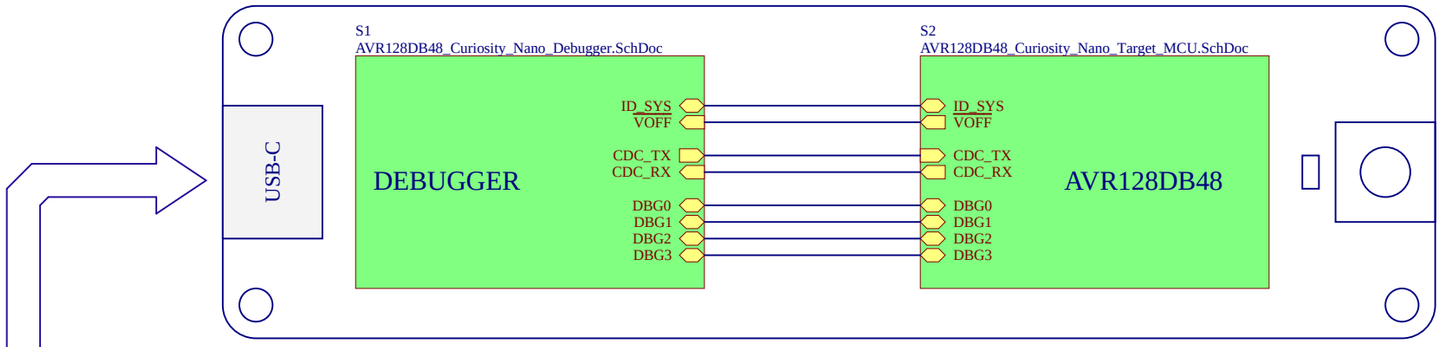
AVR128DB48 Curiosity Nano



On-Board Peripherals		
LED0	PB3	Active Low
SW0	PB2	Active Low

Program / Debug Interface	
UPDI	UPDI

IDE

Program Debug

Mass Storage

CURIOSITY (E:)

Drag & Drop Programming

helloworld.hex

Serial / CDC port	
USART3 TX	PB0
USART3 RX	PB1

Terminal

> Hello World!

DGI (Data Gateway Interface)	
Debug GPIO 0	PB2 (SW0)
Debug GPIO 1	PB3 (LED0)

Data Visualizer

TESTDOC1
A12-1314

TEST1
$ >_
A11-0474

FW1
A11-0406

PCBADOC1
A12-1425

PCB1
A08-3057

LABEL1
Product number/revision
Serial number
Label PCBA

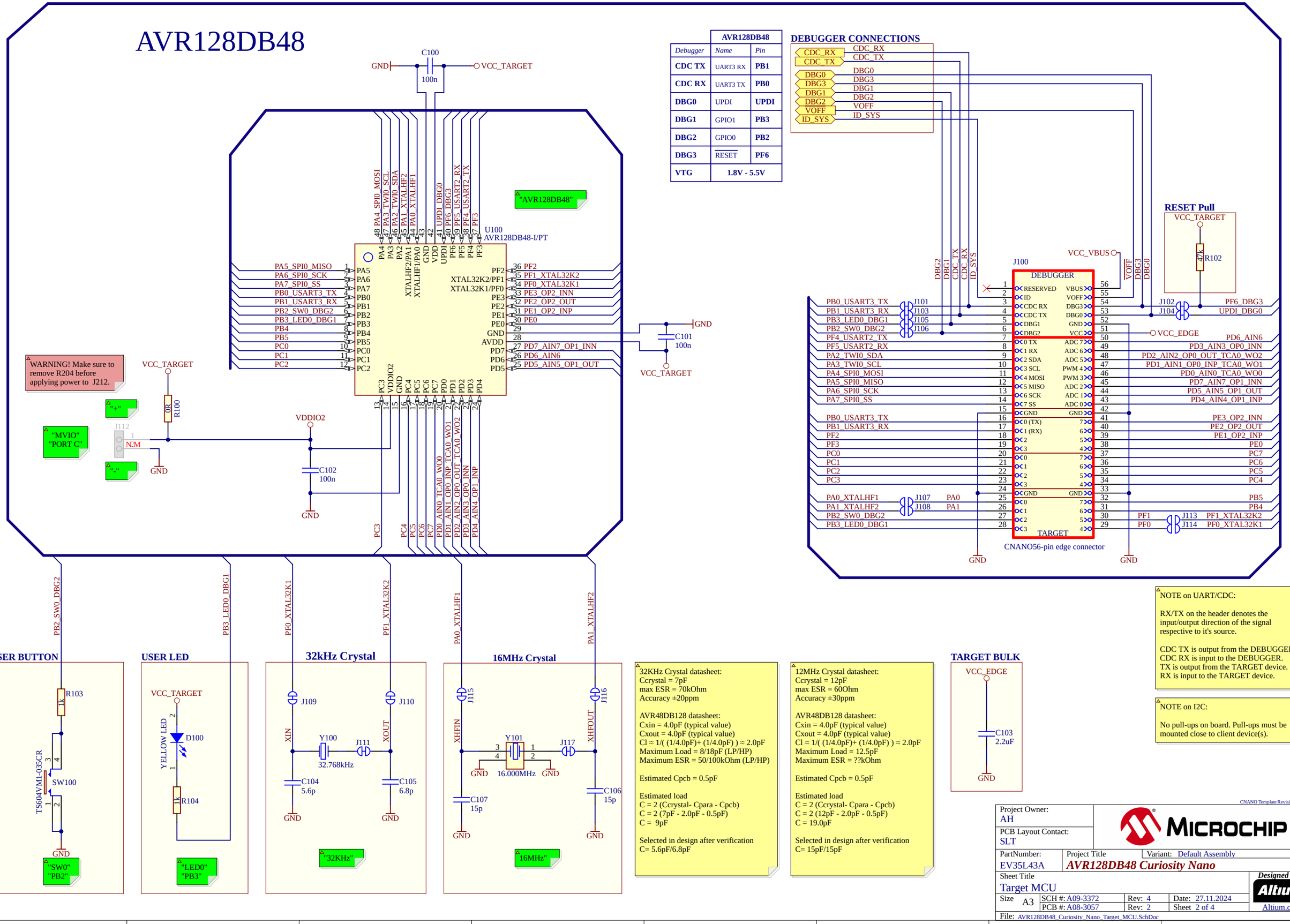
S3
AVR128DB48_Curiosity_Nano_Revision_History.SchDoc

