TRK-MPC5604P User Manual

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Purchase Agreement

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1 INTRODUCTION

1.1 Overview

The TRK-MPC5604P is a low-cost development system supporting Freescale MPC5604P microcontrollers in 144LQFP packages. The Embedded OSJTAG circuitry on the TRK-MPC5604P 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-MPC5604P package includes the following items:

- TRK-MPC5604P Board
- CodeWarrior Development Studio DVD-ROM
- TRK-MPC5604P Resources CD
- USB A-to-B Cable
- Freescale Warranty Card

1.3 Supported Devices

The TRK-MPC5604P supports the following devices:

- MPC5604P microcontrollers in 144LQFP packages

1.4 Recommended Materials

- Freescale MPC5604P reference manual and datasheet
- TRK-MPC5604P 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-MPC5604P is a demonstration and development system for Freescale's MPC5604P microcontrollers in 144LQFP 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-MPC5604P 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-MPC5604P Board Features

- Soldered MPC5604P LQFP144 device
- Access to MCU pins with standard headers
- Embedded OSJTAG: USB to JTAG circuitry which allows host PC to communicate with the microcontroller through USB 2.0.
- On-board Virtual Serial Port
- ON/OFF Power Switch w/ LED indicator
- A 9VDC to 12VDC power supply input barrel connector
- Power Input Selection Jumpers for selecting the input voltage source:
  - Power Input from USB Connector
  - Power Input from DC Power Jack
    - Freescale MC3390x
    - External LDO power circuitry
- Oprerating Voltage Selection Jumpers for selecting operating voltage source:
  - 5V

- • 3.3V from on-board LDO
- • 3.3V from Motor Control Port
- • Jumper to select BAM source:
  - • From internal memory
  - • From CAN
  - • From LIN Flex
- • RESET Push Button and LED indicator w/ enable
- • User Features:
  - • 4 User Push Buttons w/ enable and pull-up & pull-down options
  - • 4 DIL switches w/ enable and pull-up & pull-down options
  - • 10K Ohm POT connected to an ADC input channel w/ enable
  - • 1 photocell w/ enable
  - • 4 User LED's w/ enable
  - • 1 RS232 interface w/ enable (DB9 and transceiver footprint only)
  - • 1 CAN interface w/ enable to high-speed CAN transceiver with DB9 CAN connector
  - • 2 LIN channels w/ enable sharing one LIN transceiver with two standard LIN connectors
  - • 4 distinct GND test points
- • Specifications:
  - • Board Size 4.7" x 4.3"
  - • Power Input:
    - • USB Cable: 5VDC, 500mA max
    - • DC Power Jack: 2.1/5.5mm barrel connector, 9VDC to 12VDC Center Positive
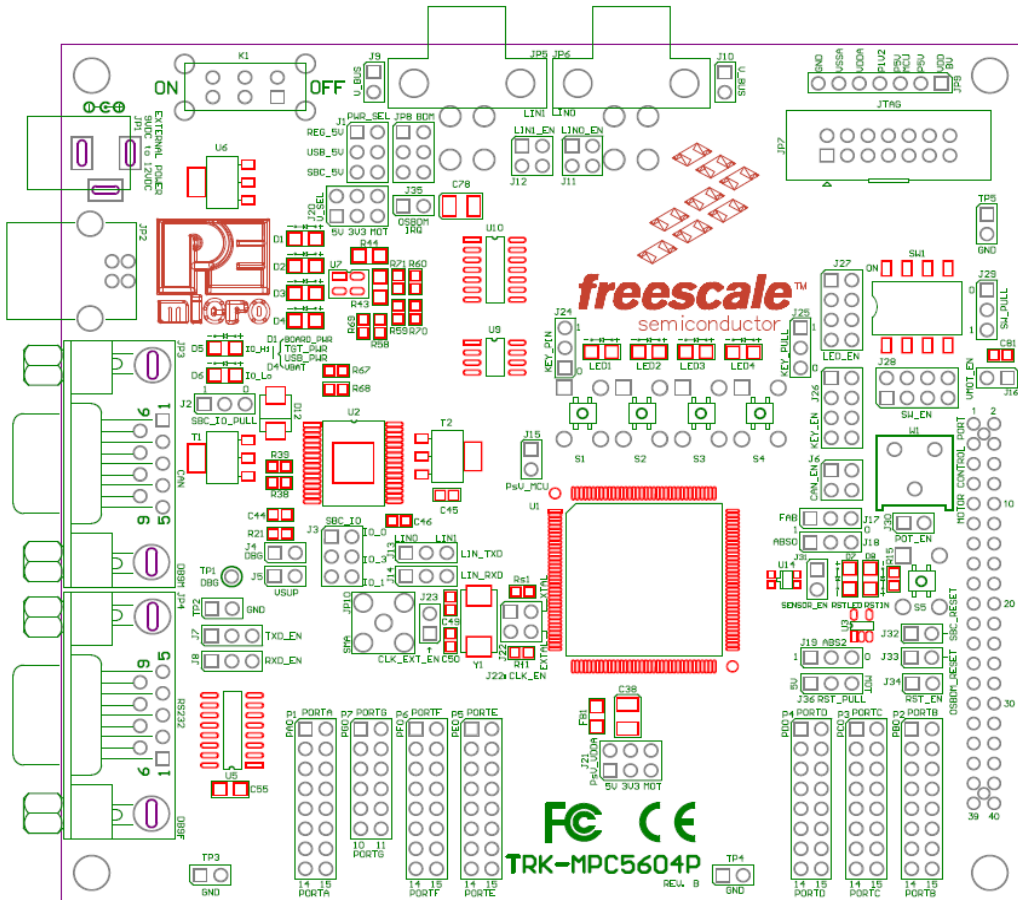
Figure 2-1: Top Component Placement

