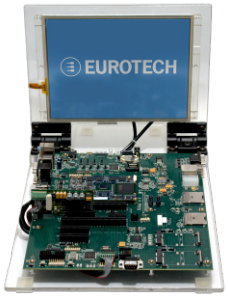
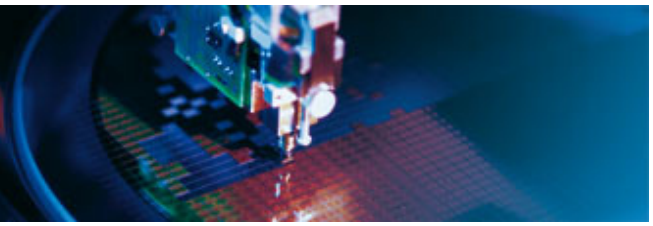
USER MANUAL





Catalyst TC

Development Kit

Rev 2 – June 2011 – 110125-90002

www.eurotech.com

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Document Revision History

REVISION	DESCRIPTION	DATE
1	Preliminary release	February 2011
2	Initial release	June 2011

Table of Contents

Important User Information

In order to lower the risk of personal injury, electric shock, fire, or equipment damage, users must observe the following precautions as well as good technical judgment, whenever this product is installed or used.

All reasonable efforts have been made to ensure the accuracy of this document; however, Eurotech assumes no liability resulting from any error/omission in this document or from the use of the information contained herein.

Eurotech reserves the right to revise this document and to change its contents at any time without obligation to notify any person of such revision or changes.

Safety Notices and Warnings

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Eurotech assumes no liability for the customer's failure to comply with these requirements.

The safety precautions listed below represent warnings of certain dangers of which Eurotech is aware. You, as the user of the product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Installation in Enclosures

In the event that the product is placed within an enclosure, together with other heat generating equipment, ensure proper ventilation.

Do Not Operate in an Explosive Atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Alerts that can be found throughout this manual

The following alerts are used within this manual and indicate potentially dangerous situations.

Danger, electrical shock hazard:
Information regarding potential electrical shock hazards:

- Personal injury or death could occur. Also damage to the system, connected peripheral devices, or software could occur if the warnings are not carefully followed.
- Appropriate safety precautions should always be used, these should meet the requirements set out for the environment that the equipment will be deployed in.

Warning:
Information regarding potential hazards:

- Personal injury or death could occur. Also damage to the system, connected peripheral devices, or software could occur if the warnings are not carefully followed.
- Appropriate safety precautions should always be used, these should meet the requirements set out for the environment that the equipment will be deployed in.

Information and/or Notes:
These will highlight important features or instructions that should be observed.

Use an Appropriate Power Supply

- Only start the product with a power supply that conforms to the voltage requirements as specified in Power Supply, page 56. In case of uncertainty about the required power supply, please contact your local Eurotech Technical Support Team.
- Use power supplies that are compliant with SELV regulation.
- Use certified power cables. The power cable must fit the product, the voltage, and the required current. Position cable with care. Avoid positioning cables in places where they may be trampled on or compressed by objects placed on it. Take particular care of the plug, power-point, and outlet of power cable.
- Avoid overcharging power-points.

Antistatic Precautions

To avoid damage caused by ESD (Electro Static Discharge), always use appropriate antistatic precautions when handing any electronic equipment.

Life Support Policy

Eurotech products are not authorized for use as critical components in life support devices or systems without the express written approval of Eurotech.

Warranty

For Warranty terms and conditions users should contact their local Eurotech Sales Office.

See Eurotech Worldwide Presence, page 67 for full contact details.

WEEE

The information below is issued in compliance with the regulations as set out in the 2002/96/EC directive, subsequently superseded by 2003/108/EC. It refers to electrical and electronic equipment and the waste management of such products. When disposing of a device, including all of its components, subassemblies, and materials that are an integral part of the product, you should consider the WEEE directive.

This device is marketed after August 13, 2005 and you must separate all of its components when possible and dispose of them in accordance with local waste disposal legislations.

- Because of the substances present in the equipment, improper use or disposal of the refuse can cause damage to human health and to the environment.
- With reference to WEEE, it is compulsory not to dispose of the equipment with normal urban refuse and arrangements should be instigated for separate collection and disposal.
- Contact your local waste collection body for more detailed recycling information.
- In case of illicit disposal, sanctions will be levied on transgressors.

RoHS

This device, including all it components, subassemblies and the consumable materials that are an integral part of the product, has been manufactured in compliance with the European directive 2002/95/EC known as the RoHS directive (Restrictions on the use of certain Hazardous Substances). This directive targets the reduction of certain hazardous substances previously used in electrical and electronic equipment (EEE).

Technical Assistance

If you have any technical questions, cannot isolate a problem with your device, or have any enquiry about repair and returns policies, contact your local Eurotech Technical Support Team.

See Eurotech Worldwide Presence, page 67 for full contact details.

Transportation

When transporting any module or system, for any reason, it should be packed using anti-static material and placed in a sturdy box with enough packing material to adequately cushion it.

Warning:
Any product returned to Eurotech that is damaged due to inappropriate packaging will not be covered by the warranty.

Conventions

The following table describes the conventions for signal names used in this document.

Convention	Explanation
GND	Digital ground plane
#	Active low signal
_P	Positive signal in differential pair
_N	Negative signal in differential pair

The following table describes the abbreviations for direction and electrical characteristics of a signal used in this document.

Type	Explanation
I	Signal is an input to the system
O	Signal is an output from the system
IO	Signal may be input or output
P	Power and ground
A	Analog signal
OD	Open-drain
CMOS	3.3 V CMOS
LVCMOS	1.05 V CMOS
LVTTL	Low Voltage TTL
3.3	3.3 V signal level
5	5 V signal level
HDA	High Definition Audio, 3.3 V
LVDS	Low Voltage Differential Signalling
PCIe	PCI Express signal
SDVO	Serial-DVO differential buffer, not 3.3 V tolerant
NC	No Connection
Reserved	Use is reserved to Eurotech

Some signals include termination on the Catalyst TC or carrier board. The following table describes the abbreviations that specify the signal termination.

Termination	Explanation
PU	Pull-up resistor to the specified voltage
PD	Pull-down resistor
R	Series resistor
C	Series capacitor

Product Overview

The Catalyst TC Development Kit provides a development platform for the Catalyst TC and a reference for custom carrier board design. The kit consists of the following components:

- Catalyst TC with Catalyst TC Development Kit carrier board
- 10.4-inch TFT LCD with SVGA resolution (800 x 600, 6-bit color) and cable
- CCFL backlight inverter and cable
- 4-wire resistive touch panel and cable
- Catalyst Module Display Adapter
- USB flash drive loaded with Windows® Embedded Standard or Wind River Linux (future option)
- FreeDOS USB flash drive for BIOS updates
- 12 VDC adapter and AC cord
- DB9FF cable (for maintenance port P2 only)
- Plexiglas mounting
- Stylus and screen cleaning cloth

Please make sure you have received all the components before you begin your development. For details about getting started, refer to the *Catalyst TC Development Kit Quick Start (Eurotech document #110125-9001)*.

As a development platform, this kit allows you to become familiar with the Catalyst TC functionality prior to customization for your specific application. Utilize the development kit to validate your proposed design for both software and hardware. For example, if a USB device is to be used on USB port 6, test that device by connecting it to USB port 6 on the development kit running your application. This type of testing also allows you to validate your operating system image with all required drivers loaded.

To provide flexibility and allow development across a broad spectrum of end-use applications, the Catalyst TC Development Kit carrier board maximizes the Catalyst TC functionality and implements many industry-standard interfaces. This configuration provides a valuable reference for your application-specific carrier board. Use Eurotech's carrier board as a starting point for your design. Using the same connectivity to the module and the same components will minimize the time spent in debugging your new design.

In addition to the Catalyst TC Development Kit, Eurotech provides a variety of services to ensure that your Catalyst TC-based product is up and running from the first prototype release. Stay in contact with your sales and support representatives throughout your development cycle to ensure a complete and robust solution with which to move forward.

Block Diagram

The following diagram illustrates the system organization of the Catalyst TC Development Kit. Notice that the data connector has been divided into two sections for this illustration. Functionality provided by the Catalyst TC is included in the dark blue section, while functionality provided by the carrier board is included in the light blue-gray section. Dotted lines indicate options.

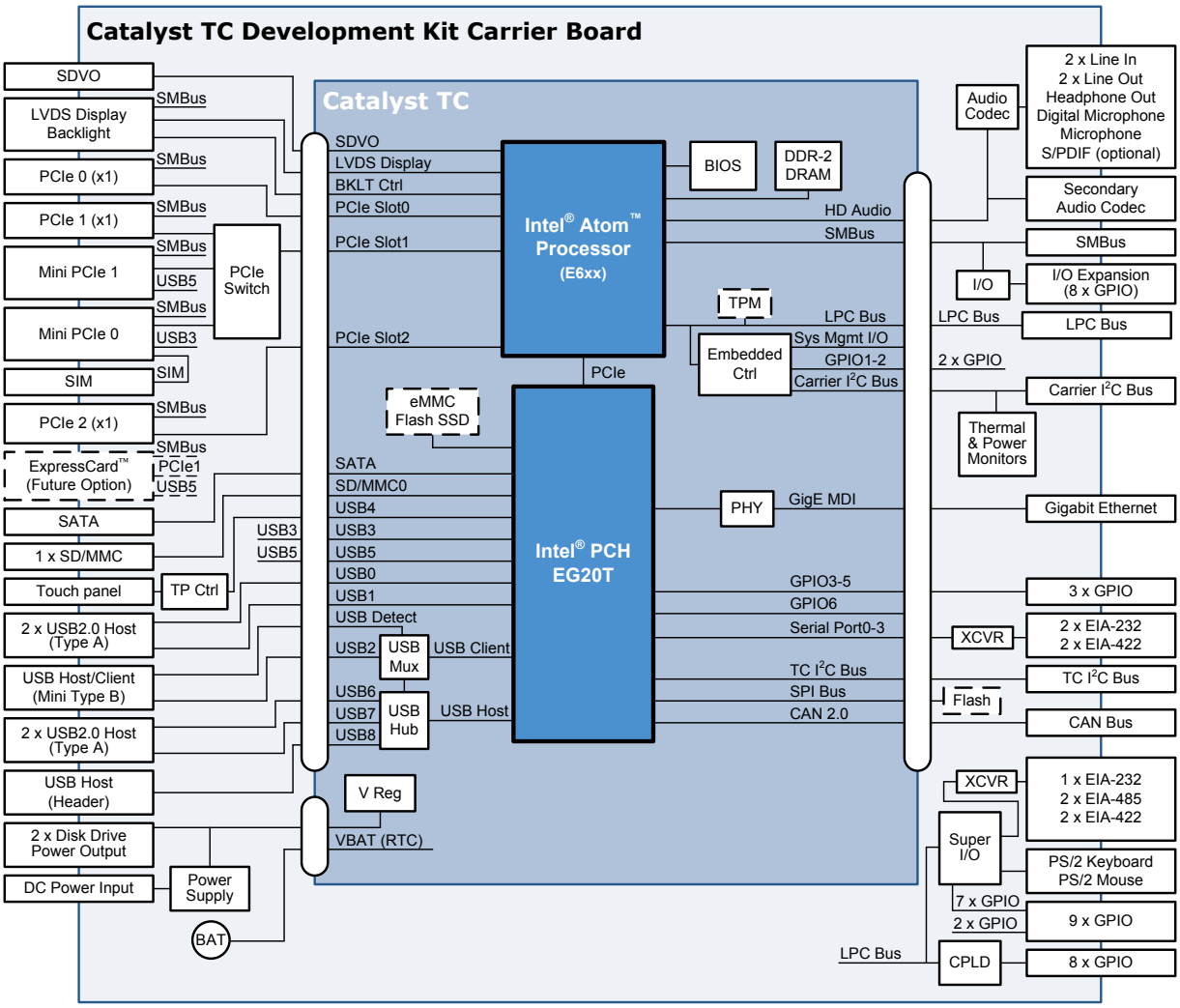


Figure 1. Catalyst TC Development Kit Block Diagram

Features

The following table describes the features of the Catalyst TC Development Kit and how the design partitions these features across the Catalyst TC and carrier board.

Feature	Catalyst TC	Carrier Board
Processor (Contact Eurotech for availability)	Intel® Atom™ Processor E6xx, up to 1.6 GHz Intel® Platform Controller Hub EG20T	
Integrated System Functions	Embedded Controller Trusted Platform Management (option)	
On-board Memory	Up to 2 GB DDR-2 DRAM Integrated system BIOS Real-time clock function eMMC flash SSD (option)	Real-time clock battery SPI flash memory (option)
Serial ATA (SATA)	SATA bus	SATA header
Secure Digital and MultiMediaCard (SD/MMC)	SD/MMC interface	SD/MMC socket with power switch
PCI Express (PCIe)	3 x PCIe one lane port	2 x PCIe sockets (direct to module) PCIe switch providing 1 x PCIe socket 2 x Mini PCIe socket
ExpressCard™	(uses PCIe slot, USB host, and SMBus)	ExpressCard host connector (future option)
Universal Serial Bus (USB)	8 x USB host port signals 1 x USB host/client port signals	4 x USB host socket with host power supply, current limiter circuit, EMI choke, and over-voltage protection (USB Type A) 1 x USB host port header 1 x USB host/client port socket with detection input (Mini USB Type B)
Ethernet	Gigabit Ethernet with physical layer transceiver	RJ-45 socket with built-in magnetics
I²C Bus	Carrier I²C bus with I²C master TC I²C bus with I²C master	2 x I²C header
System Management Bus (SMBus)	SMBus with bus master	SMBus header
Controller Area Network (CAN)	CAN 2.0 bus signals	Transceiver, common mode filter, ESD protection, and header
Serial Ports	1 x Full-function serial port signals 3 x RX/TX only signals	1 x EIA-232 transceiver and DB-9 plug 1 x EIA-232 transceiver and header 2 x EIA-422 transceiver and header Super I/O Controller with associated transceivers providing 1 x EIA-232, full-function, DB-9 plug 2 x EIA-422, header 2 x EIA-485, header
LVDS Display	LVDS display output with backlight control signals for intensity and on/ff	Catalyst Module Display Adapter socket
User Interface		Touch panel controller PS/2 keyboard and mouse support
Serial Digital Video (SDVO)	SDVO output	SDVO socket
I/O Expansion	Low Pin Count bus (LPC bus)	LPC bus header
GPIO	5 x GPIO (GPIO6 is not available on the carrier board)	23 x GPIO
System Monitoring	Temperature and voltage monitoring	Temperature, voltage, and power monitoring On-board temperature sensor
Audio Interface	Intel® High Definition Audio interface	Intel® High Definition Audio compatible codec with supporting circuitry for 2 x stereo line input jack 2 x stereo line output jack Stereo headphone jack Digital microphone socket S/PDIF RCA jack (option) Secondary audio codec expansion
Power Supply	3.3 V and 5 V main power inputs supplied by carrier board ACPI power management	12 V main power input supplied by 100-240 VAC power adapter Power sequencing for on-board 3.3 V and 5 V power supplies Two auxiliary power outputs

Table 1. Catalyst TC Development Kit Features

Carrier Board Configuration

The Catalyst TC conforms to the same footprint as other Eurotech modules. However, the modules are not pin-compatible. Each module has a unique pinout on connector J1 providing different feature sets. When installed in a carrier board, the Catalyst TC reads the input signal Cat_TC_Detect (J1 B103) to determine the configuration of the carrier board. The Catalyst TC Development Kit carrier board includes a 10kΩ pull-up resistor to V3.3A and a 10kΩ pull-down resistor on this input.

Warning:

Install Catalyst TC modules or other compatible modules only in carrier boards designed for the Catalyst TC. Installing incompatible modules may result in damage to the carrier board and module.

If the Cat_TC_Detect input is connected incorrectly on the carrier board, the Catalyst TC will not boot.

For full details about compatibility between modules, see the technical bulletin for your module.

Related Documents

This manual describes how the Catalyst TC integrates with Eurotech's carrier board to provide a development platform and reference design for your specific application. It complements the information provided in the *Catalyst TC Design-In Guide* and is intended for software application developers, system integrators, and hardware design engineers.

The following documents are also important resources for developing applications for the Catalyst TC.

Document	
Catalyst TC Design-In Guide	110125-5000
Catalyst TC Carrier Board Routing Guidelines	110125-5001
Catalyst XL - Catalyst TC Compatibility Technical Bulletin	110125-5002
Catalyst TC Development Kit Quick Start	110125-9001
Catalyst Module Display Adapter User Manual	110122-4000
Catalyst Module Installation and Removal	110122-2014
Catalyst System Management Programmer Reference	110122-2021
Catalyst SMBus Programmer Reference	110122-2022
Catalyst I2C Bus Programmer Reference	110122-2023

Table 2. Related Documents

Check the Eurotech support site (http://support.eurotech-inc.com/) for errata reports and for the latest releases of these documents.

