PPM-PS394-533

PC/104-*Plus* DC/DC Power Supply with Dual Inputs, Maximum Power Point Tracking (MPPT) Smart Battery Charger, and UPS Controller

PCM-PS394-500

PC/104 DC/DC Power Supply with Dual Inputs, Maximum Power Point Tracking (MPPT) Smart Battery Charger, and UPS Controller

ISM-PS394-533

Dual Output DC/DC Power Supply with Dual Inputs, Maximum Power Point Tracking (MPPT) Smart Battery Charger, and UPS Controller

PRODUCT MANUAL

WinSystems, Inc.
715 Stadium Drive
Arlington, TX 76011

http://www.winsystems.com

MANUAL REVISION HISTORY

P/N G400-0394-000A (PPM-PS394-533, PCM-PS394-500, ISM-PS394-533)

Revision Date Code	ECO Number
130403	
130715	

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BEFORE YOU BEGIN

WinSystems offers best practice recommendations for using and handling WinSystems embedded PCs. These methods include valuable advice to provide an optimal user experience and to prevent damage to yourself and/or the product.

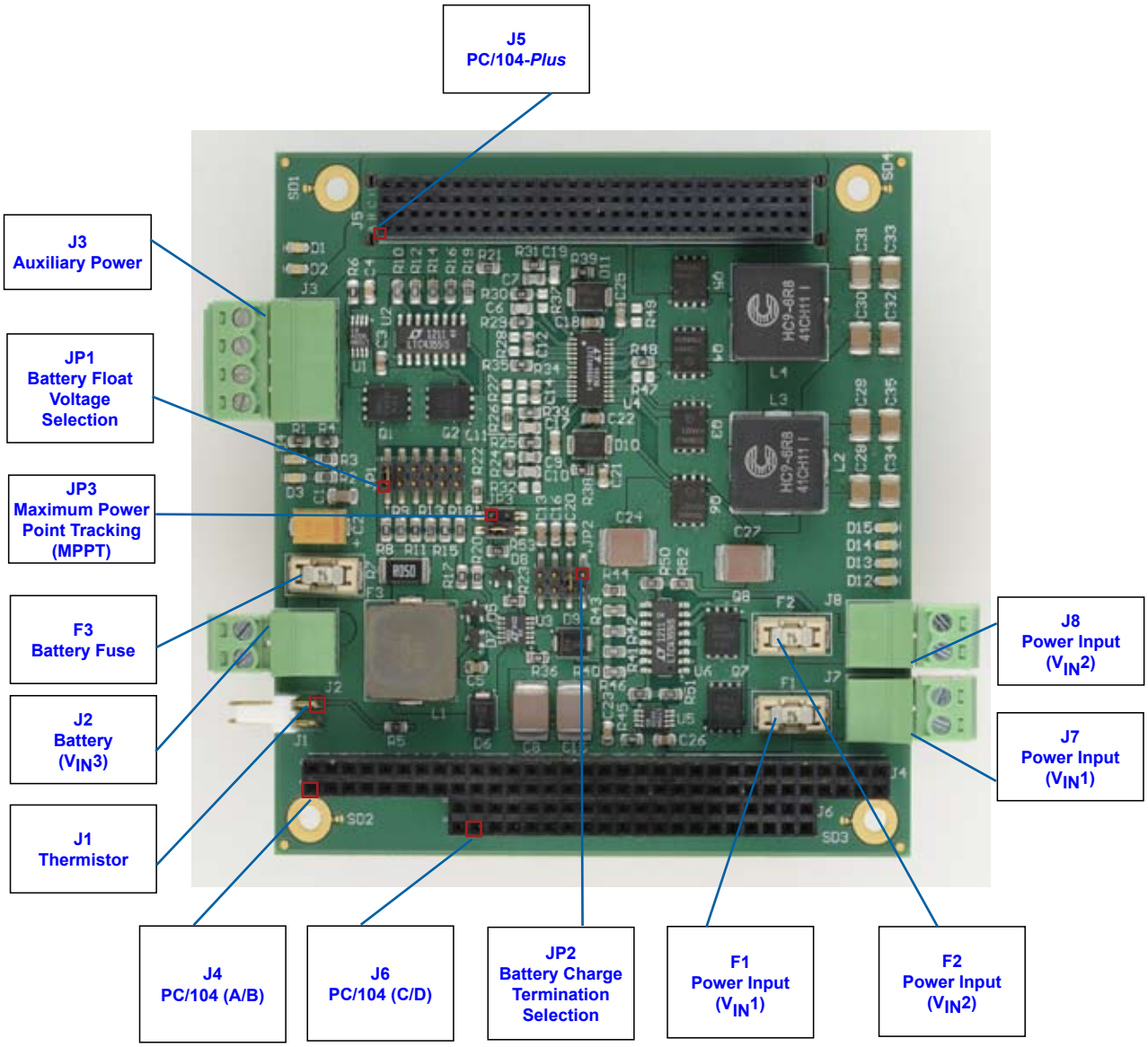
YOU MAY VOID YOUR WARRANTY AND/OR DAMAGE AN EMBEDDED PC BY FAILING TO COMPLY WITH THESE BEST PRACTICES.

Reference **Appendix - A** for **Best Practices**.

Please review these guidelines carefully and follow them to ensure you are successfully using your embedded PC.

For any questions you may have on WinSystems products, contact our Technical Support Group at (817) 274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

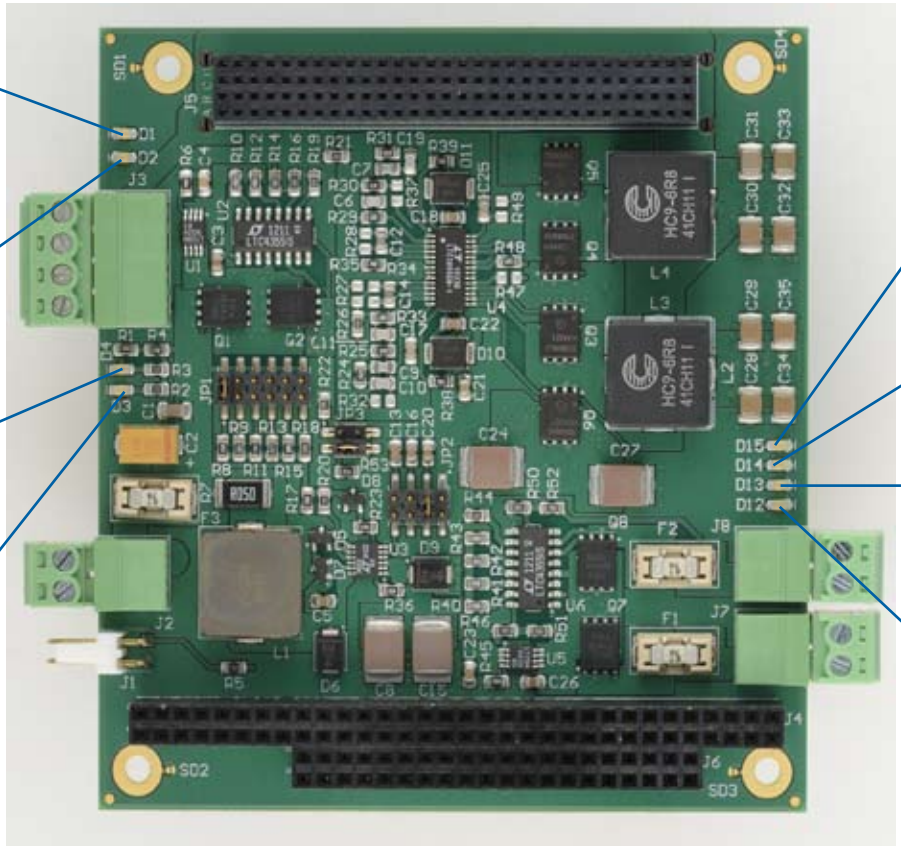
Visual Index - Top View (Connectors & Jumpers) - PPM-PS394-533



