General Description

The MAXQ610 evaluation kit (EV kit) provides a proven platform for conveniently evaluating the capabilities of the MAXQ610 low-power, 16-bit, RISC microcontroller targeted for battery-powered applications. The EV kit includes the MAXQ610 EV kit board, which contains infrared (IR) transmit and receive devices, two RS-232 serial channels, four 8-pin headers providing access to the processor's I/O port pins, a 5V power-supply input, and a bank of eight pushbutton switches for user input. The EV kit also includes software, USB-to-JTAG/1-Wire® Adapter, 10-pin JTAG interface cable, serial cable, and a standard A-to-mini-B USB cable for connecting to a personal computer. The EV kit provides a complete, functional system ideal for developing and debugging applications as well as evaluating the overall capabilities of the MAXQ610 RISC processor.

EV Kit contents

- MAXQ610 EV Kit Board
- USB-to-JTAG/1-Wire Adapter
- MAXQ610 EV Kit Resource Package
  - Includes MAXQ610 Data Sheet, MAXQ® Family User's Guide and its MAXQ610 Supplement, Application Notes, and Example Programs Including Source Code
- A-to-Mini-B USB Cable
- Serial Cable
- JTAG Ribbon Cable

Features

- Easily Load and Debug Code Using Supplied USB-to-JTAG/1-Wire Adapter
- JTAG Interface Provides In-Application Debugging Features
  - Step-by-Step Execution Tracing
  - Breakpointing by Code Address, Data Memory Address, or Register Access
  - Data Memory or Register Content View and Edit
- On-Board 3.3V Voltage Regulator (Single 5V Input)
- Eight User Input Pushbutton Switches
- Included Level-Shifted RS-232 Interface for Serial Ports 0 and 1
- Prototyping Area
- Included Board Schematics Provide a Convenient Reference Design

