

**PHILIPS**

Fortimo

LED System



**Design-in Guide**

# Philips Fortimo HighBay Module

design in guide

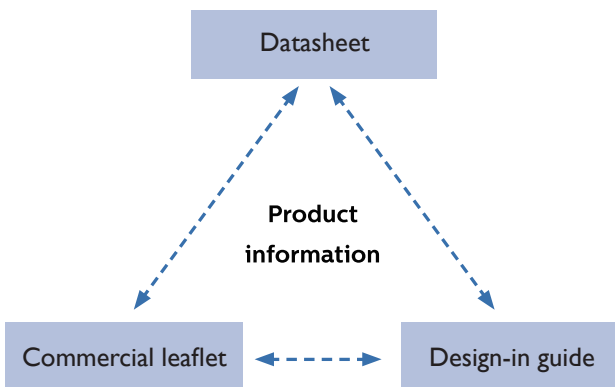
April 2017

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# Introduction to this guide



Thank you for choosing the Philips product. In this guide you will find the information required to design this module into a luminaire.

## Information and support

If you require any further information or support, please consult your local Philips office or visit our website:

<http://www.lighting.philips.com.sg/oem-sg>

## Determine which documents contain what information

In order to provide information in the best possible way, Philips' philosophy on product documentation is the following.

**Commercial leaflet** contains product family information & system combinations (compatible Philips driver information)

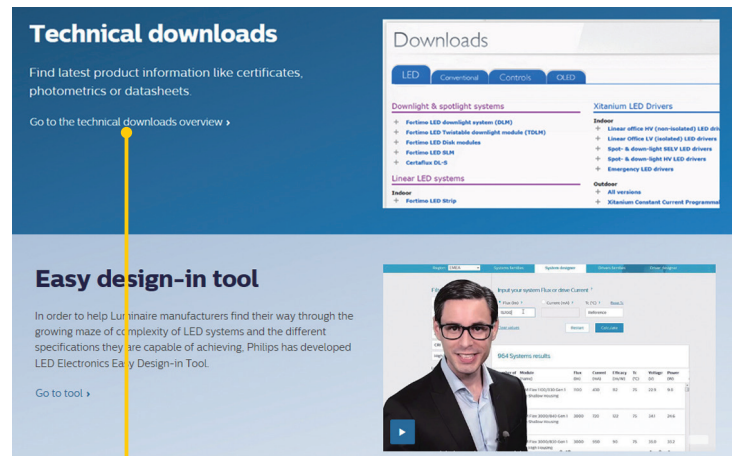
**Datasheet** contains the module (module and multi-connector) specification

**Design-In Guide** describes how to design-in the products

All these documents can be found on the download page of the OEM website

<http://www.lighting.philips.com.sg/oem-sg>

If you require any further information or support, please consult your local Philips office.



Download section of the OEM web

# Warnings and instructions

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## Warnings:

- Metal enclosure of module must be grounded

## Safety warnings and installation instructions

To be taken into account during design-in and manufacturing.

### Design-in phase

- Do not apply mains power to the module directly.
- Connect the modules and drivers before switching on mains.
- Avoid contamination (direct or indirect) from any incompatible chemicals reacting with the LED. A list of incompatible chemicals is provided in the chapter for Compliance and Approval.
- The general IEC recommendations for luminaire design and legal safety regulations are also applicable to Philips module. Luminaire manufacturers are advised to conform to the international standards for luminaire design Class I, IEC 60598-Luminaires).
- Class I luminaires must provide a protective earth.
- The luminaire must be constructed in such a way that the LED module cannot be touched by an end-user, both in off state and when live.
- It is mandatory to design the luminaire in such a way that it can only be opened with special tools (by a qualified person) in order to prevent touching of live parts.
- Do take into account the minimum required creepage and clearance distances.
- Connect all electrical components first before switching on mains.
- The LED module shall be powered by a LED control gear IEC/EN 61347-2-13 certified.
- Module is not applicable for outdoor application (>IP65).
- Module is not applicable for Explosion-Risk application, such as gasoline station.

