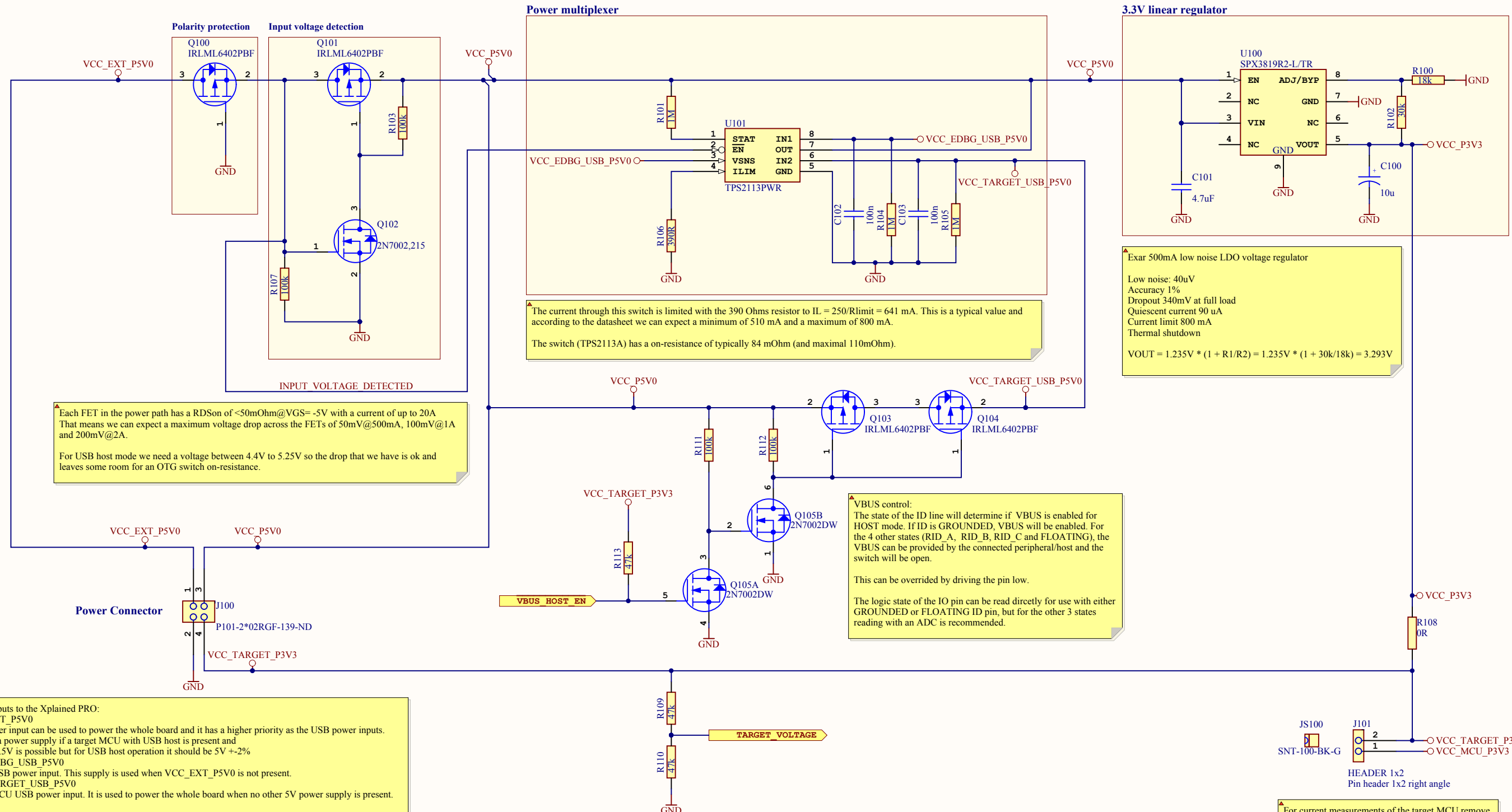


ATMEL Norway	*			
Vestre Rosten 79	*			
N-7075 TILLER	*			
NORWAY				
Date:	28.09.2015	12:37:47	PAGE: 1 of 5	
Document number:	A09-2130		Revision	2
TITLE: Top Level Schematics				
SAMD21_Xplained_Pro_TopLevel.SchDoc				



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

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 an OTG switch on-resistance.

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

The switch (TPS2113A) has an on-resistance of typically  $84m\Omega$  (and maximal  $110m\Omega$ ).

**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 GROUNDED or FLOATING ID pin, but for the other 3 states reading with an ADC is recommended.

Exar 500mA low noise LDO voltage regulator

Low noise:  $40\mu V$   
Accuracy 1%  
Dropout  $340mV$  at full load  
Quiescent current  $90\mu A$   
Current limit  $800mA$   
Thermal shutdown

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

**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.

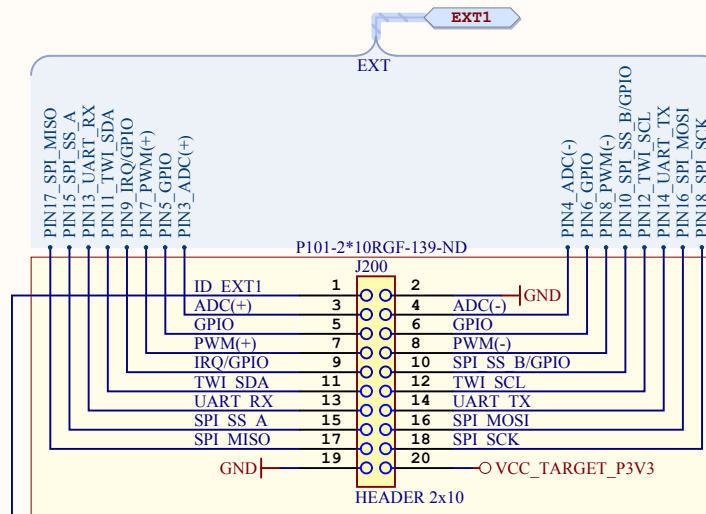
**Other voltages:**  
VCC\_P5V0  
This supply is connected to either VCC\_EXT\_P5V0, VCC\_EDBG\_USB\_P5V0 or VCC\_TARGET\_USB\_P5V0, based on the availability and priority of these supplies.

VCC\_P3V3  
Regulated  $3.3V$  from VCC\_P5V0

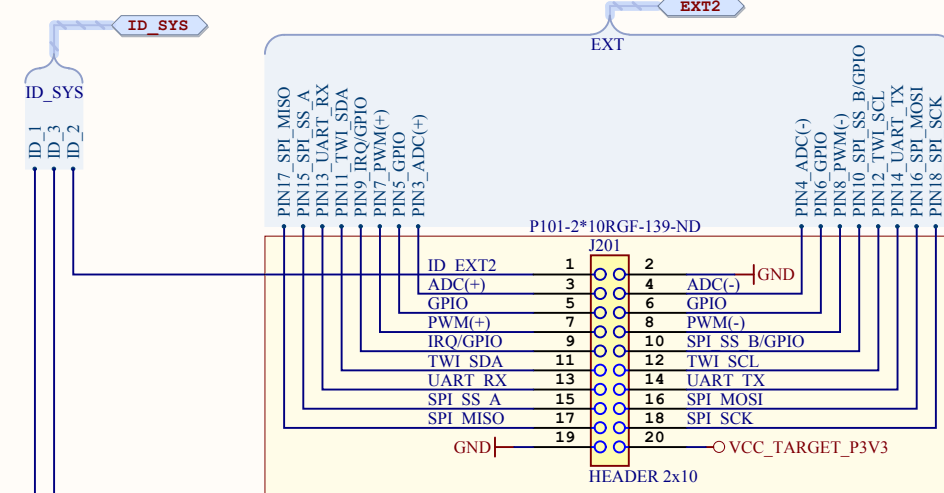
VCC\_TARGET  
Target supply voltage (target MCU and peripherals)

