

# Interfacing AP13192USLK with Microcontroller Student Learning Kits

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**Applicable part numbers:**  
[PB/AP/CSM9]S08QG8SLK  
DEMO9S08QG8  
[PB/AP/CSM9]S12C32SLK  
[PB/AP/CSM9]S12DT256SLK  
[PB/AP/CSM9]S12XDT512SLK

## 1 Introduction

This document guides you through the steps necessary to begin development with the AP13192USLK Radio Frequency (RF) transceiver, Freescale Project Board, and select Student Learning Kits (or equivalent microcontroller evaluation boards). The hardware setup section will walk you through configuring the RF-Transceiver, project board, application module. The software setup section assists you in running a demonstration wireless UART application. This application uses SMAC protocol and includes all necessary CodeWarrior project files.

Refer to the project board user guide, application module user guide, and CodeWarrior documentation available at [www.freescale.com/universityprogram](http://www.freescale.com/universityprogram) for additional resources.

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## 2 Naming Conventions

For the purposes of this document the following terminology will refer to these interchangeable parts numbers.

APS08QG8SLK	PBS08QG8SLK, CSM9S08QG8SLK, DEMO9S08QG8SLK
APS12C32SLK	PBS12C32SLK, CSM9S12C32SLK
APS12D	APS12DT256SLK, PBS12DT256SLK, CSM9S12DT256SLK APS12XDT512SLK, PBS12XDT512SLK, CSM9S12XDT256SLK
MCU Project Board	PBMCSULK, MCUSLK (identified by on-board labels such as MCU PROJECT BOARD – 2 and MCU PROJECT BOARD)

## 3 Software Setup

In order to test this application you need:

- Two microcontroller boards with Wireless UART project loaded into memory.
- Two MC13192 transceiver boards connect to microcontroller boards
- Two serial cables.
- Two PC's with one serial port or one PC with two serial ports.

Once you have all the necessary, follow the steps below:

- .
- Connect the serial cable between demo board and the PC.
- Launch Windows HyperTerminal. With the following port settings:
  - Bits per second: 38400.
  - Data bits: 8.
  - Parity: None.
  - Stop bits: 1.
  - Flow control: None.
- Press reset button on each board. On each HyperTerminal you will see the message “Wireless Typematic Demo”
- Type over one HyperTerminal, all characters typed will be displayed on the other HyperTerminal window and vice versa.

## 4 Hardware Setup

### 4.1 Configuring the AP13192USLK Board

Set one jumper on option header JP1 and one jumper on option header JP2 between the position 1-2 as illustrated in Figure 1.

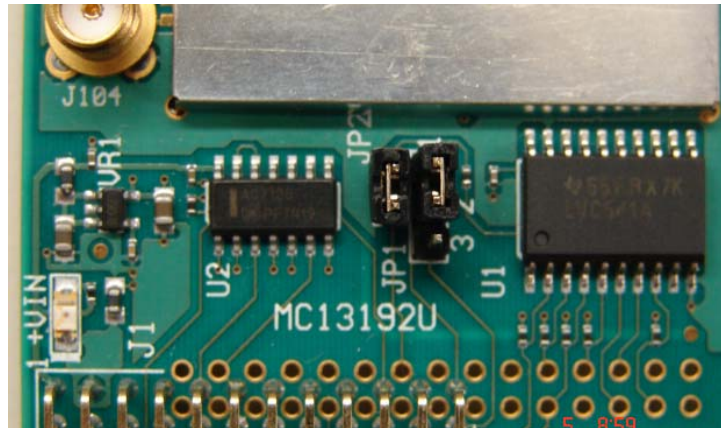


Figure 1 - AP13192USLK Jumper Settings

Connect the AP13192USLK board on J7 connector of the Freescale Microcontroller Project Board. Make sure the AP13192USLK connector pin 1 aligns with MCU PORT pin 1 shown in Figure 2 .

