



# 深圳市维尔乐思科技有限公司

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## 产品规格书

产品名称：BLE 蓝牙芯片

产品型号：WL6601

客户：\_\_\_\_\_

确认：\_\_\_\_\_

日期：\_\_\_\_\_

# 1 General Description

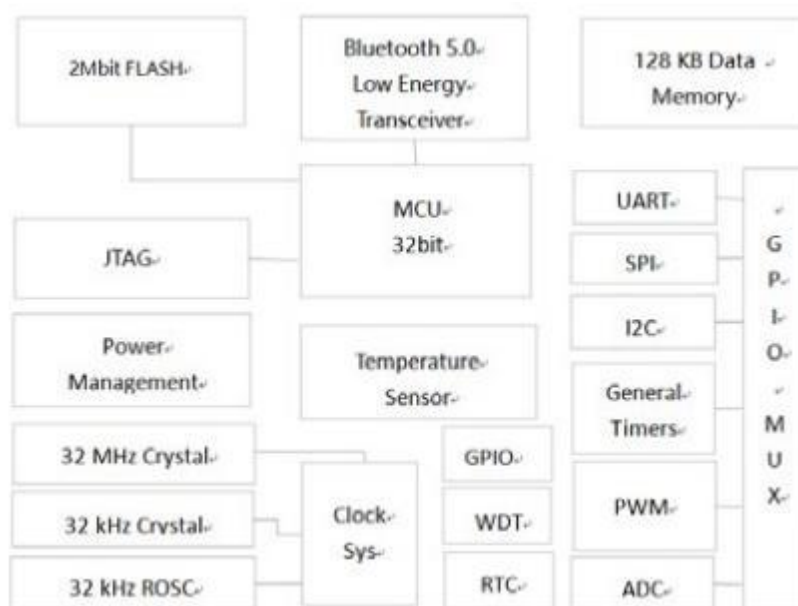
## 1.1 Overview

The WL6601 chip is a very low power, high performance and highly integrated SoC with Bluetooth 5.0 BLE transceiver. It integrates a high-performance 2.4GHz RF transceiver, rich features baseband, 32 bit MCU and various peripheral IOs. It support 1 Mbit FLASH and 128KByte RAM to enable programmable protocol and profile to support customized applications.

The WL6601 is manufactured using advanced 55nm CMOS low leakage process, which offers highest integration, lowest power consumption, lowest leakage current and reduced BOM cost while simplifying the overall system design. Rich peripherals include an 8 channel general purpose ADC, power-on-reset(POR), 3axisQ-decoder, UART/SPI/I2C and up to 9 GPIOs, which further reduce overall system cost and size.

The WL6601 operates with a power range from 1.8 to 3.3V and very low power consumption in both Tx and Rx modes, enabling long lifetimes in battery-operated systems while maintaining excellent RF performance. The device can enter an ultra low power sleep mode in which the registers and retention memory content are retained while low power oscillator and sleep timer are ON.