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### **Manufacturing phase**

- Do not use damaged or defective LED modules, including damaged connectors or PCB.
- Do not drop the LED module or let any object fall onto the LED module because this may damage the glass of the module. If the LED module has been dropped or an object has fallen onto the LED module, do not use it, even if there are no visible defects or signs of damage.
- Connect all electrical components first before switching on mains.
- The LED module shall be powered by a LED control gear IEC/EN 61347-2-13 certified.

### **Installation and service for luminaires incorporating with Philips module**

- Do not service the luminaire when the mains voltage is connected; this includes connecting or disconnecting the LED module cables.
- Do not use damaged products.
- Module should always be replaced by an OEM-qualified installer.
- The water proof connector has to be fully tightened up to prevent the water penetration via the connection in the field application.
- Any luminaire design please refer to the Tc definition for Philips module, to avoid any potential risk happened.

### **Philips Design-in support**

Is available; please contact your Philips sales representative.

# Introduction to this module

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## **Applications and luminaire classification**

Philips Fortimo Highbay module is an integrated module solution, excellent optical and heat management, made possible by its mid-power LED and glass lens technology. The entire system set includes module, driver perfect for easy design-in for industrial applications. The portfolio has been defined to include color temperatures of 4000K and 5600K, lumen package of 10K, 15K, 20K, 24K lumen totally.

## **Luminaire Class I applications**

The module are suitable for luminaire Class I applications in combination with approved Philips Highbay IP67 driver. Approved combinations comply with the latest IEC60598 luminaire standard requirements.

## **In this design-in guide**

In this design-in guide you will find all necessary guidelines to configure the module to your needs. The module range is designed to enable all types of luminaires in industrial field. And it is capable of truly replacing all those conventional industrial luminaires

## **Cautions during storage and transportation When storing this product for a long time (more than oneweek)**

- Store in a dark place. Do not expose to direct sunlight
- Please refer to the relevant product datasheet.

## **During transportation and storage for a short time**

Maintain temperature below 65°C at normal, noncondensing relative humidity.



#### **Philips Highbay IP67 driver for this module**

These highly efficient LED drivers are designed for this modules. These are available as an independent IP67 driver.

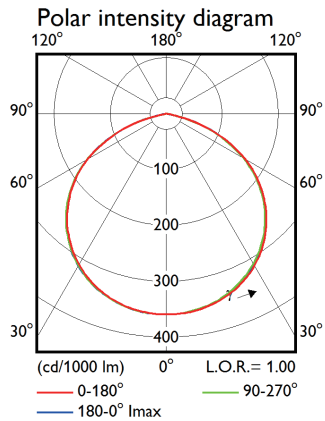
More information about the Xitanium drivers can be found in the Xitanium outdoor driver design in guide and commercial leaflet. These documents can be downloaded via

<http://www.lighting.philips.com.sg/oem-sg>

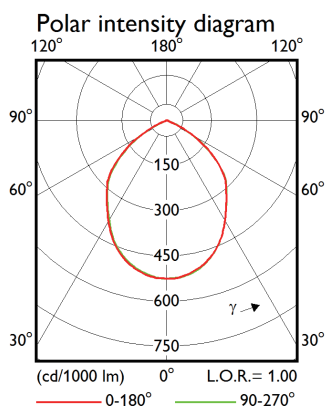
The Xitanium driver datasheets can also be downloaded on this website.

It is highly recommended to use the approved Philips Xitanium LED drivers. For a list of approved drivers please refer to [www.easydesignintool.com](http://www.easydesignintool.com)

# Optical design-in



Light distribution without reflector



Light distribution without  
60D reflector

## Light distribution

This module is suitable for industrial application. Optical files can be downloaded from <http://www.lighting.philips.com.sg/oem-sg>

## Color consistency

Color consistency refers to the spread in color points between modules. It is specified in SDCM (Standard Deviation of Color Matching) or MacAdam ellipses, which are identical. The current general specification of module is 7 SDCM. This results in good color consistency performance for industrial application.

