HARVATEK

Ambient Light, Solar_UV_Index, IR and Proximity Sensor Data Sheet
B4252PLVP—U1930
P

Official Product	HT Part No. B4252PLVP--G1B0001X3U1930	Customer Part No.	Data Sheet No.	
Tentative Product	****************	****************	-	
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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Product Specifications

Item	Specification	Material	Quantity
Supply Voltage V_{DD}	2.5V~3.6V		
Operating Temperature T_{ope}	-40~+85 ˚C		
IR Peak Wavelength	850nm@2.5/5/10/15mA		
Resin	Clear	Epoxy	
Carrier tape	EIA 481-1A specs	Conductive black tape	
Reel	EIA 481-1A specs	Conductive black	
Label	HT standard	Paper	
Packing bag	220x240mm	Aluminum laminated bag/ no-zipper	One reel per bag
Carton	HT standard	Paper	Non-specified

Others:

Each immediate box consists of 5 reels. The 5 reels may not necessarily have the same lot number or the same bin combinations. Each reel has a label identifying its specification; the immediate box consists of a product label as well.

Note :This is shipped test conditions

※Remarks: This product should be operated in forward bias. If a reverse voltage is continuously applied to the product, such operation can cause migration resulting in products damage.

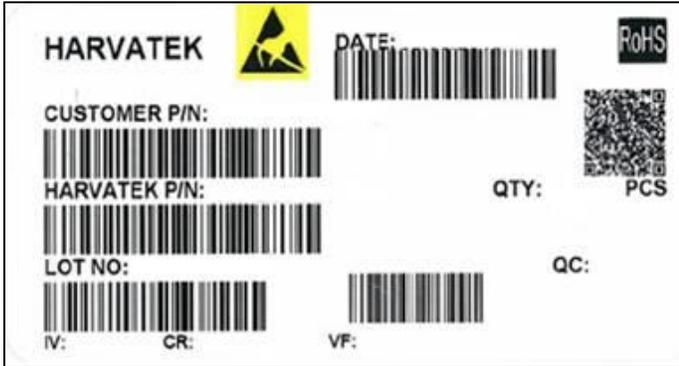**ATTENTION: Electrostatic Discharge (ESD) protection**

The symbol to the left denotes that ESD precaution is needed. ESD protection Silicon semiconductor is necessary even though they are relatively safe in the presence of low static-electric discharge. ESD precaution must be taken during design and assembly.
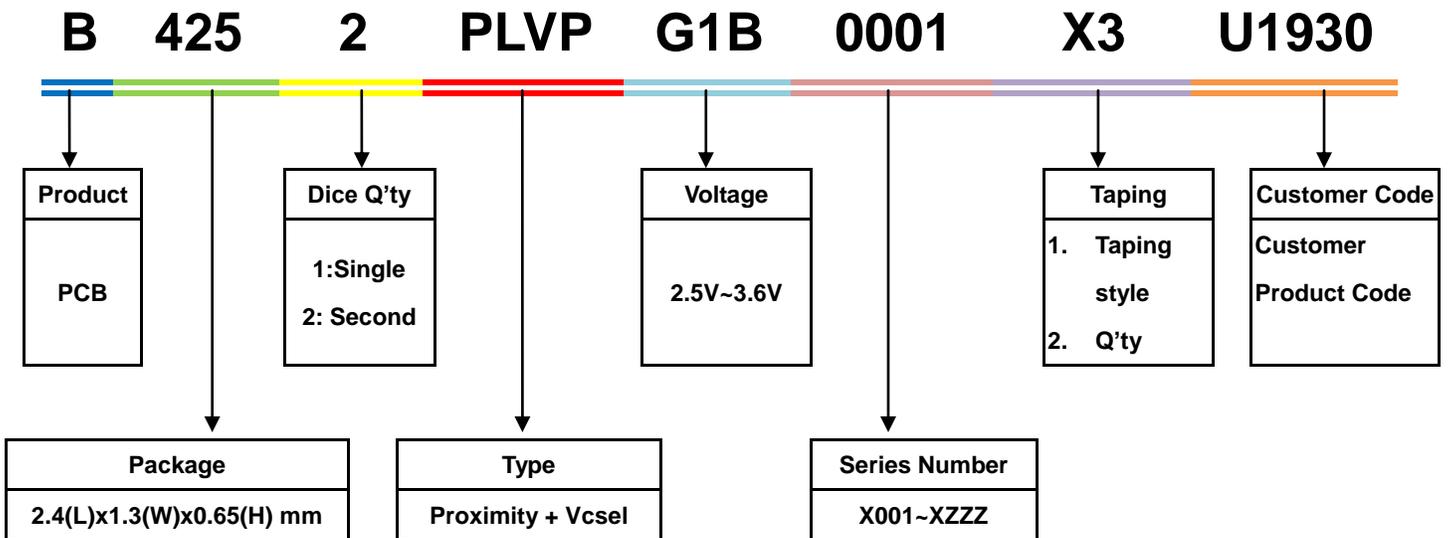
If manual work or processing is needed, please ensure the device is adequately protected from ESD during the process.

Label Specifications

■**Harvatek P/N:**

B	425	2	PLVP	G1B	0001	X3	U1930

Product	Dice Q'ty	Voltage	Taping	Customer Code
PCB	1:Single 2: Second	2.5V~3.6V	1. Taping style 2. Q'ty	Customer Product Code

Package	Type	Series Number
2.4(L)x1.3(W)x0.65(H) mm	Proximity + Vcsel	X001~XZZZ

■ **Lot No.:**

1	2	3	4	5	6	7	8	9	10
E	1	A	1	A	2	2	L	1	2
Code 1 2		Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9	Code 10
		Mfg. Year	Mfg. Month	Mfg. Date	Consecutive number			Special code	
Internal Tracing Code		2010-A 2011-B 2012-C 2013-D . .	1:Jan. 2:Feb. .... A:Oct. B:Nov. C:Dec.	1:A 2:B 3:C ... 26:Z 27:7 28:8 29:9 30:3 31:4	01~ZZ			000~ZZZ	

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Block Diagram
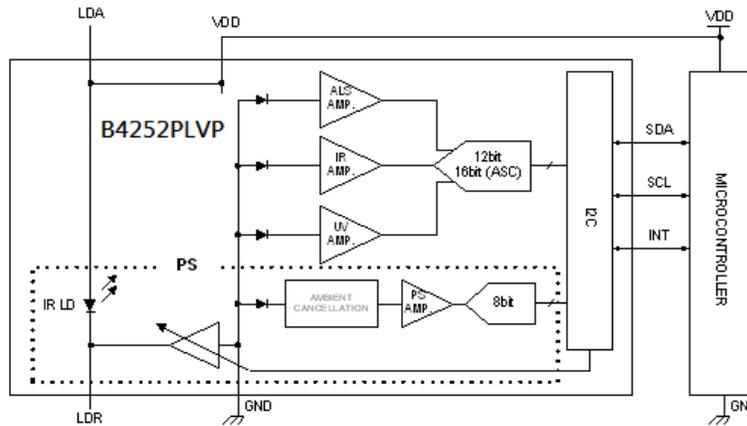
I/O Pins Configuration
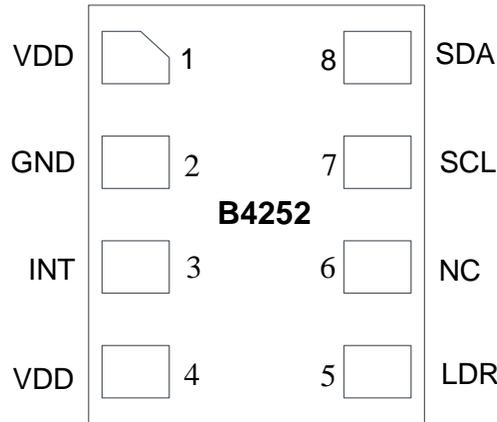
Bottom View

Pin	I/O Type	Pin Name	Description
1	P	VDD	Power Supply
2	P	GND	Ground
3	O	INT	Interrupt pin
4		VDD	NC (Pin4 = Pin1)
5	P	LDR	VCSEL Cathode
6		LDR	NC
7	I	SCL	I^2C serial clock line
8	I/O	SDA	I^2C serial data line

Absolute Maximum Rating at 25℃

Parameters	Symbol	Value	Unit
Supply Voltage	VDD	-0.6 to 4.0	V
Transient Voltage (<20ns) on Any Pin to Ground Potential.		-2.0 to 2.0	V
Operating Temperature	Tope	-40 to +85	˚C
Storage Temperature [Note1]	Tstg	-45 to +100	˚C
ESD Rating [Note2]	Human Body Model	2	KV

Notes:

1. Compliant with JEDEC Std J-STD-020B (for small body, Sn-Pb or Pb assembly). For wave solder process, IC could meet 265°C, 5secs.

