1. Product Overview

• The OKLED-KS4DK-1 is an advanced educational LED electronics and logic circuit kit designed specifically for Key Stage 4 (KS4) students in the UK National Curriculum (ages 14-16, Years 10-11, targeting GCSE Science/Physics and Design & Technology). This solderless kit provides a comprehensive, hands-on introduction to complex electronic systems, logic gates, and transistor switching circuits using mini solderless breadboards and specialized components.

• The kit features onboard integrated circuit concepts and standard electronic troubleshooting platforms. It serves as an ideal foundation for KS4 curriculum requirements, covering essential higher-level physics and electronics topics such as logic functions (AND, OR, NOT), thermistor/LDR sensor inputs, transistor amplification/switching, and full-color RGB LED modulation.

•Designed for independent student investigation or small collaborative groups (1-2 students per kit), the OKLED-KS4DK-1 offers an immediate pathway from basic component observation to advanced electronic circuit design and troubleshooting. The kit bridges advanced theoretical electronics knowledge with practical engineering investigation, aligning perfectly with the UK GCSE National Curriculum requirements for electricity and electromagnetic systems.

2. Safety Compliance & KS4 Curriculum Suitability

Safety Compliance

• **100% solderless design:** Fully compliant with school safety regulations for general classroom science labs, allowing complex logic circuit configuration without the hazards of soldering irons or chemical fumes

• **Component-level integrated protection:** The kit includes multiple high-precision carbon film resistors to ensure current-limiting protection, preventing component burnout or overheating from incorrect student wiring.

• **Low voltage operation:** Powered by a 4.5V DC battery box, providing a completely safe handling environment well below standard dangerous voltage thresholds.

• **Controlled power management:** The heavy-duty battery box includes an integrated On/Off switch, allowing students to instantly kill power during circuit reconfigurations or troubleshooting.

• **RoHS compliant materials:** All components meet strict environmental and educational safety standards, ensuring no toxic materials are exposed during practical lessons.

• **Curriculum Suitability — Key Stage 4 (Ages 14-16)**

This kit directly aligns with the UK GCSE National Curriculum (Key Stage 4) Science (Physics) and Design & Technology specifications for "Electricity", "Mains Electricity and Circuits", and "Electronic Systems". It enables students to:

• **Construct and analyze complex series and parallel circuits:** Combining multiple active components, logic gates, and sensor inputs on a breadboard.

• **Understand and apply circuit symbols and diagrams:** Translating advanced schematic diagrams (including logic gates, transistors, and diodes) into physical breadboard layouts.

• **Investigate sensor circuits (LDR/Thermistor):** Exploring how environmental factors change resistance and control electronic switching.

• **Master Logic Functions:** Experimenting with logic IC chips to understand binary operations and logic control loops (AND, OR, NOT gates).

• **Explore Optoelectronics:** Analyzing the technical differences between standard LEDs, flashing LEDs, and full-color RGB LEDs, including forward voltage and color mixing principles.

3. Kit Contents

Packaging: 1 kit per box

Box Dimensions: 200 x 135 x 45 mm

4. Material & Technical Features

4.1 Optoelectronic Components (LED Series)

• **Standard 5mm Round LED (OSXXXX5A3XA):** High luminous intensity, standard directivity (30°), color diffused/white diffused epoxy encapsulation.

• **5mm Round Flashing LED (OSXXXS5A3XA):** Features a built-in integrated circuit to achieve a 1.8Hz flashing frequency with a 1/2 duty cycle. Operating voltage ranges from 3.0V to 5.0V.

• **5mm Color Changing RGB LED (OST1DA5B32A):** Combines Red, Green, and Blue chips inside a single package for full color-mixing experiments.

4.2 High-Precision Carbon Film Resistors

• **Power Rating:** 0.25W (1/4W)

• **Tolerance:** ±0.5% high-recission matrix

• **Max Working Voltage:** 250V / Max Overload Voltage: 500V

• **Color Coding:** 4-band color code system for fast engineering value identification.

4.3 Hardware Interface Platforms

• **Mini Solderless Breadboard** OEB5585D0-W**(OEB5585D0-W):** 400 tie-points, features self-adhesive backing and interlocking capabilities for multi-board circuit extensions.

• **Battery Power Supply Unit (OECB534V):** Houses 3x AA batteries to provide a stable 4.5V DC output; integrated with a slider switch and 150mm insulated lead wires.

• **Renewable Solar Panel Module (OSSFA6540BP-WH100):** Rated output at 5.5V DC, optimized for green technology and voltage conversion experiments.

