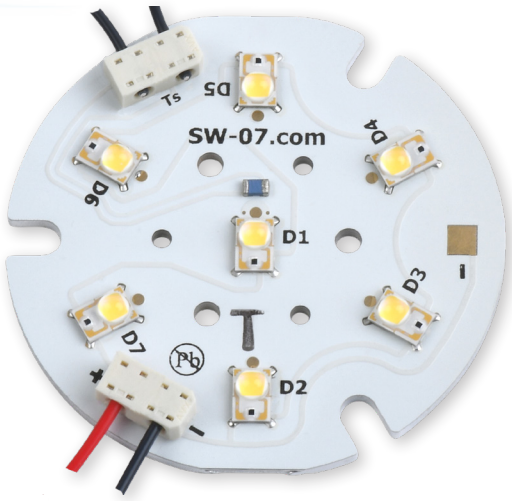
SABER²

SW-07

Series Connected 7-Up Round Rebel LED Module

The SABER² SW-07 series of high power LED modules features seven series connected[1] Rebel LEDs soldered to a 40 mm round x 1.6 mm thick, high-performance, COFAN Super Pillar aluminum board for optimal heat dissipation. This patented technology significantly lowers the LED junction temperature, enhancing LED longevity, brightness, and reliability.

Wire connections to the module can be made using optional AVX 9176-800 series solderless IDC connectors, or soldered using standard bench top soldering tools. The IDC connectors are 100% compatible with the Polymer 7 Cell Cluster and Khatod PL121 series of secondary optics.



Module shown with optional connectors

SPECIFICATIONS

Base Type	1.6 mm COFAN USA Pillar Aluminum
Thermal Performance[2] $R\theta_{C-B}$	0.39 °C/W
Pad Finish	Immersion Gold, ENIG
Solder Mask Color	White
Solder Paste	AIM NC258-M8 Lead-Free, No-Clean
Max Operating Temperature[3]	120°C
Overall Dimensions (mm)	40d x 3.98h (max height without IDC connectors)
Optional Connectors	AVX 9176-800 Low Profile IDC (22, 24 or 26AWG)
Weight	1.5g

FEATURES

- COFAN USA Pillar direct thermal path technology
- Optional, one-step IDC connections that are compatible with most secondary optics and do not require special installation tools
- Available with your choice of any Rebel LED currently produced by Lumileds.
- Available with binned LEDs[4]
- RoHS/REACH compliant
- PB free
- No minimum order requirements

BENEFITS

- High-performance Pillar technology minimizes cooling requirements, increases lumens output and extends LED life
- AVX IDC connectors make the creation of robust wire-to-board connections a simple one-step process
- Production quantity binning provides consistent color and brightness
- Cost-effective design delivers a low-cost option in both small and large quantities
- No minimum order requirement means fast, low-cost prototyping

APPLICATIONS

- Specialty lighting
- Microscope illumination
- Inspection lighting
- Flashlights
- Task Lamps
- Spot lighting
- Recreational lighting (dive lights, bicycle lights, light sabers, etc.)
- Fiber optic illuminators

1. Addressable & color mixing versions of this LED module are available. See page 9 for more details.
2. See the thermal model on page 8.
3. For maximum life, the board temperature must be kept below this value.
4. Minimum order quantities apply.

WIRE CONNECTIONS

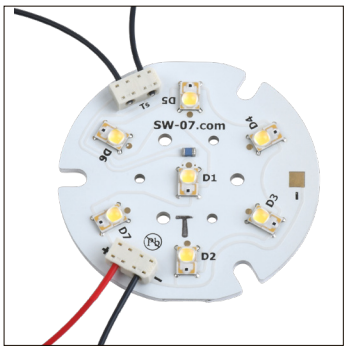


Image 1

Connecting wires can be hand-soldered directly to the module or pressed into place using two optional, low-profile AVX 9176-800 IDC wire-to-board connectors.

These industrial-grade connectors include an integrated cap that precisely holds and guides the wire while it is pressed into the contact, creating a gas-tight, cold-welded connection. The connectors are designed for single use. Wires cannot be removed after they are pressed into place.

