QYPS1 Series

9 - 36V Wide Input

Encapsulated Quarter Brick Converters

Features

- High Efficiency: up to 93.0%
- Excellent thermal performance
- Remote sense, remote control, over-voltage, over-current, short-circuit, and over temperature protection
- Monotonic start-up
- Fixed frequency operation
- Basic Insulation, 2250Vdc input-to output isolation
- Encapsulated for harsh environment

Absolute Maximum Ratings

Excessive stresses over these absolute maximum ratings can cause damage to the converter. Operation should be limited to the conditions outlined under the Electrical Specifications.

Parameter	Symbol	Min	Max	Unit
Input Voltage (continuous)	Vi	-0.5	40	Vdc
Input Voltage (< 100ms, operating)	Vi	-	50	Vdc
Input Voltage (continuous, non-operating)	Vi	-	50	Vdc
Storage Temperature	Tstg	-55	125	˚C

Part Numbering System

QYPS	1	□□□	□	□□□	□	□	□	□
Series Name:	**Input Voltage:**	**Output Voltage:**	**Enabling Logic:**	**Rated Output Current:**	**Pin Length:**	**Electrical Options:**	**Packaging**	**Operating Temperature Grade (°C)***
QYPS	**1:**9-36V	**Unit:**0.1V **120:**12V	**P:**positive **N:**negative	**Unit:** A **012:**12A	**N:**0.125” **R:**0.160” **J:**0.220”	**0:**latch off **2:**auto- restart	**P:** regular **F:** flanged	**C:** -20 to +85 **T:** -40 to +85 **H:** -40 to +100

* Operating temperature is the temperature measured at the center of the baseplate (the top of the case).

Available Codes:

Output Voltage	3.3V	5V	12V	28V	48V	56V
Output Current	30A	30A, 40A	12A	5A	3A	2A

Electrical Specifications

These specifications are valid over the converter's full range of input voltage, resistive load, and operating temperature unless noted otherwise.

Series Input Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Input Voltage	Vi	9*	18	36	Vdc
Input Turn-on Voltage Threshold	-	8.0	8.5	9.0*	V
Input Turn-off Voltage Threshold	-	7.0	7.5	8.0	V
Input Voltage ON/OFF Hysteresis	-		1.0		V

* For 28V and 48V output modules, the minimum input voltage and the maximum input turn-on threshold are 11V.

Series Output Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Output Voltage Set Point Accuracy (Vi = Typical Vin; Io = Io,max; Ta = 25°C)	-	-1.5		+1.5	%Vo
Output Voltage Set Point Accuracy (over all conditions)	-	-3		+3	%Vo
Output Regulation:					
Line Regulation (full range input voltage, 1/2 full load)	-	-	0.05	0.2	%Vo
Load Regulation (full range load, Typical Vin)	-	-	0.05	0.2	%Vo
Temperature (Ta = -40°C to 85 °C)	-	-	0.1		%Vo
Output Trim Range in % of Vo,typical		80	-	110*	%

* For 56V output module, the output trim up range from 80% to 100%

Series General Specifications

Parameter		Symbol	Min	Typical	Max	Unit
Remote Enable						
Logic Low:						
	ION/OFF = 1.0mA	VON/OFF	0	-	1.2	V
	VON/OFF = 0.0V	ION/OFF	-	-	1.0	mA
Logic High:	ION/OFF = 0.0µA	VON/OFF	3.5	-	15	V
	Leakage Current	ION/OFF	-	-	50	µA
Isolation Capacitance		-	-	4800	-	pF
Isolation Resistance		-	10	-	-	MΩ

Module Specific Specifications

3.3V/30A Module (QYPS1033x030xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max	-	-	20	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt	-	120	135	mA
Standby Input Current	Iin,Stdby	-	8	10	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η	-	92.0	-	%
Output Over Current Protection Set Point / Io_max	Io,cli	115	130	150	%
Output Over Voltage Protection Set Point* / Vo_typical		120	130	140	%
Output ripple frequency	-	180	210	240	kHz
Output Ripple and Noise Voltage					
RMS	-	-	-	20	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				80	mVp-p
External Load Capacitance	-			20,000	µF

