

## High-performance self-capacitive touch chip

V1.2

## Overview

CST820 Self-capacitive touch chip, using high-speed MCU Kernel and embedded DSP The circuit, combined with its own fast self-capacitance sensing technology, can widely support a variety of self-capacitance patterns including triangles, on which single-point gestures and real two-point operations can be realized, achieving extremely high sensitivity and low standby power consumption.

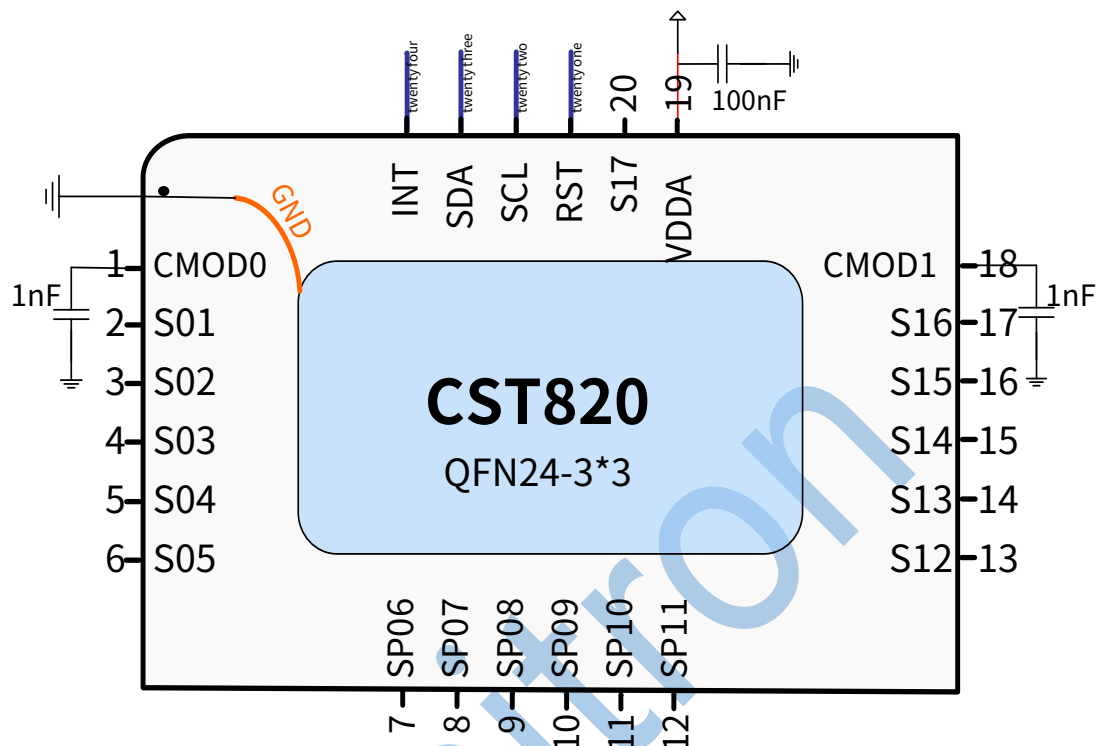
## Chip Features

- Built-in fast self-capacitance detection circuit and high performance DSP Modules
- Support online programming;
- Built-in watchdog;
- Multiple key support;
- Support standby gesture wake-up function;
- Capacitive screen support
  - Maximum support 17 sensing channels;
  - Channel suspension/pull-down design support;
  - Automatic adjustment of module parameters;
- Performance Indicators
  - Refresh rate > 100Hz;
  - Single-point gestures and real two-point operation;
- Power consumption index
- Typical power consumption in dynamic mode 1.9mA;
- Typical power consumption in standby mode 10uA;
- Typical power consumption in sleep mode 2uA;
- Communication interface
  - I2C Master/slave communication interface, rate 10KHz~400KHz Configurable;
  - compatible 1.8V/3.3V Interface level.
- Power supply
  - Single power supply 2.8V ~ 3.6V, power supply ripple <= 50mv;
- Package Type: QFN3X3-24L (P0.35T0.55)

## Application

Bracelets, watches and other products, TP Size recommendation: 2inch Within.