5. KS Student Practical Operation (Lesson Workflow)

• **Lesson Duration:** 60 - 90 minutes (Optimized for double school periods)

• **Target Age:** 14 - 16 years (Key Stage 4, Years 10 - 11, GCSE level)

• **Group Size:** 1 - 2 students per kit

Part 1: Intermediate Electronics & Circuit Theory (15 minutes)

1. The teacher introduces GCSE electricity topics: Ohm's law (V=IR), diode forward voltage drops (V_F), and the functions of complex electronic components.
2. Students unbox the kit, classify components into optoelectronics, power, breadboard platforms, and resistors, and review schematic symbols.
3. Safety briefing: proper handling of active semiconductor components, power-off rules during breadboard wiring, and understanding polarity constraints.

Part 2: Advanced Breadboard Construction & Optoelectronic Analysis (20 minutes)

1. Students configure standard, flashing, and RGB LEDs on the breadboard using separate 220Ω, 330Ω, and 470Ωcurrent-limiting resistors.
2. Students use a voltmeter/multimeter (if available) to measure the voltage drop across different colored LEDs and verify resistor function.
3. Troubleshooting challenge: Students intentionally reverse an LED to observe the reverse voltage blocking characteristics of diodes and document the results.

Part 3: Logic Circuits & Sensor Integration (25 minutes)

1. The teacher explains logic system concepts (AND, OR, NOT operations) and how transistor switches function in automation.
2. Students build sensor logic simulation circuits combining the solar panel (as a light sensor input) or automated pathways on the breadboard.
3. Students create a color-mixing matrix using the 5mm Full Color RGB LED, manually wiring different resistor values to the Red, Green, and Blue anodes to observe color variations and cross-wavelength mixing.

Part 4: Analytical Investigation & Fair Testing (20 minutes)

1. Students test the electrical output of the 5.5V Solar Module under varying light intensities and angles, recording current/voltage patterns.
2. Students chart the relationship between resistor values (220Ω, 330Ω, 470Ω) and the resulting LED brightness and current draw.
3. Students complete their GCSE alignment worksheets, drawing accurate schematic diagrams using standard international symbols for logic nodes, diodes, and power blocks.

Part 5: Wrap-up & System Evaluation (10 minutes)

1. Students present their findings on color mixing and solar voltage data.
2. The teacher summarizes core principles: electrical characteristics of semiconductors, green tech integration, and real-world industrial logic controls.
3. Inventory check: Students systematically categorize the 65 connector wires and components back into their specialized storage grids.

6. Educational Learning Objectives (KS Match)

Key Stage 4 Science / GCSE Physics Curriculum Alignment

Working Scientifically (GCSE Skills)

- Use abstract electronic models and equations to predict circuit behavior.
- Design, configure, and safely execute comprehensive comparative electrical circuit tests.
- Utilize advanced instrumentation (multimeters, breadboard rails) to record precise electrical metrics.
- Translate physical breadboard systems into standardized formal engineering schematic diagrams.
- Analyze quantitative data from solar cells and component matrices to derive causal scientific relationships.

GCSE Electricity & Electronics Specifications

Curriculum Objective	Kit Activity Match
Draw and interpret circuit diagrams containing diodes, LEDs, LDRs, and transistors.	Translating advanced lab work cards into physical layouts using the breadboard and jumper wires.
Explain that an appliance changes energy from one form to another (Electrical to Light).	Analytical study of standard and flashing LEDs converting electrical energy into radiant energy.
Investigate how current varies with potential difference for non-ohmic components (diodes/LEDs).	Measuring forward voltage (V_F) characteristics across different color LED matrix lines.
Understand the application of sensing circuits in control systems.	Utilizing the solar panel module to trigger voltage changes based on environmental lighting.
Explore color addition and light wave blending.	Pin-out modulation of the 5mm Full Color RGB LED to synthesize secondary and tertiary colors.

Cross-curricular Links

- **Design & Technology:** Engineering electronic control subsystems, layout planning on breadboards, prototyping functional system modules.
- **Mathematics:** Applying algebraic conversions (V=IR), plotting non-ohmic characteristic curves, calculating duty cycles of flashing elements.
- **Computing:** Laying the foundational hardware logic (AND/OR blocks) required for hardware programming and micro processing units.
- **English:** Authoring detailed technical logs, compiling systematic engineering test briefs, and summarizing causal analytical conclusions.