Software Specification

Eurotech provides an application-ready platform including BIOS, operating system, and development environment. This section gives a brief description of the software support available for the Catalyst TC Development Kit. For additional details, contact your local Eurotech representative.

Operating System Support

The Catalyst TC Development Kit is compatible with the following operating systems:

- Windows Embedded Standard
- Windows CE 6.0
- Windows® 7
- Wind River Linux
- Select real-time operating systems

For details about available support of each operating system, contact your local Eurotech representative.

BIOS

The Catalyst TC incorporates a custom system BIOS developed by Eurotech.

Software Development Kit

Eurotech has developed a Software Development Kit (SDK) and its Application Programming Interface (API) for the following functions:

- System Management
- SMBus
- I^2C bus

For details about the availability of these SDKs, contact your local Eurotech representative.

Everyware™ Software Framework

Everyware Software Framework (ESF) is an inclusive software framework that puts a middleware layer between the operating system and the OEM application. It provides industry-standard interfaces that shorten development time, simplify coding, and allow software to be ported from one Eurotech hardware platform to another. The Catalyst TC supports ESF; however, the standard Catalyst TC Development Kit does not include ESF. If your application requires ESF, contact your local Eurotech representative.

Information about ESF is available at http://esf.eurotech.com.

Hardware Specification

Core Processor

The Catalyst TC provides the processing power on the development kit. This high-performance, low-power module is based on the Intel® Atom™ Processor E6xx. It uses an integrated two-chip solution comprised of the Intel Atom Processor and Intel® Platform Controller Hub (Intel® PCH EG20T). For performance specifications, see Performance page 56.

The following sections describe how the features of the Catalyst TC work in conjunction with the carrier board to provide a complete out-of-the-box development platform. For a detailed description of the Catalyst TC, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

Memory

The Catalyst TC combined with a carrier board provides a variety of storage capabilities. The following sections describe the different types of memory supported by the Catalyst TC Development Kit.

On-board Memory

The following table describes the various types of memory located on the Catalyst TC and carrier board.

Functionality	Catalyst TC	Carrier Board
Synchronous DRAM	Up to 2 GB DDR-2 DRAM	
Non-Volatile Memory (For details about options, contact Eurotech.)	Integrated system BIOS eMMC flash SSD (option)	SPI flash memory (option)
Real-Time Clock	Real-time clock function	Real-time clock battery

Table 3. On-board Memory

Catalyst TC Memory

The Catalyst TC includes Double Data Rate Synchronous DRAM, non-volatile memory for system BIOS storage, a real-time clock (RTC) functionality, and an optional eMMC flash SSD.

Double Data Rate Synchronous DRAM (DDR-2) is used on the Catalyst TC for system main memory and frame buffer memory. Options up to 2 GB are available. The maximum burst bandwidth is 3.2 GB/s (4 B @ 800 MHz). The Intel Atom Processor supports unified memory architecture in which the integrated 2D/3D graphics controller memory is “unified” with the system main memory. The default frame buffer is 8 MB with options in the BIOS Setup for selecting various sizes from 4 MB to 64 MB. Extended graphics memory space is available up to 256 MB. The graphics driver controls this size based on usage.

A serial interface flash memory device on the module stores the BIOS boot firmware, BIOS Setup settings, and module configuration data. Standard configuration is 2 MB. This flash memory device connects to the Intel Atom Processor E6xx using a serial peripheral interface (SPI).

The Catalyst TC includes a RTC function to retain the system date and time when the system is powered down as long as the 3.3 V “always” power or backup power is provided to the module. To supply backup power, the carrier board includes a long-life 3 V battery. For specifications, see Real-Time Clock, page 60.

As an option, the Catalyst TC can include an eMMC flash SSD. An 8 GB option is available in the standard module configuration. Options of 16 GB and 32 GB are available as custom module configurations. In addition to providing mass storage, this memory is a system boot option.

Carrier Board Memory

The carrier board supports an optional serial interface flash memory device that connects to the Catalyst TC SPI bus. If your application requires this capability, contact your local Eurotech representative.

External Memory Interfaces

Six types of external memory interfaces provide mass storage options on the development kit. The following table describes how each interface is implemented.

Functionality	Catalyst TC	Carrier Board
Serial ATA (SATA)	SATA bus	SATA header
Universal Serial Bus (USB)	4 x USB host port signals	Host power switches, current limiter circuits, EMI chokes, and over-voltage protection 4 x USB host socket (USB Type A)
NAND Flash Solid State Device (SSD)	1 x USB host port signals	USB host port header
Secure Digital and MultiMediaCard (SD/MMC)	SD/MMC interface	SD/MMC socket with software-controlled power switch
PCI Express (PCIe)	3 x PCIe one lane port (PCIe slot 1 connects to a PCIe switch on carrier board or ExpressCard connector.)	2 x PCIe socket (direct to module) PCIe switch providing 1 x PCIe socket 2 x Mini PCIe socket
ExpressCard™	(uses PCIe slot, USB host, and SMBUS)	ExpressCard host connector (future option)

Table 4. External Memory Interfaces

For additional details about the signals provided by the Catalyst TC, including specific routing guidelines and design constraints, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

SATA Disk Drive

The Catalyst TC inlcudes a serial ATA (SATA) bus providing the option to add a high-capacity, removable storage SATA disk drive to the development kit. The SATA bus supports the Serial ATA Specification, Revision 2.6 with data transfer rates of up to 3.0 Gb/s. The SATA signals route to header J67, page 49 on the carrier board. The carrier board also includes 0.01µF AC coupling capacitors between the module and J67.

USB Mass Storage Device

A USB mass storage device can connect to one of two dual USB sockets on the development kit. For a description of these ports, see Universal Serial Bus, page 17.

NAND Flash Solid State Device

A NAND flash Solid State Device (SSD) device, such as the Intel® Z-U130 Value Solid State Device, can connect to the USB Host 8 header J77 page 50.

SD Card

The Catalyst TC provides a Secure Digital and MultiMediaCard (SD/MMC) interface that is routed to socket J51, page 47 on the carrier board enabling the option for additional memory and I/O expansion. In addition to the SD/MMC signals, the Catalyst TC drives signals to control SD/MMC support circuitry on the carrier board. The carrier board includes a power switch and status LED.

The SD/MMC interface is compliant with the following specifications:

- SD Memory Card Specifications Part 1 Physical Layer Specification Ver2.0
- SDIO Card Specification Ver1.10
- MMC System Specification Ver4.1

PCIe or Mini PCIe Memory Card

PCIe and Mini PCIe memory cards can connect to one of three PCIe x1 sockets or one of two Mini PCIe sockets on the development system. For a description of the PCI Express capability, see PCI Express, page 16.

ExpressCard™ (future configuration option)

As a future configuration option, the development kit can support an ExpressCard memory module. For additional information about this feature, see ExpressCard, page 17.

Communications

The Catalyst TC Development Kit implements several industry-standard channels for communication allowing development across a broad spectrum of end-use applications. These include PCIe, Mini PCIe, USB, Gigabit Ethernet, I^2C bus, SMBus, CAN, and serial ports. The following sections describe these interfaces.

For additional details about the signals provided by the Catalyst TC, including specific routing guidelines and design constraints, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

PCI Express

A key capability of the Catalyst TC Development Kit is its PCI Express (PCIe) connectivity. The development kit provides three PCIe one lane (PCIe x 1) and two Mini PCIe ports. For details about the Catalyst TC's compliance with the PCI Express Base Specification, Revision 1.0a, contact your local Eurotech representative. The following table describes how this PCIe connectivity is implemented.

Functionality	Catalyst TC	Carrier Board
PCIe	Intel Atom Processor E6xx provides 3 x PCIe one lane port	PCIe switch provides 3 x PCIe one lane port PCIe clock buffer
Connectors		1 x PCIe x16 socket (one lane) 2 x PCIe x4 socket (one lane) 1 x Mini PCIe socket 1 x Mini PCIe socket with SIM
AC Coupling	Capacitors on PCIe transmit differential pairs	Capacitors on PCIe receive differential pairs

Table 5. PCI Express

Catalyst TC PCIe Slots

Three of the four Intel Atom Processor E6xx PCIe x1 ports are available for use on the carrier board. The fourth PCIe port connects to the Intel PCH EG20T on the module. Catalyst TC PCIe slot 0 and Catalyst TC PCIe slot 2 connect directly from the Catalyst TC to sockets on the carrier board, while Catalyst TC PCIe slot 1 connects to a PCIe switch located on the carrier board. An on-module clock buffer supplies the PCIe clocks for two of the three ports: PCIe slot 0 and PCIe slot 1.

The module includes 0.1µF AC coupling capacitors on the PCIe transmit differential pairs (PCIE_TX_SLOTx_P, PCIE_TX_SLOTx_N); while the carrier board includes 0.1µF AC coupling capacitors on the PCIe receive differential pairs (PCIE_RX_SLOTx_P, PCIE_RX_SLOTx_N) driven from the carrier board to the Catalyst TC.

The following table describes the connectivity of the three Catalyst TC PCIe slots.

Carrier Board Connector	Carrier Board PCIe Slot	Catalyst TC PCIe Slot	Intel Atom Processor PCIe Port
J12	PCIe 0	0	1
	(PCIe Switch)	1	2
J15	PCIe 2	2	3

Table 6. Catalyst TC PCIe Slots

As a future configuration option, the PCIe switch is not populated and Catalyst TC PCIe slot 1 routes directly to ExpressCard socket J74, page 50.

Carrier Board PCIe Slots

The carrier board includes a PLX Technology PEX 8505 PCIe switch that connects directly to Catalyst TC PCIe slot 1. This device is a 5-lane, 5-port PCIe switch that provides additional PCIe connectivity on the carrier board as described in the following table.

Carrier Board Connector	Carrier Board PCIe Slot	PCIe Switch Port
J14	PCIe 1	1
J16	Mini PCIe 0	3
J17	Mini PCIe 1	4

Table 7. Carrier Board PCIe Slots

The carrier board also includes a differential buffer to provide additional reference clocks.

As a future configuration option, the PCIe switch, PCIe 1 socket J14, and Mini PCIe sockets J6 and J17 are not populated. ExpressCard socket J74, page 50 replaces these features.

ExpressCard (future configuration option)

As a future configuration option, the Catalyst TC Development Kit can include ExpressCard socket J74, page 50, expanding the types of modules supported by the development kit. This option conforms to the ExpressCard standard and supports a wide variety of plug-in modules. The ExpressCard standard replaces the parallel buses supported by the older PC Card standard with high-speed serial PCIe and USB buses. Slot J74 includes the Catalyst TC PCIe slot 1, USB5, SMBus, discrete control signals, and power output.

For additional information about the availability of this feature and the ExpressCard modules supported by the Catalyst TC Development Kit, contact your local Eurotech representative.

Universal Serial Bus

The Catalyst TC Development Kit includes eight Universal Serial Bus (USB) ports. Seven of the eight ports function as USB host ports, while the remaining port functions as a USB host or USB client port. USB host ports support the USB 1.1 specification operating at low (1.5 Mbps) and full (12 Mbps) speeds and the USB 2.0 specification operating at high speed (480 Mbps). The USB client port supports full and high speeds.

The following table describes how this functionality is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
USB Host	Intel PCH EG20T includes USB Host Controller providing 8 x USB host port signals (Touch panel controller uses USB 4.)	
USB Device	1 x USB host/client port signals	
Support Circuitry		Host power switches, current limiter circuits, EMI chokes, and over-voltage protection
Jumper		USB host/client jumper
Connectors		2 x dual USB Type A socket 1 x header 2 x Mini PCIe socket 1 x Mini USB Type B socket

Table 8. USB Ports

Catalyst TC USB Ports

On the Catalyst TC, the Intel PCH EG20T and an on-board USB Hub provide nine Universal Serial Bus (USB) ports. Eight of the nine ports function as general-purpose USB host ports, while the remaining port functions as a USB host or USB client port. The following table describes the mapping of the Catalyst TC USB ports on the module and the carrier board.

Carrier Board Connector	Carrier Board USB Port	Catalyst TC USB Port	Intel PCH EG20T USB Port	On-board USB Hub Port
J3 A	**Host 0**	**0**	EG20T Port 0	
J3 B	**Host 1**	**1**	EG20T Port 1	
J6	**Host/Client**	**2**	USB Client	Hub Port 4
J16	**Host 3**	**3**	EG20T Port 2	
	(Touch Panel Controller)	**4**	EG20T Port 3	
J17 or J74 (future option)	**Host 5**	**5**	EG20T Port 4	
J4 A	**Host 6**	**6**		Hub Port 1
J4 B	**Host 7**	**7**		Hub Port 2
J77	**Host 8**	**8**		Hub Port 3
			EG20T Port 5	Upstream Port

Table 9. Catalyst TC USB Ports

The Catalyst TC USB ports USB0, USB1, USB3, USB4, and USB5 include over-current detection inputs, while USB6, USB7, and USB8 do not include the associated over-current detection signals. USB2 functions as a USB host or USB client. The module includes an input signal to select between these two functions. As a USB host, this port includes the associated over-current detection signal.

Carrier Board USB Circuitry and Connectors

The carrier board includes the supporting circuitry and connectors to allow external connections to the Catalyst TC USB signals. USB Host 0, USB Host 1, USB Host 6, and USB Host 7 are fully functioning USB host ports. The carrier board includes a power switch, current limiter circuit, common mode chokes, and over-current protection for each port. Since the Catalyst TC does not provide over-current detection signals for USB Host 6 and USB Host 7, a CPLD located on the carrier board implements this functionality. For electrical specifications, see Universal Serial Bus, page 56.

When configured as a USB host port, USB Host/Client also includes all supporting circuitry for a fully functioning USB host port. When configured as a USB client port, the power input is used to sense a connection to this port. Jumper J5, page 37 selects the configuration of the USB Host/Client port.

The USB Host 3, USB Host 5, and USB Host 8 signals route directly from the Catalyst TC to connectors on the carrier board. The carrier board does not include additional support circuitry for these USB host ports.

Gigabit Ethernet

For direct network connectivity, the Catalyst TC Development Kit provides a Gigabit Ethernet connection that conforms to the IEEE 802.3 standard for 10Base-T, 100Base-TX, and 1000Base-T applications. The following table describes how this connection is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
Ethernet	Intel PCH EG20T provides Gigabit Ethernet MAC	
Transceiver	Physical layer transceiver	
Connectors		RJ-45 socket with built-in magnetic and status LEDs

Table 10. Gigabit Ethernet

Catalyst TC MDI

On the Catalyst TC, the Intel PCH EG20T includes a Gigabit Ethernet MAC that conforms to the IEEE 802.3 standard. This MAC device connects to a Realtek RTL8211CL Gigabit Ethernet Physical Layer Transceiver located on the module, supporting a Media Dependent Interface (MDI) for 10Base-T, 100Base-TX, and 1000Base-T applications. This transceiver also drives three programmable LED control signals which are available to the carrier board. For information about the transceiver, refer to www.realtek.com.

Carrier Board RJ45 Socket

The MDI provided by the Catalyst TC routes directly to RJ-45 socket J63, page 48 located on the carrier board. This RJ-45 socket includes built-in magnetics and two Ethernet LEDs, page 35.

I²C Bus

I²C (Inter-IC) bus is a multi-master, "two-wire" synchronous serial bus for communications between integrated circuits (ICs) and for addressing peripherals in a system. The Catalyst TC Development Kit includes two I²C buses with the Catalyst TC acting as the bus master for each bus. The following table describes how these buses are implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
I²C Bus	Embedded controller provides carrier I²C bus Intel PCH EG20GT provides TC I²C bus	
Devices		Thermal sensor Power monitor
Connectors		2 x I²C header
Termination	Pull-up resistors on TC I²C bus	Pull-ups resistors on carrier I²C bus

Table 11. I²C Bus

Carrier I²C Bus

The carrier I²C bus connects to the embedded controller located on the Catalyst TC. The following diagram illustrates the I²C architecture on the development kit.

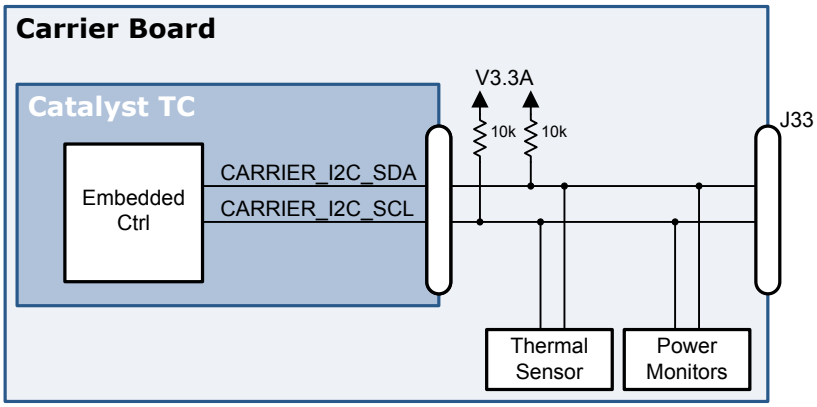


Figure 2. Carrier I²C Bus Architecture

The carrier board provides termination on the carrier I²C bus and an external connection on header J33, page 43. Power all devices connected to this bus using the 3.3 V “Always” (V3.3A) power or isolate the devices from the bus when powered off. When possible, use the TC I²C bus or SMBus to communicate with devices on the carrier board instead of the carrier I²C bus. For electrical specifications, see I²C Bus, page 57.

