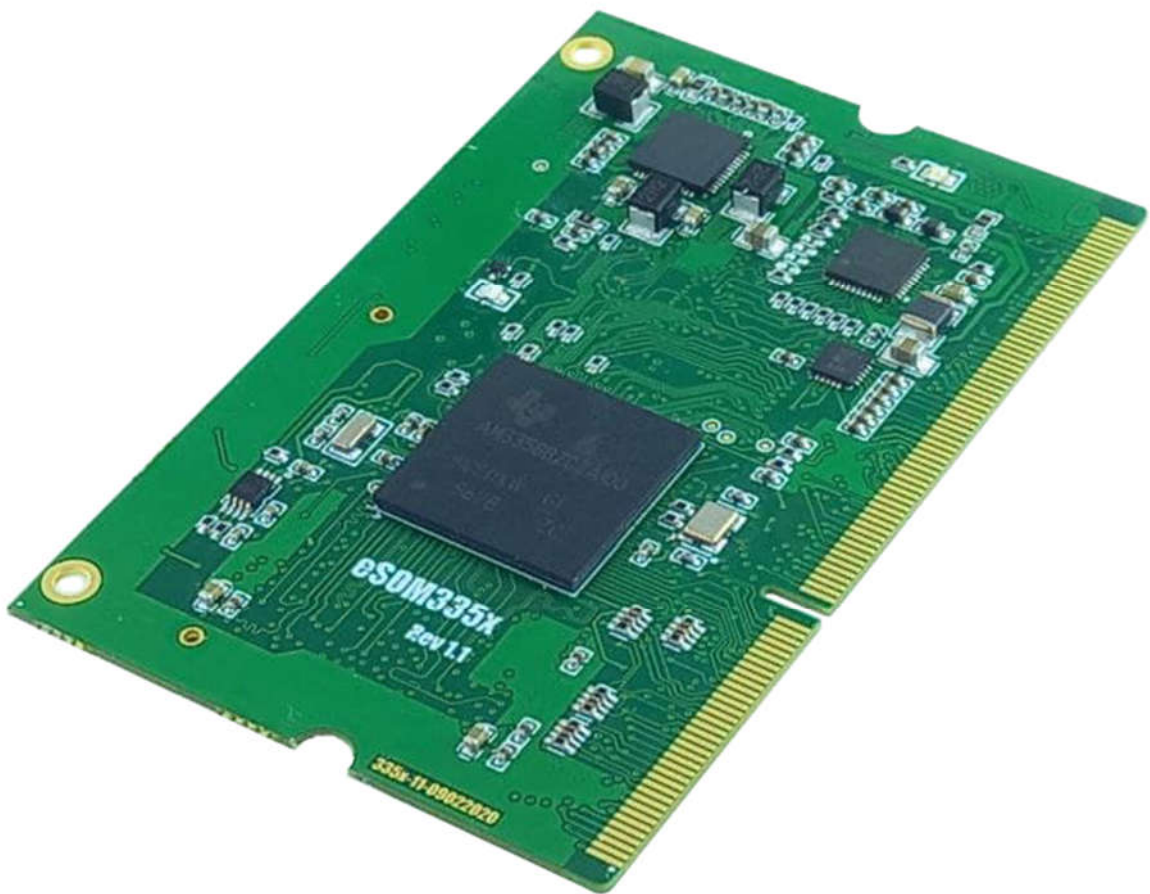


# eSOM335x

## Hardware Manual



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## Introduction

The eSOM335x is a small form factor System on Module(SoM) based on AM3358BZCZA100 ARM Cortex-A8 microprocessor family from Texas Instrument. The AM335x microprocessors are enhanced with image, graphics processing, peripherals and industrial interface options. The PowerVR SGX™ Graphics Accelerator subsystem provides 3D graphics acceleration to support display and gaming effects. The PRU-ICSS enables additional peripheral interfaces and real-time protocols such as EtherCAT, PROFINET, EtherNet/IP, PROFIBUS, Ethernet Powerlink, Sercos, and others.

The eSOM335x was designed very flexible, its memories are replaceable easily without any soldering work. RAM and eMMC units were designed modular and plug into coreboard through two 60pin specific connectors. DDR3L RAM modules come with 512MB capacity in standard version, but customizable to 128, 256, 1024MB depend upon customer needs. The eMMC modules exist in 8GB with 8bit Bus width by default, and it is customizable with 2, 4, 16, 32GB versions. Upgrade, repair and troubleshooting in this way is easy, quick, and cost-effective and improve maintenance ability.

This SOM with small footprint 67.6mm × 44.0mm × 5.6mm allows designers to leverage the ARM hardware and WinCE software stack in their own custom systems. The eSOM335x integrated a PMU to reduces complexity of external power supply. This module has extra IO interfaces like HDMI, LCD, Ethernet, USB, GPIO, UART, I2C, ADC and etc, that users can access them through DDR3-SODIMM 204 pin straight connector that enables hardware customization and gives more hardware flexibility to various projects.

This tiny single board computer targets a wide range of applications, including: Medical Devices, PLC, Industrial Automation, HMIs, Entertainment system, POS, Data Acquisition, Gaming and much more.

## Features

- Texas Instrument AM3358BZCZA100 ARM Cortex-A8 Up to 1GHz Processor
- Replaceable and optional modular memories
- Support HDMI, TFT and LVDS as Video Output
- Rich interface through DDR3-SODIMM 204 pin connector
- On-board Gigabit Ethernet PHY, customizable Up to 2 Ethernet port
- Support 4G Module
- Support Camera
- Ready to Run WIN CE7 with quick launching
- Easy configuration OS parameters and driver settings

