The right one.™

CONDOR C1216
GPS RECEIVER MODULE

Top View: Condor C1216

TECHNICAL HIGHLIGHTS

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

NMEA output and input: serial port, USB port

On-board low noise amplifier

Use with passive or active antennas; up to 25 dB input gain at RF input

Built-in antenna circuit protection

SBAS (WAAS, EGNOS, MSAS) capable

aGPS capable

Update rate up to 5 Hz

PPS timing output

24 surface mount castellations
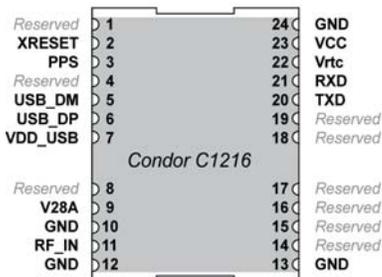
Pin Out Diagram

GENERAL OVERVIEW

Trimble's Condor C1216 GPS receiver module is a smart alternative to a GPS chipset for many consumer and commercial positioning applications. Use the C1216 to bring innovative products to market faster.

The Condor C1216 receiver features powerful positioning performance in a 16.0 mm x 12.2 mm x 2.13 mm package.

The module's 24 reflow-solderable surface-mount edge castellations provide an interface for your design without the need for costly I/O and RF connectors.

The Condor C1216 provides an L1 Frequency GPS receiver, with NMEA protocol from both a serial port and a USB port, and also a PPS timing output.
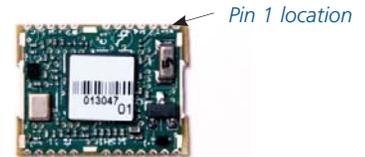
The C1216 has an onboard low noise amplifier (LNA) that is compatible with both active and passive antenna implementations.

The C1216 has built-in antenna detection for open and short circuit conditions; alerts are on by default, but can be turned off by command. The C1216 also has a 2.8 V reference output that can supply up to 25 mA. Choose the Condor C1216 for top tier positioning performance, the best components, and the highest production quality standards.

PIN OUT TABLE

PIN#	FUNCTION	I/O	DESCRIPTION
1	Reserved		Do not connect
2	XRESET	Input	Pull low 100 ms for reset
3	1PPS	Output	PPS Interface Time pulse
4	Reserved		Do not connect
5	USB_DM	Input/Output	USB data minus
6	USB_DP	Input/Output	USB data plus
7	VDD_USB	Input	USB power (VDDU)
8	Reserved		Do not connect
9	V28A	Output	Reference voltage (@ 2.8 V) for up to 25 mA
10	GND		Ground
11	RF_IN	Input	GPS signal input 50 Ω unbalanced (coaxial) RF input
12	GND		Ground
13	GND		Ground
14–19	Reserved		Do not connect
20	TXD	Output	Serial port 1 Transmit @ 2.8 V LVTTL
21	RXD	Input	Serial port 1 Receive @ 2.8 V LVTTL
22	V_{RTC}	Input	RTC power supply voltage 2.0 V to V_{CC}
23	V_{CC}	Input	Main power supply 3.0 V to 3.6 V
24	GND		Ground

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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%
Acquistion 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
Acquistion	–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 LVTTL level
USB Interface	USB 2.0, 1 differential serial line, NMEA
PPS Interface	1 Hz timing pulse, output
Level	2.8 V LVTTL 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 Supplys	
V_{CC} DC Levels	3.0 V to 3.6 V; 3.3 V typical
Consumption (current)	<37 mA
RTC and Backup Power Supply	
V_{RTC} DC Levels	2.0 V to V_{CC}
Consumption (current)	6 µA typ @ +25°C
USB Supply Power (V_{DDU})	3.0 V to 3.6 V; 3.3 V typical

GPS COMMUNICATION PARAMETERS

GPS output is available from either a Serial Interface (UART)
or a USB Interface. 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^2/Hz
20 Hz to 100 Hz	0.05 g^2/Hz
100 Hz to 900 Hz	–3 dB/octave

