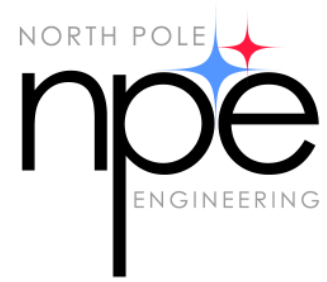


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Adaptor Card Design for the WiFi-IT! 802.11 Wireless Module

Engineering Design Guide

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Version 1.0

Contents

Scope	3
Schematic Recommendations	3
PCB Recommendations	4
Connector Layout and Routing Considerations	5
PCARD Connector and Mounting Hole Layout	6
Connector Pin Out	7
Conclusion	11
References	11

Schematic Recommendations

Considerations that should be taken into account when designing for the NPE WiFi-IT! 802.11 wireless module.

PCB Recommendations

Additional design considerations that should be taken into account when laying out a design using the NPE WiFi-IT! 802.11 wireless module.

Scope

This guide offers recommendations and advice for designing custom peripheral cards (Pcards) that operate with the North Pole Engineering, Inc. WiFi-IT! 802.11 wireless module; with the goal of designing a high reliability and low spurious emissions WiFi system. Reducing spurious emissions will help ensure that your device does not interfere with other devices.

The list of recommendations contained in this document is not exhaustive, however, and additional engineering judgment is required.

Schematic Recommendations

The table that follows should be added to the Pcard's schematic review process to ensure that the following necessary design considerations have been taken into account.

Item	Description	Processor Signal State ¹	Module Signal State ²	Reviewed & Verified
1	ALARM1 is pulled high or low through a pull-up or pull-down resistor, as customer design requires. If pulled high, the signal must be pulled to VDD_RTC.			
2	ALARM2 is pulled high or low through a pull-up or pull-down resistor, as customer design requires. If pulled high, the signal must be pulled to VDD_RTC.			
3	DC_DC_CNTRL is pulled low to GND through a pull-down resistor.			
4	EXT_RESETn is pulled high to VDD_IO through a pull-up resistor.			
5	JTAG_NTRST is pulled low to GND through a pull-down resistor. -or- Connect JTAG_NTRST (pin 4) to EXT_RESETn (pin 61) through a 0 ohm resistor.	H		
6	JTAG_TDI is pulled high to VDD_IO through a pull-up resistor.		H	
7	JTAG_TMS is pulled high to VDD_IO through a pull-up resistor.	H		
8	JTAG_TCK is pulled high to VDD_IO through a pull-up resistor.	H		
9	JTAG_TDO is pulled high to VDD_IO through a pull-up resistor.			

¹ The processor is the GainSpan GS1010. The GS1010 datasheet lists these signals having internal pull-ups or pull-downs. Designers may wish to use an external resistor to pull-up or pull-down these signals to meet design considerations.

² These signals are pulled up on the WiFi-IT! Module using 10k resistor.

Item	Description	Processor Signal State ¹	Module Signal State ²	Reviewed & Verified
10	JTAG_CFG[0] (GPIO28) is pulled high to VDD_IO, or to GND, through a pull-up or pull-down resistor			
11	JTAG_CFG[1] (GPIO29) is pulled high to VDD_IO, or to GND, through a pull-up or pull-down resistor.	L		
12	GPIO27 is pulled down through a pull-down resistor. If the PCARD is to support flash downloads, provisions should also be made to temporarily pull GPIO27 high through a pull-up resistor. See GainSpan 1010 documentation for information on how flash downloads.	L		
13	At least six 0.1 uF bypass capacitors, to be placed within 0.250" of the WiFi-IT! [®] connector between VDD_IO and GND.	L		
14	Three 0.1 uF bypass capacitors are placed within 0.250" of the WiFi-IT! [®] connector between VDD and GND.			
15	At least one 0.1 uF bypass capacitor(s) are placed within 0.250" of the WiFi-IT! [®] connector between 1.8V_ADC and GND.			
16	A power supply capable of supplying 300 mA peak current to the WiFi-IT! [®] card is provided over VDD_RTC.			
17	A power supply capable of supplying 100 mA peak current at 3.3 volts over VDD_IO, plus any other current requirements of the PCARD. This power supply voltage must be enabled with the GainSpan GS1010's DC_DC_CNTRL signal.			
18	All I/O connecting to VDD_IO referenced signals on the GS1010 are held low whenever the GS1010 drives DC_DC_CNTRL low. This will protect against possibility of causing latch-up in the GS1010.			
19	All I/O connecting to VDD_IO referenced signals on the GS1010 meet the minimum and maximum voltage specification of the GS1010.			