RESERVED -

NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

Visual Index - Top View (LEDs) - PPM-PS394-533



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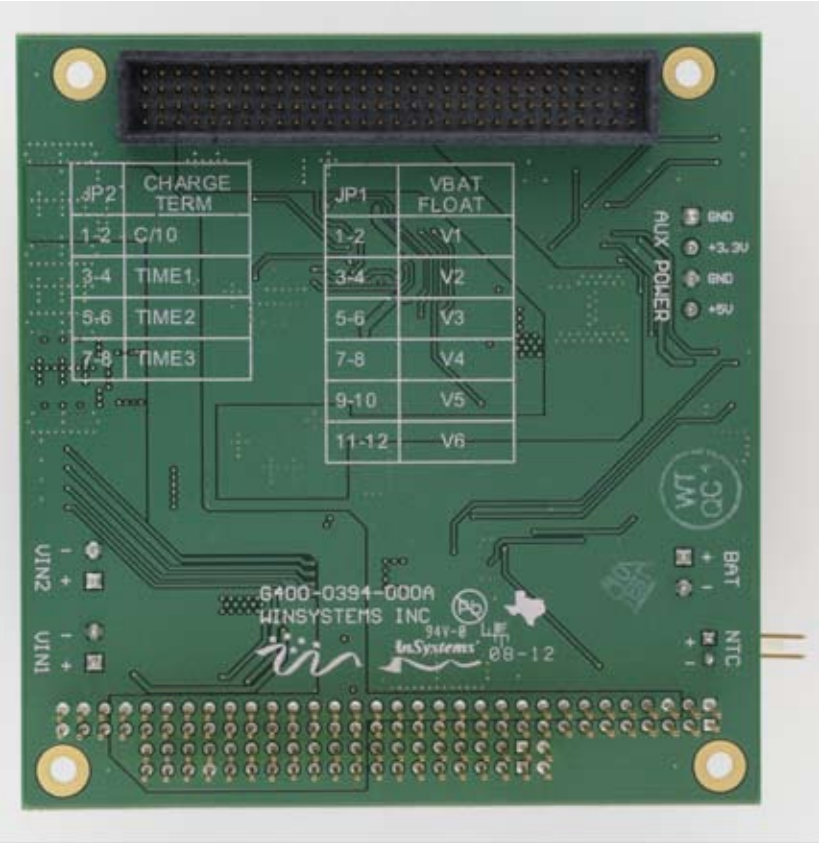
NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

Visual Index - Bottom View - PPM-PS394-533



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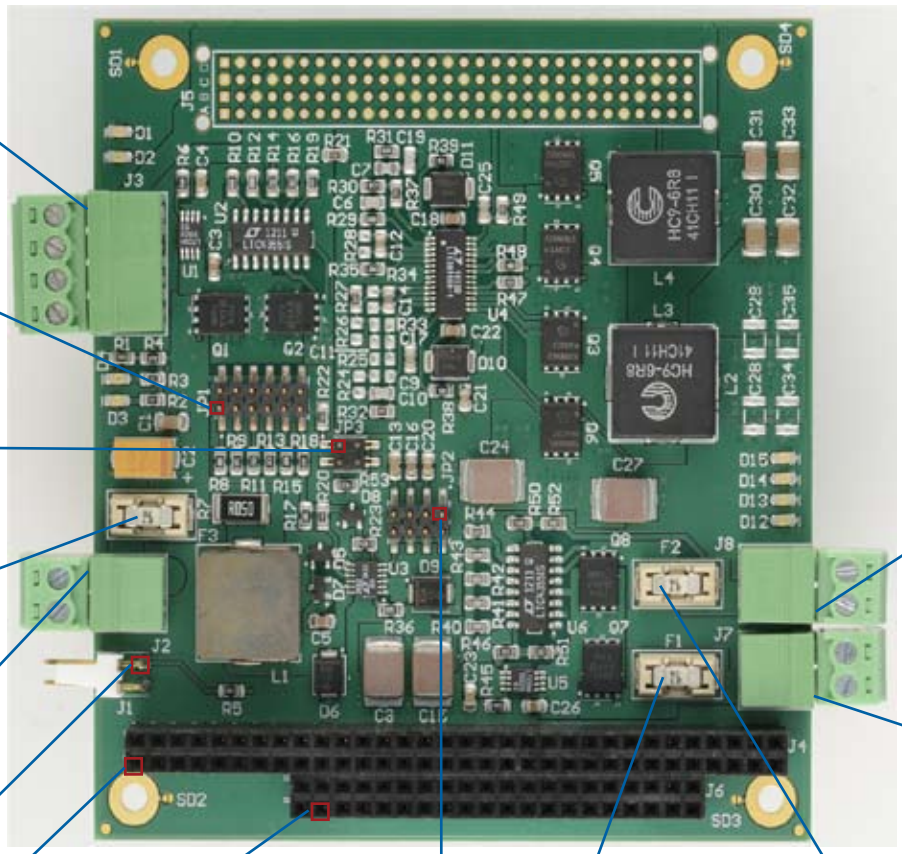
Visual Index - Top View (Connectors & Jumpers) - PCM-PS394-500