"Text in Silkscreen on PCB"

CNANO Template Revision: TLM 2.3

Project Owner: AH	MICROCHIP
PCB Layout Contact: SLT	
PartNumber: EV35L43A	Project Title: *AVR128DB48 Curiosity Nano* — Variant: Default Assembly
Sheet Title: Top Level	Designed with Altium — Altium.com
Size: A3 — SCH #: A09-3372 — Rev: 4 — Date: 27.11.2024	
PCB #: A08-3057 — Rev: 2 — Sheet 1 of 4	
File: AVR128DB48_Curiosity_Nano_TopLevel.SchDoc	

AVR128DB48



AVR128DB48		
Debugger	*Name*	*Pin*
CDC TX	UART3 RX	**PB1**
CDC RX	UART3 TX	**PB0**
DBG0	UPDI	**UPDI**
DBG1	GPIO1	**PB3**
DBG2	GPIO0	**PB2**
DBG3	$\overline{\text{RESET}}$	**PF6**
VTG	**1.8V - 5.5V**	

TARGET BULK

NOTE on UART/CDC:

RX/TX on the header denotes the input/output direction of the signal respective to it's source.

CDC TX is output from the DEBUGGER.
CDC RX is input to the DEBUGGER.
TX is output from the TARGET device.
RX is input to the TARGET device.

NOTE on I2C:

No pull-ups on board. Pull-ups must be mounted close to client device(s).

32KHz Crystal datasheet:
Ccrystal = 7pF
max ESR = 70kOhm
Accuracy ±20ppm

AVR48DB128 datasheet:
Cxin = 4.0pF (typical value)
Cxout = 4.0pF (typical value)
Cl ≈ 1/((1/4.0pF)+ (1/4.0pF)) ≈ 2.0pF
Maximum Load = 8/18pF (LP/HP)
Maximum ESR = 50/100kOhm (LP/HP)

Estimated Cpcb = 0.5pF

Estimated load
C = 2 (Ccrystal- Cpara - Cpcb)
C = 2 (7pF - 2.0pF - 0.5pF)
C = 9pF

Selected in design after verification
C= 5.6pF/6.8pF

12MHz Crystal datasheet:
Ccrystal = 12pF
max ESR = 60Ohm
Accuracy ±30ppm

AVR48DB128 datasheet:
Cxin = 4.0pF (typical value)
Cxout = 4.0pF (typical value)
Cl ≈ 1/((1/4.0pF)+ (1/4.0pF)) ≈ 2.0pF
Maximum Load = 12.5pF
Maximum ESR = ??kOhm

Estimated Cpcb = 0.5pF

Estimated load
C = 2 (Ccrystal- Cpara - Cpcb)
C = 2 (12pF - 2.0pF - 0.5pF)
C = 19.0pF

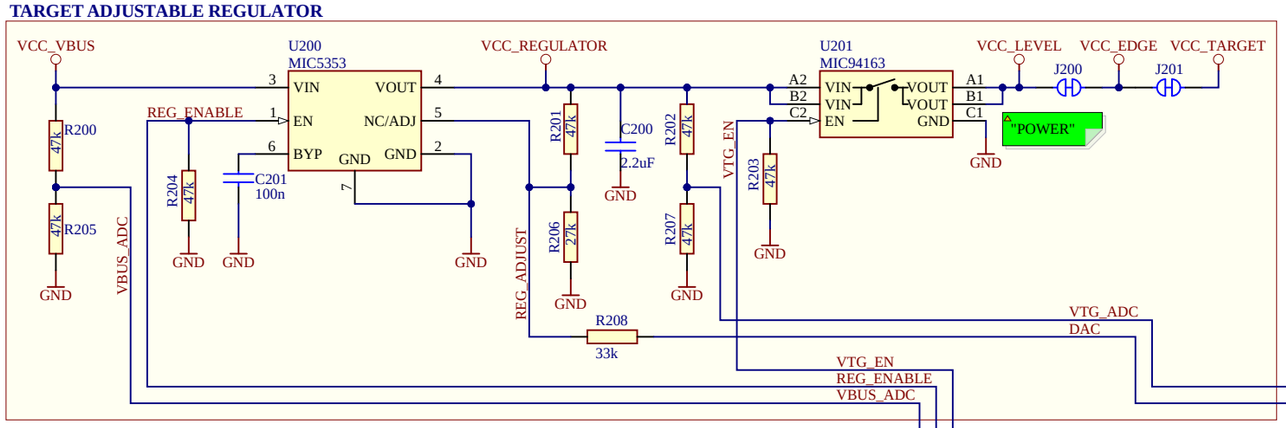
Selected in design after verification
C= 15pF/15pF

CNANO Template Revision: TLM 2.3

Project Owner: AH			
PCB Layout Contact: SLT			
PartNumber: EV35L43A	Project Title: *AVR128DB48 Curiosity Nano*	Variant: Default Assembly	
Sheet Title: Target MCU			Designed with Altium — Altium.com
Size: A3	SCH #: A09-3372	Rev: 4	Date: 27.11.2024
	PCB #: A08-3057	Rev: 2	Sheet 2 of 4
File: AVR128DB48_Curiosity_Nano_Target_MCU.SchDoc			

DEBUGGER

TARGET ADJUSTABLE REGULATOR



J200:
- Cut-strap used for full separation of target power from the level shifters and on-board regulators.
- For current measurements using an external power supply, this strap could be cut for more accurate measurements. Leakage back through the switch is in the micro ampere range.

