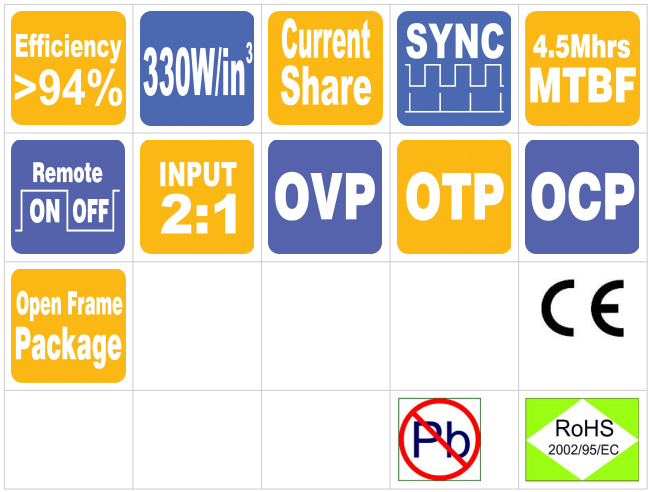
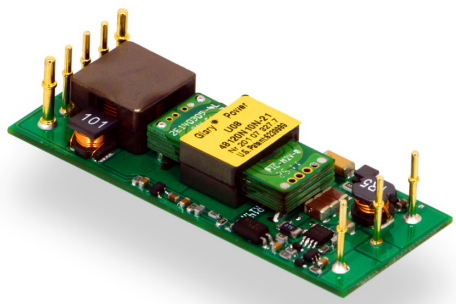
# Glary Power Technology

## U08 Series 1/8 Brick



The ***U08 Series*** 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 that operates at -40ºC~+100ºC. 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 330W/in$^3$ power density.

A proprietary ultra-fast current limiting circuit is also embedded in the U08 series to eliminate the long existing technical challenge of ***"Short-Circuit-Current-Runaway"***, which is a destructive high output current driven by the minimum output voltage in proportion with the propagation delay flowing through the short circuit loop or the low-impedance non-Ohmic loads. The propagation delay of the U08 series with ultra-fast current limiting can be as short as 60nS, effectively shifting the current limit set point higher than that of conventional converters without reliability impact. To provide higher power and improve the system reliability, the U08 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. The system built by paralleling multiple U08 modules is capable to respond full scale step load within 20μS without evidently overshot and ringing. The U08 modules also built with ***"Anti-Back-Driving"*** circuit to prevent the reversed current and further reduce the power loss.

The junction temperature of the power semiconductor chips used in U08 module can be minimized by attaching optional base-plate, which can be mounted to external cooling means by using two screws to provide sufficient mechanical strength and better thermal contact. A proprietary fin-type base-plate as called as ***"Sink-plate"*** can be integrated with U08 module to ensure full power delivering with low speed airflow cooling. All the special design efforts embedded in this product effectively simplifies the system power design of high performance computing system, high capacity semiconductor testing system and other equipments that the conventional module cannot be used.

## MODEL NUMBER SYSTEM

| U08 | 48 | 120 | a | b | c | d | - | XX | XX | X |
|---|---|---|---|---|---|---|---|---|---|---|
| Series Name | Input Voltage | Output Voltage | Enable Logic | Pin Length | Standoff Height | Base-Plate / module thickness | | Setting | Suffix | Version |
| **U08** | **24:**18V~36V<br>**48:**36V~75V | **Unit:** 0.1V Increments<br>**120= 12V**<br>**050= 5.0**V | **P:** Positive<br>**N:** Negative | **0:** 0.12"<br>**1:** 0.16"<br>**2:** 0.20"<br>**3:** 0.24" | **0:** 0.02"<br>**1:** 0.08"<br>**2:** 0.16" | **M**: 1.0mm Metal Plate / 0.46"<br>Contact Glary for special option | - | For customer function only | For marketing purpose only | |

The selected option codes for the "**abcd**" section in the model number determine what options will be applied in production. For example, the U0848**120N10N-25** module is configured to has negative enable logic, 0.16" pin length, 0.02" standoff height without base-plate, which result in 0.35" of the module thickness. The total height is 0.37" obtained by summing up the 0.02" standoff height and the 0.35" module thickness.

