LEADTEK

GPS

Global
Positioning
System





LR9805ST
GPS Module

www.leadtek.com

Changes

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Customer Support

- Visit our Web site at www.leadtek.com.tw.
- For support via e-mail, submit your question at service@leadtek.com.tw.

Leadtek Research Inc.
18F, 166, Chien-Yi Rd., Chung Ho, Taipei Hsien, Taiwan (235)
Telephone: +886-(0)2 8226 5800
Fax: +886-(0)2 8226 3087
gpssales@leadtek.com.tw
gpsfae@leadtek.com.tw

Leadtek Research USA
910 Auburn Ct. Fremont, CA 94538, USA
Telephone: +510 490 8076, ext. 203
Fax: +510 490 7759
gps@leadtek.com

Contents

Introduction

The Leadtek LR9805ST GPS module is a high sensitivity, low power, Surface Mount Device (SMD). This 12-channel global positioning system (GPS) receiver is designed for a broad spectrum of OEM applications and is based on the fast and deep GPS signal search capabilities of SiRFstarII™ single chipset. As the single chip version of the LR9805T, The LR9805ST is pin-to-pin compatible with the LR9805-T for easier and faster transition.

The LR9805ST is designed to allow quick and easy integration into GPS-related applications such as:

- PDA, Pocket PC, and other computing devices
- Car and Marine Navigation
- Fleet Management /Asset Tracking
- AVL and Location-Based Services
- Hand-Held Device for Personal Positioning and Navigation

Features

Hardware and Software

- Based on the high performance features of the SiRFstarII single chipset
- Compact module size for easy integration: 24x20x2.9 mm (0.94x0.79x0.11 in)
- Fully automatic assembly: reflow solder assembly ready
- Hardware compatible with SiRFXTrac software
- Multiple I/O pins reserved for customizing special user applications
- RoHS compliance

Performance

- Cold/Warm/Hot Start Time: 45/35/4 sec at open sky and stationary environments
- Reacquisition Time: 0.1 second
- RF Metal Shield for best performance in noisy environments
- Multi-path Mitigation Hardware

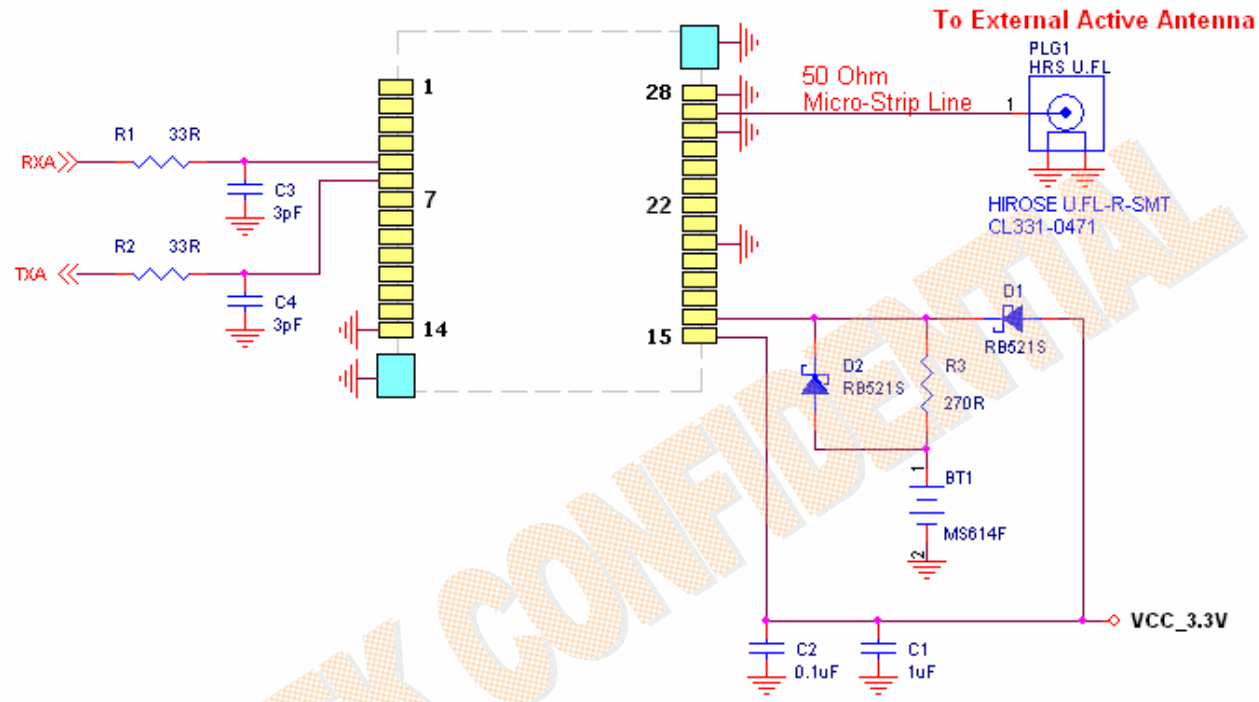
Interface

- TTL level serial port for GPS communications interface
- Protocol: NMEA-0183 / SiRF Binary (default NMEA)
- Baud Rate: 4800, 9600, 19200, 38400 or 57600 bps (default 4800)

Advantages

- Ideal for high volume mass production(Taping reel package)
- Cost saving through elimination of RF and board to board digital connectors
- Flexible and cost effective hardware design for different application needs
- Secure SMD PCB mounting method

Reference design



- All ground pads attach directly to ground plane by way of via.
- All components are reference only.