***Ordering Information* appears at end of data sheet.**

19-5765; Rev 3; 10/13

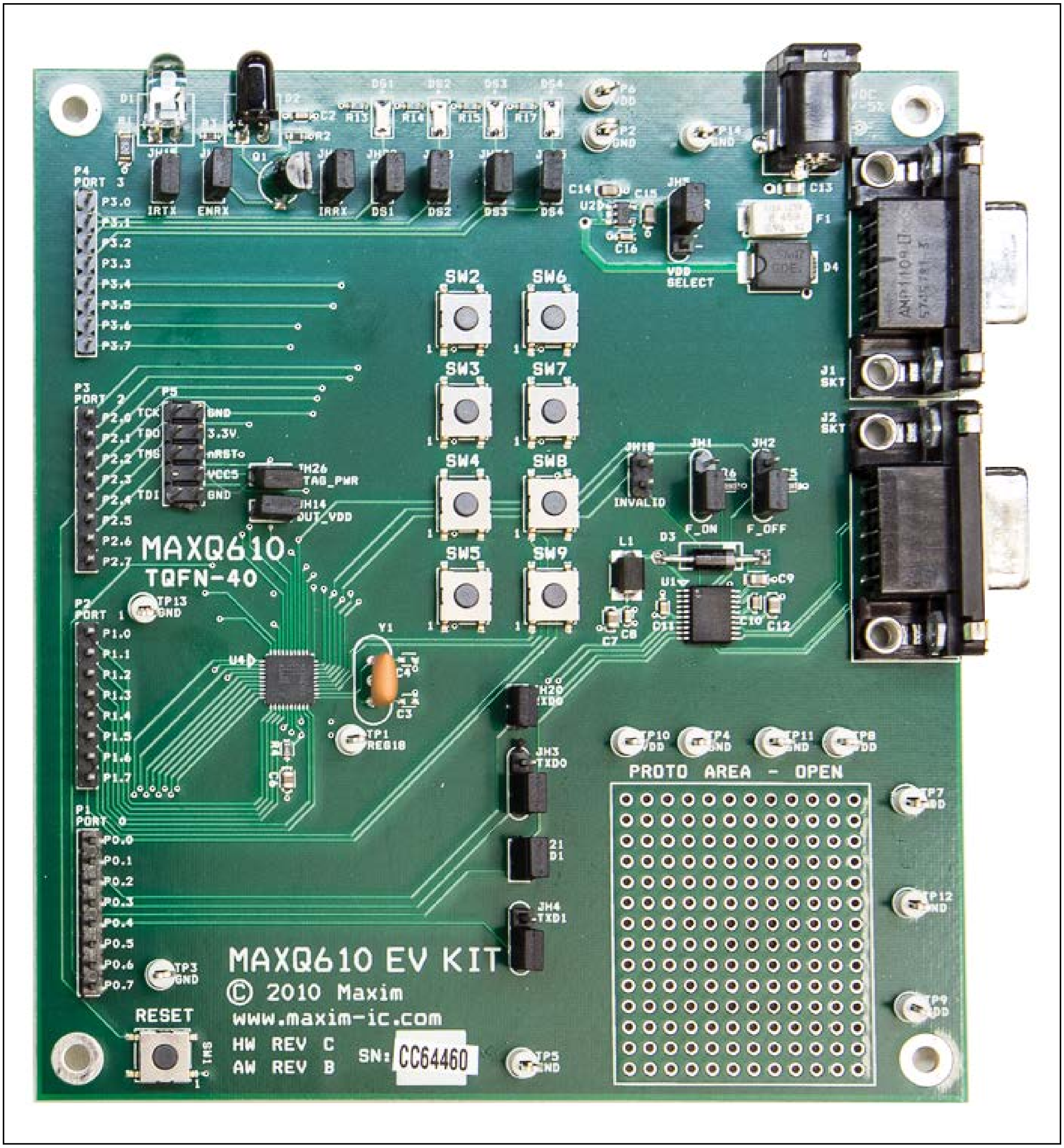

Figure 1. MAXQ610 EV Kit Board

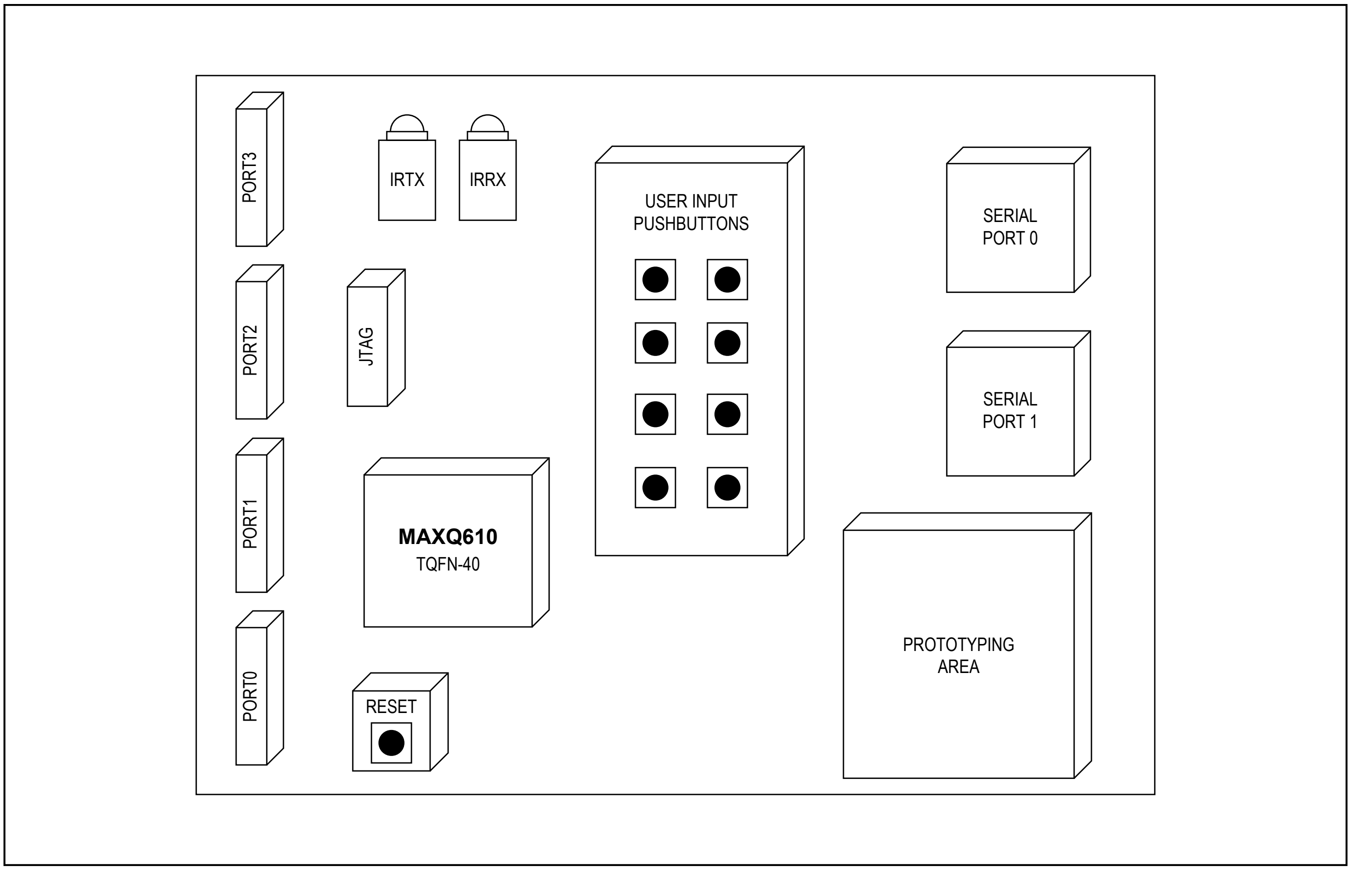

Figure 2. MAXQ610 EV Kit Board Functional Layout

Detailed Description

This EV kit must be used in conjunction with the following documents:

- MAXQ610 EV Kit Example Code
- MAXQ610 Data Sheet and User Guide
- MAXQ USB-to-JTAG/1-Wire Adapter Data Sheet and User Guide
- MAXQ610 EV Kit Data Sheet (this document)

These documents are available in the EV kit QuickView on the Maxim website at **www.maximintegrated.com/MAXQ610-KIT**.

The MAXQ610 EV kit board is fully defined in the schematic (Figure 3). A short description of the major sections and functions of the board follows.

Jumper Functions

The MAXQ610 EV kit board contains a number of jumpers to configure its operation. Table 1 describes the jumpers and their function

Power Supply

The MAXQ610 EV kit board can be powered directly using an external DC power supply applied to connector J3. A regulated 5V (±5%), 300mA, center positive, 2.5mm power supply is required. The EV kit board includes a regulator to supply 3.3V power to its circuitry.

The USB-to-JTAG/1-Wire Adapter can also be used to provide 5.0V power to the EV kit board (connector P5 pin 8). This capability is enabled by installing jumper JH26 on the EV kit board. In this configuration, an external power source should not be applied to connector J3.

Infrared (IR) Interface

The MAXQ610 microcontroller provides a dedicated IR timer/counter module to simplify support for IR communication. The IR timer/counter implements two pins (IRTX and IRRX) for supporting IR transmit and receive, respectively. The IRTX output pin can be manipulated high or low using the IRTXOUT bit of the power control register (PWCN) when the IRTX function is not enabled. However, the IRTX pin has no corresponding port pin designation, so the standard port direction (PD), port output (PO), and port input (PI) control status bits are not present.

The MAXQ610 EV kit board includes circuitry for both receiving and transmitting IR signals. The IR source is diode D1. Its anode is connected to the board's VDD supply through an 82Ω resistor, and its cathode is connected to the MAXQ610's IRTX pin (pin 39) when jumper JH15 is installed. The IR receiving circuitry consists of silicon PIN photodiode D2 and an npn bipolar transistor with biasing resistors. The photodiode D2 is intended for IR applications in the 700nm to 1100nm range, and the transistor is configured as a common emitter amplifier for the diode. Its collector is connected to the processor's IRRX pin (when JH16 is installed), and the emitter is connected to the processor's P0.7 (TBB1, pin 10) pin when jumper JH17 is installed. This allows the processor's port pin to be used as an IR receiver-enable signal.

Serial Port Interface

The MAXQ610's serial ports are both connected to RS-232 level translators, and these RS-232 level signals are connected the DB9 connectors (J1 and J2). A number of jumpers are used to connect various serial signals to the level translator and configure its operation. Table 1 describes these jumper functions.

Table 1. Jumper Functions

JUMPER	SETTING	EFFECT
JH1	1-2 Closed	Connects pin 3 (FORCEON) of the RS-232 level translator U1 to MAXQ610 pin 28 (port pin P3.5).
	2-3 Closed*	Connects pin 3 (FORCEON) of the RS-232 level translator U1 to the board's VDD.
	Open	Connects pin 3 (FORCEON) to ground.
JH2	1-2 Closed	Connects pin 4 ($\overline{\text{FFORCEOFF}}$) of the RS-232 level translator U1 to MAXQ610 pin 33 (P3.6).
	2-3 Closed*	Connects pin 4 ($\overline{\text{FORCEOFF}}$) of the RS-232 level translator U1 to the board's VDD.
	Open	Connects pin 4 ($\overline{\text{FORCEOFF}}$) to ground.
JH3	1-2 Closed	Connects pin 7 (T1IN) of the RS-232 level translator U1 to the board's VDD.
	2-3 Closed*	Connects pin 7 (T1IN) of the RS-232 level translator U1 to MAXQ610 pin 5 (TX0, P0.2).
	Open	Pin 7 (T1IN) is floating.
JH4	1-2 Closed	Connects pin 8 (T2IN) of the RS-232 level translator U1 to the board's VDD.
	2-3 Closed*	Connects pin 8 (T2IN) of the RS-232 level translator U1 to MAXQ610 pin 7 (TX1, P0.4).
	Open	Pin 8 (T2IN) is floating.
JH5	1-2 Closed*	Connects the board's VDD source to U2's pin 5 (3.3V OUT).
	2-3 Closed	Connects the board's VDD source to GND.
	Open	VDD is floating.
JH14	Open	Disconnects the MAXQ610's pin 38 (VDD input) from the board's VDD source.
	Closed*	Connects the MAXQ610's pin 38 (VDD input) to the board's VDD source.
JH15	Open	Disconnects the board's D1 LED IR emitter from the MAXQ610's pin 39 (IRTX).
	Closed*	Connects the board's D1 LED IR emitter to the MAXQ610's pin 39 (IRTX).
JH16	Open	Disconnects the board's D2 LED IR receiver amplified signal from the MAXQ610's pin 40 (IRRX).
	Closed*	Connects the board's D2 LED IR receiver amplified signal to the MAXQ610's pin 40 (IRRX).
JH17	Open	Disconnects the IR Rx enable from the MAXQ610's pin 10 (P0.7).
	Closed*	Connects the IR Rx enable to the MAXQ610's P0.7 pin 10 (P0.7).

