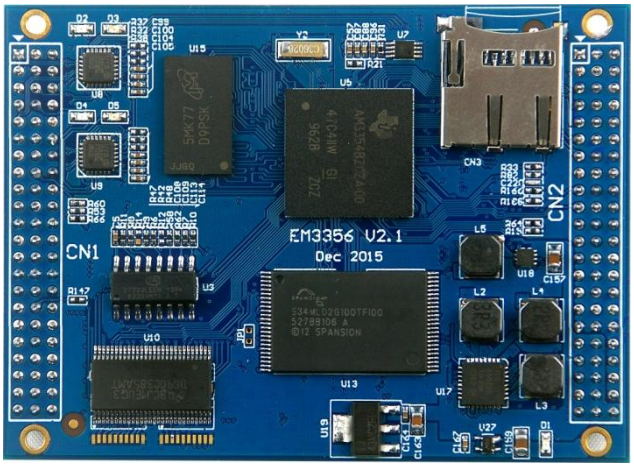
Emtronix



ESMARC 335x Datasheet

1. Introduction

ESMARC 335x is a set of low cost embedded computer modules with the same size and pin configuration. Three module types, ESM3356, ESM3354, and ESM3352, are included in ESMARC 335x. The main difference among these modules is the CPU frequency which ranges from 600MHz to 1GHz, so that they can meet various application requirements with low cost.

For briefly name ESM335x will be used to refer all ESM3356, ESM3354, and ESM3352 in the rest of this document except for features belonging to any specific the module.

1.1 Hardware

The ESM335x is a computer module based on the TI AM335x embedded System-on-Chip (SoC). The SoC features an ARM Cortex™ A8 processor clocking between 600MHz and 1GHz. The modules are available in both a commercial temperature range (-10°C to 60°C) and an industrial temperature range (-40°C to 85°C).

The modules target a wide range of industrial applications, including smart meters, data communication and management, HMIs, POS, data acquisition, process control, and much more. It provides many interfaces which can be found in section 1.3.

The ESM335x modules are highly optimized for layout. The system robustness is also guaranteed in design with impedance matching for high speed connections and in practice with numerous testing in harsh environments. This allows the customer to create a carrier board which implements the application specific hardware, which significantly reduce the complexity of a project.

1.2 Software

The ESM335x comes with either embedded Linux, or a core runtime license for Windows Embedded Compact 7 (Windows Embedded Compact 2013 are also available).

The embedded Linux image contains a kernel of Linux-4.1.6 and UBIFS root file system. The booting time of the image are about 8 seconds.

Windows Embedded Compact 7 images are with BinFS driver which shorten booting time to

less than 16 seconds. A SDK are provided to support development of application programming in Visual Studio 2008 or higher version.

1.3 Main Features

Core Unit

- Cortex-A8 Processor with FPU
- CPU frequency: 1GHz(ESM3354), 800MHz(ESM3356), 600MHz(ESM3352)
- 256MB DDR3, user space > 180MB
- 256MB FLASH, user file system > 180MB
- USB host interface for mass storage
- MicroSD socket supporting SDHC card
- Real-Time Clock backup with external battery
- Hardware Watchdog Timer
- UART port (115200，8-N-1) as console

Display

- LCD Interface with format of 18-bit RGB or LVDS
- Multiple resolution configurable(320*240 to 1024*768)
- 4-wired resistive touch screen (default setting)
- Capacitive touch screen with multi-point

General IO

- 32-bit GPIO
- Part of GPIO are pin multiplexed with other interfaces
- Interrupt source capable with rising edge
- 3.3V LVCMOS level
- All GPIO are in input mode on power up

Communication Interfaces

- 2 Ethernet Ports, 10Mb/100Mb self-adaptive
- 2 CAN bus ports, multiplexed with GPIO
- 5 Standard UART ports, maximum baud rate 3Mbps
- 1 I2C interface, master mode, 400kbps, multiplexed with GPIO
- 1 4-wire SPI, full-duplex, 12Mbps, multiplexed with GPIO
- 4 USB 2.0 host ports
- 1 USB 2.0 OTG port

Other Interfaces

- Simplified ISA (external memory controller) bus, 8-bit address/data multiplexing, maximum transfer rate 5MByte/s
- On-board main power and temperature monitoring

Power Supply and Operation Temperature

- +5V±10% power supply with consumption in section 4.2
- Operation Temperature: -10°C to 60°C (commercial)

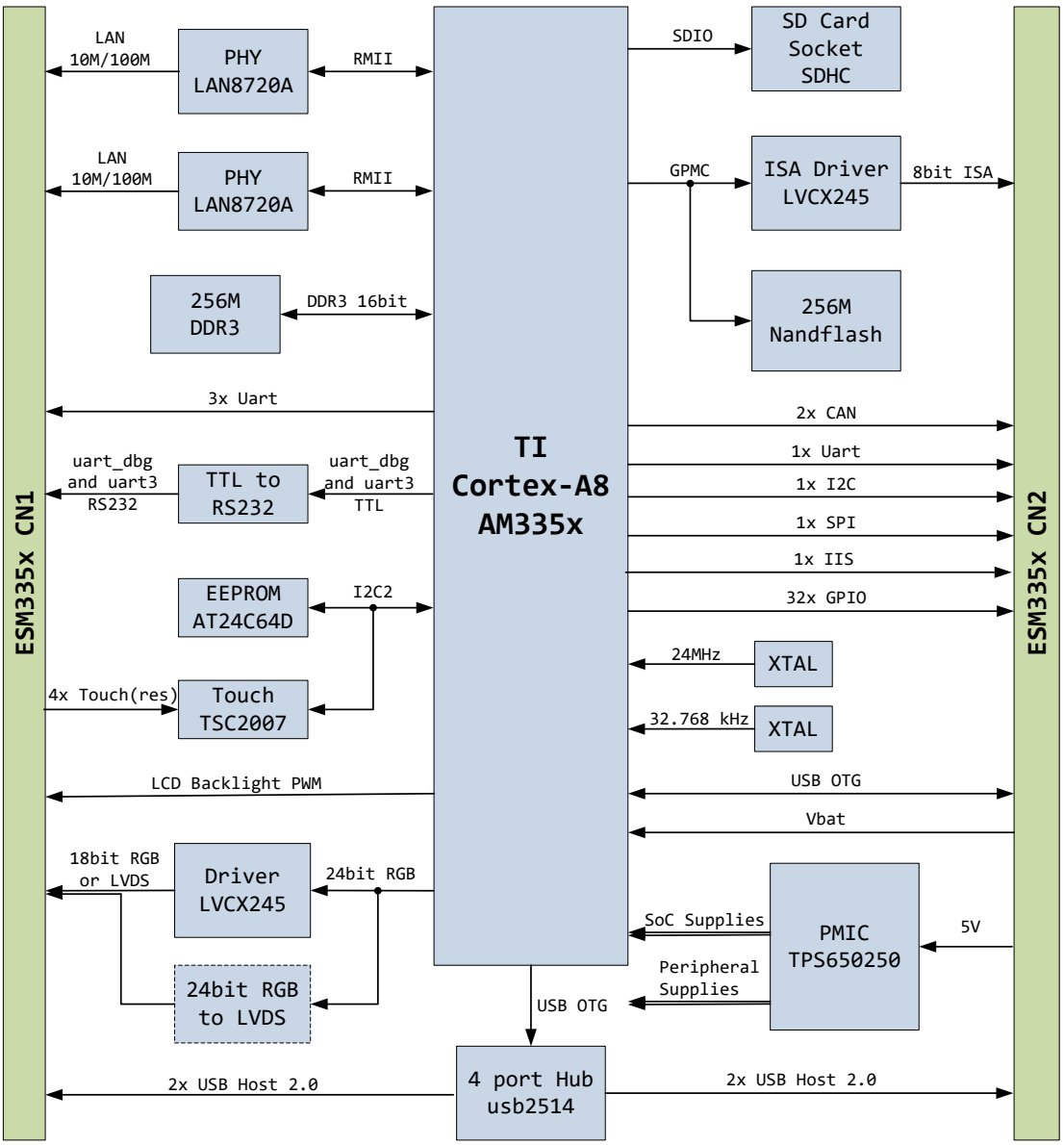
  -40°C to 85°C (industrial)

