

Certification Exhibit

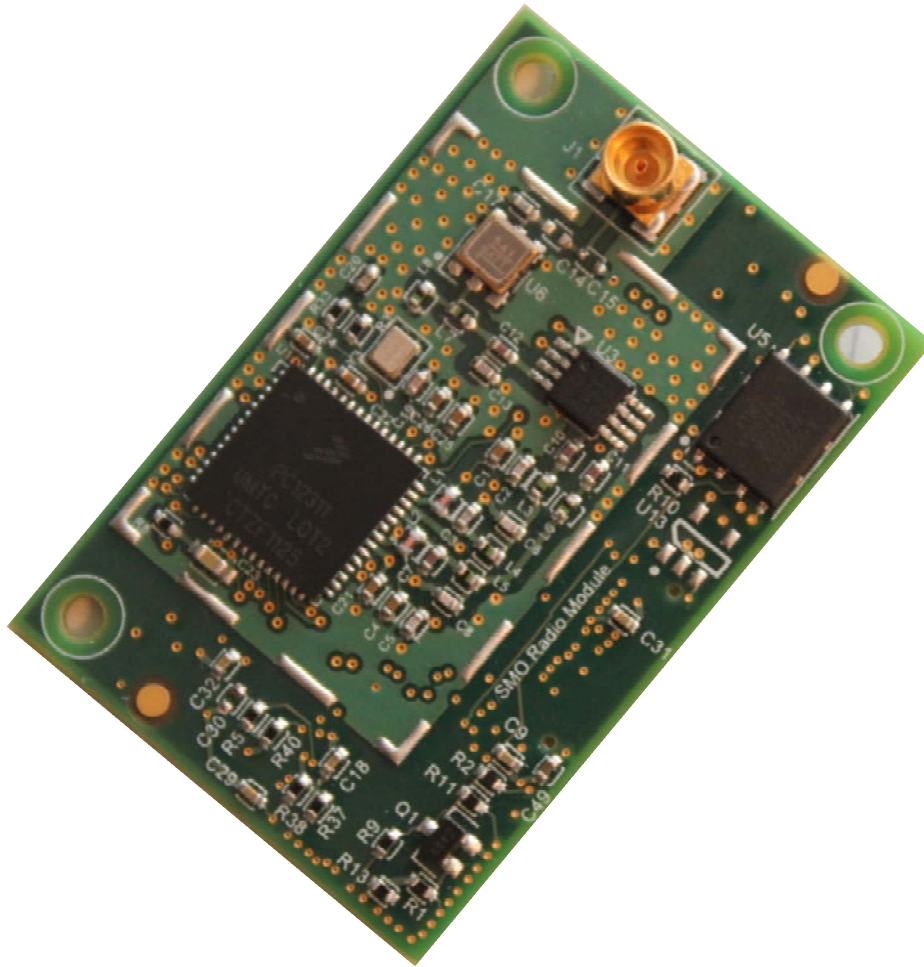
**FCC ID: SQB-NIVISVN400
IC: 6546A-NIVISVN400**

**FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210**

ACS Project Number: 12-0358

**Manufacturer: Nivis, LLC
Model: VersaNode 400**

Manual



VersaNode 400 Hardware Integration Application Note

Version 2.2

Date: January 4, 2013

Revision History

Date	Version	Description	Name
11/8/12	1.0	Initial Release	K. Scott
11/30/12	2.0	Added FCC/IC Info Corrected footer and formatting	K. Scott
12/6/12	2.1	Added Figure 3 to show J2 Pin 1 location	K. Scott
1/3/13	2.2	Added FCC two part warning Updated Dimension Drawing	K. Scott

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1. Purpose and Audience

The purpose of this document is to define the VN400 radio's connectivity options and to provide the necessary data to achieve hardware integration of the VN400 with a customer's external application processor.

By definition, the VN400 is a radio module, approximately 1.0"W x 1.5"L, that is pre-loaded with the Nivis Smart Objects communications stack. The small form factor enables the radio to be used in a variety of applications.

2. Pin-out and Interface Summary

The VN400 radio module uses the Freescale MC12311 SoC. Please refer to the block diagram in Figure 1 for the following section.

The MC12311 operates in the 868 & 915 MHz ISM bands. It utilizes an internal PA (power amplifier) with a range of -20 to +15 dBm at the antenna connector. The output power is adjustable in 1 dB steps.

The advantages of a radio module with adjustable power output are the following:

1. Ability to increase power output to +15 dBm for applications where battery consumption is not critical.
2. Enables the unit to be configured for different certification needs, especially locations that require reduced power, such as Europe, Japan and China.
3. Provides greater power level consistency, for systems where symmetrical links are more critical.

