Module for Lighting kit

BLELED

Document Information	
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Module for Lighting kit	BLELED	Mass Production

Contents

1 General Description

The BLELED is a highly integrated Bluetooth 4.2 BLE module, designed for high data rate, short-range wireless communication in the 2.4GHz ISM band. The module is based on Nordic nRF518xx radio Transceiver IC, has a 32 bit ARM Cortex-M0 CPU, Flash memory and analog and digital peripherals. The BLELED provides a low power and ultra-low cost BLE solution for wireless transmission applications.

2 Applications

- Computer peripherals and I/O devices
  - Mouse
  - Keyboard
  - Multi-touch trackpad
- Interactive entertainment devices
  - Remote control
  - 3D Glasses
  - Gaming controller
- Personal Area Networks
  - Health/fitness sensor and monitor devices
  - Medical devices
  - Key-fobs + wrist watches
- Remote control toys
- Beacons
- Bluetooth Gateway
- Indoor Location
- Colourful LED Control

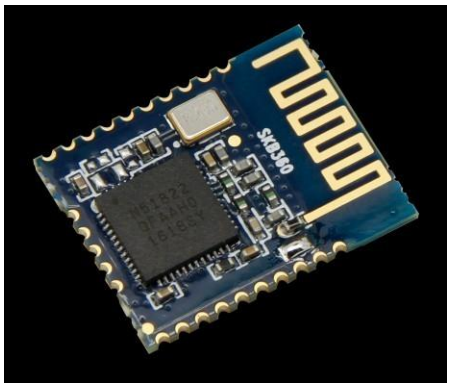

Figure 1: BLELED Top View

3 Features

◆ Main Chip: nRF518xx

◆ Bluetooth® 4.2 low energy single-mode protocol stack L2CAP, ATT, GAP, GATT and SM protocols

Central and Peripheral roles

GATT Client and Server

Full SMP support including MITM and OOB pairing

◆ Data rates up to 1Mbps

◆ 8/9/10 bit ADC-4 configurable channels

◆ 20 General Purpose I/O pins

◆ SPI Master/Slave

◆ Two-wire Master (I2C compatible)

◆ UART (CTS/RTS)

◆ CPU independent Programmable Peripheral Interconnect (PPI)

◆ Quadrature Decoder (QDEC)

◆ AES HW encryption

◆ RoHS compliance (Lead-free)

◆ CE,FCC compliance

4 Application Block Diagram

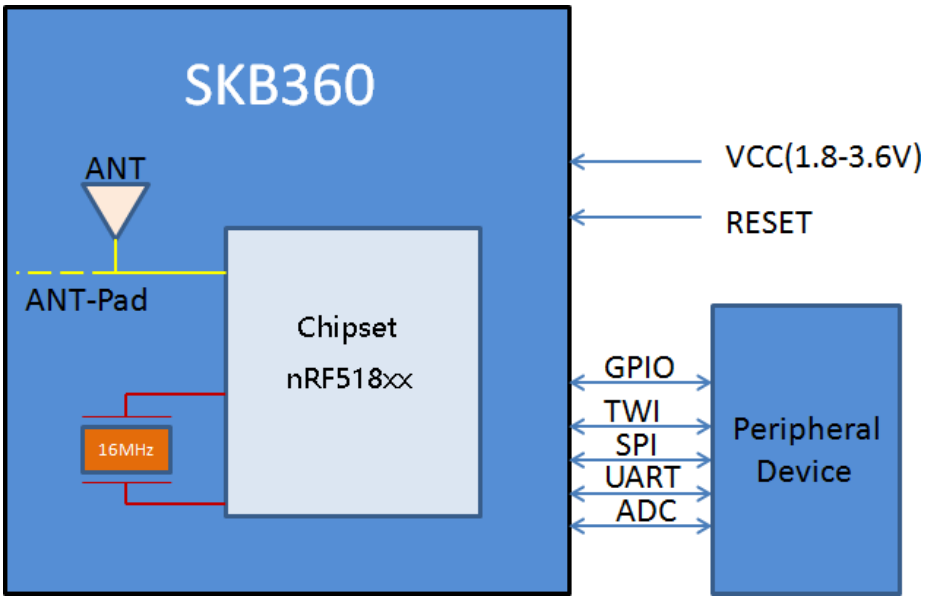

Figure 2: BLELED Block Diagram

5 Interfaces

5.1 Power Supply

Regulated power for the BLELED is required. The input voltage Vcc range should be 1.8V to 3.6V, current is not less than 20mA. Suitable decoupling must be provided by external decoupling circuitry (10uF and 0.1uF). It can reduce the noise from power supply and increase power stability.

