NRK220X系列语音识别芯片
（NRK2201/NRK2202）

数据手册

Version Number	Reverse Date	Remark
1.0	2020 .05.19	第一版本

目 录

1 .概述

NRK220X系列语音识别芯片是广州九芯电子科技最新推出的一款适合工厂量产型的工业级语音识别芯片。

NRK220X 系列语音识别芯片专用于语音处理的人工智能芯片， 可广泛应用于家电、家居、照明、音箱、玩具、穿戴设备、汽车等产品领域， 实现语音交互及控制。

NRK220X支持本地大词汇量语音识别和声纹识别， 和内置的CPU核结合可以做各类智能语音方案应用。NRK220X内置高性能低功耗Audio Codec 模块和硬件音频处理模块， 可以外接麦克风实现单芯片远场降噪和回声消除等功能。同时该芯片还集成多路UART、I2C、SPI、PWM、GPIO 等外围控制接口， 可以开发低成本的单芯片智能语音离线识别方案。

NRK220X系列语音识别芯片中的NRK2201无内置DRAM,根据用户需求结合SPI flash，可最高支持80条词条识别，NRK2202内置8M DRAM,可最高支持300条词条的识别，NRK2202可通过内置的高速UART 接口对接WIFI、蓝牙等无线模块， 实现离在线语音识别方案。产品基本功能可通过离线语音实现控制， 内容和服务可通过在线实现，NRK2202方案可无缝连接本地智能与云端智能， 在满足云端应用的前提下， 又能解决网络不稳、延迟、断网影响用户体验和纯云端交互无法保障用户隐私安全等痛点。

2 .功能特点

1 .生产周期快， 最快仅需一天， 下单无最小量限制
2 .支持几十至几百条词条的识别
3 .IO 口丰富， 内置MCU，可以定制各种特殊功能
4 .工作电压范围：2.97-3.63V
5.32 位高主频CPU
6 .支持6 路PWM接口
7.3路UART 接口， 最高可支持3M波特率
8.2路I2C 接口
9.1路通用SPI 接口
10.1路QSPI 接口
11 .内置4 通道12bit SAR ADC
12 .支持外接晶体或有源晶振
13 .内置PLL
14 .内置上电及欠压复位电路
15 .神经网络运算DNN 处理器内核
16 .本地语音识别
17 .硬件VAD 语音检测和中断唤醒

