

XRD9827REF USER MANUAL

CANNON CIS 36-BIT COLOR SINGLE LINE SCANNER



PRELIMINARY EVALUATION KIT PART LIST

This kit contains the following:

- XRD9827REF CIS 36-Bit Color Single Line Scanner
- XRD9827REF User Manual
- SenseIt 1.0 Software Installation Diskettes (2)
- XRD9827 Data Sheet
- Scan Targets (Black, White, Color)

FEATURES

- One line scanning functionality of XRD9827 with CANON 600DPI CIS (Contact Image Sensor)
- Easy to use with most personal computers through Parallel Port Interface
- Simple way of loading the Serial Port of XRD9827 to adjust gain and offset
- Software SenseIt 1.0 to view single line scan
- Optimized PCB Layout with Four Layer

SYSTEM REQUIREMENTS

- Intel 486 compatible computer with Windows 95 operating system
- 8 MBytes system memory
- 25-pin D-shape parallel port receptacles
- 3 1/2" floppy disk drive

INTRODUCTION

The XRD9827REF is a demo system which includes a PCB design with a CANON CVA-60216K 600DPI Color Contact Image Sensor (CIS). It demonstrates how to interface a CIS with EXAR's XRD9827, a 12-bit Linear CIS/CCD Sensor Signal Processor to output a single line scan and display the amplitude of each of the three colors. The XRD9827REF is designed to provide a signal path for the CIS output signals to be processed, digitized by the XRD9827 and transmitted to a personal computer. There are no software algorithms or hardware implementations, for example, gamma correction, to adjust for color response.

The XRD9827REF board is loaded with the XRD9827, a Vantis MACH435 CPLD, two FIFO SRAMs and peripheral circuits for the CIS. The MACH435, which is a CMOS Programmable Logic Device (CPLD) provides timing signals to the XRD9827, the SRAMs and the CIS. It also programs the XRD9827 to operate in the correct mode and adjust for gain and offset values. The XRD9827 processes the analog output from the CIS sensor, level-shifts and converts the signal into 12-bit digital codes. The SRAMs gate the digitized data from the XRD9827 and stores the data temporarily. Controlled by the software, the SRAMs send the data through a parallel port connection to the PC and histograms of raw data are displayed in the monitor using the SenseIt software. A block diagram of the XRD9827REF is shown below in Figure 1.

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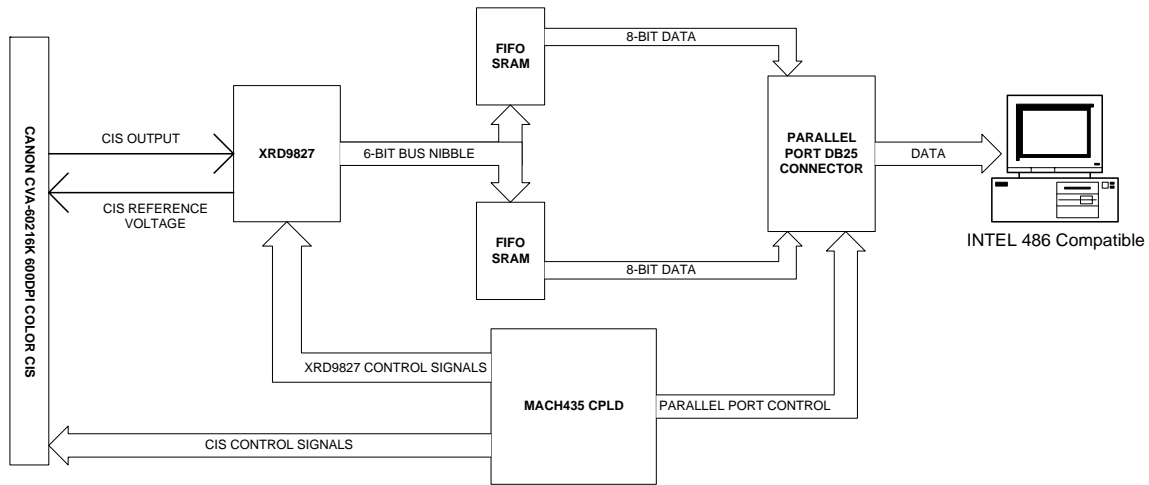


Figure 1. Block Diagram of XRD9827REF

The XRD9827 is a complete linear CIS or CCD sensor signal processor on a single monolithic chip. The XRD9827 includes a high speed 12-Bit ADC, a 6-Bit Programmable Gain Amplifier with gain adjustment of 1 to 10 and an 8-Bit programmable input referred offset calibration range of 800 mV. The XRD9827 also provides the necessary biasing voltage for the CANON CIS, eliminating the use of external components (two diodes and two resistors). See the XRD9827EVAL User Manual / PCB board for evaluating the XRD9827 CIS / CCD signal processor chip. A simplified functional block diagram of XRD9827 is shown below for your reference.

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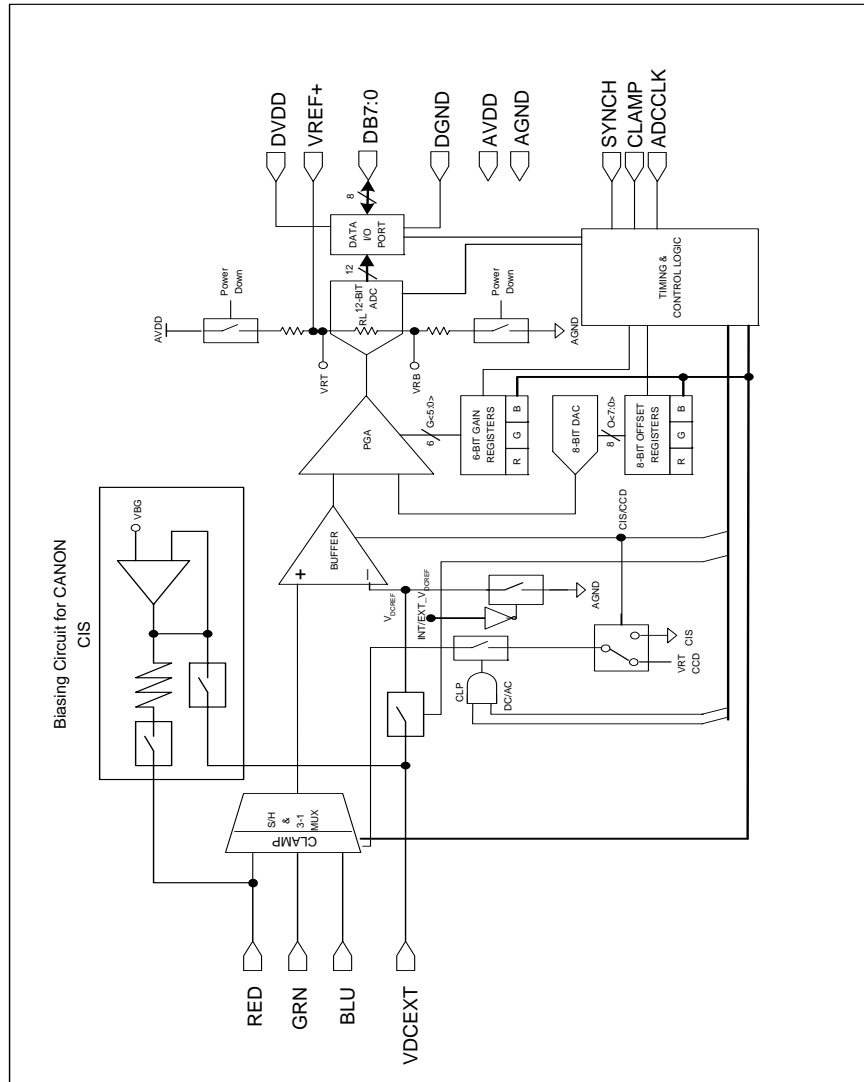


Figure 2. Simplified Functional Block Diagram of XRD9827

OPERATIONAL PROCEDURE

The routine listed below will first calibrate the photo response of the CIS using the XRD9827 by optimize its offset and gain. After calibration, the XRD9827REF can be used to scan any color target to show CIS non-color corrected response. (Color correction is typically done in the digital ASIC.)

