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

Pb-free

e4

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

APPLICATIONS

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

LINKS TO ADDITIONAL RESOURCES

Application Notes

3D Models

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.

PRODUCT SUMMARY

PART NUMBER	TARGET MATERIAL	DISTANCE RANGE WITH $I_{Fmax.}$ AND I_C > 0.5 mA (mm)	TYPICAL CTR (1) (%)	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

(1) CTR: current transfer ratio, I_{out}/I_{in}

ORDERING INFORMATION

ORDERING CODE	PACKAGING	VOLUME (1)	REMARKS
VCNT2030	Tape and reel	MOQ: 3000	Drypack, MSL 3

Note

(1) MOQ: minimum order quantity

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT (VCSEL)				
Reverse voltage		V_R	5	V
Forward current		I_F	15	mA
Power dissipation		P_{VCSEL}	38	mW
Junction temperature		T_J	100	°C
Thermal resistance junction to ambient	JESD 51	R_{thJA}	410	K/W
OUTPUT (DETECTOR)				
Collector emitter breakdown voltage	I_C = 0.1 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
SENSOR				
Total power dissipation		P_{tot}	138	mW
Ambient temperature range		T_{amb}	-40 to +85	°C
Storage temperature range		T_{stg}	-40 to +85	°C
Soldering temperature	In accordance with Fig. 14	T_{sd}	260	°C

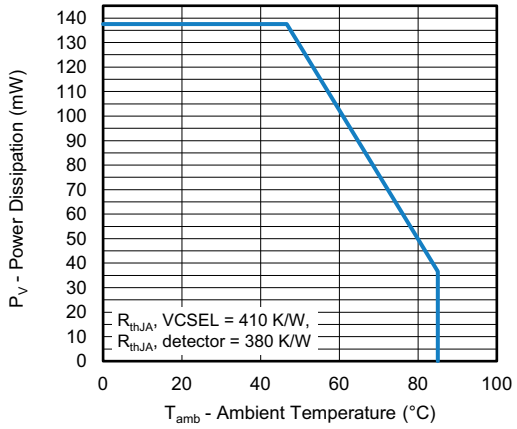


Fig. 1 - Power Dissipation vs. Ambient Temperature

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

Note

[1] It is recommended to apply at least 5 mA forward current, to ensure expected device performance