Skills Developed

- **Advanced Engineering Dexterity:** Precise breadboard routing, handling high-density pinout multi-terminal chips, micro-wire manipulation.
- **System Troubleshooting:** Diagnosing open loops, identifying short circuits, and detecting component polarity mismatches logically.
- **Independent Inquiry:** Formulating test scripts, monitoring hardware parameters, and implementing adaptive modifications.
- **Quantitative Data Analysis:** Evaluating color spectrum yields, voltage behaviors, and multi-load current patterns.

7. Conclusion

The OKLED-KS4DK-1 serves as an advanced, curriculum-synchronized instructional platform specifically optimized for Key Stage 4 students. By utilizing a 100% solderless breadboard topology paired with current-limiting carbon film resistors, it provides a safe, highly repeatable laboratory environment that complies fully with UK secondary education safety guidelines.

This kit smoothly bridges the gap between abstract electronic formulas and concrete physical engineering. Moving beyond basic component identification, it introduces advanced concepts like logic functions, sensor integration, and optoelectronic behavior. This progressive design builds the analytical confidence and technical foundation students need to excel in higher-level GCSE physics assessments and practical coursework.

As a core element of the OptoSupply Easy-Plug Science series, the OKLED-KS4DK-1 provides a seamless upgrade path from KS2/KS3 foundations. It prepares students for advanced engineering systems and higher education electronics design, making it a comprehensive, highly effective teaching solution for modern STEM classrooms

OptoSupply
Light It Up

Product Name：
KS4 Advanced LED Electronic & Circuit Logic Kit

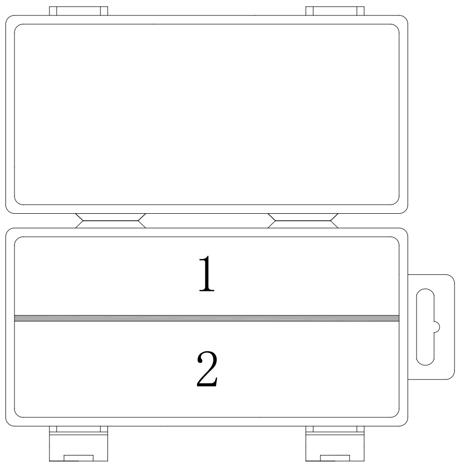
Model No.：OKLED-KS4DK-1

■Kit Part List

Section	Contents	Pcs	P/N	Spec
1	5mm LED, Red	5	OSR5JA5A34A	Page 8
	5mm LED, Yellow	5	OSY5JA5A34A	
	5mm LED, Blue	5	OSB5YU5A34A	
	5mm LED, Pure Green	5	OSG5TA5A34A	
	5mm LED, Cool White	5	OSW5YK5A32A	
	5mm Flashing LED, Red	2	OSR5JS5A34A	Page 9
	5mm Flashing LED, Blue	2	OSB5YS5A34A	
	5mm Flashing LED, Pure Green	2	OSG5TS5A34A	
	5mm Color Changing LED, RGB	2	OST1DA5B32A	Page 10
	5mm Full Color LED, RGB	2	OSTAMC5B32A	Page 11
2	Battery box No. 5, 3 batteries, 4.5V	1	OECB534V	Page 12
	5.5V Small solar module	1	OSSFA6540BP-WH100	Page 13
	Breadboards	1	OEB5585D0-W	Page 14
	Breadboards connector wires	30		
1	220Ω Carbon Film Resistor，0.25W±0.5%	20		Page 15
	330Ω Carbon Film Resistor，0.25W±0.5%	20		
	470Ω Carbon Film Resistor，0.25W±0.5%	20		
	10KΩ Carbon Film Resistor，0.25W±0.5%	15		
	100KΩ Carbon Film Resistor，0.25W±0.5%	10		
	10KΩ Adjustable Resistor	2		
	74HC08 IC	2		Page 16
	74HC32 IC	2		
	74HC04 IC	1		Page 17
	2N3904 Transistor	5		
	5537 Light-dependent resistor (LDR)	2		
	NTC 10K Thermistor	2		

■ Product Picture

169pcs/Box (Dimensions: 200*135*45mm)

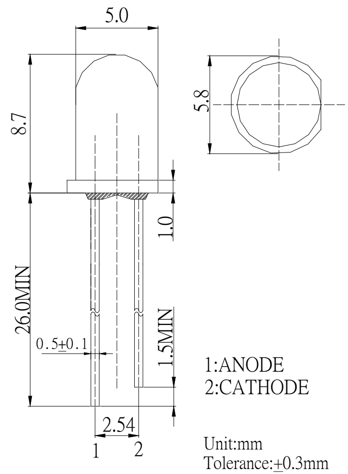


LED & Application Technologies

■Features

- High Luminous Intensity
- 5mm Round Standard Directivity
- Long Lifetime Operation
- UV Resistance
- Color Diffused / White Diffused (W, M only)

