

PCM-DC-AT512-P

+5V and $\pm 12V$ DC/DC PC/104 Power Supply

PRODUCT MANUAL



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MANUAL REVISION HISTORY

P/N G400-0379-000B (PCM-DC-AT512-P)

Revision Date Code	ECO Number
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120614	
130718	
130725	
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130809	

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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.

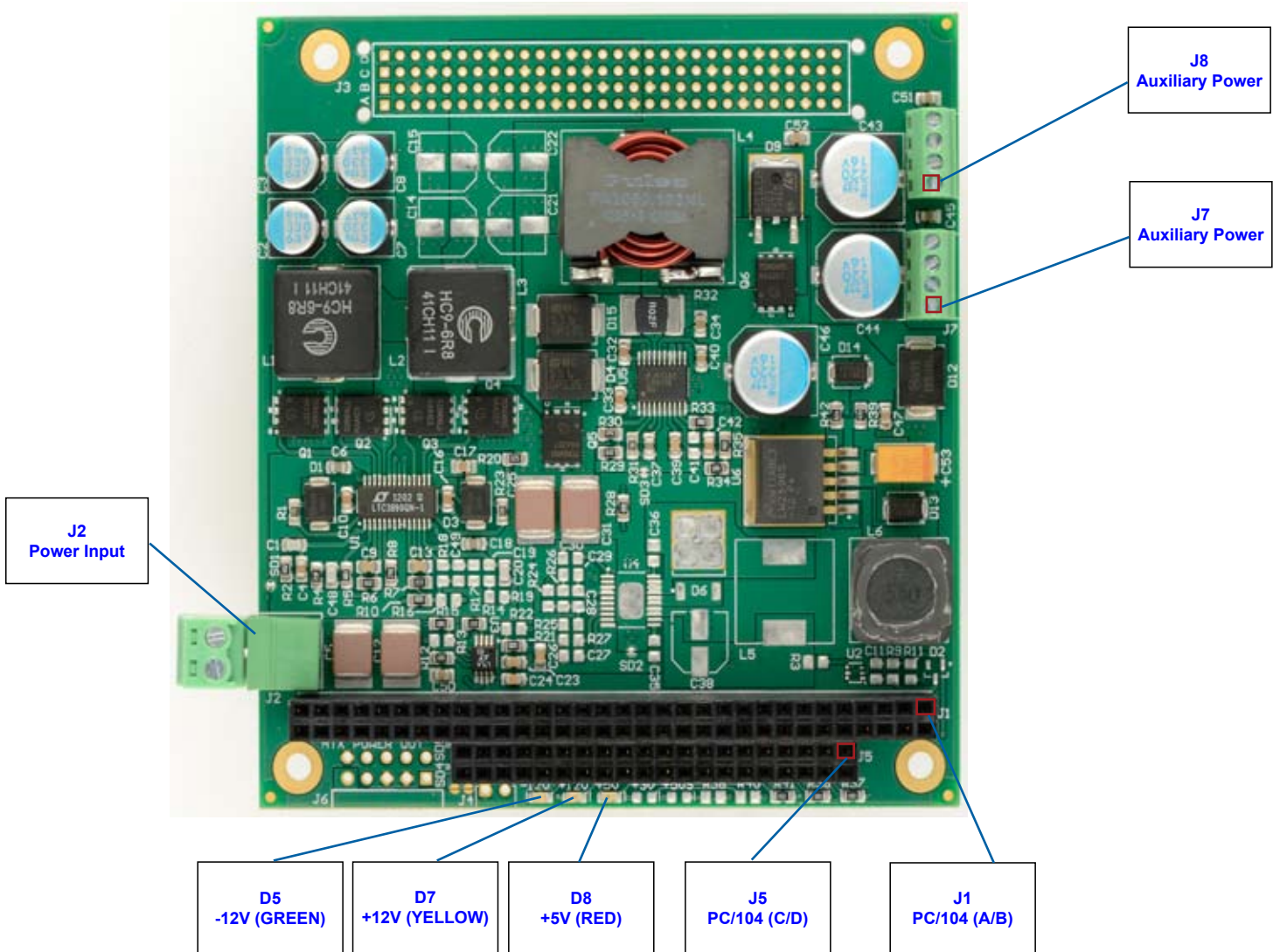
Reference [Appendix - A](#) for **Best Practices**.



