

Optical Mouse Sensor Data Sheet

No.	Part No.	Description	Remark
1	ATA1160XC	Optical Mouse Sensor Chip	

Your Application Model No.	
Inspected By	
Checked By	
Approved By	
Date	

Please kindly find and approve the specification inserted herein and return one copy hereof with your signature of approval

Prepared By : _____

Checked By : _____

Confirmed By : _____

WIRELESS OPTICAL MOUSE SYSTEM IC

ATA1160XC

(ATA1180XC+ Mosart MA60H223)

Version 0.2

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@Lab ATA1160XC

Wireless Optical Mouse Sensor

Data Sheet



INTRODUCTION

Description

ATA1160XC is a wireless optical mouse sensor that supports all functions required in a wireless optical mouse system. The chip includes an optical sensor, a 27MHz transmitter, a controller, and other components in one complete package. ATA1160XC also contains a DC-to-DC converter to boost up the battery supply voltage so that the whole system can operate adequately and safely.

The key differences in ATA1160XC from other optical sensors may be highlighted in that it is designed based on a system-level architecture in order to reduce manufacturing costs by eliminating side parts. ATA1160XC contains MosArt's MCU (MA60H223) within one package so that no additional MCU and transmitting (TX) device are needed. MA60H223 encodes data from the optical sensor and sends the encoded data via RF at 27MHz. This MA60H223 also equipped with a complete set of FSK modulator that also provides a single-channel RF solution, and hence reducing further external components for RF interface.

ATA1160XC captures "snapshots" of the work surface at a rate of 1,700 times per second, then sends the captures images to the navigation engine to determine direction and magnitude of the movement in accordance with speed and acceleration. ATA1160XC tolerates all different scales of movement so that the chip can be used both with design purpose where accuracy is the most important factor and with gaming purpose where speed is now the critical factor.

ATA1160XC is in a 24-pin optical DIP package with a resolution of 800 counts per inch (dpi) and the rate of motion up to 12.75 inches per second.

General Features of ATA1160XC

- Optical navigation technology
- No mechanical parts
- High reliability
- Complete 2-D motion sensor
- High speed motion detection
- Proprietary enhanced navigation accuracy over a wide variety of surfaces
- No precision optical alignment
- Low operation current
- Power conservation Mode during times of no movement (No-Motion mode).
- No additional MCU is needed.
- 800 CPI

General Features of MCU and Transmitter

- 76.8KHz clock rate (low power consumption)
- Build in data scrambler and error detection encoder.
- Build in single-channel RF oscillator, modulator and power amplifier.
- 4Kbps Baud rate in air.
- ID change solution (256 random IDs) to resist the interference from the same device.
- Adjustable output voltage (a DC/DC converter is included (3V~5V)).
- Selection of sensor direction (0, 90, 270 degree).
- ID retention function when battery is removed.
- Z axis supports for optical & mechanical inputs by application circuits.
- Low battery detection signal (included in the transmitted data).

Applications

- Wireless mice for desktop PC's, Workstations, and notebook PC's
- Wireless Trackballs
- Integrated wireless input devices

Top View of ATA1160XC

Pinout Configuration

Pin	Name	I/O	Description
1	NRST	I	Reset
2	DVDD	PWR	Power (Digital)
3	XY_LED	O	LED On/Off
4	DGND	GND	Ground(Digital)
5	Z2IN	I	Z axis Input (3D)
6	Z1IN	I	Z axis Input (3D)
7	PD	I/O	Power-down signal of the sensor
8	TXD	O	Digital encoded data
9	ORFO	O	RF Internal Buffer output (27MHz Oscillator input)
10	ORFIN	I	RF Internal Buffer Input Set (27MHz Oscillator input)
11	RFOUT	O	Internal Modulated RF Output
12	LB	I	Left Button
13	MB	I	Middle Button
14	RB	I	Right Button
15	VDD	PWR	Battery Power
16	OSCO	O	Oscillator/Clock
17	OSCI	I	Oscillator/Clock
18	VL	O	DC/DC Lx switch output
19	DCVR	I	DC/DC Voltage Reference
20	SVDIN	I	Battery power detection signal
21	TXCB	I	ID Change Button
22	TYPESEL	I/O	Serial Degree of Sensor
23	AGND	GND	Ground(Analog)
24	AVDD	PWR	Power (Analog)

Note: Pin assignments can be altered without notice

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Unit	Min.	Typ.	Max.	Note
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Absolute Maximum Ratings

