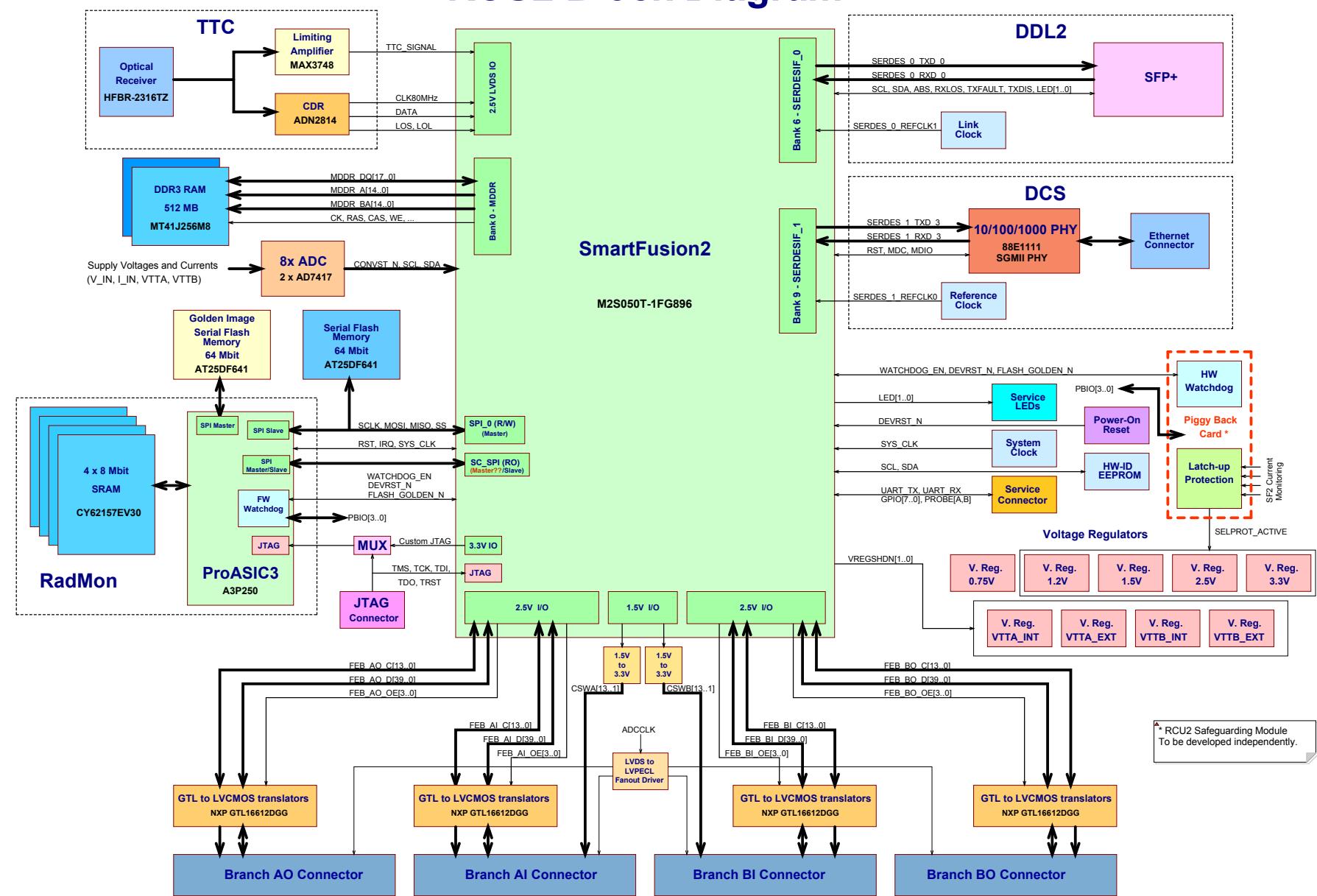


RCU2 Block Diagram



Cerntech Ltd.				Title	RCU2_v1.1.PriPcb
				RCU2 Block Diagram	
Size	Scale	-	Document Number	Revision	
A3	-				1.1
Designer: Cerntech Ltd.	Drawn by: E. David	Modified: 2014.03.03.	Printed: 2014.04.10.	Sheet	1 of 19
Approved: T. Kiss				File:	rcu2_block_diagram.SchDoc

RCU2 Top Level Schematic

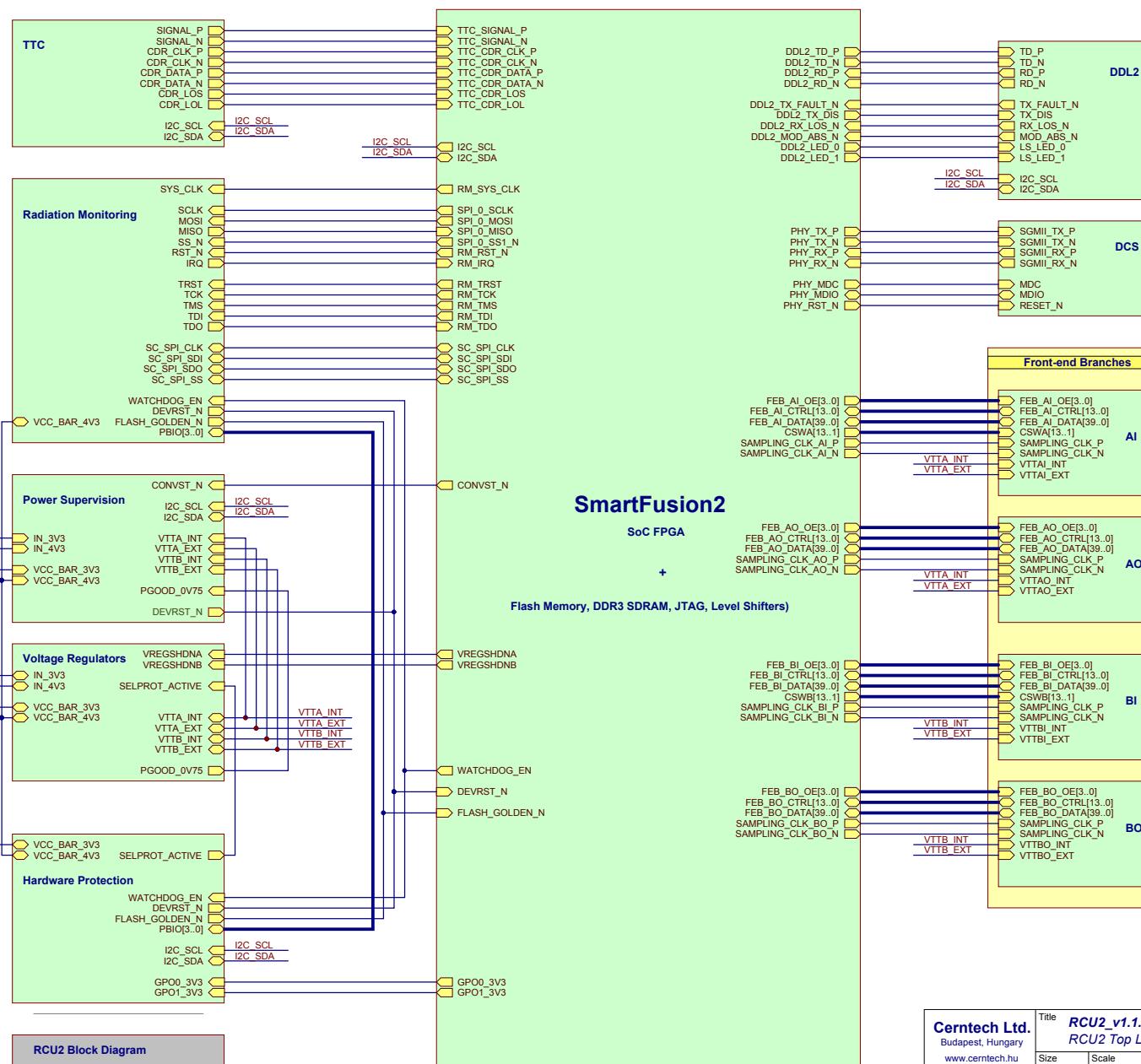
Drawing Concept

The present drawing concept is as follows:

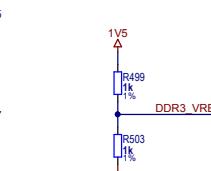
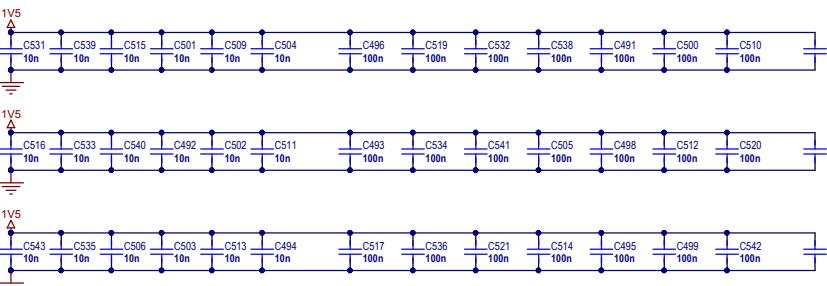
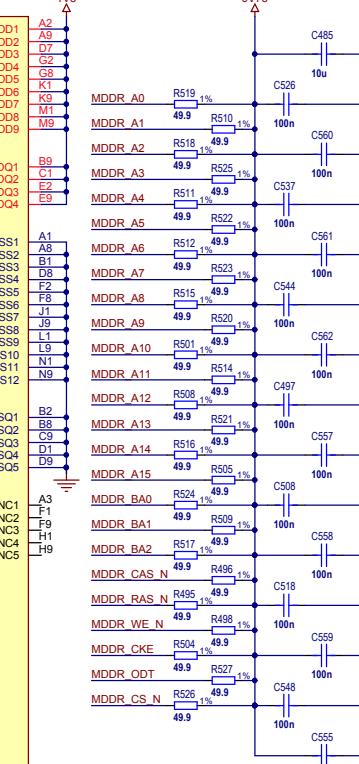
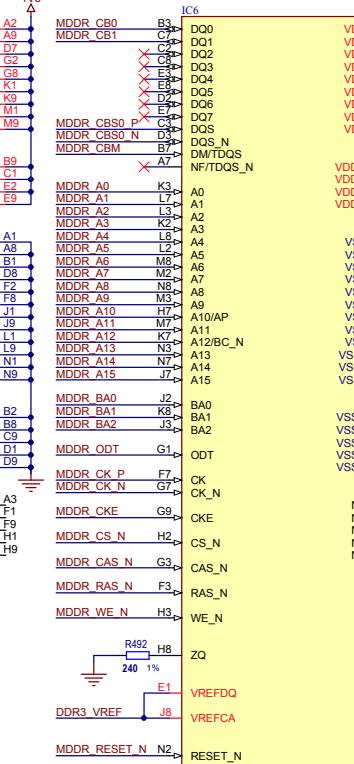
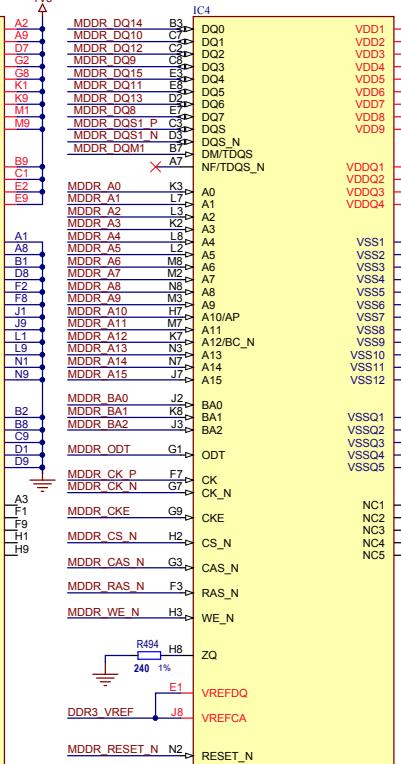
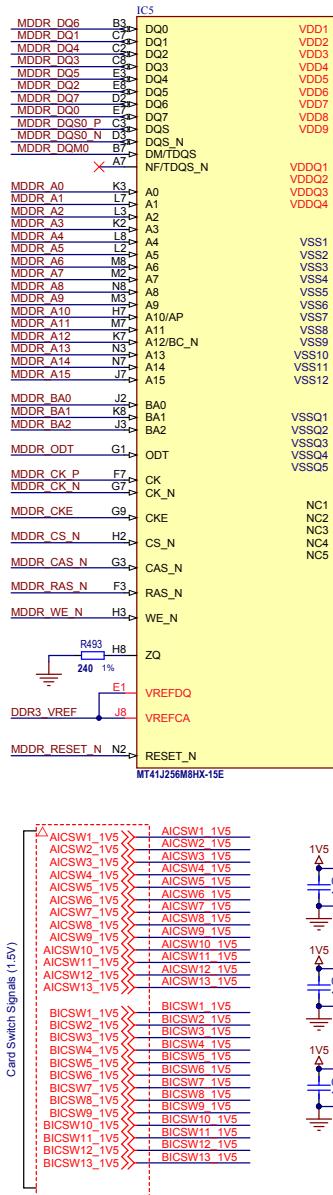
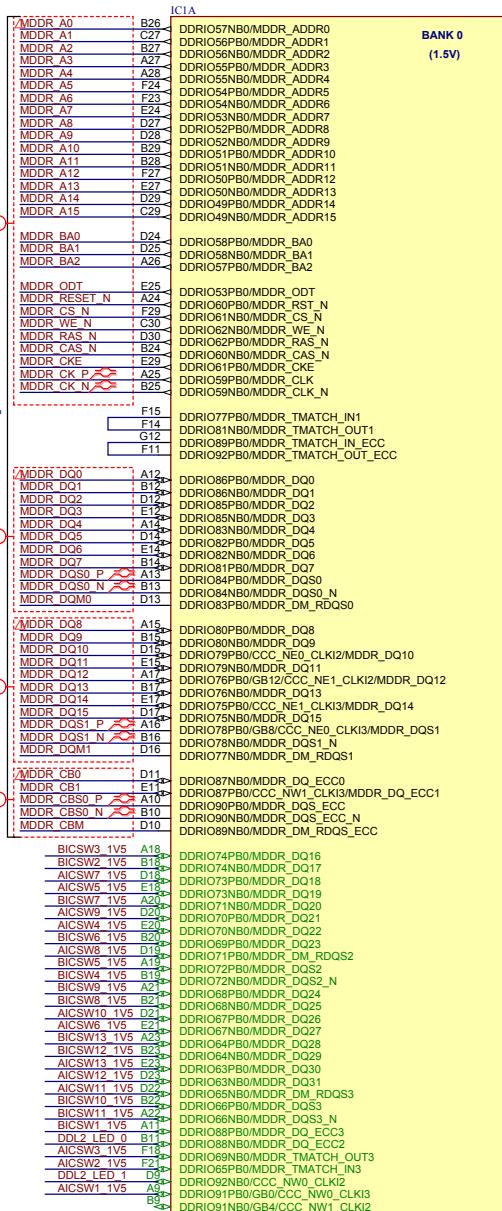
- The hierarchical drawing consists of modules (the green rectangles on the top level schematic sheet).
- Modules (the green rectangles) may consist of one or more sheets (pages), which belong to the same hierarchical module (green rectangles). (Actually now it is only the FPGA module that consist of multiple sheets. All other modules consist of one sheet.)

