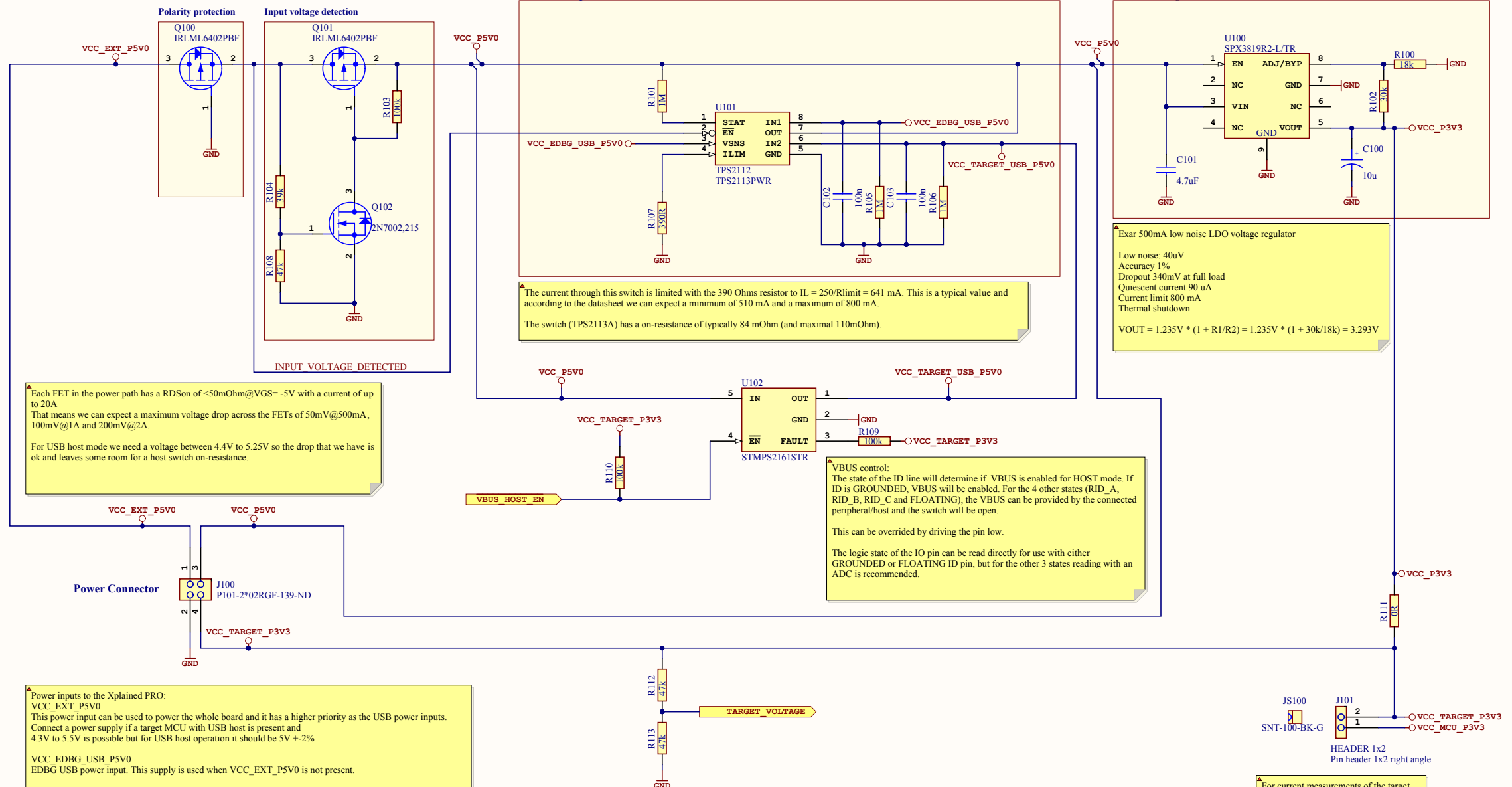


Product information and documentation links:

- LABEL1**: Product number/revision, Serial number
- TEST1**: A11-0277
- TESTDOC1**: A12-0794
- FW1**: A11-0196
- PCB1**: A08-2194 SAMG55 PCB Documentation
- PCBADOC1**: A12-0941
- FIXTURE1**: A13-0086

*	GS			
Atmel	MSK			
Chennai	*			
Date:	31-10-2014	14:31:36	PAGE:	1 of 6
Document number:	A12-0941		Revision:	2
TITLE: Top Level Schematics				
SAMG55_Xplained_Pro_TopLevel.SchDoc				



Each FET in the power path has a $R_{DS(on)}$ of $<50\text{m}\Omega$ at $V_{GS} = -5\text{V}$ with a current of up to 20A. That means we can expect a maximum voltage drop across the FETs of 50mV @ 500mA , 100mV @ 1A and 200mV @ 2A .

For USB host mode we need a voltage between 4.4V to 5.25V so the drop that we have is ok and leaves some room for a host switch on-resistance.

The current through this switch is limited with the 390 Ohms resistor to $I_L = 250/R_{limit} = 641\text{ mA}$. This is a typical value and according to the datasheet we can expect a minimum of 510 mA and a maximum of 800 mA.

The switch (TPS2113A) has an on-resistance of typically 84 mOhm (and maximal 110mOhm).

VBUS control:
The state of the ID line will determine if VBUS is enabled for HOST mode. If ID is GROUNDED, VBUS will be enabled. For the 4 other states (RID_A, RID_B, RID_C and FLOATING), the VBUS can be provided by the connected peripheral/host and the switch will be open.

This can be overridden by driving the pin low.

The logic state of the IO pin can be read directly for use with either GROUNDED or FLOATING ID pin, but for the other 3 states reading with an ADC is recommended.

Power inputs to the Xplained PRO:
VCC_EXT_P5V0
This power input can be used to power the whole board and it has a higher priority as the USB power inputs. Connect a power supply if a target MCU with USB host is present and 4.3V to 5.5V is possible but for USB host operation it should be 5V $\pm 2\%$

VCC_EDBG_USB_P5V0
EDBG USB power input. This supply is used when VCC_EXT_P5V0 is not present.

VCC_TARGET_USB_P5V0
Target MCU USB power input. It is used to power the whole board when no other 5V power supply is present.

Other voltages:
VCC_P5V0
This supply is connected to either VCC_EXT_P5V0, VCC_EDBG_USB_P5V0 or VCC_TARGET_USB_P5V0, based on the availability and priority of these supplies.

