SONY

SMD Type GPS Receiver Module

GXB5005

Description

The GXB5005 is a 12-channel GPS (Global Positioning System) receiver module.
This small module includes all the functions required for GPS and is designed for using an active antenna.
The GXB5005 can support the various kinds of the portable applications as well as the car navigation system.

Features

◆ General
  ◆ Implementation of Sony CXD2951GA-4 single chip GPS
  ◆ Small size with SMD type pads and shield case
  ◆ Module size (typ.):   22.4 (W) × 23.5 (D) × 3.2 (H) [mm]
  ◆ Current consumption: Acquisition (typ):   70 [mA]
                             Tracking (typ):   41 [mA]
                             Battery backup (typ): 7 [μA]
  ◆ Datum: WGS-84
  ◆ Communication method: Supports NMEA-0183 version 3.01
  ◆ Internal 32.768kHz RTC
  ◆ Internal 18.414MHz TCXO
  ◆ Antenna input 50Ω
  ◆ Recommended antenna element
        An active antenna with 0dB and RF amplifier with NF ≤ 2dB, 8 to 30dB gain
◆ Functionality
  ◆ 12-channel GPS receiver capable of simultaneously receiving 12 satellites
  ◆ All-in-view measurement
  ◆ Valid fix indication output
  ◆ 1PPS output
  ◆ WAAS/EGNOS compatible
  ◆ Supported baud rate: 4800bps/9600bps/19200bps/38400bps by HW setting
  ◆ Internal power on reset circuit
  ◆ Antenna sense (option)

◆ Performance

- Tracking sensitivity: −152dBm (typ.)
- Acquisition sensitivity: −139dBm (typ.)
- Time to first fix (time until initial measurement after power-on) (typ., Open sky)
  - Cold start (without ephemeris and almanac): 40s
  - Warm start (without ephemeris with almanac): 33s
  - Hot start (with ephemeris and almanac): 2 to 3s
- Positioning accuracy (Open air with ≥ −130dBm, PDOP ≤ 2.0)
  - Stand alone (GPS unit only) 2DRMS: approx. 2m
- Follow-up performance: Velocity: 500km/h or less
 - Acceleration: 1G or less

Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power supply voltage	V_{DD}	−0.5	3.7	V
Input voltage	V_I	−0.5	5.5	V
Output voltage	V_O	−0.5	V_{DD} + 0.5	V
Operating temperature	Topr	−40	+85	℃
Storage temperature	Tstg	−40	+105	℃

Operating Conditions

Item	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{DD}	3.1	3.4	3.7	V
Power supply voltage ripple	V_{DD}-rip			50	mVp-p
Backup battery voltage	Vbat	2.6	2.8	3.0	V
Input pin voltage	V_{IN}	−0.3		5.5	V
Supply current: Acquisition (25℃)	Icc		70		mA
Supply current: Tracking (25℃)	Icc		41		mA
Standby current	Istdby		7	120	μA
Operating temperature	Topr	−40	+25	+85	℃
Reception frequency, L1 CA code	F_{IN}		1575.42		MHz