5V/30A Module (QYPS1050x030xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max	-	-	27	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt	-	260	300	mA
Standby Input Current	Iin,Stdby	-	10	15	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η	-	90.5	-	%
Output Over Current Protection Set Point / Io_max	Io,cli	105	130	165	%
Output Over Voltage Protection Set Point* / Vo_typical		120	130	150	%
Output ripple frequency	-	260	280	300	kHz
Output Ripple and Noise Voltage					
RMS	-	-	-	25	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				50	mVp-p
External Load Capacitance	-			6000	µF

5V/40A Module (QYPS1050x040xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max			35	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt		260	300	mA
Standby Input Current	Iin,Stdby	-	10	15	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η		89.5		%
Output Over Current Protection Set Point / Io_max	Io,cli	105	130	165	%
Output Over Voltage Protection Set Point* / Vo_typical		120	130	150	%
Output ripple frequency	-	260	280	300	kHz
Output Ripple and Noise Voltage					
RMS	-			25	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				100	mVp-p
External Load Capacitance	-			8000	µF

12V/12A Module (QYPS1120x012xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max	-	-	25	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt	-	200	250	mA
Standby Input Current	Iin,Stdby	-	18	25	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η	-	93.0	-	%
Output Over Current Protection Set Point / Io_max	Io,cli	105	130	165	%
Output Over Voltage Protection Set Point* / Vo_typical		125	135	150	%
Output ripple frequency	-	190	210	230	kHz
Output Ripple and Noise Voltage					
RMS	-	-	-	50	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				100	mVp-p
External Load Capacitance	-	-	-	1800	µF

28V/5A Module (QYPS1280x005xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max			25	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt		220	250	mA
Standby Input Current	Iin,Stdby	-	10	15	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η		88		%
Output Over Current Protection Set Point / Io_max	Io,cli	120	130	140	%
Output Over Voltage Protection Set Point* / Vo_typical		115	120	125	%
Output ripple frequency	-	270	300	330	kHz
Output Ripple and Noise Voltage					
RMS	-			30	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				100	mVp-p
External Load Capacitance	-			1000	µF

48V/3A Module (QYPS1480x003xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max	-	-	28	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt	-	250	300	mA
Standby Input Current	Iin,Stdby	-	10	15	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η		89		%
Output Over Current Protection Set Point / Io_max	Io,cli	110	120	140	%
Output Over Voltage Protection Set Point* / Vo_typical		120	130	140	%
Output ripple frequency	-	270	300	330	kHz
Output Ripple and Noise Voltage					
RMS	-			25	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				100	mVp-p
External Load Capacitance	-			1000	µF

56V/2A Module (QYPS1560x002xxxx)

Parameter	Symbol	Min	Typical	Max	Unit
Input Current	Iin,Max	-	-	20	A
Quiescent Input Current (Typical Vin)	Iin,Qsnt	-	290	340	mA
Standby Input Current	Iin,Stdby	-	10	15	mA
Efficiency (Typical Vin; Io,max, TA = 25ºC)	η		90		%
Output Over Current Protection Set Point / Io_max	Io,cli	110	130	150	%
Output Over Voltage Protection Set Point* / Vo_typical		105	110	130	%
Output ripple frequency	-	270	300	330	kHz
Output Ripple and Noise Voltage					
RMS	-			28	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				120	mVp-p
External Load Capacitance	-			400	µF
Output to Baseplate isolation				2250	Vdc
Output Trim Range in % of Vo,typical		80	-	100	%

Feature Descriptions

ON/OFF

The converter can be turned on and off by changing the voltage between the ON/OFF pin and Vin(-). The QYPS1 Series of converters are available with positive logic and negative logic.