Storage Temperature	T _{stg}	°C	-20		70	
Operating Temperature	T _{opr}	°C	0		50	
Supply Voltage	V _{dd}	V	-0.5		7.0	
Input Voltage	V _{in}	V	V _{ss} -0.3		V _{dd} +0.3	
ESD	-	V	200			All pins, machine model
			2000			All pins, human body model

Recommended Operating Conditions

Operating Temperature	T _{opr}	°C	0	25	40	
Supply Voltage	V _{dd}	V	-	3.0	-	
System clock (OSC)	F _{clk}	Khz	-	76.8	-	
RF Carrier frequency	F _{rf}	MHz		27.042		
Distance from lens reference plane to surface	D	mm	1.9	2.1	2.3	
Maximum Speed	S	Inch/sec	12.75	-	-	

AC Electrical Specification (Recommended operating conditions: Temp=25°C, DVDD & AVDD=3.7V)

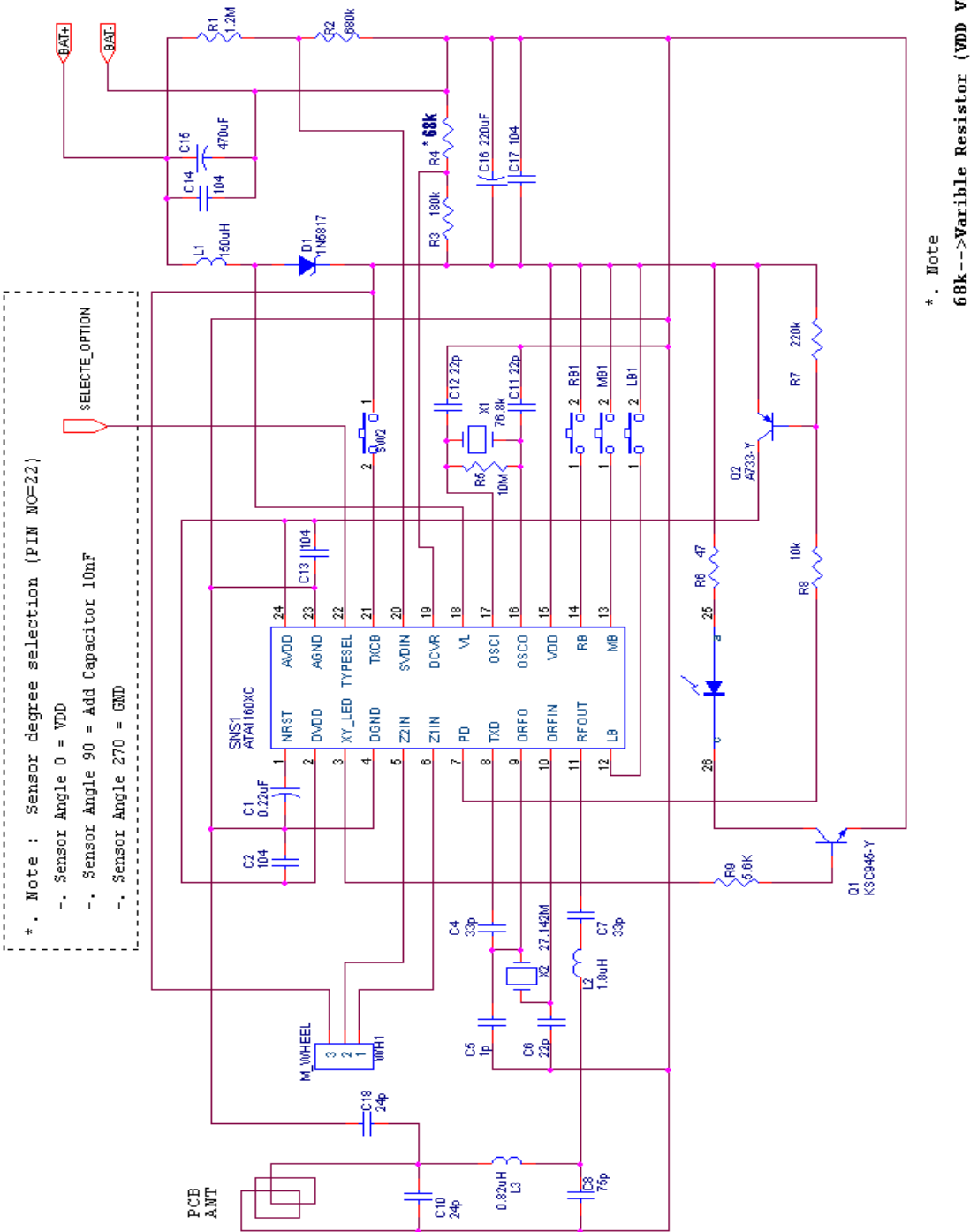
Motion Scale Factor		count/sec	-	800	-	
Response Time (Default)	T _{rsp1}	msec	8.7	10.9	13.1	Movement to data in no motion mode.
Power-On Reset	T _{res}	msec	300	426	500	

