

ADF7023_MB4z Evaluation Guide

Features

Suitable for all ADF7023 Daughter Boards
Programmable 64pin Renesas RL78
Ethernet Capability
SD card slot
128 x 64 Dot Matrix Screen
Touch Screen Capability
USB communications
Dual UART Communications
Onboard Debugger
Expansion Header to all uC GPIOs
8 x General Purpose LEDs
Multiple powering options
GUI for controlling ADF7023

General Description

The EVAL-ADF7xxxMB4z Evaluation Board is a Motherboard that controls all ADF7023 daughter boards. The daughter board plugs directly into the motherboard to provide a full ADF7023 development kit for a wide range of applications depending on the daughterboard selection.

The various available daughter boards can be selected from the following Table 1.

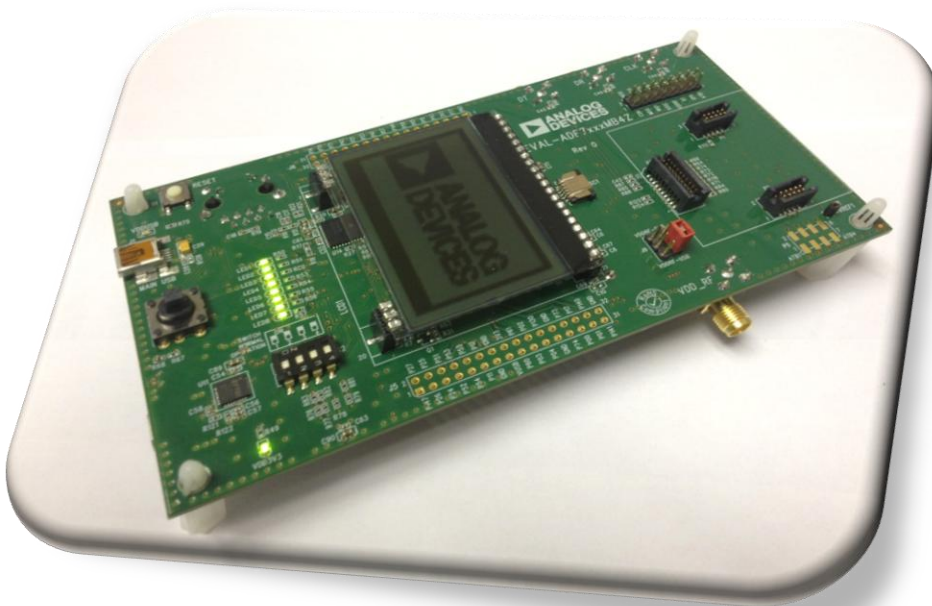


Table 1 Evaluation Boards

Board Number	RF Frequency	Description
EVAL-ADF7XXXMBZ4	-	Mother board required for evaluation of the ADF7023 daughter boards
Eval-ADF7023DB1Z	868/915 MHz	Two separate matching networks: One for the single ended PA and one for the LNA
Eval-ADF7023DB2Z	868/915 MHz	One combined matching network incorporating the single ended PA and LNA
Eval-ADF7023DB3Z	433 MHz	Two separate matching networks: One for the single ended PA and one for the LNA
Eval-ADF7023DB4Z	433 MHz	One combined matching network incorporating the single ended PA and LNA

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Revision History

Date: August 16th 2013

Revision: Rev.1.0

Using this Manual

This manual covers the main aspects of the ADF7xxxMB4z and the ADF7023_MB4z GUI. The user of the board is advised to use this hardware and software in conjunction with the latest ADF7023 datasheet.

Hardware Overview

The development platform consists of the Eval-ADFxxxMB4Z mother board to which an appropriate daughter card may be connected. The available daughter cards are given in [Table 1](#). Schematics for the motherboard are given in the [schematics](#) section of this document.

Power Supply

There are two options to power the ADFxxxMB4Z mother board.

1. USB powered
2. Battery powered

The mother board may be powered via the USB cable supplied. The 5V from the USB cable is regulated down to 3.3 V for supplying the components. Alternatively a battery may be used to power the microcontroller and transceiver. A 3.6V battery is shipped with the boards.

Getting Started

Installing Software

The ADF7023_MB4z evaluation software and documentation can be installed from the CD supplied with the board, or the Analog Devices Website.

Before connecting the ADF7xxxMB4z to the PC via the USB connector, it is mandatory to install the USB drivers needed for proper communication between the ADF7xxxMB4z and applicable PC tools.

The drivers are bundled and installed together with IAR Embedded Workbench for the Renesas RL78 microcontroller and the ADF7023_MB4z Evaluation software.

Installation Procedure

1. Run **ADF7023_MB4z_Setup.exe** to install the evaluation software. The install will create the relevant shortcuts on the start menu for easy access to the software and documentation.
2. The **install software will** initially load with the following welcome [Figure 1](#). Click “Next”



Figure 1

3. Once components to be installed are selected as in [Figure 2](#) click “Install”.

Install components:

- a. Install ADF7023 evaluation software
- b. Install USB drivers
- c. Install IAR RL78 Embedded Workbench

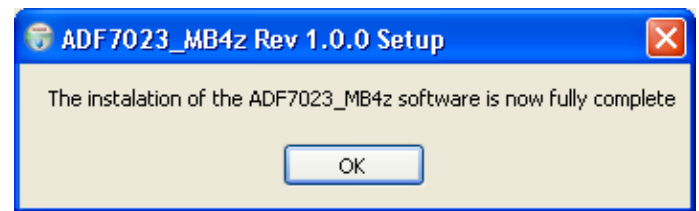


Figure 3

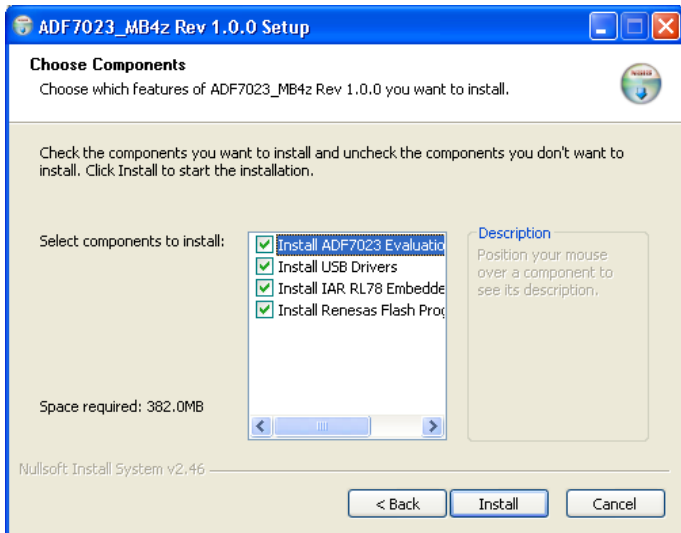


Figure 2

4. If “**Install ADF7023 Evaluation Software**” component is selected this will install the evaluation software for the ADF7023. Follow the onscreen instructions to complete the installation.
5. If “**Install USB Drivers**” component is selected this will install the drivers for the ADF7xxxMB4z Main USB port followed by the FTDI drivers for the Secondary USB port. Follow the onscreen instructions to complete the driver’s installation.
6. At a minimum, the ADF7023 Evaluation Software and the USB Drivers should be selected to be installed. If you wish to develop your own code for the RL78 you will also need to select and install IAR RL78 Embedded Workbench.
7. Follow all instructions on screen until the message in [Figure 3](#) appears. At this point the installation is fully complete and your pc is ready to run the evaluation software.

Using the ADF7xxxMB4z Evaluation Board

1. Once the required software is installed, ensure the ADF7023 daughter card is plugged into the ADF7xxxMB4z motherboard. Once complete, plug the USB cable into the **"MAIN USB"** port (Figure 4) on the ADF7xxxMB4z and the other end to the PC on which the software is installed.

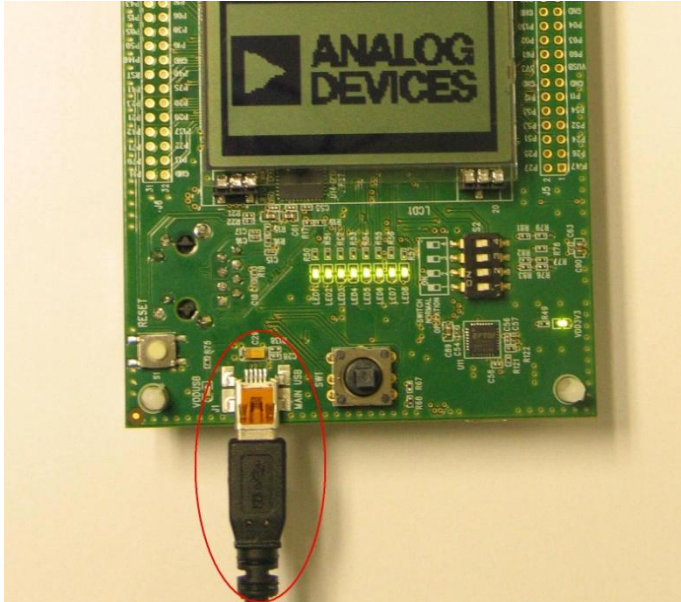


Figure 4

2. Start the ADF7023_MB4z software from **"StartMenu"** -> **"All Programs"** -> **"Analog Devices"** -> **"ADF7XXX"** -> **"ADF7023_MB4z"** -> **"ADF7023_MB4z"**
3. The ADF7023 start screen will appear once the program is opened (Figure 6). If the PC is connected to the internet, the program will automatically check for updates. If an update to the software exists, the user will have the option to install the updates by clicking **"YES"** or to ignore by clicking **"NO"** (Figure 5). It is however recommended that you install all updates.

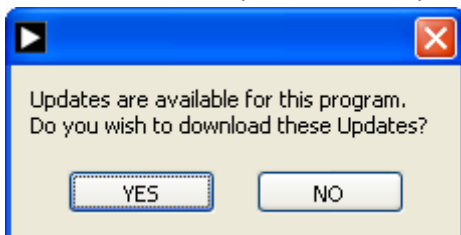


Figure 5

4. The main screen gives the user, the option to open the software in Simulation mode or, if the board is plugged into the PC, **"Hardware Mode"** becomes available (Figure 6).

Simulation mode allows the same functionality as Hardware Mode but disables the ability to read and write to and from the part.

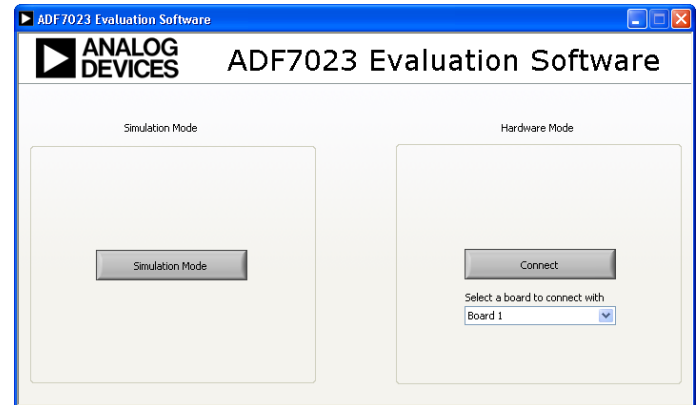


Figure 6

5. The **"Select a board to connect with"** dropdown list will populate with the number of boards connected to the PC. Select one of the boards to connect with followed by clicking on the **"Connect"** Button.
6. The Evaluation screen will guide you through the setup which fits your requirements best. You can choose from a default list of specific standard configurations or choose a setup you have already saved. (Figure 7)

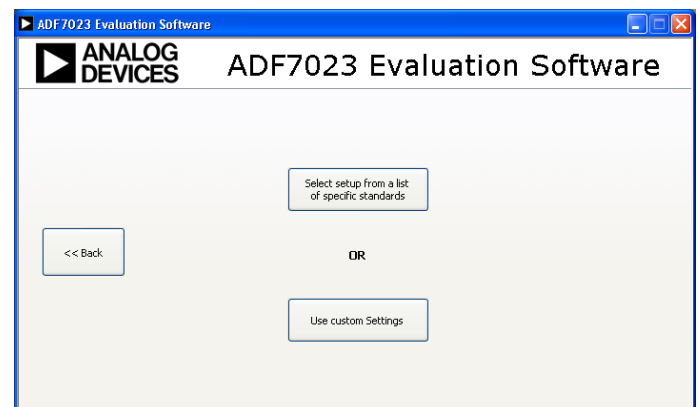


Figure 7

- 6.1. If you choose to select a standard from the default standards list by pressing the button on screen, the standard configuration list will appear (Figure 8). Choose a standard from the list and click **"Finish"**.
- 6.2. If you choose the **"Use custom Settings"** button you will be given the option of using the default

setup for the part or you can chose to use a previously saved configuration file. (Figure 9)

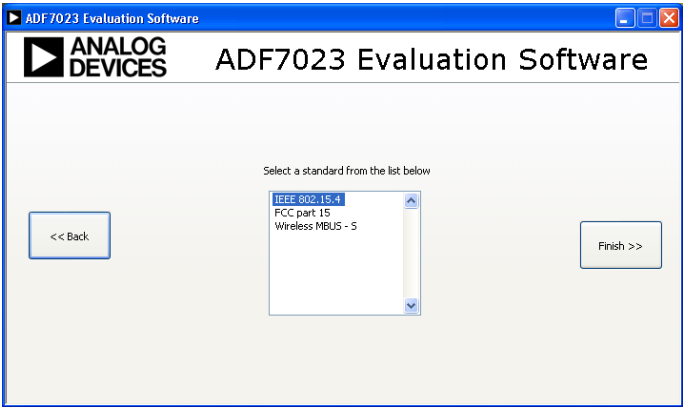


Figure 8

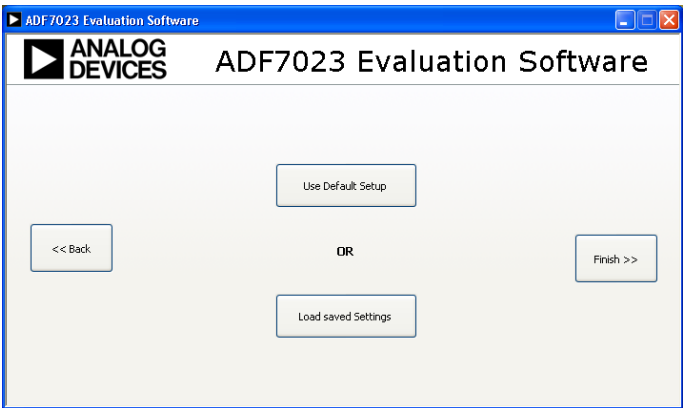


Figure 9

7. After pressing “Finish” the main evaluation screen will appear (Figure 10)
Please refer to “Main Configuration Table” section for information on this window and its uses.

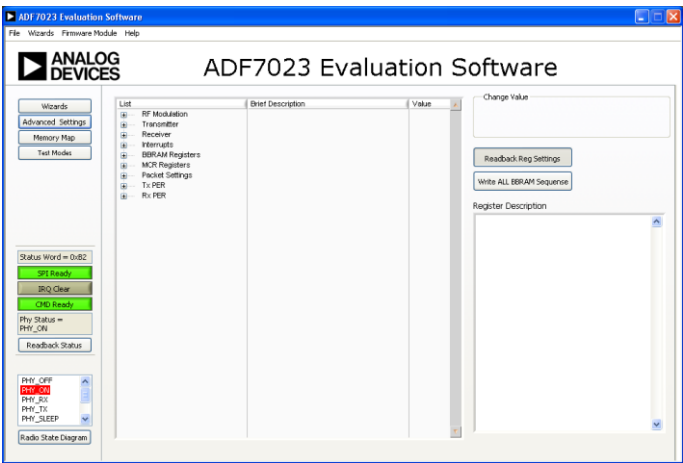


Figure 10

Using the ADF7023_MB4z Evaluation Software

This section will go through the GUI screen in detail. Ensure the motherboard remains plugged into the pc throughout the evaluation process to avoid any communication errors.

Menu Bar

The menu bar on the top of the screen ([Figure 11](#)) can be used for extra functionality.

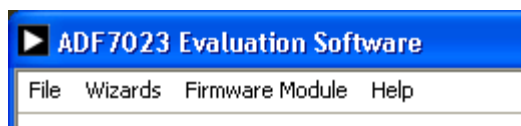


Figure 11

1. File

- 1.1. **Load** : Allows the user to load a previously saved configuration for the ADF7023.
- 1.2. **Save** : Allows the user to save the current configuration which can be loaded at another time.

2. Wizards

- 2.1. **RF Setup Wizard** : Brings the user, step by step through a wizard to configure the required RF settings on the ADF7023.
- 2.2. **Packet Setup Wizard** : Brings the user, step by step through a wizard to configure the required RF Tx packet settings on the ADF7023.

3. Firmware Module

- 3.1. **Load Firmware Module** : Allows the user to load a firmware module such as the “IR_Cal” firmware module, the “AES” firmware module or a generic firmware module onto the ADF7023.

4. Help

- 4.1. **Version Info** : This displays the version of ADF7023_MB4z software which is currently open on the user’s machine.
- 4.2. **Check ADF7xxxMB4z Firmware Revision** : This will check the revision of firmware on the ADF7xxxMB4z motherboard and display it on screen.

Buttons on main screen

This section will go through the buttons and functions on the main applications screen.

Wizards Button

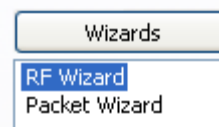


Figure 12

The wizards button ([Figure 12](#)) can be pressed to display a list of setup wizards available. The two available wizards are :

RF Setup Wizard

By double clicking on the “RF Setup Wizard” text the user is brought to a new window which goes step by step through a wizard to configure the required RF settings on the ADF7023.

Packet Setup Wizard

By double clicking on the “Packet Setup Wizard” text the user is brought to a new window which goes step by step through a wizard to configure the required RF Tx packet settings on the ADF7023.

Advanced Settings Button

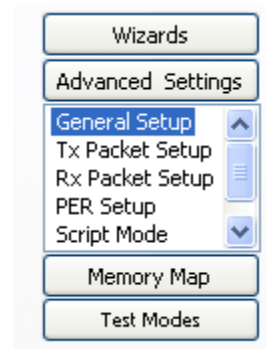


Figure 13

The Advanced Settings button can be pressed to display a list of advanced setup options for the ADF7023 ([Figure 13](#)). The available lists are listed in the following sections.

General Setup

By double clicking on the “General Setup” text the user is brought back to the main screen with the advanced table of settings as shown in ([Figure 14](#)). Please refer to the [Main Configuration Table](#) section for more information on how to use this table.

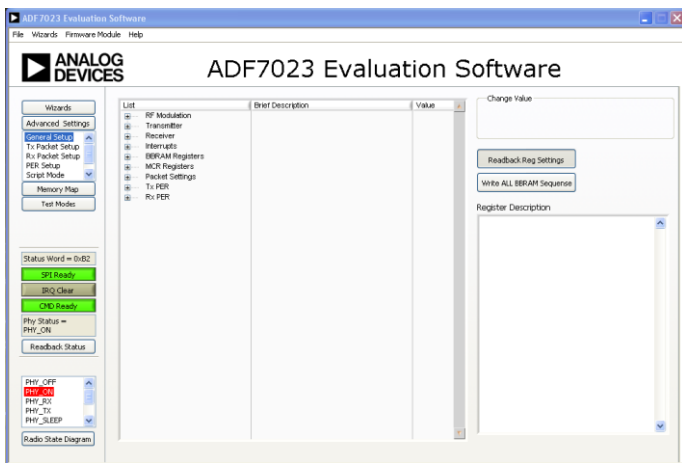


Figure 14

Tx Packet Setup

By double clicking on the “Tx Packet Setup” text the user is brought to a screen where all of the Tx packet settings for the ADF7023 can be configured. (*Figure 15*) Here all parameters associated with transmitting a packet such as the Preamble, Sync Word, Tx Payload, etc. can be configured.

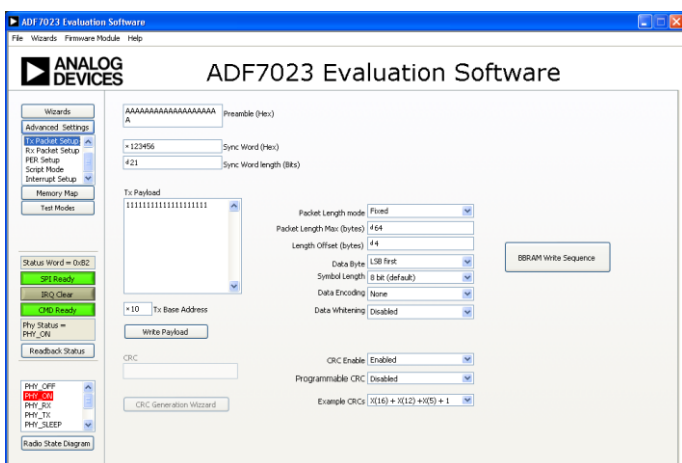


Figure 15

Rx Packet Setup

By double clicking on the “Rx Packet Setup” text the user is brought to a screen where all of the Rx packet settings for the ADF7023 can be configured. (*Figure 16*) Here all parameters associated with receiving a packet such as the Preamble, Sync Word, Preamble Match Tolerance, Sync Error Tolerance, etc. can be configured.

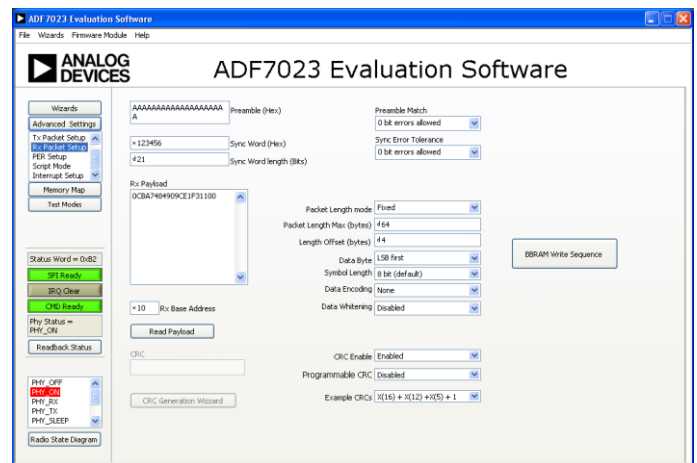


Figure 16

PER Setup

By double clicking on the “Rx Packet Setup” text the user is brought to a screen where the user can setup and perform a Packet Error Rate test (PER test) [Figure 17]. Please refer to the [PER Setup](#) section for more information on setting up a PER test.