1.4 ESM335x Comparison

Most of functions of ESM335x modules are the same. The following table lists the differences among ESM3354, ESM3356, and ESM3352.

Specifications	ESM3354	ESM3356	ESM3352
CPU Frequency	1GHz	800MHz	600MHz
Hardware Graphics Engine	√	-	-
PRU	-	√	-

1.5 ESM335x Block Diagram

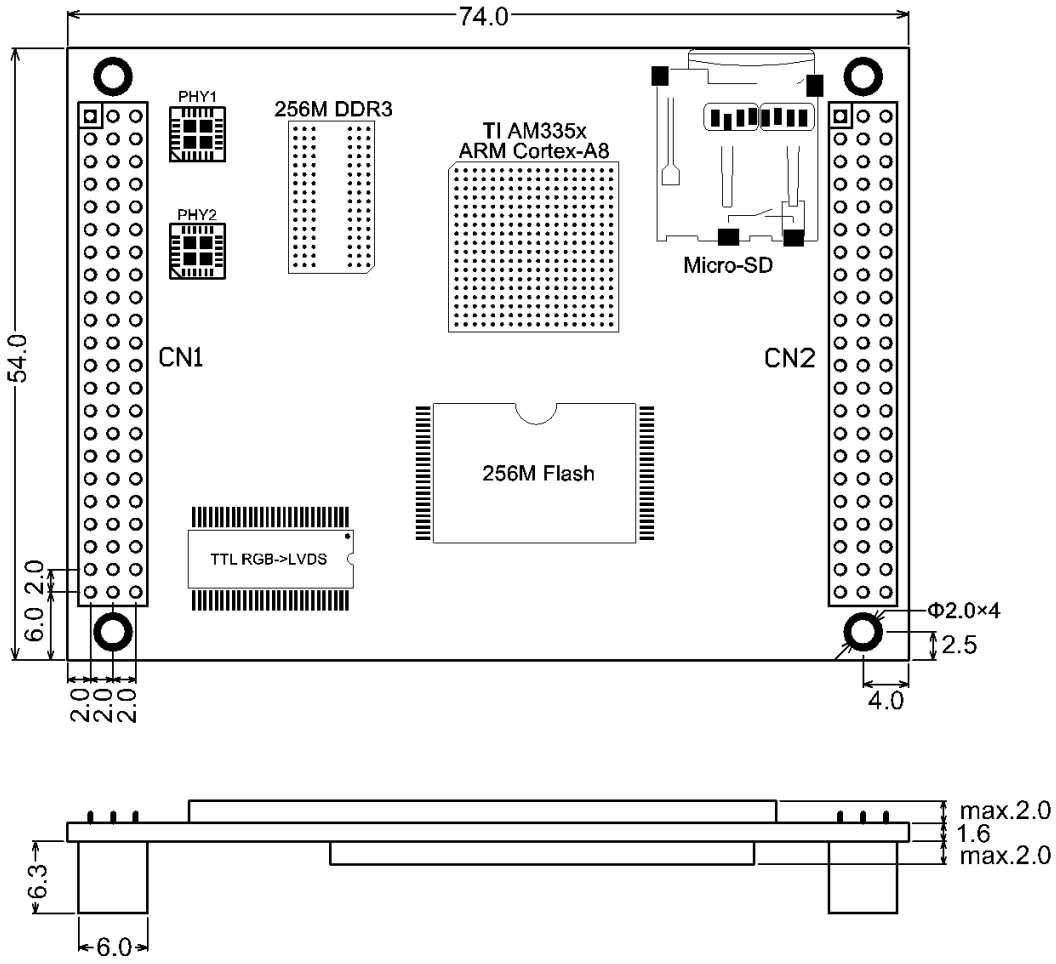

ESM335x CN1
LAN
10M/100M
PHY
LAN8720A
RMII
LAN
10M/100M
PHY
LAN8720A
RMII
256M
DDR3
DDR3 16bit
3x Uart
uart_dbg
and uart3
RS232
TTL to
RS232
uart_dbg
and uart3
TTL
EEPROM
AT24C64D
I2C2
4x Touch(res)
Touch
TSC2007
LCD Backlight PWM
18bit RGB
or LVDS
Driver
LVCX245
24bit RGB
24bit RGB
to LVDS
2x USB Host 2.0
TI
Cortex-A8
AM335x
SDIO
SD Card
Socket
SDHC
GPMC
ISA Driver
LVCX245
8bit ISA
256M
Nandflash
2x CAN
1x Uart
1x I2C
1x SPI
1x IIS
32x GPIO
24MHz
XTAL
32.768 kHz
XTAL
USB OTG
Vbat
SoC Supplies
Peripheral
Supplies
PMIC
TPS650250
5V
USB OTG
4 port Hub
usb2514
2x USB Host 2.0
ESM335x CN2

2. Emtronix Smart Module Architecture

Emtronix Smart Module Architecture (ESMARC) is a specification which describes mechanical characteristics of an embedded computer module and its connections with a carrier board. ESM335x is compliance with ESMARC specification.