VCC_P3V3
Regulated 3.3V from VCC_P5V0

VCC_TARGET
Target supply voltage (target MCU and peripherals)

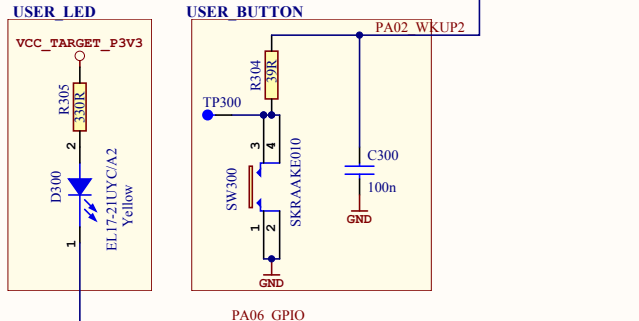
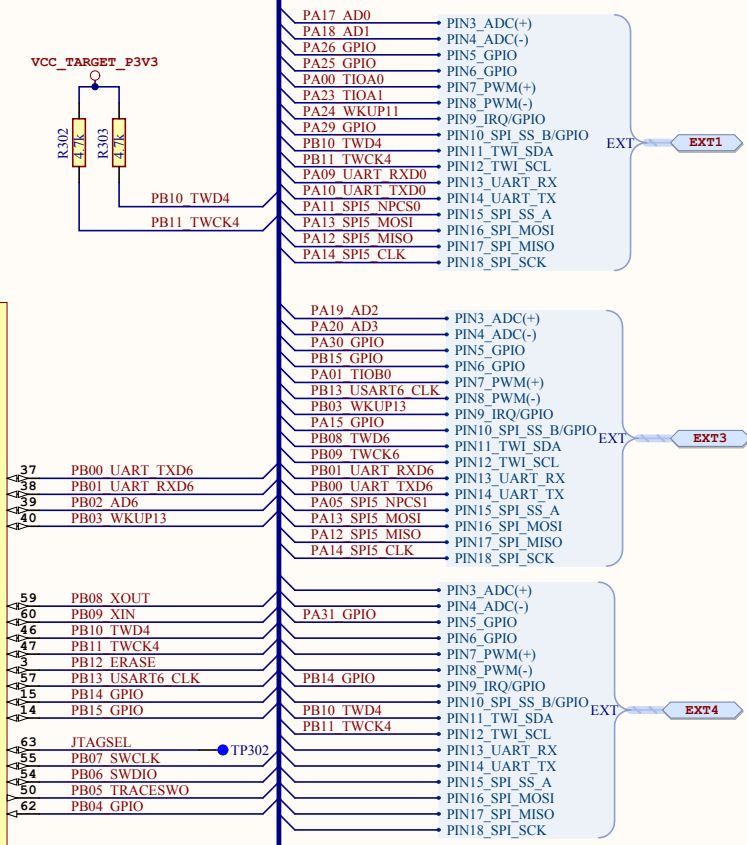
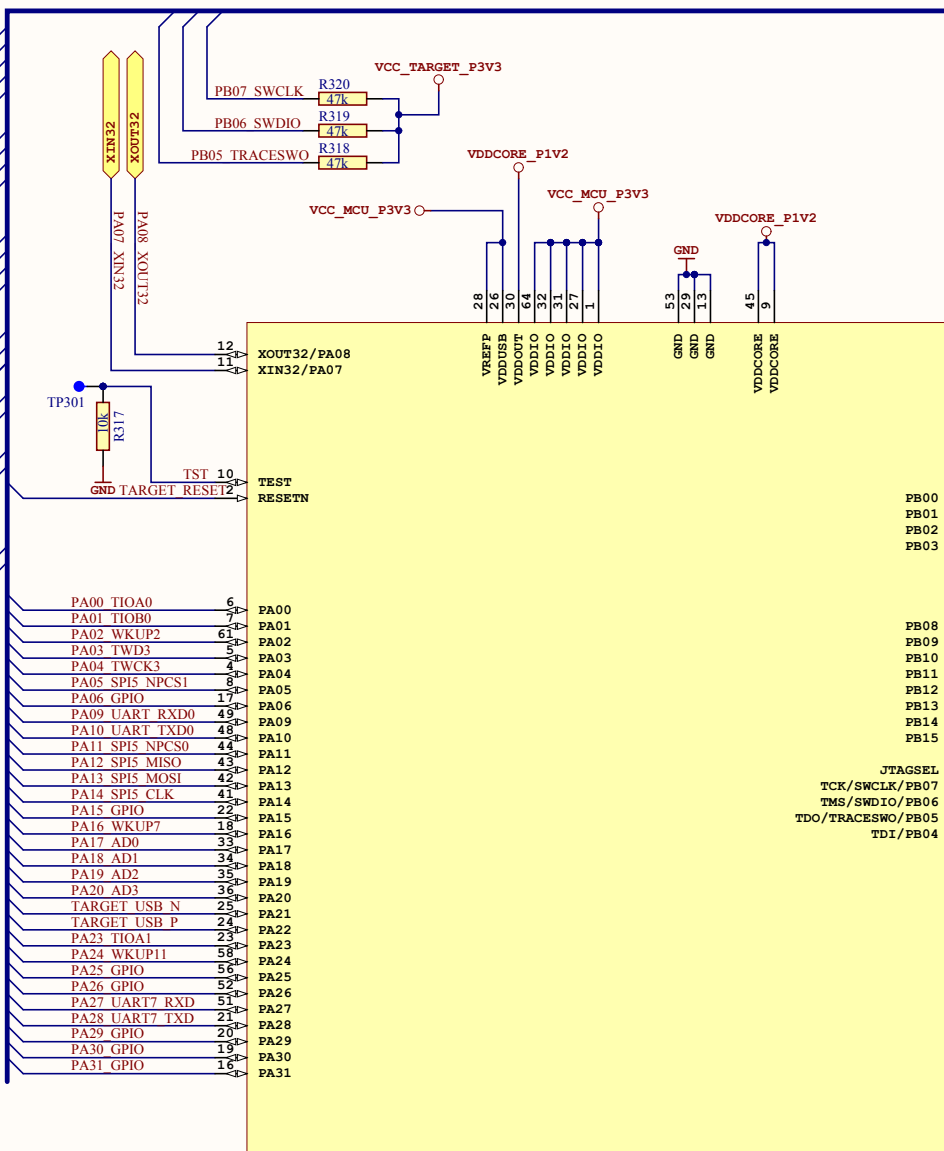
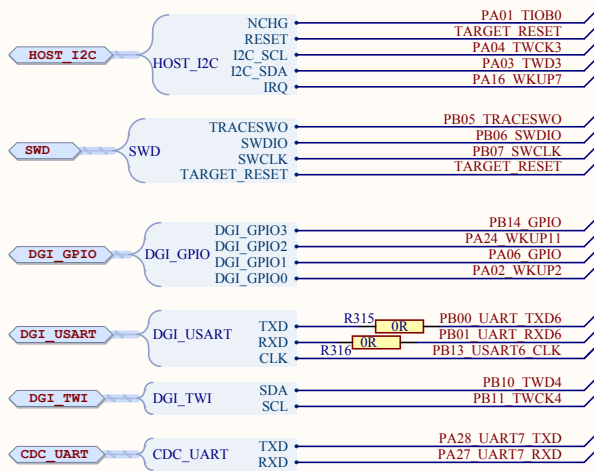
Exar 500mA low noise LDO voltage regulator

Low noise: 40uV
Accuracy 1%
Dropout 340mV at full load
Quiescent current 90 uA
Current limit 800 mA
Thermal shutdown

$V_{OUT} = 1.235\text{V} * (1 + R1/R2) = 1.235\text{V} * (1 + 30k/18k) = 3.293\text{V}$

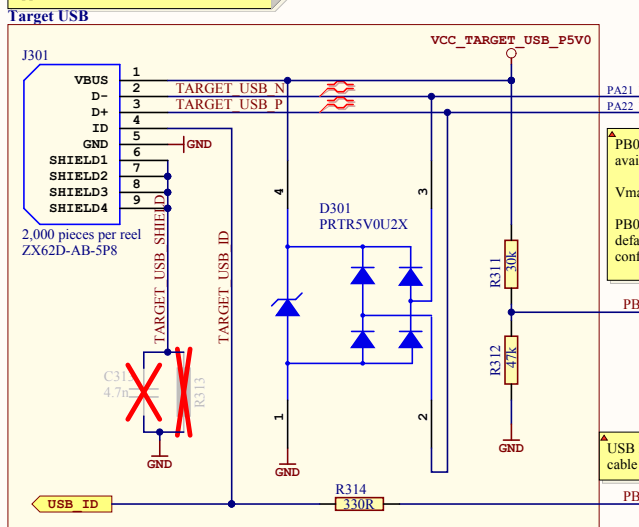
For current measurements of the target MCU remove this jumper and connect a measurement instrument.

