CHANGE HISTORY

REV	PAGE/ZONE DESCRIPTION OF CHANGE	DATE
R01	Alpha Release	6/3/2016
R02	Initial Build	6/6/2016
R03	Antenna match and test points	7/13/2016

U_RevisionLog
Revision_Log.SchDoc
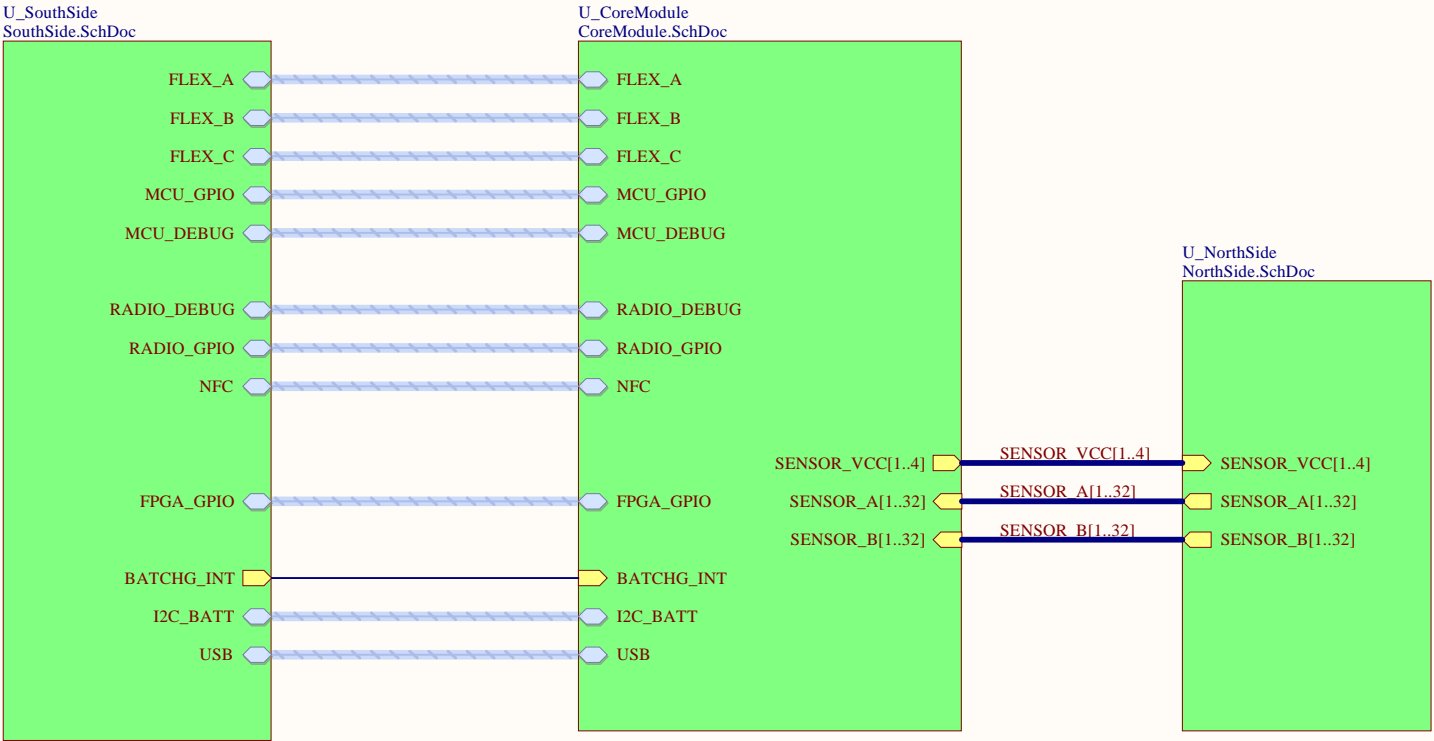
U_SouthSide
SouthSide.SchDoc

FLEX_A
FLEX_B
FLEX_C
MCU_GPIO
MCU_DEBUG
RADIO_DEBUG
RADIO_GPIO
NFC
FPGA_GPIO
BATCHG_INT
I2C_BATT
USB

U_CoreModule
CoreModule.SchDoc

FLEX_A
FLEX_B
FLEX_C
MCU_GPIO
MCU_DEBUG
RADIO_DEBUG
RADIO_GPIO
NFC
SENSOR_VCC[1..4]
FPGA_GPIO
SENSOR_A[1..32]
SENSOR_B[1..32]
BATCHG_INT
I2C_BATT
USB

U_NorthSide
NorthSide.SchDoc

SENSOR_VCC[1..4]
SENSOR_A[1..32]
SENSOR_B[1..32]

SENSOR_VCC[1..4]
SENSOR_A[1..32]
SENSOR_B[1..32]

Design Notes:

Layout Notes:

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Project: Watchman

PCBA: Core Module iCE40

Sheet Title: Block Diagram

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835

Schematic Revision: 03

Date: 9/22/2016

Sheet: 1 / 10

U_FPGA_Power
FPGA_Power.SchDoc

U_MCU_IMU
MCU_IMU.SchDoc

U_FPGA_IO
FPGA_IO.SchDoc

FLEX_A — FLEX_A
FLEX_B — FLEX_B

IMU_INT — IMU_INT

FPGA_CRESET — FPGA_CRESET
FPGA_CDONE — FPGA_CDONE

USB — USB — FPGA_SPI — FPGA_SPI
I2C_BATT — I2C_BATT — FPGA_nCS — FPGA_nCS
BATCHG_INT — BATCHG_INT — FPGA_nRST — FPGA_nRST
FPGA_DATA_RDY — FPGA_DATA_RDY
FPGA_MCU_1 — FPGA_MCU_1
MCU_GPIO — MCU_GPIO — FPGA_MCU_2 — FPGA_MCU_2
MCU_DEBUG — MCU_DEBUG — FPGA_MCU_3 — FPGA_MCU_3
POWER_EN

SENSOR_A[1..32] — SENSOR_A[1..32]
SENSOR_B[1..32] — SENSOR_B[1..32]
SENSOR_VCC[1..4] — SENSOR_VCC[1..4]

FPGA_GPIO — FPGA_GPIO

NRF_FPGA_GPIO_1
NRF_FPGA_GPIO_2

U_PowerCore
PowerCore.SchDoc

POWER_EN — POWER_EN

U_RADIO
Radio.SchDoc

NRF_DR — NRF_DR
NRF_nCS — NRF_nCS
FLEX_C — FLEX_C

NRF_FPGA_GPIO_2
NRF_FPGA_GPIO_1
RADIO_DEBUG — RADIO_DEBUG
RADIO_GPIO — RADIO_GPIO
NFC — NFC

FLEX_C

VRC ONLY

Design Notes:

