

TOF10120

Time-of-Flight ranging Sensor

Description/Description

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

The TOF (time-of-flight) measurement technology of TOF10120 is realized by Sharp's original low-cost CMOS process SPAD (Single Photon Avalanche Diode). It makes the measurement results accurate and has higher immunity 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 complies with the Class 1 operating conditions specified in the third edition of IEC 60825-1:2014
- Sensor size (20×13.2×2.0mm)
- The maximum measurement distance indoors can reach 1.8 meters, and the accuracy is within 5%
- The measurement range has nothing to do with the reflectance of the target object
- Can work in high infrared light environment
- High optical crosstalk compensation
- Measurement time is less than 30ms
- Standard-compliant 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

Application/Applications

- High-speed autofocus
- Video continuous auto focus
- 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.)

2.1 Recommended Operating Conditions / Recommended Operating Conditions

project	Rated	unit
Items	Rating	Unit
Range Range	100 ~ 1800	mm
Working voltage VCC	3 ~ 5	V
Working current ICC_VDD	35	mA
Working temperature Topr	- 20 + 70	°C
Storage temperature Tstg	- 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 positive 3 ~ 5V
③	RXD	Input 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:	None

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2.4.1 Data transmission format / Data delivery format

1.

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

2.4.2 Write Command / Write a command

2.

① Set the deviation value positive and negative deviation command	s1+xx#	Return information > Set successfully: ok Set failed: fail
	Command s1-xx#	s1+xx#(positive deviation) or s1-xx#(negative deviation)
		Explanation xx=00~99mm s1=0# or s1-0# The deviation is cleared to 0
② Set the serial port sending interval	command s2-xxxx#	Return information > Set successfully: ok Set failed: fail
		Description xxxx=10~9999ms default 100ms
③ Set distance mode	Command s3-x#	Return information > Setting success: ok Setting failure: fail
		Explanation x=0 distance after filtering x=1 real-time distance default=0 distance after filtering
④ Set the maximum distance	Command s4-xxxx#	Return information > Set successfully: ok Set failed: fail
		Explanation xxxx=100~2000mm xxxx=0 means unlimited maximum distance
⑤ Set the distance sending method	Command s5-x#	Return information > Set successfully: ok Set failed: fail
		Description x=0 active sending x=1 passive reading
⑥ Set I2C slave ID	Command s7-xxx#	Return information > Set successfully: ok Set failed: fail
		Description xxx=1~254(0x01~0xFE) default 164(0xA4)
⑦ Calibration command	Command s8-x#	Calibration success: x=0 return > offset deviation value x=1 return > xtalk deviation parameter setting failure: fail
		Description offset deviation value (-99~99mm) xtalk deviation parameter 0~200

2.4.3 Routine / Routine

command	send	Description	returned messages
String input box	s4-1000#	OK	The setting is successful: ok means the distance is set up to 1000mm

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2.5 Ranging characteristics / Ranging Characteristics

parameter	meets the	Minimum	typical	Max	unit	condition
Parameter	Symbol	Min.	Typ.	Max.	Unit	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 (grey 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	Target and reflectivity	surroundings	Distance accuracy and offset conditions
Condition	Target & Reflectance	Environment	Range Accuracy & Offset condition
①	White 88%	Indoor: no infrared	10cm
		Indoor: no infrared	
②	White 88%	Indoor: no infrared	120cm
		Indoor: no infrared	
③	Gray 17%	Indoor: no infrared	70cm

		Indoor: no infrared			
		Outdoor: equivalent to 5KLUX daylight			
④	White 88%	Outdoor: equivalent to 5kLux daylight		60cm	
		Outdoor: equivalent to 5KLUX daylight			
⑤	Gray 17%	Outdoor: equivalent to 5kLux daylight		40cm	
		Outdoor: equivalent to 5kLux daylight			
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2.6 Electrical and optical characteristics / Electrical and Optical Characteristics

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

2.7 With cover glass / with cover window

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

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 1.0 g

Product mass: Approx. 1.0g

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