

Telink

User Manual for TL3228X-PDG96D PA Dongle Board

UM-TL3228X-PDG96D-E1

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Keyword

TL3228X-PDG96D, Bluetooth[®] LE, Zigbee, Thread, Matter, 2.4 GHz

Brief

This document is the PA dongle board user manual for the Telink multi-standard wireless SoC TL3228X. It mainly introduces the development board block diagram, features, peripheral interfaces, and detailed function descriptions.

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Revision History

Version	Change Description
1.0.0	Initial release.

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1 Overview

The TL3228X-PDG96D PA dongle board is based on the TL3228X chip and integrates a PA chip and an Audio CODEC. It can be used for high-power output and audio-related application evaluation.

The TL3228X is a wireless SoC for Bluetooth® LE 6.0, 802.15.4, and 2.4 GHz proprietary. This chip supports industrial alliance standards, including Bluetooth® LE, Zigbee, Thread, Matter, and 2.4 GHz proprietary standard.

This development board supports testing of various functions, such as RF conduction testing, audio input and output testing, LCM display, lights, and buttons. Sufficient GPIOs are reserved for debugging.

This document provides a detailed description of the TL3228X-PDG96D PA dongle board's interfaces, power supply, debugging methods, audio sockets, buttons, LEDs, and other components to help users familiarize themselves with the board and use it for subsequent development and debugging.

1.1 Block Diagram

The top and bottom views of the TL3228X-PDG96D PA dongle board are shown below.

Figure 1-1 Board Top View

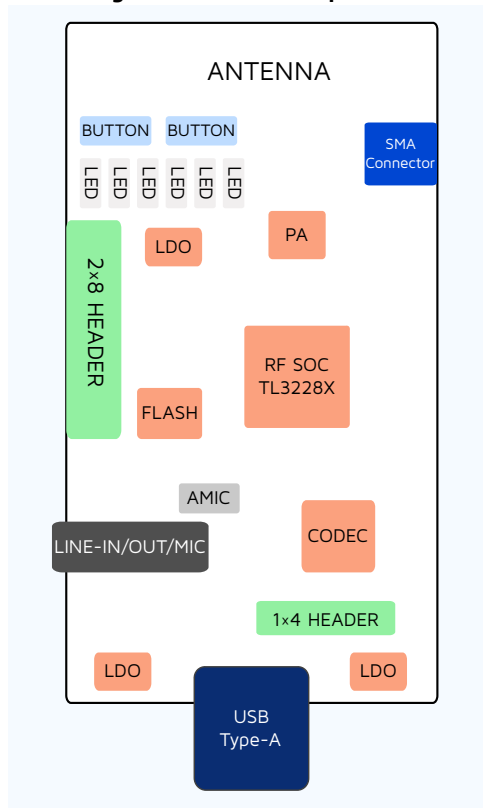
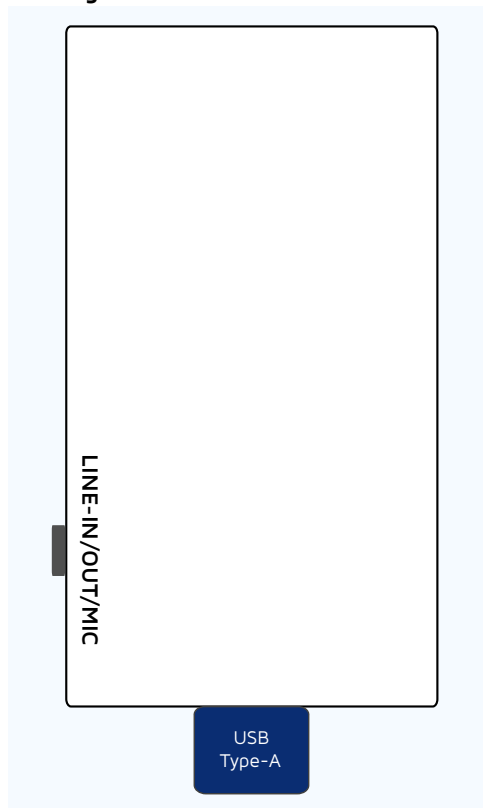


Figure 1-2 Board Bottom View



1.2 Board Features

The following table lists the features of the TL3228X-PDG96D PA dongle board.

