



# TRK-USB-MPC5604B User Manual





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Manual version 1.00, May 2012

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# 1 INTRODUCTION

## 1.1 Overview

The TRK-USB-MPC5604B is a low-cost development system supporting Freescale MPC5604B microcontrollers in 100LQFP packages. The Embedded OSJTAG circuitry on the TRK-USB-MPC5604B board allows the processor on the board to be debugged and programmed via USB from a PC. In addition, the demo board can be powered using the USB bus.

## 1.2 Package Contents

The TRK-USB-MPC5604B package includes the following items:

- TRK-USB-MPC5604B Board
- Freescale Warranty Card

## 1.3 Supported Devices

The TRK-USB-MPC5604B supports the following devices:

- MPC5604B microcontrollers in 100LQFP packages

## 1.4 Recommended Materials

- Freescale MPC5604B reference manual and datasheet
- TRK-USB-MPC5604B board schematic

## 1.5 Handling Precautions

Please take care to handle the package contents in a manner such as to prevent electrostatic discharge.

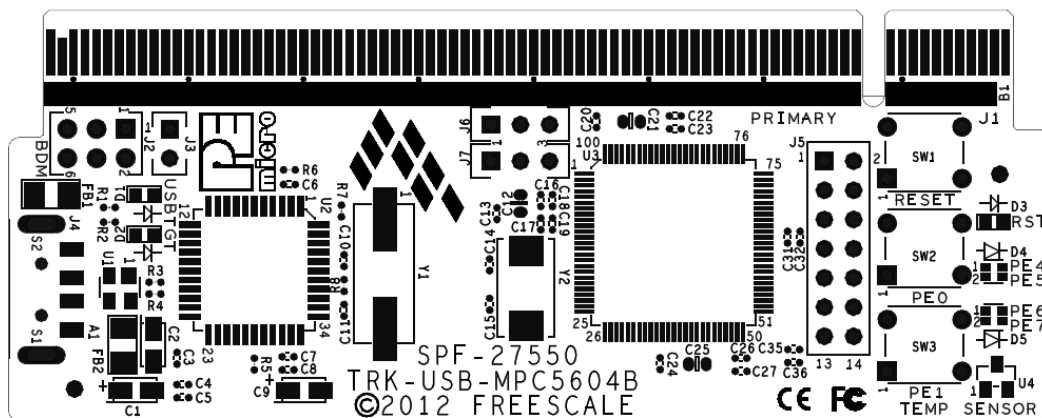
## 2 HARDWARE FEATURES

The TRK-USB-MPC5604B is a demonstration and development system for Freescale's MPC5604B microcontrollers in 100LQFP packages. Application development is quick and easy using Embedded OSJTAG. An optional 14-pin JTAG port is provided to allow the use of an external Qorivva MPC55xx/56xx interface such as P&E's USB Multilink or Cyclone MAX automated programmer. P&E's USB Multilink provides faster communication speeds and can be used to debug both the TRK-USB-MPC5604B and the user's own targets.

**Note:** The DEMO board's Embedded OSJTAG is intended to function with the on-board processor only. It cannot be used to communicate with other devices.

### 2.1 TRK-USB-MPC5604B Board Features

- Tower Connection
- Board is black in color
- Minimal Size ~ 3.5" x 1.375"
- Soldered SPC5604CF2MLL6 device
- Embedded OSJTAG: USB to JTAG circuitry which allows host PC to communicate with the microcontroller through USB 2.0.
- 14-Pin JTAG connection port
- Two power LEDs for USB and Target respectively
- RESET Push Button and LED indicator
- User Features:
  - 2 User-programmable Push Buttons
  - 2 3x1 Jumpers to select signals for virtual serial or LIN0
  - 2 User-programmable bi-color LED's
  - 1 Temperature Sensor
- Specifications:
  - Board Size 3.5" x 1.375"
  - Power Input:
    - USB Cable: 5VDC, 500mA max



**Figure 2-1: Top Component Placement**

## 2.2 TRK-USB-MPC5604B Jumper/Connector Quick Reference

### Default Jumper Settings

The following is a list of default jumper settings for TRK-USB-MPC5604B board. The settings listed indicate the “on” (or installed) position.

### Default Jumper Settings

JUMPER	OPTION	SETTINGS	DESCRIPTION
J3	OSJTAG Bootloader Enable (default: OFF)	1-2	Forces OSJTAG to start up in bootloader mode for firmware updates
J6	TxD Enable (default: ON)	1-2	Selects TxD signal for virtual serial port
J7	RxD Enable (default: ON)	1-2	Selects RxD signal for virtual serial port

### 3 GETTING STARTED WITH THE TRK-USB-MPC5604B

The TRK-USB-MPC5604B is a low-cost board targeting quick microcontroller evaluation. Please refer to the TRK-USB-MPC5604B Quick Start Guide for instructions on how to install software, connect the TRK-USB-MPC5604B to your PC, and run quick demonstrations.

