TOF10120

Time-of-Flight ranging Sensor

Description / Descripti

TOF10120 ranging sensor provides accurate and repeatable long-distance measurement for high-speed autofocus (AF). Innovative TOF time-of-flight
Technology makes the performance of this sensor independent of the reflectivity of the target object.

TOF10120's TOF (time-of-flight) measurement technology is implemented with Sharp's original low-cost CMOS process SPAD (single photon avalanche diode).
It makes the measurement result accurate and has higher anti-interference ability to ambient light.

TOF10120 range sensor provides accurate and repeatable long range distance measurement for high-speed autofocus (AF). The innovative time-of-flight technology allows
performance independent of object reflectance.

TOF10120's time-of-flight sensing technology is realized by Sharp's original SPAD (Single Photon Avalanche Diodes) using low-cost standard CMOS process. It enables accurate
ranging result, higher immunity to ambient light and better robustness to cover-glass optical cross-talk by special optical package design.

Features / Features

- The 940nm laser meets the Class 1 operating conditions specified in the third edition of IEC 60825-1: 2014

- Sensor size (20 × 13.2 × 2.0mm)

- Maximum measurement distance indoors up to 1.8 meters with accuracy within 5%

- The measurement range is independent of the reflectance of the target object

- Can work in high infrared light environment

- High optical crosstalk compensation

- Measurement time less than 30ms

- Standard reflow soldering process

- No additional optics required

- Single power supply

- Standard TTL level serial port

- Lead free, RoHS compliant

- 940nm laser classified as class 1 under operation condition
  by IEC 60825-1: 2014-3rd edition

- Small ceramic package (20 × 13.2 × 2.0mm)

- Long range absolute range measurement up to 1.8m
  within 5% accuracy at indoor

- Reported range is independent of the target reflectance

- Operates in high infrared ambient light levels

- Advanced optical cross-talk compensation

- High speed ranging MAX 30ms

- Standard solder reflow compatible

- No additional optics

- Single power supply

- Txd interface for device control and data transfer

- Lead-free, RoHS compliant

Applications / Applications

- High-speed autofocus

- Video continuous autofocus

- User detection of computers and other equipment

- Obstacle detection

- Automatic gesture recognition of white goods

(Such as faucet, refrigerator, etc.)

- High-speed AF

- Continuous AF for video

- User detection for Personal Computers /
  Laptops / Tablets

- Robotics (obstacle detection)

- White goods (hand detection in automatic
  Faucets, refrigerator etc.)

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2.1 Recommended Operating Conditions **/ Recommended Operating Conditions**

project	Rated	unit
Items	Rating	Unit
Measuring Range Ranging Range	100 ~ 1800	mm
Working voltage VCC	3 ˜ 5	V
Working current ICC_VDD	35	mA
Working temperature Topr	ˉ 20 + 70	° C
Storage temperature Tstg	ˉ 40 + 85	° C

2.2 Pin Description **/ Pin Description**

Pin	Pin name	condition	Features
Pin	Pin name	Condition	Function
①	GND		Power ground GND
②	VDD		Power supply positive electrode 3 ˜ 5V
③	RXD	INPUT	Serial input TTL level RXD OUTPUT TTL
④	TXD	OUTPUT	Serial output TTL level TXD OUTPUT TTL
⑤	SDA	INPUT / OUTPUT	I2C data TTL level I2C DATA I / O TTL
⑥	SCL	OUTPUT	I2C clock TTL level I2C CLK OPUTPUT TTL

2.3 Communication Protocol **/ Communication protocol**

Baud rate Bits per Second:	9600
Data Bits:	8
Parity without Parity:	None
Stop bits:	1
Flow Control Flow Control:	None

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2.4.1 Data transmission format / **Data delivery format**

1.

① Read deviation value	command	r1 #	Return value D = xx	Note xx = 00 ˜ 99mm is 0 before calibration
② Read the serial port sending interval	command	r2 #	Return value T = xxxx	Note xxx = 10 ~ 9999ms default 100ms
③ Reading distance mode	command	r3 #	Return value M = x	Note x = 0 filtered distance x = 1 real-time distance default = 0 filtered distance
④ Maximum reading distance	command	r4 #	Return value Max = x	Note xxx = 100 ~ 2000mm The default is not to limit the maximum distance> 2000mm
⑤ Reading distance sending method	command	r5 #	Return value S = x	Note x = 0 active sending (UART) x = 1 passive reading (UART / I2C) default = 0 active sending
⑥ Reading distance	command	r6 #	Return value L = xxxx	Note xxx = 100 ~ 2000mm is valid only when the sending mode is passive reading
⑦ Read module I2C slave ID	command	r7 #	Return value I = xxx	Note xxx = 1 ~ 254 (0x01 ~ 0xFE) default 164 (0xA4)
⑧ Read xtal calibration parameters	command	r8 #	Return value X = xxx	Note xx = 0 ~ 200 0 before calibration

2.4.2 Write Command / **Write a command**

2.