*	GS			
Atmel	MSK			
Chennai	*			
Date:	31-10-2014	14:31:36	PAGE: 2 of 6	
Document number:	A12-0941		Revision: 2	
TITLE: Power supply				
SAMG55_Xplained_Pro_triple_input_power_supply.SchDoc				



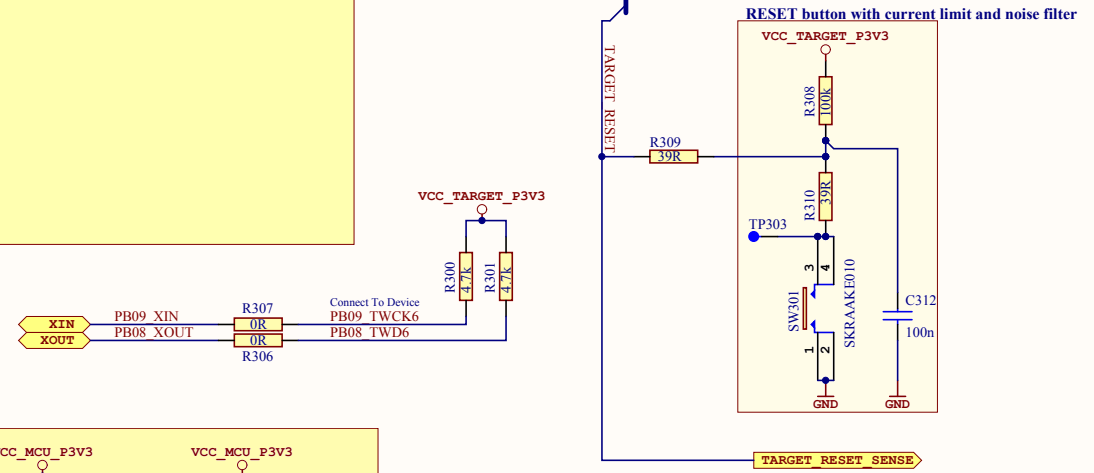
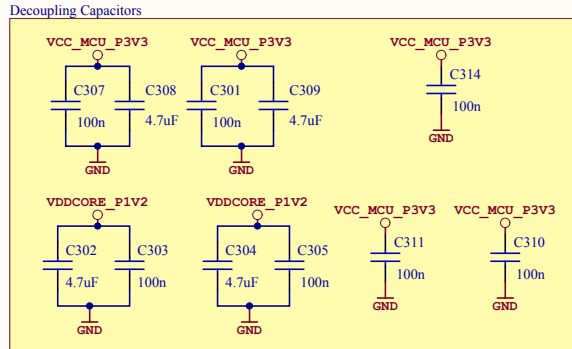
Procedure for SAMG55 chip erase:
 1) Connect the two pins of the header with the jumper
 2) Remove power from the kit
 3) Connect power to the kit
 4) Remove jumper

The ERASE pin has an internal pull-down if not configured as GPIO in the user application.



PB04 can be used to check if power is available on the target USB.
 Vmax 3.20V, Vmin 2.69V
 PB04 is configured as JTAG TDI as default, to use this pin it has to be configured as a GPIO.

USB ID can be used to check if a OTG cable is plugged in or enable host mode.



*	GS		
Atmel	MSK		
Chennai	*		
*			
Date:	31-10-2014	14:31:36	PAGE: 3 of 6
Document number:	A12-0941	Revision: 2	
TITLE: Target MCU			
SAMG55_Xplained_Pro_Target_MCU.SchDoc			



Crystal datasheet:
 Accuracy: +/-20ppm
 max ESR: 60 kOhm
 CLcrystal: 7pF

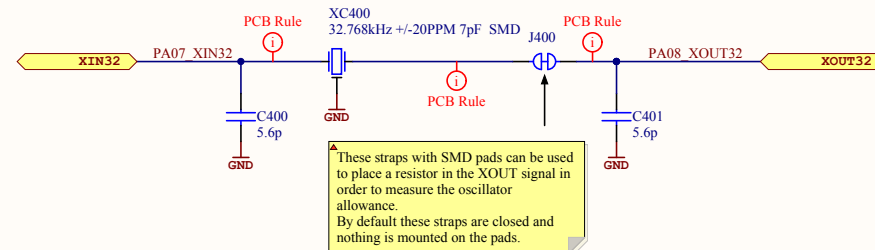
SAMG53 datasheet:
 CLmcu = 0.7 pF (equivalent load)

Cpcb = 0.5pF (estimate)

Calculation of crystal load capacitors:
 $C_{ext} = 2x (CL_{crystal} - CL_{mcu} - C_{pcb})$
 $C_{ext} = 2x(7.0pF - 0.7pF - 0.5pF) = 11.6pF$

The data is similar to SAM4N and actual measurements have shown that 5.6pF gives the best result therefore we select this value here as well.

Verification results:
 Accuracy: TBD
 Startup time: full swing is reached after TBD ms (probe loading TBD)
 Safety factor: TBD



These straps with SMD pads can be used to place a resistor in the XOUT signal in order to measure the oscillator allowance.
 By default these straps are closed and nothing is mounted on the pads.

