AC7912D Datasheet

Zhuhai Jieli Technology Co.,LTD

Version：V1.1

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AC7912D Features

High performance 32-bit RISC CPU

- Double core RISC 32-bit CPU(Support FPU)
- 24KB D-Cache 6 way, 32KB I-Cache 8way
- DC-320MHz operation
- 128 Vectored interrupts
- Four Levels interrupt priority

Flexible I/O

- 50 GPIO pins
- All GPIO pins can be programmable as input or output individually
- All GPIO pins are internal pull-up/pull-down selectable individually
- CMOS/TTL level Schmitt triggered input
- External wake up/interrupt on all GPIOs

Peripheral Feature

- FUSB 1.1 OTG controller
- Audio interface supports IIS, left adjusted, right adjusted and DSP mode
- Multi-function 32-bit timers, support capture and PWM mode
- 16-bit PWM generator for motor driving
- 16-bit active parallel port
- Three full-duplex advanced UART
- Four SPI interface supports host and device mode
- Two SD Card Host controller
- One IIC interface supports host and device mode
- One SPDIF receiving interface without analog amplify
- Quadrate decoder
- Watchdog
- Two Crystal Oscillator
- Fourteen channels 10-bit ADC
- Power-on reset
- Embedded PMU support low power mode

Bluetooth Feature

- CMOS single-chip fully-integrated radio and baseband
- Compliant with Bluetooth V2.1(BR+EDR)+ BLE V5.3 specification
- Bluetooth Piconet and Scatternet support
- Meet class2 and class3 transmitting power requirement
- Support GFSK and π/4 DQPSK all paket types
- Provides +15dbm transmitting power
- Receiver with -93dBm sensitivity
- Support a2dp\avctp\avdtp\avrcp\hfp\spp\smp \att\gap\gatt\rfcomm\sdp\l2cap profile

WIFI Feature

- Support all mandatory IEEE 802.11b data rates of 1, 2, 5.5 and 11 Mbps, all 802.11g payload data rates of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, as well as 802.11n MCS0~ MCS7, MCS32, 20MHz/40MHz BW, 800ns and 400ns guard interval.
- Support advanced 1x1 802.11n features:
  Full / Half Guard Interval
  Frame Aggregation
  Reduced Inter-frame Space (RIFS)
  Space Time Block Coding (STBC)
- Greenfield mode Support
  WEP/WPA-PSK(TKIP/CCMP) /WPA2-PSCK/AES256/AES128/SHA256 /SHA128
- Support apply to AP/STA
- Transmitter power:

DSSS 1M/S	17	dBm
MCS0	16	dBm
MCS7	13	dBm

- Receiver sensitivity:

DSSS 1M/S	-95	dBm
MCS0	-92	dBm
MCS7	-74	dBm

Packages

- QFN68(8mm*8mm)

