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XETK-V2.0
Emulator Probe for MPC5600 and SPC5600 Family
User's Guide

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XETK-V2.0 - User's Guide R14 EN - 07.2020

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1 About this Document

1.1 Classification of Safety Messages

The safety messages used here warn of dangers that can lead to personal injury or damage to property:

DANGER

indicates a hazardous situation with a high risk of death or serious injury if not avoided

WARNING

indicates a hazardous situation of medium risk which could result in death or serious injury if not avoided.

CAUTION

indicates a hazardous situation of low risk which may result in minor or moder-ate injury if not avoided.

NOTICE

indicates a situation which may result in damage to property if not avoided.

1.2 Presentation of Instructions

The target to be achieved is defined in the heading. The necessary steps for this are in a step-by-step guide:

Target definition

1. Step 1
2. Step 2
3. Step 3

> Result

1.3 Typographical Conventions

Software

`OCI_CANTxMessage msg0 =`	Code snippets are presented on a gray background and in the Courier font. Meaning and usage of each command are explained by means of comments. The comments are enclosed by the usual syntax for comments.
Choose **File → Open**.	Menu commands are shown in boldface.
Click **OK**.	Buttons are shown in boldface.
Press <ENTER>.	Keyboard commands are shown in angled brackets.
The "Open File" dialog box is displayed.	Names of program windows, dialog boxes, fields, etc. are shown in quotation marks.
Select the file `setup.exe`.	Text in drop-down lists on the screen, program code, as well as path- and file names are shown in the Courier font.
A *distribution* is always a one-dimensional table of sample points.	General emphasis and new terms are set in italics.

Hardware

Bold	Menu commands, buttons, labels of the product
Italic	Emphasis on content and newly introduced terms

1.4 Presentation of Supporting Information

NOTE

Contains additional supporting information.

2 Basic Safety Notices

This chapter contains information about the following topics:

- "General Safety Information" on page 9
- "Requirements for Users and Duties for Operators" on page 9
- "Intended Use" on page 9
- "Identifications on the Product" on page 13
- "Taking the Product Back and Recycling" on page 14
- "CE marking" on page 14
- "RoHS Conformity" on page 14
- "Declarable Substances" on page 15
- "Use of Open Source Software" on page 15

2.1 General Safety Information

Please observe the Product Safety Notices ("ETAS Safety Notice") and the following safety notices to avoid health issues or damage to the device.

NOTE

Carefully read the documentation (Product Safety Advice and this User's Guide) that belongs to the product prior to the startup.

ETAS GmbH does not assume any liability for damages resulting from improper handling, unintended use or non-observance of the safety precautions.

2.2 Requirements for Users and Duties for Operators

The product may be assembled, operated and maintained only if you have the necessary qualification and experience for this product. Incorrect operation or operation by users without sufficient qualification may lead to injuries or death or property damages.

General Safety at Work

The existing regulations for safety at work and accident prevention must be followed. All applicable regulations and statutes regarding operation must be strictly followed when using this product.

2.3 Intended Use

An ETK is an electronic component that is installed in a vehicle control unit (ECU) to read data from the ECU or write data to the ECU.

Application Area of the Product

This product was developed and approved for automotive applications. For use in other application areas, please contact your ETAS contact partner.

2.3.0.1 Requirements for Operation

The following requirements are necessary for safe operation of the product:

- Use the product only according to the specifications in the corresponding User's Guide. With any deviating operation, the product safety is no longer ensured.
- Observe the regulations applicable at the operating location concerning electrical safety as well as the laws and regulations concerning work safety!
- Do not apply any voltages to the connections of the product that do not correspond to the specifications of the respective connection.
- Connect only current circuits with safety extra-low voltage in accordance with EN 61140 (degree of protection III) to the connections of the product.
- The power supply for the product must be safely disconnected from the supply voltage. For example, use a car battery or a suitable lab power supply.
- Use only lab power supplies with double protection to the supply system.
- Ensure that the connections of the power supply are easily accessible.
- The module does not have an operating voltage switch.
  - Switch on the product by connecting the power supply cable with the power supply or by switching on the power supply.
  - Switch off the product by disconnecting it from the power supply or by switching off the power supply.

DANGER

Connect the power cord only with a vehicle battery or with a lab power supply! A connection to power outlets is prohibited.

Route the power cord in such a way that it is protected against abrasion, damages, deformation and kinking. Do not place any objects on the power cord.

Never apply force to insert a plug into a socket. Ensure that there is no contamination in and on the connection, that the plug fits the socket, and that you correctly aligned the plugs with the connection.

Do not use the product in a wet or damp environment.

Do not use the product in potentially explosive atmospheres.

Keep the surfaces of the product clean and dry.

Potential Equalization

CAUTION

Danger from inadvertent current flow!

Depending on the design, the shield of the Ethernet cables can be connected with the housing of the module. Install the products only on components with the same electrical potential or isolate the products from the components.

Requirements for the technical State of the Product

The product is designed in accordance with state-of-the-art technology and recognized safety rules. The product may be operated only in a technically flawless condition and according to the intended purpose and with regard to safety and dangers as stated in the respective product documentation. If the product is not used according to its intended purpose, the protection of the product may be impaired.

Maintenance and Cleaning

The product is maintenance-free. Use a lightly moistened, soft, lint-free cloth for cleaning the product. Ensure that no moisture can enter. Never spray cleaning agents directly onto the product. Do not user any sprays, solvents or abrasive cleaners which could damage the product.

Transport and Installation

CAUTION

The ETK can be damaged or destroyed!

Some components of the ETK board may be damaged or destroyed by electrostatic discharges. Please keep the ETK in its storage package until it is installed.

The board should only be taken from its package, configured, and installed at a work place that is protected against static discharge.

CAUTION

During installation and removal, ECU and ETK must be in a de-eenergized state!

CAUTION

Risk of short circuiting the internal signals of the ETK!

When you mount the ETK to the ECU, you must ensure that the screws and washers used will not penetrate the ETK printed circuit board.

CAUTION

Differences in case ground potentials can cause high currents to flow through the shields of the cables that connect various system modules.

Ensure that the module mounting surfaces are at the same electrical potential or insulate the modules from their mounting surfaces.

Cabling

Use exclusively ETAS cables at the connections of the product! Adhere to the maximum permissible cable lengths! Observe the assignment of the cables to the connectors! Detailed information about cabling is located in the ETK User's Guides.

2.4 Identifications on the Product

Fig. 2-1 Adhesive Label (Example: Label for XETK-S14.0)

The following symbols are used for identifications of the product:

Symbol	Description
	The User's Guide must be read prior to the startup of the product!
	Symbol for WEEE, see chapter 2.5 on page 14
	Symbol for CE conformity, see chapter 2.6 on page 14
	Symbol for China RoHS, see chapter 2.7.2 on page 14
	Symbol for China RoHS, see chapter 2.7.2 on page 14
	Symbol for electrostatic sensitive components
XETK-S14.0A	Product designation (example)
F 00K 110 722	Order number of the product (example)
SN: yyxxxxx	Serial number (7-digit)
XXXX/YY	Product version
ZZZZ	Year of manufacture
ETAS GmbH, PO Box 300220, 70442 Stuttgart, Germany	Manufacturer's address

NOTE

For symbols and product information one or several adhesive labels can be used.

2.5 Taking the Product Back and Recycling

The European Union has passed a directive called Waste Electrical and Electronic Equipment, or WEEE for short, to ensure that systems are setup throughout the EU for the collection, treating and recycling of electronic waste.

This ensures that the devices are recycled in a resource-saving way representing no danger to health or the environment.

Fig. 2-2 WEEE-Symbol

The WEEE symbol (see Fig. 2-2 on page 14) on the product or its packaging shows that the product must not be disposed of as residual garbage.

The user is obliged to collect the old devices separately and return them to the WEEE take-back system for recycling. The WEEE directive concerns all ETAS devices but not external cables or batteries.

For more information on the ETAS GmbH Recycling software, contact the ETAS sales and service locations.

2.6 CE marking

With the CE mark attached to the product or its packaging, ETAS confirms that the product corresponds to the applicable product-specific European Directives. The CE Declaration of Conformity for the product is available upon request.

2.7 RoHS Conformity

2.7.1 European Union

The EU Directive 2011/65/EU limits the use of certain dangerous materials for electrical and electronic devices (RoHS conformity).

This product does not contain any of the restricted substances specified in the EU Directive 2011/65/EU or exceeds the maximum concentrations stipulated therein. For individual electronic components used in our products, there are currently no equivalent alternative substances, which is why we make use of the exceptions 7A and 7C-I in Annex III of this Directive.

ETAS confirms that the product corresponds to this directive which is applicable in the European Union.

2.7.2 China

ETAS confirms that the product meets the product-specific applicable guidelines of the China RoHS (Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation) applicable in China with the China RoHS marking affixed to the product or its packaging.

2.8 Declarable Substances

European Union

Some products from ETAS GmbH (e.g. modules, boards, cables) use components with substances that are subject to declaration in accordance with the REACH regulation (EU) no.1907/2006.
Detailed information is located in the ETAS download center in the customer information "REACH Declaration" (www.etas.com/Reach). This information is continuously being updated.

2.9 Use of Open Source Software

The product uses Open Source Software (OSS). This software is installed in the product at the time of delivery and does not have to be installed or updated by the user. Reference shall be made to the use of the software in order to fulfill OSS licensing terms. Additional information is available in the document "OSS Attributions List" at the ETAS website www.etas.com.

3 Introduction

This section contains general safety instructions, information about the basic features and applications of the XETK-V2.0 Interface Board (ETK = Emulator Test Probe), hints to system requirements, and delivery scope.

3.1 Applications

The XETK-V2.0 is an emulator probe for the Freescale MPC5600 microcontroller family and ST SPC5600 microcontroller family using the Nexus debug interface (IEEE/ISTO 5001). To cover the multiple microcontroller packaging options, the XETK-V2.0 is available in three variants: the XETK-V2.0A, XETK-V2.0B, and XETK-V2.0C.

The XETK-V2.0A/C combines a typical (X)ETK serial interface with a 32 bit SRAM and is based on the VertiCal interface concept from Freescale and ETAS. It can be used with the above microcontrollers packaged with a Vertical Base Board.

The XETK-V2.0B is a typical (X)ETK serial interface and is suitable for the above microcontrollers in all packages.

NOTE

Refer to chapter 7.1.4 on page 57 for a list of supported microcontrollers and the required software versions to use them.

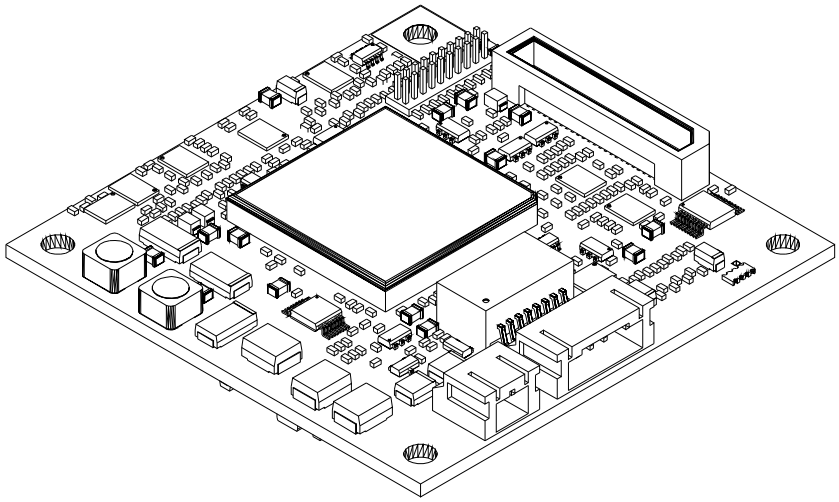

Fig. 3-1 XETK-V2.0 Top View

NOTE

The XETK-V2.0 can be ordered in three different functional and mechanical variants: XETK-V2.0A, XETK-V2.0B, and XETK-V2.0C. Within the manual the term "XETK-V2.0" describes features common to all variants. The term "XETK-V2.0A/C" describes specific features common to the XETK-V2.0A and XETK-V2.0C variants. The term "XETK-V2.0B" describe features specific to the XETK-V2.0B variant.

The XETK-V2.0's Nexus (JTAG) debug interface at 2.5 V or 3.3 V. The XETK-V2.0 performs measurement and calibration of variables as well as flashing via the JTAG portion of the Nexus interface. Additionally the Nexus Auxiliary interface can be used for high speed trace measurement.

The XETK-V2.0A/C provides a Synchronous RAM (SRAM) that can be used by the ECU to store calibration or other ECU variables (XETK-V2.0A provides 2 MByte SRAM, XETK-V2.0C provides 4 MByte SRAM). This SRAM is only accessible to the XETK-V2.0A/C via the microcontroller's Nexus (JTAG) debug interface. This interface operates at 2.5 V or 3.3 V.

The XETK-V2.0 supports the standard full duplex 100Base-T Ethernet interface and be connected directly or via ES51x/ES59x/ES600 modules to the PC. No additional ETAS modules are required for the access to the ECU. The XETK-V2.0 can be used for rapid prototyping applications (bypass) as well as for measurement and calibration applications.

3.2 Features

- Measurement Interface
  - Nexus / JTAG interface (operates at 2.5 V or 3.3 V)
  - Configurable JTAG interface clock speed: 20 MHz, 30 MHz, or 40 MHz
  - Nexus Trace interface clock speed: up to 66 MHz
  - Supports coldstart measurement mechanism
  - Supports high speed measurement rasters with Nexus Trace (down to 10 µs)
  - Hardware synchronization and time stamping
- Startup protocol for XETK / ECU synchronization
  - DAI pins (all microcontrollers)
  - Pinless via Nexus / JTAG
- Trigger interface
  - 2 DAI triggers
  - 32 Pinless triggers via Nexus / JTAG
  - 4 triggers generated by internal timers
  - 16 trace triggers
  - 64 total measurement rasters
- Calibration interface
  - XETK-V2.0A/C provides SRAM to be used for emulation data with a configurable chip select
  - XETK-V2.0A/C provides power for both the Microcontroller External Bus Interface and the on board XETK RAM
  - Microcontroller capability of re-mapping Flash to RAM emulation used by ECU software
  - Supports “Start on Working Page”
- Debugger interface
  - XETK-V2.0 arbitration possible with "Lauterbach Power Trace"
  - XETK-V2.0A/C provides additional Nexus (JTAG) compliant Samtec connector for external debug hardware
  - XETK-V2.0B hardware is prepared to be used simultaneously with a debugger, but an additional external arbitration circuit and debugger connection is required
- ECU flashing via XETK
  - Braindead flashing under ProF control
- XETK-V2.0A/C VertiCal interface
  - Small form factor
  - Short signal lines for minimal impedance
  - Applicable for multiplexed 32-bit microcontroller bus
  - Supports 32-, 16- and 8-bit access to the provided memory
  - VertiCal Shroud installed to aid in alignment during product installation
- Fast Ethernet interface
  - Direct connection to PC

  - Open XCP on Ethernet protocol
  - Supports a variety of standard applications
- Firmware update (programming of the logic device) through service software "Hardware Service Pack" (HSP); removal of XETK or ECU not necessary
- Temperature range suitable for automotive application
- Permanent storage of configuration in EEPROM

For more technical data on the XETK-V2.0 consult the chapter “Technical Data” on page 56.

4 Hardware Description

In this chapter, the function blocks of the XETK-V2.0 are explained in detail.

NOTE

The XETK-V2.0 can be ordered in three different functional and mechanical variants: XETK-V2.0A, XETK-V2.0B, and XETK-V2.0C. Within the manual the term "XETK-V2.0" describes features common to all variants. The term "XETK-V2.0A/C" describes specific features common to the XETK-V2.0A and XETK-V2.0C variants. The term "XETK-V2.0B" describe features specific to the XETK-V2.0B variant.

4.1 Overview

4.1.1 XETK-V2.0 Variants

The XETK-V2.0 can be ordered in three different functional and mechanical variants: XETK-V2.0A, XETK-V2.0B, and XETK-V2.0C. The primary differences between the XETK-V2.0 variants are described below.

	XETK-V2.0A/C	XETK-V2.0B
ECU Connection	156 pin VertiCal	50 pin Samtec to ETAHx Adapter: ETAH1 - 38 pin Mictor
Calibration RAM	2 / 4 MByte SRAM provided on XETK	Provided by ECU [1)]
Debugger Connection	50 pin Samtec	None [2)]
Supported Microcontroller Packages	Vertical Base Board	All Packages (e.g. Production Package or Vertical Base Board)
Installation Mounting	VertiCal Base Board, additionally 4 mounting holes	Internal ECU housing or ECU pcb using 4 mounting holes
JTAG / Nexus Interface	Minimal signal conditioning on ECU (direct from VertiCal Base Board)	Signal Conditioning required on ECU
Trigger Pin Connection	Microcontroller GPIO via DAI circuit back to VertiCal Base Board optional ball locations[3]	microcontroller GPIO via DAI circuit to XETK ECU connector
ECU Switched Power Monitoring (Ignition / microcontroller power)	Built into VertiCal Base Board	Route signal to XETK ECU connector
Standby Power Monitoring (Validity of Calibration RAM)	Built into XETK	Route signal to XETK ECU connector

	XETK-V2.0A/C	XETK-V2.0B
Watchdog Timer Disable	ECU circuit back to VertiCal Base Board optional ball location [3)]	ECU circuit back to XETK ECU connector
Dimension (H/W/D)	12 / 60 / 60 mm	9 / 60 / 60 mm

[1)]: ECU application specific: internal or external RAM
[2)]: XETK-V2.0B hardware is prepared to be used simultaneously with a debugger (additional external arbitration circuit and debugger connection is required).
[3)]: For ECUs with BGA adapters, VertiCal Base Boards with optional balls are required to use the DAI startup/ triggering and Watchdog Timer Disable features of the XETK-V2.0A/C.

4.1.2 XETK-V2.0A/C VertiCal Interface Concept

4.1.2.1 Overview

The XETK-V2.0A/C uses the VertiCal interface concept to connect to the development ECU. The VertiCal Base Board uses a microcontroller in a chip scale package (CSP), which is fully compatible to the standard microcontroller.

With the VertiCal interface, the microcontroller of the ECU is not mounted on the ECU or XETK, but on an additional board, the VertiCal Base Board.

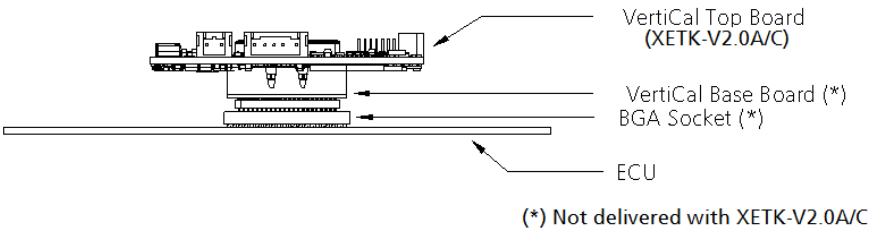

Fig. 4-1 VertiCal Interface Concept (Side View)

The complete XETK-V2.0A/C VertiCal solution and its components are mounted on two different boards:

- The VertiCal Base Board with
  - a microcontroller in chip scale package (CSP)
  - VertiCal connector (provides access to the ECU microcontroller adapter and the VertiCal top board)
  - a Pin Array / BGA / QFP Adapter to plug the base board into the ECU
- The VertiCal Top Board (XETK-V2.0A/C) with
  - Ethernet interface (converts microcontroller signals into tool interface)
  - 2 MByte SRAM for XETK-V2.0A or 4 MByte for XETK-V2.0C
  - Samtec connector with Nexus (JTAG) interface for a debugger
  - VertiCal Shroud installed around the VertiCal connector to aid in alignment during product installation

NOTE

For ECUs with BGA adapters VertiCal Base Boards with optional balls are required to use the DAI startup/ triggering and Watchdog Timer Disable features of the XETK-V2.0A/C.

NOTE

For ECUs with QFP adapters the DAI startup/triggering is already considered in the VertiCal Base Board. The Watchdog Timer Disable feature of the XETK-V2.0A/C is not available.

4.1.2.2 VertiCal Base Board

The printed circuit board (PCB), one of the VertiCal base board components, is used as a base to mount the other components of the VertiCal Base Board.

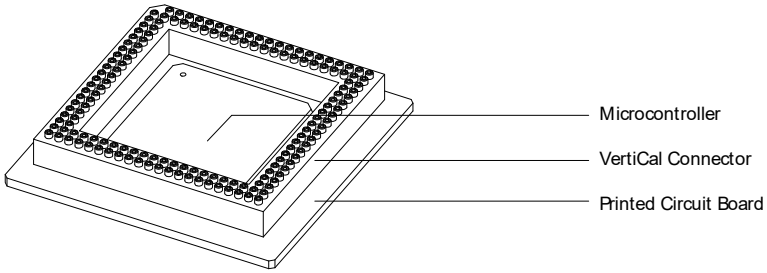

Fig. 4-2 VertiCal Base Board

The upper side of the printed circuit board is assembled with

- the microcontroller device (packaged into the specified CSP package)
- the VertiCal connector (standardized 156-way connector)

The lower side of the printed circuit board has a footprint similar to that used by MPC5600 family devices in standard production packages. It is populated with a "BGA adapter" connector allowing connection and removal from an ECU development PCB which has been populated with a compatible "BGA receiver" socket (see Fig. 4-3).

