Quectel Smart Module

Product Overview

Duty of confidentiality

The Receiving Party shall keep confidential all documentation and information provided by Quectel, except when specific permission has been granted by Quectel. The Receiving Party shall not access or use Quectel's documentation and information for any purpose except as expressly provided herein. Furthermore, the Receiving Party shall not disclose any of the Quectel's documentation and information to any third party without the prior written consent of Quectel. For any non-compliance to the above requirements, unauthorized use, or other illegal or malicious use of the documentation and information, Quectel will reserve the right to take legal action.

Contents

Quectel smart module advantages

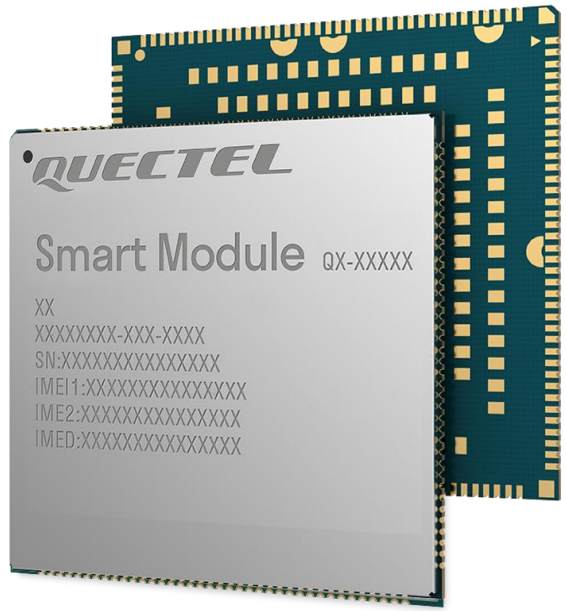
SoC platforms

High-performance CPU/ GPU/ NPU/ DSP

Various multimedia functions: LCD/ audio/ camera/ video

Global certifications

Open Android, Linux or Ubuntu



Cellular: 5G/ LTE/ UMTS/ GSM + GNSS

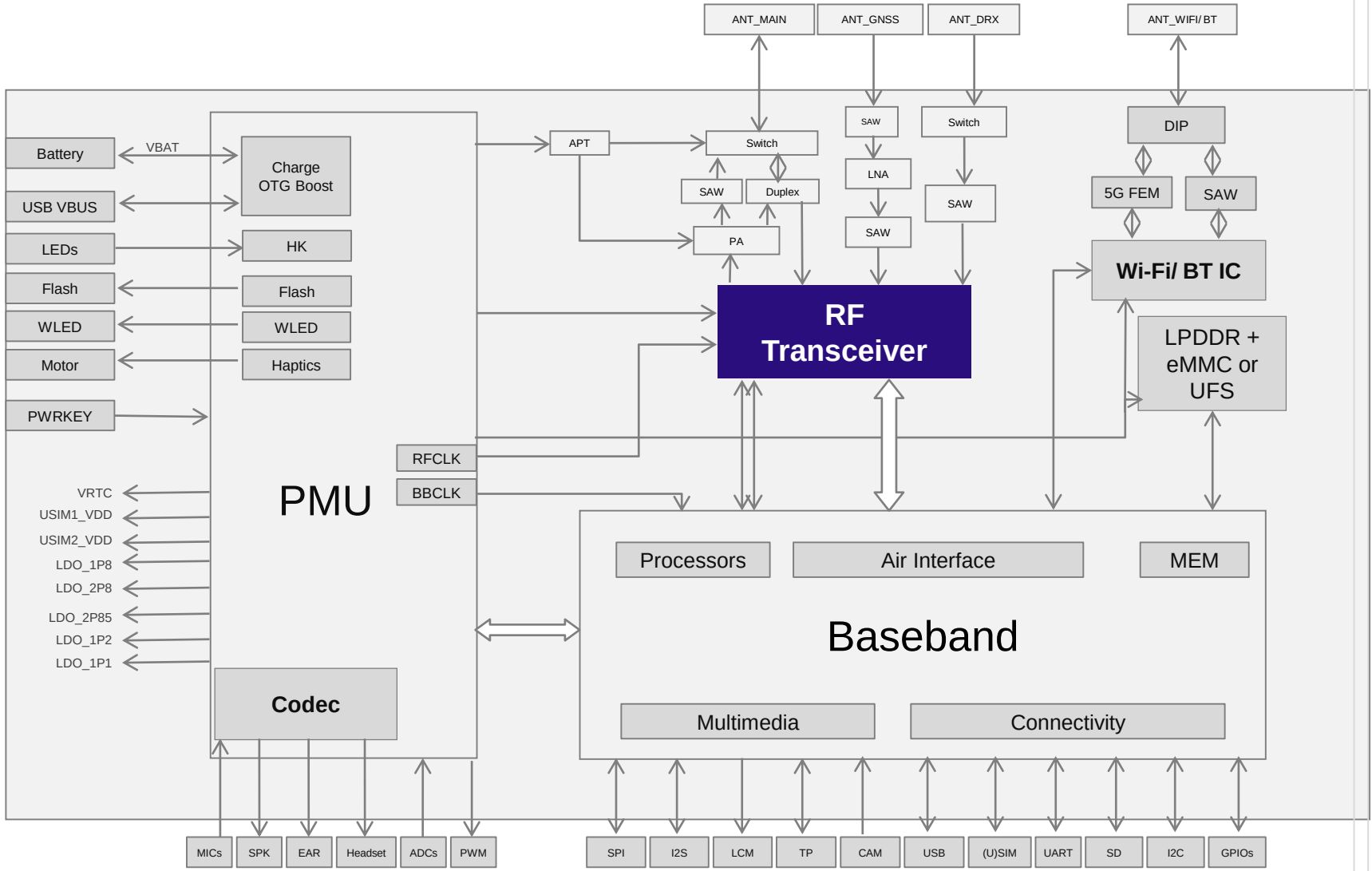
Built-in Wi-Fi/ Bluetooth

Abundant peripheral interfaces

Excellent customer service

GPU: Graphics Processing Unit DSP: Digital Signal Processing NPU: Neural Processing Unit LCD: Liquid-crystal Display

