SynQor®

Rail transportation isolated DC-DC Converters

RailQor®

Railway Power Supply

DC-DC Converter Key Performance Highlights

SynQor's RailQor® line of DC-DC converters is designed to provide isolated DC power in the transportation industry for such electronics as LED displays, audio amplifiers, safety monitors, lighting, and communications systems under the European Standard EN 50155. These converters use SynQor's synchronous rectifier based technology to achieve extremely efficient industry leading performance. Due to the difficult environmental conditions the transportation market poses on power supplies, SynQor has designed the RailQor line for optimal performance in the most demanding applications.

RailQor Input/Output Ratings

Family	VOUT	3.3V	5V	12V	15V	24V	48V	56V	Package Size / Power Level
2:1 Input Ratio		**72V (42V - 110V) Continuous Input Range, (150V Transient, QT and HP only)**							
RQ72	Max. Iout / Power Out		10A / 50W	4.1A / 49W	3.3A / 50W	2A / 48W			Quarter-brick / Mega
			25A / 125W	12A / 144W	10A / 150W	6A / 144W	3A / 144W		Quarter-brick / Tera
			46A / 230W	21A / 252W	17A / 255W	10.4A / 250W	5.2A / 250W		Half-brick / Peta
2:1 Input Ratio		**110V (66V - 160V) Continuous Input Range, 200V Transient**							
RQ1B	Max. Iout / Power Out	15A / 50W	10A / 50W	4.1A / 49W	3.3A / 50W	2A / 48W	1A / 48W		Quarter-brick / Mega
			20A / 100W	8.4A / 101W		4.2A / 101W	2.1A / 101W		Quarter-brick / Giga
		30A/99W	25A / 125W	12A / 144W	10A / 150W	6A / 144W	3A / 144W	3A / 168W	Quarter-brick / Tera
			48A / 240W	21A / 252W	17A / 255W	10A / 240W	5.2A / 250W		Half-brick / Peta
			60A / 300W	27A / 324W	27A / 326W	13.6A / 326W	6.8A / 326W		Half-brick / Exa
			60A / 300W	42A / 504W	33A / 495W	21A / 504W	10A / 480W		Half-brick / Zeta
4:1 Input Ratio		**18V (9V - 36V) Continuous Input Range, 40V Transient**							
RQ18	Max. Iout / Power Out		10A / 50W	4.1A / 49W	3.3A / 50W	2A / 48W			Quarter-brick / Mega
			20A / 100W	8.0A / 96W	7.0A / 105W	4A / 96W	2A / 96W		Quarter-brick / Tera
			36A / 180W	15A / 180W	12A / 180W	7.5A / 180W	3.7A / 178W		Half-Brick / Peta
4:1 Input Ratio		**36V (18V - 75V) Continuous Input Range, 80V Transient**							
RQ36	Max.		10A / 50W	4.1A / 49W	3.3A / 50W	2A / 48W	1A / 48W		Quarter-brick / Mega
4:1 Input Ratio		**90V (34V - 160V) Continuous Input Range, 200V Transient**							
RQ90	Max. Iout / Power Out		10A / 50W	4.2A / 50W	3.3A / 50W	2.1A / 50W	1A / 48W		Quarter-brick / Mega
			24A / 120W	10A / 120W	8A / 120W	5A / 120W	2.5A / 120W		Quarter-brick / Tera
			40A / 200W	19A / 228W	15A / 225W	9.5A / 228W	4.6A / 221W		Half-brick / Peta
		13.8Vout – 21.7A / 300W (40V - 160V Continuous, 200V Transient)							Half-brick / Exa
12:1 Input Ratio		**68V (12V - 155V) Continuous Input Range, 170V Transient**							
RQ68	Max. Iout / Power Out		5.3A / 26W	2.2A / 27W	1.8A / 27W	1.1A / 26W			Quarter-brick / Mega
			10.6A / 53W	4.4A / 53W	3.5A / 53W	2.2A / 53W			Half-brick / Giga
			20A / 100W	8.4A / 101W	6.7A / 101W	4.2A / 101W	2.1A / 101W		Half-brick / Exa
			30A / 150W	12.5A / 150W	10A / 150W	6A / 144W	3A / 144W		Half-Brick / Zeta

Family	Output Voltage	40V	Package Size / Power Level
2:1 Input Ratio		**24V (18V - 45V) Continuous Input Range, 50V Transient**	
RQ24	Max. Iout / Power Out	12.5A / 500W	Half-brick Zeta