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

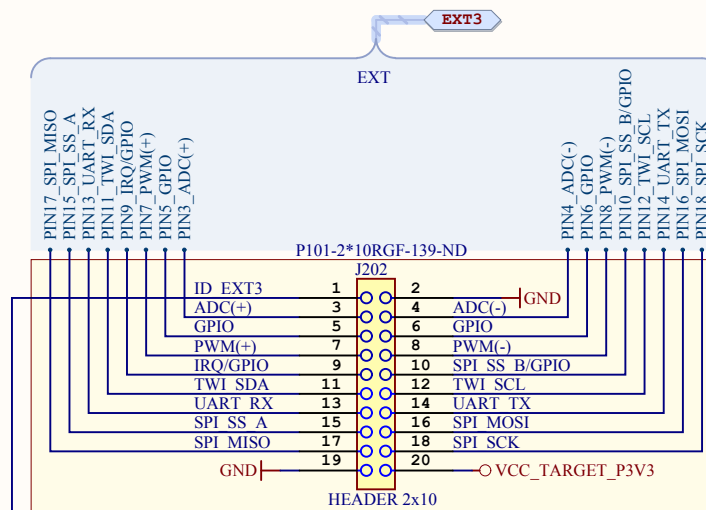
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N-7075 TILLER	*			
NORWAY				
Date:	28.09.2015	12:37:47	PAGE:	2 of 5
Document number:	A09-2130		Revision:	2
TITLE: Power supply				
SAMD21_Xplained_Pro_triple_input_power_supply.SchDoc				



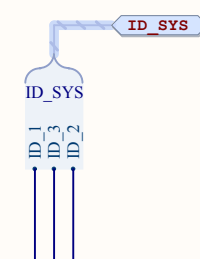
EXT1 extension header




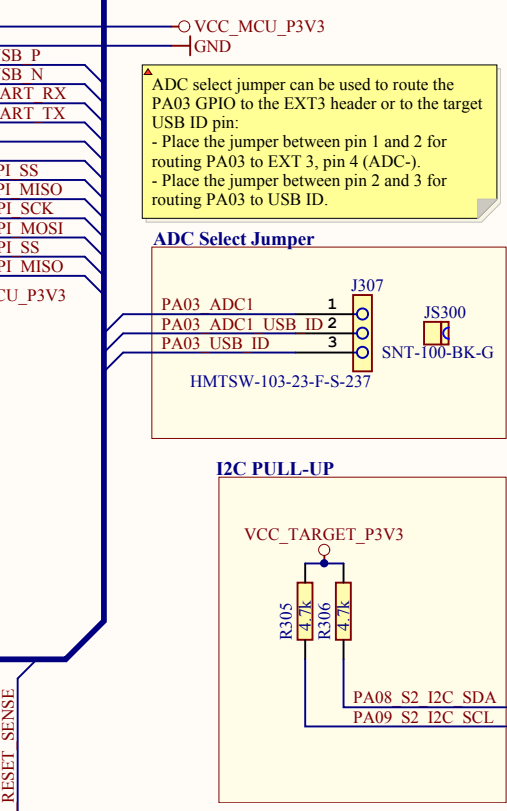
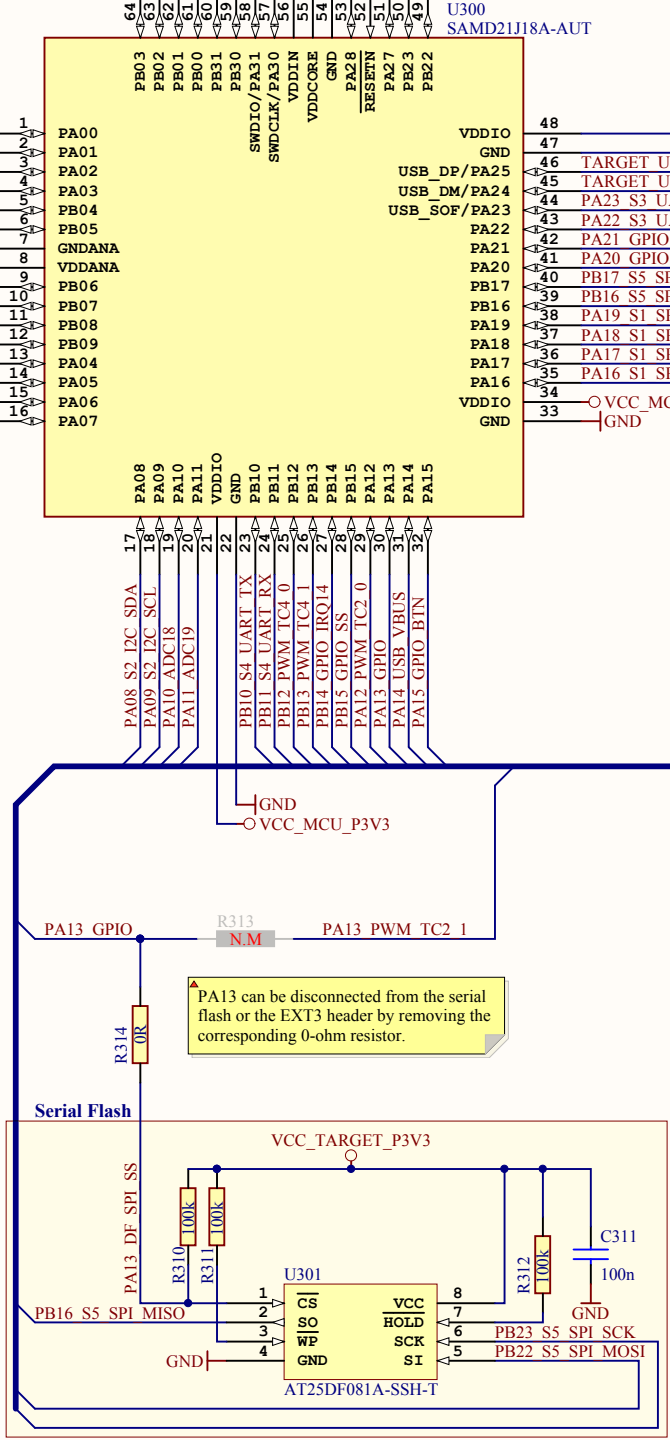
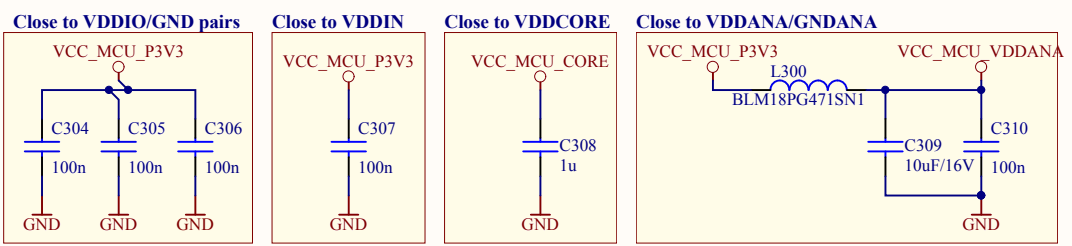
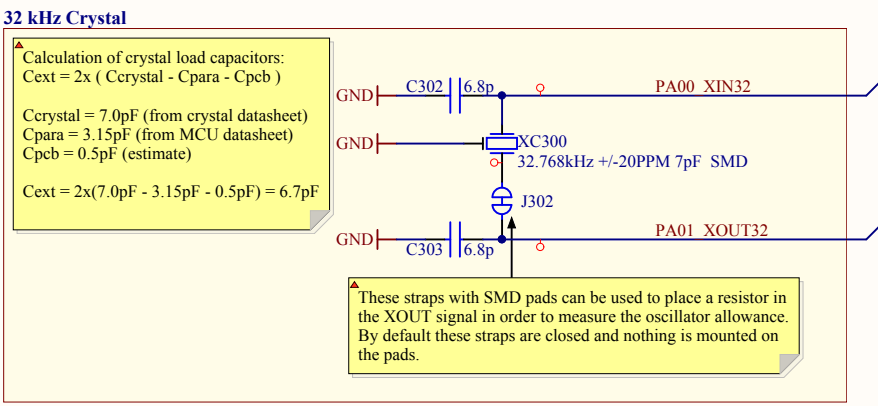
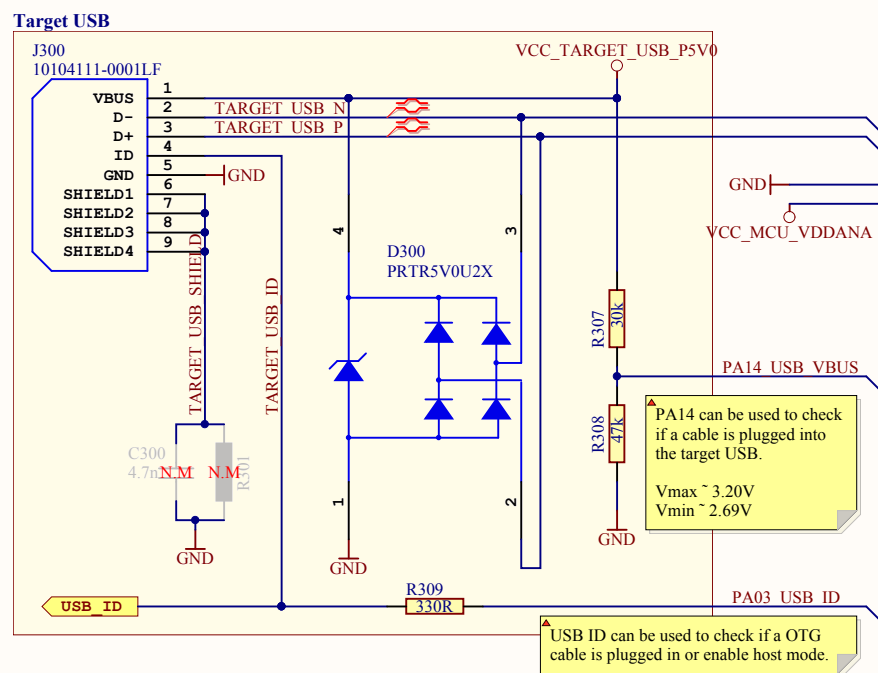
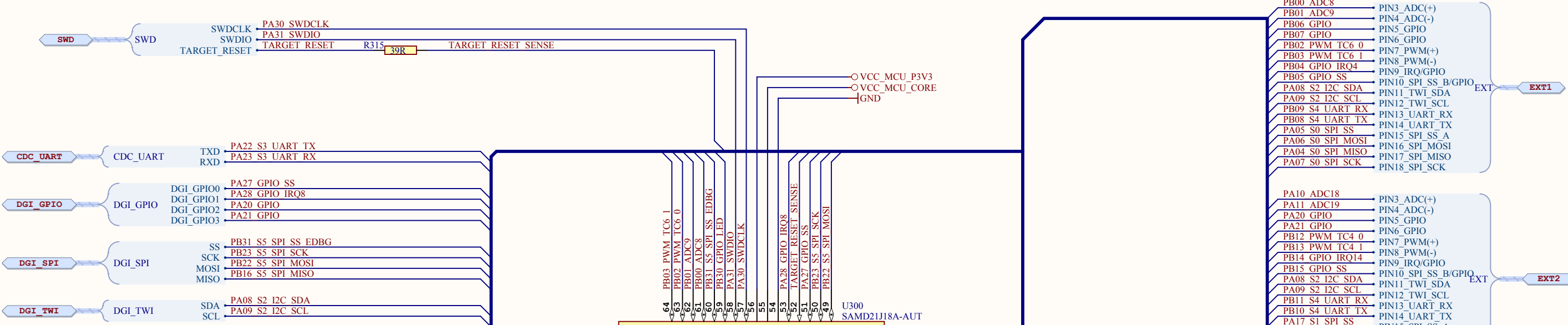
EXT2 extension header



