



## Optical Sensor With Photodiode Output for Optical Communication



### DESCRIPTION

The VCND2040X02, VCND2040SLX02 is an optical sensor in a miniature SMD package used for optical data communication and reflective encoding. It has a compact construction where the emitting light source and the detector are arranged in the same plane. The operating infrared wavelength is 855 nm. The detector consists of a silicon photodiode. The sensor's analog output signal (photo current) is triggered by light from the other device for bidirectional, optical data transmission.

### FEATURES

- Package type: SMD
- Package form: top view, side view
- Detector type: photodiode
- Dimensions (L x W x H in mm): 4.4 x 2.25 x 1.9
- Emitter wavelength: 855 nm
- Moisture sensitivity level (MSL): 3
- AEC-Q102 qualified
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

AUTOMOTIVE GRADE



RoHS COMPLIANT  
HALOGEN FREE  
GREEN (5-2008)

### APPLICATIONS

- Wireless optical communication
- Position sensor
- Optical switch
- Optical encoder

PRODUCT SUMMARY - EMITTER				
PART NUMBER	$I_e$ (mW/sr) at $I_F = 24$ mA	$\phi$ (°)	$\lambda_p$ (nm)	$t_r$ (ns) (1)
VCND2040X02	35	± 13	855	18
VCND2040SLX02	35	± 13	855	18

#### Note

(1) Conditions as in "Basic Characteristics"

PRODUCT SUMMARY - PHOTODIODE				
PART NUMBER	$I_{ra}$ (µA) at $E_e = 1$ mW/cm <sup>2</sup> , $\lambda = 850$ nm, $V_R = 2$ V	$\phi$ (°)	$\lambda_p$ (nm)	DAYLIGHT BLOCKING FILTER INTEGRATED
VCND2040X02	7.8	± 29	820	No
VCND2040SLX02	7.8	± 29	820	No

ORDERING INFORMATION			
ORDERING CODE	PACKAGING	VOLUME (1)	REMARKS
VCND2040X02	Tape and reel	MOQ: 1000 pcs	Top looker variant
VCND2040SLX02	Tape and reel	MOQ: 1500 pcs	Side looker variant

#### Note

(1) MOQ: minimum order quantity



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT (EMITTER)</b>				
Reverse voltage		V <sub>R</sub>	5	V
Forward current		I <sub>F</sub>	45	mA
Junction temperature		T <sub>J</sub>	125	°C
Thermal resistance junction to ambient	Top looker, JESD 51	R <sub>thJA</sub>	200	K/W
	Side looker, JESD 51	R <sub>thJA</sub>	250	K/W
<b>OUTPUT (DETECTOR)</b>				
Reverse voltage		V <sub>R</sub>	5	V
<b>SENSOR</b>				
Total power dissipation		P <sub>tot</sub>	73	mW
Ambient temperature range		T <sub>amb</sub>	-40 to +110	°C
Storage temperature range		T <sub>stg</sub>	-40 to +110	°C
Soldering temperature	In accordance with Fig. 15	T <sub>sd</sub>	260	°C

