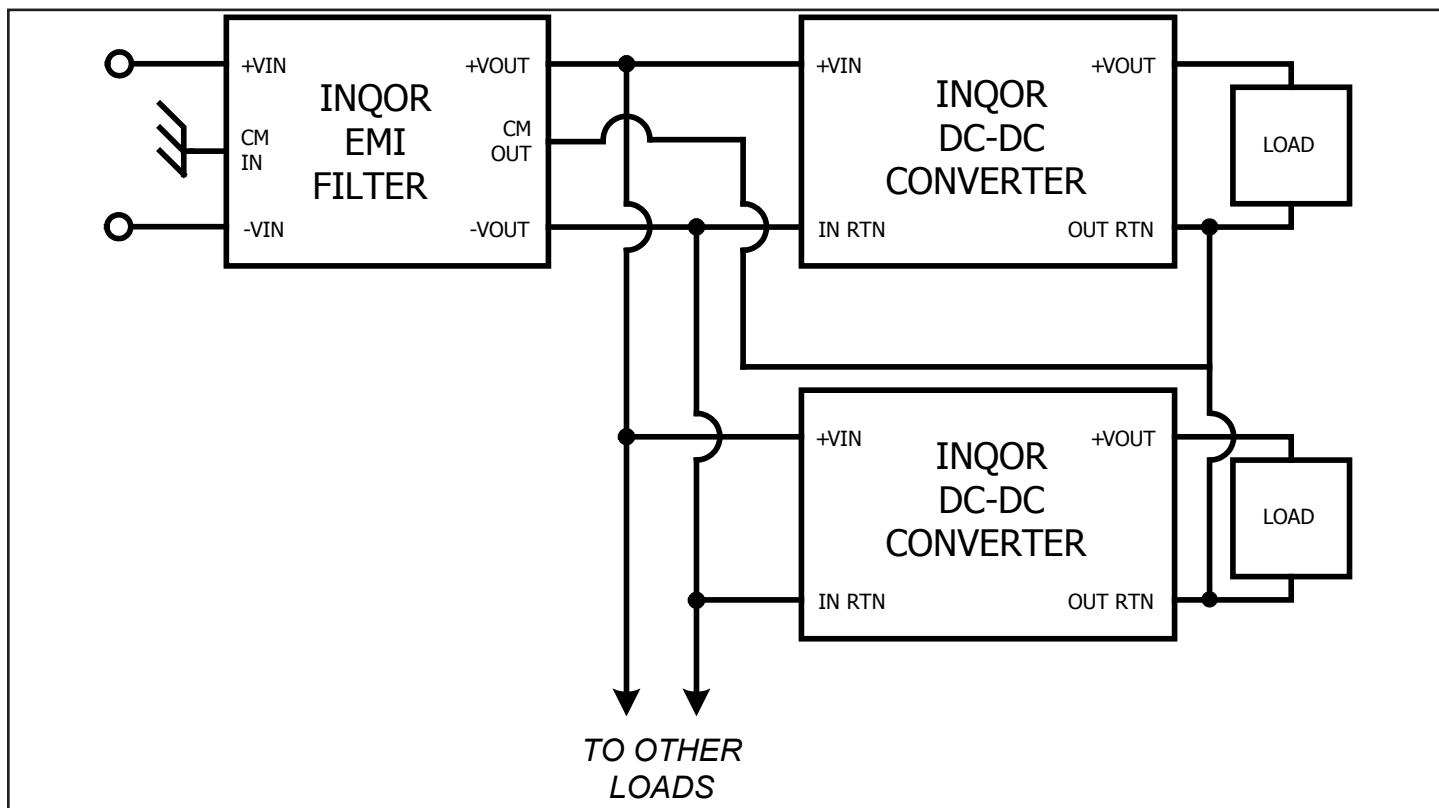
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### Fundamental Circuit Diagram



