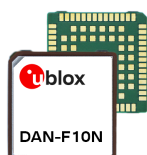


# DAN-F10N

**Standard precision GNSS module**

**Professional grade**

Data sheet



## Abstract

This data sheet describes the DAN-F10N antenna module, an L1/L5 dual-band GNSS receiver for meter-level accuracy in urban environment and a simple design-in requiring no RF expertise.

**Note!** GPS L5 signals are pre-operational and not used by default. Refer to the Overview section for more information.

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C2-Restricted



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<b>Engineering sample</b>	Advance information	Data based on early testing. Revised and supplementary data will be published later.
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This document applies to the following products:

<b>Product name</b>	<b>Type number</b>	<b>FW version</b>	<b>IN/PCN reference</b>	<b>Product status</b>
DAN-F10N	DAN-F10N-00B-00	EXT SPG 6.00	N/A	In development

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# 1 Functional description

## 1.1 Overview

DAN-F10N patch-antenna module is built on the u-blox F10 dual-band GNSS technology using the L1 and L5 band signals. The proprietary dual-band multipath mitigation technology enables the u-blox F10 to use the best signals from the L1 and L5 bands providing a solid meter-level position accuracy in urban environment.

The compact 20 x 20 x 8 mm patch antenna provides the optimal balance between the size and the performance of a Right Hand Circular Polarized (RHCP) L1/L5 dual-band antenna. The wide beamwidth of the patch antenna enhances flexibility for device installation and the option to use an external antenna further increases design flexibility.

The DAN-F10N module has robust SAW, LNA, and SAW RF architecture for best possible out-of-band interference mitigation. It is highly suitable for designs with a nearby cellular modem.

The future-proof DAN-F10N includes internal flash to enable firmware upgradability. It also supports antenna switch function and can optionally be connected to an external dual-band GNSS antenna. The DAN-F10N is designed as a surface mount device, allowing for an automated manufacturing.

Incorporating the DAN-F10N dual-band antenna module into customer designs is easy and straightforward, thanks to the embedded antenna module, robust RF design, simple interface, and sophisticated interference suppression that ensures maximum performance even in GNSS-hostile environments.

- ⚠ At the time of writing, the GPS L5 signals remain pre-operational and are set as unhealthy until sufficient monitoring capability is established. This is an operational issue concerning the satellites / space segment and not a limitation of u-blox products.
- ⚠ Due to the pre-operational status, the GPS L5 signals are not used for the navigation solution by default. However, it is possible to evaluate the GPS L5 signals before they become fully operational by changing the receiver configuration to override the GPS L5 health status. Refer to the Integration manual [1] for details.

## 1.2 Performance

Parameter	Specification	Value
Receiver type		u-blox F10 dual-band receiver
Accuracy of time pulse signal	RMS	30 ns
	99%	60 ns
Frequency of time pulse signal		Default 1PPS (0.25 Hz to 10 MHz configurable)
Operational limits <sup>1</sup>	Dynamics	≤ 4 g
	Altitude	80,000 m
	Velocity	500 m/s
Velocity accuracy <sup>2</sup>		0.05 m/s
Dynamic heading accuracy <sup>2</sup>		0.3 deg

**Table 1: DAN-F10N specifications**

<sup>1</sup> Assuming Airborne 4 g platform.

<sup>2</sup> 50% at 30 m/s for dynamic operation.

Table 2 shows typical performance values with the internal antenna in multi-GNSS configurations<sup>3</sup>. SBAS is enabled in all measurements.

Parameter	GPS+GAL +BDS (Default)	GPS+BDS	GPS+GAL	GPS+NavIC	Unit
Max navigation update rate <sup>4</sup>	10	10	10	10	Hz
Position accuracy (CEP) <sup>5</sup>	1	1	1	1	m
Time To First Fix (TTFF) <sup>6</sup>	Cold start	28	27	27	s
	Hot start	2	2	2	s
	AssistNow Online <sup>7</sup>	2	2	2	s
	AssistNow Offline <sup>8</sup>	3	3	3	s
	AssistNow Autonomous <sup>9</sup>	4	4	4	s
Sensitivity <sup>10</sup>	Tracking and navigation	-164	-164	-164	dBm
	Reacquisition	-156	-156	-156	dBm
	Cold Start	-145	-145	-145	dBm
	Hot start	-156	-156	-156	dBm

**Table 2: DAN-F10N typical performance in multi-GNSS configurations**

Table 3 shows typical performance values with the internal antenna in single-GNSS configurations<sup>3</sup>. SBAS is enabled in all measurements.