2. JEDEC Std JESD22-A114A (C1=100 pF, R1=1500Ω, R2=500Ω)

Electrical & Optical Specifications

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage		2.5		3.6	V
T_A	Operating Temperature		-40		85	°C
I_{LI}	Input Leakage Current				± 2	μA
I_{LO}	OutputLeakage Current				± 2	μA
V_{IL}	Input Low Voltage				0.55	V
V_{IH}	Input High Voltage		1.25			V
V_{OL}	Output Low Voltage	I_{SINK} = 6mA			0.4	V
I_{CC1}	Standby Current	No I2C activity		0.5	1	μA
I_{CC2}	Operating Current @Wait Time=60ms (without LD)	Light sensing only (ALS/IR/SUVI)		17	20	μA
		PS only (with I_{LD} = 10mA)		27		μA
		PS and Light sensing (I_{LD} = 10mA)		30		uA

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ALS/IR Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
λ_{P_ALS}	Peak Sensitivity Wavelength for ALS			550		nm
λ_{P_IR}	Peak Sensitivity Wavelength for IR			850		nm
$Data_{AI\_F}$	Full Scale ALS/IR Count		0		65535 (Note 1)	Count
$Data_{AI\_O}$	Dark ALS/IR Count			0	3	Count
	ALS Detecting Light Intensity (ASC mode, ASC_Gain=x1)	High Intensity Mode (ALS_H=1, ALS_L=0)	~7.6		~400k	7.6 Lux/LSB
		Normal Mode (ALS_H=0, ALS_L=0)	~0.1		~8K	0.13 Lux/LSB
		Low Intensity Mode (ALS_H=0, ALS_L=1)	(Note 2)		~200	0.003m Lux/LSB
	ALS Detecting Light Intensity (Manual mode)	(Note 3)			~400k	Lux
-	ALS/IR Sensing Tolerance				±10	%

Notes:

The full ADC scale is 65535 counts under ASC mode, and 4095 counts under non ASC mode.

To get better resolution under 0.1 lux to 0.001 lux, the user can set ALS_Gain value.

The manual mode ALS light intensity is defined by the value of ALS_H/L, ALS_Gain, and ALS_IT. Please refer the page of ALS Lux Calculation

IR LD Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
λ_{P_LD}	Peak Wavelength			850		nm
$\triangle\lambda$	Spectrum Width, Half Power			1		nm
T_R	Optical Rise Time			1		ns
T_F	Optical Fall Time			1		ns

PS Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
λ_{P_PS}	Peak Sensitivity Wavelength	(Note)		850/550		nm
$Data_{PS\_F}$	Full Scale PS Count		0		255	Count
$I_{LED/LD}$	LED/LD Sink Current		2.5		300	mA
t_{LED/LD_P}	LED/LD Pulse Period		0.05		6.4	ms

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Note:

The spectrum of LED/LD light source could be IR or Green selected by customer using user command 0x0D[3:0].

Solar UV Index Characteristics

| Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Data$_{SUVI\_F}$	Full Scale Solar UV Index Count		0		255	Count
Data$_{SUVI\_O}$	Dark Solar UV Index Count			0	1	Count
-	Solar UV Index Sensing Tolerance				±15	%
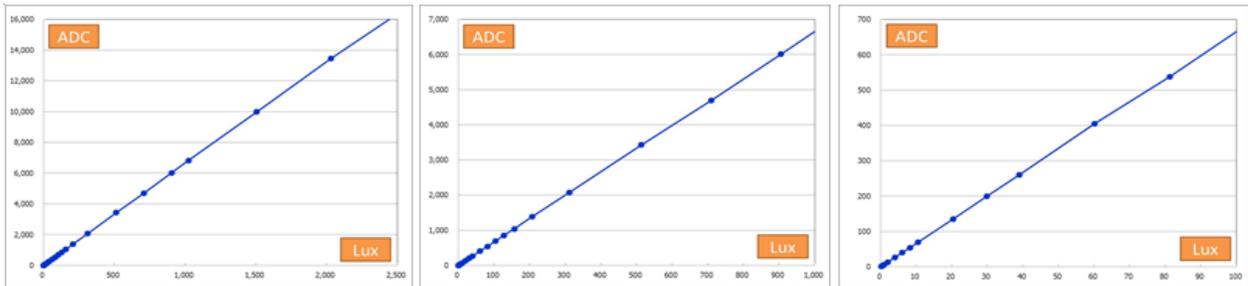
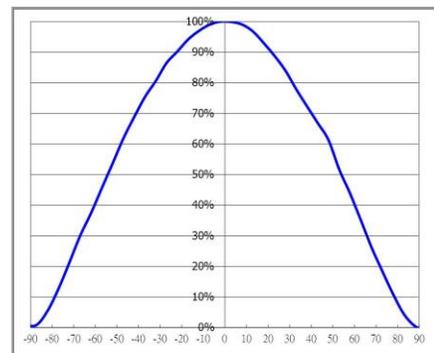**ALS ADC count vs. Lux @ASC_Normal mode with ASC_Gain=x1**
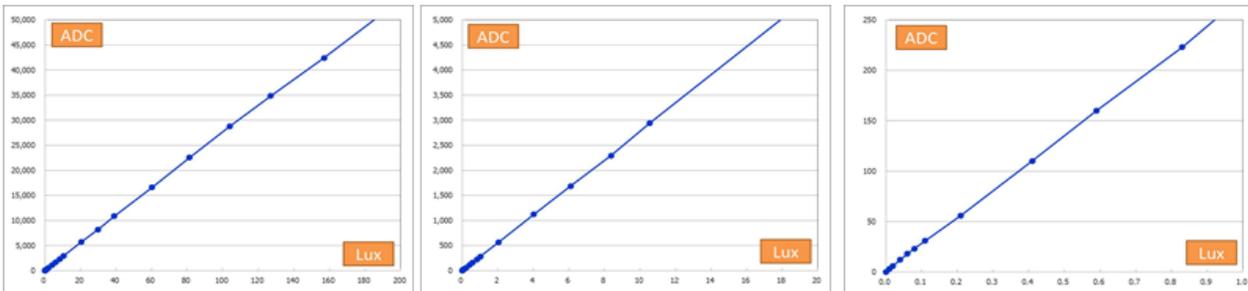
ALS ADC count vs. Lux @ASC_Low mode with ASC_Gain=x1

Note: To get better resolution under 0.1 lux to 0.001 lux, the user can set ALS_Gain value.
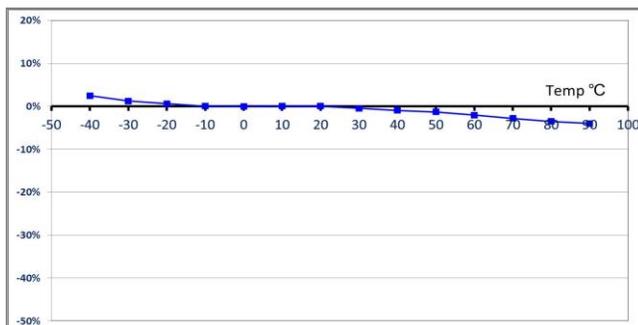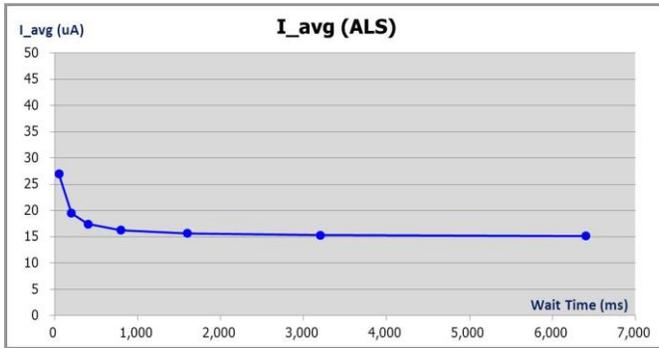

