CBP23-V3
Manual

Capacitive Backup Power
For
HESC Series Power Supplies

Manufactured by
TRI-M ENGINEERING
Engineered Solutions for Embedded Applications

Technical Manual

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This manual is for integrators of applications of embedded systems. It contains information on hardware requirements and interconnection to other embedded electronics.

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CHAPTER 1: GENERAL DESCRIPTION

The CBP23 creates a complete UPS system when plugged directly into the bottom of an HESC Vehicle Power Supply. The CBP23 includes six "C" size Ultra Capacitor (each capacitor is 140 farads to maximum of 2.5V) wired in series for a total of 23.3 farads up to 15 volts. Therefore a CBP23 can supply backup power for over four minutes to a 10 watt load.

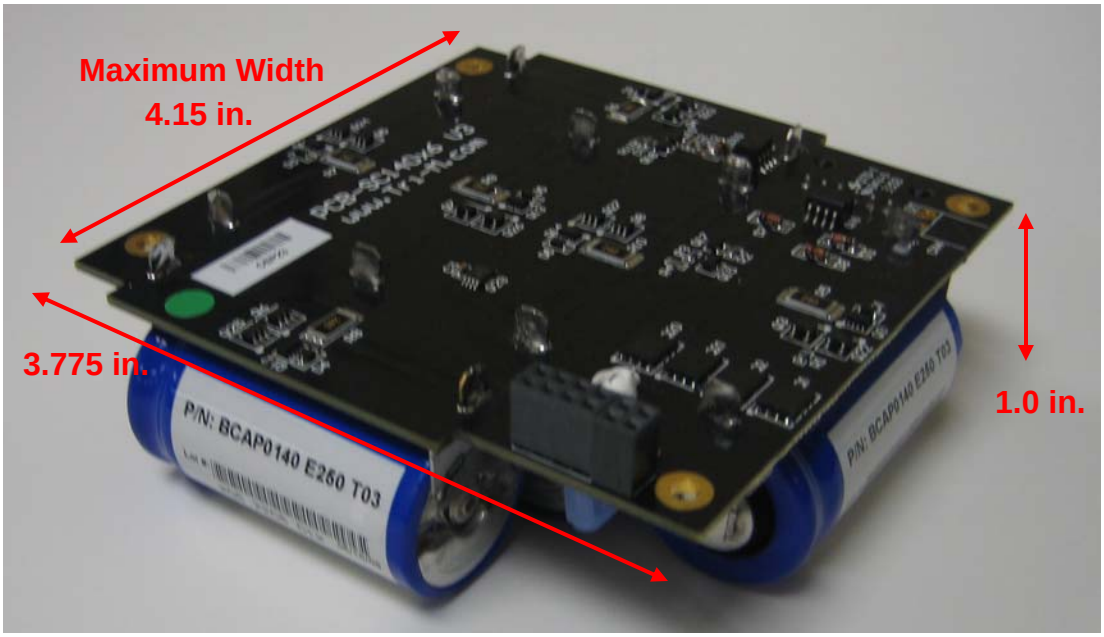
The CBP23 includes Mosfet transistors (Q1 & Q2) for preventing deep discharge occurrences during extended power outages. The Mosfet transistors electrically isolate the CBP23 from the HESC whenever the BE output of the HESC is de-asserted (pulled to 5V).

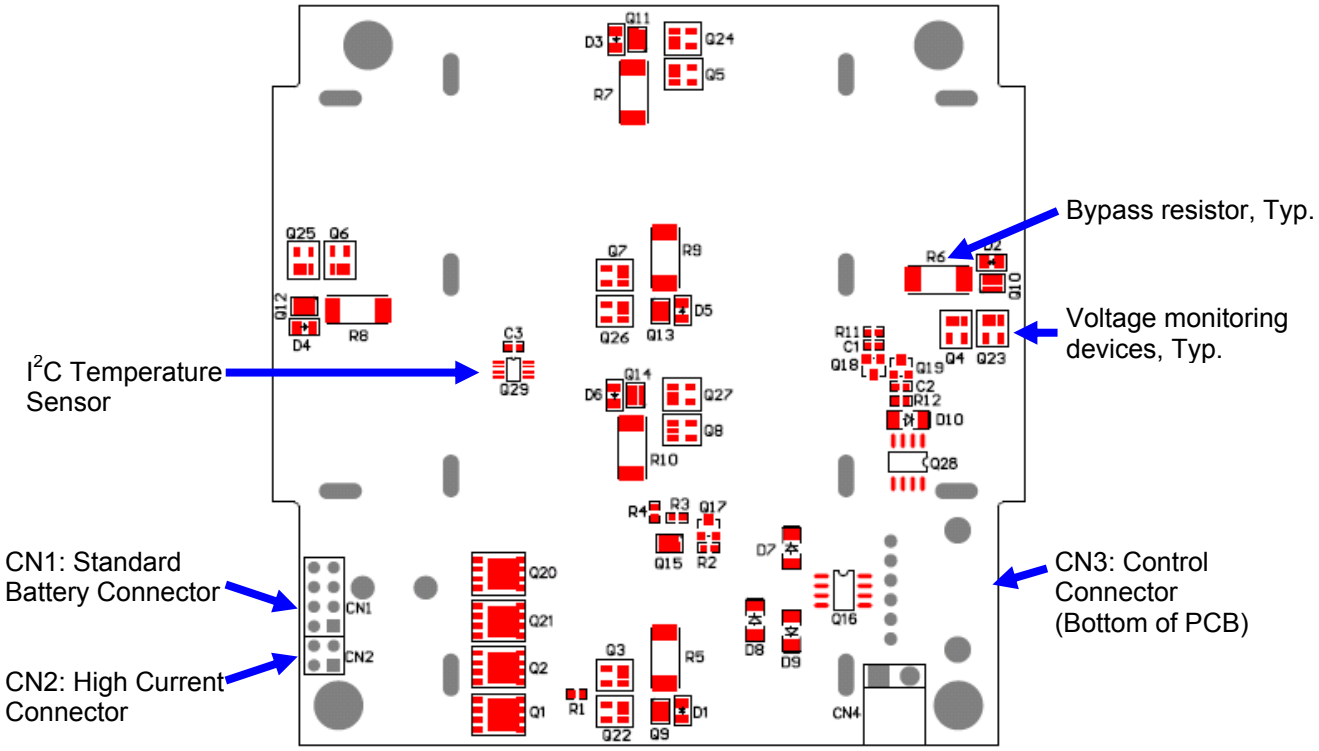
The CBP23 has two voltage monitoring devices for each Ultra Capacitors. One voltage monitor is used to enable the capacitor bypass resistor (24.9 ohms) when the voltage approached the maximum operating threshold. The second voltage monitor detects when the voltage across the Ultra Capacitor exceeds the maximum operating voltage. When this occurs the signal Status-OV is generated, and the CPB23 is isolated from the system via Mosfets (Q20 & Q21)

