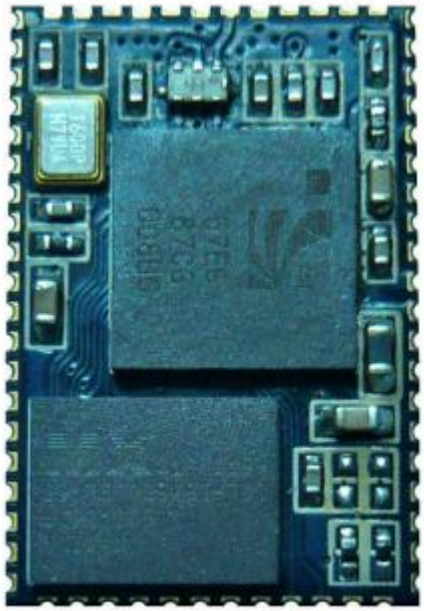
RG-BT10-05 型近距离蓝牙语音模块

一、 概述

基于 Class 2 功率等级的 RG-BT10-05 型近距离蓝牙语音模块，采用了世界上领先的蓝牙芯片供应商 CSR （ Cambridge Silicon Radio ） 公 司 的 BlueCore5-Multimedia External 蓝牙芯片，完全遵循 Bluetooth V2.1 + EDR 蓝牙规范。具有全速 USB 和 UART 主设备接口；音频接口支持 I2S、 PCM 及 SPDIF 协议；内嵌了功能强大的 Kalimba DSP 数据处理器，能实现各种数字语音处理算法，为 CVC 回音消除与 TTS 文本语音转换提供了灵活的软件运行环境 。



RG-BT10-05 型近距离蓝牙语音模块是深圳市红果电子技术有限公司专业打造的 Class 2 蓝牙精品，充分体现了公司在高频 PCB 板设计、防 EMI 电磁辐射及射频微带天线阻抗控制领域的技术优势。本产品具有收发灵敏性高、低成本、体积小、功耗低等优点。在无遮挡的情况下，同功率等级的模块点对点传输距离可达 10 米。本模块可以根据用户需求定制为 1.8V 或 3.3V 输入输出接口电平。

二、 特征

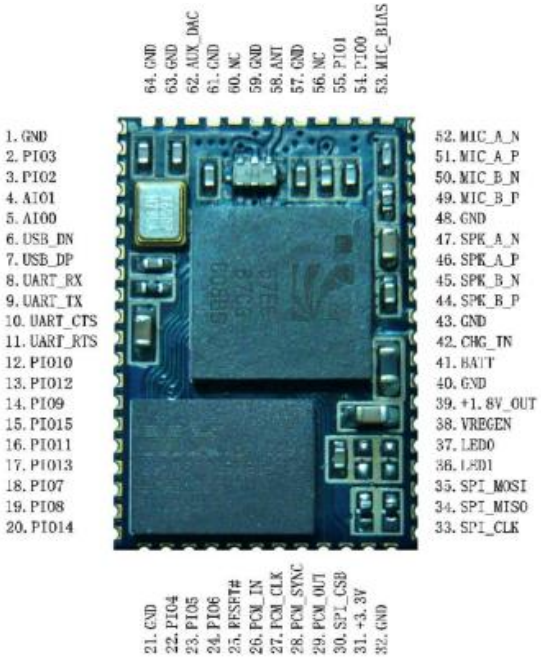
■ Fully Qualified Bluetooth v2.1 + EDR Specification System for data and voice
■ Best in Class Bluetooth Radio with 8dbm Transmit Power and -90dBm Receive Sensitivity
■ 64MIPS Kalimba DSP Co-processor
■ 16-bit Internal Stereo Codec: 95dB SNR for DAC
■ Low-power 3.3V Operation, 1.8V to 3.6V I/O
■ Integrated Battery Charger
■ Full speed (12Mbits/s) USB interface for communicating with other compatible digital device
■ UART interface with programmable baud rate，Maximum baud rate：3686400bps
■ Supports up to 32Mbit of External Flash Memory(8Mbit Typical Requirement)
■ Multi-configurable I2S, PCM or SPDIF Interface
■ Enhanced Audibility and Noise Cancellation
■ Support for IEEE 802.11 Coexistence
■ Green (RoHS Compliant and no Antimony orHalogenated Flame Retardants)
■ Full Speed Bluetooth Operation with Full Piconet
■ Standard HCI(UART or USB)
■ With Audio Out & Audio in