Table 1. Jumper Functions (continued)

JUMPER	SETTING	EFFECT
JH18	Open*	Connects pin 2 ($\overline{\text{INVALID}}$) of the RS-232 level translator U1 to the MAXQ610's pin 27 (P3.4).
	Closed	Disconnects pin 2 ($\overline{\text{INVALID}}$) of the RS-232 level translator U1 from the MAXQ610's pin 27 (P3.4).
JH20	Open	Disconnects pin 9 (R1OUT) of the RS-232 level translator U1 from the MAXQ610's pin 3 (RX0, P0.1).
	Closed*	Connects pin 9 (R1OUT) of the RS-232 level translator U1 to the MAXQ610's pin 3 (RX0, P0.1).
JH21	Open	Disconnects pin 10 (R2OUT) of the RS-232 level translator U1 from the MAXQ610's pin 6 (RX1, P0.3).
	Closed*	Connects pin 10 (R2OUT) of the RS-232 level translator U1 to the MAXQ610's pin 6 (RX1, P0.3).
JH22	Open	Disconnects the board's DS1 LED cathode from the MAXQ610's pin 2 (P3.0).
	Closed*	Connects the board's DS1 LED cathode to the MAXQ610's pin 2 P3.0.
JH23	Open	Disconnects the board's DS2 LED cathode from the MAXQ610's pin 4 (P3.1).
	Closed*	Connects the board's DS2 LED cathode to the MAXQ610's pin 4 (P3.1).
JH24	Open	Disconnects the board's DS3 LED cathode from the MAXQ610's pin 15 (P3.2).
	Closed*	Connects the board's DS3 LED cathode to the MAXQ610's pin 15 (P3.2).
JH25	Open	Disconnects the board's DS4 LED cathode from the MAXQ610's pin 16 (P3.3).
	Closed*	Connects the board's DS4 LED cathode to the MAXQ610's pin 16 (P3.3).
JH26	Open	Disconnects the board's V50 source from pin 8 of the JTAG connector (VCC5).
	Closed*	Connects the board's V50 source to pin 8 of the JTAG connector (VCC5) allowing the JTAG connection to source the 5V power.

**Default setting.*

User Input Pushbuttons

The MAXQ610 EV kit board provides eight momentary contact switches intended for user input. Each switch is connected to a separate port pin on the MAXQ610's port 1 (P1.7–P1.0) as illustrated in Table 2. The other side of each switch is connected to ground. Therefore, by using the weak pullup capability of the port pins, switch closure can be detected by reading a low on the normally high corresponding port pin.

Table 2. Switch Input Connections

PORT PIN	SWITCH
P1.0	SW2
P1.1	SW3
P1.2	SW4
P1.3	SW5
P1.4	SW6
P1.5	SW7
P1.6	SW8
P1.7	SW9

General-Purpose LEDs

The MAXQ610 EV kit board has four general-purpose LEDs labeled DS1, DS2, DS3, and DS4. Each anode is connected to the board's VDD through a 100Ω resistor, and each cathode is connected to a processor port 3 pin through a jumper as specified in Table 3. By setting the related port pin as an output, each LED can be illuminated by setting the port pin output register bit (PO3.x) to a logic 0.

JTAG Interface

A USB-to-JTAG/1-Wire Adapter (provided with the EV kit) is used to program and debug applications running on the MAXQ610 EV kit board. Refer to the MAXQ USB-to-JTAG/1-Wire Adapter data sheet and user's guide found in the EV kit Resource Package. Connect the 10-pin ribbon cable from the USB-to-JTAG/1-Wire Adapter's JTAG connector to connector P5 on the MAXQ610 EV kit board, being careful to note the polarity. Tools such as the Microcontroller Tool Kit (MTK) and IAR's Embedded Workbench have built-in support for loading applications through the JTAG interface and using all the MAXQ610 debug functionality (break-points, register and memory reading, etc.).

Getting Started

IAR Embedded Workbench

IAR Embedded Workbench® is the primary IDE used for coding in C with the MAXQ610. The latest version of IAR can be obtained online from the MAXQ Development Tools webpage at **www.maximintegrated.com/MAXQ_tools**. IAR offers both time-limited and size-limited licenses of the IDE for evaluation. Download and execute the installer. Follow the installer directions to install the software.

Table 3. General-Purpose LED Connections

LED	JUMPER	PORT PIN
DS1	JH22	P3.0
DS2	JH23	P3.1
DS3	JH24	P3.2
DS4	JH25	P3.3

Figure 3. MAXQ USB-to-JTAG/1-Wire Adapter

IAR Embedded Workbench is a registered trademark of IAR Systems AB.

Once the software has been installed, open the application and create a new project in the current workspace. Ensure that the MAXQ Tool chain is selected from the drop-down menu, and open a new C project with a generated **main.c** file (Figure 4).

To configure the project to run on the MAXQ610, select **Options** from the **Project** menu or press **ALT+F7**. Select **MAXQ61x** from the drop-down menu and ensure that **CLIB** is selected under the **Library Configuration** tab (Figure 5).