8 . 支持单麦远场降噪、单麦回声消除

3 . 选型指南

型号	词条	封装	离在线支持
NRK2201	80	QFN56	离线
NRK2202	300	QFN56	在线或离线

4 . 引脚图和功能描述

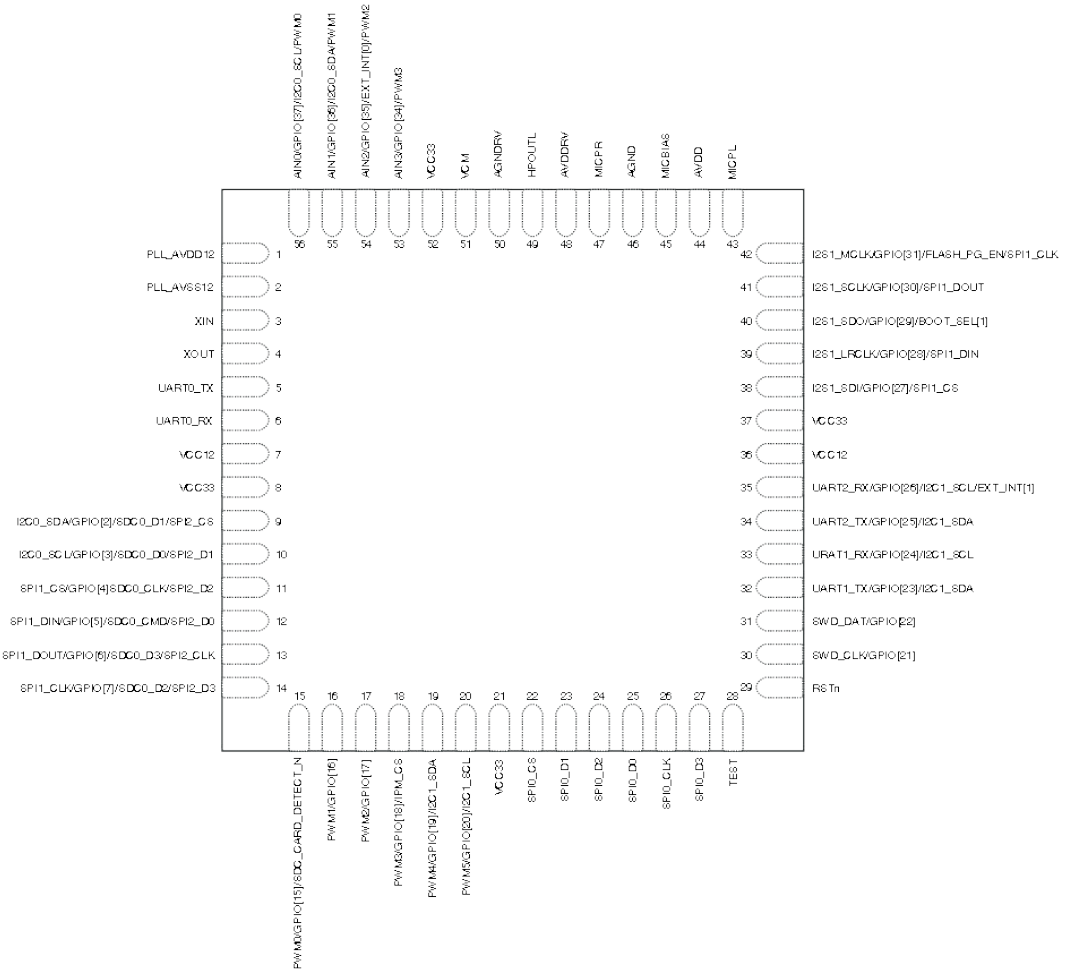


图1 引脚图

4.1 引脚功能描述

Pin Number	Pin name	Pin type	IO driving capability	IO power-on default state	Alternate functions
1	PLL_AVDD12	P	-	-	PLL 1.2V power supply
2	PLL_AVSS12	P	-	-	PLL ground
3	XIN	I	-	-	12.288MHZ crystal oscillator interface
4	XOUT	O	-	-	12.288MHZ crystal oscillator interface
5	UART0_TX	IO	4mA	IN,T+U	1.GPIO[0] 2.UART0_TX:Transmit channel

					ofUART0
6	UART0_RX	IO	4mA	IN,T+U	1.GPIO[1] 2.UART0_RX:Receivechannelof UART0
7	VCC12	P	-	-	1.2VCorepowersupply
8	VCC33	P	-	-	3.3Vpowersupply
9	I2C0_SDA	IO	4mA	IN,T+U	1.GPIO[2] 2.I2C0_SDA:I2C0SerialData 3.SDC0_D1:SDC0 interface data 1 4.SPI2_CS:SPI2 interface chip selectionsignal
10	I2C0_SCL	IO	4mA	IN,T+U	1.GPIO[3] 2.I2C0_SCL:I2C0SerialClock 3.SDC0_D0:SDC0 interface data 0 4.SPI2_D1:SPI2interfacedata1
11	SPI1_CS	IO	4mA	IN,T+D	1.GPIO[4] 2.SPI1_CS:SPI1 interface chip selectionsignal 3.SDC0_CLK:SDC0SerialClock 4.SPI2_D2:SPI2interfacedata2
12	SPI1_DIN	IO	4mA	IN,T+D	1.GPIO[5] 2.SPI1_DIN:SPI1 interface data input 3.SDC0_CMD:Command pin for SDC0interface 4.SPI2_D0:SPI2interfacedata0
13	SPI1_DOUT	IO	8mA	IN,T+D	1.GPIO[6] 2.SPI1_DOUT:Transmit channel ofSPI1 3.SDC0_D3:SDC0 interface data 3 4.SPI2_CLK:SPI2SerialClock
14	SPI1_CLK	IO	8mA	IN,T+D	1.GPIO[7] 2.SPI1_CLK:Serial Clock for SPI1interface 3.SDC0_D2:SDC0 interface data 2 4.SPI2_D3:SPI2interfacedata3
15	PWM0	IO	4mA	IN,T+D	1.GPIO[15] 2.PWM0Output 3.SDC_CARD_DETECT_N
16	PWM1	IO	4mA	IN,T+D	1.GPIO[16] 2.PWM1Output
17	PWM2	IO	4mA	IN,T+D	1.GPIO[17] 2.PWM2Output
18	PWM3	IO	4mA	IN,T+D	1.GPIO[18] 2.PWM3Output 3.IPM_CS
19	PWM4	IO	4mA	IN,T+D	1.GPIO[19] 2.PWM4Output 3.I2C1_SDA:I2C1SerialData
20	PWM5	IO	4mA	IN,T+D	1.GPIO[20] 2.PWM5Output 3.I2C1_SCL:I2C1SerialClock