■ 工业级设计
■ 安全认证、数据加密
■ 支持 USB 和 UART 主机接
■ 支持多通道语音输入、
■ 支持 SPI 编程接口
■ 支持 DFU 软件升级
■ 支持连接 7 个蓝牙从设备
■ 最高可内置 Flash 存储容量：32Mbit
■ 同功率等级点对点传输距离可达 10 多米
■ 支持低耗模式: Park, Sniff, Hold 和 Deep Sleep
■ 支持 A2DP、AVRCP、PBAP、DUN、FTP、HSP、HFP1.0、HFP1.5、HID、OPP、PAN、SPP 等多种蓝牙应用规范。

三、 应用领域

■ 高品质单声道、立体声蓝牙无线耳机
■ 高品质蓝牙音频传输
■ 高品质的蓝牙音箱
■ 蓝牙对讲
■ 蓝牙车载免提
■ VoIP 蓝牙音频传输
■ Skype 蓝牙网络电话
■ 模拟音频和 USB 多媒体适配器
■ 蓝牙汽车无线网关
■ 蓝牙 mp3 播放器
■ 蓝牙局域网接入与拨号网络
■ 。。。

四、 管脚分布



五、 管脚描述

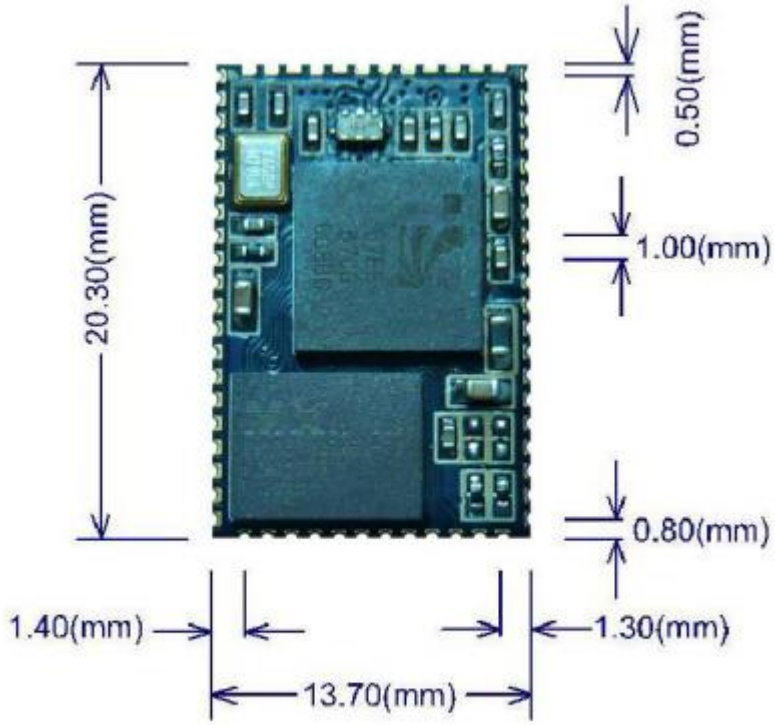
管脚序号	名称	类型	描述
1	GND	VSS	Ground
2	PIO3	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
3	PIO2	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
4	AIO1	Bi-directional	Analogue programmable input/output line
5	AIO0	Bi-directional	Analogue programmable input/output line
6	USB_DN	Bi-directional	USB data minus
7	USB_DP	Bi-directional	USB data plus with selectable internal 1.5k pull-up resistor
8	UART_RX	CMOS input with weak internal pull-down	UART data input
9	UART_TX	Bi-directional CMOS output, tri-state, with weak internal pull-up	UART data output
10	UART_CTS	CMOS input with weak internal pull-down	UART clear to send active low
11	UART_RTS	Bi-directional CMOS output, tri-state, with weak internal pull-up	UART request to send active low
12	PIO10	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
13	PIO12	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
14	PIO9	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line