Parameter		GPS	BDS	Unit
Max navigation update rate <sup>4</sup>		20	20	Hz
Position accuracy (CEP) <sup>5</sup>		1.5	1	m
Time To First Fix (TTFF) <sup>6</sup>	Cold start	27	42	s
	Hot start	2	2	s
	AssistNow Online <sup>7</sup>	2	N/A	s
Sensitivity <sup>10</sup>	Tracking and navigation	−164	−160	dBm
	Reacquisition	−156	−153	dBm
	Cold Start	−145	−134	dBm
	Hot start	−156	−154	dBm

**Table 3: DAN-F10N typical performance in single-GNSS configurations**

## 1.3 Supported GNSS constellations

DAN-F10N is a concurrent GNSS receiver that can receive and track multiple GNSS systems. The dual-band RF front-end architecture enables concurrent reception of multiple dual frequency GNSS constellations. The receiver can be configured for a subset of GNSS constellations to achieve lower power consumption.

<sup>3</sup> The GPS L5 signal health status is ignored. Configuration required.

<sup>4</sup> Minimum 98% fix rate under typical conditions.

<sup>5</sup> CEP, 50%, 24 hours static, -130 dBm, > 6 SVs for each GNSS system.

<sup>6</sup> Commanded starts. All satellites signals at -130 dBm. Measured at room temperature.

<sup>7</sup> Depends on the speed and latency of the aiding data connection, commanded starts.

<sup>8</sup> Using seven days old AssistNow Offline data. External memory may be required.

<sup>9</sup> Using two days old orbital predicted data. External memory may be required.

<sup>10</sup> Demonstrated with a good external LNA. Measured at room temperature.

The default configuration on DAN-F10N is concurrent reception of GPS, Galileo and BeiDou with SBAS enabled.



Single-band operation is not supported. Both L1 and L5 signals must be enabled or disabled for GPS, Galileo, BeiDou, and QZSS.

The following GNSS and their signals are supported:

System	Signals
GPS / QZSS	L1C/A (1575.42 MHz), L5 (1176.450 MHz)
Galileo	E1-B/C (1575.42 MHz), E5a (1176.450 MHz)
BeiDou	B1C (1575.42 MHz) , B2a (1176.450 MHz)
NavIC	SPS-L5 (1176.450 MHz)

**Table 4: Supported GNSS and signals on DAN-F10N**

The following GNSS assistance services are supported:

Service	Support
AssistNow™ Online	GPS L1C/A, Galileo E1, QZSS L1C/A
AssistNow™ Offline	GPS L1C/A, Galileo E1, QZSS L1C/A
AssistNow™ Autonomous	GPS L1C/A, Galileo E1

**Table 5: Supported Assisted GNSS (A-GNSS) services**

The following augmentation systems are supported:

System	Support
SBAS <sup>11</sup>	EGNOS, GAGAN, MSAS, WAAS, BDSBAS, KASS and SouthPAN
QZSS	L1S (SLAS), L1Sb (SBAS)

**Table 6: Supported augmentation systems**

The augmentation system QZSS can be enabled only if GPS operation is also enabled.

## 1.4 Supported protocols

DAN-F10N supports the following interface protocols:

Protocol	Type
UBX	Input/output, binary, u-blox proprietary
NMEA versions 2.1, 2.3, 4.0, 4.10 and 4.11 (default)	Input/output, ASCII

**Table 7: Supported protocols**

## 1.5 Firmware features

Feature	Description
Antenna supervisor <sup>12</sup>	Antenna supervisor for active antenna control and short detection
Assisted GNSS	AssistNow Online, AssistNow Offline and AssistNow Autonomous
Backup modes	Hardware backup mode and software standby mode

<sup>11</sup> Ionospheric correction service is the only SBAS service supported by DAN-F10N

<sup>12</sup> External components required, some pins need to be reconfigured.

