

AC7003F Datasheet

Zhuhai Jieli Technology Co.,LTD

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AC7003F Features

CPU

- 32bit Dual-Issue DSP
- Up to 160MHz programmable processor
- With IEEE754 Single precision FPU
- With cordic accelerate engine
- Advanced debug with 8 hardware breakpoints/watchpoints
- Advanced system exception capture unit

Interrupt

- Support for up to 64 interrupts with 8 priority level
- NMI supported
- SWI supported, with configurable priority
- Low power wake up by polling pending 7 IO interrupts for low power wake up

DSP Audio Processing

- SBC, AAC Audio decodes supported for BT audio
- mSBC voice codec supported for BT phone
- Supports MP2, MP3, WMA, APE, FLAC, AAC, MP4, M4A, WAV, AIF, AIFC audio decoding
- Packet Loss Concealment (PLC) for voice processing
- Single/Dual MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 20-band EQ configuration for voice Effects

Audio Codec

- Two channels 24-bit DAC, SNR $\geq$ 102dB
- One channels 24-bit ADC, SNR $\geq$ 95dB
- DAC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/32kHz/44.1kHz/48kHz/64kHz/88.2kHz/96kHz are supported
- ADC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/32kHz/44.1kHz/48kHz are supported

- Two analog MIC amplifier, build-in MIC bias generator
- Supports Four PDM digital MIC inputs
- Two channels analog AUX, supports Stereo
- Supports cap-less, single-ended, and Two differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

Bluetooth

- Compliant with Bluetooth V5.3+BR+EDR+BLE specification
- Meet class2 and class3 transmitting power requirement
- Support GFSK and DQPSK all packet types
- Provides a maximum +10dbm transmitting power
- EDR receiver with -94dBm sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smpt\att\gap\gatt\rfcomm\sdp\l2cap profile a2dp 1.3.2\avctp 1.4\avdtp 1.3\avrcp 1.6.2\hfp 1.8\spp 1.2\rfcomm 1.1\pnp 1.3\hid 1.1.1\sdpcore5.3\l2cap core 5.3

Peripherals

- One full speed USB 2.0 OTG controller
- Six multi-function 32-bit timers, support capture and PWM mode
- Three full-duplex basic UART, UART0, UART1 support DMA mode
- One hardware IIC interface supports host and device mode
- LED controller, support 2LED control by one IO
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs
- Crossbar IO support: timer\SPI\SDC\IIC\UART\RDEC\ALINK\PLINK

PMU

- Low voltage LDO and DC-DC for internal digital and analog circuit supply
- Less 2uA current consumption in the soft-off mode
- Built-in LDO and DC-DC for the core, I/O, Bluetooth and flash
- VBAT is 2.2V to 4.4V
- IOVDD is 2.2V to 3.6V

Packages

- QFN20(3mm*3mm)

Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

Applications

- Bluetooth Stereo Headsets and Headphones

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1、 Pin Definition

1.1 Pin Assignment

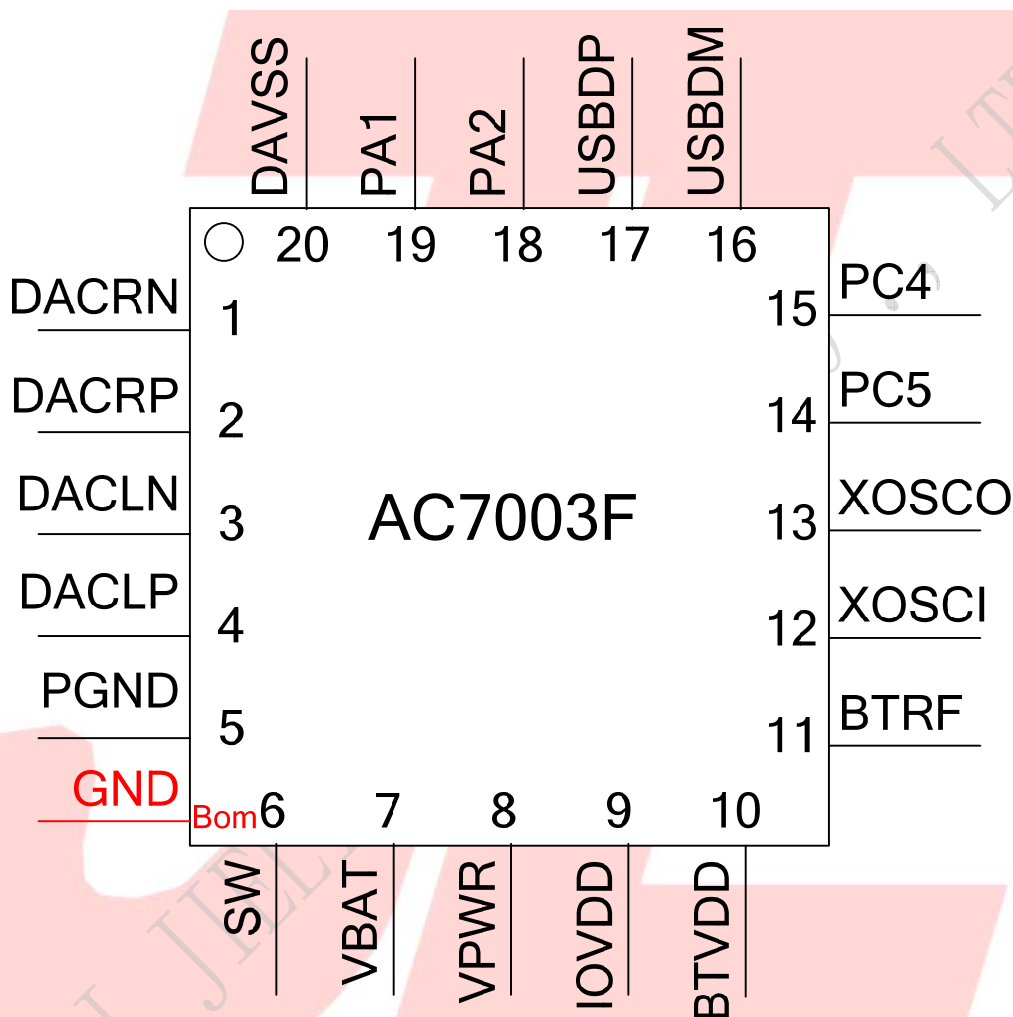


Figure 1-1 AC7003F Package Diagram

1.2 Pin Description

Table 1-1 AC7003F Pin Description

PIN NO.	Name	I/O Type	Drive (mA) 4 level	Function	Other Function
1	DACRN	O	/		Different DAC Right Negative Channel
2	DACRP	O	/		Different DAC Right Positive Channel
3	DACLN	O	/		Different DAC Left Negative Channel
4	DACLP	O	/		Different DAC Left Positive Channel
5	PGND	P	/		DCDC Ground
6	SW	P	/		DCDC switch output, connected to inductor
7	VBAT	PI	/		Power Supply, connect to battery
8	VPWR	PI	/		Charge Power Input;
		I/O	8	GPIO	High Voltage Resistance I/O; UART0TXC: Uart0 Data Output(C); UART0RXC: Uart0 Data Input(C); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture;
9	IOVDD	PO	/		IO Power 3.3v
10	BTVDD	PO	/	GPIO	BT Power
11	BTRF	/	/		BT Antenna
12	XOSCI	I	/		XOSC In
13	XOSCO	O	/		XOSC Out
14	PC5	I/O	2.4~64	GPIO	SD0CLKA: SD0 Clock(A); UART2RXD: Uart2 Data Input(D); SPI1DOB: SPI1 Data Out(B); ALNK_DAT3(B): Audio Link Data3(B); IIC_SDA_B: IIC SDA(B); ADC5: ADC Input Channel 5;
15	PC4	I/O	2.4~64	GPIO	SD0CMDA: SD0 CMD(A); UART2TXD: Uart2 Data Output(D); SPI1CLKB: SPI1 Clock(B); ALNK_DAT2(B): Audio Link Data2(B); IIC_SCL_B: IIC SCL(B); ADC4: ADC Input Channel 4; PWM4: Timer4 PWM Output;
16	USBDM	I/O	4	USB Negative Data	UART1RXD: Uart1 Data Input(D); IIC_SDA_A: IIC SDA(A); ADC11: ADC Input Channel 11;