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How to Run the XRD9827REF Demonstration

1. Make sure the computer is powered off and the AC power adapter is disconnected from a wall outlet
2. Connect the parallel port cable to the printer port of the computer
3. Connect the AC power adapter into a wall outlet
4. Turn on the computer and activate Windows 95

Loading EXAR Software

5. Load the diskette labeled SenseIt 1.0 Disk # 1 into the floppy drive
6. Select the Start menu in the program manager and choose RUN
7. Inside the small pop-up window, type: A:\setup
8. Follow the instructions to finish software installation

Parallel Port Configurations

9. Confirm the parallel port address as follows:
 - I. Select the Start Menu, choose Settings, then choose Control Panel
 - II. From the Control Panel window which pops up, double-click on System
 - III. In the System Properties window, select Device Manager
 - IV. From the Device Manager window, double-click on Ports (COM & LPT)
 - V. Double-click on Printer Port (LPT1). If you can not find it, please goto Step 10
 - VI. From the pop-up window, select Resources
 - VII. Verify the Input/Output Range is set to 0378 - 037F
 - VIII. If the range is not correct, clear the Use Automatic Settings check box by clicking it
 - IX. Choose correct address which is 0378 by default and click OK
 - X. Re-start the computer as advised
10. If you do not have a Printer Port configured on your computer, please follow the steps listed below:
 - I. From the Control Panel window which pops up, double-click on Add New Hardware
 - II. From the pop-up window, click the Next > button
 - III. Select 'No' when prompted for 'Do you want Windows to search for your new hardware?', then click the Next > button
 - IV. Choose Ports (COM & LPT), then click the Next > button
 - V. Choose Printer Port, then click the Next > button
 - VI. Make a note of the Input/Output Range of Printer Port of your computer and click OK. You will use these values later when configure the SenseIt software
 - VII. Re-start the computer as advised

Offset Adjustment With a Black Target

11. Set the dip switches located on the side panel of the scanner to [110 01000000] as shown in Figure 3 and push the Serial Port button which is located on the front panel of the demo system. This will reset the XRD9827.

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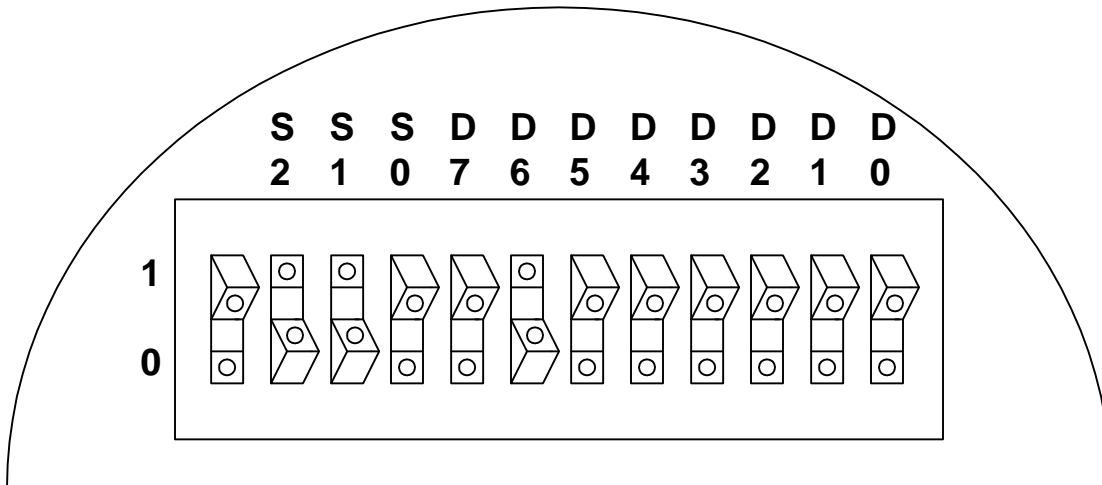


Figure 3. Dip Switches Set to Value [110 01000000] to Reset XRD9827

12. Select the Start Menu, choose Programs, then choose SenseIt icon
13. A window will pop up as shown below. The upper window shows the plot of captured data and the lower window shows the histogram of data. Figure 4 shows the pop-up window when SenseIt is first started.

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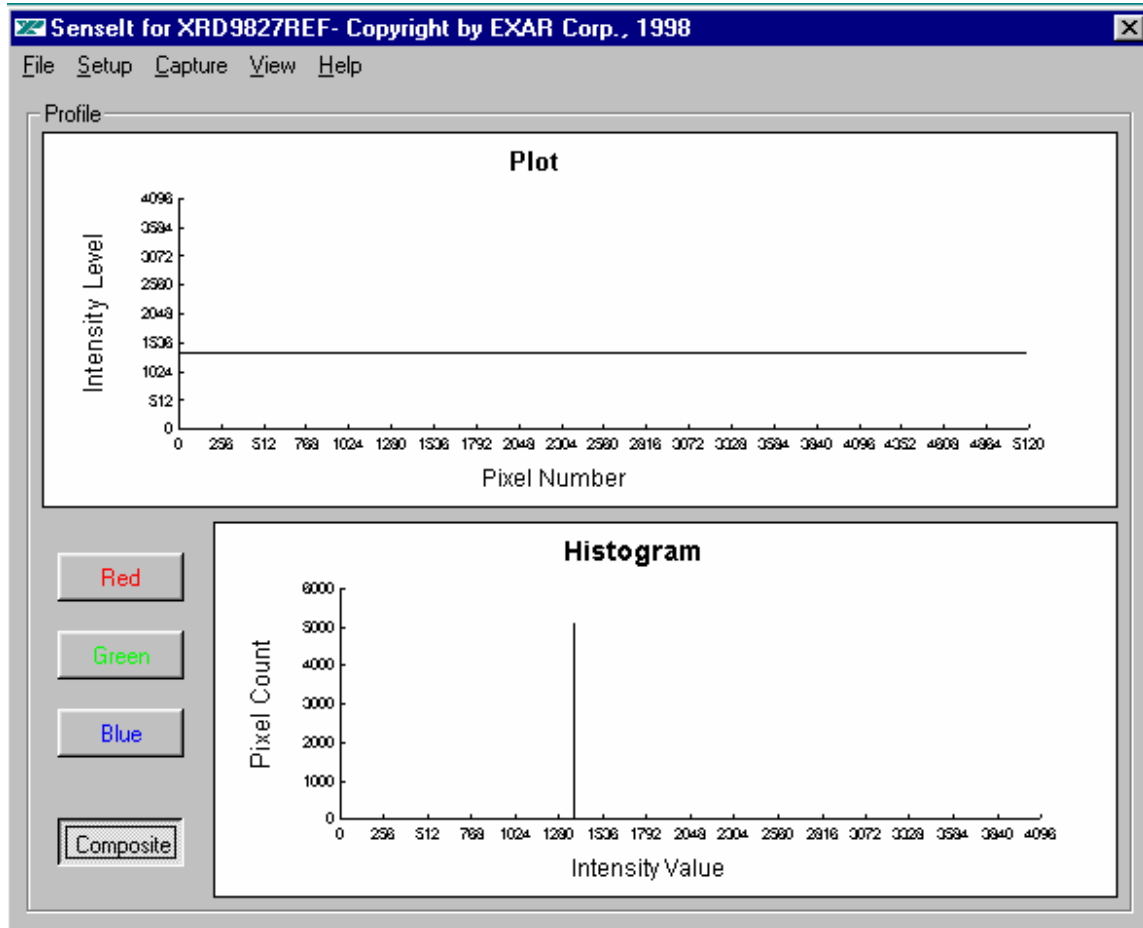


Figure 4. SenseIt Software Window Before Scanning

14. Select SETUP from the pull-down menu and choose I/O ADDRESS. In the window that pops up, type in the Input/Output Range of Printer Port of your computer. The default setting is 378H.