2.2   On-Board Virtual USB Port

The TRK-MPC5604P board has a built-in virtual serial port which may be connected to the MPC5604P processor's SCI RXD/TXD. This allows certain PC applications to be able to connect in a serial fashion to the microcontroller without the actual use of serial port hardware.

2.3 TRK-MPC5604P Jumper/Connector Quick Reference

Default Jumper Settings

The following is a list of default jumper settings for TRK-MPC5604P board. The settings listed indicate the "on" (or installed) position.

Default Jumper Settings

JUMPER	OPTION	SETTINGS	DESCRIPTION
J1	System Power Source Select	1-2	External Power 9VDC to 12VDC Regulated Down to 5VDC
		3-4 (default)	USB OSJTAG Supplies 5VDC
		5-6	SBC MC33905 Supplies 5VDC
J2	SBC I/O LED Pull Up/Down	1-2 (default)	Pull Up
		2-3	Pull Down
J3	SBC I/O Signal	1-2 (default)	I/O-0
		3-4	I/O-3
		5-6	I/O-1
J4	SBC DBG Short to GND (default: OFF)	1-2	Short SBC DBG Pin to GND, Bypass R21 and D11
J5	SBC DBG Pull Up (default: OFF)	1-2	Pull Up SBC DBG Pin to SBC Power Supply via 330 Ohm Resistor

Default Jumper Settings

J6	CAN Signals to Transceiver Enable	1-2, 3-4 (default)	Enables TXD and RXD signals to CAN Transceiver
J7	RS232 TXD Signal	1-2 (default)	MCU TXD to Virtual Serial Port
		2-3	MCU TXD to RS232 Transceiver
J8	RS232 RXD Signal	1-2 (default)	MCU RXD to Virtual Serial Port
		2-3	MCU RXD to RS232 Transceiver
J9	LIN1 VBus Enable (default: OFF)	1-2	Provides Power to LIN1 Connector
J10	LIN0 VBus Enable (default: OFF)	1-2	Provides Power to LIN0 Connector
J11	LIN0 Signals to Connector Enable	1-2 (default), 3-4 (default)	Connects LIN0 Signals to LIN0 Connector
J12	LIN1 Signals to Connector Enable (default: OFF)	1-2, 3-4	Connects LIN1 Signals to LIN1 Connector
J13	LIN TXD Signal	1-2 (default)	MCU LIN0TX to Transceiver
		2-3	MCU LIN1TX to Transceiver