## 1.2 Block Diagram



## 1.3 Application

Lighting Control

Wireless Sensor Networks

3D Glassed

Proximity and Find Me

## 1.4 Features

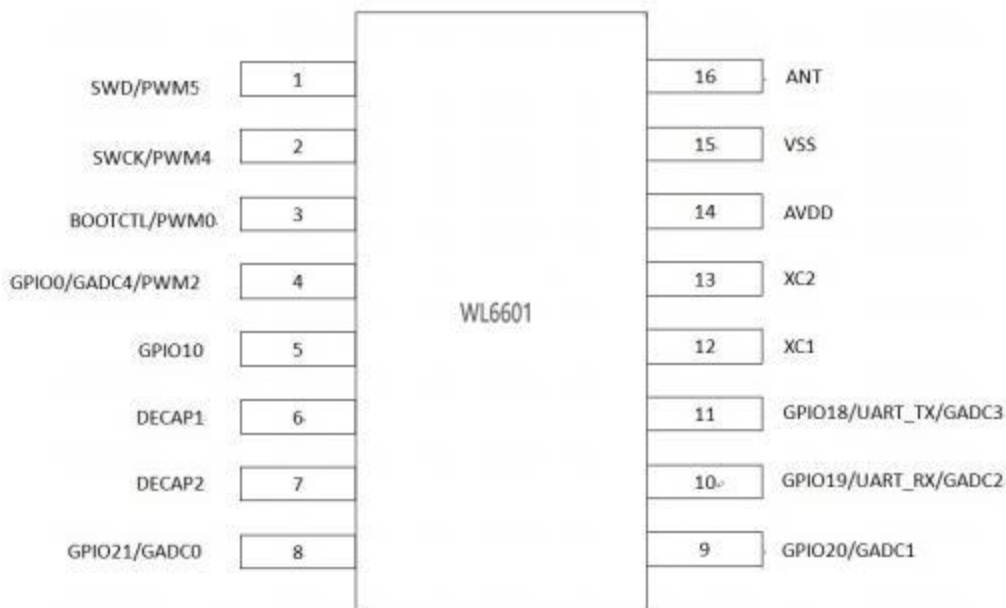
- Bluetooth 5.0 BLE RF SOC
- Operation voltage 1.8 V to 3.6 V
- -94 dBm Sensitivity@1 Mbps
- Maximum 6 dBm output power
- Low Jitter 32K RC oscillator
- 32bit MCU Integrated
- 4-wires ext.-FLASH Interface
- 128 KByte data RAM
- I2Cs, SPI and UART Interface
- 10-channel 10-bit General ADC
- PWM(max 5, 2 wi inv)
- keyscan
- 3 axis Q-decoder
- Low Power Real Time Counter
- 1 uA in Sleep Mode
- 14 uA in Suspend Mode
- 16 mA Transceiver RX Active
- 15 mA Transceiver TX Active
- SOP16

## 2 WL6601系列产品选择

产品型号	封装形式	GPIO个数	Flash容量	支持OTA	是否带5V LDO
WL6601	SOP16	9	2Mbit	yes	no

## 3 Pin Information (WL6601 SOP16)

The pin assignment for SOP16 package is shown in picture below.



NO	Name	Description
1	SWD	SWI data/ General I/O/PWM5
2	SWCK	SWI clk/ General I/O/PWM4
3	BOOTCTL	Chip boot mode control/ General I/O/PWM0(PWM0 INVERTING can mux to pin1,2,4,5,8,9,10,11)
4	GPIO0	General I/O/ PWM2
5	GPIO10	General I/O/
6	DECAP1	The output of digital LDO, 100nF decap cap
7	DECAP2	The output of digital LDO, 1uF decap cap
8	GPIO21	General I/O/GADC input0/
9	GPIO20	General I/O/GADC input1/
10	GPIO19	General I/O/GADC input2/uart_rx
11	GPIO18	General I/O/GADC input3/uart_tx
12	XC1	The input of 32M crystal oscillator
13	XC2	The output of 32M crystal oscillator
14	AVDD	3V power supply
15	VSS	GND
16	ANT	The input of RF

Note: max 5 PWM, PIN1=PWM5,PIN2=PWM4,PIN4=PWM2. PWM0,1(wi INV) can mux to PIN3,5,8,9. Can be waked up by alarm &GPIO0(pin4) in deepsleep mode. Can be waked up by sleep timer & any GPIO in sleep mode.