Table 1: Schematic Review Checklist

PCB Recommendations

The items shown in Table 2, should be added to the PCARD printed circuit board (PCB) review process to ensure that the necessary design considerations have been taken into account.

Item	Description	Verified
1	VDD_RTC traces and vias from the PCARD to the WiFi-IT!® connector are sized to carry 200 mA per WiFi-IT!® connector pin. Two vias per WiFi-IT! VDD_RTC connector pin is recommended.	
2	At least six 0.1 uF bypass capacitors are placed within 0.250" of the WiFi-IT!® connector between VDD_IO and GND.	
3	Three 0.1 uF bypass capacitors are placed within 0.250" of the WiFi-IT! WiFi-IT!® connector between VDD and GND.	
4	At least one 0.1 uF bypass capacitor(s) are placed within 0.250" of the WiFi-IT!® connector between 1.8V_ADC and GND.	
5	A power supply and distribution system (planes, vias, and traces) capable of supplying 300 mA peak current to the WiFi-IT!® connector is provided over VDD.	
6	A power supply capable of supplying 100 mA peak current at 3.3 volts over VDD_IO, plus any other current requirements of the PCARD. This power supply voltage must be enabled with the GainSpan GS1010's DC_DC_CNTRL signal.	
7	All I/O connecting to VDD_IO referenced signals on the GS1010 are held low whenever the GS1010 drives DC_DC_CNTRL low. This will protect against latch-up in the GS1010.	
8	All I/O connecting to VDD_IO referenced signals on the GS1010 meet the minimum and maximum voltage specification of the GS1010.	
9	Connector to mounting hole spacing is correct. See <i>Figure 2</i> .	

Table 2: PCB Design Checklist

Connector Layout and Routing Considerations

VDD on pins 71, 76, and 79 provides power to the GS1010 Real Time Clock (VDD_RTC) and to the 1.8V RF power amplifier, per FCC requirements. When routing VDD on the PCARD, a low impedance high current path should be maintained between the PCARD power source and the VDD pins on the mezzanine connector. The low impedance path will help ensure that the WiFi-IT! module's power supply does not droop during transmission when instantaneous demand for more current occur.

For example, Figure 1 shows VDD routed as .008" traces on 1 Oz. Copper with two vias from the plane to the connector pins and two traces per connector pin. In addition, one of the traces per VDD pad is routed directly to its associated 0.01 uF bypass capacitor. This provides an ideal routing layout to minimize EMI and guarantee adequate power at all times.