5.2 System Function Interfaces

5.2.1 GPIOs

The general purpose I/O is organized as one port with up to 20 I/Os enabling access and control of up to 20 pins through one port. Each GPIO can be accessed individually with the following user configurable features:

1、Input/output direction

2、Output drive strength

3、Internal pull-up and pull-down resistors

4、Wake-up from high or low level triggers on all pins

5、Trigger interrupt on all pins

6、All pins can be used by the PPI task/event system; the maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels

7、All pins can be individually configured to carry serial interface or quadrature demodulator signals

8、All pins can be configured as PWM signal.

9、There are 4 ADC/LPCOMP input in the 20 I/Os.

5.2.2 Two-wire Interface (I2C Compatible)

The two-wire interface can communicate with a bi-directional wired-AND bus with two lines (SCL, SDA). The protocol makes it possible to interconnect up to 127 individually addressable devices. The interface is capable of clock stretching, supporting data rates of 100 kbps and 400 kbps. The module has 2 TWI ports and they properties like following table.

Instance	Master/Slave
TWI0	Master
TWI1	Master

Table5-1: TWI Pin Share Scheme

Note：I2C:Inter—Integrated Circuit

5.2.3 Flash Program I/Os

The module has two programmer pins, respectively SWDCLK pin and SWDIO pin. The two pin Serial Wire Debug (SWD) interface provided as a part of the Debug Access Port (DAP) offers a flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints and single stepping are part of this support.
SWDIO can also be used as system reset pin, the system reset pin is active low.

5.2.4 Serial Peripheral Interface

The SPI interfaces enable full duplex synchronous communication between devices. They support a three-wire (SCK, MISO, MOSI) bi-directional bus with fast data transfers. The SPI Master can communicate with multiple slaves using individual chip select signals for each of the slave devices attached to a bus. Control of chip select signals is left to the application through use of GPIO signals. SPI Master has double buffered I/O data. The SPI Slave includes EasyDMA for data transfer directly to and from RAM allowing Slave data transfers to occur while the CPU is IDLE. The GPIOs are used for each SPI interface line can be chosen from any GPIOs on the device and configed independently. This enables great flexibility in device pinout and efficient use of printed circuit board space and signal routing.
The SPI peripheral support SPI mode 0,1,2,and 3.The module have 3 SPI ports and theirs they properties are as below:

Instance	Master/Slave
SPI0	Master
SPI1	Master
SPIS1	Slave

Table5-2: SPI Properties

5.2.5 UARTs

The Universal Asynchronous Receiver/Transmitter offers fast, full-duplex, asynchronous serial communication with built-in flow control (CTS, RTS), support in hardware up to 1 Mbps baud. Parity checking is supported.
The default P0.08 is UART_TX, P0.09 is UART_RX. Support the following baudrate in bps unit: 1200/2400/4800/9600/14400/19200/28800/38400/57600/76800/115200.

BLELED Pin Number	Pin Name	UART	Pin Share
16	P0.08	UART_TX	UART(For Debug)
17	P0.09	UART_RX	

Table5-3: UART Pin Share Scheme

Note: The GPIOs are used for each SPI/TWI/UART interface line can be chosen from any GPIOs on the device and configed independently.

5.2.6 Analog to Digital Converter (ADC)

The 10 bit incremental Analog to Digital Converter (ADC) enables sampling of up to 8 external signals through a front-end multiplexer. The ADC has configurable input and reference prescaling, and sample resolution (8, 9, and 10 bit).

Note: The ADC module uses the same analog inputs as the LPCOMP module. Only one of the modules can be enabled at the same time.

