

## Passive EMI Filter

<b>-200 to +200V</b> Input	<b>10A</b> Output Current	<b>70mΩ @ 100°C</b> Max DC Resistance	<b>&gt;80dB @ 250kHz</b> Differential Attenuation
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Full Power Operation: -40°C to +100°C



RQ200PFQTC10SRS-G Module



The RailQor 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.

### Operational Features

- ▶ 10A output current
- ▶ Very low DC resistance
- ▶ >80dB @ 250kHz differential-mode attenuation
- ▶ >50dB @ 250kHz common-mode attenuation
- ▶ Stabilizing bulk capacitor and damping resistor included
- ▶ All capacitors are X7R multi-layer ceramic
- ▶ Meets requirements of standard EN 50155

### Mechanical Features

- ▶ Industry standard quarter-brick pin-out configuration
- ▶ Size: 1.536” x 2.386” (39.01 x 60.6mm)
- ▶ Height: 0.500” (12.7mm)
- ▶ Weight: 3.53oz (100g)

### In-Line Manufacturing Process

- ▶ AS9100 and ISO 9001 certified facility
- ▶ Full component traceability

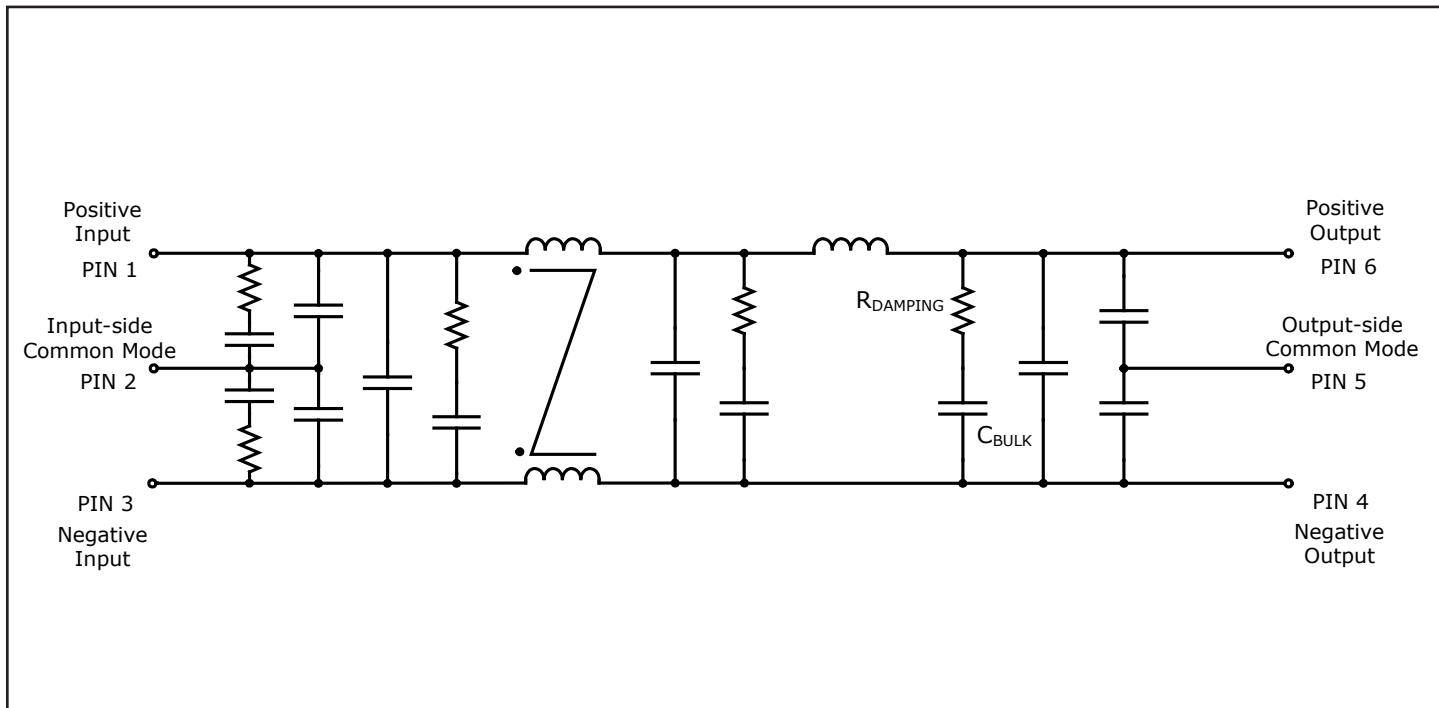
### Safety Features

- ▶ Baseplate isolation 2000Vrms, 60s per EN 50155
- ▶ UL 60950-1
- ▶ CAN/CSA C22.2 No. 60950-1
- ▶ EN 60950-1
- ▶ EN45545-2 R24/R25 Compliant
- ▶ CE Marked

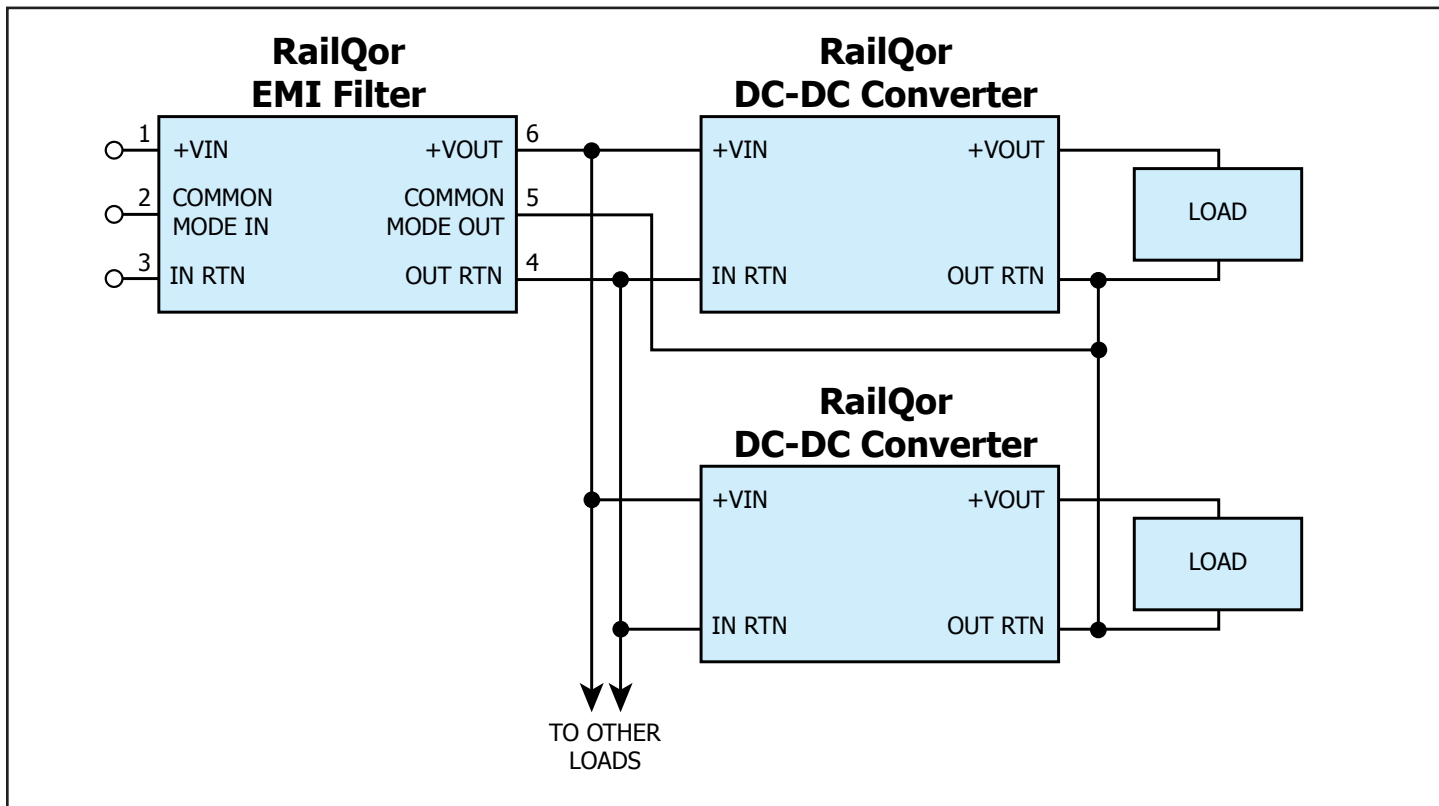
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### Fundamental Circuit Diagram



