18-36V Input, 12V/17A Output Quarter Brick

Features

- **High Efficiency: 93.5% at 12V/17A output**
- **Optimal thermal performance**
- **Low profile in standard footprint**
- **Wide input-voltage range: 18-36V**
- **+10%/-20% output trim**
- **Remote sense, On/Off control,**
- **Over-voltage, over-current, short-circuit, and over temperature protection**
- **Monotonic start-up into pre-biased load**
- **1,500V isolation between input and output**

For High Reliability Applications

Options

- **Open-frame, Baseplate, or Encapsulated**
- **Auto-restart or lock-up protection mode**
- **Negative / Positive enable logic**

Part Numbering System

QB	24	X	120	X	017	X	X	X	X
Series Name	Nominal Input Voltage	Temperature Grade（Baseplate Temperature）	Output Voltage	Enabling Logic	Rated Output Current	Pin Length	Electrical Option	Mechanical Options	Lead-free, ROHS Compliant
VQB	24: 18-36V	C: -40˚C --80˚C H: -40˚C --100˚C M: -55˚C --100˚C	Unit: 0.1V 120: 12.0V	P: Positive N: Negative	Unit: A 017:17A	R: 0.180"	0: Lock-up 2: Auto-restart	0: Open-frame 1: Baseplate 2: Encapsulated 3:with mounting holes	G: Lead-free

General Specification

Absolute Maximum Rating

Excessive stresses over these absolute maximum ratings can cause permanent damage to the converter. Also, exposure to absolute maximum ratings for extended periods of time can adversely affect the reliability of the converter. Operation should be limited to the conditions outlined under the Electrical Specification Section.

Parameter	Symbol	Min	Max	Unit
Input Voltage (continuous)	Vi	-0.5	36	Vdc
Input Voltage (< 100ms, operating)	Vi	-	50	Vdc
Input Voltage (continuous, non-operating)	Vi	-	50	Vdc
I/O Isolation Voltage		-	1500	Vdc
Operating Ambient Temperature				
"C" Temperature grade	To	-40	80	˚C
"H" Temperature grade		-40	100	˚C
"M" Temperature grade		-55	100	˚C
Storage Temperature	Tstg	-55	125	˚C

Electrical Specifications

The specifications are valid over all operating conditions including input voltage, resistive load, and temperature except as noted.

Input Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Input Voltage	Vi	18	24	36	Vdc
Input Current	I_{in_Max}	-	-	15	A
Quiescent Input Current (Typical Vin)	I_{in_Qsnt}	-	150	200	mA
Standby Input Current	I_{in_Stdby}	-	6	10	mA
Inrush Transient	I^2t	-	-	0.1	A^2s
Input Reflected-ripple Current, Peak-to-peak (5 Hz to 20 MHz, 12 µH source impedance)	-		10		mA
Input Ripple Rejection			-		dB
Input Turn-on Voltage Threshold	-	17	17.5	18	V
Input Turn-off Voltage Threshold	-	15.5	16	16.5	V
Input Voltage ON/OFF Hysteresis	-		1.5		V

Output Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Output Voltage Set Point Accuracy (Vi = Typical Vin; Io = Io_max; Ta = 25°C)	-	-2		+2	%Vo
Output Voltage Set Point Accuracy (over all conditions)	-	-3		+3	%Vo
Output Regulation:					
Line Regulation (full range input voltage, 1/2 full load)	-	-	0.2	0.5	%Vo
Load Regulation (full range load, Typical Vin)	-	-	0.2	0.5	%Vo
Temperature (Ta = -55°C to 100 °C)	-	-	0.1		%Vo
Output Current	Io	0	-	17	A
Output Power	Po	0		204	W
Efficiency (Typical Vin; Io_max, T_A = 25ºC)	η	91.5	93.5	-	%
Output ripple frequency	-	220	250	230	kHz
Output Ripple and Noise Voltage					
RMS	-	-	-	75	mVrms
Peak-to-peak (5 Hz to 20 MHz bandwidth, Typical Vin)				200	mVp-p
External Load Capacitance	-	-	-	2200	µF

Output Specifications (continued)