Architecture
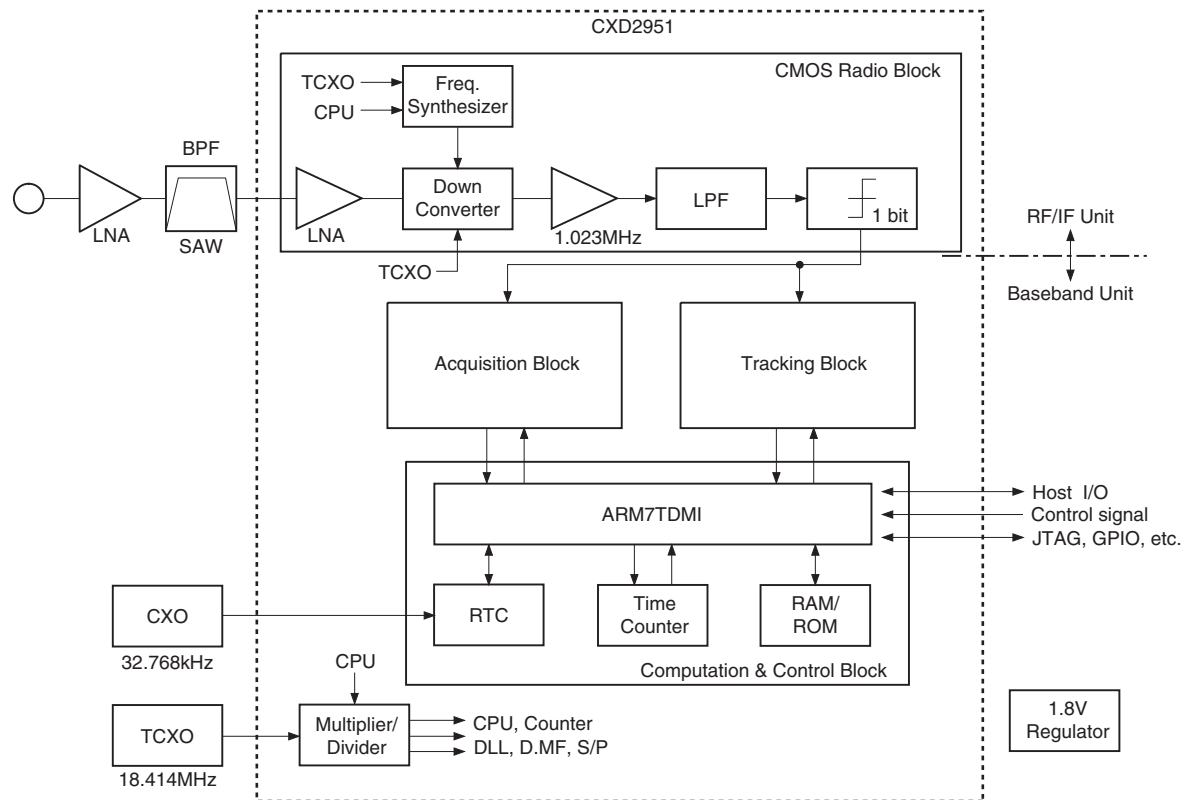
Pin Configuration

(Top View)
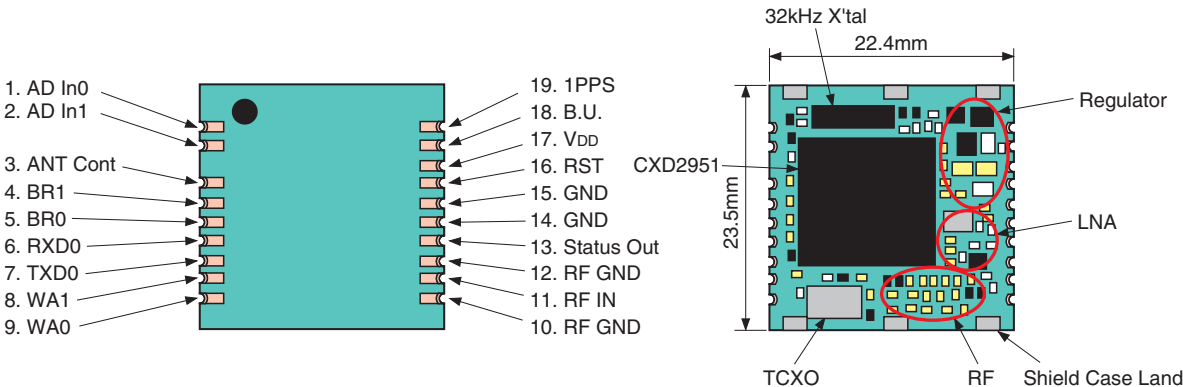
Pin Description

Pin No.	Symbol	I/O	Description
1	AD In0	I	Antenna sense input 0
2	AD In1	I	Antenna sense input 1
3	ANT Cont	I/O	Antenna sense enable (High active)
4	BR1	I	Baud rate setting 1
5	BR0	I	Baud rate setting 0
6	RXD0	I	UART (CH0) reception data
7	TXD0	O	UART (CH0) transmission data
8	WA1	I	WAAS enable 1
9	WA0	I	WAAS enable 0
10	RF GND		RF GND
11	RF IN	I	GPS signal input
12	RF GND		RF GND
13	Status Out		Status output
14	GND		GND
15	GND		GND
16	RST	I	Hardware reset (Low active)
17	V_{DD}		Power supply 3.4V
18	B.U.		Battery backup 2.8V
19	1PPS	O	1PPS output

Baud Rate Setting

Baud rate	BR1	BR0
4800	Open (L)	H
9600	Open (L)	Open (L)
19200	H	Open (L)
38400	H	H

WAAS Enable

WAAS	WA1	WA0
Command[*1]	Open (L)	Don't care
Disable	H	Open (L)
Enable	H	H

[*1] WAAS function is set by @WA command via UART when WA1 is Low.

