L76 and LC76 series Hardware Comparison Summary

GNSS Module Series

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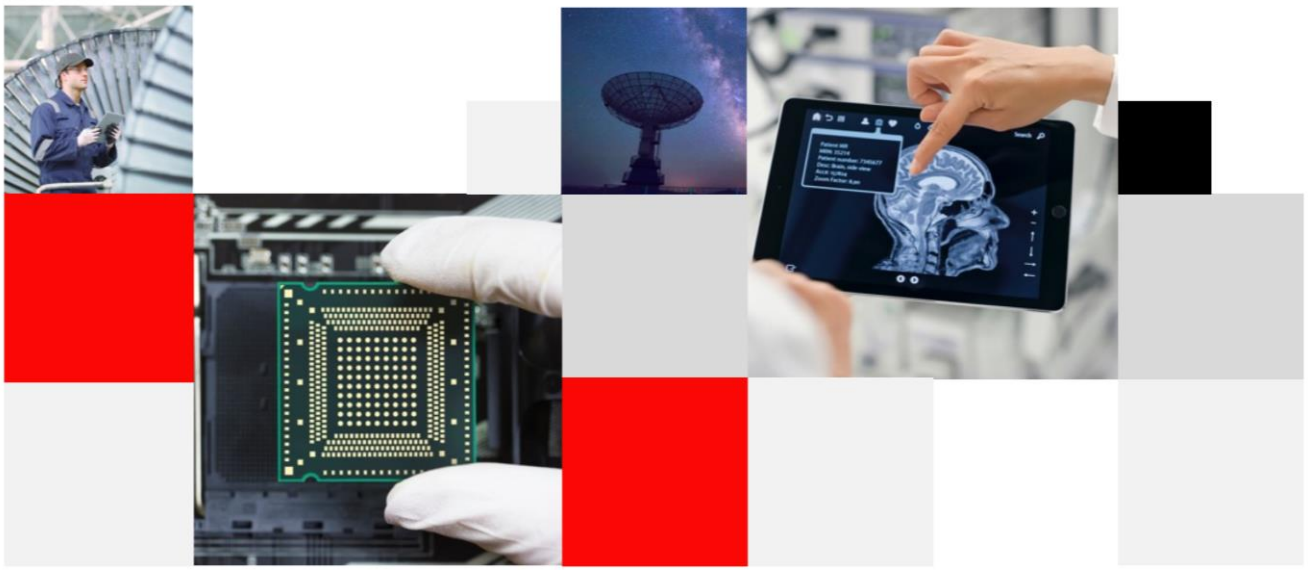
Status: Released



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The following safety precautions must be observed during all phases of operation, such as usage, service, or repair of any terminal or mobile incorporating the module. Manufacturers of the terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all product manuals. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

	Ensure that the product may be used in the country and the required environment, as well as that it conforms to the local safety and environmental regulations.
	Keep away from explosive and flammable materials. The use of electronic products in extreme power supply conditions and locations with potentially explosive atmospheres may cause fire and explosion accidents.
	The product must be powered by a stable voltage source, and the wiring shall conform to security precautions and fire prevention regulations.
	Proper ESD handling procedures must be followed throughout the mounting, handling and operation of any devices and equipment that incorporate the module to avoid ESD damages.

About the Document

Document Information	
Title	**L76_and_LC76_series_Hardware_Comparison_V1.0**
Subtitle	GNSS Module Series
Document Type	Comparison
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Revision History

Version	Date	Description
1.0	**2022-05-15**	Initial version

Contents

1 Scope

This document offers a comparison of the Quectel **L76, L76L, L76LB, LC76F** and **LC76G** GNSS modules.

2 Feature Comparison

Each of the modules present different features and correspond to different technologies. We present a brief summary of the most relevant features and characteristics of each module.

The most recent module is the LC76G, which has 2 versions. The pinning, reference design, command set and behavior is the same. Following are their differences.

LC76GAA This module uses a DC-DC converter and a low power LNA.
It's optimized for current consumption.

LC76GAB Uses an LDO and a normal power LNA inside the module.
It's a cost optimized product.

