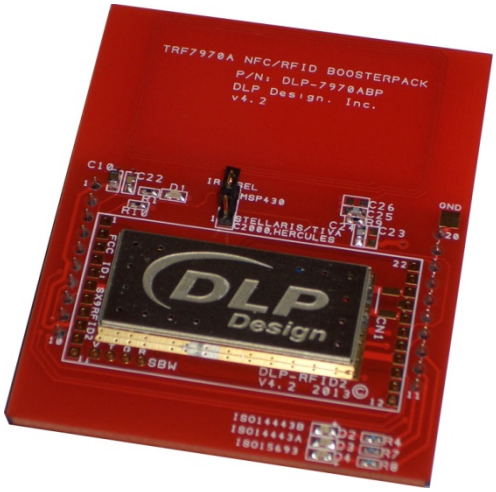
DLP-7970ABP

BoosterPack User's Guide



FEATURES:

- 13.56MHz HF RFID Reader/Writer
- Compatible with the NFCLink Library
- Compatible with the MSP-EXP430G2X LaunchPad
- Compatible with the MSP-EXP430F5529LP LaunchPad
- Compatible with the C2000 LaunchPad
- Compatible with the TIVA C Series LaunchPad
- Compatible with the Hercules LaunchPad
- Supports ISO 15693, 18000-3, 14443A/B and FeliCa
- RFID/NFC Reader, NFC Peer or Card-Emulation Mode
- NFCIP-1 (ISO/IEC 18092) and NFCIP-2 (ISO/IEC 21481)
- On-Board Antenna
- FCC/IC Approvals in Place
- Operational Power Supplied by the LaunchPad

1.0 INTRODUCTION

The DLP-7970ABP is an add-on board designed to fit TI's MCU LaunchPads that incorporates DLP Design's DLP-RFID2 RFID module. This BoosterPack allows the software application developer to get familiar with the functionalities of the TRF7970A multi-protocol, fully-integrated, 13.56MHz RFID/NFC IC on their Texas Instruments embedded microcontroller platform of choice without having to worry about developing the RF section.

The NFCLink library is an industry-proven modular firmware/software solution that provides a programming interface for TI's family of TRF79XX NFC devices supporting the hardware level up through the host operating system via an API. NFCLink is a library of NFC and HF RFID firmware using the NCI protocol to communicate with a host OS or MPU. NFCLink currently supports MSP430 5XX and 6XX series devices. Visit the TI website for more details: www.ti.com/tool/nfclink

This document provides direction for TRF79XX users implementing a 13.56MHz RFID reader solution using the TRF79XX IC connected to a Texas Instruments embedded microcontroller or microprocessor development platform. Examples of such development platforms are the MSP-EXP430G2 LaunchPad and the MSP-EXP430F5529LP LaunchPad.

LaunchPads from Texas Instruments are easy-to-use flash programming and debugging tools for the MSP430, C2000, TIVA, etc. line of microcontrollers. They feature everything you need to start developing on a Texas Instruments microcontroller device. They have on-board emulation for programming and debugging, on-board button switches and LED's and BoosterPack-compatible pinouts to support a wide range of plug-in modules like the DLP-7970ABP.

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Free software development tools are also available, such as TI's Eclipse-based Code Composer Studio. Open-source development is also available thanks to community-driven projects such as the MSPGCC compiler or Energia, a branch of the popular Wiring framework.

2.0 SCOPE

This document describes the DLP-7970ABP module for evaluation and development purposes in conjunction with Texas Instruments embedded development platforms. This manual does not cover the in-depth details of the TRF79XX reader IC family as those details are documented in the datasheets for those parts along with application notes that can be found on the product pages (see the hyperlinks in Section 3).