Electrical Characteristics

DC Characteristics

(Ta = −40 to +85℃)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Pins
Supply voltage		V_{DD}		3.1	3.4	3.7	V	17
		Vbat		2.6	2.8	3.0	V	18
Supply voltage ripple		V_{DD}-rip				50	mVp-p	17, 18
Input voltage	H level	V_{IH}		2.0		5.5	V	3, 4, 5, 6, 8, 9, 16
	L level	V_{IL}		−0.3		0.8	V	
	AD	V_{AD}		0		(V_{DD} − 0.1)	V	1, 2
Output voltage	H level	V_{OH}	I_{OH} = −8mA	2.4			V	3, 7, 19
	L level	V_{OL}	I_{OL} = 2mA			0.4	V	
Current consumption		I_{CC} (3.3V)	Acquisition		70		mA	17
			Tracking		41			
		Istdby	Vbatt = 2.8V		7	120	μA	18

AC Characteristics

(Ta = 25℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
C/N output value	CN	−130dBm input, Tracking, [1]		42		dB
TCXO frequency	Ftcxo	Internal		18.414		MHz
Message latency	TI				1.0	s
RF gain	Grf			114		dB
Noise figure	NF			2		dB
Output signal rise time	Ttlh	Zload = 5kΩ, 20pF		25	55	ns
Output signal fall time	Tthl	Zload = 5kΩ, 20pF		30	60	ns

[1] Using SONY evaluation software "GPS View"

Timing of Output Signal
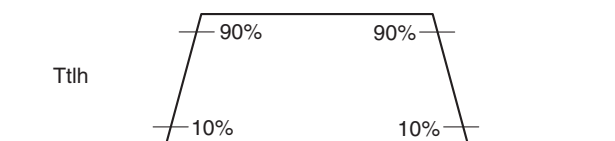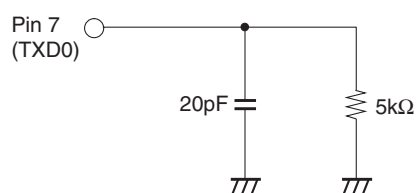
Status Out

"Status Out" signal turns over

1. Definition of internal status
   - ◆ Searching: Searching satellites after initialization
   - ◆ Tracking: Navigation message decoded at least one satellite
   - ◆ Positioning: Position fixing

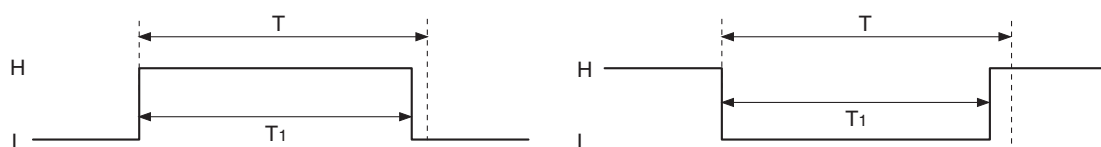2. "Status Out" status by each internal status
   - ◆ Reset: Input, pulled down internally
   - ◆ Initialization: Output Low
   - ◆ Searching: Output 1s High, 1s Low turn over
   - ◆ Tracking: Output 0.5s High, 0.5s Low turn over
   - ◆ Positioning: Output High (keeping)
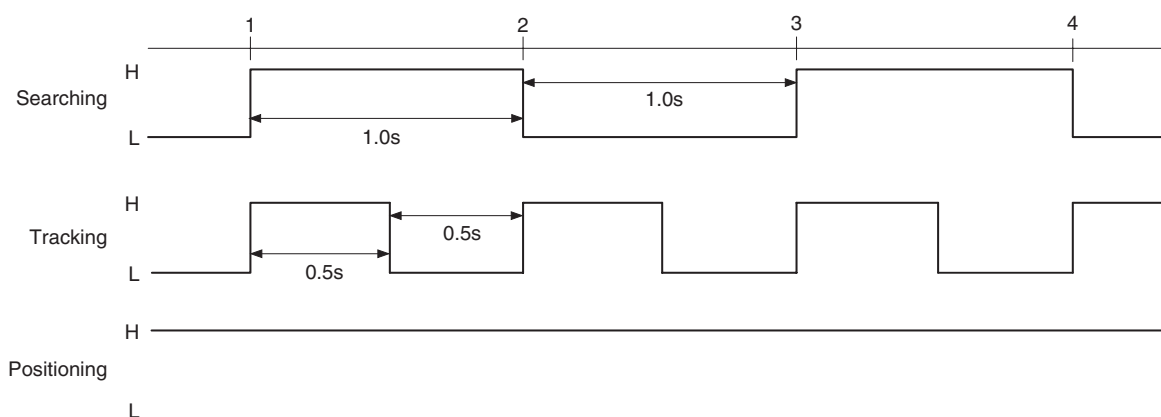
3. Jitter
   Turns over regular pulse width ±5% max.
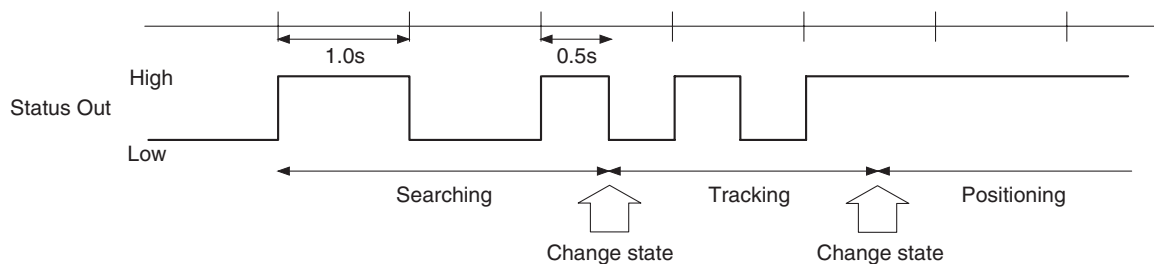 $|T - T_1| / T \leq 5\%$