Specifications

Technical Specifications

Feature	Item	Description
Chipset	GSC2x Series	SiRFstarII single chip technology
General	Frequency	L1, 1575.42 MHz
	C/A code	1.023 MHz chip rate
	Channels	12
Accuracy	Position	10 meters, 2D RMS
		5 meters 2D RMS, WAAS corrected
		<5meters(50%), DGPS corrected
	Velocity	0.1 meters/second
	Time	1 microsecond synchronized to GPS time
Datum	Default	WGS-84
	Other	selectable for other Datum
Time to First Fix (TTFF) (Open Sky and Stationary Environment)	Reacquisition	0.1 sec., average
	Hot start	4 sec., average typical TTFF
	Warm start	35 sec., average typical TTFF
	Cold start	45 sec., average typical TTFF
Dynamic Conditions	Altitude	18,000 meters (60,000 feet) max.
	Velocity	515 meters/second (1000 knots) max.
	Acceleration	4g, max.
	Jerk	20 meters/second^3, max.
Power	Main power input	3.3 ± 0.3VDC input
	Power consumption	≈106 mW (continuous mode)
	Supply Current	≈32 mA
	Backup Power	1.5 ± 0.1V DC input.
Serial Port	Electrical interface	Two full duplex serial TTL interface.
	Protocol messages	NMEA-0183@4800 bps (Default)
Time-1PPS Pulse	Level	TTL
	Pulse duration	1 µs
	Time reference	At the pulse positive edge.
	Measurement	Aligned to GPS second, ±1 microsecond

Environmental Characteristics

Items	Description
Operating temperature range	-40 deg. C to +85 deg. C
Storage temperature range	-55 deg. C to +100 deg. C

Physical Characteristics

Items	Description
Length	24 mm (0.94in)
Width	20 mm (0.79 in)
Height	2.9 mm (0.11 in)
Weight	2.5g

Interface Specifications

Items	Description
I/O	28 pin SMD micro package

Software

The Leadtek LR9805ST module includes SiRFXTrac high sensitivity software solution.

Features include:

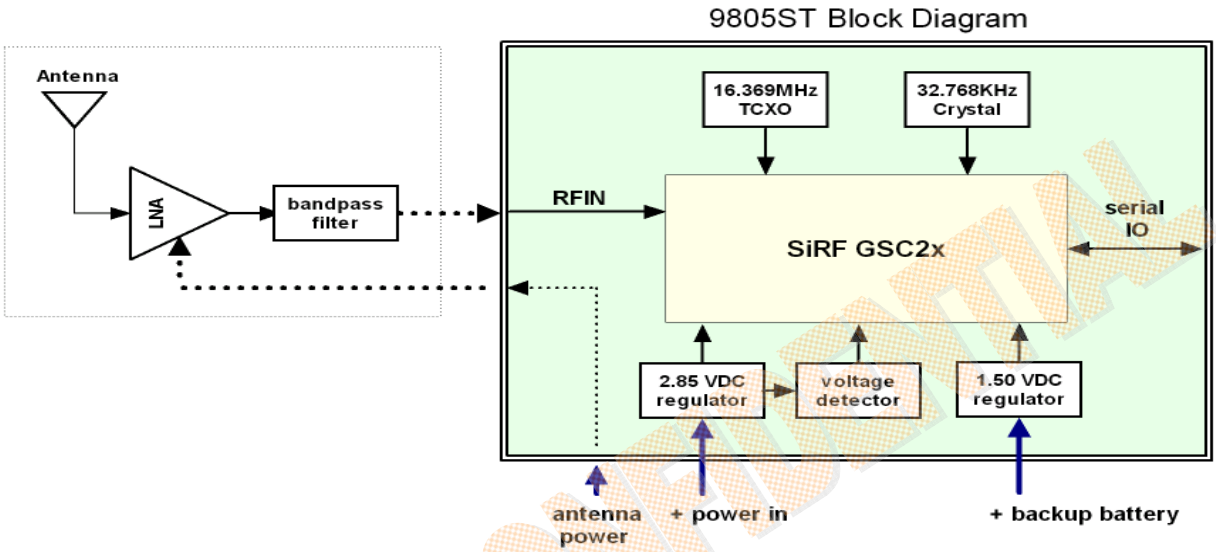
- High tracking sensitivity (-154 dBm)
- High configurability
- 1 Hz position update rate
- Real-time Operating System (RTOS) friendly
- Capable of outputting both NMEA and SiRF-proprietary binary protocols
- Designed to accept custom user tasks executed on the integrated ARM7TDM1 processor
- Runs in full power operation or optional power saving modes

