



Emerging with  HV Bulb<sup>®</sup>

海立爾股份有限公司

**HK** International  
Lighting Fair  
Oct.27-30, 2011  **HK TDC**

# About HV

- HV是High-Voltage之簡稱  
HV stands for High-Voltage.
- HV LED在我司定義上指的是比一般LED晶片本身電壓還有高至少一倍的電壓, 也就是6V以上, 在目前我司應用上有50V, 55V, 60V,與70V藍光晶片與35V紅光晶片組合設計成為135V與270V之球泡燈以因應世界各國電力系統100V至240V之照明應用

HV LED by our definition refers to the operating voltage at least one time higher than the forward voltage of any typical LED chip, which means above 6V. The HV LED chips available at Helipto have forward voltage at 50V, 55V, 60V, and 70V for blue LED chip and 35V for red LED chip to make 135V and 270V HV bulbs that are suitable for 100V to 240V mains power systems in any country.

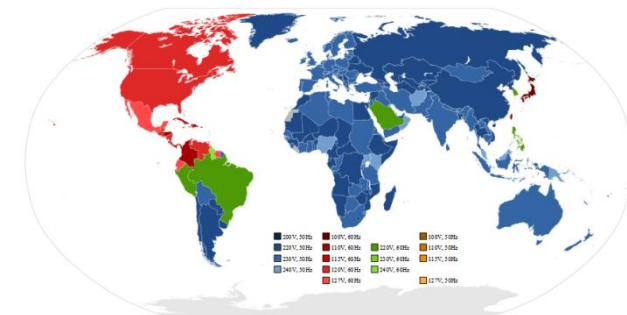
## 各國電力系統參考 Power grid reference

### 100V~120V

巴西 Brazil, 美加 US/Canada, 哥倫比亞 Columbia, 中美洲 Central America, 日本 Japan, 台灣 Taiwan, 委內瑞拉 Venezuela

### 220V~240V

非洲 Africa, 阿根廷 Argentina, 澳洲 Australia, 巴西 Brazil, 智利 Chile, 中國 China, 歐洲 Europe, 香港 Hong Kong, 印度 India, 俄羅斯Russia, 東南亞 Southeast Asia, 南韓 South Korea,



- HV LED與 AC LED和DC LED不同, HV LED是用高壓直流電, AC LED是用高壓交流電, 而DC LED則是用低壓直流電  
HV LED operates under high-voltage and direct current; AC LED operates under high-voltage and alternative current; while DC LED operates under low-voltage and direct current

