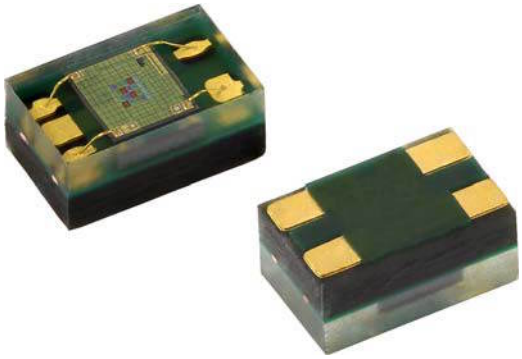
UVA and UVB Light Sensor with I²C Interface



FEATURES

- Package type: surface mount
- Dimensions (L x W x H in mm): 2.0 x 1.25 x 1.0
- Integrated modules: ultraviolet sensor (UV), and signal conditioning IC
- Converts solar UV light intensity to digital data
- Excellent UVA and UVB sensitivity
- Reliable performance of UV radiation measurement under long time solar UV exposure
- 16-bit resolution per channel
- UVA and UVB individual channel solution
- Low power consumption I²C protocol (SMBus compatible) interface
- Package: OPLGA
- Temperature compensation: -40 °C to +85 °C
- Output type: I²C bus
- Operation voltage: 1.8 V to 3.6 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e4

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

DESCRIPTION

The VEML6075 senses UVA and UVB light and incorporates photodiode, amplifiers, and analog / digital circuits into a single chip using a CMOS process. When the UV sensor is applied, it is able to detect UVA and UVB intensity to provide a measure of the signal strength as well as allowing for UVI measurement.

The VEML6075 provides excellent temperature compensation capability for keeping the output stable under changing temperature. VEML6075's functionality is easily operated via the simple command format of I²C (SMBus compatible) interface protocol. VEML6075's operating voltage ranges from 1.8 V to 3.6 V. VEML6075 is packaged in a lead (Pb)-free 4 pin OPLGA package which offers the best market-proven reliability.

APPLICATIONS

- Handheld device
- Notebook
- Consumer device
- Industrial and medical application

PRODUCT SUMMARY

PART NUMBER	OPERATING VOLTAGE RANGE (V)	I²C BUS VOLTAGE RANGE (V)	PEAK SENSITIVITY (nm)	RANGE OF SPECTRAL BANDWIDTH $\lambda_{0.5}$ (nm)	OUTPUT CODE
VEML6075	1.8 to 3.6	1.8 to 3.6	TBD	TBD	16 bit, I²C

Note

(1) Adjustable through I²C interface

ORDERING INFORMATION

ORDERING CODE	PACKAGING	VOLUME (1)	REMARKS
VEML6075	Tape and reel	MOQ: 2500 pcs	2.0 mm x 1.25 mm x 1.0 mm

Note

(1) MOQ: minimum order quantity

For technical questions, contact: sensorstechsupport@vishay.com

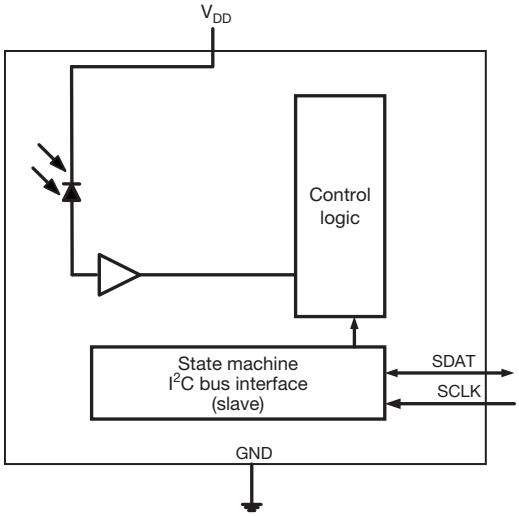
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)					
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**MAX.**	**UNIT**
Supply voltage		V_{DD}	1.8	3.6	V
Operation temperature range		T_{amb}	-40	+85	°C
Storage temperature range		T_{stg}	-40	+85	°C

RECOMMENDED OPERATING CONDITIONS (T_{amb} = 25 °C, unless otherwise specified)					
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**MAX.**	**UNIT**
Supply voltage		V_{DD}	1.8	3.6	V
Operation temperature range		T_{amb}	-40	+85	°C
I^2C bus operating frequency		$f_{(I2CCLK)}$	10	400	kHz

PIN DESCRIPTIONS			
PIN ASSIGNMENT	**SYMBOL**	**TYPE**	**FUNCTION**
1	GND	I	Ground
2	SDAT	I / O (open drain)	I^2C data bus data input / output
3	SCLK	I	I^2C digital bus clock input
4	V_{DD}	I	Power supply input