SiRFXTrac default configuration is as follows:

Item	Description
Core of firmware	SiRFXTrac
Baud rate	4800, 9600, 19200, 38400 or 57600 bps (default 4800)
Code type	NMEA-0183 ASCII
Datum	WGS-84
Protocol message	GGA(1sec), GSA(5sec), GSV(5sec), RMC(1sec),VTG(1sec)
Output frequency	1 Hz

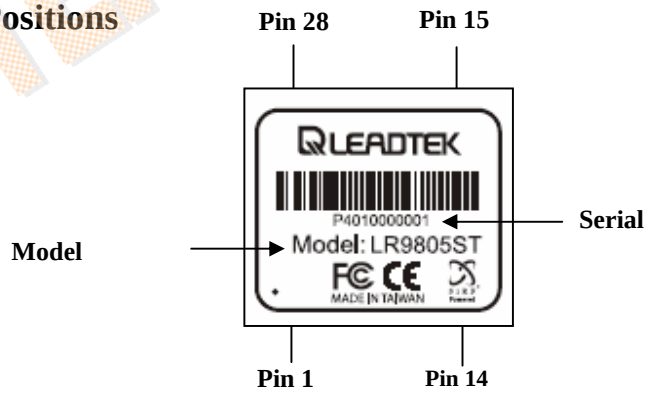
Electrical Specifications

Block Diagram



Interface Specification

Photos and Pin Positions



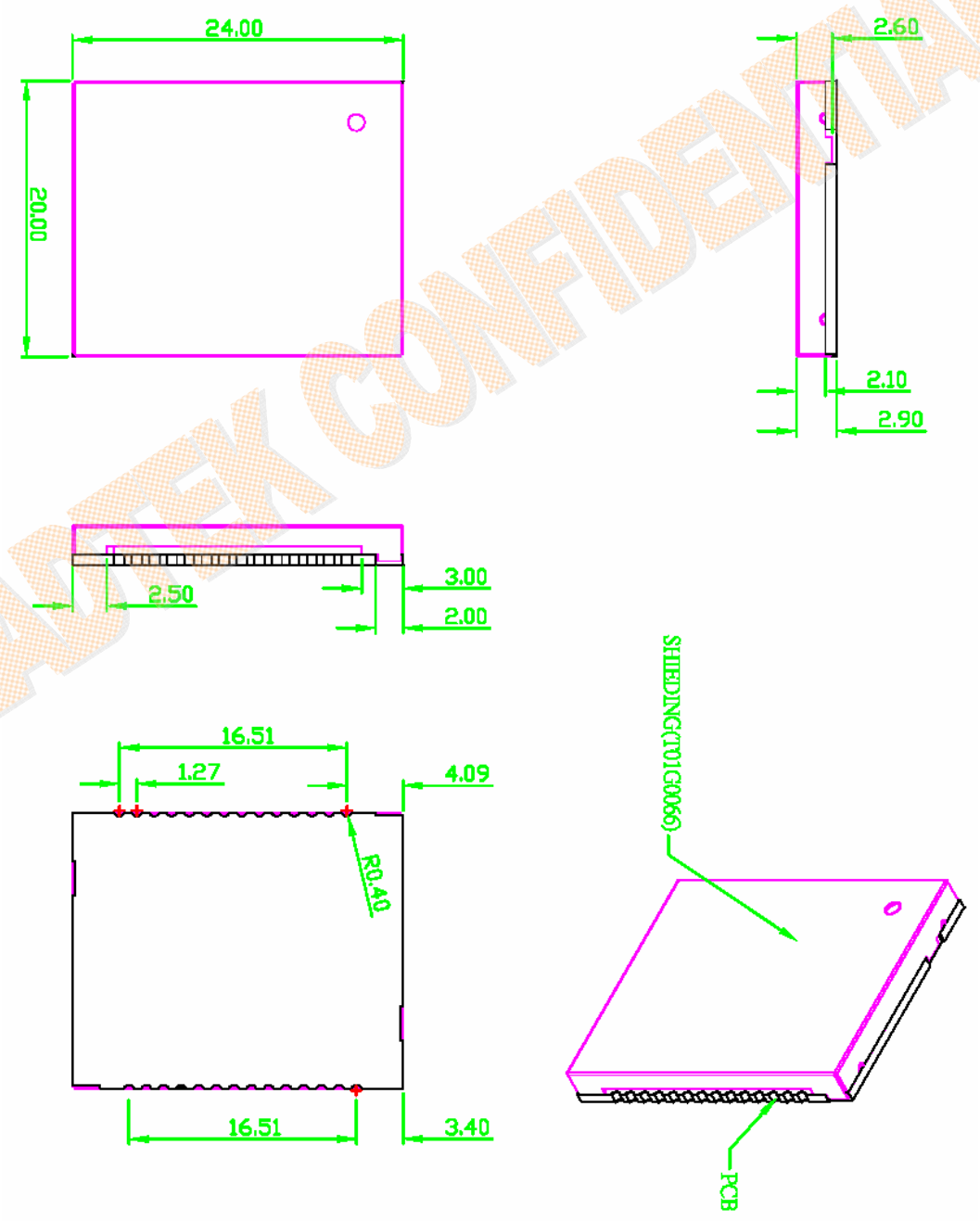
Pin Settings

PIN	Name	Type	Description
1	REV	I	Reserved
2	GPIO6	I/O	Reserved
3	GPIO10	I/O	Reserved
4	RXDB	I	TTL UART Port B input. If not used, keep floating
5	RXDA	I	TTL UART Port A input
6	TXDA	O	TTL UART Port A output
7	GPIO5	I/O	Reserved
8	TIMEMARK	O	1 PPS timemark output
9	GPIO7	I/O	Reserved
10	GPIO11	I/O	Reserved
11	GPIO0	I/O	Reserved
12	GPIO1	I/O	Reserved
13	GPIO12	I/O	Reserved
14	GND	PWR	Ground
15	VCC_IN	PWR	3.3V supply input
16	VSTBY	PWR	Apply 1.5V DC for backup RTC & SRAM. If not used, keep floating
17	BOOTSEL1	I	Pull high for programming mode. If not used, keep floating
18	PBRESN	I	Reset pin, active low, If not used, keep floating
19	GPIO13	I/O	Reserved
20	GND	PWR	Ground
21	GPIO2	I/O	Reserved
22	GPIO3	I/O	Reserved
23	TXDB	O	TTL UART Port B output. If not used, keep floating
24	BOOTSEL0	I	Pull low for programming mode. If not used, keep floating
25	ANTPWR	PWR	Antenna power input
26	GND	PWR	Ground
27	RFIN	I	RF Signal input
28	GND	PWR	Ground