## Specification

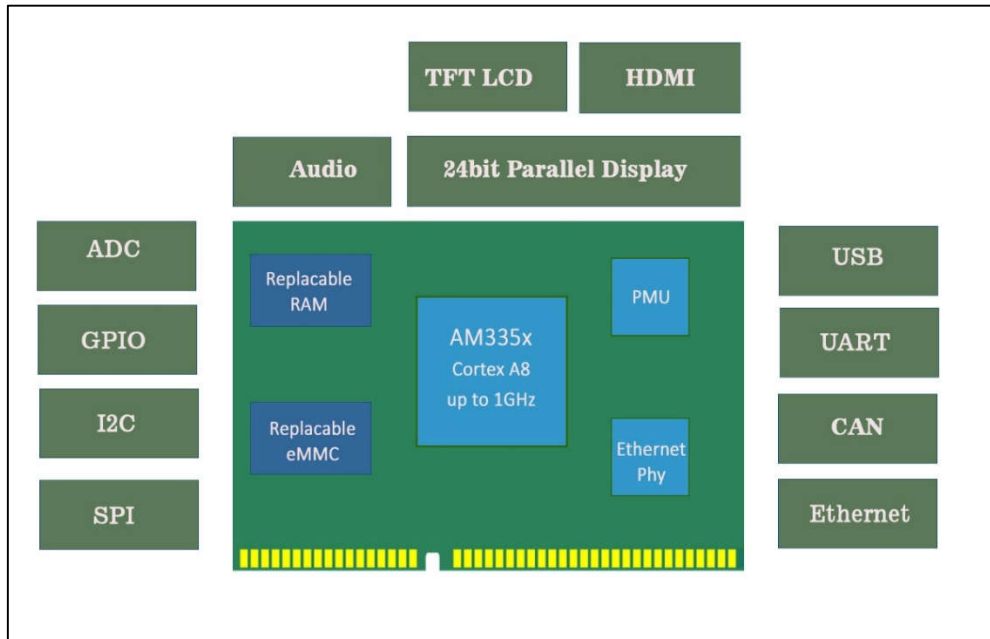
Characteristics	Standard	Customizable
<b>Processor Details</b>		
CPU Name	TI AM3358BZCZA100 (Sitara Family)	AM3359 / AM3354 / AM3352
CPU Type	Single Core ARM Cortex A8 32-Bit RISC Processor NEON™ SIMD Coprocessor	
CPU Clock	600, 800, <b>1000MHz</b>	
Cache	32KB L1 + 256KB L2	
<b>Memory</b>		
On-Chip Memory	64KB	
RAM Capacity	512MB	128, 256, 1024MB
RAM Type	DDR3L	
RAM BUS Width	16bit	
RAM BUS Frequency	400MHz (800MT/s)	
Non-Volatile Memory Type	eMMC 4.3 + ECC	
Non-Volatile Memory Capacity	8GB	2, 4, 16, 32GB
Bus Width	8bit	
<b>Multimedia</b>		
Display Type	Single Channel, 24bit Parallel Data Output	
Color Depth	24Bit	
Resolution	1024 x 768 (Tested)	Up to 2048 * 2048
Graphics Engine	PowerVR SGX530 3D	
Multichannel Audio Serial Ports	-	2
Analog Sound (Over MASPO)	HeadPhone(Stereo) MIC(Mono) LineOut(Stereo) (not implemented on OS) LineIn(Stereo) (not implemented on OS)	
<b>Connectivity</b>		
USB	2 HOST Mode	Dual OTG Function
UART	5 (RX,TX)	6 (RX, TX, RTS, CTS)
SPI	1	2
I2C	2	3

Ethernet	1 (10/100/1000)	2 (10/100/1000)
CAN	1	2
SDIO	1 (4bit SD-Card Reader)	1 (8bit SDIO) + 1 (4bit SD-Card Reader)
Analog Input	8 (12bit 200KS/s)	
GPIO	17	77
<b>OS</b>		
WinCE	CE 7	Debian
<b>Physical</b>		
Size	67.6 x 44.0 x 5.6	
Working Temperature	0 to +70	
Power	5V 700mA (Max)	

## Electrical Specification

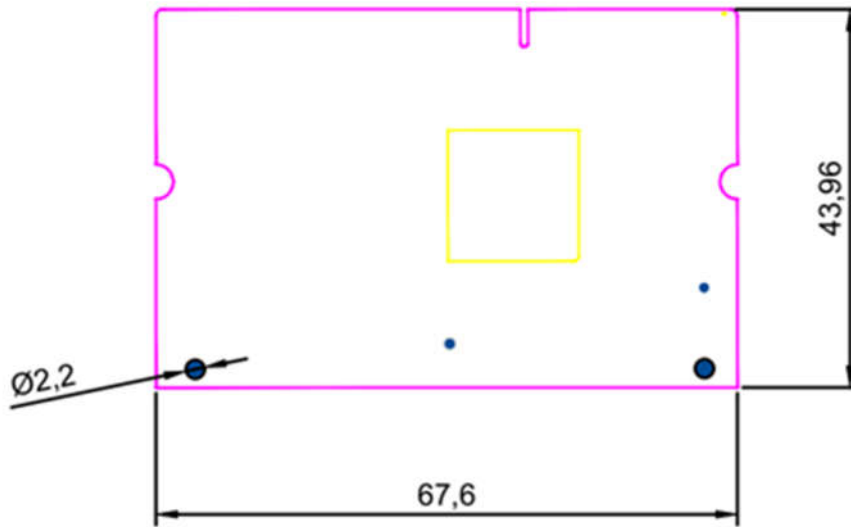
Symbol	Description	Value
VIO	General IO Voltage	3.3V
VBAT	Main Power	5V
VBUS	Power for USB Subsystem	5V
VRTC	Backup Battery for RTC	3V

## Functional Block Diagram



## Mechanical Drawing

Dimension	
PCB	6 Layer, ENIG, 0.8mm
Weight	11g
Size	67.6mm × 43.96mm × 5.6mm



## Memory

The eSOM335x memories is designed modular and install on coreboard through two 60pin specific connectors, therefore users can behave with this coreboard like a PC with modular hard drive and RAM modules. Benefits of this approach are:

- Users are free for selection RAM and eMMC module upon their needs.
- Memories are replaceable easily without any soldering work.
- Upgrade, repair, and troubleshooting is easy, quick, and cost-effective
- Improve maintenance ability in mass production.