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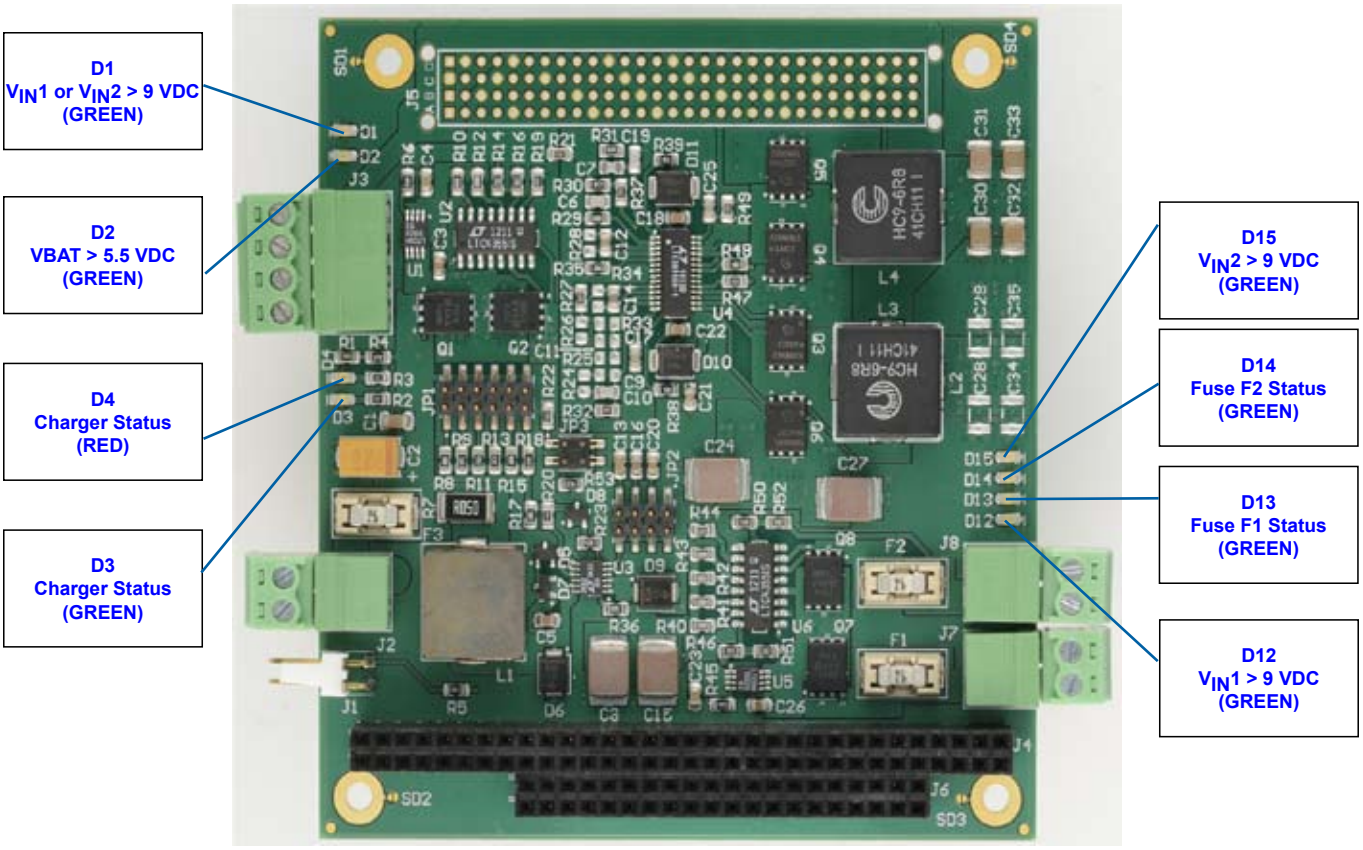
NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

Visual Index - Top View (LEDs) - PCM-PS394-500



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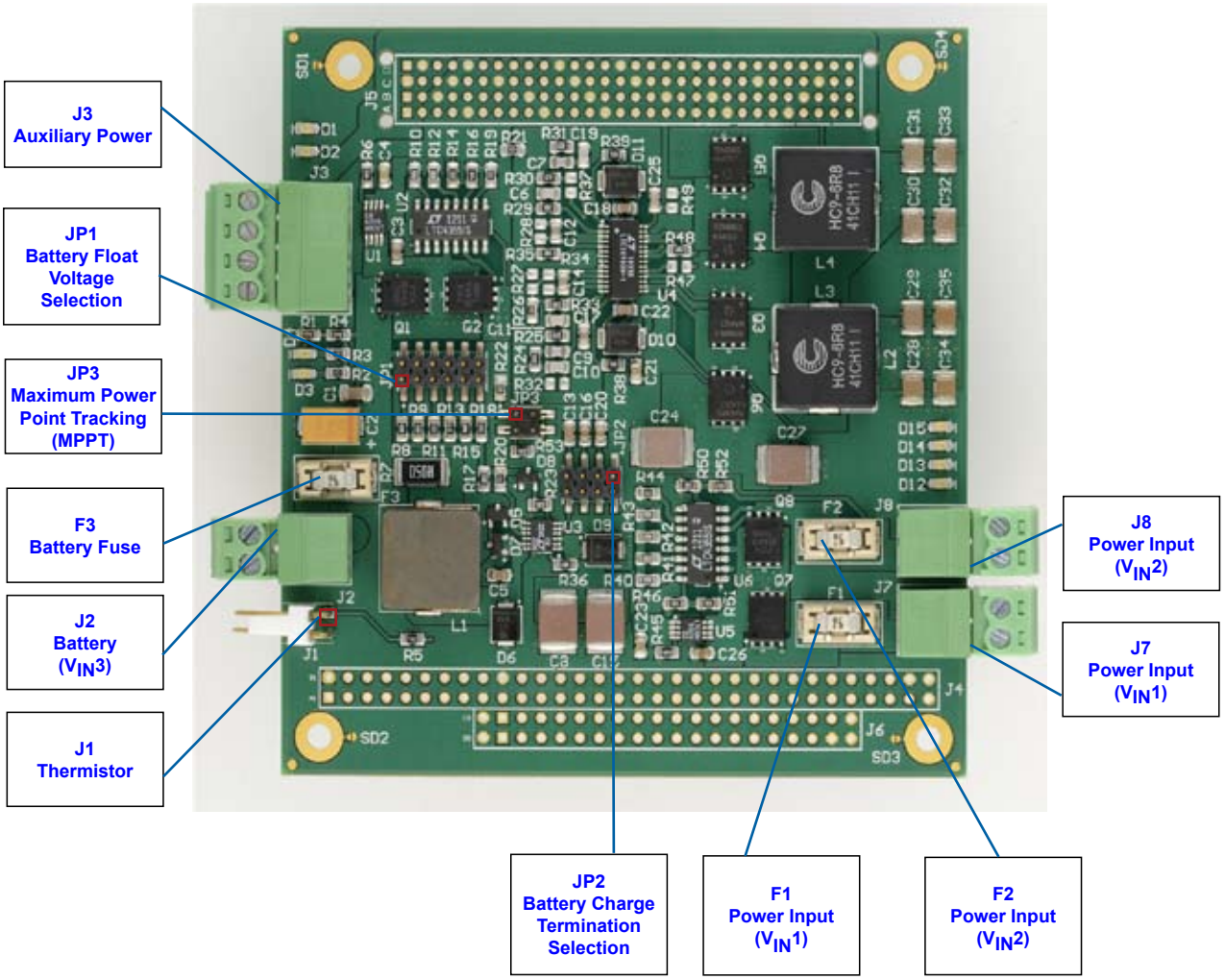
NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

