



WSD377

Wi-Fi 5 (802.11ac) 2.4/5GHz WiFi + Bluetooth SDIO Module

Hardware User Guide

Wi-Fi 5 / 802.11ac Dual-Band 2.4/5GHz	QCA9377-3 Qualcomm Atheros QCA9377	SDIO 3.0 Interface Low-Power SDIO	1×1 SISO Up to 433 Mbps (5GHz)
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1. Introduction

Thank you for choosing the Compex WSD377. This document provides complete hardware integration guidance for engineers and system developers deploying the WSD377 WiFi and Bluetooth SDIO module in embedded, industrial, and networking platforms.

The WSD377 is a dual-band (2.4GHz/5GHz) Wi-Fi 5 (802.11ac) wireless module with integrated Bluetooth 5.0, based on the Qualcomm Atheros QCA9377-3 single-die WLAN+BT combo chipset. Built on the Qualcomm Atheros WB396 reference design, the module delivers 1×1 SISO WLAN operation through a low-power SDIO 3.0 host interface, with Bluetooth carried over a UART/PCM interface. The module is supplied as a surface-mount component; mounting follows the recommended reflow temperature profile (see Section 7.1).

Key Highlights

- Qualcomm Atheros QCA9377-3 single-die WLAN + Bluetooth combination chipset.
- Supports 1x1 IEEE 802.11b/g/n at 2.4GHz and 1x1 IEEE 802.11a/n/ac at 5GHz.
- Provides a highly integrated WLAN System-on-Chip (SoC) for 5GHz 802.11ac, or 2.4GHz/5GHz 802.11n WLAN applications.
- Supports Bluetooth 5.0 + HS, BLE, and ANT+, with backward compatibility for BT 1.x, BT 2.x, and BT 4.2 + Enhanced Data Rate.
- Supports 20/40MHz channel widths at 2.4GHz and 20/40/80MHz at 5GHz.
- Supports multiuser MIMO.
- Supports BT-WLAN coexistence and ISM-LTE coexistence.
- Supports IEEE 802.11d, e, h, i, k, r, v, and w standards.
- Supports Dynamic Frequency Selection (DFS).
- Low-power SDIO 3.0 interface for WLAN; UART/PCM interface for Bluetooth.
- Based on the Qualcomm Atheros WB396 reference design.
- Supports up to 256-QAM modulation (802.11ac).
- Compact 12.1mm x 12.1mm x 2.5mm surface-mount package.
- Operating temperature: -20°C to 70°C. Storage: -40°C to 90°C.
- FCC, IC, CE RED, REACH, and RoHS compliant.

2. Package Contents

Verify the following items are included in the package before proceeding with installation:

Checklist

- 1 × WSD377 WiFi + Bluetooth SDIO module

⚠ Note: A host PCB with a matching pad footprint, RF trace/antenna, and power supply are not included; this module is a surface-mount component; mounting (reflow soldering per Section 7.1) is performed by the customer. Contact sales@compex.com.sg for design-in support.

If any item is missing or damaged, contact Compex Technical Support (see Chapter 10) before proceeding.

3. Hardware Overview

The WSD377 is a radio-only, single-die WLAN and Bluetooth combination module, mounted onto the host platform's PCB by reflow soldering per the recommended temperature profile (see Section 7.1). It is not a card-edge or socketed module; host designers must lay out a matching pad footprint and RF/antenna trace on their board. All wireless baseband and RF processing is handled onboard the module; the host platform supplies power and exchanges WLAN data over the SDIO 3.0 interface (Bluetooth data over UART/PCM).

