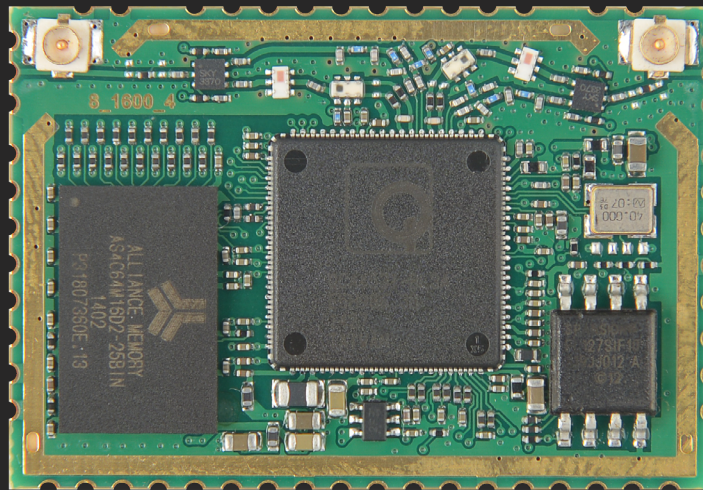




Lima is a QCA-4531/QCA-9531 chipset based module with a 650 MHz CPU and 802.11N 2x2 (MIMO) radio. Module is available in two temperature ranges: commercial* (Lima) and industrial** (Lima-I).

Lima is a surface mountable, dual-sided, Wi-Fi enabled Linux module for the (IoT) internet of everything applications. Faster CPU, 300 Mbps data-rate, low power consumption, larger 32 MB flash memory and a development kit with more interfaces (e.g. PCIe) are the key differentiators from Carambola 2 module.

8devices is providing OpenWRT linux distribution source code with necessary patches on GitHub <https://github.com/8devices>

Quick specs

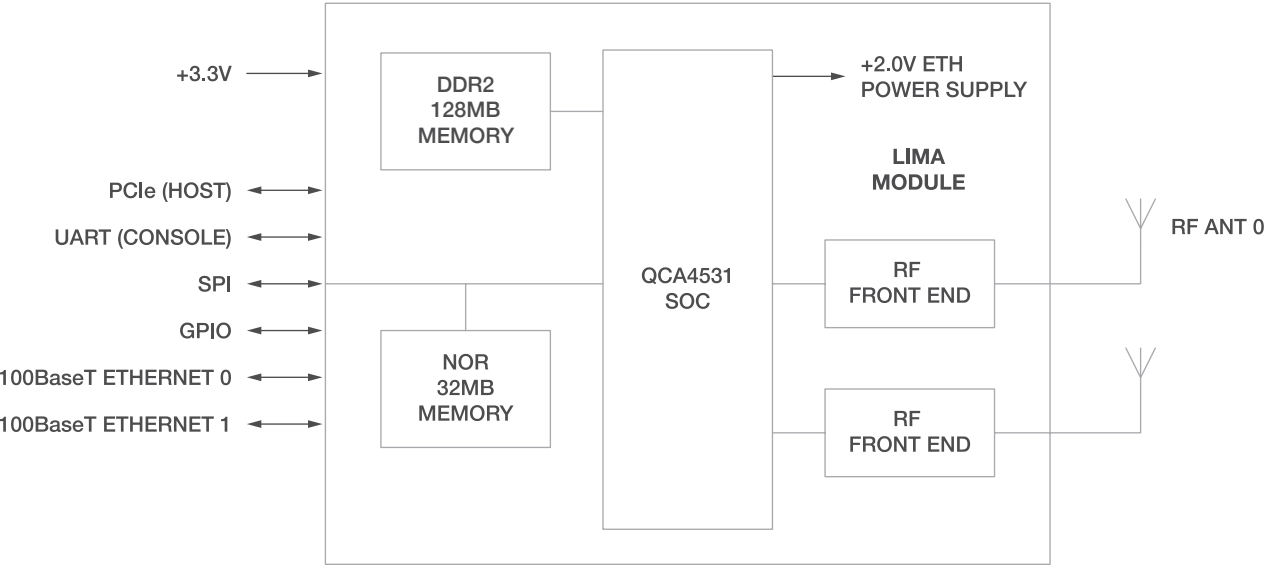
- 802.11 b/g/n, 2.4 GHz, 2x2 MIMO, 300 Mbps data rate, 21 dB per chain output power
- U.FL connectors or external pin for external antenna
- 32 MB FLASH, 128 MB DDR2 RAM
- Linux friendly , OpenWRT flash image and source code are available for download on <https://wiki.8devices.com>
- CPU – QCA-4531/QCA-9531, 650 MHz clock speed
- Small form factor (25 by 35 mm)
- Surface mountable, dual-side design
- Industrial and commercial temperature range models
- Available interfaces - USB 2.0 host, 2 x Ethernet, UART, PCIe, GPIO, JTAG

*Commercial temperature range: 0 - 65° C **Industrial temperature range: -40 - 85° C