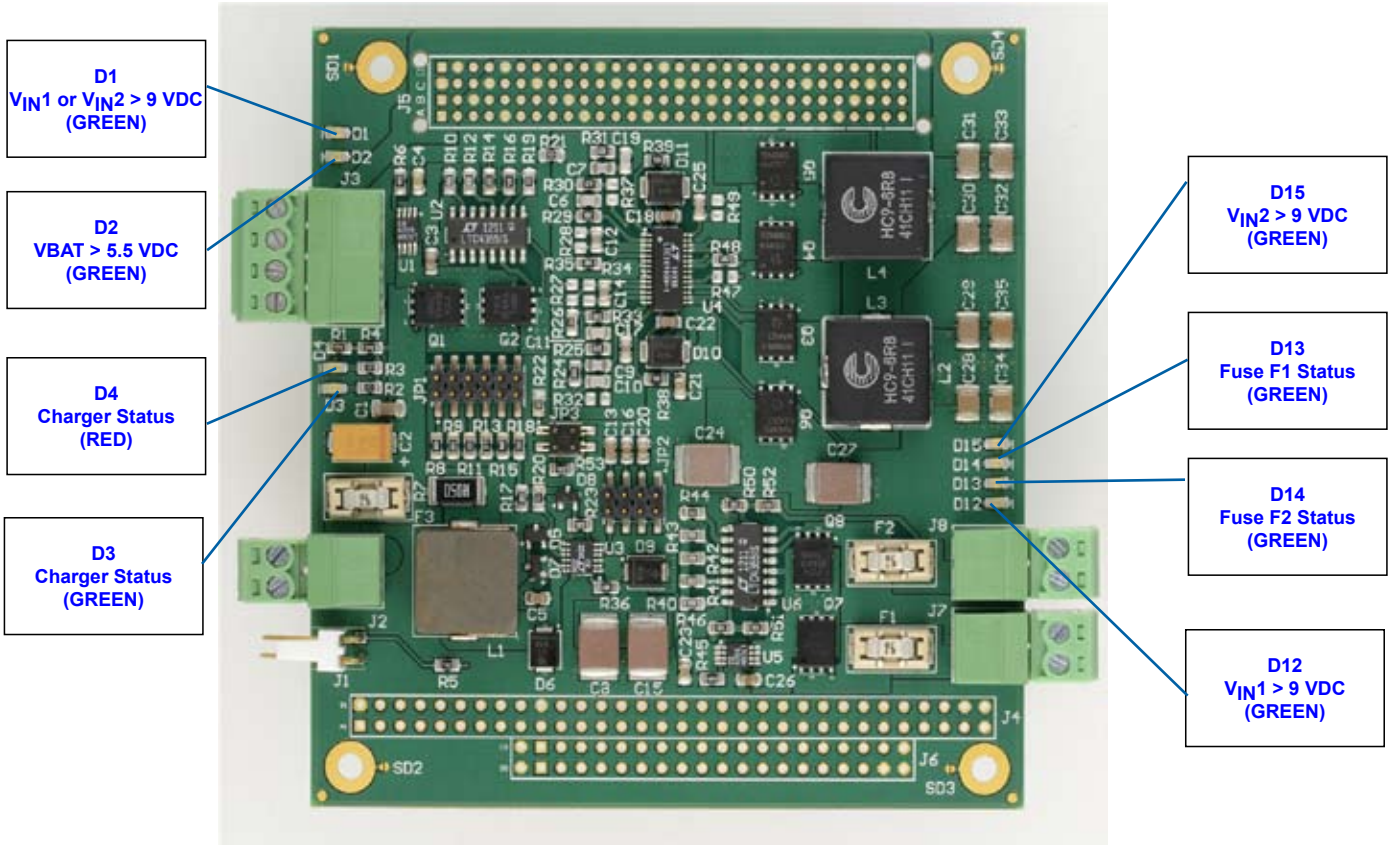
Visual Index - Top View (Connectors & Jumpers) - ISM-PS394-533



RESERVED -

NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

Visual Index - Top View (LEDs) - ISM-PS394-533



RESERVED -

NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

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INTRODUCTION

This manual is intended to provide the necessary information regarding configuration and usage of the PPM-PS394-533, PCM-PS394-500, and ISM-PS394-533 power supplies. WinSystems maintains a Technical Support Group to help answer questions not adequately addressed in this manual. Contact Technical Support at (817) 274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

FEATURES

Power Supply Modules

- PC/104-*Plus* DC/DC power supply with smart battery charger (PPM-PS394-533)
- PC/104 DC/DC power supply with smart battery charger (PCM-PS394-500)
- Dual output DC/DC power supply with smart battery charger (ISM-PS394-533)

Input Voltage

- Wide range: 9-32 VDC
- Dual fused inputs accept solar panel, wind turbine, or other DC sources
- Automatically selects best input source and provides rapid switchover

Output Voltage

- +5V @ 5A, +3.3V@5A (PPM-PS394-533 and ISM-PS394-533)
- +5V @ 10A (PCM-PS394-500)
- Over current protection (OCP) and over voltage protection (OVP) for all outputs
- No minimum load required for regulation

Battery Charger

- UPS operation with battery pack
- MPPT charging supported for solar panels
- Supports Lead Acid, Li-Ion/Polymer, LiFePO, and SLA chemistries
- User replaceable safety fuse for the battery and NTC thermistor input to monitor temperature
- Jumper configurable End of Change (EOC) and Float Voltage

Industrial Operating Temperature

- -40°C to 85°C

Mechanical

- PC/104-*Plus*-compliant (PPM-PS394-533)
- PC/104-compliant (PCM-PS394-500)
- Dimensions: 3.6 x 3.8 inches (90 x 96 mm)
- Weight: 3.66 oz (104g) (PPM-PS394-533)
- Weight: 3.1 oz (87.1g) (PCM-PS394-500)
- Weight: 2.44 oz (69g) (ISM-PS394-533)

Additional Features

- LEDs provide visual status of DC power inputs, battery, and charger status
- High efficiency
- Fast transient response
- Low voltage ripple
- No fan or heat sink required
- RoHS compliant
- Custom OEM configurations available

System

The PPM-PS394-533, PCM-PS394-500, and ISM-PS394-533 are high efficiency power supplies with a wide input range of 9-32 Volts DC. These DC/DC converters include a built in battery charger and uninterruptible power supply (UPS) controller. They provide power to a single board computer (SBC) from a wind turbine, solar panel, or other DC source. They can source power from either of the two input power connectors or from an external battery. The source with the highest available power will automatically be selected. LEDs provide visual indicators for DC input, battery, fuse, and charge status.

Theory of Operation

The PS394 product line is based on wide input range DC-DC converters. The main converter is implemented with a multiphase SMPS controller that can be configured to provide a single or dual output. Two standard variants (PPM-PS394-533 and ISM-PS394-533) provide dual outputs of 5V @ up to 5A and 3.3V @ up to 5A on the PC/104-*Plus* (PPM only) and auxiliary connectors. The PCM-PS394-500 variant provides a single 5V@ up to 10A output to the PC104 and auxiliary connectors. The supply is designed to meet these output capacities while operating in a -40° to 85°C ambient environment with normal convection cooling (i.e no airflow). The overall efficiency of the power supply can vary between 80 and 92% depending on the input voltage and loading.

There are two 9-32 VDC inputs and a 6-12V battery connection on the PS394 products. The DC inputs can connect renewable sources such as wind turbines and solar panels or an appropriately rated external DC supply. The battery input can connect a 6-12V Lead Acid, Li-Ion/Polymer, LiFePO, and SLA battery to the system. The supply continuously monitors the two external DC inputs and takes power from the source with the highest voltage. Should both inputs drop below 9 VDC the supply switches to an external battery input and continues to provide uninterrupted power. When one or both external DC inputs are restored the supply switches its input back to the source with the highest input voltage and begins re-charging the battery. The UPS feature provides a fast switchover free of oscillations between the two external sources and battery. Switching is accomplished in <500 nS and hysteresis prevents oscillation. Care must be taken to select sources and batteries with sufficient power to drive the intended loads.

