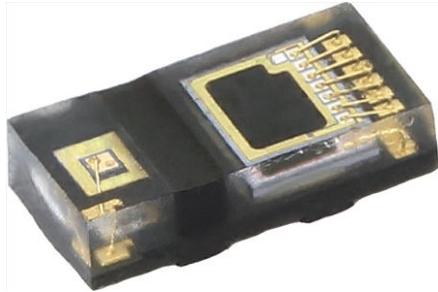


## A Small Package Proximity Sensor With a VCSEL, Low Idle Current, I<sup>2</sup>C Interface, and Smart Dual Slave Address



### LINKS TO ADDITIONAL RESOURCES


[3D Models](#)

[Application Notes](#)

### DESCRIPTION

The VCNL36828P is a fully integrated proximity sensor. It combines a vertical-cavity surface-emitting laser (VCSEL), photodiode, and application-specific integrated circuit (ASIC) within a single package. The VCNL36828P has been developed for proximity detection applications that require a dual slave address, low power consumption, small package size, small window size, and short range operation. In addition, given the typical rated supply voltage of 1.8 V to reduce power consumption, the sensor is intended for battery-powered applications.

### FEATURES

- Package type: surface-mount
- Dimensions (L x W x H in mm): 2.0 x 1.0 x 0.5
- Integrated modules: vertical-cavity surface-emitting laser (VCSEL), photodiode, and application-specific integrated circuit (ASIC)
- 1.8 V rated power supply and I<sup>2</sup>C bus
- Low power consumption with 5 µA idle current
- A small package allows a design with a small window size
- Smart dual I<sup>2</sup>C slave address in one package
- Immunity to red glow (940 nm VCSEL)
- Programmable I<sub>VCSEL</sub> sink current
- Intelligent cancellation to reduce cross talk phenomenon
- Smart persistence scheme to reduce measurement response time
- Interrupt functionality
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### APPLICATIONS

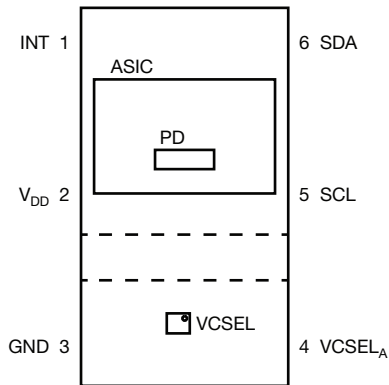
- Smartphones and true wireless stereo (TWS) earbuds
- VR / AR headsets and smart glasses
- Smartwatches
- Touchless button / dispensing

| PRODUCT SUMMARY |                      |                             |  |                                 |                                   |  |
|-----------------|----------------------|-----------------------------|--|---------------------------------|-----------------------------------|--|
| PART NUMBER     | OPERATING RANGE (mm) | OPERATING VOLTAGE RANGE (V) | I <sup>2</sup> C BUS VOLTAGE RANGE (V) | MAX. VCSEL DRIVING CURRENT (mA) | OUTPUT CODE                       | ADC RESOLUTION PROXIMITY / AMBIENT LIGHT |
| VCNL36828P      | 200                  | 1.65 to 2.00                | 1.2 to 3.6                             | 20                              | 12 bit / 16 bit, I <sup>2</sup> C | 16 bit / -                               |

| ORDERING INFORMATION |               |                              |                          |
|----------------------|---------------|------------------------------|--------------------------|
| ORDERING CODE        | PACKAGING     | VOLUME <sup>(1)</sup>        | REMARKS                  |
| VCNL36828P           | Tape and reel | MOQ: 5000 pcs, 5000 pcs/reel | 2.0 mm x 1.0 mm x 0.5 mm |

#### Note

<sup>(1)</sup> MOQ: minimum order quantity

**PIN DEFINITION**


| PIN DESCRIPTION |                    |                    |                               |
|-----------------|--------------------|--------------------|-------------------------------|
| PIN NUMBER      | PIN NAME           | TYPE               | DESCRIPTION                   |
| 1               | INT                | O (open drain)     | Interrupt                     |
| 2               | V <sub>DD</sub>    | I                  | Supply voltage                |
| 3               | GND                | I                  | Ground                        |
| 4               | VCSEL <sub>A</sub> | I                  | VCSEL anode                   |
| 5               | SCL <sup>(1)</sup> | I / O (open drain) | I <sup>2</sup> C serial clock |
| 6               | SDA <sup>(1)</sup> | I / O (open drain) | I <sup>2</sup> C serial data  |

**Note**

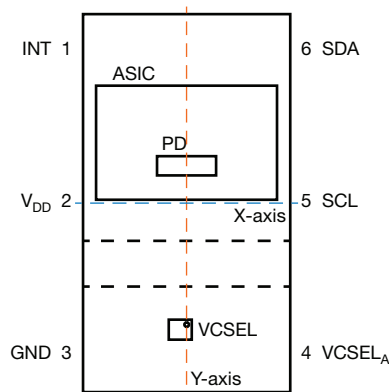
<sup>(1)</sup> Pin 5 (SCL) and pin 6 (SDA) can be swapped to change the slave address from 0x60 to 0x51; please refer to Table 1

| ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                |                  |      |      |      |
|---|----------------|------------------|------|------|------|
| PARAMETER   | TEST CONDITION | SYMBOL           | MIN. | MAX. | UNIT |
| Supply voltage  |                | V <sub>DD</sub>  | 0    | 2    | V    |
| Ambient temperature range   |                | T <sub>amb</sub> | -40  | +85  | °C   |
| Storage temperature range   |                | T <sub>stg</sub> | -40  | +100 | °C   |

| <b>BASIC CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |                 |      |           |      |               |
|---|--|-----------------|------|-----------|------|---------------|
| PARAMETER   | TEST CONDITION   | SYMBOL          | MIN. | TYP.      | MAX. | UNIT          |
| <b>ASIC</b>   |  |                 |      |           |      |               |
| Supply voltage  |  | $V_{DD}$        | 1.65 | 1.80      | 2.00 | V             |
| Supply current <sup>(1)</sup>   | Shutdown state; light condition = dark;<br>$V_{DD} = 1.8\text{ V}$ | $I_{DD}$        | -    | 1         | -    | $\mu\text{A}$ |
|   | Idle state <sup>(2)</sup> ; $V_{DD} = 1.8\text{ V}$                |                 | -    | 5         | -    |               |
|   | Active state <sup>(2)</sup> ; $V_{DD} = 1.8\text{ V}$              |                 | -    | 330       | -    |               |
| I <sup>2</sup> C supply voltage   |  | $V_{PULL\ UP}$  | 1.2  | 1.8       | 3.6  | V             |
| I <sup>2</sup> C signal input, logic high   | $V_{DD} = 1.8\text{ V}$  | $V_{IH}$        | 1    | -         | -    | V             |
| I <sup>2</sup> C signal input, logic low  | $V_{DD} = 1.8\text{ V}$  | $V_{IL}$        | -    | -         | 0.5  | V             |
| <b>VCSEL</b>  |  |                 |      |           |      |               |
| Supply voltage of the VCSEL <sup>(3)</sup>  |  | $V_{VCSEL}$     | 2.62 | -         | 3.60 | V             |
| Forward voltage   | $I_F = 9\text{ mA}$  | $V_F$           | -    | 1.92      | -    | V             |
| Forward current   |  | $I_F$           | 7    | -         | 20   | mA            |
| Angle of half intensity   |  | $\phi$          | -    | $\pm 4.5$ | -    | $^{\circ}$    |
| Peak wavelength   | $I_F = 9\text{ mA}$  | $\lambda_p$     | -    | 940       | -    | nm            |
| Spectral bandwidth  | $I_F = 9\text{ mA}$  | $\Delta\lambda$ | -    | 3         | -    | nm            |
| <b>PHOTODIODE</b>   |  |                 |      |           |      |               |
| Angle of half sensitivity   | X-axis <sup>(4)</sup>  | $\phi$          | -    | $\pm 60$  | -    | $^{\circ}$    |
|   | Y-axis <sup>(4)</sup>  |                 | -    | $\pm 45$  | -    |               |
| Peak sensitivity wavelength   |  | $\lambda_p$     | -    | 850       | -    | nm            |

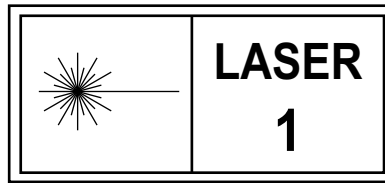
**Notes**

- (1) Actual current consumption depends on the register settings. Please refer to the application note on the current consumption
- (2) Excluding VCSEL driving current
- (3)  $V_{VCSEL}$  should at least match the minimum required supply voltage for the VCSEL  $V_{VCSEL, min}$ . Please refer to the  $V_{VCSEL, min}$  table
- (4) Cross section of the package



| <b><math>V_{VCSEL, min}</math></b>   |        |        |        |        |        |        |       |        |
|--------------------------------------|--------|--------|--------|--------|--------|--------|-------|--------|
| <b>PS_CURRENT (<math>I_F</math>)</b> | 7 mA   | 9 mA   | 11 mA  | 12 mA  | 15 mA  | 17 mA  | 19 mA | 20 mA  |
| <b><math>V_{VCSEL, min}</math></b>   | 2.62 V | 2.74 V | 2.86 V | 2.91 V | 3.08 V | 3.19 V | 3.3 V | 3.36 V |
| <b><math>V_{VCSEL, max}</math></b>   | 3.6 V  |        |        |        |        |        |       |        |