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1. Block diagram



2. Module pinout and pin description

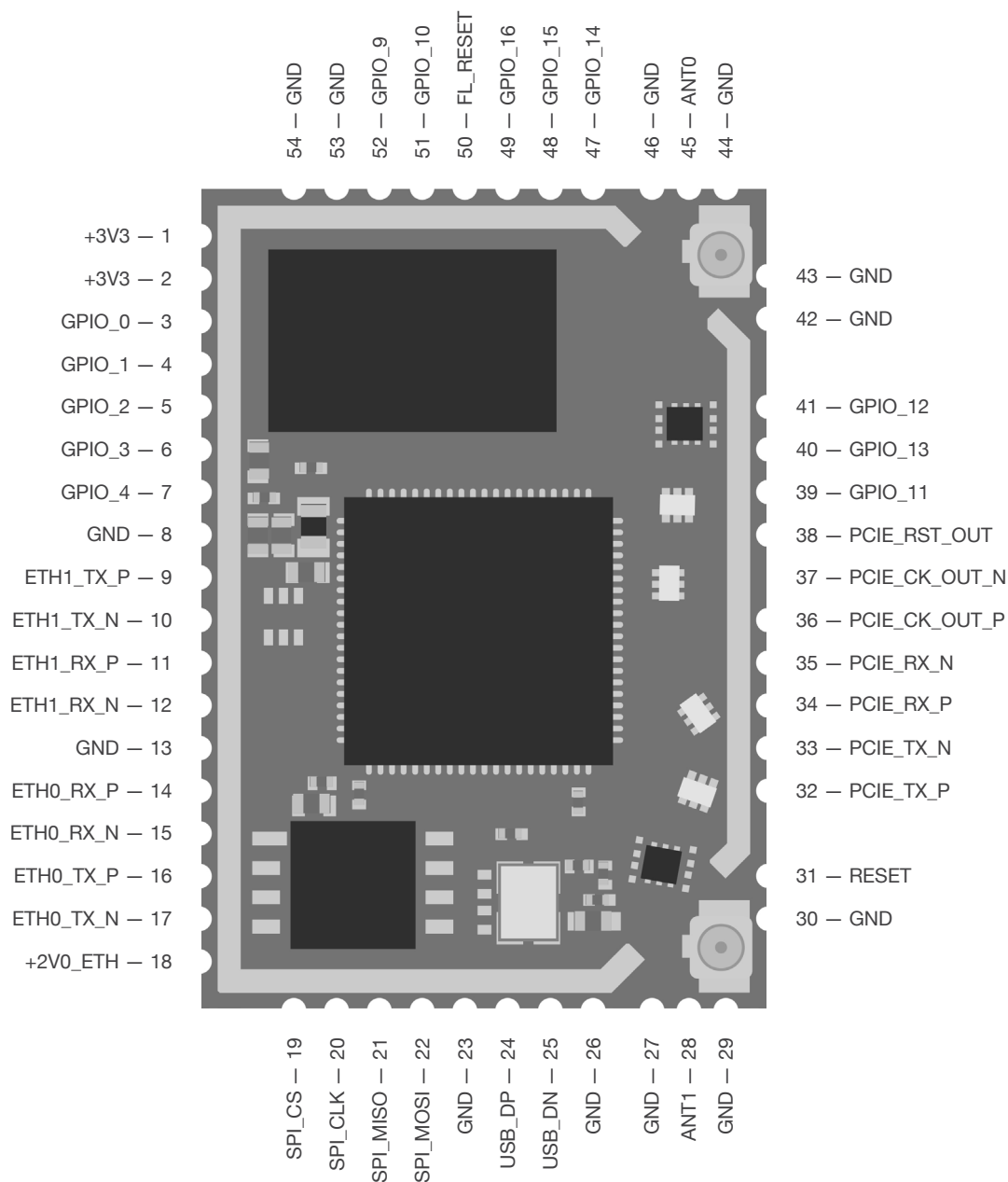


TABLE 2-1. I/O DESCRIPTION (PAD TYPE) PARAMETERS

Symbol	Description
PI	Power input
I/O	Digital bidirectional signal
GND	Ground
AO	Analog output
AI	Analog input
PO	Power output
O	Digital output signal
I	Digital input signal

TABLE 2.2. POWER, GROUND AND RESET

Pin	Pin name	Type	Description
1, 2	+3V3	PI	+3V3 power supply
18	+2V0_ETH	PO	+2V ethernet power supply
31	Reset	I	Hardware reset
8, 13, 23, 26, 27, 29, 30, 42, 43, 44, 46, 53, 54	GND	GND	Ground connection

TABLE 2.3. RADIO

Pin	Pin name	Type	Description
28	ANT1	IA/OA	External antenna connection
45	ANT0	IA/OA	External antenna connection

TABLE 2.4. USB

Pin	Pin name	Type	Description
24	USB1_DP	IA/OA	Positive USB connection
25	USB1_DN	IA/OA	Negative USB connection

TABLE 2.5. PCIE

Pin	Pin name	Type	Description
32	PCIE_TX_P	OA	PCIE positive TX connection
33	PCIE_TX_N	OA	PCIE negative TX connection
34	PCIE_RX_P	IA	PCIE positive RX connection
35	PCIE_RX_N	IA	PCIE negative RX connection
36	PCIE_CK_OUT_P	OA	PCIE positive clock connection
37	PCIE_CK_OUT_N	OA	PCIE negative clock connection
38	PCIE_RST_OUT	O	PCIE reset connection