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					SPI2DOB: SPI2 Data Out(B); ISP_DI:
17	USBDP	I/O	4	USB Positive Data	UART1TXD: Uart1 Data Output(D); IIC_SCL_A: IIC SCL(A); ADC10: ADC Input Channel 10; SPI2CLKB: SPI2 Clock(B); ISP_CLK:
18	PA2	I/O	2.4~64	GPIO	ALNK_MCLK(A): ALNK Master Clock(A); MIC_BIAS0: MIC0 Bias Output; MIC0_N: Different MIC0 Negative AMUX_A1: Analog Channel A1 L/R Input; CAP3: Timer3 Capture; UART1RXC: Uart1 Data In(C); CLKOUT1:
19	PA1	I/O	2.4~64	GPIO	MIC0: MIC0 Input Channel ; MIC0_P: Different MIC0 Positive AMUX_A0: Analog Channel A0 L/R Input; PWM0: Timer0 PWM Output; UART1TXC: Uart1 Data Output(C);
20	DAVSS	P	/		Analog Ground
/	Bom	P	/		Ground

P: Power or Ground PO:Power Output PI:Power Input I/O:Input or Output I:Input O:Output

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2、Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

Symbol	Parameter	Min	Max	Unit
T _{opt}	Operating temperature	-40	+85	°C
T _{stg}	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	4.5	V
VPWR	Charger Voltage	-0.3	6	V
V _{3.0IO}	3.0V IO Input Voltage (IOVDD)	-0.3	3.6	V

Note : The chip can be damaged by any stress in excess of the absolute maximum ratings listed below

2.2 PMU Characteristics

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	4.4	V	
VPWR	Charger supply Voltage	4.5	5.0	5.5	V	
Normal mode						
IOVDD	Voltage output	—	3.0	—	V	VBAT = 4.2V, 10mA loading
	Loading current	—	—	100	mA	IOVDD=3.0V@VBAT = 4.2V
BTVDD	Voltage output	—	1.25	—	V	IOVDD=3.0V, 10mA loading
	Loading current	—	—	60	mA	BTVDD=1.25V@IOVDD=3.0v
EVDD	Voltage output	—	1.1	—	V	BTVDD=1.25V, 1mA loading
	Loading current	—	—	5	mA	EVDD=1.1V@BTVDD=1.25v
LP mode						
IOVDD	Loading current			5	mA	IOVDD=3V@VBAT = 4.2V

2.3 Battery Charge

Table 2-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VPWR	Charge Input Voltage	4.5	5	5.5	V	—

V _{Charge}	Charge Voltage	4.15	4.2	4.25	V	VPWR>4.5V
		4.30	4.35	4.40	V	VPWR>4.65V
I _{Charge}	Charge Current	20		200	mA	Charge current at fast charge mode
I _{Trinkl}	Trickle Charge Current	20	45	70	mA	V _{BAT} <V _{Trinkl}

2.4 IO Input/Output Electrical Logical Characteristics

Table 2-4

IO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{IL}	Low-Level Input Voltage	-0.3	—	0.3* IOVDD	V	IOVDD = 3.0V
V _{IH}	High-Level Input Voltage	0.7* IOVDD	—	IOVDD+0.3	V	IOVDD= 3.0V
IO output characteristics						
V _{OL}	Low-Level Output Voltage	—	—	0.33	V	IOVDD= 3.0V
V _{OH}	High-Level Output Voltage	2.7	—	—	V	IOVDD = 3.0V

2.5 Internal Resistor Characteristics

Table 2-5

Port	Drive(mA)				Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA0~PA8 PC4、PC5	2.4	8	26.4	64	10K	10K	1、USBDM & USBDP default pull Down
PP0(VPWR)	8				10K	10K	2、PP0(VPWR) are high voltage resistance to 5V
USBDP	4				1.5K	15K	3、internal pull-up/pull-down resistance accuracy ±20%
USBDM	4				180K	15K	

2.6 DAC Characteristics

Table 2-6

Parameter	Min	Typ	Max	Unit	Audio Format	Test Conditions
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Frequency Response	20	—	20K	Hz	—	Differential Mode 1KHz/0dB 32 ohm loading With A-Weighted Filter
Output Swing		0.55	0.74	Vrms	—	
THD+N	—	-76.5	—	dB	PCM	
	—	-68.5	—	dB	SBC	
S/N	—	100	102	dB	PCM	
	—	98.5	—	dB	SBC	
Crosstalk	—	-111.3	—	dB	—	Differential Mode 1KHz/-60dB 32 ohm loading With A-Weighted Filter
Dynamic Range	—	100	—	dB	PCM	
	—	99.0	—	dB	SBC	
Noise Floor		6.0		uV	—	A-Weighted Filter
DAC Output Power	—	9.5	17.0	mW	—	Differential Mode 32ohm loading