Connectors for 22, 24, or 26 AWG solid or stranded wire can be specified when the module is ordered. The connector can accommodate a maximum wire insulation diameter of 1.40 mm.


Image 2

When the wire is pressed into place, the overall height of the connector is 2.55 mm, which minimizes interference with the light output of the LED and allows it to be used with many secondary optic holders.

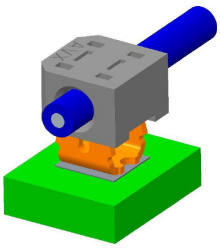


Image 2

To use IDC connectors, insert the wire into the cap so that the wire extends beyond the face of the connector to help position the punch-down tool. (Image 3) Wires do not need to be stripped.

Ensure that the LED module is firmly supported on a solid, flat surface. Using the supplied press-down tool[1] (image 2) with a multi-bit driver, press the cap down until it reaches the stop. When pressed into place, the gap between the bottom of the cap and the PCB should not be greater than 0.05 mm. (Image 4)

The insertion force will be approximately 80N (18 lbf) depending on the wire gauge, conductor strands, and insulation material.

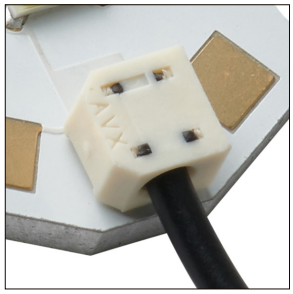


Image 3

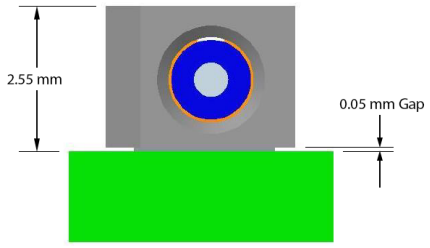


Image 4

Always ensure that the bottom of the LED module is firmly supported on a flat surface while pressing the wire into place.

1. While any flat-surfaced tool can be used to press the wire cap into place, the press down tool that we supply ensures that the tool does not accidentally slip off the top of the cap, potentially damaging the LED.

WIRE CONNECTIONS

The same pads are used for hand soldered connections or the optional AVX IDC connectors.

PAD No	Connection
1	LEDs - Cathode
2	LEDs - Cathode
3	LEDs - Anode
4	Ts
5	Ts

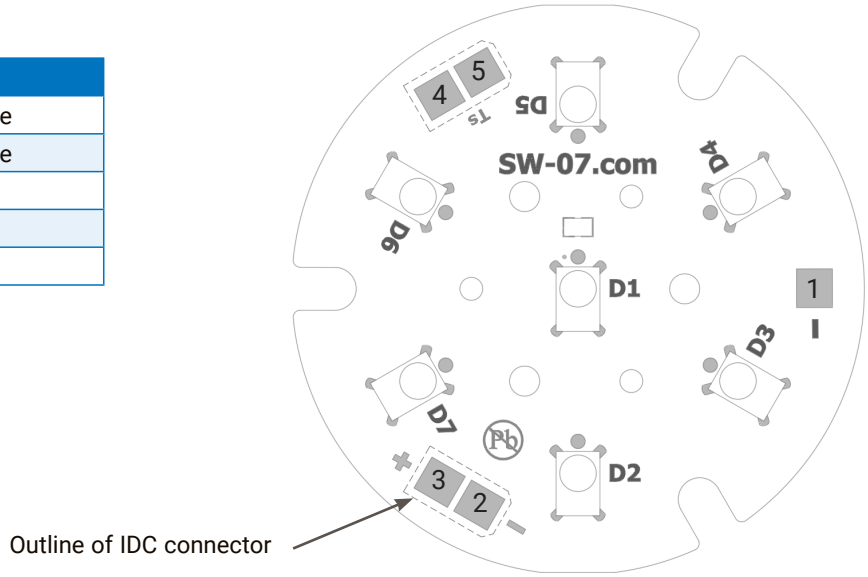


Image 6

SECONDARY OPTICS

The SABER² SW-07 has been designed to accommodate the following optics.