### Typical Connection Diagram



## IQ040PFQTx30 Electrical Characteristics

|Vin| ≤ ±40V, |Iout| ≤ 30A unless otherwise specified

| Parameter                                 | Min.                     | Typ.     | Max. | Units                | Notes & Conditions                            |
|---|--------------------------|----------|------|----------------------|---|
| <b>ABSOLUTE MAXIMUM RATINGS</b>           |                          |          |      |                      |   |
| Input Voltage                             |                          |          |      |                      |   |
| Continuous                                | -40                      |          | +40  | V                    |   |
| Transient (≤ 1 s)                         | -50                      |          | 50   | V                    |   |
| Isolation Voltage                         | -2250                    |          | 2250 | V dc                 | Input/output to common-mode pins              |
| Output Current                            |                          |          | 35   | A                    |   |
| Operating Case Temperature                | -40                      |          | 100  | °C                   | Baseplate temperature                         |
| Storage Case Temperature                  | -65                      |          | 135  | °C                   |   |
| Lead Temperature (20 s)                   |                          |          | 300  | °C                   |   |
| <b>RECOMMENDED OPERATING CONDITIONS</b>   |                          |          |      |                      |   |
| Input Voltage                             |                          |          |      |                      |   |
| Continuous                                | -40                      |          | +40  | V                    |   |
| Transient (≤ 1 s, Rs* = 0Ω)               | -50                      |          | 50   | V                    | * Rs = Source Impedance                       |
| Output Current (continuous)               | -30                      |          | 30   | A                    |   |
| <b>ELECTRICAL CHARACTERISTICS</b>         |                          |          |      |                      |   |
| Output Voltage (continuous)               | Vout = Vin - (Iin x Rdc) |          |      | V                    |   |
| DC Resistance Rdc                         |                          |          |      |                      | total   |
| Tcase = 25°C                              |                          |          | 15   | mΩ                   |   |
| Tcase = 100°C                             |                          |          | 20   | mΩ                   |   |
| Power Dissipation                         |                          |          |      |                      | 30A output current                            |
| Tcase = 25°C                              |                          |          | 13.5 | W                    |   |
| Tcase = 100°C                             |                          |          | 18   | W                    |   |
| Total Differential-Mode Capacitance       |                          | 220      |      | μF                   | Measured across input or output pins          |
| Total Common-Mode Capacitance             |                          | 0.15     |      | μF                   | Measured between any pin and common-mode pins |
| Bulk Capacitor                            |                          | 180      |      | μF                   |   |
| Damping Resistor                          |                          | 0.1      |      | Ω                    |   |
| Noise Attenuation                         |                          |          |      |                      | See fig 1                                     |
| Isolation Resistance                      | 100                      |          |      | mΩ                   | Any pin to common-mode pins                   |
| <b>RELIABILITY CHARACTERISTICS</b>        |                          |          |      |                      |   |
| Calculated MTBF (Telcordia) TR-NWT-000332 |                          | 28.8     |      | 10 <sup>6</sup> Hrs. | Tb = 70°C                                     |
| Calculated MTBF (MIL-217) MIL-HDBK-217F   |                          | 10.5     |      | 10 <sup>6</sup> Hrs. | Tb = 70°C                                     |
| Field Demonstrated MTBF                   |                          |          |      | 10 <sup>6</sup> Hrs. | See our website for details                   |
| <b>WEIGHT CHARACTERISTICS</b>             |                          |          |      |                      |   |
| Device Weight                             |                          | 3.53/100 |      | oz/g                 |   |