TABLE 2.6. ETHERNET

Pin	Pin name	Type	Description
9	ETH1_TX_P	OA	LAN port 1 positive TX connection
10	ETH1_TX_N	OA	LAN port 1 negative TX connection
11	ETH1_RX_P	IA	LAN port 1 positive RX connection
12	ETH1_RX_N	IA	LAN port 1 negative RX connection
14	ETH0_RX_P	OA	LAN port 0 positive RX connection
15	ETH0_RX_N	OA	LAN port 0 negative RX connection
16	ETH0_TX_P	IA	LAN port 0 positive TX connection
17	ETH0_TX_N	IA	LAN port 0 negative TX connection

TABLE 2.7. SPI

Pin	Pin name	Type	Description
19	SPI_CS (GPIO 5)	O (I/O)	SPI chip select
20	SPI_CLK	O	SPI serial interface clock
21	SPI_MISO	I	Data transmission from an external device to the Lima. On reset, SPI_MISO is input, which should be interfaced with an SPI device via a resistor divider for reliability.
22	SPI_MOSI	O	Data transmission from the Lima to an external device. On reset, SPI_MOSI is output and can directly interface with a SPI device such as a serial flash.

TABLE 2.7. SPI

Pin	Pin name	Type	Description
3	GPIO_0, JTAG TCK	I/O	General-purpose digital I/O pin (JTAG TCK)
4	GPIO_1, JTAG TDI	I/O	General-purpose digital I/O pin (JTAG TDI)
5	GPIO_2, JTAG TDO	I/O	General-purpose digital I/O pin (JTAG TDO)
6	GPIO_3, JTAG TMS	I/O	General-purpose digital I/O pin (JTAG TMS)
7	GPIO_4 Bootstrap L – do not pull up	I/O	General-purpose digital I/O pin (Bootstrap L – do not pull up)
39	GPIO_11	I/O	General-purpose digital I/O pin
40	GPIO_13	I/O	General-purpose digital I/O pin (Bootstrap L)
41	GPIO_12	I/O	General-purpose digital I/O pin
47	GPIO_14	I/O	General-purpose digital I/O pin
48	GPIO_15	I/O	General-purpose digital I/O pin (Bootstrap L)
49	GPIO_16	I/O	General-purpose digital I/O pin (Bootstrap L)
50	GPIO_17	I/O	General-purpose digital I/O pin (FLASH_RESET)
51	GPIO_10	I/O	General-purpose digital I/O pin (Bootstrap L, UART TX)
52	GPIO_9	I/O	General-purpose digital I/O pin (UART RX)

3. Electrical characteristics

3.1. CHARACTERISTICS

For the optimal performance and stability recommended power ratings must be used.
Device might malfunction outside minimum and maximum power ratings.

TABLE 3-1. POWER SUPPLY DC CHARACTERISTICS

Parameter	Units	Min	Typ	Max
Supply Voltage (+3V3)	V	3.14	3.3	3.47
Network Transformer Voltage (+2V0_ETH)	V	1.9	2.0	2.15
Current consumption	mA	-	-	1200

The module can operate in a wide temperature range and different conditions depending on the enclosure.
The following guidelines guarantee that it will work correctly.

TABLE 3-2. OPERATING CONDITIONS

Parameter	Units	Min	Typ	Max
Supply Voltage (+3V3)	V	3.14	3.3	3.47
Network Transformer Voltage (+2V0_ETH)	V	1.9	2.0	2.15
Current consumption	mA	-	-	1200

TABLE 3-3. GPIO CHARACTERISTICS

Parameter	Units	Min	Max
Output high voltage	V	2.44	2.8
Output low voltage	V	-0	0.1
Input high voltage	V	1.93	3.0
Input low voltage	V	-0.3	0.75
Current drive	mA	-	24

3.2. BOOTSTRAP

Bootstrap HIGH or LOW means that during bootstrap process (first few milliseconds when the device is turned on) these pins need to be in the specified state. If pins are not in required state then device will not boot correctly.

3.3. GPIO

If you have some hobby project, it is advised to use GPIO pins 11, 12, 14 without any worries. These pins are not used during the booting process. Other GPIO pins should not be used if you don't know exactly what you want to achieve, because they are used during the boot process (bootstrap).

3.4. SPI INTERFACE

SPI interface must be used carefully, it's connected to the internal FLASH memory and CS1 or CS2 must be used.

3.5. POWER SUPPLY

It is recommended to use pin 1 and pin 2 to give power supply to the module. Use 100nF ceramic capacitors for decoupling.