## Color targets

The color target points of modules are found in the respective datasheets on <http://www.lighting.philips.com.sg/oem-sg>

## Spectral light distribution

The spectral light distribution of modules are found in the respective datasheets on <http://www.lighting.philips.com.sg/oem-sg>

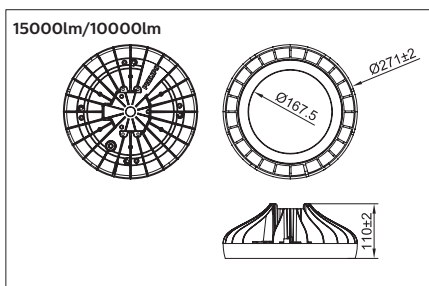
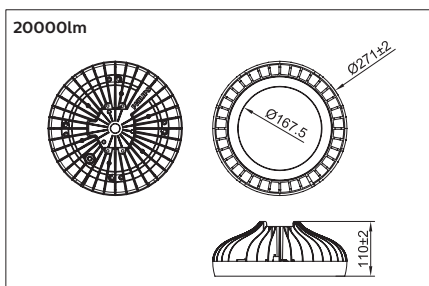
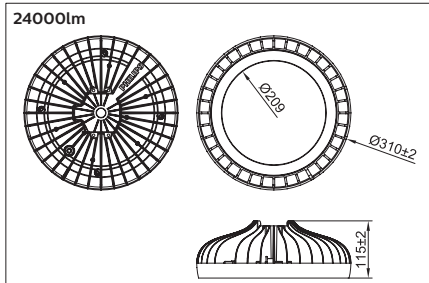
### Note:

Component and process tolerances can result in imperfectly symmetrical light distributions. Maximum acceptable tolerances will have minimal impact on optical distributions and optical performance in the final application for a variety of reasons.

All polar intensity diagram illustrations are just an indication of the beam shape. We suggest making use of the IES files available on the module website.



# Mechanical design-in



## Modules dimensions

3D CAD files can be downloaded from our website  
<http://www.lighting.philips.com.sg/oem-sg>

Basic dimensions for each module can also be found in the datasheets which are also available at the aforementioned website.

The recommended torque for mechanical fixation of modules to the luminaire fixture is 4 - 4.5 Nm.  
Required screw is included in the product package.

## Wiring

IP67 connector solution, more information please check datasheet.

## Installation instructions

Please refer to the explosive view on the right, more detail need please check the installation guideline.



# Thermal design-in

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The critical thermal management points for the LED module are set out in this chapter in order to facilitate the design-in of this module. If these thermal points are taken into account, this will help to ensure optimum performance and lifetime of the LED system.

## Optimum performance

The main thermal specification that needs to be taken into account when designing in LED module is the  $T_{case}$  temperature. The  $T_{case}$  must never exceed  $T_{case, lifetime}$  test in a draft-free lab environment. Please refer to the product datasheet for further details.

## Operating temperature

### Definitions

Module temperature: temperature measured at the specified  $T_{case}$  point (at the base) of the module

Driver temperature: temperature measured at the specified  $T_{case}$  point on the driver

Ambient temperature: temperature of the air surrounding the luminaire in the test environment or application

Ambient temperature in a lab environment: air temperature in a testing area, in a controlled environment free from drafts

Average ambient temperature: monthly average temperature based on at least 2 measurements per day, with at least 8-hour intervals between measurements

### Module temperature

To achieve typical product lifetime characteristics, it is crucial to ensure that the product is operating within the specified temperature limits. These limits are determined not only by the product and the application, but also by the luminaire design and ambient environment.