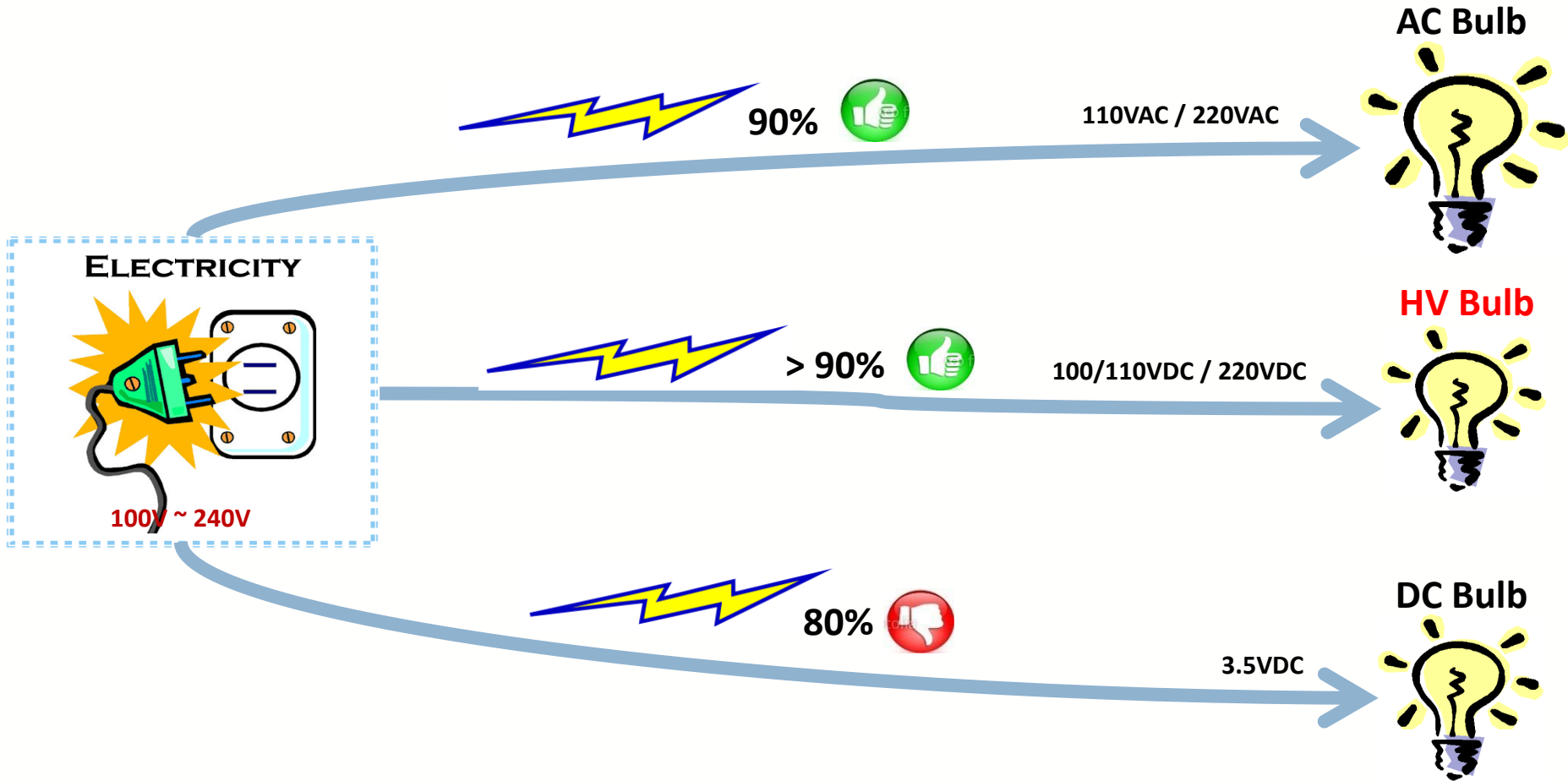


## HV LED之優點 / Advantages of HV Bulb

		AC Bulb	HV Bulb	DC Bulb
1	Transformer	Not needed	Less needed	Needed
2	Driving current	Low	Low	High
3	Additional wire cost	Low	Low	High
4	Driver cost	Lower	Low	High
5	Power factor	0.9	> 0.9	0.5 ~ 0.9
Light engine (#1-#5)		Good	Excellent	Poor
6	Forward voltage	High	High	Low
7	Flicker	Yes	No	No
8	Efficacy	Low	High	High
9	Voltage fluctuation	Yes	No	No
10	Reliability	Good	Excellent	Good
11	Dimming	No	Yes	Yes
LED (#6-#11)		Poor	Excellent	Good
Price/performance ratio as a light bulb		Good	Excellent	Poor
Recommended application		<5W Indoor lighting Candle light	5W~15W Indoor lighting (Light bulb)	>15W Outdoor lighting Indoor lighting (High bay / low bay)