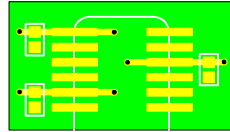
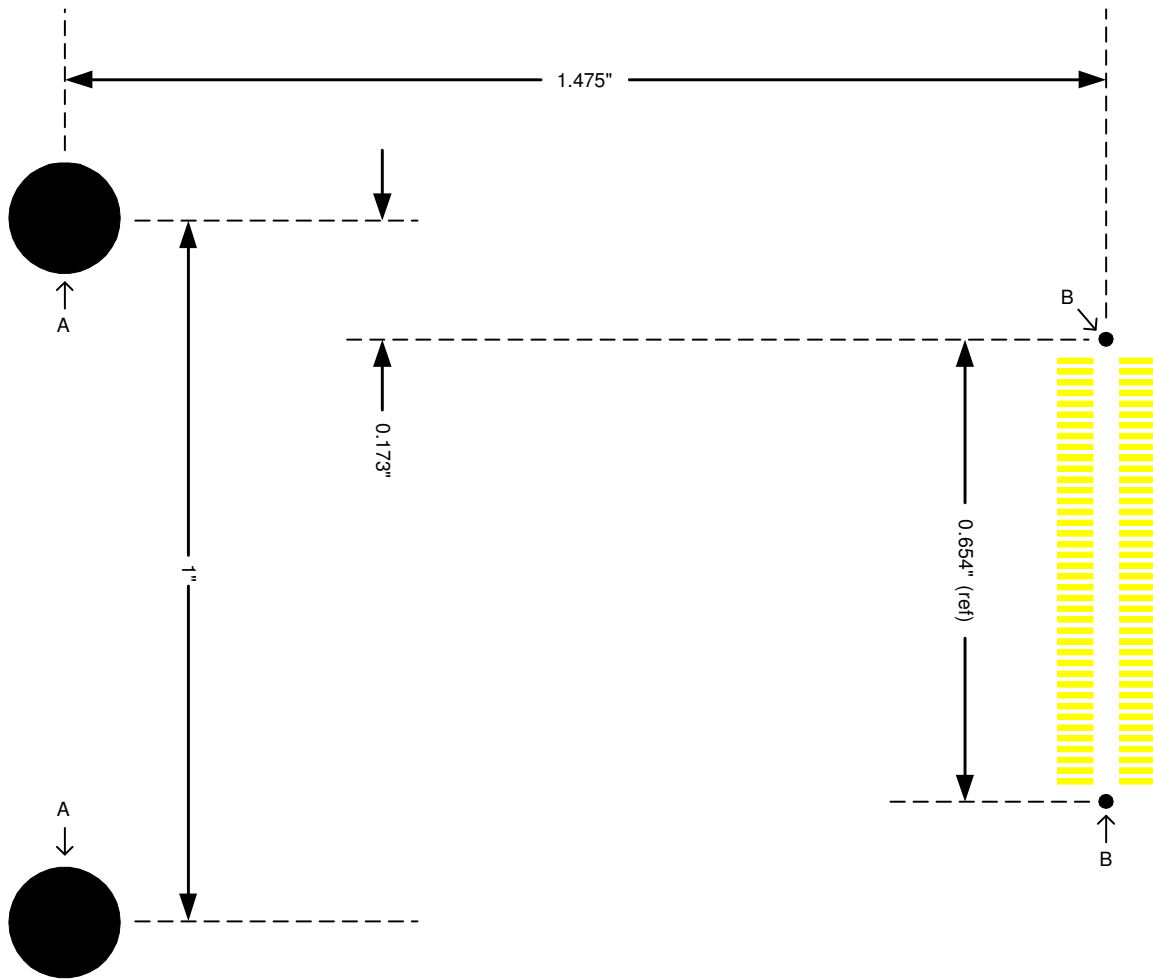


Figure 1: Example Layout for VDD_RTC Power Traces

PCARD Connector and Mounting Hole Layout



Hole	Diameter	Tol.	Plated
A	0.157"	±0.005	No
B	0.028	±0.003	No

Figure 2: PCARD Connector Mounting

NPE Pin	GS1010 Pin	Signal	Alternative Name	Description
				output.
12	A4	GPIO29	JTAG CFG	The GS1010 JTAG CFG input and GPIO28. GainSpan recommends using this as an output only.
13	A1	GPIO31		GainSpan general purpose I/O.
14	A72	GPIO24	UART0 CTS	GainSpan general purpose I/O, also used for UART0 Clear to Send (CTS) input.
15	A71	GPIO00	UART0 RX	GainSpan general purpose I/O, also used for UART0 receive (RX) input.
16	B30	GPIO25	UART0 RTS	GainSpan general purpose I/O, also used for UART 0 Request to Send (RTS) output.
17	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
18		GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system.
19	A69	GPIO02	UART1 TX	GainSpan general purpose I/O, also used for UART 1 Transmit (TX) output.
20	A70	GPIO01	UART0 TX	GainSpan general purpose I/O, also used for UART 0 Transmit (TX) output.
21	A68	GPIO03	UART1 RX	GainSpan general purpose I/O, also used for UART 1 Receive (TX) input.
22	B27	GPIO26	UART1 CTS	GainSpan general purpose I/O, also used for UART1 Clear to Send (CTS) input.
23	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system.
24	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
25	A66	SSPIDIN	NA	Slave SPI data input.
26	A67	GPIO27	UART1 RTS, FDL	GainSpan general purpose I/O, also used for UART1 Request to Send (RTS) output. Also used during boot for flash download branch.
27	A65	SSPICS	NA	Slave SPI chip select input
28	B24	GPIO16	AUXSNAP0	GainSpan general purpose I/O, also used for Auxiliary snapshot Input 0.
29	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
30	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system.
31	A64	SSPICK	NA	Slave SPI clock input.
32	A63	SSPIDOUT	NA	Slave SPI data output.
33	A62	GPIO08	I2C DATA	GainSpan general purpose I/O, also used for I2C data I/O.
34	A61	GPIO09	I2C CLK	GainSpan general purpose I/O, also used for I2C clock I/O.
35	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system