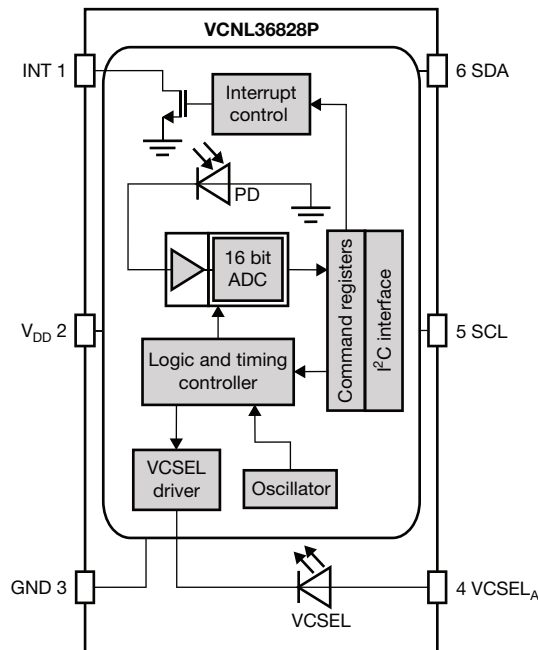
## LASER CLASS



### Note

- Product specification with IEC / EN 60825-1:2014 compliance and above label

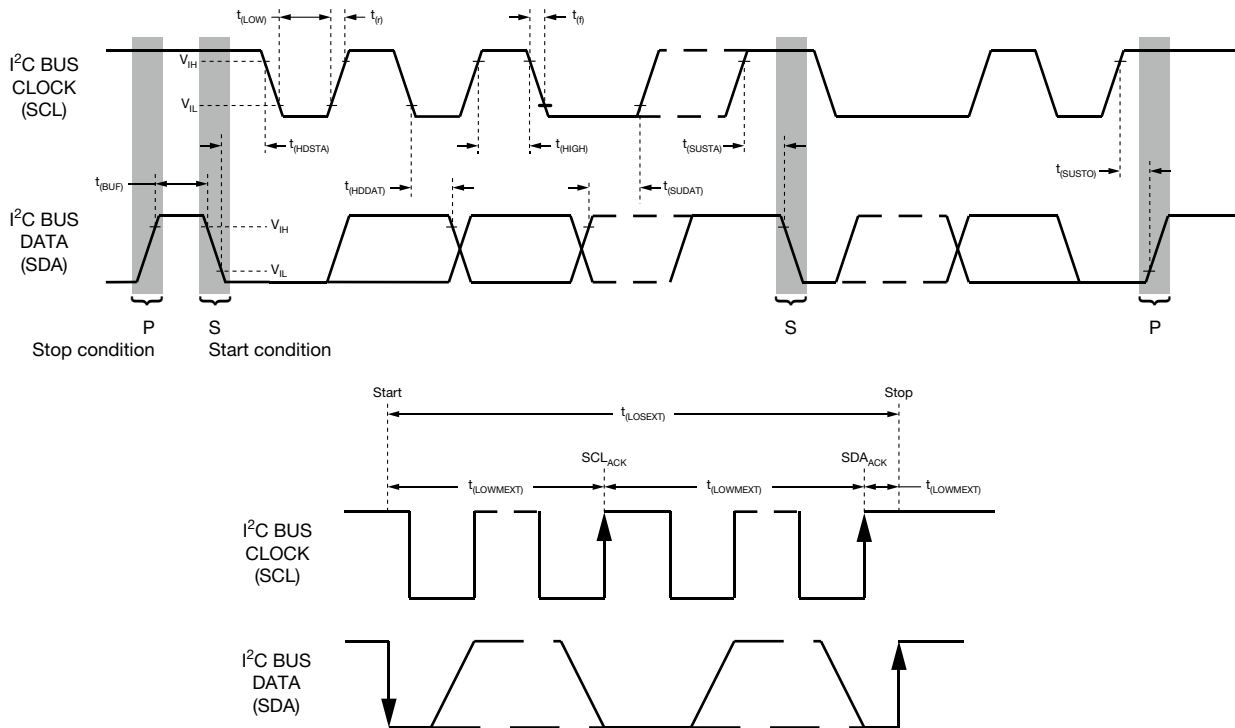
## BLOCK DIAGRAM



| <b>I<sup>2</sup>C BUS TIMING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                |               |      |           |      |               |
|---|----------------|---------------|------|-----------|------|---------------|
| PARAMETER   | SYMBOL         | STANDARD MODE |      | FAST MODE |      | UNIT          |
|   |                | MIN.          | MAX. | MIN.      | MAX. |               |
| Clock frequency   | $f_{(I2CCLK)}$ | 10            | 100  | 10        | 400  | kHz           |
| Bus free time between start and stop condition  | $t_{(BUF)}$    | 4.7           | -    | 1.3       | -    | $\mu\text{s}$ |
| Hold time after (repeated) start condition;<br>after this period, the first clock is generated                          | $t_{(HDSTA)}$  | 4.0           | -    | 0.6       | -    | $\mu\text{s}$ |
| Repeated start condition setup time   | $t_{(SUSTA)}$  | 4.7           | -    | 0.6       | -    | $\mu\text{s}$ |
| Stop condition setup time   | $t_{(SUSTO)}$  | 4.0           | -    | 0.6       | -    | $\mu\text{s}$ |
| Data hold time  | $t_{(HDDAT)}$  | 0             | 3450 | 0         | 900  | ns            |
| Data setup time   | $t_{(SUDAT)}$  | 250           | -    | 100       | -    | ns            |
| I <sup>2</sup> C clock (SCL) low period   | $t_{(LOW)}$    | 4.7           | -    | 1.3       | -    | $\mu\text{s}$ |
| I <sup>2</sup> C clock (SCL) high period  | $t_{(HIGH)}$   | 4.0           | -    | 0.6       | -    | $\mu\text{s}$ |
| Clock / data fall time  | $t_{(f)}$      | -             | 300  | -         | 300  | ns            |
| Clock / data rise time  | $t_{(r)}$      | -             | 1000 | -         | 300  | ns            |

**Note**

- Data based on standard I<sup>2</sup>C protocol requirement, not tested in production


