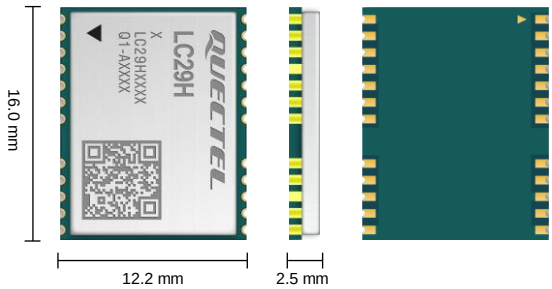
Quectel LC29H Series

Dual-Band Multi-Constellation GNSS Module with RTK and DR Functions



LC29H is a series of dual-band, multi-constellation GNSS modules that support the concurrent reception of GNSS constellations such as GPS, GLONASS, Galileo, BDS, NavIC, and QZSS.

Compared to GNSS modules that track only L1 signals, the LC29H series can track a higher number of visible satellites in multi bands, thereby significantly mitigating the multipath effect in deep urban canyons and improving positioning accuracy. By having an internal LNA and diplexer, the module achieves improved sensitivity and anti-interference capability. Featuring dual frequency support, the module delivers enhanced accuracy values of 1 m in autonomous mode and centimeter levels in the RTK capable variants. The optional DR function ensures the module's superior positioning performance even in weak signal areas or when GNSS signals are not available.

Based on the receiver chip using 12 nm technology, the LC29H series provides advanced power management enabling low-power GNSS sensing and position fix, which makes the module an ideal solution for power-sensitive and battery-powered systems.

Featuring high-precision positioning and low power consumption makes the LC29H series perfectly suited for applications such as real time tracking and sharing economy related services.

Key Features

- Multi-GNSS engine for GPS, GLONASS, Galileo, BDS, NavIC, and QZSS
- Reception of L1 and L5 GNSS bands signals concurrently
- Integrated DR function (optional)
- RTK (optional) providing sub-meter accuracy with fast convergence time and outstanding performance
- Output GNSS and IMU raw data messages (optional)
- Integrated LNA for high sensitivity
- Integrated diplexer for noise cancellation
- UART, I2C and SPI interfaces
- Integrated AGNSS function
- Integrated AIC and jamming function