■Outline Dimension



1:ANODE
2:CATHODE

Unit:mm
Tolerance:±0.3mm

■Applications

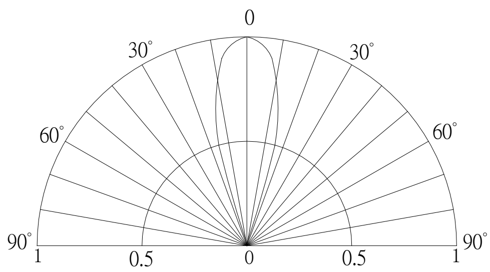
- General Purpose Indicators
- Decorations
- Toys & Games
- General Use

■Absolute Maximum Rating (Ta=25°C)

Item	Symbol	Value W/B/PG	Value R/Y	Unit
DC Forward Current	I_F	30	30	mA
Pulse Forward Current#	I_{FP}	100	100	mA
Reverse Voltage	V_R	5	5	V
Power Dissipation	P_D	102	78	mW
Operating Temperature	Topr	-30 ~ +85		℃
Storage Temperature	Tstg	-40~ +100		℃
Lead Soldering Temperature	Tsol	260℃/5sec		-

#Pulse width Max 0.1ms, Duty ratio max 1/10

■Directivity



■Electrical -Optical Characteristics (Ta=25°C)

Part Number	Color			V_F (V) Min.	V_F (V) Typ.	V_F (V) Max.	I_R(μA) Max.	Iv(mcd)* Min.	Iv(mcd)* Typ.	Iv(mcd)* Max.	λD(nm)* Min.	λD(nm)* Typ.	λD(nm)* Max.	2θ1/2(deg) Typ.
				I_F=20mA			V_R=5V	I_F=20mA						
OSW5YK5A32A	White	W		-	2.9	3.4	10	1120	1560	-	CCT:8500-18000K			30
OSB5YU5A34A	Blue	B	■	-	2.9	3.4	10	220	330	-	465	470	475	30
OSG5TA5A34A	Pure Green	PG	■	-	2.9	3.4	10	1120	1560	-	520	525	530	30
OSY5JA5A34A	Yellow	Y	■	-	2.1	2.6	10	220	330	-	585	590	595	30
OSR5JA5A34A	Red	R	■	-	2.1	2.6	10	220	330	-	620	625	630	30

*1 Tolerance of measurements of dominant wavelength is ±1nm *2 Tolerance of measurements of chromaticity coordinate is ±10%
*3 Tolerance of measurements of luminous intensity is ±15% *4 Tolerance of measurements of forward voltage is±0.1V

LED & Application Technologies

ISO 9001: 2008

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

■Features

- High Luminous Intensity
- 5mm Round Standard Directivity
- UV Resistant Epoxy
- Color Diffused / White Diffused (W, M only)

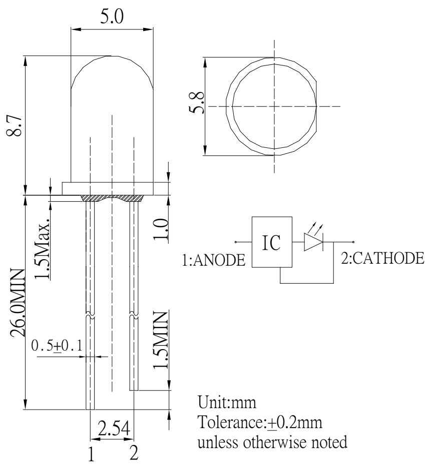
■Applications

- Toys
- Games
- Audio / Other Lighting

■Warning

- Do not install in reverse

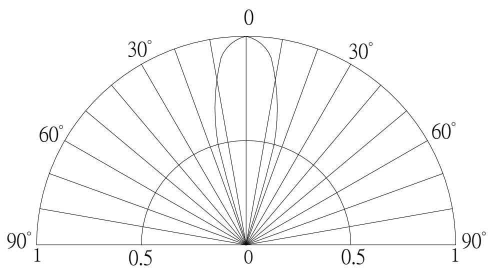
■Outline Dimension



■Absolute Maximum Rating (Ta=25°C)

Item	Symbol	Value	Unit
Power Supply	Voltage	5	V
Duty Cycle	Duty	1/2	-
Operating Temperature	Topr	-30 ~ +85	℃
Storage Temperature	Tstg	-40~ +100	℃
Lead Soldering Temperature	Tsol	260°C/5sec	-