 Fig. 1 - I<sup>2</sup>C Bus Timing Diagram

**PARAMETER TIMING INFORMATION**

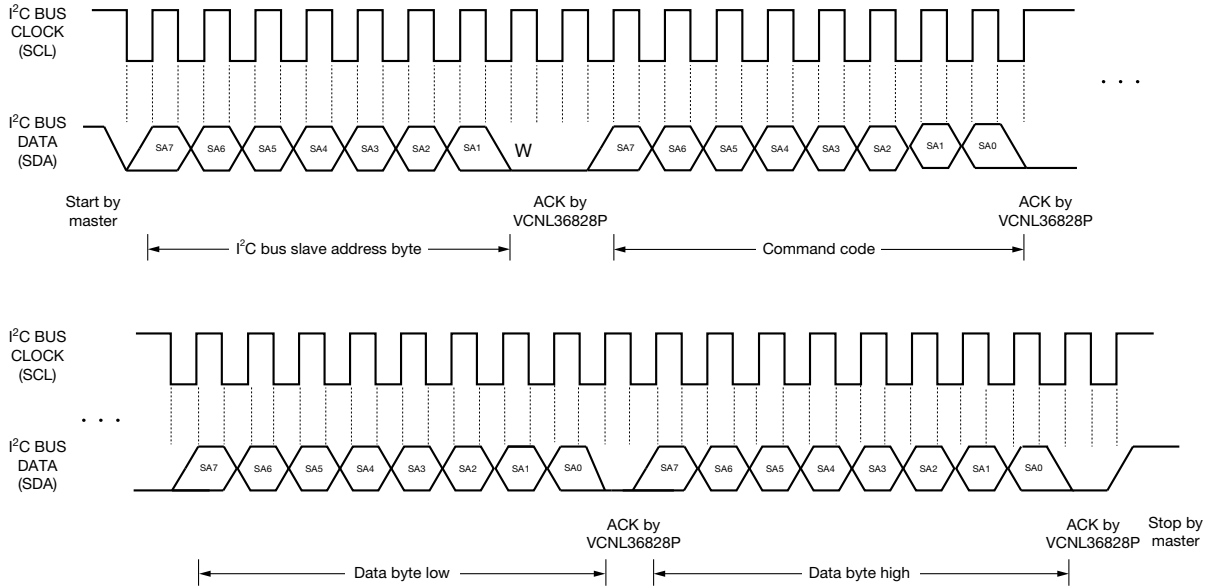


Fig. 2 - I<sup>2</sup>C Bus Timing for Sending Word Command Format

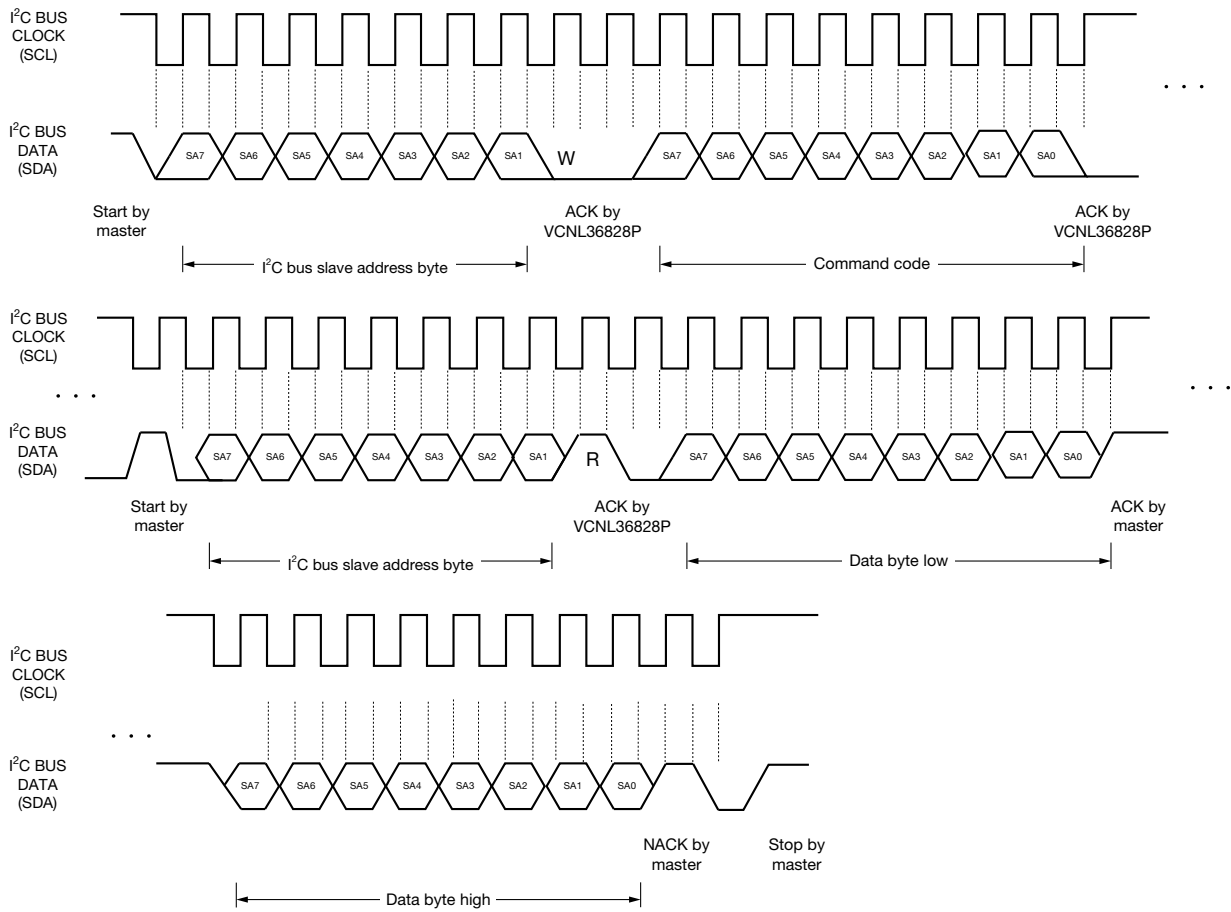


Fig. 3 - I<sup>2</sup>C Bus Timing for Receiving Word Command Format

**TYPICAL PERFORMANCE CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

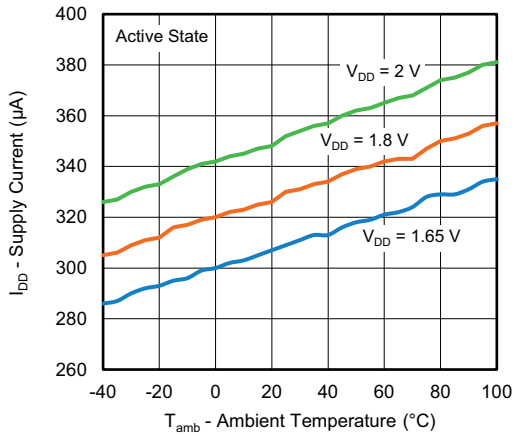


Fig. 4 - Supply Current vs. Ambient Temperature

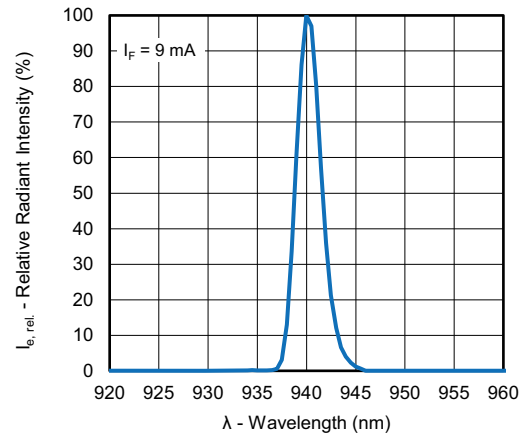


Fig. 7 - Relative Radiant Intensity vs. Wavelength of the VCSEL

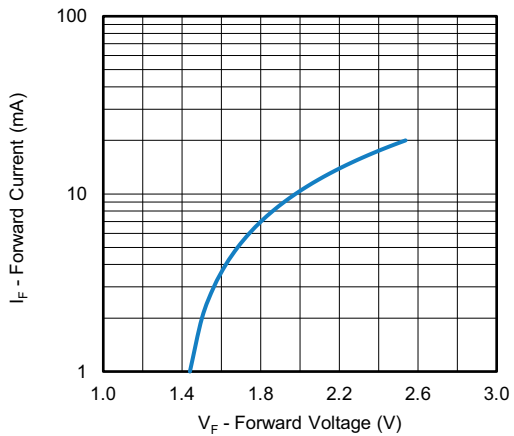


Fig. 5 - Forward Current vs. Forward Voltage of the VCSEL

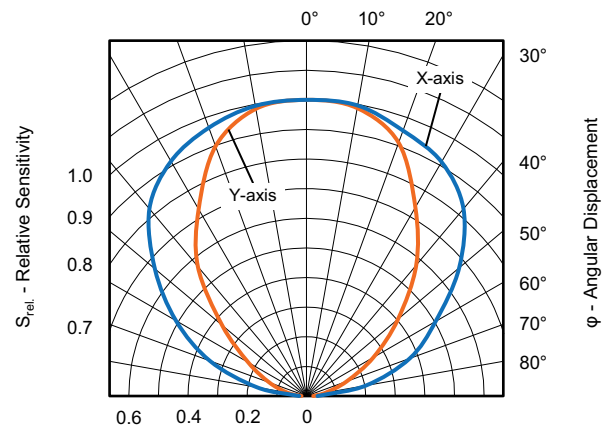


Fig. 8 - Relative Sensitivity vs. Angular Displacement of the Photodiode

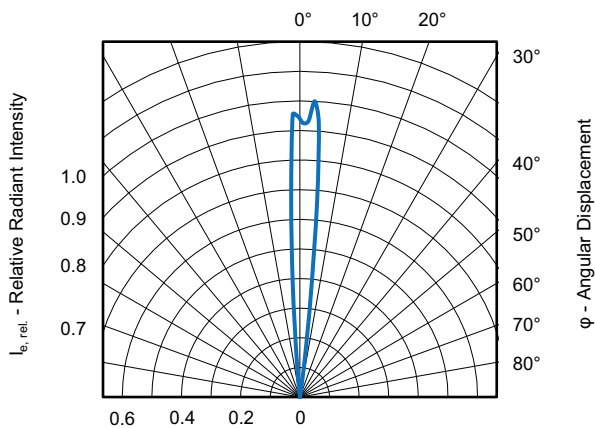


Fig. 6 - Relative Radiant Intensity vs. Angular Displacement of the VCSEL

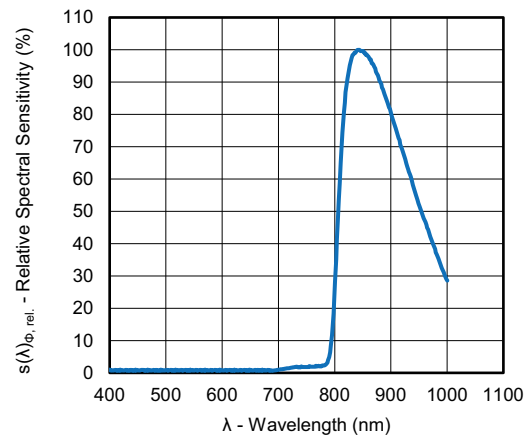


Fig. 9 - Relative Spectral Sensitivity vs. Wavelength of the Photodiode

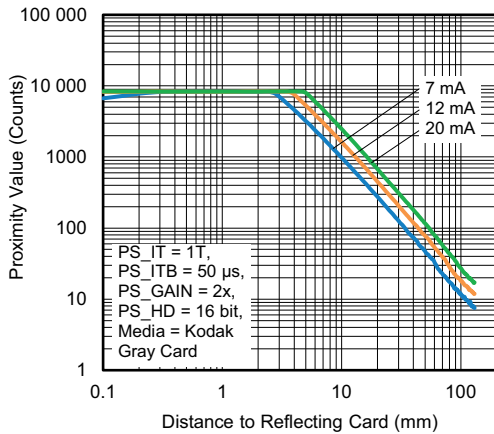


Fig. 10 - Proximity Value vs. Distance

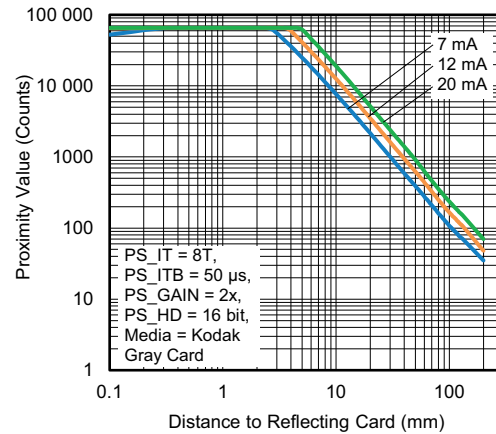


Fig. 11 - Proximity Value vs. Distance

## APPLICATION INFORMATION

### Slave Address Selection

The VCNL36828P supports a smart dual slave address where the designer can change the slave address by swapping the SCL and SDA pins, as shown in Table 1.

| TABLE 1 - SLAVE ADDRESS TABLE |       |                     |                             |                            |      |
|-------------------------------|-------|---------------------|-----------------------------|----------------------------|------|
| PIN 5                         | PIN 6 | 7 BIT SLAVE ADDRESS | 8 BIT SLAVE ADDRESS (WRITE) | 8 BIT SLAVE ADDRESS (READ) |      |
| SCL                           | SDA   | 0x60                |                             | 0xC0                       | 0xC1 |
| SDA                           | SCL   | 0x51                | 0xA2                        | 0xA3                       |      |

A smart dual slave address provides the flexibility for the designer to connect two devices from two different slave addresses on the same I<sup>2</sup>C bus. Besides that, the two slave address options allow designers to select a different slave address if one is used by the other slave devices on the same I<sup>2</sup>C bus in a single device application.

### Application Circuit With a Single Device - Slave Address 0x60

Fig. 12 shows an application circuit example with a single device. As described in Table 1, when pins 5 and 6 are connected to the clock and data signal from the microcontroller, as shown in Fig. 12, they will then be configured as an SCL pin and SDA pin, respectively. The 7 bit slave address option of 0x60 will be automatically selected.

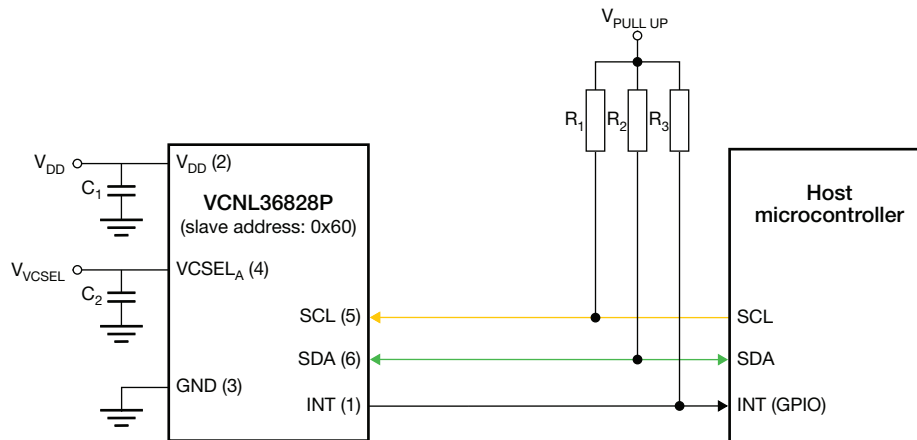


