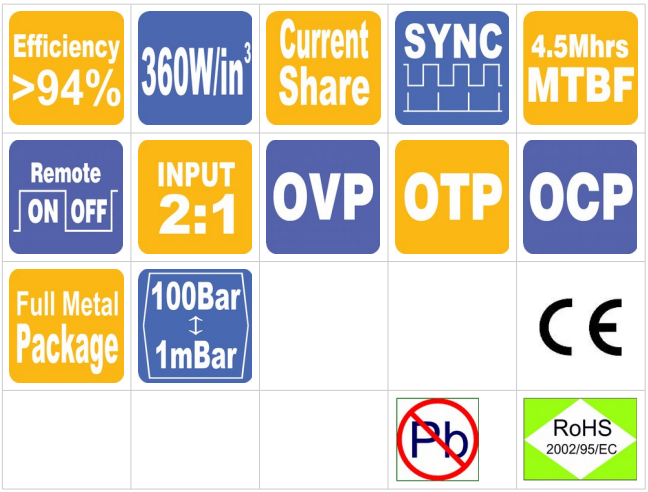
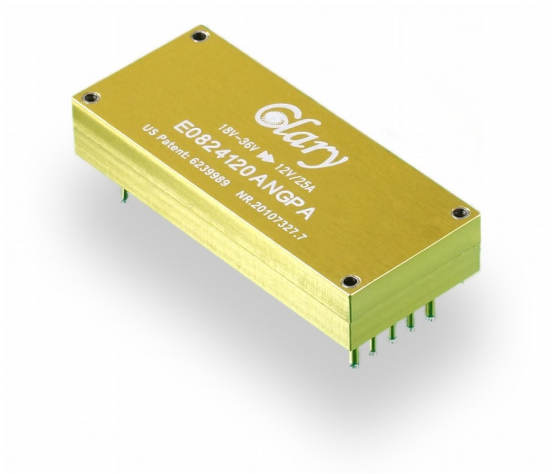
IDEAL POWER
experts in power conversion

E08 Series 1/8 Brick





As the most powerful member of Glary's new ***E-Generation*** power module, the ***E08*** provides three outputs including 12V, 5V and 3.3V from 18~36V or 36~75V input ranges with industry standard 1/8-Brick pin assignment. The efficient converter core is designed with patented ***"Buck-Reset Forward"*** topology, which cooperates with special designed ***"Partial-Resonant-Synchronous-Rectifier"*** stages at 450kHz switching frequency to efficiently deliver more power, achieving 94% of conversion efficiency and 360W/in^3 power density.

A proprietary ultra-fast current limiting circuit is also embedded in the E08 series to eliminate the so called ***"Short-Circuit-Current-Runaway"***, which is a destructive high output current driven by the minimum output voltage caused by non-zero propagation delay of the current limiting loop of the PWM converter. With this technology, the E08 can largely cut the delay time from 350us to 60nS, effectively shifting the current limit set point to be higher than that of conventional converters without reliability impact, providing superior driving capability to motors and capacitive loads. To provide higher power and improve the system reliability, the E08 series utilizes a proprietary wide-band ***"Droop Current Sharing"*** control circuit, which allows directly connecting the outputs of modules without a noise sensitive current share bus. System built by paralleling multiple E08 modules is capable to respond full scale step load within 20μS without evident overshot and ringing. The E08 modules are also built with ***"Anti-Back-Driving"*** circuit to prevent the reversed current and further reduce the power loss.

All the power semiconductor chips of E08 are attached onto the inner surface of a low profile six-sided metallic case to spread heat to the outer surface homogeneously, and further result in lower thermal resistance for better cooling. The package is designed to allow external cooling means to be attached on its top or bottom sides by using four M2 screws, which provide sufficient mechanical strength to install the module on applications of vehicles for resisting harsh vibration. The cavity of E08 metal case is vacuum potted with high thermal conductivity silicone, which helps the heat transfer and maintains hydrostatic pressure balance in the high strength metallic case to withstand pressure range from 1mBar to 100Bar. E08 can effectively simplify the system power design of deep water probes, high altitude instruments and other equipments that its conventional cousins cannot.