EN50155 Requirements and RailQor Features

RailQor Capabilities			
Input Ratio	Family	Continuous Input	Transient Input
2:1	**RQ72**	42V– 110V	42V – 150V (1s)
2:1	**RQ1B**	66V– 160V	66V – 200V (1s)
4:1	**RQ18**	9V– 36V	9V – 40V (1s)
4:1	**RQ36**	18V– 75V	18V – 80V (1s)
4:1	**RQ90**	34V– 160V	34V – 200V (1s)
12:1	**RQ68**	12V– 155V	12V – 170V (1s)

EN50155 Requirements		
Nominal	Continuous Input	Transient Input
72V	50V – 90V	43V – 101V
110V	77V – 137V	66V – 160V
24V	17V – 30V	14V – 34V
72V – 110V	50V – 137V	43V – 160V
24V – 110V	17V – 137V	14V – 160V

Applications

Video Surveillance Systems

Cabin Electrical Equipment

LED Information Displays

Door Control

Entertainment Systems

Wireless & Radio Communications

Internal & External Lighting

Access & Ticketing Machines

Braking Control

Motor Drive Controllers

Embedded Computer Systems

Technical Support

SynQor understands the need for rapid development of new projects in the transportation industry and provides excellent support for new designs incorporating the RailQor product lines. Concerns regarding EN 50155 compliance, transient and surge suppression to meet RIA 12, design for optimal thermal performance and other techniques are described in our RailQor datasheets and in technical papers available at ***www.synqor.com***.

RailQor DC Converter Part Numbering Guide

Family	Cont. Vin	Output Voltage	Package Size	Series	Thermal Design	Max. Output Current	Enable Logic	Pin Length	Features
RQ	**18:** 9 - 36V **24:** 18 - 45V **36:** 18 - 75V **68:** 12 -155V **72:** 42 -110V **90:***34-160V **1B:** 66 -160V	**033:** 3.3V **050:** 5V **120:** 12V **138:** 13.8V **150:** 15V **240:** 24V **480:** 48V **560:** 56V	**Q:** Quarter-brick **H:** Half-brick	**G:** Giga **M:** Mega **P:** Peta **T:** Tera **E:** Exa **Z:** Zeta	**C:** Encased **D:** Encased, Non-threaded Baseplate **V:** Encased, Flanged Baseplate	**60:** 60A **48:** 48A **46:** 46A **36:** 36A **25:** 25A **21:** 21A **15:** 15A **12:** 12A **10:** 10A **08:** 8A **07:** 7A **06:** 6A **05:** 5A **04:** 4A **02:** 2A **01:** 1A	**N:** Negative	**R:** 0.180"	**S:** Standard **F:** Full Feature (HE/HZ only)

Part Numbering Example: RQ90050QMC10NRF-G For valid part numbers, refer to the website or contact your local sales representative or distributor.
*RQ90138HEx22 Only Vin Range 40 - 160V.

RailQor DC Filter Part Numbering Guide

Family	Cont. Vin	Filter Type	Package Size	Series	Thermal Design	Max. Output Current	Options Description		
							Enable Logic	Pin Length	Features
RQ	**200:**±200V	**PF:** Passive Filter	**Q:** Quarter Brick	**T:** Tera	**C:** Encased **V:** Flanged Baseplate	**10:** 10A	**S:** Standard	**R:** 0.180"	**S:** Standard

Part Numbering Example: RQ200PFQTC10NRS-G For valid part numbers, refer to the website or contact your local sales representative or distributor.

Model Number	Input Voltage		Max. Output Current	Isolation Voltage (to common-mode / baseplate)	Maximum DC Resistance @ 100°C	Differential-Mode Attenuation	Common-Mode Attenuation
	Continuous	Surge (<100ms)					
RQ200PFQTx10	±200V	±250V	10A	3000V	70mΩ	>80dB @ 250kHz	>50dB @ 250kHz

RailQor Qualification Testing

Testing Type	Units	Test Conditions
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 60068-2-3:2005**
Solderability	**15**	**Pins MIL-STD-883, method 2003**

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

Product Features

The RailQor converter series is composed of next-generation, board-mountable, isolated, fixed switching frequency DC-DC converters that use synchronous rectification to achieve extremely high power conversion efficiency, even at low output power levels. The Quarter-brick 25W-50W Mega Series power dissipation is so low that no heatsink is necessary to operate at 85°C in an enclosed environment without airflow. Each module is supplied completely encased to provide protection from the harsh environments seen in many industrial and transportation applications.

