Connect Tech Inc.

Embedded Computing Experts

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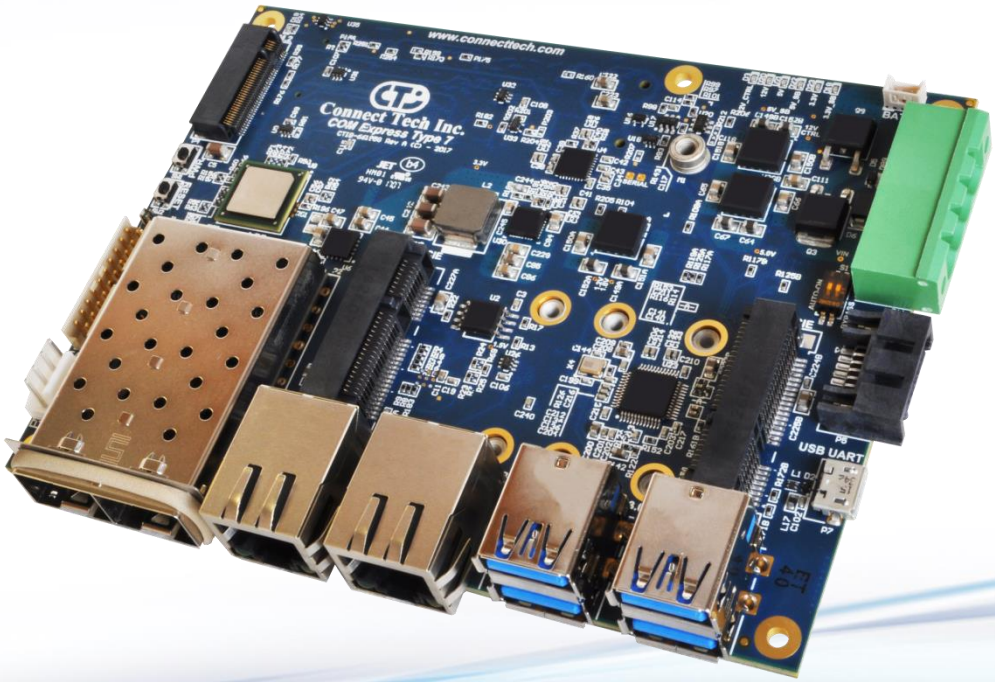
# USERS GUIDE

# COM Express® Type 7 Carrier Board

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**CTIM-00151 Revision 0.08 2020-02-05**

# Table of Contents

# Preface

## Disclaimer

The information contained within this user's guide, including but not limited to any product specification, is subject to change without notice.

Connect Tech assumes no liability for any damages incurred directly or indirectly from any technical or typographical errors or omissions contained herein or for discrepancies between the product and the user's guide.

## Customer Support Overview

If you experience difficulties after reading the manual and/or using the product, contact the Connect Tech reseller from which you purchased the product. In most cases the reseller can help you with product installation and difficulties.

In the event that the reseller is unable to resolve your problem, our highly qualified support staff can assist you. Our support section is available 24 hours a day, 7 days a week on our website at: http://connecttech.com/support/resource-center/. See the contact information section below for more information on how to contact us directly. Our technical support is always free.

## Contact Information

**Mail/Courier**
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42 Arrow Road
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**Email/Internet**

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support@connecttech.com
www.connecttech.com

**Note:**
Please go to the Connect Tech Resource Center for product manuals, installation guides, device drivers, BSPs and technical tips. Submit your technical support questions to our support engineers.

**Telephone/Facsimile**
Technical Support representatives are ready to answer your call Monday through Friday, from 8:30 a.m. to 5:00 p.m. Eastern Standard Time. Our numbers for calls are:

**Toll Free**: 800-426-8979 (North America only)
**Telephone**: 519-836-1291 (Live assistance available 8:30 a.m. to 5:00 p.m. EST, Monday to Friday)
**Facsimile**: 519-836-4878 (on-line 24 hours)

# Limited Product Warranty

Connect Tech Inc. provides a two-year Warranty for the COM Express® Type 7 Carrier Board. Should this product, in Connect Tech Inc.'s opinion, fail to be in good working order during the warranty period, Connect Tech Inc. will, at its option, repair or replace this product at no charge, provided that the product has not been subjected to abuse, misuse, accident, disaster or non-Connect Tech Inc. authorized modification or repair.