DC Electrical Specification (Recommended operating conditions: Temp=25C and Vdd=3.0V)

Supply Current (In Motion)*	I _{dd}	mA	-	15	36	DC/DC OUT=3.75V
Supply Current (No Motion)	I _{dd1}	mA	-	2.3	5	DC/DC OUT=3.75V
Supply Current (Power Down)	I _{ddpd}	mA	-	0.07	0.1	DC/DC OUT=3.75V
Maximum DC/DC converter output voltage	V _{odc}	V	-	-	5	
Input Low Voltage	V _{IL}	V	-	-	0.8	
Input High Voltage	V _{IH}	V	2.0	-	-	
Output Low Voltage (LED)	V _{OLL}	V	-	0.3	0.5	
Maximum LED control Current output	I _{OHLED}	mA	1.5	2.0		DC/DC OUT=3.75V

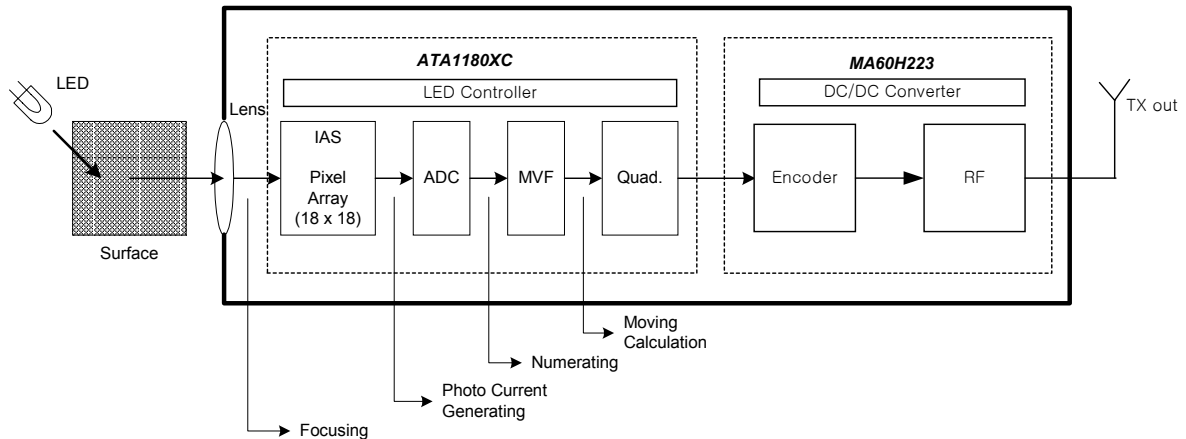
* Including LED current.

TYPICAL APPLICATION



OPERATIONS

Theory of Operation



ATA1160XC is designed based on an optical navigation technology: It contains an Image Acquisition System (IAS), a Motion Vector Finding (MVF) Processor, and a two-channel quadrature output.

The IAS captures microscopic surface images at a rate of 1,700 times per second through lens and an illumination system provided externally. Then the MVF Processor processes these images to determine the direction and distance of the movement, and generates the Δx and Δy relative displacement values that are converted into two-channel quadrature signals.

The MCU (MA60H223) receives these quadrature signals, encodes them with error detection codes, and scrambles these encoded data. The MCU then performs 2-level FSK modulation using 27.042MHz carrier and transmits the modulated RF signal through RF Amplifier and Antenna on the air.