PHYSICAL SPECIFICATIONS

PARAMETER	VALUE(S)
Dimensions	16.0 mm x 12.2 mm x 2.13 mm
Weight	0.544 g

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
USB supply voltage	(V_{DDU})	–0.3	3.6	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
Primary power supply voltage[1]	(V_{CC})	3.0	3.6	V
RTC Power Supply Voltage	(V_{RTC})	2.0	Vcc	V
USB Supply Voltage	(V_{DDU})	3.0	3.6	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} = 1.6~14 mA)	(V_{OH})	2.4	Vcc	V
with Status = Low (I_{OL} = 1.6~14 mA)	(V_{OL})	–0.3	0.4	V
Hardware XRESET (assert XRESET pin)	(XRESET)	100		ms
Ambient operating temperature	(T_A)	–40	+85	°C

ELECTRICAL CHARACTERISTICS

Measurements are made over temperature range –40 °C to +85 °C

PARAMETER	MIN	MAX	UNIT
Current draw, continuous tracking		<37	mA
Power supply, power consumption, continuous tracking		<133	mW
Current draw, during acquisition		<35	mA
Power consumption, during acquisition		<126	mW
Current draw, standby mode (only V_{RTC})	6	<13.5	µA
Current Draw, sleep mode command (both V_{CC} and V_{RTC})	2.5	<2.8	mA
Supply ripple noise, 1 Hz to 1 MHz		50	mV_{PP}
Supply ripple noise, GPS TCXO frequency ±5 kHz		1	mV_{PP}
Input gain at RF input		25	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.
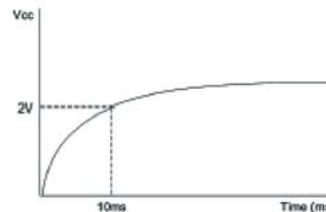
Supply Voltage Requirement

FEATURES

Antenna Input RF_IN (Pin 11) and Circuit Detection

The RF input pin is the 50 Ω unbalanced GPS RF input, and can be used with active or passive antennas.

The C1216 has built-in antenna detection for open and short circuit conditions. By default, the open and short alerts are enabled but can be disabled by using the $PMTK324 command.

The SHORT alert is triggered if more than approximately 19 mA is drawn from the antenna pin; the current is limited to a maximum of 33 mA by a current clamp.

This diagram shows the active antenna drawing current through a 10 Ω sense resistor, supplied by an internal 2.8 V regulator. As a result, there will be an associated voltage drop as the current increases.

Antenna Detection Circuit

PPS – Pulse-Per-Second Output (Pin 3)

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

USB Data IO and Power (Pins 5 – 7)

There are three connections for one differential serial USB line. USB_DM (pin 5) is for USB data minus and USB_DP (pin 6) is for USB data plus. VDD_USB (pin 7) is for USB power. Refer to the Condor manual for more information on USB.

Serial Port Default Settings (Pins 20, 21)

The Condor C1216 GPS module supports one serial port. Baud rate is user configurable. Data bits, parity and stop bits are not. Flow control is not available.

SERIAL PORT DEFAULT SETTINGS

PORT DIRECTION	PIN #	PROTOCOL	CHARACTERISTICS				
			Default Baud Rate	Data Bits	Parity	Stop Bits	Flow Control
TXD	20	NMEA out	9600	8	None	1	None
RXD	21	NMEA out	9600	8	None	1	None

XRESET (Pin 2)

Connects to the host system reset controller or GPIO for host-controlled resetting of the GPS module.

APPLICATION NOTES
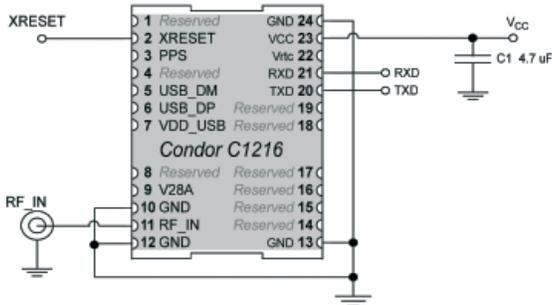
Condor C1216 Application Antenna Circuit

Notes:

• Backup battery is not connected to pin 22 (V_{RTC}) in this example, but may be added to maintain user configuration and RTC.

