

User Manual DA16600 EVK PRO

UM-WI-041

Abstract

This document describes how to set-up and use the DA16600 EVK PRO (504-02-A) with the Wi-Fi IoT Power Profiler toolbox. This document explains the calibration process step-by-step for the DA16600 development kits.



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DA16600 EVK PROEVK PRO

1 Terms and Definitions

DPM	Dynamic Power Management
AP	Access Point
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver-Transmitter
RTC	Real Time Clock
WPS	Wi-Fi Protected Setup
SSID	Service Set Identifier
SDK	Software Development Kit
ARP	Address Resolution Protocol

2 References

- [1] DA16200, Datasheet, Dialog Semiconductor
- [2] UM-WI-023, DA16200, EVK User Manual, Dialog Semiconductor
- [3] UM-B-114, DA14531, Devkit Pro Hardware, User Manual, Dialog Semiconductor
- [4] UM-WI-026, DA16600, EVK User Manual, Dialog Semiconductor



3 Current Measurement

Current Measurement with DA16600 EVK PRO and Wi-Fi IoT Power Profiler Tool

3.1 Test Setup

Figure 1 shows a typical test setup environment with DA16600 EVK PRO and Wi-Fi IoT Power Profiler Tool.



Figure 1: Hardware Setup with DA16600 EVK PRO

- 1. To measure current with DA16600 EVK PRO, connect the two boards via PCI connectors.
- 2. Change the jumper setting (P1 and P2) and switch (SW5) settings on the DA16600 EVK.
- 3. Open the DA16600 EVK's power two jumper caps as shown in Figure 2.

There is a selectable DIP Switch (SW5):

- If SW (1) moves to switch on, you can measure the current of WIFI chipset.
- If SW (2) moves to switch on, you can measure the current of the Bluetooth[®]LE chipset.

By switching on both, you can measure all current consumed by Bluetooth[®] LE and WIFI.



Figure 2: Setup DA16600 EVK Jumper



3.2 DA16600 EVK PRO (504-02-A)

The actual component locations of the DA16600 EVK PRO are shown in Figure 3.



Figure 3: DA16600 EVK PRO(504-02-A)

Description

- PCI Connector: a connector on which to install the DA16600 EVK
- UART MCU: provides communication between DA16600 EVK PRO and PC. Also transfers the current measurement samples to the PC
- Current Sense Circuit: monitors the current of the DA16600 EVK
- USB Hub: USB interfaces to the PC

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3.3 Wi-Fi IoT Power Profiler

Wi-Fi IoT Power Profiler uses the SPI port of a device connected via USB for communication. The user needs to select the SPI port to connect before using the Power Profiler tool.

To select the SPI port, simply click the checkbox next to the SPI port. The port might be preselected already since the application remembers the last selected SPI port. If necessary, use the **Refresh** button to update the list of available SPI ports for the devices connected via USB. If the device is connected but not listed, it is better to use a different USB port, wait a few seconds and then click the **Refresh** button again. Problems in identifying the FTDI device may indicate an invalid installation of the FTDI drivers.

The **3** button can be used to access the application's user guide, release notes, license and about info. When the user click the **OK** button to launch the main application window (Figure 4), the SmartSnippets Wi-Fi IoT Power Profiler tool can be downloaded from the customer support portal. Direct link: windows.

📵 Wi-Fi lo	oT Power Profiler v1.0.2.3048 - Virtual COM Port Selec 🔀	<
1	Please select your device:	
	✓ COM67	
	Refresh <u>Cannot see my board?</u> OK	

Figure 4: Virtual COM Port Selection Window

3.4 Wi-Fi IoT Power Profiler Setup

When the proper COM port is selected (Figure 4), click **OK** button then the main window of the Power Profiler application in SmartSnippets Wi-Fi IoT Power Profiler Toolbox will pop up (Figure 5). Click the **Config** button at the bottom right and check that the configuration is correct (Figure 6).



WI-FI IoT Power Profiler v1.0.2.3048 @ COM69 [Device	ce: DA14531]												– 🗆 ×
Q Selective Boot 1005 Power Prime → Messare Boot 10 cav % C ↓ Add Time Marker Dear secondary data Chart Controls Data	Snapshot Current(1)Charge Current(1)/Current(2) Cha	Current(1)/Osciloscope	Current(2)/Charge									
Power Protier 🗴													-
1.1 1.0 0.9													Peak Current (mA)
0.8 0.7													Avg Current (mA)
0.5 0.5													Charge (uC)
0.3													Sleep Mode Deep
0.0													Control
100 0.75 ebiety 0.75 0.05 0.00													Auto Trigger Threshold (mA) 0.00 Auto Stop Time Interval (ms) 1500 Filtering Standard •
0.00 0.05 0.10	0.15 0.20	0.25 0.30 0.35	5 0.40 0.4	45 0.50 Time (ms)	0.55 0.	60 0.65	0.70	0.75	0.80	0.85	0.90	0.95 1.00	4
			🔺 Current Data 🛛	Secondary Currer	t Data								
initialize][Start			0	Stop					Config	
Log X													₩ * 7* 0