4. Radio characteristics

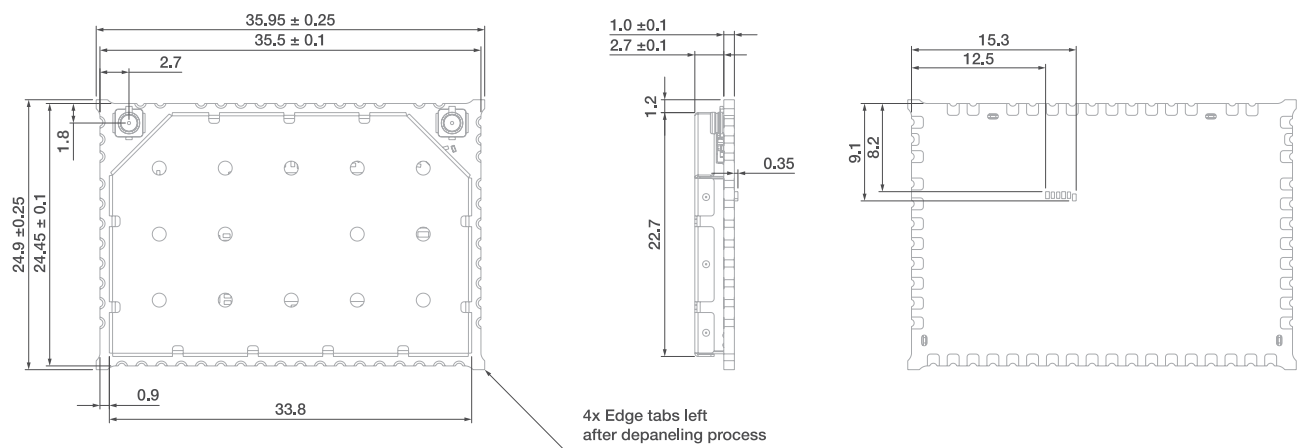
Receive sensitivity (dBm)	802.11N (20 MHz)	7.2 Mbps	14.4 Mbps	21.7 Mbps	28.9 Mbps	43.3 Mbps	57.8 Mbps	65 Mbps	72.2 Mbps
		-90	-90	-88	-83	-79	-75	-74	-72
	802.11N (40 MHz)	15 Mbps	30 Mbps	45 Mbps	60 Mbps	90 Mbps	120 Mbps	135 Mbps	150 Mbps
		-90	-89	-87	-83	-78	-73	-72	-71

Output power (dBm)	802.11N 20 MHz	7.2 Mbps	14.4 Mbps	21.7 Mbps	28.9 Mbps	43.3 Mbps	57.8 Mbps	65 Mbps	72.2 Mbps
		20	19	19	18	18	17	16.5	16
	802.11N 40 MHz	15 Mbps	30 Mbps	45 Mbps	60 Mbps	90 Mbps	120 Mbps	135 Mbps	150 Mbps
		20	19	19	18	18	17	16.5	16

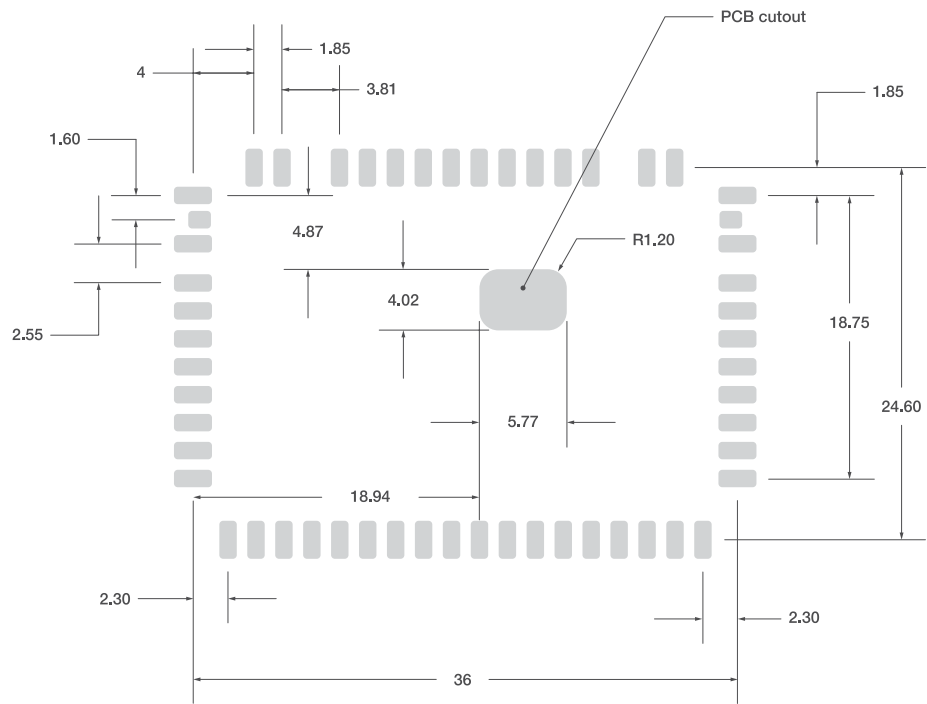
Output power shown in the table is per chain. Lima has two chains, so it means its total power is double or 3 dB higher.

