

# Reflective Optical Sensor With VCSEL and Transistor Output



## FEATURES

- Package type: SMD
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 1.85 x 1.2 x 0.6
- Emitter wavelength: 940 nm
- Moisture sensitivity level (MSL): 3
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

## APPLICATIONS

- Position sensor
- Optical switch
- Optical encoder
- Object detection (e.g. paper presence in printer and copy machines)

## DESCRIPTION

The VCNT2030 is a reflective sensor in a miniature SMD package. It has a compact construction where the emitting light source and the detector are arranged in the same plane. The emitter uses a vertical cavity surface emitting laser (VCSEL) chip technology with high radiant intensity, high optical power, and high speed. The operating infrared wavelength is 940 nm. The detector consists of a silicon phototransistor. The sensor's analog output signal at the phototransistor is dependent on the amount of the light emitted by the VCSEL and reflected of an object in the sensor's field of view.

## LINKS TO ADDITIONAL RESOURCES



PRODUCT SUMMARY					
PART NUMBER	TARGET MATERIAL	DISTANCE RANGE WITH $I_{Fmax}$ AND $I_C > 0.5$ mA (mm)	TYPICAL CTR <sup>(1)</sup> (%)	DISTANCE OF PEAK SENSITIVITY (mm)	DAYLIGHT BLOCKING FILTER INTEGRATED
VCNT2030	Kodak Gray Card, gray side (18 %)	0 to 7	31	0.9	No
	Kodak Gray Card, white side (90 %)	0 to 38	314		

### Note

<sup>(1)</sup> CTR: current transfer ratio,  $I_{out}/I_{in}$

ORDERING INFORMATION			
ORDERING CODE	PACKAGING	VOLUME <sup>(1)</sup>	REMARKS
VCNT2030	Tape and reel	MOQ: 3000	Drypack, MSL 3

### Note

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



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT (VCSEL)</b>				
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	15	mA
Power dissipation		$P_{VCSEL}$	38	mW
Junction temperature		$T_J$	100	$^{\circ}\text{C}$
Thermal resistance junction to ambient	JESD 51	$R_{thJA}$	410	K/W
<b>OUTPUT (DETECTOR)</b>				
Collector emitter breakdown voltage	$I_C = 0.1\text{ mA}$ , $E = 0$	$V_{(BR)CEO}$	20	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	mA
Power dissipation		$P_{PTR}$	100	mW
Thermal resistance junction to ambient	JESD 51	$R_{thJA}$	380	K/W
<b>SENSOR</b>				
Total power dissipation		$P_{tot}$	138	mW
Ambient temperature range		$T_{amb}$	-40 to +85	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	-40 to +85	$^{\circ}\text{C}$
Soldering temperature	In accordance with Fig. 14	$T_{sd}$	260	$^{\circ}\text{C}$