### Typical Connection Diagram



## RQ200PFQTx10 Family Electrical Characteristics

|Vin| <= 200V, |Iout| <= 10A unless otherwise specified. Specifications subject to change without notice.

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
<b>ABSOLUTE MAXIMUM RATINGS</b>					
Input Voltage					
Continuous	-200		200	V	
Transient (≤ 1 s)	-250		250	V	
Baseplate Isolation Voltage			2000	Vrms	60s per EN 50155
Common Mode Isolation Voltage	-3000		3000	Vdc	
Output Current			10	A	
Operating Case Temperature	-40		100	°C	Baseplate temperature
Storage Case Temperature	-40		135	°C	
Recommended Input Fuse			15	A	Fast acting external fuse recommended
<b>RECOMMENDED OPERATING CONDITIONS</b>					
Output Voltage (continuous)	Vout = Vin - (Iin x Rdc)			V	
DC Resistance Rdc					Total
Tcase = 25°C			56	mΩ	
Tcase = 100°C			70	mΩ	
Power Dissipation					10A output current
Tcase = 25°C			5.6	W	
Tcase = 100°C			7	W	
Total Differential-Mode Capacitance		1.760		μF	Measured across input or output pins
Total Common-Mode Capacitance		0.130		μF	Measured between any pin and common-mode pins
Bulk Capacitor		7.92		μF	
Damping Resistor		1.8		Ω	
Noise Attenuation					See Figure 1
Isolation Resistance	100			MΩ	Any pin to baseplate or common-mode pins; Tested @ 500Vdc per EN 50155
<b>RELIABILITY CHARACTERISTICS</b>					
Calculated MTBF (Telcordia) TR-NWT-000332		194		10 <sup>6</sup> Hrs.	Tb = 70°C
Calculated MTBF (MIL-217) MIL-HDBK-217F		166		10 <sup>6</sup> Hrs.	Tb = 70°C
<b>WEIGHT CHARACTERISTICS</b>					
Device Weight		3.53/100		oz/g	

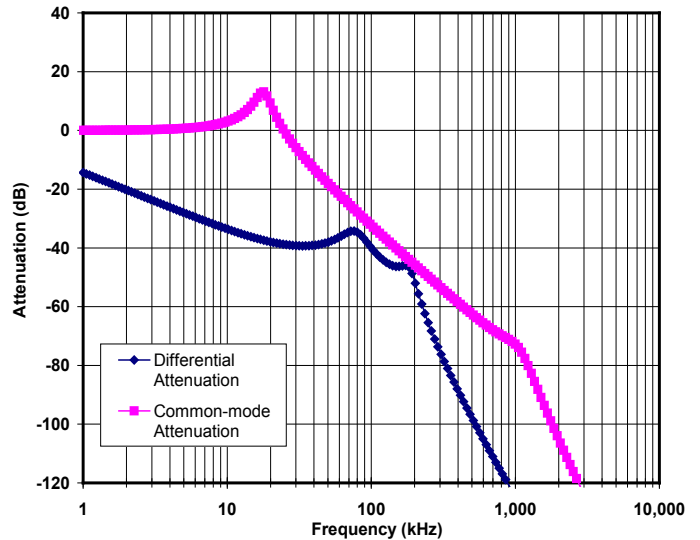
## BASIC OPERATION AND FEATURES

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.