3.0 REFERENCES

- DLP-RFID2: www.dlpdesign.com
- TRF7970A product page: http://www.ti.com/product/trf7970a
- TRF7970A datasheet: http://www.ti.com/lit/ds/slos743g/slos743g.pdf

4.0 MODULE DESCRIPTION

The DLP-7970ABP BoosterPack (see Figure 1) allows the software application developer to become familiar with the functionalities of TRF7970A multi-standard, fully integrated, 13.56MHz RFID reader IC with the freedom to develop on the Texas Instruments embedded microcontroller development platform of choice.

The DLP-7970ABP module also allows customer-driven antenna tuning with an onboard coil antenna. The module is hardwired for SPI communication with the associated LaunchPad; and it supports slave select, TRF7970A Direct Mode 2 (default), Direct Mode 1 and Direct Mode 0 operations. The user also has access to and full control over the TRF7970A EN line, allowing for design and development of ultra low-power/high-frequency (HF) RFID systems.

The DLP Design module has been modified from its original form by removing the onboard microcontroller (MSP430F2370) so that the RF circuitry on the module can be controlled by the microcontroller on the connected LaunchPad. Additionally, the I/O pins required by the TRF7970A's SPI interface have been brought out of the DLP-RFID2 module for connection to the microcontroller on the LaunchPad.

An impedance-matching circuit from 4Ω to 50Ω is designed into the DLP-RFID2 module, and is connected to a tuned 50Ω antenna system that consists of an onboard five-turn coil with series and parallel passive elements (capacitors and a resistor).

Connection to Texas Instruments LaunchPad platforms are made via 10-pin, 0.1-inch spaced, 0.025-square inch post female headers located on the back of the board.

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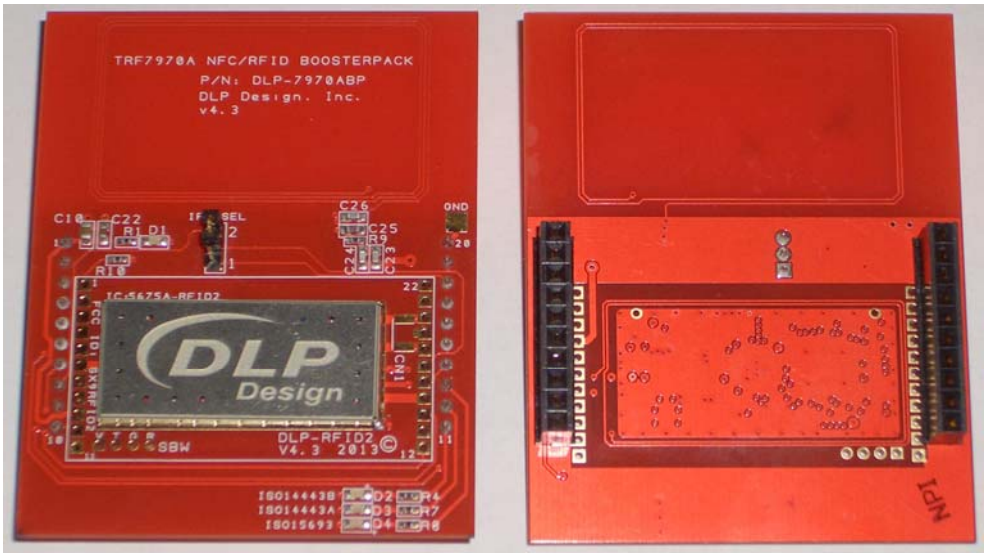