EXT3 extension header

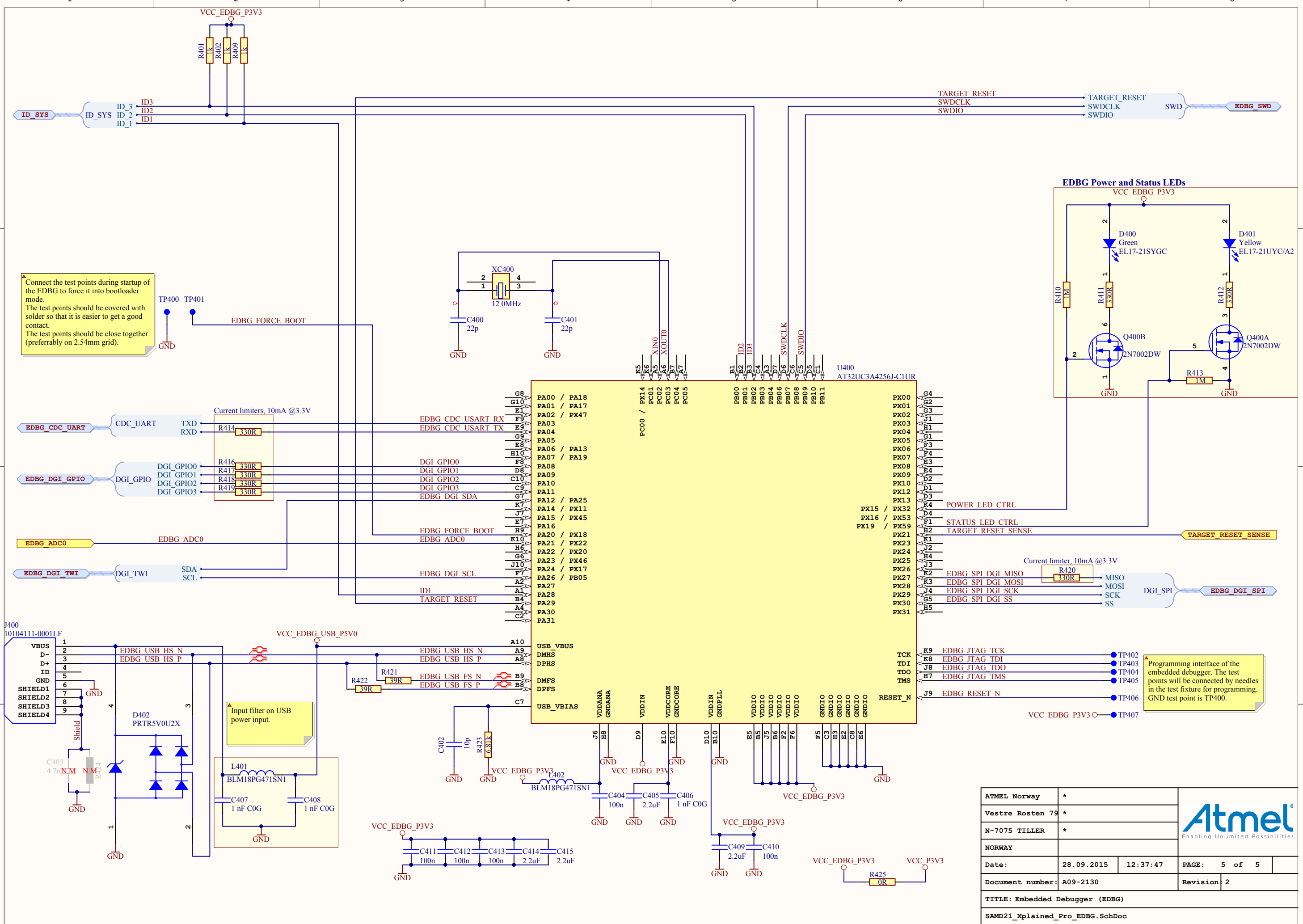


ATMEL Norway	*	 Enabling Unlimited Possibilities	
Vestre Rosten 79	*		
N-7075 TILLER	*		
NORWAY			
Date:	28.09.2015	12:37:47	PAGE: 3 of 5
Document number:	A09-2130		Revision 2
TITLE: Extension connectors			
SAMD21_Xplained_Pro_Connectors.SchDoc			




ATMEL Norway	*			
Vestre Rosten 79	*			
N-7075 TILLER	*			
NORWAY				
Date:	28.09.2015	12:37:47	PAGE:	4 of 5
Document number:	A09-2130		Revision:	2
TITLE: Target MCU				
SAM21_Xplained_Pro_Target_MCU.SchDoc				