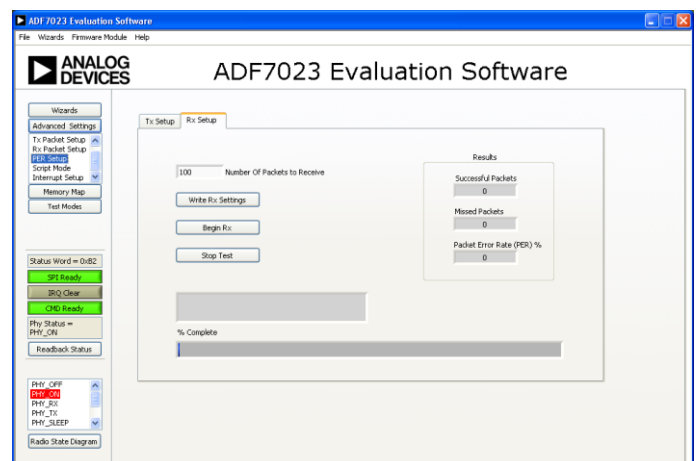


Figure 17

Script Mode

By double clicking on the “Script Mode” text the user is brought to a screen where you can load and run scripts to configure the ADF7023 (*Figure 18*).

For more information on Scripts, please refer to the [Scripts](#) section of this document.

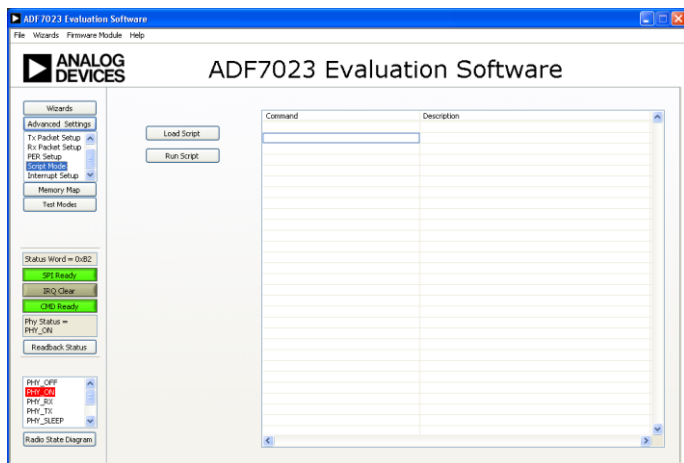


Figure 18

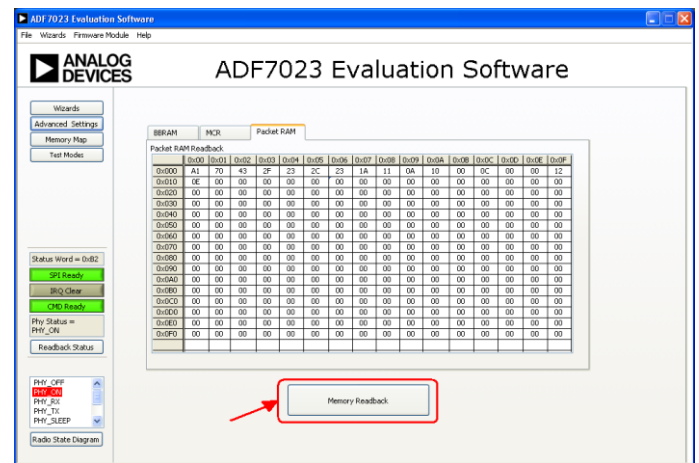


Figure 20

Interrupt Setup

By double clicking on the “Interrupt Setup” text the user is brought to a screen where the user can configure and read the interrupts generated by the ADF7023 ([Figure 19](#)).

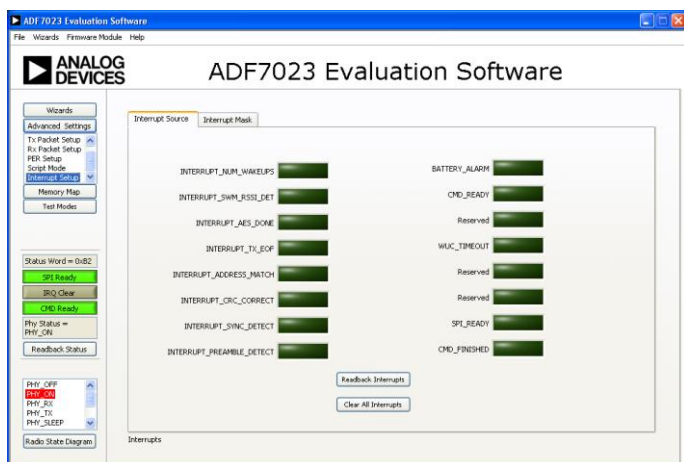


Figure 19

Memory Map Button

By clicking on the “Memory Map” button the user is brought to a screen where they can readback all of the data stored in memory on the ADF7023. BBRAM, MCR and Packet RAM are displayed.

To readback all memory locations, click on the “Memory Readback” button highlighted in ([Figure 20](#)).

Test Modes Button

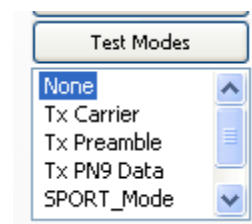


Figure 21

The Test Modes button can be pressed to display a list of the test mode options available for the ADF7023 ([Figure 21](#)).

1. **None**

By double clicking on the “None” text, all test modes on the ADF7023 are turned off.

2. **Tx Carrier**

By double clicking on the “Tx Carrier” text the ADF7023 will be setup to transmit a continuous tone at the carrier frequency. Once this testmode has been set the user must issue a PHY_Tx command to put the ADF7023 into transmit.

3. **Tx Preamble**

By double clicking on the “Tx Preamble” text the ADF7023 will be setup to transmit a continuous 1 -> 0 pattern. Once this testmode has been set the user must issue a PHY_Tx command to put the ADF7023 into transmit.

4. **Tx PN9**

By double clicking on the “Tx Preamble” text the ADF7023 will be setup to transmit a continuous pseudo random pattern. Once this testmode has been set the user must issue a PHY_Tx command to put the ADF7023 into transmit.

5. **SPORT Mode**

By double clicking on the “SPORT MODE” text the ADF7023 will be setup in SPORT Mode. Please refer to the [Sport Mode Setup](#) section for more information on how to setup SPORT mode.

6. **Flash LEDs**

By double clicking on the “Flash LEDs” text the LEDs labelled “LED1” to “LED8” should flash sequentially. This test can be used as an indication to the user which Motherboard is linked to a particular instance of the evaluation software.

Status Word Readback

The ADF7023 status word can be read back by pressing the “Readback Status” button [Label A – in [Figure 22](#)].

The hexadecimal status word readback is displayed [Label B – in [Figure 22](#)].

The status word is then formatted for ease of readability and displayed as “SPI_Ready”, “IRQ_Clear”, “CMD_Ready”, and the “PHY_Status” [Label B – in [Figure 22](#)].

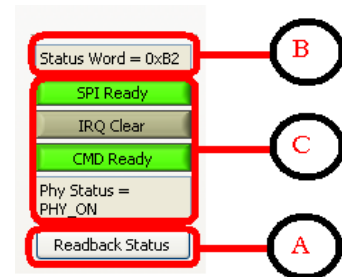


Figure 22

Issuing a PHY Command

A PHY command such as PHY_OFF, PHY_ON, PHY_Rx, PHY_Tx, etc. can be issued by clicking on the PHY text as shown in ([Figure 23](#))

The current PHY_status of the ADF7023 will be highlighted in **Red** [Label A – in [Figure 23](#)] once the selected command is issued.

To see the full state transition table click on the “Radio State Diagram” button [Label B – [Figure 23](#)]

The full state transition table will then be displayed as in [Figure 24](#). States can be clicked on in this table to change the states. The light green color signifies the current PHY status.

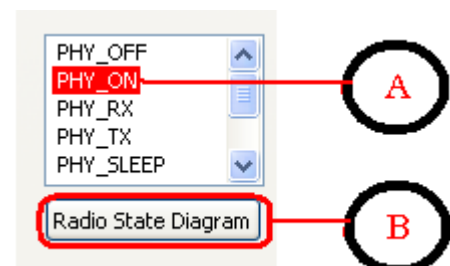


Figure 23

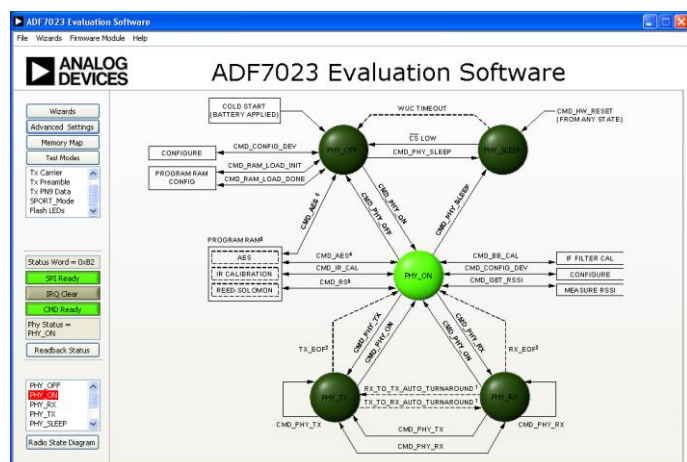


Figure 24

Main Configuration Table

The main configuration table contains all of the settings associated with the ADF7023. It contains the full list of BBRAM and MCR configuration settings. Some of these MCR and BBRAM settings such as RF_Frequency, Frequency_Deviation, Data_Rate, etc. are broken down and set separately to improve usability and setup speed.

A list of these settings can be seen in (Figure 25).

List	Brief Description	Value
[-] RF Modulation		
..... Channel Frequency	RF Channel Frequency (MHz)	433
..... Frequency Deviation	RF Frequency Deviation (kHz)	20
..... Data Rate	RF Data Rate (kbps)	40
[-] Transmitter		
..... Modulation Scheme	Transmitter Modulation Scheme	2FSK
..... PA Level	PA Amplitude	15
..... PA Ramp	Ramp Rate of Tx Power	No Ramp
..... PA Select	Select Between Differential or Single Ended PA	Single Ended
[-] Receiver		
..... IF Bandwidth	IF Filter Bandwidth (kHz)	100kHz
..... Demod Scheme	Demodulation Scheme Selection	2FSK/GFSK
..... AFC Mode	Automatic Frequency Control	Manual
..... Max RF Frequency Error	Expected Max RF Frequency Error (kHz)	50
..... AFC Kp		3
..... AFC Ki		7
..... AGC Mode		Free Running
[+] Interrupts		
[+] BBRAM Registers		
[+] MCR Registers		
[+] Packet Settings		
[+] Tx PER		
[+] Rx PER		

Figure 25

Each of the lists in the table can be expanded by clicking on the “+” box to the left of the group title.

Changing the values in the Main Configuration Table

- Select the value on the table you wish to change. The whole line will be highlighted and a value box will appear in the “Change Value” section. [Label A – in Figure 26]
- Change the value in the box displayed [Label A – in Figure 26] and once this is done the value in the table will reflect this new change.
- Changing a value in the table will cause a change in the “BBRAM_Registers” list. The changed BBRAM value will be highlighted in Red [Label B – in Figure 26]. The value’s will remain red until the “Write All BBRAM Sequence” button is pressed. [Label C – in Figure 26]

List	Brief Description	Value
RF Module		
Channel Frequency	RF Channel Frequency (MHz)	434
Frequency Deviation	RF Frequency Deviation (kHz)	20
Data Rate	RF Data Rate (Kbps)	40
Transmitter		
Receiver		
Interrupts		
BRRM Registers		
0x100	INTERRUPT_MASK_0	0x14
0x101	INTERRUPT_MASK_1	0x00
0x102	NUMBER_OF_JAWEUPS_0	0x00
0x103	NUMBER_OF_JAWEUPS_1	0x00
0x104	NUMBER_OF_JAWEUPS_PRO_THRESHOLD_0	0x00
0x105	NUMBER_OF_JAWEUPS_PRO_THRESHOLD_1	0x00
0x106	RX_DWELL_TIME	0x00
0x107	PARTIME_DIVIDER	0x00
0x108	SWR_RSD_THRESH	0x00
0x109	CHANNEL_FREQ_0	0x38
0x10A	CHANNEL_FREQ_1	0xB1
0x10B	CHANNEL_FREQ_2	0x16
0x10C	RADIO_CFG_0	0x80
0x10D	RADIO_CFG_1	0x01
0x10E	RADIO_CFG_2	0xC8
0x10F	RADIO_CFG_3	0xA2
0x110	RADIO_CFG_4	0x0F
0x111	RADIO_CFG_5	0x00
0x112	RADIO_CFG_6	0x00
0x113	RADIO_CFG_7	0x00
0x114	RADIO_CFG_8	0x7F
0x115	RADIO_CFG_9	0x00
0x116	RADIO_CFG_10	0x09
0x117	RADIO_CFG_11	0x37

Change Value
Channel Frequency
434

Readback-Reg Settings
Write ALL BRRM Sequence

Register Description

Figure 26

When a BBRAM or MCR register value is selected a description of the register will be displayed in the “Register Description” section.

Sport Mode Setup

- SPORT mode can be configured by clicking the “Test Modes” button followed by double clicking on the “SPORT_Mode” text. (Figure 27)

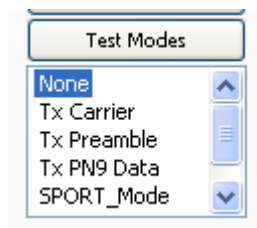


Figure 27

- After clicking on the “SPORT_Mode” text, the user will be brought through a wizard where the user can select the appropriate configuration for their desired setup.
- The first screen allows the user to choose whether the GP4 interrupt should occur on Preamble Detect or on Sync word detect. Click the “Next” button after your selection. ([Figure 28](#))

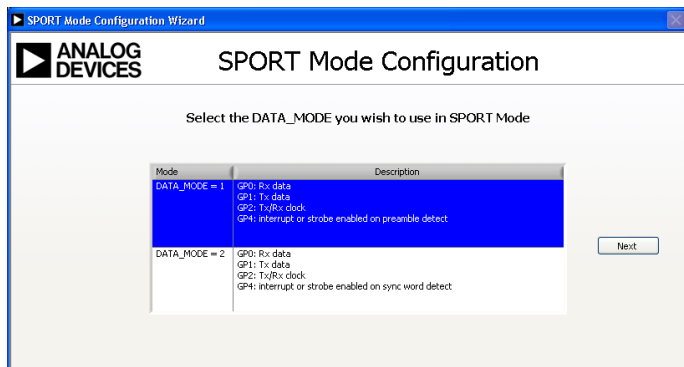


Figure 28

- The next screen allows the user how the GP4 pin should function. ([Figure 29](#)) The options are:
 - Not used
 - GP4 Used as interrupt
 - GP4 used as a Strobe
- After selecting the functionality of GP4, click “Finish”. Once complete the ADF7023 will be setup in SPORT MODE.

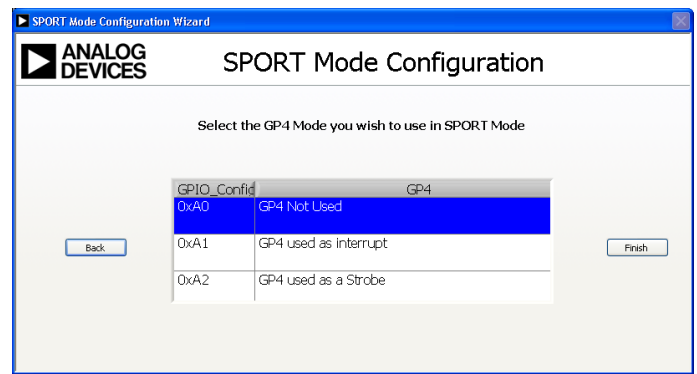


Figure 29

The ADF7xxxMB4z has 3 SMA connectors available for operating the transceiver in SPORT mode. CLK, DR and DT are labelled in ([Figure 30](#)).

- CLK SMA** – Is connected to the GP2 pin of the ADF7023. The Clock connection is used for clocking in and out the SPORT Mode data to and from the ADF7023.
- DR SMA** – Is connected to the GP0 pin of the ADF7023. This is the pin where the received data appears in SPORT Mode.
- DT SMA** – Is connected to the GP1 pin of the ADF7023. This is the pin where the data to be transmitted is passed to while in SPORT Mode.

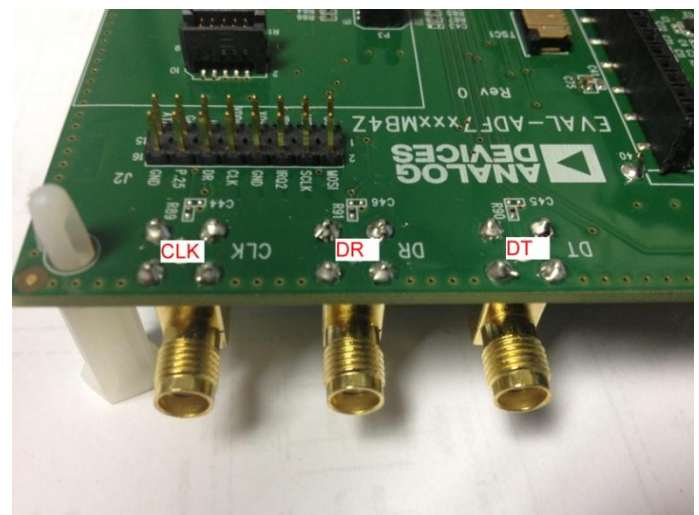


Figure 30 (SPORT Mode SMA Headers)

Packet Error Rate Test

To do a Packet error rate test the user must have two ADF7xxxMB4z mother boards and two ADF7023DBx daughter boards. A PER test is a transmit and receive test using a large amount of packets. One board will be set up in Tx mode and the second will be set up in Rx mode. The Tx board will transmit a fixed number of packets to the Rx board. The Rx board will count the number of successfully received packets and report the PER figure once the test is complete.

- Open 2 instances of the ADF7023_MB4z applications software. Setup the configuration settings on both to be the same. (i.e. Frequency, Deviation, Datarate, etc.)
- Ensure the TxEOF interrupt is set on the transmitter GUI.
- Ensure the CRC interrupt is set on the receiver GUI.
- Configure packet parameters on the Transmitter GUI and the Receiver GUI to be the same.
- Click on the “Advanced Settings” button, on the Rx GUI instance, and navigate to the PER option. Select the Rx Setup tab in the new window (Figure 31).

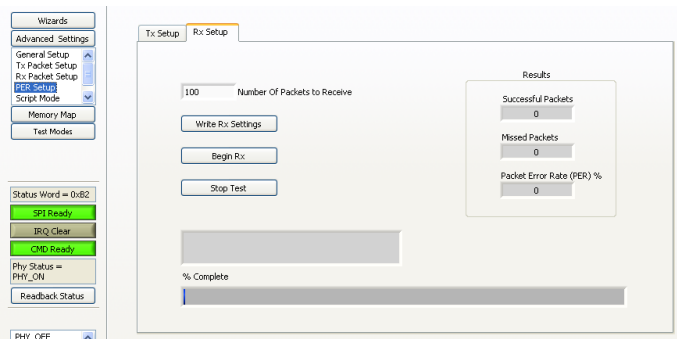


Figure 31

- Set the Number of packets to Receive.
- Click on “Write Rx Settings”
- Click on “Begin Rx”. This will setup the receiver board in Receive and it will wait for the transmit board to transmit.
- Click on the “Advanced Settings” button, on the Tx GUI instance, and navigate to the PER option. Select the Tx Setup tab in the new window (Figure 32).

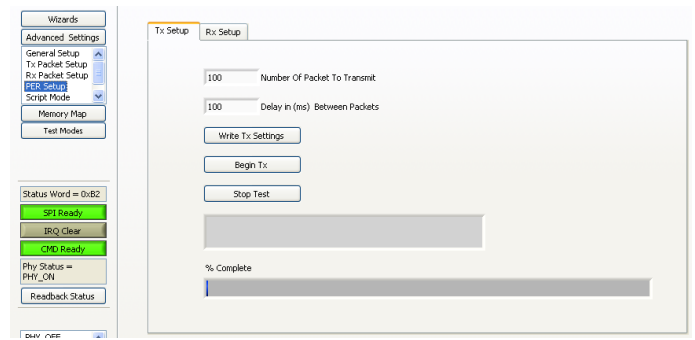


Figure 32

- Set the Number of packets to Transmit.
- Set the delay you wish to have, between the end of each packet transmitted and the start of the next packet to transmit, in milliseconds.
- Click on “Write Tx Settings”
- Click on “Begin Tx”. This will start the Tx sequence. The “% Complete” bar should begin filling up as the test progresses on both the Rx and Tx GUI.
- If at any stage you need to suspend testing, press the “Stop Test” button on each of the GUIs.

Scripts

Scripts can be developed in a text editor and saved with a file extension of .txt

The following are examples:

- To write to a PACKET_RAM register enter the line “18xxyy” where “xx” represents the last eight bits of the address to be written to and “yy” represents the value to be stores at this address.
 - For Example if you need to write 0xAB to PACKET_RAM location 0x010, then the script code would be : 1810AB
- To write to a BBRAM register enter the line “19xxyy” where “xx” represents the last eight bits of the address to be written to and “yy” represents the value to be stores at this address.
 - For Example if you need to write 0xCD to BBRAM location 0x123, then the script code would be : 1923CD
- To write to a MCR register enter the line “1Bxxyy” where “xx” represents the last eight bits of the address to be written to and “yy” represents the value to be stores at this address.
 - For Example if you need to write 0xEF to MCR location 0x345, then the script code would be : 1B45EF
- To introduce a delay before the next script command, enter the line “sxxx”. Where “xxx” represents an integer multiple of 1ms.
 - For example to enter a delay of 120ms before the next command is to be issued then the script code would be: “s120”
- To issue a COMMAND enter the desired command.
 - For Example to enter “**PHY OFF**”, then the script code would be : B1
 - For Example to enter “**PHY ON**”, then the script code would be : B2
 - For Example to enter “**PHY TX**”, then the script code would be : B5
- To introduce comments in the file use “# ” before the comment.

