

***DLP® Products for Optoma
Interactive Pen -- AirDraw II
Interactive Module -- PBM***



Preliminary

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Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. 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 undesired operation.

Industry Canada Statement

This device complies with **RSS-210** of the Industry Canada Rules. Operation is subject to the following two conditions:

- 1) this device may not cause interference and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

NCC 警語

FOR PBM

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

本模組於取得認證後將依規定於模組本體標示審合格籤，並要求平台上標示「本產品內含射頻模組：ID 編號」

FOR AirDraw II

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

1 Scope

This document specifies the functional and performance parameters of the PointBlank enabled DLP® component set. PointBlank is supported on DDP2230 and DDP243x platforms by adding additional hardware and software components to the reference design. These additions are defined in this document.

2 Applicable Documents

- DDP2230 Reference Design Documentation
- DDP2431 Reference Design Documentation

3 Overview

A PointBlank enabled DLP® projector provides an interactive white board capability without requiring a white board or special screen. The PointBlank system is comprised of a laptop or desktop computer with USB mouse capability, a PointBlank enabled DLP® projector and a pointing device with a light sensor and RF transmitter. The PointBlank™ system is depicted in Figure 1.

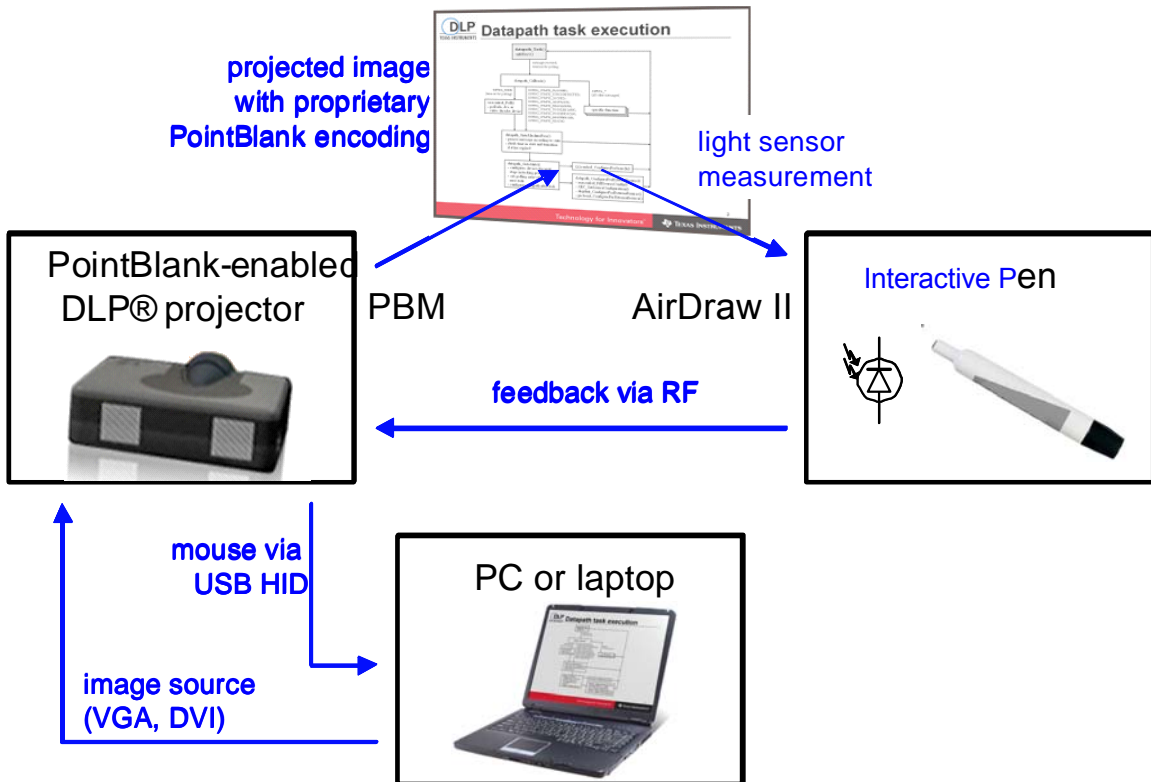


Figure 1 PointBlank System Diagram

The computer sources an image to the projector over VGA, DVI/HDMI or another interface. The PointBlank enabled projector displays the source image with special encoded patterns that the pointing device measures and transmits back to the projector over the RF link. These measurements allow the PointBlank projector to determine the screen location that the pointing device is directed at. Once the pointer location is known, the projector software sends it to the computer using the USB Human Interface Device (HID) interface. Standard Microsoft drivers intercept these coordinates just as a standard mouse device would send them and interacts with the application being projected accordingly. While any mouse driven application can interact with the PointBlank projector, additional application software can be developed to enhance how the pointing device can interact with the computer.