ALS ADC count vs. Temperature

ALS View Angle

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Power Management

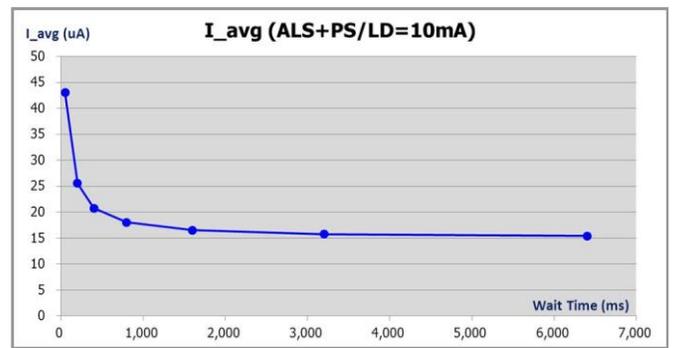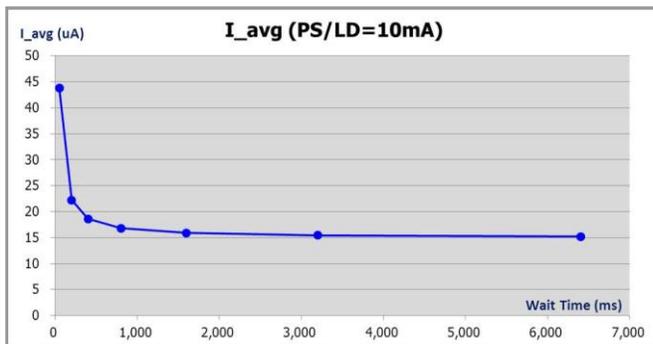Example: ALS Ts=40ms, PS (PS_PT=Tps x1, LD=10mA included), Wait Time=200ms
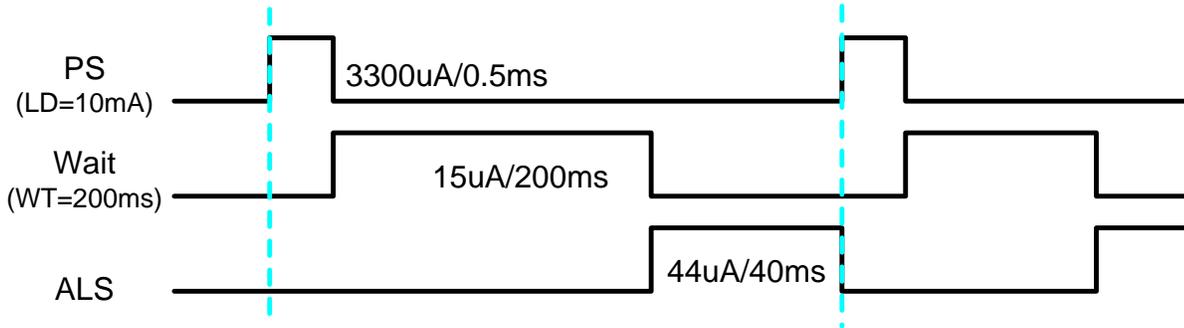
$$I\_avg = (3300 \times 0.5 + 15 \times 200 + 44 \times 40)/(0.5 + 200 + 40) = 26uA$$

ALS Average I_{CC2}

ALS+PS/LD=10mA Average I_{CC2}

PS/LD=10mA Average I_{CC2}

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Function Description

Light Sensor

The B4252PLVP converts light intensity of ambient light (ALS), Infrared light (IR) or Solar_UV_Index to digital signal through I2C interface by various photodiodes and ADC circuit. The I2C interface follows Philip^{TM} I2C specification with an open drain active Interrupt pin.

The built-in ADC has 12 bits resolution. B4252PLVP offers user flexibility selection in integration time or gain for different specific light detection range. If the light detection is in general purpose, the user can use ASC (Auto Scale Control) mode which can automatically adjust integration time and gain to the best resolution for various light intensity. The user has no need manually to set the integration time or gain. With ASC mode, the output data is in dynamic range of 16 bits. The Solar_UV_Index sensing adopts only ASC mode internally without manual mode option.

If the sensor will be under an overlay that is not 100% transmits to light source, the light data can be trimmed back on chip to the correct one.

Proximity Sensor

Proximity sensing equips an internal IR VCSEL LD (Laser Diode) as light source to emit light, which is then viewed by the integrated light detector to measure the amount of reflected light when an object is in the light path. The amount of light detected from a reflected surface can then be used to determine an object's proximity to the sensor.
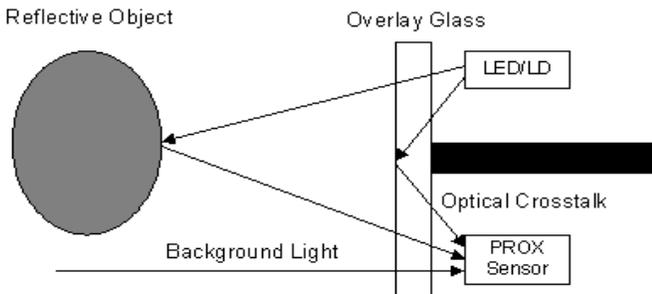
When the proximity sensing is enabled, the internal LD is driven by the built-in driver through the LDR pin. The driving current of LD is optional with range from 2.5mA to 15mA, and the pulse time is also changeable from 0.05ms to 6.4ms. These optional settings are according to the distance to be detected in application.

The ADC resolution of PS sensing is 8 bits with PS Offset function to cancel the PS optical crosstalk from overlay reflection. The PS offset value can be measured by PS_OS function without any object in front of the overlay. After setting the offset value to 0xA5, the B4252PLVP can cancel the system internal reflection but still keep full dynamic range of PS output with 8 bits (256 steps) resolution, and, the user has no need to modify PS threshold setting.

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Solar Ultraviolet (UV) Index

The Solar_UV_Index is a number linearly related to the intensity of sunlight reaching the earth and is weighted according to the CIE Erythemal Action Spectrum. This weighting is a standardized measure of human skin's response to different wavelengths of sunlight from UVB to UVA. The UV Index has been standardized by the World Health Organization and includes a simplified consumer UV exposure level. B4252PLVP can sense Solar_UV_Index with 8 bits output data, and user can multiply it by P_SUVI to get Solar_UV_index.
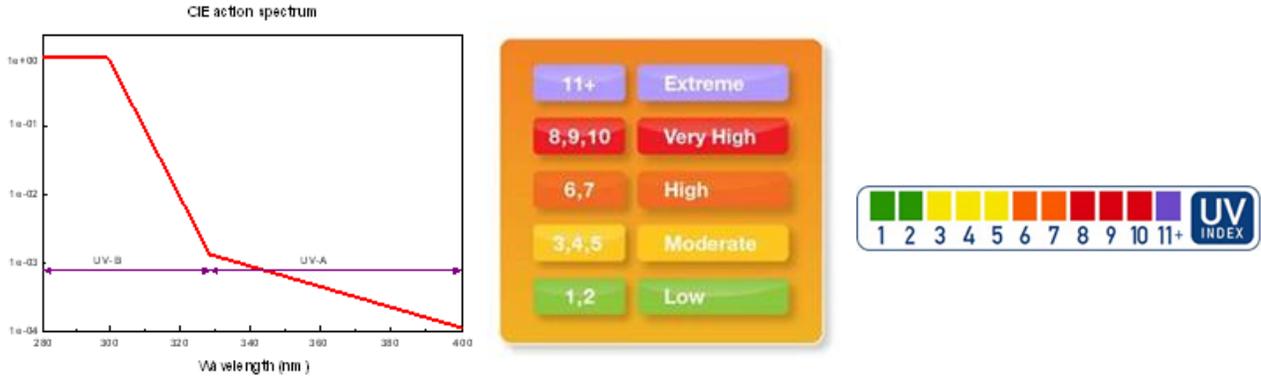
CIE Erythemal Action Spectrum and UV Index Scale

Interrupt Function

The B4252PLVP has an intelligent interrupt scheme designed for light and PS sensing. The active low interrupt pin is an open drain pull-down configuration. The interrupt pin serves as an alarm or monitoring function to determine whether the ambient light or PS data exceeds the upper threshold or goes below the lower threshold. The user can also configure the persistency for the interrupt to eliminate any false triggers, such as noise or sudden spikes in ambient light conditions. The user uses 0x00[3,2] to identify which interrupt status, light sensing or PS one, is raised.

