



# CONDOR C1011

## GPS RECEIVER MODULE

### TECHNICAL HIGHLIGHTS

Receiver: GPS L1 frequency (1575.42 MHz), C/A code, 22-channel continuous tracking

NMEA output & input: 1 serial port

Use with either active or passive antenna; C1011's RF input requires external LNA with 17–42 dB gain

SBAS (WAAS, EGNOS, MSAS) capable

aGPS capable

Update rate up to 5 Hz

PPS timing output

38 surface mount pads, quad flat no leads LGA package

Tracking power consumption 122 mW

Requires external RTC

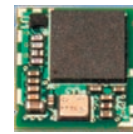
### GENERAL OVERVIEW

For highly portable consumer and commercial positioning applications, Trimble's Condor C1011 GPS receiver module is the smart alternative to a GPS chipset.

At 10 x 11 mm, the C1011 is the smallest receiver in the Condor family. And it packs powerful positioning performance into its optimal size.

The Condor C1011 provides an L1 Frequency GPS receiver with NMEA protocol output and input on a serial port, and a PPS timing output.

The module's 38 reflow-solderable surface mount pads provide an interface for your design without the need for costly I/O and RF connectors.



← Pin 1 location

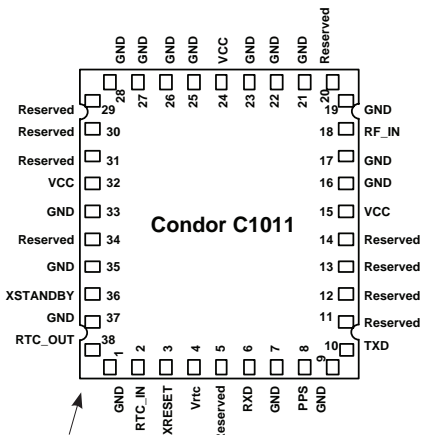
Condor C1011 – Top View

Bring your innovative products to market faster and at lower cost.

Choose the Condor C1011 for top tier positioning performance, the best components, and the highest production quality standards.

### PIN OUT TABLE

PIN#	FUNCTION	I/O	DESCRIPTION
1	GND		Ground
2	RTC_IN	Input	32 kHz XTAL or buffered signal
3	XRESET	Input	Pull low 100 ms for reset; do not connect if not used
4	V <sub>RTC</sub>	Input	RTC backup power supply voltage 2.0 V to V <sub>CC</sub>
5	Reserved		Do not connect
6	RXD	Input	Serial port UART Receive @ 2.8 V LVTTTL
7	GND		Ground
8	PPS	Output	1 Hz PPS 2.8 V LVTTTL pulse; do not connect if not used
9	GND		Ground
10	TXD	Output	Serial port UART Transmit @ 2.8 V LVTTTL
11–14	Reserved		Do not connect
15	V <sub>CC</sub>	Input	Main power supply voltage 3.0 V to 3.6 V
16–17	GND		Ground
18	RF_IN	Input	GPS signal input 50 Ω unbalanced (coaxial) RF input
19	GND		Ground
20	Reserved		Do not connect
21–23	GND		Ground
24	V <sub>CC</sub>	Input	Main power supply voltage 3.0 V to 3.6 V
25–28	GND		Ground
29–31	Reserved		Do not connect
32	V <sub>CC</sub>	Input	Main power supply voltage 3.0 V to 3.6 V
33	GND		Ground
34	Reserved		Do not connect
35	GND		Ground
36	XSTANDBY	Input	Selects Run or Standby mode; do not connect if not used
37	GND		Ground
38	RTC_OUT	Output	32 kHz XTAL



Top View Rotated 180°

### GPS PERFORMANCE SPECIFICATIONS

GPS performance statistics are clear view, stationary.  
Sensitivity based on signals measured at the antenna.