Default Jumper Settings

J14	LIN RXD Signal	1-2 (default)	MCU LIN0RX to Transceiver
		2-3	MCU LIN1RX to Transceiver
J15	MCU VDD Enable	1-2 (default)	Provides Power to MCU; Current Measurement
J16	VMOT_EN Enable	1-2 (default)	Provides Power to TRK-MPC5604P from Motor Control Port
J17	FAB	1-2	FAB Pulled Up High
		2-3 (default)	FAB Pulled Down Low
J18	ABS0	1-2	ABS0 Pulled Up High
		2-3 (default)	ABS0 Pulled Down Low
J19	ABS2	1-2	ABS2 Pulled Up High
		2-3 (default)	ABS2 Pulled Down Low
J20	System Power Voltage Select	1-2 (default)	5V On-Board
		3-4	3.3V From LDO
		5-6	3.3V From Motor Control Port

Default Jumper Settings

J21	VDDA Enable	1-2 (default)	Provides 5V Power to VDDA; Current Measurement
		3-4	Provides 3.3V Power from On-Board LDO to VDDA; Current Measurement
		5-6	Provides 3.3V Power from Motor Control Port; Current Measurement
J22	External Crystal Circuitry Enable (default: ALL ON)	1-2 (default)	XTAL
		3-4 (default)	EXTAL
J23	External Oscillator via SMA Enable (default: OFF)	1-2	EXTAL
J24	Push Button Active High or Low; Opposite of J25	1-2 (default)	Active Low
		2-3	Active High
J25	Push Button Pull Up/Down Enable; Opposite of J24	1-2 (default)	Pull Up
		2-3	Pull Down
J26	Push Button Signals Enable (default: ALL ON)	1-2 (default), 3-4 (default), 5-6 (default), 7-8 (default)	Connects MCU Port D0, D1, D2, and D3 to Push Buttons Correspondingly

Default Jumper Settings

J27	LED Signals Enable (default: ALL ON)	1-2 (default), 3-4 (default), 5-6 (default), 7-8 (default)	Connects MCU Port D4, D5, D6, and D7 to LEDs Correspondingly
J28	DIL Switch Signals Enable (default: ALL ON)	1-2 (default), 3-4 (default), 5-6 (default), 7-8 (default)	Connects MCU Port D8, D9, D10, and D11 to DIL Switch Correspondingly
J29	DIL Switch Active High or Low	1-2 (default)	Active High
		2-3	Active Low
J30	Analog Input Enable	1-2 (default)	Connects MCU PE0 to Potentiometer
J31	Photo Sensor Enable	1-2 (default)	Connects MCU PE1 to Photo Cell
J32	SBC Reset to MCU Enable (default: OFF)	1-2	Enables SBC Reset Signal to Trigger MCU Reset
J33	OSJTAG Reset to MCU Enable	1-2 (default)	Enables OSJTAG Reset Signal to Trigger MCU Reset
J34	System Reset Enable	1-2 (default)	Connects Reset Sources to MCU Reset Signal
J35	OSJTAG Bootloader Enable (default: OFF)	1-2	Forces OSJTAG to start up in bootloader mode for firmware updates

Default Jumper Settings

		1-2 (default)	Pull-Up SBC Reset to 5V if SBC power is used
J36	SBC Reset Pullup	2-3	Pull-Up to 3.3V if Motor Control Port is used to provide power

3   GETTING STARTED WITH THE TRK-MPC5604P

The TRK-MPC5604P is a low-cost board targeting quick microcontroller evaluation. Please refer to the TRK-MPC5604P Quick Start Guide for instructions on how to install software, connect the TRK-MPC5604P to your PC, and run quick demonstrations.

4   SYSTEM SETUP

4.1   Overview

The Embedded OSJTAG driver is required to operate the TRK-MPC5604P using a PC. The Embedded OSJTAG driver should be installed with the CodeWarrior Development Studio software before the PC is connected to the TRK-MPC5604P.

4.2   Operating System Requirements

The following are the resources required to run the CodeWarrior Development Studio and the TRK-MPC5604P:

- 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 DVD-ROM drive for software installation
- A USB port

4.3 Software Setup

4.3.1 Installing CodeWarrior Development Studio

To install the CodeWarrior Development Studio, follow the instructions on the DVD-ROM.