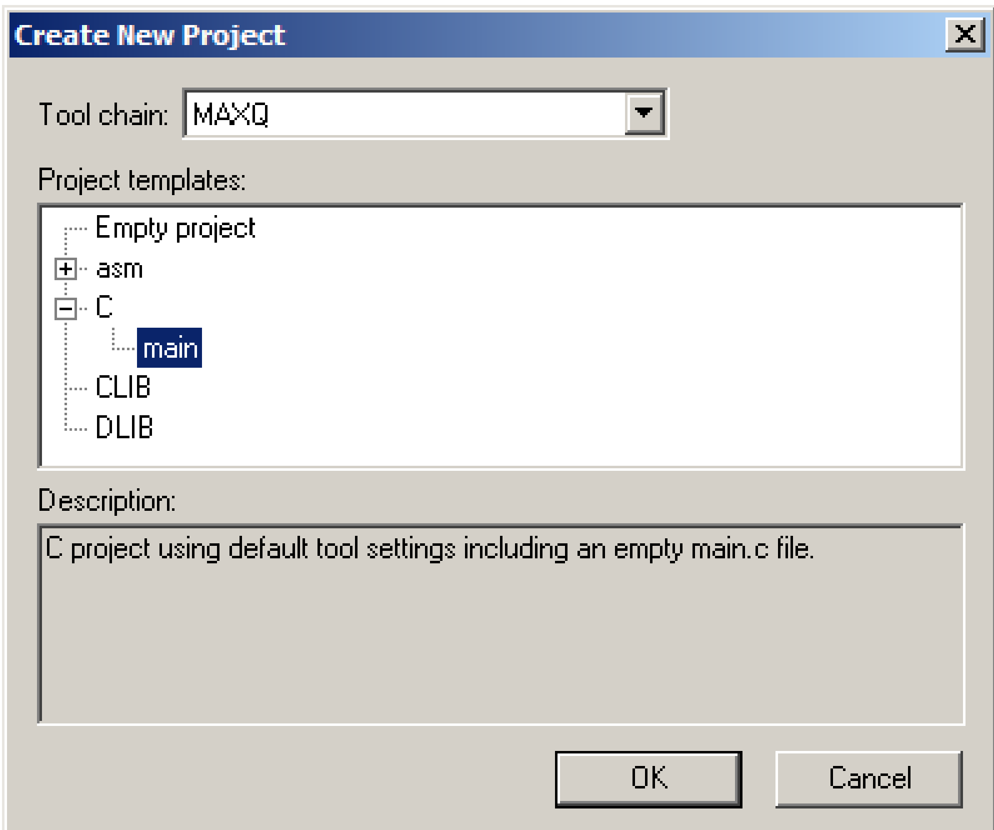

Figure 4. IAR New Project Wizard

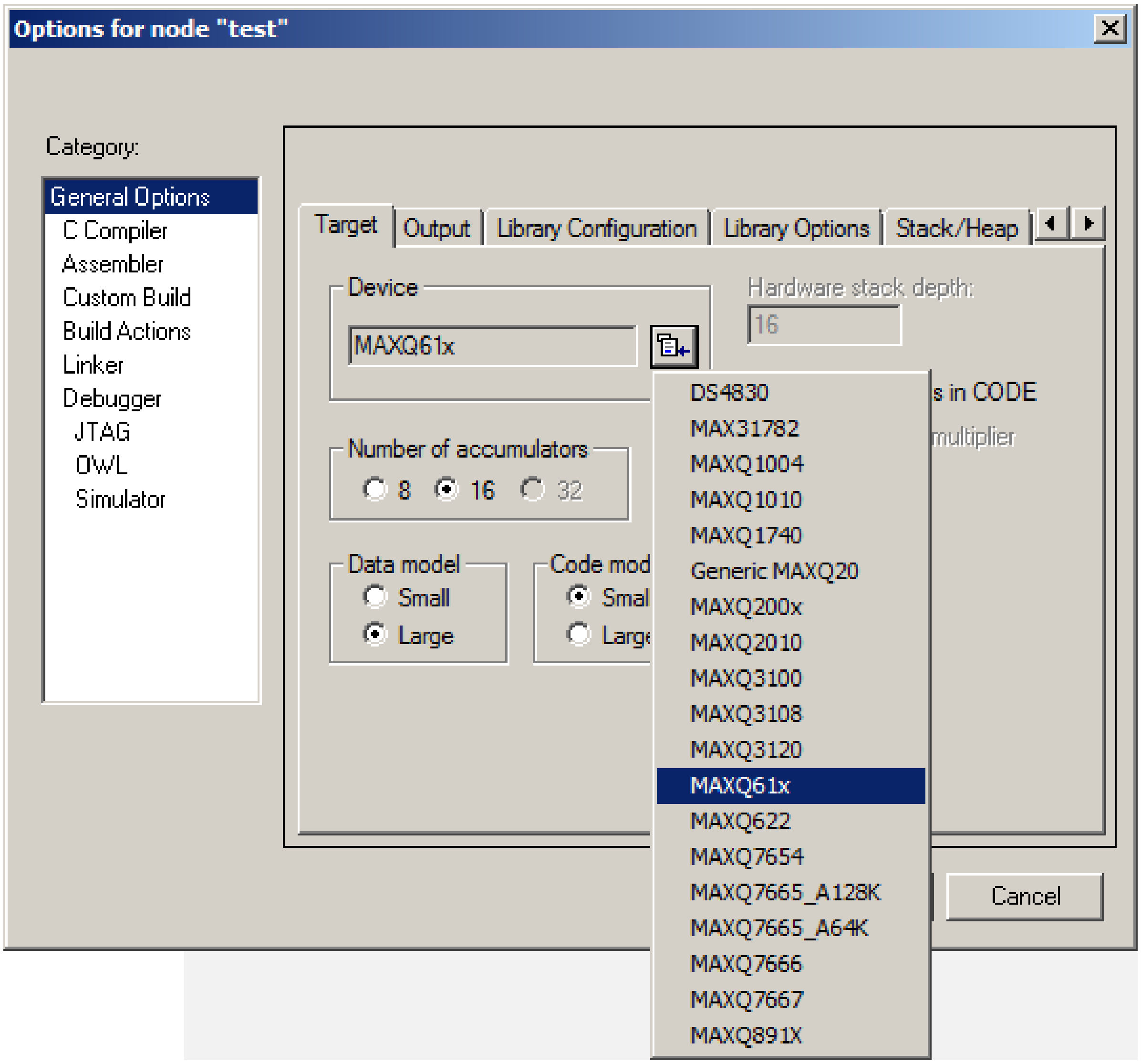

Figure 5. IAR Project Configuration

Select the **Debugger** category and ensure that **Driver** is set to **JTAG**. Next, select the **JTAG** subcategory and enter in the appropriate **COM port** for your USB-to-JTAG/1-Wire Adapter. This can be found by finding the Adapter under Window's **Device Manager** (Figure 6).

The sample projects are included in the workspace **maxq61xevkit.eww** and can be viewed in the **Workspace** window. Each project in the workspace should be configured to match the MAXQ610 by following the above steps. The projects are now ready to be compiled, loaded, and debugged on the EV kit.

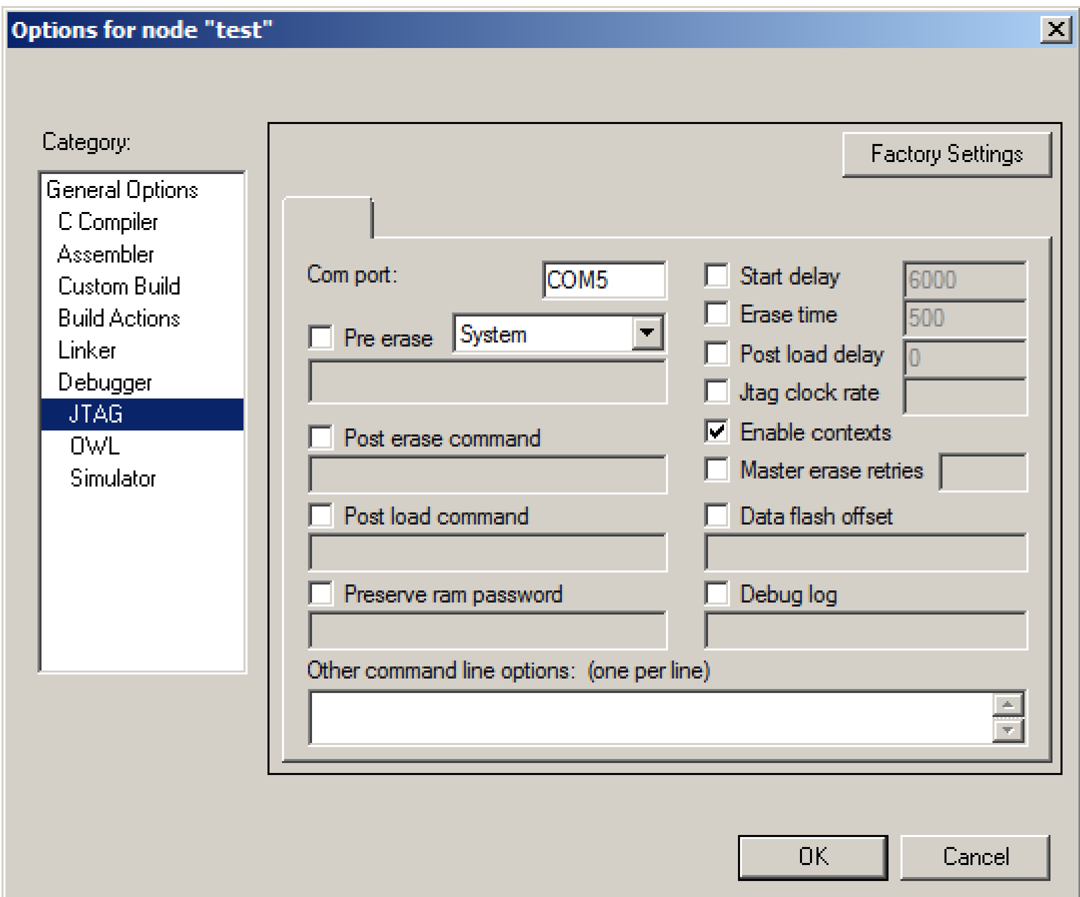

Figure 6. IAR JTAG Settings

Debugging with IAR

Open the **gpio** project from the **Workspace** menu and ensure that the project settings described above have been properly configured. To view the source code for the project, simply double click **gpio.c**. The file **isr.c** is not used in this project, but contains the interrupt callback functions for other projects included with the EV kit. To begin debugging the project, click the **Debug** button or press **Ctrl+D**. Doing so automatically compiles the source code and loads it onto the MAXQ610. The default debug settings automatically place a breakpoint at the main function (Figure 7).