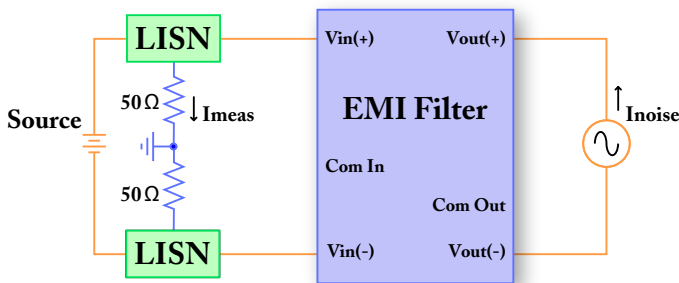
This InQor EMI filter includes a large bulk capacitor with a series damping resistor to correct for the unstabilizing effect of a converter's negative input resistance. A white paper discussing this negative input resistance and the need for corrective damping can be found on the SynQor website (see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

A typical application would place the InQor filter close to the input of the dc-dc converter. The input-side 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-side common-mode pin would be connected to the output ground or plane of the power converters 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.

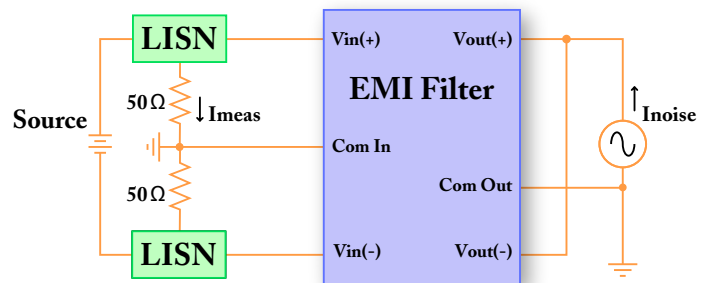
Do not connect the outputs of multiple InQor filters in parallel. Connecting filters in this manner may result in slightly unequal currents to flow in the positive and return paths of each filter. These unequal currents may cause the internal common-mode chokes to saturate and thus cause degraded common-mode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



**Figure 1:** Simulation of calculated common-mode and differential-mode current attenuation. The plots show the ratio of the measured current in a 50Ω LISN sensing port connected to pins 1 or 3 to the noise current injected into pins 4 and 6. See Figs. 2 & 3.



