Technical Specification
PQ60120SMx04

35-75V	100V	12V	48W	2250V dc	Sixteenth-Brick
Input	Transient Input	Output	Max Power	Isolation	DC-DC Converter

The PQ60120SML04 PowerQor® Mega sixteenth brick converter is a next-generation, board-mountable, isolated, fixed switching frequency DC-DC converter that uses synchronous rectification to achieve extremely high conversion efficiency. The power dissipated by the converter is so low that a heatsink is not required, which saves cost, weight, height, and application effort. All of the power and control components are mounted to the multi-layer PCB substrate with high-yield surface mount technology. Since the PowerQor converter has no explicit thermal interfaces, it is extremely reliable. RoHS compliant (see page 15).

PQ60120SMx04 Module

Operational Features

- High efficiency, 87% at full rated load current
- Delivers up to 48W of output power with minimal derating
- Operating input voltage range: 35-75Vdc, with 100V for 100ms input transient capability
- Fixed frequency switching provides predictable EMI
- No minimum load requirement

Mechanical Features

- Industry standard Sixteenth-brick pin-out configuration
- Size: 0.95" x 1.35" (24.1 x 34.3 mm)
- Height: .327" (8.3mm) low profile and .397" (10.1mm) standard
- Weight: .476oz (13.5g)

Safety Features

- UL 60950-1/R2011-12
- EN60950-1/A2:2013
- CAN/CSA-C22.2 No. 60950-1/A1:2011

Protection Features

- Input under-voltage lockout
- Output current limit and short circuit protection
- Active back bias limit

Control Features

- On/Off control referenced to input side (positive and negative logic options are available)
- Remote sense for the output voltage compensates for output distribution drops
- Output voltage trim permits custom voltages and voltage margining

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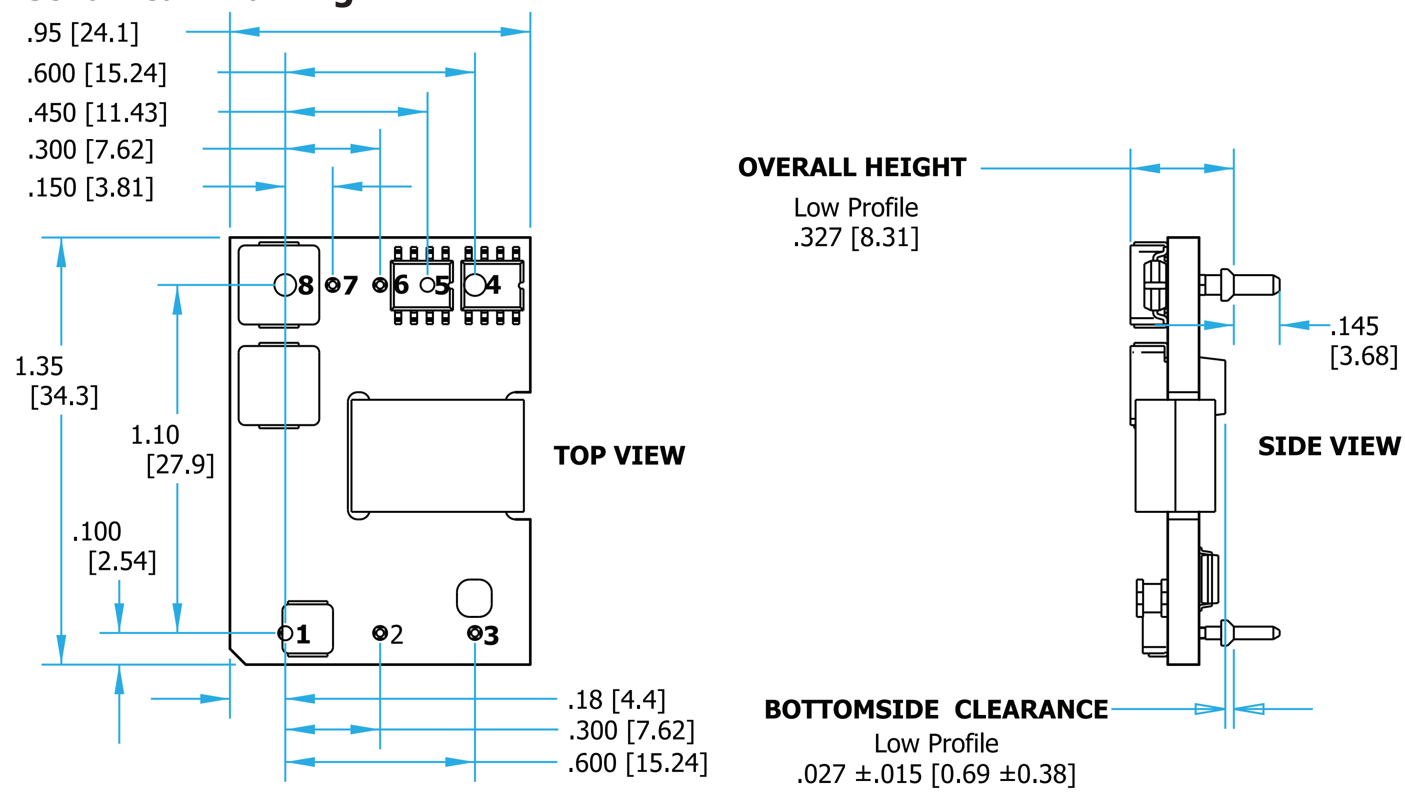
Mechanical Drawing



NOTES

1) Pins 1-3, 5-7 are 0.040" (1.02mm) diameter, with 0.080" (2.03mm) diameter standoff shoulders.
2) Pins 4 and 8 are 0.062" (1.57 mm) diameter with 0.100" (2.54 mm) diameter standoff shoulders.
3) Other pin extension lengths available. Recommended pin length is 0.03" (0.76mm) greater than the PCB thickness.
4) All Pins: Material - Copper Alloy- Finish (RoHS 6/6) - Matte Tin over Nickel plate
5) Undimensioned components are shown for visual reference only.
6) All dimensions in inches (mm) Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm)
7) Weight: .476oz (13.5g)
8) Workmanship: Meets or exceeds IPC-A-610C Class II
9) Open frame units have flanged pins are designed to permit surface mount soldering (avoid wave solder) using PiP technique.