PARAMETER	VALUE(S)
Update Rate	1 Hz (default), up to 5 Hz
Number of Channels	22
Accuracy	
Position (autonomous)	<2.5 m 50%, <5 m 90%
Position (SBAS)	<2 m 50%, <4 m 90%
Altitude (autonomous)	<5 m 50%, <8 m 90%
Altitude (SBAS)	<3 m 50%, <5 m 90%
PPS	< ±25 ns @ 50%
Acquisition time	
Re-Acquisition	2 s 50%
Hot Start	2 s 50%
Warm Start	35 s 50%
Cold Start	38 s 50%
Sensitivity	
Tracking	-160 dBm
Acquisition	-146 dBm
Dynamics	
Acceleration	2 g
Velocity	515 m/s (COCOM Limit)

### ELECTRICAL SPECIFICATIONS

PARAMETER	VALUE(S)
Serial Interface – UART	1 bi-directional NMEA
Level	2.8 V LVTTTL level
PPS Interface	1 Hz timing pulse, output
Level	2.8 V LVTTTL level
PPS Accuracy to UTC	< ±25 ns @ 50%
Pulse Width	4.2 µs default (configurable)
GPS Input RF Interface	GPS signal input 50 Ω unbalanced (coaxial) RF input
Main Power Supply	
V <sub>CC</sub> DC Levels	3.0 V to 3.6 V; 3.3 V typical
Consumption (current), excluding external LNA and RTC	33mA typ
RTC and Backup Power Supply (V <sub>RTC</sub> )	
V <sub>RTC</sub> DC Levels	2.0 V to V <sub>CC</sub>
Consumption (current) using V <sub>RTC</sub> pin only	5 µA typ @ +20°C
Consumption using XSTANDBY pin	840 µA

### GPS COMMUNICATION PARAMETERS

GPS output is available from a Serial Interface (UART). The output adheres to NMEA 0183 protocol with the following characteristics.

PARAMETER	VALUE(S)
Protocol	NMEA 0183
Baud Rate	
Default	9600
Other	4800, 19200, 38400, 57600, 115200
Message Output Rate	Up to 5 Hz
Number of message types restricted by Baud Rate	

### NMEA 0183 MESSAGES

MESSAGE	DEFAULT	DESCRIPTION
GGA	Default	GPS fix data
GSA	Default	GPS DOP and active satellites
GSV	Default	GPS satellites in view
RMC	Default	Recommended minimum specific GPS/Transit data
CHN	Other	GPS channel status
GLL	Other	Geographic position – Latitude/Longitude
VTG	Other	Track Made Good and Ground Speed
ZDA	Other	Time and date

### ENVIRONMENTAL SPECIFICATIONS

PARAMETER	VALUE(S)
Temperature	
Operating	-40 °C to +85°C
Storage	-55 °C to +105°C
Humidity	5% to 95% non-condensing @ 60°C
Vibration	
5 Hz to 20 Hz	0.008 g <sup>2</sup> /Hz
20 Hz to 100 Hz	0.05 g <sup>2</sup> /Hz
100 Hz to 900 Hz	-3 dB/octave

### PHYSICAL SPECIFICATIONS

PARAMETER	VALUE(S)
Dimensions	10.0 mm x 11.0 mm x 2.01 mm
Weight	0.364 grams

### ABSOLUTE MAXIMUM RATINGS

**CAUTION**—Absolute maximum ratings indicate conditions beyond which permanent damage to the device may occur. Electrical specifications do not apply when operating the device outside its recommended operating conditions.

PARAMETER		MIN	MAX	UNIT
Main power supply voltage	( $V_{CC}$ )	-0.3	4.0	V
RTC power supply voltage	( $V_{RTC}$ )	-0.3	4.0	V
Antenna input power at RF input	(dBm)		+10 max	dBm
Storage temperature	( $T_S$ )	-55	+105	°C

