



# **NUV100-CI**

## **Nuvation BMS™ Cell Interface Datasheet**

**2015-11-07, Rev. 0.5**

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## Hardware Overview

The Cell Interface (CI) module contains the AFE which converts the cell voltage and temperature to a digital value read by Nuvation BMS™. It also enables/disables cell balancing as required. The external interfaces to this module are:

- Battery Cells connector
- Temperature Sensors connector
- Two (2) Link Bus connectors
- Two (2) Indicator LEDs

The CI has high-voltage connectors and connects to battery stack-referenced signals. Safety precautions are required to handle and connect cables into this module.

There are two variations of CIs; the CI-12 which supports up to 12 cells and 8 temperature sensors and the CI-16 which supports up to 16 cells and 8 temperature sensors.

The following subsections will describe the external interfaces in more detail. For wiring/pin-out information, please refer to the *Nuvation BMS Implementation Guidebook*.

## Battery Cells

The Battery Cells connector is an 18-pin Micro-Fit 3.0™ Molex connector. This interface is used to connect the battery cell voltage sense wires to the AFE. It also carries the cell balancing current and the wires should be sized accordingly. Cell 0 must be connected to the negative terminal of the lowest potential cell in the module and Cell 12 (or Cell 16 in a CI-16 module) must be connected to the positive terminal of the highest potential cell in the module. If less than 12 cells are used (or less than 16 in a CI-16 module), unused inputs should be tied to Cell 12 (or Cell 8/16 in a CI-16 module).

Note: when not powering the CI module from the Link Bus, a minimum of 11V must be present between Cell 0 and Cell 12 in a CI-12 variant and a minimum of 11 V must be present between Cell 0 and Cell 8 as well as between Cell 8 and Cell 16 in a CI-16 variant. There is no minimum cell voltage when powering the CI from the Link Bus.

## Temperature Sensors

The Temperature Sensors connector is a 16-pin Micro-Fit 3.0™ Molex connector. This interface is used to connect up to 8 10kΩ NTC thermistors to the CI module. The sensors are referenced to Cell 0 so care must be taken to ensure they are electrically isolated from cell voltage terminals. These sensors are used by Nuvation BMS™ to sense over and under temperature conditions.

## Link In

The Link In connector is a 4-pin Micro-Fit 3.0™ Molex connector. This interface is used to connect the CI module to the next lower potential CI module or to the Stack Controller if the CI is the lowest potential CI in the chain. A Link Bus cable is used to connect the Link In connector to either the Link Out connector on the next lower potential CI or to the Link Out connector on the Stack Controller. The CI also accepts power from this connector to power itself and any higher potential CIs connected out the Link Out connector.

## Link Out

The Link Out connector is a 4-pin Micro-Fit 3.0™ Molex connector. This interface is used to connect the CI to the next higher potential CI in the chain. The Link Out also provides power out this connector to power the CI modules. Leave the Link Out connector unconnected if the CI is the highest potential CI in the chain.

## Indicator LEDs

The two (2) LEDs are used by the CI to indicate functional status to the user. The Activity LED is controlled by the AFE and the Fault LED is controlled by the Stack Controller. The Activity LED indicates the AFE has received a communication packet via the Link Bus and the Fault LED indicates a fault has occurred in Nuvation BMS™.

## Operating Limits

This section states the operating limits of the Cell Interface module.

WARNING: Exceeding the maximum ratings will damage the module.

## Electrical Characteristics

**Table 1: Electrical Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Link In Specifications</b>						
+VBUS	Input Voltage		9	24	60	Vdc
	Input Current, CI-12	+VBUS = 24Vdc, Link Out disconnected	-	-	25.5	mAdc
	Input Current, CI-16	+VBUS = 24Vdc, Link Out disconnected	-	-	31.7	mAdc
IP_LINK	Output Current		-	-	20	mAdc
IN_LINK	Output Current		-	-	20	mAdc
<b>Link Out Specifications</b>						
+VBUS	Output Voltage		-	+VBUS	-	Vdc
	Output Current	+VBUS = 24Vdc	-	-	31.7	mAdc/CI-16
IP_LINK	Output Current		-	-	20	mAdc
IN_LINK	Output Current		-	-	20	mAdc
<b>Battery Cells Specification</b>						
C(n)	Input Cell Voltage Range	+VBUS = 24Vdc	0	-	5	Vdc
Vsum	Voltage between C0 and C12	CI-12, +VBUS = 0Vdc	11	-	60	Vdc
	Voltage between C0 and C8	CI-16, +VBUS = 0Vdc	11	-	30	Vdc
	Voltage between C8 and C16	CI-16, +VBUS = 0Vdc	11	-	30	Vdc
TME	Total Measurement Error	+VBUS = 24Vdc	±0.1	±1.2	±1.6	mVdc
I(n)	Cell Balancing Current	C(n) = 4Vdc	304	307	310	mAdc
<b>Temperature Sensors Specifications</b>						
I(n)	Output Current to Temperature Sensor		-	-	300	uA
Rt(n)	Temperature Sensor Resistance at 25°C		-	10	-	kΩ
T(n)	Input Temperature Sensor Voltage Range	Cell 0 = 0V	0	-	3	V