Fig. 12 - Application Circuit Example for a Single VCNL36828P - Slave Address 0x60



**Application Circuit With a Single Device - Slave Address 0x51**

On the other hand, when pins 5 and 6 are connected to the data and clock signal from the microcontroller, as shown in Fig. 13, they will then be configured as an SDA pin and SCL pin, respectively. The 7 bit slave address option of 0x51 will be automatically selected.

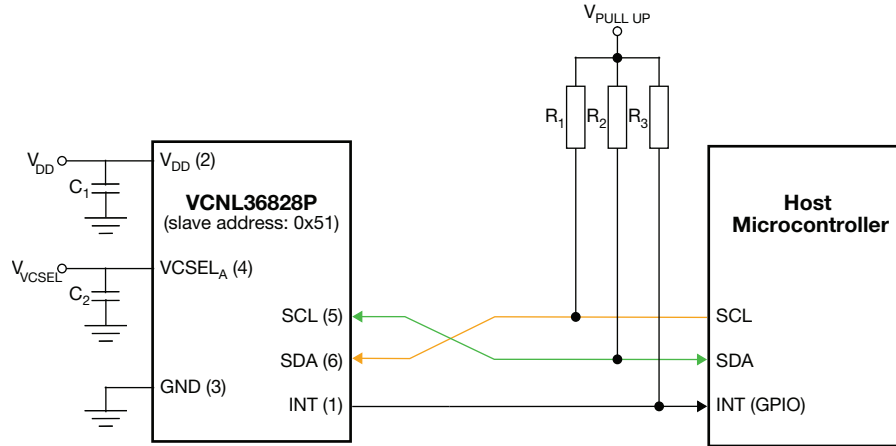


Fig. 13 - Application Circuit Example for a Single VCNL36828P - Slave Address 0x51

Table 2 shows the required values and the explanation for the individual application circuit parameters.

| TABLE 2 - APPLICATION CIRCUIT PARAMETERS |                                  |  |
|--|----------------------------------|--|
| CIRCUIT PARAMETER                        | VALUE                            | DESCRIPTION  |
| $V_{DD}$                                 | 1.65 V to 2.00 V                 | A stable power supply such as a low dropout regulator or a switching regulator is required; the power supply isolation can be further improved with a decoupling capacitor $C_1$   |
| $V_{VCSEL}$                              | 2.62 V to 3.60 V                 | A stable power supply such as a low dropout regulator or a switching regulator that can supply an adequate amount of power (max. VCSEL pulse driving current of 20 mA) is required; the power supply isolation can be further improved with a decoupling capacitor $C_2$ ; the minimum voltage depends on the selected driving current of the VCSEL; please refer to Table $V_{VCSEL, min.}$ for reference |
| $V_{PULL UP}$                            | 1.2 V to 3.6 V                   | A stable power supply such as a low dropout regulator or a switching regulator is required; a voltage level shifter is required if the I <sup>2</sup> C bus voltage from the microcontroller is higher than 3.6 V  |
| $C_1 - C_4$                              | 100 nF to 1 $\mu$ F              | Decoupling capacitors are recommended to reduce the noise in the supply voltage  |
| $R_1 - R_2$                              | 2.2 k $\Omega$ to 4.7 k $\Omega$ | Pull-up resistors within the range of 2.2 k $\Omega$ to 4.7 k $\Omega$ are recommended; any increase in bus capacitance or resistance will increase the logic high transition time   |
| $R_3$                                    | 4.7 k $\Omega$ to 22 k $\Omega$  | Pull-up resistor within the range of 4.7 k $\Omega$ to 22 k $\Omega$ is recommended  |

**Application Circuit With a Smart Dual Slave Address**

Fig. 14 shows an application circuit example with a smart dual slave address. By swapping the SCL and SDA pins of the second device, as shown in Table 1, the designer can change the 7 bit slave address of the VCNL36828P. This provides the flexibility for the designer to connect two devices from two different slave addresses on the same I<sup>2</sup>C bus.