Layout Notes:
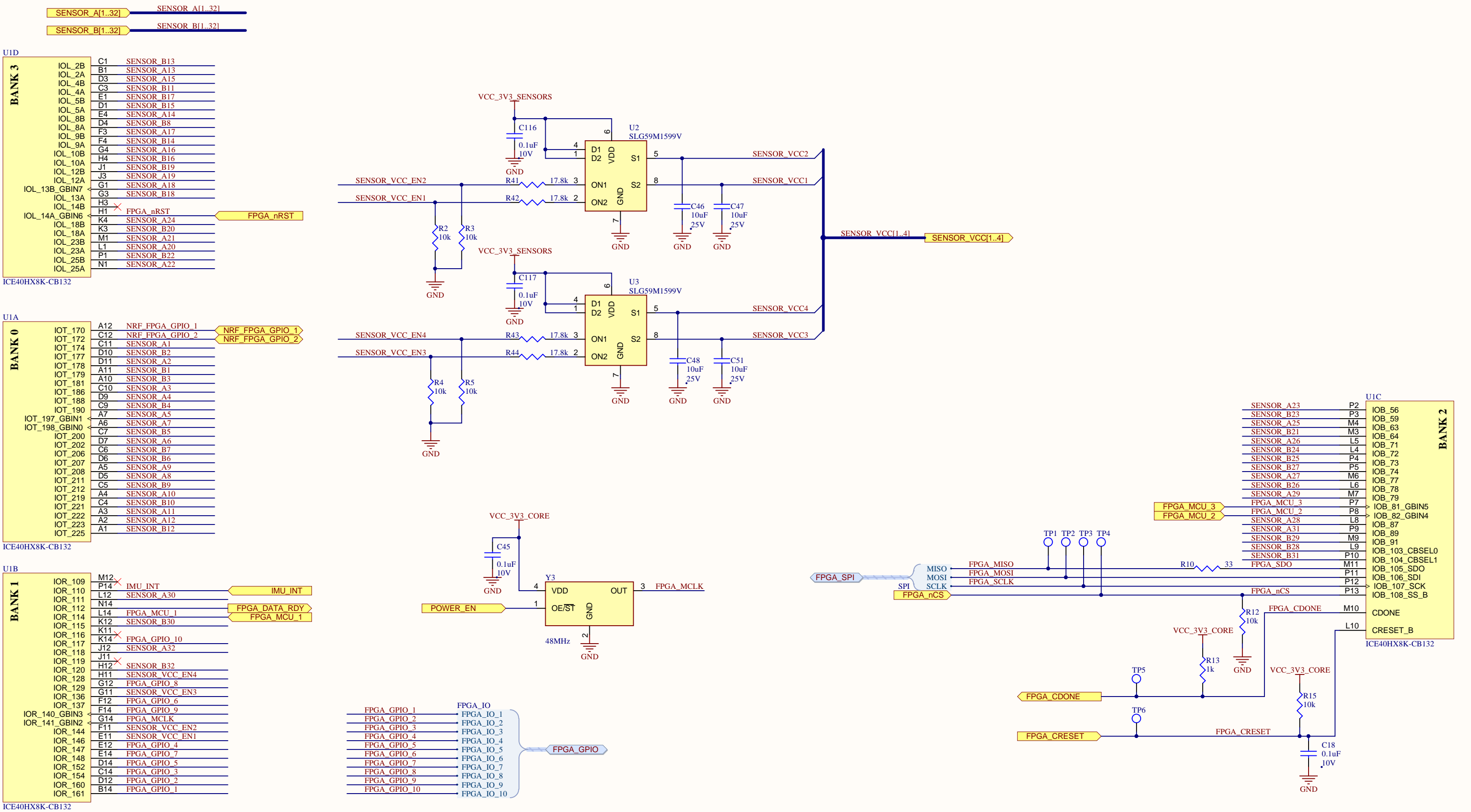
Project: Watchman

PCBA: Core Module iCE40

Sheet Title: Core Module

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835

Schematic Revision: 03

Date: 9/22/2016

Sheet: 2 / 10

SENSOR_A[1..32]   SENSOR_A[1..32]
SENSOR_B[1..32]   SENSOR_B[1..32]

U1D
BANK 3
ICE40HX8K-CB132

Pin	Net
C1	SENSOR_B13
IOL_2B B1	SENSOR_A13
IOL_2A D3	SENSOR_A15
IOL_4B C3	SENSOR_B11
IOL_4A E1	SENSOR_B17
IOL_5B D1	SENSOR_B15
IOL_5A E4	SENSOR_A14
IOL_8B D4	SENSOR_B8
IOL_8A F3	SENSOR_A17
IOL_9B F4	SENSOR_B14
IOL_9A G4	SENSOR_A16
IOL_10B H4	SENSOR_B16
IOL_10A J3	SENSOR_B19
IOL_12B J1	SENSOR_A19
IOL_12A G1	SENSOR_A18
IOL_13B_GBIN7 G3	SENSOR_B18
IOL_13A H3	
IOL_14B H1	FPGA_nRST
IOL_14A_GBIN6 K4	SENSOR_A24
IOL_18B K3	SENSOR_B20
IOL_18A M1	SENSOR_A21
IOL_23B L1	SENSOR_A20
IOL_23A P1	SENSOR_B22
IOL_25B N1	SENSOR_A22
IOL_25A	

FPGA_nRST

U1A
BANK 0
ICE40HX8K-CB132

Pin	Net
IOT_170 A12	NRF_FPGA_GPIO_1
IOT_172 C12	NRF_FPGA_GPIO_2
IOT_174 C11	SENSOR_A1
IOT_177 D10	SENSOR_B2
IOT_178 D11	SENSOR_A2
IOT_179 A11	SENSOR_B1
IOT_181 A10	SENSOR_B3
IOT_186 C10	SENSOR_A3
IOT_188 D9	SENSOR_A4
IOT_190 C9	SENSOR_B4
IOT_197_GBIN1 A7	SENSOR_A5
IOT_198_GBIN0 A6	SENSOR_A7
IOT_200 C7	SENSOR_B5
IOT_202 D7	SENSOR_A6
IOT_206 C6	SENSOR_B7
IOT_207 D6	SENSOR_B6
IOT_208 A5	SENSOR_A9
IOT_211 D5	SENSOR_A8
IOT_212 C5	SENSOR_B9
IOT_219 A4	SENSOR_A10
IOT_221 C4	SENSOR_B10
IOT_222 A3	SENSOR_A11
IOT_223 A2	SENSOR_A12
IOT_225 A1	SENSOR_B12

NRF_FPGA_GPIO_1
NRF_FPGA_GPIO_2

U1B
BANK 1
ICE40HX8K-CB132

Pin	Net
IOR_109 M12	
IOR_110 P14	IMU_INT
IOR_111 L12	SENSOR_A30
IOR_112 N14	FPGA_DATA_RDY
IOR_114 L14	FPGA_MCU_1
IOR_115 K12	SENSOR_B30
IOR_116 K11	
IOR_117 K14	FPGA_GPIO_10
IOR_118 J12	SENSOR_A32
IOR_119 J11	
IOR_120 H12	SENSOR_B32
IOR_128 H11	SENSOR_VCC_EN4
IOR_129 G12	FPGA_GPIO_8
IOR_136 G11	SENSOR_VCC_EN3
IOR_137 F12	FPGA_GPIO_6
IOR_140_GBIN3 F14	FPGA_GPIO_9
IOR_141_GBIN2 G14	FPGA_MCLK
IOR_144 F11	SENSOR_VCC_EN2
IOR_146 E11	SENSOR_VCC_EN1
IOR_147 E12	FPGA_GPIO_4
IOR_148 E14	FPGA_GPIO_7
IOR_152 D14	FPGA_GPIO_5
IOR_154 C14	FPGA_GPIO_3
IOR_160 D12	FPGA_GPIO_2
IOR_161 B14	FPGA_GPIO_1

IMU_INT
FPGA_DATA_RDY
FPGA_MCU_1

U1C
BANK 2
ICE40HX8K-CB132

Net	Pin	
SENSOR_A23	P2	IOB_56
SENSOR_B23	P3	IOB_59
SENSOR_A25	M4	IOB_63
SENSOR_B21	M3	IOB_64
SENSOR_A26	L5	IOB_71
SENSOR_B24	L4	IOB_72
SENSOR_B25	P4	IOB_73
SENSOR_B27	P5	IOB_74
SENSOR_A27	M6	IOB_77
SENSOR_B26	L6	IOB_78
SENSOR_A29	M7	IOB_79
FPGA_MCU_3	P7	IOB_81_GBIN5
FPGA_MCU_2	P8	IOB_82_GBIN4
SENSOR_A28	L8	IOB_87
SENSOR_A31	P9	IOB_89
SENSOR_B29	M9	IOB_91
SENSOR_B28	L9	IOB_103_CBSEL0
SENSOR_B31	P10	IOB_104_CBSEL1
FPGA_SDO	M11	IOB_105_SDO
	P11	IOB_106_SDI
	P12	IOB_107_SCK
FPGA_nCS	P13	IOB_108_SS_B
FPGA_CDONE	M10	CDONE
	L10	CRESET_B