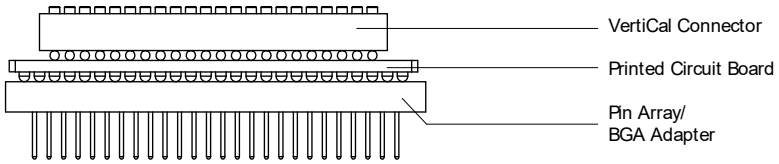

Fig. 4-3 VertiCal Base Board (fitted with Pin Array/ BGA Adapter, Side View)

4.1.2.3 Typical Usage

The standard ECU microcontroller is replaced by the VertiCal base board with the same dimensions and the same pinout.

The VertiCal base board connects the ECU with the XETK-V2.0A/C.

4.1.3 XETK-V2.0B Interface Concept

The XETK-V2.0B connects to the ECU in a similar manner to other serial (X)ETKs, using a cable with a standard debugging interface connector. The XETK-V2.0B is equipped with a 50 pin Nexus Samtec connector and connects to the ECU using an ETAHx ECU adapter cable.

The ETAH1 ECU adapter cable offers a connection to an ECU equipped with a 38 pin Mictor connector. Other ETAHx variants are possible.

4.2 Architecture

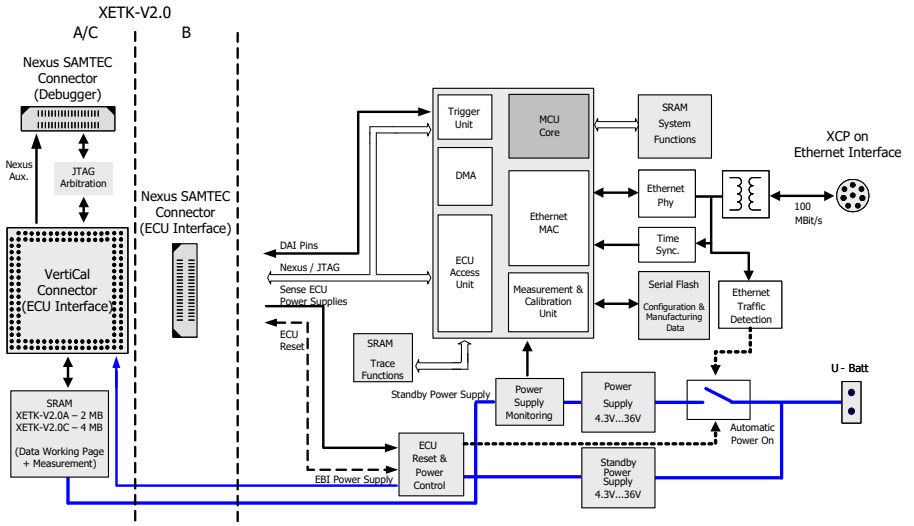

Fig. 4-4 XETK-V2.0 Architecture

The XETK-V2.0's primary interface to the development ECU is the Nexus / JTAG interface of the microcontroller. This interface is available at the VertiCal connector of the XETK-V2.0A/C or the Samtec connector of the XETK-V2.0B. This interface provides the XETK access to the same memories accessible to the microcontroller, including both internal and/or external Flash and/or RAM. The XETK-V2.0 can only access these memories while the microcontroller is powered and out of reset.

The XETK-V2.0A/C provides a SRAM the development ECU can use as data emulation memory and/or as measurement data memory. The XETK-V2.0A/C accesses this SRAM in the same way as other development ECU memories, via the microcontroller's Nexus /JTAG interface.

While the microcontroller accesses the program data (not the program code) out of the data emulation memory provided by either the XETK-V2.0A/C or the ECU, the content of the data emulation memory can simultaneously be modified by the calibration and development system through the XETK Ethernet interface. This process enables adjustments of parameters, characteristic lines and maps through the calibration and development system. Using an additional measurement data memory area, the ECU microcontroller can provide data to the calibration and development system by buffering the data (DISTAB13) and triggering the XETK to read the data via JTAG. The XETK then reads, buffers, processes and sends this measured data to the PC.

If no additional measurement data memory is available, the XETK-V2.0 can alternatively read the data to be measured directly from the microcontroller's memory. This process is Triggered Direct Measurement (TDM) with DISTAB13.

The XETK-V2.0 can also receive the data to be measured via the Nexus Auxiliary interface using data trace windows and trace triggering. The data trace can be used with or without DISTAB13.

The 100 Mbit/s XETK Ethernet interface provides communication with the PC.

The power supply for the XETK-V2.0 is provided by a switch mode power supply, to minimize power dissipation.

4.3 ECU Interface

The XETK-V2.0A/C and XETK-V2.0B utilize different connectors of the XETK-V2.0 as the ECU interface.

The XETK-V2.0A/C interfaces to the microcontroller via the VertiCal connector, CON1 (refer to Fig. 4-6 on page 25). The interface provides access to the microcontroller's external bus and Nexus (JTAG) interface.

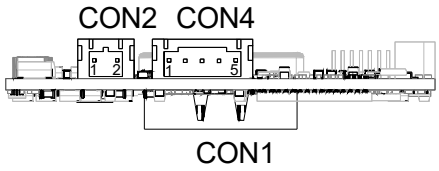

Fig. 4-5 XETK-V2.0A/C ECU Interface CON1

The XETK-V2.0B interfaces to the microcontroller via the Samtec connector, CON5 (refer to Fig. 4-6 on page 25). The interface provides access to the microcontroller's Nexus (JTAG) interface.

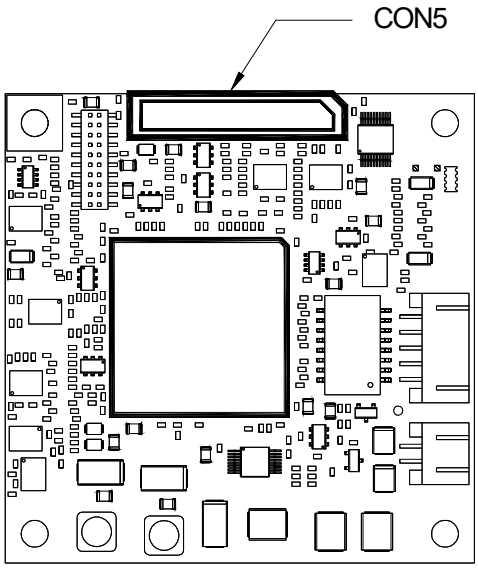

Fig. 4-6 XETK-V2.0B ECU Interface CON5

For a complete list of the pins of the XETK-V2.0A/C ECU interface refer to section 7.11.1 on page 81 and to section 7.11.3 on page 88 for the XETK-V2.0B ECU Interface. In general the interface of each device consists of:

- ECU voltage lines, which are not used for powering the XETK, but for detecting the ECU status; therefore the power consumption on these lines is negligible (refer to chapter 4.4 on page 27)
- Data Acquisition Interrupt lines (DAI lines) which are used for XETK synchronization at startup and for Data Acquisition (refer to chapter 4.11.4 and 4.11.5)
- Reset lines which allow the XETK to both monitor and control the system reset of the ECU (refer to chapter 4.7 on page 31)
- JTAG Interface used as the measurement and calibration interface between the XETK-V2.0 and the microcontroller (refer to chapter 4.9 on page 35)
- Nexus Auxiliary Interface used as an optional measurement interface between the XETK-V2.0 and the microcontroller

4.4 Power Supply

The XETK-V2.0 needs a permanent power supply. It is powered directly from the car battery. The input voltage may vary between 4.3 V and 36 V

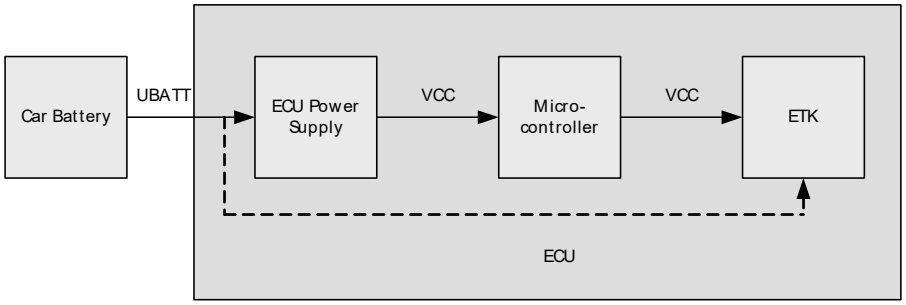

Fig. 4-7 Power Supply monitoring

All necessary voltages required by the XETK are created through switching power supplies which minimizes heat build-up. The power supply of the ECU is not affected by the XETK-V2.0. An automatic switch ensures that the power supply of the XETK-V2.0 is automatically switched on and off. The ECU voltage VCC (V_RESET for XETK-V2.0A/C and V_NEXUS for XETK-V2.0B) is monitored by the XETK to recognize whether the ECU is switched on or off.

The XETK-V2.0 must be supplied with power through the 2-pin power supply connector CON2 in Fig. 4-8 below.

Fig. 4-8 Power Supply Connector CON2 (left: XETK-V2.0A/C, right: XETK-V2.0B)

Pin CON2	Signal	Description
1	U_{Batt}	Battery Supply Voltage for XETK
2	GND	Ground

Additionally the through-hole solder pad CON3 can be used to connect a power supply U_{Batt2}. The power supply on CON3 must use the GND of CON2.

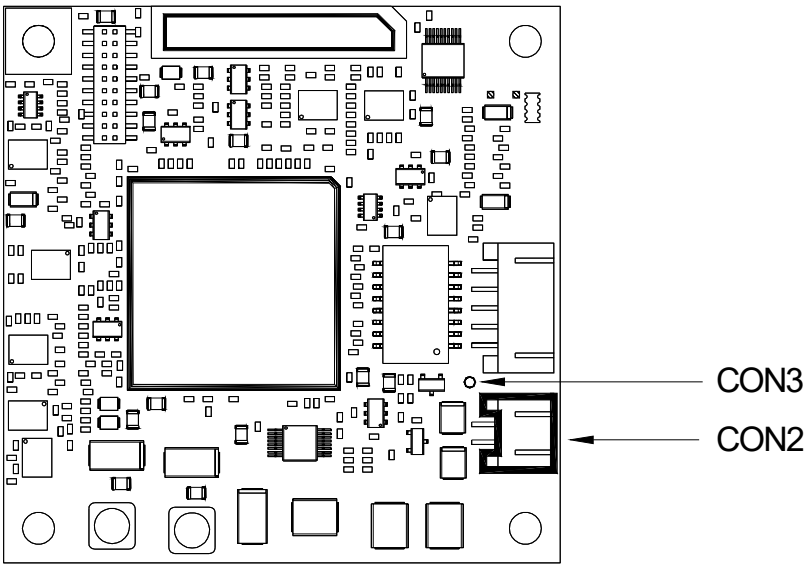

Fig. 4-9 Power Supply Connectors CON2 and CON3

4.5 XETK Ethernet Interface

The XETK Ethernet interface shown in Fig. 4-10 can be directly connected to the PC. No additional ETAS module is required for the access to the ECU.

The interface is a standard full duplex 100Base-TX Ethernet interface using the XCP protocol. The XETK Ethernet interface is integrated in the ETAS IP world with automatic IP management and supports the open automotive "Universal Measurement and Calibration" standard "XCP on Ethernet" (TCP/IP, UDP/IP). The open XCP on Ethernet interface allows for connecting to the XETK-V2.0 with third party application software.

NOTE

The XETK Ethernet interface is not compatible with the ETK interfaces in modules like e.g. ES910, ES590, ES591, ES592, ES593-D, ES595, ES1232-A. The XETK Ethernet interface is compatible with the ECU interface of the ES910 module and the Ethernet interfaces of the ES51x/ ES592/ ES593-D/ ES595/ES600 modules.

The maximum length of the interface cable is specified for 30 m.

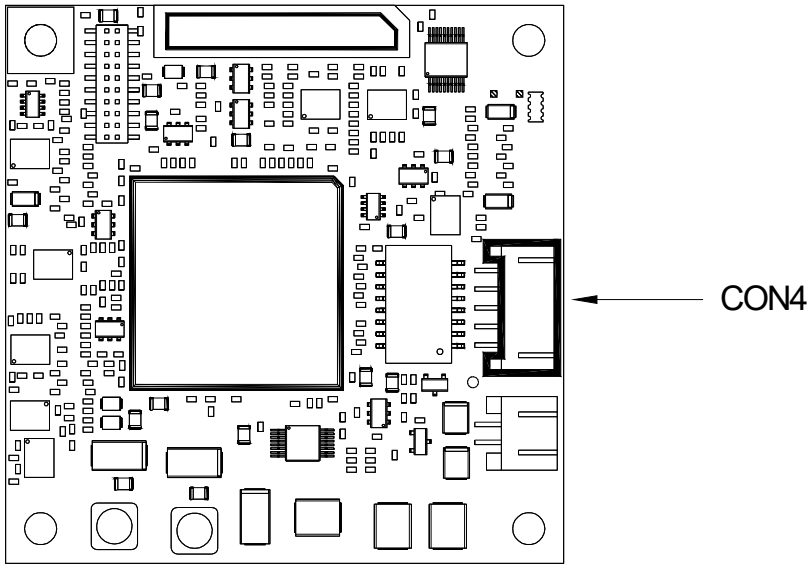

Fig. 4-10 Location of the Ethernet Interface CON4

4.6 Status LEDs

There are three LEDs displaying the operating status of the XETK-V2.0 (Fig. 4-11 on page 30).

LED	State	Meaning
Red	On	XETK-V2.0 is supplied with power and active (i.e. the ECU is switched on or the ETAS calibration and development system is connected and ready to communicate with the XETK-V2.0)
Green	On	Power supply has dropped under 4.3V (XETK-V2.0A/C) or the selected standby threshold (XETK-V2.0B): - data retention of the calibration data in the XETK-V2.0A/C SRAM or the ECU RAM monitored by the XETK-V2.0B is no longer ensured - as soon as ECU switches on again, it should switch to the Reference Page. Green LED stays lit until the calibration and development system downloads data into the calibration data memory. Until then switching to the Working Page is not possible.
	Off	Working page may be different to reference page. Calibration and development system has downloaded data since the last power failure. Switching between the Reference Page and Working Page is possible.
Yellow	On	100 Mbit/s link to calibration system established
	Flashing	Communication active

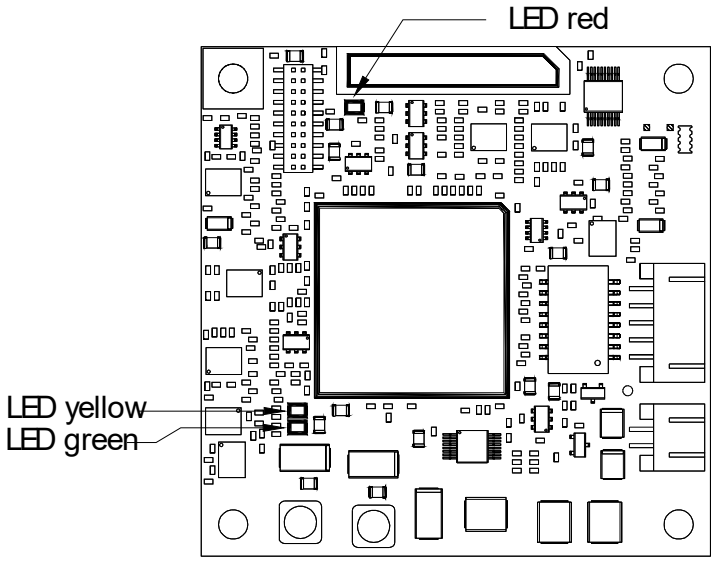

Fig. 4-11 Status LEDs

4.7 Reset

The requirement for XETK reset mechanism is to ensure that power-up and power-down behavior of ECU is clean and to prevent corruption of data stored in the XETK-V2.0A/C's SRAM.

To accomplish this the XETK-V2.0 senses the microcontroller power supply at the ECU interface connection; V_RESET of the XETK-V2.0A/C and V_NEXUS of the XETK-V2.0B. This allows the XETK to detect when the ECU is off and forward this information to INCA. In addition, it allows the XETK to enter the power save mode if the ECU is off and the PC is off or unplugged.

Furthermore, the XETK-V2.0 senses the status of the /RESET line to generate a write protect signal for its memory. If configured, the /RSTOUT line can also be used to sense the status of the ECU reset.

Finally, the XETK-V2.0 generates a reset signal by pulling /RESET to keep the ECU in reset while the XETK is in power save mode and to prevent the microcontroller from starting until the XETK is ready to work.

The XETK is ready to work when it has finished its initialization after leaving power save mode or after initial power-up. This feature allows it also to reset the ECU under tool control (required for INCA and ProF) and to perform an emergency stop of the ECU in case of XETK failure.

4.8 Data Emulation Memory

The XETK-V2.0 is a serial XETK using JTAG / Nexus as its primary microcontroller interface. Typical of all serial XETKs, the RAM used for data emulation and data measurement is not accessible by the XETK until the microcontroller is powered up and the startup handshake is performed. This includes the 2 MByte of SRAM provided on the XETK-V2.0A or the 4 MByte provided on the XETK-V2.0C.

As with parallel XETKs, serial XETKs have a system consisting of both a Reference and a Working Page (ETAS two page XETK concept).

The Reference Page is located in the ECU flash and can not be modified by a simple write access. All changes to the Reference Page must be done via Flash programming. The INCA user can use ProF to invoke a customized flash programming algorithm.

When using the XETK-V2.0A/C, the Working Page should be located within the XETK-V2.0A/C's on board SRAM. The Working Page may be a portion of or the entire size of this RAM. To make the Working Page accessible to the XETK-V2.0A/C, the microcontroller software must configure the external bus interface correctly.

When using the XETK-V2.0B, the Working Page may be located in either a internal or external RAM of the ECU. It is recommended that this RAM is permanently powered.

Another important restriction is that no access to the memory is possible, while the ECU is not running. To enable a cold start measurement in spite of this restriction, a special procedure is defined to give the user the feeling of a parallel XETK.

NOTE

Because there is no write protection of the data emulation memory possible, the user must be take care not to overwrite emulation data.

4.8.1 Page Switching

To enable calibration, the Working Page must be activated. The process of switching from the Reference Page to the Working Page and vice versa is known as page switching. The XETK-V2.0 supports two methods of page switching; however, one method is only available for certain microcontrollers.

Regardless of which page switch method is used and which page is activated from the microcontroller's point of view, both the Reference Page and Working Page are accessible for standard operations using INCA such as upload or checksum calculations.

4.8.1.1 Protocol Based

The XETK-V2.0 supports Protocol Based page switching for all supported microcontrollers. Switching between Reference and Working Page is done in microcontroller software by re-directing accesses to calibration data between either the Flash (Reference Page) or the RAM (Working Page) using microcontroller internal mechanisms. The XETK-V2.0 does not directly control the microcontroller mechanism used to do this re-direction. Instead the XETK-V2.0 and microcontroller software share a mailbox in RAM. The XETK uses this mailbox to request and monitor page switching; the microcontroller is responsible to service this mailbox and perform the page switches.

4.8.1.2 Direct Register Access

The XETK-V2.0 supports Direct Register Access page switching for microcontrollers which provide additional internal registers for page switching. Switching between Reference and Working Page is done in microcontroller hardware by re-directing accesses to calibration data between either the Flash (Reference Page) or the RAM (Working Page) using microcontroller internal registers. The XETK-V2.0 has direct access to control these registers.

To use Direct Register Access page switching the microcontroller software must initialize the necessary registers; however, it must not change the values after the XETK startup handshake has taken place.

NOTE

The XETK-V2.0 can use the Direct Register Access page switch method with the MPC5676R, MPC5644A, SPC564A80, and MPC5777C.

4.8.2 XETK-V2.0A/C SRAM Characteristics & Data Retention

The XETK-V2.0A's SRAM is 2 MBytes, 32 x 512 kBytes. The XETK-V2.0C's SRAM is 4 MBytes, 32 x 1024 kBytes. It is a synchronous memory connected to the VertiCal Base Board supporting 32 bit multiplexed mode or 16 bit non multiplexed mode using the configuration feature "Calibration Bus Data Width". The 16 bit non multiplexed mode setting can only be configured for microcontrollers that do not support 32 bit multiplexed mode; otherwise 32 bit multiplexed mode must be used.

NOTE

In 16 bit mode, the XETK-V2.0A/C's SRAM is only 1 MByte, 16 x 512 kBytes.

In multiplexed mode during the address cycle of a read or write access the Address pins are used as Address. The address is latched into the SRAM during this cycle using CLKOUT and /TS. During the data cycle of a read or write access the Address and Data pins both contain data to create the 32 bit data bus.

