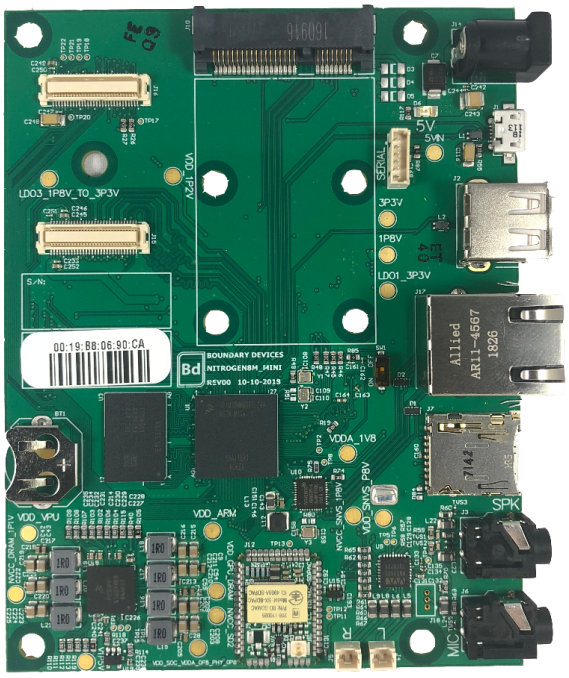
Boundary Devices

Nitrogen8M_Mini User Manual

REVISION HISTORY		
Date	**Revision**	**Description**
12/12/2018	0.1	First Draft
5/16/2019	0.2	Updated Power Consumption and Block Diagram for CSI
8/28/2019	0.3	Updated UART2 Console Port
07/15/2020	0.4	Updated BT + eMMC Spec
06/24/2021	0.5	Add QNX support Ubuntu as default OS Add U-Boot/Linux details Add J34/J45 tables
07/27/2022	0.6	Add REV40 details
10/20/2022	0.7	Add board revision history table



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1. NITROGEN8M_MINI OVERVIEW

1.1 NITROGEN PLATFORM

The first Nitrogen platform was launched in 2014 after the worldwide success of Boundary Devices' i.MX 6 SABRE Lite Reference Design (now BD-SL-i.MX6). The Nitrogen platforms consist of Single Board Computers (SBC) and System on Modules (SOM) using BD's proprietary board layout design and featuring NXP's i.MX 6, i.MX 7, and i.MX 8 applications processors.

The Nitrogen platforms come fully supported by Boundary Devices' engineering team, and includes a full Board Support Package. Nitrogen platforms are designed to serve as a development platform as well as a production-ready solution. All Nitrogen boards can be de-populated or fully customized to meet specific project and budget requirements. Contact a Boundary Devices representative at info@boundarydevices.com to learn more.

1.2 NITROGEN8 FAMILY

The Nitrogen8 family of SBCs and SOMs are the latest in Boundary Devices' i.MX based embedded computing solutions. The Nitrogen8 family includes the Nitrogen8M and Nitrogen8M_Mini featuring NXP's i.MX 8 family of processors that were released in 2018.

The different Nitrogen8 series of SBCs and SOMs include offerings designed to best leverage the advantages of the i.MX 8M and i.MX 8M applications processors to fit a variety of embedded and IoT applications including: industrial automation, aviation & aerospace, HMI, industrial control, robotics, building control, digital displays, infotainment, telematics, and more.

1.3 SOFTWARE SUPPORT

Boundary Devices provides a full Board Support Package (BSP) for all Nitrogen boards.

The BSP includes boot loader, kernel and user-space components optimized for each platform.

The boards ship with U-Boot, Linux Kernel as well as an Ubuntu operating system.

Industry leading OS-Level support can be found on the Boundary Devices website via the Blog (https://boundarydevices.com/blog) and Wiki (https://wiki.boundarydevices.com). You can also find images for the latest versions of popular OS supported by the Nitrogen platforms including: Yocto, Buildroot, Ubuntu, Debian, Android, QNX, and FreeRTOS.