FPGA_MCU_3
FPGA_MCU_2

U2 SLG59M1599V
VCC_3V3_SENSORS
C116 0.1uF 10V
R41 17.8k   SENSOR_VCC_EN2
R42 17.8k   SENSOR_VCC_EN1
D1 D2 VDD ON1 ON2 GND S1 S2
SENSOR_VCC2
SENSOR_VCC1
R2 10k   R3 10k
C46 10uF 25V   C47 10uF 25V

U3 SLG59M1599V
VCC_3V3_SENSORS
C117 0.1uF 10V
R43 17.8k   SENSOR_VCC_EN4
R44 17.8k   SENSOR_VCC_EN3
SENSOR_VCC4
SENSOR_VCC3
R4 10k   R5 10k
C48 10uF 25V   C51 10uF 25V

SENSOR_VCC[1..4]   SENSOR_VCC[1..4]

Y3 48MHz
VCC_3V3_CORE
C45 0.1uF 10V
VDD OE/ST GND OUT
POWER_EN
FPGA_MCLK

FPGA_IO
FPGA_GPIO_1 — FPGA_IO_1
FPGA_GPIO_2 — FPGA_IO_2
FPGA_GPIO_3 — FPGA_IO_3
FPGA_GPIO_4 — FPGA_IO_4
FPGA_GPIO_5 — FPGA_IO_5
FPGA_GPIO_6 — FPGA_IO_6
FPGA_GPIO_7 — FPGA_IO_7
FPGA_GPIO_8 — FPGA_IO_8
FPGA_GPIO_9 — FPGA_IO_9
FPGA_GPIO_10 — FPGA_IO_10
FPGA_GPIO

FPGA_SPI
MISO FPGA_MISO
MOSI FPGA_MOSI
SPI   SCLK FPGA_SCLK
FPGA_nCS
R10 33 FPGA_SDO

TP1 TP2 TP3 TP4
R12 10k
VCC_3V3_CORE
R13 1k
GND
TP5
FPGA_CDONE
VCC_3V3_CORE
R15 10k
TP6
FPGA_CRESET
C18 0.1uF 10V
GND

Design Notes:
From iCE40 Programming and Configuration appnote
Set for maximum SPI frequency
CDONE Pullup = 1/(2*configFrequency*CDONETraceCap)
CDONE Pullup = 1/(2*40MHz*10pF)
CDONE Pullup = 1.25k

Layout Notes:

Project: Watchman   **PCBA:** Core Module iCE40
Sheet Title: FPGA IO
Drawn by: D. Bruey, M.Ciuffo
Schematic Part Number: 602-100835   Schematic Revision: 03
Date: 9/22/2016   Sheet: 3 / 10

VCC_3V3_CORE VCC_3V3_CORE

C14
0.1uF
10V
GND

D1
A C
RB520S30T1G

VCC_3V3_CORE

C12 C11 C10 C9 C8 C7 C6 C5 C4 C13
4.7uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF
6.3V 10V 10V 10V 10V 10V 10V 10V 10V 10V

GND

VCC_1V2

C1 C2 C3 C41 C42 C15
4.7uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF
6.3V 10V 10V 10V 10V 10V

GND

U1E

Pin	Signal	Signal	Pin
L11	VCC_SPI	NC	M14
A14	VPP_2V5		
A13	VPP_FAST		
A8	VCCIO_0		
F6	VCCIO_0		
F9	VCCIO_1	GND	A9
H14	VCCIO_1	GND	F1
J9	VCCIO_2	GND	F7
M5	VCCIO_2	GND	G7
E3	VCCIO_3	GND	G8
J6	VCCIO_3	GND	G9
K1	VCCIO_3	GND	H6
		GND	H7
F8	VCC	GND	H8
G6	VCC	GND	J8
H9	VCC	GND	J14
J4	VCC	GND	L3
J7	VCC	GND	P6
M8	VCCPLL0	GNDPLL0	L7
C8	VCCPLL1	GNDPLL1	D8

ICE40HX8K-CB132

GND

VCC_1V2 R16 100 VCC_PLL

C19 C20
10uF 0.1uF
25V 10V

GND_PLL

GNDPLL should not be connected to GND

Design Notes:

Layout Notes:

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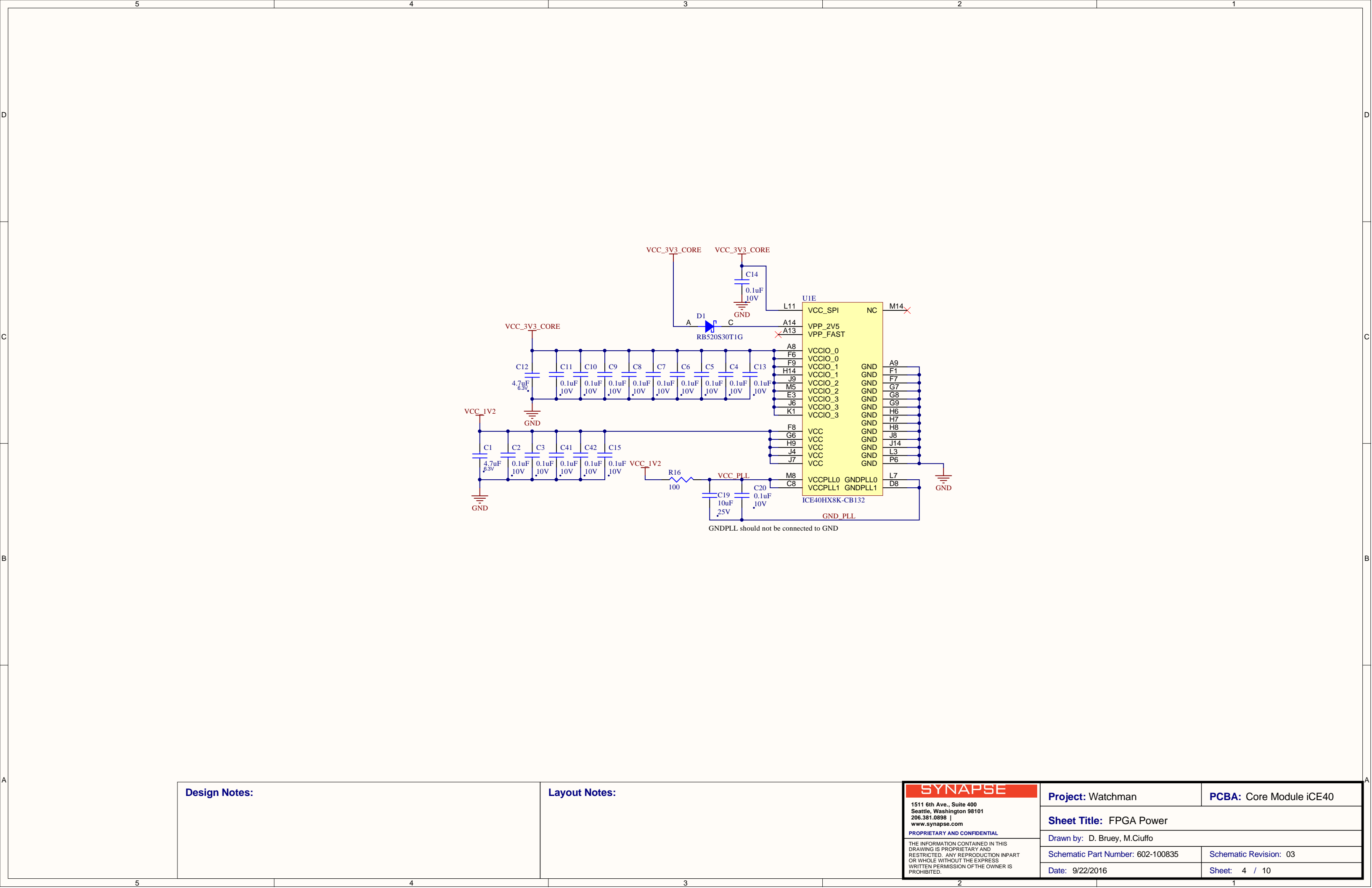**Project:** Watchman **PCBA:** Core Module iCE40
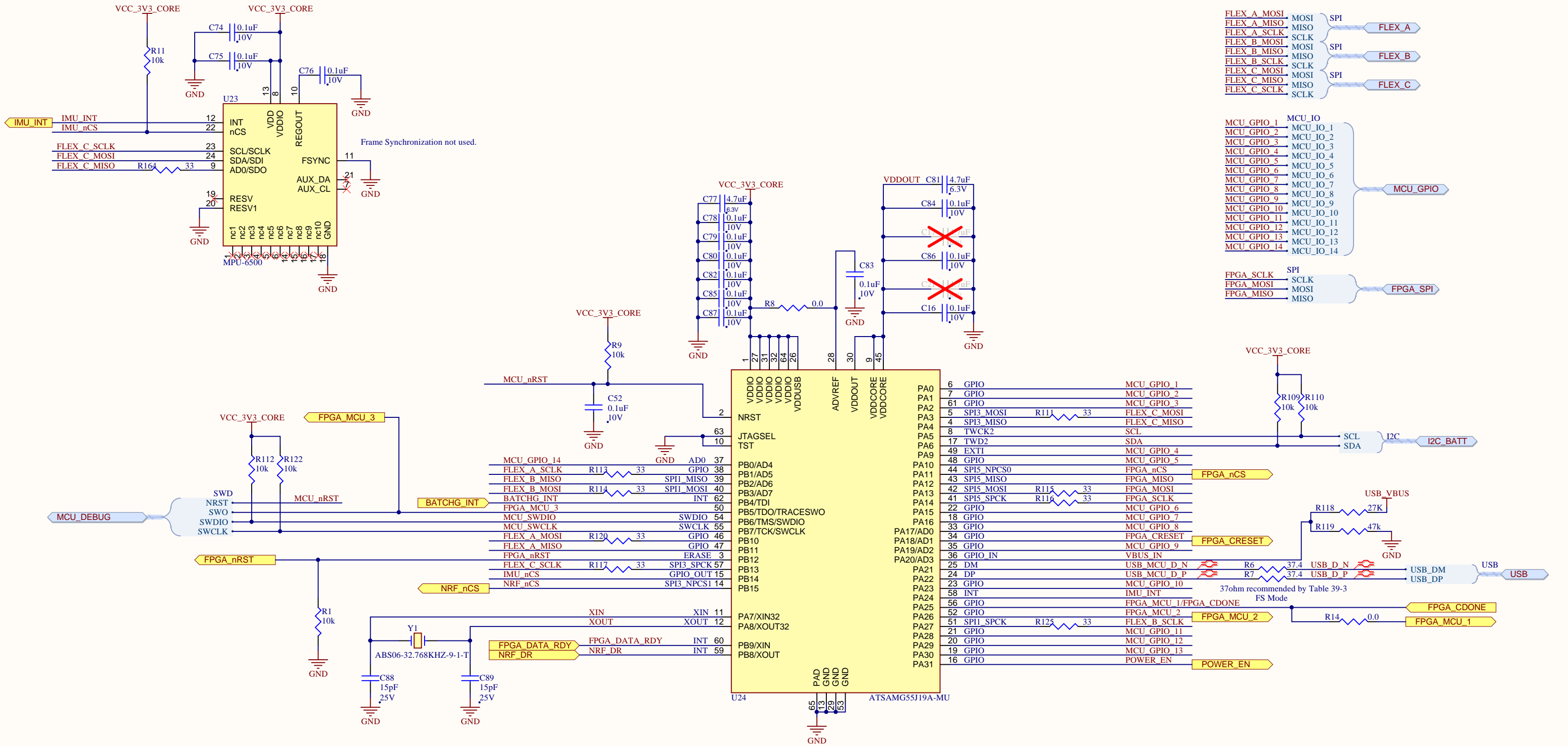
Sheet Title: FPGA Power