Smart module hardware block diagram

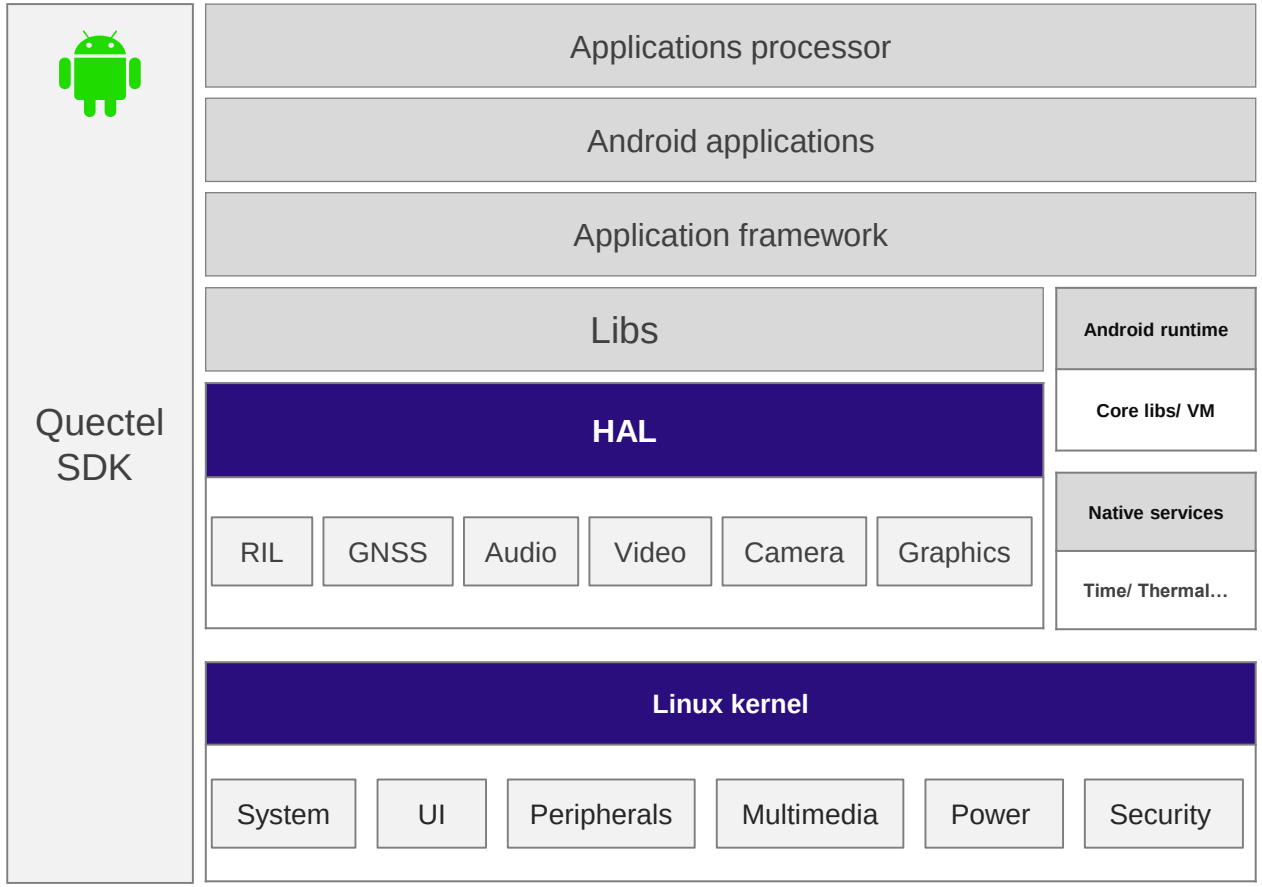


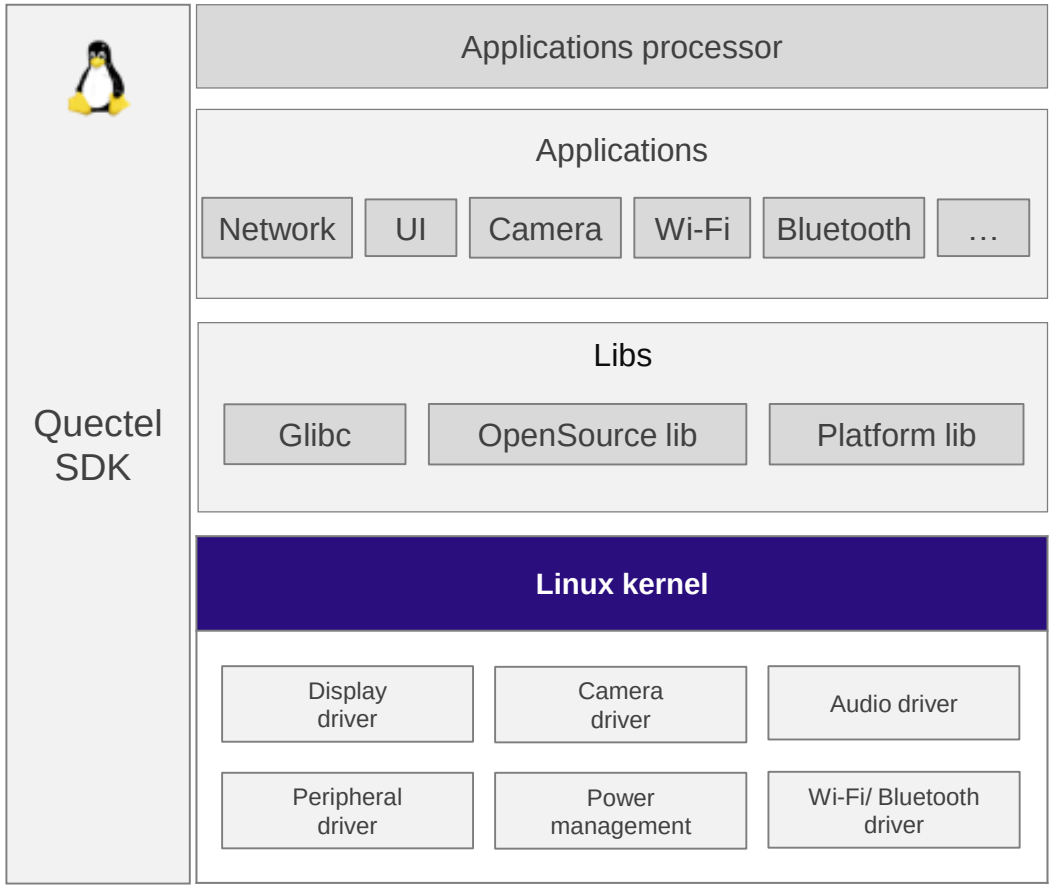
- Baseband: SoC with CPU, GPU, DSP, NPU processors, multimedia and other digital peripherals
- PMU: Provides power supply internally; some PMUs have codec inside
- RF Transceiver: Implements 2G/ 3G/ 4G/ 5G and GNSS functionalities
- Wi-Fi/ Bluetooth IC: Implements Wi-Fi/ Bluetooth functionalities
- LPDDR + eMMC or UFS: Internal DDR and storage