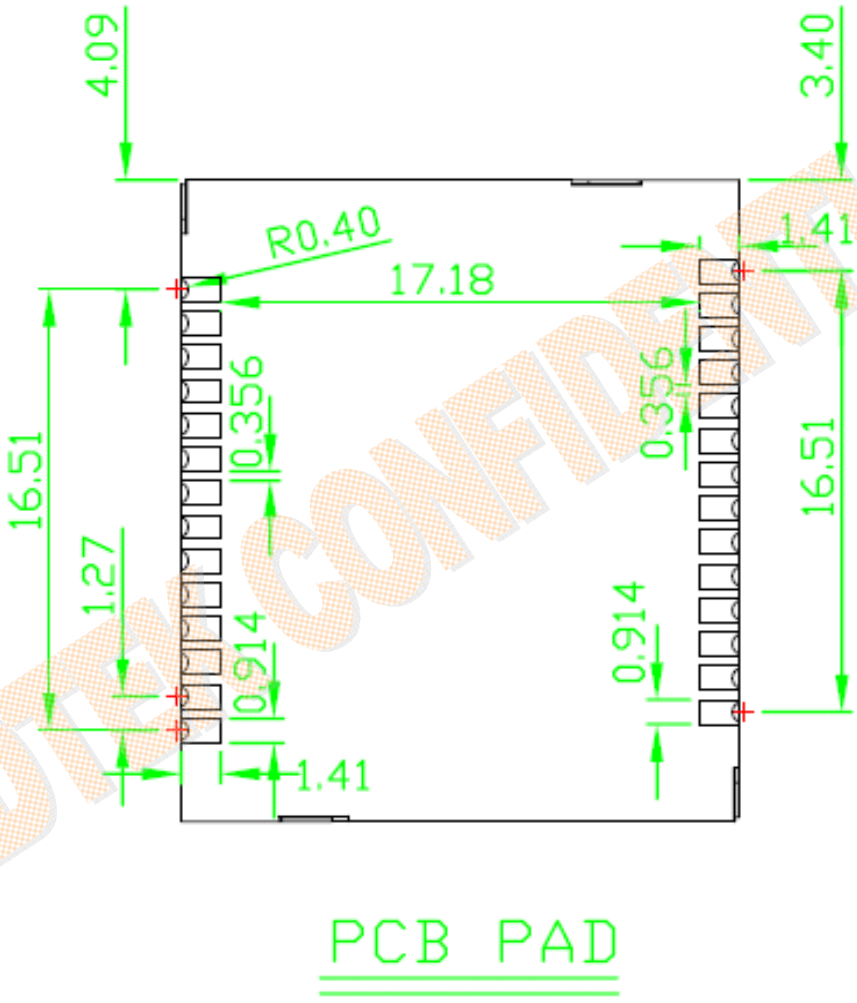
Mechanical Dimensions

Outline Drawing **Tolerance:**

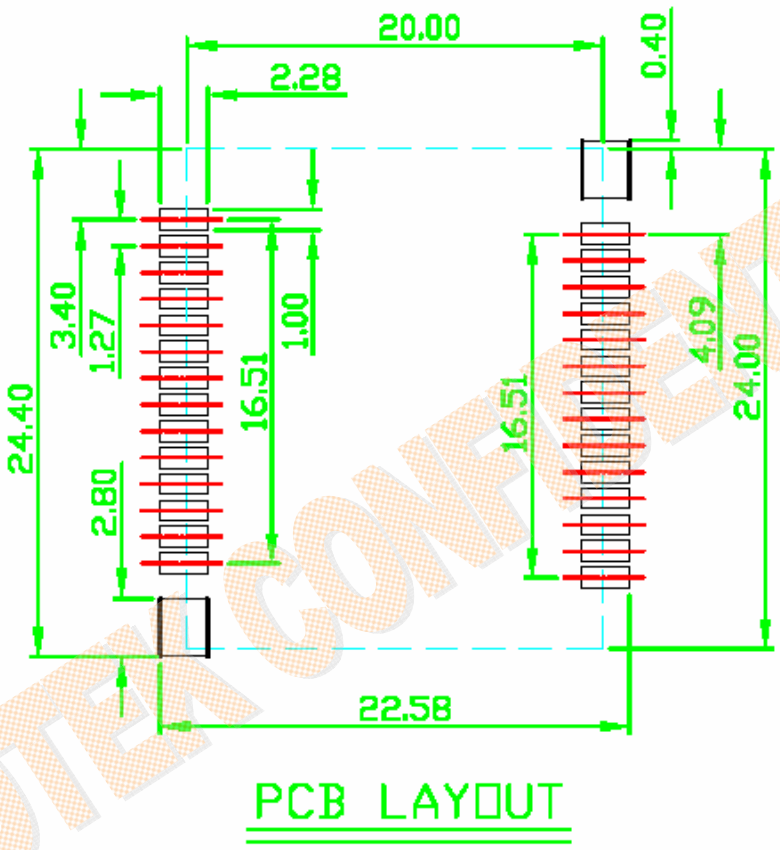
Length	24.0 ± 0.4 mm
Width	20.0 ± 0.1 mm
Height	2.90 ± 0.1 mm



Bottom view (unit : mm)



Recommended Footprint (Unit : mm)

