GX8303
Compact BLE IoT SoC
Datasheet

Revision History:

Version	Time	Change Log	Author
V0.1	2024.4.15	Initial	Robot.Ling
V0.2	2024.7.22	Add function description,applications， electronic specification and package information.	Liqr

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Table of contents

1. Key Features

GX8303 is a compact and small foot-print Bluetooth LE SoC. The chip integrates BLE radio & baseband, CPU, system, RAM, OTA memory and peripherals. This is a high-cost performance and compact chip with a wide range of BLE and 2.4G based applications.

Bluetooth

- Bluetooth Low Energy V5.2 qualified
- Support 1Mbps, 2Mbps, and 125K/500K coded PHY
- Support 2.4G proprietary mode
- RX sensitivity:
  - -96dBm@BLE1M
  - -93dBm @BLE2M
- TX power: 10dBm

CPU

- 32bit RISC CPU
- Frequency up to 64 MHz

Memory

- Built-in 8KB Retention SRAM
- 64KB ROM for BT stack and peripheral drivers
- 16kB OTP with online programming
- EEPROM(optional)

System

- Use 16MHz crystal
- Internal 32kHz and 32Mhz OSC
- Power on reset and brow out reset

Peripherals

- USB2.0 Full Speed slave
- 3-channel PWM
- X1 I2C, 100khz and 400khz
- X1 SPI Master
- X1 UART, up to 1Mbps baud rate
- SWD
- 3 Quadrature Decoder
- Multi-channel 12-bit ADC
- Real Timer Counter
- X4 32-bit Timer, and 1 Watchdog Timer

Power management

- Wide Input voltage range: 1.8~5.5v
- Build in LDOs
- Support lithium battery charging
- Typical power consumption:
  - OFF Mode: 0.7uA
  - Sleep with 32Khz RTC: 2uA
  - RX mode: 10ma@3.3v
  - TX mode(0db): 10mA@3.3v

Package

- SOP8
- Operating Temperature: -40 ~ 125 ℃

2. Chip architecture

2.1. Block diagram

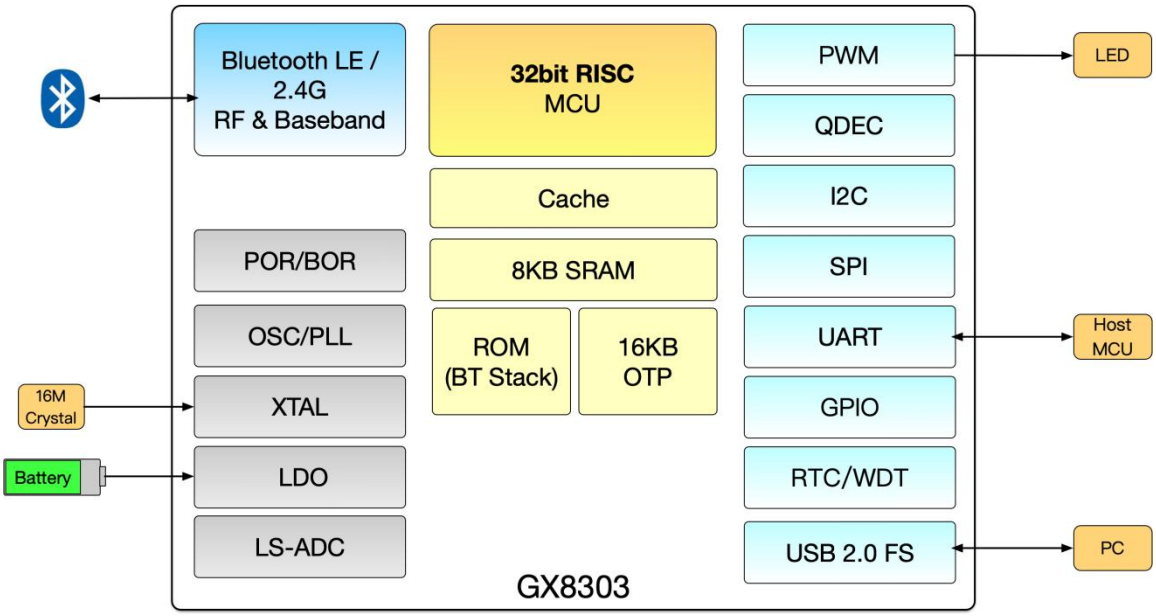


Figure 2.1 GX8303 Chip block diagram

3. Pin map

3.1. Acronyms

DP => Digital Power
AP => Analog Power
I => Digital Input
IO => Bi-directional
DG => Digital Ground
AG => Analog Ground
O => Digital Output