The XETK-V2.0A/C's SRAM is powered by the same power that is supplied to the XETK-V2.0A/C. To guarantee that data in the SRAM is preserved even when the ignition is switched off, the XETK-V2.0A/C must be permanently supplied with power from the car battery. If the ECU with XETK-V2.0A/C is disconnected from the battery, all data in the SRAM is not guaranteed and may be lost.

The XETK-V2.0A/C's SRAM content is not backed up in a data flash. To store the Working Page data in the SRAM permanently to the ECU, the INCA user can use ProF to invoke a customized flash programming algorithm to store the content of the Working Page to the Reference Page in Flash.

NOTE

To access the XETK-V2.0A/C's SRAM the microcontroller software must configure the microcontroller's external bus interface for either multiplexed or non multiplexed mode. The chip select for the XETK-V2.0A/C must be configured for 32 bit (multiplexed) accesses or for 16 bit (non multiplexed) accesses. Additionally the VertiCal Base Board may require configuration by hardware solder bridges to select 32 bit (multiplexed) or for 16 bit (non multiplexed).

NOTE

The XETK-V2.0A/C does not support burst accesses to this SRAM.

4.8.3 Data Emulation Power Failures

The XETK-V2.0 has a circuit which recognizes and stores power failures. The XETK-V2.0 will notify the microcontroller software of the power failure using the DAI pins and additionally will prevent the user from switching to the working page until the PC software has downloaded a new Working Page data into the data emulation memory.

NOTE

The calibration feature "start on working page" or "start on last active page with the last active page being the working page" is only possible when the working page has been downloaded since the last power failure. Until a download occurs after a power failure the microcontroller software is informed of a power failure by the DAI pins and is responsible to make the reference page active.

4.9 Nexus (JTAG) Interface

4.9.1 XETK-V2.0A/C

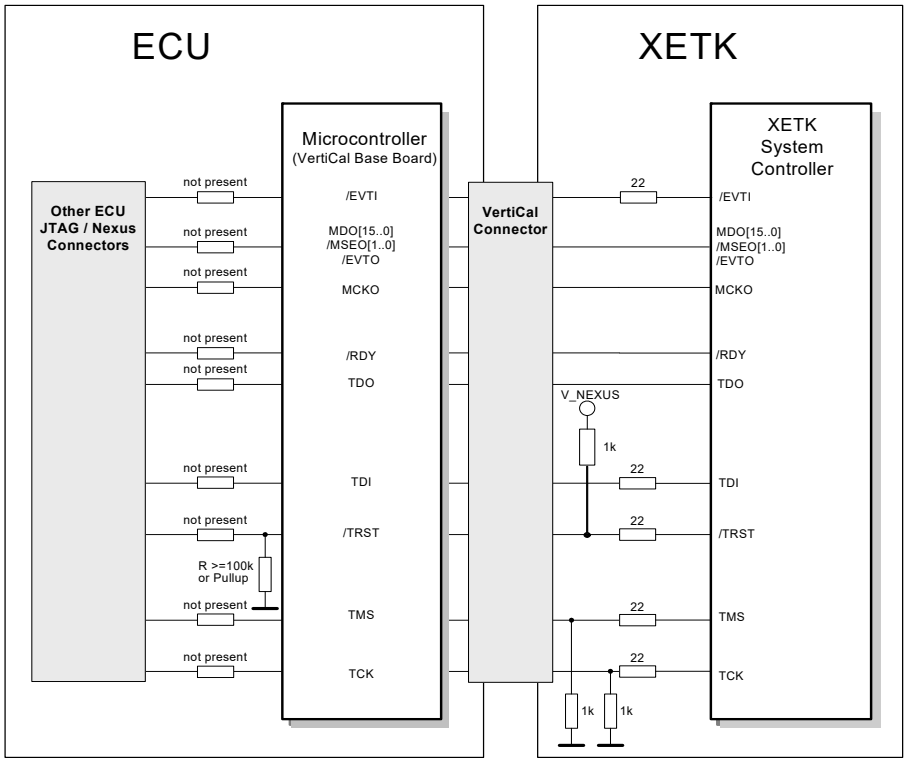

Fig. 4-12 Equivalent Circuitry of the XETK-V2.0A/C Nexus (JTAG) Interface

The ECU part of the XETK-V2.0A/C Nexus (JTAG) interface is depicted in Fig. 4-12. The XETK incorporates 22 Ohm series resistors for the TDI, /TRST, TCK, and TMS lines on the ECU interface. Additional pull ups / downs are as shown.

The microcontroller is mounted directly on the VertiCal Base Board; therefore it is not possible to add additional series resistors between the microcontroller and XETK for TDO, /RDY, /EVTO, MCKO, MDOx, and /MSEOx.

When the ECU design incorporates JTAG / Nexus connectors, additional circuitry is required to ensure these connectors and the signal routing do not influence the interface between the microcontroller and XETK. The ECU must incorporate 0 Ohm series resistors on every signal which goes to an additional JTAG / Nexus connection. Additionally, the resistors must be placed as close to the microcontroller as possible; especially for TCK and MCKO. For proper oper-

ation of the XETK-V2.0A/C it is mandatory to depopulate these resistors (e.g. not present), as shown in Fig. 4-12. For ECUs used without the XETK-V2.0A/C, the resistors can be populated to provide functional JTAG / Nexus connectors.

CAUTION

Risk of damaging the XETK due to short circuiting the JTAG signals!

When the XETK-V2.0A/C is connected to the ECU, you must ensure that no other device is actively driving the JTAG signals (TCK, TDI, TMS) via another connector on the ECU (e.g. Lauterbach debugger directly on ECU pcb). To use these other tools you must remove the XETK-V2.0A/C or plug the other tools into the ECU via the XETK-V2.0A/C's NEXUS (JTAG) Debugger Connector.

4.9.2 XETK-V2.0B

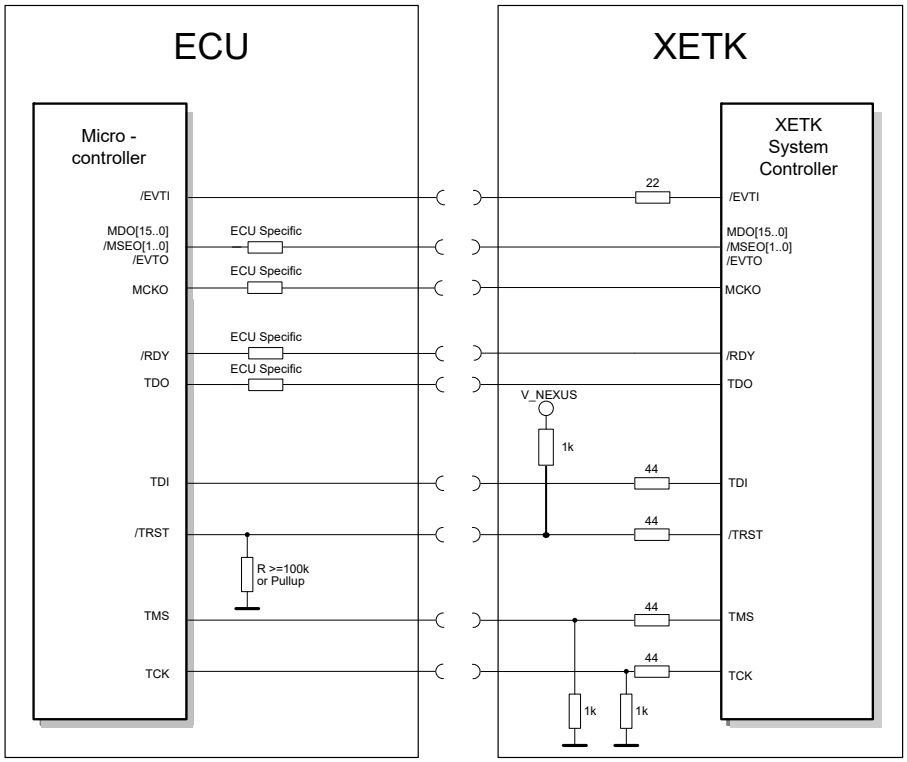

Fig. 4-13 Equivalent Circuitry of the XETK-V2.0B Nexus (JTAG) Interface

The ECU part of the XETK-V2.0B Nexus (JTAG) interface is depicted in Fig. 4-13. For proper operation of the XETK-V2.0B it is mandatory to provide impedance matched series termination resistors on the ECU pcb for the signals TDO and /RDY (if available). If trace measurement is used it is mandatory to provide impedance matched series termination resistors on the ECU pcb for the signals /EVTO, MCKO, MDOx, and /MSEOx.

The ECU specific impedance matched series termination resistor values (e.g. 22 Ohm, 33 Ohm, 50 Ohm, or other) must be chosen with the consideration to match the source impedance to the cable impedance. The ETAHx cables used between the microcontroller and XETK-V2.0B have a 50 Ohm impedance.

The XETK incorporates 44 Ohm series resistors for the TDI, /TRST, TCK, and TMS lines on the ECU interface. Additional pull ups / downs are as shown.

CAUTION

Risk of damaging the XETK due to short circuiting the JTAG signals!

When the XETK-V2.0B is connected to the ECU, you must ensure that no other device is actively driving the JTAG signals (TCK, TDI, TMS) via another connector on the ECU (e.g. Lauterbach debugger directly on ECU pcb). To use these other tools you must remove the XETK-V2.0B or plug the other tools into a debugger arbitration board.

4.10 Watchdog Timer Disable / Tool Detect Interface

The XETK-V2.0 provides a method to disable an external watchdog timer (WDT) circuit on the ECU.

4.10.1 XETK-V2.0A/C

The watchdog disable control signal is available on the VertiCal connector on signal TOOL_IO2 (pin N22). This signal is routed directly to a ball of the BGA VertiCal Base Board, completely bypassing the microcontroller on the VertiCal Base Board. The ECU receives the signal on the TOOL_IO2 optional ball. Each microcontroller package has a unique ball number for TOOL_IO2, see Fig. 4-14 for listing of ball numbers and package information.

When the XETK-V2.0A/C is configured to use this signal (configuration parameter "ECU Watchdog Control" set to "Disabled"), the signal TOOL_IO2 is set to logic high. Logic high is defined within the section “Electrical Characteristics” on page 64. When "ECU Watchdog Control" is set to "Enabled" the TOOL_IO2 pin is set to logic high when the debugger requests that the watchdog is enabled, else the pin is not driven (high-Z). When the "ECU Watchdog Control" is set to "Controlled by ECU", the TOOL_IO2 pin is not driven by the XETK-V2.0A/C (high-Z), regardless of the debugger request.

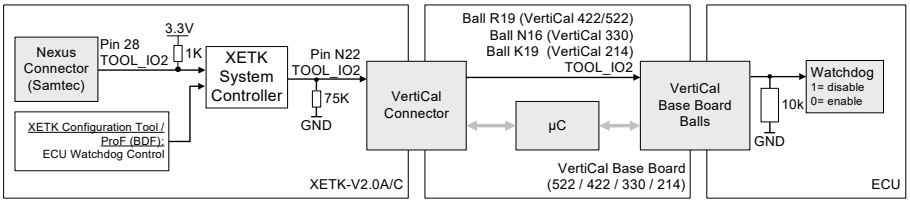

Fig. 4-14 Equivalent Circuitry of the XETK-V2.0A/C WDT Interface via VertiCal (BGA)

Prior to being used as the WDT disable interface, the signal TOOL_IO2 is additionally used as a tool detection interface by the XETK-V2.0A/C and other tools. This is required to determine if the tool is directly connected to the ECU or is connected to the ECU behind another tool. The XETK-V2.0A/C reads the TOOL_IO2 signal at power up to make this determination. If the signal is low, the XETK-V2.0A/C is directly connected to the ECU. If the signal is high, the XETK-V2.0A/C is connected to the ECU via another tool.

To ensure proper operation of the startup protocol the XETK-V2.0A/C and other tools the ECU circuitry has to respect the following topics for TOOL_IO2:

- When the external WDT disable function is required, a 10 kOhm pull-down resistor on TOOL_IO2 is required (refer to Fig. 4-14).
- When the external WDT disable function not required, TOOL_IO2 is left unconnected or pulled down via 10 kOhm resistor.
- TOOL_IO2 is never pulled up or driven high without the XETK or other tool present. This would cause the XETK to detect another tool is present between the ECU and XETK. Only the XETK or other tools (e.g. Lauterbach debugger) must drive this signal high, but only after the tool detection phase.

- Any ECU circuitry connected to TOOL_IO2 must not violate the XETK's signal characteristics defined within the section "Electrical Characteristics" on page 64. TOOL_IO2 is not 5 V tolerant.

CAUTION

Risk of damaging the XETK due to over voltage on TOOL_IO2!

The XETK-V2.0 signal TOOL_IO2 is not 5 V tolerant, refer to the section "Electrical Characteristics" on page 64 for the complete electrical specification of the TOOL_IO2 pin.

NOTE

The ECU must be equipped with a Watchdog disable circuit and a BGA VertiCal Base Board with optional balls when this feature is required.

NOTE

This functionality is not available with a QFP VertiCal Base Board.

4.10.2 XETK-V2.0B

The watchdog disable control signal is available on the Samtec connector on signal TOOL_IO2 (pin 28).

When the XETK-V2.0B is configured to use this signal (Configuration parameter "ECU Watchdog Control" set to "Disabled"), the signal TOOL_IO2 is set to logic high. Logic high is defined within the section "Electrical Characteristics" on page 64. When the "ECU Watchdog Control" is set to "Controlled by ECU" or "Enabled", the TOOL_IO2 pin is not driven by the XETK-V2.0B (high-Z).

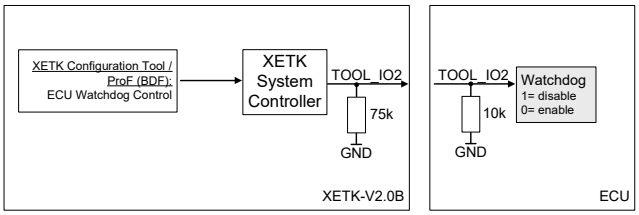

Fig. 4-15 Equivalent Circuitry of the XETK-V2.0B WDT Interface

CAUTION

Risk of damaging the XETK due to over voltage on TOOL_IO2!

The XETK-V2.0 signal TOOL_IO2 is not 5 V tolerant, refer to the section "Electrical Characteristics" on page 64 for the complete electrical specification of the TOOL_IO2 pin.

NOTE

The ECU must be equipped with a Watchdog disable circuit when this feature is required.

4.11 Startup and Triggering with DAI Pins

4.11.1 XETK-V2.0A/C DAI Interface via BGA VertiCal Base Boards

When using BGA VertiCal Base Boards additional circuitry and a VertiCal Base Board with optional balls must be present on the ECU PCB to use the DAI interface of the XETK-V2.0A/C. The XETK-V2.0A/C uses the same DAI Interface circuitry as other serial (X)ETKs; however, the connection between the microcontroller and XETK is made using the optional balls of the BGA VertiCal Base Board.

NOTE

For ECUs with BGA adapters VertiCal Base Boards with optional balls are required to use the DAI startup/ triggering and Watchdog Timer Disable features of the XETK-V2.0A/C.

The DAI circuitry of the ECU is connected to the XETK-V2.0A/C using the balls TOOL_IO0 (DAI1) and TOOL_IO1(DAI2) which are present on the BGA VertiCal Base Board equipped with optional balls. Refer to Fig. 4-16 for the required circuitry and VertiCal Base Board package specific ball locations.

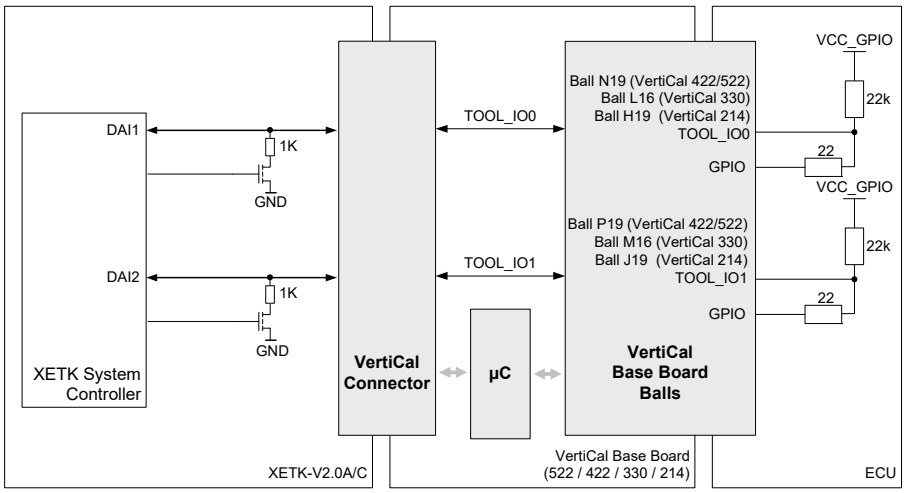

Fig. 4-16 Equivalent Circuitry of the XETK-V2.0A/C DAI Interface via VertiCal (BGA)

To ensure proper operation of the startup protocol between ECU and XETK the circuitry has to respect the following topics:

- 2 GPIO pins of the microcontroller are dedicated for the DAI functions, referred to as DAI1 and DAI2
- 22 Ohm or similar value for matched impedance series resistors on each of the DAI signals is recommended.
- 22 kOhm pull-up resistors on each of the DAI signals (refer to Fig. 4-16) is required; internal CPU pull-up may be used.
- DAI1 and DAI2 must be tri-state or an input out of reset
- DAI1 and DAI2 must be configurable first as inputs and then as outputs for the XETK-V2.0

4.11.2 XETK-V2.0A/C DAI Interface via QFP VertiCal Base Boards

When using QFP VertiCal Base Boards there is no additional circuitry required on the ECU PCB to use the DAI interface of the XETK-V2.0A/C. The XETK-V2.0A/C uses the same DAI Interface circuitry as the BGA VertiCal Base Boards; however, the connection between the microcontroller and XETK is made directly on the QFP VertiCal Base Board.

NOTE

For ECUs with QFP adapters the DAI startup/triggering is already considered in the VertiCal Base Board. The Watchdog Timer Disable feature of the XETK-V2.0A/C is not available.

The DAI circuitry of the ECU is connected to the XETK-V2.0A/C directly on the QFP VertiCal Base Board. GPIO pins available in the VertiCal Base Board, but unused in the QFP package are utilized for this purpose. Refer to Fig. 4-17 for the circuitry of the QFP VertiCal Base Board package.

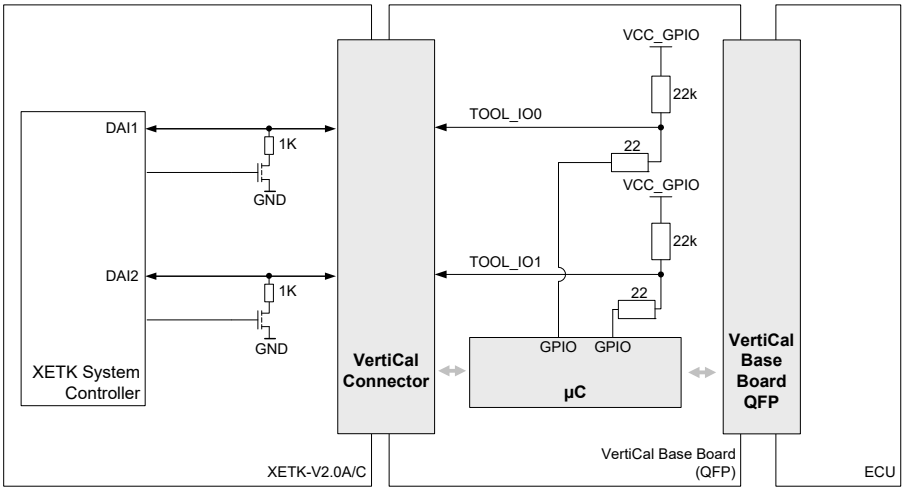

Fig. 4-17 Equivalent Circuitry of the XETK-V2.0A/C DAI Interface via VertiCal (QFP)

To ensure proper operation of the startup protocol between ECU and XETK the QFP VertiCal Base Board contains circuitry to respect the following topics:

- 2 GPIO pins of the microcontroller are dedicated for the DAI functions, referred to as DAI1 and DAI2
- 22 Ohm or similar value for matched impedance series resistors on each of the DAI signals is recommended.
- 22 kOhm pull-up resistors on each of the DAI1 signals (refer to Fig. 4-17) is required; internal CPU pull-up may be used.
- DAI1 and DAI2 must be tri-state or an input out of reset
- DAI1 and DAI2 must be configurable first as inputs and then as outputs for the XETK-V2.0

The QFP VertiCal Base Boards from Freescale and ST accomplish these requirements with the following connections:

VertiCal Base Board (QFP)	TOOL_IO0 (DAI1)	TOOL_IO1 (DAI2)	VCC_GPIO
MPC5644A_Rev1.1	GPIO203	GPIO204	VDDEH7
SPC564A80_Rev1.1	GPIO195	GPIO196	VDDEH4

4.11.3 XETK-V2.0B DAI Interface

The XETK-V2.0B uses the same DAI Interface circuitry as other serial (X)ETKs, refer to Fig. 4-18 for the required ECU circuitry.