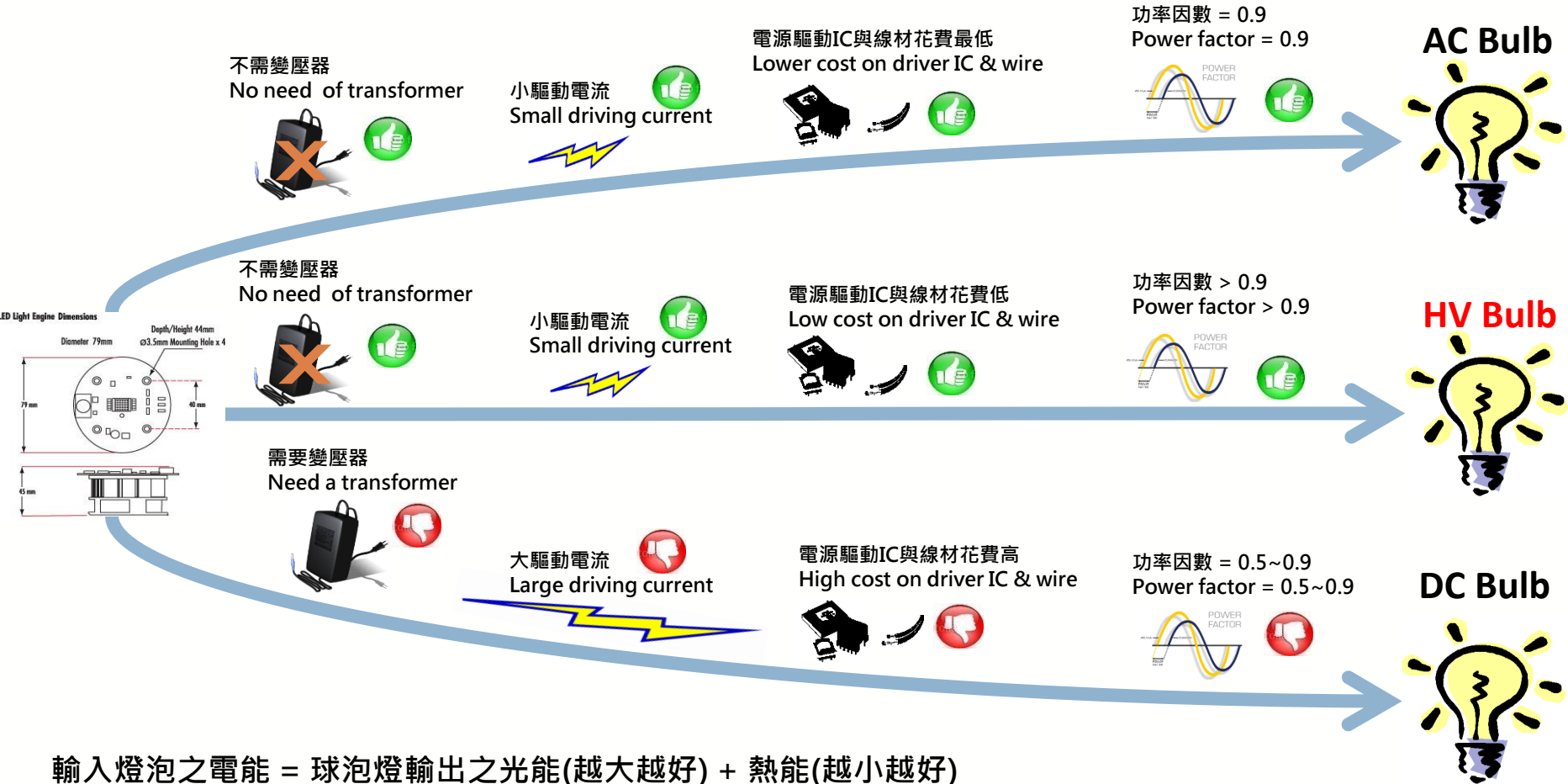
# 經市電系統之能源轉換 Power efficiency via mains electricity



從電力系統接受之電能 = 輸入燈泡之電能 (越大越好) + 電力轉換損失 (轉換效率越高越好)  
 Input power from mains system = input power to light bulb + energy loss due to power conversion  
 >> Higher power efficiency means lower energy loss due to power conversion



# 球泡燈電源模組之比較 Comparison among light engines (power modules)



輸入燈泡之電能 = 球泡燈輸出之光能(越大越好) + 熱能(越小越好)  
 Light bulb: Electrical input power = Optical output power (max.) + heat (min.)



