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AarLogic GPS 3T

stand-alone GPS combined antenna module

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1 Introduction

AarLogic GPS 3T is a complete stand-alone GPS smart antenna module, including embedded patch antenna and GPS receiver circuits, dedicated designed for cellular phones that are going to integrate GPS function. The module is powered by SiRF Star III and can track up to 20 satellites at a time while providing fast time-to-first-fix, one-second navigation update and low power consumption. Besides, it can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment.

It is easy to install without both RF connector and coaxial cable that are needed in a separated active antenna. In other words, reduce the cost and size. Also, speed up the time to market by eliminating R&D efforts on RF matching and stability between separated GPS antenna and module. Furthermore, it can be directly powered by a lithium battery without any external voltage regulars. A built-in hardware enable pin provides the convenience to turn on/off the module. Therefore, AarLogic GPS 3T of miniature size and brilliant performance is the best choice to be integrated into your slim cellular phones.

2 Features

- Optimal RF design for cellular phone
- Easy to install (SMT process capable)
- SiRF Star III high sensitivity solution
- Support 20-channel GPS
- Fast TTFF at low signal level
- Capable of SBAS (WAAS, EGNOS, MSAS)

3 Application

- Cellular phones with GPS function
- GPS personal tracker
- Mobile internet device with GPS function