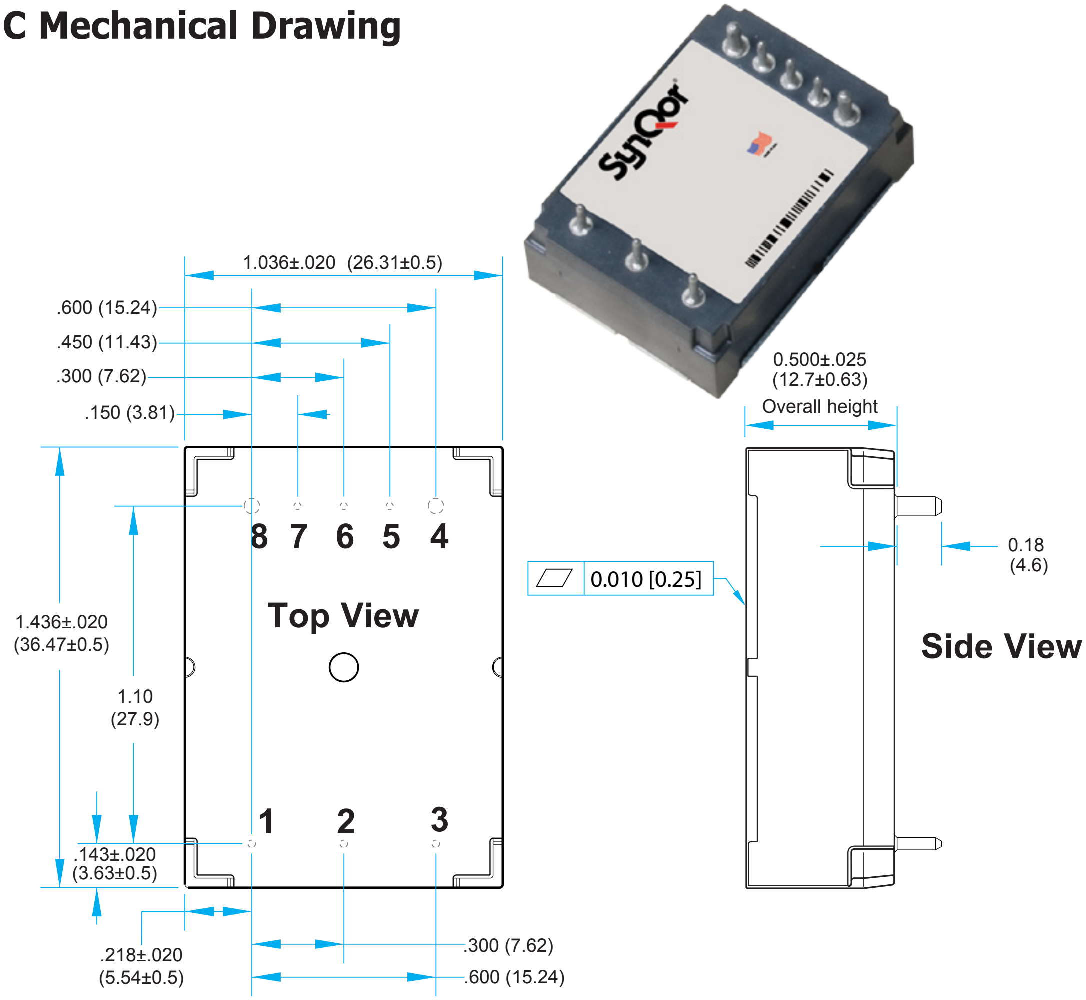
PIN DESIGNATIONS

Pin	Name	Function
1	Vin(+)	Positive input voltage
2	ON/OFF	TTL input to turn converter on and off, referenced to Vin(–), with internal pull up.
3	Vin(–)	Negative input voltage
4	Vout(–)	Negative output voltage
5	SENSE(–)	Negative remote sense(see note 1)
6	TRIM	Output voltage trim (see note 2)
7	SENSE(+)	Positive remote sense (see note 3)
8	Vout(+)	Positive output voltage

Notes:

1) SENSE(–) should be connected to Vout(–) either remotely or at the converter.
2) Leave TRIM pin open for nominal output voltage.
3) SENSE(+) should be connected to Vout(+) either remotely or at the converter.

PQ60-SMC Mechanical Drawing



NOTES

1) Pins 1-3, 5-7 are 0.040” (1.02mm) diameter, with 0.080” (2.03mm) diameter standoff shoulders.
2) Pins 4 and 8 are 0.062” (1.57 mm) diameter with 0.100" (2.54 mm) diameter standoff shoulders.
3) Other pin extension lengths available. Recommended pin length is 0.03” (0.76mm) greater than the PCB thickness.
4) All Pins: Material - Copper Alloy- Finish (RoHS 6/6) - Matte Tin over Nickel plate
5) Undimensioned components are shown for visual reference only.
6) All dimensions in inches (mm) Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm)
7) Weight: 1.14oz (32.3g)
8) Workmanship: Meets or exceeds IPC-A-610C Class II

PIN DESIGNATIONS

Pin	Name	Function
1	Vin(+)	Positive input voltage
2	ON/OFF	TTL input to turn converter on and off, referenced to Vin(–), with internal pull up.
3	Vin(–)	Negative input voltage
4	Vout(–)	Negative output voltage
5	SENSE(–)	Negative remote sense(see note 1)
6	TRIM	Output voltage trim (see note 2)
7	SENSE(+)	Positive remote sense (see note 3)
8	Vout(+)	Positive output voltage

Notes:
1) SENSE(–) should be connected to Vout(–) either remotely or at the converter.
2) Leave TRIM pin open for nominal output voltage.
3) SENSE(+) should be connected to Vout(+) either remotely or at the converter.

PQ60120SML04 ELECTRICAL CHARACTERISTICS

Ta = 25 °C, airflow rate = 300 LFM, Vin = 48V dc unless otherwise noted; full operating temperature range is -40 °C to +100 °C ambient temperature with appropriate power derating. Specifications subject to change without notice.

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Non-Operating			100	V	Continuous
Operating			80	V	Continuous
Operating Transient Protection			100	V	100ms transient
Isolation Voltage					
Input to Output			2250	V dc	Input to output
Operating Temperature	-40		100	°C	
Storage Temperature	-45		125	°C	
Voltage at ON/OFF input pin	-2		8	V	
INPUT CHARACTERISTICS					
Operating Input Voltage Range	35	48	75	V	
Input Under-Voltage Lockout					
Turn-On Voltage Threshold	31.2	32.5	33.8	V	
Turn-Off Voltage Threshold	28.9	30.5	32.2	V	
Lockout Voltage Hysteresis		2.0		V	
Maximum Input Current			1.7	A	100% Load, Vin min, nominal Vout
No-Load Input Current	0	60	80	mA	
Disabled Input Current		10	14	mA	
Response to Input Transient		90		mV	1000V/ms input transient
Input Reflected Ripple Current		3		mA	RMS thru 10µH inductor; Figures 13 & 15
Input Terminal Ripple Current		45		mA	RMS; Figures 13 & 14
Recommended Input Fuse			20	A	
Recommended External Input Capacitance		100		µF	Typical ESR 0.1-0.2 Ω
Input Filter Component Values (L\C)		1.0/2.35		µH/µF	Internal values; see Figure E
OUTPUT CHARACTERISTICS					
Output Voltage Set Point	11.88	12	12.12	V	
Output Voltage Regulation					
Over Line		±0.1/12	+0.30/36	%mV	
Over Load		±0.1/12	+0.3/36	%mV	
Over Temperature	-180		180	mV	
Total Output Voltage Range	11.700		12.300	V	Over sample, line, load, temperature & life
Output Voltage Ripple and Noise					20 MHz bandwidth; Figures 13 & 16; see Note 1
Peak-to-Peak		50	100	mV	Full load
RMS		10	20	mV	Full load
Operating Output Current Range	0		4	A	Subject to thermal derating; Figures 5 - 8
Output DC Current-Limit Inception	4.4	4.9	5.2	A	Figure 17
Back-Drive Current Limit while Enabled		2.5		A	Negative current drawn from output
Back-Drive Current Limit while Disabled		2		mA	Negative current drawn from output
Maximum Output Capacitance Ceramic			1.2	mF	Vout nominal at full load (resistive load); See Note 2
EFFICIENCY					
100% Load		87		%	See Figure 1 for efficiency curve
50% Load		85		%	See Figure 1 for efficiency curve

Note 1: For applications requiring reduced output voltage ripple and noise, consult SynQor applications support (email: support@synqor.com)

Note 2: Recommended minimum output capacitance is 100uF

PQ60120SML04 ELECTRICAL CHARACTERISTICS

Ta = 25 °C, airflow rate = 300 LFM, Vin = 48V dc unless otherwise noted; full operating temperature range is -40 °C to +100 °C ambient temperature with appropriate power derating. Specifications subject to change without notice.

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
DYNAMIC CHARACTERISTICS					
Input Voltage Ripple Rejection		-55		dB	120 Hz; Figure 20
Output Voltage during Load Current Transient					
Step Change in Output Current (0.1 A/µs)		200		mV	50% to 75% to 50% Iout max; Figure 11
Step Change in Output Current (2 A/µs)		125		mV	50% to 75% to 50% Iout max; Figure 12
Settling Time		200		µs	To within 1% Vout nom
Turn-On Transient					
Turn-On Time		35		ms	Full load, Vout=90% nom.
Start-Up Inhibit Time	180	200	250	ms	Figure F; See Note 1
First Startup Delay:		2		ms	
Output Voltage Overshoot		0		%	Max output capacitance and full load
ISOLATION CHARACTERISTICS					
Isolation Voltage (dielectric strength)		2250			
Isolation Resistance		30		MΩ	
Isolation Capacitance (input to output)		1000		pF	See Note 2
TEMPERATURE LIMITS FOR POWER DERATING CURVES					
Semiconductor Junction Temperature			125	°C	Package rated to 150 °C
Board Temperature			125	°C	UL rated max operating temp 130 °C
Transformer Temperature			125	°C	See Figure 2 for derating curve
FEATURE CHARACTERISTICS					
Switching Frequency	315	350	385	kHz	
ON/OFF Control (Option P)					
On-State Voltage	2.4		8	V	
Off-State Voltage	-2		0.8	V	
ON/OFF Control (Option N)					
On-State Voltage	-2		0.8	V	
Off-State Voltage	2.4		8	V	
ON/OFF Control (Either option)					Figures A & B
Pull-Up Voltage	4.5	5	5.5	V	
Pull-Up Resistance		10		kΩ	
Output Voltage Trim Range	-10		10	%	Measured across Pins 8 & 4; Figure C
Output Voltage Remote Sense Range			10	%	Measured across Pins 8 & 4
Output Over-Voltage Protection	14.3	15	16.2	V	Over full temp range
Over-Temperature Shutdown OTP Trip Point		125		°C	Average PCB Temperature; Auto Recovery
Over-Temperature Shutdown Restart Hysteresis		10		°C	
RELIABILITY CHARACTERISTICS					
Calculated MTBF (Telcordia) TR-NWT-000332		3.9		10^6 Hrs.	
Calculated MTBF (MIL-217) MIL-HDBK-217F		3.5		10^6 Hrs.	
Field Demonstrated MTBF				10^6 Hrs.	See our website for details