From here, you can step through the program using the functions on the **Debug** toolbar. To set more breakpoints throughout the code, double-click in the margin to the left of the line where you want the program to break (Figure 8).

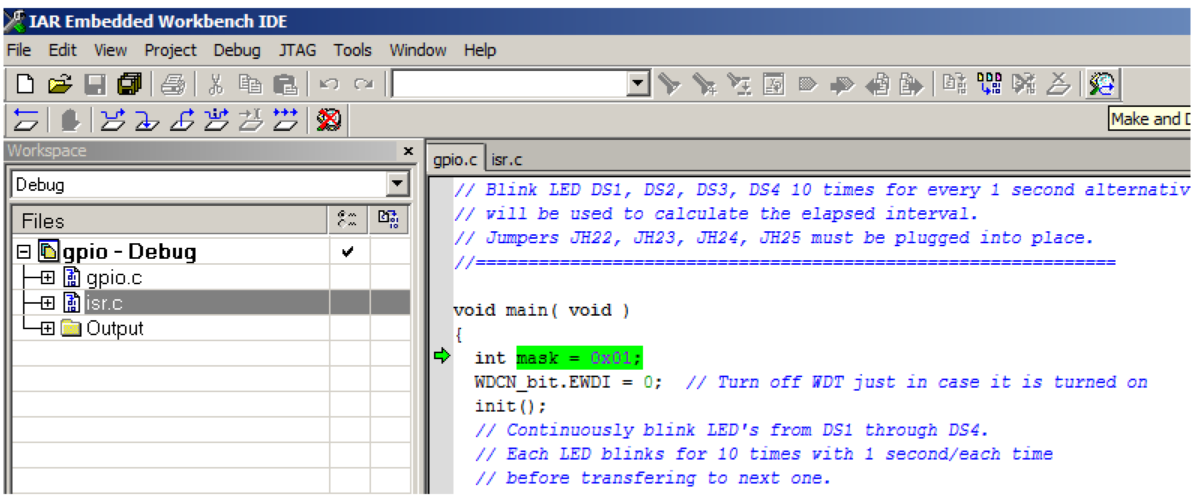

Figure 7. IAR Debugging

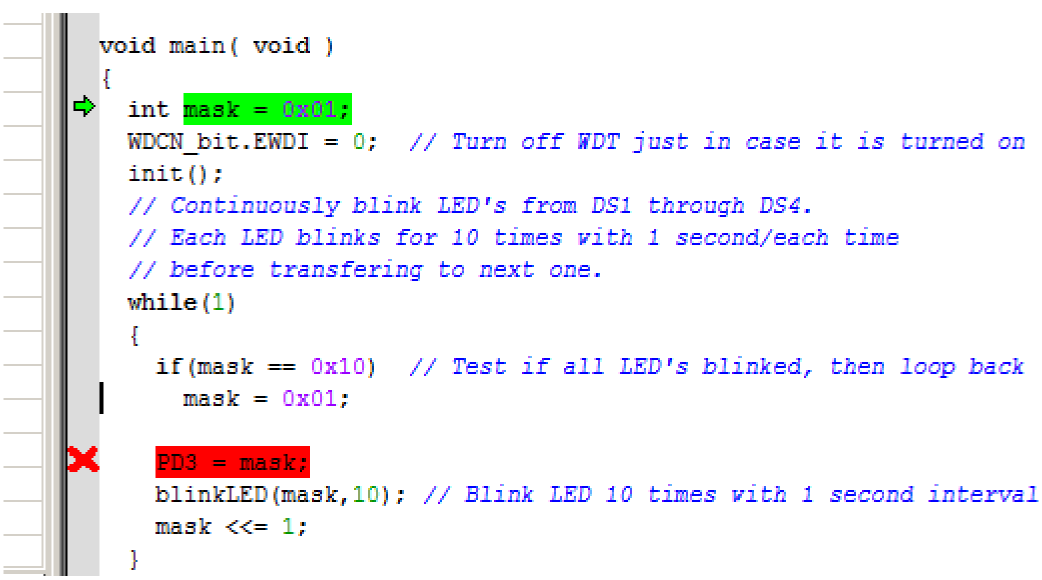

Figure 8. IAR Breakpoints

The **gpio** example uses a timer on the MAXQ610 to blink four LEDs. The first four pins of Port 3 are wired to these LEDs, and can be manipulated by the software. By shifting the mask variable, the position of the high bit moves through the mask to the bit for each LED (Figure 6). The PD3 register controls the direction of the pins on Port 3. Setting these bits to one configures them for output and allows the voltage to be driven low to turn on the LED.

A timer in the MAXQ610 is then used to control the blink rate of the LEDs. The timer is initialized to count at a constant rate (Sysclk/256) from 0 up to 0xB71B. The default Sysclk is 12MHz, making the timer raise its flag every second (Figure 9).

In the blinkLED() function, the mask is used to toggle one of the LEDs count number of times. Setting the bits of the P03 register to zero turns on the LED. Raising the bits to one turns off the LED (Figure 10).

IAR allows the user to view variable and register values while debugging. To watch a register or variable, right-click on the expression and select **Add to Watch**. When execution has been halted by breakpoint or pressing the **Break** button, these values are updated and can be changed by the user (Figure 11). Registers can also be viewed by selecting the **View** menu and clicking **Register**.

```
//=======================================
// Timer0_init: Init all timer 0 registers
// Input : None
// Output: TB0CN = 0, TB0V = 0, TB0C = 0, TB0R = 0xB71B
//=======================================

void Timer0_init(void)
{
  TB0V = TB0C = 0;
  TB0CN = 0x400; // Divide Sysclk by 256
  TB0R = 0xB71B; // Every 1 second when Sysclk = 12Mhz
}
```

Figure 9. Timer Initialization

```
void blinkLED(int mask, int count)
{
  int i;
  for(i = 0; i < count; i++)
  {
    do
    {
      PO3 = mask;                // Turn off LED
    }while(!TB0CN_bit.TFB);   // Wait for Timer0 flag

    TB0CN_bit.TFB = 0;          // Reset Timer0 flag

    do
    {
      PO3 = 0x00;               // Turn on LED
    }while(!TB0CN_bit.TFB);

    TB0CN_bit.TFB = 0;          // Reset Timer0 flag
  }
}
```