**ABSOLUTE MAXIMUM RATINGS**

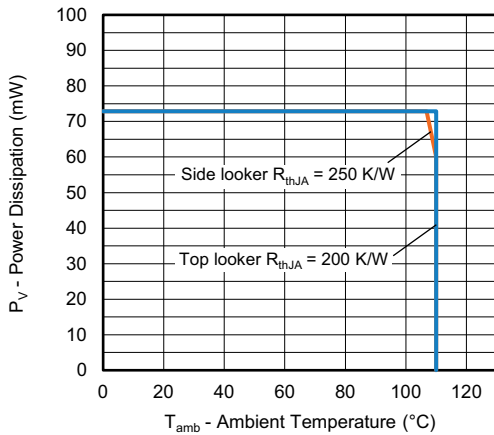


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

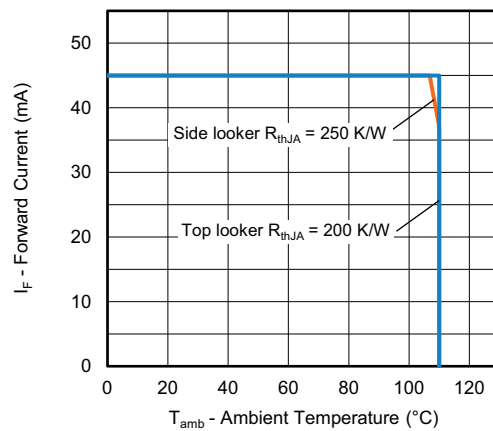


Fig. 2 - Forward Current Limit vs. Ambient Temperature

BASIC CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
<b>INPUT (EMITTER)</b>							
Forward voltage	I <sub>F</sub> = 24 mA	V <sub>F</sub>	-	1.5	1.7	V	
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 24 mA	TKV <sub>F</sub>	-	-1.5	-	mV/K	
Reverse current		I <sub>R</sub>	Not designed for reverse operation				μA
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz, E = 0	C <sub>j</sub>	-	28.1	-	pF	
Radiant intensity	I <sub>F</sub> = 24 mA, t <sub>p</sub> = 20 ms	I <sub>e</sub>	19	35	65	mW/sr	
Radiant power	I <sub>F</sub> = 24 mA, t <sub>p</sub> = 20 ms	φ <sub>e</sub>	-	8	-	mW	
Angle of half intensity		φ	-	± 13	-	°	
Peak wavelength	I <sub>F</sub> = 24 mA	λ <sub>p</sub>	-	855	-	nm	
Spectral bandwidth	I <sub>F</sub> = 24 mA	Δλ <sub>P, 0.5</sub>	-	28	-	nm	



BASIC CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>OUTPUT (DETECTOR)</b>						
Forward voltage	I <sub>F</sub> = 50 mA	V <sub>F</sub>	-	0.9	1.1	V
Reverse dark current	V <sub>R</sub> = 10 V, E = 0	I <sub>ro</sub>	-	0.01	10	nA
Diode capacitance	V <sub>R</sub> = 0 V, f = 1 MHz, E = 0	C <sub>D</sub>	-	5.8	-	pF
Open circuit voltage	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , λ = 850 nm	V <sub>O</sub>	-	429	-	mV
Temperature coefficient of V <sub>O</sub>	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , λ = 850 nm	TKV <sub>O</sub>	-	-2.6	-	mV/K
Short circuit current	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , λ = 850 nm	I <sub>k</sub>	-	7.8	-	μA
Temperature coefficient of I <sub>k</sub>	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , λ = 850 nm	TKI <sub>k</sub>	-	0.1	-	%/K
Reverse light current	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , λ = 850 nm, V <sub>R</sub> = 2 V	I <sub>ra</sub>	4	7.8	10	μA
Wavelength of peak sensitivity		λ <sub>p</sub>	-	820	-	nm
Angle of half sensitivity		φ	-	± 29	-	°
<b>SENSOR</b>						
Reverse light current	V <sub>R</sub> = 2 V, I <sub>F</sub> = 24 mA, d = 4 mm, mirror, reflective setup <sup>(1)</sup>	I <sub>ra</sub>	-	96	-	μA
	V <sub>R</sub> = 2 V, I <sub>F</sub> = 24 mA, d = 4 mm, KODAK Gray Card, gray side, reflective setup <sup>(1)</sup>		-	6	-	
	V <sub>R</sub> = 2 V, I <sub>F</sub> = 24 mA, d = 4 mm, KODAK Gray Card, white side, reflective setup <sup>(1)</sup>		-	32	-	
	V <sub>R</sub> = 2 V, I <sub>F</sub> = 24 mA, d = 10 mm, communication setup <sup>(2)</sup>		-	145	-	
Output rise time (20 % to 80 %)	Push-pull driver with I <sub>F</sub> = 24 mA, I <sub>ra</sub> = 5 μA, V <sub>R</sub> = 2 V, communication setup <sup>(2)</sup>	t <sub>r</sub>	-	18	-	ns
Output fall time (80 % to 20 %)		t <sub>f</sub>	-	18	-	ns

**Notes**

- (1) Reflective test setup as described in Fig. 4
- (2) Communication test setup as described in Fig. 5