Note 1: Maximum value is 400ms for DC current limit and short circuit fault conditions

Note 2: Higher values of isolation capacitance can be added external to the module.

PQ60120SMx04 Standards & Qualification Testing

Parameter	Notes & Conditions
STANDARDS COMPLIANCE	
UL 60950-1/R2011-12	Basic insulation
EN60950-1/A2:2013	
CAN/CSA-C22.2 No. 60950-1/A1:2011	

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

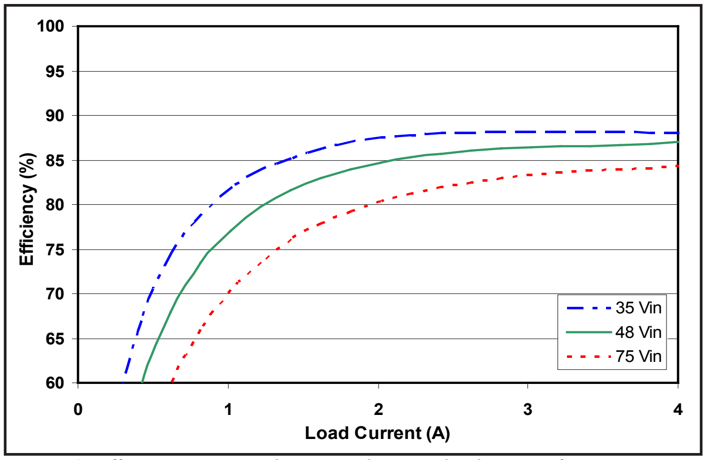


Figure 1: Efficiency at nominal output voltage vs. load current for minimum, nominal, and maximum input voltage at 25°C.

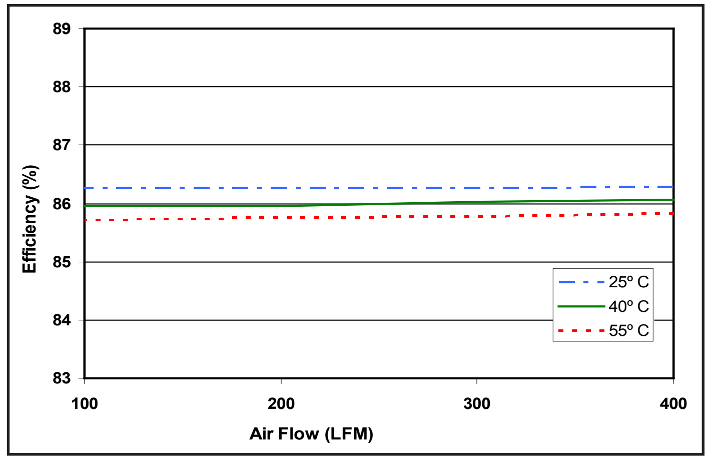


Figure 2: Efficiency at nominal output voltage and 60% rated power vs. airflow rate for ambient air temperatures of 25°C, 40°C, and 55°C (nominal input voltage).

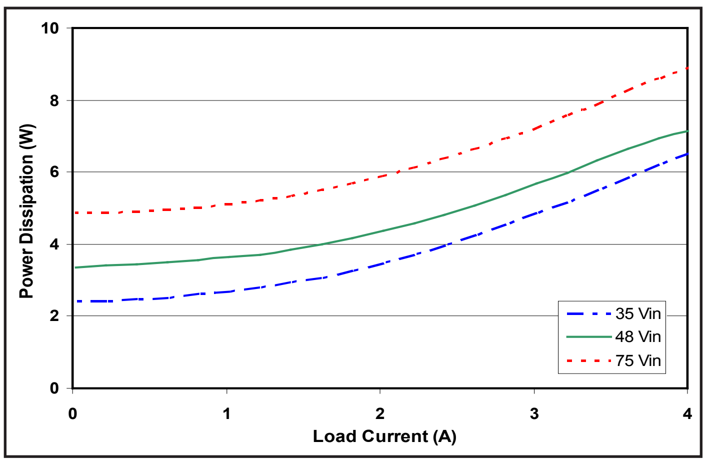


Figure 3: Power dissipation at nominal output voltage vs. load current for minimum, nominal, and maximum input voltage at 25°C.

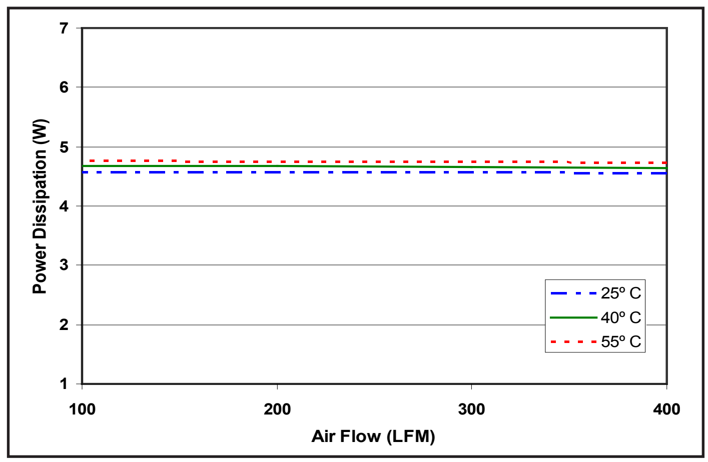


Figure 4: Power dissipation at nominal output voltage and 60% rated power vs. airflow rate for ambient air temperatures of 25°C, 40°C, and 55°C (nominal input voltage).

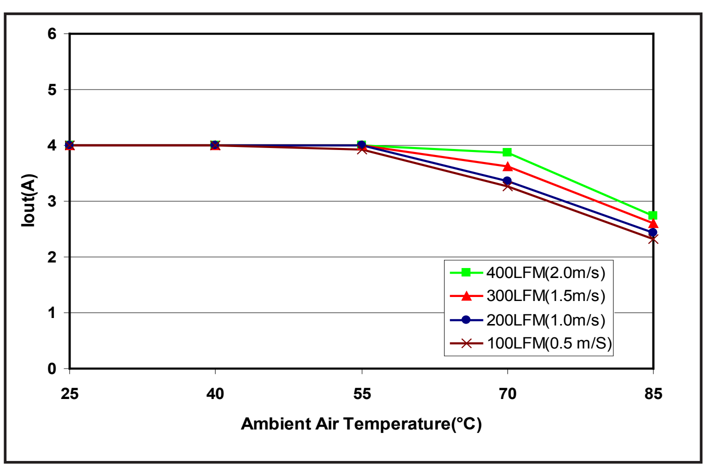


Figure 5: Maximum output power derating curves vs. ambient air temperature for airflow rates of 100 LFM through 400 LFM with air flowing from pin 3 to pin 1 (nominal input voltage).