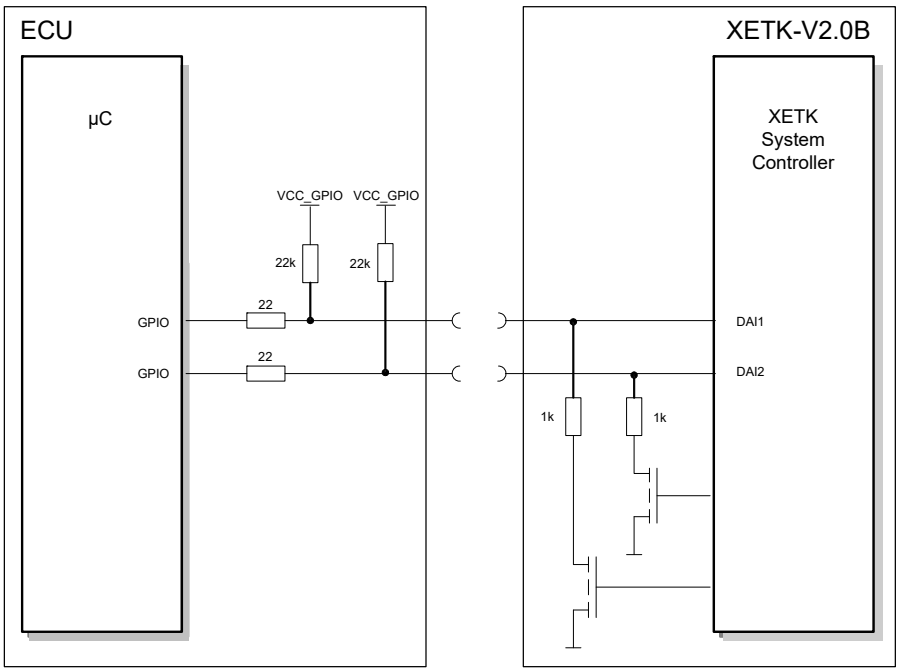

Fig. 4-18 Equivalent Circuitry of the XETK-V2.0B DAI Interface

To ensure proper operation of the startup protocol between ECU and XETK the circuitry has to respect the following topics:

- 2 GPIO pins of the microcontroller are dedicated for the DAI functions, referred to as DAI1 and DAI2
- 22 Ohm or similar value for matched impedance series resistors on each of the DAI signals is recommended.
- 22 kOhm pull-up resistors on each of the DAI signals (refer to Fig. 4-18) is required; internal CPU pull-up may be used.
- DAI1 and DAI2 must be tri-state or an input out of reset
- DAI1 and DAI2 must be configurable first as inputs and then as outputs for the XETK-V2.0

4.11.4 Phases of the Startup Protocol

During the startup phase the XETK and the ECU use a defined startup procedure. This ensures the XETK does not access the ECU memory while it is being initialized by the ECU software.

The DAI1 signal is dedicated to XETK detection, i.e. the XETK pulls DAI1 low during the initial phases of the startup protocol. If no XETK is connected, DAI1 will be pulled weakly high via the 22 kOhm pull-up resistor on the ECU.

The DAI2 signal is dedicated to signal an ECU Standby power fail of the calibration RAM. DAI2 high indicates that a power failure occurred and that the calibration RAM content has not been restored by the XETK, while DAI2 low indicates no power failure occurred.

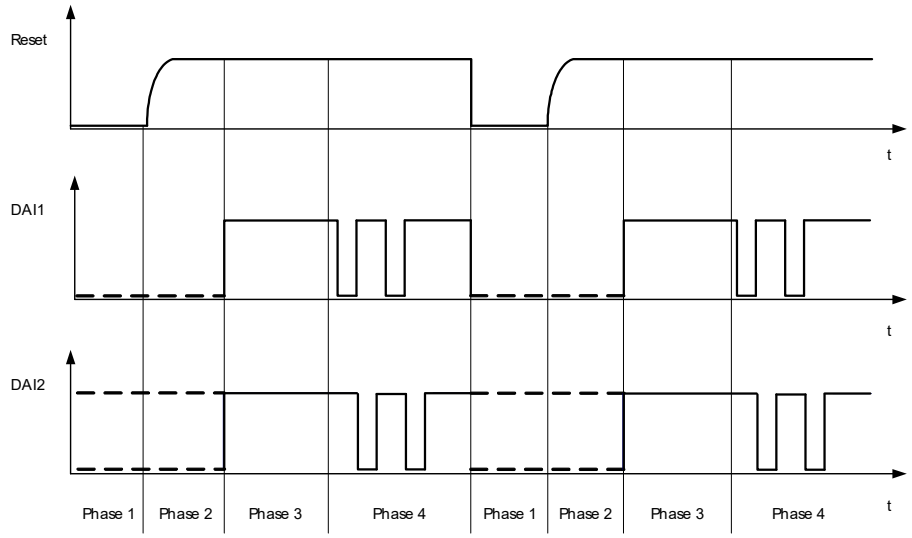

Fig. 4-19 Phases of the Startup Protocol (XETK connected)

4.11.4.1 Successive phases of the startup protocol (XETK connected)

- **Reset phase:** The ECU is in reset, the DAI ports are configured as inputs or tri-state. The XETK pulls DAI1 low via 1 kOhm, DAI2 may be pulled low (no power fail) via 1 kOhm.
- **ECU Initialization phase:** The ECU boots and performs internal initialization based on reading the state of the DAI ports. The DAI signals remain in the same states as in phase 1.
- **Initialization of ECU resources by XETK:** The ECU configures the DAI ports as outputs and drives a logical high to signal the transition from phase 2 to phase 3. Then the XETK removes any pull-down resistors and starts initialization of the ECU resources.
- **Calibration and data acquisition:** The ECU pulls the appropriate DAI port low to signal a trigger condition to the XETK, i.e. a measurement raster is ready for acquisition.

4.11.5 Triggering of Measurement Data Acquisition

Parallel ETKs or XETKs offer two or more trigger addresses that the ECU can write to for signaling the validity of the specific raster data to the INCA system.

To achieve the same result, serial XETKs use hardwired pins. The XETK-V2.0 provides two data acquisition interrupt lines (DAI1, DAI2) as hardware trigger signals. Within XETK's configuration and/or A2L file the signal DAI1 is referred to as hardware trigger 15 and the signal DAI2 is referred to as hardware trigger 16.

NOTE

To trigger the XETK correctly. the DAI pin must be low for at least 100 ns, but no more than 500 ns. Otherwise it is possible triggers will be missed by the XETK.

The required circuitry for the trigger lines DAI1 and DAI2 on the ECU is shown in Fig. 4-16 "Equivalent Circuitry of the XETK-V2.0A/C DAI Interface via VertiCal (BGA)",Fig. 4-17 "Equivalent Circuitry of the XETK-V2.0A/C DAI Interface via VertiCal (QFP)", and Fig. 4-18 "Equivalent Circuitry of the XETK-V2.0B DAI Interface". The two hardware triggers are active low signals.

NOTE

Interrupt lines DAI1 and DAI2 are also used for startup communication, see chapter 4.11.4 on page 43.

4.12 Startup and Triggering with Registers

The XETK-V2.0 also offers a pinless mechanism for the startup handshake and triggering. This mechanism is only available with certain microcontrollers. Pinless refers to the concept that no additional microcontroller GPIO pins are required for triggering. Instead, built in microcontroller registers and a dedicated Nexus signal, /EVTO, are utilized.

NOTE

The XETK-V2.0 can use the pinless startup and triggering mechanism with the MPC5676R, MPC5644A, SPC564A80, and MPC5777C.

4.12.1 Startup Handshake

During reset the microcontroller registers are initialized to reset values: DTS_SEMAPHORE is 0xFFFFFFFF, DTS_STARTUP is 0x00000000, and the DTS_EN bit of DTS_ENABLE is 0.

When the reset is deactivated the XETK enables the link between the DTS_SEMAPHORE register and the signal /EVTO by setting the DTS_EN bit to 1. The /EVTO signal goes low and the XETK reads the DTS_SEMAPHORE, this register automatically clears to 0x00000000 after being read.

A special pattern is then written to the DTS_STARTUP register by the XETK. This pattern includes the standby RAM power fail status of the ECU/XETK. (No power fail: 0x0000000A is written, Power fail: 0x00000009 is written). In case the XETK or the RAM being monitored by the XETK looses power then the Power fail pattern will be written. This pattern indicates to the ECU that the working page data is invalid and should not be used. If the working page was previously initialized, the XETK and the RAM being monitored by the XETK remain powered, the No power fail pattern will be written. This pattern indicates to the ECU that the working page data is still valid and may be used.

The DTS_STARTUP register is written to by the XETK within 500 microseconds after the microcontroller is out of reset.

4.12.1.1 Application running

The ECU software detects the connected XETK by reading the DTS_STARTUP register. Thereafter the ECU software performs basic initilizations and when finished writes 0x55555555 to the DTS_SEMAPHORE register. The XETK is notified of the write by the /EVTO signal, reads the DTS_SEMAPHORE register and compares the value to the expected value of 0x55555555. When the pattern matches, the XETK starts initialization and data acquisition (e.g. coldstart, checksum, downloads, etc).

4.12.2 Triggering of Measurement Data Acquisition

4.12.2.1 Initialization

After the startup handshake and measurement is enabled, the XETK is waiting for triggers from the ECU software via the DTS_SEMAPHORE and /EVTO signal.

4.12.2.2 Application running

To generate triggers, the ECU software sets bits by writing the associated bits in the "trigger register", DTS_SEMAPHORE.

> **NOTE**
>
> The selective setting of trigger bits is accomplished in hardware by the microcontroller and does not require a Read-Modify-Write sequence by the ECU software. When the ECU software writes 0x00000001 to the DTS_SEMAPHORE register it will set bit 0, all other bits remain unchanged.

Each bit of the "trigger register", DTS_SEMAPHORE, corresponds to an XETK hardware trigger. Within the XETK's configuration and/or A2L file bit 0 corresponds to hardware trigger 1 and bit 31 corresponds to hardware trigger 32.

When DTS_SEMAPHORE contains a non-zero value, the microcontroller automatically asserts the /EVTO signal. This in turn causes the XETK to read DTS_SEMAPHORE. The XETK then starts acquisition of appropriate measurement data based on which bits of the register are set.

Active bits in DTS_SEMAPHORE are automatically cleared by the microcontroller when the register is read by XETK.

4.13 Startup and Triggering with RAM

4.13.1 Startup Handshake

Microcontroller RAM addresses are used for XETK startup handshake. During this handshake, ECU software detects the connected XETK by reading and writing to specific RAM location and performing basic initializations based on the handshake values. When these initializations are done, the handshake is finished with success acknowledgment to the XETK. Thereafter, if a success acknowledgment is received by the XETK, it starts additional initialization processes (e.g. coldstart, checksum, downloads, etc.).

After the startup handshake and measure enabled, the XETK waits for triggers from ECU software.

4.13.2 XETK Trigger Generation

To generate triggers, the ECU software toggles bits of specific RAM address (next to handshake address) and each bit corresponds to an XETK hardware trigger.

The XETK periodically polls (reads) the trigger registers via JTAG. The polling rate is configurable, with 50 µs default. The XETK then starts acquisition of appropriate measurement data based on which bits of the registers are set.

4.14 Triggering with Timers

The XETK provides support for up to four internal timers of the for triggering the XETK without the need for DAI pins or microcontroller software. The time intervals between trigger events are in accordance with the configured timer values.

These values are defined in the XETK's configuration and/or in the A2L file. Each timer has a time resolution of 1 µs and can be configured to any value between 100 µs and 1 s.

The timers trigger the XETK in an asynchronous manner to the microcontroller software. Variables assigned to a measurement raster using a timer trigger are acquired from their original locations in RAM via JTAG.

4.15 Triggering with Trace

The XETK provides support for up to sixteen data trace triggers for triggering the XETK using the Nexus Auxiliary Interface. The trace triggers are defined within a section of RAM covered by a trace window. Both the trace window and trace triggers are defined in the XETK's configuration and/or A2L file. A write by the microcontroller software to a trace trigger location causes a trace trigger.

The trace trigger events to the XETK are synchronous to the microcontroller software. Variables assigned to a measurement raster using a trace trigger are acquired using the Nexus Auxiliary trace interface, not via JTAG.

NOTE

It is not possible to use the XETK-V2.0 configured with trace triggers and a debugger with program/data trace simultaneously.

4.16 XETK-V2.0A/C Microcontroller EBI Voltage Supply

The XETK-V2.0A/C supplies the microcontroller with voltage for the External Bus Interface using the V_CALBUS signals. The XETK-V2.0A/C can source up to 200 mA of current on the V_CALBUS signals at either 2.5 V or 3.3 V. The XETK-V2.0A/C also monitors the voltage on this interface to ensure it does not provide V_CALBUS if it is already present at the ECU VertiCal interface.

4.17 XETK-V2.0A/C Nexus (JTAG) Debugger Interface

The XETK-V2.0A/C provides a Nexus (JTAG) debugging interface connector, CON5, as specified in the "The Nexus 5001 Forum - Standard for a Global Embedded Processor Debug Interface, Version 2.0". The connector is a 50 pin Samtec. This connector can be used to attach debug and trace tools if they support XETK arbitration (e.g. Lauterbach debugger for MPC56xx - LA7610 or LA7630).

CAUTION

This is only a debugger interface for the XETK-V2.0A/C. A debugger must not be plugged into this connector of the XETK-V2.0B.

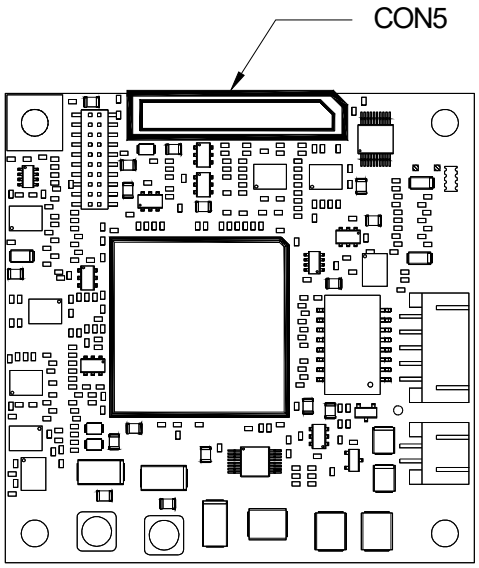

Fig. 4-20 Location of the XETK-V2.0A/C Nexus (JTAG) Debugger Interface

When using debug and trace tools with the XETK-V2.0A/C the devices must be powered on and powered off in the correct order. The power on sequence is as follows. First power on the debug and trace tool, next the XETK-V2.0A/C, and finally the ECU. The power to the ECU can then be turned on and off as needed, while the other devices remain powered.

The power off sequence is as follows. First power off the ECU, next the XETK-V2.0A/C, and finally the debug and trace tool.

The devices should only be connected and disconnected from each other while they are all un-powered.

CAUTION

Do not connect an un-powered debug and trace tool to a powered XETK-V2.0A/C. It will result in high current draw through the debugger connector and may damage the XETK-V2.0A/C. For proper operation of all connected devices, please observe the power on and power off guidelines within this section.

The tool vendor specific signal TOOL_IO2 (TDET/WDT) can be used by the debug tool to control and disable an external watchdog circuit on the ECU. Refer to the chapter “Watchdog Timer Disable / Tool Detect Interface” on page 38 for details about the disable watchdog logic circuit and requirements of the ECU circuitry to use this feature.

4.18 Braindead Flashing

Braindead Flashing (BDF) means downloading program code to the non-volatile memory of the ECU (i.e. internal or external flash), regardless of the current memory contents. It is not required that a programming routine is present in the ECU - the memory may be empty or corrupted.

The XETK-V2.0 supports Braindead Flashing via Nexus (JTAG) debug interface for its supported microcontrollers. It is recommended as the standard method of flashing for all for XETK-V2.0 projects.

4.18.1 Braindead Flashing via Nexus (JTAG) Debug Interface

This method uses the Nexus (JTAG) interface of the ECU's microcontroller to enable the debug mode of microcontroller and to download a flash programming driver into the microcontroller's internal SRAM.

After download, the microcontroller is given a resume/go command. It executes the programming driver which receives data via the XETK mailbox and programs it into the microcontroller's flash. When flash programming is done, a reset is issued and the microcontroller executes the recently programmed code.

The following steps are sequenced by a ProF control flow:

- Put ECU's microcontroller into reset
- Disable external watchdog timer (optional, see chapter 4.18.2 on page 49)
- Initiate microcontroller's debug mode and halt state
- Initialize the Internal SRAM
- Initialize the MMU registers to a known state
- Download flash programming driver into the internal RAM region of the controller that contains communication and flash routines
- Set Program Counter to point to the beginning of the flash programming driver
- Resume microcontroller code execution by issuing a go/resume command
- Program the new ECU software to the non-volatile memory (internal or external flash)
- Reset the CPU (release Nexus (JTAG) debug interface control)

CAUTION

During Braindead Flashing via Nexus (JTAG), any external debugger should be removed.

NOTE

The first command of the downloaded flash driver must be a "NOP" command, otherwise the driver will **not** work!

4.18.2 External Watchdog disable

The XETK-V2.0 provides a method to disable an external watchdog circuit on the ECU during Braindead flashing. See chapter “Watchdog Timer Disable / Tool Detect Interface” on page 38 for details about the disable watchdog logic circuit and requirements of the ECU circuitry.

5 Installation

In this chapter, the hardware installation of the XETK-V2.0 is described.

CAUTION

The XETK can be damaged or destroyed!

Some components of the interface board may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.

The board should only be taken from its package, configured, and installed at a work place that is protected against static discharge.

5.1 Connection to the ECU

5.1.1 XETK-V2.0A/C

CAUTION

Risk of bending or breaking pins of XETK ECU Interface!

When you mount the XETK to the ECU, you must ensure that the VertiCal connector pins are aligned properly before applying pressure to the XETK for insertion into the VertiCal Base Board.

CAUTION

Risk of short circuiting the internal signals of the XETK!

When you mount the XETK to the ECU, you must ensure that the screws and washers used will not penetrate the XETK printed circuit board.

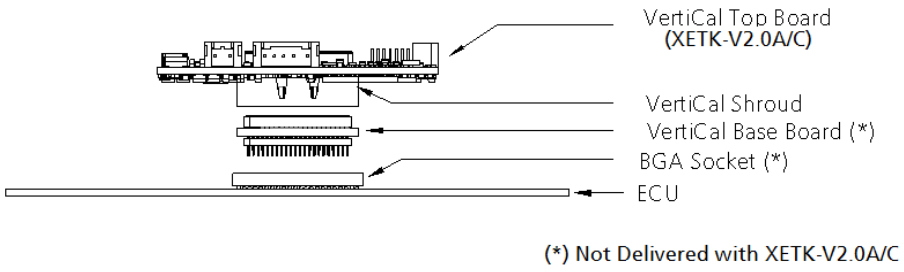

Fig. 5-1 XETK-V2.0 Connection to the ECU with Socket/Adapter

For mounting the XETK-V2.0 on the ECU accessories are required (see Fig. 5-1):

- a VertiCal base board
- a QFP or BGA Socket from ST or Freescale, mounted on the ECU printed circuit board

These accessories need to be ordered separately (refer chapter “Ordering Information” on page 102).

5.1.2 XETK-V2.0B

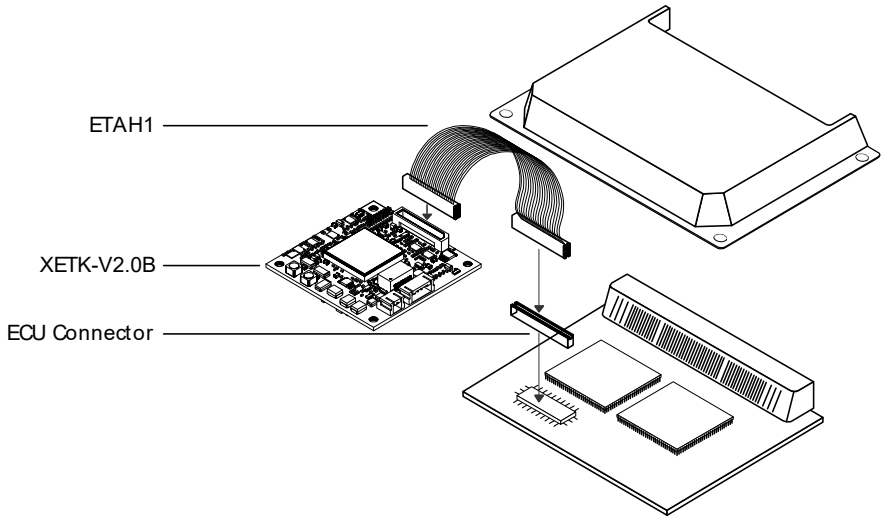

Fig. 5-2 XETK-V2.0B Connection to the ECU with Socket/Adapter

For mounting the XETK-V2.0B on the ECU accessories are required (see Fig. 5-2):

- ETAH1 - A Mictor 38 receptacle mounted on the ECU printed circuit board. Refer to“Connector XETK-V2.0B - ECU Adapter ETAH1” on page 104 for ordering information.
- ETAH4 - A Samtec 50 receptacle mounted on the ECU printed circuit board. Refer to “Connector XETK-V2.0B - ECU Adapter ETAH4” on page 104 for ordering information.