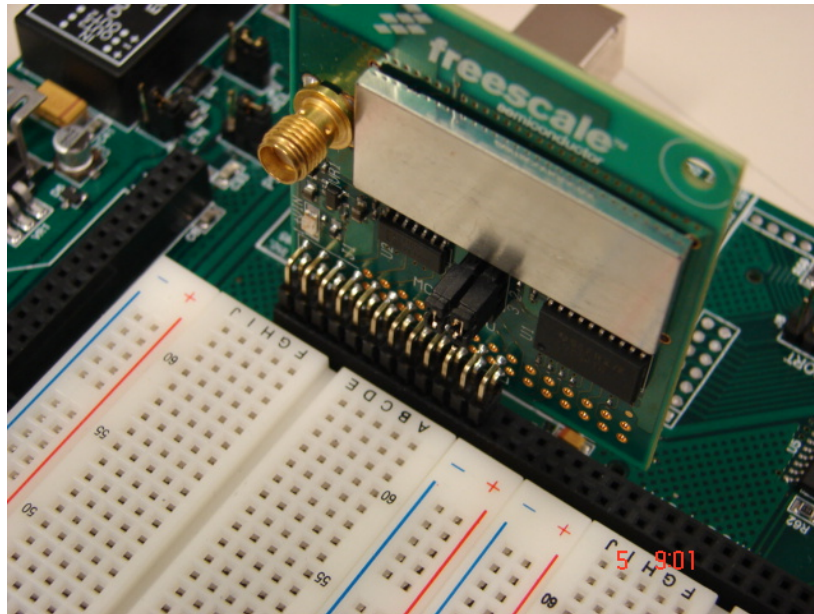


Figure 2 - Connecting AP13192USLK to Freescale Project Board

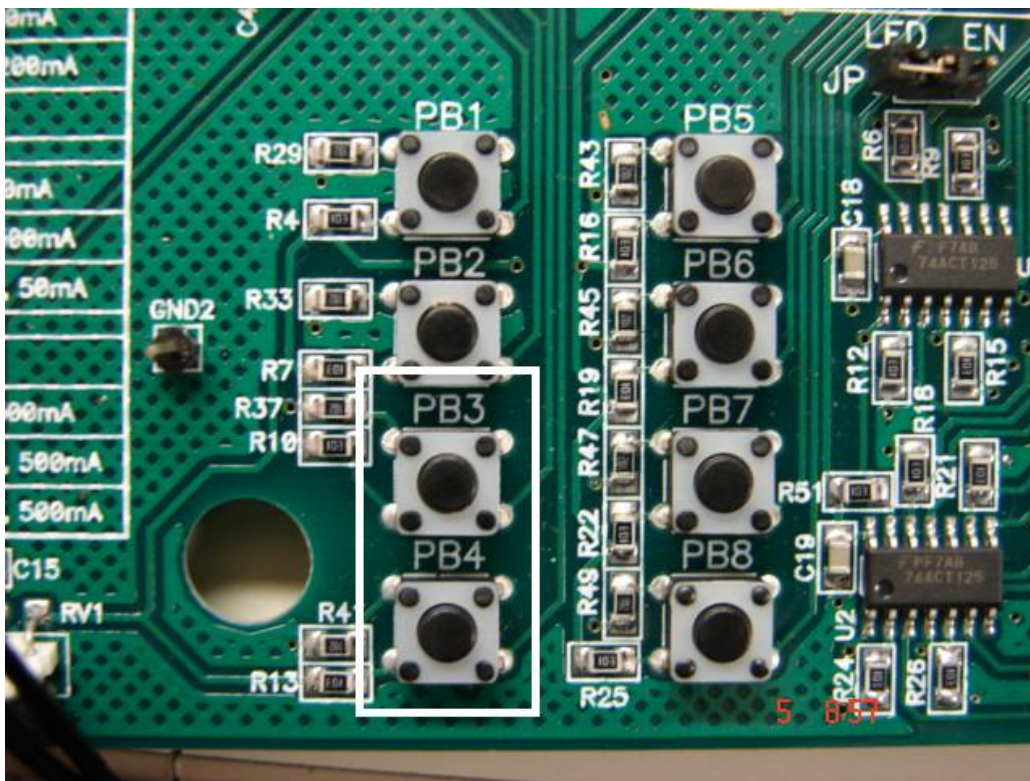
## 4.2 Defining Test Mode Buttons

The Test Mode Application uses two push buttons. One of them changes the mode and the other changes the channel. For S08QG8 boards you can use the buttons placed on the S08QG8 board (not the project board) for the following functions:

**Table 1. APS08QG8 PushButton Function**

Pushbutton Label	Effect
SW1	Changes the Mode
SW2	Changed the Channel

For all the others boards (S12D and S12C families) you should use the push buttons placed on the Freescale MCU Project Board. These push buttons are PB3 and PB4 as pictured in



**Figure 3 Project Board Pushbuttons for use with HCS12 Family of MCU's**

The function of each push buttons is as follow:

**Table 2 Project Board PushButton Function**

Pushbutton Label	Effect
PB3	Changes the Mode
PB4	Changed the Channel
<i>Only for use with HCS12 Family of Microcontroller Boards</i>	

### 4.3 Configuring the Freescale MCU Project Board

Make sure the SS\* option header on MCU PROJECT BOARD 2 is unconnected as pictured in Figure 4. This configuration applies for all previous board generations as well. Refer to the Project Board user guide for legacy board naming conventions.

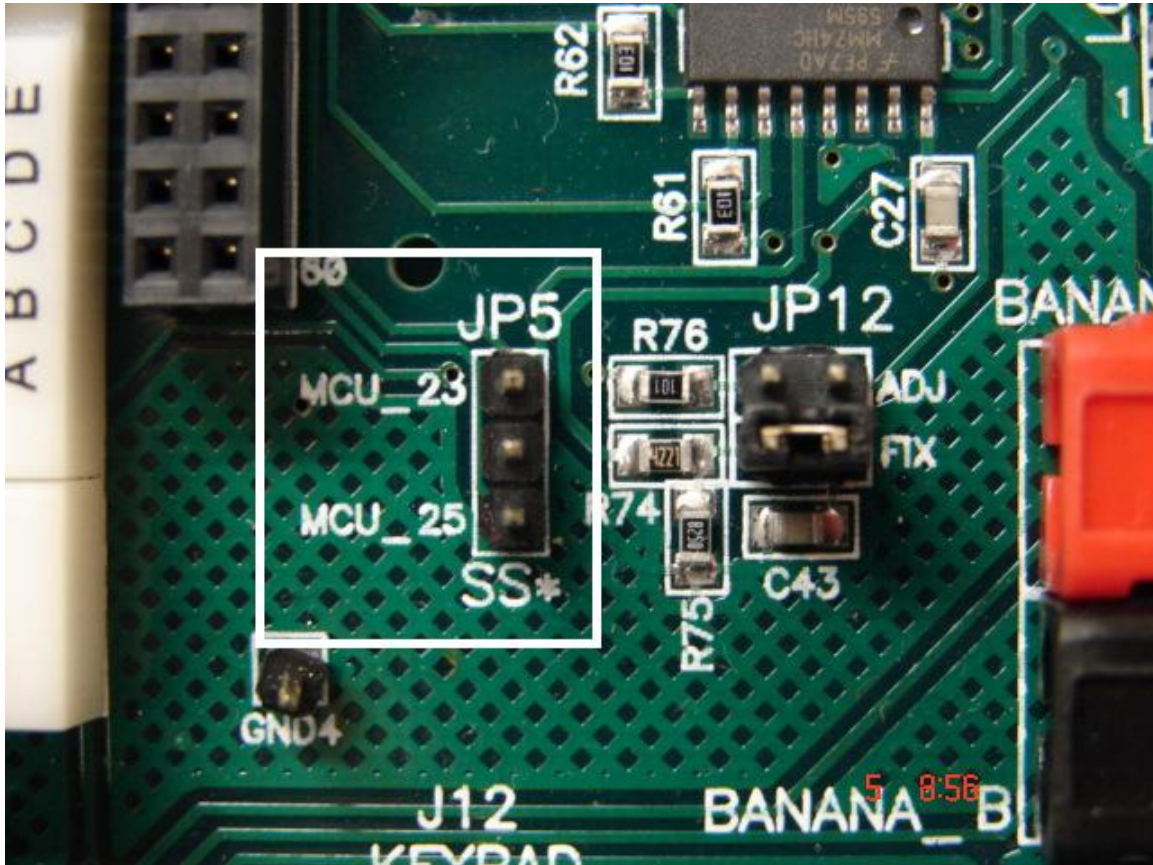


Figure 4 Project Board Jumper SS\*

- ◆ PSI\_EN option header should be unconnected.
- ◆ PSEL\_A option header should be set to VIN option.
- ◆ PSEL\_B option header should be set to JP1 option.
- ◆ USB SPEED option header should be set to HIGH.