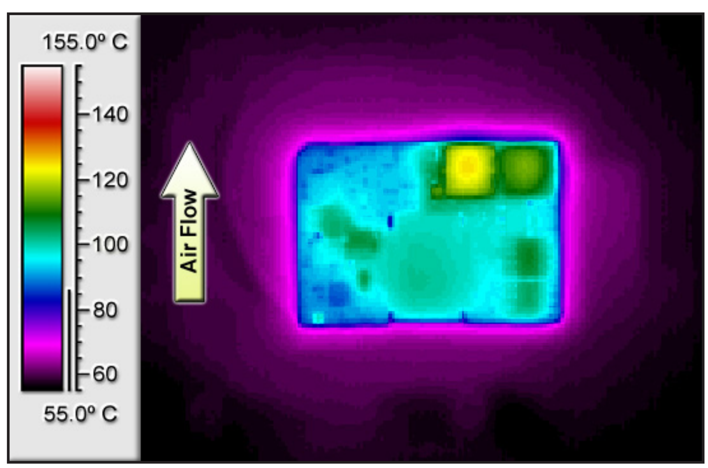


Figure 6: Thermal plot of converter at 4.0 amp load current (48W) with 55°C air flowing at the rate of 200 LFM. Air is flowing from pin 3 to pin 1 (nominal input voltage).

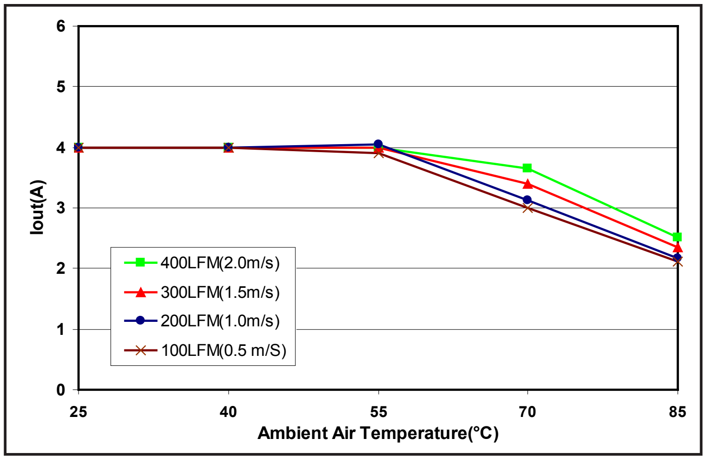


Figure 7: Maximum output power derating curves vs. ambient air temperature for airflow rates of 100 LFM through 400 LFM with air flowing lenghtwise from input to output (nominal input voltage).

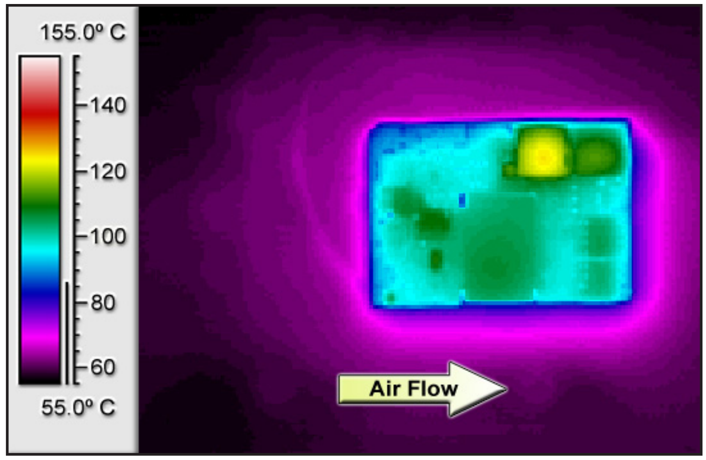


Figure 8: Thermal plot of converter at 4.0 amp load current (48W) with 55°C air flowing at the rate of 200 LFM. Air is flowing across the converter from input to output (nominal input voltage).

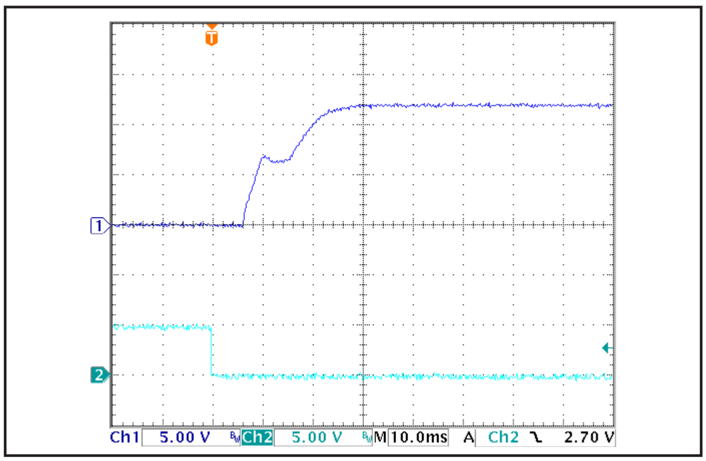


Figure 9: Turn-on transient at full load (resistive load) (10 ms/div). Input voltage pre-applied. Top Trace: Vout (5V/div). Bottom Trace: ON/OFF input(5V/div)

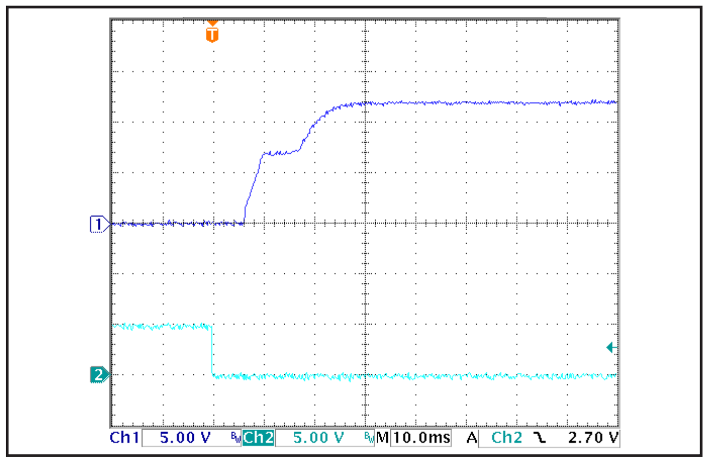


Figure 10: Turn-on transient at zero load (10 ms/div). Top Trace: Vout (5V/div). Bottom Trace: ON/OFF input (5V/div)

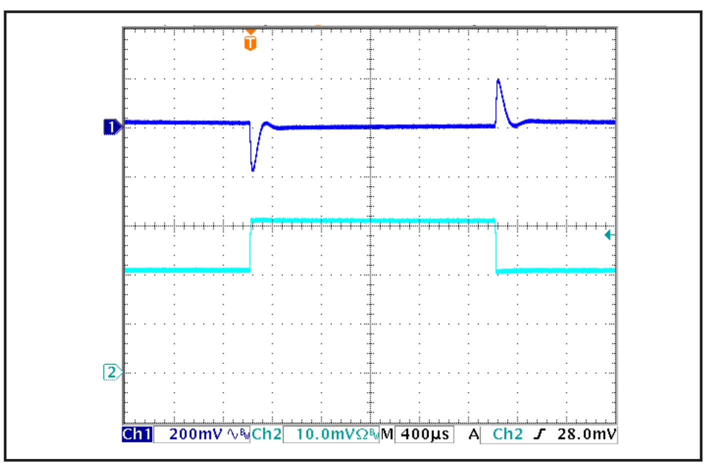


Figure 11: Output voltage response to step-change in load current (50%-75%-50% of Iout(max); dI/dt = 0.1A/µs). Load cap: 100µF electrolytic output capacitance. Top trace: Vout (200mV/div). Bottom trace: Iout (1A/div).

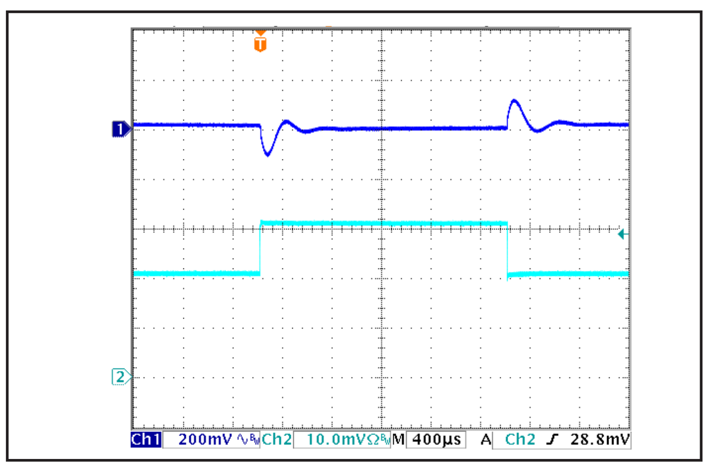


Figure 12: Output voltage response to step-change in load current (50%-75%-50% of Iout(max): dI/dt = 2A/µs). Load cap: 330µF electrolytic output capacitance. Top trace: Vout (200mV/div). Bottom trace: Iout (1A/div).