5.2 Wiring

5.2.1 XETK Ethernet Interface

The XETK Ethernet interface can be directly connected to the PC. No additional ETAS module is required for the access to the ECU.

NOTE

The XETK Ethernet interface is not compatible with the ETK interfaces in modules like e.g. ES910, ES590, ES591, ES592, ES593-D, ES595, ES1232-A. The XETK Ethernet interface is compatible with the ECU interface of the ES910 module and the Ethernet interfaces of the ES51x/ ES592/ ES593-D/ ES595/ES600/ES89x modules.

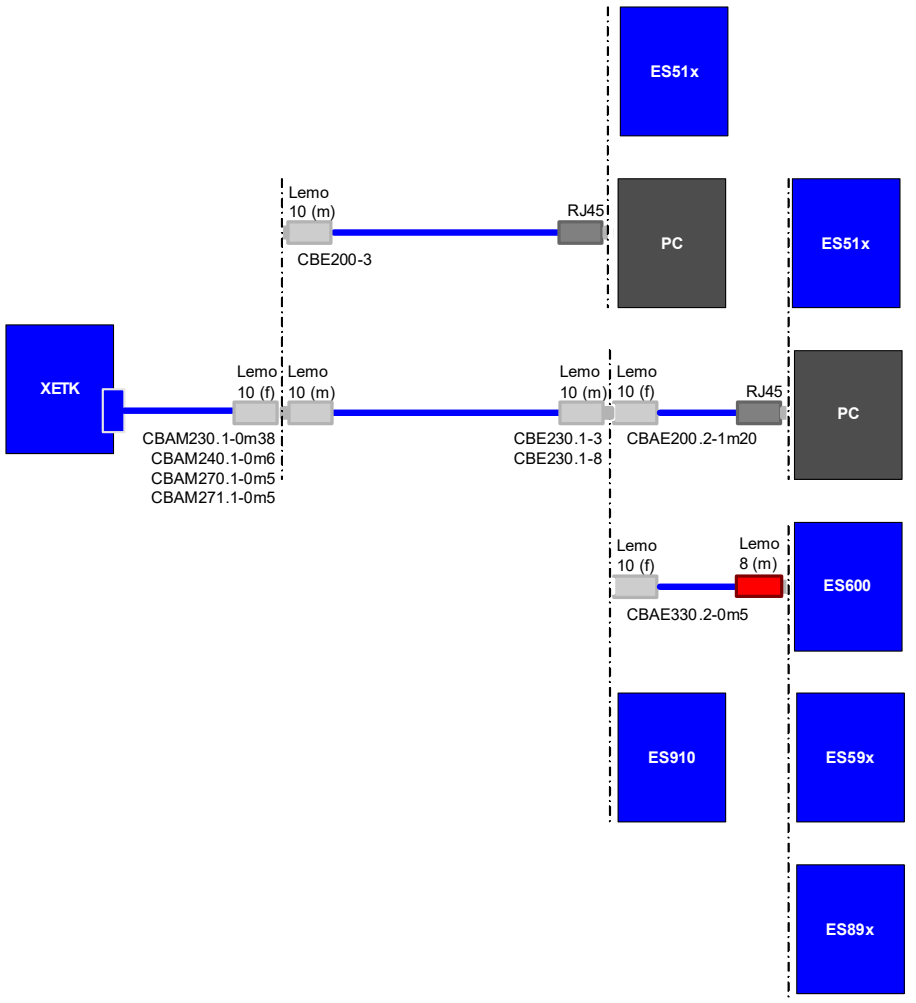

Fig. 5-3 Wiring - XETK Ethernet Interface

5.2.2 Power Supply

The XETK-V2.0 needs a permanent power supply (refer chapter “Power Supply” on page 27). There are different versions to ensure it.

5.2.2.1 Permanent Power Supply inside ECU available

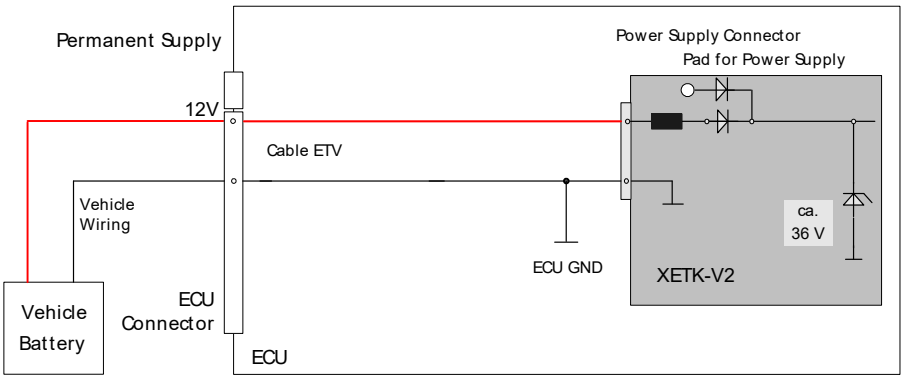

Fig. 5-4 Wiring - Permanent Power Supply inside ECU available

5.2.2.2 Permanent Power Supply inside ECU not available

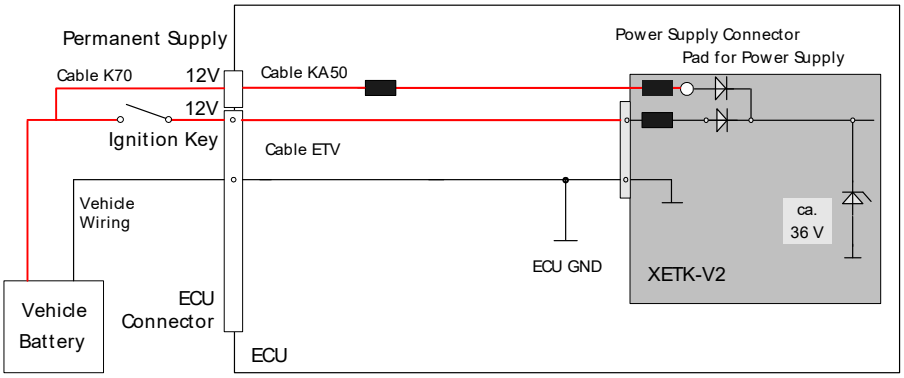

Fig. 5-5 Wiring - Permanent Power Supply inside ECU not available

5.2.2.3 Isolated Power Supply inside ECU

The XETK-V2.0 does not require a galvanically isolated power supply. For special applications ETAS offers the isolated power supply ETP2.

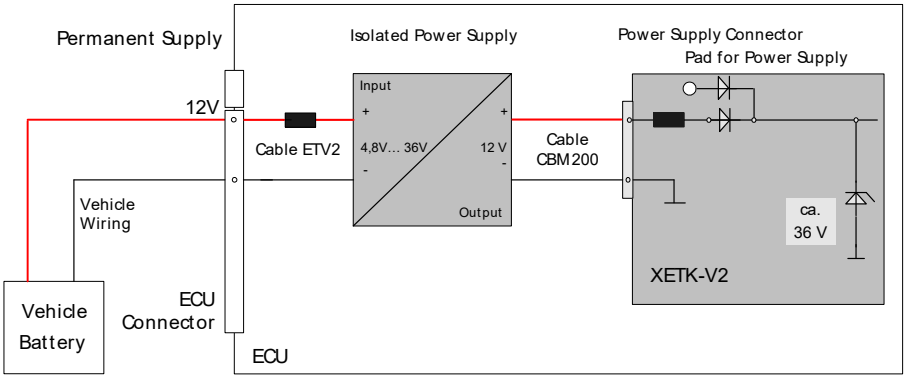

Fig. 5-6 Wiring - Isolated Power Supply inside ECU

6 XETK Configuration

The "XETK Configuration" chapter describes the XETK-V2.0 hardware configuration.

6.1 Overview

As already mentioned in previous chapters, some project-specific adjustments are necessary. Configuration data is stored permanently in a serial Flash.

Generating a valid configuration data set is supported by the "(X)ETK Configuration Tool" (XCT Tool). The XCT Tool contains information on all available XETKs. The user is supported through a graphical interface.

The configuration is done in two steps:

1. Generation of the special address offset for the emulation and measurement data memory.

   The location of data areas, measured data output areas, trigger segment addresses etc. are familiar to the ECU software developer, or can be generated automatically. If an ECU description database (ASAP, ...) with the corresponding input exists, these inputs can be downloaded from this database. If necessary, a plausibility check is performed.

2. Connection of the XETK to the ECU.

   The ECU hardware developer defines the connection of the XETK to the ECU. The corresponding signals usually have to be adjusted for each microcontroller. All inputs are checked for plausibility, to make sure that a valid configuration is generated.

The "(X)ETK Configuration Tool" can create the following output:

- Direct XETK configuration
- Storage of the configuration in a data file
- The corresponding ASAP2 input

The most important outputs are the entries for the ASAP2 file. All A2L definitions necessary for configuring an ETK will be created. These are:

- Overlay Region definitions
- Memory Segment definitions
- XETK configuration features
- Raster definitions

If these parameters are entered correctly in the corresponding ECU description file, it guarantees that every time the calibration system is started, the XETK is checked for the appropriate configuration. If necessary, the XETK will be configured appropriately to the corresponding project.

6.2 Configuration Parameter

The XCT Tool provides support concerning hardware configuration parameters and their possible values.

They are described for the different (X)ETK types in the help document of the "(X)ETK Configuration Tool".

Starting the "XCT Tool" help

1. Start the XCT Tool.

   The main window of the XCT tool opens.
2. Select in the menu bar ? → **Contents**.

   The XCT Tool help window opens.
3. Choose **Reference to User Interface** → **(X)ETK Hardware Configuration Parameters**.
4. Choose the topic **XETK-V2.0**.

   The topic **XETK-V2.0** contains information about the XETK-V2.0 hardware configuration parameters and their possible values.

7 Technical Data

The “Technical Data” chapter contains a summary of all technical data, pin assignments and hints to system requirements for operating the XETK-V2.0.

7.1 System Requirements

7.1.1 ETAS Hardware

ES51x, ES592, ES593-D, ES595, ES600 (INCA)

ES89x, ES910 (INCA, INTECRIO)

7.1.2 PC with one Ethernet interface

A PC with one open Ethernet interface (100 Mbit/s, full duplex) with RJ-45 connection is required to connect the ES89x module. Ethernet interfaces that are implemented with an additional network card in the PC must feature a 32-bit data bus.

7.1.3 Requirement to ensure successful Initialization

NOTE

It is imperative you disable the function which automatically switches to power-saving mode on your PC network adapter when there is no data traffic on the Ethernet interface!

To deactivate the power saving mode

Choose in Windows System Control Center / Device Manager / Network Adapter the used network adapter by double-click. Deactivate the "Allow the computer to turn off this device to save power" option in the "Power Management" register. Confirm your configuration.

The manufacturers of network adapter have different names for this function.

Example:

- "Link down Power saving"
- "Allow the computer to turn off this device to save power"

7.1.4 Supported Microcontrollers and Software Versions

7.1.4.1 XETK-V2.0A/C and XETK-V2.0B

You need at least the following software versions to support the XETK-V2.0A/C or XETK-V2.0B with the listed microcontrollers:

Microcontroller	HSP	INCA	ETK Drivers and Tools	ASCET-RP	INTECRIO
MPC5674F_Rev2	V8.1.2	V6.2.1	V2.1.7	V6.1	V3.2
	V9.0.0	V7.0.0	V3.0.0		
MPC5644A_Rev1.1	V8.1.3	V6.2.1	V2.1.8	V6.1	V3.2
	V9.0.0	V7.0.0	V3.0.0		
MPC5644A_Rev2	V9.9	V7.0.0	V3.7.0	V6.1	V3.2
SPC564A80_Rev1.1	V8.1.3	V6.2.1	V2.1.8	V6.1	V3.2
	V9.0.0	V7.0.0	V3.0.0		
SPC564A80_Rev2	V9.9	V7.0.0	V3.7.0	V6.1	V3.2
MPC5566_Rev1[1)]	V9.2.0	V7.0.0	V3.2.0	V6.1	V3.2
MPC5566_Rev1	V9.9	V7.0.0	V3.7.0	V6.1	V3.2
MPC5676R_Rev1	V9.3.1	V6.2.1	V2.1.12	V6.1	V3.2
	V9.3.1	V7.0.0	V3.2.1		
MPC5777C_Rev1[2)]	V10.4	V7.1.4	V4.0.1	V6.1	V3.2

[1)] Data Acquisition via the Nexus Auxiliary trace interface is not possible with this microcontroller and the listed software versions.
[2)] MPC5777C_Rev1B supported with HSP 10.8

Operating the XETK-V2.0A/C or XETK-V2.0B with older software versions is not possible.

The configuration instructions for the XETK-V2.0 under INCA and HSP are contained in the relevant software documentation.

7.1.4.2 XETK-V2.0B only

You need at least the following software versions to support the XETK-V2.0B with the listed microcontrollers:

Microcontroller	HSP	INCA	ETK Drivers and Tools	ASCET-RP	INTECRIO
MPC5643L_Rev1_LSM (Lock Step Mode)	V9.2.0	V6.2.1	V2.1.10	V6.1	V3.2
	V9.2.0	V7.0.0	V3.1.0		
MPC5643L_Rev1	V9.9	V7.0.0	V3.7.0	V6.1	V3.2
MPC5675K_Rev1	V9.9	V7.0.0	V3.7.0	V6.1	V3.2
MPC5746C_Rev1	V10.7.0	V7.1.7	V4.0.3	V6.1	V3.2
MPC5744P_Rev1	V10.8.0	V7.1.8	V4.0.4	V6.1	V3.2

Operating the XETK-V2.0B with older software versions is not possible.

The configuration instructions for the XETK-V2.0 under INCA and HSP are contained in the relevant software documentation.

7.2 Environmental Conditions

Item	Characteristics
Temperature range	- 40 °C to +110 °C - 40 °F to +230 °F

7.3 Power Supply

7.3.1 XETK-V2.0A/C

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply (car battery)	U_{Batt}	Vehicle usage [1]	4.3 [all values ±0%]	12	36	V
Standby current [2]	I_{STBY}	U_{Batt} = 12 V; ECU off; T = 20 °C		30	35	mA
Operating current [3]	I_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		130	180	mA
Operating current [4]	I_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		170	440	mA
Power dissipation [3]	P_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		1.56		W
Power dissipation [4]	P_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		2.04		W

1) The XETK-V2.0 implements reverse voltage protection in the same range and may be used only with central load dump protection.
24 V vehicles require U_{Batt} disturbing pulse reduction to 12 V vehicle system.
12 V vehicles don't require special disturbing pulse reductions.
2) Ethernet is disconnected and the ECU is off.
3) I = 0 mA on V_CALBUS supply
4) I = 200 mA on V_CALBUS supply

7.3.2 XETK-V2.0B

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply (car battery)	U_{Batt}	Vehicle usage [1]	4.3 [all values ±0%]	12	36	V
Standby current [2]	I_{STBY}	U_{Batt} = 12 V; ECU off; T = 20 °C		21	26	mA
Operating current	I_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		110	160	mA
Power dissipation	P_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C		1.3		W

[1] The XETK-V2.0 implements reverse voltage protection in the same range and may be used only with central load dump protection.
24 V vehicles require U_{Batt} disturbing pulse reduction to 12 V vehicle system.
12 V vehicles don't require special disturbing pulse reductions.
[2] Ethernet is disconnected and the ECU is off.

7.4 Configuration

Item	Characteristics
Configuration	Project-specific; stored in EEPROM for different microcontrollers and memory configurations
Update	Logic devices updated using HSP software

7.5 XETK Ethernet Interface

Item	Characteristics
Connection	100 Mbit/s Ethernet, Full Duplex
	PC Card 32 bit
Protocol	XCP on TCP/IP or UDP/IP
IP address	Dynamic (standard, for INCA) or static (e.g. for Rapid Prototyping) by using the XETK Configuration Tool (default IP address: 192.168.40.16)
Cable length	max. 30 m / 100 ft
Ethernet interface	DC decoupling

NOTE

To ensure successful initialization of the network card of your PC, refer to chapter 7.1.3 on page 56.

7.6 ECU Interface Characteristics

7.6.1 XETK-V2.0A/C

Parameter	Symbol	Condition	Min	Typ	Max	Unit
ECU Power Supply Supervision Voltage (3.3 V selected)	U_{V_RESET}	ECU on: 3.3 V	2.75	2.90	3.05	V
		ECU off: 3.3 V	2.55	2.70	2.85	V
ECU Power Supply Supervision Voltage (5.0 V selected)	U_{V_RESET}	ECU on: 5.0 V	3.75	3.90	4.05	V
		ECU off: 5.0 V	3.55	3.70	3.85	V
ECU Power Supply Supervision Voltage	I_{V_RESET}	Level Detect: 3.3 V			150	µA
		Level Detect: 5.0 V			200	µA
Nexus Level Voltage - Level Detect	U_{V_NEXUS}	Level Detect: 2.5 V	1.9		2.1	V
		Level Detect: 3.3 V	2.95		3.1	V
Nexus Level Voltage - Level Detect	I_{V_NEXUS}	Level Detect: 2.5 V			100	µA
		Level Detect: 3.3 V			120	µA
V_CALBUS Output Voltage	U_{V_CALBUS}	Level: 3.3 V max. 200 mA	3.13	3.3	3.46	V
V_CALBUS Output Voltage	U_{V_CALBUS}	Level: 2.5 V max. 200 mA	2.37	2.5	2.62	V

7.6.2 XETK-V2.0B

Parameter	Symbol	Condition	Min	Typ	Max	Unit
ECU Power Supply Supervision Voltage (3.3 V selected)	U_{V_NEXUS}	ECU on: 3.3 V	2.75	2.90	3.05	V
		ECU off: 3.3 V	2.55	2.70	2.85	V
ECU Power Supply Supervision Voltage (5.0 V selected)	U_{V_NEXUS}	ECU on: 5.0 V	3.75	3.90	4.05	V
		ECU off: 5.0 V	3.55	3.70	3.85	V
ECU Standby Power Supply Supervision Voltage (1.2 V selected)	U_{VSTBY}	ECU on: 1.2 V	1.01	1.16	1.31	V
		ECU off: 1.2 V	0.81	0.96	1.11	V
ECU Standby Power Supply Supervision Voltage (2.5 V selected)	U_{VSTBY}	ECU on: 2.5 V	2.15	2.30	2.45	V
		ECU off: 2.5 V	1.96	2.11	2.26	V
ECU Standby Power Supply Supervision Voltage (3.3 V via 10K selected)	U_{VSTBY}	ECU on: 3.3 V via 10K	2.75	2.90	3.05	V
		ECU off: 3.3 V via 10K	2.43	2.58	2.73	V
ECU Standby Power Supply Supervision Voltage (3.3 V selected)	U_{VSTBY}	ECU on: 3.3 V	2.75	2.90	3.05	V
		ECU off: 3.3 V	2.55	2.70	2.85	V
ECU Power Supply Supervision Voltage	I_{V_NEXUS}	Level Detect: 3.3 V			150	µA
		Level Detect: 5.0 V			200	µA
Nexus Level Voltage - Level Detect	U_{V_NEXUS}	Level Detect: 2.5 V	1.9		2.1	V
		Level Detect: 3.3 V	2.95		3.1	V
Nexus Level Voltage - Level Detect	I_{V_NEXUS}	Level Detect: 2.5 V			100	µA
		Level Detect: 3.3 V			120	µA

7.7 Test Characteristics

Parameter	Symbol	Condition	Min	Max	Unit
Reset delay 1	t_{Reset1}	U_{Batt} = 12 V U_{V_RESET}= 0 V ↑ 3.3 V/ 5.0 V	25	40	ms
Reset delay 2	t_{Reset2}	U_{Batt} = 0 V ↑ 12 V	250	460	ms

NOTE

t_{Reset1}: Delay of ECU reset through XETK without transferring the Flash (U_{Batt} present, U_{V_RESET} will be switched on)
t_{Reset2}: max. delay of ECU reset through XETK (U_{Batt} and U_{V_RESET} will be switched on)

7.8 Electrical Characteristics

7.8.1 XETK-V2.0A/C

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF] [1)]
ADDR[30]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.62	0.75	1.5	2.8	-1/+1	23
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	23
ADDR[29...16]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.62	0.75	1.5	2.8	-1/+1	18
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	18