A thermal sensor and power monitors, also located on the carrier board, connect to the carrier I²C bus and provide hardware monitoring. For additional details, see System Monitoring, page 27. The following table lists the addresses of these devices.

Carrier Board I²C Device	Address	Function
Thermal Sensor	1001 0000 1001 0001	Write Read
V3.3 Power Monitor	1000 0000 1000 0001	Write Read
V5S Power Monitor	1000 0010 1000 0011	Write Read
V3.3S Power Monitor	1000 1000 1000 1001	Write Read
V5A Power Monitor	1000 1010 1000 1011	Write Read
V3.3A Power Monitor	1000 1100 1000 1101	Write Read

Table 12. Carrier I²C Bus Addresses

TC I²C Bus

The TC I²C bus connects to the Intel PCH EG20T located on the Catalyst TC and supports the I²C Bus Specification, version 2.1. The following diagram illustrates the I²C architecture on the development kit. Notice that the module includes 10kΩ pull-up resistors to V3.3S on the TC I²C bus.

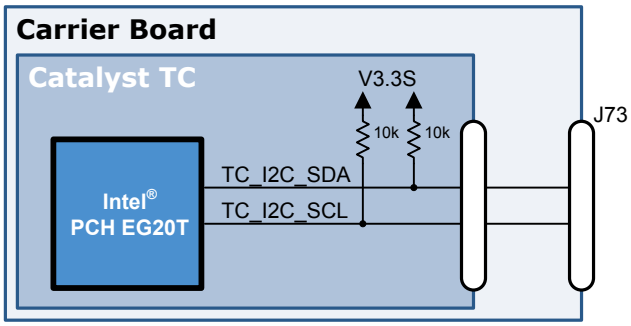


Figure 3. TC I²C Bus Architecture

Header J73, page 49, located on the carrier board, provides an external connection to the TC I²C bus. Power all devices connected to this bus using the V3.3S power or isolate the devices from the bus when powered off. For electrical specifications, see I²C Bus, page 57.

System Management Bus

System Management Bus (SMBus) follows the same operating principles as I²C. Similar to I²C, SMBus is a “two-wire” interface allowing multiple devices to communicate with each other. The development kit includes a SMBus supporting the SMBus Specification, Version 1.0 with hardware alerting on the SMBus using the I/O signal SMB_ALERT#. The Catalyst TC acts as bus master.

The following table describes how the SMBus is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
SMBus	Intel Atom Processor E6xx includes host controller providing SMBus	
Devices		I/O expansion port
Connectors		SMBus header
Termination	Pull-up resistors on SMBus signals	

Table 13. SMBus

Catalyst TC SMBus

On the Catalyst TC, the SMBus is driven by the Intel Atom Processor E6xx. The following diagram illustrates the SMBus architecture on the development kit.

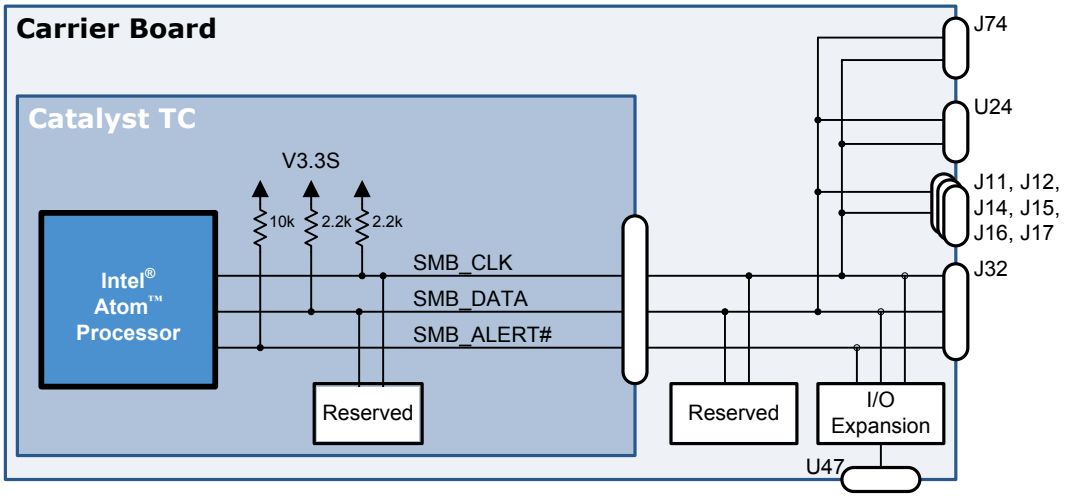


Figure 4. SMBus Architecture

Notice that the module supports hardware alerting on the SMBus using the I/O signal SMB_ALERT#. Consider this capability when you are selecting between connectivity to this bus or the TC I^2C bus.

Notes:
SMBus is not compatible with all I^2C devices. Review the device data sheet carefully before connecting an I^2C device to the SMBus.

The following table lists the addresses of the SMBus devices on the Catalyst TC.

Module SMBus Device	Address	Function
Reserved	1101 0010 1101 0011	Write Read

Table 14. Catalyst TC SMBus Addresses

Carrier Board SMBus Devices and Connector

The carrier board provides an external connection to the SMBus on header J32, page 43. Power all devices connected to this bus using the V3.3S power or isolate the devices from the bus when powered off. For electrical specifications, see SMBus, page 57.

In addition, an I/O expansion port connects to the SMBus on the carrier board. For details about this feature, see General-Purpose Inputs and Outputs, page 26. The following table lists the addresses of the SMBus devices on the carrier board.

Carrier Board SMBus Device	Address	Function
I/O Expansion	0100 0000 0100 0001	Write Read
Reserved	1101 0100 1101 0101	Write Read

Table 15. Carrier Board SMBus Addresses

CAN 2.0B Bus

The Catalyst TC Development Kit provides a CAN (Controller Area Network) bus that is compliant with the CAN Protocol Version 2.0B Active supporting bit rates up to 1 Mbps. For availability of this feature, contact your local Eurotech representative. The following table describes how this bus is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
CAN Bus	Intel PCH EG20T includes CAN controller providing CAN 2.0 bus signals	
Support Circuitry		Transceiver, common mode filter, and ESD protection
Connectors		CAN bus header

Table 16. CAN 2.0B Bus

Catalyst TC CAN2.0B Bus

The Intel PCH EG20T includes a CAN controller supporting communication between the Catalyst TC and a CAN network. The CAN signals are available on the module connector J1.

Carrier Board Support Circuitry and Connector

The CAN signals provided by the Catalyst TC route to an NXP PCA82C251 CAN transceiver, common mode filter, and ESD protection on the carrier board. This CAN 2.0 bus is available externally on header J72, page 49.

Serial Ports

The Catalyst TC Development Kit includes nine serial ports. The Catalyst TC provides four of the nine serial ports, while a Super I/O Controller located on the carrier board provides the remaining five serial ports. The following table describes how the serial ports are implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
Serial Port	Intel PCH EG20T provides 1 x Full-function serial port signals 3 x RX/TX only	Super I/O Controller provides 1 x Full-function serial port signals 4 x RX/TX only
Transceivers		3 x EIA-232 4 x EIA-422 2 x EIA-485
Connectors		Dual DB-9 plug 7 x header

Table 17. Serial Ports

Catalyst TC Serial Ports

The Catalyst TC provides the signals for four serial ports directly from the on-module Intel PCH EG20T. The carrier board includes the EIA-232/422 transceivers and corresponding connectors. One serial port is a full-function UART supplying the full complement of modem control signals; while the remaining three serial ports provide receive and transmit signals only. The following table describes the four general-purpose serial ports of the Catalyst TC.

Carrier Board Connection	Carrier Board Serial Port	Catalyst TC Serial Port	Intel PCH EG20T Serial Port	Communications
P1	TC Serial 0	0	0	EIA-232, 9-wire
J75	TC Serial 1	1	1	EIA-422
J76	TC Serial 2	2	2	EIA-422
J78	TC Serial 3	3	3	EIA-232, 3-wire (note 1)

Note:

1. Revision 1 of the carrier board does not support TC Serial 3. Future revisions will support this feature. For information about availability, contact your local Eurotech representative.

Table 18. Catalyst TC Serial Ports

Super I/O Controller Serial Ports

The carrier board includes a Super I/O Controller that is connected to the Catalyst TC using the LPC bus. This device provides five additional serial ports on the carrier board. The following table describes the general-purpose serial ports of the Super I/O Controller.

Carrier Board Connector	Carrier Board Serial Port	Super I/O Controller Serial Port	Communication
J40	Serial 2	2	EIA-422
P1	Serial 3	3	EIA-232, 9-wire
J38	Serial 4	4	EIA-485
J39	Serial 5	5	EIA-422
J37	Serial 6	6	EIA-485

Table 19. Super IO Controller Serial Ports

Display and User Interface

The Catalyst TC Development Kit is a complete out-of-the-box development platform including a display subsystem and a Serial Digital Video Out (SDVO) secondary display output. The display subsystem consists of the following components:

- 10.4-inch TFT LCD with SVGA resolution (800 x 600, 6-bit color) and cable
- 4-wire resistive touch panel and cable
- CCFL backlight inverter and cable
- Catalyst Module Display Adapter
- Display cable

The following sections provide an overview of the display subsystem. For a complete description, refer to the *Catalyst Module Display Adapter User Manual (Eurotech document #110122-4000)*.

The following table describes how the display and user interface are implemented on the development kit.

Functionality	Catalyst TC	Carrier Board	Catalyst Module Display Adapter
Display	LVDS display output SDVO output		LVDS buffer
Backlight	Backlight control signals for intensity and on/ff		
User Interface		Touch panel controller PS/2 keyboard and mouse support	
Connectors		Catalyst Module Display Adapter socket SDVO socket	Display header Touch panel header
AC Coupling	Capacitors on SDVO data differential pairs	Capacitors on SDVO clock differential pair	
Termination		Pull-up resistors on SDVO DDC I^2C bus	Pull-up resistors on LCD DCC I^2C bus and Backlight I^2C bus

Table 20. Display and User Interface

LVDS Display and Backlight Control

Catalyst TC LVDS Display Output and Backlight Control

The display is driven by an LVDS display output from the Catalyst TC, in conjunction with the Catalyst Module Display Adapter. This output consists of four LVDS data pairs, as well as an LVDS pixel clock. The Catalyst TC supports 18-bit and 24-bit color; however, standard Catalyst Module Display Adapters support only 18-bit color. Additional signals from the module include the discrete signal L_VDDEN that controls power to the display and an I^2C bus (L_DDC_DATA, L_DDC_CLK) for communication with the LCD Display Data Channel (DDC).

To control the display subsystem's backlight inverter, the Catalyst TC drives three backlight control signals and an I²C bus (L_CTLB_DATA, L_CTLA_CLK) for communication with the backlight. The following table describes the backlight control signals.

Signal	J11 Pin	Type	Description
L_BKLTCTL	A26	O	Controls the intensity of the backlight
L_BKLTEN	A29	O	Turns power to the backlight on or off
L_BKLTSEL0_GPIO#	A25	O	Selects backlight control (PWM vs. I2C)

Table 21. Backlight Control Signals

Carrier Board LVDS Display and Backlight Socket

Socket J11, page 37 is a Eurotech-specific socket that mates to the Catalyst Module Display Adapter providing an interface between the Catalyst TC and display subsystem.

User Interface

Carrier Board Touch Panel Controller

To drive the resistive touch panel, the carrier board includes a USB touch panel controller and separate analog multiplexer. This circuitry supports 4-, 5-, and 8-wire resistive touch panels. The pinout for header J26, page 41 easily interfaces to 4- and 5-wire touch panels, while the pinout for header J27, page 41 is suited for 8-wire touch panels. Standard Catalyst TC Development Kits include a 4-wire touch panel. The touch panel signals are routed from header J27 on the carrier board through the Catalyst Module Display Adapter to the touch panel. For electrical specifications, see Touch Panel Controller, page 57.

The carrier board includes two jumpers to control the touch panel controller. Jumper J25, page 42 configures the development kit for support of 4-, 5- and 8-wire touch panels; while jumper J69, page 42 enables or disables the touch panel controller on the carrier board.

Carrier Board PS/2 Support

The carrier board supports a direct connection to a PS/2 mouse and keyboard using the dedicated keyboard/mouse interface of the Super I/O Controller. Connect these devices to socket J34, page 44.

Catalyst Module Display Adapter

The Catalyst Module Display Adapter is a custom board that provides the interface between the Catalyst TC and the LVDS display, touch panel, and backlight inverter. Its card edge connector mates to the Eurotech-specific socket J11 on the carrier board. An LVDS buffer/repeater with configurable pre-emphasis is included on the display adapter to boost the data and pixel clock signals from the Catalyst TC enabling transmission over the display cable. The maximum cable length is 24 inches for controlled impedance cables that target 97 Ω. ± 20%. The display cable should not introduce major impedance discontinuities that cause signal reflections.

In addition, the adapter includes an on-board power switch and fuse control power to the display, 2.2kΩ pull-up resistors to V3.3S on the LCD DDC I²C bus (L_DDC_CLK and L_DDC_DATA), and 4.7kΩ pull-up resistors to V3.3S on the Backlight I²C bus (L_CTLA_CLK and L_CTLB_DATA). For a complete description, refer to the *Catalyst Module Display Adapter User Manual (Eurotech document #110122-4000)*.

Serial Digital Video

Catalyst TC Serial Digital Video Out

As a secondary display option, the Catalyst TC drives a Serial Digital Video Out (SDVO) supporting external devices that convert the SDVO protocol to DVI, HDMI, LVDS Analog-CRT, and TV-Out interfaces. The Catalyst TC supports only ADD2-N cards. ADD2-R cards are not supported. For recommended Intel/HP SDVO cards, contact your local Eurotech technical support.

The SDVO includes seven high-speed differential pair signals and an I^2C bus (SDVO_CTLDATA, SDVO_CTLCLK) to connect to a SDVO panel DDC. The module includes 0.1µF AC coupling capacitors on the SDVO data differential pairs (SDVO_RED, SDVO_GREEN, SDVO_BLUE).

Carrier Board SDVO Socket

The Catalyst TC SDVO is available on socket J10, page 37 on the carrier board. In addition to the SDVO socket, the carrier board includes 0.1µF AC coupling capacitors on the SDVO clock differential pair (SDVO_CLK) and 3.3kΩ pull-up resistors to 2.5V on the I^2C signals (SDVO_CTLDATA, SDVO_CTLCLK).

Inputs and Outputs

Several signals on the Catalyst TC Development Kit support I/O expansion and system management. The Catalyst TC provides a Low Pin Count bus supporting legacy I/O capabilities and GPIO; while the carrier board includes a Super I/O Controller on the LPC bus and additional GPIO.

For additional details about the signals provided by the Catalyst TC, including specific routing guidelines and design constraints, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

Low Pin Count Bus

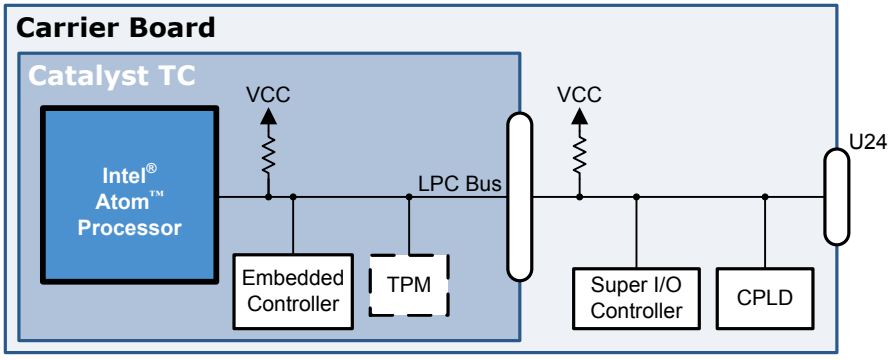
In response to the transition from ISA-based systems, the Low Pin Count (LPC) bus provides a migration path for legacy I/O capabilities. This interface enables general-purpose I/O expansion and provides communication to low-bandwidth devices. For this purpose, the Catalyst TC Development Kit supplies a LPC bus supporting the LPC1.1 Specification. The following table describes how this bus is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
I/O Expansion	Intel Atom Processor E6xx includes LPC controller providing LPC bus	
Devices	Embedded controller Optional TPM	Super I/O Controller CPLD
Connectors		LPC bus header
Termination	Pull-up resistors on LPC bus signals	Pull-up resistors on LPC bus signals

Table 22. LPC Bus

Catalyst TC LPC Bus

On the Catalyst TC, the LPC bus is driven by the Intel Atom Processor E6xx and connects to the embedded controller and optional TPM. The following diagram illustrates the LPC bus architecture on the development kit.