You may obtain warranty service by delivering this product to an authorized Connect Tech Inc. business partner or to Connect Tech Inc. along with proof of purchase. Product returned to Connect Tech Inc. must be pre-authorized by Connect Tech Inc. with an RMA (Return Material Authorization) number marked on the outside of the package and sent prepaid, insured and packaged for safe shipment. Connect Tech Inc. will return this product by prepaid ground shipment service.

The Connect Tech Inc. Limited Warranty is only valid over the serviceable life of the product. This is defined as the period during which all components are available. Should the product prove to be irreparable, Connect Tech Inc. reserves the right to substitute an equivalent product if available or to retract the Warranty if no replacement is available.

The above warranty is the only warranty authorized by Connect Tech Inc. Under no circumstances will Connect Tech Inc. be liable in any way for any damages, including any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, such product.

# Copyright Notice



# Trademark Acknowledgment

## ESD Warning

Electronic components and circuits are sensitive to Electrostatic Discharge (ESD). When handling any circuit board assemblies including Connect Tech COM Express carrier assemblies, it is recommended that ESD safety precautions be observed. ESD safe best practices include, but are not limited to:

- Leaving circuit boards in their antistatic packaging until they are ready to be installed.
- Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static charge that may be present on you.
- Only handling circuit boards in ESD safe areas, which may include ESD floor and table mats, wrist strap stations and ESD safe lab coats.
- Avoiding handling circuit boards in carpeted areas.
- Try to handle the board by the edges, avoiding contact with components.

# Revision History

| Revision | Date | Changes |
|---|---|---|
| 0.00 | 2017-03-13 | Preliminary Release |
| 0.01 | 2017-03-14 | Add Appendix |
| 0.02 | 2017-03-17 | Update cable kit |
| 0.03 | 2017-04-17 | Add detailed features |
| 0.04 | 2017-05-19 | Update installation notes, and 3rd party equipment list |
| 0.05 | 2017-07-11 | Added cable drawing links |
| 0.06 | 2018-04-12 | Updated Serial/GPIO P8 |
| 0.07 | 2018-11-29 | Added product weight |
| 0.08 | 2020-02-05 | Added CCG170 |

# Introduction

Connect Tech's COM Express® Type 7 Carrier Board is based on the PICMG COM Express® COM.0 R3.0 specification. It includes 2x 10G ethernet from SFP+ modules, 2x Gigabit Ethernet ports, M.2 NVMe Storage, 4x USB 3.0, full and half size Mini PCIe expansion slots, 8x 3.3V buffered GPIO, and a Console connection via Micro USB.

The carrier board is ideal for high-compute, enterprise level applications that have a need for a small form factor rugged solution providing access to high-end Xeon D class processors.