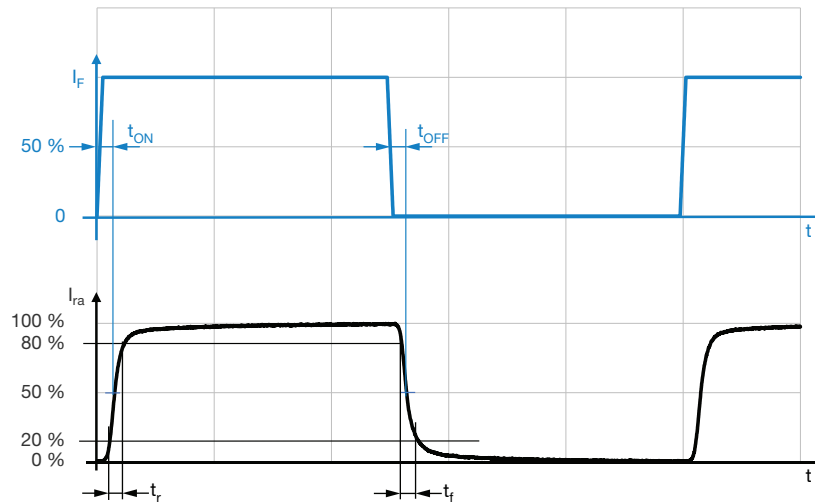


Fig. 3 - Switching Times

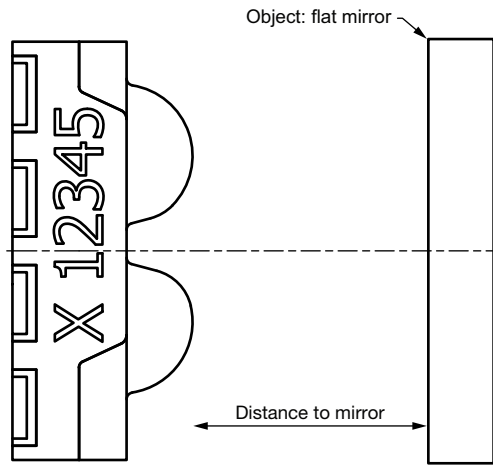


Fig. 4 - Test Setup - Reflective

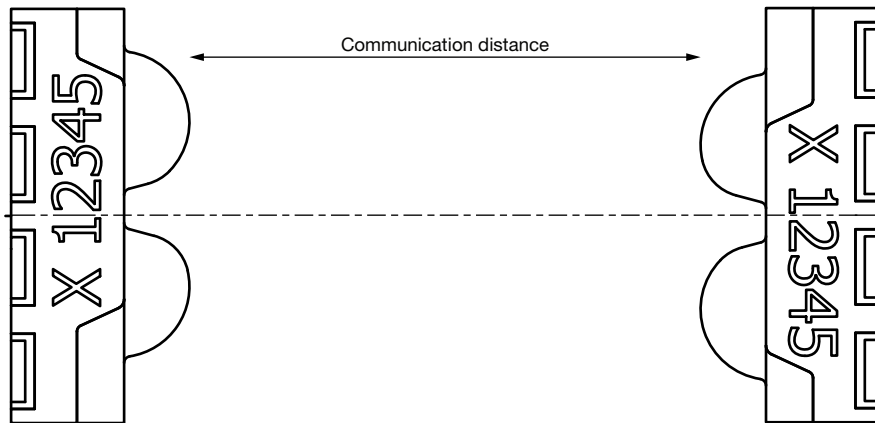


Fig. 5 - Test Setup - Communication

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

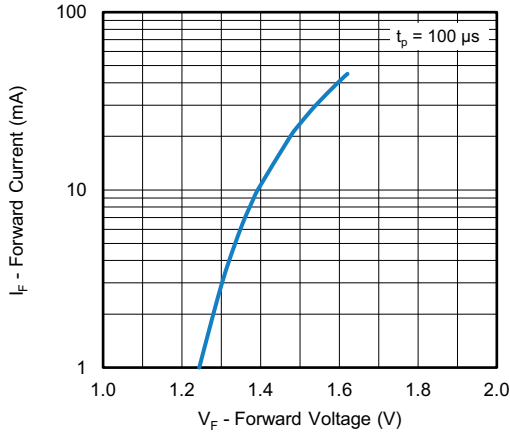


Fig. 6 - Forward Current vs. Forward Voltage

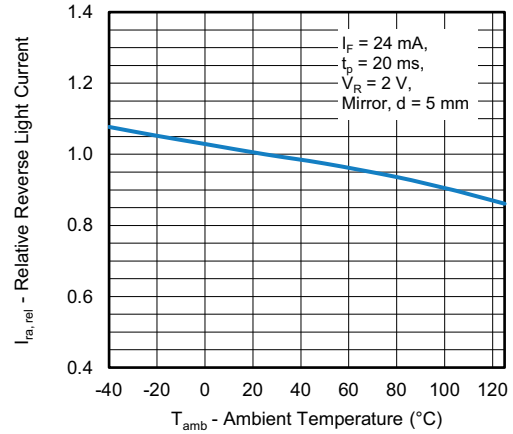


Fig. 9 - Relative Reverse Light Current vs. Ambient Temperature

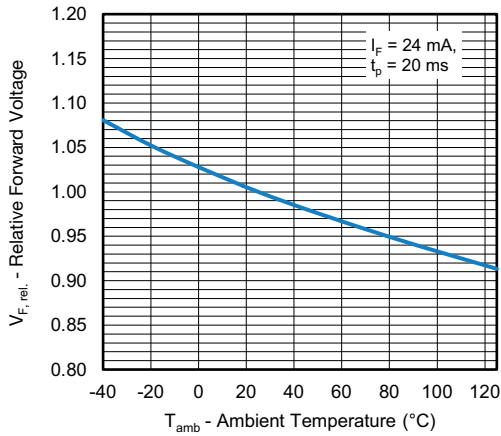