J201:
- For current measurements using the on-board power supply, this strap must be cut and an ammeter connected across.

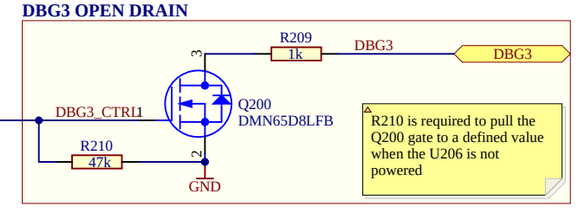
MIC5353:
Vin: 2.6V to 6V
Vout: 1.25V to 5.1V
Imax: 500mA
Dropout (typical): 50mV@150mA, 160mV @ 500mA
Accuracy: 2% initial
Thermal shutdown and current limit

Maximum output voltage is limited by the input voltage and the dropout voltage in the regulator.

Interface / Signal	ICSP™ TARGET	UPDI TARGET	SWD TARGET
CDC TX	UART RX	UART RX	UART RX
CDC RX	UART TX	UART TX	UART TX
DBG0	DAT	UPDI	SWDAT
DBG1	CLK	GPIO	SWCLK
DBG2	GPIO	GPIO	SWO/GPIO
DBG3	$\overline{MCLR}$	$\overline{RESET}$	$\overline{RESET}$
VCC	-	-	-

ADJUSTABLE OUTPUT AND LIMITATIONS:
- The DEBUGGER can adjust the output voltage of the regulator between 1.25V and 5.1V to the target.
- The voltage output is limited by the input (USB), which can vary between 4.40V to 5.25V
- The level shifters have a minimal voltage level of 1.65V and will limit the minimum operating voltage allowed for the target to still allow communication.
- The MIC94163 has a minimal volatege level of 1.70V and will limit the minimum voltage delivered to the target.
- Firmware configuration will limit the voltage range to be within the the target specification.

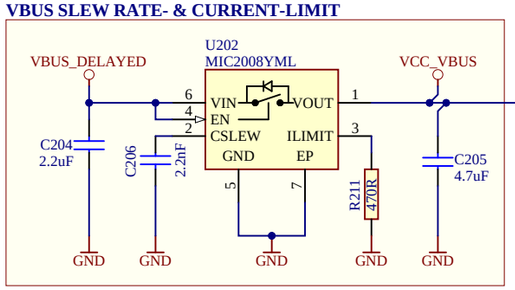
DBG3 OPEN DRAIN



R210 is required to pull the Q200 gate to a defined value when the U206 is not powered

VOFF
VOFF

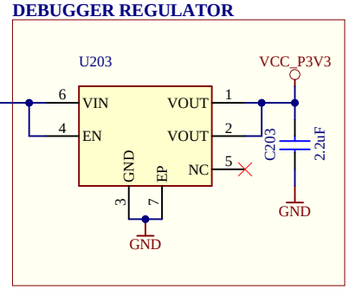
VBUS SLEW RATE- & CURRENT-LIMIT



SLEW RATE LIMIT:
- With C206 set to 2200pF, the slew rate of VCC_VBUS is limited to 2 V/ms by the power switch MIC2008.

CURRENT LIMIT:
- With R211 set to 470ohm, the current through the power switch MIC2008 is limited to 500mA.

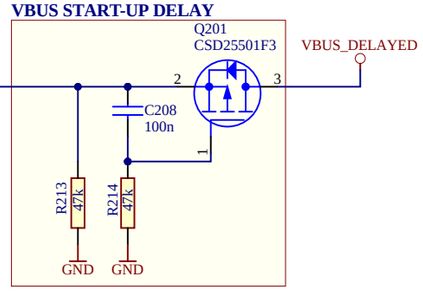
DEBUGGER REGULATOR



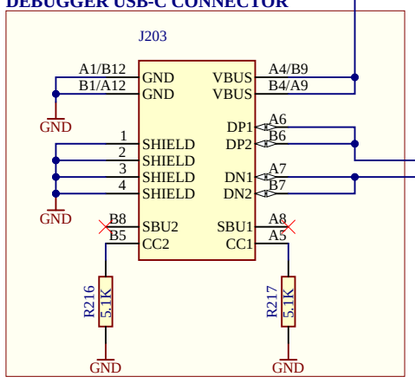
MIC5528:
Vin: 2.5V to 5.5V
Vout: Fixed 3.3V
Imax: 500mA
Dropout: 260mV @ 500mA

START-UP DELAY::
- With C208 set to 0.1uF and R214 set to 47kohm, the P-MOS is delaying the turn-on of VCC_DELAYED by ~1ms, compared to VBUS.

VBUS START-UP DELAY



DEBUGGER USB-C CONNECTOR

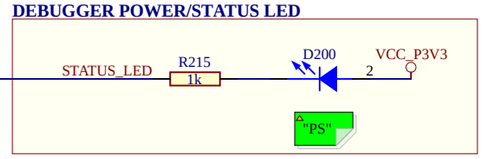


USBD_P
USBD_N

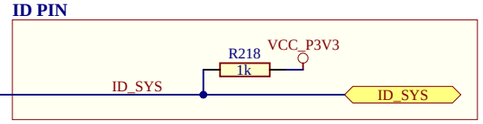
TP200
TP201

TP200 and TP201 are MTG Holes in the corners of the PCB in the DEBUGGER section labelled "GND" on the silkscreen.