Crystal datasheet:
 CLcrystal = 20pF
 max ESR = 80 Ohm
 Accuracy = +/-30 ppm

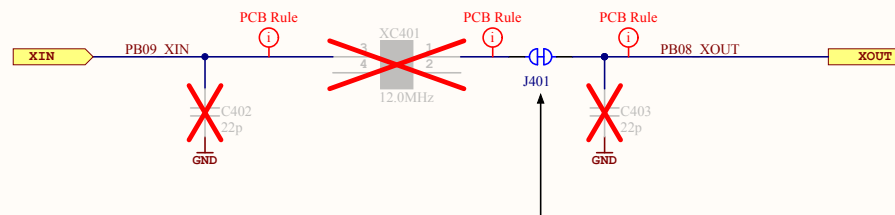
SAMG53 datasheet:
 CLmcu = TBD (equivalent load)

Cpcb = 0.5pF (estimate)


Calculation of crystal load capacitors:
 $C_{ext} = 2x (CL_{crystal} - CL_{mcu} - C_{pcb})$

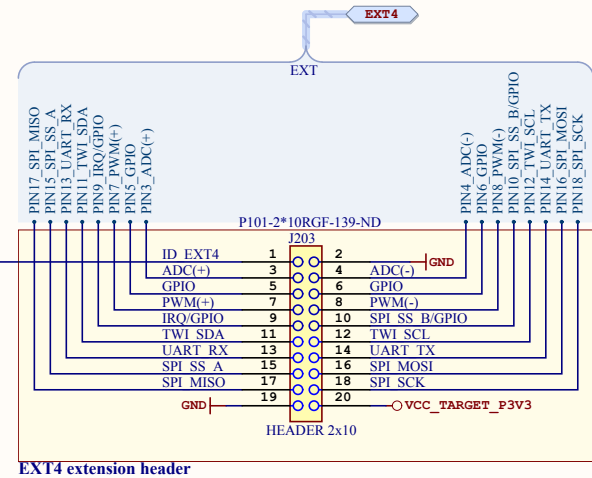
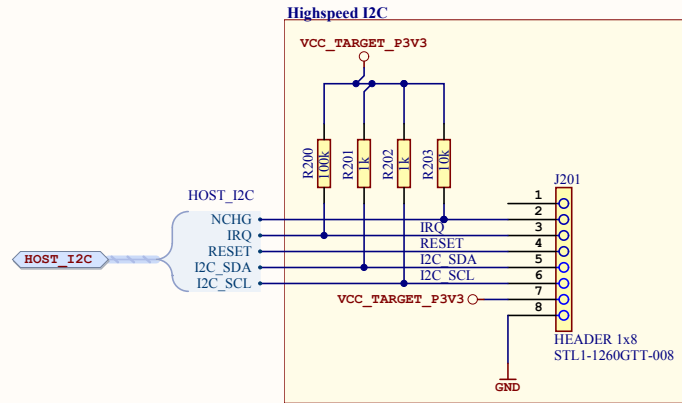
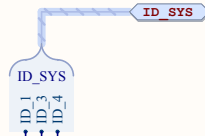
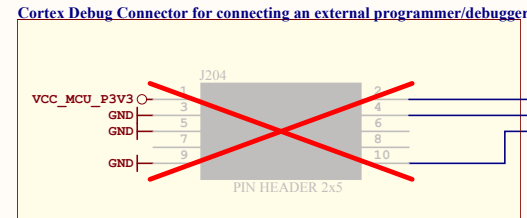
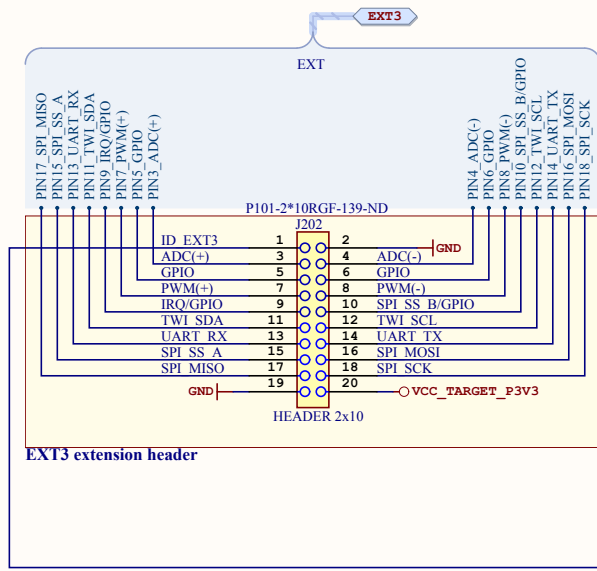
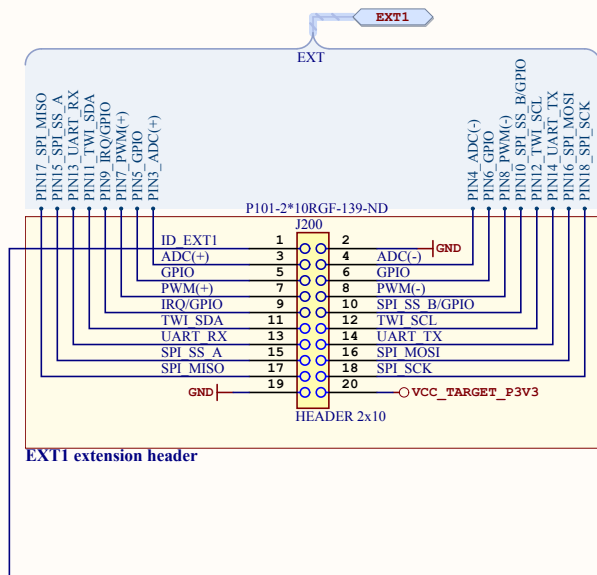
$C_{ext} = 2x(20pF - TBD - 0.5pF) = TBD$
 Selected value TBD

Verification results:
 Accuracy: TBD
 Startup time: TBD ms to reach full swing (first clock edge after TBD us)
 Safety factor: TBD



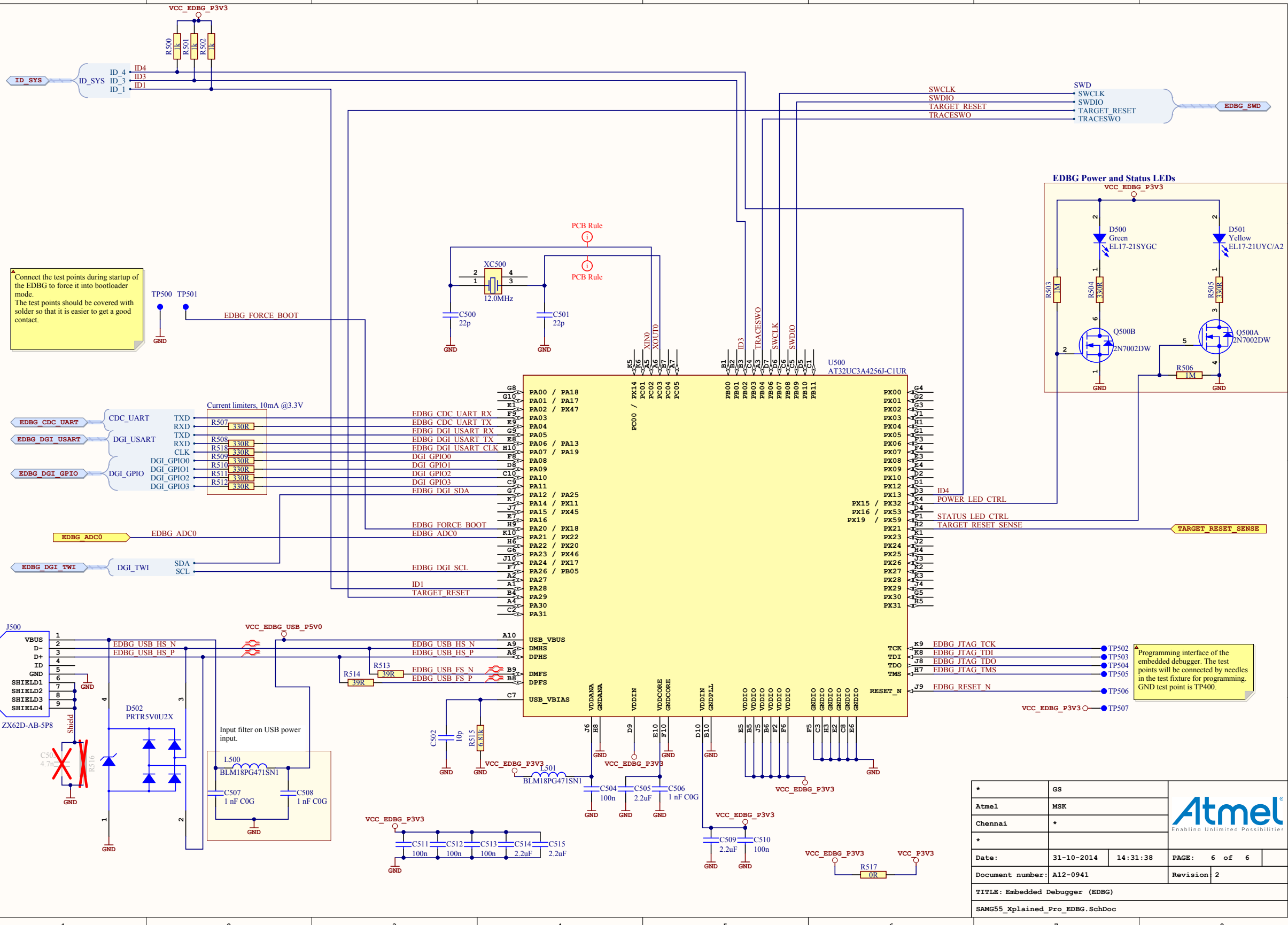
These straps with SMD pads can be used to place a resistor in the XOUT signal in order to measure the oscillator allowance.
 By default these straps are closed and nothing is mounted on the pads.