The design of the RF section of the unit uses additional transmit components:

1. Dual LPF's to reduce harmonic output and spurious output for regulatory compliance, such as FCC, IC, R&TTE, and Giteki certifications.
2. Tx / Rx switch to select the transmit / receive RF path.
4. A SAW (Surface Acoustic Wave) filter is in line with the TX/RX path to significantly reduce out-of-band interference as well as harmonic output.

As shown in the block diagram, the receive path utilizes the same Tx / Rx switch. The receive path is passive without any additional amplification.

The Freescale SoC is clocked at 100MHz using a 15 ppm crystal, to maintain frequency stability. A 32.768 kHz real-time clock IC is utilized to maintain SoC clocking operation during the low power / standby mode. An additional external flash memory IC (serial) with a capacity of 2 MB is utilized for additional data storage. The Freescale Kinetis processor has the ability to control MC12311 power and reset as needed for hibernate and low power modes.

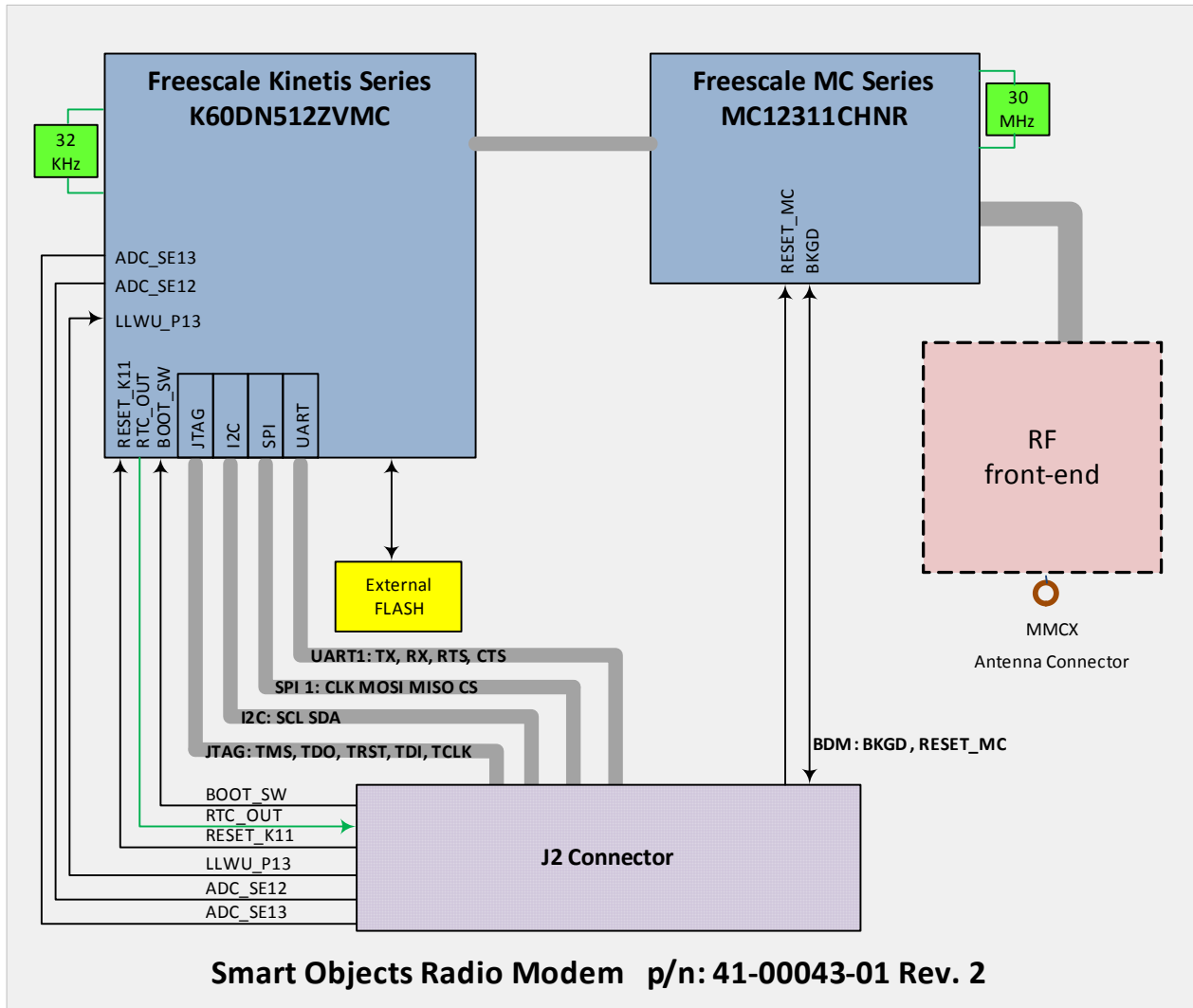


Figure 1. VN400 Functional Block Diagram

The following section presents the I/O connector pin assignments of the VN400.

An external processing entity can talk to the VN400 using UART and SPI communication channels. The current channel used for application communication is selected by J2-pin25 (PTA5).