The connection rules are the following ones:

- Net labels are local to sheets.
- Net labels on different sheets but in the same hierarchical module must be connected by off-sheet connectors.
- Net labels in different modules must be connected by module entries (port connections) which must be connected to each other by wires and busses on the top level schematic sheet.
- Dashed red lines denote net classes.

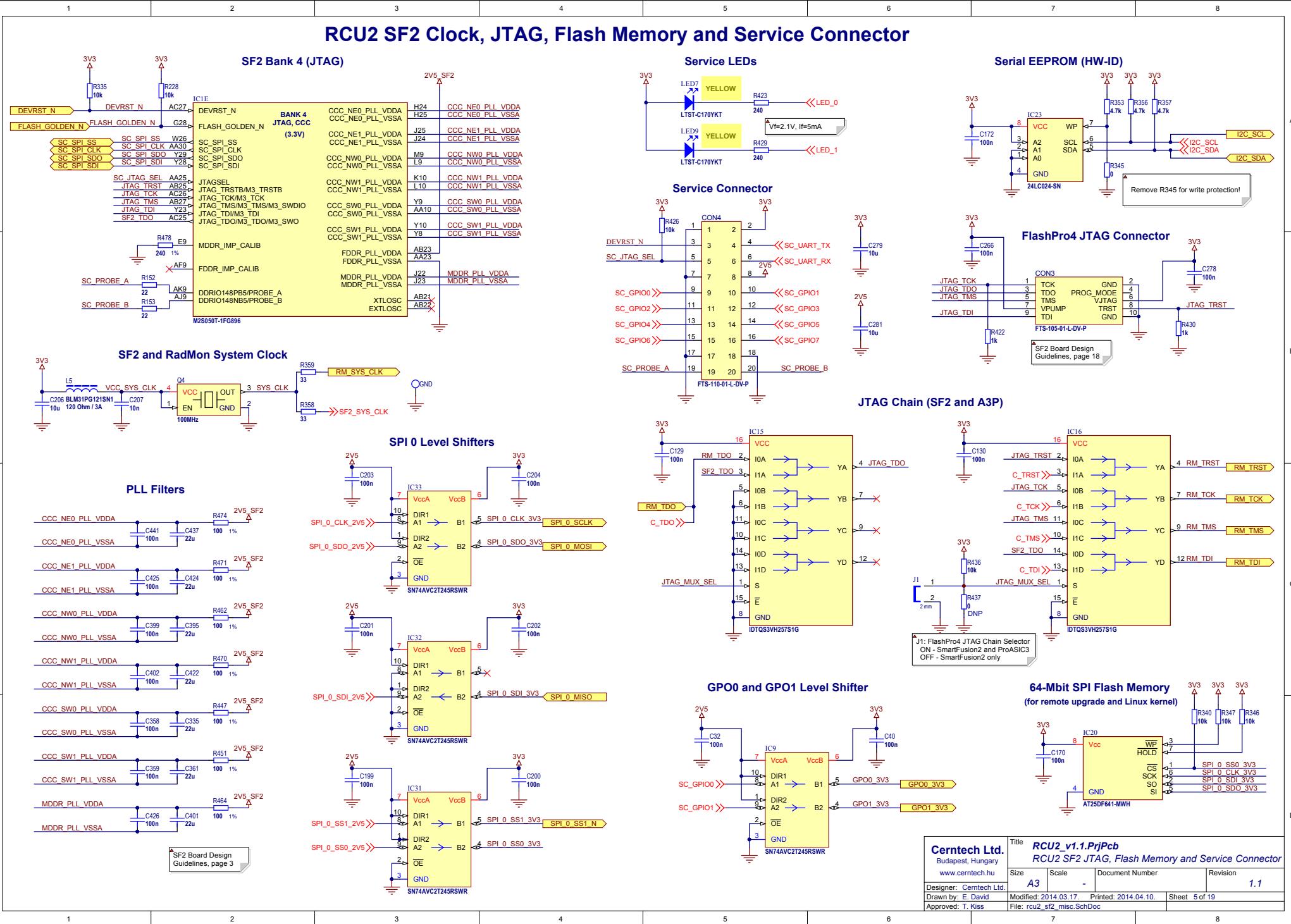


Cerntech Ltd.		Title RCU2_v1.1.PnjPcb RCU2 Top Level Schematic		
Size	Scale	Document Number	Revision	1.1
A3	-			
Designer: Cerntech Ltd.				
Drawn by: E. David		Modified: 2014.03.06.	Printed: 2014.04.10.	Sheet 2 of 19
Approved: T. Kiss				
		File: rcu2_top.SchDoc		

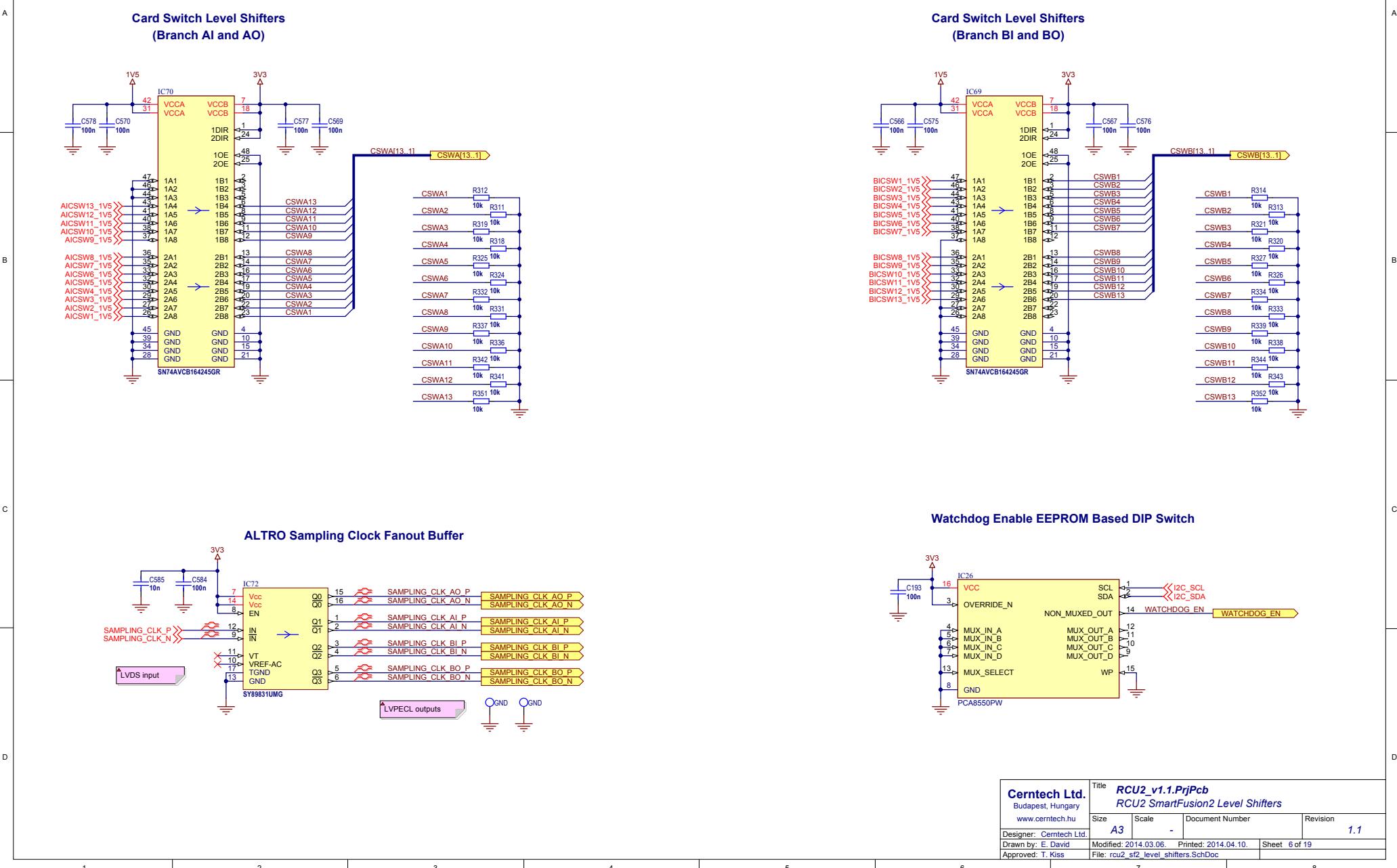


Cerntech Ltd. Budapest, Hungary www.cerntech.hu	Title RCU2_v1.1.PrjPcb RCU2 SmartFusion2 MDDR and DDR3
Designer: Cerntech Ltd.	Size A3 Scale - Document Number Revision 1.1
Drawn by: E. David	Modified: 2014.03.06. Printed: 2014.04.10. Sheet 4 of 19