4.3.2 Installing P&E Resources

Use the TRK-MPC5604P Resources in the DVD-ROM to access and install P&E resources for the DEMO board. These materials are not required for operation. The TRK-MPC5604P Resources CD-ROM contains the following support materials:

- TRK-MPC5604P User Manual (this document)
- TRK-MPC5604P Board Schematic
- TRK-MPC5604P Component Breakdown List
- P&E Evaluation Software
- Links to Freescale documentation, P&E Discussion Forums, and TRK-MPC5604P FAQs.

4.4 Quick Startup

Only a few steps are required to get the TRK-MPC5604P up and running. Please reference the Quick Start Guide.

4.5 Hardware Setup

4.5.1 First-Time Connection

The TRK-MPC5604P may be connected to a PC through a USB port. Connection steps are listed below in typical order:

1. Install the required software, as described in the previous section.
2. Make sure the jumper USB_5V for POWER_SELECT is installed.
3. Plug the USB cable A-M connector into a free USB port of the PC.
4. Plug the USB cable B-M connector into the USB connector on the TRK-MPC5604P Board.
5. 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).

6. Select the "Install the software automatically (Recommended)" option and click the "Next" button. Windows will install the driver files to your system. 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-MPC5604P hardware interface driver is now properly installed on your system, the green USB LED on the TRK-MPC5604P Base Board should be illuminated. In addition, if you turn on the system power of the TRK-MPC5604P you will see the yellow Power LED illuminate.

5 OPERATING MODES

5.1 Overview

The TRK-MPC5604P'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-MPC5604P.

5.2 Debug Mode

A host communicates with the TRK-MPC5604P through the Embedded OSJTAG circuitry. Either the CodeWarrior Development Studio or P&E's Qorivva software tools will work with the TRK-MPC5604P. Please refer to **Section 8 - TRK-MPC5604P CODE DEVELOPMENT SOFTWARE** for more information.

5.3 Run Mode

The TRK-MPC5604P'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-MPC5604P has an optional JTAG/Nexus header for debugging and programming the on-board MPC5604P microcontroller using an external Qorivva hardware tool, such as P&E's USB Multilink or Cyclone MAX. Please refer to **Section 9 - TRANSITIONING TO YOUR OWN TARGET** for more information. A user can take advantage of this mode to develop a target-specific MPC5604P system and compare it with the TRK-MPC5604P when necessary.

6 JUMPER SETTINGS

This section describes the various jumpers settings that are available on the TRK-MPC5604P. Figures depict the default setting for each jumper.

6.1 System Power

The TRK-MPC5604P board provides 3 power options: SBC MC33905 or LDO can regulate external power to 5VDC, or USB can provide 5VDC through OSJTAG.

6.1.1 J1 - System Power

1-2 External Power 9VDC to 12VDC Regulated Down to 5VDC

3-4 USB OSJTAG Supplies 5VDC (default)

5-6 SBC MC33905 Supplies 5VDC

Figure 6-2: System Power (J1)
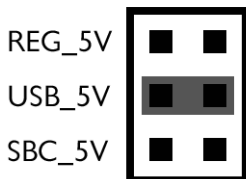
6.2   I/O Pins

The SBC MC33905 provides three I/O pins. Two of them are jumper (J3) selectable to two LEDs, which are further jumper (J2) selectable to pull-up or pull-down.

6.2.1   J2 - SBC I/O LED Pull Up/Down

1-2 Pull Up (default)

3-4 Pull Down
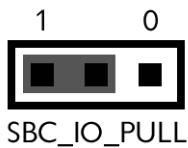
Figure 6-3: SBC I/O LED Pull Up/Down (J2)

6.2.2   J3 - SBC I/O Signal

1-2 I/O-0 (default)

3-4 I/O-3

5-6 I/O-1
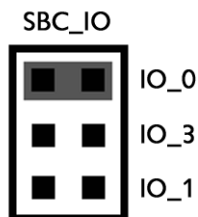
SBC_IO

Figure 6-4: SBC I/O Signal (J3)

6.3   Debug Mode

The SBC MC33905 has a DBG pin to put it into debug mode. Jumpers J4 and J5 are designed for this purpose.

