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# e-CAM130_MI1335_MOD Datasheet

**Revision 1.3**
13 May 2019

# Contents

# 1 Revision History

| Rev | Date | Description | Author |
|---|---|---|---|
| 1.0 | 04-Sep-2018 | Initial draft | Camera Team |
| 1.1 | 22-Jan-2019 | Responsivity updated | Camera Team |
| 1.2 | 13-Feb-2019 | Electrical Characteristics updated.<br>Pin description added. | Camera Team |
| 1.3 | 13-May-2019 | Minor changes updated on the document format | Camera Team |

# 2 Introduction

e-CAM130_MI1335_MOD is a small form-factor, 13 MP autofocus camera module with MIPI CSI-2 interface from e-con Systems, a leading Embedded Product Design Services Company which specializes in the advanced camera solutions.

e-CAM130_MI1335_MOD is a flexible Printed Circuit Board (PCB) camera module, and Voice Coil Motor (VCM) autofocus lens is soldered directly to the board. This camera module can be used with any application processors, digital signal or media processors or with USB UVC controllers with a compatible camera interface.

This document serves as the datasheet for e-CAM130_MI1335_MOD with electrical and mechanical features.

# 3 Disclaimer

The specifications and features of e-CAM130_MI1335_MOD camera module are provided here as reference only and e-con Systems reserves the right to edit or modify this document without any prior intimation of whatsoever.

# 4 Description

e-CAM130_MI1335_MOD is a high performance, and 13 MP autofocus camera module on a flex PCB. The camera module is based on AR1335 which is a 1/3.2", 13 MP, CMOS image sensor from On Semiconductor®. AR1335 is a Bayer RGB image sensor with an active pixel resolution of 4208 x 3120 pixels and has a 4-lane MIPI CSI-2 interface. The camera module houses a compatible lens with VCM controlled autofocus. The front view of e-CAM130_MI1335_MOD camera module is shown in the following figure.


**Figure 1: Front View of e-CAM130_MI1335_MOD Camera Module**

## 4.1 Camera Module Features

The following table lists the specifications of e-CAM130_MI1335_MOD camera module.

| Description | Specification |
|---|---|
| Module size (L x W x H) | 24.18 mm x 11.6 mm x 6.525 mm |
| Sensor type | AR1335 |
| Array size (13 MP) | 4208H x 3120V |
| Pixel size | 1.1 µm x 1.1 µm Back Side Illuminated (BSI) |
| Responsivity | 4700 e-/Lux-sec |

| | | |
|---|---|---|
| Output format | | Raw 6, Raw 8 and Raw 10 |
| SNR (max) | | 37 dB |
| Dynamic range | | 69 dB |
| Lens ratio | | 1/3.2” Optical format |
| TV-distortion | | < 1.5% |
| Effective focal length | | 3.81±0.1mm |
| Focus (F .NO) | | 2.2 ± 5 % (Infinite) |
| View angle | | 74.4° |
| Object distance | | 10 cm to Infinity |
| Autofocus mechanism | | Voice coil motor |
| Input clock frequency | | 6 MHz - 48 MHz |
| Maximum image transfer-rate | 13 MP | 20 fps |
| | 3840 x 2160 | 30 fps |
| | 1080P | 80 fps |
| | 720P | 80 fps |
| | VGA | 120 fps |
| Power supply | Core (DVDD) | 1.2V |
| | Analog (AVDD) | 2.7V |
| | I/O (DOVDD) | 1.8V |
| | AF_VDD | 2.7V |
| Sensor temperature (Operating temperature) | | -30°C to 70°C |

**Table 1: Camera Module Features**

## 4.2 Pin Description

The e-CAM130_MI1335_MOD has a 40-pin connector. The signal names and pin numbers are listed in the following table.

| S.No | Pin Name | Pin Type | Description |
|---|---|---|---|
| 1 | AF_VDD | Power | Power for VCM |
| 2 | GPIO [1] | I/O | RESERVED FOR FUTURE PURPOSE |
| 3 | AF_VDD | Power | Power for VCM |
| 4 | GND | Power | Ground |
| 5 | AF_GND | Power | Ground for VCM |
| 6 | TXDN3 | Output | MIPI TX data lane 3 negative output |
| 7 | GND | Power | Ground |
| 8 | TXDP3 | Output | MIPI TX data lane 3 positive output |
| 9 | EXTCLK | Input | Clock Input |
| 10 | GND | Power | Ground |
| 11 | GND | Power | Ground |
| 12 | TXDN2 | Output | MIPI TX data lane 2 negative output |
| 13 | FLASH | Output | Flash LED control |
| 14 | TXDP2 | Output | MIPI TX data lane 2 positive output |

