BBU Battery Backup Module 3600W for V2 Power Shelf

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Scope

This Specification defines the requirement for a 3600W, stand-alone, Li-Ion V2 BBU module (Battery Backup Unit), 13S4P configuration, single-voltage 52V max output voltage (with cells at 4.0V), used in conjunction with a V2 Power Module for backup power functions. At the System level, the BBU is installed in a V2 Power Shelf paired with a V2 Power Module, (also installed in the shelf). There are three BBUs and three power modules in each shelf. The power station works autonomously for online power functions, and provides short-term backup power functions during AC-grid power outages.

The V2 BBU is used for IT Systems, and it is intended for internal use only.

Contents

Overview

This document lists the requirements for the 3,600W V2 BBU. This document is complementary to the V2 Power Shelf. At the system level the BBUs are installed in the power shelf.

The V2 Power Shelf is 3 OU high; it has (3 + 3) slots on front for three V2 Power Modules and for three V2 BBU modules, and has a 12V output on the rear panel side. At shelf level, each power module is individually connected to its own BBU module: the BBU is the energy storage module allocated to one power module, and is used solely during AC power grid outages. No 12V interruptions from the system shelf occur during backup transitions.

The three power modules have their 12V outputs paralleled, for a total shelf output power of 6600W at 12V (2 + 1) redundant. The whole power station is (2 + 1) redundant, and it outputs 6600W at 12V. The BBU modules are hot swappable, and no air forced cooling. There is a handle and LEDs on the faceplate, and a power connector on the rear panel.

NOTE: 1 OU = 1 OpenU = 48mm.

The station is fully compatible with the OCP V2 Open Rack.

Sheet metal thickness for the BBU is 1mm, and 1.2mm for the shelf.

Throughout the specification, the V2 BBU is referred to as a BBU, the V2 Power Shelf is referred to as a shelf (or a system shelf), the V2 Power Module is referred to as a module or a power supply module, and the populated shelf (Power Station) is referred to as a station. For example, three V2 Power Modules installed and three V2 BBUs installed.

License

1 Mechanical requirements

The module size is 160mm × 62mm × 435mm [Width × Height × Depth].

Sheet metal is 1mm thick, Zinc pre-plated (hot-dip) base material.

The BBU Module is hot pluggable, with a handle on the front panel and a connector on the rear panel.

The BBU module has a keying feature on the chassis that allows for only one correct insertion orientation of the module in the system shelf.

The BBU chassis is to feature a guide pin for installation into the system shelf.

The BBU module to be fully closed with no openings on any side of the battery.

Note: Some design validation testing (DVT) samples to be provided with air holes in the front for testing.

The BBU must latch into the Power Shelf with a side latch (left side). The latch to follow all requirements indicated in mechanical drawings, including dimension and materials used.

The BBU latch must be green (Color Code: Pantone 375C Green).

2 Thermal requirements

The temperature is to be measured by at least two temperature sensors, internally in the BBU, with +/- 4°C accuracy. Temperature control and logic is to be done by the BMS system inside the unit.

The maximum temperature for the battery pack is 75°C. If this temperature is reached, the Stop Discharge signal should assert.

If the temperature of the BBU reaches 85°C or more, the BBU must assert a permanent Fail signal. The signal assertion should be done with minimal delay (100ms) once the temperature is reached.

3 Electrical Requirements

There is a Battery Pack installed inside the BBU, with a mechanical assembly, together with an independent battery management system (BMS) circuit. The BMS will include logic to circuitry to generate and control a few signals.

This BMS system is to include a cell balancing circuit where the cell voltage on all battery cells in a pack are kept within at least +/-1% of each other.

There are fuses and shunts for current readings in the BBU. At least a 120A fuse is to be used on the (+) discharge line for protection.

Sense lines must be added to all fuses used to indicate whether a fuse has blown. Blown fuses must assert a Fail signal and a red LED.

The configuration of the battery pack is 13S4P (four paralleled strings of 13 cells in series for each string).

The reference battery cell is 18650 type, for high-current-discharge applications (min 1.5Ah, 3.7V nominal, 4.2V max, 30A max).

The BBU Positive and Negative (return) are isolated from chassis ground by 2 capacitors and 3 resistors in parallel.

The capacitors used must be made of X7R ceramic, 1206 package or bigger. Suggested capacitor rating is 200V, 47nF.
Resistors are to be of a high pulse current type, 1ohm.

The maximum floating voltage of a fully charged BBU is 52V (max 4.0V per cell x 13).

The periodical charging mode (See Section 6.2.1.) is set between 3.9V and 4.0V per cell, (50.7V to 52V of battery pack output voltage).

The constant charging current of the BBU pack is set by the system (the power module) at a constant 5Amps.

During full power discharge, the BBU delivers 3,600W of constant power to the system, for a maximum of 90 seconds (the power supply module will stop discharging the BBU at/before the timeout).

NOTE: At the system level, it is not anticipated to have more than one full discharge sequence every month. In other words, AC power outages are not expected to occur more than once a month. The battery test, however, could occur the same month the AC power outage occurred.

The BBU must be able to support the described backup sequence at end of life (EoL) status, at least 6 years of service at +25C ambient temperature, and with cells charged at 3.9V.

A protection pin is to be provisioned for an analog signal from the temperature sensors and the cell balancing circuits directly to BBU output connector (Pin B4). The signal on this pin is a result of an out of range sense on Temperature. The out of range values are to be set while keeping in mind that this is to be active after all other primary protections have been asserted. A delay must be implemented to ensure such behavior. The signal should be asserted once the temperature reaches 80°C and released at 65°C.

4 Connector

A connector carrying the BBU input (charge) voltage, output (discharge) voltage and several signals, is installed on a PCB that is mounted on the BBU sheet metal. The connector assembly is fixed, not floating.

The connector is located on the rear panel, centered and close to the back wall.

The connector PCB is to protrude 8.7mm (+/- 0.5) from the back wall of the BBU chassis.

This connector is socket type, press fit, PCB mount (right angle or straight pins), FCI-51915-415 (3 blade-24 pins-3 blade); where there are 6 high current blades, 3 for positive (+), 3 for negative (-) return, 24 pins for the signals and the +/- charging.

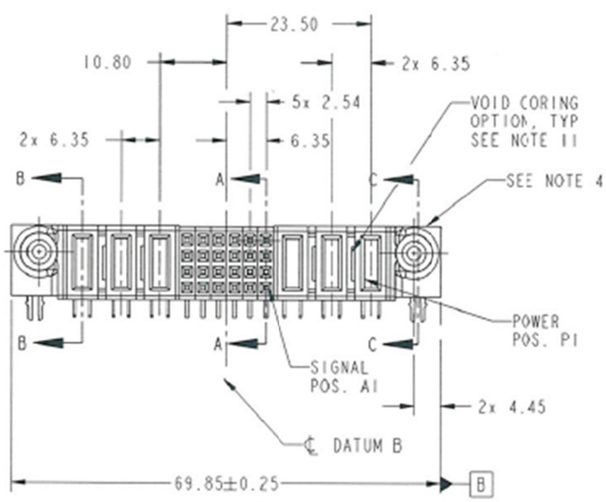


Figure 1: FCI-51915-415 Female Connector

The tables below display the connector blade and pin arrangements.