Figure 1. DLP-7970ABP Evaluation Module

5.0 MODULE PINOUT

DLP-7970ABP MODULE PIN CONNECTIONS TO THE LAUNCHPAD	
1	VCC - 3.0V power from the LaunchPad
2	P1.0 - Unused by the DLP-7970ABP
3	UART RXD - Unused by the DLP-7970ABP
4	UART TXD - Unused by the DLP-7970ABP
5	P1.3 - Unused by the DLP-7970ABP
6	P1.4 - Unused by the DLP-7970ABP
7	DATA_CLK - Clock for the SPI interface
8	IRQ - Interrupt request from the TRF7970A to the microcontroller on the LaunchPad
9	Slave Select - Used by the SPI interface
10	EN - Used to enable the TRF7970A
11	P2.3 - I/O used to light an LED on the DLP-7970ABP when an ISO14443B tag is present in the RFID field
12	P2.4 - I/O used to light an LED on the DLP-7970ABP when an ISO14443A tag is present in the RFID field
13	P2.5 - I/O used to light an LED on the DLP-7970ABP when an ISO15693 tag is present in the RFID field
14	MISO - SPI serial data from the TRF7970A to the microcontroller on the LaunchPad
15	MOSI - SPI serial data to the TRF7970A from the microcontroller on the LaunchPad
16	RESET
17	TEST - Unused by the DLP-7970ABP
18	XOUT - Alternate interrupt source from the LaunchPad (see Section 6.0)
19	XIN - Unused by the DLP-7970ABP
20	GROUND

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6.0 IRQ_SEL

A 3-pin jumper selection labeled as “IRQ_SEL” is provided to allow the user to connect the “IRQ” interrupt source generated by the TRF7970A RFID IC on the BoosterPack to the interrupt input on the microcontroller located on the LaunchPad. Since this BoosterPack is designed to work with several TI LaunchPads, and the interrupts are located on different pins on the various LaunchPads, this 3-pin jumper was provided to make the selection. (Position 2 is typically used with the MSP-EXP430G2 LaunchPad, and Position 1 is typically used with all other LaunchPads.)

7.0 QUICK START GUIDE

1. Plug the DLP-7970ABP module into the LaunchPad microcontroller development platform of choice.

2. Apply power by connecting a USB cable to the LaunchPad.

3. Load and run base application firmware specific to the selected platform.

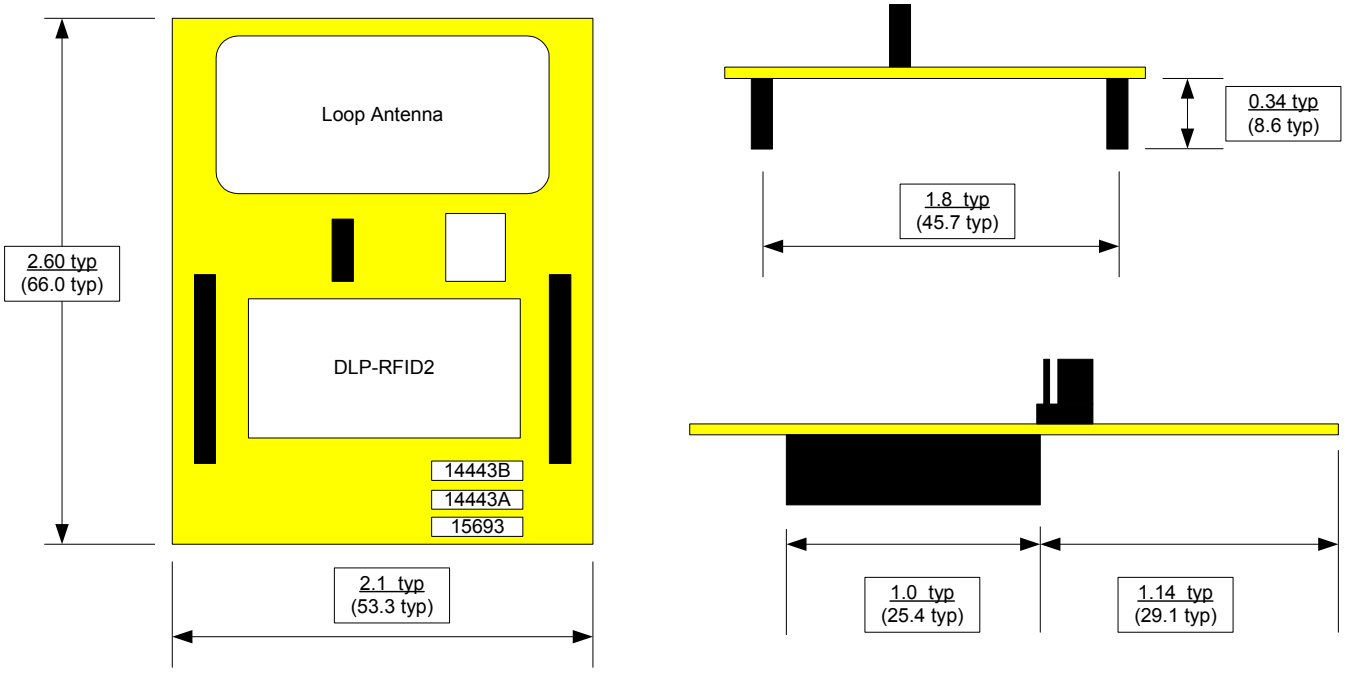
4. Test for basic communication and functionality by holding RFID tags close to the onboard loop antenna. A corresponding red, green or blue LED will light for ISO15693, ISO44443A and ISO14443B tags that are presented to the antenna.