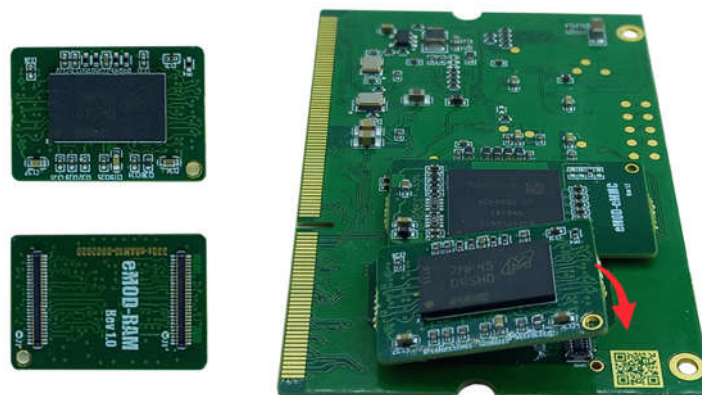
### *RAM*

The eSOM335x support 512MB DDR3L RAM with 16bit RAM BUS Width in standard version, but customizable to 128, 256, 1024MB depend upon customer needs. RAM BUS Frequency is 400MHz (800MT/s).RAM memories are designed modular and plug into coreboard through two 60pin specific connectors as shown in the following image:



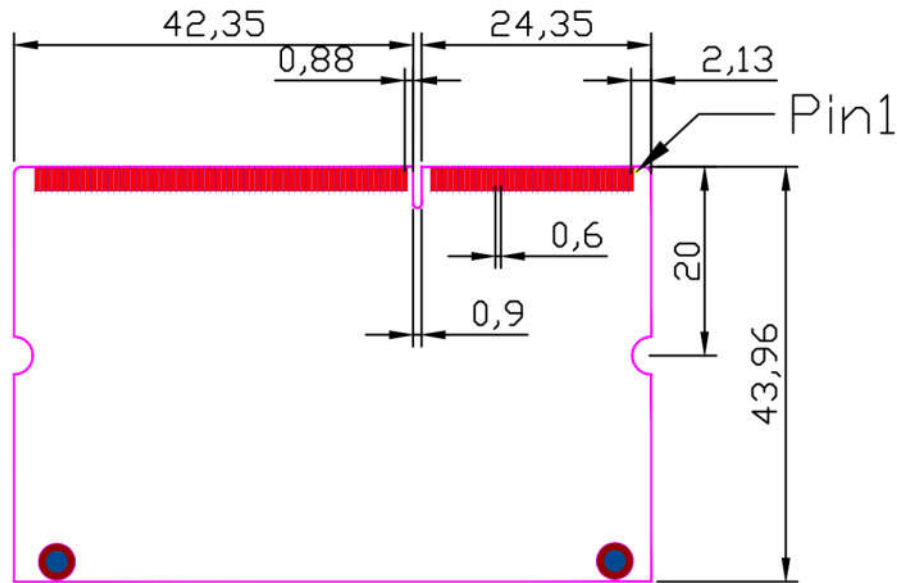
### *eMMC*

The eSOM335x supports 8GB with 8bit Bus width eMMC modules by default, and it is customizable with 2, 4, 16, 32GB versions. eMMC modules are designed modular and plug into coreboard through two 60pin specific connectors as shown in the following image:

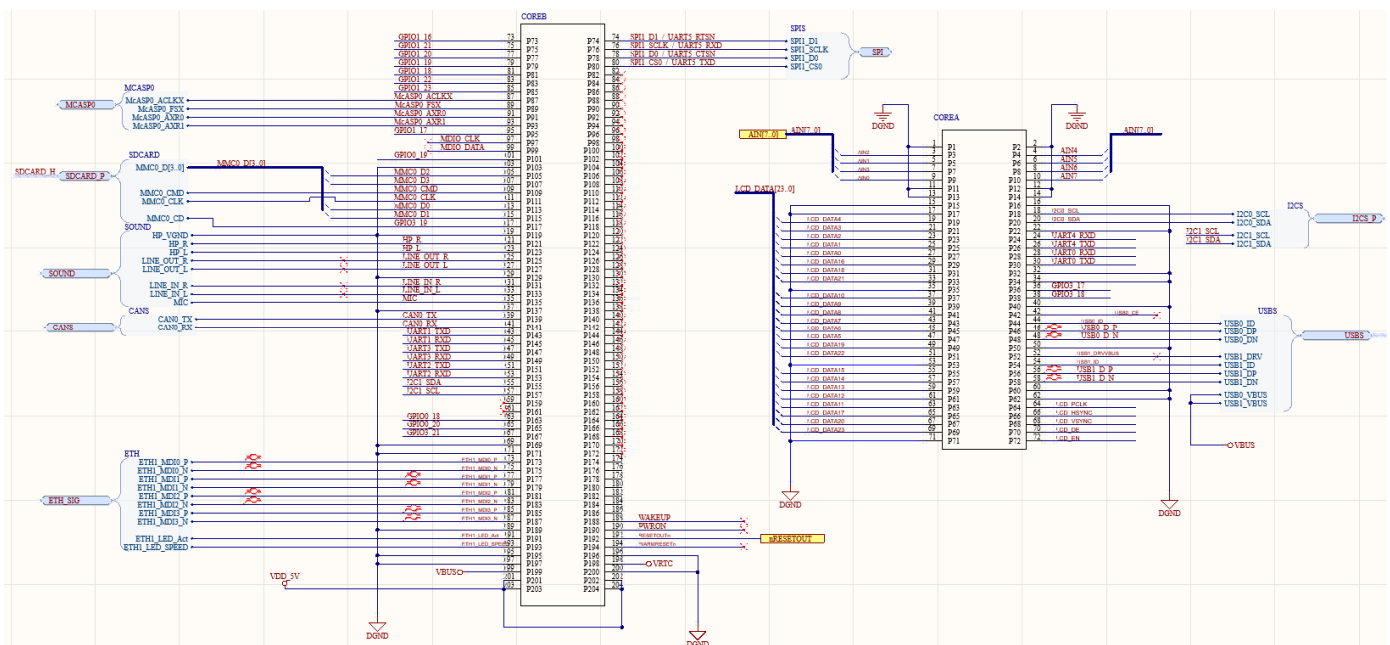


## PIN Description

The eSOM335x has DDR3-SODIMM 204 pin form factor, the diagrams in following figures show the pin numbering schema:



The pinMux document describes the SODIMM connector pin out. Some pins have multiple functions. This document is associated to pads config file ( *bsp\_padcfg.h* ) existed *Source\WINCE700\platform\eSOM335x\SRC\INC* folder (in net disk URL accessible after buy this product). Following image shows pin assignment is used for eDVK335x carrier board. This carrier board is designed 4-layer PCB, users can design their carrier board even 2-layer PCB but prefer to design 4-layer PCB for their carrier boards.