The UART port is also used for serial firmware upload under J1-pin17 control (BOOT_SW).

Figure 2 shows the VN400 pin assignments on the 30 pins Hirose high density connector.

Note: For minimum battery consumption, all unused GPIOs should be left unconnected.

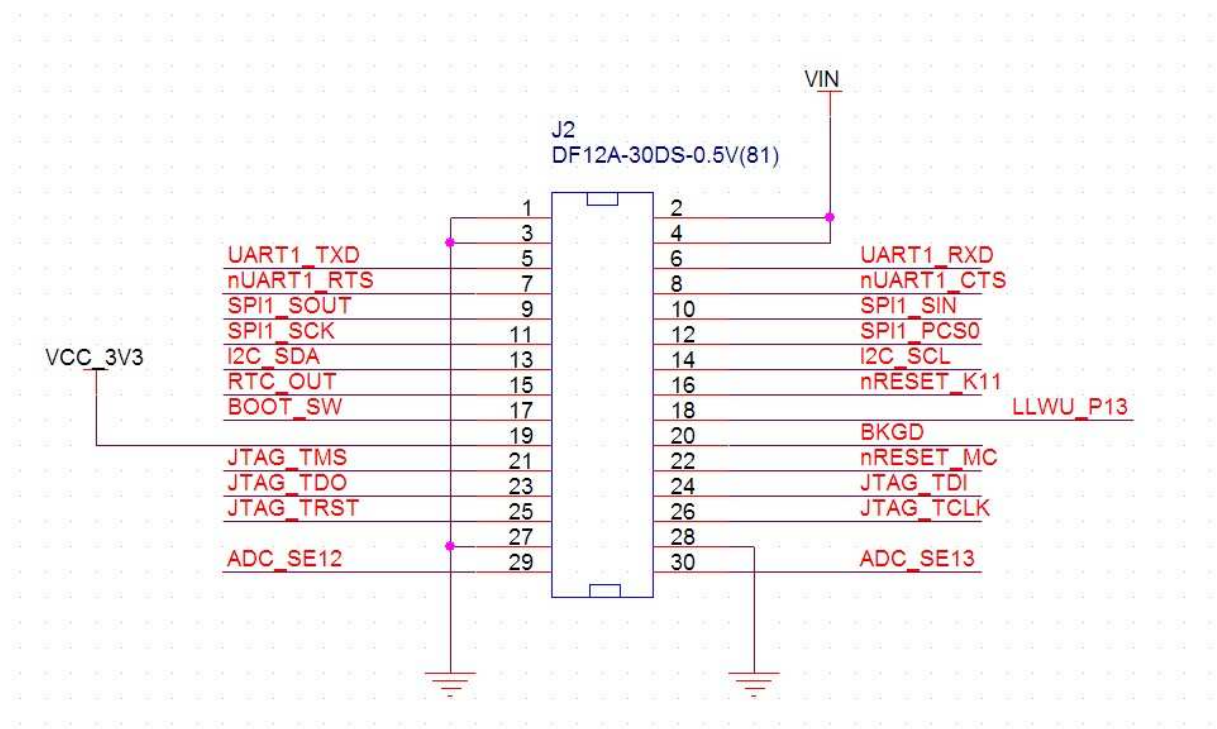


Figure 2. VN400 J2 Pinout

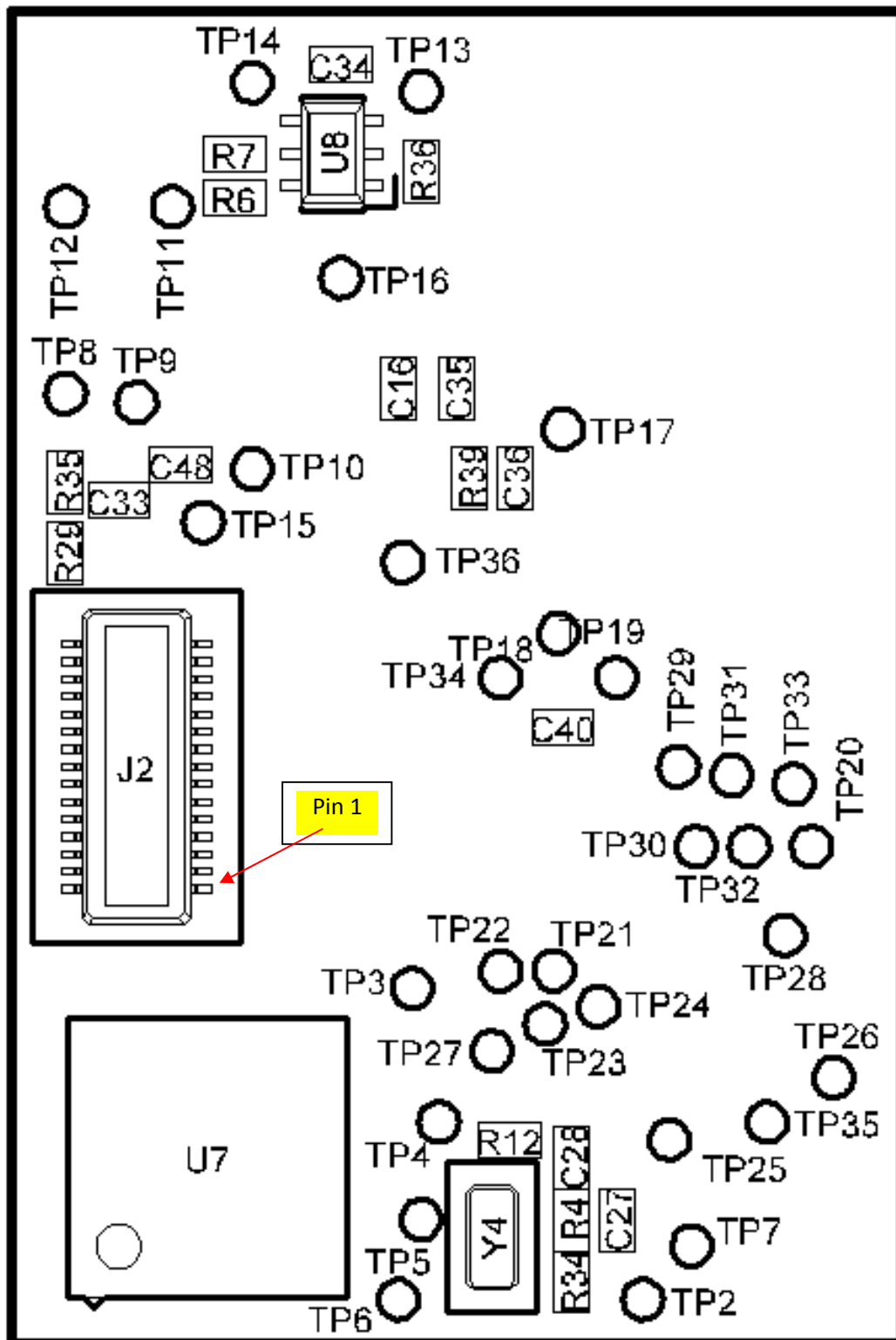


Figure 3. VN400 PC Board Bottom View Showing J2, Pin 1 Location

No.	Name	Description	Type	Dir	Comments
1	GND	Ground	N/A	N/A	
2	Vin	Voltage Input 3.3V	N/A	I	
3	GND	Ground	N/A	N/A	
4	Vin	Voltage Input 3.3V	N/A	I	
5	UART1_TXD	UART1 Transmit Data	DIG	O	Standard UART communication port.
6	UART1_RXD	UART1 Receive Data	DIG	I	Standard UART communication port.
7	nUART1_RTS	UART1 Request to Send	DIG	O	Standard UART communication port.
8	nUART1_CTS	UART1 Clear to Send	DIG	I	Standard UART communication port.
9	SPI1_SOUT	SPI Master Data Out	DIG	O	Standard SPI Communication port.
10	SPI1_SIN	SPI Master Data In	DIG	I	Standard SPI Communication port.
11	SPI1_SCK	SPI Clock Out	DIG	O	Standard SPI Communication port.
12	SPI_PCS0	SPI Slave Select	DIG	O	Standard SPI Communication port.
13	I2C_SDA	I2C Data Line	DIG	I/O	Standard I2C Communication
14	I2C_SCL	I2C Clock Line	DIG	O	Standard I2C Communication