## References



### Note:

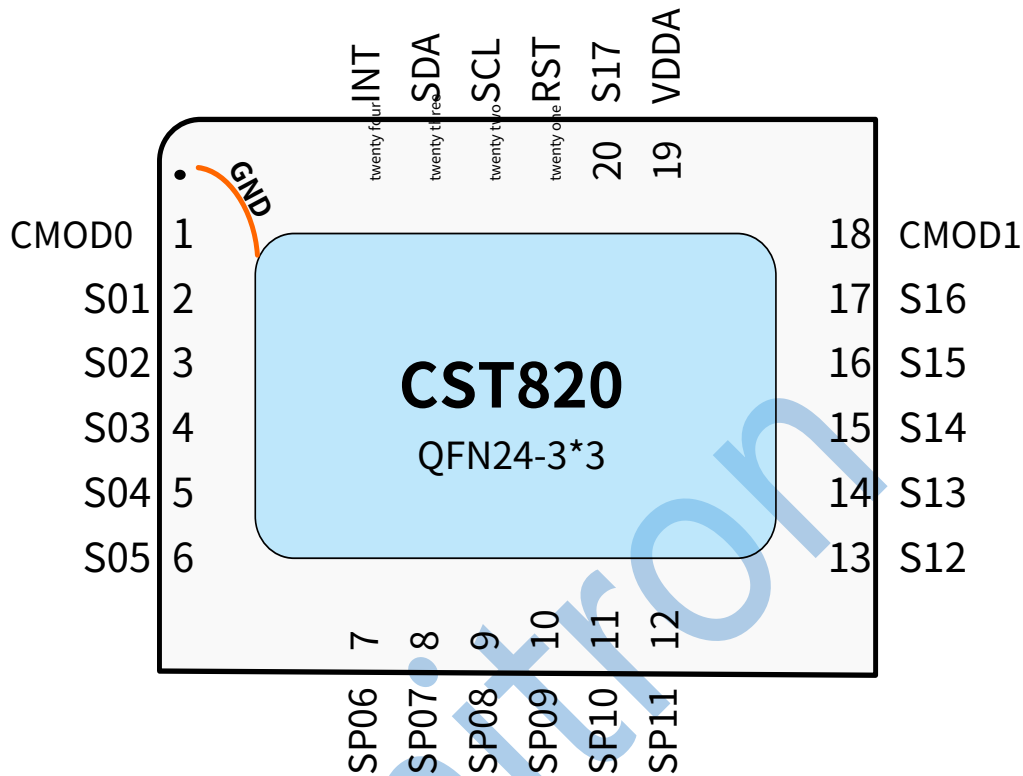
- CMODThe filter capacitor should be at least 10% Accuracy NPO/COG Material Capacitor
- CMODThe capacitance value can be selected in the range of 1nF to 5.6nF. Between, generally choose 1nF. The specific optimal value is related to the corresponding body capacitance.
- CMODThe filter capacitor must be placed close to the corresponding pins of the chip, and the wiring between the chips should be as short as possible.

## Ordering Information

Part Number	Encapsulation	Surface printing	Package
CST820	QFN3X3-24L(P0.35T0.55)	CST820 XXXXXXXX (Production tracking code)	Taping (5000)

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## Pinout/Description



name	illustrate	Remark
S01~S17	Sensing channel	
VDDA	power supply	2.8V~3.6V,catch2.2uF~ 10uFcapacitance
CMOD0/CMOD1	Voltage stabilizing capacitor	catch1nF~5.6nFVoltage stabilizing capacitor
INT	Interrupt output	Rising/falling edge selectable
SCL/SDA	I2C	Selectable internal pull-up/open-drain mode
RST	Reset input	Low effective