Note:

2. For details about the termination on individual signals, refer to the Catalyst TC Design-In Guide (Eurotech document #110125-5000) and U24, page 54.

Figure 5. LPC Bus Architecture

The LPC bus power down signal, LPCPD# (J1 pin B2), is not presently implemented. If this signal is needed for your specific application usage, contact your local Eurotech representative for functional details. In addition, the Catalyst TC does not support Direct Memory Access (DMA) on the LPC bus.

For details about restrictions on INT_SERIRQ usage, contact your local Eurotech representative.

Carrier Board LPC Bus Devices and Connector

The carrier board provides an external connection to the LPC bus for general-purpose expansion on U24, page 54. In addition, the carrier board includes a Super I/O Controller and CPLD that are connected to the LPC bus.

Reset Signals

Two signals, BUF_RST# and SWX_RESET#, force a hard reset of the Catalyst TC Development Kit. The carrier board buffers the system reset (RST#, J1 B56) from the Catalyst TC and uses this buffered signal, BUF_RST#, to reset all devices on the carrier board and several external peripherals. BUF_RST# acts as a power-on reset forcing a complete system hardware reset and ensuring proper reset timing and logic synchronization. BUF_RST# is available on J10, page 37, J11, page 37, J12, page 38, J14, page 38, J15, page 39, J16, page 39, J17, page 39, and U24, page 54.

The input signal SWX_RESET# connects to the on-board reset switch SW1, page 33 and is also available on header J55, page 48 for connection to an external switch. This signal drives the Catalyst TC front panel reset input (FP_RESET#, J1 A59). The FP_RESET# signal initiates a hardware reset including the Intel Atom Processor and Intel PCH EG20T. However, do not use this signal as a power-on reset. For electrical specifications, see Reset Circuitry, page 57.

General-Purpose Inputs and Outputs

The Catalyst TC Development Kit includes twenty eight general-purpose inputs and outputs (GPIO) signals as given in the following table. For electrical specifications, see General-purpose Inputs and Outputs, page 57.

Header	# of GPIO	Catalyst TC	Carrier Board
U27	2	Embedded Controller	
	7		Super I/O Controller
U47	8		I/O expansion port
J64	8		CPLD
J79	3	Intel PCH EG20T	

Table 23. General-Purpose Inputs and Outputs

Catalyst TC GPIO

The Catalyst TC embedded controller and Intel PCH EG20T provide five GPIO as described in the following table. Notice that GPIO6 on the Catalyst TC is not available externally on the carrier board.

Header	Name	Description
U27 1	GPIO1	Embedded controller GPIO
U27 3	GPIO2	Embedded controller GPIO
J79 1	GPIO3	Intel PCH EG20T GPIO2
J79 2	GPIO4	Intel PCH EG20T GPIO3
J79 3	GPIO5	Intel PCH EG20T GPIO4

Table 24. Catalyst TC GPIO Signals

GPIO1 and GPIO2 are software-controlled using the Catalyst System Management API. For details about this API, refer to the *Catalyst System Management Programmer Reference (Eurotech document #110122-2021)*. Future revisions of the API will support the Intel PCH EG20T GPIO.

Carrier Board GPIO

Three devices on the carrier board provide additional GPIO: Super I/O Controller, I/O expansion port, and CPLD. The Super I/O Controller on the carrier board provides seven GPIO on header U27, page 54. The following table maps these GPIO to the Super I/O Controller GPIO.

U27 Pin	Name	Super I/O Controller GP
5	SIOC_GPIO0	61
9	SIOC_GPIO1	56
11	SIOC_GPIO2	57
13	SIOC_GPIO3	50
15	SIOC_GPIO4	51
17	SIOC_GPIO5	31
19	SIOC_GPIO6	46

Table 25. Super I/O Controller GPIO Signals

An I/O expansion port provides eight GPIO on header U47. A NXP PCA9554 device connected to the SMBus on the carrier board implements this I/O expansion port. The GPIO are programmed as inputs at power up. For the SMBus address, see System Management Bus, page 20. For specific mapping of the GPIO, see header U47, page 55.

Lastly, a CPLD on the carrier board provides eight general-purpose inputs and outputs. For specific mapping of the GPIO, see header J64, page 48. For additional details about controlling these GPIO, contact your Eurotech representative.

Carrier Board Super I/O Controller

On the carrier board, a Super I/O Controller connects to the Catalyst TC LPC bus and provides system I/O control. This device's runtime registers control various discrete I/O on the carrier board. For detailed information about the control of the Super I/O Controller including a memory map, refer to the SMSC SCH3116 datasheet available at www.smsc.com. The following table lists the controls that are specific to the carrier board.

Super I/O Controller GPIO	Name	Type	Description
GP30	LVDS_PRESENT#	I	Indicates that the Catalyst Module Display Adapter is installed in J11
GP34	SLOT1_PRESENT	I	Indicates that a card is installed in J14
GP36	H_INIT#	O	Initiates a soft reset of the module. (For details, contact Eurotech.)
GP37	SLOT2_PRESENT	I	Indicates that a card is installed in J15
GP40	Reserved		
GP42	PCIE_WAKE#	I	Supports WAKE# functionality
GP60	SLP_LED	O	Control for external LED connection on J55
GP62	UART1_SHUTDOWN	O	Used in conjunction with J57 to control the TC Serial 0 transceiver
GP63	UART3_SHUTDOWN	O	Used in conjunction with J57 to control the Serial 3 transceiver
GP66	Reserved		

Table 26. System I/O Control

System Monitoring

Both the Catalyst TC and devices on the carrier board perform system monitoring of temperature, voltage, and power. The following table describes how this function is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
Temperature Monitoring	Embedded controller	Super I/O Controller with on-board temperature sensors Temperature Sensor
Voltage Monitoring	Embedded controller	Super I/O Controller
Power Monitoring		Power Monitors

Table 27. System Monitoring

Temperature Monitoring

Catalyst TC Temperature Monitoring

On the Catalyst TC, the embedded controller performs temperature monitoring by measuring the temperatures on the Intel Atom Processor die and near the memory chips.

Carrier Board Temperature Monitoring

The carrier board includes three temperature sensors that are accessible using the Super I/O Controller hardware monitoring registers. The following table identifies these sensors and their location on the carrier board.

Sensor	Location
Internal	Internal to the Super I/O Controller
Remote 1 (Q61)	Component side near Super I/O Controller
Remote 2 (Q62)	Component side near Super I/O Controller

Table 28. Temperature Sensors

For external cooling applications or motor control, the Super I/O Controller includes two tachometer inputs and two pulse width modulation (PWM) outputs. These signals are available on header J35, page 44 and header J36, page 44.

In addition to the temperature monitoring capabilities of the Super I/O Controller, the carrier board includes a National Semiconductor LM75. The LM75 is a temperature sensor, Delta-Sigma analog-to-digital converter, and digital over-temperature detector. This device is access-able using the carrier I^2C bus and drives the thermal monitor LED D29. For the I^2C bus address of the LM75, see Carrier I^2C Bus, page 19.

Voltage Monitoring

Catalyst TC Voltage Monitoring

In addition to temperature monitoring, the embedded controller performs voltage monitoring of the input power and on-module voltage regulators.

Carrier Board Voltage Monitoring

The Super I/O Controller also provides the capability to monitor voltages generated on the carrier board. Four analog inputs to the Super I/O Controller monitor the on-board voltages as described in the following table.

Super I/O Controller Input	On-board Voltage
VCCP_IN	V1.8S
+2.5V_IN	V3.3S
+12V_IN	V12S
+5V_IN	V5S

Table 29. Voltage Monitors

Power Monitoring

Carrier Board Power Monitoring

Power consumption varies based on the actual application. Several factors including level of processor activity and peripheral connections affect the total power consumption of a system. The carrier board includes power monitoring circuitry that allows the actual current draw of the system to be measured in real-time. Five Texas Instruments INA209 power monitor devices connect to the carrier I^2C bus. Each device monitors one of the five voltages supplied to the module on docking connector J2, page 35. For details about addressing these devices, see Carrier I^2C Bus, page 19.

Audio Interface

The Catalyst TC Development Kit offers a variety of audio inputs and outputs supporting a wide range of applications. The following table describes how the audio capability is implemented on the development kit.

Functionality	Catalyst TC	Carrier Board
Audio Interface	Intel® High Definition Audio interface	
Codec		Intel® High Definition Audio compatible codec with supporting circuitry
Connectors		2 x stereo line input jack 2 x stereo line output jack Stereo headphone jack Digital microphone socket S/PDIF RCA jack (option) Secondary audio codec expansion

Table 30. Audio Interface

Catalyst TC Audio Interface

The Catalyst TC supports the Intel High Definition Audio (Intel HD Audio) specification implementing high quality audio in an embedded environment. This specification defines a uniform interface between a host computer and audio codec, specifying register control, physical connectivity, programming model, and codec architectural components. The Intel Atom Processor provides an Intel HD Audio interface capable of supporting up to two external audio codecs. Docking functionality is supported allowing control of an external switch for isolation of the codec within a docking station during normal docking request and acknowledge cycles. The Intel Atom Processor supports only 3.3 V signalling levels.

Carrier Board Audio Codec and Connectors

The Intel HD Audio interface, provided by the Catalyst TC, connects to an IDT 92HD71B8 4-channel audio codec located on the carrier board and is available to a secondary codec on header J18, page 39 and JP1, page 40. The audio codec and supporting circuitry located on the carrier board provides the following audio inputs and outputs:

- SPDIF on RCA jack J19, page 40 (optional)
- Stereo Line Inputs and Headphones on stereo jack J20, page 40
- Digital Microphone on socket J22, page 40
- Stereo Line Out 1 on stereo phone jack J23, page 41
- Stereo Line Out 0 on stereo phone jack J53, page 47
- Microphone stereo phone jack J54, page 47

For electrical specifications, see Audio Codec, page 59.

Power and Power Management

Power and power management are especially critical on the Catalyst TC Development Kit. The Catalyst TC has very specific power and power-on sequence requirements in order to power-up and operate correctly. If the system does not meet the module's requirements, the module will not boot.

The following sections provide an overview of the Catalyst TC power requirements. For a complete description, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*. Custom carrier boards must implement the exact power supply sequencing described in the design-in guide.

Power Supply Architecture

The following diagram illustrates the power supply architecture of the Catalyst TC Development Kit. Notice that voltages ending with an "A" indicate "always" power (power states S0, S3, S4, and S5), voltages with no suffix indicate primary power (power states S0 and S3), and voltages ending with an "S" indicate normal operating power (power state S0).

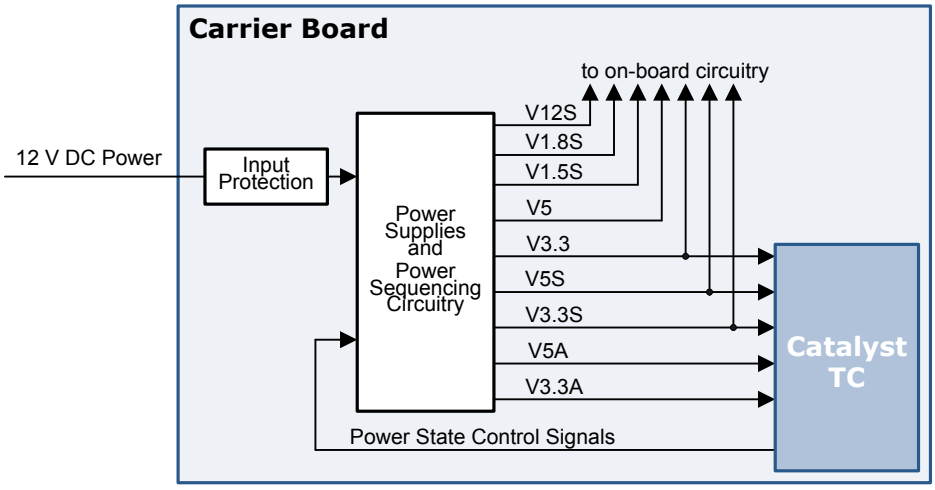


Figure 6. Power Supply Architecture

The architecture of the power supply partitions power distribution across the Catalyst TC and the carrier board. Power jack J29, page 42 accepts +12 VDC input power from an external supply such as the AC power adapter included with the Catalyst TC Development Kit. The maximum main input voltage is limited by input protection.

The development kit includes the capability to selectively turn off power to the display subsystem including LVDS Display, Touch Panel, and Backlight. For details, see Display and User Interface, page 23. This load-shedding feature can significantly reduce power consumption. Applications and the operating system determine how selective power management is utilized.

ACPI Power Management States

The Catalyst TC supports the Advanced Configuration and Power Interface (ACPI) version 3.0 which defines the low power states for ACPI-compliant systems. This capability allows the Catalyst TC to cycle into power saving states. Wake events transition the Catalyst TC from a low-power state back to full operation. The following table lists the signals on the carrier board that can function as wake events. These signals are valid as wake event inputs in power state S3.

Wake Event	Carrier Board Connector	Description
PCIE_WAKE#	J12, J14, J15, J16, J17, and J74	Standard I/O device wake event signal
SWX_ONOFF#	J55	Front panel power button input (BTN_ONOFF#)
SW2	-	Power button

Table 31. Wake Events

Mechanical

Installing and Removing the Catalyst TC

The Catalyst TC connects to the carrier board through two connectors that are in line with each other. A high-density, stacking board-to-board connector carries the data signals, while a smaller 2x7-pin 1 mm-pitch connector carries power. When fully connected, these fine pitch connectors provide reliable and durable connection. However, care is required when removing or installing the module onto the carrier board. If correct procedures for installation and removal are not followed, damage to the connectors and/or the connector pins can result.

For detailed procedures to install a module onto or remove a module from a carrier board, refer to the *Catalyst Module Installation and Removal (Eurotech document #110122-2014)*. Download this document from the Eurotech support site (http://support.eurotech-inc.com/, topic 2778).

Warning:
Observe industry-standard electronic handling procedures when handling the module. Eurotech recommends using a grounded wrist strap and heel strap. The connectors expose signals on the system bus that do not have ESD protection.

Connectors, Switches, Jumpers, and Indicators

Identifying Connectors

The following diagram illustrates the location and numbering of the connectors on the carrier board. The Catalyst TC mates to two docking connectors, J1 and J2, which lie under the module when installed. Socket J74 is located on the bottom side of the carrier board. This connector is shown by dashed lines. Unlabeled connectors are not used on the standard Catalyst TC Development Kit.

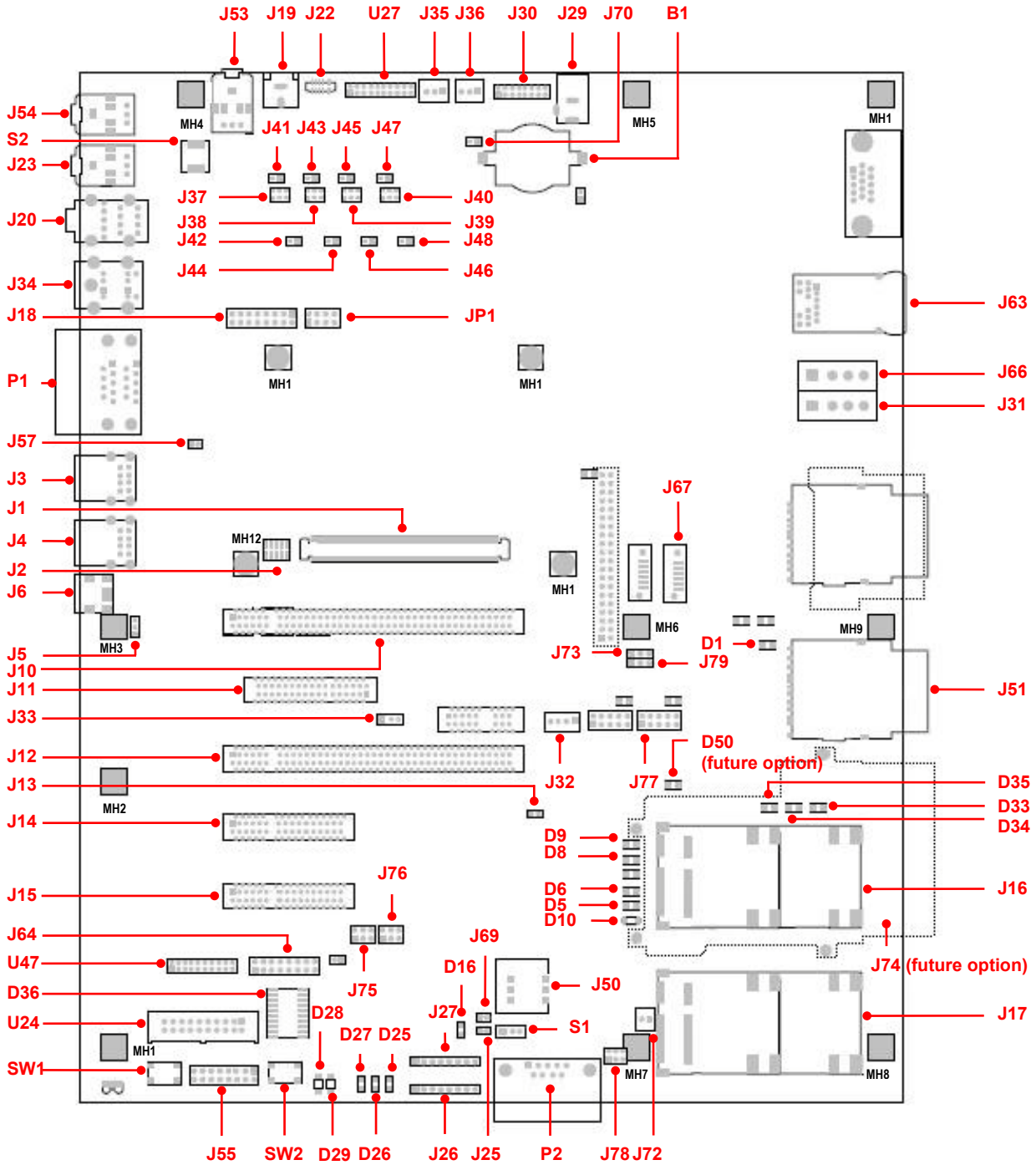


Figure 7. Connector Location

Switches, Jumpers, and Indicators

This section describes various switches, jumpers, and indicators on the carrier board.

