BROOKMAN TECHNOLOGY

Time of Flight 3D Depth Sensor

Product Catalog

株式会社ブルックマンテクノロジ
Brookman Technology, Inc.

brookmantech.com

BROOKMAN TECHNOLOGY

BT008D

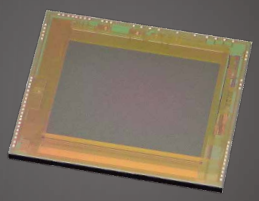
Brookman's

CMOS-ToF 3-Tap Depth Image Sensor

BT008D is a CMOS-ToF depth image sensor designed for 3D depth sensing based on indirect Time of Flight (iToF) method with short pulse modulation (SPM). Brookman's innovative multi-tap gating pixel structure and an optimized pixel operation for iToF with SPM achieve high speed and high SNR depth sensing without dynamic motion defects. A QVGA resolution, approximately 80,000 effective pixel points, can be reasonable and well-matched for fast post-processing. In addition, this sensor is equipped with on-chip 12-bit high speed analog to digital converter so that it gets a fast readout time with low temporal noise. MIPI CIS-2 and CCI are adopted to the sensor interface.

Application Example

Self-driving vehicle(Drone, AGV, etc.), Gesture/Body Recognition, AR/MR, Gaming, Biological Device



Key specification

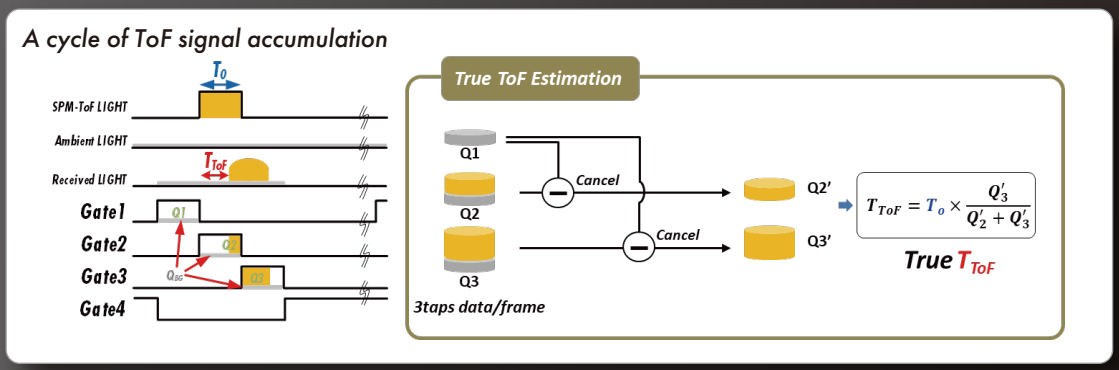
Sensor model	BT008D
Optical format	1/2.8 Type
Die size	7.6mm x 6.5mm
Pixel size	16.8μm x 16.8μm
Number of pixels	328(H) x 247(V) pixels
Temperature sensor	328(H) x 1(V); 1 line
Pixel structure	3-tap gates and a drain gate
ADC resolution	12-bit on-chip
Frame rate	10fps, 30fps (typ.) and 60fps
Readout time	5.6msec (typ.)
Sensor interface	MIPI CSI-2; 2 data and 1 clock lanes CCI(I2C standard); 2-lane serial interface
Input clock frequency	27MHz(typ.)
Output data rate	378Mbps(typ.)
Power supply	3.3V
Power consumption	≦150mW @ 30fps (typ.)
Sensor I/O pins	47 pins