Table 1: FCI - 51915-415## Blade and Pin Location (Rear Panel View)

<table>
<tr><td rowspan="4">P6</td><td rowspan="4">P5</td><td rowspan="4">P4</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td rowspan="4">P3</td><td rowspan="4">P2</td><td rowspan="4">P1</td></tr>
<tr><td>C6</td><td>C5</td><td>C4</td><td>C3</td><td>C2</td><td>C1</td></tr>
<tr><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td></tr>
<tr><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td></tr>
</table>

Table 2: FCI - 51915-415## Blade and Pin Current Rating (Rear Panel View)

For 3 blades: - 120A for 90s - 80A forever	0.1A	-	-	1A	1A	-	for 3 blades: - 120A for 90s - 80A forever
	0.1A	2A	2A	1A	1A	0.1A	
	0.1A	1A	1A	1A	-	0.1A	
	0.1A	0.1A	0.1A	0.1A	-	0.1A	

Table 3: FCI - 51915-415## Blade and Pin Assignments (Rear Panel View)

			Sense (+)	SPARE	SPARE	Charge	Charge	SPARE		BAT_R	
			Sense (-)	12V (-)	12V (+)	Charge	Charge	S_RTN			
			Fail	Sleep	Protection	Charge	SPARE	S_RTN			
			Stop Discharge	EoL	SoH Check	Charge Enable	SPARE	Insert			

NOTE: Red pins indicate short pins on the male connector.

Table 4: FCI - 51915-415##

Pin Assignment	Function	Notes
P1	Negative Blade 52V(-)	Power
P2	Negative Blade 52V (-)	Power
P3	Negative Blade 52V (-)	Power
P4	Positive Blade 52V (+)	Power
P5	Positive Blade 52V (+)	Power
P6	Positive Blade 52V (+)	Power
D1	SPARE	
D2	Charge 52V (+)	Charge line from Power module (Section 6.11.)
D3	Charge 52V (+)	Charge line from Power module (Section 6.11.)
D4	SPARE	
D5	SPARE	
D6	Sense (+)	Used to reading battery pack voltage (Section 6.1.)
C1	S_RTN	Signal Return (Section 6.10.)
C2	Charge 52V (+)	Charge line from Power module (Section 6.11.)
C3	Charge 52V (+)	Charge line from Power module (Section 6.11.)
C4	12V (+)	From power module, used for BBU LEDs (Section 6.6.)
C5	12V (-)	From power module, used for

		BBU LEDs (Section 6.6.)
C6	Sense (-)	Used to reading battery pack voltage (Section 6.1.)
B1	S_RTN	Battery return used for protection (Section 6.9.)
B2	SPARE	
B3	Charge 52V (+)	Charge line from Power module (Section 6.11.)
B4	Protection	Provisioned for analog protection to the PSU drivers
B5	Sleep	Sleep Mode indicator
B6	Fail	Fail signal (Section 6.5.)
A1	Insert	Signal to exiting 'Sleep Mode' (Section 6.8.)
A2	SPARE	
A3	Charge Enable	Charge Enable signal as BBU requests to be charged (Section 6.2.)
A4	SoH	State of Health test (Section 6.7.)
A5	EoL	End of Life signal (Section 6.4.)
A6	Stop Discharge	Stop Discharge signal to prohibit BBU discharge (Section 6.3.)

5 BBU Installed at System Shelf Level

The BBU module is the energy storage device that allows the power module installed in the shelf (located just above the BBU) to perform the power backup functions at AC power outage. The objective is to never lose the 12V shelf output (6,600W) during the AC power grid outages.

The power modules installed in the system shelf are AC-to-DC power converters with 12V output and rated 3,300W each. The shelf is (2 + 1) redundant.

With a fully working redundant shelf (in which no power modules have failed), each BBU needs to deliver less than 3,600W at AC power outage because the shelf is (2 + 1) redundant (with a working redundant shelf, each BBU delivers max 3,600W/3×2 = 2,400W during discharge). This specification requires the BBU to support 7,200W with two BBUs installed in the system, which equals a total shelf 12V output power of 6,600W with one power module failed in the shelf. The efficiency between the BBU output and the 12V output during backup sequence, considered in all the calculations, is ~92.5%: (6,600W / 0.925) = 7,200W.

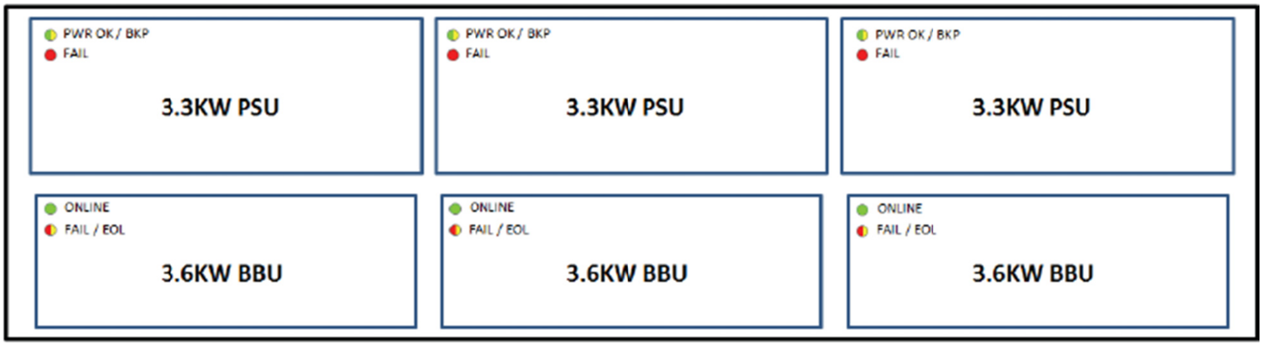


Figure 2: Arrangement of power module and BBUs installed in a shelf (front view)

The BBU should have roughly similar arrangements as the mockup figures below.

