



Intel[®] Euclid[™] Development Kit

Product Datasheet

May 2017

Revision 001



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Revision History

Document Number	Revision Number	Description	Revision Date
335926	001	Initial Release	May 2017

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1 Description and Features

The Intel® Euclid™ Development Kit features the integration of Intel® RealSense™ depth camera technology, a motion camera, and an Intel® Atom™ x7-Z8700 Quad core CPU to produce a compact and sleek all-in-one computer and depth camera . The Intel® Euclid™ Development Kit is designed to be operable out of the box with pre-installed software including an Ubuntu® operating system.

Figure 1-1. Intel® Euclid™ Development Kit



Table 1-1: Intel® Euclid™ Development Kit Features

Feature	Specification
SOC	Intel® Atom™ x7-Z8700 Quad Core CPU Burst Speed 2.4GHz Intel Gen8 LP GPU
Memory	Single Channel, x64, LPDDR3-1600, 4GB
PMIC	Intel Whiskey Cove
WLAN	802.11 a/b/g/n, 1x1 DB
Bluetooth	BT4.0

Feature	Specification
GPS	Independent GPS
Storage	eMMC MLC 5.0 32GB BIOS 8MB Micro SD card reader Up to 128GB
Imaging	Intel RealSense 3D camera Intel RealSense Motion camera
Audio	Audio Codec - Low power, dual I2S interface Speaker - X1, MONO mode, 1W D-MIC - X3, two always on
Sensor	Sensor Hub ISH Accelerometer Digital Compass Gyro Ambient Light Sensor & Proximity Environmental sensors Barometer/Altimeter/Humidity/Temperature sensing Thermal sensor NTC thermistor x4
LEDs	Power On LED x1, Green, Power on/off indicator Charging LED x1, Red, Lower power and charging indicator
Buttons	Power On/Off Soft Key x2
Fan	Fan x1
I/O	Micro USB3.0 x1 Standard USB3.0 type A x1 Micro HDMI - HDMI1.4b, 4K2K@30fps UART(Micro-USB2.0 CONN) x1
Battery/Charging	Battery - 1S1P, 3.8V, 2200mAh Charging - DC IN through Micro-USB3.0 CONN, 5V/3A
Debug Hook	LPC, USB debug, UART, SPI, I2C
OS	Linux
Accessories	DC-IN power adapter box USB 5V/3A power adapter Micro USB3.0 cable Micro HDMI cable Adaptors to UK/EU
Others	Tripod hole

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2 Overview

2.1 Description

The Intel® Euclid™ Development Kit can provide 6 degree of freedom motion, fisheye monochrome, color, depth, and infrared video streams.

It uses stereovision techniques augmented by an infrared projection system to produce a depth stream in a compact, low power package.