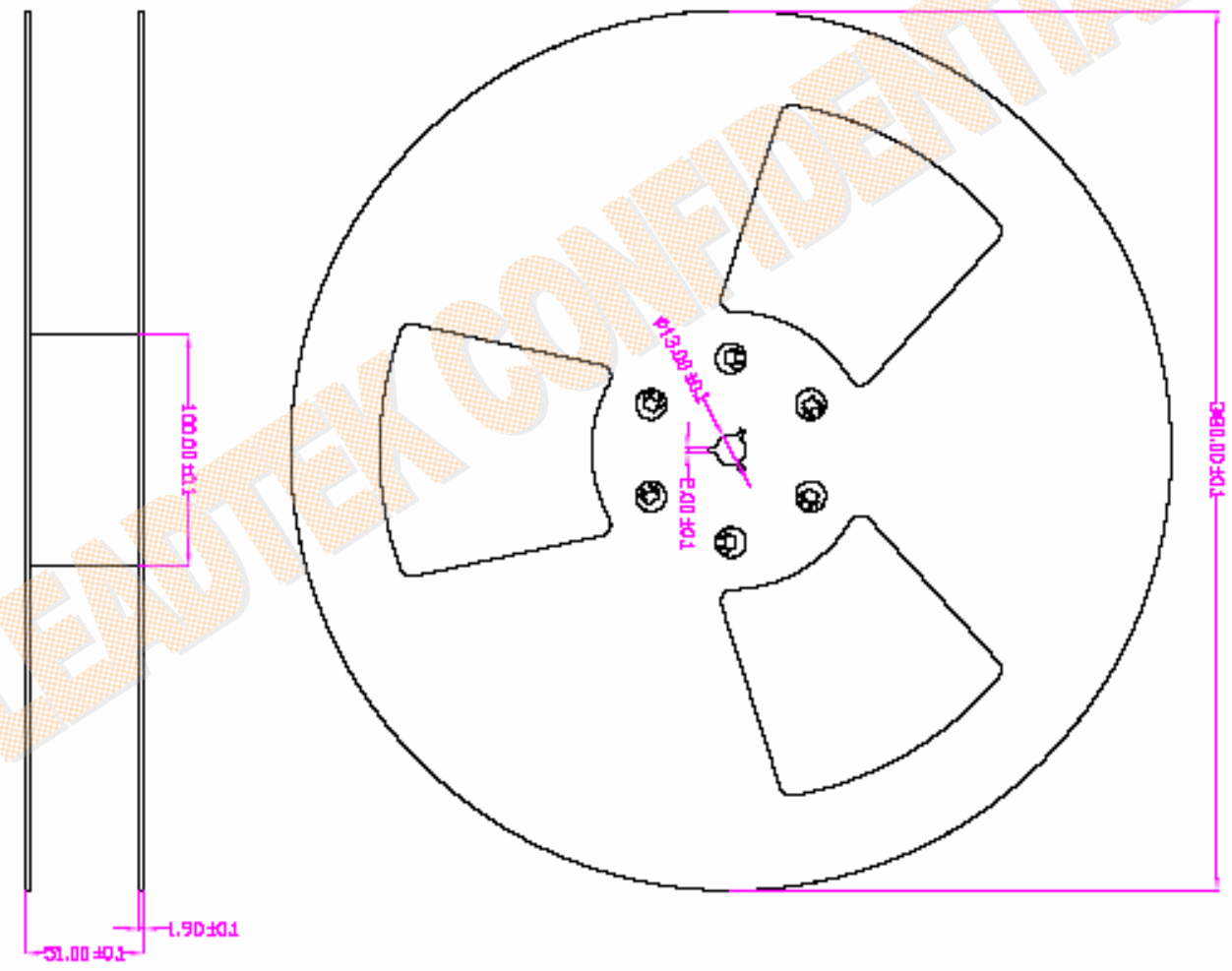


Automated Manufacturing Components

Reel Taping Specification

- Material: Black Conductive High Impact Polystyrene Alloy (UP-6100)