15. Pick the black target out from the kit and put it on a flat area. Place the XRD9827REF on top of the black target with the CIS sensor facing downwards. From the CAPTURE menu select SNAP SHOT (or simply press CTRL and B buttons simultaneously) for a single line scan of the black target with the dip switches set to [000 00000000]. A typical result of a black target scan is shown below:

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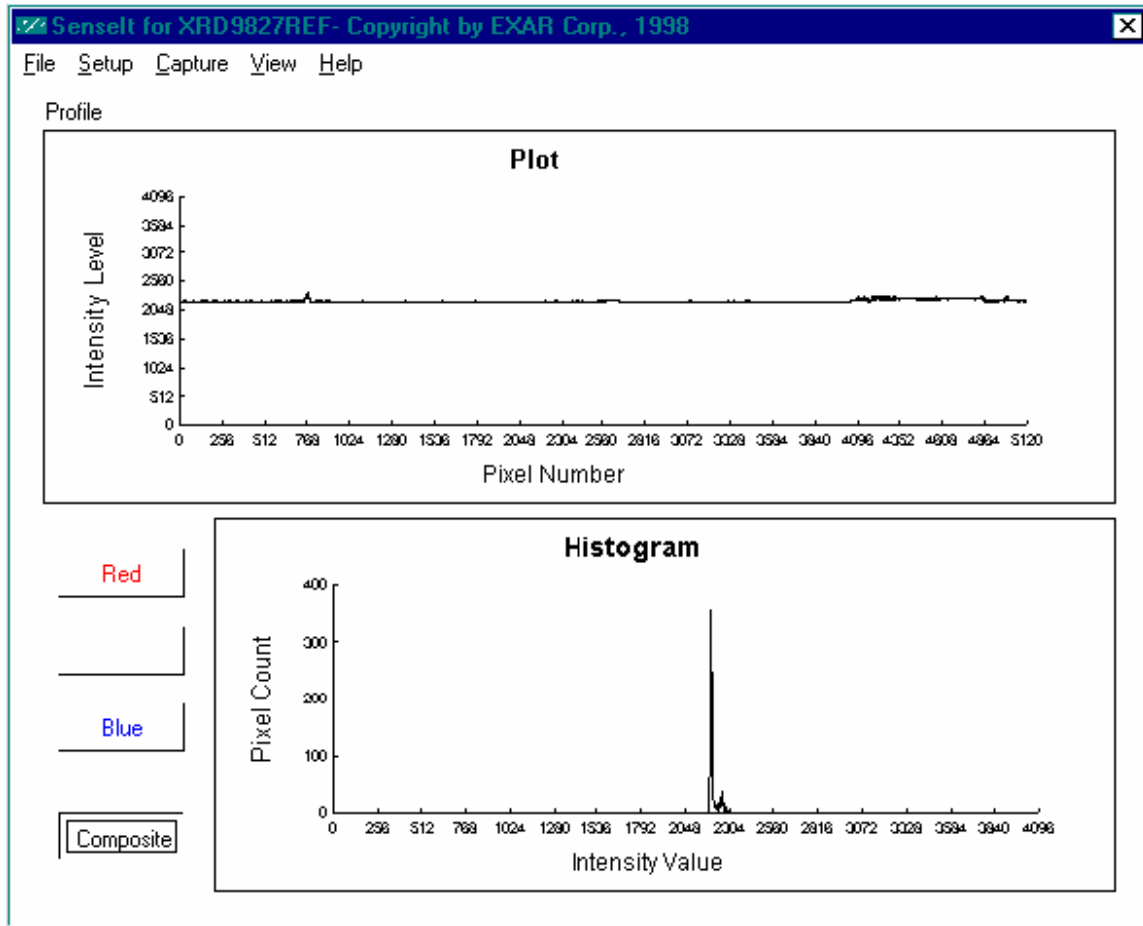


Figure 5. Non-calibrated Black Target Scan

16. Set the dip switches to [110 00010000] to tie VDCREF and VDCEXT pin together internally. Push the Serial Port button. The XRD9827 will subtract whatever voltage appears on VDCEXT (pin 16) from the input and thus perform a global offset adjustment. A typical result of the global offset adjustment is shown below. Please notice that the black code value has moved down.

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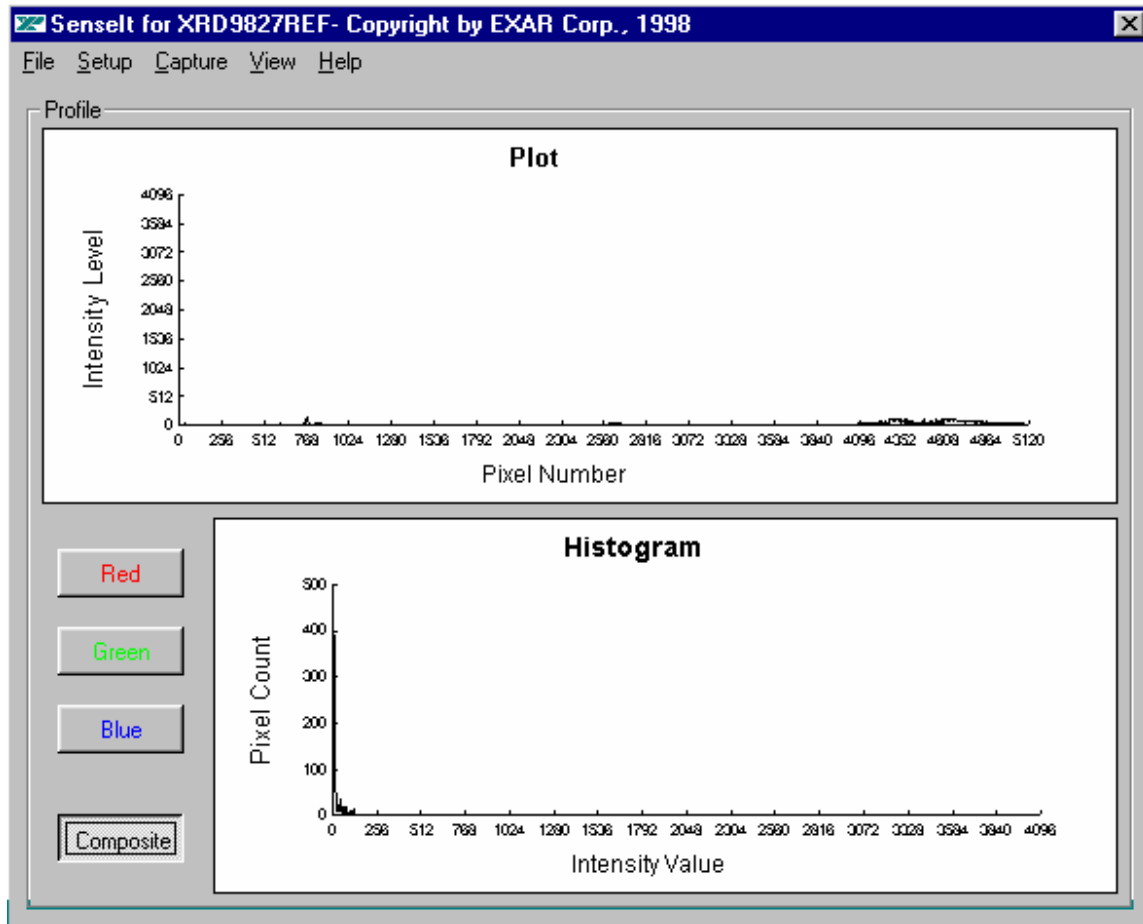


Figure 6. Black Target Scan After Global Offset Adjust Using the 9827 Internal Bandgap Reference Voltage

17. Then, set the dip switches to [111 00010000] and push the Serial Port button again. By doing this, a 1.24V reference voltage provided by an internal bandgap is applied to the VDCEXT pin. VDCEXT is connected to VREF pin (Pin 5) of the CANON CIS, this voltage is used by the CIS as a biasing voltage. Moreover, a 12K built-in resistor of the XRD9827 serves as a pull-down for the output of the CIS. By interfacing the XRD9827 with a CANON CIS, a designer can save two biasing diodes and two resistors and thus reduce cost.

