

JF2 Product Description

80403ST10103A r8 – 2015-07-09



APPLICABILITY TABLE

PRODUCT
JF2



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1. Introduction

1.1. Scope

Scope of this document is to give an overview of new standalone GPS module JF2.

1.2. Audience

This document is intended for customers developing applications using JF2 module.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

<http://www.telit.com/en/products/technical-support-center/contact.php>

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

<http://www.telit.com>

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:



[“Chapter 1: “Introduction”](#) provides a scope for this document, target audience, contact and support information, and text conventions.

[“Chapter 2: “General Description”](#) gives an overview of the features of the product.

[“Chapter 3: “Technical Description”](#) describes the features of the product.

[“Chapter 4: “Software”](#) describes in detail the characteristics of the product.

[“Chapter 5: “Performance Characteristics”](#) shows the performance of the product.

[“Chapter 6: “Electrical Requirements”](#) describes in details the electrical characteristics of the product.

[“Chapter 7: “Software Interface”](#) provides some fundamental hints about the conformity assessment that the final application might need.

[“Chapter 8: “Mechanical Drawings”](#) provides info about Hardware interfaces.

[“Chapter 9: “Conformity Assessment”](#) provides certifications and assessment of JF2.

[“Chapter 10: “Evaluation Kit”](#) provides some fundamental hints about evaluation Kit.

[“Chapter 11: “Product Handling”](#) describes the packaging and mounting of the module.

[“Chapter 12: “Ordering Information”](#) describes the ordering information for obtaining product.

[“Chapter 13: “Glossary and acronyms”](#) contain the explanation of acronyms used in the present document

[“Chapter 14: “Safety Recommendation”](#) provides some safety recommendations that must be follow by the customer in the design of the application that makes use of the JF2

[“Chapter 15: “Document History”](#) provides the history of the present document.

1.5. Text Conventions



Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.



Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.



Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.



1.6. Related Documents

- JF2 Hardware User Guide,
- JF2 EVK User Guide,
- JF2 Serial Interfaces Application Note,
- JF2_JN3 Low Power Modes Application Note
- JF2_JN3 MEMS Application Note,
- JF2 Antenna Sense Application Note



2. General description

Building upon the SiRFstarIV™ architecture's high-performance and micro-power capabilities, the JF2 devices incorporate innovations such as SiRFaware™, SiRFInstantFix™ and Active Jammer Removal. The JF2 can navigate to -160dBm and track to -163dBm, providing higher coverage, accuracy and availability. This next generation Jupiter Module consumes only 10mA (1.8V) in 1-Hz TricklePower™ mode and can maintain hot-start conditions continuously in SiRFaware™ mode while drawing as little as 50-500uA. The JF2 offers A-GPS support and operate with a 1.8V power supply. JF2 supports a full range of satellite-based augmentation systems, including WAAS, EGNOS, MSAS and GAGAN. The GPS module combines the SiRFstarIV™ GSD4e™ GPS engine, TCXO, SAW filter, RTC and memory (Flash and EEPROM modules only).

2.1. SiRFaware™ Technology

SiRFaware™ maximizes performance of the JF2 without requiring it to maintain full power. This is achieved by using the following advanced technology to maintain continuous location awareness while minimizing power consumption:

- Opportunistic ephemeris decode and advanced power management, which allow the GPS receiver to stay in hot start conditions nearly continuously while consuming very little power.
- Local ephemeris prediction for three days in advance using captured ephemerides, which boosts sensitivity and performance.
- Dynamic contextual awareness by monitoring temperature change and by interfacing with MEMS sensors to detect movement, which conserves power and also boosts performance.



3. Technical Description

High-speed Location Engine – Twice the available DSP memory and search speed of SiRFstarIII architecture for enhanced sensitivity and navigation performance, greater coverage, reduced time to fix and improved positional accuracy.

Adaptive Micro Power Manager – Advanced power management with integrated LDO regulation to maintain hot-start conditions with minimal energy. Always ON 1.8V supply must be used.

MEMS Sensor Interface (I²C DR port) – Static detection is implemented and utilizes an accelerometer to determine if the module is moving in order to pin position. Additionally, the SiRFaware/MPM feature utilizes the accelerometer for MEMS wakeup to control the frequency of wakeup from hibernate for updating data.

Active Jammer Remover – Advanced DSP technology actively identifies and removes jammers prior to correlation. This feature maximizes GPS performance and helps identify issues during the design phase. Up to 8 CW jammers can be identified and removed.

External LNA Control – The JF2 SYSTEM-ON signal is available for use to control an external LNA. When the JF2 is in hibernate/sleep mode, SYSTEM-ON is low. When the JF2 is in full power state, SYSTEM-ON is HIGH.

5Hz Navigation – The JF2 can run with a navigation update rate of 1Hz or 5Hz. This is controllable in NMEA and OSP mode. Note that the UART baud rate will need to be increased to support the higher message output (about 38400 baud minimum in NMEA).

High Performance Solution:

- High sensitivity navigation engine (PVT) tracks as low as -163dBm
- 48 track verification channels
- SBAS: WAAS, EGNOS, MSAS, GAGAN.

Adaptive Micro Power Controller:

- Only 50 to 500uA maintains hot start capability

Active Jammer Remover:

- Removes in-band jammers up to 80 dB-Hz
- Tracks up to 8 CW jammers

Advanced Navigation Features:

- Smart sensor I2C interface
- Interrupt input for context change detection

3.1. Product Compatibility

The JF2 incorporates a new technology far advanced compared to the previous SiRFstarIII designs. It offers an upgrade path from existing Telit and competitive designs.

JF2 incorporates the same footprint as the Jupiter3 (J3) with the same pad dimensions. Pinouts are adapted to make use of the SiRFstarIV advanced technology. Please check the HW User Guide for more details.

Note that the JF2 is not backwards compatible with the J3.



NMEA version 3.0 protocol is supported as well as the new SiRF ONE SOCKET binary PROTOCOL (OSP).

3.2. Receiver Architecture

The functional architecture of the JF2 receiver is shown in Figure 1.

Note: The LNA is included in the GPS chip for passive antenna operation.