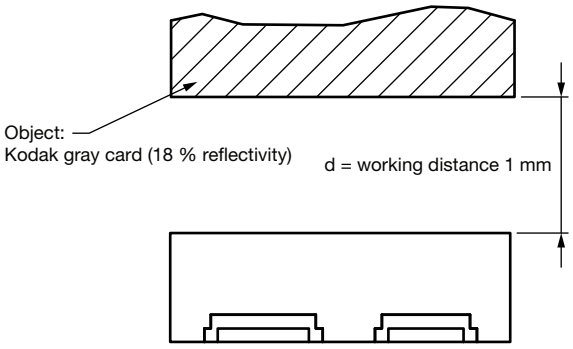


Fig. 2 - Test Circuit

BASIC CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

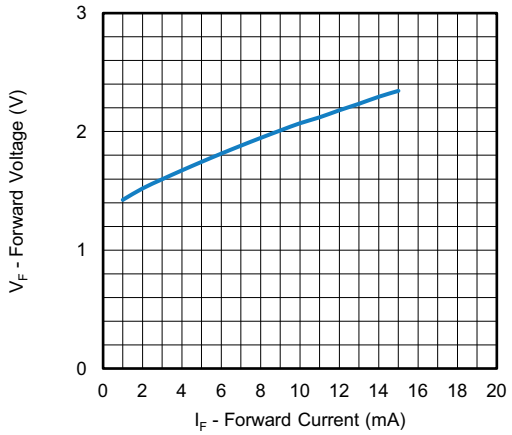


Fig. 3 - Forward Voltage vs. Forward Current

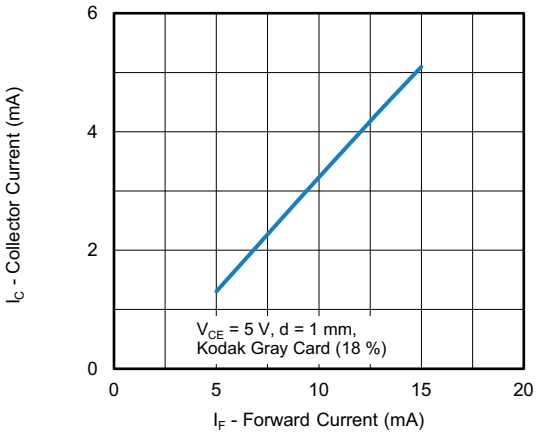


Fig. 6 - Collector Current vs. Forward Current

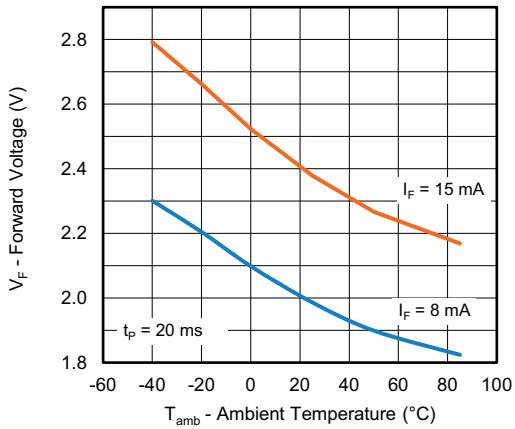


Fig. 4 - Forward Voltage vs. Ambient Temperature

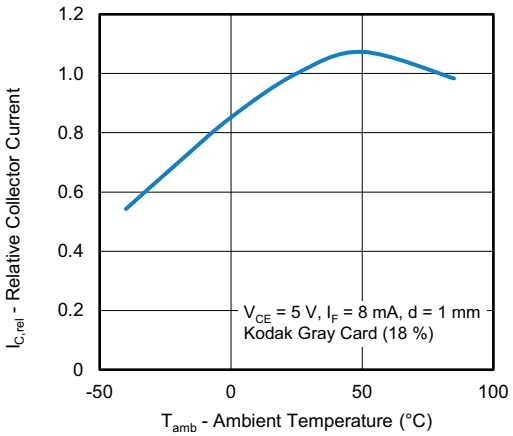


Fig. 7 - Relative Collector Current vs. Ambient Temperature

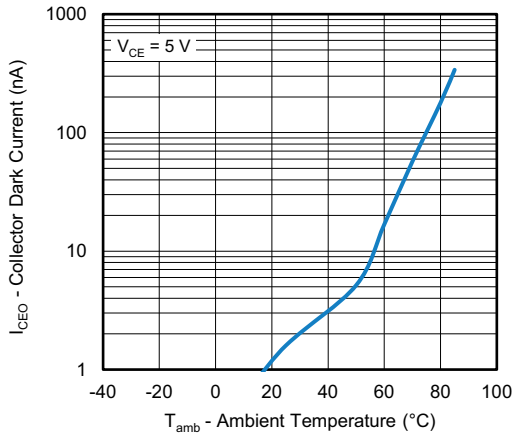


Fig. 5 - Collector Dark Current vs. Ambient Temperature

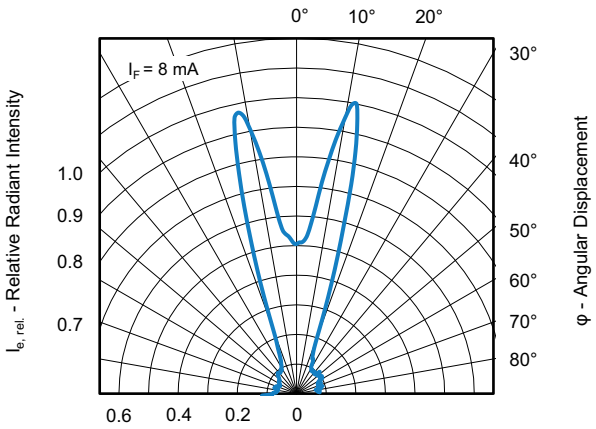


Fig. 8 - Relative Radiant Intensity vs. Angular Displacement