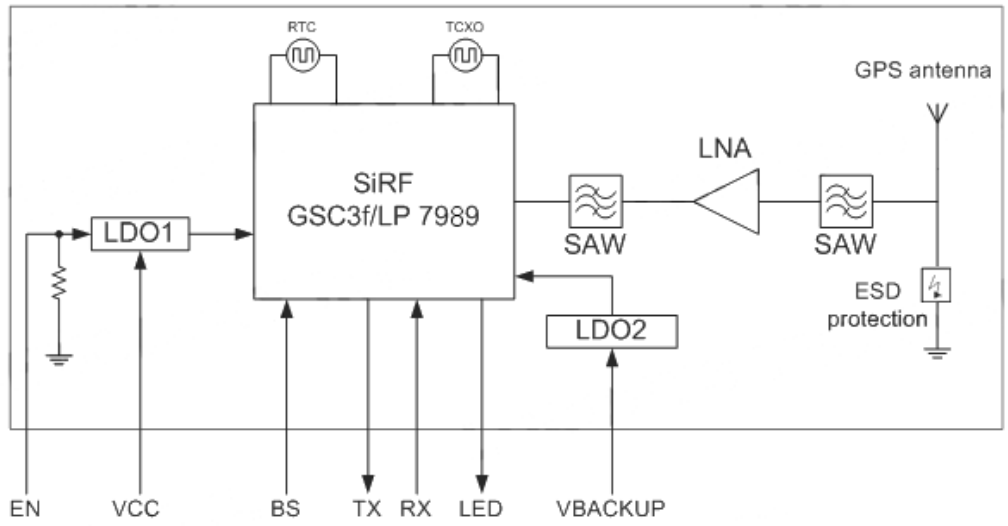


Figure 3.1: system block diagramm

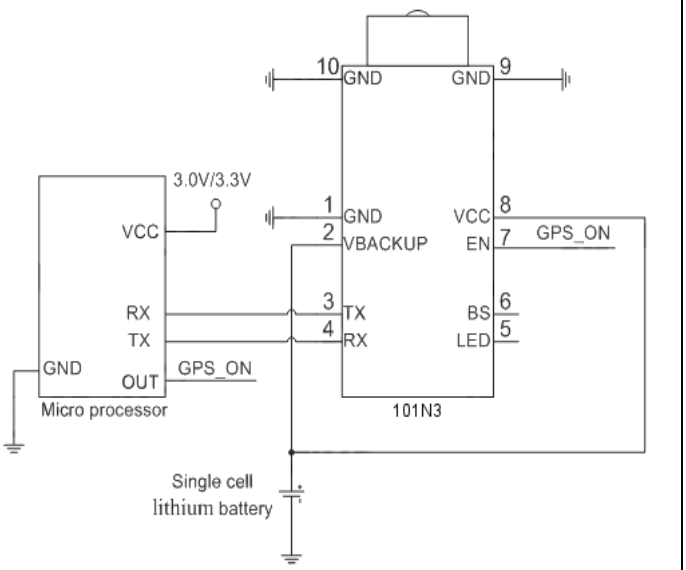


Figure 3.2: Application, battery

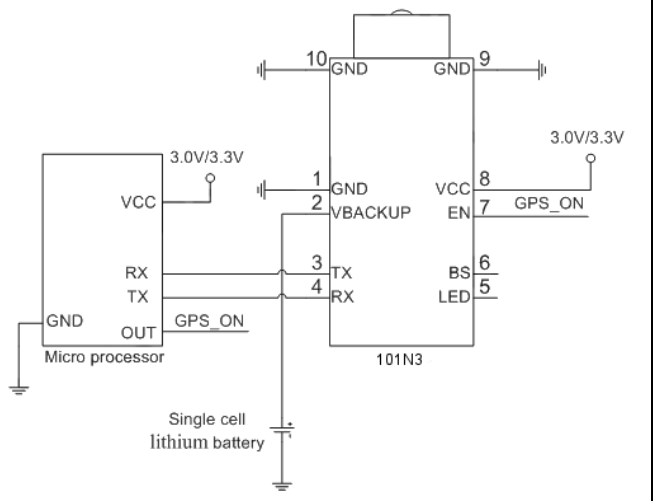


Figure 3.3: Application, VCC

4 GPS receiver and antenna

4.1 GPS receiver

Chip	SiRF Star III, GSC3f/LPx 7989	
Frequency	L1 1575.42MHz, C/A code	
Channels	Support 20 channels	
Update rate	1Hz	
Acquisition Time	Hot start (Open Sky)	< 2s
	Cold Start (Open Sky)	35s (typical)
Position Accuracy	Autonomous	< 10m (2D RMS)
	SBAS	< 5m (2D RMS)
Datum	WGS-84 (default)	
Max. Altitude	< 18,000 m	
Max. Velocity	< 515 m/s	
Protocol	NMEA 0183 ver 3.0	9600 bps (1), 8 data bits, no parity, 1 stop bits 1Hz: GGA, GLL, GSA, GSV, RMC, VTG

Table 4.1: Specifications, GPS receiver

Note 1: Both baud rate and output message rate are configurable.

4.2 GPS antenna

Antenna type	Patch antenna
Polarization	RHCP
Frequency Range	1575.42MHz ± 1.023MHz (1)
Gain	-2 dBic Typ. @zenith (1)
Axial ratio	Max 4.0dB @zenith (1)

Table 4.2: Specifications, GPS antenna

Note 1: This value is measured with evaluation board and must be fine tuned when installed into your device.

5 Software interface

5.1 NMEA output message

NMEA record	Description
GGA	Global positioning system fixed data
GLL	Geographic position - latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

Table 5.1: NMEA output sentence

The AarLogic GPS 3T is fully compatible to the NMEA-0183. For standard NMEA command please use the NMEA reference manual and/or the documentation of the AarLogic GPS 3M module.

5.2 Proprietary NMEA input message

Start Sequence	Payload	Checksum	End Sequence
$PSRF<MID>[1]	Data[2]	*CKSUM[3]	<CR><LF>[4]

Table 5.2: Message Parameters

1. Message Identifier consisting of three numeric characters. Input messages begin at MID 100.
2. Message specific data. Refer to a specific message section for <data>…<data> definition.
3. CKSUM is a two-hex character checksum as defined in the NMEA specification, *NMEA-0183Standard For Interfacing Marine Electronic Devices.* Use of checksums is required on all input messages.
4. Each message is terminated using Carriage Return (CR) Line Feed (LF) which is \r\n which is hex 0D0A. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message.