Scripting Example

The following script would be used for the previous examples:

```
#          #Start of script
1810AB    # Set Packet_Ram address 0x010 to AB
1923CD    # Set BBRAM address 0x123 to CD
1B45EF    # Set MCR address 0x345 to EF
S120      # Delay for 120ms
B1        # Enter PHY_OFF
B2        # Enter PHY_ON
B5        # Enter PHY_Tx
#         # End of script
```

Running Scripts from the ADF7023 software

1. Click on the “Advanced Settings” button, and navigate to the “Script Mode” option. Once this is selected the Script Mode screen will appear as in *(Figure 33)*

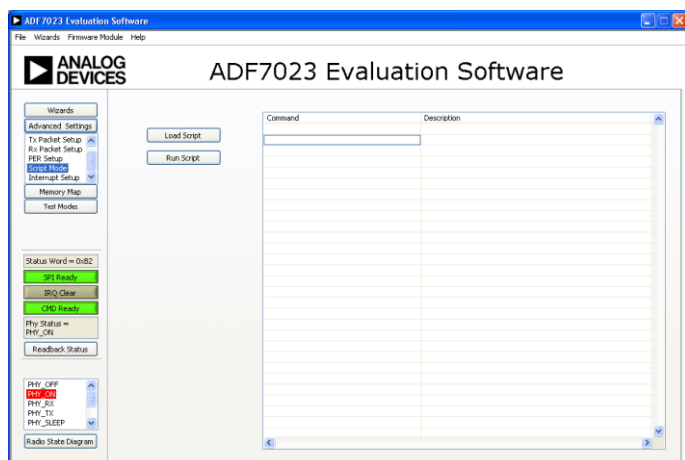


Figure 33

2. Load a previously saved script by clicking the “Load Script” button and navigating to the script file. Once open is selected, the script will be loaded into the script window *(Figure 34)*

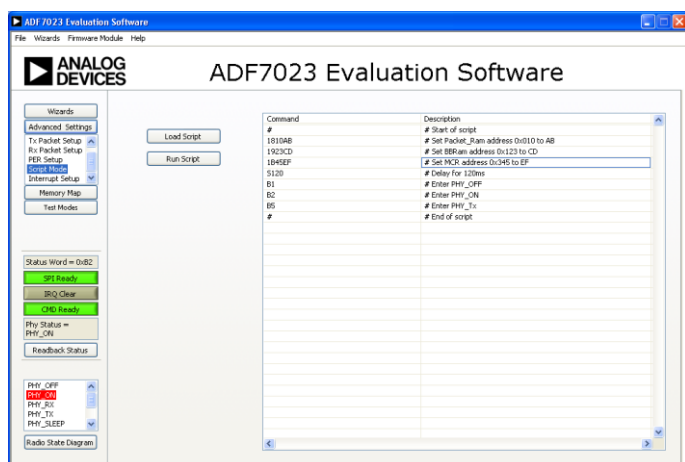


Figure 34

3. To run the script, click on the “Run Script” button.

ADF7xxxMB4z Evaluation Hardware

This section gives a description of all hardware sections on the ADF7xxxMB4z motherboard. The board is designed for evaluating the ADF7023 transceiver along with allowing the user to do their own code development using the onboard Renesas RL78.

This section will describe in detail

- USB/Communication Ports
- Reset Button
- Programming and TK debugger interface
- ADF7023 Daughter Card connection
- ADF7023 external Interfaces
- ADF7023 Powering options
- SD Micro Card
- Ethernet Port
- Dot Matrix LCD
- Touch Screen Controller

USB PORTS

The ADF7xxxMB4z has 2 USB connections on board.

Main USB

The USB connection on the top side of the board is the main USB/Communication port connection. (Figure 35) This port

- Provides the main COM port for the ADF7023_MB4z program.
- Is used for uploading the .hex code to the uC.
- Is used as the TK debugger when debugging user code in IAR
- Provides Power to the PCB

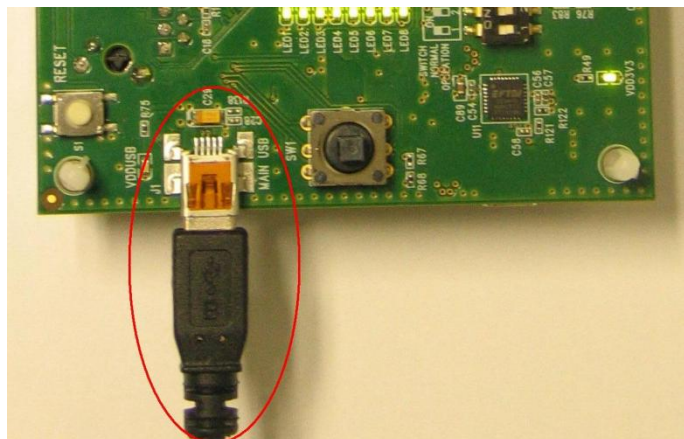


Figure 35: Main USB

Secondary USB

The secondary USB connection is on the underside of the board (Figure 36). While the uC is in debug mode, the COM port interface cannot be used in by the main USB port and therefore the only option is to use a second COM port while debugging serial communications.

This port does NOT power the Motherboard however and so requires a second USB lead to go from it to the PC. This USB port creates a virtual COM port with an FTDI FT232 chip.



Figure 36: Secondary USB

Reset

The reset switch on the board provides a hardware reset of the onboard Renesas uC (Figure 37). The code on the uC will be reset and start again from the beginning once the Reset switch is released.

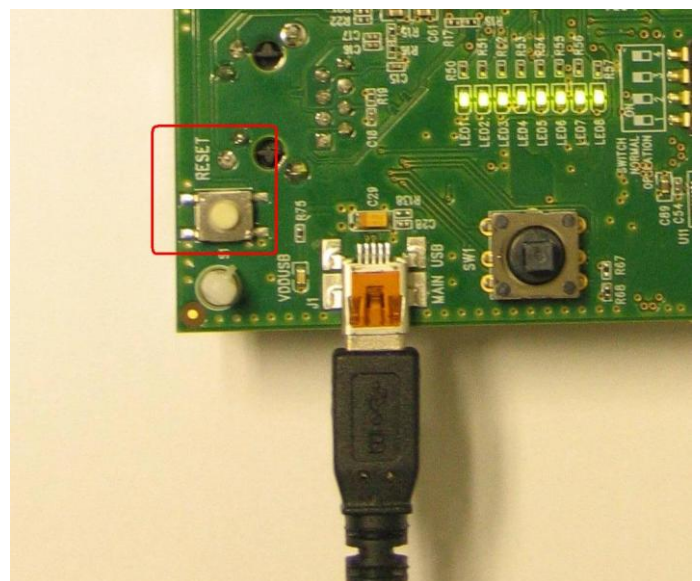


Figure 37: Reset Switch

Programming and TK interface

The TK interface can be used in IAR to provide onboard debug capabilities, avoiding the need for a JTAG debugger. To put the device into debug mode, ensure dipswitch 1 is in the ON position and that all the others are OFF, as per (Figure 38)

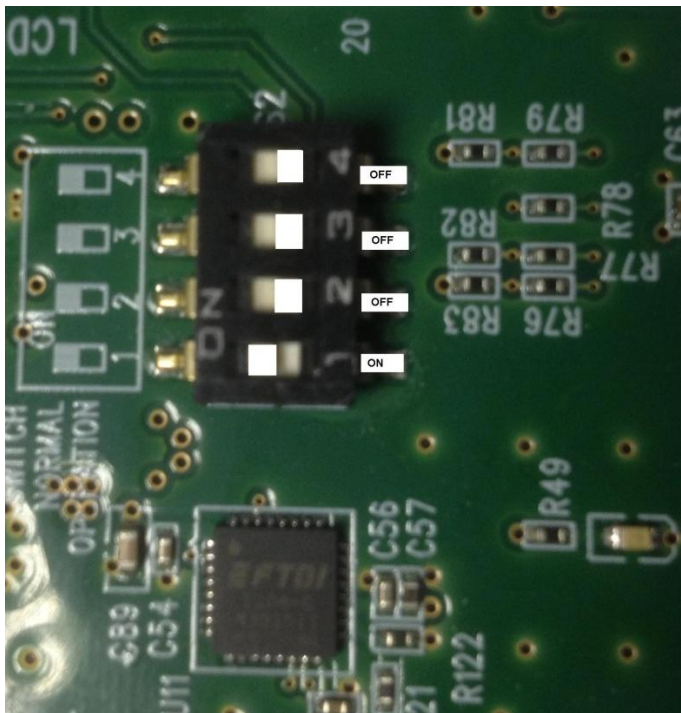


Figure 38 (Debug Mode Setup)

ADF7023 Daughter Card Connection

All of the ADF7023 daughter cards plug into the ADF7xxxMB4z motherboard. The card plugs into the headers highlighted in (Figure 39). Ensure the motherboard is powered down before connecting the daughter board. Care must be taken when connecting and disconnecting the two boards to avoid damaging the headers on the each of the boards.

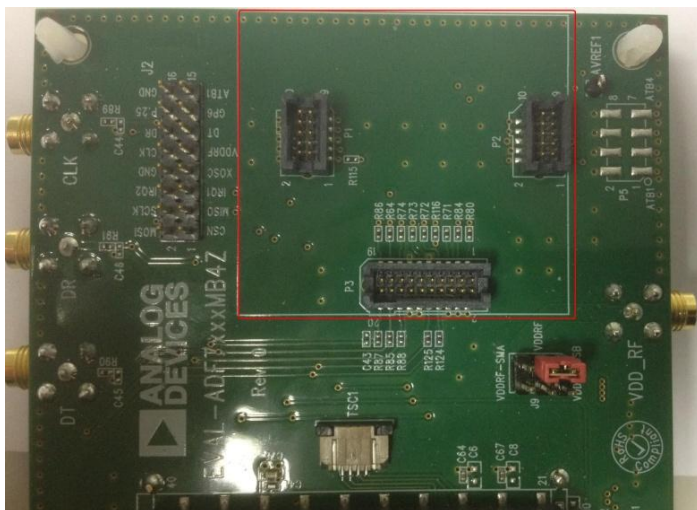


Figure 39 (ADF7023 Daughter Board Headers)

ADF7023 External Interfaces

SMA Connectors

The ADF7xxxMB4z has 3 SMA connectors available for operating the transceiver in SPORT mode.

- CLK SMA – Is connected to the GP2 pin of the ADF7023. The clock connection is used for clocking in and out the SPORT Mode data to and from the ADF7023.
- DR SMA – Is connected to the GP0 pin of the ADF7023. This is the pin where the received data appears in SPORT Mode.
- DT SMA – Is connected to the GP1 pin of the ADF7023. This is the pin where the data to be transmitted is passed to while in SPORT mode.

CLK, DR and DT are labelled in (Figure 40).

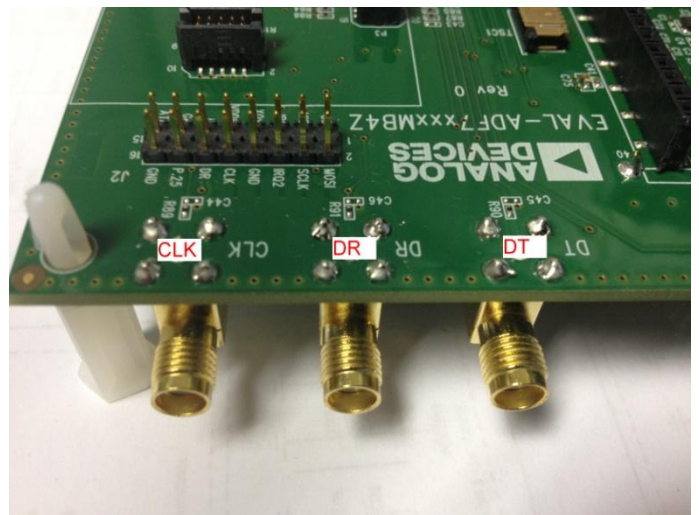


Figure 40 (Sport Mode SMA Headers)

ADF7023 Connections Header

All of the interface connections on the ADF7023 are available on header J2. This provides an external interface to the ADF7023 where connections can be made to an external uC or alternative testing hardware.

The connections, in pin order are as follows:

1. CSN
2. MOSI
3. MISO
4. SCLK
5. IRQ1
6. IRQ2
7. XOSC
8. GND
9. VDDRF
10. CLK
11. DT
12. DR
13. GP6
14. P.25
15. ATB1
16. GND

ATB Header

All of the ATB pins on the ADF7023 come out to a single interface header. This header is not populated on the board.

The Connections, in pin order, are as follows:

1. ATB1
2. GND
3. ATB2
4. GND
5. ATB3
6. GND
7. ATB4
8. GND

This header is shown in (Figure 41).

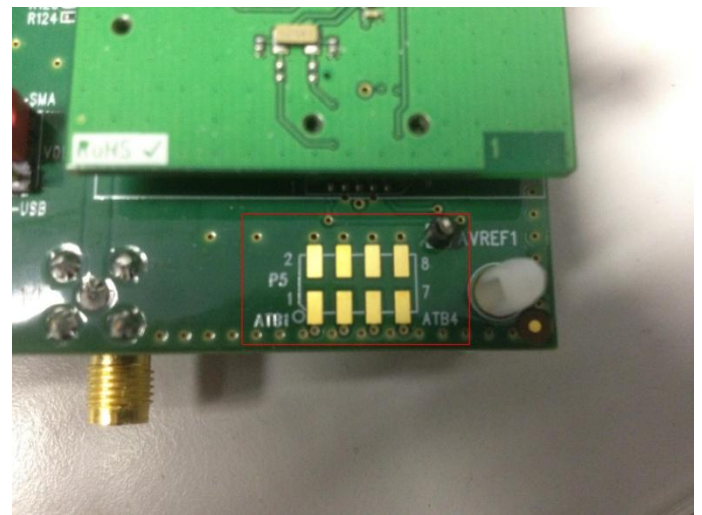


Figure 41 (ATB Connections Header)

ADF7023 Powering Options

The ADF7023 daughter board has 4 different powering options.

It can be powered from the main USB, a 3.6V battery, SMA connector, or directly from PCB header J9.

Powering the ADF7023 from the USB

The default method is to power the board from the main USB. For this option ensure the jumper is in position 1 (Figure 42)



Figure 42 (Default Jumper configuration)

Powering the ADF7023 from the Battery

To power the ADF7023 and all other components on the ADF7xxxMB4z ensure the 3.6V battery is inserted and that the jumper is in the default position as in (Figure 42).

Powering the ADF7023 from the SMA connector

Ensure the VDD_RF SMA power lead is connected to the board and that the Jumper on header J9 is in the correct position as in (Figure 43).

WARNING: The SMA connection powers the ADF7023 directly and is not regulated. Please ensure that the MAX Power rating of 3.6V as per the ADF7023 datasheet is abided by. If this max rating is not adhered to the ADF7023 daughter card may be permanently damaged as a result. Note also that the center pin of the SMA is the positive and the shielding is ground. Care must be taken to ensure reverse polarity does not occur as there is no protection circuitry in place for such an event.

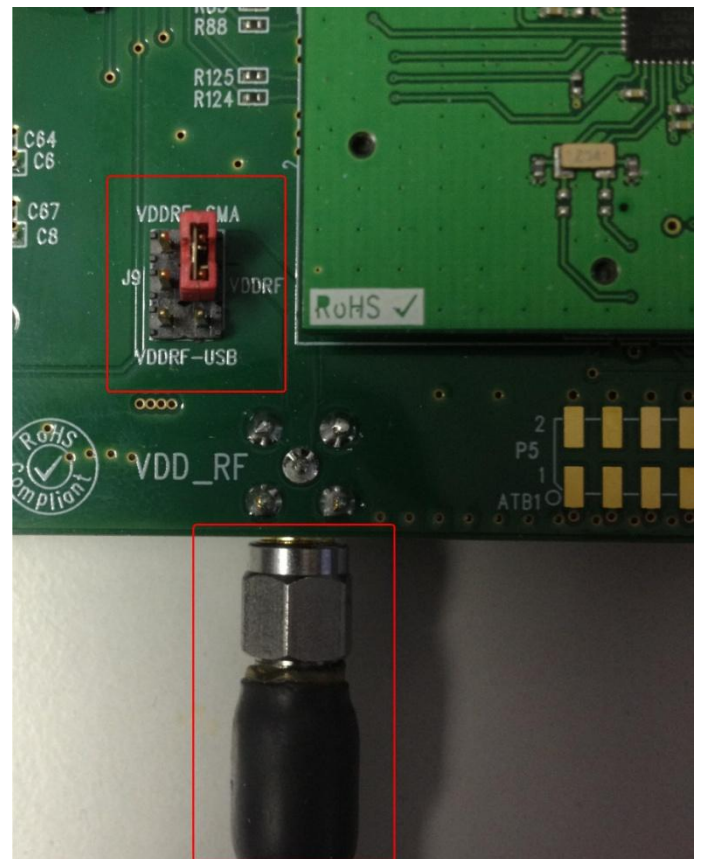


Figure 43 (Powering externally from an SMA Cable)

Powering the ADF7023 directly from Header J9

The ADF7023 can be powered directly from the Header J9. This can be achieved by connecting placing a connector directly on the VDDRF pin and ground. Refer to (Figure 44) for connection orientation.



Figure 44 (Powering the ADF7023 Directly from Header J9)

WARNING: Direct connection to Header J9 powers the ADF7023 directly and is not regulated. Please ensure that the MAX power rating of 3.6V as per the ADF7023 datasheet is abided by and that care is taken to ensure correct polarity as indicated in (Figure 44). If the Max rating is not adhered to or polarity is reversed, the ADF7023 daughter card may be permanently damaged as a result.

SD Micro Card

The micro SD card slot is situated on the underside of the ADF7xxxMB4z. This card can be used to provide extra memory for larger applications. The SD card slot is connected directly to the SPI lines of the onboard uC. Please refer to the [Schematics](#) section of the document for more information on the connection details. (Figure 45) shows the location of the micro SD card slot on the ADF7xxxMB4z motherboard.



Figure 45

Ethernet Port

The Ethernet port connection is provided in the development kit and can be used in applications requiring a physical connection to Ethernet. This is directly controlled by Microchip's ENC424J600 Stand-Alone 10/100 Ethernet Controller and this is interfaced with the onboard uC through SPI. Please refer to the [Schematics](#) section for further connection information.

Dot Matrix LCD

The ADF7xxxMB4z has DOGM128E 128 x 64 Dot Matrix LCD. This can be used by the developer in battery applications where USB communications is not achievable. Future code revisions will have more screen capabilities with the selection menu available on screen, to allow the user to operate the ADF7023 completely on battery power.

Touch Screen Controller

A Touch Screen Controller is available on the ADF7xxxMB4z. This is an ADI AD7879 resistive touch screen controller. The communications between this controller and the host uC is done through the SPI interface. This hardware allows the developer to evaluate touch screen capabilities in their application.

uC Development code for the ADF7023

The ADF7xxxMB4z is designed to be used as a code development kit as well as an evaluation platform. Documented reference code is supplied and installed as part of the main software installation. This code can be edited and used by the developer and is supplied as a coding reference.

The following sections go through the functionality of the reference code and how the part can be setup using a simple HyperTerminal program.

The Reference code can be compiled with “IAR RL78 Embedded Workbench”

Programming the RL78 with the Reference Code

- Plug in the USB lead into the ADF7xxxMB4z board and the PC.
- Ensure the Dipswitches are as per (Figure 46)
- Ensure the jumper is inserted correctly on J9
- Ensure an ADF7023DBx board is plugged into the motherboard.
- Ensure the screen is plugged into the motherboard.

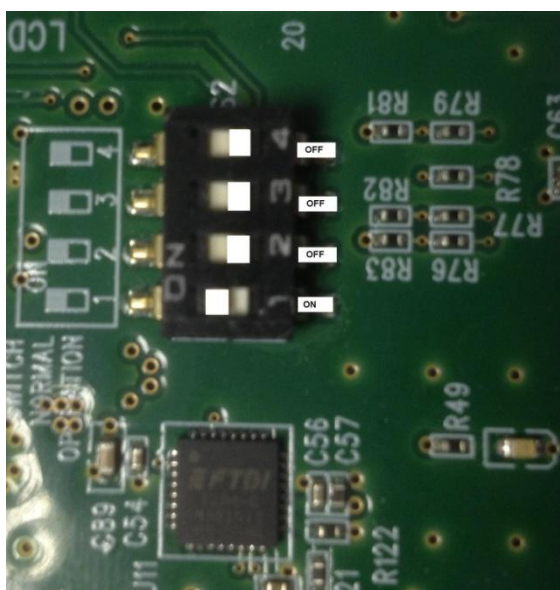


Figure 46 Debug Mode

- Open the “Test_Code” link from the start menu: “Start”-> “All Programs” -> “Analog Devices”-> “ADF7xxxMB4z” -> “SourceCode” -> “Test_Code”.

The screen in (Figure 47) will appear.

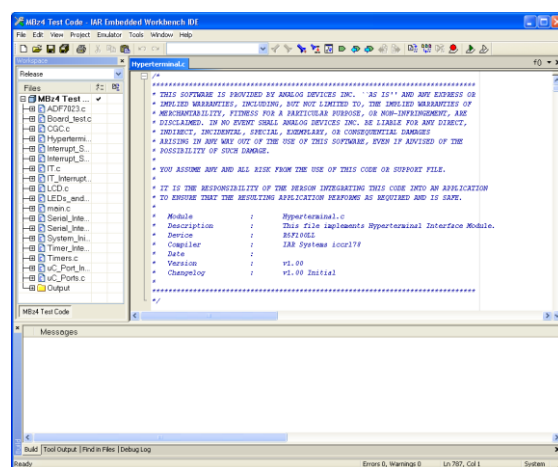


Figure 47

Press the Debug and Run Button as circled in (Figure 48)

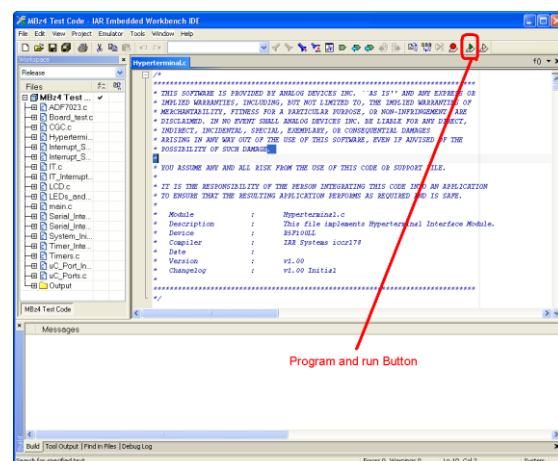


Figure 48

If the USB interface is functioning correctly a message window will appear as in (Figure 49) after the program and run button is pressed.

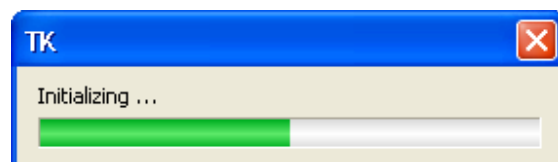


Figure 49

The testing program is now loaded to the MB4z board and ready for Debug.

Using the ADF7xxxMB4z Evaluation Board after flashing the supplied example code to the RL78.

1. Once the required software is installed, plug the USB cable into the **"MAIN USB"** port (Figure 50) on the ADF7xxxMB4z and the other end to the PC on which the software is installed.

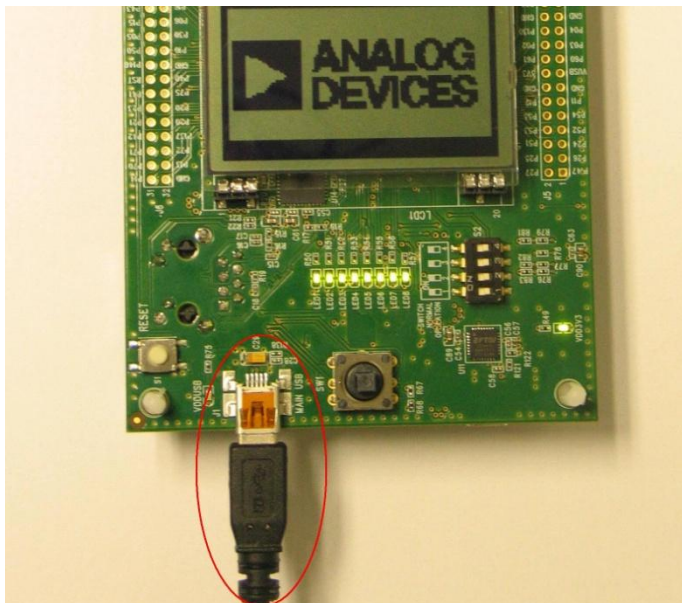


Figure 50

2. Start TeraTerm Software from **"StartMenu"** -> **"All Programs"** -> **"Analog Devices"** -> **"ADF7xxxMB4z"** -> **"HyperTerminal"**
3. The COM Port will need to be set up on initialization.