   T: Regular pulse width (1s/0.5s)
   T_1: Actual pulse width

4. Status transition
   Check internal status every 0.5s, only the status changes, "Status Out" output logic turns over and keeps specified High-Low output interval.
   Only status changes to positioning, "Status Out" output turns over High caused by the previous status.

UART Interface

Interface: Asynchronous serial interface (UART)
Baud rate: 4800bps/9600bps/19200bps/38400bps
Start bit: 1 bit
Data bit: 8 bits
Stop bit: 1 bit
Parity bit: None
Flow control: Xon/Xoff
Data output cycle: Approximately 1 second (default)
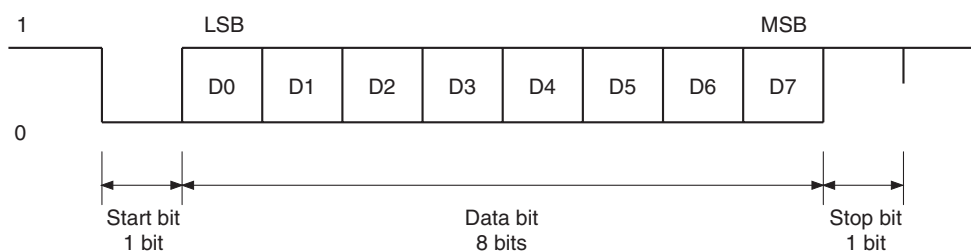
NMEA0183 Format