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
ADDR[15, 13, 12]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	7
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	7
ADDR[14]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	27
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	27
DATA[15,13,12]; DATA[9..0]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	7
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	7

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
DATA[14] **(CPU Type =** MPC5674F_Rev1 MPC5674F_Rev2	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	14
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	14
DATA[14] **(CPU Type =** MPC5644A_Rev1.1 SPC564A80_Rev1.1	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	27
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	27
DATA[10, 11]	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	31
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/O	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	31
RD_/WR; /OE; /TS; /BDIP	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	7
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	7

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
/CS[3] (not selected)	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	10
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	10
/CS[3] (selected)	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	29
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	29
/CS[2] **(CPU Type =** MPC5674F_Rev1 MPC5674F_Rev2 (used as DATA[31])	U_{V_CALBUS} = 2.5 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/0	0.4	2.37	2.5	0.75	1.5	2.8	-1/+1	36
	U_{V_CALBUS} = 3.3 V; I_{OH} = -8 mA; I_{OL} = 8 mA	I/0	0.4	3.13	3.46	0.8	2.0	3.6	-1/+1	36
/CS[2] (not selected) **(CPU Type =** MPC5644A_Rev1.1 SPC564A80_Rev1.1	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	12
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	12
/CS[2] (selected) **(CPU Type =** MPC5644A_Rev1.1 SPC564A80_Rev1.1	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	31
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	31
/CS[1..0] (not selected)	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	5
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	5

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
/CS[1..0] (selected)	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	24
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	24
/WE[3..2]	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	18
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	18
/WE[1..0]	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	7
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	7
CLKOUT	U_{V_CALBUS} = 2.5 V;	I	-	-	-	0.75	1.5	2.8	-1/+1	7
	U_{V_CALBUS}= 3.3 V;	I	-	-	-	0.8	2.0	3.6	-1/+1	7
/RSTOUT		I	-	-	-	0.7	1.7	5.5	-25/+25	23
/RESET	I_{Dmax} = 0.2A	I/OD	-	-	-	0.7	1.7	5.5	-25/+25	65
BOOTCFG[1..0]; /RSTCFG		I	-	-	-	0.7	1.7	5.5	-25/+25	20
TOOL_IO[1..0]; (DAI2/DAI1)		I	-	-	-	0.7	1.7	5.5	-25/+25	20
TOOL_IO[2]; (WDT Disable)	I_{OH} = -4 mA;	I/O	.45	2.4	3.3	0.7	1.7	4.6	-30/+30	14
TOOL_IO[3];		I	-	-	-	0.7	1.7	5.5	-25/+25	20

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
TCK	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	2.3	2.5	-	-	4.6	-15/+15	12
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	3.1	3.3	-	-	4.6	-15/+15	12
TMS;TDI; /TRST (JCOMP)	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	2.3	2.5	-	-	4.6	-15/+15	12
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	3.1	3.3	-	-	4.6	-15/+15	12
/RDY	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.7	1.7	4.6	-15/+15	12
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.7	1.7	4.6	-15/+15	12
TDO	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.8	1.7	4.6	-30/+30	19
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.7	1.7	4.6	-30/+30	19
MDO[15..0]; /EVTO; MCKO; /MSEO[1..0]	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.7	1.6	4.6	-5/+5	10
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.8	2.0	4.6	-5/+5	10

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
/EVTI	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.55	1.75	2.5	-	-	4.6	-5/+5	10
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.55	2.3	3.3	-	-	4.6	-5/+5	10

[1)] VertiCal plug, Samtec connector, and PCB not considered

7.8.2 XETK-V2.0B

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF](1)
TCK	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	2.3	2.5	-	-	4.6	-15/+15	17
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	3.1	3.3	-	-	4.6	-15/+15	17
TMS;TDI; /TRST (JCOMP)	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	2.3	2.5	-	-	4.6	-15/+15	17
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.45	3.1	3.3	-	-	4.6	-15/+15	17
/RDY	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.7	1.7	4.6	-15/+15	17
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.7	1.7	4.6	-15/+15	17
TDO	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.8	1.7	4.6	-30/+30	24
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.7	1.7	4.6	-30/+30	24
MDO[15..0]; /EVTO; MCKO; /MSEO[1..0]	U_{V_NEXUS} = 2.5 V;	I	-	-	-	.8	2.0	5.5	-100/+100	13
	U_{V_NEXUS} = 3.3 V;	I	-	-	-	.8	2.0	5.5	-100/+100	13

Signal	Condition	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional Load by XETK (typ) [pF][1)]
/EVTI	U_{V_NEXUS} = 2.5 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.55	1.75	2.5	-	-	5.5	-100/+100	13
	U_{V_NEXUS} = 3.3 V; I_{OH} = -1 mA; I_{OL} = 1 mA	O	0.55	2.3	3.3	-	-	5.5	-100/+100	13
/RSTOUT		I	-	-	-	0.7	1.7	5.5	-25/+25	23
/RESET	I_{Dmax} = 0.2A	I/OD	-	-	-	0.7	1.7	5.5	-25/+25	65
TOOL_IO[1..0]; (DAI2/DAI1)		I	-	-	-	0.7	1.7	5.5	-25/+25	20
TOOL_IO[2]; (WDT Disable)	I_{OH} = -4 mA;	I/O	.45	2.4	3.3	0.7	1.7	4.6	-30/+30	7

[1)] Samtec connector, ETAHx cable, and PCB not considered

7.9 Switching Characteristics

The following diagrams show the timings the XETK-V2.0 can process.

> **NOTE**
>
> JTAG and Nexus timing parameters in this chapter refer to the ECU Interface of the XETK-V2.0 (XETK-V2.0A/C CON1 or XETK-V2.0B CON5). The wiring to the ECU (XETK-V2.0B ETAHx) and the ECU pcb routing or wiring must be additionally taken into account.
> All timings are measured at a reference level of 1.5 V. Output signals are measured with 20 pF to ground and 50 Ω to 1.5 V.

7.9.1 JTAG Timing Characteristics

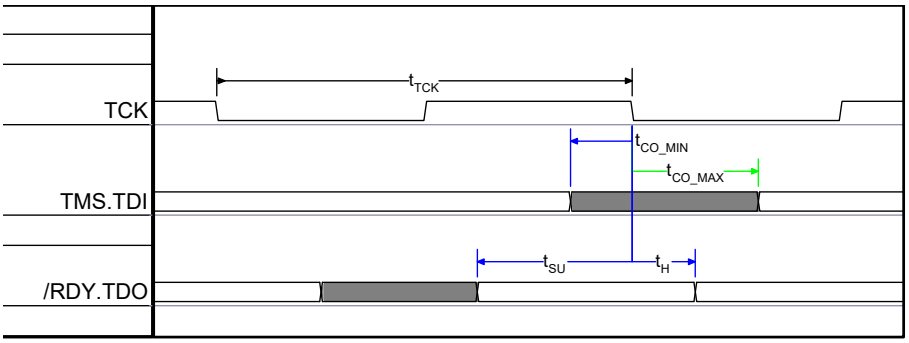

Fig. 7-1 XETK-V2.0 JTAG Timing Diagram

JTAG Clock	20 MHz		30 MHz		40 MHz		
Parameter	Min	Max	Min	Max	Min	Max	Unit
t_{TCK}	50	50	33.33	33.33	25	25	ns
t_{CO_TDI}	-6	12	-6	12	-6	12	ns
t_{CO_TMS}	-6	12	-6	12	-6	12	ns
t_{SU_TDO}	-12	n/a	-12	n/a	-12	n/a	ns
t_{H_TDO}	4.5	n/a	4.5	n/a	4.5	n/a	ns
$t_{SU\_/RDY}$	-12	n/a	-12	n/a	-12	n/a	ns
$t_{H\_/RDY}$	4.5	n/a	4.5	n/a	4.5	n/a	ns

7.9.2 Nexus Timing Characteristics

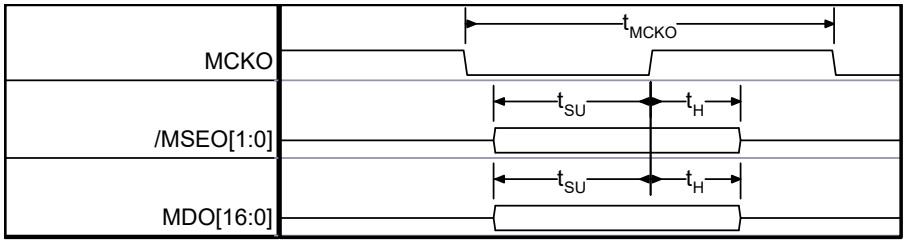

Fig. 7-2 XETK-V2.0 Nexus Timing Diagram (valid up to 66 MHz)

Parameter	Min	Max	Unit
t_{MCKO}	15	n/a	ns
$t_{SU\_MDO[15:0]}$	3	n/a	ns
$t_{H\_MDO[15:0]}$	3	n/a	ns
$t_{SU\_/MSEO[1:0]}$	3	n/a	ns
$t_{H\_/MSEO[1:0}$	3	n/a	ns

7.9.3 XETK-V2.0A/C SRAM Read Timing

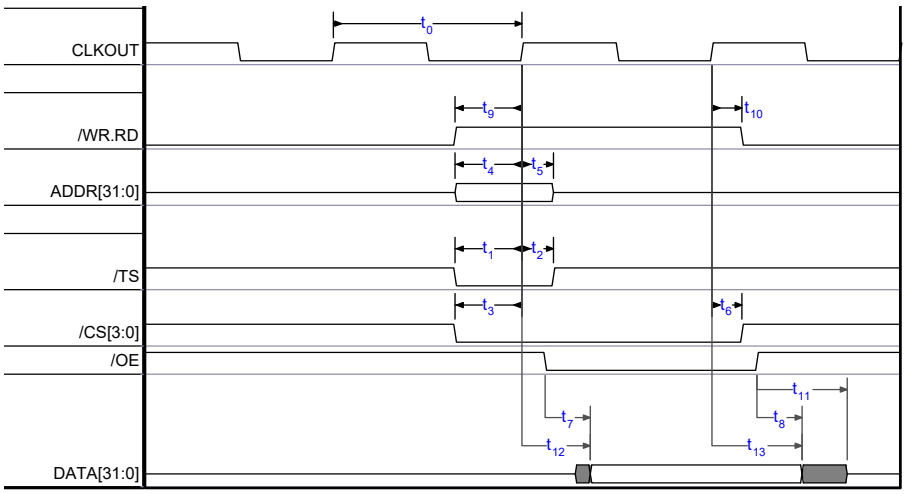

Fig. 7-3 SRAM Read Cycle

Para.	Description	Min	Max	Unit
t_0	Clock Cycle Time	14.84	50	ns
t_1	/TS (Transfer Start) Setup Time	3.5	-	ns
t_2	/TS (Transfer Start) Hold Time	1	-	ns
t_3	/CS[x] (Chip Select) Setup Time	3.5	-	ns
t_4	Address Setup Time	3.5	-	ns
t_5	Address Hold Time	1	-	ns
t_6	/CS[x] (Chip Select) Hold Time	1	-	ns
t_7	/OE (Output Enable) to Data Valid	4.5	-	ns
t_8	/OE (Output Enable) to Data Invalid	4.5	-	ns
t_9	RD/WR (Read/Write) Setup Time	3.5	-	ns
t_{10}	RD/WR (Read/Write) Hold Time	1	-	ns
t_{11}	/OE (Output Enable) to Data Not Driven (High Z)	-	4.5	ns
t_{12}	Clock to Data Valid	-	7.5	ns
t_{13}	Clock to Data Invalid	4	-	ns

7.9.4 XETK-V2.0A/C SRAM Write Timing

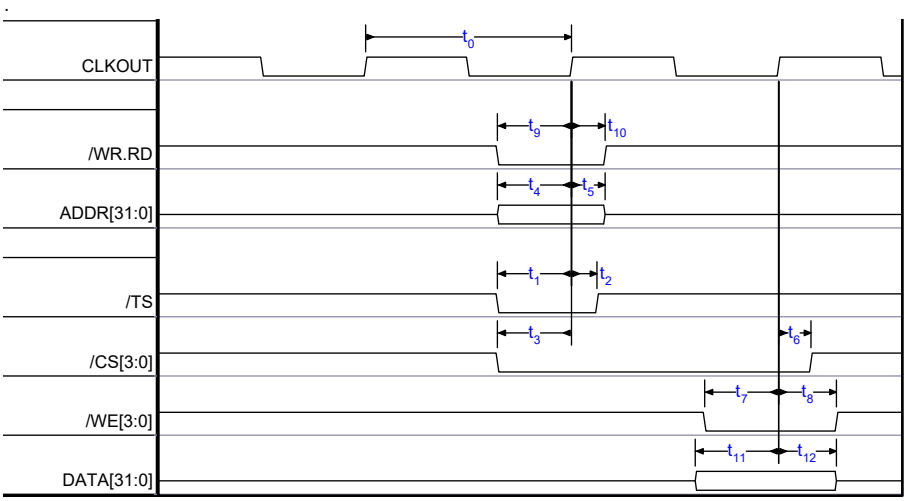

Fig. 7-4 SRAM Write Cycle

Para.	Description	Min	Max	Unit
t_0	Clock Cycle Time	14.84	50	ns
t_1	/TS (Transfer Start) Setup Time	3.5	-	ns
t_2	/TS (Transfer Start) Hold Time	1	-	ns
t_3	/CS[x] (Chip Select) Setup Time	3.5	-	ns
t_4	Address Setup Time	3.5	-	ns
t_5	Address Hold Time	1	-	ns
t_6	/CS[x] (Chip Select) Hold Time	1	-	ns
t_7	/WE[x] (Write/Byte Enable) Setup Time	3.5	-	ns
t_8	/WE[x] (Write/Byte Enable) Hold Time	1	-	ns
t_9	RD/WR (Read/Write) Setup Time	3.5	-	ns
t_{10}	RD/WR (Read/Write) Hold Time	1	-	ns
t_{11}	Data Setup Time	3.5	-	ns
t_{12}	Data Hold Time	1	-	ns

7.10 Mechanical Dimensions

The reference measure for all drawings is millimeter.

7.10.1 XETK-V2.0A/C

7.10.1.1 XETK-V2.0A/C Dimensions - Top View

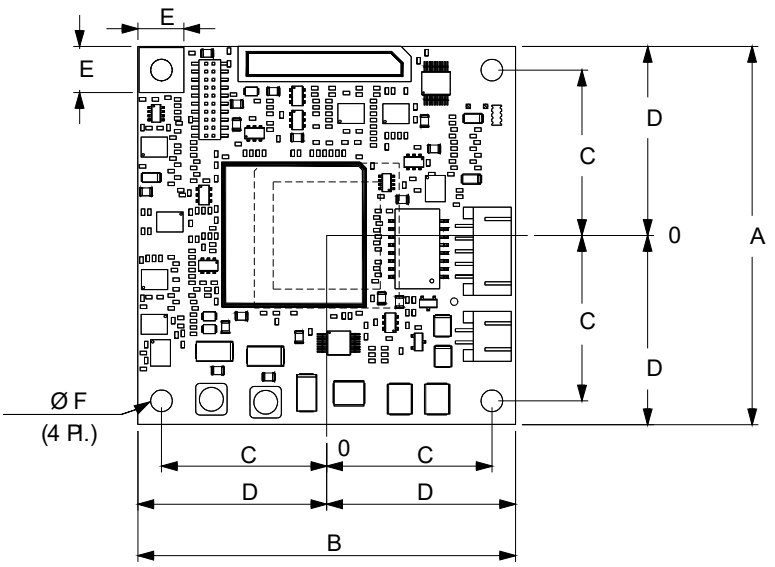

Fig. 7-5 XETK-V2.0A/C Dimensions - Top View

Dimension	Millimeters	Inches
A	60.00	2.362
B	60.00	2.362
C	26.25	1.033
D	30.00	1.181
E	7.5	0.295
F	3.45	0.136

7.10.1.2 XETK-V2.0A/C Dimensions - Side View

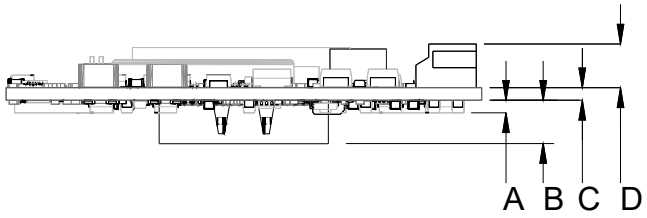

Fig. 7-6 XETK-V2.0A/C Dimensions - Side View

Dimension	Millimeters	Inches
A	2.00	0.079
B	5.50	0.217
C	1.60	0.063
D	5.51	0.217

7.10.1.3 XETK-V2.0A/C VertiCal Connector Pin A1 Indicator - Top View

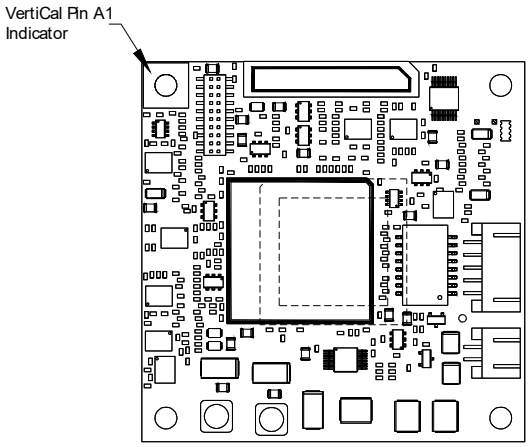

Fig. 7-7 XETK-V2.0A/C Vertical Connector Pin A1 Indicator - Top View

NOTE

The XETK-V2.0A/C is delivered with a VertiCal Shroud installed on its VertiCal Connector. The shroud aids in aligning the XETK-V2.0A/C and VertiCal Base Board prior to insertion.

NOTE

Additional mechanical information (e.g. 3D IGES files) can be provided upon request. Refer to “Contact Information” on page 107 for the contact information of your local sales and technical support team.

7.10.2 XETK-V2.0B

7.10.2.1 XETK-V2.0B Dimensions - Top View

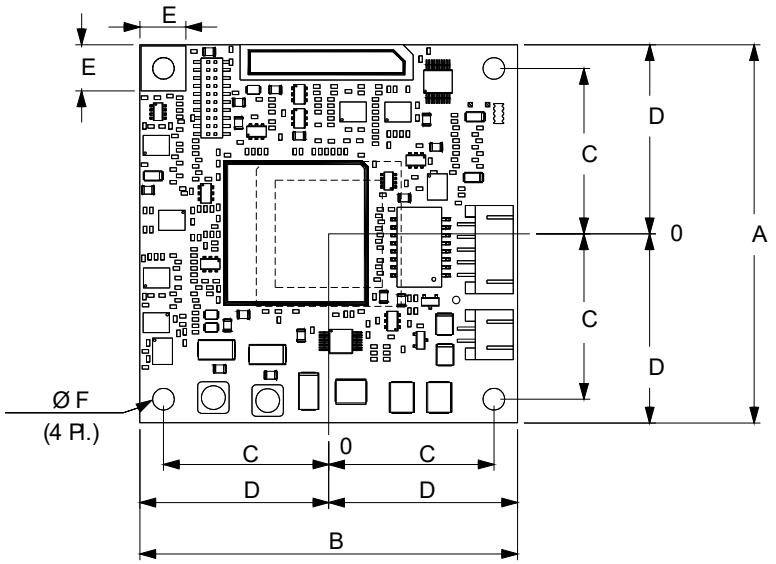

Fig. 7-8 XETK-V2.0B Dimensions - Top View

Dimension	Millimeters	Inches
A	60.00	2.362
B	60.00	2.362
C	26.25	1.033
D	30.00	1.181
E	7.5	0.295
F	3.45	0.136

7.10.2.2 XETK-V2.0B Dimensions - Side View

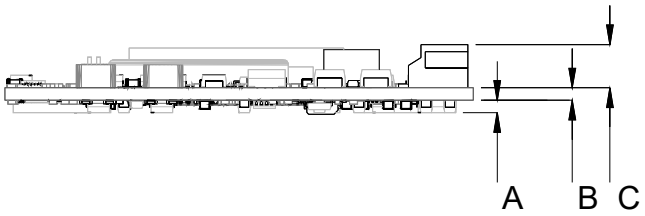

Fig. 7-9 XETK-V2.0B Dimensions - Side View

Dimension	Millimeters	Inches
A	2.00	0.079
B	1.60	0.063
C	5.51	0.217

NOTE

Additional mechanical information (e.g. 3D IGES files) can be provided upon request. Refer to “Contact Information” on page 107for the contact information of your local sales and technical support team.