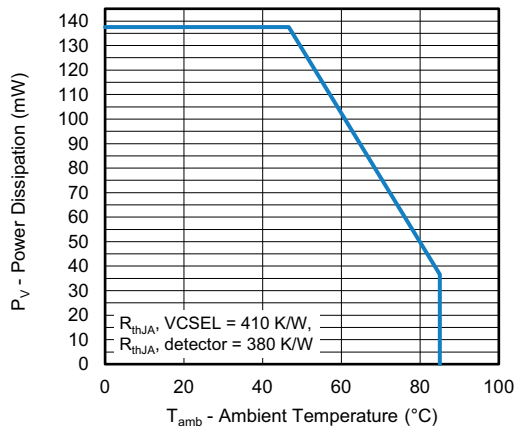


Fig. 1 - Power Dissipation vs. Ambient Temperature

<b>BASIC CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT (VCSEL)</b>						
Forward current <sup>(1)</sup>		$I_F$	-	5	-	mA
Forward voltage	$I_F = 8\text{ mA}$	$V_F$	1.7	1.9	2.1	V
	$I_F = 15\text{ mA}$		-	2.3	-	
Temperature coefficient of $V_F$	$I_F = 8\text{ mA}$	$TKV_F$	-	-4	-	mV/K
Angle of half intensity	$I_F = 8\text{ mA}$	$\phi$	-	17	-	$^{\circ}$
Reverse current		$I_R$	Not designed for reverse operation			
Peak wavelength	$I_F = 8\text{ mA}$	$\lambda_P$	-	940	-	nm
<b>OUTPUT (DETECTOR)</b>						
Emitter collector voltage	$I_E = 100\text{ }\mu\text{A}$ , $E = 0$	$V_{ECO}$	7	-	-	V
Collector emitter dark current	$V_{CE} = 5\text{ V}$ , $E = 0$	$I_{CEO}$	-	1	100	nA
<b>SENSOR</b>						
Collector current	$V_{CE} = 5\text{ V}$ , $I_F = 8\text{ mA}$ , $d = 1\text{ mm}$ (Kodak gray card, 18 %)	$I_C$	1.8	2.5	5.4	mA
	$V_{CE} = 5\text{ V}$ , $I_F = 8\text{ mA}$ , $d = 1\text{ mm}$ (Kodak gray card, white side, 90 %)	$I_C$	-	25.1	-	mA
Current transfer ratio	$I_C/I_F$ , $V_{CE} = 5\text{ V}$ , $d = 1\text{ mm}$ (Kodak gray card, 18 %)	CTR	-	31	-	%
Rise time	$I_C = 0.8\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$	$t_r$	-	10	-	$\mu\text{s}$
Fall time	$I_C = 0.8\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$	$t_f$	-	15	-	$\mu\text{s}$

**Note**

<sup>(1)</sup> It is recommended to apply at least 5 mA forward current, to ensure expected device performance

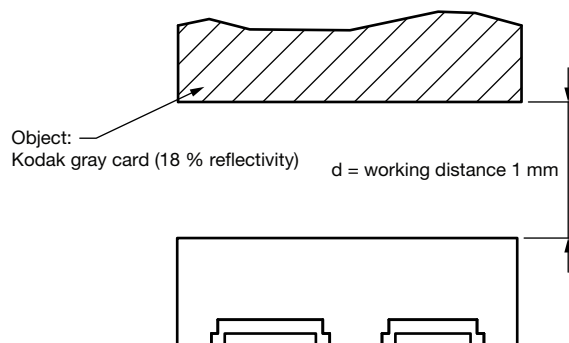


Fig. 2 - Test Circuit

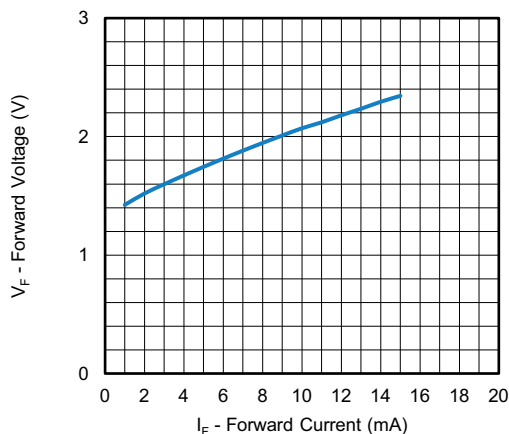
**BASIC CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - Forward Voltage vs. Forward Current

