CBP58-V3
Manual

Power Backup Module
For
HESC & HPSC Series Power Supplies

Manufactured by
Tri-M Technologies Inc.
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 CBP58-V3 creates a complete UPS system when plugged directly into the bottom of an HESC/HPSC power supply. The CBP58-V3 also can be charged and discharged by other power supplies through the “CH/DIS POWER” and “CH/DIS CTRL” connectors.

The CBP58-V3 has six “D” size Ultra Capacitor (each capacitor is 350 farads to maximum of 2.7V) wired in series for a total of 58.3 farads up to 16.2 volts. Therefore a CBP58-V3 can supply backup power for over four minutes to a 20 watt load.

Two Voltage Monitoring Controllers (VMCs) per capacitor are employed, one is used to shunt (bypass) current around the capacitor when the capacitor voltage approaches the maximum charge voltage and the second is used to activate the Charge Isolation Mosfets (CIMs) when the capacitor voltage is at the maximum charge voltage. Note: The CBP58-V3 is able to supply backup energy even when the CIMs are in isolation mode.

A set of Discharge Isolation Mosfets (DIMs) on the CBP58-V3 allow the HESC/HPSC power supply to put the CBP58-V3 into isolation mode when the CPB58-V3 output voltage drops below the minimum backup voltage level of the HESC/HPSC power supply.

The CBP58-V3 has a field replaceable automotive style “MINI Blade” fuse is provided to prevent excessively large currents.

Six “D” size Ultra Capacitors are mounted on a PCB along with the DIMs, CIMs, and voltage monitoring controllers. A bottom protective PC/104 sized metal plate and four 2.6 inch spacers, one per corner, are used to “enclose” the Ultra Capacitors and allow the CBP58-V3 to be installed in the Tri-M CanTainer and VersaTainer enclosures.

