

QPC20A Non-isolated Quarter Brick Buck Converters
36V – 58Vdc Input, 12Vdc Output, Maximum Output Current; 20A

November 13, 2011

QPC20A Non-isolated Quarter Brick Buck Converters**Features**

- Industry standard Quarter-brick
58.42mm x 36.83mm x 13mm
(2.3in x 1.45in x 0.512in)
- High efficiency
- Single output
- Constant switching frequency
- Synchronous – rectifier topology
- Output over current protection
- Input under voltage lock out
- Output short-circuit protection
- Over-temperature protection
- Remote ON/OFF control
- Output voltage trimming
- Output voltage sense terminal
- Power good signal
- RoHS directive compliance

**Applications**

- Distributed power architecture
- Networking Equipment
- Enterprise Networks

PRELIMINARY**Description**

The QPC20A-48 Series are high efficient Non-isolated DC/DC converters provide up to 20A of output current from a nominal 48V input. These converters are provided in an industry standard quarter-brick package

These converters achieved a high efficiency by adopting a synchronous rectification topology.

Aluminum base plate can spread a heat fast and easy to attach an extra heatsink

The converters provide the precise regulation include remote on/off, output voltage trimming, over current protection and under voltage lockout,

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage Continuous	-0.3	-	60	Vdc	
Operating Ambient Temperature	-40	-	85	°C	
Storage Temperature	-40	-	125	°C	
I/O Isolation	-	-		Vdc	

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

Electrical Specifications

Input Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating voltage Range	V_{in}	36	48	58	Vdc
Input current at 36V	I_{in}	-	-	7.07	A
Input current at 55V		-	-	4.30	A
Input reflected ripple current (Reflected ripple current through A 10uH source inductor at nominal input voltage and rated load current)		-	10	-	mA
Input Under voltage Lockout (adjustable)	$V_{in,UVLO}$				
- Turn-on Threshold			33		Vdc
- Turn-off Threshold			32		Vdc
Input Overvoltage shutdown	$V_{in,OVLO}$		NO		
- Turn-off Threshold		-		-	Vdc
Input Ripple Rejection voltage (Pk to Pk)	V_{jac}				Vdc
No load Input current(@48V)			60		mA
Input standby current (Remote on/off control)			1		mA

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Output Characteristics

 T_A = +25°C Vin = 36 ~ 60V unless otherwise specified

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage Set-point	V _{o, set}	-	12	-	Vdc
Output Current	I _o	0	-	20	A
Output Regulation; - Line Regulation - Load Regulation - Temp Regulation		-	±0.3 ±0.4	-	% %
Output Current Limit		-	26	-	A
Short circuit current (input)					A
Output Ripple and noise (Vin = 48V, and I _o = 20A,)		-	120	-	mVp-p
Efficiency (100% of max I _o , Vin = 48V)		-	94.5	-	%
Dynamic Load Response (1uF Ceramic & 15uF Tantalum, 25% to 50 %, 50% to 25%, di/dt=0.1A/us)		-	±100	-	mV
Recovery Time (with in 1% Nominal V _o , 300us at max)		-	100	-	us
Rising Time (From 10% to 90% of output voltage)		-	20	-	ms
Turn – on overshoot		-	5	-	%

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
I/O Isolation Voltage		-	-		Vdc
Isolation Resistance	RISO				MΩ
Isolation Capacitance	CISO				pF

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General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency		-	250	-	KHz
Remote ON/OFF control - Positive Logic On = open, short to GND Off= high		0	-	0.8	Vdc
Over Temperature Protection		-	120	-	°C
MTBF		-		-	
Dimensions		-	58.42x36.83x13 (2.3x1.45x0.512)	-	mm (in)
Weight		-	40	-	Grams