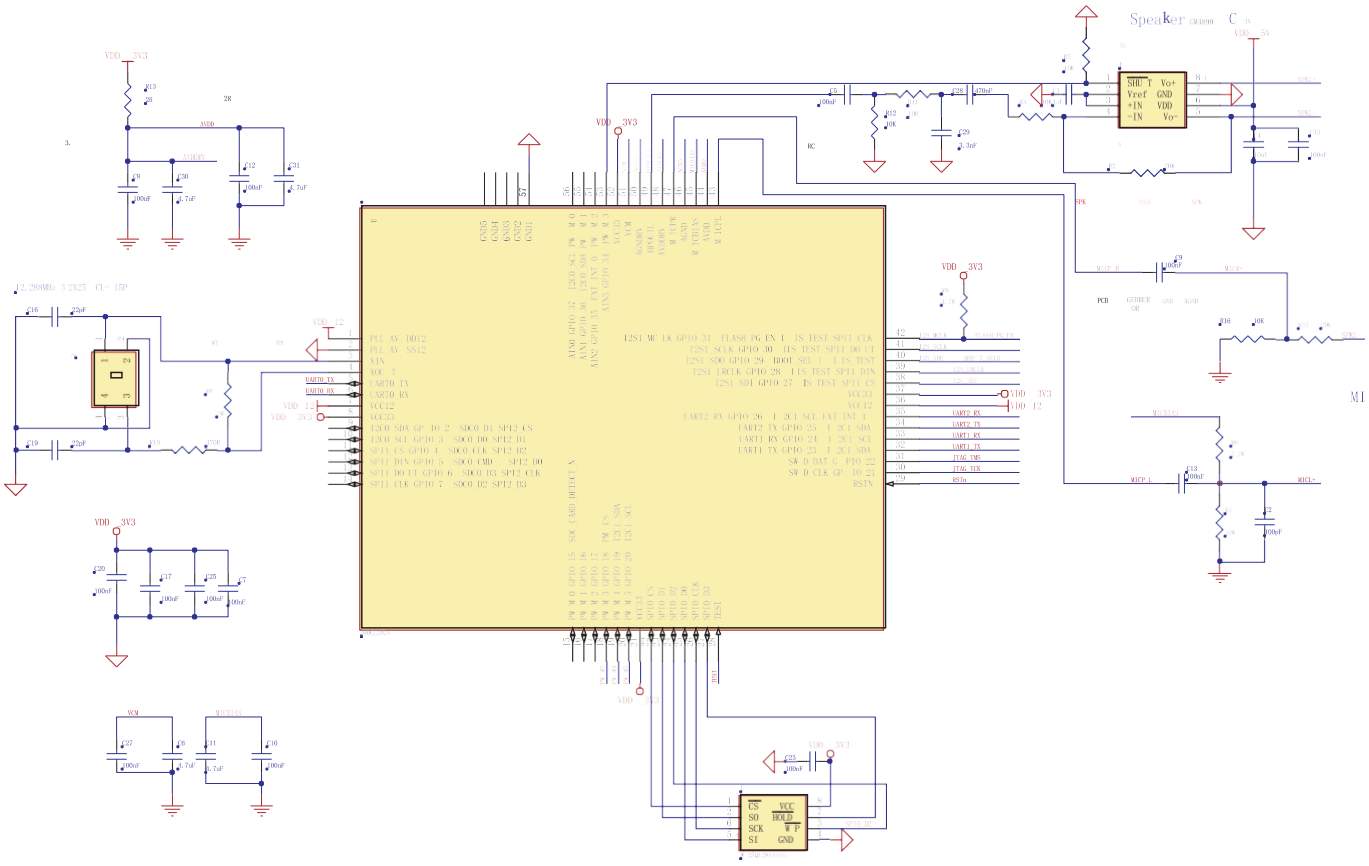
21	VCC33	P	-	-	3.3V power supply
22	SPI0_CS	IO	8mA	OUT,T	QSPI interface chip selection signal
23	SPI0_D1	IO	8mA	OUT,T+U	QSPI interface data 1
24	SPI0_D2	IO	8mA	OUT,T	QSPI interface data 2
25	SPI0_D0	IO	8mA	IN,T	QSPI interface data 0
26	SPI0_CLK	IO	8mA	IN,T	Serial Clock for QSPI interface
27	SPI0_D3	IO	8mA	IN,T	QSPI interface data 3
28	TEST	I	-	IN,L	Internal pull-down 0—functional mode 1—test mode
29	RSTn	I	-	IN,H	External reset input.Pull this pin low to reset device to initial state.Has internal weak pull-up.
30	SWD_CLK	IO	4mA	IN,T+D	1.TCK:Serial Wire Debug port clock pin.Has internal weak pull-down. 2.GPIO[21]
31	SWD_DAT	IO	4mA	IN,T+U	1.TMS:Serial Wire Debug port data pin.Has internal weak pull-up. 2.GPIO[22]
32	UART1_TX	IO	4mA	IN,T+U	1.GPIO[23] 2.UART1_TX:Transmit channel of UART1 3.I2C1_SDA:I2C1 Serial Data
33	UART1_RX	IO	4mA	IN,T+U	1.GPIO[24] 2.UART1_RX:Receive channel of UART1 3.I2C1_SCL:I2C1 Serial Clock
34	UART2_TX	IO	4mA	IN,T+U	1.GPIO[25] 2.UART2_TX:Transmit channel of UART2 3.I2C1_SDA:I2C1 Serial Data
35	UART2_RX	IO	4mA	IN,T+U	1.GPIO[26] 2.UART2_RX:Receive channel of UART2 3.I2C1_SCL:I2C1 Serial Clock 4.EXT_INT[1]
36	VCC12	P	-	-	Core 1.2V power supply
37	VCC33	P	-	-	3.3V power supply
38	I2S1_SDI	IO	4mA	OUT,T+D	1.GPIO[27] 2.I2S1_SDI:Serial Data Input for I2S1 interface 4.SPI1_CS:SPI1 interface chip selection signal
39	I2S1_LRCLK	IO	4mA	IN,T+D	1.GPIO[28] 2.I2S1_LRCLK:I2S1 interface LRCLK clock 4.SPI1_DIN:SPI1 interface data input
40	I2S1_SDO	IO	4mA	IN,T+D	1.GPIO[29](BOOT_SEL[1]) At startup,Boot1 option bit is used to select one of two modes:

					0---Normalfunctionalmodel 1---Debugmode 2.I2S1_SDO:Serial Data Output forI2S1interface
41	I2S1_SCLK	IO	4mA	IN,T+D	1.GPIO[30] 2.I2S1_SCLK:Serial Clock for I2S1interface 4.SPI1_DOUT:Transmit channel ofSPI1
42	I2S1_MCLK	IO	4mA	IN,T+D	1.GPIO[31](UART_UPDATE_EN) Atstartup,thispinisusedtoselect oneoftwofunctionalmodes: 1---Start serial port upgrade serviceandprogram 0---StartdirectlyfromFlash 2.I2S1_MCLK:Master Clock for I2S1reference 4.SPI1_CLK:Serial Clock for SPI1interface
43	MICPL	I		IN	LeftADCchannelinput
44	AVDD	P	-	-	3.3Vanalogsupply
45	MICBIAS	O			Microphonebiasoutput
46	AGND	P	-	-	Analogground
47	MICPR	I		IN	RightADCchannelinput
48	AVDDRV	P	-	-	3.3Vanalogsupply
49	HPOUTL	O		OUT	LeftDACchanneloutput
50	AGNDRV	P	-	-	Analogground
51	VCM	O		OUT	Referencevoltageoutput
52	VCC33	P	-	-	3.3Vpowersupply
53	AIN3	IO	-	IN,T+D	1.GPIO[34] 2.ADC3Input 4.PWM3Output
54	AIN2	IO	-	IN,T+D	1.GPIO[35] 2.ADC2Input 3.EXT_INT[0] 4.PWM2Output
55	AIN1	IO	-	IN,T+D	1.GPIO[36] 2.ADC1Input 3.I2C0SerialData 4.PWM1Output
56	AIN0	IO	-	IN,T+D	1.GPIO[37] 2.ADC0Input 3.I2C0SerialClock 4.PWM0Output

