



GV-5-MOD Manual

Solar Charge Controller with Maximum Power Point Tracking



The GV-5-MOD is a connectorized module version of Genasun's GV-5 series of MPPT solar charge controllers. The GV-5-MOD allows for easy integration into solar-powered products by reducing assembly labor and total system cost, and is available for nearly all 12V battery types, whether lithium- or lead-based.

For models:

GV-5-MOD-Pb:	12V Lead-Acid/AGM/Gel/Sealed/Flooded
GV-5-MOD-Li:	11.1V (3s) and 14.8V (4S) Lithium Cobalt/Magnesium/Nickel
GV-5-MOD-LFP:	9V (3S) and 12V (4s) Lithium Iron Phosphate
GV-5-MOD-CV:	One Custom Voltage CC/CV or Multi-Stage Lithium or Lead-Acid Variation
GV-5-MOD-CV-SEL:	Two Custom CC/CV or Multi-Stage Lithium or Lead-Acid Variations

Safety Instructions:

This manual contains important instructions for the GV-5-MOD solar charge controllers that shall be followed during installation and maintenance. Various models of the GV-5-MOD are available to charge different battery types as follows:

GV-5-MOD-Pb:	12V Lead-Acid/AGM/Gel/Sealed/Flooded
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GV-5-MOD-CV-SEL:	Two Custom CC/CV or Multi-Stage Lithium or Lead-Acid Variations

Consult your battery charging specifications to ensure that the GV-5-MOD is compatible with your chosen batteries.

The GV-5-MOD does not include a fuse. Overcurrent protection suitable for the application must be provided by the user.

UL SAFETY AND HAZLOC WARNING: EXPLOSION HAZARD. DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED. DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITABLE CONCENTRATIONS.

ATTENTION: RISQUE D'EXPLOSION. NE PAS CONNECTER NI DÉCONNECTER PAS LORSQU'IL EST SOUS TENSION. NE PAS CONNECTER LE CIRCUIT ALORS QUE EST VIVANT OU A MOINS QUE LA ZONE EST LIBRE DE CONCENTRATIONS IGNITAIRES.

CAUTION for the GV-5-MOD-Pb (Lead-Acid Versions Only): **INTERNAL TEMPERATURE COMPENSATION. RISK OF FIRE, USE WITHIN 0.3m (1 ft) of BATTERIES.** Lead-acid batteries can create explosive gases. Short circuits can draw thousands of amps from a battery. Carefully read and follow all instructions supplied with the battery. Use only 12V lead-acid batteries with **GV-5-MOD-Pb-12V** and **GV-5-MOD-Pb-CV**.

DO NOT SHORT CIRCUIT the solar array when plugged into the controller. **DO NOT MEASURE SHORT CIRCUIT CURRENT** of the array while connected to the controller. This may damage the controller, and such damage will not be covered under warranty. Grounding is not necessary for operation and is at the user's discretion. If the GV-5-MOD is to be used with a solar array electrically connected to earth ground, please note the following:

WARNING: THIS UNIT IS NOT PROVIDED WITH A GFDI DEVICE. Consult Article 690 of the National Electrical Code (or the standards in force at the installation location) to determine whether a GFDI is necessary for your installation.

WARNING: THIS UNIT IS NOT PROVIDED WITH DISCONNECT DEVICES. Consult Article 690 of the National Electrical Code (or the standards in force at the installation location) to determine whether disconnect devices are necessary for your installation.

LITHIUM WARNING: Use caution when working with lithium systems. Genasun Li controllers use the CC/CV charging profile indicated on the controller. CHECK the specifications of the battery pack to ensure that the CV voltage is correct. Further CHECK that the power supplied by the solar array and Genasun controller is within the battery specified design limits.

LITHIUM BMS WARNING: Genasun recommends using a lithium battery with a Battery Management System capable of disconnecting the solar charge controller in the event that any cell in the pack is outside of its rated temperature, current, or voltage range. Failure to do so may result in property damage, injury or death. Genasun highly recommends the use of a BMS with cell balancing. Cell balancing is mandatory for lithium iron phosphate.

