



NRK330x 语音识别芯片

(NRK3301/NRK3302)

数据手册

Version Number	Reverse Date	Remark
1.0	2020.12.21	第一版本
1.1	2021.03.01	纠正部分硬件参数



目录

一、概述.....	3
二、特征.....	3
三、芯片引脚描述.....	5
四、芯片引脚描述.....	8
五、芯片封装尺寸.....	11





一、概述

NRK330X 系列语音识别芯片是广州市九芯电子有限公司推出的一款32位高性能、低成本语音识别IC,其具有具有识别精准、远场降噪等优势，最多可支持不超过100条离线指令，现已广泛用于智能家电、智能卫浴、智能照明、智能机电、智能家居、智能玩具 等领域。

二、特征

内核和存储

- 高性能 32 位 RISC 内核，主频 240MHz，支持硬件浮点运算
- 内置 1MB SPI FLASH

AI 算法

- 离线语音识别，采用最新的神经网络（TDNN）算法，具有识别精准，误判率低等优势，5米远场可靠识别
- 语音降噪算法：过滤掉稳态噪声、对动态噪声也有很好的抑制作用，噪音下也可准确识别
- 音频解码：
 - ◆ 支持 MP3, WAV, WMA, APE, FLAC, AAC, MP4, M4A, AIF, AIFC 音频解码
 - ◆ BT 支持 SBC, AAC 音频解码音频
 - ◆ BT 电话支持 mSBC 语音编解码器

音频

- 两通道 16 位 DAC, SNR >= 95dB
- 单通道 16 位 ADC, SNR >= 90dB
- 采样率支持 8KHz / 11.025KHz / 16KHz / 22.05KHz / 24KHz / 32KHz / 44.1KHz / 48KHz
- 三通道立体声模拟 MUX
 - ◆ DAC 支持直推式，单端或者差分输出

电源

- VBAT 为 2.2V 至 5.5V
- VDDIO 为 2.2V 至 3.6V

蓝牙

- 符合蓝牙 V5.1 + BR + EDR + BLE 规范
- 满足 Class1 class2 和 class3 传输功耗需求
- 支持 GFSK 和 $\pi/4$ DQPSK 所有包装类型
- 提供+ 6dbm 发射功率
- 具有-90dBm 灵敏度的接收器



- 快速 AGC 可增强动态范围
- 支持 a2dp \ avctp \ avdtp \ avrcp \ hfp \ spp \ smp \ att \ gap \ gatt \ rfcmm \ sdp \ l2ca 配置文件

外设

- 一个全速 USB 2.0 OTG 控制器
- 一个 I2S 数字音频接口，支持主机和从机模式
- 四个多功能 16 位定时器，支持捕获和 PWM 模式
- 三个用于电机的 16 位 PWM 驱动发生器
- 三个全双工基本 UART，UART0 和 UART1 支持 DMA 模式
- 两个 SPI 接口支持主机和设备模式
- 一个 SD 卡主机控制器
- 一个硬件 IIC 接口支持主机和从机模式
- 内置 Cap Sense Key 控制器
- 10 位 ADC 用于模拟采样
- 所有 GPIO 上的外部唤醒/中断

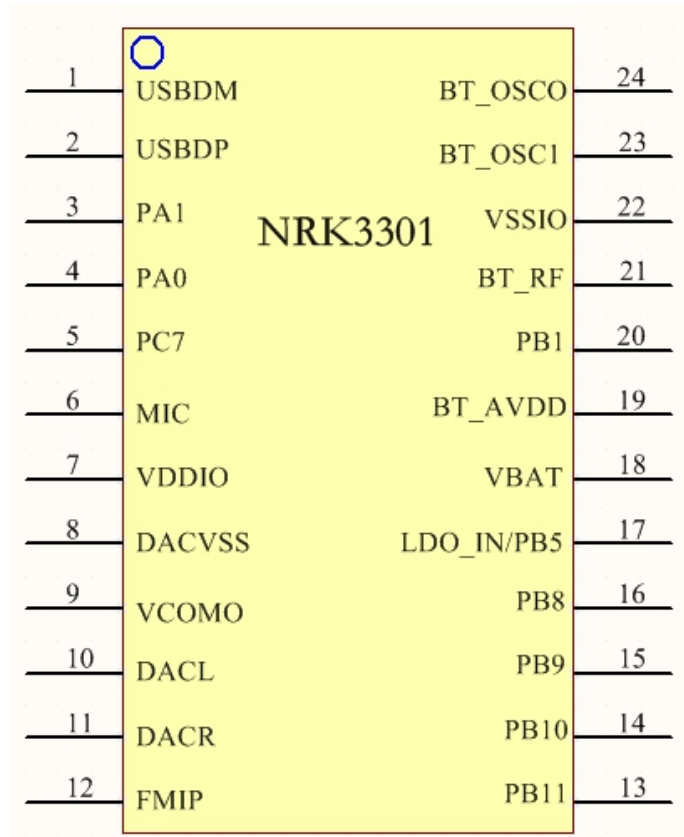
封装和工作温度

- QSOP24
- 工作温度：-40°C to +85°C
- 储存温度：-65°C 至+ 150°C



三、芯片引脚描述 (注: NRK3301和NRK3302仅引脚封装不同)

