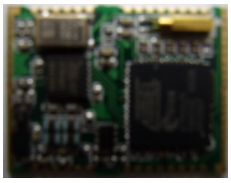
RB2217A

Enhanced ANTARIS4 GPS Module with ultra high sensitivity and antenna open/short detection/protection

Documentation History

Revision	Description	Date	Remark
V0.1	RB2217A release	Oct 2008	

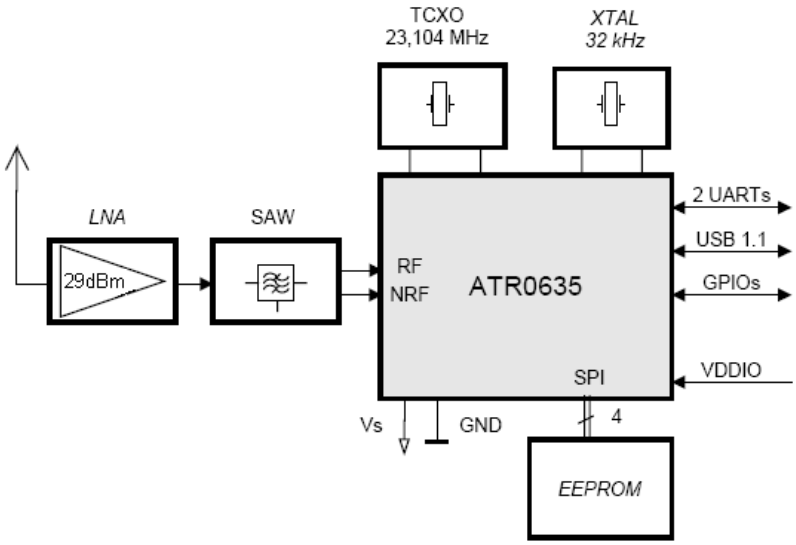
Content



Features

- ✓ 16 channel ANTARIS4 positioning engine
- ✓ Ultra high sensitivity to -158 dBm
- ✓ Supports DGPS, WAAS, EGNOS and MSAS
- ✓ Support 1 USB and 1 USART ports
- ✓ Customized and configurable serial I/O architecture (using on-board EEPROM)
- ✓ Support 4 Hz position update rate capability (using on-board EEPROM)
- ✓ Support power saving modes (using on-board EEPROM)
- ✓ Support external interrupt pin (wake up) in power saving mode
- ✓ Antenna short/open circuit detection and protection
- ✓ Ultra low power consumption 45mA
- ✓ 5 µA backup current
- ✓ Low position/velocity drift in static mode
- ✓ Small form factor 22.4 x 17.0 mm with SMT pads (micro package)
- ✓ RoHS compliant (lead-free)

Block diagram



RB2217A GPS module

Technical Specifications

1. Electrical Characteristics

1.1 Chipset	ATR0635	ATMEL ANTARIS4 GPS chipset family (ARM7TDMI Thumb processor core embedded)
1.2 General	Frequency	L1, 1575.42MHz
	Channels, C/A code	16, 1.023 MHz chip rate, 8192 time/frequency search windows
1.3 Accuracy	Position	2.5 meters CEP
	Time	50 nanosecond rms (1 PPS)
1.4 DGPS Accuracy	Position	2.0 meters CEP
1.5 Acquisition Rate	Reacquisition	< 1 sec, typical
	Cold start	34 sec, typical
	Warm start	33 sec, typical
	Hot start	3.5 sec, typical
1.6 Sensitivity	Tracking	-158dBm
	Acquisition/Reacquisition	-148dBm
	Cold start	-142dBm
1.7 Dynamic Condition	Altitude	18,000 meters (60,000 Feet) max.
	Velocity	515 meters /sec (1000 Knots) max.
1.8 Power	Main Power	3.3 VDC typical
	Supply current	45 mA 80uA in “power saving” mode, (using on-board EEPROM).
	Backup power	1.5 ~ 3.6V
	Backup current	5µA typical
1.9 Serial Port	Electrical interface	USART, USB
	Protocols	NMEA, UBX (ublox proprietary), RTCM Default I/O configuration 8 data bits, no parity, 1 stop bits USART1/USB: 9600 baud, output NMEA Low position/velocity drift in static mode 4 Hz position update rate capability (using on-board EEPROM) Customized and configurable I/O (using on-board EEPROM).

