Air105 MCU Design Manual

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Version number modification record	date	author
V1.6 revised some GPIO numbers and added VBAT3.3 power supply instructions	2022-4-22	
V1.7 revised some GPIO numbers	2022-5-13	

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I. Overview

1.1 Product Overview

Hezhou Air105 is a QFN88 package, 10mm x 10mm size MCU, not only provides

Basic peripherals such as UART/GPIO/I2C/ADC/SPI, and advanced peripherals such as DAC/USB/DCMI/HSPI/KCU

Interface, built-in charging function, support 5V/3.3V power supply, at the same time comes with 5v to 3.3V LDO, 4M bytes Flash,

640K bytes of RAM.

1.2 Electrical performance

Limit parameters			
parameter		scope	unit
Iddpd	Description	-	nA
Tamb	Shutdown	-40~+85	°C
Tstg	current	-40~+125	°C
Ground	Operating	-0.3~0.3	V
Voh	temperature Storage	VDD -0.3 ~ VDD+0.3	V
Vol	temperature Digital	<0.4	V
Ioh	output high level Digital output low level	27(@3V)	mA
	Source current (PA2/3/4/5,	16(@3V)	mA
Iol	PC6/7/8/9) Source current (other IO) Sink	27(@0.5V)	mA
	current (PA2/3/ 4/5, PC6/7/8/9)	16(@0.5V)	mA
Vih	sink current (other IO) digital input	ÿ0.7×VDD	V
ViL	high level digital input low level	ÿ0.3×VDD	V

Electrical Characteristics				
parameter	Conditions (-40°C to +85°C)	value		unit
		minimum	maximum	
VCC		3.6	5.5	V
CHARGE_VCC		4.7	5.5	V
AVD33		2.7	3.6	V
VDD33		2.7	3.6	V
VBAT33		2	3.6	V

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Vol	VDD=3.3V	-	0.4	V
Voh	VDD=3.3V	VDD – 0.3		V
VIH	VDD=3.3V	0.7×VDD		V
VIL	VDD=3.3V		0.3×VDD	V

Safety-Related Features			
sensor		**scope**	**unit**
Voltage sensor	**Description** Main power voltage high voltage	4.0±0.1	V
	detection range Main power voltage low voltage	2.8±0.1	V
	detection range Battery voltage high voltage	4.0±0.1	V
	detection range Battery voltage low voltage detection range	1.9±0.1	V
clock frequency sensor	12M clock frequency detection range	12±50%	MHz
	32K clock frequency detection range	32±50%	KHz

1.3 Pin Definition

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The figure below shows the pin definition of Air105, which supports up to 54 GPIOs, and each IO shares pins with peripherals. each

GPIO can be configured as input, output, and interrupt mode. When used as output, each IO output value can be configured individually.

IO supports strong push-pull output/open-drain output mode.

Pin Details					
The default state of all general-purpose I/Os is pull-up after reset, and the resistance value is 51Kÿ					
edit No	name	kind type	Multiplexing function	Up and down ability	Remark
1	CVCC	P			NC, can not be connected
2	VDD33	P			Minimum voltage 2.7V, maximum voltage 3.6V This pin must be powered to power on! ! !
3	VCC	P			The minimum input voltage is 3.6V, and the maximum voltage voltage is 5.5V, must be used when using the internal LDO catch
4	VDD33_OUT	P		Chip 3.3V output	The output capability of the chip is about 400mA. When using the 3.3V of the chip around the load, it is necessary to Pay attention to the maximum current conditions
5	POWER_KEY			NC	It is only connected if the switch function needs to be realized. Electric direct start without connecting, switch machine to achieve Refer to the switch circuit below
6	PA7	I/O	GPIO7/SPI1_CSN	UP/DOWN	
7	PA6	I/O	GPIO6/SPI1_SCK	UP/DOWN	
8	PB2	I/O	GPIO18/SPI2_SCK	UP/DOWN	
9	PB3	I/O	GPIO19/SPI2_CSN	UP/DOWN	
10	PB4	I/O	GPIO20/SPI2_MOSI/UART2_CTS	UP/DOWN	
11	PB5	I/O	GPIO21/SPI2_MISO/UART2_RTS	UP/DOWN	
12	PE6	I/O	GPIO70/UART3_CTS/I2C0_SCL	UP/DOWN	
13	PE7	I/O	GPIO71/UART3_RTS/I2C0_SDA	UP/DOWN	
14	PE8	I/O	GPIO72/UART3_RX	UP/DOWN	
15	PE9	I/O	GPIO73/UART3_TX	UP/DOWN	
16	PE10	I/O	GPIO74/UART3_CTS	UP/DOWN	
17	PE11	I/O	GPIO75/UART3_RTS	UP/DOWN	