# 球泡燈LED晶片之比較 Comparison among LED chips

交流電壓導致發光閃爍且不可調亮度  
Flickering light & no dimming



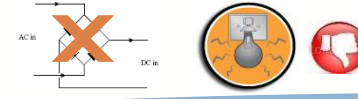
高順向偏壓  
High forward voltage



低發光效率  
Low luminous efficacy



不能承受電力系統電壓不穩定因無穩壓元件做橋整  
Cannot endure power-line flicker due to lack of bridge rectifier to absorb voltage fluctuation



AC Bulb



定電流發光不閃爍且可改變電壓調整亮度  
Stable & dimming light



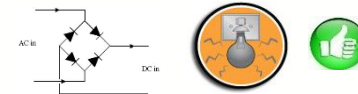
高順向偏壓  
High forward voltage



高發光效率  
High luminous efficacy



能承受電力系統電壓不穩定因有穩壓元件做橋整  
Can endure power-line flicker due to installed bridge rectifier to absorb voltage fluctuation



HV Bulb



定電流發光不閃爍且可改變電壓調整亮度  
Stable & dimming light



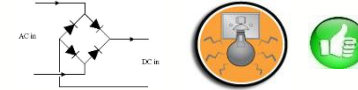
低順向偏壓  
Low forward voltage



高發光效率  
High luminous efficacy



能承受電力系統電壓不穩定因有穩壓元件做橋整  
Can endure power-line flicker due to installed bridge rectifier to absorb voltage fluctuation



DC Bulb



輸入燈泡之電能 = 球泡燈輸出之光能(越大越好) + 熱能(越小越好)

Light bulb: Electrical input power = Optical output power (max.) + heat (min.)

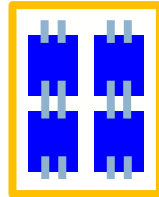




# LED晶片之比較 Comparison among LED chips

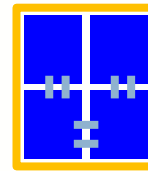
空間需要  
Space requirement

DC LED (low power)



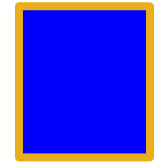
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HV LED



=

DC LED (high power)



輸出光能  
Optical output

多晶片結構所以發光表面積較大  
Extra light from the sides

=

發光面積多了晶片內側溝面發光  
Extra light from trenches

>

只有正面及側面等表面可發光  
No extra light

信賴性/可靠度  
Reliability

多晶片結構所以需要為增加許多打線需求的複雜性導致信賴性降低  
The risk of poor reliability in multiple chips packaged devices over the packaging process should be much higher than those deemed single HV chip packaging due to "MORE" wire bonding required, which is the major process causing the reliability issue.

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晶片結構單純而可減少打線需求從而確保高信賴性  
High reliability due to less wire bonding required for chip package.