Feature	Description
Protection level	Real-time position accuracy estimate with 95% confidence level <sup>13</sup>
Galileo return link messages	Galileo search and rescue (SAR) return link messages (RLM) via Galileo satellite signal
Odometer	Measure traveled distance with support for different user profiles

**Table 8: Firmware features**

Feature	Description
Anti-jamming	RF interference and jamming detection and reporting
Anti-spoofing	Spoofing detection and reporting
Configuration lockdown	Receiver configuration can be locked by command
Message integrity	All messages can be cryptographically signed
Secure boot	Only signed firmware images are executed

**Table 9: Security features**

<sup>13</sup> Verified for automotive environment only.

## 2 Block diagram

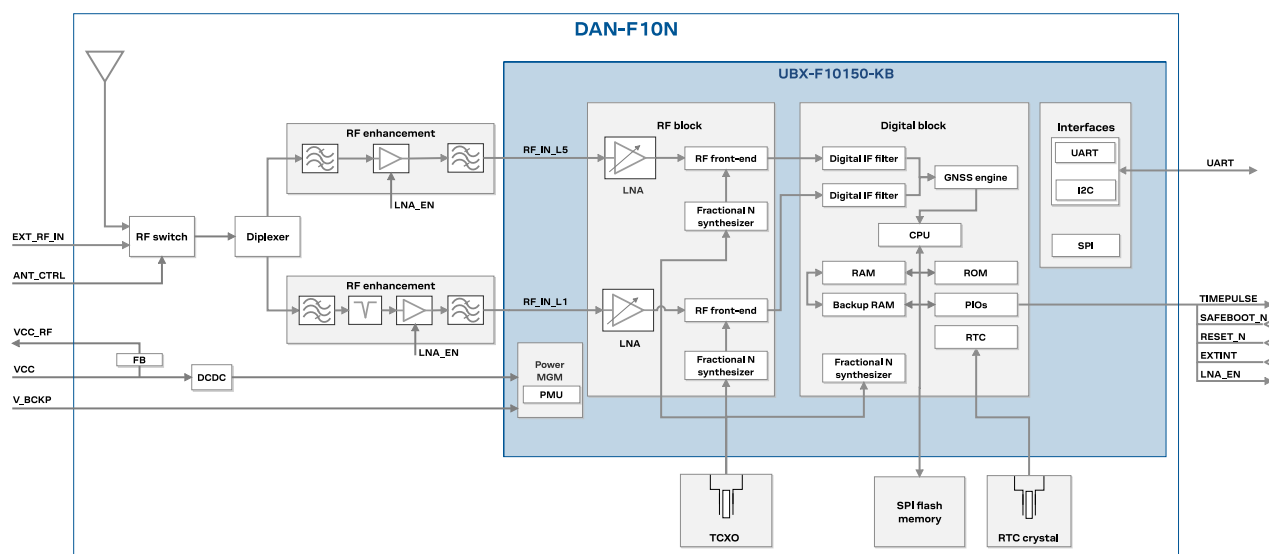


Figure 1: DAN-F10N block diagram



## 3 Pin definition

### 3.1 Pin assignment

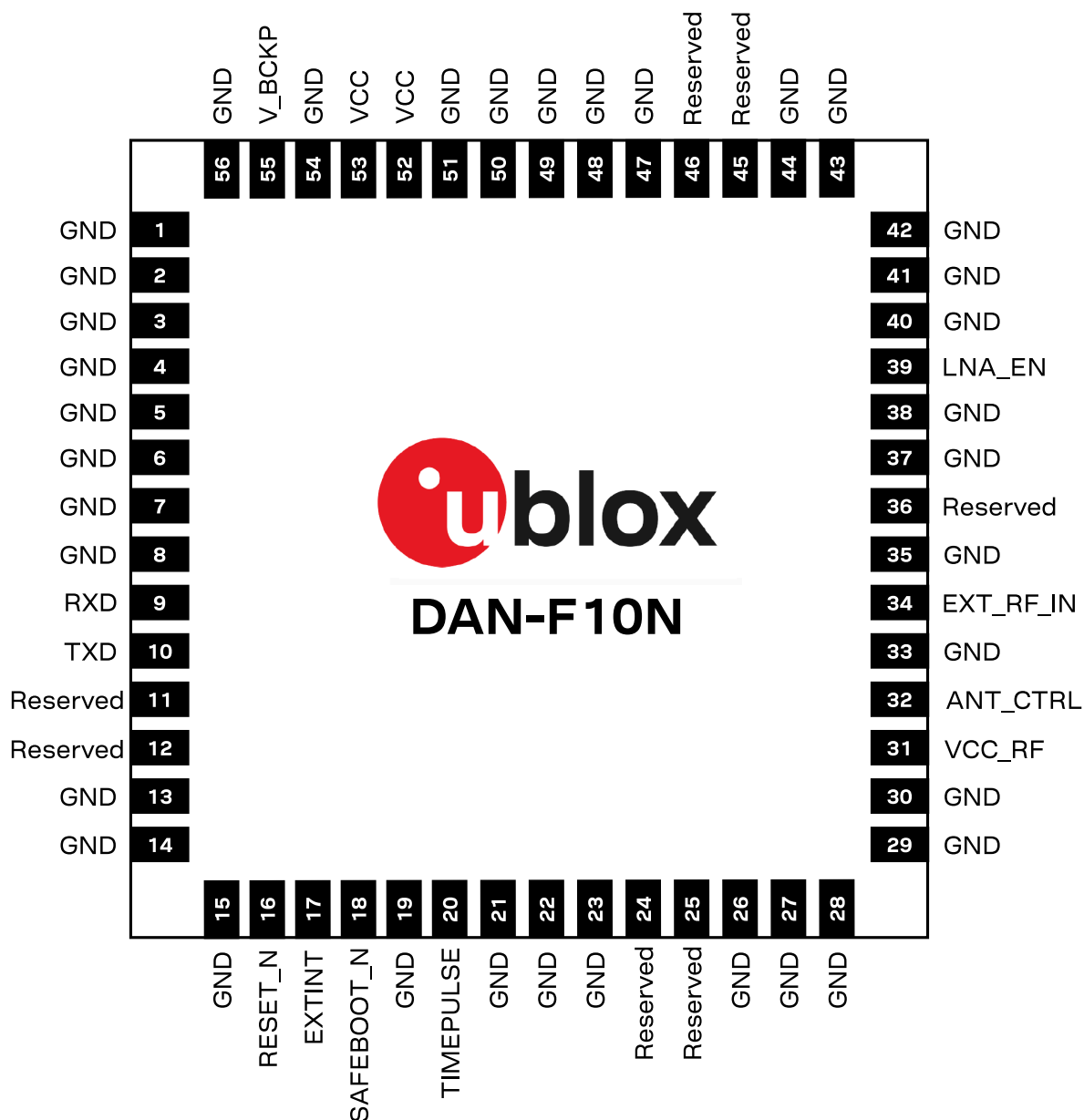


Figure 2: DAN-F10N pin assignment

Pin no.	Name	PIO no.	I/O	Description
1	GND	-	-	Connect to GND
2	GND	-	-	Connect to GND
3	GND	-	-	Connect to GND
4	GND	-	-	Connect to GND