*	GS		 <small>Enabling Unlimited Possibilities</small>	
Atmel	MSK			
Chennai	*			
Date:	31-10-2014	14:31:37	PAGE:	4 of 6
Document number:	A12-0941		Revision:	2
TITLE: Crystals				
SAMG55_Xplained_Pro_crystals.SchDoc				

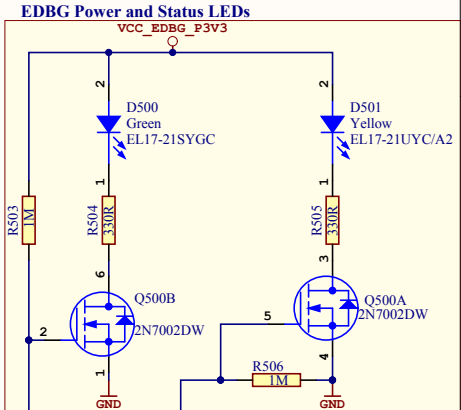


*	GS		
Atmel	MSK		
Chennai	*		
*			
Date:	31-10-2014	14:31:37	PAGE: 5 of 6
Document number:	A12-0941		Revision: 2
TITLE: Extension connectors			
SAMG55_Xplained_Pro_Connectors_SchDoc			





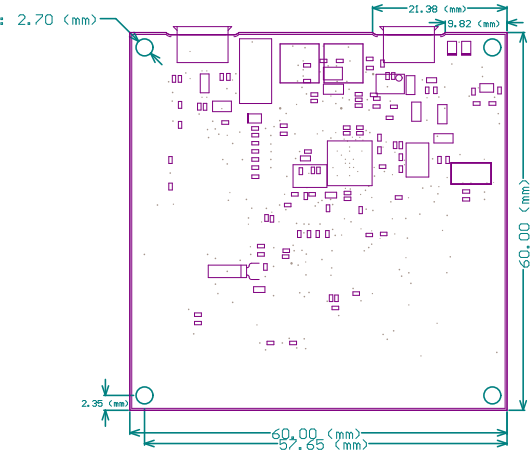
Connect the test points during startup of the EDBG to force it into bootloader mode. The test points should be covered with solder so that it is easier to get a good contact.



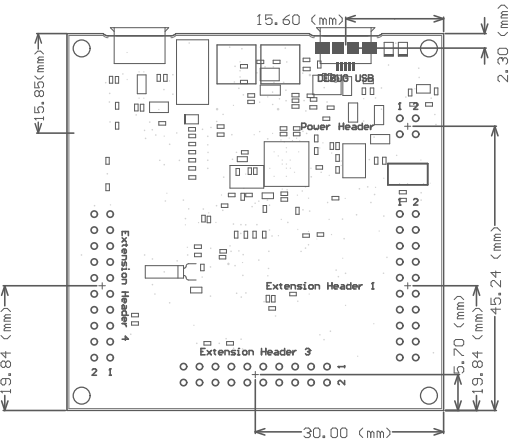
Programming interface of the embedded debugger. The test points will be connected by needles in the test fixture for programming. GND test point is TP400.

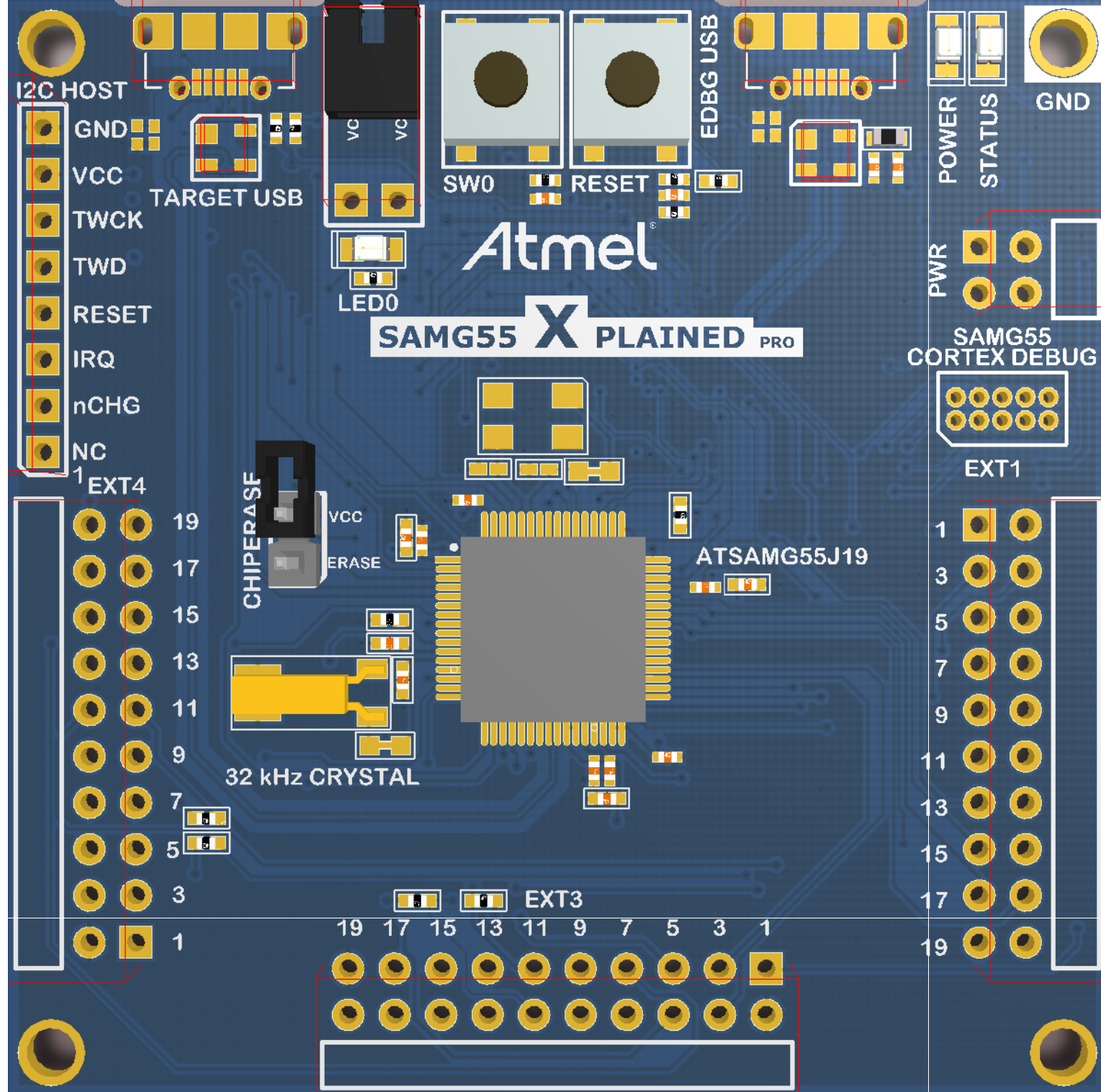
*	GS		
Atmel	MSK		
Chennai	*		
*			
Date:	31-10-2014	14:31:38	PAGE: 6 of 6
Document number:	A12-0941	Revision:	2
TITLE: Embedded Debugger (EDBG)			
SAMG55_Xplained_Pro_EDBG.SchDoc			