Temperature

- Operating temperature: -40℃ to +85℃
- Storage temperature: -65℃ to +150℃

1. Pin Definition

1.1 Pin Assignment

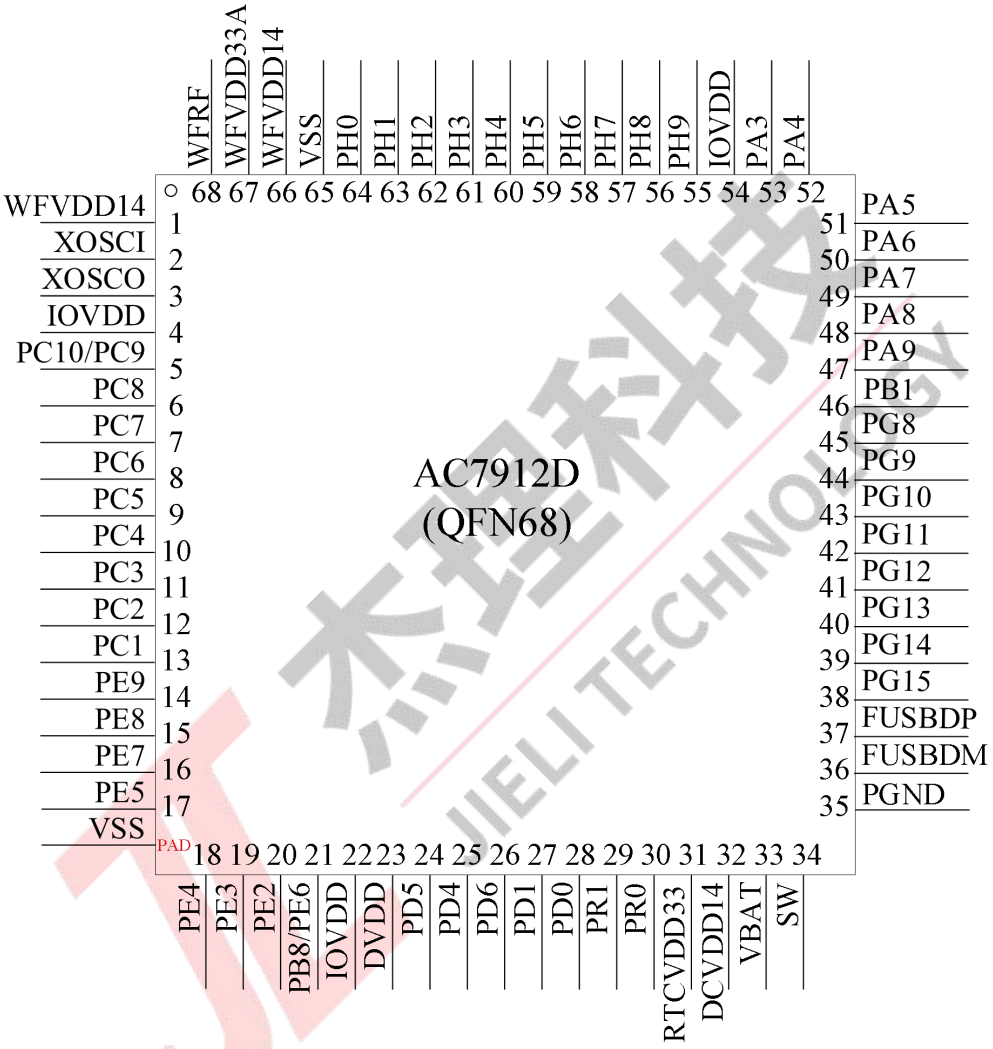


Figure 1-1 AC7912D_QFN68 Package Diagram

1.2 Pin Description

Table 1-1 AC7912D_QFN68Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	WFVDD14	P	/	RF Power 1.4V	-
2	XOSCI	I	/	RF OSCI	-
3	XOSCO	O	/	RF OSCO	-
4	IOVDD	P	/	IO Power 3.3V	-
5	PC10	I/O	24/16/8/2.4	GPIO	EMI_WR: EMI Write PAP_RD_A: PAP Read(A) Q-decoder1 UART2_RXB: Uart2 Data In(B) ADC9: ADC Channel 9 TMR5CK(MCPWM) PWM3: Timer3 PWM Output TOUCH10: Touch Input Channel 10 SDTAP_DATA
	PC9	I/O	24/16/8/2.4	GPIO	PAP_WR_A: PAP Write(A) Q-decoder0 UART2_TXB: Uart2 Data Out(B) ADC8: ADC Channel 8 TMR4CK(MCPWM) TOUCH9: Touch Input Channel 9 SDTAP_CLKA
6	PC8	I/O	24/16/8/2.4	GPIO	EMI_D7: EMI Data7 PAP_D15_A: PAP Data15(A) SPDIF_B PWMCH2L(MCPWM) CAP5: Timer5 Capture TOUCH8: Touch Input Channel 8
7	PC7	I/O	24/16/8/2.4	GPIO	EMI_D6: EMI Data6 PAP_D14_A: PAP Data14(A) SPDIF_A PWMCH2H(MCPWM) CAP4: Timer4 Capture TOUCH7: Touch Input Channel 7
8	PC6	I/O	24/16/8/2.4	GPIO	EMI_D5: EMI Data5 PAP_D13_A: PAP Data13(A) TMR3CK(MCPWM) PWM5: Timer5 PWM Output TOUCH6: Touch Input Channel 6

