AB5756T

Audio Player Microcontroller

Versions: 0.0.1
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Declaration

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Revision History

Date	Version	Comments	Revised by
2024-09-29	0.0.1	First draft	Leo

Table of Contents

1 General Description

This datasheet provides a comprehensive overview of the AB575X Bluetooth audio system-on-a-chip (SoC). The AB575X is designed to deliver high-quality audio experiences for a wide range of wireless audio applications, including headsets, earbuds, and speakers. AB5756T is a highly integrated solution that combines a 32-bit RISC-V processor core with DSP instruction, high-performance audio processor, Bluetooth radio, power management unit, and various peripherals, offering a compelling balance of performance, power efficiency, and flexibility.

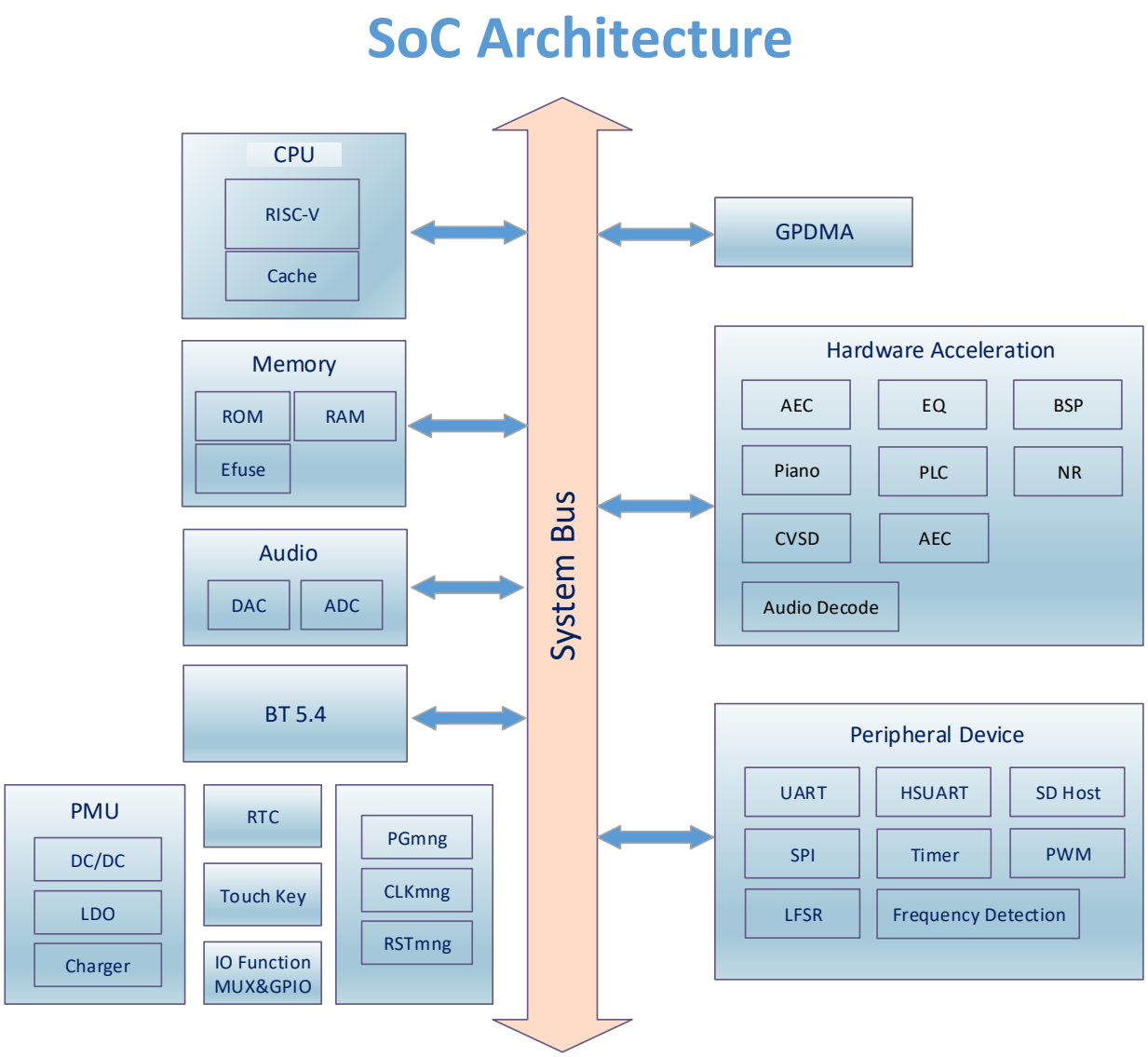


Figure 1-1 AB5756T Block Diagram

2 Product Features

CPU and Flexible IO

- High performance 32bit RISC-V processor Core with DSP instruction
- RISC-V typical speed: 120MHz
- Program memory: internal OTP
- Flexible GPIO pins with Programmable pull-up and pull-down resistors;
- Support GPIO wakeup or interrupt;

Bluetooth Radio

- Compliant to Bluetooth 5.4（QDID: 215269）;
- TX maximum output power +10dBm;
- RX Sensitivity with -91 @ Basic Rate;