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 & LEDs)



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

STATUS LED

D5, D7, D8 - Status LED

[Visual Index](#)

The PCM-DC-AT512-P has up to 3 status LED indicators populated on the board at **D5**, **D7**, and **D8**, which can display the status of each regulated output. When one of the LEDs is not lit or pulses ON and OFF, the respective supply is not in regulation. A pulsating LED indicates the respective converter is in current limit. See the table below for a description of the status LEDs.

LED	Function	Color
D5	-12V	GREEN
D7	+12V	YELLOW
D8	+5V	RED

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INTRODUCTION

This manual is intended to provide the necessary information regarding configuration and usage of the PCM-DC-AT512-P power supply. 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 Module

- PC/104 triple output DC/DC power supply

Input Voltage

- Wide range: 10-50 VDC

Output Voltage

- +5V @ 20A (Refer to the [Derating Formula](#) section of this manual.)
- +12V @ 3A
- -12V @ 800 mA
- Over current protection (OCP) and over voltage protection (OVP) for all outputs

Bus Expansion

- PC/104

Industrial Operating Temperature

- -40°C to 85°C ambient

Mechanical

- PC/104-compliant
- Dimensions: 3.6 x 3.8 inches (90 x 96 mm)
- Weight: 4 oz (114g)

Additional Features

- LED provides visual status of power
- High efficiency
- Fast transient response
- Low voltage ripple
- No minimum load required for regulation
- No fan or heat sink required
- RoHS compliant
- Custom OEM configurations available
- Two connectors for disk driver/accessory power

System

The PCM-DC-AT512-P is a high efficiency, non-isolated switch mode power supply with a wide input range of 10-50 VDC. From one common DC input, it supplies +5V, -12V, and 12V. The overall efficiency of the power supply varies between 80 and 92% depending on the individual converter loading and input level.

Theory of Operation

The PCM-DC-AT512-P employs a variety of synchronous and asynchronous, single and multiphase, buck and buck-boost topology DC-DC converters. The guaranteed input voltage range is 10-50 VDC, however operation is possible above and below this input limit. Inputs below 10V may result in startup instability issues on the -12V and 12V supplies. With a converter silicon rating of 60 VDC or greater, operation up to the 60 VDC is possible with reduced output power or active cooling.

Derating Formula

The main 5V output on the PCM-DC-AT512-P may have to be derated depending on the user's input voltage and maximum ambient operating temperature.

Use the following formula to derate the main 5V, 20A output current:

$$I_{OUT} = (215 - V_{IN} - T_{AMB}) / 8.$$

$$I_{OUT} = \text{The output current in Amps. (} I_{OUT} < 20 \text{)}$$

$$V_{IN} = \text{Input voltage in Volts.}$$

$$T_{AMB} = \text{Ambient operating temperature in degrees Celsius. (} -40^{\circ}\text{C} < T_{AMB} < 85^{\circ}\text{C)}$$

See [Appendix D](#) for more derating chart information.

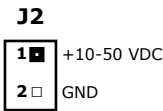
CONNECTOR REFERENCE

POWER

J2 - VDC Input



PCB Connector: PHOENIX 180327 (J2)
Mating Connector: PHOENIX 1803578 (Housing) *Note: Mating Connector ships with board.

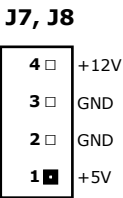


DC power input is supplied to the PCM-DC-AT512-P via the 2-pin Phoenix connector at **J2**.

J7, J8 - Auxiliary Power



PCB Connector: PHOENIX CONTACT 1725672



The connectors at **J7** and **J8** provide auxiliary power output.