System Operation State

The B4252PLVP provides control of ambient light (ALS), IR light, Solar_UV_Index, proximity sensing (PS) detection, and power management through an internal state machine. After a power on reset, the device is in standby mode. As soon as any of light or PS sensing bit is enable, the device will move to the start state, and then it will continue through PS, UV, wait, and ALS/IR states.

If any Write command is executed during sensing in operation, then the device will interrupt the sensing process and move back to standby stage. It will then restart the process according to the new written conditions. Regarding the enable setting of PS, UV and ALS/IR, customer can refer to the register 0x01configuration.

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VDD Power-up and Power Supply Considerations

Upon power-up, a VDD slew rate of 0.5V/ms or greater is preferable. After power-up, or if the user's power supply is temporarily fluctuated by unknown noise causing system abnormal, recommends the user to issue a soft reset command 0x5B with data 0xB5, and then rewrite all registers to the desired values. If the user prefers a hardware reset method instead of soft reset, please set VDD = 0V for 1 second or more, and then power up at the required slew rate.
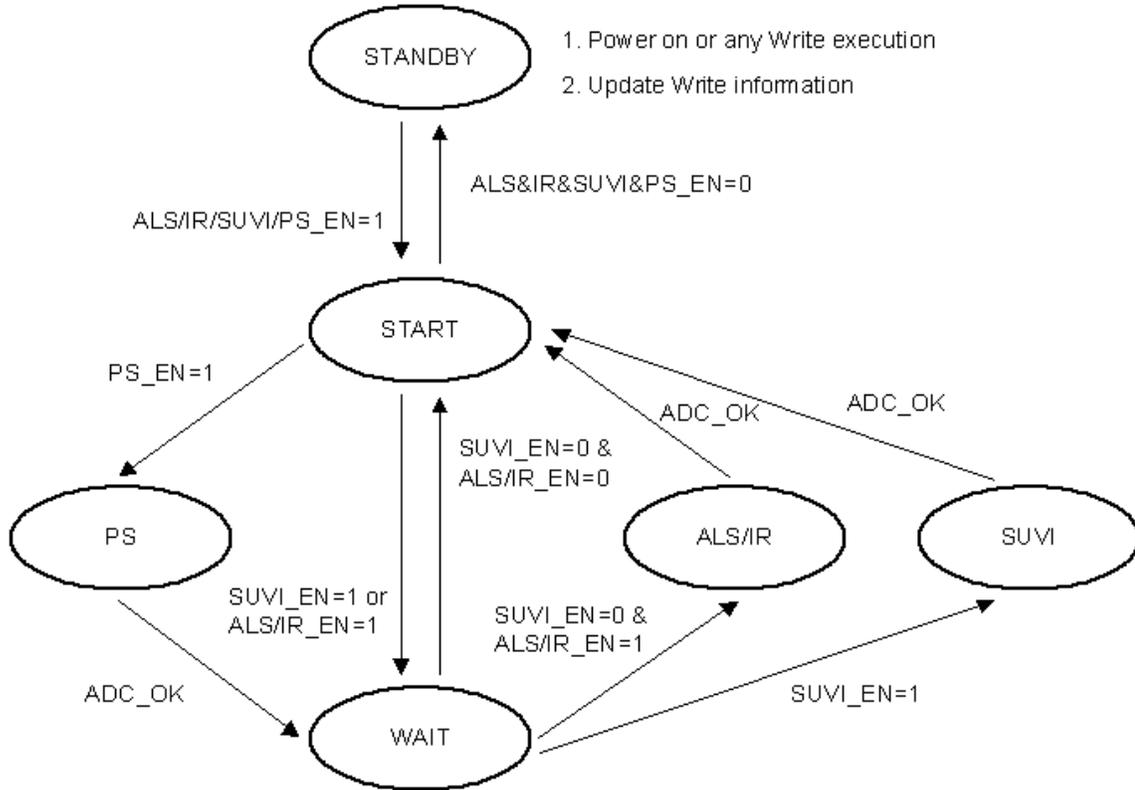
Note: When the SUVI sensing enables, all the other sensing will be disable, and their data will remain as previous sensing before SUVI was enable.

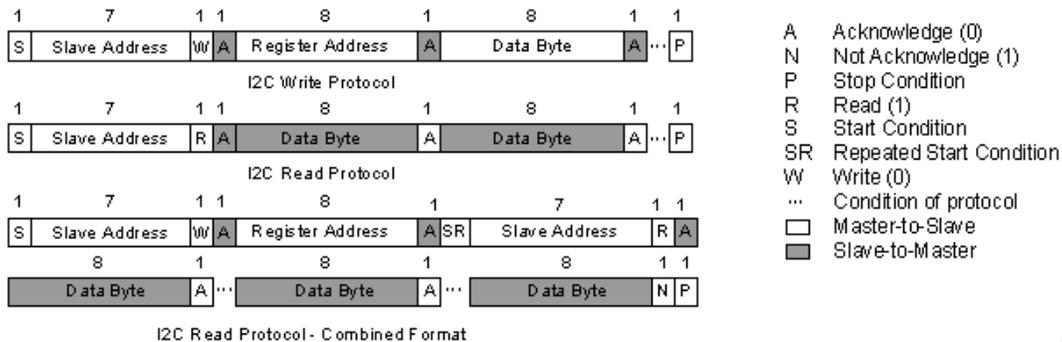| Official Product	HT Part No. B4252PLVP--G1B0001X3U1930	Customer Part No.	Data Sheet No.		
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I2C Protocol

The bus interface and control are accomplished through an I2C compatible, 2-wire serial interface consisting of a serial-data line (SDA) and a serial-clock line (SCL). SDA and SCL facilitate communication between the IC and the master at clock rate up to 400k Hz. The devices support the 7-bit I2C addressing protocol and 8-bit register address and data byte.

The I2C standard provides for three types of bus transaction: read, write, and a combined protocol.

During a write operation, after (slave_address + R/W) byte, the first byte written is a register address followed by data byte. If a read command is issued, the register address from the previous command will be used for data access. In a combined protocol, the first byte written is the register address followed by reading a series of data bytes.

B4252PLVP slave address is 1001010X, which 0x94 is Write to B4252PLVP, and 0x95 is Read from B4252PLVP. The I2C bus protocol follows Philip^{TM} (now NXP company) I2C specification. For a complete description of I2C protocol, please refer to NXP I2C design specification.

I2C Protocols

Timing Diagrams

I2C Bus Timing Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
$f_{(SCL)}$	Serial-Clock Frequency			400	KHz
$t_{(HIGH)}$	Clock High Period	0.6			µs
$t_{(LOW)}$	Clock Low Period	1.3			µs
$T_{(R)}$	Clock/Data Rise Time		100		ns
$T_{(F)}$	Clock/Data Fall Time		100		ns
$t_{(SUDAT)}$	Data Setup Time	100			ns
$t_{(HDDAT)}$	Data Hold Time	100			ns
$t_{(BUF)}$	Bus Free Time Between STOP and START	1.3			µs
$t_{(HDSTA)}$	Hold Time (Repeated) Start Condition	0.6			µs
$t_{(SUSTA)}$	Repeated Start Condition Setup Time	0.6			µs
$t_{(SUSTO)}$	Stop Condition Setup Time	0.6			µs
$t_{(SP)}$	Pulse Width of Suppressed Spike	0		50	ns

B4252PLVP Register Map

1. B4252PLVP slave address is 1001010X, which 0x94 is Write to B4252PLVP, and 0x95 is Read from B4252PLVP

2. Register 0xA5 (PS Offset Trim_A5) must be written once after power on for accurate PS sensing (Note).

3. Register 0x10 (Special Mode) is recommended to be written at least once after power on.

System Registers

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x5B	W	Soft Reset	Soft Reset, 0xB5								
0xE3	R	Device ID	Device ID, 0xA0								
0x10	R/W	Special Mode	0	0	ALS/IR#_Low	One Shot	ALS/IR_High	OVR_ENB	0	0	0x00

Status Bits and Operation Command Registers

0x00	R	State (Ready, Interrupt)	AI/SUVI_RDY	L_OVR (Reserved)	---	---	ALS/IR_INTS	PS_INTS	---	---	0x00
0x01	R/W	Mode (Operation Mode)	WT [2:0]			ALS/IR_EN[1:0]		PS/SUVI_EN[1:0]		IR mode	0x00