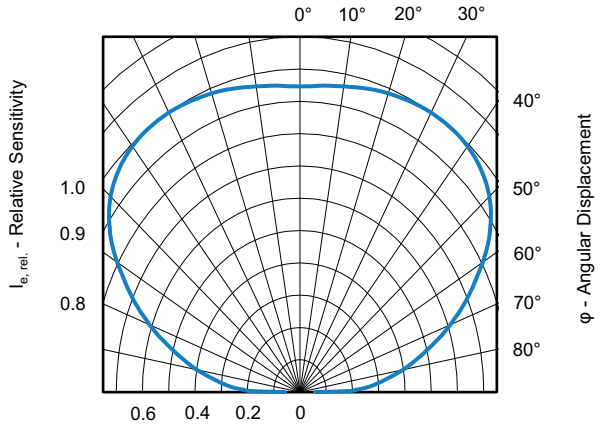


Fig. 9 - Relative Sensitivity vs. Angular Displacement

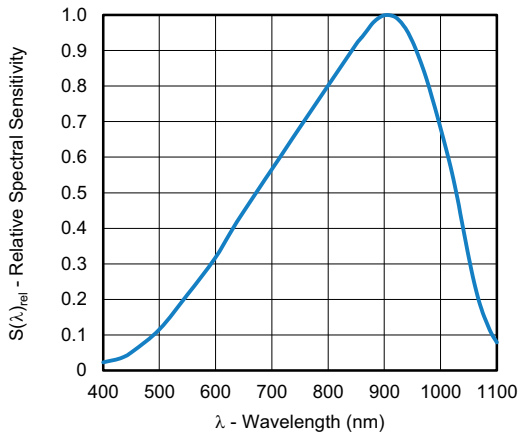


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

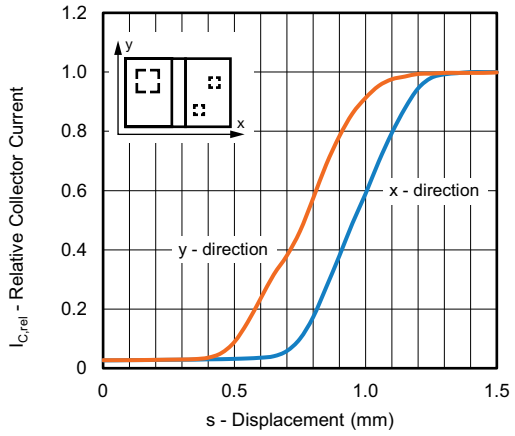


Fig. 11 - Relative Collector Current vs. Displacement

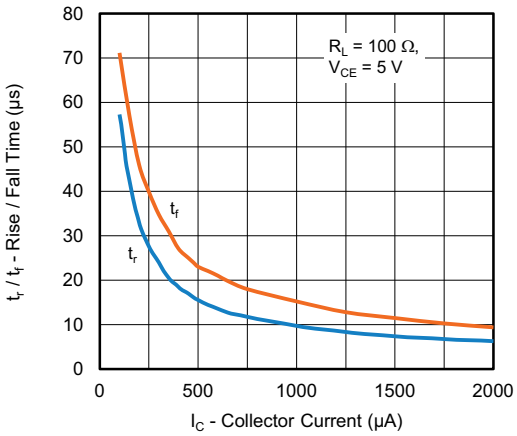


Fig. 12 - Rise / Fall Time vs. Collector Current

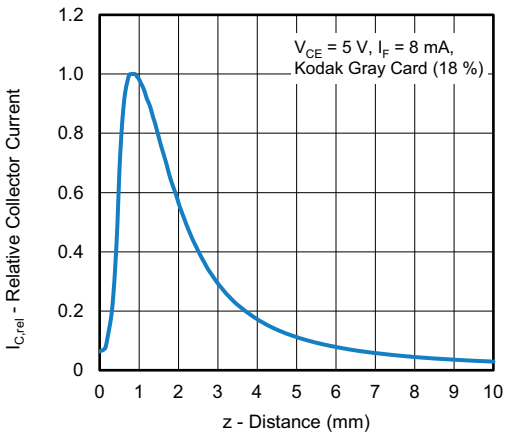


Fig. 13 - Relative Collector Current vs. Distance

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 °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 °C (+ 5 °C), RH < 5 %
or
96 h at 60 °C (+ 5 °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