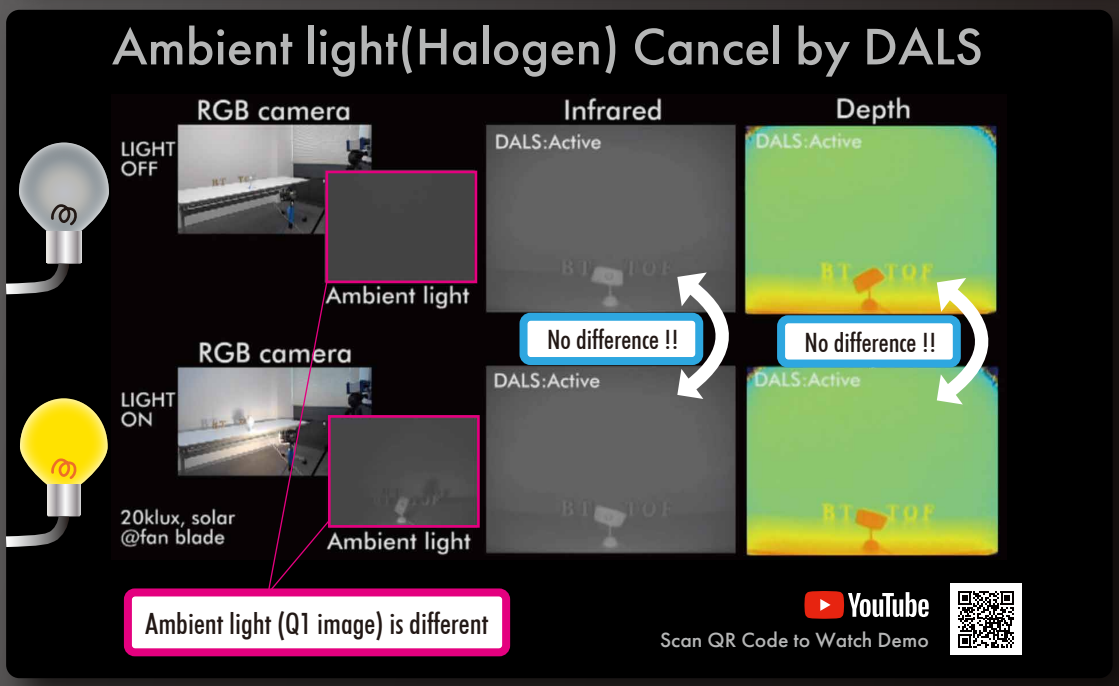
BROOKMAN TECHNOLOGY

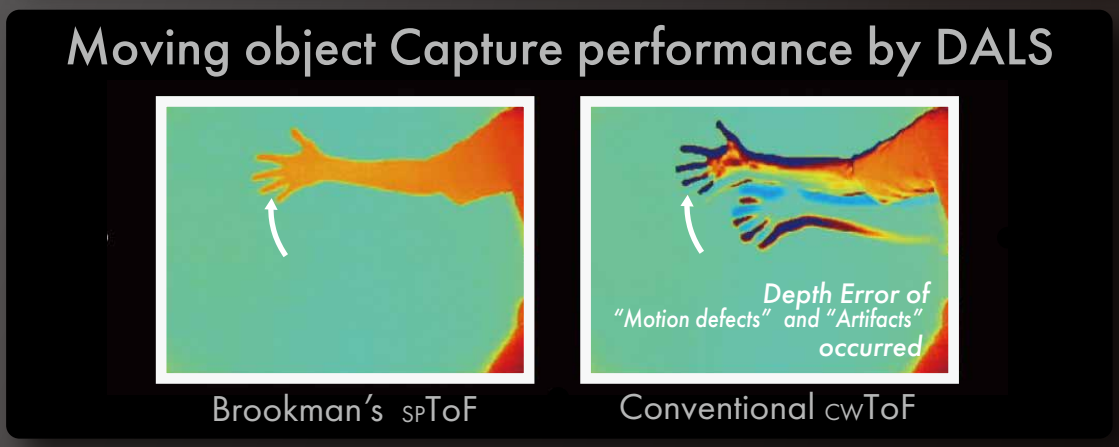
BT008D

Dynamic Ambient Light Suppression Technology

Dynamic Ambient Light Suppression (DALS) technology by BT008D 3-tap depth image sensor reduces distance error caused by the interference of ambient light. For the DALS operation, this sensor outputs 12-bit of signal amplitude data per pixel from each of three taps. While the ToF calculation, ambient light noise can be canceled by calculating with 3-tap outputs, and the true ToF is simply derived within the same frame. It is notably effective in the situations, not only under strong ambient light, but also for sensing high-speed moving objects.







