Application Note: JN-AN-1252

High Power Support

Supporting High Power Mode on a JN5189/QN9090/K32W device.

1 Application Note Overview

The following devices

- JN5189(T)/JN5188(T)
- QN9090(T)/QN9030(T)
- K32W061/K32W041

feature an integrated radio, which can be used with an external Front End. This application note is concerned with setting up the device for hardware designs that uses a FEM (FrontEnd module).

1.1 Contents

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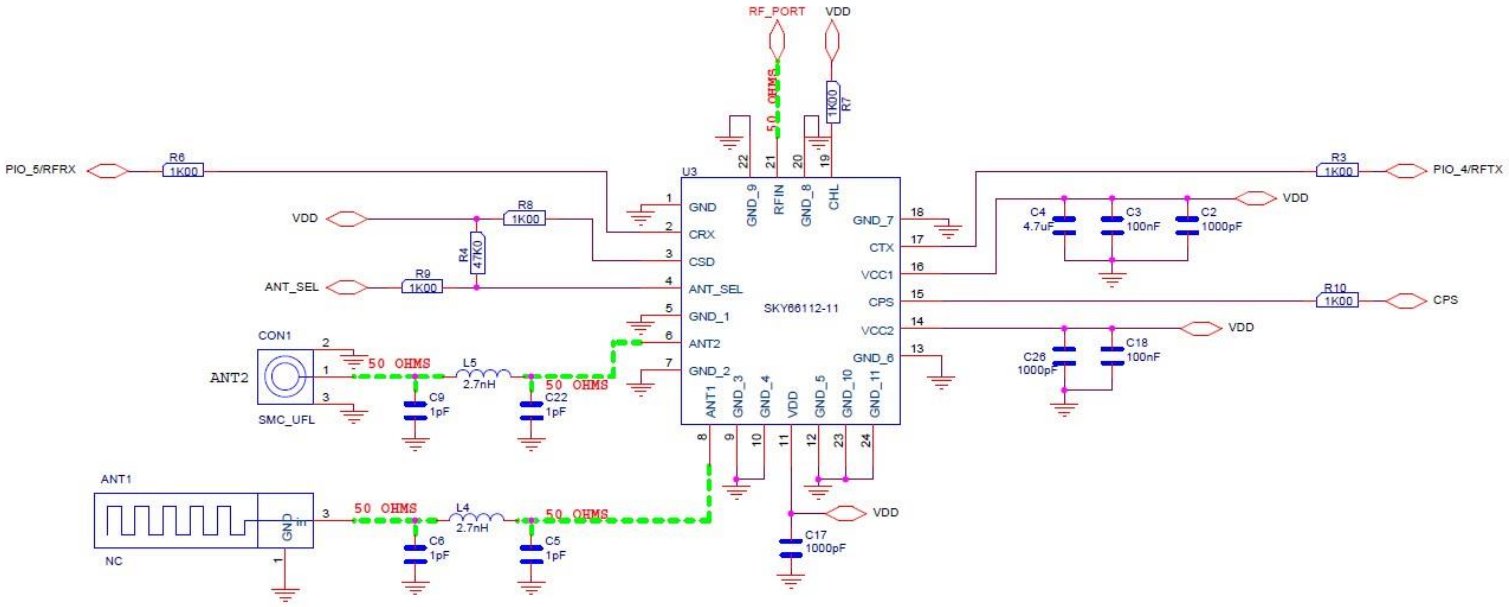
2 FEM Design

The parameters used in this example are suitable for a test design based on a Skyworks SKY66112-11. The exact parameters needed for compliance with different Front Ends or different layouts will require additional testing to confirm that the parameters used are compliant. The examples design used is shown below:



3 What is Required

To support a Front-End module the following is required

1) Set up RX and TX DIO control
2) Set the compliance limit parameter on the radio

3.1 Setting up the DIO

Some of the PIO lines can be used to generate RFRX and RFTX signals. These signals are connected directly from the MODEM with the device and indicate if the device is in RX or TX mode and, by implication, if the MODEM is idle. Any of the PIOS that have RFRX and RFTX options can be used from the table below