1. NRK3301



NRK3301引脚图

NRK3301芯片引脚类型说明:

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	USBDM	I/O	4	USB Negative Data (pull down)	UART1RXD: Uart1 Data In(D); SPI2DOB: SPI2 Data Out(B); IIC_SDA_A: IIC SDA(A);
2	USBDP	I/O	4	USB Positive Data (pull down)	UART1TXD: Uart1 Data Out(D); SPI2CLKB: SPI2 Clock(B); IIC_SCL_A: IIC SCL(A); ADC12: ADC Input Channel 12;
3	PA1	I/O	8/24	GPIO	AMUX0R: Analog Channel0 Right; Touch1: Touch Input Channel 1; ADC0: ADC Input Channel 0; UART1RXC: Uart1 Data In(C); PWMCH0L: Motor PWM Channel0(L);



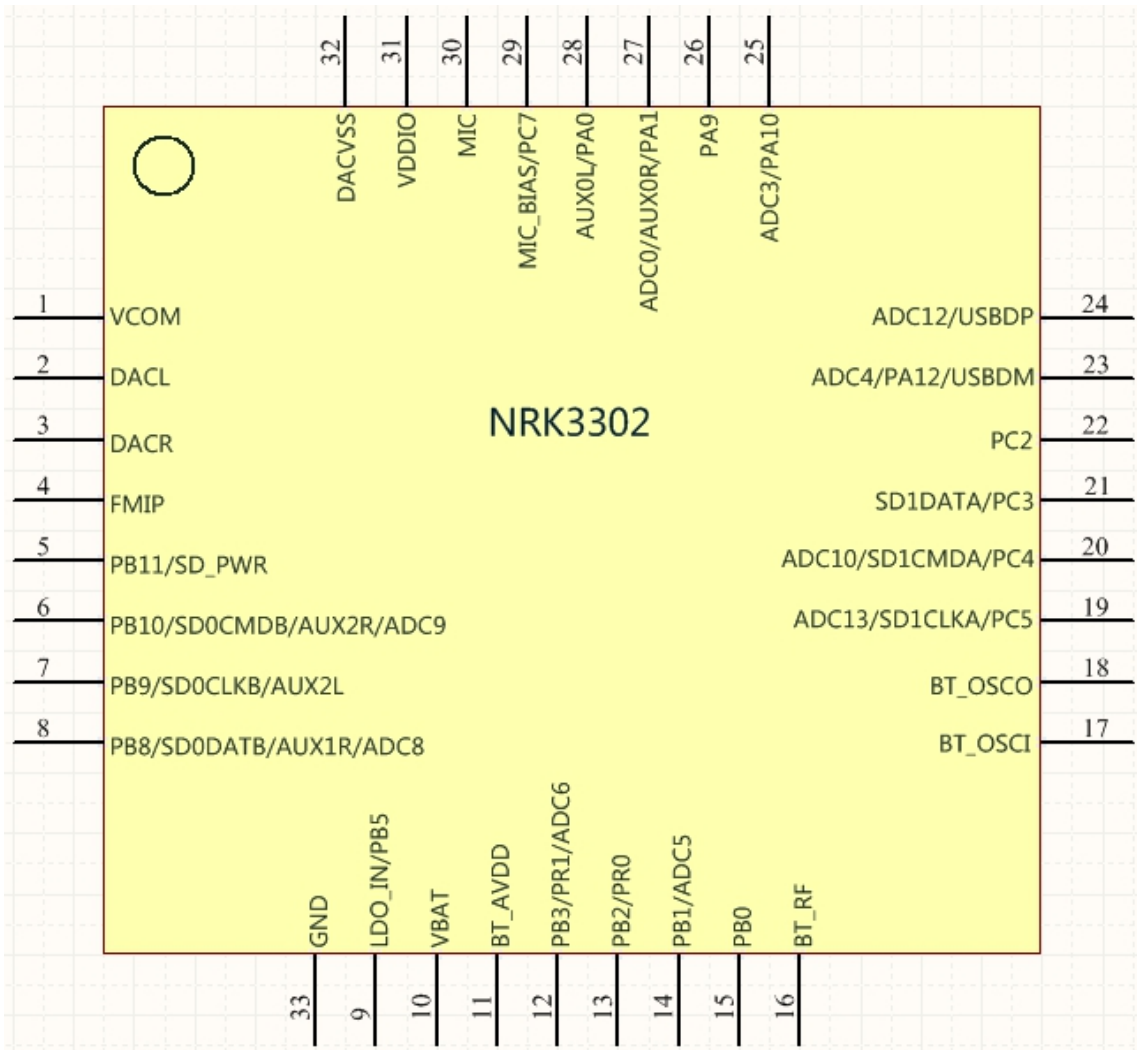
4	PA0	I/O	8/24	GPIO	AMUX0L: Analog Channel0 Left; Touch0: Touch Input Channel 0; CLKOUT0: UART1TXC: Uart1 Data Out(C); PWMCH0H: Motor PWM Channel0(H);
5	PC7	I/O	/	GPIO	MIC_BIAS: Microphone Bias Output
6	MIC	I	/		MIC: MIC Input Channel;
7	VDDIO	P	/		IO Power 3.3v
8	DACVSS	P	/		DAC Ground
9	VCOM	P	/	DAC Reference Output	
10	DACL	O	/		DAC Left Channel
11	DACR	O	/		DAC Right Channel
12	FMIP	I	/		FM Single Input
13	PB11	I/O	/	GPIO	SDPG:SDC Power Gate; Interface Out
14	PB10	I/O	8/24	GPIO	AMUX2R: Analog Channel2 Right; SD0CMB: SD0 Command(B); SPI2DOA: SPI2 Data Out(A); ADC9: ADC Input Channel 9; UART2RXC: Uart2 Data In(C); PWMCH3L: Motor PWM Channel3(L);
15	PB9	I/O	8/24	GPIO	AMUX2L: Analog Channel2 Left; SD0 Clock(B); SPI2CLKA: SPI2 Clk(A); CAP0: Timer0 Capture; UART2TXC: Uart2 Data Out(C); PWMCH3H: Motor PWM Channel3(H);
16	PB8	I/O	8/24	GPIO	AMUX1R: Analog Channel1 Right; SD0DAT0B: SD0 Data0(B); SPI2_DIA: SPI2 Data In(A); ADC8: ADC Input Channel 8; CLKOUT1: Clk Out1;