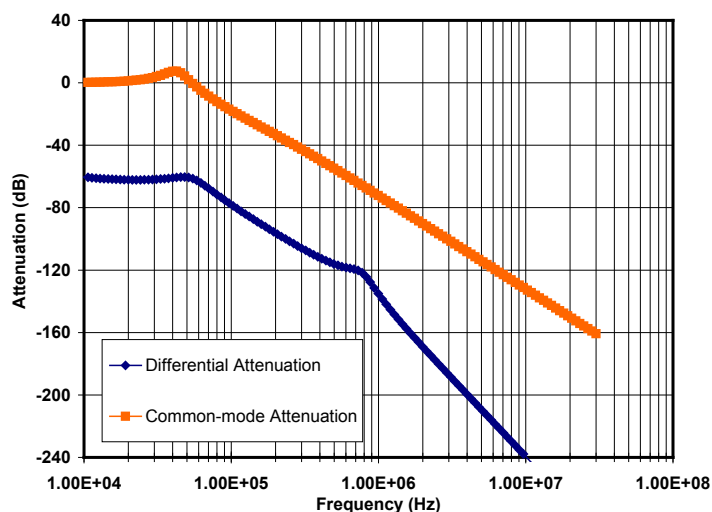
## BASIC OPERATION AND FEATURES

This module is a multi-stage differential-mode and common-mode passive EMI filter designed to interface a power source with one or more SynQor dc-dc converters (or other loads that create EMI). Each stage of this filter is well damped to avoid resonances and oscillations, and only X7R multi-layer ceramic capacitors are used.

This InQor EMI filter includes a large bulk capacitor with a series damping resistor to correct for the unstabilizing effect of a converter's negative input resistance. A white paper discussing this negative input resistance and the need for corrective damping can be found on the SynQor website (see Input System Instability application note).

A typical application would place the InQor filter close to the input of the dc-dc converter. The Input common-mode pin would be connected to the chassis ground that is common with the system input line filter or other earthed point used for EMI measurement. The output common-mode pin would be connected to the output ground or plane of the power convectors with as low inductance a path as possible. There are no connections to the metal baseplate, which may also be connected to the chassis ground if desired.

Do not connect the outputs of multiple InQor filters in parallel. Connecting filters in this manner may result in slightly unequal currents to flow in the positive and return paths of each filter. These unequal currents may cause the internal common-mode chokes to saturate and thus cause degraded common-mode rejection performance.



**Figure 1:** Typical Common Mode and Differential Mode Attenuation provided by the filter as a function of frequency. both input lines are connected to chassis ground through 50Ω resistors.



## Standards & Qualification Testing

## Technical Specification IQ040PFQTx30

| Parameter | Notes & Conditions |
|-----------|--------------------|
|-----------|--------------------|

### STANDARDS COMPLIANCE

|                      |                  |
|----------------------|------------------|
| UL 60950-1/R:2011-12 | Basic Insulation |
|----------------------|------------------|

|                                   |  |
|-----------------------------------|--|
| CAN/CSA-C22.2 No. 60950-1/A1:2011 |  |
|-----------------------------------|--|

|                     |                  |
|---------------------|------------------|
| EN 60950-1/A12:2011 | Certified by TUV |
|---------------------|------------------|

Note: An external input fuse must always be used to meet these safety requirements. Contact SynQor for official safety certificates on new releases or download from the SynQor website.

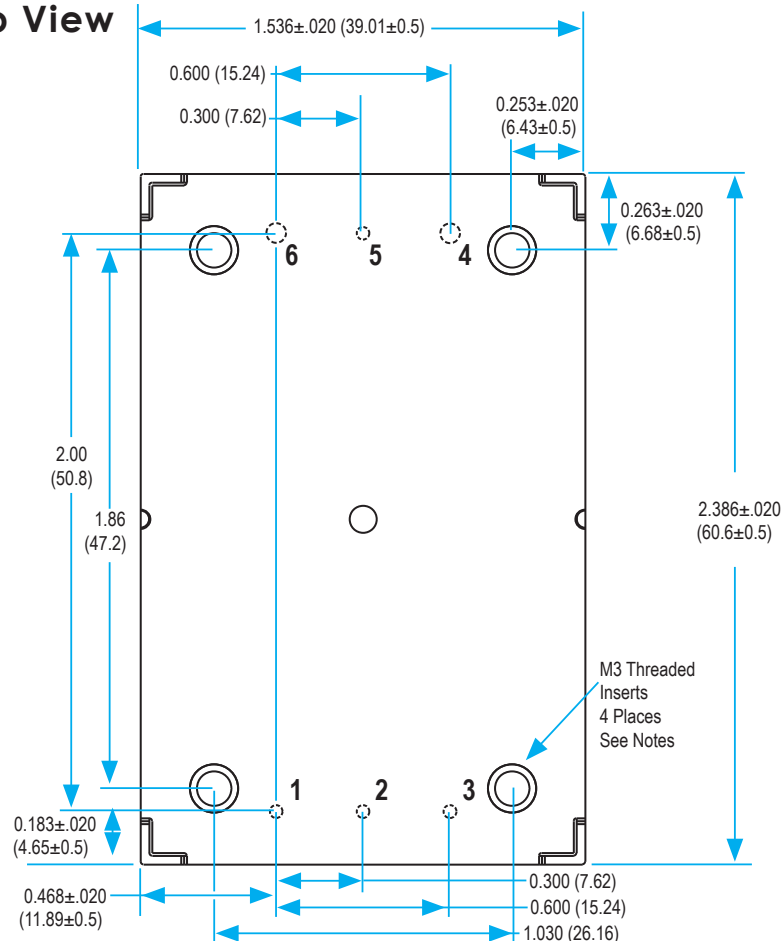
| Parameter | # Units | Test Conditions |
|-----------|---------|-----------------|
|-----------|---------|-----------------|