AGNSS Technology

Ultra Low Power Consumption

Ultra Compact Size

Tracking Sensitivity: -165 dBm

Operating Temperature Range: -40 to +85 °C

Anti-jamming

RoHS Compliant

Multi-constellation System

Version: 1.9 | Status: Released

Quectel LC29H Series

GNSS Module	LC29H (AA)	LC29H (BA)	LC29H (CA)
Dimensions	12.2 mm × 16.0 mm × 2.5 mm	12.2 mm × 16.0 mm × 2.5 mm	12.2 mm × 16.0 mm × 2.5 mm
Weight	Approx. 0.9 g	Approx. 0.9 g	Approx. 0.9 g
Temperature Range			
Operating Temperature	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Storage Temperature	-40 °C to +90 °C	-40 °C to +90 °C	-40 °C to +90 °C
GNSS Features			
Supported Bands	GPS/QZSS: L1 C/A, L5 GLONASS: L1 Galileo: E1, E5a BDS: B1I, B2a NavIC: L5	GPS/QZSS: L1 C/A, L5 GLONASS: L1 Galileo: E1, E5a BDS: B1I, B2a NavIC*: L5	GPS/QZSS: L1 C/A, L5 GLONASS: L1 Galileo: E1, E5a BDS: B1I, B2a NavIC: L5
Default GNSS Constellations	GPS + GLONASS + Galileo + BDS + QZSS	GPS + GLONASS + Galileo + BDS + QZSS	GPS + GLONASS + Galileo + BDS + QZSS
Number of Concurrent GNSS	4 + QZSS	4 + QZSS	4 + QZSS
SBAS	WAAS, EGNOS, MSAS and GAGAN	WAAS, EGNOS, MSAS and GAGAN	WAAS, EGNOS, MSAS and GAGAN
Function(s)	Standard	RTK + DR (integrated IMU)	DR (integrated IMU)
Horizontal Position Accuracy	Autonomous①: 1 m	Autonomous①: 1 m RTK②: < 0.1 m + 1 ppm	Autonomous①: 1 m
Vertical Position Accuracy	Autonomous①: 2 m	Autonomous①: 2 m RTK②: 2.5 cm + 1 ppm	Autonomous①: 2 m
DR Position Error (ADR)	-	4-wheeler: < 2 % of distance traveled without GNSS 2-wheeler: < 4 % of distance traveled without GNSS	4-wheeler: < 2 % of distance traveled without GNSS 2-wheeler: < 4 % of distance traveled without GNSS
DR Position Error (UDR)	-	4-wheeler: < 3 % of distance traveled without GNSS 2-wheeler: < 6 % of distance traveled without GNSS	4-wheeler: < 3 % of distance traveled without GNSS 2-wheeler: < 6 % of distance traveled without GNSS
Velocity Accuracy③	0.03 m/s	0.03 m/s	0.03 m/s
Accuracy of 1PPS Signal (RMS)③	20 ns	20 ns	20 ns
RTK Convergence Time	-	RTK②: < 10 s	-
Heading Accuracy	-	-	-
TTFF (with AGNSS)④	Full Cold Start: 5 s	Full Cold Start: 5 s	Full Cold Start: 5 s
TTFF (Without AGNSS)③	Full Cold Start: 26 s Warm Start: 16 s Hot Start: 1 s	Full Cold Start: 26 s Warm Start: 16 s Hot Start: 1 s	Full Cold Start: 26 s Warm Start: 16 s Hot Start: 1 s
Sensitivity (@ Default GNSS Constellations)	Acquisition: -147 dBm Tracking: -165 dBm Reacquisition: -159 dBm	Acquisition: -145 dBm Tracking: -165 dBm Reacquisition: -157 dBm	Acquisition: -145 dBm Tracking: -165 dBm Reacquisition: -157 dBm
Dynamic Performance③	Maximum Altitude: 10000 m Maximum Velocity⑤: 500 m/s Maximum Acceleration⑤: 4g	Maximum Altitude: 10000 m Maximum Velocity⑤: 500 m/s Maximum Acceleration⑤: 4g	Maximum Altitude: 10000 m Maximum Velocity⑤: 500 m/s Maximum Acceleration⑤: 4g
PVT Update Rate	1–10 Hz	1–10 Hz	1–10 Hz
Raw Data Update Rate	GNSS: 1 Hz	GNSS: 1 Hz IMU: 100 Hz (Max.)	GNSS: 1 Hz IMU: 100 Hz (Max.)
Certifications			
Regulatory	**Europe:** CE	**Europe:** CE	**Europe:** CE
Others	RoHS	RoHS	RoHS
Interfaces			
I2C	× 1 Up to 400 kbps	× 1 Up to 400 kbps	× 1 Up to 400 kbps
UART	× 2 Adjustable: 4800–3000000 bps Default: 115200 bps (UART1) or 3000000 bps (UART2)	× 2 Adjustable: 4800–3000000 bps Default: 115200 bps (UART1) or 3000000 bps (UART2)	× 2 Adjustable: 4800–3000000 bps Default: 115200 bps (UART1) or 3000000 bps (UART2)
SPI	× 1 (Multiplexed from I2C and UART1)	× 1 (Multiplexed from I2C and UART1)	× 1 (Multiplexed from I2C and UART1)
Protocols			
Protocols	NMEA 0183/RTCM 3.x	NMEA 0183/RTCM 3.x	NMEA 0183/RTCM 3.x
External Antenna Interface			
Antenna Type	Active⑥ or Passive	Active⑥ or Passive	Active⑥ or Passive
Antenna Power Supply	External or VDD_RF pin of module	External or VDD_RF pin of module	External or VDD_RF pin of module
Electrical Characteristics			
Supply Voltage Range (VCC)	3.1–3.6 V, typ. 3.3 V	3.1–3.6 V, typ. 3.3 V	3.1–3.6 V, typ. 3.3 V
I/O Voltage⑦	Typ. 2.8 V	Typ. 2.8 V	Typ. 2.8 V
Power Consumption (@ Default GNSS Constellations, 3.3 V)③	**Normal Operation:** 24 mA (79.2 mW) @ Acquisition 24 mA (79.2 mW) @ Tracking **Power Saving Mode:** 25 μA (82.5 μW) @ Backup Mode	**Normal Operation:** 32 mA (105.6 mW) @ Acquisition 32 mA (105.6 mW) @ Tracking **Power Saving Mode:** 25 μA (82.5 μW) @ Backup Mode	**Normal Operation:** 30 mA (99 mW) @ Acquisition 30 mA (99 mW) @ Tracking **Power Saving Mode:** 25 μA (82.5 μW) @ Backup Mode

