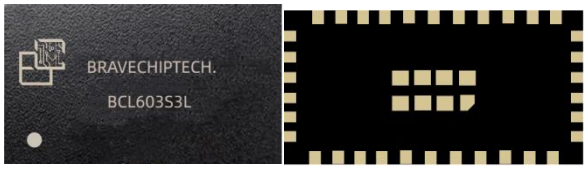
BCL603S3L Smart Ring Chiplet Datasheet



Features

- Integrates more than 20 devices such as Apollo3 blue, LDO, crystal oscillator, resistance and capacitance
- Working voltage: 1.755V~3.63V
- can provide up to 20 GPIO ports, including 2 I^2C, 3 SPI, 14bit ADC, PPG, NTC, IMU, ECG, NFC, LED and other peripherals and sensors
- supports BLE 5.2, embedded Bluetooth Low Energy stack, and GATT services
- ARM Cortex-M4 32bit with floating point computing core, the main frequency up to 96MHz
- SPOT technology, the CPU power consumption is 6uA/MHz
- 384KB SRAM, 1M ROM, of which the Bluetooth protocol stack occupies 20KB, supports various algorithms such as heart rate, blood oxygen, blood pressure, sleep, step counting, and 3DoF
- 1MB Flash. Historical data can be retained for more than 7 days. Dual-backup OTA upgrade is supported
- Transmit power: -20 DBM ~ +4dBm
- High receiving sensitivity: -94dBm
- TX RX Peak current < 3mA(0dBm)
- Ring resting current < 0.6μA
- Ring broadcast status current <50uA at 1s interval
- Ring heart rate oximetry current <1.6mA
- Ring battery life can be more than 7 days
- Operating temperature range: -40 ℃ ~85 ℃

Application

- Smart Health ring
- XR space interactive controller
- Wearable devices
- Anti-loss device
- Data transparent module
- Miniaturized Bluetooth device

Number	Package Type	Type
BCL603S3L	LGA34（4×6.8mm）	Tape/Reel

Description

BCL603S3L is a high-performance, ultra-low power dedicated chip for smart ring Chiplet. It adopts 4mm width LGA package form. Smart ring can adopt two-layer FPC design, reduce BOM quantity by 30%, ensure the yield of PCBA can reach 95% or more when bending, and provide special communication protocol and calculation

library for smart ring. Support secondary development and custom protocol development.

Revision record：

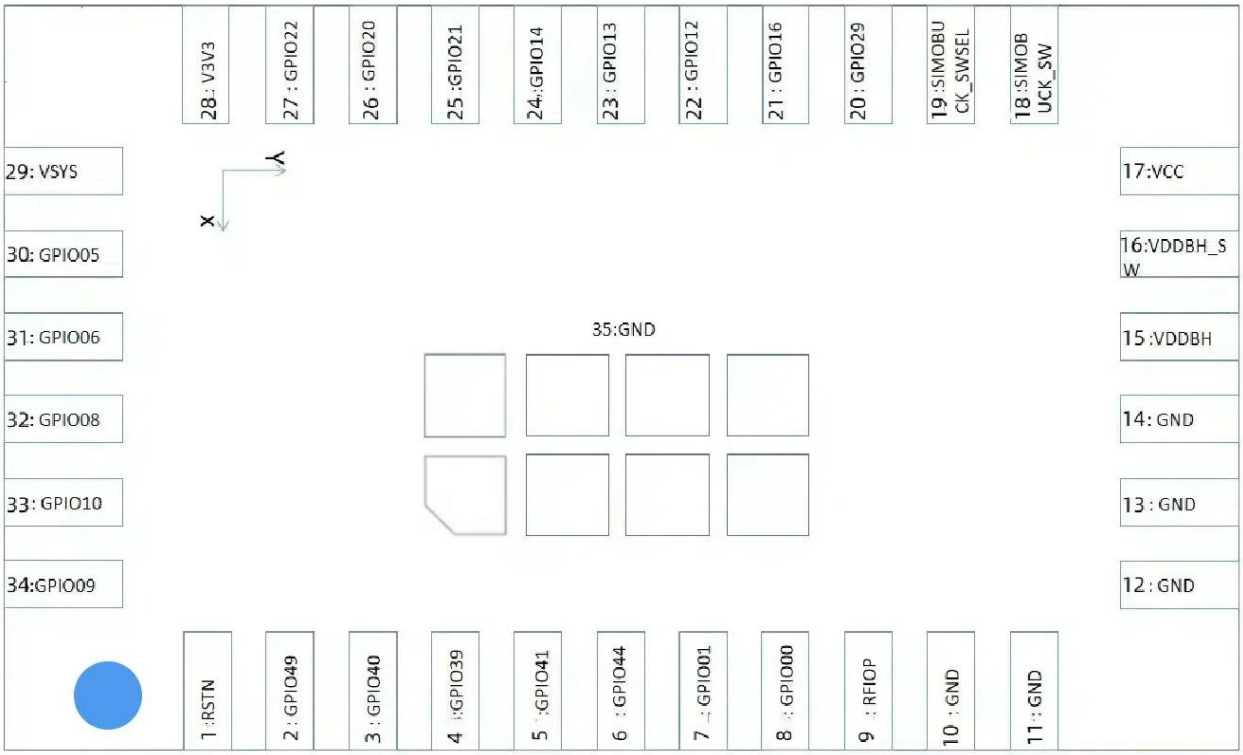
Version	Name	Date	Description
V1.0	Wenxuan Liu	2023.05.22	Original Version
V1.1	Wenxuan Liu	2023.12.28	Pin Description
V1.2	Lizhen Zou	2024.1.22	Update Pinout Diagram
V1.3	Danlei Wang	2025.04.24	Update the chip diagram, Pinout Diagram, pin definition, and typical circuit diagram