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835 Schematic Revision: 03

Date: 9/22/2016 Sheet: 4 / 10

VCC_3V3_CORE
VCC_3V3_CORE

C74 0.1uF 10V
C75 0.1uF 10V
R11 10k
C76 0.1uF 10V
GND
GND

U23
13 VDD
8 VDDIO
10 REGOUT
12 INT
22 nCS
23 SCL/SCLK
24 SDA/SDI
9 AD0/SDO
11 FSYNC
21 AUX_DA
AUX_CL
19 RESV
20 RESV1

IMU_INT
IMU_nCS
FLEX_C_SCLK
FLEX_C_MOSI
FLEX_C_MISO R16 33
Frame Synchronization not used.

nc1 nc2 nc3 nc4 nc5 nc6 nc7 nc8 nc9 nc10 GND
MPU-6500
GND
GND
GND
GND

FLEX_A_MOSI MOSI SPI
FLEX_A_MISO MISO
FLEX_A_SCLK SCLK FLEX_A
FLEX_B_MOSI MOSI SPI
FLEX_B_MISO MISO
FLEX_B_SCLK SCLK FLEX_B
FLEX_C_MOSI MOSI SPI
FLEX_C_MISO MISO
FLEX_C_SCLK SCLK FLEX_C

MCU_IO
MCU_GPIO_1 MCU_IO_1
MCU_GPIO_2 MCU_IO_2
MCU_GPIO_3 MCU_IO_3
MCU_GPIO_4 MCU_IO_4
MCU_GPIO_5 MCU_IO_5
MCU_GPIO_6 MCU_IO_6
MCU_GPIO_7 MCU_IO_7
MCU_GPIO_8 MCU_IO_8
MCU_GPIO_9 MCU_IO_9
MCU_GPIO_10 MCU_IO_10
MCU_GPIO_11 MCU_IO_11
MCU_GPIO_12 MCU_IO_12
MCU_GPIO_13 MCU_IO_13
MCU_GPIO_14 MCU_IO_14
MCU_GPIO

FPGA_SCLK SPI
FPGA_MOSI SCLK
FPGA_MISO MOSI
MISO FPGA_SPI

VCC_3V3_CORE
C77 4.7uF 6.3V
C78 0.1uF 10V
C79 0.1uF 10V
C80 0.1uF 10V
C82 0.1uF 10V
C85 0.1uF 10V
C87 0.1uF 10V
GND

VDDOUT C81 4.7uF 6.3V
C84 0.1uF 10V
C86 0.1uF 10V
C83 0.1uF 10V
C16 0.1uF 10V
R8 0.0
GND
GND

VCC_3V3_CORE
R9 10k
MCU_nRST
C52 0.1uF 10V
GND

VCC_3V3_CORE
R109 R110 10k 10k
SCL I2C
SDA
I2C_BATT

FPGA_MCU_3
R112 R122 10k 10k
VCC_3V3_CORE

U24 ATSAMG55J19A-MU
27 31 32 64 26 VDDIO VDDIO VDDIO VDDIO VDDIO VDDUSB
28 ADVREF
30 VDDOUT
9 45 VDDCORE VDDCORE

2 NRST
63 JTAGSEL
10 TST

37 AD0 PB0/AD4
38 GPIO PB1/AD5
39 SPI1_MISO PB2/AD6
40 SPI1_MOSI PB3/AD7
62 INT PB4/TDI
54 SWDIO PB5/TDO/TRACESWO
55 SWCLK PB6/TMS/SWDIO
46 GPIO PB7/TCK/SWDIO
47 GPIO PB10
3 ERASE PB11
57 SPI3_SPCK PB12
15 GPIO_OUT PB13
14 SPI3_NPCS1 PB14
PB15