3.2. Pin map

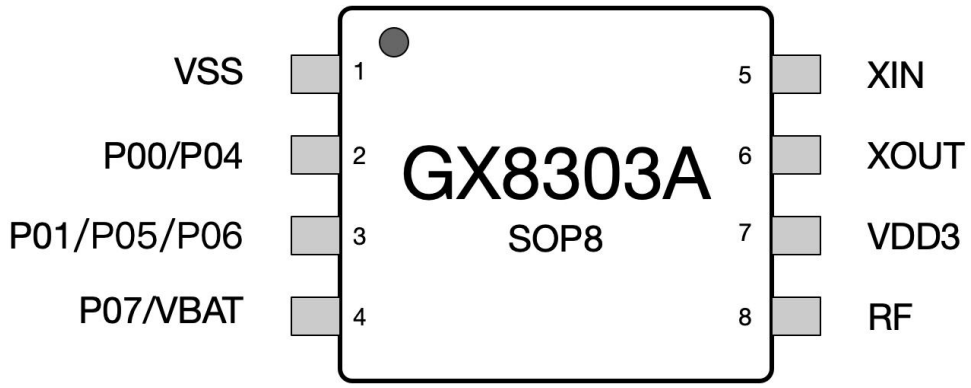


Figure 3.1 GX8303 Pin map

3.3. GX8303 pin description

Pin Number	Pin Name	Type	Description
1	VSS	AG	Digital and analog ground
2	P00/P04	IO	GPIO_00/USBDP/PWM0/UART_TX/GPIO_04/IIC_SCL/SPI_SCK/ADC_0/UART_TX
3	P01/P05/P06	IO	GPIO_01/USBDM/PWM1/UART_RX/GPIO_05/IIC_SDA/UART_TX/ADC_1/UART_RX/GPIO_06
4	P07/VBAT	IO	GPIO_07/PWM3/VBAT/USBDM

5	XIN	I	16Mhz crystal input
6	XOUT	O	16Mhz crystal output
7	VDD3	AP	3.3v power supply
8	RF	IO	RF antenna

3.4. IO pin-mux table

#	Name	Function0	Function1	Function2	Function3	Function4
0	GPIO_00	GPIO	USBDP	PWM0	UART_TX	/
1	GPIO_01	GPIO	USBDM	PWM1	UART_RX	/
2	GPIO_02	SWD_IO	GPIO	SPI_RX	PWM0	UART_TX
3	GPIO_03	SWD_CLIK	GPIO	SPI_SSN	PWM1	UART_RX
4	GPIO_04	GPIO	IIC_SCL	SPI_SCK	Analog_io0	UART_TX
5	GPIO_05	GPIO	IIC_SDA	UART_TX	Analog_io1	UART_RX
6	GPIO_06	GPIO	PWM2	USBDP	Analog_io2	/
7	GPIO_07	GPIO	PWM3	USBDM	/	/

4. Function description

4.1. Bluetooth Features

- Bluetooth Low Energy V5.2 qualified
- Support BLE1M, BLE2M, 125K and 500K coded PHY
- Support all BLE master and slave
- 2.4G proprietary mode
- Performance:
  - -96dBm @ BLE 1Mbps
  - -93dBm @ BLE 2Mbps
  - TX power -20 to +10dBm in 3dB steps
  - Single-pin antenna: no RF matching or Rx/Tx switching required

4.2. CPU

- 32bit RISC CPU, with 512 bytes cache.