MODEL NAME SYSTEM

E08	48	120	a	b	c	d	XXXX
Series	VIN	VOUT	Startup / Shutdown	Enable	Pin Length	Standoff	Suffix
E08	**24:**18V~36V **48:**36V~75V	**120= 12V** **050= 5.0**V	**I**: -40ºC / +110ºC **A**: -60ºC / +130ºC	**P:** Positive **N:** Negative	**0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"	**0**: 0.02"	Classification only if used

The selected option codes for the "**abcd**" section in the model number determine various options for the user. For example, the E0824**120IN10** module is configured to has negative enable logic, 0.16" pin length, 0.02" standoff height with -40ºC ~ +110ºC of Startup / Shutdown setting

MODEL LIST (Contact to factory for special specifications)

Preliminary Data Sheet

Part Number	Maximum Input		Maximum Output		Efficiency
E0824120	18V~36V	325W	12.0V/25A	300W	93%
E0824050	18V~36V	305W	5.0V/55A	275W	92%
E0824033	18V~36V	250W	3.3V/65A	215W	90%

Part Number	Maximum Input		Maximum Output		Efficiency
E0848120	36V~75V	385W	12.0V/30A	400W	94%
E0848050	36V~75V	330W	5.0V/70A	350W	92%
E0848033	36V~75V	260W	3.3V/80A	264W	90%

Since the E08 modules are designed to fulfill some critical mechanical and environmental requirements, which cannot be managed by just few digits of model name. Please contact Glary or our local distributors to obtain an additional ***Part Code*** *for purchasing of the specific E08 part.*

COMMON SPECIFICATIONS

Absolute Maximum Ratings

Temperature	Storage	-55°C to +125°C
Input Voltage Range	Operation: 48V Models 24V Models Transient (100mS): 48V Models 24V Models	 -0.5V to +80Vdc -0.5V to +40Vdc 100V Maximum 50V Maximum
Isolation Voltage	Input to Output Input to Case Output to Case	2.0KV Minimum 1.0KV Minimum 1.0KV Minimum
Remote Control		-0.5V to +12Vdc

General Parameters

MTBF	Bellcore TR-332 issue 6	4.50×10^6 hrs @GB/25°C (E0848120abcd)
OTP	T_C	See Startup / Shutdown
Weight	Metal Enclosed	32g

Control Functions

Remote Control	Logic High Logic Low	+3.0V to +6.5V 0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

Input

Operation Voltage Range	48V Models 24V Models	+36V to +75Vdc +18V to +36Vdc
Power ON Voltage Ranges	48V Models 24V Models	+34.0V to +36.0Vdc +17.0V to +18.0Vdc
Power OFF Voltage Ranges	48V Models 24V Models	+31.2V to +33.2Vdc +15.6V to +16.6Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	48V Models 24V Models	20.0uF Max 40.0uF Max

Output Limitations

Part Number	Capacitive Load C_E	Pre-biased Voltage V_B	Reverse Current I_B	Short Circuit Output Current I_S	Note
E0824033	<47000uF@51mΩ Load	<3.1V	<1000mA@V_B	<150A @ 2mΩ Load	
E0824050	<22000uF@90mΩ Load	<4.75V	<1000mA@V_B	<140A @ 2mΩ Load	
E0824120	<2200uF@480mΩ Load	<11.4V	<500mA@V_B	<75A @ 2mΩ Load	
E0848033	<47000uF@42mΩ Load	<3.1V	<1500mA@V_B	<200A @ 2mΩ Load	
E0848050	<22000uF@72mΩ Load	<4.75V	<1500mA@V_B	<180A @ 2mΩ Load	
E0848120	<2200uF@364mΩ Load	<11.4V	<800mA@V_B	<100A @ 2mΩ Load	