## 4.4 Connections between APS08QG8SLK and AP13192USLK boards

### Problem Found:

The APS08QG8SLK PCB has some pins on MCU PORT connector routed to the same pin (IRQ pin). It causes a bad performance because these pins manage some signals of AP13192USLK board and these signals need to be handled separately. Such signals are: RESET, RTXEN and ANTCTL.

### Workaround:

To connect APS08QG8SLK board with MCU PORT you need to use a 2x16 pins connector as pictured in Figure 5. You will need to take off the pins numbered 4, 9, 11, 13 and 20 in order to isolate the RESET, RTXEN and ANTCTL signals. Remove the pins from the connection header with pliers as pictured in Figure 6.

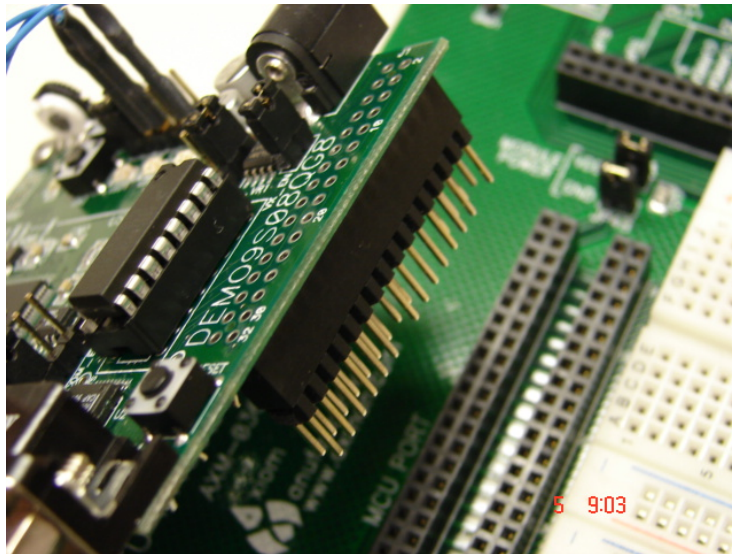
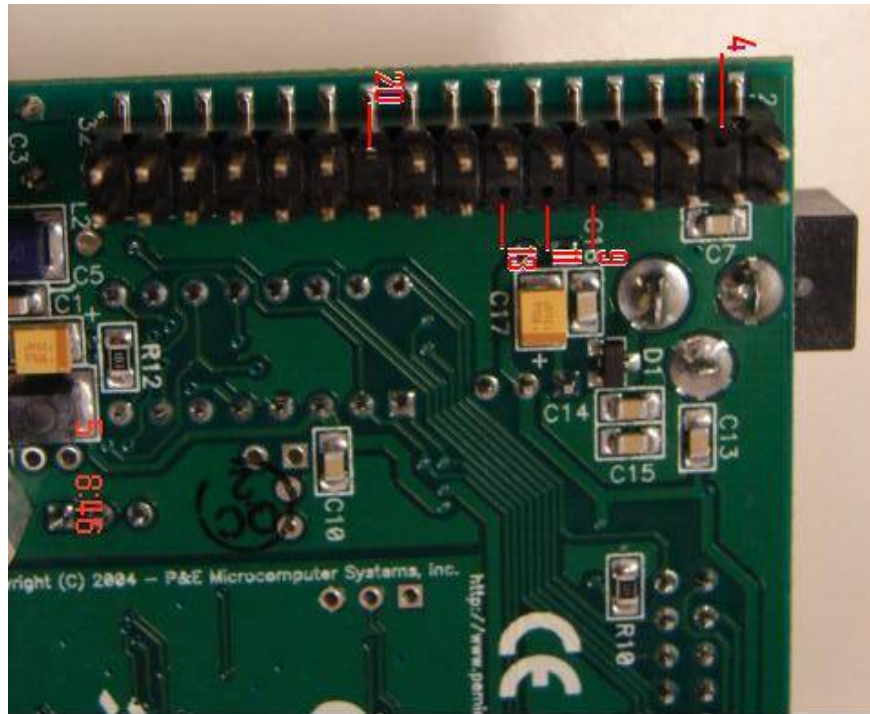
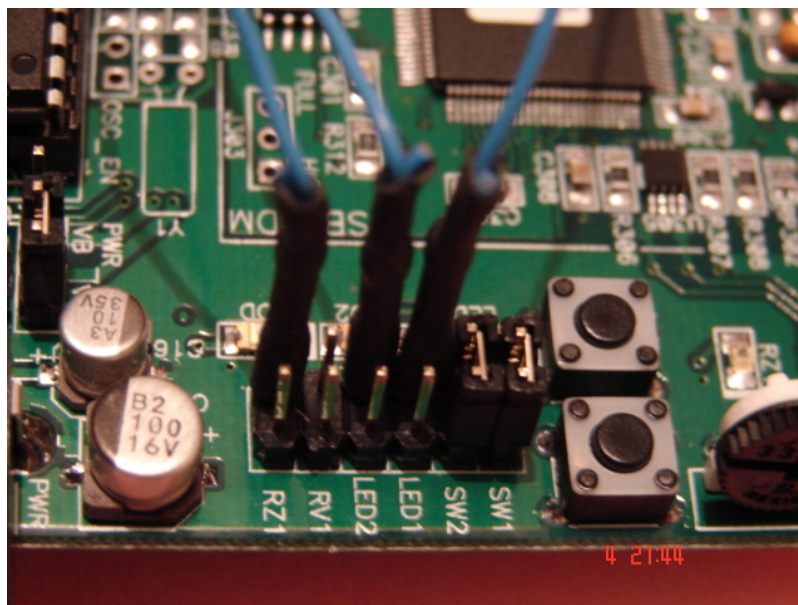