3.1 Module Layout

The WSD377 features the following major components and connectors:



Chipset	Qualcomm Atheros QCA9377-3 'Tufello' Series
Reference Design	Qualcomm Atheros WB396
Host Interface	Low-Power SDIO 3.0 (WLAN) / UART-PCM (Bluetooth)
RF Interface	1× RF I/O pad (WL_BT_ANT, shared WLAN/Bluetooth)
Dimensions (W × H × D)	12.1mm × 12.1mm × 2.5mm

3.2 Connector Descriptions

Power & Control Pads

- VCC33 (pin 9): main 3.3V power input. VDDIO (pin 22): I/O voltage supply, 1.8V or 3.3V.
- WL_EN (pin 12) and BT_EN (pin 34): independent enable pins for the WLAN and Bluetooth subsystems (pull high to enable, low to disable).
- HOST_WAKE_BT (pin 6), BT_WAKE_HOST (pin 7) form a bidirectional wake handshake between the host and Bluetooth subsystem. WL_HOST_WAKE (pin 13) is a separate, one-directional signal used by the WLAN subsystem to wake the host.

WLAN Interface (SDIO)

- Low-power SDIO 3.0 interface: SDIO_DATA_0-3, SDIO_DATA_CMD, and SDIO_DATA_CLK (pins 14-19).

Bluetooth Interface (UART/PCM)

- UART interface: UART_TXD, UART_RXD, UART_RTS_N, UART_CTS_N (pins 41-44) for Bluetooth HCI.
- PCM interface: PCM_OUT, PCM_CLK, PCM_IN, PCM_SYNC (pins 25-28) for Bluetooth audio.
- Debug_UART_TXD/RXD (pins 39-40) provide an optional debug console.

RF Interface

- WL_BT_ANT RF I/O pad (pin 2), shared between WLAN and Bluetooth; route to a single external antenna via the host PCB's RF trace and matching network.
- LPO pad (pin 24): optional external 32.768kHz low-power clock input.

3.3 Hardware Pinouts

Module Pad Assignment (44-pad)

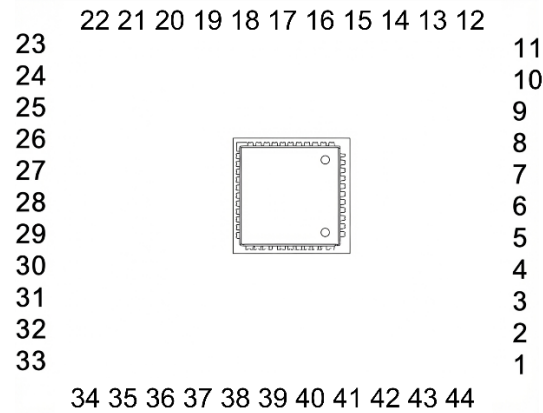


Figure: Relative pin positions (top view)

Pin	Name	Type	Description
1	GND	-	Ground connection
2	WL_BT_ANT	I/O	RF I/O port
3	GND	-	Ground connection
4	NC	-	Floating (don't connect to ground)
5	NC	-	Floating (don't connect to ground)
6	HOST_WAKE_BT	I	HOST to wake-up Bluetooth device
7	BT_WAKE_HOST	O	Bluetooth device to wake-up HOST
8	NC	-	Floating (don't connect to ground)
9	VCC33	P	Main power voltage source input, 3.3V
10	GND	-	Ground connection
11	NC	-	Floating (don't connect to ground)
12	WL_EN	I	Enable pin for WLAN device: ON = pull high; OFF = pull low
13	WL_HOST_WAKE	O	WLAN to wake-up HOST
14	SDIO_DATA_2	I/O	SDIO data line 2
15	SDIO_DATA_3	I/O	SDIO data line 3
16	SDIO_DATA_CMD	I/O	SDIO command line

17	SDIO_DATA_CLK	I/O	SDIO clock line
18	SDIO_DATA_0	I/O	SDIO data line 0
19	SDIO_DATA_1	I/O	SDIO data line 1
20	GND	-	Ground connection
21	GPIO11	-	Reserved
22	VDDIO	P	I/O voltage supply input, 1.8V or 3.3V
23	NC	-	Floating (don't connect to ground)
24	LPO	I	External low-power clock input (32.768kHz)
25	PCM_OUT	O	PCM data output
26	PCM_CLK	I/O	PCM clock
27	PCM_IN	I	PCM data input
28	PCM_SYNC	I/O	PCM sync signal
29	NC	-	Floating (don't connect to ground)
30	NC	-	Floating (don't connect to ground)
31	GND	-	Ground connection
32	NC	-	Floating (don't connect to ground)
33	GND	-	Ground connection
34	BT_EN	I	Enable pin for Bluetooth device: ON = pull high; OFF = pull low
35	NC	-	Floating (don't connect to ground)
36	GND	-	Ground connection
37	NC	-	Floating (don't connect to ground)
38	NC	-	Floating (don't connect to ground)
39	Debug_UART_TXD	O	Floating (don't connect to ground)
40	Debug_UART_RXD	I	Floating (don't connect to ground)
41	UART_RTS_N	O	Bluetooth UART interface
42	UART_TXD	O	Bluetooth UART interface
43	UART_RXD	I	Bluetooth UART interface
44	UART_CTS_N	I	Bluetooth UART interface