Product Certifications

				
Safety Conforms to: UL STD 1741 Certified to: CSA STD C22.2#107.1	HazLoc (C1D2) Conforms to: UL STD 121201 Certified to: CSA STD C22.2#213	EMC Conforms to: EN 61000-6-3:2007+A1:2011 EN 61000-6-2:2005 AS/NZS 61000-6-3:2012	EMC Conforms to: FCC (CFR Title 47) Part 15 Radio frequency Devices, Subpart B - Unintentional Radiators. Tested for compliance.	Restriction Hazardous Substances Conforms to: EN 50581:2012

Inspection & Maintenance

- No user-serviceable parts inside.
- Check for animal or insect damage
- Inspect for corrosion / water damage
- Inspect the security of all connections.
- Inspect the controller at least once per year to ensure proper performance.
- Ensure the solar array does not exceed the maximum input voltage.
- Repair and clean as necessary.

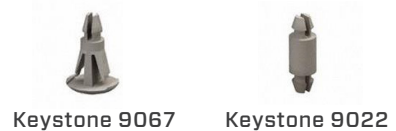
Installation & System Connections:

1 MOUNTING

The end of the GV-5-MOD opposite the connector should be supported at the same height as the height of the mated connector stack. For the suggested mates, this height is very close to 0.500"; therefore, a half-inch/12.7 mm or 12 mm spacer may be used. Two holes of different diameters are provided (0.187" / 3.18 mm and 0.125" / 2.29 mm) in the GV-5-MOD to allow the use of a wide range of spacers and fasteners. A clearance radius of 0.200" / 5 mm is provided from the center of each hole; the use of a fastener with a larger radius may cause damage to the GV-5-MOD.

- Do not expose to water.
- Do not mount in direct sunlight or near a source of heat.
- Allow adequate airflow around the controller to achieve maximum output capability.
- For outdoor use, the controller must be housed in an enclosure providing protection at least equivalent to NEMA Type 3.

Two suitable example fasteners:



2 ELECTRICAL CONNECTIONS

- Connections should be made according to Article 690 of the National Electrical Code (NFPA 70) or the standards in force at the installation location.
- Electrical connections may be made in any order; however the sequence below is recommended.

Solar Panel

- Never connect the panel negative to the battery negative, as your batteries may be damaged.
-  **Note:** In the GV-5-MOD, the positive side of the battery is connected internally to the positive side of the solar panel.
- Do not use blocking diodes for single-panel installations. The GV-5-MOD prevents reverse-current flow.
- If multiple panels are being used in parallel, blocking diodes are recommended in series with each panel, unless the panel manufacturer recommends otherwise.
- Solar panel voltage rises in cold weather. Check that the solar panel open circuit voltage (Voc) will remain below the maximum input voltage of the GV-5-MOD at the coldest possible expected temperature.
- **Optional: Genasun Overdrive (GO) for Oversized Solar Arrays.** On request, the GV-5-MOD can be programmed with adaptive power-limiting technology (only with P/Ns GV-5-MOD-CV or GV-5-MOD-CV-SEL), allowing it to be used with solar arrays far in excess of its rated power. If an oversized array is connected, the GV-5-MOD with GO will deliver the most power possible while keeping its electronics at a safe temperature for long-term operation. This GV-5-MOD automatically adjusts for temperature and other factors to smoothly deliver power at up to 85 °C ambient. When limiting in this manner, the LED will display the "Charging at current limit" blinks (see *Status Indication*, p.6). Moving the GV-5-MOD to a cooler location or providing increased airflow may increase charging power. If the GV-5-MOD will be used with a solar panel or array with a short circuit current (Isc) of more than 8 A, the GV-5-MOD input should be protected with a fast-acting fuse or circuit breaker of 10 A and rated for the maximum solar panel voltage. Note that solar input voltage limits **MUST ALWAYS** be respected. Exceeding the input voltage limit will void the warranty and damage the GV-5-MOD. For more info, please read our Genasun Overdrive blog (<https://sunforgellc.com/genasun-overdrive-go-for-gv-5-and-gv-5-mod/>).

Battery

- A small spark while connecting the battery is ok.

 **CAUTION, RISK OF FIRE OR EXPLOSION:** Do not make the final battery connection near lead-acid batteries that have recently been charging.

Load

- The load draw should not exceed 5A continuous.
- Larger loads should be connected directly to the battery. The GV-5-MOD will not be able to provide protection against over-discharge (low voltage disconnect) in this case.