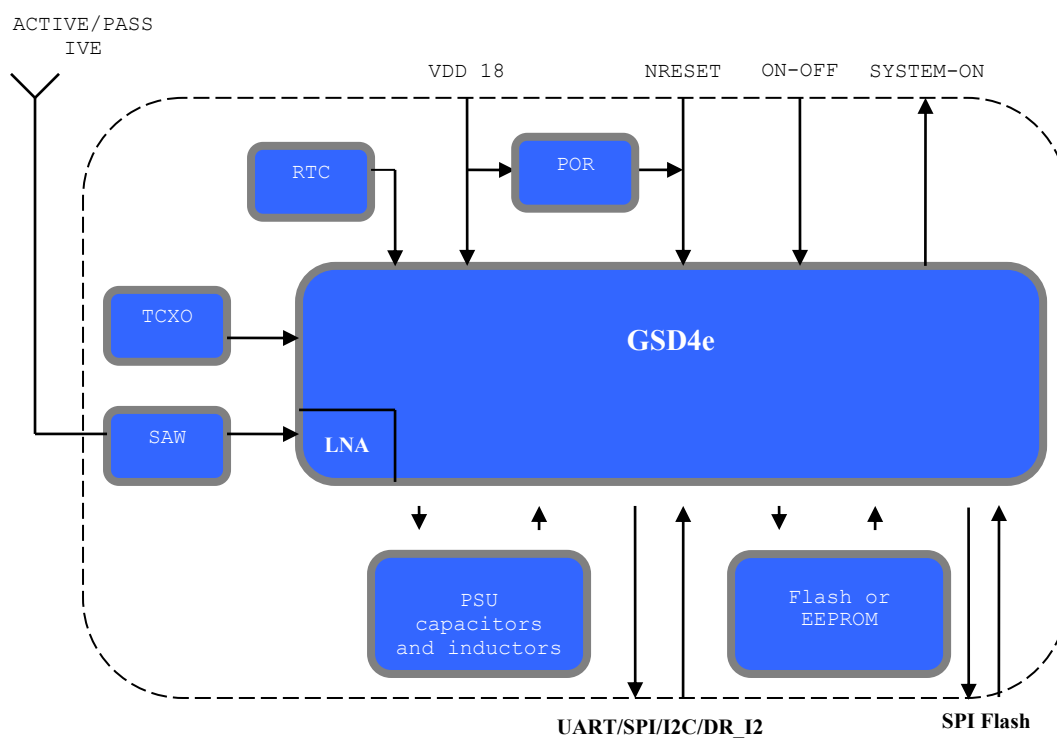


Figure 1 – JF2 Architecture

Note: LNA is included in the GPS chip for passive antenna operation.



3.3. Major Components

All power supply components are on board including capacitors and additional Power-On-Reset (POR) for the 1.8V supply.

A 1.8V always ON supply with noise and ripple characteristics mentioned in section 5.1 is critical for reliable operation. This can be a 1.8V supply that is backed up by a very low current 1.8V LDO that will supply the 14uA typical when the GPS has been shut down into Hibernate mode. Refer to the HW User Guide for additional details. If the 1.8V supply is inadvertently cut off the GPS 1.8V POR will shut it down into Hibernate with loss of data. It is important that the GPS has sufficient bulk capacitance to enable the GPS to shut down gracefully into Hibernate mode. In addition this would only be possible if a 1.8V battery backed supply is also provided to retain the GPS in Hibernate mode ready to accept an ON pulse once the main 1.8V supply is available again.

3.3.1. ON-OFF

This control 1.8V to 3.6V input signal is used to turn ON and turn OFF the GPS receiver. Main 1.8V power must be already available and stable.

There is a minimum time period before the receiver will accept an ON pulse once the 1.8V power has been first applied, 3 seconds typical. It is suggested the SYSTEM-ON line is monitored as it will indicate when the GPS can accept an ON pulse after the first 1.8V power application. If a 1.8V battery back-up system is used and the GPS has already been powered up, shut down should be done via the ON-OFF line. The SYSTEM-ON line will not indicate a READY state if the main 1.8V supply is re-applied. The battery back-up supply has kept the system ready and valid and an ON pulse can be applied as soon the main 1.8V supply is stable. Note, clean application of this 1.8V supply is required.

3.3.2. SYSTEM-ON

This is an active high (1.8V) indication that the system is ready to receive an ON pulse or that the system is ON and running. A short duration active high pulse occurs on this line if the main 1.8V supply has been connected (if no 1.8V battery back-up is used) and is valid. Note, that noisy or unstable application of the 1.8V power will cause the 1.8V POR monitor to shut the GPS down and lose data.

3.3.3. Band pass SAW filter (1.575 GHz):

This filters the GPS signal and removes unwanted signals caused by external influences that would corrupt the operation of the receiver. The filtered signal is fed to the RF input of GSD4e chipset for further processing. The filter has a bandwidth of 2 MHz.

3.3.4. GSD4e Chip

This single chip GPS device includes an integrated Baseband and RF sections. The LNA amplifies the GPS signal and provides enough gain for the receiver to use a passive antenna. A very low noise design is utilized to provide maximum sensitivity. This LNA is internal to the GPS baseband and can be switched between low and high gain mode.



3.3.5. VDD 18

This is the primary, always-ON supply voltage for the module. A very low noise 1.8V always-ON source must be used.

3.3.6. NRESET

This is the user Reset input, however it is recommended not be used. The module has two internal POR devices. One POR for the 1.2V core and a POR for the 1.8V supply. No user POR is required.

3.3.7. Host Port

The JF2 has a single HOST port. The user can select between UART, I2C and SPI ports through the use of external pull-up and pull-downs resistors. See the HW User Guide for more details.

The UART port is the preferred serial communications port, most popular and easiest to utilize.

3.3.8. MEMS Sensor Interface

The DR I2C port is used for MEMS sensor interface. Reference the HW User Guide for more details on how to connect to an accelerometer and/or magnetic sensor.

3.3.9. TCXO

This highly stable 16.369 MHz oscillator controls the down conversion process for the RF block.

3.3.10. Memory

Two versions of the JF2 are available with internal memory, Flash or EEPROM.