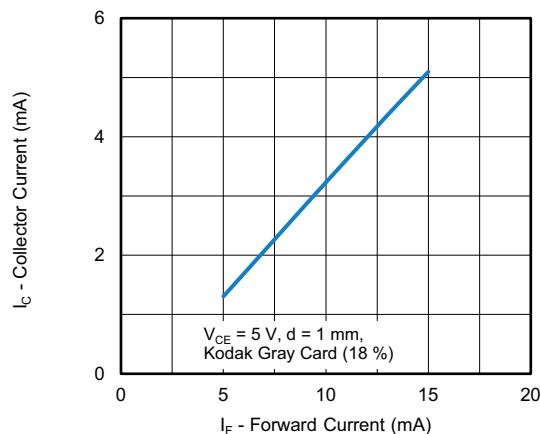


Fig. 6 - Collector Current vs. Forward Current

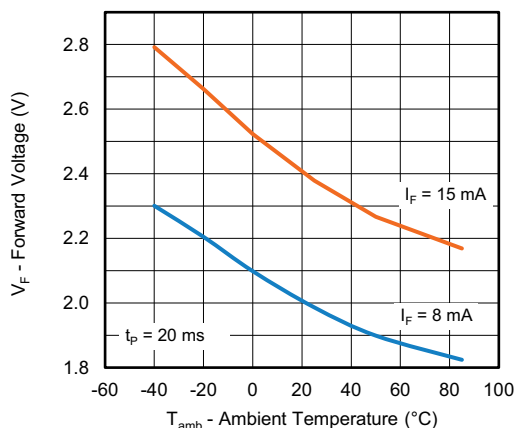


Fig. 4 - Forward Voltage vs. Ambient Temperature

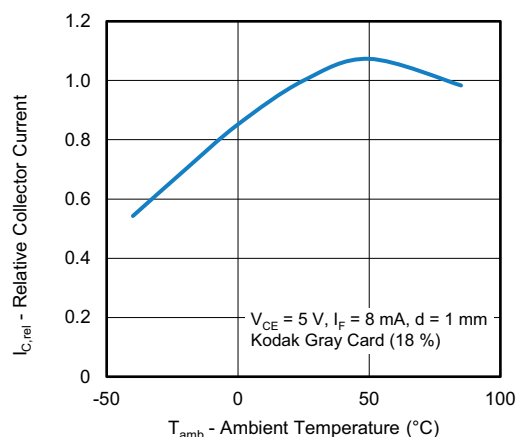


Fig. 7 - Relative Collector Current vs. Ambient Temperature

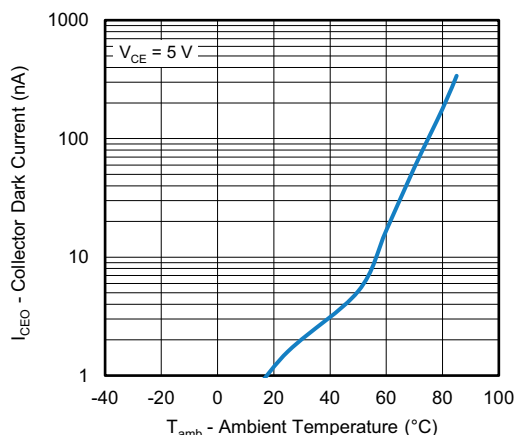


Fig. 5 - Collector Dark Current vs. Ambient Temperature

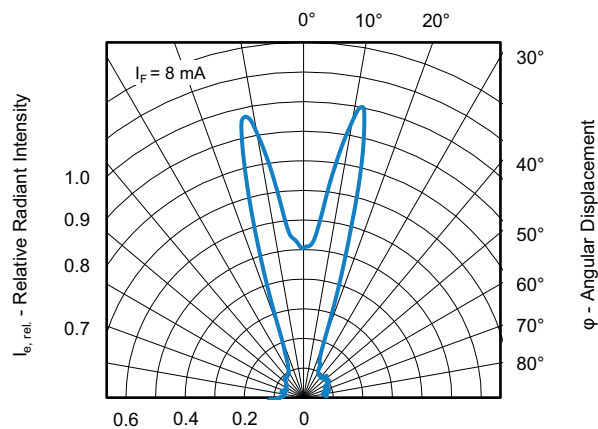


Fig. 8 - Relative Radiant Intensity vs. Angular Displacement

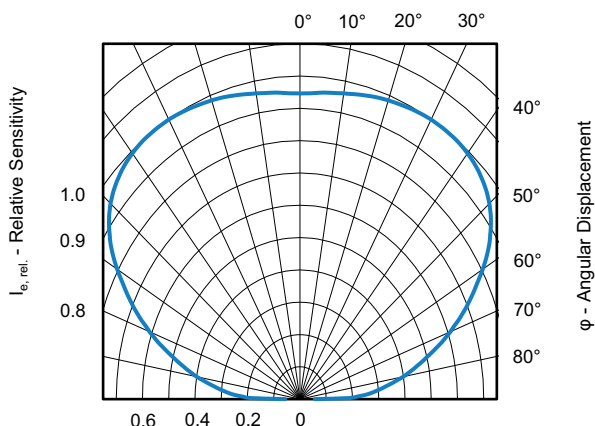


Fig. 9 - Relative Sensitivity vs. Angular Displacement

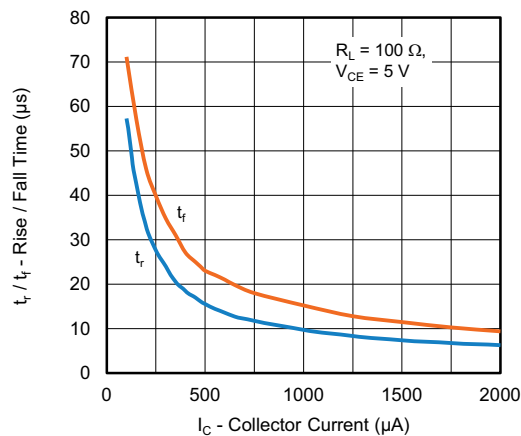


Fig. 12 - Rise / Fall Time vs. Collector Current

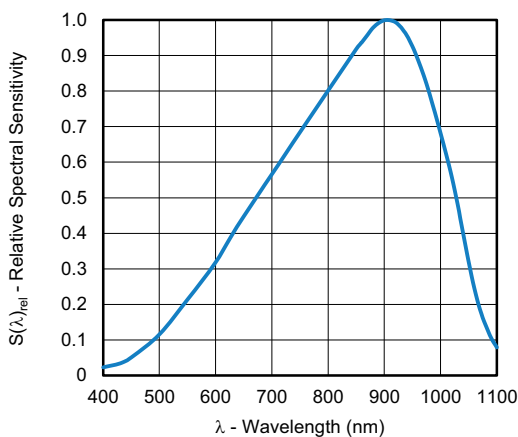


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

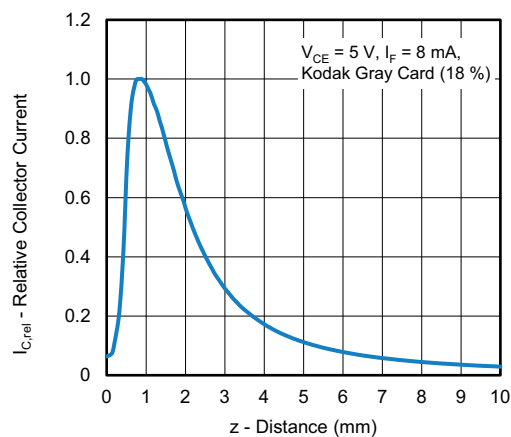


