NXP LPC1768 System Development Kit User Manual

Contents

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System Overview

The LPC1768 Industrial Reference Design (IRD) is a platform targeted at RTOS-based embedded systems. Designed around a flexible “Core” and “Base” Printed Circuit Board (PCB) concept, it features many of the system functions and wired communications protocols found in today’s embedded applications. The flexible design allows for changing of core and base boards, displays, and keypads as needed by the targeted application. The platform is powered by an external 5VDC power supply and provides circuitry to measure the current consumption of 3.3VDC while operating the platform in different modes. Software development and debugging are accomplished with the use of a JTAG connection and Keil IDE development environment. Hardware circuitry is incorporated to facilitate In-System-Programming (ISP), allowing software updates to be easily loaded and demonstrated on the platform.
The version 1.3 kit features:

- NXP-designed (green PCB) LPC1768 core board
- NXP-designed base (green PCB) board
- A phone-style keypad board
- A 20X4 character LCD module

The platform provides demonstration software to perform functional tests of the microcontroller features, such as Ethernet, USB Devices, UART, I²C, ADC, and GPIO ports. In the future, the platform will support Micrium µC/OS-II Real-Time Operating System (RTOS), and provides software support for 10/100Base Ethernet, USB Host/Device, CAN, RS-232, and I2C wired communication protocols. Additionally, the platform provides flexible interfaces for:

- Vacuum Fluorescent Displays (VFD) or Liquid Crystal Displays (LCD)
- UART expansion
- I2C expansion
- Application-specific hardware through connection headers on the baseboard

Assembling the Hardware

Packing List

The IRD kit includes the following:

1. LPC1768 “Processor Core Board”
2. NXP Industrial Reference Design (IRD) “Baseboard”, version 1.3
3. LCD Display Lumex model# LCM-S02004DSR
4. A display ribbon cable (assembled on the LCD/VFD Display)
5. NXP I2C keypad, version 1
6. External temperature sensor (2N3906-type red/white cabled temperature sensor)
7. Condor 5VDC 2.5A power supply
8. Ethernet Cable
9. USB A/B cable
10. RS232 cable
11. Keil ULINK-ME JTAG Debugger and cables
12. QuickStart Guide (this document)

Contact your supplier if components are missing. The kit may also include other components as NXP bundles this kit with other reference platforms (e.g. CAN Board, DALI Solid State Lighting Board, etc). If other components are included, see the guide associated with that platform. The guide can be found on the included CD.

Kit Assembly

Please read carefully the following assembly instructions. Failure to follow these instructions may cause the platform not to function properly. The following instructions apply to the IRD platform only. The IRD demonstration code programmed into the LPC1768 MCU enables GPIO LED “Blinky” and provides a baseline for customers to start their LCP17xx development.

Connect the following boards as shown in Figure 1 (next page):

- LCD display: Connected to J_VFD
- I2C Keypad: Connected to J_KEYPAD
- External temperature sensor: Connected to J_TEMP(Red wire to D+, White to D-)

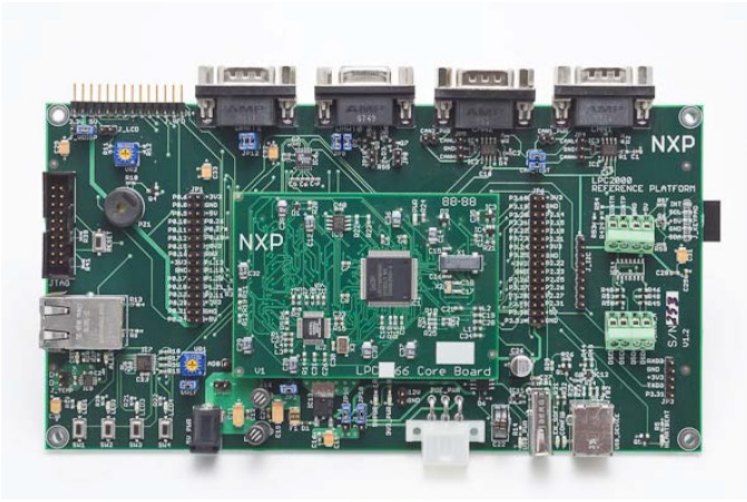
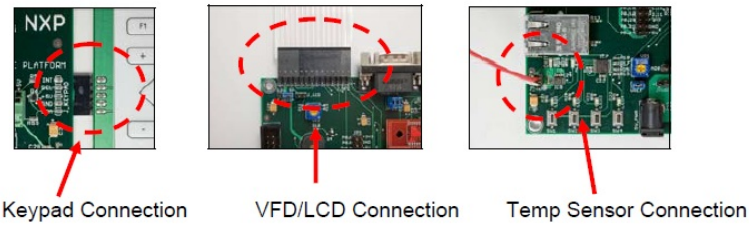
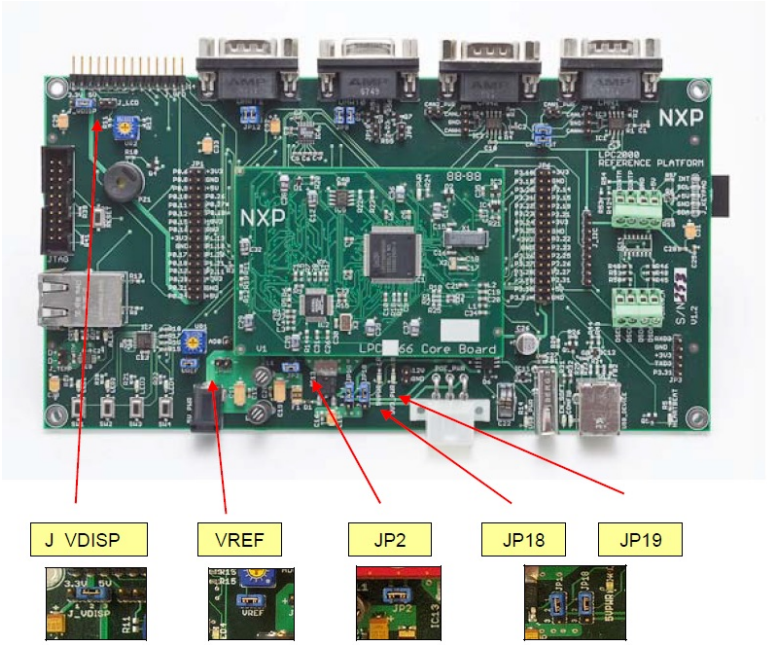


