Future Technology Devices International Limited

CleO-Camera Module Datasheet

Version 1.0

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1 Introduction

The CleO-Camera module is a camera accessory for the CleO series – the smart TFT display for Arduino. It consists of an OV5640 sensor module and Flash LEDs. The OV5640 sensor is a low voltage, high-performance, 1/4-inch 5 megapixel CMOS image sensor that provides the full functionality of a single chip 5 megapixel (2592×1944) camera using OmniBSI™ technology in a small footprint package. It is controlled through the standard Serial Camera Control Bus (SCCB) interface.

The CleO-camera module is supplied with a standard 24 Pin 0.5mm pitch FFC cable.

1.1 Features

- 1.4 µm x 1.4 µm pixel with OmniBSI™ technology for high performance (high sensitivity, low crosstalk, low noise, improved quantum efficiency)
- Optical size 1/4"
- Embedded 1.5V regulator for core power
- On-board regulator for VDDA,VDDIO, only 3V3 supply needed
- Support for output format: RAW RGB, RGB565/555/444, YUV422/420, YCbCr422 and compression
- Image quality control: color saturation, hue, gamma, sharpness(edge enhancement), lens correction, defective pixel cancelling and noise cancelling
- Support for anti-shake
- Standard SCCB interface
- In built Flash light LED
- 24 pin 0.5mm pitch FFC cable interface
2 Ordering Information

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CleO-CAM1</td>
<td>CleO-camera module, 5M Pixel HD CMOS camera module with adaptor board and FPC Flex</td>
</tr>
</tbody>
</table>
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3 Pin Out and Signal Description

3.1 Module Description

![Camera Module Features](image)

Figure 1 – Camera Module Features

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Reference Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.8V fixed voltage LDO</td>
<td>U7</td>
</tr>
<tr>
<td>2</td>
<td>LED driver</td>
<td>U16</td>
</tr>
<tr>
<td>3</td>
<td>24pin 0.5 mm pitch FFC connector interface to OV5640 module</td>
<td>CN13</td>
</tr>
<tr>
<td>4</td>
<td>24pin 0.5 mm pitch FFC connector interface to CleO</td>
<td>CN3</td>
</tr>
<tr>
<td>5</td>
<td>White LED</td>
<td>LEDs5, LEDs6, LEDs7, LEDs8</td>
</tr>
<tr>
<td>6</td>
<td>OV5640 camera module</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1 - Camera Module Features & Description

3.2 Module Interface Signal Description

The pin description of CN3 is given in **Table 2**.

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Pin Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PWM0</td>
<td>Input</td>
<td>Pulse Width Modulation to control LED brightness</td>
</tr>
<tr>
<td>2</td>
<td>CAM_5V</td>
<td>Power</td>
<td>5V Supply</td>
</tr>
<tr>
<td>3</td>
<td>CAM_D2</td>
<td>Output</td>
<td>Pixel Data Output 2</td>
</tr>
<tr>
<td>4</td>
<td>CAM_D1</td>
<td>Output</td>
<td>Pixel Data Output 1</td>
</tr>
<tr>
<td>5</td>
<td>CAM_D3</td>
<td>Output</td>
<td>Pixel Data Output 3</td>
</tr>
<tr>
<td>Pin No</td>
<td>Pin Name</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>---------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>CAM_D0</td>
<td>Output</td>
<td>Pixel Data Output 0</td>
</tr>
<tr>
<td>7</td>
<td>CAM_D4</td>
<td>Output</td>
<td>Pixel Data Output 4</td>
</tr>
<tr>
<td>8</td>
<td>CAM_PCLK</td>
<td>Output</td>
<td>Pixel Clock Output from Sensor</td>
</tr>
<tr>
<td>9</td>
<td>CAM_D5</td>
<td>Output</td>
<td>Pixel Data Output 5</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>11</td>
<td>CAM_D6</td>
<td>Output</td>
<td>Pixel Data Output 6</td>
</tr>
<tr>
<td>12</td>
<td>CAM_XCLK</td>
<td>Input</td>
<td>Master Clock into Sensor</td>
</tr>
<tr>
<td>13</td>
<td>CAM_D7</td>
<td>Output</td>
<td>Pixel Data Output 7</td>
</tr>
<tr>
<td>14</td>
<td>CAM_3V3</td>
<td>Power</td>
<td>3V3 Supply</td>
</tr>
<tr>
<td>15</td>
<td>CAM_3V3</td>
<td>Power</td>
<td>3V3 Supply</td>
</tr>
<tr>
<td>16</td>
<td>CAM_HD</td>
<td>Output</td>
<td>Active High: Line/Data Valid; indicates active pixels</td>
</tr>
<tr>
<td>17</td>
<td>CAM_PWDN</td>
<td>Input</td>
<td>Camera Power Down, active High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Always pull low enable the sensor</td>
</tr>
<tr>
<td>18</td>
<td>CAM_VD</td>
<td>Output</td>
<td>Active High: Frame Valid; indicates active frame</td>
</tr>
<tr>
<td>19</td>
<td>RESETn</td>
<td>Input</td>
<td>Camera Reset, Active low</td>
</tr>
<tr>
<td>20</td>
<td>I2C0_SCL</td>
<td>Input</td>
<td>Two-Wire Serial Interface Clock</td>
</tr>
<tr>
<td>21</td>
<td>CAM_5V</td>
<td>Power</td>
<td>5V Supply</td>
</tr>
<tr>
<td>22</td>
<td>I2C0_SDA</td>
<td>Bi-Directional</td>
<td>Two-Wire Serial Interface Data I/O</td>
</tr>
<tr>
<td>23</td>
<td>GND</td>
<td>Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>24</td>
<td>GND</td>
<td>Ground</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**Table 2 - CN3 Pin Description**
4 Devices Characteristics and Ratings