PMU: Power Management Unit LPDDR: Low-power Double Data Rate

Smart module SDK

Quectel provides Android AOSP or Linux SDK which include libs and source codes to customers under NDA.





AOSP: Android Open-source Project HAL: Hardware Abstraction Layer VM: Virtual Machine RIL: Radio Interface Layer

Smart module evaluation kit

Interfaces

- UART
- USB Type-C
- LCM
- Audio
- Camera
- SIM
- SD

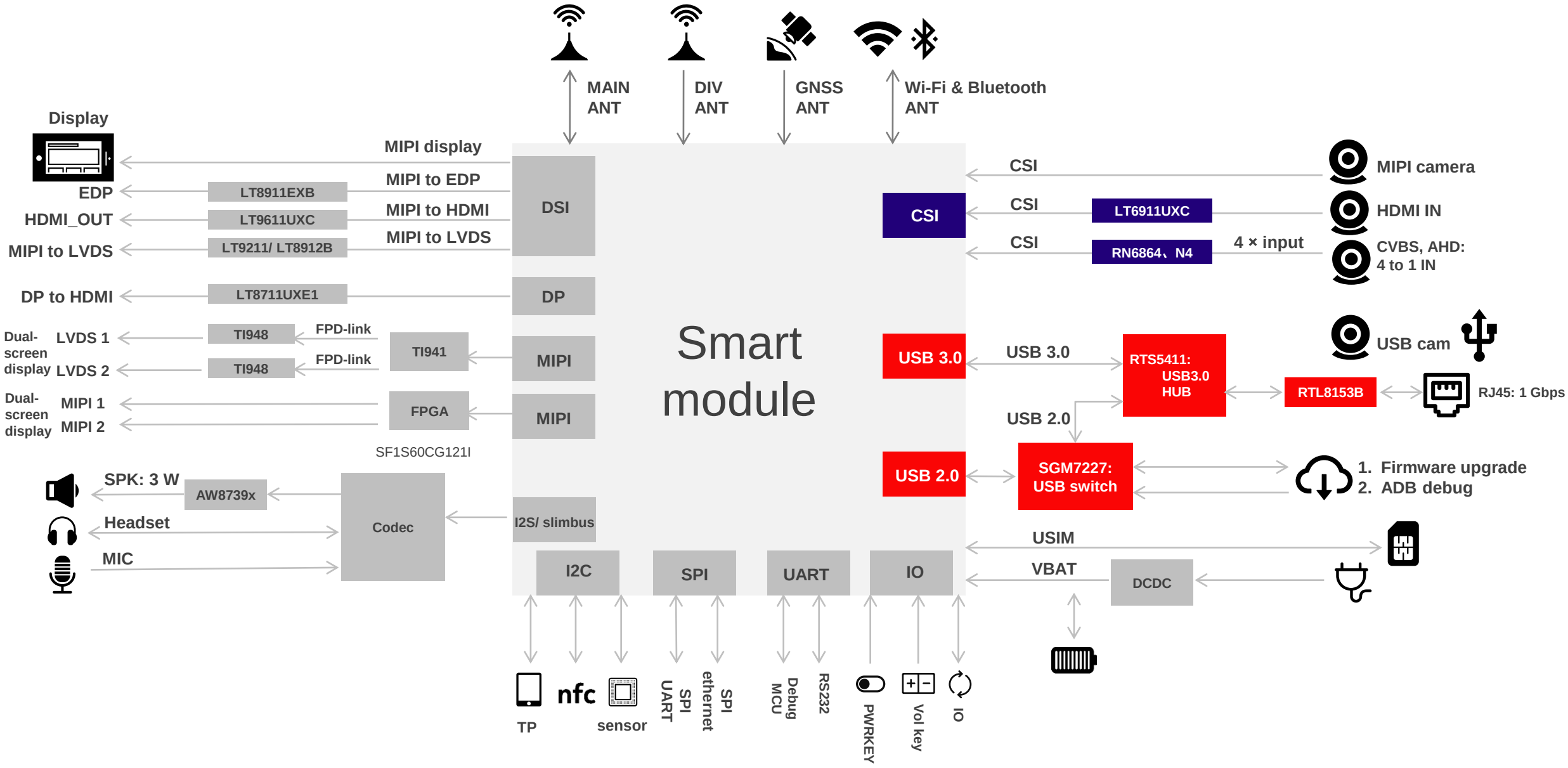
Accessories

- Antenna
- Earphone
- Adapter
- USB Type-C
- RF cables
- USB to UART cables
- U-disk

Reference documents

- Evaluation (main) board schematic
- TE-A (carrier) schematic
- Evaluation and TEA board BOM
- Smart module SDK

Customer hardware design based on smart module



Smart module portfolio

Premium level

SG865W

- QCS8250 ①
- CPU: 8x Kryo585 2.84 GHz
- GPU: Adreno 650
- Camera: 64 MP
- Video: 4K @ 240 fps/ 8K @ 60 fps
- Wi-Fi: 2 × 2 11ax; Bluetooth 5.1

