

Intel® RealSense™ Tracking Camera

Datasheet

Intel® RealSense™ Tracking Camera T265

March 2019

Revision 002

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Revision History

Document Number	Revision Number	Description	Revision Date
572522	001	Initial Release	Jan 2019
	002	<ul style="list-style-type: none">• Table 1-1. Inertial Measurement Specifications• Figure 1-1. Center of Tracking Location• Table 4-5: Boot Device Vendor and Product IDs• 5.1 Manufacturer's Information• 5.2 NRTL Statement	Mar 2019

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1 *Description and Features*

<p><u>Description</u></p> <p>Intel® RealSense™ Tracking Camera T265 is a tracking capable peripheral device based on visual and inertial sensor fusion. The assembly contains fisheye cameras, IMU module and a processing ASIC (Intel® Movidius™ Myriad™ 2 MA215x) with USB 3.0 interface to host processor SoC.</p> <p><u>Features</u></p> <ul style="list-style-type: none"> • Tracking feature using Fisheye Camera and Inertial Measurement Unit (IMU) • Intel® Movidius™ Myriad™ 2 ASIC solution • Middleware processed on Myriad 2 ASIC; Enabling higher CPU performance • 6DoF data streaming to host • Low latency 	<p><u>Usages/Markets</u></p> <ul style="list-style-type: none"> • Robots • Drones • Augmented Reality and Virtual Reality <p><u>Minimum System Requirements</u></p> <ul style="list-style-type: none"> • Windows* 10/Linux* • USB 3.0 (without video streaming USB 2.0 is sufficient) <p>Please check with your Intel representative for platform and OS combination supported and enablement timelines</p>
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2 Introduction

2.1 Purpose and Scope of this Document

This document captures the specifications for the Intel® RealSense™ Tracking Camera T265.

2.2 Terminology

Term	Description
6DoF	6 Degrees of Freedom refers to the freedom of movement in three dimensional space. Movement such as forward/backward, up/down, left/right, pitch, roll and yaw.
Fisheye camera	Also referred as wide angle camera
FOV	Field Of View describes the angular extent of a given scene that is imaged by a camera. A camera's FOV can be measured horizontally, vertically, or diagonally
Lens	This refers to the optical component of an imager. Its purpose is to focus the incoming light rays onto the CMOS chip in the imager.
System On Chip (SoC)	Integrated circuit (IC) that integrates all components of a computer or referred in this document as host processor SOC
Imaging or Optical module	This refers to a stiffened module containing at least two imagers. The distance between the imagers, which is referred to as the baseline or intraocular spacing, is typically in the range of 20 mm to 70 mm.
IMU	Inertial Measurement Unit
B2B	Board to Board connector
IR Cut Filter	Filter designed to prevent infrared (IR) light reaching the imagers.
TBD	To Be Determined. In the context of this document, information will be available in a later revision.

2.3 Overview

Intel® RealSense™ Tracking Camera T265 is a computer vision solution that outputs 6DoF data to the host system for immersive experience, navigation and mapping.

2.4 Tracking Camera Technology Overview

Intel® RealSense™ Tracking Camera T265 uses inputs from dual fisheye cameras (OV9282) and an IMU (BMI055) along with processing capabilities from the Movidius MA215x ASIC in order to provide the host system 6DoF poses.

2.5 T265 Tracking System

The Intel® RealSense™ Tracking Camera T265 has one main board which includes all components on a single board. The camera is connected to the host platform via USB connector.

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3 Intel® RealSense™ Tracking Camera T265 Component Specification

Components in the Intel® RealSense™ Tracking Camera T265 are listed in the table below.

3.1 T265 Device Components

The device components are described in Table 3-1. The form factor module includes two fisheye image sensors, an Inertial Measurement Unit (IMU) and VPU processing ASIC.

Table 3-1. Form Factor Module

Component	Description
BMI055 IMU	Accelerometer and Gyroscope in a single package
OV9282 Fisheye Camera	Monochrome image sensor with wide field of view
Movidius MA215x	VPU Processing ASIC
Stiffener	Reinforcement housing to keep imagers aligned
Label	Manufacture and product identifier information
Other Components	IR Cut Filter, Voltage Regulators, etc.

