

Reflective Optical Sensor With VCSEL and Transistor Output



LINKS TO ADDITIONAL RESOURCES





FEATURES

Package type: SMD

• Detector type: phototransistor



• Emitter wavelength: 940 nm

Moisture sensitivity level (MSL): 3

 Material categorization: for definitions of compliance please see www.vishay.com/doc?99912





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)

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 SENSITIVIY (mm)	DAYLIGHT BLOCKING FILTER INTEGRATED	
VCNT2030	Kodak Gray Card, gray side (18 %)	0 to 7	31	0.9	No	
VOIN12030	Kodak Gray Card, white side (90 %)	0 to 38	314	0.9		

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

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ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT (VCSEL)				
Reverse voltage		V_R	5	
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	$I_C = 0.1 \text{ mA, E} = 0$	V _{(BR)CEO}	20	
Emitter collector voltage		V _{ECO}	7	V
Collector current		Ic	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

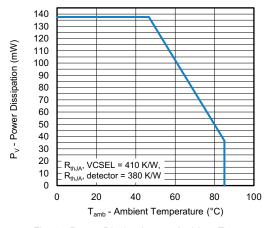


Fig. 1 - Power Dissipation vs. Ambient Temperature



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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
Forward voltage	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	-	0
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	$V_{CE} = 5 \text{ V}, E = 0$	I _{CEO}	=	1	100	nA
SENSOR	•					
Collector current	V _{CE} = 5 V, I _F = 8 mA, d = 1 mm (Kodak gray card, 18 %)	Ic	1.8	2.5	5.4	mA
Collector current	$V_{CE} = 5 \text{ V}, I_F = 8 \text{ mA}, d = 1 \text{ mm}$ (Kodak gray card, white side, 90 %)	I _C	-	25.1	-	mA
Current transfer ratio	I_C/I_F , $V_{CE} = 5$ V, $d = 1$ mm (Kodak gray card, 18 %)	CTR	ı	31	-	%
Rise time	I_C = 0.8 mA, V_{CE} = 5 V, R_L = 100 Ω	t _r	-	10	-	μs
Fall time	$I_C = 0.8 \text{ mA}, V_{CE} = 5 \text{ V}, R_L = 100 \Omega$	t _f	-	15	=	μs