To do this go to **"Setup"** -> **"Serial port"** then select the relevant COM Port for the ADF7xxxMB4z as shown in (Figure 51).

(Note: The COM Port number will normally be >10)

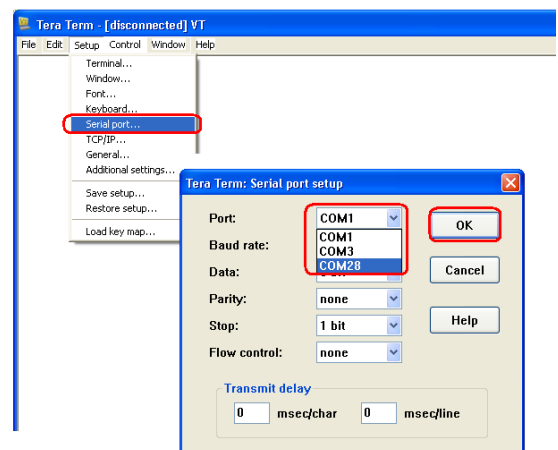


Figure 51

Once the terminal window is setup press the **"Reset"** button on the board (Figure 52) to bring up the text menus in the TeraTerm window (Figure 53).

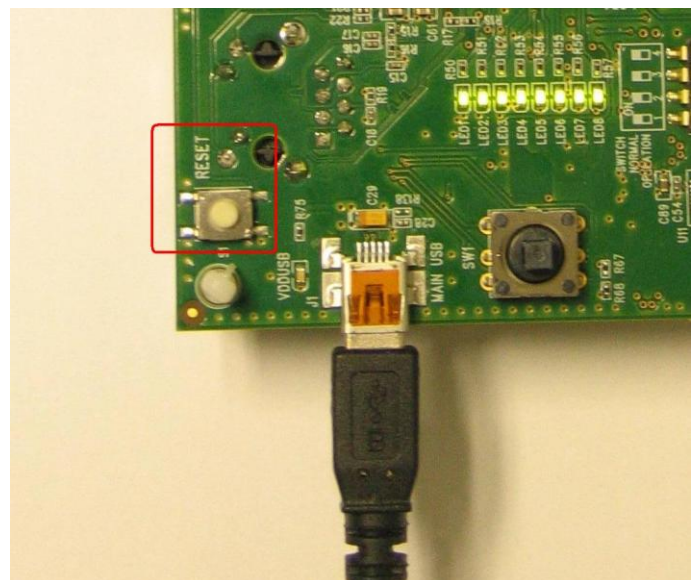


Figure 52

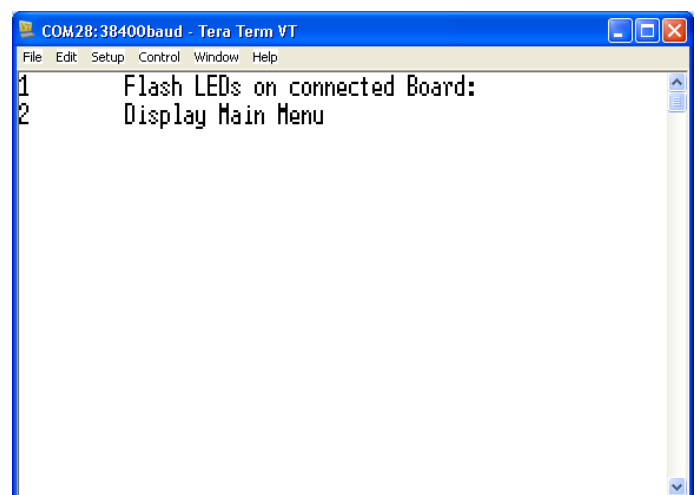


Figure 53

Using the HyperTerminal Text Menu

The HyperTerminal eval approach gives the user a text based menu driven interface for controlling the functionality of the ADF7023. To select an option on a particular menu type the number associated with the option followed by ENTER. This will bring the user to a follow on menu or to a particular function.

The following examples go through using the menu driven functions.

Frequency setup

From the reset state Type “2” followed by “ENTER” (Figure 54), which will bring the user to the “Main Menu”.

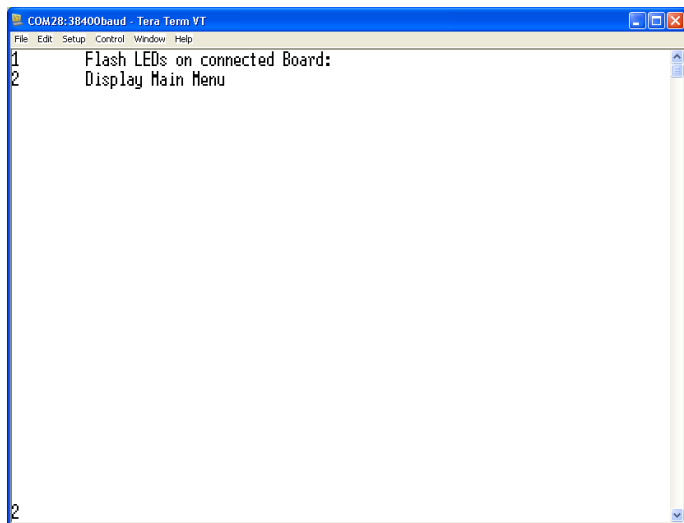


Figure 54

To enter the Frequency Setup Menu from the Main Menu Type “1” followed by “ENTER” (Figure 55). This will bring the user to the Frequency Setup.

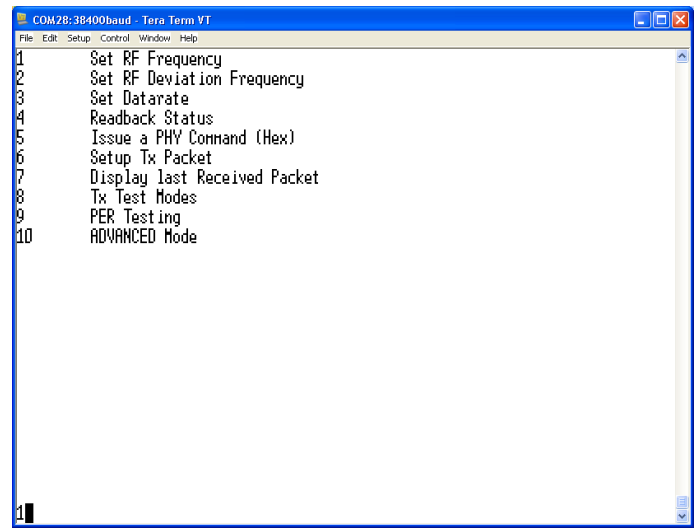


Figure 55

Enter the frequency in HERTZ (Hz). This will set the frequency of the ADF7023 to the frequency entered and then display the new frequency on screen, (Figure 56). Press ENTER to return back to the Main Menu.

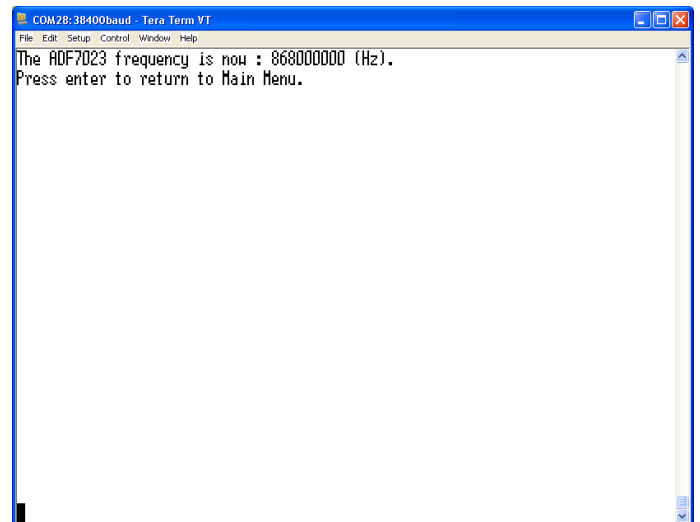


Figure 56

Set RF Deviation Frequency

To enter the RF Deviation Frequency Menu from the Main Menu Type “2” followed by “ENTER”. This will bring the user to the RF Deviation Frequency Setup. The RF Deviation Frequency will be set in the same way as setting the RF Frequency. The deviation must be entered in HERTZ (Hz).

Set the Datarate

To enter the Datarate Menu from the Main Menu Type “3” followed by “ENTER”. This will bring the user to the datarate setup. The datarate will be set in the same way as setting the RF Frequency. The datarate must be entered in Bits per Second (bps).

Readback Status

To enter the Readback Status option from the Main Menu Type “4” followed by “ENTER”. This will bring the user to an information screen showing the status of the ADF7023 (Figure 57).

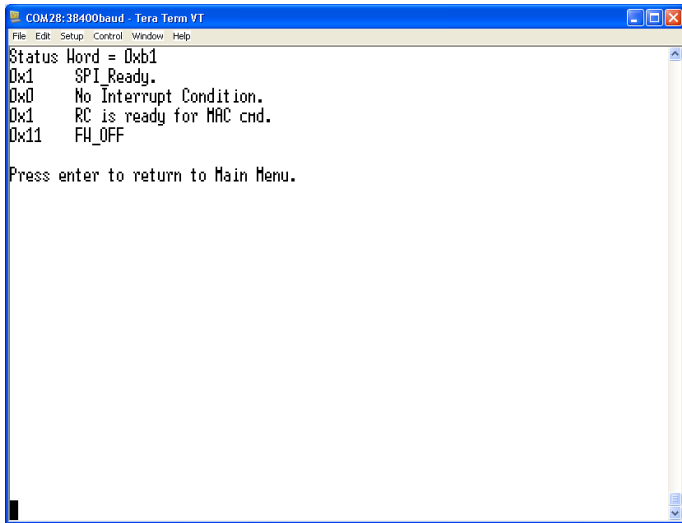


Figure 57

Issue a PHY command

To enter the Issue PHY command option from the Main Menu Type “5” followed by “ENTER”. The user must then enter the PHY_Command in HEX followed by ENTER (Figure 58). (PHY_ON for example is HEX value 0xB1). After ENTER has been pressed the uC issues the ADF7023 with the PHY command and reports back the PHY status on screen (Figure 59).

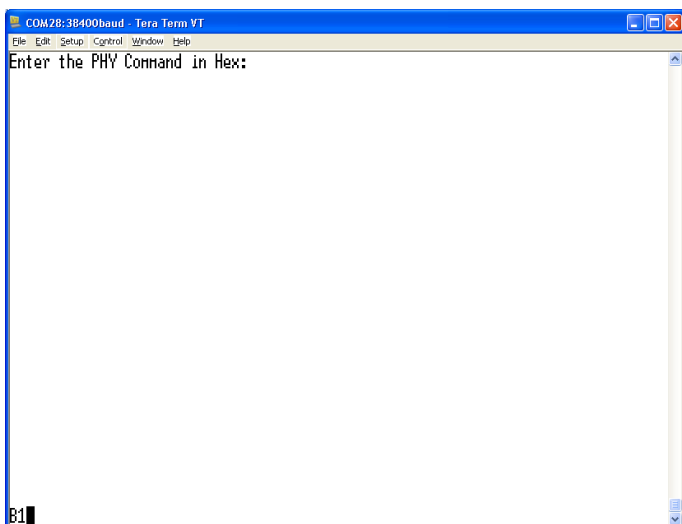


Figure 58

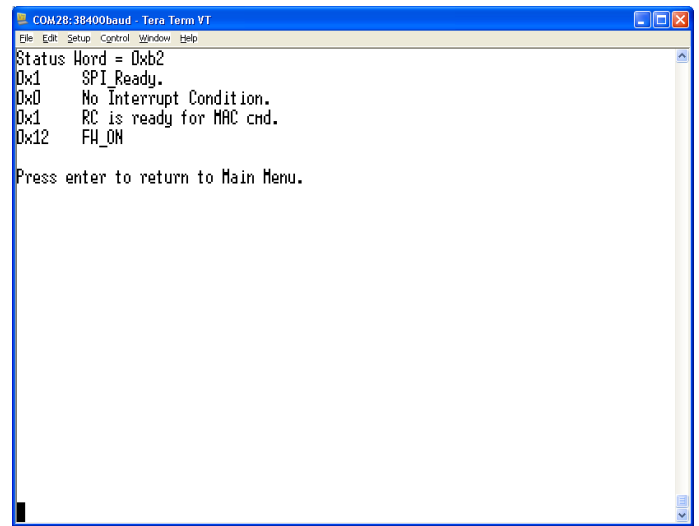


Figure 59

Setup a Tx Packet

To enter the Setup Tx Packet option from the Main Menu Type “6” followed by “ENTER”. This will bring the user to the packet setup for the ADF7023. The user must first enter the DECIMAL length, in Bytes, of the Payload to be entered followed by enter (Figure 60)

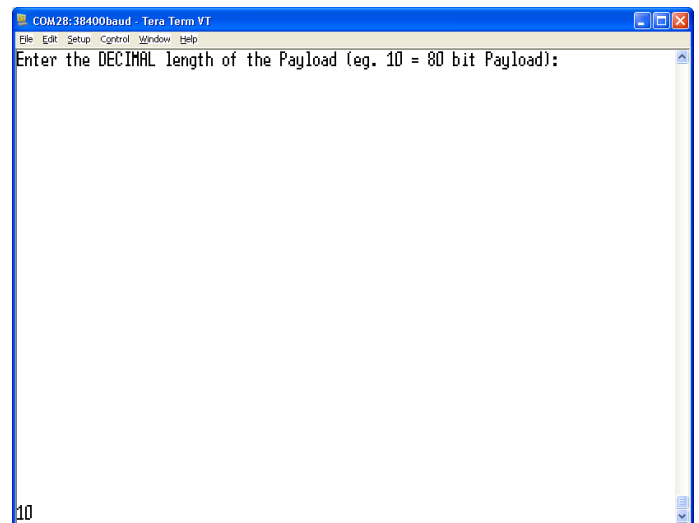


Figure 60

Following this each byte of PAYLOAD data must be entered, each followed by ENTER. (Figure 61) A text file containing each byte of the payload data can alternatively be sent instead of entering each byte individually. (Please refer to “sending a text file” for more info.)

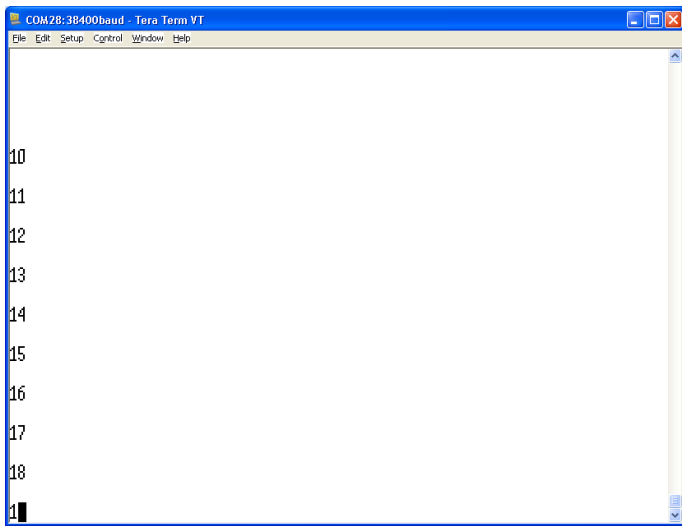


Figure 61

Once the number of Payload Bytes has been entered the entered payload will then be sent to packet RAM on the ADF7023 and displayed on screen. (Figure 62)

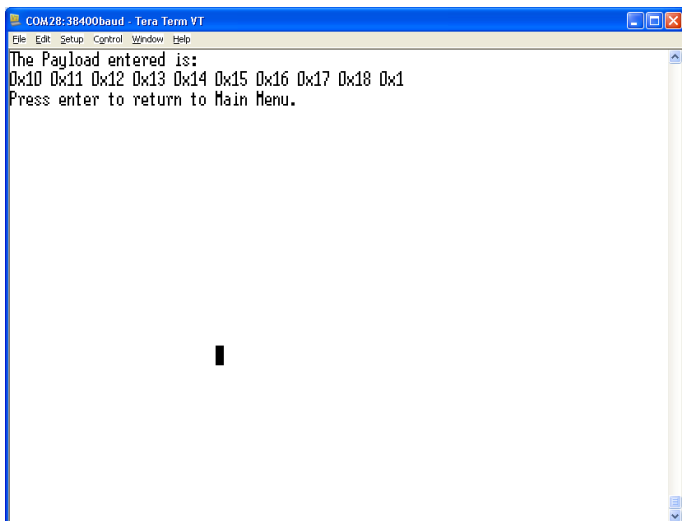


Figure 62

Display the Last Received Packet

To enter the Display Last Received Packet option from the Main Menu Type "7" followed by "ENTER". The user is then asked for the number of bytes to readback from packet RAM (Figure 63).

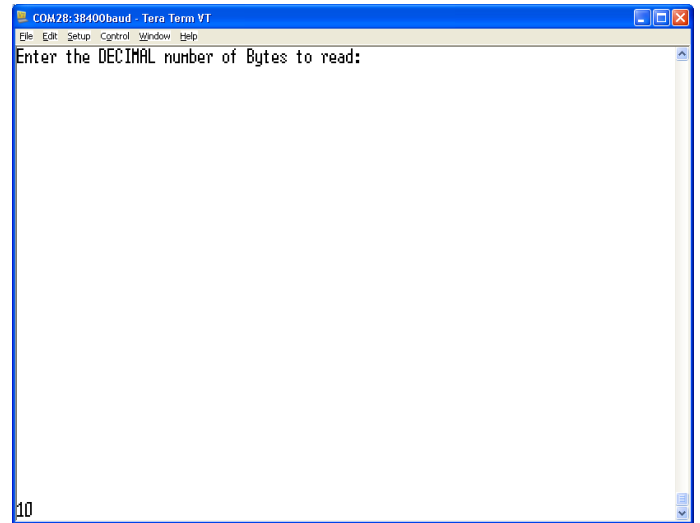


Figure 63

Once the number of bytes to be read back has been entered, the contents of packet RAM will be displayed on screen. (Figure 64)

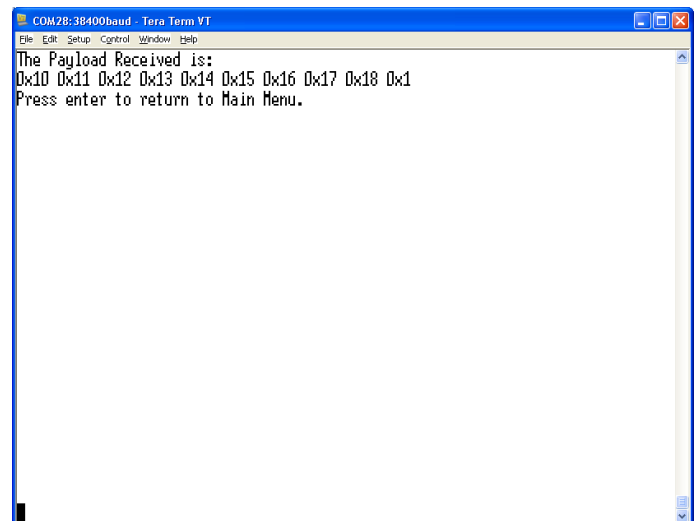


Figure 64

Tx Test Modes

To enter the Tx Test Modes option from the Main Menu Type “8” followed by “ENTER”. The ADF7023 then goes into Tx Carrier mode. (Figure 65) Press ENTER to return to the Main Menu.

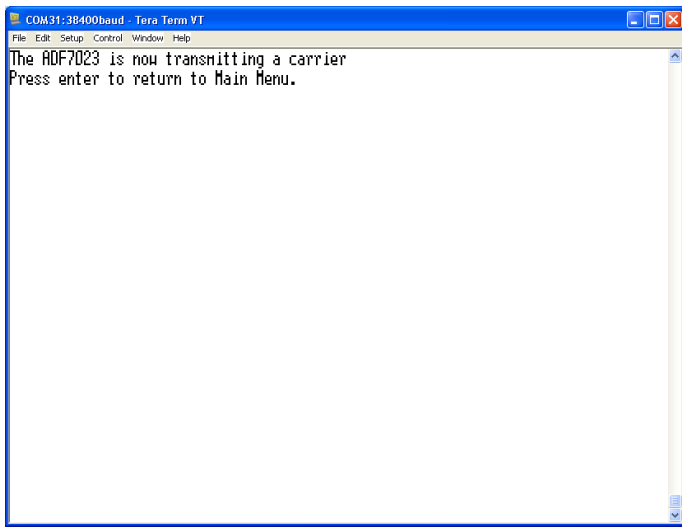


Figure 65

PER Testing Tx

To enter the PER Testing option from the Main Menu Type “9” followed by “ENTER”. The ADF7023 then goes into the PER Testing menu. (Figure 66)

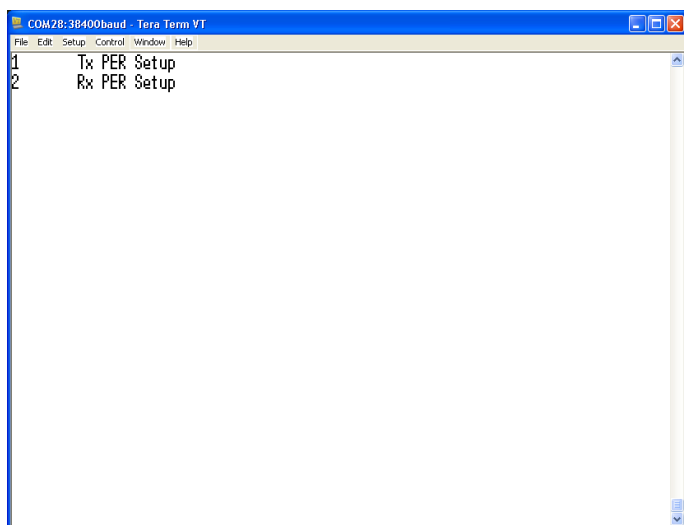


Figure 66

To enter the Tx menu Type “1” followed by “ENTER”.