18	PA0	I/O	GPIO0/UART0_RX	Serial download	fixed
19	PA1	I/O	GPIO1/UART0_TX		fixed
20	PA2	I/O	GPIO2/UART0_CTS/PWM2	UP/DOWN	
twenty one	PA3	I/O	GPIO3/UART0_RTS/PWM3	UP/DOWN	
twenty two	PB0	I/O	GPIO16/PWM0/XTAL32K	UP/DOWN	
twenty three	PB1	I/O	GPIO17/PWM1/CLK_24M	UP/DOWN/Configurable output 24M	
24 CHARGE_VBAT P				CHARGE Power input out, connect the battery	Can charge 3.7V lithium battery, max. Charging current 200mA
25 CHARGE_VCC P				CHARGE power input	The minimum input voltage is 4.7V, and the maximum voltage Voltage is 5.4V, if need use internal LDO And power on, you must connect
26	PD1	I/O	GPIO49/DCMIS_DATA0	UP/DOWN	
27	PD2	I/O	GPIO50/DCMIS_DATA1	UP/DOWN	
28	PD3	I/O	GPIO51/DCMIS_DATA2	UP/DOWN	
29	PD8	I/O	GPIO56/DCMIS_DATA3	UP/DOWN	
30	PD9	I/O	GPIO57/DCMIS_DATA4	UP/DOWN	
31	PD10	I/O	GPIO58/KeyBoard7/DCMIS_DATA5	UP/DOWN	
32	PD11	I/O	GPIO59/KeyBoard8/DCMIS_DATA6	UP/DOWN	
33	PE0	I/O	GPIO64/KeyBoard4/DCMIS_DATA7	UP/DOWN	
34	PD6	I/O	GPIO54/UART1_CTS/DCMIS_DATA8	UP/DOWN	
35	PD7	I/O	GPIO55/UART1_RTS/DCMIS_DATA9	UP/DOWN	
36	PC6	I/O	GPIO38/PWM4/DCMIS_DATA10	UP/DOWN	
37	PC7	I/O	GPIO39/PWM5/DCMIS_DATA11	UP/DOWN	
38	PC8	I/O	GPIO40/PWM6/DCMIS_DATA12	UP/DOWN	
39	PC9	I/O	GPIO41/PWM7/DCMIS_DATA13	UP/DOWN	
40	PE1	I/O	GPIO65/KeyBoard5/DCMIS_VSYNC	UP/DOWN	
41	PE2	I/O	GPIO66/KeyBoard6/DCMIS_HSYNC	UP/DOWN	
42	PE3	I/O	GPIO67/DCMIS_PIX_CLK	UP/DOWN	

43	PB12	I/O	GPIO28/SPI0_CLK	UP/DOWN	
44	VSS	GND		chip ground	
45	PB13	I/O	GPIO29/SPI0_CSN	UP/DOWN	
46	PB14	I/O	GPIO30/SPI0_MOSI/UART1_CTS	UP/DOWN	
47	PB15	I/O	GPIO31/SPI0_MISO/UART1_RTS	UP/DOWN	
48	PC12	I/O	GPIO44/SPI5_MISO	UP/DOWN	
49	PC13	I/O	GPIO45/SPI5_MOSI	UP/DOWN	
50	PC14	I/O	GPIO46/SPI5_CSN	UP/DOWN	
51	PC15	I/O	GPIO47/SPI5_CLK	UP/DOWN	
52	VDD33	P			This pin must be powered to power on! ! !
53	PD13	I/O	GPIO61/UART2_TX/KeyBoard1	UP/DOWN	
54	PD12	I/O	GPIO60/UART2_RX/KeyBoard0	UP/DOWN	
55	PD15	I/O	GPIO63/UART2_RTS/KeyBoard3	UP/DOWN	
56	PD14	I/O	GPIO62/UART2_CTS/KeyBoard2	UP/DOWN	
57	NC			NC	
58	NC			NC	
59	NC			NC	
60	NC			NC	
61	REFP	O		Connect 1uF capacitor to ground	
62	PC5	I/O	GPIO37/ADC_IN6/CLK_27P12	Configurable output 27.12M	
63	PC4	I/O	GPIO36/ADC_IN5/XTAL32K	UP/DOWN	
64	PC3	I/O	GPIO35/ADC_IN4/UART1_RTS	UP/DOWN	
65	PC1	I/O	GPIO33/ADC_IN2/DAC/UART1_TX	Convert digital audio to analog audio interface	
66	PC0	I/O	GPIO32/ADC_IN1/UART1_RX	UP/DOWN	
67	VDD25	O		Connect 1uF capacitor to ground	
68	DN	I		Pay attention to keep the difference	