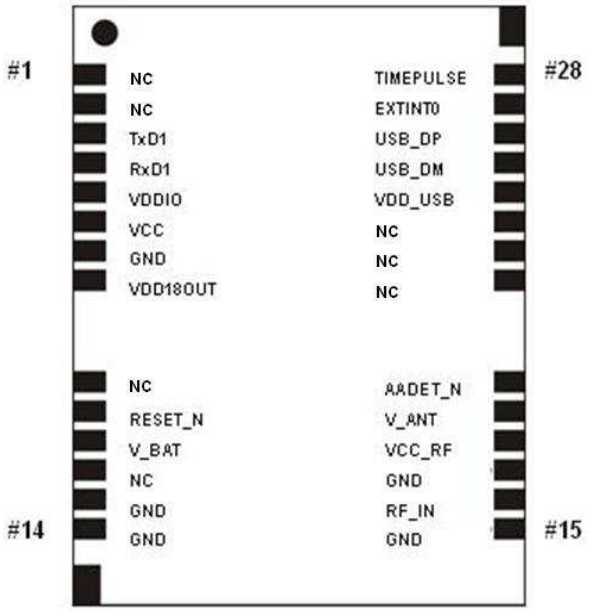
2. Environmental Characteristics

2.1Temperature	Operating range	- 40 ℃ to + 85 ℃
2.2 Mechanical dimensions	L x W x H	22.4 x 17.0 x 3.0 mm
2.3 Interface	I/O connector	28 pin SMD micro package

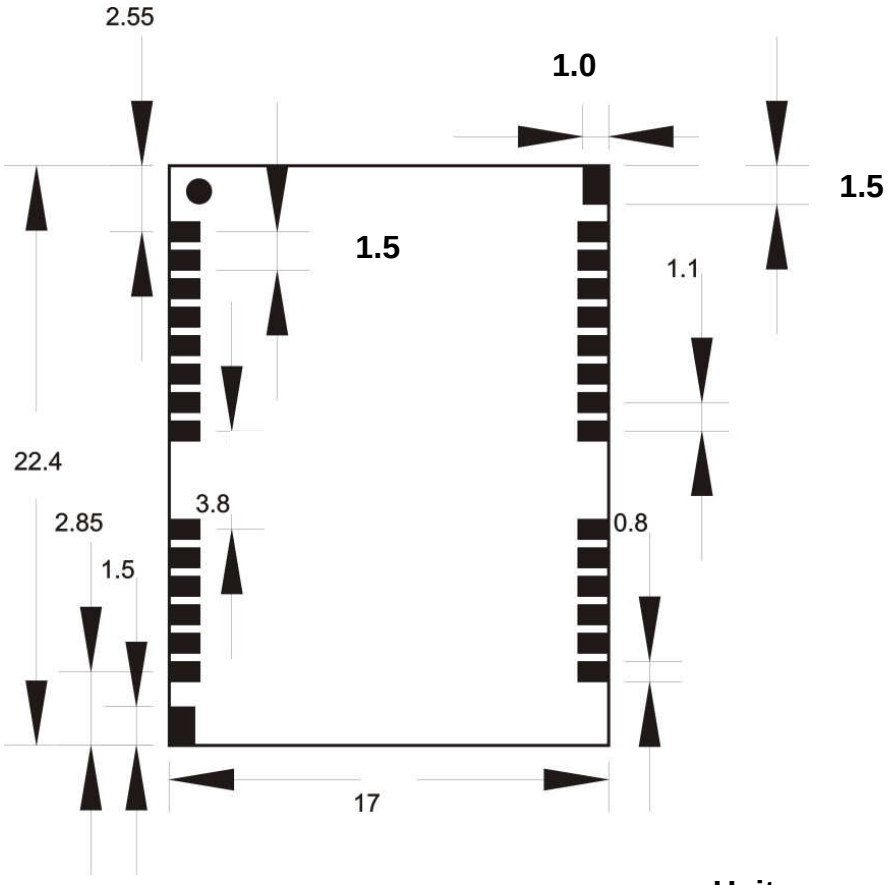
3 Antenna

Parameter	Specification
3.1 Antenna type	Passive and/or active antenna
3.2 Active Antenna	15 ~ 25 dB Gain recommended (50dB max.) 1.5 dB noise figure max.
3.3 Antenna Supply	Using VCC_RF (pin #18) or external voltage source V_ANT (pin#19)
3.4 Antenna Supervisor (see application circuit)	Short circuit detection (built-in) Open circuit detection enabled with external circuit