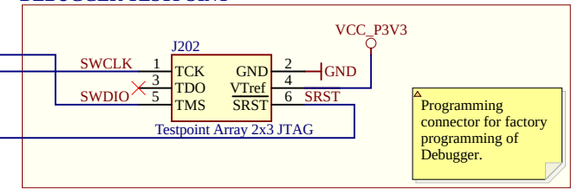
DEBUGGER POWER/STATUS LED



ID PIN



DEBUGGER TESTPOINT



Programming connector for factory programming of Debugger.

CNANO Template Revision: TLM 2.3

Project Owner: AH			
PCB Layout Contact: SLT			
PartNumber: EV35L43A	Project Title: *AVR128DB48 Curiosity Nano*	Variant: Default Assembly	
Sheet Title: Debugger			
Size: A3	SCH #: A09-3372	Rev: 4	Date: 27.11.2024
	PCB #: A08-3057	Rev: 2	Sheet 3 of 4
File: AVR128DB48_Curiosity_Nano_Debugger.SchDoc			

Designed with Altium — Altium.com

Revision History

PCB Assembly Rev 1:

Design Changes:

Initial Design

PCB:

PCB revision 1

PCB Assembly Rev 2:

Design Changes:

Changed to crystals from Microchip (Vectron)

PCB:

PCB revision 1

PCB Assembly Rev 4:

Design Changes:

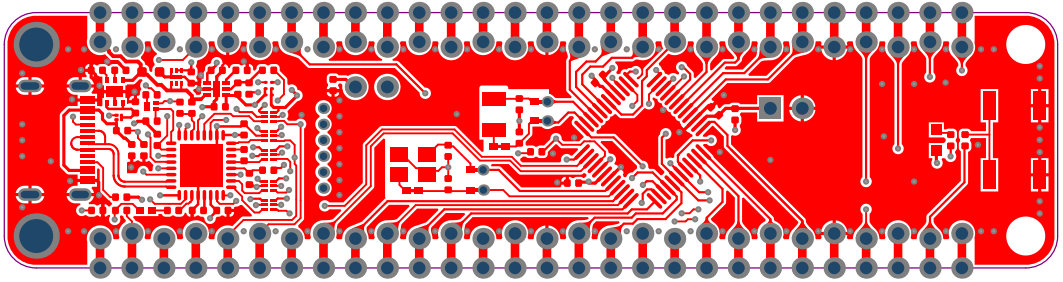
Designators reset
USB-C Connector
Power input and current limit redesign
32KHz changed to one that meets the Low Power requirements for the AVR128DB48.

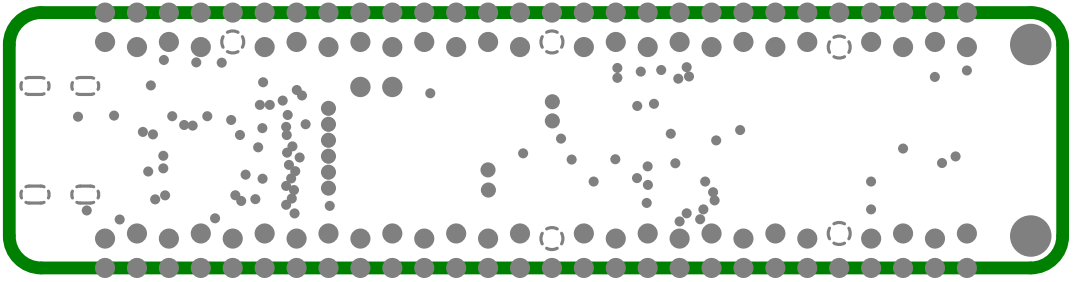
PCB:

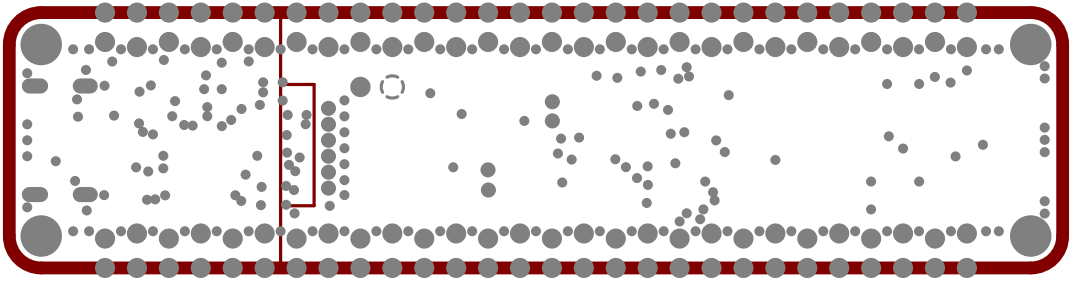
PCB revision 4
Updated footprint for J100, U204, U205, U207, U208, U209
U100 Placement changed slightly, and adjusted tracks, polygons, teardrops and text accordingly