15	RTC_OUT	RTC 1Hz Clock Out	DIG	O	See Notes (not available on current revision)
16	nRESET_K11	K11/K60 RESET pin	DIG	I	
17	BOOT_SW	BOOT Switch	DIG	I	Switch to Firmware Load mode BOOT_SW="1" – normal operation BOOT_SW="0" – firmware update
18	LLWU_P13	Wake-Up Interrupt	DIG	O	
19	3V3_OUT	Internal 3V3	N/A	O	Use for level shifting powering. Low current output <20mA.
20	BKGD	BDM Background Mode	DIG	I/O	Standard BDM interface MC12311
21	JTAG_TMS	JTAG Test Mode Select	DIG	I	Standard JTAG interface Kinetis
22	nRESET_MC	MC12311 Reset pin	DIG	I	Standard BDM interface MC12311
23	JTAG_TDO	JTAG Test Data Output	DIG	O	Standard JTAG interface Kinetis
24	JTAG_TDI	JTAG Test Data Input	DIG	I	Standard JTAG interface Kinetis
25	PTA5 (JTAG_TRST)	UART/SPI App Mode	DIG	I	Define communication channel used by application PTA5="1" – UART Mode PTA5="0" – SPI Mode
26	JTAG_TCLK	JTAG Test Data Clock	DIG	I	Standard JTAG interface Kinetis
27	GND	Ground	N/A	N/A	
28	GND	Ground	N/A	N/A	
29	ADC_SE12	ADC pin SE12	Analog	I	12 bit Single Ended ADC, Note: Analog Reference is Vdd=3.3V
30	ADC_SE13	ADC pin SE13	Analog	I	12 bit Single Ended ADC, Note: Analog Reference is Vdd=3.3V

Table 1. Pin Definitions for VN400 Applications

Note: The radio is powered directly from a 3.3 volt external power source for standard operation.