SG885G

- QCS8550 ①
- CPU: 1 + 4 + 3 Kryo™ CPU (3.2/ 2.8/ 2.0 GHz)
- GPU: Adreno 740 – 4K 120 fps UI
- Camera: 64 MP
- Video: 4K @ 240 fps / 8K @ 60 fps
- Wi-Fi: 2.4 & 5 & 6 GHz, Wi-Fi 7; Bluetooth 5.3

High level

SC600T/ SC606T (MSM8953)

SC66

- SDM660 ①
- CPU: 4 + 4 Kryo 260 (2.2/ 1.8 GHz)
- GPU: Adreno 512
- Camera: 24 MP
- Video: 4K @ 30 fps
- Wi-Fi: 2 × 2 11ac; Bluetooth 5.0
- Modem: LTE Cat 6
- GNSS: L1

SC668S/ SC696S

- QCM6125 ①
- CPU: 4 + 4 Kryo 260 2.0/ 1.8 GHz
- GPU: Adreno 610
- Camera: 24 MP
- Video: 4K @ 30 fps
- Wi-Fi: 11ac; Bluetooth 5.0
- Modem: LTE Cat 4
- GNSS: L1

SG560D

- QCM6490/ QCS6490 ①
- CPU: 1 + 3 + 4 Kyro 670 (2.7/ 2.4/ 1.9 GHz)
- GPU: Adreno 643
- Camera: 64 MP
- Video: 4K30D/ 4K30E
- Wi-Fi: 2 × 2 11ax DBS; Bluetooth 5.2
- Modem: 5G Sub 6/ LTE Cat 18
- GNSS: L1 + L5

Medium level

SC600Y (SDM450)

SC200K

- UIS8581E ②
- CPU: 8x A55 1.6 GHz
- GPU: GE8322
- Camera: 16 MP
- Video: 1080P @ 60 fps
- Wi-Fi: 11ac; Bluetooth 5.0
- Modem: LTE Cat 4
- GNSS: L1

SC682A

- SM6115 ①
- CPU: 4 + 4 Kryo 260 (2.0/ 1.8 GHz)
- GPU: Adreno 610
- Camera: 25 MP triple ISPs
- Video: 1080P @ 60 fps
- Wi-Fi: 2.4 & 5 GHz, 11ac
- Bluetooth 5.1
- Modem: LTE Cat 4
- GNSS: L1

SC680A/ SC686A

- QCM4290 ①
- CPU: 4 + 4 Kryo 260 (2.0/ 1.8 GHz)
- GPU: Adreno 610
- Camera: 25 MP
- Video: 1080P @ 60 fps
- Wi-Fi: 11ac; Bluetooth 5.1
- Modem: LTE Cat 6
- GNSS: L1

SG520B

- QCM4490 ①
- CPU: 2 + 6 Kyro CPU (2.4/ 2.0 GHz)
- GPU: Adreno 613
- Camera: 25 MP
- Video: 1080P @ 60fps
- Wi-Fi: 2 × 2 11ax DBS; Bluetooth 5.2
- Modem: 5G Sub 6/ LTE Cat 15
- GNSS: L1

Entry level

SC20 (MSM8909)

SC200R

- QCM2150 ①
- CPU: 4x A53 1.3 GHz
- GPU: Adreno 308
- Camera: 13 MP
- Video: 1080P @ 30 fps
- Wi-Fi: 11n; Bluetooth 4.2
- Modem: LTE Cat 4
- GNSS: L1

SC200E/ SC206E

- QCM2290 ①
- CPU: 4x A53 2.0 GHz
- GPU: Adreno 702
- Camera: 25 MP
- Video: 1080P @ 30 fps
- Wi-Fi: 11ac; Bluetooth 5.0
- Modem: LTE Cat 4
- GNSS: L1

SC200L

- SL8541E ②
- CPU: 4x A53 1.4 GHz
- GPU: Mali-T820
- Camera: 8 MP
- Video: 1080P @ 30 fps
- Wi-Fi: 11ac; Bluetooth 5.0
- Modem: LTE Cat 4
- GNSS: L1

SG150H

- SL8521E ②
- CPU: 2x A53 1.3 GHz
- GPU: Mali-T820
- Camera: 5 MP
- Video: 720P @ 30 fps
- Wi-Fi: 11n; Bluetooth 4.2
- Modem: LTE Cat 4
- GNSS: L1