Figure 10. blinkLED() Function

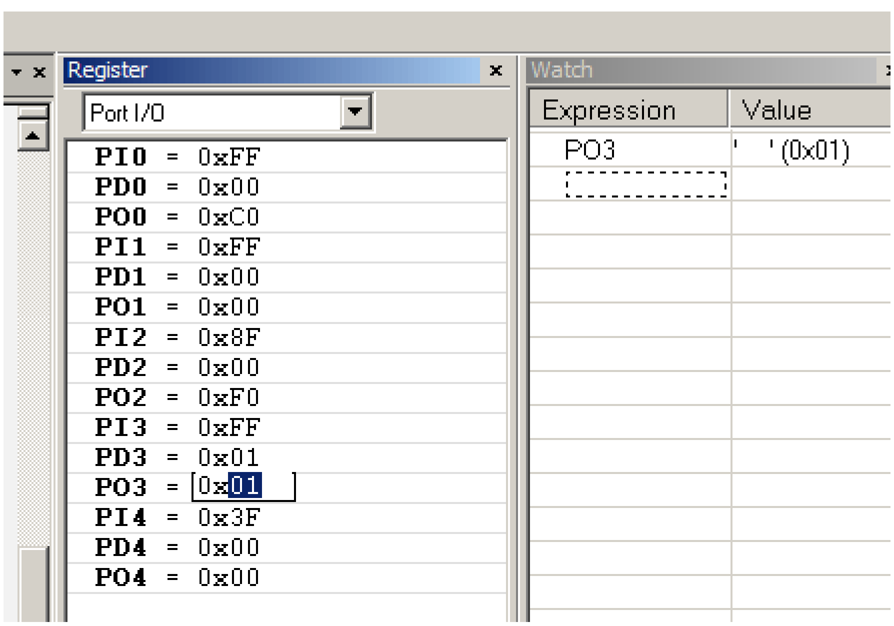

Figure 11. IAR Register and Watch

MAX-IDE

MAX-IDE is the primary IDE used to program the MAXQ610 using assembly code. The latest version of MAX-IDE can be obtained from the MAXQ Development Tools webpage at **www.maximintegrated.com/MAXQ_tools**. Once installed, open MAX-IDE and create a new project (Figure 12).

Select **MAXQ JTAG** under the **Device** menu and open the **Options** menu. From this menu, enter the appropriate COM port for the USB-to-JTAG/1-Wire Adapter. For the **Device Configuration File**, locate **MAXQ61x.cfg** in the EV Kit Resource Package (Figure 13).

The project is now configured for the MAXQ610. Assembly files can be added to the project and loaded onto the EV kit using the IDE. The included examples come with the project files inside of the **bin** directory and the assembly source files are included in the **src** directory. After configuring the project with the steps above, the debugger is ready to assemble the code and load it onto the MAXQ610.

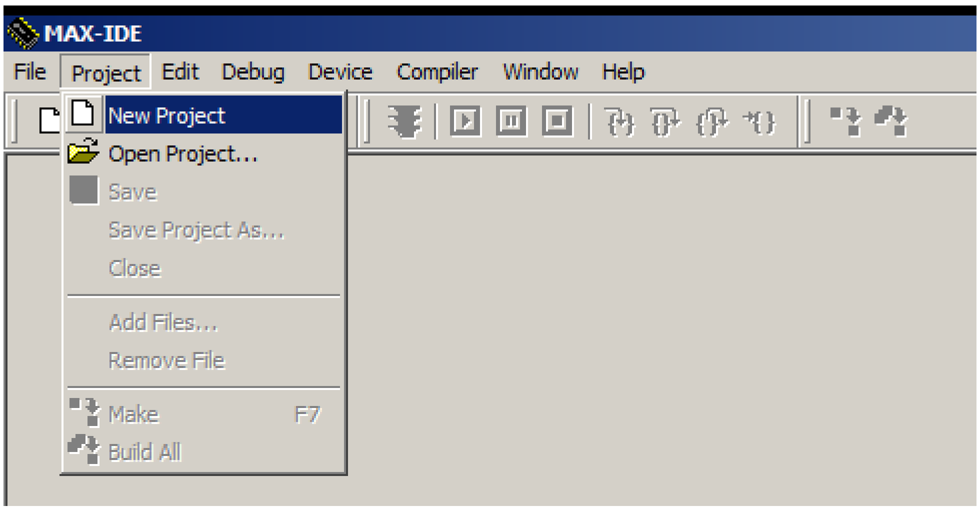

Figure 12. MAX-IDE Project

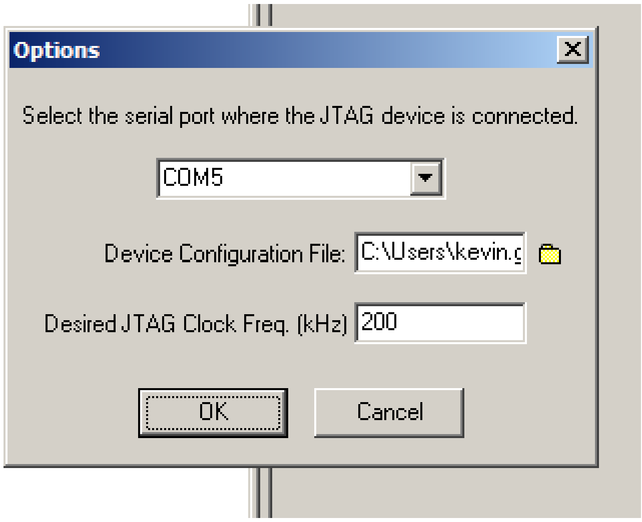

Figure 13. MAX-IDE Device Options

Debugging with MAX-IDE

Using MAX-IDE to debug an application is similar to using IAR. Open the **gpio** project in MAX-IDE and the corresponding source code should open with the project. This example is the same as the previous example, only it is written in MAXQ assembly instead of C. Once the project is open, place a breakpoint by clicking in the margin next to the **Main** tag. Unlike IAR, MAX-IDE does not automatically place a breakpoint at **Main** (Figure 14).

To start debugging, simply click the run button, and use the **Debug** toolbar to step through the program.

To view the different register values, click the **Window** menu and select **Show | Registers**. Doing so allows you to view the values in all of the registers and alter them when the execution is halted (Figure 15). Similarly, you can view and alter the memory contents by selecting **Window | Show | Memory**.