11 XIN PA7/XIN32
12 XOUT PA8/XOUT32
60 INT PB9/XIN
59 INT PB8/XOUT

6 GPIO PA0 MCU_GPIO_1
7 GPIO PA1 MCU_GPIO_2
61 GPIO PA2 MCU_GPIO_3
5 SPI3_MOSI PA3 R111 33 FLEX_C_MOSI
4 SPI3_MISO PA4 FLEX_C_MISO
8 TWCK2 PA5 SCL
17 TWD2 PA6 SDA
49 EXTI PA9 MCU_GPIO_4
48 GPIO PA10 MCU_GPIO_5
44 SPI5_NPCS0 PA11 FPGA_nCS
43 SPI5_MISO PA12 FPGA_MISO
42 SPI5_MOSI PA13 R115 33 FPGA_MOSI
41 SPI5_SPCK PA14 R116 33 FPGA_SCLK
22 GPIO PA15 MCU_GPIO_6
18 GPIO PA16 MCU_GPIO_7
33 GPIO PA17/AD0 MCU_GPIO_8
34 GPIO PA18/AD1 FPGA_CRESET
35 GPIO PA19/AD2 MCU_GPIO_9
36 GPIO_IN PA20/AD3 VBUS_IN
25 DM PA21 USB_MCU_D_N
24 DP PA22 USB_MCU_D_P
23 GPIO PA23 MCU_GPIO_10
58 INT PA24 IMU_INT
56 GPIO PA25 FPGA_MCU_1/FPGA_CDONE
52 GPIO PA26 FPGA_MCU_2
51 SPI1_SPCK PA27 R125 33 FLEX_B_SCLK
21 GPIO PA28 MCU_GPIO_11
20 GPIO PA29 MCU_GPIO_12
19 GPIO PA30 MCU_GPIO_13
16 GPIO PA31 POWER_EN

PAD GND GND GND
65 13 29 53
GND

SWD
NRST
SWO
SWDIO
SWCLK
MCU_DEBUG
MCU_nRST
BATCHG_INT
FPGA_MCU_3
MCU_SWDIO
MCU_SWCLK
FLEX_A_MOSI R120 33
FLEX_A_MISO
FPGA_nRST
FLEX_C_SCLK R117 33
IMU_nCS
NRF_nCS
BATCHG_INT
NRF_nCS

MCU_GPIO_14 R113 33
FLEX_A_SCLK
FLEX_B_MISO
FLEX_B_MOSI R114 33

R1 10k
GND

Y1 ABS06-32.768KHZ-9-1-T
XIN
XOUT
FPGA_DATA_RDY
NRF_DR
FPGA_DATA_RDY
NRF_DR

C88 15pF 25V
C89 15pF 25V
GND GND

FPGA_nRST
NRF_nCS

VCC_3V3_CORE
R118 27K
R119 47k
USB_VBUS
GND

FPGA_nCS
FPGA_CRESET

37ohm recommended by Table 39-3
FS Mode
R6 37.4 USB_D_N USB_DM USB
R7 37.4 USB_D_P USB_DP USB

FPGA_MCU_2
R14 0.0
FPGA_CDONE
FPGA_MCU_1

POWER_EN

Design Notes:
Layout Notes:

Project: Watchman
PCBA: Core Module iCE40
Sheet Title: MCU and IMU
Drawn by: D. Bruey, M.Ciuffo
Schematic Part Number: 602-100835
Schematic Revision: 03
Date: 9/22/2016
Sheet: 5 / 10

U4   EP5357LUI

Pin	Signal
13	AVIN
14	PVIN
11	VS0
10	VS1
9	VS2
12	ENABLE
3	LLM
8	VOUT1
7	VOUT2
5	VSENSE
4	VFB
1	NC(SW)1
15	NC(SW)2
16	NC(SW)3
2	PGND
6	AGND

VCC_3V6 VCC_3V6
C38 10uF 25V
R54 4.7K
POWER_EN
R53 4.7K
GND
GND

TP7 TP10 VCC_1V2
C37 47uF 6.3V
GND

TP13 TP14
GND GND

M1 MTGC300H130P M2 MTGC300H130P
GND GND

U13 TLV70733DQNR1
VCC_3V6
C49 10uF 25V
POWER_EN
4 IN OUT 1
3 EN GND PAD
2 5
GND
TP8 TP11 VCC_3V3_SENSORS
C50 47uF 6.3V
GND GND

U6 TLV70733DQNR1
VCC_3V6
C39 10uF 25V
TP15 TP16
4 IN OUT 1
3 EN GND PAD
2 5
GND
TP9 TP12 VCC_3V3_CORE
C40 47uF 6.3V
GND GND

Design Notes:

Layout Notes:

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Project: Watchman   **PCBA:** Core Module iCE40

Sheet Title: Power Core

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835   Schematic Revision: 03

Date: 9/22/2016   Sheet: 6 / 10

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Project: Watchman
PCBA: Core Module iCE40