The Flash version includes a 16MB Flash storage device for operational software and satellite data.

The EEPROM version includes a 512KB EEPROM storage device for patch code, satellite data, and client generated predicted ephemeris.

The ROM-only does not include on-module memory. External Host memory or SPI flash may be used to store patch code, satellite data, and predicted ephemeris.



3.4. Physical Characteristics

The JF2 receiver has advanced miniature packaging and a LGA footprint and is smaller than the Jupiter 32 and similar in size to the Jupiter3 (J3). It is a surface mount device packaged on a printed circuit board, with a metallic RF enclosure on one side. There are 32 surface mount connection pads with a base metal of copper and an Electroless Nickel Immersion Gold (ENIG) finish.

3.5. Mechanical Specification

The physical dimension of the JF2 is as follows:

- length: 11.0 mm \pm 0.1 mm
- width: 11.0 mm \pm 0.1 mm
- thickness: 2.8 mm max
- weight: 1 g max

Refer to Figure 2 for the JF2 mechanical layout drawing.

3.6. External Antenna Connection

The RF connection for the external antenna has a characteristic impedance of 50 ohms.

3.7. Input/Output and Power Connections

The I/O (Input / Output) and power connections use surface mount pads.

Note that GPIO and UART/SPI/I2C/DR_I2C are 1.8V signals.

3.8. Environmental

The environmental operating conditions of the JF2 are as follows:

- temperature: -40°C to $+85^{\circ}\text{C}$ (measured on the shield)
- humidity: up to 95% non-condensing or a wet bulb temperature of $+35^{\circ}\text{C}$
- shock (non-operating): 18 G peak, 5 ms

3.9. Compliances

The JF2 complies with the following:

- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Manufactured in an ISO 9000: 2008 accredited facility
- Manufactured to TS 16949 requirement (upon request)



4. Software

4.1. TTF (Time to First Fix)

TTF is the actual time required by a GPS receiver to achieve a valid position solution. This specification will vary with the operating state of the receiver, the length of time since the last position fix, the location of the last fix, and the specific receiver design.

4.1.1. Hot Start

A hot start results from a software reset after a period of continuous navigation, or a return from a short idle period (i.e. a few minutes) that was preceded by a period of continuous navigation. In this state, all of the critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in memory. Requires always ON 1.8V main supply.

4.1.2. Warm Start

A warm start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available in memory. In this state, position and time data are present and valid but ephemeris data validity has expired. Requires always ON 1.8V main supply.

4.1.3. Cold Start

A cold start acquisition results when either position or time data is unknown. Almanac information is used to identify previously healthy satellites.

Please refer to section 3.6 for performance data.



4.2. AGPS

GPS aiding comes in several forms, for the purposes of this document we will focus on extended ephemeris data as a form of assisted GPS data.

InstantFix (SGEE and CGEE) is a method of GPS aiding that effectively reduces the TTFF by making every start a Hot or Warm start, through the use of ephemeris predictions.

Client Generated Extended Ephemeris (CGEE) captures ephemeris data from satellites locally and predicts ephemeris for those visible satellites for up to 3 days.

Server Generated Extended Ephemeris (SGEE) does not require local ephemeris collection from satellites; it receives the extended ephemeris data from a server and has ephemeris predictions for all available satellites in the sky.

The module supports AGPS as standard. TELIT provides a server for customers to mirror with their own servers for download of the SGEE file. Contact TELIT for support regarding this service.

Note: Due to memory size constraints, modules with EEPROM do not support SGEE.

Note: The ROM-only module does not support CGEE or SGEE. External Host memory can be used to enable both these features. See HW User Guide for more details on how to interface with external Host memory.

4.3. Time Mark Pulse (1PPS)

A 1PPS time mark pulse is provided as an output with a width of 200ms. This signal has not been verified or characterized for all operational conditions.

Note: The GPS will only provide 1PPS when a 3D fix has been obtained using 5 SVs. When the fix degrades below a 3D solution, the 1PPS will be blanked. Once the fix quality improves back to a 3D FIX the 1PPS will again be output.

4.4. Power Management

The following paragraphs describe the power management modes and power states supported by the JF2.

Note that power consumption will be lower if AGPS is used.

4.4.1. Hibernate State

This is the lowest power consumption state (14uA typical) and allows a Hot Start within 2-4 hours of last shut down. The GPS receiver must have had a valid fix with sufficient visible satellites before having been shut down via the ON-OFF line or serial command.

Note: If AGPS is used there will be no time limit as long as the AGPS data is still valid.

4.4.2. Micro Power Mode

Micro Power mode is a very low power maintenance mode implementing SiRFaware™ technology. In this mode the JF2 remains predominantly in the Hibernate state, but exits this state only as needed to maintain location awareness and valid ephemeris data. Thus high



sensitivity hot start conditions are always present when the ON-OFF signal is used to wake up the JF2 and obtain a navigation update.

4.4.3. Adaptive Trickle Power (ATP)

Trickle Power mode is a duty-cycled power management mode that reduces average current consumption by the JF2 while retaining a high quality of GPS accuracy and dynamic motion response. The duty cycle and navigation update rate are specified by the user to best fit in the operating environment. This mode adapts to weak or blocked satellite signals by transitioning the JF2 in and out of full power mode as needed in order to maintain GPS performance.

4.4.4. Push to Fix Mode (PTF)

Push to Fix mode is designed for applications that do not require frequent navigation updates. In this mode the JF2 remains in the hibernate state most of the time, but wakes up periodically to perform a hot start acquisition (up to once every two hours) and provide a quality navigation solution. The JF2 also wakes up when requested by a signal on the ON-OFF line.

4.5. Differential Aiding (DGPS)

4.5.1. Satellite Based Augmentation Systems (SBAS)

The JF2 is capable of receiving WAAS and EGNOS, MSAS, GAGAN differential corrections which are regional implementations of SBAS. SBAS improves horizontal position accuracy by correcting GPS signal errors caused by ionospheric disturbances, timing and satellite orbit errors.

