

# ISM-DC-AT512-P

+5V and +12V DC/DC PC/104 Power Supply

# PRODUCT MANUAL



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## MANUAL REVISION HISTORY

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

Revision Date Code	ECO Number
120410	Initial Release
120510	
120614	
130718	
130725	
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.

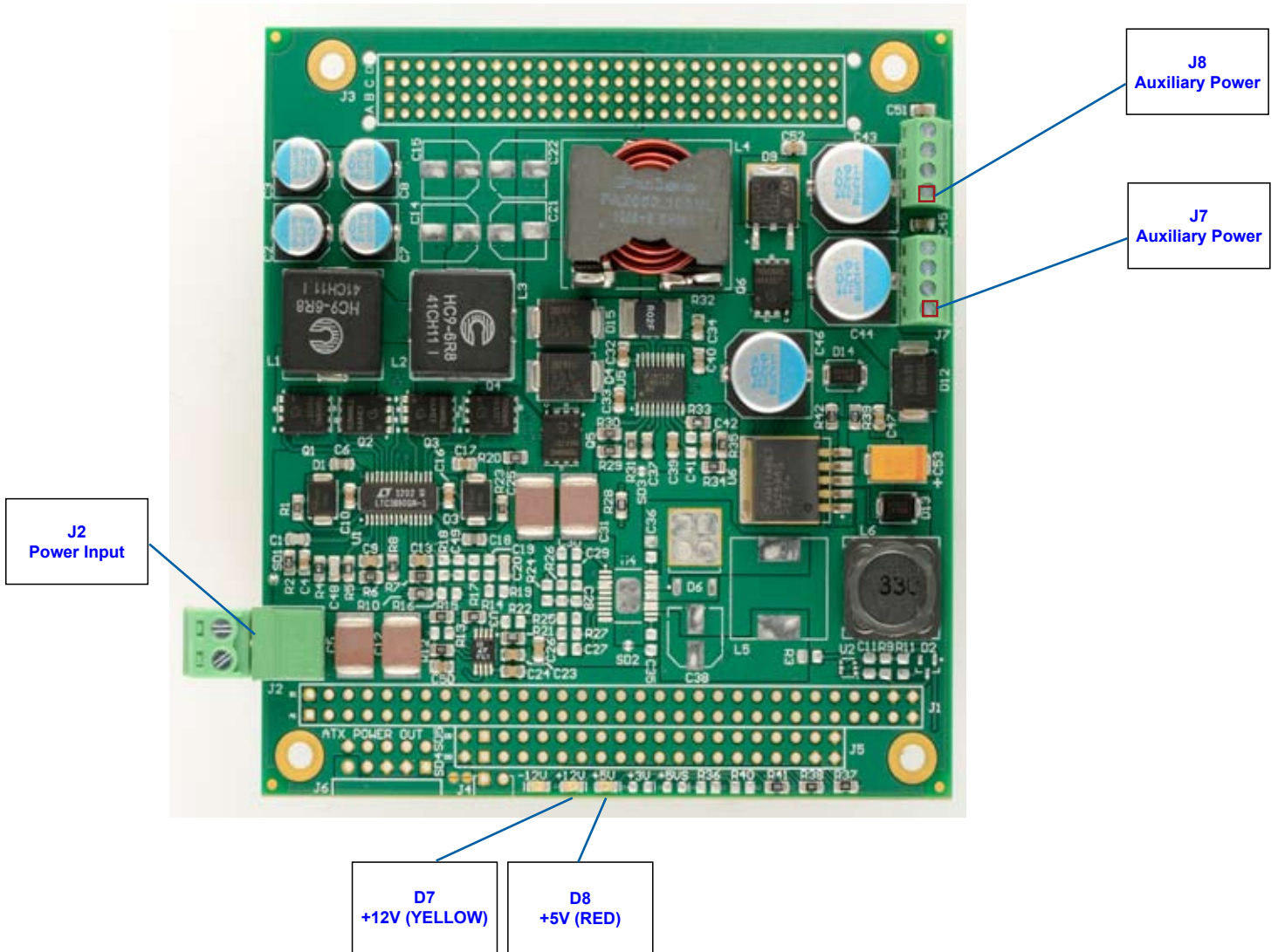
Reference [Appendix - A](#) for **Best Practices**.