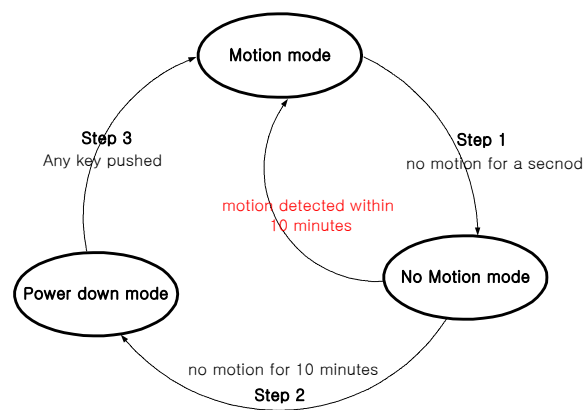
Description of Operation

Once power is on, ATA1160XC requires 75.3 msec to be stabilized in motion mode. When there is no motion in the sensor, ATA1160XC turns its operation into no-motion mode in order to minimize the power consumption. More specifically, when there is no motion for one second (default time period) in motion mode, the chip goes into no-motion mode. On the other hand, from no-motion mode, ATA1160XC wakes up every 10.9 msec for one report time (588 μ sec) and compares the captured image data with those captured in the previous wake-up period to check if there is any movement.

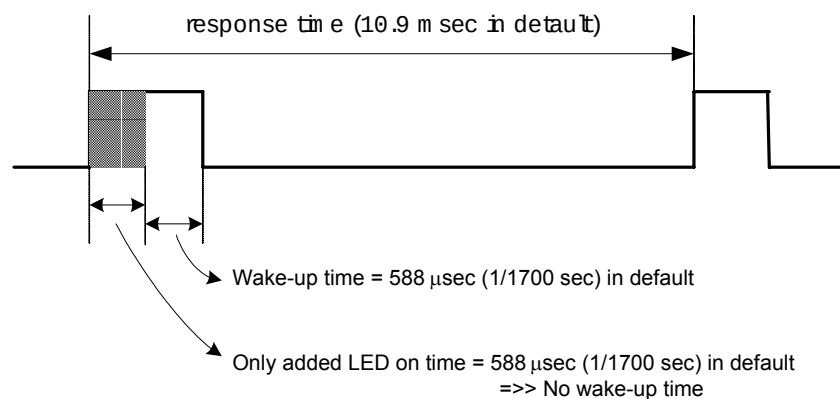
In order to save further power consumption, if there is no motion longer than 10 minutes, then ATA1160XC goes into power-down mode. In both no-motion and power-down modes, there is no RF signal output, and especially in power-down mode, the whole circuit goes into inactive state and produces no circuit current.

The output voltage of DC/DC converter is fixed by ratio of R3 and R4 resistors in the above-presented application circuit by the relation: $V_{odc} = (1+R3/R4) \times 1V$.