Connector

Sullins Corporation SBH11-NBPC-D12-SM-BK, 24-pin, dual-row shrouded header, 0.100" spacing, gold-plated 0.025" (0.64mm) square posts.

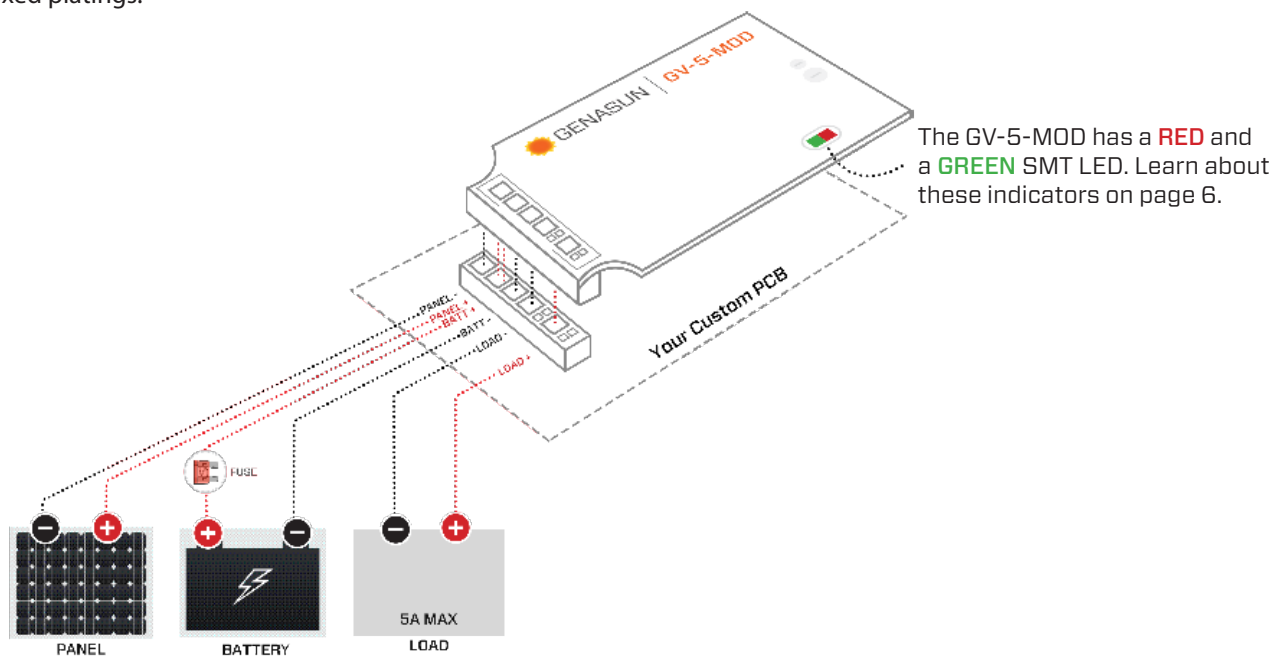
Suggested Mating Connectors

PCB, Through-hole: Sullins Corp. SFH11-PBPC-D12-ST-BK or PPPC122LFBN-RC

PCB, SMT: Sullins Corp. NPPC132KFMS-RC

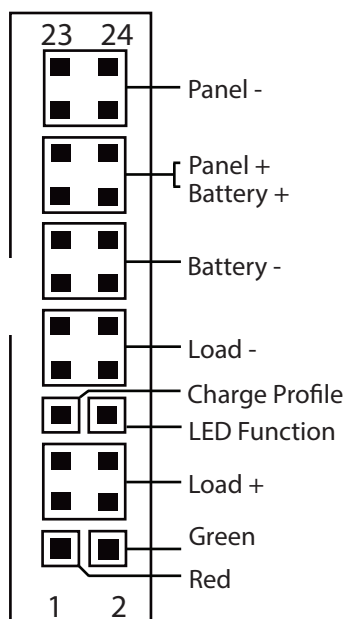
Ribbon cable, IDC: Sullins Corp. SFH210-PPPC-D12-ID-BK

Many compatible mates are available from various manufactures. Use a gold-plated mate to avoid galvanic-corrosion problems from mixed platings.