Figure 5 APS08QG8SLK with 2X16 header



**Figure 6 - APS08QG8SLK Removed pins for signal isolation**

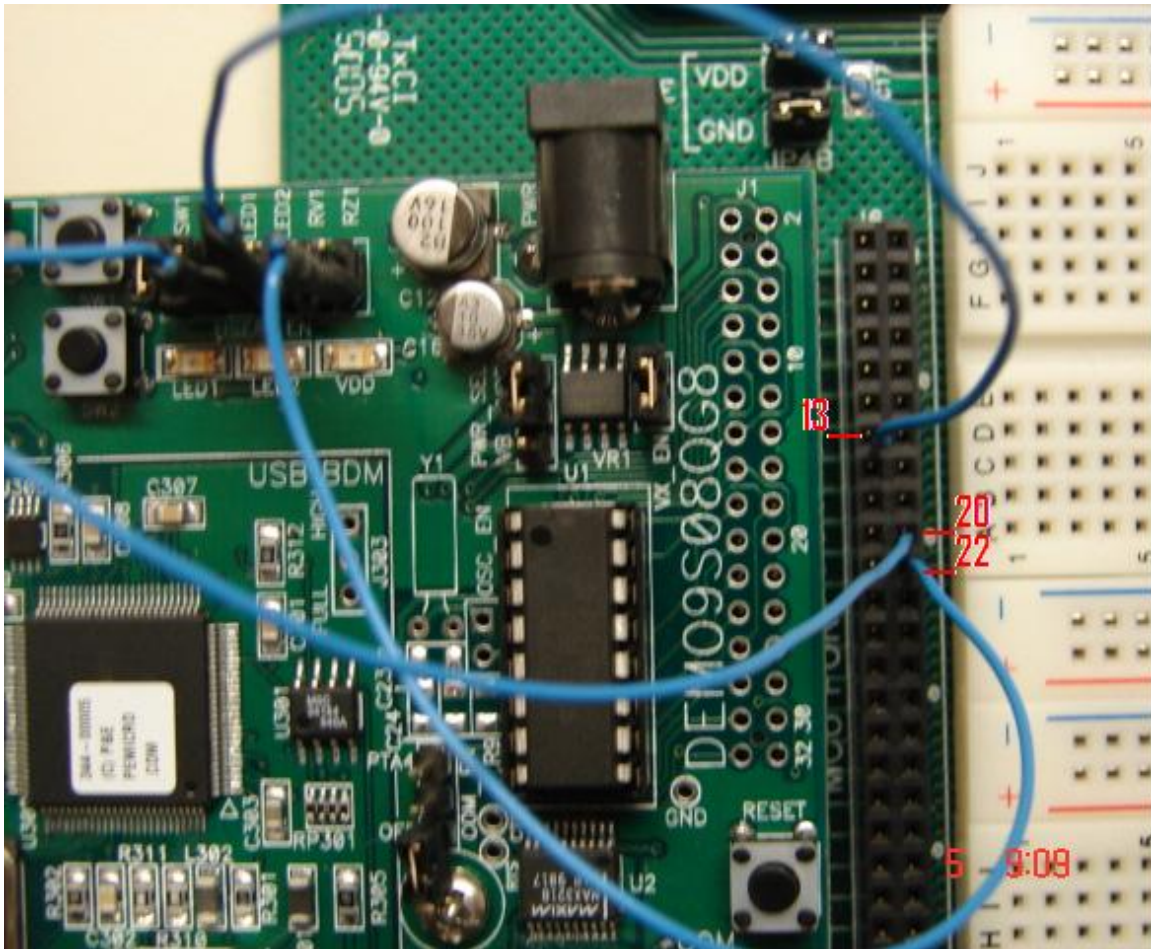
Once these pins are removed, you will need to connect three wires from the option header USER\_EN on the APS08QG8SLK board to MCU PORT connector on MCU Project Board. First, remove the jumpers LED1, LED2, RV1, and RZ1. Then connect the wires to the USER\_EN header on the pins furthest from the edge of the board as pictured in Figure 7.



**Figure 7 APS08QG8SLK USER\_EN header required jumper wires**

Once you have attached the wires to the USER\_EN header connect to the MCU Project Board MCU PORT as follows and pictured in Figure 8.

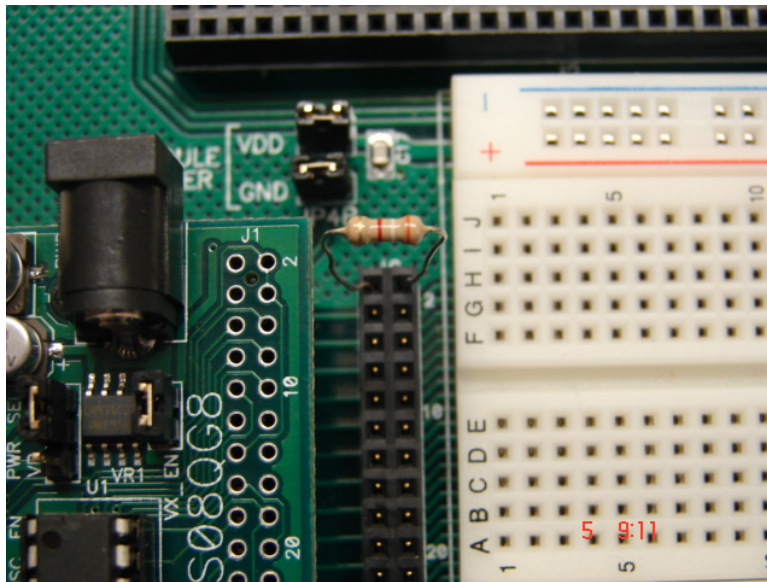
- ◆ Connect the wire attached to LED1 option header to MCU PORT pin number 20.
- ◆ Connect the wire attached to LED2 option header to MCU PORT pin number 13.
- ◆ Do not connect anything to RV1.
- ◆ Connect the wire attached to RZ1 option header to MCU PORT pin number 22.