4.6. 5Hz Update Rate

The JF2 defaults to an update rate of 1Hz. The JF2 can be configured to operate in 5Hz through NMEA or SiRF Binary OSP command (v4.1.0 firmware or later). In UART mode, it is necessary to increase the baud rate to meet the higher rate of message output from the receiver.

For example, in NMEA, an output of RMC, GGA, and GSA at five times per second, and GSV at once per second will require at least a baud rate of 19200. This will ensure that the messages are outputted within about 0.75 seconds.

Note that the JF2 will continue to run in 1Hz navigation until it gets a navigation fix. Once a navigation fix is attained, it will transition into 5Hz navigation.

Utilize \$PSRF103 for control in NMEA and MID136 in SiRF Binary OSP.



4.7. Dynamic Constraints

The JF2 receiver will lose track if any of the following limits are exceeded:

- ITAR limits: velocity greater than 514 m/s AND altitude above 18,288 m
- altitude: 24,000 m (max) or -500 m (min)
- velocity: 600 m/s (max)
- acceleration: 4 G (max)
- vehicle jerk: 5 m/s³ (max)



5. Performance Data

Parameter	Description	Performance			
		Min	Typical	Max	Units
Horizontal Position Accuracy ¹	Autonomous	-	<2.5	-	m
Velocity Accuracy ²	Speed	-	-	<0.01	m/s
	Heading	-	-	<0.01	°
Time to First Fix ³	Hot Start: Autonomous	-	<1	-	s
	Warm Start: Autonomous	-	<35	-	s
	Cold Start: Autonomous	-	<35	-	s
Sensitivity	Autonomous acquisition	-147	-	-	dBm
	Tracking	-163	-	-	dBm
	Navigation	-160	-	-	dBm

1. 50%, 24 hr static, -130 dBm
2. 50% @ 30 m/s
3. 50% , -130 dBm (Fu 0.5 ppm, Tu ±2 s, Pu 30 Km)
4. Supported on JF2 Flash designs only. Not available in standard code release.

Table 2 – JF2 Performance Data



6. Electrical Requirements

6.1. Power Supply

6.1.1. VDD 18

Main 1.8V always ON power input.

Noise and ripple requirements are:

- Supply voltage: Nominal 1.8V, +50mV, -50mV.
- 0-3MHz range, less than 50mV peak to peak noise.
- >3MHz range, less than 15mV peak to peak noise.

Note: protected by POR, which will force the GPS receiver into Hibernate mode, if triggered. It will require an ON pulse to wake it up again.

Sufficient low ESR capacitance is required and the 1.8V supply must have low source impedance to prevent the 1.8V rail POR to trigger when the module is started up via the ON-OFF line. This causes inrush current that can cause the 1.8V supply to drop.

Refer to the HW User Guide for more details.

6.1.2. External Antenna Voltage

The JF2 requires an external antenna Bias-T to provide the voltage to the antenna. This is detailed in the HW User Guide.

6.1.3. RF (Radio Frequency) Input

RF input is 1575.42 MHz (L1 Band) at a level between -135 dBm and -165 dBm into 50 Ohm impedance.

6.1.4. Antenna Gain

The receiver will operate with a passive antenna with Isotropic gain down to a minimum of -6dBi. Active antennas are supported. The internal LNA must be switched to low gain mode if an active antenna is used.

An active antenna of 20dB minimum (exiting the cable) will offer the best performance. 30dB exiting the antenna cable is maximum useable active antenna gain.

Refer to section 2.11 for more details.

Contact TELIT for in depth passive antenna design support.

6.1.5. Burnout Protection

The receiver accepts without risk of damage a signal of +10 dBm from 0 to 2 GHz carrier frequency, except in band 1560 to 1590 MHz where the maximum level is -10 dBm.



6.1.6. Jamming Performance

Eight separate in band jammers can be detected and digitally removed in the GPS DSP. This is over and above the excellent SAW filter response that exists before the GPS LNA input.

Note: The spectral purity of oscillators and RF transmitters in the host system will determine if harmonics are formed that are equal to the frequencies above.

Compact wireless product design requires close monitoring of jamming issues.

6.1.7. Flash Upgradability (Flash only)

The firmware programmed in the Flash memory may be upgraded via the serial port TX/RX pads. The user can control this by driving the Serial BOOT select line high at startup, then downloading the code from a PC with suitable software (SiRFFlash). In normal operation this pad should be left floating for minimal current drain. It is recommended that in the user's application, the BOOT select pad is connected to a test pad for use in future software upgrades. Refer to the HW User Guide for additional information.

6.1.8. Patch Updates (EEPROM only)

Modules with EEPROM can be patched from the Host using simple One Socket Protocol (OSP) Patch Protocol serial messages. Patches are stored inside the I2C Serial EEPROM and are automatically applied by internal firmware whenever the baseband CPU is started.

Note: ROM-only modules can support patch updates if Host memory is available.

6.1.9. Reset Input

This active low input to NRESET. No user POR is required. It is recommended to not use or connect to this pin, except as indicated by TELIT.

The module contains a POR that monitors the 1.8V supply. This POR has strict criteria to ensure system software reliability. If this signal is triggered by low voltage on the 1.8V supply the JF2 will drop into Hibernate mode and the patch RAM and CGEE will be cleared. The JF2 will require an ON pulse once the supply has stabilized to wake up the GPS receiver and return to a full power state (CGEE must be reloaded). If the supply voltage drops low enough for a long enough period of time the RAM/BBRAM will be cleared and the GPS will carry out a Cold start once woken up.

Note: If the voltage drops low enough to affect the RAM/BBRAM/PATCH RAM and the 1.8V POR has triggered, all power must be removed from the module for a minimum of 10 seconds to ensure the memory is cleared of all corrupted data. It is strongly recommend a 1.8V back up supply is used to ensure this does not happen. The 1.8V back up supply (14uA typical) will take over once the GPS has been shut down into Hibernate mode via the 1.8V rail POR as the main 1.8V supply inadvertently drops. Enough isolation is required on the main 1.8V supply to prevent current draining back through the main 1.8V supply and cause memory corruption. Review the Designer's Note for more details.

It is important that the always ON 1.8V is primary design consideration and must be maintained as much as possible.

Review the Designer's Note for in depth information on the 1.8V supply requirements.