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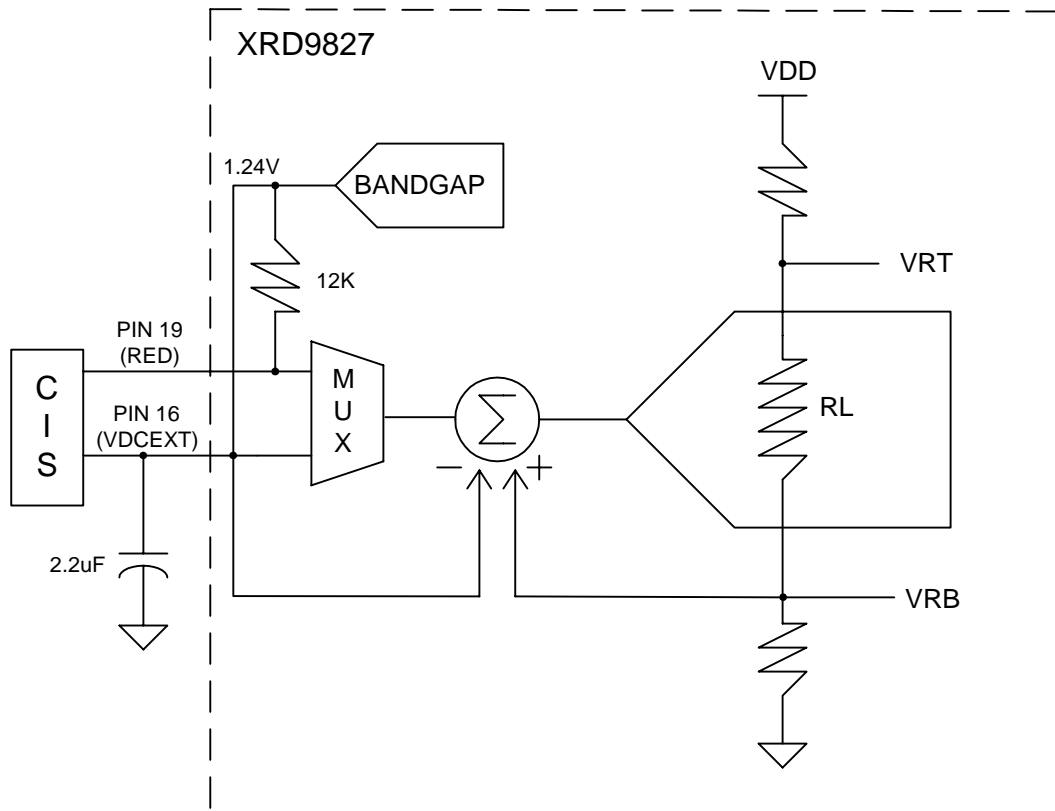


Figure 7. Simplified Block Diagram Showing Global Offset Adjustment by XRD9827 Using Internal Bandgap and CIS Using VDCEXT for Biasing

18. Set the dip switches to [001 01010000] to select the internal offset DAC for fine offset adjustment. Push the Serial Port button. From the CAPTURE menu select SNAP SHOT. The offset should now move the output of the CIS to almost zero scale. The other way to do a SNAP SHOT is by pressing CTRL and B button at the same time. Please refer to data sheet for offset adjustment. A typical result of the fine offset adjustment is shown below.

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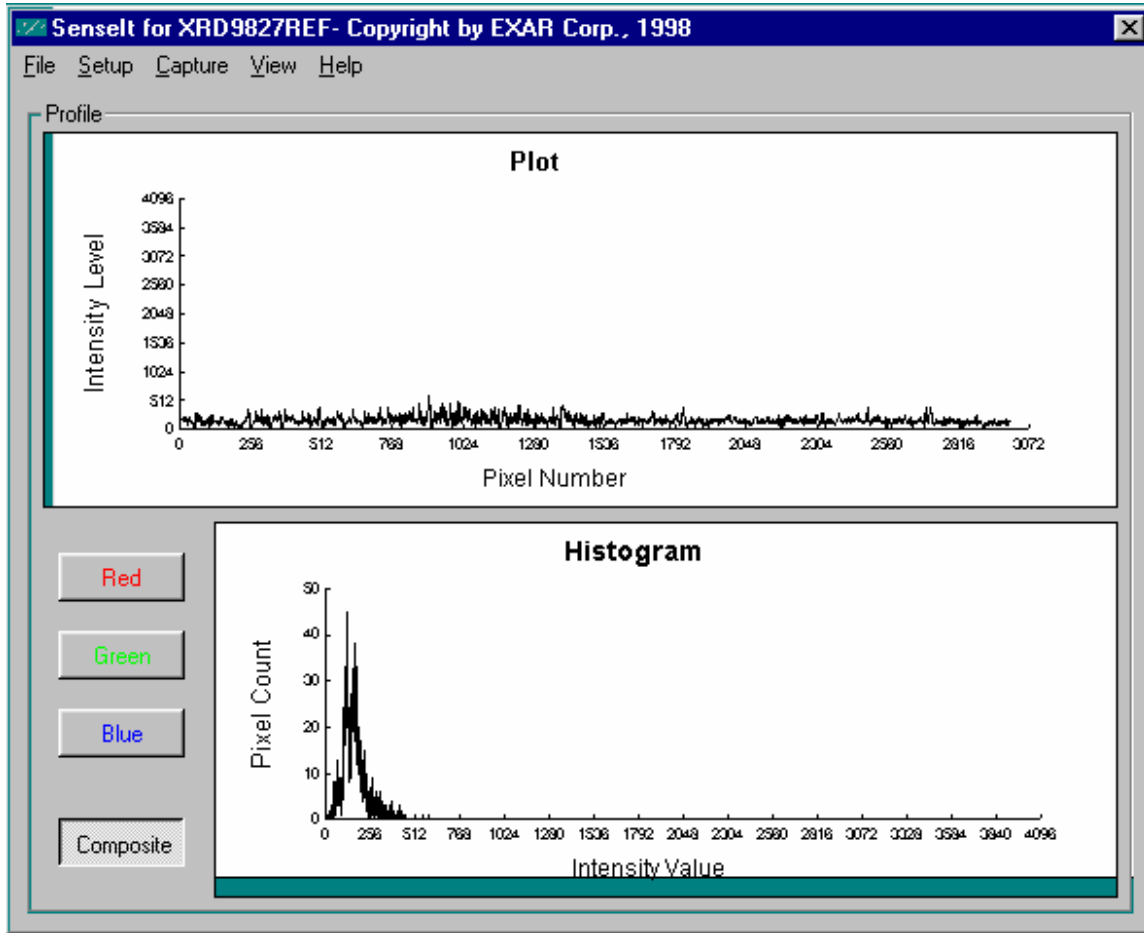