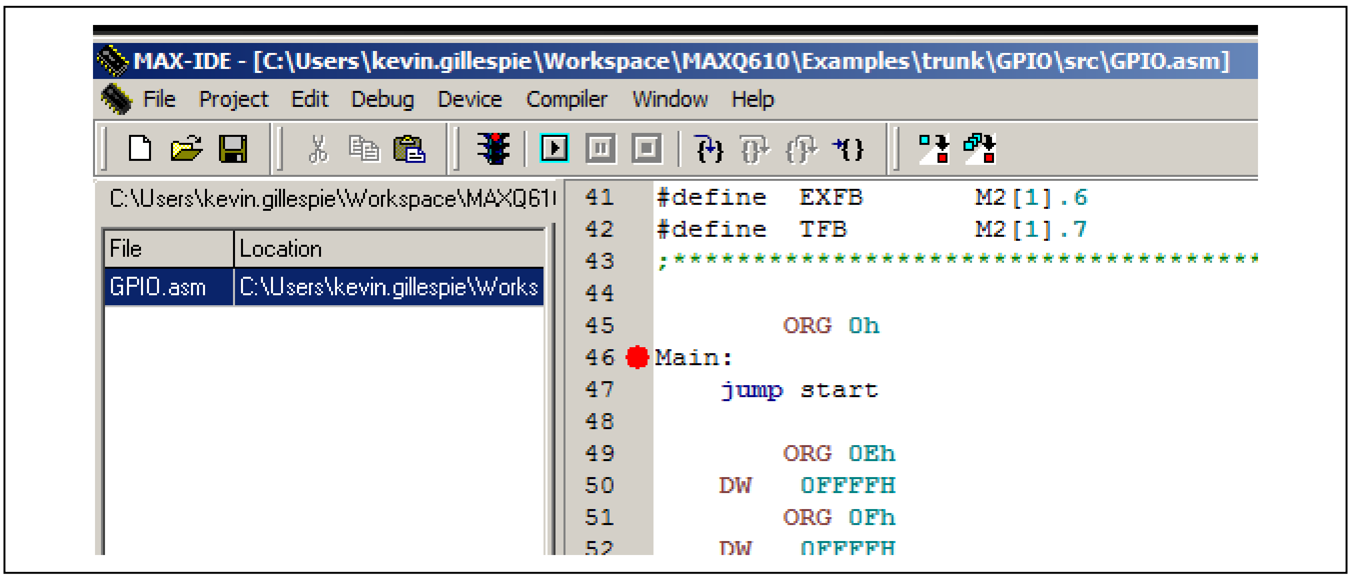

Figure 14. MAX-IDE Breakpoint

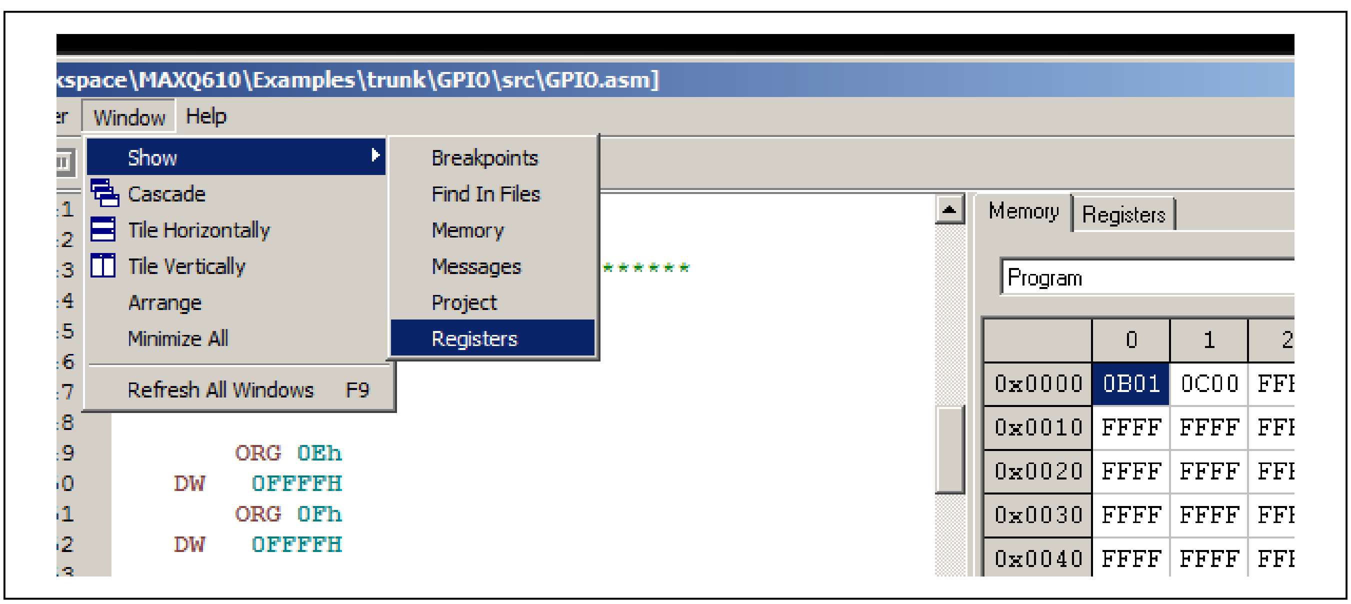

Figure 15. MAX-IDE Registers and Memory

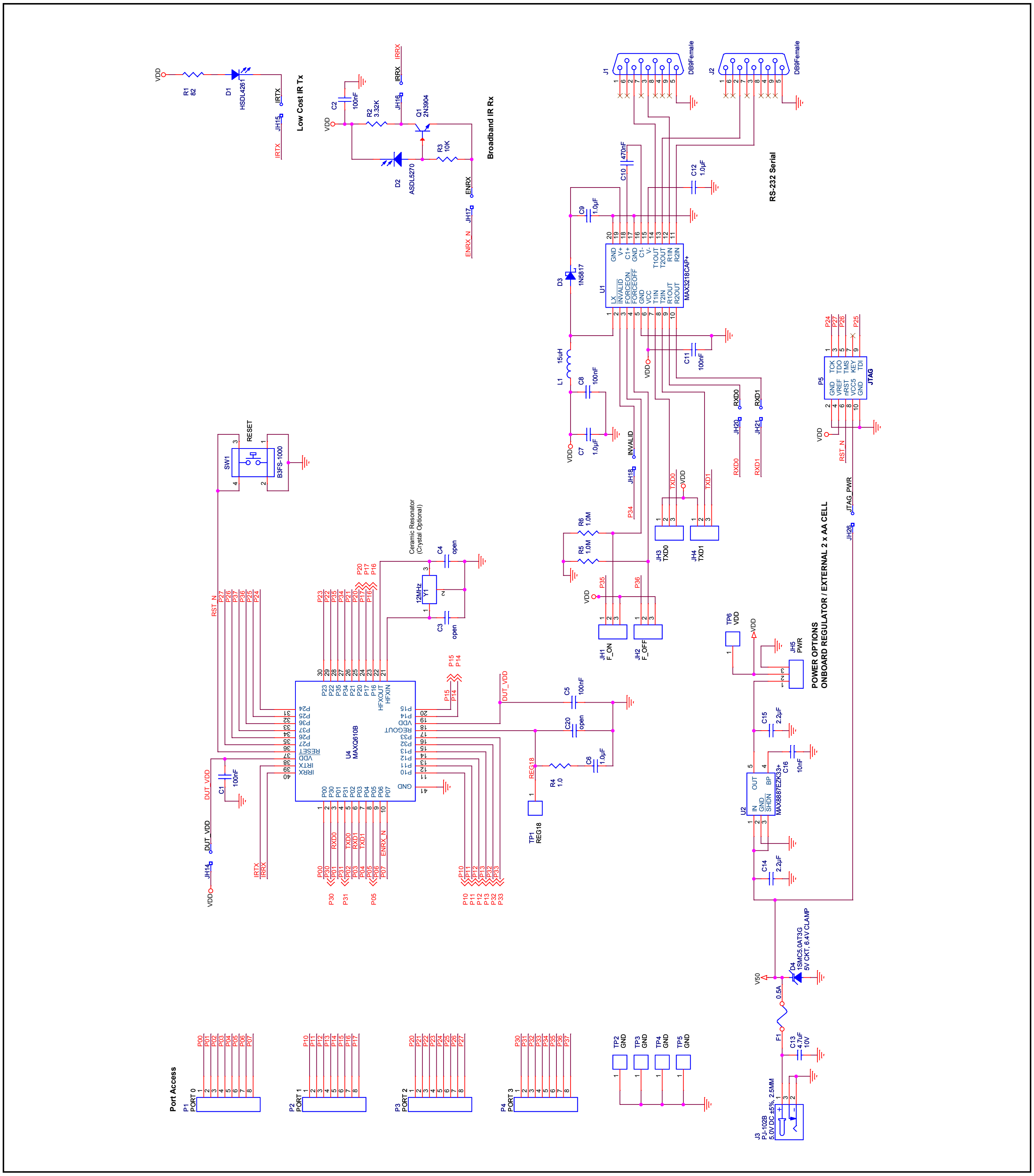

Figure 16a. MAXQ610 EV Kit Board Schematic—MAXQ, IR, RS-232 (Sheet 1 of 2)