For the negative control logic, the converter is ON when the ON/OFF pin is at a logic low level and OFF when the ON/OFF pin is at a logic high level. For the positive control logic, the converter is ON when the ON/OFF pin is at a logic high level and OFF when the ON/OFF pin is at a logic low level.

With the internal pull-up circuitry, a simple external switch between the ON/OFF pin and Vin(-) can control the converter.

The logic low level is from 0V to 1.2V and the maximum sink current during logic low is 1mA. The external switch must be capable of maintaining a logic-low level while sinking up to this current. The logic high level is from 3.5V to 15V. The converter has an internal pull-up circuit that ensures the ON/OFF pin at a high logic level when the leakage current at ON/OFF pin is no greater than 50µA.

Remote SENSE

The remote SENSE pins are used to sense the voltage at the load point to accurately regulate the load voltage and eliminate the impact of the voltage drop in the power distribution path.

SENSE(+) and SENSE(-) pins should be connected between the points where voltage regulation is desired. The voltage between the SENSE pins and the output pins must not exceed

the smaller of 0.5V or 10% of typical output voltage.

[Vout(+) - Vout(-)] - [SENSE(+) - SENSE (-)] < MIN{0.5V, 10%Vo}

When remote sense is not used, the SENSE pins should be connected to their corresponding output pins. If the SENSE pins are left floating, the

converter will deliver an output voltage slightly higher than its specified typical output voltage.

Output Voltage Adjustment (Trim)

The trim pin allows the user to adjust the output voltage set point. To increase the output voltage, an external resistor is connected between the TRIM pin and SENSE(+). To decrease the output voltage, an external resistor is connected between the TRIM pin and SENSE(-). The output voltage trim range is 80% to 110% of the specified typical output voltage. The circuit configuration for trim down operation is shown in Figure 1.

To decrease the output voltage, the value of the external resistor should be.

$$Rdown = (\frac{511}{\Delta} - 10.22)(k\Omega)$$

Where

$$\Delta = (\frac{|Vnom - Vadj|}{Vnom}) \times 100$$

and

V_{nom}= Typical Output Voltage

V_{adj}=Adjusted Voltage

The circuit configuration for trim up operation is shown in Figure2. To increase the output voltage, the value of the resistor should be:

$$Rup = (\frac{5.11Vo(100 + \Delta)}{1.225\Delta} - \frac{511}{\Delta} - 10.22)(k\Omega)$$

Where

Vo = Typical Output Voltage

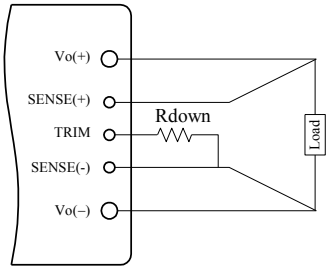


Figure 1. Circuit to Decrease Output Voltage

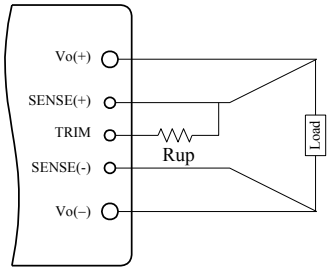


Figure 2. Circuit to Increase Output Voltage

Output Over-Current Protection (OCP)

This converter can be ordered in either latch-off or auto-restart version upon OCP, OVP, and OTP.

With the latch-off version, the converter will latch off when the load current exceeds the limit. The converter can be restarted by toggling the ON/OFF switch or recycling the input voltage.

With the auto-restart version, the converter will operate in a hiccup mode (repeatedly try to restart) until the cause of the over-current condition is cleared.

Output Over-Voltage Protection (OVP)

With the latch-off version, the converter will latch off when the output voltage exceeds the limit. The converter can be restarted by toggling the ON/OFF switch or recycling the input voltage.

With the auto-restart version, the converter will operate in a hiccup mode (repeatedly try to restart) until the cause of the over-voltage condition is cleared.