**Figure 2:** Differential-Mode Current Attenuation,  $I_{meas} / I_{noise}$



**Figure 3:** Common-Mode Current Attenuation,  $I_{meas} / I_{noise}$



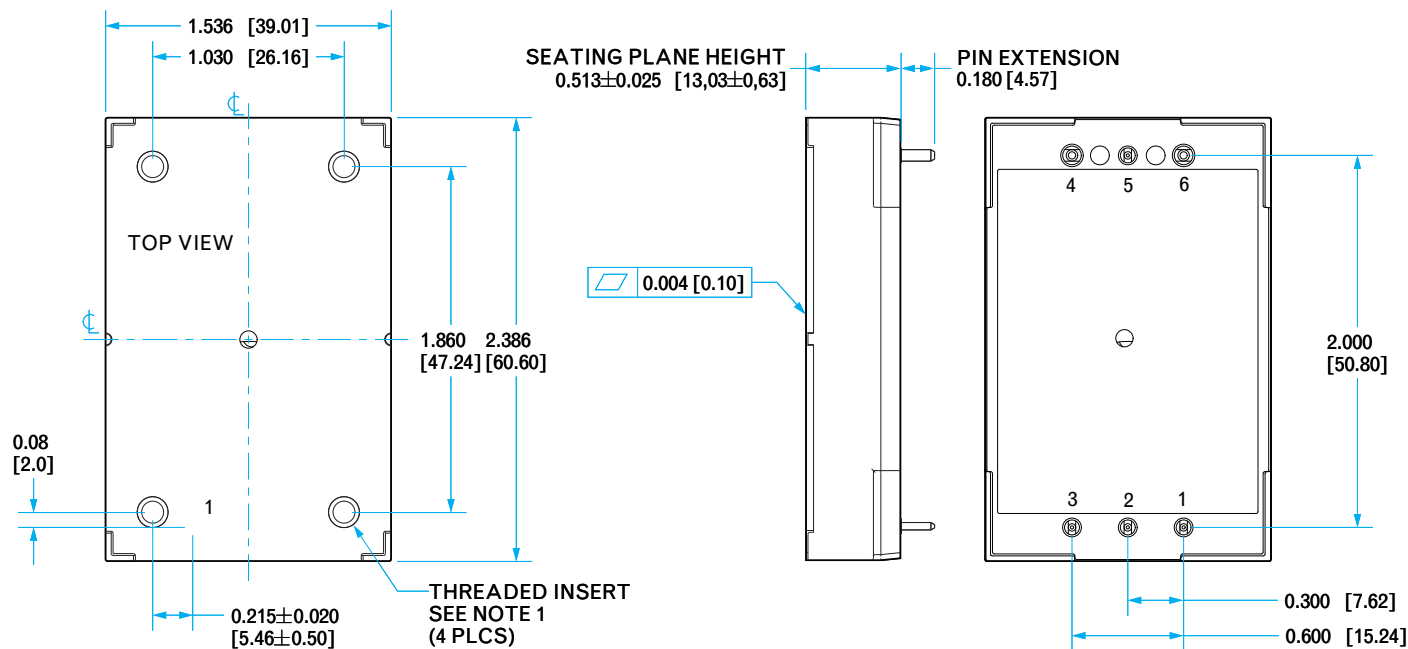
## STANDARDS COMPLIANCE

Parameter	Notes & Conditions
<b>STANDARDS COMPLIANCE</b>	
EN 60950-1	
UL 60950-1	
CAN/CSA C22.2 No. 60950-1	
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.	

## QUALIFICATION TESTING

Parameter	# Units	Test Conditions
<b>QUALIFICATION TESTING</b>		
Vibration	5	EN 61373:1999 Category I, Class B, Body mounted
Life Test	30	95% rated Vin and load, units at derating point, 1000 hours
Cold	5	EN 60068-2-1:2007
Dry Heat	5	EN 60068-2-2:2007
Mechanical Shock	5	EN 61373:1999 Category I, Class B, Body mounted
Temperature Cycling	5	-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
Damp Heat, Cyclic	5	EN 60068-2-30:2005
Solderability	15 pins	MIL-STD-883, method 2003.8

Note: Governing Standard BS EN 50155:2007 Railway applications - Electronic equipment used on rolling stock

