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Spec No: 001-72428

Spec Title: SCHEMATIC REVIEW CHECKLIST FOR
WIRELESSUSB(TM) NL - AN72428

Replaced by: NONE

Schematic Review Checklist for WirelessUSB™ NL

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Associated Part Family: CYRF8935

Associated Code Examples: None

Related Application Notes: For a complete list, [click here](#).

AN72428 discusses the hardware considerations and recommended practices for systems that use WirelessUSB™ NL, the Cypress third generation 2.4-GHz low-power RF technology. WirelessUSB NL operates in the 2.4-GHz ISM band and delivers the next level of low-power performance on a small 4-mm × 4-mm footprint.

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1 Introduction

WirelessUSB NL enables a Gaussian frequency-shiftkeying (GFSK) radio by using a differentiated single-mixer, closed-loop modulation design that optimizes power efficiency and interference immunity. Closed-loop modulation effectively eliminates the problem of frequency drift, which enables WirelessUSB NL to transmit up to 255-byte payloads without repeatedly having to pay power penalties for relocking the phase-locked loop (PLL) as in open-loop designs.

The hardware considerations when you use WirelessUSB NL in a system are as follows.

2 Crystal

- The only crystal frequency supported is fundamental mode, parallel resonant 12.000 MHz, with a frequency tolerance of ± 40 ppm and a maximum ESR of 80 Ω .
- Make sure that the load capacitance values for the crystal match with the specifications provided by crystal vendor. Note that WirelessUSB NL places no constraints on these values.
- Although $2.2 \text{ k}\Omega \pm 10\%$ is a common value for the crystal, you may need to modify the value of the series resistance (R_s) in the crystal circuit based on crystal vendor's specification.

- The feedback resistor (R_f) between buffer input and output serves to self-bias the buffer, with a typical recommended value of 680 k Ω through $2.2 \text{ k}\Omega \pm 10\%$.