5. Modify and debug code as desired for the specific application or protocol.

8.0 BASE APPLICATION FIRMWARE

DLP-7970ABP Module Application Firmware for the various Texas Instruments LaunchPads is available from the DLP Design website. Visit the product page on the DLP Design site for all available firmware project downloads.

9.0 MECHANICAL DIMENSIONS – Inches (mm)



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10.0 ANTENNA TUNING DETAILS

This module's antenna, as shipped, is tuned for 50Ω impedance at 13.56MHz. It has a nominal bandwidth of 1.3MHz, which results in a Q (quality factor) of approximately 10. The PCB trace loop antenna on the DLP-7970ABP has a nominal value of approximately 2.0µH at 13.56MHz. The dampening resistor value was set at 1.3KΩ to achieve this value of Q, which is an appropriate value for supporting ISO15693, ISO14443A and ISO14443B tags.
Figures 2 and 3 show the Smith Charts for the actual measurements of the loop antenna used on the DLP-7970ABP module:

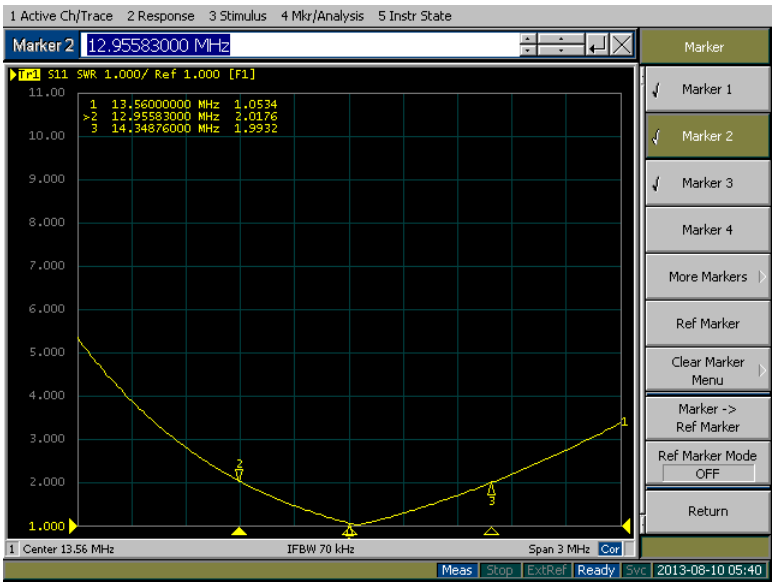

Figure 2.