The radio IC has internal LDO regulators to provides a constant source for the PA, clock and other sections to maintain a stable and controlled output power range and to comply with regulatory requirements. ***Contact Nivis engineering for more information.

3. VN400 Power Supply Considerations

3.1 Key Specifications

Table 2. Key Specifications

Parameter	Min	Typ	Max	Units	Comment
Supply Voltage (regulated supply)	3.2	3.3	3.4	V	
Voltage on any digital I/O	-0.3	Vcc	Vcc + 0.3 V	V	
RF Output Level	-20		+15	dBm	Output power at antenna connector
Storage Temp Range (Max)	-40		+85	°C	
Operating Temp Range (Max)	-40		+85	°C	

3.2 Electrical Characteristics

Table 3. Electrical Characteristics

Parameter	Min	Typ	Max	Units	Comments
Voltage on analog pins	0	3.3	Vcc	V	
Voltage supply noise			200	mVpp	50Hz – 15MHz
Peak current		125	140	mA	TX mode, maximum output power
Operating relative humidity	10		90	%RH	Non condensing
Transmit current			124	mA	At 15 dBm output
Receive current		35	50	mA	
Hibernate current ¹⁾		38		µA	
Output High-level Voltage (IOH = 5 mA) (All digital outputs)	90% Vcc		Vcc	V	
Output Low Voltage (IOL = -5 mA) (All digital outputs)	0		10% Vcc	V	

Input Low Voltage (All digital inputs)	0	30% V _{cc}	V	
Input High-level Voltage (all digital inputs)	70% V _{cc}	V _{cc}	V	
Input hysteresis (all digital inputs)	0.06 V _{cc}		V	

For additional information please consult the VersaNode 400 datasheet.