Catalogue

1、 Introduction

BCL603S3L uses Chiplet technology to integrate Apollo3 blue, LDO, crystal oscillator and critical resistance and capacitance, designed for smart ring applications, greatly reducing product size, improving production yield, and simplifying power, clock and RF design. The specific parameters of the main chip can be found in the official ambiq specification.

2、 Pin description



Pin Number	Pin Name	Type	Description
1	RSTN	I/O	External Reset Input
2	GPIO49/UART 0RX/NCE49/C T30/M5SDAW IR3/M5MISO	I/O	1. General Purpose I/O 2. UART0 Receive 3. IO Master N Chip Select 49 4. Timer/Counter Interface Signal 30 5. I2C Master 5 I/O Data SPI Master 5 3 Wire Data 6. SPI Master 5 Input Data
3	GPIO40/UART 0RX/UART1R X/TRIG0/M4S DAWIR3/M4	I/O	1. General Purpose I/O 2. UART0 Receive 3. UART1 Receive 4. ADC Trigger Input 0

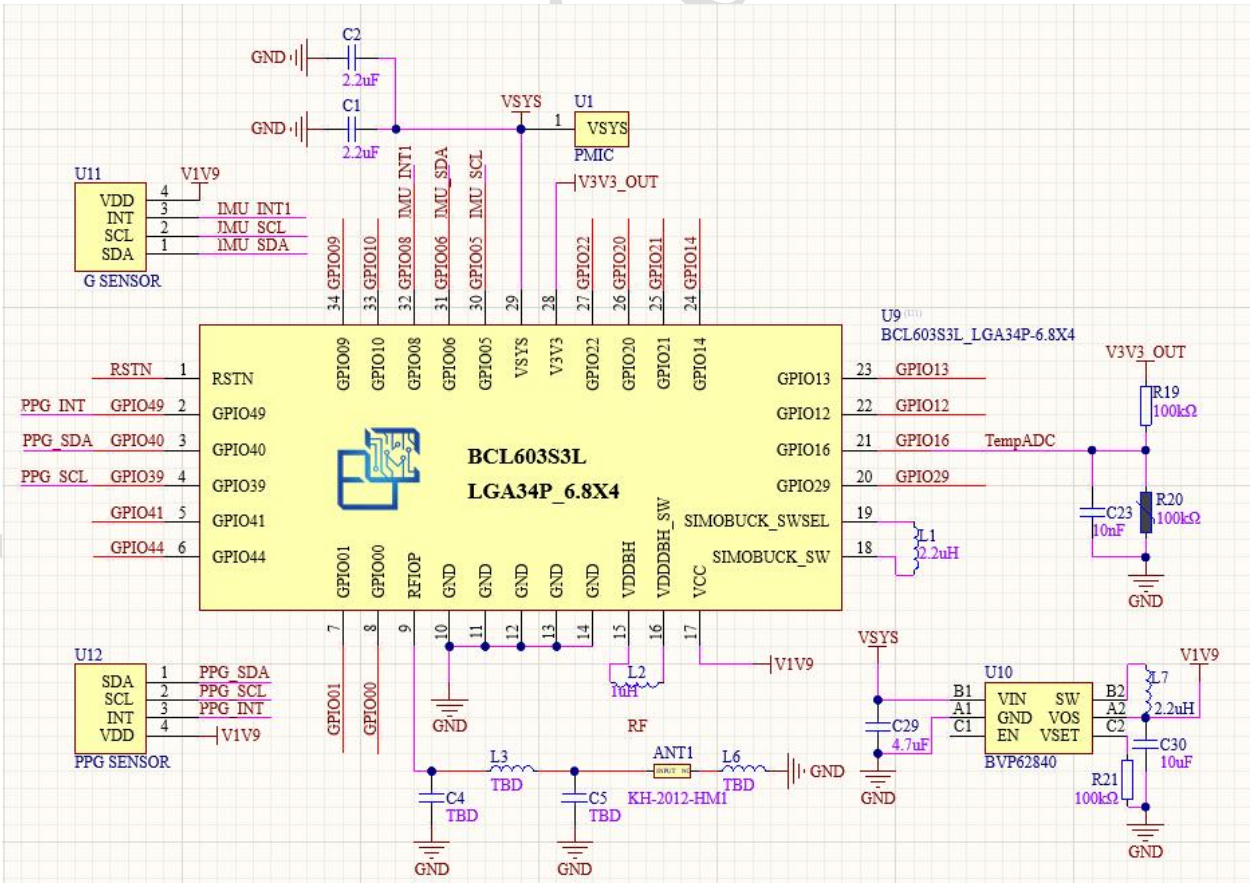
	MISO		5. I2C Master 4 I/O Data SPI Master 4 3 Wire Data 6. SPI Master 4 Data Input
4	GPIO39/UART0TX/UART1TX/CT25/M4SCL/M4SCK	I/O	1. General Purpose I/O 2. UART0 Transmit 3. UART1 Transmit 4. Timer/Counter Interface Signal 25 5. I2C Master 4 Clock 6. SPI Master 4 Clock