Note: All fields in all proprietary NMEA messages are required, none are optional. All NMEA messages are comma delimited.

Message	MID[1]	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z[2]
SetDGPSPort	102	Set PORT B parameters for DGPS input
Query/Rate Control	103	Query standard NMEA message and/or set output rate
LLANavigationInitialization	104	Parameters required for start using Lat/Lon/Alt[3]
Development Data On/Off	105	Development Data messages On/Off
Select Datum	106	Selection of datum to be used for coordinate transformations

Table 5.3: Proprietary NMEA input messages

Please find detailed information regarding proprietary NMEA input commands in the basic documentation of the AarLogic GPS 3M

6 Pin-out and descriptions

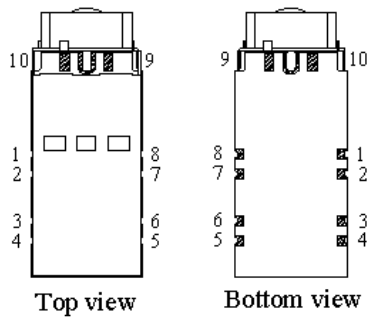


Figure 6.1: GPS 3T pin assignment

Pin #	Name	Type	Description
1	GND	P	Ground
2	VBACKUP	P	Backup battery supply voltage. This pin must be powered to enable the module.
3	TX	O	Serial data output
4	RX	I	Serial data input
5	LED	O	LED indicator (1). Internal pulled down via 100KΩ resistor. (Default input at reset)
6	BS	I	Boot mode selection (2). Internal pulled down via 115KΩ resistor. Do not connect in normal operation.
7	EN	I	Enable pin (3). (High active with internal pull-down resistor.)
8	VCC	P	DC supply voltage
9	GND	P	Ground
10	GND	P	Ground

Table 6.1: Pin description

Notes:

1. When GPS position fix is available, it outputs 50ms high per second, otherwise it outputs low.
2. When this pin is low at system reset, the module will boot in normal operation. Otherwise, it will boot in internal mode.
3. This pin only controls the main power through VCC pin, not apply to VBACKUP pin.

7 DC & Temperature characteristics

7.1 Absolute maximum ratings

Parameter	Symbol	Ratings	Units
Input Voltage	VCC	5.5	V
Input Backup Battery Voltage	VBACKUP	7	V
Operating Temperature Range	Topr	-30 ~ 85	℃
Storage Temperature Range	Tstg	-40 ~ 85	℃

7.2 DC Electrical characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	VCC		3.0		4.3	V
Input Backup Battery Voltage	VBACKUP		1.3		6.0	V
Supply Current	I_{VCC}	Full operation		31(1)	49	mA
		EN = Low		< 0.1		uA
Backup Battery Current	I_{BAT}	EN = Low		5.8		uA
High Level Input Voltage	V_{IH}		2.1		3.6	V
		For EN pin	1.3		VCC	
Low Level Input Voltage	V_{IL}		-0.3		0.8	V
		For EN pin			0.25	
High Level Input Current	I_{IH}		-10		60	uA
		For EN pin	-0.2		10	
Low Level Input Current	I_{IL}		-10		60	uA
		For EN pin	-0.2		1	
High Level Output Voltage	V_{OH}		2.0			V
Low Level Output Voltage	V_{OL}				0.73	V
High Level Output Current	I_{OH}			2		mA
Low Level Output Current	I_{OL}			2		mA