## Environmental Conditions

**Table 2: Environmental Conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Thermal Specifications</b>						
Ta	Operating Temperature		-10	25	60	°C
	Storage Temperature		-10	25	60	°C
<b>Humidity Specifications</b>						
RH	Operational RH		5	-	85	%
	Storage RH		5	-	85	%
<b>Shock and Vibration Specifications</b>						
Vertical	Vertical shock/vibration		-	-	1	m/s <sup>2</sup>
Longitudinal	Longitudinal shock/vibration		-	-	1	m/s <sup>2</sup>
Transverse	Transverse shock/vibration		-	-	1	m/s <sup>2</sup>

The CI has also met industry standards CISPR 22 Class A and IEC/EN 61000-4-2 for EMC/EMI and ESD respectively. The CI has been designed to meet EN 60950 high voltage creepage/clearance distances to prevent arcing to the metal enclosure. All components are EU RoHS/China RoHS compliant.

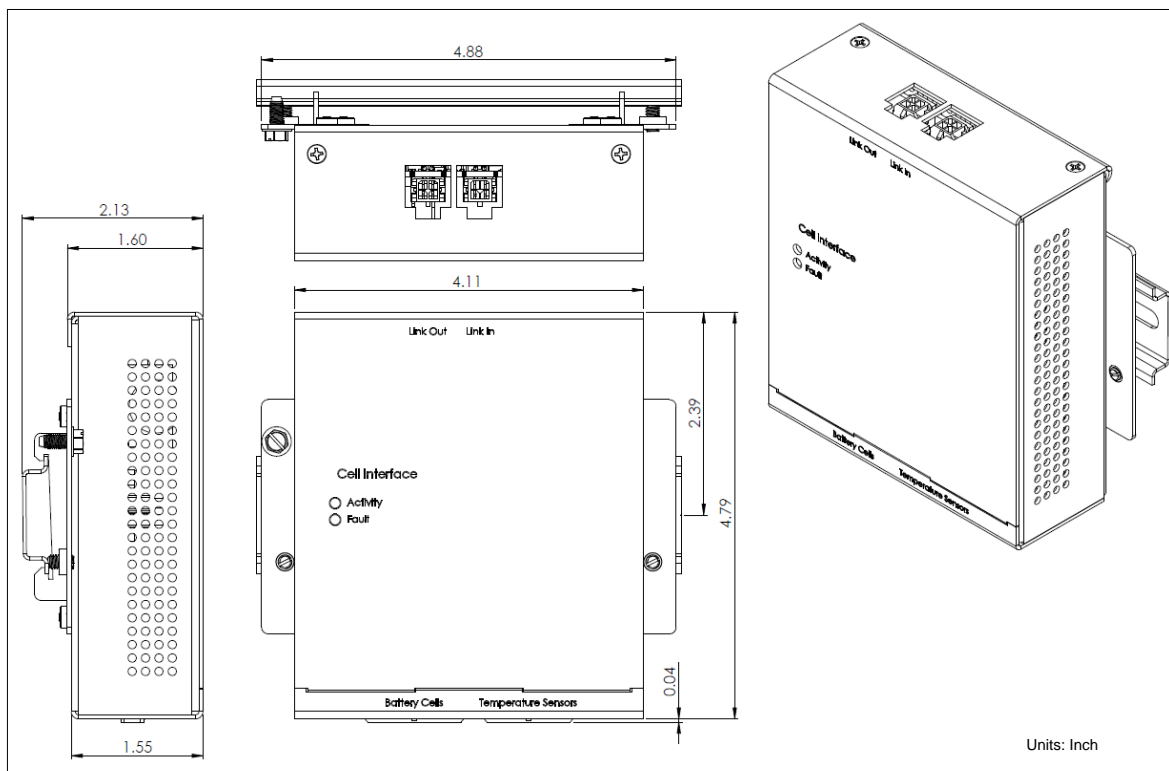
## Mechanical Overview

The overall dimensions of the CI are 104.4mm X 121.58mm X 40.6mm. It comes standard with DIN clips that enable it to be securely mounted to EN50022-compliant DIN rails. The clips add an extra 19.6mm to the overall width of the CI module, bringing it from 104.4mm to 124mm. Extra space should be provided around the module to allow for easy installation/maintenance.