| | | | |
|---|---|---|---|
| 15 | SID | Input | Sensor slave address selection input |
| 16 | GND | Power | Ground |
| 17 | GND | Power | Ground |
| 18 | GND | Power | Ground |
| 19 | DOVDD | Power | Power for I/O circuit |
| 20 | TXCN | Output | MIPI TX clock lane negative output |
| 21 | SDATA | I/O | I2C Data |
| 22 | TXCP | Output | MIPI TX clock lane positive output |
| 23 | SCLK | I/O | I2C Clock |
| 24 | GND | Power | Ground |
| 25 | GND | Power | Ground |
| 26 | GND | Power | Ground |
| 27 | AVDD | Power | Power for Analog Circuit |
| 28 | TXDN1 | Output | MIPI TX data lane 1 negative output |
| 29 | GND | Power | Ground |
| 30 | TXDP1 | Output | MIPI TX data lane 1 positive output |
| 31 | GND | Power | Ground |
| 32 | GND | Power | Ground |
| 33 | DVDD | Power | Power for core circuit |
| 34 | TXDN0 | Output | MIPI TX data lane 0 negative output |
| 35 | DVDD | Power | Power Supply for Digital Core |
| 36 | TXDP0 | Output | MIPI TX data lane 0 positive output |
| 37 | XSHUTDOWN | Input | Camera Reset (Active Low) |
| 38 | GND | Power | Digital Ground |
| 39 | GND | Power | Digital Ground |
| 40 | GPI [3] | Input | RESERVED FOR FUTURE PURPOSE |

**Table 2: Pin Description**

## 4.3 Connector Details

The details of connector are listed in following table.

| S.No | Connector | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| 1 | Connector on the module | 40 Position Connector Header, Center Strip Contacts Surface Mount Gold | Panasonic | AXT640124 |
| 2 | Module mating connector (to be used on the customer board) | 40 Position Connector Socket, Outer Shroud Contacts Surface Mount Gold | Panasonic | AXT540124 |

**Table 3: Connector Details**

## 4.4 Autofocus Specification

The following table lists the autofocus specification of e-CAM130_MI1335_MOD camera module.

| S.No | Item | Specification |
|---|---|---|
| 1 | Autofocus type | VCM |
| 2 | VCM driver | Internal to the sensor |
| 5 | Hysteresis | Maximum 7 µm |
| 6 | Focusing range | 10 cm to Infinity |

**Table 4: Autofocus Specification**

# 5 Electrical Specification

The electrical specifications of e-CAM130_MI1335_MOD camera module are as follows:

- DC Characteristics
- Timing Characteristics
- Functional Temperature Range
- Two-Wire Serial Interface Timing Characteristics
- Power-Up Sequence

The following sections describe each of the electrical specifications in detail.

## 5.1 DC Characteristics

The following table lists the DC characteristics of e-CAM130_MI1335_MOD camera module.

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **Power Supply** | | | | | |
| AVDD | Supply Voltage (Analog) | 2.6 | 2.7 | 2.9 | V |
| DVDD | Supply Voltage (Digital Core) | 1.14 | 1.20 | 1.3 | V |
| DOVDD | Supply Voltage (Digital I/O) | 1.7 | 1.8 | 1.9 | V |
| AF_VDD | Supply Voltage (Auto Focus) | 2.6 | - | 2.8 | V |
| $I_{(ANALOG)}$ | Operating Current | - | 30 | 30 | mA |
| $I_{(IO)}$ | | - | 26 | 26 | mA |
| $I_{(CORE)}$ | | - | 118 | 130 | mA |
| $I_{(AF\_VDD)}$ | | 20 | 40 | 195* | mA |
| **Control Interface (XSHUTDOWN,TEST, GPIOs)** | | | | | |
| $V_{IL}$ | Input Voltage Low | –0.5 | - | 0.3 x DOVDD | V |
| $V_{IH}$ | Input Voltage High | 0.7 x DOVDD | - | DOVDD + 0.5 | V |
| $C_{IN}$ | Input pad Capacitance | - | 6 | - | pF |
| $V_{OL}$ | Output Voltage Low | - | - | 0.1 x DOVDD | V |
| $V_{OH}$ | Output Voltage High | 0.9 x DOVDD | - | - | V |
| **Serial Interface Inputs(SCLK and SDATA)** | | | | | |
| $V_{IL}$ | Input Voltage Low | -0.3 | - | 0.3 x DOVDD | V |
| $V_{IH}$ | Input Voltage High | 0.7 x | - | DOVDD + | V |

| | | | | | |
|---|---|---|---|---|---|
| | | DOVDD | | 0.3 | |
| $V_{OL}$ | Output LOW voltage | 0.11 | - | 0.3 | V |