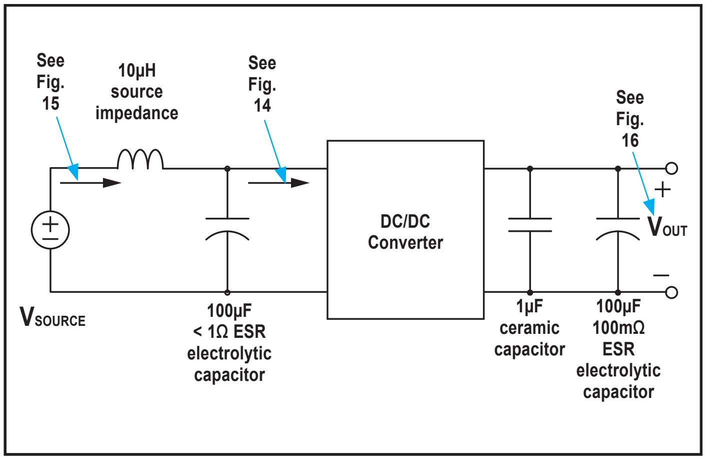


Figure 13: Test set-up diagram showing measurement points for Input Terminal Ripple Current (Figure 14), Input Reflected Ripple Current (Figure 15) and Output Voltage Ripple (Figure 16).

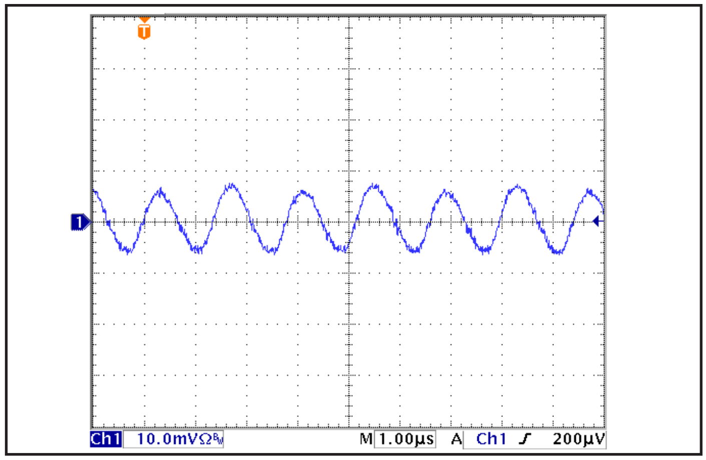


Figure 14: Input Terminal Ripple Current, ic, at full rated output current and nominal input voltage with 10µH source impedance and 100µF electrolytic capacitor (Ch.1 100mA/div). (See Figure 13).

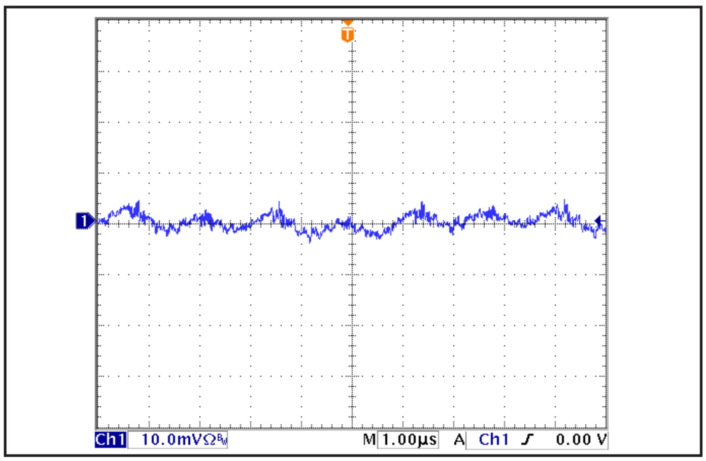


Figure 15: Input reflected ripple current, is, through a 10 µH source inductor at nominal input voltage and rated load current (5 mA/div). (See Figure 13).

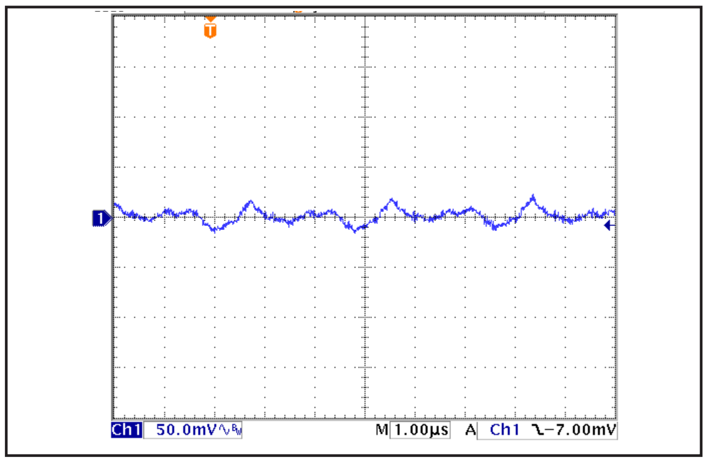


Figure 16: Output voltage ripple at nominal input voltage and rated load current (50 mV/div). Load capacitance: one 1.0µF ceramic capacitor and one 100µF electrolytic capacitor. Bandwidth: 20 MHz. (See Figure 13).

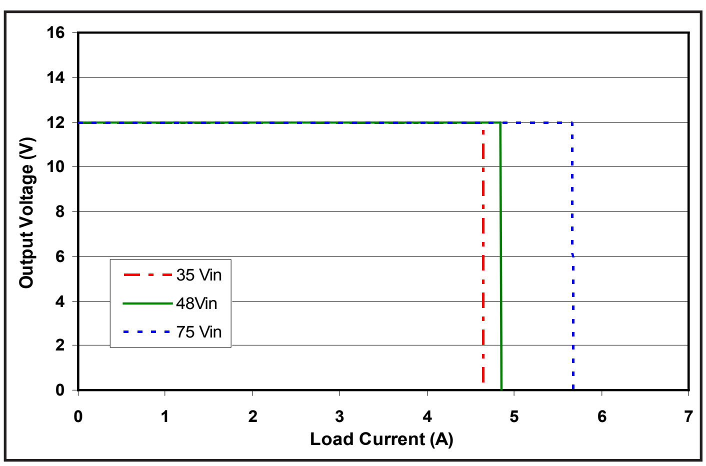


Figure 17: Output voltage vs. load current showing typical current limit curves and converter shutdown points.

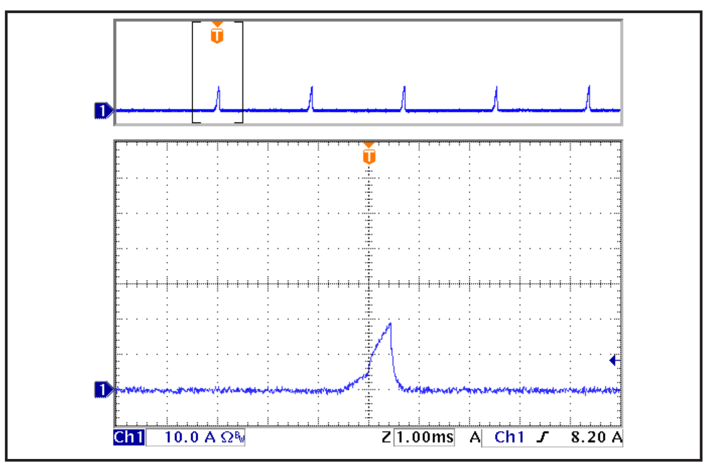


Figure 18: Load current (10A/div) as a function of time when the converter attempts to turn on into a 1 mΩ short circuit. Top trace (100ms/div) is an expansion of the on-time portion of the bottom trace.