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69	DP	O		line, the impedance is done 90 Ohm control	
70	VBUS	I		100ÿ electrical impedance in series surge	
71	VDD33	P			Minimum voltage 2.7V, maximum voltage 3.6V This pin must be powered to power on! ! !
72	XO12M	0		XTAL 12MHz Output	The chip supports internal 12MHz oscillator and external Set 12MHz crystal, use external 12MHz
73	XI12M	1		XTAL 12MHz Input	For the chip-to-chip interface of the crystal, you can refer to The following clock circuit
74	VDD12	O		Connect 1uF capacitor to ground	
75	AVD33	P			Minimum voltage 2.7V, maximum voltage 3.6V This pin must be powered to power on! ! !
76	XI32	I		XTAL 32KHz Input	The chip supports internal or external 32KHz input output, use an external 32KHz circuit to Consider the clock circuit below
77	XO32	O		XTAL 32KHz Output	
78	NC			NC	
79	NC			NC	
80	NC			NC	
81	NC			NC	
82	NC			NC	
83	NC			NC	
84	VBAT33	P			This pin must be powered to power on! ! !
85	PA5	I/O	GPIO5/CLK_24M	Configurable output 24M	
86	PA8	I/O	GPIO8/SPI1_MOSI	When multiplexing as IO, it must be related mail must be opened first register to achieve power supply, Luatos has automatically played open	
87	PA9	I/O	GPIO9/SPI1_MISO		
88	PA10	I/O	GPIO10		
Note: I, for input; O, for output; P, for power					

Note: VDD33, AVDD33, VBAT33 must be powered on to boot! ! !

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2. Peripheral circuit design

2.1 Power supply circuit

The chip has 2 power supply modes:

Internal LDO, input power through VCC pin, internal conversion output 3.3V, power supply source is 3.6~5.5V USB

Or lithium battery. The internal LDO output capacity is limited, if you need to drive high-power peripherals, please add an additional LDO or DC2DC.

3.3V direct supply, the power supply range is 3.2V~3.4V, directly supply power to the chip's VDD33, AVDD33 pins and

VBAT33 pin, it will automatically turn on when power on, and the following switch circuit will be invalid.

Note: VDD33, AVDD33, VBAT33 must be powered on to boot! ! !

2.2 Switch circuit

The switch circuit realizes the switch function of the chip by controlling the internal 5V to 3.3V LDO to enable/disable. When using CHARGE_VBAT for power supply and using the power on/off function, the POWER_KEY is pulled high for 150ms when the chip is not powered on. The internal LDO is enabled, and the circuit is turned on through the POWER_KEY. Note: The POWER_KEY key is usually low level, press it and pull it high; CHARGE_VCC is powered on (voltage Range 4.7V~5.4V) The internal LDO directly enables the output to 3.3V and cannot be turned off. You can refer to the two power-on modes in the figure below.
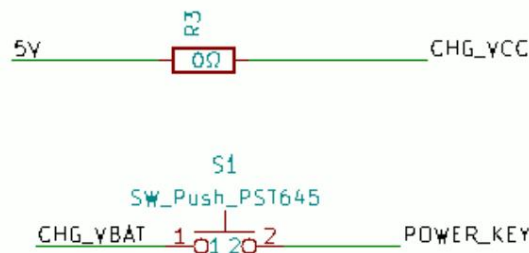
The shutdown function can turn off the internal LDO output by pulling up POWER_KEY for 7S to achieve the purpose of shutdown.

Note: VDD33, AVDD33, VBAT33 must be powered on to boot! ! !

If you want to use the internal **LDO and power on, CHARGE_VCC** must be connected! ! !

2.3 Charging module circuit

The Air105 chip supports the battery charging function, which can charge the 3.7V lithium battery with a maximum charging current of 200mA.

The full voltage of the battery is 4.15±0.05V. After the battery is fully charged, the voltage drops to 4.05V and the battery will be recharged. When the

battery supplies power to the module, it is recommended to add a diode switching circuit

2.4 LDOs

When the VCC input voltage of the Air105 chip is 4-5.5V, the maximum driving capacity of the internal LD0 is 400mA, so

When there are many external loads, consider adding some external LDO circuits.

