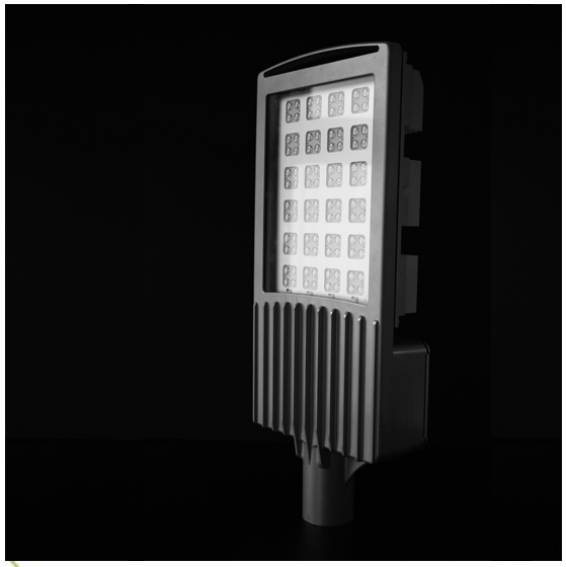
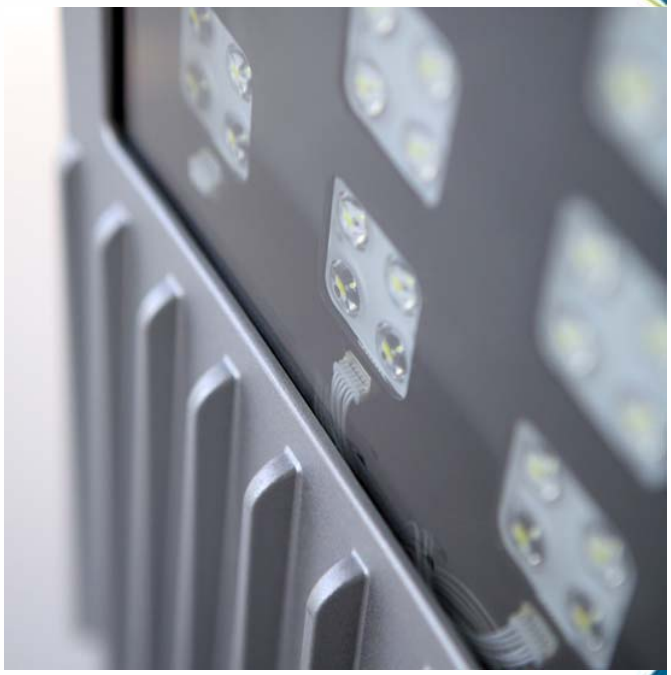
STREET LIGHT 120W





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Summary of Features

Optical performance:
Combining symmetric and asymmetric light patterns design to illuminate roadway and sidewalk areas, and to meet the full cut-off luminaire request of IESNA luminaire classification. (Patent pending).

Thermal management:
Unique thermal design achieves 2°C temperature variation on heat-sink base and control LED junction temperature below 75°C@30°C ambient under still-air condition. With over-temperature protection design, LED current is auto-adjusted as sink base temperature reaches 70°C.

Power control:
Switching mode power supply with multi-channel constant current design to drive individual LED series so as to ensure LED constant current operation. Active power factor correction allows PF> 0.98 @120W full loading. In additions, overtemperature,
over-voltage protection, and thermal compensation ensure LED life
and optical performance.

Mechanical design:
Simplified screw-in power cover open/close design reduce installation labor. Luminaire possesses IP65 rating which prevents the dust and water intrusion.

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Optical Benefits

- Both asymmetric and symmetric beam are designed in the secondary optical lens.
- Symmetric beam shape allocates light on the road uniformly to meet the standard. While asymmetric beam shape places more light on the road than that on the sidewalk.
- Our design meets most regulations of road illumination for many international standards, e.g. CIE, IES, IESNA, CNS, etc.
- Street Lights from other companies use typical lens to provide waterdrop shape beam, bat-wing shape beam, or use reflector to constrain the beam. These designs may only meet some portion of ordinaryregulation, but not the overall standard of road illumination.

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Heat Dissipation Benefits

- We use 1W LEDs with uniform light source placement to achieve heat dissipation uniformity providing no hot–spot for high power street lighting. AOP provides an optimized modular design of heat sink of which temperature variation of the heat sink is less that 2ºC. In additions, junction temperature of LED is controlled under 75ºC when operated at ambient temperature 30ºC under still-air situation. By doing this, the lifetime of LEDs is therefore guaranteed up to 50,000hours.

- Some other LED street lights use high-wattage LED modules or use 1W LED with centralized placement. Due to the non-uniform distribution of heat, these designs can cause hot spotting which will reduce the operation life of LEDs. To avoid hot-spotting some manufacturers use heat pipe or similar technology to “pull” heat from LED modules. These solutions are not cost-effective while difficult to maintain consistency of the heat dissipation control.