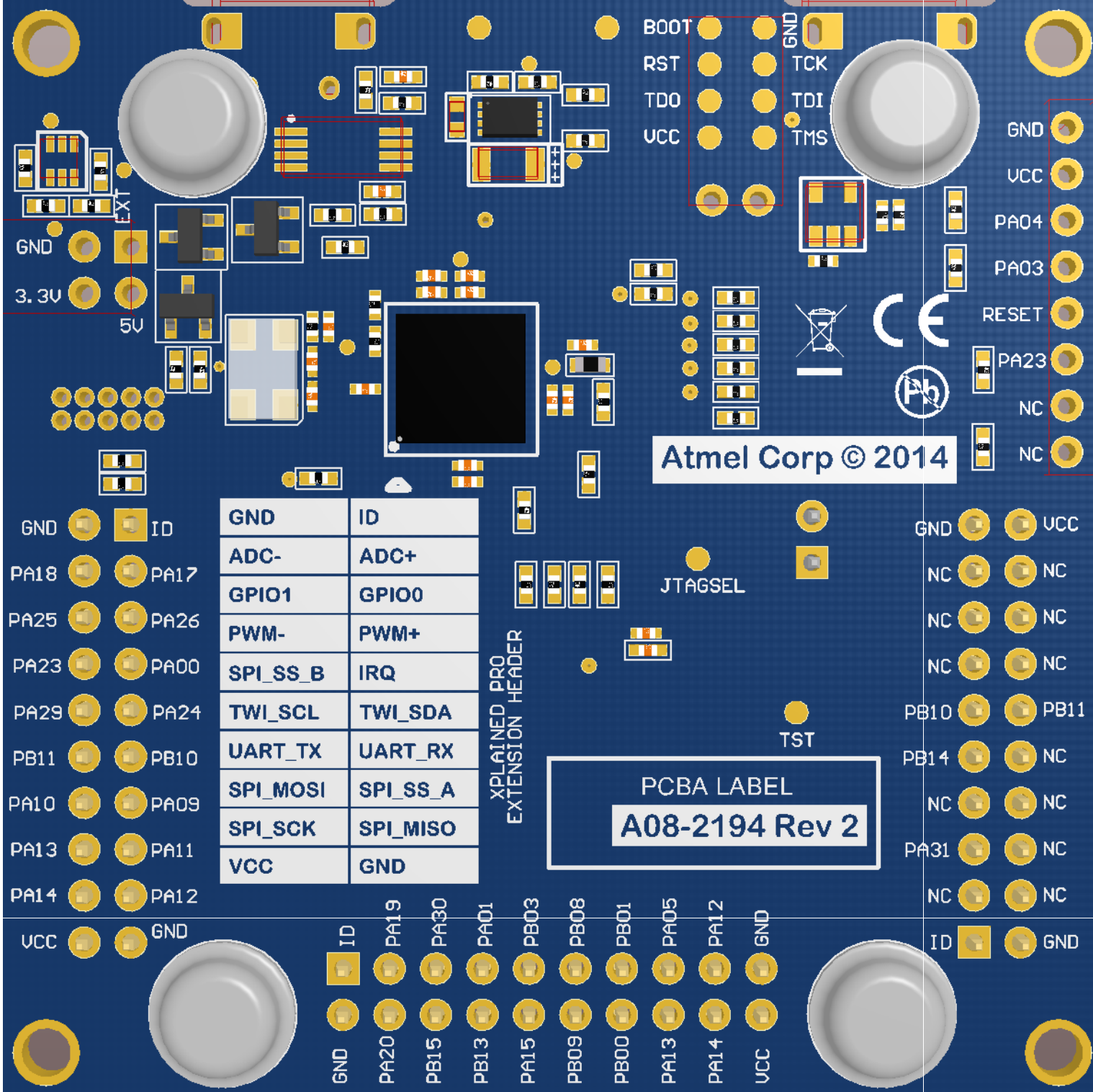
Mechanical Dimensions



Connector Placement





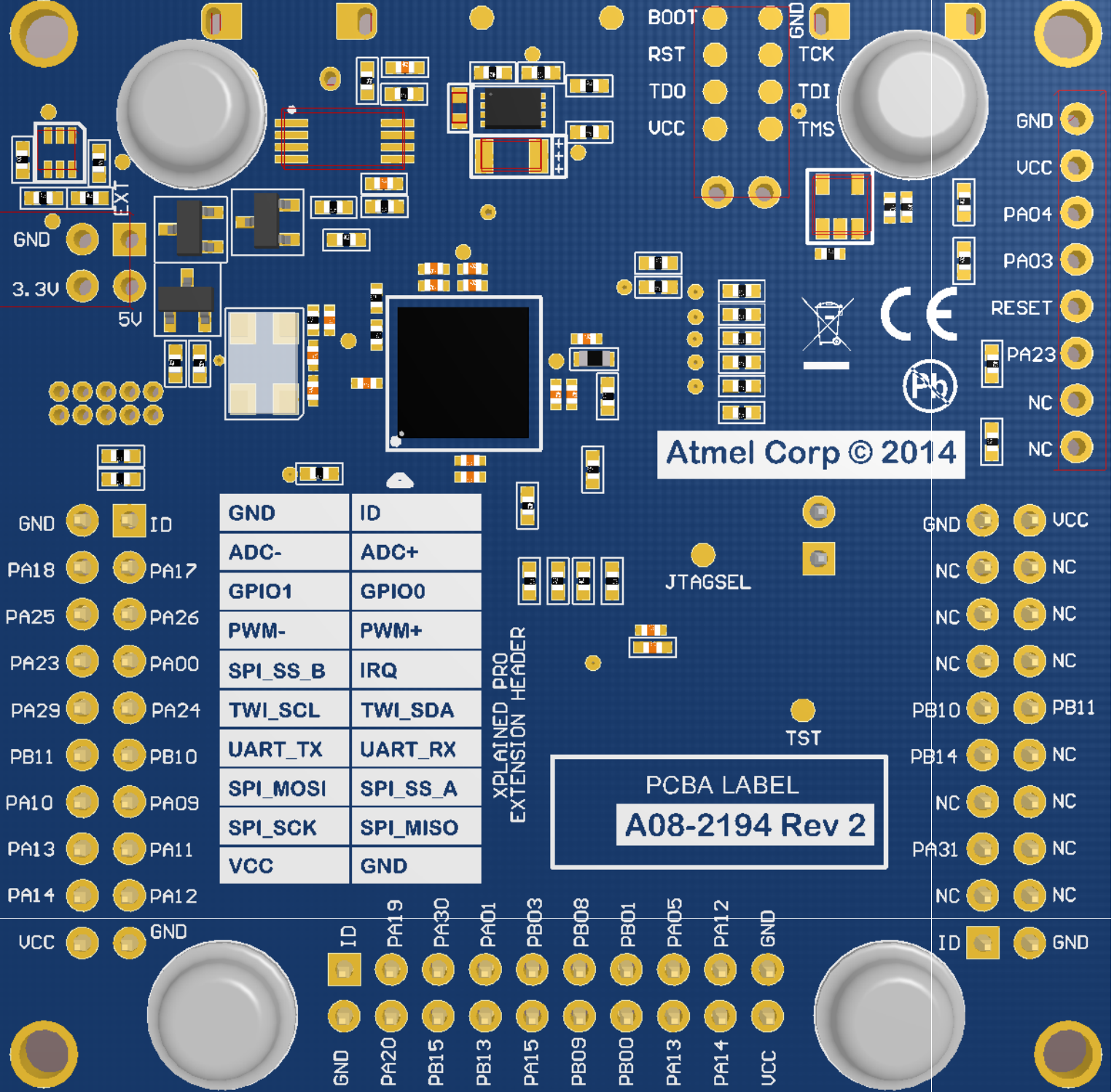


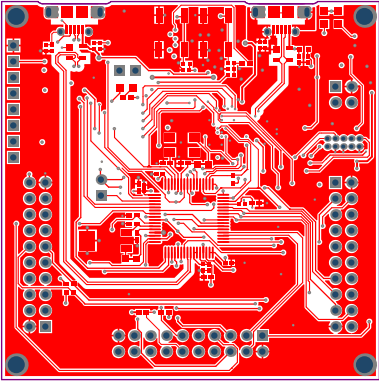
Atmel Corp © 2014

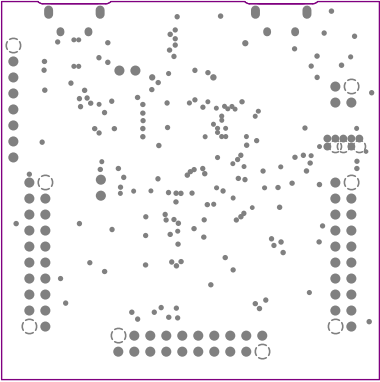
PCBA LABEL
A08-2194 Rev 2

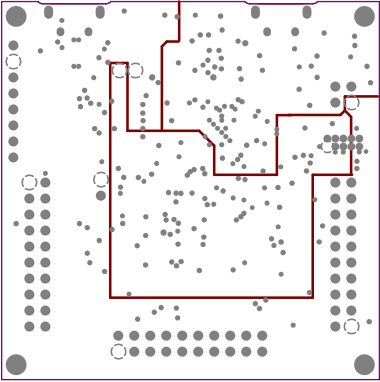
GND	ID	GND	ID
ADC-	ADC+	ADC-	ADC+
GPIO1	GPIO0	GPIO1	GPIO0
PWM-	PWM+	PWM-	PWM+
SPI_SS_B	IRQ	SPI_SS_B	IRQ
TWI_SCL	TWI_SDA	TWI_SCL	TWI_SDA