Pin Assignment



Top View



Unit: mm

Pin Definition

Pin#	Name	Type	Description
1	NC		Not Connected, keep floating
2	NC		Not Connected, keep floating
3	TxD1	O	Serial Port 1 (if not used keep floating), V_{OH} > VDDIO-0.5, V_{OL} < 0.4V
4	RxD1	I	Serial Port 1 (if not used keep floating), 5V > V_{IH} > 1.46V, V_{IL} < 0.41V
5	VDDIO	I	Pad voltage supply, 3.3V typical
6	VCC	I	Supply voltage, 3.3V typical
7	GND	I	Ground
8	VDD18OUT	O	Internal 1.8V regulator output, if not used keep floating
9	NC		Not Connected, keep floating
10	RESET_N	I	Reset Pin, active low, if not used keep floating, V_{IL} < 0.41V
11	V_BAT	I	1.5V~ 3.6V Input for backup RTC&SRAM
12	NC		Not Connected, keep floating
13~15	GND	I	Ground
16	RF_IN	I	GPS signal input
17	GND	I	Ground
18	VCC_RF	O	Output Voltage RF section
19	V_ANT	I	Antenna Bias voltage
20	AADET_N	I	Active Antenna Detect (see application circuit)
21	NC		Not Connected, keep floating
22	NC		Not Connected, keep floating
23	NC		Not Connected, keep floating
24	VDD_USB	I	USB Supply, 3.3V typical
25	USB_DM	I/O	USB data
26	USB_DP	I/O	USB data
27	EXTINT0	I	External Interrupt Pin (wake up pin), active low 5V > V_{IH} > 1.46V, V_{IL} < 0.41V
28	TIMEPULSE	O	Time pulse (1 PPS), V_{OH} > VDDIO-0.5, V_{OL} < 0.4V

Default Serial I/O Configuration

USART1 Port **Baud, Protocol**	**USB Port** **Baud, Protocol**	**Messages**
9600, Output: NMEA, Input: NMEA, UBX, RTCM	9600, Output: NMEA, Input: NMEA, UBX	Medium (see Table 2)

Table 1

Messages

NMEA Protocol	GGA, GLL, GSA, GSV, RMC, VTG, ZDA
UBX Protocol	UBX-NAV, UBX-MON

Table 2

Customized and Configurable Serial I/O (using on-board EEPROM)

In principle, customized and configurable serial I/O can be properly set by sending proprietary input NMEA/UBX messages to SDT12E on-board EEPROM memory. The serial I/O to be configured can be 1) Baud rate, 2) Output messages, 3) Navigation mode (such as “static hold threshold” setting), 4) Power saving mode, 5) 4 Hz position update rate, 6) and other parameters.

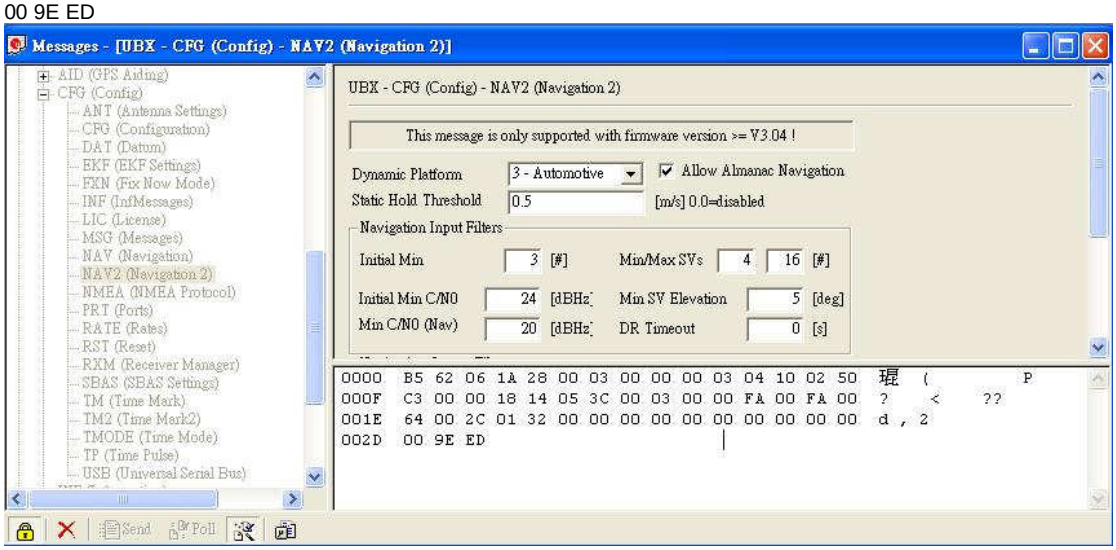
For detailed description, please refer to proprietary input NMEA/UBX protocol manual or contact tech support window.