The system does not require any calibration and can work over a wide range of screen lumens, screen sizes, pointing device distance from screen and ambient lighting conditions. It also works

for any input computer source supported by the projector and independent of projector settings such as keystone, scaling mode, etc.

The PointBlank patterns are not visible to the viewer, except for an increase in the black level and a small decrease in the red, green and blue lumens. Depending on the DLP sequence approach, there can be some color distortion of the black level as well. Since the PointBlank patterns affect the projector contrast and lumens, a non PointBlank mode can also be supported and is recommended to maintain projector specifications relative to brightness, contrast and color points.

4 Detailed Description

4.1 PointBlank Hardware

The PointBlank hardware additions to the DDP2431 and DDP2230 reference designs are shown in Figure 2 and Figure 3, respectively. They include a PointBlank FPGA inserted between the DDP ASIC and the DMD, a RF radio transceiver and some changes to the GPIOs. Due to the additional software memory required for the PointBlank functionality either SRAM or SDRAM is required for DDP2230 and SRAM is required for DDP2431.

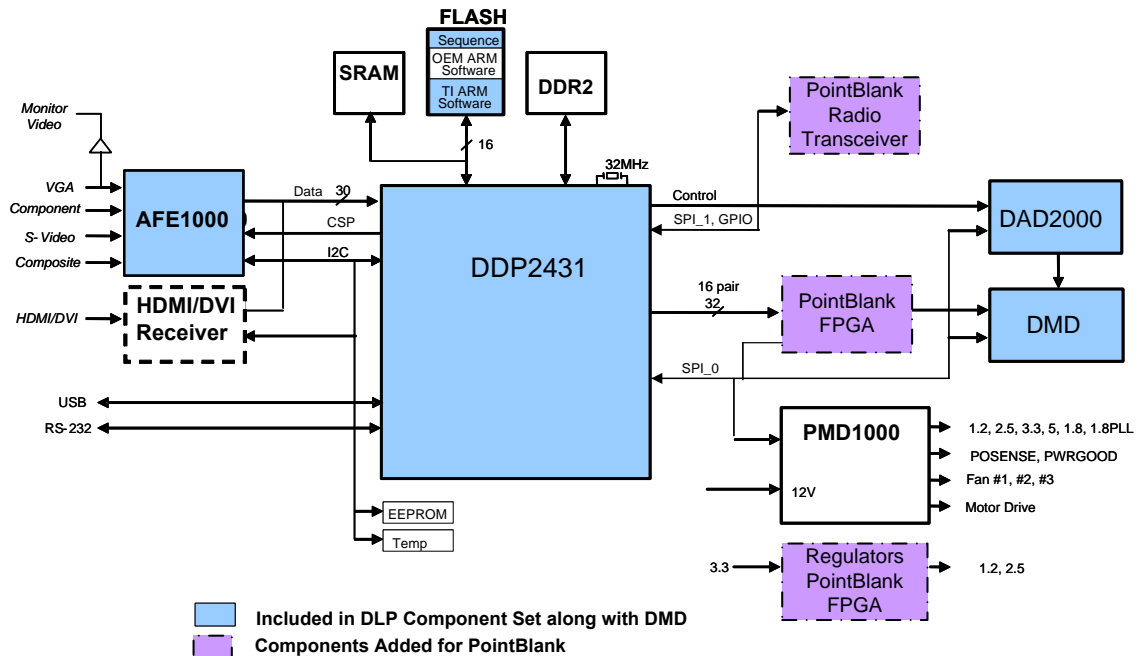


Figure 2 PointBlank DDP2431 Electronics Diagram

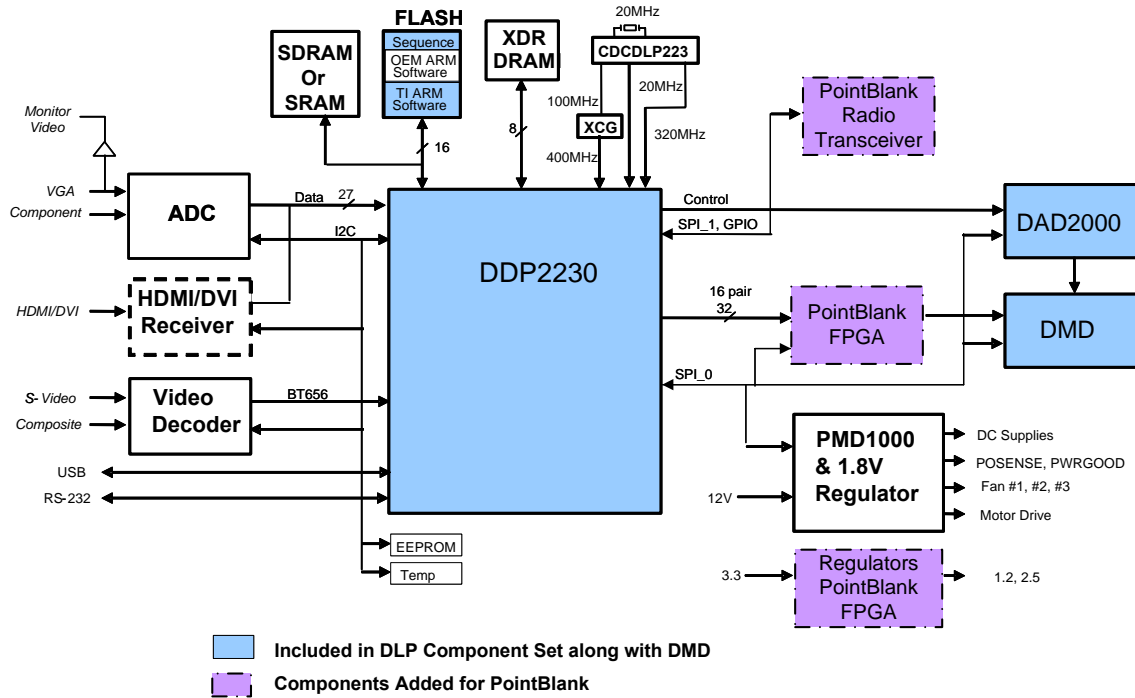


Figure 3 PointBlank DDP2230 Electronics Diagram

4.1.1 PointBlank FPGA

The PointBlank FPGA receives LVDS image data from the DDP ASIC. Under control of the software and sequences in the DDP ASIC, it inserts the PointBlank patterns into the normal image data and outputs it to the DMD.

The LVDS inputs in the FPGA do not have internal termination resistors so external parallel termination must be added on the PCB. TI recommends using filled vias for these signals at the FPGA so the termination resistors can be placed across the vias.

The FPGA is a LFE2-12E-5FN256CB9 made by Lattice Semiconductor. Firmware and an I/O spec for the part are available on the PointBlank Knowledge Base. Further information on the FPGA is available on the Lattice Semiconductor website.

The FPGA requires 3.3V, 2.5V and 1.2V. The 3.3V is powered directly from the 3.3V from the PMD1000. The 2.5V and 1.2V should be generated with linear regulators from the 3.3V. See the reference design for details.

4.1.2 PointBlank Radio Transceiver (PBM)

The TI reference design uses an eZ430-RF2500 2.4GHz radio transceiver development board. This board's main components are a TI CC2500 2.4GHz transceiver and a TI MSP430F2274. Documentation for this board and its components is available on the TI website (www.ti.com). Additional information on antenna selection is also available.

