

EVAL-ADPD188BIZ-SK User Guide UG-1274

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Evaluating the ADPD188BI Optical Module

FEATURES

Supports the detection of UART UDP transfer capability Full configuration of the ADPD188BI Register level High level Graph view Time graph Frequency graph

EVALUATION KIT CONTENTS

EVAL-ADPD188BIZ-SK evaluation board Ribbon cable

ADDITIONAL EQUIPMENT NEEDED

PC running Windows 7 or Windows 10 operating system EVAL-ADPDUCZ microcontroller board

ONLINE RESOURCES

ADPD188BI data sheet Applications WaveTool software package

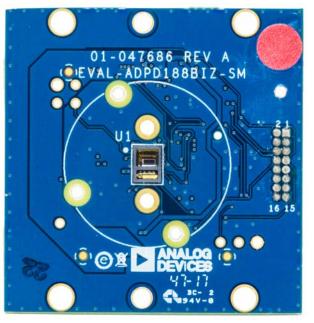
GENERAL DESCRIPTION

The EVAL-ADPD188BIZ-SK evaluation board provides users with a simple means of evaluating the ADPD188BI optical module for smoke and aerosol detection applications. The evaluation system includes the Applications WaveTool graphical user interface (GUI), providing users with low level and high level configurability, real-time frequency and time domain analysis, and user datagram protocol (UDP) transfer capability so that the evaluation board can easily interface to the user development system.

The EVAL-ADPD188BIZ-SK is powered through the ribbon cable from the EVAL-ADPDUCZ microcontroller board, obtained separately.

For additional information on the functionality of the ADPD188BI, refer to the ADPD188BI data sheet.

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EVALUATION BOARD PHOTOGRAPH

Figure 1.

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REVISION HISTORY

6/2018—Revision 0: Initial Version

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GETTING STARTED INSTALLING THE APPLICATIONS WAVETOOL

Download the Applications WaveTool software package from the EVAL-ADPD188BIZ-SK product page. Unzip the folder and run Applications_WaveToolx_x_x.exe. Follow the prompts for software installation, beginning with the setup window shown in Figure 2.



Figure 2. Applications WaveTool Setup Window

CONNECTING THE EVAL-ADPDUCZ MICROCONTROLLER BOARD AND THE EVAL-ADPD188BIZ-SK EVALUATION BOARD

Connect the USB cable to the EVAL-ADPDUCZ evaluation board, connect the ribbon cable to the EVAL-ADPD188BIZ-SK board, and switch the power switch to the **ON** position (see Figure 3).

When the USB cable is connected, the second light emitting diode (LED) below the power switch illuminates, indicating that the on-board battery is being charged. When the power switch is turned to the **ON** position, the LED immediately below the power switch illuminates, indicating that the EVAL-ADPDUCZ microcontroller board is on.



CHECKING THE USB SERIAL CONNECTION IN WINDOWS

Ensure that the COM port driver is installed correctly. To verify proper installation of the COM port driver, go to **Control Panel** > **All Control Panel Items** > **System** > **Device Manager**, as shown in Figure 4. In this case, the proper COM port selection is **USB Serial Port (COM16)**.

The EVAL-ADPDUCZ microcontroller board uses an FT232 USB universal asynchronous receiver transmitter (UART) IC. If the USB driver installation does not install properly, refer to the corresponding FTDI driver installation guide that is compatible with the operating system being used.

¢reφitani la mainte ≥ na Dink dives ≥ Na Dink valoren	
Ga IDE ATAVATAPI controllers Taylor devices	
Composition Compositi	
Vigit Sense from (CCM36)	

Figure 4. USB Serial Port in Windows® 7

The EVAL-ADPDUCZ also contains a Bluetooth^{*} radio that can be paired with the PC if a wireless connection is desired.

RUNNING THE APPLICATIONS WAVETOOL

To start the Applications WaveTool application, navigate to the Start menu > Analog Devices > ApplicationsWaveTool and click ApplicationsWaveTool.

INSTRUCTIONS TO LOAD THE FIRMWARE

It is possible that the EVAL-ADPDUCZ microcontroller board is loaded with an older version of the firmware at the time that it was stocked. In this scenario, the user receives the message shown in Figure 5 when attempting to connect to the WaveTool.