17	LDO_IN	P	/	Charge Power 5v	
	PB5	I/O	8	GPIO (High Voltage Resistance)	PWM3: Timer3 PWM Output; CAP1: Timer1 Capture; UART0TXC: Uart0 Data Out(C); UART0RXC: Uart0 Data In(C);
18	VBAT	P	/		Power Supply
19	BT_AVD D	P	/		BT Power
20	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset; SPI1DOA: SPI1 Data Out(A); ADC5: ADC Input Channel 5; TMR2: Timer2 Clock Input; UART1RXA: Uart1 Data In(A);
21	BT_RF	/	/		BT Antenna
22	VSSIO	P	/		Ground
23	BT_OSCI	I	/	OSC In	
24	BT_OSC O	O	/	OSC Out	



2. NRK3302



NRK3302引脚图

NRK3301芯片引脚类型说明:

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	VCOM	P	/		DAC Reference
2	DACL	O	/		DAC Left Channel
3	DACR	O	/		DAC Right Channel
4	FMIP	I	/		FM Single Input
5	PB11	I/O	/	GPIO	SDPG:SDC Power Gate;
6	PB10	I/O	8/24	GPIO	AMUX2R: Analog Channel2 Right; SPI2DOA: SPI2 Data Out(A); ADC9: ADC Input Channel 9; UART2RXC: Uart2 Data In(C); PWMCH3L: Motor PWM Channel3(L);