BROOKMAN TECHNOLOGY

Evaluation Camera Kits

BROOKMAN TECHNOLOGY

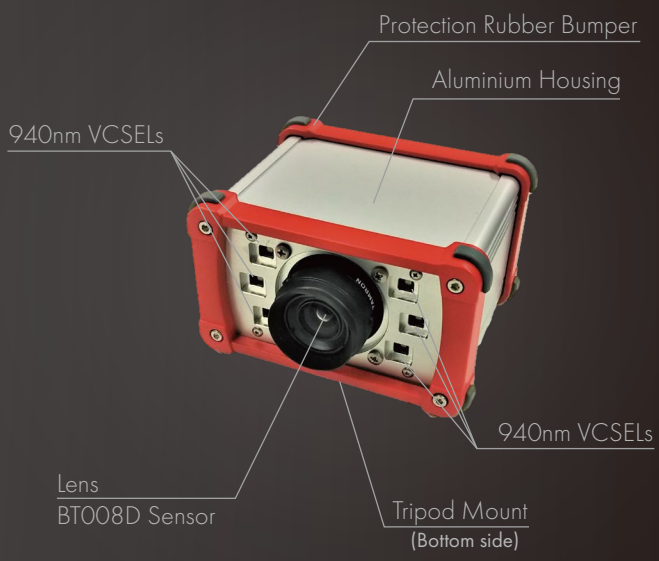
BEC80T RED

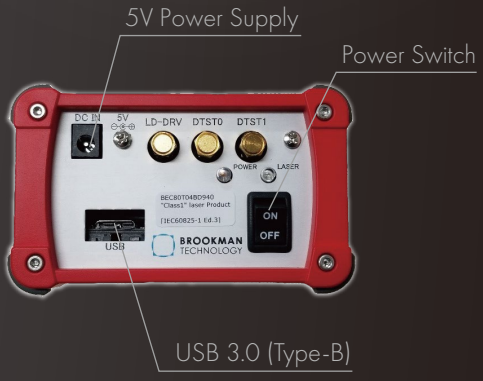
High Tolerance to Sunlight

Short Pulse ToF | **VCSEL 940nm** | **Max. Range ~10m** | **Up to 60fps**

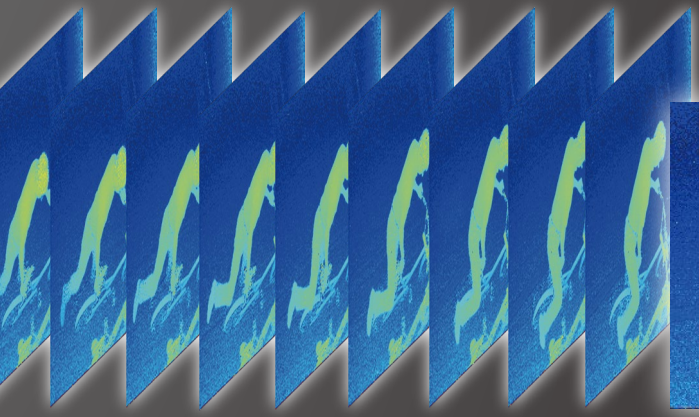
The Brookman's ToF Standard Evaluation Camera