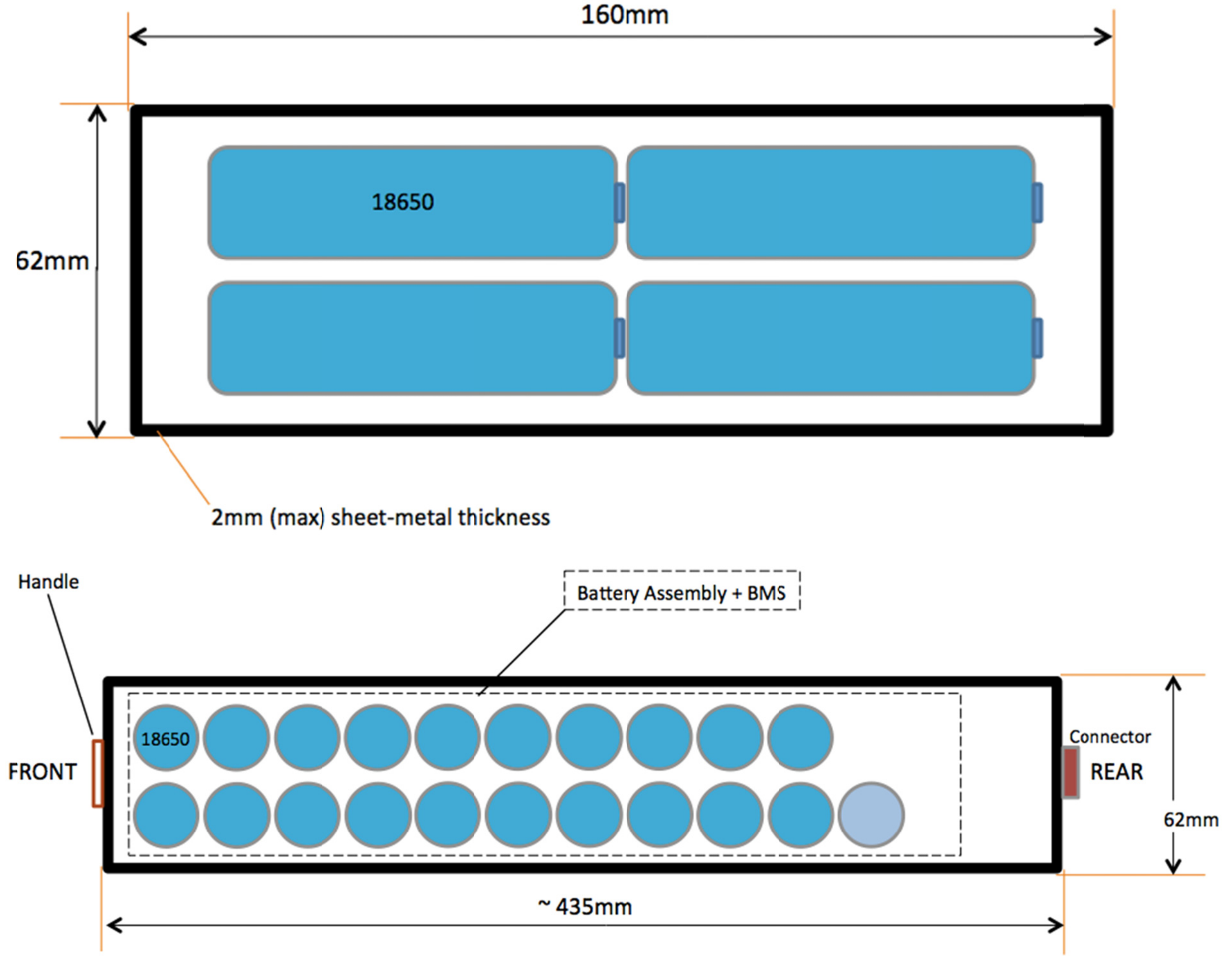


Figure 3: BBU cell and module arrangement

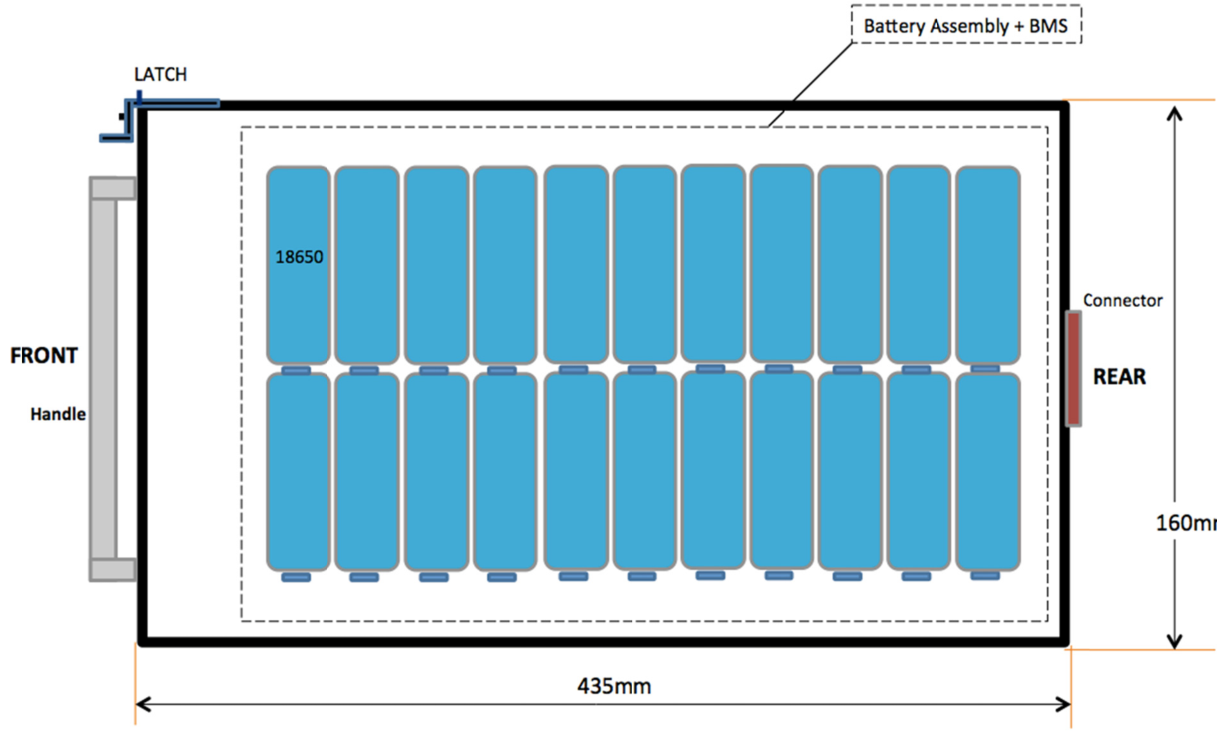


Figure 4: BBU top view arrangement (top view)

The diagram in below shows a high-level block diagram of the BBU and its many connections to the Power Module.