BLOCK DIAGRAM



BASIC CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER		**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Supply operation voltage			V_{DD}	1.8	-	3.6	V
Supply current			I_{DD}	-	500	-	µA
I^2C signal input	Logic high	V_{DD} = 3.3 V (1)	V_{IH}	1.5	-	-	V
	Logic low		V_{IL}	-	-	0.8	
I^2C signal input	Logic high	V_{DD} = 2.6 V (1)	V_{IH}	1.4	-	-	V
	Logic low		V_{IL}	-	-	0.6	
Operating temperature			T_{amb}	-40	-	+85	°C
Shutdown current		Light condition = dark; V_{DD} = 3.6 V, T_{amb} = 25 °C	I_{DD} (SD)	-	800	-	nA

Note

(1) Test condition: V_{DD} = 3.3 V, temperature: 25 °C

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

I²C TIMING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**SYMBOL**	**STANDARD MODE**		**FAST MODE**		**UNIT**
		MIN.	**MAX.**	**MIN.**	**MAX.**	
Clock frequency	$f_{(SMBCLK)}$	10	100	10	400	kHz
Bus free time between start and stop condition	$t_{(BUF)}$	4.7	-	1.3	-	µs
Hold time after (repeated) start condition; after this period, the first clock is generated	$t_{(HDSTA)}$	4.0	-	0.6	-	µs
Repeated start condition setup time	$t_{(SUSTA)}$	4.7	-	0.6	-	µs
Stop condition setup time	$t_{(SUSTO)}$	4.0	-	0.6	-	µs
Data hold time	$t_{(HDDAT)}$	-	3450	-	900	ns
Data setup time	$t_{(SUDAT)}$	250	-	100	-	ns
I²C clock (SCK) low period	$t_{(LOW)}$	4.7	-	1.3	-	µs
I²C clock (SCK) high period	$t_{(HIGH)}$	4.0	-	0.6	-	µs
Clock / data fall time	$t_{(F)}$	-	300	-	300	ns
Clock / data rise time	$t_{(R)}$	-	1000	-	300	ns