## Product Features and Specifications

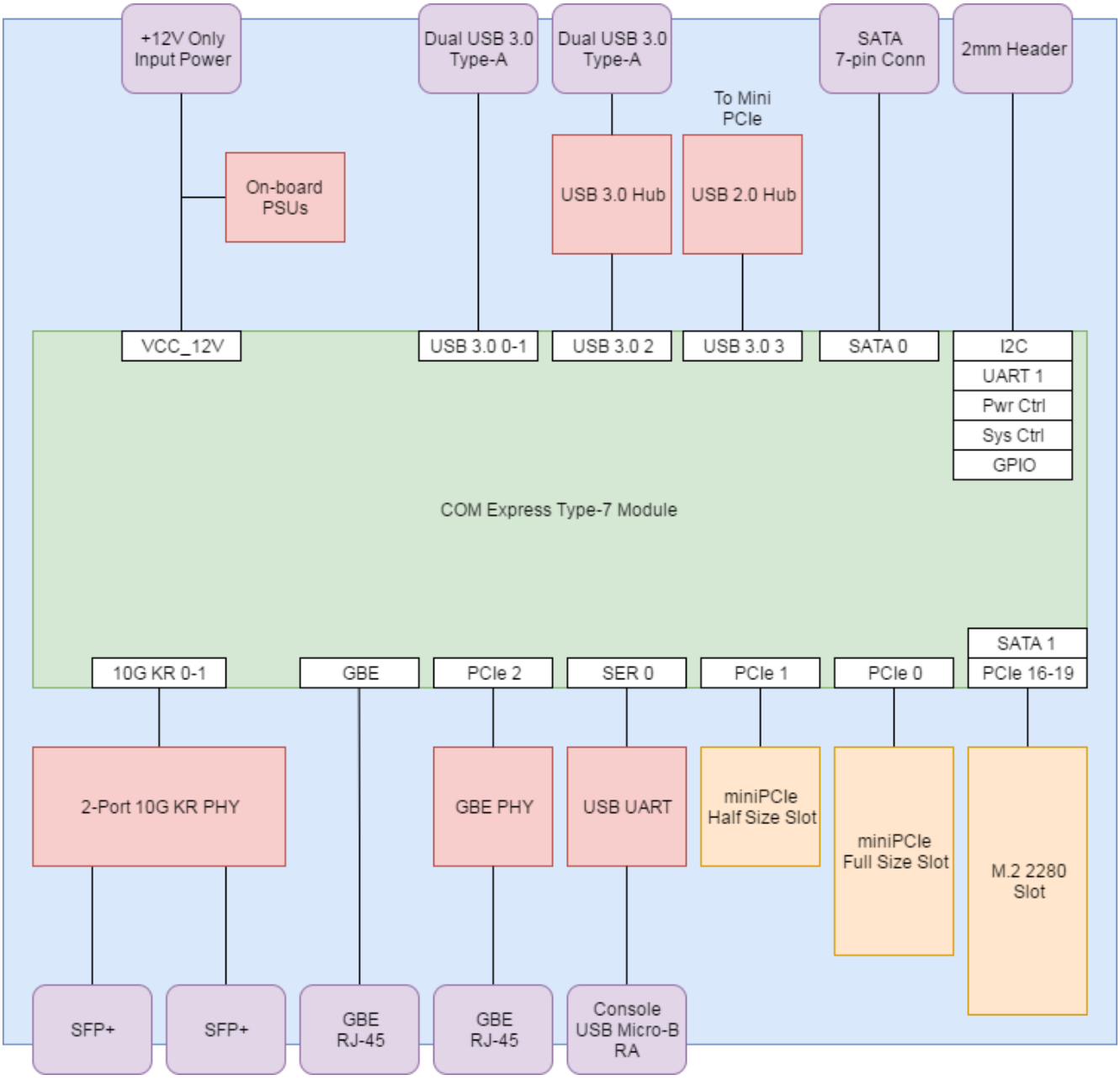
| Specifications | |
|---|---|
| Compatibility | COM Express Type 7 Modules<br>PICMG COM Express® COM.0 R3.0<br>Support for current and next-gen Xeon-D (Broadwell DE) processor modules |
| Network | 2 x 10GbE (via SFP+ cages)<br>Integrated 10Gbps PHY located directly on the carrier board<br>Capable of 10GBASE-SR, 10GBASE-LR or 10GBASE-T using when using the appropriate SFP+ transceiver module.<br><br>2 x GBE Ports (via RJ-45) 1000BASE-T (10/100/1000Mbps) Capable |
| Storage | 1 x M.2 2280 M-Key Slot (Dual function PCIe + SATA)<br>- NVMe (PCIe x4 Gen3) Capable<br>- SATA III (6Gbps) Capable<br><br>1 x Standard SATA Port (7-Pin) |
| USB | 4x USB 3.0 ports |
| Mini PCIe Expansion | 1x mini PCIe slot full size (USB + PCIe)<br>1x mini PCIe slot half size (USB + PCIe) |
| Serial | 1x CPU Console UART (via Micro USB)<br>1x General Purpose UART (via 2mm header) |
| GPIO | 8x 3.3V buffered GPIO |
| Display | Not directly supported, possible through Mini PCIe expansion |
| Audio | Not directly supported, possible through Mini PCIe expansion |
| Misc External Interfaces | Reset Button, Power Button, Sys Ctrl |
| Power | +12V DC only |
| RTC Battery | Available through header |
| Dimensions | 125mm x 95mm (4.921" x 3.74")<br>3D model: http://www.connecttech.com/ftp/3d_models/CCG070_3D_MODEL.zip |
| Weight | 124g (0.27lbs) |
| Operating Temperature | -40°C to +85°C |