6.3.1   J4 - SBC DBG Short To GND

1-2 Short SBC DBG Pin to GND, Bypass R21 and D11 (default: OFF)

DBG

Figure 6-5: SBC DBG Short To GND (J4)

6.3.2   J5 - SBC DBG Pull Up

1-2 Pull Up SBC DBG Pin to SBC Power Supply via 330 Ohm Resistor (default: OFF)

VSUP

Figure 6-6: SBC DBG Pull Up (J5)

6.4   CAN Port

The TRK-MPC5604P board has implemented a CAN port.

6.4.1 J6 – CAN Signals To Transceiver Enable CAN_EN

Enables TXD and RXD signals to the CAN transceiver. By default, the jumpers are installed.
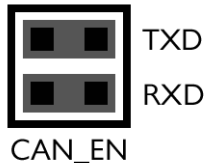
Figure 6-7: CAN_EN (J6)

6.5 Virtual Serial Port

The TRK-MPC5604P board has a built-in virtual serial port which may be connected to the MPC5504P processor's SCI. This allows certain PC applications to be able to connect in a serial fashion to the microcontroller without the actual use of serial port hardware. It can be enabled or disabled by installing or removing the jumpers J7 and J8.

6.5.1 J7 - RS232 TXD Signal

Figure 6-8: TXD_EN (J7)

6.5.2 J8 - RS232 RXD Signal

Figure 6-9: RXD_EN (J8)

6.6 LIN Channels/Connectors

The TRK-MPC5604P board provides two jumper selectable LIN channels to two jumper selectable LIN connectors.

6.6.1 J9 - LIN1 VBus Enable

1-2 Provides Power to LIN1 Connector (default: OFF)
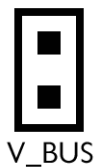
Figure 6-10: LIN1 VBus Enable (J9)

6.6.2 J10 - LIN0 VBus Enable

1-2 Provides Power to LIN0 Connector (default: OFF)
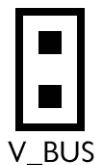
Figure 6-11: LIN0 VBus Enable (J10)

6.6.3 J11 - LIN0 Signals To Connector Enable

1-2, 3-4 Connects LIN0 Signals to LIN0 Connector (default)
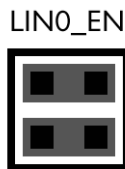
Figure 6-12: LIN0 Signals To Connector Enable (J11)

6.6.4 J12 - LIN1 Signals To Connector Enable

1-2, 3-4 Connects LIN1 Signals to LIN1 Connector (default: OFF)

LIN1_EN
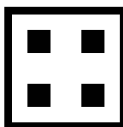
Figure 6-13: LIN1 Signals To Connector Enable (J12)

6.6.5   J13 - LIN TXD Signal

1-2 MCU LIN0TX to Transceiver (default)

2-3 MCU LIN1TX to Transceiver

LIN_TXD

LIN0 LIN1
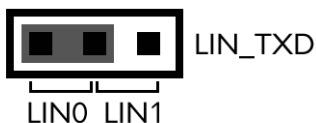
Figure 6-14: LIN TXD Signal (J13)

6.6.6   J14 - LIN RXD Signal

1-2 MCU LIN0RX to Transceiver (default)

2-3 MCU LIN1RX to Transceiver

LIN_RXD

LIN0 LIN1

Figure 6-15: LIN RXD Signal (J14)

6.7   MCU VDD Enable

6.7.1   J15 - MCU VDD Enable

1-2 Provides Power to MCU, Current Measurement (default)

Figure 6-16: MCU VDD Enable (J15)

6.8 VMOT_EN Enable

6.8.1 J16 - VMOT_EN Enable

1-2 Provides Power to TRK-MPC5604P Board from Motor Control Port (default)

Figure 6-17: VMOT_EN Enable (J16)

6.9 Boot Configuration

6.9.1 J17 - FAB

1-2 FAB Uses Serial Boot Mode

2-3 FAB Uses Internal Boot Mode (default)

Figure 6-18: FAB (J17)

6.9.2   J18 - ABS0

1-2 Processor uses FlexCAN interface (if ABS2 = 0) if configured for Serial boot mode (J17)