4.3. Memory

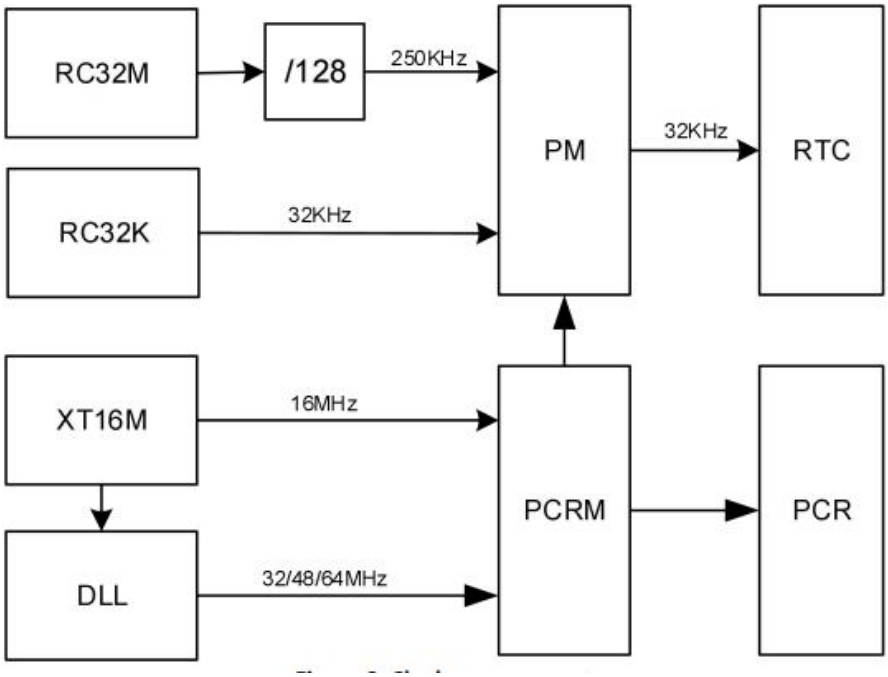
- Total 64kB ROM, for Boot code, protocol stack, common peripheral drivers.
- 8KB retention SRAM , can be used to store program or data.
- 16KB OTP, integrated charge pump for programming.

Name	Size(kB)	Master	Physical Address
ROM	64K	MCU	0000_0000 ~ 0000_FFFF
SRAM	8K	MCU	1FFF_0000 ~ 1FFF_1FFF
OTP	16K	MCU	1FFF_8000 ~ 1FFF_BFFF

4.4. Clock

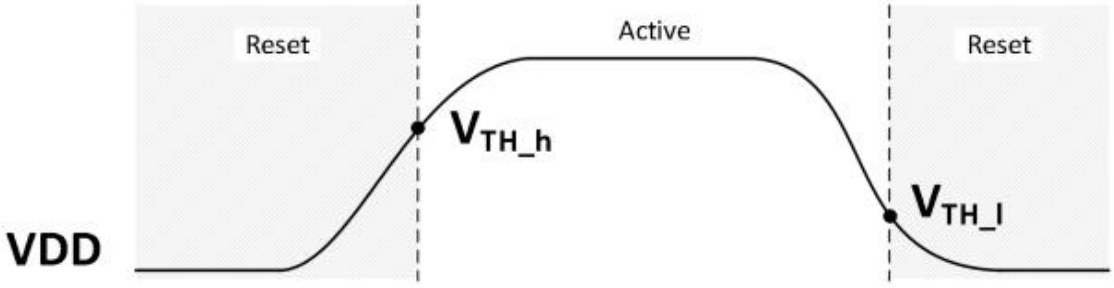
- 16MHz external crystal

- Integrated internal 32KHz and 32MHz OSC
- Integrated PLL for system, audio and USB applications



4.5. Reset

- Integrated power on reset and brown out reset.
- UVLO:



VDD	Min.	TYP	Max.	Unit
V_{TH_h}	1.7	1.74	1.78	V
V_{TH_l}	1.63	1.66	1.69	V

4.6. GPIO

- All GPIOs can be configured as bi-directional serial interface, by selecting as input or output direction, and their corresponding data can be either read from or written to registers
- All GPIOs support wake-up and debounce function, and all pins support interrupt
- Each GPIO pins can be pulled up to VDD3 or pulled down to ground by adding pull up or pull down resistors to have default functions/states
- Each IO supports function reuse,please check the function reuse tabel

4.7. 2.4GHz Radio

- Operate in the worldwide ISM frequency band at 2.4 to 2.4835 GHz
- General modulation format
  - FSK (configurable modulation index) with configurable Gaussian Filter Shaping
  - On-air data rates
  - 1Mbps/2Mbps
- Transmitter with programmable output power of -20dBm to +10dBm, in 3dB steps
- RSSI function (1 dB resolution, ± 2 dB accuracy)
- Receiver sensitivity
  - -96dBm@1Mbps BLE
  - -93dBm@2Mbps BLE
- Embedded RF balun
- Integrated frac-N synthesizer with phase modulatio

4.8. Timer,RTC&WDT

- A 32-bit system timer (SysTick)
- A count down watchdog timer
- The Real Time Counter (RTC) module

4.9. Security

- The ECB encryption block supports 128-bit AES encryption

- Support hash generation, digital signatures, and keystream generation for data encryption/decryption