RCU2 SF2 Clock, JTAG, Flash Memory and Service Connector

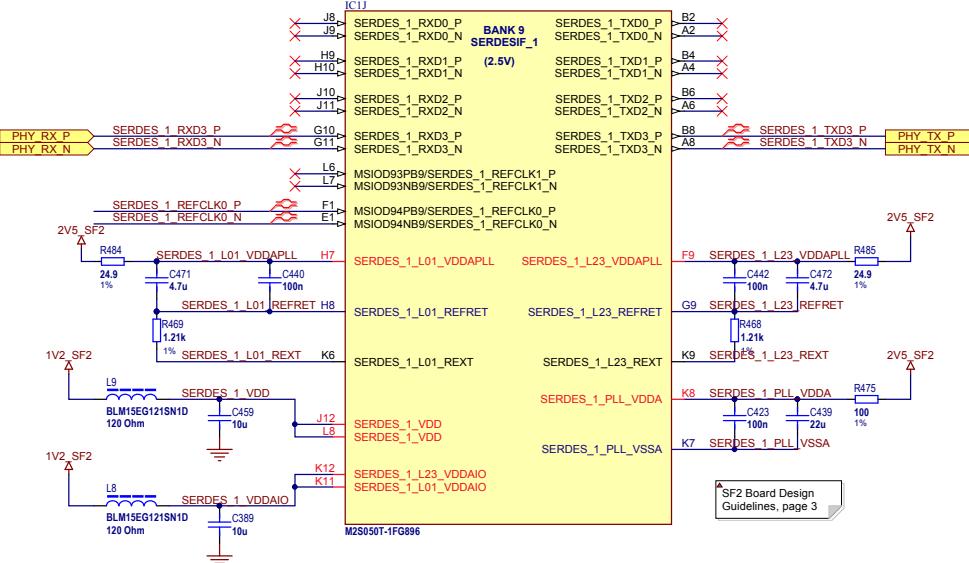
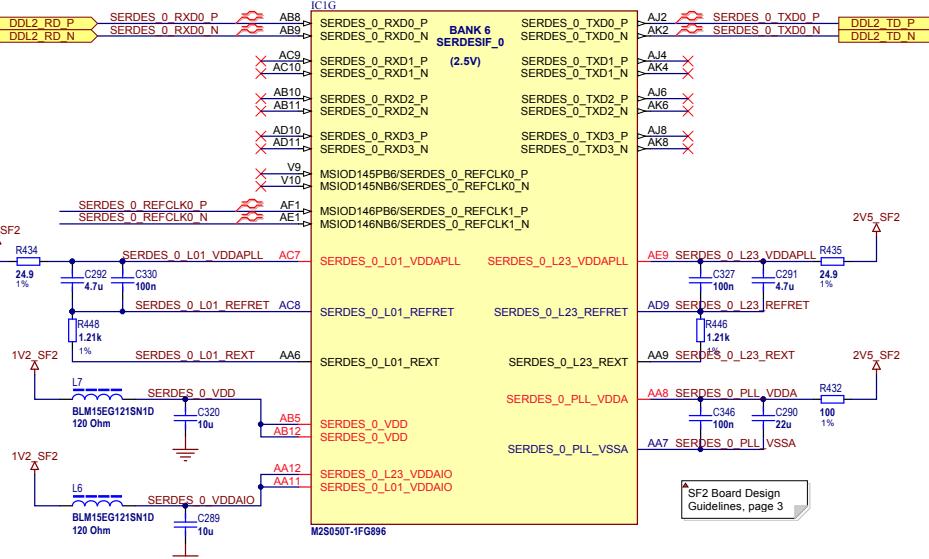


RCU2 SmartFusion2 Level Shifters

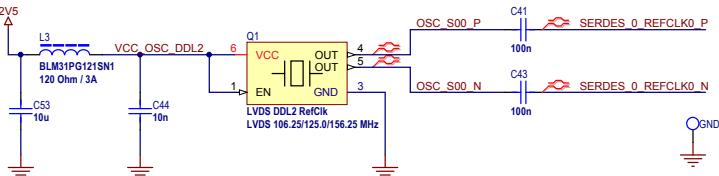


RCU2 SmartFusion2 SERDESIFs

SERDESIF 0 - DDL2 Interface

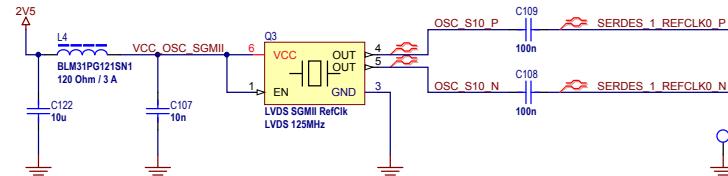


Reference Clock for DDI 2 Link



Recommended Discrete Components by Microsemi:		
Part Number	Manufacturer	Description
CRCW0402100RFKED	Vishay/Dale	Resistor 100 Ohms, 1%, 0402
CRCW0402250RFKED	Vishay/Dale	Resistor 25 Ohms, 1/16 W, 1%
CRCW04021K21KFED	Vishay/Dale	Resistor 1.21 Kohms, 1/16 W, 1%
CRCW04021K01KFED	Vishay/Dale	Resistor 1 Kohms, 1%, 0402, S

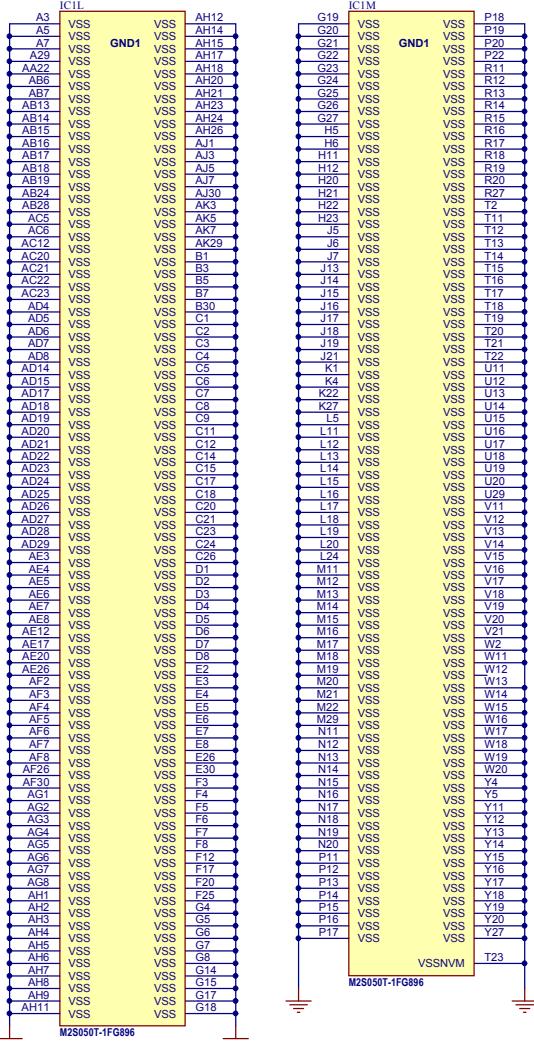
Reference Clock for SGMII Link



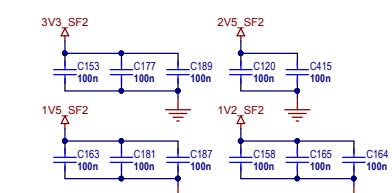
Cerntech Ltd. Budapest, Hungary www.cerntech.hu		Title RCU2_v1.1.PnjPcb RCU2 SmartFusion2 SERDESIFs		
Size	Scale	Document Number	Revision	
A3	-		1.1	
Designer: Cerntech Ltd.	Drawn by: E. David	Modified: 2014.04.10.	Printed: 2014.04.10.	Sheet 7 of 19
Annotated: T. Kiss		File: rcu2_st2.schdnc		

RCU2 SmartFusion2 Power and Decoupling

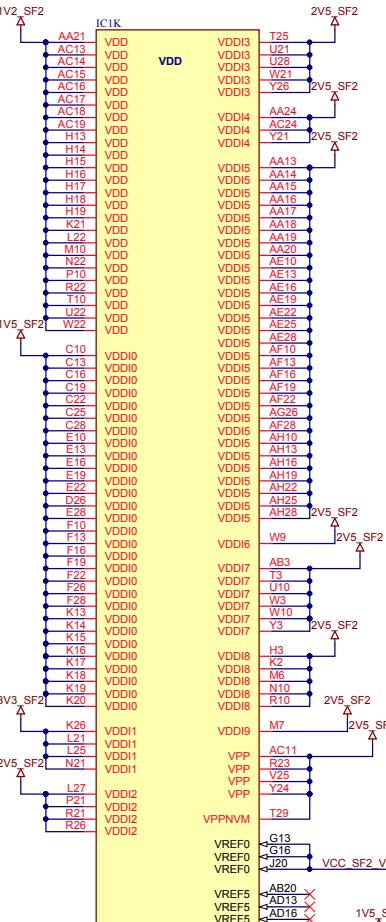
SmartFusion2 Ground Connections



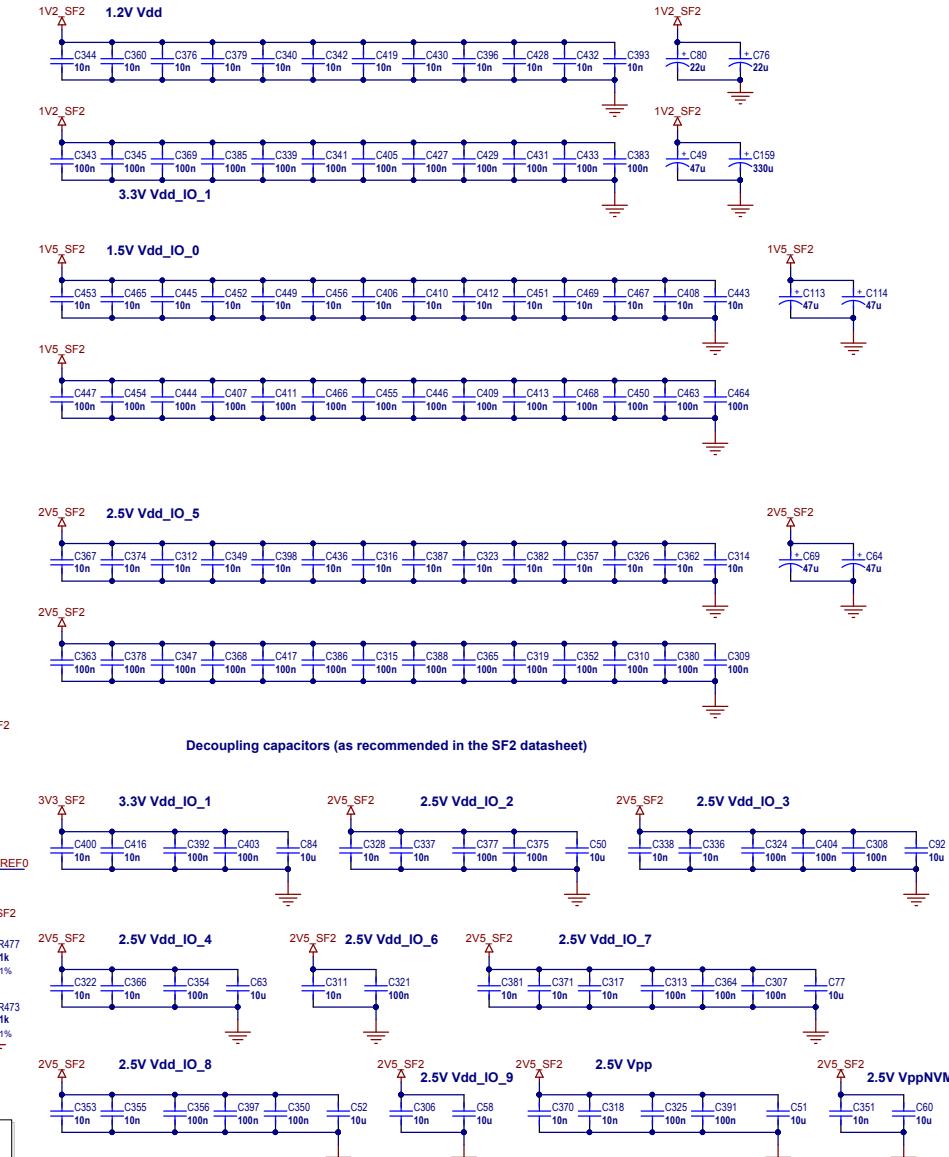
Some additional decoupling capacitors on the SF2 power planes