Here we present some typical examples

1. Change static hold threshold value (Item 3) to 0.5 m/s (factory: 0.9 m/s):

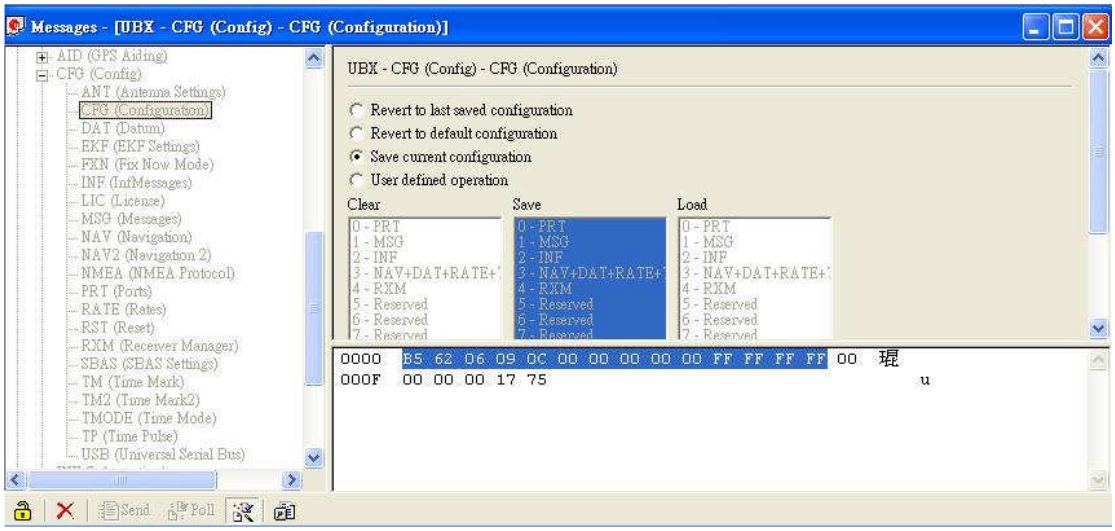
   Send input UBX messages as follows

   B5 62 06 1A 28 00 03 00 00 00 03 04 10 02 50
   C3 00 00 18 14 05 3C 00 03 00 00 FA 00 FA 00
   64 00 2C 01 32 00 00 00 00 00 00 00 00 00 00
   00 9E ED