Note: The positive or negative battery cable must be protected by a fast-acting fuse or circuit breaker of 10A or less, rated for the maximum battery voltage and connected close to the battery terminal or power distribution block. This fuse will protect the wiring in the event of a short circuit or controller damage.

Pin Descriptions



Pin 1: Red LED Output.

Optional. Indicates errors. 56 Ohm output resistance, 15mA maximum source, 20mA maximum sink. See LED Function Select (Pin 8) description and LED Timings section for additional information.

Pin 2: Green LED Output.

Optional. Indicates normal operating modes. 56 Ohm output resistance, 15mA maximum source, 20mA maximum sink. See LED Function Select (Pin 8) description and LED Timings section for additional information.

Pins 3-6: Load Positive Output.

Optional. Connect pins in parallel if used. This is a MOSFET-switched output from Battery Positive (Pins 17-20) that controls the load to provide over-discharge protection (LVD or low voltage disconnect) for the battery. If this function is not needed, or the load draws more than 5A continuous, 10A peak, the load positive should be connected to Battery Positive.

Pin 7: Charge Profile Select.

Optional. Leave this pin floating for the default charge profile. If a second charge profile is programmed (see GV-5-MOD label), connect this pin to Load Negative (Pins 9-12) to select the alternate charging profile and voltage setpoints (typically higher voltage). The source current on this pin is 180 uA or less. See the description for Load Negative (Pins 9-12) for additional information. Connecting this pin to Load Negative (Pins 9-12) if a second charge profile is not programmed will disable all functions of the GV-5-MOD. In this state, the quiescent current drawn from the battery will be 1-2 mA.

Pin 8: LED Function Select.

Optional. If this pin is left floating, the internal LEDs are active, and the LED Outputs (Pins 1 and 2) are driven to 5 V when the associated LED is active and 0 V when inactive (voltages relative to Load Negative (Pins 9-12)). In this mode, these outputs can be used with additional current-limiting resistors to drive independent external LEDs referenced to Load Negative (Pins 9-12), or two LEDs connected in reverse parallel, such as a 2-pin bi-color LED.

If this pin is connected to Load Negative (Pins 9-12), then the internal LEDs are disabled, and the LED Outputs (Pins 1 and 2) function as open-collector outputs. When the associated LED would be on, the output is tied to Load Negative (Pins 9-12). Otherwise, the output is left floating. The maximum voltage, relative to Load Negative (Pins 9-12), that should be applied to the LED outputs (Pins 1 and 2) is 5 V. Greater voltages may damage the internal microcontroller. This operating mode can be used to interface the GV-5-MOD to digital systems with lower-voltage logic, such as 1.8 V or 3.3 V.

Note that if the LED Function Select pin is changed while the GV-5-MOD is operating, the change will take effect at the next LED transition. The source current on this pin is 270 uA or less. See the description for Pins 9-12 for additional information.

Pins 9-12: Load Negative Output.

Optional. Connect pins in parallel if used. This group of pins is connected in parallel to the Battery Negative through a MOSFET. Under normal operation, this MOSFET is on (closed). If the battery is connected in reverse, this MOSFET turns off (open) to protect the GV-5-MOD and the attached load from reverse polarity. If the load draws more than 5 A continuous, 10 A peak, the load negative should be connected to the battery negative.

This output is also the internal ground and signal reference for the GV-5-MOD, including the LED output and control inputs (Pins 1, 2, 7 and 8). If any of these pins are connected to equipment connected to battery negative, rather than load negative, care should be taken to prevent damaging reverse current flow from the connected equipment to the GV-5-MOD in the event the battery is connected in reverse. This protection can be implemented by connecting diodes (such as common LL4148/1N914/1N4148 diodes, etc.), between the GV-5-MOD pins and connected equipment, with the anode of the diode connected to the GV-5-MOD.

Pins 13-16: Battery Negative.

Required. Connect in parallel to the Battery Negative. The GV-5-MOD and attached loads are protected from reverse battery connections provided there are no explicit connections or accidental ground loops connecting Battery Negative (Pins 13-16) to Load Negative (Pins 9-12).

Pins 17-20: Battery Positive and Panel Positive.

Required. Connect these pins in parallel to the battery positive terminal and the solar panel positive lead. The battery should be fused close to the battery terminals with a fast-acting fuse or circuit breaker of 10A or less.