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Power Benefit

- We employ digital controlled switching power design with active high power factor correction which obtains p.f. >0.995 Moreover, power supply is designed to equip the multi-channel current sharing circuitry, with 8 independent constant current driver allowing LEDs serve constant light output during life expectancy. In additions, an intelligent circuit is utilized to compensate the temperature of the light module, which adjust its output current automatically to avoid LED overheated, i.e., light module under 70ºC.
- Some other street lights may use constant current design with LEDs either serial or parallel connected. This design can cause damage by chain-reaction when any LED fails, most likely due to variation of forward voltage from the nature of LEDs. Consequently, the light output and reliability are difficult to maintained specially under high temperature operation.

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Mechanical Benefits

- Our street light is such a unique design which integrates optical, thermal, power, electronic parts in single unit, which ensures the service reliability and water-resistance (IP65) while allows easy installation and maintenance. Light source adopts modular light panel design (4 individual modules) and up-lifted power cover design for easyreplacement. Installation and maintenance, our street light is almost the same as traditional street light, no extra effort needed.
- Most other LED street lights are assembled by separated or irrelevant part, with no systematic or integrated design, these cause complexity, uncertainty and low-yield in assembly process and therefore result in low reliability. Moreover, for installation or maintenance procedure, some other street lights are labor intensive or time consuming due to improper mechanical design.

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Comparison of Light Sources

Light Source	Efficiency (Lm/W)	Color Temperature (°K)	Color Rendering (CRI)	Lifetime (Hrs.)	Remarks
Mercury Lamp	30~65	CW WW	22 44~50	12,000	➢200W-9900Lm ➢300W-15800Lm ➢400W-22000Lm
High Pressure Sodium	100~150	2100°K	20	15,000	Most use on highway ➢150W-14000Lm ➢250W-28000Lm ➢400W-48000Lm
Low Pressure Sodium	175 (Max.)	1600°K	~0	14,000	Near the end of life, power consumption very high. Most use in the tunnel
Metal Halide Lamp	75~100	CW WW	65~90	8,000	Short lifetime Good efficiency and Ra ➢100W-6500Lm ➢250W-20000Lm ➢400W-38000Lm
LED	60 → 100 (Keep growing)	CW WW	70~80	50,000	Long lifetime ➢100W-6000Lm ➢250W-15000Lm ➢400W-24000Lm

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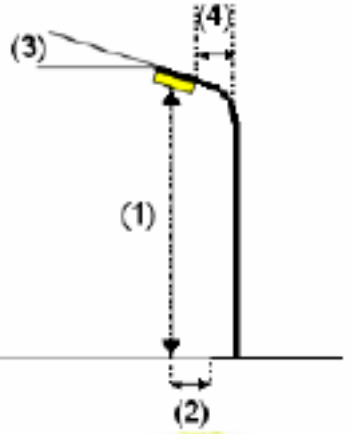
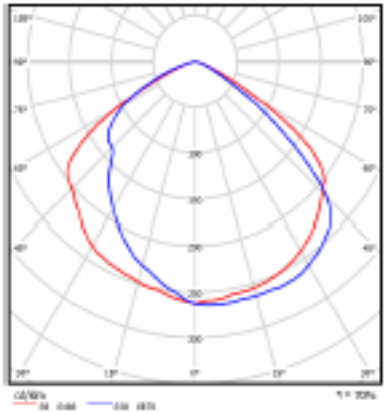
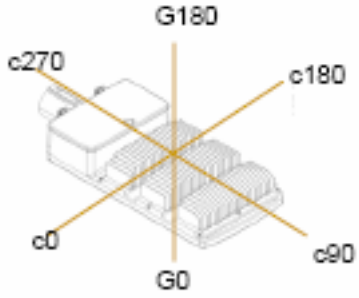
Street Light Simulation

