

CW20 / 20S GPS Receiver

Description

The CW20 is a compact, powerful GPS tool that builds on NavSync's position as a market leader in the field of low signal strength GPS tracking. Utilizing a new baseband processor and RF front end, the CW20 delivers superior GPS performance in small surface mount package that minimizes power consumption, maximizing battery life.

The CW20 takes up only 21 x 16.4 mm of PCB space and connects directly to the host system through a UART using NMEA protocols. Additionally, the device provides expanded protocols for enhanced performance and flexibility. The device has been specifically developed for mobile hardware platforms running off batteries, where power consumption and small size are critical. Unlike many other options in this space, the CW20 delivers enhanced GPS tracking, down to -152 dBm, enabling tracking in many obstructed view environments such as urban canyons.



This document provides information on the Hardware Elements of the CW20 / 20S. Unless explicitly stated, CW20 is generically used for both the CW20 and CW20S (SBAS enabled) models.

Features

- Supports either active or passive antenna
- Low power consumption: 19 mA avg fully active
- Compact design: 21 x 16.4 x 2.4 mm
- Support of WAAS/EGNOS

Applications

- Battery Powered Devices
- Navigation
- Vehicle tracking
- Asset tracking
- Personnel tracking
- Location Based Services

2. SPECIFICATIONS

2.1 Performance

Physical

Module Dimensions	21mm (D) x 16.35mm (W) x 2.4mm (H)	Notes
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Electrical

Supply Voltages	3V3 (NVDD), 1V5 (VBAT)	1
Operating Temperature Range	-30°C to 65°C	
Storage Temperature Range	-40°C to 85°C	

GPS Performance

GPS Channels	16	
Frequency	1575.42 MHz – L1 C/A Code	
TTFF Cold Start @ -135 dBm	46 seconds	2, 8
TTFF Warm Start @ -141 dBm	34 seconds	2, 8
TTFF Hot Start @ -141 dBm	5 seconds	2, 8
Re-acquisition time @ -147 dBm	<3 seconds	3
Acquisition Sensitivity (fix not available)	TTFF (Hot) with all signals at -138 dBm: 30 s TTFF (Hot) with all signals at -141 dBm: 41 s	4
Acquisition Sensitivity (fix available) (dBm)	-147 dBm	5
Tracking Sensitivity (dBm)	-150 dBm	6
Acquisition Sensitivity SBAS Satellites (dBm)	-135 dBm	7
Tracking Sensitivity SBAS Satellites (dBm)	-143 dBm	7
Static Accuracy (without SBAS)	50% Confidence (CEP) 1.2 m 95% Confidence 3.1 m	8
Static Accuracy (with SBAS)	50% Confidence (CEP) 0.8 m 95% Confidence 2.0 m	9
Maximum Horizontal Speed	515 m/s	10
Maximum Vertical Speed	15 m/s	11
Maximum Altitude	18 Km	12
Maximum Acceleration (g)	2 g	

Power

During acquisition (fully active)	69 mW
While tracking (fully active)	56 mW
During Sleep Mode (NVDD)	1.3 mA
VBAT Current	4 µA

Interfaces

I/O Port	UART
Protocols	NMEA 0183

Antenna (pin 16 or 26)

Configuration Supported	Active or Passive	13
Impedance	50Ω	
Voltage	2.5 - 2.8V	14
1 dB Compression Point	-31 dBm	15

Table 1: General Specifications

Notes:

1. Typical listed are maximum, see Section 2.3 for Absolute Max Ratings
2. These are RMS values
3. Maximum Sensitivity -147 dBm
4. Simulator Test, all signals at specified power level.
5. Estimated
6. Simulator Test, continuous fix with all signals at specified power level.
7. Simulator Test with signal at specified power level.
8. Open-sky, 24 hrs statistic, active antenna (signal range is between 30 to 49 dB/Hz).
9. Open sky, 24 hrs statistic, active antenna (EGNOS signal used).
10. Limited by International Traffic in Arms Regulation (ITAR)
11. Defined by navigation integrity check
12. Limited by International Traffic in Arms Regulation (ITAR)
13. Either pin 16 or pin 26 may be used, but not both
14. Specification apply to active antenna configuration. A 15Ω current sense resistor is included in the on-board antenna sense circuitry which drops the available antenna voltage linearly to 2.5V if 20 mA is drawn by the antenna.
15. Input referred to antenna input at pin 16 or 26.