SW1: Reset

SW1 is the reset button for the Catalyst TC Development Kit. Pressing SW1 initiates a hardware reset of module circuitry including the processor. Press this button to restart the system without cycling power. In addition, this switch connects to the front panel reset signal, SWX_RESET# (J55 pin 7) allowing connection of an external reset switch.

SW2: Power

SW2 is the power button for the Catalyst TC Development Kit. SW2 turns power used for normal operation on and off. The following table defines the functionality of the power button.

Power Button	Operation
Momentary press (less than 4 sec.)	From shutdown, initiates a power-up sequence to full operation. From full operation, initiates an orderly shutdown sequence and turns off power.
Press and hold (greater than 4 sec.)	Initiates a “4 second over-ride” and turns off power without notification to the operating system.

Table 32. Power Button

Switch SW2 also connects to the front panel power signal, SWX_ONOFF# (J55 pin 6) allowing connection of an external on/off switch.

S1: Radio Disable

S1 is a one-position slide switch that controls the radio operation of a wireless communications add-in card connected to J16, page 39.

Switch Setting	Configuration
On (toward pin 3)	Radio disabled
Off (toward pin 1)	Radio enabled (default)

S2: Audio Sense

S2 is a four-position dip switch that controls the audio jack sense input on J20, page 40.

Switch Setting	Configuration
All open	(default)
Position 1	Indicates jack inserted into Headphone port (J20 middle, green)
Position 2	Indicates jack inserted into Microphone port (J20 bottom, pink)
Position 3	Indicates jack inserted into Line In port (J20 top, blue)

J13: PCIe Switch EEPROM

Type: 2-post header, 2 mm

Jumper J13 enables configuration of the carrier board PCIe switch using a serial EEPROM.

Jumper Setting	Configuration
1-2	Serial EEPROM output connects to the PCIe switch data out.
NC	10kΩ pull-up resistor on PCIe switch data out (default)

J70: RTC Battery

Type: 2-post header, 2 mm

Jumper J70 completes the connection of the RTC battery to the Catalyst TC.

Jumper Setting	Configuration
1-2	RTC battery is connected. (default)
NC	RTC battery is disconnected.

Carrier Board LED Indicators

The carrier board uses fourteen green light-emitting diodes (LEDs) and three red LEDs to indicate system operation. The following tables describe the LED functionalities.

D1: SD/MMC LEDs

LED	Type	Description
D1	Green	On indicates activity on the SD/MMC socket J51

D5, D6, D8, D9, and D10: PCIe Switch LEDs

LED	Type	Description
D5	Green	On indicates PCIe connection between module and PCIe switch
D6	Green	On indicates a connection on the PCIe 1 slot J14
D8	Green	On indicates a connection on the Mini PCIe 0 slot J16
D9	Green	On indicates a connection on the Mini PCIe 1 slot J17
D10	Red	On indicates a fatal error

D16: Touch Panel LED

LED	Type	Description
D16	Green	Blinking indicates activity on the touch panel

D25-D27: Power LEDs

LED	Type	Description
D25	Green	On indicates normal operating power (V3.3S)
D26	Green	On indicates primary supply voltage (V3.3)
D27	Green	On indicates power is connected (V3.3A)

D28-D29: Thermal Monitoring LEDs

LED	Type	Description
D28	Red	On indicates a SIO thermal alert
D29	Red	On indicates a carrier thermal alert

D33-D35: Mini PCIe 0 Status LEDs

LED	Type	Description
D33	Green	Indicates Wireless Personal Area Network (WPAN)
D34	Green	Indicates Wireless Local Area Network (WLAN)
D35	Green	Indicates Wireless Wide Area Network (WWAN)

D36: Port 80 Status Display

D36 displays the Port 80 POST codes from the Catalyst TC.

D49: USB Host 8 LED

LED	Type	Description
D49	Green	Dependent on the device connected to J77

D50: ExpressCard LED (future configuration option)

LED	Type	Description
D50	Green	On indicates an over-current condition on the ExpressCard power interface switch

Ethernet LEDs

Ethernet socket J63 includes two LEDs. The LED on the left side indicates connection as follows.

Color	Speed (Mbps)
Amber	On indicates an active link
Off	No link

The green LED on the right side indicates connection and activity as follows.

Operation	Link/Activity
Green	Blinking indicates Ethernet activity
Off	No activity

Display Adapter LED Indicators

The Catalyst Module Display Adapter, installed in J11, has two green light-emitting diodes (LEDs) to indicate system operation. The tables provided in this section describe the LED functionalities.

D1: Backlight On LED

This LED indicates the status of the backlight power on the Catalyst Module Display Adapter.

LED	Type	Description
D1	Green	On indicates backlight power on

D2: Power-On LED

This LED indicates when power is applied to the Catalyst Module Display Adapter.

LED	Type	Description
D2	Green	On indicates 3.3 V power on

Signal Headers

The following tables describe the electrical signals available on the connectors of the carrier board. Each section provides relevant details about the connector including part numbers, mating connectors, signal descriptions, and references to related sections.

For the location of the connectors, see Identifying Connectors, page 32.

J1: Docking Connector: Data

The Catalyst TC connector J1 mates to the carrier board connector J1. Most data signals are provided on this docking connector.

J2: Docking Connector: Power

The Catalyst TC receives the power input and controls for interfacing with an external power supply on this docking connector.

J3: USB Host 0 and 1

Board connector: USB Type A dual receptacle, Molex 67298-3091
Mating connector: USB Type A plug

The dual USB socket J3 provides USB Host 0 and USB Host 1. These ports support USB 2.0 high, full, and low speed devices. The connector shield is tied to chassis ground. For further details including the mapping of the J3 USB ports to the Intel PCH EG20T USB ports, see Universal Serial Bus, page 17.

Socket	Pin	Name	Type	Description
A	1	5V_USB_PORT0	PO	5 V DC power output
	2	USB_PORT0_N	IO	USB Host 0
	3	USB_PORT0_P		
	4	GND	P	Ground
B	1	5V_USB_PORT1	PO	5 V DC power output
	2	USB_PORT1_N	IO	USB Host 1
	3	USB_PORT1_P		
	4	GND	P	Ground

J4: USB Host 6 and 7

Board connector: USB Type A dual receptacle, Molex 67298-3091
Mating connector: USB Type A plug

The dual USB socket J4 provides USB Host 6 and USB Host 7. These ports support USB 2.0 high, full, and low speed devices. The connector shield is tied to chassis ground. For further details including the mapping of the J4 USB ports to the Intel PCH EG20T USB ports, see Universal Serial Bus, page 17.

Socket	Pin	Name	Type	Description
A	1	5V_USB_PORT6	PO	5 V DC power output
	2	USB_PORT6_N	IO	USB Host 6
	3	USB_PORT6_P		
	4	GND	P	Ground
B	1	5V_USB_PORT7	PO	5 V DC power output
	2	USB_PORT7_N	IO	USB Host 7
	3	USB_PORT7_P		
	4	GND	P	Ground

J6: USB Host/Client

Board connector: Mini USB Type B receptacle, FCI 10033526-N3215LF
Mating connector: Mini USB Type B plug

The USB signals located on socket J6 support a USB host or USB client port. Jumper J5 selects the operation of this port. The connector shield is tied to chassis ground. For further details including the mapping of the J6 USB port to the Intel PCH EG20T USB ports, see Universal Serial Bus, page 17.

Pin	Name	Type	Description	
			USB Host (default)	USB Client
1	USBPWR_CLIENT	PIO	5 V DC output	DC power input
2	USB_PORT2_N	IO	USB Host	USB Client
3	USB_PORT2_P			
4	NC			
5	GND	P	Ground	Ground

Warning:
Socket J6 pin 1 is a power input or power output based on jumper J5. Check the jumper setting before connecting a USB device to this port.

J5: USB Host/Client Jumper

Type: 3-post header, 2 mm

Jumper J5 selects the configuration of the USB Host/Client port as shown in the following table.

Jumper setting	Mode	Configuration of J6, pin 1
1-2	USB Client	DC power input (used to sense connection)
2-3	USB Host	DC power output (default)
nc		No power connection

J10: SDVO Socket

Board connector: PCIe x16 socket, Molex 87715-9306
Mating connector: Intel/HP SDVO cards

In addition to the LVDS display output, the Catalyst TC Development Kit provides a secondary display output on SDVO socket J10. For further details, see Serial Digital Video, page 24.

Warning:
Socket J10 does not support the standard PCIe pinout. Install recommended Intel/HP SDVO cards only.

J11: LVDS Display & Backlight

Board connector: PCIe x4 socket, Molex 87715-9106
Mating connector: Custom display adapter card

Socket J11 is a Eurotech-specific socket that includes the LVDS display and backlight control signals. The Catalyst Module Display Adapter included with the Catalyst TC Development Kit mates to socket J11 and provides an interface between the module and display subsystem. For further details, see LVDS Display and Backlight Control, page 23.

Warning:
Socket J11 is a Eurotech-specific socket. Install the Catalyst Module Display Adapter card in this socket only.

Pin	Name	Type	Description
A1	GND	P	Ground
A2	V12S	PO	12 V power
A3	V12S	PO	12 V power
A4	GND	P	Ground
A5	NC		
A6	NC		
A7	NC		
A8	NC		
A9	V3.3S	PO	Normal operating 3.3 V
A10	V3.3S	PO	Normal operating 3.3 V
A11	BUF_RST#	O-3.3	Buffered reset
A12	GND	P	Ground
A13	LA_CLK_P	O-LVDS	LVDS clock
A14	LA_CLK_N		
A15	GND	P	Ground
A16	L_DDC_CLK	O-CMOS	LCD DDC I^2C clock
A17	L_DDC_DATA	IO-CMOS	LCD DDC I^2C data
A18	GND	P	Ground
A19	NC		
A20	GND	P	Ground

Pin	Name	Type	Description
A21	L_CTLA_CLK	O-LVTTL	Backlight I^2C clock
A22	L_CTLB_DATA	IO-LVTTL	Backlight I^2C data
A23	GND	P	Ground
A24	GND	P	Ground
A25	L_BKLTSEL0_GPIO#	O-LVTTL	Selects backlight control (PWM vs. I^2C)
A26	L_BKLTCTL	O-CMOS	Controls intensity of the backlight
A27	GND	P	Ground
A28	GND	P	Ground
A29	L_BKLTEN	O-CMOS	Turns power to the backlight on or off
A30	L_VDDEN	O-CMOS	LCD power enable
A31	GND	P	Ground
A32	NC		
B1	V12S	PO	12 V power
B2	V12S	PO	12 V power
B3	V12S	PO	12 V power
B4	GND	P	Ground
B5	SMB_CLK	O-CMOS	SMBus clock
B6	SMB_DATA	IO-CMOS	SMBus data
B7	GND	P	Ground
B8	V3.3S	PO	Normal operating 3.3 V
B9	NC		
B10	NC		
B11	LVDS_PRESENT	I-3.3	Display adapter detect (Super I/O Controller GP30)
B12	V5S	PO	Normal operating 5 V
B13	GND	P	Ground
B14	LA_DATA0_P	O-LVDS	LVDS data 0
B15	LA_DATA0_N		
B16	GND	P	Ground
B17	SLOT_PRESENCE	I-3.3	Card present
B18	GND	P	Ground
B19	LA_DATA1_P	O-LVDS	LVDS data 1
B20	LA_DATA1_N		
B21	GND	P	Ground
B22	GND	P	Ground
B23	LA_DATA2_P	O-LVDS	LVDS data 2
B24	LA_DATA2_N		
B25	GND	P	Ground
B26	GND	P	Ground
B27	LA_DATA3_P	O-LVDS	LVDS data 3
B28	LA_DATA3_N		
B29	GND	P	Ground
B30	NC		
B31	SLOT_PRESENCE	I-3.3	Card present
B32	GND	P	Ground

J12: PCIe 0 (x1)

Board connector: PCIe x16 socket, Molex 87715-9306
Mating connector: PCIe card

Socket J12 provides a direct PCIe x1 connection to the Catalyst TC. The socket accepts x1, x4, x8, and x16 cards. However, it automatically negotiates down to an x1 slot. PCIe 0 does not support the optional JTAG signals. For further details, see Catalyst TC PCIe Slots, page 16.

J14: PCIe 1 (x1)

Board connector: PCIe x4 socket, Molex 87715-9106
Mating connector: PCIe card

Socket J14 provides a PCIe x1 connection to the PCIe switch located on the carrier board. This socket accepts x1 and x4 cards. However, it automatically negotiates down to an x1 slot. PCIe 1 does not support the optional JTAG signals. For further details, see Carrier Board PCIe Slots, page 17.

J15: PCIe 2 (x1)

Board connector: PCIe x4 socket, Molex 87715-9106
Mating connector: PCIe card

Socket J15 provides a direct PCIe x1 connection to the Catalyst TC. This socket accepts x1 and x4 cards. However, it automatically negotiates down to an x1 slot. PCIe 2 does not support the optional JTAG signals. For further details, see Catalyst TC PCIe Slots, page 16.

J16: Mini PCIe 0 with UIM

Board connector: 52-pin MiniCard, Molex 67910-0001
Mating connector: Mini PCIe card

Socket J16 connects to the on-board PCIe switch providing the Mini PCIe 0 slot. For further details, see Carrier Board PCIe Slots, page 17. Socket J16 supports an UIM interface which also connects to socket J50, radio operation of a wireless communications add-in card, and status indicators. For details about control of the radio operation, see S1, page 33. For details about the status indicators, see Carrier Board LED Indicators, page 34.

J17: Mini PCIe 1

Board connector: 52-pin MiniCard, Molex 67910-0001
Mating connector: Mini PCIe card

Socket J17 connects to the on-board PCIe switch providing the Mini PCIe 1 slot. For further details, see Carrier Board PCIe Slots, page 17. Unlike socket J16, socket J17 does not support a UIM interface, radio operation of a wireless communication add-in card, and status indicators.

J18: Secondary Audio Codec

Board connector: 2x8 header, 0.1-inch, Samtec HMTSW-108-07-LD-200
Mating connector: Samtec HCSD series socket

The Intel HD Audio interface provided by the Catalyst TC supports up to two audio codecs. The primary codec is populated on the carrier board, while header J18 and JP1 provide a connection to an external secondary codec. For further details, see Audio Interface, page 29.

Pin	Name	Type	Termination	Description
1	GND	P		Ground
2	NC			
3	V3.3	PO		3.3 V primary supply voltage
4	NC			
5	NC			
6	HDA_SDATAIN1	I-HDA		Serial data input 1
7	V12S	PO		12 V power
8	Reserved			
9	V3.3	P		3.3 V primary supply voltage
10	HDA_SDATAOUT	O-HDA	R 33Ω	Serial data out
11	GND	P		Ground
12	HDA_SYNC	O-HDA	R 33Ω	Frame sync
13	DVDD_IO	PO		Reference voltage
14	HDA_RST#	O-HDA	R 33Ω	Reset
15	GND	P		Ground
16	HDA_BITCLK	O-HDA	R 33Ω	Bit clock

JP1: Secondary Audio Codec Jumper

Type: 2x4 header, 0.1-inch

Jumper JP1 provides additional signals for the secondary codec.