Boundary Devices does not provide application development or support, but does have a large list of software partners who can. You can browse our partners at https://boundarydevices.com/support

1.3.1 U-BOOT CONFIGURATION

Since there are different variants of the same platform, it depends on your configuration:

- nitrogen8mm_2g_defconfig for REV00/REV10/REV20 with 2G of LPDDR4
- nitrogen8mm_4g_defconfig for REV00/REV10/REV20 with 4G of LPDDR4
- nitrogen8mm_rev2_2g_defconfig for REV30/REV40 with 2G of LPDDR4
- nitrogen8mm_rev2_4g_defconfig for REV30/REV40 with 4G of LPDDR4

For more information about the build process, please refer to this blog post:

https://boundarydevices.com/u-boot-2020-10-for-i-mx-platforms/

1.3.2 LINUX DEVICE TREE

The device tree to use depends on the revision of your platform, see marking on the PCB:

- From REV00 to REV20:

arch/arm64/boot/dts/freescale/imx8mm-nitrogen8mm.dts

- From REV30 to REV40:

arch/arm64/boot/dts/freescale/imx8mm-nitrogen8mm_rev2.dts

1.4 MAIN SPECIFICATIONS

The Nitrogen8M_Mini SBC is the latest in our line of i.MX based Nitrogen platforms, leveraging the i.MX 8M_Mini family of applications processors from NXP. Built with i.MX's industry-leading video capabilities and an emphasis on low power consumption, the i.MX 8M Mini applications processor family is ideal for applications scaling from consumer home audio to industrial building automation and mobile kiosks. The Nitrogen8M_Mini series of SBCs will include a robust set of attribute options, allowing them to be scaled up or down to fit any embedded project. Key Features of the Nitrogen8M Mini Series:

- Cortex-A53 (64-bit) + Cortex-M4F
- PF8121 PMIC (for low power consumption)
- 2GB of LPDDR4 RAM (Up to 4GB)
- 16GB eMMC (Up to 128GB)
- x2 USB 2.0
    - **REV40** includes 1 extra USB2.0 port on the mPCIe connector
- 4-Lane MIPI-DSI Display (up to 1080p)
- Camera Input (4-Lane MIPI-CSI)
- Optional Wi-Fi + BT BD-SDMAC Module (Pre-Certified 802.11 AC & BT 5.0)
- Optional PoE (via daughter board)

1.4.1 CPU

CPU	
CPU Name	NXP i.MX 8M Mini Quad
CPU Type	4x Cortex-A53 1x Cortex-M4F
CPU Cores	4
CPU Clock (Max)	2GHz

1.4.2 MEMORY & STORAGE

MEMORY & STORAGE	
RAM	2GB LPDDR4 (up to 4GB)
eMMC	16GB eMMC (up to 128GB)

1.4.3 MULTIMEDIA

MULTIMEDIA	
2D/3D Graphics Acceleration	GC NanoUltra for 3D, GC320 for 2D
Video Encode **Video Decode**	1080p60 H.264, VP8 1080p60 H.265, H.264, VP8, VP9
Camera Interfaces	1x MIPI CSI

1.4.4 DISPLAY & AUDIO CONNECTIONS

DISPLAY CONNECTIONS	
MIPI DSI	1x 4-lane (up to 1080p)
AUDIO INTERFACES	
Headphone	1x (WM8960)
Microphone	1x (analog)
Amplifier	1W (per channel)

1.4.5 NETWORKING CONNECTIONS

NETWORKING CONNECTIONS	
Ethernet	10/100/1GB
WiFi	Optional Add-on 802.11ac (BD-SMAC / QCA9377)
Bluetooth	Optional Add-on BT5.0 (BD-SMAC / QCA9377)

1.4.6 CONNECTIVITY PORTS

CONNECTIVITY PORTS	
I2C	3x
SPI	1x
UART	2x RS-232
SD / MMC	1x (optional)
USB	2x (USB 2.0 Host + USB 2.0 OTG)
RTC	1x + battery
PCIe	1x

1.4.7 MISCELLANEOUS SPECIFICATIONS

PCB SPECIFICATIONS	
Dimensions (L x W)	114.3mm x 88.90mm
MISCELLANEOUS SPECIFICATIONS	
Temperature Rating	0°- +70°C (-40°- +85°C optional)
Power Supply	5V