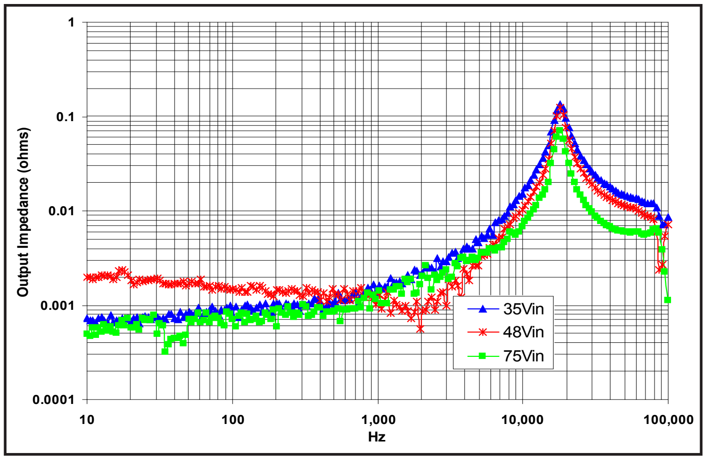


Figure 19: Magnitude of incremental output impedance (Zout = vout/iout) for minimum, nominal, and maximum input voltage at full rated power.

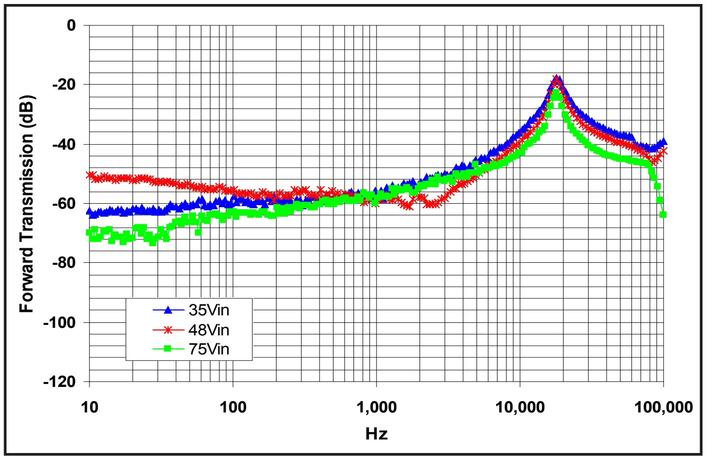


Figure 20: Magnitude of incremental forward transmission (FT = vout/vin) for minimum, nominal, and maximum input voltage at full rated power.

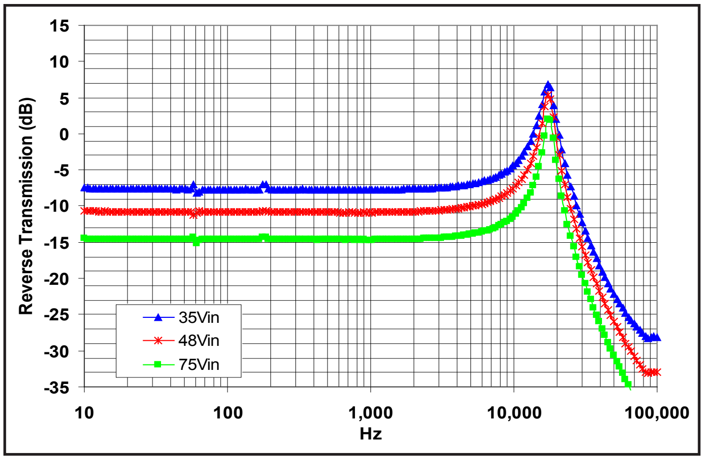


Figure 21: Magnitude of incremental reverse transmission (RT = iin/iout) for minimum, nominal, and maximum input voltage at full rated power.

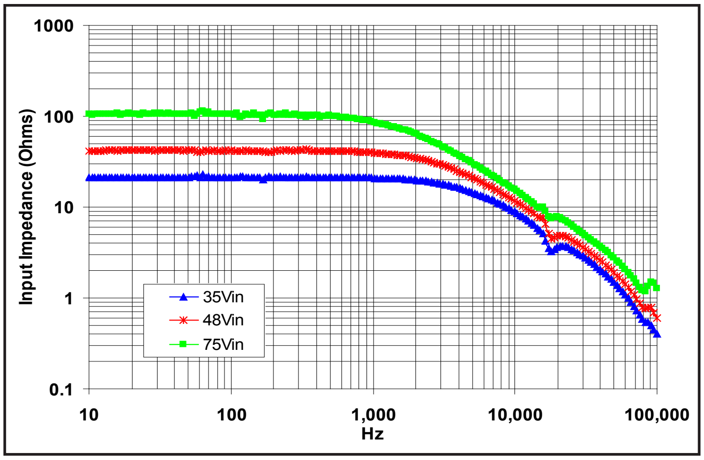


Figure 22: Magnitude of incremental input impedance (Zin = vin/iin) for minimum, nominal, and maximum input voltage at full rated power.

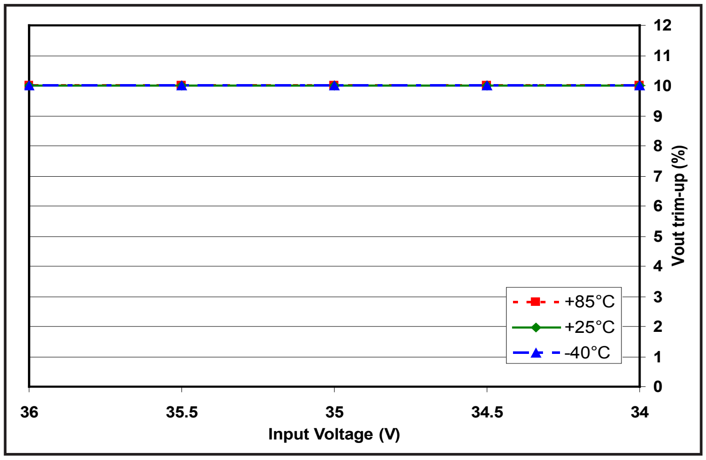


Figure 23: Achievable trim-up percentage vs. input voltage at +85°C, +25°C, and -40°C (all at full load). Full trim-up percentage is achieved at loads of 50% or less across full temperature and input voltage range.

BASIC OPERATION AND FEATURES

This converter switches at a fixed frequency for predictable EMI performance. Rectification of the transformer's output is accomplished with synchronous rectifiers. These devices, which are MOSFETs with a very low on-state resistance, dissipate far less energy than Schottky diodes. This is the primary reason that the converter has such high efficiency, even at very low output voltages and very high output currents.

These converters are offered totally encased to withstand harsh environments and thermally demanding applications. Dissipation throughout the converter is so low that it does not require a heatsink for operation in many applications; however, adding a heatsink provides improved thermal derating performance in extreme situations.

This series of converters uses the industry standard footprint and pin-out configuration.

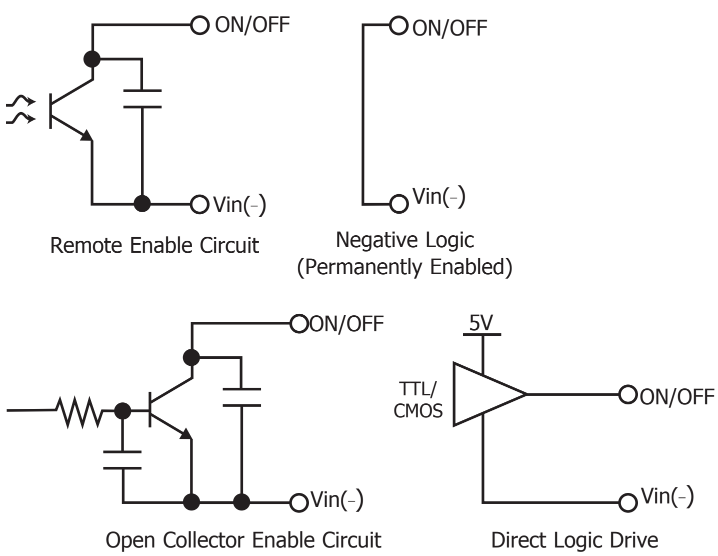


Figure A: *Various circuits for driving the ON/OFF pin.*

CONTROL FEATURES

REMOTE ON/OFF (Pin 2): The ON/OFF input, Pin 2, permits the user to control when the converter is on or off. This input is referenced to the return terminal of the input bus, Vin(-). The ON/OFF signal is active low (meaning that a low turns the converter on). Figure A details four possible circuits for driving the ON/OFF pin. Figure B is a detailed look of the internal ON/OFF circuitry.