15	PIO15	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
16	PIO11	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
17	PIO13	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
18	PIO7	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
19	PIO8	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
20	PIO14	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
21	GND	VSS	Ground
22	PIO4	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
23	PIO5	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
24	PIO6	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
25	RESET#	CMOS input with weak internal pull-up	Reset if low. Input debounced so must be low for >5ms to cause a reset
26	PCM_IN	CMOS input, with weak internal pull-down	PCM data input
27	PCM_CLK	Bi-directional with weak internal pull-down	PCM data clock
28	PCM_SYNC	Bi-directional with weak internal pull-down	PCM data sync
29	PCM_OUT	CMOS output, tri-state, with weak internal pull-down	PCM data output
30	SPI_CSB	Input with weak internal pull-up	Chip select for SPI, active low

31	VDD	Supply Power	VDD supply with On-chip Input within 3.0～3.3V
32	GND	VSS	Ground
33	SPI_CLK	Input with weak internal pull-down	SPI clock
34	SPI_MISO	CMOS output, tri-state, with weak internal pull-down	SPI data output
35	SPI_MOSI	CMOS input, with weak internal pull-down	SPI data input
36	LED1	Open drain output	LED driver
37	LED0	Open drain output	LED driver
38	VREGEN	Analogue	Take high to enable high-voltage linear regulator and switch-mode Regulator、both low-voltage regulator and audio low-voltage regulator
39	1.8V_OUT	Supply Power	1.8V (+) supply with On-chip output within 1.7～1.9V
40	GND	VSS	Ground
41	VBATT	Battery terminal +	Lithium ion/polymer battery positive terminal.
42	CHG_IN	Charger input	Lithium ion/polymer battery charger input
43	GND	VSS	Ground
44	SPK_B_P	Analogue	Speaker output positive, right
45	SPK_B_N	Analogue	Speaker output negative, right
46	SPK_A_P	Analogue	Speaker output positive, left
47	SPK_A_N	Analogue	Speaker output negative, left
48	GND	VSS	Ground
49	MIC_B_P	Analogue	Microphone input positive, right
50	MIC_B_N	Analogue	Microphone input negative, right
51	MIC_A_P	Analogue	Microphone input positive, left
52	MIC_A_N	Analogue	Microphone input negative, left
53	MIC_BIAS	Analogue	Microphone bias
54	PIO0	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
55	PIO1	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line

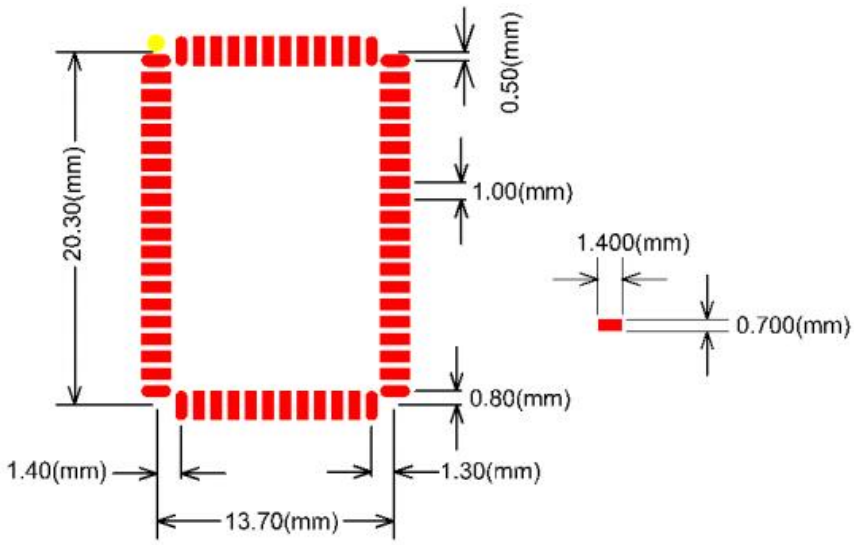
56	NC	——	Leave unconnected
57	GND	VSS	Ground
58	RF_ANT	Analogue	RF In/Out
59	GND	VSS	Ground
60	NC	——	Leave unconnected
61	GND	VSS	Ground
62	AUX_DAC	Analogue	8-bit voltage-output DAC
63	GND	VSS	Ground
64	GND	VSS	Ground