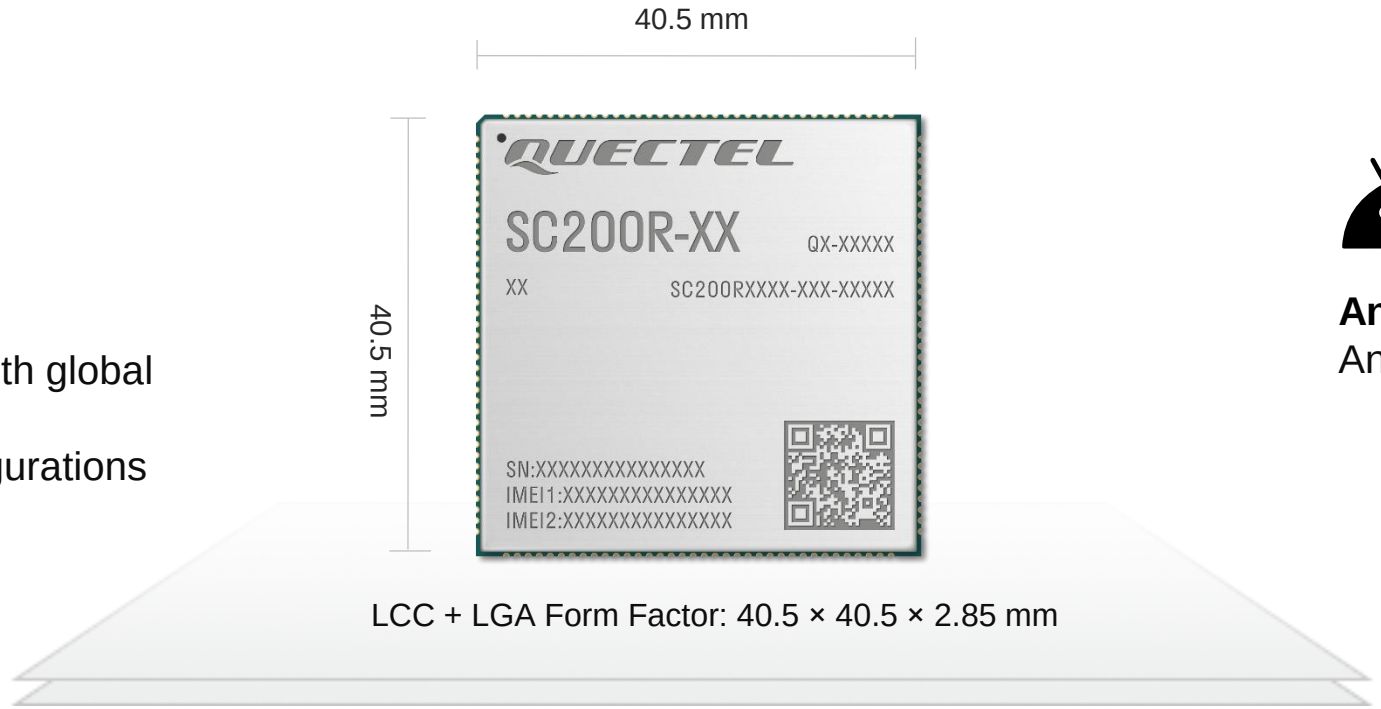
SG368Z

- RK3568 ③
- CPU: 4x A55 2.0 GHz
- GPU: Mali-G52
- Camera: 8 MP
- Video: 1080P @ 60 fps
- Wi-Fi: 11ac; Bluetooth 4.2

①: Qualcomm ②: Unisoc ③: Rockchip

SC200R series highlights

Multiple Variants:
- Multi-region variants with global certifications
- Multiple memory configurations



Android OS:
Android 10

Chipset platform: QCM2150.
Entry level SoC chipset supporting multimedia, LTE Cat 4,
Wi-Fi 802.11n, Bluetooth and GNSS

Long life time:
Till the year of 2028

Compatible with SC20, SC200E, SC206E, SC200L, SC200K series

SC200R series specifications

Variant		SC200R-EM	SC200R-NA	SC200R-CE	SC200R-JP ①	SC200R-WF
Region		EMEA/ India/ South Korea/ South Asia/ Latin America/ Australia/ New Zealand/ South Africa	North America	China	Japan	Global
LTE	**FDD Band**	B1/ 2/ 3/ 4/ 5/ 7/ 8/ 20/ 28	B2/ 4/ 5/ 7/ 12/ 13/ 14/ 17/ 25/ 26/ 66/ 71	B1/ 3/ 5/ 8	B1/ 3/ 5/ 8/ 11/ 18/ 19/ 21/ 26/ 28	-
	TDD Band	B38/ 40/ 41	B41	B34/ 38/ 39/ 40/ 41	B41	-
UMTS	**WCDMA Band**	B1/ 2/ 4/ 5/ 8	B2/ 4/ 5	B1/ 8	B1/ 6/ 8/ 19	-
EVDO/ CDMA		-	-	BC0	-	-
GSM/ EDGE		850/ 900/ 1800/ 1900 MHz	-	900/ 1800 MHz	-	-
Embedded GNSS		Supported	Supported	Supported	Supported	-
Wi-Fi/ Bluetooth		Supported	Supported	Supported	Supported	Supported
Certification		**Carrier:** Telstra* **Regulatory:** GCF/ CE/ RCM/ Anatel/ KC	**Carrier:** Verizon/ AT&T/ T-Mobile ① **Regulatory:** GCF/ PTCRB/ FCC/ IC	**Regulatory:** CCC/ SRRC/ NAL ①	**Carrier:** NTT DOCOMO ① **Regulatory:** JATE ①/ TELEC ①	**Regulatory:** CE/ FCC/ IC/ RCM
Project Stage		MP	MP	MP	Developing	MP

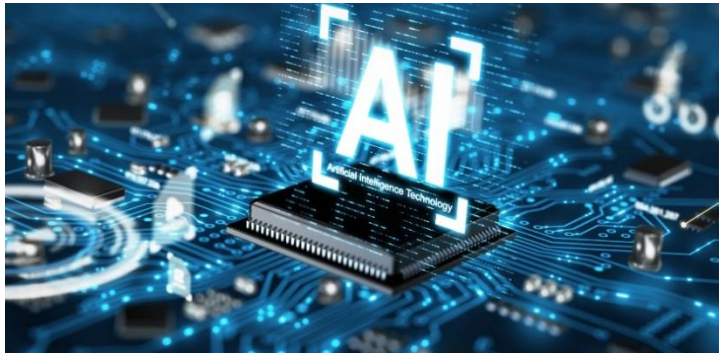
*: under development/ in progress/ planning ①: TBD (to be determined)

SC200R series features and interfaces

Key Features		Interfaces	
CPU	QCM2150, Quad-core ARM Cortex-A53 64-bit CPU @ 1.3 GHz	**LCM**	4-lane MIPI DSI, HD+ (1440 × 720) @ 60 fps Wi-Fi display: 1080P @ 30 fps (UBWC)
GPU	Qualcomm® Adreno™ 308 Graphics Processing Unit (GPU) with 64-bit addressing, up to 485 MHz	**Camera**	Two 4-lane MIPI CSI, up to 2.1 Gbps/ lane, 2 × ISP Support 2 or 3 cameras, up to 13 MP with dual ISP
Video	Video encoding: • 720P (H.264) @ 30 fps • WVGA (MPEG-4/ VP8) @ 30 fps Video decoding: • 1080P (H.264/ MPEG-4/ VP8/ H.265/ DivX4/ 5/ 6) @ 30 fps • WVGA (H.263) @ 30 fps	**Touch Panel**	Capacitive touch panel, I2C controls
Memory ①	1 GB LPDDR3 + 8 GB eMMC 2 GB LPDDR3 + 16 GB eMMC 3 GB LPDDR3 + 32 GB eMMC	**Audio**	3 analog inputs: MIC1, MIC2, MIC3 (including one noise-canceling MIC) 3 analog outputs: speaker, earpiece, headphone
OS	Android 10	**USB**	× 1 USB 2.0, supports USB OTG
Wi-Fi	2.4 & 5 GHz, 802.11a/ b/ g/ n 150 Mbps; STA/ AP/ P2P	**(U)SIM**	× 2 Support 1.8/ 2.95 V (U)SIM cards, with (U)SIM card detection function DSDS supported
Bluetooth	Bluetooth 2.1 EDR/ 3.0 HS/ 4.1 LE/ 4.2/ 5.0 BLE Support a maximum of 10 ACL/ BEL/ SCO links	**UART**	× 3 Up to 4 Mbps, one of them supports hardware flow control
GNSS	GPS/ BDS/ GLONASS or GPS/ BDS/ Galileo	**SD Card**	× 1 SD 3.0, 4-bit SDIO
Modem	3GPP Release 10 compliant	**I2C/ SPI/ ADC/ GPIO/ PWRKEY**	Supported
Battery Charge	Supported	**Antenna**	× 4, Main/ Rx-diversity/ GNSS/ Wi-Fi & Bluetooth (SC200R-WF: × 1, Wi-Fi & Bluetooth Antenna)