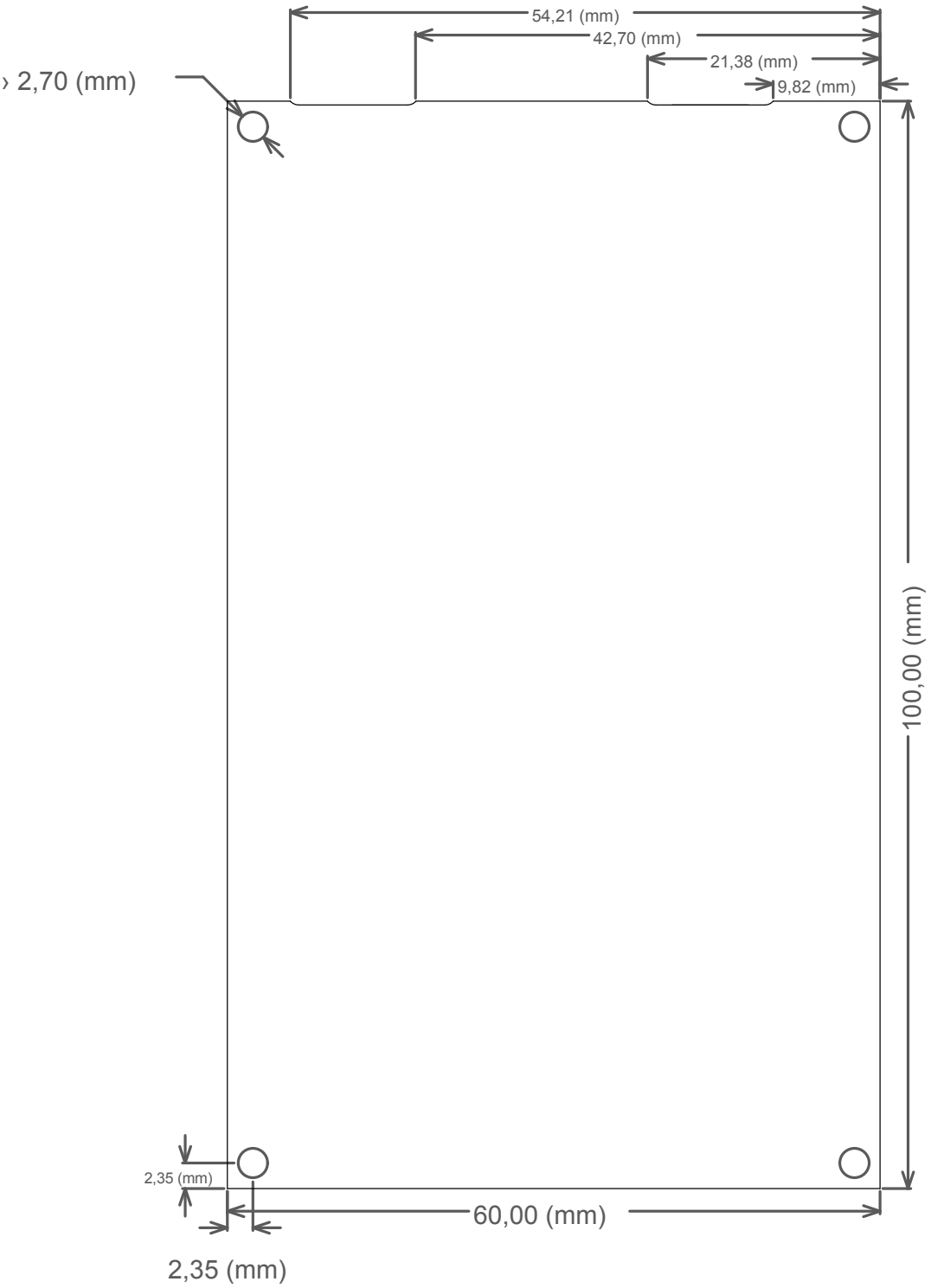


Connect the test points during startup of the EDBG to force it into bootloader mode. The test points should be covered with solder so that it is easier to get a good contact. The test points should be close together (preferably on 2.54mm grid).

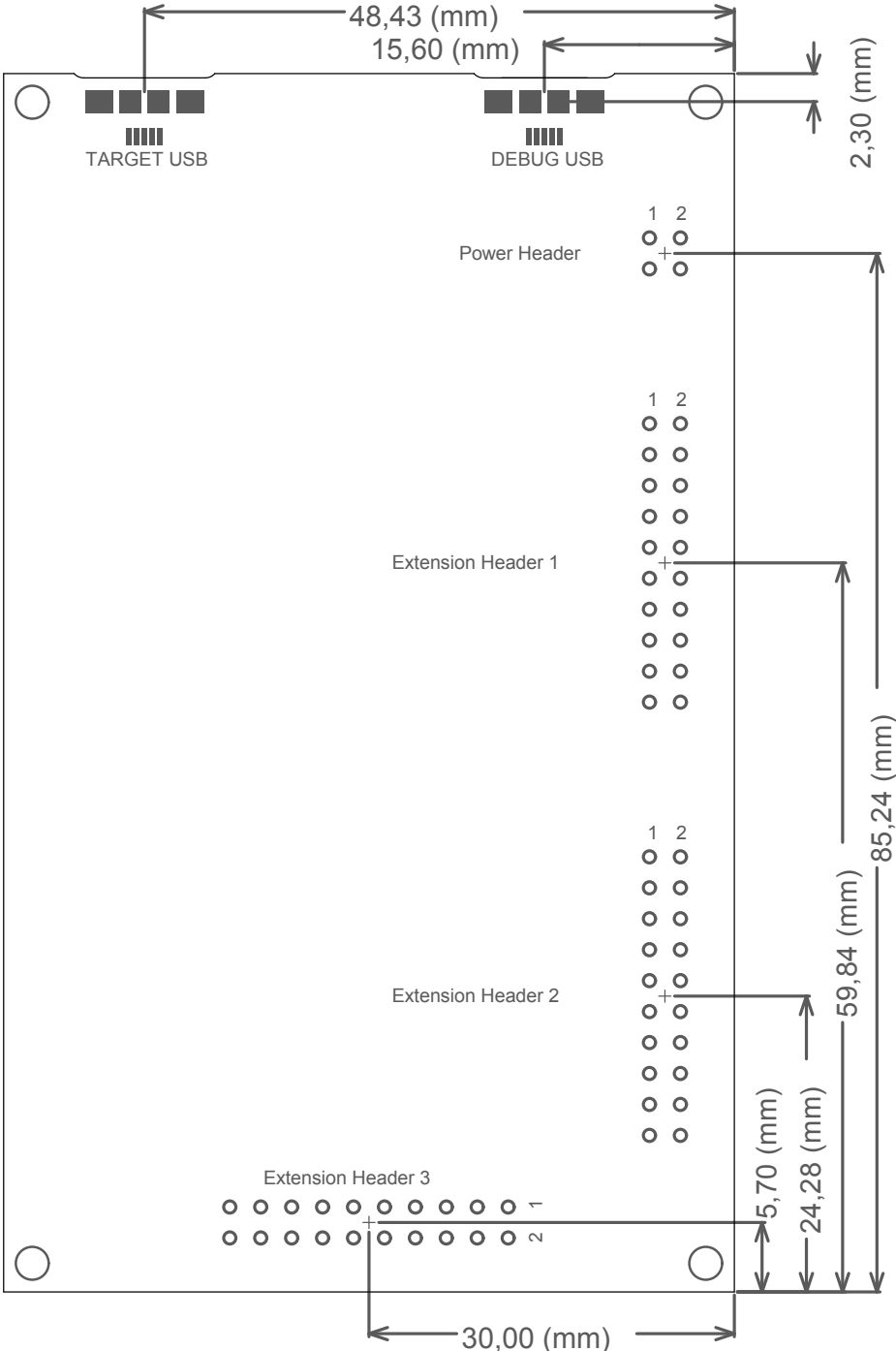
Programming interface of the embedded debugger. The test points will be connected by needles in the test fixture for programming. GND test point is TP400.