### RECOMMENDED CONDITIONS OF OPERATION

PARAMETER		MIN	MAX	UNIT
Main power supply voltage <sup>1</sup>	( $V_{CC}$ )	3.0	3.6	V
RTC power supply voltage	( $V_{RTC}$ )	2.0	$V_{CC}$	V
Input pin threshold voltage (RXD, Reserved Pins, XRESET)				
with Status = High	( $V_{IH}$ )	2.0	3.6	V
with Status = Low	( $V_{IL}$ )	-0.3	0.8	V
Output pin threshold voltage (TXD)				
with Status = High ( $I_{OH} = 1.6\sim 14$ mA)	( $V_{OH}$ )	2.4	$V_{CC}$	V
with Status = Low ( $I_{OL} = 1.6\sim 14$ mA)	( $V_{OL}$ )	-0.3	0.4	V
Hardware XRESET (assert XRESET pin)	(XRESET)	100		ms
Ambient operating temperature	( $T_A$ )	-40	+85	°C

See "Supply Voltage Requirement" on page 4.

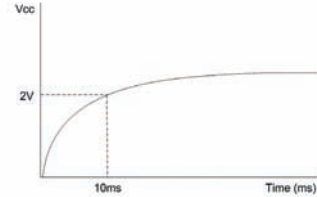
### ELECTRICAL CHARACTERISTICS

Characteristics apply to corresponding operating conditions as stated or with typical @ 20 °C

PARAMETER	MIN	TYP	MAX	UNIT
Current draw, continuous tracking (excluding antenna supply; temperature: -40 °C to +85 °C)	31	33	42	mA
Power supply, power consumption, continuous tracking (excluding antenna supply; temperature: -40 °C to +85 °C)	93.00	122.10	<151.20	mW
Current draw, standby mode ( $V_{RTC}$ pin only ; $V_{RTC} = 2.96$ )		5		μA
Current draw, standby mode using serial command ( $V_{CC}$ and $V_{RTC}$ pins)		2.42		mA
Current draw, standby mode using XSTANDBY pin (and $V_{CC}$ and $V_{RTC}$ pins)		840		μA
Supply ripple noise, 1 Hz to 1 MHz			50	mV <sub>PP</sub>
Supply ripple noise, GPS TCXO freq 16.368 MHz ± 5 kHz			1	mV <sub>PP</sub>
RTC input – RTC signal on pin 2 from a XTAL		32.768		kHz
Input gain at RF input	17		42	dB
External LNA noise			2	dB

## SUPPLY VOLTAGE REQUIREMENT

The Primary supply voltage ( $V_{CC}$ ) slope from 0 V to 2 V must have a rise time that is less than 10 ms.



Supply Voltage Requirement

## FEATURES

### Antenna Input RF\_IN (Pin 18)

The RF input pin is the 50  $\Omega$  unbalanced GPS RF input, and can be used with an active antenna. For a passive antenna, an external LNA must be used.

### PPS – Pulse-Per-Second Output (Pin 8)

This logic level output provides a 1 Hz timing signal to external devices. The default pulse width of this signal is 4.2  $\mu$ s. The pulse width is configurable by using the \$PMTK324 command.

### Serial Port Default Settings (Pins 6, 10)

The Condor C1011 GPS module supports one serial port. Baud rate is user configurable. Data bits, parity, and stop bits are not. Flow control is not available. The RXD logic level input is the serial port

receive line (data input to the module). The TXD logic level output is the transmit line. Do not hold the TXD low or pull to ground while the GPS module is starting up.

### XSTANDBY (Pin 36)

This logic level transition input is used to control the RUN/STANDBY state of the module:

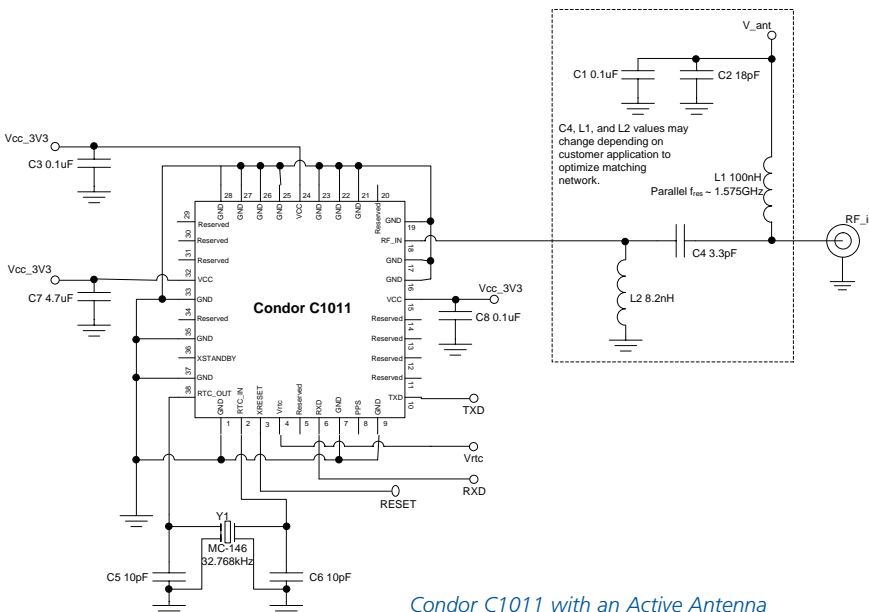
- If the signal is High, the unit runs normally.
- If the signal changes from High to Low, the unit goes to STANDBY mode.
- If the signal changes from Low to High, the unit goes into RUN mode.

Leave disconnected if not used.

## SERIAL PORT DEFAULT SETTINGS

PORT DIRECTION	PIN #	PROTOCOL	CHARACTERISTICS				
			Default Baud Rate	Data Bits	Parity	Stop Bits	Flow Control
TXD	6	NMEA out	9600	8	None	1	None
RXD	10	NMEA out	9600	8	None	1	None

## APPLICATION NOTES



Condor C1011 with an Active Antenna

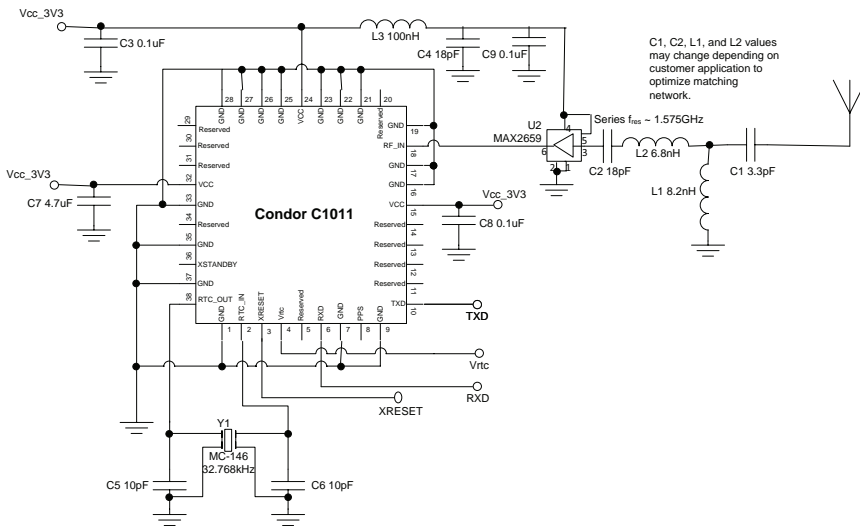
### Active Antenna

#### Notes:

In the schematic:

- An active antenna is used.
- The XRESET pin is pulled low for 100 ms after power is applied to  $V_{CC}$ .
- $V_{RTC}$  is connected to battery backup to preserve current GPS data. If no battery backup is used  $V_{RTC}$  must be connected to  $V_{CC}$ .

You can optimize the values of L2 and C4 by applying a GPS signal from a simulator and adjusting the component values to determine the best combination to provide the maximum displayed C/N value from the constant-level GPS signal. Alternatively, use a network analyzer to optimize the input return loss.