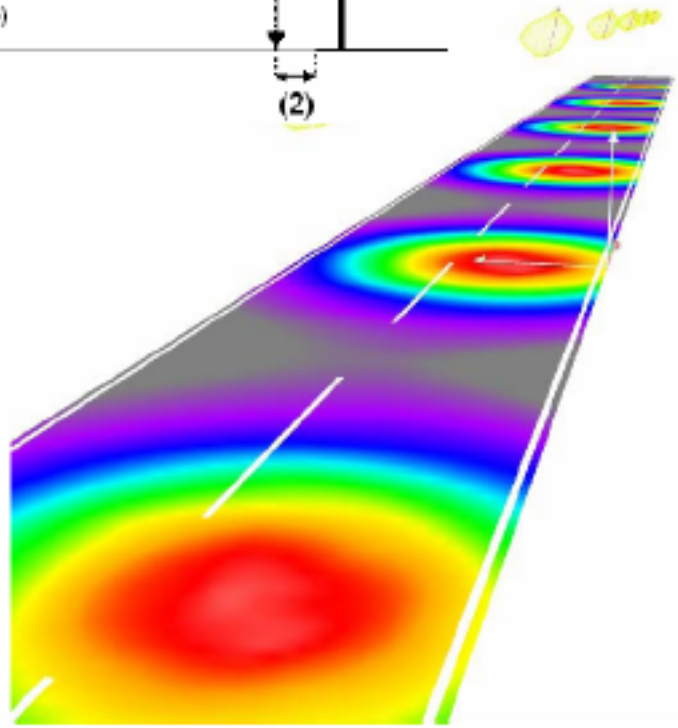
- Roadway Simulation Parameters
  - ✓ Road with:10m
  - ✓ Single Row
  - ✓ Pole Pitch: 24
  - ✓ Mounting Height: 8m (1)
  - ✓ Arm Length: 2 m (4)
  - ✓ Luminaire extend: 1.876m (2)
  - ✓ Install inclined angle: 15 degree (3)





Symmetric and Asymmetric light pattern
(Patent Pending)





Simulation result

- ✓ 70 degree: 110cd/klm
- ✓ 80 degree: 29cd/klm <30cd
- ✓ 90 degree: 6.24cd/klm <10cd

Meet cut-off luminaire requirement

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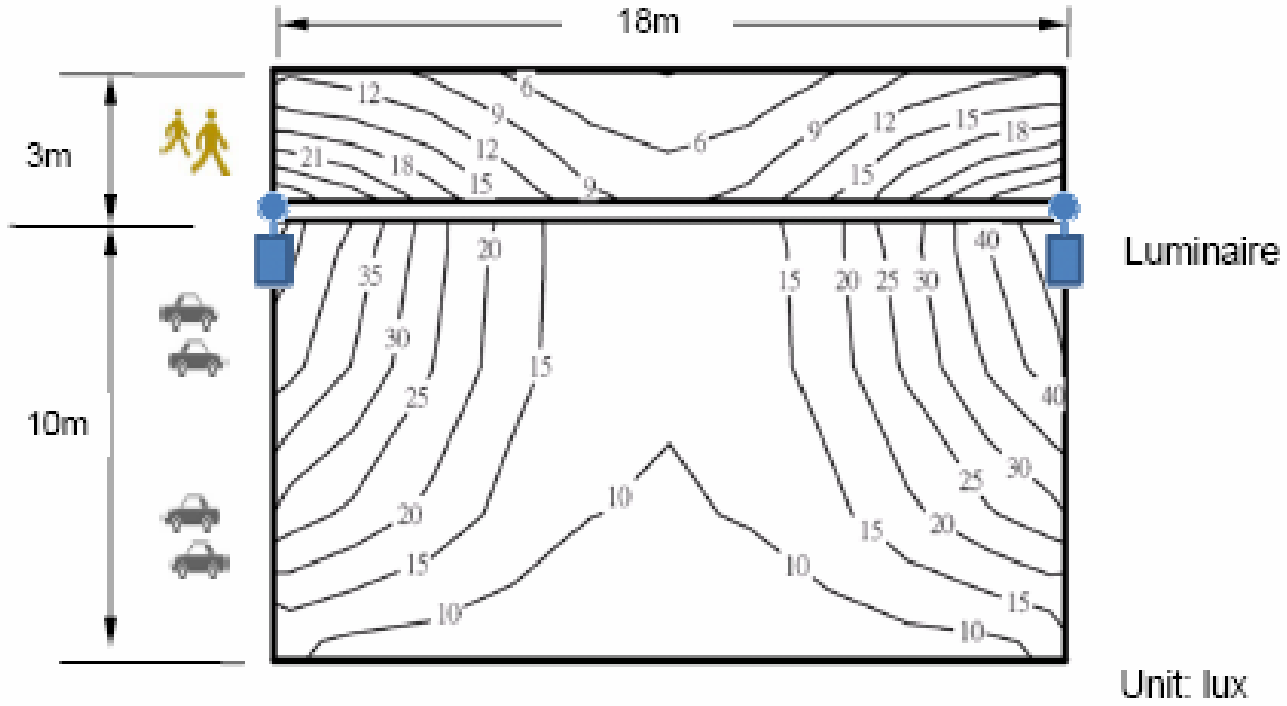
Illumination distribution simulation of Street Light at 6m height



Unit: lux

	Avg. (Lux)	Min. (Lux)	Max. (Lux)	Min./Avg.	Min./Max.
Sidewalk	12	3.56	26	0.29	0.14
Roadway	19	7.58	43	0.39	0.18