2.2 Electrical Characteristics

Symbol	Condition	Min	Max	Units	Notes
NVDD		3.0	3.6	Volts	
VBAT		1.2	2.0	Volts	1
VIH		1.26		V	2
VIL			0.3	V	2
VOH	$I_{OH} = -50\mu A$	1.62		V	2
VOL	$I_{OL} = 50\mu A$.18	V	2
Output Rise Time	Load = 15 pF		5	ns	
Output Fall Time	Load = 15 pF		5	ns	

Table 2: Electrical Characteristics

Notes:

1. A means to limit charge voltage below 2V should be included if the battery can be removed while the main power is on.
2. Digital Inputs and Outputs are 1.8V CMOS.

2.3 Absolute Maximum Ratings

Parameter	Max
Max Supply Voltage, NVDD	6V
Max Supply Voltage, VBAT	2.2V
Max Voltage on any pin	2.1V
Max current into any pin (except NVDD and VBAT)	± 20 mA

Table 3: Absolute Maximum Ratings

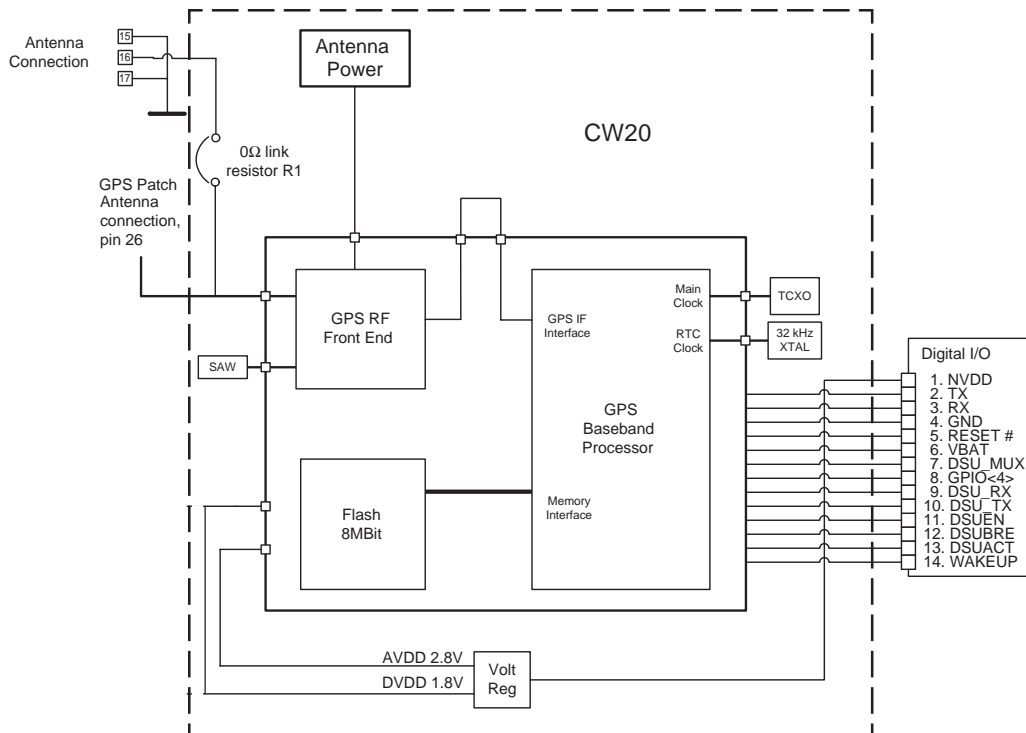


Figure 1. CW20 Block Diagram

3. PHYSICAL CHARACTERISTICS

3.1 Form and Size

The CW20 is a multi-chip module built on an FR4 fiberglass PCB. All digital and power connections are via castellations on the 21 x 16.35 mm PCB. The general arrangement of the CW20 is shown in the diagram below.