ANALOG				
DEVICES D OF WHAT'S POSSIBLE"				
Warning				
			Qk	
		į	Qk	
		_	<u>Q</u> k	
Tool only support firmware versi Software Version : 1.8.3-Optical	n 3.4.2	-	<u>O</u> k	

Figure 5. Warning Message for Outdated Firmware

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If the firmware must be updated, take the following steps:

- Download and install the latest DfuSe USB device 1. firmware upgrade software.
- 2. Plug in a micro USB cable between the EVAL-ADPDUCZ and the PC with the power to the EVAL-ADPDUCZ turned off (see Figure 6).
- Press and hold the BOOT0 button, and switch the power 3. switch to the ON position



Figure 6. Micro USB Connection and BOOTO Button Used when Upgrading Firmware

- Go to Device Manager > Universal Serial Bus controllers 4. and wait until the PC detects STM Device in DFU Mode (see Figure 7). If the PC does not detect the STM device in DFU mode, then the STM drivers must be manually installed to continue updating the firmware.
- Universal Serial Bus controllers ü
- 🏮 Generic USB Hub
- Generic USB Hub
- Intel(R) 6 Series/C200 Series Chipset Family USB Enhanced Host Controller 1C26
- Intel(R) 6 Series/C200 Series Chipset Family USB Enhanced Host Controller 1C2D ë
- STM Device in DFU Mode
- USB Root Hub USB Root Hub

Figure 7. STM Device in DFU Mode Displayed

- 5. Release the **BOOT0** button.
- Open the DfuSe Demo by going to Start > All Programs > 6. STMicroelectronics > DfuSe > DfuSe Demo. Figure 8 shows the DfuSe demo settings at startup.
- 7. Click the **Choose** button from the **Upgrade or Verify** Action window and select Adpd_M4_uC.dfu from the Firmware folder of the downloaded software package.

Click the Upgrade button and follow the prompts to upgrade 8. the firmware of the EVAL-ADPDUCZ microcontroller board.

After the firmware updates, connection to the WaveTool completes. DfuSe Demo (v3.0.4) . . . Available DFU Devices Application Mode DFU Mode STM Device in DFU Mode • Vendor ID: 0483 Vendor ID: Supports Upload Manifestation toleran Procuct ID: DF11 Supports Download Procuct ID. Accelerated Upload (ST) Can Detach Version: 2200 Version Enter DFU mode/HID detach Leave DFU mode Actions Select Target(s): Available Sectors (Double Click for more) Target Id Name 00 Internal Flash 12 sectors. 01 Option Bytes 1 sectors OTP Memory 02 2 sectors... 03 **Device** Feature 1 sectors Upgrade or Verify Action Upload Action File File Targets in file Vendor ID Choose ... Procuct ID Transferred data size Version 0 KB(0 Bytes) of 0 KB(0 Bytes) Verify after download Optimize Upgrade duration (Remove some FFs) Operation duration 00:00:00 Choose... Upgrade Venty 3756-00R Abort Quit

Figure 8. DfuSe Demo Settings

USB UART CONNECTION

To establish the USB UART connection, use the following menu path: Connection > Connect > UART Bridge.

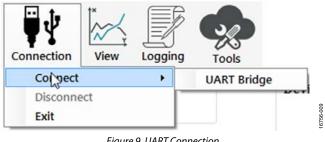


Figure 9. UART Connection

Select the proper COM port to connect the WaveTool to the device. If connection via Bluetooth is required, or if there are any other connection issues, refer to the Applications WaveTool user guide that is provided in the software package download.

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ACQUIRING DATA SELECTING THE PROPER VIEW

The EVAL-ADPD188BIZ-SK is intended for smoke and aerosol detection applications. Select the **Smoke Device** data view (see Figure 10) to open a window that allows the user to run the ADPD188BI device and to collect data (see Figure 19).

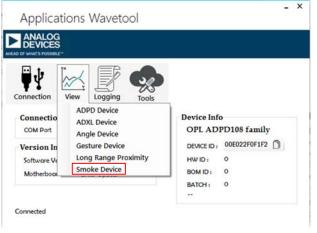


Figure 10. Selecting the Smoke Device Data View

LOAD CONFIGURATION

In the upper right corner of the data view window, click the **ADPD Config** button (see Figure 11) to open the **Configuration** window.