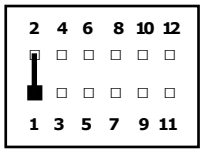
The PS394 product line also charges a battery or battery pack. The battery charger employs a CC/CV charging characteristic and is capable of charging a variety of different battery chemistries. The charger float voltage and charge termination schemes are user programmable to allow batteries as low as 6V and as high as 12V to be used. The battery charger is a 2A charger that features maximum power point tracking (MPPT) and can servo the output current based on a preset maximum power point voltage to increase charging efficiency. The charger has built in state of charge (SOC), bad battery detection, preconditioning, and end of charge (EOC) features. LEDs provide DC input, battery and charge status. The controller will charge the battery until either the charge current drops below 200 mA or a user configured EOC time limit is exceeded. The user must select external sources and batteries capable of providing adequate power to their system.

Jumper Reference

NOTE: Jumper Part# SAMTEC 2SN-BK-G is applicable to all jumpers. These are available in a ten piece kit from WinSystems (Part# KIT-JMP-G-200).

JP1 - Battery Float Voltage

JP1



Jumpering Position	Battery Float Voltage	Resistor Value
1-2	6.6V	100
3-4	8.25V	150
5-6	9.9V	200
7-8	12.1V	267
9-10	13.5V	309
11-12	14.2V	332

JP1 is used to select the desired battery float voltage. The above represents the individual jumper settings 1 of 6 common battery float charge voltages. It is possible to combine jumpers to achieve several possible float voltages, which are shown in Appendix - D. The following equations can be used to combine jumper settings and calculate the resulting float voltage.

$$V_{FLOAT} = (3.3R_{EQ} + 330) / 100$$

$$R_{EQ} = 1 / (\sum_{n}^{1} \frac{1}{R_n}).$$

Example:

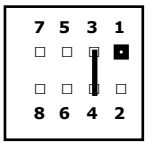
Setting both Jumpers 7-8 and 9-10

$R_{EQ} = 1 /((1/267) + (1/309)) = 143$

$V_{FLOAT} = ((3.3*143) + 330)) / 100 = 8.02V$

JP2 - Battery Charge Termination

JP2

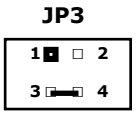


Avoid Simultaneous Jumpering of pins 1-2, 3-4, 5-6, and 7-8.
Misjumpering pins may cause damage to the board.

Jumpering Position	Battery Charge Termination
1-2	I_{OUT} < 200 mA
3-4	3 hours
5-6	10 hours
7-8	20 hours

JP2 is used to select the desired charge termination method. Only a single jumper position should be installed on this jumper block. Table 2 shows the jumper settings and corresponding charge termination methods. The battery charger automatically enters a battery precondition mode if the sensed battery voltage is very low, reducing the charge current until it reaches 70% of the programmed float voltage. When the timer-based scheme is used, the PS394 also supports bad battery detection, which triggers a fault if a battery stays in precondition mode for more then 1/8 of the total selected charge time. The controller continuous monitors the battery voltage while in standby and will automatically start a new charge cycle when the battery falls 2.5% from the selected float voltage.

JP3 - Maximum Power Point Tracking (MPPT)



Avoid Simultaneous Jumpering of pins 1-2, 3-4.
Misjumpering pins may cause damage to the board.

Jumpering Position	Battery Charge Termination
1-2	VMP=17.5V
3-4	VMP = 9V

JP3 is used to select the proper Servo Voltage (VMP of the solar panel) used to achieve Maximum Power Point Tracking. Placing a jumper in Position 1-2 will cause the battery charger to reduce the charge current when the input voltage drops below the VMP set point. The battery charger will then servo the output charge current to the battery system effectively tracking the VMP set point. Placing a jumper in position 3-4 will cause the same behavior to occur at 9V. This behavior is referred to as Maximum Power Point Tracking (MPPT) and can result in 15-20% higher charge efficiencies. The benefits of MPPT allow smaller (lower wattage) panels to be used in off-grid systems. The benefits of MPPT are most evident when operating in overcast or cloudy conditions when chargers without this feature tend to deliver little or no power to a battery system.

Battery Float Voltage Selection

The charge float voltage is user programmable, allowing batteries as low as 6V and as high as 12V to be used.
The following equations can be used to combine jumper settings and calculate the resulting float voltage.

$$V_{FLOAT} = (3.3R_{EQ} + 330) / 100$$

$$R_{EQ} = 1 / (\sum_{n}^{1} \frac{1}{R_n}).$$

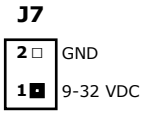
CONNECTOR REFERENCE

POWER

J7 - VDC Input ($V_{IN}1$)

Visual Index

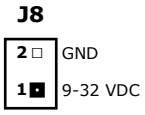
PCB Connector: **PHOENIX 1803277 (J7)**
Mating Connector: **PHOENIX 1803578**



J8 - VDC Input ($V_{IN}2$)

Visual Index

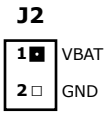
PCB Connector: **PHOENIX 1803277 (J8)**
Mating Connector: **PHOENIX 1803578**



J2 - Battery ($V_{IN}3$)

Visual Index

PCB Connector: **PHOENIX 1803277 (J2)**
Mating Connector: **PHOENIX 1803578**

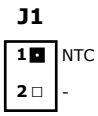


BATTERY CHARGE SHUT DOWN

J1 - Thermistor

Visual Index

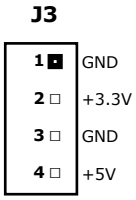
PCB Connector: **MOLEX 22-12-2024 (J1)**
Mating Connector: **MOLEX 10-11-2023 (Housing)**
MOLEX 08-55-0129 (Crimp)



A 10KΩ NTC thermistor located at **J1** can be mounted at the battery which will shut down the charger if the battery temperature is too high or too low. CBL-219-G-2-1.5 is available for connection to the board.

J3 - Auxiliary Power Output

PCB Connector: **PHOENIX 1803293 (J3)**
Mating Connector: **PHOENIX 1803594**



LED INDICATORS

LEDs (Functions and Colors)

LEDs provide visual indication of the DC power input, battery, fuses and charger status. See the tables below for LED definitions.

LED	Function	Color
D12	$V_{IN}1$ > 9 VDC	GREEN
D15	$V_{IN}2$ > 9 VDC	GREEN
D1	$V_{IN}1$ or $V_{IN}2$ > 9 VDC	GREEN
D2	VBAT > 5.5 VDC	GREEN
D3	Charger Status	GREEN
D4	Charger Status	RED
D13	Fuse F1 Status	GREEN
D14	Fuse F2 Status	GREEN

Charging Status		
D3	D4	LED
OFF	OFF	Not Charging - Standby or Shutdown
OFF	ON	Timeout / EOC/ Failure
ON	OFF	Normal Charging
ON	ON	NTC Fault (Pause)

User Replaceable Fuses (Part number Littelfuse #054007)

Visual Index

The PPM-PS394-533, PCM-PS394-500, and ISM-PS394-533 each have three user replaceable fuses on the inputs. The purpose of the fuses is to provide a failsafe mechanism in case of catastrophic hardware failure. All fuses are rated for 7A. Each output is short circuit protect and current limited due to the over current and overvoltage protection built in to the main converter and battery charge circuits. Each fuse description relative to the input and battery is provided below.

Fuse	Battery Float Voltage
F1	VIN1 7A
F2	VIN2 7A
F3	Battery Fuse 7A

J4, J6 - PC/104

Visual Index

PCB Connector: **TEKA PC232-A-1A7-M (J4)**
TEKA PC220-A-1A7-M (J6)

The PC/104 bus is electrically equivalent to the 16-bit ISA bus. Standard PC/104 I/O cards can be populated on PPM-PS394-533 and PCM-PS394-500's connectors, located at **J4** and **J6**. The interface does not support hot swap capability. The PC/104 bus connector pin definitions are provided below for reference. Refer to the PC/104 Bus Specification for specific signal and mechanical specifications.