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ALS/IR Registers

0x02	R/W	AI_CTRL (ALS/IR)	ASC#	ALS/IR_IT [2:0]		ALS/IR_GAIN [1:0]	ALS/IR_PRST [1:0]	0x00
0x03	R	AI_D_L	ALS/IR Data Low Byte [7:0]					0x00
0x04	R	AI_D_H	ALS/IR Data High Byte [11:8], ASC mode [15:8]					0x00
0x05	R/W	AI_HTH_L	ALS/IR High Threshold - Low Byte [7:0]					0x00
0x06	R/W	AI_HTH_H	ALS/IR High Threshold - High Byte [11:8], ASC mode [15:8]					0x00
0x07	R/W	AI_LTH_L	ALS/IR Low Threshold - Low Byte [7:0]					0x00
0x08	R/W	AI_LTH_H	ALS/IR Low Threshold - High Byte [11:8], ASC mode [15:8]					0x00

PS Registers

0x09	R/W	PS_CTRL (PS)	PS_OS	PS_PT [2:0]	PS_I [1:0]	PS_PRST [1:0]	0x00
0x0A	R	PS_D	PS Data [7:0]				0x00
0x0B	R/W	PS_HTH	PS High Threshold [7:0]				0x00
0x0C	R/W	PS_LTH	PS Low Threshold [7:0]				0x00
0x0D	R/W	PS_DRIVE	PS Driving Current Magnification [3:0]		PS Light Type (IR/Green) [3:0]		0x00

Solar_UV_Index Registers

0x0E	R	SUVI_D	Solar UV Index Data [7:0]	0x00

Trim Registers

0xA0 ~ 0xA4/A7	R/W	Trim_A0 ~ Trim_A4/A7	(reserved)	
0xA5	R/W	Trim_A5	PS Offset [7:0]	0x28
0xA6	R/W	Trim_A6	PS_PT Trim [7:0]	0x28

Note:

The best PS Offset setting value of 0xA5 is generated by executing PS function with PS_OS register 0x09[7]=1. Please refer the "Application Note of B4252xxxx PS Offset Cancellation" to get this 0xA5 value.

System Registers

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x5B	W	Soft Reset	Soft Reset, 0xB5								
0xE3	R	Device ID	Device ID, 0xA0								
0x10	R/W	Special Mode	0	0	ALS/IR#_Low	One Shot	ALS/IR_High	OVR_ENB	0	0	0x00

Register 0x10 (Special Mode)

Bit	Name	Function Description				
5	ALS/IR#_Low (with 0x10[3]=0)	Set the ALS/IR# sensing to low intensity range				
		0	ALS Normal intensity sensing (IR Low intensity sensing)	1	ALS Low intensity sensing (IR Normal intensity sensing)	
4	One Shot	Set One Shot sensing only to each enable.				
		0	Repeat sensing	1	One Shot sensing	
3	ALS/IR_High (with 0x10[5]=0 @ALS or 0x10[5]=1 @IR)	Set the ALS sensing to high intensity range				
		0	Normal intensity sensing	1	High intensity sensing	
2	OVR_ENB (reserved)	ALS_OVR function (reserved)				
		0	ALS_OVR function enable	1	ALS_OVR function disable	

Status Bits and Operation Command Registers

Register 0x00 (Data Ready & Interrupt Status Bits)

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x00	R	State (Ready, Interrupt)	AI/SUVI_RDY	L_OVR (Reserved)	---	---	ALS/ IR _INTS	PS _INTS	---	---	0x00

Bit	Name	Function Description	
7	AI/SUVI Ready Status	ALS/IR & SUVI Data Ready Status	
		0	Data is NOT available to be used since power-on or last "clear".
		1	The data is available after enable. Once this bit is set, the only 2 ways to clear it to 0 are to read this register or set such sensing disable.
3:2	Interrupt Status	Interrupt Status Bits ([3]=ALS/IR_INTS, [2]=PS_ INTS)	
		0	No interrupt event has occurred since power-on or last "clear".
		1	The data has exceeded the designated window limits defined by Threshold registers, and persist timer is greater than the set Persist count. Once this bit is set, the only 2 ways to clear it to 0 are to read this register or set such sensing disable.

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Register 0x01 (Operation Control)

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x01	R/W	Mode (Operation Mode)	WT [2:0]			ALS/IR_EN[1:0]		PS/SUVI _EN[1:0]		IR mode	0x00

Bit	Name	Function Description				
7:5	Wait Time	Wait Time Setting for power consumption control, Tw=50ms				
		000	Tw x1	100	Tw x32	
		001	Tw x4	101	Tw x64	
		010	Tw x8	110	Tw x128	
		011	Tw x16	111	NO wait time (NOT recommended to use)	
4:3	ALS/IR_Enable	ALS/IR Sensing enable				
		00	ALS/IR sensing disable	10	(reserved)	
		01	ALS sensing enable	11	IR sensing enable (must set 0x01[0]=1)	
2:1	PS/SUVI _Enable	PS/Solar_UV_Index Sensing enable (Note)				
		00	PS/SUVI sensing disable	10	Solar_UV_ Index sensing enable	
		01	PS sensing enable	11	(reserved)	
0	IR mode	IR Mode				
		0	ALS/PS/SUVI mode	1	IR mode	

Note:

When the SUVI sensing enables, all the other sensing will be disable, and their data will remain as previous sensing before SUVI was enable.

ALS/IR Registers

Register 0x02 (ALS/IR Command Set)

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x02	R/W	AI_CTRL (ALS/IR)	ASC#	ALS/IR_IT [2:0]			ALS/IR_Gain [1:0]		ALS/IR_PRST [1:0]		0x00

Bit	Name	Function Description			
7	Auto Scale Control # (ASC mode)	Auto Scale Control of ALS/IR mode			
		0	ASC mode is active, ALS/IR_IT is automatically scaled by internal circuit, and ALS/IR Data and Hi/Lo threshold would be defined as 16 bits of [15:0]. The default ALS/IR_Gain value is x1 Gain, and it can be assigned higher to increase the sensitivity when the ASC ADC data is too low under measurement.		
		1	ALS/IR_IT and ALS/IR_Gain are controlled by register 0x02[6:4] and 0x02[3:2].		
6:4	ALS/IR_IT	ALS Integration Time Setting, Ts=5ms			
		000	Ts x1	100	Ts x16
		001	Ts x2	101	Ts x32
		010	Ts x4	110	Ts x64
		011	Ts x8	111	Ts x128
3:2	ALS/IR_Gain	ALS/IR Gain Setting for sensitivity range selection			
		00	x1 Gain	10	x4 Gain
		01	x2 Gain	11	x8 Gain
1:0	ALS/IR_PRST	ALS/IR Persist Setting for consecutive count of data value out of threshold range			
		00	1 count	10	4 counts
		01	2 counts	11	8 counts

Register 0x03/04/05/06/07/08 (ALS/IR Data and Hi/Lo Threshold)

ADDR	R/W	Register Name	Function Description
0x03	R	AI_D_L	Read ALS/IR_Data 12 bits of [11:0].
0x04	R	AI_D_H	If ASC mode is active, the data is auto scaled as 16 bits of [15:0].
0x05	R/W	AI_HTH_L	The ALS/IR High Threshold registers provide the values to be used as the high trigger point for interrupt generation. An interrupt is generated when the value of ALS/IR conversion is greater than the high threshold and persist count is reached. If ASC mode is active, the data is defined as 16 bits of [15:0].
0x06	R/W	AI_HTH_H	
0x07	R/W	AI_LTH_L	The ALS/IR Low Threshold registers provide the values to be used as the low trigger point for interrupt generation. An interrupt is generated when the value of ALS/IR conversion is lower than the low threshold and persist count is reached. If ASC mode is active, the data is defined as 16 bits of [15:0].
0x08	R/W	AI_LTH_H	

PS Registers

Register 0x09 (PS Command Set)

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x09	R/W	PS_CTRL (PS)	PS_OS	PS_PT [2:0]			PS_I [1:0]		PS_PRST [1:0]		0x00

Bit	Name	Function Description					
7	PS_OS	PS Offset measurement: While this PS_OS measurement is under operation, NO any reflective object should be in front of the sensor or overlay. The measurement is set by PS mode enable with this bit = "1"; the value of PS_OS would be automatically written to register 0xA5, and the system needs to write this value to register 0xA5 (PS Offset) to cancel PS offset after each power-on (Note).					
6:4	PS_PT	PS Light Pulse Time Setting, Tps=0.05ms					
		000	Tps x1		100	Tps x16	
		001	Tps x2		101	Tps x32	
		010	Tps x4		110	Tps x64	
		011	Tps x8		111	Tps x128	
3:2	PS_I	PS Light Driving Current Setting, the current can be magnified as x1, x2, x10, x20 times by 0x0D[7:4].					
		00	2.5mA	01	5mA	10	10mA	11	15mA
1:0	PS_PRST	PS Persist Setting for consecutive count of data value out of threshold range					
		00	1 count		10	3 counts	
		01	2 counts		11	4 counts	

Note:

For the initial use of B4252PLVP without any overlay, it needs a first register values setting of 0xA5 (PS Offset) and 0xA6 (PS_IT Trim). Below table are the reference values for user to set.