BLELED Pin Number	Pin Number	Description
12	P0.01	Digital I/O; Analog input 2
13	P0.02	Digital I/O; Analog input 3
14	P0.03	Digital I/O; Analog input 4
15	P0.04	Digital I/O; Analog input 5

Table5-4: ADC Pins

5.2.7 Low Power Comparator (LPCOMP)

In System ON, the block can generate separate events on rising and falling edges of a signal, or sample the current state of the pin as being above or below the threshold. The block can be configured to use any of the analog inputs on the device. Additionally, the low power comparator can be used as an analog wakeup source from System OFF or System ON. The comparator threshold can be programmed to a range of fractions of the supply voltage.

5.2.8 Reset

The reset pin of the BLELED module is in the internal pull-high state , when the reset pin of the

module is input to a low level , the module will be automatically reset .After the reset pin is used , the parameters of the current setting will not be reserved .

6 Module Specifications

Hardware Features	
Model	BLELED
Antenna Type	PCB Antenna
Chipset Solution	nRF518xx
Voltage	1.8V~3.6V
Dimension(L×W×H)	17.4×13.7×1.9 mm
Wireless Features	
Wireless Standards	Bluetooth ® 4.2
Frequency Range	2400MHz---2483.5MHz
Data Rates	1Mbps
Modulation Technique	GFSK Modulation
Wireless Security	AES HW Encryption
Transmit Power	Tx Power -20 to +4 dBm in 4 dB Steps
Work Mode	Central/Peripheral
Others	
Certification	RoHS, FCC, CE
Environment	Operating Temperature: -25℃~75℃
	Storage Temperature: -40℃~85℃
	Operating Humidity: 10%~90% Non-condensing
	Storage Humidity: 5%~90% Non-condensing