J6 (C/D)

GND	D0	C0		GND
MEMCS16#	D1	C1		SBHE#
IOCS16#	D2	C2		LA23
IRQ10	D3	C3		LA22
IRQ11	D4	C4		LA21
IRQ12	D5	C5		LA20
IRQ15	D6	C6		LA19
IRQ14	D7	C7		LA18
DACK0#	D8	C8		LA17
DRQ0	D9	C9		MEMR#
DACK5#	D10	C10		MEMW#
DRQ5	D11	C11		SD8
DACK6#	D12	C12		SB9
DRQ6	D13	C13		SD10
DACK7#	D14	C14		SD11
DRQ7	D15	C15		SD12
+5V	D16	C16		SD13
MASTER#	D17	C17		SD14
GND	D18	C18		SD15
GND	D19	C19		KEY

J4 (A/B)

IOCHK#	A1	B1		GND
SD7	A2	B2		RESET
SD6	A3	B3		+5V
SD5	A4	B4		IRQ
SD4	A5	B5		-5V
SD3	A6	B6		DRQ2
SD2	A7	B7		-12V
SD1	A8	B8		SRDY#
SD0	A9	B9		+12V
IOCHRDY	A10	B10		KEY
AEN	A11	B11		SMEMW#
SA19	A12	B12		SMEMR#
SA18	A13	B13		IOW#
SA17	A14	B14		IOR#
SA16	A15	B15		DACK3#
SA15	A16	B16		DRQ3
SA14	A17	B17		DACK1#
SA13	A18	B18		DRQ1
SA12	A19	B19		REFRESH#
SA11	A20	B20		BCLK
SA10	A21	B21		IRQ7
SA9	A22	B22		IRQ6
SA8	A23	B23		IRQ5
SA7	A24	B24		IRQ4
SA6	A25	B25		IRQ3
SA5	A26	B26		DACK2#
SA4	A27	B27		TC
SA3	A28	B28		BALE
SA2	A29	B29		+5V
SA1	A30	B30		OSC
SA0	A31	B31		GND
GND	A32	B32		GND

= Active Low Signal

NOTES:

1. Rows C and D are not required on 8-bit modules.
2. B10 and C19 are key locations. WinSystems uses key pins as connections to GND.
3. Signal timing and function are as specified in ISA specification.
4. Signal source/sink current differ from ISA values.

J5 - PC/104-*Plus*

PCB Connector: **TEKA 2MR430-A7WM-368-00**

The PC/104-*Plus* is electrically equivalent to the 33 MHz PCI bus and is terminated to a 120-pin, nonstackthrough connector. The standard PC/104-*Plus* I/O modules can be populated on PPM-PS394-533's PC104-*Plus* bus. The interface does not support hot swap capability. The PC/104-*Plus* bus connector is located at **J5**. Refer to the PC/104-*Plus* Bus Specification for specific signal and mechanical specifications. The pin definitions are:

PIN	A	B	C	D
1	GND	RESERVED	+5V	AD00
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0#	AD007	GND	AD06
5	GND	AD009	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V	C/BE1#	AD15	+3.3V
9	SERR#	GND	RESERVED	PAR
10	GND	PERR#	+3.3V	RESERVED
11	STOP#	+3.3V	LOCK#	GND
12	+3.3V	TRDY#	GND	DEVSEL#
13	FRAME#	GND	IRDY#	+3.3V
14	GND	AD16	+3.3V	C/BE2#
15	AD18	+3.3V	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V	AD23	AD22	+3.3V
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3#	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0#	GND	REQ1#	VI/O
24	GND	REQ2#	+5V	GNT0#
25	GNT1#	VI/O	GNT2#	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	INTD#	+5V	RST#
29	+12V	INTA#	INTB#	INTC#
30	-12V	REQ3#	GNT3#	GND

SPECIFICATIONS

MODELS	PPM-PS394-533 PCM-PS394-500 ISM-PS394-533
Electrical (Input)	
Input Voltage	9-32 VDC
Input Current	3-12A
Inrush Current	20A (Inrush currents at startup can be larger than steady state currents.)

Electrical (Outputs)						
Output	**V_{OUT}**	**I_{OUT}**	**Load Regulation**	**Line Regulation**	**Ripple**	**Power**
1 (PPM/ISM)	+5V	5A	30 mV	10 mV	<150 mV	25W
2 (PPM/ISM)	+3.3V	5A	20 mV	10 mV	<100 mV	16W
3 (PCM)	+5V	10A	30 mV	10 mV	<150 mV	50W

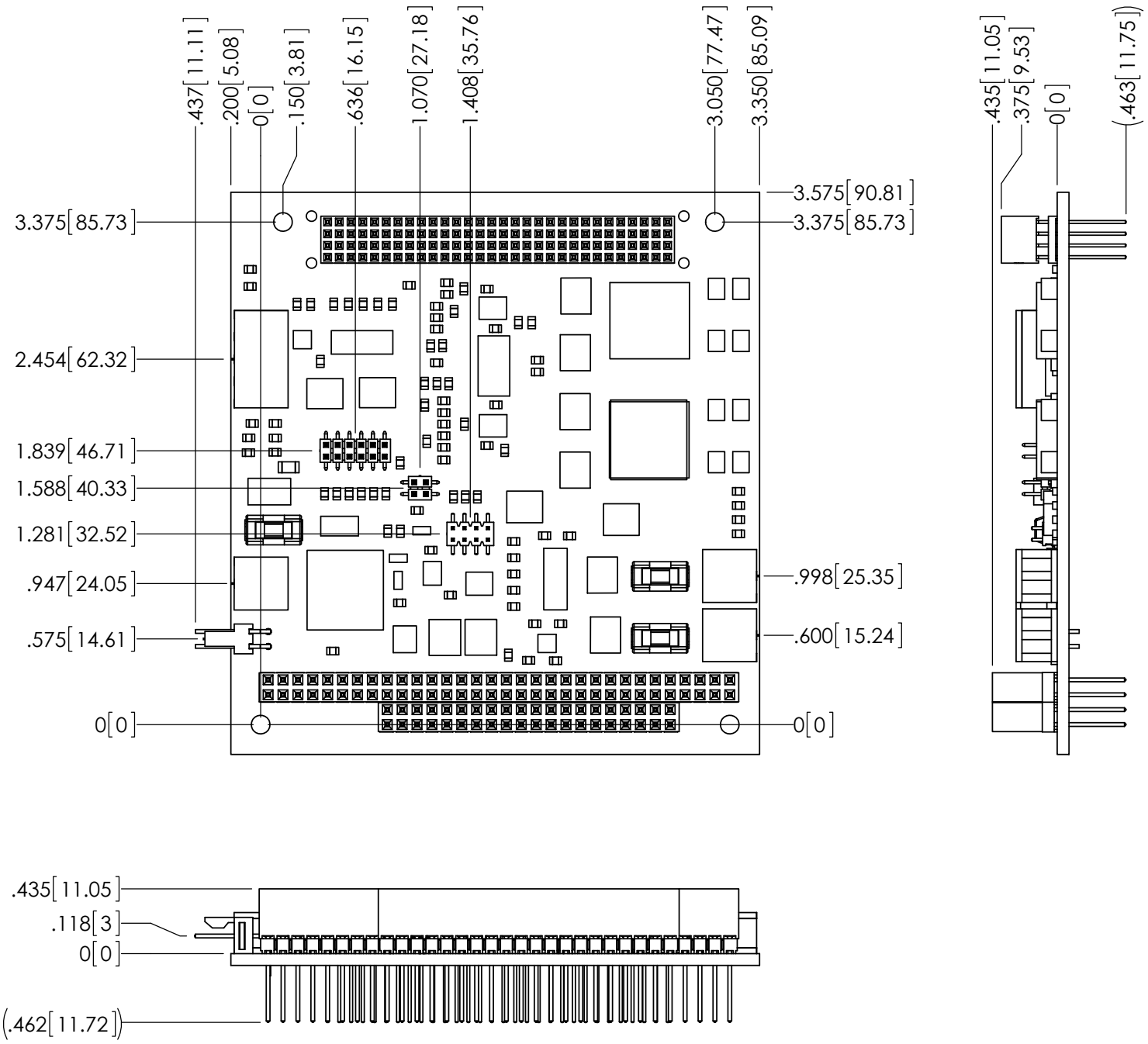
Current Limiting		
Output	**Voltage**	**Current Limit**
1 (PPM/ISM)	+5V	6A
2 (PPM/ISM)	+3.3V	6A
1 (PCM)	+5V	12A