Pin no.	Name	PIO no.	I/O	Description
5	GND	-	-	Connect to GND
6	GND	-	-	Connect to GND
7	GND	-	-	Connect to GND
8	GND	-	-	Connect to GND
9	RXD	0	I	UART RX
10	TXD	1	O	UART TX
11	Reserved	-	-	Not connected, leave open
12	Reserved	-	-	Not connected, leave open
13	GND	-	-	Connect to GND
14	GND	-	-	Connect to GND
15	GND	-	-	Connect to GND
16	RESET_N	-	I	System reset (active low). Has to be low for at least 1 ms to trigger a reset.
17	EXTINT	5	I	External interrupt. Leave open if not used.
18	SAFEBOOT_N	-	I	Safeboot mode (active low). Leave open if not used. <sup>14</sup>
19	GND	-	-	Connect to GND
20	TIMEPULSE	4	O	Time pulse signal (shared with SAFEBOOT_N pin)
21	GND	-	-	Connect to GND
22	GND	-	-	Connect to GND
23	GND	-	-	Connect to GND
24	Reserved	-	-	Not connected, leave open
25	Reserved	-	-	Not connected, leave open
26	GND	-	-	Connect to GND
27	GND	-	-	Connect to GND
28	GND	-	-	Connect to GND
29	GND	-	-	Connect to GND
30	GND	-	-	Connect to GND
31	VCC_RF	-	O	Output voltage RF section
32	ANT_CTRL	-	I	Choose either internal or external antenna
33	GND	-	-	Connect to GND
34	EXT_RF_IN	-	I	RF signal input for external antenna
35	GND	-	-	Connect to GND
36	Reserved	-	-	Not connected, leave open
37	GND	-	-	Connect to GND
38	GND	-	-	Connect to GND
39	LNA_EN	-	O	On/Off external LNA or active antenna
40	GND	-	-	Connect to GND
41	GND	-	-	Connect to GND
42	GND	-	-	Connect to GND
43	GND	-	-	Connect to GND
44	GND	-	-	Connect to GND
45	Reserved	-	-	Not connected, leave open

<sup>14</sup> The receiver enters safeboot mode if this pin is low at startup. The SAFEBOOT\_N pin is internally connected to TIMEPULSE pin through a 1 kΩ series resistor.

Pin no.	Name	PIO no.	I/O	Description
46	Reserved	-	-	Not connected, leave open
47	GND	-	-	Connect to GND
48	GND	-	-	Connect to GND
49	GND	-	-	Connect to GND
50	GND	-	-	Connect to GND
51	GND	-	-	Connect to GND
52	VCC	-	I	Supply voltage
53	VCC	-	I	Supply voltage
54	GND	-	-	Connect to GND
55	V_BCKP	-	I	Backup voltage supply
56	GND	-	-	Connect to GND

**Table 10: DAN-F10N pin assignment**

## 4 Electrical specifications

### 4.1 Absolute maximum ratings

- ⚠ CAUTION. Risk of device damage. Exceeding the absolute maximum ratings may affect the lifetime and reliability of the device or permanently damage it. Do not exceed the absolute maximum ratings.
- ⚠ This product is not protected against overvoltage or reversed voltages. Use appropriate protection to avoid device damage from voltage spikes exceeding the specified boundaries.

Symbol	Parameter	Min	Max	Unit
VCC	Main supply voltage	-0.3	3.6	V
	Voltage ramp on VCC <sup>15</sup>	25	35000	μs/V
V_BCKP	Backup supply voltage	-0.3	3.6	V
V_PIO	Input voltage on RESET_N and digital pins	-0.3	VCC + 0.3 (max 3.6)	V
I_PIO	Max source / sink current, digital pins <sup>16</sup>	-10	10	mA
ICC_RF	Max source current, VCC_RF		250	mA
V_DC <sub>rfin</sub>	DC voltage at EXT_RF_IN	-5.5	+5.5	V
P <sub>rfin</sub>	RF input power at EXT_RF_IN <sup>17</sup>		0	dBm
T <sub>amb</sub>	Ambient temperature	-40	+85	°C
T <sub>s</sub>	Storage temperature	-40	+85	°C

**Table 11: Absolute maximum ratings**

### 4.2 Operating conditions

Table 12 shows the general operating conditions. Table 13 shows the electrical parameters for digital I/O.