Fig. 7 - Relative Forward Voltage vs. Ambient Temperature

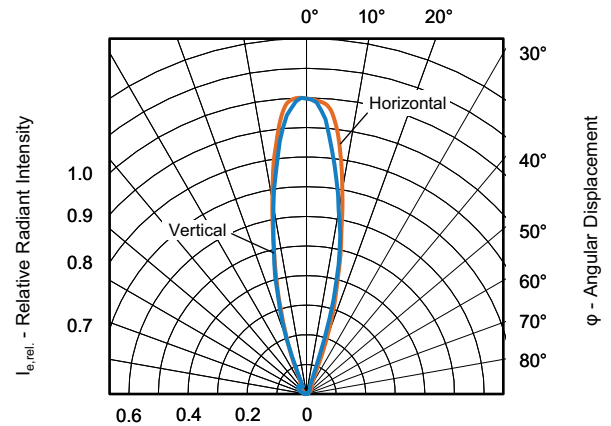


Fig. 10 - Relative Radiant Intensity vs. Angular Displacement

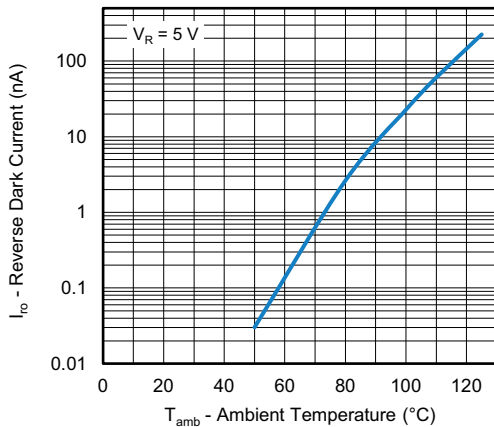


Fig. 8 - Reverse Dark Current vs. Ambient Temperature

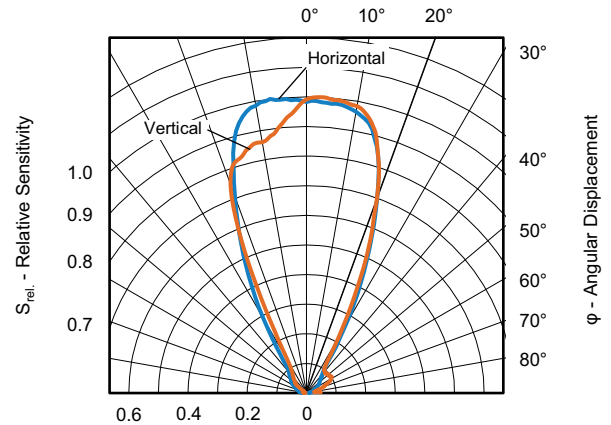


Fig. 11 - Relative Sensitivity vs. Angular Displacement

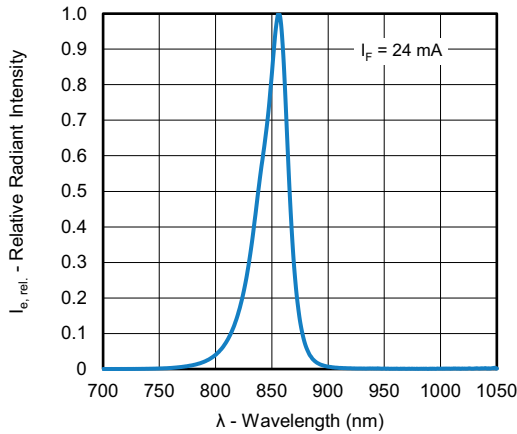


Fig. 12 - Relative Radiant Intensity vs. Wavelength

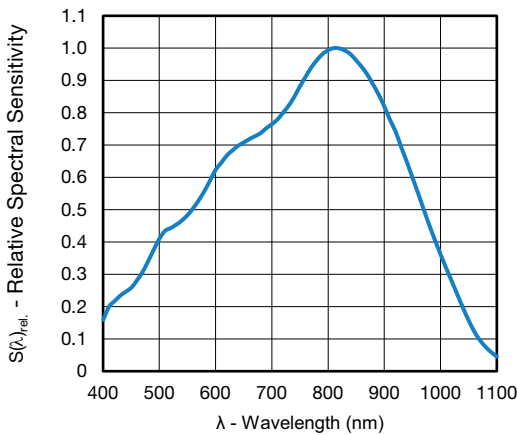