### Warnings:

- Maximum  $T_{case}$  should never exceed specified  $T_{case max}$
- Please refer to the specific datasheet for the maximum  $T_{case}$  Value
- Thermal design should ensure that driver  $T_{case} < \text{max specified driver } T_{case}$
- Thermal design must ensure maximum  $\Delta T (T_{case} - T_{amb}) \leq 50^\circ\text{C}$

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### Thermal measurements

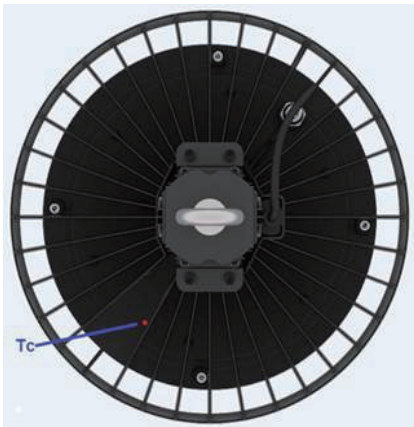
The maximum ambient temperature at which the luminaire will operate constitutes the initial key criterion for defining the correct temperature limit and validating the thermal luminaire design.

#### Note:

The ambient temperatures given above are average temperatures during the operational period of the module

### Critical temperature point (Tcase)

For LEDs, the junction temperature is the critical factor for operation. Since there is a direct relation between the case temperature and the LED junction temperature, it is sufficient to measure the aluminum casing of the module at its critical temperature point, Please refer to figure (Tc point on module). If the case temperature at the Tcase point exceeds the recommended Tcase lifetime, this will have an adverse effect on the performance of module in terms of light output, lifetime and lumen maintenance.



### Measurement of critical temperature point

On the back of the module there is a Tcase (Tc) point, which should be used for all temperature measurements. The temperature must be stable before any reliable data can be obtained (depending on the size and material of the luminaire, this will take between 30 and 180 minutes and even overnight).

#### Note:

It is important that the Tcase point is free of thermal interface material when the thermocouple is connected so that temperature measurements can be taken.

In order to ensure accurate Tcase test results, the case temperature should not vary by more than 1°C for a period of at least 30 minutes.

Recommended minimum module mounting pitch is 5mm.

Recommend Open slots in top cover have been designed to optimize heat management and minimize environmental pollution (i.e. dirt, dust etc).

# Electrical design-in and flexibility

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## Connection to the mains supply

The mains supply must be connected to the LED driver

## Philips Xitanium Highbay IP67 driver

The Fortimo Highbay modules are designed to be used with Philips Xitanium highbay IP67 driver. This allows for an easier design-in for highbay luminaire design.

More information about this driver family can be found in the Xitanium outdoor driver design in guide and commercial leaflet. These documents can be downloaded via

<http://www.lighting.philips.com.sg/oem-sg>

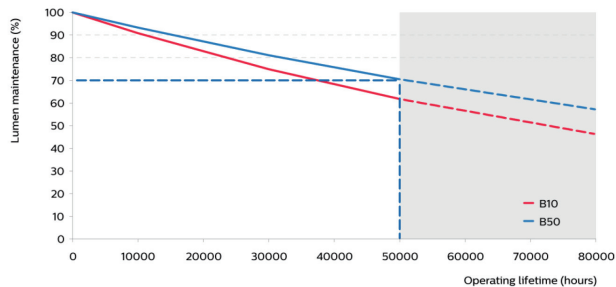
The Xitanium driver datasheets can also be downloaded on this website. Full system overviews can be obtained using the Easy Design-in tool at [www.easydesignintool.philips.com](http://www.easydesignintool.philips.com).

## Compatible Drivers

A list of compatible drivers, specific to your choice of module and operating point can be obtained from the Easy Design-in Tool that can be found at [www.easydesignintool.com](http://www.easydesignintool.com)

In case of queries, please contact your Philips representative.

# Reliability



## Lumen maintenance

### B50L70 @ 50,000 hours

The quality of Philips module portfolio by the Philips' claim of B50L70 @ 50,000 hours. This means that at 50,000 hours of operation at least 50% of the module population will emit 70% of its original amount of lumens.

# Controllability

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## **Dimmable function offer this system**

As a system, we recommend Philips Xitanium highbay IP67 drivers according to the low voltage solution for customer.

Philips Xitanium HighBay driver are specially designed for maximum reliability and core exibility in low voltage outdoor applications. With superior surge protection, these durable, independently housed drivers deliver consistent, high performance to luminaires even after multiple indirect lightning strikes – an ideal solution for OEMs that need reliable, adjustable output in a rugged independent form factor.