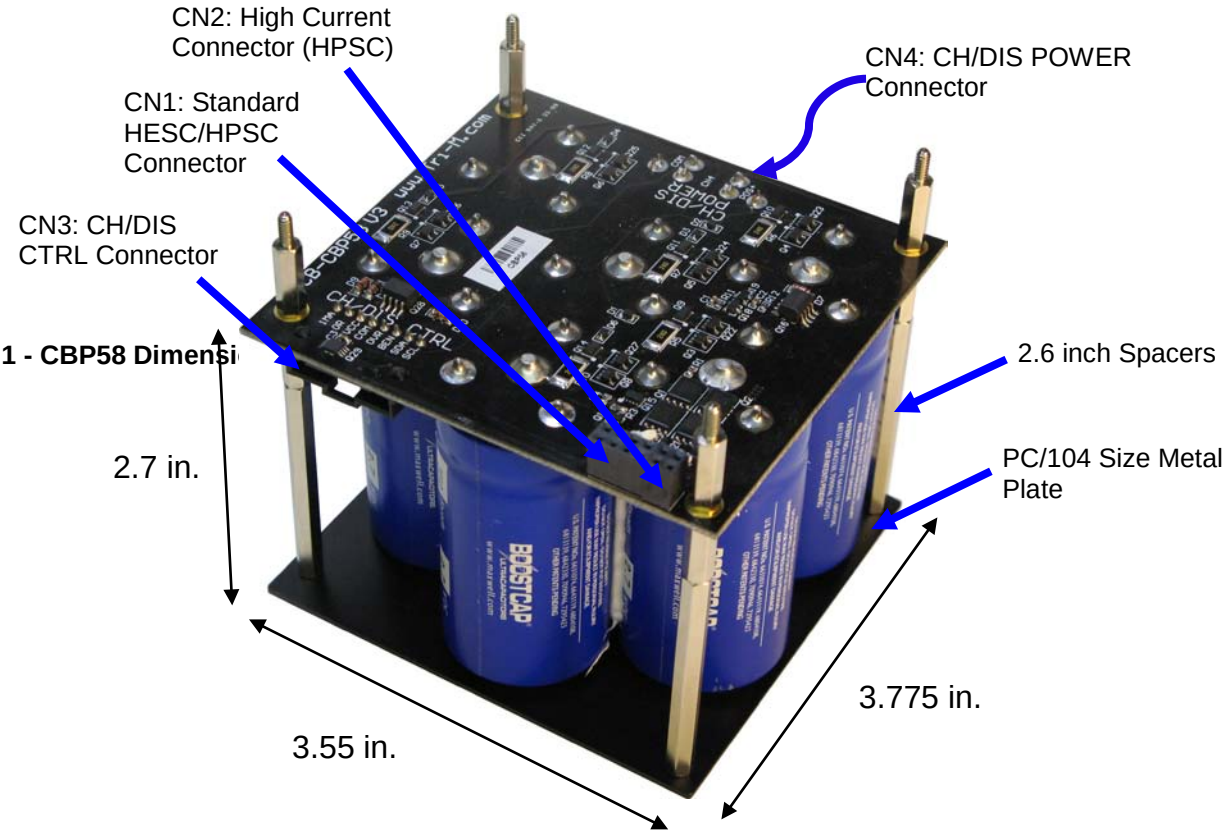


Figure 1 - CBP58 Dimensi

CHAPTER 2: Installation and Operation

2.1 Installing the CBP58-V3

The CBP58-V3 mounts directly to the bottom of HESC products by plugging CN1 into the mating connector on the power supply. Spacers of 0.6 inch size are used between the CBP58-V3 and the HESC/HPSC power supply it is plugged into.

2.2 Field Plug and Fuse Part Numbers

Tri-M Part No.	Qty	Description	Part Number	Manufacturer	Part Location
FUSE-MINI-15A	1	Fuse 15A/32V MINI Blade Fast-act	0297015.WXNV	Littelfuse Inc	Plugs into F1
CON-PLUG2-10mm	1	2 Position Connector Receptacle	42816-0212	Molex	Plug for CN4
CON-PLUG-LOC8	1	8 Position Locking Plug	50-57-9408	Molex	Plug for CN3
HW-CRMP-22-24	8	Connector Term Female 22-24 AWG	16-02-0102	Molex	Crimps for plugs for CN3
HW-CRMP-10-12	2	Conn Term Male 10-12AWG Gold	42815-0012-C	Molex	Crimps for plugs CN4

2.3 Connector Pin Outs

CN1 Standard HESC/HPSC Connector			
Pin#	**Signal**	**Description**	**Range**
1,3	CAP+	Positive connection for charge & discharge.	0 to 16.2VDC
2, 4	Com	Electrical common	0VDC
5	SDA	I^2C Bidirectional Data Signal to/from HESC/HPSC or remote charger.	Open collector signal pulled to Vcc by HESC/HPSC or remote charger.
6	SCL	I^2C Clock from HESC/HPSC or remote charger.	Open collector signal pulled to Vcc by HESC/HPSC or remote charger.
7	VccCtrl	Control power supplied by HESC/HPSC or remote charger.	5VDC
8	CEN	Low active enable signal.	0V = activate, Vcc = de-activate

CN2 High Current HPSC Connector			
Pin#	**Signal**	**Description**	**Range**
1,3	CAP+	Positive connection for charge & discharge.	0 to 16.2VDC
2, 4	Com	Electrical common	0VDC

CN3 CH/DIS CTRL Connector			
Pin#	**Signal**	**Description**	**Range**
1	1MA	1mA current limited supply directly from positive of capacitors.	1mA via current limiting diode.
2	OREN	Enables the DIMs (Discharge Isolation Mosfets) thus turning on the CBP58-V3. If an HESC/HPSC is the charger for the CPB58 then use of this signal should be by a momentary "contact" and not a maintained contact such as an ignition switch so that the HESC/HPSC can de-activate the CBP58-V3 when not required.	1mA current limited. A dry contact between the 1mA signal and OREN can be used.
3	VccCtrl	Control power supplied by HESC/HPSC or remote charger.	5VDC
4	Com	Electrical common	0VDC
5	OVR	Opto-isolated open collector status of any capacitor detected in an overvoltage condition.	Hi-impedance = normal operation. 0V = overvoltage condition exists on one of more capacitors.
6	CEN	Low active enable signal.	0V = activate, Vcc = de-activate
7	SDA	I^2C Bidirectional Data Signal to/from HESC/HPSC or remote charger.	Open collector signal pulled to Vcc by HESC/HPSC or remote charger.
8	SCL	I^2C Clock from HESC/HPSC or remote charger.	Open collector signal pulled to Vcc by HESC/HPSC or remote charger.

CN4 CH/DIS POWER Connector			
Pin#	**Signal**	**Description**	**Range**
1,2	CAP+	Positive connection for charge & discharge.	0 to 16.2VDC
3, 4	Com	Electrical common	0VDC