## MODEL LIST (Contact to factory for 4X input models or special specifications)

*Preliminary Data Sheet*

| Part Number * | Maximum Input | | Maximum Output | | Efficiency |
|---|---|---|---|---|---|
| U0824120abcd-XXXXX | 18V~36V | 325W | 12.0V/25A | 300W | 93% |
| U0824050abcd-XXXXX | 18V~36V | 305W | 5.0V/55A | 275W | 92% |
| U0824033abcd-XXXXX | 18V~36V | 250W | 3.3V/65A | 215W | 90% |

| Part Number * | Maximum Input | | Maximum Output | | Efficiency |
|---|---|---|---|---|---|
| U0848120abcd-XXXXX | 36V~75V | 385W | 12.0V/30A | 360W | 94% |
| U0848050abcd-XXXXX | 36V~75V | 330W | 5.0V/60A | 300W | 92% |
| U0848033abcd-XXXXX | 36V~75V | 260W | 3.3V/70A | 231W | 90% |

## COMMON SPECIFICATIONS

### Absolute Maximum Ratings

| | | |
|---|---|---|
| Temperature | Operation<br>Storage | -40°C to +110°C<br>-55°C to +125°C |
| Input Voltage Range | Operation:<br>48V Models<br>24V Models<br>Transient (100mS):<br>48V Models<br>24V Models | <br>-0.5V to +80Vdc<br>-0.5V to +40Vdc<br><br>100V Maximum<br>50V Maximum |
| Isolation Voltage | Input to Output<br>Input to Case<br>Output to Case | 2.0KV Minimum<br>1.0KV Minimum<br>1.0KV Minimum |
| Remote Control | | -0.5V to +12Vdc |

### General Parameters

| | | |
|---|---|---|
| MTBF | Bellcore<br>TR-332 issue 6 | $4.50\times10^6$ hrs @GB/25°C<br>(U0848120abcd-30XXX ) |
| OTP | $T_C$ | 110°C ±5°C for standard setting |
| Weight | M-type base-plate | 32g |

### Control Functions

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

### Input

| | | |
|---|---|---|
| Operation Voltage Range | 48V Models<br>24V Models | +36V to +75Vdc<br>+18V to +36Vdc |
| Power ON Voltage Ranges | 48V Models<br>24V Models | +34.0V to +36.0Vdc<br>+17.0V to +18.0Vdc |
| Power OFF Voltage Ranges | 48V Models<br>24V Models | +31.2V to +33.2Vdc<br>+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<br>24V Models | 20.0uF Max<br>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 |
|---|---|---|---|---|---|
| U0824033abcd-65xxx | <47000uF@51mΩ Load | <3.1V | <1000mA@$V_B$ | <130A @ 2mΩ Load | |
| U0824050abcd-55xxx | <22000uF@90mΩ Load | <4.75V | <1000mA@$V_B$ | <110A @ 2mΩ Load | |
| U0824120abcd-25xxx | <2200uF@480mΩ Load | <11.4V | <500mA@$V_B$ | <50A @ 2mΩ Load | |
| U0848033abcd-70xxx | <47000uF@47mΩ Load | <3.1V | <1500mA@$V_B$ | <140A @ 2mΩ Load | |
| U0848050abcd-60xxx | <22000uF@83mΩ Load | <4.75V | <1500mA@$V_B$ | <120A @ 2mΩ Load | |
| U0848120abcd-30xxx | <2200uF@400mΩ Load | <11.4V | <800mA@$V_B$ | <60A @ 2mΩ Load | |