Figure 5: Power Profiler of SmartSnippets Toolbox Main Window

Chart Settings		_
age (1.1V - 3.3V) 3.30 Pre trigger sampling time (ms) 0.07	100	_
tion Offset (mA) 0 Max Allowed Sampling Time (ms) 600	000	1
Factor Sample Rate 105	5 kSamples	1
bards: 50 Sleep Mode Dee	ер	
s for SW Cursor 5 Sleep Mode Threshold (uA) 50.0	00	_
r Tolerance (uA) 0.0000 Sleep Mode Extended (uA) 1.20	0	
Cursors to Stop 0 Sleep Mode Deep (uA) 0.55	5	
SW Cursor (ms) 0.3600 CSV File Path		
Threshold (mA) 0.00 julee\Wi-Fi_loT_Power_Profiler\Project	ts\Power_Pro	file
pling Time (ms) 1500		

Figure 6: Power Profiler Configuration

In the H/W Settings tab of the new profile, the **Voltage (1.1 V - 3.3V)** field is typically empty and the **Calibration Offset (mA)** field is zero. Apply the correct voltage as configured in the Power Meter LDO (typically, it is 3.3 V). The Calibration offset (mA) will be filled automatically with a calculated

value. This value is good enough to be able to measure with $\pm 2\%$ accuracy, so in most cases we can leave it as is.

Check the multiplication factor. For DA16600 it should be 155.

The user can set a maximum scale for the waveform window optionally, since there are large peaks on wakeup from sleep (charging capacitors) generally. So the useful part of the signal is compressed to a very small area. To set a maximum scale for the waveform window, open the **Chart Settings** tab (Figure 7) and for **Plot** *Current1*, set the **MAX** scale of **Current (mA)** to 10 mA. Note that this does not affect anything to the accuracy of the measurement. It can only zoom the waveform, which is presented in the viewer.

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Click Apply and return to the measurement window.

O Configuration Dialog	>
H/W Settings Chart Settings	
Basic Show Current value when mouse on graph Create Event Markers on max sample values Enable Level Of Detail process (LOD)	Axis Plot Current1 Fit Current Axis To Maximum Value Fit Current Axis To Range Values
Snapshot File Path setWi-Fi_IoT_Power_Profiler/Projects\Power_Profiler	MIN MAX Current (mA) 0.000 1.000
Ap	ply

Figure 7: Power Profiler Chart Settings

3.5 Measurements

In the measurement window (Figure 8), click **Initialize** at the bottom left (this step is only needed at the first communication with the A/D converter).

Click Start.



Figure 8: Free Running Capture



Wi-Fi IoT Power Pr	ofiler v1.0.2.3048 @ COM3-	4 [Device: DA14531]											- 0 ×
Layout	Tools Power Profiler												
SelectMove	Export to cav	🆄 Clear primary data			—								
- - Measure	🍃 Import from csv	Snapshot	Current/1)/Charge	Current(1)/Current(2)) Current(1)/Oscilloscope	Current/2)/Charge							
Add Time Marker	🔛 Clear secondary data												
Chart Controls		Data		0	Chart View								
Dower Profiler	×												-
								_					Info
80.				<u>u</u>	225.3634 ms		2129.4	570 ms				75,4333 mA	Peak Current (mA)
70 -													75.43329
Q 60													Avo Current (mA)
5 ຄ.						<u>ΔΕ:9</u>	4900 uJ - ΔC: 2.8758 uC	-l _e ; 0.0032 mA -l	ok: 0.0535 mA				0.09395
1													Charge (uC)
9 40 ·													319.83454
5 30-				r		ΔE 904.0	936 ms/ ΔI: -0.3032 mA	ł 1					Sleep Mode
20-													Deen
10.													
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0,													Auto Trioger
350 1					1225.3634 ms		2129.	570 ms					Threshold (mA)
<u>;</u> 300-													0.00
250							N: 00	133 mA					Auto Stop
2 200 ·													Time Interval (ms)
150 ·													1500
Ğ 100-													Filtering
50 -													Standard
0													Num of patterns
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						Time (ms)						
					A Gument Da	ta 🦲 Secondary () me	nt Data						
			V				1000						
	🗿 Initialio	te .			Start			Stop				💭 Config	
													11.42
Log X													
[INFO Power Pro	ofiler #20-05-10 15:41	[55] Connection to CDM34 (571) Connection to CDM34 (port has successfully port has successfully	y opened.									ĥ
[INFO Power Pro	ofiler #20-06-10 15:41	:57] Device initialized s	uccessful ly	a second									
[INFO Power Pro	ofiler #20-06-10 15:41	:57] Capturing data proces	ss enabled										
IL FINED Downer Dev													
[INFO Power Pro	ofiler #20-06-10-15:42 ofiler #20-06-10-15:42	2:00] Capturing data proces 2:00] Analyzing data proces	ss terminated, 35902 ss terminated	2 samples collected									

Figure 9: Consumption Measurement by Using Chart Controls

3.6 Manual Calibration

For the most accurate measurement, follow the manual calibration steps below:

- 1. Remove the daughterboard, i.e. the load, by physically disconnecting the DA16600 EVK from the motherboard.
- In the main window of the Power Profiler, click Config and temporarily set the Calibration Offset (mA) field to zero (Figure 10).