Table 3-2. Form Factor Properties

Imaging Module	Intel® RealSense™ Tracking Camera T265
Baseline	64mm +/- 0.15mm
Left/Right Fisheye Imagers	OV9282
Shutter Type	Global
Fisheye FOV (degrees)	D:163

H – Horizontal FOV, V – Vertical FOV, D – Diagonal FOV, X – Length, Y – Breadth, Z – Thickness

3.1.1 Inertial Measurement Unit

The IMU is a system-in-package for the detection of acceleration in 3 dimensions and rotations in 3 dimensions.

Table 3-3. Inertial Measurement Specifications

Parameter	Properties
Degrees of Freedom	6
Acceleration Range	±4g
Accelerometer Sample Rate	200Hz
Gyroscope Range	±2000 Deg/s
Gyroscope Sample Rate	62.5Hz

NOTES:

1. 6DoF pose data provided to host platform at a sample rate of 200Hz. The sample rate indicate average number of samples per second and might not imply a uniform distribution of the samples.

3.1.2 Fisheye Imagers

The fisheye imagers are used in the process of producing 6DoF data streamed to the host platform. The imagers provide monochrome images at a high frame rate.

Table 3-4. Fisheye Image Sensor Properties

Parameter	Camera Sensor Properties
Active Pixels	848 X 800
Sensor Aspect Ratio	1.06
Format	8bit, 10-bit RAW
Filter Type	IR Cut Filter
Focus	Fixed
Shutter Type	Global Shutter
Signal Interface	MIPI CSI-2, 2 X Lanes



3.1.3 Form Factor Power Requirements

The form factor is powered through USB VBUS power.

Table 3-5. Form Factor Power Requirements

Parameter		Min	Nom	Max	Unit
VCC	Supply Voltage	4.5	5	5.25	V
ICC	Supply Current		300	300	mA

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4 Intel® RealSense™ Tracking Camera T265

4.1 Intel® RealSense™ Tracking Camera T265 Device

Figure 4-1. Intel® RealSense™ Tracking Camera T265



4.1.1 Intel® RealSense™ Tracking Camera T265 Mechanical Dimensions

Table 4-1. Intel® RealSense™ Tracking Camera T265 Mechanical Dimensions

Dimension	Min	Nominal	Max	Unit
Width	-	108.00	-	mm
Height	-	24.50	-	mm
Depth	-	12.50	-	mm
Weight	-	60	-	gr

4.1.2 Intel® RealSense™ Tracking Camera T265 Thermals

Table 4-2. Max Skin Temperature

Tracking Camera	Max Skin Temperature (25°C Ambient in Open Environment)
T265	40°C

4.1.3 Intel® RealSense™ Tracking Camera T265 Storage and Operating Conditions

Table 4-3. Storage and Operating Conditions

Condition	Description	Min	Max	Unit
Storage (Still Air), Not Operating	Temperature (Sustained, Controlled) ⁽¹⁾	0	40	°C
	Temperature (Short Exposure) ⁽²⁾	-30	65	°C
	Humidity, Non-Condensing	90% RH, 30°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.

