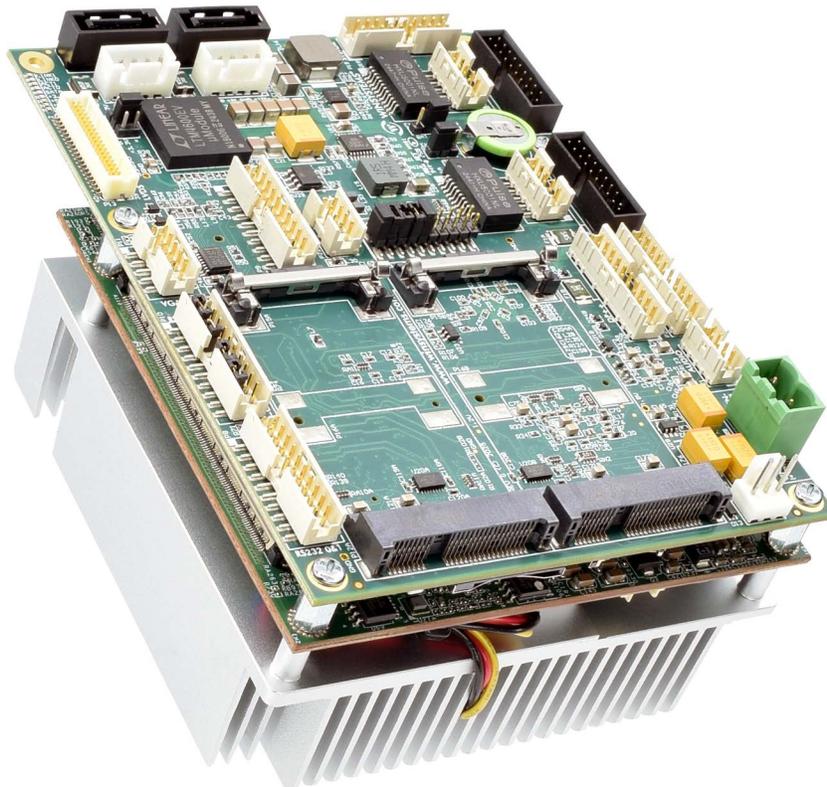


SBC-477

PowerTier™ Series

Rugged Compact Carrier with 13th Generation
Intel® Core™ Processor COM Express Type 6 Module

Product Manual



Revision History

Document Version	Last Updated Date	Brief Description of Change
v1.0	12/10/2025	Initial release
v1.2	01/14/2026	Added PassMark® information section

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1. Before You Begin

Review the warnings in this section and the best practice recommendations (See “Best Practices” on page 41.) when using and handling the WINSYSTEMS SBC-477 PowerTier Series module. Following these recommendations provides an optimal user experience and prevents damage. Read through this document and become familiar with the SBC-477 PowerTier Series before proceeding.



APPLYING CONFORMAL COATING AFTER PURCHASE WILL VOID YOUR WARRANTY. FAILING TO COMPLY WITH THESE BEST PRACTICES MAY DAMAGE THE PRODUCT AND VOID YOUR WARRANTY.

1.1 Warnings

Only qualified personnel should configure and install the SBC-477 PowerTier Series. While observing best practices, pay particular attention to the following:.



Avoid Electrostatic Discharge (ESD)

Only handle the circuit board 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.

2. Introduction

This manual provides configuration and usage information for the SBC-477 PowerTier Series. If you still have questions, contact Technical Support at +1-817-274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

3. Functionality

The SBC-477 PowerTier Series of rugged single board computers meet the needs of industrial applications where performance, power, reliability and space are critical. These embedded computers support a wide range of uses including industrial automation, energy management, transportation management and MIL/COTS.

The SBC-477 PowerTier Series delivers powerful computing in a compact footprint, powered by an 13th Gen Intel® Core™ Raptor Lake hybrid CPU – an i7, i5, i3, or Intel® Processor U300E, to achieve the balance of performance and power efficiency to fit your application's needs. They operate in an extended temperature range of -40° to +85°C with an appropriate thermal solution and support Windows 10/11, Linux Ubuntu, and other x86 real-time operating systems.

COM Express modules allow users to retain the same carrier board design across scalable CPU series and over multiple generations of COM Express modules providing a long project lifetime. Updating a COM Express module to improve performance or replace an end of life processor drastically improves time to market when revising existing projects. Users have the option to choose the default BIOS settings and layout, or request a custom branded configurable BIOS to support specific project requirements.

Drivers are available from the WINSYSTEMS website at <https://www.winsystems.com/>

4. Product Features and Specifications

SBC Board Features and Specifications				
Compatibility	COM Express Type 6 Modules PICMG COM Express® COM.0 R2.0			
Part Number	SBC-477 PowerTier Series			
Processor Options	13th Gen Intel® Core Raptor Lake Processors			
	Intel® Core™ U300E Cores: 5 Speed: 1.1 (4.3) GHz Cache: 8 MB Base Power: 15W	Intel® Core™ i3-1315UE Cores: 6 Speed: 1.2 (4.5) GHz Cache: 10 MB Base Power: 15W	Intel® Core™ i5-1335UE Cores: 10 Speed: 1.3 (4.5) GHz Cache: 12 MB Base Power: 15W	Intel® Core™ i7-1365UE Cores: 10 Speed: 1.7 (4.9) GHz Cache: 12 MB Base Power: 15W
RAM	Up to 64 GB DDR5 5200 MT/s, in 2 sockets			
Expansion	Mini PCIe Expansion: 2x full length cards (Both sockets have PCIe and USB) 1x SIM Card Expansion (One socket supports 4G/5G and SIM Card)			
Storage	2x SATA ports with External Vertical Locking Connector			
Network	2x Ethernet Ports <ul style="list-style-type: none"> 1x Port 0, Intel I226IT, 2.5Gb from COM Express 1x Port 1, 1Intel 82574I, 1Gb from Carrier 			
Security	On-board discrete TPM 2.0 hardware security			
I/O	<ul style="list-style-type: none"> 8x GPIO (4 input / 4 output) 4x USB 2.0 (2 used for miniPCIe) 4x USB 3.0 2x mini PCIe 1x Console RS-232 port (TX/RX) 2x RS-232 (w/ full modem signals) 2x RS-422/485 I2C 			
I/O Connectors	All low-profile shrouded locking ruggedized 2mm pitch headers. Can be mated to panel mountable cable set or MIL type connectors.			
Display	<ul style="list-style-type: none"> Triple display, UltraHD 2x DisplayPort++ (DDI) interface, which can be used for DisplayPort, HDMI, DVI or VGA 1x VGA (Analog/CRT) 1x LVDS interface (single ch 24-bit, dual ch 48-bit) 			
Audio	HD Audio (Cirrus Logic CS4207 codec) <ul style="list-style-type: none"> 1x stereo input 1x stereo output 			
Operating System	Ubuntu Linux, Windows 10/11 IoT, and other x86 real-time OS			
Software	<ul style="list-style-type: none"> Custom configurable UEFI based AMI BIOS System Management Libraries and Tools 			
External Interfaces	<ul style="list-style-type: none"> Battery Low Indication PC speaker Interface System Status (S3 and Reset Outputs) 			
Power	<ul style="list-style-type: none"> Input: Single +12V input +/- 5% (5mm pitch terminal connector) Power Supply: > 60W power budget recommended *Average power use under a standard load.			
Typical Power Use	Intel® Core™ U300E TPU: 31 W* TDP: 18W - 38W*	Intel® Core™ i3-1315UE TPU: 30 W* TDP: 16W - 37W*	Intel® Core™ i5-1335UE TPU: 32 W* TDP: 16W - 37W*	Intel® Core™ i7-1365UE TPU: 30 W* TDP: 16W - 37W*
	(See PassMark® details on page 9 & page 10)			
Battery	On-board RTC Battery 3V 48mAh (BR1125A) (With option to select from RTC external battery)			

SBC Board Features and Specifications		
Thermal Solution	1 = Heat Spreader	3 = Heatsink & Fan
Mechanical	Dimensions: 125mm x 95mm x 35mm Weight: 290 g / 10.23 oz	Dimensions: 125mm x 95mm x 99mm Weight: 490 g / 17.30 oz
MTBF	717,128 hrs (For carrier only)	
Operating Temperature	Industrial Temp. -40°C to +85°C (-40°F to +185°F) (See NOTE below table)	
Humidity (RH)	5% to 95% non-condensing	
RoHS compliant	Yes	
CE Compliant	Yes	
Warranty and Support	Limited two-year Warranty and Free Technical Support	

NOTE Requires appropriate thermal solution to achieve maximum 85°C such as our SBC-477-1365UE-32-3. The maximum measurable temperature on any spot of the heat spreader or heat sink, and module surfaces must not exceed the operating temperature specified in the table above.

Contact Winsystems at <https://winsystems.com/contact/> for more information.

5. Power Consumption Details

5.1 Power Input Ratings

Below are the power input ratings for the SBC-477 PowerTier Series.

Power Input Ratings				
Power	<ul style="list-style-type: none"> Input: Single +12V input +/- 5% (5mm pitch terminal connector) Power Supply: > 60W power budget recommended *Average power use under a standard load.			
Typical Power Use	Intel® Core™ U300E TPU: 31 W* TDP: 18W - 38W*	Intel® Core™ i3-1315UE TPU: 30 W* TDP: 16W - 37W*	Intel® Core™ i5-1335UE TPU: 32 W* TDP: 16W - 37W*	Intel® Core™ i7-1365UE TPU: 30 W* TDP: 16W - 37W*
*See Passmark® test results on page 10				

5.2 PassMark Information

What is PassMark®?

PassMark refers to both a software company and its popular benchmarking software, PerformanceTest, which is used to evaluate a computer's performance. The company is known for its benchmark tests that measure the performance of a computer's CPU, graphics, hard drive, and memory. The benchmark scores allow users to compare their PC's performance against millions of other computers worldwide.

PassMark (<https://www.passmark.com/>) has offered industry standard PC benchmarking and diagnostic solutions since 1998 and as such provides an industry accepted standardized way to measure and compare the power consumption of computers.

WINSYSTEMS uses a PassMark PerformanceTest that is a comprehensive benchmarking tool that evaluates the power performance of the SBC-477 PowerTier Series. Below in Section 6 you can view the PassMark Test Results table which includes the SBC Setup showing you how the SBC was set up for the test. It also includes the Burn-In Features used and the BIOS Idle, OS Idle and the Load test results.

Contact an engineer — If you have additional questions about the PassMark test results at <https://winsystems.com/support/>.

5.3 PassMark Test Setup and Results

Here is the PassMark Test Results table which includes the SBC Test Setup and the load test results for various standard PassMark setups.