For the first setup of B4252PLVP in application or if any PS_PT/I of 0x09[6:2] registers have been changed, the PS_OS function must be executed again to get proper PS offset value of 0xA5, so that the cross talk can be fully cancelled when PS measurement. Please refer the "Application Note of B4252xxxx PS Offset Cancellation.

Part Number	LD to Sensor pitch (λ P_LD)	PS register set		PS condition
		0xA6	0xA5	
B4252PLVP	1.778mm (850nm)	0x1D	0x55	@PS_PT=Tpsx1, PS_I=15mA

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Register 0x0A/0B/0C (PS Data and Hi/Lo Threshold)

ADDR	R/W	Register Name	Function Description
0x0A	R	PS_D	Read the PS_Data 8 bits of [7:0].
0x0B	R/W	PS_HTH	The PS Hi_THreshold register provides the values to be used as the high trigger point for interrupt generation. An interrupt is generated when the value of proximity conversion is higher than the threshold and persist count is reached.
0x0C	R/W	PS_LTH	The PS Lo_THreshold register provides the values to be used as the low trigger point for interrupt generation. An interrupt is generated when the value of proximity conversion is lower than the threshold and persist count is reached.

Register 0x0D (PS Driving Current Magnification and Light Type Selection)

ADDR	R/W	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x0D	R/W	PS Light Source	PS Driving Current Magnification				PS Light Type (IR/Green)				0x00

Bit	Name	Function Description			
7:4	PS Driving Current Magnification	PS Driving Current Magnification of PS_I 0x09[3:2]			
		0000	PS_I current x1	0101	PS_I current x10
		1000	PS_I current x2	1101	PS_I current x20
3:0	PS Light Type	PS Light Source Type (IR/Green)			
		0000	Infrared (IR) Light	0101	Green Light (with ALS_L=0x10[5]=1)

Solar UV Index Registers

Register 0x0E (Solar_UV_Index Data)

ADDR	R/W	Register Name	Function Description
0x0E	R	SUVI_D	Solar_UV_Index_Data [7:0]

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ALS Lux Calculation (value in decimal base)

Parameter List:

P_Lux = 0.2 (ALS_ADC_Data to Lux_value ratio)

P_ASC_G = 2^(0x02[3:2]) (ASC mode Gain value)

P_Man = 2^(IT_value + GAIN_value - 4) = 2^(0x02[6:4] + 0x02[3:2] - 4) (Manual mode value)

P_ALS_L =1 @ ALS_L = <u>0x10[5]</u> = 0

  = 42   @ ALS_L = <u>0x10[5]</u> = 1 (ALS **Low** intensity sensing)

P_ALS_H = 1   @ ALS_H = <u>0x10[3]</u> = 0

  = (<u>0xA0[7:0]</u>x64 +1) ÷ (<u>0xA0[7:0]</u> +1)   @ ALS_H = <u>0x10[3]</u> = 1 (ALS **High** intensity sensing)

ALS Lux in ASC Mode (Auto Scale):

ALS_Lux = ALS_ADC_Data x (P_Lux ÷ P_ASC_G) x (P_ALS_H ÷ P_ALS_L)

Example_1   @ALS_ADC_Data=0AB8h=2744, ALS_H/L=0x10[3,5]=[0,0], Gain=0x02[3:2]=[10]=2
      ALS_Lux = 2744x(0.2/2^2)x1 = 2744x0.05 = 137.2 lux

Example_2   @ALS_ADC_Data=1234h=4660, ALS_H/L=0x10[3,5]=[1,0]
      @Gain=0x02[3:2]=[00]=0, 0xA0[7:0]=0Ah=10
       ALS_Lux = 4660x(0.2/1)x[(10x64+1)÷(10+1)/1] = 4660x0.2x58.27 = 54307.6 lux

Example_3   @ALS_ADC_Data=5678h=22136, ALS_H/L=0x10[3,5]=[0,1], Gain=0x02[3:2]=[01]=1
      ALS_Lux = 22136x(0.2/2^1)x(1/42) = 22136x0.1x(1/42) = 52.7 lux

ALS Lux in Manual mode: (Sensing range set by ALS_IT and ALS_GAIN)

ALS_Lux = ALS_ADC_Data x (P_Lux ÷ P_Man) x (P_ ALS_H ÷ P_ALS_L)

Example_1   @ALS_ADC_Data=0234h=564, ALS_H/L=0x10[3,5]=[0,0]
       @ IT=0x02[6:4]=[101]=5, Gain=0x02[3:2]=[11]=3
       ALS_Lux = 564x[0.2/2^(5+3-4)]x1 = 564x(0.2÷16)x1 = 7.05 lux

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Example_2   @ALS_ADC_Data=0ABCh=2748, ALS_H/L=0x10[3,5]=[1,0], 0xA0[7:0]=0Ah=10

@IT=0x02[6:4]=[010]=2, Gain=0x02[3:2]=[01]=1

ALS_Lux = 2748x[0.2/2^(2+1-4)]x[(10x64+1)÷(10+1)/1] = 2748x(0.2/0.5)x58.27 = 64050 lux

Example_3   @ALS_ADC_Data=0789h=1929, ALS_H/L=0x10[3,5]=[0,1]

@IT=0x02[6:4]=[110]=6, Gain=0x02[3:2]=[00]=0

ALS_Lux = 1929x[0.2/2^(6+0-4)]x(1/42) = 1929x(0.2/4)x(1/42) = 2.29 lux

Solar UV index (SUVI) Calculation

Please refer "B4252xxxx Application Note of Solar UV index (SUVI) Calculation"

ALS Lux Calculation between Different Modes

For some applications like surveillance or Sun light measurement, High/Normal/Low Intensity Modes would be mixed use in between. We offer an application note to help users smoothly calculate the lux value when different modes are switched.

Please refer to the "Application Note of B4252PLVP ALS Lux Calculation between Different Modes"

Main Flow
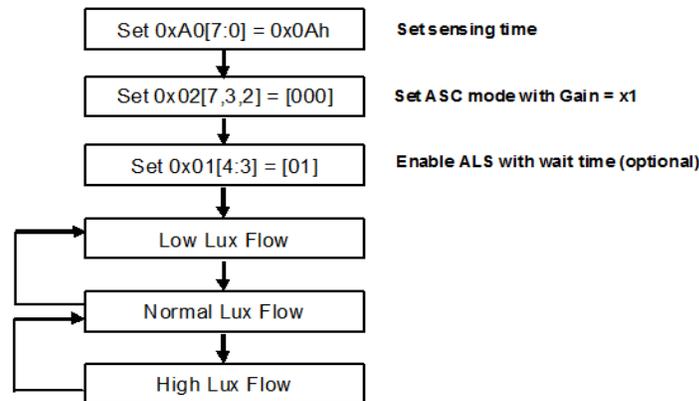
Notes:

1. Please skip the ASC ADC data of 65,535 (0xFFFF) to calculate the Lux value due to data overflow issue when different modes change in between.

2. When ASC_Gain=x4 or x8, ASC ADC data of (511, 1023, 2047, 4095, 8191, 16383, 32767, 65535) should be skipped to calculate the Lux value due to data overflow issue caused by noise in ASC mode operation.

3. ASC_Gain=x8 is not recommended to be used in ASC mode unless the measured light is too small to be detected.

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ALS Measurement Calibration

The overlay components in system, such as dark overlay windows, might have optical effect that affects accuracy of ALS measurement. System usually set a software calibration factor to correct back this effect. This device provides a hardware calibration method to get best accuracy in this case. When this hardware calibration process is done, the user would get a new value of 0xA2[7:0]. After the system write the new value of 0xA2[7:0] to device each time after power on, the ALS_ADC_Data would be automatically adjusted to the correct one

Please refer to the "Application Note of B4252PLVP ALS Measurement Calibration Flow"

PS Offset Cancellation

When PS measurement operates, optical crosstalk offset would be naturally generated due to reflective components in application system such as overlay glass in front. This offset needs to be cancelled to get suitable dynamic range in measurement; otherwise it would lead to mistake in PS threshold check.