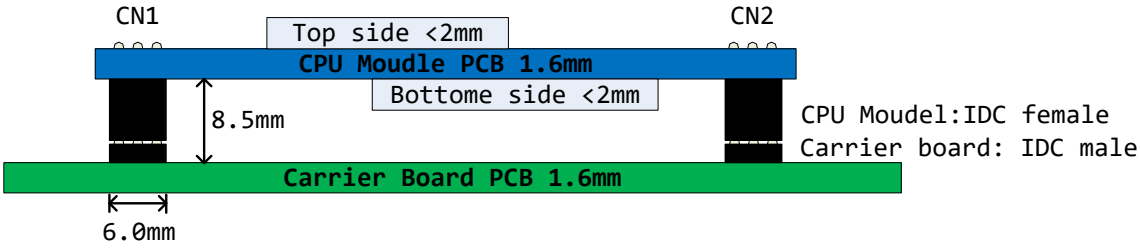
2.1 Mechanical Characteristics

ESMARC defines small form factor computer module with size of 74mm*54mm and 4 mounting holes near the corners of the board. The following figure shows mechanical characteristics of ESMARC computer module.



ESMARC Computer Module Size (unit: mm)

ESMARC specification defines two insulation-displacement contact (IDC) connectors to connect a computer module and its carrier board. The two IDC connectors CN1 and CN2 are located on the opposite side of the module. Each connector has the same 3 x 22 pin configuration with 2mm pitch. The following figure shows the connection between ESMARC computer module and its carrier board.

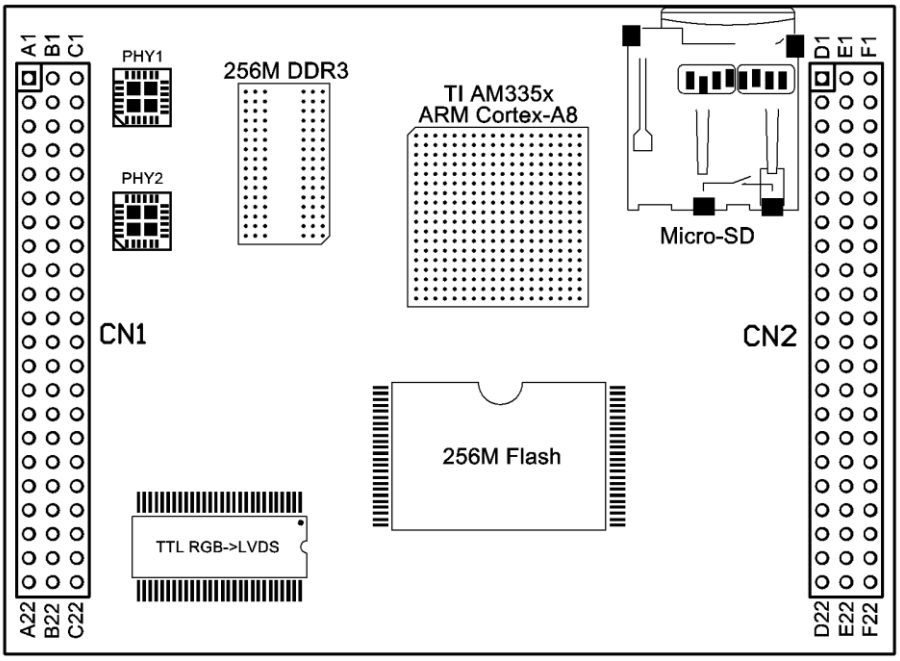


Relationship of Connection in ESMARC

The female connectors are on the computer module and male connectors are to be placed on the carrier board. The female connectors on computer module have certain header pin filled which enforces correct docking orientation with the carrier board.

2.2 Connectors

The rows in the two connectors are indexed from A to F and the pins in each row are numbered from 1 to 22. The following figure shows header pin indexes in ESMARC connectors.



Locations of Connector in ESMARC Module

Row A to C are in CN1 and row D to F are in CN2. The row A and F are located in outside of connectors, and row C and D are located in inside of connectors.

2.3 Reverse-Mate Proof

The pin B1 in CN1 is filled for purpose of reverse-mate proof. It is required that the correspondent header pin in carrier board has to be blanked out so that ESMARC module can be plugged in correct orientation.

3. I/O Pins

There are 132 pins in the two connectors. Some pins are not used in some type of module as the pins usage depends on the interfaces implemented in the module. If a pin is not used, it should be in state of no connection (NC) instead of routing it to ground or power which may damage the module.

Warning: All of digital pins in ESM335x are 3.3V LVCMOS level signals which are NOT 5V input tolerant. It is important to ensure none of these pins are in contact with any 5V signal including VCC.

The signal name and description of all of pins in ESM335x will be listed in following sections.

3.1 Pins in ESM335x CN1

Table of CN1 in CE platform with RGB LCD interface

Column A(Outside)		Column B		Column C(Inside)	
A1	TPTX1-	B1	(Filled)	C1	TPTX2-
A2	TPTX1+	B2	LINK1	C2	TPTX2+
A3	VDD_CMT1	B3	SPEED1	C3	VDD_CMT2
A4	TPRX1-	B4	LINK2	C4	TPRX2-
A5	TPRX1+	B5	SPEED2	C5	TPRX2+
A6	GND	B6	GND	C6	GND
A7	COM2_RXD	B7	COM4_RXD	C7	USB3_HD+
A8	COM2_TXD	B8	COM4_TXD	C8	USB3_HD-
A9	COM3_RXD	B9	COM5_RXD	C9	USB4_HD+
A10	COM3_TXD	B10	COM5_TXD	C10	USB4_HD-
A11	GND	B11	GND	C11	GND
A12	DBG_RX	B12	Y- / TSC_I2C_SCL	C12	X- / TSC_IRQn
A13	DBG_TX	B13	Y+ / TSC_I2C_SDA	C13	X+ / TSC_RSTn
A14	GND	B14	GND	C14	GND
A15	LCD_HSYNC	B15	-	C15	LCD_DCLK
A16	LCD_VSYNC	B16	LCD_BLn	C16	LCD_DE
A17	LCD_B2	B17	LCD_G2	C17	LCD_R2
A18	LCD_B3	B18	LCD_G3	C18	LCD_R3

A19	LCD_B4	B19	LCD_G4	C19	LCD_R4
A20	LCD_B5	B20	LCD_G5	C20	LCD_R5
A21	LCD_B6	B21	LCD_G6	C21	LCD_R6
A22	LCD_B7	B22	LCD_G7	C22	LCD_R7