4.1.4 Product Identifier and Material Code

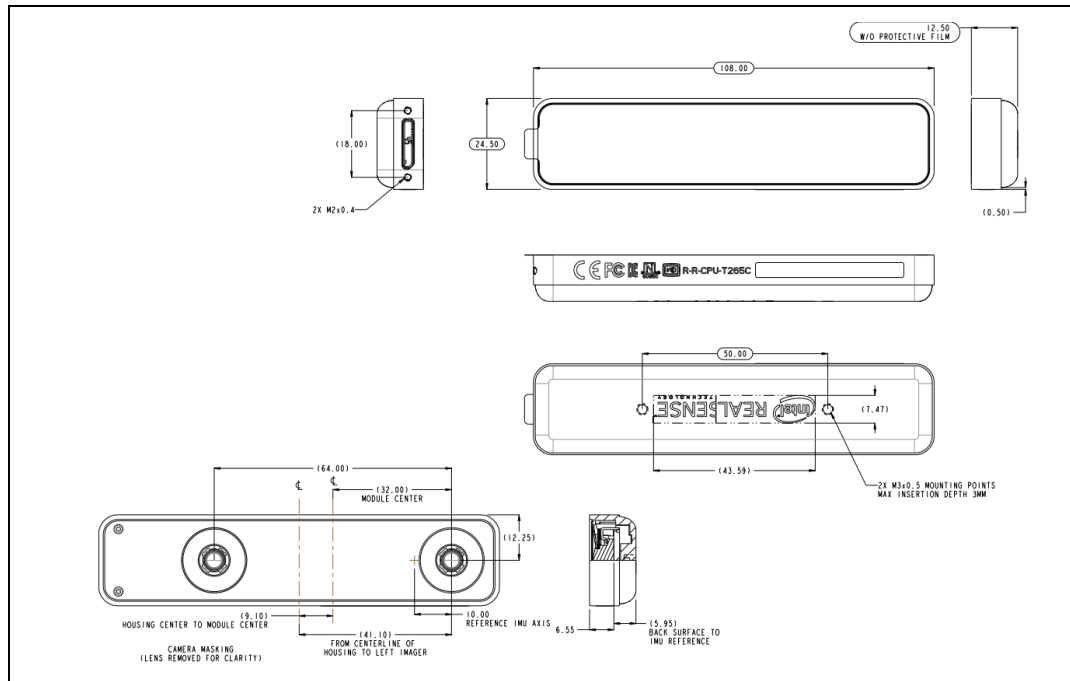
Table 4-4. Product Identifier and Material Code

Production	Product Material Code
Tracking Camera T265	999AXJ

4.2 T265 Center of Tracking Location

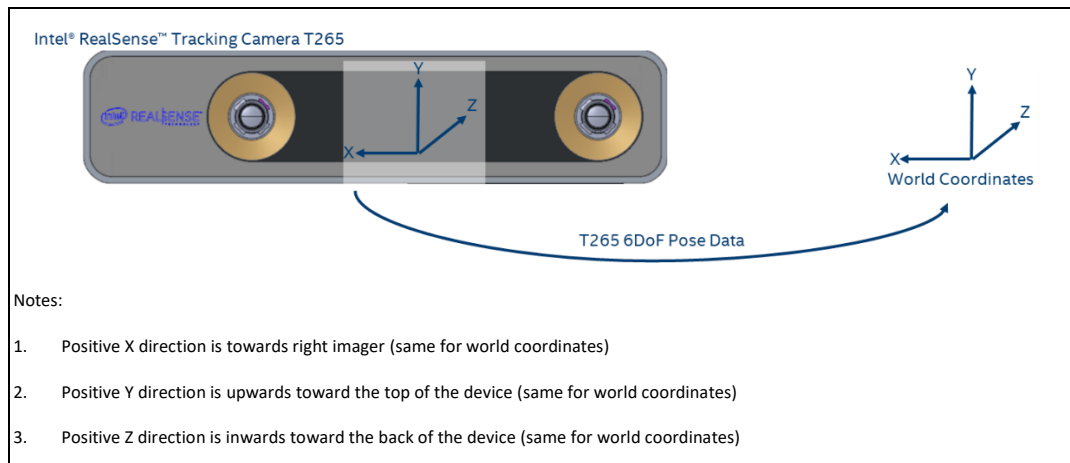
The user of the T265 device must take into consideration the location of tracking as it pertains to the PCB inside chassis and the relationship this location has with respect to the overall peripheral camera device. The center of tracking corresponds to the center location between the right and left imagers on the PCB. The information in the figure below shows the different mechanical distances of the chassis that houses the PCB. The center of tracking information also pertains to the coordinate system which will be discussed in future section in this document.