- Surface resistivity 10^9 – 10^{12} Ω/□
- Quantity per reel: 1000 pcs./reel

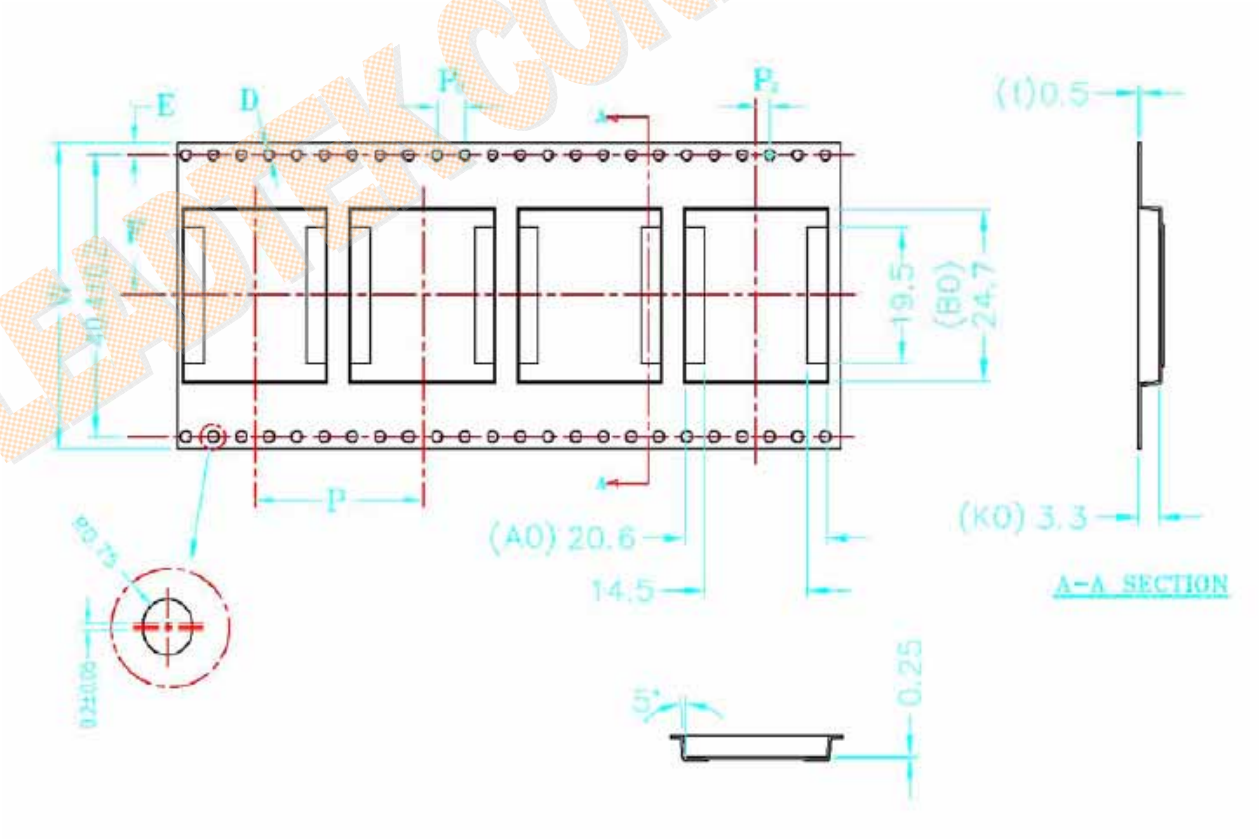
Tape Reel Drawing (Unit: mm)