PCB Connector: **TEKA PC232-A-1A7-M (J1)**
TEKA PC220-A-1A7-M (J5)

The PC/104 bus is electrically equivalent to the 16-bit ISA bus. Standard PC/104 I/O cards can be populated on PCM-DC-AT512-P's connectors, located at **J1** and **J5**. 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.

J5 (C/D)			J1 (A/B)		
GND	D0 ■ □ C0	GND	IOCHK#	A1 ■ □ B1	GND
MEMCS16#	D1 □ □ C1	SBHE#	SD7	A2 □ □ B2	RESET
IOCS16#	D2 □ □ C2	LA23	SD6	A3 □ □ B3	+5V
IRQ10	D3 □ □ C3	LA22	SD5	A4 □ □ B4	IRQ
IRQ11	D4 □ □ C4	LA21	SD4	A5 □ □ B5	-5V
IRQ12	D5 □ □ C5	LA20	SD3	A6 □ □ B6	DRQ2
IRQ15	D6 □ □ C6	LA19	SD2	A7 □ □ B7	-12V
IRQ14	D7 □ □ C7	LA18	SD1	A8 □ □ B8	SRDY#
DACK0#	D8 □ □ C8	LA17	SD0	A9 □ □ B9	+12V
DRQ0	D9 □ □ C9	MEMR#	IOCHRDY	A10 □ □ B10	KEY
DACK5#	D10 □ □ C10	MEMW#	AEN	A11 □ □ B11	SMEMW#
DRQ5	D11 □ □ C11	SD8	SA19	A12 □ □ B12	SMEMR#
DACK6#	D12 □ □ C12	SB9	SA18	A13 □ □ B13	IOW#
DRQ6	D13 □ □ C13	SD10	SA17	A14 □ □ B14	IOR#
DACK7#	D14 □ □ C14	SD11	SA16	A15 □ □ B15	DACK3#
DRQ7	D15 □ □ C15	SD12	SA15	A16 □ □ B16	DRQ3
+5V	D16 □ □ C16	SD13	SA14	A17 □ □ B17	DACK1#
MASTER#	D17 □ □ C17	SD14	SA13	A18 □ □ B18	DRQ1
GND	D18 □ □ C18	SD15	SA12	A19 □ □ B19	REFRESH#
GND	D19 □ □ C19	KEY	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.