**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

### D7, D8 - Status LED

Visual  
Index

The ISM-DC-AT512-P has up to two status LED indicators populated on the board at **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
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 ISM-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

- Embedded dual 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
- 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 ISM-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 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 ISM-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 supply. 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 ISM-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:

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

$I_{OUT}$  = 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 chart information.

## CONNECTOR REFERENCE

### POWER

#### J2 - VDC Input

[Visual Index](#)

PCB Connector: PHOENIX 180327 (J2)

Mating Connector: PHOENIX 1803578 (Housing) \*Note: Mating Connector ships with board.

#### J2

1	+10-50 VDC
2	GND

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

#### J7, J8 - Output Power

[Visual Index](#)

PCB Connector: PHOENIX CONTACT 1725672

#### J7, J8

4	+12V
3	GND
2	GND
1	+5V

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

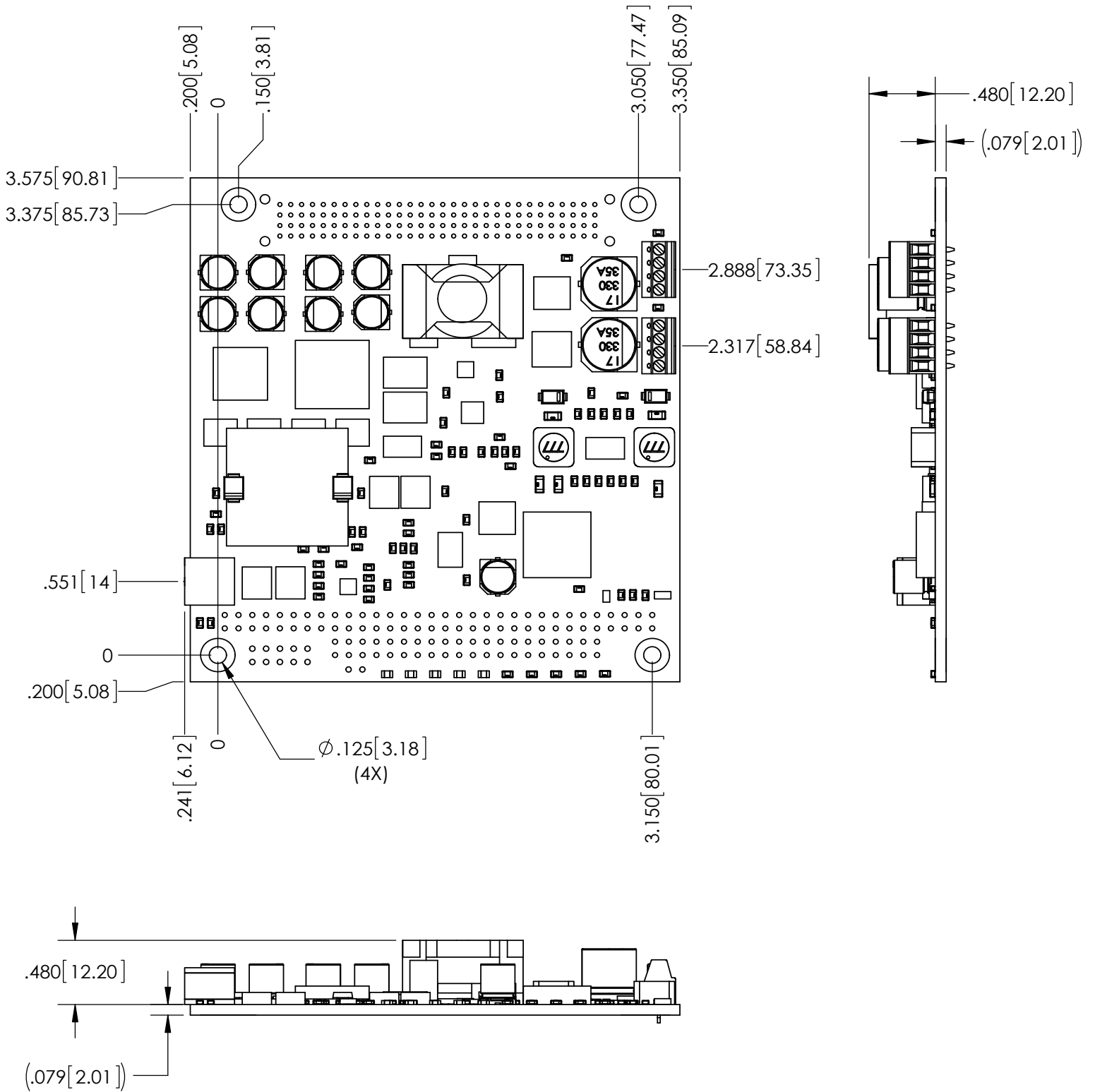
## CABLES

[See WinSystems website.](#)