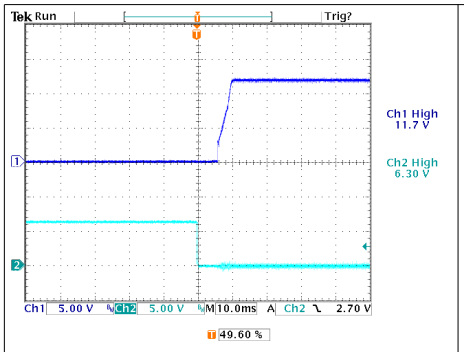
# Model Number: U0848120N10M-30xxx

## MODEL PARAMETERS

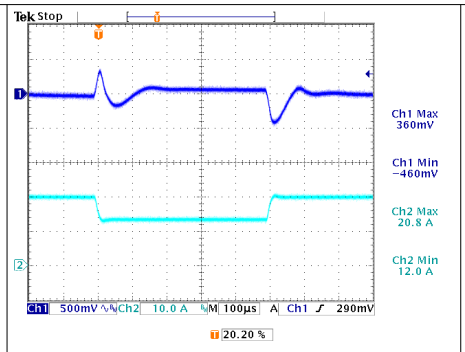
| General | | |
|---|---|---|
| Conversion Efficiency | Typical | See efficiency plots |
| Switching Frequency | Typical | 450KHz |

| 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 |

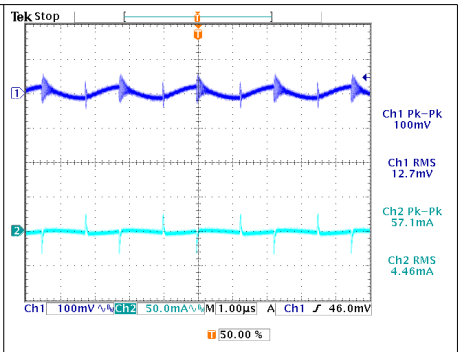
## TYPICAL WAVES AND CURVES



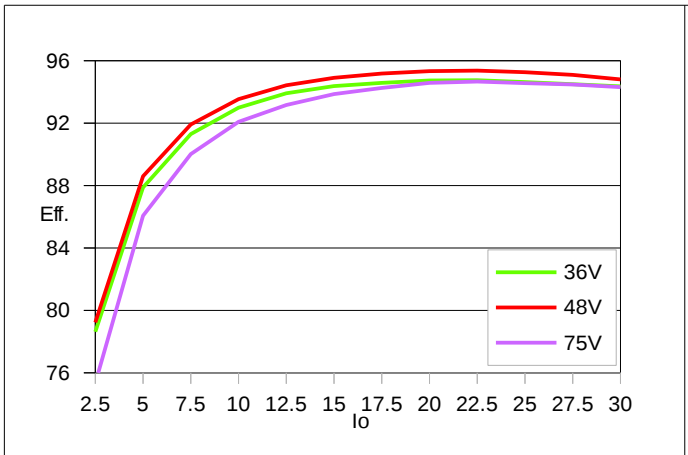

Start-up waveform of U0848120N10M-30xxx
($V_{IN}$: 48V, Load: 30A)



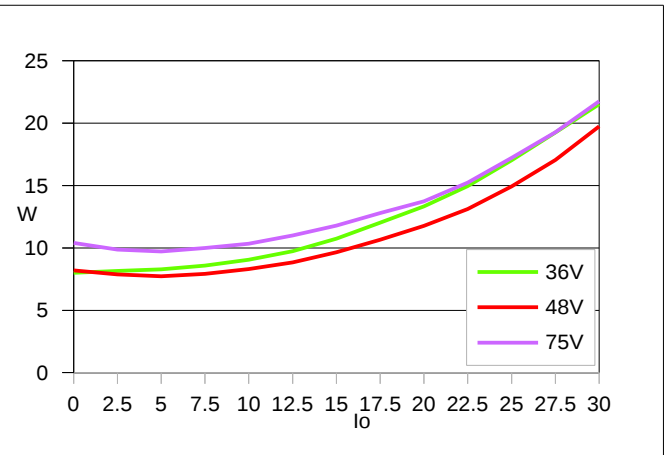

Transient response of U0848120N10M-30xxx
($V_{IN}$: 48V, Load: 22.5A/15A@2.5A/μS)




Input/Output ripples of U0848120N10M-30xxx
($V_{IN}$: 48V, Load: 30, $L_{IN}$=10uH)