### QUALIFICATION TESTING

|                       |         |   |
|-----------------------|---------|---|
| Life Test             | 32      | 95% rated Vin and load, units at derating point, 1000 hours                 |
| Vibration             | 5       | 10-55 Hz sweep, 0.060" total excursion, 1 min./sweep, 120 sweeps for 3 axis |
| Mechanical Shock      | 5       | 100g minimum, 2 drops in x, y, and z axis                                   |
| Temperature Cycling   | 10      | -40 °C to 100 °C, unit temp. ramp 15 °C/min., 500 cycles                    |
| Power/Thermal Cycling | 5       | Toperating = min to max, Vin = min to max, full load, 100 cycles            |
| Design Marginality    | 5       | Tmin-10 °C to Tmax+10 °C, 5 °C steps, Vin = min to max, 0-105% load         |
| Humidity              | 5       | 85 °C, 95% RH, 1000 hours, continuous Vin applied except 5 min/day          |
| Solderability         | 15 pins | MIL-STD-883, method 2003  |
| Altitude              | 2       | 70,000 feet (21 km), see Note   |

Note: A conductive cooling design is generally needed for high altitude applications because of naturally poor convective cooling at rare atmospheres.

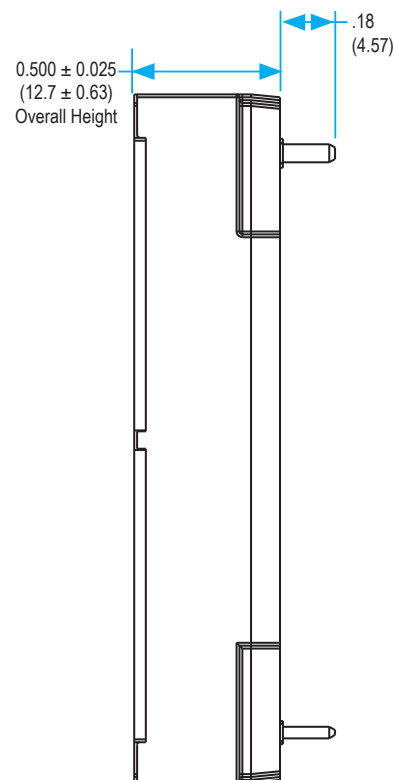
### Top View



## NOTES

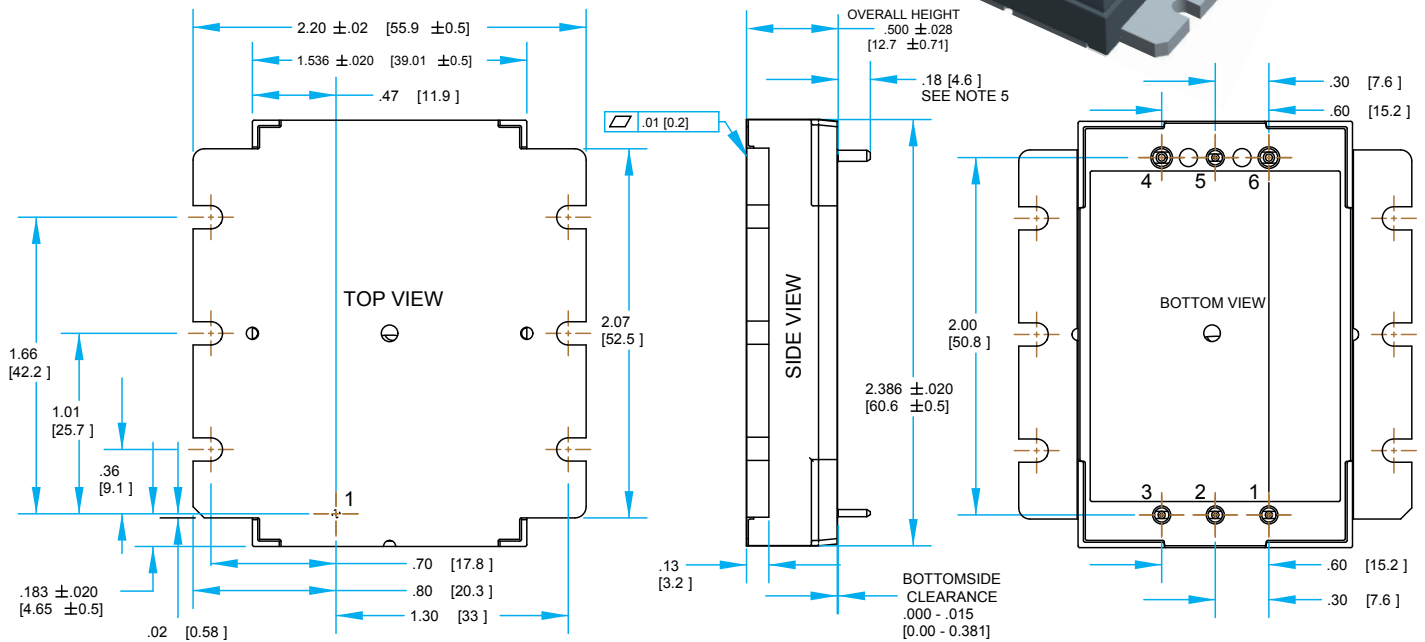