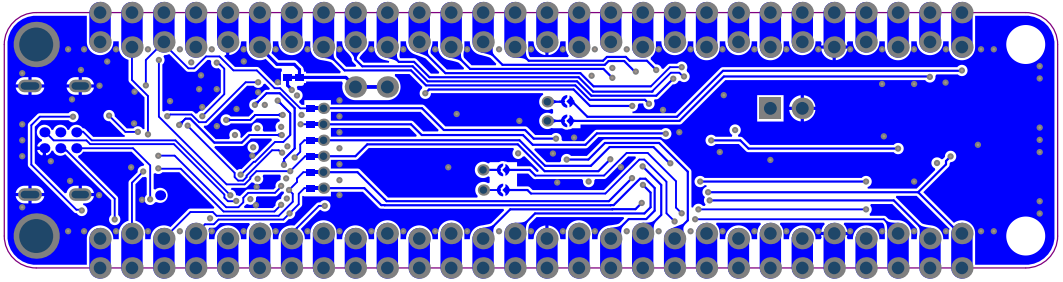
CNANO Template Revision: TLM 2.3

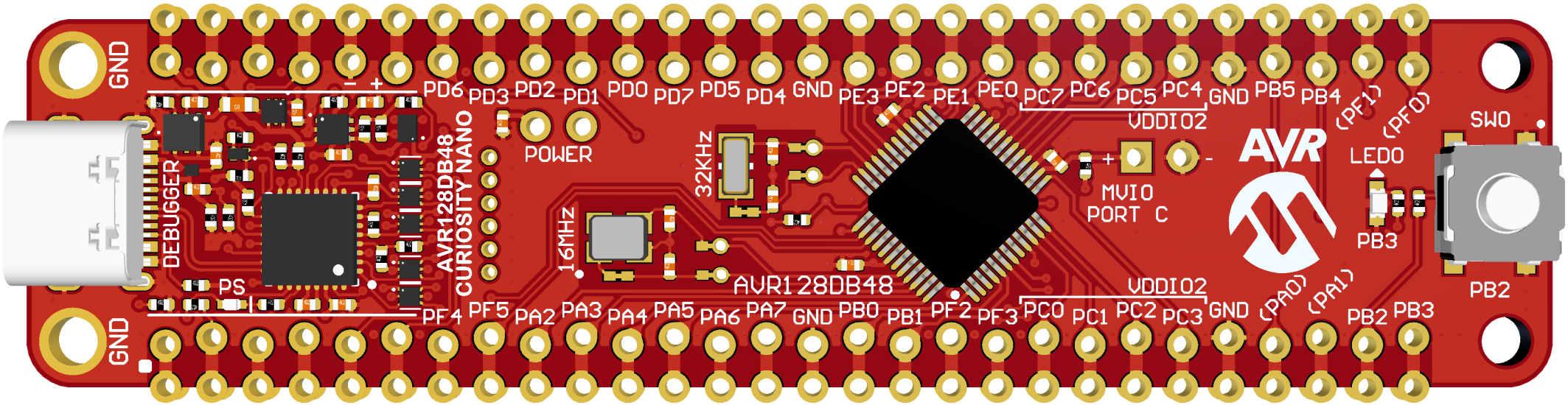
Project Owner: AH			
PCB Layout Contact: SLT			
PartNumber: EV35L43A	Project Title: *AVR128DB48 Curiosity Nano*	Variant: Default Assembly	
Sheet Title: Revision History			Designed with Altium — Altium.com
Size: A3	SCH #: A09-3372	Rev: 4	Date: 27.11.2024
	PCB #: A08-3057	Rev: 2	Sheet 4 of 4
File: AVR128DB48_Curiosity_Nano_Revision_History.SchDoc			