The CBP23 has does not have a thermal fuse as the Ultra Capacitors do not generate internal heat when reaching a full charge state. A current fuse (F1) is provided should an Ultra Capacitor or other component on the CBP23 fail resulting in excessive currents.

The CBP23 has an I^2C temperature sensor (Q29) that can be read by the HESC power supply plugged into CN1.

The Ultra Capacitors are mounted on the "bottom" of the PCB with an overall height below the PCB of 1.0 inch. The size of each of the PCBs is 3.55 x 3.775 inches with small "wings" on two sides. The CBP23 mounts directly to the "bottom" of a HESC power supply using 0.6 inch standoffs.





CHAPTER 2: INSTALLATION

2.1 Installing the CBP23

The CBP23 mounts directly to the bottom of HESC products by plugging CN1 and CN2 into the mating connectors. Spacers of 0.6 inch size are used between the CBP23 and the HESC power supply it is plugged into.

The I2C digital temperature sensor (Q29) is accessed by configuring the HESC power supply to read the temperature at the I^2C address of "79" (0x4F).

CHAPTER 3: Connector Descriptions

3.1 Connector CN1, Standard Battery Connector

The standard battery connector, CN1, can handle loads up to 60 watts.

Dual Row Socket Connector: 2x4 Positions					
Pin #	**Signal**	**Description**	**Pin #**	**Signal**	**Description**
8	BEN	Battery Enable Low True	7	Vcc5C	5V "continuous" from HESC
6	SCL	Serial Clock	5	SDA	Serial Data
4	COM	Common	3	BAT+	Battery Positive
2	COM	Battery Positive	1	BAT+	Battery Positive

3.2 Connector CN2: High Current Battery Connector

For loads greater than 60 watts, the high current connector CN2 must be plugged into the mating connector. Power supplies HESC104+ and HPSC104-SER are available with a "high current" option. Please specify the "-HC" option when ordering these power supplies for loads greater than 60 watts.

Dual Row Socket Connector: 2x2 Positions					
Pin #	**Signal**	**Description**	**Pin #**	**Signal**	**Description**
4	COM	Common	3	BAT+	Battery Positive
2	COM	Common	1	BAT+	Battery Positive

3.3 Connector CN3: Control Interface Connector

The Connector CN3 provides an input for "waking" a system that is in "hibernation" mode. Hibernation mode is when there is no main input power and the CBP23 has disconnected the backup power capacitors from supplying and power (ie: when the HESC has no power at all applied to it). CN3 also provide an open collector output that provides a status indication whenever an Ultra Capacitor is "over-voltage".

LOCKING HEADER: 6 Positions Molex 70555-0040 Mating Plug Molex 50-57-9406, Crimps for Plug: Molex 16-02-0102		
Pin #	**Signal**	**Description**
1	1ma	1ma current source from Ultra Capacitors. Can be used for OREN
2	OREN	Momentary Input for waking from "Hibernation" mode. Provide 3-40VDC or dry contact to Pin-1 (Signal "1ma") of CN3 to wake.
3	Vcc5C	5V "continuous" from HESC.
4	COM	Common.
5	STATUS-OV	Status indication whenever an Ultra Capacitor is actively "rebalancing".
6	BEN	Battery Enable Low True.

CHAPTER 4: Determining Power Hold-Up Time

Energy decrease in capacitor: $\Delta E = \frac{1}{2} C(V_{wv}^2 - V_{min}^2)$

Where:

- C is the capacitance in farads.
- V_{wv} is the maximum voltage.
- V_{min} is the cutoff voltage.
- E is energy in joules (watt-seconds)

Therefore for the CBP23, total energy available is $\Delta E = 0.5 * 28.3 (15^2 - 7^2) = 2490$ joules.
For a 10 watt load the hold-up time is 2490/10 = 249 seconds or just over four minutes.
For a 25 watt load the hold-up time is 2490/25 = 99.6 seconds or about 1.6 minutes.