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
9	PC5	I/O	24/16/8/2.4	GPIO	EMI_D4: EMI Data4 PAP_D12_A: PAP Data12(A) SPI0_CSB: SPI0 Chip Select(B) TMR2CK(MCPWM) PWM4: Timer4 PWM Output TOUCH5: Touch Input Channel 5
10	PC4	I/O	24/16/8/2.4	GPIO	UART1_RXB: Uart1 Data In(B) EMI_D3: EMI Data3 PAP_D11_A: PAP Data11(A) SPI0_DOB(0): SPI0 Data Out(B) FPIN7(MCPWM) TMR5: Timer5 Clock In TOUCH4: Touch Input Channel 4
11	PC3	I/O	24/16/8/2.4	GPIO	UART1_TXB: Uart1 Data Out(B) EMI_D2: EMI Data2 PAP_D10_A: PAP Data10(A) SPI0_CLKB: SPI0 Clock(B) FPIN6(MCPWM) TMR4: Timer4 Clock In TOUCH3: Touch Input Channel 3
12	PC2	I/O	24/16/8/2.4	GPIO	IIC_SDA_C: IIC SDA(C) EMI_D1: EMI Data1 PAP_D9_A: PAP Data9(A) PWMCH4L(MCPWM) CAP1: Timer1 Capture TOUCH2: Touch Input Channel 2
13	PC1	I/O	24/16/8/2.4	GPIO	IIC_SCL_C: IIC SCL(C) EMI_D0: EMI Data0 PAP_D8_A: PAP Data8(A) ADC7: ADC Channel 7 PWM1: Timer1 PWM Output Wakeup11: Port Wakeup 11 TOUCH1: Touch Input Channel 1
14	PE9	I/O	24/16/8/2.4	GPIO	EMI_D15: EMI Data15 PAP_D15_B: PAP Data15(B)
15	PE8	I/O	24/16/8/2.4	GPIO	EMI_D14: EMI Data14 PAP_D14_B: PAP Data14(B)
16	PE7	I/O	24/16/8/2.4	GPIO	EMI_D13: EMI Data13 PAP_D13_B: PAP Data13(B)
17	PE5	I/O	24/16/8/2.4	GPIO	EMI_D11: EMI Data11 PAP_D11_B: PAP Data11(B)
18	PE4	I/O	24/16/8/2.4	GPIO	EMI_D10: EMI Data10 PAP_D10_B: PAP Data10(B)

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
19	PE3	I/O	24/16/8/2.4	GPIO	EMI_D9: EMI Data9 PAP_D9_B: PAP Data9(B)
20	PE2	I/O	24/16/8/2.4	GPIO	EMI_D8: EMI Data8 PAP_D8_B: PAP Data8(B)
21	PE6	I/O	24/16/8/2.4	GPIO	EMI_D12: EMI Data12 PAP_D12_B: PAP Data12(B)
	PB8	I/O	24/16/8/2.4	GPIO	SDGAT: SD Power Gate
22	IOVDD	P	/	IO Power 3.3V	-
23	DVDD	P	/	Core Power 1.2V	-
24	PD5	I/O	24/16/8/2.4	GPIO	SPI0_DOA(0): SPI0 Data Out(A) SFC_DOA(0): SFC Data Out(A)
25	PD4	I/O	24/16/8/2.4	GPIO	SPI0_CLKA: SPI0 Clock(A) SFC_CLKA: SFC Clock(A)
26	PD6	I/O	24/16/8/2.4	GPIO	SFGAT: Flash Power Gate
27	PD1	I/O	24/16/8/2.4	GPIO	SPI0_DIA(1): SPI0 Data In(A) SFC_DIA(1): SFC Data In(A)
28	PD0	I/O	24/16/8/2.4	GPIO (pull up)	SPI0_CSA: SPI0 Chip Select(A) SFC_CSA: SFC Chip Select(A)
29	PR1	I/O	16/2.4	GPIO	OSC32KO
30	PR0	I/O	16/2.4	GPIO	OSC32KI
31	RTCVDD33	P	/	RTC Power 3.3V	-
32	DCVDD14	P	/	Core Power 1.4V	-
33	VBAT	P	/	LDO Power	-
34	SW	P	/	DC-DC Switch Pin	-
35	PGND	P	/	PMU Ground	-
36	FUSBDM	I/O	10	USB Negative Data (pull down)	UART1_RXD: Uart1 Data In(D) ISP_DI_A SPI2_DOB: SPI2 Data Out(B) IIC_SDA_A: IIC SDA(A) ADC12: ADC Channel 12 SDTAP_DATB
37	FUSBDP	I/O	10	USB Positive Data (pull down)	UART1_TXD: Uart1 Data Out(D) ISP_CLK_A SPI2_CLKB: SPI2 Clock(B) IIC_SCL_A: IIC SCL(A) ADC13: ADC Channel 13 SDTAP_CLKB
38	PG15	I/O	24/16/8/2.4	GPIO	EMI_D31: EMI Data31 SPI2_DIB: SPI2 Data In(B)