5. Mechanical characteristics

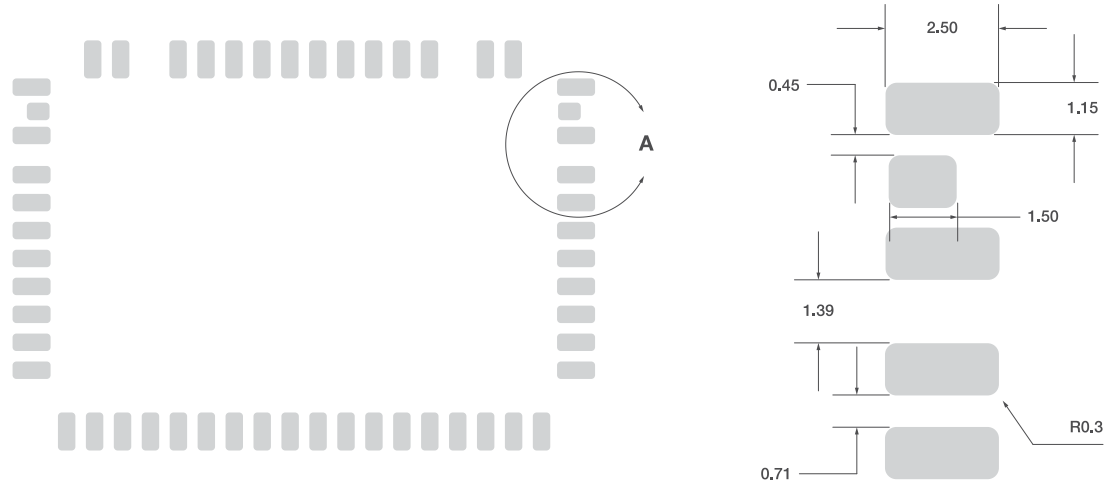
5.1. MODULE DIMENSIONS



5.2. PCB FOOTPRINT



5.3. SOLDERING PASTE FOOTPRINT

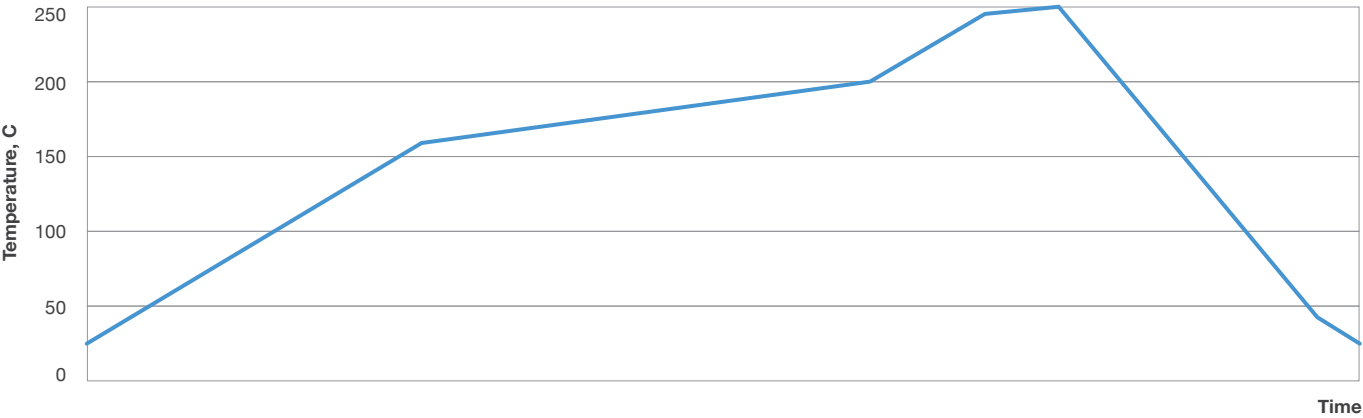


6. Reflow profile recommendations

6.1. REFLOW PROFILE PARAMETERS

Reflow profile recommendation	
Ramp up rate	3°C/second max
Maximum time maintained above 217°C	120 seconds
Peak temperature	250°C
Maximum time within 5°C of peak temperature	20 seconds
Ramp down rate	6°C/second max

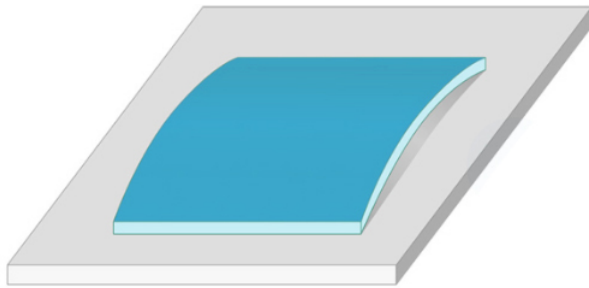
6.2. REFLOW PROFILE



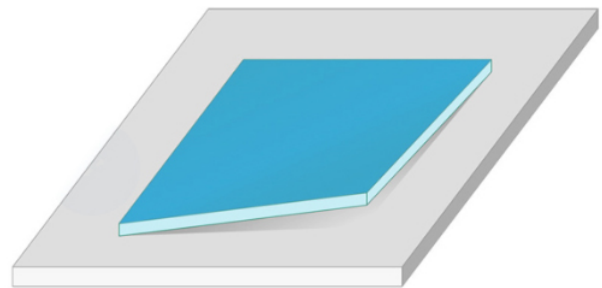
7. Laminate Conditions

8devices modules are manufactured according to the standard IPC-A-610 Norm Class 2. Standard states: “Bow/twist after solder should not exceed 1.5% for through-hole and 0.75% for surface mount printed board applications”. According to this statement, Lima module can be bowed and twisted up to 0.269mm. To avoid negative effects of bow and twist we recommend to increase the paste thickness for the module pads to achieve better co-planarity.

