
LC6976D Datasheet

Zhuhai Jieli Technology Co.,LTD

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LC6976D Features

CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 160MHz programmable processor
- 64Vectored interrupts
- 4 Levels interrupt priority

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
- Acoustic echo cancellation/suppression (AEC,AES)
- 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 >= 101dB
- Two channels 24-bit ADC , SNR >= 92dB
- 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 two PDM digital MIC inputs
- Two channels Stereo analog MUX
- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

Bluetooth

- Compliant with Bluetooth V5.1+BR+EDR+BLE specification

- Meet class1 class2 and class3 transmitting power requirement
- Support GFSK and $\pi/4$ DQPSK all packet types
- Provides amaximum+8dbm transmitting power
- receiver with -94dBm sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gap\gatt\rfcomm\sdp\l2cap profile
- a2dp 1.3\avctp 1.4\avdtp 1.3\ avrcp 1.5\ hfp 1.5 \spp 1.0\rfcomm 1.2\pnp 1.3\ hid 1.0\sdp core4.2\l2cap core 4.2

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, support DMA mode
- One hard ware IIC interface supports host and device mode
- Built-in Cap Sense Key controller
- Two Built-in low power Cap Sense Keys
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs

PMU

- Low voltage LDO and DC-DC for internal digital and analog circuit supply
- 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 4.5V
- VDDIO is 2.2V to 3.4V

Packages

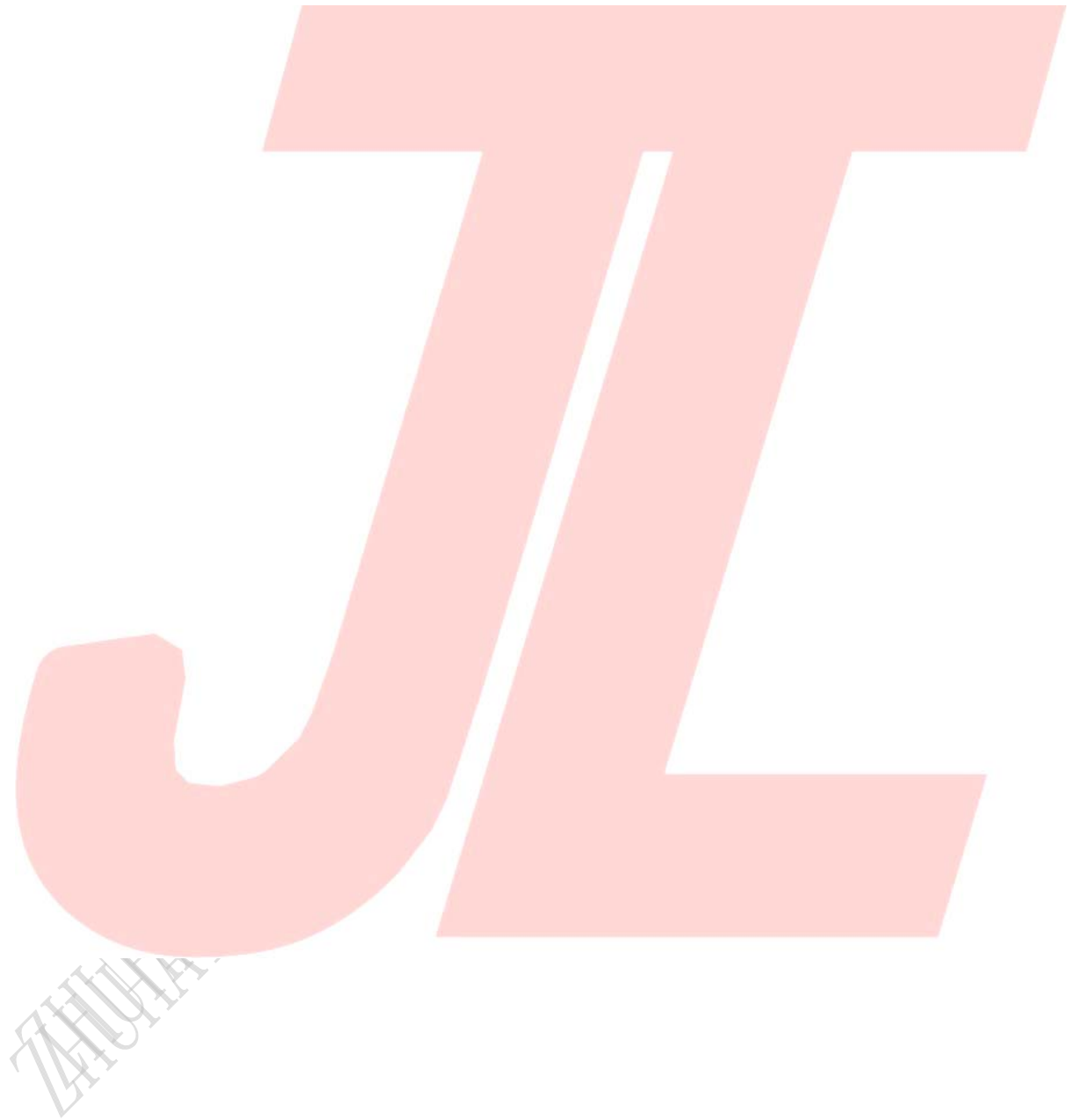
- QFN32(4mm*4mm)