Table 1-1 Board Features

No.	Name	Description	Reference section
1	Power supply interface	Power supply via USB Type-A or header	2.1 Power Supply
2	Debug and GPIO interfaces	• Supports 2-wire SDP and 4-wire JTAG interface • Supports High-speed USB interface • 10 GPIOs are reserved for debugging	2.2 Debug and GPIO Interfaces
3	RF interface	• Supports external whip antenna • Supports onboard inverted-F PCB antenna	2.3 RF Test
4	Peripheral interface	Supports peripherals such as buttons, LEDs, external flash, CODEC (supports AMIC input and stereo output), LCM, etc.	2.4 Peripheral Interface - USB Type-A 2.5 Peripheral Interface - LCM 2.6 Peripheral Interface - CODEC 2.7 Peripheral Interface - Flash 2.8 Peripheral Interface - PA

1.3 Kit List

The following table lists the main materials in this development kit.

Table 1-2 Kit List

No.	Name	Quantity
1	TL3228X-PDG96D PA dongle board	1
2	Whip antenna	1
3	Display (optional)	1

1.4 Board Pictures

The following picture shows the board's default state for user verification.

Figure 1-3 Real Board Top View



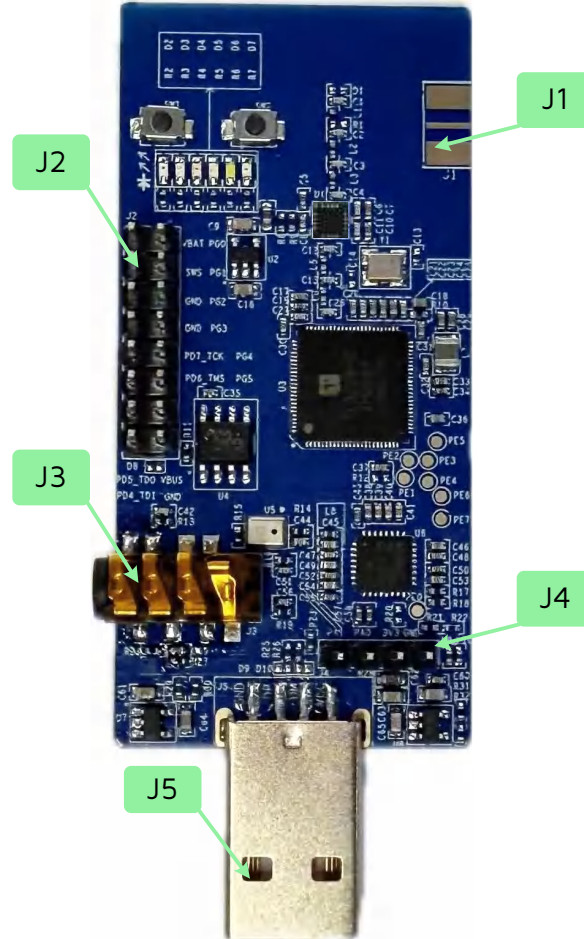
Figure 1-4 Real Board Bottom View



1.5 Connectors

The following figure identifies the connectors such as test headers and sockets on the top of the development board.

Figure 1-5 Board Top Connectors



The following table lists the connectors on the top of the development board.