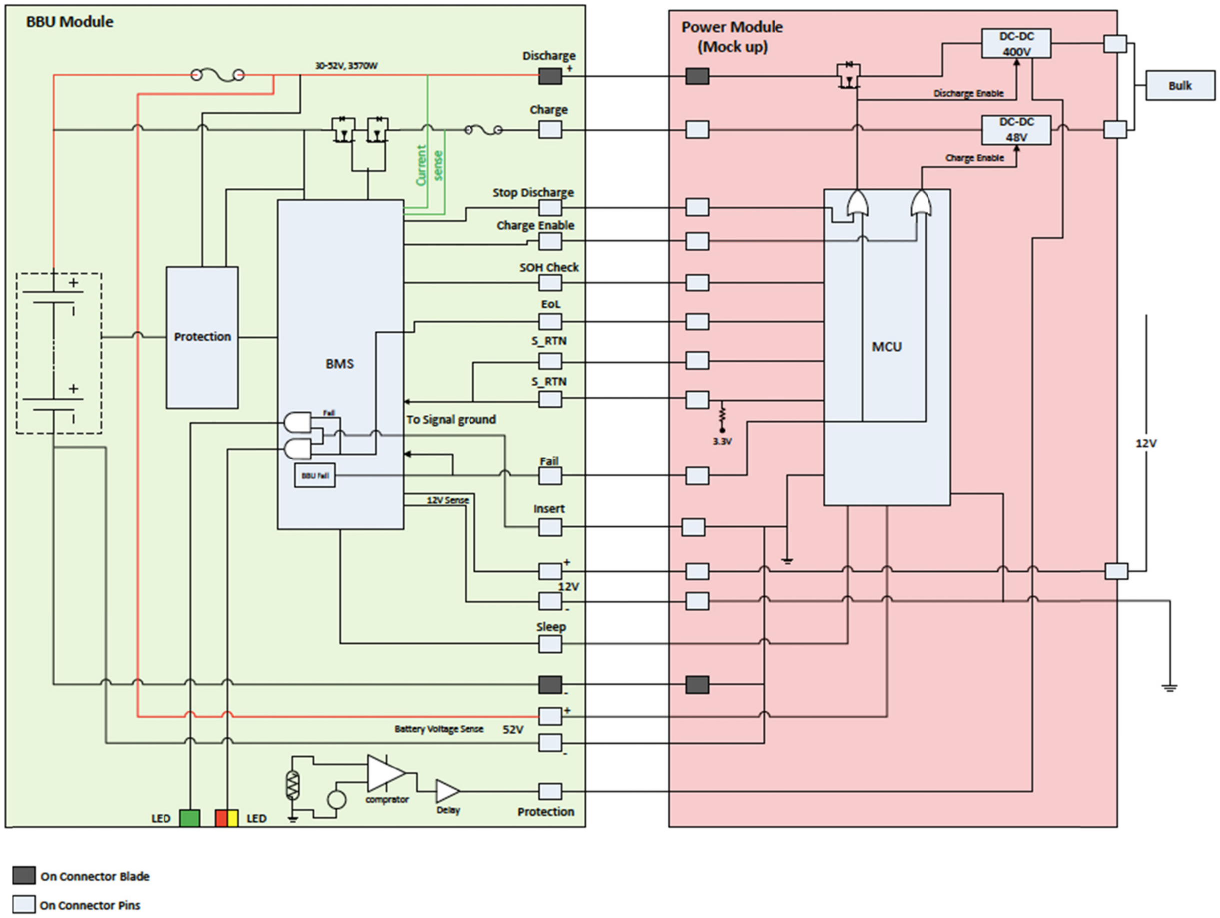


Figure 5: BBU and PSU high-level block diagram

The diagram below shows a high level ground and return connection between the BBU and the power supply module.

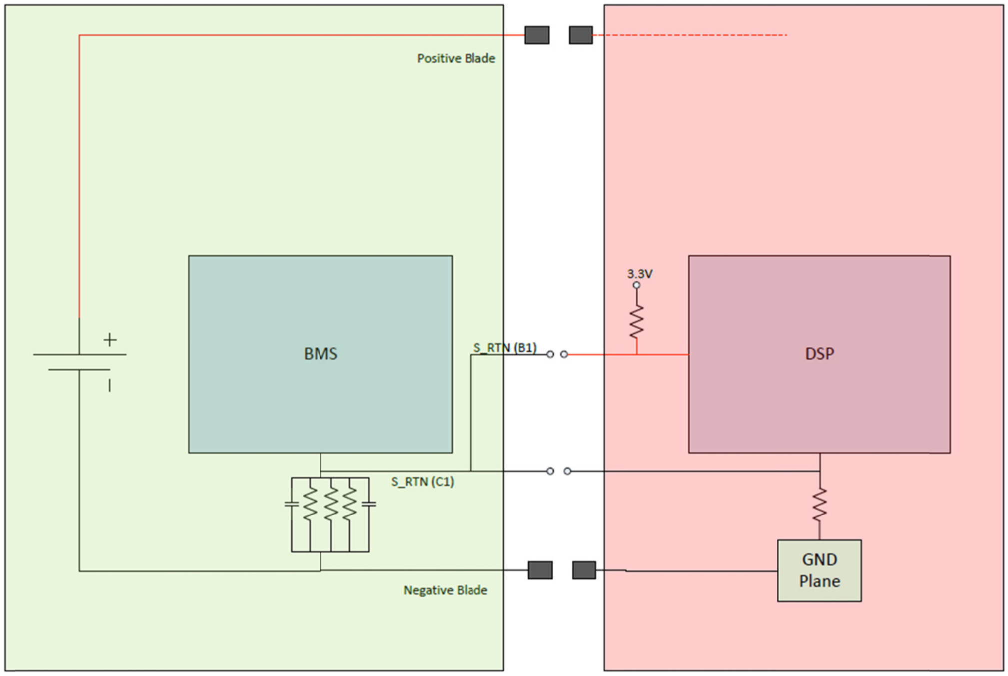


Figure 6: BBU return signal diagram

6 Signals and Pins

There are several signals available at the individual BBU output connector. When the BBU is installed in the system shelf, the signals are directly connected to the corresponding power module in the shelf, through the mating connector installed in the shelf.

Each BBU module installed in the system shelf interconnects ONLY with the power module installed just above it.

6.1 Voltage Sense

Battery Pack Voltage **+Sense** (analog signal)

Battery Pack Voltage **-Sense** (analog signal)

Plus and minus sense lines must have series thermal fuses for protection.

NOTE: the power module uses the +/- sense signals to accurately read the battery pack voltage at its local terminations inside the BBU module. This voltage reading is used as voltage feedback to provide the correct charging voltage locally to the battery pack. The charging voltage is fixed at 52.5V +/-0.2%, with current limitation of 5Amps (max). In addition, the power module uses it for potential second- and third-level battery pack overvoltage and under voltage protections.

The +Sense is to be connected after the main discharge fuse on the (+) line and before the output blade.

6.2 Charge Enable

This signal is normally high. The signal is low when the BBU asks to be charged.

The power module turns OFF the 52V charger when the BBU notifies about the condition with this signal. The BBU stops the charge whenever the first cell in the pack reaches 4.0V. The BBU resumes the charge whenever the first cell in the pack drops to 3.9V (due to unavoidable battery-pack-shelf discharge). This is called Periodical Charging Mode.

The bidirectional switch on the (+) charge line should close immediately after the Charge Enable signal is low. Furthermore, when the signal goes high, a one-second delay is to be introduced before opening the switch. This is to ensure the procedure, enumerated in the bullet points below are followed when charging the battery:

To charge: Turn on charger and close the switch.

To stop the charge: Turn off charger, then open the switches.

Charge Enable shall not be asserted if the BBU temperature is above 54°C, batteries are being discharged or if a fail condition has occurred.

The battery must sense the charge current. If the charge current is 0.2A or less for more than 5 minutes, the BBU should enter Sleep mode (this means that the power supply has failed).

The charge switch must be open at all time except when the charge conditions are met.

6.3 Stop Discharge

This signal prohibits discharge. When the signal is high, the BBU maybe discharged at any time (normal behavior). When the signal is low, the power module is not allowed to discharge the BBU.

For temperature failures, the Stop Discharge signal must be asserted until the temperature of the BBU reaches an acceptable range. Hysteresis in the range must be implemented.

NOTE: A BBU Temperature above 85°C asserts a permanent FAIL as well as a Stop Discharge.

Once the cell voltage reaches 2.6V or less, or, if the battery pack voltage is less than 33.8V, the Stop Discharge is asserted to prevent further battery discharge.

NOTE: The power module installed in the system shelf stops using the BBU as an energy source for backup power purposes when the BBU triggers this signal.

6.4 End of Life

The signal is usually high. When the battery pack's End of Life status is reached, the signal is turned low. This signal indicates that the BBU has reached its end of life.

The EoL status is asserted when the BBU is determined to be near to the end of life and amber LED is turned on. In this case, the BBU may still be discharged.

The EoL signal is asserted indefinitely. This means that the signal status must be written to the EEPROM/Flash. So, if the BBU is removed from the shelf or it is powered off, the most recent status is reasserted.

6.5 Fail

The signal is normally high. The signal is low when the BBU logic detects a failure condition inside the BBU module.

This signal triggers the red LED to turn on.

This signal also asserts the Stop Discharge, so the power module does not try to discharge the battery during failures.

The Charge Enable signal must remain high when a failure has occurred (this is to prevent the charger from starting)

The Fail signal is asserted until the BBU is reset, or reinserted into the system. If there is a permanent failure, the Fail signal will be reasserted and the BBU will be replaced.