2-3 Processor uses LINFlex interface (if ABS2 = 0) or Autobaud scan (if ABS2 = 1) if configured for Serial boot mode (J17)

ABS0

Figure 6-19: ABS0 (J18)

6.9.3   J19 - ABS2

1-2 Processor uses Autobaud scan (if ABS0 = 0) if configured for Serial boot mode (J17)

2-3 Processor uses LINFlex interface (if ABS0 = 0) or FlexCAN interface (if ABS0 = 1) if configured for Serial boot mode (J17)

ABS2

Figure 6-20: MPC5604P ABS2 (J19)

6.10   System Power Voltage Select

6.10.1   J20 - System Power Voltage Select

1-2 5V (default)

3-4 3.3V from On-Board LDO

5-6 3.3V from Motor Control Port

POWER SELECT

5V 3.3V MOT
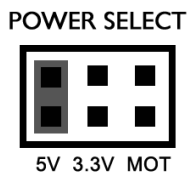
Figure 6-21: System Power Voltage Select (J20)

6.11   VDDA Enable

6.11.1   J21 - VDDA Enable

1-2 Provides 5V Power to VDDA, Current Measurement (default)

3-4 Provides 3.3V Power from On-Board LDO to VDDA, Current Measurement

5-6 Provides 3.3V Power from Motor Control Port, Current Measurement

VDDA

5V 3.3V MOT
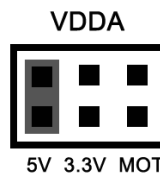
Figure 6-22: VDDA Enable (J21)

6.12   Clock Selection

6.12.1   J22 - External Crystal Circuitry Enable

1-2 XTAL

2-3 EXTAL

(default: ALL ON)

XTAL

EXTAL

CLK_EN

Figure 6-23: External Crystal Circuitry Enable (J22)

6.12.2   J23 - External Oscillator via SMA Enable

1-2 EXTAL (default: OFF)

CLK_EXT_EN

Figure 6-24: External Oscillator via SMA Enable (J23)

6.13   Push Buttons

The TRK-MPC5604P board is designed with 4 jumper enabled push buttons with jumper selectable active high or low states.

6.13.1   J24 - Push Button Active High or Low (Opposite of J25)

1-2 Active Low (default)

2-3 Active High

KEY_PIN

0   1

Figure 6-25: Push Button Active High or Low (J24)

6.13.2   J25 - Push Button Pull Up/Down Enable (Opposite of J24)

1-2 Pull Up (default)

2-3 Pull Down

KEY_PULL

1   0

Figure 6-26: Push Button Pull Up/Down Enable (J25)

6.13.3   J26 - Push Button Signals Enable

1-2, 3-4, 5-6, 7-8 Connects MCU Port D0, D1, D2, and D3 to Corresponding Push Buttons (default: ALL ON)
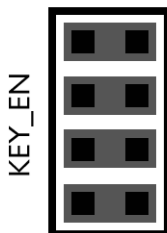
Figure 6-27: Push Button Signals Enable (J26)

6.14   LED Display Port

The TRK-MPC5604P has 4 LEDs connected to signals D4, D5, D6, and D7. They can be enabled or disabled by installing or removing the corresponding jumper, J27, in the LED_ENABLE header.

6.14.1   J27 - LED Display Enable Port LED_ENABLE
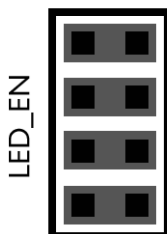
Enables all LED outputs. This is the default setting.

Figure 6-28: LED Display Enable Header LED_ENABLE (J27)

6.15   DIL Switch

The TRK-MPC5604P board is designed with a 4 jumper-enabled DIL Switch signal with jumper-selectable active high or low states.