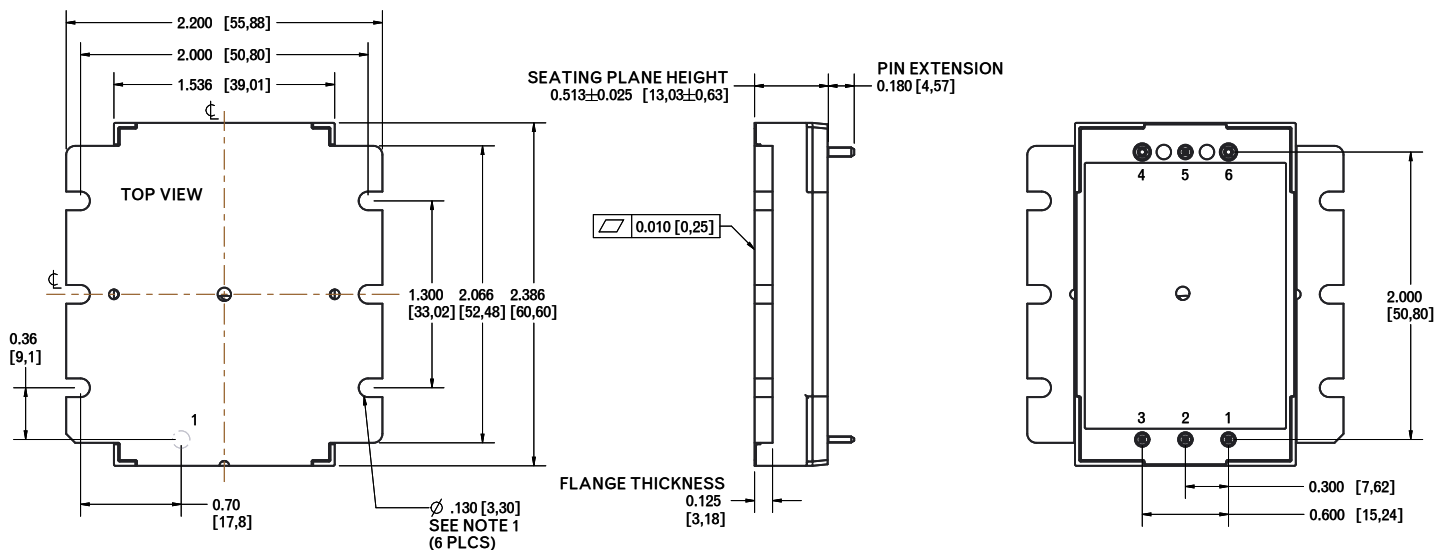


### NOTES

- Applied torque per M3 screw should not exceed 6in-lb (0.7Nm). Screw should not exceed 0.100" (2.54mm) depth below the surface of the baseplate.
- Baseplate flatness tolerance is 0.004" (.10 mm) TIR for surface.
- Pins 1-3 & 5 are 0.040" (1.02mm) diameter, with 0.080" (2.03mm) diameter standoff shoulders.
- Pins 4 & 6 are 0.062" (1.57 mm) diameter with 0.100" (2.54mm) diameter standoff shoulders.
- All Pins: Material - Copper Alloy  
Finish: Matte Tin over Nickel plate
- Undimensioned components are shown for visual reference only
- Total weight: 3.53oz (100g)
- All dimensions in inches (mm)  
Tolerances: x.xxIN +/-0.02 in. (x.xmm +/-0.5mm)  
x.xxxIN +/-0.010 in. (x.xxmm +/-0.25mm)

### PIN DESIGNATIONS

Pin	Label	Name	Function
1	+VIN	Vin(+)	Positive input voltage
2	COMMON MODE IN	Com In	Input-side common-mode
3	IN RTN	Vin(-)	Negative input voltage
4	OUT RTN	Vout(-)	Negative output voltage
5	COMMON MODE OUT	Com Out	Output-side common-mode
6	+VOUT	Vout(+)	Positive output voltage



### NOTES

- Applied torque should not exceed 6in-lb (0.7Nm)
- Baseplate flatness tolerance is 0.010" (.25mm) TIR for surface.
- Pins 1-3 & 5 are 0.040" (1.02mm) Dia. with 0.080" (2.03mm) Standoff shoulders
- Pins 4 & 6 are 0.062" (1.57mm) Dia. with 0.100" (2.54mm) Dia. Standoff shoulders
- All Pins: Material - Copper Alloy  
  
Finish: Matte Tin over Nickel plate
- Undimensioned components are shown for visual reference only
- Weight: 3.74oz. (106g) typical
- All dimensions in inches (mm)  
  
Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm)  
x.xxx +/-0.010 in. (x.xx +/-0.25mm)

### PIN DESIGNATIONS

Pin	Label	Name	Function
1	+VIN	Vin(+)	Positive input voltage
2	COMMON MODE IN	Com In	Input-side common-mode
3	IN RTN	Vin(-)	Negative input voltage
4	OUT RTN	Vout(-)	Negative output voltage
5	COMMON MODE OUT	Com Out	Output-side common-mode
6	+VOUT	Vout(+)	Positive output voltage

### 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).

### 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
RQ200PFQTx10SRS-G	-200 to +200V	10A

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

Thermal Design	Enable Logic	Pin Style	Feature Set
<b>x</b>			
C - Encased 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.

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

Phone: 978-849-0600

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

### WARRANTY

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

### PATENTS

SynQor holds numerous U.S. patents, one or more of which apply to most of its power conversion products. Any that apply to the product(s) listed in this document are identified by markings on the product(s) or on internal components of the product(s) in accordance with U.S. patent laws. SynQor's patents include the following:

7,765,687    7,787,261

8,149,597    8,644,027