- RX Sensitivity with -94 @ EDR;

Audio Interface

- Audio codec with 16bit mono DAC and 16bit mono ADC;
- Support flexible audio EQ adjust;
- Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1 and 48KHz;
- Mono MIC amplifier input;
- High performance mono audio ADC with 95dB SNR @Single-end mode;
- High performance mono audio DAC with 107dB SNR, support single-ended , differential and VCMBUF mode;

Peripheral and Interfaces

- Support Low power Touch Key;
- SD Card Host controller x1;
- Master/Slave SPI x1;
- Watch Dog;
- 10-bit SAR ADC x6;
- Frequency detector;
- Normal UART x3; High Speed UART with CTS/RTS x1;
- 16-bit Basic Timer x2;
- 32-bit Basic Timer x3, 32-bit multi-function timers that supports capture mode and PWM mode x1;
- Built in PMU; buck DCDC converter; capless LDOs; LDO; Li-battery charger;

Application

- OWS Earbud;
- TWS Earphone;
- Headset;
- Bluetooth Speaker;

Key Parameters

Part Num： AB5756T

Parameter	Value
Max. TX Power	+10 dBm
RX Sensitivity	-91dBm@Basic Rate -94dBm@EDR
TX Current @0dBm,3V, LDO mode	TBC
RX Current @-94dBm,3V, LDO mode	TBC
Sleep Current with retention	TBC
Deep Sleep Mode Current	TBC
Sniff Mode Current	TBC
Flash	OTP
Supply Voltage	3.0~4.5V
GPIO	5
Operating Temperature	-40~+85°C
Storage Temperature	-65℃ ~ +150℃
Package Size	QFN20 3*3
PMU	LDO/Buck mode + Charger