Pins 21-24: Panel Negative.

Required. Connect in parallel to the panel negative lead. The GV-5-MOD is protected from reverse panel polarity by an antiparallel diode across the input. Long term operation with reverse polarity or sources producing more than the rated power may cause damage to the GV-5-MOD through overheating.

Troubleshooting

If the LED Indicator will not light, or displays an indication not listed in this manual:

- Verify correct battery polarity
- Check that there is a solid electrical connection to the battery;
- Check the GV-5-MOD terminal area for evidence of water or mechanical damage.

The GV-5-MOD will not operate without a battery. If the system appears to be overcharging or the GV-5-MOD will not begin charging, ensure that the solar panel is wired only to the GV-5-MOD, and in particular that the solar panel negative terminal is not connected to ground (battery negative). For more in-depth system troubleshooting, please visit the support area of our website: <https://sunforgellc.com/learning-center/>

Status Indication:

The GV-5-MOD has two SMT LED lights.

GREEN LED RUN/CHARGE INDICATION

Standby: The battery is connected properly and ready to charge when solar panel power is available.

 8-10 SEC. BETWEEN GREEN BLINKS

Charging (low current, less than 0.3 A):

 4-5 SEC. BETWEEN GREEN BLINKS

Charging (between 0.3 A - 3 A):

 FAST GREEN BLINKS

Charging (current limit): charging at current limit. The GV-5-MOD is overloaded and limiting charging current.

 LONG, THEN SHORT GREEN BLINKS

Charging (high current, more than 3 A):

 LONGER, SLOWER GREEN BLINKS

Battery charged: The battery is in the absorption or float charging stage.

 SOLID GREEN

RED LED ERROR INDICATION

Over-temperature: The controller's internal temperature is too high.

 SETS OF 2 RED BLINKS.

Overload: This could be caused by changing the solar panel connections while the controller is operating.

 SETS OF 3 RED BLINKS.

Panel voltage too high: Only 12V nominal solar panels may be used with this controller.

 SETS OF 6 RED BLINKS.

Internal error: Contact your dealer for assistance.

 2 LONG BLINKS, FOLLOWED BY ANY
NUMBER OF SHORT BLINKS.

Battery voltage too high: If the nominal battery voltage is correct (12V), check the functioning of other chargers that may be connected to the system.

 SETS OF 5 RED BLINKS.

Battery voltage too low: The controller cannot begin charging normally due to low battery voltage. Check the battery connections, wait for the GV-5-MOD's trickle function to charge the battery, or charge the battery by another means.

 SETS OF 4 RED BLINKS

 SOLID RED

OTHER LED INDICATIONS NOT LISTED

The LED timings below can be used for electronic interpretation of charging status. The timings given are approximate and may vary somewhat with temperature, operating parameters, and between GV-5-MODs.

Color	Duration	Spacing	Period	Meaning
Green	0.4ms	N/A	8-10s	Sleep, insufficient solar input
Green	0.4ms	N/A	4-5s	Charging, <~0.3 A
Green	0.4ms	N/A	1-1.2s	Solar present, but below minimum battery charge temperature (if applicable), not charging
Green	0.4ms	N/A	1-10ms	Charging startup
Green	0.4ms	N/A	40-500ms	Charging ~0.3-3 A
Green	100-200ms	N/A	0.8-1.6s	Charging > ~3 A
Green Long/ Short	100-200ms, 50-100ms	100-200ms	0.8-1.6s	Operating at internal current limit
Green	Solid	N/A	N/A	Battery at charging voltage setpoint
Red/Green	0.4s each	None	N/A	Power-on LED sequence
Red/Green	0.4s each	None	Any	Repetition indicates battery voltage too low
Red	Solid	N/A	N/A	Error, battery voltage too low
2 Red	0.2s	0.2s	>1s	Error, over-temperature
3 Red	0.2s	0.2s	>1s	Error, exceeded hard current limit
4 Red	0.2s	0.2s	>1s	Error, battery voltage too low
5 Red	0.2s	0.2s	>1s	Error, battery voltage too high
6 Red	0.2s	0.2s	>1s	Error, input voltage too high