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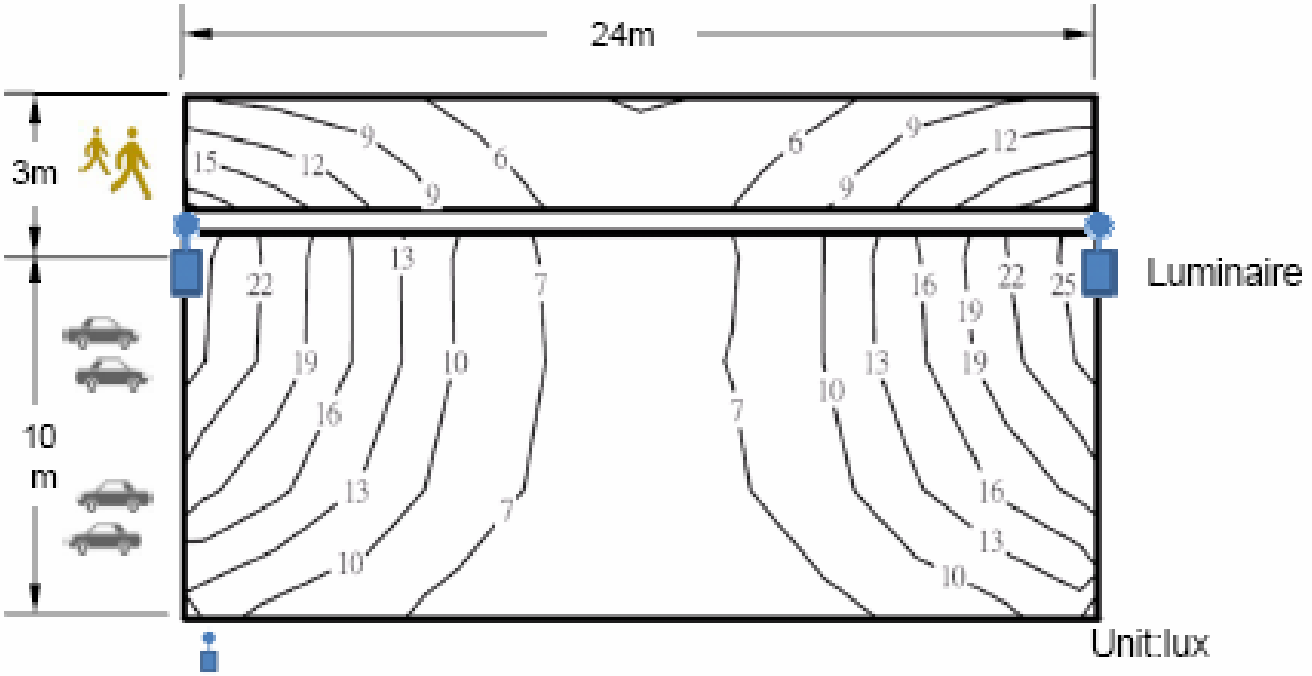
Illumination distribution simulation of Street Light at 8m height



	Avg.(Lux)	Min.(Lux)	Max.(Lux)	Min./Avg.	Min./Max.
Sidewalk	8.66	3.09	18	0.36	0.17
Roadway	12	5.28	24	0.44	0.22

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Thermal Measurement Result

	Ta (℃)	Heat Sink Temperature(℃)						
		T_{S1}	T_{S2}	T_{S3}	T_{S4}	T_{S5}	T_{S6}	T_{S7}
Measurement	24.4	45.7	46.0	45.7	45.6	44.5	46.0	45.2
Ta=30℃ (estimated)	30.0	51.3	51.6	51.3	51.2	50.1	51.6	50.8

Results:

(1) Max. Heat sink base temperature ＜52℃@30 ℃ (with still air) meets requirement.

(2) Heat sink base temperature uniformity≦2℃

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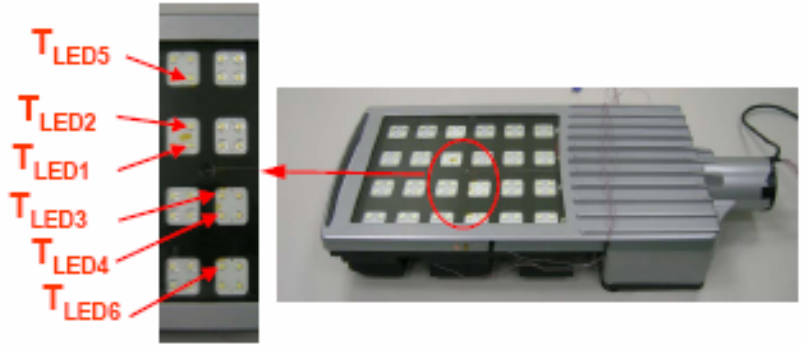
Thermal Measurement Result



	Ta (℃)	LED Leg and Space Temperature (℃)						
		T_{LED1}	T_{LED2}	T_{LED3}	T_{LED4}	T_{LED5}	T_{LED6}	$T_{LED\ Space}$
Measurement	24.4	47.7	47.9	47.8	47.6	47.5	47.3	43.9
Ta=30℃ (estimated)	30.0	53.3	53.5	53.4	53.2	53.1	52.9	49.5