3 Package Definition

3.1 Pin Assignment

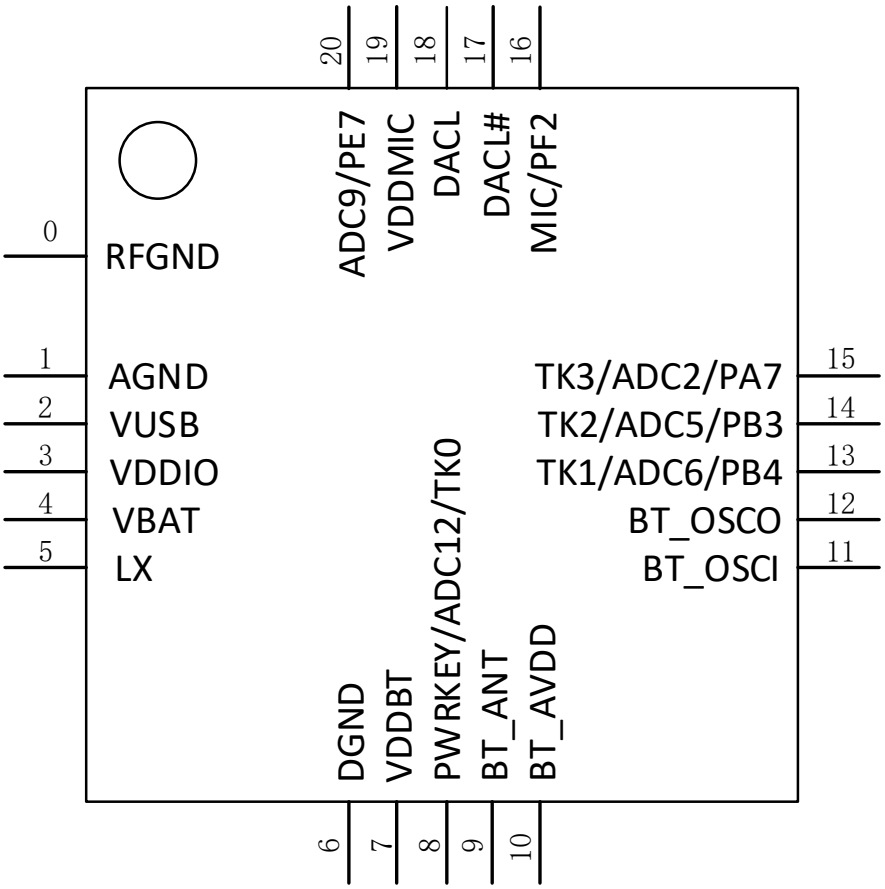


Figure 3-1 Pin assignment

3.2 Pin Description

Table 3-1 QFN20 pin description

Pin No.	Name	Type	Drive（mA)	Function
0	RFGND	GND	/	BT RF Ground
1	AGND	GND	/	DAC Ground
2	VUSB	PWR	/	VUSB power input TX0-G5(RX)/RX0-G5 TX1-G2(RX)/RX1-G2 HSTRX-G10
3	VDDIO	PWR	/	VDDIO Power Output

4	VBAT	PWR	/	VBAT Power Input
5	LX	PWR	/	Buck inductor connect pin
6	DGND	GND	/	Digital Ground
7	VDDBT	PWR	/	BT Power
8	PWRKEY	I/O	/	Power key input ADC12 TK0
9	BT_ANT	A	/	BT ANT
10	BT_AVDD	PWR	/	BT Power
11	BT_OSCI	A	/	26M OSC input
12	BT_OSCO	A	/	26M OSC output
13	PB4	I/O	8/32	Touch key CH1 ADC6 SDCMD-G2 UART0_RX0-G3 HSTRX-G8 FMOSC-G4 TMR3CAP_G4 PWM0-T3 PB4
14	PB3	I/O	8/32	Touch key CH2 ADC5 SDDAT0-G1/G2 UART0_TX0-G3(RX) HSTRX-G3 FMOSC-G3 PWM2-T3 TMR3CAP_G2 PB3
15	PA7	I/O	8/32	Touch key CH3 ADC2 SDCLK-G1/G2 UART0_TX0-G1 UART1_TX1-G1(RX) HSTRX-G1 FMOSC-G1 PWM1-T3 TMR3CAP_G1 PA7
16	PF2/MIC	I/O	8/32	ADC10 UART0_TX0-G7(RX) UART2_TX2-G1(RX) HSTRX-G5 UDET_TX2-G1(RX) FMOSC-G7 PF2
17	DACL#	A	/	DAC differential L#
18	DACL	A	/	DAC L
19	VDDMIC	PWR	/	MIC Power
20	PE7/ADC9	I/O	8/32	ADC9

				UART0_TX0-G4 UART2_RX2-G1 HSTRX-G4 UDET_RX2-G1 FMOSC-G6 TMR3CAP_G6 PE7

Note: I/O: Digital input/output; I : Digital input; A : Analog Pin; PWR: Power Pin; GND: Ground.

4 Characteristics

4.1 Absolute Maximum Ratings

Table 4-1 Absolute Maximum Ratings

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
Tamb	Ambient Temperature	-40		+80	℃	
IIN	Input Current	-32		+32	mA	
VIN	Input Voltage	-0.3		VDDIO+0.3	V	VDDIO=3.3V

4.2 PMU Parameters

Table 4-2 PMU voltage input Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger Voltage input	4.6	5.0	5.5	V	
VBAT	Voltage input	3.0	3.7	4.5	V	
V_{IL}	CMOS Low Level Input Voltage	0		0.3*VDDIO	V	VDDIO=3.3V
V_{IH}	CMOS Low Level Input Voltage	0.7*VDDIO		VDDIO	V	
V_{TH}	CMOS Threshold Voltage		0.5*VDDIO		V	