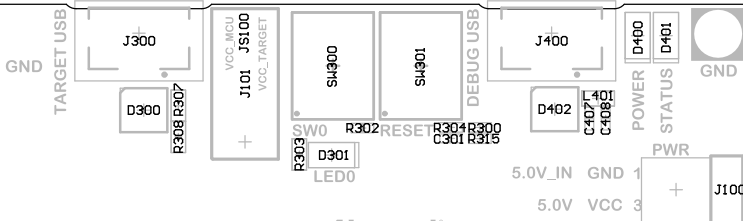
ATMEL Norway	*			 Enabling Unlimited Possibilities
Vestre Rosten 79	*			
N-7075 TILLER	*			
NORWAY				
Date:	28.09.2015	12:37:47	PAGE:	5 of 5
Document number:	A09-2130		Revision	2
TITLE: Embedded Debugger (EDBG)				
SAMD21_Xplained_Pro_EDBG.SchDoc				

# Medium MCU Mechanical Dimensions



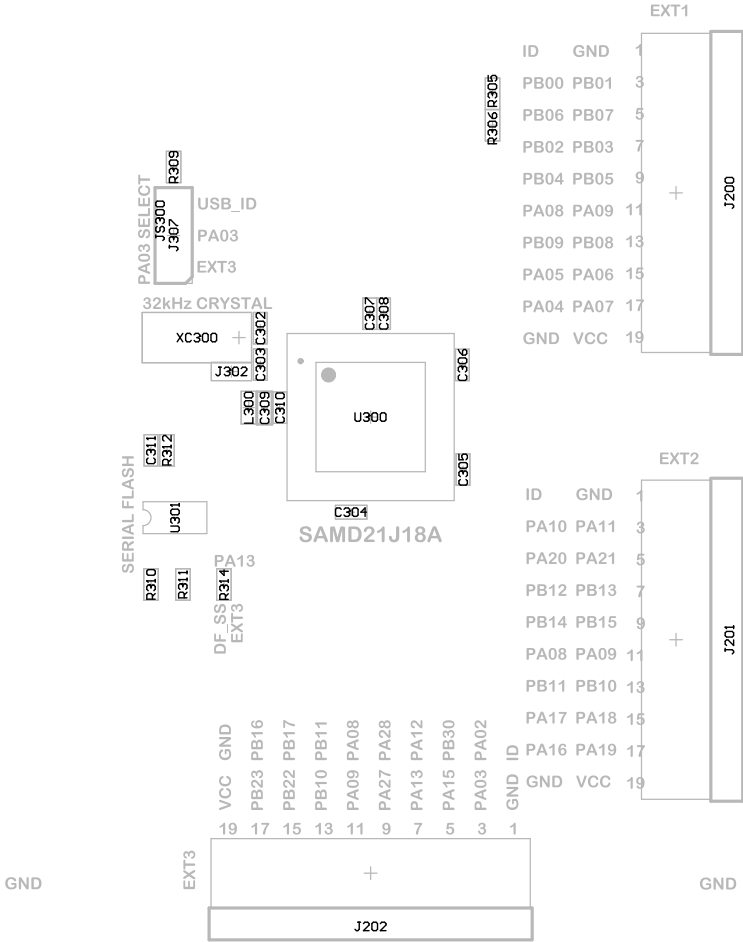
# Medium MCU Connector Placement



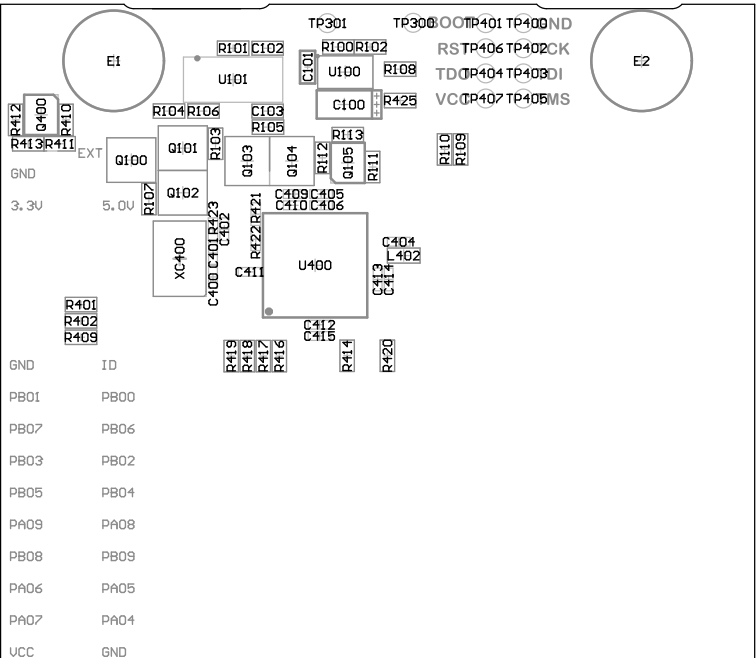


# Atmel

## SAMD21 X PLAINED PRO







GND ID  
 PB01 PB00  
 PB07 PB06  
 PB03 PB02  
 PB05 PB04  
 PA09 PA08  
 PB08 PB09  
 PA06 PA05  
 PA07 PA04  
 UCC GND

XPLAINED PRO  
 EXTENSION HEADER

GND ID  
 PA11 PA10  
 PA21 PA20  
 PB13 PB12  
 PB15 PB14  
 PA09 PA08  
 PB10 PB11  
 PA18 PA17  
 PA19 PA16  
 UCC GND

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

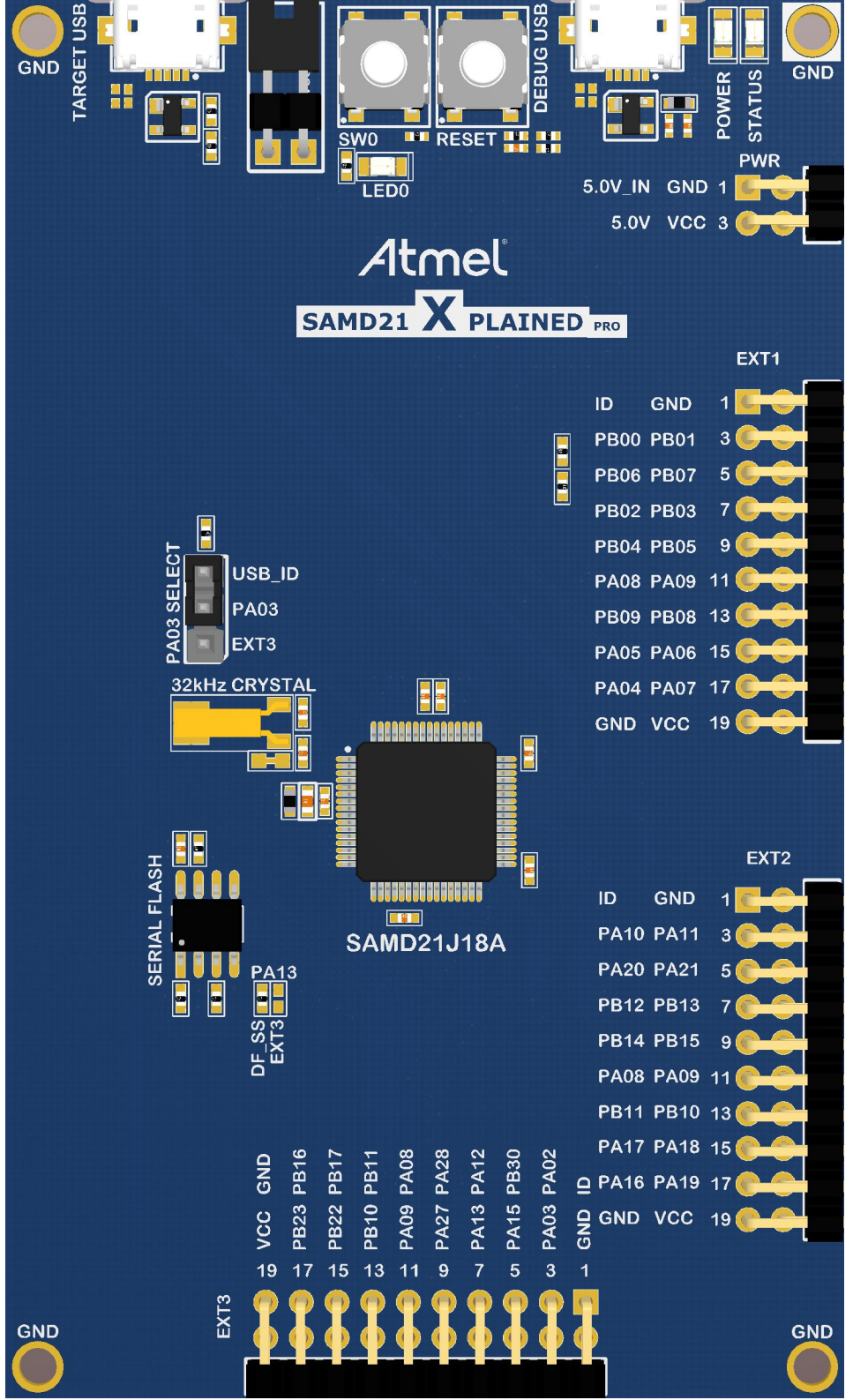
ID PA02 PB30 PA12 PA28 PA08 PB11 PB17 PB16 GND  
 GND PA03 PA15 PA13 PA27 PA09 PB10 PB22 PB23 UCC