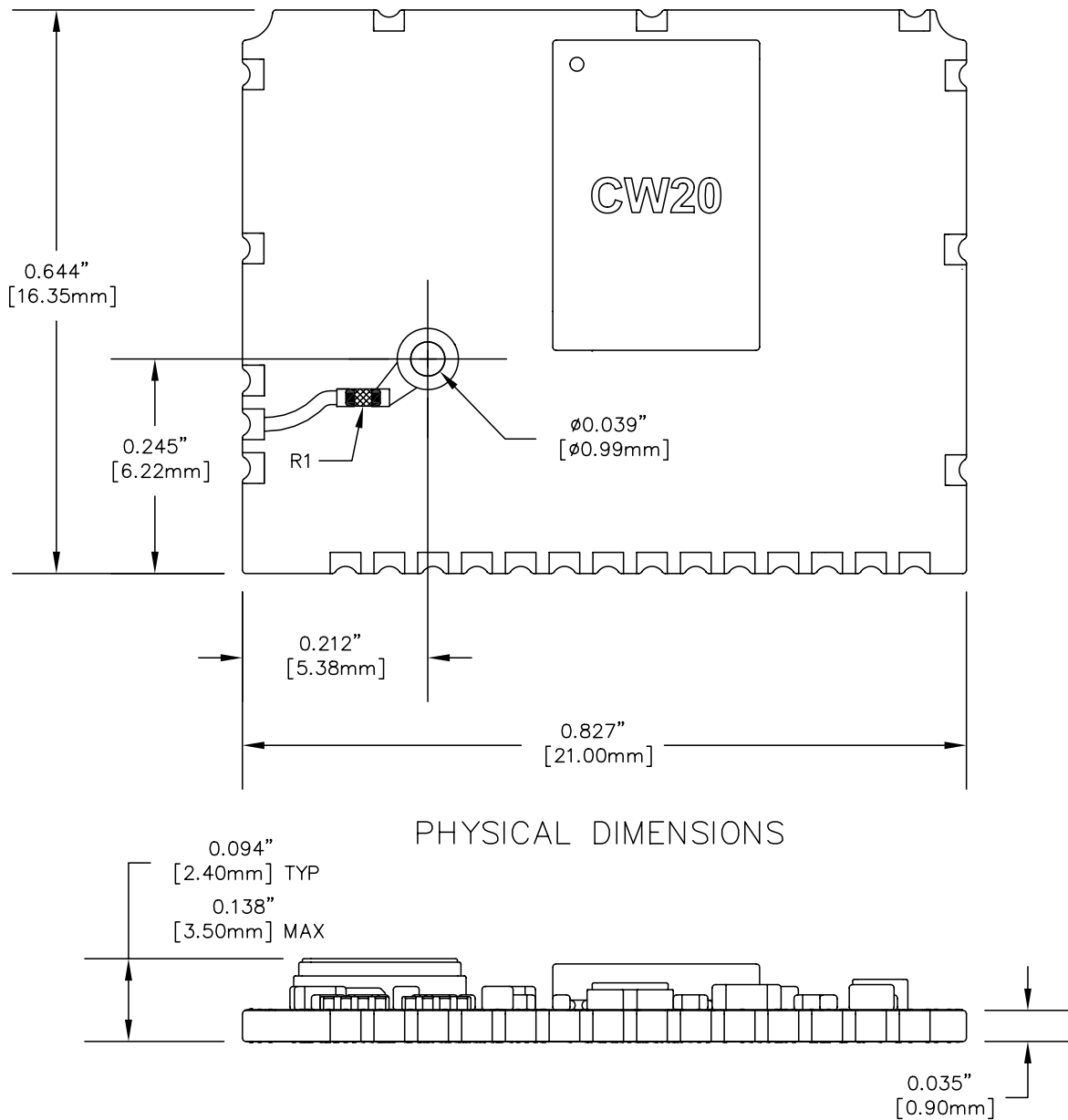


Figure 2: Form & Size

3. PHYSICAL CHARACTERISTICS continued

3.2 Physical Interface Details

The interface to the CW20 is via 0.90 mm castellations on a 1.27 mm pitch. There are 25 castellations in all, along with an additional patch antenna connection (pin 26, See Figure 2) for direct connection of a ceramic patch antenna. If pin 26, rather than pin 16, is used as the antenna connection, it is recommended to remove R1 (shown in figure 2). The details of the interface connections are given below.

Pin	Function	Pin	Function
1	NVDD	14	WAKEUP
2	TX	15	GND
3	RX	16	ANT
4	GND	17	GND
5	RESET #	18	GND
6	VBAT	19	GND
7	DSU_MUX	20	GND
8	GPIO <4>	21	GND
9	DSU_RX	22	GND
10	DSU_TX	23	GND
11	DSUEN	24	GND
12	DSUBRE	25	GND
13	DSUACT	26	ALT_ANT