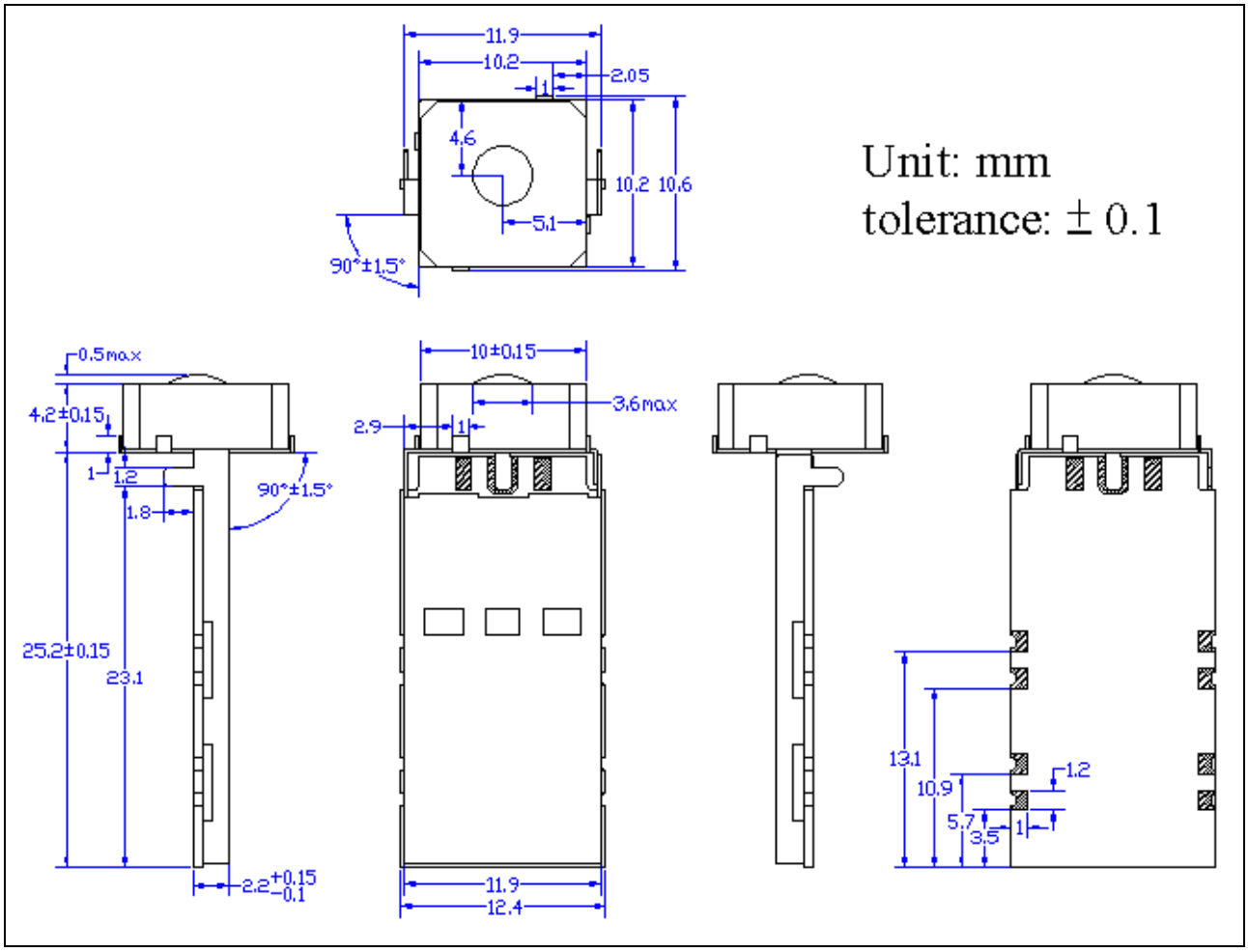
Note 1: Measured when position fix is available and input voltage is 3.3V.