Table 4-3 VDDIO LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDIO	3.3V LDO voltage output	2.4	3.3	3.8	V	Load current < 10mA
△VVDDIO	Output Mismatch 1-sigma	-	12	-	mV	VDDIO=3.3v
ILOAD	Maximum output current	-	-	150	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	525	mA	@VBAT=3.8v

Table 4-4 VDDBT LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.6V LDO voltage output	0.85	1.25	1.6	V	Load current < 5mA
△VVDDBT	Output Mismatch 1-sigma	-	12	-	mV	VDDBT=1.6v
ILOAD	Maximum output current	-	-	370	mA	@VBAT=3.0v
ISC	Short Circuit Current Limit	-	-	580	mA	@VBAT=3.8v

Table 4-5 VDDCORE LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.2V LDO voltage output	0.7	1.1	1.35	V	Load current < 3mA
△VVDDCORE	Output Mismatch 1-sigma	-	5.7	-	mV	VDDCORE=1.1v
ILOAD	Maximum output current	-	-	230	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	700	mA	@VBAT=3.8v

Table 4-6 VDDBT BUCK Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.2V LDO voltage output	0.85	1.25	1.6	V	Load current < 5mA
△VVDDBT	Output Mismatch 1-sigma	-	6	-	mV	VDDBT=1.25v
ILOAD	Maximum output current	-	-	366	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	366	mA	@VBAT=3.8v

Table 4-7 Battery Charge

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger input voltage	4.6	5	5.5	V	
$VBAT_{float}$	Charge Voltage	4.15	4.2	4.25	V	VUSB>4.6V
			4.35		V	VUSB>4.75V
			4.4		V	VUSB>4.8V
			4.45		V	VUSB>4.85V
I_{CH}	Charge current	5		320	mA	VBAT<=$VBAT_{float}$ -150mV, VUSB>=$VBAT_{folat}$ +550mV
I_{End}	End of charge current	2.5		37.5	mA	
$V_{Trickle}$	Trickle charge Voltage	2.9	3	3.1	V	VUSB>4.6V

4.3 IO Parameters

Table 4-8 I/O Parameters

IOTYPE1—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
VIL	Low-level input voltage		-0.3		0.93	V	VDDIO=3.3V
VIH	High-level input voltage		2.31		3.6	V	VDDIO=3.3V
Driver Ability 1	Output Driver Ability 1			32		mA	VDDIO=3.3V
Driver Ability 0	Output Driver Ability 0			8		mA	VDDIO=3.3V

IOTYPE1—Electrical Characteristics							
RPUP0	Internal pull-up resister 0		8	10	12	KΩ	
RPUP1	Internal pull-up resister 1		0.24	0.3	0.36	KΩ	
RPUP2	Internal pull-up resister 2		160	200	240	KΩ	
RPDN0	Internal pull-down resister 0		8	10	12	KΩ	
RPDN1	Internal pull-down resister 1		0.24	0.3	0.36	KΩ	
RPDN2	Internal pull-down resister 2		160	200	240	KΩ	

IOTYPE4—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
VIL	Low-level input voltage		-0.3		0.93	V	VDDIO=3.3V
VIH	High-level input voltage		2.31		5.5	V	VDDIO=3.3V
Driver Ability	Output Driver Ability			8		mA	VDDIO=3.3V
RPUP	Internal pull-up resister		8	10	12	KΩ	
RPDN	Internal pull-down resister		8	10	12	KΩ	

Table 4-9 Internal Resistor Characteristics

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA6-PA7 PB3-PB4 PE7 PF2 PG1/2/4/5	8mA	32mA	0.3K/10K/200K	0.3K/10K/200K	Internal pull-up/pull-down resistance accuracy +/-20%
PE0 (High Voltage IO)	8mA	-	10K	10K	

4.4 Audio DAC Parameters

Table 4-10 Differential Mode

Parameter	Conditions	Min	Typ	Max	Unit
Resolution				16	Bits
Fsample		8	/	48	KHz
SNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 1.25 Vrms	/	107	/	dB

Parameter	Conditions	Min	Typ	Max	Unit
	Fsample 48KHz , 32R;				
THD+N	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 1.25 Vrms Fsample 48KHz , 32R;	/	-78	/	dB
Noise Floor	Audio PA on A-WT without DRE		4.786		uVrms
DNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Fsample 48KHz , 32R;		100.4		