4.10. SPI

- Supports SPI, SSP and Microwire serial protocols
- The SPI is master only

4.11. I2C

- Supports 100Khz, and 400Khz modes
- Supports 7-bit address and 10-bit address
- Built-in configurable spike suppression function

4.12. UART

- Full-duplex operation
- Supports speed up to 1Mbps

4.13. USB

- Supports full speed(FS) and low speed(LS)
- 8 endpoints: EP0 IN/OUT supports input and output control data transfer,EP1~EP7 IN/OUT support input and output interrupt data transfer
- EP7 supports input isochronous data transfer

4.14. ADC

- 12bit SAR ADC has total 10 inputs
- 4 pairs of differential input or six single-ended inputs can be programmed
- Max 320KHz ADC sampling rate

4.15. Power consumption

- 0.7uA@OFF Mode (IO wake up only)
- 2uA@Sleep Mode with 32KHz RTC
- Receive Mode: 10mA@3.3V Power Supply
- Transmit Mode: 10mA (0dBm output power) @3.3V Power Suppl

5. Applications

5.1. BLE IoT module

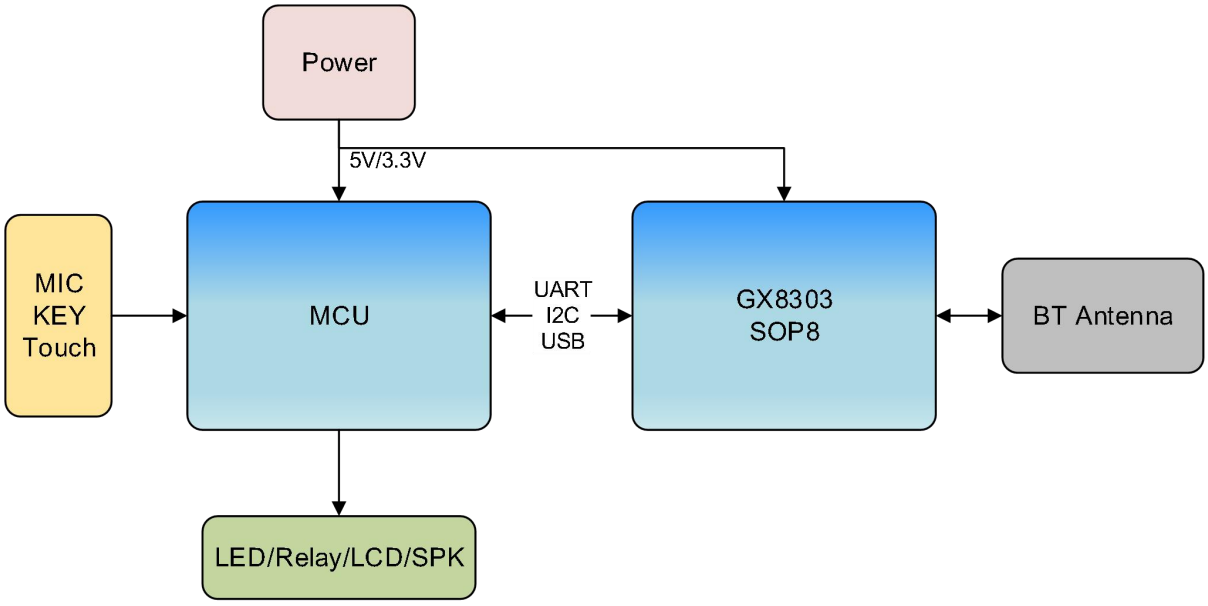


Figure 5.1 BLE IoT module

5.2. BLE/2.4G USB Dongle

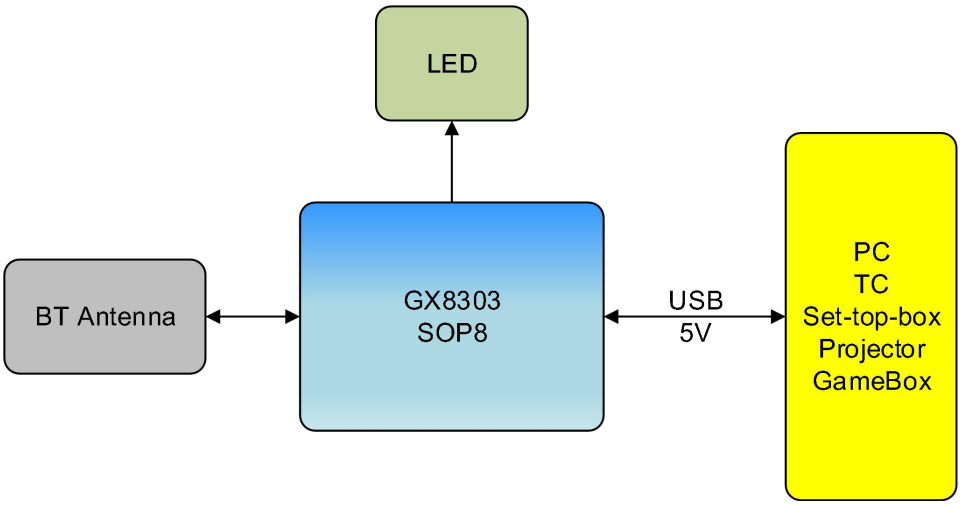


Figure 5.2 BLE USB Dongle

6. Electronic specification

6.1. Recommended operating condition

Table 6.1 Recommended operating condition

Parameters	Min	Typ	Max	Units
VBAT power supply voltage	3.0	3.7	5.5	V
VDD3 power supply voltage	1.8	3	3.6	V
IO Voltage	Same with VDD3			V
Output High Level (VOH)	2.5			V
Output Low Level (VOL)			0.5	V
Input High Level (VIH)	2.4			V
Input Low Level (VIL)			0.5	V
Input Leakage Current			±50	nA
Storage Temperature	-40		125	℃
Operating Ambient Temperature	-40		125	℃

6.2. RF performance

Table 6.2 RF Receiver performance

RX BLE 1Mbps GFSK					
Parameter	Description	MIN	TYP	MAX	UNIT
Rx Sensitivity	Sensitivity test 1Mbps BLE ideal transmitter,37 Byte BER=1E-3		-96		dBm
co-channel rejection	modulated interferer in channel, 37 Byte BER=1E-3		-6		I/C dB
Selectivity +-1MHz	Wanted signal at -67dBm,modulated interferer at +/- 1MHz,37 Byte BER=1E-3		7		I/C dB