Fig. 13 - Relative Spectral Sensitivity vs. Wavelength

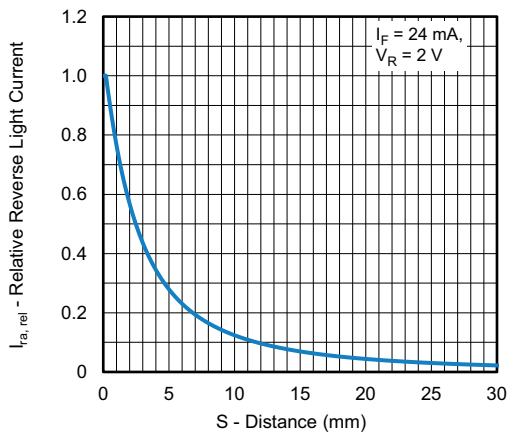


Fig. 14 - Relative Reverse Light Current vs. Distance (communication setup)

**FLOOR LIFE**

Time between soldering and removing from MBB must not exceed the time indicated in J-STD-020:

Moisture sensitivity: level 3

Floor life: 168 h

Conditions:  $T_{amb} < 30\text{ }^{\circ}\text{C}$ , RH < 60 %

**DRYING**

In case of moisture absorption devices should be baked before soldering. Conditions see J-STD-020 or recommended conditions:

192 h at  $40\text{ }^{\circ}\text{C}$  (+ 5  $^{\circ}\text{C}$ ), RH < 5 %

or

96 h at  $60\text{ }^{\circ}\text{C}$  (+ 5  $^{\circ}\text{C}$ ), RH < 5 %

**REFLOW SOLDER PROFILE**

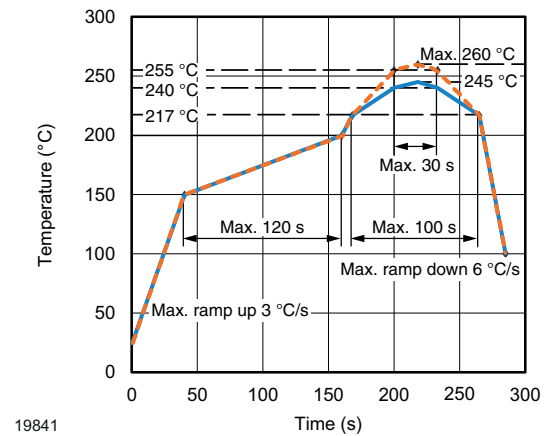
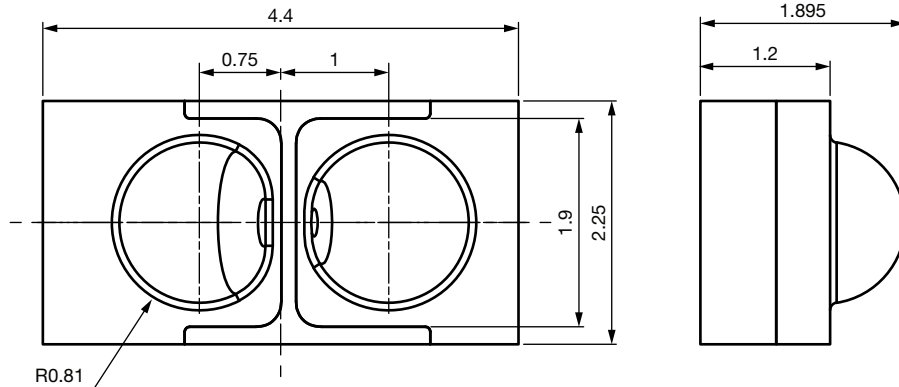


Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

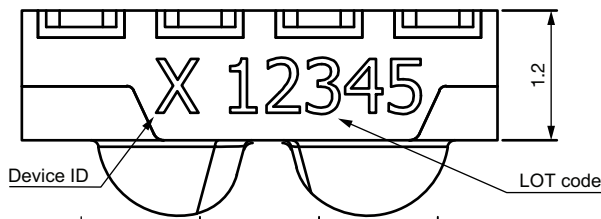


### PACKAGE DIMENSIONS in millimeters



R0.81

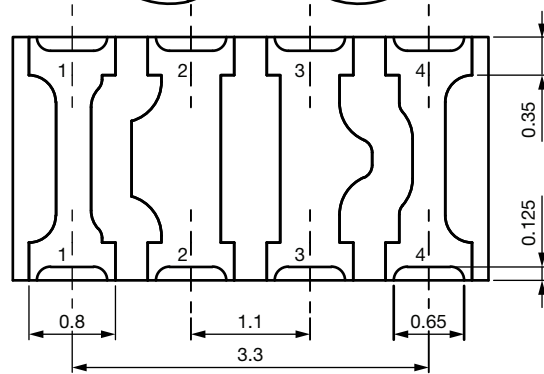
Not indicated tolerances  $\pm 0.1$



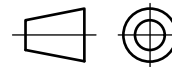
Device ID

LOT code

Device ID:  
 1 = VCND2040  
 2 = VCND2045



PIN	SIGNAL
1	PD anode
2	PD cathode
3	LED anode
4	LED cathode

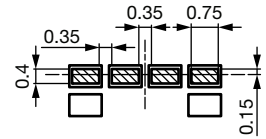
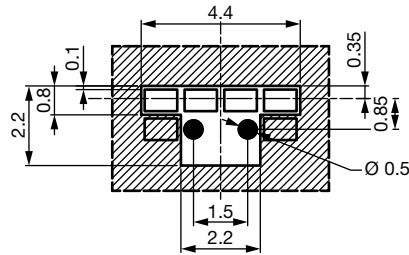
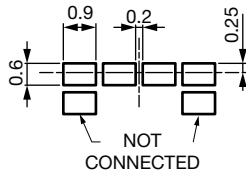
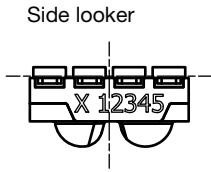


Technical drawings according to DIN specification

Drawing-No.: 6.550-5376.01-4  
 Issue: 1\_A; 27.08.2025



### RECOMMENDED SOLDER PAD in millimeters



Component location on pad



Cu area



Solder resist

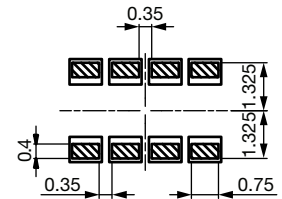
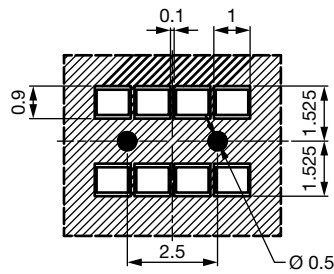
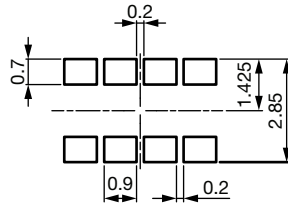
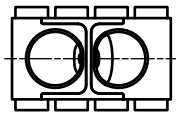