4.1 Electrical Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-40°C to 95°C</td>
<td>Degrees C</td>
<td></td>
</tr>
<tr>
<td>Ambient Operating Temperature (Power Applied)</td>
<td>-30°C to 70°C</td>
<td>Degrees C</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 - Temperature Parameter

DC Characteristics (Ambient Temperature = -30°C to +70°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{dc}$</td>
<td>5V DC input</td>
<td>4.75</td>
<td>3.3</td>
<td>5.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{dc}$</td>
<td>3V3 DC input</td>
<td>3.0</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{ih}$</td>
<td>Input high voltage</td>
<td>1.26</td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{il}$</td>
<td>Input low voltage</td>
<td></td>
<td></td>
<td>0.54</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{oh}$</td>
<td>output high voltage</td>
<td>1.62</td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{ol}$</td>
<td>output low voltage</td>
<td></td>
<td></td>
<td>0.18</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 - Operating Voltage and Current
4.2 Sensor Key Specification

key specifications (typical)

- active array size: 2592 x 1944
- power supply:
  - core: 1.5V ± 5% (with embedded 1.5V regulator)
  - analog: 2.6 ~ 3.0V (2.8V typical)
  - I/O: 1.8V / 2.8V
- power requirements:
  - active: 140 mA
  - standby: 20 μA
- temperature range:
  - operating: -30°C to 70°C junction temperature
  - stable image: 0°C to 50°C junction temperature
- output formats: 8-/10-bit RGB RAW output
- lens size: 1/4"
- lens chief ray angle: 24°
- input clock frequency: 6~27 MHz

- max S/N ratio: 38 dB (maximum)
- dynamic range: 68 dB @ 8x gain
- maximum image transfer rate:
  - QSXGA (2592x1944): 15 fps
  - 1080p: 30 fps
  - 1280x060: 45 fps
  - 720p: 60 fps
  - VGA (640x480): 90 fps
  - QVGA (320x240): 120 fps
- sensitivity: 600 mV/Lux-sec
- shutter: rolling shutter / frame exposure
- maximum exposure interval: 1964 x t\text{ROW}
- pixel size: 1.4 μm x 1.4 μm
- dark current: 8 mV/s @ 80°C junction temperature
- image area: 3673.6 μm x 2738.4 μm
- package dimensions: 5985 μm x 5835 μm

Figure 2 - Sensor Key Specifications
5 Board Schematic

Figure 3 - Camera Schematic
6 Mechanical Dimensions

Figure 4 - CleO - Camera Module Dimensions
# 7 Contact Information

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Appendix A – References

Document References

For module documentations, please refer to URL below:
OV5640 datasheet: OV5640 Datasheet
LDO 2.8V Fixed Voltage datasheet: FTS31GA Datasheet

Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>LED</td>
<td>Light-emitting diode</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulation</td>
</tr>
<tr>
<td>SCCB</td>
<td>Serial Camera Control Bus</td>
</tr>
<tr>
<td>TFT</td>
<td>Thin Film Translator</td>
</tr>
<tr>
<td>FFC/FPC</td>
<td>Flexible Flat Cable/Flexible Printed Circuit</td>
</tr>
</tbody>
</table>
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<thead>
<tr>
<th>Revision</th>
<th>Changes</th>
<th>Date</th>
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<tbody>
<tr>
<td>Version 1.0</td>
<td>Initial Release</td>
<td>2016-04-20</td>
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