7 Module Pinout and Pin Description

7.1 Module Pinout

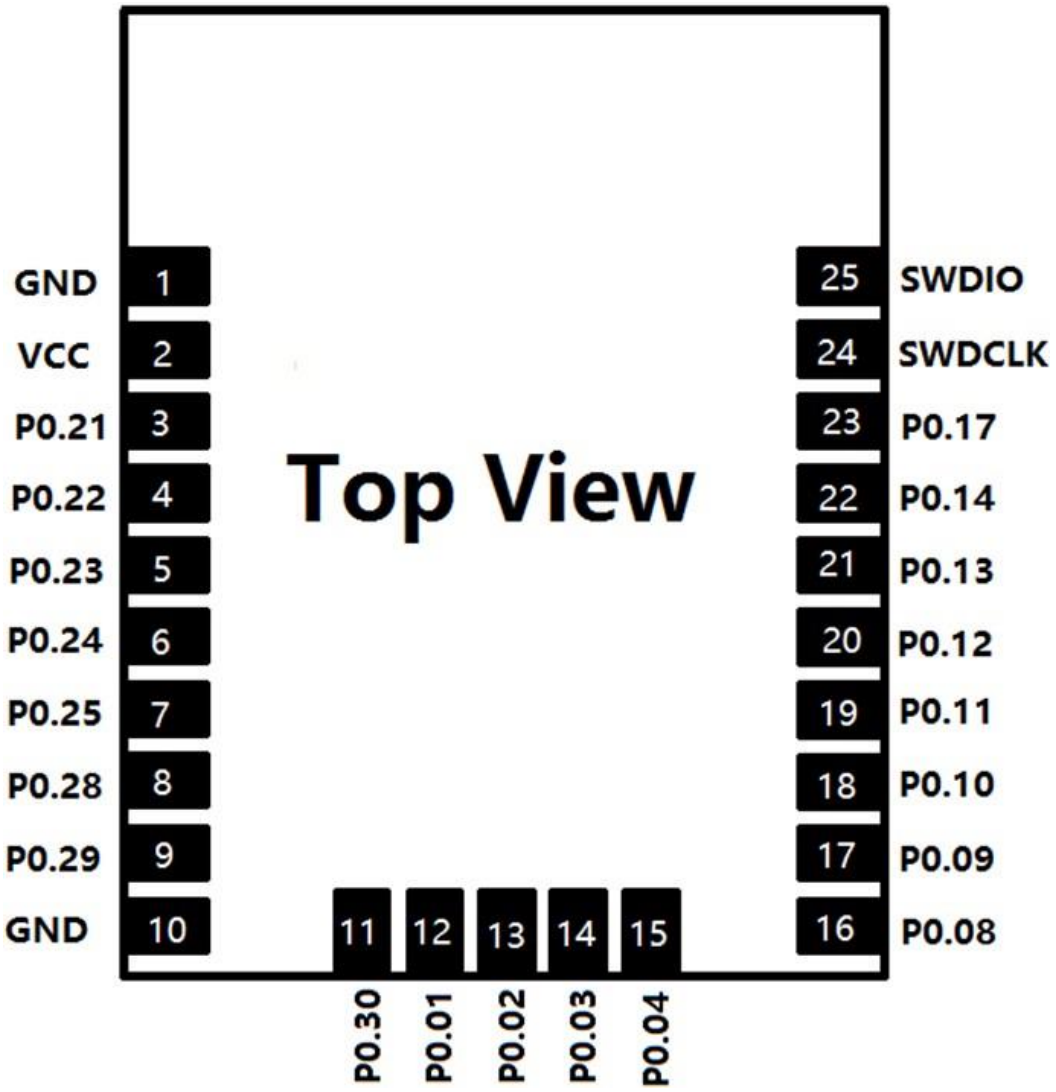

Figure 3: BLELED Module Pinout

7.2 Pin Description

Pin No.	Pin Name	Description	Remark
1	GND	Ground	
2	VCC	Main Power Supply	1.8V to 3.6V
3	P0.21	General Purpose I/O	Digital I/O
4	P0.22	General Purpose I/O	Digital I/O
5	P0.23	General Purpose I/O	Digital I/O
6	P0.24	General Purpose I/O	Digital I/O
7	P0.25	General Purpose I/O	Digital I/O
8	P0.28	General Purpose I/O	Digital I/O
9	P0.29	General Purpose I/O	Digital I/O
10	GND	Ground	
11	P0.30	General Purpose I/O	Digital I/O
12	P0.01	Digital I/O; Analog input	ADC/LPCOMP input 2
13	P0.02	Digital I/O; Analog input	ADC/LPCOMP input 3
14	P0.03	Digital I/O; Analog input	ADC/LPCOMP input 4
15	P0.04	Digital I/O; Analog input	ADC/LPCOMP input 5
16	P0.08	General Purpose I/O	Default UART TX
17	P0.09	General Purpose I/O	Default UART RX
18	P0.10	General Purpose I/O	Digital I/O
19	P0.11	General Purpose I/O	Digital I/O
20	P0.12	General Purpose I/O	Digital I/O
21	P0.13	General Purpose I/O	Digital I/O
22	P0.14	General Purpose I/O	Digital I/O
23	P0.17	General Purpose I/O	Digital I/O
24	SWDCLK	Hardware debug and Flash program I/O	Digital input
25	SWDIO/n RESET	Hardware Debug and Flash Program I/O; System Reset (Active low)	Digital I/O

8 PCB Design Guide

Please reserve empty area for PCB antenna when you are going to design a board, the empty range device's minimum size :16.5*6.6mm , please kindly check the "PCB footprint and Dimensions" for reference.