1.5 SUPPORTED OPERATING SYSTEMS

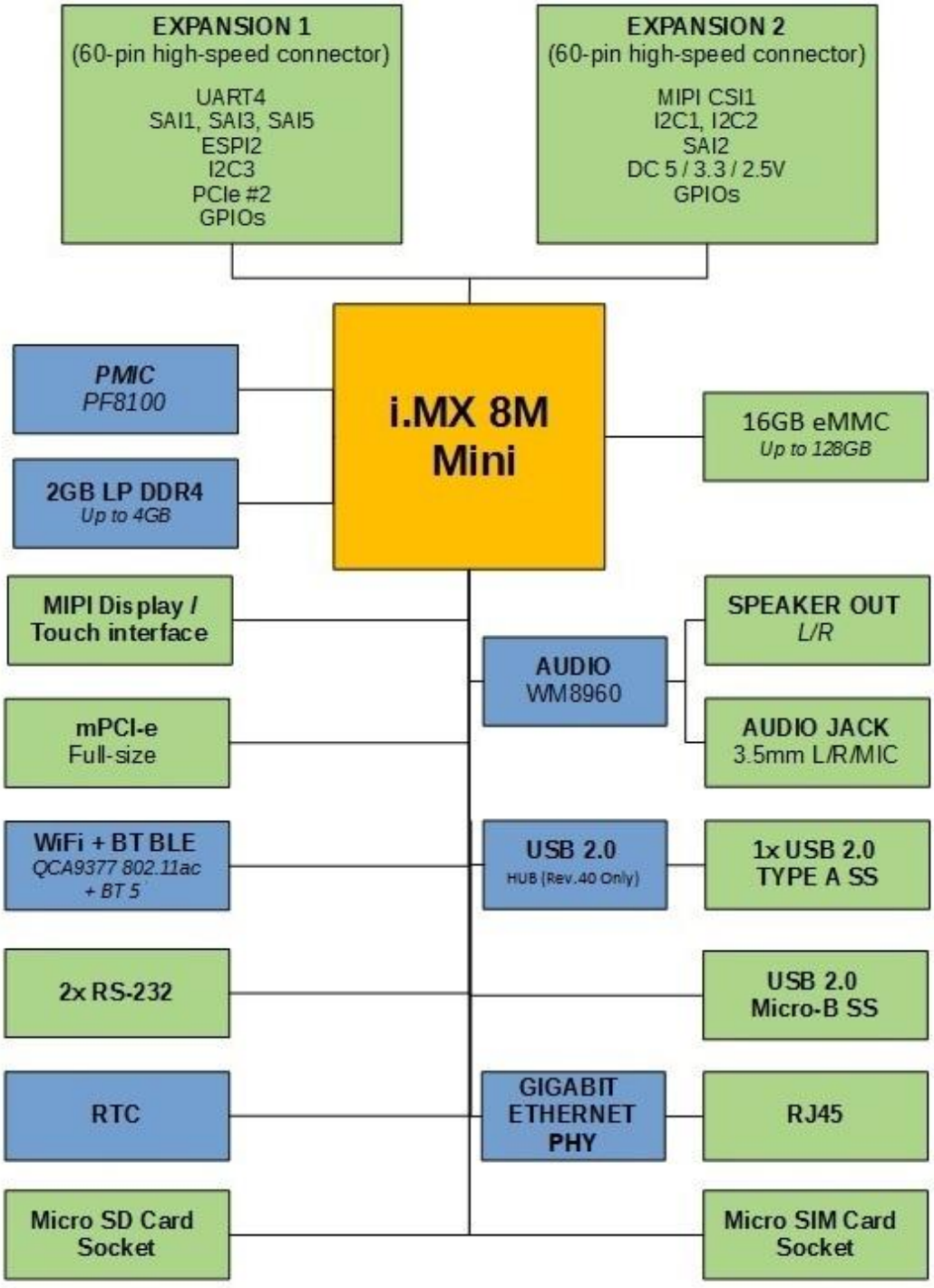
OS SUPPORTED	
Yocto	Yes
Buildroot	Yes
Debian	Yes
Ubuntu	Yes
Android	Yes
QNX	Yes
FreeRTOS	Yes (M4 core)
Windows Embedded Compact (WEC)	No

1.6 BOARD REVISION HISTORY

REVISION HISTORY	
REV00	- Initial production revision
REV10	- PoE support addition (via J35/J45)
REV20	- External RTC addition (RV-4162) - Level shifter addition for wdog signal
REV30	- Move VDD_ARM to SW3 only - Add pull-up to wdog signal
REV40	- Wi-Fi Bluetooth changed to be on-board - PHY changed to KSZ9031 / KSZ902108 - USB Hub addition for mPCIe connector