5	GPIO41/NCE41/BLEIF_IRQ/SWO/I2SWCLK/UA1RTS/UART0TX/UA0RTS	I/O	1. General Purpose I/O 2. IO Master N Chip Select 41 3. BLE Interface IRQ Observation 4. Serial Wire Debug Output 5. I2S Word Clock 6. UART1 Request To Send (RTS) 7. UART0 Transmit 8. UART0 Request To Send (RTS)
6	GPIO44/UA1RTS/NCE44/CT20/M4MOSI/UART0TX	I/O	1. General Purpose I/O 2. UART1 Request To Send (RTS) 3. IO Master N Chip Select 44 4. Timer/Counter Interface Signal 20 5. SPI Master 4 Output Data 6. UART0 Transmit
7	GPIO01/SLSDAWIR3/SLMOSI/UART0TX/MSPI5/NCE1	I/O	1. General Purpose I/O 2. I2C Slave I/O Data SPI Master 3 3 Wire Data 3. SPI Slave Input Data 4. UART0 Transmit 5. MSPI Master Interface Signal 5 6. IO Master N Chip Select 1
8	GPIO00/SLSCL/SLSCK/CLKOUT/MSPI4/NCE0	I/O	1. General Purpose I/O 2. I2C Slave Clock 3. SPI Slave Clock 4. Programmable Output Clock 5. MSPI Master Interface Signal 4 6. IO Master N Chip Select 0
9	RFIOP	RF	Single Ended Antenna connection end
10	GND	Ground	Ground
11	GND	Ground	Ground
12	GND	Ground	Ground
13	GND	Ground	Ground