9 PCB Footprint and Dimensions

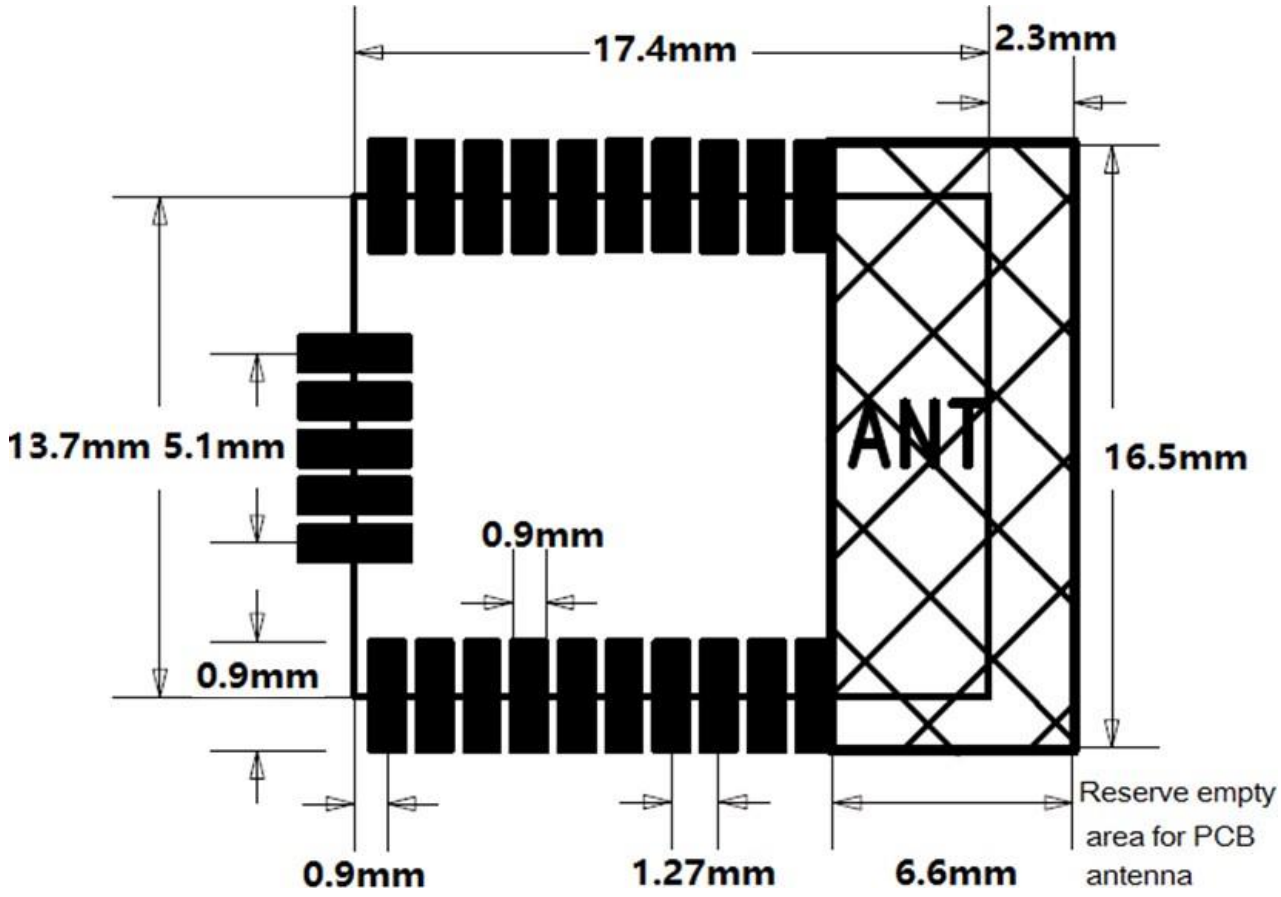

Figure 4: BLELED Recommended PCB Footprint

10 Electrical Characteristics

10.1 Absolute Maximum Ratings

Parameter	Condition	Min.	Typ.	Max.	Unit
Storage Temperature Range		-40		85	°C
ESD Protection	VESD	/		4000	V
Supply Voltage	VCC	-0.3		3.9	V
Voltage On Any I/O Pin		-0.3		3.63	V

Table10-1: Absolute Maximum Ratings

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

*BLELED series modules are Electrostatic Sensitive Devices and require special precautions while handling.

ESD precautions

The BLELED series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the BLELED series modules without proper ESD protection may destroy or damage them permanently.

The BLELED series modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling, transportation and operation of any application that incorporates the BLELED series module. Don’t touch the module by hand or solder with non-anti-static soldering iron to avoid damage to the mode.