## Part Numbers / Ordering Information

| Part Number | |
|---|---|
| CCG070 | supports Broadwell processors |
| CCG170 | supports Denverton processors |

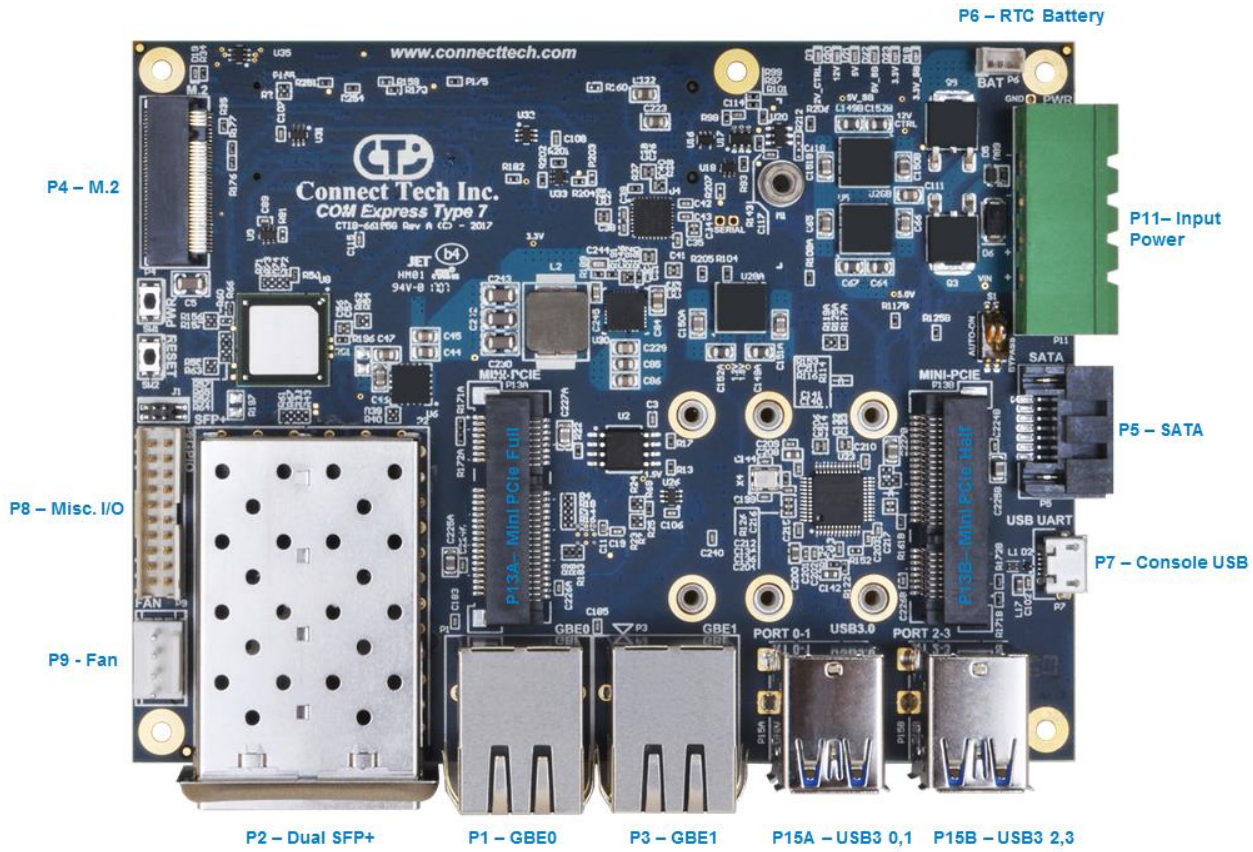
# Product Overview

## Block Diagram

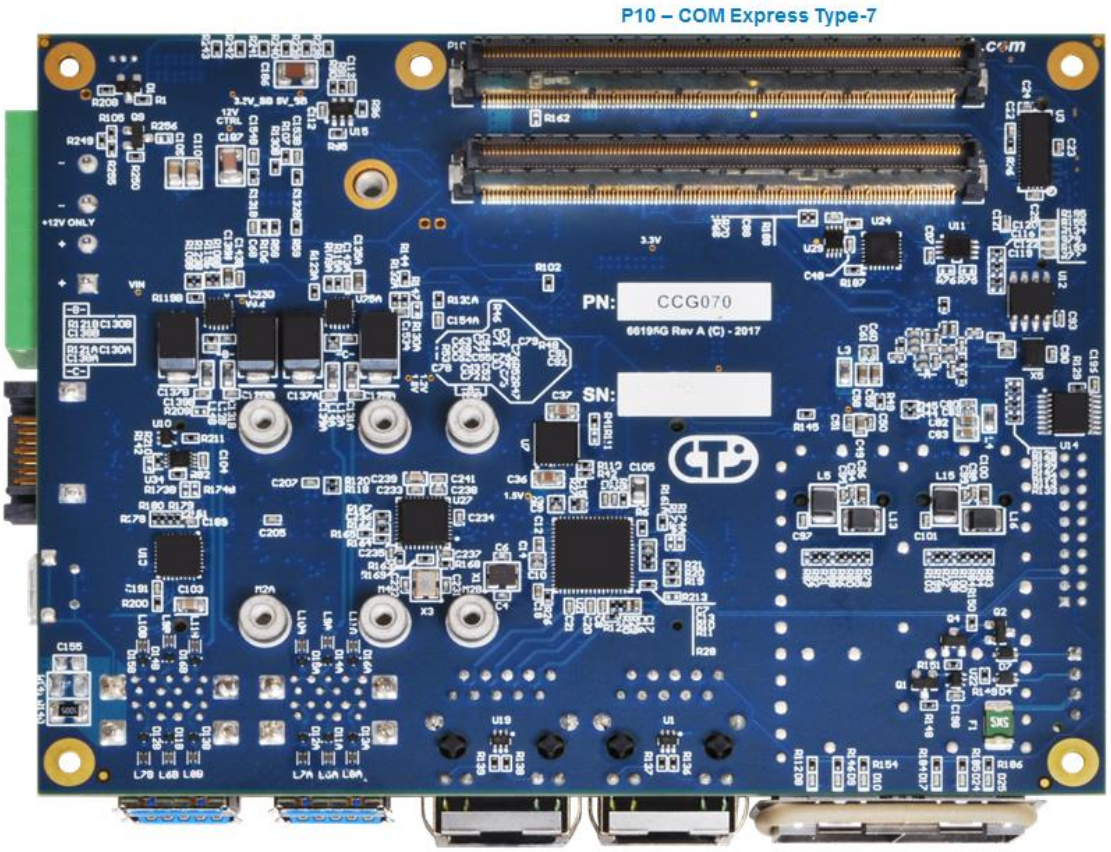


# Connector Locations

## Top View



### Bottom View




## Jumper and Connector Summary

| Designator | Description |
|---|---|
| P1 | 10/100/1000 Ethernet |
| P2 | Dual SFP+ |
| P3 | 10/100/1000 Ethernet |
| P4 | M.2 |
| P5 | SATA |
| P6, | RTC Battery |
| P7 | Micro USB Console |
| P8 | Misc. I/O |
| P9 | CPU Fan |
| P10 | COM Express |
| P11 | Input Power |
| P13A, P13B | Mini PCIe |
| P15A, P15B | USB 3.0 |
| J1 | NVMe selection |
| S1 | Power Selection |

# Detailed Feature Description

Preface: This section includes pinouts for all non-standard connectors. For all industry standard connectors; the user will need to refer to the appropriate specification provided by the governing body.