6.2. Data Input/Output Specifications

All communications between the JF2 receiver and external devices are through the I/O surface mount pads. These provide the contacts for power, ground, serial I/O and control. Power requirements are discussed in the following sections.

6.2.1. Voltages and Currents

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage ^{1,3}	VDD	1.75	1.8	1.90	V
Operating Temperature ²	T _{OPR}	-40		+85	°C
Current Consumption ⁴ :					
Acquisition			46		mA
Tracking			37		mA
1Hz Trickle Power Current ⁵			10		mA
Hibernate Current: Flash/EEPROM/ROM module			<14		uA

1. Power must be always applied. The GPS will control its own power consumption depending on the required power configuration. The ON-OFF pin must be used to power the GPS OFF and ON.
2. Operating temperature is ambient.
3. Ripple characteristics must be ensured for best GPS performance and reliable operation. The 1.8V POR has strict requirements and will shut the GPS down if these minimum specifications are not maintained.
4. LNA set to High Gain Mode.
5. 1Hz, 100ms On time.

Table 3 – Power Requirements

Note: Allowable ripple on the 1.8V supply is <50mV (0-3MHz) and <16mV above 3MHz. This is WITH the GPS and all systems running.



Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Power Supply Voltage	VDD	2.2	V
Input Pin Voltage	VIO_IN	3.6	V
Output Pin Voltage	VIO_OUT	3.6	V
Storage Temperature	T _{stg}	-50 to 150	°C
<p>Warning – Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. Operation beyond the “Operating Conditions” is not recommended and extended exposure beyond the “Operating Conditions” may affect device reliability.</p>			

Table 4 – Digital Core and I/O Voltage (Volatile)

Parameter	Symbol	Min	Typ	Max	Units
Low level output voltage Test conditions I _{ol} =2mA and 4.0mA	V _{ol}	-	-	0.40	V
High level output voltage Test conditions I _{oh} =2mA and 4.0mA	V _{oh}	0.75xVDD	-	-	V
Low level input voltage	V _{il}	-0.4	-	0.45	V
High level input voltage	V _{ih}	0.7xVDD	-	3.6	V
Internal pull-up resistor equivalent	R _{pu}	50	86	157	kΩ
Internal pull-down resistor equivalent	R _{pd}	51	91	180	kΩ
Input leakage at V _i =1.8V or 0V	L _i	-10	-	10	uA
Tristate output leakage at V _o =1.8V or 0V	L _{oz}	-10	-	10	uA
Input capacitance	C _{in}	-	5	-	pF
Output capacitance	C _{load}	-	-	-	pF

Table 5 – DC Electrical Characteristics

Note: VDD=1.8V



6.2.2. Pinout Description

Bottom pad pinouts as viewed from the top through to the bottom.

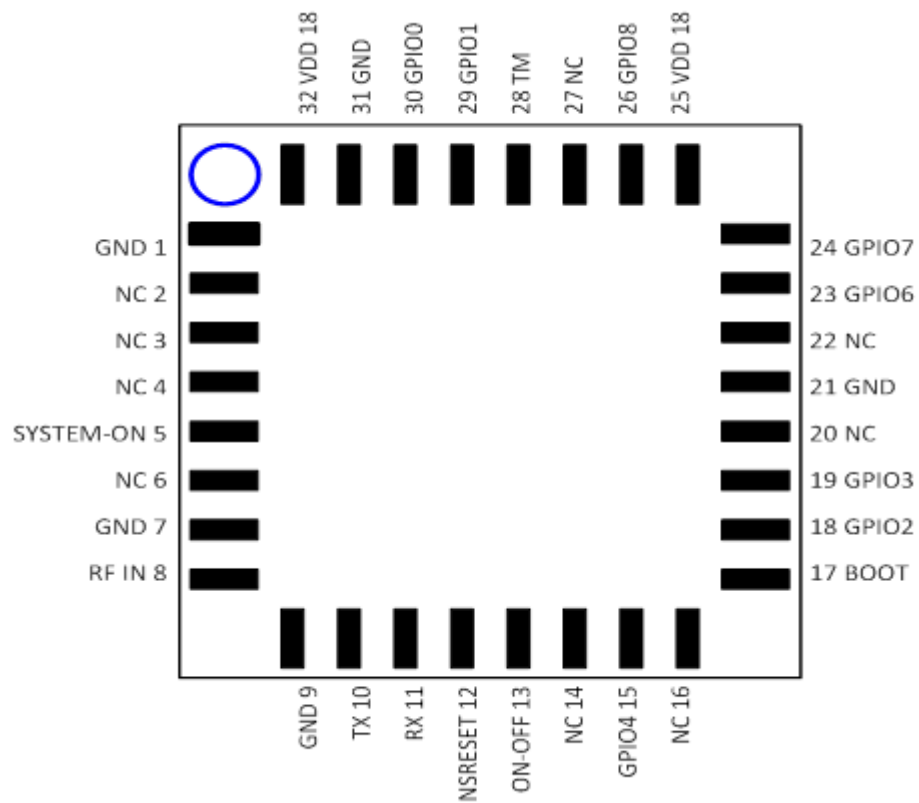


Figure 2 Pinout (Top View)



Details of the LGA pad functions are shown in Table 6.