Environmental

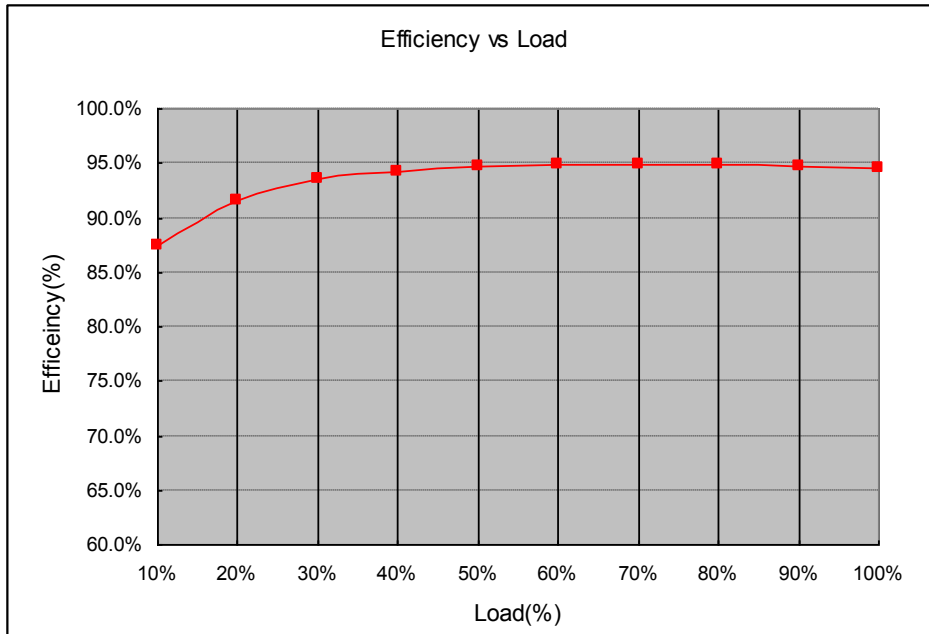
Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature		-40	-	+85	°C
Operating Humidity (RH non-condensing)		30	-	95	%
Storage Temperature		-55	-	+125	°C
Shock					
Vibration					

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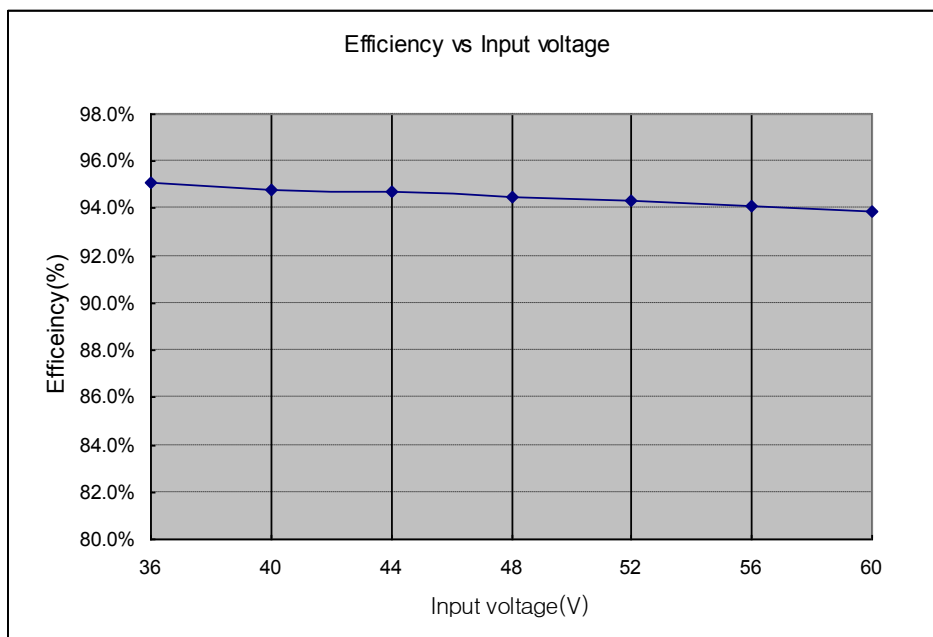
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Characteristic Curves