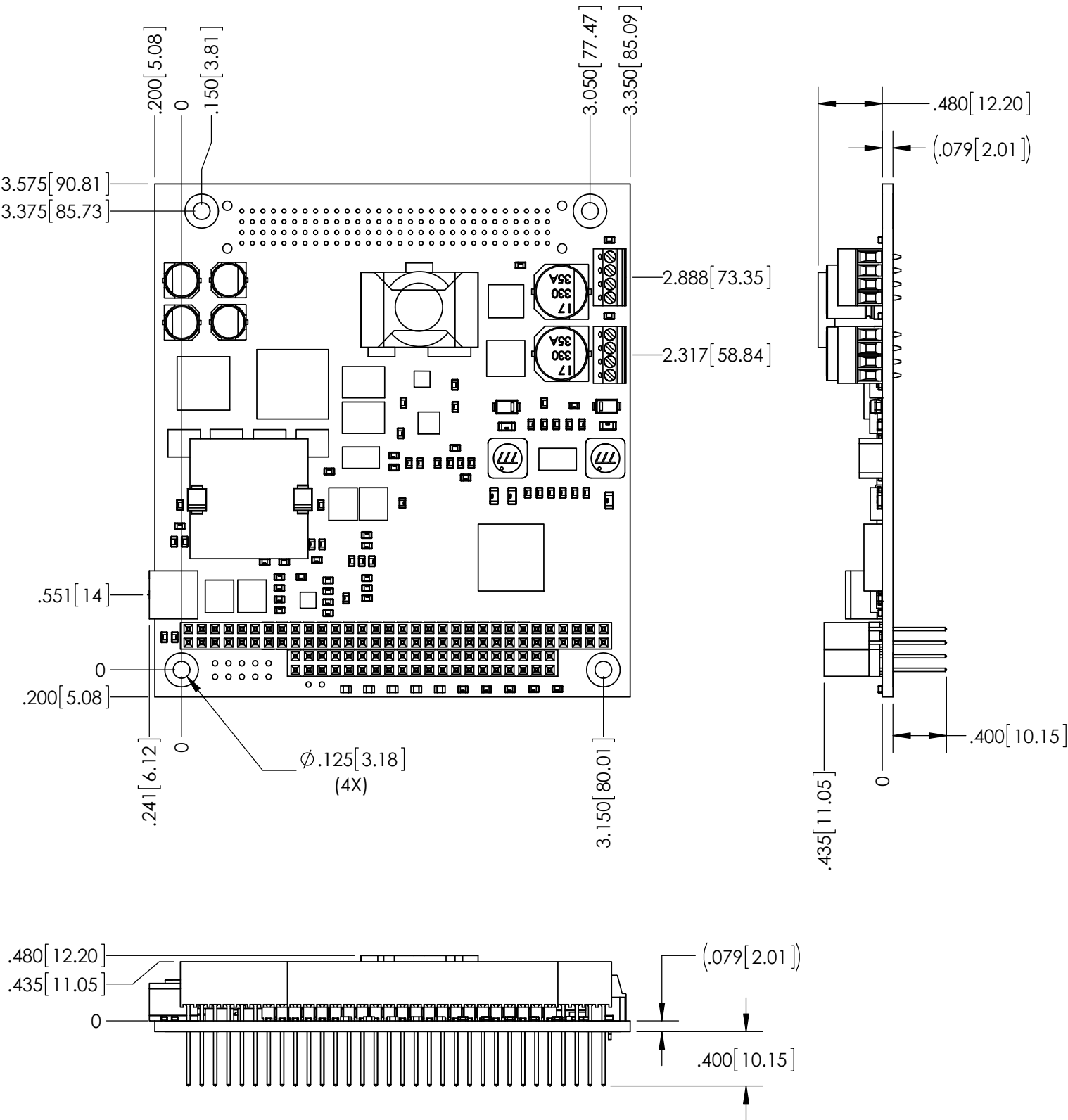
CABLES

[See WinSystems website.](#)

SPECIFICATIONS

MODELS		PCM-DC-AT512-P			
Electrical (Input)					
Input Voltage		10-50 VDC			
Input Current		3-12A			
Inrush Current		20A (Inrush currents at startup can be larger than steady state currents.)			
Electrical (Outputs)					
V _{OUT}	I _{OUT}	Load Regulation	Line Regulation	Ripple	Power
+5V	20A	30 mV	10 mV	<100 mV	100W*
+12V	3A	10 mV	20 mV	<150 mV	36W
-12V	800 mA	10 mV	20 mV	<150 mV	6W
* Use the following formula to derate the main 5V, 20A output current: $I_{OUT} = (215 - V_{IN} - T_{AMB}) / 8.$ I_{OUT} = The output current in Amps. ($I_{OUT} < 20$) V_{IN} = Input voltage in Volts. T_{AMB} = Ambient operating temperature in degrees Celsius. ($-40^{\circ}\text{C} < T_{AMB} < 85^{\circ}\text{C}$) See Appendix D for more derating charge information.					
Current Limiting					
Voltage		Current Limit			
+5V		22A			
+12V		4.5A			
-12V		3A			
MTBF		3,068,324 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		4 oz (114g)			
Printed Circuit Board		0.078 inches 4-Layer FR4			
Environmental					
Operating Temperature		-40°C to 85°C ambient			
Humidity		5% to 95% non-condensing			

MECHANICAL DRAWING



PCM-DC-AT512-P

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 ($\pm 5\%$) 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/powering 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.

MOUNTING AND PROTECTING THE SINGLE BOARD COMPUTER (continued)



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 mounting 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. Periodically 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.