UART_TX	UART_RX	UART_TX	UART_RX
SPI_MOSI	SPI_SS_A	SPI_MOSI	SPI_SS_A
SPI_SCK	SPI_MISO	SPI_SCK	SPI_MISO
VCC	GND	VCC	GND

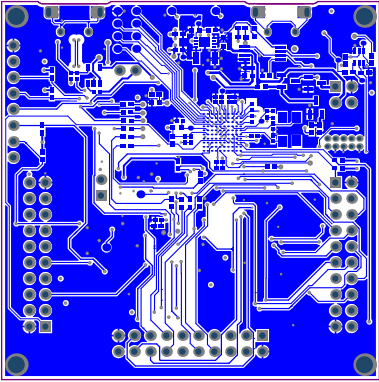
XPLAINED PRO
EXTENSION HEADER

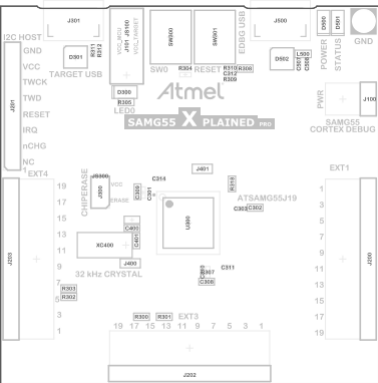


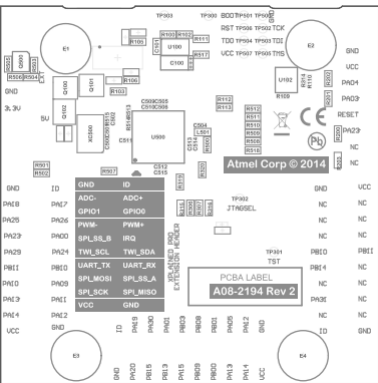












Component list

Top Level Schematics



Source Data From: SAMG55_Xplained_Pro.PrjPCB
 Project: SAMG55_Xplained_Pro.PrjPCB
 Variant: Default_assembly