H/W Settings Chart Settings				
Voltage (1.1V - 3.3V)	3.30	Pre trigger sampling time (ms)	0.0100	_
Calibration Offset (mA))	Max Allowed Sampling Time (ms)	60000	
Multiplication Factor		Sample Rate	105 kSamples	1
revD, revE motherboards: 100 revC motherboards: 50	155.0000	Sleep Mode	Deep	
Samples for SW Cursor	5	Sleep Mode Threshold (uA)	50.00	
SW Cursor Tolerance (uA)	0.000	Sleep Mode Extended (uA)	1.20	
SW Cursors to Stop)	Sleep Mode Deep (uA)	0.55	
Time offset of SW Cursor (ms)	0.3600	CSV File Path		_
Auto Trigger Threshold (mA)	0.00	julee\Wi-Fi_loT_Power_Profiler\Pr	ojects\Power_Pro	file
Auto Stop Sampling Time (ms)	1500			

Figure 10: Setting Offset to Zero

- Run a free running capture for a few seconds and note down the number in the Avg Current (mA) field (Figure 11). Note the last digits of the number keep changing slowly due to temperature drift. It is important to do the calibration steps periodically.
- 4. Finally, put this average value with a negative sign in the **Calibration Offset (mA)** field. CTRL-C and CTRL-V are also workable.(Figure 11).

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O WI-FI IoT Power Profiler	v1.0.2.3048 @ COM69 [Device: DA14531]						- 0 ×
Layout Tools	Power Profiler						
R Select/Move	Export to cav		3 🗃				
-j- Measure	mport from cav Snapshot	Current(1)/Charge Current(1)/Current(2) Current(1)	Osciloscope Current(2)/Charge				
Chart Controls	Data	Chart View					
👝 Power Profiler 🗙							
0.0350 /							Info
0.0225						1.0234 mA	Peak Current (mA)
- 0.0200	فالجار ومراقق وحمالا المترج فالمتح والمعر التقالة	indiated and a second second in the second second	the b. Elimica de Liti Manifester	the Makes with the seconds of male to the bill and	which the belief of such as	this the second of a stid	0.02337
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0.0125					5		Charge (uC)
0.0100		Voltage (1.1V	- 3.3V) 3.30	Pre trigger sampling time (ms) 0.0100			201.30089
J 0.0075		Calibration Offs	tt (mA -0.01932	Max Allowed Sampling Time (ms) 60000			Sleep Mode
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0.0025		revD, revE motherboard	IS: 100 155 0000				
0,0000		revC motherboards: 50	155.0000	Sleep Mode Deep			Control
**		Samples for SW	Dursor 5	Sleep Mode Threshold (uA) 50.00			Auto Trigger
200		SW Cursor Toleran	ce (uA) 0.0000	Sleep Mode Extended (uA) 1.20	in local cost of the second second		Threshold (mA)
Û		SW Cursors	o Stop 0	Since Mode Doop (uk) 0.55			0.00
150						····\$······	Auto Stop
E 100		Time offset of SW Curse	r (ms) 0.3600	CSV File Path			Time Interval (ms)
ha		Auto Trigger Threshol	d (mA) 0.00	juleeWii-Fi_IoT_Power_ProfilerProjects\Power_Profiler			1500
O 50		Auto Stop Sampling Tim	e (ms) 1500		· · • · · · · · · · · · • • · · · · · ·		Filtering
0							Standard
0	500 1,000 1,500 2,00	0 2,500 3,000	4	and a	8,000 8,500 9,000	9,500 10,000	Num of patterns
			·				
		A C	urrent Data 🛎 Secondary Ourren	t Data			
1	initialize	Start		Stop		Config	1
Log X							kal ≠ 7 * c
(INFO Power Profiler	(20-06-15 16:28:06) Connection to COM69 p	ort has successfully opened.					
[INFO Power Profiler	020-06-15 16:28:07] Connection to COM69 p	ort has successfully opened.					
INFO Power Profiler	#20-06-15 16:28:07] Device initialized su #20-06-15 16:28:07] Centuring data process	cossfully seabled					
[INFO Power Profiler	#20-06-15 16:28:17] Capturing data proces	s terminated. 1099081 samples collected					
[INFO Power Profiler	#20-06-15 16:28:17] Analyzing data proces	s terminated					-

Figure 11: Setting Calibration Offset

The user manual can be downloaded from the customer support portal. Link: https://www.dialog-semiconductor.com/products/da16600-modules



Revision History

Revision	Date	Description
1.0	02-Feb-2021	First Release



Status Definitions

Status	Definition
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