■Directivity



■Electrical -Optical Characteristics (Ta=25°C)

Part Number	Color			V_F (V)			Iv(mcd)*			λD(nm)*			Fled (Hz)*	2θ1/2(deg)
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Typ
				I_F =20mA			I_F =20mA							
OSB5YS5A34A	Blue	B	■	3.0	3.5	5.0	220	330	-	465	470	475	1.8	30
OSG5TS5A34A	Pure Green	G	■	3.0	3.5	5.0	1120	1560	-	520	525	530		
OSR5JS5A34A	Red	R	■	3.0	3.5	5.0	220	330	-	620	625	630		

*1 Tolerance of measurements of chromaticity coordinates is ±10%
*2 Tolerance of measurements of dominant wavelength is ±1nm
*3 Tolerance of measurements of luminous intensity is ±15%
*4 Tolerance of measurements of forward voltage is ±0.1V
*5 Tolerance of measurements of Frequency is ±20%

5mm Round Color Changing Red & Blue & Green LED

OST1DA5B32A

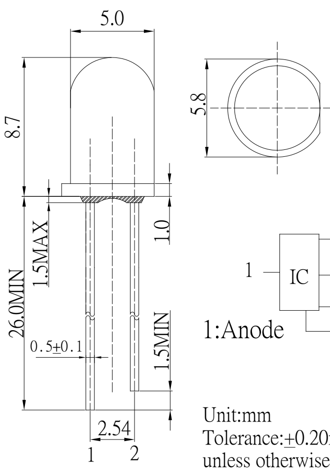
▪Features

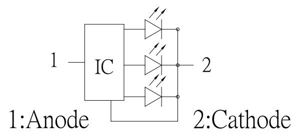
- High Luminous Intensity
- 5mm Round Standard Directivity
- Color Changing Type
- White Diffused Type

▪Applications

- General Purpose Indicators
- Decorations
- Toys & Games
- General Use

▪Outline Dimension



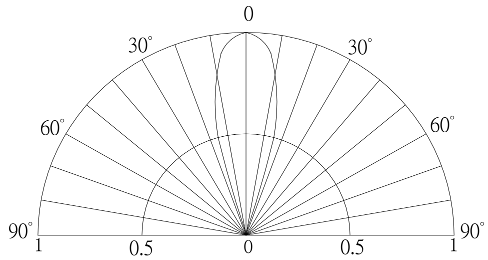


Unit:mm
Tolerance:±0.20mm
unless otherwise noted

▪Absolute Maximum Rating (Ta=25°C)

Item	Symbol	Value	Unit
IC Output Current	Iop	100	mA
Blinking Cycle	T	33	S
Power Supply	Voltage	5.0	V
Operating Temperature	Topr	-30 ~ +85	°C
Storage Temperature	Tstg	-40 ~ +100	°C
Lead Soldering Temperature	Tsol	260°C/5sec	°C

▪Directivity



▪Electrical -Optical Characteristics (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
DC Forward Voltage	Vdd	I_F=20mA	3.8	4.5	5	V
DC Reverse Current	I_R	V_R=5V	-	-	10	µA
Domi. Wavelength	λ_D (Red)	I_F=20mA	620	625	640	nm
	λ_D (Blue)	I_F=20mA	465	470	475	nm
	λ_D (Green)	I_F=20mA	520	525	530	nm
Luminous Intensity	Iv(Red)	I_F=20mA	220	330	500	mcd
	Iv(Blue)	I_F=20mA	330	500	750	mcd
	Iv(Green)	I_F=20mA	500	750	1120	mcd
50% Power Angle	$2\theta_{1/2}$	I_F=20mA	-	30	-	deg

*1 Tolerance of measurements of forward voltage is ±0.1V
*2Tolerance of measurements of Frequency is ±20%
*3 Tolerance of measurements of dominant wavelength is ±1nm
*4 Tolerance of measurements of luminous intensity is ±15%

LED & Application Technologies

ISO 9001: 2008

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

5mm Full Color RGB LED

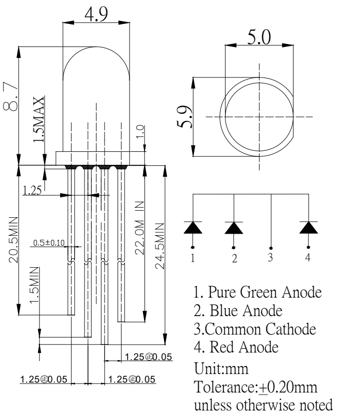
■Features

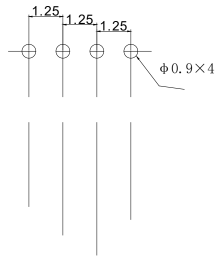
- High Luminous LEDs
- 5mm Round Standard Directivity
- White Diffused Type
- Common Cathode Type