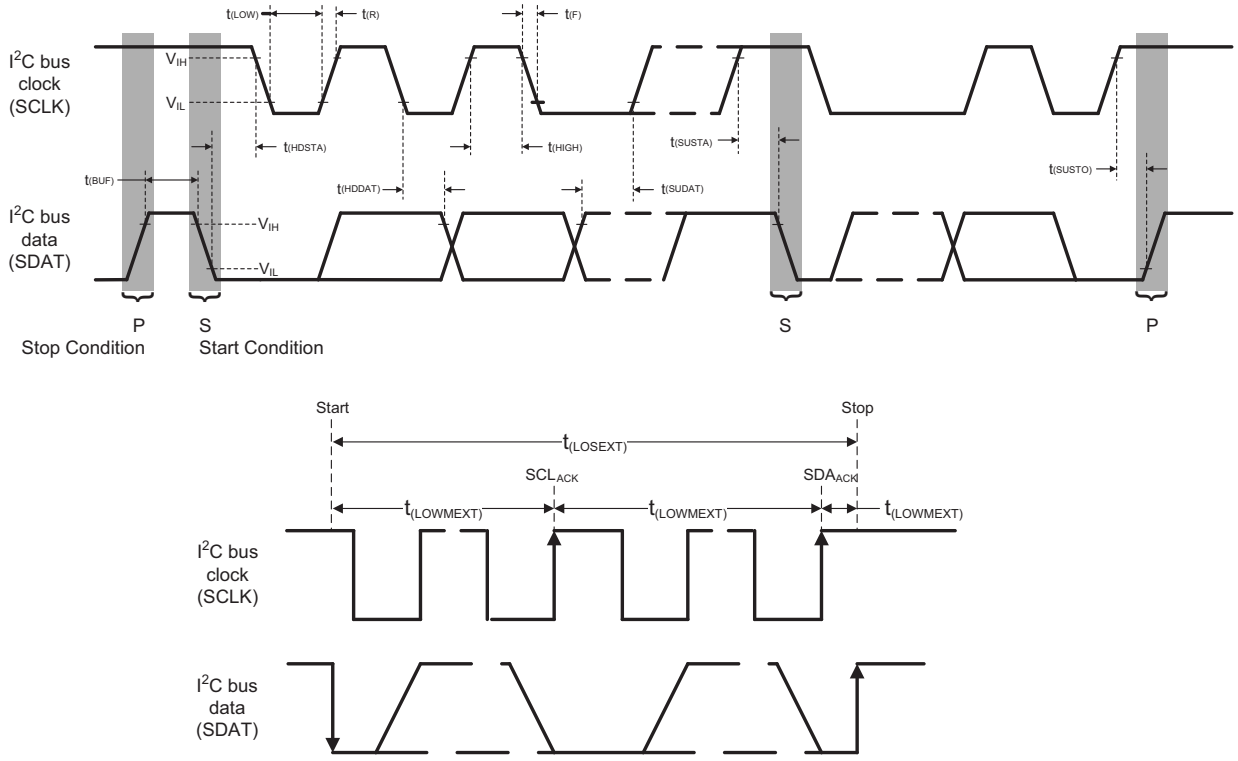


Fig. 1 - I²C Bus Timing Diagram

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

PARAMETER TIMING INFORMATION

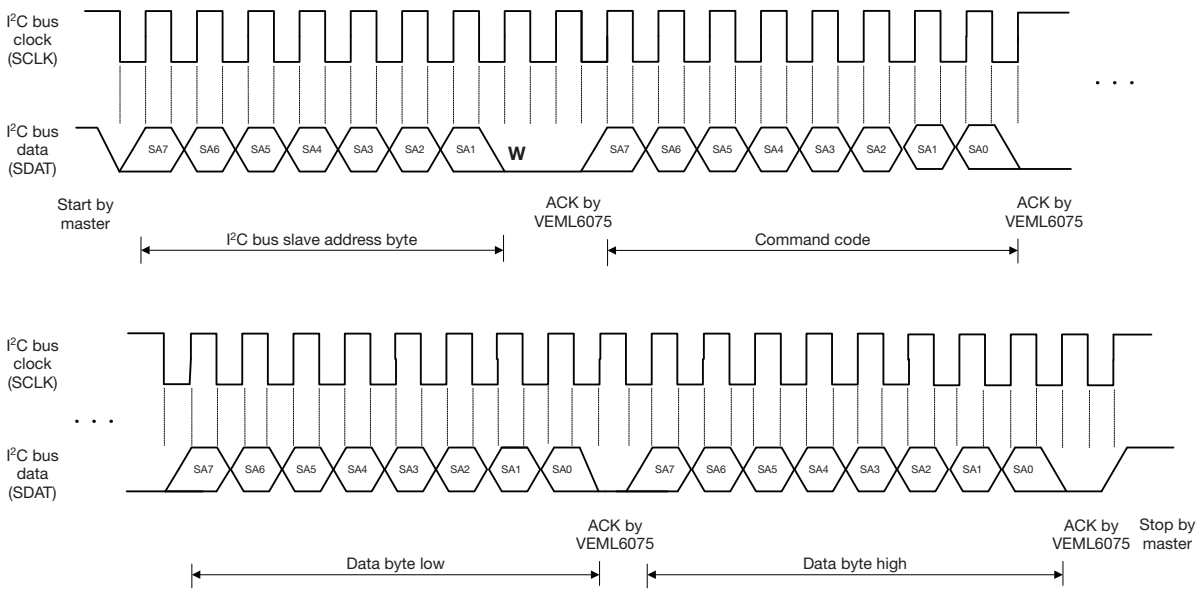


Fig. 2 - I²C Bus Timing for Sending Word Command Format

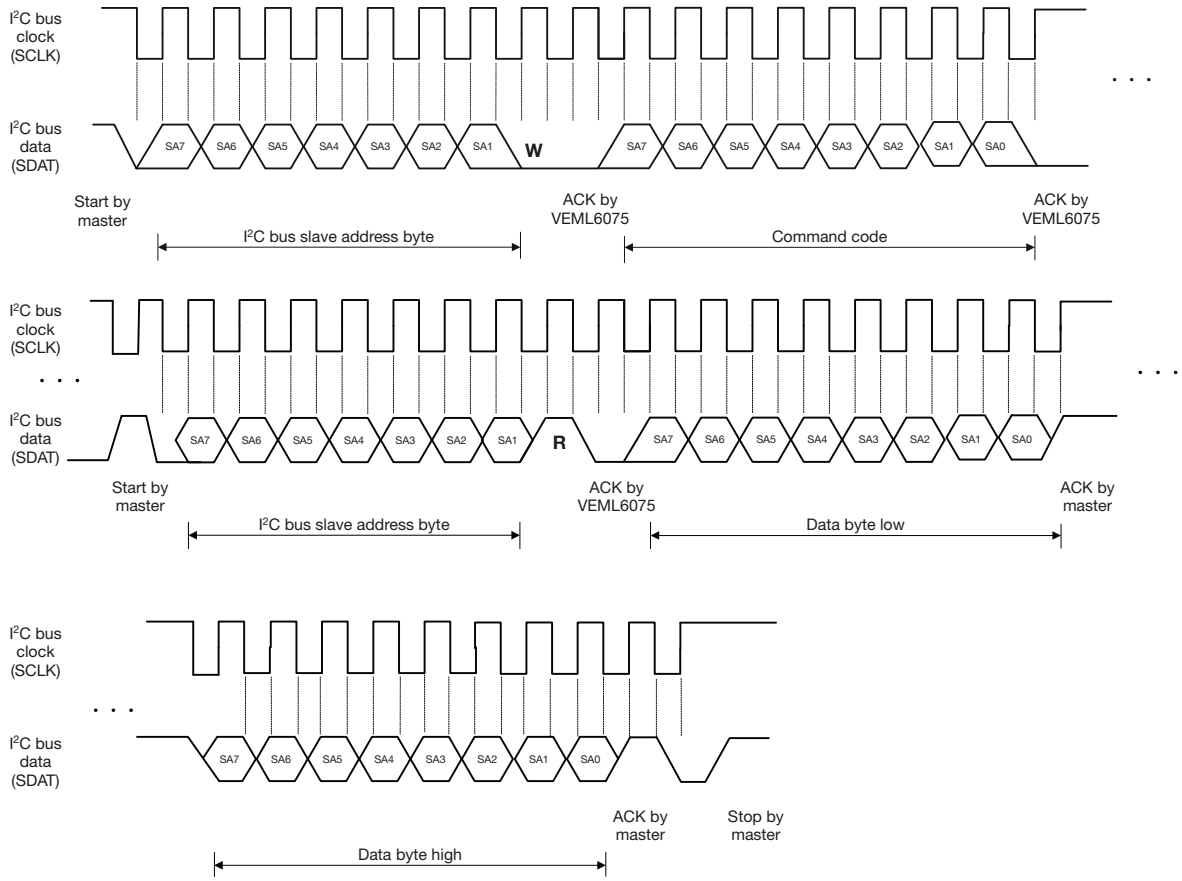


Fig. 3 - I²C Timing for Receive Word Command Format

For technical questions, contact: sensorstechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

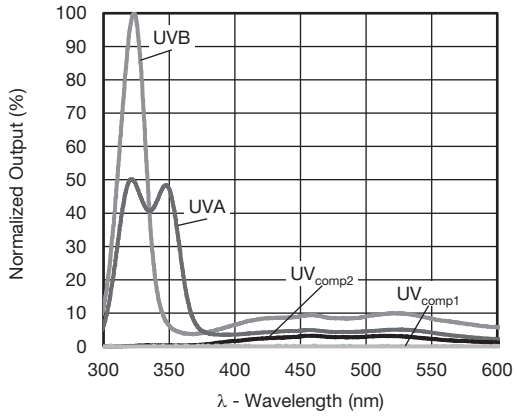


Fig. 4 - Normalized Spectral Response

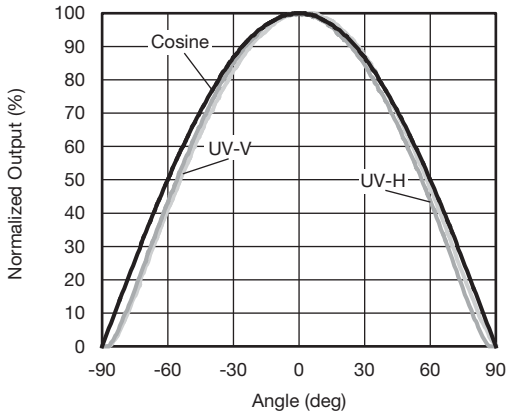


Fig. 5 - Normalized Output vs. View Angle

APPLICATION INFORMATION

Pin Connection with the Host

VEML6075 integrates UVA, UVB, UV_{comp1}, and UV_{comp2} channel photo diodes which is accessed via I^2C interface. The hardware schematic is shown below in figure 6.

The 0.1 µF capacitor near the V_{DD} pin is used for power supply noise rejection. The 2.2 kΩ is suitable for the pull high resistor of I^2C.

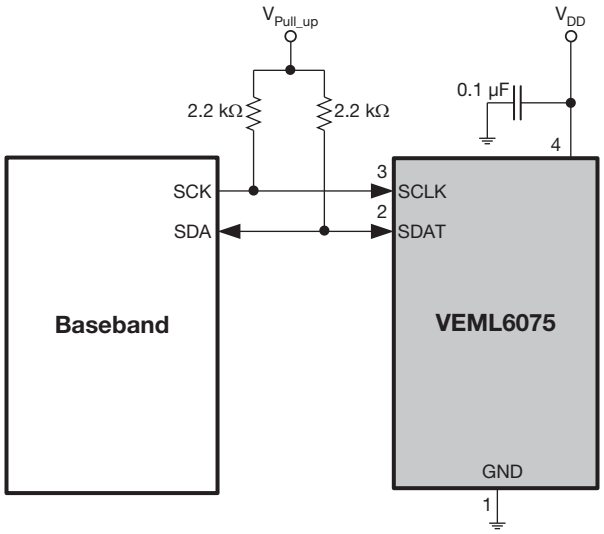


Fig. 6 - Hardware Pin Connection Diagram

For technical questions, contact: sensorstechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Digital Interface

VEML6075 uses I²C slave address 0x10 of 7 bit addressing protocol. VEML6075 contains an 8-bit command register following each slave address as shown in figure 7. All operations can be controlled by the command register. The simple command structure helps users easily program the operation setting and latch the light data from VEML6075. Following I²C command format is simple for read and write operations between VEML6075 and the host as shown in figure 7. The white sections indicate host activity and the gray sections indicate VEML6075's acknowledgement of the host access activity. Based on write word protocol, 8-bit command codes can be written by the host under the same slave address. All registers follow read word and write word protocol.



Fig. 7 - Command Protocol Format

Slave Address and Function Description

VEML6075 uses 0x10 slave address for 7-bit I²C addressing protocol. VEML6075 has 16-bit resolution for each channel (UVA, UVB, UV_{comp1}, and UV_{comp2}).