## 4 SYSTEM SETUP

### 4.1 Overview

The Embedded OSJTAG driver is required to operate the TRK-USB-MPC5604B using a PC. The Embedded OSJTAG driver should be installed before the PC is connected to the TRK-USB-MPC5604B. This driver can be found at [freescale.com/TRK-USB-MPC5604B](http://freescale.com/TRK-USB-MPC5604B), or at <http://www.pemicro.com/osbdm>.

Because new features and bug fixes are implemented frequently, it is strongly recommended that the user download and install the latest OSJTAG drivers.

### 4.2 Operating System Requirements

The following are the resources required to run the CodeWarrior Development Studio and the TRK-USB-MPC5604B:

- A PC-compatible system running Windows 2000, Windows XP, Windows Vista, or Windows 7
- 128MB of available system RAM, and 1GB of available hard disk space
- A USB port

### 4.3 Hardware Setup

#### 4.3.1 First-Time Connection

The TRK-USB-MPC5604B may be connected to a PC through a USB port. Connection steps are listed below in typical order:

1. Plug the USB connector on the TRK-USB-MPC5604B Board into a free USB port of the PC.



2. The operating system will recognize the Embedded OSJTAG circuitry and P&E's USB to Serial circuitry. Depending on the operating system, you may see the "Found New Hardware Wizard" dialog to assist you with installation. Follow the onscreen Windows instructions to install the OSJTAG driver (these instructions may vary slightly depending on your specific operating system). For the latest drivers, please visit [www.freescale.com/TRK-USB-MPC5604B](http://www.freescale.com/TRK-USB-MPC5604B).
3. Select the "Install the software automatically (Recommended)" option and click the "Next" button. Windows will install the driver files to your system.
4. At the end of the installation, click the "Finish" button.

**Note:** Depending on the operating system, you may see the "Found New Hardware Wizard" dialog again to assist you with software installation for "PEMicro USB Serial Port (i1)." Follow the onscreen Windows instructions.

1. Select the "Install the software automatically (Recommended)" option and click the "Next" button.
2. Windows will install the driver files to your system. Click the "Finish" button to exit the "Found New Hardware Wizard."

If the TRK-USB-MPC5604B hardware interface driver is now properly installed on your system, the green USB LED on the TRK-USB-MPC5604B should be illuminated. In addition, if you turn on the system power of the TRK-USB-MPC5604B you will see the yellow Power LED illuminate.

## 5 OPERATING MODES

### 5.1 Overview

The TRK-USB-MPC5604B's Embedded OSJTAG circuitry, featured hardware components, and optional external JTAG header make it a versatile development tool. Below are some of the featured operating modes of the TRK-USB-MPC5604B.

### 5.2 Debug Mode

A host communicates with the TRK-USB-MPC5604B through the Embedded OSJTAG circuitry. Either the CodeWarrior Development Studio or P&E's

Qorivva software tools will work with the TRK-USB-MPC5604B. Please refer to **Section 7 - TRK-USB-MPC5604B CODE DEVELOPMENT SOFTWARE** for more information.

### 5.3 Run Mode

The TRK-USB-MPC5604B's rich component list empowers it to perform a variety of tasks. Once an application is developed, debugged, and programmed properly into the microcontroller's internal flash memory, it can run with or without connecting to a host.

### 5.4 External JTAG/Nexus Mode

The TRK-USB-MPC5604B has an optional JTAG/Nexus header for debugging and programming the on-board MPC5602P microcontroller using an external Qorivva hardware tool, such as P&E's USB Multilink or Cyclone MAX. Please refer to **Section 8 - TRANSITIONING TO YOUR OWN TARGET** for more information. A user can take advantage of this mode to develop a target-specific MPC5602P system and compare it with the TRK-USB-MPC5604B when necessary.

## 6 JUMPER SETTINGS

This section describes the various jumpers settings that are available on the TRK-USB-MPC5604B. Figures depict the default setting for each jumper.