Conformitywithdefinition ：

I	input
O	output
IO	bidirectional
P	powerorground
L	lowlevel
H	highlevel
T	tristatestate
T+D	tristatepluspull-down
T+U	tristate plus pull-up
OUT	power-on defaults to output mode
IN	power-on defaults to input mode

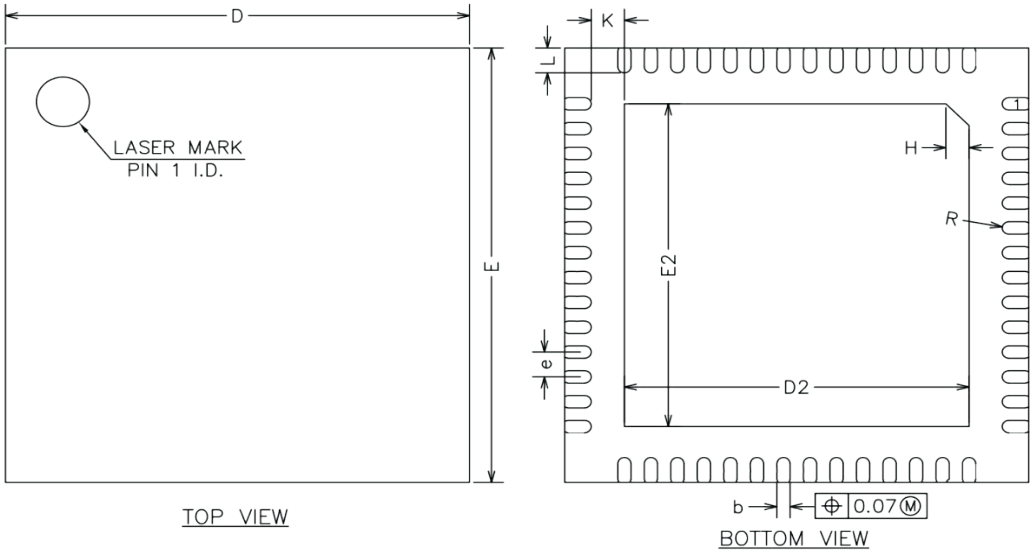
5 . 应用原理图

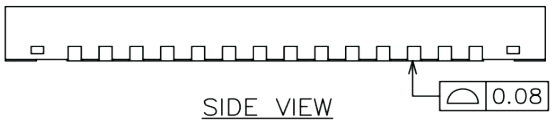


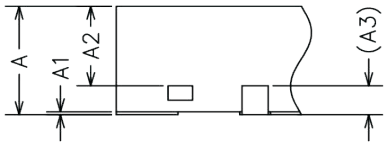
6 . 电气特性

符号	参数	最小值	典型值	最大值	单位
VCC	芯片IO供电电压	2.97	3.3	3.63	V
VDD	芯片内核供电电压	1.08	1.2	1.32	V
V_{IH}	输入高电压	2.0	-	3.6	V
V_{IL}	输入低电压	-0.3	-	0.8	V
V_{OL}	输出低电压 @I_{OL} = 2,4,8mA	-	-	0.4	V
V_{OH}	输出高电压 @I_{OH} = 2,4,8mA	2.4	-	-	V
ADC_VREF33	SAR ADC参考电压	2.97	3.3	3.63	V
PLL_AVDD12	PLL模拟供电电压	1.08	1.2	1.32	V
$I_{3.3V}$	芯片3.3V供电工作电流	9.83	13	14.5	mA
$I_{1.2V}$	芯片1.2V供电工作电流	49	51	53	mA
$I_{S3.3V}$	芯片3.3V供电睡眠模式工作电流	9.5	9.51	9.53	mA
$I_{S1.2V}$	芯片1.2V供电睡眠模式工作电流	4.5	4.75	5	mA
TA	芯片工作环境温度	0	-	+70	℃
T_{ST}	芯片储存环境温度	-55	-	+150	℃

7 . 封装信息







SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A2	0.50	0.55	0.60
A3		0.20REF	
b	0.15	0.20	0.25
D	6.90	7.00	7.10
E	6.90	7.00	7.10
D2	5.10	5.20	5.30
E2	5.10	5.20	5.30
e	0.30	0.40	0.50
H		0.35REF	
K		0.50REF	
L	0.35	0.40	0.45
R	0.09	-	-