Figure 4-2. Center of Tracking Location



4.3 Coordinate System

Figure 4-3. T265 Coordinate System



4.4 Boot Device Information

Table 4-5: Boot Device Vendor and Product IDs

Description	VID	PID
Movidius Device	03E7	2150
Intel® RealSense™ Tracking Camera T265	8087	0B37

1. If T265 is being connected to host system via USB hub, keep in mind that T265 will enter into USB enumeration protocol as soon as 5V has been provided on VBUS pin. USB protocol is handled by the Movidius MA215x device.
2. <1% drift observed in repeated testing in multiple use cases and environments. AR/VR use cases were tested with the T265 mounted on the head in indoor living and office areas with typical indoor lighting including sunlight entering the room. Wheeled robot use cases tested with wheel odometer data integrated, in indoor office and home environments. Sufficient visibility of static tracked visual features is required, the device will not work in smoke, fog, or other conditions where the camera cannot observe visual reference points. Performance will vary across use cases and environments, the system will attempt to detect and report degraded performance but may fail to do so.

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5 Regulatory Compliance



System integrators should refer to their respective regulatory and compliance owner to finalize regulatory requirements for a specific geography.



Do not power on the product if any external damage was observed.

Do not try to update camera firmware that is not officially released for specific camera module SKU and revision.

5.1 Manufacturer's Information

Manufactured by Intel Corporation
Attn: Corp. Quality
2200 Mission College Blvd., Santa Clara, CA 95054 USA

EU Single Place of Contact:
Attn: Corp Quality
Intel Deutschland GmbH
Am Campeon 10-12
Neubiberg, 85579 - Germany

5.2 NRTL Statement

For the US and Canada market, this product has been tested and certified by Nemko, and found to be compliant with all applicable requirements of the specifications below.

UL 60950-1 2nd Edition, CAN/CSA C22.2 No. 60950-1-07, Information Technology Equipment – Safety – Part 1: General Requirements

Nemko is a Nationally Recognized Testing Laboratory (NRTL), recognized by US Occupational Safety and Health Administration (OSHA) as qualified to perform safety testing and certifications covered within its scope of recognition.

Figure 5-1. NRTL Certification



<https://www.nemko.com/certification/product-certification/certificates>

5.3 Ecology Compliance

5.3.1 RoHS Declaration

China RoHS Declaration

产品中有毒有害物质的名称及含量
Hazardous Substances Table

部件名称 Component Name	有毒有害物质或元素 Hazardous Substance					
	铅 Pb	汞 Hg	镉 Cd	六价铬 Cr (VI)	多溴联苯 PBB	多溴二苯醚 PBDE
相机 Camera	X	○	○	○	○	○
印刷电路板组件 Printed Board Assemblies	X	○	○	○	○	○
电缆 Cable	○	○	○	○	○	○

<p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。</p> <p>○：Indicates that this hazardous substance contained in all homogeneous materials of such component is within the limits specified in GB/T 26572.</p> <p>×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 标准规定的限量要求。</p> <p>×：Indicates that the content of such hazardous substance in at least a homogeneous material of such component exceeds the limits specified in GB/T 26572.</p> <p>对销售之日的所售产品，本表显示我公司供应链的电子信息产品可能包含这些物质。注意：在所售产品中可能会也可能不会含有所有所列的部件。</p> <p>This table shows where these substances may be found in the supply chain of our electronic information products, as of the date of sale of the enclosed product. Note that some of the component types listed above may or may not be a part of the enclosed product.</p>	<p>除非另外特别的标注，此标志为针对所涉及产品的环保使用期限标志。某些可更换的零部件可能会有一个不同的环保使用期限（例如 电池单元模块）。</p> <p>用于产品在产品手册中所规定的条件下工作。</p> <div data-bbox="266 798 527 1022" data-label="Image">  </div> <p>The Environment-Friendly Use Period (EFUP) for all enclosed products and their parts are per the symbol shown here, unless otherwise marked. Certain field-replaceable parts may have a different EFUP (for example, battery modules) number. The Environment-Friendly Use Period is valid only when the product is operated under the conditions defined in the product manual.</p>
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In the European Union, this symbol indicates that this product including battery must not be disposed of with household waste. It is your responsibility to hand it over to a designated collection point for the recycling of waste electrical and electronic equipment. For more information, please contact your local waste collection center or the point of purchase of this product.