Results:

Nichia NS6W083T(300mA; 3.8V) Rj-c=10℃/W； Max. LED junction Temp.= 120℃

(1) Ta= 30℃, LED Leg Temperature @ 53.5℃； LED junction Temp.= 64.9℃

(2) Ta= 40℃, LED Leg Temperature @ 64.0℃； LED junction Temp.= 75.4℃

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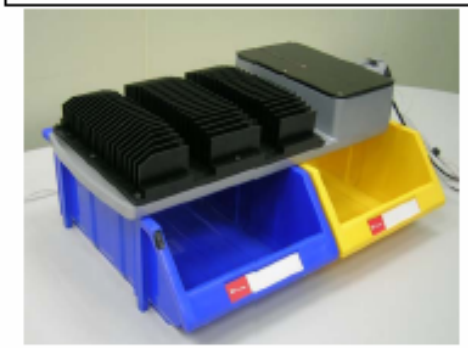
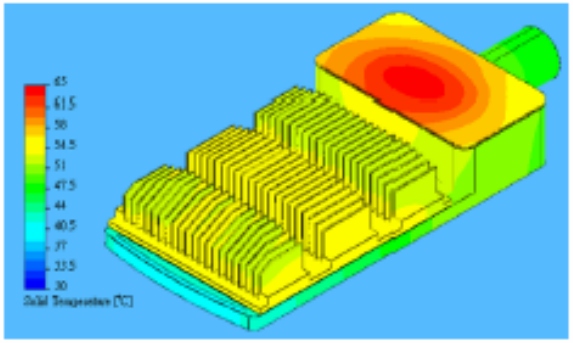
Comparison of Experiment & Simulation

	Experiment	Simulation
Heat Sink Base (mm^3)	360×290×8	360×290×8
Heat Sink Fin (mm^3)	75×70×1.5 (13Fins)	75×70×1.5 (13Fins)
Heat Sink Weight (g)	4000	4010
LED Power (Watt)	96	115.2
Ta(℃)	30	30
Max. Heat sink base Temp. (℃)	51.6	56.3
Rc-a (℃/W)	0.2250	0.2283



Experiment



Simulation

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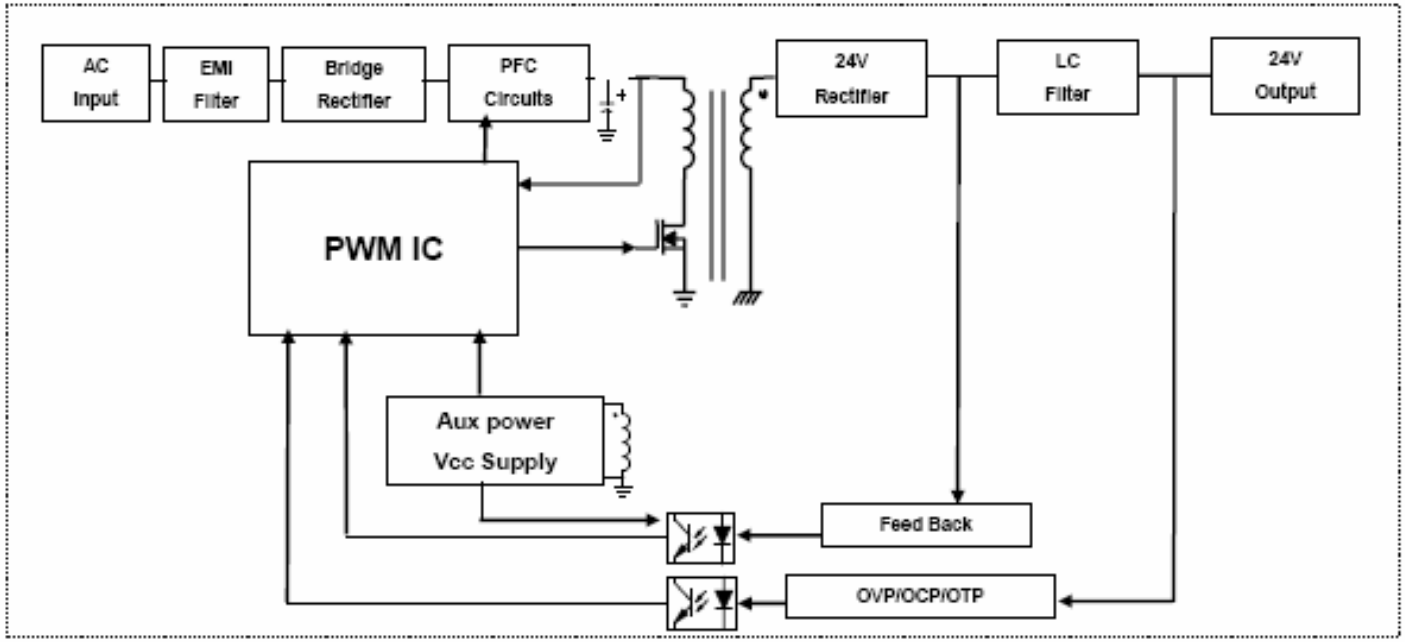
Power Design Feature

- **1. High Power Factor Switching Power design**

High efficiency of AC-DC power conversion with active high power factor circuit design which eliminate unnecessary energy waste and meet most electricity code.