### Remark:

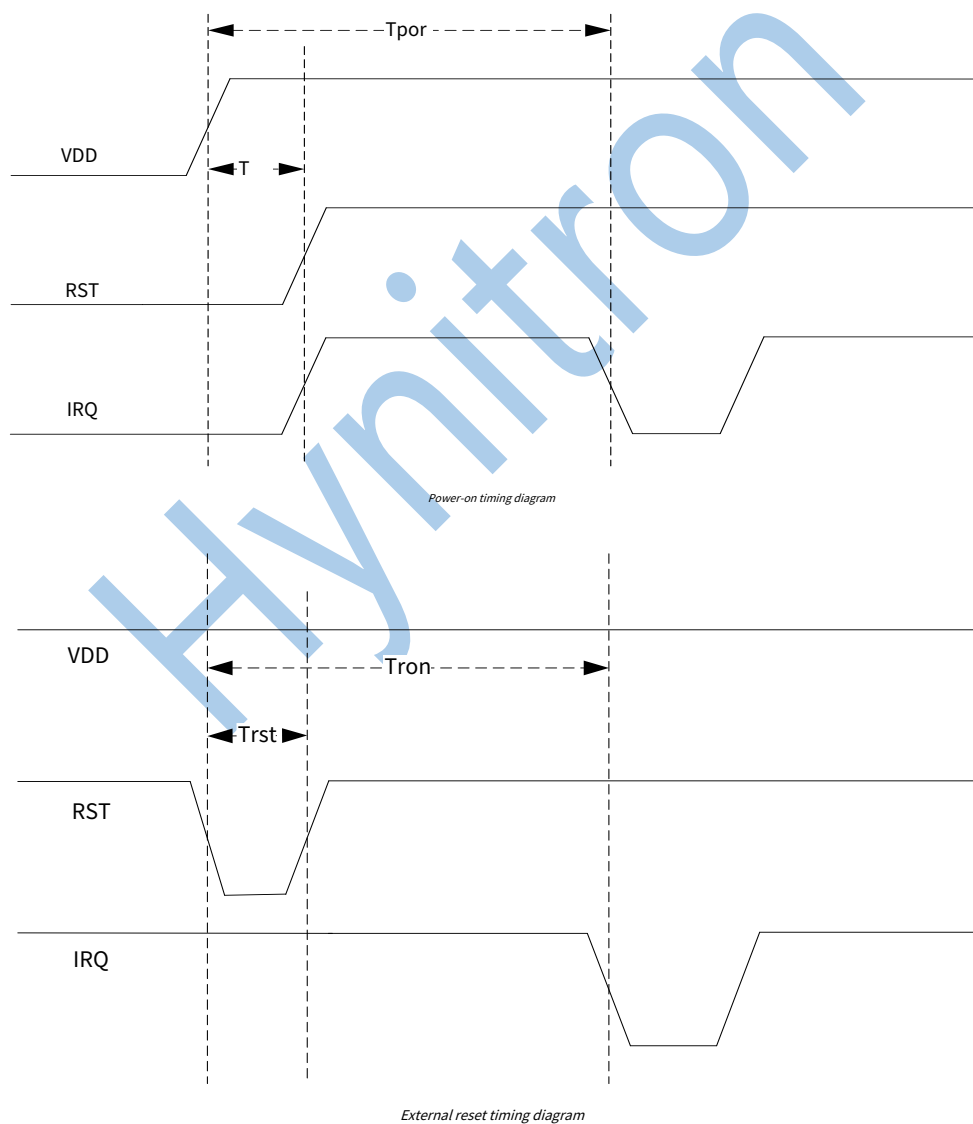
1. CMOD0/CMOD1A voltage stabilizing capacitor must be connected, the size of1nF ~ 5.6nF;

## Functional Description

CST820The self-capacitive touch chip, through its built-in fast self-capacitive sensing module, can realize single-point gestures and real two-point functions on patterns such as triangles without any external devices (except circuit bypass capacitors); while achieving fast response, it has extremely excellent noise resistance, waterproofness, and low power consumption performance.