The following conditions may assert the Fail signal:

Permanent temperature failures – including:

- Temperature above 85°C
- Temperatures that trigger cell level protection
- Blown fuse
- Cell balancing failure
- Individual cell failures (e.g., a rapid cell discharge or similar)

- Any general BMS/BBU/battery failure
- Cell voltage under 2.0V

The following table summarizes the Fail and Stop Discharge conditions:

Table 2: Failure Type Summary

Failure Type	Permanent Fail	Stop Discharge
Temperature above 85°C	✔	✔
Temperature below 85°C and above 75°C		✔
Blown Fuse	✔	✔
Cell Balancing Failure	✔	✔
Individual cell failures	✔	✔
BMS Failure	✔	✔
Cell Voltage below 2.6V		✔
Cell Voltage under 2.0V	✔	✔

6.6 LED 12V Supply (+12V and -12V)

Positive and negative 12V terminations are supplied to the BBU by the system shelf and used to power the two LEDs in the BBU module.

Maximum current on this 12V supply is 2A. This supply is protected on the power module side.

The 12V supply is to be used for the LEDs and additional protection circuitry only.

6.7 State of Health Check - Battery Test Request

The signal is normally high. When the BBU requests a battery test, the signal is asserted low.

The state of health (SoH) signal is returned to a high state as soon as the battery test ends. This means for open circuit voltage (OCV) time, the SoH will be high.

NOTE: The AC power outage is given priority over all other states in the system. This means that at any time before, during, or after a battery test, the AC power outage will dictate the discharge on the BBU.

The counter inside the BMS asserts the SoH signal. The random number programmed in the EEPROM dictates the initial assertion (See Section 10 for battery test details).

The signal must remain asserted until a battery test is performed.

On a discharge where the SoH signal was asserted low, the battery must wait for the duration of the OCV time before it requests to be charged.

Reinsertion of the BBU to the system resets the SoH signal and the next scheduled test is set back to the random time programmed in the EEPROM.

6.8 Insert

The signal is high when the BBU is not connected to the system.

This signal connects to the negative return of the power module upon insertion to the system shelf slot, and hence is asserted low.

The Insert signal tells to the BBU logic that the BBU is properly installed in the system shelf slot.

This meets one of the two requirements to exit the BBU from Sleep Mode (or Shipping Mode).

NOTE: To exit Sleep Mode, the Insert pin must be asserted low and the BBU must determine that the 12V supply is present. See Section 8.1 for the full requirements for exiting Sleep Mode.

Removal of the BBU module from the system shelf puts the Insert signal high and the BBU is put back in Sleep Mode.

Reassertion of the Insert signal, i.e., if a BBU is reinserted to the system shelf, it must attempt to clear the following signals:

- Stop Discharge
- Charge Enabled
- SoH Test
- Temporary Failures

6.9 S_RTN (B1)

This pin connects a high signal from the system shelf to the negative return of the battery. The purpose of the pin is to promptly alert the power supply module to turn off all converters connected to the BBU before the BBU is removed from the shelf.

6.10 S_RTN (C1)

This pin is the BBU signal ground.

On the BBU side, the pin is connected to the BMS ground through three parallel 1ohm decoupling resistors and two 1uF X7R ceramic capacitors, as shown in Figure 6.

For the resistors, through hole components may be used. If not, the SMT package must be package 1206. For the capacitor, the SMT package must be 1206 or 0805.

This pin is connected the power supply module signal ground (also with decoupling) to close the loop.

6.11 Charge

A total of five signal pins are used in parallel to charge the battery pack from the system shelf at 5A maximum.

A timeout feature should be implemented where if the charge current is above 0.4A for more than 4 hours, a Fail signal asserts.

6.12 Sleep (B4)

This signal indicates Sleep mode. When the BBU is awake the signal is low. When the BBU is sleep the signal asserts high.

6.13 Protection (B5)

This pin is reserved for the analog protection feature for monitoring temperature. If temperature failure is detected, is signal is asserted low. Normally, the signal is high.

The table below indicates the states of the signals described above with respect to the operational conditions of the BBU:

States	12V Present	LED		Analog Signals						Others	
		Online	Fail/EOL	FAIL	Chg Enable	SOH	EOL	Stop Discharge	Sleep Signal	Insert	Charge FET (Open or Closed)
Charging	Yes	Yes	No	High	Low	High	High	High	Low	Low	Close
Sleep (Charge Fail)	Yes	No	No	High	High	High	High	High	High	Low	Open
Shutdown (shipping condition)	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	High	Open
During SOH discharge time	Yes	Yes	No	High	High	Low	High	High	Low	Low	Open
During OCV check time	Yes	Yes	No	High	High	High	High	High	Low	Low	Open
Fail	Yes	No	Yes	Low	High	High	High	Low	Low	Low	Open
Discharge	Yes	Yes	No	High	High	High	High	High	Low	Low	Open

Figure 7: BBU operational state and corresponding signals

7 LEDs

There are two 3mm LEDs installed on BBU faceplate.

The LEDs must be silkscreened.

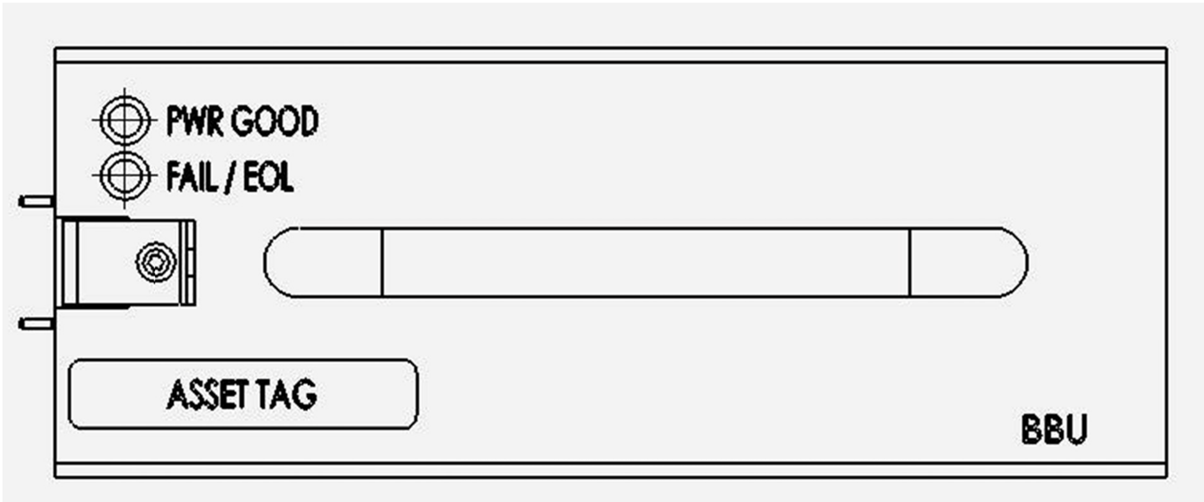


Figure 8: BBU front plate

The behavior of the LEDs are below:

Green (PWR GOOD)	
State	Condition
On	BBU installed and working properly

Red (FAIL / EoL)	
State	Condition
On	Persistent fail (Fail Signal)
Off	No Fail
Amber	End of Life (EoL signal)
Off	BBU not installed or Fail

The LEDs are powered using the 12V coming from the system shelf. If the shelf 12V output voltage is not present, then the LEDs are off, regardless.

The Green LED and the Red LED cannot be on at the same time.

If the BBU detects a failure conditions within the BBU after an EoL condition priorly assessed (amber light) then the amber light turns permanently to a red light (latched Off).

LEDs are to be Off while in Sleep mode.