Sheet Title: Radio
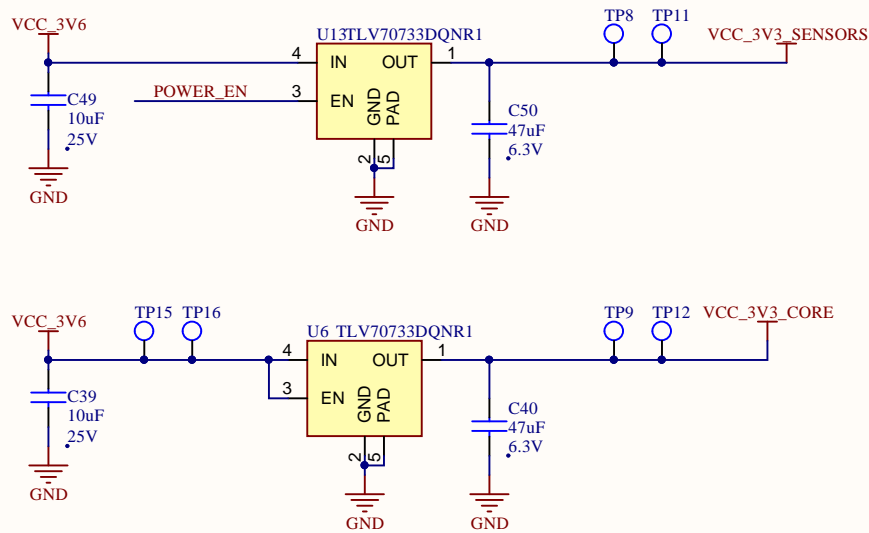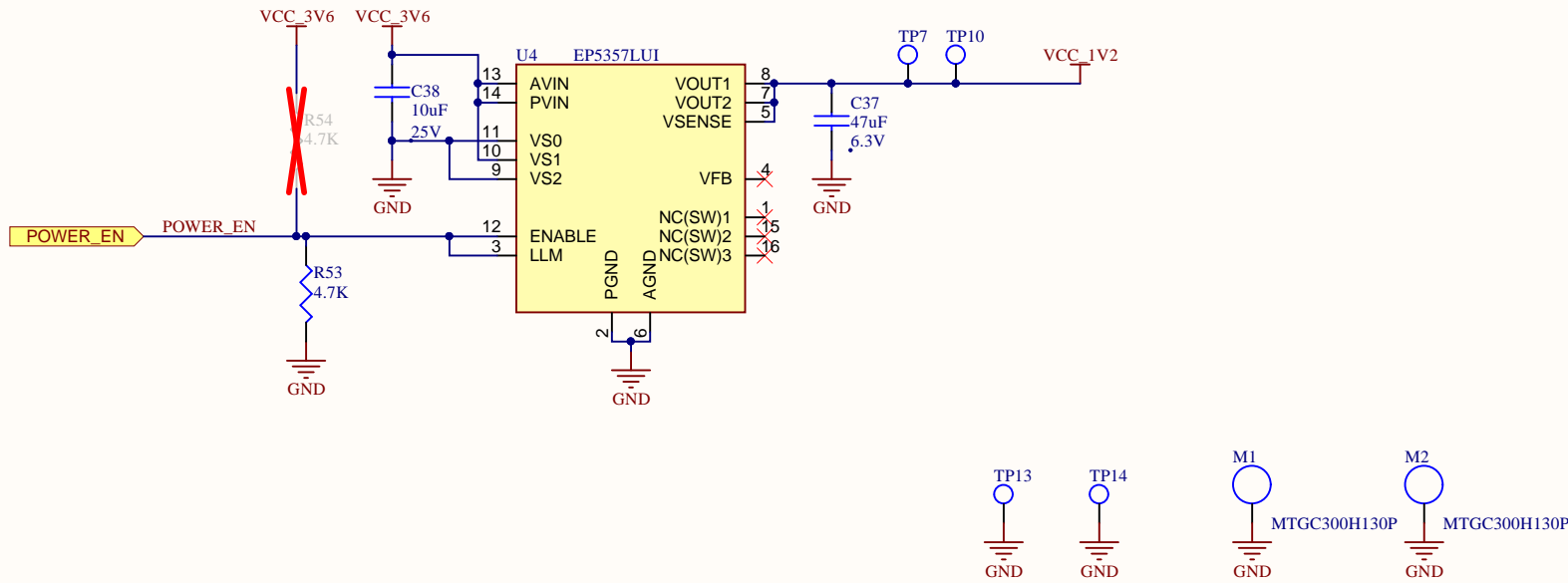
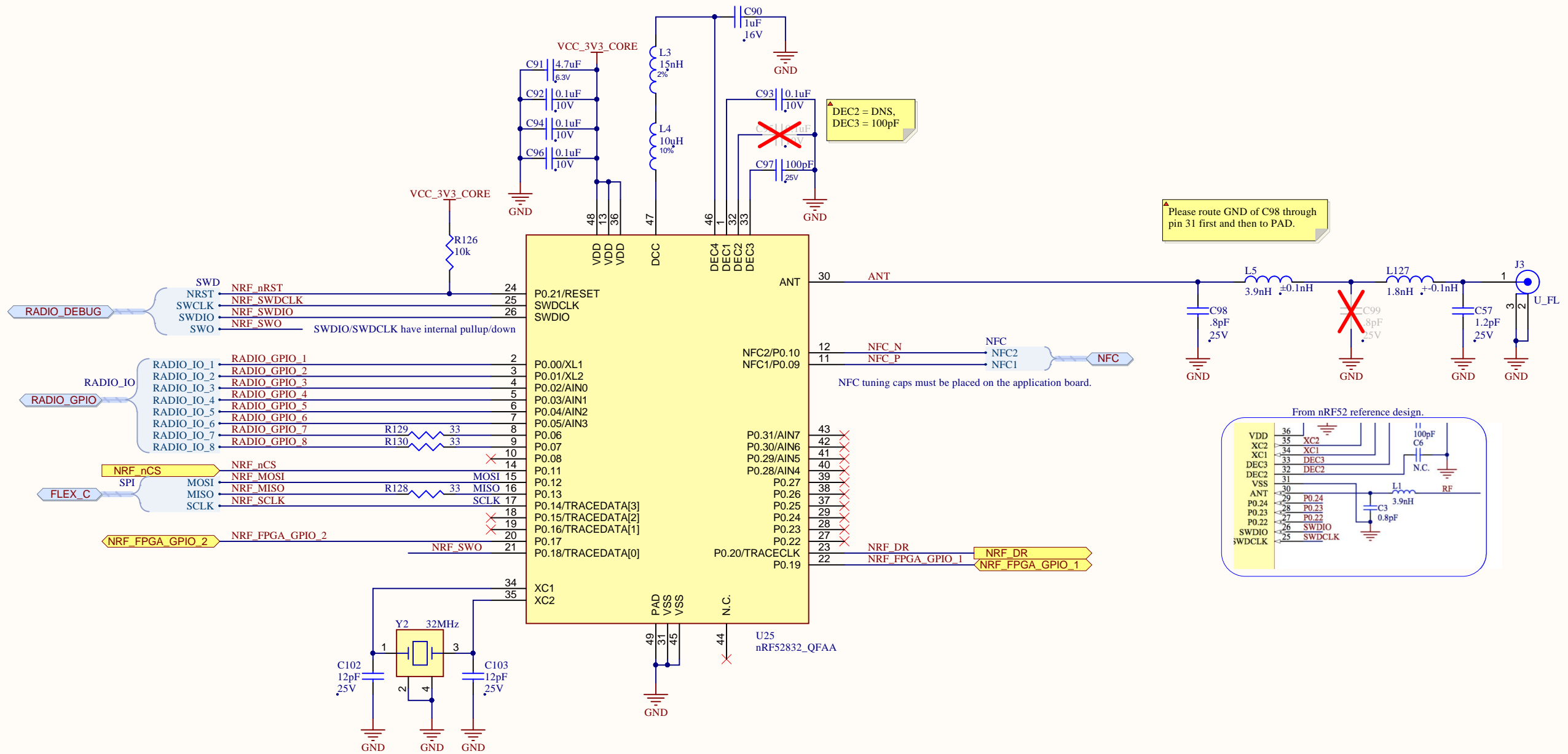Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835
Schematic Revision: 03

Date: 9/22/2016

Design Notes:

Layout Notes:

U25
nRF52832_QFAA

VCC_3V3_CORE

C90 1uF 16V
C91 4.7uF 6.3V
C92 0.1uF 10V
C94 0.1uF 10V
C96 0.1uF 10V
C93 0.1uF 10V
C97 100pF 25V

L3 15nH 2%
L4 10uH 10%

R126 10k

DEC2 = DNS,
DEC3 = 100pF

Please route GND of C98 through
pin 31 first and then to PAD.

GND

SWD
NRST
SWCLK
SWDIO
SWO

NRF_nRST
NRF_SWDCLK
NRF_SWDIO
NRF_SWO

RADIO_DEBUG

SWDIO/SWDCLK have internal pullup/down

RADIO_IO_1
RADIO_IO_2
RADIO_IO_3
RADIO_IO_4
RADIO_IO_5
RADIO_IO_6
RADIO_IO_7
RADIO_IO_8

RADIO_GPIO_1
RADIO_GPIO_2
RADIO_GPIO_3
RADIO_GPIO_4
RADIO_GPIO_5
RADIO_GPIO_6
RADIO_GPIO_7
RADIO_GPIO_8

RADIO_IO
RADIO_GPIO

R129 33
R130 33

NRF_nCS
NRF_MOSI
NRF_MISO
NRF_SCLK

FLEX_C

SPI
MOSI
MISO
SCLK

R128 33

NRF_FPGA_GPIO_2

NRF_FPGA_GPIO_2

NRF_SWO

P0.21/RESET
SWDCLK
SWDIO

P0.00/XL1
P0.01/XL2
P0.02/AIN0
P0.03/AIN1
P0.04/AIN2
P0.05/AIN3
P0.06
P0.07
P0.08
P0.11
P0.12
P0.13
P0.14/TRACEDATA[3]
P0.15/TRACEDATA[2]
P0.16/TRACEDATA[1]
P0.17
P0.18/TRACEDATA[0]

XC1
XC2

VDD
VDD
VDD
DCC
DEC4
DEC1
DEC2
DEC3

ANT

NFC2/P0.10
NFC1/P0.09

P0.31/AIN7
P0.30/AIN6
P0.29/AIN5
P0.28/AIN4
P0.27
P0.26
P0.25
P0.24
P0.23
P0.22
P0.20/TRACECLK
P0.19

PAD
VSS
VSS

N.C.

NFC_N
NFC_P

NFC
NFC2
NFC1

NFC

NFC tuning caps must be placed on the application board.

NRF_DR
NRF_FPGA_GPIO_1

NRF_DR
NRF_FPGA_GPIO_1

ANT

L5 3.9nH ±0.1nH
L127 1.8nH ±0.1nH

C98 .8pF 25V
C99 .8pF 25V
C57 1.2pF 25V

J3
U_FL

GND

From nRF52 reference design.