Table 1: Feature comparison

Feature		L76	L76L	L76LB	LC76F	LC76GAA/AB
Chipset		MT3333	MT3333	AG3331	GK9501	AG3352
Type GNSS Receiver		Single Band				
Constellations		GPS, QZSS, GLONASS, Galileo, BeiDou	GPS, QZSS, GLONASS, Galileo, BeiDou	GPS, QZSS, GLONASS, BeiDou	GPS, QZSS, GLONASS, Galileo, BeiDou	GPS, QZSS, GLONASS, Galileo, BeiDou
Number of concurrent Satellite Constellations		3	3	2	**3	4
SBAS		WAAS, EGNOS, MSAS, GAGAN				
Memory Type		Flash				
Current Consumption	**Condition**	GPS+GLO	GPS+GLO	GPS+GLO	GPS+GLO	G+G+G+B+Qz
	Acquisition	23mA	31mA	31mA	28mA	Tbd / 36mA
	Tracking	18mA	31mA	27mA	28mA	Tbd / 34mA
	Backup	7μA	8μA	8uA	30μA	Tbd / 13μA
Sensitivity	**Acquisition**	-148dBm	-149dBm	-149dBm	-148dBm	-147dBm***
	Reacquisition	-160dBm	-161dBm	-161dBm	-162dBm	-159dBm***
	Tracking	-165dBm	-167dBm	-167dBm	-165dBm	-165dBm***
TTFF Standalone	**Cold**	35s	32s	32s	30s	30s
	Warm	30s	30s	28s	2s	2s
	Hot	1s	2s	1s	2s	2s
TTFF AGNSS	**Cold**	15s	15s	15s	6s	15s
	Warm	5s	5s	8s	2s	2s
	Hot	1s	2s	1s	2s	2s
Extra LNA		Optional	Integrated	Integrated	Integrated	Integrated
Oscillator		Integrated	Integrated	Integrated	Integrated	Integrated
Accuracy (CEP50)		< 2.5m	< 2.5m	< 2.5m	< 2m	< 2m
Velocity Accuracy		0.1m/s	0.1m/s	0.1m/s	0.1m/s	0.1m/s
Acceleration Accuracy		0.1m/s²	0.1m/s²	0.1m/s²	0.1m/s²	0.1m/s²
Operating Temperature		-45 – 85°C	-45 – 85°C	-45 – 85°C	-40 - 85°C	-40 - 85°C
Default Baudrate		9600bps	9600bps	9600bps	9600bps	115200bps
Power Supply		2.8V - 4.3V	2.8V - 4.3V	2.8V - 4.3V	3.0V - 4.3V	2.55V – 3.6V
I/O Level*		2.8V	2.8V	2.8V(L76LB) 1.8V(L76LBL)	2.8V	VCC
Requires External Components		No				

** The I/O Voltage is 2.8V but could handle up to 3.1V. Please check the Hardware Design Guide.*

** It's suggested to use series resistors for all I/O lines.*

*** Under development*

**** The supplier is using a different test method, the performance is the same as other versions*

3 Hardware Comparison

3.1. Module View

Figure 1: Module View

The L76, L76L, L76LB, LC76F and LC76G have a compatible footprint, it's easy to replace one module for the other.
LG76G has more pins for extra features. These pins can be left non connected when replacing another module.