Table 4: PIN Assignments

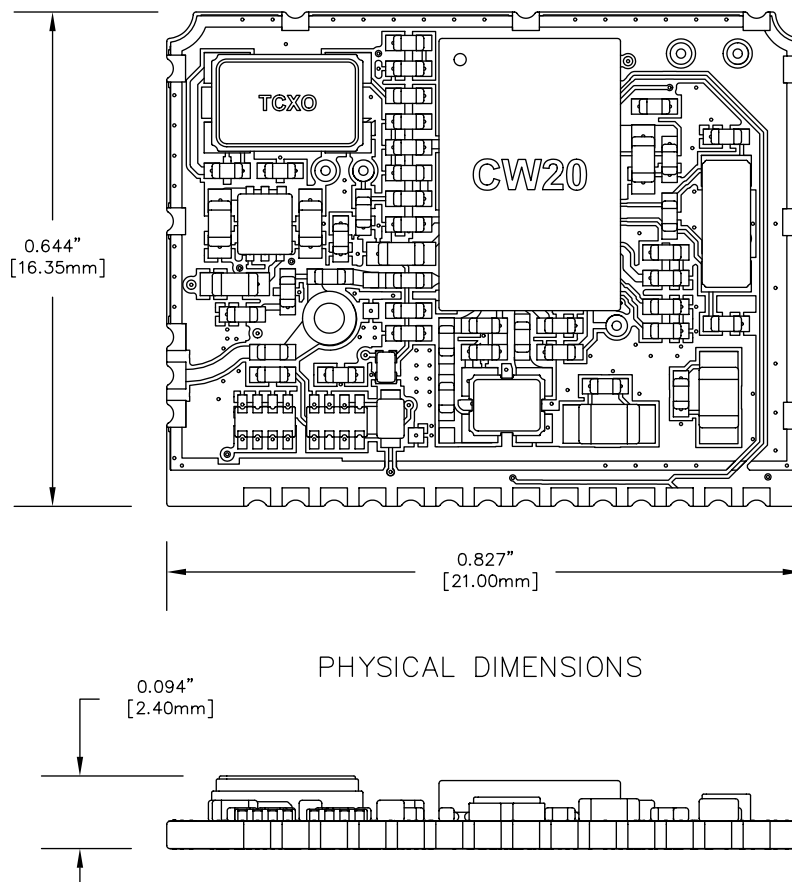


Figure 3: Mechanical Dimensions

3. PHYSICAL CHARACTERISTICS continued

3.3 Solder Pad Size and Placement

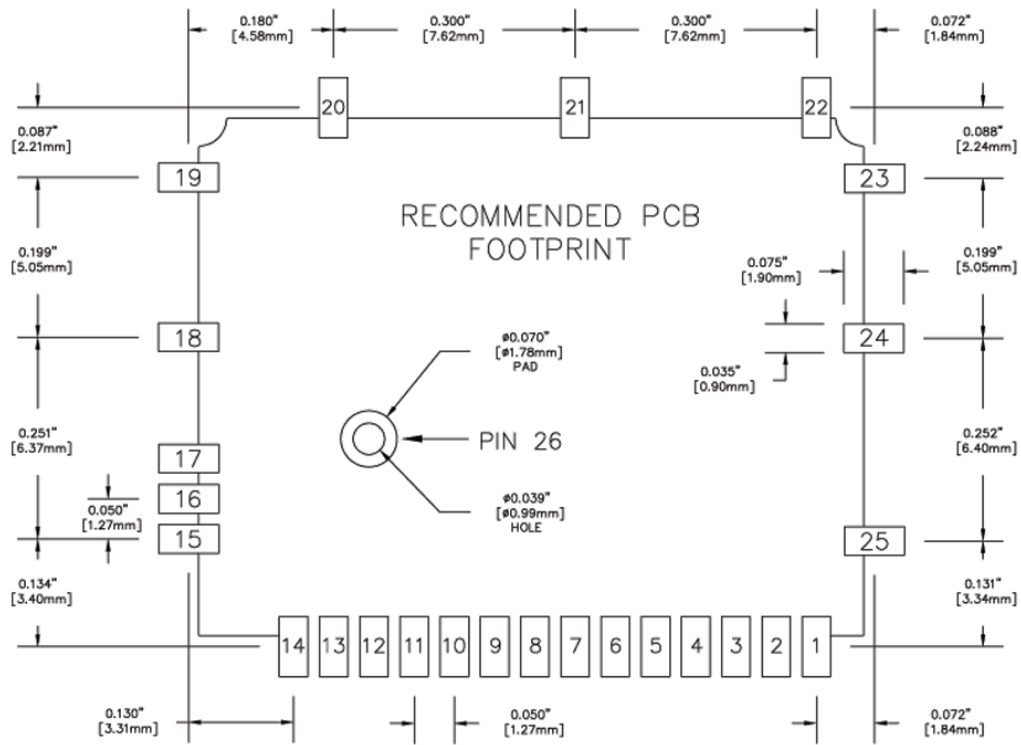


Figure 4: Solder Pad Size and Placement

4. SIGNAL DESCRIPTIONS

4.1 Signal Descriptions

NVDD	Type: Power	Direction: Input	Pin 1
	The supply input. This 3.3V input supplies power to RF and digital sections of the CW20 and should be properly filtered.		
TX	Type: Signal	Direction: Output	Pin 2
	The UART transmit signal for the CW20.		
RX	Type: Signal	Direction: Input	Pin 3
	The UART receive signal for the CW20. (↑)		
GND	Type: Power	Direction: Input/Output	Pin 4
	The ground pin for the CW20. The return path of the NVDD and ground reference for all signal pins.		
RESET #	Type: Control	Direction: Input/Output	Pin 5
	The system reset signal. This asynchronous signal must be held low for a minimum of 1ms following valid power on the NVDD pin to generate a device reset. (↑)		
VBAT	Type: Power	Direction: Input	Pin 6
	The backup battery supply input. Minimum voltage of 1.2V required to maintain NVRAM settings. This is a 1.5 V input that must not exceed 2.0 V. The charging circuit should ensure this limit is not exceeded.		
