A320
Optical Finger Navigation Sensor

Frequently Asked Questions

General

1. What is an OFN sensor?

Avago Technologies has introduced a low profile Optical Finger Navigation (OFN) sensor family that is suitable for navigation interface devices and mobile input devices. These OFN sensors are integrated with IR LED (InfraRed Light Emitting Diode) and have low power consumption. They are coupled with small form factor package, which are suitable for hand-held devices requiring navigation capabilities. Examples of applications include integrated input devices, battery-powered input devices and finger input devices. These sensors also incorporated a slew of optical finger navigation features that were specifically designed to heighten, improve and enhance user enjoyment and experience.

2. What are the features in the OFN sensor?

The OFN sensor has a number of feature namely speed switching, assert / deassert function, finger presence detection, XY quantization and XY scaling. For more explanation and uses of features, please see the OFN A320 application note.

3. What is the pixel size of the OFN sensor?

Depending on the OFN sensor, the typical sensor pixel size is 50um per pixel.

4. Could other capacitor values be used for the digital voltage pin, DVDD, when internal regulator is used?

When the internal regulator is enabled, the recommended bypass capacitor is 3.3uF. However a 2.2uF can also be used.

Mechanical

5. What design parameters to be taken in account to avoid electrostatic discharge?

Several considerations can be taken to protect the OFN sensor against electrostatic discharge (ESD). A simple mechanical design which has the casing grounded or the module top cover grounded can be employed. These covers can be coated with metallic paint and then grounded to the system ground. Another method is to design the flexible printed circuit with a ground layer that is also connected to the top cover via conductive epoxy. For more information, see A320 mechanical guide application note section4.0.

6. What is the ESD specification tested for OFN module?

The Avago modules demo were tested according to JEDEC standard JESD22-A114-E specification.

7. When changing top cover thickness and materials what consideration needs to be taken into account?

Different materials will refract light differently and causes changes in optical properties. When changing optical properties, several performance parameters must be taken care of. These are the top cover opening to allow light out of the light emitting diode and into the sensor pixel array, the top cover material transmissivity and the sensor assert/deassert function. The top cover dimensions must also meet minimum dimensions for the sensor and lens. See A320 mechanical guide application note for more information.

8. Would the top cover thickness affect the navigation performance?

The top cover thickness will affect the light refraction path. Therefore this will affect the navigation performance. It is suggested that the dimension must meet the minimum dimensions as set out in the mechanical guide application note and datasheet.

9. What adjustments are needed when changing top cover design?

Whenever optical components such as top cover are changed or modified, then the finger presence detection (FPD) and assert/deassert (A/D) thresholds are required to be changed according to top cover material. It is suggested to perform shutter value and pixel statistics check for a number of units to determine new threshold values

10. What is the recommended top cover tolerance?

The recommended top cover thickness tolerance is +/-0.02. It must be kept in a tight range in order for consistent performance by the OFN sensor.

11. What is the maximum force that can be pressed on the module with dome click?

There are several design considerations to be taken care of when designing the dome click. The application note on mechanical guide explains this in section called Actuator for dome switch. Note the design properties that must be observed in order to make a robust dome click.

12. What are design properties when designing dome click?

When designing dome click to achieve good click feel and avoiding excessive press force which can damage the module, there are several considerations to be taken into account. These can include mechanical parameters, using silicone actuator and rigid flexible printed circuit to provide strength to the module. Please see mechanical application note for more details.

Firmware

13. Which has higher priority setting, OFN_Engine or Configuration_bits?

When OFN engine is turned on, the 5 steps counts per inch (cpi) are in effect. When OFN engine is turned off, the Configuration_bits is in effect.

14. Is there extra buffer in DeltaX/Y?

The A320 has internal motion accumulator buffer that is 16 bit signed. It works regardless of cpi.

15. How long does it take for the motion value to be output to the 8 bits DeltaX/Y registers?

When sensor is in tracking, the internal motion data processing and transferring to DeltaX/Y registers all happen in less than 8ms time.

16. When sensor exits from shutdown mode what mode is the sensor in?

The sensor will be in the mode before shutdown was initiated.

17. What is the recommended polling period time for the device driver to check motion with OFN sensor?

If customer is using Motion pin, then the method is polling according to the Motion interrupt. If customer is using fixed polling method, the recommended polling interval is 8ms.

18. In Observation register address 0x2e, what is OBS_3-0 used for?

The OBS bits changing values indicate that the sensor internal functions and circuits such as digital and analog circuits are working during that frame. There is no need to constantly check these bits in normal operation. Those bits just indicate if navigation engine is in good status. If the bits does not change in value, this means the sensor is not working.

19. Is hard reset necessary during TWI or I2C initialization?

Hard reset is necessary. Customers may use NRST pin to perform the reset.

20. Is there a predefined power up sequence to be followed?

The OFN sensor requires a sequence of power up and down sequence. The general sequence to be followed is firstly power up, followed by communication initialization and then registers loading. The full sequence is listed in the datasheet.