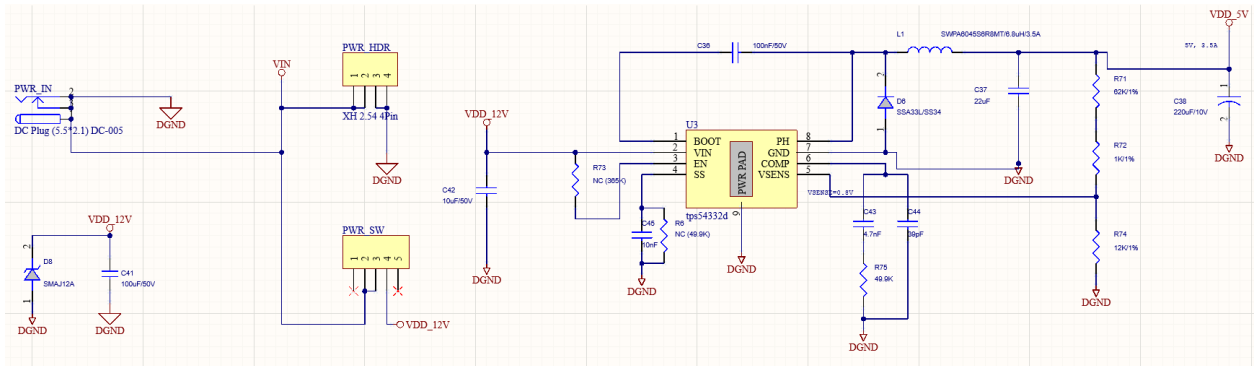


***Power pin***

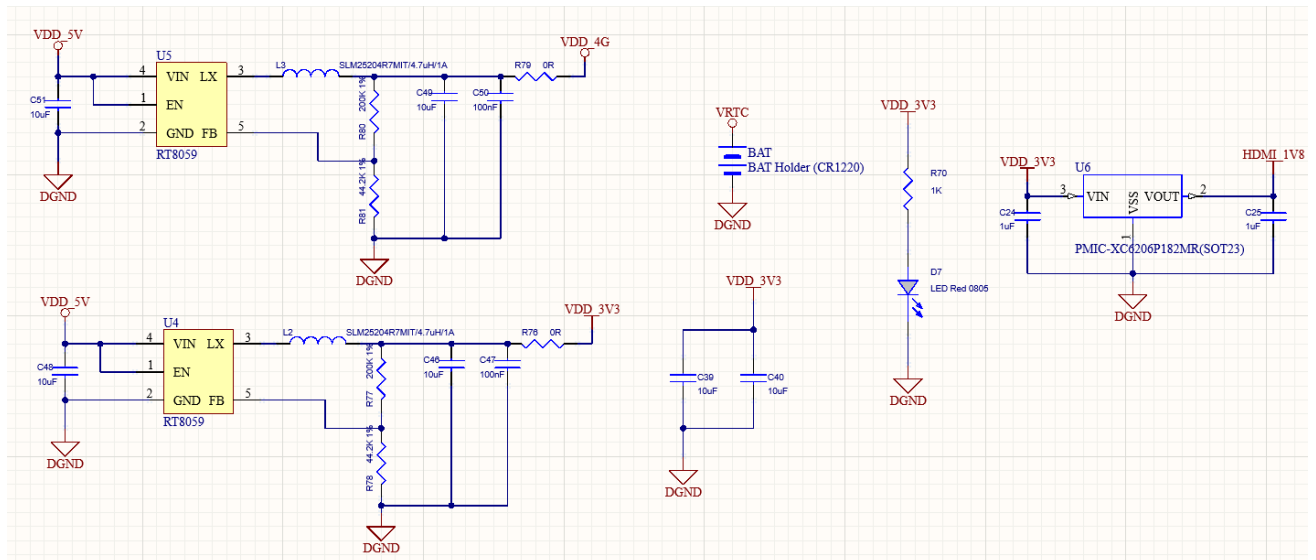
Following table explained power pins in eSOM335x:

Power Signals	Core PIN number	Description
AGND	1	Analog Ground for ADC
AGND	2	
AGND	11	
AGND	12	
AGND	13	
AGND	14	
DGND	15	Digital Ground
DGND	16	
DGND	17	
DGND	22	
DGND	32	
DGND	34	
DGND	35	
DGND	40	
DGND	50	
DGND	53	
DGND	60	
DGND	62	
DGND	71	
DGND	103	
DGND	119	
DGND	129	
DGND	137	
DGND	169	
DGND	171	
DGND	189	
DGND	195	
DGND	196	
DGND	197	
DGND	200	
VBAT	201	Main Power: 3.7 to 5VDC
VBAT	202	
VBAT	203	
VBAT	204	
VBUS	199	USB Power 5V
VRTC	198	RTC Battery 3VDC

In eDVK335x power circuit is implemented as following figure, power input voltage is acceptable from 7.5 to 24VDC and users can plug power from power jack and PWR\_HDR. Development board converts input power to +5VDC through a 3.5A, 1MHz Step-Down Converter. Output of this stage is used for VBAT pins of coreboard.



In addition, there are two step-down DC/DC converter that their output is used for 4G module and +3.3V of development board. A +3.3V to +1.8VDC IC is integrated to supply HDMI chip.



VBUS is used for USB and its voltage is very important and must be +5V DC for good performance.

A RTC battery holder is considered in eDVK335x to power up VRTC of coreboard and can power with CR1220 coin batteries with +3VDC.