7.11 Pin Assignment

7.11.1 XETK-V2.0A/C VertiCal Connector

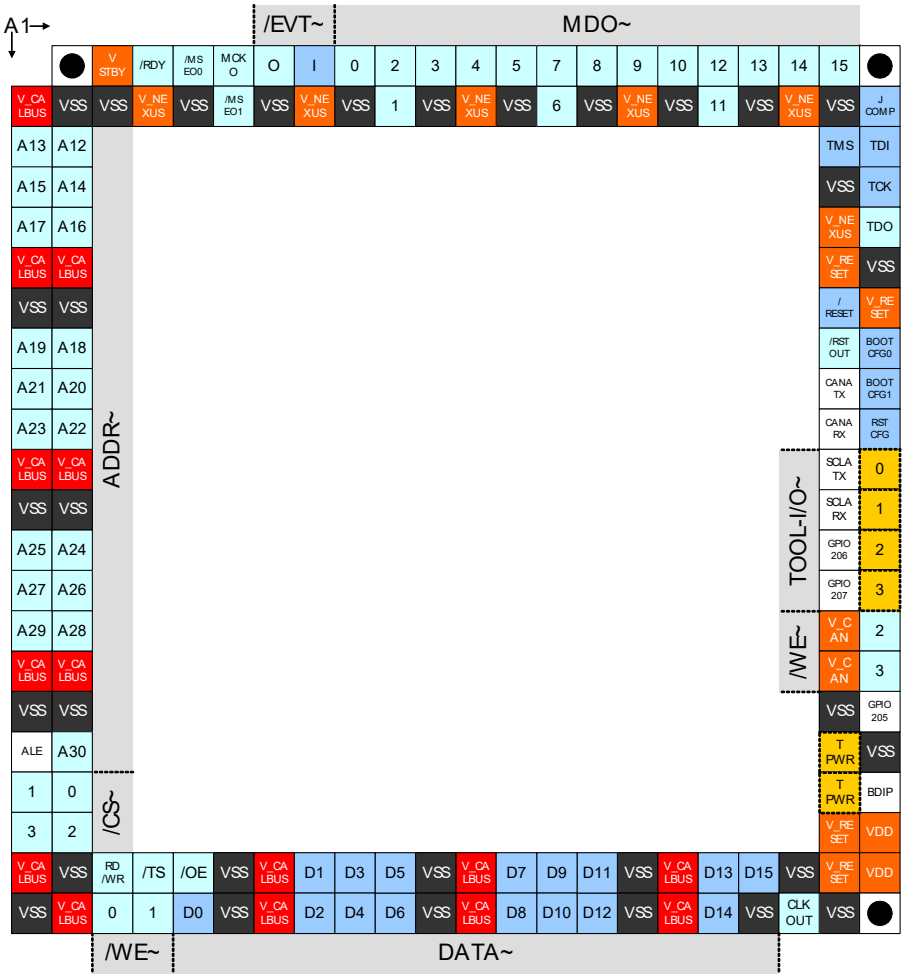

Fig. 7-10 VertiCal Connector

Pin(s)	Name	Description
C2	ADDR12	External Address / Data Bus
C1	ADDR13	
D2	ADDR14	
D1	ADDR15	
E2	ADDR16	
E1	ADDR17	
H2	ADDR18	
H1	ADDR19	
J2	ADDR20	
J1	ADDR21	
K2	ADDR22	
K1	ADDR23	
N2	ADDR24	
N1	ADDR25	
P2	ADDR26	
P1	ADDR27	
R2	ADDR28	
R1	ADDR29	
V2	ADDR30	
W2	/C_CS0	Chip Select
W1	/C_CS1	Chip Select
Y2	/C_CS2	Chip Select
Y1	/C_CS3	Chip Select
AA3	RD/WR	Read/Write
AB3	/WE0	Write/Byte Enable
AB4	/WE1	Write/Byte Enable
AA5	/OE	Output Enable
AA4	/TS	Transfer Start

Pin(s)	Name	Description
AB5	DATA0	External Address / Data Bus
AA8	DATA1	
AB8	DATA2	
AA9	DATA3	
AB9	DATA4	
AA10	DATA5	
AB10	DATA6	
AA13	DATA7	
AB13	DATA8	
AA14	DATA9	
AB14	DATA10	
AA15	DATA11	
AB15	DATA12	
AA18	DATA13	
AB18	DATA14	
AA19	DATA15	
A6	MCKO	Nexus Message Clock Out
A9	MDO0	Nexus Message Data Out
B10	MDO1	
A10	MDO2	
A11	MDO3	
A12	MDO4	
A13	MDO5	
B14	MDO6	
A14	MDO7	
A15	MDO8	
A16	MDO9	
A17	MDO10	
B18	MDO11	
A18	MDO12	Nexus Message Data Out
A19	MDO13	
A20	MDO14	
A21	MDO15	
A5	/MSEO0	Nexus Message Start/End Out
B6	/MSEO1	
A8	/EVTI	Nexus Event Input
A7	/EVTO	Nexus Event Output
A4	/RDY	Nexus Ready Output
D22	TCK	JTAG Test Clock Input
C21	TMS	JTAG Test Mode Select Input
C22	TDI	JTAG Test Data Input

Pin(s)	Name	Description
E22	TDO	JTAG Test Data Output
B22	JCOMP (/TRST)	JTAG Compliance Input (JTAG Reset)
G21	/RESET	External Reset Input/Sense
H21	/RSTOUT	External Reset Output
K22	RSTCFG[1)]	Reset Configuration Input
H22	BOOTCFG0[1)]	Reset Configuration 0
J22	BOOTCFG1[1)]	Reset Configuration 1
U22	GPIO205 [1)]	General Purpose I/O
N21	GPIO206 [1)]	General Purpose I/O
P21	GPIO207 [1)]	General Purpose I/O
J21	CNTXA [2)]	CAN A Transmit
K21	CNRXA [2)]	CAN A Receive
L21	TXDA [2)]	SCI A Transmit
M21	RXDA [2)]	SCI A Receive
R22	/WE2	Write/Byte Enable
T22	/WE3	Write/Byte Enable
AB20	CLKOUT	System Clock Output
L22	TOOLIO_0	Data Acquisition Interrupt 1 (DAI1)
M22	TOOLIO_1	Data Acquisition Interrupt 2 (DAI2)
N22	TOOLIO_2	External Watchdog Disable (not connected to MCU)
P22	TOOLIO_3 [1)]	VertiCal Tool I/O connection to ECU
B1, F1, F2, L1, L2, T1, T2, AA1, AA7, AA12, AA17, AB2, AB7, AB12, AB17	V_CALBUS	ECU Calibration Bus Supply Voltage - Supplied by XETK
A3	VSTBY[1)]	Microcontroller Internal RAM Supply Voltage
Y22, AA22	VDD [2)]	Microcontroller Internal Logic Supply Voltage
Y21, AA21	V_RESET	Microcontroller Supply Voltage (Reset)
B4, B8, B12, B16, B20, E21	V_NEXUS	Microcontroller Supply Voltage (Nexus) - Monitored by XETK
F21, G22	V_RESET	Microcontroller Supply Voltage (Reset) - Monitored by XETK
R21, T21	V_CAN [2)]	Microcontroller Supply Voltage
V21, W21	TPWR [2)]	Unregulated Battery Voltage Input

Pin(s)	Name	Description
B2, B3, B5, B7, B9, B11, B13, B15, B17, B19, B21, D21, F22, G1, G2, M1, M2, U1, U2, U21, V22, AA2, AA6, AA1, AA16, AA20, AB1, AB6, AB11, AB16, AB19, AB21	VSS	Ground
V1	ALE [2)]	Address Latch Enable
W22	BDIP [2)]	Burst Data
A2, A22, AB22	Locating Pins	No electrical function

[1)] = not used by XETK-V2.0
[2)] = not connected to XETK-V2.0

7.11.2 XETK-V2.0A/C Nexus (JTAG) Debugger Interface

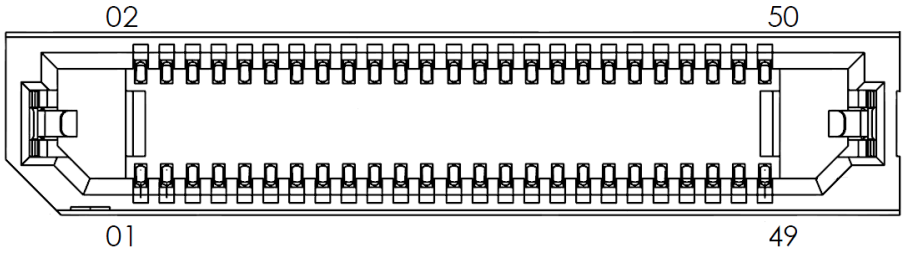

Fig. 7-11 XETK-V2.0A/C Samtec Connector

Pin(s)	Name	Description
1	/MSEO0	
2	V_NEXUS	Nexus I/O voltage (sense only)
3	/MSEO1	
4	TCK	
5	Ground	
6	TMS	
7	MDO0	
8	TDI	
9	MDO1	
10	TDO	
11	Ground	
12	JCOMP	=/TRST
13	MDO2	
14	/RDY	
15	MDO3	
16	/EVTI	
17	Ground	
18	/EVTO	
19	MCKO	
20	/RESET	
21	MDO4	
22	/RSTOUT	
23	Ground	
24	Ground	
25	MDO5	
26	N/C	No Connect
27	MDO6	
28	TOOLIO_2 (TDET/WDT)	Watchdog disable and tool detect
29	Ground	
30	Ground	
31	MDO7	

Pin(s)	Name	Description
32	TOOLIO_0	Data Acquisition Interrupt 1 (DAI1)
33	MDO8	
34	TOOLIO_1	Data Acquisition Interrupt 2 (DAI2)
35	Ground	
36	Ground	
37	MDO9	
38	BREQ	JTAG Arbitration: Bus Request
39	MDO10	
40	BGRANT	JTAG Arbitration: Bus Grant
41	Ground	
42	Ground	
43	MDO11	
44	MDO13	
45	MDO12	
46	MDO14	
47	Ground	
48	Ground	
49	MDO15	
50	VSTBY	

NOTE

The specification of the Nexus (JTAG) interface bases on the "Nexus 5001 Forum™ Standard for a Global Embedded Processor Debug Interface".

7.11.3 XETK-V2.0B ECU Interface

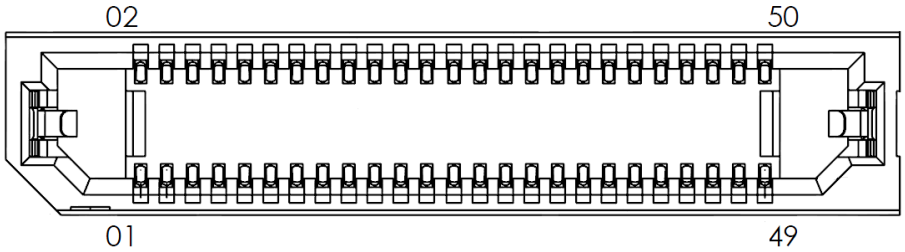

Fig. 7-12 XETK-V2.0B Samtec Connector

Pin(s)	Name	Comment
1	/MSEO0	Nexus Message Start/End Out
2	V_NEXUS	Microcontroller Supply Voltage (Nexus) - Monitored by XETK
3	/MSEO1	Nexus Message Start/End Out
4	TCK	JTAG Test Clock Input
5	Ground	
6	TMS	JTAG Test Mode Select Input
7	MDO0	Nexus Message Data Out
8	TDI	JTAG Test Data Input
9	MDO1	Nexus Message Data Out
10	TDO	JTAG Test Data Output
11	Ground	
12	JCOMP (/TRST)	JTAG Compliance Input (JTAG Reset)
13	MDO2	Nexus Message Data Out
14	/RDY	Nexus Ready Output
15	MDO3	Nexus Message Data Out
16	/EVTI	Nexus Event Input
17	Ground	
18	/EVTO	Nexus Event Output
19	MCKO	Nexus Message Clock Out
20	/RESET	External Reset Input/Sense
21	MDO4	Nexus Message Data Out
22	/RSTOUT	External Reset Output
23	Ground	
24	Ground	
25	MDO5	Nexus Message Data Out
26	N/C	No Connect
27	MDO6	Nexus Message Data Out
28	TOOLIO_2	External Watchdog Disable
29	Ground	
30	Ground	
31	MDO7	Nexus Message Data Out

Pin(s)	Name	Comment
32	TOOLIO_0	Data Acquisition Interrupt 1 (DAI1)
33	MDO8	Nexus Message Data Out
34	TOOLIO_1	Data Acquisition Interrupt 2 (DAI2)
35	Ground	
36	Ground	
37	MDO9	Nexus Message Data Out
38	BREQ	JTAG Arbitration: Bus Request
39	MDO10	Nexus Message Data Out
40	BGRANT	JTAG Arbitration: Bus Grant
41	Ground	
42	Ground	
43	MDO11	Nexus Message Data Out
44	MDO13	Nexus Message Data Out
45	MDO12	Nexus Message Data Out
46	MDO14	Nexus Message Data Out
47	Ground	
48	Ground	
49	MDO15	Nexus Message Data Out
50	VSTBY	Microcontroller Standby Supply Voltage (Working Page Memory) - Monitored by XETK

NOTE

The specification of the Nexus (JTAG) interface bases on the "Nexus 5001 Forum™ Standard for a Global Embedded Processor Debug Interface".

8 Cables and Accessories

The “Cables and Accessories” chapter contains an overview of the available cables and accessories.

8.1 ECU Adapter Cable

NOTE

The screws for mounting ECU adapter cables are not included in the cable delivery, they need to be ordered separately. For detailed information on mounting accessories contact ETAS technical support.

8.1.1 CBAM230.1 Adapter Cable

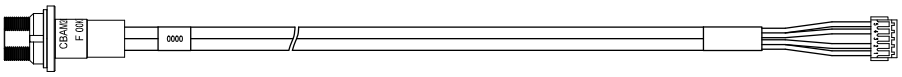

Fig. 8-1 CBAM230.1 Adapter Cable

XETK ECU Adapter Cable, 100 MBit/s, suitable for ECU flush mounting (M12), 0.38 m length, shield connected to socket. Usable for ECUs with shielded housing.

Product	Length	Order Number
CBAM230.1-0m38	0.38 m	F 00K 105 791

8.1.2 CBAM240.1 Adapter Cable

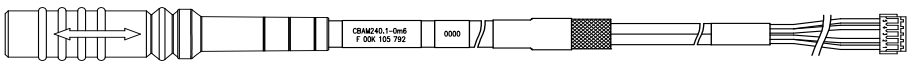

Fig. 8-2 CBAM240.1 Adapter Cable

XETK ECU Adapter Cable, 100 MBit/s, shield connected to ECU-housing (lead-through diameter for cable: 10 mm), 0.6 m length, shield bare for cable gland, isolated to the XETK. Usable for ECUs with shielded housing.

Product	Length	Order Number
CBAM240.1-0m6	0.6 m	F 00K 105 792

8.2 PC Interface Cable

8.2.1 CBE200-3 Cable

Fig. 8-3 CBE200-3 Cable

Product	Length	Order Number
CBE200-3	3 m	F 00K 104 373

8.2.2 CBAE200.2 Adapter Cable

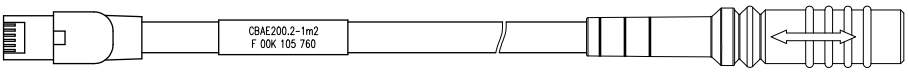

Fig. 8-4 CBAE200.2 Adapter Cable

Cable adapter to connect CBE230 cable to the PC over an RJ45 connector. The CBAE200.2-1m20 supports Gigabit Ethernet.

Product	Length	Order Number
CBAE200.2-1m20	1.20 m	F 00K 105 760

8.3 ETAS Module Interface Adapter Cable

8.3.1 CBE230.1 Cable

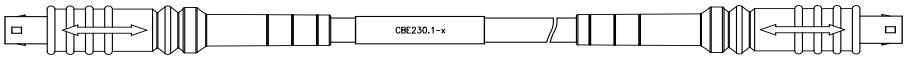

Fig. 8-5 CBE230.1 Cable

Gigabit Ethernet connection cable for ETAS devices. IP67 rated Lemo connectors on both sides. Gigabit Ethernet cable with power supply.

Product	Length	Order Number
CBE230.1-3	3 m	F 00K 105 757
CBE230.1-8	8 m	F 00K 105 758

8.3.2 CBAE330.2 Adapter Cable

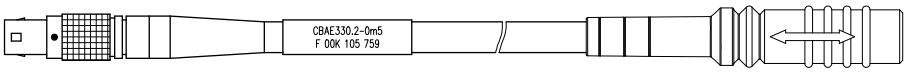

Fig. 8-6 CBAE330.2 Adapter Cable

Gigabit to 100 MBit/s Ethernet Adapter for connection of CBE230 to ES600.

Cable adapter to connect CBE230 cable with the ES600. Power supply over the CBAE330.2 cable adapter is not supported.

Product	Length	Order Number
CBAE330.2-0m5	0.5 m	F 00K 105 759

8.4 Power Supply Cables

8.4.1 Cable ETV

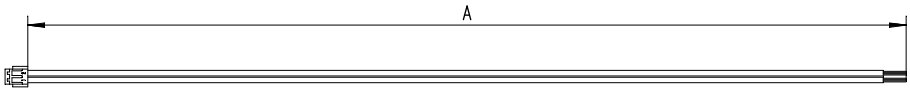

Fig. 8-7 Cable ETV

Dim	Millimeters	Inches
A	190.00	7.480

8.4.2 Cable K70

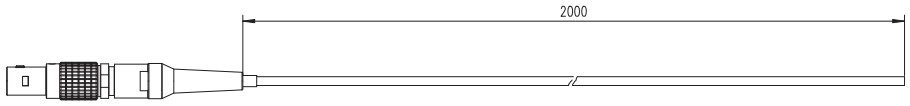

Fig. 8-8 Cable K70

Dim	Millimeters	Inches
A	2000	78.74

8.4.3 Cable KA50

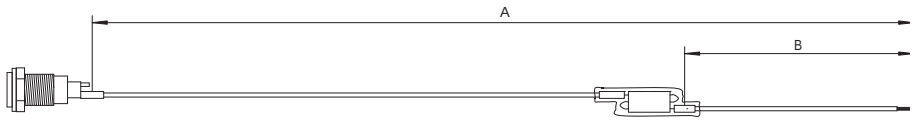

Fig. 8-9 Cable KA50

Dim	Millimeters	Inches
A	200	7.87
B	50	1.97

8.4.4 Cable CBM200

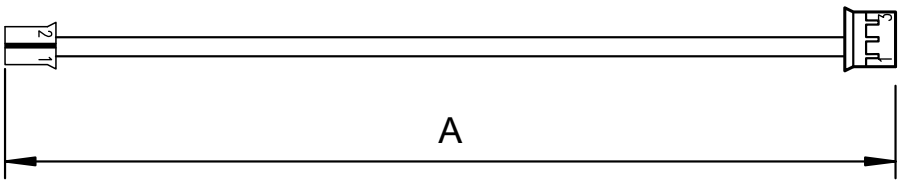

Fig. 8-10 Cable CBM200

Dim	Millimeters	Inches
A	100	3.94

8.5 Adapters

8.5.1 ETAH1 ECU Interface Adapter for XETK-V2.0B

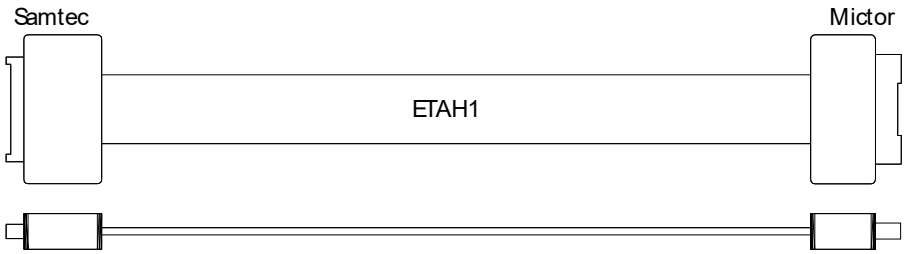

Fig. 8-11 ETAH1 XETK-V2.0B - ECU Adapter Cable

Adapter to connect XETK-V2.0B to an ECU equipped with a female Mictor 38 connector. The ETAH1 cable has a 50 Ohm impedance. The bend radius of the cable is 3.175 millimeters (.125 inches).