⚠ Note: 3.3V power is supplied via VCC33 (pin 9). The I/O voltage supply VDDIO (pin 22) can be independently set to 1.8V or 3.3V to match the host platform logic level. WL_EN (pin 12) and BT_EN (pin 34) must be pulled high to enable the respective WLAN and Bluetooth subsystems.

4. Radio Module Specifications

4.1 Wi-Fi Capability

Wi-Fi Standards	2.4GHz: 802.11b/g/n 5GHz: 802.11a/n/ac
Bands	Dual-Band 2.4GHz + 5GHz (selectable, not concurrent)
Stream Configuration	1x1 SISO
Max Physical Data Rate	2.4GHz: up to 150 Mbps 5GHz: up to 433 Mbps
Frequency Range	WLAN 2.4GHz: 2.412 ~ 2.472GHz WLAN 5GHz: 5.150 ~ 5.825GHz Bluetooth: 2.402 ~ 2.480GHz
Modulation Techniques	CCK, OFDM: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Channel Spectrum Widths	Supports 20/40MHz at 2.4GHz Supports 20/40/80MHz at 5GHz
TX Power	2.4GHz: up to 16dBm (802.11b) 5GHz: up to 11dBm (802.11a)
RF Interface	1x RF I/O pad (WL_BT_ANT, shared WLAN/Bluetooth)
Security	64/128-bit WEP, WPA, WPA2, WPA3, 802.1X
Advanced RF Features	Multiuser MIMO, Dynamic Frequency Selection (DFS), BT-WLAN coexistence, ISM-LTE coexistence
Supported Standards	IEEE 802.11d, e, h, i, k, r, v, and w

4.2 Bluetooth Capability

Bluetooth Standard	Bluetooth 5.0 + HS, BLE, and ANT+; backward compatible with BT 1.x, BT 2.x, and BT 4.2 + Enhanced Data Rate
Bluetooth Frequency Range	2.402 ~ 2.480GHz
Bluetooth Modulation Techniques	FHSS, GFSK, DPSK, DQPSK
Bluetooth TX Power	8dBm (per chain)
Bluetooth Host Interface	UART (HCI) and PCM (audio)
Coexistence	Supports BT-WLAN coexistence and ISM-LTE coexistence
Shared Antenna	Bluetooth shares the WL_BT_ANT RF pad with WLAN

4.3 Notes & Recommendations

- Route the WL_BT_ANT RF pad to a single external antenna via a matched RF trace and matching network on the host PCB; both WLAN and Bluetooth share this single antenna path.
- Since 2.4GHz and 5GHz WLAN and 2.4GHz Bluetooth share the same antenna, BT-WLAN coexistence (supported by the chipset) manages simultaneous use.
- Refer to the Linux driver/SDK documentation supplied by Compex or Qualcomm for channel and regulatory domain configuration.
- Actual throughput will vary depending on host platform, driver configuration, channel width, and RF environment.