Efficiency vs Load



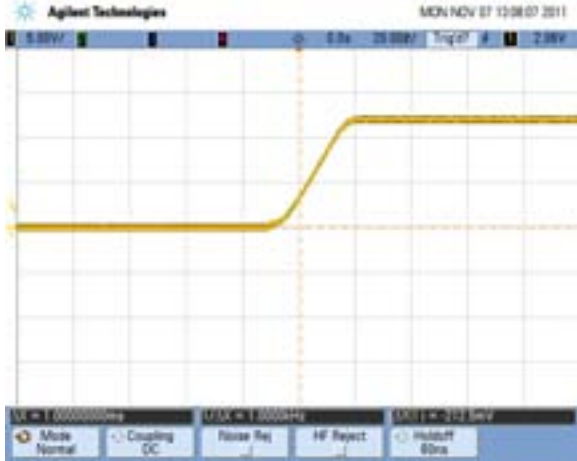
Efficiency vs Input volage



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Turn-on from Vin



CH1: 5V/DIV 20ms/DIV

Turn-on waveform using input switch at 25°C

Vin=48V, Vo@Full load

Turn-off from Vin

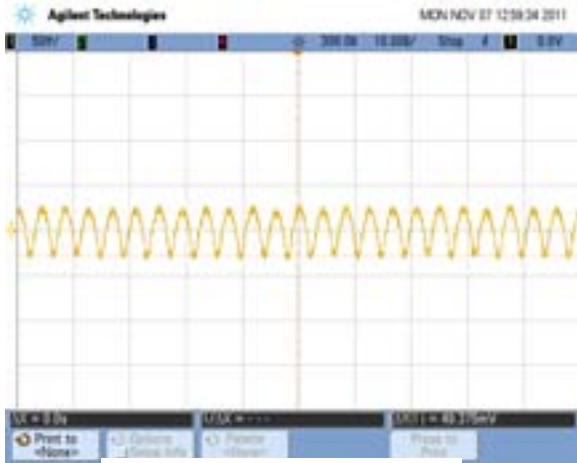


CH1: 5V/DIV 0.5ms/DIV

Turn-off waveform using input switch at 25°C

Vin=48V, Vo@Full load

Output Ripple/Noise



CH1: 50mV/DIV 10us/DIV

Vin = 48Volts Vo @Full load, At 25°C

Output Load Transient Response



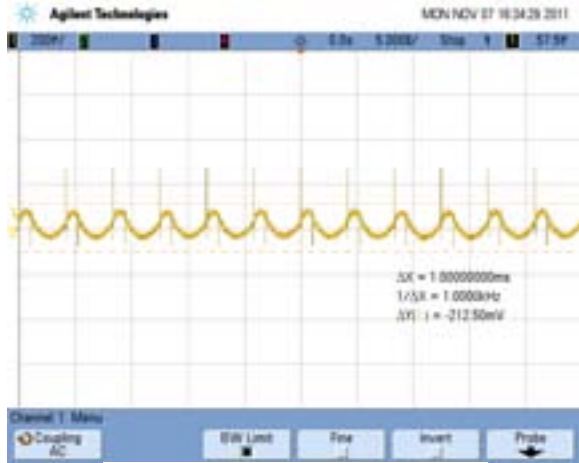
CH1: 200mV/DIV 500us/DIV

Vin = 48V, Vo @ 5A to 10A (25% to 50%),
 Slew Rate= 0.1A/usec, Frequency = 1KHz

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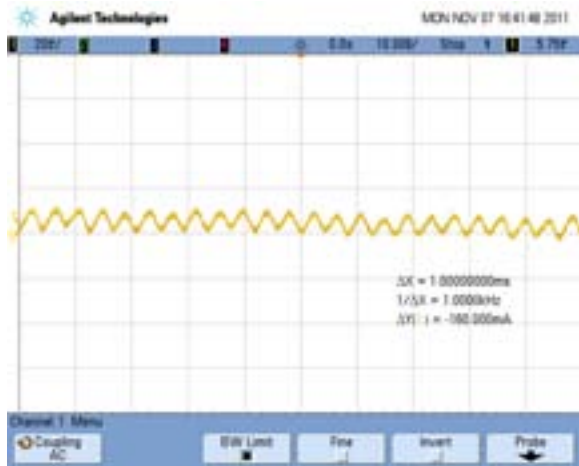
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Input Reflected Ripple voltage



CH1: 200mV/DIV 5us/DIV

Input Reflected Ripple Current



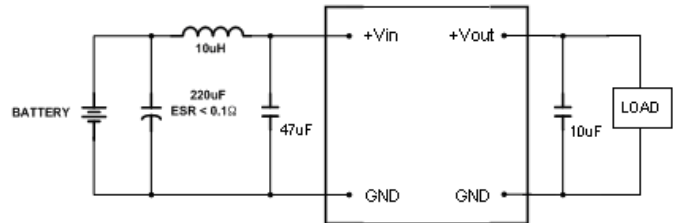
CH1: 20mA/DIV 10us/DIV

Thermal Derating Curves - Tref = 120°C