## COM Express Module Connector

The processor and chipset are implemented on the COM Express Type 7 CPU module, which connects to the COM Express carrier via a Tyco fine pitch stacking connector. 8mm standoffs are required to mount COM Express module. The following table describe how each of Type-7 module interfaces are used and allocated to the carrier resources.

| | |
|---|---|
| Function | COM Express interface |
| Location | P10 |
| Type | Tyco 3-5353652-6 |
| Pinout | Refer to PICMG COM Express 3.0 |

### COM Express Interface Usage and Allocation

| Module Interface | Carrier Endpoint | Connection Type | Circuitry Involved |
|---|---|---|---|
| 10G KR0 | P2 | Dual SFP+ | KR-SFP PHY |
| 10G KR1 | P2 | Dual SFP+ | KR-SFP PHY |
| 10G KR2 | N/A | not used | |
| 10G KR3 | N/A | not used | |
| GBE0 | P1 | P1 - RJ45 | |
| GPIO (in and out) | *not used* | *not used* | |
| I2C | P8 | Header | various |
| LPC | *not used* | *not used* | |
| NCSI | *not used* | *not used* | |
| PCIe0 | P13A | Mini PCIe | |
| PCIe1 | P13B | Mini PCIe | |
| PCIe2 | P3 | RJ45 | PCIe MAC/PHY |
| PCIe3-15 | *not used* | *not used* | |
| PCIe16-19 | P4 | M.2 | PCIe / SATA mux on 16 |
| PCIe20-31 | *not used* | *not used* | |
| SATA0 | P5 | 7 pin SATA | PCIe / SATA mux |
| SATA1 | P4 | M.2 | |
| SER0 | P7 | Micro USB | USB UART |
| SER1 | P8 | Header | |
| SMB | *not used* | *not used* | |
| SPI | *not used* | *not used* | |
| USB0 | P15A | USB 3.0 | |
| USB1 | P15A | USB 3.0 | |
| USB2 | P15B Top, Bottom | USB 3.0 | USB 3.0 Hub |
| USB3 (2.0 only) | P13A, B | Mini PCIe | USB 2.0 Hub |

# Network

The carrier provides 4 network interfaces. One 10/100/1000 Ethernet direct from the COM Express module, one 10/100/1000 ethernet from a PCIe MAC/PHY, and two SFP+ 10G Ethernet implement use the Type-7 10G BASE KR Interfaces. All connectors are industry standard RJ-45 pinout and SFP+ pinout

| | |
|---|---|
| Function | Dual SFP+ |
| Location | P2 |
| Type | Samtec SFPK-2SL-02-S-TR |
| Pinout | Refer to Small Form Factor Pluggable SFF-8431 |

| | |
|---|---|
| Function | RJ-45 |
| Location | P1. P3 |
| Type | Pulse JXD0-0001NL |
| Pinout | Refer to IEEE 802.3 |

# USB

The carrier provides 2x Dual USB3.0 connectors. One connector has USB3.0 directly from the COM Express module. The other connector has USB3.0 supplied by a Hub. All connectors are industry standard USB3.0 right angle.

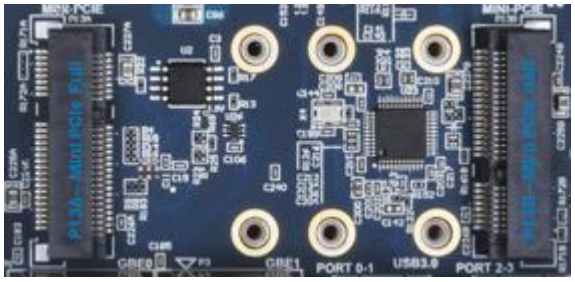
| | |
|---|---|
| Function | USB |
| Location | P15A,B |
| Type | TE 1932355-4 |
| Pinout | Refer to Universal Serial Bus 3.0 Specification |

# Bus Expansion

One half sized Mini PCIe and One full sized Mini PCIe are provided. These slots support both a x1 PCIe and USB2.0 connection simultaneously to facilitate using WIFI / Bluetooth combo cards. Both 3.3V and 1.5V are provided to each slot.

These slots DO NOT support mSATA modules and DO NOT have support for external SIM cards.

| | |
|---|---|
| Function | Mini PCIe |
| Location | P15A, P15B |
| Type | TE 1932355-4 |
| Pinout | Refer to PCISIG PCI Express Mini Card Electromechanical Specification Revision 2.0 |



# Storage

The carrier can either be booted from an external SATA HDD/SDD or through an onboard M.2 NVMe or M.2 SATA drive.