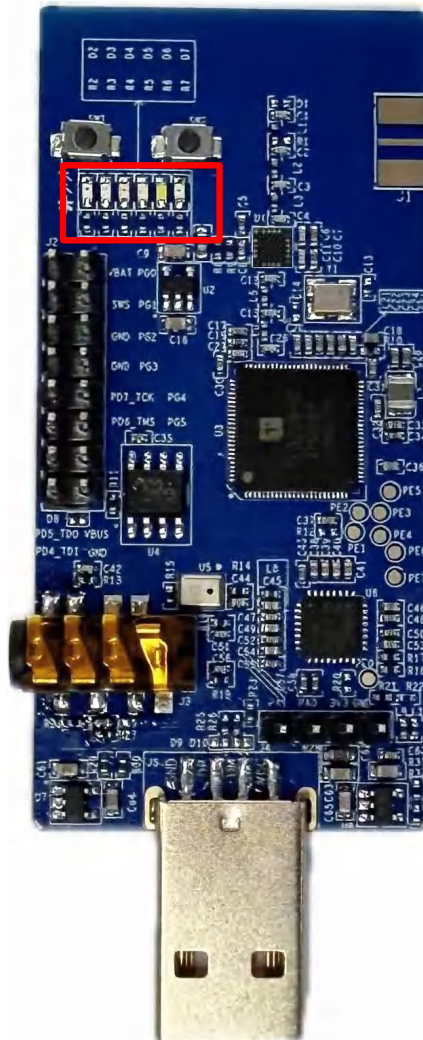
Table 1-3 Board Top Connector List

No.	Ref. Des.	Connector type	Description	Reference section
1	J1	SMA connector	RF connector	2.3 RF Test
2	J2	2x8-pin header	JTAG, single wire, debug and GPIO connector	2.2 Debug and GPIO Interfaces
3	J3	8-pin 3.5mm jack	Uplink & Downlink connector	2.6 Peripheral Interface - CODEC
4	J4	1x4-pin header	LCM connector	2.5 Peripheral Interface - LCM
5	J5	USB Type-A	High-speed USB connector	2.4 Peripheral Interface - USB Type-A

1.6 LED

The following figure identifies the LEDs on the top of the development board.

Figure 1-6 Board Top LEDs



The following table lists the LEDs on the top of the board.

Table 1-4 Board Top LEDs

No.	Ref. Des.	LED color	Description
1	D2	Green	PF6 of TL3228X connects to D2 via current-limiting resistor R2.
2	D3	Red	PF5 of TL3228X connects to D3 via current-limiting resistor R3.
3	D4	Yellow	PF4 of TL3228X connects to D4 via current-limiting resistor R4.
4	D5	Blue	PF3 of TL3228X connects to D5 via current-limiting resistor R5.
5	D6	White	PF1 of TL3228X connects to D6 via current-limiting resistor R6.
6	D7	Orange	PFO of TL3228X connects to D7 via current-limiting resistor R7.

1.7 Button

The following figure identifies the Buttons on the top of the board.

Figure 1-7 Board Top Buttons



The following table lists the buttons on the top of the board.

Table 1-5 Board Top Button List

No.	Ref. Des.	Function	Description
1	SW2	GPIO KEY	PF2 of TL3228X connects to SW2.
2	SW1	GPIO KEY	PF7 of TL3228X connects to SW1.

2 Function Description

2.1 Power Supply

The TL3228X-PDG96D PA dongle board can be powered in the following ways:

- 5V via the USB Type-A port and through LDO U7&U8&U2 for regulated power supply;
- 5V via the J2 PIN13 interface and through LDO U7&U8&U2 for regulated power supply.

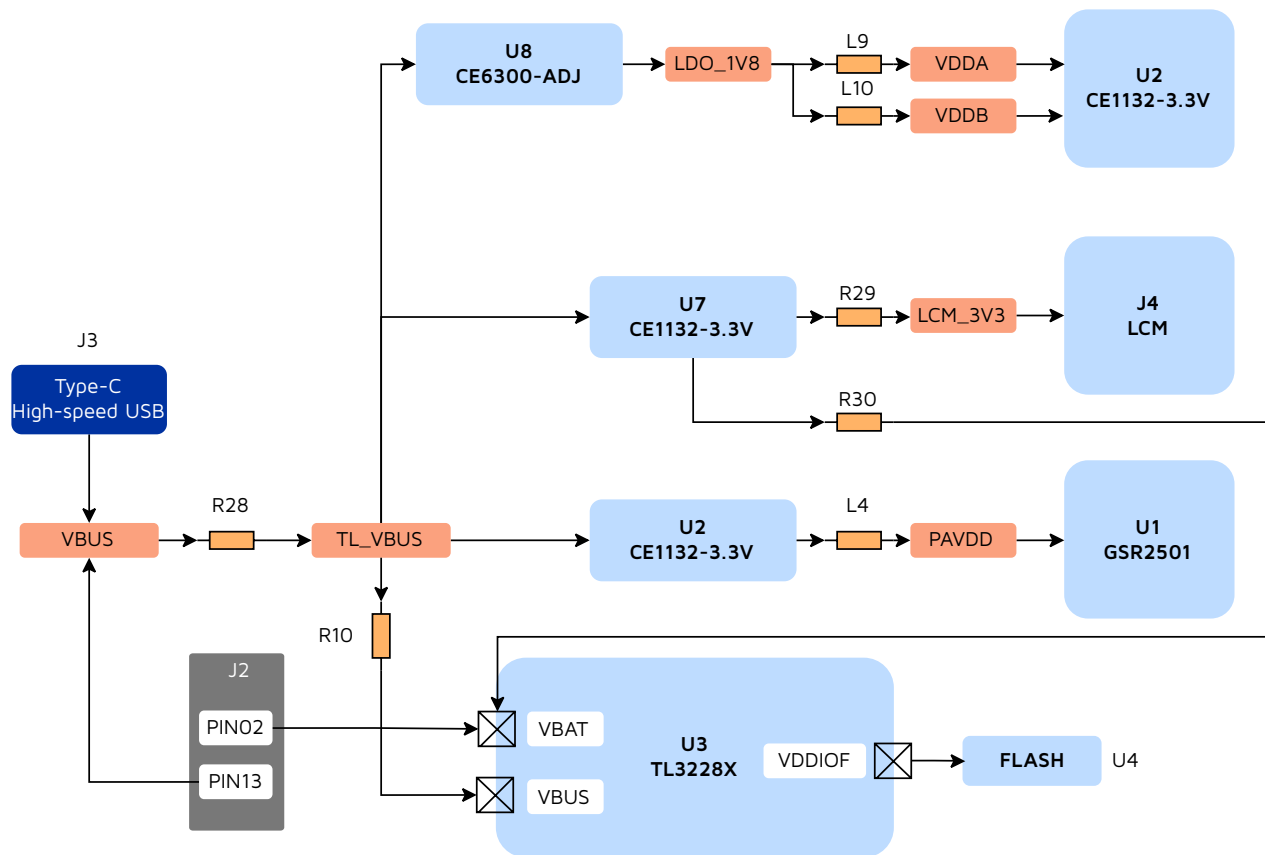
The following table shows the chip's power path.