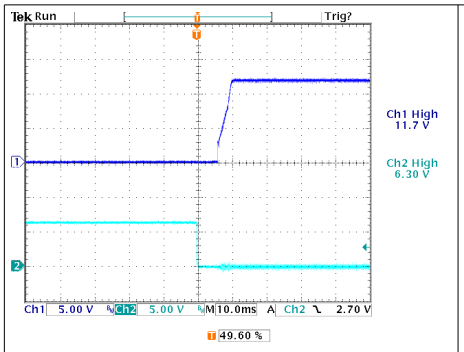
Model Number: E0848120

MODEL PARAMETERS

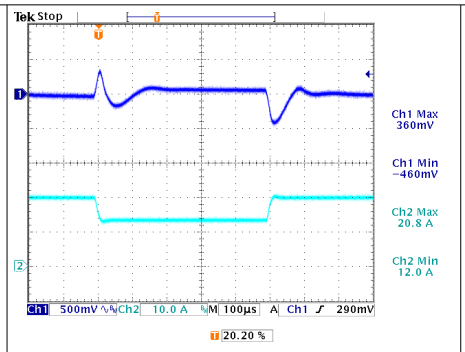
General		
Conversion Efficiency	Typical	See efficiency plots
Switching Frequency	Typical	450KHz

Input/Output		
Reflected Input Ripple Current	L_{EXT} = 10uH	20mA rms/60mAp-p
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Voltage Accuracy	Typical	±1.0%
Line Regulation	Full Input Range	±0.2%
Load Regulation	0%~100%	±0.2%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (RMS)	3% (1%) V_O
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %V_O
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Step Load (2.5A/μS)	50%~75% Load	±6%Vo/500μS
Start-Up Delay Time	V_{NOM}, Full Load	20mS/250mS

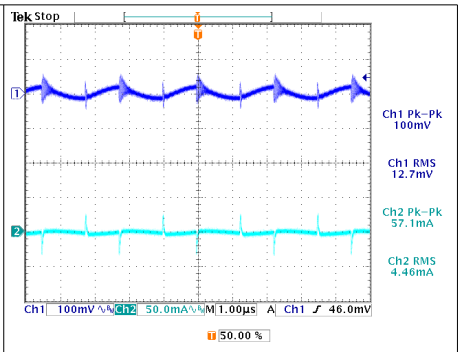
TYPICAL WAVES AND CURVES



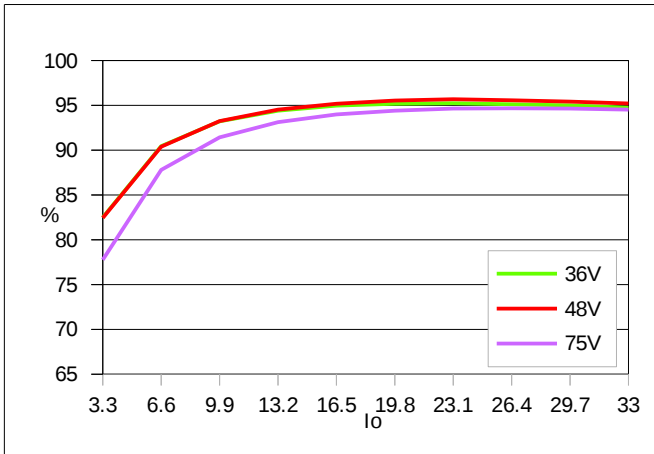
Start-up waveform of E0848120
(V_{IN}: 48V, Load: 33A)



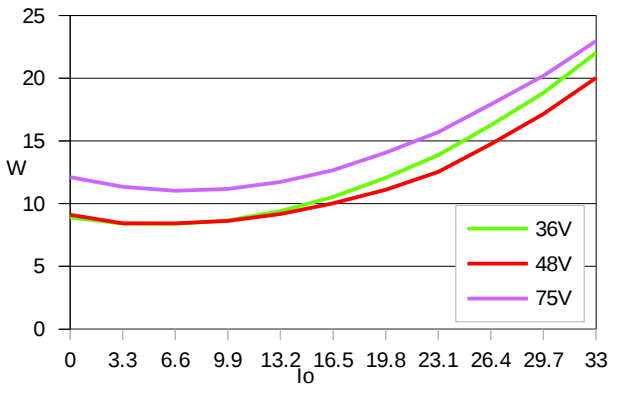
Transient response of E0848120
(V_{IN}: 48V, Load: 22.5A/15A@2.5A/μS)