21. When will the GPIO state change from undefined to functional?

GPIO pin is undefined until after the user sets the status in the register. The user will need to set GPIO status to become valid. This is done through register address 0x75. The status can be read back from register address 0x02 or from the pin itself.

22. How is the shutter value read from the OFN sensor?

The shutter values can be read from registers 0x06 for Shutter_Upper and 0x07 Shutter_Lower sequentially. The hexadecimal values for 0x06 and 0x07 are combined together to form the complete value. For example if the value in address 0x06 is 0x04 and address 0x07 is 0x5E, then the shutter value is 0x45E hexadecimal or 1118 decimal. Shutter value is important as it defines the OFN sensor assert/deassert and finger presence detection.

23. What are some of the OFN features which can minimize interference from sunlight?

The OFN comes with a feature called Finger Presence Detection (FPD). FPD uses the sensor shutter value (exposure time) to differentiate the state of finger (or surface) covering the sensor or not. Sun light or a bright artificial light source with high Infra Red (IR) content shining directly into the sensor when not covered will cause very short shutter times similar to a finger reflecting the IR light from the integrated LED onto the sensor. By implementing the FPD firmware, it can be determined to indicate the finger-up event, and the commencement of new data reporting to indicate finger-on. See application note for complete details of FPD.

24. When Motion pin is interrupt, would DeltaX and Y return zero value?

Yes it is possible.

25. What is the status of Motion pin when VDDA or VDDIO is off?

The Motion pin state is controlled by VDDA and VDDIO. If either voltage is not present, the Motion pin becomes undefined. It can remain low, high or in an undefined state.

26. When will the motion pin change state after the sensor detects motion?

The sensor captures and processes the data at every frame while in Run mode. The Motion pin will only change state to indicate motion after the last frame is taken by the sensor in Run mode.

27. How reliable is the SQUAL value as a 'standard' measurement in indicating the imaging and velocity sensing performance?

The Squal is a good value to determine the surface features that are visible to the sensor. The value will not be stable but will fluctuate around a mean value. Any value that is high indicates good feature and the sensor will navigate. This value however does not tell us the pattern of the surface which may cause navigation problems.

28. Surface quality is around 30~50 when measured with finger. Does it mean good tracking for SQUAL of 30~50?

Generally higher Squal values are good or indicate good surface. Depending on optics design such as lens and top cover, a large difference between no finger with low squal (for example less than 10) and finger with high squal (for example more than 20) indicates good surface to track.

29. After power up, the sensor cannot communicate via I2C, why is that?

A hard reset or NRST is required for proper I2C operation. There are also some I2C idle time required and must be observed during hard reset, shutdown after hard reset and during hard reset after shutdown. See datasheet for more explanation.

30. What are some of the functional tests which can be done on the module?

There are many tests which can be done on the module and these are not limited to dimensional, visual inspection. Examples of functional tests which can be done are continuity test, communication test, self test, analog test and motion test. Please contact your local field application engineer for the list of test.

31. If a shutter is to be tested, what environment should the module be tested?

The shutter value should be taken in a complete module together with top cover. This will ensure the entire optical path is taken into account when measuring shutter values. In testing the shutter value, the finger or surface on and off the module should be taken. The module should also in dark environment to minimize external lighting.

32. Can the OFN emulate rocker movement?

Yes. Avago Technologies has written a demo kit firmware implementation of rocker modes. There is the single step rocker, multiple step rocker and 8-way rocker mode. The rocker mode implementation methods, code and description can be found in the application note. Please contact your local field sales for the application note and demo kit firmware.

33. What other modes are available on the demo kit?

Other modes implemented on the demo kit firmware are mouse mode, scroll mode and joystick mode.

34. If a faster response for tracking motion is required to large screen applications, what can be done to the sensor?

The OFN sensor has a feature called speed switching. The speed switching has the capability to increase to a higher resolution for a given speed. Thus the cursor will move faster across the screen when setting to a higher resolution at a lower speed.

35. What are trade offs to be expected when setting to higher resolution?

Higher resolution enables faster screen swipes however cursor placement would be difficult. It is suggested to use lower resolution when placing cursor by optimizing the speed switching registers.

36. Where can I find the OFN register threshold in the demo kit code?

The OFN sensor initialization and OFN register settings are found in the ADBM_Axxx.c file where xxx is the product code. Alternatively the settings are also found in the respective OFN datasheet.

Assembly

37. What are the test materials and surface used for performance test?

Most Avago Technologies performance tests were done using human fingers. A similar test surface solution is a prosthetic finger made of hypoallergenic medical grade silicone made similar to human skin.

38. Where are the areas of the OFN lens which can be touched or used for press fit?

Areas of the lens outside the imaging and illumination lens can be touched. The lens imaging and illumination path must be clear of any scratches or defects caused by touching. Please see datasheet and application note for more details of drawings.

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