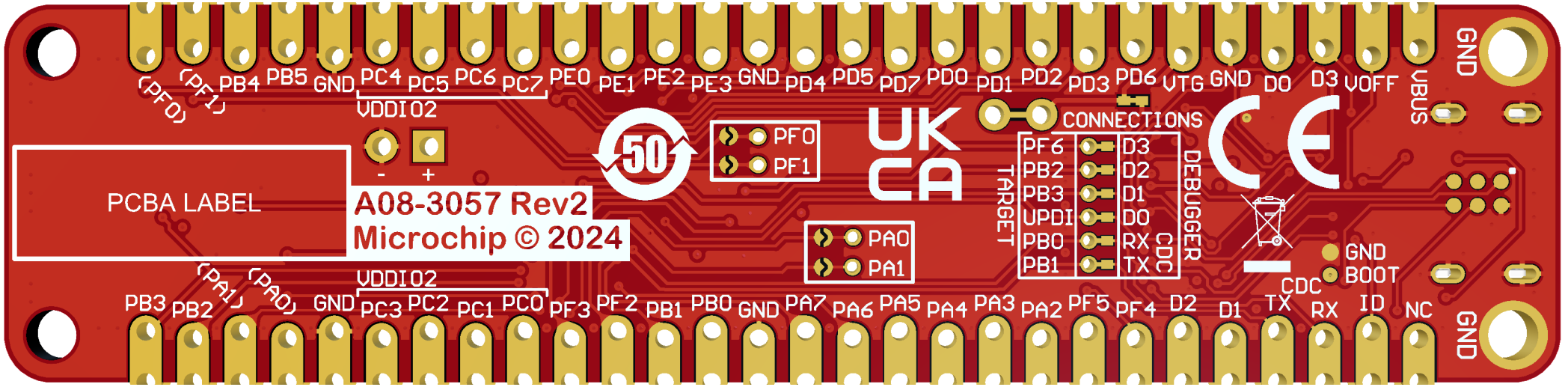


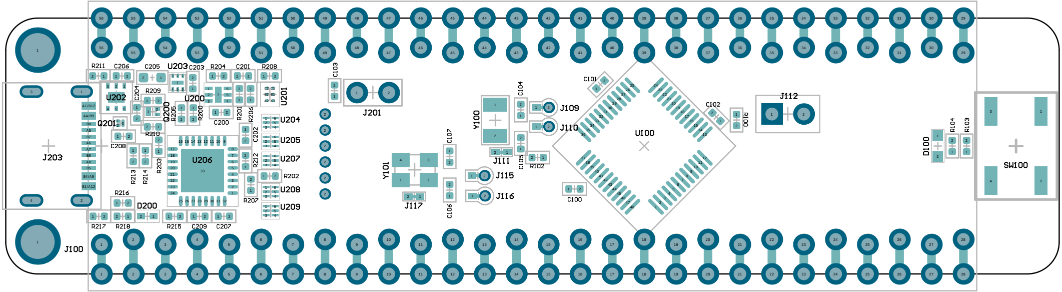


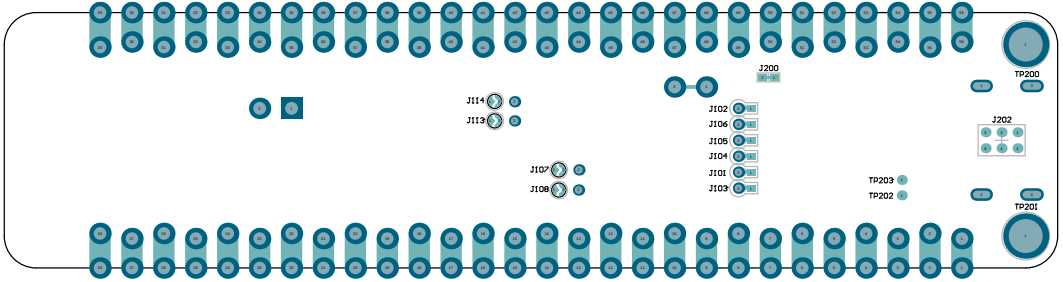




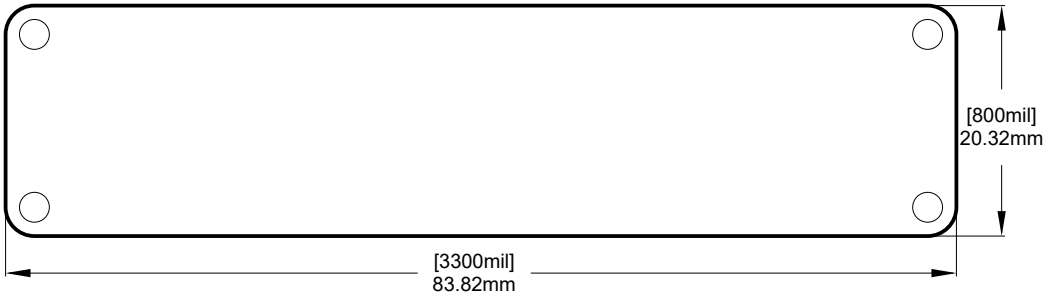

GND
PD6
PD3
PD2
PD1
PD0
PD7
PD5
PD4
GND
PE3
PE2
PE1
PE0
PC7
PC6
PC5
PC4
GND
PB5
PB4
(PF1)
(PF0)
SW0
DEBUGGER
AVR128DB48
CURIOSITY NANO
POWER
32KHz
16MHz
VDDIO2
MVIO
PORT C
AVR
LED0
PB3
PS
AVR128DB48
PB2
PF4
PF5
PA2
PA3
PA4
PA5
PA6
PA7
GND
PB0
PB1
PF2
PF3
PC0
PC1
PC2
PC3
GND
(PA0)
(PA1)
PB2
PB3


(PF0)
(PF1)
PB4
PB5
GND
PC4
PC5
PC6
PC7
PE0
PE1
PE2
PE3
GND
PD4
PD5
PD7
PD0
PD1
PD2
PD3
PD6
VTG
GND
D0
D3
VOFF
VBUS
GND
VDDIO2
PCBA LABEL
A08-3057 Rev2
Microchip © 2024
PF0
PF1
PA0
PA1
CONNECTIONS
TARGET
DEBUGGER
CDC
PF6
PB2
PB3
UPDI
PB0
PB1
D3
D2
D1
D0
RX
TX
GND
BOOT
(PA1)
(PA0)
PB3
PB2
GND
VDDIO2
PC3
PC2
PC1
PC0
PF3
PF2
PB1
PB0
GND
PA7
PA6
PA5
PA4
PA3
PA2
PF5
PF4
D2
D1
TX
RX
ID
NC
GND

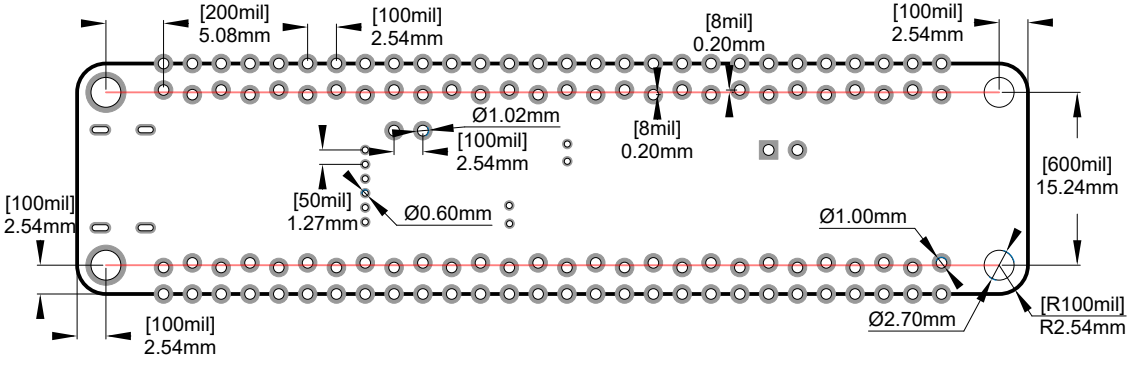

R211
C206
C205
U203
C203
R204
C201
R208
U202
C204
R209
U200
U201
Q200
R205
R200
R201
R206
C200
Q201
R210
C202
U204
U205
U207
U208
U209
C208
U206
R212
R202
R213
R214
R203
R207
R216
D200
R217
R218
R215
C209
C207
J203
J100
C103
J201
C104
Y100
J109
J110
J111
C105
R102
C107
Y101
J115
J116
J117
C106
C101
C102
R100
U100
C100
J112
D100
R104
R103
SW100