Report Date: 31-10-2014 14:33:13
 Print Date: 31-10-2014 14:32:03

Fitted	Designator	Quantity	Value	Manufacturer	MPN	Description
Fitted	C100	1	10u	vishay	TR3A106K016C1700	SMD tantalum capacitor, ESR = 1.7, 3216-18 (EA) 1206
Fitted	C101	1	4.7uF	tdk	C1608XR1A475K	Ceramic capacitor, SMD 0603, X5R, 10V, 10% (de31036)
Fitted	C102, C103	2	100n	Kemet	C0402C104K4RACTU	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C300, C301, C303, C305, C307, C310, C311, C312, C314, C504, C510, C511, C512, C513	14	100n	Kemet	C0402C104K4RACTU	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C302, C304, C308, C309	4	4.7uF	tdk	C1005XR0J475K	Ceramic capacitor, SMD 0402, X5R, 6.3V, +/-10%
Fitted	C400, C401	2	5.6p			Ceramic capacitor, SMD 0402, NPO, 50V, +/-5%
Fitted	C500, C501	2	22p			Ceramic capacitor, SMD 0402, NPO, 50V, +/-5%
Fitted	C502	1	10p			Ceramic capacitor, SMD 0402, NPO, 50V, +/-5%
Fitted	C505, C509, C514, C515	4	2.2uF	Kemet	C0402C225MPPAC	Ceramic capacitor, SMD 0402, X5R, 6.3V, +/-20%
Fitted	C506, C507, C508	3	1 nF COG	Murata	GRM1555C1H102JA01D	Ceramic capacitor, SMD 0402, COG, 50V, +/-5%
Fitted	D300, D501	2	EL17-21UYG/AZ	Everight	17-21UYO5530-A317F8	LED, Yellow, Wave length=591nm, SMD 0805, ±70°
Fitted	D301, D502	2	FRTR5V0L2X	Philips	FRTR5V0L2X	Double rail-to-rail USB ESD protection diode
Fitted	D500	1	EL17-21SYG/C	Everight	EL17-21SYG/C	LED, Green, Wave length=575nm, SMD 0805, ±70°
Fitted	E1, E2, E3, E4	4	SJ-5076	3M	SJ-5076	2.8mm adhesive feet, diam 8.0mm
Fitted	FXTURE1	1	Xplained PRO MCU board Jupiter Test Fixture	ESCA TEC	Xplained PRO MCU board Jupiter Test Fixture	Xplained PRO MCU board Jupiter Test Fixture
Fitted	FW1	1	EDBG secured firmware	ATMEL		EDBG secured firmware
Fitted	J100	1	P101-2'02R3F-139-ND		P101-2'02R3F-139-ND	Pin header, 2x2, Right Angle, 2.54mm, TH, Pin In Paste
Fitted	J101	1	Pin header 1x2 right angle	Pro-data International Corp	2213R-2G	1x2 pin header, right angle, 2.54 mm pitch, through-hole
Fitted	J200, J202, J203	3	P101-2'10R3F-139-ND		P101-2'10R3F-139-ND	Pin header, 2x10, Right Angle, 2.54mm, THM, Pin In Paste
Fitted	J201	1	STL1-1260GT-008	Garry	STL1-1260GT-008	1x8 Pin Header, 2.54mm pitch, THM
Fitted	J300	1	HMTSW-102-23-F-S-237	SAMTEC	HMTSW-102-23-F-S-237	1x2 pin header, 2.54mm pitch, Pin-in-Paste THM
Fitted	J301, J500	2	ZX62D-AB-5P8			Micro USB AB Connector, Standard SMT + DIP
Fitted	JS100, JS300	2	SNT-100-BK-G	SAMTEC	SNT-100-BK-G	Jumper cap for 2.54mm pinheader
Fitted	L500, L501	2	BLM18PG471SN1	Murata	BLM18PG471SN1	SMD RF inductor 0603, Z=470Ohm (@100MHz), Max R(dc)=0.65Ohm, Max current=1A
Fitted	LABEL1	1	Label PCBA	ACT Logmark AS	505462	PCBA identification label PP Top White Gloss
Fitted	PCB1	1	SAMG55 PCB Documentation			SAMG55 PCB Documentation
Fitted	PCBADO1	1	A09-2393 PCBA documentation			SAMG55 Xplained Pro PCBA documentation
Fitted	Q100, Q101	2	IRLML6402PBF	International Rectifier	IRLML6402PBF	P-ch. MOSFET, -30V, -3.7A continuous, RDS(ON)=0.05Ohm@VGS=-4.5V, RDS(ON)=0.080hm@VGS=-2.5V
Fitted	Q102	1	2N7002.215	NXP	2N7002.215	N-Channel MOSFET, 60V, 0.300A continuous, 1.2A Peak, RDS(ON) = 3.8Ohm@VGS=4.5V, VGS(th)<2.5V
Fitted	Q500	1	2N7002DW	Fairchild	2N7002DW	Dual N-Channel MOSFET, 60V, 115mA cont, RDS(ON) < 7.5 Ohm @50mA@50V, SOT-363
Fitted	R100	1	18k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R101, R105, R106, R503, R506	5	1M			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R102	1	30k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R103, R200, R308	3	100k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R104	1	39k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R107	1	390R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R108, R112, R113, R318, R319, R320	6	47k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R109, R110	2	100k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R111, R306, R307, R315, R316, R517	6	0R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R201, R202, R500, R501, R502	5	1k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R203, R317	2	10k	vishay	CRW040210K0FKED	Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R300, R301, R302, R303	4	4.7k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R304, R309, R310, R513, R514	5	39R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R305, R504, R505, R507, R508, R509, R510, R511, R512, R518	10	330R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R311	1	30k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R312	1	47k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R314	1	330R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R515	1	6.81k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	SW300, SW301	2	SKRAAKE010	ALPS	SKRAAKE010	6.2x6.2 mm SMD tact swtch, same as A08-0091 but less force is needed
Fitted	TEST1	1	SAMG55 Test software			SAMG55 Test software
Fitted	TESTDOC1	1	SAMG53 Xplained Pro test instructions	ATMEL		SAMG53 Xplained Pro test instructions
Fitted	U100	1	SFX3819R2-L/TR	Exar	SFX3819R2-L/TR	500mA LDO, ADJ. low noise, 8-DFN package
Fitted	U101	1	TPS2113PWR	Texas Instruments	TPS2113PWR	Autosw Itching 2:1 Pwr er Mux
Fitted	U102	1	STMP52161STR			Single channel pow er swtch, 1A, reverse block, active low enabled.
Fitted	U300	1	SAMG55 LOFP64			SAMG55 LOFP64
Fitted	U600	1	AT32UC3A4256J-C1UR	ATMEL	AT32UC3A4256J-C1UR	AVR 32-bit RISC MCU
Fitted	XC400	1	32.768kHz +/-20PPM 7pF SMD	Micro Crystal	MS1V-11K 32.768kHz 7pF +/-20PPM TA	32k768 crystal, +/-20ppm, CL=7pF, max ESR 60kOhm, SMD
Fitted	XC500	1	12.0MHz	Fox Electronics	FQ5032B-12-C-C-C-200-1	Fox FQ5032B 12.0MHz SMD crystal 738B-12
Not Fitted	C313, C503	0	4.7n			Ceramic capacitor, SMD 0402, X7R, 25V, +/-10%
Not Fitted	C402, C403	0	22p			Ceramic capacitor, SMD 0402, NPO, 50V, +/-5%
Not Fitted	J204	0	PN HEADER 2x5	Garry	STL21-0730 G TT-10U	2x5 pin header, 1.27mm pitch, THM
Not Fitted	R313, R516	0	1M	KOA	RK73H1ETTP1004F	Thick film resistor, SMD 0402, 1/16W, 1%
Not Fitted	XC401	0	12.0MHz	Fox Electronics	FQ5032B-12-C-C-C-200-1	Fox FQ5032B 12.0MHz SMD crystal 738B-12

Approved

Notes

132