NOTE:

1. ①: CEP, 50 %, 24 hours static, -130 dBm, more than 6 SVs.
2. ②: CEP, 50 %, with active high-precision antennas in an open-sky environment and within 1 km from the base station.
3. ③: Tested at room temperature, with typical operating voltage, and satellite signal of -130 dBm configured by the instrument.
4. ④: Open-sky, active high-precision antenna.
5. ⑤: ITAR limits.
6. ⑥: To further mitigate the impact of out-of-band signals on GNSS module performance, you must choose the active antenna whose SAW filter is placed in front of the LNA in the internal framework. DO NOT place the LNA in the front.
7. ⑦: The domain is 1.8 V for certain interfaces or pins. See hardware design for voltage details.
8. * : Under development.

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Quectel LC29H Series

GNSS Module	LC29H (DA)	LC29H (EA)	LC29H (AI)
Dimensions	12.2 mm × 16.0 mm × 2.5 mm	12.2 mm × 16.0 mm × 2.5 mm	12.2 mm × 16.0 mm × 2.5 mm
Weight	Approx. 0.9 g	Approx. 0.9 g	Approx. 0.9 g
Temperature Range			
Operating Temperature	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Storage Temperature	-40 °C to +90 °C	-40 °C to +90 °C	-40 °C to +90 °C
GNSS Features			
Supported Bands	GPS/QZSS: L1 C/A, L5 GLONASS: L1 Galileo: E1, E5a BDS: B1I, B2a NavIC*: L5	GPS/QZSS: L1 C/A, L5 GLONASS: L1 Galileo: E1, E5a BDS: B1I, B2a NavIC*: L5	GPS/QZSS: L1 C/A GLONASS: L1 Galileo: E1 BDS: B1I NavIC: L5
Default GNSS Constellations	GPS + GLONASS + Galileo + BDS + QZSS	GPS + GLONASS + Galileo + BDS + QZSS	GPS + GLONASS + Galileo + BDS + NavIC + QZSS
Number of Concurrent GNSS	4 + QZSS	4 + QZSS	5 + QZSS
SBAS	WAAS, EGNOS, MSAS and GAGAN	WAAS*, EGNOS*, MSAS* and GAGAN*	WAAS, EGNOS, MSAS and GAGAN
Function(s)	RTK	RTK + Heading①	Standard
Horizontal Position Accuracy	Autonomous②: 1 m RTK③: 1 cm + 1 ppm	Autonomous②: 1 m RTK③: 1 cm + 1 ppm	Autonomous②: 1.8 m
Vertical Position Accuracy	Autonomous②: 2 m RTK③: 2.5 cm + 1 ppm	Autonomous②: 2 m RTK③: 2.5 cm + 1 ppm	Autonomous②: 2 m
DR Position Error (ADR)	-	-	-
DR Position Error (UDR)	-	-	-
Velocity Accuracy④	0.03 m/s	0.03 m/s	0.1 m/s
Accuracy of 1PPS Signal (RMS)④	20 ns	20 ns	80 ns
RTK Convergence Time	RTK③: < 10 s	RTK③: < 10 s	-
Heading Accuracy⑤	-	Heading: 0.2°	-
TTFF (with AGNSS)⑥	Full Cold Start: 5 s	Full Cold Start: 5 s	Full Cold Start: 5 s
TTFF (Without AGNSS)④	Full Cold Start: 26 s Warm Start: 16 s Hot Start: 1 s	Full Cold Start: 26 s Warm Start: 16 s Hot Start: 1 s	Full Cold Start: 29 s Warm Start: 24 s Hot Start: 1 s
Sensitivity (@ Default GNSS Constellations)	Acquisition: -145 dBm Tracking: -165 dBm Reacquisition: -157 dBm	Acquisition: -145 dBm Tracking: -165 dBm Reacquisition: -157 dBm	Acquisition⑦: -150 dBm Tracking⑦: -165 dBm Reacquisition⑦: -160 dBm