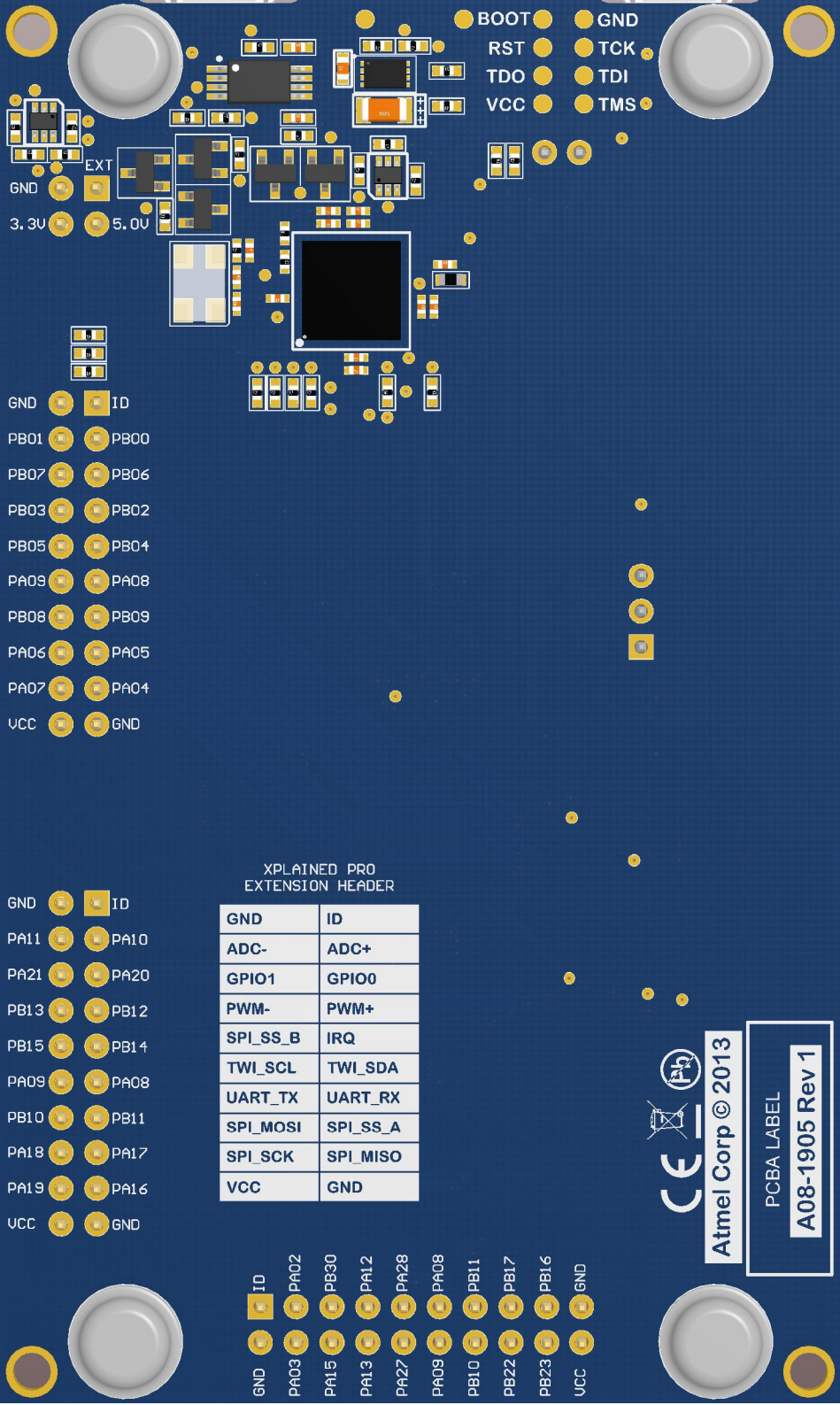


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LABEL  
 A08-1905 Rev 1





BOOT ● GND ●  
 RST ● TCK ●  
 TDO ● TDI ●  
 VCC ● TMS ●  
 GND ●  
 3.3V ● 5.0V ●

GND ● ID ●  
 PB01 ● PB00 ●  
 PB07 ● PB06 ●  
 PB03 ● PB02 ●  
 PB05 ● PB04 ●  
 PA09 ● PA08 ●  
 PB08 ● PB09 ●  
 PA06 ● PA05 ●  
 PA07 ● PA04 ●  
 VCC ● GND ●

GND ● ID ●  
 PA11 ● PA10 ●  
 PA21 ● PA20 ●  
 PB13 ● PB12 ●  
 PB15 ● PB14 ●  
 PA09 ● PA08 ●  
 PB10 ● PB11 ●  
 PA18 ● PA17 ●  
 PA19 ● PA16 ●  
 VCC ● GND ●

XPLAINED PRO  
EXTENSION HEADER

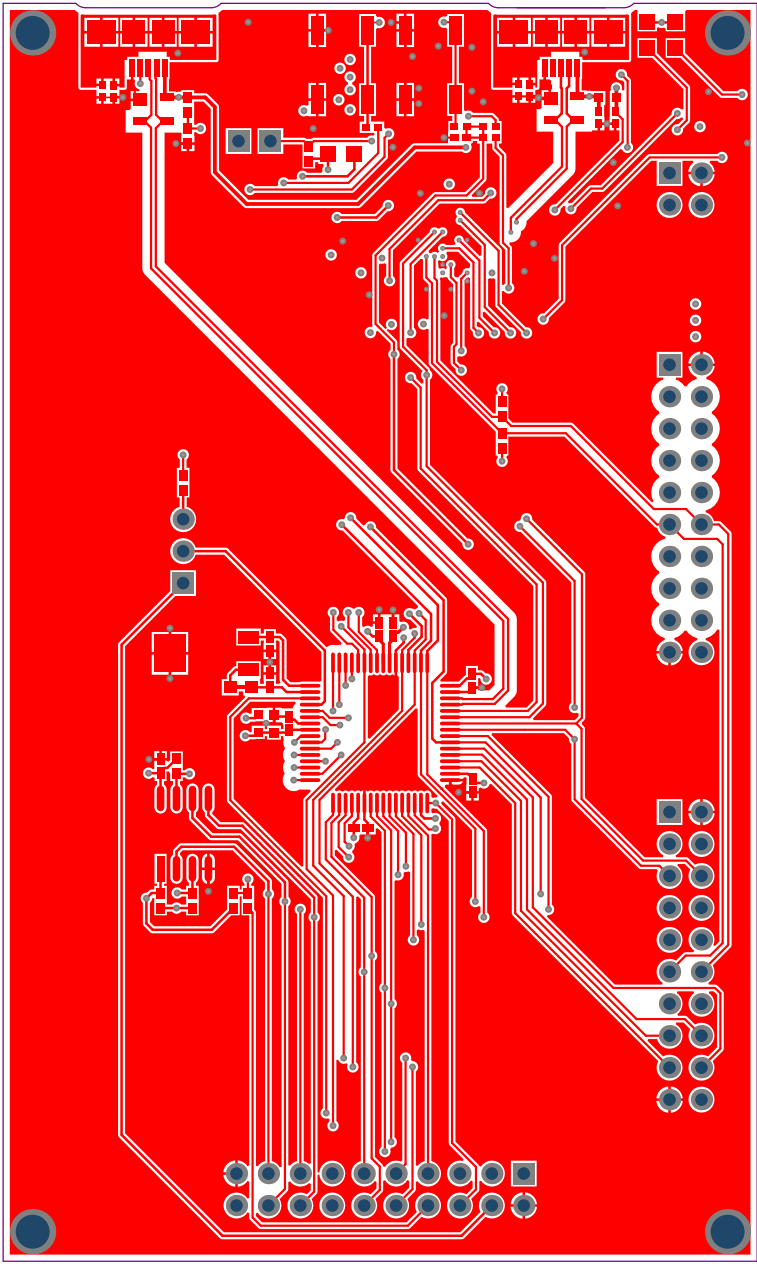
GND	ID
ADC-	ADC+
GPIO1	GPIO0
PWM-	PWM+
SPI_SS_B	IRQ
TWI_SCL	TWI_SDA
UART_TX	UART_RX
SPI_MOSI	SPI_SS_A
SPI_SCK	SPI_MISO
VCC	GND