OPERATIONAL

- High efficiency at full load up to 93%
- Quarter-brick 25-50W Mega Series has no derating in environments with zero airflow and ambient temperatures up to 85°C with no heatsink.
- Input voltage ranges: 9-36V, 18-45V, 18-75V, 12-155V, 42V-110V, 34V-160V and 66V-160V
- Input voltage ranges fully cover the requirements of EN 50155
- Full power operation at baseplate temperature range from -40°C to 100°C.
- Output power up to 500W
- Fixed frequency switching, low output noise
- No minimum load requirement
- Encased module to provide protection from harsh environments and available with optional flanged style baseplate.

MECHANICAL

- Industry standard pin-out configuration
- Flanged baseplate available
- Industry standard footprint:
  Half-brick: 2.4" x 2.5"
  Quarter-brick: 1.5" x 2.4"

PROTECTION/CONTROL

- Input under-voltage lockout
- Output current limit and short circuit protection
- Active back bias limit prevents damage to converter
- Output over-voltage protection
- Thermal shutdown

GENERAL SPECIFICATIONS

- Operating Temperature -40ºC to +100ºC
- Output Voltage Set Point ±1.0%
- Output Voltage Ripple <1% of Vout (typ.)
- Switching Frequency 240 - 350kHz
- Transient Response <7% of Vout (typ.)
- Output Voltage Trim Range +10% to -20%
- Isolation Voltage Up to 2000Vrms
- EN50155 Compliance
- RIA 12 Compliance with external circuit

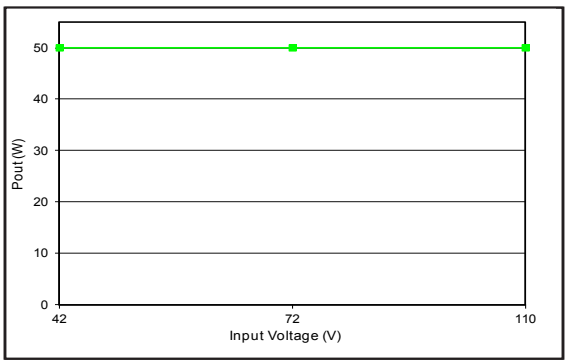
SAFETY

RQ1B, RQ72, RQ68 & RQ90

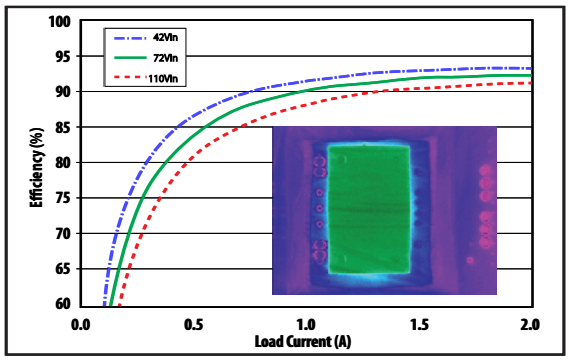
- Up to 2000Vrms, 100MΩ input-to-output isolation
- CAN/CSA C22.2 NO. 60950-1
- UL 60950-1
- EN 60950-1
- EN45545-2 R24/R25 Compliant
- CE marked

RQ18, RQ24, RQ36

- 1500Vrms, 100MΩ input-to-output isolation
- CAN/CSA C22.2 NO. 60950-1
- UL 60950-1
- EN 60950-1
- EN45545-2 R24/R25 Compliant



Typical RailQor quarter-brick 50W encased converter (no heatsink) maximum output power derating over input voltage at 85°C and natural convection airflow.



Efficiency at nominal output voltage vs. load current for minimum, nominal, and maximum input voltages at 25°C of a typical RailQor quarter-brick 50W converter.

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MADE IN USA

RailQor Application Notes

- ***"RailQor EN 50155 / RIA-12 Compliance & Evaluation Board Application Note"*** – Addresses the input voltage requirements of the European Railway Standards EN50155 and RIA-12 and how to meet them using SynQor's RailQor DC-DC converters. The RailQor converters are designed to meet or exceed EN50155 input static and transient DC voltage requirements. Since some equipment is being designed to also comply with RIA-12 surges and transients, those requirements are discussed as well, along with the supplemental circuitry needed to meet those requirements.
- ***"EMI Characteristics"***
  - An overview of EMI with suggestions for external filtering solutions and suggested layout and grounding practices.
- ***"Input System Instability"***
  - Describes the phenomena of input instability in DC-DC converters and the preferred solution for correcting it.

RailQor Datasheet Application Information

- How to lay out a board for optimal thermal performance with RailQor product
- Circuits for driving the enable pin
- How to trim the converter to compensate for resistive drops between supply and load