### 6.1 OSJTAG Bootloader Enable

#### 6.1.1 J3 - OSJTAG Bootloader Enable

1-2 Forces OSJTAG to start up in bootloader mode for firmware updates (default: OFF)



Figure 6-2: OSJTAG IRQEnable (J3)

### 6.1.2 J6 - TxD Enable

1-2 Selects TxD for the virtual serial port (default: ON)

2-3 Selects TxD for LIN0



TxD Enable

Figure 6-3: TxD Enable (J6)

### 6.1.3 J7 - RxD Enable

1-2 Selects RxD for the virtual serial port (default: ON)

2-3 Selects RxD for LIN0



RxD Enable

Figure 6-4: RxD Enable (J7)

## 7 TRK-USB-MPC5604B CODE DEVELOPMENT SOFTWARE

The TRK-USB-MPC5604B includes P&E's OSJTAG circuitry, so no external Qorivva hardware tool is needed to debug and program the TRK-USB-MPC5604B. A user only needs to connect the TRK-USB-MPC5604B to their PC to start developing code for it.

The TRK-USB-MPC5604B package comes with a special edition of Freescale's CodeWarrior studio. In addition, P&E's evaluation software for Qorivva is available online at [www.pemicro.com](http://www.pemicro.com). A user may use either CodeWarrior or P&E software tools to develop code for the TRK-USB-MPC5604B.

### 7.1 Using CodeWarrior With The TRK-USB-MPC5604B

The CodeWarrior studio supports Freescale's Qorivva devices. It offers C, C++, and assembly-level support, and provides debugging capabilities based

on P&E's debug and programming technologies.

A programming or debug session with the project-based CodeWarrior IDE may be launched by double-clicking on the project name (the format is *projectname.mcp*) from your file storage. Its tutorials, FAQs, and quick start guides are easy to follow and will allow you use pre-built templates to begin creating a new project in a short time. Codewarrior tutorials can be followed based on the instructions provided.

## 7.2 Using P&E Software With The TRK-USB-MPC5604B

P&E offers an integrated development environment for Freescale's Qorivva devices, which combines a GNU C compiler, in-circuit debugger, and flash memory programmer. The debugger supports both assembly and C source-level debugging. The programmer can program/reprogram both internal and external flash devices in-circuit.

# 8 TRANSITIONING TO YOUR OWN TARGET

Once you have finished working with the TRK-USB-MPC5604B and are ready to build your own target, you will need a hardware tool to allow you to develop using your own board.

The Multilink Universal and Multilink Universal FX are development tools that are functionally comparable to the Embedded Multilink circuitry on the TRK-USB-MPC5604B. Either interface will enable you to debug your code and program it onto your target. The Cyclone MAX is a more versatile and robust development tool with advanced features and production capabilities.

These solutions all work with Freescale's CodeWarrior as well as P&E software, and provide a seamless transition to working with your own hardware. More information is available below to assist you in choosing the appropriate development tool for your needs.

## 8.1 Hardware Solutions At A Glance

The Multilink Universal and Multilink Universal FX each offer an affordable and compact solution for your development needs, and allow debugging and programming to be accomplished simply and efficiently. Those doing rapid development will find these interfaces easy to use and fully capable of fast-paced debugging and programming.

The Cyclone MAX is a more complete solution designed for both development and production. The Cyclone MAX features automated power switching, multiple communications interfaces (including USB, Ethernet, and Serial), stand-alone programming functionality, and many other advanced capabilities.

Below is an overview of the features and intended use of the Multilink Universal and USB Qorivva Multilink, as well as the Cyclone MAX.

### 8.1.1 Multilink Universal and Multilink Universal FX Features

- Direct user control of target's execution
- Programming and debugging capabilities
- Read/write registers and memory values
- Compact and lightweight
- Communication via High Speed USB (2.0)
- Supported by P&E software and Freescale's CodeWarrior
- Works with Freescale's Kinetis, Qorivva MPC55xx/56xx, HCS08, HC(S)12(X), RS08, ColdFire V1/+V1, ColdFire V2-4, DSC, and PX Series MCU families. FX also supports CPU16 & 683xx.
- Multilink Universal FX features up to 10X download speeds and can supply power to the target

### 8.1.2 Cyclone MAX Key Features

Advanced programming and debugging capabilities, including:

- PC-Controlled and User-Controlled Stand-Alone Operation
- Interactive Programming via Host PC
- In-Circuit Debugging, Programming, and Testing
- Compatible with Freescale's Kinetis, ColdFireV2/3/4, Power Architecture 5xx/8xx, Qorivva MPC55xx/56xx, DSC, Power Architecture PX Series, and ARM MAC7xxx microcontroller families
- Communication via USB, Serial, and Ethernet Ports
- Multiple image storage
- LCD screen menu interface
- Supported by P&E software and Freescale's CodeWarrior