Temperature

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

Applications

- Bluetooth TWS headse



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1、 Pin Definition

1.1 Pin Assignment

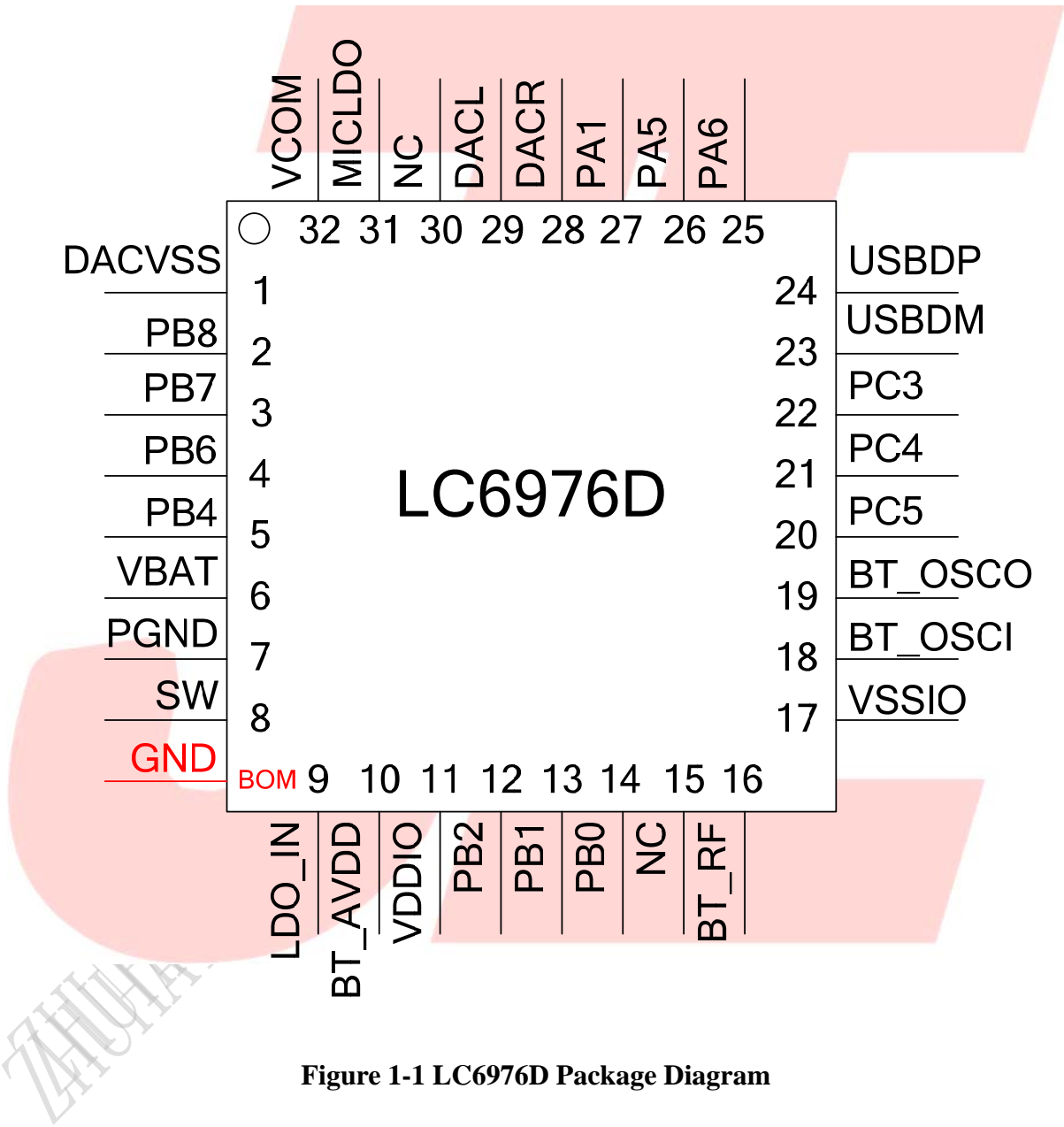


Figure 1-1 LC6976D Package Diagram

1.2 Pin Description

Table 1-1 LC6976D Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	DACVSS	P	/		Analog Ground
2	PB8	I/O	8/24	GPIO	MIC1: MIC1 Input Channel; UART0RXB: Uart0 Data Input(B); CAP4: Timer4 Capture;
3	PB7	I/O	8/24	GPIO	MIC_BIAS1: MIC1 Bias Output; UART0TXB: Uart0 Data Output(B);
4	PB6	I/O	8/24	GPIO	UART1RXA: Uart1 Data Input(A); PWM2: Timer2 PWM Output; ADC9: ADC Input Channel 9; Touch7: Touch Input Channel 7;
5	PB4	I/O	8/24	GPIO	ADC9: ADC Input Channel 12; TMR2: Timer2 Clock Input;
6	PGND	P	/		DCDC Ground
7	SW	P	/		DCDC switch output, connected to inductor
8	VBAT	P	/		Power Supply, connect to battery
9	LDO_IN	P	/		Charge Power Input; UART0TXC: Uart0 Data Output(C); UART0RXC: Uart0 Data Input(C); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture;
10	BT_AVDD	P	/	GPIO	BT Power
11	VDDIO	P	/		IO Power 3.3v
12	PB2	I/O	8/24	GPIO	UART2RXC: Uart2 Data Input(C); SPI2DOC: SPI2 Data Out(C); CAP5: Timer5 Capture; ADC7: ADC Input Channel 7; LP_TH1: Low Power Touch Channel 1
13	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset; SPI2CLKC: SPI2 Clk(C); UART2TXC: Uart2 Data Output(C) ADC6: ADC Input Channel 6; LP_TH0: Low Power Touch Channel 0
14	PB0	I/O	8	GPIO (High Voltage Input)	SPI2_DIC: SPI2 Data In(C); ALNK_MCLK(B): ALNK1 Master Clock(B); TMR4: Timer4 Clock Input;