7	PB9	I/O	8/24	GPIO	AMUX2L: Analog Channel2 Left; SPI2CLKA: SPI2 Clk(A); CAP0: Timer0 Capture; UART2TXC: Uart2 Data Out(C); PWMCH3H: Motor PWM Channel3(H);
8	PB8	I/O	8/24	GPIO	AMUX1R: Analog Channel1 Right; SPI2_DIA: SPI2 Data In(A); ADC8: ADC Input Channel 8; CLKOUT1: Clk Out1; Battery Charge Input
9	LDO_IN	P	/		
	PB5	I/O	8	GPIO (High Voltage Resistance)	PWM3: Timer3 PWM Output; CAP1: Timer1 Capture; UART0TXC: Uart0 Data Out(C); UART0RXC: Uart0 Data In(C);
10	VBAT	P	/		Power Supply
11	BT_AVDD	P	/		BT Power
12	PB3	I/O	8/24	GPIO	PWM2: Timer2 PWM Output; ADC6: ADC Input Channel 6;
13	PB2	I/O	8	GPIO (High Voltage Resistance)	SPI1DIA: SPI1 Data In(A); PWMCH1L: Motor PWM Channel1 (L);
14	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset; SPI1DOA: SPI1 Data Out(A); ADC5: ADC Input Channel 5; TMR2: Timer2 Clock Input; UART1RXA: Uart1 Data In(A);
15	PB0	I/O	8	GPIO (High Voltage Resistance)	SPI1CLKA: SPI1 Clock(A); UART1TXA: Uart1 Data Out(A); PWMCH1H: Motor PWM Channel1(H);
16	BT_RF	/	/		BT Antenna
17	BT_OSCI	I	/	OSC In	
18	BT_OSCO	O	/	OSC Out	
19	PC5	I/O	8/24	GPIO	SD1CLKA: SD1 Clock(A); SPI1DOB: SPI1 Data Out(B); UART2RXD: Uart2 Data In(D); IIC_SDA_B: IIC SDA(B); ADC13: ADC Input Channel 13; PWMCH5L: Motor PWM Channel5(L);
20	PC4	I/O	8/24	GPIO	SD1CMDA: SD1 Command(A); SPI1CLKB: SPI1 Clock(B); UART2TXD: Uart2 Data Out(D); IIC_SCL_B: IIC SCL(B); ADC10: ADC Input Channel 10; PWMCH5H: Motor PWM Channel5(H);



21	PC3	I/O	8/24	GPIO	SD1DAT0A: SD1 Data0(A); SPI1DIB: SPI1 Data In(B);
22	PC2	I/O	8/24	GPIO	SD1DAT1A: SD1 Data1(A); ALNK1_DAT0: Touch12: Touch Input Channel 12;
23	USBDM	I/O	4	USB Negative Data (pull down)	UART1RXD: Uart1 Data In(D); IIC_SDA_A: IIC SDA(A);
24	USBDP	I/O	4	USB Positive Data (pull down)	UART1TXD: Uart1 Data Out(D); IIC_SCL_A: IIC SCL(A); ADC12: ADC Input Channel 12;
25	PA10	I/O	8/24	GPIO	SD0CLKA: SD0 Clock(A); ADC3: ADC Input Channel 3; TMR1: Timer1 Clock Input; Touch9: Touch Input Channel 9; UART2RXB: Uart2 Data In(B); PWMCH4L: Motor PWM Channel4(L);
26	PA9	I/O	8/24	GPIO	SD0CMA: SD0 Command(A); Touch8: Touch Input Channel 8; UART2TXB: Uart2 Data Out(B); PWMCH4H: Motor PWM Channel4(H)
27	PA1	I/O	8/24	GPIO	AMUX0R: Analog Channel0 Right; Touch1: Touch Input Channel 1; ADC0: ADC Input Channel 0; UART1RXC: Uart1 Data In(C); PWMCH0L: Motor PWM Channel0(L);
28	PA0	I/O	8/24	GPIO	AMUX0L: Analog Channel0 Left; Touch0: Touch Input Channel 0; CLKOUT0: UART1TXC: Uart1 Data Out(C); PWMCH0H: Motor PWM Channel0(H);
29	PC7	I/O	/	GPIO	MIC_BIAS: Microphone Bias Output
30	MIC	I	/		MIC: MIC Input Channel;
31	VDDIO	P	/		IO Power 3.3v
32	DACVSS	P	/		DAC Ground



四、芯片电气特性

Absolute Maximum Ratings

参数	标识	最小	最大	单位
Tamb	Ambient Temperature	-40	+85	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	4.5	V
LDO_IN	Charger Voltage	-0.3	6	V
V _{3.3IO}	3.3V IO Input Voltage	-0.3	3.6	V

PMU Characteristics

符号	含义	最小	典型	最大	单位	测试条件
VBAT	Voltage Input	2.2	3.7	5.5	V	
LDO_IN	Charger Voltage	4.5	5.0	5.5	V	
V _{3.3}	Voltage output	2.2	3.0	3.4	V	VBAT = 4.2V, 100mA loading
V _{BT_AVDD}	Voltage output	1.2	1.25	1.35	V	VBAT = 4.2V, 100mA loading
V _{DACVDD}	DAC Voltage		2.7		V	VBAT = 4.2V, 100mA loading
I _{L3.3}	Loading current			150	mA	VBAT = 4.2V