14	GND	Ground	Ground
15	VDDBH	Power	BLE/Burst Buck Converter Voltage Output Supply
16	VDDBH_SW	Power	BLE/Burst Buck Converter Inductor Switch
17	VCC	Power	Digital Voltage Supply
18	SIMOBUCK_SW	Power	SIMO Buck Converter Inductor Switch Output
19	SIMOBUCK_SWSEL	Power	SIMO Buck Converter Inductor Switch Input
20	GPIO29/ADCSE1/NCE29/CT9/UA0CTS/UA1CTS/UART0RX/PDMDATA	I/O	1. General Purpose I/O 2. Analog to Digital Converter Single-Ended Input 1 3. IO Master N Chip Select 29 4. Timer/Counter Interface Signal 9 5. UART0 Clear To Send (CTS) 6. UART1 Clear To Send (CTS) 7. UART0 Receive 8. PDM Data
21	GPIO16/ADCSE0/NCE16/TRIG0/SCCRST/CMPIN0/UART0TX/UA1RTS	I/O	1. General Purpose I/O 2. Analog to Digital Converter Single-Ended Input 0 3. IO Master N Chip Select 16 4. ADC Trigger Input 0 5. Secure Card Controller Reset 6. Voltage Comparator Input 0 7. UART0 Transmit 8. UART1 Request To Send (RTS)
22	GPIO12/ADCD0NSE9/NCE12/CT0/PDMCLK/UA0CTS/UART1TX	I/O	1. General Purpose I/O 2. Analog to Digital Converter Differential N Input 0 / Single-Ended Input 9 3. IO Master N Chip Select 12 4. Timer/Counter Interface Signal 0 5. PDM Clock Output 6. UART0 Clear To Send (CTS) 7. UART1 Transmit
23	GPIO13/ADCD0PSE8/NCE13/CT2/I2SBCLK/UA0RTS/UART1RX	I/O	1. General Purpose I/O 2. Analog to Digital Converter Differential P Input 0 / Single-Ended Input 9 3. IO Master N Chip Select 13 4. Timer/Counter Interface Signal 2 5. I2S Bit Clock 6. UART0 Request To Send (RTS) 7. UART1 Receive

24	GPIO14/ADCD1P/NCE14/UART1TX/PDMCLK/SWDCK/32kHzXT	I/O	1. General Purpose I/O 2. Analog to Digital Converter Differential P Input 1 3. IO Master N Chip Select 14 4. UART1 Transmit 5. PDM Output Clock 6. Serial Wire Debug Clock 7. 32kHz Clock
25	GPIO21/SWDIO/NCE21/UART0RX/UART1RX/SCCRST/UA1CTS	I/O	1. General Purpose I/O 2. Software Data I/O 3. IO Master N Chip Select 21 4. UART0 Receive 5. UART1 Receive 6. Secure Card Controller Reset 7. UART1 Clear To Send (CTS)
26	GPIO20/SWDCK/NCE20/UART0TX/UART1TX/I2SBCLK/UA1RTS	I/O	1. General Purpose I/O 2. Software Debug Clock 3. IO Master N Chip Select 20 4. UART0 Transmit 5. UART1 Transmit 6. I2S Bit Clock 7. UART1 Request To Send (RTS)
27	GPIO22/UART0TX/NCE22/CT12/PDMCLK/MSPI0/SWO	I/O	1. General Purpose I/O 2. UART0 Transmit 3. IO Master N Chip Select 22 4. Timer/Counter Interface Signal 12 5. PDM Output Clock 6. MSPI Master Interface Signal 0 7. Serial Wire Debug Output
28	V3V3	Power	3.3V output of internal LDO
29	VSYS	Power	Power input of internal LDO
30	GPIO05/M0SCL/M0SCK/UA0RTS/CT8	I/O	1. General Purpose I/O 2. I2C Master 0 Clock 3. SPI Master 0 Clock 4. UART0 Request To Send (RTS) 5. Timer/Counter Interface Signal 8
31	GPIO06/M0SDAWIR3/M0MISO/UA0CTS/CT10/I2SDAT	I/O	1. General Purpose I/O 2. I2C Master 0 Data SPI Master 0 3 Wire Data 3. SPI Master 0 Input Data 4. UART0 Clear To Send (CTS) 5. Timer/Counter Interface Signal 10 6. I2S Data
32	GPIO08/M1SCL/M1SCK/NC	I/O	1. General Purpose I/O 2. I2C Master 1 Clock

	E8/SCCCLK/UART1TX		3. SPI Master 1 Clock 4. IO Master N Chip Select 8 5. Secure Card Controller Clock 6. UART1 Transmit
33	GPIO10/UART1TX/M1MOSI/NCE10/PDMCLK/UA1RTS	I/O	1. General Purpose I/O 2. UART1 Transmit 3. SPI Master 1 Output Data 4. IO Master N Chip Select 10 5. PDM Clock Output 6. UART1 Request To Send
34	GPIO09/M1SDAWIR3/M1MISO/NCE9/SCCIO/UART1RX	I/O	1. General Purpose I/O 2. I2C Master 1 Data SPI Master 1 3 Wire Data 3. SPI Master 1 Input Data 4. IO Master N Chip Select 9 5. Secure Card Controller I/O 6. UART1 Receive
35	GND	Ground	Ground