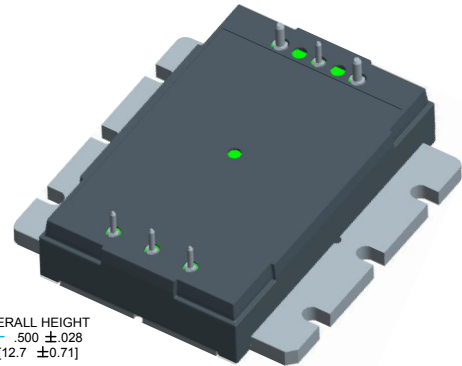
- 1) Pins 1-3 & 5 are 0.040" (1.02mm) diameter, with 0.080" (2.03mm) diameter standoff shoulders.
- 2) Pins 4 & 6 are 0.062" (1.57 mm) diameter with 0.100" (2.54mm) diameter standoff shoulders.
- 3) Recommended pin length is 0.03" (0.76 mm) greater than the PCB thickness.
- 4) All Pins: Material - Copper Alloy  
Finish: Matte Tin over Nickel plate
- 5) M3 screws used to bolt unit's baseplate to other surfaces such as heatsink must not exceed 0.100" (2.54mm) depth below the surface of the baseplate.
- 6) Applied torque per screw should not exceed 6in-lb. (0.7 Nm).
- 7) Baseplate flatness tolerance is 0.004" (.10 mm) TIR for surface.
- 8) All dimensions in inches (mm)  
Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm)  
                  x.xxx +/-0.010 in. (x.xx +/-0.25mm)
- 9) Total weight: 3.53oz (100g)
- 10) Workmanship: Meets or exceeds current IPC-A-610 Class II

### Side View



## PIN DESIGNATIONS

| Pin | Name    | Function                |
|-----|---------|-------------------------|
| 1   | Vin(+)  | Positive input voltage  |
| 2   | Com In  | Common-mode input       |
| 3   | Vin(−)  | Negative input voltage  |
| 4   | Vout(−) | Negative output voltage |
| 5   | Com Out | Common-mode output      |
| 6   | Vout(+) | Positive output voltage |