Selectivity +-2MHz	Wanted signal at -67dBm,modulated interferer at +/-2MHz, 37 Byte BER=1E-3		45		I/C dB
Selectivity +-3MHz	Wanted signal at -67dBm, modulated interferer at +/- 3MHz, 37 Byte BER=1E-3		50		I/C dB
Selectivity+-4MHz	Wanted signal at -67dBm,modulated interferer at +/- 4MHz, 37 Byte BER=1E-3		50		I/C dB
Selectivity+-5MHz or More	Wanted signal at-67dBm,modulated interferer at >=+/-5MHz, 37 Byte BER=1E-3		55		I/C dB
Selectivity Imagfrequency	Wanted signal at -67dBm,modulated interferer at imagefrequency, 37 Byte BER=1E-3		22		I/C dB
Intermodulation	Wanted signal at 2402MHz, -64dBm, Two interferers at 2405 and 2408 MHz respectively, at thegiven power level, 37 Byte BER=1E-3		-20		dBm
Carrier Frequency Offset Tolerance			+-350		KHz
Sample Clock Offset Tolerance			+-120		ppm
RX BLE 2Mbps GFSK					
Parameter	Description	MIN	TYP	MAX	UNIT
Rx Sensitivity	Sensitivity test 2Mbps BLE ideal transmitter, 37 Byte BER=1E-3		-93		dBm
co-channel rejection	modulated interferer in channel, 37 Byte BER=1E-3		-6		I/C dB
Selectivity+-1MHz	Wanted signal at -67dBm, modulated interferer at +/-1MHz, 37 Byte BER=1E-3		-5		I/C dB
Selectivity +-2MHz	Wanted signal at -67dBm, modulated interferer at +/- 2MHz, 37 Byte BER=1E-3		9		I/C dB
Selectivity+-3MHz	Wanted signal at -67dBm, modulated interferer at +/-3MHz,37 Byte BER=1E-3		30		I/C dB
Selectivity+-4MHz	Wanted signal at -67dBm,modulated interferer at +/- 4MHz, 37 Byte BER=1E-3		40		I/C dB

Selectivity +-5MHz or More	Wanted signal at -67dBm,modulated interferer at>=+/-5MHz, 37 Byte BER=1E-3		55		I/C dB
Selectivity Imag frequency	Wanted signal at -67dBm, modulated interferer at imagefrequency, 37 Byte BER=1E-3		22		I/C dB
Intermodulation	Wanted signal at 2402MHz, -64dBm, Two interferers at 2405 and 2408 MHz respectively, at the given power level, 37 Byte BER=1E-3		-20		dBm
Carrier Frequency Offset Tolerance			+-350		KHz
Sample Clock Offset Tolerance			+-120		ppm