Figure 8. Black Target Scan After Global and Fine Adjustment

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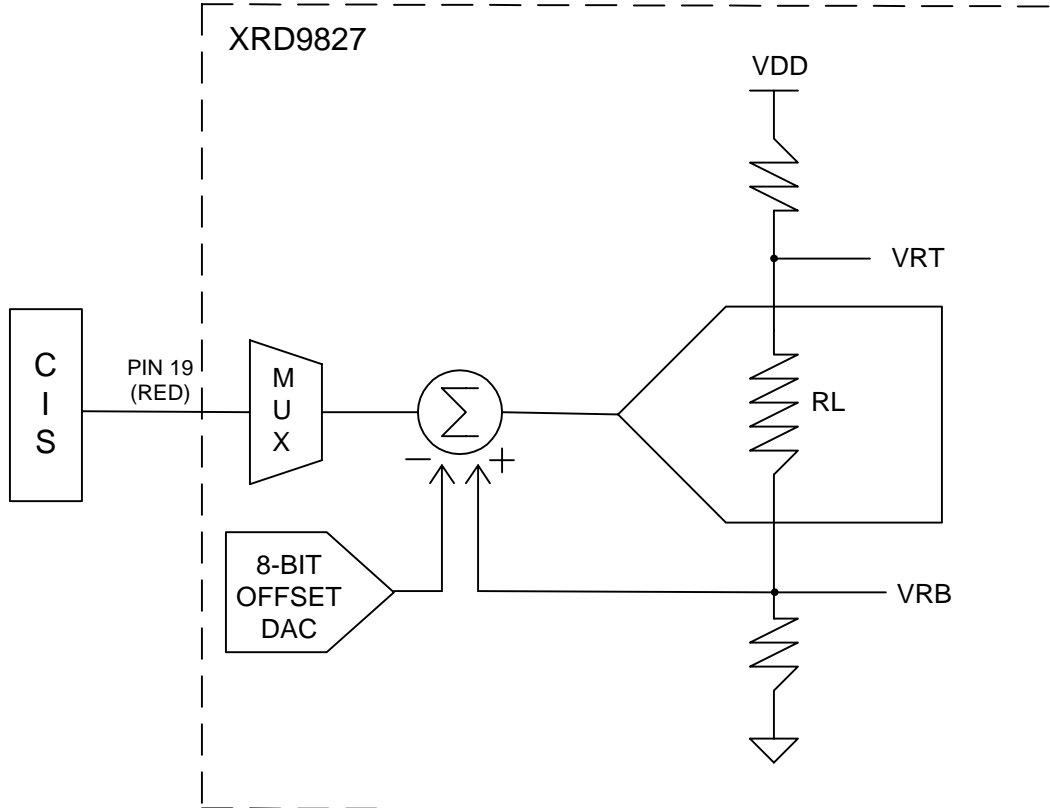


Figure 9. Simplified Block Diagram Showing Fine Offset Adjustment by XRD9827

19. Switch the black target to the enclosed white target. From the CAPTURE menu select SNAP SHOT for a single line scan of the white target. A typical result of a white target is shown below.

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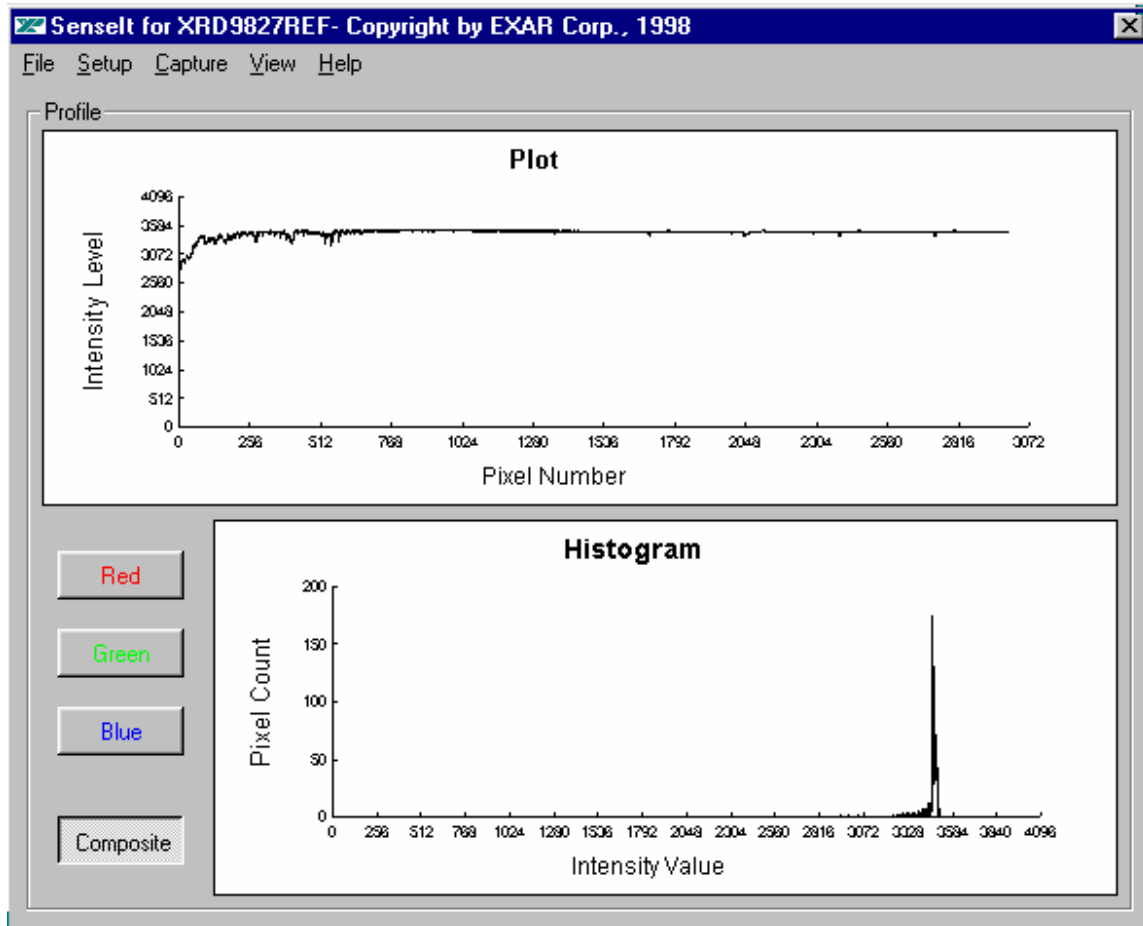


Figure 10. White Target Scan Without Gain Adjustment

20. Set the dip switches to [000 00001000] to select the desired gain. Push the Serial Port button. From the CAPTURE menu select SNAP SHOT. The gain should move the output of the CIS to almost full scale. Please refer to data sheet for further gain adjustment and optimal values of dip switches for your scanner. A typical result of the white target with gain adjustment is shown below.