Condor C1011 with an LNA and a Passive Antenna

## External LNA and Passive Antenna

### Notes:

In the schematic:

- An external LNA (U2 in the diagram) is connected to RF\_IN.
- A passive antenna is used; it is connected to the external LNA (U2).
- The external LNA (U2) gain range is 17 dB–42 dB.
- The enable pin of the external LNA is connected to  $V_{CC}$ . Alternatively it could be connected to the XSTANDBY line if used to turn off the LNA at the same time as the C1011.
- XSTANDBY is not connected in this example.
- The XRESET pin is pulled low for 100 ms after power is applied to  $V_{CC}$ .
- $V_{RTC}$  is connected to battery backup

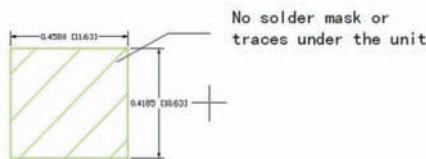
You can optimize the values of C1, C2, L1, and L2 by applying a GPS signal from a simulator or a network analyzer as described in the Active Antenna application notes (previous page).

## SOLDERING INFORMATION

When soldering the Condor module to a PCB, keep an open cavity underneath the Condor module.

Do not place copper or solder mask underneath the module.

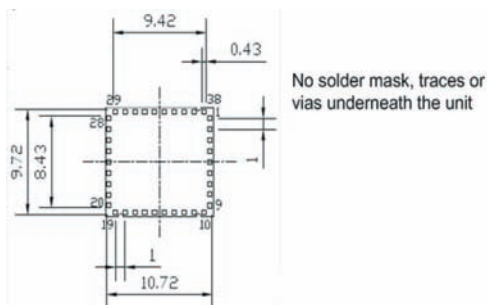
### Solder Mask



SUGGESTED CUSTOMER SOLDER MASK PATTERN

Suggested Solder Mask

### Pad Pattern

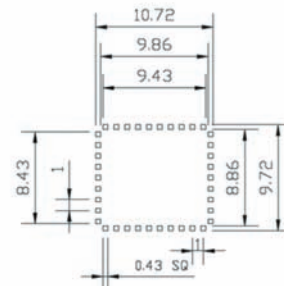


Suggested Pad Pattern

### Paste Mask

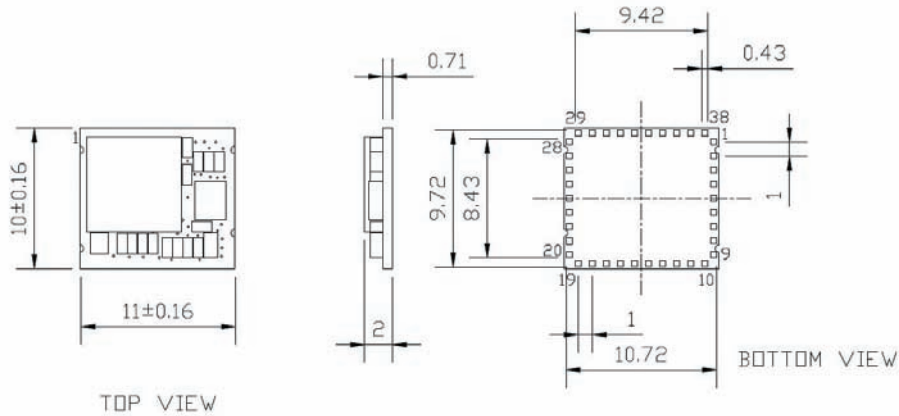
To ensure good mechanical bonding with sufficient solder to form a castellation solder joint, use a solder mask ratio of 1:1 with the solder pad.

When using a  $5 \pm 1$  mil stencil to deposit the solder paste, Trimble recommends a 4 mil toe extension on the stencil.



Suggested Paste Mask

**MECHANICAL OUTLINE DRAWING**



Top View per mechanical drawing

Pin 1 location



**ORDERING INFORMATION**

Model	Part #	Packaging			Starter Kit P/N
		20-piece tray	100-piece tray	500-piece reel	
C1011	68674-00	√	√	√	70897-05

**SUPPORT INFORMATION**

Get support information, including documentation and support software, at [trimble.com](http://trimble.com):

<http://www.trimble.com/embeddedsystems/condor-gps-module.aspx?dtID=support>

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