■Applications

- General Purpose Indicators
- Decorations
- Toys & Games
- General Use

■Outline Dimension



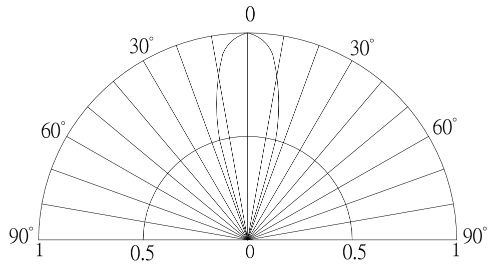


■Absolute Maximum Rating (Ta=25°C)

Item	Symbol	Value		Unit
		Red	Blue/Green	
DC Forward Current	I_F	30	30	mA
Pulse Forward Current#	I_{FP}	100	100	mA
Reverse Voltage	V_R	5	5	V
Power Dissipation	P_D	78	102	mW
Operating Temperature	Topr	-30 ~ +85		℃
Storage Temperature	Tstg	-40 ~ +100		℃
Lead Soldering Temperature	Tsol	260℃/5sec		-

#Pulse width Max.10ms Duty ratio max 1/10

■Directivity



■Electrical -Optical Characteristics (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
DC Forward Voltage*1	V_F (R)	I_F=20mA	-	2.1	2.6	V
	V_F (B/G)	I_F=20mA	-	2.9	3.4	V
DC Reverse Current	I_R	V_R=5V	-	-	10	μA
Domi. Wavelength*2	λ_D (Red)	I_F=20mA	620	625	630	nm
	λ_D (Blue)	I_F=20mA	465	470	475	nm
	λ_D (Green)	I_F=20mA	520	525	530	nm
Luminous Intensity*3	Iv (Red)	I_F=20mA	3000	4200	-	mcd
	Iv (Blue)	I_F=20mA	1560	2000	-	mcd
	Iv (Green)	I_F=20mA	5800	7000	-	mcd
50% Power Angle	$2\theta_{1/2}$	I_F=20mA	-	30	-	deg

*1 Tolerance of measurements of forward voltage is ±0.1V
*2 Tolerance of measurements of dominant wavelength is ±1nm
*3 Tolerance of measurements of luminous intensity is ±15%

LED & Application Technologies

ATTENTION
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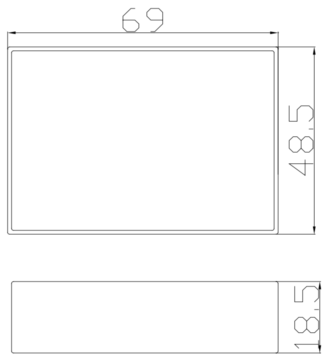
Battery Box

Color:	Black

■Product Information & Outline Dimension:

P/N	Item	Product Picture	Outline Dimension
OECB534V	Battery box No. 5, 3 batteries, 4.5V		 Unit: mm Tolerance: ±1mm

Small Solar Module Series

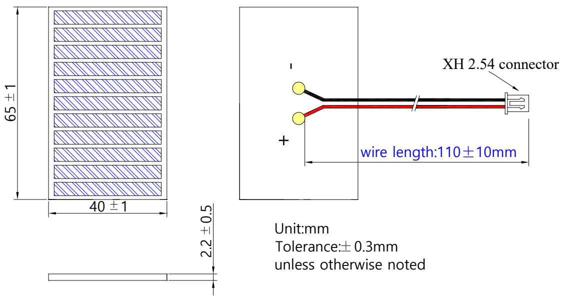
OSSFA6540BP-WH100

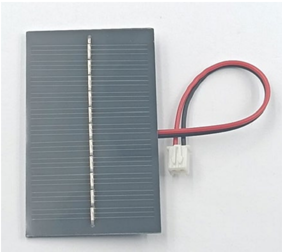
Features:

Copes easily with devices required drive voltage

Since multiple cells can be simultaneously connected in a series when the solar cells are formed, unlike the fabrication technique used with crystalline silicon solar cells in which multiple solar cells are severed and connected, it is easy to create cells with a variety of voltages.