PassMark® Test Setup and Results for SBC-477-U300-16-3									
SBC Test Setup									
RAM: 16GB OS: Windows 11 IOT SW: PassMark, HWInfo Thermal: Heatsink + Fan		DC IN	BIOS PL1-PL2	Burn-In Feature	Idle (BIOS)	Idle (OS)	Setup 1 50% Load	Setup 2 50% Load	Setup 3 50% Load
		12V	Disabled		23.0W*	18.0W*	33.0W*	31.0W*	38.0W*
DP0 (P2A)	4K Monitor				X	X	X	X	X
SATA0 (OS) (P17A)	SATA SSD				X	X	X	X	X
SATA1 (P17B)	NA							X	X
mPCIe (P12A)	4x Serial (PCIe module)							X	X
mPCIe (P12B)	2x ENET (PCIe module)							X	X
USB2_1 (P22)	Keyboard				X	X	X	X	X
USB2_2 (P22)	Mouse				X	X	X	X	X
USB3_1 (P3A)	32GB USB3							X	X
USB3_2 (P3A)	32GB USB3							X	X
USB3_3 (P3B)	32GB USB3							X	X
USB3_4 (P3B)	32GB USB3							X	X
ENET_1 (P24A)	Loopback					X	X	X	X
ENET_2 (P24B)	Loopback					X	X	X	X
SOUND (P21)	NA							X	X
				CPU			X	X	X
				RAM				X	X
				Video				X	X
				2D Graphic					X
				3D Graphic 1x1920x1080			X		X
				Disk					X
				Sound					X
				Network				X	X
				GPGPU					X

*Instantaneous power draw can be higher.

PassMark® Test Setup and Results for SBC-477-1315UE-16-3									
SBC Test Setup									
RAM: 16GB OS: Windows 11 IOT SW: PassMark, HWInfo Thermal: Heatsink + Fan		DC IN	BIOS PL1-PL2	Burn-In Feature	Idle (BIOS)	Idle (OS)	Setup 1 50% Load	Setup 2 50% Load	Setup 3 50% Load
		12V	Disabled		22.0W*	16.0W*	31.0W*	30.0W*	37.0W*
DP0 (P2A)	4K Monitor				X	X	X	X	X
SATA0 (OS) (P17A)	SATA SSD				X	X	X	X	X
SATA1 (P17B)	NA							X	X
mPCIe (P12A)	4x Serial (PCIe module)							X	X
mPCIe (P12B)	2x ENET (PCIe module)							X	X
USB2_1 (P22)	Keyboard				X	X	X	X	X
USB2_2 (P22)	Mouse				X	X	X	X	X
USB3_1 (P3A)	32GB USB3							X	X
USB3_2 (P3A)	32GB USB3							X	X
USB3_3 (P3B)	32GB USB3							X	X
USB3_4 (P3B)	32GB USB3							X	X
ENET_1 (P24A)	Loopback					X	X	X	X
ENET_2 (P24B)	Loopback					X	X	X	X
SOUND (P21)	NA							X	X
				CPU			X	X	X
				RAM				X	X
				Video				X	X
				2D Graphic					X
				3D Graphic 1x1920x1080			X		X
				Disk					X
				Sound					X
				Network				X	X
				GPGPU					X

*Instantaneous power draw can be higher.

PassMark® Test Setup and Results for SBC-477-1335UE-16-3									
SBC Test Setup									
RAM: 16GB OS: Windows 11 IOT SW: PassMark, HWInfo Thermal: Heatsink + Fan		DC IN	BIOS PL1-PL2	Burn-In Feature	Idle (BIOS)	Idle (OS)	Setup 1 50% Load	Setup 2 50% Load	Setup 3 50% Load
		12V	Disabled		23.0W*	16.0W*	33.0W*	32.0W*	37.0W*
DP0 (P2A)	4K Monitor				X	X	X	X	X
SATA0 (OS) (P17A)	SATA SSD				X	X	X	X	X
SATA1 (P17B)	NA							X	X
mPCIe (P12A)	4x Serial (PCIe module)							X	X
mPCIe (P12B)	2x ENET (PCIe module)							X	X
USB2_1 (P22)	Keyboard				X	X	X	X	X
USB2_2 (P22)	Mouse				X	X	X	X	X
USB3_1 (P3A)	32GB USB3							X	X
USB3_2 (P3A)	32GB USB3							X	X
USB3_3 (P3B)	32GB USB3							X	X
USB3_4 (P3B)	32GB USB3							X	X
ENET_1 (P24A)	Loopback					X	X	X	X
ENET_2 (P24B)	Loopback					X	X	X	X
SOUND (P21)	NA							X	X
				CPU			X	X	X
				RAM				X	X
				Video				X	X
				2D Graphic					X
				3D Graphic 1x1920x1080			X		X
				Disk					X
				Sound					X
				Network				X	X
				GPGPU					X

*Instantaneous power draw can be higher.

PassMark® Test Setup and Results for SBC-477-1365UE-16-3									
SBC Test Setup									
RAM: 16GB OS: Windows 11 IOT SW: PassMark, HWInfo Thermal: Heatsink + Fan		DC IN	BIOS PL1-PL2	Burn-In Feature	Idle (BIOS)	Idle (OS)	Setup 1 50% Load	Setup 2 50% Load	Setup 3 50% Load
		12V	Disabled		23.0W*	16.0W*	32.0W*	30.0W*	37.0W*
DP0 (P2A)	4K Monitor				X	X	X	X	X
SATA0 (OS) (P17A)	SATA SSD				X	X	X	X	X
SATA1 (P17B)	NA							X	X
mPCIe (P12A)	4x Serial (PCIe module)							X	X
mPCIe (P12B)	2x ENET (PCIe module)							X	X
USB2_1 (P22)	Keyboard				X	X	X	X	X
USB2_2 (P22)	Mouse				X	X	X	X	X
USB3_1 (P3A)	32GB USB3							X	X
USB3_2 (P3A)	32GB USB3							X	X
USB3_3 (P3B)	32GB USB3							X	X
USB3_4 (P3B)	32GB USB3							X	X
ENET_1 (P24A)	Loopback					X	X	X	X
ENET_2 (P24B)	Loopback					X	X	X	X
SOUND (P21)	NA							X	X
				CPU			X	X	X
				RAM				X	X
				Video				X	X
				2D Graphic					X
				3D Graphic 1x1920x1080			X		X
				Disk					X
				Sound					X
				Network				X	X
				GPGPU					X

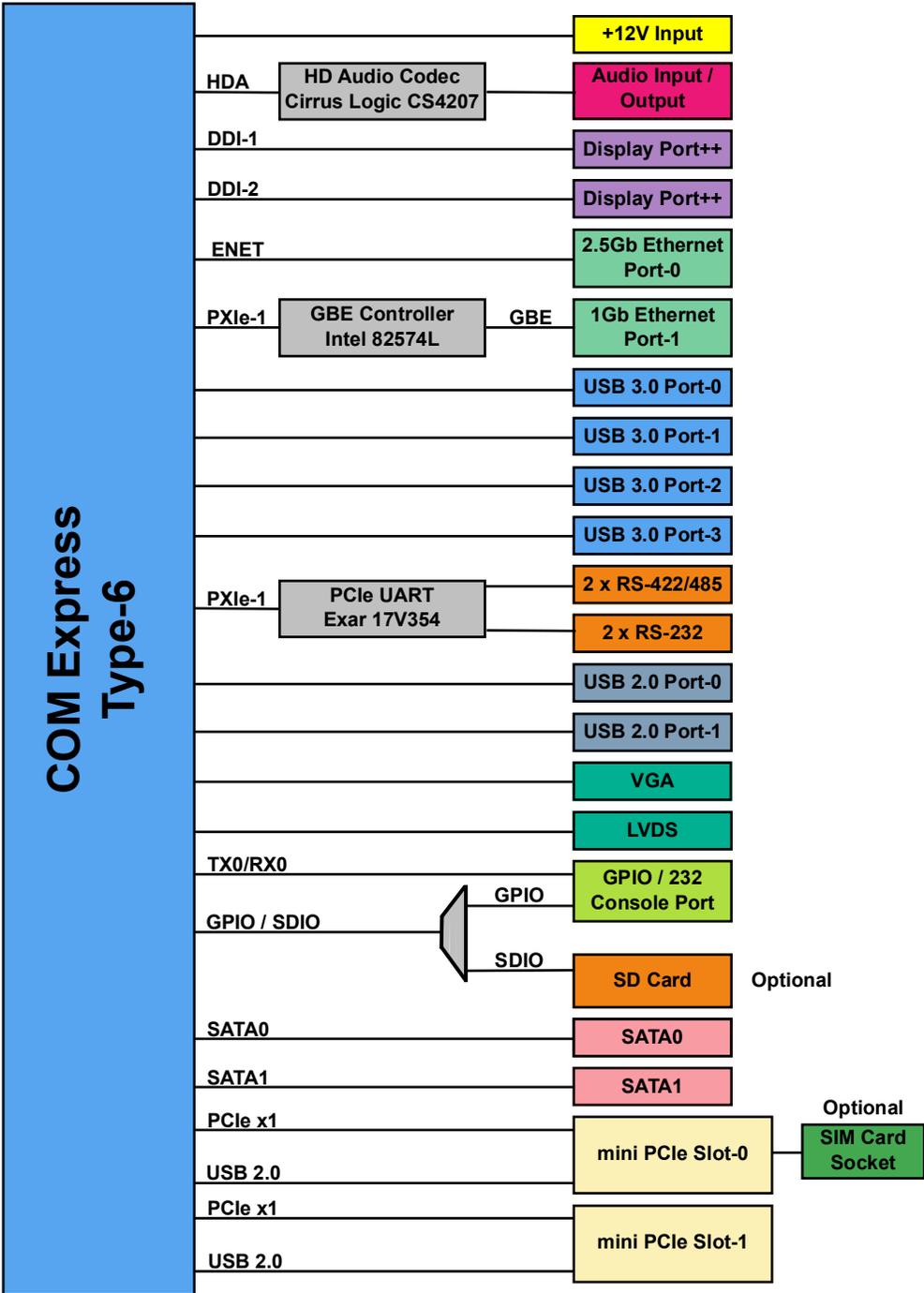
*Instantaneous power draw can be higher.