Pin	Name	Type	Termination	Description
1	HDA_PWRDN_NET	O	PD 10kΩ	Audio power down
2	SPKR	O-CMOS		Speaker
3	GND	P		Ground
4	V5	PO		5 V primary supply
5	V3.3S	PO		Normal operating 3.3 V
6	NC			
7	HDA_DOCK_RST#	O-HDA		Docking function reset
8	HDA_DOCK_EN#	O-HDA		Docking function enable

J19: S/PDIF (option)

Board connector: RCA jack, right angle, CUI Inc RCJ-041
Mating connector: RCA plug

Socket J19 provides an optional Sony/Philips Digital Interconnect Format (S/PDIF) output for connectivity to consumer electronic equipment. For further details, see Audio Interface, page 29.

Pin	Name	Type	Description
1	GND	P	Ground
2	SPDIF	O	S/PDIF

J20: Stereo Line Input, Microphone Input, and Headphone Output

Board connector: 3.5 mm stereo jack, stacked, Kycon STX-4335-5BGP-S1
Mating connector: 3.5 mm stereo plug

Socket J20 provides direct connections to two stereo line inputs and one headphone output. The shell of the socket is connected to chassis ground. For further details, see Audio Interface, page 29.

Socket	Pin	Name	Type	Description
Top, Blue	32	PORT_C_R_L	AI	Line In 1
	35	PORT_C_L_L		
Center, Green	22	PORT_A_R_L	AO	Headphone
	25	PORT_A_L_L		
Bottom, Pink	2	PORT_B_R_L	AI	Line In 0 (Microphone)
	5	PORT_B_L_L		
	1	GND_HDA	P	Audio ground

J22: Digital Microphone

Board connector: 6-pin FFC/FPC connector, 0.5 mm, Molex 52559-0672

In addition to the analog microphone input, the codec included on the carrier board supports a digital microphone input on socket J22. For further details, see Audio Interface, page 29.

Pin	Name	Type	Description
1	DMIC_CLK_OUT	O	Digital microphone clock
2	GND	P	Ground
3	V_DMIC_L	PO	Digital microphone power (default 3.3 V)
4	DMIC0	I	Digital microphone channel 0
5	GND	P	Ground
6	DMIC1	I	Digital microphone channel 1

J23: Stereo Line Out 1

Board connector: 3.5 mm stereo phone jack, Kobiconn 161-3503-EX
Mating connector: 3.5 mm stereo phone plug

Socket J23 provides the connection to one stereo line output capable of driving powered speakers. For further details, see Audio Interface, page 29.

Pin	Name	Type	Description
1	GND_HDA	P	Audio ground
2	PORT_D_L_L	AO	Line out 1, left channel
3	NC		
4	NC		
5	PORT_D_R_L	AO	Line out 1, right channel
6	NC		
7	GND_HDA	P	Audio ground
8	SENSE_A_PD	AI	Detects a connection on Port D

J26: Touch Panel (4- or 5-wire)

Board connector: 8-pin header, 0.1-inch, Samtec HMTSW-108-07-L-S-200
Mating connector: Samtec HCSS series socket

Header J26 supplies the signals for a 4- or 5-wire touch panel. Standard Catalyst TC Development Kits include a 4-wire touch panel. For further details, see Carrier Board Touch Panel Controller, page 24.

Pin	Name	Type	4-Wire	4-Wire (Alt)	5-Wire	5-Wire (Alt)	Description
1	TC0	AIO		Left	UR		Touch panel
2	TC1	AIO		Right	UL		
3	TC2	AIO		Top	Wiper		
4	TC4	AIO	Bottom	Bottom	LL	LL	
5	TC3	AIO	Right		LR	UL	
6	TC2	AIO	Top			Wiper	
7	TC1	AIO	Left			LR	
8	TC0	AIO				UR	

J27: Touch Panel (8-wire)

Board connector: 8-pin header, 0.1-inch, Samtec HMTSW-108-07-L-S-200
Mating connector: Samtec HCSS series socket

Header J27 supports an 8-wire touch panel by adding sense lines to the excite lines. Standard Catalyst TC Development Kits include a 4-wire touch panel. For further details, see Carrier Board Touch Panel Controller, page 24.

Pin	Name	Type	8-Wire	Description
1	TC2	AIO	Bottom	Touch panel
2	SY+	AIO	Bottom sense	
3	SX+	AIO	Right sense	
4	TC0	AIO	Right	
5	TC4	AIO	Top	
6	SY-	AIO	Top sense	
7	SX-	AIO	Left sense	
8	TC1	AIO	Left	

J25: Touch Panel Configuration Jumper

Type: 2-post header, 2 mm

Jumper J25 configures the development kit for support of 4-, 5- and 8-wire touch panels.

Jumper Setting	Configuration
1-2	4-, 5-, and 8-wire support (default)
NC	8-wire only support

J69: Touch Panel Enable Jumper

Type: 2-post header, 2 mm

Jumper J69 enables or disables the touch panel controller on the carrier board.

Jumper Setting	Configuration
1-2	Disables touch panel controller
NC	Enables touch panel controller (default)

J29: DC Power Input

Board connector: power jack, 2.1 mm x 5.5 mm, CUI Inc PJ-202AH
Mating connector: 2.1 mm power supply plug

Power jack J29 accepts +12 VDC input power from an external supply such as the AC power adapter included with the Catalyst TC Development Kit. The power input is on the center pin. For details about the power supply architecture, see Power Supply Architecture, page 30.

Warning:
Disconnect the power input before removing the module. Removing the module from a powered carrier board may result in damage to both the carrier board and to the module. For detailed instructions for removing the module, refer to the *Catalyst Module Installation and Removal (Eurotech document #110122-2014)*.

J30: JTAG

Board connector: 2x8 socket, 2 mm, Samtec SQT-108-01-L-D
Mating connector: Samtec TCMD series IDC assembly

The Catalyst TC Development Kit provides a full IEEE1149.1 JTAG port for programming the CPLD on the module, factory test, and software debugging. Otherwise, the JTAG port is not supported for application use.

Pin	Name	Type	Description
1	JTAG_TRST#	I	JTAG interface
2	JTAG_TMS	I	
3	GND	P	
4	JTAG_TDI	I	
5	JTAG_TCK	I	
6	V3.3S	PO	
7	GND	P	
8	JTAG_TDO	O	
9	NC		
10	NC		
11	NC		
12	V5S	PO	
13	NC		
14	NC		
15	NC		
16	GND	P	

J31: Disk Drive Power Out 0

Board connector: 4-pin header, 0.2-inch, Molex 15-24-4449
Mating connector: Molex 15-24-4048 crimp housing

Header J31 supplies power to an optional external disk drive used for mass storage in the Catalyst TC Development Kit.

Warning:
J31 provides output power only. Do not connect to an input power source.

Pin	Name	Type	Description
1	V12S	PO	12 V power
2	GND	P	Ground
3	GND	P	Ground
4	V5S	PO	5 V normal operating power

J32: SMBus

Board connector: 4-pin shrouded header, 0.1-inch, FCI 69167-104HLF
Mating connector: PV CTW housings and contacts

The SMBus provides I/O expansion capabilities on header J32. For further details, see System Management Bus, page 20.

Pin	Name	Type	Termination	Description
1	SMB_DATA	IO-CMOS	PU 2.2kΩ V3.3S	SMBus data
2	SMB_CLK	O-CMOS	PU 2.2kΩ V3.3S	SMBus clock
3	SMB_ALERT#	IO-CMOS	PU 10kΩ V3.3S	SMBus activity alert
4	GND	P		Ground

Notes:
The SMBus is not compatible with all I^2C devices. Review the device data sheet carefully before connecting an I^2C device to the SMBus.

J33: Carrier I^2C Bus

Board connector: 3-pin header, 0.1-inch, Samtec HMTSW-103-07-L-S-200-LL
Mating connector: Samtec HCSS series socket

Header J33 provides an external connection to the I^2C bus of the Catalyst TC embedded controller. For further details, see Carrier I^2C Bus, page 19.

Pin	Name	Type	Termination	Description
1	CARRIER_I2C_SDA	IO	PU 10kΩ V3.3A	I^2C bus data
2	CARRIER_I2C_SCL	O	PU 10kΩ V3.3A	I^2C bus clock
3	GND	P		Ground

J34: PS/2 Keyboard & Mouse

Board connector: double-stacked Mini-DIN socket, Kycon KMDGX-6SG/P-S4N
Mating connector: Mini-DIN plug

The Catalyst TC Development Kit supports a PS/2 keyboard and PS/2 mouse on socket J34. The connector shield is tied to chassis ground. For further details, see Carrier Board PS/2 Support, page 24.

Socket	Description
Top	PS/2 Mouse
Bottom	PS/2 Keyboard

J35: Tachometer 1

Board connector: 3-pin header, 0.1-inch, Molex 22-23-2031
Mating connector: Molex 22-01-2031 crimp terminal housing

Two tachometer outputs are available on header J35 and header J36 for motor control or external cooling applications. For further details, see Carrier Board Temperature Monitoring, page 28.

Pin	Name	Type	Description
1	TACH1	O	Tachometer 1
2	V12S	PO	12 V power
3	TACH1_PWR	AO	Switched adjustable control 1

J36: Tachometer 2

Board connector: 3-pin header, 0.1-inch, Molex 22-23-2031
Mating connector: Molex 22-01-2031 crimp terminal housing

Two tachometer outputs are available on header J35 and header J36 for motor control or external cooling applications. For further details, see Carrier Board Temperature Monitoring, page 28.

Pin	Name	Type	Description
1	TACH2	O	Tachometer 2
2	V12S	PO	12 V power
3	TACH2_PWR	AO	Switched adjustable control 2

J37: Serial 6

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J37 supports an EIA-485 serial port. For further details, see Super I/O Controller Serial Ports, page 23.

Pin	Name	Type	Description
1	RX6_485_P	I	Non-inverting Receive Data 6
2	RX6_485_N	I	Inverting Receive Data 6
3	485_6_GND	P	Ground (through ferrite bead)
4	TX6_485_P	O	Non-inverting Transmit Data 6
5	TX6_485_N	O	Inverting Transmit Data 6
6	GND	P	Ground

J41: Serial 6 Receive Termination Jumper

Type: 2-post header, 2 mm

Jumper J41 provides termination across the inverting and non-inverting receive lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J42: Serial 6 Transmit Termination Jumper

Type: 2-post header, 2 mm

Jumper J42 provides termination across the inverting and non-inverting transmit lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J38: Serial 4

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J38 supports an EIA-485 serial port. For further details, see Super I/O Controller Serial Ports, page 23.

Pin	Name	Type	Description
1	RX4_485_P	I	Non-inverting Receive Data 4
2	RX4_485_N	I	Inverting Receive Data 4
3	485_4_GND	P	Ground (through ferrite bead)
4	TX4_485_P	O	Non-inverting Transmit Data 4
5	TX4_485_N	O	Inverting Transmit Data 4
6	GND	P	Ground

J43: Serial 4 Receive Termination Jumper

Type: 2-post header, 2 mm

Jumper J43 provides termination across the inverting and non-inverting receive lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J44: Serial 4 Transmit Termination Jumper

Type: 2-post header, 2 mm

Jumper J44 provides termination across the inverting and non-inverting transmit lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J39: Serial 5

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J39 supports an EIA-422 serial port. For further details, see Super I/O Controller Serial Ports, page 23.

Pin	Name	Type	Description
1	RX5_422_P	I	Non-inverting Receive Data 5
2	RX5_422_N	I	Inverting Receive Data 5
3	422_5_GND	P	Ground (through ferrite bead)
4	TX5_422_P	O	Non-inverting Transmit Data 5
5	TX5_422_N	O	Inverting Transmit Data 5
6	GND	P	Ground

J45: Serial 5 Receive Termination Jumper

Type: 2-post header, 2 mm

Jumper J45 provides termination across the inverting and non-inverting receive lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J46: Serial 5 Transmit Termination Jumper

Type: 2-post header, 2 mm

Jumper J46 provides termination across the inverting and non-inverting transmit lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J40: Serial 2

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J40 supports an EIA-422 serial port. For further details, see Super I/O Controller Serial Ports, page 23.

Pin	Name	Type	Description
1	RX2_422_P	I	Non-inverting Receive Data 2
2	RX2_422_N	I	Inverting Receive Data 2
3	422_2_GND	P	Ground (through ferrite bead)
4	TX2_422_P	O	Non-inverting Transmit Data 2
5	TX2_422_N	O	Inverting Transmit Data 2
6	GND	P	Ground

J47: Serial 2 Receive Termination Jumper

Type: 2-post header, 2 mm

Jumper J47 provides termination across the inverting and non-inverting receive lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J48: Serial 2 Transmit Termination Jumper

Type: 2-post header, 2 mm

Jumper J46 provides termination across the inverting and non-inverting transmit lines.

Jumper Setting	Configuration
1-2	121Ω termination resistor
NC	No termination (default)

J50: SIM

Board connector: Slide-in SIM card socket, AVX 00-9162-006-206-175
Mating connector: Micro SIM cards

The carrier board includes a standard Subscriber Identity Module (SIM) socket supporting handheld devices requiring secure subscriber identification.

J51: SD/MMC

Board connector: SD/MMC socket, FCI 10067847-001RLF
Mating connector: SD/MMC card

The Catalyst TC Development Kit provides a SD/MMC card slot on socket J51 for memory and I/O expansion. Power to this socket is software-controlled. For further details, see SD Card, page 15.

J53: Stereo Line Out 0

Board connector: 3.5 mm stereo phone jack, Kobiconn 161-3503-EX
Mating connector: 3.5 mm stereo phone plug

Socket J53 provides the connection to one stereo line output capable of driving powered speakers. For further details, see Audio Interface, page 29.

Pin	Name	Type	Description
1	GND_HDA	P	Audio ground
2	PORT_F_L_L	AO	Line out 0, left channel
3	NC		
4	NC		
5	PORT_F_R_L	AO	Line out 0, right channel
6	NC		
7	GND_HDA	P	Audio ground
8	SENSE_B_PF	AI	Detects a connection on Port F

J54: Microphone

Board connector: 3.5 mm stereo phone jack, Kobiconn 161-3503-EX
Mating connector: 3.5 mm stereo phone plug

Socket J54 provides the connection for a microphone. For further details, see Audio Interface, page 29.

Pin	Name	Type	Description
1	GND_HDA	P	Audio ground
2	PORT_E_L_L	AI	Microphone, left channel
3	NC		
4	NC		
5	PORT_E_R_L	AI	Microphone, right channel
6	NC		
7	GND_HDA	P	Audio ground
8	SENSE_B_PE	AI	Detects a connection on Port E

J55: Front Panel

Board connector: 16-pin header, 0.1-inch, Samtec HTSW-116-07-F-D
Mating connector: Samtec HCSD series socket

Header J55 allows connections of external switches and LEDs to the carrier board.

Pin	Name	Type	Termination	Description
1	FRONT1	O-5	PU 332Ω V5S 470pF to GND	Front 1
2	FRONT2	O-5	PU 332Ω V5A 470pF to GND	Front 2
3	IDE_PDACTIVE#	O	470pF to GND	IDE drive active
4	GND	P		Ground
5	GND	P		Ground
6	SWX_ONOFF#	I-5	PU 10kΩ V5A 470pF to GND	Front panel power button (BTN_ONOFF#)
7	SWX_RESET#	I-3.3	PU 10kΩ V3.3S 470pF to GND	Front panel reset switch (FP_RESET#)
8	GND	P		Ground
9	V5	PO		5 V primary supply voltage
10	NC			
11	NC			
12	GND	P		Ground
13	GND	P		Ground
14	NC			
15	SLP_LED	O-3.3		External LED control (Super I/O Controller GP60)
16	V5	PO		5 V primary supply voltage

J63: Gigabit Ethernet

Board connector: RJ-45 socket with LEDs, Pulse Engineering JK0-0036NL
Mating connector: RJ-45 plug

Socket J63 provides a direct connection to a Gigabit Ethernet network. The socket includes two Ethernet LEDs, page 35 and built-in magnetics. The connector shield is tied to chassis ground. For further details, see Gigabit Ethernet, page 18.

J64: CPLD GPIO

Board connector: 16-pin header, 0.1-inch, Samtec HTSW-116-07-F-D
Mating connector: Samtec HCSD series socket

The CPLD on the carrier board provides eight general-purpose inputs and outputs on header J64. For further details, see General-Purpose Inputs and Outputs, page 26.