2.5 Clock circuit

The chip supports an internal 12MHz oscillator and an external 12MHz crystal. The precision of the integrated 12MHz crystal is

±2%, after PLL frequency multiplication, it provides input for the system. The multiplied PLL clock frequency can be configured by software.

The frequency can be configured as: 108MHz, 120MHz, 132MHz, 144MHz, 156MHz, 168MHz, 180MHz,

192MHz, 204MHz.

When selecting an external 12MHz crystal oscillator, select different temperature grades, stability and load capacitance according to actual product requirements

value crystal. The load capacitance connected to both ends of the crystal needs to be adjusted according to the crystal and frequency offset of different manufacturers.
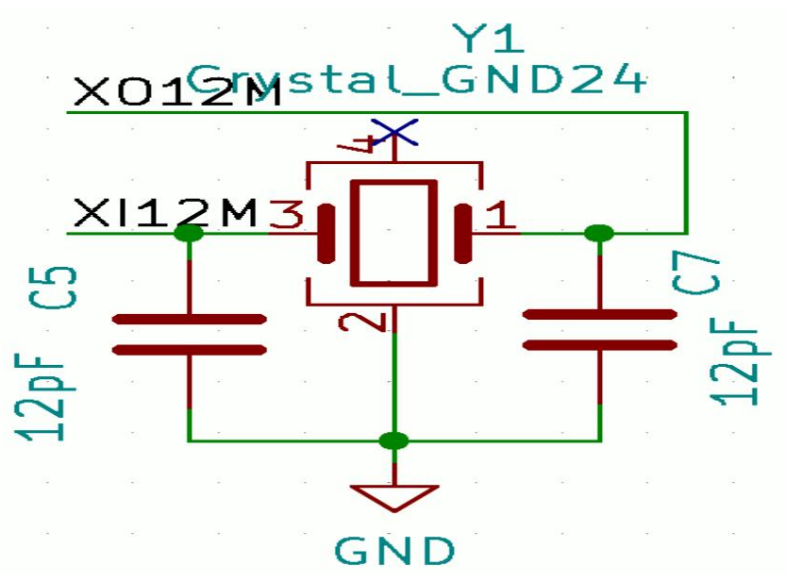
The crystal should be placed as close to the chip as possible, the traces should be as short as possible, and far away from interference sources, and there are multiple ground holes around the clock for isolation. under the clock

All layers on the surface are prohibited from passing through other traces to prevent interference with the clock source.

The entire safe area of the chip is based on the internal 32KHz work, and the RTC works based on the internal OSC 32K by default.

Switch to work with external XTAL 32K, support internal or external 32KHz output.

The external 32KHz circuit can refer to the figure below
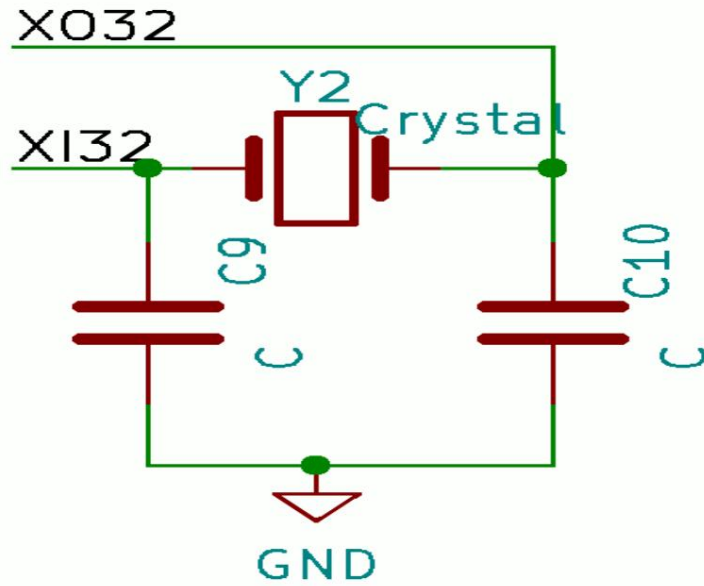
2.6 I2C circuit

The I2C (Inter-Chip) bus interface connects the microcontroller and the serial I2C bus. It provides multi-master function, controls all I2C

Bus-specific timing, protocol, arbitration, and timing. Both standard and express modes are supported. Depending on the needs of specific equipment,

DMA can be used to offload the CPU.