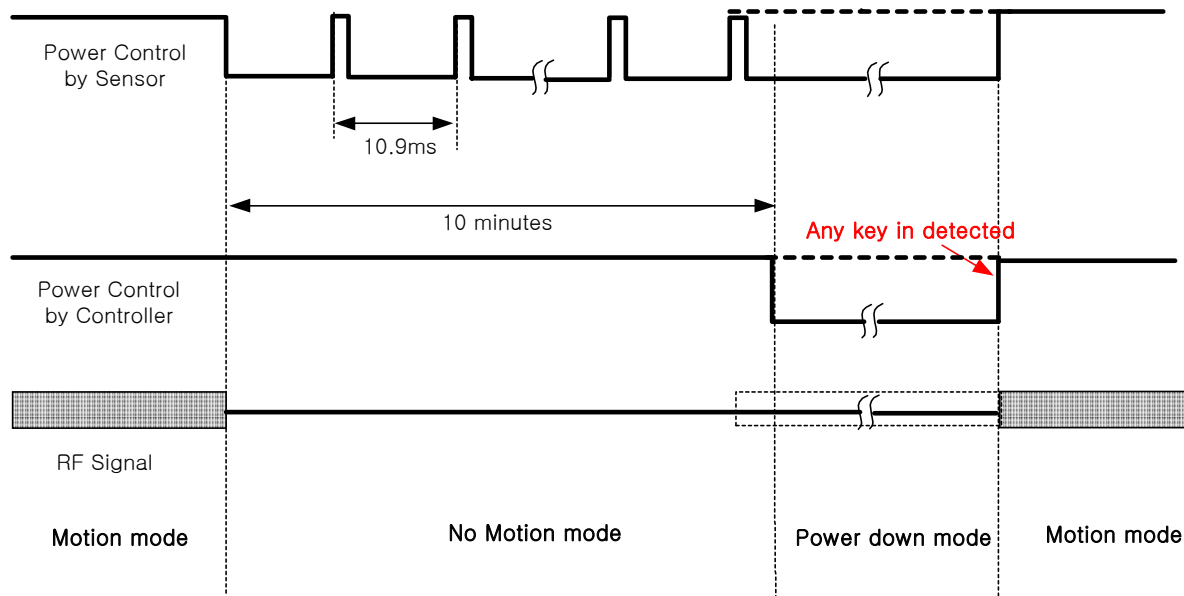
Optical Sensor Power Saving Flow



Timing in No-Motion Mode



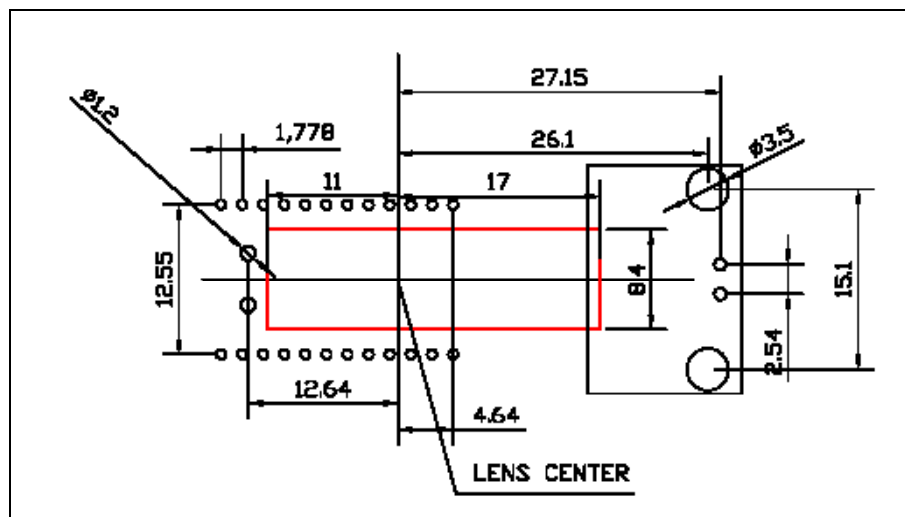
Timing in Over-All Power Saving Sequence



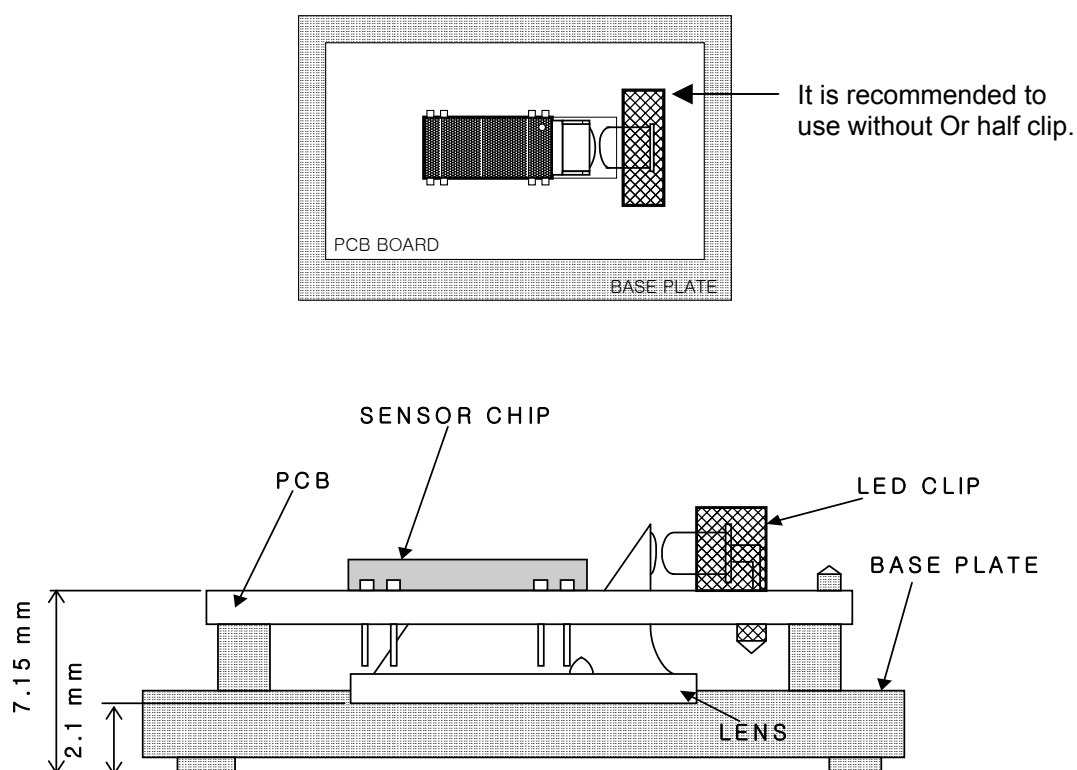
Note: Dashed lines in the above figure shows the case where motion is detected in no-motion mode.