Table 4-11 Single-ended Mode

Parameter	Conditions	Min	Typ	Max	Unit
Resolution				16	Bits
Fsample		8	/	48	KHz
SNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 560m Vrms Fsample 48KHz , 32R;	/	94.5	/	dB
THD+N	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 560m Vrms Fsample 48KHz , 32R;	/	-77.2	/	dB
Noise Floor	Audio PA on A-WT without DRE		10.59		uVrms
DNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Fsample 48KHz , 32R;		94.3		

Table 4-12 VCMBUF Mode

Parameter	Conditions	Min	Typ	Max	Unit
Resolution				16	Bits

Parameter	Conditions	Min	Typ	Max	Unit
Fsample		8	/	48	KHz
SNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 561.5m Vrms Fsample 48KHz , 32R;	/	102.1	/	dB
THD+N	Sin -1Khz ;BW=20-20KHz; A-Weighted Output Level : 561.5m Vrms Fsample 48KHz , 32R;	/	-82.6	/	dB
Noise Floor	Audio PA on A-WT without DRE		4.365		uVrms
DNR	Sin -1Khz ;BW=20-20KHz; A-Weighted Fsample 48KHz , 32R;		98.3		

4.5 Audio ADC Parameters

Table 4-13 Audio ADC Parameters

Mode	Sym	Characteristics	Min	Typ	Max	Unit	Conditions
Diff Mode	SNR		-	95	-	dB	VCM cap=NC VDDMIC cap=1uF with A-wt filter Input 1dBV @ Fin=1KHz
	THD+N		-	-94	-	dB	
	Input Range	Maximum input voltage	-	2	-	dBV	
External-RC Single Mode	PGA Gain		0		12	dB	0dB / 6dB /12dB
	SNR		-	91	-	dB	VCM cap=NC VDDMIC cap=1uF with A-wt filter Input -2dBV @ Fin=1KHz PGA Gain=0dB
	THD+N		-	-70	-	dB	
	Input Range	Maximum input voltage	-	-2	-	dBV	
Internal-RC Single Mode	PGA Gain		0		12	dB	0dB / 6dB /12dB
	SNR		-	89	-	dB	VCM cap=NC VDDMIC cap=1uF with A-wt filter Input -2dBV @ Fin=1KHz PGA Gain=0dB
	THD+N		-	-68	-	dB	
	Input Range	Maximum input voltage	-	-2	-	dBV	

4.6 BT Parameters

Table 4-14 BT Parameters

Characteristics	Min	Typical	Max	Unit	Conditions
Maximum Transmit Power	-	9.5	10	dBm	GFSK TX power
RMS DEVM	-	6	-	%	Typical TX power 2-DH5 packet
Peak DEVM	-	15	-	%	
EDR Relative Transmit Power	-	-1.8	-	dB	
Sensitivity @ Basic Rate	-	-91	-	dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR	-	-94	-	dBm	BER=0.01%, using 2-DH5 packet