Outline Dimension:





View of Electrical Properties of Amorton:

Voc : Open-circuit voltage

Isc : Short-circuit current

Vpm : Optimum power operating voltage

Ipm : Optimum power operating current

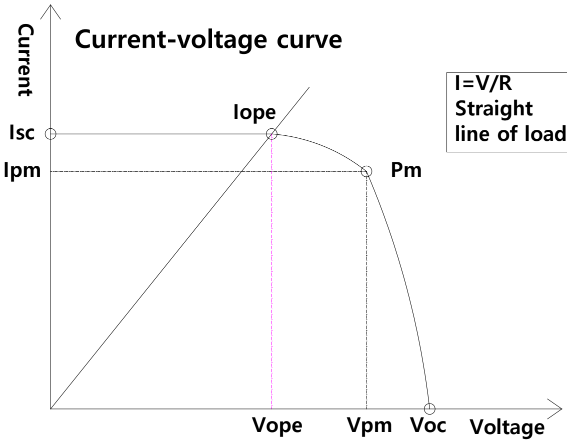
Pm : Maximum power =Vpm x Ipm

Vope : Operating voltage (specified voltage)

Iope : Operating current

※Current drastically changes under Vpm or higher.

For keeping the stable current under the anticipated illumination level, set the Vope as high as or lower than the Vpm



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Specification and Selection Table:

P/N	Dimension	Cells	Operating Current	Power	Short Circuit Current(Isc)	Operating Voltage	Open Circuit Voltage	Applications Cell
OSSFA6540BP-WH100	65*40*2.2mm	11	55mA	0.3W	58mA	5.5V	6.6V	3.7V

LED & Application Technologies

ISO 9001: 2008

ATTENTION
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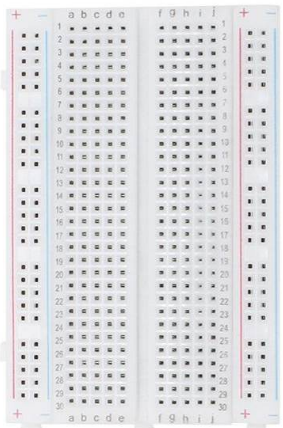
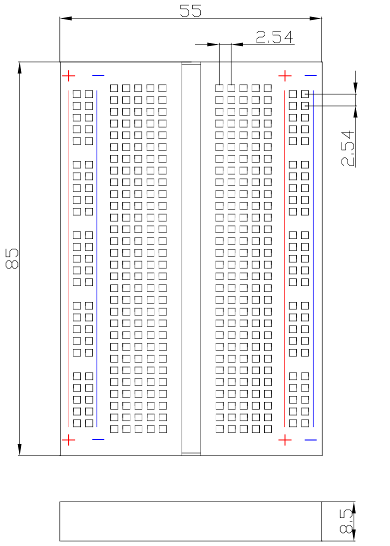
SENSITIVE DEVICES

Breadboards

Color:	White

■Product Information & Outline Dimension:

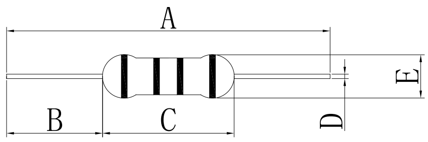
P/N	Item	Product Picture	Outline Dimension
OEB5585D0-W	Breadboards		 Unit: mm Tolerance: ±1mm

LED & Application Technologies

Carbon Film Resistor

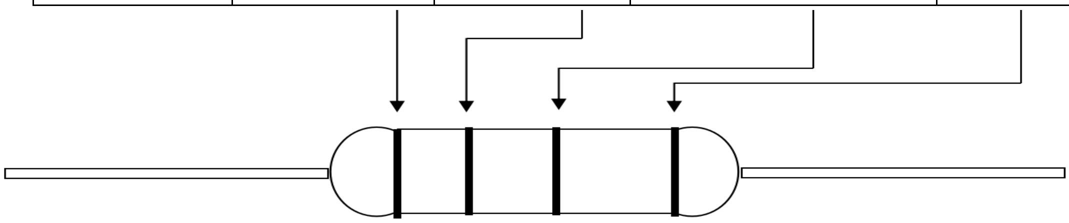
■ Specifications

Power Rating	Maximum Working Voltage	Maximum Overload Voltage	Dimension (mm)					Resistance Range
			A	B	C	D	E	
1/4W	250V	500V	45±3	19.5±3	6.0±1	0.35±0.1	2.3±0.3	0.1E-22M