Please refer to the driver design-in guide for more detailed information.

Further information about our entire portfolio of control products is available at:

[www.Philips.com/lightingcontrols](http://www.Philips.com/lightingcontrols)

# Compliance and approval

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## Compliance and approbation

The modules bear the CE mark indicating that they comply with the appropriate European EU directives. Philips modules will also be LED module performance (IEC62717) certified.

The relevant standards are summarized below. To ensure luminaire approval, the conditions of acceptance need to be fulfilled. Details can be requested from your local sales representative. All luminaire manufacturers are advised to conform to the international (luminaire standards IEC 60598-1) and national standards of luminaire design.

## Electrostatic discharge (ESD)

### ESD consultancy

Depending on the protection level of the LED module a minimum set of measures has to be taken when handling the modules. Philips LED products have a high degree of ESD protection by design. ESD measures are required in a production environment.

## Environmental compliance

The product is compliant with European Directive 2011/65/EC on Restriction of the Use of Certain Hazardous Substances in electrical and electronic equipment (RoHS2).

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### Blue Light Hazard

The photobiological safety standard IEC TR 62778 ('Photobiological safety of lamps and lamp systems') gives guidance on how to evaluate the photobiological safety of lamps and lamp systems including luminaires. This standard specifies the exposure limits, reference measurement technique and classification scheme for the evaluation and control of photobiological hazards from all electrically powered incoherent broadband sources of optical radiation including LEDs in the wavelength range from 200 nm through 3000 nm. Measured results of emission limits for Philips modules using the non-GLS (20 cm) method are listed in the datasheets that can be found at

<http://www.lighting.philips.com.sg/oem-sg>

From the nature of most LEDs applying blue light, emphasis has been put on the hazard in terms of Photo Biological Safety (PBS). Evaluation by the European lighting industry (ELC, Celma) has concluded LED light sources are safe for customers when used as intended. A photobiological safety report is available at

<http://www.lighting.philips.com.sg/oem-sg>

Nevertheless luminaire makers have to comply with luminaire standards including PBS. To avoid extensive retesting, it is preferred to build on the test conclusions of the LED (module) suppliers; however this should be discussed and agreed upon with the used certification body. The testing conclusion then will be expressed in Risk Groups (RG), where RG0 and RG1 are considered safe and/or do not require specific action for the luminaire makers (as compared to RG2 and 3).



| Chemical Name   | Normally used as |
|---|------------------|
| Acetic acid   | Acid             |
| Hydrochloric acid   | Acid             |
| Nitric acid   | Acid             |
| Sulfuric acid   | Acid             |
| Ammonia   | Alkali           |
| Potassium hydroxide                                       | Alkali           |
| Sodium hydroxide  | Alkali           |
| Acetone   | Solvent          |
| Benzene   | Solvent          |
| Dichloromethane   | Solvent          |
| Gasoline  | Solvent          |
| MEK (Methyl Ethyl Ketone)                                 | Solvent          |
| MIBK (Methyl Isobutyl Ketone)                             | Solvent          |
| Mineral spirits (turpentine)                              | Solvent          |
| Tetrachlorometane   | Solvent          |
| Toluene   | Solvent          |
| Xylene  | Solvent          |
| Castor oil  | Oil              |
| Lard  | Oil              |
| Linseed oil   | Oil              |
| Petroleum   | Oil              |
| Silicone oil  | Oil              |
| Halogenated hydrocarbons<br>(containing F,Cl,Br elements) | Misc             |
| Rosin flux  | Solder flux      |
| Acrylic tape  | Adhesive         |
| Cyanoacrylate   | Adhesive         |

## Chemical Compatibility

The LED contains a silicone overcoat to protect the LED chip and extract the maximum amount of light.

As with most silicones used in LED optics, care must be taken to prevent any incompatible chemicals from directly or indirectly reacting with the silicone.