10.2 Recommended Operation Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Extended Temp. Range	TA	-25		75	ºC
Power Supply	VCC	1.8	3.3	3.6	V
Input Low Voltage	VIL	0		1	V
Input High Voltage	VIH	2.3		3.9	V

Table10-2: Operating Conditions

10.3 Current

System State	TX Peak @0dBm	RX Peak	Advertise Interval @100ms (0dBm)(avg)	Sleep Mode （avg）	Idle Mode (avg)
Current (peak)@3V	10.5 mA	13 mA	270uA	0.28uA	2.43uA

Table10-3: Power Consumption in Different States

11 Manufacturing Process Recommendations

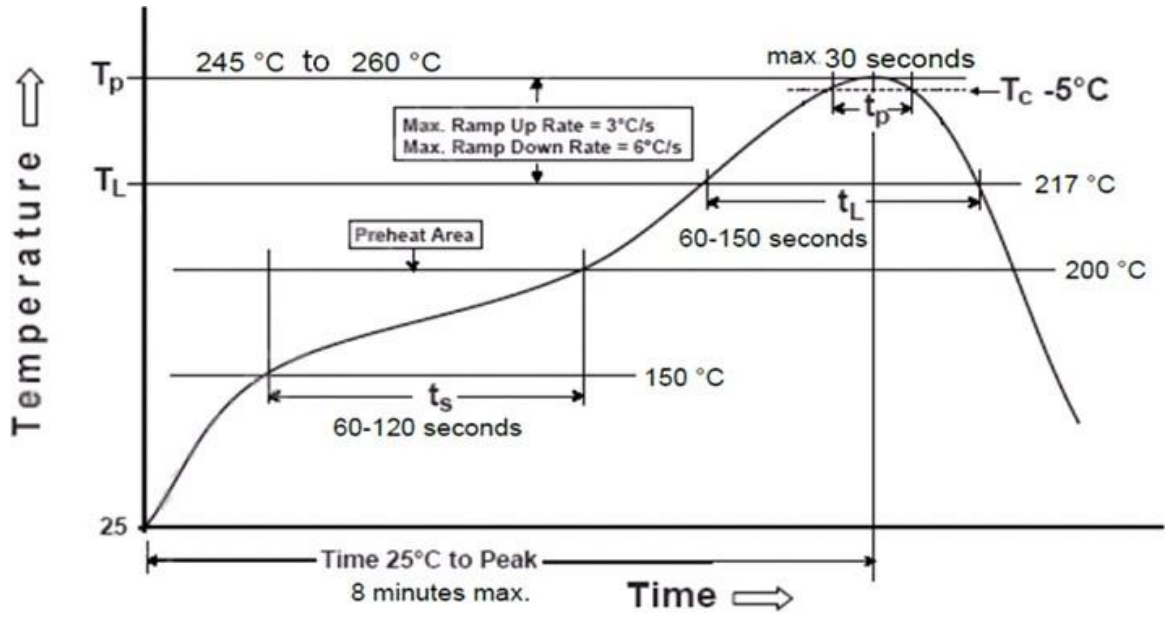

Figure 5: BLELED Typical Lead-free Soldering Profile

Note：The final re-flow soldering temperature map chosen at the factory depends on additional external factors, for example, choice of soldering paste, size, thickness and properties of the module`s baseboard etc.

Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

12 Ordering Information

Module No.	Type number	Chipset	Certification
BLELED	09192	nRF51822	RoHS, FCC, CE
BLELED	0919204	nRF51802	RoHS, FCC, CE

13 Packaging Specification

BLELED modules are put into tray and 528 units per tray. Each tray is ‘dry’ and vacuum packaging.