Model	BEC80T04BD940
Dimensions	116mm x 107mm x 70mm (body only)
Weight	530g
Depth sensor	BT008D CMOS-ToF 3 tap sensor
Depth sensing method	Indirect ToF with short pulse modulation
Measurement range	0.5m ~ 10m
Frame rate	10fps, 30fps(Typ.) and 60fps
Acquisition time of per frame	27msec(Typ.) @30fps
Number of active pixels	320(H) x 240(V); ~80000 Measuring points
Illumination*	6x VCSEL (λ : 940nm) Laser class 1 certificated
Illumination power	Peak: 2.7W/VCSEL Ave.: 1.82W/Camera
Depth noise	≦2.5% of distance @ 8m**
Field of view	40°(H) x 30°(V)
Lens	F#1.2, 1/3 Type
Power supply	DC 5V / ≦6A
Interface	USB 3.0 (Micro-B)
Operation system	64-bit Windows 10





Don't disassemble and/or modify the products for safety reasons.
* This camera is classified in IEC standards (IEC 60825-1 Ed.3: 2014).
** Targert reflectance: 80%, Integration time: 27msec, Frame rate: 30fps, 30frames average, 10x10 pixels @Center of active pixel area.



Depth image

Infrared image

Ambient light ~55k Lux (solar) @ Outdoor

YouTube
Scan QR Code to Watch Demo

BROOKMAN TECHNOLOGY

BEC80T BLUE

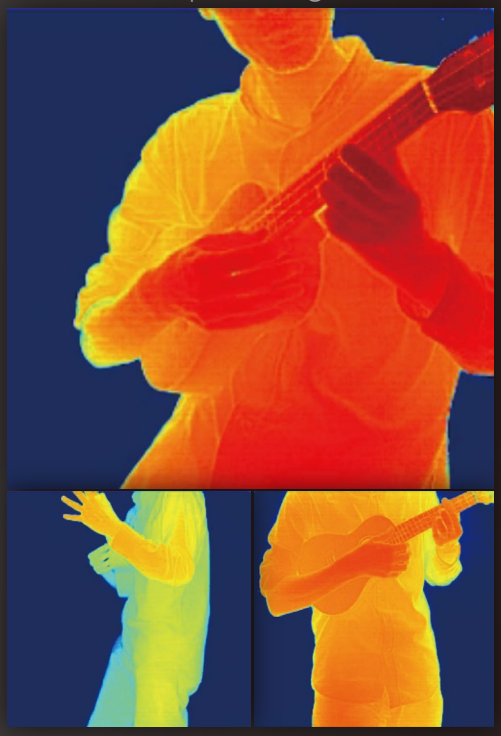
For Indoor Use

Short Pulse ToF **VCSEL 850nm** **Range shift ~8m** **Up to 60fps**

2x higher "Sensor Q.E." than BEC80T VCSEL 940nm model

Model	BEC80T04BC
Dimensions	116mm x 107mm x 70mm (body only)
Weight	485g
Depth sensor	BT008D CMOS-ToF 3 tap sensor
Depth sensing method	Indirect ToF with short pulse modulation
Measurement range	0.5m ~ 4m (Range shift 4m ~ 8m)
Frame rate	10fps, 30fps(Typ.) and 60fps
Acquisition time of per frame	27msec(Typ.) @30fps
Number of active pixels	320(H) x 240(V); ~80000 Measuring points
Illumination*	2x VCSEL (λ : 850nm) Laser class 1 certificated
Illumination power	Peak: 1.2W/VCSEL Ave.: 0.22W/Camera
Depth noise	≦1% of distance @ 4m**
Field of view	60°(H) x 45°(V)
Lens	F#1.2, 1/3 Type
Power supply	DC 5V / ≦3A
Interface	USB 3.0 (Micro-B)
Operation system	64-bit Windows 10