FIGURE 7-1. EXAMPLE OF BOW AND TWIST



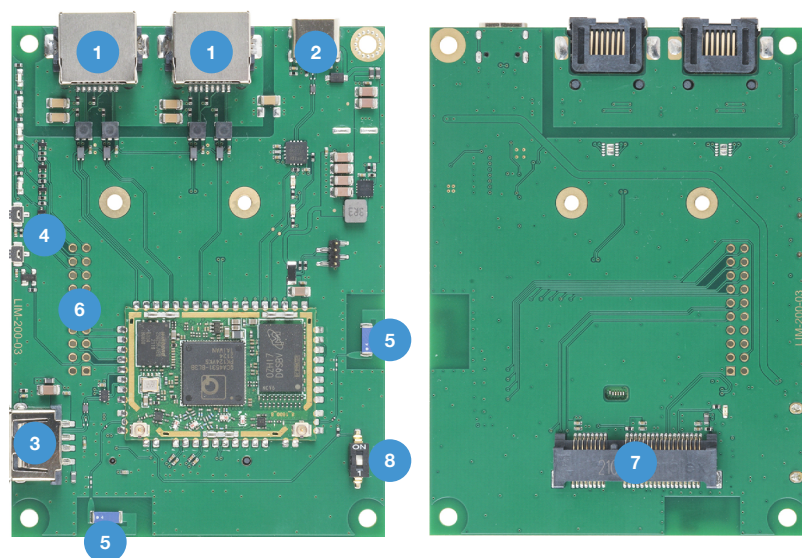
Bow



Twist

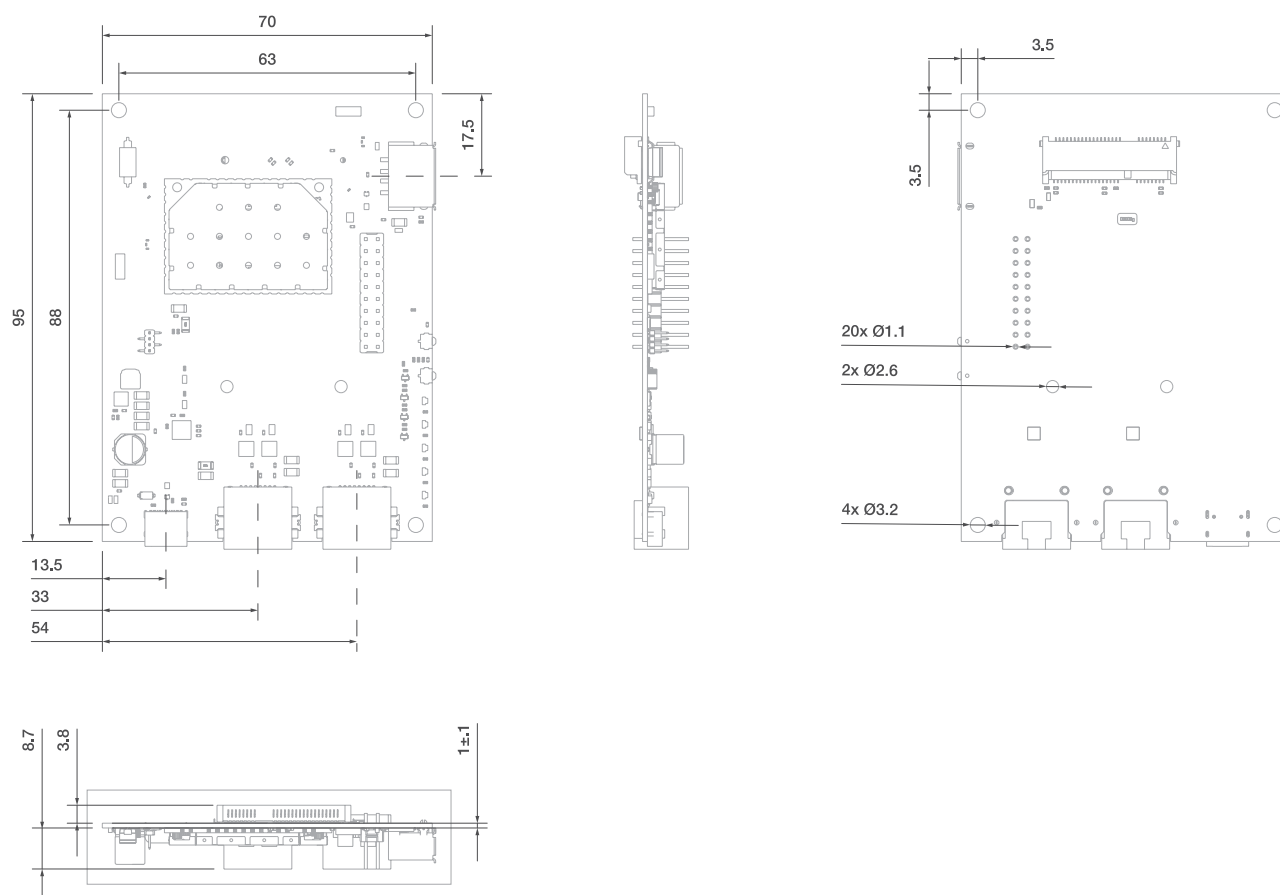
8. Development kit

8.1. DEVELOPMENT KIT INTERFACES

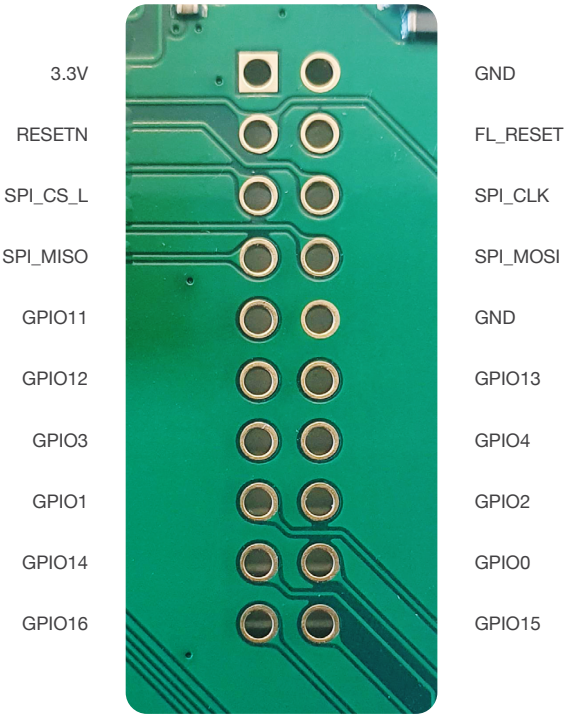


- 1 - 2 x 100 Base-T Ethernet ports
- 2 - USB Type C socket (console + power)
- 3 - USB Type-A socket
- 4 - Buttons: S1 - programmable (GPIO connected), S2 - reset
- 5 - Two integrated antennas
- 6 - 2.45 mm pitch connector holes
- 7 - MINI PCIe socket