6. Part Numbers / Ordering Information

Part Number	Description	
SBC-477-P-R-T	Base part number	
P = Processor	U300, 1315UE, 1335UE, 1365UE	
R = DDR5	16, 32, 64 GB	
T = Thermal Option	1 = heat spreader, 3 = heatsink + fan)	
Part Number	Top View	Bottom View
SBC-477-P-R-1		
SBC-477-P-R-3		

7. Product Overview

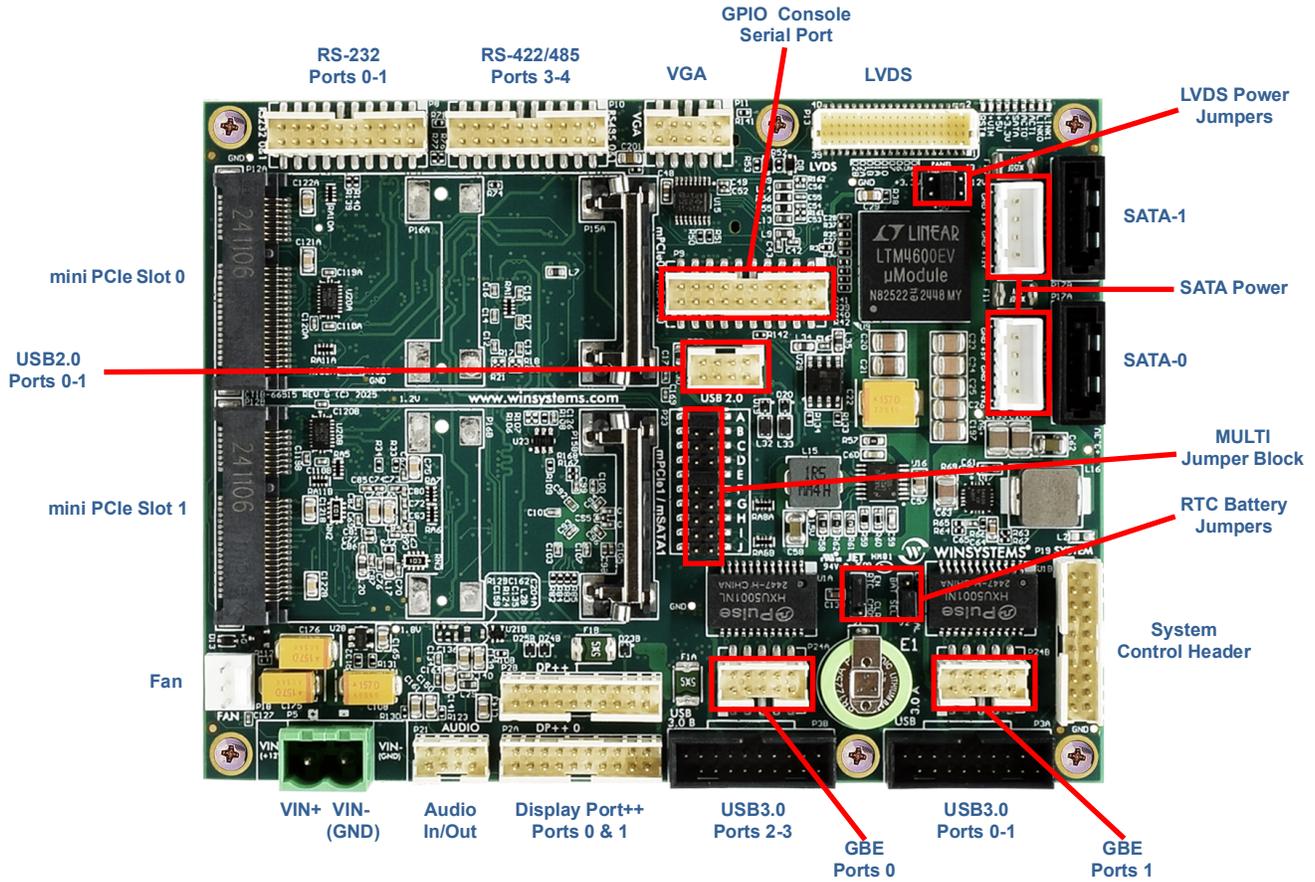
7.1 Block Diagram



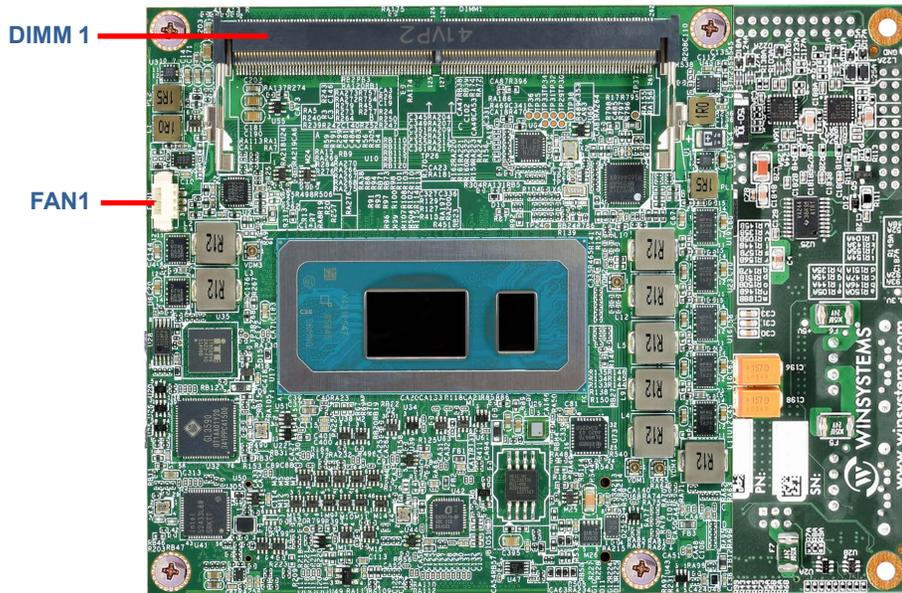
8. Connector Locations

This section describes the SBC-477 PowerTier Series components and configuration.

Carrier Top View

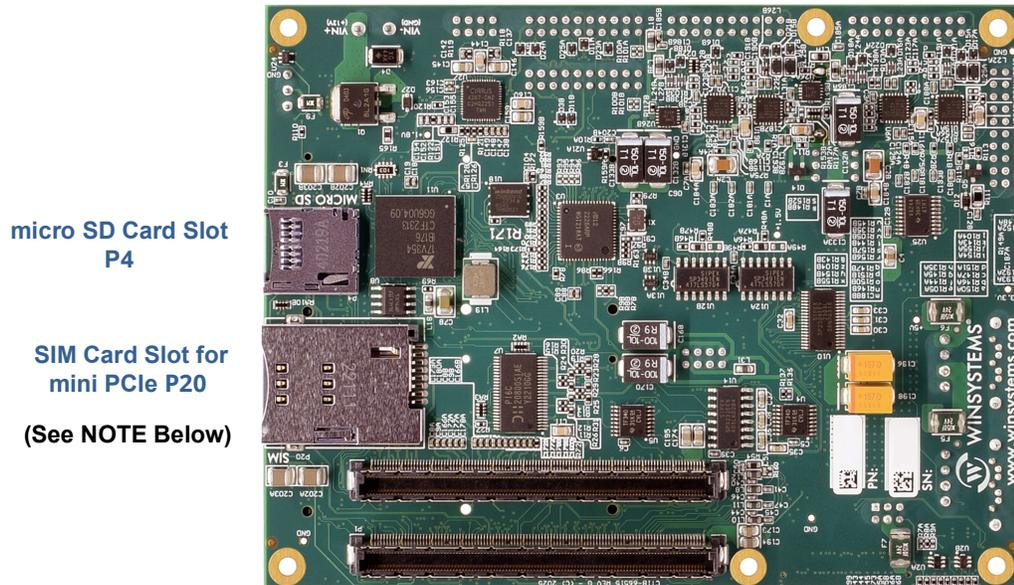


COM and Carrier Bottom View



Carrier Bottom View

(Showing Options Below)



NOTE SIM's Card option requires a WAN interface controller card that allows the device to connect to a wide area network.

9. Carrier Jumper and Connector Summary

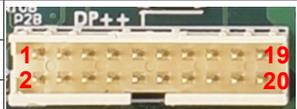
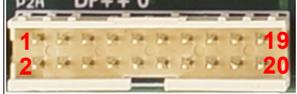
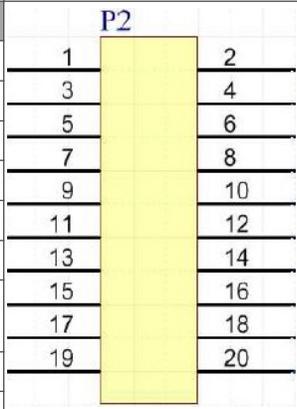
Item	Description	Reference
P2A P2B	DisplayPort ++ Video	page 19
P3A P3B	USB 3.0 Ports 0, 1 USB 3.0 Ports 2, 3	page 20
P4	Micro SD card (Optional)	page 21
P5	+12VDC Power In	page 22
P6, P7	External SATA HDD Power	page 33
P8, P10	Asynchronous Serial Ports	page 23
P8	RS232 Ports 1 & 2	page 24
P9	GPIO and COM Express Type 6 simple serial	page 26
P10	Serial Connector RS-422/485 Ports 3 & 4	page 24
P11	VGA	page 27
P12A, P12B	miniPCIe Slots	page 28
P12A, P12B	Full Length mini PCIe Installation	page 29
P13	LVDS Video	page 31
P17A, P17B	External SATA Ports	page 33
P18	CPU Fan Connector	page 34
FAN1	COM Fan Connector (Optional)	page 34
P19	System Control Header	page 35
P20	SIM card slot (Optional)	page 36
P21	Stereo Audio In and Out	page 36
P22	USB2.0 Connector	page 37
P23	Multifunction Jumper Block	page 38
P24A	Ethernet (Port-0) 2.5Gb	page 37
P24B	Ethernet (Port-1) 10/100/1000 (Max Speed at 1Gb)	page 37
J1	RTC Clear	page 23
J2	RTC Selection	page 23
J3	LVDS power selection	page 32

10. Detailed Feature Pinouts and Descriptions

10.1 DisplayPort ++ Video [P2A,P2B]

The SBC-477 PowerTier Series Carrier features two DisplayPort++ connectors. This can be configured to output Display Port and HDMI/DVI.

The configuration of each interface is setup via the COM Express module's BIOS settings. Refer to the COM Express module's documentation for more details.

Function	DisplayPort++ Video Output Connectors					
Location	P2A, P2B					
Type	FCI 98414-G06-20LF, 2x10 2mm					
Cable Number	CBL-DP-CNT DisplayPort to 20-pin Minitex Cable w/Latch (Qty. 2)					
Pinout	Pin	Description	Pin	Description		
	1	DP0+	2	DP3+		
	3	DP0-	4	DP3-		
	5	GND	6	GND		
	7	DP1+	8	DPAUX-		
	9	DP1-	10	DPAUX+		
	11	GND	12	GND		
	13	DP2+	14	DP Hot Plug Detect		
	15	DP2-	16	GND		
	17	GND	18	GND		
	19	DP Power	20	DP AUX SEL [1]		

[1]- For **DP_AUX_SEL**-Cable assembly must tie high (+3.3V) for HDMI/DVI output and low (GND) for DisplayPort output.

10.1.1 HDMI / DVI / VGA from DisplayPort++

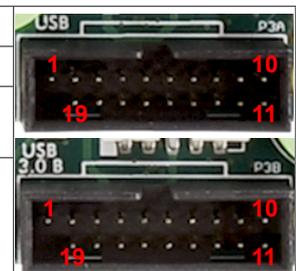
The SBC-477 PowerTier Series DisplayPort++ connector can be used for display outputs other than DisplayPort. The use of HDMI, DVI or VGA can be done through a simple dongle or cable assembly like the ones shown below. These can be purchased from any OEM vendor (such as www.startech.com) or contact Winsystems.