**Table 5: DC Characteristics**

***VCM Macro current 195mA(Max).

## 5.2 Timing Characteristics

The following table lists the timing characteristics of e-CAM130_MI1335_MOD camera module.

| Symbol | Parameter | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|
| **Clock Input** | | | | | | |
| $f_{EXTCLK}$ | Input clock frequency | PLL enabled | 6 | 24 | 48 | MHz |
| $t_{JITTER}$ | Input clock jitter | Cycle to cycle | - | 545 | 600 | ps |

**Table 6: Timing Characteristics**

## 5.3 Functional Temperature Range

The following table lists the functional temperature range of e-CAM130_MI1335_MOD camera module.

| Temperature Range | Parameter Description |
|---|---|
| -30°C to 70°C | Electrically functional operating range |

**Table 7: Functional Temperature Range**

## 5.4 Two-Wire Serial Interface Timing Characteristics

The following figure shows the timing diagram of the e-CAM130_MI1335_MOD two-wire serial interface.

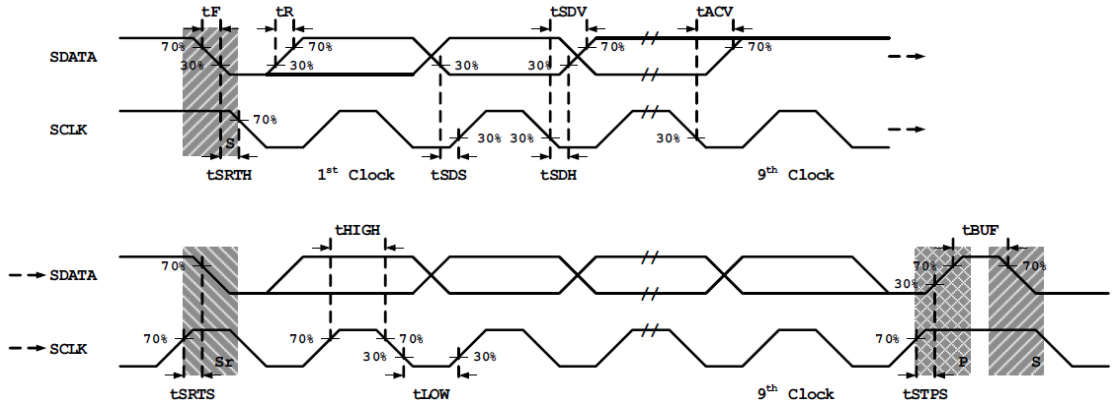


**Figure 2: e-CAM130_MI1335_MOD Two-Wire Serial Interface Timing Diagram**

The following table lists the parameters of e-CAM130_MI1335_MOD two-wire serial interface timing diagram.

| Symbol | Parameter | Minimum | Maximum | Unit |
|---|---|---|---|---|
| $f_{SCLK}$ | SCLK Frequency | 0 | 400 | KHz |
| $t_{LOW}$ | SCLK Low Period | 1.3 | - | µs |
| $t_{HIGH}$ | SCLK High Period | 0.6 | - | µs |
| $t_{SRTS}$ | Start Setup Time | 0.6 | - | µs |
| $t_{SRTH}$ | Start Hold Time | 0.6 | - | µs |
| $t_{SDS}$ | Data Setup Time | 100 | - | ns |
| $t_{SDH}$ | Data Hold Time | 0 | - | µs |
| $t_{SDV}$ | Data Valid Time | - | 0.9 | µs |
| $t_{ADV}$ | Data Valid Acknowledge Time | - | 0.9 | µs |
| $t_{STPS}$ | Stop Setup Time | 0.6 | - | µs |
| $t_R$, $t_F$ | SCLK and SDATA rise/fall times | 20 | 300 | ns |
| $t_{BUF}$ | Bus Free Time between Stop and Start | 1.3 | - | µs |

**Table 8: Parameters of Two-Wire Serial Interface Timing Characteristics**

## 5.5 Power-Up Sequence

The power-up sequence recommended by e-con Systems in the customer design is shown below.