**Figure 8 Connection of APS08QG8SLK USER\_EN wires to MCU PORT**



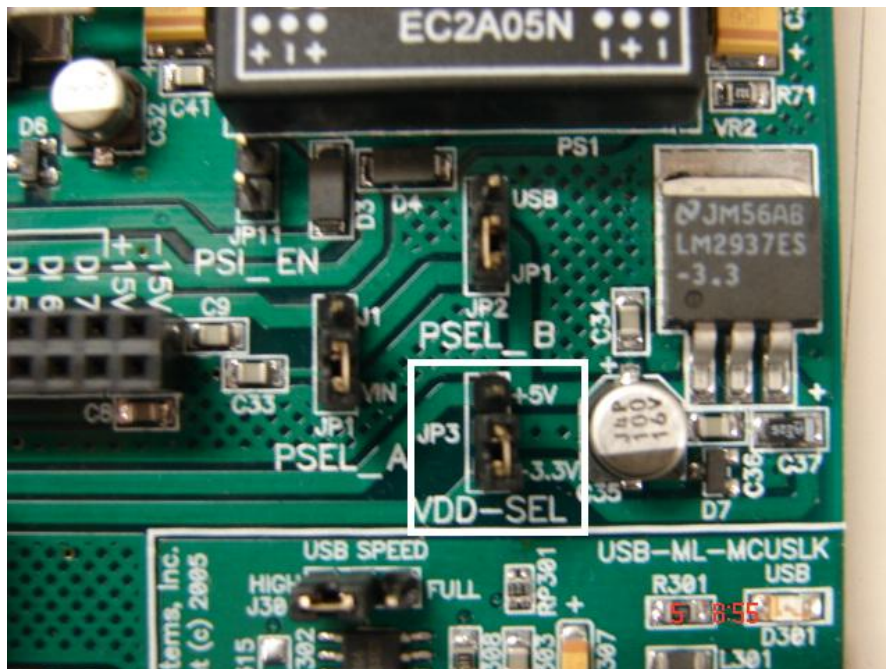
- ◆ Connect a 10K Ohms resistor between MCU PORT pin number 1 and pin number 2 as pictured in Figure 9



**Figure 9 Resistor placement on MCU PORT**

**WARNING**

Make sure the voltage supplied to VDD by MCU Project Board is +3.3 volts.  
See Figure 10



**Figure 10 MCU Project board power supply jumpers for APS08QG8SLK**

- ◆ Make sure the APS08QG8SLK connector pin 1 aligns with MCU PORT pin 1.
- ◆ Make sure all jumpers on option header FEA\_EN on MCU PROJECT BOARD 2 are unconnected as pictured in Figure 11.

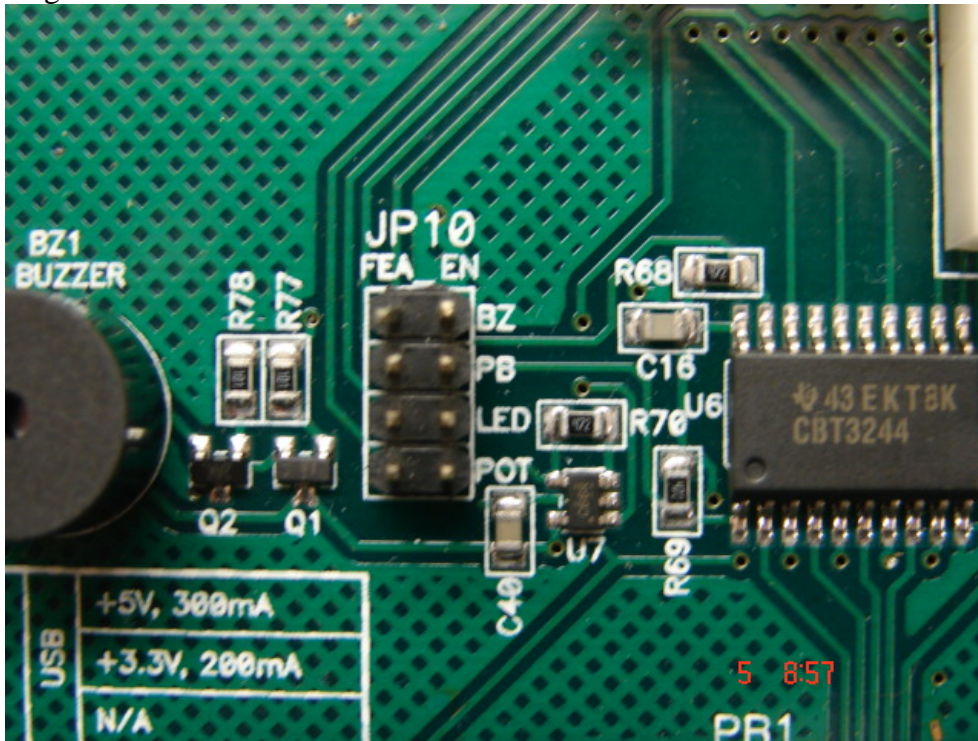


Figure 11 MCU Project Board option header FEA\_EN configurations

In order to program the device you need to plug in the USB cable into the USB connector on APS08QG8SLK board as pictured in Figure 12.

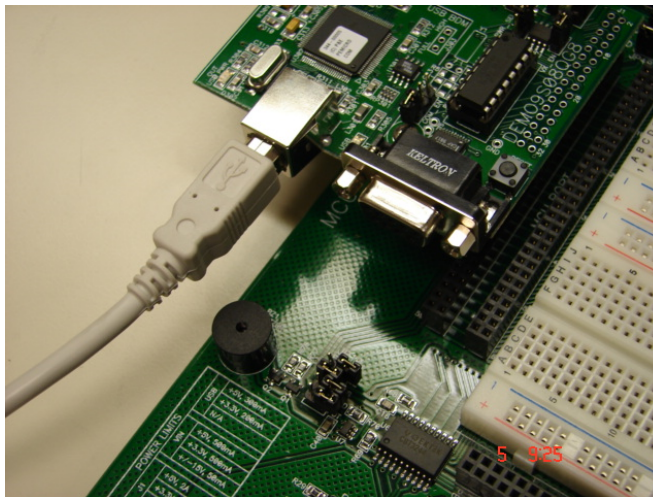


Figure 12 APS08QG8SLK USB Programming Cable Connection

## 4.5 Connections between APS12D board(s) and AP13192USLK board.

The APS12D board supports the devices MC9S12DT256 and MCS12XDT512.

### Problem found:

The microcontroller needs to manage the RTXEN and ANTCTL signals via two output pins. These two signals are mapped on the port AD, and this port is an input port only.

### Workaround:

Handle these signals via other available output pins. First, you need to connect two wires from option header (USER) on board APS12D to MCU PORT connector. To do that, remove the jumpers SW3-1 and SW3-2. Then connect the wires at the same side of label USER pictured in Figure 13.