Symbol	Parameter	Min	Typical	Max	Unit
VCC	Main supply voltage	2.7	3.0	3.6	V
V_BCKP	Supply voltage, backup domain	1.65		3.6	V
VCC <sub>SWITCH</sub>	VCC voltage threshold to switch an internal supply for the backup domain from VCC to V_BCKP		1.45		V
VCC_RF	VCC_RF output voltage		VCC - 0.1		V
ICC_RF	VCC_RF output current			50	mA
Z <sub>in</sub> <sup>18</sup>	Input impedance at EXT_RF_IN		50		Ω
NF <sub>tot</sub>	Receiver chain noise figure (L1)		3		dB
	Receiver chain noise figure (L5)		3		dB
Ext_gain <sup>19</sup>	External gain at EXT_RF_IN, normal gain mode (default)			25	dB

<sup>15</sup> Exceeding the voltage ramp speed may permanently damage the device.

<sup>16</sup> The SAFEBOOT\_N pin has an internal 1 kΩ series resistor.

<sup>17</sup> Test conditions: source impedance = 50 Ω, continuous wave.

<sup>18</sup> The EXT\_RF\_IN input integrates a built-in DC block.

<sup>19</sup> The internal LNA gain is configurable.

Symbol	Parameter	Min	Typical	Max	Unit
T <sub>opr</sub>	Operating temperature	-40		+85	°C

**Table 12: General operating conditions**

Symbol	Parameter	Min	Typical	Max	Unit
I <sub>leak</sub>	Leakage current input pins <sup>20</sup>		25		nA
V <sub>in</sub>	Input pin voltage range	0		VCC	V
V <sub>il</sub>	Low-level input voltage			0.63	V
V <sub>ih</sub>	High-level input voltage	0.68 x VCC			V
V <sub>ol</sub>	Low-level output voltage, I <sub>out</sub> = -2 mA <sup>21</sup>			0.4	V
V <sub>oh</sub>	High-level output voltage, I <sub>out</sub> = 2 mA <sup>21</sup>	VCC - 0.4			V
R <sub>pu, IO</sub>	Pull-up resistance, Digital IO	8	18	40	kΩ
R <sub>pd, IO</sub>	Pull-down resistance, Digital IO	21	80	180	kΩ
R <sub>pu, SAFEBOOT_N</sub>	Pull-up resistance, SAFEBOOT_N <sup>22</sup>	6	17	72	kΩ
R <sub>pu, RESET_N</sub>	Pull-up resistance, RESET_N	7	10	13	kΩ

**Table 13: Digital IO**

## 4.3 Indicative power requirements

This section provides examples of typical current requirements. They are characterized on samples using a cold start command. The actual power requirements may vary depending on the firmware version used, the external circuitry, the number of satellites tracked, the signal strength, the type and time of start, duration, internal LNA gain mode, and the test conditions.

All values in [Table 14](#) and [Table 15](#) have been measured at 25 °C ambient temperature with the default configuration unless otherwise stated. SBAS is active in all measurements.

[Table 14](#) shows indicative current consumption for VCC with a 3.0 V supply.

Symbol (Parameter)	Conditions	GPS+GAL +BDS (Default)	GPS+BDS	GPS+GAL	GPS +NavIC	GPS	BDS	Unit
I <sub>VCC</sub> <sup>23</sup>	Acquisition <sup>24</sup>	26	26	22	21	20	24	mA
(VCC current)	Tracking	21	20	19	18	18	19	mA

**Table 14: Typical currents for 3.0 V supply at VCC**


The inrush current can go up to 100 mA at startup. Ensure that the external power supply is able to deliver up to 100 mA.

[Table 15](#) shows current consumption for backup modes.

Symbol	Parameter	Conditions	Typical	Unit
I <sub>V_BCKP</sub> <sup>25</sup>	Total current in hardware backup mode	V <sub>BCKP</sub> = 3.0 V; VCC = 0 V	31	μA

<sup>20</sup> V<sub>in</sub> = VCC, at room temperature.

<sup>21</sup> TIMEPULSE has 4 mA current drive/sink capability.