Input/Output ripples of E0848120
(V_{IN}: 48V, Load: 33A, L_{IN}=10uH)



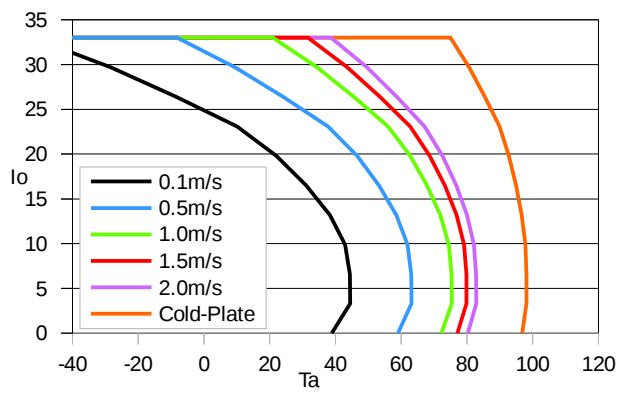
Efficiency plot of E0848120



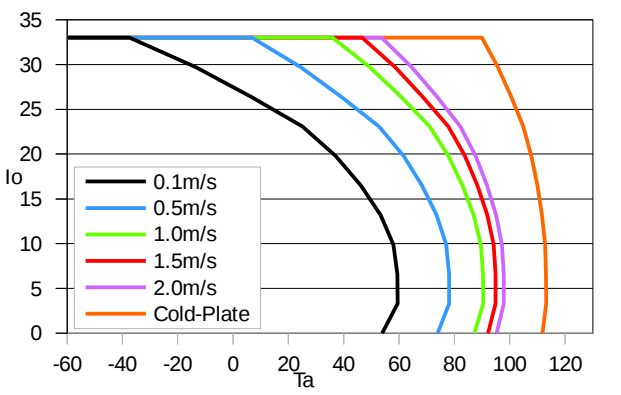
Power loss curves of E0848120

Model Number: E0848120

DERATING CURVES



Calculated derating of E0848120I

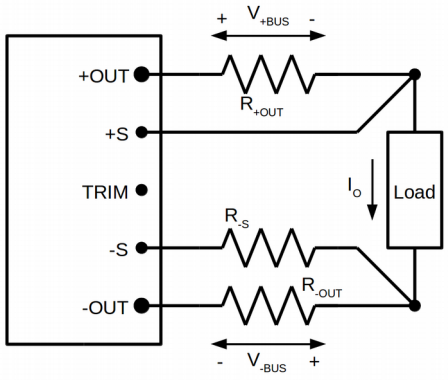


Calculated derating of E0848120A

VOLTAGE DROP COMPENSATION

The resistors R_{+OUT} and R_{-OUT} on the right-hand side circuit represent the impedances of the power distribution bus contributing voltage drops V_{+BUS} and V_{-BUS} respectively. The voltage drop V_{+BUS} can be eliminated by connecting the +S to the positive node of the load. The -S pin functions differently as it can disable the droop current sharing, compensate the voltage drop V_{-BUS}, manipulate the load regulation of droop current sharing function or enhance the step load performance.

By connecting a resistor R_{-S} between the -S pin and the negative node of the voltage on the load can be regulated. The values of R_{-S} for eliminating different V_{-BUS} and droop current sharing regulation at full load condition are listed in table below, which can be calculated from the equation right-hand below by leting $I_O = I_{RATED}$ and $V_O = V_{RATED}$. Precision resistor with less than 1% of tolerance is recommended for R_{-S}.