SmartFusion2 Power Connections



SmartFusion2 Decoupling Capacitors



▲ SF2 Board Design Guidelines, page 1

Recommended Capacitors by Microsemi:			
Part Number	Manufacturer	Description	
GMS158R1C101G00400D	Murata	Cap Ceramic 0.01 μ F, 16 V, 10%, X7R, 0402	
GMS158R1C101G00400S	Murata	Cap Ceramic 0.01 μ F, 16 V, 10%, X7R, 0402	
GMS158R0S01J06ME47D	Murata	Cap Ceramic 10 μ F, 6.3 V, X5R, 0603	
T491A75M016A	KEMET	Cap Tantalum 4.7 μ F, 16 V, 20%, 1411	
T491A75M016B	KEMET	Cap Tantalum 22 μ F, 16 V, 20%, 1411	
T491A75M016C	KEMET	Cap Tantalum 100 μ F, 16 V, 20%, 2917	
TPS201V07M01A0T2E050	KEMET	Cap Tantalum 100 μ F, 10 V, 20%, 2917	
TPS233K010R0050	AVX	Cap Tantalum 330 μ F, 10 V, 10%, 2917	

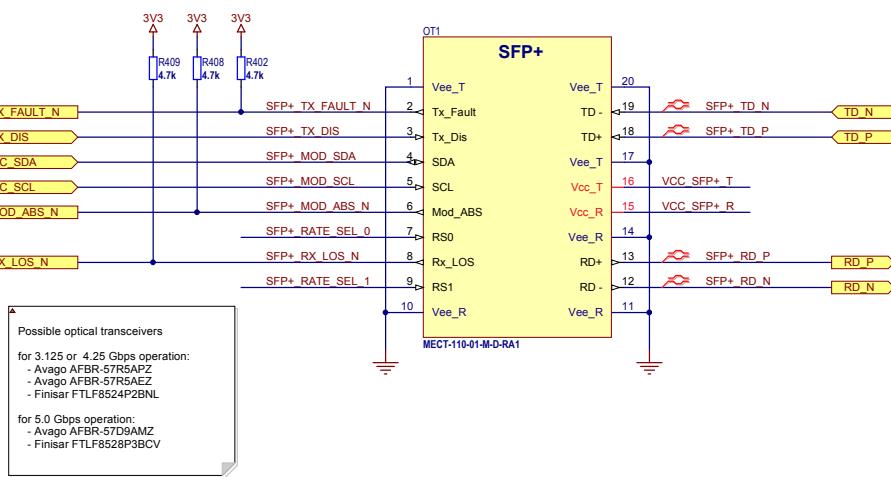
Cerntech Ltd

Budapest, Hungary RCU2 SmartFusion2 Power and Decoupling

www.cerntech.hu Size **A3** Scale **-** Document Number Revision **1.1**
 Designer: **Cerntech Ltd.** Modified: **2014-03-17** Printed: **2014-04-10** Sheet **8 of 10**
 Design by: **C. David**

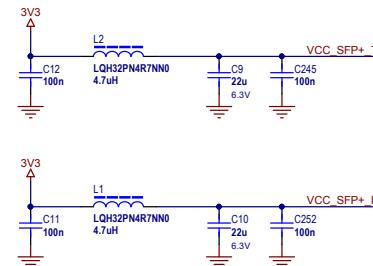
RCU2 DDL2 Link

SFP+ Module



SFP+ Power Filters

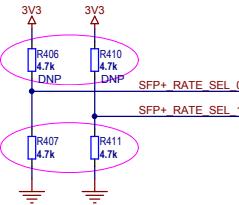
* SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module SFP+, p 64



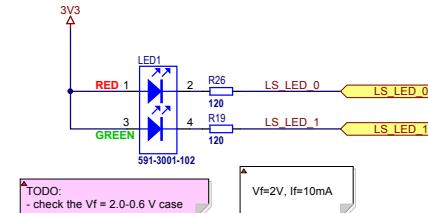
SFP+ Module Signaling Rate Configuration

According to the SFF specification, if Tx and Rx signaling rate is greater than 4.25 Gbs then:
- populate R406 and R410
- DNP: R407 and R411
else:
- DNP: R406 and R410
- populate R407 and R411
(SFF-8431 page 9)

Certain double data rate SFP transceivers may have different signaling rate control specification. Please, check transceivers datasheets!



DDL2 Link Status LED

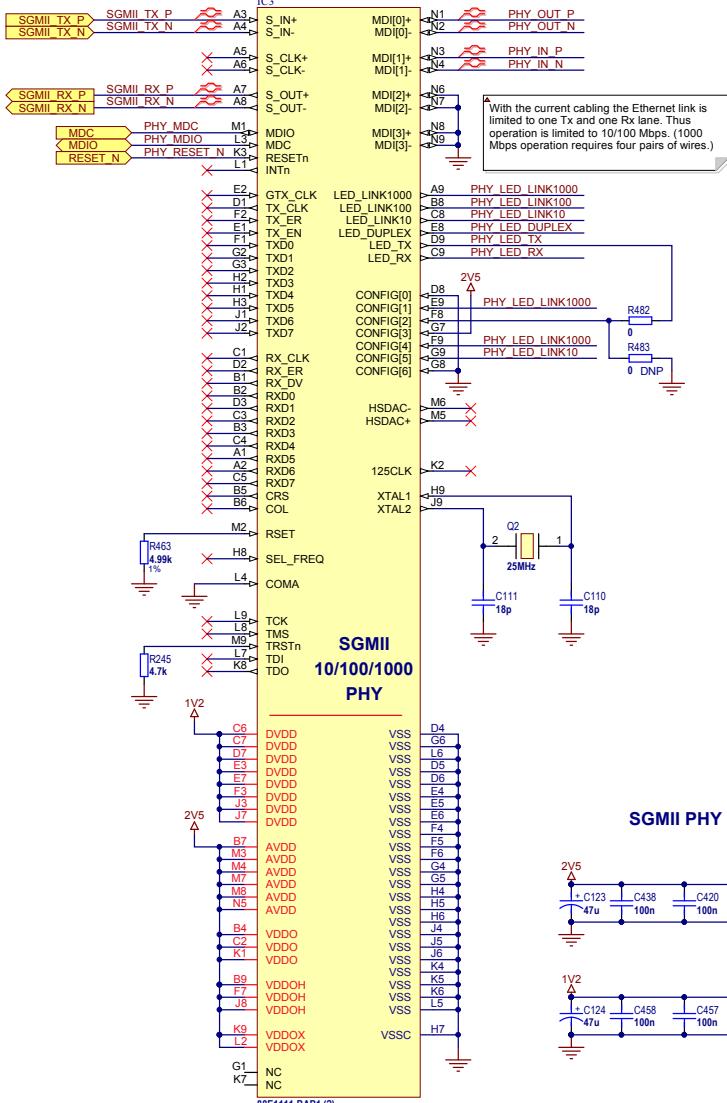


Cerntech Ltd.

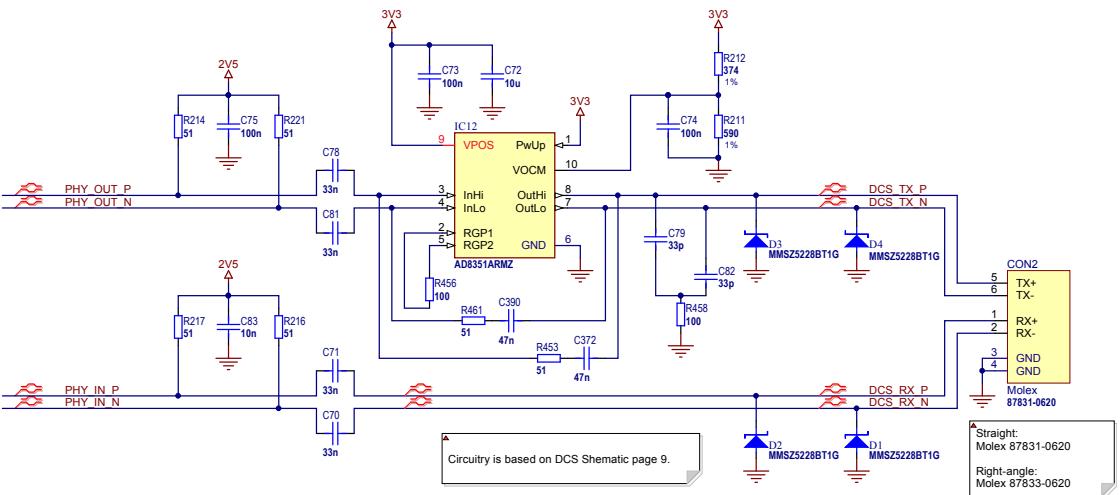
Title **RCU2_v1.1.PriPcb**
RCU2 DDL2 Link

Size	Scale	Document Number	Revision
A3	-		1.1
Designer: Cerntech Ltd.			
Drawn by: E. David	Modified: 2014.03.17.	Printed: 2014.04.10.	Sheet 9 of 19
Approved: T. Kiss			
File: rcu2_ddl2.SchDoc			

RCU2 Ethernet Link (DCS)

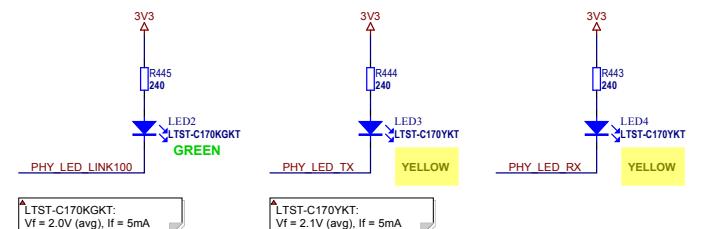


With the current cabling the Ethernet link is limited to one Tx and one Rx lane. Thus operation is limited to 10/100 Mbps. (1000 Mbps operation requires four pairs of wires.)

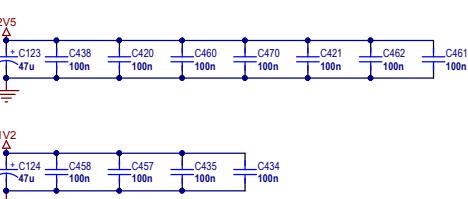


Circuitry is based on DCS Shematic page 9.