Polystyrene Alloy Taping Specifications

- 10 sprocket hole pitch cumulative tolerance ±0.20mm
- Carrier camber is within 1mm in 250mm
- A0 and B0 measured on a plane 0.3mm above the bottom of the pocket
- K0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier
- Material: black anti-static polystyrene alloy
- All dimensions meet EIA-481-3 requirements
- Thickness: 0.50±0.05cm
- Packing length per 22" reel: 50.0 Meters (1:2)
- Component load per 15" reel: 1000 pcs. (SUR-56-3-XL)

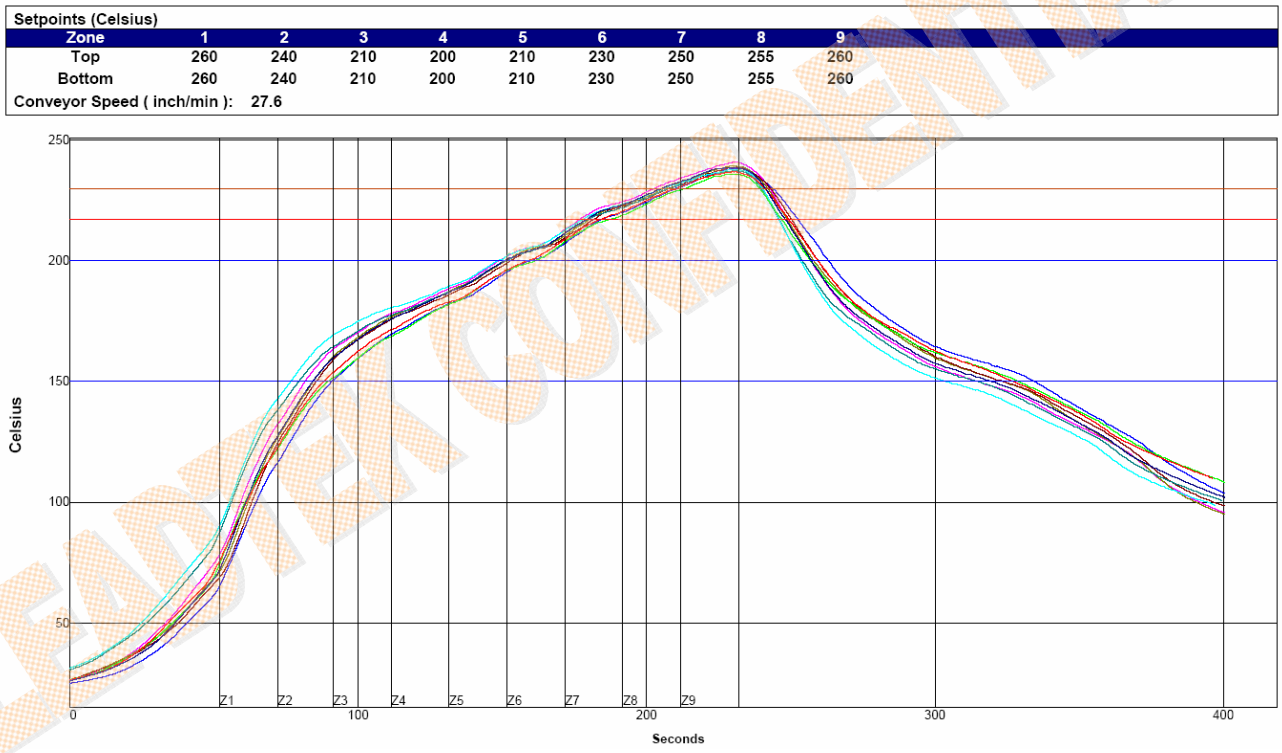
Polystyrene Alloy Taping Drawing



Reflow Profile

High quality, low defect soldering requires identifying the optimum temperature profile for reflowing the solder paste. To have the correct profile assures components, boards, and solder joints are not damaged and reliable solder connection is achievable. Profiles are essential for establishing and maintaining processes. You must be able to repeat the profile to achieve process consistency. The heating and cooling rise rates must be compatible with the solder paste and components. The amount of time that the assembly is exposed to certain temperatures must first be defined and then maintained.

The following is an example of a typical thermal profile.



Ordering Information

For every order of 1000 pcs , Leadtek will ship the modules with the reel package (shown on page 15). For order quantities less than 1000 pcs, or when ordering non-whole numbers, Leadtek will snip the taping and ship the quantity that you request without the reel.