①: 3 GB LPDDR3 + 32 GB eMMC is only optional for SC200R-CE/ -EM currently.

Typical applications



Retail

Functions supported

Secure payment
Meet the security requirements for digital transaction applications in mobile and NFC payments

Multiple wireless modes
Cellular/ Wi-Fi/ Bluetooth

Dual-screen display
Dual-screen display to meet the requirements for cash register

Form-factor compatibility in different modules
Module form-factor is compatible in different modules for easy upgrade

Applications

- Finance
- Restaurant
- Supermarket
- Hotel
- Hospital
- Transportation

Recommended smart modules

Quad-core entry level

Octa-core medium level

Octa-core high level

Vehicle aftermarket

Functions supported

Camera

Multi-way surround view, driving record, fast reverse

Infotainment

Supports multiple video formats, 192K/ 24 Bit audio source output, dynamic and static sound effects adjustment

Internet of Vehicles

4G/ 5G/ Wi-Fi/ GNSS connectivity to meet the requirements for global certification

Vehicle algorithm

ADAS/ DMS, audio algorithm, distortion correction and parity frames

Applications

- Infotainment
- Edging computing BOX
- Dash cam
- Navigation
- Rear headrests
- Smart rear-view mirror

Recommended smart modules

Quad-core entry level

Octa-core medium level

Octa-core high level

Smart home & appliances

Functions supported

- Large high-definition screen
- Smart camera
- Voice recognition
- Abundant peripheral interfaces
- Visual recognition
- Multiple cellular modes
- Wi-Fi
- Multiple operating systems supported

Recommended smart modules

Quad-core entry level

Octa-core medium level

Octa-core high level

Industrial handheld

Functions supported

Abundant interfaces with easy expandability

Multiple cameras, NFC expansion, QR code scanning, RFID

Multiple modules for easy selection

Compatible module form-factor, ease to upgrade

Multiple algorithm integration

Multi MIC noise reduction, EIS, TTS, etc.

Multiple wireless modes

Cellular/ Wi-Fi/ Bluetooth

Applications

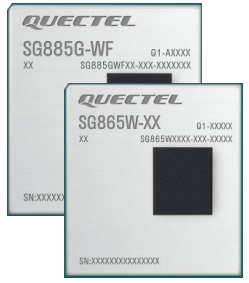
- Office
- Logistics & warehouse anagement
- Education
- Enforcement
- Operation & maintenance inspection
- Medical assistance
- Engineering surveying & mapping
- Automotive diagnosis
- Handheld game console

Recommended smart modules

Quad-core entry level

Octa-core medium level

Octa-core high level



Octa-core premium level

Livestreaming & video conferences

Functions supported

- Multiple functions
- MIC
- Virtual background
- Multiple applications
- Multiple shot switching
- App store

Configuration

- Android
- Processor: Octa-Core CPU
- Memory: 8 GB + 256 GB or higher
- Camera: 21M or higher pixels
- Video: 4K,1080p
- TOPS: 3.5–12.5 TOPS
- Display: 10’’, 32/43’’ with touch
- 4G/ Wi-Fi/ Bluetooth/ GNSS
- Speaker, Mic
- Remote control

Recommended smart modules

Robotics

Applications

- Reception
- Airport guider
- Bank guider
- Lawn mower
- Hospital guider
- Hotel reception
- Logistics

Configuration

- Android or Linux
- Processor: Octa-Core CPU
- TOPS: 3.5–12.5 TOPS
- Memory: 8 GB + 256 GB or higher
- Camera: 21M or higher pixels
- Video: 4K,1080p, 720p
- Display: 10’’ or larger with touch
- 4G/ Wi-Fi/ Bluetooth/ GNSS
- Speaker, Mic
- Battery
- Machinery parts

Recommended Smart Modules

AR/ VR

Augmented reality

Augmented reality overlays computer-generated images on the view of the natural world with the camera on smart phones, tablets, or other mobile devices. Quectel works hard to bring the vision of lightweight and stylish AR glasses to life.

Virtual reality

Through cutting-edge graphics, best-in-class hardware, and artistically rendering experiences, VR lets us explore new worlds, defy obstacles. VR has enormous potential to transform how we play, work, learn, communicate, and experience the world around us.

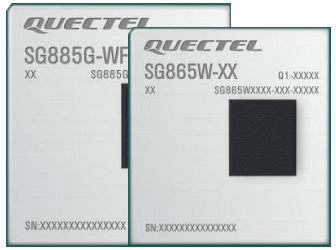
3D scanner

3D measurement scanners can measure cross-sections, thickness, and perform GD&T measurements in a single scan.