Cal. Select	Statist	tics	
Sample Count 5	0 4	ADPD Config	
Blue / IR			

Figure 11. Selecting ADPD Config to the Open the Configuration Window

In the **Configuration** window, click **Load DCFG** to select a configuration file, as shown in Figure 12. For smoke and aerosol measurements, select the **ADPD188BI_SK.dcfg** configuration file from the file dialog box.

		Name
	Deviator	PAD_IO_CTRL (02)
	Register	FIFO_LENGTH (06)
	Save DCFG	CHIPID (08) OP_MODE_CFG (11)
Register Dump Info	Load DCFG	SAMPLING_FREQ (12)
ADPD1	PD_SELECT (14) INT_AVG_MODE (15)	
Timing Control	CH1_OFFSET_A (18)	

Figure 12. Selecting Load DCFG to Select the Configuration File

OPTIMIZING AND RUNNING THE ADPD188BI

Using the **ADPD188BI_SK.dcfg** configuration file, the ADPD188BI is set up with an infrared (IR) LED firing in Time Slot A and the blue LED firing in Time Slot B. The initial configuration is as shown in Figure 18. Before running the Applications WaveTool, a few steps must be taken to optimize the data collection view and provide valid blue/IR ratios.

 In the data view (see Figure 19), click the **Op Select** button to open the view shown in Figure 13. Select **SB_Sum**, **SA_Sum**, and the / operation, as shown in Figure 13, to configure the blue/IR ratio in the data view.

Constants		Source	C	peration	
1.000	÷	B_Sum	• /	•	
1.000	÷	A_Sum	•	•	
0.000	÷	lo source	•	•	
0.000	÷	lo source	•		

Figure 13. Op Select View

 Before running the WaveTool, make sure the operating mode shown in the Set SlotMode window of the data view is set to ADPDDrv_SUM_32 for both Time Slot A and Time Slot B, as shown in Figure 14.

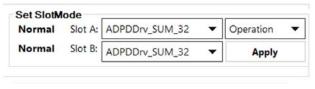


Figure 14. Selecting ADPDDrv_SUM_32

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3. With the sensor board in a fixed position and no aerosol or smoke in the optical path, run the WaveTool by pressing the play button. The raw data view, **Slot A/B vs Time**, must be at some average level. This average level must be nulled out before measuring smoke or aerosol, as described in the following steps (Step 4 to Step 6).

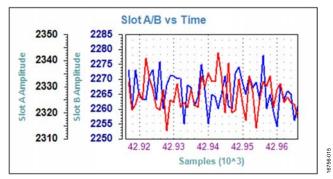


Figure 15. Average Value Prior to Nulling Offset

- 4. Open the **Statistics** window by clicking the **Statistics** button in the data view.
- 5. In the **Statistics** window, select **Continuous Update**. Allow the **Statistics** window to calculate the mean value. After a mean value is calculated, click the **Subtract mean from Offsets** button.

	SLOT A	SLOT B	MATH		
Channels	SUM	SUM	Opr.Val		
Mean	-0.5	-1.1	0.000		
Offsets	-2332.	-2277.	-1.02		
itandard Deviation	5.64	5.58	0.000		
Ainimum	2318	2263	1		
Aaximum	2349	2291	1		
pdate Sta	tistics	ntinuous Up Save to File	Lange Lange	Subtract mean from Offse	ts : Set
Grab 1		Save Raw Da		Set Offsets to 0 :	Set

Figure 16. Statistics Window

6. In the data view, click the **Null Offset** button to set the Time Slot A and Time Slot B raw data values to approximately zero, plus or minus the noise that may be present (see Figure 17).

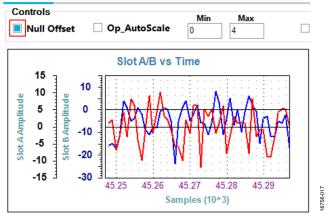


Figure 17. Data View Following Null Offset

After these steps are complete, the user can begin testing with different aerosols. Figure 19 shows the raw output data, as well as the blue/IR ratio of the response to a jet of smoke spray. The **EN_MW** button can be pressed to enable an eight point moving average filter on the data being plotted.

The settings can be further optimized by manipulating the LED drive currents, the transimpedance amplifier (TIA) gain, the number of pulses, and the decimation rate until the desired signal-to-noise ratio (SNR) is obtained from the response to the smoke or aerosol being detected. For information about optimizing the ADPD188BI, refer to the ADPD188BI data sheet. For functional descriptions of the Applications WaveTool, refer to the Applications WaveTool user guide provided in the software package download.