This device offers user an easy way to precisely compensate the PS offset. Through this process, user can record and cancel the offset data for the following PS measurement.
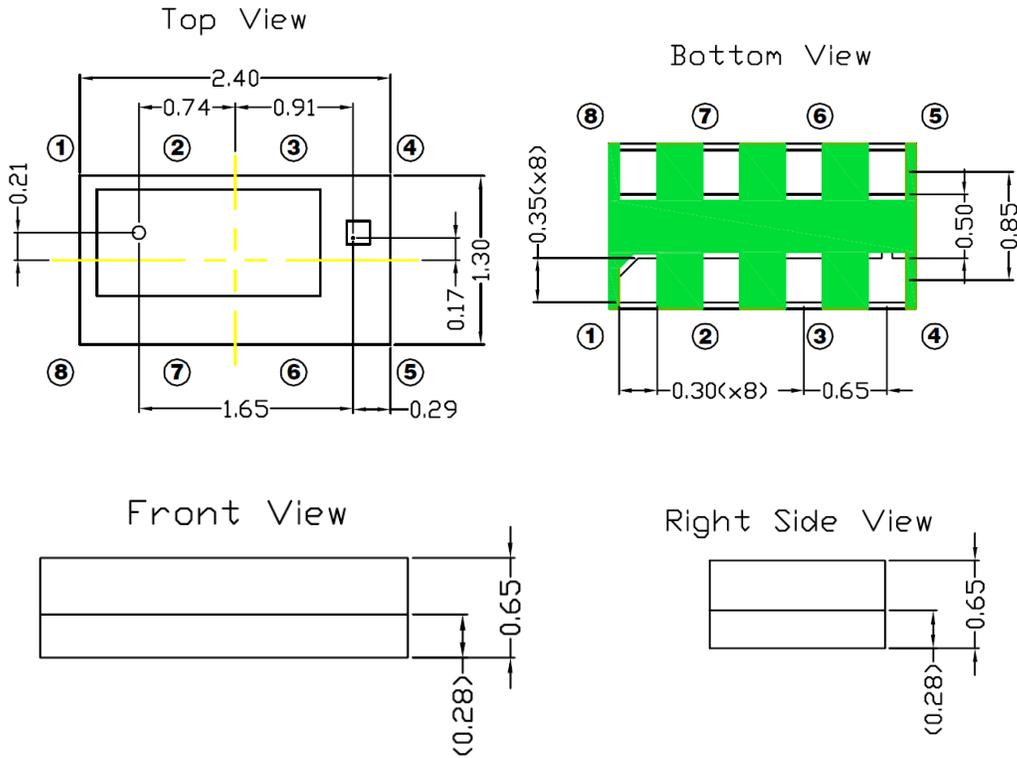
Please refer the "Application Note of B4252xxxx PS Offset Cancellation" to process this PS offset cancellation.
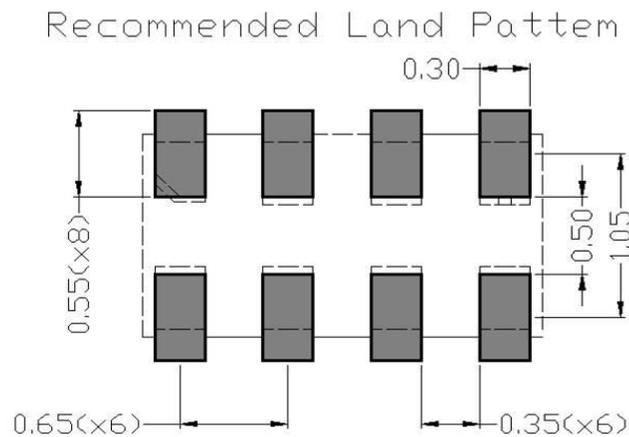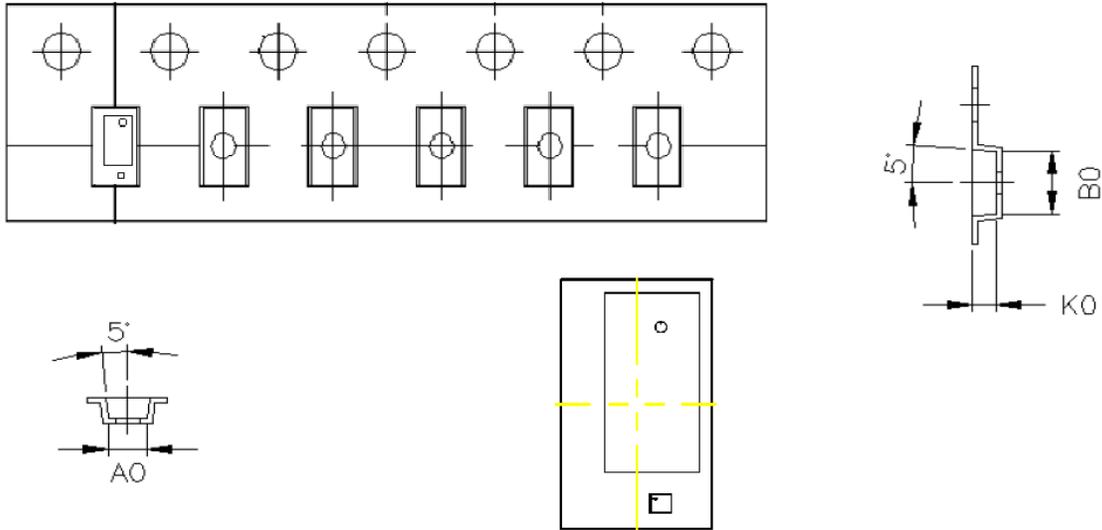
Application Circuit Reference

Package Outline Dimensions

Top View

Bottom View

Front View

Right Side View

Recommended Land Pattern

Recommended Land Pattern

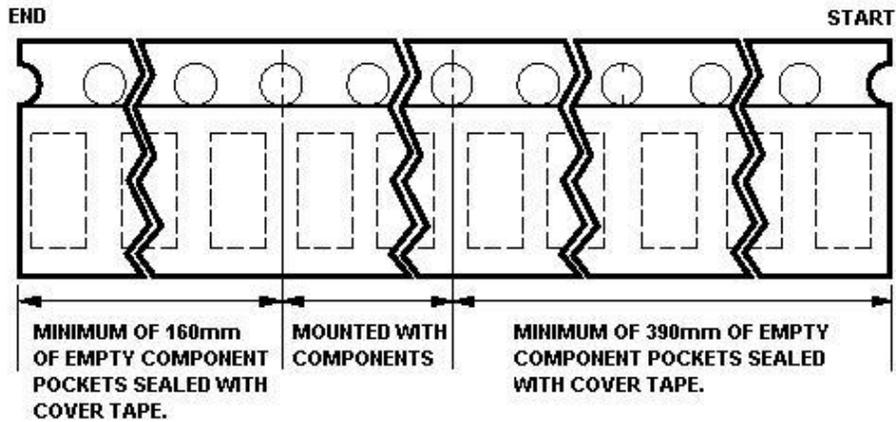| Official Product	HT Part No. B4252PLVP--G1B0001X3U1930	Customer Part No.		Data Sheet No.	
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Packaging

