FSK MULTICHANNEL TRANSCEIVER 868.30 MHz

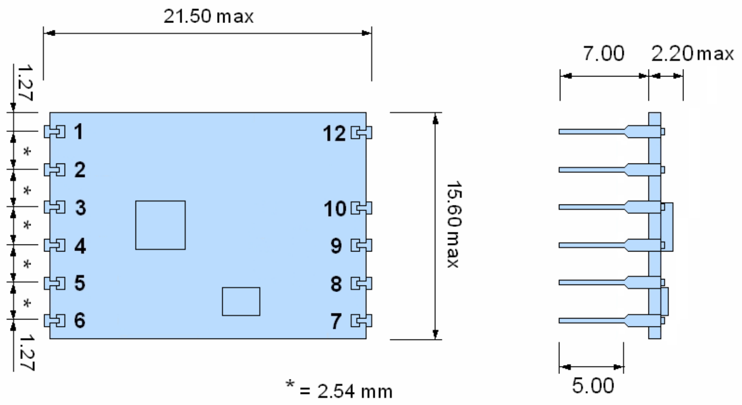
Product Code: **32000985A**

DESCRIPTION:
The 32000985A transceiver module is a multichannel transceiver completely programmable operating in the 868 MHz band.
The transceiver has based on CC1101 RF IC manufactured by Texas Instruments; for programming instructions see the related datasheet.

HIGHLIGHTS:
50 Ω RF Input/output
SPI interface for the setup of the transceiver
Compliant with **REACH** and **RoHS** directives.

APPLICATIONS:
Security systems, data transmission, industrial controls, home automation, etc.

MECHANICAL CHARACTERISTICS



PIN DESCRIPTION

Pin	Name	Description	
1	SI	SPI interface → Data Input	Note 8
2	SCLK	SPI interface → Clock	
3	SO	SPI interface → Data Output	
4	GDO2	Generic I/O	
5	GDO0	Generic I/O	
6	CSn	SPI interface → Chip Select	
7	GND	Ground (0 V)	
8	GND	Ground (0 V)	
9	GND	Ground (0 V)	
10	RF I/O	RF I/O	
12	VCC	Voltage power supply	

RF WIRELESS

MIPOT S.P.A.
Via Corona, n.5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel.+39 0481 630200 ra.
Fax +39 0481 62387
mipot@mipot.com

MIPOT HI-TECH COMPANY

RF WIRELESS

ABS. MAX. RATINGS

Transceiver Power Supply +Vcc (pin 15)	+ 3.9 V
Max. Voltage allowed on input pins (pins 1 ÷ 6)	+Vcc + 0.3 V, max. 3.9 V
Storage Temperature	- 40 ÷ 100 °C
Operating Temperature	- 20 ÷ 70 °C
Radio Frequency Input, pin 2:	10 dBm

ELECTRICAL CHARACTERISTICS @ 25 °C

Parameter		***Min.***	***Typ.***	***Max.***	***Unit***	***Notes***
Power Supply Voltage (+Vcc)		1.8	3.0	3.6	V	Note 8
Supply Current	Tx mode	-	35	-	mA	
	Rx mode	-	18	-	mA	Note 2
	Power down	-	0.2	-	µA	
V_{low} on Input pins		0	-	0.7	V	
V_{high} on Input pins		+Vcc - 0.7	-	+Vcc	V	
V_{low} on Output pins		0	-	0.5	V	Note 3
V_{high} on Output pins		+Vcc - 0.3	-	+Vcc	V	Note 3

RECEIVER CHARACTERISTICS @ 25 °C

Sensitivity	-	-107	-	dBm	Note 5
Operating frequency	-	868.30	-	MHz	Note 6
Frequency accuracy	-	±25	-	kHz	Note 7
Digital filter bandwidth	58	-	812	kHz	Note 4
FSK Deviation	±1.5	-	±380	kHz	Note 4
Baud rate RF	1.2	-	500	kBaud	Note 4

TRANSMITTER CHARACTERISTICS @ 25 °C

Output Power (on 50 Ω load)	-	+10	-	dBm	Note 1
Operating Frequency	-	868.30	-	MHz	Note 6
FSK Deviation	±1.5	-	±380	kHz	Note 4
Frequency accuracy	-	±25	-	kHz	Note 7
Baud rate RF	1.2	-	500	kbaud	Note 4

Note 1: All RF parameters measured with RF I/O (pin 10) connected to 50-Ω impedance signal source or load, 3 V power supply if not otherwise specified.