REMOTE SENSE(±) (Pins 7 and 5): The SENSE(±) inputs correct for voltage drops along the conductors that connect the converter's output pins to the load.

Pin 7 should be connected to Vout(+) and Pin 5 should be connected to Vout(-) at the point on the board where regulation is desired. A remote connection at the load can adjust for a voltage drop only as large as that specified in this datasheet, that is

$$[\text{Vout}(+) - \text{Vout}(-)] - [\text{Vsense}(+) - \text{Vsense}(-)] \leq \text{Sense Range \% x Vout}$$

Pins 7 and 5 must be connected for proper regulation of the output voltage. If these connections are not made, the converter will deliver an output voltage that is slightly higher than its specified value.

<u>Note</u>: the output over-voltage protection circuit senses the voltage across the output (pins 8 and 4) to determine when it should trigger, not the voltage across the converter's sense leads (pins 7 and 5). Therefore, the resistive drop on the board should be small enough so that output OVP does not trigger, even during load transients.

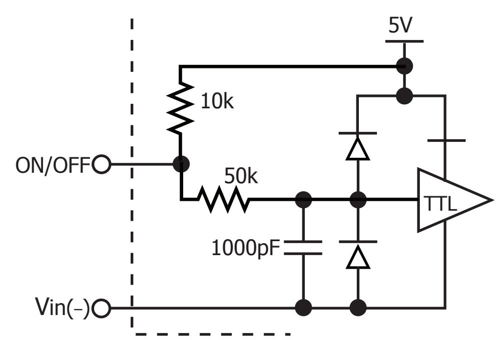


Figure B: *Internal ON/OFF pin circuitry*

OUTPUT VOLTAGE TRIM (Pin 6): The TRIM input permits the user to adjust the output voltage across the sense leads up or down according to the trim range specifications.

To decrease the output voltage, the user should connect a resistor between Pin 6 and Pin 5 (SENSE(-) input). For a desired decrease of the nominal output voltage, the value of the resistor should be

$$R_{\text{trim-down}} = \left(\frac{511}{\Delta\%}\right) - 10.22 \quad (\text{k}\Omega)$$

where

$$\Delta\% = \left|\frac{\text{Vnominal} - \text{Vdesired}}{\text{Vnominal}}\right| \times 100\%$$

To increase the output voltage, the user should connect a resistor between Pin 6 and Pin 7 (SENSE(+) input). For a desired increase of the nominal output voltage, the value of the resistor should be

$$R_{\text{trim-up}} = \left(\frac{5.11 V_{OUT} \times (100+\Delta\%)}{1.225\Delta\%} - \frac{511}{\Delta\%} - 10.22\right) (\text{k}\Omega)$$

where V_{out} = Nominal Output Voltage

Graphs on Page 3 show the relationship between the trim resistor value and Rtrim-up and Rtrim-down, showing the total range the output voltage can be trimmed up or down.

Note: the TRIM feature does not affect the voltage at which the output over-voltage protection circuit is triggered. Trimming the output voltage too high may cause the over-voltage protection circuit to engage, particularly during transients.

It is not necessary for the user to add capacitance at the Trim pin. The node is internally bypassed to eliminate noise.

Total DC Variation of V_{OUT}: For the converter to meet its full specifications, the maximum variation of the dc value of V_{OUT}, due to both trimming and remote load voltage drops, should not be greater than that specified for the output voltage trim range.

PROTECTION FEATURES

Input Under-Voltage Lockout: The converter is designed to turn off when the input voltage is too low, helping avoid an input system instability problem, described in more detail in the application note titled "0" on our website. The lockout circuitry is a comparator with dc hysteresis. When the input voltage is rising, it must exceed the typical Turn-On Voltage Threshold value (listed on the specifications page) before the converter will turn on. Once the converter is on, the input voltage must fall below the typical Turn-Off Voltage Threshold value before the converter will turn off.

Output Current Limit: If the output current exceeds the Output Current Limit threshold, the converter turns off. The converter then enters a 'hiccup mode' where it repeatedly turns on and off at a 5 Hz (nominal) frequency with a 5% duty cycle until the short circuit condition is removed. This prevents excessive heating of the converter or the load board.

Output Over-Voltage Limit: If the voltage across the output pins exceeds the Output Over-Voltage Protection threshold, the converter will immediately stop switching. This prevents damage to the load circuit due to 1) excessive series resistance in output current path from converter output pins to sense point, 2) a release of a short-circuit condition, or 3) a release of a current limit condition. Load capacitance determines exactly how high the output voltage will rise in response to these conditions. After 200 ms the converter will automatically restart.

Over-Temperature Shutdown: A temperature sensor on the converter senses the average temperature of the module. The thermal shutdown circuit is designed to turn the converter off when the temperature at the sensed location reaches the Over-Temperature Shutdown value. It will allow the converter to turn on again when the temperature of the sensed location falls by the amount of the Over-Temperature Shutdown Restart Hysteresis value.

APPLICATION CONSIDERATIONS

Input System Instability: This condition can occur because any dc-dc converter appears incrementally as a negative resistance load. A detailed application note titled "Input System Instability" is available on the SynQor website which provides an understanding of why this instability arises, and shows the preferred solution for correcting it.

Application Circuits: Figure D provides a typical circuit diagram which details the input filtering and voltage trimming.

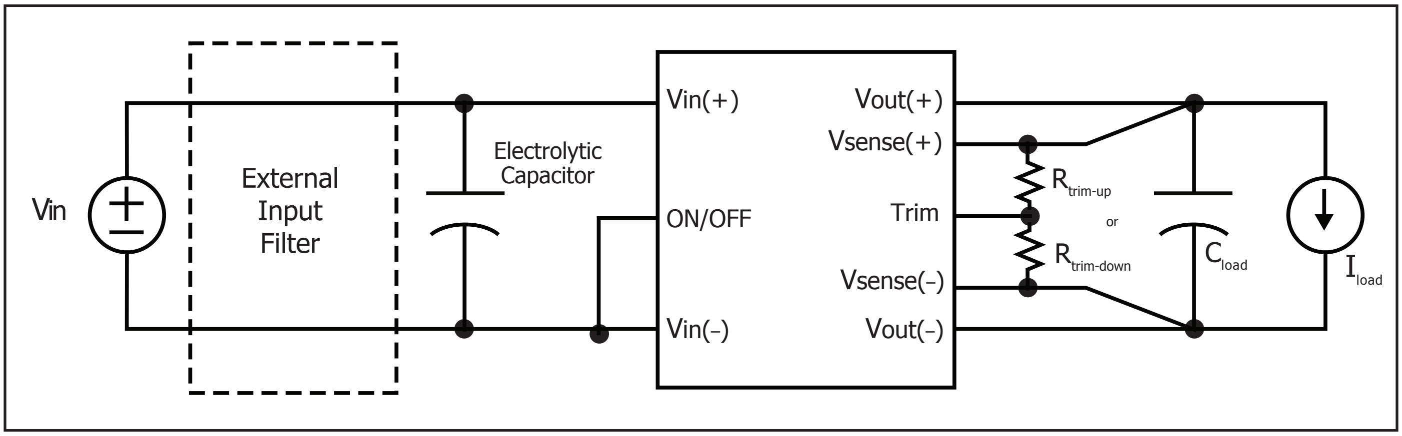


Figure D: *Typical application circuit (negative logic unit, permanently enabled).*

Input Filtering and External Capacitance: Figure E provides a diagram showing the internal input filter components. This filter dramatically reduces input terminal ripple current, which otherwise could exceed the rating of an external electrolytic input capacitor. The recommended external input capacitance is specified in the Input Characteristics section on the Electrical Characteristics page. More detailed information is available in the application note titled "EMI Characteristics" on the SynQor website.