六、 外型尺寸



（模块厚度：2mm）

七、 PCB 封装



警示： 蓝牙模组粘贴区域内 PCB 顶层尽量不要走线或铺铜(建议加铺丝印油)； 模组底部射频测试点区域 PCB 顶层严禁走线或铺铜；外接天线周围应尽可能远离金属物， PCB 板各层不得在天线（PCB 布线天线或陶瓷贴片天线）区域走线、铺铜，电源层和电源参考层也不得穿过此区域。通常将天线靠近 PCB 板边沿安放。

八、 电气特性

1、最大绝对额定值：

项 目	最 小	最 大	单 位
存储温度	-40	+150	℃
电流峰值	0	50	mA
I/O电压	-0.4	3.6	V
VBATT	-0.4	4.4	V
CHG_IN	-0.4	6.5	V
VREGEN	-0.4	4.9	V
LED0、LED1	-0.4	4.4	V
电源电压（VDD）	-0.4	3.6	V

2、推荐使用条件：

操作条件	最小	正常	最大	单位
工作温度	-20	20	+85	℃
RF性能保证温度	-20	20	+85	℃
电源电压（VDD）	0	+3.3	+3.6	V
VREGEN	0	+3.3	+4.2	V
CHG_IN	0	+5.0	+6.5	V
VBATT	0	+3.3~+4.2	+4.4	V
其它端口电压	VSS-0.4	-	VDD+0.4	V

3、**+1.8V_OUT稳压输出：**

操作条件	最小	典型	最大	单位
Normal Operation				
Output voltage (I_{load} = 100mA)	1.70	1.80	1.95	V
Temperature coefficient	-300	0	300	ppm/°C
Maximum output current	200	-	-	mA
Minimum load current	5	-	-	μA
Drop-out voltage (I_{load} = 200mA)	-	-	900	mV
Quiescent current (excluding load, I_{load} < 1mA)	30	50	60	μA
Low-power Mode (1)				
Quiescent current (excluding load, I_{load} < 100μA)	11	15	21	μA

(1) The regulator is in low power mode when the chip is in deep sleep mode, or in reset.

4、**电池充电：**

充 电	最小	典型	最大	单位
CHG_IN：输入电压	4.5		6.5	V

充电模式 (VBATT rising to 4.2V)		最小	典型	最大	单位
Supply current（a）		-	4.5	6	mA
Battery trickle charge current (b) (c)	Maximum setting (I-CTRL = 15)		14		mA
	Minimum setting (I-CTRL = 0)		4		mA
Maximum battery fast charge current (I-CTRL = 15)(c)(d)	Headroom(e)> 0.7V		140		mA
	Headroom =		120		mA
Minimum battery fast charge current (I-CTRL = 0)	Headroom> 0.7V		40		mA
	Headroom =		35		mA
Fast charge step size (I-CTRL = 0 to 15)	Spread ±17%		6.3		mA
Trickle charge voltage threshold			2.9		V
Float voltage (with correct trim value set), VFLOAT (f)		4.17	4.2	4.23	V
Float voltage trim step size(f)			50		mV
Battery charge termination current, % of fast charge		5	10	20	%

(a).Current into CHG_IN does not include current delivered to battery (ICHG_IN – IVBATT)
(b).VBATT < Float voltage
(c).Charge current can be set in 16 equally spaced steps.
(d).Trickle charge threshold < VBATT < Float voltage
(e).Where headroom = CHG_IN - VBATT
(f).Float voltage can be adjusted in 15 steps. Trim setting is determined in production test and must be loaded into the battery charger by firmware during boot-up sequence

待机模式(VBATT falling from 4.2V)	最小	典型	最大	单位
Supply current(a)		1.5	2	mA
Battery current	-	-5	-	μA
Battery recharge hysteresis(b)		-	200	mV

(a).Current into CHG_IN - does not include current delivered to battery (ICHG_IN – IVBATT)
(b).Hysteresis of (VFLOAT - VBATT) for charging to restart