Depth image

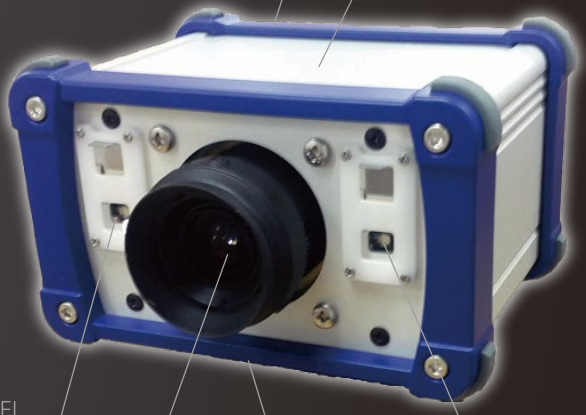


Don't disassemble and/or modify the products for safety reasons.
* This camera is classified in IEC standards (IEC 60825-1 Ed.3: 2014).
** Targert reflectance: 80%, Integration time: 27msec, Frame rate: 30fps, 30frames average, 10x10 pixels @Center of active pixel area.

5V Power Supply

Power Switch

USB 3.0 (Type-B)



Protection Rubber Bumper

Aluminium Housing

850nm VCSEL

Lens

BT008D Sensor

Tripod Mount
(Bottom side)

850nm VCSEL

YouTube
Scan QR Code to Watch Demo

BROOKMAN TECHNOLOGY

BEM80T MODULE

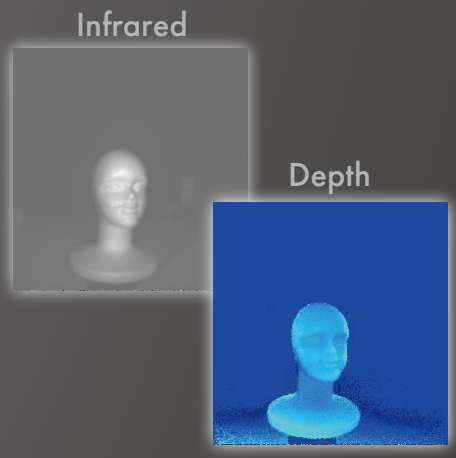
For Near-range Tracking

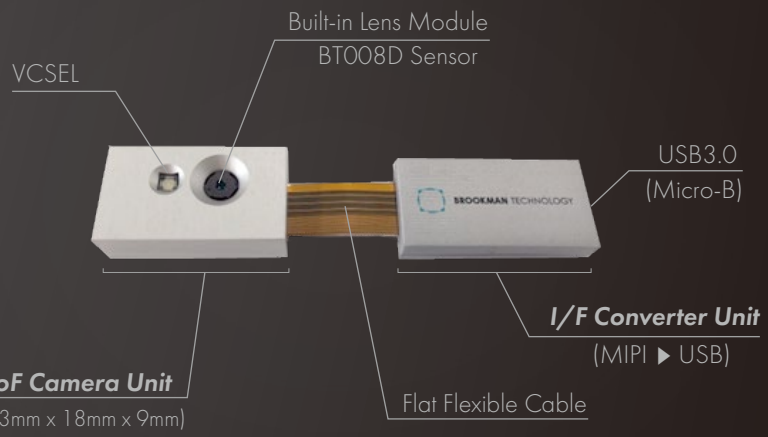
Smaller design **Short Pulse ToF** **Up to 60fps**

Reference design of ***Tiny!*** Camera Unit

Model	BEM80T04BB	BEM80T04BC940
Dimensions	90mm x 18mm x 9mm	90mm x 18mm x 9mm
Weight	16g	16g
Depth sensor	BT008D CMOS-ToF 3 tap sensor	BT008D CMOS-ToF 3 tap sensor
Depth sensing method	Indirect ToF with short pulse modulation	Indirect ToF with short pulse modulation
Measurement range	0.2m ~ 2m	0.2m ~ 1.3m(T.B.D.)
Frame rate	10fps, 30fps(Typ.) and 60fps	10fps, 30fps(Typ.) and 60fps
Acquisition time of per frame	27msec(Typ.) @30fps	27msec(Typ.) @30fps
Number of active pixels	240(H) x 240(V) ; ~58k measuring points	240(H) x 240(V) ; ~58k measuring points
Illumination*	1x VCSEL (λ : 850nm) Laser class 1 certificated	1x VCSEL (λ : 940nm) Laser class 1 certificated
Illumination power	Peak: 1.2W/VCSEL Ave.: 0.12W/Camera	Peak: 2W/VCSEL Ave.: 0.2W/Camera
Depth noise	≦2% of distance @ 1.5m**	≦2% of distance @ 1m(T.B.D.) **
Field of view	45°(H) x 45°(V)	45°(H) x 45°(V)
Lens	Integrated F#2.2 lens in module	Integrated F#2.2 lens in module
Power supply	DC 5V/ ≦0.9A (USB bus power)	DC 5V/ ≦0.9A (USB bus power)
Interface	USB 3.0 (Micro-B)	USB 3.0 (Micro-B)
Operation system	64-bit Windows 10	64-bit Windows 10