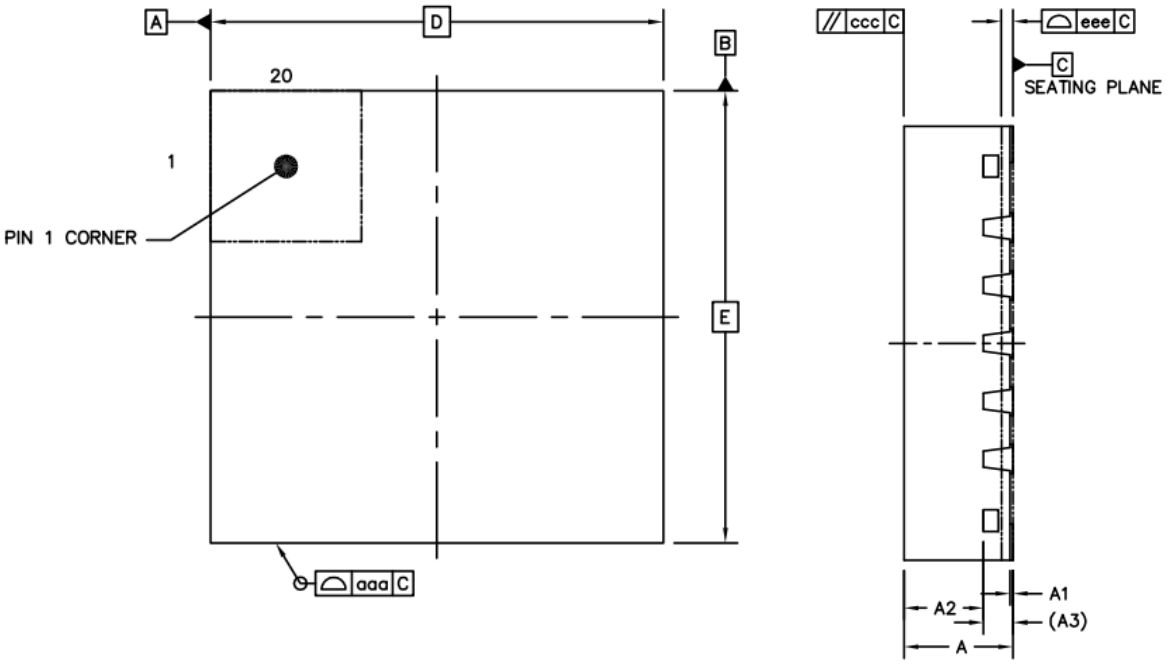
4.7 Current Parameters

Table 4-15 Current Parameters

Mode	Characteristics	Min	Typ	Max	Unit	Conditions
With DC DC Buck Mode	TX RF Current @Pout = 0dBm		TBC		mA	V_{BAT}=3.3V
	RX RF Current @Sensitivity level		TBC		mA	
	Supply Current @Sleep with RAM retention		TBC		uA	
	Supply Current @Deep sleep		TBC		uA	
	Supply Current @Power Off		TBC		uA	
	Supply Current @Sniff		TBC		uA	500ms interval
	Supply Current @Broadcast		TBC		uA	500ms interval
W/O DC DC LDO Mode	TX RF Current @Pout = 0dBm		TBC		mA	V_{BAT}=3.3V
	RX RF Current @Sensitivity level		TBC		mA	
	Supply Current @ Sleep with RAM retention		TBC		uA	
	Supply Current @Deep sleep		TBC		uA	
	Supply Current @Power Off		TBC		uA	
	Supply Current @Sniff		TBC		uA	500ms interval
	Supply Current @ Broadcast		TBC		uA	500ms interval

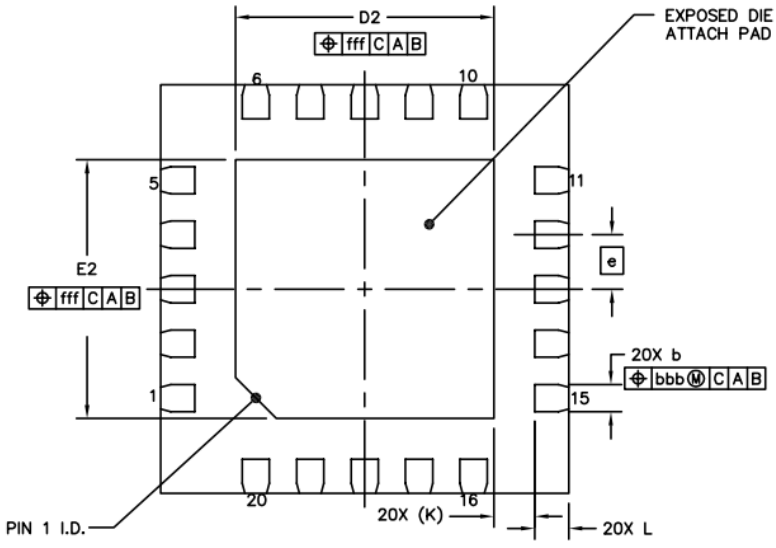
5 Package Information

QFN3X3-20L(P0.4T0.75)



TOP VIEW

SIDE VIEW



BOTTOM VIEW

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		3 BSC	
	Y	E		3 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	D2	1.8	1.9	2
	Y	E2	1.8	1.9	2
LEAD LENGTH		L	0.15	0.25	0.35
LEAD TIP TO EXPOSED PAD EDGE		K		0.3 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.07	
EXPOSED PAD OFFSET		fff		0.1	

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