To place an order, please contact gpssales@leadtek.com.tw

Glossary

A-GPS

Assisted GPS or AGPS is a technology that uses an assistance server to cut down the time needed to find the location. Although GPS provides excellent position accuracy, position fixes require lines of sight to the satellites. In regular GPS networks there are only GPS satellites and GPS receivers.
In A-GPS networks, the receiver, being limited in processing power and normally under less than ideal locations for position fixing, communicates with the assistance server that has high processing power and access to a reference network. Although dependent on cellular coverage, AGPS processing is quicker and more efficient than regular GPS.

API

An application programming interface is a set of definitions of the way one piece of computer software communicates with another. One of the primary purposes of an API is to provide a set of commonly used functions, such as to draw windows or icons on the screen. Programmers can then take advantage of the API by making use of its functionality, saving them the task of programming everything from scratch.

Baud Rate

Is a measure of the signaling rate, which is the number of changes to the transmission media per second in a modulated signal.
For Example: 250 baud means that 250 signals are transmitted in one second. If each signal carries 4 bits of information then in each second 1000 bits are transmitted. This is abbreviated as 1000 bit/s.

Dead Reckoning

The process of estimating your position by advancing a known position using course, speed, time and distance to be traveled. It is figuring out where you will be at a certain time if you hold the speed, time and course you plan to travel.

Differential GPS (DGPS)

An extension of the GPS system that uses land-based radio beacons to transmit position corrections to GPS receivers. DGPS reduces the effect of selective availability, propagation delay, etc. and can improve position accuracy to better than 10 meters.

EGNOS (European Geostationary Navigation Overlay System)

A satellite navigation system being developed by the European Space Agency, the European Commission, and EUROCONTROL. It is intended to supplement the GPS and GLONASS systems by reporting on the reliability and accuracy of the signals. According to specifications, horizontal position accuracy should be better than 7 meters. In practice, the horizontal position accuracy is at the meter level. It will consist of three geostationary satellites and a network of ground stations.
Similar service is provided in America by the WAAS system. See WAAS.

LNA (Low Noise Amplifier)

A special type of electronic amplifier or amplifier used in communication systems to amplify very weak signals captured by an antenna. It is usually located at the antenna and is a key component, which is placed at the front-end of a receiver system.

Multi-path mitigation

Anticipating errors caused when a satellite signal reaches the GPS receiver antenna by more than one path. Usually caused by one or more paths being bounced or reflected off of structures near the antenna and occurs to some extent everywhere. The signal which traverses a longer path will yield a larger pseudo range estimate and increase the error.

NMEA (National Marine Electronics Association)

An U.S. standards committee that defines data message structure, contents, and protocols to allow the GPS receiver to communicate with other pieces of electronic equipment.

1PPS

Pulse which is generated once per second. GPS and some radio clocks and related timekeeping gear have a pulse-per-second or PPS signal that is needed for high accuracy time synchronization. The PPS signal can be connected in either of two ways, either through the data leads of a serial port or through the modem control leads. Either way requires conversion of the PPS signal.

Most GPS devices emit an RS-232 serial stream with some kind of timestamp format. Many GPS devices are small realtime systems with the satellite tracking done at high priority, positioning done at medium priority, and time output done at low priority. The timestamps often have +- 200 ms of jitter (variance in delay), and output a PPS signal on the exact second.

SMD (Surface Mount Device)

Electronic device components that are mounted directly onto the surface of printed circuit boards (PCBs). In the industry it has largely replaced the previous construction method of fitting components with wire leads into holes in the circuit board (also called through-hole technology).

TCXO (Temperature Controlled Crystal Oscillator)

An electronic device that uses the mechanical resonance of a physical crystal to create an electrical signal with a very precise frequency and can be embedded in integrated circuits. TCXO reduces the environmental changes of temperature, humidity, and vibration, to keep a stable output frequency.

Time To First Fix (TTFF)

The time it takes a GPS receiver to find satellites after you first turn it on, when the GPS receiver has lost memory, or has been moved over 300 miles from its last location. Standard TTFF Timing consists of:

Mode	Requires	Timing
Snap Start	Hot + Clock + Sat Pos	3 minutes off
Hot Start	Warm + Ephemeris	30 minutes off
Warm Start	Position Accuracy Time Accuracy Almanac	<500 KM <2 hours <1 year
Cold Start	Nothing	N/A

Specifications are typical times assuming good satellite visibility and above threshold signal strengths.

WAAS (Wide Area Augmentation System)

A system of satellites and ground stations that provide GPS signal corrections for better position accuracy. A WAAS-capable receiver can give you a position accuracy of better than three meters, 95 percent of the time. (At this time, the system is still in the development stage and is not fully operational.) WAAS consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations, located on either coast, collect data from the reference stations and create a GPS correction message.

Leadtek Research Inc.
18F, 166, Chien-Yi Rd.,
Chung Ho, Taipei Hsien,
Taiwan (235)

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