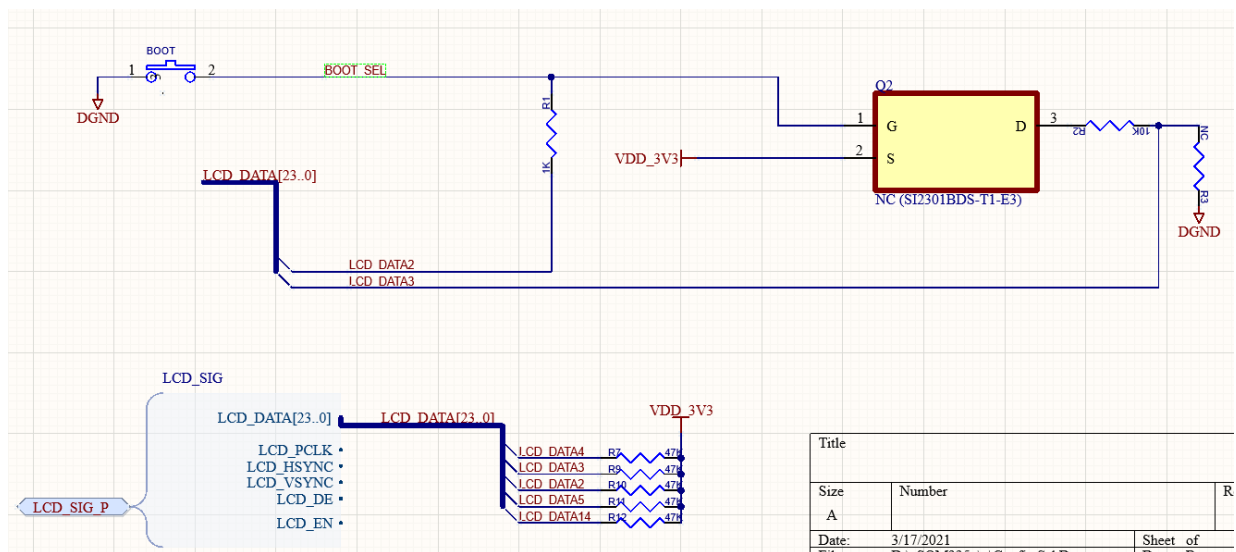
### Boot Pin

For determine boot sequence, CPU check the boot pins, in default state boot sequence is described as the following sequence:

Boot Priority Sequence	1	2	3	4
Device	MMC1	MMC0	UART0	USB0

MMC1 is stand for eMMC module and MMC0 refer to uSD card in eSOM335x.

In eDVK335x a BOOT button is considered to switch from eMMC to uSD card, and the circuit for this work as shown in the following figure. O2 chip is not soldered



In this circuit, LCD\_DATA2, LCD\_DATA3, LCD\_DATA4, LCD\_DATA5 and LCD\_DATA14 is pulled up and LCD\_DATA2 is also connected to BOOT Button and if user hold this button, boot sequence is changed as following figure and CPU boots from MMC0.

Boot Priority Sequence	1	2	3	4
Device	SPI0	MMC0	USB0	UART0

## Display and Touch

The eSOM335x support 24-bit parallel display, users can handle these formats and convert to HDMI or LVDS format. Following table describe LCD signals.

Color	LCD Signal	Core PIN	Color	LCD Signal	Core PIN	Color	LCD Signal	Core PIN	LCD Signal	Core PIN
R0	LCD_DATA21	33	G0	LCD_DATA22	51	B0	LCD_DATA23	69	LCD_PCLK	64
R1	LCD_DATA18	31	G1	LCD_DATA19	49	B1	LCD_DATA20	67	LCD_HSYNC	66
R2	LCD_DATA16	29	G2	LCD_DATA5	47	B2	LCD_DATA17	65	LCD_VSYNC	68
R3	LCD_DATA0	27	G3	LCD_DATA6	45	B3	LCD_DATA11	63	LCD_DE	70
R4	LCD_DATA1	25	G4	LCD_DATA7	43	B4	LCD_DATA12	61	LCD_EN	74
R5	LCD_DATA2	23	G5	LCD_DATA8	41	B5	LCD_DATA13	59		
R6	LCD_DATA3	21	G6	LCD_DATA9	39	B6	LCD_DATA14	57		
R7	LCD_DATA4	19	G7	LCD_DATA10	37	B7	LCD_DATA15	55		

In eDVK335x a HDMI chip is integrated onboard that convert LCD data to HDMI interface. Users can connect HDMI display to HDMI port. In addition, for select HDMI port as video output and its resolution, users should edit *eSOM335x.ini* file that explained in *Quick start guide* document.

A 45 pin FPC connector is also used for connecting to TFT LCDs. users are free to choose LCD display, for using their LCD with eSOM335x needs to edit *eSOM335x.ini* configurations parameters explained in *Quick start guide* document. In addition of LCD signals, touch signals are included in FPC connector as shown in the following table:

Touch signals	Core PIN number	FPC connector PIN
I2C0_SCL	18	2
I2C0_SDA	20	3
GPIO3[17]	36	4
GPIO3[18]	38	5
HUSB4_P	-	7
HUSB4_N	-	8