10.2 USB 3.0 Ports [P3A, P3B]

The SBC-477 PowerTier Series implements 4x USB 3.0 ports on two 19-pin header, 2x USB 2.0 ports on 8-pin headers and 2x USB 2.0 through the miniPCIe slots. Below is a description of the 19-pin USB 3.0 header on the SBC-477 PowerTier Series carrier. Each USB 3.0 port is capable of bitrates of up to 5Gbps, as well as accepting USB 2.0 connections.

Function	Dual, USB 3.0			
Location	P3A, P3B			
Type	Intel Locking Motherboard Style 19-pin USB 3.0 connector			
Cable Number	<p>CBL-USB3-INNER-CNT Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Inner Exit (Qty. 2)</p> <p>CBL-USB3-OUTTER-CNT Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Outer Exit (Qty. 2)</p> <p>CBL-USB3-VERT-CNT Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Vertical Exit (Qty. 2)</p>			
Pinout	Pin	Description	Pin	Description
	-	-	1	P1-VBUS
	19	P2-VBUS	2	P1-SSRX
	18	P2-SSRX-	3	P1-SSRX+
	17	P2-SSRX+	4	GND
	16	GND	5	P1-SSTX-
	15	P2-SSTX-	6	P1-SSTX+
	14	P2-SSTX+	7	GND
	13	GND	8	P1-D-
	12	P2-D-	9	P1-D+
	11	P2-D+	10	-



10.3 MicroSD Card [P4] (Optional)

The SBC-477 PowerTier Series provides a Micro SD Card Slot at P4. This Micro SD Card slot sources the SDIO interface from the COM Express modules GPIO pins.

NOTE This SD card slot will ONLY operate if the COM Express module provides the SDIO interface over the GPIO pins. See below for the SDIO / GPIO mapping.

Also ensure **MULTI-JUMPER position "B"** is installed to select the SDIO interface.

Function	micro SD Card Slot		
Locations	P4		
Type	Micro SD Card Socket Molex 502570-0893		
Pinout	Pin	SDIO Signal	COM Express GPIO Mapping
	1	SD D2	GPI2
	2	SD D3	GPI3
	3	SD CMD	GP01
	4	SD_VCC (+3.3V)	-
	5	SD CLK	GPO0
	6	GND	-
	7	SD D0	GPIO
	8	SD D1	GPI1
	9	GND	-
	10	SD CD#	GP03



micro SD Card Slot

10.4 Input Power [P5]

The SBC-477 PowerTier Series is designed to be powered from a regulated single +12VDC power supply. The carrier board features a 5mm screw terminal style connector. The COM Express carrier generates all of the necessary voltages on board from this single input.

Function	Main Input Power			
Locations	P5			
Range	+12V DC (+/-5%)			
Type	2 Position 5mm pitch terminal connector Mating Connector: PN: 796634-2 MFG: TE Connectivity			
Power Supply	Recommend power supplies with > 60W power budget.			
Typical Power Use	Intel® Core™ U300E TPU: 31 W* TDP: 18W - 38W*	Intel® Core™ i3-1315UE TPU: 30 W* TDP: 16W - 37W*	Intel® Core™ i5-1335UE TPU: 32 W* TDP: 16W - 37W*	Intel® Core™ i7-1365UE TPU: 30 W* TDP: 16W - 37W*
Fuse	+12V is protected with a one-time 10A fuse, at F4.			
Pinout	Pin	Signal	Description	 VIN+ VIN- +12V GND
	1	+12V	Power In	
	2	GND	Power Return	
	*DO NOT REVERSE POLARITY!			

10.5 RTC Battery [J1, J2]

The Panasonic Lithium battery (BR1225A/FA) provides 3V@48mAh to VBAT. VBAT is the supply for the RTC Clock of the COM Express module.

If the BR1225A is not sufficient for the application, an external battery can be connected to P19 with J2 selection jumper set appropriately.

NOTE The battery ships with a non-conductive label to prevent accidental discharge. It can be removed before installation.

Function	RTC Clear		
Locations	J1		
Type	1x3		
Pinout	Location	Description	
	1-2	Enable RTC	
	2-3	Clear CMOS	

Function	RTC Battery Selection		
Locations	J2		
Type	1x3		
Pinout	Location	Description	
	1-2	External battery	
	2-3	Local On-board Battery	

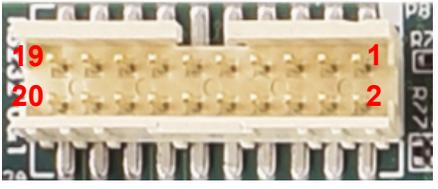
10.6 Asynchronous Serial Ports [P8, P10]

The SBC-477 PowerTier Series features four “external” serials ports. Port1 and Port2 are standard RS-232 and Port3 and Port4 can be configured as RS-422/485. These serial ports are generated from on-board PCIe 4-port UART the Exar 17V358

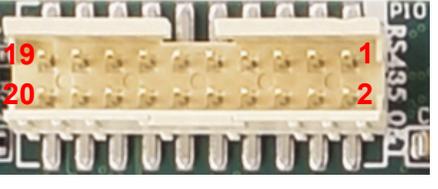
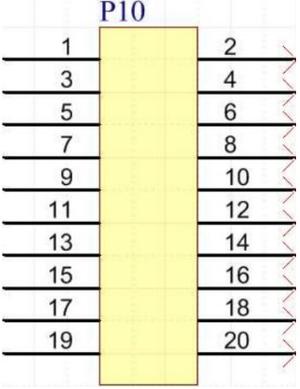
10.7 Software Support for the Exar 17V358

Additional drivers will be needed to properly operate the 4 additional serial ports on the COM Express carrier. Drivers for this functionality can be found on Winsystems website: <https://www.winsystems.com/>.

10.8 Serial Connector RS-232 [P8]

Function	RS232 Serial				
Location	P8				
Type	FCI 98424-G52-20LF, 2x10 2mm				
Cable Number	CBL-SER2-CNT Dual DB-9 to 20-Pin Minitex Cable (Qty. 3)				
Pinout	Pin	Description	Pin	Description	
	1	Port A, DCD	2	Port A, DSR	
3	Port A, RXD	4	Port A, RTS		
5	Port A, TXD	6	Port A, CTS		
7	Port A, DTR	8	Port A, RI		
9	GND	10	-		
11	Port B, DCD	12	Port B, DSR		
13	Port B, RXD	14	Port B, RTS		
15	Port B, TXD	16	Port B, CTS		
17	Port B, DTR	18	Port B, RI		
19	GND	20	-		

10.9 Serial Connector RS-422/485 Ports 3 & 4 [P10]

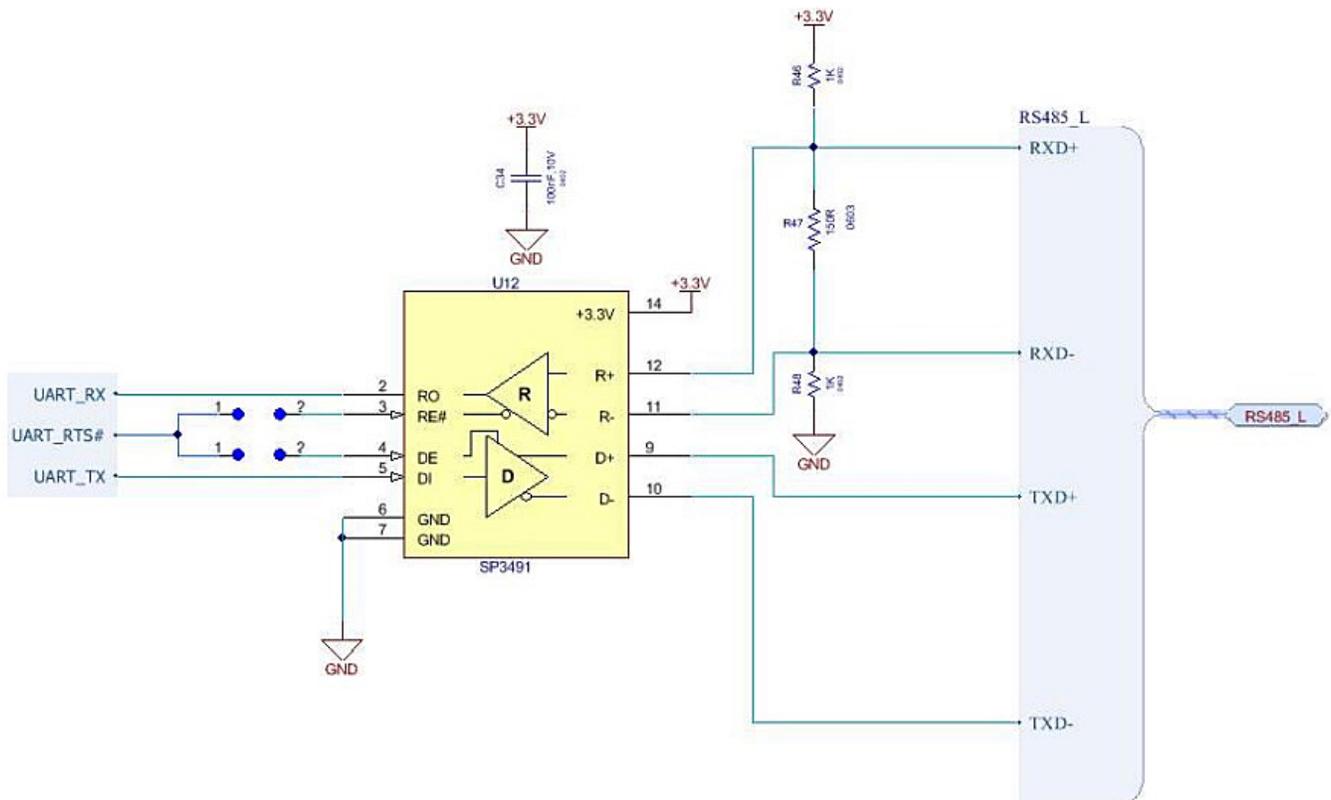
Function	RS-422/485 Serial				
Location	P10				
Type	FCI 98424-G52-20LF, 2x10 2mm				
Cable Number	CBL-SER2-CNT Dual DB-9 to 20-Pin Minitex Cable (Qty. 3)				
Pinout	Pin	Description			
	1	Port A, RXD+			
3	Port A, TXD+				
5	Port A, TXD-				
7	Port A, RXD-				
9	GND				
11	Port B, RXD+				
13	Port B, TXD+				
15	Port B, TXD-				
17	Port B, RXD-				
19	GND				

10.10 RS485 Control Jumpers

The RS485 Control Jumpers are used for implementing the following RS485 modes of operations:

- 1/2 Duplex Multidrop
- Full Duplex Multidrop

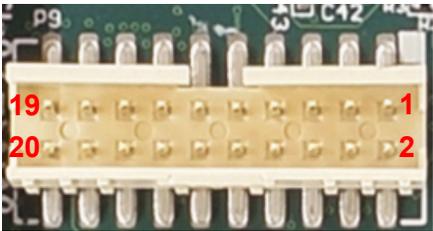
The UART RTS signals can be used for TX/RX control and can be enabled via the MULTI jumper block. See below for the RS-422/485 circuit diagram.