The user is then asked to enter the decimal number of bytes in the Payload. Type the number of Bytes followed by the “ENTER” key. [For example 10 as in (Figure 67)]

NOTE: The Range of payload bytes is 1 - 239

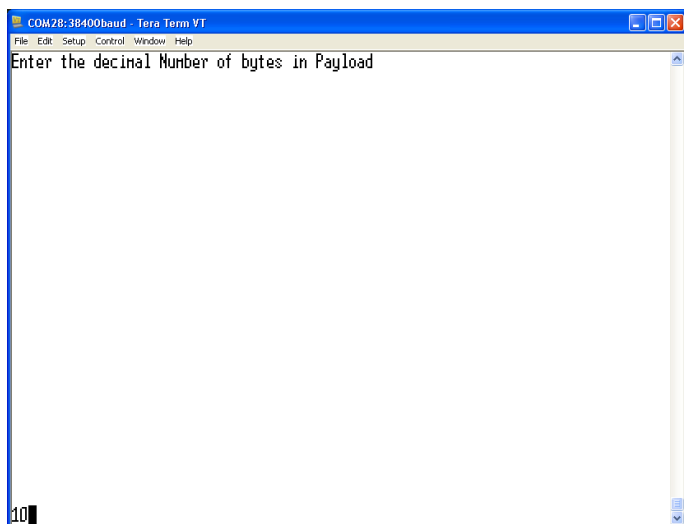


Figure 67

The user is then asked to enter the decimal number of packets to be transmitted in the test. Type the number of packets followed by the “ENTER” key. [For example 10 as in (Figure 68)]

NOTE: The decimal number of packets range is 1 - 65000

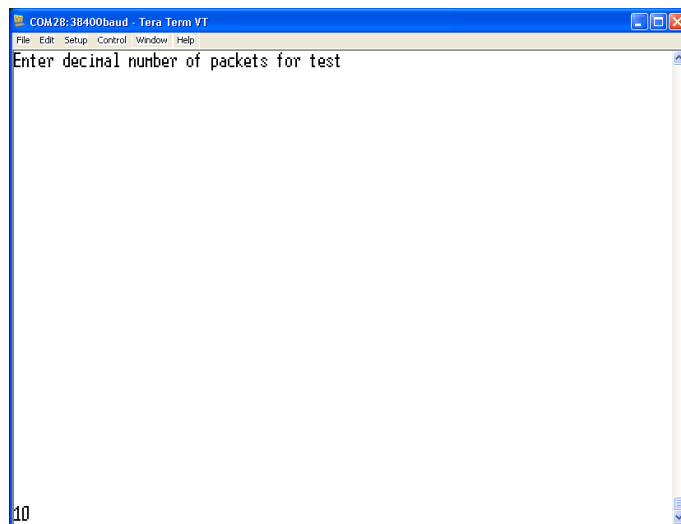


Figure 68

The user is then asked to enter the decimal delay in milliseconds that the transmitter will wait for, after transmitting a packet, before transmitting the next packet. Type the delay value followed by the “ENTER” key. [For example 100 as in (Figure 69)]

NOTE: The decimal delay number range is 0 - 65000

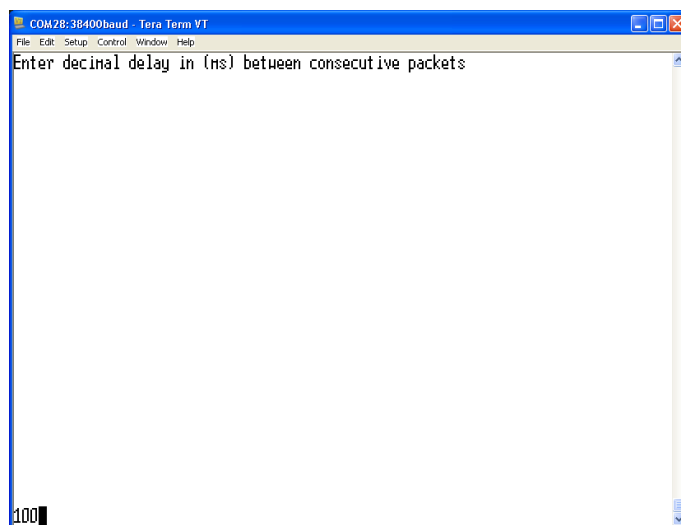


Figure 69

The next screen (Figure 70) asks the user to press ENTER to begin the Tx PER test. Ensure the Rx Board is setup before you begin the test.

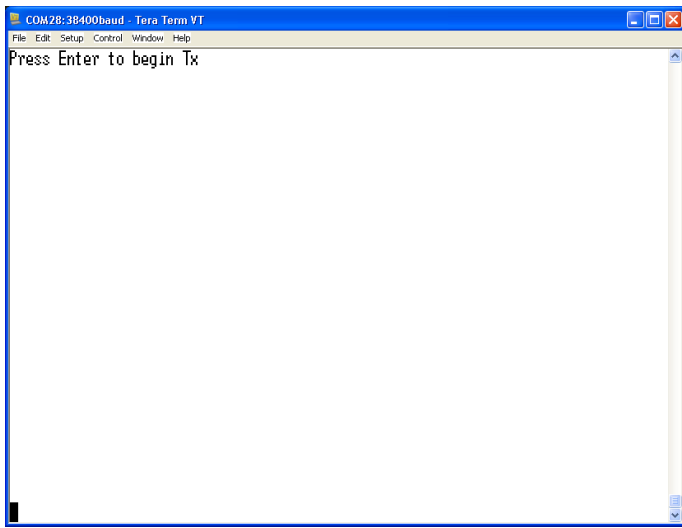


Figure 70

If desired the user can cancel testing and return to the main Menu by pressing “ENTER” after the testing has begun (Figure 71).

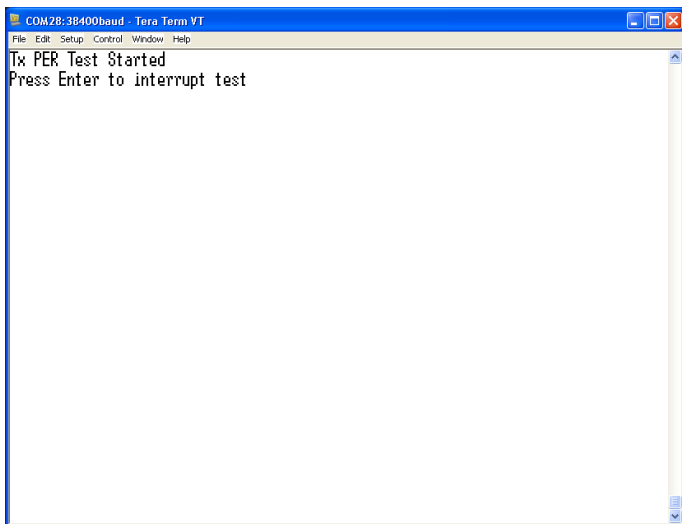


Figure 71

Once the Tx Testing is complete, the number of transmitted packets is returned. To return to the main menu press “ENTER”.

PER Testing Rx

To enter the PER Testing option from the Main Menu Type “9” followed by “ENTER”. The ADF7023 then goes into the PER Testing menu. (Figure 72)

Ensure all settings in the Rx Test setup match those of the Tx setup otherwise the test will not successfully run.

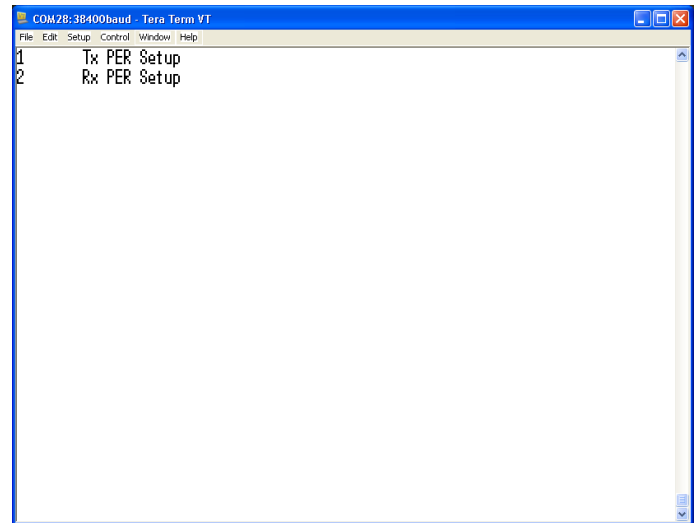


Figure 72

To enter the Rx menu Type “2” followed by “ENTER”.

The user is then asked to enter the decimal number of bytes in the Payload. Type the number of Bytes followed by the “ENTER” key. [For example 10 as in (Figure 73

NOTE: The Range of payload bytes is 1 - 239

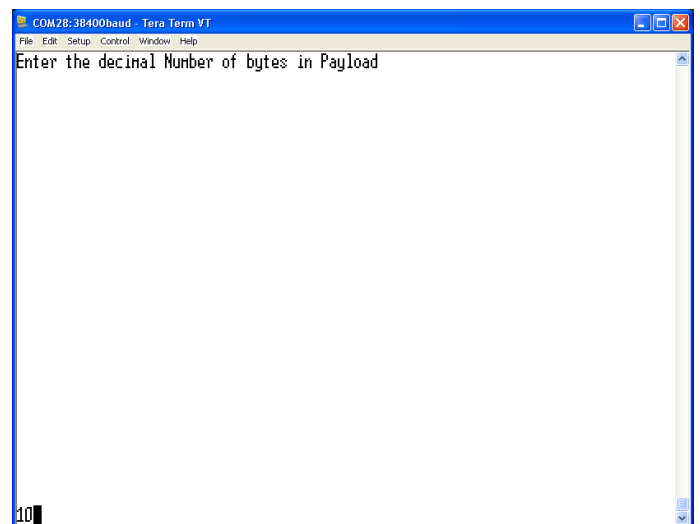


Figure 73

The user is then asked to enter the decimal number of packets which will be transmitted throughout the test. Type the number of packets followed by the “ENTER” key. [For example 10 as in (Figure 74)]

NOTE: The decimal number of packets range is 1 - 65000

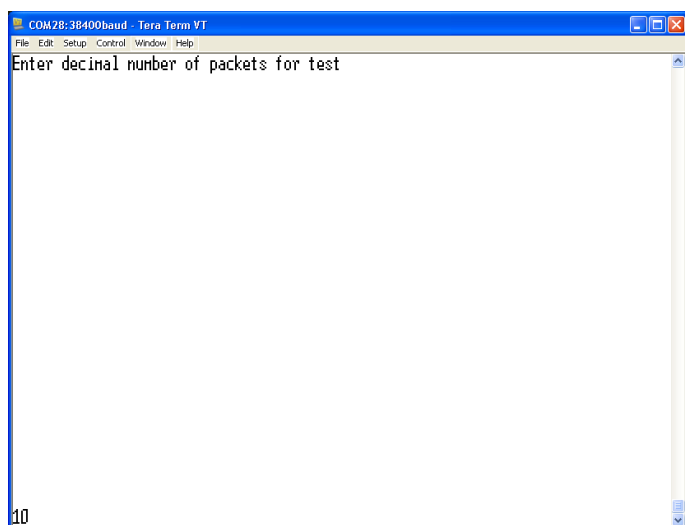


Figure 74

The next screen (Figure 75) asks the user to press ENTER to begin the Rx PER test.

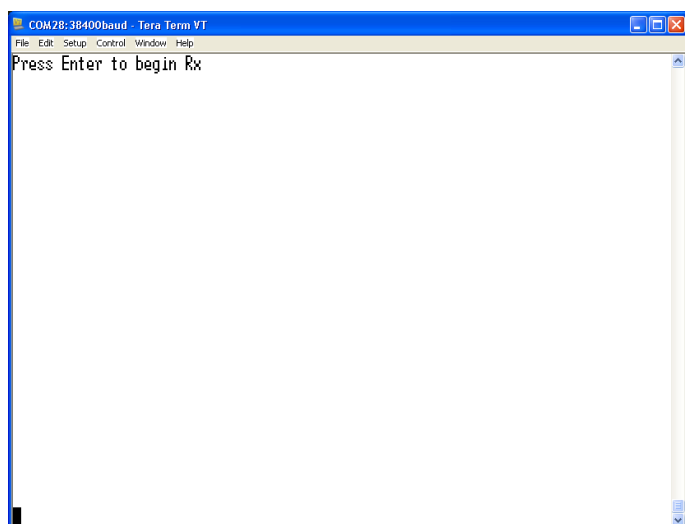


Figure 75

Once the PER Rx board has been setup and in Rx, the PER Tx board can now be set to start transmitting.

If desired the user can cancel testing and return to the main Menu by pressing "ENTER" after the testing has begun (Figure 76).

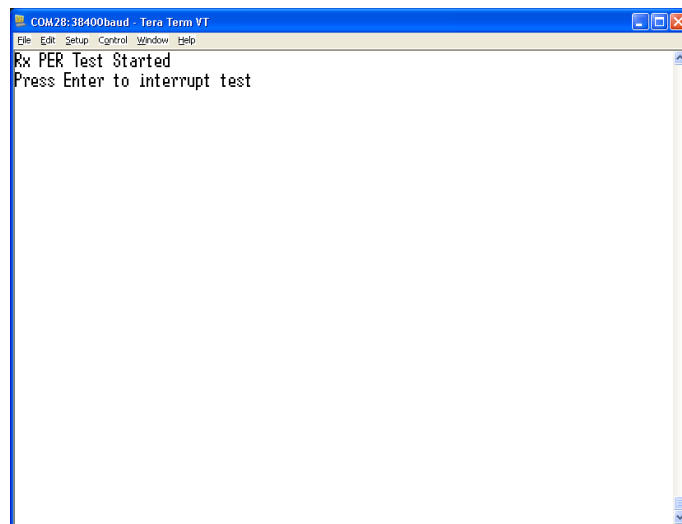


Figure 76

Once the Tx Testing is complete, the number of Correctly Received packets is returned. (Figure 77) To return to the main Menu press "ENTER".

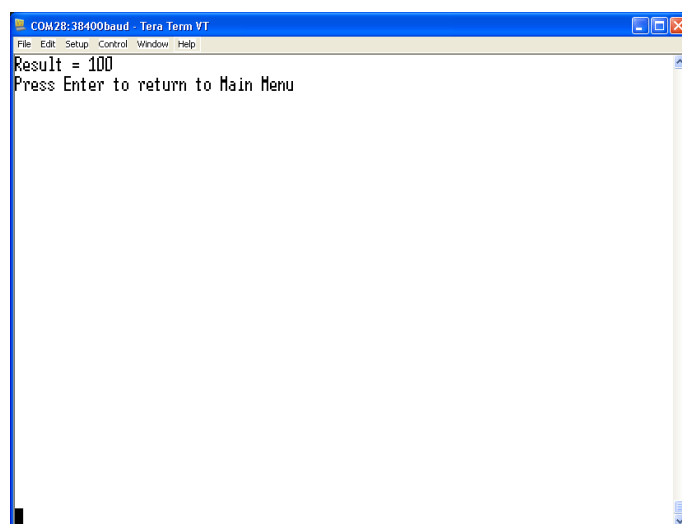


Figure 77

Advanced Modes

To enter the Advanced Mode option from the Main Menu Type “10” followed by “ENTER”. The ADF7023 then goes into the Advanced Mode menu. (Figure 78)

The Advanced Mode menu gives the option to:

- Write to MCR Address
- Write to BBRAM Address
- Write to Packet Ram Address
- Download a Patch to Program RAM
- Read contents of the BBRAM
- Read the contents of MCR
- Read the contents of Packet RAM.

Writing to MCR

To enter the “Write to MCR Address” option from the ADVANCED Menu Type “1” followed by “ENTER”. (Figure 78)

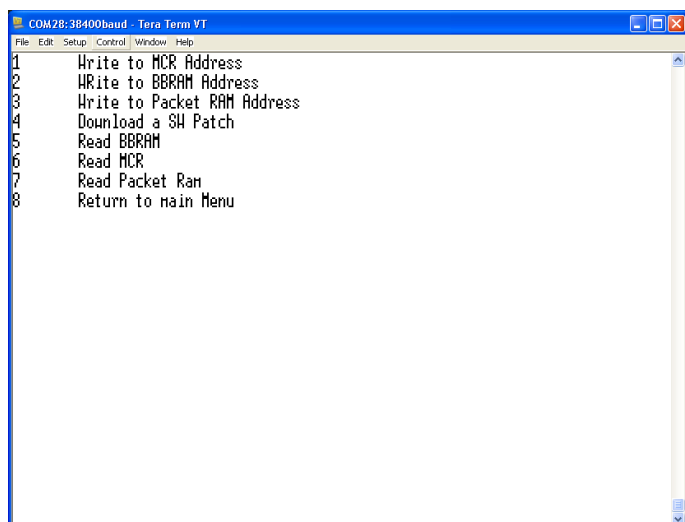


Figure 78

Enter the first memory address of the MCR, in Hex, where you wish to start writing from. (Figure 79)

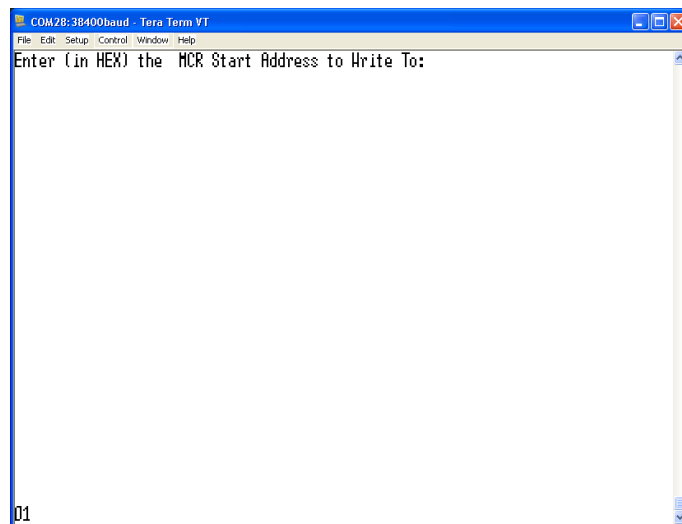


Figure 79

Enter the decimal number of bytes to write to the MCR (Figure 80)

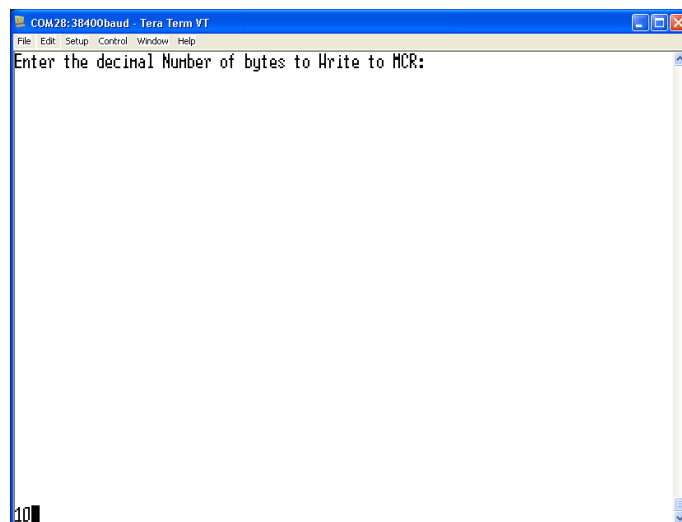


Figure 80

At this point you can manually enter the Hex values to be stored in MCR (Figure 81). A second option is to send a text file containing the hex values you wish to send. Please refer to [sending a text file](#) section for more information on how to send a text file.

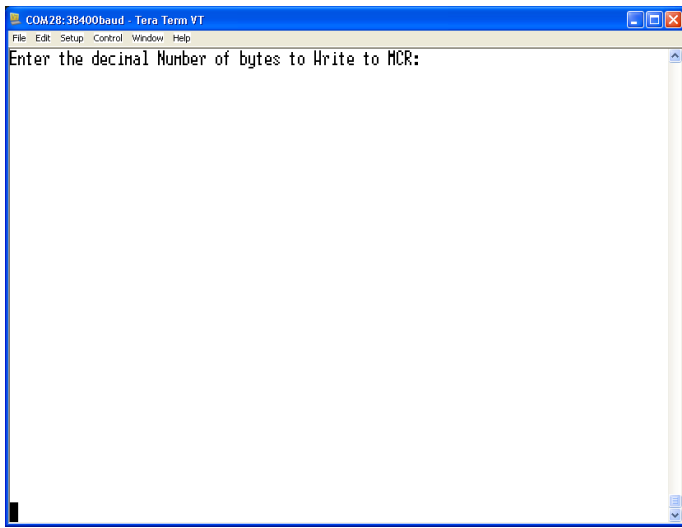


Figure 81

Once the number of bytes to store in MCR has been entered, the user is returned back to the ADVANCED Menu.

Writing to BBRAM

To enter the “Write to BBRAM Address” option from the ADVANCED Menu Type “2” followed by “ENTER”.

The procedure for writing to BBRAM is the same as writing to MCR so please refer to the [Writing to MCR](#) section for the full procedure.

Writing to Packet RAM

To enter the “Write to Packet RAM Address” option from the ADVANCED Menu Type “3” followed by “ENTER”.

The procedure for writing to Packet RAM is the same as writing to MCR so please refer to the [Writing to MCR](#) section for the full procedure.

Download a Patch to Program RAM

To enter the “Download a Patch to Program Ram” option from the ADVANCED Menu Type “4” followed by “ENTER”.

The procedure for downloading a patch to Program Ram is the same as Writing to MCR so please refer to the [Writing to MCR](#) section for the full procedure.

Reading BBRAM

To enter the “Read BBRAM” option from the ADVANCED Menu Type “5” followed by “ENTER”. (Figure 82)

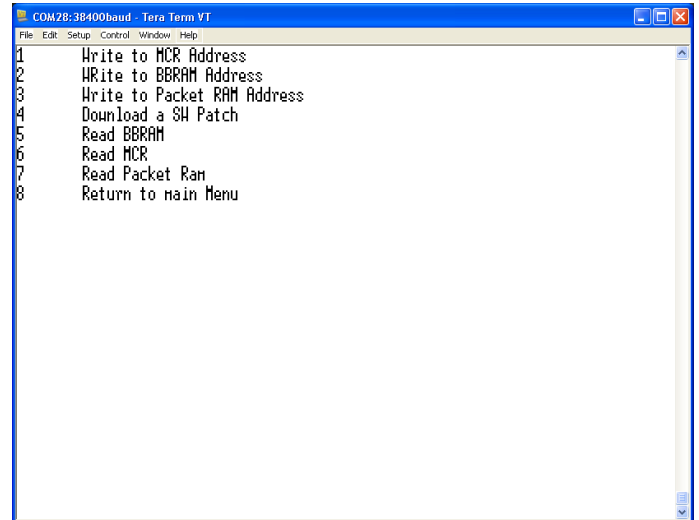


Figure 82

Enter the start address, in Hex, of the BBRAM to begin reading from. (Figure 83)

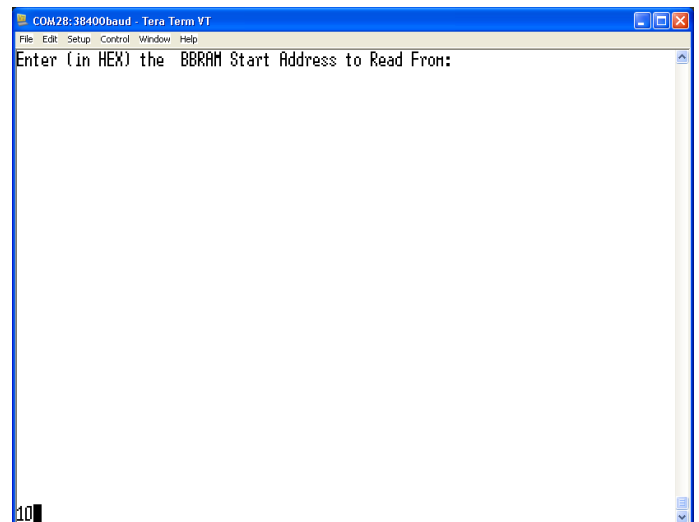


Figure 83

Enter the number of bytes to read back from BBRAM. (Figure 84)

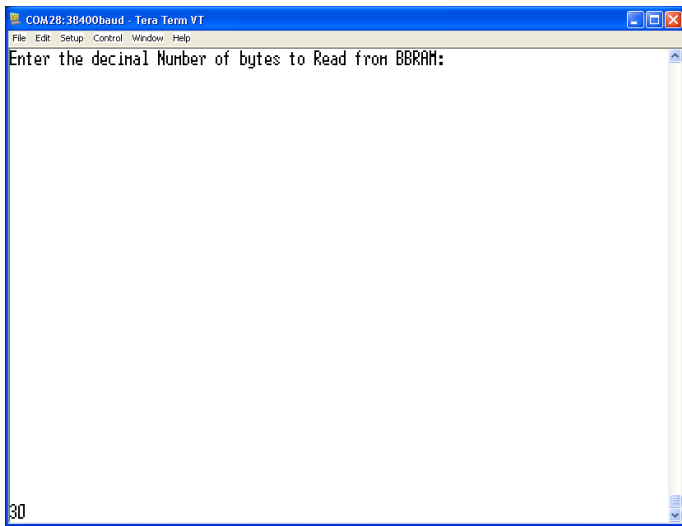


Figure 84

The BBRAM Register values will be displayed on screen page by page. (Figure 85) Press "ENTER" display the next page. Once the requested number of BBRAM values has been displayed, press "ENTER" to return back to the ADVANCED Menu.