In terms of circuit, a 4.7K pull-up should be added to 3.3V at the I2C interface.
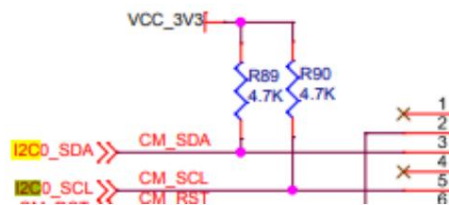
2.7 USB circuit

When connecting Air105 to USB, pay attention to DN and DP to ensure 90 Ohm impedance control and differential wiring; connect a 100ÿ resistor in series between the VBUS pin

and the chip for anti-surge, and a 22ÿ resistor in series on the signal line (also It can be other (such as 33 ohms) to prevent signal reflection, you can refer to the following schematic

diagram.
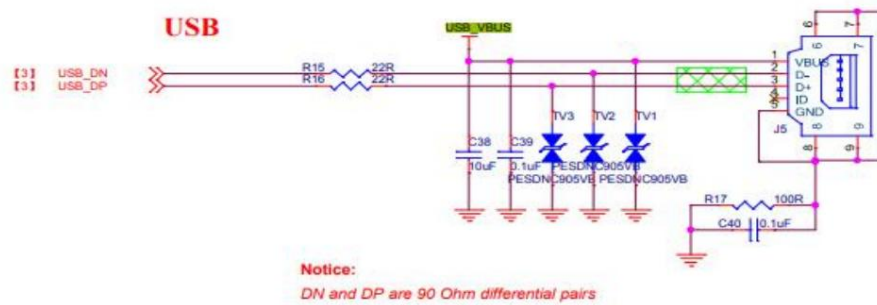
3. Reference circuit design

The power supply voltage of Air105 chip is 5V, the normal working power supply range: 4.0V~5.5V, the maximum driving energy of the internal LDO

The force is 400mA, pay attention to the external load to avoid exceeding the maximum driving capacity. Each power input pin of the chip should be placed with a corresponding filter.

For wave capacitors, add 1uF capacitors to ground at the 3 pins 61, 67, and 74.