5. Mechanical Specifications

5.1 Module Dimensions

Dimensions (W × H × D)	12.1mm × 12.1mm × 2.5mm
Form Factor	Surface-mount, reflow solder, no heatsink

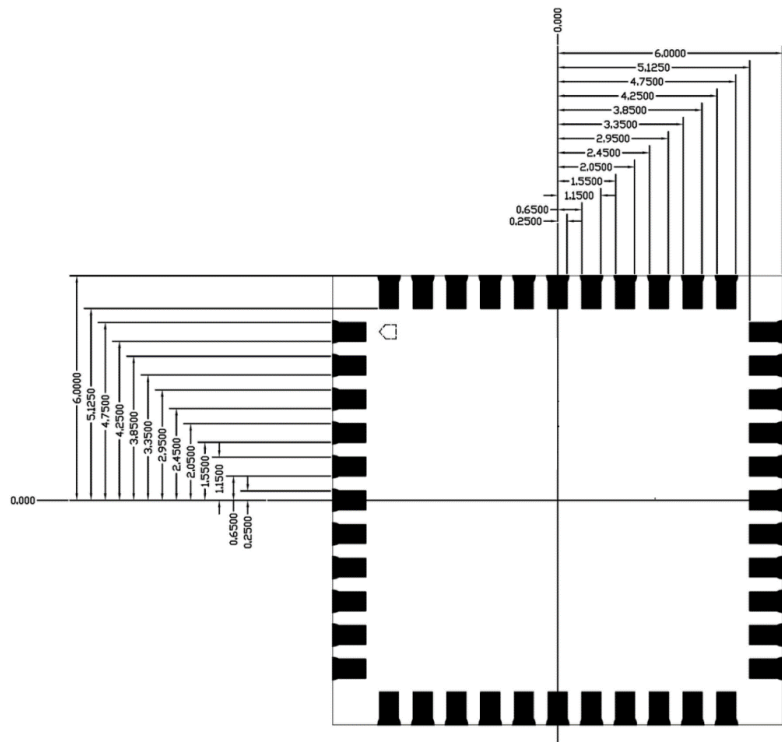


Figure: Module mechanical dimensions (units in mm)

5.2 Environmental Ratings

Operating Temperature	-20°C to 70°C
Storage Temperature	-40°C to 90°C
Operating Humidity	5% to 95%, Non-Condensing
Storage Humidity	Max. 90%

5.3 Mounting & Installation Notes

- Reflow-solder the module to the host PCB following the recommended profile: peak temperature below 250°C, maximum 2 reflow passes (refer to the IPC/JEDEC standard).
- Follow the module's recommended pad layout and land pattern exactly to ensure reliable solder joints and RF ground continuity.
- Ensure adequate airflow around the module for sustained high-throughput operation.
- Confirm ambient temperature remains within the -20°C to 70°C operating range for reliable operation.

6. Power Specifications

6.1 Power Requirements

Operating Voltage	3.3V DC + I/O supply of 1.8V or 3.3V
Power Consumption	3.83W (Max)
Power Source	3.3V supplied via VCC33 (pin 9); I/O voltage supplied via VDDIO (pin 22)

6.2 Power Delivery Protection

- The host PCB must provide regulated 3.3V power (VCC33) and I/O supply (VDDIO, 1.8V or 3.3V) with short-circuit/overcurrent protection.
- Ensure the host power rail can supply the module's peak 3.83W power consumption without voltage droop.

6.3 Notes & Recommendations

- Use a host power rail with a stable, well-regulated 3.3V supply and I/O supply.
- Avoid hot-plugging the module; always power down the host before installation or removal.
- For high-duty-cycle or industrial deployments, verify thermal dissipation is adequate at sustained 3.83W operation.
- The I/O supply voltage (1.8V or 3.3V) must match the host platform's logic level; confirm compatibility before installation.

7. Installation & Integration

7.1 Pre-Installation Checklist

- Confirm the host PCB layout matches the module's recommended pad footprint and land pattern.
- Verify the host PCB provides a matched RF trace and antenna for the shared WL_BT_ANT pad.
- Prepare the reflow oven/process per the recommended temperature profile (peak < 250°C, max 2 passes).