7.3 Temperature characteristics

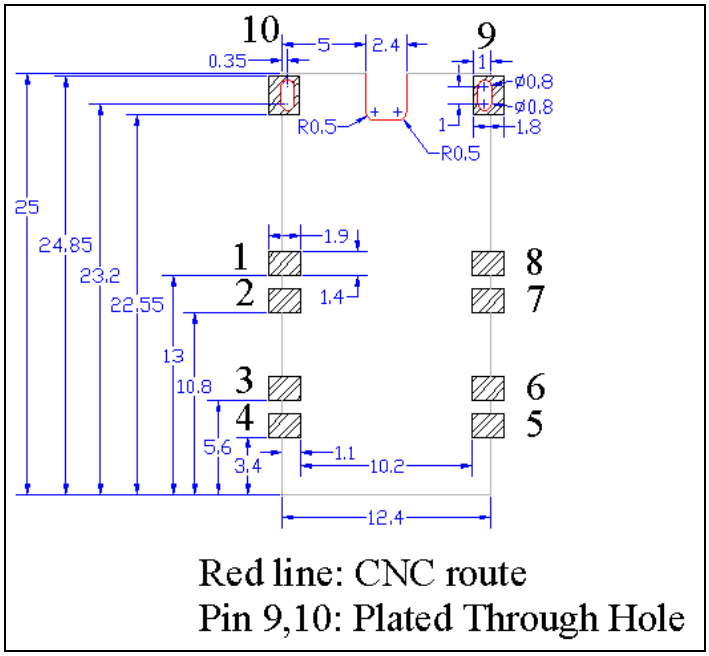
Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	Topr	-30	-	85	℃
Storage Temperature	Tstg	-40	25	85	℃

8 Mechanical specifications

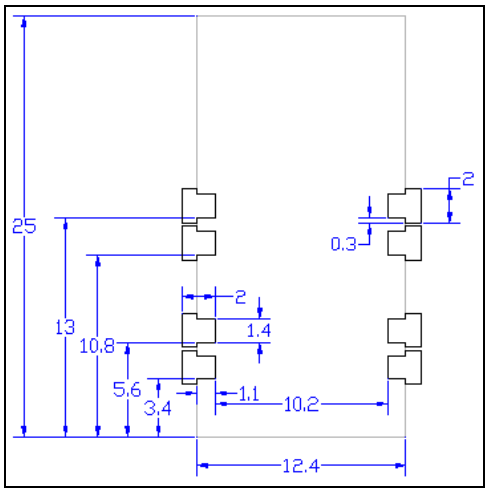
8.1 Outline dimensions



8.2 Recommended land patterns



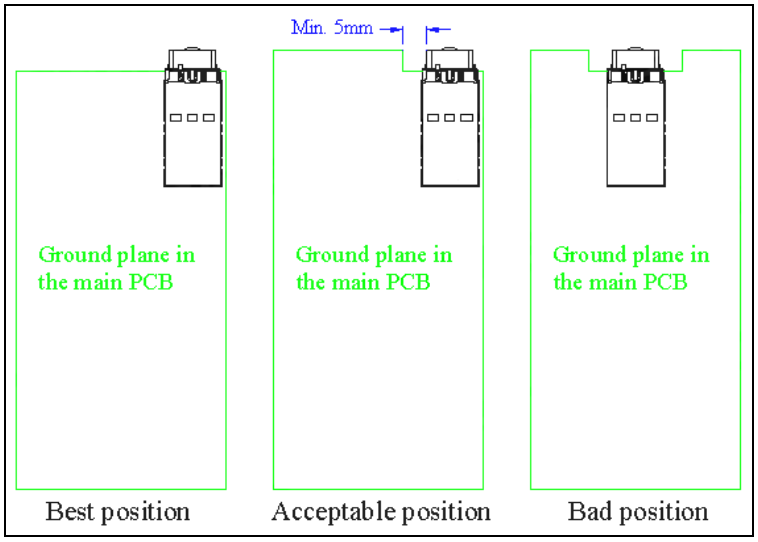
8.3 Recommended solder paste stencil dimensions



GPS 3T can be soldered by SMT process. But please note that if your PCB is double sided components and has to go into reflow oven twice, GPS 3T must be designed to be secondary reflow process. Otherwise GPS 3T has to be hand soldered.