Manufacturer	Part / Part Series	Part Type	IDC Compatible
Polymer	263	7 LED Cell Cluster Concentrator Optic	Yes
Polymer	264	7 LED Cell 12° Circular Beam Diffused Optic	Yes
Polymer	261	7 LED Cell 12° Circular Beam Optic	Yes
Polymer	262	7 LED Cell 50° Circular Beam Diffused Optic	Yes
Khatod	PL1214	50mm 7 Cell Optic Arrays	Yes
Khatod	PL 1211	39mm 7 Cell Optic Arrays	Yes

More information about all of these optics is available on our website at luxeonstar.com/optics.

SW-07 Module With Wire Connections & Mounted Polymer Optic

MOUNTING & COOLING

The SW-07 LED module requires careful attention to mounting and cooling to ensure that the LED junction temperature is kept well below the maximum rating as specified in the LED documentation published by Lumileds.

For optimal cooling, the LED module needs to be mounted to a suitable finned heat sink (aluminum or copper) that is exposed to open air. The LED module can be fastened to the heat sink in one of two ways:

- Pressure sensitive, thermally conductive tape
- Thermally conductive adhesive

Always ensure that the module is being adequately cooled by testing the LED junction temperature using the method described in Measuring LED Junction Temperature section on page 6 of this document.

BASE CONDUCTIVITY

The bottom of the LED module is electrically neutral, so it is not necessary to electrically isolate the base from the cooling surface.

Bottom View

MOUNTING USING PRESSURE SENSITIVE THERMAL TAPE

Pressure-sensitive thermal tape such as Bond-Ply© 100 makes it easy to fasten the base directly to a heat sink without the need for screws, clip mounts, or fasteners. However, to ensure a sound thermal bond, it is essential that the tape is used correctly. This includes:

- Ensuring that all mating surfaces are clean, totally flat, and free of voids
- Sizing and positioning the tape so that all mating surfaces are covered
- Applying a minimum of 10 PSI of even pressure between the LED and heat sink for at least 30 seconds

Applying even pressure to bond the LED module to the heat sink can be difficult due to the small size of the module and the need to avoid touching or applying any pressure to the LED optic. To overcome this problem, we include an assembly press tool (image 8) with our pre-cut thermal tape. This press has been designed to apply even, constant pressure to the module and heat sink without touching the LED itself. A video that demonstrates how to apply pressure-sensitive thermal tape and use a thermal press is available at luxeonstar.com/using-thermal-tape.

Image 8

If pressure sensitive thermal tape is applied correctly, there is no need to use additional mechanical fasteners.

MOUNTING USING THERMALLY CONDUCTIVE ADHESIVE

Thermally conductive adhesive such as Arctic Silver™ requires more effort to use than thermal tape but offers a permanent bond, wider operating temperature range, and higher reliability, especially in environments where the module will be subjected to mechanical shock and vibration.

To create a thermally efficient and reliable bond:

- Ensure that all mating surfaces are clean and free of any grease or oil
- Use just enough epoxy to create as thin a bond line as possible
- Apply as much pressure as possible between the LED and heat sink for at least 30 seconds, and then maintain pressure using a clamp or weight until the epoxy has set

Like our thermal tape, we include a thermal press with every order of Arctic Silver Thermal Adhesive to make it easier to create a sound bond. A video that demonstrates how to properly use the Arctic Silver Thermal Adhesive and a thermal press is available at luxeonstar.com/using-arctic-silver.

MECHANICAL FASTENERS WITH THERMAL PASTE

Mechanical fasteners and thermal paste are generally not recommended for SABER² LED modules. However, if your application requires that the LED module is mechanically fastened to the heatsink, then ensure that the fasteners are insulated from any nearby connecting pads and that they are carefully tightened to avoid twisting or bending the aluminum base. Even a slight distortion of the base can cause solder joint cracking, which will lead to reduced thermal efficiency and electrical problems.

POWER DRIVERS

The FlexBlock Wide Range DC Driver is ideally suited for powering all seven series connected LEDs modules with voltages as low as 10VDC.

The BuckPuck/PowerPuck series of drivers also offer a variety of options for powering the SW-07.