Figure 1



Ensure that the following jumpers are in place

Jumper	Default Connection	Description
JP2	Jumper connected	Used for I_{CC} measurement on IRD platform when d isconnected
JP18	Pins 1&2 connected	Enables 3.3VDC from onboard regulator
JP19	Pins 1&2 connected	Enables 5.0VDC from external Condor power supply.
J_VDISP	Pin 2&3 connected	Provides 5.0VDC to LCD Display
VREF	Jumper connected	Provides ADC/ DAC VREF connection to the micro controller

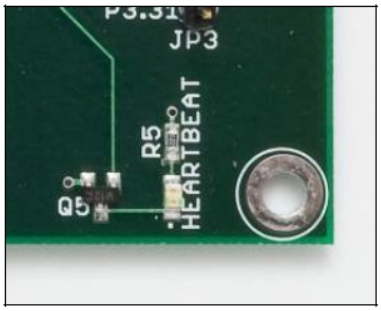


Before moving to Step 3, make sure that ALL the instructions described in Step 1, Hardware connections, and Step 2 Jumper configuration have been properly followed. Failure to follow these instructions may cause the platform not to function properly

- Connect the external Condor 5VDC power supply to JPWR (2.5mm plug)

- Wait a few seconds for the system to power up and examine the four LEDs on the bottom left side of the baseboard above the 4 push button switches. They should be blinking ON from left to right and then OFF from left to right. By adjusting AD0 (VR1), you can adjust the rate of the blinking LEDs.

- The Heartbeat LED (bottom right corner of base PCB) should be blinking at a 1Hz rate.



The following LEDs should be ON

1. 5VPWR (Red LED located at the bottom middle of Base Board)
2. 3V3_PWR (Red LED located bottom middle of Base Board)
3. USB_PWR (Green LED located bottom right of Base Board)

Troubleshooting

A few common problems that can occur when operating the IRD are:

Hardware-related issues

1. The keypad and the LCD need to be correctly connected to the “Baseboard”. Refer to the section of this manual for more information
2. All jumpers must be configured as per section 2.2 of this manual
3. The keypad will not respond if the user unplugs and plugs it back in while the IRD is still powered. When this happens, power down the board and power it up again

Information and Documents on CDs

Documentation
The kit includes a copy of this QuickStartQuickStart Guide. Schematics, Bill of Material, Gerber files for the Baseboard, IRD User Interface html web pages, and training modules for the major functions of the IRD platform can be found on the NXP website: **http://www.standardics.nxp.com/support/boards/ird/**

Software – Keil
The IRD LPC1768 kit software was developed using KEIL uVision3 version 3.5. Keil is providing a 60-day, 256kB trial version for customers using the IRD kit.
To install the Keil IDE go to: **https://www.keil.com/demo/eval/arm.htm**

1. Follow the instructions in the Auto-Installer window.

2. During the installation process, it is required to register the product with Keil to receive the license key for the IDE. You will be asked to enter the PSN number provided in this kit (label with a 15-digit serial number) to register the trial version of uVision.
3. You then will receive the license key for the tool via email. This may take up to 24 hours to process.