Ethernet Link Status LEDs

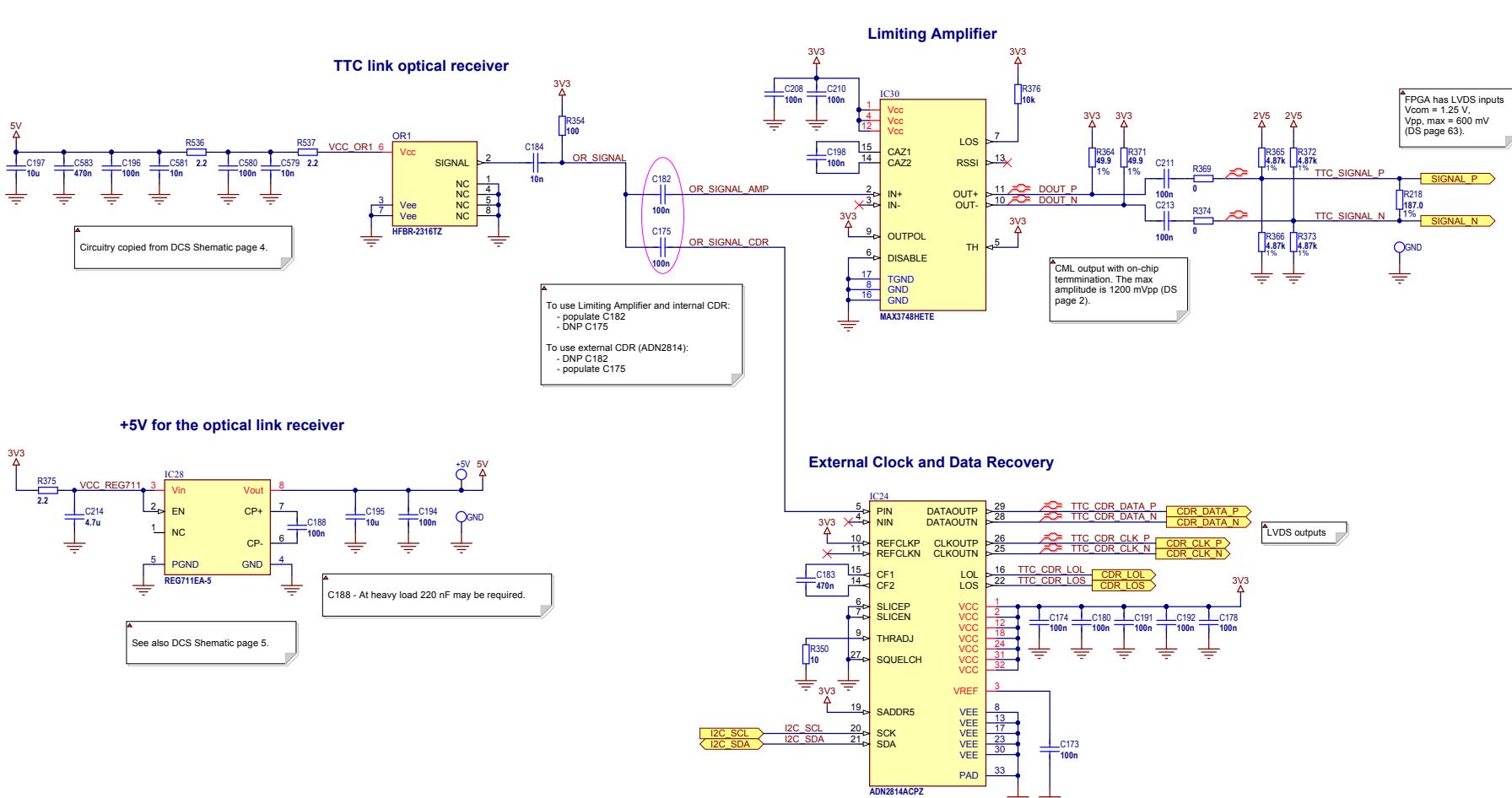


SGMII PHY Decoupling Capacitors



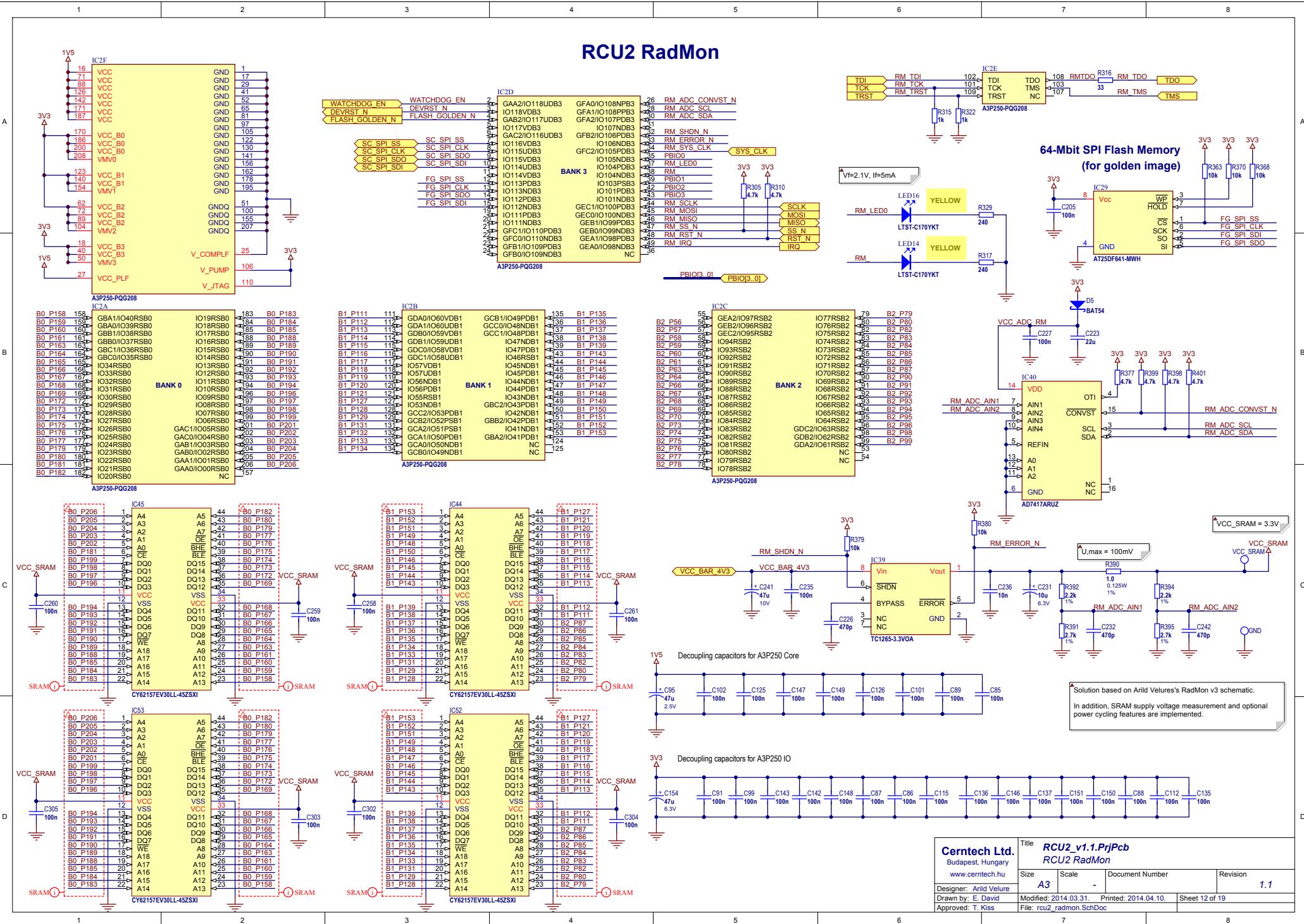
Cerntech Ltd. Budapest, Hungary www.cerntech.hu	Title RCU2_v1.1.PrvPcb RCU2 Ethernet Link (DCS)			
	Size	Scale	Document Number	Revision
Designer: Cerntech Ltd.	A3	-		1.1
Drawn by: E. David	Modified: 2014.04.10.	Printed: 2014.04.10.	Sheet 10 of 19	
Approved: T. Kiss	File: rcu2_ethernet.SchDoc			

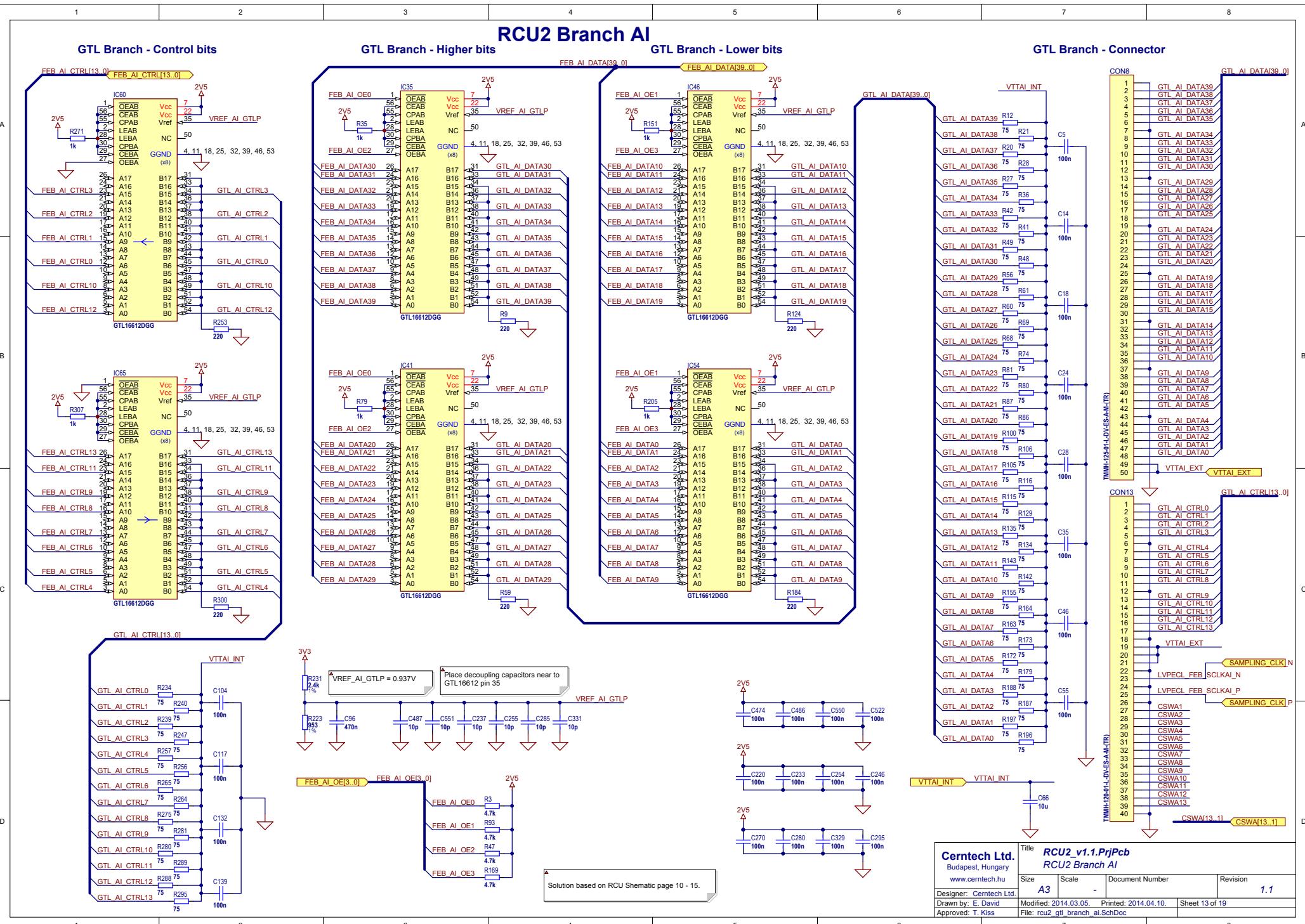
RCU2 Timing, Trigger and Control Link (TTC)