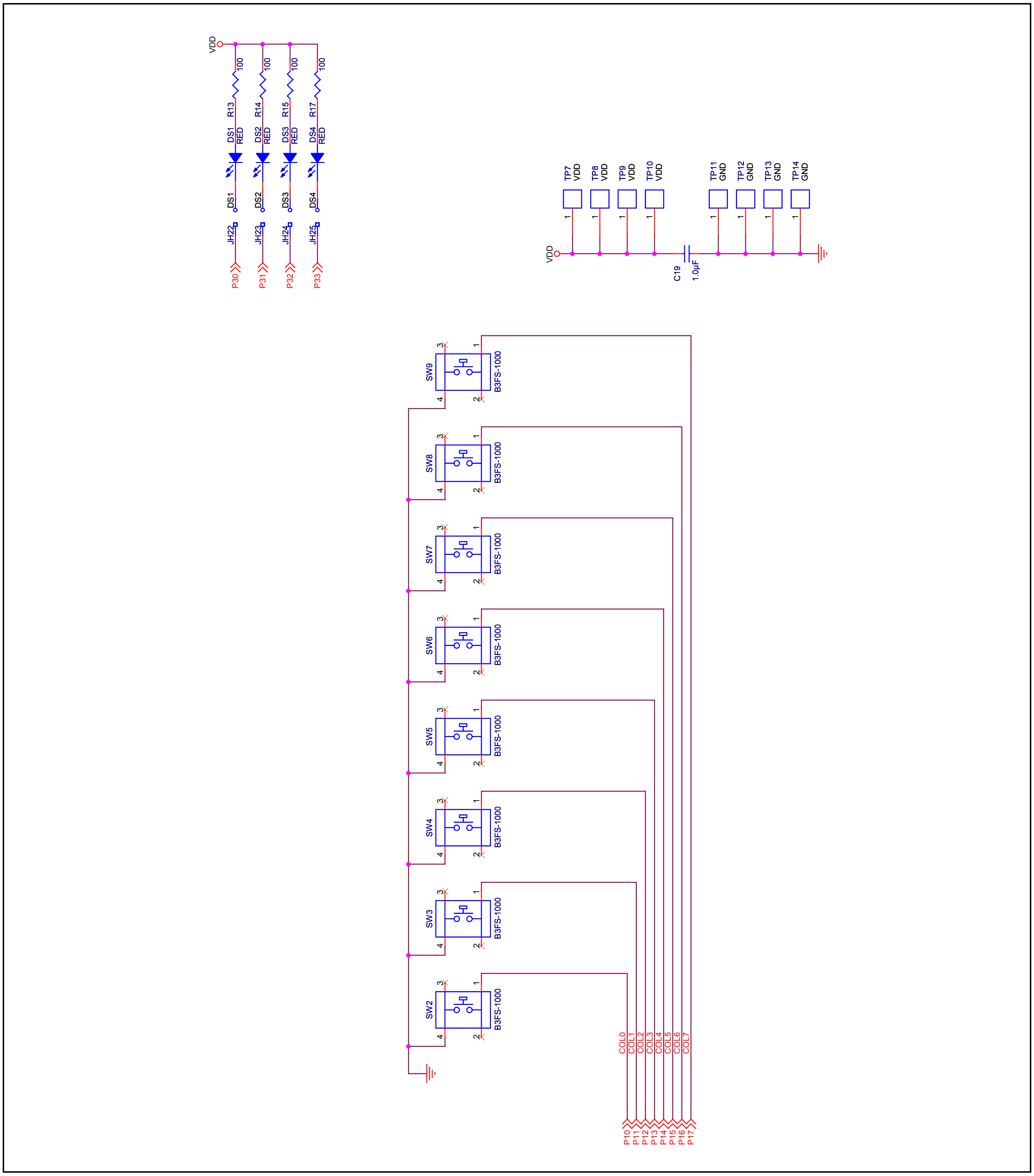

Figure 16b. MAXQ610 EV Kit Board Schematic—Pushbuttons (Sheet 2 of 2)

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C5, C8, C11	5	0.1µF, 16V X7R ceramic capacitors (0603)
C3, C4	2	Capacitors, DNI
C6, C7, C9, C12, C19	5	1.0µF, 16V X7R ceramic capacitors (0805)
C10	1	0.47µF, 16V X7R ceramic capacitor (0603)
C13	1	4.7µF, 10V X7R ceramic capacitor (0805)
C14, C15	2	2.2µF, 16V X7R ceramic capacitors (0805)
C16	1	10,000pF, 16V X7R ceramic capacitor (0603)
C20	1	Capacitor, DNI
D1	1	High-power AlGaAS IR (870nm) T-1 3/4 (5mm) LED
D2	1	PIN photodiode 60°
D3	1	1A, 20V Schottky diode (DO-41 case)
D4	1	1500W, 5.0V SMC TVS Zener Unidir
DS1–DS4	4	660nm super red LEDs (water clear lens) (SMD 1206)
F1	1	0.500A, 125V fast PICO-SMD fuse
J1, J2	2	Right-angle, 9-position connectors, female socket receptacle (gold)
J3	1	2.5mm power jack PCB circ
JH1–JH5	5	3-position 0.100in single-strip connectors
JH14–JH18, JH20–JH26	12	2-position 0.100in single-strip connectors
L1	1	15µH SMD power inductor
P1–P4	4	8-position 0.100in single-strip connectors

DESIGNATION	QTY	DESCRIPTION
P5	1	10-position 0.100in dual-strip connector
Q1	1	General-purpose small-signal npn transistor (40V, 200mA TO-92)
R1	1	82Ω ±5%, 1/4W SMD resistor (1206)
R2	1	3.32kΩ ±1%, 1/10W SMD resistor (0603)
R3	1	10kΩ ±1%, 1/10W SMD resistor (0603)
R4	1	1.0Ω ±1%, 1/10W SMD resistor (0603)
R5, R6	2	1.0MΩ ±1%, 1/10W SMD resistors (0603)
R13–R17	4	100Ω ±1%, 1/10W SMD resistors (0603)
SW1–SW9	9	SPST normally open pushbutton switches
TP1–TP14	14	Multipurpose white PC test points
U1	1	1µA supply current, 1.8V to 4.25V powered RS-232 transceiver with AutoShutdown™ (20 SSOP) Maxim MAX3218CAP+
U2	1	Low-dropout, 300mA linear regulator in SOT23 (5 SOT23) Maxim MAX8887EZK33+
U4	1	16-bit microcontroller with infrared module (40 TQFN) Maxim MAXQ610B-0000+
Y1	1	12.00MHz ceramic resonator with capacitor
—	—	PCB: MAXQ610 EV KIT

AutoShutdown is a trademark of Maxim Integrated Products, Inc.

Ordering Information

PART	TYPE
MAXQ610-KIT#	EV Kit

#Denotes a RoHS-compliant device that may include lead that is exempt under the RoHS requirements

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/08	Initial release	—
1	2/11	Updated *Features*, changed "serial" to "USB"	1, 4, 7
2	7/13	Changed reference of "JTAG board" to "USB-to-JTAG/1-Wire Adapter" per board revision change	1, 5, 6, 7
3	10/13	Updated Figure 1, Table 1, *Component List*, and schematics; added the *Getting Started* section	All

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