## 4 Electrical Specifications

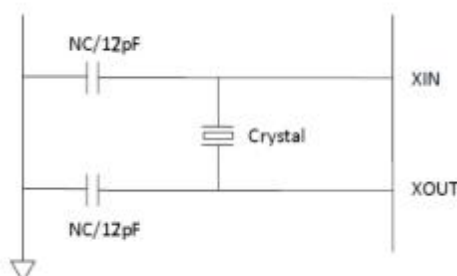
Name	Parameter(condition)	Min	Typ	Max	Unit	Com ment
<b>Power Supplies</b>						
HVIN	Voltage Input, typically 4.7uF decouple cap	3.1	5	5.5	V	(1)
HVOUT	Voltage Output, typically 1uF decouple cap, maximum 50mA load capability	2.4	2.9	3.3	V	
IQ HV	Quiescent Current of high voltage LDO		600		nA	
AVDD	Voltage Input, typically 1uF decouple cap	1.7		3.6	V	(2)
AVDD	Voltage Input, typically 1uF decouple cap	1.7		3.6	V	
AVDD	Voltage Input	1.7		3.6	V	
VDDIO	Voltage Input	1.7		3.6	V	(3)
VDD	Voltage Output, typically 100nF decouple cap	1.1	1.2	1.3	V	
VDD	Voltage Output, typically 100nF decouple cap,	1.1	1.2	1.3	V	
<b>Temperature</b>						
TEMP	Temperature	-40		+125	°C	
<b>Digital Input Pin</b>						
VIH	High Level	VIO-0.3		VIO+0.3	V	
VIL	Low Level	VSS		VSS+0.3	V	
<b>Digital Output Pin</b>						
VOH	High Level	VIO-0.3		VIO+0.3	V	
VOL	Low Level	VSS		VSS+0.3	V	
<b>Current Consumption</b>						
IVDD	Deep sleep mode (LPO, POR, alarm, I/O interrupts on), <b>can be waked up by alarm &amp; GPIO0~4</b>		1		uA	(4)
IVDD	Suspend mode (LPO, 128kB retention RAM, POR, sleep timer, I/O interrupts on), <b>can be waked up by sleep timer &amp; any GPIO</b>		14		uA	
IVDD	RX mode, BLE, 100% on(wo DCDC @3V)		16		mA	(5)
IVDD	TX mode, BLE mode, 100% on(wo DCDC @3V)		15		mA	(6)
IVDD	Average Current, 500ms sniff, hold connection			32	uA	
<b>Normal RF Condition</b>						
FOP	Operating Frequency	2400		2480	Mhz	
FXTAL	Crystal Frequency	16	32			(7)
<b>Transmitter Characteristics</b>						
PRF	RF output power	-24	0	6	dBm	
CD	Carrier Drift Rate		5		kHz/50us	
PRF1	Out of band emission 2Mhz(GFSK)		-40		dBm	

PRF2	Out of band emission 3Mhz(GFSK)		-48		dBm	
BW	20dB bandwidth		0.9		Mhz	
PRF1	Out of band emission 2Mhz ( $\pi/4$ DQPSK & 8PSK)		-30	-20		
PRF2	Out of band emission 3Mhz ( $\pi/4$ DQPSK & 8PSK)		-42	-40		
Receiver Characteristics						
<b>BT4.0 (BLE)</b>						
SEN	High Gain mode, Sensitivity @0.1%		-94		dBm	
MaxIn	Maximum Input Power		5		dBm	
C/ICO	Co-channel I C/I, Basic Rate, GFSK		7		dB	
C/I1ST	ACS C/I 1Mhz, Basic Rate, GFSK		5 5	7	dB	
C/I2ND	ACS C/I 2Mhz, Basic Rate, GFSK		-36	-34	dB	
C/I3RD	ACS C/I 3Mhz, Basic Rate, GFSK		-43		dB	
C/I1STI	ACS C/I image channel I, Basic Rate, GFSK		-34		dB	
C/I2NDI	C/I 1 MHz adjacent to image channel I, Basic Rate,		-28		dB	