# SPECIFICATIONS

<b>MODELS</b>		<b>ISM-DC-AT512-P</b>			
<b>Electrical (Input)</b>					
Input Voltage	10-50 VDC				
Input Current	3-12A				
Inrush Current	20A (Inrush currents at startup can be larger than steady state currents.)				
<b>Electrical (Outputs)</b>					
V <sub>OUT</sub>	I <sub>OUT</sub>	Load Regulation	Line Regulation	Ripple	Power
+5V	20A	30 mV	10 mV	<100 mV	100W*
+12V	3A	10 mV	20 mV	<150 mV	36W
<p>* Use the following formula to derate the main 5V, 20A output current:</p> $I_{OUT} = (215 - V_{IN} - T_{AMB}) / 8.$ <p><math>I_{OUT}</math> = The output current in Amps. (<math>I_{OUT} &lt; 20</math>)</p> <p><math>V_{IN}</math> = Input voltage in Volts.</p> <p><math>T_{AMB}</math> = Ambient operating temperature in degrees Celsius. (<math>-40^{\circ}\text{C} &lt; T_{AMB} &lt; 85^{\circ}\text{C}</math>)</p> <p>See Appendix D for more derating charge information.</p>					
<b>Current Limiting</b>					
<b>Voltage</b>			<b>Current Limit</b>		
+5V			22A		
+12V			4.5A		
<b>MTBF</b>					
		3,068,324 hours			
<b>Mechanical</b>					
Dimensions		3.6 x 3.8 inches (90 x 96 mm)			
Weight		4 oz (114g)			
Printed Circuit Board		0.078 inches 4-Layer FR4			
<b>Environmental</b>					
Operating Temperature		-40°C to 85°C ambient			
Humidity		5% to 95% non-condensing			

# MECHANICAL DRAWING



ISM-DC-512-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.

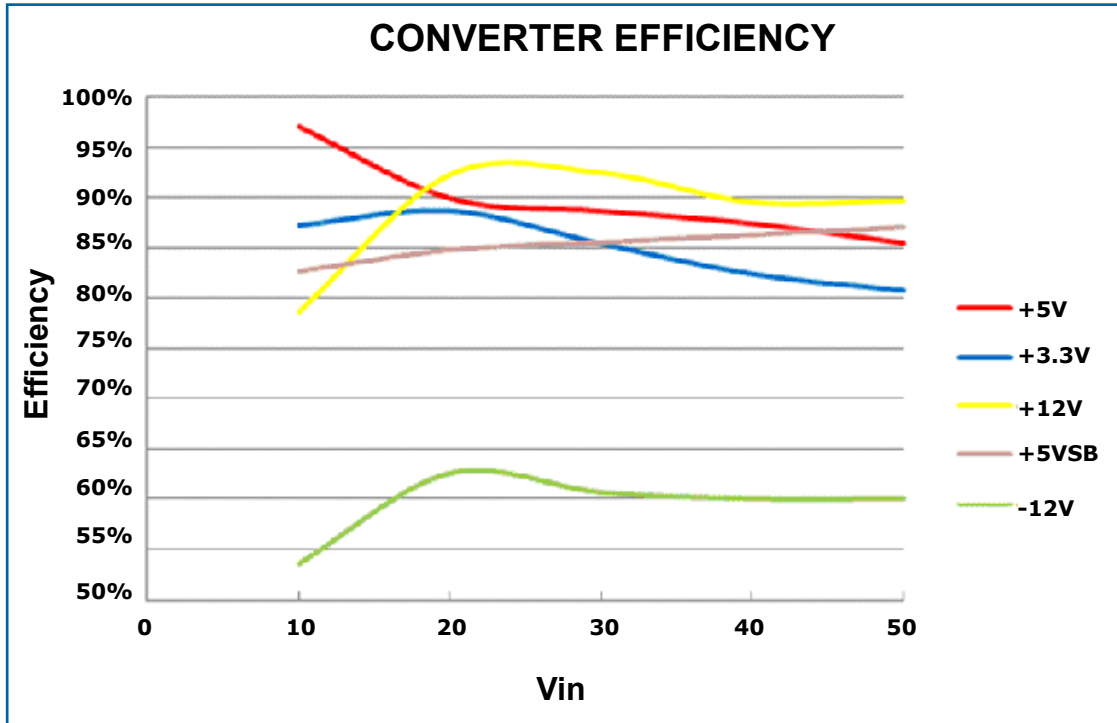
### **Contact an Applications Engineer with questions**