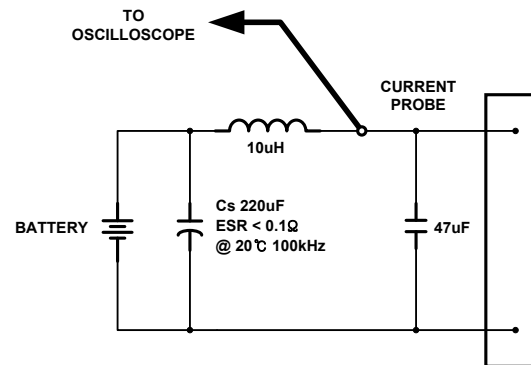
PREPARING

TEST Configurations

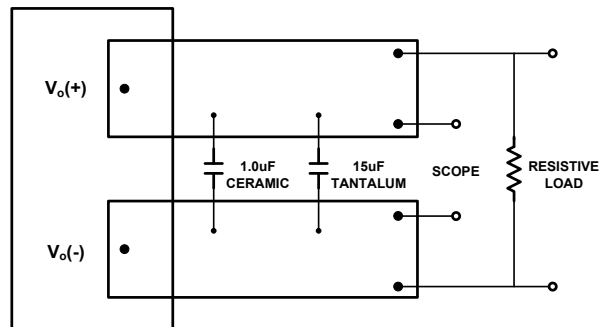
Basic connection



Input Reflected Ripple Current Test



Output ripple and noise Test

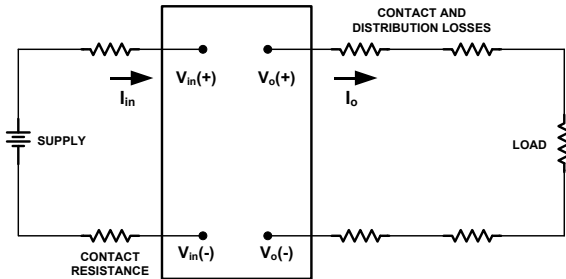


* Conductor from Vout-pins to capacitors = 50mm (1.97in)

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Output Voltage and Efficiency Test



*All measurements are taken at the module terminals when Socketing, place Kelvin connections at module terminals to Avoid measurement errors due to socket contact resistance

Efficiency

$$\eta = \left(\frac{[V_o(+)-V_o(-)] \times I_o}{[V_{in}(+)-V_{in}(-)] \times I_{in}} \right) \times 100\%$$

Thermal Considerations

The DC/DC converters are designed to operate in different thermal environments and sufficient Cooling must be provided to ensure reliable operation. Cooling is achieved mainly by conduction which is dependant on the airflow across the converter. Increased airflow enhances the cooling of the converter.