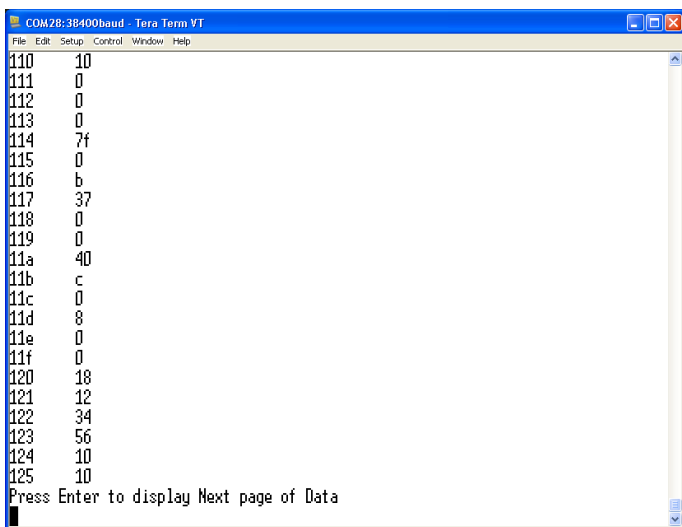


Figure 85

Read MCR

To enter the "Read MCR" option from the ADVANCED Menu Type "6" followed by "ENTER".

The procedure for reading from MCR is the same as reading from BBRAM so please refer to the [Reading BBRAM](#) section for the full procedure.

Read Packet RAM

To enter the "Read Packet RAM" option from the ADVANCED Menu Type "7" followed by "ENTER".

The procedure for reading from Packet RAM is the same as reading from BBRAM so please refer to the [Reading BBRAM](#) section for the full procedure.

Sending a Text file

To send a text file from the HyperTerminal program “TeraTerm” to a Memory location such as Packet RAM. This section describes the procedure of sending a text file with the list of hex bytes to be written to the required location after the screen in (Figure 86) is displayed. This example is for Packet RAM but the same procedure can be followed for MCR, BBRAM and Program RAM.

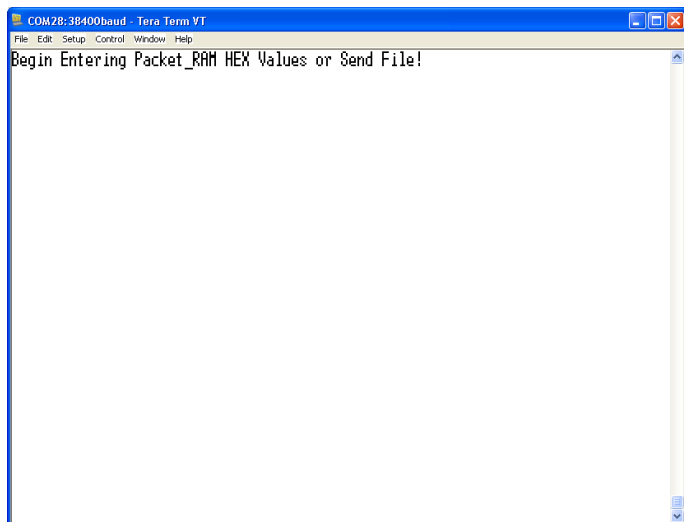


Figure 86

Firstly create and save a text file with the correct number of bytes to be written to the desired memory location such as Packet RAM. [The example in (Figure 87) shows 10 bytes]

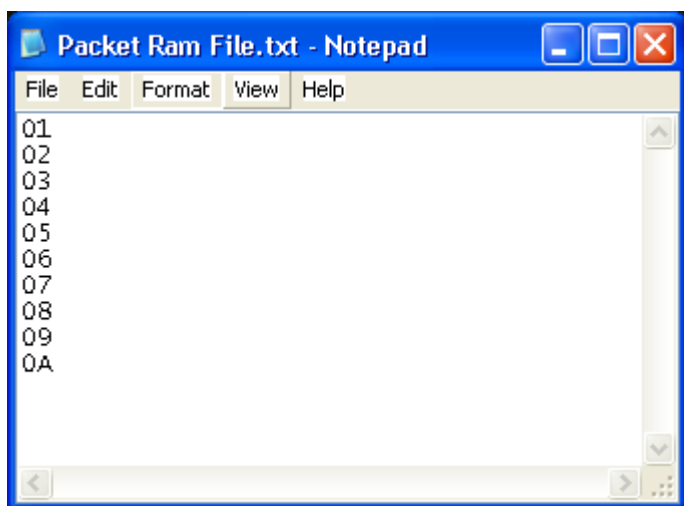


Figure 87

Return to the HyperTerminal window. Click on **File -> Send File** (Figure 88)

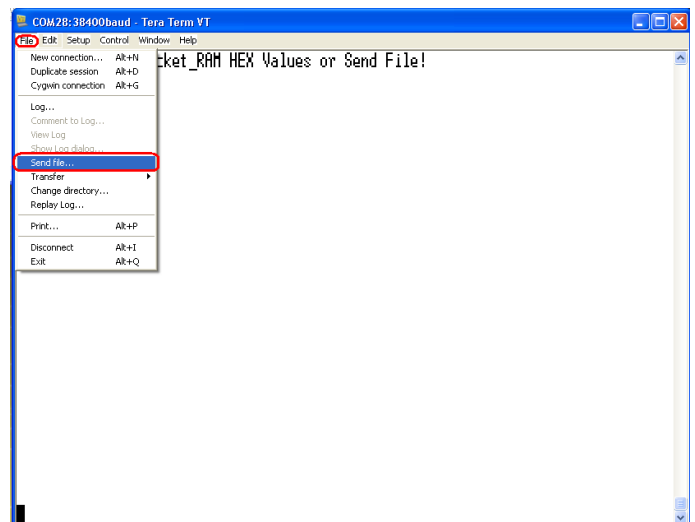


Figure 88

Select the saved file to load with the required number of bytes and click “Open” (Figure 89)

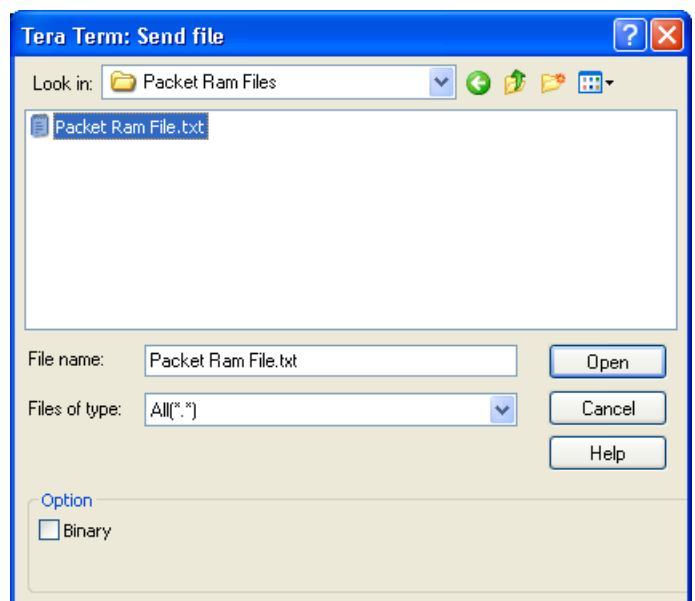


Figure 89

Once “Open” is pressed, the contents of the file will be written to the appropriate memory destination. If no return character exists at the end of the file you will see the contents of the sent file printed in the HyperTerminal window, (Figure 90), press enter to return to the ADVANCED Menu. If a return character exists at the end of the file the user will be automatically returned to the advanced menu.

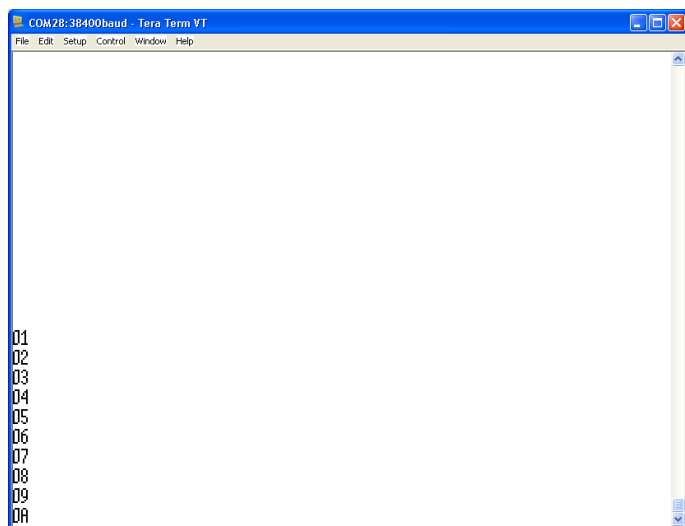


Figure 90

Communication Error

If in the event that the user enters a value or character not supported by the program, the communications may break down. In this event the uC must be reset. To do this press the reset button on the motherboard shown in Figure 91). This will also reset the ADF7023 back to the default configuration.

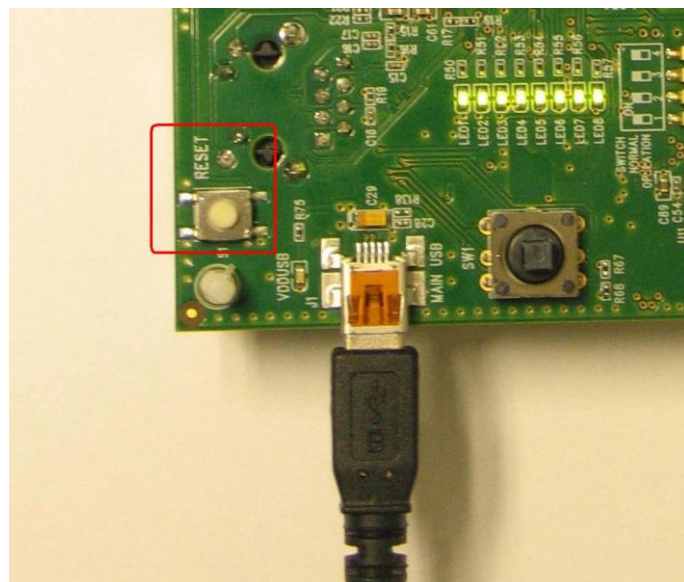
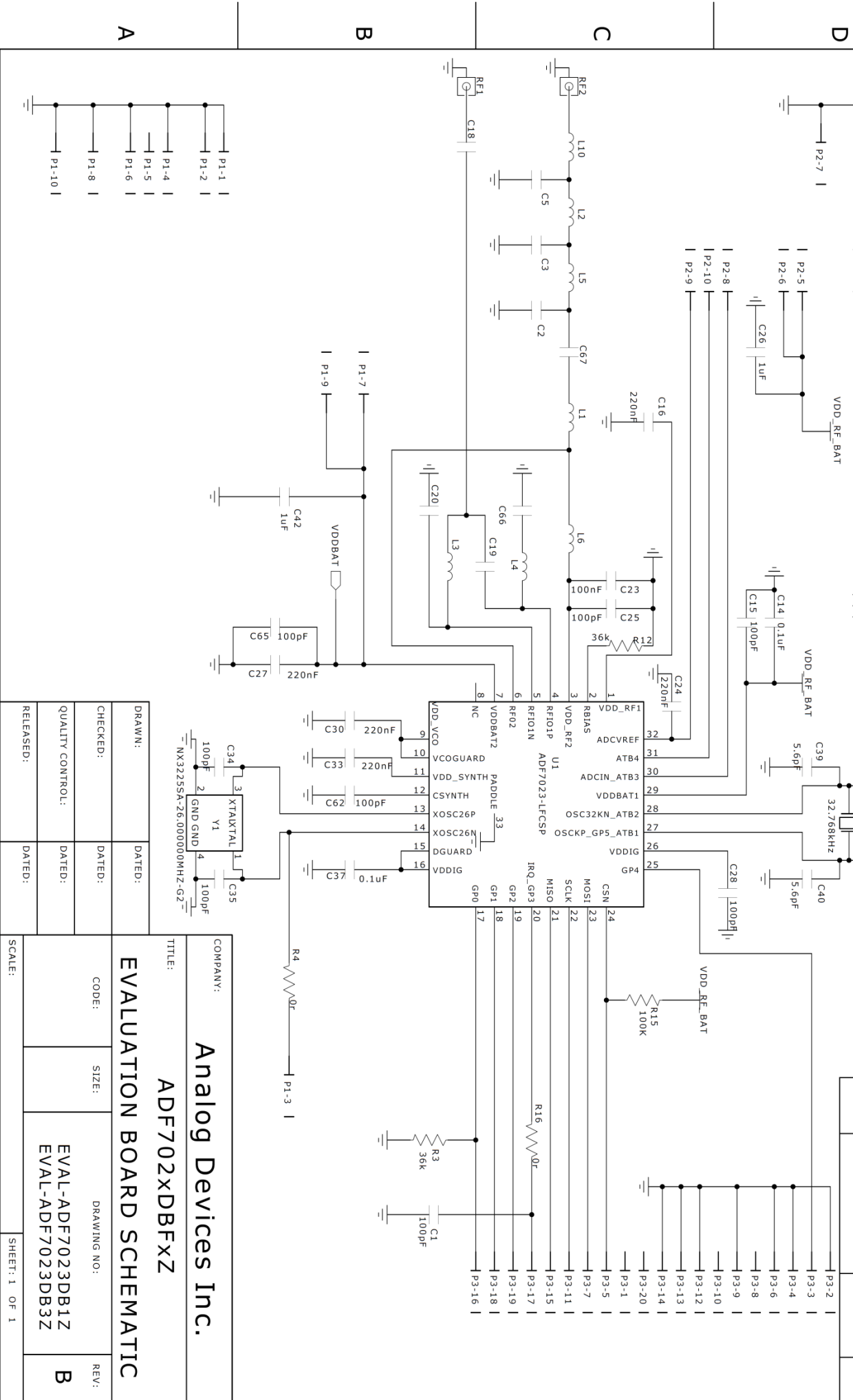


Figure 91

ADF7023DBx

**Separate
Match
Schematic**

REVISION RECORD		
LTR	ECO NO:	APPROVED: DATE:



DRAWN:	DATED:
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY:				Analog Devices Inc.	
TITLE:				AD7023DBFXZ	
EVALUATION BOARD SCHEMATIC					
CODE:		SIZE:		DRAWING NO:	
				EVAL-AD7023DB1Z	
				EVAL-AD7023DB3Z	
				B	
SCALE:				SHEET: 1 OF 1	

ADF7023DBx

Combined

Match

Schematic

ADF7023DBx

Bill of Materials (BOM)

Table 2 Components Common to All Daughter Boards

Qty	Name	Value	Tolerance	PCB Decal	Manufacturing Part No.
1	C1	1.5nF	±5%	0402	GRM155R71H152KA01D
9	C14, C16, C24, C28, C30, C33, C37, C62, C65	220nF	±10%	0402	GRM155R61A224KE19D
2	C15, C27	100pF	±5%	0402	GRM1555C1H101JZ01D
3	C23, C34, C35	18pF	±5%	0402	GRM1555C1H180JZ01D
1	C25	150nF	±5%	0402	GRM155R61A154KE19D
2	C26, C42	10uF	±20%	0603	6R3R14X106MV4T
2	C39, C40	5.6pF	±5%	0402	GRM1555C1H5R6DZ01D
4	R3, R4, R8, R9	DNI			Not inserted
1	R12	36k	±1%	0402	MCR01MZPF3602
1	R15	100k	±1%	0402	MCR01MZPF1003
1	R16	1.1k	±1%	0402	MCR01MZPF1101
1	Y1	26MHz			NX3225SA-26.000000MHZ-G2
1	Y2	32.768kHz			ABS07-32.768KHZ-7-T
1	U1			LFCSP-32	ADF7023

Table 3 Eval-ADF7023DB1Z Components (868/915MHz Separate Matches)

Qty	Name	Value	Tolerance	PCB Decal	Manufacturing Part No.
1	C2	1pF	±0.25pF	0402	GRM1555C1H1R0CA01D
2	C3, C5	2.2pF	±0.25pF	0402	GRM1555C1H2R2CZ01D
1	C18	56pF	±5%	0402	GRM1555C1H470JZ01D
1	C19	2.7pF	±0.25pF	0402	GRM1555C1H2R7CZ01D
1	C20	1.2pF	±0.25pF	0402	GRM1555C1H1R2CZ01D
1	C66	100pF	±5%	0402	GRM1555C1H101JZ01D
1	C67	47pF	±5%	0402	GRM1555C1H470JZ01D
1	L1	1.8nH	±5%	0402	Coilcraft 0402CS-1N8XJL
1	L2	24nH	±5%	0402	Coilcraft 0402CS-24NXJL
1	L3	12nH	±5%	0402	Coilcraft 0402CS-12NXJL
1	L4	6.2nH	±5%	0402	Coilcraft 0402CS-6N2XJL
1	L6	47nH	±5%	0402	Coilcraft 0402CS-47NXJL
2	L5, L10	12nH	±5%	0402	Coilcraft 0402CS-12NXJL

Table 4 Eval-ADF7023DB2Z Components (868/915MHz Combined Match)

Qty	Name	Value	Tolerance	PCB Decal	Manufacturing Part No.
1	C2	DNI			Not Inserted
2	C3,C22	2.2pF	±0.25pF	0402	GRM1555C1H2R2CZ01D
1	C18	56pF	±5%	0402	GRM1555C1H470JZ01D
2	C19	2.7pF	±0.25pF	0402	GRM1555C1H2R7CZ01D
1	C20	1.8pF	±0.25pF	0402	GRM1555C1H1R8CZ01D
1	C66	100pF	±5%	0402	GRM1555C1H101JZ01D
1	C67	47pF	±5%	0402	GRM1555C1H470JZ01D
1	L1	1.8nH	±5%	0402	Coilcraft 0402CS-1N8XJL
3	L2, L4, L9	12nH	±5%	0402	Coilcraft 0402CS-11NXJL
1	L3	11nH	±5%	0402	Coilcraft 0402CS-11NXJL
1	L6	47nH	±5%	0402	Coilcraft 0402CS-47NXJL
1	L7	24nH	±5%	0402	Coilcraft 0402CS-24NXJL

Table 5 Eval-ADF7023DB3Z Components (433MHz Separate Matches)

Qty	Name	Value	Tolerance	PCB Decal	Manufacturing Part No.
1	C2	1.2pF	±0.25pF	0402	GRM1555C1H1R2CZ01D
2	C3, C5	3.9pF	±0.25pF	0402	GRM1555C1H3R9CZ01D
3	C19, C20	5.6pF	±0.25pF	0402	GRM1555C1H5R6DZ01D
2	C18, C67	270pF	±5%	0402	GRM1555C1H271JA01D
1	C66	100pF	±5%	0402	GRM1555C1H101JZ01D
1	L1	15nH	±5%	0402	Coilcraft 0402CS-15NXJL
1	L2	82nH	±5%	0402	Coilcraft 0402CS-82NXJL
2	L3, L4	27nH	±5%	0402	Coilcraft 0402CS-27NXJL
2	L5, L10	33nH	±5%	0402	Coilcraft 0402CS-11NXJL
1	L6	100nH	±5%	0402	Coilcraft 0402CS-R10XJL

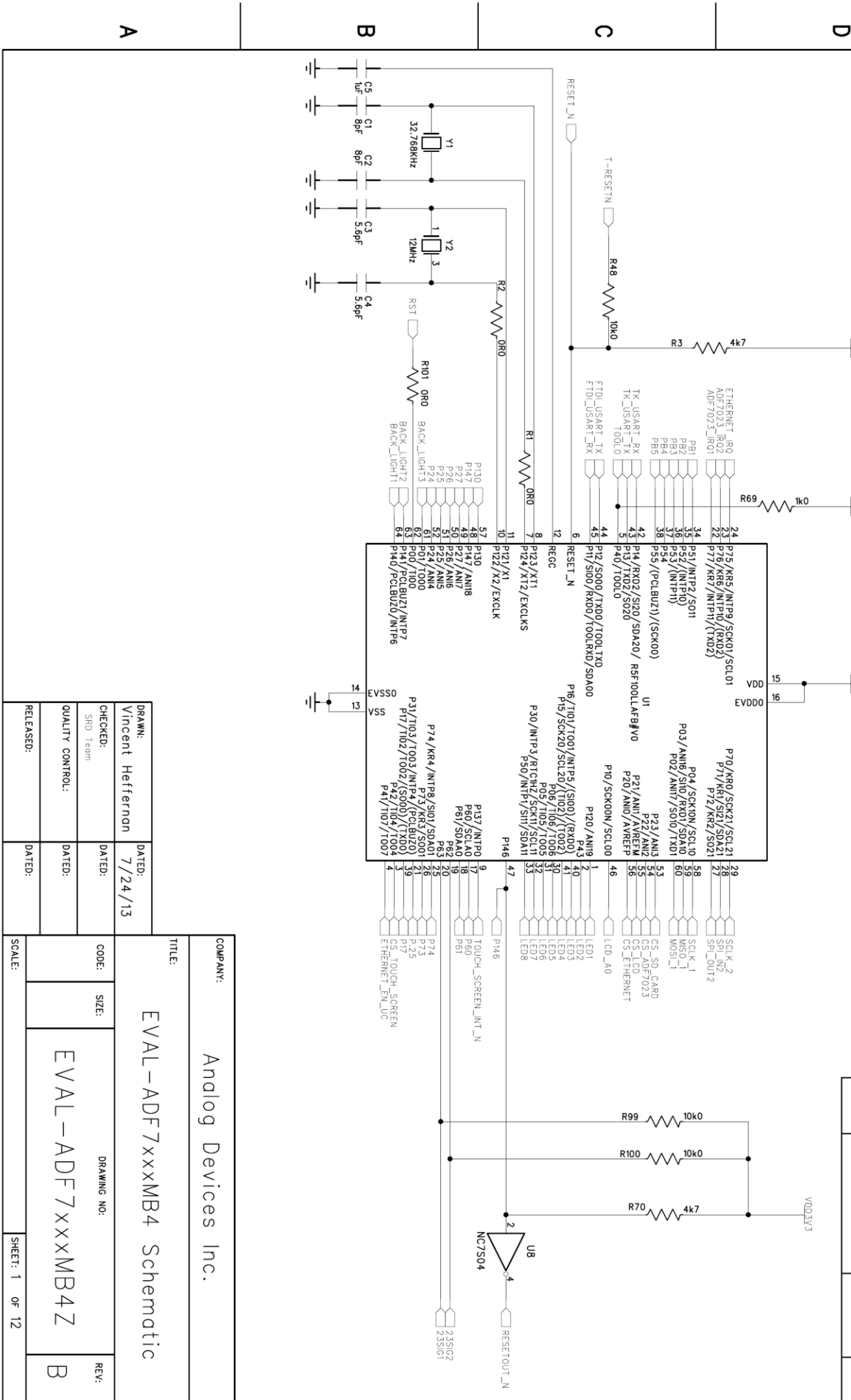
Table 6 Eval-ADF7023DB4Z Components (433MHz Combined Match)