Table 2-1 Power Supply of the Chip

No.	Power source	Power supply	Description
1	External power via USB Type-A J5	5V	• The external power provides 5V to U7, and provides 3.3V to TL_VBAT and LCM. • The external power provides 5V to U2, and provides 3.3V to the PA chip separately. • The external power provides 5V to U8, and provides 1.8V to external CODEC.
3	External power via J2 PIN13	5V	• The external power provides 5V to U7, and provides 3.3V to TL_VBAT and LCM. • The external power provides 5V to U2, and provides 3.3V to the PA chip separately. • The external power provides 5V to U8, and provides 1.8V to external CODEC.

The following figure shows the power supply path of the main power sources.

Figure 2-1 Power Supply Path



2.2 Debug and GPIO Interfaces

The TL3228X-PDG96D PA dongle board supports the following two debug methods.

Table 2-2 Debug Methods

No.	Debug method	Connector	Description
1	JTAG	J4	(1) Power up the TL3228X-PDG96D PA dongle board. (2) J2 supports a 4-wire JTAG function - U3.PIN19.PD4 to J2.PIN16 - TDI - U3.PIN18.PD5 to J2.PIN14 - TDO - U3.PIN17.PD6 to J2.PIN12 - TMS - U3.PIN16.PD7 to J2.PIN10 - TCK
2	Single Wire		(1) Power up the TL3228X-PDG96D PA dongle board. (2) J2 supports Telink proprietary debug protocol, single wire. U3.PIN37.PA7 to J2.PIN04 - SWS (3) Connect the SWM of the burner with this SWS. (4) The SWS connects to U3.PIN37 of the chip.

