

## I/O Pins Configuration

| PIN | NAME            | TYPE | DESCRIPTION                                                                                   |
|-----|-----------------|------|-----------------------------------------------------------------------------------------------|
| 1   | SDA             | I/O  | I <sup>2</sup> C serial data I/O terminal – serial data I/O for I <sup>2</sup> C.             |
| 2   | INT             | O    | Interrupt – open drain.                                                                       |
| 3   | LDR             | I    | LED driver for proximity emitter – up to 100 mA, open drain.                                  |
| 4   | LEDK            | O    | LED Cathode, connect to LDR pin in most systems to use internal LED driver circuit            |
| 5   | LEDA            | I    | LED Anode, connect to V <sub>BATT</sub> on PCB                                                |
| 6   | GND             |      | Power supply ground. All voltages are referenced to GND.                                      |
| 7   | SCL             | I    | I <sup>2</sup> C serial clock input terminal – clock signal for I <sup>2</sup> C serial data. |
| 8   | V <sub>DD</sub> |      | Power Supply voltage.                                                                         |

## Absolute Maximum Ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

| Parameter                 | Symbol           | Min  | Max | Units | Test Conditions |
|---------------------------|------------------|------|-----|-------|-----------------|
| Power Supply voltage      | V <sub>DD</sub>  |      | 3.8 | V     | [1]             |
| Digital voltage range     |                  | -0.5 | 3.8 | V     |                 |
| Digital output current    | I <sub>O</sub>   | -1   | 20  | mA    |                 |
| Storage temperature range | T <sub>stg</sub> | -40  | 85  | °C    |                 |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note:

1. All voltages are with respect to GND.

## Recommended Operating Conditions

| Parameter                                                                    | Symbol            | Min | Typ | Max | Units |
|------------------------------------------------------------------------------|-------------------|-----|-----|-----|-------|
| Operating Ambient Temperature                                                | T <sub>A</sub>    | -30 |     | 85  | °C    |
| Supply voltage                                                               | V <sub>DD</sub>   | 2.5 | 3.0 | 3.6 | V     |
| Supply Voltage Accuracy, V <sub>DD</sub><br>total error including transients |                   | -3  |     | +3  | %     |
| LED Supply Voltage                                                           | V <sub>BATT</sub> | 2.5 |     | 4.5 | V     |

## Available Options

| Part Number | Interface Description                 |
|-------------|---------------------------------------|
| APDS-9901   | I <sup>2</sup> C VBUS = VDD Interface |
| APDS-9900   | I <sup>2</sup> C 1.8V VBUS Interface  |

**Operating Characteristics,  $V_{DD} = 3\text{ V}$ ,  $T_A = 25^\circ\text{ C}$  (unless otherwise noted)**

| Parameter                           | Symbol     | Min                   | Typ | Max                   | Units         | Test Conditions             |
|-------------------------------------|------------|-----------------------|-----|-----------------------|---------------|-----------------------------|
| Supply current <sup>[1]</sup>       | $I_{DD}$   |                       | 175 | 250                   | $\mu\text{A}$ | Active (ATIME=0xadb, 100ms) |
|                                     |            |                       | 70  |                       |               | Wait Mode                   |
|                                     |            |                       | 2.5 | 4.0                   |               | Sleep Mode                  |
| INT SDA output low voltage          | $V_{OL}$   | 0                     |     | 0.4                   | V             | 3 mA sink current           |
|                                     |            | 0                     |     | 0.6                   |               | 6 mA sink current           |
| Leakage current, SDA, SCL, INT pins | $I_{LEAK}$ | -5                    |     | 5                     | $\mu\text{A}$ |                             |
| Leakage current, LDR pin            | $I_{LEAK}$ |                       |     | 10                    | $\mu\text{A}$ |                             |
| SCL, SDA input high voltage         | $V_{IH}$   | 0.7 $V_{BUS}$<br>1.25 |     |                       | V             | APDS-9901<br>APDS-9900      |
| SCL, SDA input low voltage,         | $V_{IL}$   |                       |     | 0.3 $V_{BUS}$<br>0.54 | V             | APDS-9901<br>APDS-9900      |
| Oscillator frequency                | fosc       | 705                   | 750 | 795                   | kHz           | PON = 1                     |

Note:

- The power consumption is raised by the programmed amount of Proximity LED Drive during the 8  $\mu\text{s}$  the LED pulse is on. The nominal and maximum values are shown under Proximity Characteristics. There the  $I_{DD}$  supply current is  $I_{DD}$  Active + Proximity LED Drive programmed value.