The M.2 slot can support either a M.2 x4 PCIe based NVMe or SATA based. The carrier board automatically handles the switching, however J1 can be used to forced the selection. (J1 off = PCIe based, on = SATA based)

| | |
|---|---|
| Function | M.2, Key M |
| Location | P4 |
| Type | TE 1-2199230-5 |
| Pinout | Refer to PCISIG PCI Express M.2 Specification |


| | |
|---|---|
| Function | SATA |
| Location | P5 |
| Type | Molex 0470804001 |
| Pinout | Refer to SATA-IO Serial ATA |

# Serial and GPIO

The carrier provides an on-board USB UART which acts as a USB client to an external USB host; such as a laptop. This allows the user to view the BIOS or OS over USB, providing the module and operating system have been configured correctly. This UART is connected to the SER0 interface of the COM Express module.

Also provided are the SER1 interface (3.3V UART signal levels only), GPIO from an I2C expander, and a connection to the I2C bus.

The GPIO Expander is XRA1200 at address 0x40 (8 bit address).

| | |
|---|---|
| Function | Micro USB, USB serial Console |
| Location | P7 |
| Type | Molex 47589-0001 |
| Pinout | Refer to Universal Serial Bus 2.0 Specification |


| | |
|---|---|
| Function | Micro USB, USB serial Console |
| Location | P8 |
| Type | FCI 98414-G06-20LF |
| Cable | See Cables and Accessories |
| Pinout | |

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | PWRBTN# (*) | 2 | GND |
| 3 | SYS_RST# (*) | 4 | GND |
| 5 | I2C_SCL (*) | 6 | GND |
| 7 | I2C_SDA (*) | 8 | GND |
| 9 | GPIO0 | 10 | GPIO4 |
| 11 | GPIO1 | 12 | GPIO5 |
| 13 | GPIO2 | 14 | GPIO6 |
| 15 | GPIO3 | 16 | GPIO7 |
| 17 | SER1_TX (*) | 18 | GND |
| 19 | SER1_RX (*) | 20 | GND |

(*) COM Express module signals

# Input Power, RTC Battery and Fan

Input power is provided through a two-part terminal connector. The carrier accepts only a +12V DC input; and uses that to generate all other power rails.

On-board circuitry facilitates an ATX power up scheme, which is controllable through switch S1. The COM Express module's active cooling solution can be connected to the fan connector P9. The COM Express module's RTC battery is supplied through connector P6. Users can provide their own RTC battery solution or purchase one provided by Connect Tech.

| | |
|---|---|
| Function | Input Power |
| Location | P11 |
| Type | FCI 20020111-G041A01LF (on board)<br>FCI 20020003-G041B01LF(provided) |
| Pinout | |

| Pin | Signal |
|---|---|
| 1 | VIN |
| 2 | VIN |
| 3 | GND |
| 4 | GND |


| | |
|---|---|
| Function | RTC Battery |
| Location | P6 |
| Type | Molex 53047-0310 |
| Cable | See Cables and Accessories |
| Pinout | |

| Pin | Signal |
|---|---|
| 1 | VBAT |
| 2 | No connect |
| 3 | GND |


| | |
|---|---|
| Function | CPU Fan, standard 4 pin |
| Location | P9 |
| Type | Molex 22232041 |
| Pinout | |

| Pin | Signal |
|---|---|
| 1 | PWM |
| 2 | TACH |
| 3 | +12VV |
| 4 | GND |

<table>
<tr><td>Function</td><td colspan="2">Power Selection</td><td rowspan="5"> 
</td></tr>
<tr><td>Location</td><td colspan="2">S1</td></tr>
<tr><td>Type</td><td colspan="2">2x 2 position switch</td></tr>
<tr><td>Pinout</td><td colspan="2"><table>
<tr><th>Switch</th><th>State</th><th>Function</th></tr>
<tr><td>1</td><td>Off (up)</td><td>12V controlled by SUS_S3#</td></tr>
<tr><td>1</td><td>On (down)</td><td>12V always on (Bypass)</td></tr>
<tr><td>2</td><td>Off (up)</td><td>Manual Power Button</td></tr>
<tr><td>2</td><td>On (down)</td><td>Auto Power Button</td></tr>
</table>
Both switches Off will produce an ATX style power up sequence.</td></tr>
</table>

## RTC Battery

This carrier has a connector P6 providing 3.3V to VBAT, which is the supply for the RTC Clock of the COM Express module.