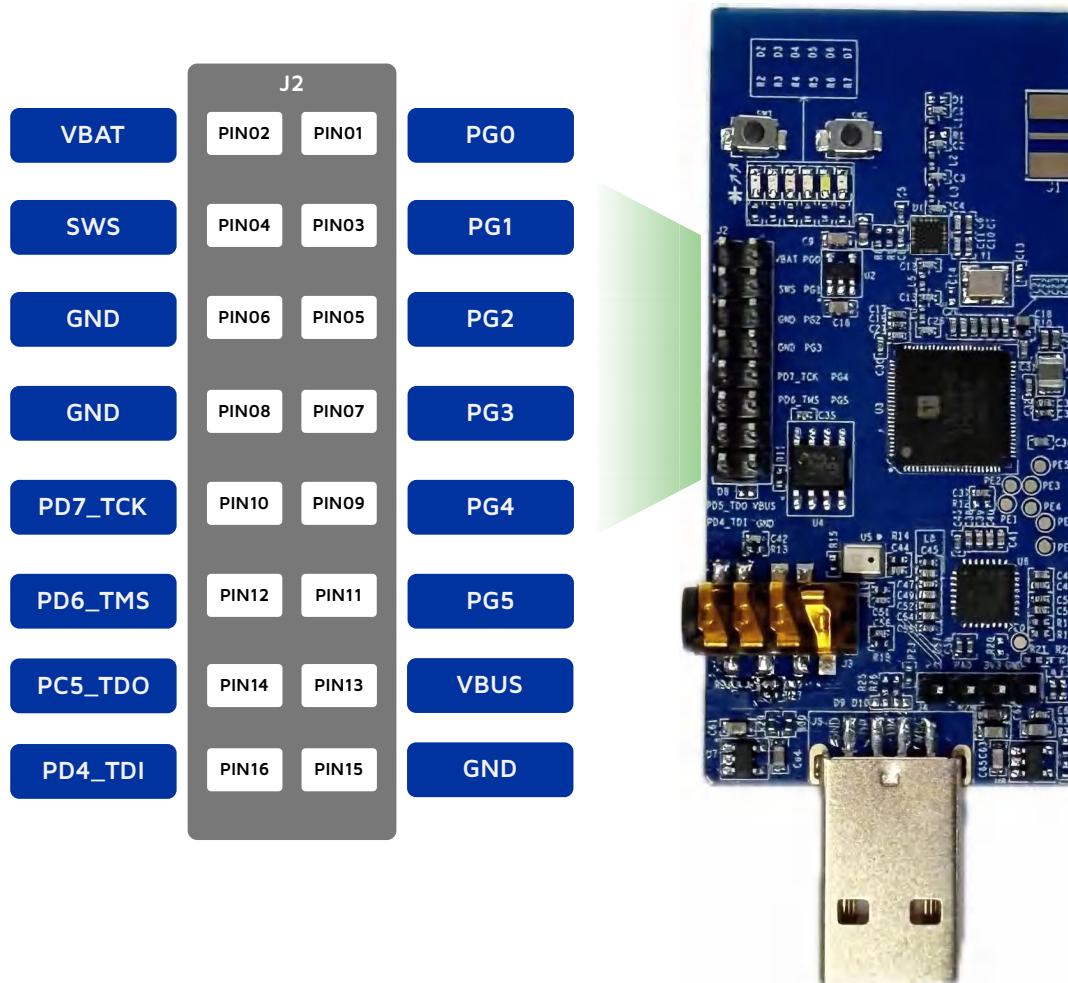
On the TL3228X-PDG96D PA dongle board, some GPIOs are connected to the connectors for easy access.

The following table lists the connections of all GPIOs.

Table 2-3 GPIO Connections

No.	Chip pins	IO name	Connector pins
1	U3.PIN86	PG0	J2.PIN01
2	U3.PIN87	PG1	J2.PIN03
3	U3.PIN88	PG2	J2.PIN05
4	U3.PIN89	PG3	J2.PIN07
5	U3.PIN90	PG4	J2.PIN09
6	U3.PIN91	PG5	J2.PIN11
7	U3.PIN16	PD7	J2.PIN10
8	U3.PIN17	PD6	J2.PIN12
9	U3.PIN18	PD5	J2.PIN14
10	U3.PIN19	PD4	J2.PIN16

The following figure shows the details of each J2 pin, including the debug and GPIO interfaces.

Figure 2-2 Debug and GPIO Interfaces on the Board


2.3 RF Test

The methods for conducting and radiating RF tests on the TL3228X-PDG96D PA dongle board are provided. The following table lists the methods of RF test.

Table 2-4 RF Test Method

No.	Test item	Connector	Description
1	RF test	J1	(1) Power up the TL3228X-PDG96D PA dongle board normally. (2) RF radiation test: The on-board PCB antenna is used by default, allowing RF radiation testing to be performed directly. (3) RF conduction test: Move the default 0 Ω resistor populated at L1 to R1, then solder an SMA connector to perform RF conduction testing.

2.4 Peripheral Interface - USB Type-A

The TL3228X-PDG96D PA dongle board is designed with a USB Type-A connector for power supply and high-speed communication.

The following table lists the connections of DM and DP.

Table 2-5 DM and DP of USB

No.	Chip pins	IO name	Connector pins	Description
1	U3.PIN34	PA3	J5.PIN02	Connects to the USB DM pin.
2	U3.PIN33	PA4	J5.PIN03	Connect to the USB DP pin.