MTBF	4,581,263 hours MIL-217 Part Count Reliability method using Manufacturer's Failure Rate Data

Mechanical	
Dimensions	3.6 x 3.8 inches (90 x 96 mm)
Weight	3.66 oz (104g) (PPM-PS394-533) 3.1 oz (87.1g) (PCM-PS394-500) 2.44 oz (69g) (ISM-PS394-533)
Printed Circuit Board	0.078 inches 4-Layer FR4

Environmental	
Operating Temperature	-40°C to 85°C ambient
Humidity	5% to 95% non-condensing
Random Vibration	MIL-STD-202G, Method 214A, Condition D .1g/Hz (11.95g rms), 20 minutes per axis, 3 axis
Mechanical Shock	MIL-STD-202G, Method 213B, Condition A 50g half-sine, 11 ms duration per axis, 3 axis

MECHANICAL DRAWING



PPM-PS394-533 Mechanical

APPENDIX - A

BEST PRACTICES

POWER SUPPLY

The power supply and how it is connected to the Single Board Computer (SBC) is very important.

Avoid Electrostatic Discharge (ESD)
Only handle the SBC and other bare electronics when electrostatic discharge (ESD) protection is in place. Having a wrist strap and a fully grounded workstation is the minimum ESD protection required before the ESD seal on the product bag is broken.

Power Supply Budget
Evaluate your power supply budget. It is usually good practice to budget 2X the typical power requirement for all of your devices.

Zero-Load Power Supply
Use a zero-load power supply whenever possible. A zero-load power supply does not require a minimum power load to regulate. If a zero-load power supply is not appropriate for your application, then verify that the single board computer's typical load is not lower than the power supply's minimum load. If the single board computer does not draw enough power to meet the power supply's minimum load, then the power supply will not regulate properly and can cause damage to the SBC.

Use Proper Power Connections (Voltage)
When verifying the voltage, you should always measure it at the power connector on the SBC. Measuring at the power supply does not account for voltage drop through the wire and connectors.

The single board computer requires +5V (±5%) to operate. Verify the power connections. Incorrect voltages can cause catastrophic damage.

Populate all of the +5V and ground connections. Most single board computers will have multiple power and ground pins, and all of them should be populated. The more copper connecting the power supply to the single board computer the better.

Adjusting Voltage
If you have a power supply that will allow you to adjust the voltage, it is a good idea to set the voltage at the power connector of the SBC to 5.1V. The SBC can tolerate up to 5.25V, so setting your power supply to provide 5.1V is safe and allows for a small amount of voltage drop that will occur over time as the power supply ages and the connector contacts oxidize.

Power Harness
Minimize the length of the power harness. This will reduce the amount of voltage drop between the power supply and the single board computer.

Gauge Wire
Use the largest gauge wire that you can. Most connector manufacturers have a maximum gauge wire they recommend for their pins. Try going one size larger; it usually works and the extra copper will help your system perform properly over time.

Contact Points
WinSystems' boards mostly use connectors with gold finish contacts. Gold finish contacts are used exclusively on high speed connections. Power and lower speed peripheral connectors may use a tin finish as an alternative contact surface. It is critical that the contact material in the mating connectors is matched properly (gold to gold and tin to tin). Contact areas made with dissimilar metals can cause oxidation/corrosion resulting in unreliable connections.

Pin Contacts
Often the pin contacts used in cabling are not given enough attention. The ideal choice for a pin contact would include a design similar to Molex's or Trifurcons' design, which provides three distinct points to maximize the contact area and improve connection integrity in high shock and vibration applications.

POWER DOWN

Make sure the system is **completely off/powered down** before connecting anything.

Power Supply OFF
The power supply should always be off before it is connected to the single board computer.

I/O Connections OFF
I/O Connections should also be off before connecting them to the single board computer or any I/O cards. Connecting hot signals can cause damage whether the single board computer is powered or not.

MOUNTING AND PROTECTING THE SINGLE BOARD COMPUTER

Do Not Bend or Flex the SBC
Never bend or flex the single board computer. Bending or flexing can cause irreparable damage. Single board computers are especially sensitive to flexing or bending around Ball-Grid-Array (BGA) devices. BGA devices are extremely rigid by design and flexing or bending the single board computer can cause the BGA to tear away from the printed circuit board.

Mounting Holes
The mounting holes are plated on the top, bottom and through the barrel of the hole and are connected to the single board computer's ground plane. Traces are often routed in the inner layers right below, above or around the mounting holes.

Never use a drill or any other tool in an attempt to make the holes larger.

Never use screws with oversized heads. The head could come in contact with nearby components causing a short or physical damage.

Never use self-tapping screws; they will compromise the walls of the mounting hole.

Never use oversized screws that cut into the walls of the mounting holes.

Always use all of the mounting holes. By using all of the mounting holes you will provide the support the single board computer needs to prevent bending or flexing.

Plug or Unplug Connectors Only on Fully Mounted Boards
Never plug or unplug connectors on a board that is not fully mounted. Many of the connectors fit rather tightly and the force needed to plug or unplug them could cause the single board computer to be flexed.

Avoid cutting of the SBC
Never use star washers or any fastening hardware that will cut into the single board computer.

Avoid Overtightening of Mounting Hardware
Causing the area around the mounting holes to compress could damage interlayer traces around the mouting holes.

Use Appropriate Tools
Always use tools that are appropriate for working with small hardware. Large tools can damage components around the mounting holes.

Placing the SBC on Mounting Standoffs
Be careful when placing the single board computer on the mounting standoffs. Sliding the board around until the standoffs are visible from the top can cause component damage on the bottom of the single board computer.

Avoid Conductive Surfaces
Never allow the single board computer to be placed on a conductive surface. Almost all single board computers use a battery to backup the clock-calendar and CMOS memory. A conductive surface such as a metal bench can short the battery causing premature failure.