AC-DC High Power Factor Switching Power module design

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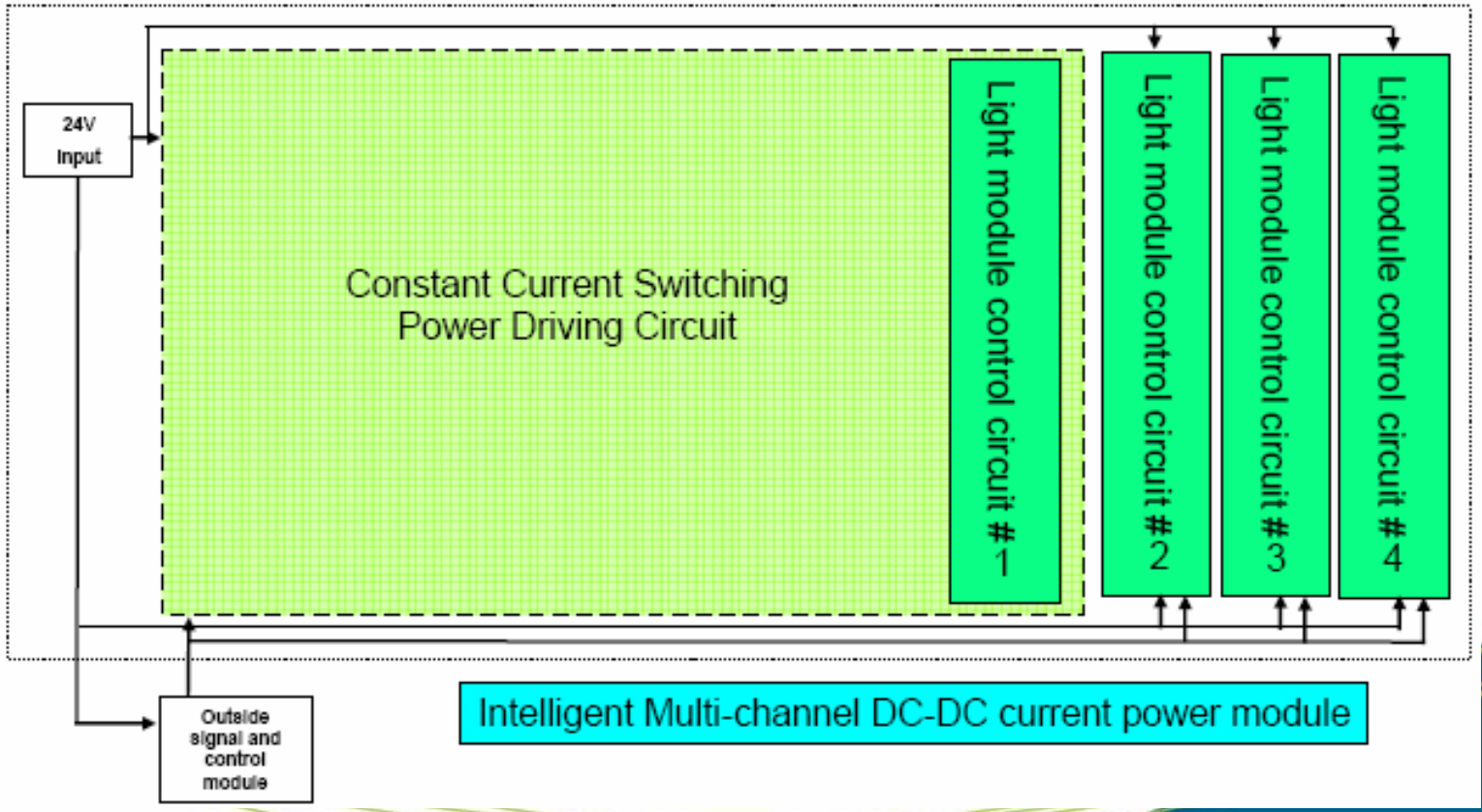
- **2. Multi-channel circuit design (Patent Pending)**

Multi-channel DC-DC true current source design provides constant current to each branch of light modules and therefore guarantees every LED receive the same power during operation.