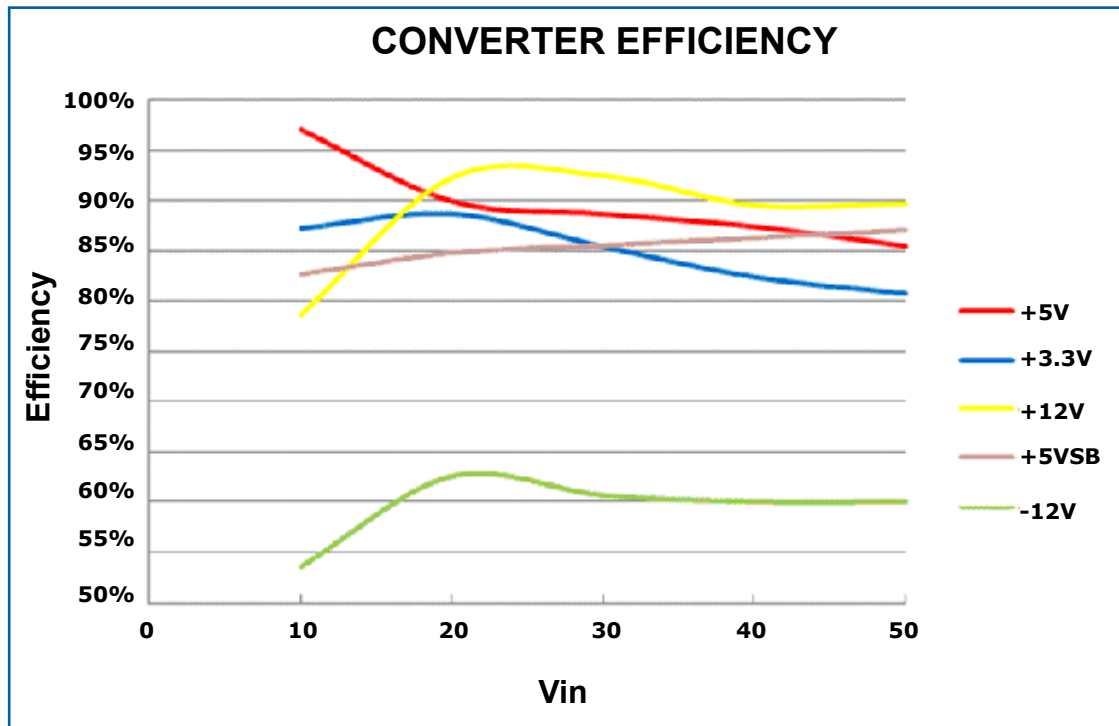
Contact an Applications Engineer with questions