## Power on and reset

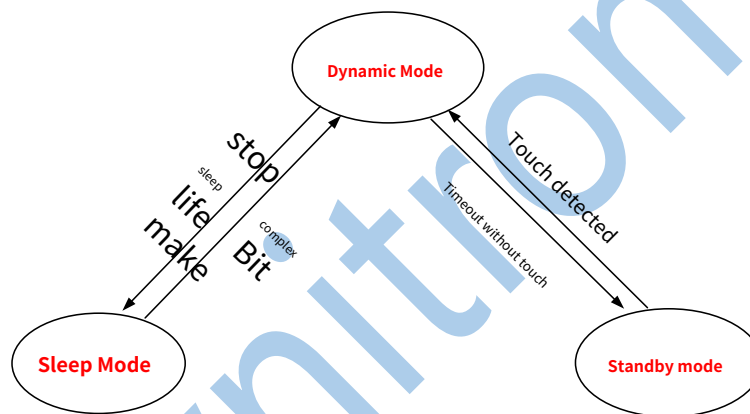
The chip has a built-in power-on reset circuit, so there is no need to connect an external reset circuit. The built-in power-on reset module will keep the chip in reset state until the voltage is normal. When the voltage is below a certain threshold, the chip will also be reset. RSTWhen it is low, the entire chip will be reset and the pin can be left floating.



symbol	describe	Minimum	Maximum	unit
Tpor	Chip initialization time after power-on	100	-	mxD
T	RSTPin delay high time	5	-	mxD
Tron	Chip reinitialization time after reset	100	-	mxD
Trst	Reset pulse time	0.1	-	mxD

Power-on and reset timing description

## Working Mode



- **Dynamic Mode**  
This mode is used when there are frequent touch operations. In this mode, the touch chip quickly scans the touch screen's self-capacitance to detect touches in a timely manner and report them to the host.  
Without touching2SAfter that, it automatically enters the standby mode. The function of automatically entering the standby mode can be controlled by registers.
- **Standby mode**  
In this mode, the touch chip scans the touch screen at a low frequency and enters the dynamic mode after detecting a finger touch.IRQ pin to wake up the host; it is also possible to switch to dynamic mode through the reset pin.
- **Sleep Mode**  
When the sleep command is received, it is in this mode; in this mode, the touch chip is in deep sleep state to save power consumption to the maximum extent, and can be switched to dynamic mode through the reset pin.

## Channel/Node Configuration

CST820 Self-capacitive touch chips can provide up to 17 channels. Each channel can support self-capacitance scanning without external devices. The range of self-capacitance supported by each channel is: **1pF ~ 400pF**

## I2C Communication

The chip supports standard I2C Communication protocol standard, can be realized 10KHz~400KHz Configurable communication rate. Two I2C Pinout SCL and SDA. In addition to supporting open-drain mode, it also supports internal pull-up mode for flexible selection.

## Interrupt mode

The touch chip will only detect a valid touch and report it to the host. IRQ pin notifies the host to read valid data to improve efficiency and reduce CPU burden;

The interrupt edge can be configured as rising edge or falling edge as needed; When matching a predefined gesture in standby mode, IRQ pin is also used to wake up the host.

## IIC Interface Description

The chip itself supports IIC Operation, you can also use IIC Pins for simple I/O operation. Specific functions can be customized by the software according to specific projects.

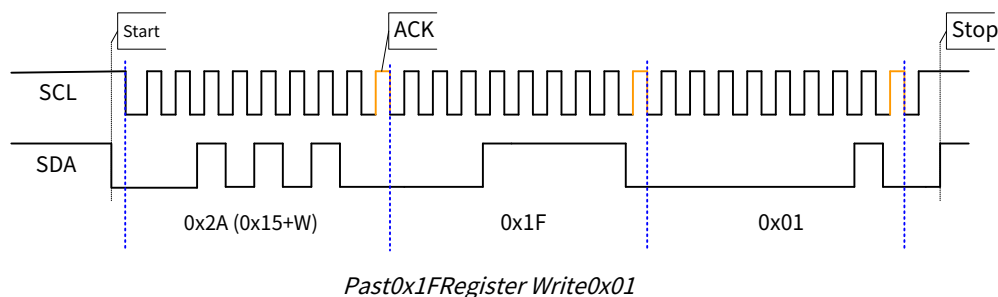
### a) Device IIC Address

The 7-bit device address of the chip is generally 0x15, that is, the device write address is 0x2A and the read address is 0x2B. *The device addresses of some projects may be different, please consult the corresponding project and engineering personnel.*