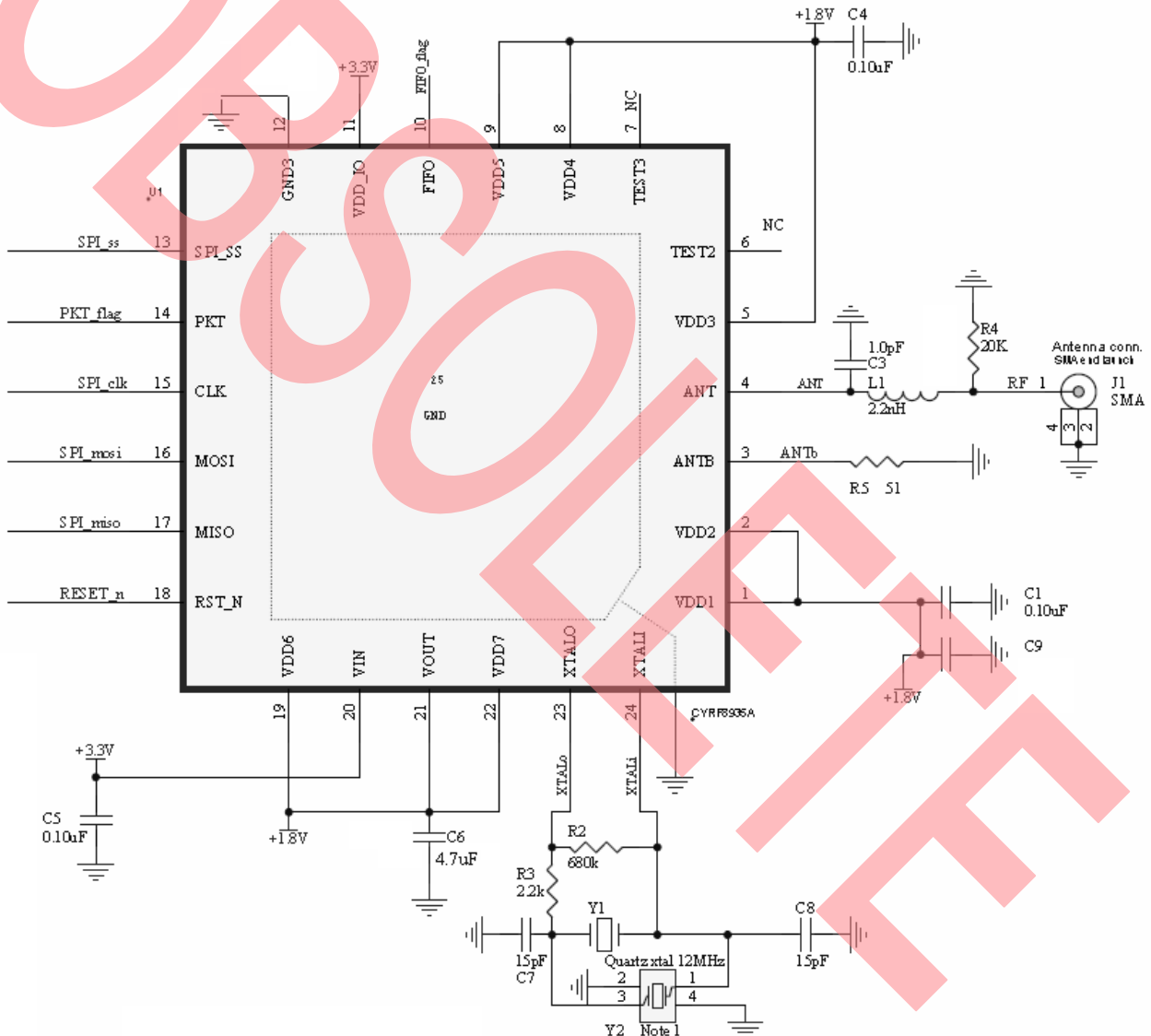
3 Decoupling for Power Supplies

- VDD1 and VDD2 can share a single $0.10 \mu\text{F} \pm 10\%$ decoupling capacitor.
- VDD3, VDD4, and VDD5 can share a single $0.10 \mu\text{F} \pm 10\%$ decoupling capacitor.
- V_{in} requires a $0.10 \mu\text{F} \pm 10\%$ decoupling capacitor. VDD6, VDD7, and V_{out} can share a single
- decoupling capacitor of $0.10 \mu\text{F} \pm 10\%$ depending on power supply noise at V_{in} (see the following table),

Input Noise at V_{in} (50 kHz Component)	Recommended Capacitor
< 10mV pk	0.10 μF
10 – 50 mV pk	4.7 μF
50 – 100 mV pk	$2 \times 4.7 \mu\text{F}$

4 Miscellaneous Recommendations

- The ANT pin requires a DC path to ground. If the antenna does not provide a ground end, a resistor of $20\text{ k}\Omega \pm 20\%$ to ground should be placed on the antenna side end of the matching network (see example schematic in the WirelessUSB NL datasheet).
- The ANTb (differential antenna input/output) pin should have a resistance to ground of $51\ \Omega \pm 20\%$. This is for matching the $50\ \Omega$ impedance of ANTb.
- The digital interface operates at VDD_IO. Any pull-ups on SPI lines should be pulled up to this level. Typically, VDD_IO should be the same level as MCU VDD.



- It is recommended that you place test points on the SPI lines to enable interface debugging.
- A simple matching LC network is recommended for the antenna matching and should consist of a 1.0 pF capacitor and a 2.2 nH inductor.
- RF pins (ANT, ANTb) should be routed away from noisy power supplies for the best RF performance.
- Vin pin: This is the power supply input of the LDO of the NL radio, with a range of 1.9 V to 3.3 V. The WirelessUSB NL internal LDO has an output of approximately 1.67 V to 1.8 V to supply voltage to its internal radio circuit. For battery-powered systems, Vin can be directly connected to the battery output if there are two batteries in series. This bypasses the external DC-DC and saves system power consumption.
- FIFO_FLAG pin: This is needed only when the Tx or Rx packet length is greater than approximately 63 bytes. For short packets (less than 63 bytes), FIFO_FLAG is not needed and can be left floating.
- NL_RESET Pin should be pulled up with 10 K resistor to avoid any improper resets and radio lock ups.
- PKT_Flag pin: This gives a hardware indication of a packet received. If it is possible to poll register 48 for this information, then this pin is not strictly necessary and can be left floating. NL radio driver released by Cypress no longer use this pin. However, it may be used again in the future.

5 Summary

AN72428 discussed the hardware considerations and recommended practices for systems that use WirelessUSB™ NL.

6 Related Application Notes

[AN4004 - Interference Mitigation Challenges and Solutions in the 2.4 to 2.5 GHz ISM Band](#)

[AN48399 - WirelessUSB LP Transceiver PCB Layout Guidelines](#)

[AN64285- WirelessUSB NL Low Power Radio Recommended Usage and PCB Layout](#)

[AN5033 - WirelessUSB Dual Antenna Design Layout Guidelines](#)

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Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	3536165	CSAI	03/06/2012	New application note
*A	4705122	CSAI	04/29/2015	Updated to latest Appnote template
*B	5740123	ANKC	05/23/2017	Obsoleting the AN

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