Note

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

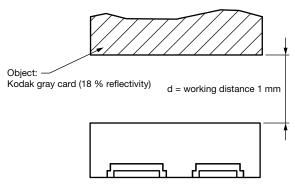


Fig. 2 - Test Circuit



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

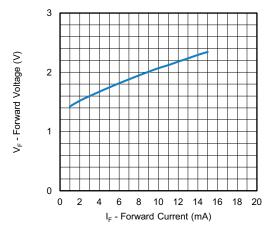


Fig. 3 - Forward Voltage vs. Forward Current

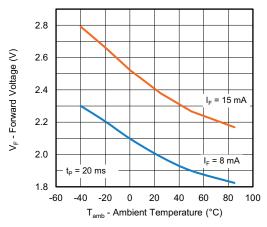


Fig. 4 - Forward Voltage vs. Ambient Temperature

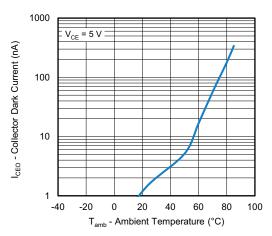


Fig. 5 - Collector Dark Current vs. Ambient Temperature

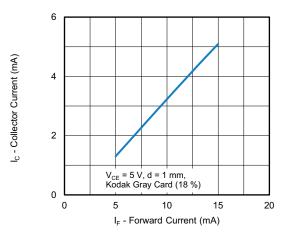


Fig. 6 - Collector Current vs. Forward Current

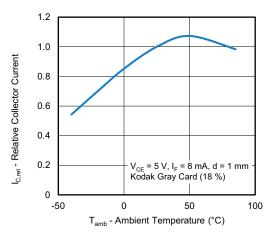


Fig. 7 - Relative Collector Current vs. Ambient Temperature

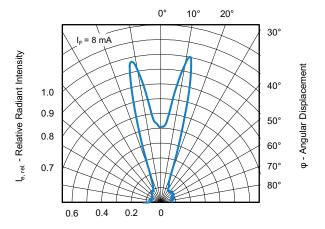


Fig. 8 - Relative Radiant Intensity vs. Angular Displacement

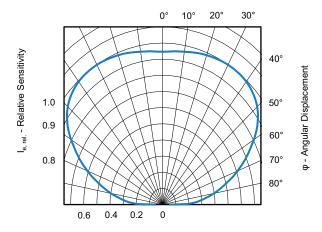


Fig. 9 - Relative Sensitivity vs. Angular Displacement

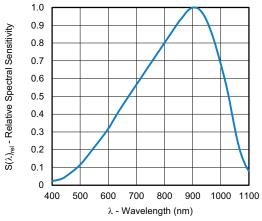


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

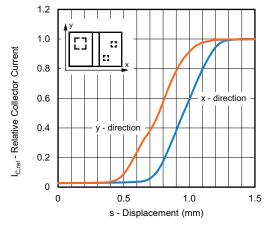


Fig. 11 - Relative Collector Current vs. Displacement

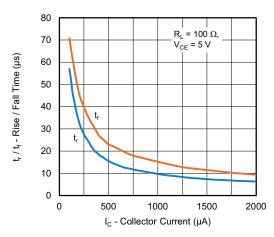


Fig. 12 - Rise / Fall Time vs. Collector Current

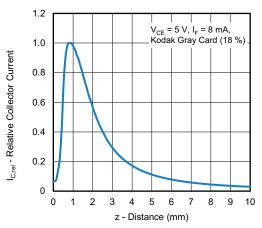


Fig. 13 - Relative Collector Current vs. Distance

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

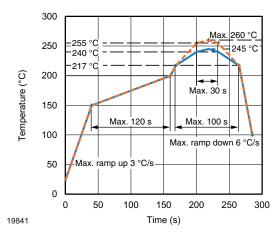
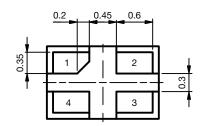
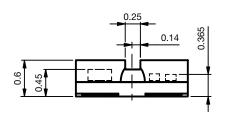


Fig. 14 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

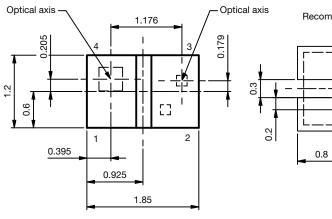


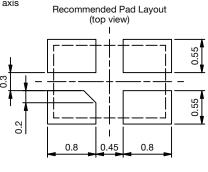
PACKAGE DIMENSIONS in millimeters





PIN	SIGNAL		
1	Emitter		
2	VCSEL_A		
3	VCSEL_C		
4	Collector		





 $\exists \ \oplus$

Not indicated tolerances \pm 0.1

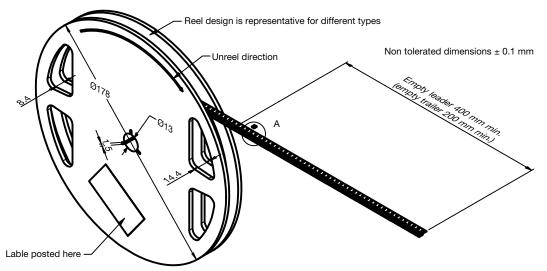
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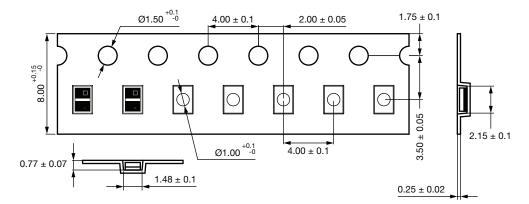
Issue: 1; 18.07.2022

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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