关断模式(CHG_IN too low or disabled by firmware)		最小	典型	最大	单位
Supply current			1.5	2	mA
Battery current		-1	-	0	μA
CHG_IN under-voltage threshold	CHG_IN rising	-	3.9	-	V
	CHG_IN falling	-	3.7	-	V
CHG_IN - VBATT lockout threshold	CHG_IN rising	-	0.2	-	V
	CHG_IN falling	-	0.1	-	V

5、输入/输出端口特性（数字）

数字端口	最小	典型	最大	单位
Input Voltage Levels				
V_{IL} input logic level low	-0.3	-	0.25 x VDD	V
V_{IH} input logic level high	0.625 x VDD	-	VDD + 0.3	V
VSCHMITT Schmitt voltage	0.25 x VDD	-	0.625 x VDD	V
Output Voltage Levels				
V_{OL} output logic level low, (I_O = 4.0mA)	-	-	0.125	V
V_{OH} output logic level high, (I_O = -4.0mA)	0.75 x VDD	-	VDD	V
Input and Tri-state Current with				
Ii input leakage current at Vin = VDD or 0V	-100	0	100	nA
Ioz tri-state output leakage current at Vo = VDD or 0V	-100	0	100	nA
With strong pull-up	-100	-40	-10	μA
With strong pull-down	10	40	100	μA
With weak pull-up	-5	-1.0	-0.2	μA
With weak pull-down	-0.2	1.0	5.0	μA
C_I Input Capacitance	1.0	-	5.0	pF

抗负载能力	最小	典型	最大	单位
Rpuw weak pull-up strength at VDD - 0.2V	0.5	-	2	MΩ
Rpdw weak pull-down strength at 0.2V	0.5	-	2	MΩ
Rpus strong pull-up strength at VDD - 0.2V	10	-	50	KΩ
Rpds strong pull-down strength at 0.2V	10	-	50	KΩ

6、**输入/输出端口特性**（LED）

LED Driver Pads		最小	典型	最大	单位
Off current		-	1	2	μA
On resistance		-	20	33	Ω
On resistance, pad enabled by battery charger		-	20	50	Ω

7、**输入/输出端口特性**（USB）

USB端口	最小	典型	最大	单位
VDD_USB for correct USB operation （VDD_USB equal to VDD）	3.1		3.6	V
Input Threshold				
V_{IL} input logic level low	-	-	0.3VDD_USB	V
V_{IH} input logic level high	0.7VDD_USB	-	-	V
Input Leakage Current				
VSS < VIN < VDD_USB(a)	-1	1	5	μA
C_I Input capacitance	2.5	-	10.0	pF
Output Voltage Levels to Correctly Terminated USB Cable				
V_{OL} output logic level low	0.0	-	0.2	V
V_{OH} output logic level high	2.8	-	VDD_USB	V

（a）Internal USB pull-up disabled

8、**输入/输出端口特性**（Auxilliary ADC）

Auxiliary ADC		最小	典型	最大	单位
Resolution		-	-	10	Bits
Input voltage range(a) (LSB size = VDD_ANA/1023)		0	-	VDD_ANA	V
Accuracy	INL	-1	-	1	LSB
(Guaranteed monotonic)	DNL	0	-	1	LSB
Offset		-1	-	1	LSB
Gain Error		-0.8	-	0.8	%
Input Bandwidth		-	100	-	kHz
Conversion time		-	2.5	-	s
Sample rate(b)		-	-	700	Samples/s

(a) VDD_ANA = +1.5V（Internal voltage regulation）

(b) ADC is accessed through the VM function. The sample rate given is achieved as part of this function

9、**输入/输出端口特性**（Auxiliary DAC）

Auxiliary DAC	最小	典型	最大	单位
Resolution	-	-	8	Bits
Average output step size(a)	12.5	14.5	17.0	mV
Output Voltage		monotonic(a)		
Voltage range (IO = 0mA)	VSS	-	VDD	V
Current range	-10.0	-	0.1	mA
Minimum output voltage (IO=100μA)	0.0	-	0.2	V
Maximum output voltage (IO=10mA)	VDD -0.3	-	VDD	V
High Impedance leakage current	-1	-	1	μA
Offset	**-220**	-	120	mV
Integral non-linearity(a)	**-2**	-	2	LSB
Settling time (50pF load)	-	-	10	μs

(a) Specified for an output voltage between 0.2V and VDD - 0.2V. Output is high impedance when chip is in Deep Sleep mode.