Pad Number	Pad Function	Type	Description
1	GND	PWR	GROUND
2	NC	-	No connection
3	NC	-	No connection
4	NC	-	No connection
5	SYSTEM-ON	O	Indication that GPS is running (Active high)
6	NC	-	No connection
7	GND	PWR	GROUND
8	RF IN	I	GPS RF Input
9	GND	PWR	GROUND
10	TX	O	UART TX/SPI MISO/I2C CLOCK (1.8V)
11	RX	I	UART RX/SPI MOSI/I2C DATA (3.6V tolerant)
12	NRESET	I	GPS Reset (Active low)
13	ON-OFF	I	Input signal turns GPS ON or OFF (Active high pulse)
14	NC	-	No connection
15	GPIO4	I/O	General Purpose Input Output/EIT
16	NC	-	No connection
17	BOOT	I	Boot pin for firmware update (Active high)
18	GPIO2	I/O	General Purpose Input/Output
19	GPIO3	I/O	General Purpose Input/Output
20	NC	-	No connection
21	GND	PWR	GROUND
22	NC	-	No connection
23	GPIO6	I/O	General Purpose Input Output/SPI Clock
24	GPIO7	I/O	General Purpose Input Output/SPI CHIP Select
25	VDD 18	PWR	Redundant supply (1.8V). Connect to Pin 32.
26	GPIO8	I/O	General Purpose Input/Output
27	NC	-	No connection
28	TM	O	1PPS time mark pulse
29	GPIO1	I/O	General Purpose Input/Output (DR I2C CLK)



30	GPIO0	I/O	General Purpose Input/Output (DR I2C IO)
31	GND	PWR	GROUND
32	VDD 18	PWR	Main supply voltage, 1.8V (ALWAYS ON)

Table 6 – LGA Pad Functions

Note: GPIO/UART/SPI/I2C/DR_I2C voltages and levels are based on 1.8V.



7. Software Interface

The host serial I/O port of the receiver's serial data interface supports full duplex communication between the receiver and the user.

The default serial configuration is as follows:

UART: NMEA, 4800 bps, 8 data bits, no parity, 1 stop bit

Note: Contact your local sales representative for details on module configurations with default NMEA 9600 bps.



Warning – it is possible to revert the JF2 EEPROM 9600 version to 4800 NMEA if the patch file is erased in the EEPROM by command.

7.1. NMEA Output Messages

NMEA v3.0 is the default protocol. The following messages are output by default in 4800 default products:

- RMC = 1 second update
- GGA = 1 second update
- GSA = 1 second update
- GSV = 5 second update

Reference the NMEA protocol manual for additional message details.

7.2. SiRF OSP Output Messages

SiRF One Socket Protocol (OSP) is supported. This is an extension of the existing SiRF Binary protocol.

The following messages are output once per second:

- MID2
- MID4
- MID9
- MID41
- MID56, 5
- MID56, 35

Reference the SiRF One Socket Protocol manual for additional message details.



7.3. Software Functions and Capabilities

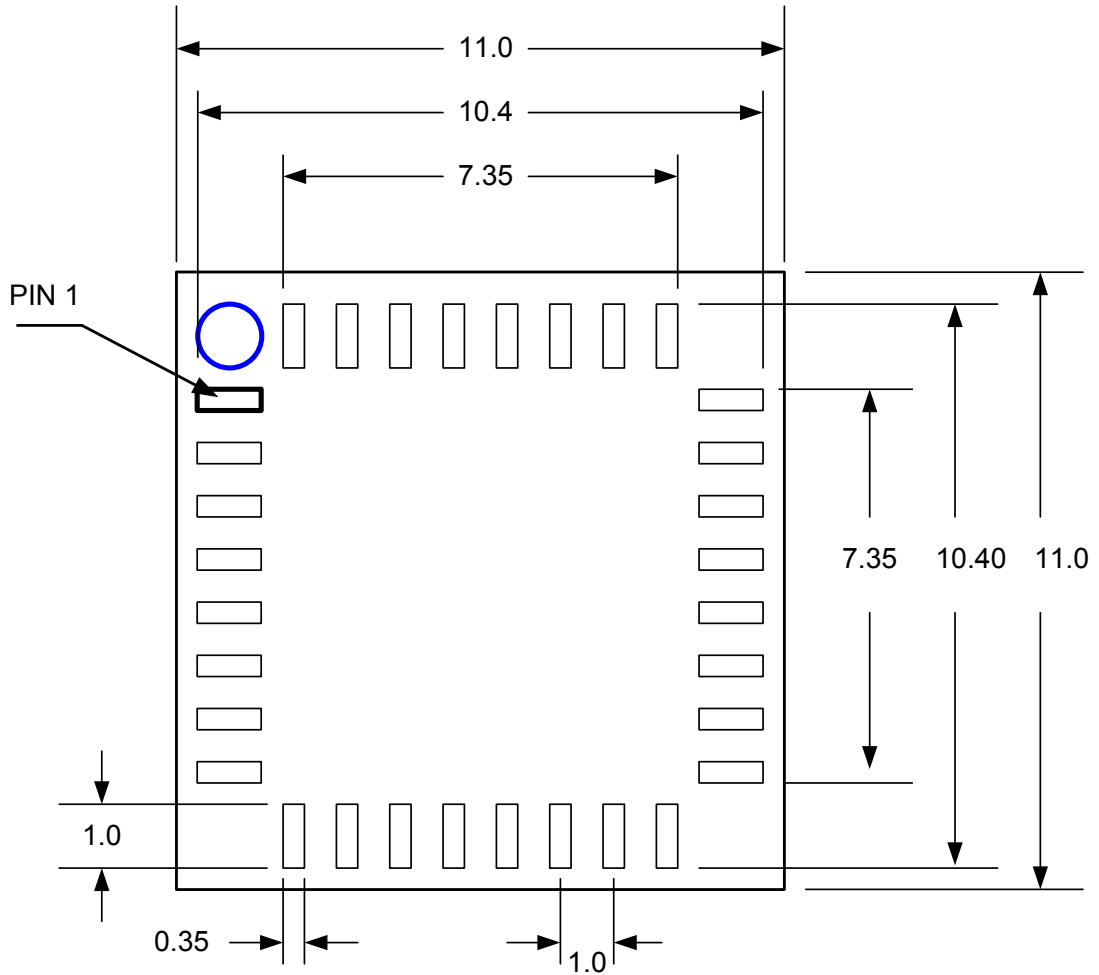
Table 7 shows the software features available to the JF2.