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

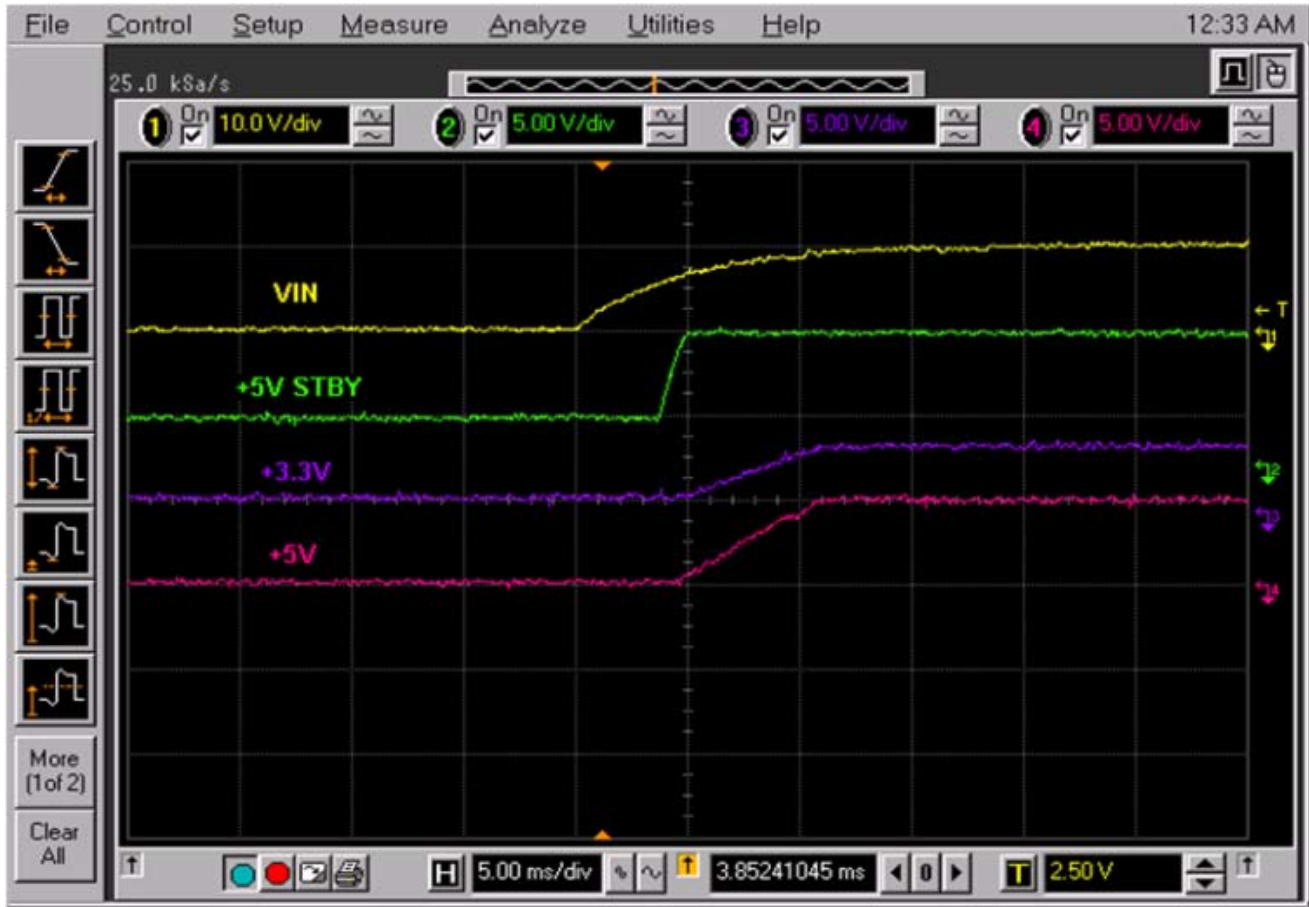
#### CONVERTER EFFICIENCY



# APPENDIX - C

## START-UP TIMING

### ITO



ITO (No Load)