J200
TP200
J114
J113
J102
J106
J105
J104
J101
J103
J202
TP203
TP202
J107
J108
TP201

Board Outline

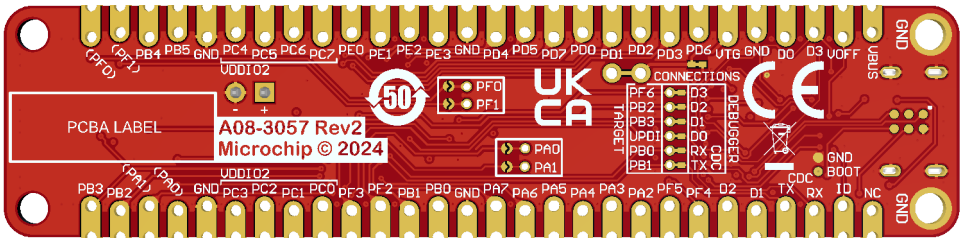


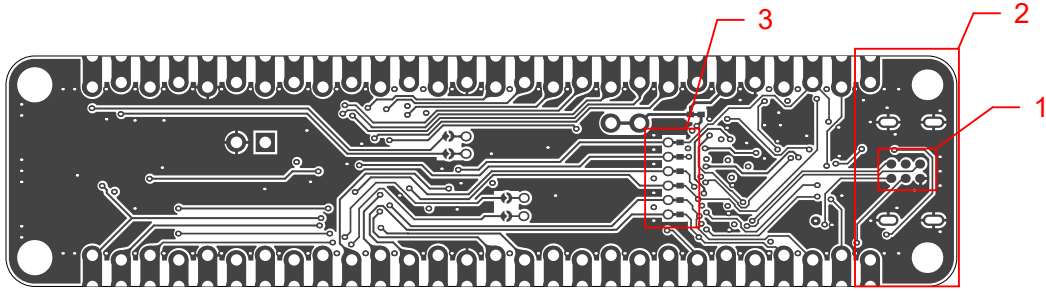
Through-Hole Dimensions

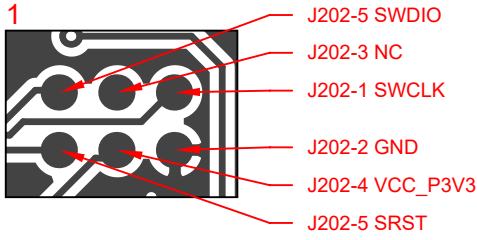


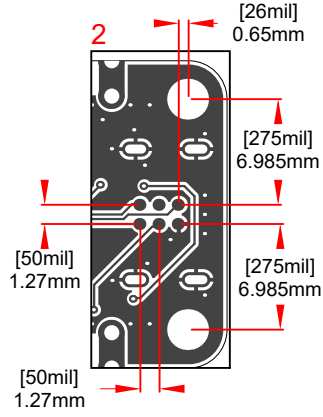
Centerline of staggered through-holes for pin headers.

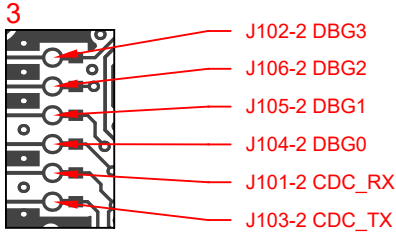
Test Point Placement [Bottom View]



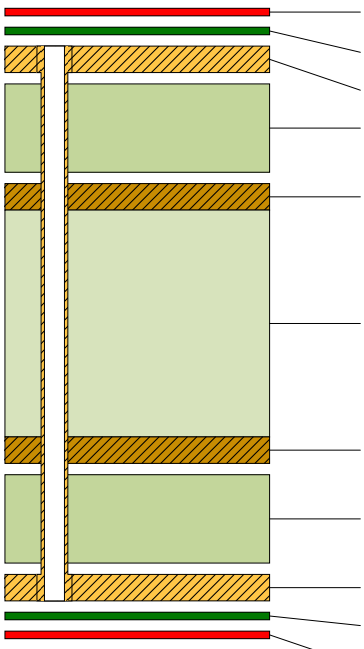








PCB Stackup



Material	Layer	Thickness	Dielectric Material	Type	Gerber
	Top Overlay			Legend	GTO
Surface Material	Top Solder	0.010mm	Solder Resist	Solder Mask	GTS
Copper	Top Layer	0.035mm		Signal	GTL
Prepreg		*0.117mm*	*PP-016*	*Dielectric*	
Copper	Gnd Plane	0.035mm		Internal Plane	GP1
Core		*1.200mm*	*FR-4*	*Dielectric*	
Copper	Pwr Plane	0.035mm		Internal Plane	GP2
Prepreg		*0.117mm*	*PP-016*	*Dielectric*	
Copper	Bottom Layer	0.035mm		Signal	GBL
Surface Material	Bottom Solder	0.010mm	Solder Resist	Solder Mask	GBS
	Bottom Overlay			Legend	GBO