Figure 2-1. Example Color Stream

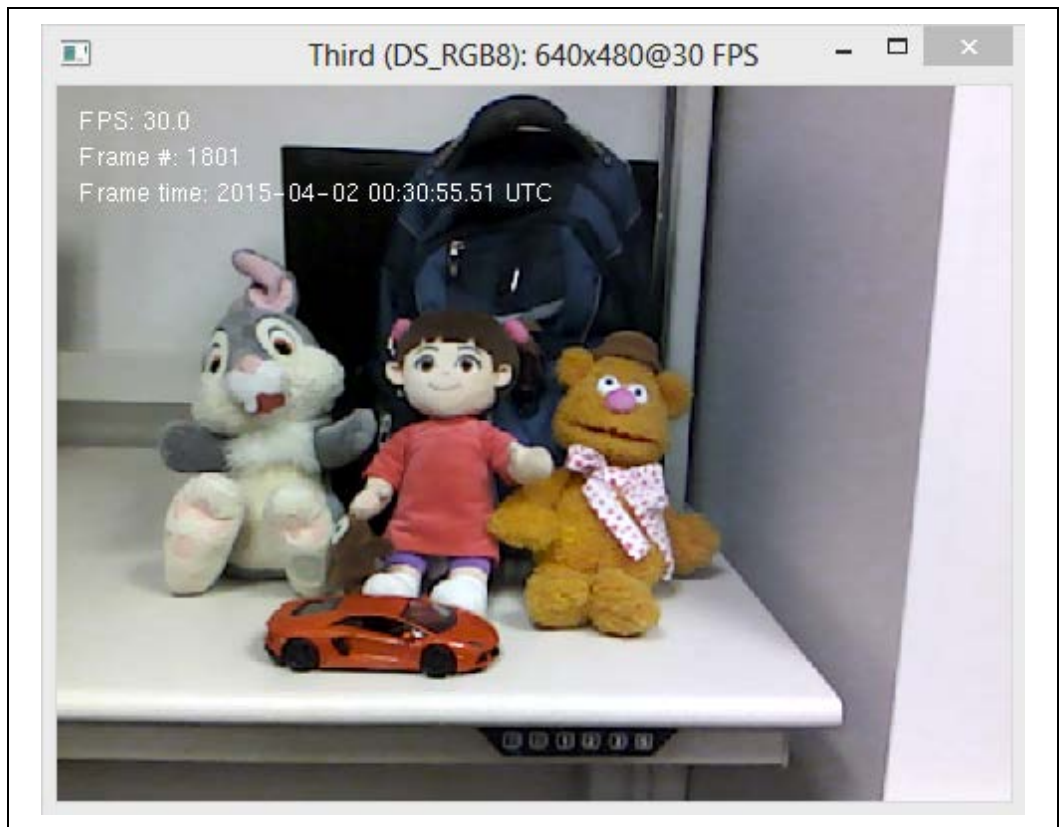


Figure 2-2. Example Depth Stream

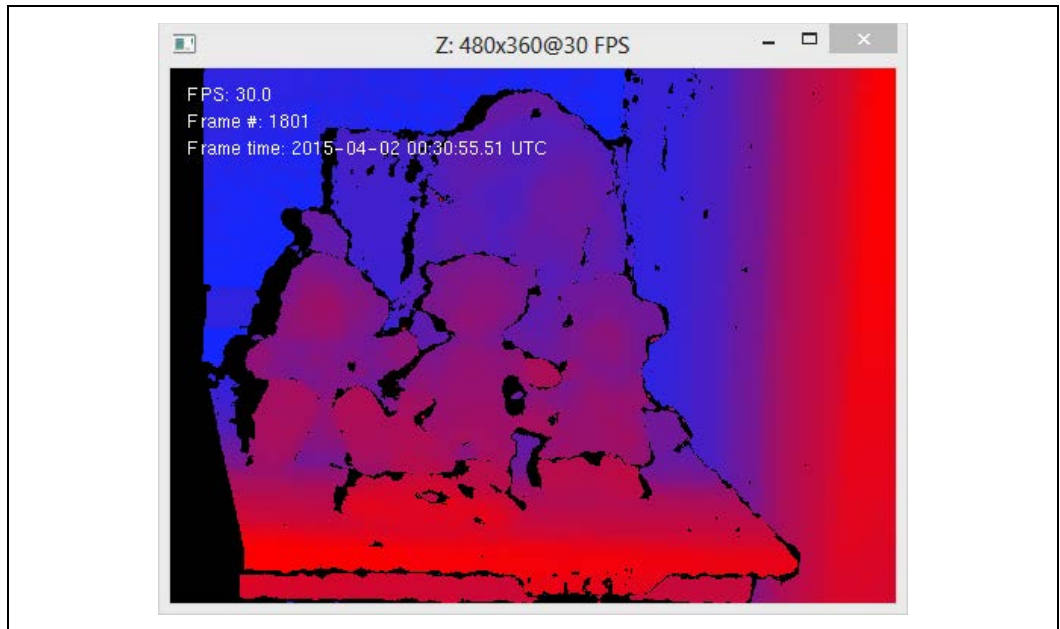


Figure 2-3. Example Fisheye Stream



2.2 Product Code

The product code is an identification number. The Intel® Euclid™ Development Kit product code is MM# 956912.

2.3 Storage and Operating Conditions

Table 2-1: Storage and Operating Conditions

CONDITION	DESCRIPTION	MIN	MAX	UNIT
Storage (Still Air), Not Operating	Temperature (Sustained, Controlled) ⁽¹⁾	0	60	°C
	Temperature (Short Exposure) ⁽²⁾	0	35	°C
	Humidity, Non-Condensing	95 RH, 35 °C		
Operating ⁽³⁾ (Still Air)	Temperature	0	35	°C
NOTES: ⁽¹⁾ Controlled conditions should be used for long term storage of product. ⁽²⁾ Short exposure represents temporary max limits acceptable for transportation conditions. ⁽³⁾ Component case temperature limits must be met for all operating temperatures.				