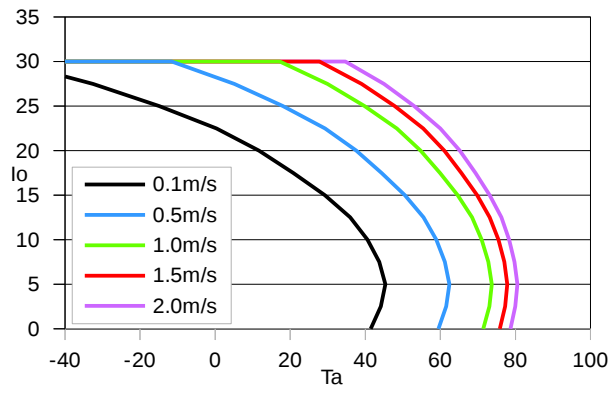

Efficiency plot of U0848120N10M-30xxx



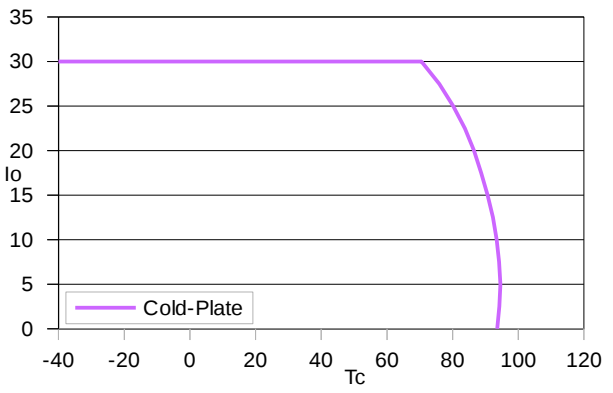

Power loss curves of U0848120N10M-30xxx

# Model Number: U0848120N10M-30xxx

## DERATING CURVES




Calculated derating of U0848120N10M-30xxx with Forced-Air cooling

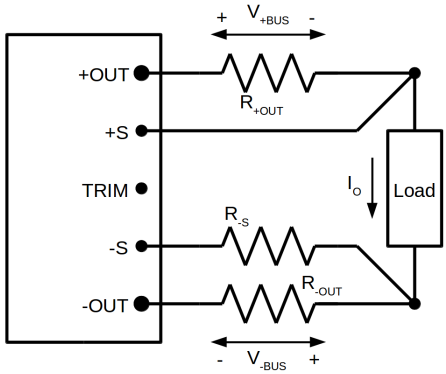



Calculated derating of U0848120N10M-30xxx with Could-Plate cooling

## 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 $R_{-S}$.



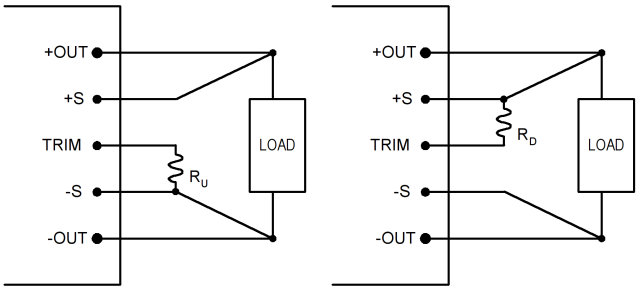

$$R_{-S} = \frac{(5\,V_{-BUS} + \frac{0.05\,I_O}{I_{RATED}})\,V_{RATED}}{V_O + V_{-BUS} + (\frac{I_O}{60\,I_{RATED}} - 1)\,V_{RATED}} - 3$$

| $V_{-BUS}$ | 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 U0848120abcd-30xxx 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 U08 modules. The droop current sharing function of U08 module 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. On U08 module, 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.