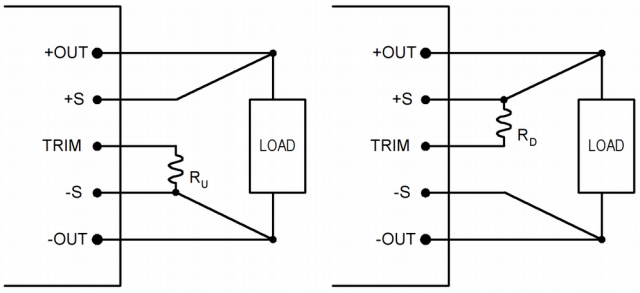
$$R_{-S} = \frac{(5\,V_{-BUS} + \frac{0.05\,I_O}{I_{RATED}})\,V_{RATED}}{V_O + V_{-BUS} + (\frac{I_O}{60\,I_{RATED}} - 1)\,V_{RATED}} - 3$$

V_{-BUS}	60mV	120mV	180mV	240mV	300mV	360mV	420mV	480mV	540mV	600mV
$R_S(\Omega)$	13.15	21.37	27.00	31.09	34.20	36.64	38.61	40.24	41.59	42.75

** Please consult Glary Power for manipulating load sharing and dynamic performance.*

TRIM AND TRIM TABLE

The output of the E0848120 power module can be adjusted for higher or lower than the rated voltage level by connecting the TRIM pin through a resistor to the pins of -S or +S respectively as shown as on the right hand side. The resistor for trimming output voltage higher or lower are denoted as R_U and R_D, which have different resistances for each different output voltage level. The resistance table for trimming the output voltage with 1% of step are listed as below for reference.



Trim Up	+1%	+2%	+3%	+4%	+5%	+6%	+7%	+8%	+9%	+10%	-	-	-	-	-	-	-	-	-	-
R_U (KΩ)	324.2	162.1	108.1	81.04	64.83	54.03	46.31	40.52	36.02	32.42	-	-	-	-	-	-	-	-	-	-

Trim Down	-1%	-2%	-3%	-4%	-5%	-6%	-7%	-8%	-9%	-10%	-	-	-	-	-	-	-	-	-	-
R_D (KΩ)	78.12	37.03	23.33	16.48	12.37	9.63	7.68	6.21	5.07	4.19	-	-	-	-	-	-	-	-	-	-

** Please contact Glary Power if a trim range beyond ±10% is needed.*

DROOP CURRENT SHARING

Fig. 1 shows schematic of the droop current sharing connection by using E-Generation modules. The droop current sharing function allows directly connecting outputs of multiple modules in parallel without current sharing bus. The reliable current sharing is achieved not only by minimizing the output voltage error but also the balancing the impedance of distribution bus. The output voltage error between modules determines the output current error constantly as show in Fig. 2. However, as shown in Fig. 3, the ratio of the shared current error for each module is gradually approaching to zero while the total output current increases.