Note 2: Measured at the RF input sensitivity limit, 1200 baud, register settings for sensitivity optimization.

Note 3: Voltage levels guaranteed up to a maximum 4-mA pin output current.

Note 4: Parameter programmable by user. Values also depending on crystal value (26 MHz).

Note 5: Measured with 2-FSK modulation, 1200-baud dev. 5.2 kHz register settings for sensitivity optimization, 58 kHz digital filter bandwidth.

Note 6: Center frequency programmable by user in the 868 MHz band.

Note 7: Tolerances defined on temperature and voltage limit operating conditions.

Note 8: Further information on operating and programming modes for the radio chip available for the CC1101 datasheet at: http://focus.ti.com/docs/prod/folders/print/cc1101.html

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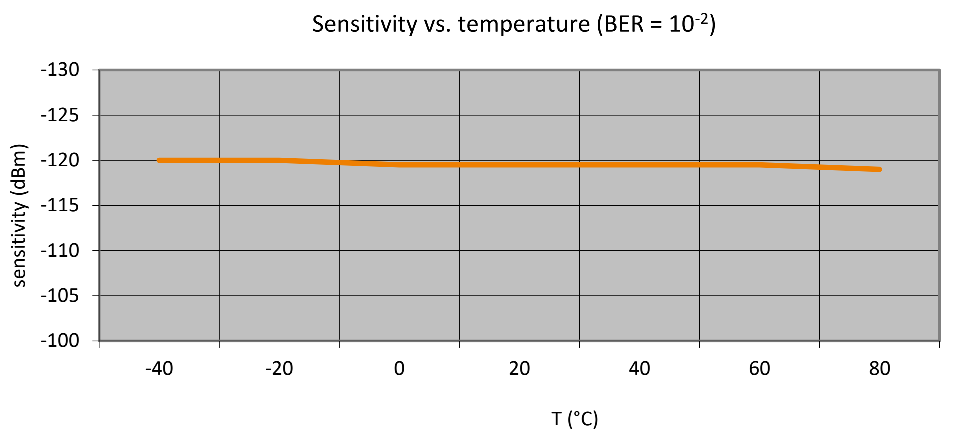
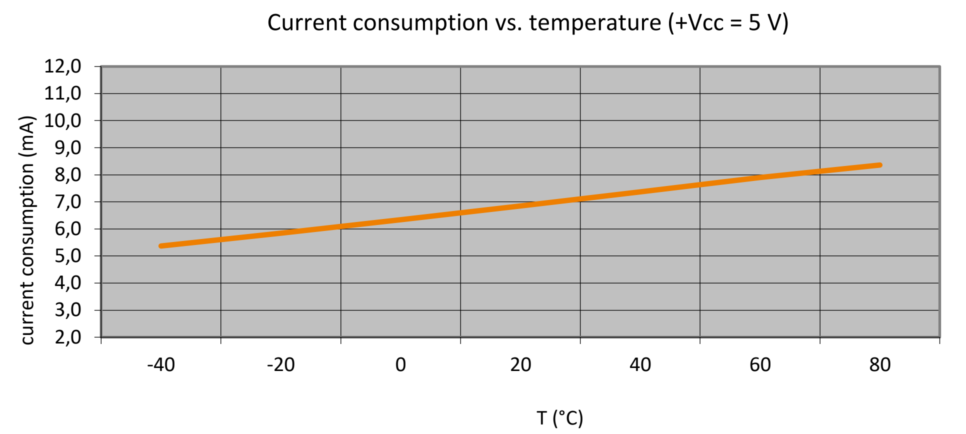
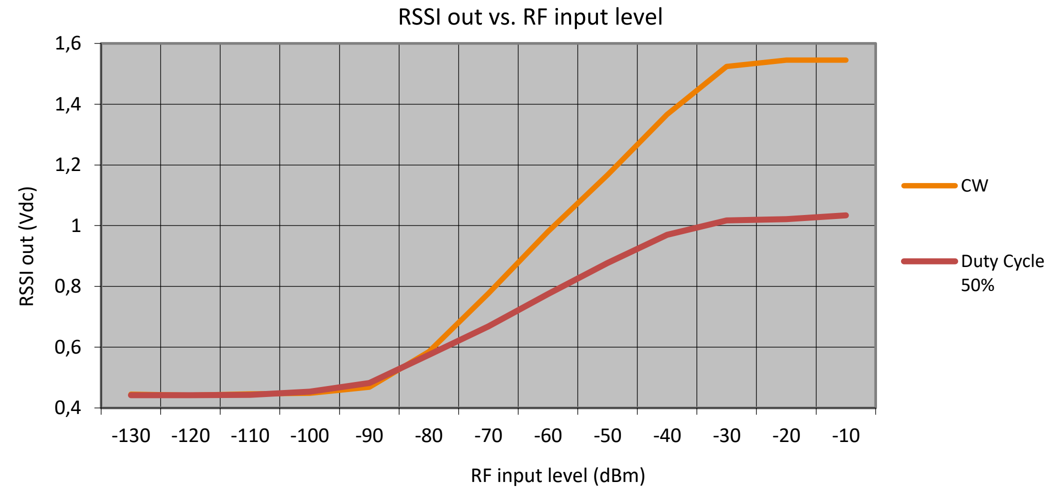
TYPICAL CHARACTERISTICS (*) ------ da inserire misure ------