The CI can also come in a bulkhead-mountable enclosure. The enclosure has five metal walls, leaving the bottom of the unit fully exposed. It must be mounted to a metal bulkhead panel so that the panel will become the missing side. The module will produce up to 24W (32W if it is the CI-16 model) during cell balancing. A portion of this heat will be transferred to the bulkhead.

The CI can contain high-voltage signals. Each CI can be another 60V away from earth ground up to a maximum of 1250Vdc. Care must be taken when mounting the PCB into a metal enclosure to ensure the metal walls remain the correct distance from the exposed conductor on the PCB. Using the 1250Vdc as an example, the metal walls must be at least 4.2mm from the nearest exposed conductor and not touch the PCB or any component on the PCB, including the connector housings.

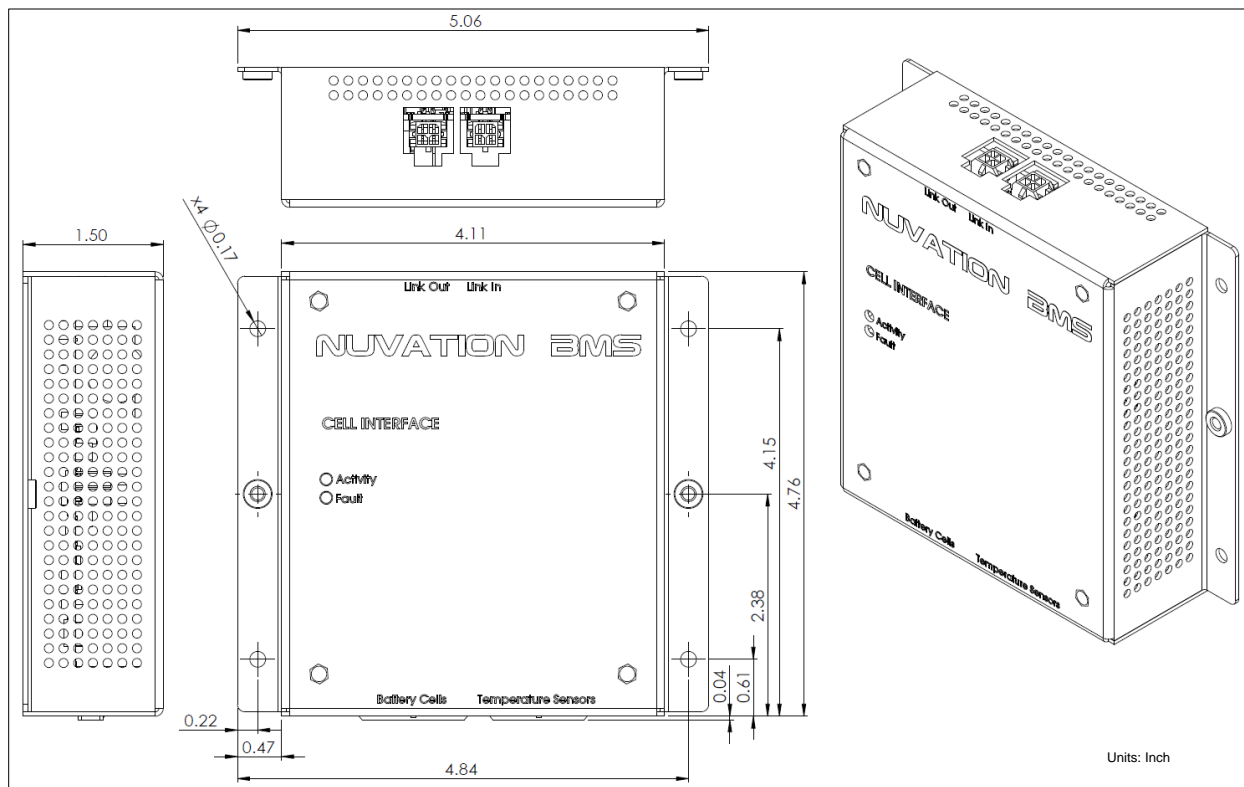
The CI with DIN mountable enclosure weighs approximately 538g.