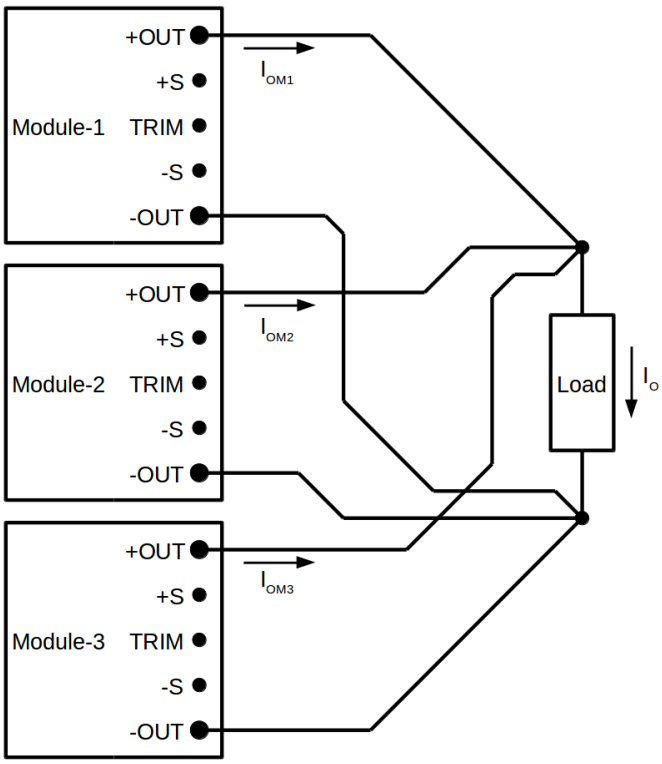


Fig. 1. Schematic of droop current sharing

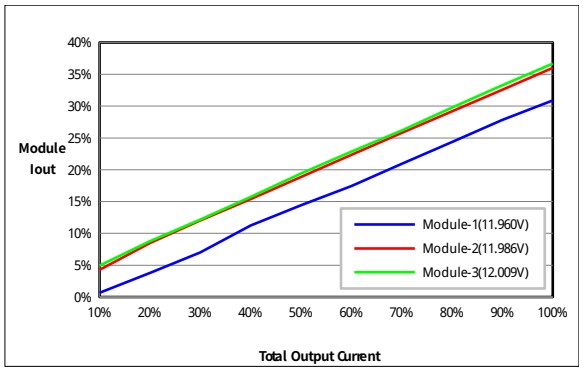


Fig. 2. Current sharing error

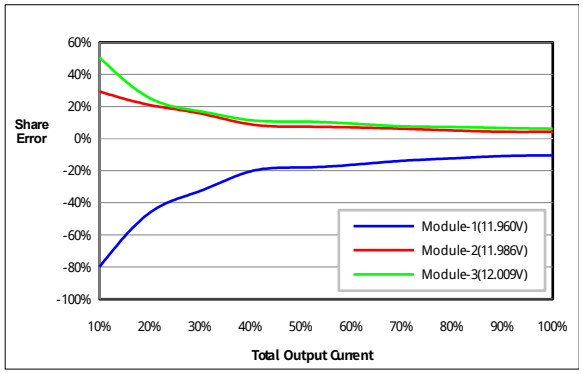


Fig. 3. Related current sharing error

The bandwidth of the droop current sharing loop is comparable to that of the voltage loop, which can respond to high current slew rate load transient without high current peak deviation. Fig. 4 shows waveforms of two E-series modules in current sharing responding to a 0A to 20A step load, the maximum current slew rate is 2.5A/μS limited by the used electrical load for testing. The waveform shows that the current error of two paralleled modules in the time period of 0A load is relatively large due to a significantly output voltage error, which has been reduced with a very short of settling time in the time period of the 20A load current.