Parameter	Symbol	Min	Typ	Max	Unit
Startup Delay, duration from enabling signal to Vo reaches 10% of its set point. (Typical Vin; Io_max, T_A = 25ºC)			1.5		ms
Startup Time, duration for Vo to rise from 10% of its set point to within its regulation band. (Typical Vin; Io_max, T_A = 25ºC)			3		ms
Output Over Current Protection Set Point / Io_max		105	125	150	%
Output Over Voltage Protection Set Point / Vo_typical		115	125	150	%
Output Trim Range in % of Vo_typical		80	-	110	%
Output Remote Sense Range in % of Vo_typical				10	%
Dynamic Response (Vi = 36V; Ta = 25°C; Load transient 0.1A/µs) Load steps from 50% to 75% of full load: Peak deviation Settling time (within 10% band of Vo deviation) Load step from 50% to 25% of full load Peak deviation Settling time (within10% band of Vo deviation)			 5 200 5 200		 %Vo µs %Vo µs

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Remote Enable Logic Low: $I_{ON/OFF}$ = 1.0mA $V_{ON/OFF}$ = 0.0V	 $V_{ON/OFF}$ $I_{ON/OFF}$	 0 -	 - -	 1.2 1.0	 V mA
Logic High: $I_{ON/OFF}$ = 0.0µA Leakage Current	$V_{ON/OFF}$ $I_{ON/OFF}$	3.5 -	- -	15 50	V µA
Over-temperature Protection set point	To	-	120	-	°C
Isolation Capacitance	-	-	1200	-	pF
Isolation Resistance	-	10	-	-	MΩ
Calculated MTBF Telecordia SR-332, full load, 40°C, Typ. Vin			3.8		10^6 -hour
Calculated MTBF Telecordia SR-332, 50% load, 25°C, Typ. Vin			6.3		10^6 -hour

Feature Descriptions

The converter can be turned on and off by changing the voltage between the ON/OFF pin and Vin(-). The VQB Series of converters is available with factory selectablepositive 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. A few example circuits for controlling the ON/OFF pin are shown in Fig. 1,2and 3.

The logic low level is from 0V to 1.2V and the maximum switch 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 maximum voltage at the ON/OFF pin generated by the converter internal circuitry is less than 15V. The maximum allowable leakage current is 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 to the point where regulation is desired. The voltage between the SENSE pins and the output pins must not exceed 0.5V:

[Vout(+) - Vout(-)] - [SENSE(+) - SENSE (-)] < 0.5V

When remote sense is not used, the SENSE pins should be connected to their corresponding output terminals (positive and negative). If the SENSE pins are left floating, the converter will deliver an output voltage slightly higher than its specified typical output voltage. Since the OVP (output over-voltage protection) circuit senses the voltage across the output pins (Pin 8 and Pin 4), the total voltage rise should not exceed the minimum OVP setpoint given in the Specifications table.

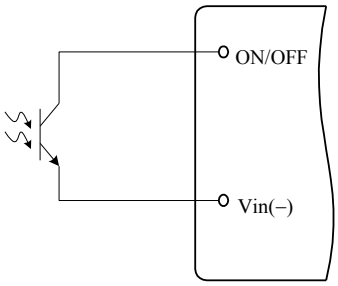


Fig. 1 Opto Coupler Enable Circuit

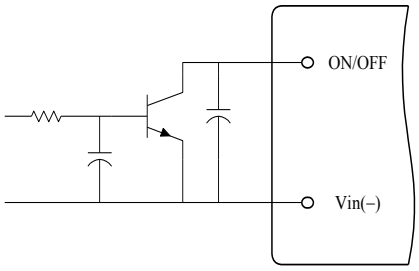


Fig. 2 Open Collector Enable Circuit

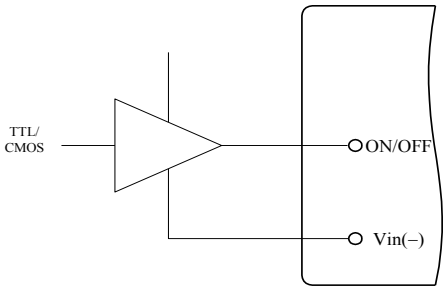


Fig. 3 Direct Logic Drive

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 its specified nominal output voltage. The circuit configuration for trim down operation is shown in Fig.4.

