

Application Note 5358

Introduction

Avago Technologies pioneered optical mouse technology and continues to be a dominant supplier of these sensors to optical mouse manufacturers worldwide. Avago Technologies has developed a new device ADNS-3530 which is a low-power optical navigation sensor. The sensor is also in a small form factor package and surface mountable device.

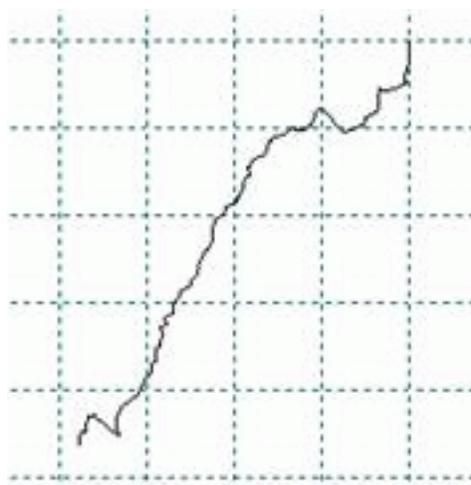


Figure 1. ADNS-3530 jitter

Upside down performance

The sensor may report some unintentional motion was turned upside down. The sensor would face the office fluorescent light source. The light from the fluorescent tube would cause accidental motion to be reported by the sensor. The motion reported is shown in Figure 1.

The reported motion is very small but incrementally can cause the cursor to drift very far from the point of origin.

It is hear-by proposed the following method to solve this issue.

Surface study

The following were study done on many surfaces for Shutter, Squal and Pixel Maximum values. A range of values were obtained and studied for optimum setting of firmware.

Table 1. Surface data

Surface	Shutter value (dec)		Squal value (dec)		Pixel Max (dec)	
	Mean	Range	Mean	Range	Mean	Range
Photo paper	35	<46	20	10 to 25	208	190-230
White paper	30	<50	47	40-60	200	180-240
Black formica	433	400-850	48	40-60	200	160-245
Spruce wood	32	<60	79	70-100	210	180-240
White delrin	256	200-300	14	5 to 20	196	180-240
Manila	33	<50	61	40-60	208	180-240
White formica	34	<50	36	20-40	196	190-230
No surface (Upside down)	976	300-1000	33	10 to 45	254	>240

Shutter, Squal and Pixel Max variation for Upside down

The below firmware algorithm was implemented to reduce the jitter issue. The sensor has a few registers Shutter Upper at address 0x06 and Shutter Lower at address 0x07, Squal value at 0x05 and Pixel Maximum at 0x08 which can be used to detect this problem. When the sensor is on normal surfaces, the shutter values are often below 800 decimal value. When the sensor is turned upside down, the shutter values become very unstable and often reports higher than 900 decimal values. By reading the shutter, squal and pixel maximum value, the microcontroller (MCU) can determine if jitter has occurred. 3 flags are used to determine if the sensor is turned upside down.

If the shutter values are less than 250, a shutter valid flag is set. If the squal value is more than 45, the squal valid flag is set. If the pixel maximum is not equal to 254, the pixel maximum flag is set. In a single frame the three flags are OR'ed to determine sensor condition. If the all three conditions are set to 0, then another over flag is raised. The purpose of this over flag is monitor the condition over 2 frames to determine sensor stability. If over 2 frames the over flag is set to 1, then the MCU can report valid motion. Otherwise the motion is invalid.

The implementation is shown in Figure 2.