Pin	Name	Type	Description
1	CPLD_IO_B1_68	IO-CMOS	CPLD IO row B1 pin 68
2	GND	P	Ground
3	CPLD_IO_B1_69	IO-CMOS	CPLD IO row B1 pin 69
4	GND	P	Ground
5	CPLD_IO_B1_70	IO-CMOS	CPLD IO row B1 pin 70
6	GND	P	Ground
7	CPLD_IO_B1_76	IO-CMOS	CPLD IO row B1 pin 76
8	GND	P	Ground
9	CPLD_IO_B1_97	IO-CMOS	CPLD IO row B1 pin 97
10	GND	P	Ground
11	CPLD_IO_B1_98	IO-CMOS	CPLD IO row B1 pin 98
12	GND	P	Ground
13	CPLD_IO_B1_99	IO-CMOS	CPLD IO row B1 pin 99
14	GND	P	Ground
15	CPLD_IO_B1_100	IO-CMOS	CPLD IO row B1 pin 100
16	GND	P	Ground

J66: Disk Drive Power Out 1

Board connector: 4-pin header, 0.2-inch, Molex 15-24-4449
Mating connector: Molex 15-24-4048 crimp housing

Header J66 supplies power to an optional external disk drive used for mass storage in the Catalyst TC Development Kit.

Warning:
J66 provides output power only. Do not connect to an input power source.

Pin	Name	Type	Description
1	V12S	PO	12 V power
2	GND	P	Ground
3	GND	P	Ground
4	V5S	PO	5 V normal operating power

J67: SATA

Board connector: 7-pin header, 0.05-inch, Molex 67800-5002
Mating connector: SATA receptacle

Header J67 provides connection to a SATA disk drive. For further details, see SATA Disk Drive, page 15.

Pin	Name	Type	Description
1	GND	P	Ground
2	SATA_TX_C_P	IO	SATA Transmit pair
3	SATA_TX_C_N		
4	GND	P	Ground
5	SATA_RX_C_N	IO	SATA Receive pair
6	SATA_RX_C_P		
7	GND	P	Ground

J72: CAN

Board connector: 2-pin header, 0.1-inch, Molex 22-23-2021
Mating connector: crimp housing, Molex 22-01-2021

Header J72 supplies a CAN 2.0B bus. For further details, see CAN 2.0B Bus, page 22.

Pin	Name	Type	Description
1	CANHIGH	IO	CAN
2	CANLOW		

J73: TC I²C Bus

Board connector: 3-pin header, 0.1-inch, Samtec HMTSW-103-07-L-S-200-LL
Mating connector: Samtec HCSS series socket

Header J73 provides an external connection to the I^2C bus of the Intel PCH EG20T located on the Catalyst TC. For further details, see TC I^2C Bus, page 20.

Pin	Name	Type	Termination	Description
1	TC_I2C_SDA	IO	PU 10kΩ V3.3S	I^2C data
2	TC_I2C_SCL	O	PU 10kΩ V3.3S	I^2C clock
3	GND	P		Ground

J74: ExpressCard (future configuration option)

Board connector: ExpressCard host connector, FCI 10055262-100BBSLF
Mating connector: ExpressCard module

As a future configuration option, the Catalyst TC Development Kit will support ExpressCard compliant modules on header J74. For further details, see ExpressCard, page 17.

J75: TC Serial 1

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J75 supports an EIA-422 serial port. For further details, see Catalyst TC Serial Ports, page 22.

Pin	Name	Type	Description
1	SP1_422_RX_P	I	Non-inverting Receive Data
2	SP1_422_RX_N	I	Inverting Receive Data
3	422_1_GND	P	Ground (through ferrite bead)
4	SP1_422_TX_P	O	Non-inverting Transmit Data
5	SP1_422_TX_N	O	Inverting Transmit Data
6	GND	P	Ground

J76: TC Serial 2

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J76 supports an EIA-422 serial port. For further details, see Catalyst TC Serial Ports, page 22.

Pin	Name	Type	Description
1	SP2_422_RX_P	I	Non-inverting Receive Data
2	SP2_422_RX_N	I	Inverting Receive Data
3	422_2_GND	P	Ground (through ferrite bead)
4	SP2_422_TX_P	O	Non-inverting Transmit Data
5	SP2_422_TX_N	O	Inverting Transmit Data
6	GND	P	Ground

J77: USB Host 8

Board connector: 2x5 header, 0.1-inch, Samtec HMTSW-105-07-L-D-200
Mating connector: Samtec HCSD series socket

Header J77 provides the signal for a USB host port. Notice that this port routes directly to the Catalyst TC and does not include additional support circuitry on the carrier board. For further details, see Universal Serial Bus, page 17.

Pin	Name	Type	Description
1	V5S	PO	Normal operating 5 V
2	NC		
3	USB8_N	IO	USB 8, negative signal
4	NC		
5	USB8_P	IO	USB 8, positive signal
6	NC		
7	GND	P	
8	NC		
9	NC		(Pin 9 is keyed)
10	USB_HD_LED#	I-5	Control for LED D49, page 34

J78: TC Serial 3

Board connector: 2x3 header, 2 mm, Samtec TMM-103-03-T-D
Mating connector: Samtec TCSD series socket

Header J78 supports an EIA-232 serial port. For further details, see Catalyst TC Serial Ports, page 22.

Notes:
Revision 1 of the carrier board does not support TC Serial 3. Future revisions will support this feature. For information about availability, contact your local Eurotech representative.

Pin	Name	Type	Description
1	SP3_RS232_RX	I	Receive Data
2	SP3_RS232_TX	O	Transmit Data
3	NC		
4	GND	P	Ground
5	GND	P	Ground
6	GND	P	Ground

J79: Catalyst TC GPIO

Board connector: 1x3 header, 0.1-inch, Samtec HMTSW-103-07-L-S-200
Mating connector: Samtec HCSS series socket

Header J79 provides three general-purpose I/O that connect directly to the Intel PCH EG20T located on the Catalyst TC. For further details, see General-Purpose Inputs and Outputs, page 26.

Pin	Name	Type	Description
1	GPIO3	IO	Intel PCH EG20T GPIO2
2	GPIO4	IO	Intel PCH EG20T GPIO3
3	GPIO5	IO	Intel PCH EG20T GPIO4

P1: TC Serial 0 and Serial 3

Board connector: DB-9 plug-over-plug, Tyco 1734280-3
Mating connector: DB-9 socket

The dual plug P1 supports two full-feature EIA-232 serial ports. The connector shield is tied to chassis ground. For further details, see Catalyst TC Serial Ports, page 22.

Pin		Name	Type	Description
Top	B1	DCD3	I	Data Carrier Detect 3
	B2	RXD3	I	Receive Data 3
	B3	TXD3	O	Transmit Data 3
	B4	DTR3	O	Data Terminal Ready 3
	B5	UART1_UART2_GND	P	Ground (through ferrite bead)
	B6	DSR3	I	Data Set Ready 3
	B7	RTS3	O	Request To Send 3
	B8	CTS3	I	Clear To Send 3
	B9	RI3	I	Ring Indicator 3
Bottom	A1	DCD0	I	Data Carrier Detect 0
	A2	RXD0	I	Receive Data 0
	A3	TXD0	O	Transmit Data 0
	A4	DTR0	O	Data Terminal Ready 0
	A5	UART1_UART2_GND	P	Ground
	A6	DSR0	I	Data Set Ready 0
	A7	RTS0	O	Request To Send 0
	A8	CTS0	I	Clear To Send 0
	A9	RI0	I	Ring Indicator 0

J57: TC Serial 0 and Serial 3 Control Jumper

Type: 2-post header, 2 mm

Both TC Serial 0 and Serial 3 are driven by a Sipex SP3243 transceiver. These EIA-232 transceivers include automatic shutdown circuitry that allows the device to automatically shutdown, saving power when an EIA-232 cable is disconnected or a connected peripheral is turned off.

Notes:
If two connected serial ports enable automatic shutdown, neither port will turn on. Disable automatic shutdown if your device connects to another device that also uses automatic shutdown of the serial port.

Jumper J57 and the signal UARTx_SHUTDOWN control the operation of each EIA-232 transceiver. The on-board Super I/O Controller drives the signals UART1_SHUTDOWN and UART2_SHUTDOWN. For further details about these signals, see Carrier Board Super I/O Controller, page 27.

The following table describes the operation of the EIA-232 transceivers.

UARTx_SHUTDOWN	J57	Signal at Rcvr Input	Transceiver Operation
Logic level low	NC (default) or 1-2	yes or no	Shutdown mode Drivers are shut down
Logic level high	NC (default)	yes or no	Automatic shutdown circuitry is disabled Drivers remain active
Logic level high	1-2	yes	Automatic shutdown circuitry enabled Normal operation
Logic level high	1-2	no	Automatic shutdown circuitry enabled Drivers are shut down

P2: Maintenance Port

Board connector: DB-9 plug, Tyco 5747840-4
Mating connector: DB-9 socket

Connector P2 provides a serial maintenance port for the Catalyst TC embedded controller. The connector shield is tied to chassis ground. This maintenance serial port is extremely important in bring-up of a new carrier board design, troubleshooting, and software debug. For additional information about using this port, see Appendix C – Maintenance Port, page 64.

Notes:
The pinout of P2 does not follow the EIA-232 standard. The signals on pin 2 and pin 3 should be swapped for a standard DB-9 plug. If you are directed to use this port, use a gender changer or create a custom cable. Refer to forum topic 2556.

Pin	Name	Type	Description
1	NC		
2	DEBUG_TX	O	Transmit Data
3	DEBUG_RX	I	Receive Data
4	NC		
5	GND	P	Ground
6	NC		
7	NC		
8	NC		
9	NC		

U24: LPC Bus

Board connector: 2x10 shrouded header, 0.1-inch, Adam Tech BHR20VUA
Mating connector: IDC socket

The LPC bus is available for general-purpose I/O expansion on header U24. For further details, see Low Pin Count Bus, page 25.

Pin	Name	Type	Termination	Description
1	CLK_LPC_FWH	O-CMOS	R22.6Ω	LPC bus clock
2	GND	P		Ground
3	LPC_FRAME#	O-CMOS	PU 10kΩ V3.3S	LPC bus frame sync
4	NC			
5	BUF_RST#	O-3.3	PD 100kΩ	Buffered reset
6	V5S	PO		Normal operating 5 V
7	LPC_AD3	IO-CMOS	PU 5kΩ V3.3S	LPC bus address/data 3
8	LPC_AD2	IO-CMOS	PU 5kΩ V3.3S	LPC bus address/data 2
9	V3.3S	PO		Normal operating 3.3 V
10	LPC_AD1	IO-CMOS	PU 5kΩ V3.3S	LPC bus address/data 1
11	LPC_AD0	IO-CMOS	PU 5kΩ V3.3S	LPC bus address/data 0
12	GND	P		Ground
13	SMB_CLK	O-CMOS	PU 2.2kΩ V3.3S	SMBus clock
14	SMB_DATA	IO-CMOS	PU 2.2kΩ V3.3S	SMBus data
15	V3.3	PO		3.3 V primary supply
16	INT_SERIRQ	IO-CMOS	PU 5kΩ V3.3S	LPC bus interrupt (For details, contact Eurotech)
17	GND	P		Ground
18	PM_CLKRUN#	IO-CMOS	PU 10kΩ V3.3S	Initiates active clock output from LPC bus master
19	LPCPD#	O	PU 10kΩ V3.3S	(For details, contact Eurotech)
20	NC			

U27: Catalyst TC GPIO and Super I/O Controller GPIO

Board connector: 2x10 terminal strip, 2 mm, Samtec TMM-110-03-T-D
Mating connector: Samtec TCSD series socket

The Catalyst TC Development Kit includes nine GPIO signals on header U27. Two GPIO connect directly to the Catalyst TC embedded controller; while the remaining seven GPIO connect to the Super I/O Controller located on the carrier board. Nine pull-up resistors connect to U27 for termination of each GPIO. For further details, see General-Purpose Inputs and Outputs, page 26.

Pin	Name	Type	Description
1	GPIO1	IO-CMOS	Embedded controller GPIO
2	PU1		100kΩ pull-up resistor to V3.3S
3	GPIO2	IO-CMOS	Embedded controller GPIO
4	PU2		100kΩ pull-up resistor to V3.3S
5	SIOC_GPIO0	IO-3.3	Super I/O Controller GP61
6	PU3		100kΩ pull-up resistor to V3.3
7	NC		
8	PU4		100kΩ pull-up resistor to V3.3
9	SIOC_GPIO1	IO-3.3	Super I/O Controller GP56
10	PU5		100kΩ pull-up resistor to V3.3
11	SIOC_GPIO2	IO-3.3	Super I/O Controller GP57
12	PU6		100kΩ pull-up resistor to V3.3
13	SIOC_GPIO3	IO-3.3	Super I/O Controller GP50
14	PU7		100kΩ pull-up resistor to V3.3
15	SIOC_GPIO4	IO-3.3	Super I/O Controller GP51
16	PU8		100kΩ pull-up resistor to V3.3
17	SIOC_GPIO5	IO-3.3	Super I/O Controller GP31
18	PU9		100kΩ pull-up resistor to V3.3
19	SIOC_GPIO6	IO-3.3	Super I/O Controller GP46
20	PU10		100kΩ pull-up resistor to V3.3

U47: I/O Expansion

Board connector: 2x10 terminal strip, 2 mm, Samtec TMM-110-03-T-D
Mating connector: Samtec TCSD series socket

The carrier board includes an I/O expansion port on header U46 providing eight GPIO signals that are accessible using the SMBus. Eight pull-up resistors connect to U47 for termination of each GPIO. For further details, see General-Purpose Inputs and Outputs, page 26.

Pin	Name	Type	Description
1	SMB_GPIO0	IO-3.3	I/O Expansion P0
2	SMB_PU0	P	10kΩ pull-up resistor to V3.3S
3	SMB_GPIO1	IO-3.3	I/O Expansion P1
4	SMB_PU1	P	10kΩ pull-up resistor to V3.3S
5	SMB_GPIO2	IO-3.3	I/O Expansion P2
6	SMB_PU2	P	10kΩ pull-up resistor to V3.3S
7	SMB_GPIO3	IO-3.3	I/O Expansion P3
8	SMB_PU3	P	10kΩ pull-up resistor to V3.3S
9	SMB_GPIO4	IO-3.3	I/O Expansion P4
10	SMB_PU4	P	10kΩ pull-up resistor to V3.3S
11	SMB_GPIO5	IO-3.3	I/O Expansion P5
12	SMB_PU5	P	10kΩ pull-up resistor to V3.3S
13	SMB_GPIO6	IO-3.3	I/O Expansion P6
14	SMB_PU6	P	10kΩ pull-up resistor to V3.3S
15	SMB_GPIO7	IO-3.3	I/O Expansion P7
16	SMB_PU7	P	10kΩ pull-up resistor to V3.3S
17	NC		
18	V3.3S	PO	Normal operating 3.3 V
19	V3.3A	PO	“Always” power
20	GND	P	Ground

System Specifications

Power Supply

The Catalyst TC Development Kit accepts input power on jack J29, page 42. For a description of the power supply, see Power Supply Architecture, page 30.

Symbol	Parameter	Min	Typ.	Max	Units
AC Power Adapter					
V_{OUT}	Supply voltage		12		V
I_{OUT}				5	A
System Power Outputs					
V3.3	Primary supply voltage	3.135	3.3	3.465	V
V3.3A	"Always" power	3.135	3.3	3.465	V
V3.3S	Normal operating power	3.135	3.3	3.465	V
V5A	"Always" power	4.75	5.0	5.25	V
V5S	Normal operating power	4.75	5.0	5.25	V
V12S			12		V
V_ON			12		V
SWX_ONOFF# (note 3)					
V_{IH}	High-level input voltage	2.5	5		V
V_{IL}	Low-level input voltage			1.0	V
R_{PU}	Pull-up resistance		10		kΩ
V_{PU}				5	V

Note:

3. SWX_ONOFF# connects to the Catalyst TC signal BTN_ONOFF# through a 0 Ω resistor on the carrier board. The module includes a pull-up resistor to V5A.

Performance

The Catalyst TC meets the performance specifications listed in the following table. For additional details about the processor, see Core Processor, page 14.

Parameter	Min	Typ.	Max	Units
Processor operating frequency (note 4)	0.6	1.3	1.6	GHz
System bus clock			400	MHz

Note:

4. For availability of the 600 MHz and 1.6 GHz module, contact your local Eurotech representative.

Electrical

This section provides electrical specifications for the Catalyst TC Development Kit. For additional details about termination of individual signals, see the signal connectors in Signal Headers, page 35.

Universal Serial Bus

The Catalyst TC Development Kit provides up to five full-function USB host ports on J3, page 36, J4, page 36, and J6, page 36 that supply 5 V power through power switches with over-current detection. For a description of the USB host ports, see Universal Serial Bus, page 17.

Symbol	Parameter	Min	Typ.	Max	Units
USB Host Ports					
I_{USB}	USB current			500	mA

I²C Bus

The Catalyst TC Development Kit includes two I²C buses on header J33, page 43 and J73, page 49. For a description of these buses, see I²C Bus, page 19.