The GXB5005 can output 8 different types of sentence: GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG, GPZDA and PSGSA. If 9600bps, 19200bps or 38400bps baud rate is set for port setting, it outputs 7 types of sentence: GPGGA, GPGSA, GPGSV, GPRMC, GPVTG, GPZDA and PSGSA as default. Moreover, if 4800bps baud rate is set, it outputs 4 types of sentences: GPGGA, GPGSA, GPGSV and GPRMC as default.
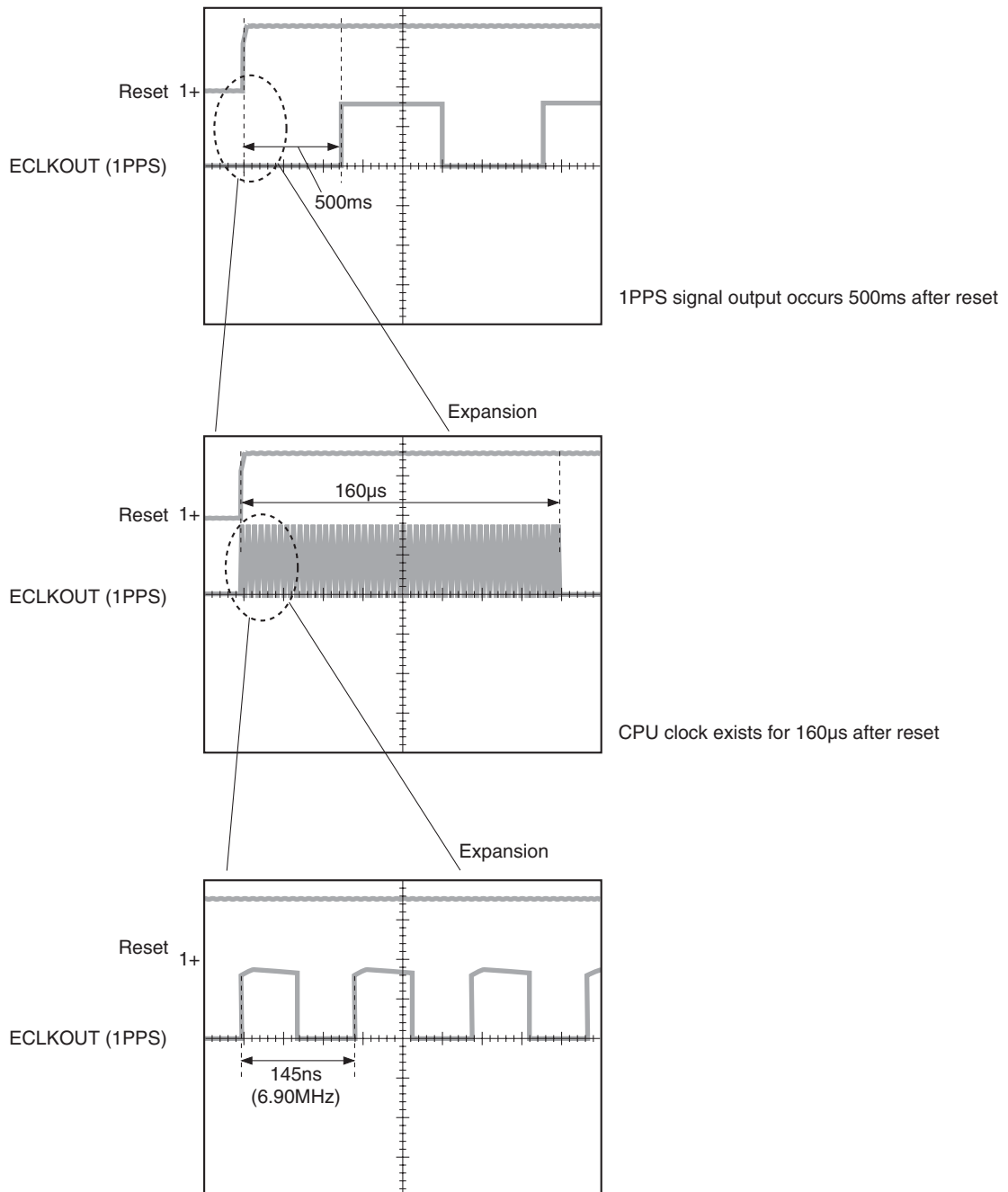
NMEA Message Output Timing

NMEA messages are output within 1s after the 1PPS pulse.
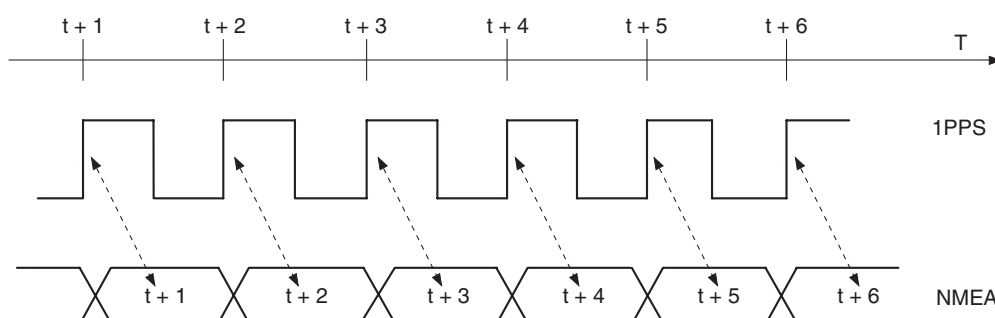
1PPS Output

The 1PPS output provides a timing pulse synchronized to GPS time once a valid fix is available.
The figure below shows the behavior of the 1PPS output signal after reset. For a period of 160μs after reset, the 1PPS signal outputs the system clock. The actual 1PPS signal is activated at 500ms after reset.