## 8.2 Working With P&E's Multilink Universal or Multilink Universal FX



**Figure 8-1: Multilink Universal (left) & Multilink Universal FX (right)**

### 8.2.1 Product Features & Implementation

P&E's Multilink Universal and Multilink Universal FX each connect your target to your PC and allow the PC access to the debug mode on Freescale's Qorivva MPC5xxx microcontrollers (as well as a variety of other Freescale processors). These interfaces connect between a USB port on a Windows 2000/XP/2003/Vista/7 machine and a standard 14-pin JTAG/Nexus connector on the target. Headers for other MCU families can easily be accessed by flipping the case open, and ribbon cables for these additional MCU families are included.

By using either of these interfaces, the user can take advantage of the background debug mode to halt normal processor execution and use a PC to control the processor. The user can then directly control the target's execution, read/write registers and memory values, debug code on the processor, and program internal or external FLASH memory devices. The Multilink Universal and Multilink Universal FX each enable you to debug, program, and test your code on your board. The Multilink Universal FX provides up to 10X faster download speeds and can provide power to the target.

### 8.2.2 Software

The Multilink Universal and Multilink Universal FX interfaces each work with Codewarrior as well as P&E's in-circuit debugger and flash programmer to allow debug and flash programming of the target processor. P&E's Qorivva software includes a flash programmer, in-circuit debugger, Windows IDE, and a register file editor, and can be bundled with these interfaces.

### 8.3 Working With P&E's Cyclone MAX



Figure 8-2: P&E's Cyclone MAX

#### 8.3.1 Product Features & Implementation

P&E's Cyclone MAX is an extremely flexible tool designed for debugging, testing, and in-circuit flash programming of Freescale's Kinetis, ColdFireV2/3/4, Power Architecture 5xx/8xx, Qorivva MPC5xxx, DSC, Power Architecture PX Series, and ARM MAC7xxx microcontrollers. The Cyclone MAX connects your target to the PC via USB, Ethernet, or Serial Port and enables you to debug your code, program, and test it on your board. After development is complete the Cyclone MAX can be used as a production tool on your manufacturing floor.

For production, the Cyclone MAX may be operated interactively via Windows-based programming applications as well as under batch or .dll commands from a PC. Once loaded with data by a PC it can be disconnected and operated manually in a stand-alone mode via the LCD menu and control buttons. The Cyclone MAX has over 7Mbytes of non-volatile memory, which allows the on-board storage of multiple programming images. When connected to a PC for programming or loading it can communicate via the ethernet, USB, or serial interfaces.

#### 8.3.2 Software

The Cyclone MAX comes with intuitive configuration software and interactive programming software, as well as easy to use automated control software. The Cyclone MAX also functions as a full-featured debug interface, and is supported by Freescale's CodeWarrior as well as development software from P&E.

P&E's Cyclone MAX is also available bundled with additional software as part of various Development Packages. In addition to the Cyclone MAX, these

Development Packages include in-circuit debugging software, flash programming software, a Windows IDE, and a register file editor.

## 9 TROUBLESHOOTING

### 9.1 TRK-USB-MPC5604B Is Undetected

**Q:** The connection assistant indicates that my TRK-USB-MPC5604B is undetected even though I have connected the hardware to my USB port. What should I do?

**A:** The connection assistant, which displays in either Codewarrior or P&E's development software, is a dialog which allows the user to connect to the TRK-USB-MPC5604B hardware. If this dialog indicates that the TRK-USB-MPC5604B hardware is not connected to the PC, the first step is to make sure that the TRK-USB-MPC5604B hardware is connected to the PC via a USB 2.0 high-speed cable. If it is connected, unplug and then plug in the USB cable on the TRK-USB-MPC5604B board and click refresh in the connection assistant. If the hardware still does not show up, try the following remedies:

#### **(A) Re-Install the USB driver**

If the Multilink device does not show up in the device manager, re-install the driver, which can be found at [freescale.com/TRK-USB-MPC5604B](http://freescale.com/TRK-USB-MPC5604B). After driver installation, unplug the TRK-USB-MPC5604B from the PC and reboot the PC. When the reboot has completed, connect the interface to the PC with the USB 2.0 cable. Run the software again to see if the interface is now detected.

#### **(B) USB Hub Usage**

The TRK-USB-MPC5604B is a high-power USB device. If a USB Hub is used, it must be a self-powered hub (i.e., with its own power supply). If the Hub is not self-powered the TRK-USB-MPC5604B will not work. In general, USB ports located directly on the PC are high-power (self-powered) ports.





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