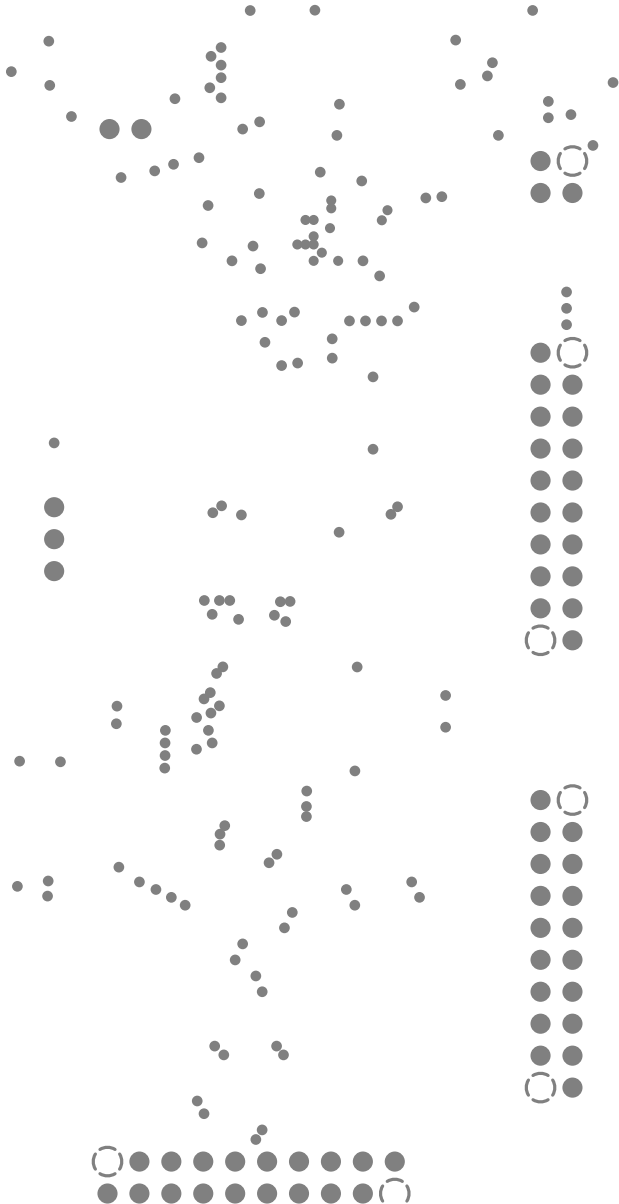
GND ● ID ●  
 PA03 ● PA02 ●  
 PA15 ● PB30 ●  
 PA13 ● PA12 ●  
 PA27 ● PA28 ●  
 PA09 ● PA08 ●  
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 PB22 ● PB17 ●  
 PB23 ● PB16 ●  
 VCC ● GND ●