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

Where

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

and

V_{nom} = Nominal Voltage
V_{adj} = Adjusted Voltage

The circuit configuration for trim up operation is shown in Fig.5.

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 = Nominal Output Voltage

As the output voltage at the converter output terminals are higher than the specified nominal level when using the trim up and/or remote sense functions, it is important not to exceed the maximum power rating of the converter as given in the Specifications table.

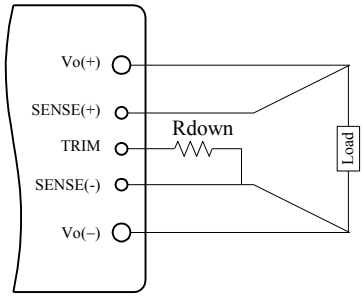


Fig. 4 Circuit to Decrease Output Voltage

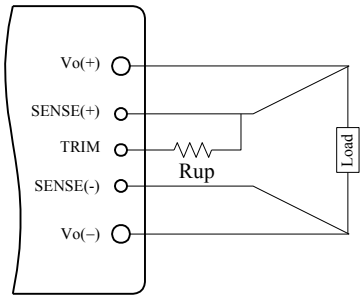


Fig. 5 Circuit to Increase Output Voltage

Input Under-Voltage Lockout

This feature prevents the converter from starting until the input voltage reaches the turn-on voltage threshold, and keeps the converter running until the input voltage falls below the turn-off voltage threshold. Both turn-on and turn-off voltage thresholds are defined in the Input Specifications table. The hysteresis prevents oscillations.

Output Over-Current Protection

As a standard feature, the converter will latch off when the load current exceeds the current limit. The converter can be restarted by toggling the ON/OFF switch or recycling the input voltage. With the auto-restart option, the converter will operate in a hiccup mode (repeatedly try to restart) until the over-current condition is cleared.

Output Over-Voltage Protection

If the voltage across the output pins exceeds the output voltage protection threshold as given in the Specifications table, the converter will shut down to protect the converter and the load.

As a standard feature, the converter will shut down and latch off when this fault occurs. The converter can be restarted by toggling the ON/OFF switch or recycling the input voltage. With the auto-restart option, the converter will operate in a hiccup mode until the over-voltage cause is cleared.

Thermal Shutdown

As a standard feature, 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 option, the converter will resume operation after the converter cools down.

Design Considerations

Input Source Impedance

As with any DC/DC converter, the stability of the VQB converters may be compromised if the sourceimpedance 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 an additional input capacitor for typical source impedance, it is recommended to use at least a 220 - 470 μF low ESR electrolytic capacitor at the input of the converter to reduce the potential impact of the source impedance. This electrolytic capacitor should have sufficient RMS current rating over the operating temperature range.

Safety Considerations

The QB Series of converters are designed in accordance with EN 60950 Safety of Information Technology Equipment Including Electrical Equipment. The converters are recognized by UL in both USA and Canada to meet 1500V Basic Insulation requirements in UL 60950, Safety of Information Technology Equipment and applicable Canadian Safety Requirement, and ULc 60950. Flammability ratings of the PWB and plastic components in the converter meet 94V-0.