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
39	PG14	I/O	24/16/8/2.4	GPIO	EMI_D30: EMI Data30 ALNK0_DAT3B2: Audio Link0 Data3(B2) ALNK1_DAT3B2: Audio Link1 Data3(B2) SPI3_DOB(0): SPI3 Data Out(B) SFP_DOB(0): SFP Data Out(B)
40	PG13	I/O	24/16/8/2.4	GPIO	EMI_D29: EMI Data29 ALNK0_DAT2B2: Audio Link0 Data2(B2) ALNK1_DAT2B2: Audio Link1 Data2(B2) SPI3_DAT2B(2): SPI3 Data2 In(B) SFP_DAT2B(2): SFP Data2 In(B)
41	PG12	I/O	24/16/8/2.4	GPIO	EMI_D28: EMI Data28 ALNK0_DAT1B2: Audio Link0 Data1(B2) ALNK1_DAT1B2: Audio Link1 Data1(B2) SPI3_DIB(1): SPI3 Data In(B) SFP_DIB(1): SFP Data In(B)
42	PG11	I/O	24/16/8/2.4	GPIO	EMI_D27: EMI Data27 ALNK0_DAT0B2: Audio Link0 Data0(B2) ALNK1_DAT0B2: Audio Link1 Data0(B2) SPI3_CSB: SPI3 Chip Select(B) SFP_CSB: SFP Chip Select(B)
43	PG10	I/O	24/16/8/2.4	GPIO	EMI_D26: EMI Data26 ALNK0_LRCKB2: Audio Link0 Word Select (B2) ALNK1_LRCKB2: Audio Link1Word Select (B2) SPI3_CLKB: SPI3 Clock(B) SFP_CLKB: SFP Clock(B)
44	PG9	I/O	24/16/8/2.4	GPIO	EMI_D25: EMI Data25 ALNK0_SCLKB2: Audio Link0 Serial Clock(B2) ALNK1_SCLKB2: Audio Link1 Serial Clock(B2) SPI3_DAT3B(3): SPI3 Data3 In(B) SFP_DAT3B(3): SFP Data3 In(B)
45	PG8	I/O	24/16/8/2.4	GPIO	EMI_D24: EMI Data24 ALNK0_MCKB2: Audio Link0 Master Clock(B2) ALNK1_MCKB2: Audio Link1 Master Clock(B2)