TABLE 1 - VEML6070 SLAVE ADDRESS AND FUNCTION DESCRIPTION

COMMAND CODE	DATE BYTE LOW / HIGH	REGISTER NAME	R / W	DEFAULT VALUE	FUNCTION DESCRIPTION
0x00	L	UV_CONF	R / W	0x00	UV integration time, function enable and disable
	H	Reserved	R / W	0x00	Reserved
0x01	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x02	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x03	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x04	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x05	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x06	L	Reserved	R / W	0x00	Reserved
	H	Reserved	R / W	0x00	Reserved
0x07	L	UVA_Data_L	R	0x00	UVA LSB output data
	H	UVA_Data_M	R	0x00	UVA MSB output data
0x08	L	Reserved	R	0x00	Reserved
	H	Reserved	R	0x00	Reserved
0x09	L	UVB_Data_L	R	0x00	UVB LSB output data
	H	UVB_Data_M	R	0x00	UVB MSB output data
0x0A	L	UVCOMP1_Data_L	R	0x00	UV_{comp1} LSB output data
	H	UVCOMP1_Data_M	R	0x00	UV_{comp1} MSB output data
0x0B	L	UVCOMP2_Data_L	R	0x00	UV_{comp2} LSB output data
	H	UVCOMP2_Data_M	R	0x00	UV_{comp2} MSB output data
0x0C	L	ID_L	R	0x26	Device ID LSB
	H	ID_M	R	0x00	Device ID MSB

Note

- Slave address is 7-bit addressing protocol.

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Command Register Format

VEML6075 provides an 8-bit command register for controlling. The description of each command format is shown in the following tables.

TABLE 2 - REGISTER UV_CONF DESCRIPTION

REGISTER NAME		COMMAND CODE: 0x00_L (0x00 DATA BYTE LOW) OR 0x00_H (0x00 DATA BYTE HIGH)							
COMMAND	BIT	7	6	5	4	3	2	1	0
REGISTER: UV_CONF		**COMMAND CODE: 0x00_L (0x00 DATA BYTE LOW)**							
COMMAND	BIT	Description							
Reserved	7	0							
UV_IT	6 : 4	(0 : 0 : 0) = 50 ms, (0 : 0 : 1) = 100 ms, (0 : 1 : 0) = 200 ms, (0 : 1 : 1) = 400 ms, (1 : 0 : 0) = 800 ms, (1 : 0 : 1) = reserved, (1 : 1 : 0) = reserved, (1 : 1 : 1) = reserved.							
HD	3	0 = normal dynamic setting, 1 = high dynamic setting							
UV_TRIG	1	0 = no active force mode trigger, 1 = trigger one time cycle VEML6075 output one cycle data every time host writes in '1' to sensor. The state returns to '0' automatically.							
UV_AF	0	0 = active force mode disable (normal mode), 1 = active force mode enable							
SD	0	0 = power on, 1 = shut down							

TABLE 3 - REGISTER 00_H DESCRIPTION

REGISTER: reserved		COMMAND CODE: 0x00_H (0x00 DATA BYTE HIGH)
COMMAND	BIT	Description
Reserved	7 : 0	Default = (0 : 0 : 0 : 0 : 0 : 0 : 0 : 0)

TABLE 4 - REGISTER 01_L TO 06_L AND 01_H TO 06_L DESCRIPTION

REGISTER: reserved		COMMAND CODE: 0x01_L TO 0x06_L (0x01 TO 0x06 DATA BYTE LOW) COMMAND CODE: 0x01_H TO 0x06_H (0x01 TO 0x06 DATA BYTE HIGH)
REGISTER	BIT	Description
Reserved	7 : 0	Default = (0 : 0 : 0 : 0 : 0 : 0 : 0 : 0)
Reserved	7 : 0	Default = (0 : 0 : 0 : 0 : 0 : 0 : 0 : 0)

TABLE 5 - READ OUT COMMAND CODES DESCRIPTION

REGISTER	COMMAND CODE	BIT	DESCRIPTION
UVA_Data_L	0x07_L (0x07 data byte low)	07:00	0x00 to 0xFF, UVA LSB output data
UVA_Data_M	0x07_H (0x07 data byte high)	07:00	0x00 to 0xFF, UVA MSB output data
Reserved	0x08_L (0x08 data byte low)	07:00	Reserved
Reserved	0x08_H (0x08 data byte high)	07:00	Reserved
UVB_Data_L	0x09_L (0x09 data byte low)	07:00	0x00 to 0xFF, UVB LSB output data
UVB_Data_M	0x09_H (0x09 data byte high)	07:00	0x00 to 0xFF, UVB MSB output data
UVCOMP1_Data_L	0x0A_L (0x0A data byte low)	07:00	0x00 to 0xFF, UV_{comp1} LSB output data
UVCOMP1_Data_H	0x0A_H (0x0A data byte high)	07:00	0x00 to 0xFF, UV_{comp1} MSB output data
UVCOMP2_Data_L	0x0B_L (0x0B data byte low)	07:00	0x00 to 0xFF, UV_{comp2} LSB output data
UVCOMP2_Data_H	0x0B_H (0x0B data byte high)	07:00	0x00 to 0xFF, UV_{comp2} MSB output data
ID_L	0x0C_L (0x0C data byte low)	07:00	Default = 0x26, device ID LSB byte
ID_M	0x0C_H(0x0C data byte high)	07:06 05:04 03:00	Company code = 00, (0 : 0) Slave address = 0x20 Version code (0 : 0 : 0 : 0) = VEML6075 CS Device ID MSB byte