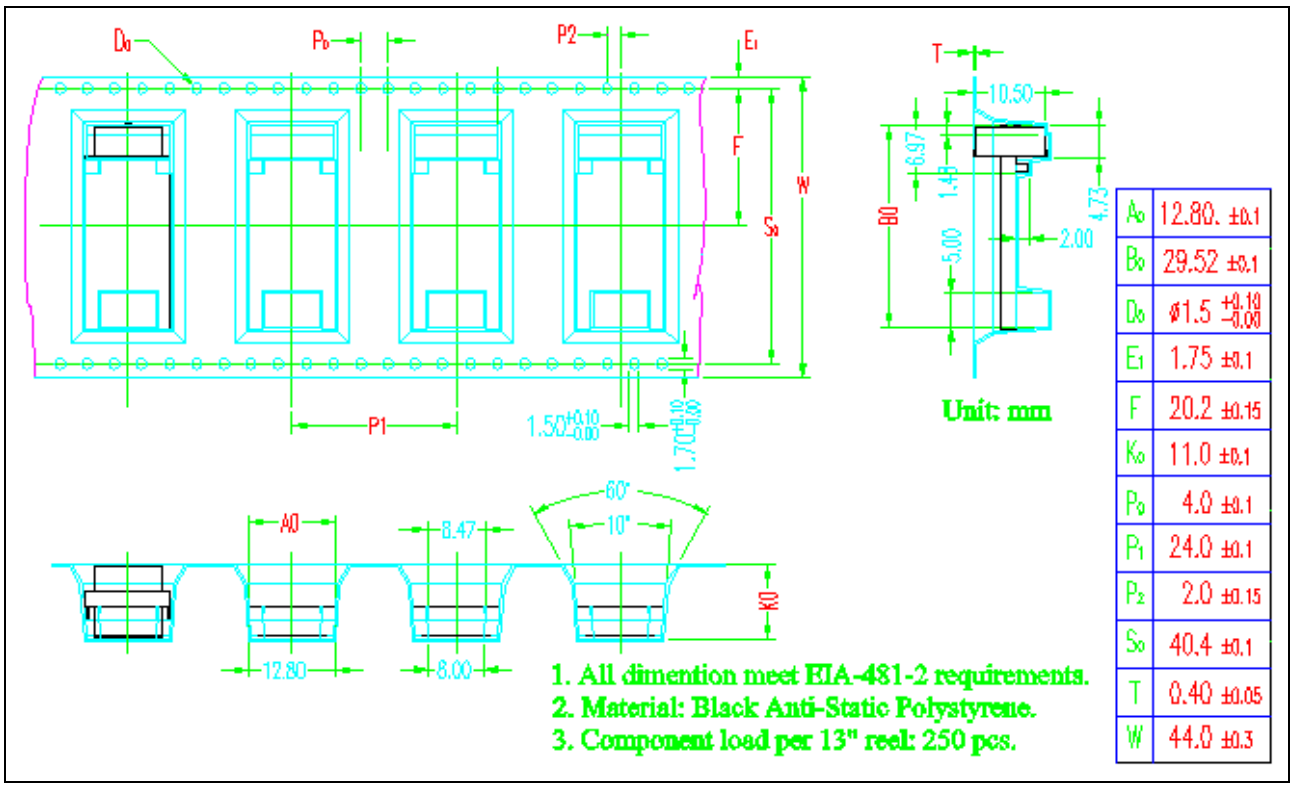
Pin number 9 and 10 of GPS 3T are designed for hand soldered in order to tightly fix onto your PCB.

8.4 Installation on the main PCB



For using the AarLogic GPS 3T in the final mass production customisation of the antenna is strongly recommended. Pleas contact us when the development of your product enters its final stage. Then the used antenna patch can be optimized for your enclosure and your specific groundplane size.

9 Reel packing information



A0	12.80. ±0.1
B0	29.52 ±0.1
D0	ø1.5 +0.10 −0.00
E1	1.75 ±0.1
F	20.2 ±0.15
K0	11.0 ±0.1
P0	4.0 ±0.1
P1	24.0 ±0.1
P2	2.0 ±0.15
S0	40.4 ±0.1
T	0.40 ±0.05
W	44.0 ±0.3