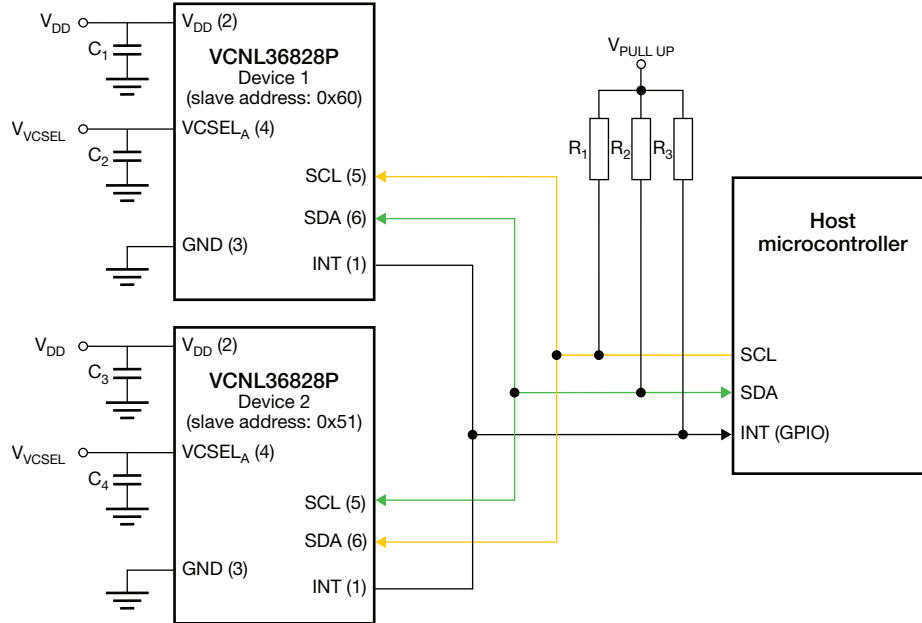
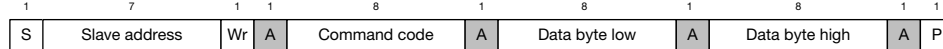


Fig. 14 - Application Circuit Example for Two VCNL36828Ps - Smart Dual Slave Address

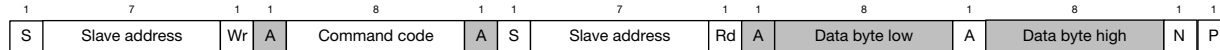
**I<sup>2</sup>C Write and Read Protocol**

The communication with the VCNL36828P can be performed via I<sup>2</sup>C. The I<sup>2</sup>C write and read protocol when communicating with the proximity sensor is shown in Fig. 15.

Send byte → write command to VCNL36828P



Receive byte → read data from VCNL36828P



S = start condition  
 P = stop condition  
 A = acknowledge  
 N = not acknowledge

Host action  
 VCNL36828P response

Fig. 15 - I<sup>2</sup>C Write and Read Protocol

It is imperative that only the restart condition for the I<sup>2</sup>C read is implemented instead of the stop and restart condition.



## Function Description

**TABLE 3 - COMMAND CODE AND REGISTER DESCRIPTION**

| COMMAND CODE | DATA BYTE LOW / HIGH | REGISTER NAME   | DEFAULT VALUE | FUNCTION  | ACCESS         |
|--------------|----------------------|-----------------|---------------|---|----------------|
| 0x00         | L                    | PS_CONF1_L      | 0x00          | Internal calibration setting  | Write and read |
|              |                      |                 |               | Switch the sensor on / off  |                |
|              | H                    | PS_CONF1_H      | 0x00          | High dynamic range setting  |                |
|              |                      |                 |               | Persistence setting   |                |
| 0x01         | L                    | PS_CONF2_L      | 0x00          | Interrupt setting   |                |
|              |                      |                 |               | Measurement period setting  |                |
|              |                      |                 |               | Signal strength setting (Integration time and multi-pulse)                    |                |
|              | H                    | PS_CONF2_H      | 0x00          | High gain setting   |                |
|              |                      |                 |               | Sensitivity of the ADC setting  |                |
|              |                      |                 |               | Internal crosstalk cancellation setting                                       |                |
| 0x02         | L                    | PS_CONF3_L      | 0x00          | VCCSEL driving current setting  |                |
|              |                      |                 |               | Sensor mode setting   |                |
|              | H                    | PS_CONF3_H      | 0x00          | Active force mode trigger setting   |                |
|              |                      |                 |               | Short measurement period setting  |                |
| 0x03         | L                    | PS_THDL_L       | 0x00          | Low threshold interrupt value setting (low byte)                              |                |
|              | H                    | PS_THDL_H       | 0x00          | Low threshold interrupt value setting (high byte)                             |                |
| 0x04         | L                    | PS_THDH_L       | 0x00          | High threshold interrupt value setting (low byte)                             |                |
|              | H                    | PS_THDH_H       | 0x00          | High threshold interrupt value setting (high byte)                            |                |
| 0x05         | L                    | PS_CANC_L       | 0x00          | Offset count cancellation value setting (low byte)                            |                |
|              | H                    | PS_CANC_H       | 0x00          | Offset count cancellation value setting (high byte)                           |                |
| 0xF8         | L                    | PS_DATA_L       | 0x00          | Proximity output data (low byte)  | Read only      |
|              | H                    | PS_DATA_H       | 0x00          | Proximity output data (high byte)   |                |
| 0xF9         | L                    | Reserved        | 0x00 - 0xFF   | Reserved  |                |
|              | H                    | INT_FLAG        | 0x00          | Interrupt flag  |                |
| 0xFA         | L                    | VCNL36828P_ID_L | 0x28 / 0x29   | Device ID<br>Slave address: 0x60; ID = 0x28<br>Slave address: 0x51; ID = 0x29 |                |
|              | H                    | VCNL36828P_ID_H | 0x01          | Device ID   |                |

**Notes**

- All of the reserved registers are used for internal test. These values must be kept constant
- (1) The default ID depends on the connection of the SCL and SDA pins on the VCNL36828P with the SCL and SDA pins on the host MCU. If pins 5 and 6 on the VCNL36828P are connected to the SCL and SDA pins on the host, the default value will be 0x28. On the other hand, if pins 5 and 6 on the VCNL36828P are connected to the SDA and SCL pins on the host, the default value will be 0x29. Please refer to Fig. 13



## Command Register Format

| TABLE 4 - REGISTER NAME: PS_CONF1_L |   |       |       |       |                 |  |       |
|-------------------------------------|---|-------|-------|-------|-----------------|--|-------|
| Bit 7                               | Bit 6                                     | Bit 5 | Bit 4 | Bit 3 | Bit 2           | Bit 1                                    | Bit 0 |
| PS_CAL                              | Reserved                                  |       |       |       |                 |  | PS_ON |
| COMMAND CODE                        |   |       |       |       | 0x00            |  |       |
| Bit Name                            | Function                                  |       |       | Bit   | Value           | Description                              |       |
| PS_CAL                              | Enable / disable the internal calibration |       |       | 7     | 0x0 (0b0)       | Disable (default)                        |       |
|                                     |   |       |       |       | 0x1 (0b1)       | Enable                                   |       |
| Reserved                            | Reserved                                  |       |       | 6 : 1 | 0x00 (0b000000) | Should be kept default                   |       |
| PS_ON                               | Switch the sensor on / off                |       |       | 0     | 0x0 (0b0)       | Turn off the sensor (shutdown) (default) |       |
|                                     |   |       |       |       | 0x1 (0b1)       | Turn on the sensor                       |       |

| TABLE 5 - REGISTER NAME: PS_CONF1_H |  |           |               |         |            |  |       |
|-------------------------------------|--|-----------|---------------|---------|------------|--|-------|
| Bit 15                              | Bit 14   | Bit 13    | Bit 12        | Bit 11  | Bit 10     | Bit 9                                      | Bit 8 |
| Reserved                            | PS_HD  | PS_SP_INT | PS_SMART_PERS | PS_PERS |            | PS_INT                                     |       |
| COMMAND CODE                        |  |           |               |         | 0x00       |  |       |
| Bit Name                            | Function   |           |               | Bit     | Value      | Description                                |       |
| Reserved                            | Reserved   |           |               | 15      | 0x0 (0b0)  | Should be kept default                     |       |
| PS_HD                               | Enable / disable high dynamic range (12 bit / 16 bit) ADC output setting               |           |               | 14      | 0x0 (0b0)  | Disable (12 bit) (default)                 |       |
|                                     |  |           |               |         | 0x1 (0b1)  | Enable (16 bit)                            |       |
| PS_SP_INT                           | Enable / disable the sunlight protection mode interrupt setting                        |           |               | 13      | 0x0 (0b0)  | Disable (default)                          |       |
|                                     |  |           |               |         | 0x1 (0b1)  | Enable                                     |       |
| PS_SMART_PERS                       | Enable / disable the smart persistence setting when the interrupt event is triggered   |           |               | 12      | 0x0 (0b0)  | Disable (default)                          |       |
|                                     |  |           |               |         | 0x1 (0b1)  | Enable                                     |       |
| PS_PERS                             | Set the amount of consecutive threshold crossing events necessary to trigger interrupt |           |               | 11 : 10 | 0x0 (0b00) | 1 time (default)                           |       |
|                                     |  |           |               |         | 0x1 (0b01) | 2 times                                    |       |
|                                     |  |           |               |         | 0x2 (0b10) | 3 times                                    |       |
|                                     |  |           |               |         | 0x3 (0b11) | 4 times                                    |       |
| PS_INT                              | Set the interrupt mode setting   |           |               | 9 : 8   | 0x0 (0b00) | Interrupt disable (default)                |       |
|                                     |  |           |               |         | 0x1 (0b01) | Logic high / low mode                      |       |
|                                     |  |           |               |         | 0x3 (0b11) | Trigger by each high / low threshold event |       |