The Output current Derating graph found in the output section for each model provides the available output current vs. ambient air temperature and air velocity at Vin = 48V

Definition of reference temperature

(T_{ref})

The reference temperature is used to monitor the temperature limits of the product. Temperature above maximum Tref is not allowed and may cause degradation or permanent damage to the product. Tref is also used to define the temperature range for normal operating conditions. Tref is defined by the design to guarantee safety margins, proper operation and high reliability of the module.

*Mechanical Information on page 12 for Tref

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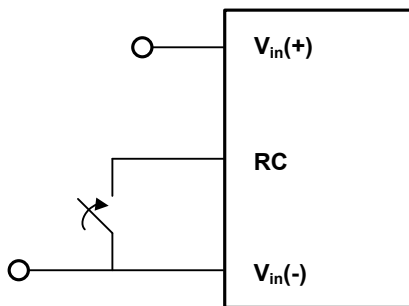
Feature Description

I/O Filtering and Noise Reduction

To minimize the ripple and noise of the input voltage, Low-ESR polymer and ceramic capacitors are required at the input of the converter.

Remote ON/OFF Control (RC)

Without turning the input on and off, the output can be enabled and disabled using this function. This function is useful for sequence control when building multiple output power supplies. This control circuit is on the input side using the RC terminal pin. RC's ground is the input –Vin terminal. When not using this function, open RC to input –Vin terminal.

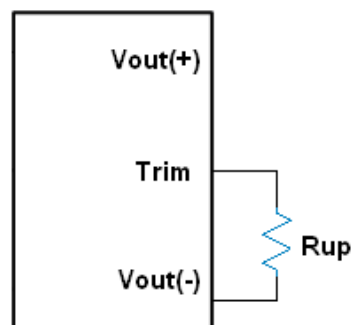


RC level for INPUT-V	OUTPUT
Open or short to GND	ON
High	OFF

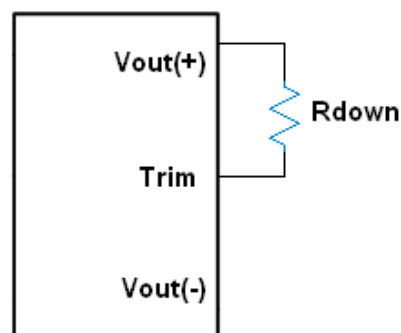
Output voltage trimming

Output voltage can be variable by using trim pin. With additional fixed resistor between trim pin and output pin, designer can drop output voltage. Also, designer can increase output voltage by inserting fixed resistor between trim pin and GND pin.

Trim-resistor values also can be calculated by those equations in the below.



$$R_{up} = \frac{70.965}{2.49 \times (V_o - 0.6) - 28.5}$$



$$R_{down} = \frac{118.275 \times (V_o - 0.6)}{28.5 - 2.49 \times (V_o - 0.6)}$$

Vo : Desired output voltage

Calculated value is a KΩ

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Output voltage sense terminal

The Remote sense function correct a voltage drop caused by conduction loss($I \times R$). Sense pin should be connected to $V_{out}(+)$ at the point where regulation is desired. Trim and sense function can increase an output voltage, but adjusted output power must not beyond its maximum rating.

If sense function is not being used, leave sense pin disconnected.

Over current Protection (OCP)

To provide protection in an output overload condition, the module is equipped with internal current-limiting for unlimited duration. If the output current exceeds the current limit inception value , the module enters into the hiccup mode operation, where it shuts down and automatically attempts to restart. As long as the fault condition exists, the module will remain in this hiccup mode, and can sustain this mode of operation until the over current fault condition is corrected.

Over Temperature Protection (OTP)

The converters are protected from thermal overload by an internal over temperature shutdown circuit.