10、**立体声编解码器** (模数转换器)

参数	条件		最小	典型	最大	单位
Resolution			-	-	16	Bits
Input Sample Rate, Fsample			8	-	44.1	kHz
Signal to Noise Ratio, SNR(a)	fin = 1kHz B/W = 20Hz→20kHz A-Weighted THD+N < 1% 150mVpk-pk input	Fsample				
		8kHz	-	79	-	dB
		11.025kHz	-	77	-	dB
		16kHz	-	76	-	dB
		22.050kHz	-	76	-	dB
		32kHz	-	75	-	dB
		44.1kHz	-	75	-	dB
Digital Gain	Digital Gain Resolution = 1/32dB		-24	-	21.5	dB
Analogue Gain	Analogue Gain Resolution = 3dB		-	-	42	dB
Input full scale at maximum gain (differential)			-	4	-	mV rms
Input full scale at minimum gain (differential)			-	800	-	mV rms
3dB Bandwidth			-	20	-	kHz
Microphone mode input impedance			-	6.0	-	Ω
THD+N (microphone input) @ 30mV rms input			-	0.04	-	%

(a) Improved SNR performance can be achieved at the expense of current consumption. See Optimising BlueCore5-Multimedia ADC Performance Application Note for details.

11、**立体声编解码器** (数模转换器)

参数	条件		最小	典型	最大	单位
Resolution			-	-	16	Bits
Input Sample Rate, Fsample			8	-	48	kHz
Signal to Noise Ratio, SNR	fin = 1kHz B/W = 20Hz→ 20kHz A-Weighted THD+N < 0.01% 0dBFS signal Load = 100kΩ	Fsample				
		8kHz	-	95	-	dB
		11.025kHz	-	95	-	dB
		16kHz	-	95	-	dB
		22.050kHz	-	95	-	dB
		32kHz	-	95	-	dB
		44.1kHz	-	95	-	dB
Digital Gain	Digital Gain Resolution = 1/32dB		-24	-	21.5	dB
Analogue Gain	Analogue Gain Resolution = 3dB		0	-	-21	dB
Output voltage full-scale swing (differential)(a)			-	750	-	mV rms
Allowed Load		Resistive	16(8)	-	O.C.	Ω
		Capacitive	-	-	500	pF
THD+N 100kΩ load			-	-	0.01	%
THD+N 16Ω load			-	-	0.1	%
SNR (Load = 16Ω, 0dBFS input relative to digital silence)			-	95	-	dB

(a) Any combination of gain (digital and / or analogue) and input signal which results in the output signal level exceeding the minimum or maximum signal level (analogue or digital) could result in distortion.

12、**功耗**

角色	条件	音频数据包类型	说明	电流		Unit
				16MHz Operation	32MHz Operation	
-	Stand-by	-	Host connection	0.06	0.07	mA
-	Page Scan	-	Interval = 1280ms	0.45	0.5	mA
-	Inquiry and Page Scan	-	Inquiry scan = 1280ms Page scan = 1280ms	0.84	0.88	mA
Master	ACL	-	No traffic	4.4	4.4	mA
Master	ACL	-	File transfer TX	9.1	9.2	mA
Master	ACL	-	Sniff = 40ms	1.8	1.9	mA
Master	ACL	-	Sniff = 1280ms	0.19	0.2	mA
Master	eSCO	EV3	-	22	23	mA
Master	eSCO	EV3	Setting S1	24	24	mA
Master	eSCO	2 EV3	Setting S2	22	22	mA
Master	eSCO	2 EV3	Setting S3	17	17	mA
Master	eSCO	EV5	-	16	17	mA
Master	eSCO	HV1	-	40	42	mA