(*): All graphs must be considered as indicative typical results in accordance with temperature variation.

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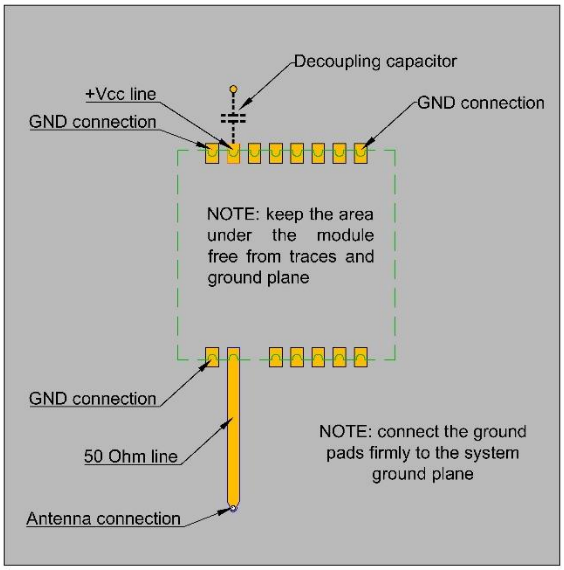
GUIDELINES FOR CORRECT POWER SUPPLY AND GROUND PLANE LAYOUT DESIGN IN TRANSCEIVER APPLICATIONS

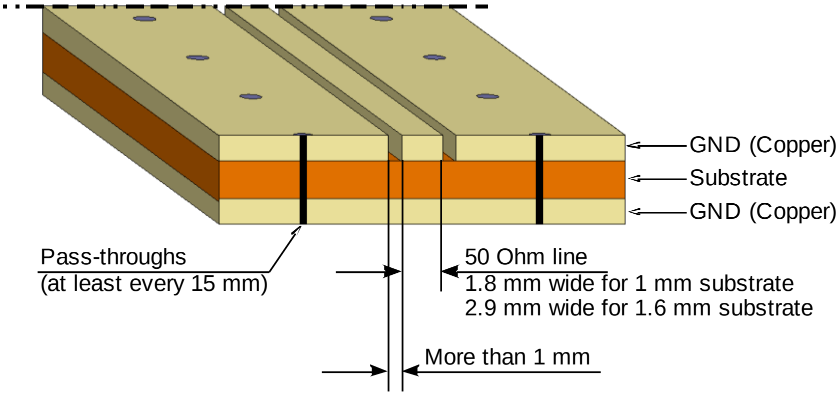
In dealing with applications that use Mipot Transceiver Modules, must be taken care in designing the layout of the ground plane and power supply paths with particular attention to some general rules, as described in the following sections.