VDD
XC2
XC1
DEC3
DEC2
VSS
ANT
P0.24
P0.23
P0.22
SWDIO
SWDCLK

XC2
XC1
DEC3
DEC2

P0.24
P0.23
P0.22
SWDIO
SWDCLK

C6 100pF
N.C.
L1 3.9nH
RF
C3 0.8pF

Y2 32MHz

C102 12pF 25V
C103 12pF 25V

GND

J1

Pin			Pin	
SENSOR_A1	1	1 2	2	SENSOR_VCC1
SENSOR_B1	3	3 4	4	SENSOR_A2
GND	5	5 6	6	SENSOR_B2
SENSOR_A3	7	7 8	8	SENSOR_VCC1
SENSOR_B3	9	9 10	10	SENSOR_A4
GND	11	11 12	12	SENSOR_B4
SENSOR_A5	13	13 14	14	SENSOR_VCC1
SENSOR_B5	15	15 16	16	SENSOR_A6
GND	17	17 18	18	SENSOR_B6
SENSOR_A7	19	19 20	20	SENSOR_VCC1
SENSOR_B7	21	21 22	22	SENSOR_A8
GND	23	23 24	24	SENSOR_B8
SENSOR_A9	25	25 26	26	SENSOR_VCC2
SENSOR_B9	27	27 28	28	SENSOR_A10
GND	29	29 30	30	SENSOR_B10
SENSOR_A11	31	31 32	32	SENSOR_VCC2
SENSOR_B11	33	33 34	34	SENSOR_A12
GND	35	35 36	36	SENSOR_B12
SENSOR_A13	37	37 38	38	SENSOR_VCC2
SENSOR_B13	39	39 40	40	SENSOR_A14
GND	41	41 42	42	SENSOR_B14
SENSOR_A15	43	43 44	44	SENSOR_VCC2
SENSOR_B15	45	45 46	46	SENSOR_A16
GND	47	47 48	48	SENSOR_B16
SENSOR_A17	49	49 50	50	SENSOR_VCC3
SENSOR_B17	51	51 52	52	SENSOR_A18
GND	53	53 54	54	SENSOR_B18
SENSOR_A19	55	55 56	56	SENSOR_VCC3
SENSOR_B19	57	57 58	58	SENSOR_A20
GND	59	59 60	60	SENSOR_B20
SENSOR_A21	61	61 62	62	SENSOR_VCC3
SENSOR_B21	63	63 64	64	SENSOR_A22
GND	65	65 66	66	SENSOR_B22
SENSOR_A23	67	67 68	68	SENSOR_VCC3
SENSOR_B23	69	69 70	70	SENSOR_A24
GND	71	71 72	72	SENSOR_B24
SENSOR_A25	73	73 74	74	SENSOR_VCC4
SENSOR_B25	75	75 76	76	SENSOR_A26
GND	77	77 78	78	SENSOR_B26
SENSOR_A27	79	79 80	80	SENSOR_VCC4
SENSOR_B27	81	81 82	82	SENSOR_A28
GND	83	83 84	84	SENSOR_B28
SENSOR_A29	85	85 86	86	SENSOR_VCC4
SENSOR_B29	87	87 88	88	SENSOR_A30
GND	89	89 90	90	SENSOR_B30
SENSOR_A31	91	91 92	92	SENSOR_VCC4
SENSOR_B31	93	93 94	94	SENSOR_A32
GND	95	95 96	96	SENSOR_B32
GND	97	97 98	98	GND
GND	99	99 100	100	GND
GND	101	M1		
	102	M2		
	103	M3		
	104	M4		

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GND

SENSOR_B[1..32]   SENSOR_B[1..32]
SENSOR_A[1..32]   SENSOR_A[1..32]
SENSOR_VCC[1..4]   SENSOR_VCC[1..4]

Design Notes:

Layout Notes:

Project: Watchman   **PCBA:** Core Module iCE40

Sheet Title: North Side Connector

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835   Schematic Revision: 03
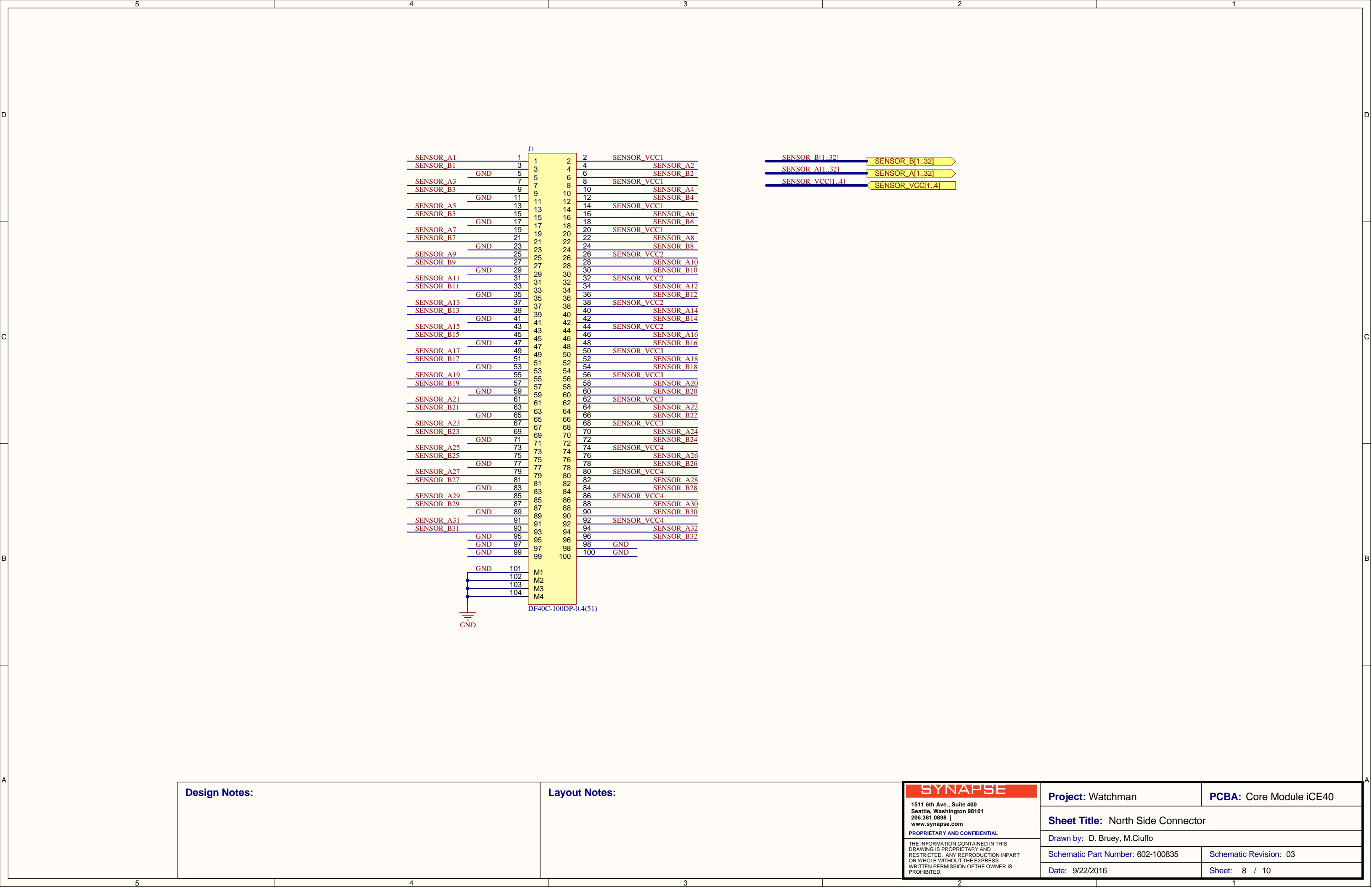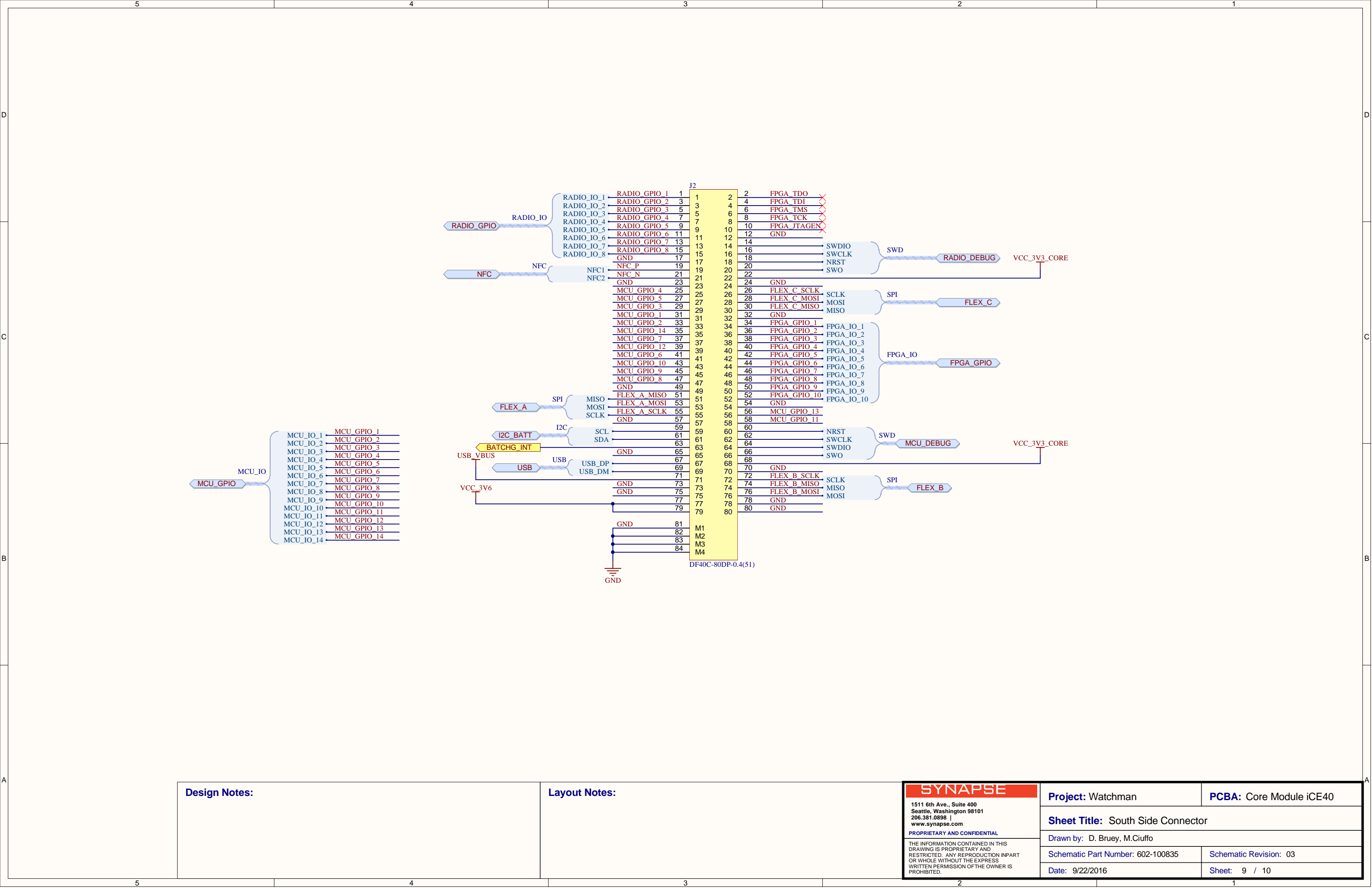
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J2