Specifications

	GV-5-MOD-Pb		GV-5-MOD-LFP		GV-5-MOD-Li		GV-5-MOD-CV-SEL		GV-5-MOD-CV
Charge Profile (Selectable with Pin 7):	Default Charge Profile	Charge Profile 2	Default Charge Profile	Charge Profile 2	Default Charge Profile	Charge Profile 2	Default Charge Profile	Charge Profile 2	Default Charge Profile
Battery Type:	Gel SLA	AGM FLOODED	3S LiFePO ₄	4S LiFePO ₄	3S LiCo/ Mn/Ni	4S LiCo/ Mn/Ni	Lead-Acid or Lithium		
Charge Profile:	Multi-Stage		CC-CV				CC-CV or Multi-Stage		
Rated Panel Power:	65 W		50 W	65 W	55 W	75 W	See specs for closest voltage.		
Genasun Overdrive: ¹	Optional								
Bulk Voltage:	14.3 V	14.6 V	-				To Customer Spec. ²		
Absorption Voltage:	14.1 V	14.4 V	-				To Customer Spec.		
Absorption Time:	2 hours		-				To Customer Spec.		
Float Voltage (Pb mod.) or CV Voltage (Li mod.):	13.6 V	13.4 V	10.7 V	14.2 V	12.5 V	16.7 V	To Customer Spec.		
Re-Absorb (Re-Bulk): ³	12.5 V		-		-		12.5V for Pb mod.		
Load (LVD) Disconnect/ Reconnect Voltage:	11.4 V / 12.5 V		8.2 V / 9.0 V	11.0 V / 12.0 V	9.3 V / 10.5 V	12.4 V / 14.0 V	To Customer Spec.		
Battery Temperature Compensation:	-24 mV/°C (referred to 25 °C)		Disabled				Li mod.: Disabled Pb mod.: Customer Spec		

(1) See *Genasun Overdrive*, p.3.

(2) The maximum custom voltage is 16.2V for lead-acid and 17.5V for lithium.

(3) If the battery voltage drops below this point, the controller will attempt to run an absorption cycle. Otherwise, it will charge to the float voltage.

Specifications (cont.):

GV-5-MOD-** All Models

Max Input Voltage:	27 V
Recommended Max Panel Voc at STC:	22 V
Minimum Battery Voltage for Normal Operation:	7.2 V
Trickle Charge to Recover Dead (0V) Battery:	Yes
Input Voltage Range:	0-27 V
Maximum Input Short Circuit Current: ³	5 A
Maximum Input Current: ⁴	9 A
Electrical Efficiency:	94% - 99.85% typical
Rated Battery (Output) Current:	5 A
Continuous Rated Load Current:	5 A
Maximum Full Power Operating Ambient: ⁵	45 °C
Operating Temperature:	-40 °C – 85 °C
Tracking Efficiency:	99+% typical
MPPT Tracking Speed:	15 Hz
Operating Consumption:	0.150 mA (150 uA)
Night Consumption:	0.125 mA (125 uA)
Environmental Protection:	Conformal Coating, Nickel-Plated Brass & Stainless Hardware
Connection:	24-pin, dual-row shrouded polarized male header, 0.100" spacing, gold-plated
Certifications:	cETLus, CE, FCC, RoHS
Weight:	1.0 oz., 28 g
Dimensions:	3.28" x 1.88" x 0.48", 8.32 x 4.78 x 1.22 cm
Warranty:	10 years

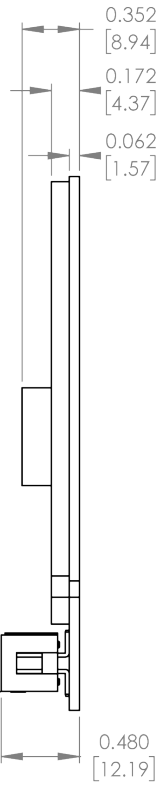
(3) Panel Isc. Inputs exceeding this rating may cause damage to the GV-5 if the input or battery voltage changes abruptly.

(4) Maximum steady-state current that the controller could draw from an unlimited source. This specification is intended for sizing input circuit protection.