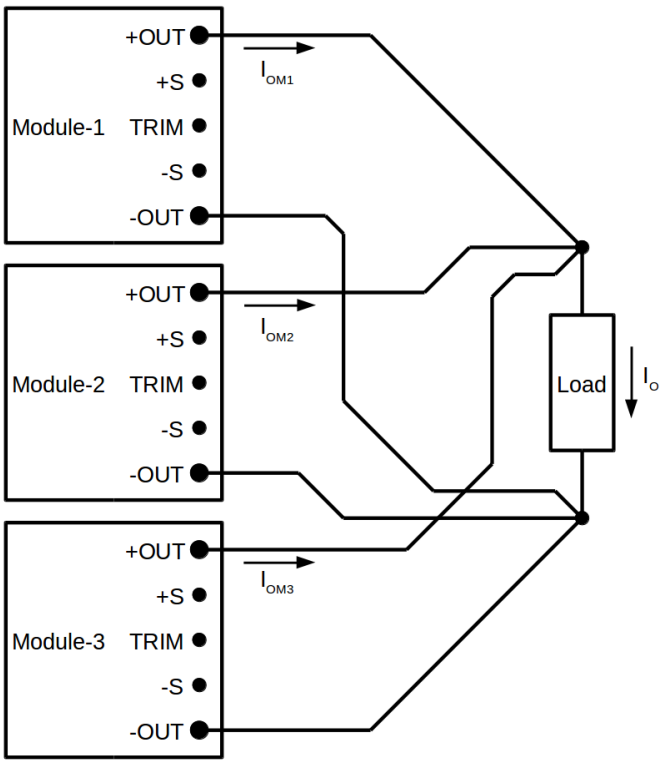



Fig. 1. Schematic of droop current sharing

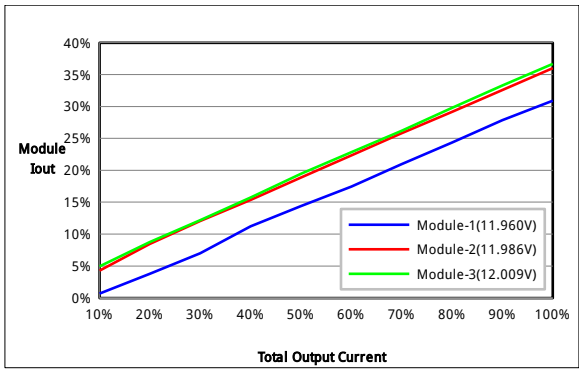



Fig. 2. Current sharing error

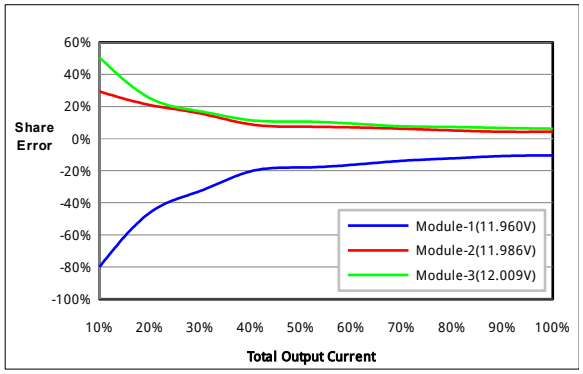



Fig. 3. Related current sharing error

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 U08 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.

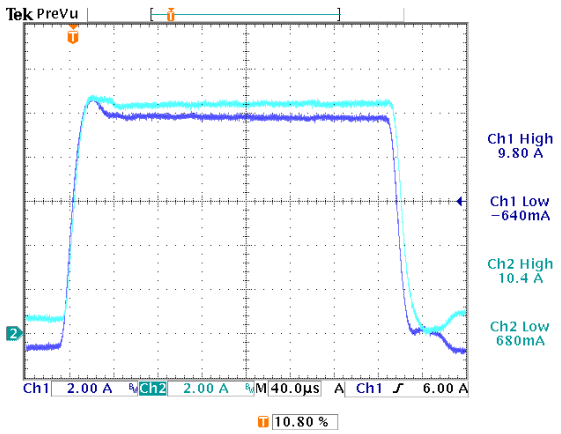



Fig. 4. Step-load response 0A/20A@2.5A/μS

## NOTE:

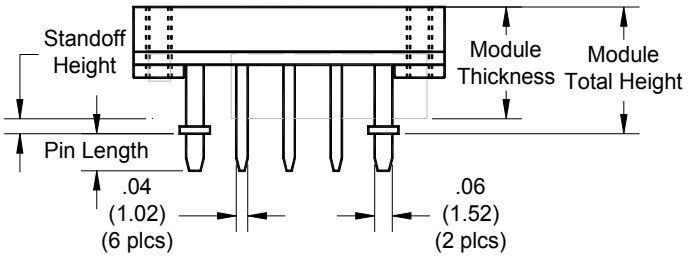
1. **It is recommended that the input should be protected by fuses or other protection devices.**
2. Specifications are subject to change without notice.
3. Printed or downloaded datasheets are not subject to Glary document control.
4. Product labels shown, including safety agency certificates, may vary 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.