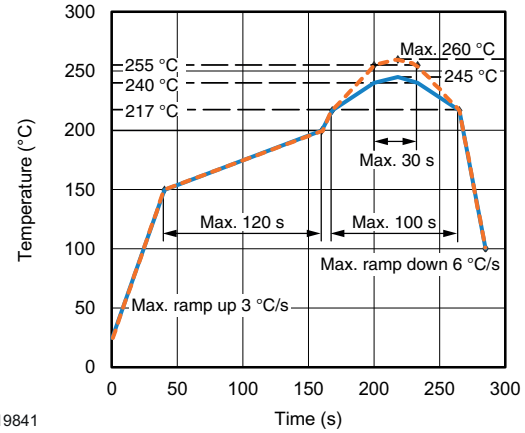
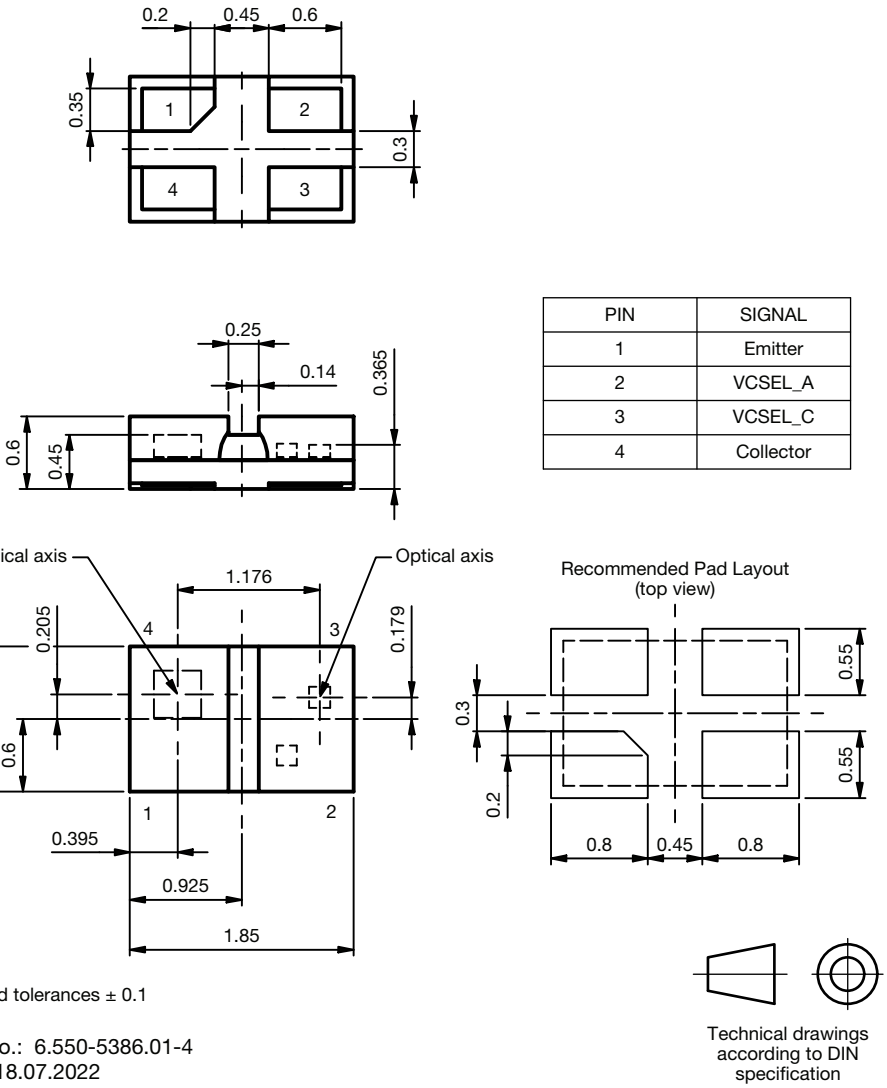