- 8 - USB switch. (USB data lines connected to USB A connector (3) or to PCIe connector (7))

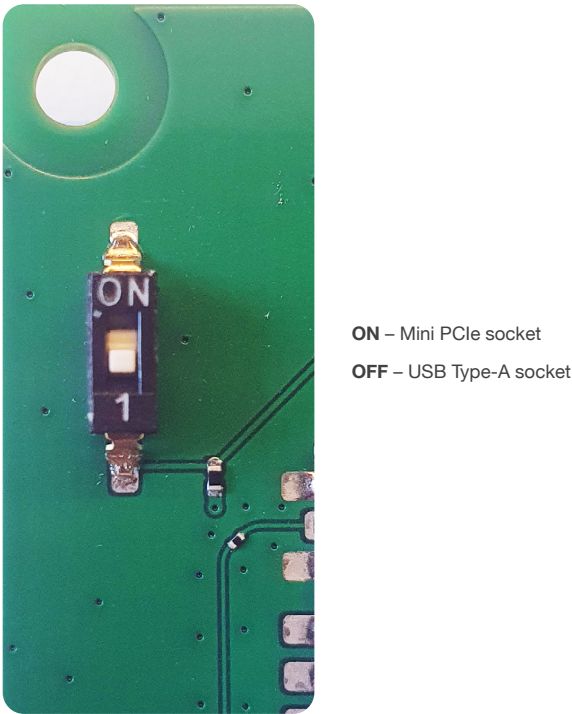
8.2. DEVELOPMENT KIT DIMENSIONS



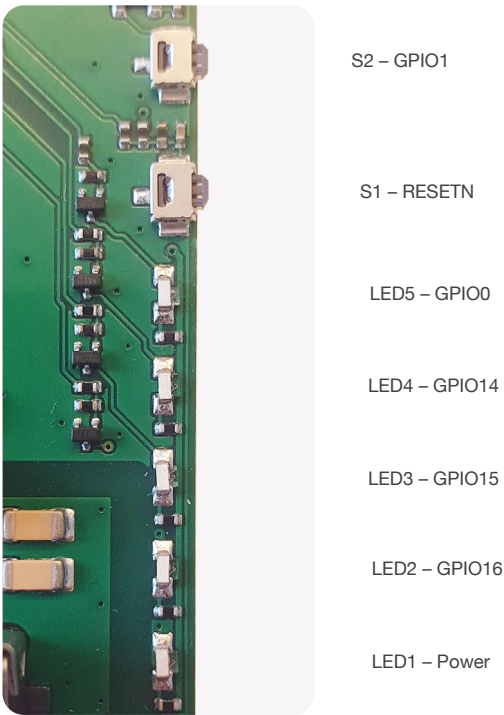
8.3. GPIO PINS



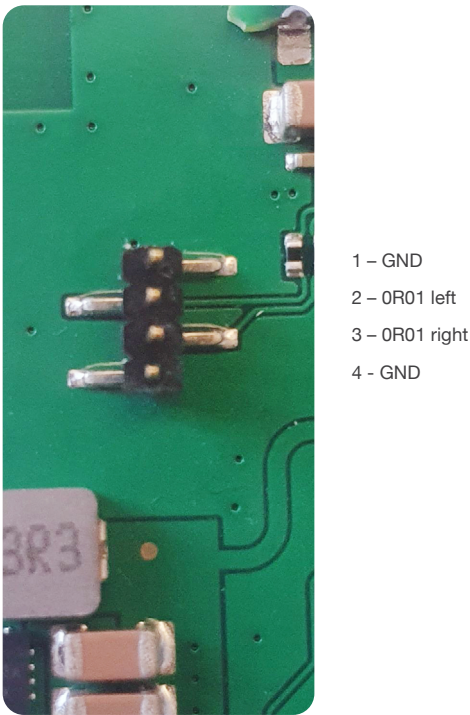
8.4. USB SWITCH



8.5. SWITCHES AND BUTTONS



8.6. POWER MONITOR HEADER



9. Lima packaging and ordering info

Lima modules are packed into trays. Each tray fits 25 modules. Every 5 trays are vacuum sealed and one standard packaging box contains 625 modules.