The choice of power driver will depend on the Rebel LED that is mounted to the base, the desired lumens output, the number of LEDs being powered, the input voltage source, and the drive current. For help with selecting and using LED power drivers, visit our online support center at luxeonstar.com/powering-leds.

MEASURING THE LED JUNCTION TEMPERATURE

The following steps describes how to determine the junction temperature of the LED to ensure it is adequately cooled.

REQUIRED TOOLS

- Digital Multimeter
- Temperature measurement meter
- Thermocouple or thermistor with Kapton tape and/or thermal adhesive epoxy

TEST PROCEDURE

1. Enter the LED Typical Thermal Resistance Junction to Thermal Pad (°C/W) $R\theta_{J\text{-}C}$ value from the Rebel LED datasheet into box **B** of the formula on page 7 of this document.
2. Ideally, the temperature should be tested with the LED module mounted in the location where it will be operated.

   If the module's location is difficult to reach, then a thermocouple or thermistor will need to be attached to the module using Kapton tape or Arctic Silver™ thermal adhesive epoxy so that the tip of the sensor is in direct contact with the temperature measurement point as shown in images 9 & 10. Be sure to allow the adhesive to cure before testing.

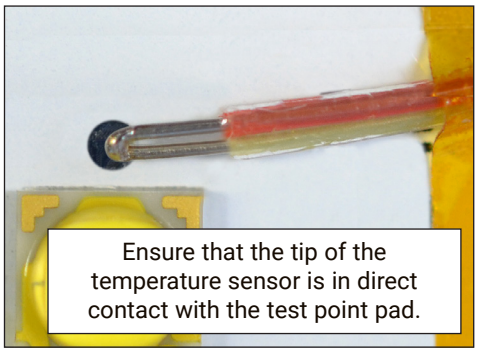


Image 9

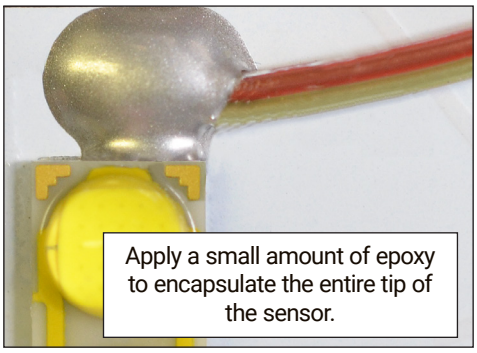


Image 10

3. After the temperature measurement has stabilized, note the test point temperature and enter it in box **A** on page 7.
4. Measure the forward voltage of the LED while at the stabilized temperature (Image 11) and note it in box **C**.
5. Enter the current, that the LED will be powered at in box **D**.
6. Evaluate the completed formula to determine the junction temperature of the LED.
7. If the same LED is mounted in each position on the module, and if you are powering all three LEDs in series with the module mounted in the center of a symmetrically shaped heat sink in open air, then it is only necessary to test a single LED to determine the junction temperature of all the LEDs. For all other operating configurations, you need to separately test each LED to ensure that the junction temperature is below its safe operating point.

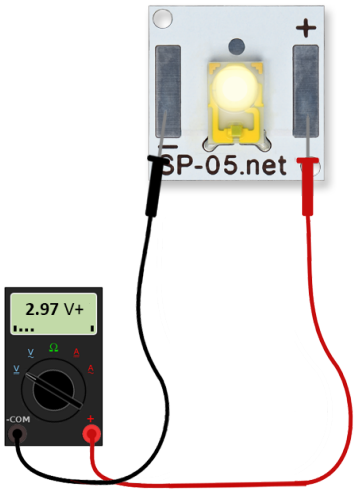


Image 11

$$\boxed{A} + (0.5 + \boxed{B}) \times (\boxed{C} \times \boxed{D}) = \boxed{}^{*}$$

A	0.5 + B	C	D	
Test Point T_C Temperature °C	$R\theta_{C\text{-}S}$	$R\theta_{J\text{-}C}$	LED Forward Voltage V_f	LED Forward Current I_f	LED Junction Temperature °C

More information about this junction measurement technique can be found in the LUXEON LED Thermal Measurement Application Brief (AB33) published by Lumileds.