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



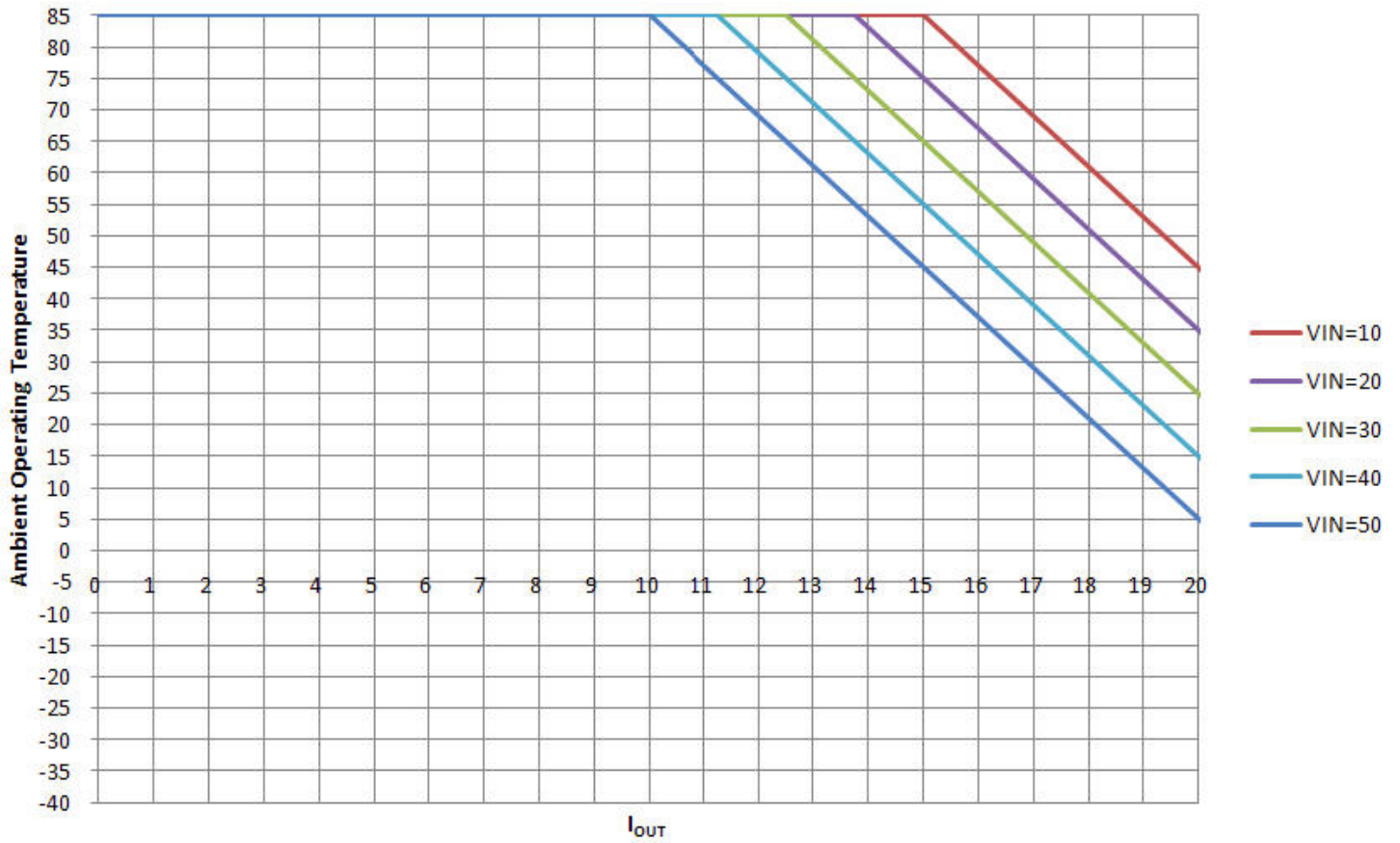
ITO (No Load)

# 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.