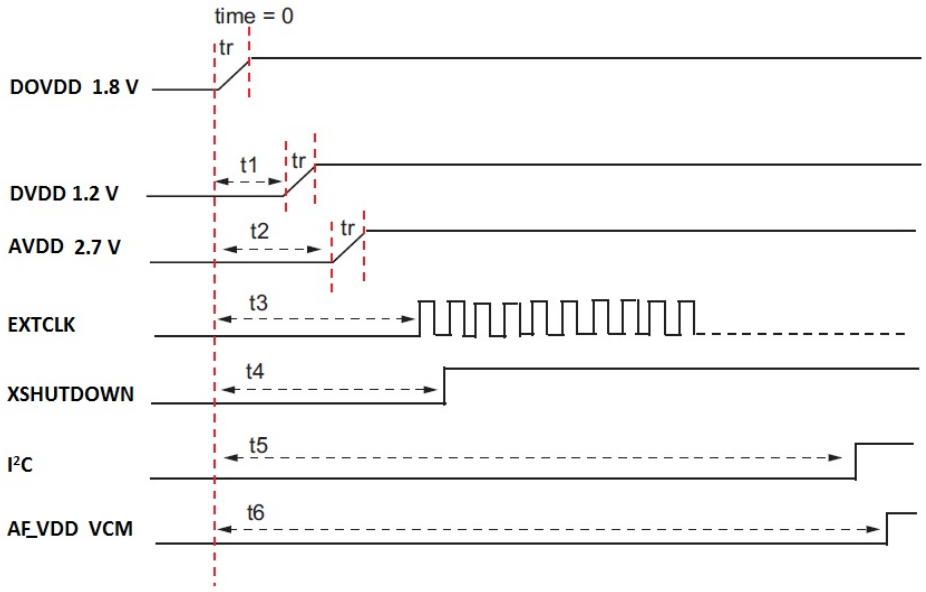


**Figure 3: e-CAM130_MI1335_MOD Camera Module Power-Up Sequence**

**Note**: The I²C activity must not be performed during power-up sequence.

The following table lists the parameter of e-CAM130_MI1335_MOD camera module power-up sequence.

| Timing | Minimum | Maximum |
|---|---|---|
| $t_1$ | 1 ms | - |

| | | |
|---|---|---|
| $t_2$ | t1 + 1 ms | - |
| $t_3$ | - | < t4 |
| $t_4$ | t2 + 1 ms | - |
| $t_5$ | t4 + 1 ms | - |
| $t_r$ | 100 µs | - |

**Table 9: Parameters of e-CAM130_MI1335_MOD Power-Up Sequence**

# 6 Mechanical Specifications

The e-CAM130_MI1335_MOD camera module size is 24.18 mm x 8.74 mm and the stack-up height of the board with its connector is 6.525 mm.

## 6.1 e-CAM130_MI1335_MOD Camera Module Mechanical Drawing

The mechanical drawing of e-CAM130_MI1335_MOD camera module is shown in the following figure.

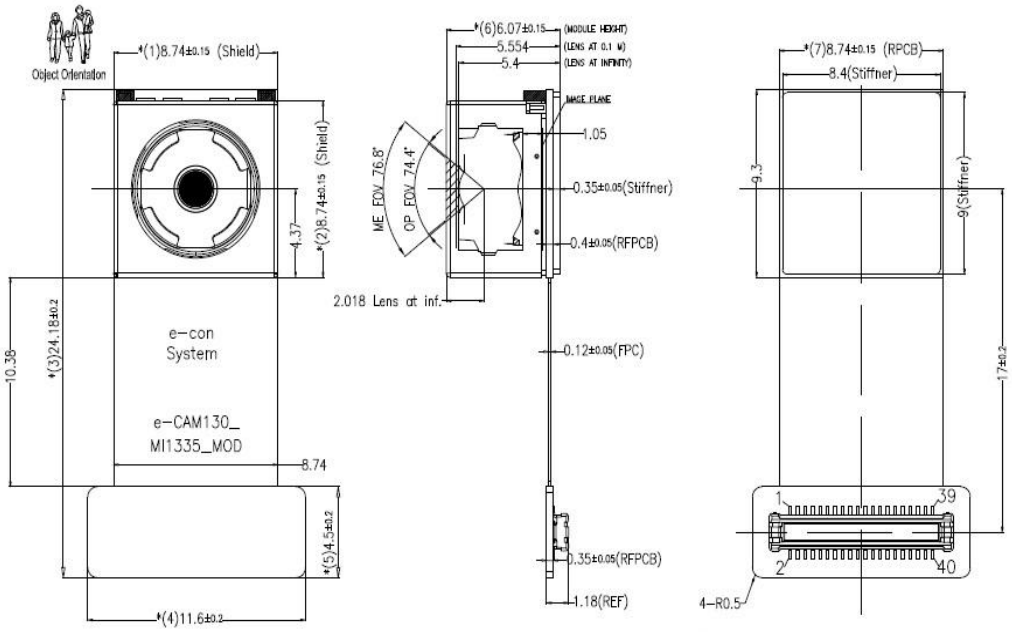


**Figure 4**: **e-CAM130_MI1335_MOD Camera Module Mechanical Drawing**

# Support

**Contact Us**

If you need any support on e-CAM130_MI1335_MOD product, please contact us using the Live Chat option available on our website - https://www.e-consystems.com/

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If you need to create a ticket for any type of issue, please visit the ticketing page on our website - https://www.e-consystems.com/create-ticket.asp

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