Qty	Name	Value	Tolerance	PCB Decal	Manufacturing Part No.
1	C2	DNI			Not Inserted
1	C3, C22	3.9pF	±0.25pF	0402	GRM1555C1H3R9CZ01D
2	C18, C67	270pF	±5%	0402	GRM1555C1H271JA01D
1	C19	4.7pF	±0.1pF	0402	GRM1555C1H4R7BA01D
1	C20	2.7pF	±0.1pF	0402	GRM1555C1H2R7BA01D
1	C66	100pF	±5%	0402	GRM1555C1H101JZ01D
1	L1	13nH	±5%	0402	Coilcraft 0402CS-13NXJL
1	L2, L9	33nH	±5%	0402	Coilcraft 0402CS-33NXJL
1	L3	30nH	±5%	0402	Coilcraft 0402CS-30NXJL
1	L4	41nH	±5%	0402	Coilcraft 0402CS-41NXJL
1	L6	100nH	±5%	0402	Coilcraft 0402CS-R10XJL
1	L7	82nH	±5%	0402	Coilcraft 0402CS-82NXJL

ADF7xxxMB4z

Schematics

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



6

5

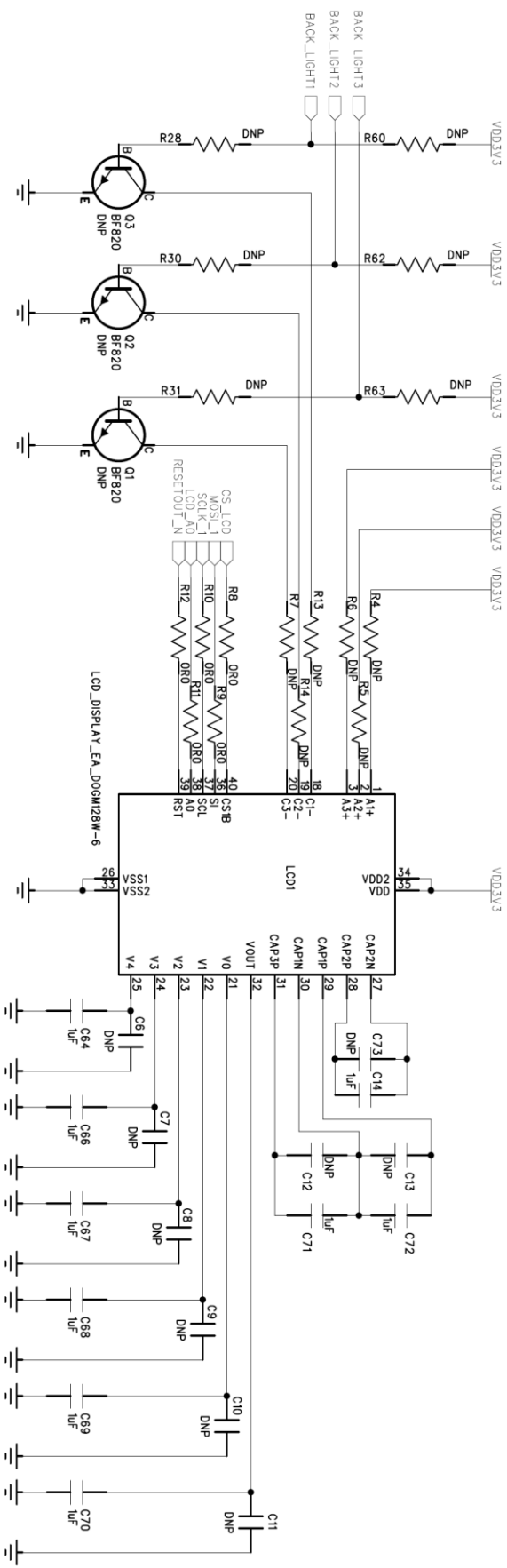
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3

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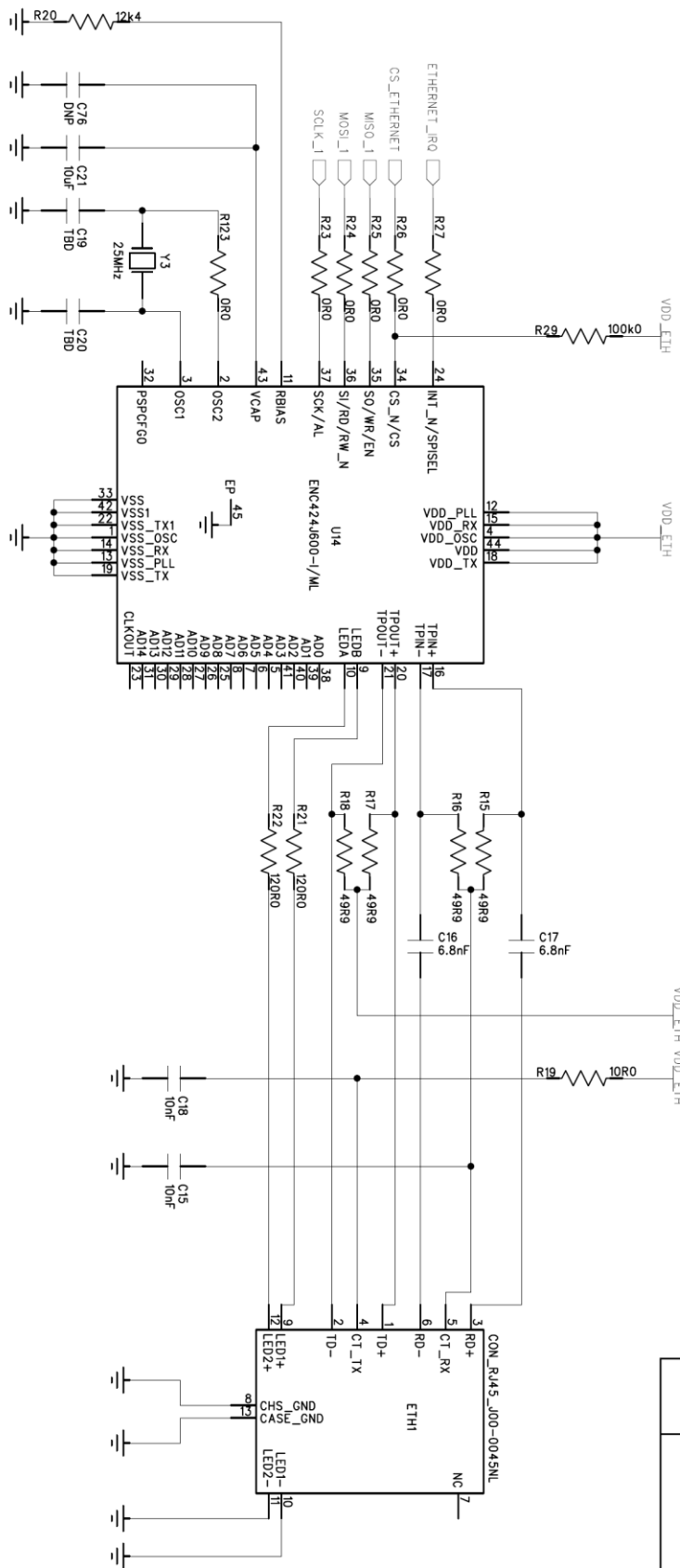
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REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



COMPANY:		Analog Devices Inc.	
TITLE:		EVAL-ADF7xxxMB4 Schematic	
DRAWN:		Vincent Heffernan	
CHECKED:		7/24/13	
SRO Team			
QUALITY CONTROL:			
RELEASED:			
CODE:		SIZE:	
DRAWING NO:		EVAL-ADF7xxxMB4Z	
REV:		B	
SCALE:		SHEET: 2 of 12	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



D

C

B

A

COMPANY:		Analog Devices Inc.	
TITLE:		EVAL-ADF7xxxMB4 Schematic	
DRAWN:		Vincent Heffernan	
CHECKED:		SRD Team	
QUALITY CONTROL:		EVAL-ADF7xxxMB4Z B	
RELEASED:		SCALE: SHEET: 4 OF 12	

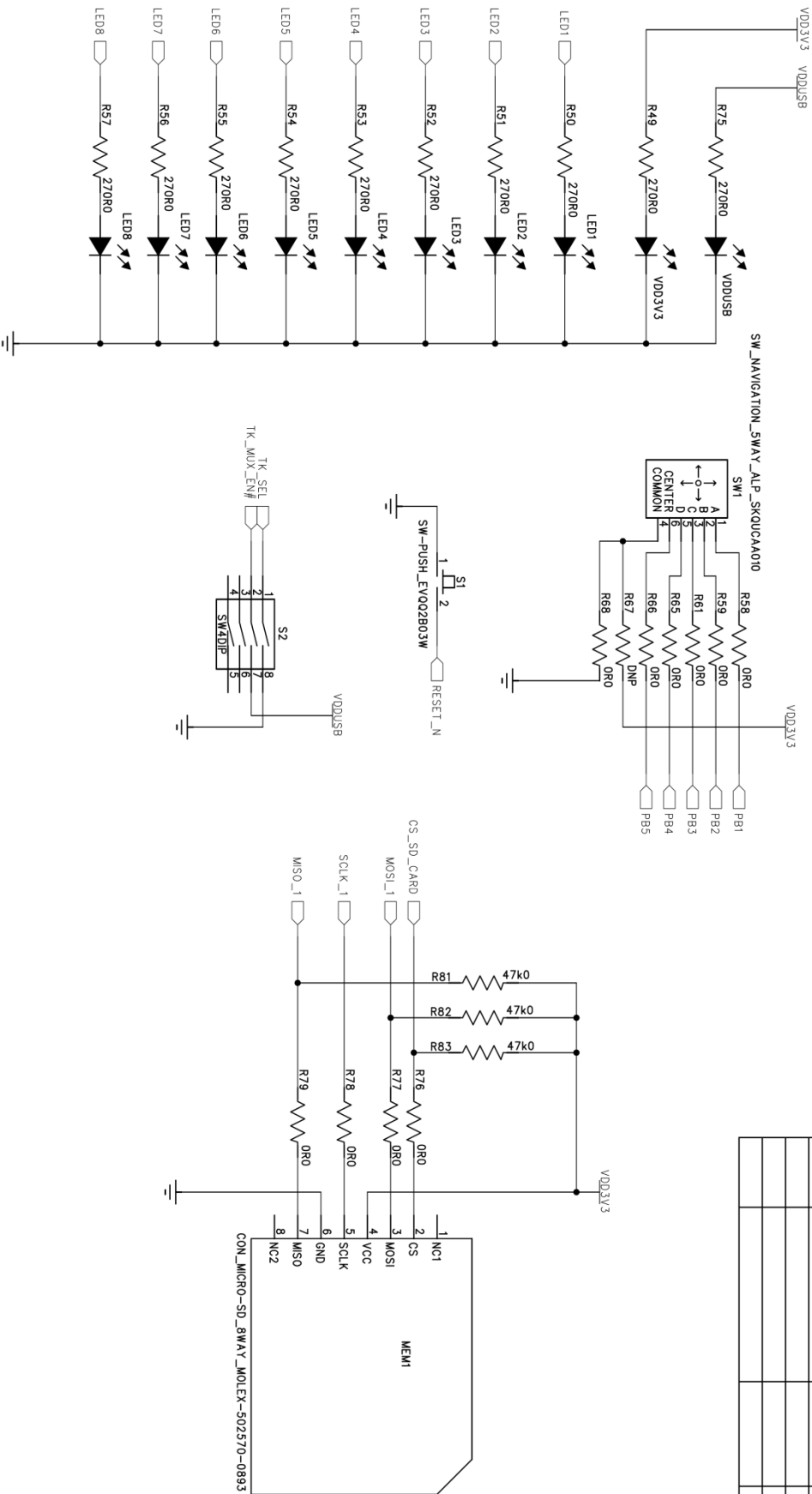
D

C

B

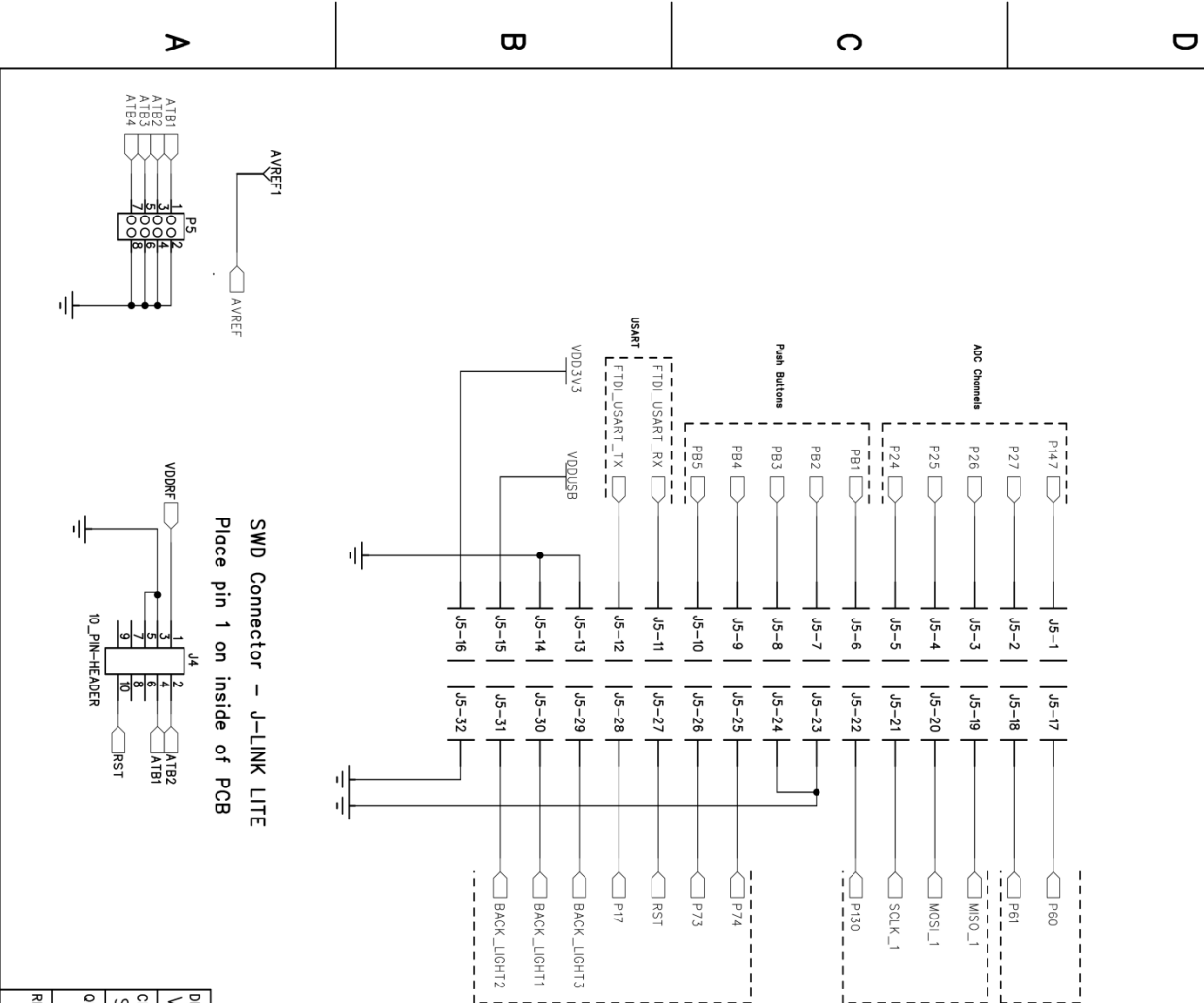
A

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



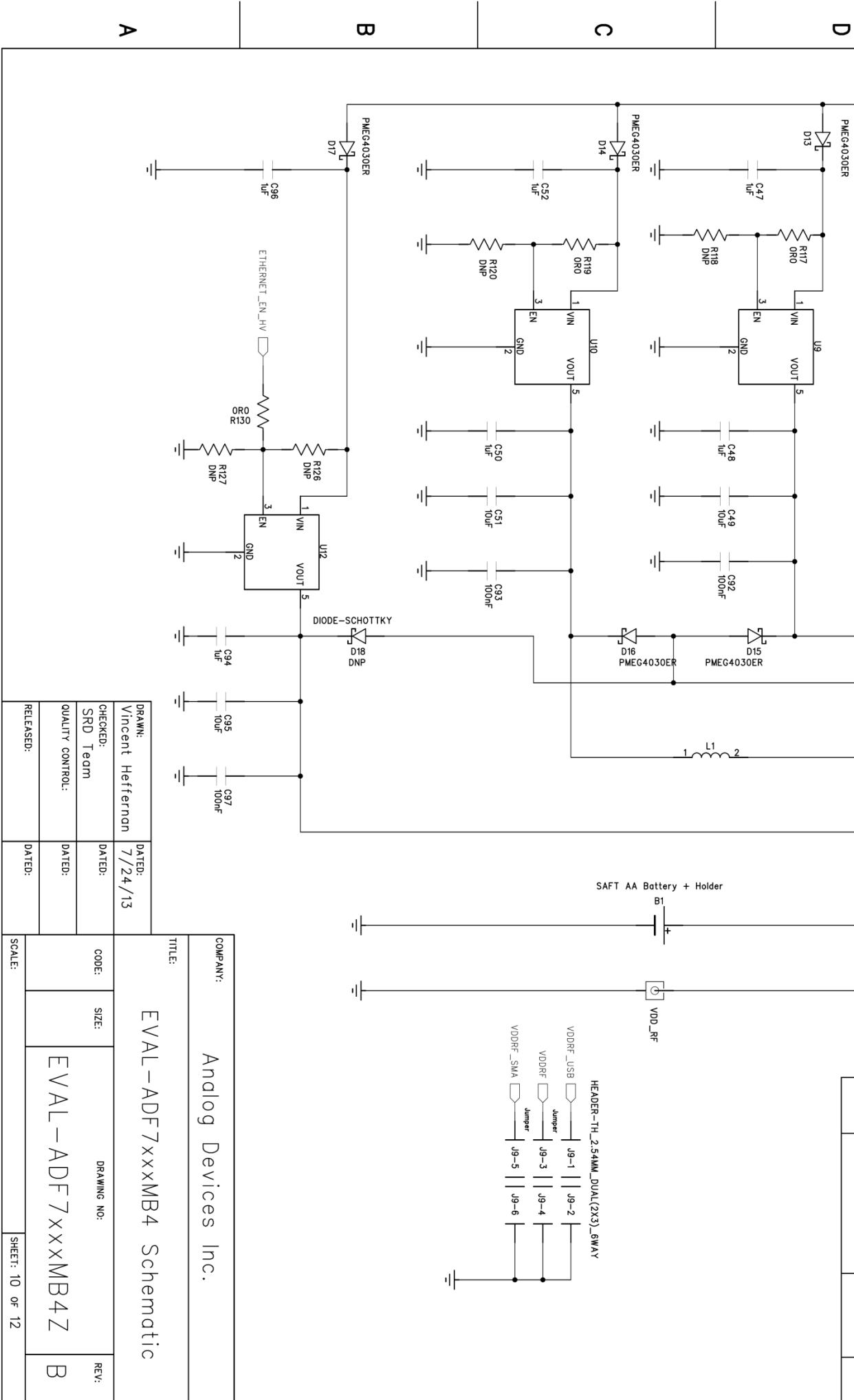
COMPANY: Analog Devices Inc.			
TITLE: EVAL-ADF7xxxMB4 Schematic			
DRAWN: Vincent Heffernan	DATED: 7/24/13	CODE: EVAL-ADF7xxxMB4Z	REV: B
CHECKED: SRD Team	DATED:	DRAWING NO:	
QUALITY CONTROL:	DATED:		
RELEASED:	DATED:	SCALE:	SHEET: 7 of 12

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



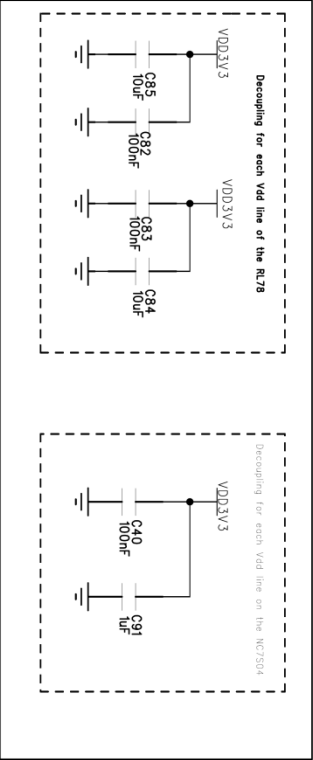
COMPANY: Analog Devices Inc.			
TITLE: EVAL-ADF7xxxMB4 Schematic			
DRAWN: Vincent Heffernan	DATED: 7/24/13		
CHECKED: SRD Team	DATED:		
QUALITY CONTROL:	DATED:		
RELEASED:	DATED:		
SCALE:		SHEET: 9 of 12	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

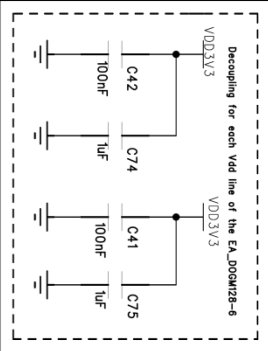


COMPANY:		Analog Devices Inc.	
TITLE:		EVAL-ADF7xxxMB4 Schematic	
DRAWN:	Vincent Heffernan	DATED:	7/24/13
CHECKED:	SRD Team	DATED:	
QUALITY CONTROL:		DATED:	
RELEASED:		DATED:	
CODE:		DRAWING NO:	
SIZE:		EVAL-ADF7xxxMB4Z	
SCALE:		REV: B	
SHEET: 10 of 12			