**ALS Characteristics,  $V_{DD} = 3\text{ V}$ ,  $T_A = 25^\circ\text{ C}$ , Gain = 16, AEN = 1 (unless otherwise noted)**

| Parameter                                 | Channel | Min  | Typ  | Max   | Units                                    | Test Conditions                                                                                       |
|-------------------------------------------|---------|------|------|-------|------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Dark ALS ADC count value                  | Ch0     | 0    | 1    | 5     | counts                                   | Ee = 0, AGAIN = 120x,<br>ATIME = 0xDB(100ms)                                                          |
|                                           | Ch1     | 0    | 1    | 5     |                                          |                                                                                                       |
| ALS ADC Integration Time Step Size        |         | 2.58 | 2.72 | 2.90  | ms                                       | ATIME = 0xff                                                                                          |
| ALS ADC Number of Integration Steps       |         | 1    |      | 256   | steps                                    |                                                                                                       |
| Full Scale ADC Counts per Step            |         |      |      | 1023  | counts                                   |                                                                                                       |
| Full scale ADC count value                |         |      |      | 65535 | counts                                   | ATIME = 0xC0                                                                                          |
| ALS ADC count value                       | Ch0     | 4000 | 5000 | 6000  | counts                                   | $\lambda_p = 640\text{ nm}$ , Ee = 56 $\mu\text{W}/\text{cm}^2$ ,<br>ATIME = 0xF6 (27 ms), GAIN = 16x |
|                                           | Ch1     |      | 790  |       |                                          |                                                                                                       |
|                                           | Ch0     | 4000 | 5000 | 6000  |                                          | $\lambda_p = 850\text{ nm}$ , Ee = 79 $\mu\text{W}/\text{cm}^2$ ,<br>ATIME = 0xF6 (27 ms), GAIN = 16x |
|                                           | Ch1     |      | 2800 |       |                                          |                                                                                                       |
| ALS ADC count value ratio: Ch1/Ch0        |         | 10.8 | 15.8 | 20.8  | %                                        | $\lambda_p = 640\text{ nm}$ , ATIME = 0xF6 (27 ms)                                                    |
|                                           |         | 41   | 56   | 68    |                                          | $\lambda_p = 850\text{ nm}$ , ATIME = 0xF6 (27 ms)                                                    |
| Irradiance Responsivity: Re               | Ch0     |      | 29.1 |       | Counts per ( $\mu\text{W}/\text{cm}^2$ ) | $\lambda_p = 640\text{ nm}$ , ATIME = 0xF6 (27 ms)                                                    |
|                                           | Ch1     |      | 4.6  |       |                                          |                                                                                                       |
|                                           | Ch0     |      | 22.8 |       |                                          | $\lambda_p = 850\text{ nm}$ , ATIME = 0xF6 (27 ms)                                                    |
|                                           | Ch1     |      | 12.7 |       |                                          |                                                                                                       |
| Gain scaling, relative to 1x gain setting |         | -5   |      | 5     | %                                        | 8x                                                                                                    |
|                                           |         | -5   |      | 5     |                                          | 16x                                                                                                   |
|                                           |         | -5   |      | 5     |                                          | 120x                                                                                                  |

Notes:

- Optical measurements are made using small-angle incident radiation from light-emitting diode optical sources. Visible 640 nm LEDs and infrared 850 nm LEDs are used for final product testing for compatibility with high-volume production.
- The 640 nm irradiance Ee is supplied by an AlInGaP light-emitting diode with the following characteristics: peak wavelength = 640 nm and spectral halfwidth  $\frac{1}{2} = 17\text{ nm}$ .
- The 850 nm irradiance Ee is supplied by a GaAs light-emitting diode with the following characteristics: peak wavelength = 850 nm and spectral halfwidth  $\frac{1}{2} = 40\text{ nm}$ .
- The specified light intensity is 100% modulated by the pulse output of the device so that during the pulse output low time, the light intensity is at the specified level, and zero otherwise.