Table of CN1 in CE platform with LVDS LCD interface

Column A(Outside)		Column B		Column C(Inside)	
A1	TPTX1-	B1	(Filled)	C1	TPTX2-
A2	TPTX1+	B2	LINK1	C2	TPTX2+
A3	VDD_CMT1	B3	SPEED1	C3	VDD_CMT2
A4	TPRX1-	B4	LINK2	C4	TPRX2-
A5	TPRX1+	B5	SPEED2	C5	TPRX2+
A6	GND	B6	GND	C6	GND
A7	COM2_RXD	B7	COM4_RXD	C7	USB3_HD+
A8	COM2_TXD	B8	COM4_TXD	C8	USB3_HD-
A9	COM3_RXD	B9	COM5_RXD	C9	USB4_HD+
A10	COM3_TXD	B10	COM5_TXD	C10	USB4_HD-
A11	GND	B11	GND	C11	GND
A12	DBG_RX	B12	Y- / TSC_I2C_SCL	C12	X- / TSC_IRQn
A13	DBG_TX	B13	Y+ / TSC_I2C_SDA	C13	X+ / TSC_RSTn
A14	GND	B14	GND	C14	GND
A15	-	B15	-	C15	-
A16	-	B16	LCD_BLn	C16	-
A17	-	B17	-	C17	-
A18	LVDS_DATA0_N	B18	LVDS_DATA0_P	C18	-
A19	LVDS_DATA1_N	B19	LVDS_DATA1_P	C19	-
A20	LVDS_DATA2_N	B20	LVDS_DATA2_P	C20	-
A21	LVDS_CLK_N	B21	LVDS_CLK_P	C21	-
A22	LVDS_DATA3_N	B22	LVDS_DATA3_P	C22	-

Table of CN1 in Linux platform with RGB LCD interface

Column A(Outside)	Column B	Column C(Inside)

A1	TPTX1-	B1	(Filled)	C1	TPTX2-
A2	TPTX1+	B2	LINK1	C2	TPTX2+
A3	VDD_CMT1	B3	SPEED1	C3	VDD_CMT2
A4	TPRX1-	B4	LINK2	C4	TPRX2-
A5	TPRX1+	B5	SPEED2	C5	TPRX2+
A6	GND	B6	GND	C6	GND
A7	ttyS1_RXD	B7	ttyS3_RXD	C7	USB3_HD+
A8	ttyS1_TXD	B8	ttyS3_TXD	C8	USB3_HD-
A9	ttyS2_RXD	B9	ttyS4_RXD	C9	USB4_HD+
A10	ttyS2_TXD	B10	ttyS4_TXD	C10	USB4_HD-
A11	GND	B11	GND	C11	GND
A12	DBG_RX	B12	Y- / TSC_I2C_SCL	C12	X- / TSC_IRQn
A13	DBG_TX	B13	Y+ / TSC_I2C_SDA	C13	X+ / TSC_RSTn
A14	GND	B14	GND	C14	GND
A15	LCD_HSYNC	B15	-	C15	LCD_DCLK
A16	LCD_VSYNC	B16	LCD_BLn	C16	LCD_DE
A17	LCD_B2	B17	LCD_G2	C17	LCD_R2
A18	LCD_B3	B18	LCD_G3	C18	LCD_R3
A19	LCD_B4	B19	LCD_G4	C19	LCD_R4
A20	LCD_B5	B20	LCD_G5	C20	LCD_R5
A21	LCD_B6	B21	LCD_G6	C21	LCD_R6
A22	LCD_B7	B22	LCD_G7	C22	LCD_R7

Table of CN1 in Linux platform with LVDS LCD interface

Column A(Outside)		Column B		Column C(Inside)	
A1	TPTX1-	B1	(Filled)	C1	TPTX2-
A2	TPTX1+	B2	LINK1	C2	TPTX2+
A3	VDD_CMT1	B3	SPEED1	C3	VDD_CMT2
A4	TPRX1-	B4	LINK2	C4	TPRX2-
A5	TPRX1+	B5	SPEED2	C5	TPRX2+
A6	GND	B6	GND	C6	GND
A7	ttyS1_RXD	B7	ttyS3_RXD	C7	USB3_HD+
A8	ttyS1_TXD	B8	ttyS3_TXD	C8	USB3_HD-
A9	ttyS2_RXD	B9	ttyS4_RXD	C9	USB4_HD+

A10	ttyS2_TXD	B10	ttyS4_TXD	C10	USB4_HD-
A11	GND	B11	GND	C11	GND
A12	DBG_RX	B12	Y- / TSC_I2C_SCL	C12	X- / TSC_IRQn
A13	DBG_TX	B13	Y+ / TSC_I2C_SDA	C13	X+ / TSC_RSTn
A14	GND	B14	GND	C14	GND
A15	-	B15	-	C15	-
A16	-	B16	LCD_BLn	C16	-
A17	-	B17	-	C17	-
A18	LVDS_DATA0_N	B18	LVDS_DATA0_P	C18	-
A19	LVDS_DATA1_N	B19	LVDS_DATA1_P	C19	-
A20	LVDS_DATA2_N	B20	LVDS_DATA2_P	C20	-
A21	LVDS_CLK_N	B21	LVDS_CLK_P	C21	-
A22	LVDS_DATA3_N	B22	LVDS_DATA3_P	C22	-

3.2 Interfaces Description in CN1

The pins in ESM335x CN1 connector include interface of Ethernet, UART, USB Host and LCD etc.

Ethernet

ESM335x supports 2 Ethernet ports with Auto-MDIX enabled. The signals in CN1 are listed as follows

Signal	Description
TPTX1+	Port 1 Transmit/Receive Differential Channel 1, default setting as transmit
TPTX1-	
TPRX1+	Port 1 Transmit/Receive Differential Channel 2, default setting as receive
TPRX1-	
VDD_CMT1	Port 1 Bias Voltage(3.3V), connecting to common point of chip side of transformer
LINK1	Port 1 Link Indication Output, active high

SPEED1	Port 1 Speed Indication Output, active high
TPTX2+	Port 2 Transmit/Receive Differential Channel 1, default setting as transmit
TPTX2-	
TPRX2+	Port 2 Transmit/Receive Differential Channel 2, default setting as receive
TPRX2-	
VDD_CMT2	Port 2 Bias Voltage(3.3V), connecting to common point of chip side of transformer
LINK2	Port 2 Link Indication Output, active high
SPEED2	Port 2 Speed Indication Output, active high

LINK and SPEED signals can drive LED with a series resistor. Ethernet transformer should be as close to the RJ45 connector as possible.

UART

There are 5 serial ports for application in ESM335x. The baud rate of each port can be set up to 3Mbps. The name of serial ports in CE are different from those in Linux. In CE platform, serial port is named from COM2 to COM6, COM1 is used by CE ActiveSync. With manufacture default setting, COM3 is configured as RS232 with ±9V level, and others in 3.3V LVCMOS. COM6 pins are multiplexed with GPIO. COM2 can be enabled with hardware RTS/CTS flow control, and other ports can be configured by software to use a GPIO (GPIO6 – GPIO31) as hardware direction control for application of RS485. In Linux platform, name of serial port starts from ttyS1.