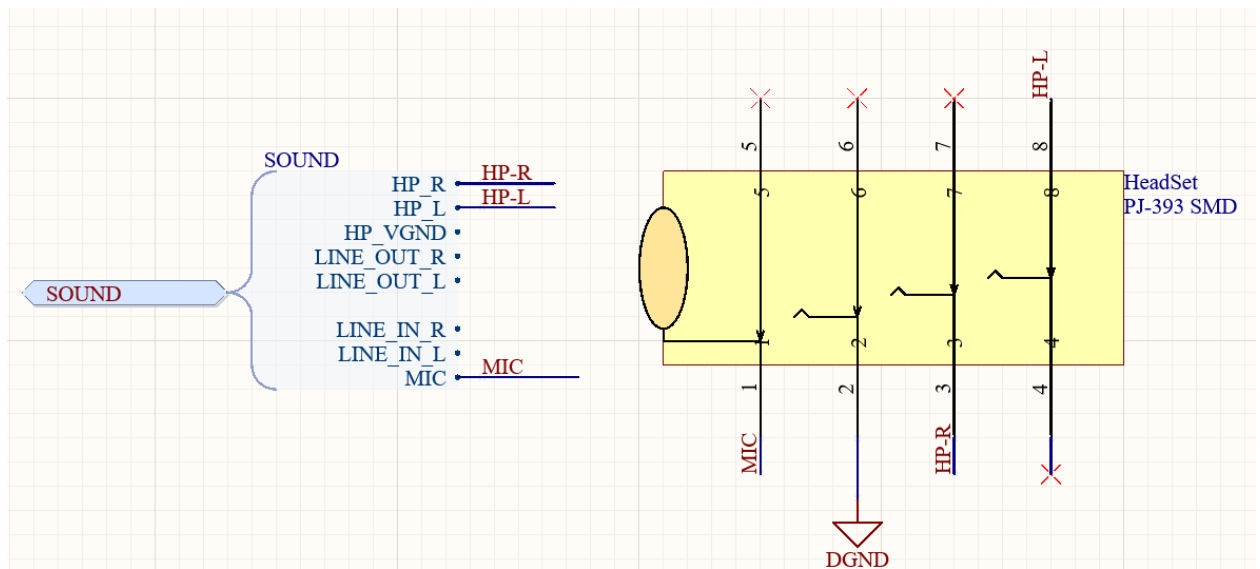
Currently capacitive and resistive touch is implemented through USB interface, and I2C signals is included in FPC pins for developers want to customize touch with I2C interface.

## Sound

eSOM335x support audio output and input functions. Following table describe assigned pins for audio functions.

Sound Signal	Core PIN number
HP_R	121
HP_L	123
LINE_OUT_R	125
LINE_OUT_L	127
LINE_IN_R	131
LINE_IN_L	133
MIC	135

In eDVK335x an audio connector is integrated, this connector and associated pins as show in the following figure, HP\_L and HP\_R signals is used for audio output and MIC is considered as audio input.



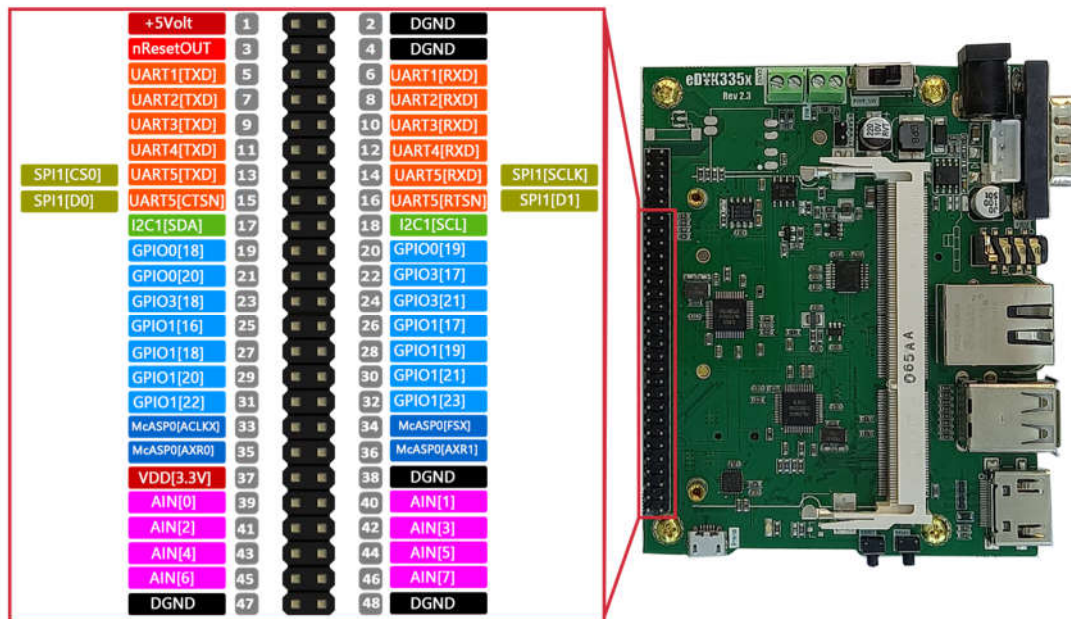
Note: LINE\_OUT\_R, LINE\_OUT\_R, LINE\_IN\_R and LINE\_IN\_L not implemented on Windows CE OS.

## ***GPIO***

Some of eSOM335x pin can be used as GPIO, these pins are specified in [pinmux](#) document. In default version, 17 pins are considered as GPIO but can extended to 77 pins as customer request. These 17 pins listed as following table:

<b>GPIO Signal</b>	<b>Core PIN number</b>
GPIO0[18]	163
GPIO0[19]	101
GPIO0[20]	165
GPIO1[16]	73
GPIO1[21]	75
GPIO1[20]	77
GPIO1[19]	79
GPIO1[18]	81
GPIO1[22]	83
GPIO1[23]	85
GPIO1[24]	87
GPIO1[25]	89
GPIO1[26]	91
GPIO1[27]	93
GPIO1[17]	95
GPIO3[17]	36
GPIO3[18]	38

If you are using eDVK335x, some of GPIOs are accessible through a 2×24 pin header as shown in the following figure:



**Note:** GPIO3[21] is reserved for sound chip. GPIO3[17] and GPIO3[18] is used as touch panel interrupt and reset. GPIO0[18] and GPIO0[19] are also reserved.