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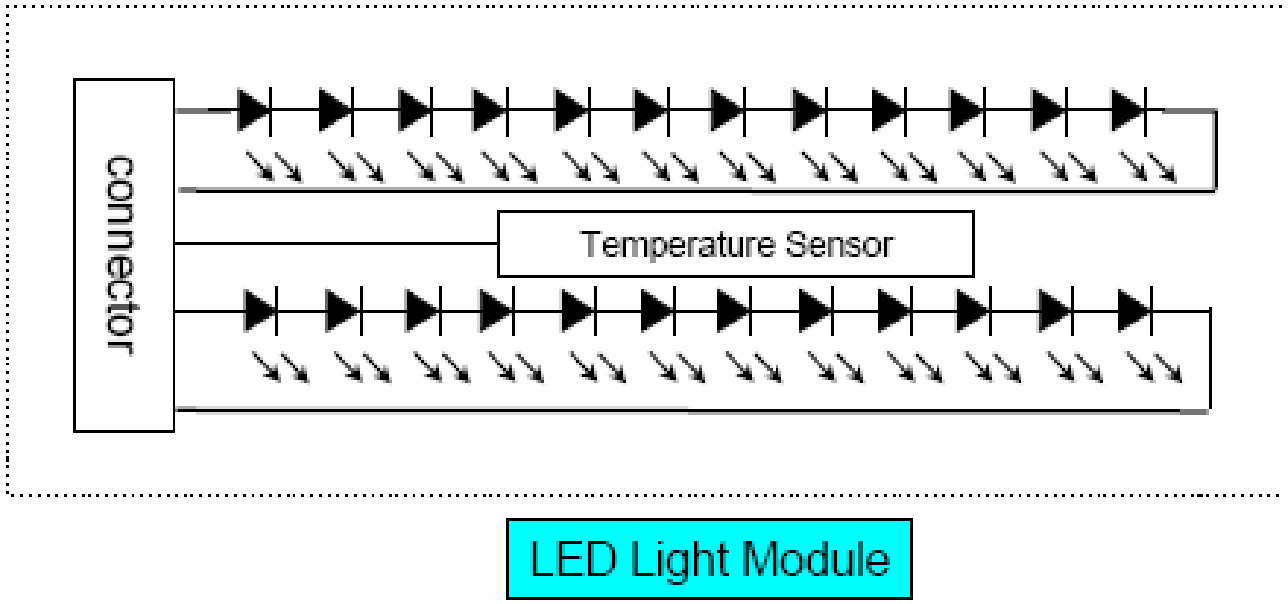
- **3. Automatic Temperature Compensation for power adjustment**

Temperatures of LED light modules are sensed and adjust input LED current automatically to prevent LED light module overheat.



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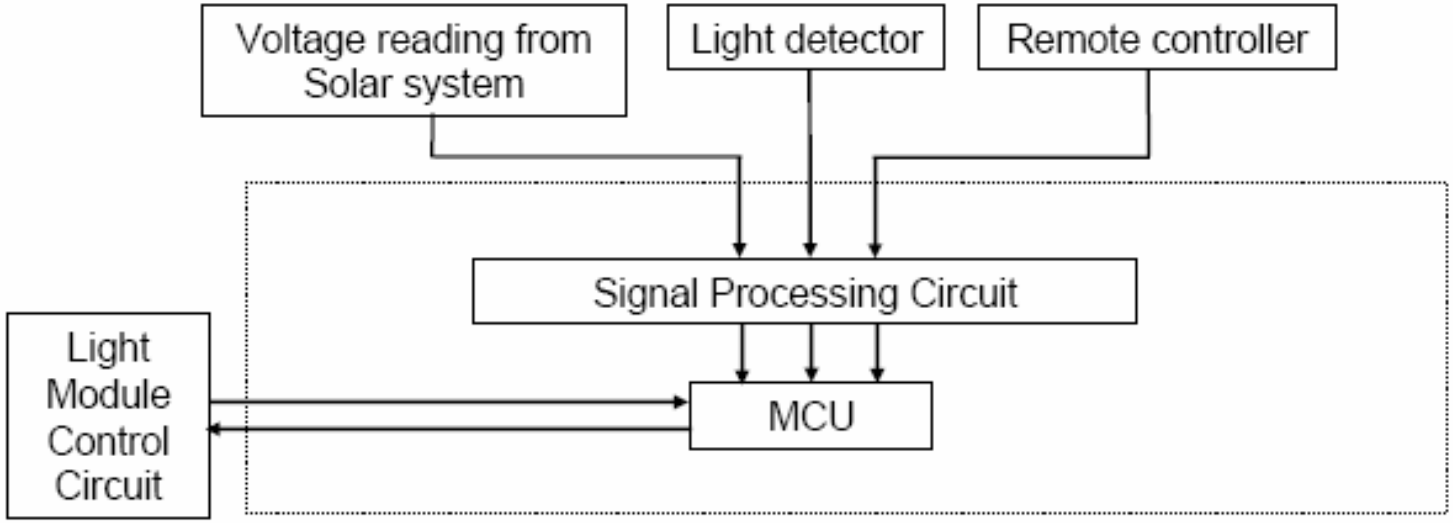
- **4. Intelligent Lighting Control Expandability (Patent Pending)**

Our street lights are designed to compatible with auxiliary control devices, such as Solar-cell power system, light detector, etc. to obtain scheduling, dimming, and/or energy-saving controls.