• V28A on pin 9 is a 2.8V reference. It maybe used to power an LNA up to 25mA.

• XRESET is connected to the host microcontroller or host reset controller.

• Do not connect any of the Reserved pins.

• The external LNA gain range is 17 dB ~ 25 dB.

• Trimble recommends the use of a stable X5R dielectric for capacitor C1.

• Capacitor C1 should be placed as close as possible to the power supply pin.

See "Supply Voltage Requirement" on page 4.

SOLDERING INFORMATION

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

Do not place copper traces or solder mask immediately underneath the module.

Solder Mask
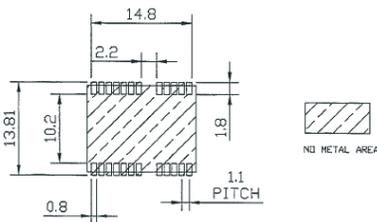
Suggested Solder Mask

Pad Pattern
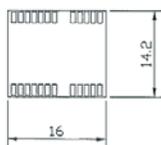
Suggested Pad Pattern

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 ±1 mil stencil to deposit the solder paste, Trimble recommends a 4 mil toe extension on the stencil.
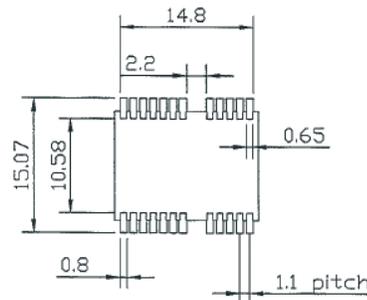
Suggested Paste Mask

MECHANICAL OUTLINE DRAWING
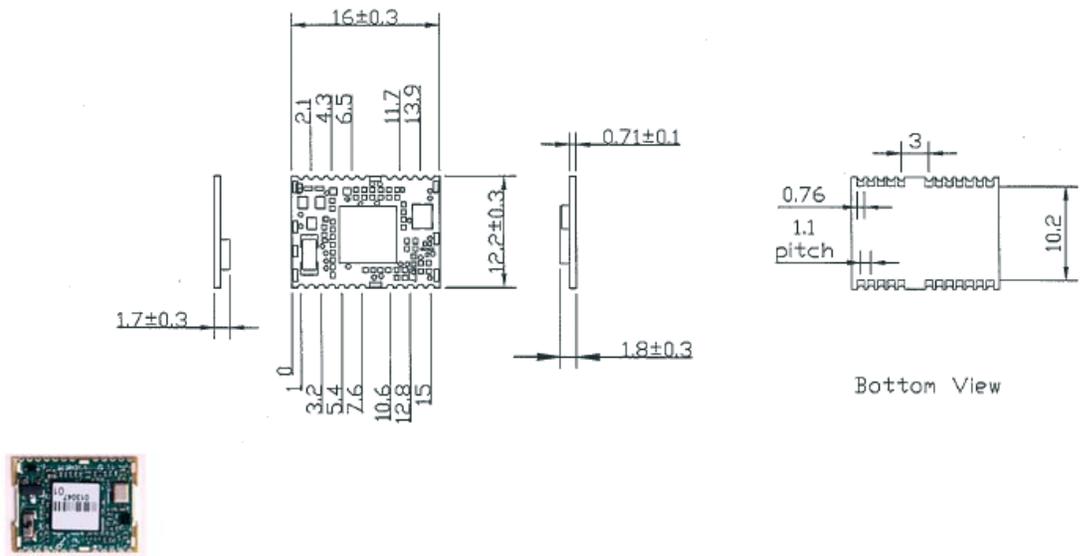
Top View per mechanical drawing

ORDERING INFORMATION

Model	Part #	Packaging		Starter Kit P/N
		50-piece tray	500-piece reel	
C1216	68676-10	√	√	N/A

SUPPORT INFORMATION

Get support information, including documentation and support software, at trimble.com:

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

www.trimble.com