Symbol	Parameter	Min	Typ.	Max	Units
CARRIER_I2C_SDA, CARRIER_I2C_SCL					
$F_{CARRIER\_I2C\_SCL}$	Bus clock	100		400	kHz
R_{PU}	Pull-up resistance (note 5)		10		kΩ
V_{PU}				3.3	V
TC_I2C_SDA, TC_I2C_SCL					
$F_{CARRIER\_I2C\_SCL}$	Bus clock	100		400	kHz
R_{PU}	Pull-up resistance (note 6)		10		kΩ
V_{PU}				3.3	V

Notes:

5. CARRIER_I2C_SDA and CARRIER_I2C_SCL include pull-up resistors to V3.3A on the carrier board.
6. TC_I2C_SDA and TC_I2C_SCL include pull-up resistors to V3.3S on the Catalyst TC.

SMBus

The Catalyst TC Development Kit includes an external connection to the Catalyst TC SMBus on connector J32, page 43. For a description of this bus, see System Management Bus, page 20.

Symbol	Parameter	Min	Typ.	Max	Units
SMB_CLK, SMB_DATA					
F_{SMB_CLK}	Bus clock	1		1000	kHz
R_{PU}	Pull-up resistance (note 7)		2.2		kΩ
V_{PU}				3.3	V
SMB_ALERT#					
R_{PU}	Pull-up resistance (note 7)		10		kΩ
V_{PU}				3.3	V

Note:

7. SMB_CLK, SMB_DATA, and SMB_ALERT# include pull-up resistors to V3.3S.

Touch Panel Controller

A Hampshire TSHARC USB controller and separate analog multiplexer included on the carrier board drives a resistive touch panel on header J26, page 41 or header J27, page 41. Standard systems include a 4-wire touch panel. All touch-panel signals include protection diodes. For a description of this interface, see Carrier Board Touch Panel Controller, page 24.

Symbol	Parameter	Min	Typ.	Max	Units
V_{DD}	Supply voltage		5.0		V

Reset Signals

The Catalyst TC Development Kit includes two reset signals. For a description of these signals, see Reset Signals, page 26.

Symbol	Parameter	Min	Typ.	Max	Units
BUF_RST#					
V_{OH}	High-level output voltage I_{OH} = -24 mA, V_{CC} = 3.3 V	2.2	3.3		V
V_{OL}	Low-level output voltage I_{OL} = 24 mA, V_{CC} = 3.3 V			0.55	V
R_{PU}	Pull-down resistance		100		kΩ
V_{PU}		0			V
SWX_RESET# (note 8)					
V_{IH}	High-level input voltage	2.0	3.3		V
V_{IL}	Low-level input voltage			0.8	V
R_{PU}	Pull-up resistance		10		kΩ
V_{PU}				3.3	V

Note:

8. SWX_RESET# connects to the Catalyst TC signal FP_RESET# through a 0Ω resistor on the carrier board. The module includes debounce circuitry and a pull-up resistor to V3.3S.

General-Purpose Inputs and Outputs

The Catalyst TC Development Kit provides twenty eight GPIO on header U27, page 54, header U47, page 55, header J64, page 48,and header J79, page 51 For a description of these signals, see General-Purpose Inputs and Outputs, page 26.

Symbol	Parameter	Min	Typ.	Max	Units
GPIO1-2, CPLD_IO_B1_xx (note 9)					
V_{IH}	High-level input voltage	1.7	3.3		V
V_{IL}	Low-level input voltage			0.8	V
V_{OH}	High-level output voltage I_{OH} = -0.1 mA, V_{CC} = 3.3 V	V_{CC}-0.2			V
V_{OL}	Low-level output voltage I_{OL} = 0.1 mA, V_{CC} = 3.3 V			0.2	V
GPIO3-5 (note 10)					
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
V_{OH}	High-level output voltage I_{OH} = -8 mA, V_{CC} = 3.3 V	V_{CC}-0.5			V
V_{OL}	Low-level output voltage I_{OL} = 8 mA, V_{CC} = 3.3 V			0.4	V
SIOC_GPIO0-6 (note 11)					
V_{IH}	High-level input voltage	2.0	3.3		V
V_{IL}	Low-level input voltage			0.8	V
V_{OH}	High-level output voltage I_{OH} = -4 mA	2.4			V
V_{OL}	Low-level output voltage I_{OL} = 8 mA			0.4	V
SMB_GPIO0-7 (note 12)					
V_{IH}	High-level input voltage	2.0	3.3		V
V_{IL}	Low-level input voltage			0.8	V
V_{OH}	High-level output voltage I_{OH} = -8 mA, V_{CC} = 3.0 V	2.6			V
V_{OL}	Low-level output voltage I_{OL} = 8 mA, V_{CC} = 3.0 V			0.5	V

Notes:

9. Specifications per the Altera MAX II Device Handbook, August 2009 (MII5V1-3.3).
10. Specifications per the Intel Platform Controller Hub EG20T, October 2010 (#324211-002US).
11. Specifications per the SMSC SCH3116 Super I/O Controller data sheet.
12. Specifications per the NXP PCA9554 Product data sheet, Rev. 07 – 13 November 2006.

System I/O Control

The Super I/O Controller supports common I/O capabilities on the development kit that include several discrete I/O. One of these I/O controls an external LED on J55, page 48. For additional details this signal, see Carrier Board Super I/O Controller, page 27.

Symbol	Parameter	Min	Typ.	Max	Units
SLP_LED (note 13)					
V_{OH}	High-level output voltage I_{OH} = -6 mA	2.4	3.3		V
V_{OL}	Low-level output voltage I_{OL} = 12 mA			0.4	V

Note:

13. Specifications per the SMSC SCH3116 Super I/O Controller data sheet.

Intel High Definition Audio

The Catalyst TC Development Kit provides a connection to an external codec that complies with the Intel High Definition Audio specification. For a description of the audio interface, see Audio Interface, page 29.

Symbol	Parameter	Min	Typ.	Max	Units
HDA (note 14)					
V_{CC}	Supply voltage		3.3		V
V_{IH}	High-level input voltage	$0.65*V_{CC}$			V
V_{IL}	Low-level input voltage			$0.35*V_{CC}$	V
V_{OH}	High-level output voltage I_{OH} = -500 µA	$0.9*V_{CC}$			V
V_{OL}	Low-level output voltage I_{OL} = 1500 µA			$0.10*V_{CC}$	V
F_{HDA_SDIx}	Data rate		24		Mbps

Note:

14. Specifications are from the Intel High Definition Audio Specification Revision 1.0.

Audio Codec

The IDT 92HD71B8 4-channel HD audio codec provides the audio interface for the Catalyst TC Development Kit. This audio codec supports three audio inputs and three audio outputs on socket J20, page 40, socket J23, page 41, socket J53, page 47, and socket J54, page 47.

In addition, the codec provides an optional S/PDIF output on J19, page 40 and a digital microphone input on J22, page 40. For a description of the audio interface, see Audio Interface, page 29.

Symbol	Parameter	Min	Typ.	Max	Units
D_{VDD}	Codec digital supply voltage		3.3		V
A_{VDD}	Codec analog supply voltage		3.3		V
f_S	Sample rate		192		kHz
---	A/D sample resolution		24		bit
Line In					
V_{IN}	Full scale input voltage	1.00	1.03		Vrms
$Gain_{IN}$	Microphone boost	0		30	dB
R_{IN}	Input impedance		50		kΩ
C_{IN}	Input capacitance		15		pF
Line Out					
V_{OUT}	Full scale output voltage, 10kΩ load	0.707	0.758		Vrms
Headphone					
P_{OUT}	Output power, 32Ω load	31	42		mW(peak)
Digital Microphone (note 15)					
$V_{V\_DMIC\_L}$		1.8	3.3	3.3	V
$F_{DMIC\_CLK\_OUT}$			2.352		MHz

Note:

15. Power for the digital microphone, V_DMIC_L, is dependent on the digital microphone selected. The carrier board supports 1.8 V or 3.3 V. Standard Catalyst TC Development Kits are configured for 3.3 V. Contact your local Eurotech technical support if your application requires 1.8 V.

General

This section provides general specifications for the Catalyst TC Development Kit.

Crystal Frequencies

Agencies certifying the Catalyst TC for compliance for radio-frequency emissions typically need to know the frequencies of on-system oscillators. The following table lists the frequencies of all crystals on the Catalyst TC and carrier board.

Crystals	Device	Typ.	Units
Catalyst TC			
X3	Embedded Controller	14.7456	MHz
X5	Clock Generator	25.000	MHz
X6	USB Hub	24.000	MHz
X7	Reserved	25.000	MHz
X1	RTC	32.768	kHz
X10	Ethernet Controller	25.000	MHz
OS2	USB	48.0	MHz
OS3	Serial Port	1.8432	MHz
Carrier Board			
OS1	Super I/O Controller	14.31818	MHz
X1	Touch Panel Controller	4.000	MHz

In addition, the Catalyst TC generates the following on-board clocks: 14.318 MHz, 33 MHz, 75 MHz, 96 MHz, and 100 MHz.

Real-Time Clock

The Catalyst TC includes a RTC function that retains the system date and time. To supply backup power when the power input is disconnected, the carrier board includes a long-life battery. For a description of this function, see Catalyst TC Memory, page 14.

Parameter	Typ.	Units
Accuracy per month @ 25°C	+/-55	sec
Battery	3	V
Operating temperature	-30 to +80	°C

Environmental

The Catalyst TC is designed to meet the environmental specifications listed in the following table. For additional details about the module, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

Parameter	Min	Typ.	Max	Units
Commercial operating temperature	0		+70	°C
Industrial operating temperature (note 16)	-40		+85	°C
Storage temperature	-40		+85	°C
Relative humidity, non-condensing	5		95	%

Note:

16. For availability of industrial temperature range modules, contact your local Eurotech representative.

Appendix A – Reference Information

Product Information

Product notices, updated drivers, support material:
www.eurotech.com

Intel

Information about the Intel products, High Definition Audio specification, and LPC bus specification:
www.intel.com

Trusted Computing Group

Trusted Computer Group specifications:
www.trustedcomputinggroup.org

SATA

Serial ATA specification:
www.sata-io.org

USB

Universal Serial Bus specification:
www.usb.org

SDIO Card

SD Card Association and SDIO specification:
www.sdcard.org

MMC Card

MultiMediaCard specification:
www.jedec.org

PCI SIG

PCI Express specification:
www.pcisig.com

ExpressCard

Information about the ExpressCard standard:
www.usb.org/developers/expresscard

PLX Technology

Information about the PCI Express switch:
www.plxtech.com

MDI

Gigabit Ethernet Physical Layer Transceiver and Media Dependent Interface:
www.realtek.com

I^2C Bus

I^2C bus specification and information about the general-purpose I/O ports:
www.nxp.com

SMBus

SMBus specification:
www.smbus.org

CAN

CAN specification:
www.semiconductors.bosch.de

SMSC

Information about the Super I/O Controller:
www.smsc.com

National Semiconductor

Information about the LM75 temperature sensor:
www.national.com

TI

Information about the INA209 current/power monitor:
www.ti.com

IDT

Information about the HD audio codec:
www.idt.com

ACPI Specification

ACPI specification:
www.acpi.info

Appendix B – Board Revision

This manual applies to the current revision of the Catalyst TC Development Kit carrier board as given in the following sections. For the Catalyst TC revision history, refer to the *Catalyst TC Design-In Guide (Eurotech document #110125-5000)*.

Identifying the Board Revision

The revision number of the carrier board is printed on the printed wiring board. That number is 170125-900Rx, where "x" is the revision level of the PWB.

Carrier Board Revision History

The following is an overview of the revisions to the carrier board.

Revision 1

Prototype

Appendix C – Maintenance Port

The serial port located on connector P2, page 53 is used for maintenance functions such as reprogramming the embedded controller, troubleshooting, software debug, and bring-up of a new carrier board design. If you are directed to use this port when working with Eurotech staff, use the information provided in this appendix to connect the port to your computer.

Cable Connection

Connect any available serial port of your computer to connector P2 on your development kit. Use the DB9FF gender changer supplied with the Catalyst TC Development Kit or create a custom cable using the information given on page 53.

Port Settings

Use a terminal emulation application such as HyperTerminal or TeraTerm to access the maintenance port. Configure the port settings as follows:

- Baud: 57600 bps
- Data bits: 8
- Parity: None
- Stop Bits: 1
- Flow control: none

Port Output

Connect power to the carrier board. The power LED D27 lights, and the following text is displayed on the terminal.

```
EUROTECH, INC.
Catalyst Core Module:  Embedded Controller Firmware
Copyright (c) 2007 EuroTech, Inc.  All rights reserved.
==================================================================
```

Appendix D – BIOS Setup Utility

The Catalyst TC BIOS includes a utility called BIOS Setup that allows you to view and to set system parameters. Use BIOS Setup to:

- Set the current time and date
- Modify system settings controlling system initialization and operation
- Secure your computer with a boot password

To enter BIOS Setup, press the F2 key when prompted during the Eurotech splash screen display at start-up.

BIOS Setup Menus

BIOS Setup uses the following six menus to present system settings. These menu names are displayed in a menu bar along the top of the screen.

Main	Use this menu to see system configuration information; set the system date/time; or set the default language that BIOS Setup will use.
Advanced	Use this menu to control system ports, peripherals, and I/O subsystems.
Security	Use this menu to establish BIOS passwords.
Power	Use this menu to modify system power settings.
Boot	Use this menu to control system boot device ordering.
Exit	Use this menu to exit BIOS Setup with various save / discard options.

Use the following keys to navigate and to use BIOS Setup menus:

Key	Description
Enter	Selects an option or accepts a change
Up or Down Arrow	Moves between options on a single menu
Left or Right Arrow	Moves between menus
Esc	Exits the current sub-menu
F1	Provides a help screen
F5 or F6	Changes the value of the currently selected option
F9	Loads optimal/default values for all options
F10	Saves all changes and exits BIOS Setup

Main Menu

The Main Menu is displayed when you first enter BIOS Setup.

System BIOS Version	Displays the current System BIOS version number
CPLD version	Displays the current CPLD version number
Microcontroller Version	Displays the current microcontroller version number
MAC Address	Displays the MAC address assigned to the Catalyst TC GbE controller
Processor Type	Displays the processor identification string (including CPU speed)
System Bus Speed	Displays the System Bus speed in MHz
System Memory Speed	Displays the System Memory speed in MHz
Cache RAM	Displays the total processor L2 cache memory size in kB
Total Memory	Displays the total physical memory available on the Catalyst TC
Language	Selects the language used in BIOS Setup: **English, French, Chinese,** or **Japanese**
System Time	Sets the system time (*hh:mm:ss*)
System Date	Sets the system date (*mm/dd/yyyy*)

Advanced Menu

(This section to be determined)

Security Menu

(This section to be determined)

Power Menu

(This section to be determined)

Boot Menu

(This section to be determined)

Exit Menu

(This section to be determined)

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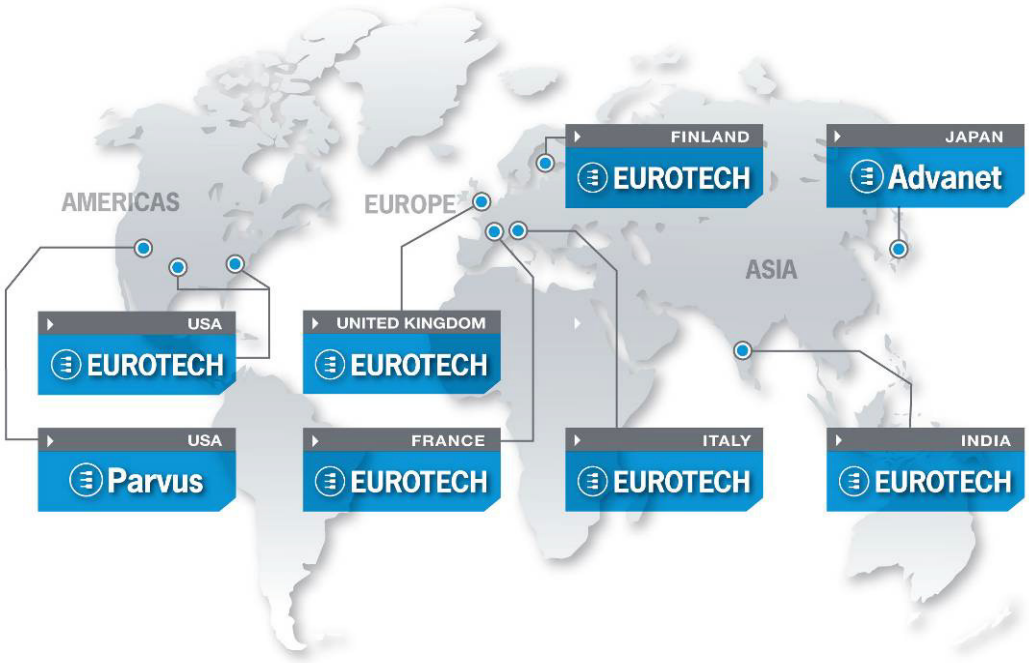

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