2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		95		dB	Fsample=44.1kHz Fin=1KHz 2mVpp Input
S/N	—	95	—	dB	Fsample=44.1kHz Fin=1KHz 2Vpp Input
THD+N	—	-72	—	dB	
Crosstalk	—	-80	—	dB	

2.8 BT Characteristics

2.8.1 Transmitter

Basic Data Rate

Table 2-8

Parameter	Min	Typ	Max	Unit	Test Conditions
RF Transmit Power		7.3	10	dBm	25°C, Power Supply VBAT=3.7V 2441MHz 2 Layer Board
RF Power Control Range		18.5		dB	
20dB Bandwidth		950		KHz	
Adjacent Channel	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	2 Layer Board
	-3MHz	-35		dBm	

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Enhanced Data Rate**Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1.3		dB	25°C, Power Supply VBAT=3.7V 2441MHz 2 Layer Board
$\pi/4$ DQPSK	DEVM RMS	6	8.6		%	
	DEVM 99%	10	15.6		%	
	DEVM Peak	15	19.8		%	
Modulation Accuracy	+2MHz		-40		dBm	
Adjacent Channel	-2MHz		-38		dBm	
Transmit Power	+3MHz		-44		dBm	
	-3MHz		-35		dBm	

2.8.2 Receiver**Basic Data Rate****Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25°C, Power Supply VBAT=3.7V 2441MHz DH5 2 Layer Board
Co-channel Interference Rejection			-10		dB	
Adjacent Channel	+1MHz		+4		dB	
	-1MHz		+2		dB	
	+2MHz		+38		dB	
Interference Rejection	-2MHz		+38		dB	
	+3MHz		>+40		dB	
	-3MHz		+34		dB	

Enhanced Data Rate**Table 2-11**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25°C, Power Supply VBAT=3.7V 2441MHz 2DH5 2 Layer Board
Co-channel Interference Rejection			-11		dB	
Adjacent Channel	+1MHz		+4		dB	
	-1MHz		+2		dB	
	+2MHz		+38		dB	
Interference Rejection	-2MHz		+38		dB	
	+3MHz		>+40		dB	
	-3MHz		+34		dB	

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3、 Package Information

3.1 QFN20_3.0x3.0

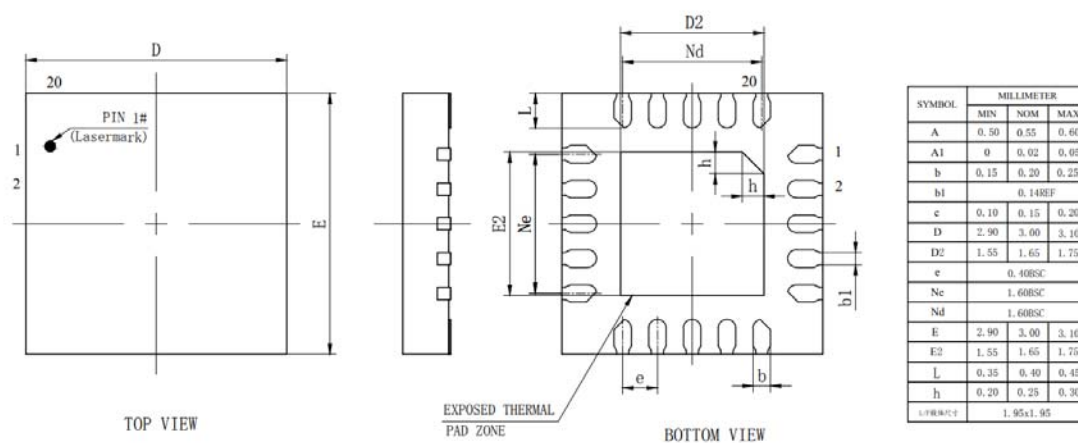


Figure 3-1 AC7003F Package

4、Revision History

Date	Revision	Description
2021.05.13	V1.0	Initial Release
2021.05.27	V1.1	Update Electrical Characteristics
2021.08.03	V1.2	Update Bluetooth and profile Visions

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