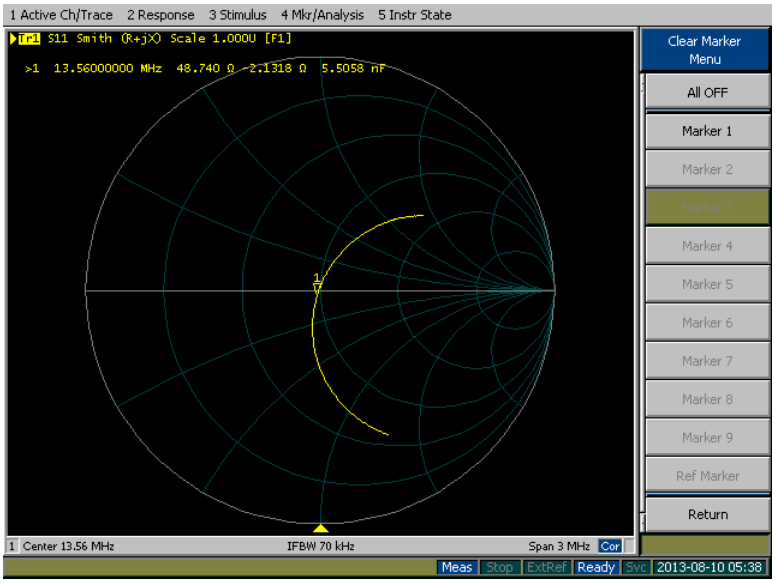

Figure 3.

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11.0 REGULATORY AGENCY CONSIDERATIONS

11.1 AGENCY IDENTIFICATION NUMBERS

Compliance with the appropriate regulatory agencies is essential in the deployment of all transceiver devices. DLP Design has obtained modular approval for this RF product such that an OEM need only meet a few basic requirements in order to utilize their end product under this approval. Corresponding agency identification numbers are listed below:

PART NUMBER	US/FCC	CAN/IC
DLP-RFID2	SX9RFID2	5675A-RFID2

11.2 EXTERNAL ANTENNAS

The DLP-RFID2 is approved for use with an external antenna. The maximum gain allowed for the external antenna is a gain of 1. All loop antennas properly tuned for 50Ω at 13.56MHz have a gain of 1.

11.3 FCC/IC REQUIREMENTS FOR MODULAR APPROVAL

Any changes or modifications to the DLP-RFID2's printed circuit board could void the user's authority to operate the equipment. Operation of an unapproved antenna could void the user's authority to operate the equipment.

11.4 WARNINGS

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

This device is intended for use under the following conditions:

1. The transmitter module may not be co-located with any other transmitter or antenna.

2. The module is approved using the FCC "unlicensed modular transmitter approval" method.

As long as these two conditions are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance measures necessitated by the installation of this module (i.e. digital device emissions, PC peripheral requirements, etc.).

Note: In the event that these conditions cannot be met (i.e. co-location with another transmitter), then the FCC authorization is no longer valid, and the corresponding FCC ID may *not* be used on the final product. Under these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

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11.5 OEM PRODUCT LABELING

The final end product must be labeled in a visible area with the following text:

“Contains TX FCC ID: SX9RFID2”

11.6 RF EXPOSURE

In order to comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

11.7 ADDITIONAL INFORMATION FOR OEM INTEGRATORS

The end user should NOT be provided with any instructions on how to remove or install the DLP-RFID2.

12.0 DISCLAMER

Neither the whole nor any part of the information contained herein nor the product described in this datasheet may be adapted or reproduced in any material or electronic form without the prior written consent of the copyright holder.

This product and its documentation are supplied on an as-is basis, and no warranty as to their suitability for any particular purpose is either made or implied. DLP Design will not accept any claim for damages whatsoever arising as a result of the use or failure of this product. Your statutory rights are not affected.

This product or any variant of it is not intended for use in any medical appliance, device or system in which the failure of the product might reasonably be expected to result in personal injury.

This document provides preliminary information that may be subject to change without notice.

13.0 CONTACT INFORMATION

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