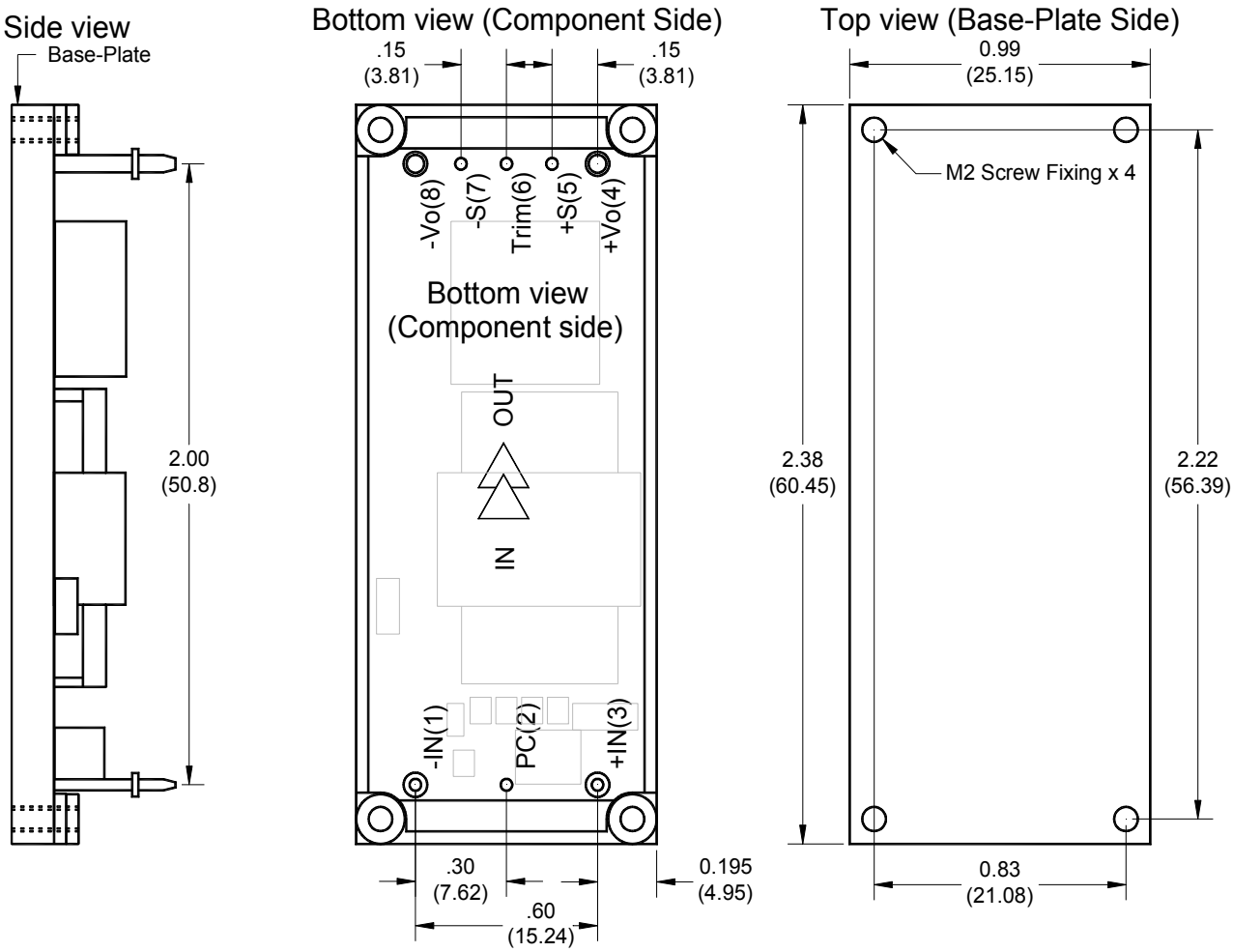
*IMPORTANT*

*※ 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.*

# U08 Series 1/8 Brick

## 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 / M-type base-plate
**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