Over Temperature Protection (OTP)

With the latch-off version, the converter will shut down and latch off if an over-temperature condition is detected. The converter has a temperature sensor located at a carefully selected position in the converter circuit board, which represents the thermal condition of key components of the converter. The thermal shutdown circuit is designed to turn the converter off when the temperature at the sensor reaches 120°C. The module can be restarted by toggling the ON/OFF switch or recycling the input voltage.

With the auto-restart version, the converter will resume operation after the converter cools down.

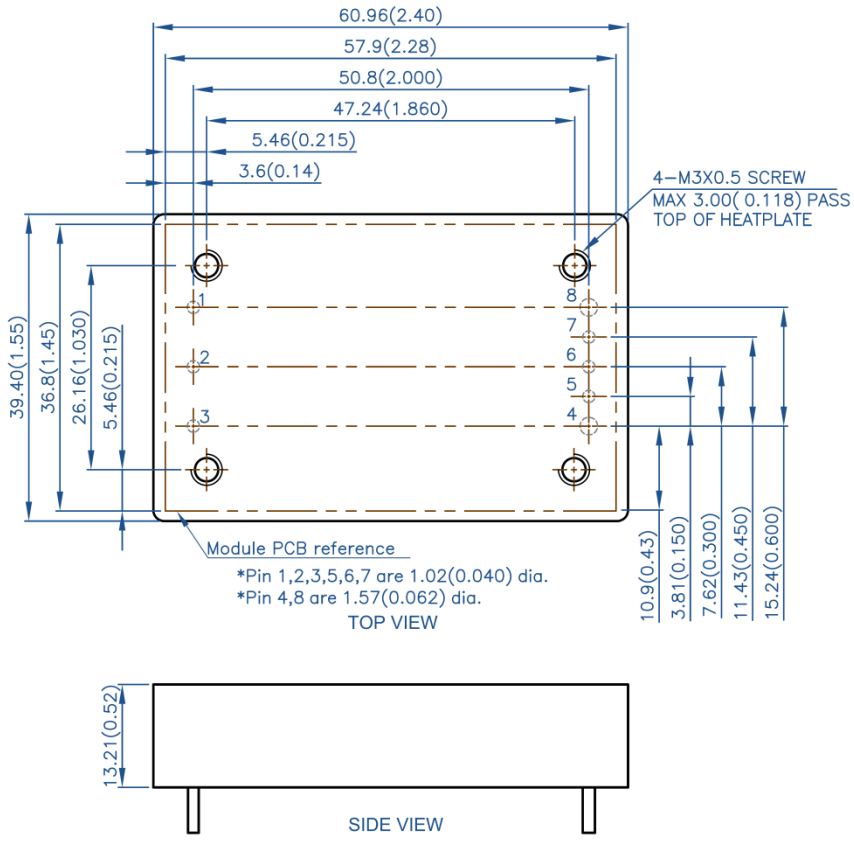
Design Considerations

As with any DC/DC converter, the stability of the QYPS1 converters may be compromised if the source impedance is too high or inductive. It's desirable to keep the input source ac-impedance as low as possible. Although the converters are designed to be stable without adding external input capacitors for typical source impedance, it is recommended to add 100 μF low ESR electrolytic capacitors at the input of the converter for each 100W output power, which reduces the potential negative impact of the source impedance on the converter stability. These electrolytic capacitors should have sufficient RMS current rating over the operating temperature range.

The converter is designed to be stable without additional output capacitors. To further reduce the output voltage ripple or improve the transient response, additional output capacitors are often used in applications. When additional output capacitors are used, a combination of ceramic capacitors and tantalum/polymer capacitors shall be used to provide good filtering while assuring the stability of the converter.