| TABLE 6 - REGISTER NAME: PS_CONF2_L |  |       |            |   |       |        |         |
|-------------------------------------|--|-------|------------|---|-------|--------|---------|
| Bit 7                               | Bit 6  | Bit 5 | Bit 4      | Bit 3   | Bit 2 | Bit 1  | Bit 0   |
| PS_PERIOD                           |  | PS_IT |            | PS_MPS  |       | PS_ITB | PS_GAIN |
| COMMAND CODE                        |  |       |            | 0x01  |       |        |         |
| Bit Name                            | Function   | Bit   | Value      | Description   |       |        |         |
| PS_PERIOD                           | Set the measurement period   | 7 : 6 | 0x0 (0b00) | 50 ms, which translates into 20 measurement/s (default) |       |        |         |
|                                     |  |       | 0x1 (0b01) | 100 ms, which translates into 10 measurements/s         |       |        |         |
|                                     |  |       | 0x2 (0b10) | 200 ms, which translates into 5 measurements/s          |       |        |         |
|                                     |  |       | 0x3 (0b11) | 400 ms, which translates into 2.5 measurements/s        |       |        |         |
| PS_IT                               | Set the integration time for one measurement; the pulse length "T" is determined by PS_ITB | 5 : 4 | 0x0 (0b00) | 1 T (default)   |       |        |         |
|                                     |  |       | 0x1 (0b01) | 2 T   |       |        |         |
|                                     |  |       | 0x2 (0b10) | 4 T   |       |        |         |
|                                     |  |       | 0x3 (0b11) | 8 T   |       |        |         |
| PS_MPS                              | Set the number of infrared signal pulses per measurement                                   | 3 : 2 | 0x0 (0b00) | 1 pulse (default)                                       |       |        |         |
|                                     |  |       | 0x1 (0b01) | 2 pulses  |       |        |         |
|                                     |  |       | 0x2 (0b10) | 4 pulses  |       |        |         |
|                                     |  |       | 0x3 (0b11) | 8 pulses  |       |        |         |
| PS_ITB                              | Set the pulse length "T" for PS_IT   | 1     | 0x0 (0b0)  | T = 25 µs (default)                                     |       |        |         |
|                                     |  |       | 0x1 (0b1)  | T = 50 µs   |       |        |         |
| PS_GAIN                             | Set the gain of the ADC  | 0     | 0x0 (0b0)  | x 1 gain (default)                                      |       |        |         |
|                                     |  |       | 0x1 (0b1)  | x 2 gain  |       |        |         |

| TABLE 7 - REGISTER NAME: PS_CONF2_H |  |         |             |                              |            |       |       |
|-------------------------------------|--|---------|-------------|------------------------------|------------|-------|-------|
| Bit 15                              | Bit 14   | Bit 13  | Bit 12      | Bit 11                       | Bit 10     | Bit 9 | Bit 8 |
| Reserved                            |  | PS_SENS | PS_OFFSET   | Reserved                     | PS_CURRENT |       |       |
| COMMAND CODE                        |  |         |             | 0x01                         |            |       |       |
| Bit Name                            | Function   | Bit     | Value       | Description                  |            |       |       |
| Reserved                            | Reserved   | 15 : 14 | 0x0 (0b00)  | Should be kept default       |            |       |       |
| PS_SENS                             | Set the sensitivity of the ADC                       | 13      | 0x0 (0b0)   | Normal sensitivity (default) |            |       |       |
|                                     |  |         | 0x1 (0b1)   | High sensitivity             |            |       |       |
| PS_OFFSET                           | Enable / disable the internal crosstalk cancellation | 12      | 0x0 (0b0)   | Disable (default)            |            |       |       |
|                                     |  |         | 0x1 (0b1)   | Enable                       |            |       |       |
| Reserved                            | Reserved   | 11      | 0x0 (0b0)   | Should be kept default       |            |       |       |
| PS_CURRENT                          | Set the VCSEL driving current                        | 10 : 8  | 0x0 (0b000) | 7 mA (default)               |            |       |       |
|                                     |  |         | 0x1 (0b001) | 9 mA                         |            |       |       |
|                                     |  |         | 0x2 (0b010) | 11 mA                        |            |       |       |
|                                     |  |         | 0x3 (0b011) | 12 mA                        |            |       |       |
|                                     |  |         | 0x4 (0b100) | 15 mA                        |            |       |       |
|                                     |  |         | 0x5 (0b101) | 17 mA                        |            |       |       |
|                                     |  |         | 0x6 (0b110) | 19 mA                        |            |       |       |
|                                     |  |         | 0x7 (0b111) | 20 mA                        |            |       |       |



| TABLE 8 - MAXIMUM BIT RESOLUTION AND DIGITAL OUTPUT COUNTS |                       |                      |                        |                        |                        |
|--|-----------------------|----------------------|------------------------|------------------------|------------------------|
| BIT NAME   |                       | PS_IT = 1T           | PS_IT = 2T             | PS_IT = 4T             | PS_IT = 8T             |
| PS_HD = 0 (12 bit)   | PS_GAIN = 0 (x1 gain) | 12 bit / 4095 counts |                        |                        |                        |
|  | PS_GAIN = 1 (x2 gain) |                      |                        |                        |                        |
| PS_HD = 1 (16 bit)   | PS_GAIN = 0 (x1 gain) | 12 bit / 4095 counts | 13 bit / 8191 counts   | 14 bit / 16 383 counts | 15 bit / 32 767 counts |
|  | PS_GAIN = 1 (x2 gain) | 13 bit / 8191 counts | 14 bit / 16 383 counts | 15 bit / 32 767 counts | 16 bit / 65 535 counts |

| TABLE 9 - REGISTER NAME: PS_CONF3_L |  |         |         |          |              |                        |       |
|-------------------------------------|--|---------|---------|----------|--------------|------------------------|-------|
| Bit 7                               | Bit 6  | Bit 5   | Bit 4   | Bit 3    | Bit 2        | Bit 1                  | Bit 0 |
| Reserved                            |  | PS_TRIG | PS_MODE | Reserved |              |                        |       |
| COMMAND CODE                        |  |         |         | 0x02     |              |                        |       |
| Bit Name                            | Function   |         |         | Bit      | Value        | Description            |       |
| Reserved                            | Reserved   |         |         | 7 : 6    | 0x0 (0b00)   | Should be kept default |       |
| PS_TRIG                             | Set the active force mode trigger; This bit will be reset to 0 after the measurement cycle |         |         | 5        | 0x0 (0b0)    | Off (default)          |       |
|                                     |  |         |         |          | 0x1 (0b1)    | Trigger                |       |
| PS_MODE                             | Set the measurement mode of the sensor   |         |         | 4        | 0x0 (0b0)    | Auto mode (default)    |       |
|                                     |  |         |         |          | 0x1 (0b1)    | Active force mode      |       |
| Reserved                            | Reserved   |         |         | 3 : 0    | 0x0 (0b0000) | Should be kept default |       |

| TABLE 10 - REGISTER NAME: PS_CONF3_H |  |          |        |         |             |   |       |
|--------------------------------------|--|----------|--------|---------|-------------|---|-------|
| Bit 15                               | Bit 14                                     | Bit 13   | Bit 12 | Bit 11  | Bit 10      | Bit 9   | Bit 8 |
| PS_SPERIOD                           |  | Reserved | PS_SC  |         |             | Reserved  |       |
| COMMAND CODE                         |  |          |        | 0x02    |             |   |       |
| Bit Name                             | Function                                   |          |        | Bit     | Value       | Description   |       |
| PS_SPERIOD                           | Set the short measurement period           |          |        | 15 : 14 | 0x0 (0b00)  | Disable the short period (follow PS_PERIOD setting) (default) |       |
|                                      |  |          |        |         | 0x1 (0b01)  | 6.25 ms, which translates into 160 measurements/s             |       |
|                                      |  |          |        |         | 0x2 (0b10)  | 12.5 ms, which translates into 80 measurements/s              |       |
|                                      |  |          |        |         | 0x3 (0b11)  | 25 ms, which translates into 40 measurements/s                |       |
| Reserved                             | Reserved                                   |          |        | 13      | 0x0 (0b0)   | Should be kept default  |       |
| PS_SC                                | Enable / disable the sunlight cancellation |          |        | 12 : 10 | 0x0 (0b000) | Disable (default)   |       |
|                                      |  |          |        |         | 0x7 (0b111) | Enable  |       |
| Reserved                             | Reserved                                   |          |        | 9 : 8   | 0x0 (0b00)  | Should be kept default  |       |