Tape Dimension

Dim. A	Dim. B	Dim. C	Q'ty/Reel
1.60±0.10	2.80±0.10	0.95±0.10	3K

Unit: mm

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Reel Dimension
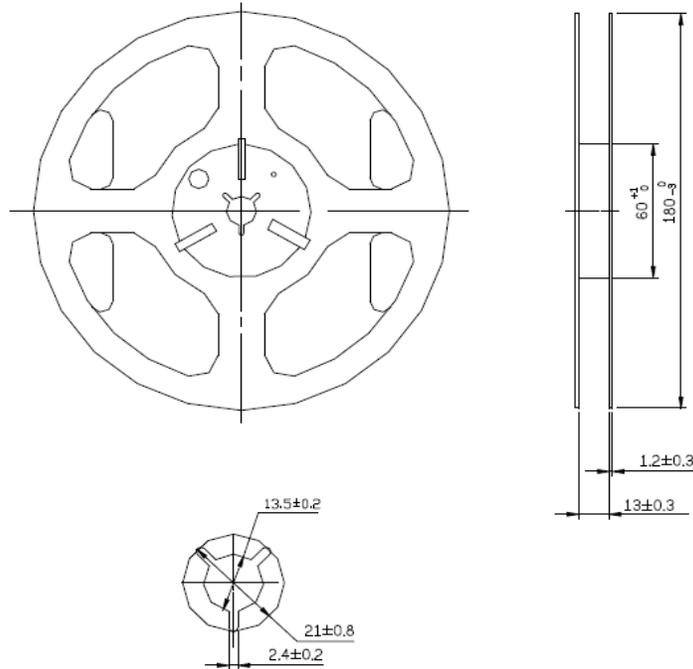
Packing
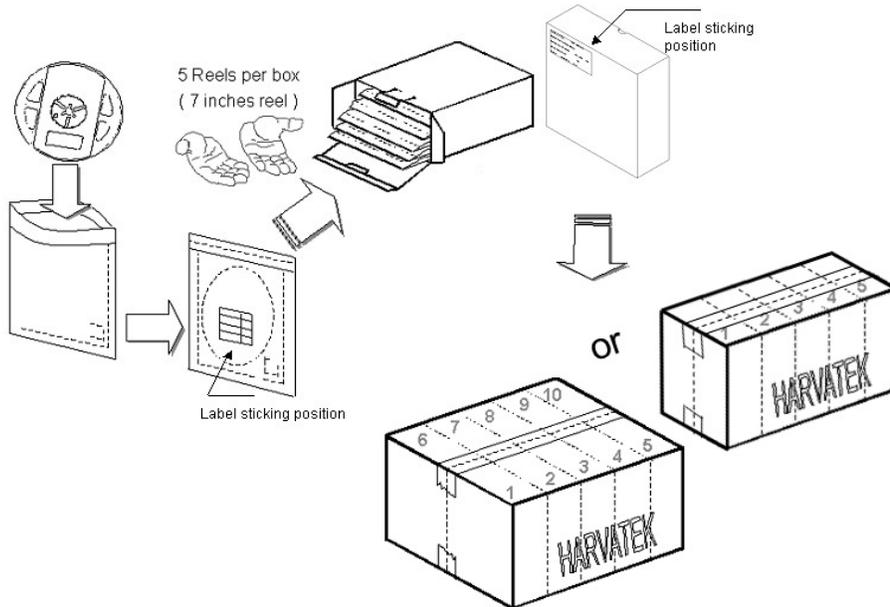
5 or 10 boxes per carton is available depending on shipment quantity.

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Dry Pack

All SMD optical devices are **MOISTURE SENSITIVE**. Avoid exposure to moisture at all times during transportation or storage. Every reel is packaged in a moisture protected anti-static bag. Each bag is properly sealed prior to shipment.

A humidity indicator will be included in the moisture protected anti-static bag prior to shipment.

The packaging sequence is as follows:
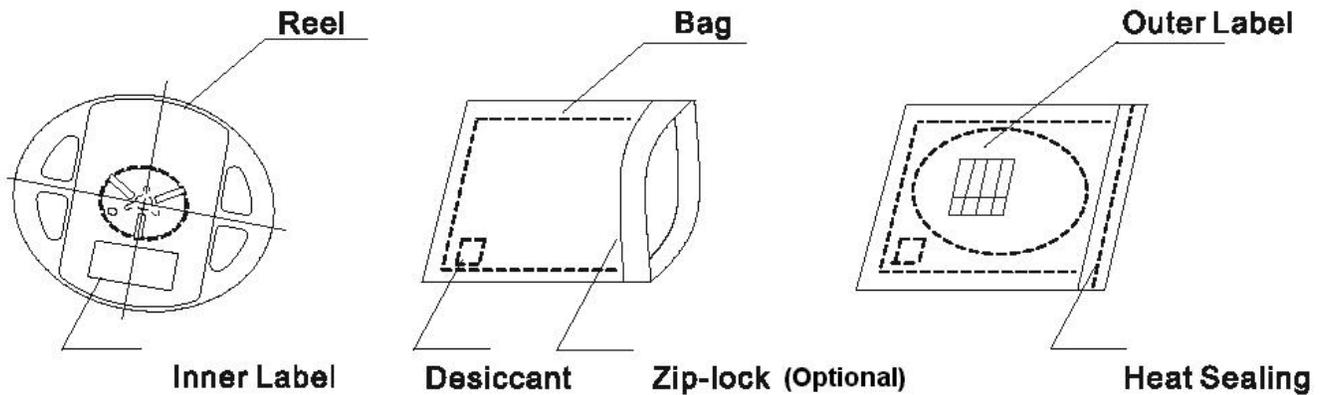
Baking

Baking before soldering is recommended when the package has been unsealed for 4 weeks. The conditions are as followings:
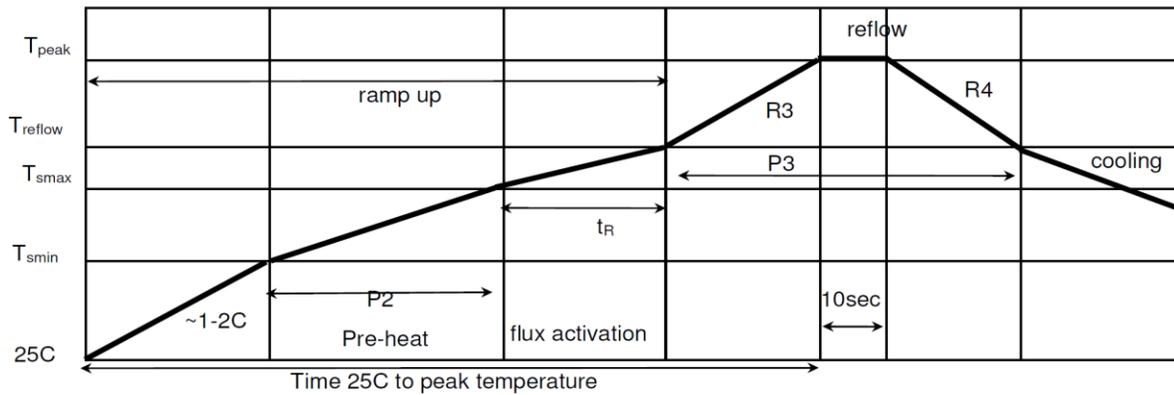
1. 60±3℃×(12~24hrs)and<5%RH, taped reel type.
2. 100±3℃×(45min~1hr), bulk type.
3. 130±3℃×(15min~30min), bulk type.

Precautions

1. Avoid exposure to moisture at all times during transportation or storage.
2. Anti-Static precaution must be taken when handling products.
3. It is suggested to connect the unit with a current limiting resistor of the proper size. Avoid applying a reverse.
4. Avoid operation beyond the limits as specified by the absolute maximum ratings.
5. Avoid direct contact with the surface through which the products emits light.
6. If possible, assemble the unit in a clean room or dust-free environment.

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Reflow Soldering

	Peak temperature (Tpeak)	255-260C (max) ; 10sec
Pre-Heat	Temperature min (Tsmin) Temperature max (Tsmax) P2: (Ts min to Ts max)	150C 2C/sec 150C-217C 100s to 180s 90-110s
Time maintain above	Temperature (Treflow) Time (P3) R3 slope (from 217C -> peak) R4 slope (from peak -> 217C)	217C 60-90sec 2C/sec [typ] -> 2.5C/sec (max) -1.5C/sec [typ]-> -4C/sec (max)
	Time to peak temperature	480s max
	Cooling down slope (peak to 217C)	2-4C/ sec

Reworking

Rework should be completed within 5 seconds under 260℃.

The iron tip must not come in contact with the copper foil.

Twin-head type is preferred.

Cleaning

Following are cleaning procedures after soldering:

An alcohol-based solvent such as isopropyl alcohol (IPA) is recommended.

Temperature x Time should be 50℃ x 30sec. or <30℃ x 3min

Ultra sonic cleaning: < 15W/ bath; bath volume ≤ 1liter

Curing: 100℃ max, <3min

Cautions of Pick and Place

Avoid stress on the resin at elevated temperature.

Avoid rubbing or scraping the resin by any object.

Electric-static may cause damage to the component. Please ensure that the equipment is properly grounded. Use of an ionizer fan is recommended.

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Revise History

Rev.	Descriptions	Date	Page
Preliminary 1.0	-	08/05/2019	-
1.1	**Add I2C Bus Timing Characteristics**	2020/8/18	14
1.2	**Update I/O Pins Configuration**	2020/8/28	5

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