The following table lists information of UART ports in ESM335x.

Name in CE	Name in Linux	Function Description
COM2	ttyS1	RTS/CTS hardware flow control
COM3	ttyS2	3-wire, RS232, ±9V level
COM4	ttyS3	3-wire, 3.3V LVCMOS level
COM5	ttyS4	3-wire, 3.3V LVCMOS level
COM6	ttyS5	3-wire, 3.3V LVCMOS level

The signals are named with COM#_RXD (receive) and COM#_TXD (transmit) in CE platform, and ttyS#_RXD, ttyS#_TXD in Linux platform.

There is another independent UART port in ESM335x, which is used as debug port (DBG_RX, DBG_TX). In CE platform, the debug port is mainly used to dump booting message from kernel. In Linux platform, the debug port is used as a console. The debug port comes with RS232 level, 115200 baud rate and 8-N-1 frame format default setting.

LCD

ESM335x comes with one of two LCD interfaces. One is parallel RGB interface which is suitable for low cost display. The other is a standard LVDS which is used in high resolution display and can drive longer display cable.

RGB interface is the default setting of ESM335x. The signals of RGB interface are shown in following table.

Signals	Description
LCD_R2 – LCD_R7	Red component output, R7(MSB), R2(LSB)
LCD_G2 – LCD_G7	Green component output, G7(MSB), G2(LSB)
LCD_B2 – LCD_B7	Blue component output, B7(MSB), B2(LSB)
LCD_DCLK	Pixel Clock, falling edge update data, rising edge latch data
LCD_HSYNC	Horizontal Sync Pulse, active low
LCD_VSYNC	Vertical Sync Pulse, active low
LCD_DE	Display Enable, active high
LCD_BLn	Backlight control, active low, PWM configurable

LVDS interface shares part of pins of RGB, and the pins are shown as follows.

Pin	Signal	Description
A18	LVDS_DATA0_N	LVDS Differential Channel 0
B18	LVDS_DATA0_P	(R2,R3,R4,R5,R6,R7,G2)
A19	LVDS_DATA1_N	LVDS Differential Channel 1
B19	LVDS_DATA1_P	(G3,G4,G5,G6,G7,B2,B3)
A20	LVDS_DATA2_N	LVDS Differential Channel 2
B20	LVDS_DATA2_P	(B4,B5,B6,B7,HS,VS,DE)
A21	LVDS_CLK_N	LVDS Differential Clock

B21	LVDS_CLK_P	
A22	LVDS_DATA3_N	LVDS Differential Channel 3
B22	LVDS_DATA3_P	(R0,R1,G0,G1,B0,B1,RSV)

The LVDS interface is compatible with both 18-bit mode and 24-bit mode. The signal group LVDS_DATA3 is used in 24-bit mode only.

The table lists information of typical display panel used with ESM335x.

Resolution	Size in Inches	Description
480×272	4.3”	High price-performance ratio
640×480	5.6” – 6.4”	
800×480	7” – 8”	ESM335x default setting
800×600	8.4” – 10.4”	Normally for LVDS interface
1024×768	10.4” – 12.1”	LVDS interface only

Touch Screen

The default setting of touchscreen in ESM335x is 4-wire resistive. The value of resistor on touchscreen should be normally in range of 200 – 600 ohms. ESM335x can also support capacitive touchscreen which can be selected on order. The capacitive touchscreen driver is based on FT15x16 controller.

The pins for both touchscreens are multiplexed as following table.

CN1 Pin#	Resistive Touchscreen	Capacitive Touchscreen	CN1 Pin#	Resistive Touchscreen	Capacitive Touchscreen
B12	Y-	TSC_I2C_SCL	C12	X-	TSC_IRQn
B13	Y+	TSC_I2C_SDA	C13	X+	TSC_RSTn

USB Host

The Microchip USB2514 USB hub is connected to the USB_H1 port of the AM335x SoC. Four USB hub ports are assigned to CN1 (USB3_HD, USB4_HD) and CN2 (USB1_HD, USB2_HD) respectively.

Signal Name	Description
USB3_HD+	USB3 data differential pair

USB3_HD-	
USB4_HD+	USB4 data differential pair
USB4_HD-	

+5V power supplies of the ports should be provided by customer's carrier board.

3.3 Pins in ESM335x CN2

The pins and the associated signals in CN2 are listed as follows.

Column D (Inside)		Column E		Column F (Outside)	
D1	GPIO0 / COM2_CTS#	E1	GND	F1	GPIO16
D2	GPIO1 / COM2_RTS#	E2	ISA_D0	F2	GPIO17
D3	GPIO2 / COM6_RXD	E3	ISA_D1	F3	GPIO18
D4	GPIO3 / COM6_TXD	E4	ISA_D2	F4	GPIO19
D5	GPIO4	E5	ISA_D3	F5	GPIO20
D6	GPIO5	E6	ISA_D4	F6	GPIO21
D7	GPIO6 / PWM1	E7	ISA_D5	F7	GPIO22
D8	GPIO7 / PWM2	E8	ISA_D6	F8	GPIO23
D9	GPIO8 / PWM3	E9	ISA_D7	F9	GPIO24 / IRQ1
D10	GPIO9 / PWM4	E10	ISA_RDn	F10	GPIO25 / IRQ2
D11	GPIO10 / CAN1_RXD	E11	ISA_WEn	F11	GPIO26 / I2C_SDA
D12	GPIO11 / CAN1_TXD	E12	ISA_ADVn	F12	GPIO27 / I2C_SCL
D13	GPIO12	E13	ISA_CSn	F13	GPIO28 / SPI_MISO
D14	GPIO13	E14	GND	F14	GPIO29 / SPI_MOSI
D15	GPIO14	E15	DBGSLn	F15	GPIO30 / SPI_SCLK
D16	GPIO15	E16	RSTIN_OUTn	F16	GPIO31 / SPI_CS0N
D17	GND	E17	GND	F17	GND
D18	USB1_HD+	E18	VCC	F18	USB_OTG_VBUS
D19	USB1_HD-	E19	VCC	F19	USB_OTG_ID
D20	USB2_HD+	E20	VCC	F20	USB_OTG_D+
D21	USB2_HD-	E21	VCC	F21	USB_OTG_D-
D22	BATT3V	E22	VCC	F22	VCC

3.4 Interfaces Description in CN2

The pins in ESM335x CN2 connector include interface of GPIO, USB, ISA and power supply

etc.