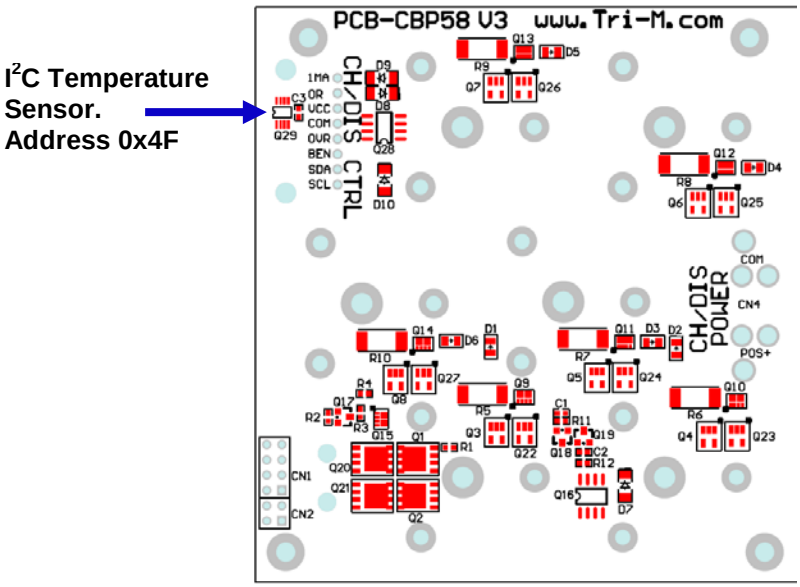
2.4 I^2C Temperature Sensor

The CBP58-V3 includes an I^2C temperature sensor at address 0x9F. The temperature sensor readings can be accessed over the I^2C port through connector CN1 or CN3. The temperature readings can be used to decrease the charging voltage as the ambient temperature of the CBP58-3 increases and to halt all charging if the temperature increases past the maximum (65°C). A negative compensation of 10mV/K (based on starting @ 25°C) will lower the maximum charging voltage 400mV @ 65°C but will extend the life expectancy of operation. The "10" mV/K value can be set into the HESC/HPSC "Temperature Compensation Applied to BattVDef" field in the charge "Cycle 1" settings using the SCU.exe utility. Note that the "Enable compensate the BattVDef voltage for the temperature" radio button must also be enabled for the temperature compensation to be applied (located under the "Cycle 1 – Charge Termination" settings.

When using the SCU.exe utility to configure an HESC/HPSC type of power supply to read the I^2C temperature sensor set the "I2C Temperature Sensor Address" to 79 (decimal) and enable the "Address R/W, Enable for Read, Disable For Write" check box (located in the "Temperature Sensor Control" settings).

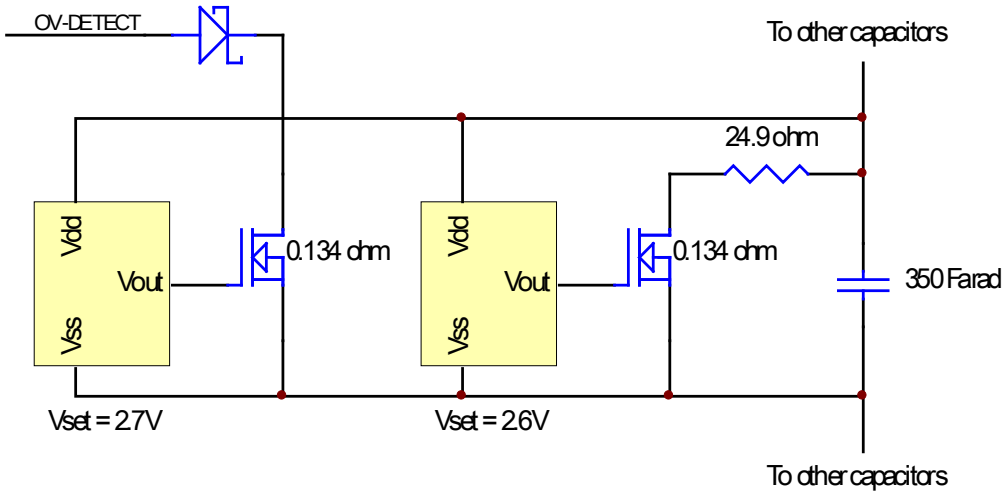
I^2C Address Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	1	1	1	1	R/W
0x4F, (79 dec)							R=1

Note: The I^2C temperature readings are only available when VccCtrl power is applied. When using the HESC/HPSC the VccCtrl power is applied whenever the HESC/HPSC has power either from its main input or from the CBP58-V3. Therefore if the CBP58-V3 was enabled through OREN, backup power from the CBP58-V3 would flow to the HESC/HPSC which would in return supply the VccCtrl to the CBP58-V3.



2.5 Capacitor Voltage Monitoring

Each capacitor has two Voltage Monitoring Controllers (VMCs). One VMC with a setting of 2.6V is used to shunt (bypass) current around the capacitor through a 24.9 ohm resistor. The other VMC with a setting of 2.7V generates the OV-DETECT signal which activates the Charge Isolation Mosfets (CIMs) preventing additional charging of the CBP58-V3. The CBP58-V3 can still provide backup power even when the CIMs are activated. To prevent repeated overcharging of the capacitors, the CIMs can only be reset by the removal of the charging voltage.