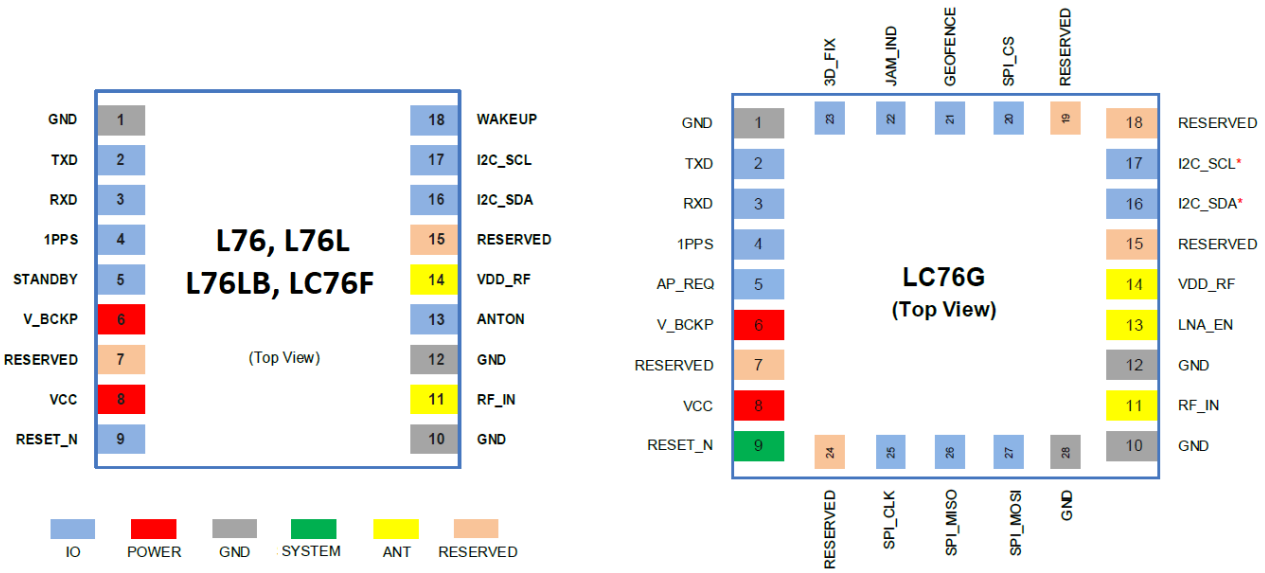


Figure 2: L76, L76L, L76LB, LC76F, LC76G Pinout

3.2. Pinning Comparison

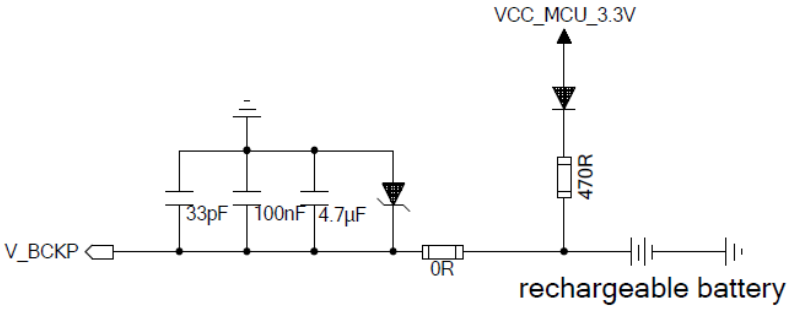
Table 2: Functional pin comparison

Pin	L76	L76L	L76LB	LC76F	LC76G
1	GND	GND	GND	GND	GND
2	TXD1	TXD1	TXD1	TXD	TXD
3	RXD1	RXD1	RXD1	RXD	RXD
4	1PPS	1PPS	1PPS	1PPS	1PPS
5	STANDBY	STANDBY	STANDBY	STANDBY	AP_REQ
6	V_BCKP	V_BCKP	V_BCKP	V_BCKP	V_BCKP
7	NC	NC	NC	NC	NC
8	VCC	VCC	VCC	VCC	VCC
9	RESET	RESET	RESET	RESET	RESET
10	GND	GND	GND	GND	GND
11	RF_IN	RF_IN	RF_IN	RF_IN	RF_IN
12	GND	GND	GND	GND	GND
13	ANTON	ANTON	ANTON	ANTON	LNA_EN
14	VCC_RF	VCC_RF	VCC_RF	VCC_RF	VCC_RF
15	NC	NC	NC	NC	NC
16	NC	I2C_SDA	I2C_SDA	I2C_SDA	I2C_SDA
17	NC	I2C_SCL	I2C_SCL	I2C_SCL	I2C_SCL
18	WAKEUP	FORCE_ON	FORCE_ON	WAKEUP	NC
19					NC
20					SPI_CS
21					GEOFENCE
22					JAM_IND
23					3D_FIX
24					NC
25					SPI_CLK
26					SPI_MISO
27					SPI_MOSI
28					GND

The LC76G has more pins for SPI communication, Geofence, Jamming and 3D_Fix indication. For details please refer to the Hardware Design Documentation.