The silicone overcoat used in the LED is gas sensitive. Consequently, oxygen and volatile organic compound (VOC) gas molecules can diffuse into it. VOCs may originate from adhesives, solder fluxes, conformal coating materials, potting materials and even some of the inks that are used to print the PCBs.

A list of commonly used chemicals, that should be avoided as they may react with the silicone material, is provided on the left. Note that Philips does not warrant that this list is exhaustive since it is impossible to determine all chemicals that may affect LED performance. These chemicals may not be directly used in the final products but some of them may be used in intermediate manufacturing steps (e.g. cleaning agents). Consequently, trace amounts of these chemicals may remain on (sub) components, such as heat sinks. It is recommended to take precautions when designing your application.

## Cautions

### During storage and transportation

Store in a dark place. Do not expose to sunlight. Maintain temperature between -40 +65 °C, and RH 5 – 95%.

### During operation

Philips shall not be held responsible or liable for any damage, costs or expenses to the user, resulting from an accident or any other cause during operation if the system is used without due observance of the absolute maximum ratings and other instructions provided by Philips.

### Note:

That warranty is applicable for Philips module for 1 switching cycle per day in combination with a released Philips Xitanium driver.

# Contact details

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## **Philips**

[www.Philips.com/Technology](http://www.Philips.com/Technology)

Or contact your local Philips sales representative

## **Philips ESD support**

[www.innovationservices.philips.com](http://www.innovationservices.philips.com)

Phone : +31- (0) 40 27 46658

Fax : +31 – (0) 40 27 42224

The Philips corporate EMC competence center is a leading provider of approbation and consultancy services.

# Disclaimer

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Philips will perform the testing of the LED systems to high standards of workmanship. The tests are carried out with reference to the EN/IEC standards, if any, which are regarded by Philips as being of major importance for the application of the lamp gear and the lamp within the fixture for horticultural applications.

The design-in guide, regarding the testing and design in of the LED system provided by Philips, is not an official testing certificate, and cannot be regarded as a document for official release of the fixture. The OEM is liable for the official testing by a certified test body and all markings, such as CE and ENEC marks, on the fixture assembly.

The design-in guide is for information purposes only and may contain recommendations for detecting weak points in the design of the system (lamp – lamp gear – fixture), if any.

Specifically mentioned materials and/or tools from third parties are only indicative: other equivalent equipment may be used but it is recommended that you contact Philips for verification.

Philips will not be liable for unforeseen interactions of the proposed solutions when applied in the fixtures or applications using these fixtures. Philips has not investigated whether the recommendations are or will in the future be in conflict with existing patents or any other intellectual property right. Philips does not warrant that its recommendations are technically or commercially the best options.

Since the tests are only performed on one particular fixture provided by the customer, it will be treated as a prototype. This means that there is no statistical evidence regarding later production quality and performance of the lamp – lamp gear – fixture system.

As Philips does not have control over manufacturing of the fixtures, Philips cannot be held liable for the fixture assembly.

Philips will not accept claims for any damage caused by implementing the recommendations.

No warranty whatsoever may be claimed by the OEM with regard to the content and/or quality of the design-in guide or any other advice, or the conclusions and/or recommendations in the design-in guide or any other document, either express or implied, and Philips expressly disclaims any implied warranties of any kind, including without limitation any warranties of satisfactory quality, fitness for a particular purpose or non-infringement and any warranties regarding the design-in guide or any other advice or the use of the results of any activity performed while testing the fixture with respect to its correctness, quality, accuracy, completeness, reliability, performance or otherwise.

The OEM expressly agrees that test design-in guides are provided by Philips on an 'as is' basis and an 'as available' basis at customer's sole risk and expense. Philips shall not be liable for any lost profits or lost savings, indirect, incidental, punitive, special, or consequential damages whether or not such damages are based on tort, warranty, contract, or any other legal theory – even if Philips has been advised, or is aware, of the possibility of such damages.

The OEM must bring any claim for damages within ninety (90) days of the day of the event giving rise to any such claim, and all lawsuits relative to any such claim.



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<http://www.lighting.philips.com.sg/oem-sg>

10 April 2017  
Data subject to change