High Level Controls	10.000	prima -						Name	Value
ampling Frequency	100	*					Register	PAD_IO_CTRL (02) FIFO_LENGTH (06)	0x0005 0x0E00
Internal Average		•					Save DCFG	CHIPID (08)	0x0916
Calculated ODR Measured ODR	25.00	Hz		P	ower Calculation	Register Dump Info	Load DCFG	OP_MODE_CFG (11) SAMPLING_FREQ (12)	0x30A9 0x0050
Dropped Samples	0							PD_SELECT (14)	0x0117
LOT A CONTROL				SLOT B CO	NTROL Normal	ADPD	188BI_SK.delg	INT_AVG_MODE (15)	0x0220
LED Control	ormai	Timing Control		LED Contr	normal	Timing Control		CH1_OFFSET_A (18)	0x1F00
		AFE Width(us)	4 👽			AFE Width(us)	4 🗘	CH2_OFFSET_A (19)	0x3FFF
LED LED 3	-	Pulse Width(us)	3	LED	LED 1 -	Pulse Width(us)	3 🗣	CH3_OFFSET_A (1A)	0x3FFF
								CH4_OFFSET_A (1B)	0x3FFF
LED Status LED ON	•	Pulse Offset(us)	25 🜩	LED Status	LED ON	Pulse Offset(us)	25 🜩	CH1_OFFSET_B (1E)	0x1F00
	123	AFE Offset(us)	16 🕏			AFE Offset(us)	16 🗘	CH2_OFFSET_B (1F)	0x3FFF
Number Of Pulses 8	(\$)	AFE Fine Offset(ns)		Number O	f Pulses 8 🗘	AFE Fine Offset(ns)	93.75	CH3_OFFSET_B (20)	0x3FFF
	_	See Charles Conserving	00.10				00.70	CH4_OFFSET_B (21)	0x3FFF
TIA Gain 200k	-			TIA Gain	200k 💌			LED3_DRV (22)	0x3531
								LED1_DRV (23)	0x3533
ED 1	LE	202	LED 3		Single Regi	stor Control		LED2_DRV (24)	0x3531
				70		ster conuor		LED_TRIM (25)	0x6317
LED Coarse 110	 LLE 	D Coarse 70	 I_LED Coarse 	70 •				PULSE_OFFSET_A (30)	0x0319
cale Factor 100%	- Scal	e Factor 100%	Scale Factor	100%	Register Add	ress(hex):	Default DCFG	PULSE_PERIOD_A (31)	0x0810
100%		100%	- scare r setor	100%	Register Va	hadhay):		LED_DISABLE (34)	0x000x0
					Register Va	inte(nex).	Refresh	PULSE_OFFSET_B (35)	0x0319
		-					Notesh	PULSE_PERIOD_B (36)	0x0810
				70.00	. Read Registe	er Write Register		AFE_CTRL_A (39)	0x2203
inal I_LED 136.69	mA Fina	11_LED 70.38	mA Final I_LED	70.38 m	A		Apply	AFE_CTRL_B (3B)	0x2203
								ALE CTRIZ (2C)	0/21/16

Figure 18. Smoke Device Configuration (Smoke Config) View



Figure 19. Raw Data Response and Blue/IR Ratio Measurement of Smoke Spray

OLD STYLE RIBBON CONNECTOR OPTION

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EVALUATION BOARD SCHEMATICS AND ARTWORK