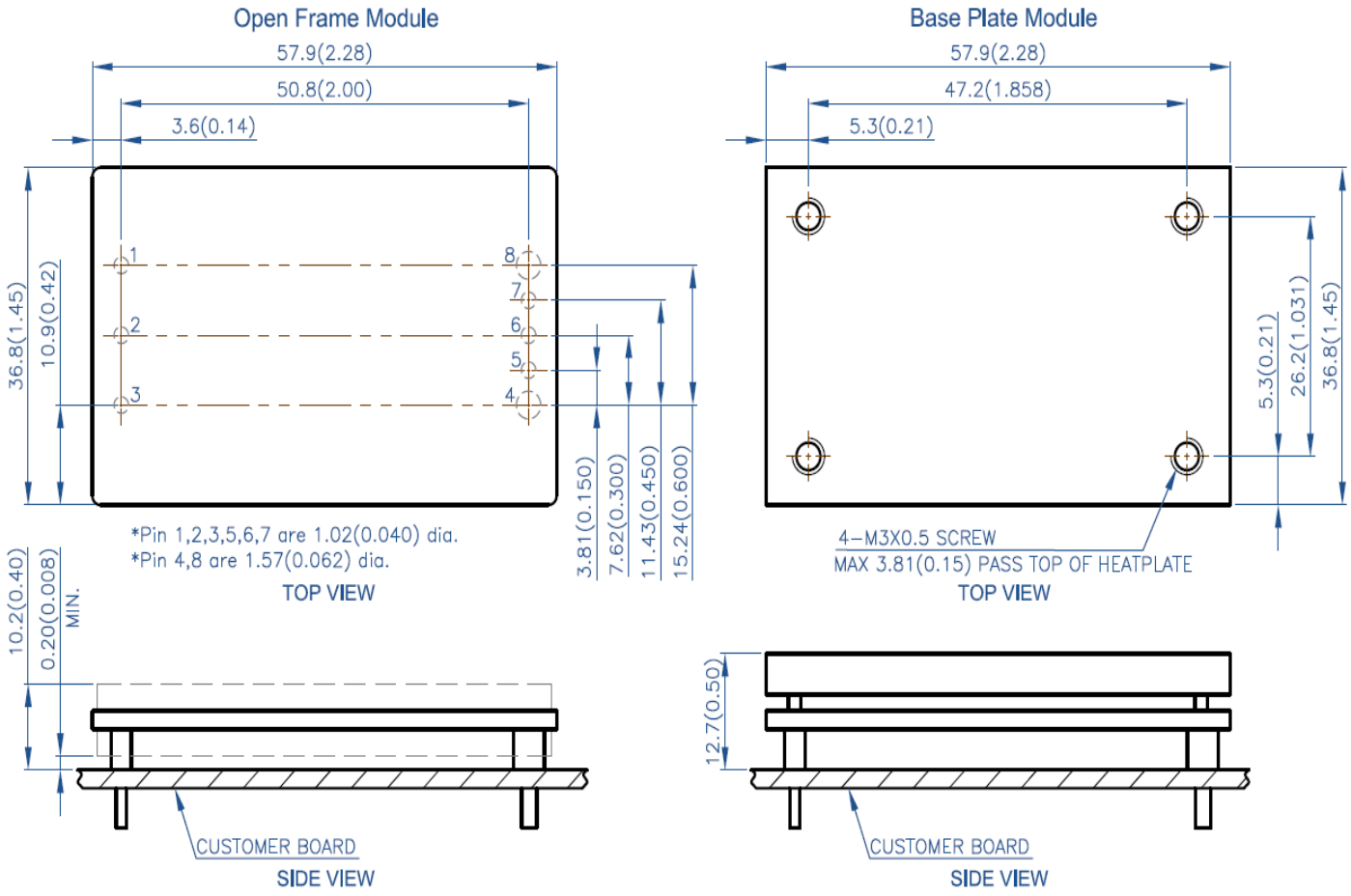
To protect the converter and the system, an input line fuse is highly recommended on the un-grounded input end.

Thermal Considerations

The VQB Series of converters can operate in variousthermal environments. Due to the high efficiency andoptimal heat distribution, these converters exhibitexcellent thermal performance. Proper cooling can beverified by monitoring the temperature of the case not
continuously exceeding 120 °C.

The maximum allowable output power of any power converter is usually determined by the electrical design and the maximum operating temperature of its components.