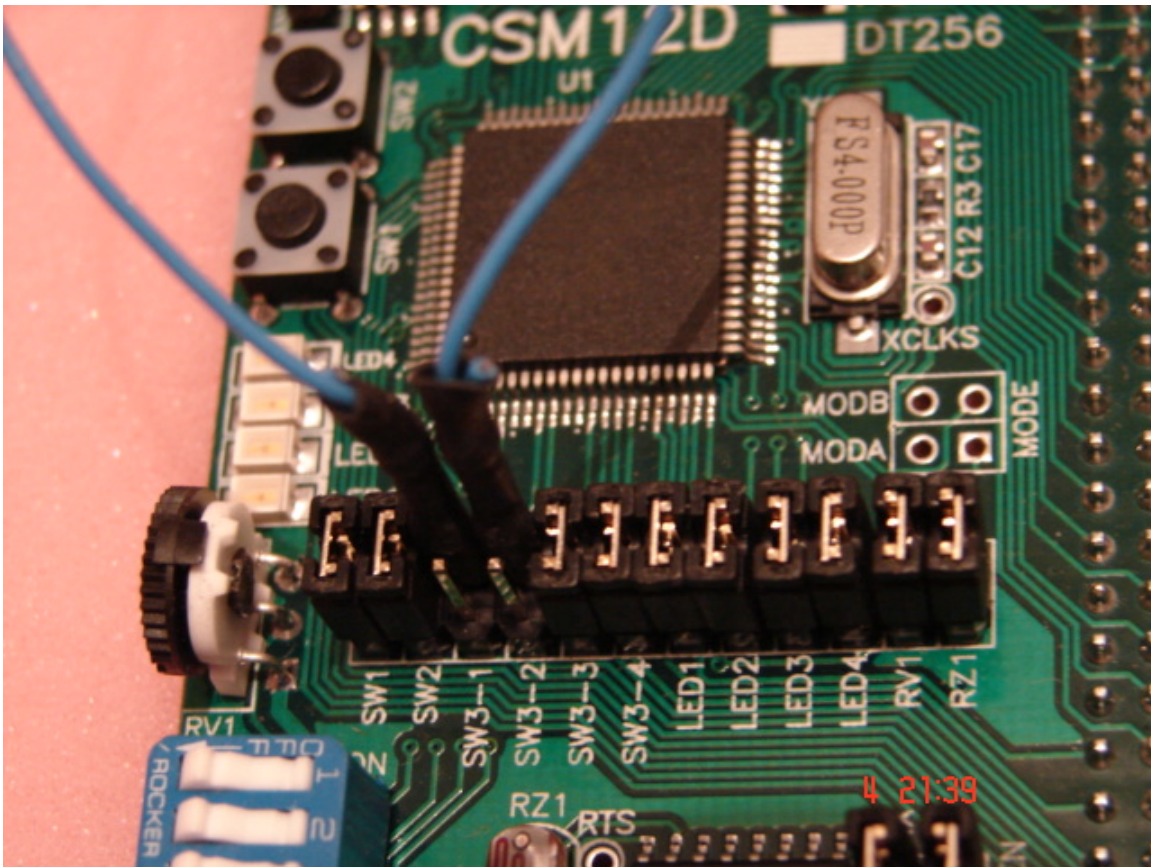


Figure 13 APS12D Hardware Configuration

Next, run the wires from the APS12D board to the MCU PORT as detailed below and pictured in Figure 14.

- ◆ Connect wire from APS12D SW3-1 option header to MCU PORT pin number 20.
- ◆ Connect wire from APS12D SW3-2 option header to MCU PORT pin number 22.

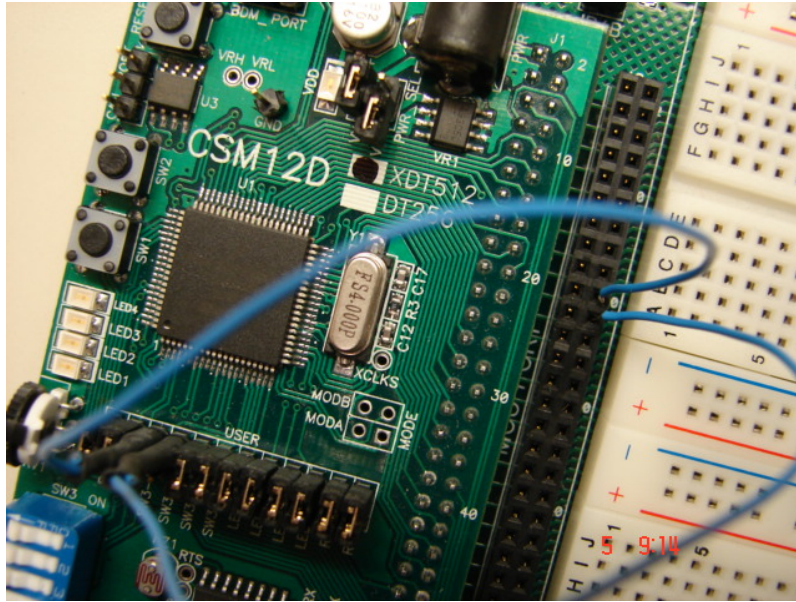


Figure 14 Wire connections from APS12D to MCU PORT

**WARNING**

Make sure the voltage supplied to VDD by MCU PROJECT BOARD 2 is +5 volts as pictured in Figure 15

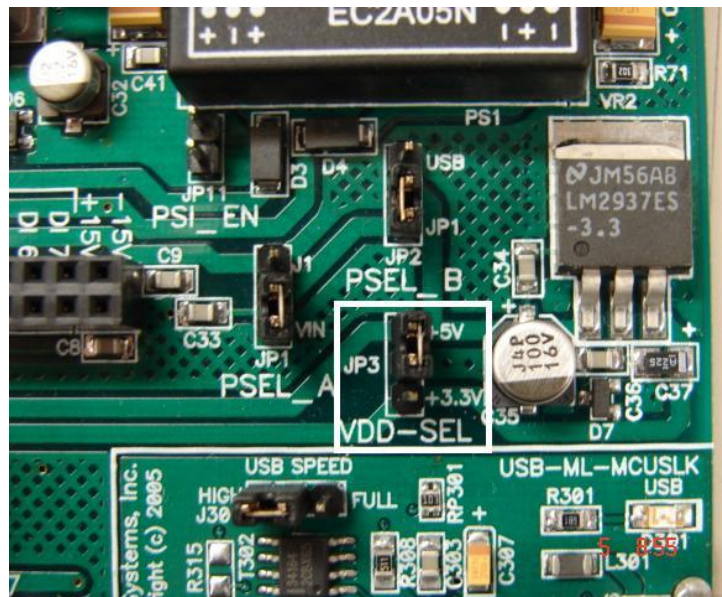


Figure 15 APS12D Power Supply Jumper Settings

- ◆ Make sure the CSM12D connector pin 1 is aligned with MCU PORT pin 1.
- ◆ Make sure only the jumper PB on option header FEA\_EN on MCU PROJECT BOARD 2 is connected and all the others are unconnected as pictured in Figure 16