Fig. 14 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

PACKAGE DIMENSIONS in millimeters



PIN	SIGNAL
1	Emitter
2	VCSEL_A
3	VCSEL_C
4	Collector

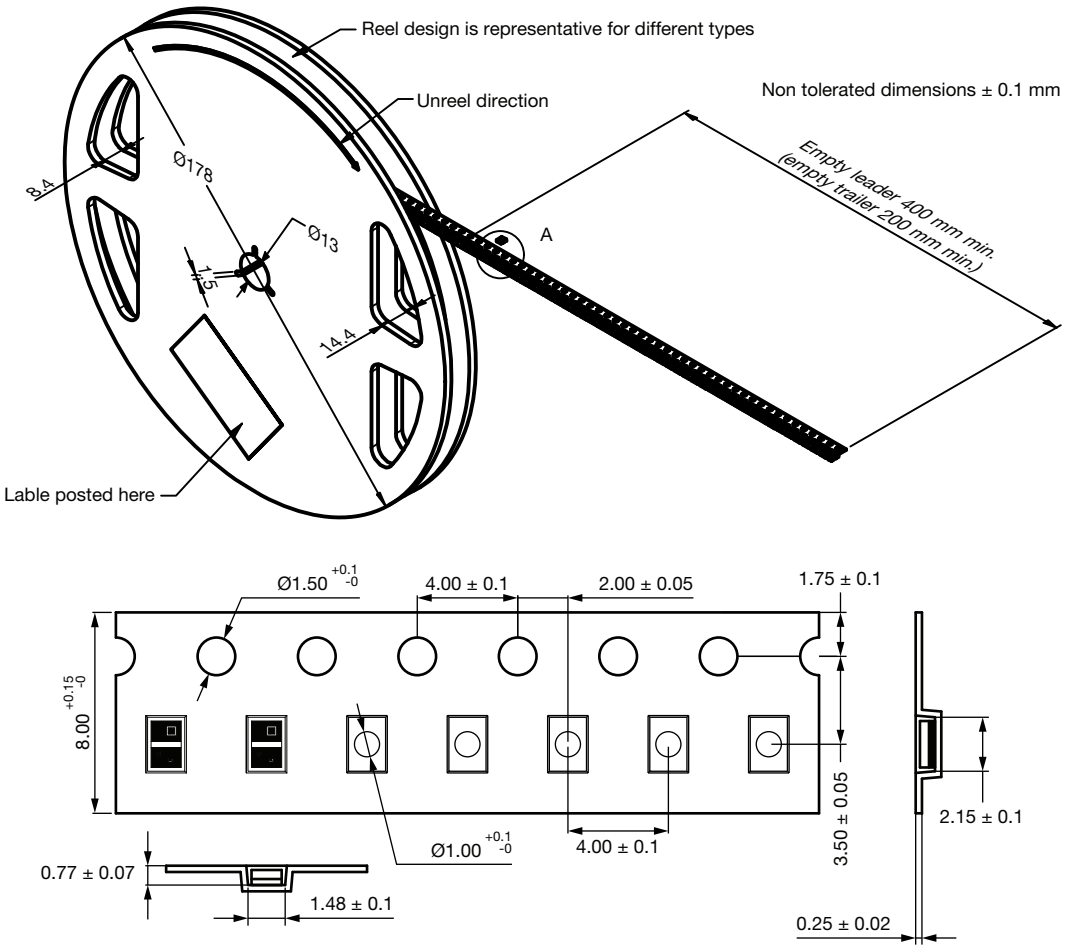
Not indicated tolerances ± 0.1

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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