Failure to ensure that the LED junction temperature is kept below its maximum temperature rating will result in poor color rendering, early degradation of light output, and premature LED failure.

* For maximum LED life, color stability, and reliability, the calculated junction temperature must always be below the maximum LED junction temperature published in the Lumileds datasheet for Rebel LEDs.

THERMAL MODEL

Image 12 is a cross-section of a typical SABER² LED module that illustrates how each LED is attached to the base and shows the thermal paths between the LED junction, temperature test point and bottom of the LED module.

- $R\theta_{J-C}$ is the thermal resistance from the LED junction (T_j) to the LED thermal pad
- $R\theta_{C-S}$ is the thermal resistance from the LED thermal pad to the temperature test point (T_C)
- $R\theta_{C-B}$ is the thermal resistance from the LED thermal pad to the bottom of the module

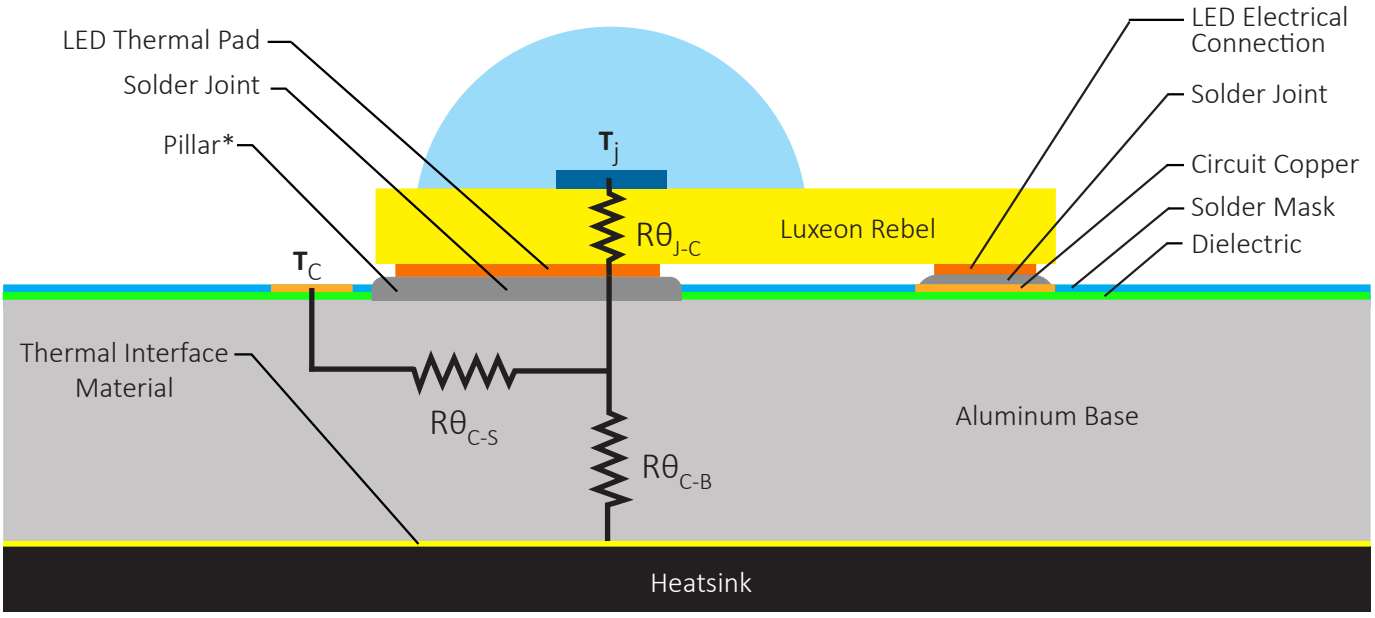


Image 12

* PILLAR

Pillar technology eliminates the dielectric layer and provides a solderable surface on the aluminum base, removing a significant barrier of thermal resistance between the LED and heatsink.