① Set deviation value positive and negative deviation command s1 + xx # Return information ＞ Successful setting: ok Setting failed: fail

Command s1-xx #   s1 + xx # (positive deviation) or s1-xx # (negative deviation)

Explanation xx = 00 ~ 99mm s1 + 0 # or s1-0 # deviation clear to 0

② Set the serial port sending interval Command s2-xxxx #   Return information ＞ Successful setting: ok Setting failed: fail

Note xxx = 10 ~ 9999ms default 100ms

③ Set distance mode   Command s3-x #   Return information ＞ Setting success: ok Setting failure: fail

Note x = 0 filtered distance x = 1 real-time distance default = 0 filtered distance

④ Set the maximum distance   Command s4-xxxx #   Return information ＞ Successful setting: ok Setting failed: fail

Note xxx = 100 ~ 2000mm xxxx = 0 means unlimited maximum distance

⑤ Set the distance sending method Command s5-x #   Return information ＞ Successful setting: ok Setting failed: fail

Note x = 0 active sending x = 1 passive reading

⑥ Set I2C slave ID   Command s7-xxx #   Return information ＞ Successful setting: ok Setting failed: fail

Note xxx = 1 ~ 254 (0x01 ~ 0xFE) default 164 (0xA4)

⑦ Calibration command   Command s8-x #   Calibration successful: x = 0 returns> offset deviation value x = 1 returns> xtalk deviation parameter setting failure: fail

Description offset deviation value (-99 ~ 99mm) xtalk deviation parameter 0 ~ 200

2.4.3 Routine / **Routine**

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command	send	Explanation	returned messages
String input box	s4-1000 #	OK	Successful setting: ok means the distance is set to a maximum of 1000mm

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2.5 Ranging characteristics / **Ranging Characteristics**

parameter Parameter	meets the Symbol	Minimum value Min.	typical Typ.	Maximum Max.	unit Unit	condition Condition
Minimum distance and accuracy (indoor white) Min Range distance & accuracy (White indoor)	Rmin	-	10	-	cm	※ Condition ①
	Rminacc	-	-	± 5	%	
Maximum range distance and accuracy (indoor white) Max Range distance & accuracy (White indoor)	Rinw	120	180	-	cm	※ Condition ②
	Rinaccw	-	-	± 4	%	
Maximum range distance and accuracy (indoor gray) Max Range distance & accuracy (White indoor)	Ring	70	80	-	cm	※ Condition ③
	Rinaccw	-	-	± 7	%	
Maximum range distance and accuracy (white outdoor) Max Range distance & accuracy (White outdoor)	Routw	60	-	-	cm	※ Condition ④
	Routaccw	-	-	± 7	%	
Maximum range distance and accuracy (gray outdoor) Max Range distance & accuracy (Gray outdoor)	Routg	40	-	-	cm	※ Condition ⑤
	Routaccg	-	-	± 12	%	
Ranging speed Ranging speed	Trange	-	-	33	msec	

2.5.1 ※ **Ranging condition**

condition Condition	Target and reflectivity Target & Reflectance	surroundings Environment	Distance accuracy and offset conditions Range Accuracy & Offset condition
①	White card White 88%	Indoor: no infrared Indoor: no infrared	10cm
②	White card White 88%	Indoor: no infrared Indoor: no infrared	120cm
③	Gray card Gray 17%	Indoor: no infrared Indoor: no infrared	70cm
④	White card White 88%	Outdoor: equivalent to 5KLUX daylight	60cm

Outdoor: equivalent to 5kLux daylight

Outdoor: equivalent to 5KLUX daylight

⑤　　　　　　Gray card Gray 17%　　　　　　　　　　　　　　　　　　　　40cm

Outdoor: equivalent to 5kLux daylight

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2.6 Electrical and optical characteristics / **Electrical and Optical Characteristics**

parameter	meets the	Minimum value	typical	Maximum	unit	Remarks
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Peak wavelength of vertical cavity surface emitting laser VCSEL peak wavelength	λP_PS	-	940	-	nm	
Vertical cavity surface emitting laser peak current VCSEL peak current	Ivcsel		59		mA	

2.7 with a cover slip / **with cover window**

It is very important to maintain the surface finish of the window covering **.**

It is important to keep the cover window surface finish smooth.

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2.8 Size / **Outline Dimensions**

PIN	Signal Name
①	GND
②	VDD
③	RXD
④	TXD
⑤	SDA
⑥	SCL

Unit: mm

Product weight: about 1.0g

Product mass: Approx. 1.0g

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