Master	eSCO	HV3	-	22	23	mA
Master	eSCO	HV3	Sniff = 30ms	21	22	mA
Slave	ACL	-	No Traffic	15	15	mA
Slave	ACL	-	File transfer Rx	21	21	mA
Slave	ACL	-	Sniff = 40ms	1.6	1.7	mA
Slave	ACL	-	Sniff = 1280ms	0.26	0.26	mA
Slave	eSCO	EV3	-	25	26	mA
Slave	eSCO	EV3	Setting S1	27	27	mA
Slave	eSCO	2 EV3	Setting S2	27	28	mA
Slave	eSCO	2 EV3	Setting S3	24	25	mA
Slave	eSCO	EV5	-	22	22	mA
Slave	SCO	HV1	-	39	42	mA
Slave	SCO	HV2	-	26	28	mA
Slave	SCO	HV3	Sniff = 30ms	22	22	mA

12、**Kalimba DSP典型**

DSP		平均值	单位
DSP core (including PM memory access)	Minimum (NOP)	0.11	mA/MIPS
	Maximum (MAC)	0.32	mA/MIPS
DSP memory access (DM1 or DM2)		0.08	mA/MIPS

13、**典型峰值电流**（Temperature = +20°C）

Device Activity/State	电流	单位
Peak current during cold boot	45	m A
Peak TX current Master	45	m A
Peak RX current Master	45	m A
Peak TX current Slave	45	m A
Peak RX current Slave	45	m A

九、 射频特性

1、 Transmitter - Basic Data Rate

Radio Characteristics Temperature = +20°C					
	Min	Typ	Max	Bluetooth Specification	Unit
Maximum RF transmit power(1)(2)	-	4	-	-6 to +4(3)	dBm
Variation in RF power over temperature range with compensation enabled (±)(4)	-	2	-	-	dB
Variation in RF power over temperature range with compensation disabled (±)(4)	-	3	-	-	dB
RF power control range	-	35	-	≥16	dB
RF power range control resolution (5)	-	0.5	-	-	dB

Notes:

(1) BlueCore5-Multimedia External firmware maintains the transmit power to be within the Bluetooth specification v2.0+EDR limits.

(2) Measurement made using a PSKEY_LC_MAX_TX_POWER setting corresponds to a PSKEY_LC_POWER_TABLE power table entry of 63.

(3) Class 2 RF transmit power range, Bluetooth v2.0+ EDR specification.

(4) To some extent these parameters are dependent on the matching circuit used, and its behaviour over temperature. Therefore these parameters may be beyond CSR's direct control.

(5) Resolution guaranteed over the range -5dB to -25dB relative to maximum power for TX Level >20.

2、Transmitter - Enhanced Data Rate

Radio Characteristics Temperature = +20C					
	Min	Typ	Max	Bluetooth Specification	Unit
Maximum RF transmit power(1)	-	+2	-	-6 to +4(2)	dBm
Relative transmit power (3)	-	0.2	-	-4 to +1	dB
EDR Differential Phase Encoding	-	-	-	-	%

Notes:

(1) BlueCore5-Multimedia External firmware maintains the transmit power to be within the Bluetooth v2.0 + EDR specification limits

(2) Class 2 RF transmit power range, Bluetooth v2.0 + EDR specification.

(3) Measurements methods are in accordance with the EDR RF Test Specification v2.0.E.2.

3、Receiver – Basic Data Rate

Radio Characteristics Temperature = +20°C						
	Frequency (GHz)	Min	Typ	Max	Bluetooth Specification	Unit
Sensitivity at 0.1% BER for all packet types	2.402	-	-85.5	-	≤-70	dBm
	2.441	-	-85.5	-		
	2.480	-	-86.5	-		
Maximum received signal at 0.1% BER		-	≥-10	-	≥-20	dBm

4、Receiver –Enhanced Data Rate

Radio Characteristics Temperature = +20°C						
	Modulation	Min	Typ	Max	Bluetooth Specification	Unit
Sensitivity at 0.01% BER(1)	π/4 DQPSK	-	-79	-	≤-70	dBm
	8DPSK	-	-85	-	≤-70	dBm
Maximum received signal at 0.1% BER(1)	π/4 DQPSK	-	>-10	-	≥-20	dBm
	8DPSK	-	>-10	-	≥-20	dBm

(1) Measurements methods are in accordance with the EDR RF Test Specification v2.0.E.2