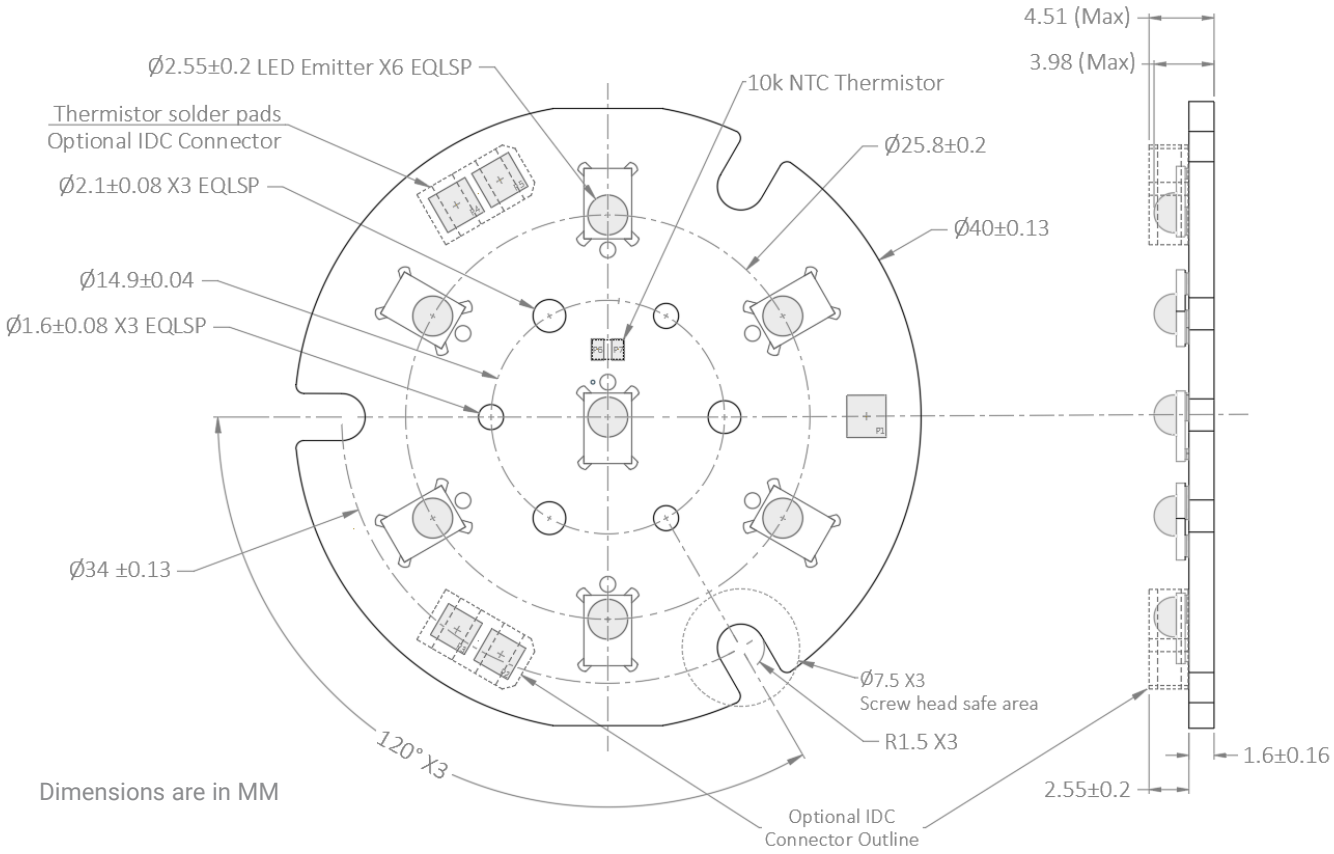
ONBOARD THERMISTOR TEMPERATURE MEASUREMENT

Every SW-07 module includes a single Vishay NTC 10K Thermistor (NTHS0805N02N1002J) mounted near the center of the board. This thermistor is intended for continuous monitoring of the module during operation and can be used as part of a foldback temperature control circuit to ensure that the module does not overheat.

The thermistor does not replace the need to ensure that each LED is being adequately cooled by using the previously described test procedure. It is only intended to be used for in situ monitoring of the entire LED module.