FIGURE 9-1. LIMA TRAY DIMENSIONS

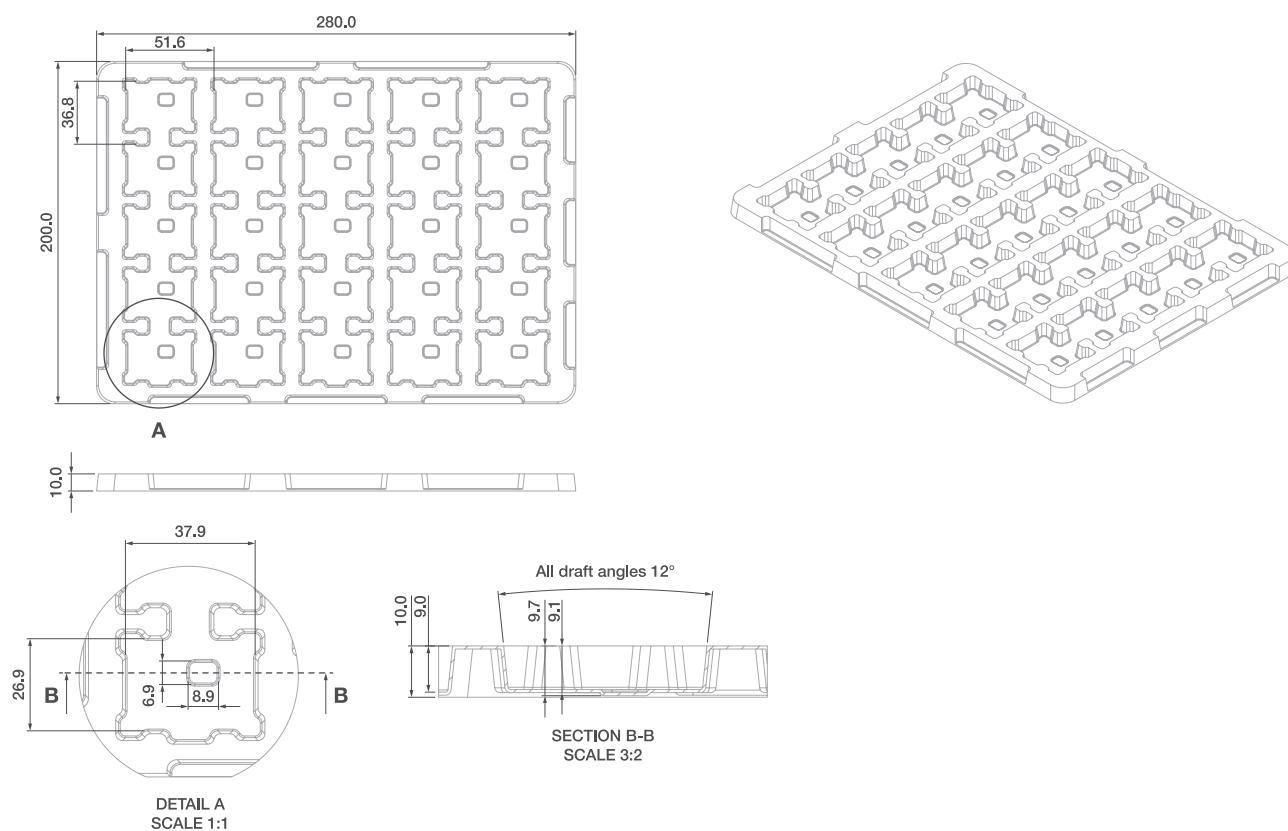


FIGURE 9-2. STANDARD PACKAGING BOX DIMENSIONS

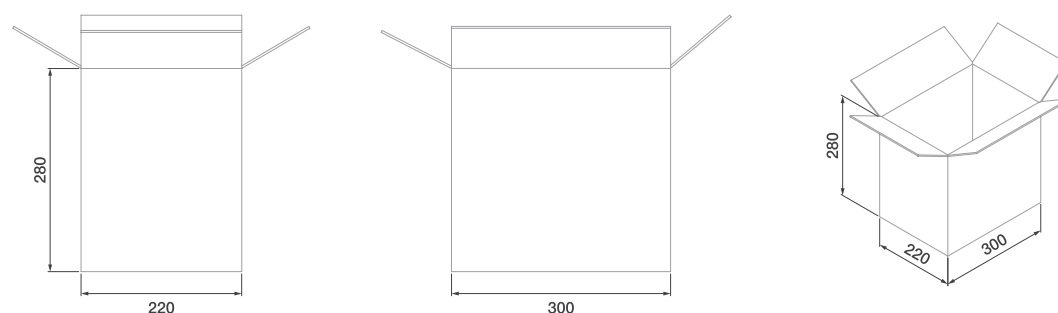


TABLE 9-3. ORDERING PART NUMBERS

Order Number	Description
Lima	Lima module, commercial temperature range 0°C to 65°C, QCA-4531-BL3A SoC
Lima-I	Lima module, industrial temperature range -40°C to 85°C, QCA-4531-BL3B SoC
Lima V2	Lima module, commercial temperature range 0°C to 65°C, QCA-9531-BL3A SoC
Lima DVK	Development kit, based on Lima module

10. Document Revision History

Revision	Revision Date	Description
v1.0	2022-03-05	Initial release on new format
v1.1	2022-12-21	Product drawings updated
v1.2	2023-01-10	Laminate conditions chapter added
V1.3	2023-05-30	Added 8.3-8.6
V1.4	2024-01-03	RAM size changed from 64MB to 128MB