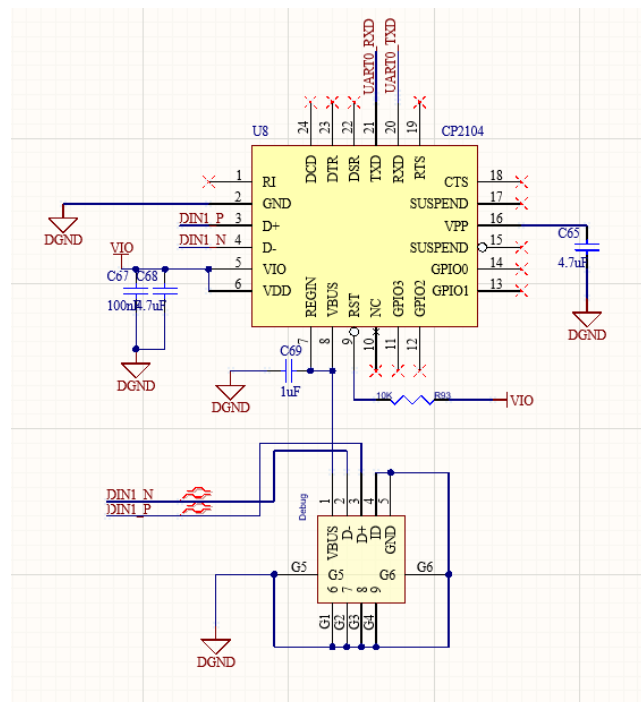
## UART

eSOM335x support up to 5 UART, that described in pinMux document, and can extend to 6 UARTs as customer request.

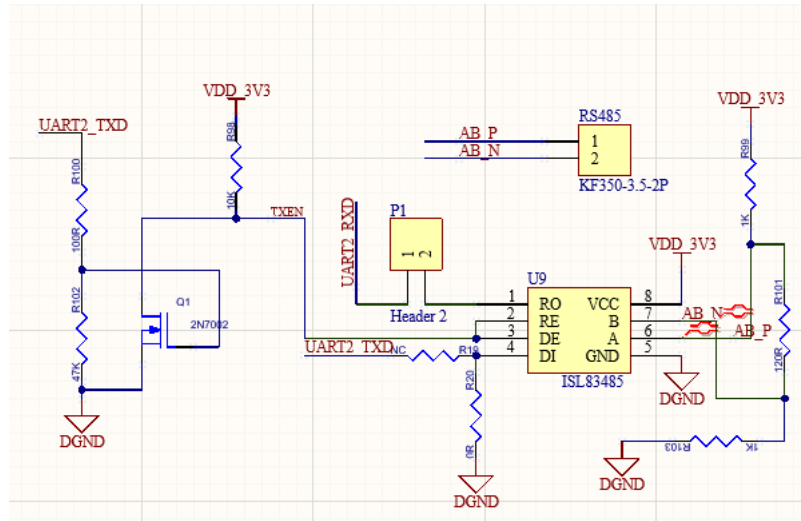
UART Signals	Core PIN number
UART0_TXD	30
UART0_RXD	28
UART1_TXD	143
UART1_RXD	145
UART2_TXD	151
UART2_RXD	153
UART3_TXD	147
UART3_RXD	149
UART4_TXD	26
UART4_RXD	24

**Note:** These pins can be used as another function.

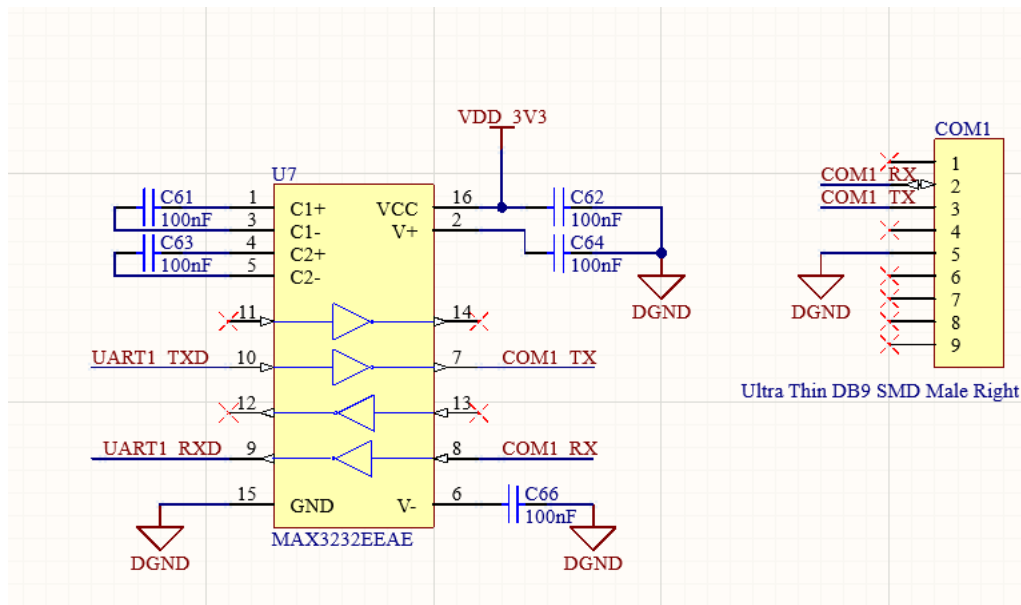
In eDVK335x UART0 is used as debug port that a UART to USB circuit is implemented and users can connect with their devices through USB cable.



In eDVK335x, UART2 is used as RS485 communication, a jumper is considered to select or deselect this UART act as RS485 or another function. If jumper is placed, UART2\_RXD acts as RS485 receivers signal.



In eDVK335x UART1 is considered as RS232 communication and a DB9 port is integrated in this development board.



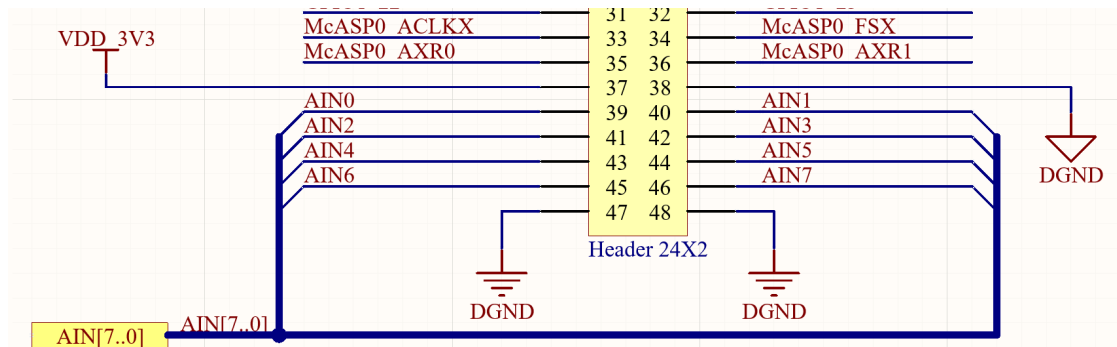


## ADC

The eSOM335x has 8 channels for analog to digital conversion with 12bit resolution and 200KS/s conversion speed, these pins are listed in the following table:

ADC Signals	Core PIN number
AIN0	9
AIN1	5
AIN2	3
AIN3	7
AIN4	4
AIN5	6
AIN6	8
AIN7	10

These pins are accessible in eDVK335x through 2×24 pin header as shown in the following picture:



## I2C

eSOM335x support two I2C communication by default, following table listed pins was assigned to I2C in this coreboard:

I2C Signals	Core PIN number
I2C0_SCL	18
I2C0_SDA	20
I2C1_SDL	157
I2C1_SCA	155

**Note:** These pins can be used as another function.

In eDVK335x, I2C0 is used in HDMI chip, in addition I2C0 is accessible in LCD Display 45 pin FPC connector.

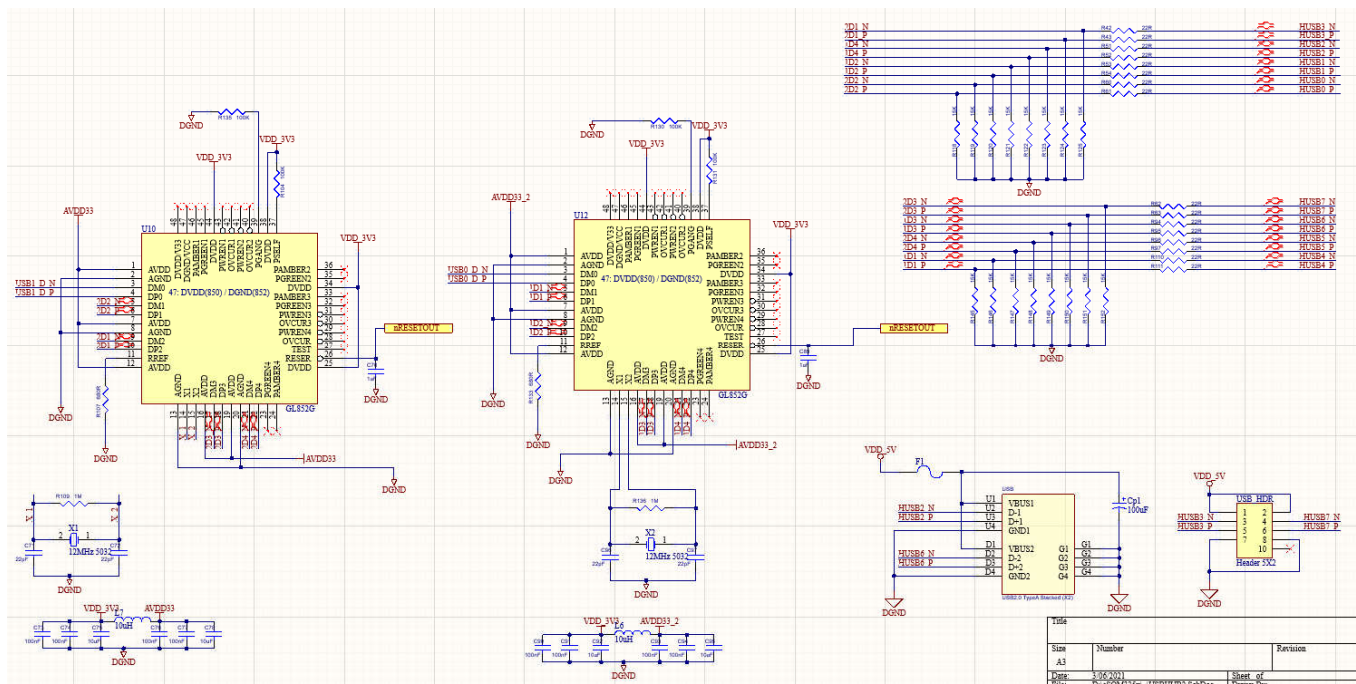
I2C1 is accessible in 2×24 pin header **PORT** connector and **eMOD1** connector located in bottom of development board.



## USB

The eSOM335x has 2 HOST Mode USB in default version but can be customized to Dual OTG Function. In eDVK335x these USB BUS is acquired with 2 USB HUB ICs and extended to 8 USB. These USB Buses is used for various purposes as shown in the following table:

USB BUS	Node	USB Name	Description
USB BUS 0	1	USB4	LCD Display Connector for touch
	2	USB1	Mini PCIe Connector
	3	USB6	USB2.0 TypeA Stacked (X2) Connector
	4	USB2	USB2.0 TypeA Stacked (X2) Connector
USB BUS 1	1	USB3	USB_HDR (9pin header) Connector
	2	USB0	eMOD1 Connector
	3	USB7	USB_HDR (9pin header) Connector
	4	USB5	-



## ***Ethernet***

The eSOM335x supports (10/100/1000) Ethernet communication. An Ethernet physical chip is integrated in this coreboard and associated pins is accessible through 204 pin SODIMM connector as listed in following table:

<b>Ethernet Signal</b>	<b>Core PIN number</b>
ETH1_LED_SPEED	193
ETH1_LED_Act	191
ETH1_MDIO_P	173
ETH1_MDIO_N	175
ETH1_MDI1_P	177
ETH1_MDI1_N	179
ETH1_MDI2_P	181
ETH1_MDI2_N	183
ETH1_MDI3_P	185
ETH1_MDI3_N	187

In eDVK335x a RJ45 connector is considered for ethernet communication.

## ***SDIO***

The eSOM335x support SDIO interface for 4bit SD-Card Reader and associated pins is assigned as shown in the following table:

<b>SDIO Signal</b>	<b>Core PIN number</b>
MMCO_DAT2	105
MMCO_DAT3	107
MMCO_CMD	109
MMCO_CLK	111
MMCO_DAT0	113
MMCO_DAT1	115

In eDVK335x GPIO3\_19 (pin 117 on coreboard) is used for SD card detection.