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

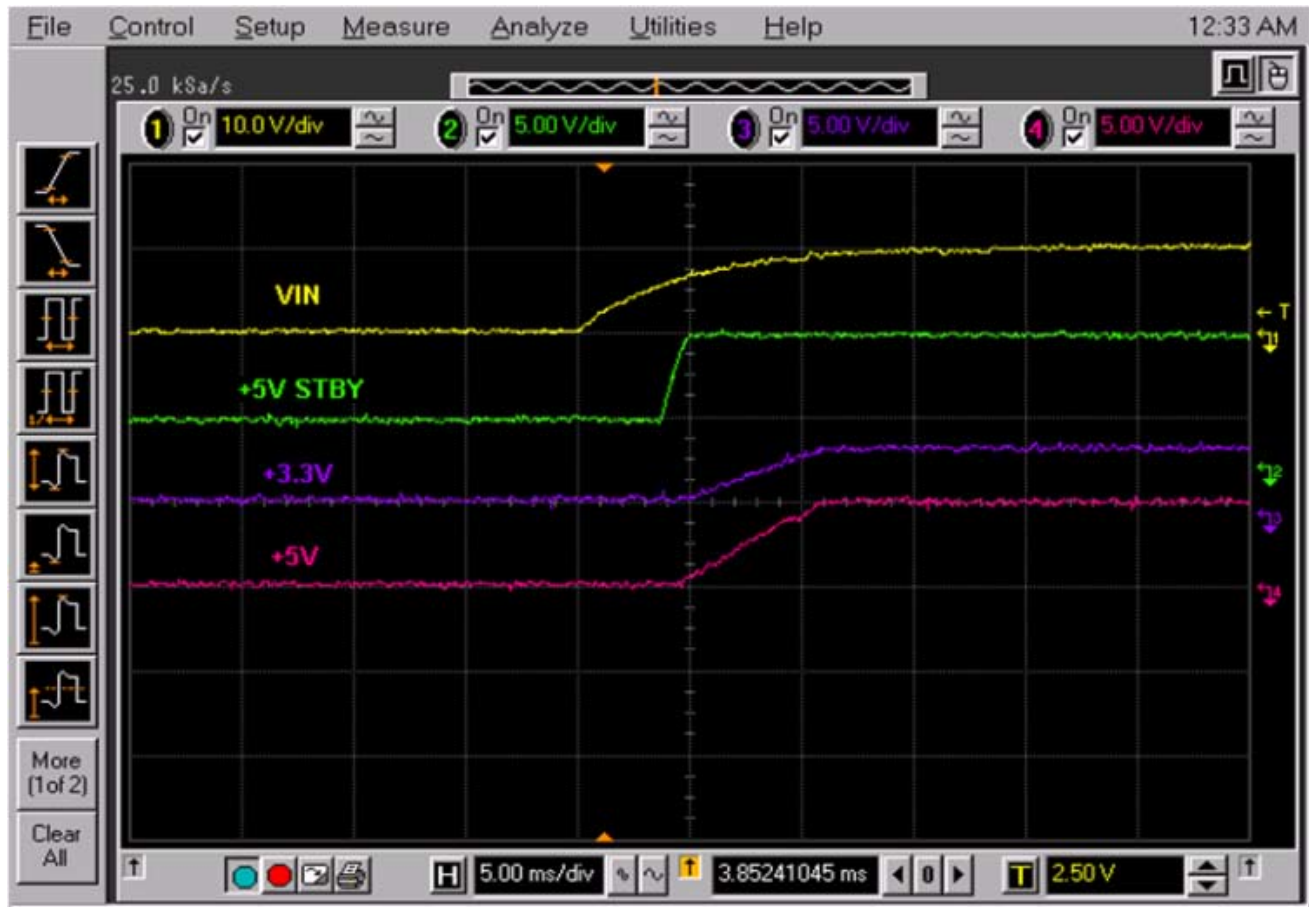
CONVERTER EFFICIENCY



APPENDIX - C

START-UP TIMING

ITO



ITO (No Load)

*Note: +5V STBY and +3.3V apply to the PPM-DC-ATX model only.