DSU_MUX	Type:	Direction: Input	Pin 7
	Debug and programming interface. (↓)		
GPIO <4>	Type: Signal	Direction: Input/Output	Pin 8
	Blinks for 1ms every time traffic is generated on the UART interface. May be left unconnected. General purpose input/output pin. The signal return path is Pin 4.		
DSU_RX	Type:	Direction: Input	Pin 9
	Debug and programming interface. (↓)		
DSU_TX	Type:	Direction: Output	Pin 10
	Debug and programming interface.		
DSUEN	Type:	Direction: Input	Pin 11
	Debug and programming interface. (↓)		
DSUBRE	Type:	Direction: Input	Pin 12
	Debug and programming interface. (↓)		
DSUACT	Type:	Direction: Output	Pin 13
	Debug and programming interface.		
WAKEUP	Type: Power	Direction: Input	Pin 14
	This is pin used to bring the CW20 out of sleep mode. This signal must be low during normal operation. A high signal for a minimum of 1ms will bring the CW20 out of sleep mode. (↓) Sleepmode is controlled by NMEA extension \$PNMRX112.		
GND	Type: Power	Additional GND Pins for the CW20	Pins 15, 17-25
ANT	Type: Antenna	Primary Antenna Connection	Pin 16
ALT_ANT	Type: Antenna	Alternate Antenna Connection. May be used instead of Pin 16.	Pin 26