NPE Pin	GS1010 Pin	Signal	Alternative Name	Description
36	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
37	B21	GPIO17	AUXSNAP1	GainSpan general purpose I/O, also used for Auxiliary snapshot Input 1.
38	A60	GPIO10	PWM0	GainSpan general purpose I/O, also used for Pulse Width Modulation (PWM) output 0.
39	A59	GPIO11	PWM1	GainSpan general purpose I/O, also used for Pulse Width Modulation (PWM) output 1.
40	B18	GPIO18	AUXTARGET	GainSpan general purpose I/O, also used for Auxiliary target output.
41	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
42	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
43	A58	GPIO12	PWM2	GainSpan general purpose I/O, also used for Pulse Width Modulation (PWM) output 2.
44	A57	GPIO19	CLKO_44MHz	GainSpan general purpose I/O, also used for 44 MHz clock output.
45	A55	GPIO21	CLKO_11MHz	GainSpan general purpose I/O, also used for 11 MHz clock output.
46	A56	GPIO20	CLKO_22MHz	GainSpan general purpose I/O, also used for 22 MHz clock output.
47	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
48	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
49	A54	GPIO22	CLK_LP	GainSpan general purpose I/O, also used for low power clock output.
50	A53	GPIO23	PPS	GainSpan general purpose I/O, also used for pulse per second output.
51	A52	GPIO13	MSPICS1	GainSpan general purpose I/O, also used for master SPI chip select 1 output.
52	A51	GPIO04	MSPICS0	GainSpan general purpose I/O, also used for master SPI chip select 0 output.
53	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
54	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
55	A49	GPIO05	MSPICLK	GainSpan general purpose I/O, also used for master SPI clock output.
56	A47	GPIO07	MSPIDOUT	GainSpan general purpose I/O, also used for master SPI data output.
57	A46	GPIO14	MSPICS2	GainSpan general purpose I/O, also used for master SPI chip select 2 output.

NPE Pin	GS1010 Pin	Signal	Alternative Name	Description
58	A45	GPIO15	MSPICS3	GainSpan general purpose I/O, also used for master SPI chip select 3 output.
59	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
60	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
61	A42	EXT_RESETn		GainSpan Open Drain Reset output/input.
62	A44	GPIO6	MSPIDIN	GainSpan general purpose I/O, also used for master SPI data input.
63	Multiple	VDDIO		Provides power to all of the GS1010 VDDIO pins
64	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
65	A40	ADC3	NC	Only on GS1011, analog to digital converter input 3.
66	A39	ADC2	VREF	Analog to digital Voltage input.
67	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
68	A38	VDD_ADC		Power for ADC.
69	A35	DC_DC_CNT RL		Enable for VDDIO power supplies.
70	A37	ADC1	DAC	ADC channel 1 input, DAC output.
71	Multiple	VDD		Power input on WiFi-IT!® card used to provide 3.3 V power to GS1010 and to provide power to the 1.8V power supplies.
72	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
73	B13	RTC_OUT2	LP_CLK_OUT	RTC Sensor Wake Output 2, Low power clock output.
74	A36	Alarm2		GainSpan wakeup input 2
75	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system
76	Multiple	VDD		Power input on WiFi-IT!® card used to provide 3.3 V power to GS1010 and to provide power to the 1.8V power supplies.
77	A31	Alarm1		GainSpan wakeup input 1
78	A32	RTC_OUT1		RTC Sensor Wake Output 1.
79	Multiple	VDD		Power input on WiFi-IT!® card used to provide 3.3 V power to GS1010 and to provide power to the 1.8V power supplies.
80	Multiple	GND		Provides a return current path and system ground for the WiFi-IT!® card/PCARD/DCARD system

Table 3 : WiFi-IT! Module to GS1010 Pin Mapping

Conclusion

Following the recommendations provided in this guide will contribute toward a low-noise, high-reliability design when using the NPE WiFi-IT! Module to provide processing capabilities with 802.11 WiFi communications.

References

- GainSpan Inc. (<http://www.gainspan.com>) GS1010 *Ultra Low-Power Wireless System-On-A-Chip Datasheet*, 10/12/2009.
- North Pole Engineering, Inc. (<http://www.npe-inc.com>) WiFi-IT! Module Datasheet, Revision 1.3

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