<sup>22</sup> The SAFEBOOT\_N pin has an additional 1 kΩ series resistor.

<sup>23</sup> 1 Hz navigation update rate. Simulated signals using power levels of -130 dBm.

<sup>24</sup> Average current from start-up until the first fix.

<sup>25</sup> I<sub>V\_BCKP</sub> current in normal operation (V<sub>BCKP</sub> = 3.0 V) is ~3 μA.

Symbol	Parameter	Conditions	Typical	Unit
$I_{VCC}$	Total current in software standby mode	VCC = 3.0 V	49	$\mu A$

**Table 15: Backup currents**

Extreme operating temperatures can significantly impact the specified values. If an application operates near the min or max temperature limits, ensure the specified values are not exceeded.

## 5 Communication interfaces

The receiver supports communication over the UART only.

All the inputs have an internal pull-up resistor in normal operation and can be left open if not used. The voltage level at the PIO pins is related to the

### 5.1 UART

The UART interface supports configurable baud rates. Hardware flow control is not supported. UART specifications are described in [Table 16](#).

Symbol	Parameter	Min	Max	Unit
$R_u$	Baud rate	9600	921600	bit/s
$\Delta_{Tx}$	Tx baud rate accuracy	-1%	+1%	-
$\Delta_{Rx}$	Rx baud rate tolerance	-2.5%	+2.5%	-

**Table 16: UART specifications**

### 5.2 Default interface settings

Interface	Settings
UART	<ul style="list-style-type: none"> <li>Input messages: NMEA and UBX.</li> <li>Output messages: NMEA GGA, GLL, GSA, GSV, RMC, VTG and TXT.</li> </ul>

**Table 17: Default interface settings**

## 6 Mechanical specifications

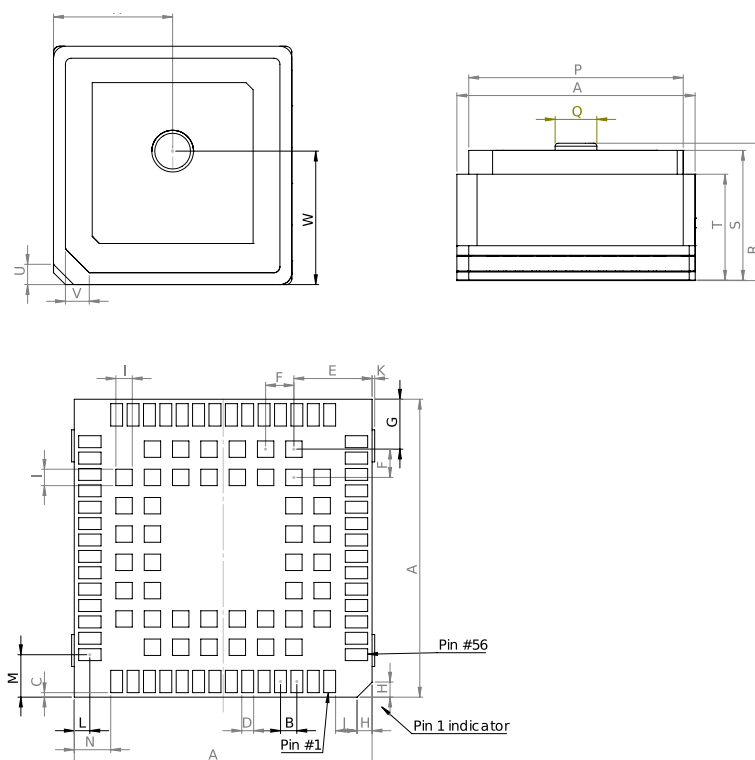


Figure 3: DAN-F10N mechanical drawing

Symbol	Min (mm)	Typical (mm)	Max (mm)
A	-	20.0	-
B	-	1.1	-
C	-	0.3	-
D	-	0.8	-
E	-	5.25	-
F	-	1.9	-
G	-	3.35	-
H	-	1.0	-
I	-	1.1	-
J	-	1.45	-
K	-	0.05	-
L	-	1.05	-
M	-	2.85	-
N	-	2.45	-
P	-	18.0	-
Q	-	3.5	-
R	-	11.5	-
S	-	10.9	-
T	-	8.9	-
U	-	1.7	-