Below has shown a typical layout of the bottom side of a PCB suited for a Transceiver:



Note: Decoupling capacitors must have placed on the top side of the PCB.
This is a generic layout; some modules could be slightly different (e.g. missing connection of pin 1 and/or pin 15)

Ground Layer:
- Must be present around the antenna output area;
- Must cover all the area around the receiver module;
- Circuit design should be on a 2-side PCB, connecting both ground planes with pass-through vias at least 15 mm each other.



Note: dimensions in the picture above have referred to a FR4 substrate PCB

Power Supply path:
- Needs a good filtered DC component;
- Connect decoupling ceramic capacitors directly near the power supply pin(s), taking care to use in parallel multiple capacitance values at different pins (10 nF to 1 µF).
- Ensure a good signal and power decoupling between Digital, RF and Power circuitry.
- Keep separate path for Power, Digital and Radio blocks.

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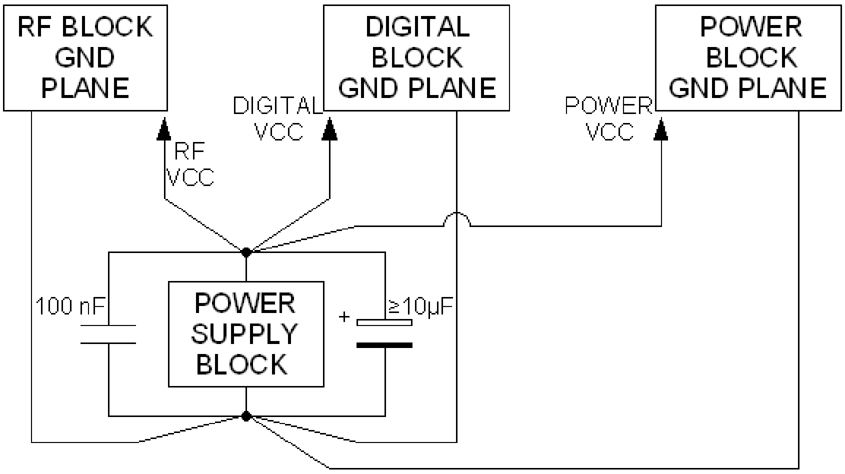
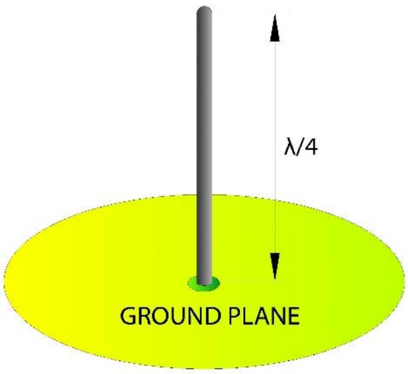
Follow the below recommended Power Supply Path structure:



HINTS FOR ANTENNA SELECTION

A good antenna design is required to achieve the maximum performances from Mipot modules and obtain the required range.

The recommended antenna is the ***Vertical Quarter-Wave Monopole Antenna (vertical Whip)***, positioned on a ground plane having a radius *R* ≥ *L* (where *L* is the antenna length) that is be kept free from other components and metallic objects.