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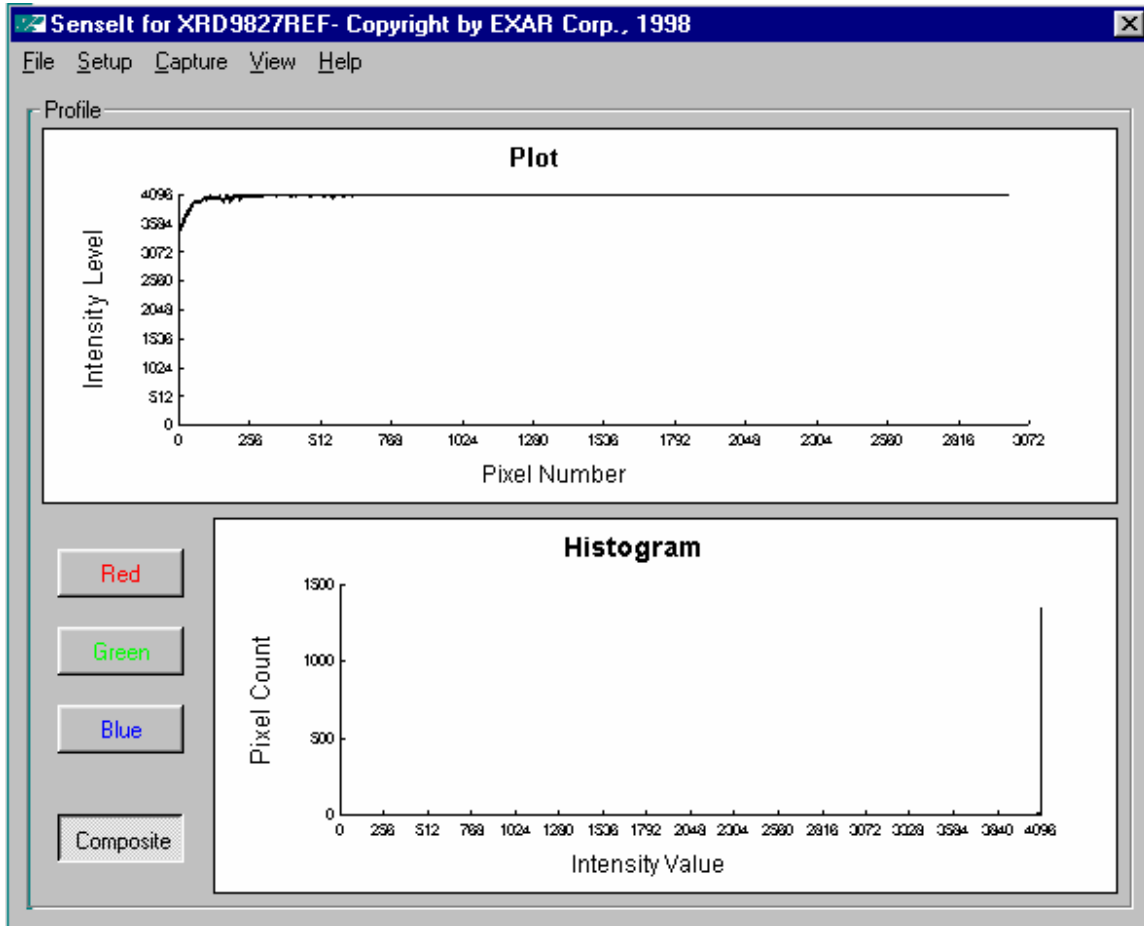


Figure 11. White Target Scan After Gain Adjustment

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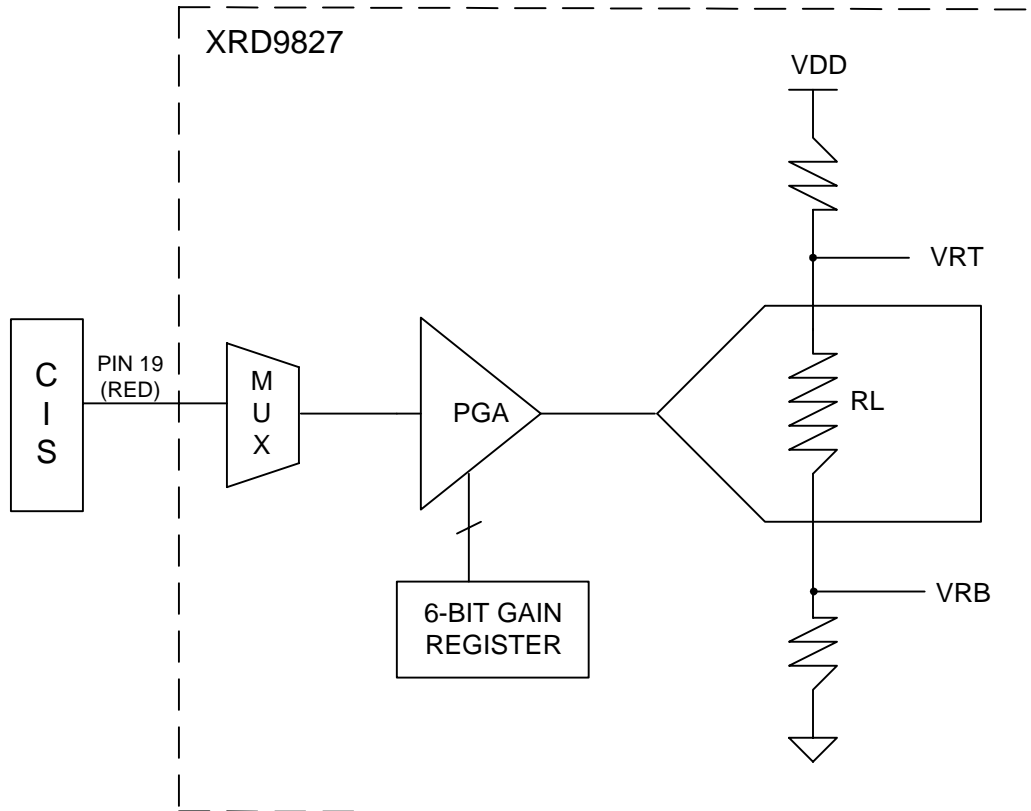


Figure 12. Simplified Block Diagram Showing Gain Adjustment by XRD9827

21. Once the XRD9827 has been fully calibrated, any target can be scanned. For example: Scan a gray scale to demonstrate the stair step response or a color target for color responsivity.

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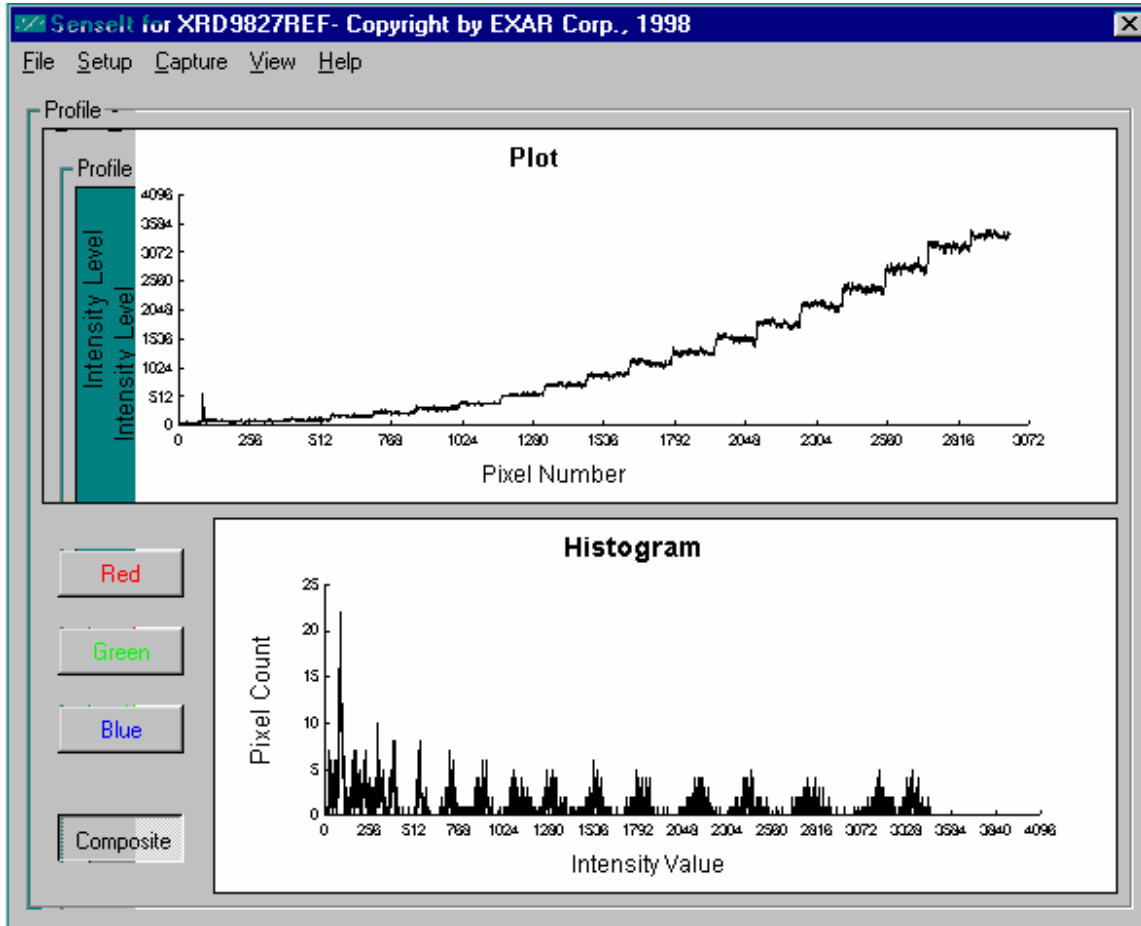


Figure 13. Gray-scale Target Scan

22. To demonstrate the noise component is contributed from the CIS, we hooked up a DC reference to the scanner and the results are shown below in Table 1.