Feature	Description	Availability
SBAS	Improve position accuracy by using freely available satellite based correction services called SBAS (Satellite Based Augmentation System)	A
Adaptive Trickle Power	Improves battery life by using enhanced power management and intelligently switching between low and full power depending on the current GPS signal level. Refer to the Low Power Operating Modes application note.	A
Push to Fix Mode	Provides an on-demand position fix mode designed to further improves battery life compared to ATP.	A
Micro Power Management	Advanced power management with integrated switched-mode regulation to maintain hot start conditions with minimal energy.	A
Almanac to Flash	Improves cold start times by storing the most recent almanac to flash memory.	Yes (Flash only)
Low Signal Acquisition	Acquires satellites and continues tracking in extremely low signal environments.	Yes
Low Signal Navigation	Continues navigating in extremely low signal environments.	Yes
Time Mark Pulse (1PPS)	A timing pulse generated every second the receiver is in a valid navigation state (5 SVs required for initial pulse start-up).	Yes
MEMS	3-axis accelerometer for static detection and MPM wake-up. 3-axis magnetometer support for compass heading.	A
Antenna Supervisor	Active antenna short circuit and open circuit detection/control, software supported.	V4.1.2
SGEE	AGPS using predicted ephemeris data from a server. Supporting Host required.	Yes (Flash only)
CGEE	AGPS using prediction of ephemeris from live (downloaded from satellites), ephemeris stored in memory.	Yes (Flash/EEPROM)
Adaptive Jammer Detection	System scan for up to 8 CW jammers for removal by the GPS	Yes
5Hz Update Rate	JF2 update rate is configurable by software command to 5Hz.	A
Yes = always enabled A = available, but not enabled by default		

Table 7 – Software Features



8. Mechanical Drawing



All dimensions are in mm.

Figure 3 – Mechanical Layout



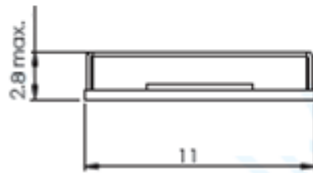
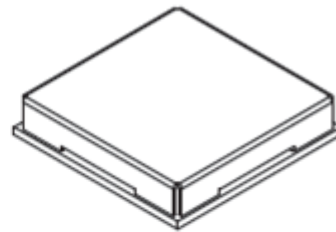
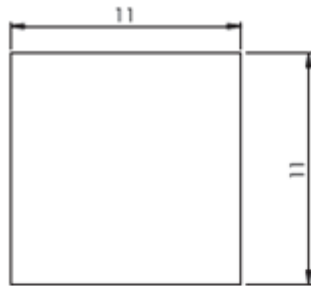



Figure 4 3D Model




9. Conformity Assessments

9.1. Declaration of Conformity




EC DECLARATION OF CONFORMITY



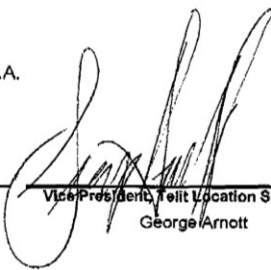
1. **JF2** (product name)
2. Telit Communications S.p.A Via Stazione di Prosecco, 5/b 34010 Sgonico –TRIESTE- ITALY (manufacturer)
3. This declaration of conformity is issued under the sole responsibility of the manufacturer.
4. Stand-alone GPS receiver module.
5. The object of the declaration described above is in conformity with the relevant Community harmonisation:
European Directive 1999/05/EC (R&TTE)
6. The conformity with the essential requirements of the 1999/05/EC has been demonstrated against the following harmonized standard:

EN 60950-1:2006 + A11:2009+A1:2010+A12:2011	For article 3.1 (a): Health and Safety of the User
EN 301 489-1 V1.8.1	For article 3.1 (b): Electromagnetic Compatibility
EN 301 489-3 V1.4.1	
EN 300 440-2 V1.4.1	For article 3.2 : Effective use of spectrum allocated
EN 300 440-1 V1.6.1	
7. The conformity assessment procedure referred to in Article 10 and detailed in Annex IV of Directive 1999/05/EC has been followed with the involvement of the following Notified Body for article 3.2:
CETECOM ICT Services GmbH, Untertürkheimer Straße 6-10, 66117 Saarbruecken, Germany
Thus, **CE 0682** is placed on the product.
8. The Technical Construction File (TCF) relevant to the product described above and which support this Declaration of Conformity, is held at: Telit Communications S.p.A Via Stazione di Prosecco, 5/b 34010 Sgonico (TRIESTE) ITALY.

Signed for and on behalf of Telit Communications S.p.A.
Trieste, **2012-05-21**



Quality & IPR Director
Guido Walcher



Vice President, Telit Location Solution LP
George Arnott

Mod 0211 2010-11 Rev.1 - This declaration of conformity is issued in compliance with 768/2008/EC



9.2. R&TTE Notify Body Opinion

CETECOM ICT Services GmbH
EC Identification Number 0682
authorized by the German Government
 Bundesnetzagentur
BNetzA-bS-02/51-52
to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of March 9, 1999.

EXPERT OPINION

Registration-No.: **U816608Z-EOrev**
Applicant & Product Manufacturer: **Telit Location Solutions**
27422 Portola Parkway, Suite 320
Foothill Ranch, CA 92610 U.S.A.

Product Designation: **JN3 / JF2**
Product Description: **Stand-alone GPS receiver module (L1 band, 1575.42 MHz);**

essential requirement (R&TTE-D article)	Specifications / Standards	Submitted documents	Result
Safety and Health (art. 3.1a)	IEC 60950-1: 2005 (2nd Edition)/A1:2009 and EN 60950-1:2006/A11:2009/A1:2010/A12: 2011	Test Report	conform
EMC (art. 3.1b)	EN 301 489-1:V1.8.1, EN 301 489-3:V1.4.1;	Test Report	conform
Radio spectrum (art. 3.2)	EN 300 440-1:V1.6.1, EN 300 440-2:V1.4.1;	Test Report	conform

Marking: The EC conformity marking (CE mark) of the products shall be accompanied by our EC identification number 0682 as shown right hand. **CE 0682**

The scope of this evaluation relates to the submitted documents only.
The certificate is only valid in conjunction with the following annex.

Milpitas, 2012-05-15
Place, Date of Issue


Signed by Nikolaus Wahl
Notified Body



CETECOM ICT Services GmbH, Untertürkheimer Straße 6-10, 66117 Saarbruecken, Germany
<http://www.cetecom-ict.de>



10. Evaluation Kit

The JF2 Evaluation Kit is available to assist in the evaluation and integration of the JF2 module in custom applications. The Development Kit contains all of the necessary hardware and software to carry out a thorough evaluation of the JF2 module.