4. Package size

TOP VIEW

SIDE VIEW

BOTTOM VIEW
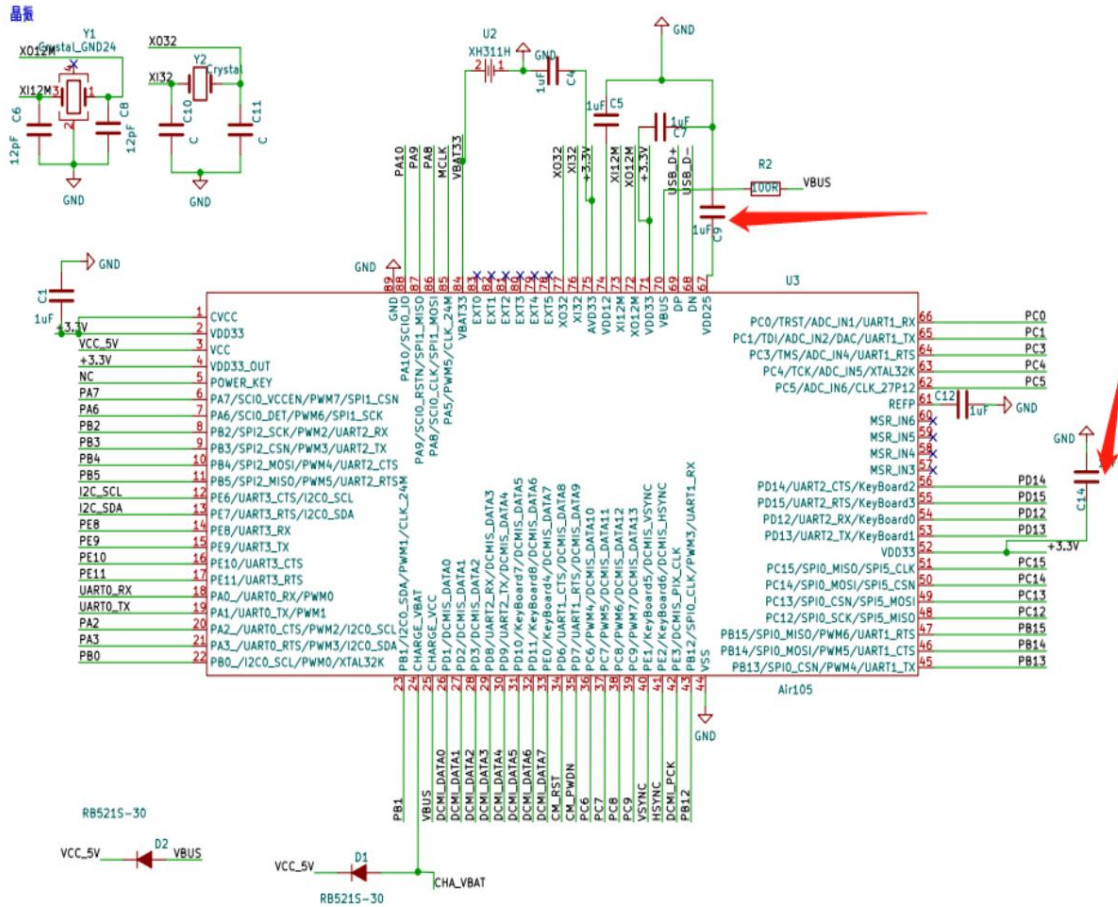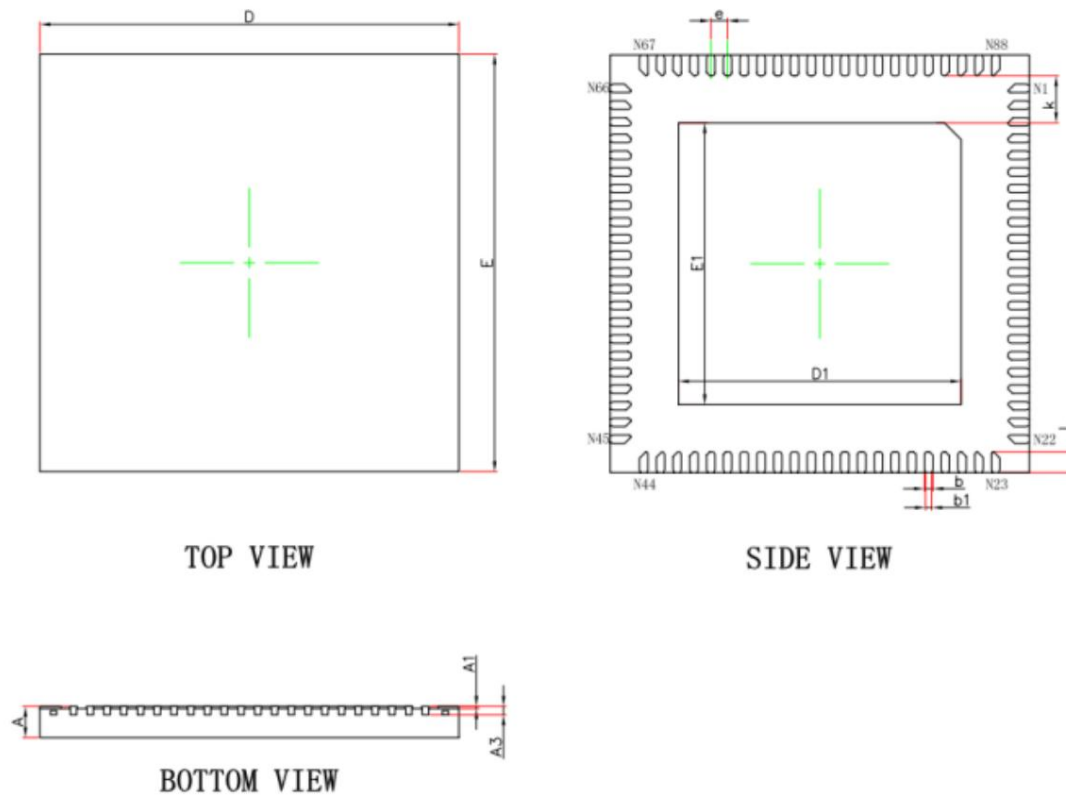
Parameter comparison table

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN.	MAX.	MIN.	MAX.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	9.900	10.100	0.390	0.398
E	9.900	10.100	0.390	0.398
D1	6.650	6.850	0.262	0.270
E1	6.650	6.850	0.262	0.270
k	1.125REF.		0.044REF.	
b	0.150	0.250	0.006	0.010
b1	0.150REF.		0.006REF.	
e	0.400BSC.		0.016BSC.	
L	0.400	0.600	0.016	0.024

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