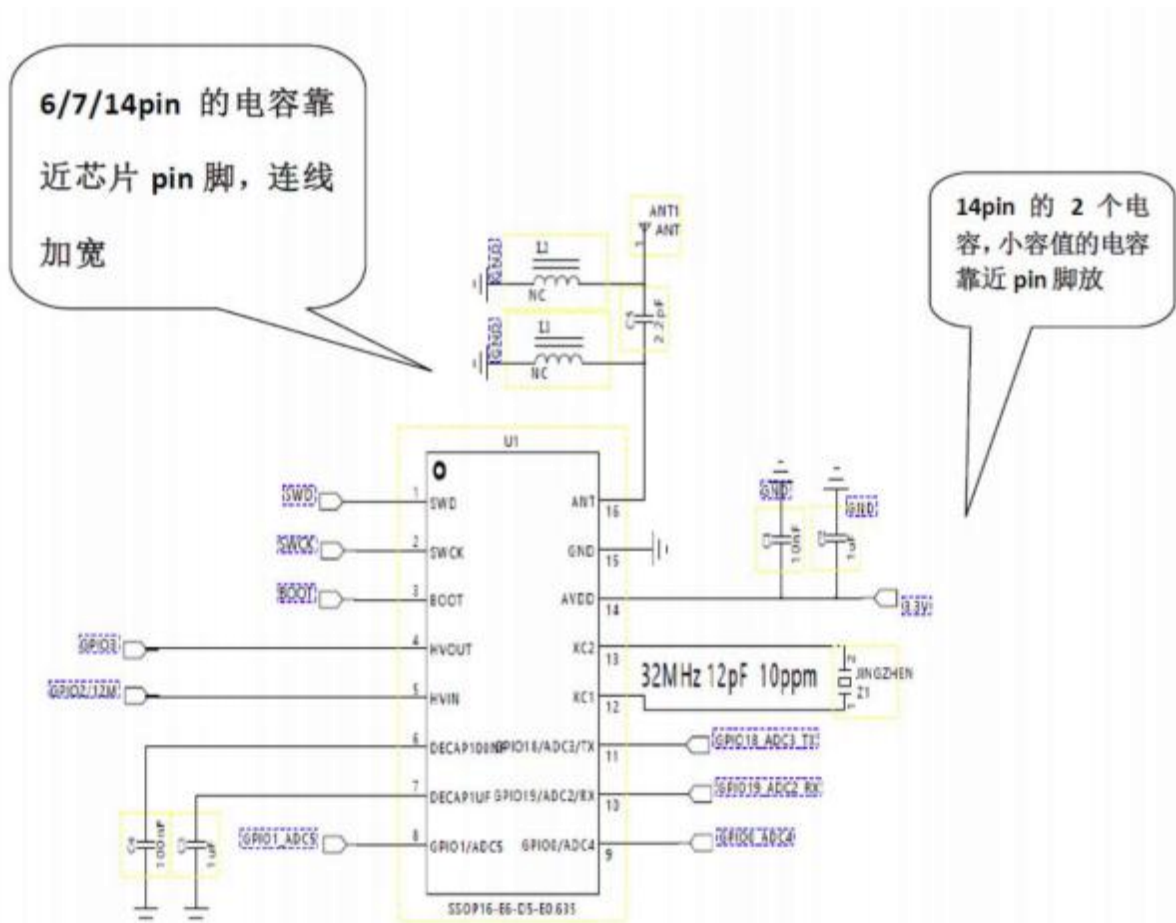
- (1) HVIN & HVOUT are input & output of a high voltage LDO which is integrated, input voltage range from 3.1~5. 5V, and maximum load capability up to 50mA. Typically used in Li\_BAT(3.0~4.2V) or USB\_ Power(4.5~3.3V) applications. If input voltage is lower than 3.6V, HVIN & HVOUT should be left unconnected and should be powered by AVDD,VDDIO directly.
- (2) If RF output power should be larger than -4dBm, AVDD should be larger than 2.4V.. (3) VDDIO should always be powered on in all working cycles..
- (4) By default, 128kB retention memory is on in retention mode, 64/96/128kB retention memory is supported. (5) Result based on standard gain mode.
- (6) Result based on 0dBm Pout.
- (7) 16M, 32M crystal supported, 32M by default.