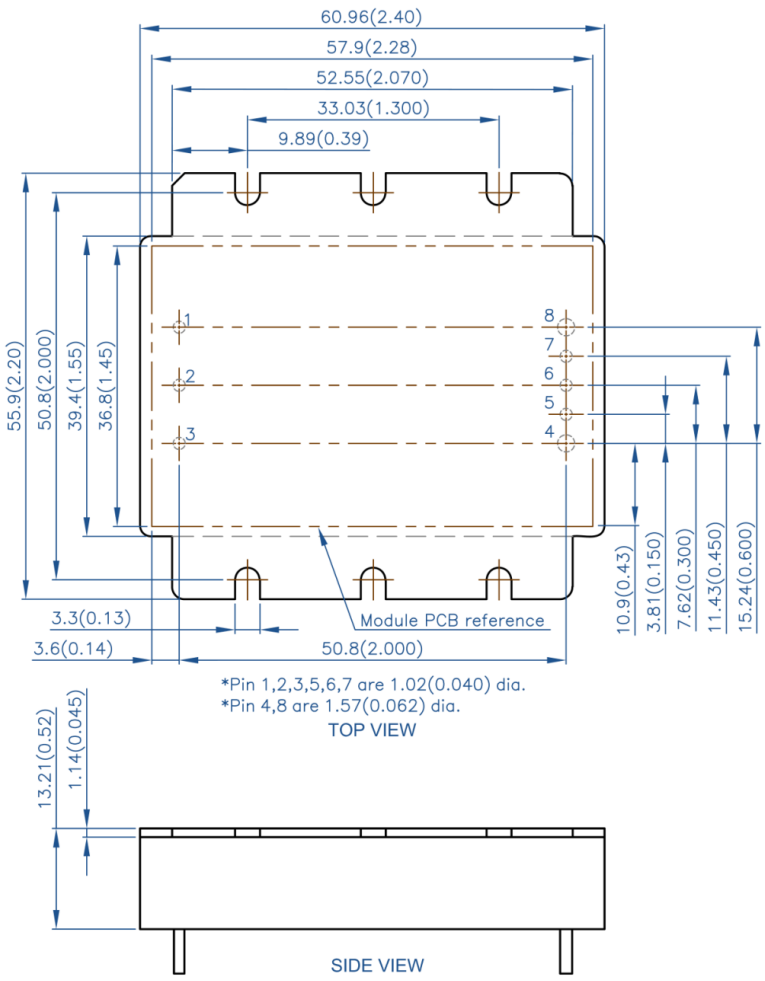
Mechanical Information

Regular



Pin	Name	Function
1	Vin(+)	Positive input voltage
2	ON/OFF	Remote control
3	Vin(−)	Negative input voltage
4	Vout(−)	Negative output voltage
5	SENSE(−)	Negative remote sense
6	TRIM	Output voltage trim
7	SENSE(+)	Positive remote sense
8	Vout(+)	Positive output voltage

Flanged



Pin	Name	Function
1	Vin(+)	Positive input voltage
2	ON/OFF	Remote control
3	Vin(−)	Negative input voltage
4	Vout(−)	Negative output voltage
5	SENSE(−)	Negative remote sense
6	TRIM	Output voltage trim
7	SENSE(+)	Positive remote sense
8	Vout(+)	Positive output voltage

Notes:

1) All dimensions in mm (inches)
   Tolerances: x ± .5 (.xx ± 0.02)
   .xx ± .25 (.xxx ± 0.010)
2) Input and function pins are 1.02mm (0.040") dia. with +/- 0.10mm (0.004") tolerance.
3) Output pins are 1.57 mm (0.062") dia. with +/- 0.10mm (0.004") tolerance.
4) All pins are coated with 90%/10% solder, Gold, or Matte Tin finish with Nickel underplating.
5) Workmanship meets or exceeds IPC-A-610 Class II
6) Torque applied on screw should not exceed 6in-lb. (0.7 Nm)
7) Baseplate flatness tolerance is 0.10mm (0.004") TIR for surface
8) If M3 screws are used to attach a heatsink to the baseplate, the screw length from the top surface of baseplate going down should not exceed 3.0 mm (0.12 ") max.