GPIO

ESM335x can provide up to 32 GPIOs. Each GPIO can be configured as input or output mode independently. All of GPIO are default setting in input mode on power up or external reset. Some pins of GPIO are multiplexed with other interfaces, and state of the pins are automatically switched to interface state as long as the corresponding device driver file is opened.

Table of GPIO pins with multiplexed function

GPIO	Multiplexed Function	CE Device	Linux Device
GPIO0 – GPIO1	RTS/CTS flow control	L“COM2:”	/dev/ttyS1
GPIO0 – GPIO1	CAN2 (RXD, TXD)	L“CAN2:”	can1
GPIO2 – GPIO3	COM6/ttyS5 (RXD, TXD)	L“COM6:”	/dev/ttyS5
GPIO4 – GPIO5	COM7/ttyS6 (RXD, TXD)	L“COM7:”	/dev/ttyS6
GPIO6	PWM1 output	L“PWM1:”	/dev/pwm1
GPIO7	PWM2 output	L“PWM2:”	/dev/pwm2
GPIO8	PWM3 output	L“PWM3:”	/dev/pwm3
GPIO9	PWM4 output	L“PWM4:”	/dev/pwm4
GPIO10 – GPIO11	CAN1 (RXD, TXD)	L“CAN1:”	can0
GPIO24	IRQ1	L“IRQ1:”	/dev/irq1
GPIO25	IRQ2	L“IRQ2:”	/dev/irq2
GPIO26 – GPIO27	I2C (SDA, SCL)	L“I2C1:”	/dev/i2c-0
GPIO28 – GPIO31	4-wire SPI (MISO, etc.)	L“SPI1:”	/dev/spidev1.0

Note: The port COM7/ttyS6 is available in ESM3356 only.

USB OTG

The USB_OTG port of the SoC is directly available on connector CN2.

Signal Name	Description
USB_OTG_D+	Positive differential USB signal, OTG capable

USB_OTG_D-	Negative differential USB signal, OTG capable
USB_OTG_VBUS	+5V output (host), input only for voltage sensing
GND	Digital ground
USB_OTG_ID	USB OTG identification

USB Host

The Microchip USB2514 USB hub is connected to the USB_H1 port of the AM335x SoC. Four USB hub ports are assigned to CN1 (USB3_HD, USB4_HD) and CN2 (USB1_HD, USB2_HD) respectively.

Signal Name	Description
USB1_HD+	USB1 data differential pair
USB1_HD-	
USB2_HD+	USB2 data differential pair
USB2_HD-	

+5V power supplies of the ports should be provided by customer's carrier board.

Simplified ISA Bus

Simplified ISA Bus, an external memory controller, is derived from GPMC of AM335x Soc. Simplified ISA consists of only 12 signals by utilizing address and data multiplexed access. It provides 200ns bus cycle which can meet the requirement of most external devices.

Signals	Description
ISA_D0 - ISA_D7	8-bit address/data bus with multiplexed access
ISA_CSn	Chip select, active low on bus cycle
ISA_ADVn	Address latch enable, active low, rising edge latch
ISA_RDn	Read enable, active low
ISA_WEn	Write enable, active low

In many cases, Simplified ISA Interface is required to working with interrupt request from

external device. GPIO pins, typical GPIO24 and GPIO25, can be used as interrupt sources.

Power Signals

Pin #	Signal Name	Description
A6, B6, C6, A11, B11, C11, A14, B14, C14, E1, E14, D17, E17, F17	GND	Digital Ground
E18, E19, E20, E21, E22, F22	VCC	+5V main power supply
D22	BATT3V	RTC backup power supply

Other Control Signals

RSTIN_OUTn is a bidirectional reset signal, active low. On power up, RSTIN_OUTn works as an output signal, and can be used to reset external devices. RSTIN_OUTn becomes an input signal after booting up, and system can be reset with RSTIN_OUTn driven to low by external reset device. There is a 10k pullup resistor on this pin. RSTIN_OUTn can be unconnected if not used.

DBGSLn is an input signal with 100k pullup resistor in the module. ESM335x can start up in debug mode by connecting DBGSLn to ground. In debug mode, some necessary parameters and customer's main program can be configured so that customer's main program can be automatically executed when system booting up with DBGSLn unconnected (running mode).

4. Electrical Specifications

4.1 Absolute Maximum Ratings

Symbol	Description	Min	Max
VCC	Main power supply	-0.3V	+6.0V
BATT3V	RTC backup power supply	-0.3V	+3.6V
GPIO_VCC	Maximum input voltage on GPIO	-0.3V	+3.63V
GPIO_ICC	Total DC I/O Current on all GPIO	-	150mA
ESD_HUB	Body discharge voltage on GPIO/LCD	-	±2kV

4.2 Recommended Operation Conditions

Symbol	Description	Min	Typ	Max
VCC	Main power supply	4.5V	5.0V	5.5V
BATT3V	RTC backup power supply	2.7V	3.0V	3.3V

4.3 Power Consumption

ESM3354 Power Consumption for Different Modes

Power Source	Conditions	Typ	Max
Main Power (Mode 1)	CPU load < 10%, no external device connected	350mA	-
Main Power (Mode 2)	CPU load < 10%, Both ethernet ports and a USB device connected	450mA	-
Main Power (Mode 3)	Estimated Value with maximum pay load	-	3A
Backup Power	Main power is off	17uA	-

ESM3352 Power Consumption for Different Modes

Power Source	Conditions	Typ	Max
Main Power (Mode 1)	CPU load < 10%, no external device connected	300mA	-
Main Power (Mode 2)	CPU load < 10%, Both ethernet ports and a USB device connected	400mA	-
Main Power (Mode 3)	Estimated value with maximum pay load	-	2.5A
Backup Power	Main power is off	17uA	-

Note: The consumption of backup power (BATT3V) is 0 when the main power of ESM335x is on.

4.4 RS232 I/O Characteristics

Parameter	Condition	Min	Max
RX input voltage range		-25V	25V
RX input resistance		3kΩ	7kΩ
TX output voltage swing	RL = 3kΩ - 7kΩ	±5V	±9V

The COM3/ttyS2 port and debug/console port are set in RS232 mode by default.

4.5 Ethernet PHY Characteristics

Parameter	Typ	Units
100BASE-TX Differential Output Voltage	2.0	V
100BASE-TX Differential Output Current	26	mA
10BASE-T Differential Output Voltage	2.5	V
Common Bias Voltage VDD_CMT	3.3	V

ESD Performance

Parameter	Conditions	Min	Typ	Max	Unit
All Pins	Human Body Model			±5	KV
System	IED61000-4-2 Contact Discharge			±8	KV
System	IED61000-4-2 Air-Gap Discharge			±15	KV

LATCH-UP Performance

Parameter	Conditions	Min	Typ	Max	Unit
All Pins	EIA/JESD 78, Class II		150		mA

More details about ethernet port can be found in datasheet of LAN8720a.