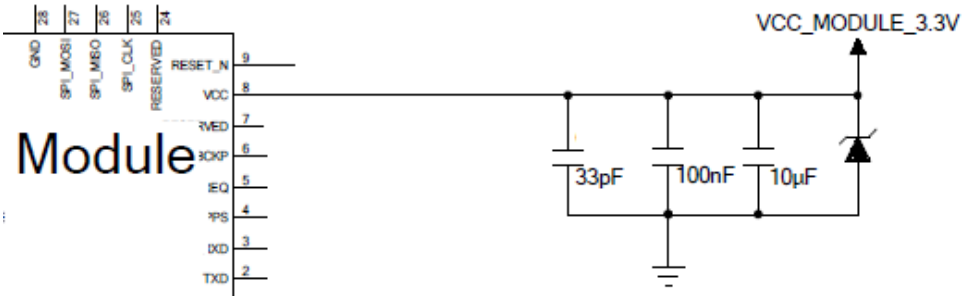
3.3. V_BCKP Power Supply

The same Backup Power Supply can be applied for all modules.
It's important that V_BCKP is applied before, or at the same time as the main voltage VCC.



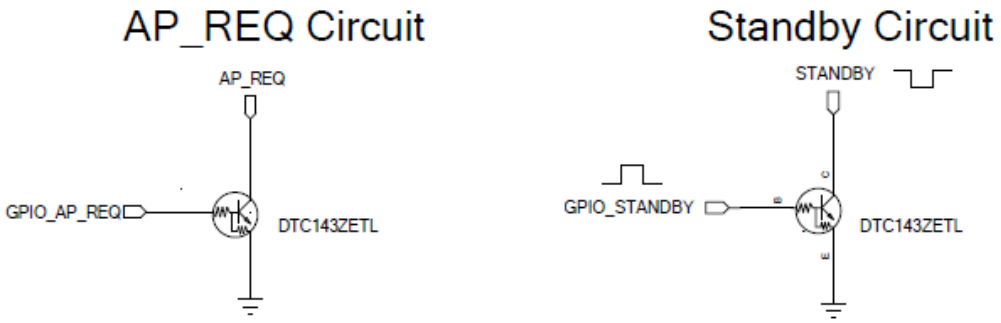
3.4. VCC Power Supply

Please apply the same filtering for all GNSS modules. The Zener will protect the module input from voltage peaks and surges. The capacitors should be placed close to the module and filter out all unwanted frequencies on the supply line.



3.5. STANDBY versus AP_REQ

STANDBY and AP_REQ are different names for the same functionality. The pin is internally pulled up so it needs an external driver circuit.
To enter STANDBY mode, the pin should be low. To exit STANDBY mode, the pin should be released.



3.6. FORCE_ON versus WAKEUP

Concerning pin 18, FORCE_ON or WAKEUP, the naming and the diagrams are different, but the functionality is exactly the same. Both wake up the modules from Backup mode, see below:

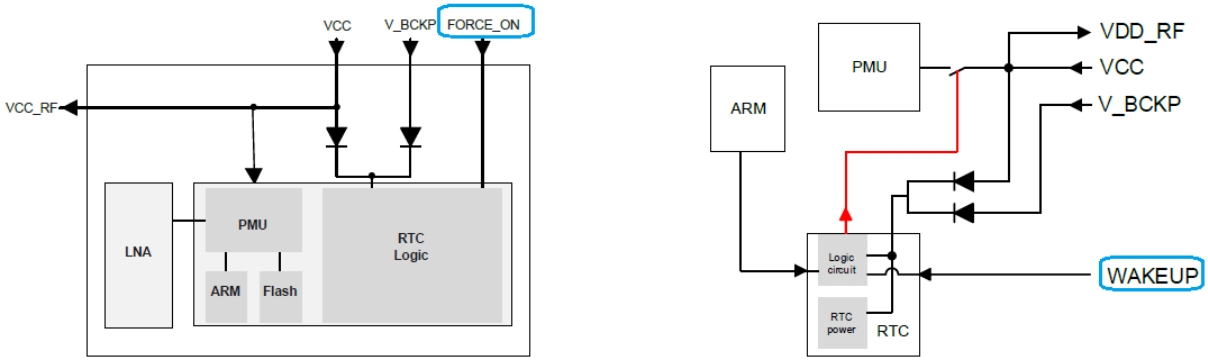


Figure 3: FORCE_ON versus WAKEUP is the same function

3.7. Mechanical Comparison

The following table presents a brief comparison of the modules. For more in-depth information please refer to the hardware documents.