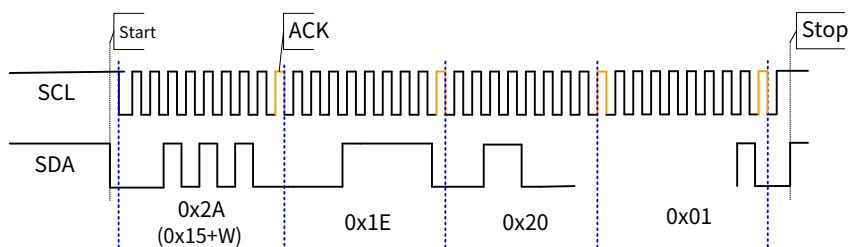
### b) IIC Communication speed

In order to ensure the reliability of communication, a maximum communication rate of 400Kbps is recommended.

### c) Write a single byte

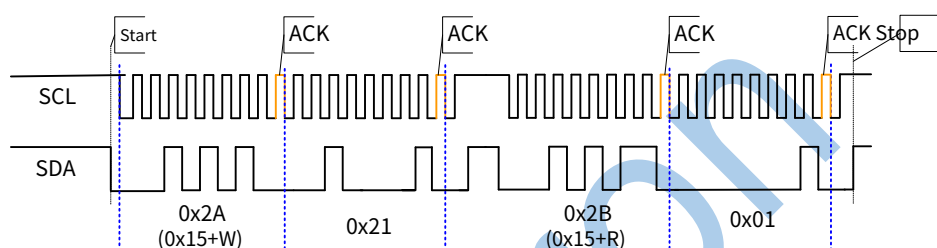


## d) Write multiple bytes continuously



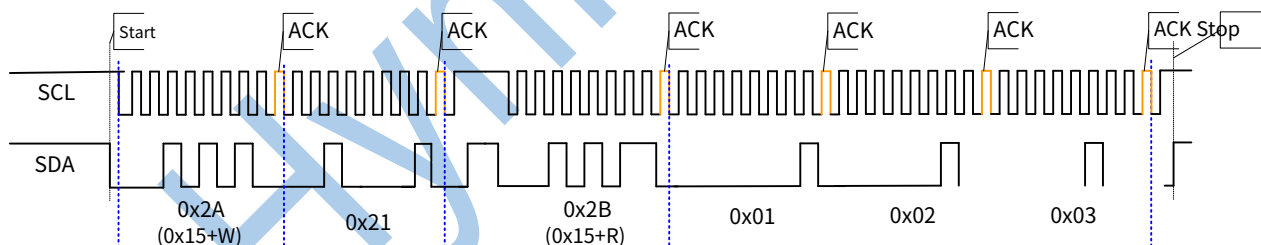
Past 0x1E, 0x1F Write separately 0x20, 0x01

## e) Read a single byte



from 0x21 Reading a single byte

## f) Read multiple bytes continuously



from 0x21, 0x22, 0x23 Read 3 Bytes

## g) Timing Description

symbol	illustrate	Minimum	Typical Value	Maximum	unit
F SCL I2C	I2C Clock frequency	10	-	400	kHz
t HDSTA I2C	Retention time (repeated) START condition. After this period of time, the first Clock pulses	0.6	-	-	us
t LOW I2C	SCL Low period of the clock	1.3	-	-	us
t HIGH I2C	SCL High period of the clock	0.6	-	-	us



t SUSTAI2C	repeatSTARTCondition establishment time	0.6	-	-	us
t SUDATI2C	Data creation time	100	-	-	ns
t SUSTOI2C	STOPCondition establishment time	0.6	-	-	us
tBUFI2C	STOPandSTARTBus idle time between conditions	4.5	-	-	us

*IICTiming Description*

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## Application Design Specifications

### Power supply decoupling capacitor

Generally in the chip VDD and VSS Connect one end 0.1uF and 10uF The ceramic capacitor can play the role of decoupling and bypassing. The decoupling capacitor should be placed as close to the chip as possible to minimize the current loop area.