2. ARCHITECTURE OVERVIEW

2.1 BLOCK DIAGRAM



3. ELECTRICAL CHARACTERISTICS

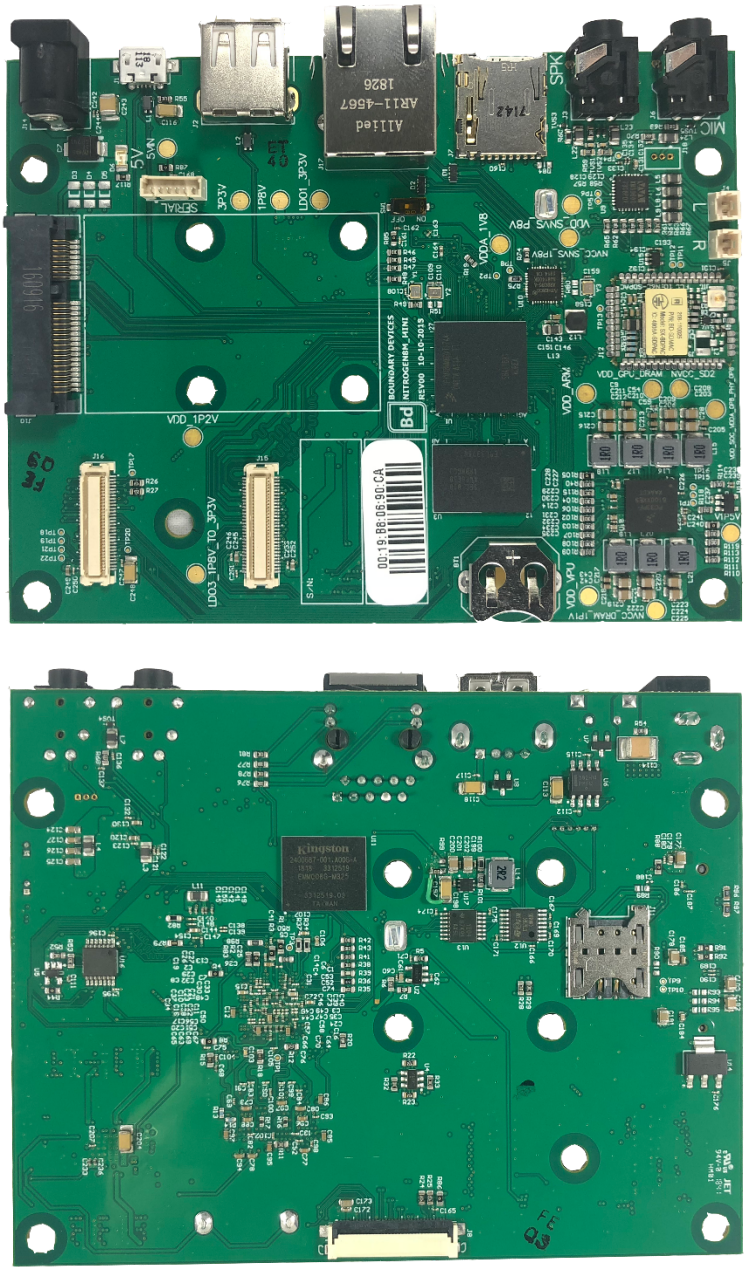
3.1 ELECTRICAL CHARACTERISTICS OF NITROGEN8M_MINI

PARAMETER	MIN	TYP	MAX	UNIT
Main Input Voltage	X	5	5	V
Power Consumption*	X	1300	2700	mW
CPU Clock	X	1.6	2	GHZ

*The Power Consumption refers to a single board with no other peripherals plugged in

4. CONNECTOR DETAILS

4.1 CONNECTOR LAYOUT



4.2 STANDARD CONNECTORS

List of industry standard connectors with known pin outs:

REF DESIGNATOR	FUNCTION
J2	USB 2.0 Host x1
J6	Microphone 3.5mm Jack
J7	Headphone 3.5mm Jack
J17	Gigabit Ethernet RJ45 port
J10	mPCIe connector (USB pins only available for **REV40**)
J14	DC Power Jack (5V)
J11	SIM Card Socket
J7	Micro SD Card Socket
J1	USB 2.0 OTG (micro-B SS)

4.3 CUSTOM CONNECTORS

The Nitrogen8M Mini has a robust set of peripheral interfaces available via custom connectors:

J4: 2W Amplified Audio – Left Channel (Molex 53047-0210)	
PIN#	**Function**
1	SPK_LN
2	SPK_LP

J5: 2W Amplified Audio – Right Channel (Molex 53047-0210)	
PIN#	**Function**
1	SPK_RN
2	SPK_RP