Don't disassemble and/or modify the products for safety reasons.
* Max integration counts at 30fps.This camera is classified in IEC standards (IEC 60825-1 Ed.3: 2014).
** Targert reflectance: 80%, Integration time: 27msec, Frame rate: 30fps, 30frames average, 10x10 pixels @Center of active pixel area.





YouTube
Scan QR Code to Watch Demo

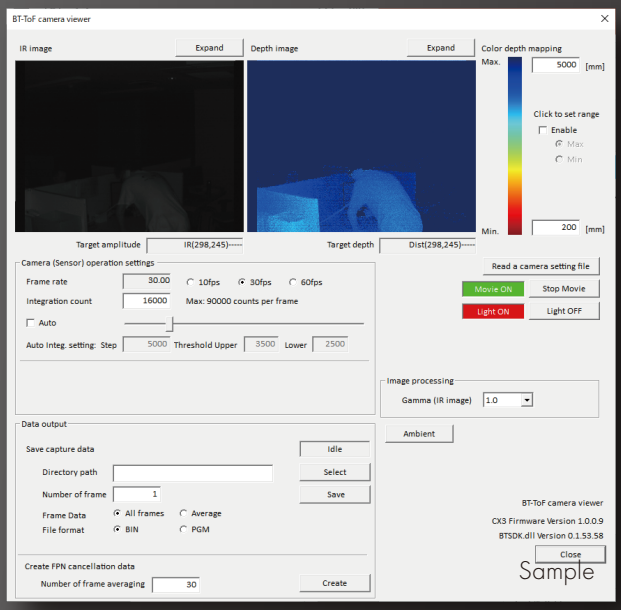
Rev. 1.0.1

Software

Newly Updated!

BEC80T04 **BEM80T04** **3rd Gen. BT-ToF Range Estimation Algorithm**

BTSDK DEMO Viewer

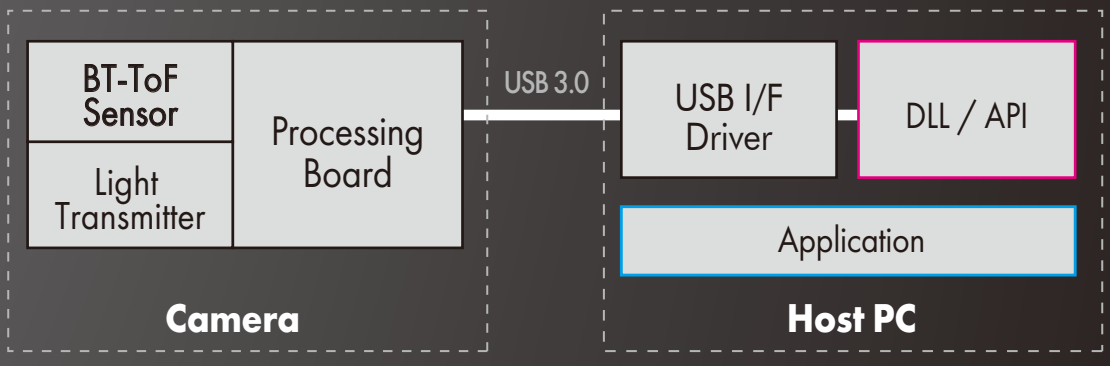


For Windows 10

GUI Functions

- VCSEL Light On/Off
- Live view window
  - Infrared image
  - Depth image
- Capture image data
  - Depth and IR image
  - Save as Binary and PGM format
- Camera and sensor control
  - Integration time control
  - Frame rate control
  - Depth color mapping
  - ...etc