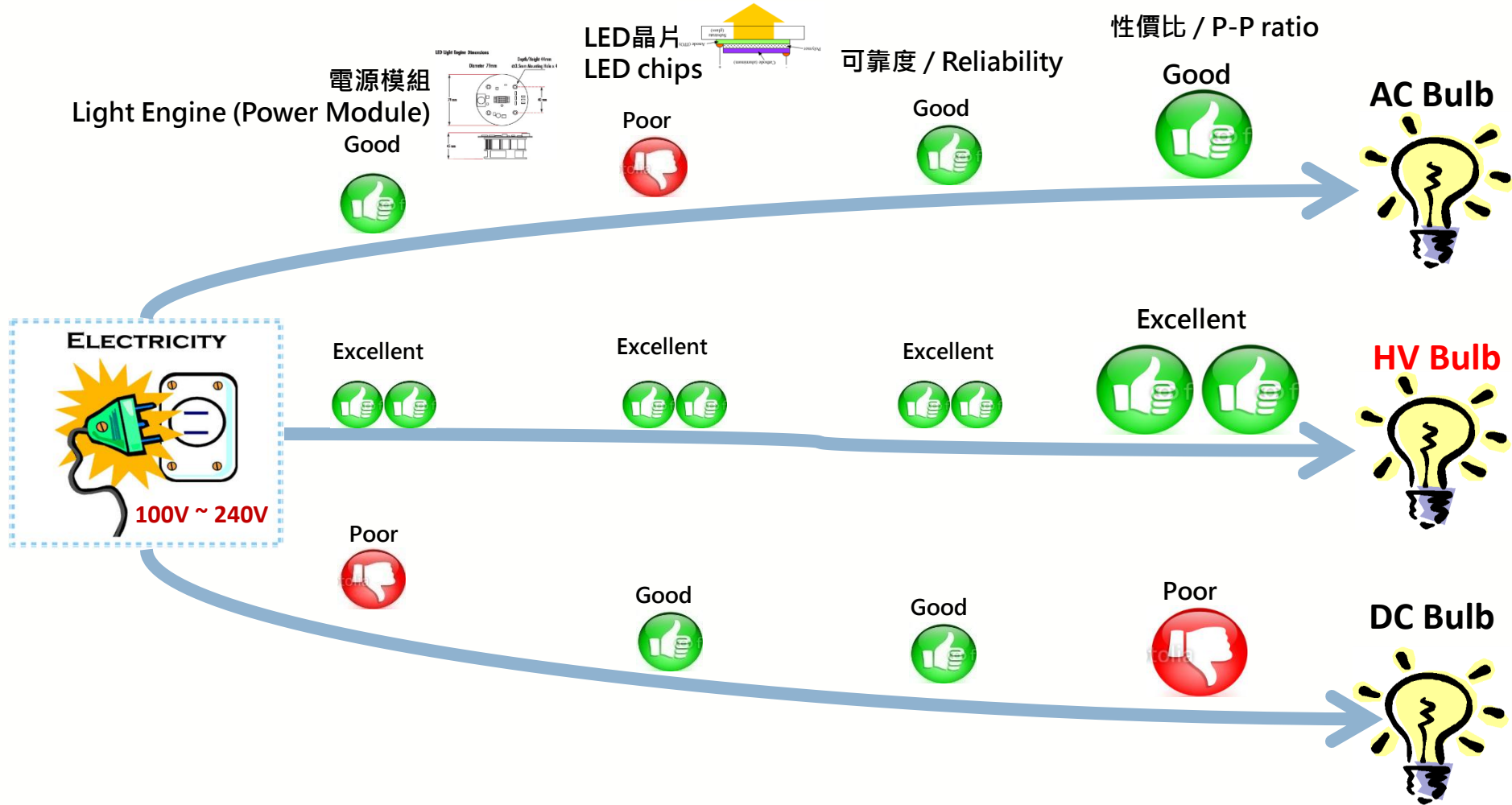
=

晶片結構單純而可減少打線需求從而確保高信賴性  
High reliability due to less wire bonding required for chip package.