Mechanical Diagrams

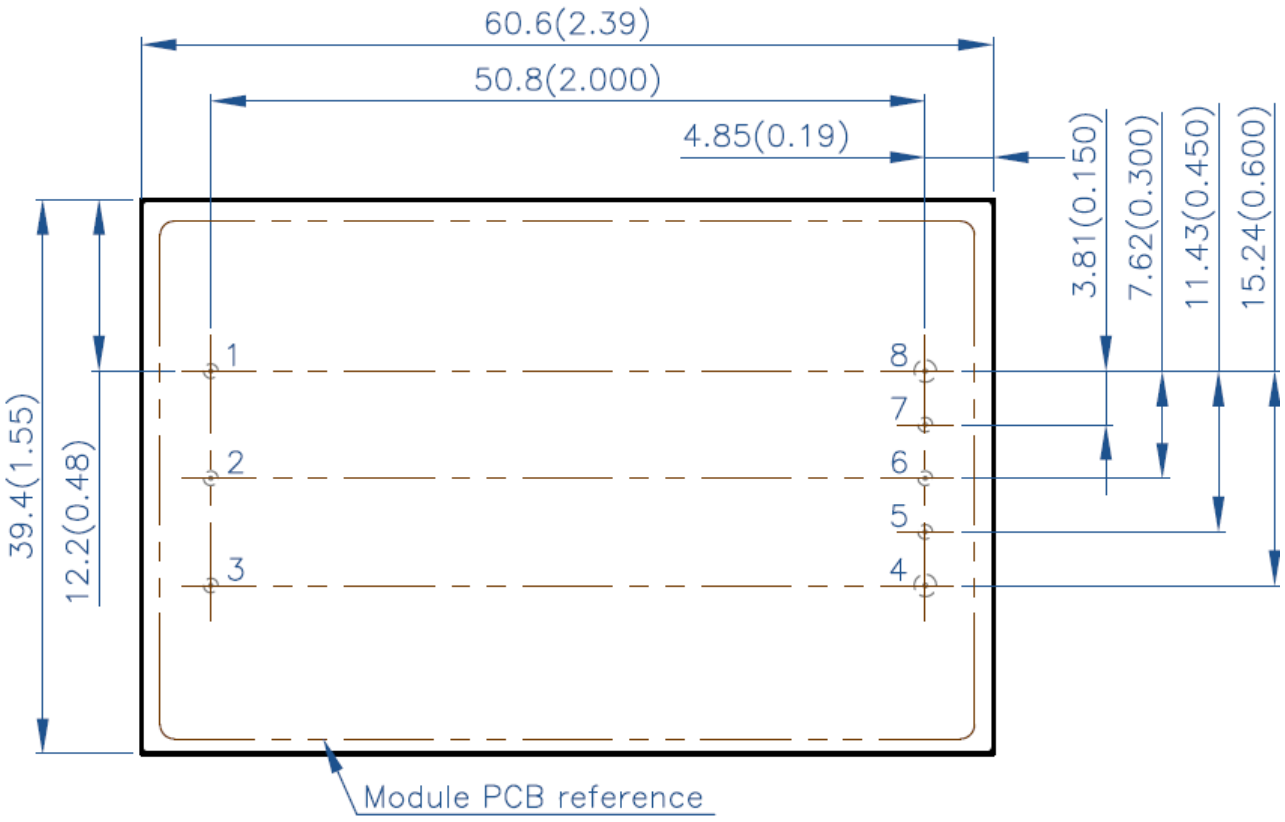


Pin	Name	Function
1	Vin(+)	Input voltage positive
2	ON/OFF	Remote control
3	Vin(−)	Input voltage negative
4	Vout(−)	Output voltage negative
5	SENSE(−)	Negative remote sense
6	TRIM	Output voltage adjust
7	SENSE(+)	Positive remote sense
8	Vout(+)	Output voltage positive

Notes:

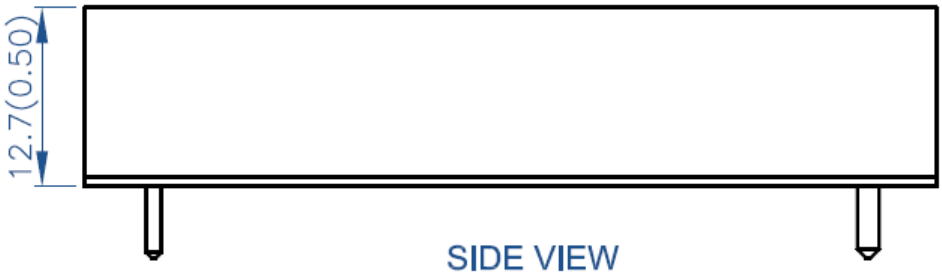
All dimensions in mm (inches)
Tolerances: .x ± .5 (.xx ± 0.02)
.xx ± .25 (.xxx ± 0.010)

Encapsulated Type- I
(without mounting holes)