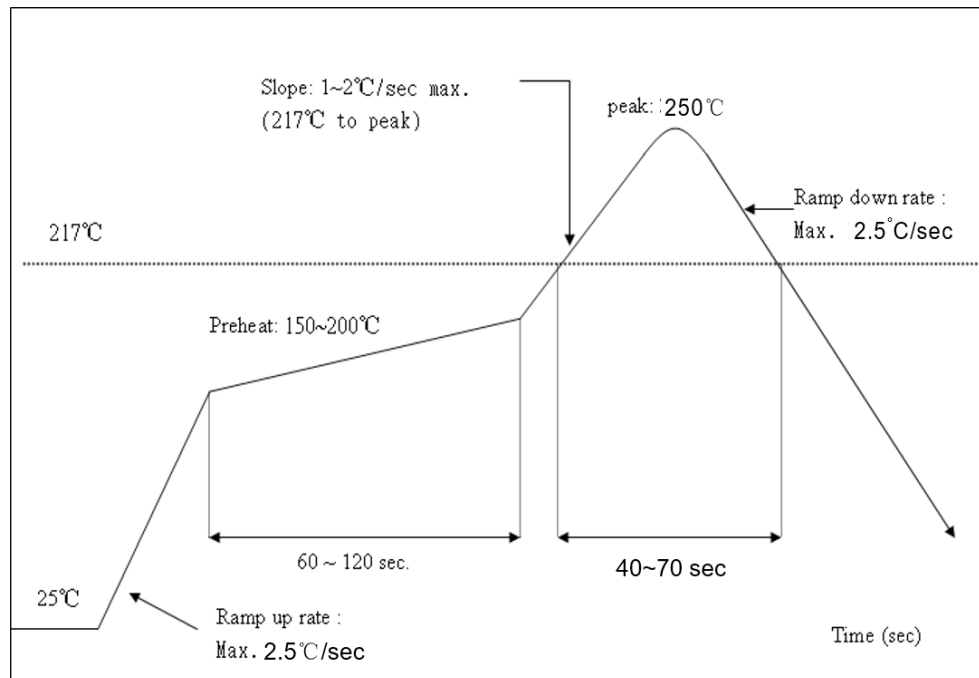


Figure: Recommended reflow temperature profile (refer to IPC/JEDEC standard)

7.2 Module Installation

- Apply solder paste to the host PCB pads per the recommended stencil design.
- Place the WSD377 module onto the pads using standard SMT pick-and-place equipment.
- Reflow-solder following the recommended temperature profile; avoid exceeding the peak temperature or reflow pass limit.
- Perform visual/X-ray inspection of solder joints, particularly the ground and RF pads, before proceeding.

7.3 Power Connection

- 3.3V power (VCC33) and I/O supply (VDDIO) must be supplied by the host PCB's power rails; there is no separate power cable or connector.
- Confirm the host power rails deliver a stable 3.3V supply and correct I/O voltage before powering on.
- Pull WL_EN and/or BT_EN high to enable the WLAN and Bluetooth subsystems as needed.

7.4 Antenna Connection

- Connect the WL_BT_ANT RF pad to a single external or PCB antenna via the host board's RF trace and matching network.
- Ensure the RF trace impedance is matched (typically 50Ω) and routed without sharp bends to avoid signal loss.

8. Troubleshooting

Module Not Detected	•Verify solder joints on VCC33, VDDIO, and ground pads with visual or X-ray inspection; reflow issues are the most common cause of a module not being detected. •Confirm WL_EN is pulled high and the host SDIO 3.0 controller is enabled. •Check that the appropriate Linux SDIO WLAN driver package is installed on the host.
No Wireless Signal / Weak RF Performance	•Verify the RF trace from the WL_BT_ANT pad to the antenna is intact and correctly matched (typically 50Ω). •Confirm the antenna is rated for the 2.4GHz and 5GHz bands in use. •Check for solder bridges or cold joints on the WL_BT_ANT pad and surrounding ground pads.
Overheating or Unexpected Shutdown	•Ensure adequate airflow around the module for sustained high-throughput operation. •Confirm ambient temperature is within the rated -20°C to 70°C operating range.
Bluetooth Not Detected / Pairing Issues	•Confirm BT_EN is pulled high and the Bluetooth UART driver is installed and enabled on the host. •Verify the WL_BT_ANT antenna path is intact, since Bluetooth shares this antenna with WLAN. •Check that the UART interface (UART_TXD/RXD/RTS_N/CTS_N) is correctly wired and enumerated by the host platform.