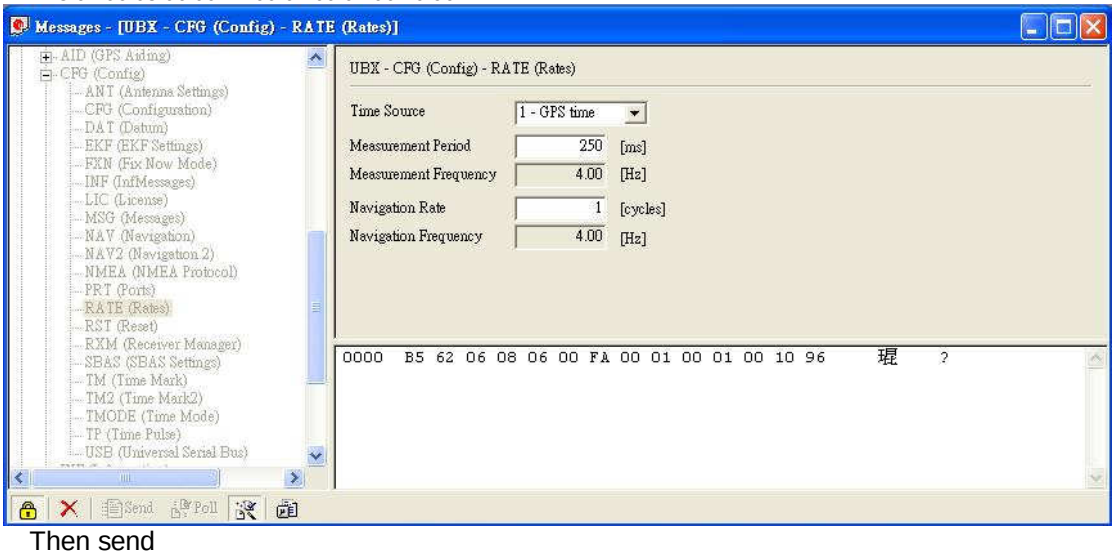


   Then send

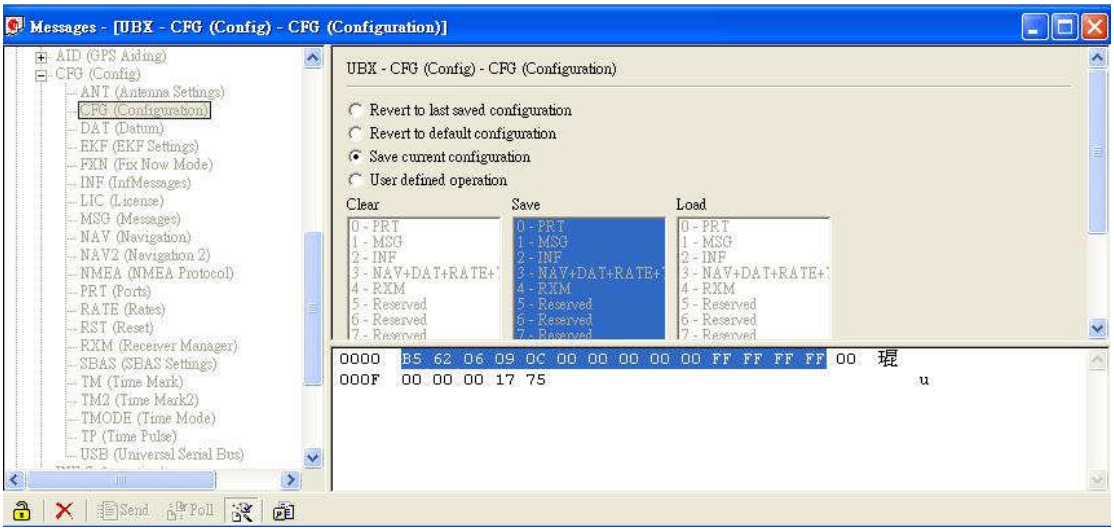
   B5 62 06 09 0C 00 00 00 00 00 FF FF FF FF 00
   00 00 00 17 75



2. Change position update rate (Item 5) to 4 Hz (factory: 1 Hz)
   Send input UBX messages as follows
   B5 62 06 08 06 00 FA 00 01 00 01 00 10 96



   Then send
   B5 62 06 09 0C 00 00 00 00 00 FF FF FF FF 00
   00 00 00 17 75



However, the more preferable business model for serial I/O configuration is:
Customized requirement is specified by “customer”, then
this requirement would be executed by “factory”!

Output NMEA Messages

Table 3 NMEA-0183 V2.3 Output Messages

NMEA Sentence	Description
GGA **(default)**	Global Positioning System Fixed Data
GLL **(default)**	Geographic Position - Latitude/Longitude
GSA **(default)**	GNSS DOP and Active Satellites
GSV **(default)**	GNSS Satellites in View
RMC **(default)**	Recommended Minimum Specific GNSS data
VTG **(default)**	Course Over Ground and Ground Speed
ZDA **(default)**	Time and Date

GGA--- Global Positioning System Fixed Data

Table 4 contains the values for the following example:

$GPGGA,092725.00,4717.11399,N,00833.91590,E,1,8,1.01,499.6,M,48.0,M,,0*5B

Table 4 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	092725.00		Current time, hhmmss.ss
Latitude	4717.11399		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91590		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 5
Satellites Used	8		Range 0 to 12
HDOP	1.01		Horizontal Dilution of Precision
MSL Altitude	499.6	m	
Units	M	meters	Meters (fixed field)
Geoid Separation	48.0	m	
Units	M	meters	Meters (fixed field)
Age of Differential Corrections		second	Blank (Null) fields when DGPS is not used
Diff. Ref. Station ID	0		
Checksum	*5B		
<CR> <LF>			End of message termination

Table 5 Position Fix Indicator

Value	Description
0	No fix or invalid
1	Standard GPS (2D/3D)
2	Differential GPS
6	Estimated (DR) Fix

GLL--- Geographic Position – Latitude/Longitude

Table 6 contains the values for the following example:

$GPGLL,4717.11364,N,00833.91565,E,092321.00,A,A*60

Table 6 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	4717.11364		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91565		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
UTC Time	092321.00		hhmmss.ss, Current time
Status	A		V = Data Invalid / Receiver Warning, A=Data Valid
Status	A		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	*60		
<CR> <LF>			End of message termination