REFERENCE DC (V)	STANDARD DEVIATION	SYSTEM SNR (dB) W/O CIS NOISE COMPONENT
2.0	2.144328	62.6117
2.5	3.48261	58.3988
3.0	2.399188	61.6356
3.5	1.983461	63.28842

Table 1. Signal-to-Noise Ratio of the XRD9827REF with DC Source as Input (No CIS Noise Component)

As we can see from Table 1, the SNR falls into the range of 58 dB to 63 dB when a DC reference is used as input to the XRD9827REF. The system alone gives a 9 1/2 to 10 bit performance. The largest noise source we saw in previous scans came from the CIS. A typical plot of the DC reference is shown in Figure 14.

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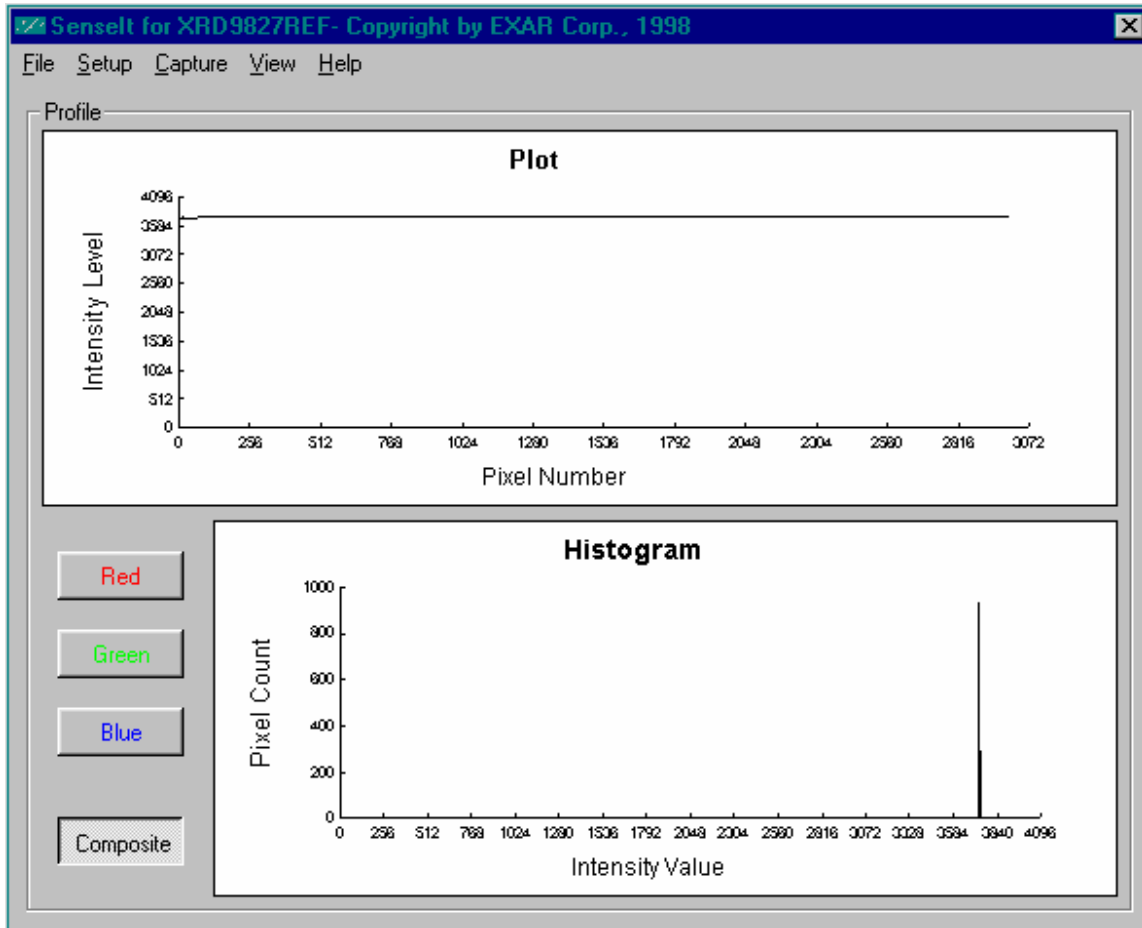
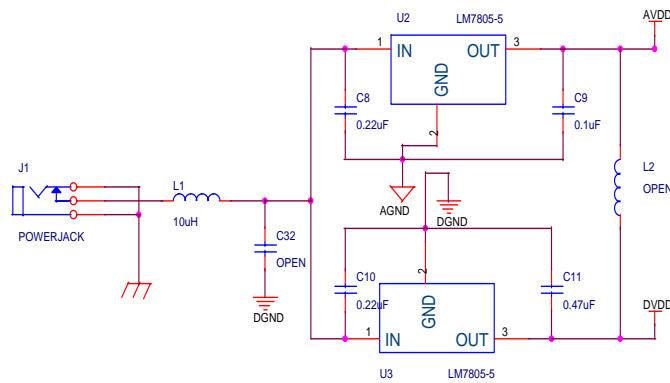
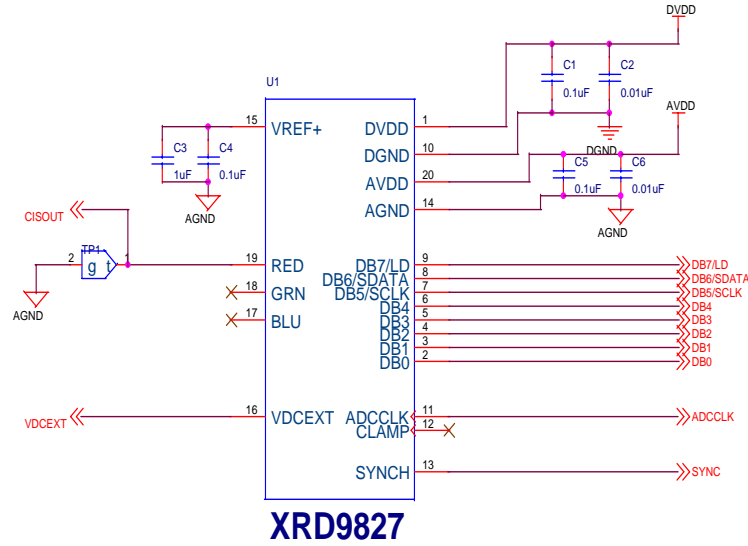


Figure 14. Plot of 3.5V DC Source as Input to the XRD9827REF

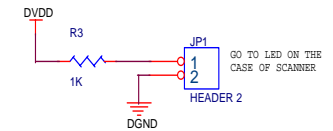
Important:

1. If at any time an unexpected result is shown or the demo system seems to not working, please pull the AC adapter out from the wall outlet to cycle power. Start the procedures again from Step 11.
2. Keep the scanner away from other electrical equipment, power cords, light dimmers, etc., as stray electrical fields can end up in the digitized data.
3. Switch off all unnecessary light sources and place the scanner flat on the image, this can prevent stray light from entering the sensor and disrupt the scan.