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Data Access

VEML6075 has 16-bit high resolution sensitivity for each UV channel. To represent the 16-bit data, it has to apply two bytes. One byte is for LSB and the other byte is for MSB. The host needs to follow the read word protocol as shown in figure 7. The data format shows as below.

TABLE 6 - 16-BIT DATA FORMAT

	VEML6075 16-BIT DATA FORMAT															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data byte low									◄							►
Data byte high	◄							►								

Note

S	Slave address	Wr	A	Command code	A	S	Slave address	Rd	A	Data byte low	A	Data byte high	A	P

- Data byte low represents LSB and data byte high represents MSB.

Data Auto-Memorization

VEML6075 can memorize the last data before shutting down and keeps this data before waking up again. When VEML6075 is in shutdown mode, the host can freely read this data directly via read command. When VEML6075 wakes up, the data is refreshed by a newly acquired detection.

PACKAGE INFORMATION in millimeters

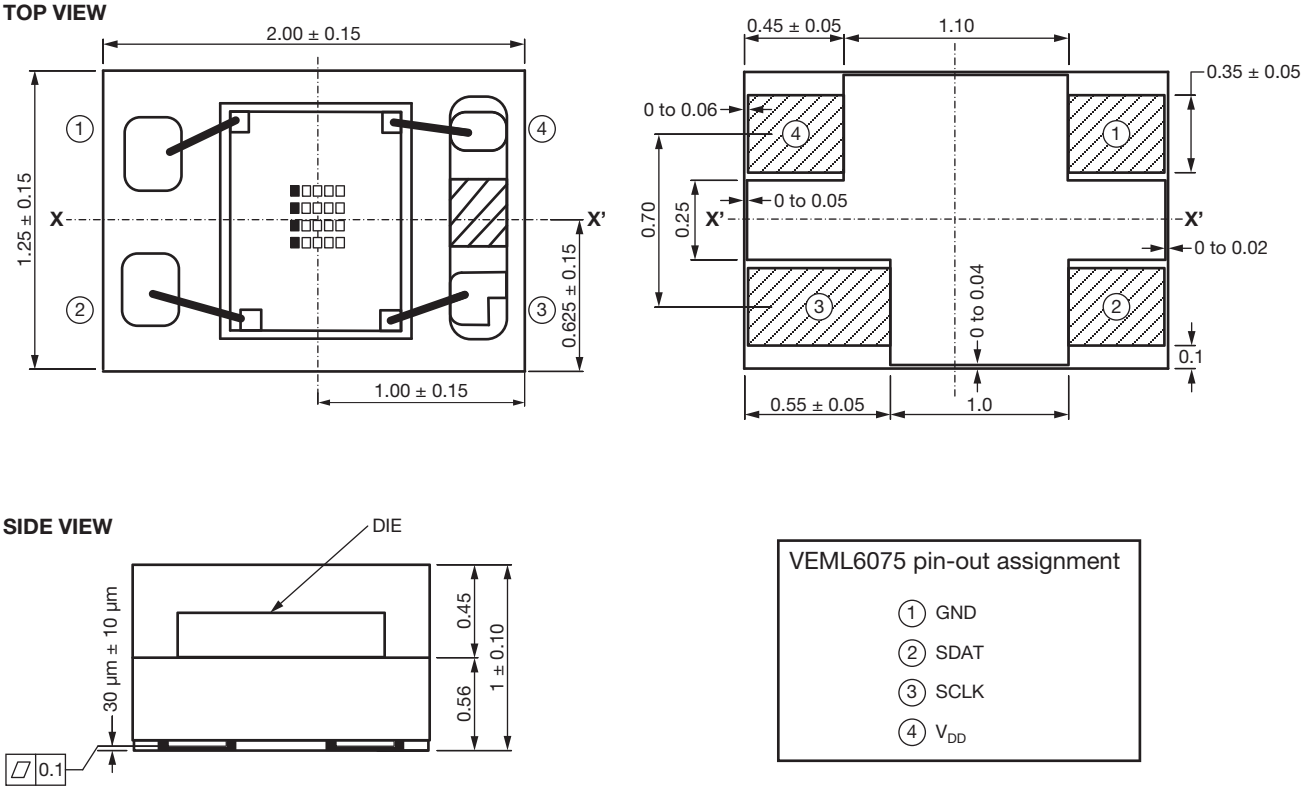


Fig. 8 - VEML6075 A3OP Package Dimensions

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

LAYOUT NOTICE AND REFERENCE CIRCUIT in millimeters

Pad and Circuit Layout Reference

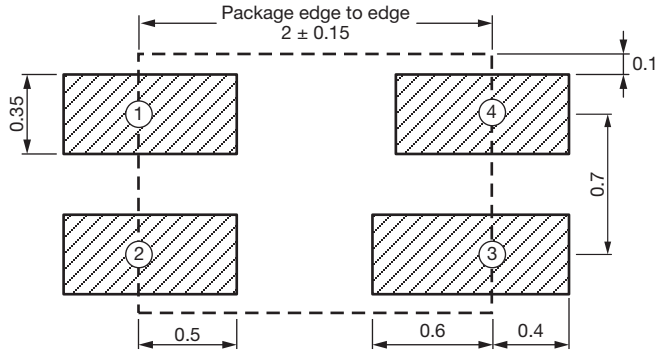


Fig. 9 - VEML6075 PCB Layout Footprint

APPLICATION CIRCUIT BLOCK REFERENCE

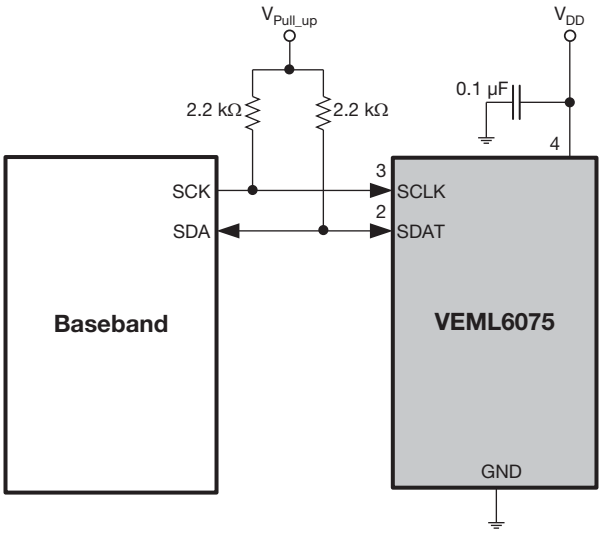


Fig. 10 - VEML6070 Application Circuit