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
46	PB1	I/O	24/16/8/2.4	GPIO (pull up)	ISP_DO UART0_TXB: Uart0 Data Out(B) ADC3: ADC Channel 3 Long Press reset TMR1: Timer1 Clock In Wakeup8: Port Wakeup 8
47	PA9	I/O	24/16/8/2.4	GPIO	SD0_DAT0B: SD0 Data0(B) ALNK0_DAT2B1: Audio Link0 Data2(B1) ALNK1_DAT2B1: Audio Link1 Data2(B1) TMR6CK(MCPWM)
48	PA8	I/O	24/16/8/2.4	GPIO	IIC_SDA_B: IIC SDA(B) SD0_CLKB: SD0 Clock(B) ALNK0_DAT1B1: Audio Link0 Data1(B1) ALNK1_DAT1B1: Audio Link1 Data1(B1) SPDIF_D ADC1: ADC Channel 1 PWMCH1L(MCPWM) Wakeup4: Port Wakeup 4 SDTAP_DATD
49	PA7	I/O	24/16/8/2.4	GPIO	IIC_SCL_B: IIC SCL(B) SD0_CMDB: SD0 CMD(B) ALNK0_DAT0B1: Audio Link0 Data0(B1) ALNK1_DAT0B1: Audio Link1 Data0(B1) SPDIF_C ADC0: ADC Channel 0 PWMCH1H(MCPWM) TMR0: Timer0 Clock In Wakeup3: Port Wakeup 3 SDTAP_CLKD
50	PA6	I/O	24/16/8/2.4	GPIO	UART0_RXA: Uart0 Data In(A) ALNK0_LRCKB1: Audio Link0 Word Select (B1) ALNK1_LRCKB1: Audio Link1 Word Select(B1) FPIN0(MCPWM)
51	PA5	I/O	24/16/8/2.4	GPIO	UART0_TXA: Uart0 Data Out(A) ALNK0_SCLKB1: Audio Link0 Serial Clock(B1) ALNK1_SCLKB1: Audio Link1 Serial Clock(B1) CAP3: Timer3 Capture

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
52	PA4	I/O	24/16/8/2.4	GPIO	CLKOUT1: Clock Out1 SPI2_DOC: SPI2 Data Out(C) ALNK0_MCKB1: Audio Link0 Master Clock(B1) ALNK1_MCKB1: Audio Link1 Master Clock(B1) UART0_RXC: Uart0 Data In(C) PWMCH0L(MCPWM)
53	PA3	I/O	24/16/8/2.4	GPIO	SPI2_CLKC: SPI2 Clock(C) UART0_TXC: Uart0 Data Out(C) PWMCH0H(MCPWM)
54	IOVDD	P	/	IO Power 3.3V	-
55	PH9	I/O	24/16/8/2.4	GPIO	MIC1P: MIC1 P Channel
56	PH8	I/O	24/16/8/2.4	GPIO	MIC1N: MIC1 N Channel
57	PH7	I/O	24/16/8/2.4	GPIO	UART1_RXA: Uart1 Data In(A) EMI_D23: EMI Data23 PAP_D7_AB: PAP Data7(AB) SD1_CLKA: SD1 Clock(A) PWMCH5L(MCPWM) Wakeup13: Port Wakeup 13
58	PH6	I/O	24/16/8/2.4	GPIO	UART1_TXA: Uart1 Data Out(A) EMI_D22: EMI Data22 PAP_D6_AB: PAP Data6(AB) SD1_CMDA: SD1 CMD(A) FPIN3(MCPWM) PWM2: Timer2 PWM Output
59	PH5	I/O	24/16/8/2.4	GPIO	SD0_DAT3C: SD0 Data3(C) EMI_D21: EMI Data21 PAP_D5_AB: PAP Data5(AB) SD1_DAT0A: SD1 Data0(A) FPIN5(MCPWM)
60	PH4	I/O	24/16/8/2.4	GPIO	SD0_DAT2C: SD0 Data2(C) EMI_D20: EMI Data20 PAP_D4_AB: PAP Data4(AB) SD1_DAT1A: SD1 Data1(A) FPIN4(MCPWM)