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15	NC				
16	BT_RF	/	/		BT Antenna
17	VSSIO	P	/		Ground
18	BT_OSCI	I	/		BTOSC In
19	BT_OSCO	O	/		BTOSC Out
20	PC5	I/O	8/24	GPIO	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;
21	PC4	I/O	8/24	GPIO	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;
22	PC3	I/O	8/24	GPIO	UART0RXD: Uart0 Data Input(D); SPI1DIB: SPI1 Data In(B); ALNK_LRCK(B): Audio Link Word Select(B); IIC_SDA_C: IIC SDA(C); TMR3: Timer3 Clock Input;
23	USBDM	I/O	4	USB Negative Data	UART1RXD: Uart1 Data Input(D); IIC_SDA_A: IIC SDA(A); ADC11: ADC Input Channel 11;
24	USBDP	I/O	4	USB Positive Data	UART1TXD: Uart1 Data Output(D); IIC_SCL_A: IIC SCL(A); ADC10: ADC Input Channel 10;
	PA6	I/O	8/24	GPIO	UART0RXA: Uart1 Data Input(A); PLNK_DAT0: PLNK Data0; Touch3: Touch Input Channel 3; IIC_SDA_D: IIC SDA(D); ADC2: ADC Input Channel 2; CAP0: Timer0 Capture;
25	PA5	I/O	8/24	GPIO	UART0TXA: Uart0 Data Output(A); PLNK_SCLK: PLNK Serial Clock; Touch2: Touch Input Channel 2; IIC_SCL_D: IIC SCL(D); ADC1: ADC Input Channel 1; PWM5: Timer5 PWM Output;
27	PA1	I/O	8/24	GPIO	MIC0: MIC0 Input Channel ; PWM0: Timer0 PWM Output;

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					UART1TXC: Uart1 Data Output(C):
28	DACR	O	/		DAC Right Channel
29	DACL	O	/		DAC Left Channel
30	NC				
31	MICLDO	O	/		MIC Power Supply
32	VCOM	P	/		DAC reference voltage

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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
LDO_IN	Charger Voltage	-0.3	6	V
V _{3.3IO}	3.3V IO Input Voltage	-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	4.2	V	
LDO_IN	Charger supply Voltage	4.5	5.0	5.5	V	
Normal mode						
VDDIO	Voltage output	—	3.0	—	V	VBAT = 4.2V, 10mA loading
	Loading current	—	—	100	mA	VDDIO=3V@VBAT = 4.2V
BT_AVDD	Voltage output	—	1.3	—	V	VDDIO=3.0V, 10mA loading
	Loading current	—	—	60	mA	BT_AVDD=1.25V@VDDIO=3.0v
EVDD	Voltage output	—	1.1	—	V	BT_AVDD=1.25V, 1mA loading
	Loading current	—	—	5	mA	EVDD=1.1V@BT_AVDD=1.25v
LP mode						
VDDIO	Loading current			5	mA	VDDIO=3V@VBAT = 4.2V

2.3 Battery Charge

Table 2-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
LDO_IN	Charge Input Voltage	4.5	5	5.5	V	—
V _{Charge}	Charge Voltage	4.15	4.2	4.25	V	—

I_{Charge}	Charge Current	20		200	mA	Charge current at fast charge mode
I_{Trinkl}	Trickle Charge Current	20	45	70	mA	$V_{\text{BAT}} < V_{\text{Trinkl}}$

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	—	$0.3 * V_{\text{DDIO}}$	V	$V_{\text{DDIO}} = 3.3\text{V}$
V_{IH}	High-Level Input Voltage	$0.7 * V_{\text{DDIO}}$	—	$V_{\text{DDIO}} + 0.3$	V	$V_{\text{DDIO}} = 3.3\text{V}$
IO output characteristics						
V_{OL}	Low-Level Output Voltage	—	—	0.33	V	$V_{\text{DDIO}} = 3.3\text{V}$
V_{OH}	High-Level Output Voltage	2.7	—	—	V	$V_{\text{DDIO}} = 3.3\text{V}$