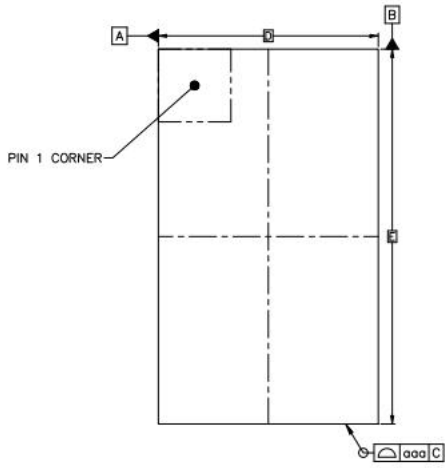
3、Typical circuit



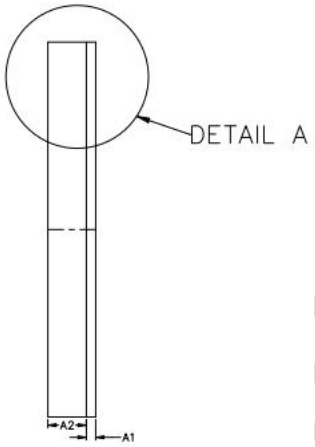
4、Electrical Characteristics

Symbol	Conditions	Min	Value	Max	Unit
Power Supply Voltage VCC	/	1.755	1.8	5.5	V
IO Voltage	/	0	1.8	3.63	V
Operating temperature	/	-40	25	80	℃
Storage temperature	/	-55	/	120	℃
Wireless modulation mode	GFSK				
Frequency range	/	2.402	/	2.480	Ghz
Number of channels	/	/	40	/	/
Air speed	/	1	/	2	Mbps
Rf port impedance	/	/	50	/	Ohm
Transmitting power	/	-20	0	+4	Dbm
Emission current	/	/	3	/	mA
Receiving current	/	/	3	/	mA
Receiving sensitivity	/	/	-94	/	dbm
Ring resting current	3.7V	/	0.6	/	uA
Ring standby current	3.7V	/	50	/	uA
Ring operating current	3.7V	/	1.6	/	mA
Ring using time	/	5	7	9	Day
Ring standby time	/	/	30	/	Day
Operating humidity	/	10%	30%	90%	/
Storage humidity	/	5%	30%	90%	/

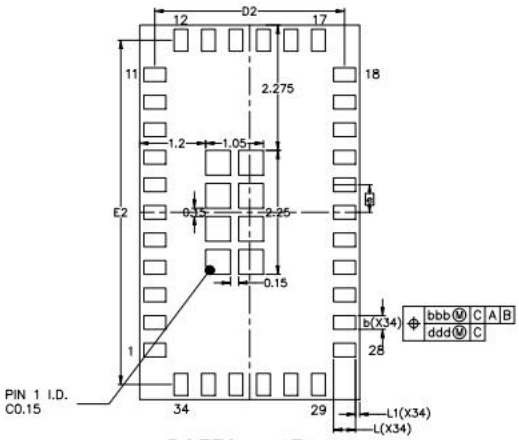
5、 Package Dimensions



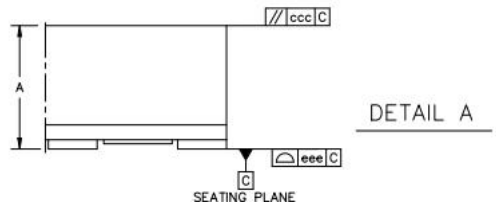
TOP VIEW



SIDE VIEW



BOTTOM VIEW



DETAIL A

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.820	0.870	0.920
MOLD CAP		A2	---	0.700	---
SUBTRATE THICKNESS		A1	0.140	0.170	0.200
LEAD WIDTH		b	0.200	0.250	0.300
BODY SIZE	X	D	3.900	4.000	4.100
	Y	E	6.700	6.800	6.900
LEAD PITCH		e	0.500		
EDGE PAD CENTER TO CENTER		D2	3.450 BSC		
		E2	6.250 BSC		
LEAD LENGTH		L	0.350	0.400	0.450
LEAD TIP TO PKG EDGE		L1	0.000	0.075	0.150
PACKAGE EDGE TOLERANCE		aaa	0.100		
MOLD FLATNESS		ccc	0.100		
COPLANARITY		eee	0.080		
LEAD OFFSET		bbb	0.100		
		ddd	0.080		