Configuration

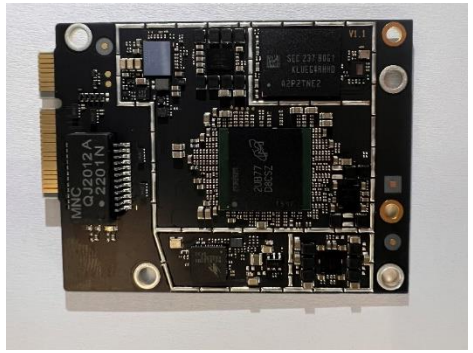
- Android or Linux
- Memory: 8 GB + 64 GB or higher
- TOPS: 12.5 TOPS

Recommended smart modules



ARM array server

Solutions



Cloud games

Cloud mobile phone

Cloud live streaming

Cloud rendering

ARM board	ARM array server case	Cloud service vendors	Cloud-based contents
The board with M.2 interface based on SoC is the core component of ARM array servers	Conduct centralized management and data allocation of multiple ARM boards	ARM array servers deployed to the cloud with the running of multiple virtual channels	Games, mobile, live streaming and rendering

Recommended smart modules

Octa-core premium level

Octa-core premium level

Edge computing

Applications

Smart manufacturing

Smart monitoring

Smart city

Unmanned retail

Functions Supported

- Low-power computing
- Abundant peripheral interfaces
- Multiple Operation Systems
- Cost-effectiveness
- Mobility
- 5G option

Recommended smart modules

Octa-core 5G high level

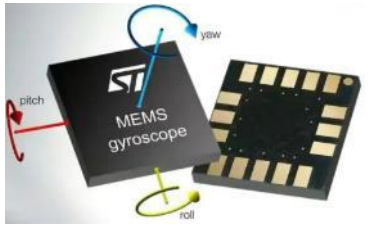
Octa-core premium level

Octa-core premium level

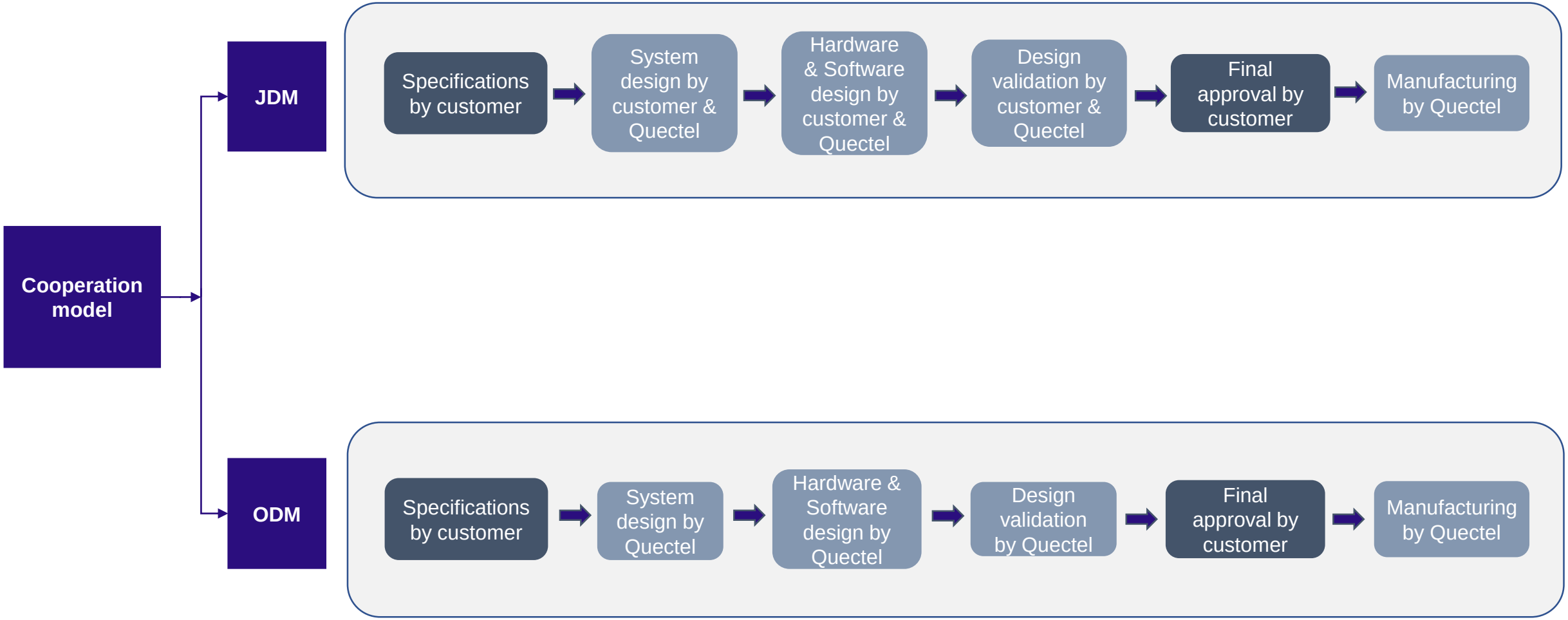
Key components supply services

Customers may face difficulties in finding key components used in their board locally. To accelerate customers' development and shorten the time to market, Quectel will use the supply chain to provide the key components to customers.

- ✓ Main key components:
  - LCM + TP
  - Camera module
  - Sensors, NFC ICs, extension ICs, etc.



PCBA & device service cooperation models



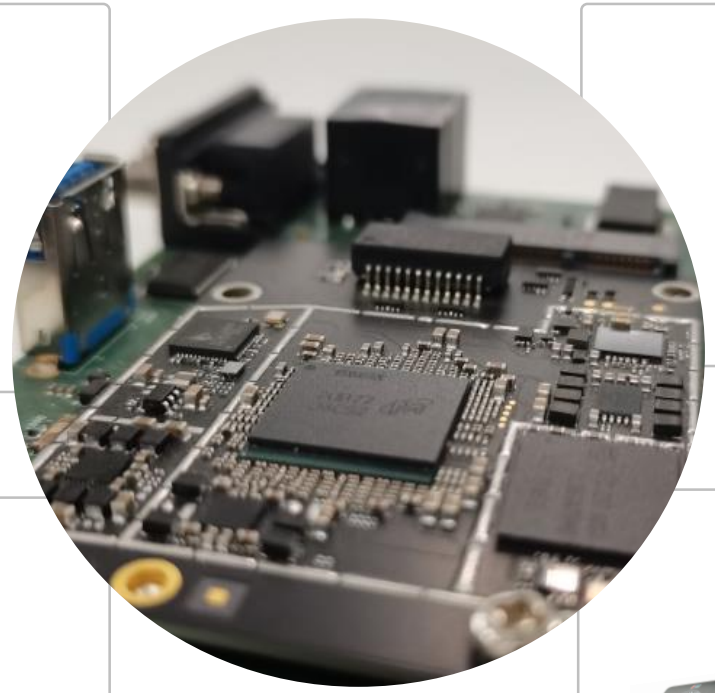
JDM: Joint Development Manufacturer ODM: Original Development Manufacturer

PCBA service – design & manufacturing

PCBA① development service centers on customer needs, focusing on System-on-Chip (SOC) platforms with Chip-on-Board (COB) or Module-on-Board (MOB) solution delivery.