IO Input/Output Electrical Logical Characteristics

IO input characteristics						
符号	含义	最小	典型	最大	单位	测试条件
V _{IL}	Low-Level Input Voltage	-0.3		0.3* VDDIO	V	VDDIO = 3.3V
V _{IH}	High-Level Input Voltage	0.7* VDDIO		VDDIO+0.3	V	VDDIO = 3.3V
IO output characteristics						
V _{oL}	Low-Level output Voltage			0.33	V	VDDIO = 3.3V
V _{oH}	High-Level output Voltage	2.7			V	VDDIO = 3.3V



Internal Resistor Characteristics

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment	
PA0、PA1 PB1 PB8~PB10	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、PB5 can pull-up resistance to 5V 4、internal pull-up/pull-down resistance accuracy $\pm 20\%$	
PB11 PC7	Output 0	8mA	24mA	10K		10K
	Output 1	8mA	64mA			
PB5	8mA		10K	10K		
USBDM	4mA		1.5K	15K		
USBDM	4mA		180K	15K		

BT Characteristics

Transmitter

Basic Data Rate

参数	最小	典型	最大	单位	测试条件
RF Transmit Power		4	6	dBm	
RF Power Control Range		20		dB	
20dB Bandwidth		950		KHz	25°C, Power Supply VBAT=5V 2441MHz
	+2MHz	-40		dBm	
Adjacent Channel	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

Enhanced Data Rate

参数	最小	典型	最大	单位	测试条件
Relative Power		-1		dB	25°C, Power Supply VBAT=5V 2441MHz
$\pi/4$ DQPSK	DEVM RMS	6		%	
	DEVM 99%	10		%	
Modulation Accuracy	DEVM Peak	15		%	
	+2MHz	-40		dBm	
Adjacent Channel	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	
	-3MHz	-35		dBm	



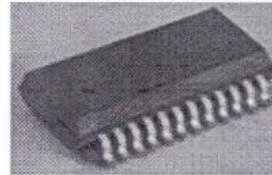
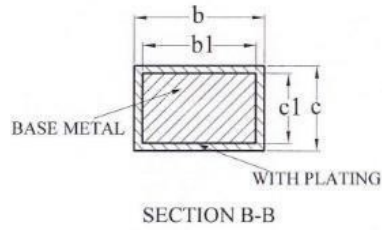
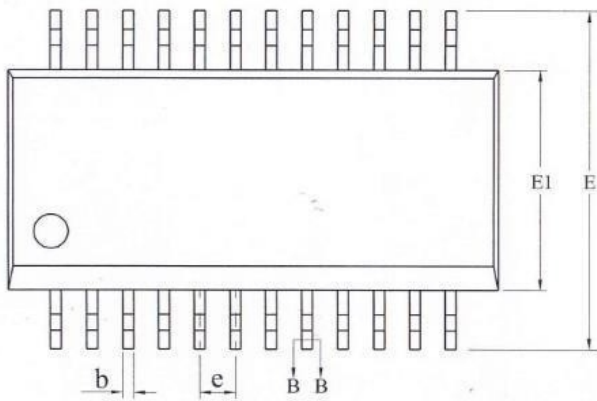
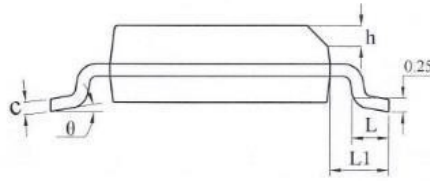
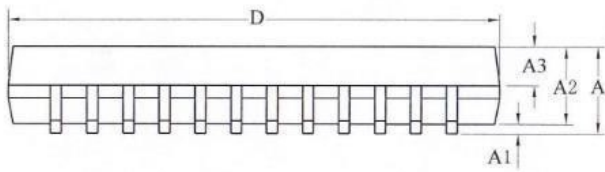
Receiver

Basic Data Rate and Enhanced Data Rate

参数	最小	典型	最大	单位	测试条件
Sensitivity		-90		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection		-13		dB	
Adjacent Channel Transmit Power	+1MHz	+5		dB	
	-1MHz	+2		dB	
	+2MHz	+37		dB	
	-2MHz	+36		dB	
	+3MHz	+40		dB	
	-3MHz	+35		dB	



五、芯片封装尺寸



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	0.15	0.25
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.23	—	0.31
b1	0.22	0.25	0.28
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	8.55	8.65	8.75
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	0.635BSC		
h	0.30	—	0.50
L	0.50	—	0.80
L1	1.05REF		
theta	0	—	8°

封装形式和尺寸