ADDING PC/104 BOARDS TO YOUR STACK

Be careful when adding PC/104 boards to your stack.

Never allow the power to be turned on when a PC/104 board has been improperly plugged onto the stack. It is possible to misalign the PC/104 card and leave a row of pins on the end or down the long side hanging out of the connector. If power is applied with these pins misaligned, it will cause the I/O board to be damaged beyond repair.

CONFORMAL COATING

Applying conformal coating to a WinSystems product will not in itself void the product warranty, if it is properly removed prior to return. Coating may change thermal characteristics and impedes our ability to test, diagnose, and repair products. Any coated product sent to WinSystems for repair will be returned at customer expense and no service will be performed.

OPERATIONS / PRODUCT MANUALS

Every single board computer has an Operations manual or Product manual.

Manual Updates
Operations/Product manuals are updated often. Periodicially check the WinSystems website (http://www.winsystems.com) for revisions.

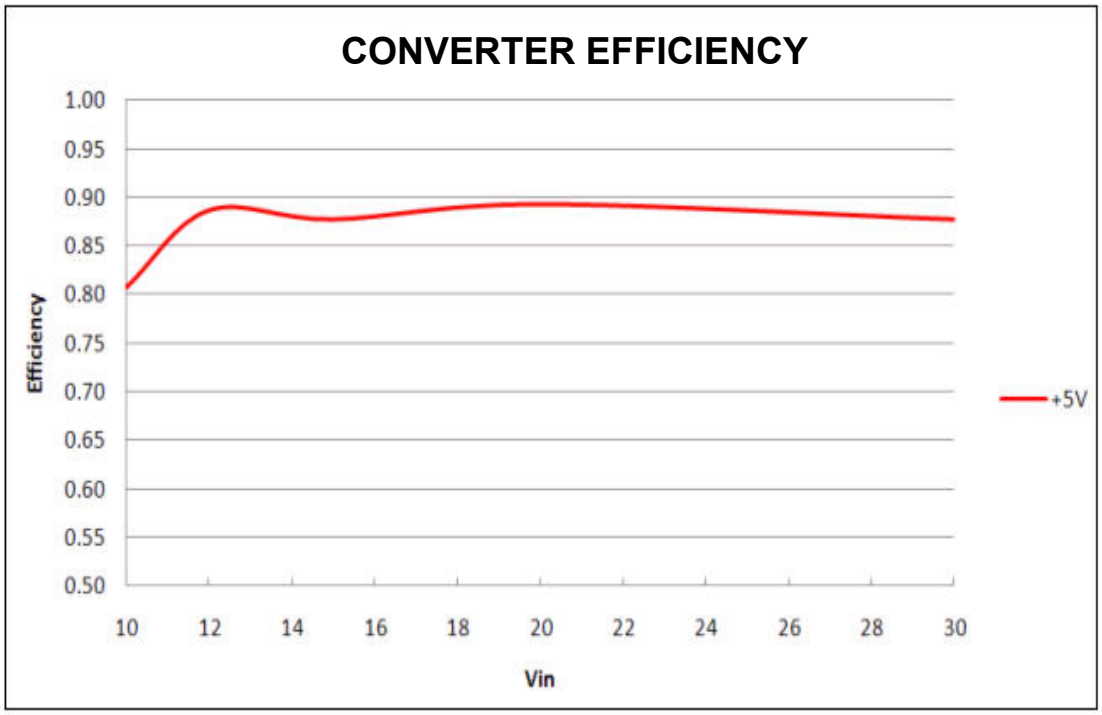
Check Pinouts
Always check the pinout and connector locations in the manual before plugging in a cable. Many single board computers will have identical headers for different functions and plugging a cable into the wrong header can have disastrous results.

Contact an Applications Engineer with questions
If a diagram or chart in a manual does not seem to match your board, or if you have additional questions, contact your Applications Engineer.

APPENDIX - B

EFFICIENCY MEASUREMENTS

CONVERTER EFFICIENCY



APPENDIX - C

START-UP TIMING

ITO

ITO (5V@5A)

APPENDIX - D

FLOAT VOLTAGES

Jumper Settings						VFLOAT
1-2	3-4	5-6	7-8	9-10	11-12	
1	0	0	0	0	0	6.6
0	1	0	0	0	0	8.25
1	1	0	0	0	0	5.28
0	0	1	0	0	0	9.9
1	0	1	0	0	0	5.5
0	1	1	0	0	0	6.128571
1	1	1	0	0	0	4.823077
0	0	0	1	0	0	12.111
1	0	0	1	0	0	5.700817
0	1	0	1	0	0	6.469424
1	1	0	1	0	0	4.916697
0	0	1	1	0	0	7.073448
1	0	1	1	0	0	5.06044
0	1	1	1	0	0	5.441191
1	1	1	1	0	0	4.5986
0	0	0	0	1	0	13.497
1	0	0	0	1	0	5.793154
0	1	0	0	1	0	6.632353
1	1	0	0	1	0	4.958049
0	0	1	0	1	0	7.30668
1	0	1	0	1	0	5.109583
0	1	1	0	1	0	5.514332
1	1	1	0	1	0	4.625146
0	0	0	1	1	0	8.026734
1	0	0	1	1	0	5.243284
0	1	0	1	1	0	5.717896
1	1	0	1	1	0	4.695453
0	0	1	1	1	0	6.054231
1	0	1	1	1	0	4.801258
0	1	1	1	1	0	5.069605
1	1	1	1	1	0	4.451904
0	0	0	0	0	1	14.256
1	0	0	0	0	1	5.836111
0	1	0	0	0	1	6.709544
1	1	0	0	0	1	4.976939
0	0	1	0	0	1	7.418797
1	0	1	0	0	1	5.132107
0	1	1	0	0	1	5.548153
1	1	1	0	0	1	4.637185
0	0	0	1	0	1	8.183559
1	0	0	1	0	1	5.269283
0	1	0	1	0	1	5.758279
1	1	0	1	0	1	4.708809
0	0	1	1	0	1	6.106751
1	0	1	1	0	1	4.816728
0	1	1	1	0	1	5.091139
1	1	1	1	0	1	4.460989
0	0	0	0	1	1	8.581441
1	0	0	0	1	1	5.330982
0	1	0	0	1	1	8.855176
1	1	0	0	1	1	4.740107
0	0	1	0	1	1	6.233778
1	0	1	0	1	1	4.853066
0	1	1	0	1	1	5.142036
1	1	1	0	1	1	4.482162
0	0	0	1	1	1	6.602109
1	0	0	1	1	1	4.950527
0	1	0	1	1	1	5.280759
1	1	0	1	1	1	4.537796
0	0	1	1	1	1	5.500937
1	0	1	1	1	1	4.620337
0	1	1	1	1	1	4.823526
1	1	1	1	1	1	4.342316

WARRANTY INFORMATION

(http://www.winsystems.com/company/warranty.cfm)

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WARRANTY SERVICE

1. To obtain service under this warranty, obtain a return authorization number. In the United States, contact the WinSystems' Service Center for a return authorization number. Outside the United States, contact your local sales agent for a return authorization number.

2. You must send the product postage prepaid and insured. You must enclose the products in an anti-static bag to protect from damage by static electricity. WinSystems is not responsible for damage to the product due to static electricity.