## 5 Crystal Oscillator

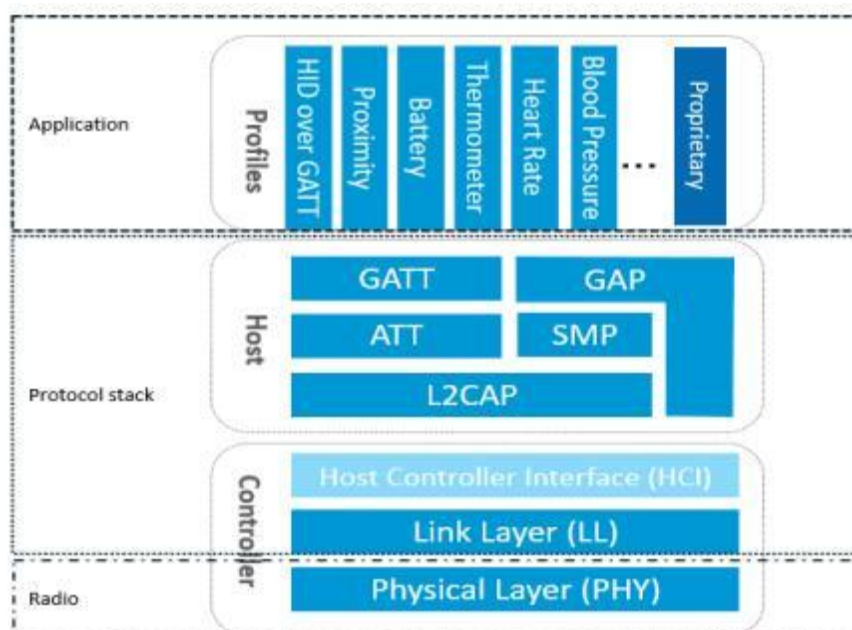
The crystal oscillator requires a crystal with an accuracy of  $\pm 40$ ppm as defined by the Bluetooth specification. Without external load capacitors are required to work with the crystal oscillator. The selection of the load capacitors is crystal dependent. The recommended crystal specification shows below



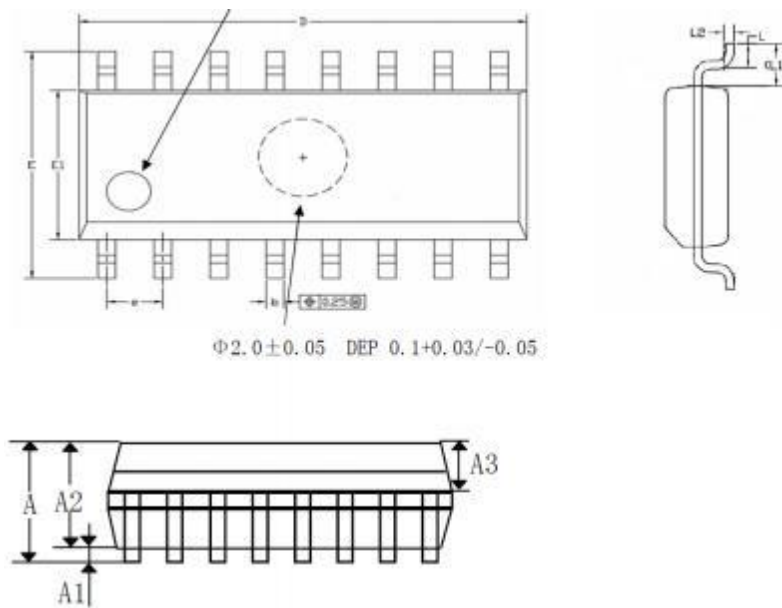
## 6 Application Schematic



## 7 Bluetooth Stack



## 8 封装外形



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.700	-	0.066
A1	0.100	0.200	0.039	0.008
A2	1.420	1.480	0.554	0.058
A3	0.620	0.680	0.242	0.027
D	9.960	10.160	3.884	0.396
E	5.900	6.100	2.301	0.238
E1	3.870	3.930	1.509	0.153
b	0.370	0.430	0.144	0.017
e	1.240	1.300	0.484	0.051
L	0.500	0.700	0.195	0.027
L1	1.050(REF)		0.041(REF)	
L2	0.250(BSC)		0.010(BSC)	

## 9 注意事项

- 本器件为静电敏感器件，在运输和使用中须使用防静电措施。
- 按推荐的典型应用使用器件。
- 在贴片时，请务必保证温度不要超过245°C。
- 建议在应用中不要采用带胶皮的弹簧天线，以保证产品更好的良率。
- 本产品说明书如有更改，恕不另行通知。