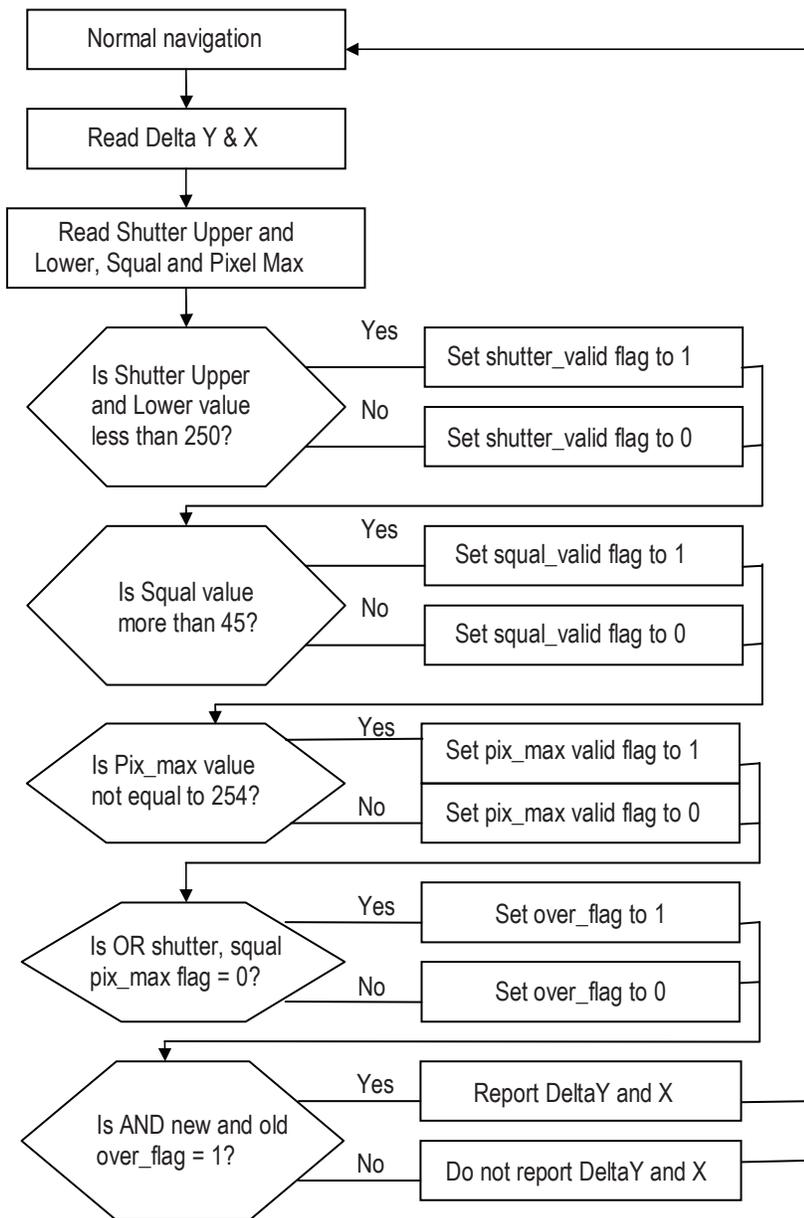


Figure 2. ADNS-3530 upside down firmware implementation

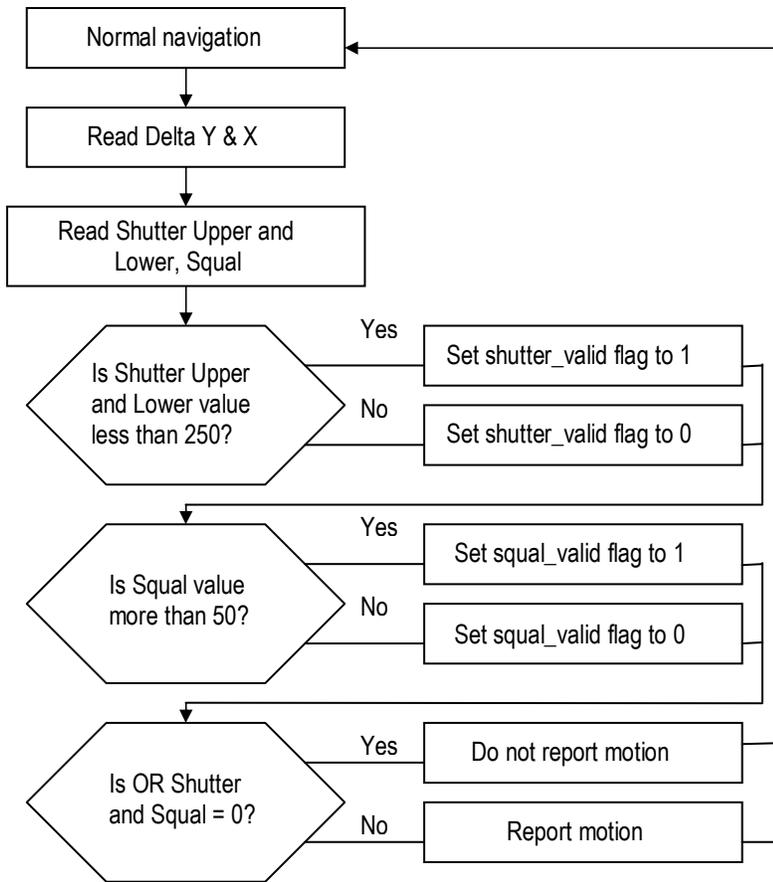
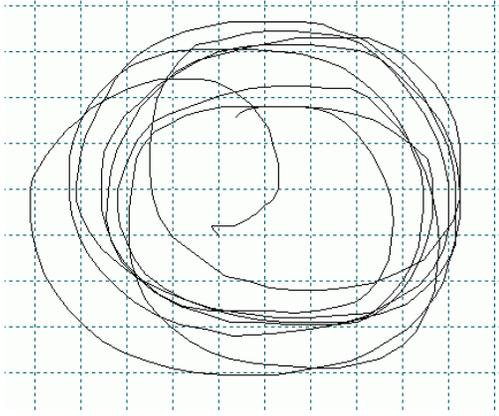
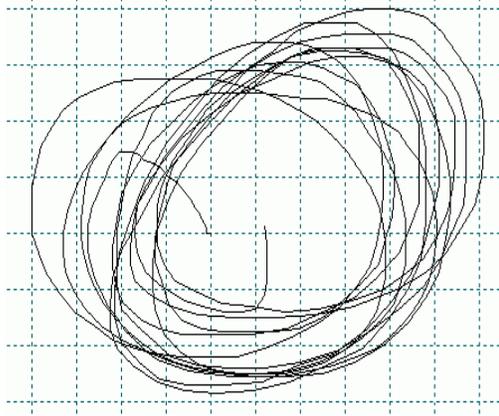
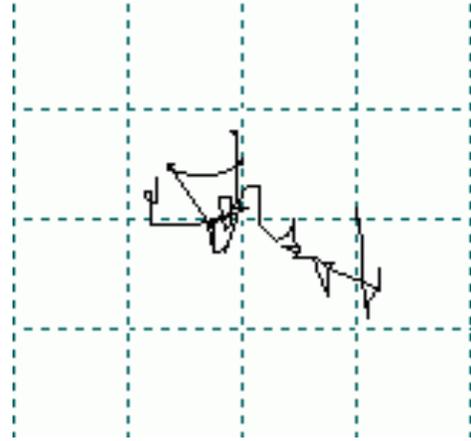
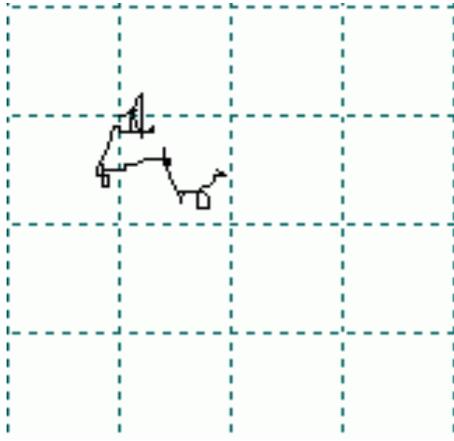


Figure 3. ADNS-3530 lifted and dropped firmware implementation

Shutter and Squal variation for lifted and dropped jitter

Further improvements can also be made to the MCU firmware to reduce the occurrences of jitter during lift and drop of sensor. The implementation involves reading the shutter and squal values while the variable for shutter is set to 250 and squal is set to 50.

Table 2. Cursor trace

	Before	After
Black Copy		
Lift and Drop		

Conclusion

The above implementation will help the MCU to stop reporting motion values when the sensor is turned up side down or when lifted and dropped onto the surface. The results in Table 2 showed no difference between before and after MCU firmware change. The improvement made in lifted and drop jitter are also shown in Table 2.

For product information and a complete list of distributors, please go to our web site: www.avagotech.com

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