For details on how to measure the LED junction temperature using the thermistor, please refer to the Determining LED Junction Temperature Using the Onboard Thermistor document.

MECHANICAL DIMENSIONS



2D Drawing Download: luxeonstar.com/sw-07-drawing.pdf
3D Model Download: luxeonstar.com/sw-07.step

ALTERNATE VERSIONS

Addressable

A version of this tri-star LED module is available where the LEDs are separately addressable with parallel connections to each LED. For more details go to luxeonstar.com/sw-02.

Color Mixer

An addressable version of this module can be ordered with different color LEDs mounted in each position. For more details, and to order go to luxeonstar.com/sw-02-mixer.

ORDERING INFORMATION

The SW-07 LED module can be ordered directly from luxeonstar.com/sw-07. There is no minimum order requirement, and shipping is available to anywhere in the World. Optional IDC connectors are specified when the module is ordered.

SW – 07 – W3

Base Type

Code	Type
SW	SABER²
SZ	Luxeon Z
SM	Micro-Z1
SP	SinkPad

Configuration

Code	Type
01	Rebel Star LED Module
02	Addressable 7-Up Round Rebel LED Module
03	Addressable Tri-Star Rebel LED Module
04	Side-Emitting Rebel LED Module
05	10 mm Square Rebel LED Module
07	Series Connected 7-Up Round Rebel LED Module
08	Addressable Quad Round Rebel LED Module
09	Series Connected Quad Round Rebel LED Module
12	Star/O Rebel LED Module
13	Series Connected Tri-Star Rebel LED Module
15	10 mm x 15 mm Rebel LED Module

Color	Color Temperature (K) or Wavelength (nm)	Rebel LED Part Number	Production Code[2]
Cool White	6500K	LXML-PWC1-0100	W3
Cool White	6500K	LXML-PWC1-0120	W4
Cool White	5650K	LXML-PWC2	W5
ANSI White	5000K	LX18-P150-3	T9
Neutral White	4100K	LXML-PWN1-0100	N2
Neutral White	4100K	LXML-PWN1-0120	N3
Neutral White	4100K	LXML-PWN2	N4
ANSI White	4000K	LX18-P140-3	T7
ANSI White	3500K	LX18-P135-3	T5
ANSI White	3000K	LX18-P130-3	T3
ANSI White	2700K	LX18-P127-3	T1
Far Red	720nm	LXML-PF01	D4
Deep Red	655nm	LXM3-PD01	D2
Red	627nm	LXM2-PD01-0040	R4
Red	627nm	LXM2-PD01-0050	R5
Red	627nm	LXM2-PD01-0060	D8
Red	627nm	LXM5-PD01	D9
Red	627nm	LXML-PD01-0040	R2
Red-Orange	617nm	LXM2-PH01-0060	E3
Red-Orange	617nm	LXM2-PH01-0070	E4
Red-Orange	617nm	LXM5-PH01	E6
Red-Orange	617nm	LXML-PH01-0050	E2
PC Amber	591nm	LXM2-PL01-0000	A5
Amber	590nm	LXM5-PL01	A8
Amber	590nm	LXML-PL01-0040	A2
Lime	567nm	LXML-PX02-0000	L1
Green	530nm	LXML-PM01-0090	G3
Green	530nm	LXML-PM01-0100	G4
Cyan	505nm	LXML-PE01-0070	C2
Blue	470nm	LXML-PB01-0030	B3
Blue	470nm	LXML-PB01-0040	B4
Royal-Blue	448nm	LXML-PR01-0500	V2
Royal-Blue	448nm	LXML-PR02-A900	V4

2. Do not confuse our production code with the LED bin code. They are not related.

SW-07

Series Connected 7-Up Round Rebel LED Module

COMPLIANCE:

Current compliance documents (e.g., RoHS, REACH, CMRT, etc.) are available for download from each product page on the luxeonstar.com website.

SAFETY:

The LED mounted onto this module will produce a highly intense point of light. Do not stare directly at the LED for any length of time.

RESTRICTED USE:

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