6.15.1   J28 - DIL Switch Signals

1-2, 3-4, 5-6, 7-8 Connects MCU Port D8, D9, D10, and D11 to Corresponding DIL Switch (default: ALL ON)

Figure 6-29: DIL Switch Signals (J28)

6.15.2   J29 - DIL Switch Active High or Low

1-2 Active Low (default)
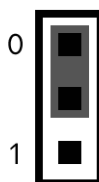
2-3 Active High

Figure 6-30: DIL Switch Active High or Low (J29)

6.16   Analog Input Enable

6.16.1   J30 - Analog Input Enable

1-2 Connects MCU PE0 to Potentiometer (default)

Figure 6-31: Analog Input Enable (J30)

6.17   Photo Sensor Enable

6.17.1   J31 - Photo Sensor Enable

1-2 Connects MCU PE1 to Photo Sensor (default)
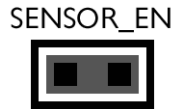
SENSOR_EN

Figure 6-32: Photo Sensor Enable (J31)

6.18   Reset Sources

The TRK-MPC5604P board is designed with 3 reset sources: From SBC MC33905, from OSJTAG, and from the Reset Button.

6.18.1   J32 - SBC Reset to MCU Enable

1-2 Enables SBC Reset Signal to Trigger MCU Reset (default: OFF)

SBC_RESET

Figure 6-33: SBC Reset to MCU Enable (J32)

6.18.2   J33 - OSJTAG Reset to MCU Enable

1-2 Enables OSJTAG Reset Signal MCU Reset (default)

OSBDM_RESET

Figure 6-34: OSJTAG Reset to MCU Enable (J33)

6.18.3   J34 - System Reset Enable

1-2 Connects Reset Sources to MCU Reset Signal (default)

Figure 6-35: System Reset Enable (J34)

6.19   OSJTAG Bootloader Enable

6.19.1   J35 - OSJTAG Bootloader Enable

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

Figure 6-36: OSJTAG IRQ Enable (J35)

6.20   SBC Reset Pull-Up Mode

6.20.1   J36 - SBC Reset Pull-Up Enable

1-2 Pull Up SBC Reset to 5V if SBC poewr is used

2-3 Pull Up SBC Reset to 3.3V provided by Motor Control Port if power is provided from it

Figure 6-37: SBC Reset Pull-Up Enable (J36)

7   MOTOR CONTROL DAUGHTER CARD CONNECTOR

The Daughter Card Connector, P8, allows the connection of TRK-MPC5604P Board to the 56F8000 Motor Control Board. The Daughter Card Connector is

a 40-pin 0.1" pitch connector with signals from the PWM, ADC, and GPIO peripheral ports. Table xxxxx below shows the Daughter Card Connector's signal-to-pin assignments.

1	+3.3V	GPIO40/FlexPWM0_FAULT2	2
3	GND	Reset	4
5	GPIO18/TXD	GPIO54/FlexPWM0_FAULT1	6
7	GPIO19/RXD	GND	8
9	GPIO58/FlexPWM0_A0	GPIO23/ADC0_AN0	10
11	GPIO59/FlexPWM0_B0	GPIO24/ADC0_AN1	12
13	GPIO0/eTimer0_ETC0	GPIO65/ADC0_AN4	14
15	GPIO1/eTimer0_ETC1	GND	16
17	GPIO3/eTimer0_ETC3	GPIO29/ADC1_AN0	18
19	GPIO2/eTimer0_ETC2	GPIO30/ADC1_AN1	20
21	GPIO6/DSPI1_SCK	GPIO31/ADC1_AN2	22
23	GPIO5/DSPI1_CS0	GND	24
25	GPIO45/eTimer1_ETC1	GPIO42	26
27	GPIO46/eTimer1_ETC2	GPIO9/FlexPWM0_FAULT0	28
29	GPIO53/FCU0_F0	GPIO61/FlexPWM0_A1	30
31	GPIO55/FCU0_F1	GPIO62/FlexPWM0_B1	32
33	GPIO34/ADC0_AN3	GPIO12/FlexPWM0_A2	34
35	GPIO33/ADC0_AN2	GPIO13/FlexPWM0_B2	36
37	GPIO32/ADC1_AN3	GPIO27/ADC0_ADC1_AN13	38
39	GPIO64/ADC1_AN5	GPIO28/ADC0_ADC1_AN14	40

Figure 7-38: Motor Control Daughter Card Signal-To-Pin Assignments

8   TRK-MPC5604P CODE DEVELOPMENT SOFTWARE

The TRK-MPC5604P includes P&E's OSJTAG circuitry, so no external Qorivva hardware tool is needed to debug and program the TRK-MPC5604P. A user only needs to connect the TRK-MPC5604P to their PC to start developing code for it.