J8: MIPI-DSI + Touch connector (Omron XF2M-3315-1A)	
PIN#	**Function**
1	GND
2	GND
3	+5V
4	+5V
5	+5V
6	+5V
7	SPDIF_TX/PWM3
8	GPIO1_IO01
9	TOUCH_INT

PIN#	Function
10	TOUCH_RESET
11	GPI01_IO09
12	GND
13	DSI_D3_N
14	DSI_D3_P
15	GND
16	DSI_D2_N
17	DSI_D2_P
18	GND
19	DSI_CLK_N
20	DSI_CLK_P
21	GND
22	DSI_D1_N
23	DSI_D1_P
24	GND
25	DSI_D0_N
26	DSI_D0_P
27	GND
28	I2C2_SCL
29	I2C2_SDA
30	GND
31	3P3V
32	3P3V
33	3P3V

J9: COM1 & COM2 (Molex 53047-0610)*	
PIN#	**Function**
1	UART4_TXD
2	+5V
3	GND
4	UART2_TXD
5	UART2_RXD
6	UART4_RXD

*UART 2 is used as the U-Boot and O/S console.
*UART 2/4 are mapped to /dev/ttymxc1 and /dev/ttymxc3 under Linux.

J15: Expansion Connector #1 (Molex 52991-0608)			
PIN#	**Function**	**PIN#**	**Function**
1	CSI_D0_N	2	GND
3	CSI_D0_P	4	SAI5_RXD0
5	GND	6	SAI5_RXD1
7	CSI_D1_N	8	SAI5_RXD2
9	CSI_D1_P	10	SAI5_RXD3
11	GND	12	SAI5_RXFS
13	CSI_CK_N	14	GND
15	CSI_CK_P	16	SAI5_MCLK
17	GND	18	GND
19	CSI_D2_N	20	SAI1_RXFS
21	CSI_D2_P	22	SAI1_RXC
23	GND	24	SAI1_RXD1
25	CSI_D3_N	26	SAI1_RXD2
27	CSI_D3_P	28	SAI1_RXD3
29	GND	30	SAI1_RXD4
31	UART3_RXD	32	SAI1_RXD5
33	UART3_RTS	34	SAI1_RXD6
35	UART3_CTS	36	SAI1_RXD7
37	UART3_TXD	38	GND
39	ECSPI2_SS0	40	SAI1_TXD1
41	ECSPI2_MISO	42	SAI1_TXD2
43	ECSPI2_SCLK	44	SAI1_TXD3
45	ECSPI2_MOSI	46	SAI1_TXD4
47	GND	48	SAI1_TXD5
49	LDO3_1P8V_TO_3P3V	50	SAI1_TXD6
51	LDO3_1P8V_TO_3P3V	52	SAI1_TXD7
53	LDO3_1P8V_TO_3P3V	54	GND
55	LDO3_1P8V_TO_3P3V	56	1P8V
57	3P3V	58	1P8V
59	3P3V	60	1P8V

J16: Expansion Connector #2 (Molex 52991-0608)			
PIN#	**Function**	**PIN#**	**Function**
1	GND	2	RTC_RESET_B
3	QSPIA_SCLK	4	TP17
5	GND	6	GND
7	QSPIA_DATA3	8	BI2C3-SCL
9	QSPIA_DATA2	10	BI2C3_SDA
11	QSPIA_DATA1	12	GND
13	QSPIA_DATA0	14	GND
15	QSPIA_NSS0	16	ON_OFF
17	NAND_CLE	18	GPIO1_IO11
19	GND	20	GND
21	CLKIN1	22	SAI3_MCLK/PWM4
23	CLKOUT1	24	GND
25	GND	26	SAI3_TXC
27	CLKIN2	28	SAI3_TXD
29	CLKOUT2	30	SAI3_RXD
31	GND	32	GND
33	JTAG_NTRST	34	SPDIF_EXT_CLK/PWM1
35	JTAG_TDO	36	GND
37	JTAG_TCK	38	SPDIF_RX/PWM2
39	JTAG_TDI	40	GND
41	JTAG_TMS	42	GPIO1_IO08
43	GND	44	GPIO1_IO5/M4NMI
45	EXT_RESET_N	46	GPIO1_IO3
47	GND	48	PMIC_ON_REQ
49	TP18	50	TP20
51	TP19	52	GND
53	TP21	54	GND
55	TP22	56	+5V
57	3P3V	58	+5V
59	3P3V	60	+5V