■Color Coding

Color	1st digit	2nd digit	Multiplier	Tolerance
Black	0	0	1Ω	
Silver			0.01Ω	±10%
Golden			0.1Ω	±5%
Brown	1	1	10Ω	±1%
Red	2	2	100Ω	±2%
Orange	3	3	1KΩ	
Yellow	4	4	10KΩ	
Green	5	5	100KΩ	±0.5%
Blue	6	6	1MΩ	±0.25%
Violet	7	7	10MΩ	±0.1%
Gray	8	8		
White	9	9		



OptoSupply
Light It Up

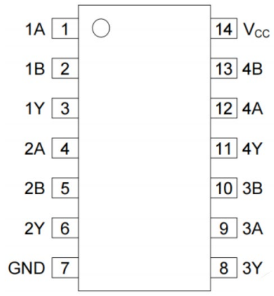
Driver IC

■ Pin Functions

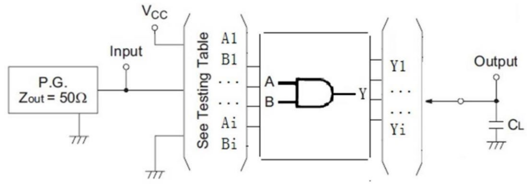
74HC08

Pin NO	Pin Definition	Description
1	1A	input
2	1B	input
3	1Y	output
4	2A	input
5	2B	input
6	2Y	output
7	GND	ground
8	3Y	output
9	3A	input
10	3B	input
11	4Y	output
12	4A	input
13	4B	input
14	Vcc	supply voltage

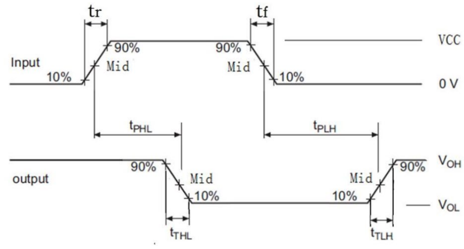
Outline



Testing Circuit



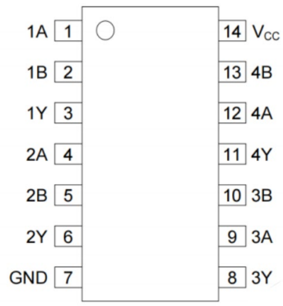
Testing wave forms



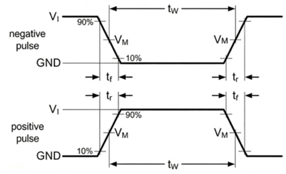
74HC32

Pin NO	Pin Definition	Description
1	1A	input
2	1B	input
3	1Y	output
4	2A	input
5	2B	input
6	2Y	output
7	GND	ground
8	3Y	output
9	3A	input
10	3B	input
11	4Y	output
12	4A	input
13	4B	input
14	Vcc	supply voltage

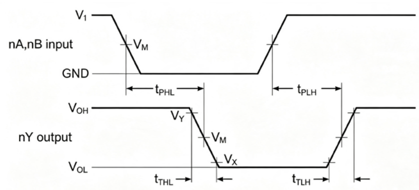
Outline



Testing Circuit



Testing wave forms



LED & Application Technologies

ISO 9001: 2008

RoHS Compliant

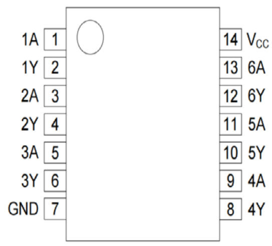
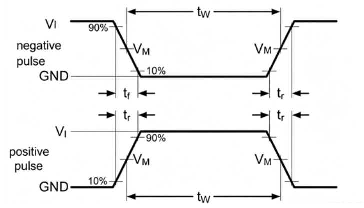
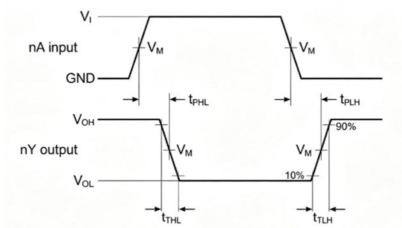
REACH The new EU chemicals legislation

ATTENTION
OBSERVE PRECAUTIONS ELECTROSTATIC SENSITIVE DEVICES

Driver IC

■ Pin Functions

74HC04

Pin NO	Pin Definition	Description	Outline	Testing Circuit
1	1A	input		
2	1Y	output		
3	2A	output		
4	2Y	input		
5	3A	input		
6	3Y	output		
7	GND	ground		**Testing wave forms**
8	4Y	output		
9	4A	input		
10	5Y	output		
11	5A	input		
12	6Y	output		
13	6A	input		
14	Vcc	supply voltage		

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