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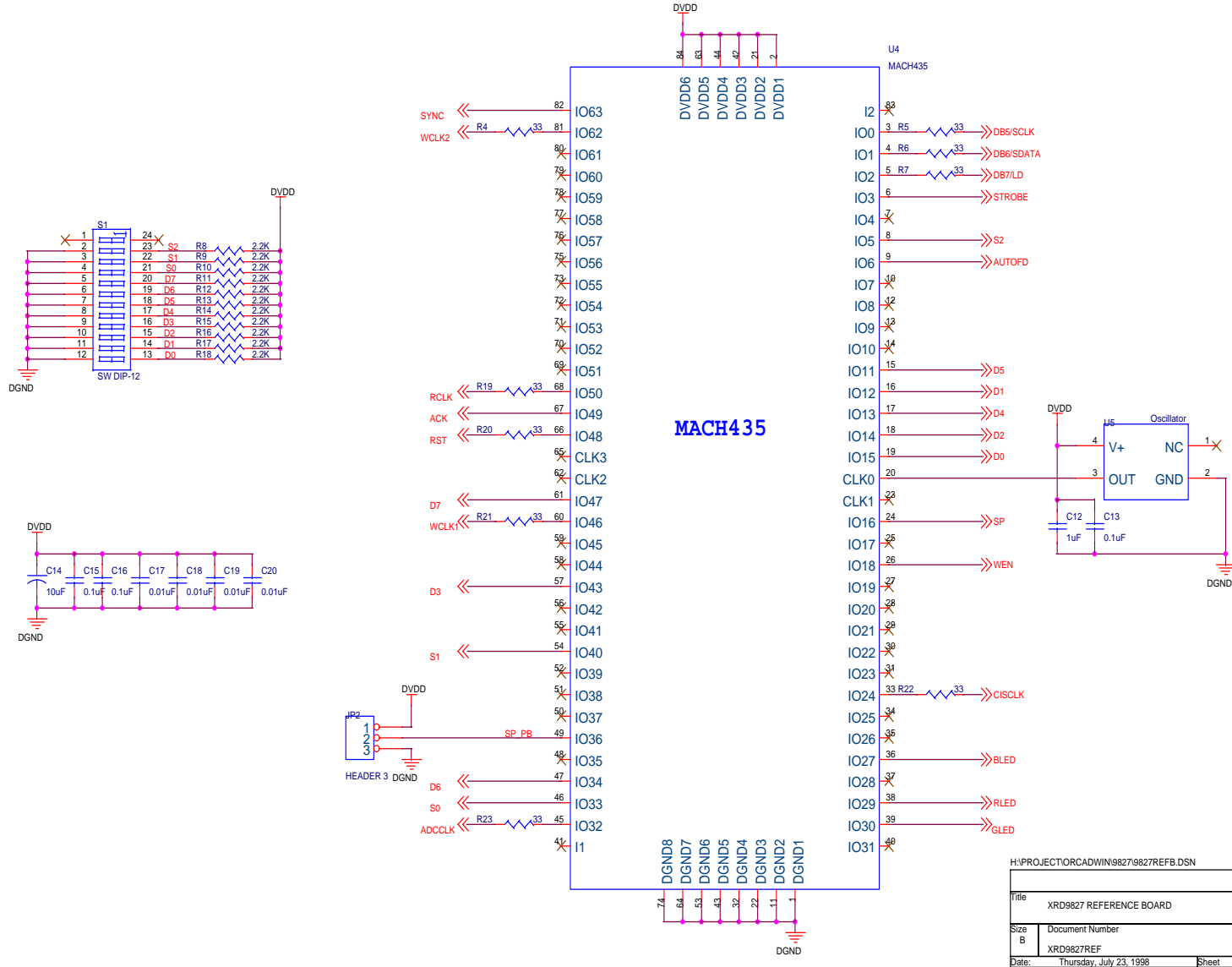
**POWER SUPPLY
CIRCUITS**



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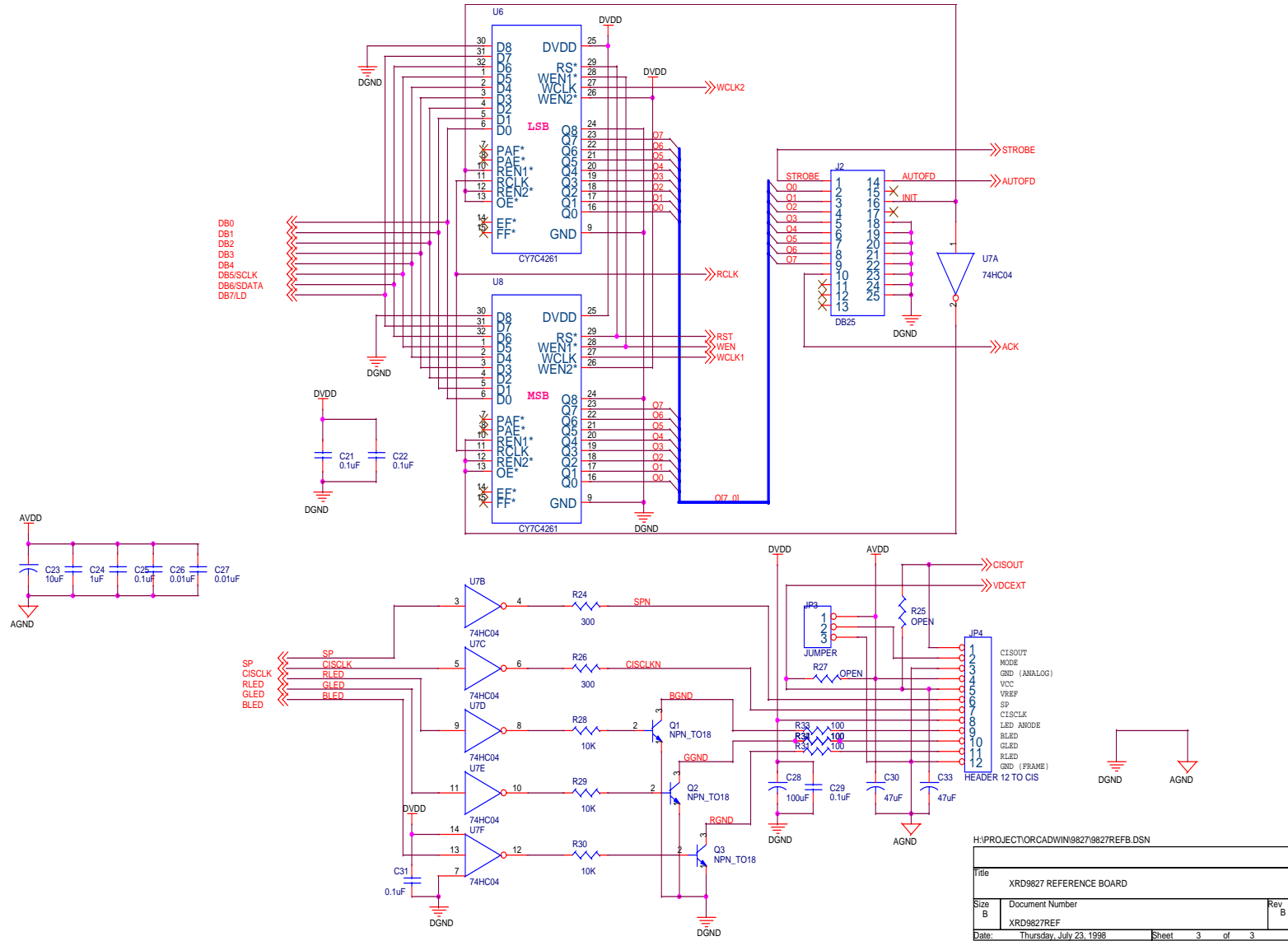
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