4. VN400 Mechanical Drawings

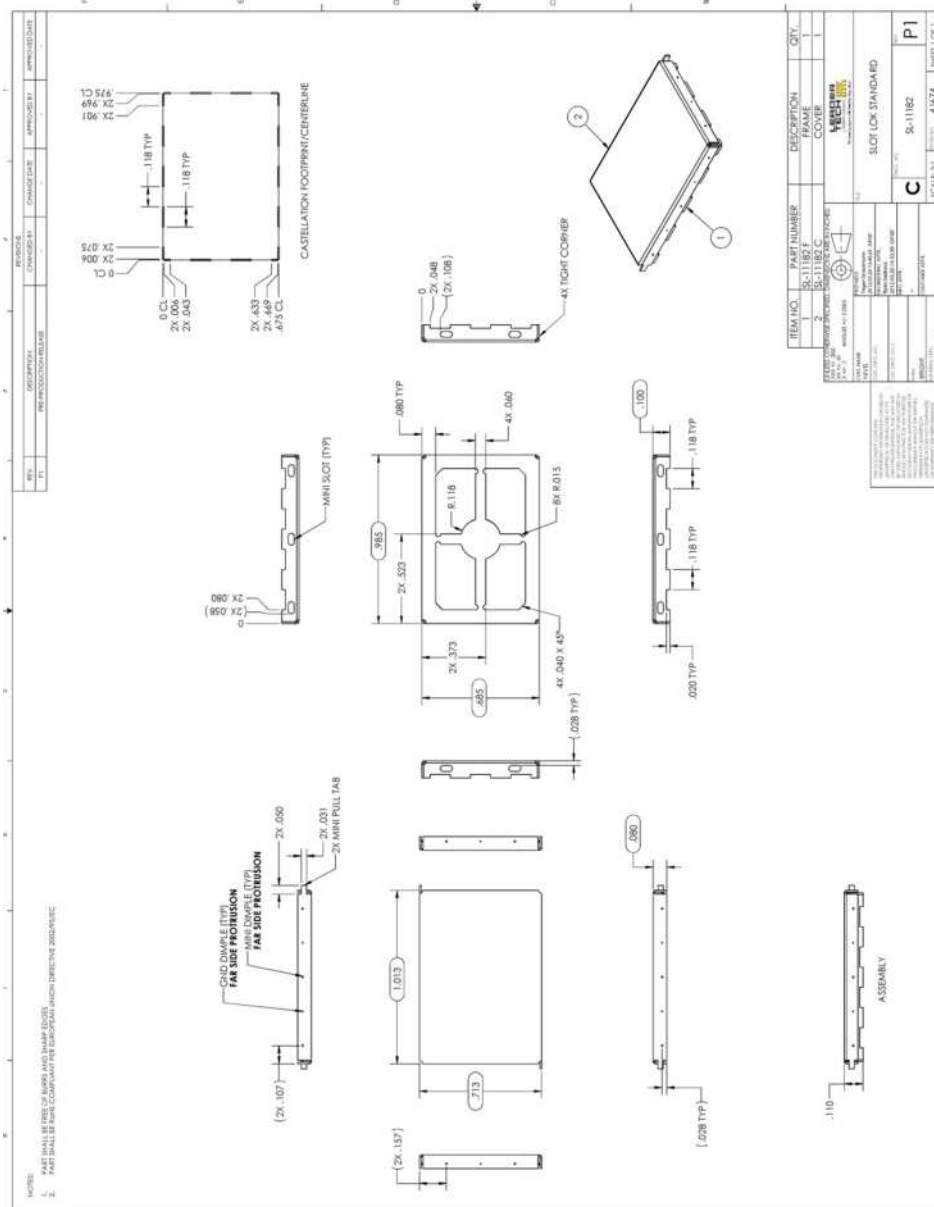


Figure 4. Shield

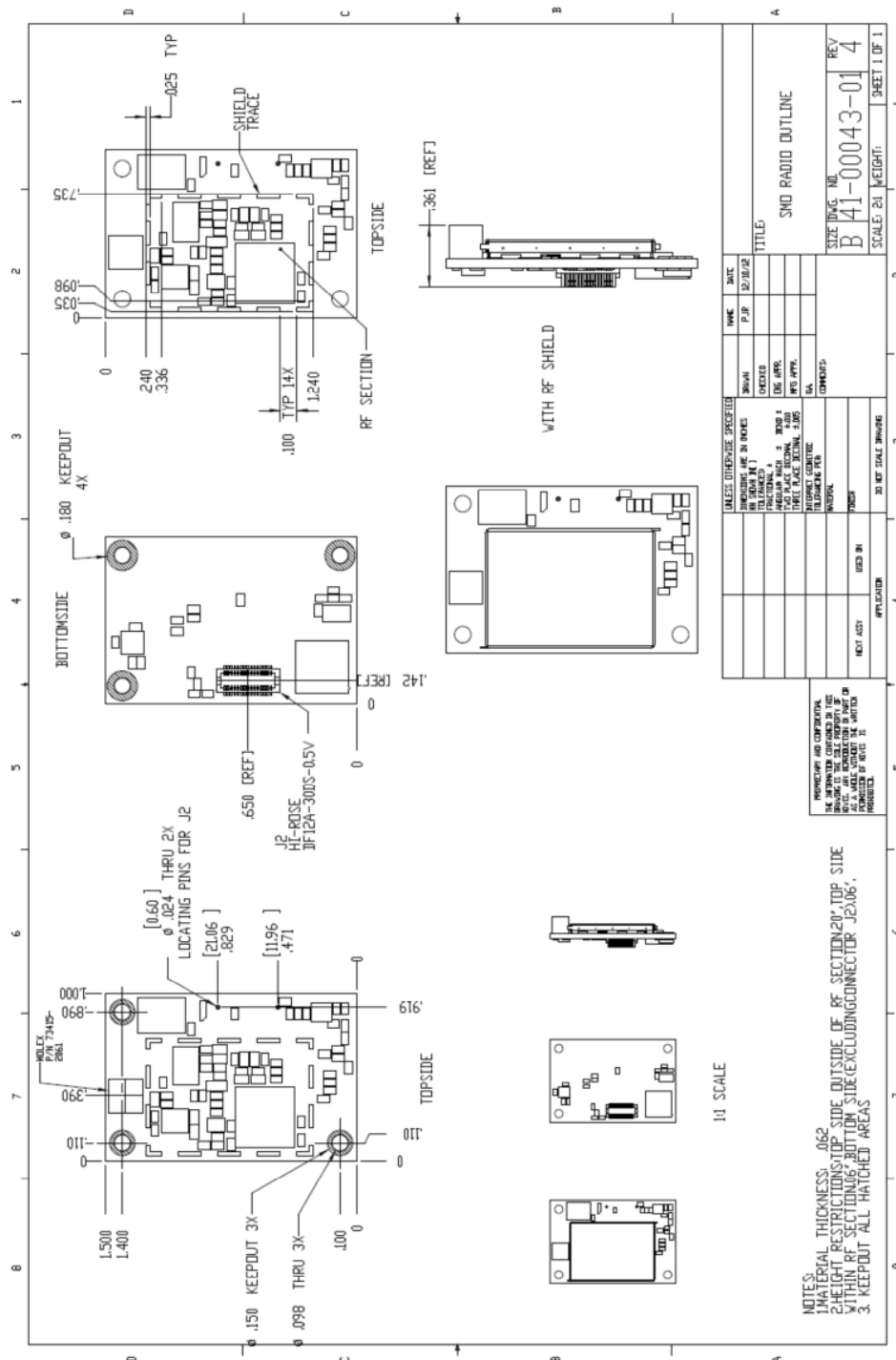


Figure 5. Dimension Drawing

Recommended Interconnect:

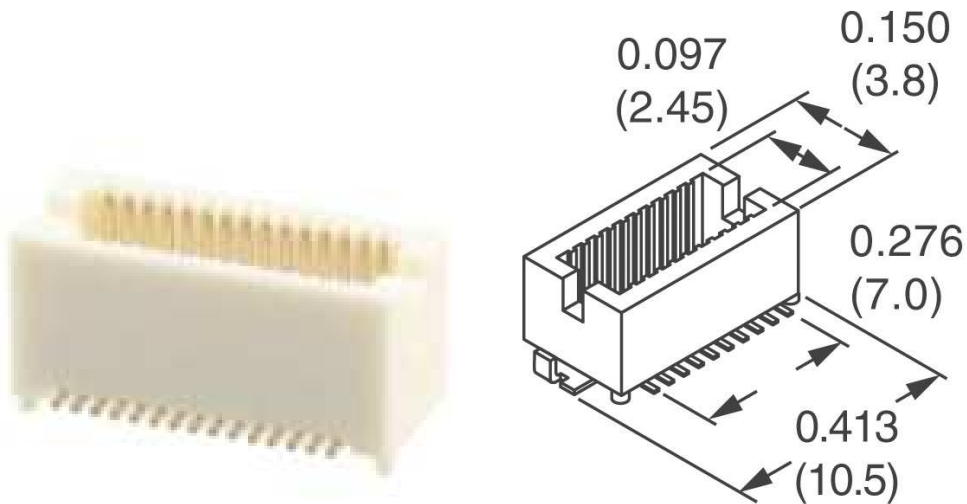
Manufacturer: **HIROSE**

Manufacturer P/N: **DF12(5.0)-30DP-0.5V(86)**

Description: **CONN HEADER 30POS 5MM SMD 0.5MM**

Datasheet Link: http://www.hirose.co.jp/cataloge_hp/e53700036.pdf

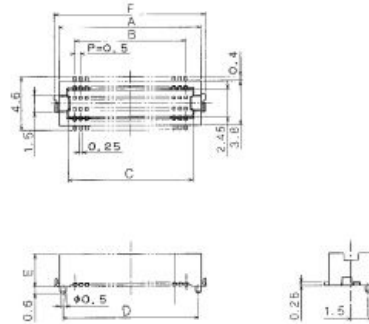
Vendor: [http://www.digikey.com/product-detail/en/DF12\(5.0\)-30DP-0.5V\(86\)/H11753TR-ND/951550](http://www.digikey.com/product-detail/en/DF12(5.0)-30DP-0.5V(86)/H11753TR-ND/951550)



The product information in this catalog is for reference only. Please request the Engineering Drawing for the most current and accurate design information.
All non-RoHS products have been discontinued as of 12/15/2024. Please check the products status on the Hirose website RoHS search at www.hirose-connectors.com, or contact your Hirose sales representative.