7.1 Latch-OFF condition

Amber LED (corresponding signal EoL), once assessed is permanently latched on. Once the LED turns on (amber), it cannot turn off anymore. It can be temporarily off during the time the unit is removed from the system shelf slot, or, if installed in the system shelf slot, whenever the 12V shelf output voltage is not present. But it will promptly turn ON again when plugged in a system shelf slot with 12V output voltage present.

The method used to guarantee the latching-off condition of the EoL signal (and yellow LED), may involve information written by the BBU logic in the non-volatile memory EEPROM.

8 EEPROM & Logic, Battery Test

8.1 Sleep Mode/Shipping Mode Status:

The BBU will be shipped with the battery pack partially charged (between 40% and 60%). At the time of shipment the BBU logic is in Sleeping mode.

The BBU logic requires a negligible current from the battery pack, near to 0 Amps, so that battery pack self discharge is very minimal. When the BBU is installed into the system shelf slot, the Insert pin will short to the negative return of the BBU logic (same as the power negative return). The BMS then checks the 12V Supply (used for LEDs):

- If the 12V is present, the BBU will quit Sleep mode.
- If the 12V is not present, the BBU must not exit Sleep mode.
- Once BBU exits Sleep mode, the leakage current from the battery pack to the BBU logic is no longer 0 Amps, but still a very small amount. After quitting Sleep mode, the BBU is supposed to start service.
- The max leakage current once the BBU is out of Sleep mode is 8mA.
- The BBU shall return to sleep mode if the 12V supply is removed at any point. This indicates that the power module has failed and prevents against BBU shelf discharge until the power supply is replaced.
- In Sleep mode, the charge line bidirectional switch is always open.

8.2 EEPROM

The BBU logic includes a non-volatile memory (EEPROM or equivalent) used to store permanent data. The following information is to be added in the said memory in addition to the vendor specific data:

- Manufacture Name
- Manufacturer Model
- Customer Part Number
- FW revision
- Build Revision: EVT, DVT, PVT
- Manufacturer Date
- End of Life status
- Battery test results
- Random Number for SoH test

9 Programming Slot

The BMS system in the BBU should have communication lines (COMs) through which the BMS firmware can be updated.

The COMs should accommodate for accessing (reading) EEPROM and BMS flash data.

The spare pins on the BBU connector may be used for such communication lines.

BBU vendor should provide the customer with necessary equipment, hardware/software, for programming or accessing data stored on the BBU.

10 Battery test

A random number is generated in the BBU production line, and stored on the EEPROM. This is to be associated permanently within each BBU shipped.

The random number is a decimal in the range of 0.001 to 0.999, including the low and high limits.

This random number 'RAND' is then multiplied by 2160, and it is used by the BBU logic to generate the first time 'SoH Check' request to the system shelf, for the very first time. This number refers the number of hours the BBU must wait until the first SoH Check request is asserted. This is called First SoH Timer (First SoH Timer = RAND x 2160).

After the BBU is exits the 'Sleep Mode', a clock timer included in the BBU logic starts to count down the hours in 'First SoH Timer' . Once the count down has reached its end, the BBU logic will submit the request of the very first battery test (SoH Check) to the system shelf.

After the very first battery test completes, the BBU will submit further battery SoH requests at 90-day intervals.

The battery test will terminate when the battery pack reaches 70% SoH (or when it become 30% drained) or after the first cell in the 13S4P battery pack reaches 2.6V during the discharge test.

All other discharge cut off conditions are to be enforced while the battery is being tested. So the test will terminate due to any failures or if the Stop Discharge signal asserts.

Reinsertion of the BBU into the shelf, resets the SoH Check intervals to the First SoH Timer and then the 90 day intervals begin to be enforced again.

If an outage occurs right before a battery test, the battery test algorithm is not affected. If an outage happens when the battery test is queued, the BBU must use the discharge data to determine the state of health. If the data is inconclusive, the BBU must wait until the next 90-day sequence to be tested.

When performing an end of life determination, keep in mind that an AC power outage may occur during or right after a battery test. This would alter the amount of energy required for a complete test. The OCV voltage may also be affected by an AC outage occurring right after a battery test. If the data is inconclusive after the discharge, the test results must be discarded. The BBU must wait for the next 90 days to determine its state of health.

Stop Discharge may not be asserted at any point during the SoH Discharge or the OCV time unless a failure has occurred.

After an SoH discharge has occurred, the BBU must wait until the end of OCV time before asking to be charged.

The BBU will periodically ask the system shelf for a battery check sequence, for SoH determination purposes, until EoL status. The system shelf will engage battery backup on that BBU in the shelf only. If another BBU requests a battery test while another BBU is already under test, or has requested a test, the new request will be queued by the system.

The load used for the test is not a constant current load, but the system load itself. This BBU load will always be between 700W and 2,400W: the system shelf is (2 + 1) redundant and the three power modules share the output current). The shelf is rated 12V @ 6600W (max) and so each BBU needs to support max 2,200W of 12V output when discharge on a redundant shelf (no failures).

The BBU battery test is randomized because the system shelf is a three-phase power shelf, and so it goes under a temporary unbalanced three-phase status during a BBU battery test sequence. Two power modules use AC power and one uses DC power from its BBU during the BBU battery test. The priority system built in the shelf logic allows the battery to test only one BBU at a time. All three must be fully charged.

The diagram below shows a high-level-discharge behavior with relation to the key signals:

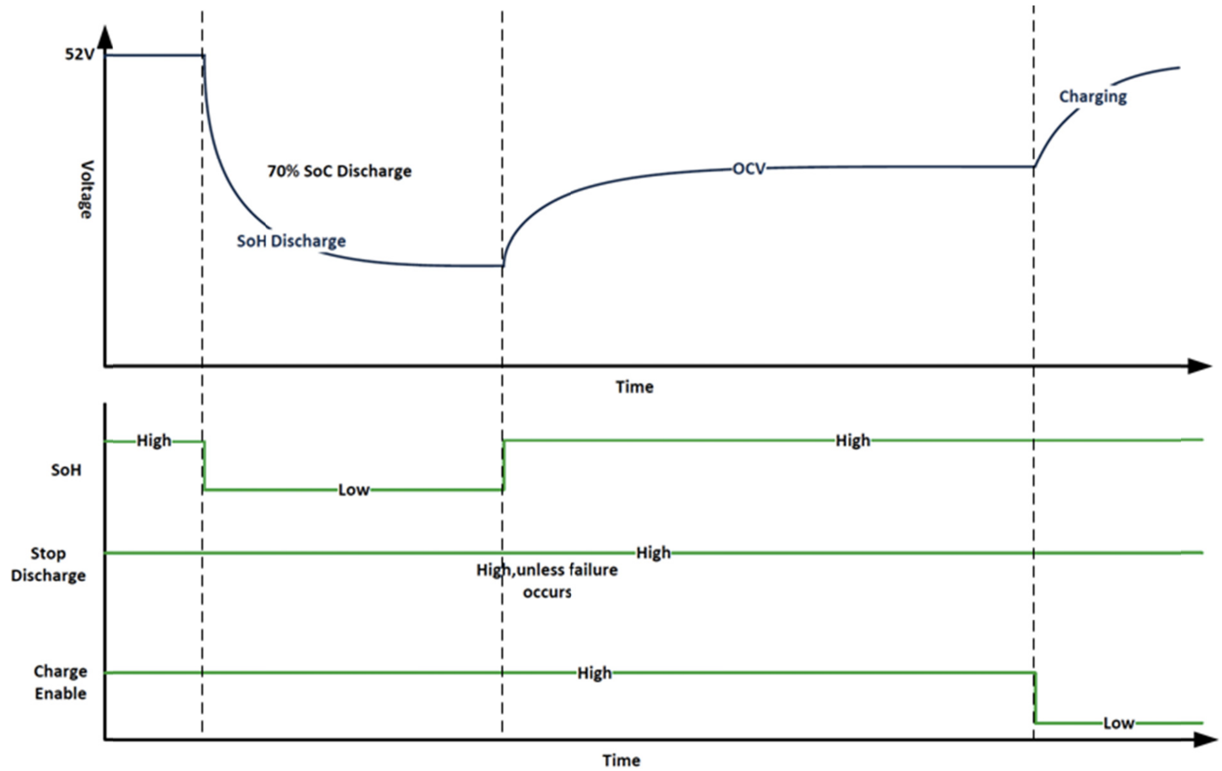


Figure 9: SoH Discharge and key signals

11 Environmental Requirements

Gaseous Contamination: Severity Level G1 per ANSI/ISA 71.04 -1985

Ambient operating temperature range: -5°C to +45°C (Electronics only), +15°C to +45°C (Batteries)

Operating and Storage relative humidity: 10% to 90% (non-condensing)

Storage temperature range: -5°C to +60°C

Transportation temperature range: -25°C to +60°C (short-term storage)

Operating altitude with no de-ratings: 3,000m (10,000 feet)

System level ambient temperature: target is < 30°C (for information only)

12 Vibration & Shock

The BBU shall meet shock and vibration test standards and levels per the IEC78-2-(*) & IEC721-3-(*) standards. During operating vibration and shock tests, the BBU shall exhibit full compliance to the standard without any electrical discontinuities. During non-operating tests, no damage of any kind (including physical damage) will occur, and corrupt the functionalities of the BBU.

Vibration:

- Operating: 0.5g acceleration, 1.5mm amplitude, 5 to 500 Hz, 10 sweeps at 1 octave / minute per each of the three axes (one sweep is 5 to 500 to 5 Hz)
- Non-Operating: 1g acceleration, 3mm amplitude, 5 to 500 Hz, 10 sweeps at 1 octave / minute per each of the three axes (one sweep is 5 to 500 to 5 Hz)

Shock:

- Operating: 6g, half-sine 11mS, 5 shocks per each of the three axes
- Non-Operating: 12g, half-sine 11mS, 10 shocks per each of the three axes

13 Safety Certifications, Applicable Documents

The BBU module is certified and labeled accordingly as stand-alone unit (UL and CE marks).

Cell Requirements:

- UL1642
- IEC 62133 CB Certificate
- UN DOT 38.3

Battery Pack Labeling Requirements:

The BBUs are to be shipped with the Safety Label applied on the body. The label is to be UL approved and made of scratch-resistant material. Place the label on the BBU chassis where the sheet metal is slightly recessed, to prevent scratching. A sample of the label will be submitted for review and approval. The label shall include at least the following information:

- UL Logo (I.T.E.)
- CB Battery Pack (BBU) Designation marking according with IEC 61960
- CE logo based on IEC 60950-1 Low Voltage Directive
- Polarity
- Words secondary (rechargeable) Li or Li-ion
- Date of manufacture (which may be in code)
- Name or Identification of manufacturer or supplier
- Rating Information Capacity
- Nominal Voltage Capacity
- Watts Hour Rating (Whr)
- Cautions
- Warning information

Industry Standards Required for the Battery Pack:

- UL60950-1/CAN/CSA-C22.2 No. 60950-1-03 Information Technology Equipment (I.T.E)
- UL Logo I.T.E. (cURus-logo)
- EN60950-1: 2006 / IEC60950-1 CB Certificate (Standard for Safety of IT Equipment)
- UN DOT 38.3
- IEC 62133 CB Certificate
- UL94V-0 material flammability rating, with an oxygen index of at least 28%.

14 Environmental Engineering Standards

Most recent standards for Li-Ion battery module safety, design, handling, and transportation:

- ETS 300 019-2-3, Class 3.2 (Operation)
- ETS 300 019-2-2, Class 2.3 (Transportation)
- ETS 300 019-2-1, Class 1.2 (Storage)

15 Restriction of Hazardous Substance Compliance

The BBU PCB must be RoHS-6 compliant (BOM & Manufacturing Process).

The battery pack must comply with EU Battery Directive 2006/66/EC.

16 Forbidden Components

- Trimmers and/or Potentiometers
- Tantalum capacitors
- Dip Switches
- SMT Ceramic Capacitors allowed with case size < 1206. The size 1206 can still be used when SMT capacitors are placed far from the PCBs edge, and with a correct orientation that minimizes the risk of cracking.
- Allowed ceramics materials for SMT capacitors are: X7R or better material.
- The COG or NP0 types should be used in critical portions of the design (PWM clock settings, stability loops, etc.).
- Relays: the usage of any electro-mechanical relays is not allowed.

17 Capacitors

All the Electrolytic Capacitors shall be rated 105°C, and shall be selected from high quality manufacturers only.

All capacitors shall have a predicted life of at least 50,000 hours at 45°C ambient temperature, under worst conditions.

18 Mechanical Drawings

NOTES

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-2009.
2. ALL DIMENSIONS ARE MM.
3. ALL COMPONENTS SHALL BE UL 94V-0 RECOGNIZED AND ROHS COMPLIANT.
4. CASE MATERIAL SHALL RESIST THE CREATION OF ZINC WHISKERS SUCH AS ASTM A653 AND JISG3302 SGOC.
5. ALL DIMENSIONS ARE CONSIDERED CRITICAL TO FUNCTION DIMENSIONS AND SHALL BE INCLUDED IN PART QUALIFICATION.

[6] LEDS LABELED IN A PERMANENT AND LEGIBLE MANNER LOCATED APPROXIMATELY WHERE SHOWN. TEXT 4MM TALL MINIMUM.

[7] LATCH COLOR PANTONE 375C GREEN. LATCHES MUST HAVE A BACKSTOP TO PREVENT DAMAGE TO LATCH DURING ACTUATION.

[8] AIRFLOW PER INDICATED DIRECTION.

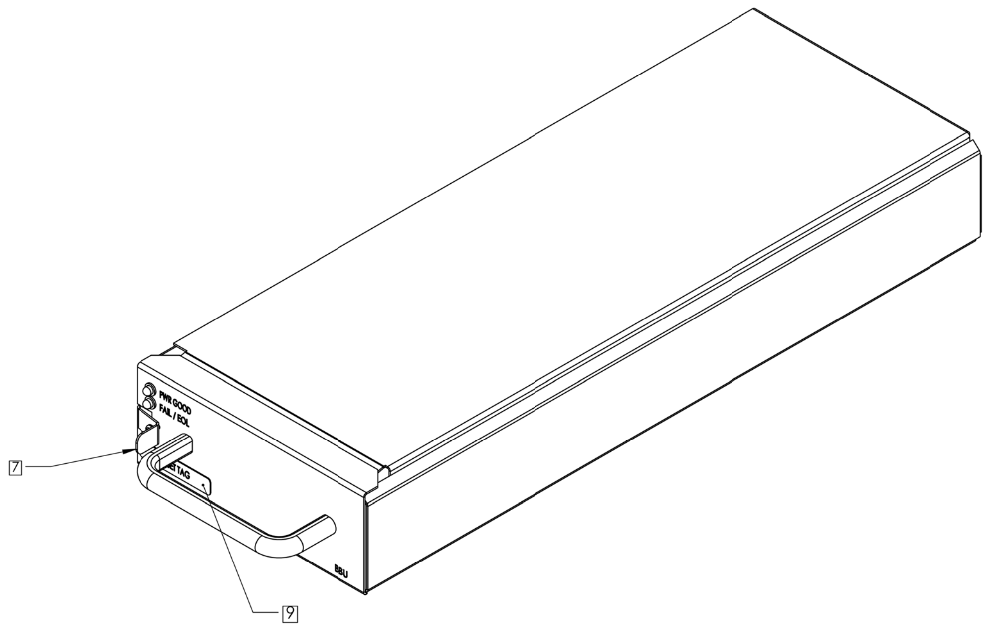
[9] RESERVE SOLID AREA IN CHASSIS TO PLACE ASSET TAG APPROXIMATELY WHERE SHOWN.