An opto-isolated open collector status (OVR) is available on pin 5 of CN3 (CH/DIS CTRL Connector) of any capacitor activating this OV-DETECT signal.

2.6 Fuse Replacement

Each Ultra Capacitor has a rated DC ESR of 3.2mohm, and the series ESR of six of them is less than 20mohm. The application of unregulated charging power or the shorting of the CBP58-V3 output can result in excessive current. An automotive style MINI Blade 15A fuse (F1) allows for field replacing in case of fuse activation. The fuse is located on the opposite side of the PCB of CN1 & CN2. The factory installation of this fuse includes a little RTV on the fuse blades for shock and vibration purposes.

2.7 Start up of an HESC/HPSC and CBP58-V3 without Main Power available.

An HESC/HPSC with CBP58-V3 can be powered up without main power available. Connect a momentary dry contact between the 1MA signal (pin 1) and OREN (pin 2) of CN3 (CH/DIS CTRL Connector). The HESC/HPSC with the HESC-UPS18 firmware can be configured to start on capacitor (battery) backup power so that when the momentary dry contact closes and backup power from the CBP58-V3 flows into the HESC/HPSC, the HESC/HPSC recognizes this as a start up request.

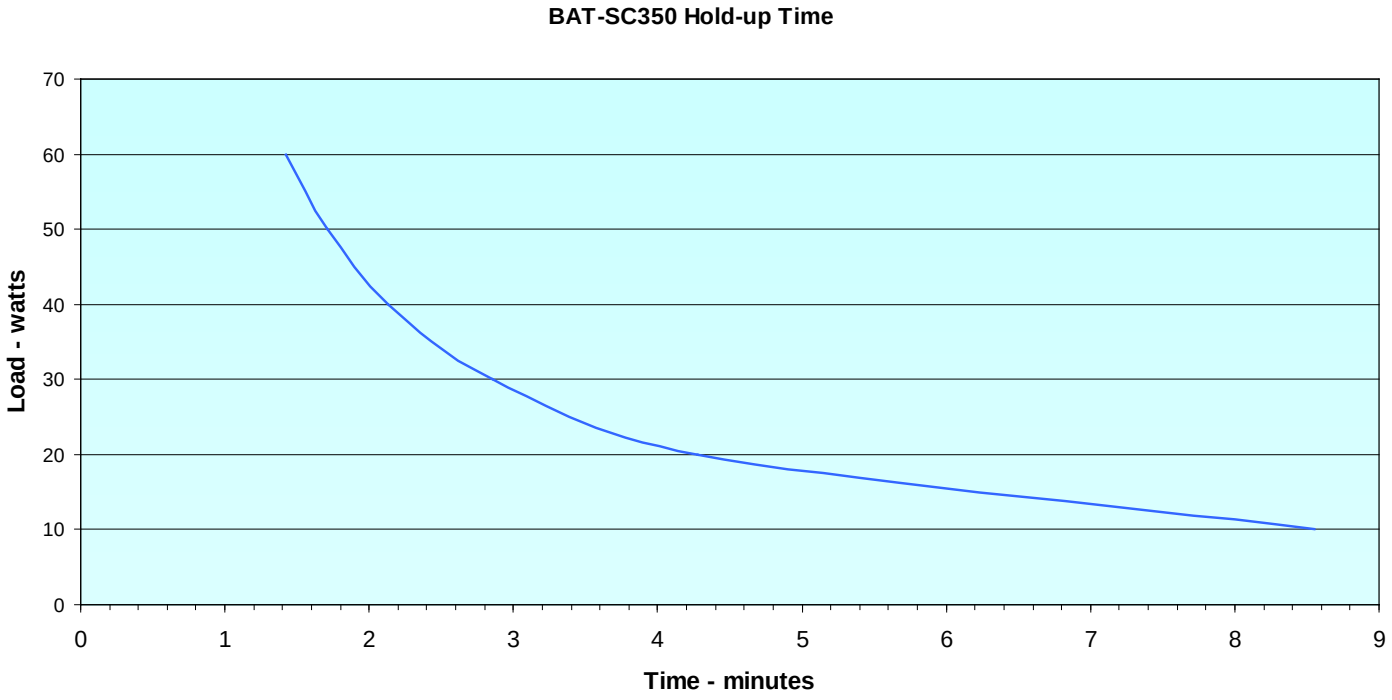
CHAPTER 3: Determining Power Hold-Up Time

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 CBP58-V3, total energy available is $\Delta E = 0.5 * 58.3 (15^{2} - 7^{2}) = 5130$ joules.
For a 20 watt load the hold-up time is 5130/20 = 256 seconds or just over four minutes.
For a 50 watt load the hold-up time is 5130/20 = 102 seconds or 1.7 minutes.


BAT-SC350 Hold-up Time
Load - watts
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
Time - minutes