GSA---GNSS DOP and Active Satellites

Table 7 contains the values for the following example:

$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54*0D

Table 7 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1 (Smode)	A		See Table 8
Mode 2 (Fix Status)	3		See Table 9
Satellite Used	23		SV on Channel 1
Satellite Used	29		SV on Channel 2
			Repeated for each channel
Satellite Used			Sv on Channel 12
PDOP	1.94		Position Dilution of Precision (00.0 to 99.99)
HDOP	1.18		Horizontal Dilution of Precision (00.0 to 99.99)
VDOP	1.54		Vertical Dilution of Precision (00.0 to 99.99)
Checksum	*0D		
<CR> <LF>			End of message termination

Table 8 Mode 1 (Smode)

Value	Description
M	Manual- forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

Table 9 Mode 2 (Fix Status)

Value	Description
1	Fix not available
2	2D Fix
3	3D Fix

GSV---GNSS Satellites in View

Table 10 contains the values for the following example:
$GPGSV,3,1,10,23,38,230,44,29,71,156,47,07,29,116,41,08,09,081,36*7F
$GPGSV,3,2,10,10,07,189,,05,05,220,,09,34,274,42,18,25,309,44*72
$GPGSV,3,3,10,26,82,187,47,28,43,056,46*77

Table 10 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages	3		Total number of GPGSV messages being output , Range 1 to 3
Message Number	1		Number of this message, Range 1 to 3
Satellites in View	10		
Satellite ID	23		SV ID (GPS: 1-32, SBAS 33-64 (33=PRN120))
Elevation	38	degree	Maximum 90
Azimuth	230	degree	Range 0 to 359
SNR (C/No)	44	dBHz	Range 0 to 99, null when not tracking
			Data of 2nd, 3rd Satellite (same as above)
Satellite ID	29		SV ID
Elevation	71	degree	Maximum 90
Azimuth	156	degree	Range 0 to 359
SNR (C/No)	47	dBHz	Range 0 to 99, null when not tracking
Checksum	*7F		
<CR> <LF>			End of message termination

RMC---Recommended Minimum Specific GNSS Data

Table 11 contains the values for the following example:
$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,,A*57

Table 11 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	083559.00		hhmmss.ss, Current time
Status	A		A=data valid or V=data not valid
Latitude	4717.11437		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91522		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
Speed	0.004	knots	Speed Over Ground
COG	77.52	degree	Course Over Ground (true)
Date	091202		Ddmmyy, Current Date in Day, Month Year format
Magnetic Variation		degrees	E=east or W=west (Not being output by receiver)
Magnetic variation E/W indicator			Not being output by receiver
Mode Indicator	A		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	*53		
<CR> <LF>			End of message termination

VTG---Course Over Ground and Ground Speed

Table 12 contains the values for the following example:

$GPVTG,77.52,T,,M,0.004,N,0.008,K,A*06

Table 12 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
COG	77.52	degrees	Course Over Ground (true)
	T		True
COG		degrees	Course Over Ground (maganetic) (Not being output by receiver)
	M		Magnetic
Speed	0.004	knots	Speed over ground
Units	N		Knots
Speed	0.008	km/hr	Speed over ground
Units	K		Kilometer per hour
Mode	A		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	*0B		
<CR> <LF>			End of message termination

ZDA---Time and Date

Table 13 contains the values for the following example:

$GPZDA,082710.00,16,09,2002,00,00*64

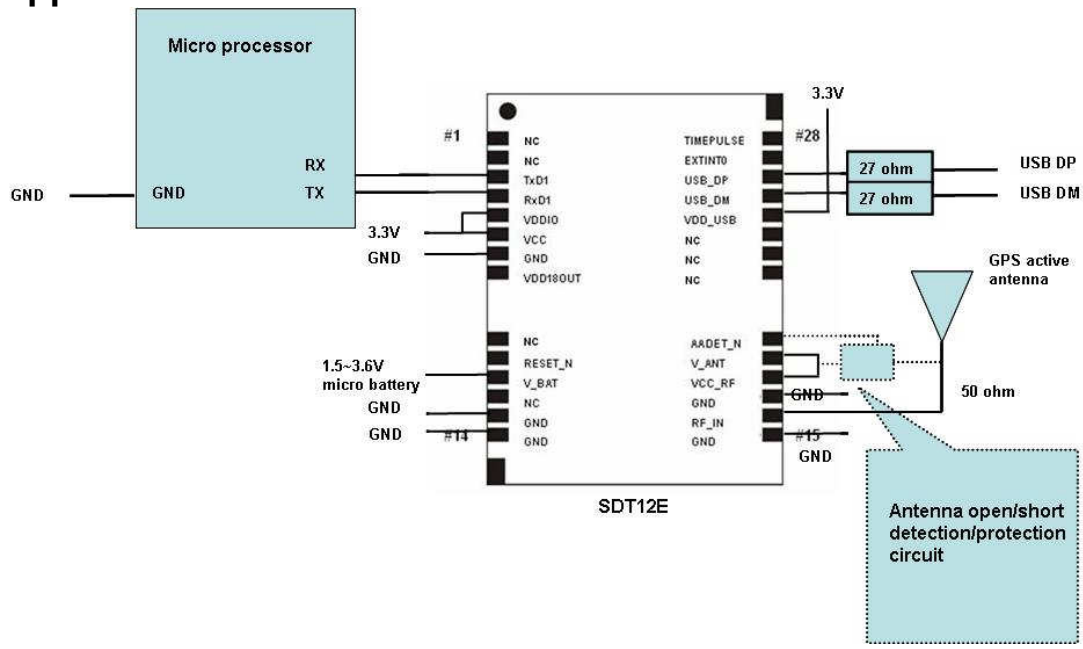
Table 13 ZDA Data Format

Name	Example	Units	Description
Message ID	$GPZDA		ZDA protocol header
UTC Time	081727.00	degrees	hhmmss.ss
Day	16		01 to 31
Month	09		01 to 12
Year	2002		4 digit year
Local zone hours	00		(Not being output by receiver) (fixed to 00)
Local zone minutes	00		(Not being output by receiver) (fixed to 00)
Checksum	*64		
<CR> <LF>			End of message termination

Proprietary NMEA/UBX Messages

Please refer to detailed protocol manual.