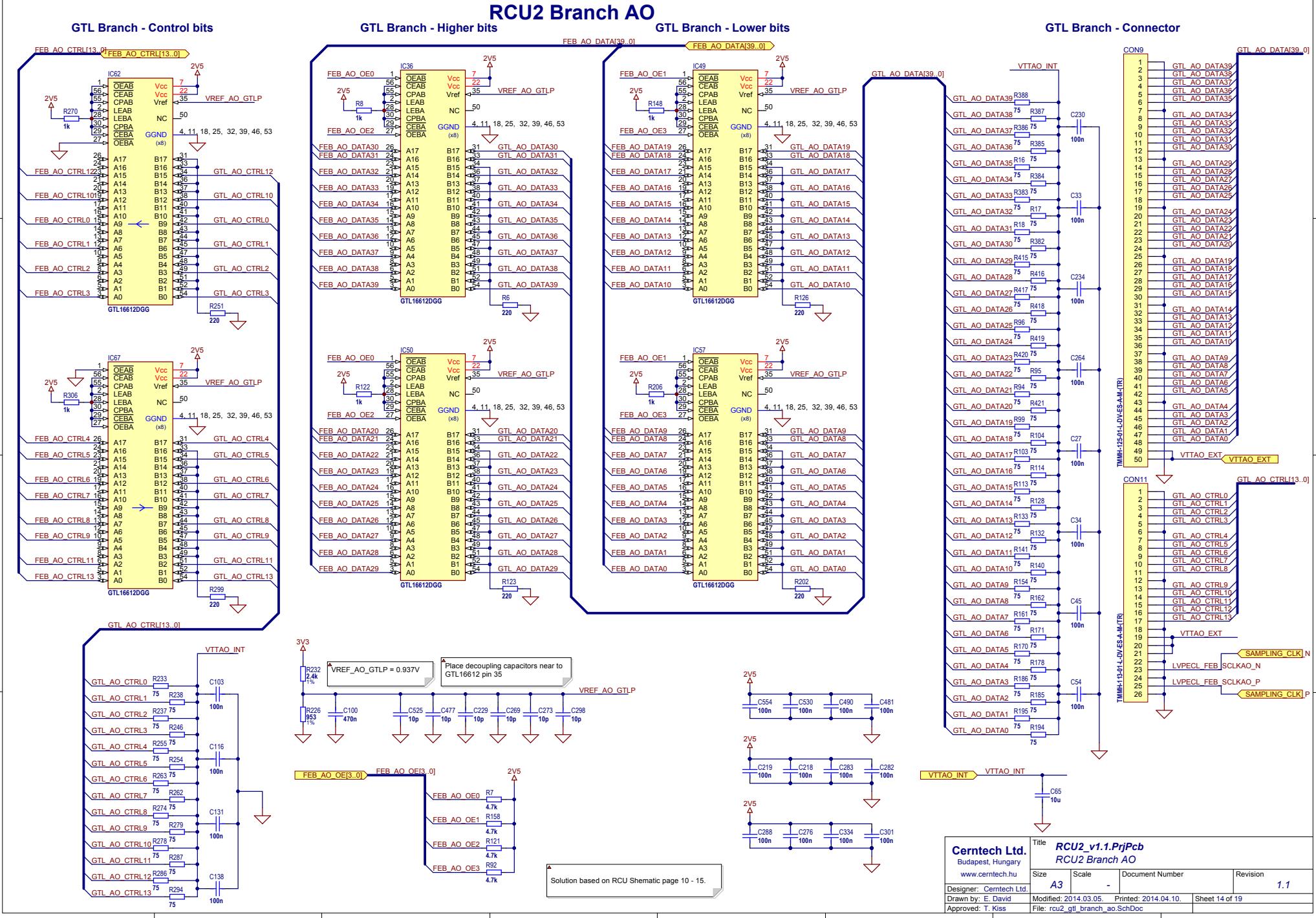
Cerntech Ltd.		Title RCU2_v1.1.PnjPcb RCU2 Timing, Trigger and Control Link (TTC)		
Size	Scale	-	Document Number	Revision
A3	-			1.1
Designer:	Cerntech Ltd.			
Drawn by:	E. David	Modified:	2014.04.10.	Printed: 2014.04.10.
Approved:	T. Kiss	File:	rcu2_ttc.SchDoc	Sheet 11 of 19

RCU2 RadMon



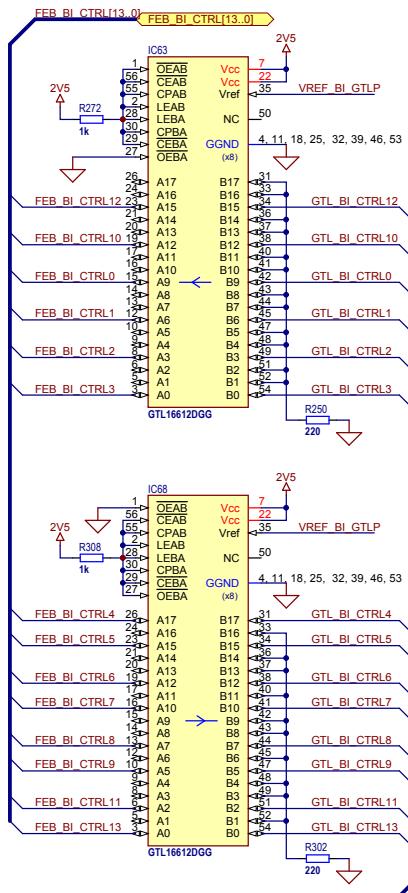


RCU2 Branch AO

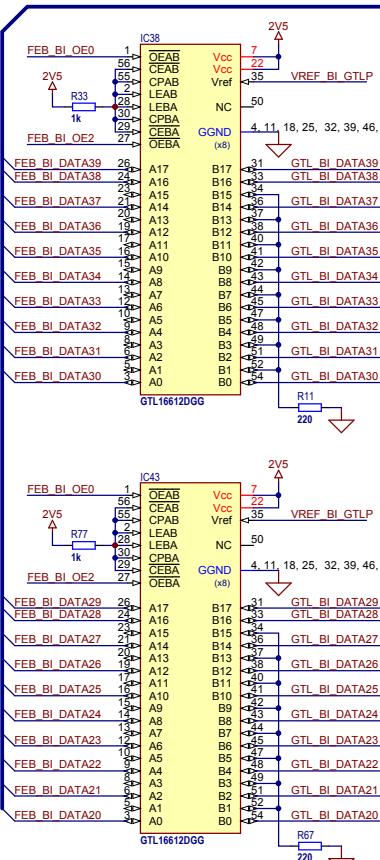


RCU2 Branch BI

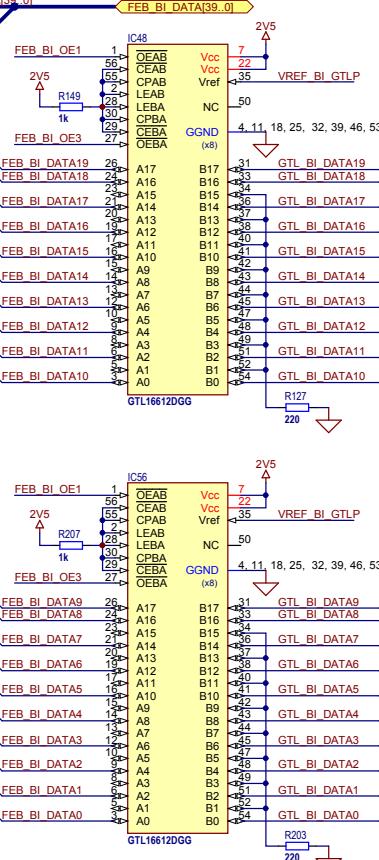
GTL Branch - Control bits



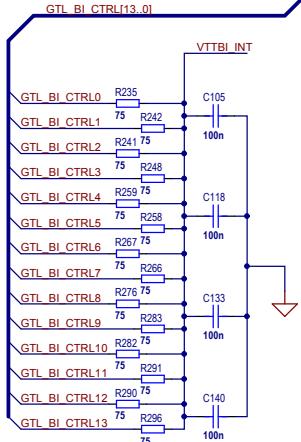
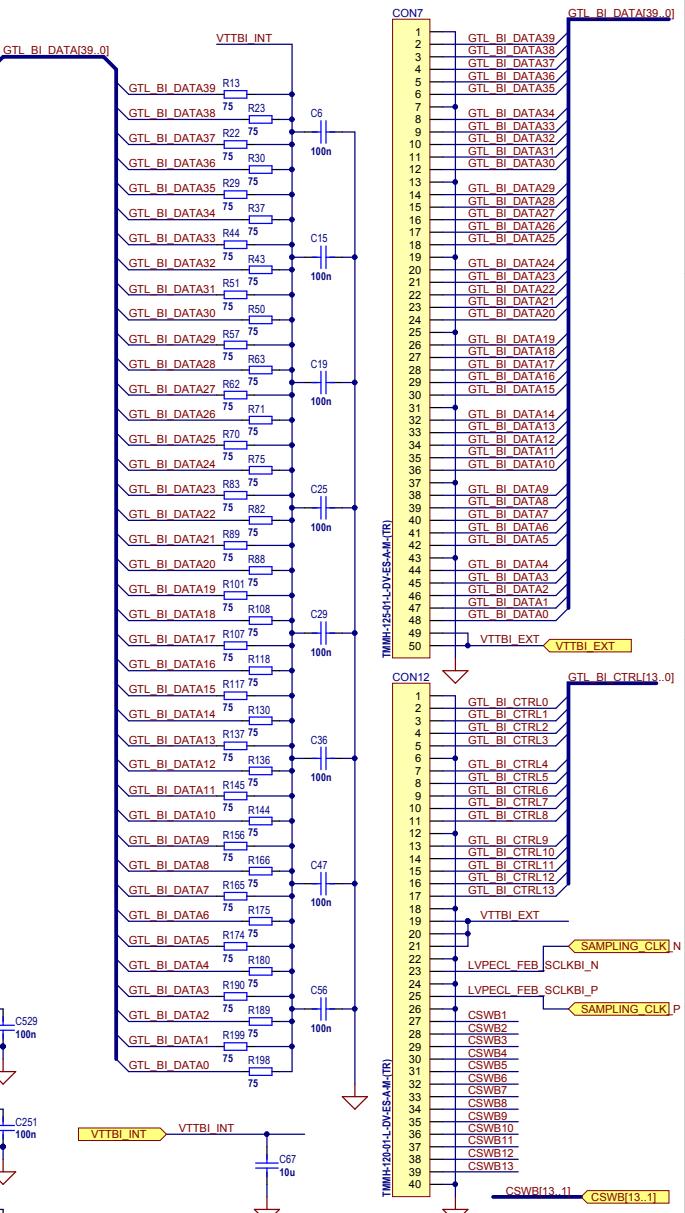
GTL Branch - Higher bits



GTL Branch - Lower bits



GTL Branch - Connector



A
Solution based on RCU Schematic page 10 - 15.

Cerntech Ltd.

Budapest, Hungary

www.cerntech.hu

Designer: Cerntech Ltd.

Drawn by: E. David

Approved: T. Kiss

Title: RCU2_v1.1.PriPcb

RCU2 Branch BI

Size: A3

Scale: -

Document Number:

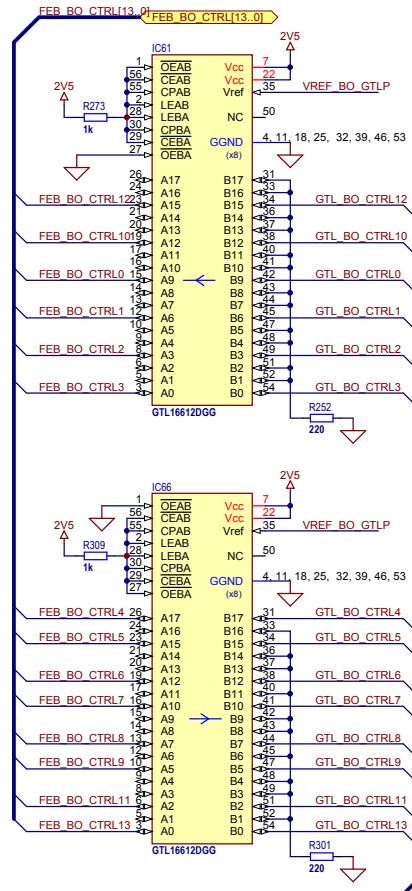
Revision: 1.1

Printed: 2014.04.10.