10. ALL EDGES SHALL BE CONDITIONED FOR HANDLING WITH A BURR NO GREATER THAN 10% OF MATERIAL THICKNESS AND SHALL CONFORM TO UL SAFETY SPECIFICATION 1439.
11. COMPONENT SHALL BE CLEAN AND FREE FROM FOREIGN MATERIAL. DIRT,OIL,GREASE,OR OTHER CONTAMINANTS ARE NOT ALLOWED.

[12] CLEARANCE FOR ALIGNMENT PIN. 12MM PROTRUSION INTO BBU MAX.

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	INITIAL RELEASE		SM
	2	CONVERT DESIGN TO CAM	29AUG13	SM
	3	ADD KEY; MOVE CONNECTOR INSIDE	9 SEP 13	SM
	4	ADD PIN LOCATIONS;CHANGE KEY DETAIL	20 SEP 13	SM
	5	REDUCE KEY SIZE; MOVE CONNECTOR AND ALIGNMENT HOLES	15 OCT 13	SM
	6	INCREASE HEIGHT TO 62MM; CHANGE CAM O LATCH AND HANDLE; REMOVED AIRHOLES AT EXIT; KEY SIZE INCREASED	5 FEB 14	SM
	7	ADD BRACKETS TO PROTECT CONNECTOR	10 MAR 14	SM
	8	REMOVE FRONT AIR HOLES; ADJUST LED AND KEY	11 MAR 14	SM
	9	ADD TOLERANCE @2D8	13MAR14	SM
	10	DELETE SHELF SIDE CONNECTOR FROM VIEWS	29MAY14	SM



	NAME	DATE
DRAWN	MILLS	7MAR13
CHECKED		
ENG APPR.		
MFG APPR.		

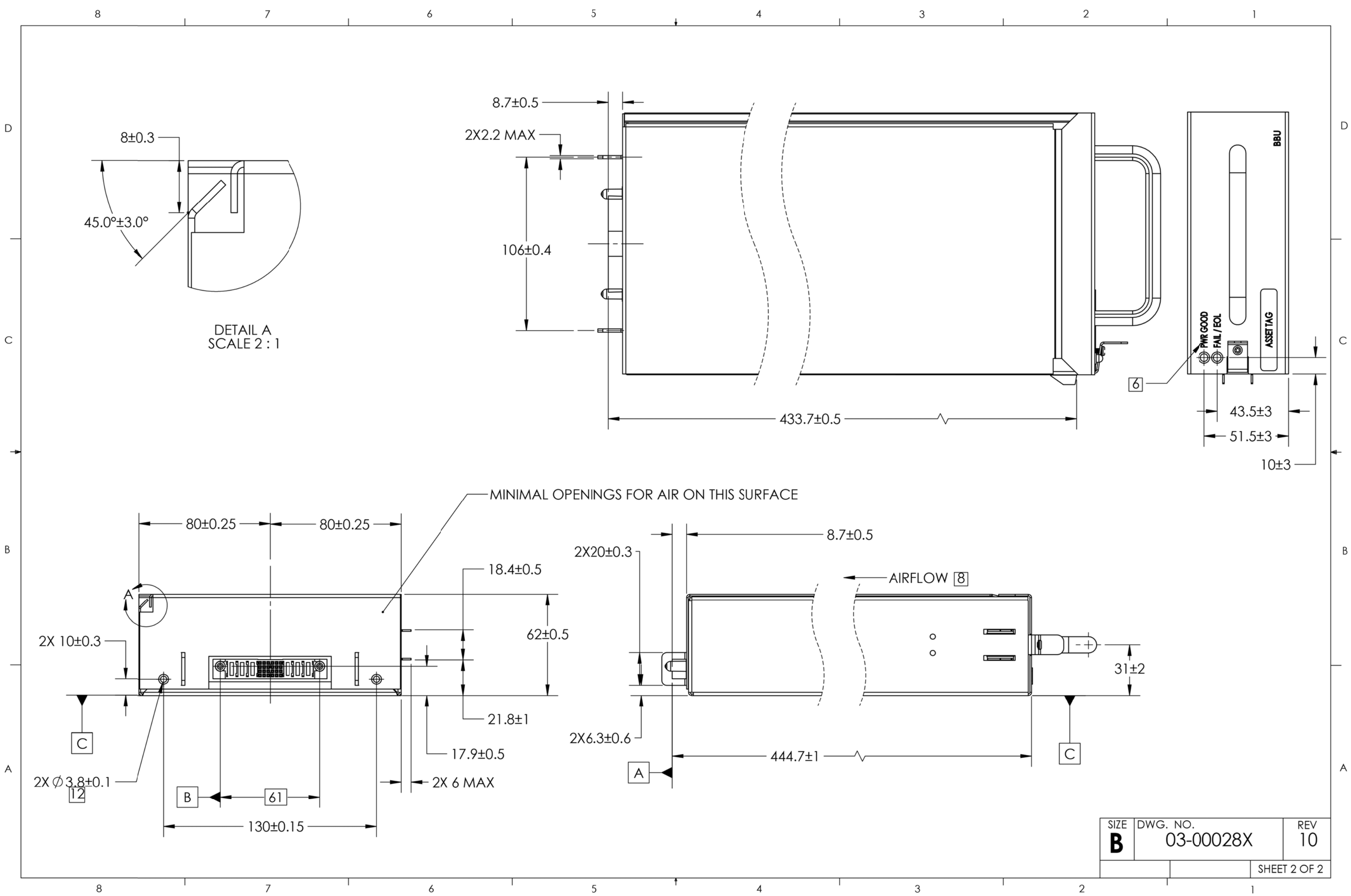
facebook

TITLE: BATTERY BACK UP UNIT, V2 53VDC BBU

SIZE	DWG. NO.	REV
B	03-00028X	10

SHEET 1 OF 2

PROPRIETARY AND CONFIDENTIAL


8±0.3
45.0°±3.0°
DETAIL A
SCALE 2 : 1
8.7±0.5
2X2.2 MAX
106±0.4
433.7±0.5
BBU
PWR GOOD
FAIL / EOL
ASSET TAG
6
43.5±3
51.5±3
10±3
MINIMAL OPENINGS FOR AIR ON THIS SURFACE
80±0.25
80±0.25
18.4±0.5
62±0.5
2X 10±0.3
21.8±1
17.9±0.5
2X 6 MAX
2X ∅ 3.8±0.1
12
B
61
130±0.15
C
A
8.7±0.5
2X20±0.3
AIRFLOW 8
31±2
2X6.3±0.6
444.7±1
SIZE B
DWG. NO. 03-00028X
REV 10
SHEET 2 OF 2