I/O Names	FUNC0	FUNC1	FUNC2	FUNC3	FUNC4	FUNC5	FUNC6	FUNC7
PIO0_0	GPIO 0	USART0_SCK	USART1_TXD	-	PWM0-PU	SPI1_SCK	-	PDM0_DATA
PIO0_1	GPIO 1	-	USART1_RXD	-	PWM1-PD	SPI1_MISO	-	PDM0_CLK
PIO0_2	GPIO 2	SPI0_SCK	USART0_RXD	-	PWM2-PD	SPI1_MOSI	ISO7816_RST	MCLK
PIO0_3	GPIO 3	SPI0_MISO	USART0_TXD	-	PWM3-PU	SPI1_SSELN0	ISO7816_CLK	-
PIO0_4	GPIO 4	SPI0_MOSI	USART0_CTS	-	PWM4-PU	SPI1_SSELN1	ISO7816_IO	RFTX
PIO0_5	GPIO 5	SPI0_SSELN	USART0_RTS	-	SPI1_MISO	SPI1_SSELN2	-	RFRX
PIO0_6	GPIO 6	SPI0_SCK	USART0_RTS	CT32B1_MAT0	PWM6-PD	I2C1_SCL	USART1_TXD	ADE
PIO0_7	GPIO 7	SPI0_MISO	USART0_CTS	CT32B1_MAT1	PWM7-PD	I2C1_SDA	USART1_RXD	ADO
PIO0_8	GPIO 8	SPI0_MOSI	USART0_TXD	CT32B0_MAT0	PWM8-PU	ANA_COMP_OUT	RFTX	PDM1_DATA
PIO0_9	GPIO 9	SPI0_SSELN	USART0_RXD	CT32B1_CAP1	PWM9-PU	USART1_SCK	ADO	PDM1_CLK
PIO0_10	GPIO 10	CT32B0_CAP0	USART1_TXD	-	RFTX	I2C0_SCL	SPI0_SCK	PDM0_DATA
PIO0_11	GPIO 11	CT32B1_CAP0	USART1_RXD	-	RFRX	I2C0_SDA	SPI0_MISO	PDM0_CLK
PIO0_12	GPIO 12	IR_BLASTER	SWCLK	-	PWM0-PU	I2C1_SCL	SPI0_MOSI	ANA_COMP_OUT
PIO0_13	GPIO 13	SPI1_SSELN2	SWDIO	-	PWM2-PU	I2C1_SDA	SPI0_SSELN	-
PIO0_14	GPIO 14	SPI1_SSELN1	USART0_SCK	CT32B0_CAP1	PWM1-PU	SWO	MCLK	RFTX
PIO0_15	GPIO 15	SPI1_SCK	ANA_COMP_OUT	-	PWM3-PU	I2C0_SCL	PDM1_DATA	RFRX
PIO0_16	GPIO 16	SPI1_SSELN0	ISO7816_RST	-	PWM5-PU	I2C0_SDA	PDM1_CLK	SPIFI_CSN
PIO0_17	GPIO 17	SPI1_MOSI	ISO7816_CLK	SWO	PWM6-PD	CLK_OUT	-	SPIFI_IO3
PIO0_18	GPIO 18	SPI1_MISO	ISO7816_IO	CT32B0_MAT1	PWM7-PD	USART0_TXD	-	SPIFI_CLK
PIO0_19	GPIO 19	ADO	USART1_RXD	CLK_IN	PWM4-PD	USART0_RXD	-	SPIFI_IO0
PIO0_20	GPIO 20	IR_BLASTER	USART1_TXD	-	PWM8-PD	RFTX	-	SPIFI_IO2
PIO0_21	GPIO 21	IR_BLASTER	USART1_SCK	-	PWM9-PU	RFRX	SWO	SPIFI_IO1

Special PIO functions are setup using IOCON_PinMuxSet. To use this function, include the following header

#include "fsl_iocon.h"

In our example, the required functions are on DIO4 and DIO5 using IOCON_FUNCTION 7. This is done with the following two lines of code:

```
IOCON_PinMuxSet(IOCON, 0, 4, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
IOCON_PinMuxSet(IOCON, 0, 5, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
```

4 Zigbee 3.0 Applications

4.1 Setting up the Radio Parameters

There are two functions that are defined to set up the radio. Both should be used in conjunction to configure the radio. These functions are defined in AppApi.h.

The first function is

PUBLIC void vAppApiSetRadioTxModes(teRadioTxMode eTxMode, teRadioTxMode eTxModeCh26);

This is concerned with changing the radios internal settings to set the radio is in different proprietary modes affect currents and setting within the radio. The following are defined

E_RADIO_TX_MODE_STD = 0
E_RADIO_TX_MODE_PROP_1 = 1
E_RADIO_TX_MODE_PROP_2 = 2

The standard way to use this would be to set the radio XT mode to standard. If there are issues on radio channel 26 with band edge due to the output power from the front end then using proprietary mode for channel 26 may be required. In our example, the following is used:

```
vAppApiSetRadioTxModes(E_RADIO_TX_MODE_STD, E_RADIO_TX_MODE_PROP_2);
```

The second function is

PUBLIC void vAppApiSetComplianceLimits(int8 i8TxMaxPower,int8 i8TxMaxPowerCh26, uint8 u8CcaThreshold);

This function deals with standard parameters for the radio such as CCA threshold. These parameters should be evaluated using CMET.

In our example, the radio is set to output 4db and the CCA threshold is adjusted to 83 to deal the RX gain in the LNA and still be compliant with the IEEE802.15.4 specification. The following is used:

```
vAppApiSetComplianceLimits(4, 4, 83);
```


4.2 Editing the Zigbee 3.0 Application Notes

The code need to be added before **BEFORE** ZPS_eAplAfInit() is called. In 'JN-AN-1244-ZigBee-3-0-Light-Bulbs-for-JN518x', the most suitable location is in APP_vInitialiseNode() in app_zlo_light_node.c. Add the following code before ZPS_eAplAfInit() is called:

```
// Start of HP Support Initialisation
IOCON_PinMuxSet(IOCON, 0, 4, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
IOCON_PinMuxSet(IOCON, 0, 5, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
vAppApiSetComplianceLimits(4, 4, 83);
vAppApiSetRadioTxModes(E_RADIO_TX_MODE_STD, E_RADIO_TX_MODE_PROP_2);
// End of HP Support Initialisation
...
// Existing Code
ZPS_u32MacSetTxBuffers (4);
/* Initialise ZBPro stack */
ZPS_eAplAfInit();
```

5 BLE Applications

5.1 Editing the BLE Example Applications

The Code need to be added within the BleApp_Init function. For example, in 'beacon_bm', the code should be added at the end of void BleApp_Init(void) in beacon.c :

```
// Start of HP Support Initialisation
IOCON_PinMuxSet(IOCON, 0, 4, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
IOCON_PinMuxSet(IOCON, 0, 5, IOCON_MODE_INACT | IOCON_FUNC7 | IOCON_DIGITAL_EN);
```

Revision History

Version	Notes
1V0	First release
1V1	Added BLE support
1V2	Added K32W

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