Fig. 13 - Relative Collector Current vs. Distance

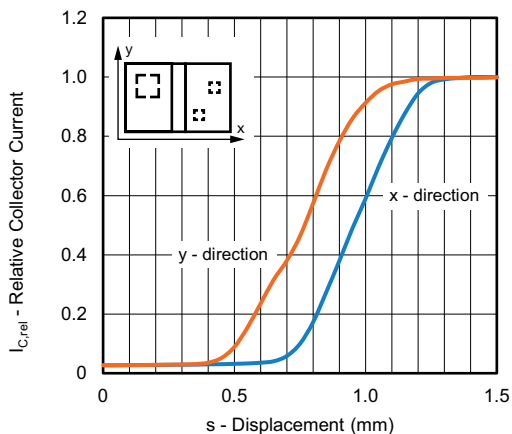


Fig. 11 - Relative Collector Current vs. Displacement

## 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 %

## PRECAUTIONS - EYE SAFETY

When VCSEL is in operation, looking into laser beam directly by naked eyes, even through a lens, microscope or optical fibers, may cause severe damage to human eyes. For observing laser beams, using safety goggles is recommended.

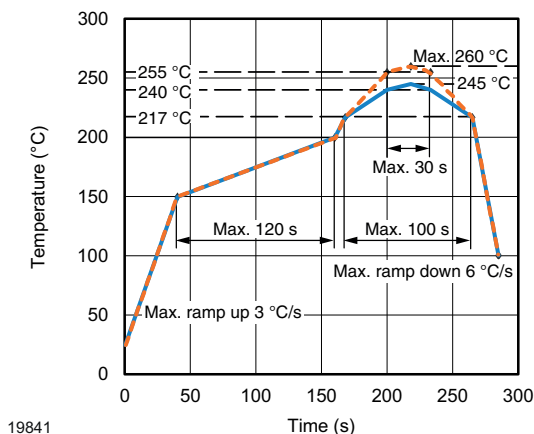
## LABEL FOR LASER CLASS 1



### Note

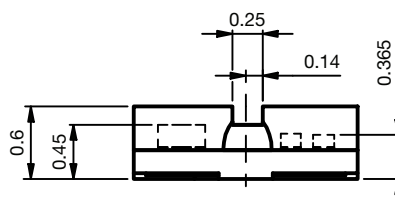
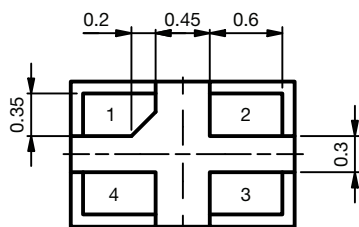
- Product specification with IEC / EN 60825-1:2014 compliance and above label

## REFLOW SOLDER PROFILE

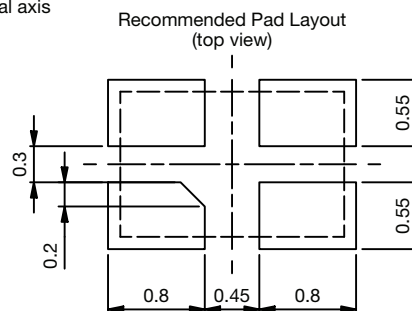
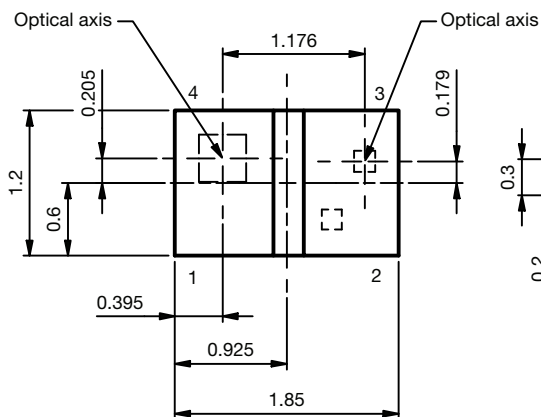