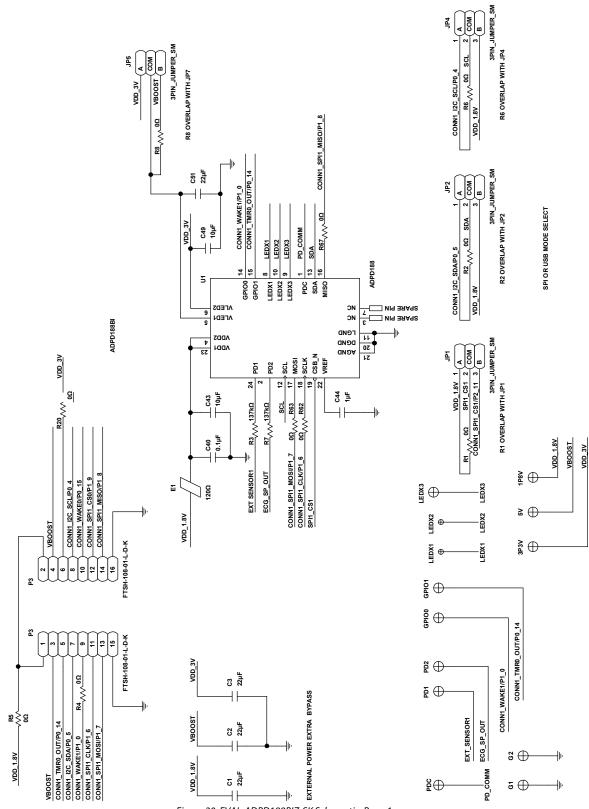


Figure 20. EVAL-ADPD188BIZ-SK Schematic, Page 1

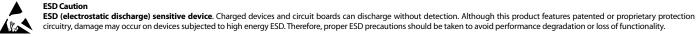
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16756-021 CONN1_SPI1_MISO/P1_8 CONN1_WAKE0/P0_15 CONN1_TMR0_OUT/P0_14 CONN1_I2C_SCL/P0_4 CONN1_I2C_SDA/P0_5 B2 CONN1_I2C_SDA/P0_5 VDD 1.8V VDD_1.8V M24C16-DFCU6TP/K 5 Construction SPARE PIN C47 10µF U2 ADXL362BCCZ վա տ Ш 120<u>0</u> ┨┠ -11 5 SCL NC_N M24C16-RDW6TP SDA ŝ INT1 9 11 - 5 A1 VCC U4A MISO VSS RESERVED VDD_1.8V A2 v v c vss ŝ ₿Š₿ FOR BOARD IDENTIFICATION 4 3 7 7 16 gND ñ EEPROM MEMORY 13 -10 4 2 CONN1_I2C_SCL/P0_4 S 5 ич зяачг SCLK cs_N MOSI 9 2 0.1µF ADXL362 CONN1_SPI1_MOSI/P1_7 CONN1_SPI1_CLK/P1_6 CONN1_SPI1_CS0/P1_9 **C**39 10µF ~ A 8 6 2 2 2 2 2 2 9 16 14 15 20 3PIN_JUMPER DF40HC(2.5)-20DS-0.4V(51) Вq COM COM USE VLD03 TO SUPPLY 3V IF VLD01 IS SET TO 1.8V (<u>m</u>) CONN1_I2C_SDA/P0_5 CONN1_I2C_SCL/P0_4 2 ~ DF40HC(2.5)-20DS-0.4V(51) DUMMY NET ONLY VLD01/IOVDD VDD_3V VLD03 CONN2_WAKE3/TMR2_OUT/P2_1 CONN2_SP12_MOSI/P1_3 CONN2_SP12_CS0/P1_5 R17 OVERLAP WITH JP6 CONN1_TMR0_OUT/P0_14 CONN1_WAKE0/P0_15 CONN1_SP11_CS0/P1_9 CONN1_SP11_MOSI/P1_7 STACKING CONNECTOR TO WATCH MOTHERBOARD VDD_1.8V_LD02 CONN2_ADC0_VIN2/P2_{ R17_____00 VLDO1/IOVDD VDD_1.8V_LDO2 VBOOST CONN2_SW_DATA CONNECTOR 1 1.8V INTERFACE N CONN2_IOVDD SYS_HWRST CONNECTOR 1 CONNECTOR 2 / D03 ₽Şa ۰li VDD 1.8V 9 11 15 19 업 £ 15 15 9 £ ი VBUCK DF40HC(2.5)-20DS-0.4V(51) CONN2_BPR0_TONE_P/SPI2_CS1/P0_{ CONN2_BPR0_TONE_N/P0_8 DF40HC(2.5)-20DS-0.4V(51) CONN1_SPI1_CS1/P2_11 CONN1_SPI1_MISO/P1_8 CONN1_ADC0_VIN1/P2_4 CONN1_SPI1_CS3/P1_10 CONN1_SPI1_CLK/P1_6 CONN2_SPI2_CLK/P1_2 CONN2_ADXL364_ADC CONN2_SPI2_MISO/P1 CONN1_WAKE1/P1_0 CONN2_UART_RX SYS_BMODE/P1_1 CONN2_SW_CLK VLD02 VB00ST -||-

Figure 21. EVAL-ADPD188BIZ-SK Schematic, Page 2

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NOTES



circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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