DF12 Series 0.5mm Pitch SMT Board to Board Connector

Header With metal fitting



Stacking Height: 3.5 to 5mm Product

Unit: mm

Part Number	CL No.	Number of Contacts	A	B	C	D	E	F	Remarks	RoHS
DF12 (3.5)-20DP-0.5V (86)	537-0028-7- 86	20	7.2	4.5	5.7	6.6	2.8	8.0	With metal fitting With boss	YES
DF12 (3.5)-30DP-0.5V (86)	537-0030-9- 86	30	9.7	7.0	8.2	9.1		10.5		
DF12 (3.5)-36DP-0.5V (86)	537-0031-1- 86	36	11.2	8.5	9.7	10.6		12.0		
DF12 (3.5)-40DP-0.5V (86)	537-0032-4- 86	40	12.2	9.5	10.7	11.6		13.0		
DF12 (3.5)-50DP-0.5V (86)	537-0034-0- 86	50	14.7	12.0	13.2	14.1		15.5		
DF12 (3.5)-60DP-0.5V (86)	537-0036-5- 86	60	17.2	14.5	15.7	16.6		18.0		
DF12 (4.0)-20DP-0.5V (86)	537-0053-4- 86	20	7.2	4.5	5.7	6.6	3.3	8.0		
DF12 (4.0)-30DP-0.5V (86)	537-0055-0- 86	30	9.7	7.0	8.2	9.1		10.5		
DF12 (4.0)-32DP-0.5V (86)	537-0926-2-86	32	10.2	7.5	8.7	9.6		11.0		
DF12 (4.0)-36DP-0.5V (86)	537-0056-2- 86	36	11.2	8.5	9.7	10.6		12.0		
DF12 (4.0)-40DP-0.5V (86)	537-0057-5- 86	40	12.2	9.5	10.7	11.6		13.0		
DF12 (4.0)-50DP-0.5V (86)	537-0059-0- 86	50	14.7	12.0	13.2	14.1		15.5		
DF12 (4.0)-60DP-0.5V (86)	537-0061-2- 86	60	17.2	14.5	15.7	16.6		18.0		
DF12 (5.0)-30DP-0.5V (86)	537-0155-4- 86	30	9.7	7.0	8.2	9.1	4.3	8.0	With metal fitting Without boss	YES
DF12 (5.0)-40DP-0.5V (86)	537-0157-0- 86	40	12.2	9.5	10.7	11.6		10.5		
DF12 (5.0)-50DP-0.5V (86)	537-0159-5- 86	50	14.7	12.0	13.2	14.1		12.0		
DF12 (5.0)-60DP-0.5V (86)	537-0161-7- 86	60	17.2	14.5	15.7	16.6		13.0		
DF12 (5.0)-60DP-0.5V (86)	537-0161-7- 86	60	17.2	14.5	15.7	16.6		15.5		
DF12B (3.5)-20DP-0.5V (86)	537-0328-0- 86	20	7.2	4.5	5.7	—	2.8	8.0		
DF12B (3.5)-30DP-0.5V (86)	537-0330-2- 86	30	9.7	7.0	8.2	—		10.5		
DF12B (3.5)-36DP-0.5V (86)	537-0331-5- 86	36	11.2	8.5	9.7	—		12.0		
DF12B (3.5)-40DP-0.5V (86)	537-0332-8- 86	40	12.2	9.5	10.7	—		13.0		
DF12B (3.5)-50DP-0.5V (86)	537-0334-3- 86	50	14.7	12.0	13.2	—		15.5		
DF12B (3.5)-60DP-0.5V (86)	537-0336-9- 86	60	17.2	14.5	15.7	—	3.3	18.0		
DF12B (4.0)-20DP-0.5V (86)	537-0353-8- 86	20	7.2	4.5	5.7	—		8.0	With metal fitting Without boss	YES
DF12B (4.0)-30DP-0.5V (86)	537-0355-3- 86	30	9.7	7.0	8.2	—		10.5		
DF12B (4.0)-32DP-0.5V (86)	537-0927-5-86	32	10.2	7.5	8.7	—		11.0		
DF12B (4.0)-36DP-0.5V (86)	537-0356-6- 86	36	11.2	8.5	9.7	—		12.0		
DF12B (4.0)-40DP-0.5V (86)	537-0357-9- 86	40	12.2	9.5	10.7	—		13.0		
DF12B (4.0)-50DP-0.5V (86)	537-0359-4- 86	50	14.7	12.0	13.2	—	4.3	15.5		
DF12B (4.0)-60DP-0.5V (86)	537-0361-6- 86	60	17.2	14.5	15.7	—		18.0		
DF12B (5.0)-20DP-0.5V (86)	537-0378-9- 86	20	7.2	4.5	5.7	—		8.0		
DF12B (5.0)-30DP-0.5V (86)	537-0380-0- 86	30	9.7	7.0	8.2	—		10.5		
DF12B (5.0)-36DP-0.5V (86)	537-0381-3- 86	36	11.2	8.5	9.7	—		12.0		
DF12B (5.0)-40DP-0.5V (86)	537-0382-6- 86	40	12.2	9.5	10.7	—	4.3	13.0		
DF12B (5.0)-50DP-0.5V (86)	537-0384-1- 86	50	14.7	12.0	13.2	—		15.5		
DF12B (5.0)-60DP-0.5V (86)	537-0386-7- 86	60	17.2	14.5	15.7	—		18.0		

Note : Please order the embossed tape packaging product per reel. (1000 pcs./reel)

Figure 6. Recommended Interconnect

5. Appendix A: FCC Related Statements

General Statements (For all devices):

Warning: Changes or modifications to this device not expressly approved by Nivis, LLC could void the user's authority to operate the equipment.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.

(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND

(2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.

FCC Specific Statements:

For Class B Devices:

"NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.*
- Increase the separation between the equipment and receiver.*
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- Consult the dealer or an experienced radio/TV technician for help."*

RF Exposure

"This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

6. Appendix B: Industry Canada Related Statements

Industry Canada Specific Statements:

Antenna (General):

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'IndustrieCanada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour

l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Detachable Antenna:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégoriel) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Approved Antenna:

Type	Gain
½ Wave Whip	2 dBi

Compliance:

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Label Information

Additional Requirements For Modular Approved Devices:

When a modular device is used in an end product where the label of the module is not visible, the host device must have an exterior label to include the information shown below. If a label for the host device is not available, the manual must provide information to the integrator on labeling requirements.

Contains FCC ID: SQB-NIVISVN400

Contains IC: 6546A-NIVISVN400