Table 5 Signal Descriptions

Notes:

(↑) Internal 47k pull-up resistor to 1.8V.

(↓) Internal 47k pull-down resistor to GND.

5 . USER INTERFACE MESSAGES

The following application protocols are implemented

5.1 NMEA Protocol

The CW20 software is capable of supporting the following NMEA message formats:

NMEA Message Prefix	Format	Direction
\$GPGGA	GPS fix data.	Out
\$GPGLL	Geographic position Latitude / Longitude.	Out
\$GPGSA	GNSS DOP and active satellites.	Out
\$GPGSV	Satellites in view.	Out
\$GPRMC	Recommended minimum specific GNSS data.	Out
\$GPVTG	Velocity and track over ground.	Out
\$GPZDA	Date and time.	Out

Table 6 NMEA Messages Summary

5.2 NMEA Extensions

The CW20 software is capable of supporting the following NMEA extensions:

NMEA Extension Prefix	Format	Direction
\$PNMRX100	Set serial port parameters.	In
\$PNMRX101	Navigation initialization.	In
\$PNMRX103	NMEA message rate control.	In
\$PNMRX104	LLA navigation initialization.	In
\$PNMRX106	Set Datum.	In
\$PNMRX107	Nemerix messages rate control	In
\$PNMRX108	NMEA message sequence control	In
\$PNMRX110	Fix Settings	In
\$PNMRX111	Software Reset	In
\$PNMRX112	Operating Mode Control	In
\$PNMRX113	Fix and Extraction control	In
\$PNMRX114	SBAS control	In
\$PNMRX300	Almanac data transfer.	In / Out
\$PNMRX301	Ephemeris data transfer.	Out
\$PNMRX302	Ionospheric correction	Out
\$PNMRX303	UTC Time	Out
\$PNMRX304	GPS Constellation Health Status	Out
\$PNMRX600	SW Version report	Out
\$PNMRX601	ISP mode	In
\$PNMRX603	Settings Report	In / Out
\$PNMRX604	Force almanac and clock bias update in flash	In
\$PNMRX605	Put a channel in test mode	In / Out
\$PNMRX606	Pulse Per Second Control (PPS)	In / Out

Table 7 Extended Messages

5.3 General NMEA Format

The general NMEA format consists of an ASCII string commencing with a '\$' character and terminating with a <CR><LF> sequence.

NMEA standard messages commence with 'GP' then a 3 letter message identifier. CW20 specific messages commence with \$PNMRX followed by a 3 digit number.

The message header is followed by a comma delimited list of fields optionally terminated with a checksum consisting of an asterisk '*' and a 2 digit hex value representing the checksum. There is no comma preceding the checksum field.