Sample circuit shown (not exact circuit that is on-board)

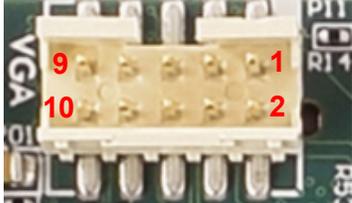
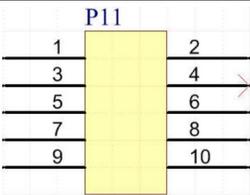
10.11 GPIO and Console Serial Port [P9]

The SBC-477 PowerTier Series provides additional functionality of COM Express Type-6 specification.

Function	Console RS-232 / GPIO																																					
Location	P9																																					
Type	FCI 98424-G52-20LF																																					
Pinout	Pin	Description	Pin	Description	<table border="1"> <thead> <tr> <th colspan="3">p9</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td>2</td></tr> <tr><td>3</td><td></td><td>4</td></tr> <tr><td>5</td><td></td><td>6</td></tr> <tr><td>7</td><td></td><td>8</td></tr> <tr><td>9</td><td></td><td>10</td></tr> <tr><td>11</td><td></td><td>12</td></tr> <tr><td>13</td><td></td><td>14</td></tr> <tr><td>15</td><td></td><td>16</td></tr> <tr><td>17</td><td></td><td>18</td></tr> <tr><td>19</td><td></td><td>20</td></tr> </tbody> </table>	p9			1		2	3		4	5		6	7		8	9		10	11		12	13		14	15		16	17		18	19		20
p9																																						
1		2																																				
3		4																																				
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11		12																																				
13		14																																				
15		16																																				
17		18																																				
19		20																																				
	1	GPIO Input 0	2	GPIO Output 3																																		
	3	GPIO Input 1	4	GPIO Output 2																																		
	5	GPIO Input 2	6	GPIO Output 1																																		
	7	GPIO Input 3	8	GPIO Output 0																																		
	9	GND	10	-																																		
	11	-	12	-																																		
	13	RS-232 RX	14	-																																		
	15	RS-232 TX	16	-																																		
	17	-	18	-																																		
	19	GND	20	-																																		

10.12 VGA Video [P11]

To allow for greater flexibility, the COM Express Type 6 Carrier provides a VGA Video Output. Routed directly from the COM Express Type-6 Module, this provides additional video output formats for operation. Please be advised that COMe modules with Sky lake series of Intel processors and newer no longer support a native VGA output as such some COMe Vendors have added an on-board DP to VGA in which may limit your display capabilities

Function	Standard VGA				
Location	P11				
Type	FCI 98424-G52-10LF, 2x5 2mm header				
Cable Number	CBL-VGA-CNT VGA to 10-Pin Minitex Cable w/Latch (Qty. 1)				
Pinout	Pin	Description	Pin	Description	
	1	Red	2	GND	
	3	Green	4	-	
	5	Blue	6	SC DDC	
	7	HSYNC	8	SD DDC	
	9	VSYNC	10	GND	

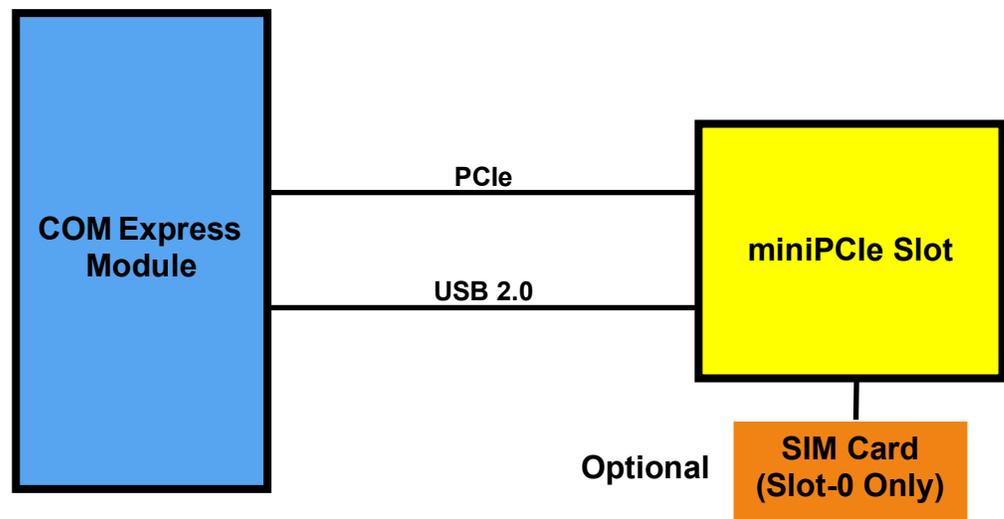
10.13 miniPCle Slots [P12A, P12B]

Dual Function miniPCle Slots

The SBC-477 PowerTier Series has two special dual purpose functionality mini PCIe slots. Each of these slots can accept a mini PCIe module. These slots have special circuitry that allows for connecting PCIe lanes.

Each of these slots are also provided with a USB 2.0 in addition to the PCIe as per the mini PCIe specification, see below for a block diagram of the slots functionality.

A SIM Card can be used in Slot-0 only.



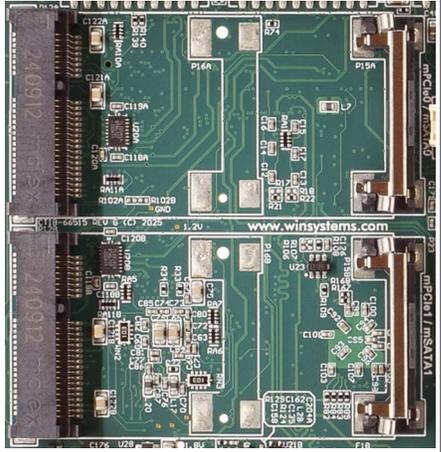
PCIe / USB 2.0 Dual Functionality Diagram

Selection for the miniPCle on and off is done on the MULTI-JUMPER block (P23)

Position	Jumper ON
C	Slot-0 miniPCle selected
D	Slot-1 miniPCle selected

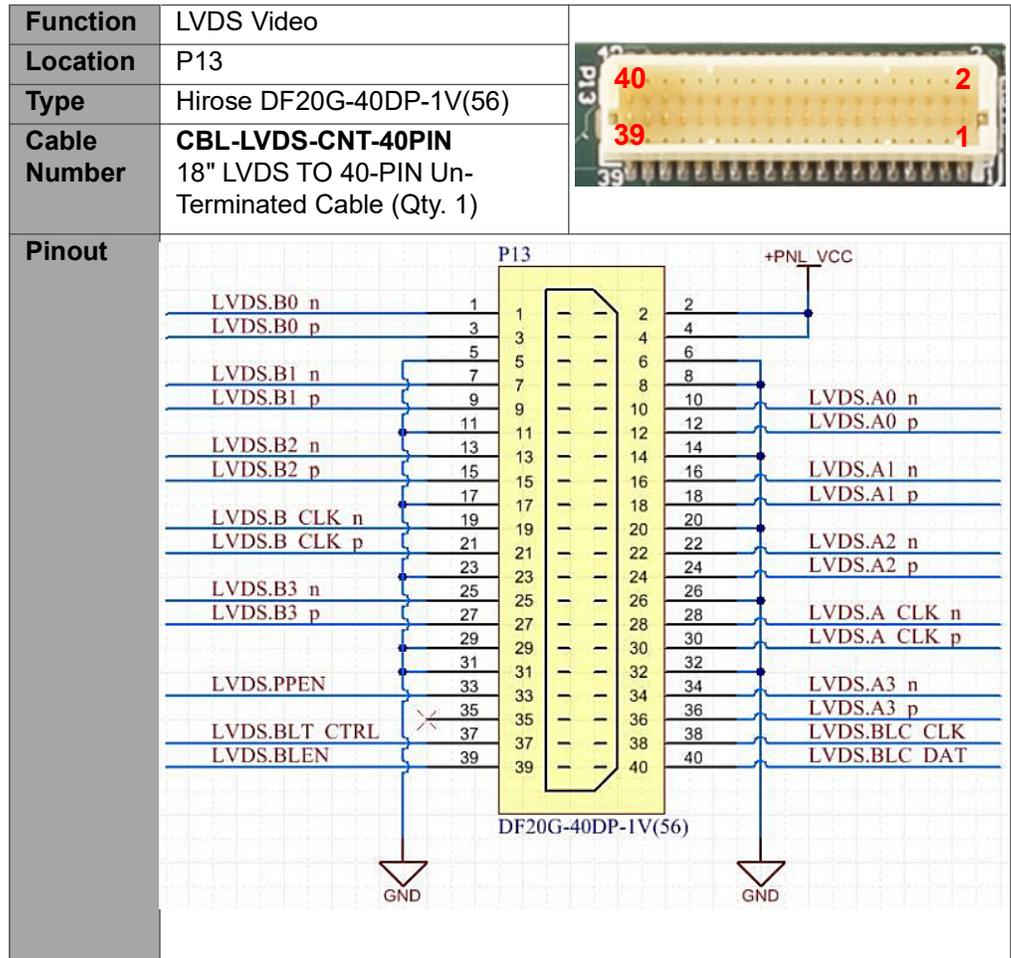
10.14 Full Length mini PCIe Installation [P12A, P12B]

The SBC-477 PowerTier Series comes with its latches in the full length position.