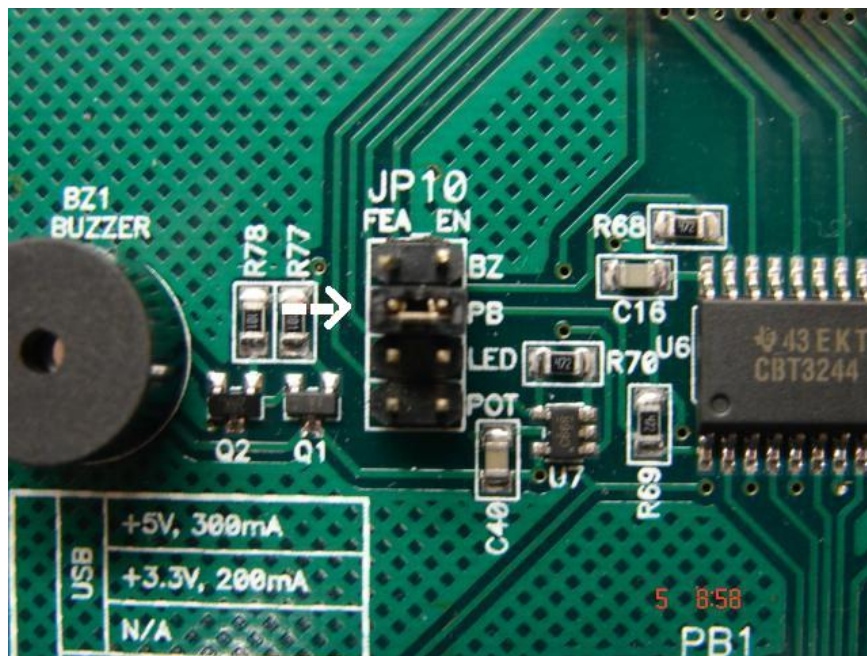


Figure 16 MCU Project Board Jumper setting for use with APS12D

- ◆ In order to program the device you need to plug in the USB cable into the USB connector on MCU Project Board as pictured in Figure 17.

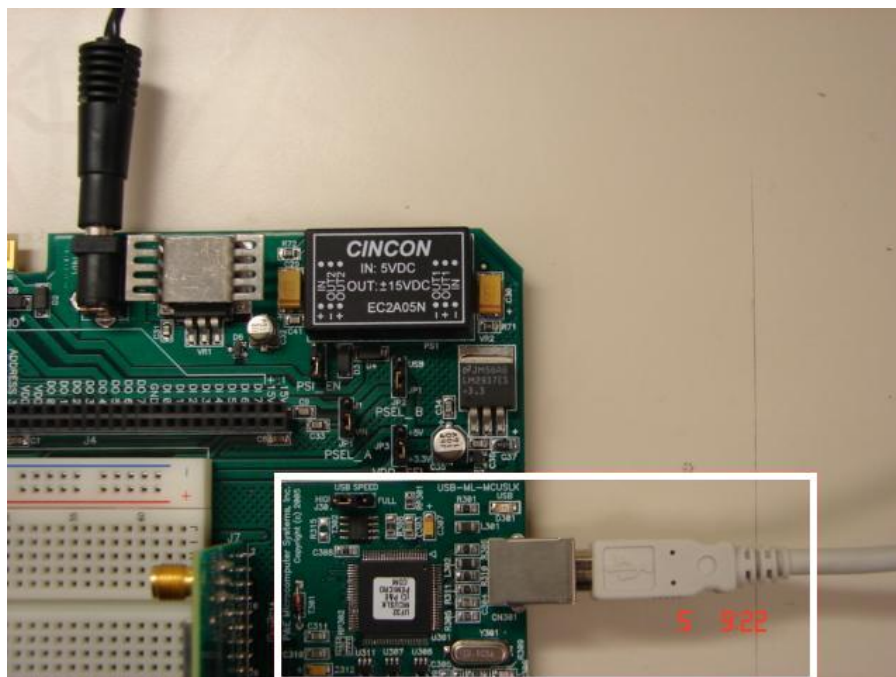


Figure 17 USB Programming Connection for APS12D

## 4.6 Connections between APS12C32 board and AP13192USLK board

To use properly this board you only need to remove all the jumpers on option header (USER), on CSM-12C32 board as pictured in Figure 18

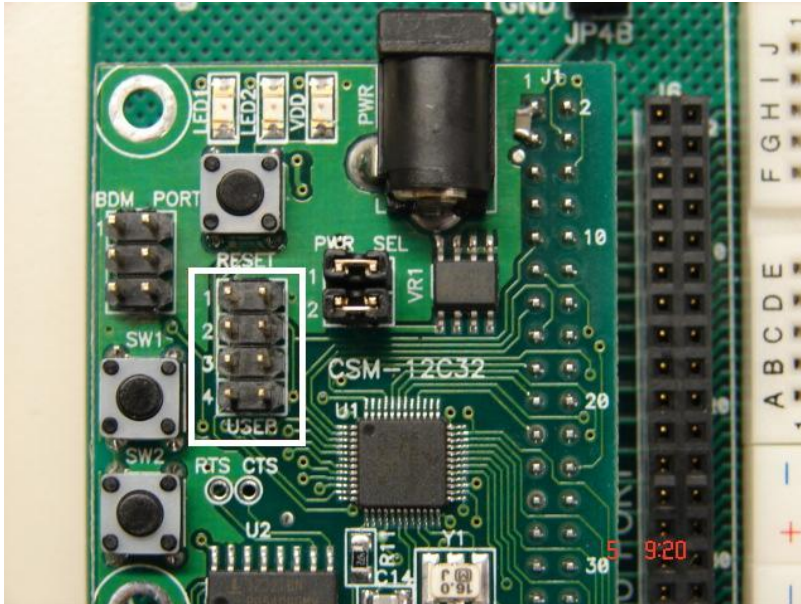


Figure 18 APS12C32SLK option header configuration

### WARNING

Make sure the voltage supplied to VDD by MCU PROJECT BOARD 2 is +5 volts as pictured in