The TRK-MPC5604P package comes with a special edition of Freescale's CodeWarrior studio. In addition, P&E's evaluation software for Qorivva is available in the TRK-MPC5604P Resources section of the TRK-MPC5604P Resources CD, or online at www.pemicro.com. A user may use either CodeWarrior or P&E software tools to develop code for the TRK-MPC5604P.

8.1   Using CodeWarrior With The TRK-MPC5604P

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.

8.2   Using P&E Software With The TRK-MPC5604P

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.

9   TRANSITIONING TO YOUR OWN TARGET

Once you have finished working with the TRK-MPC5604P 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 USB Qorivva Multilink are development tools that are functionally comparable to the OSJTAG circuitry on the TRK-MPC5604P. 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.

9.1   Hardware Solutions At A Glance

The Multilink Universal and USB Qorivva Multilink 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.

9.1.1   Multilink Universal and USB Qorivva Multilink Features

- Direct user control of target's execution
- Programming and debugging capabilities
- Read/write registers and memory values
- Compact and lightweight
- Communication via USB 2.0
- Supported by P&E software and Freescale's CodeWarrior
- USB Qorivva Multilink supports Freescale Qorivva MPC55xx/56xx.
- Multilink Universal supports Freescale Qorivva MPC55xx/56xx, HCS08, HC(S)12(X), RS08, ColdFire V1/+V1, ColdFire V2-4, and Kinetis ARM.

9.1.2   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 ColdFireV2/3/4, Power Architecture 5xx/8xx, Qorivva MPC55xx/56xx, and Kinetis ARM 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

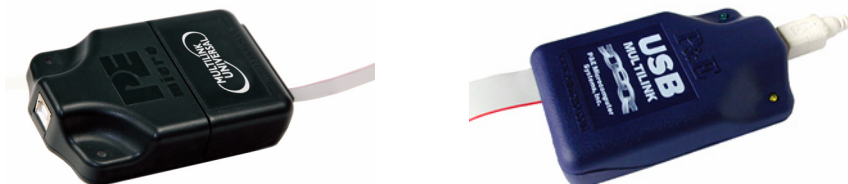## 9.2   Working With P&E's Multilink Universal or USB Qorivva Multilink

Figure 9-1: Multilink Universal (left) & USB Qorivva Multilink (right)

9.2.1   Product Features & Implementation

P&E's Multilink Universal and USB Qorivva Multilink each connect your target to your PC and allow the PC access to the debug mode on Freescale's Qorivva MPC55xx/56xx microcontrollers (the Multilink Universal also supports several 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.

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 USB Qorivva Multilink each enable you to debug, program, and test your code on your board.

9.2.2   Software

The Multilink Universal and USB Qorivva Multilink 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 USB Qorivva Multilink Development Packages come with the USB Qorivva Multilink interface, as well as flash programming software, in-circuit debugging software, Windows IDE, and a register file editor.

9.3   Working With P&E's Cyclone MAX

Figure 9-2: P&E's Cyclone MAX

9.3.1   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 ColdFireV2/3/4, Power Architecture 5xx/8xx, Qorivva MPC55xx/56xx, and Kinetis ARM 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.

9.3.2   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.

10 TROUBLESHOOTING

10.1 TRK-MPC5604P Is Undetected

Q: The connection assistant indicates that my TRK-MPC5604P 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-MPC5604P hardware. If this dialog indicates that the TRK-MPC5604P hardware is not connected to the PC, the first step is to make sure that the TRK-MPC5604P 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-MPC5604P 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 CodeWarrior Development Studio software from the DVD-ROM. After driver installation, unplug the TRK-MPC5604P 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-MPC5604P 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-MPC5604P will not work. In general, USB ports located directly on the PC are high-power (self-powered) ports.

Freescale Controller Continuum

68HC08/S08/RS08/(S)12(X)···ColdFire® V1/+V1···ColdFire® V2/V3/V4···Qorivva®···ARM®

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