Table 6.3 RF Transmitter performance

Parameter	Description	MIN	TYP	MAX	UNIT
RF Max Output Power			10		dBm
RF Min Output Power			-20		dBm
OBW for BLE 1Mbps	20dB occupy-bandwidth for BLE modulation 1Mbps		1100		KHz
OBW for BLE 2Mbps	20dB occupy-bandwidth for BLE modulation 2Mbps		2300		KHz
FDEV for BLE 1Mbps	Frequency deviation for GFSK modulation 1Mbps	160		250	KHz
FDEV for BLE 2Mbps	Frequency deviation for GFSK modulation 2Mbps	320		500	KHz

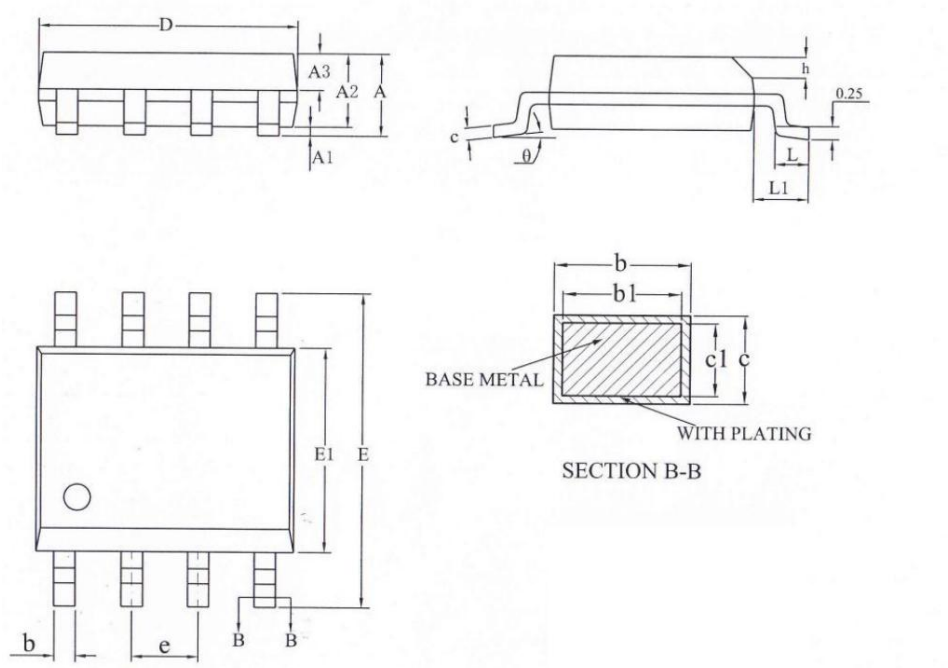
6.3. ESD

Table 6.4 Electrostatic discharge

Parameters	**Min**	**Max**	**Units**
Human Body Model (HBM)		2	kV
Charged Device Model(CDM)		500	V

7. Package

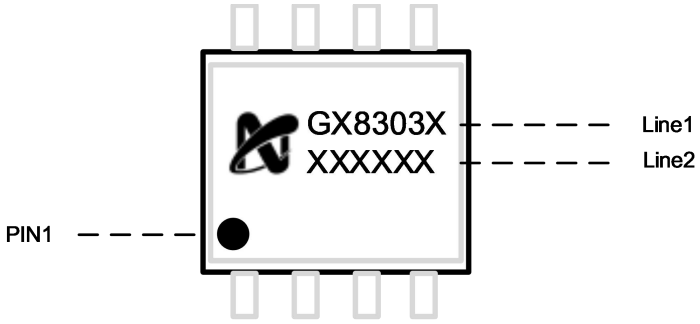
7.1. Package information



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
① b	0.39	—	0.47
① b1	0.38	0.41	0.44
① c	0.20	—	0.24
c1	0.19	0.20	0.21
① D	4.80	4.90	5.00
E	5.80	6.00	6.20
① E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

Figure: 7.1 SOP8 Package parameters

7.2. Chip mark description



- Line 1: Chip name
- Line 2 : 6 digit of production lot number

8. Ordering Information

	Package	Packing	MOQ	Other
GX8303A	SOP8	Tube		

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