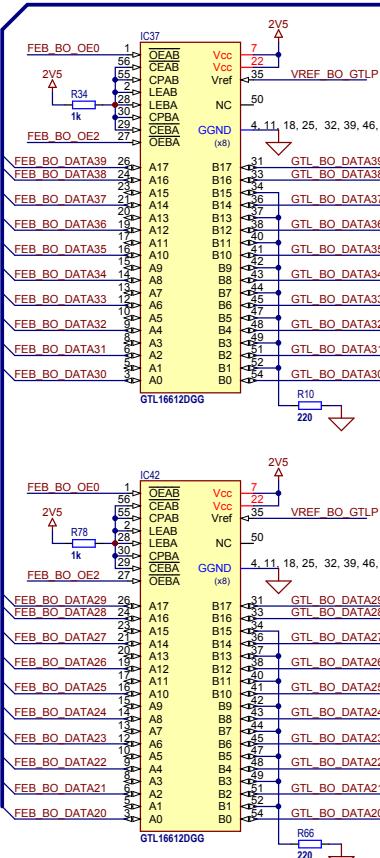
Sheet 15 of 19

RCU2 Branch BO

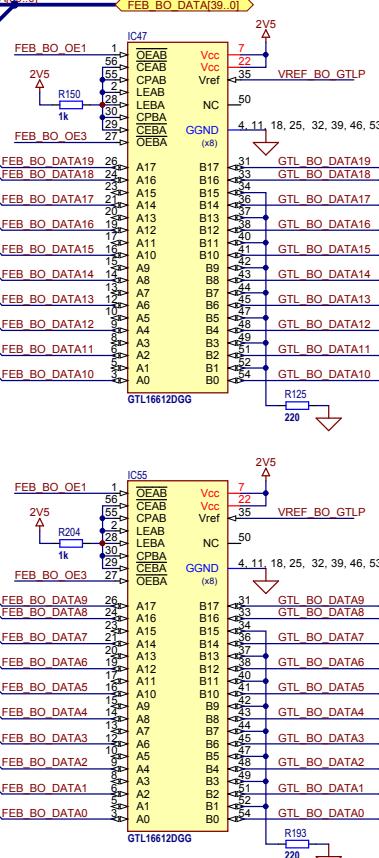
GTL Branch - Control bits



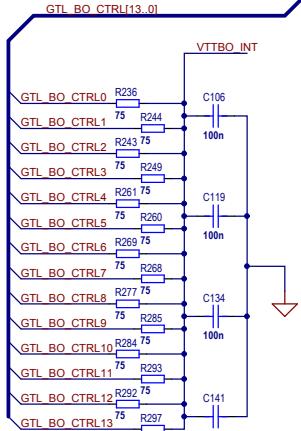
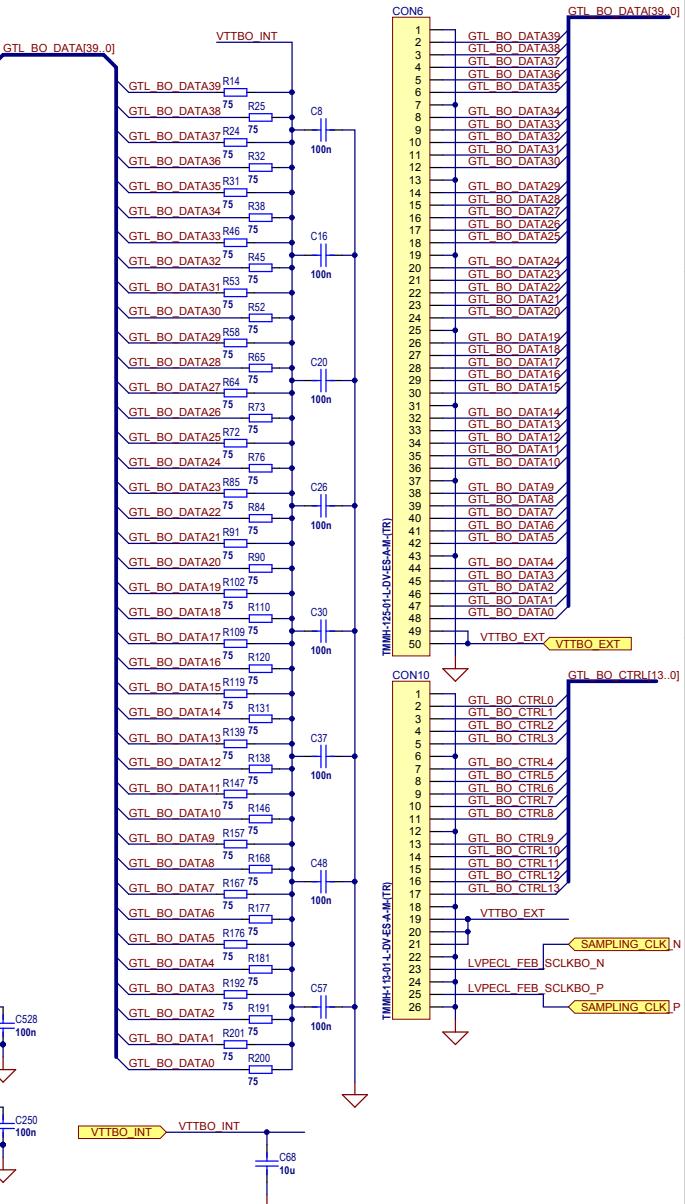
GTL Branch - Higher bits



GTL Branch - Lower bits



GTL Branch - Connector



Solution based on RCU Schematic page 10 - 15.

Cerntech Ltd.

Budapest, Hungary

www.cerntech.hu

Designer: Cerntech Ltd.

Drawn by: E. David

Approved: T. Kiss

Title: RCU2_v1.1.PriPcb
RCU2 Branch BO

Size: A3

Scale: -

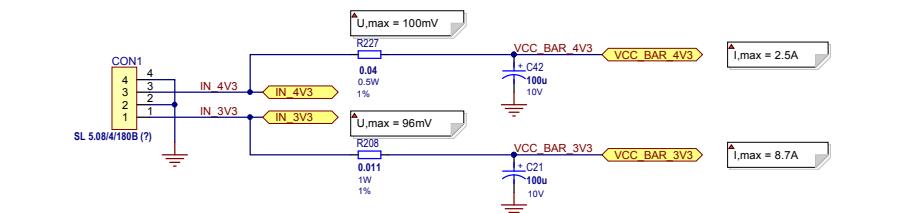
Document Number:

Revision: 1.1

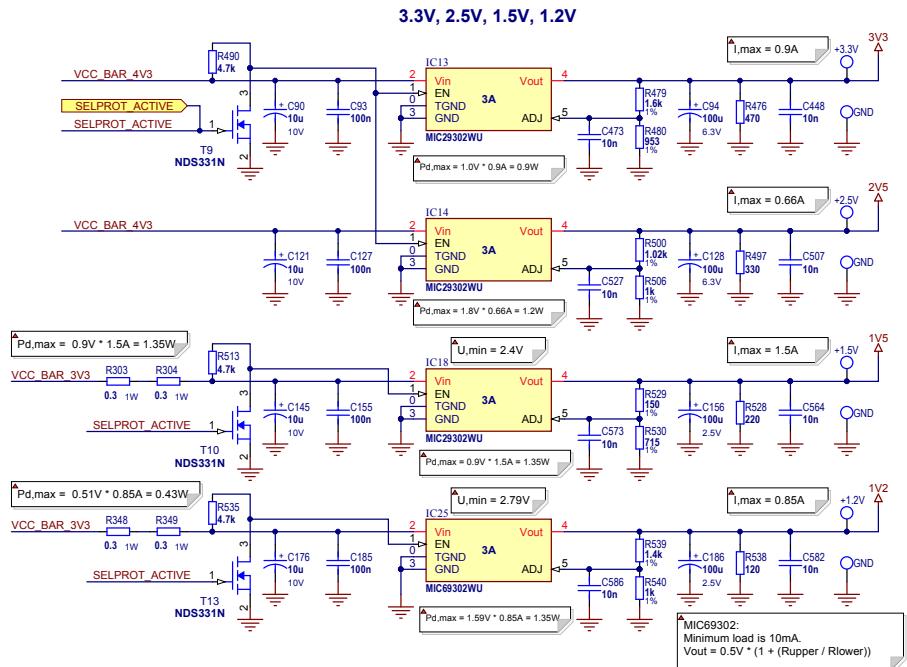
Printed: 2014.04.10.

Sheet 16 of 19

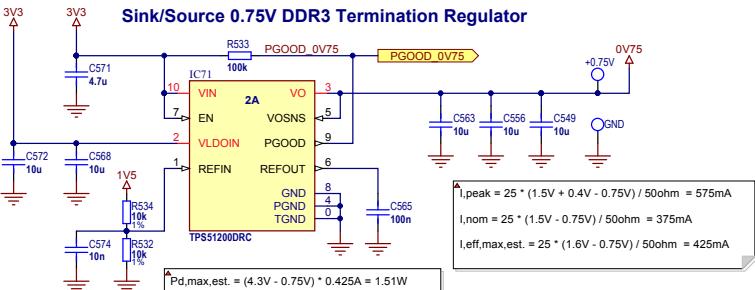
External Supply Voltage Rails with Current Sense Resistors



RCU2 Voltage Regulators

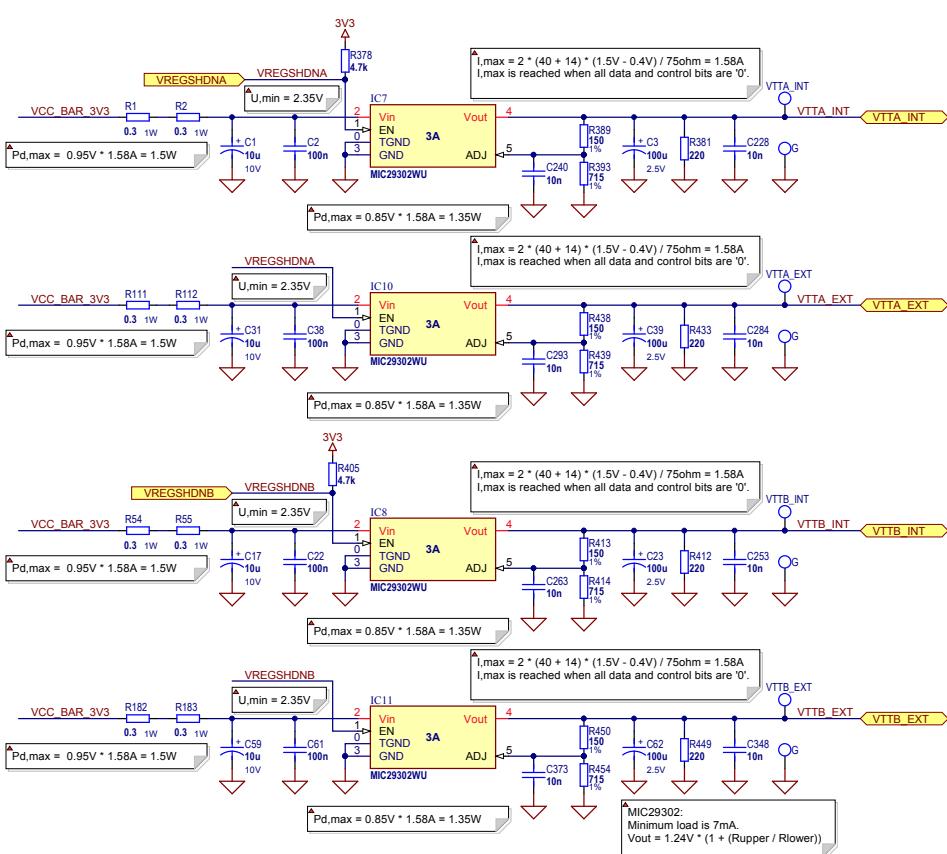


Sink/Source 0.75V DDR3 Termination Regulator

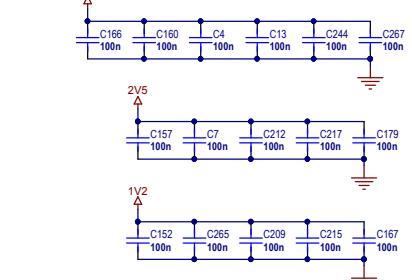


Voltage regulator circuitries are mainly based on RCU Schematic page 4.
MIC29302 and TC1265 are proved to be radiation tolerant (RCU).
MIC69302 is assumed to be of the same technology.
TFS51200 is used on the SF2 Dev. Board, rad tolerance is not known.