Reset 1+

ECLKOUT (1PPS)

500ms

1PPS signal output occurs 500ms after reset

Expansion

Reset 1+

160μs

ECLKOUT (1PPS)

CPU clock exists for 160μs after reset

Expansion

Reset 1+

ECLKOUT (1PPS)

145ns
(6.90MHz)

Backup Mode

The backup mode is established by setting all inputs Low except for B.U. (Vbat: 2.6 to 3.0V). In this mode, the low power consumption can be achieved by stopping all oscillators except for RTC oscillator. Although all registers are initialized, the SRAM for both of Ephemeris data and Almanac data in backup area are held.

Antenna Sense (Option)

The antenna sensing function detects three kinds of external active antenna connection conditions, open/ normal/short, by using A/D converter incorporated into the CXD2951.

The @ANT command shows the previous antenna sensing result and users would know the three kinds of conditions. For details, see the CXD2951 Communication Command Specifications.
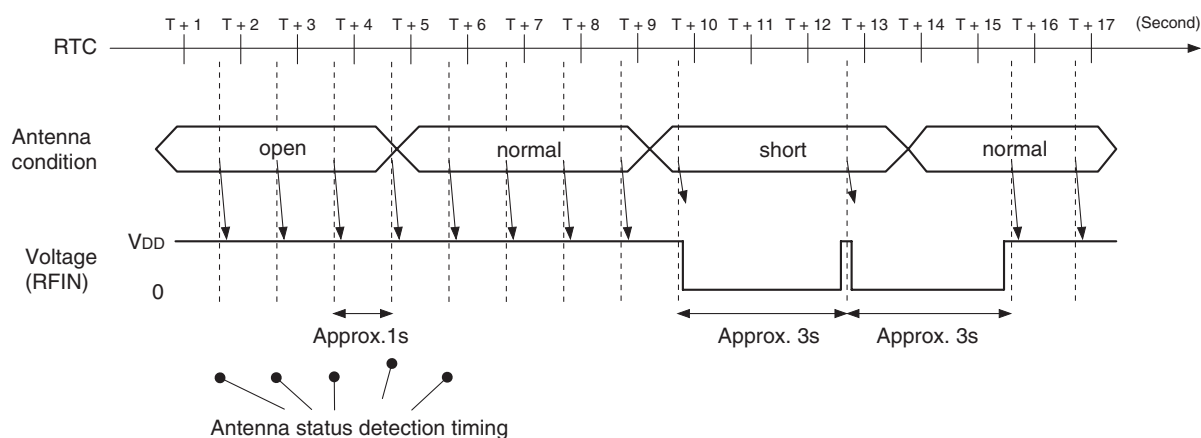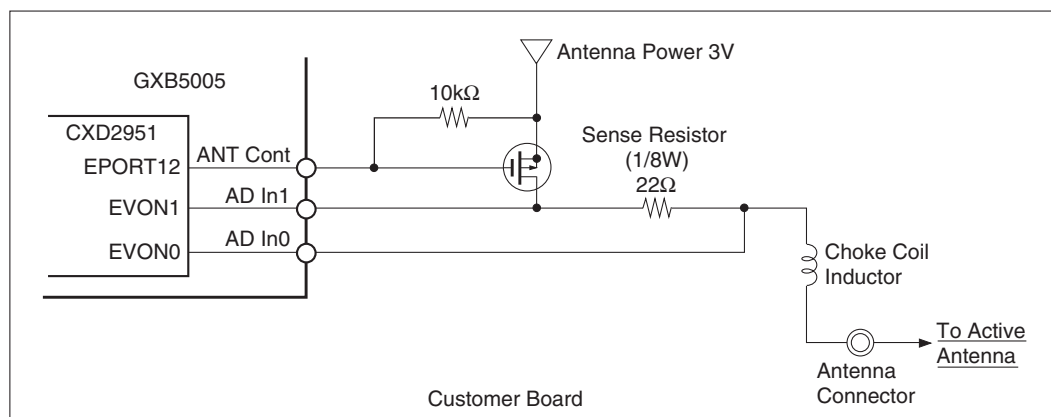

Threshold Levels

The threshold current Ir is as follows when V_{DD} = 3.3V.
- open: $Ir < 3.6mA$
- normal: $3.7mA \leq Ir \leq 44.0mA$
- short: $44.0mA < Ir$

Reference Circuit

The antenna sense circuit is available by putting a few components on the customer board.
Refer to the following diagram.

Command Specifications

The GXB5005 modules have a command format, NMEA-0183 version 3.01. A list of the supported UART interface is as follows. For detailed descriptions, see the CXD2951 Communication Command Specification document.

Mechanical Dimensions

(Unit: mm)

Top View