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
61	PH3	I/O	24/16/8/2.4	GPIO	SD0_DAT1C: SD0 Data1(C) EMI_D19: EMI Data19 PAP_D3_AB: PAP Data3(AB) UART2_RXA: Uart2 Data In(A) SD1_DAT2A: SD1 Data2(A) ADC11: ADC Channel 11 PWMCH5H(MCPWM) TOUCH14: Touch Input Channel 14
62	PH2	I/O	24/16/8/2.4	GPIO	SD0_CLKC: SD0 Clock(C) EMI_D18: EMI Data18 PAP_D2_AB: PAP Data2(AB) SPI2_DIA: SPI2 Data In(A) UART2_TXA: Uart2 Data Out(A) SD1_DAT3A: SD1 Data3(A) TOUCH13: Touch Input Channel 13
63	PH1	I/O	24/16/8/2.4	GPIO	IIC_SDA_D: IIC SDA(D) SD0_CMDC: SD0 CMD(C) EMI_D17: EMI Data17 PAP_D1_AB: PAP Data1(AB) SPI2_DOA: SPI2 Data Out(A) UART0_RXD: Uart0 Data In(D) PWMCH3L(MCPWM) TOUCH12: Touch Input Channel 12
64	PH0	I/O	24/16/8/2.4	GPIO	IIC_SCL_D: IIC SCL(D) SD0_DAT0C: SD0 Data0(C) EMI_D16: EMI Data16 PAP_D0_AB: PAP Data0(AB) SPI2_CLKA: SPI2 Clock(A) UART0_TXD: Uart0 Data Out(D) ADC10: ADC Channel 10 PWMCH3H(MCPWM) Wakeup12: Port Wakeup 12 TOUCH11: Touch Input Channel 11
65	VSS	P	/	Ground	-
66	WFVDD14	P	/	RF Power 1.4V	-
67	WFVDD33A	P	/	RF Power 3.3V	-
68	WFRF	-	/	RF Antenna	-
PAD		P	/	VSS	-

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

Symbol	Parameter	Min	Max	Unit
Tamb	Ambient Temperature	-40	+85	℃
Tstg	Storage temperature	-65	+150	℃
VBAT	Supply Voltage	-0.3	5.5	V
RTCVDD33	RTC Power Voltage	-0.3	3.5	V
WFVDD33A	RF Power 3.3V Voltage	-0.3	3.5	V
WFVDD14	RF Power 1.4V Voltage	-0.3	1.55	V
$V_{3.3IO}$	3.3V IO Input Voltage	-0.3	IOVDD+0.3	V

2.2 PMU Characteristics

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	5.5	V	_
IOVDD	Voltage output	2.1	3.3	3.5	V	LDO5V = 5V, 200mA loading
DCVDD14	Voltage output	1.2	1.4	1.55	V	LDO mode: 70mA loading DC-DC mode: 120mA loading
RTCVDD33	Voltage input	2.2	3.0	3.5	V	_
DVDD	Voltage output	0.87	1.2	1.32	V	LDO5V=5V, 100mA loading
WFVDD33A	Voltage Input	2.1	3.3	3.5	V	_
WFVDD14	Voltage Input	1.2	1.4	1.55	V	_

2.3 IO Input/Output Electrical Logical Characteristics

Table 2-3

IO input characteristics						
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
V_{IL}	Low-Level Input Voltage	-0.3	–	0.3* IOVDD	V	IOVDD = 3.3V
V_{IH}	High-Level Input Voltage	0.7* IOVDD	–	IOVDD+0.3	V	IOVDD = 3.3V
IO output characteristics						
V_{OL}	Low-Level Output Voltage	–	–	0.33	V	IOVDD = 3.3V
V_{OH}	High-Level Output Voltage	2.7	–	–	V	IOVDD = 3.3V

2.4 Internal Resistor Characteristics

Table 2-4

Port	**General Output**	**High Drive**	**Internal Pull-Up Resistor**	**Internal Pull-Down Resistor**	**Comment**
PA,PC,PD, PE,PG,PH, PB1,PB8	8mA	24mA	10K	10K	1.PB1&PD0 default pull up 2.FUSBDM & FUSBDP default pull down 3. Internal pull-up/pull-down resistance | accuracy ±20%
PR0,PR1	2.4mA	16mA	10K	10K	
FUSBDP FUSBDM	10mA	–	1.5K	15K	