Optional glue dot



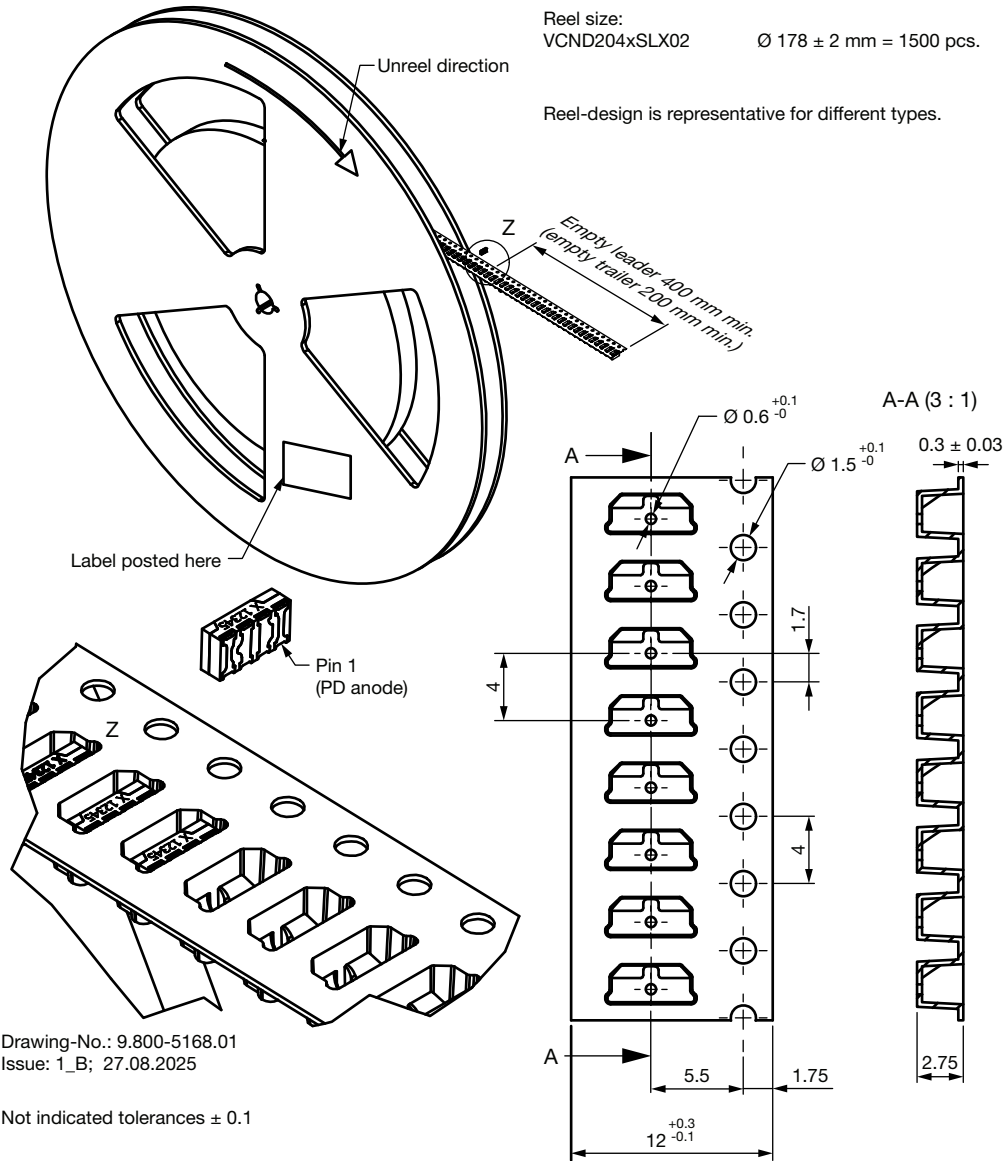
Solder stencil

Top looker



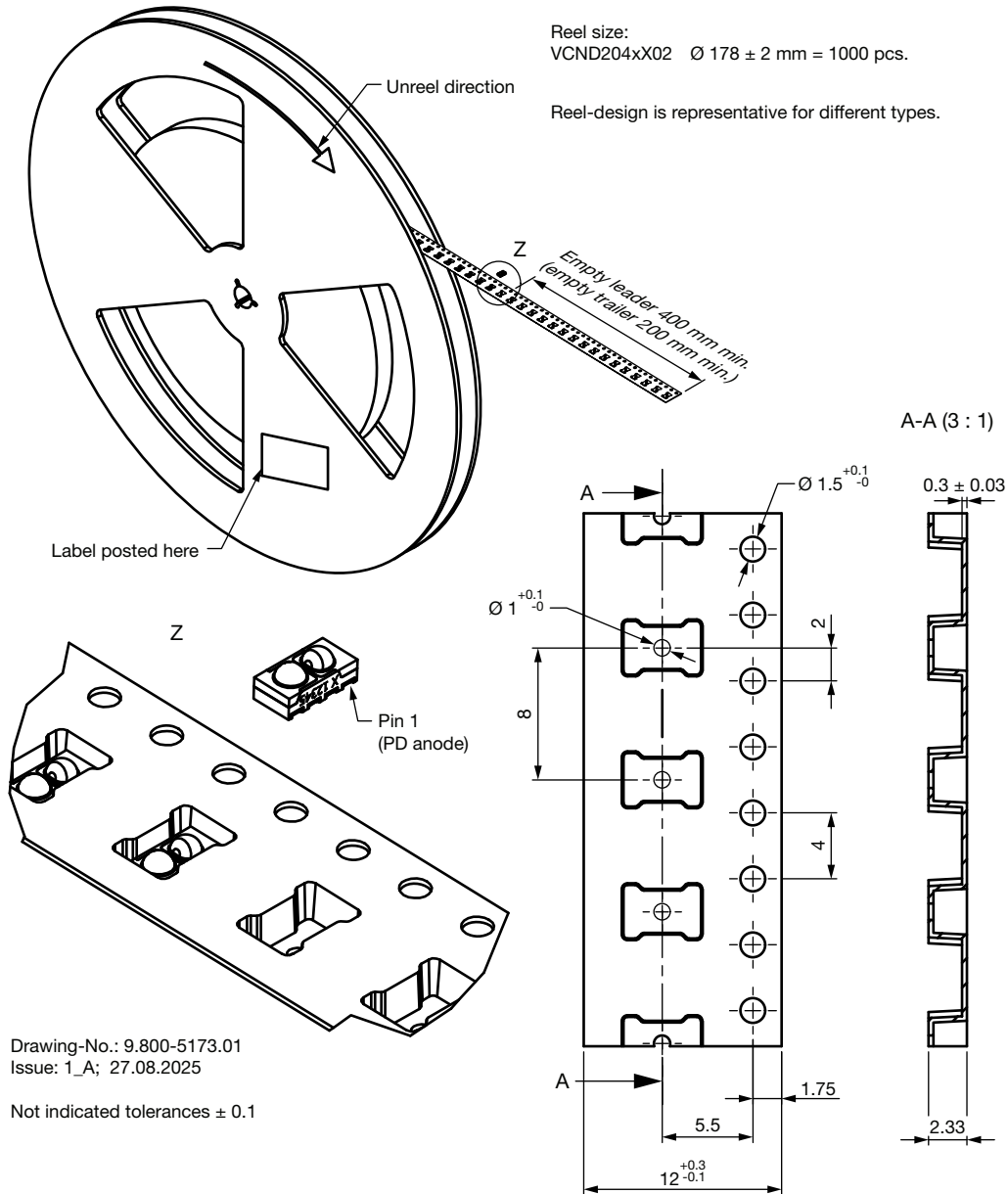


## TAPE AND REEL DIMENSIONS (SIDE LOOK) in millimeters





## TAPE AND REEL DIMENSIONS (TOP LOOK) in millimeters



Drawing-No.: 9.800-5173.01  
Issue: 1\_A; 27.08.2025

Not indicated tolerances ± 0.1



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.