When T_{ref} as defined in thermal consideration section exceed 120°C the converter will shut down. The DC-DC converter will make continuous attempts to start up and resume normal operation automatically when the temperature has dropped below the temperature threshold.

Soldering Information – Through Hole Mounting

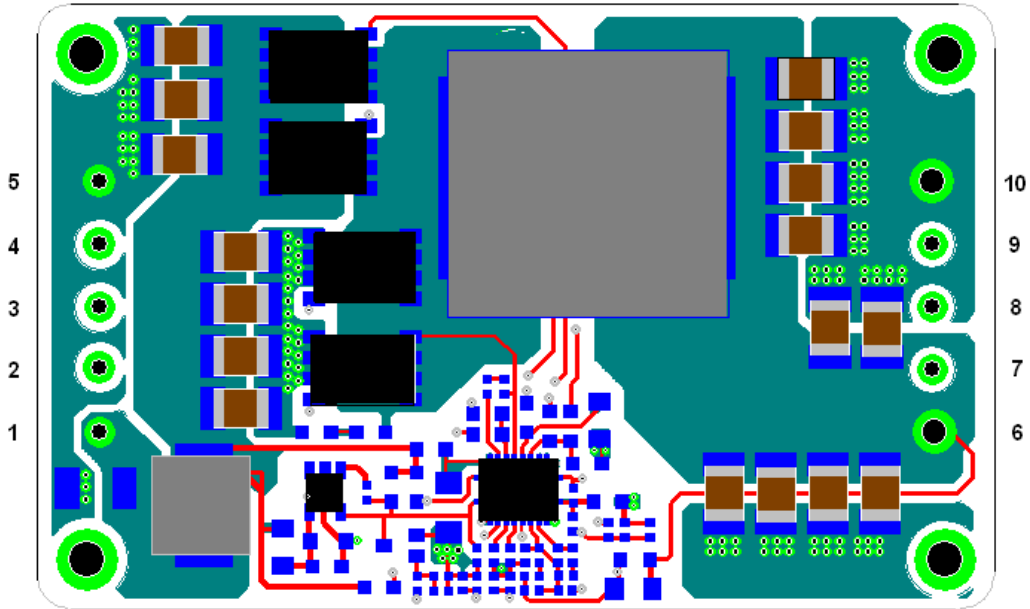
The product is intended for through hole mounting in a PCB, When wave soldering is used, the temperature on the pins is specified to maximum 260°C for maximum 10 seconds when hand soldering, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

Delivery package information

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Pin assignments

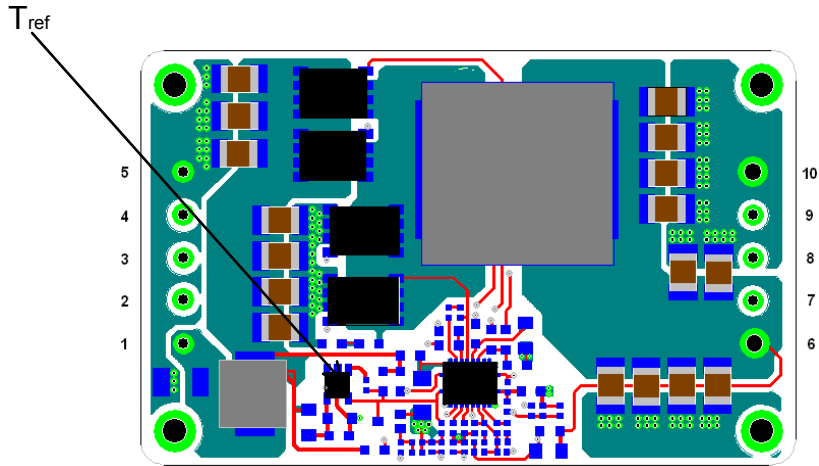


PIN NO	NAME	FUNCTION
1	Vin(+)	Positive terminal for 48V BUS
2 , 4	-	No Pin
3	ON/OFF	Logic signal reference to Vin(-) to Turn the converter ON/OFF
5	GND	Common Ground
6	Vout(+)	Positive terminal for 12Vout
7	+Sense(Optional)	Positive sense terminal
8	Trim	Output voltage trim terminal
9	PG(Optional)	Power good signal
10	GND	Common Ground