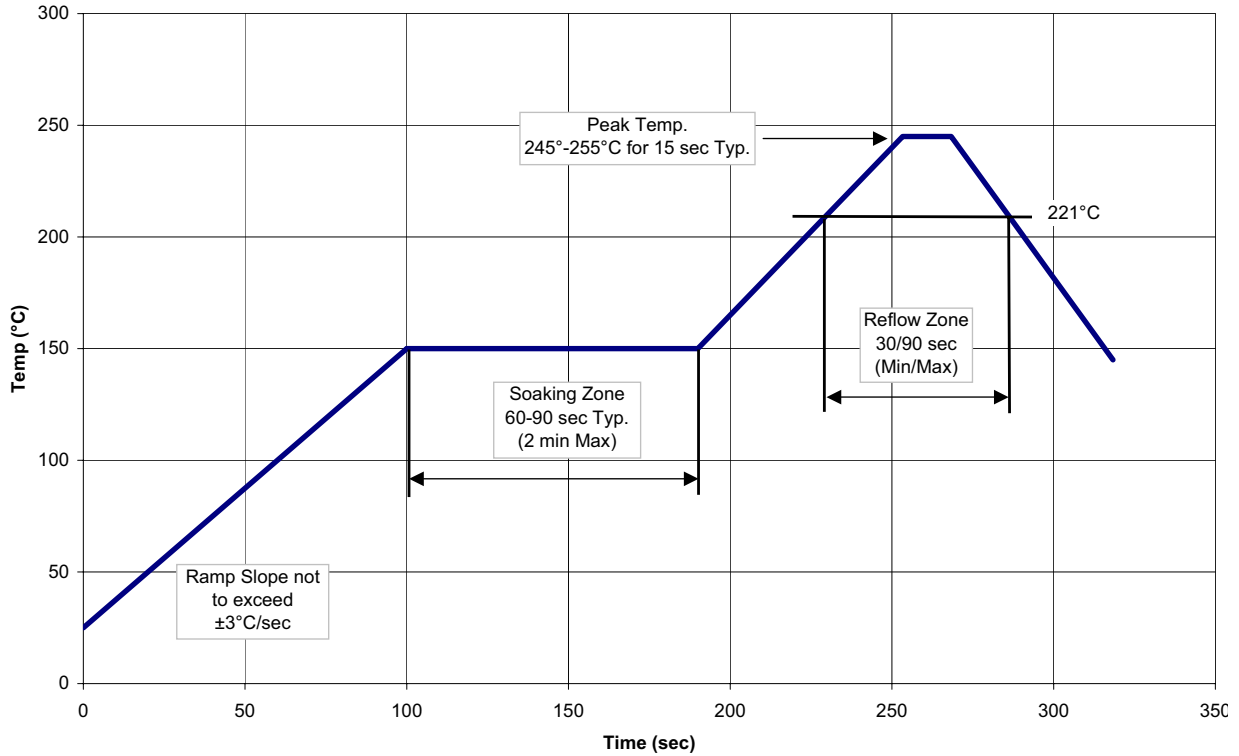
When present, the checksum is calculated as a byte wise exclusive of the characters between the '\$' and '*'.

As an ASCII representation, the number of digits in each number will vary depending on the number and precision, hence the record length will vary. Certain fields may be omitted if they are not used, in which case the field position is reserved using commas to ensure correct interpretation of subsequent fields.

By default, the CW20 will output NMEA messages at a baud rate of 9600, 8 bits, no parity, 1 stop bit. The GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG, and GPZDA messages are enabled. No CW20 specific messages are output by default, but the unit will respond appropriately to all input messages.

Please refer to the CW20 Users Guide for more detailed information on all NMEA message formats.

7. Solder Profile



8. Ordering Information

CW20 Standard Build, SBAS not supported.
Includes superior urban canyon navigation algorithms

CW20S Standard Build, SBAS Supported.

Note: MSL3 per 1PC/JEDEC, J-STD-020C, J-STD-033B. Please use appropriate processing and handling techniques.

CW20 / 20S GPS Receiver



Revision	Revision Date	Notes
A02	07/06/06	Advanced Data Sheet
P2.0	01/10/07	Preliminary Data Sheet
P2.1	02/12/07	Revised Drawings
V1.0	06/01/07	Added VBAT and Sleep Mode Current Updated Figure 3.3 Improved Wake-up Pin Description Clarified differences between CW20 and CW20S Corrected Storage Temp and Max Supply Voltage Added MSL Rating
V1.1	6/11/07	Clarified VBAT description

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