Function	mini PCIe Slots	
Location	P12A, P12B	
Type	Standard miniPCIe Slots	

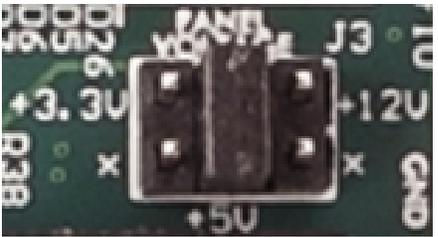
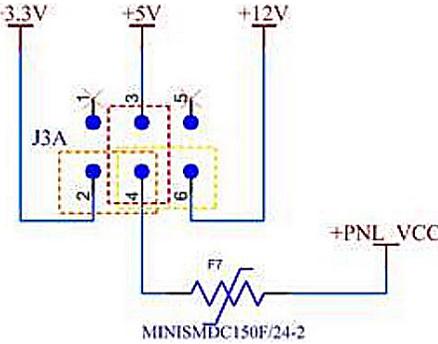
Position	mSATA Pinout		miniPCle Pinout	
	Pin Number	Description	Pin Number	Description
	1	NC	1	NC
	2	+3.3V	2	+3.3V
	3	NC	3	NC
	4	GND	4	GND
	5	NC	5	NC
	6	+1.5V	6	+1.5V
	7	NC	7	CLKREQ#
	8	NC	8	UIM_PWR
	9	GND	9	GND
	10	NC	10	UIM_DATA
	11	NC	11	PCle CLK+
	12	NC	12	UIM_CLK
	13	NC	13	PCle CLK-
	14	NC	14	UIM_RESET
	15	GND	15	GND
	16	NC	16	UIM_VPP
	17	NC	17	NC
	18	GND	18	GND
	19	NC	19	NC
	20	NC	20	W_DISABLE#
	21	RESV	21	RESV
	22	NC	22	NC
	23	SATA TX+ To Host System	23	PCle RX+ To Host System
	24	+3.3V	24	+3.3V
	25	SATA TX- To Host System	25	PCle RX- To Host System
	26	GND	26	GND
	27	GND	27	GND
	28	+1.5V	28	+1.5V
	29	GND	29	GND
	30	NC	30	SMB_CLK
	31	SATA RX- From Host System	31	PCle TX- From Host System
	32	NC	32	SMB_DATA
	33	SATA RX+ From Host System	33	PCle TX+ From Host System
	34	GND	34	GND
	35	GND	35	GND
	36	NC	36	USB D-
	37	GND	37	GND
	38	NC	38	USB D+
	39	+3.3V	39	+3.3V
	40	GND	40	GND
	41	+3.3V	41	+3.3V
	42	NC	42	NC
	43	RESV	43	RESV
	44	NC	44	NC
	45	NC	45	NC
	46	NC	46	NC
	47	NC	47	NC
	48	+1.5V	48	+1.5V
	49	NC	49	NC
	50	GND	50	GND
	51	NC	51	NC
	52	+3.3V	52	+3.3V

10.15 LVDS Video [P13]



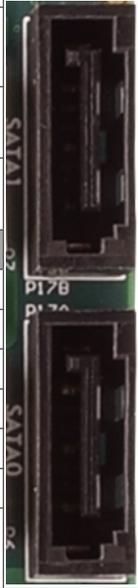
10.16 LVDS power selection [J3]

The LVDS Panel VCC voltage is selected via the J3 jumper block. The current is limited to 1.5A

Function	LVDS Panel VCC voltage		
Location	J3		
Type	2x3		
Pinout	Location	Description	
	2-4	3.3V	
	3-4	5V	
	6-4	12V	

10.17 External SATA Ports [P17A, P17B]

The SBC-477 PowerTier Series provides two SATA HDD connections as well as external power connectors for each drive.

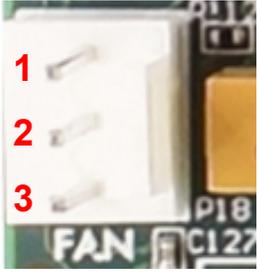
Function	SATA host		
Location	P17A- SATA- 0 P17B - SATA-1		
Type	Industry standard vertical entry SATA host connector with locking.		
Cable Number	CBL-SATA-CNT SATA HDD Signal and Power Cables (Qty. 2)		
Pinout	Pin	Description	
	1	GND	
	2	SATA_TX_P	
	3	SATA_TX_N	
	4	GND	
	5	SATA_RX_N	
	6	SATA_RX_P	
7	GND		

10.18 External SATA HDD Power [P6, P7]

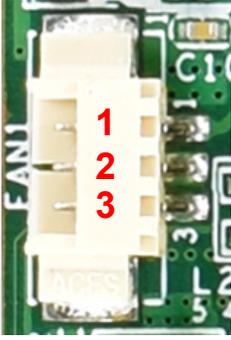
Function	SATA HDD Power		
Locations	P6, P7		
Carrier Connector PN	B4B-XH-AM(LF)(SN)(P) Manufacturer: JST		
Mating Connector PN	XHP-4 Manufacturer: JST		
Cable Number	CBL-SATA-CNT SATA HDD Signal and Power Cables (Qty. 2)		
Pinout	Pin	Description	
	1	GND (Black)	
	2	+5V (Red)	
	3	GND (Black)	
	4	+12V (Yellow)	
+12V and +5V are protected with 1200mA Raychem Poly fuses.			

NOTE The SATA power connectors are fused independently from the main +12V fuse that provides + 2V power to the board, i.e. the SATA power connectors are not double fused.

10.19 CPU Fan Connector [P18]

Function	Fan Power		
Locations	P18		
Type	Molex 22-23-2031		
Pinout	Pin	Signal	
	1	Fan Tach	
	2	+V	
	3	GND	

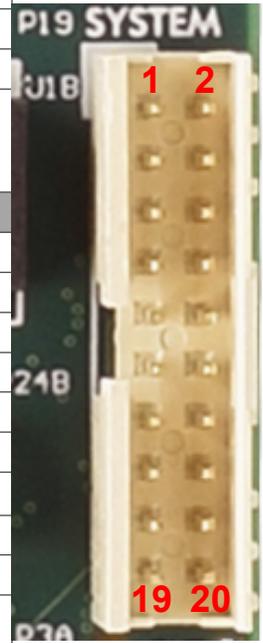
10.20 COM Fan Connector [FAN1] (Optional)

Function	Fan Power		
Locations	FAN1		
Type	Wafer 3-pin 1.25mm 85204-0300L		
Pinout	Pin	Signal	
	1	GND	
	2	+V	
	3	Fan Tach	

10.21 System Control Header [P19]

This misc header can be used to connect power button, reset button, PC speaker, I2C device and monitor other power rails. As well it provides the option of jumping the +5V rail to the +5VSB rail which may be needed by some modules.

Function	Miscellaneous Control Header			
Location	P19			
Type	FCI 98414-G06-20LF, 2x10 2mm			
Cable Number	CBL-SYS-MISC-CNT System-Misc Flying Leads to 20-Pin Minitex w/Latch (Qty. 1)			
Pinout	Pin	Description	Pin	Description
	1	+5V	2	Speaker
	3	+5V	4	+5VSB
	5	Ext CMOS Bat	6	GND
	7	System Reset	8	GND
	9	Power Button	10	GND
	11	Batlow#	12	GND
	13	Sus_S3#	14	GND
	15	I2C.CLK	16	GND
	17	I2C.DAT	18	GND
	19	+5V	20	GND



10.22 SIM card slot [P20] (Optional)

Function	SIM Socket	
Location	P20	
Type	Molex 0475530001	
Pinout		

10.23 Audio Interface [P21]

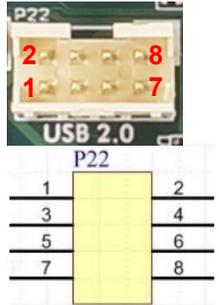
The SBC-477 PowerTier Series features HD Audio capabilities. 1 input (microphone) and 1 output (headphone) are available.

Function	Audio Connector (Cirrus Logic CS4207 codec)			
Location	P21			
Type	FCI 98414-G06-08LF, 2x4 2mm			
Cable Number	CBL-AUDIO-CNT Dual Audio to 8-Pin Minitek Cable w/Latch (Qty. 1)			
Pinout	Pin	Description	Pin	Description
	1	-	2	-
	3	MicR	4	MicL
	5	GND	6	GND
	7	Head Phone R	8	Head Phone L

10.24 USB2.0 Connector [P22]

The SBC-477 PowerTier Series external USB 2.0 ports. Each of these are directly sourced from the COM Express Type 6 module and do not go through any external hubs or bridges.

Function	USB 2.0			
Location	P22			
Type	FCI 98414-G06-08LF, 2x4 2mm			
Cable Number	CBL-USB-CNT-8PIN Dual USB 2.0 to 8-Pin MULTITEK CABLE(Qty. 1)			
Pinout	Pin	Description	Pin	Description
	1	Port A-VBUS	2	Port B-VBUS [1]
	3	Port A-D-	4	Port B-D-
	5	Port A-D+	6	Port B-D+
	7	Port A-GND	8	Port B-GND



[1] - **B-VBUS**- This voltage can be disabled for USB Client mode on USB port 6, by un-installing jumper P23 position A.

10.25 10/100/1000 Ethernet [P24A, P24B]

The SBC-477 PowerTier Series features two Ethernet Ports.

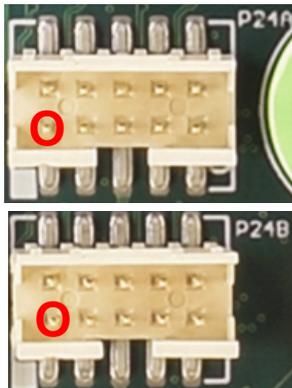
1x Port 0, Intel I226IT, 2.5Gb from COM Express

1x Port 1, 1Intel 82574I, 1Gb from Carrier

Ethernet Port 0 is coming directly from the COM Express module.

Ethernet Port 1 is coming from an Intel 82574 PCIe PHY Controller located on the carrier.

Function	LAN Connector			
Location	P24A, P24B			
Type	FCI 98424-G52-10LF			
Cable Number	CBL-ENET-CNT RJ-45 to 10-Pin Minitek Cable w/Latch (Qty. 2)			
Pinout	Pin	Description	Pin	Description
	1	MX1-	2	MX1+
	3	MX2-	4	MX2+
	5	SHELL	6	SHELL
	7	MX3-	8	MX3+
	9	MX4-	10	MX4+



10.26 Software Support for the Intel 82574

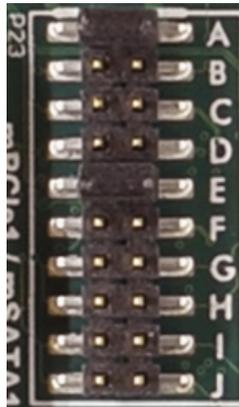
Additional drivers will be needed to properly operate the GBE Port 0 on the COM Express carrier.

These drivers can be downloaded directly from link below.

<https://www.intel.com/content/www/us/en/download-center/home.html?lang=eng&ProductFamily=Ethernet+Components&ProductLine=Ethernet+Controllers&ProductProduct=Intel%C2%AE+82574+Gigabit+Ethernet+Controller>

10.27 Multifunction Jumper Block [P23]

The SBC-477 PowerTier Series has a multi-function jumper that provides control for various interfaces and features. The "MULTI" jumper is located at P23.



Below are the full details of the MULTI jumper block functionality.