Software – ULINK-ME Debugger
The ULINK-ME Debugger that is included in the IRD kit allows code debugging and programming of the LPC1768 Cortex-M3 microcontroller.

1. Connect the ULINK-ME to a PC USB port
2. Connect the JTAG connector to the JTAG port in the IRD Base Board

Software and Document Updates
Software and documentation updates are available from: **http://www.standardics.nxp.com/support/boards/ird/**

Connection Headers Reference Table

The following list is a description of all the jumpers and connection headers on the IRD Baseboard (version 1.3). Additional information can be found in the IRD schematic and User Manual documents.

JP4 & JP5 – CAN Analyzer Connectors

Pin	Label	Function
1	CANH	Connects CAN Analyzer to CANH signal of TJA1040
2	GND	Ground connection
3	CANL	Connects CAN Analyzer to CANL signal of TJA1040

CAN_Test – CAN Loopback Interface

Pin	Label	Function
1	CAN2-L	CAN2 Channel CANL Signal
2	CAN1-L	CAN1 Channel CANL Signal
3	CAN2-H	CAN2 Channel CANH Signal
4	CAN1-H	CAN1 Channel CANH Signal

CAN1_PWR & CAN2_PWR – CAN Slave Port Power Connectors

Pin	Label	Function
1	+5VDC	+5VDC Power Supply From External Supply or POE Module
2	CAN-PWR	Connects +5VDC to CAN Slave Unit via pin 9 of DB9 Connector

JP8 & JP10 – ISP Mode Selection

JP8	P2_10	The microcontroller is placed in ISP mode when this jumper is connected, enabling FlashMagic to program the microcontroller.
JP10	RESET	The microcontroller is held in reset for ISP programming when this jumper is co nnected, enabling Flash Magic to program the microcontroler

JP9 – UART0 DCE/DTE Selection

Pin	Label	Function
1	T1OUT	RS-232 Serial Data Output from UART0
2	UART0 Pin2	Pin 2 of the UART0 DB9 Connector
3	UART0 Pin3	Pin 3 of the UART0 DB9 Connector
4	R1IN	RS-232 Serial Data Input to UART0

JP12 – UART1 DCE/DTE Selection

Pin	Label	Function
1	T2OUT	RS-232 Serial Data Output from UART1
2	UART1 Pin3	Pin 2 of the UART0 DB9 Connector
3	UART1 Pin2	Pin 3 of the UART0 DB9 Connector
4	R2IN	RS-232 Serial Data Input to UART1

J_TEMP – External Temperature Sensor Connector

Pin	Label	Function
1	D-	External Temperature Sensor negative (White Wire) connection
2	D+	External Temperature Sensor positive (Red Wire) connection

JP18 – 3.3VDC Source Selection

Pin	Label	Function
1	+3.3VDC	IC13 (Onboard 3.3VDC Regulator) Output

2	IRD +3.3V Supply	IRD +3.3VDC Supply
3	POE_3.3V	POE Connector 3.3VDC Supply

JP19 – 5.0VDC Source Selection

Pin	Label	Function
1	+5.0VDC	JPWR +5VDC Source (from Condor External Power Supply)
2	IRD +5.0VDC Supply	IRD +5VDC Supply
3	POE_5V	POE Connector 5.0VDC Supply

12V – POE 12VDC Output Connection

Pin	Label	Function
1	POE_12V	POE Connector 12VDC supply connection
2	GND	Ground connection

JP2 – IRD Current Monitor Connection

Pin	Label	Function
1	IRD +3.3V Supply	IRD 3.3VDC Source Power
2	+3V3	3.3V IRD Supply Line

J_VDISP – IRD Display Power Source Selection

Pin	Label	Function
1	IRD +3V3	3.3V IRD Supply Line
2	VFD/LCD VCC	VFD &LCD Display Supply Source
3	IRD +5.0VDC	IRD +5VDC Supply

J_LCD – LCD Contrast Control Selection

Pin	Label	Function
1	V_Contrast	Contrast voltage from VR2
2	LCD_Contrast	LCD Contrast Voltage V0

VREF – Microcontroller VREF Selection

Pin	Label	Function
1	VREF	ADC/DAC reference voltage signal to MCU
2	V3A	Filtered 3.3v source for VREF

Support

Online technical support is available at **http://www.nxp.com/support** Manuals and Datasheets: **http://www.standardics.nxp.com/support/boards/ird/** The information supplied by NXP Semiconductors. is believed to be accurate and reliable, but in no event shall NXP Semiconductors be liable for any damages whatsoever arising out of the use or inability to use the information or any errors that may appear in this publication. The information is provided as is without any warranties of any kind, either express or implied. NXP Semiconductors reserves the right, without notice, to make changes to the information or to the design and specifications of its hardware and/or software products. Products are subject to availability. NXP Semiconductors San Jose, CA USA **www.nxp.com**