TIM-LR

Dead Reckoning GPS Receiver Module

ANTARIS® Positioning Engine

The TIM-LR is an ultra-low power sensor-based dead reckoning GPS module suitable for passive and active antennas. The combination of the ANTARIS GPS positioning engine and the Enhanced Kalman Filter EKF™ algorithm provide precise navigation in locations with no or impaired GPS reception, for example tunnels, indoor car parks and deep urban canyons. Deviations in navigation caused by multipath effects, as commonly observed in cities with densely populated high-rise buildings, belong to the past. The TIM-LR is the ideal solution for high-volume applications requiring a cost-effective and tightly integrated product that fulfills 100% road coverage requirement.

25.4 x 25.4 x 3 mm

Overview

Dead reckoning GPS receivers supplement the GPS information with an incoming signal from a gyroscope (turn rate sensor) and from odometer pulses to do dead reckoning navigation through periods of GPS outages. Depending on the quality of the available GPS signals, the EKF algorithm from u-blox computes the next positions accurately by using an automatically weighted average of the GPS and sensor inputs. Dead reckoning is beneficial in following applications:

- In-Vehicle Navigation Systems (INVS) and telematics

- 24h Automatic Vehicle Location

- Car security and safety products
  - Stolen car recovery
  - Emergency and road side assistance

- GPS enabled road pricing
  - Distance-dependent billing, urban charge zones
  - Billing of metered parking areas

- Homeland security:
  - Dispatch of emergency vehicles
  - Monitoring transportation of dangerous goods

- Precise dynamic vehicle positioning
  - Agriculture, motor sport

Benefits

- High acquisition and tracking sensitivity

- Ultra-low power consumption

- Reliable navigation while satellites are out of sight
  - Left and right turns: detected by a gyroscope
  - Distanced traveled: pulses from vehicle odometer
  - Optional use of forward / reverse gear indication
  - Position output in NMEA and UBX protocols

- Excellent GPS performance
  - Excellent navigation accuracy, even at low signal levels
  - Active multipath detection and removal
  - Fast Time-To-First-Fix (TTFF)

- Highly integrated GPS module
  - Automatic pick-and-place assembly
  - Reflow solderable

- Fully EMI shielded

- Passive and active antenna support

Features

- 16 channel GPS receiver

- 8192 simultaneous time-frequency search bins

- 1 Hz position update rate

- Based on the ANTARIS GPS Technology
  - ATR0600 RF front-end IC
  - ATR0620 Baseband IC with ARM7TDMI inside
  - ATR0610 Low noise amplifier IC

- FLASH memory

- Dead Reckoning (DR) with Enhanced Kalman Filter:
  - 40 Hz DR calculation rate for high accuracy
  - Mixed GPS and DR operation, depending on availability and quality of GPS signal
  - Fully automatic calibration
  - Temperature compensation

- DGPS and SBAS (WAAS, EGNOS) support

- Operating voltage 2.7 to 3.3 V

- Battery supply pin for backup memory and RTC

- Industrial operating temperature range –40 to 85°C

Receiver Performance Data

Receiver Type	16 channel, L1 frequency, C/A code	
Max. Update Rate	1 Hz	
Accuracy	Position	2.5 m CEP
	DGPS / SBAS	2.0 m CEP [1]
Start-up Times	Hot start	<3.5 sec
	Warm start	33 sec
	Cold start	34 sec
	Reacquisition	< 1 s
Sensitivity	Acquisition	-140 dBm
	Tracking	-149 dBm
Timing accuracy	RMS:	50 ns
	99%:	<100 ns
Dynamics	< 4 g	
Operational Limits	COCOM restrictions apply	

[1] Depends on accuracy of correction data provided by the DGPS or SBAS service

Dead Reckoning (DR) Performance Data

DR calculation rate	40 Hz [2]

[2] Internal calculation rate for high accuracy in DR calculation. Not to be confused with max. navigation update rate listed under Receiver Performance Data.

Interfaces

Physical	30 pin leadless chip carrier
Serial Ports	2 UARTs @ 3 V levels 5V TTL compatible inputs
Protocols	NMEA, UBX binary, RTCM Supports protocol mixing over same serial port
Digital Inputs	@1.8 V, configured for - Odometer pulses - Forward / Backward signal
Digital Output	TIMEPULSE @ 1.8 V
SPI Interface	@1.8V, configured for specified A/D converters to receive gyroscope and temperature information [3]

[3] Please refer to the TIM-LR Data Sheet for information about supported gyroscopes, A/D converters and temperature sensors
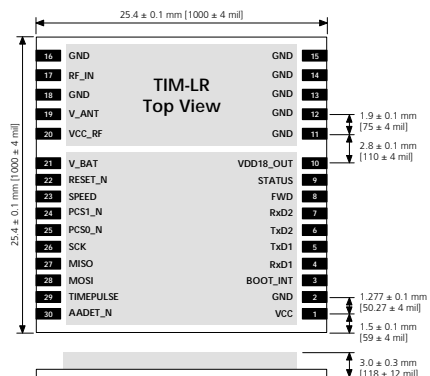
Electrical Data

Power Supply	2.7 – 3.3 V	
Power Consumption	VCC = 3.0 V:	typ. 189 mW
	VCC = 2.7 V:	typ. 170 mW
Backup Power	1.95 V – 3.6 V	
	Backup power must be provided to memorize last position and vehicle direction of the previous trip.	
Antenna Power	External or Internal VCC_RF	
Antenna Supervision	Integrated short-circuit detection and antenna shutdown, open circuit detection with little external circuit	

Environmental Data

Operating Temp.	-40°C to 85°C
Storage Temp.	-40°C to 125°C
Vibration	5 Hz to 500 Hz, 5g (IEC 68-2-6)
Shock	Half sine 30g / 11ms (DIN 40046-7)

Mechanical Data

25.4 ± 0.1 mm [1000 ± 4 mil]

Pin	Signal		Signal	Pin
16	GND	**TIM-LR Top View**	GND	15
17	RF_IN		GND	14
18	GND		GND	13
19	V_ANT		GND	12
20	VCC_RF		GND	11
21	V_BAT		VDD18_OUT	10
22	RESET_N		STATUS	9
23	SPEED		FWD	8
24	PCS1_N		RxD2	7
25	PCS0_N		TxD2	6
26	SCK		TxD1	5
27	MISO		RxD1	4
28	MOSI		BOOT_INT	3
29	TIMEPULSE		GND	2
30	AADET_N		VCC	1

25.4 ± 0.1 mm [1000 ± 4 mil]

1.9 ± 0.1 mm [75 ± 4 mil]
2.8 ± 0.1 mm [110 ± 4 mil]
1.277 ± 0.1 mm [50.27 ± 4 mil]
1.5 ± 0.1 mm [59 ± 4 mil]
3.0 ± 0.3 mm [118 ± 12 mil]

Support Product

SBE-LS ANTARIS Dead Reckoning Evaluation Kit	Dead Reckoning Evaluation Kit with built-in gyroscope to get familiarized with dead reckoning functionality on the ANTARIS technology

Ordering Information

TIM-LR-0-000-0   TIM-LR – Dead Reckoning GPS Module

Delivery Packing
0 = Single samples
1 = Tape on reel (100 pieces)
5 = Tape on reel (500 pieces)

Parts of this product are patent protected.