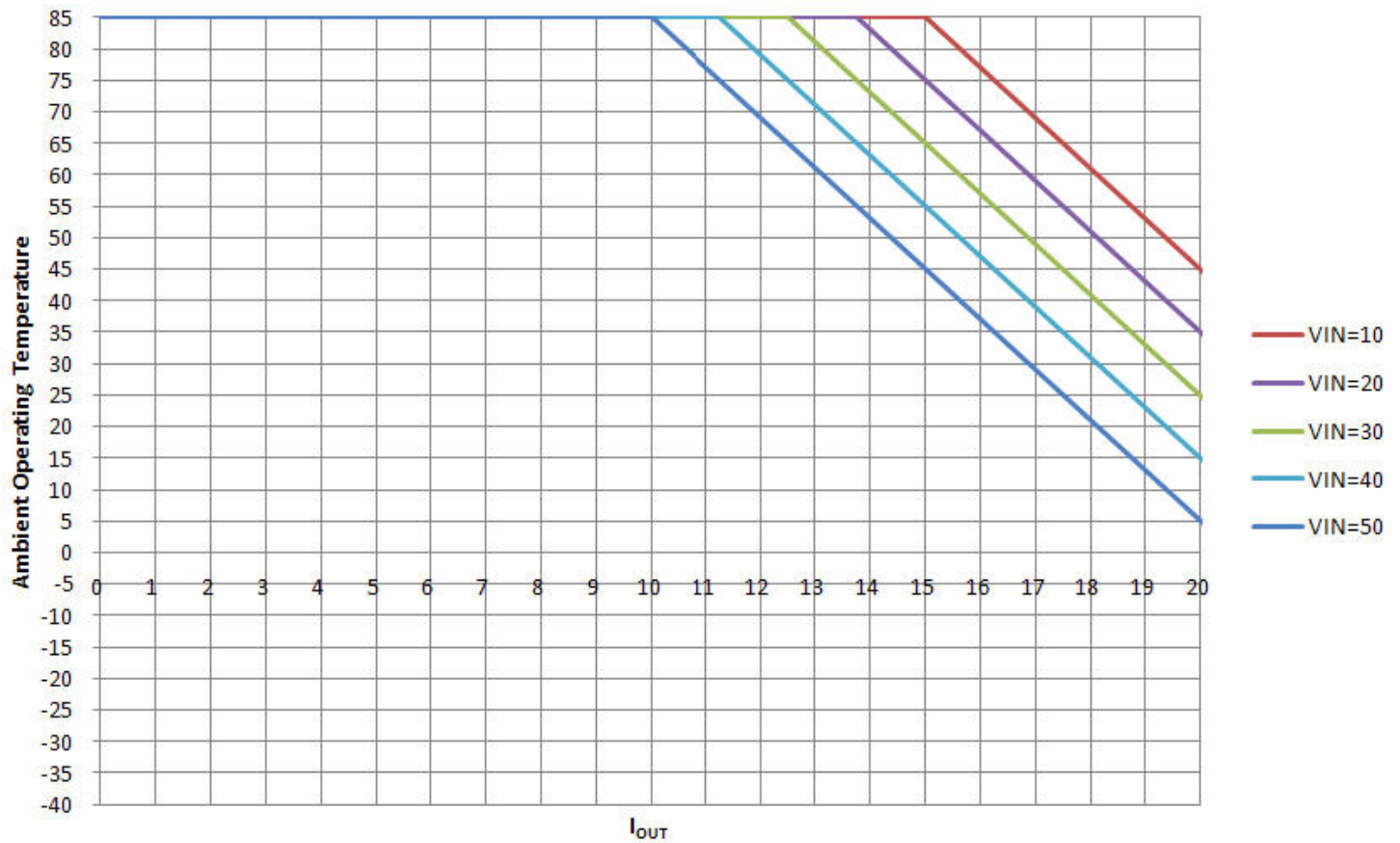
ITO (No Load)

APPENDIX - D

OUTPUT DERATING

+5V Output Derating

$$I_{OUT} = (215 - V_{IN} - T_{AMB})/8 : \{I_{OUT} < 20 ; -40 < T_{AMB} < 85\}$$



WARRANTY INFORMATION

(<http://www.winsystems.com/warranty.cfm>)

WinSystems warrants to Customer that for a period of two (2) years from the date of shipment any Products and Software purchased or licensed hereunder which have been developed or manufactured by WinSystems shall be free of any material defects and shall perform substantially in accordance with WinSystems' specifications therefore. With respect to any Products or Software purchased or licensed hereunder which have been developed or manufactured by others, WinSystems shall transfer and assign to Customer any warranty of such manufacturer or developer held by WinSystems, provided that the warranty, if any, may be assigned. Notwithstanding anything herein to the contrary, this warranty granted by WinSystems to the Customer shall be for the sole benefit of the Customer, and may not be assigned, transferred or conveyed to any third party. The sole obligation of WinSystems for any breach of warranty contained herein shall be, at its option, either (i) to repair or replace at its expense any materially defective Products or Software, or (ii) to take back such Products and Software and refund the Customer the purchase price and any license fees paid for the same. Customer shall pay all freight, duty, broker's fees, insurance charges for the return of any Products or Software to WinSystems under this warranty. WinSystems shall pay freight and insurance charges for any repaired or replaced Products or Software thereafter delivered to Customer within the United States. All fees and costs for shipment outside of the United States shall be paid by Customer. The foregoing warranty shall not apply to any Products of Software which have been subject to abuse, misuse, vandalism, accidents, alteration, neglect, unauthorized repair or improper installations.

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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.