Moreover, the control unit is expandable for remote or wireless control.



Auxiliary control signal processing circuit diagram

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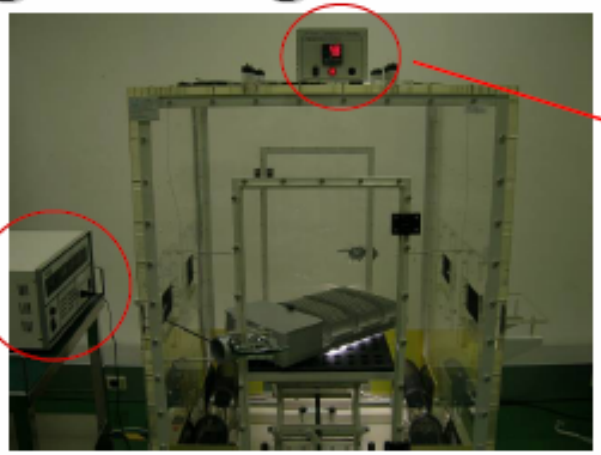
High Voltage Test

AC Power Source(277.0Vac)



Burn-in Box

Burn-in temp in (50℃)

Test Date	Voltage	Input Power	LED Leg Temperature	Adapter Surface Temperature	Ambient Temperature	
2008/05/08	227Vac	113.9Watt	69.7℃	78.6℃	50.0℃	OTP start
2007/12/05	90Vac	124.0Watt	68.1 ℃	71.1℃	45.0℃	
2007/12/05	90Vac	116.7Watt	71.3 ℃	75.9℃	50.0℃	OTP start

☐When environment temp is 50℃，substrate temp ＞70℃，OTP(Over Temperature Protection) will be start.

☐AOP tested on 2007/12/05，when OPT started，LED current reduce about 50mA，Power reduce about 7W。

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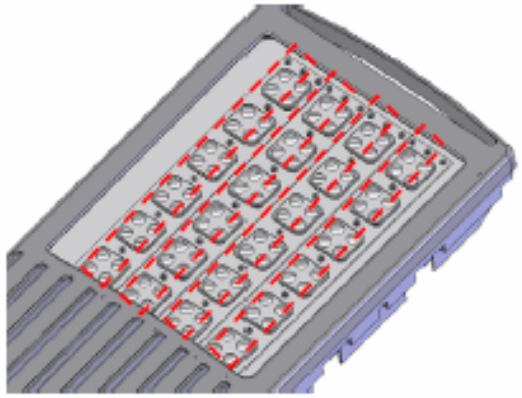
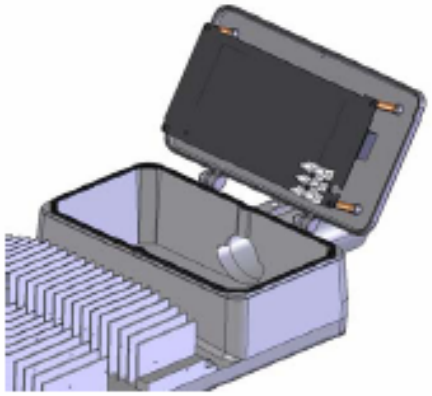
Mechanical Features (Patent Pending)

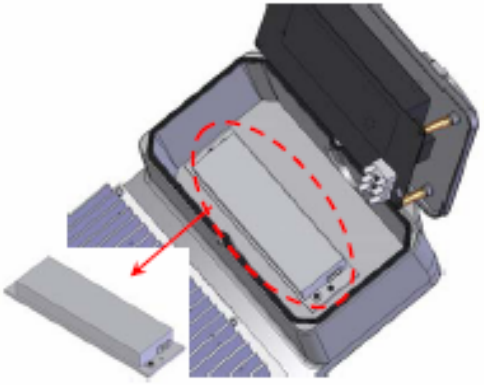
4 independent light modules



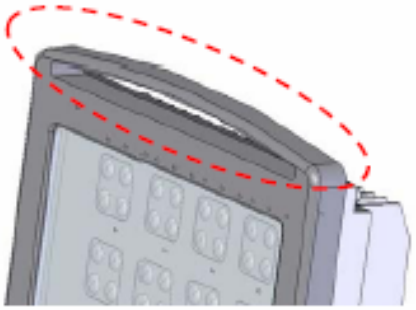
Up-lifted power cover design



IP 65 water-resistance power box



Stylish shape design



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