Position	Description	JUMPER IN	JUMPER OFF
A	USB Port-6 Client/Host	Port-6 USB Host enabled. Power connected	Port-6 USB Client enabled. Power Disconnected
B	SD Card/ GPIO Mux	SD Card Functionality is enabled	GPIO Functionality is enabled
C	miniPCle Slot-0 Selection	miniPCle enabled	-
D	miniPCle Slot-1 Selection	miniPCle enabled	-
E	PCle UART EEPROM	Enable PCle UART EEPROM	Disable PCle UART EEPROM
F	PCle UART - TRI State Enable	Enable TRI-State control for PCle UART	Disable TRI-State control for PCle UART
G	PCle UART - 485 Port 0- RTS-TX Control	Enable RS-485 Port-0 RTS-TX Control	Disable RS-485 Port-0 RTS· TX Control
H	PCle UART - 485 Port 0- RTS-RX Control	Enable RS-485 Port-0 RTS-RX Control	Disable RS-485 Port-0 RTS-RX Control
I	PCle UART - 485 Port 1- RTS-TX Control	Enable RS-485 Port-1 RTS-TX Control	Disable RS-485 Port-1 RTS· TX Control
J	PCle UART - 485 Port 1- RTS-RX Control	Enable RS-485 Port-1 RTS-RX Control	Disable RS-485 Port-1 RTS-RX Control

11. Typical Hardware Installation for +12V power input

1. Ensure all external system power supplies are off.
2. Install the necessary cables for the application. At a minimum, this would include:
 - a) + 12V Power cable to the input power connector.
 - b) Connect a video display cable HDMI, Display Port or LVDS.
 - c) Keyboard and mouse via USB
 - d) SATA Power and Signal to SATA HDD

For the relevant cables, see the Cables and Cable Kit Information section of this manual.

3. Connect the power cable to power supply.
4. Switch on the power supply. DO NOT power up your COM Express system by plugging in live power.

12. PCI Express Allocation Details

Below is a listing of how the PCI Express Links are allocated on the carrier board.

COM Express PCI Express Link	Peripheral Connection
PCIe x1 -0	PCIe UART (Exar 17V354)
PCIe x1 -1	miniPCIe Slot 0
PCIe x1 -2	miniPCIe Slot 1
PCIe x1 -3	PCIe GBE PHY (Intel 82574)
PCIe x1 -4	No Connect
PCIe x1 -5	No Connect
PCIe x1 -6	No Connect
PCIe x1 -7	No Connect
PEG /PCIe x16	No Connect

13. USB Allocation Details

Below is a listing of how the USB Ports are allocated on the carrier board.

COM Express USB Port	Peripheral Connection
USB 3.0 Port 0	USB 3.0 A Connector (P3A)
USB 3.0 Port 1	USB 3.0 A Connector (P3A)
USB 3.0 Port 2	USB 3.0 B Connector (P3B)
USB 3.0 Port 3	USB 3.0 B Connector (P3B)
USB 2.0 Port 4	miniPCIe Slot 0
USB 2.0 Port 5	miniPCIe Slot 1
USB 2.0 Port 6	USB 2.0 Connector (P22)
USB 2.0 Port 7	USB 2.0 Connector (P22)

14. Accessories

14.1 Cables

Cable Set	
Part Number	
CBL-SET-477-CNT-1	<ul style="list-style-type: none"> • 2x SATA HDD Signal and Power Cables • 1x Dual USB 2.0 to 8-Pin Minitex Cables • 2x DisplayPort to 20-pin Minitex Cable w/Latch • 1x System-Misc Flying Leads to 20-Pin Minitex w/Latch • 2x RJ-45 to 10-Pin Minitex Cable w/Latch • 1x Dual Audio to 8-Pin Minitex Cable w/Latch • 1x VGA to 10-Pin Minitex Cable w/Latch • 3x Dual DB-9 to 20-Pin Minitex Cable • 2x Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Inner Exit • 2x Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Outer Exit • 2x Dual USB 3.0 Panel Mount to 20-pin Locking Intl Style: Rt Angle Vertical Exit • 1x LVDS 40-Pin Unterminated

14.2 Other Accessories

External batteries, IO expansion, and 2.5" SATA SSD storage options are available to complete your out-of-box experience.

Contact Winsystems at <https://winsystems.com/contact/> for accessories options.

Appendix A. Best Practices

The following paragraphs outline the best practices for operating the SBC-477 PowerTier Series in a safe, effective manner, that does not damage the board. Read this section carefully.

Power Supply



Avoid Electrostatic Discharge (ESD)

Only handle the circuit board 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 twice 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 SBC-477 PowerTier Series typical load is not lower than the power supply's minimum load. If the SBC-477 PowerTier Series board does not draw enough power to meet the power supply's minimum load, then the power supply does not regulate properly and can cause damage to the SBC-477 PowerTier Series.



Use Proper Power Connections (Voltage)

When verifying the voltage, measure it at the power connector on the carrier board. Measuring it at the power supply does not account for voltage drop through the wire and connectors.

The SBC-477 PowerTier Series requires 12VDC input (+/- 5%) to operate. Verify the power connections. Incorrect voltages can cause catastrophic damage.

Power Harness

Minimize the length of the power harness. This reduces the amount of voltage drop between the power supply and the SBC-477 PowerTier Series.

Gauge Wire

Use the largest gauge wire that the pin and connector manufacture allows. Most pin and connector manufacturers have a maximum gauge wire they recommend for their pins.

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 or Trifurcon designs, which provide three distinct points to maximize the contact area and improve connection integrity in high shock and vibration applications.

Power Down

Make sure that power has been removed from the system before making or breaking any connections.



Power Supply OFF—Always turn off the power supply before connecting to the embedded system. Do not hot-plug the SBC-477 PowerTier Series on a host carrier board that is already powered.

I/O Connections OFF—Turn off all I/O connections before connecting them to the embedded computer modules or any I/O cards. Connecting hot signals can cause damage whether the embedded system is powered or not.

Mounting and Protecting the SBC-477 PowerTier Series

To avoid damage, mount the SBC-477 PowerTier Series properly. Standoff kits are available and recommended for use with the SBC-477 PowerTier Series.

Placing the SBC-477 PowerTier Series on mounting standoffs—Be careful when placing the SBC-477 PowerTier Series 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 board.

Do not bend or flex the SBC-477 PowerTier Series—Bending or flexing can cause irreparable damage. Embedded computer modules 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 embedded computer module 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. 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 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 provide the support the embedded computer module needs to prevent bending or flexing.

Avoid cutting the SBC-477 PowerTier Series—Never use star washers or any fastening hardware that cut into the SBC-477 PowerTier Series.

Avoid over-tightening 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.

Conformal Coating

Conformal coating by any source other than WINSYSTEMS voids the product warranty and will not be accepted for repair by WINSYSTEMS. If such a product is sent to WINSYSTEMS for repair, it will be returned at customer expense and no service will be performed. A WINSYSTEMS product conformally coated by WINSYSTEMS will be subject to regular WINSYSTEMS warranty terms and conditions.

Operations/Product Manuals

Every WINSYSTEMS product has an Operations manual or Product manual.

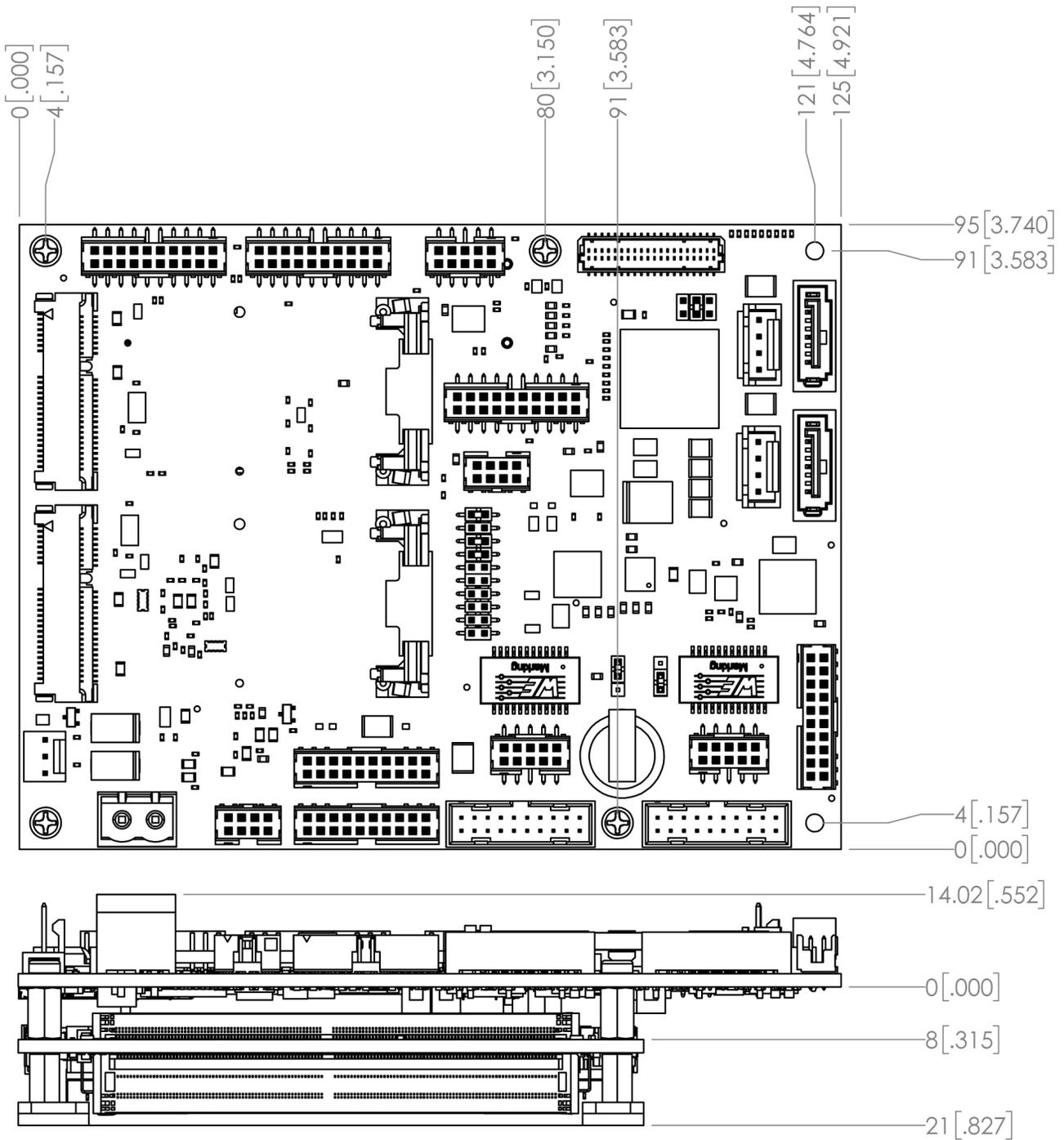
Periodic updates—Operations/product manuals are updated often. Periodically check the WINSYSTEMS website <https://www.winsystems.com/> for revisions.