Dynamic Performance④	Maximum Altitude: 10000 m Maximum Velocity⑧: 500 m/s Maximum Acceleration⑧: 4g	Maximum Altitude: 10000 m Maximum Velocity⑧: 500 m/s Maximum Acceleration⑧: 4g	Maximum Altitude: 10000 m Maximum Velocity⑧: 500 m/s Maximum Acceleration⑧: 4g
PVT Update Rate	RTK: 1 Hz	RTK: 1–10 Hz	1–10 Hz
Raw Data Update Rate	GNSS: 1 Hz	GNSS: 1 Hz	GNSS: 1 Hz
Certifications			
Regulatory	**Europe:** CE	**Europe:** CE	**Europe:** CE
Others	RoHS	RoHS	RoHS
Interfaces			
I2C	× 1 Up to 400 kbps	-	× 1 Up to 400 kbps
UART	× 2 Adjustable: 4800–3000000 bps Default: 115200 bps (UART1) or 3000000 bps (UART2)	× 1 Adjustable: 4800–3000000 bps Default: 460800 bps	× 2 Adjustable: 9600–921600 bps (UART1) or 4800–3000000 bps (UART2) Default: 115200 bps (UART1) or 3000000 bps (UART2)
SPI	× 1 (Multiplexed from I2C and UART1)	-	× 1 (Multiplexed from I2C and UART1)
Protocols			
Protocols	NMEA 0183/RTCM 3.x	NMEA 0183/RTCM 3.x	NMEA 0183/RTCM 3.x
External Antenna Interface			
Antenna Type	Active⑨ or Passive	Active⑨ or Passive	Active⑨ or Passive
Antenna Power Supply	External or VDD_RF pin of module	External or VDD_RF pin of module	External or VDD_RF pin of module
Electrical Characteristics			
Supply Voltage Range (VCC)	3.1–3.6 V, typ. 3.3 V	3.1–3.6 V, typ. 3.3 V	3.1–3.6 V, typ. 3.3 V
I/O Voltage⑩	Typ. 2.8 V	Typ. 2.8 V	Typ. 2.8 V
Power Consumption (@ Default GNSS Constellations, 3.3 V)④	**Normal Operation:** 30 mA (99 mW) @ Acquisition 30 mA (99 mW) @ Tracking **Power Saving Mode:** 25 μA (82.5 μW)@ Backup Mode	**Normal Operation:** 30 mA (99 mW) @ Acquisition 30 mA (99 mW) @ Tracking **Power Saving Mode:** 25 μA (82.5 μW) @ Backup Mode	**Normal Operation:** 16 mA (52.8 mW) @ Acquisition 16 mA (52.8 mW) @ Tracking **Power Saving Mode:** 51 μA (168.3 μW)@ Backup Mode

NOTE:
1. ①: Heading function is implemented with two pieces of LC29H (EA) modules.
2. ②: CEP, 50 %, 24 hours static, -130 dBm, more than 6 SVs.
3. ③: CEP, 50 %, with active high-precision antennas in an open-sky environment and within 1 km from the base station.
4. ④: Tested at room temperature, with typical operating voltage, and satellite signal of -130 dBm configured by the instrument.
5. ⑤: Standard deviation value, static, open-sky, 1 m baseline length.
6. ⑥: Open-sky, active high-precision antenna.
7. ⑦: Tested with an external LNA with 17 dB gain and 0.55 dB noise figure.
8. ⑧: ITAR limits.
9. ⑨: To further mitigate the impact of out-of-band signals on GNSS module performance, you must choose the active antenna whose SAW filter is placed in front of the LNA in the internal framework. DO NOT place the LNA in the front.
10. ⑩: The voltage domain is 1.8 V for certain interfaces or pins (excluding LC29H (EA)). See hardware design for details.
11. * : Under development.

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