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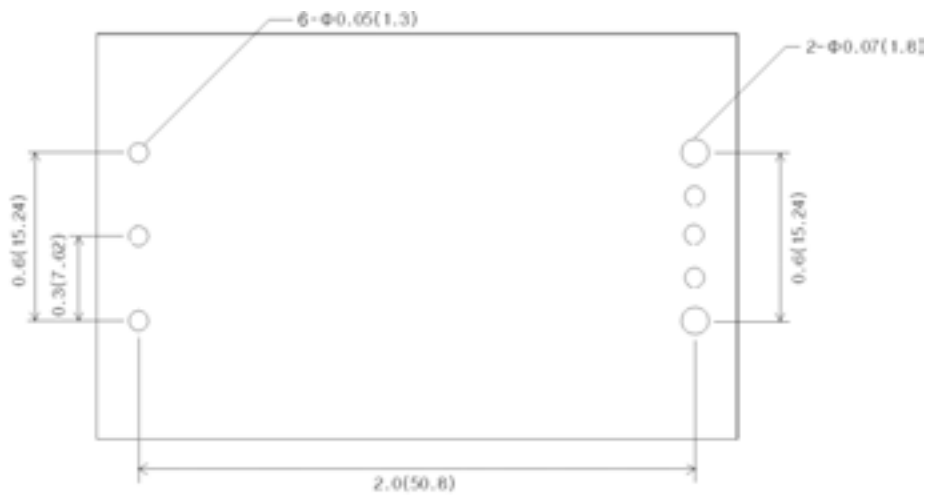
Mechanical Specification



TOP VIEW



SIDE VIEW



RECOMMENDED PAD LATOUT

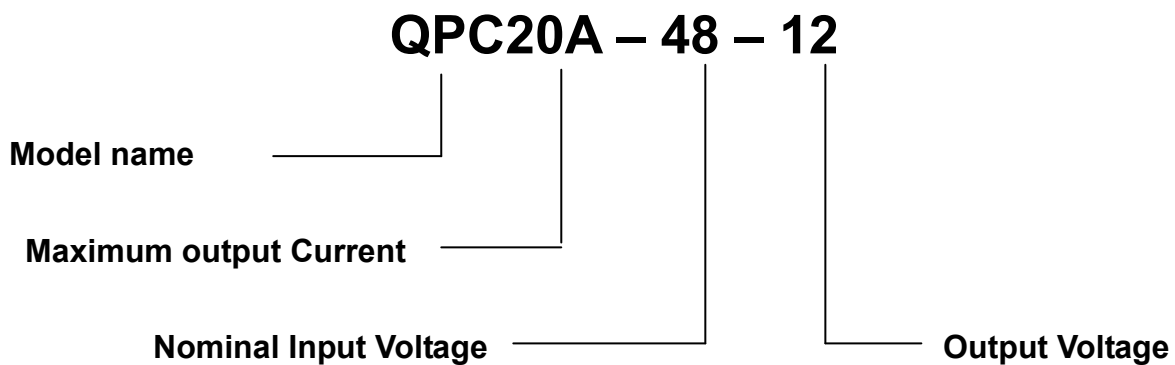
All dimensions are inches and (mm)

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Ordering Information

Input	Output	Maximum Power	Ripple & Noise Typ.	Efficiency Typ.	Model Number
48V(36 ~ 58V)	12V@20A	240W	120mVp-p	94.5%	QPC20A-48-12

Part number structure

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