SOC vendors

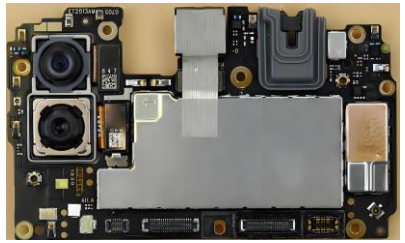
Qualcomm UNISOC MEDIATEK Rockchip



PCBA solutions

MOB

COB



Operating Systems

Applications

①: PCBA - A printed circuit board assembly (PCBA) describes the finished board after all the components have been soldered and installed on a printed circuit board (PCB)

Highly professional manufacturing

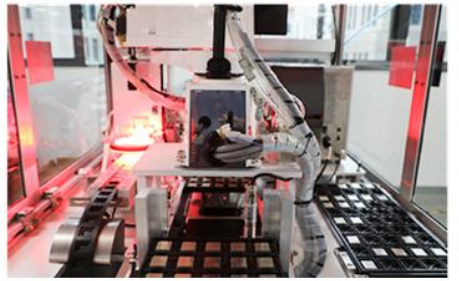
Quectel factory is **ISO 9001, IATF 16949**, **ISO 14001** and **ISO 45001 certified**.

Changzhou, China

1 Automatic De-Paneling Machine & Optical Inspection System

2 Automatic DL & RF Calibration Test Station

3 Automatic Module Flatness Inspection System



6 Real Time Monitoring System for Production Line Quick Response

5 Automatic Tape and Reel Packaging System

4 Convection Oven for module de-humidification

PCBA service – process

1. Requirement evaluation

- Customer requirement evaluation
- SoC solution evaluation
- System design evaluation
- Cost, timeline RD input and other evaluation

3. Sample production and tuning

- Material procurement
- PCBA production
- Hardware debugging and tuning
- Radio frequency performance debugging and tuning
- Software implementation and debugging

5. Product MP

- Production tool development
- Production process standardization
- Automatic test
- After-sales service

INPUT:
Requirement




OUTPUT:
Finished product

2. Product design

- Schematic and PCB layout design
- Hardware simulation
- ID/ MD/ stacking design
- EMC design
- Thermal design and simulation

4. Sample validation

- Radio frequency performance test
- Power consumption test
- Acoustic test
- Reliability and ambient test
- EMC test

PCBA service – Quectel advantages

Strong design ability

- Large and professional R&D team
- Experience in IoT module and application design
- New design or customization possible

Professional service

- Strong supply chain (part of module sourcing)
- Global support (offices in USA, EMEA and APAC)
- Value-added services

Multiple-SoC solutions

- Qualcomm, MTK, Unisoc and Rockchip SoCs
- Multiple selection of smart modules
- COB and MOB

Quality guarantee

- Tests according to defined acceptance standards
- Product quality management system
- Standardized SMT manufacturing

Value-added services

Hardware light-up service

Hardware board light-up:

Camera, LCD, etc.

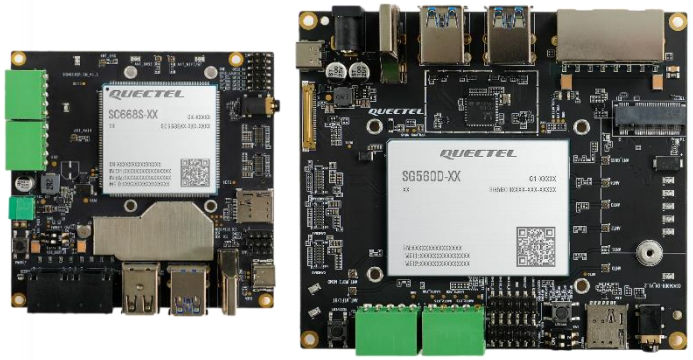
Software customization service

- Customize Android/ Linux OS deeply
- Customize algorithm
- Customize multimedia functions
- Tune camera, LCD, audio, etc.

Certification service

RED, CE certifications for the device

PCBA design cases



Robotics & industrial board

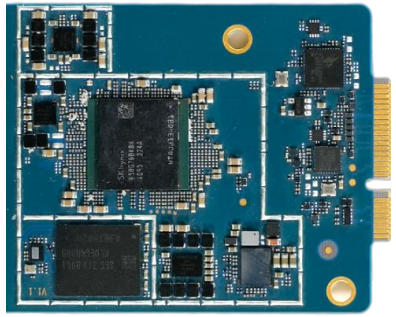
- 4G and 5G MOB boards
- Multiple interfaces
- Easy to expand

POS

- 4G COB board
- High-voltage Battery charging

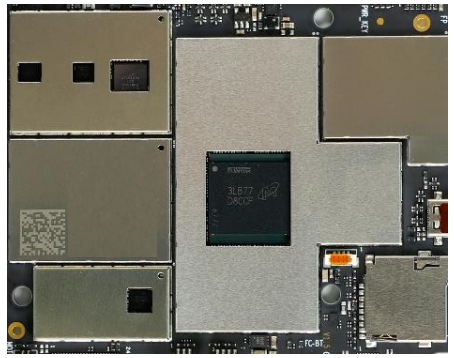
Industrial PDA

- 5G COB board
- Fast charging



ARM server board

- High performance computing COB board
- Mini-PCIe interface
- Thermal design
- Ethernet interface



Game console PCBA

- High performance computing COB board
- Wi-Fi 7
- HDMI
- Fast charging

Thank you

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