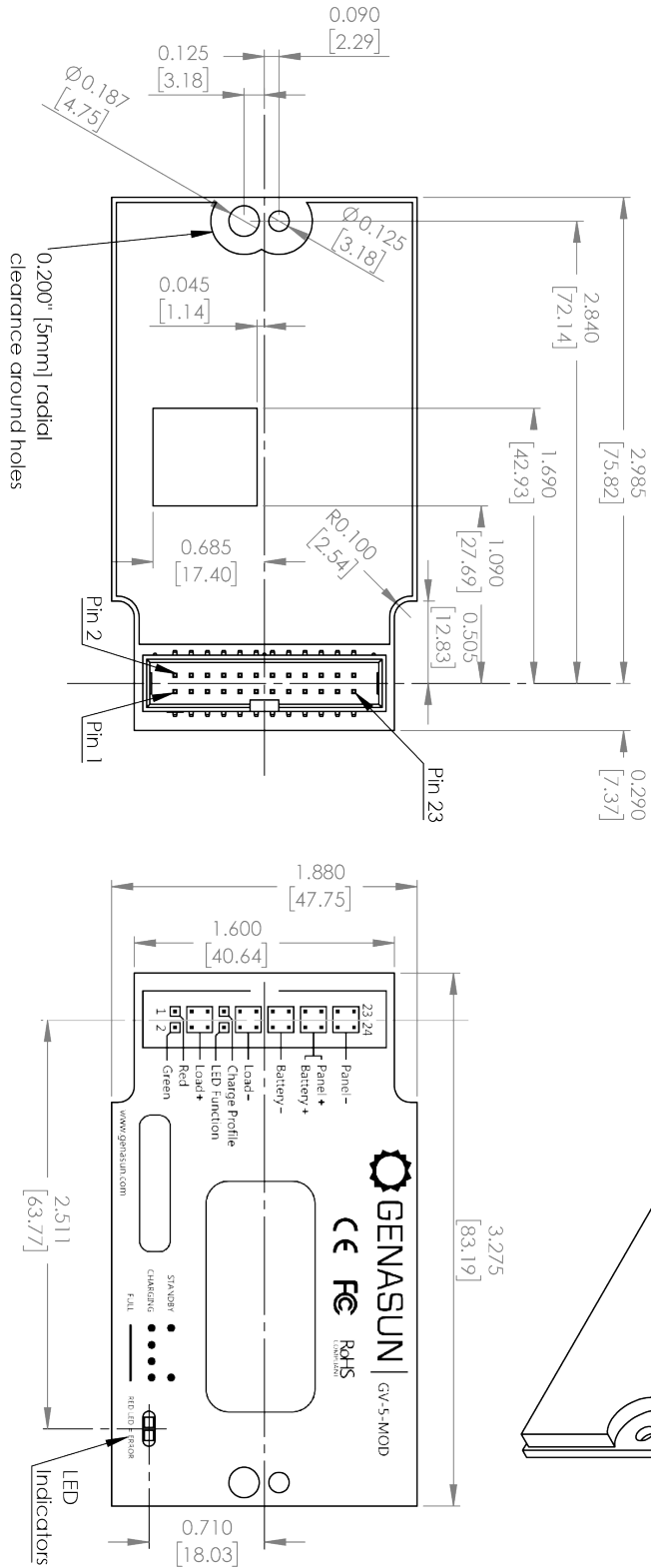
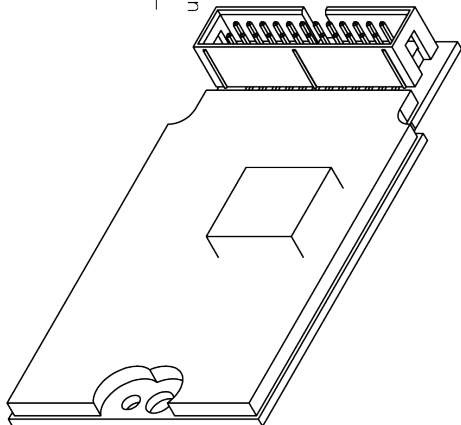
(5) Max ambient temperature for full operating power. Test conditions: 16 V input, 13 V output.

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Connector: Sullins Corp
SBH11-NBPC-D12-SM-BK
Refer to Sullins documentation
for complete specifications.



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Dimensions in inches [mm]

SIZE DWG. NO.
A **GV-5-MOD-2017-12-12**

SCALE: 1:1 SHEET 1 OF 1

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