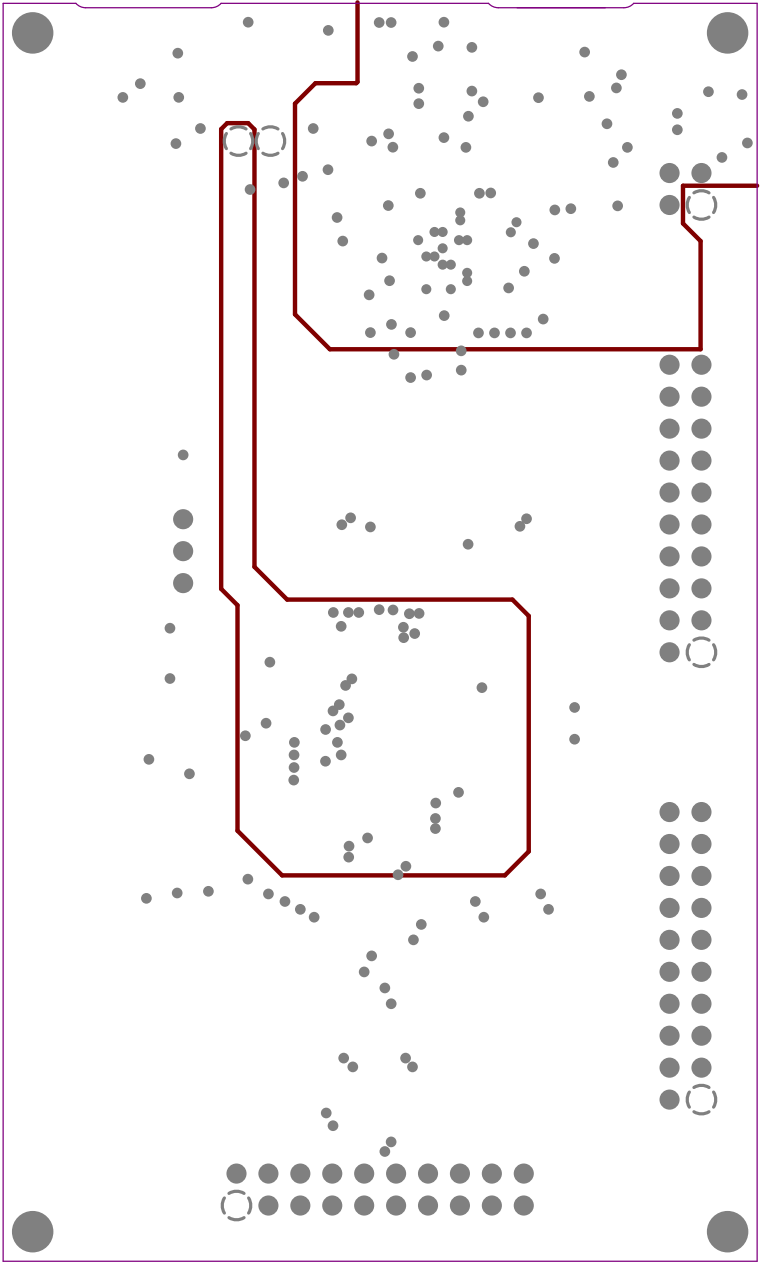


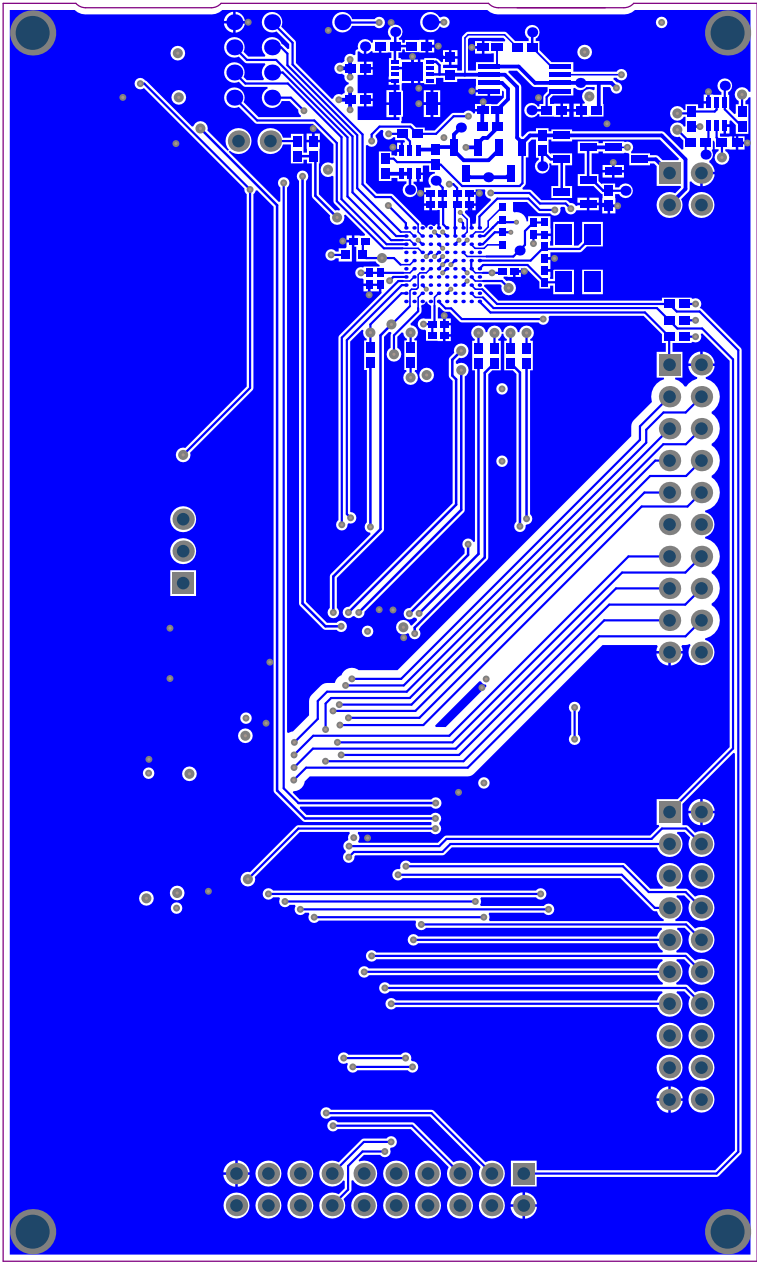
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A08-1905 Rev 1









# Component list

Top Level Schematics

Source Data From: SAMD21\_Xplained\_Pro.PrjPCB  
 Project: SAMD21\_Xplained\_Pro.PrjPCB  
 Variant: Default\_assembly



Report Date: 28.09.2015 12:38:07  
 Print Date: 28.09.2015 12:35:00

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	C1608X5R1A475K	Ceramic capacitor, SMD 0603, X5R, 10V, 10% (de31036)
Fitted	C102, C103, C304, C305, C306, C307, C310	7	100n	Kemet	C0402C104K4RACTU	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C301, C404, C410, C411, C412, C413	6	100n	Kemet	C0402C104K4RACTU	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C302, C303	2	6.8p			Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C308	1	1u	Kemet	C0402C105K9PAC	Ceramic capacitor, SMD 0402, X5R, 6.3V, +/-10% (de26942)
Fitted	C309	1	10uF/16V	Taiyo Yuden	EMK107BBJ106MA-T	Ceramic capacitor, SMD 0603, X5R, 16V, 10uF +/-20% (High Density)
Fitted	C311	1	100n	Kemet	C0402C104K4RACTU	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C400, C401	2	22p			Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C402	1	10p			Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C405, C409, C414, C415	4	2.2uF	Kemet	C0402C225M9PAC	Ceramic capacitor, SMD 0402, X5R, 6.3V, +/-20%
Fitted	C406, C407, C408	3	1 nF COG	Murata	GRM1555C1H102JA01D	Ceramic capacitor, SMD 0402, COG, 50V, +/-5%
Fitted	D300, D402	2	PR1F5V0U2X	Philips	PR1F5V0U2X	Double rail-to-rail USB ESD protection diode
Fitted	D301, D401	2	EL17-21UYC/A2	Everlight	17-21UYC/S530-A3/TR8	LED, Yellow, Wave length=591nm, SMD 0805, ±70°
Fitted	D400	1	EL17-21SYGC	Everlight	EL17-21SYGC	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	FIXTURE1	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 firm ware	ATMEL		EDBG secured firm ware
Fitted	J100	1	P101-2*02RGF-139-ND		P101-2*02RGF-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, J201, J202	3	P101-2*10RGF-139-ND		P101-2*10RGF-139-ND	Pin header, 2x10, Right Angle, 2.54mm, TH, Pin In Paste
Fitted	J300, J400	2	10104111-0001LF	FOJ	10104111-0001LF	Micro USB AB Connector
Fitted	J307	1	HMTSW-103-23-F-S-237	SAMTEC	HMTSW-103-23-F-S-237	1x3 pin header, 2.54mm pitch, Pin-in-Paste THM, 1mm hole
Fitted	JS100, JS300	2	SMT-100-BK-G	SAMTEC	SMT-100-BK-G	Jumper cap for 2.54mm pinheader
Fitted	L300, L401, L402	3	BLM18PG471SN1	Murata	BLM18PG471SN1	SMD RF inductor 0603, Z=4700Ohm (@100MHz), Max R(dc)=0.65Ohm, Max current=1A
Fitted	LABEL1	1	Label PCB	ACT Logmark AS	505462	PCBA identification label PP Top White Gloss
Fitted	PCB1	1	SAMD21 Xplained Pro PCB			SAMD21 Xplained Pro PCB, 4 layer, 60mm x 100mm
Fitted	PCBADOC1	1	A09-2130 PCB	ATMEL		SAMD21 Xplained Pro PCB documentation
Fitted	Q100, Q101, Q103, Q104	4	IRLML6402PBF	International Rectifier	IRLML6402PBF	P-ch. MOSFET, -30V, -3.7A continuous RDS(ON)=0.05Ohm@VGS=4.5V, RDS(ON)=0.08Ohm@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	Q105, Q400	2	2N7002DW	Fairchild	2N7002DW	Dual N-Channel MOSFET, 60V, 115mA cont.RDS(ON) < 7.5 Ohm @50mA@5V, SOT-363
Fitted	R100	1	18k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R101, R104, R105, R410, R413	5	1M			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R102, R307	2	30k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R103, R107, R111, R112, R310, R311, R312	7	100k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R106	1	390R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R108, R314, R425	3	0R			Thick film resistor, SMD 0402, 1/16W, 1%, RES 0.0 OHM 1/16W 0402 SMD, Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R109, R110, R113, R308	4	47k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R300	1	100k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R302, R304, R315, R421, R422	5	39R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R303, R309, R411, R412, R414, R416, R417, R418, R419, R420	10	330R			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R305, R306	2	4.7k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R401, R402, R409	3	1k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R423	1	6.81k			Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	SW300, SW301	2	SKRAAKED10	ALPS	SKRAAKED10	6.2x6.2 mm SMD tact sw tch, same as A08-0091 but less force is needed
Fitted	TEST1	1	SAMD21 Xplained Pro test	ATMEL		Fixture eggTest for SAMD21 Xplained Pro
Fitted	TESTDOC1	1	SAMD21 Xplained Pro Test Instructions	ATMEL		SAMD21 Xplained Pro Test Instructions
Fitted	U100	1	SPX3819R2-LTR	Exar	SPX3819R2-LTR	500mA LDO, ADJ, low noise, 8-DFN package
Fitted	U101	1	TFS2113PWR	Texas Instruments	TFS2113PWR	Autoswitching 2:1 Power Mux
Fitted	U300	1	SAMD21J18A-AUT	ATMEL	SAMD21J18A-AUT	Atmel 32-bit RISC MCU 64pin
Fitted	U301	1	AT25DF081A-SSH-T	Adesto Technologies	AT25DF081A-SSH-T	8Mbit SPI serial flash memory
Fitted	U400	1	AT32UC3A4256J-C1UR	ATMEL	AT32UC3A4256J-C1UR	AVR 32-bit RISC MCU
Fitted	XC300	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	XC400	1	12.0MHz	Fox Electronics	FQ5032B-12-C-C-C-200-1	Fox FQ5032B 12.0MHz SMD crystal 738B-12
Not Fitted	C300, C403	0	4.7n			Ceramic capacitor, SMD 0402, X7R, 25V, +/-10%
Not Fitted	R301, R424	0	1M	KOA	RK73H1ETT1004F	Thick film resistor, SMD 0402, 1/16W, 1%
Not Fitted	R313	0	0R		RMCF0402ZT0R00	RES 0.0 OHM 1/16W 0402 SMD

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Approved

Notes