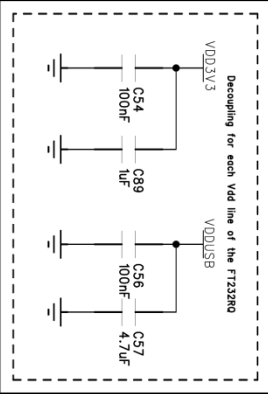
RL87 Sheet



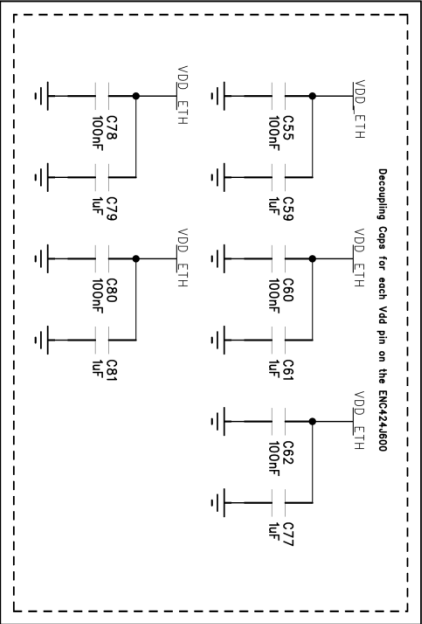
LCD Sheet



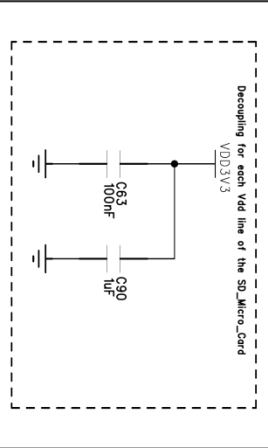
FTDI_UART Sheet



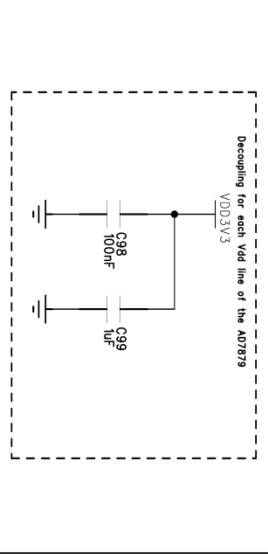
Ethernet Sheet



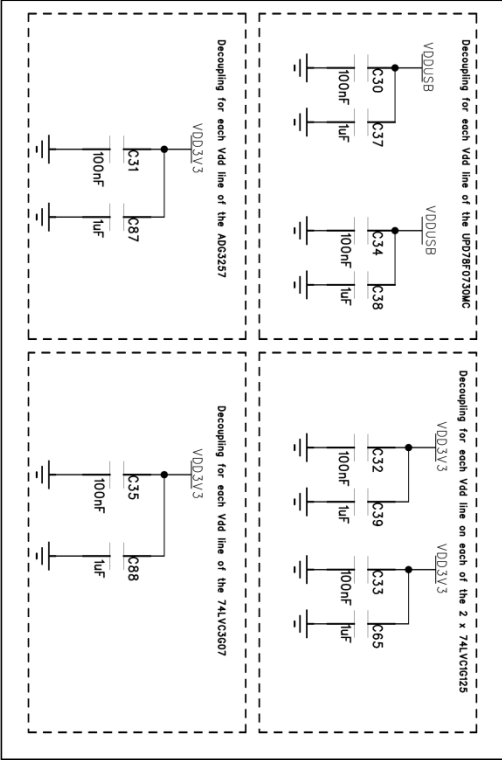
Switches_LEDs_Memory Sheet



Touch_Screen Sheet



Renesas_UART Sheet



COMPANY: Analog Devices Inc.

TITLE: EVAL-AD77xxMB4 Schematic

DRAWN: Vincent Heffernan

DATED: 7/24/13

CHECKED: SRD Team

DATED:

QUALITY CONTROL:

DATED:

RELEASED:

DATED:

SCALE:

SHEET: 11 of 12

ADF7xxxMB4z

**Bill of
Materials**

Name	Value	Tolerance	PCB Decal	Part Number
P1			TFM-105-02-X-D-A	TFM-105-02-S-D-A
P2			TFM-105-02-X-D-A	TFM-105-02-S-D-A
P3			TFM-110-02-X-D-A	TFM-110-02-S-D-A
U9			TSOT-5	ADP150AUJZ-3.3
U10			TSOT-5	ADP150AUJZ-3.3
U12			TSOT-5	ADP150AUJZ-3.3
C21	10uF	±20%	C0603	GRM188R60J106ME47D
C49	10uF	±20%	C0603	GRM188R60J106ME47D
C51	10uF	±20%	C0603	GRM188R60J106ME47D
C76	DNP	±20%	C0603	GRM188R60J106ME47D
C84	10uF	±20%	C0603	GRM188R60J106ME47D
C85	10uF	±20%	C0603	GRM188R60J106ME47D
C95	10uF	±20%	C0603	GRM188R60J106ME47D
U4			SOT353	74LVC1G125GW
U6			SOT353	74LVC1G125GW
U7			SOT353	74LVC1G125GW
S2			SW-DIP4-SMD	A6S4101H
U5			QSOP-16	ADG3257BRQZ
AVREF1			TESTPOINT	20-3131
U2			VSSOP8	SN74LVC3G07DCUR
C24	100nF	±10%	C0402	GRM155R71C104KA88D
C28	100nF	±10%	C0402	GRM155R71C104KA88D
C30	100nF	±10%	C0402	GRM155R71C104KA88D
C31	100nF	±10%	C0402	GRM155R71C104KA88D
C32	100nF	±10%	C0402	GRM155R71C104KA88D
C33	100nF	±10%	C0402	GRM155R71C104KA88D
C34	100nF	±10%	C0402	GRM155R71C104KA88D
C35	100nF	±10%	C0402	GRM155R71C104KA88D
C40	100nF	±10%	C0402	GRM155R71C104KA88D
C41	100nF	±10%	C0402	GRM155R71C104KA88D
C42	100nF	±10%	C0402	GRM155R71C104KA88D
C53	100nF	±10%	C0402	GRM155R71C104KA88D
C54	100nF	±10%	C0402	GRM155R71C104KA88D
C55	100nF	±10%	C0402	GRM155R71C104KA88D
C56	100nF	±10%	C0402	GRM155R71C104KA88D
C58	100nF	±10%	C0402	GRM155R71C104KA88D
C60	100nF	±10%	C0402	GRM155R71C104KA88D
C62	100nF	±10%	C0402	GRM155R71C104KA88D
C63	100nF	±10%	C0402	GRM155R71C104KA88D
C78	100nF	±10%	C0402	GRM155R71C104KA88D
C80	100nF	±10%	C0402	GRM155R71C104KA88D
C82	100nF	±10%	C0402	GRM155R71C104KA88D
C83	100nF	±10%	C0402	GRM155R71C104KA88D
C92	100nF	±10%	C0402	GRM155R71C104KA88D
C93	100nF	±10%	C0402	GRM155R71C104KA88D
C97	100nF	±10%	C0402	GRM155R71C104KA88D
C98	100nF	±10%	C0402	GRM155R71C104KA88D
C15	10nF	±10%	C0402	C1005X7S2A103K050BB

Name	Value	Tolerance	PCB Decal	Part Number
C18	10nF	±10%	C0402	C1005X7S2A103K050BB
C27	10nF	±10%	C0402	C1005X7S2A103K050BB
C37	1uF	±10%	C0603	C1608X5R1A105K080AC
C38	1uF	±10%	C0603	C1608X5R1A105K080AC
C39	1uF	±10%	C0603	C1608X5R1A105K080AC
C59	1uF	±10%	C0603	C1608X5R1A105K080AC
C61	1uF	±10%	C0603	C1608X5R1A105K080AC
C65	1uF	±10%	C0603	C1608X5R1A105K080AC
C74	1uF	±10%	C0603	C1608X5R1A105K080AC
C75	1uF	±10%	C0603	C1608X5R1A105K080AC
C77	1uF	±10%	C0603	C1608X5R1A105K080AC
C79	1uF	±10%	C0603	C1608X5R1A105K080AC
C81	1uF	±10%	C0603	C1608X5R1A105K080AC
C87	1uF	±10%	C0603	C1608X5R1A105K080AC
C88	1uF	±10%	C0603	C1608X5R1A105K080AC
C89	1uF	±10%	C0603	C1608X5R1A105K080AC
C90	1uF	±10%	C0603	C1608X5R1A105K080AC
C91	1uF	±10%	C0603	C1608X5R1A105K080AC
C99	1uF	±10%	C0603	C1608X5R1A105K080AC
C57	4.7uF	±10%	C0402	C1005X5R0J475K050BC
C3	5.6pF	±0.5pF	C0402	C1005C0G1H5R6D
C4	5.6pF	±0.5pF	C0403	C1005C0G1H5R6D
C16	6.8nF	±10%	C0402	C1005X7S2A682K
C17	6.8nF	±10%	C0402	C1005X7S2A682K
C1	8pF	±0.5pF	C0402	C1005C0G1H080D050BA
C2	8pF	±0.5pF	C0402	C1005C0G1H080D050BA
C22	8pF	±0.5pF	C0402	C1005C0G1H080D050BA
C23	8pF	±0.5pF	C0402	C1005C0G1H080D050BA
C29	10uF	±10%	CAP\TAJ-A	TAJA106K010RNJ
X1			STANDOFF-SPCS-12	SPCS-12
X2			STANDOFF-SPCS-12	SPCS-12
X3			STANDOFF-SPCS-12	SPCS-12
X4			STANDOFF-SPCS-12	SPCS-12
J1			USB-MINI-B	548190572
J3			USB-MINI-B	548190572
Y2	12MHz	±20ppm	XTAL-SMD-NX3225GA	NX3225GA-12MHZ- STD-CRG-1
Y4	16MHz	±25ppm	XTAL-SMD-NX3225SA	NX3225SA-16MHZ-STD-CSR-6
Y3	25MHz	±30ppm	XTAL-SMD-FQ5032B	FQ5032B-25
Y1	32.768KHz	±20ppm	XTAL-SMD-NX3215SA	NX3215SA-32.768K-STD-MUS-2
D1	40V, 3A		SOD87	PMEG4030ER
D13	40V, 3A		SOD87	PMEG4030ER
D14	40V, 3A		SOD87	PMEG4030ER
D15	40V, 3A		SOD87	PMEG4030ER
D16	40V, 3A		SOD87	PMEG4030ER
D17	40V, 3A		SOD87	PMEG4030ER
D18	DNP		SOD87	PMEG4030ER
R4	DNP		R0402	DNP
R5	DNP		R0402	DNP

Name	Value	Tolerance	PCB Decal	Part Number
R6	DNP		R0402	DNP
R7	DNP		R0402	DNP
R13	DNP		R0402	DNP
R14	DNP		R0402	DNP
R28	DNP		R0402	DNP
R30	DNP		R0402	DNP
R31	DNP		R0402	DNP
R60	DNP		R0402	DNP
R62	DNP		R0402	DNP
R63	DNP		R0402	DNP
R67	DNP		R0402	DNP
R115	DNP		R0402	DNP
R118	DNP		R0402	DNP
R120	DNP		R0402	DNP
R126	DNP		R0402	DNP
R127	DNP		R0402	DNP
R133	DNP		R0402	DNP
R134	DNP		R0402	DNP
R135	DNP		R0402	DNP
R136	DNP		R0402	DNP
R137	DNP		R0402	DNP
TSC1			FPC/FFC_1.0MM_R/A_TOP_4WAY	SFW4R-2STE9LF
L1	600 ohms @ 100MHz		1206	BLM31AJ601SN1L
P4			HEADER8_SMD	1241050-4
J5	DNP		HEADER32	TD-116-G-A
J6	DNP		HEADER32	TD-116-G-A
J4			HEADER10	n/a
J2			HEADER-TH_2.54MM_DUAL(2X8)_16WAY	TLW-108-05-G-D
U13			LFCSP-16-10-4MM	AD7879ACPZ
U11			QFN-32-5MM	FT232RQ
LCD1			LCD_DISPLAY_EA_DOGM128W-6	SAMTEC SSM-120-L-SV + 2 x SSM-103-L-SV
LED1	Green		LED-0603	LG Q971-KN-1
LED2	Green		LED-0603	LG Q971-KN-1
LED3	Green		LED-0603	LG Q971-KN-1
LED4	Green		LED-0603	LG Q971-KN-1
LED5	Green		LED-0603	LG Q971-KN-1
LED6	Green		LED-0603	LG Q971-KN-1
LED7	Green		LED-0603	LG Q971-KN-1
LED8	Green		LED-0603	LG Q971-KN-1
VDD3V3	Green		LED-0603	LG Q971-KN-1
VDDUSB	Green		LED-0603	LG Q971-KN-1
U1			LQFP64	R5F100LLAFB#V0
U3			SSOP30	UPD78F0730MC-CAB-AX
U14			QFN-44-8MM	ENC424J600-I/ML
ETH1			CON_RJ45_STARJACK_PULSE_J00-00XXNL	J00-0045NL
MEM1			CON_MICROSD_8WAY_MOLEX-	502570-0893

Name	Value	Tolerance	PCB Decal	Part Number
			502570-0893	
SW1			SW- NAVIGATION_5WAY_ALP_SKQUCAA010	SKQUCAA010
U8			SOT23-5	NC7S04M5
R1	0R0	0.01	R0402	MCR01MZPJ000
R2	0R0	0.01	R0402	MCR01MZPJ000
R8	0R0	0.01	R0402	MCR01MZPJ000
R9	0R0	0.01	R0402	MCR01MZPJ000
R10	0R0	0.01	R0402	MCR01MZPJ000
R11	0R0	0.01	R0402	MCR01MZPJ000
R12	0R0	0.01	R0402	MCR01MZPJ000
R23	0R0	0.01	R0402	MCR01MZPJ000
R24	0R0	0.01	R0402	MCR01MZPJ000
R25	0R0	0.01	R0402	MCR01MZPJ000
R26	0R0	0.01	R0402	MCR01MZPJ000
R27	0R0	0.01	R0402	MCR01MZPJ000
R58	0R0	0.01	R0402	MCR01MZPJ000
R59	0R0	0.01	R0402	MCR01MZPJ000
R61	0R0	0.01	R0402	MCR01MZPJ000
R64	0R0	0.01	R0402	MCR01MZPJ000
R65	0R0	0.01	R0402	MCR01MZPJ000
R66	0R0	0.01	R0402	MCR01MZPJ000
R68	0R0	0.01	R0402	MCR01MZPJ000
R71	0R0	0.01	R0402	MCR01MZPJ000
R72	0R0	0.01	R0402	MCR01MZPJ000
R73	0R0	0.01	R0402	MCR01MZPJ000
R74	0R0	0.01	R0402	MCR01MZPJ000
R76	0R0	0.01	R0402	MCR01MZPJ000
R77	0R0	0.01	R0402	MCR01MZPJ000
R78	0R0	0.01	R0402	MCR01MZPJ000
R79	0R0	0.01	R0402	MCR01MZPJ000
R80	0R0	0.01	R0402	MCR01MZPJ000
R84	0R0	0.01	R0402	MCR01MZPJ000
R85	0R0	0.01	R0402	MCR01MZPJ000
R86	0R0	0.01	R0402	MCR01MZPJ000
R87	0R0	0.01	R0402	MCR01MZPJ000
R88	0R0	0.01	R0402	MCR01MZPJ000
R89	0R0	0.01	R0402	MCR01MZPJ000
R90	0R0	0.01	R0402	MCR01MZPJ000
R91	0R0	0.01	R0402	MCR01MZPJ000
R92	0R0	0.01	R0402	MCR01MZPJ000
R93	0R0	0.01	R0402	MCR01MZPJ000
R94	0R0	0.01	R0402	MCR01MZPJ000
R101	0R0	0.01	R0402	MCR01MZPJ000
R109	0R0	0.01	R0402	MCR01MZPJ000
R110	0R0	0.01	R0402	MCR01MZPJ000
R111	0R0	0.01	R0402	MCR01MZPJ000
R112	0R0	0.01	R0402	MCR01MZPJ000

Name	Value	Tolerance	PCB Decal	Part Number
R113	0R0	0.01	R0402	MCR01MZPJ000
R114	0R0	0.01	R0402	MCR01MZPJ000
R117	0R0	0.01	R0402	MCR01MZPJ000
R119	0R0	0.01	R0402	MCR01MZPJ000
R123	0R0	0.01	R0402	MCR01MZPJ000
R124	0R0	0.01	R0402	MCR01MZPJ000
R125	0R0	0.01	R0402	MCR01MZPJ000
R130	0R0	0.01	R0402	MCR01MZPJ000
R44	1k0	±1%	R0402	RC0402FR-071KL
R69	1k0	±1%	R0402	RC0402FR-071KL
R32	1k5	±1%	R0402	RMCF0402FT1K50
R33	1k5	±1%	R0402	RMCF0402FT1K50
R34	1k5	±1%	R0402	RMCF0402FT1K50
R38	1k5	±1%	R0402	RMCF0402FT1K50
R41	1k5	±1%	R0402	RMCF0402FT1K50
R128	1k5	±1%	R0402	RMCF0402FT1K50
R129	1k5	±1%	R0402	RMCF0402FT1K50
R19	10R0	±1%	R0402	ERJ-2RKF10R0X
R39	10k0	±1%	R0402	RC0402FR-0710KL
R40	10k0	±1%	R0402	RC0402FR-0710KL
R42	10k0	±1%	R0402	RC0402FR-0710KL
R43	10k0	±1%	R0402	RC0402FR-0710KL
R45	10k0	±1%	R0402	RC0402FR-0710KL
R46	10k0	±1%	R0402	RC0402FR-0710KL
R47	10k0	±1%	R0402	RC0402FR-0710KL
R48	10k0	±1%	R0402	RC0402FR-0710KL
R99	10k0	±1%	R0402	RC0402FR-0710KL
R100	10k0	±1%	R0402	RC0402FR-0710KL
R122	10k0	±1%	R0402	RC0402FR-0710KL
R139	DNP	±1%	R0402	RC0402FR-0710KL
R29	100k0	±1%	R0402	MCR01MZPF1003
R35	100k0	±1%	R0402	MCR01MZPF1003
R116	100k0	±1%	R0402	MCR01MZPF1003
R20	12k4	±0.5%	R0402	RR0510P-1242-D
R21	120R0	±5%	R0402	ERJ-2GEJ121X
R22	120R0	±5%	R0402	ERJ-2GEJ121X
R49	270R0	±5%	R0402	MCR01MZPJ271
R50	270R0	±5%	R0402	MCR01MZPJ271
R51	270R0	±5%	R0402	MCR01MZPJ271
R52	270R0	±5%	R0402	MCR01MZPJ271
R53	270R0	±5%	R0402	MCR01MZPJ271
R54	270R0	±5%	R0402	MCR01MZPJ271
R55	270R0	±5%	R0402	MCR01MZPJ271
R56	270R0	±5%	R0402	MCR01MZPJ271
R57	270R0	±5%	R0402	MCR01MZPJ271
R75	270R0	±5%	R0402	MCR01MZPJ271
R36	33R0	±1%	R0402	MCR01MRTF33R0
R37	33R0	±1%	R0402	MCR01MRTF33R0

Name	Value	Tolerance	PCB Decal	Part Number
R121	4k7	±1%	R0402	ERJ-2RKF4701X
R81	47k0	±1%	R0402	ERJ-2RKF4702X
R82	47k0	±1%	R0402	ERJ-2RKF4702X
R83	47k0	±1%	R0402	ERJ-2RKF4702X
R3	4k7	5%	R0402	MCR01MRTJ472
R15	49R9	±1%	R0402	RMCF0402FT49R9
R16	49R9	±1%	R0402	RMCF0402FT49R9
R17	49R9	±1%	R0402	RMCF0402FT49R9
R18	49R9	±1%	R0402	RMCF0402FT49R9
R70	4k7	5%	R0402	MCR01MRTJ472
R138	DNP		R0402	
B1			BATT-AA-X1	LST14500 + Cat. No 2460
J9			HEADER-3X2	TLW-103-05-G-D with M7566-05
P5	DNP		HEADER8_SMD	TLW-104-05-G-D
C5	1uF	±10%	C0402	C1005X5R1C105K050BC
C6	DNP	±10%	C0603	C1005X5R1C105K
C7	DNP	±10%	C0603	C1005X5R1C105K
C8	DNP	±10%	C0603	C1005X5R1C105K
C9	DNP	±10%	C0603	C1005X5R1C105K
C10	DNP	±10%	C0603	C1005X5R1C105K
C11	DNP	±10%	C0603	C1005X5R1C105K
C12	DNP	±10%	C0603	C1005X5R1C105K
C13	DNP	±10%	C0603	C1005X5R1C105K
C14	1uF	±10%	C0402	C1005X5R1C105K050BC
C19	DNP	TBD	C0402	TBD
C20	DNP	TBD	C0402	TBD
C25	470nF	±10%	C0402	C1005X5R1C474K050BB
C26	470nF	±10%	C0402	C1005X5R1C474K050BB
C43	DNP		C0402	TBD
C44	DNP		C0402	TBD
C45	DNP		C0402	TBD
C46	DNP		C0402	TBD
C47	1uF	±10%	C0402	C1005X5R1C105K050BC
C48	1uF	±10%	C0402	C1005X5R1C105K050BC
C50	1uF	±10%	C0402	C1005X5R1C105K050BC
C52	1uF	±10%	C0402	C1005X5R1C105K050BC
C64	1uF	±10%	C0402	C1005X5R1C105K050BC
C66	1uF	±10%	C0402	C1005X5R1C105K050BC
C67	1uF	±10%	C0402	C1005X5R1C105K050BC
C68	1uF	±10%	C0402	C1005X5R1C105K050BC
C69	1uF	±10%	C0402	C1005X5R1C105K050BC
C70	1uF	±10%	C0402	C1005X5R1C105K050BC
C71	1uF	±10%	C0402	C1005X5R1C105K050BC
C72	1uF	±10%	C0402	C1005X5R1C105K050BC
C73	DNP	±10%	C0603	C1005X5R1C105K
C94	1uF	±10%	C0402	C1005X5R1C105K050BC
C96	1uF	±10%	C0402	C1005X5R1C105K050BC

Name	Value	Tolerance	PCB Decal	Part Number
CLK			SMA_90DEG	5-1814400-1
DR			SMA_90DEG	5-1814400-1
DT			SMA_90DEG	5-1814400-1
VDD_RF			SMA_90DEG	5-1814400-1
S1			SW_PUSH_EVQQ2B03W	EVQQ2B03W
Q1	DNP		SOT23-3	BF820
Q2	DNP		SOT23-3	BF820
Q3	DNP		SOT23-3	BF820