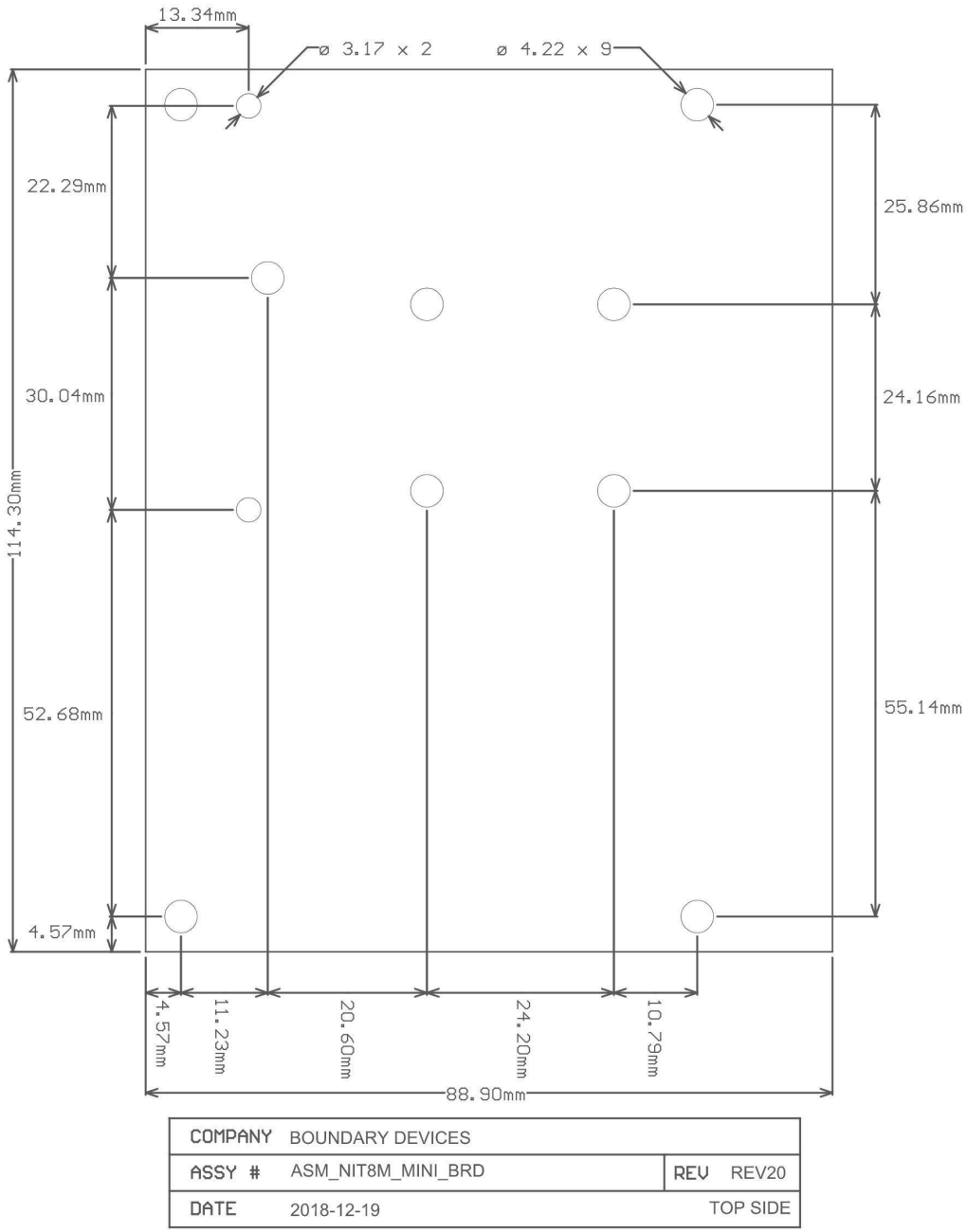
J34: PoE Connector #1 (Molex 22035065)			
PIN#	**Function**	**PIN#**	**Function**
1	5VIN	2	5VIN
3	5V_GND	4	5V_GND
5	12V_IN	6	12V_IN

J45: PoE Connector #2 (Molex 22035045)			
PIN#	**Function**	**PIN#**	**Function**
1	MCT1	2	MCT2
3	MCT3	4	MCT4

5. MOUNTING INFORMATION

5.1 NITROGEN8M_MINI MOUNTING SPECIFICATIONS

The overall dimensions of the Nitrogen8M_Mini board are 114.3mm x 88.90mm



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