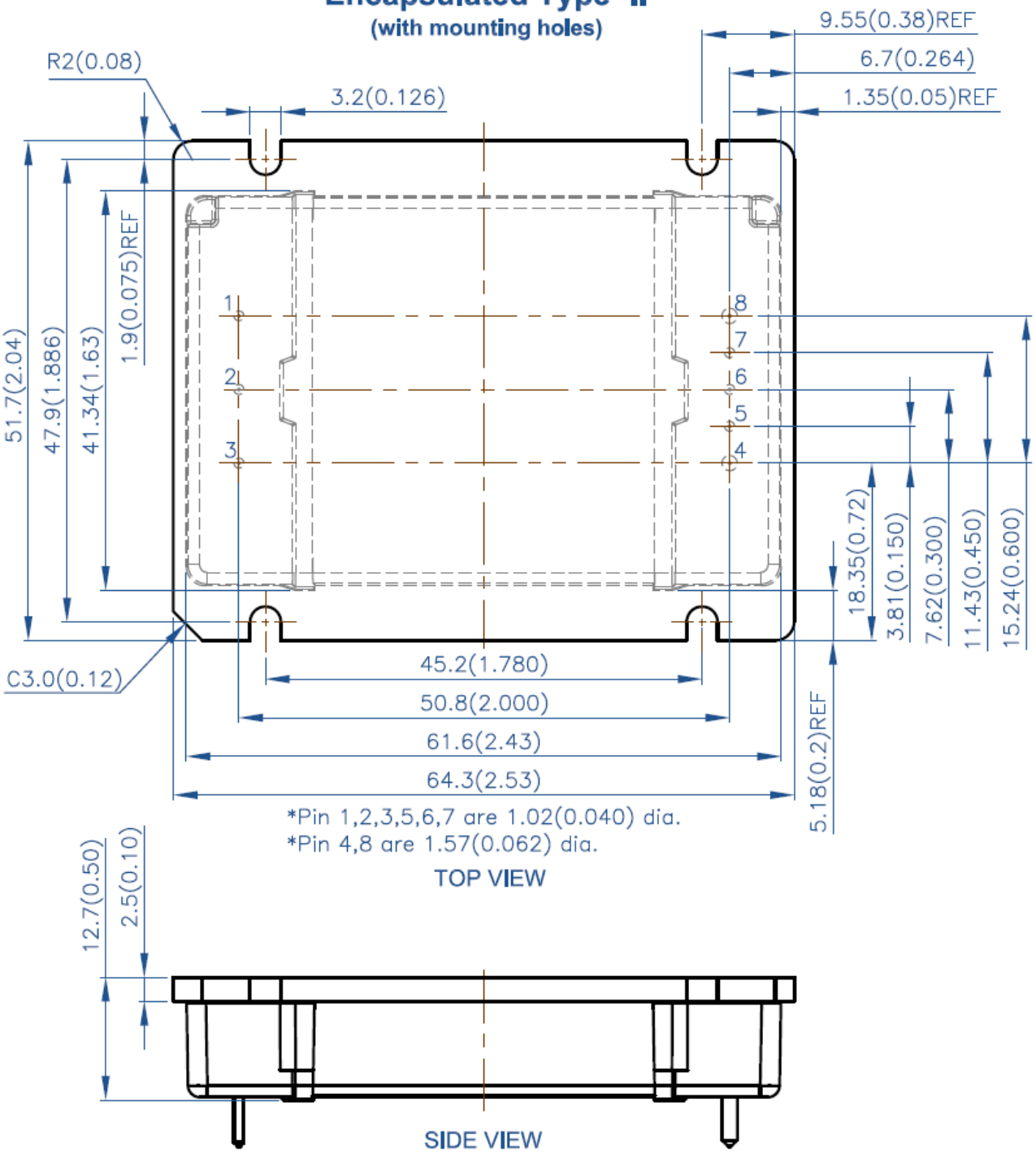
*Pin 1,2,3,5,6,7 are 1.02(0.040) dia.
*Pin 4,8 are 1.57(0.062) dia.

TOP VIEW



SIDE VIEW

Encapsulated Type- II
(with mounting holes)



For more information, please contact Dr. Power's China Representative:

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Warranty

Dr. Power offers a two (2) year limited warranty. Complete warranty information is listed on our web site or is available upon request. Information furnished by Dr. Power is believed to be accurate and reliable. However, no responsibility is assumed by Dr. Power for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Dr. Power.