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Fig. 14 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

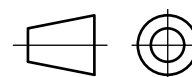
**PACKAGE DIMENSIONS** in millimeters


PIN	SIGNAL
1	Emitter
2	VCSEL_A
3	VCSEL_C
4	Collector



Not indicated tolerances  $\pm 0.1$

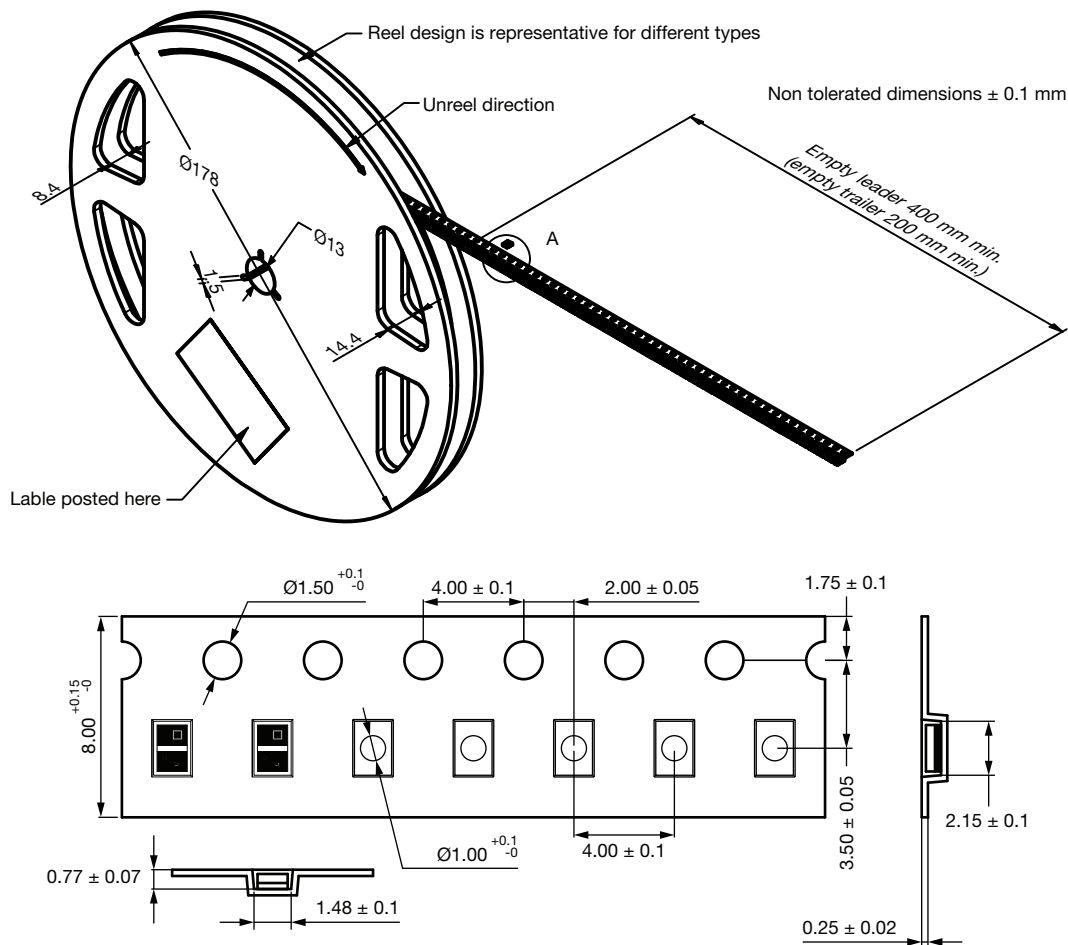
Drawing-No.: 6.550-5386.01-4  
Issue: 1; 18.07.2022



Technical drawings  
according to DIN  
specification

**TAPE AND REEL DIMENSIONS** in millimeters

3000 pcs/reel



Drawing No.: 9.800-5149.01-4  
Issue: 1; 05.12.2019





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