| TABLE 11 - REGISTER NAME: PS_THDL |                                       |        |        |             |             |       |       |
|-----------------------------------|---------------------------------------|--------|--------|-------------|-------------|-------|-------|
| Bit 7                             | Bit 6                                 | Bit 5  | Bit 4  | Bit 3       | Bit 2       | Bit 1 | Bit 0 |
| PS_THDL_L                         |                                       |        |        |             |             |       |       |
| Bit 15                            | Bit 14                                | Bit 13 | Bit 12 | Bit 11      | Bit 10      | Bit 9 | Bit 8 |
| PS_THDL_H                         |                                       |        |        |             |             |       |       |
| COMMAND CODE                      |                                       |        |        | 0x03        |             |       |       |
| Bit Name                          | Function                              |        | Bit    | Value       | Description |       |       |
| PS_THDL_L                         | Set the low threshold interrupt value |        | 7 : 0  | 0 to 65 535 | Low byte    |       |       |
| PS_THDL_H                         |                                       |        | 15 : 8 |             | High byte   |       |       |

| TABLE 12 - REGISTER NAME: PS_THDH |  |        |        |             |             |       |       |
|-----------------------------------|--|--------|--------|-------------|-------------|-------|-------|
| Bit 7                             | Bit 6                                  | Bit 5  | Bit 4  | Bit 3       | Bit 2       | Bit 1 | Bit 0 |
| PS_THDH_L                         |  |        |        |             |             |       |       |
| Bit 15                            | Bit 14                                 | Bit 13 | Bit 12 | Bit 11      | Bit 10      | Bit 9 | Bit 8 |
| PS_THDH_H                         |  |        |        |             |             |       |       |
| COMMAND CODE                      |  |        |        | 0x04        |             |       |       |
| Bit Name                          | Function                               |        | Bit    | Value       | Description |       |       |
| PS_THDH_L                         | Set the high threshold interrupt value |        | 7 : 0  | 0 to 65 535 | Low byte    |       |       |
| PS_THDH_H                         |  |        | 15 : 8 |             | High byte   |       |       |

| TABLE 13 - REGISTER NAME: PS_CANC |   |        |         |              |                        |       |       |
|-----------------------------------|---|--------|---------|--------------|------------------------|-------|-------|
| Bit 7                             | Bit 6                                   | Bit 5  | Bit 4   | Bit 3        | Bit 2                  | Bit 1 | Bit 0 |
| PS_CANC_L                         |   |        |         |              |                        |       |       |
| Bit 15                            | Bit 14                                  | Bit 13 | Bit 12  | Bit 11       | Bit 10                 | Bit 9 | Bit 8 |
| Reserved                          |   |        |         | PS_CANC_H    |                        |       |       |
| COMMAND CODE                      |   |        |         | 0x05         |                        |       |       |
| Bit Name                          | Function                                |        | Bit     | Value        | Description            |       |       |
| PS_CANC_L                         | Set the offset count cancellation value |        | 7 : 0   | 0 to 4095    | Low byte               |       |       |
| PS_CANC_H                         |   |        | 11 : 8  |              | High byte              |       |       |
| Reserved                          | Reserved                                |        | 15 : 12 | 0x0 (0b0000) | Should be kept default |       |       |

| TABLE 14 - REGISTER NAME: PS_DATA |                                |        |        |             |             |       |       |
|-----------------------------------|--------------------------------|--------|--------|-------------|-------------|-------|-------|
| Bit 7                             | Bit 6                          | Bit 5  | Bit 4  | Bit 3       | Bit 2       | Bit 1 | Bit 0 |
| PS_DATA_L                         |                                |        |        |             |             |       |       |
| Bit 15                            | Bit 14                         | Bit 13 | Bit 12 | Bit 11      | Bit 10      | Bit 9 | Bit 8 |
| PS_DATA_H                         |                                |        |        |             |             |       |       |
| COMMAND CODE                      |                                |        |        | 0xF8        |             |       |       |
| Bit Name                          | Function                       |        | Bit    | Value       | Description |       |       |
| PS_DATA_L                         | Read the proximity output data |        | 7 : 0  | 0 to 65 535 | Low byte    |       |       |
| PS_DATA_H                         |                                |        | 15 : 8 |             | High byte   |       |       |



| TABLE 15 - REGISTER NAME: INT_FLAG |  |        |           |  |  |             |            |
|------------------------------------|--|--------|-----------|--|--|-------------|------------|
| Bit 7                              | Bit 6  | Bit 5  | Bit 4     | Bit 3                                    | Bit 2  | Bit 1       | Bit 0      |
| Reserved                           |  |        |           |  |  |             |            |
| Bit 15                             | Bit 14   | Bit 13 | Bit 12    | Bit 11                                   | Bit 10   | Bit 9       | Bit 8      |
| Reserved                           |  |        | PS_SPFLAG | Reserved                                 |  | PS_IF_CLOSE | PS_IF_AWAY |
| COMMAND CODE                       |  |        |           | 0xF9                                     |  |             |            |
| Bit Name                           | Function   |        | Bit       | Value                                    | Description                                      |             |            |
| Reserved                           | Reserved   |        | 7 : 0     | 0x00 - 0xFF<br>(0b00000000 - 0b11111111) | Should be kept default                           |             |            |
| Reserved                           | Reserved   |        | 15 : 13   | 0x0 (0b000)                              | Should be kept default                           |             |            |
| PS_SPFLAG                          | Read the sunlight protection mode interrupt event flag |        | 12        | 0x0 (0b0)                                | No sunlight protection mode interrupt event flag |             |            |
|                                    |  |        |           | 0x1 (0b1)                                | Sunlight protection mode interrupt event flag    |             |            |
| Reserved                           | Reserved   |        | 11 : 10   | 0x0 (0b00)                               | Should be kept default                           |             |            |
| PS_IF_CLOSE                        | Read the high threshold crossing interrupt event flag  |        | 9         | 0x0 (0b0)                                | No high threshold crossing interrupt event flag  |             |            |
|                                    |  |        |           | 0x1 (0b1)                                | High threshold crossing interrupt event flag     |             |            |
| PS_IF_AWAY                         | Read the low threshold crossing interrupt event flag   |        | 8         | 0x0 (0b0)                                | No low threshold crossing interrupt event flag   |             |            |
|                                    |  |        |           | 0x1 (0b1)                                | Low threshold crossing interrupt event flag      |             |            |

| TABLE 16 - REGISTER NAME: VCNL36828P_ID |                    |        |        |                      |                                     |       |       |
|---|--------------------|--------|--------|----------------------|-------------------------------------|-------|-------|
| Bit 7                                   | Bit 6              | Bit 5  | Bit 4  | Bit 3                | Bit 2                               | Bit 1 | Bit 0 |
| VCNL36828P_ID_L                         |                    |        |        |                      |                                     |       |       |
| Bit 15                                  | Bit 14             | Bit 13 | Bit 12 | Bit 11               | Bit 10                              | Bit 9 | Bit 8 |
| VCNL36828P_ID_H                         |                    |        |        |                      |                                     |       |       |
| COMMAND CODE                            |                    |        |        | 0xFA                 |                                     |       |       |
| Bit Name                                | Function           |        | Bit    | Value                | Description                         |       |       |
| VCNL36828P_ID_L                         | Read the device ID |        | 7 : 0  | 0x28<br>(0b00101000) | Device with a slave address of 0x60 |       |       |
|   |                    |        |        | 0x29<br>(0b00101001) | Device with a slave address of 0x51 |       |       |
| VCNL36828P_ID_H                         |                    |        | 15 : 8 | 0x01<br>(0b00000001) | Should be kept default              |       |       |