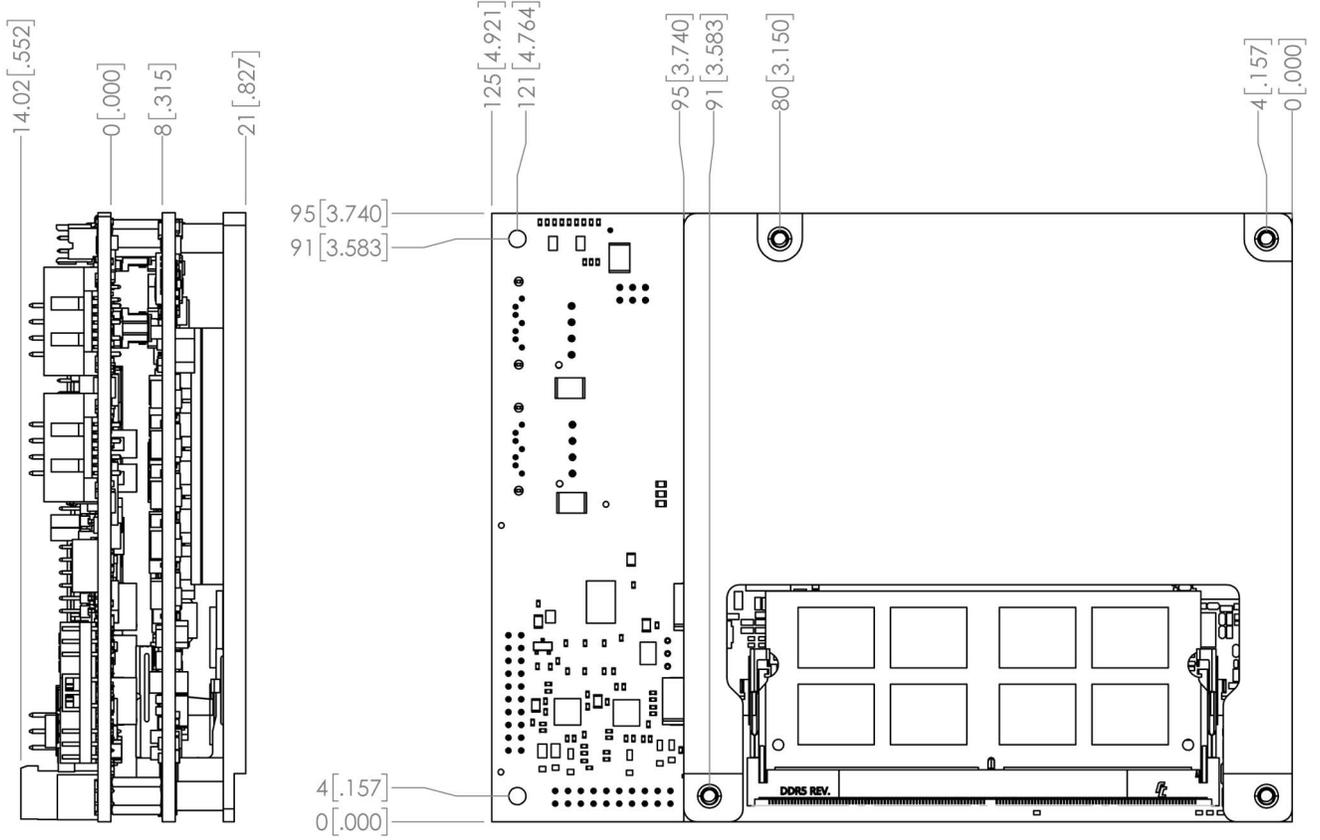
Check pin-outs—Always check the pin-out and connector locations in the manual before plugging in a cable. Many I/O modules have identical headers for different functions and plugging a cable into the wrong header can have disastrous results.

Contact an applications engineer—If a diagram or chart in a manual does not seem to match your board, or if you have additional questions, contact a WINSYSTEMS applications engineer at +1-817-274-7553.

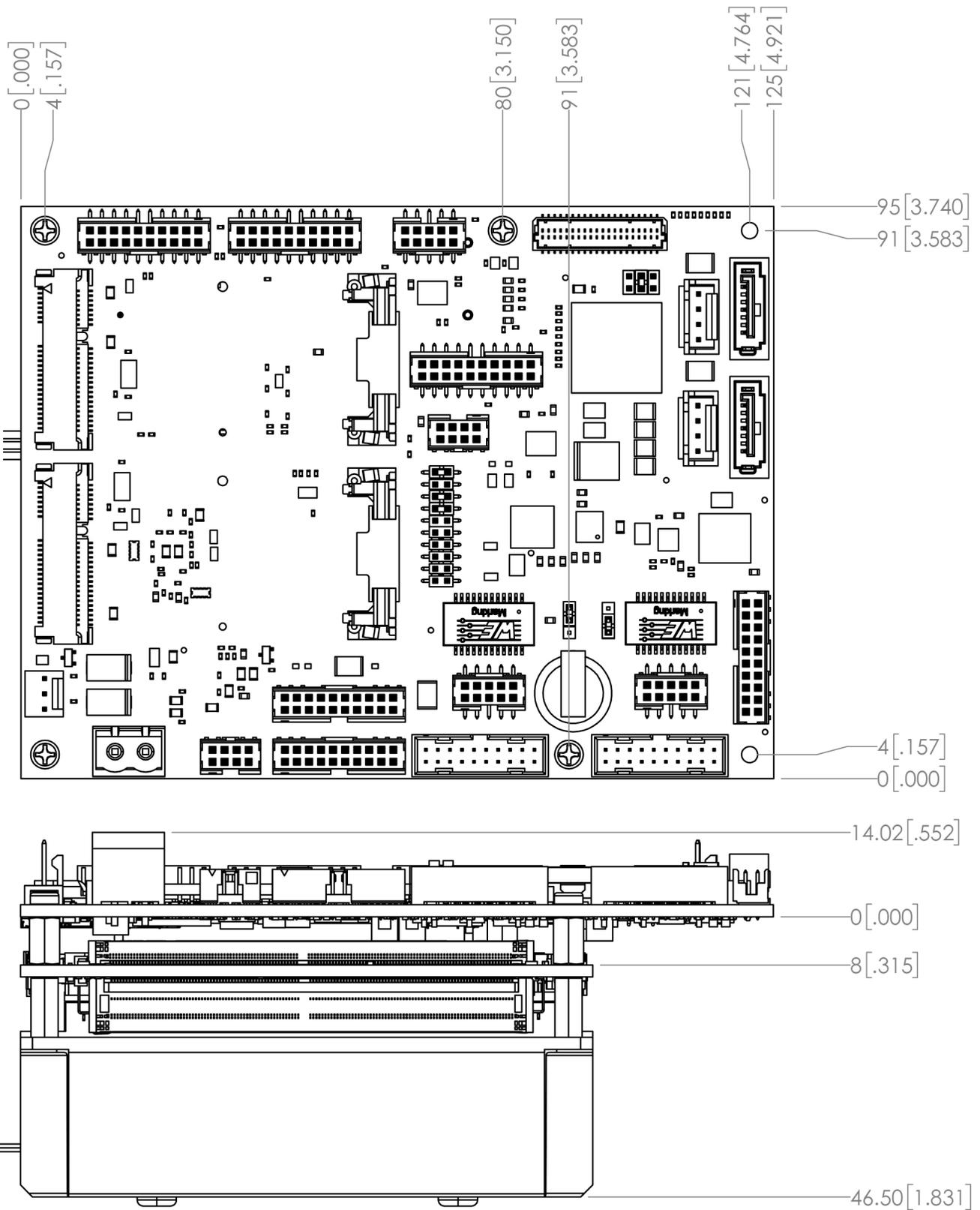
Appendix B. Mechanical Drawings

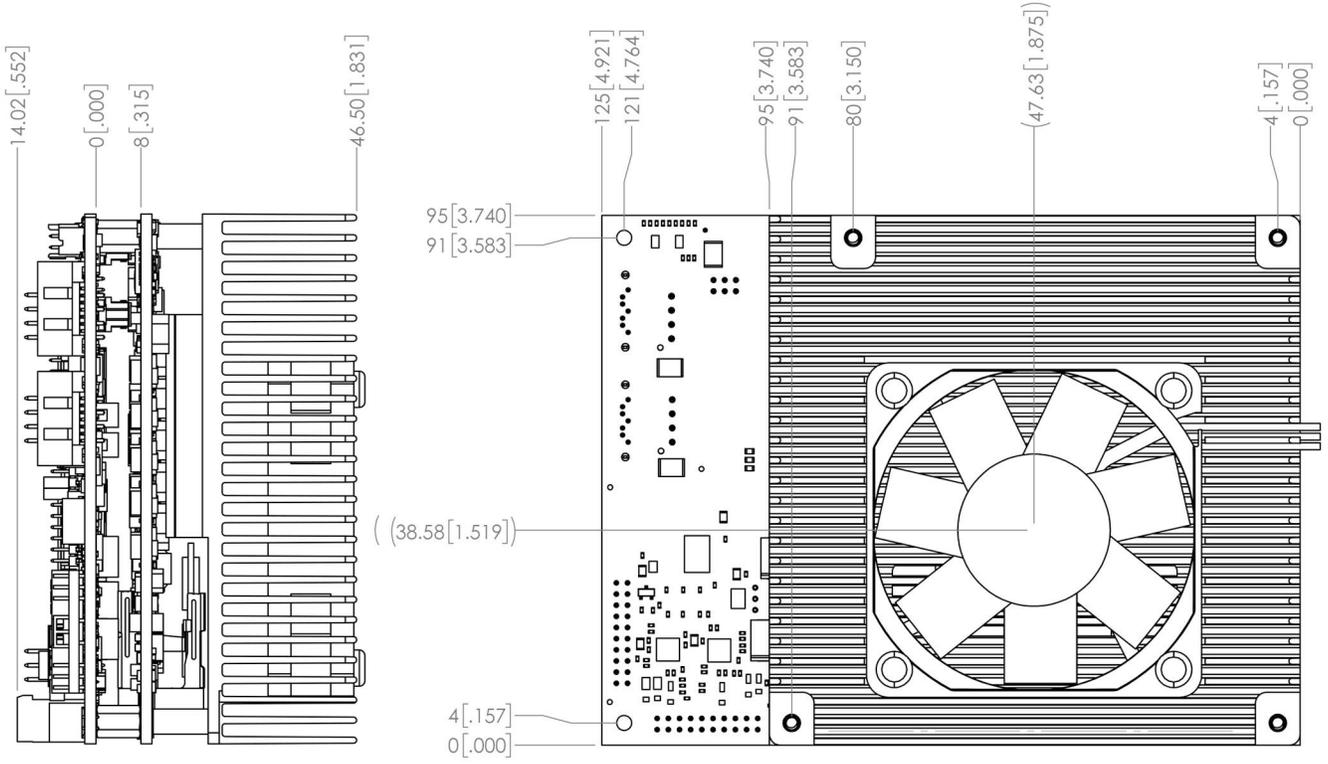
SBC-477-P-R-1





SBC-477-P-R-3





Appendix C. Warranty Information

Full warranty information is at <https://winsystems.com/company-policies/warranty/>