ASSEMBLY

Recommended PCB Mechanical Drawing (Unit: mm)



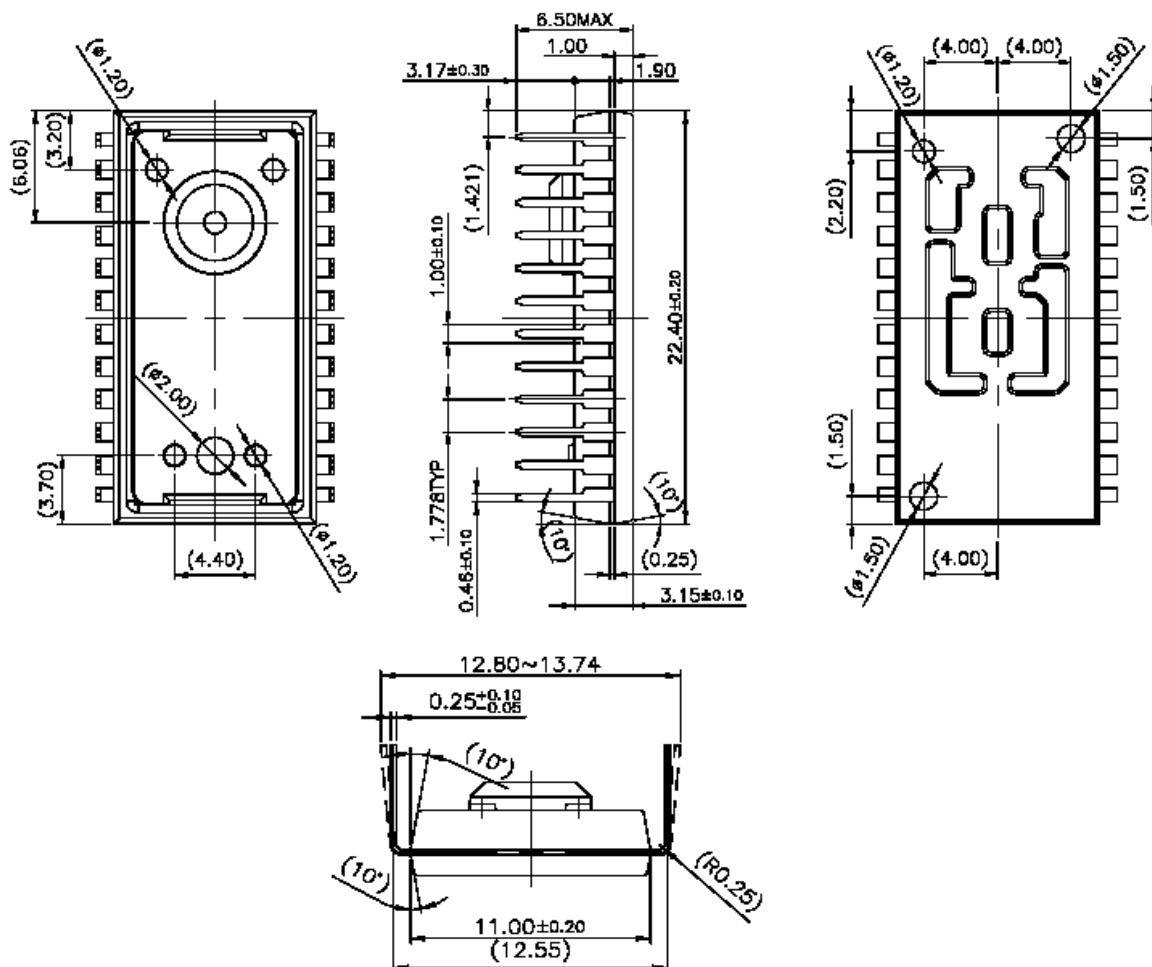
Assembly Drawing (Unit: mm)



The maximum performance of the optical mouse set can be achieved by applying the distances shown above. The tolerance of the Lens-to-surface distance is $\pm 0.2\text{mm}$.

ATA1160XC PACKAGE

Package Outline Drawing (Unit: mm)



Marking Information