RECOMMENDED STORAGE AND REBAKING CONDITIONS				
PARAMETER	**CONDITIONS**	**MIN.**	**MAX.**	**UNIT**
Storage temperature		5	50	°C
Relative humidity		-	60	%
Open time		-	168	h
Total time	From the date code on the aluminized envelope (unopened)	-	12	months
Rebaking	Tape and reel: 60 °C	-	22	h
	Tube: 60 °C	-	22	h

For technical questions, contact: sensorstechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

RECOMMENDED INFRARED REFLOW

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

IR REFLOW PROFILE CONDITION			
PARAMETER	**CONDITIONS**	**TEMPERATURE**	**TIME**
Peak temperature		255 °C + 0 °C / - 5 °C (max.: 260 °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 255 °C

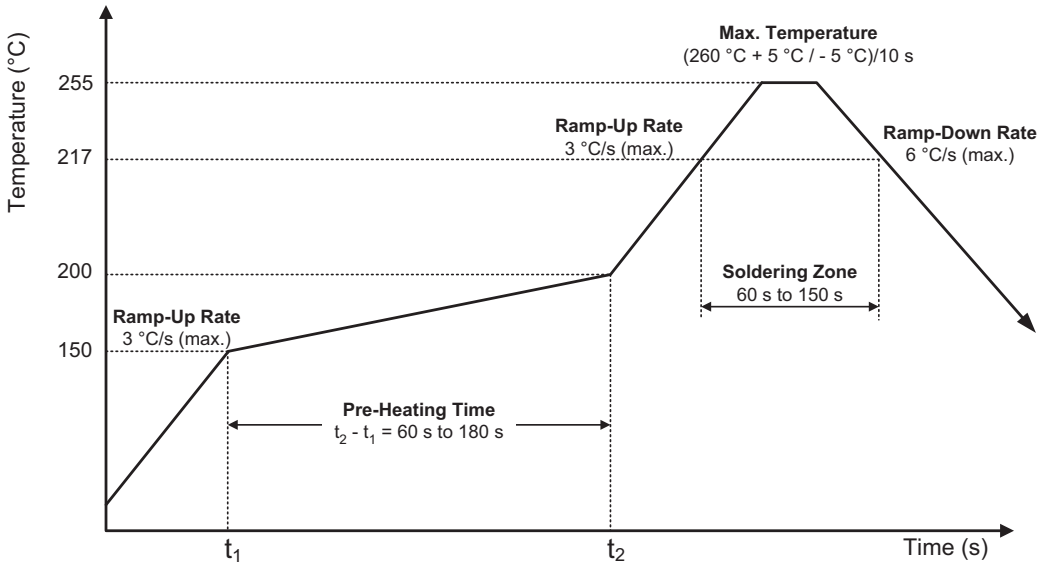


Fig. 11 - VEML6075 OPLGA Solder Reflow Profile Chart

RECOMMENDED IRON TIP SOLDERING CONDITION AND WARNING HANDLING

1. Solder the device with the following conditions:
   1.1. Soldering temperature: 400 °C (max.)
   1.2. Soldering time: 3 s (max.)
2. If the temperature of the method portion rises in addition to the residual stress between the leads, the possibility that an open or short circuit occurs due to the deformation or destruction of the resin increases.
3. The following methods: VPS and wave soldering, have not been suggested for the component assembly.
4. Cleaning method conditions:
   4.1. Solvent: methyl alcohol, ethyl alcohol, isopropyl alcohol
   4.2. Solvent temperature < 45 °C (max.)
   4.3. Time: 3 min (min.)