Evaluation Camera System Block Diagram



Brookman's ToF application SDK

- BT-ToF API documents for application developer
- BT-ToF API example source code for VS C++ 2017

BROOKMAN TECHNOLOGY

Custom Module Design Services

When you step up the stage for your own product development after testing Brookman's CMOS-ToF multi-tap sensor, we provide several solutions to assist your depth sensing system development. Our engineering team will work together for your system optimization, such as PCB design for camera module, FPGA design, algorithm study on calibration and error correction, etc..

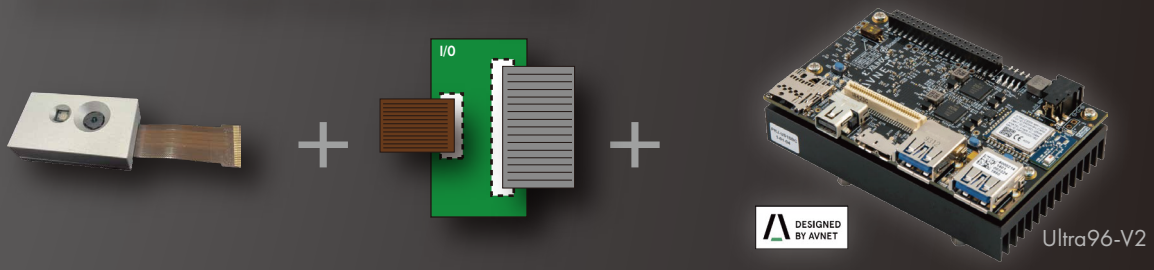
1st Prototype of Near-range motion tracking device by using BEM80T camera unit

FPGA Dev. Platform

Add-On for Development Kit

Reference Development Kit **BEC80T** **BEM80T**

An example of Depth Sensing Camera System



ToF Camera Unit (BEC80T or BEM80T)

Interface Conversion Board

Arm-based, Xilinx Zynq UltraScale+ ™ MPSoC Single board computer

We can also provide a customized FPGA-based development kit mounted Brookman's CMOS-ToF multi-tap sensor to support further system development. IR (Infrared) and depth image data can be manipulated in the small FPGA board. This development kit will reliably help you to integrate our sensor into your instruments. Our engineering team can supply stable solutions with expertise as a design partner.

Document

Time of Flight 3D Depth Sensor Product Catalog

Ver. 2020.08.19

For all product inquiries, please feel free to contact us.

Brookmantech

Brookman Technology, Inc., was started in Hamamatsu, Japan in 2006 as Brookman Lab, Inc., by leading expert for CMOS image sensor; Dr. Shoji Kawahito, a Professor in Electrical Engineering at Shizuoka University. Since then, we have been working on many kinds of CMOS Analog and Mixed Signal IC design. Particularly, we specialize in the design of advanced CMOS Image Sensors for a wide range of applications. Even though we have already had technical expertise, we still strive to pursue leading design, skill and technology. Because, Brookman Technology is challenging and seeking to the field,

where nobody can achieve, and where nobody has done before.

BROOKMAN TECHNOLOGY

株式会社 ブルックマンテクノロジ
Brookman Technology, Inc.

Tel ：053-482-7741 (+81-53-482-7741)
E-mail ：bt_request@brookmantech.com
本社 ：〒430-0936 浜松市中区大工町 125 番地
Address ：125 Daikumachi, Naka-ku, Hamamatsu, 430-0936, Japan