## NOTES

- 1) M3 screws used to bolt unit's baseplate to other surfaces such as heatsink must not exceed 0.100" (2.54mm) depth below the surface of the baseplate.
- 2) Baseplate flatness tolerance is 0.004" (.10mm) TIR for surface.
- 3) Pins 1-3 & 5 are 0.040" (1.02mm) Dia. with 0.080" (2.03mm)
- 4) Pins 4 & 6 are 0.062" (1.57mm) Dia. with 0.100" (2.54mm) Dia. Standoff shoulders
- 5) All Pins: Material - Copper Alloy  
Finish: Matte Tin over Nickel plate
- 6) Undimensioned components are shown for visual reference only
- 7) Weight: 3.63oz. (103g) typical
- 8) All dimensions in inches (mm)
- 9) Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm)  
x.xxx +/-0.010 in. (x.xx +/-0.25mm)

## PIN DESIGNATIONS

| Pin | Name    | Function                |
|-----|---------|-------------------------|
| 1   | Vin(+)  | Positive input voltage  |
| 2   | Com In  | Common-mode input       |
| 3   | Vin(-)  | Negative input voltage  |
| 4   | Vout(-) | Negative output voltage |
| 5   | Com Out | Common-mode output      |
| 6   | Vout(+) | Positive output voltage |



## Ordering Specifications

# Technical Specification IQ040PFQTx30

### Application Notes

A variety of application notes and technical white papers can be downloaded in pdf format from our website.

**RoHS Compliance:** The EU led RoHS (Restriction of Hazardous Substances) Directive bans the use of Lead, Cadmium, Hexavalent Chromium, Mercury, Polybrominated Biphenyls (PBB), and Polybrominated Diphenyl Ether (PBDE) in Electrical and Electronic Equipment. This SynQor product is 6/6 RoHS compliant. For more information please refer to SynQor's RoHS addendum available at our [RoHS Compliance / Lead Free Initiative web page](#) or e-mail us at [rohs@synqor.com](mailto:rohs@synqor.com).

### PATENTS

SynQor holds the following U.S. patents, one or more of which apply to each product listed in this document. Additional patent applications may be pending or filed in the future.

|           |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|-----------|
| 5,999,417 | 6,222,742 | 6,545,890 | 6,577,109 | 6,594,159 | 6,731,520 |
| 6,894,468 | 6,896,526 | 6,927,987 | 7,050,309 | 7,072,190 | 7,085,146 |
| 7,119,524 | 7,269,034 | 7,272,021 | 7,272,023 | 7,558,083 | 7,564,702 |
| 7,765,687 | 7,787,261 | 8,023,290 | 8,149,597 |           |           |

### Contact SynQor for further information and to order:

**Phone:** 978-849-0600  
**Toll Free:** 888-567-9596  
**Fax:** 978-849-0602  
**E-mail:** [power@synqor.com](mailto:power@synqor.com)  
**Web:** [www.synqor.com](http://www.synqor.com)  
**Address:** 155 Swanson Road  
Boxborough, MA 01719  
USA

### ORDERING INFORMATION

The tables below show the valid model numbers and ordering options the filters in this product family. When ordering SynQor filters, please ensure that you use the complete 15 character part number consisting of the 12 character base part number and the additional 3 characters for options. A "-G" suffix indicates the product is 6/6 RoHS compliant.

| Model Number             | Continuous Input Voltage | Max Output Current |
|--------------------------|--------------------------|--------------------|
| <b>IQ040PFQTx30SRS-G</b> | <b>-40 to +40</b>        | <b>30A</b>         |

The following options must be included in place of the **wxyz** spaces in the model numbers listed above.

| Options Description: <b>wxyz</b>       |              |            |              |
|--|--------------|------------|--------------|
| Thermal Design                         | Enable Logic | Pin Style  | Feature Set  |
| C - Encased<br>V - Encased with Flange | S - Standard | R - 0.180" | S - Standard |

Not all combinations make valid part numbers, please contact SynQor for availability. See the [Product Summary web page](#) for more options.

#### Warranty

SynQor offers a two (2) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.

Information furnished by SynQor is believed to be accurate and reliable. However, no responsibility is assumed by SynQor for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SynQor.