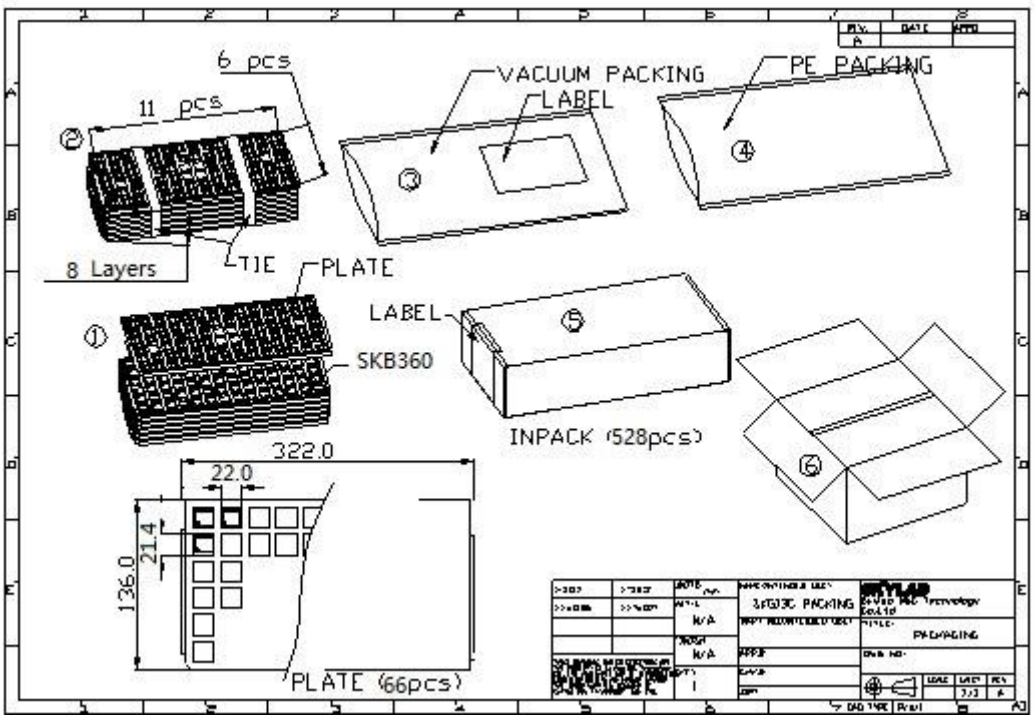

Figure 6: BLELED Packaging

14. FCC Information

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS OR CHANGE TO THIS EQUIPMENT. SUCH MODIFICATIONS OR CHANGE COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Increase the separation between the equipment and receiver.
-- Consult the dealer or an experienced radio/TV technician for help.
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.
To satisfy FCC exterior labeling requirements, the following text must be placed on the exterior of the end product
"Contains Transmitter module FCC ID: WUI-BLELED"
The modular must be installed in the host that assign by
Company name: Winplus Co., Ltd.
Product/PMN: Exterior Trim LED
Model no./HVIN: LM57485
if other host types used would need further evaluation and possible C2PC if they are not significantly similar to the one tested.

IC Information

-English:
1. This device complies with Industry Canada RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This equipment complies with ISED RF radiation exposure limits set forth for an uncontrolled environment.
-French:
Leprésent appareil est conforme aux CNR d'Industrie Canada applicable aux appareils radio
Exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement."
Cet appareil est conforme aux limitesd'exposition de rayonnement RF ISEDC établiespour un environnement non contrôlé.
Pour satisfaire la ISED extérieur étiquetage, le texte suivant doit être placéàl'extérieur du produit final "Contains émetteur module IC:7297A-BLELED".
The modular must be installed in the host that assign by
Le modulaire doit être installé dans l'hôte assigné par
Nom de la compagnie: Winplus Co., Ltd.
Produit/PMN: Exterior Trim LED
Modèle no./HVIN: LM57485
if other host types used would need further evaluation and possible C2PC if they are not significantly similar to the one tested.
si d'autres types d'hôtes utilisés nécessiteraient une évaluation plus poussée et un C2PC possible s'ils ne sont pas significativement similaires à celui testé

14 Revision History

Revision	Description	Approved	Date
V1.01	Initial Release	Sunny	20140611
V2.01	Upgrade Hardware	Sunny	20150117
V2.02	Add AT Instruction	Sunny	20150528
V2.03	Upgrade hardware	Hogan	20160611
V3.01	Upgrade format	Hogan	20161211
V3.02	Upgrade product image	Hogan	20170504
V3.03	Update certification information	George	20170831
V4.01	Add order information	George	20180209
V4.02	Add part number information	George	20180515