2.5 ESD Protection

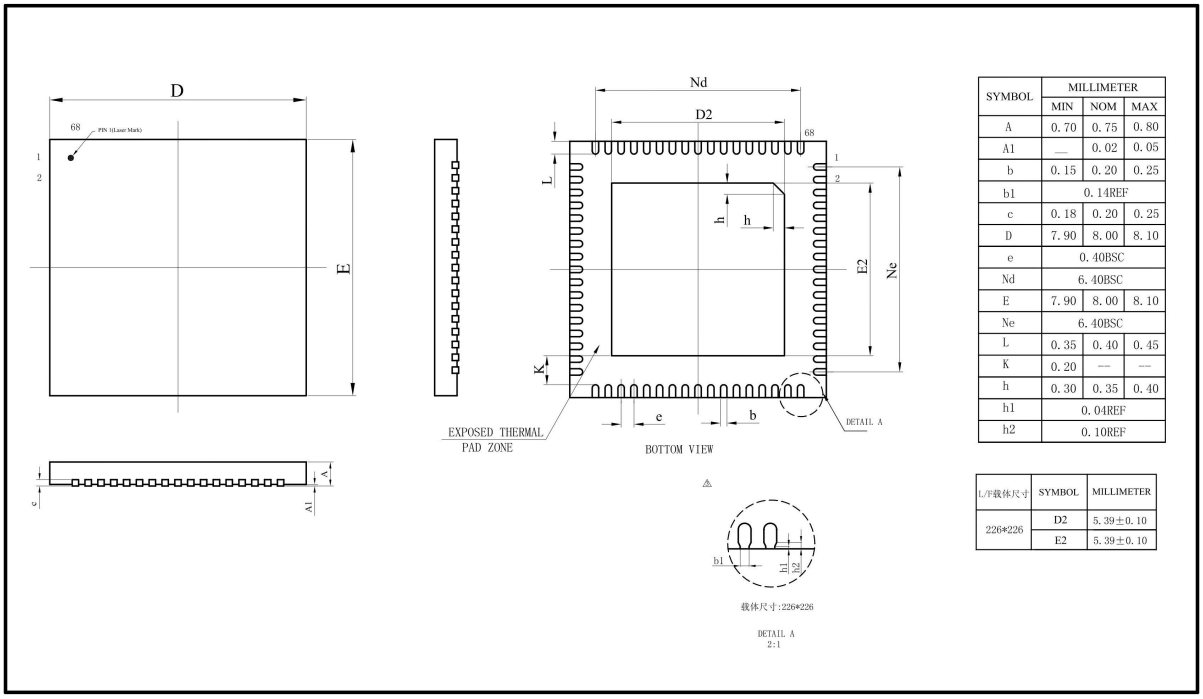
Table 2-5

Parameter	**Typ.**	**Test pin**	**Reference standard**
Human Body Mode	±4KV	All pins(except WFRF)	JEDEC EIA/JESD22-A114
Machine Mode	±200V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±1KV	All pins	JEDEC EIA/JESD22-C101F
Latch up	±200mA	All GPIO pins	JEDEC STANDARD NO.78E
	1.5xVopmax	All power pins	

Note : 1.5xVopmax = 1.5 times maximum operating voltage.

3. Package Information

3.1 QFN68(8mm*8mm)

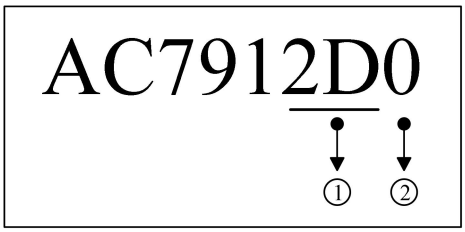


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.15	0.20	0.25
b1		0.14REF	
c	0.18	0.20	0.25
D	7.90	8.00	8.10
e		0.40BSC	
Nd		6.40BSC	
E	7.90	8.00	8.10
Ne		6.40BSC	
L	0.35	0.40	0.45
K	0.20	—	—
h	0.30	0.35	0.40
h1		0.04REF	
h2		0.10REF	