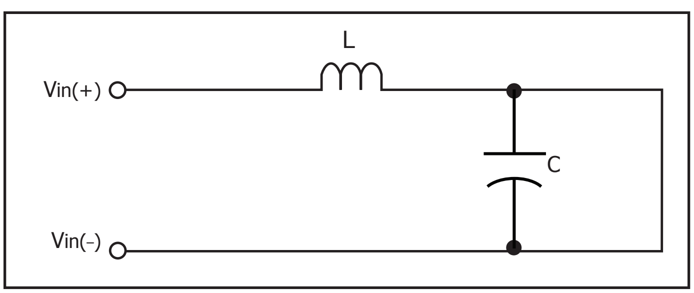


Figure E: *Internal Input Filter Diagram (component values listed on the specifications page).*

Startup Inhibit Period: The Startup Inhibit Period ensures that the converter will remain off for approximately 200 ms when it is shut down for any reason. When an output short is present, this generates a 5 Hz "hiccup mode," which prevents the converter from overheating. In all, there are six ways that the converter can be shut down, initiating a Startup Inhibit Period:

- Input Under-Voltage Lockout
- Output Over-Voltage Protection
- Over Temperature Shutdown
- Current Limit
- Short Circuit Protection
- Turned off by the ON/OFF input

Figure F shows three turn-on scenarios, where a Startup Inhibit Period is initiated at t_0, t_1, and t_2:

Before time t_0, when the input voltage is below the UVLO threshold, the unit is disabled by the Input Under-Voltage Lockout feature. When the input voltage rises above the UVLO threshold, the Input Under-Voltage Lockout is released, and a Startup Inhibit Period is initiated. At the end of this delay, the ON/OFF pin is evaluated, and since it is active, the unit turns on.

At time t_1, the unit is disabled by the ON/OFF pin, and it cannot be enabled again until the Startup Inhibit Period has elapsed.

When the ON/OFF pin goes high after t_2, the Startup Inhibit Period has elapsed, and the output turns on within the typical Turn-On Time.

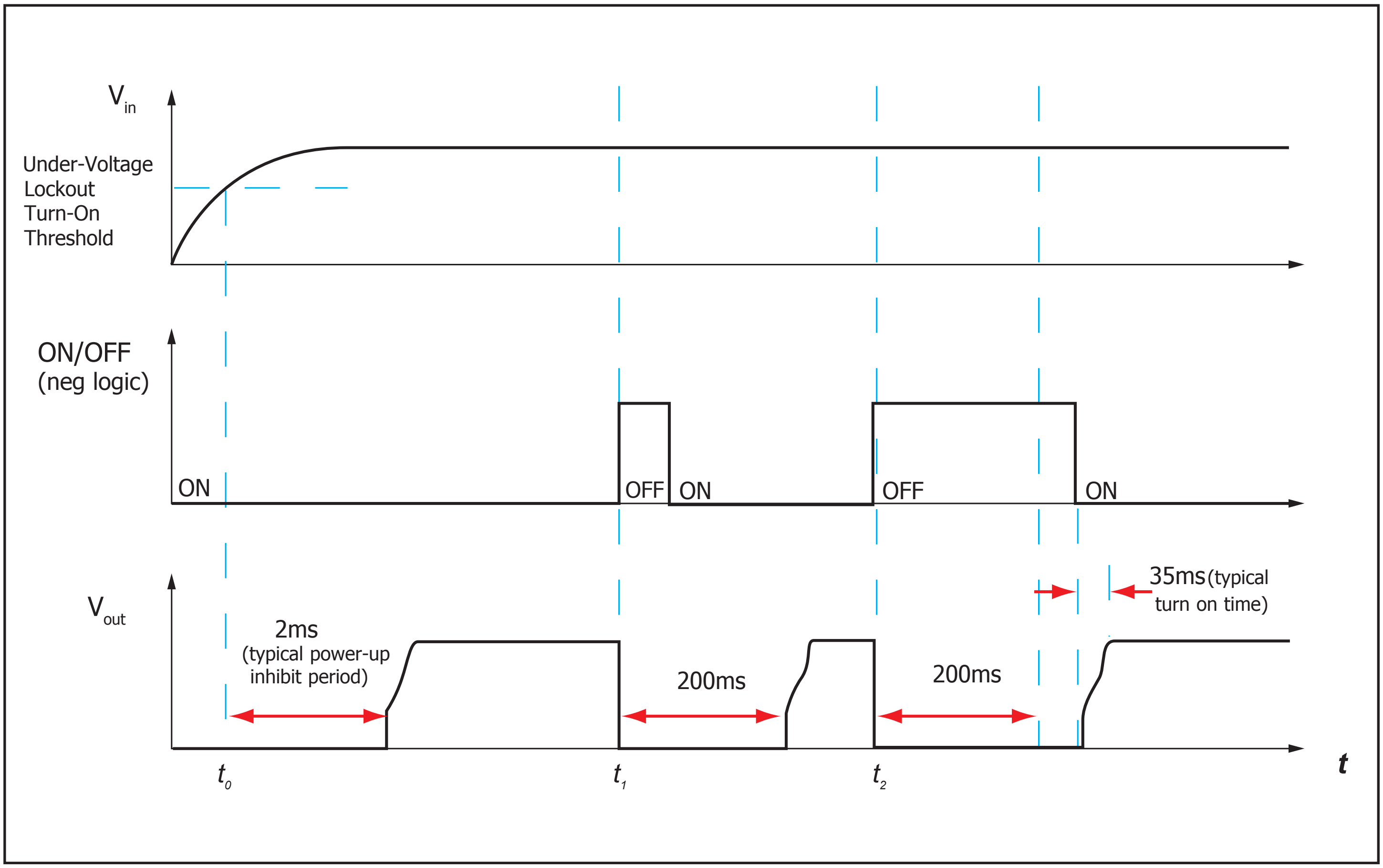
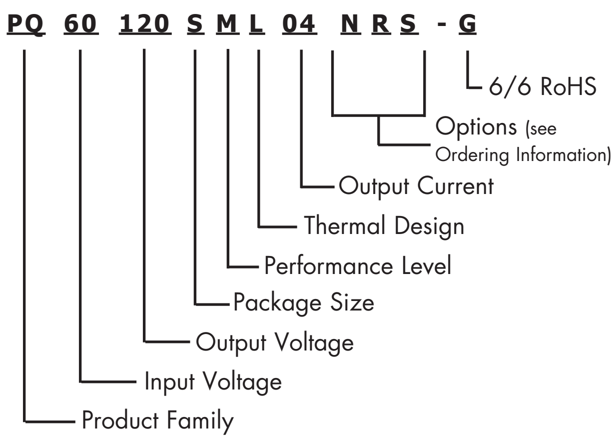


Figure F: *Startup Inhibit Period (turn-on time not to scale)*

PART NUMBERING SYSTEM

The part numbering system for SynQor's dc-dc converters follows the format shown in the example below.



The first 12 characters comprise the base part number and the last 3 characters indicate available options. The "-G" suffix indicates 6/6 RoHS compliance.

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.

ORDERING INFORMATION

The tables below show the valid model numbers and ordering options for converters in this product family. When ordering SynQor converters, please ensure that you use the complete 15 character part number consisting of the 12 character base part number and the additional characters for options. Add "-G" to the model number for 6/6 RoHS compliance.

Model Number	Input Voltage	Output Voltage	Max Output Current
PQ60120SMw04xyS	35-75 V	12V	4A

The following options must be included in place of the ***w x y z*** spaces in the model numbers listed above.

Options Description: x y			
Thermal Design	**Enable Logic**	**Pin Style**	**Feature Set**
A - Open Frame L - Low Profile C - Encased with Threaded Baseplate	N - Negative P - Positive	K - 0.110" N - 0.145" R - 0.180" Y - 0.250"	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
Toll Free:	888-567-9596
Fax:	978-849-0602
E-mail:	power@synqor.com
Web:	www.synqor.com
Address:	155 Swanson Road Boxborough, MA 01719 USA

PATENTS

SynQor holds numerous U.S. patents, one or more of which apply to most of its power converter 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:

5,999,417	6,222,742	6,545,890	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	8,493,751	8,644,027	9,143,042

WARRANTY

SynQor offers a three (3) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.