The DDP ASIC communicates with the radio board with a SSP (SPI) bus 1. The MSP430 is the master and the DDP ASIC is the slave. The DDP ASIC can request data from the MSP430 by asserting a GPIO pin (request to send). See the DDP2230 PointBlank reference design schematic for details on the connections between the DDP2230 and the eZ430-RF2500 board.

4.1.3 PointBlank Pointing Device (AirDraw II)

The PointBlank pointing device utilizes a photodiode to sense the amount of light in the projected image. Optics in the pointing device reduces the field of view of the photodiode so the pointing device sees a relatively small portion of the screen from a typical user distance. TI uses a 36mm lens with a 2mm aperture located at the focal length of the lens just in front of the photodiode. For a 75in diagonal XGA image and the pointing device located 55 in from the screen the spot size has a horizontal diameter of about 3.7in or 62 pixels. It is important to minimize any light reflections inside the optics housing as these can degrade performance at the edges of the screen.

Current from the photodiode is converted to a voltage with a trans-impedance amplifier. The output of the trans-impedance amplifier is high passed filtered to reject DC and 120Hz ambient light sources. After filtering the signal is gained up with a programmable gain amplifier. The output is then sampled with an ADC in a MSP430. The measurements are sent to the projector over a 2.4GHz wireless link. The pointing device utilizes a TI CC2500 radio transceiver to transmit messages and receive configuration. See the reference design for more details on the pointing device electronics.

4.2 *PointBlank Wireless*

The PointBlank wireless interface is a peer to peer protocol between the projector and one or more pointing devices. The radio operates in the 2.4GHz ISM band and is based on TI's SimpliciTI network protocol. At the start of operation the projector and pointing device are put in a pairing mode to establish a link. Once linked the radio transceiver in the projector receives measurement data from the PointBlank pointing device and can send configuration data to the PointBlank pointing device.

Since the radio uses the 2.4GHz ISM band there is potential for interference from other wireless devices operating in the same band such as wireless LAN (WLAN), Zigbee, Bluetooth, Wireless USB, wireless phones, microwave ovens and others. The PointBlank wireless protocol utilizes multiple channels and automatically selects the channel with the least interference.

4.3 *PointBlank Software*

The PointBlank software includes special versions of the DDP ASIC API and application software and DLP composer libraries. In addition, software API and application code are provided for the MSP430 in the pointing device and projector.