1.5V GTLP Termination Voltages

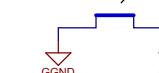


Decoupling capacitor



GTL and Power Plane Ground Separation

GND and GGND planes are routed separately and are connected to each other at the power input connector only.



Cerntech Ltd.

Budapest, Hungary

www.cerntech.hu

Designer: Cerntech Ltd.

Drawn by: E. David

Approved: T. Kiss

Title: **RCU2_v1.1.PrcPcb**
RCU2 Voltage Regulators

Size: **A3**

Scale: **-**

Document Number:

Revision: **1.1**

Modified: 2014.03.31.

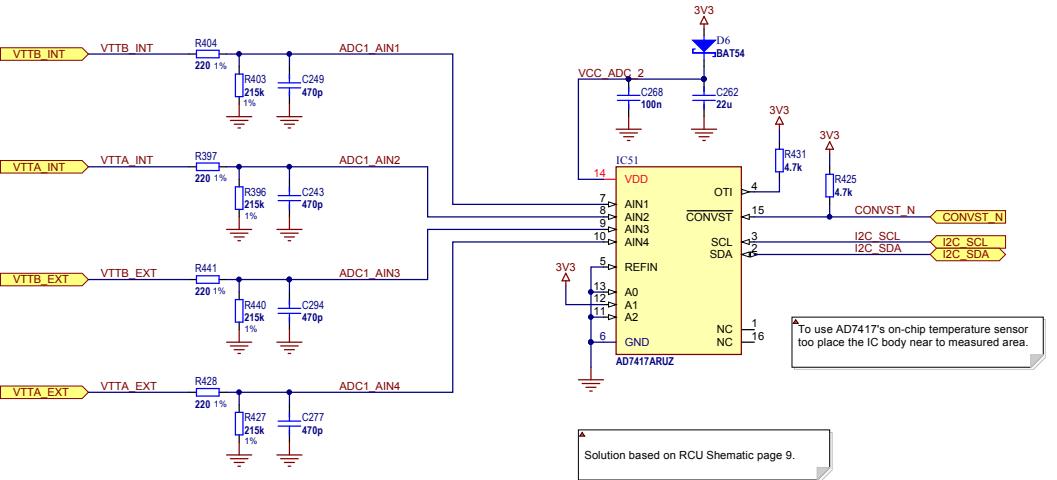
Printed: 2014.04.10.

Sheet 17 of 19

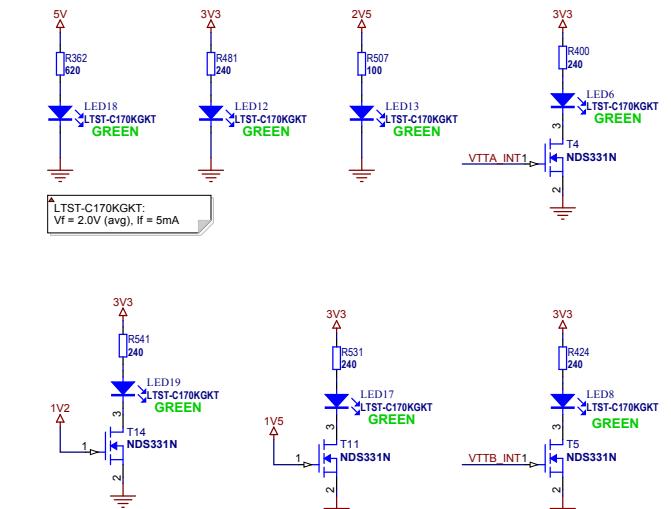
File: **rcu2_v2.power.SchDoc**

RCU2 Power Supervision

Power Supervisor A/D Converters



Voltage Regulator LEDs



The diagram illustrates the measurement of supply currents for RCU2. It features two main sections: one for the 4.3V supply and one for the 3.3V supply.

4.3V Supply Section:

- Input:** IN 4V3 connected to VCC_BAR_4V3.
- Op-Amp:** IC59 (LT1178T CMS8#PBF) configured as a voltage follower. Its output, Vout, is connected to the non-inverting input (Pin 5) of two ADCs (ADC2_AIN3 and ADC2_AIN4).
- Feedback:** The inverting input (Pin 3) of IC59 is connected to ground through a 220Ω resistor (R466). A 2.2kΩ resistor (R480) is connected between the output Vout and the inverting input.
- Biasing:** The bias voltage Vbias is generated by a feedback loop involving resistors R487 (215kΩ), R488 (2.7kΩ), and C484 (470pF).
- ADCs:** ADC2_AIN3 and ADC2_AIN4 are connected to the output of IC59. They also receive a reference voltage (REFIN) from the 3.3V section.

3.3V Supply Section:

- Input:** IN 3V3 connected to VCC_BAR_3V3.
- Op-Amp:** IC58 (LT1178T CMS8#PBF) configured as a voltage follower. Its output, Vout, is connected to the non-inverting input (Pin 5) of two ADCs (ADC2_AIN1 and ADC2_AIN2).
- Feedback:** The inverting input (Pin 3) of IC58 is connected to ground through a 220Ω resistor (R466). A 2.2kΩ resistor (R459) is connected between the output Vout and the inverting input.
- Biasing:** The bias voltage Vbias is generated by a feedback loop involving resistors R467 (215kΩ), R468 (2.7kΩ), and C483 (470pF).
- ADCs:** ADC2_AIN1 and ADC2_AIN2 are connected to the output of IC58. They also receive a reference voltage (REFIN) from the 3.3V section.

Reference Voltage (REFIN):

- REFIN is generated by the AD7417ARUZ ADC (Pin 16) using a 3.3V reference (Pin 3) and a 4.3V reference (Pin 5).
- The AD7417ARUZ also provides digital control signals: OTI (Pin 14), CONVST_N (Pin 15), SCL (Pin 3), and SDA (Pin 4).

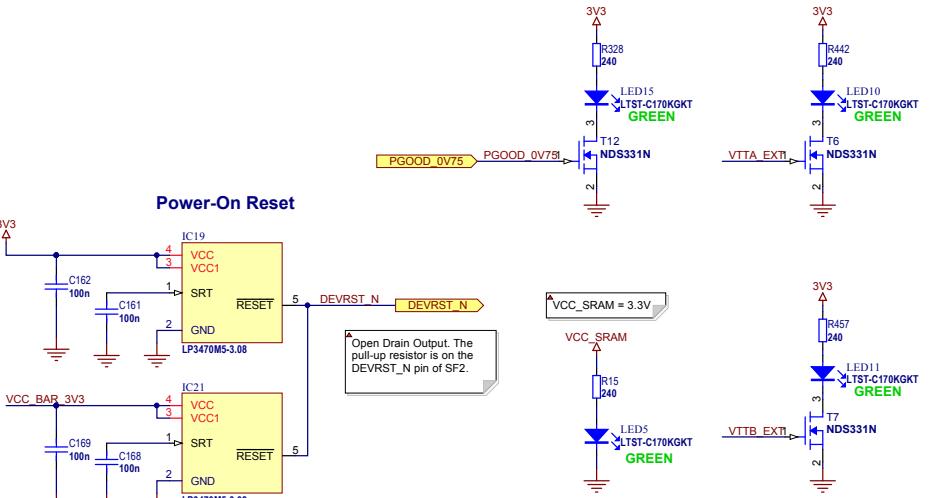
Power Supply:

- VDD is connected to Pin 7 of the AD7417ARUZ.
- 3V3 is connected to the reference pins of the op-amps (Pin 2 of IC59 and Pin 2 of IC58) and to the VCC ADC pins of the AD7417ARUZ.
- GND is connected to the ground pins of all components.

Note: This ADC measures the supply currents of RCU2 from 4.3V and 3.3V respectively, by measuring the voltage differences (drops) on R220 and R206. (See page 15.)

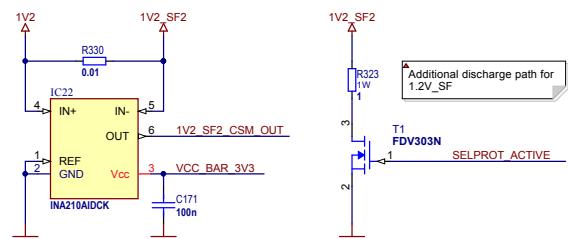
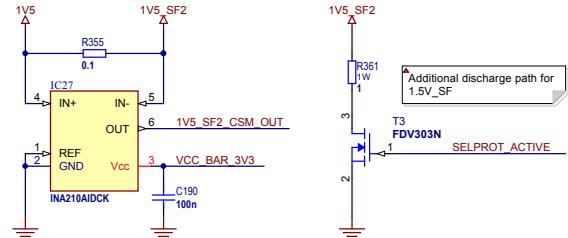
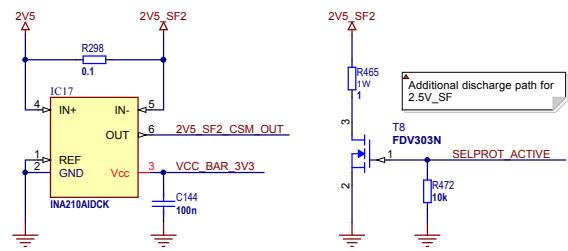
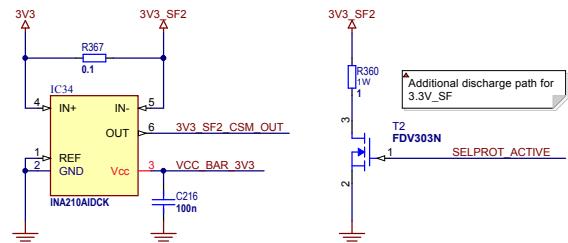
▲ This ADC measures the supply currents of RCU2 from 4.3V and 3.3V respectively, by measuring the voltage differences (drops) on R220 and R206. (See page 15.)

Power-On Reset



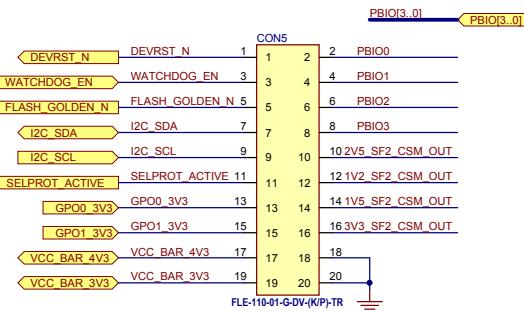
RCU2 SF2 Current Monitoring and SM connector (for latch-up protection)

Current Monitoring Amplifiers



RCU2 Safeguarding Module (SM) Connector

(piggy back card)



Cerntech Ltd.

Budapest, Hungary
www.cerntech.hu

Title **RCU2_v1.1.PriPcb**
RCU2 SF2 Current Monitoring

Size	Scale	Document Number	Revision
A3	-		1.1
Designer: Cerntech Ltd.			
Drawn by: E. David	Modified: 2014.03.19.	Printed: 2014.04.10.	Sheet 19 of 19
Approved: T. Kiss			
File: rcu2_hw_protection.SchDoc			