The antenna length L can be quickly determined as:

$$L[cm] = \frac{7500}{\text{Frequency[Mhz]}}$$

Typical length for a whip operating at 434 MHz is 17 cm (6.7 inches); for a frequency of 868 MHz the length will be 8.6 cm (3.4 inches). Some length corrections will occur in depending upon the thickness, the material, the coating, etc., in order to obtain a correctly tuned device. The antenna impedance here is approximately 35 Ω, so a matching network will be mandatory to match the 50-Ω impedance of the radio module.

Other solutions are obviously possible, keeping in mind that antenna design varies depending on the specific application, the materials used, the layout structure and the size of the ground plane; so, a *specific design* has recommended getting the maximum performance.

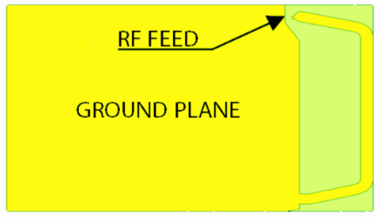
In designing antennas, it is useful to follow some general considerations:

- Keep the area near the antenna as free as possible from other components and metallic objects.
- Keep the antenna feeder as short as possible in order to reduce losses and unwanted signal radiate.
- If possible, use a large ground plane having a radius R ≥ L, where L is the antenna length, placing the antenna at the center.
- Ensure good electrical connections for the ground layer.
- If there is a need for long antenna connections, use a good 50-Ω coaxial cable with low insertion loss.

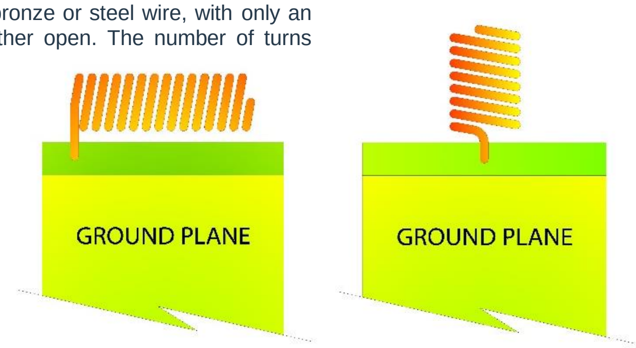
As alternative to the vertical whip, some antenna solutions can give satisfactory results if chosen correctly and dimensioned:

- **PCB antenna:**
When space in height is an issue, a quarter-wave-long PCB track is also a valid horizontal polarized antenna. Trace length will be 10 % to 20 % shorter than the theoretical value, depending on the dielectric and the thickness of the PCB. If the device is to be handheld, the antenna could be even shorter, to minimize the effect of human body. Shorter version of these antennas implicates a loss of efficiency and a poor range. An impedance compensation network has needed to obtain the correct match with the radio.

- **PCB Loop antenna:**
This is typically a PCB track with one end connected to the RF device and the other connected to the ground. An impedance compensation network has needed to have the correct match with the radio.
It is the less efficient antenna, having a reduction of efficiency by 15-20 dB respect the quarter wave one, but it is less detuned by hand effects, so it is often used in handheld transmitters.
Since it has very low gain and a narrow bandwidth, it would be taken care in tuning through a matching network.



- **Helical antenna:**
This is a coil wound with copper, phosphor bronze or steel wire, with only an end connected to the RF device and the other open. The number of turns depends upon the wavelength, the coil diameter, the spacing of the turns and the diameter of the wire; the trick is winding a coil with a great number of turns and then reducing them by cutting until it has tuned at the operating frequency. Spreading or compressing the coil achieve fine-tuning. If the coil has wound tightly enough, it may be shorter than one-tenth of a wavelength.
Thanks to its high Q factor, this antenna has typically a narrow bandwidth, and the spacing of the turns has great influence on the performance. For this reason, it can have easily de-tuned by nearby objects including human body, so it might not be suitable for handheld devices.
This antenna must have a good ground plane, and its performance is very sensitive to his position versus the ground plane. The antenna feeder must be as short as possible in order to reduce losses and unwanted signal radiate.



REVISION HISTORY

Revision	Date	Description
3.4	27-08-2019	Final release

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