For further information about RTC battery selection and life time estimation, see Application Note 00009 CTIN-00009 http://connecttech.com/pdf/CTIN-00009.pdf

# Typical Hardware Installation for +12V power input

1. Ensure all external system power supplies are off.

2. Install the COM Express module into P10. Be sure to follow the manufacturer's direction for proper heatsink/heat spreader installation and any other cooling instructions from the manufacturer. If active cooling is used plug the 4-pin fan connector into P9.

3. Install the necessary cables for the application. For the relevant cables, see the Cables & Interconnect section of this manual. Minimum recommended connections:
   - Micro USB for COM Express console redirection into P7
   - RTC Battery cable into P6

4. Connect the power cable to power supply

5. Set up console redirection
   - Plug the host end of the Micro USB cable into desktop or laptop system.
   - Assuming a Windows based system, a FTDI serial driver will install. The USB serial circuit is isolated from the rest of the CCG070 carrier and powered from the cable.
   - Run a terminal emulator such as PUTTY, and connect to COM## at 115200 kbps 8N1 (8 bit, 1 stop, no parity). Consult with the module vendor's documentation to confirm these settings.

   NOTE: not all Type-7 modules have console re-direction enabled by default. Consult the module vendor's documentation for further details.

6. For an initial installation & first time power up:
   - Set the S1 into +12V always on mode (bypass mode) and manual power button.
   - Switch on the power supply – for the very first boot after installing a module into a new carrier a power cycle may be required.

# Cables and Accessories

## Available from Connect Tech

| Drawing No. | Part No. | Description | CKG043 |
|---|---|---|---|
| CTIC-00435 | CBG116 | System-Misc to 20-pin Minitek Cable | 1 |
| CTIC-00477 | CBG136 | RTC Battery Cable | 1 |
| OEM | CBG247 | Micro USB Cable | 1 |

CKG043 Cable Kit also available.

## Useful Third Party Hardware and Accessories

### Assembly Hardware

| Manufacturer | Part No. | Description | Qty | Purpose |
|---|---|---|---|---|
| McMaster-Carr | 94669A100 | 6mm unthreaded spacer, M2.5, AL | 4 | Mini PCIe install |
| McMaster-Carr | 92000A107 | 12 mm Philips Pan Head M2.5 Screw SS | 4 | Mini PCIe install |
| McMaster-Carr | 92000A114 | 5 mm Philips Pan Head M3 Screw SS | 1 | M.2 install |
| McMaster-Carr | 94669A615<br>Or<br>94669A102 | 8mm unthreaded spacer, M2.5, AL | 5 | COM Express module install * |
| McMaster-Carr | 91828A113 | 2mm nut, M2.5 SS | 5 | COM Express module install * |
| McMaster-Carr | 92000A112<br>to<br>92005A079 | 25 mm Philips Pan Head M2.5 Screw<br><br>30 mm Philips Pan Head M2.5 Screw | 5 | COM Express module install * |

(*) Hardware required will depend on the vendor's cooling solution

### Cables and Modules

| Manufacturer | Part No. | Type | Description |
|---|---|---|---|
| Innodisk | EMPV-1201-W1 | Mini PCIe | Mini PCIe to dual VGA & HDMI(DVI-D Single Link) module |
| Innodisk | 7W9000000080 | Cable | Dual VGA Cable for above |
| Innodisk | 7W9000000020 | Cable | HDMI Cable for above |
| Avago | AFBVR-2CAR10Z | SFP+ Cable | 10G Ethernet SFP+ Active Optical Cable |
| Intel | SSDSCKJW180H601 | M.2 SSD | SSD 180GB 80mm SATA 6Gb/s, 16nm, MLC |
| Samsung | MZ-V6E250 | M.2 SSD | SSD 250GB PCIe 3.0 x4, NVMe 1.2 |