11. Product Handling

11.1. Product Packaging and Delivery

JF2 module is shipped in Tape and Reel form. The reeled modules are shipped in 24mm reels with 1000 units per reel. Each reel is 'dry' packaged and vacuum sealed in a Moisture Barrier Bag (MBB) with two silica gel packs and placed in a carton.

The minimum order quantity for shipping is 1000 units. Refer to the HW User Guide for additional details.

All packaging is ESD protective lined. The JF2 GPS receiver is a Moisture Sensitive Device (MSD) level 3. Please follow the MSD and ESD handling instructions on the labels of the MBB and exterior carton (refer to sections 9.2 and 9.3).

11.2. Moisture Sensitivity

Precautionary measures are required in handling, storing and using such devices to avoid damage from moisture absorption. If localized heating is required to rework or repair the device, precautionary methods are required to avoid exposure to solder reflow temperatures that can result in performance degradation.

Further information can be obtained from the IPC/JEDEC standard J-STD-033: Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices.

11.3. ESD Sensitivity

The JF2 GPS receiver contains class 1 devices and is Electro-Static Discharge Sensitive (ESDS). Telit recommends the two basic principles of protecting ESD devices from damage:

Only handle sensitive components in an ESD Protected Area (EPA) under protected and controlled conditions

Protect sensitive devices outside the EPA using ESD protective packaging. All personnel handling ESDS devices have the responsibility to be aware of the ESD threat to the reliability of electronic products.

Further information can be obtained from the JESD625-A requirements for Handling Electrostatic Discharge Sensitive (ESDS) Devices.

11.4. Safety

Improper handling and use of the Jupiter GPS receiver can cause permanent damage to the receiver. There is also the possible risk of personal injury from mechanical trauma or choking hazard.



11.5. Disposal

We recommend that this product should not be treated as household waste. For more detailed information about recycling this product, please contact your local waste management authority or the reseller from whom you purchased the product.



12. Ordering Information

- J-F2-B3E8-Dx JF2 Flash Module (4800 bps v4.1.2-P9 firmware)
- J-F2-B3E9-Dx JF2 Flash Module (9600 bps v4.1.2-P9 firmware)
- J-F2-C1F3-Dx JF2 512K EEPROM Module (4800bps v4.1.2 Patch 5)
- J-F2-C1F4-Dx JF2 512K EEPROM Module (9600bps v4.1.2 Patch 5)
- J-F2-C0D4-Dx JF2 ROM Module (4800 bps ROM2.2)
- J-F2-C0D5-Dx JF2 ROM Module (9600 bps ROM2.2)
- J-F2-B3EV-D JF2 Evaluation Kit

NOTE: x denotes packaging type (R=Tape & Reel, Y=Tray).

Contact your local sales representative for more details.



13. Glossary and Acronyms

AGPS: Assisted GPS. AGPS uses additional resources to locate the satellites faster and better in poor signal conditions.

Almanac: A set of orbital parameters that allows calculation of approximate GPS satellite positions and velocities. The almanac is used by a GPS receiver to determine satellite visibility and as an aid during acquisition of GPS satellite signals. The almanac is a subset of satellite ephemeris data and is updated weekly by GPS Control.

CGEE: Client Generated Extended Ephemeris data. AGPS using prediction of ephemeris from live (downloaded from satellites), ephemeris stored in memory.

EGNOS: European Geostationary Navigation Overlay Service

The system of geostationary satellites and ground stations developed in Europe to improve the position and time calculation performed by the GPS receiver.

Ephemeris (plural ephemerides): A set of satellite orbital parameters that is used by a GPS receiver to calculate precise GPS satellite positions and velocities. The ephemeris is used to determine the navigation solution and is updated frequently to maintain the accuracy of GPS receivers.

ESD: Electro-Static Discharge

large momentary unwanted currents that cause damage to electronic equipment.

GDOP: Geometric Dilution of Precision.

A factor used to describe the effect of the satellite geometry on the position and time accuracy of the GPS receiver solution. The lower the value of the GDOP parameter, the less the error in the position solution. Related indicators include PDOP, HDOP, TDOP and VDOP.

GPS: Global Positioning System.

A space-based radio positioning system that provides accurate position, velocity, and time data.

InstantFix: Eliminates the initial delay of obtaining GPS satellite location data from the satellites themselves by using algorithms to predict seven days of satellite location data.

LGA: Land Grid Array.

There are no pins on the chip; in place of the pins are pads of bare gold-plated copper that touch pins on the motherboard.

MSD: Moisture sensitive device.

NMEA: National Marine Electronics Association

POR: Power on Reset.

SBAS: Satellite Based Augmentation System

Any system that uses a network of geostationary satellites and ground stations to improve the performance of a Global Navigation Satellite System (GNSS). Current examples are EGNOS and WAAS.



SGEE: Server Generated Extended Ephemeris data. AGPS using predicted ephemeris data from a server. Supporting Host required.

TCXO: Temperature Compensated Crystal Oscillator

WAAS: Wide Area Augmentation System

The system of satellites and ground stations developed by the FAA (Federal Aviation Administration) that provides GPS signal corrections. WAAS satellite coverage is currently only available in North America.



14. Safety Recommendations

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices.

The European Community provides some Directives for the electronic equipments introduced on the market. All the relevant information's are available on the European Community website:

<http://ec.europa.eu/enterprise/sectors/rte/documents/>

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:

<http://ec.europa.eu/enterprise/sectors/electrical/>



15. Document History

Revision	Date	Changes
0	2011-01-19	First issue
1	2012-03-20	Update ordering information
2	2012-12-17	Update ordering information and inserted conformity assessment. Updated current consumption for JF2 ROM/EEPROM variants in table 3 of §5.2.1
3	2013-02-26	Update for ROM2.2 version of JF2.
4	2013-03-13	Update thickness/height data and warning for using external SPI flash.
5	2013-03-26	Update Figure 4 3D Model height
6	2013-04-09	Removed section about Baud Rate Detection
7	2013-04-18	Update Ordering Information
8	2015-07-09	Updated Ordering information



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