4.6 LVCMOS Signal DC Characteristics

Symbol	Parameter	Min	Typ	Max	Units
V_{IL}	Low-level input voltage			0.8	V
V_{IH}	High-level input voltage	2			V
V_{HYS}	Hysteresis voltage at an input	0.265		0.44	V
V_{OL}	Low-level output voltage			0.45	V
V_{OH}	High-level output voltage	2.85			V
I_O	output source or sink current		±6		mA
I_I	Input leakage current, Receiver disabled, pullup enabled	-243	-100	-19	uA

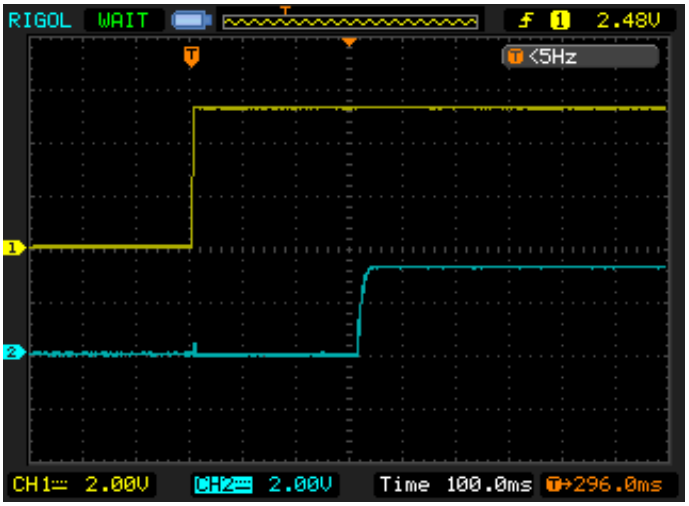
The LVCMOS Signals in ESM335x include all pins of GPIO and UART, part pins of LCD, and RSTIN_OUTn.

4.7 LVDS Signals DC Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{OD}	Differential Output Voltage	R_L = 100Ω	250	345	450	mV
I_{OS}	Output Short Circuit Current			-3.5	-5	mA
I_{OZ}	Output TRI-STATE Current	SHTDN = 0V, V_{OUT} = 0V or V_{CC}		±1	±10	uA

5. Timings

5.1 Module Power Up Timing



CH1 (yellow) = VCC, +5V main power

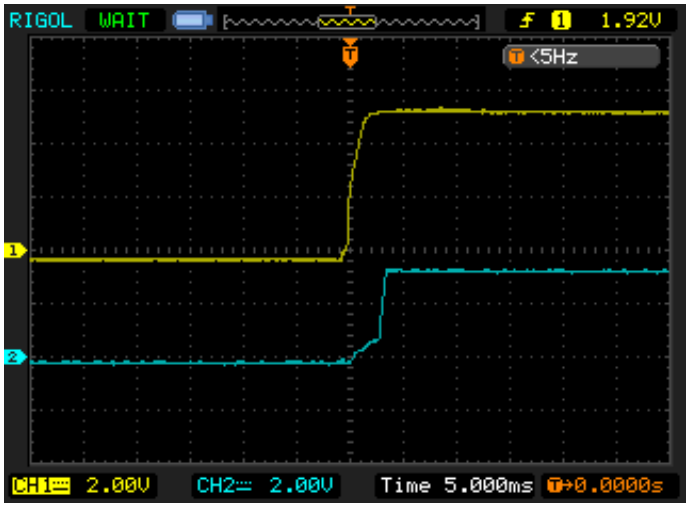
CH2 (cyan) = RSTIN_OUTn, no external reset device connected

5.2 GPIO Power Up Timing

GPIO Signals can be divided into 2 types with different power up timing as following table.

GPIO Power up Timing	ESM335x GPIO
Type 1	GPIO0、GPIO1、GPIO2、GPIO3、GPIO4、GPIO5、GPIO6、GPIO7、GPIO10、GPIO11、GPIO16、GPIO19、GPIO24、GPIO25、GPIO26、GPIO27
Type 2	GPIO8、GPIO9、GPIO12、GPIO13、GPIO14、GPIO15、GPIO17、GPIO18、GPIO20、GPIO21、GPIO22、GPIO23、GPIO28、GPIO29、GPIO30、GPIO31