2.4 Handling Conditions

The Intel® Euclid™ Development Kit has limited ESD protection built into the unit.

Table 2-2: Electrostatic Discharge Caution

	To provide a consistent ESD protection level, it is recommended that the JEDEC JESD625-A requirements standard be incorporated into the ESD environment controls.
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2.5 Camera and Projector Field of View

The FOP and FOV of each imaging component are listed below in [Table 2-3](#).

Table 2-3: Imaging Component Effective Field of View and Projections

Component	Diagonal	Vertical	Horizontal
IR Laser Projector FOP	80° ± 5%	60° ± 5%	60° ± 5%
Infrared Camera FOV	70° ± 5%	46° ± 5%	59° ± 5%
Color Camera FOV	75° ± 4%	41.5° ± 2%	68° ± 2%
Fisheye Camera FOV	166.5° ± 4%	100° ± 3%	133° ± 3%

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3 Functional Specification

3.1 Embedded 3D Imaging System

The Intel® Euclid™ Development Kit module uses stereo vision to calculate depth. The stereo vision implementation consists of left infrared camera, right infrared camera, and an infrared laser projector. The left and right camera data is sent to the Intel® Euclid™ Development Kit ASIC. The ASIC calculates depth values for each pixel in the image. The infrared projector is used to enhance the ability of the system to calculate depth in scenes with low amounts of texture. Traditionally, scenes with low texture such as walls presented a challenge for stereo vision systems to calculate depth. Note the camera module output type is a depth measurement from the parallel plane of the module and not the absolute range from the module cameras as shown in Figure 3-2.

Figure 3-1: Active Stereo Technology Overview

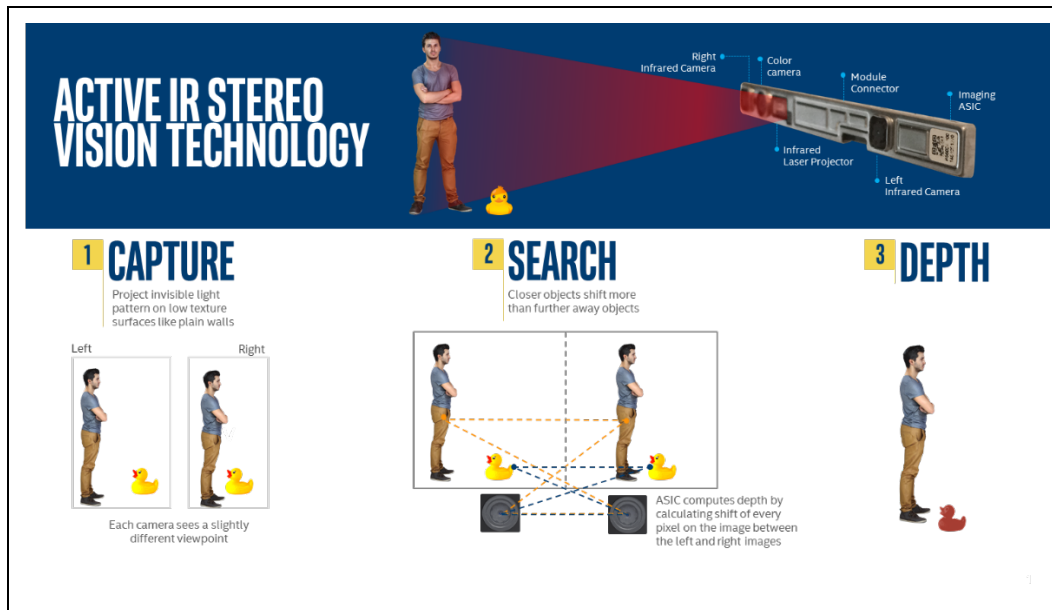
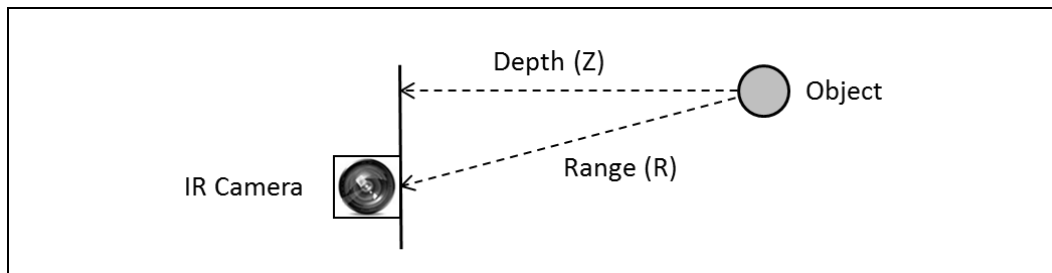