**Figure 2: Mechanical Drawing**

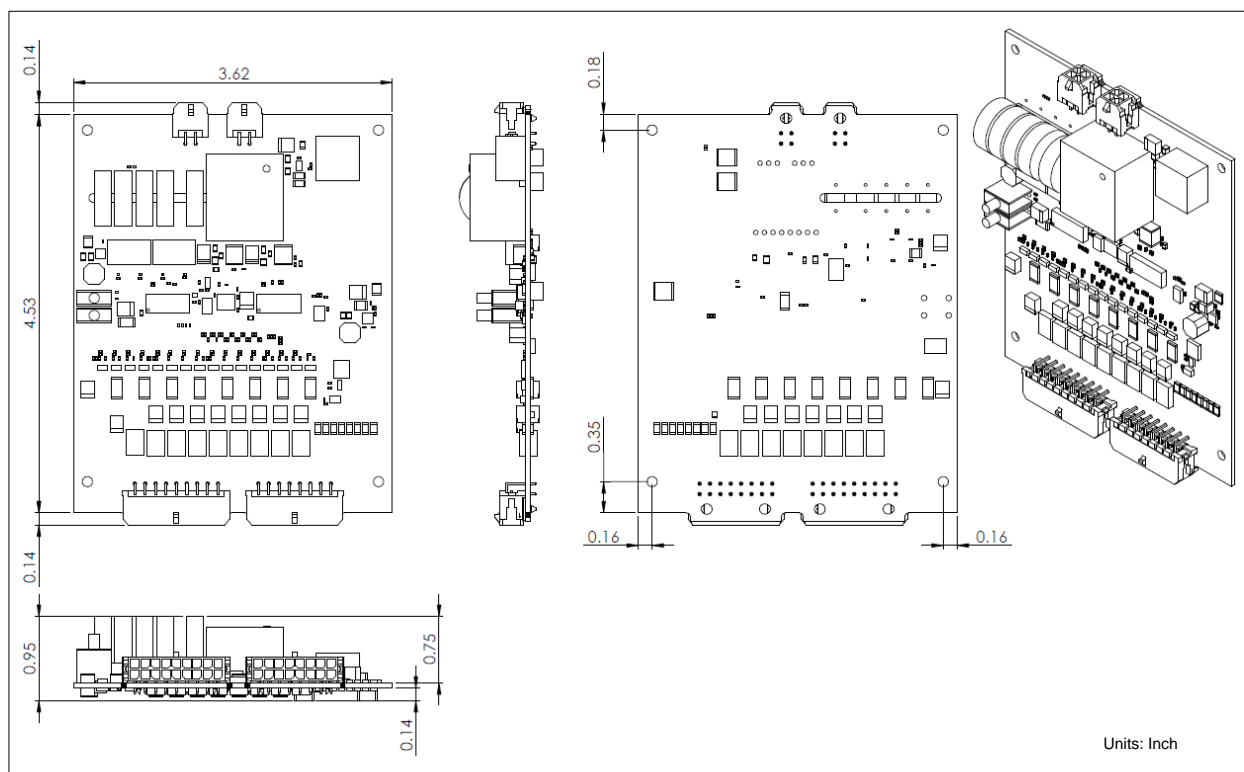


The CI with bulkhead mountable enclosure weighs approximately 450g.



**Figure 3: Mechanical Drawing of Bulkhead Enclosure**

The CI without the enclosure weighs approximately 77g.



**Figure 4: Mechanical Drawing of PCB**

## Ordering Info

Model Number	Description
NUV100-CI-12	Cell Interface 12-cell with DIN Enclosure
NUV100-CI-12-1	Cell Interface 12-cell with Bulkhead Enclosure
NUV100-CI-12-U	Cell Interface 12-cell PCB (no enclosure)
NUV100-CI-16	Cell Interface 16-cell with DIN Enclosure
NUV100-CI-16-1	Cell Interface 16-cell with Bulkhead Enclosure
NUV100-CI-16-U	Cell Interface 16-cell PCB (no enclosure)

Notes:

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# NUVATION BMS™

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