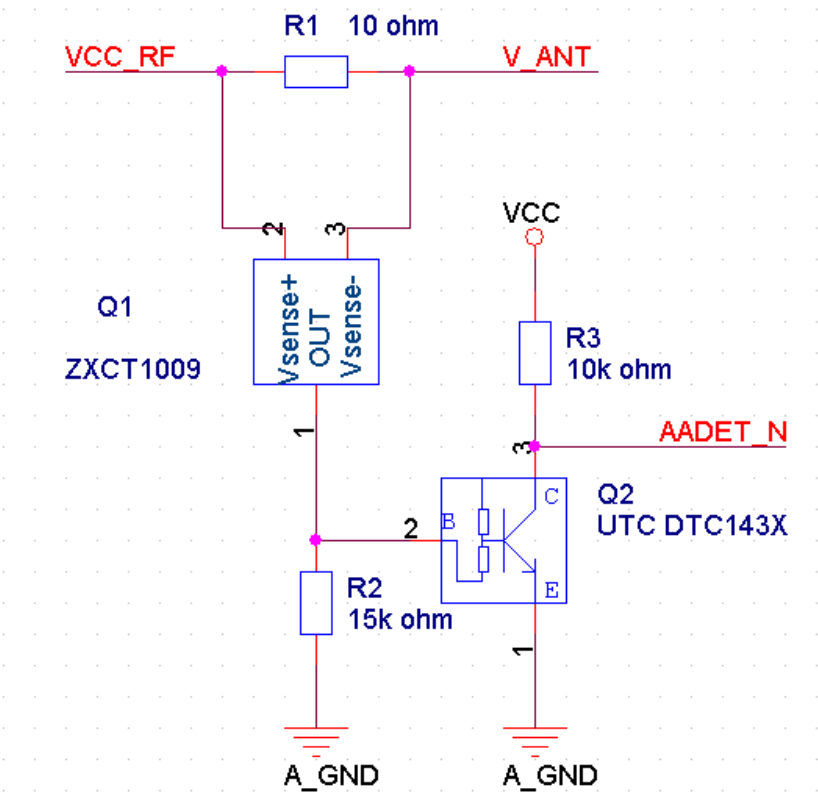
Application Circuit-1



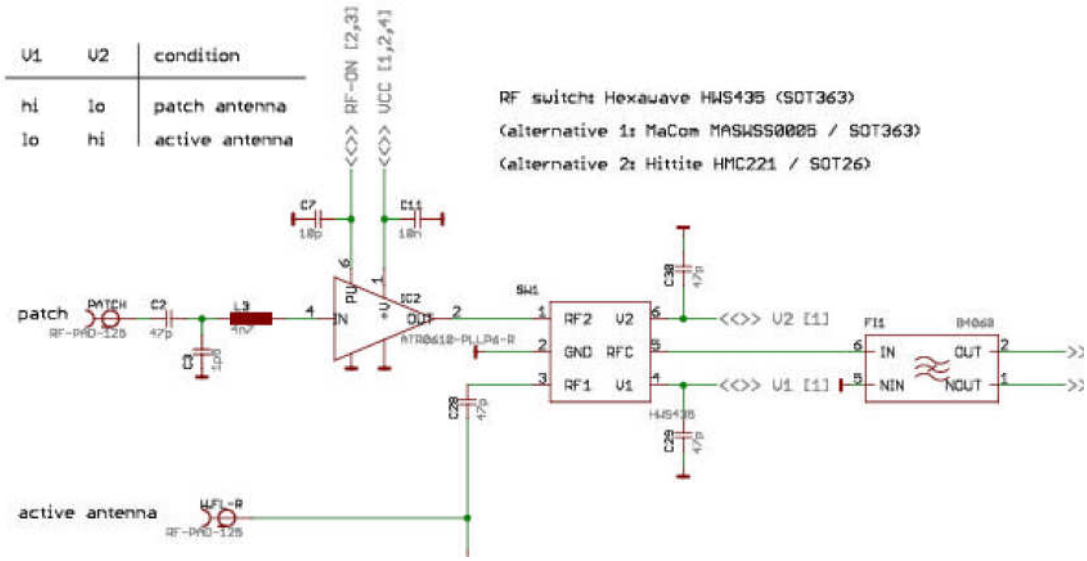
Note: It is recommended to add Low Pass filter circuitry prior to main power input pin#6 (VCC pin) as well.

Application Circuit-2

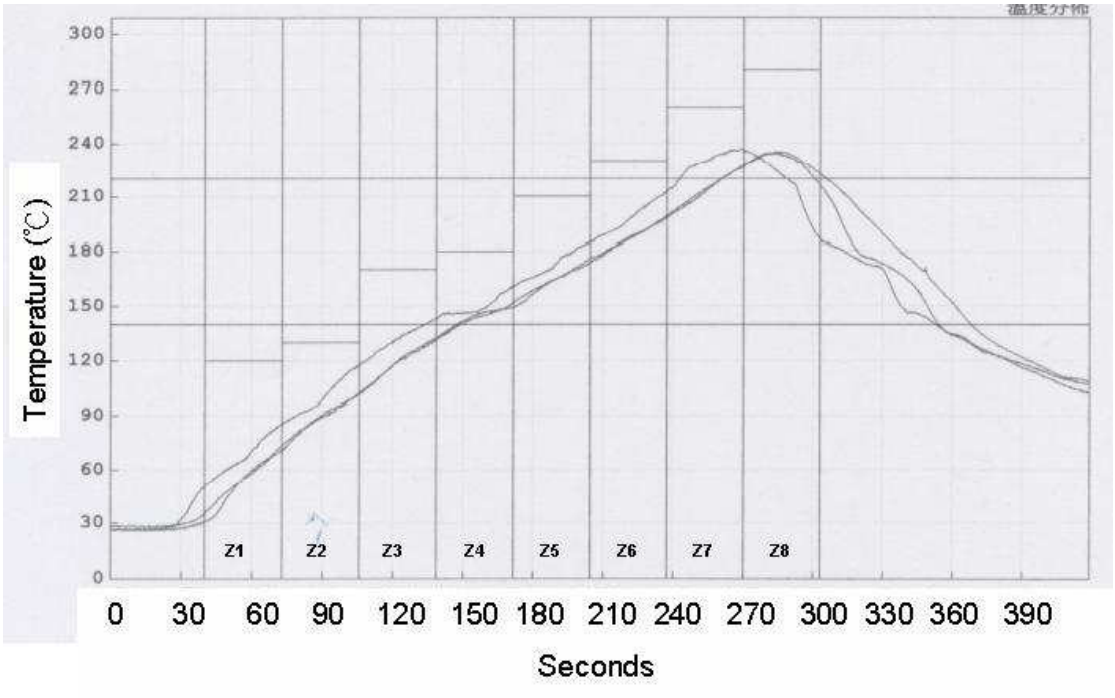
Antenna open/short detection/protection circuit



Active/Passive antenna switch circuit



Reflow Profile



Setpoints (℃)

Zone	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
Top	120	130	170	180	210	230	260	280
Bottom	120	130	170	180	210	230	260	280

Conveyer Speed (cm/min): 73