Figure 3-2: Depth (Z) versus Range (R)



3.2 Camera Video Stream Formats

Table 3-1: Supported Left/Right Infrared Camera Video Stream Formats and Modes

Format	Description	Resolution	Frame Rates
RY12LY12_4_3	12 bits right, 12 bits left, 4 pixels packed into 3 32 bit words	640x480, 492x372, 332x252	30, 60
LY_8_4_1	8 bits left, 4 pixels packed into 1 32 bit words	640x480, 492x372, 332x252	30, 60
LY12_2_1	12 bits left, 2 pixels packed into 1 32 bit words	640x480, 492x372, 332x252	30, 60
RY8LY8_2_1	8 bits right, 8 bits left, 2 pixels packed into 1 32 bit words	640x480, 492x372, 332x252	30, 60

Table 3-2: Supported Depth Video Stream Formats and Modes

Format	Description	Resolution	Frame Rates
Z16_2_1	16 bits, 2 pixels packed into 1 32 bit word	628x468, 480x360, 320x240	30, 60

Table 3-3: Supported Color Camera Video Stream Formats and Modes

Format	Description	Resolution	Frame Rates
YUY2		1920x1080	30
YUY2		640x480	15,30,60
YUY2		320x240	30,60

Table 3-4: Supported Fisheye Camera Video Stream Formats and Modes

Format	Description	Resolution	Frame Rates
Raw10	Monochrome image pattern	640x480	5, 30, 60

Note: The modes listed above are hardware supported modes and may not be visible to applications.

	<p>All frame rates are expressed as nominal. Effective frame rates can vary depending on the exposure settings of the camera. Camera settings that increase the exposure time can decrease the effective frame rate.</p>
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3.3 Intel® Euclid™ Development Kit Power Consumption

Table 3-5: Nominal Power Consumption

DEPTH MODE	COLOR MODE	Fisheye Mode	SOC Usage	POWER	UNIT
VGA, 60FPS	HD, 30FPS	VGA, 60FPS	70%	5.0	W

Note: Power consumption is affected by workloads and operating conditions, actual power consumption may vary.

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4 *Regulatory Compliance*

Refer to the Intel® Euclid™ Development Kit user manual for regulatory compliance content.

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5 Software Controls

5.1 Infrared Camera Functions

Intel® Euclid™ Development Kit exposes the following image settings.

Table 5-1: Left and Right IR Sensor Configuration

Property	Min	Max	Default	Auto
Image Gain	1	63.9	-	Yes
Image Exposure	0.01	33.3	-	Yes

Note: The left and right IR sensors must share settings; it is not possible to configure each IR sensor individually.

5.2 Color Camera Functions

Table 5-2: RGB Sensor Configuration

Property	Min	Max	Default	Auto
Image Gain	1	128	64	Yes
Image Exposure	0.1	62.5	15.62	Yes
Brightness	0	255	55	No
Contrast	16	64	32	No
Saturation	0	255	128	No
Hue	-2200	2200	0	No
Gamma	100	280	220	No
White Balance	2000	8000	4600	Yes
Sharpness	0	7	0	No
Backlight Comp	0	4	1	No
PowerLine Freq (Hz)	50	60	60	Yes

5.3 Fisheye Camera Functions

Table 5-3: Fisheye Sensor Configuration

Property	Min	Max	Default	Auto
Power Mode	Standby	Active	-	-

Property	Min	Max	Default	Auto
Trigger (from Depth Camera)	Disable	Enable	Disable	-
Exposure	0.02ms	32ms	4ms	Yes
Gain	0	255	16	Yes

5.4 Inertial Measurement Sensor Functions

Table 5-4: Inertial Measurement Sensor Configuration

Property	Min	Max	Default	Auto
IMU Sync (Gyro & Acc)	Disable	Enable	Disable	-
Resolution	32MHz	8KHz	32MHz	-

5.5 Motion Control Unit Functions

Table 5-5: Motion Control Unit

Property	Min	Max	Default	Auto
Time Stamp Events	Disable	Enable	Disabled	-
G0 Trigger	Rising Edge	Falling Edge	Rising Edge	-
G1 Trigger	Rising Edge	Falling Edge	Rising Edge	-

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