For technical questions, contact: sensorstechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TAPE PACKAGING INFORMATION in millimeters

DIMENSION OF CARRIER TAPE

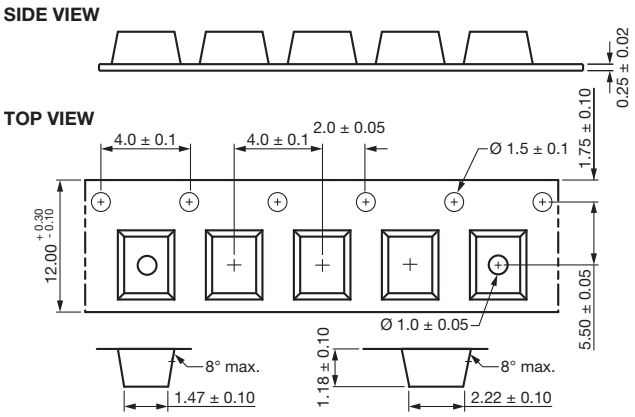


Fig. 12 - VEML6070 A3OP Package Carrier Tape

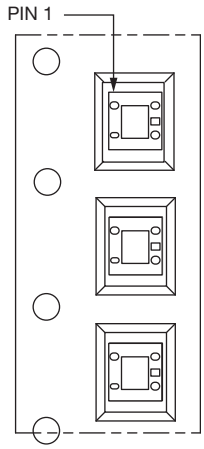


Fig. 13 - Taping Direction

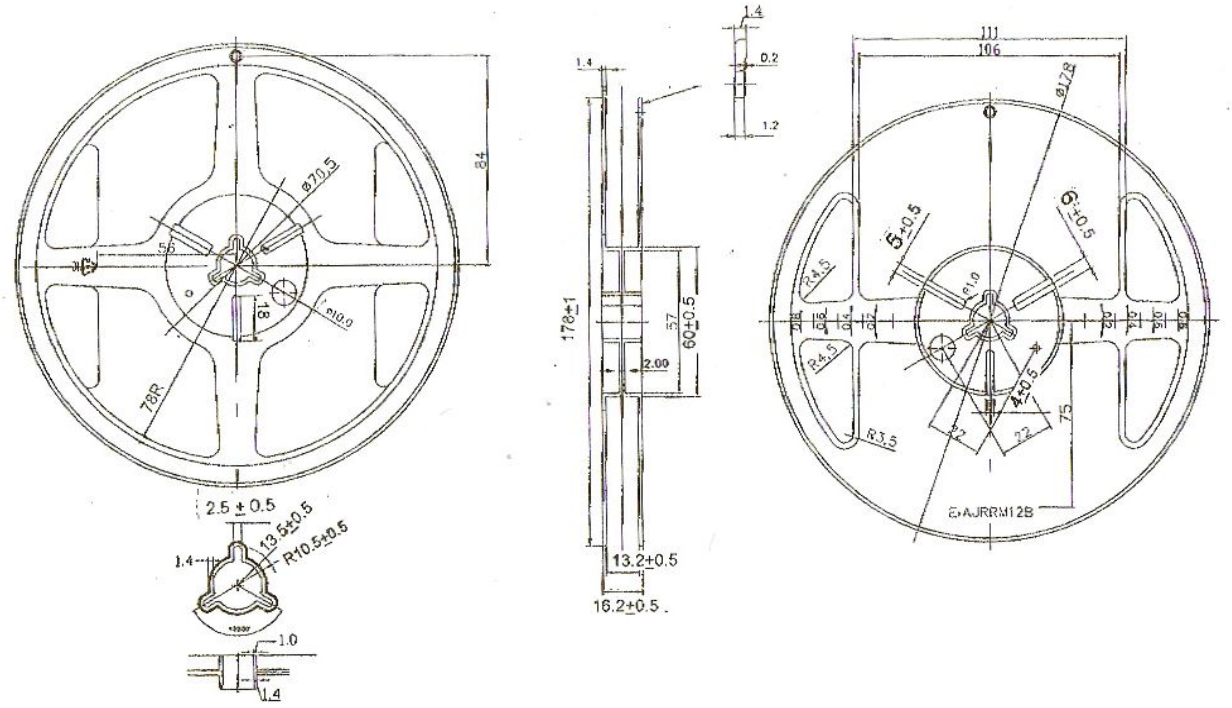


Fig. 14 - Reel Dimension

For technical questions, contact: sensorstechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000