Total thickness: 1.594mm

Component list

AVR128DB48 Curiosity Nano

PCBA Number: A09-3372
PCBA Revision: 4
Variant: Default Assembly

Print Date: 27.11.2024 10:15:07

Fitted	Designator	Quantity	Value	Manufacturer	MPN	Description
Fitted	C100, C101, C102, C201, C202, C207, C208	7	100n	Yageo	CC0402KRX7R7BB104	Ceramic capacitor, SMD 0402, X7R, 16V, +/-10%
Fitted	C103, C200, C203, C204	4	2.2uF	TDK	C1005X5R1A225K050BC	CAP CER 2.2UF 10V 10% X5R 0402
Fitted	C104	1	5.6p	Yageo	CC0402DRNPO9BN5R6	Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C105	1	6.8p	Yageo	CC0402CRNPO9BN6R8	Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C106, C107	2	15p	Yageo	CC0402JRNPO9BN150	Ceramic capacitor, SMD 0402, NP0, 50V, +/-5%
Fitted	C205	1	4.7uF	Yageo	CC0603KRX5R6BB475	Ceramic capacitor, SMD 0603, X5R, 10V, 10% (de31036)
Fitted	C206	1	2.2nF	Kemet	C0402C222J3GACTU	Ceramic capacitor, SMD 0402, C0G, 25V, +/-5%
Fitted	C209	1	1u	Kemet	C0402C105K9PAC	Ceramic capacitor, SMD 0402, X5R, 6.3V, +/-10% (de26942)
Fitted	D100	1	YELLOW LED	ROHM	SML-D12Y1WT86	LED, SMD 0603, Yellow , Wave length=590nm, 100mcd @ (20mA, 2.2Vf) rohm
Fitted	D200	1	GREEN LED	ROHM	SML-P12MTT86R	LED, SMD 0402, Green, Wave length=569nm, 2.1mcd @ (1mA, 1.9Vf)rohm
Fitted	FW1	1	nEDBG firmw are			nEDBG firmw are
Fitted	J203	1	L-KLS1-5409-R	Cabcon A/S	L-KLS1-5409-R	USB2.0 Type-C, Surface mount signals and DIP shield
Fitted	LABEL1	1	Label PCBA	ACT Logimark AS	505462	PCBA identification label PP Top White Gloss
Fitted	PCB1	1	AVR128DB48 Curiosity Nano PCB Documentation			AVR128DB48 Curiosity Nano PCB Documentation
Fitted	PCBADOC1	1	AVR128DB48 Curiosity Nano PCBA Documentation			AVR128DB48 Curiosity Nano PCBA Documentation
Fitted	Q200	1	DMN65D8LFB	Diodes Incorporated	DMN65D8LFB-7	N-channel MOSFET, DFN1006-3 (SOT883), 60V, 330mA, 4Ohm
Fitted	Q201	1	CSD25501F3	Texas Instruments	CSD25501F3	P-Channel MOSFET, LGA, 20V, 3.6A, 76mOhm
Fitted	R100	1	0R	Yageo	RC0402JR-070RL	RES 0.0 OHM 1/16W 0402 SMD
Fitted	R102, R200, R201, R202, R203, R204, R205, R207, R210, R213, R214	11	47k	KOA	RK73H1ETTP4702F	Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R103, R104, R209, R212, R215, R218	6	1k	Yageo	RC0402FR071KL	Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R206	1	27k	Yageo	RC0402FR-0727KL	Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R208	1	33k	Yageo	RC0402FR-0733KL	Thick film resistor, SMD 0402, 1/16W, 1%
Fitted	R211	1	470R	Yageo	RC0402FR-07470RL	Thick film resistror, SMD 0402, 1/16W, 1%
Fitted	R216, R217	2	5.1K	Panasonic	ERJ-2RKF5101X	Thick film resistor, SMD 0402, 1/10W, 1%
Fitted	SW100	1	TS604VM1-035CR	Dailyw ell Electronics Co.LTD	TS604VM1-035CR-R	SWITCH, SMD, 260gf, 6.4mm X 6.2mm
Fitted	TEST1	1	AVR128DB48 Curiosity Nano Test			Fixture test for AVR128DB48 Curiosity Nano
Fitted	TESTDOC1	1	Curiosity Nano Test Instructions			Generic Test Instructions for Curiosity Nano
Fitted	U100	1	AVR128DB48-I/PT	Microchip	AVR128DB48T-I/PT	AVR MCU 8-Bit 128kB Flash 48 pin 24MHz TQFP
Fitted	U200	1	MIC5353	Microchip	MIC5353YMT-TR	500mA Ultra Low Dropout LDO regulator, 2% accuracy, 1.6x1.6mm MLF
Fitted	U201	1	MIC94163	Microchip	MIC94163YCS-TR	Loadsw itch, Rds(on) = 14.5mohm, 1.0mm x 1.5mm WLCSP, reverse blocking
Fitted	U202	1	MIC2008YML	Microchip	MIC2008YML-TR	0.2A- 2.5A adjustable current limit pow er sw itch, 2mm x 2mm DFN
Fitted	U203	1	MIC5528-3.3YMT	Microchip	MIC5528-3.3YMT-T5	LDO 3.3V 0.5A 6TDFN
Fitted	U204, U205, U207, U208, U209	5	74LVC1T45FW4-7	Diodes Incorporated	74LVC1T45FW4-7	Single-Bit Dual-Supply Transceive, 1.65-5.5 Translation and 3-State Outputs
Fitted	U206	1	SAMD21E18A-MUT	Microchip	ATSAMD21E18A-MUT	32-bit RISC MCU 32pin
Fitted	Y100	1	32.768kHz	Microchip	VMK3-9002-32K7680000TR	Crystal, 32.768kHz, CL=7.0pF, ESR=70kOhm, SMD LxW=3.2 x 1.5mm, 20ppm
Fitted	Y101	1	16.000MHz	Microchip	VXM7-9040-16M0000000TR	Crystal, 16.0MHz, CL=12.0pF, ESR=80Ohm, SMD LxW=3.2 x 25mm, 20ppm
Not Fitted	J112	0	1125-1102S0S113R1	Cabcon A/S	1125-1102S0S113CR01	1x2 pin header, 2.54mm pitch, Pin-in-Paste THM
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Approved

Notes