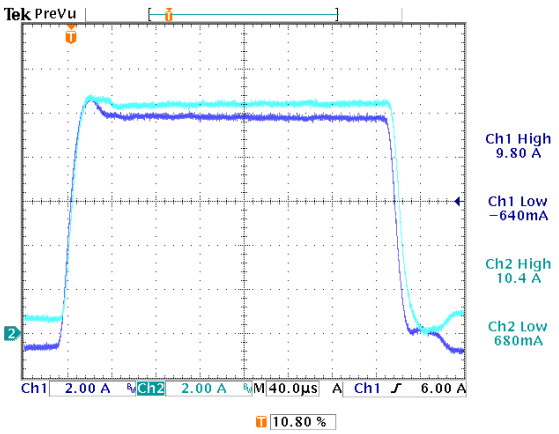


Fig. 4. Step-load response 0A/20A@2.5A/μS

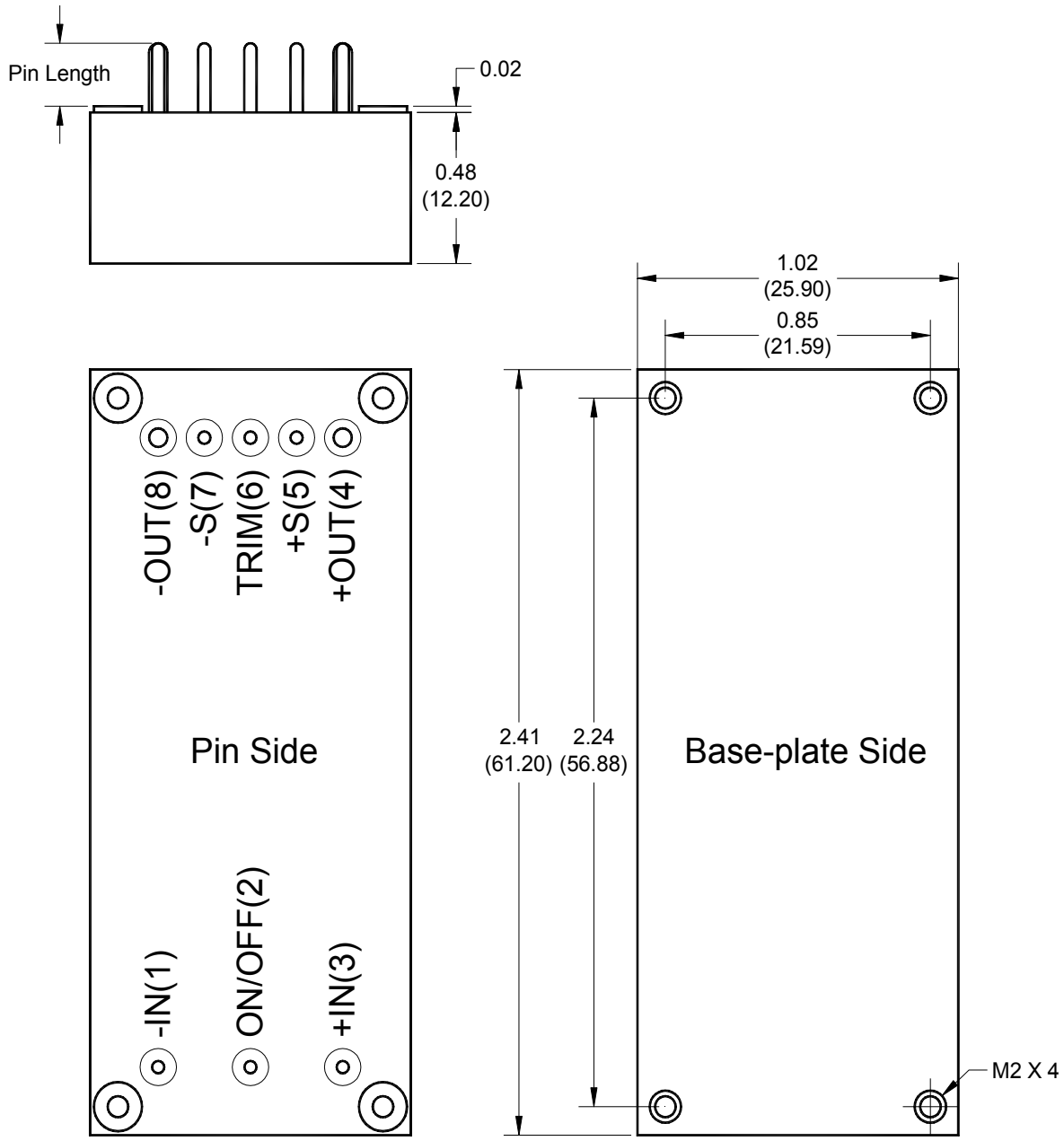
NOTE:

1. **It is recommended that the input should be protected by fuses or other protection devices.**
2. Specifications are subject to change without notice.
3. Printed or downloaded datasheets are not subject to Glary document control.
4. Product labels shown, including safety agency certificates, may vary based on the date of manufacture.
5. Information provided in this documentation is for ordering purposes only.
6. This product is not designed for use in critical life support systems, nuclear control systems or other such applications, which necessitate specific safety and regulatory standards other than the ones listed in this datasheet.

IMPORTANT

※ In order to secure effective usage of converter and the validity of Glary's service and warranty coverage, please refer to the application notes for general usage. For needs of usage beyond the application notes, please contact to Glary headquarter or our regional sales representative office for help.

MECHANICAL DRAWING



Dimensions and Pin Connections

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)
Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)
Weight: 32g
Base plate: Anode oxide aluminum alloy
Mounting inserts: M2 or through-hole
Maximum torque: 1.3in-lb (0.15Nm)
Pin material: Copper alloy or Brass
Pin plating: Golden over Nickel