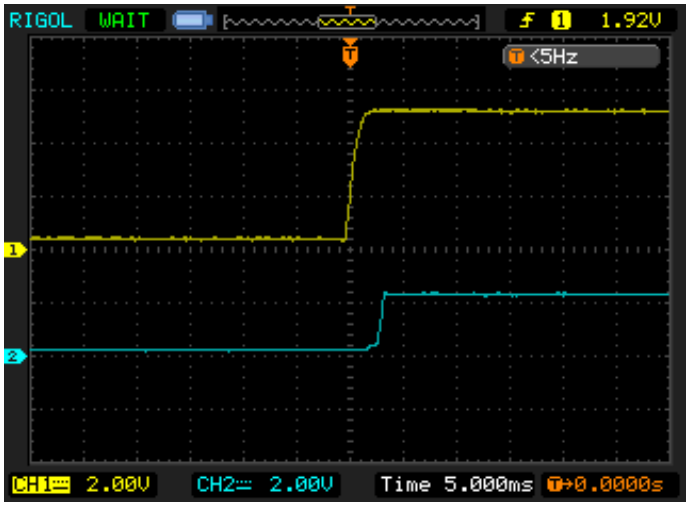
Type 1 Timing



CH1 (yellow) = VCC, +5V main power

CH2 (cyan) = one of GPIOs in Type 1

Type 2 Timing



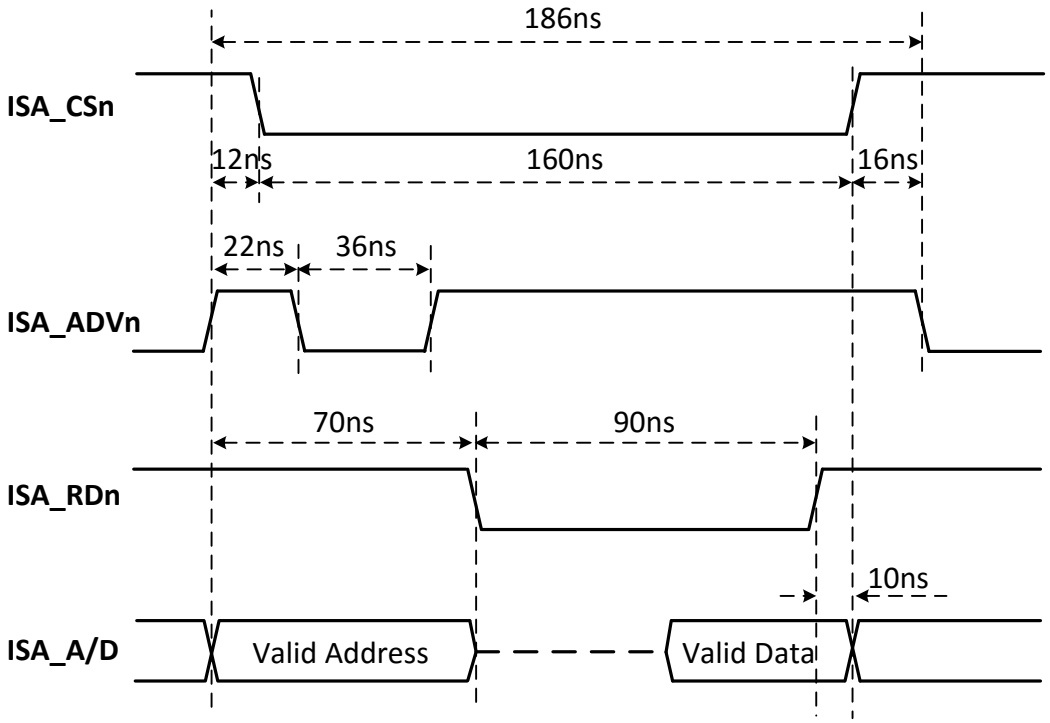
CH1 (yellow) = VCC, +5V main power

CH2 (cyan) = one of GPIOs in Type 2, which is kept in 2.5V.

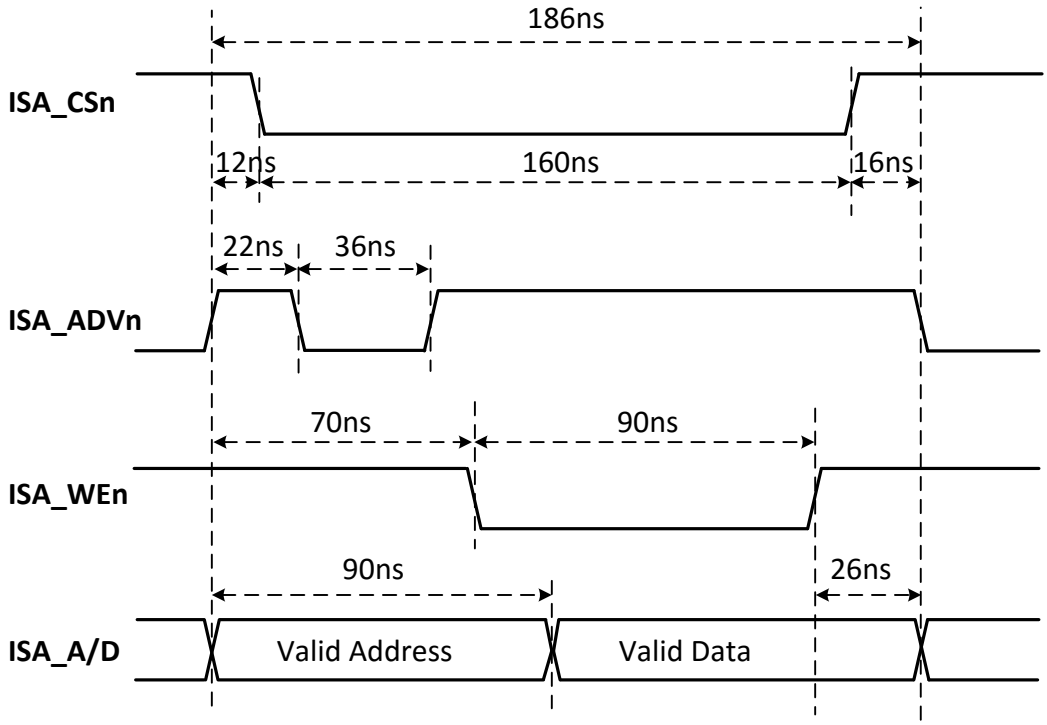
GPIO low level on power up can be implemented with 1k pull down resistor on it.

5.3 ISA Bus Cycle Timing

Bus Read Cycle Timing



Bus Write Cycle Timing



6. Carrier Board Design Notes

1. As the maximum pay load current of ESM335x can reach up to 3A, the capability of power supply should at least be larger than 5V/3A. Considering consumption of other device in system, for example LCD module, a minimum 5V/4A power supply is recommended.
2. Some pins in ESM335x CN1 and CN2 come directly from SoC chip AM335x, and these pin's body discharge voltage only have 2kV. Some ESD protection may be required, especially in winter.
3. Input voltage of GPIO must be less than its absolute maximum voltage 3.6V. It is possible for any input voltage higher than 3.6V to damage the SoC chip. It will definitely destroy the SoC chip if a 5V voltage is applied to any GPIO pins!
4. Although the drive capability of each GPIO is ±6mA, but it is necessary to control total current from all GPIO pins within 150mA (see 4.1). It may damage the GPIO controller in SoC if total current from GPIO is over maximum threshold form a long time. Some driver chip like 74HC245 can been used in carrier board to protect GPIO from damaged.
5. It's highly recommended to use ESD device for USB port in carrier board. A series ferrite in USB power rail is also recommended. Reference can be found in schematics of ESMARC Evaluation Board.
6. The state of each GPIO pin on power up is low for a few milliseconds, and it may provide a wrong state to some external output circuit. RSTIN_OUTn can be used to enable external power supply to avoid the issue, as the duration of low RSTIN_OUTn output on power up is much longer than that of GPIO.

7. Order Information

Module Type	Description
ESM3354	LCD Interface comes with RGB LCD Interface
ESM3354-LVDS	LCD Interface comes with LVDS LCD Interface
ESM3352	LCD Interface comes with RGB LCD Interface
ESM3352-LVDS	LCD Interface comes with LVDS LCD Interface

8. Technical Support

Emtronix is a company specializing on embedded computer modules for industrial applications. Technical support can be obtained from company's website, forum, email and telephone. The contact details are below:

Website: http://www.emtronix.com

Email: support@emtronix.com

Telephone: 86-28-8618-0660

FAX: 86-28-85141028

Company Location: #5 Gaopeng Dadao, Chengdu, Sichuan, China 610041

9. Revision History

Version	Module Type	Description	Date
V2.0	ESM335x V2.1	Datasheet created	2016-1

Note: The manual will be updated without notice. The latest version of the manual can be downloaded from Emtronix's website.