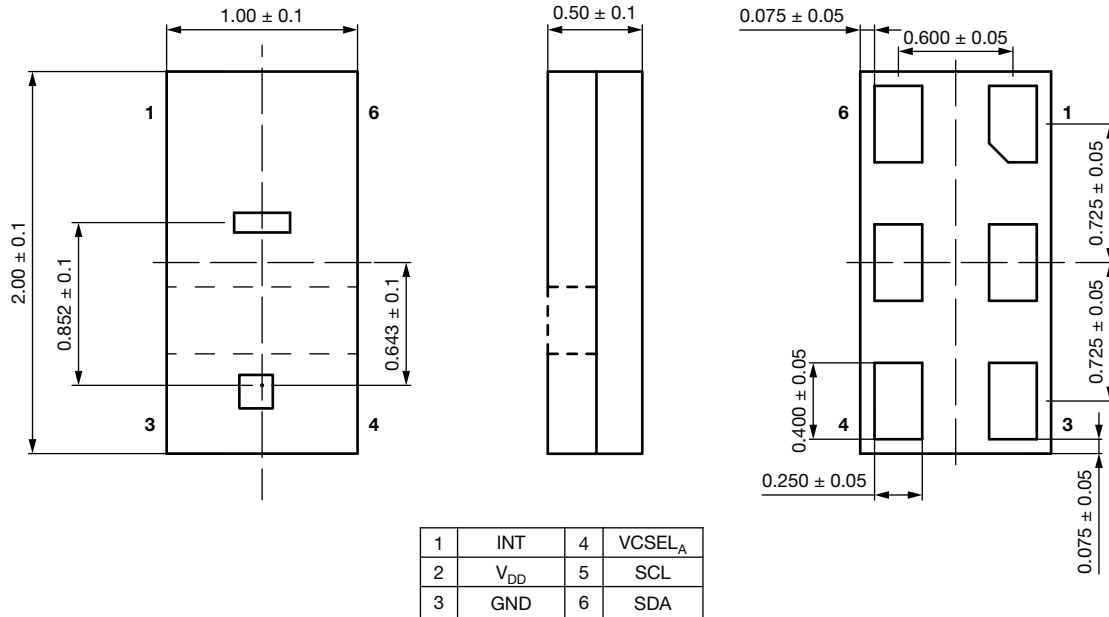
**PACKAGE INFORMATION** in millimeters


Fig. 16 - VCNL36828P Package Dimensions

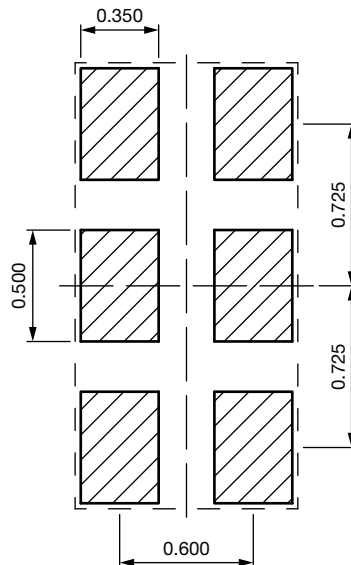
**RECOMMENDED LAYOUT PAD INFORMATION** in millimeters


Fig. 17 - VCNL36828P PCB Layout Footprint



RECOMMENDED INFRARED REFLOW

Soldering conditions which are based on J-STD-020C

| IR REFLOW PROFILE CONDITION                |            |                                       |               |
|--|------------|---------------------------------------|---------------|
| PARAMETER                                  | CONDITIONS | TEMPERATURE                           | TIME          |
| Peak temperature                           |            | 260 °C + 5 °C / - 5 °C (max.: 265 °C) | 10 s          |
| Preheat temperature range and timing       |            | 150 °C to 200 °C                      | 60 s to 180 s |
| Timing within 5 °C to peak temperature     |            | -                                     | 10 s to 30 s  |
| Timing maintained above temperature / time |            | 217 °C                                | 60 s to 150 s |
| Timing from 25 °C to peak temperature      |            | -                                     | 8 min (max.)  |
| Ramp-up rate                               |            | 3 °C/s (max.)                         | -             |
| Ramp-down rate                             |            | 6 °C/s (max.)                         | -             |

Recommend Normal Solder Reflow is 235 °C to 265 °C

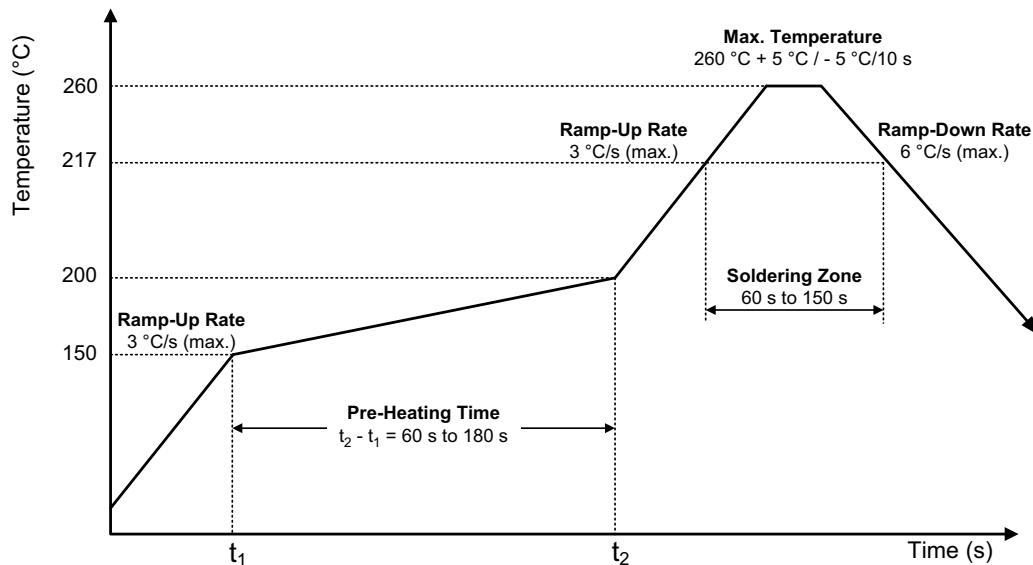
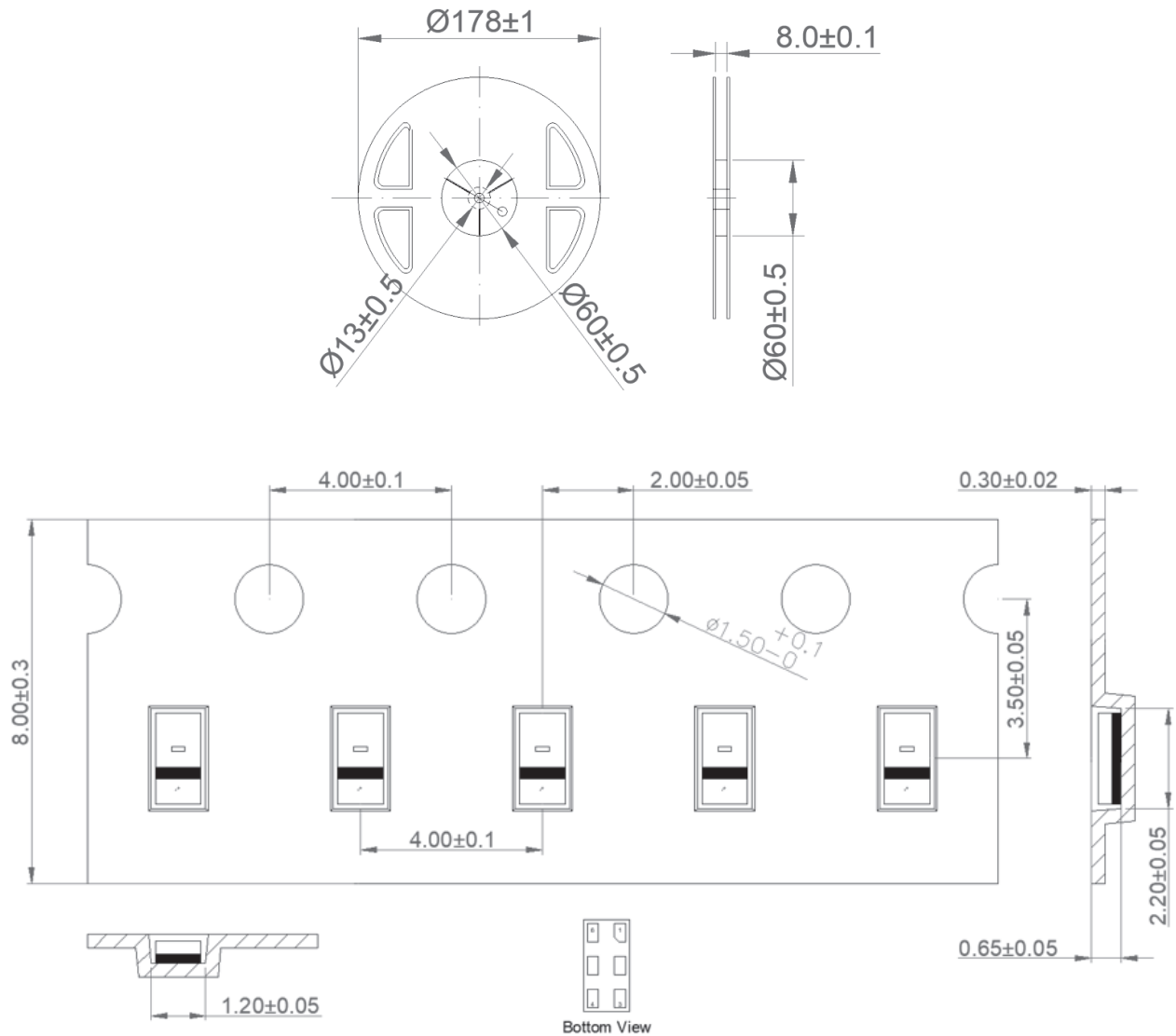


Fig. 18 - VCNL36828P Solder Reflow Profile Chart



TAPE PACKAGING INFORMATION in millimeters





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