### COMD Filter capacitor

The filter capacitor should be at least 10% Accuracy NPO/COG Material Capacitor, The capacitance value can be selected in the range of 1nF to 5.6nF Between, generally choose 1nF.

The specific optimal value is related to the corresponding body capacitance. COMD The filter capacitor must be placed close to the corresponding pins of the chip, and the wiring between the chips should be as short as possible.

### Waterproof precautions

Sensor There should not be large areas of solid ground around the wiring. Large areas of ground must be broken up.

### ESD Precautions

FP The design will directly affect ESD When designing, the following points must be noted:

- FP Try to use magnetic film for full shielding, and the magnetic film must be grounded.
- FP No Sensor Keep the pressure and position as far away from the gap of the assembly as possible to reduce ESD impact.
- The power supply access point can be considered to increase TVS to the ground to enhance resistance ESD interference performance.

### Electromagnetic Interference Considerations

Sensor The wiring must be separated from the lines that are unlikely to cause interference, such as power lines, audio lines, LCD Drive line, Bluetooth antenna, RF Antenna, etc. In particular, TP When using a full-fit design, it may be affected by LCD interference, at this time TP The parameters need special debugging.

### Ground

The high-precision detection circuit inside the touch chip is sensitive to the ground line. If possible, the user should use star grounding to isolate the noise of other chips. At the same time, insert magnetic beads in series at the ground point as much as possible to enhance the anti-interference ability.

If star grounding is difficult to achieve, users should also try to separate the ground traces of high-current devices from the ground traces of the chip.

## Electrical Characteristics

### Absolute Maximum Parameters

symbol	illustrate	Minimum	Typical Value	Maximum	unit
TSTG	Storage temperature	- 40	25	125	°C
Ta	Working environment temperature when power is on	- 20	-	85	°C
Vdd	Supply voltage relative to Vss	- 0.3	-	+ 3.6	V
Vio	DC input voltage	VSS-0.3	-	VDD+0.3	V
LU	Latch-up Current	-	200	-	mA

Absolute Maximum Parameters

### AC electrical performance (Ambient temperature 25 °C, VDDA=3.3V)

symbol	illustrate	Minimum	Typical Value	Maximum	unit
Fcpu	CPU frequency	- 2%	20	+ 2%	MHz
F32k	Internal low-speed clock frequency	- 5%	32	+ 5%	kHz
tXRST	External reset pulse width	-	0.1	-	ms
tPOWERUP	Time from POR completion to CPU execution of code	-	4	-	ms
FGPIO	GPIO switching frequency	-	2	-	MHz
tRISE	Pin level rise time, Cload=50pF	-	32	-	nS
tFAIL	Pin level fall time, Cload=50pF	-	11.2	-	nS