Product	Order Number
ETAH1	F 00K 105 252

8.5.1.1 ETAH1 Dimensions

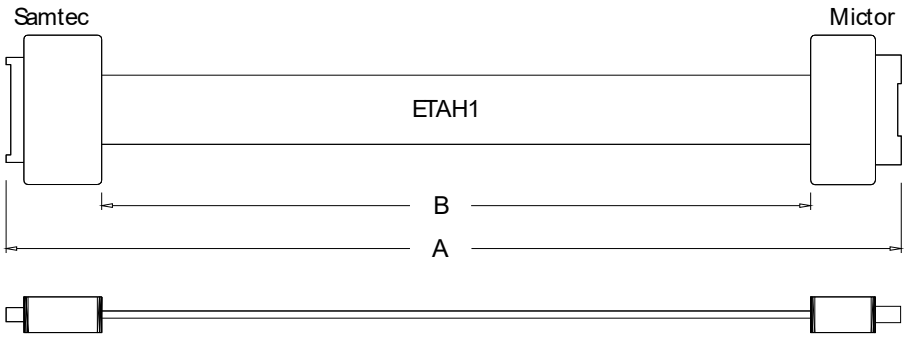

Fig. 8-12 ETAH1 Dimensions - Top View

Dimension	Millimeters	Inches
A	206.7	8.14
B	163.8	6.45

8.5.1.2 ETAH1 Pinout

Fig. 8-13 ETAH1 Samtec - Mictor (50mc - 38mc)

Samtec #	Mictor #	Comment
1	38	/MSEO0
2	12	V_NEXUS
3	36	/MSEO1
4	15	TCK
5	Ground Pins	Ground
6	17	TMS
7	30	MDO0
8	19	TDI
9	28	MDO1
10	11	TDO
11	Ground Pins	Ground
12	21	JCOMP (/TRST)
13	26	MDO2
14	14	/RDY
15	24	MDO3
16	10	/EVTI
17	Ground Pins	Ground
18	32	/EVTO
19	34	MCKO
20	9	/RESET
21	22	MDO4
22	25	/RSTOUT
25	20	MDO5
26	N/C	N/C
27	18	MDO6
28	27	TOOLIO_2 (WDT)
29	Ground Pins	Ground
30	Ground Pins	Ground
31	16	MDO7
32	35	TOOLIO_0 (DAI1)
33	8	MDO8
34	29	TOOLIO_1 (DAI2)

Samtec #	Mictor #	Comment
35	Ground Pins	Ground
36	Ground Pins	Ground
37	5	MDO9
38	N/C	BREQ (Not Available)
39	13	MDO10
40	N/C	BGRANT (Not Available)
41	Ground Pins	Ground
42	Ground Pins	Ground
43	23	MDO11
44	2	MDO13
45	1	MDO12
46	3	MDO14
49	4	MDO15
50	37	VSTBY

NOTE

The specification of the Nexus (JTAG) interface bases on the "Nexus 5001 Forum™ Standard for a Global Embedded Processor Debug Interface".

8.5.2 ETAH2 Debugger Interface Adapter for XETK-V2.0A/C

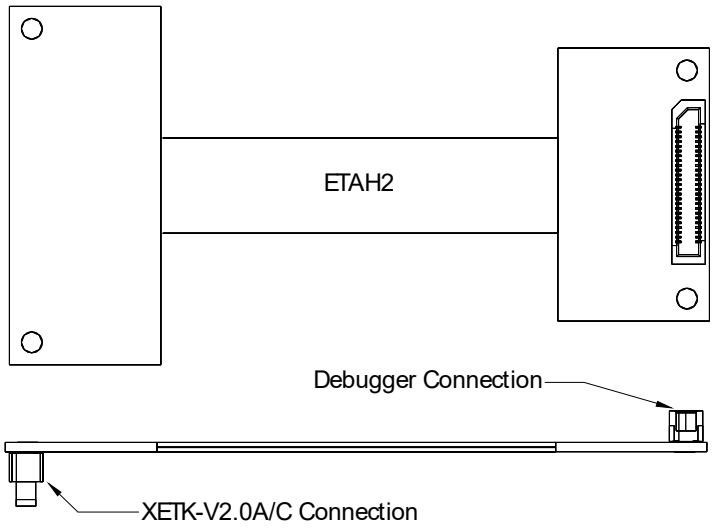

Fig. 8-14 ETAH2 XETK-V2.0A/C - Debugger Adapter Cable

Adapter used to extend the debugger interface connector of the XETK-V2.0A/C. The mounting holes on the left side (XETK-V2.0A/C Connector side) align with the mounting holes on the XETK-V2.0A/C. The ETAH2 cable has a 50 Ohm impedance. The bend radius of the cable is 3.175 millimeters (.125 inches).

Product	Order Number
ETAH2	F 00K 107 358

8.5.2.1 ETAH2 Dimensions

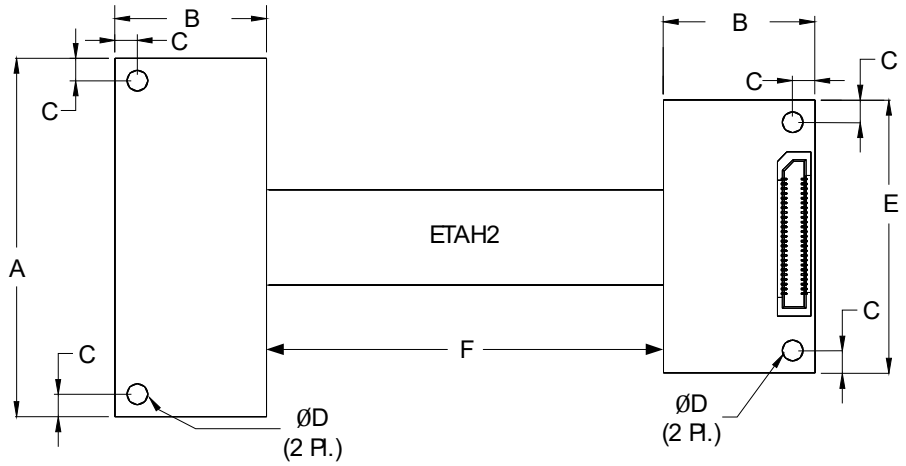

Fig. 8-15 ETAH2 Dimensions - Top View

Dimension	Millimeters	Inches
A	60.00	2.362
B	25.40	1.000
C	3.75	0.148

Dimension	Millimeters	Inches
D	3.50	0.138
E	45.71	1.800
F	101.60	4.000

8.5.2.2 ETAH2 Pinout

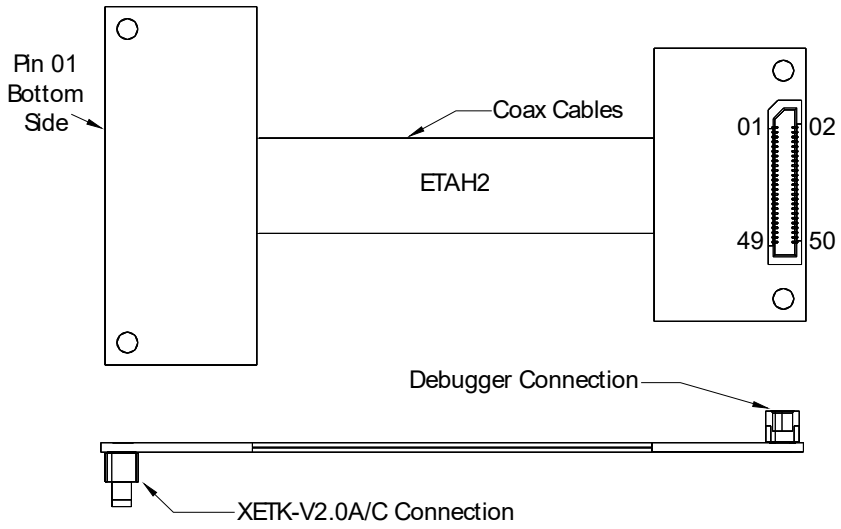

Fig. 8-16 ETAH2 Samtec - Samtec (50mc - 50fc)

The signals are connected one to one, e.g. pin 1 of the left side is connected to pin 1 of the right side.

8.5.3 ETAH5 Debugger Interface Adapter for XETK-V2.0A/C

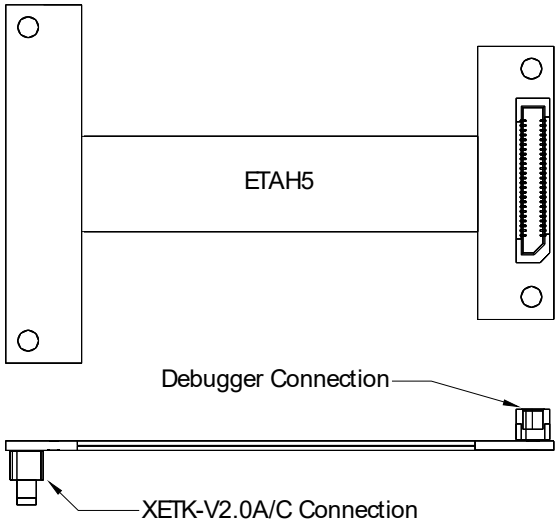

Fig. 8-17 ETAH5 XETK-V2.0A/C - Debugger Adapter Cable

Adapter used to extend the debugger interface connector of the XETK-V2.0A/C. The mounting holes on the left side (XETK-V2.0A/C Connector side) align with the mounting holes on the XETK-V2.0A/C. The ETAH5 cable has a 50 Ohm impedance. The bend radius of the cable is 3.175 millimeters (.125 inches).

Product	Order Number
ETAH5	F 00K 109 050

8.5.3.1 ETAH5 Dimensions

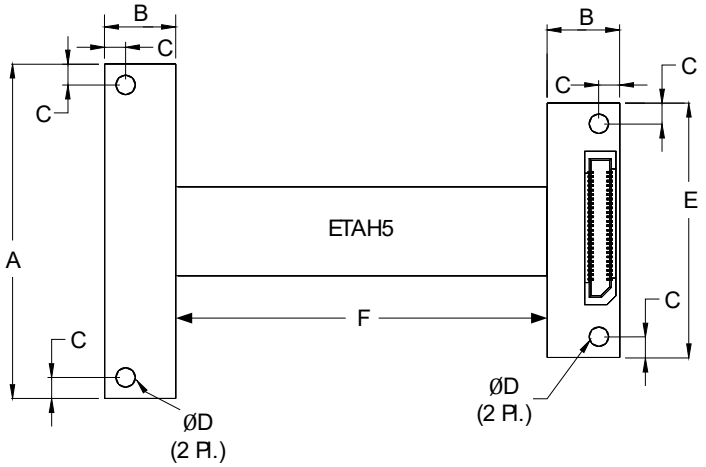

Fig. 8-18 ETAH5 Dimensions - Top View

Dimension	Millimeters	Inches
A	60.00	2.362
B	13.00	0.512
C	3.75	0.148

Dimension	Millimeters	Inches
D	3.50	0.138
E	45.71	1.800
F	80.00	3.150

8.5.3.2 ETAH5 Pinout

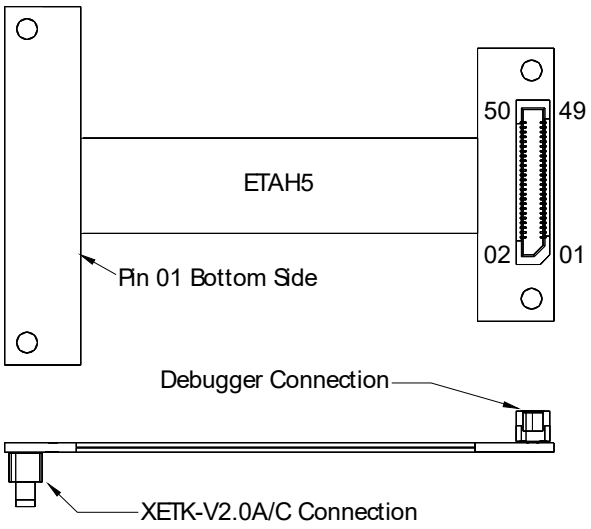

Fig. 8-19 ETAH5 Samtec - Samtec (50mc - 50fc)

The signals are connected one to one, e.g. pin 1 of the left side is connected to pin 1 of the right side.

8.5.4 ETAH4 ECU Interface Adapter for XETK-V2.0B

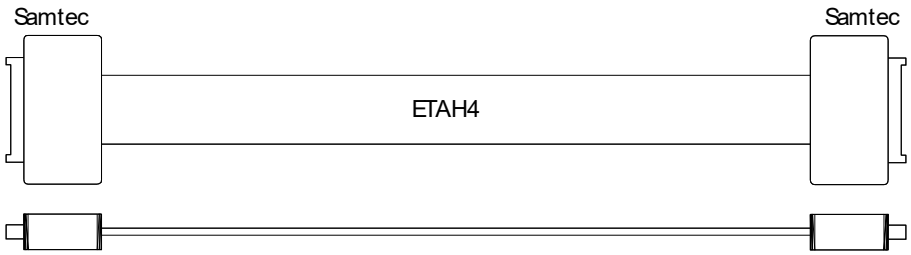

Fig. 8-20 ETAH4 XETK-V2.0B - ECU Adapter Cable

Adapter to connect XETK-V2.0B to an ECU equipped with a female Samtec 50 connector. The ETAH4 cable has a 50 Ohm impedance. The bend radius of the cable is 3.175 millimeters (.125 inches).

Product	Order Number
ETAH4	F 00K 107 803

8.5.4.1 ETAH4 Dimensions

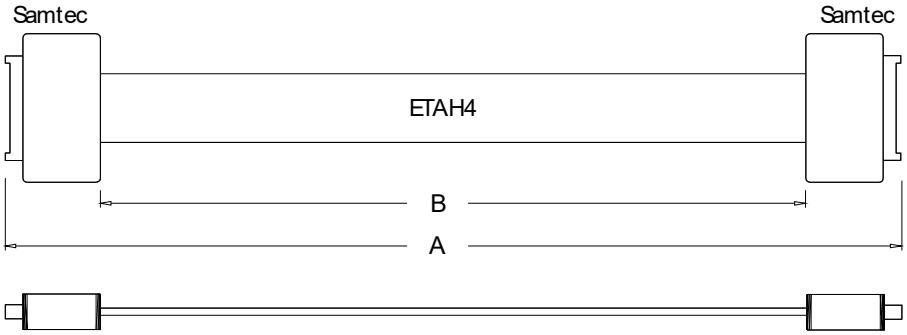

Fig. 8-21 ETAH4 Dimensions - Top View

Dimension	Millimeters	Inches
A	206.7	8.14
B	163.8	6.45

8.5.4.2 ETAH4 Pinout

Fig. 8-22 ETAH1 Samtec - Mictor (50mc - 38mc)

The signals are connected one to one, e.g. pin 1 of the left side is connected to pin 1 of the right side.

9 Ordering Information

9.1 XETK-V2.0

9.1.1 XETK-V2.0A

Order Name	Short Name	Order Number
XETK-V2.0A Emulator Probe for MPC5600 and SPC5600 Family	XETK-V2.0A	F-00K-106-941
Package Contents		
XETK-V2.0 Emulator Probe with 2 MByte emulation memory for Freescale MPC5600 and ST SPC5600 microprocessors, ECU adaption via VertiCal Base Board, List "Content of this Package", ETK Safety Advice, China-RoHS-leaflet		

9.1.2 XETK-V2.0B

Order Name	Short Name	Order Number
XETK-V2.0B Emulator Probe for MPC5600 and SPC5600 Family	XETK-V2.0B	F-00K-107-036
Package Contents		
XETK-V2.0 Emulator Probe without emulation memory for Freescale MPC5600 & ST SPC5600 microprocessors, ECU adaption via 50 pin Samtec, List "Content of this Package", ETK Safety Advice, China-RoHS-leaflet		

9.1.3 XETK-V2.0C

Order Name	Short Name	Order Number
XETK-V2.0C Emulator Probe for MPC5600 and SPC5600 Family	XETK-V2.0C	F-00K-109-733
Package Contents		
XETK-V2.0 Emulator Probe with 4 MByte emulation memory for Freescale MPC5600 and ST SPC5600 microprocessors, ECU adaption via VertiCal Base Board, List "Content of this Package", ETK Safety Advice, China-RoHS-leaflet		

9.2 XETK-V2.0A/C - Debugger Adapter

Type	Order-No.	Note
ETAH2	F-00K-107-358	ETAH2 XETK Debugger Adapter, Samtec - Samtec (50mc - 50fc), to extend the debugger connection of the XETK-V2.0A/C. Length: 15cm (0m15).
ETAH5	F-00K-109-050	ETAH5 XETK Debugger Adapter, Samtec - Samtec (50mc - 50fc), to extend the debugger connection of the XETK-V2.0A/C. Length: 11cm (0m11).

9.3 XETK-V2.0B - ECU Adapter

Type	Order-No.	Note
ETAH1	F-00K-105-252	XETK ECU Adapter, Samtec - Mictor (50mc - 38mc), for connecting an XETK-V2.0B to the ECU. Length: 21cm (0m21).
ETAH4	F-00K-107-803	XETK ECU Adapter, Samtec - Samtec (50mc - 50mc), for connecting an XETK-V2.0B to the ECU. Length: 21cm (0m21).

9.4 VertiCal Base Boards

VertiCal base boards are available from your local Freescale Semiconductor or ST Microelectronics distributors. For part numbers and ordering information please contact your local Freescale Semiconductor or ST Microelectronics distributor for further information.

Example Base Board: LFVBSJ74ZW1A

Lead-Free Pre-VertiCal assembly with 416 Pin Array footprint fitted with optional balls and MPC5674F silicon

Example Base Board: LFVBBJ74ZW1A

Lead-Free VertiCal assembly with 416 Pin Array footprint fitted with optional balls and MPC5674F silicon

NOTE

Optional ball devices are required to use DAI startup/triggering and Watchdog Timer Disable features of the XETK-V2.0A/C with MPC5674F.

NOTE

VertiCal Base Boards with optional balls are required to use the DAI startup/ triggering and Watchdog Timer Disable features of the XETK-V2.0.

9.5 Sockets ECU - VertiCal Base Board

For mounting a VertiCal base board with pin array, a socket must be used on the ECU. Please contact your local Freescale Semiconductor or ST Microelectronics distributor for further information on required sockets.

9.6 Connector XETK-V2.0B - ECU Adapter ETAH1

Connectors are available from local Tyco distributors.

Type	Order Number
38 pin Mictor Vertical Receptacle	767054-1

9.7 Connector XETK-V2.0B - ECU Adapter ETAH4

Connectors are available from Samtec.

Type	Order Number
50 pin Samtec Vertical Receptacle	ASP-148422

9.8 Cables

> **NOTE**
>
> The cables shown in chapter “Cables and Accessories” on page 90 are not included in the XETK-V2.0 delivery.

9.8.1 ECU Adapter Cables

> **NOTE**
>
> The screws for mounting ECU adapter cables are not included in the cable delivery, they need to be ordered separately. For detailed information on mounting accessories contact ETAS technical support.

Order Name	Short Name	Order Number
XETK ECU Adapter Cable, 100 Mbit/s, Shield on ECU-Housing, Lemo 1B HME - JST PHE (10fc-5fc), 0m38	CBAM230.1-0m38	F 00K 105 791
XETK ECU Adapter cable, 100 MBit/s, Lemo 1B HME - JST PHE (10fc-5fc), 0m6	CBAM240.1-0m6	F 00K 105 792

9.8.2 Ethernet Cables

9.8.2.1 PC Interface Cable

Order Name	Short Name	Order Number
Ethernet PC Connection Cable 1GBit/s, Lemo 1B FGE - RJ45 (10mc-8mc), 3 m	CBE200-3	F 00K 104 373
Ethernet Connection Adapter Cable 1 GBit/s, Lemo 1B PHE - RJ45 (10fc-8mc), 1m2	CBAE200-1m20	F 00K 105 760

9.8.2.2 ES600 / ES910 Interface Cable

Order Name	Short Name	Order Number
Ethernet Connection Cable 1 GBit/s, Lemo 1B FGE - Lemo 1B FGE (10mc- 10mc), 3 m	CBE230.1-3	F 00K 105 757
Ethernet Connection Cable 1 GBit/s, Lemo 1B FGE - Lemo 1B FGE (10mc- 10mc), 8 m	CBE230.1-8	F 00K 105 758

9.8.2.3 ES600 Interface Adapter Cable

Order Name	Short Name	Order Number
Ethernet Connection Adapter Cable 1 GBit/s to 100 MBit/s, Lemo 1B PHE - Lemo 1B FGF (10fc-8mc), 0m5	CBAE330.2-0m5	F 00K 105 759

9.8.3 Power Supply Cables

Order Name	Short Name	Order Number
Cable JST PHR - JST PHR (2fc-3fc), 0m1	CBM200-0m1	F 00K 900 052
ETK Power Supply Cable, JST PHR - open wires (2fc-2c) 0m19	ETV	Y 261 A24 446
External Power Supply Cable for ETKs, Lemo 0B FGG - open wires (2fc-1c), 2 m	K70	Y 261 A24 942
ETK Power Supply Cable for External Supply, with Filter Coil, Lemo 0B EGG - open wire (2fc-1c), 0m2	KA50	F 00K 000 940

9.9 Power Supply

Order Name	Short Name	Order Number
Isolated Power Supply Interface for (X)ETK	ETP2	F 00K 104 010

10 Contact Information

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70469 Stuttgart	Fax:	+49 711 3423-2106
Germany	Internet:	www.etas.com

ETAS Subsidiaries and Technical Support

For details of your local sales office as well as your local technical support team and product hotlines, take a look at the ETAS website:

ETAS subsidiaries	Internet:	www.etas.com/en/contact.php
ETAS technical support	Internet:	www.etas.com/en/hotlines.php

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