Table 3: Mechanical Comparison

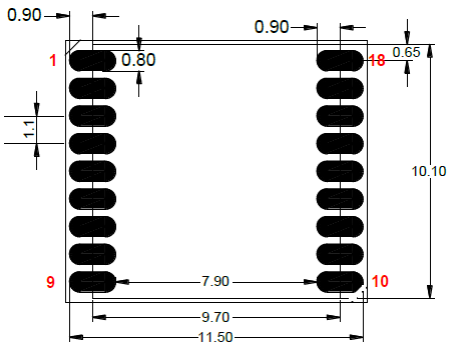
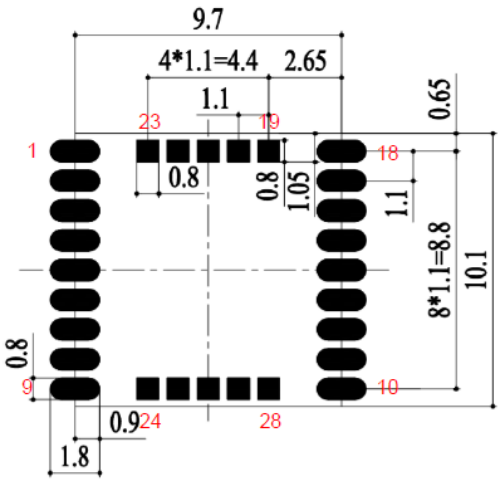
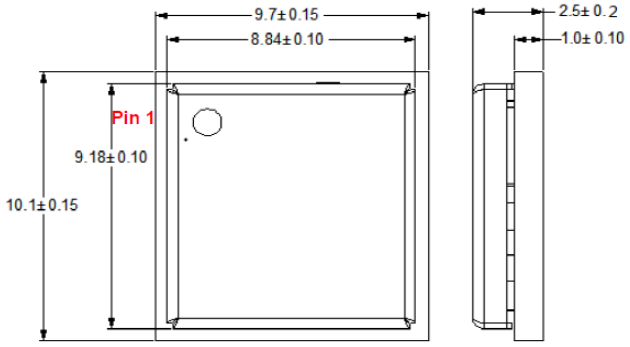
Mechanical Characteristics		
	L76 / L76L / L76LB / LC76F	**LC76G**
Footprint		
Drawing		
Length (A)	10.1mm	10.1mm
Width (B)	9.7mm	9.7mm
Height (C)	2.5mm	2.4mm

Table 4: Weight specification

	L76	**L76L**	**L76LB**	**LC76F**	**LC76G**
Weight [g]	0.6	0.6	0.5	0.5	0.5

3.8. Electrical Compatibility

From the table below, the proposed products are fully compatible for Voltage Levels.
LC76 series require a more narrow operating voltage.
LC76G has the IO's at the power supply level, which will simplify communication circuits and reduce an LDO in the BOM.

Table 5: Voltage tolerance comparison

	L76	L76L	L76LB	L76LBL*	LC76F	LC76G
VCC	2.8V - 4.3V	2.8V - 4.3V	2.8V - 4.3V	2.8V - 4.3V	3.0V - 4.3V	2.55V – 3.6V
V_BCKP	1.5V - 4.5V	1.5V - 4.5V	1.5V - 4.5V	1.5V - 4.5V	2.3V - 4.3V	1.65 V – 3.6V
RESET	**	**	**	**	**	**
RXD1	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
TXD1	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
ANTON	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
STANDBY	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
1PPS	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
FORCE_ON	2.8V	2.8V	2.8V	1.8V	2.8V	VCC
VCC_RF	VCC	VCC	VCC	VCC	VCC	VCC
SDA	n.a.	2.8V	2.8V	1.8V	2.8V	VCC
SCL	n.a.	2.8V	2.8V	1.8V	2.8V	VCC

***** *The LC76LBL version has all IO's at 1.8V*
****** *RESET_N needs an external transistor driver, it's internally pulled up.*
******* *The I/O Voltage is 2.8V but could handle up to 3.1V. Please check the Hardware Design Guide. We also suggest to use series resistors for all I/O lines.*