Symbol	Min (mm)	Typical (mm)	Max (mm)
V	-	2.0	-
W	-	11.2	-
X	-	10.0	-
Weight		18 g	

**Table 18: DAN-F10N mechanical dimensions**



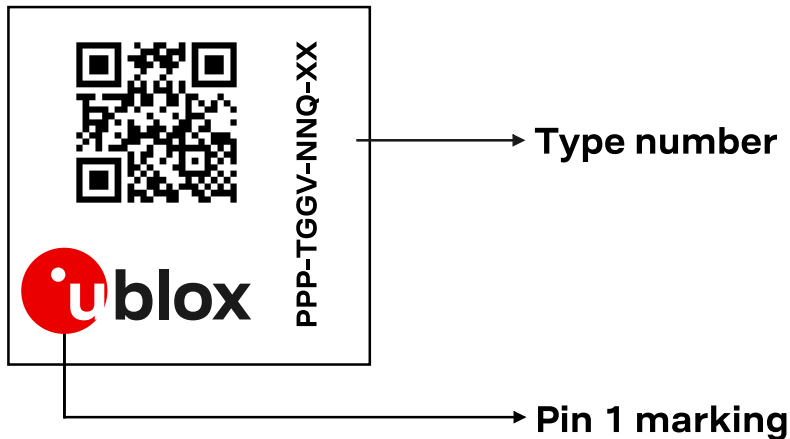
Take the size of the de-paneling residual tabs into account when designing the component keepout area.

## 7 Product marking and ordering information

This section provides information about product marking and ordering.

### 7.1 Product marking

The product marking provides information on DAN-F10N and its revision, as in [Figure 4](#). For a description of the product marking, see [Table 19](#)



**Figure 4: Example of DAN-F10N product marking**

Code	Meaning	Example
PPP	Form factor	DAN
TGG	Platform	F10 = u-blox F10
V	Variant	N = Standard precision, flash, TCXO, SAW filter, and LNA
NN	Major product version	00, 01, 02, ...
Q	Product grade	A = Automotive, B = Professional
XX	Revision	Hardware and firmware versions

**Table 19: Description of product marking**

### 7.2 Product identifiers

The DAN-F10N marking features three product identifiers: product name, ordering code and type number. The product name identifies all u-blox products, independent of packaging and product grade, and it is used in documentation such as this data sheet. The ordering code includes the major product version and product grade, while the type number additionally includes the hardware and firmware versions.

[Table 20](#) describes the three different product identifiers used in the DAN-F10N module product marking.

Identifier	Format	Example
Product name	PPP-TGGV	DAN-F10N
Ordering code	PPP-TGGV-NNQ	DAN-F10N-00B
Type number	PPP-TGGV-NNQ-XX	DAN-F10N-00B-00

**Table 20: Product identifiers**

## 7.3 Ordering codes

Ordering code	Product	Remark
DAN-F10N-00B	u-blox F10, 56 pin LCC, dual-band GNSS antenna module, professional grade	

**Table 21: Product ordering codes**

u-blox provides information on product changes affecting the form factor, size or function of the product. For the Product change notifications (PCNs), see our website at: <https://www.u-blox.com/en/product-resources>.

## Related documents

- [1] DAN-F10N Integration manual, UBXDOC-963802114-13252 (TO DO)
- [2] u-blox F10 SPG 6.00 Interface description, [UBX-23002975](#)
- [3] u-blox F10 SPG 6.00 Release note, [UBXDOC-963802114-12318](#)
- [4] Product packaging reference guide, [UBX-14001652](#)
- [5] Joint IPC/JEDEC standard, [www.jedec.org](http://www.jedec.org)



For regular updates to u-blox documentation and to receive product change notifications please register on our homepage <https://www.u-blox.com>.

## Revision history

Revision	Date	Comments
R01	12-Dec-2024	Initial release

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