Pin	Signal	#	#	Signal	Pin
RADIO_IO_1	RADIO_GPIO_1	1	2	FPGA_TDO	
RADIO_IO_2	RADIO_GPIO_2	3	4	FPGA_TDI	
RADIO_IO_3	RADIO_GPIO_3	5	6	FPGA_TMS	
RADIO_IO_4	RADIO_GPIO_4	7	8	FPGA_TCK	
RADIO_IO_5	RADIO_GPIO_5	9	10	FPGA_JTAGEN	
RADIO_IO_6	RADIO_GPIO_6	11	12	GND	
RADIO_IO_7	RADIO_GPIO_7	13	14	SWDIO	
RADIO_IO_8	RADIO_GPIO_8	15	16	SWCLK	
	GND	17	18	NRST	
NFC1	NFC_P	19	20	SWO	
NFC2	NFC_N	21	22		
	GND	23	24	GND	
	MCU_GPIO_4	25	26	FLEX_C_SCLK	SCLK
	MCU_GPIO_5	27	28	FLEX_C_MOSI	MOSI
	MCU_GPIO_3	29	30	FLEX_C_MISO	MISO
	MCU_GPIO_1	31	32	GND	
	MCU_GPIO_2	33	34	FPGA_GPIO_1	FPGA_IO_1
	MCU_GPIO_14	35	36	FPGA_GPIO_2	FPGA_IO_2
	MCU_GPIO_7	37	38	FPGA_GPIO_3	FPGA_IO_3
	MCU_GPIO_12	39	40	FPGA_GPIO_4	FPGA_IO_4
	MCU_GPIO_6	41	42	FPGA_GPIO_5	FPGA_IO_5
	MCU_GPIO_10	43	44	FPGA_GPIO_6	FPGA_IO_6
	MCU_GPIO_9	45	46	FPGA_GPIO_7	FPGA_IO_7
	MCU_GPIO_8	47	48	FPGA_GPIO_8	FPGA_IO_8
	GND	49	50	FPGA_GPIO_9	FPGA_IO_9
MISO	FLEX_A_MISO	51	52	FPGA_GPIO_10	FPGA_IO_10
MOSI	FLEX_A_MOSI	53	54	GND	
SCLK	FLEX_A_SCLK	55	56	MCU_GPIO_13	
	GND	57	58	MCU_GPIO_11	
SCL		59	60	NRST	
SDA		61	62	SWCLK	
		63	64	SWDIO	
	GND	65	66	SWO	
USB_DP		67	68		
USB_DM		69	70	GND	
	GND	71	72	FLEX_B_SCLK	SCLK
	GND	73	74	FLEX_B_MISO	MISO
		75	76	FLEX_B_MOSI	MOSI
		77	78	GND	
		79	80	GND	
GND		81	M1		
		82	M2		
		83	M3		
		84	M4		

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GND

RADIO_GPIO   RADIO_IO
NFC   NFC
MCU_GPIO   MCU_IO
I2C_BATT   I2C
BATCHG_INT
USB_VBUS   USB
VCC_3V6
FLEX_A   SPI
SWD   RADIO_DEBUG   VCC_3V3_CORE
SPI   FLEX_C
FPGA_IO   FPGA_GPIO
SWD   MCU_DEBUG   VCC_3V3_CORE
SPI   FLEX_B

MCU_IO_1 — MCU_GPIO_1
MCU_IO_2 — MCU_GPIO_2
MCU_IO_3 — MCU_GPIO_3
MCU_IO_4 — MCU_GPIO_4
MCU_IO_5 — MCU_GPIO_5
MCU_IO_6 — MCU_GPIO_6
MCU_IO_7 — MCU_GPIO_7
MCU_IO_8 — MCU_GPIO_8
MCU_IO_9 — MCU_GPIO_9
MCU_IO_10 — MCU_GPIO_10
MCU_IO_11 — MCU_GPIO_11
MCU_IO_12 — MCU_GPIO_12
MCU_IO_13 — MCU_GPIO_13
MCU_IO_14 — MCU_GPIO_14

MCU_GPIO   MCU_IO

Design Notes:

Layout Notes:

Project: Watchman
PCBA: Core Module iCE40
Sheet Title: South Side Connector
Drawn by: D. Bruey, M.Ciuffo
Schematic Part Number: 602-100835
Schematic Revision: 03
Date: 9/22/2016
Sheet: 9 / 10

CHANGE HISTORY

REV	DESCRIPTION OF CHANGE	DATE
R01	Alpha Release	6/3/2016
R02	Added 0.1uF capacitor for pin 9 of MCU Changed C81 to 1.0uF Added DNS optons C17, C21	6/6/2016
R03	Changed C81 to 4.7uF Updated antenna matching network Added test points to power rails Tuned load caps C88 and C89 to 15pF Tuned load caps C102 and C103 to 12pF	7/13/2016

Design Notes:

Layout Notes:

Project: Watchman

PCBA: Core Module iCE40

Sheet Title: Revision Log

Drawn by: D. Bruey, M.Ciuffo

Schematic Part Number: 602-100835

Schematic Revision: 03

Date: 9/22/2016