2.5 Peripheral Interface - LCM

The TL3228X-PDG96D PA dongle board is designed with an LCM interface and I2C protocol.

The following table lists the pin connections of the LCM module.

Table 2-6 Connections of LCM Module Pins

No.	Chip pins	IO name	Connector pins	Description
1	U3.PIN30	PA0	J4.PIN03	I2C: SCL
2	U3.PIN31	PA1	J4.PIN04	I2C: SDA

2.6 Peripheral Interface - CODEC

The TL3228X-PDG96D PA dongle board is designed with an external CODEC; the part number for the audio demonstration is NAU88L21. The TL3228X-PDG96D PA dongle board and CODEC connection are designed with an analog microphone, U4; the part number is WMM7037AT2. The TL3228X-PDG96D PA dongle board and CODEC connection are designed with a stereo single-ended output audio socket, J3, which is compatible with 4-pole headsets and supports headsets with built-in microphones.

The following table lists the connections of TL3228X and CODEC.

Table 2-7 Connections of TL3228X and CODEC

No.	Chip pins	IO name	CODEC	Description
1	U3.PIN21	PE0	U6.PIN15	Connects to the CODEC IRQ pin.
2	U3.PIN22	PE1	U6.PIN26	Connects to the CODEC ADCOUT pin.
3	U3.PIN23	PE2	U6.PIN25	Connects to the CODEC DACIN pin.
4	U3.PIN24	PE3	U6.PIN24	Connects to the CODEC LRCK pin.
5	U3.PIN25	PE4	U6.PIN23	Connects to the CODEC BCLK pin.
6	U3.PIN26	PE5	U6.PIN22	Connects to the CODEC MCLK pin.
7	U3.PIN27	PE6	U6.PIN18	Connects to the CODEC SCLK pin.
8	U3.PIN28	PE7	U6.PIN17	Connects to the CODEC SDIO pin .

2.7 Peripheral Interface - Flash

The TL3228X-PDG96D PA dongle board is equipped with an external flash (part number P25Q16SU), which makes it convenient for customers to extend its use or verify the new flash.

The following table lists the connections of the flash pins.

Table 2-8 Connections of Flash Pins

No.	Chip pins	IO name	Flash	Description
1	U3.PIN01	PI0	U4.PIN05	Connects to the flash MSPI_MOSI pin.
2	U3.PIN02	PI1	U4.PIN06	Connects to the flash MSPI_CK pin.
3	U3.PIN03	PI2	U4.PIN07	Connects to the flash MSPI_IO3 pin.
4	U3.PIN04	PI3	U4.PIN01	Connects to the flash MSPI_CN pin.
5	U3.PIN05	PI4	U4.PIN02	Connects to the flash MSPI_MISO pin.
6	U3.PIN06	PI5	U4.PIN03	Connects to the flash MSPI_IO2 pin.

2.8 Peripheral Interface - PA

The TL3228X-PDG96D PA dongle board is designed with an RF PA circuit, the part number GSR2501, which is used for high output power applications.

The following table lists the PA's connection and control methods.

Table 2-9 Connection and Control Methods of PA

No.	Chip pins	IO name	PA	Description
1	U3.PIN77	PD3	U1.PIN16	TXEN
2	U3.PIN76	PD2	U1.PIN1	RXEN

Table 2-10 PA Mode Control Truth Table

Mode	TXEN	RXEN
TX mode	1	0
RX mode	0	1
Bypass	1	1
Not used	0	0

3 Related Documents

The following table lists other documents and resources that you can refer to for more information. Some of these documents are only available under a Non-Disclosure Agreement (NDA). To access these documents, please contact your local Telink Field Application Engineer (FAE) or sales representative.

Table 3-1 Related Documents

No.	Name	Description	Link / Obtain method
1	TL3228X datasheet	Provides information on the electrical characteristics, hardware description, and ordering options for the TL3228X chip.	Contact a Telink FAE / Sales representative.
2	TL3228X hardware guideline	Provides a hardware design guide for the TL3228X chip.	Contact a Telink FAE / Sales representative.
3	TL3228X-PDG96D PA dongle board files	Provides design files for the schematic, PCB layout, and Gerber files for the TL3228X-PDG96D PA dongle board.	Contact a Telink FAE / Sales representative.

4 Certification Statement

4.1 FCC Statement

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.

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 or more of the following measures:

- Reorient 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.

Changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

RF warning statement:

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

The EUT is for indoor use only.