L/F载体尺寸	SYMBOL	MILLIMETER
226*226	D2	5.39±0.10
	E2	5.39±0.10

Figure 3-1 AC7912D_QFN68 Package

4. Package Type Specification



①Represents different chips (different packages or bindings)

②Represents different memory sizes

0: No memory
2: 2Mbit Flash
4: 4Mbit Flash
8: 8Mbit Flash
6: 16Mbit Flash
3: 32Mbit Flash
5: 64Mbit Flash
7: 128Mbit Flash
A: 1Mx16 SDRAM
B: 4Mx16 SDRAM
C: 16M bit PSRAM
D: 64M bit PSRAM

5. Solder-Reflow Condition

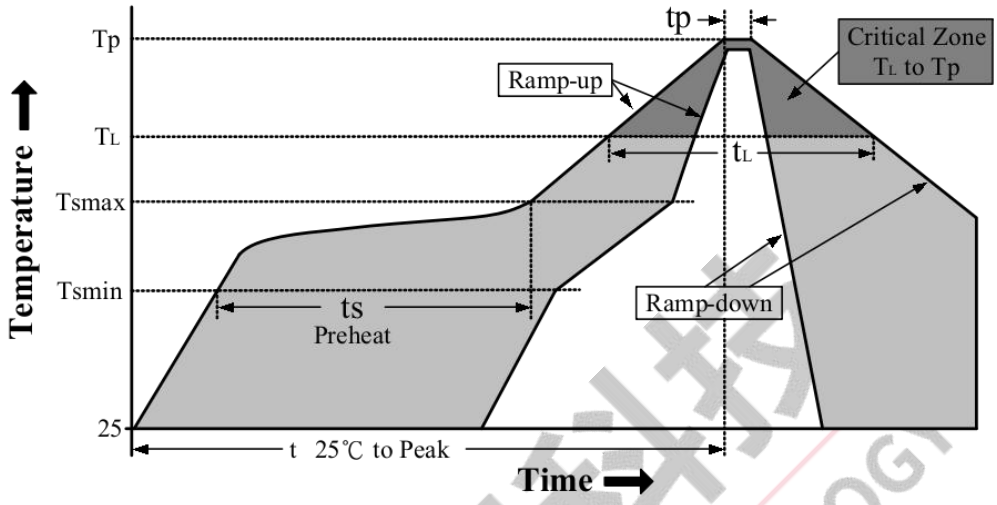


Figure 5-1 Classification Reflow Profile

Classification Profiles **Table 5-1**

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak	Temperature Min (T_{smin})	100℃	150℃
	Temperature Max (T_{smax})	150℃	200℃
	Time (ts) from (T_{smin} to T_{smax})	60-120 seconds	60-180 seconds
Average ramp-up rate (T_{smax} to T_p)		3℃/second max	3℃/second max
Liquidous temperature (T_L) Time (t_L) maintained above T_L		183℃ 60-150 seconds	217℃ 60-150 seconds
Peak package body temperature (T_p)		See Table 6-2	See Table 6-3
Time within 5℃ of actual Peak Temperature (tp)[2]		10-30 seconds	20-40 seconds
Ramp-down rate (T_p to T_L)		6℃/second max	6℃/second max
Time 25℃ to peak temperature		6 minutes max	8 minutes max

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

Note 2: Time within 5℃of actual peak temperature (tp) specified for the reflow profiles is a “supplier” minimum and “user” maximum.

SnPb - Classification Temperature **Table 5-2**

Package Thickness	Volume mm^3 < 350	Volume mm^3 ⩾350
<2.5 mm	240 +0/-5℃	225 +0/-5℃
⩾2.5 mm	225 +0/-5℃	225 +0/-5℃

Pb-free - Classification Temperature **Table 5-3**

Package Thickness	Volume mm^3 < 350	Volume mm^3 350 - 2000	Volume mm^3 > 2000
< 1.6mm	260℃	260℃	260℃
1.6 mm - 2.5mm	260℃	250℃	245℃
> 2.5mm	250℃	245℃	245℃

6. Revision History

Date	Revision	Description
2021.09.22	V1.0	Initial Release
2022.07.20	V1.1	Updated parameter