9. Safety Precautions

- Always power off and disconnect the host system before rework or removal of the module.
- Handle the module by its edges; avoid touching the RF pad or other exposed contacts.
- Use proper ESD (electrostatic discharge) precautions, including a grounded wrist strap, when handling the module.
- Do not exceed the recommended reflow profile (peak temperature below 250°C, maximum 2 reflow passes); excessive heat can permanently damage the module.
- 5GHz operation uses DFS (Dynamic Frequency Selection) channels subject to regulatory approval — see Section 12 for details.
- Do not operate the module without an antenna connected to the WL_BT_ANT pad, as this may damage the transmitter.
- Do not attempt to modify or repair the module; contact Compex Technical Support for service.

10. Technical Support

Compex Systems Pte Ltd provides engineering and technical support for the WSD377. For technical assistance, integration support, or to report a hardware issue, please contact:

Company	Compex Systems Pte Ltd
Headquarters	Singapore
Sales Enquiries	sales@compex.com.sg
Technical Support	https://compex.com.sg/support-downloads/
Website	https://compex.com.sg
Product Page (WSD377)	https://compex.com.sg/shop/wifi-module/wlan-bluetooth-modules-wi-fi-5/wsd377-2/
Qualcomm Design Centre	Qualcomm Authorized Design Centre (ADC) since 2014

Before contacting support, please:

- Note the firmware version (visible via webUI: System > Software, or via SSH/serial console: `cat /etc/openwrt_release`)
- Record the MAC address of the board (visible on PCB label).
- Describe the issue with steps to reproduce, observed symptoms, and host platform details.

For sample requests, pre-production evaluations, or OEM/ODM partnership enquiries, contact the Compex sales team at sales@compex.com.sg.

11. Full Specifications

Model	WSD377
Chipset	Qualcomm Atheros QCA9377-3 'Tufello' Series
Reference Design	Qualcomm Atheros WB396
Host Interface	Low-Power SDIO 3.0 (WLAN) / UART-PCM (Bluetooth)
Operating Voltage	3.3V DC + I/O supply of 1.8V or 3.3V
Power Consumption	3.83W (Max)
Wireless	2.4GHz 802.11b/g/n, max 16dBm 5GHz 802.11a/n/ac, max 11dBm 1× RF I/O pad (WL_BT_ANT, shared WLAN/Bluetooth)
Frequency Range	WLAN 2.4GHz: 2.412 ~ 2.472GHz WLAN 5GHz: 5.150 ~ 5.825GHz Bluetooth: 2.402 ~ 2.480GHz
Modulation Techniques	CCK, OFDM: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Channel Spectrum Widths	Supports 20/40MHz at 2.4GHz Supports 20/40/80MHz at 5GHz
Operating System	Linux (ath10k driver)
Certification	FCC, IC & CE RED, REACH and RoHS Compliance
Environmental Temperature	Operating: -20°C to 70°C Storage: -40°C to 90°C
Environmental Humidity	Operating: 5% to 95%, Non-Condensing Storage: Max. 90%
Dimensions (W × H × D)	12.1mm × 12.1mm × 2.5mm

12. Regulatory Information

Declaration of Conformity

The WSD377 is certified to FCC, IC, and CE RED requirements, and is REACH and RoHS compliant. The WSD377 is a component-level radio module intended for integration into end products. End-product manufacturers are responsible for obtaining any additional regulatory certifications required for their final product in each target market, including certifications required for the complete host platform assembly.

5GHz DFS Restrictions

Certain 5 GHz channels used by this module require Dynamic Frequency Selection (DFS) to avoid interference with radar systems, and are subject to national regulatory authority approval. Manufacturers must ensure compliance with local regulations before enabling these channels. Unauthorized use of restricted frequency bands may be illegal and could cause harmful interference to other services.

Disposal & Recycling

This product is subject to the Waste Electrical and Electronic Equipment (WEEE) Directive. At the end of its service life, return the product to an authorised recycling facility or contact Compex Systems for take-back options.

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