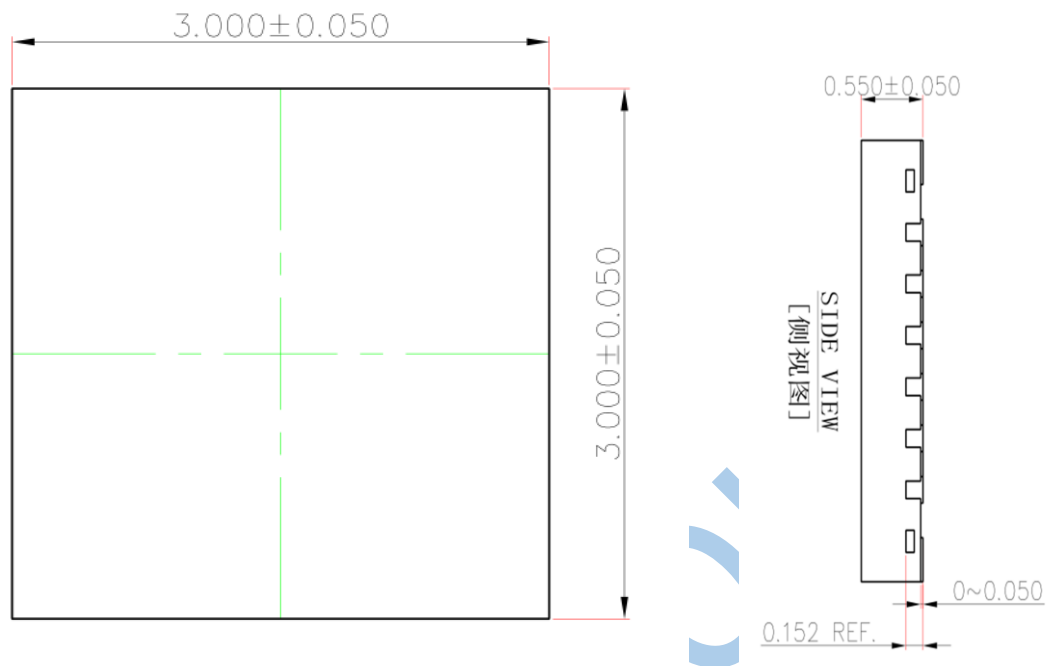
AC electrical characteristics

### DC electrical performance (Ambient temperature 25 °C, VDDA=3.3V)

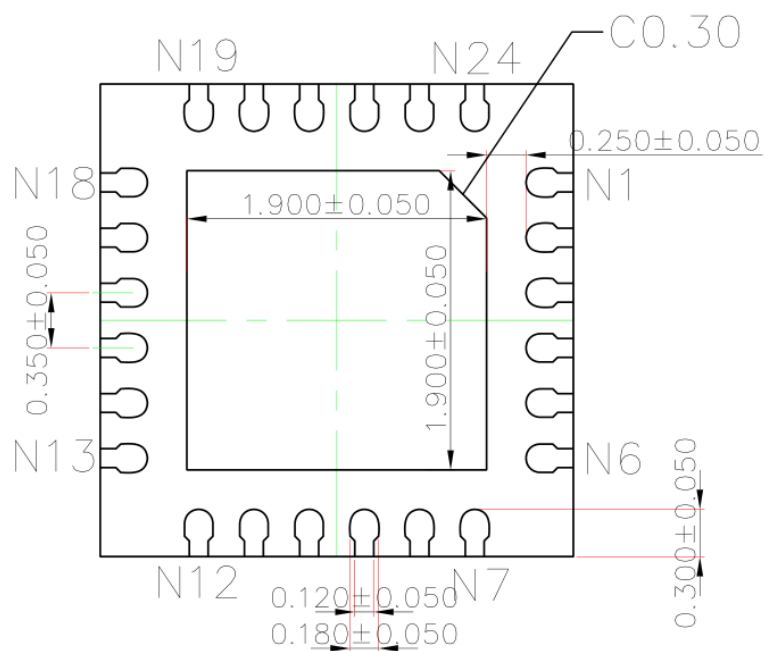
symbol	illustrate	Minimum	Typical Value	Maximum	unit
Vdd	Supply voltage	2.8	3.0	3.6	V
Rpu	Pull-up resistor	-	5	-	KΩ
Voh	High level output voltage	0.7*Vdd	-	-	V
Vol	Low level output voltage	-	-	0.3*Vdd	V
Ioh	High level output current	-	2.0	-	mA
Iol	Low level sink current	-	20.0	-	mA
Vil	Input low level voltage	-	-	0.3*Vdd	V
Vi	Input high level voltage	0.7*Vdd	-	-	V
Iil	Input leakage current	-	10	-	nA
Idd1	Operating current (dynamic mode)	-	1.9	-	mA
Idd2	Operating current (standby mode)	-	10	-	uA
Idd3	Operating current (sleep mode)	-	2	-	uA
Vddp	Programming voltage	2.8	-	3.6	V

DC electrical characteristics

## Product Packaging



TOP VIEW  
[顶视图]



BOTTOM VIEW  
[背视图]

## Revision History

Version	Revisions
V1.2	Modify the material number
V1.1	Revised power consumption data
V1.0	Initial Release

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statement

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