2.5 Internal Resistor Characteristics

Table 2-5

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA1~PA3 PC2~PC5 PB3~PB3 PB6~PB8	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、internal pull-up/pull-down resistance accuracy $\pm 20\%$
PB0	8mA	—	10K	10K	
USBDP	4mA	—	1.5K	15K	
USBDM	4mA	—	180K	15K	

2.6 DAC Characteristics

Table 2-6

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	—	20K	Hz	1KHz/0dB 10Kohm loading With A-Weighted Filter
THD+N	—	-80	—	dB	
S/N	—	101	—	dB	
Crosstalk	—	-80	—	dB	
Output Swing	—	0.45	—	Vrms	
Dynamic Range	—	90	—	dB	1KHz/-60dB

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					10Kohm loading With A-Weighted Filter
DAC Output Power	—	4	—	mW	32ohm loading

2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		80		dB	1KHz/-60dB
S/N	—	92	—	dB	1KHz/-60dB
THD+N	—	-75	—	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		6	8	dBm	25°C, Power Supply VBAT=5V 2441MHz
RF Power Control Range		20		dB	
20dB Bandwidth		950		KHz	
Adjacent Channel	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

Enhanced Data Rate

Table 2-9

Parameter	Min	Typ	Max	Unit	Test Conditions
Relative Power		-1		dB	25°C, Power Supply VBAT=5V 2441MHz
$\pi/4$ DQPSK Modulation Accuracy	DEVM RMS	6		%	
	DEVM 99%	10		%	
	DEVM Peak	15		%	
Adjacent Channel Transmit Power	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

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2.8.2 Receiver

Basic Data Rate

Table 2-10

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

Enhanced Data Rate

Table 2-11

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

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3、 Package Information

3.1 QFN32_4.0x4.0

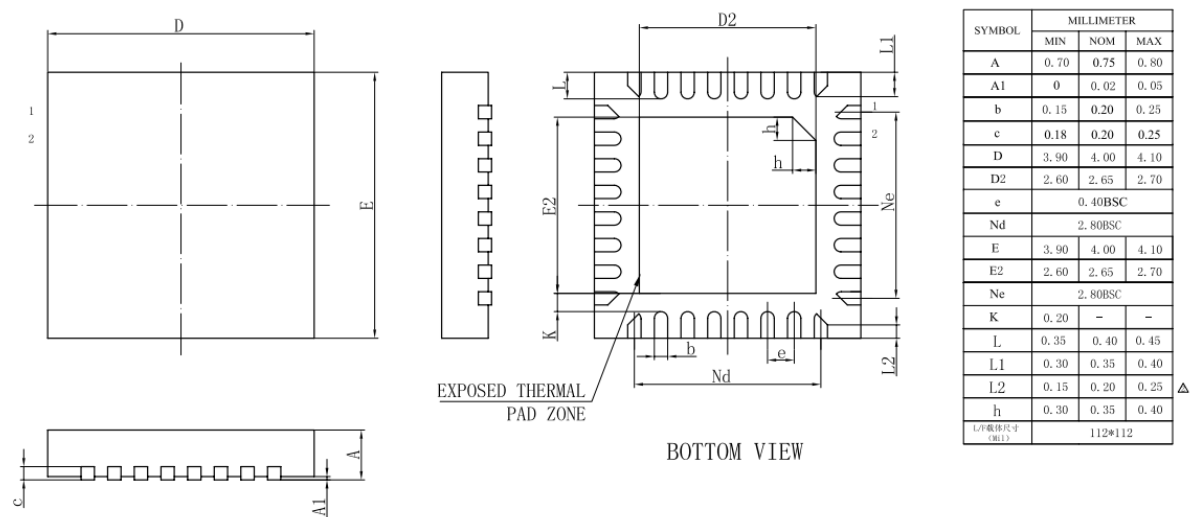


Figure 3-1 LC6976D Package

4、Revision History

Date	Revision	Description
2020.10.10	V1.0	Initial Release

74491A

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