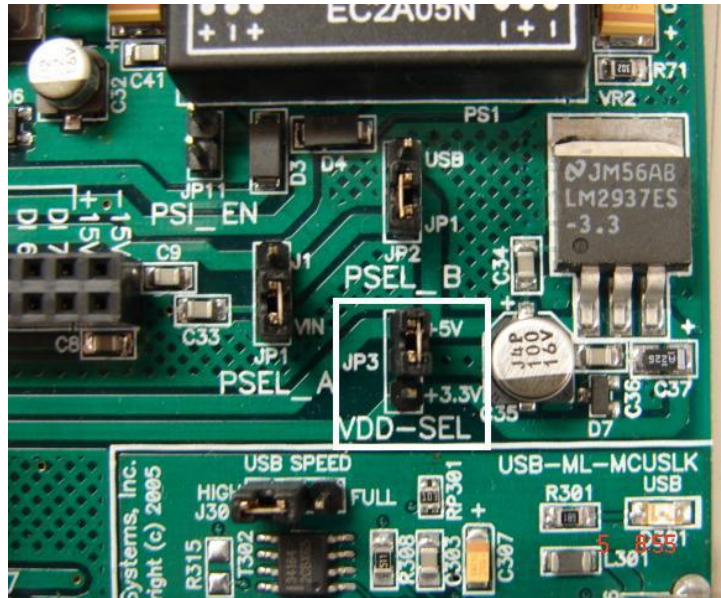


Figure 19 APS12C32SLK Power Supply Jumper Settings

- ◆ Make sure the CSM12D connector pin 1 is matched with MCU PORT pin 1.
- ◆ Make sure only the jumper PB on option header FEA\_EN on MCU Project Board is connected and all the others are unconnected as pictured in Figure 20

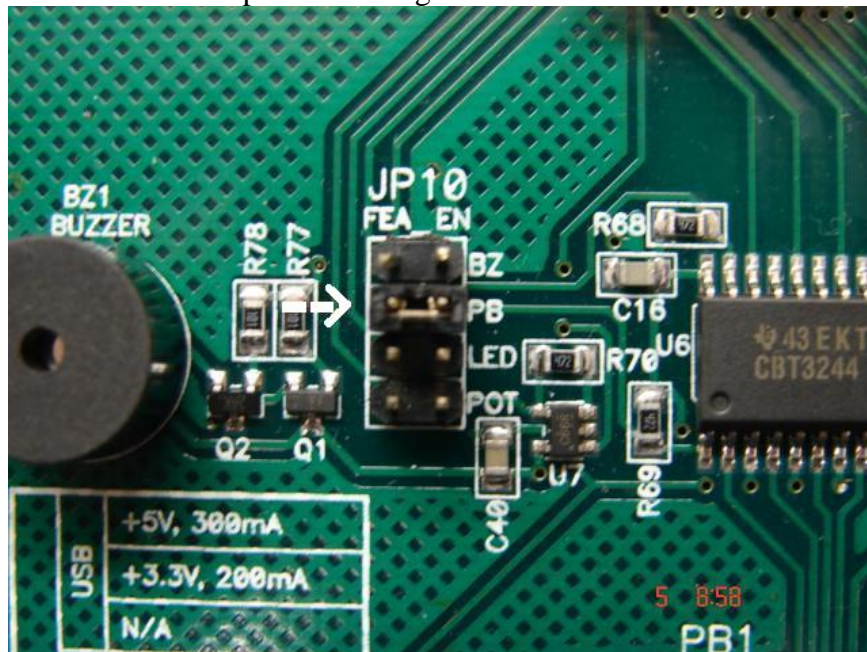


Figure 20 MCU Project Board Jumper setting for use with APS12C32SLK

- ◆ In order to programming the device you need to plug in the USB cable into the USB connector on MCU Project Board as pictured in Figure 21

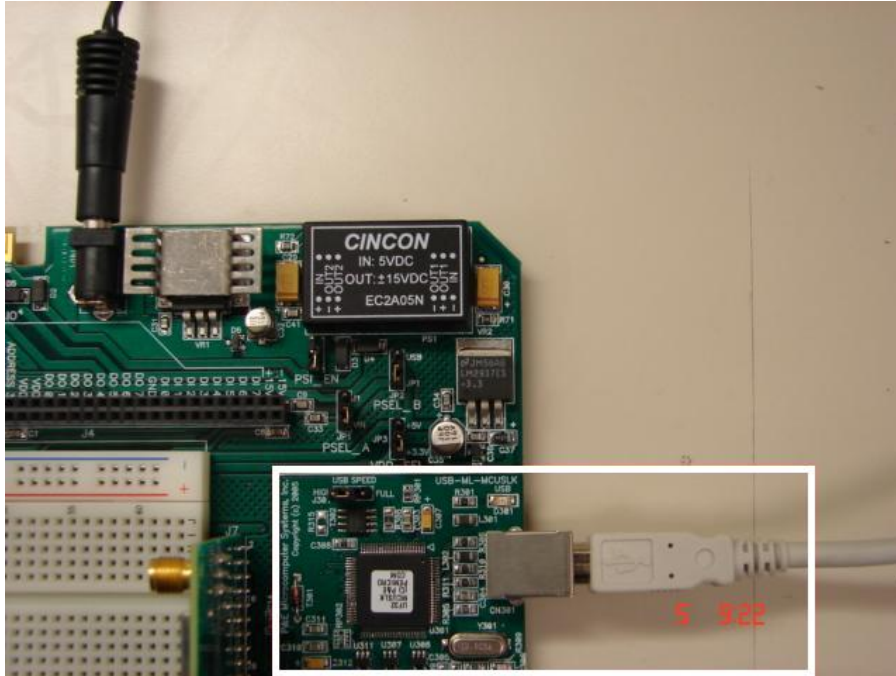


Figure 21 USB Programming Connection for APS12C32SLK

## 1 Revision History

Version	Date	Revised By	Description of Changes
0	1/2007	R2AAKL	FORMATTING
-	6/2006	RTAC	ORIGINAL



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