# 性價比較 / Comparison of Price/performance







## HV球泡燈之優點 / Advantages of HV Bulb

- HV球泡燈不須外加變壓器而能支援各國100V~240V之電力系統 (DC球泡燈不行)  
Unlike DC bulb, HV bulb does not need external transformer to support 100V~240V mains systems around the world.
- HV球泡燈為定電流線性系統所以不會有閃爍問題, 且可調亮度並有極佳的可靠性 (AC球泡燈不行)  
Unlike AC bulb, HV bulb is a constant current linear system that can overcome power-line flicker due to voltage fluctuation and is able to adjust brightness for dimming purpose. In addition, it has excellent reliability.
- HV球泡燈因為是高壓低電流所以在導電線材, 驅動電源IC, 及散熱材料上所需較低, 從而可以縮小尺寸, 節省能源及成本, 並可安裝在狹小空間的地方  
Because HV bulb adopts high voltage and low current mechanism, it requires less cost on wires, driver IC, and heat sink. This means the circuit board can be down-sized in small form-factor to fit in confined areas.
- HV球泡燈有高發光效率, 高功率因子與總和來說最佳的性價比  
HV bulb has high luminous efficacy, high power factor and overall the best price/performance ratio.





## HV球泡燈之9999宣言 9999 statement from Helipto HV Bulb

- A19球泡燈  
A19 type light bulb
- 功率因子大於0.9  
Power factor over 0.9
- 發光效率 每瓦流明大於90  
Luminous efficacy over 90 lumens per Watt
- 演色性係數大於90  
CRI (color rendering index) over 90





## IP簡介 / Introduction of IP owned by Helipto

- 海立爾擁有全世界合計超過50項專利  
Helipto owns more than 50 patents around the world (awarded and pending combined).
- 海立爾之美國HV LED已於今年核定,專利案號是US791039582  
The HV LED patent has been awarded in US in 2011. The patent number is US791039582.
- 海立爾有取得日本根本特殊化學之螢光粉特許授權  
Helipto is licensed and authorized to use the Nitride series phosphor from Japan-based NEMOTO.
- 海立爾擁有之專利遍及晶片設計,螢光粉,封裝技術,基板,被動元件,及OEIC整合元件  
The patents owned by Helipto lies across the fields of LED chip design, phosphor, package, substrate, passive components, and OEIC.





## IP簡介 / Introduction of IP owned by HELIOPTO –(1)

專利名稱	申請案號	專利証號	申請國別
次粘著基臺式及具有阻抗元件的高壓發光二極體晶片 High-voltage LED chip that is submounted type and with impedance components	200610099185.1	651824	中國
具多段臨界電壓之高壓發光二極體電路及其二極體發光裝置 High-voltage LED and the circuit with multi-critical forward voltage	PCT/CN2006/001938 095124785		PCT 中華民國
發光二極體結構 The structure of light emitting diodes	200610127425.4 PCT/CN2006/002379 095133557 12/441,204	553008 1328886 7,910,395	中國 PCT 中華民國 美國
熱電分離式之發光二極體燈泡結構 The structure of LED bulb with separated thermo and electronic design	098114403		中華民國
插件式、具有散熱件、熱電分離式的發光二極管燈泡結構 The structure of LED bulb that is inserted, with heat sink, and separated thermo and electronic design	200610127426.9 PCT/CN2006/002380 12/441,214		中國 PCT 美國
具散熱件之發光二極體燈泡結構 The structure of LED bulb with heat sink	095133556	I316771	中華民國
具有多層光學透鏡的發光二極管的製造方法及其結構 The making method and the structure of LED with multi optical lens	200710151726.5 PCT/CN2007/002829 096134740 12/664,061	692168	中國 PCT 中華民國 美國



## IP簡介 / Introduction of IP owned by HELIOPTO –(2)

專利名稱	申請案號	專利証號	申請國別
可提升出光效率之發光二極體座體結構 The structure of LED slug that can increase light extraction rate	200810009315.7 PCT/CN2008/000356 097104152		中國 PCT 中華民國
無光暈之發光二極體座體結構 The structure of LED slug with no halo	200810004232.9 PCT/CN2008/000166 097101752 12/745,974	747705	中國 PCT 中華民國 美國
並聯橋式及高壓並聯橋式電路結構 The circuit structure of parallel series with bridge diodes and high-voltage parallel series with bridge diodes	200810090479.7 PCT/CN2008/000779 097113007 12/937,784		中國 PCT 中華民國 美國
可撓式背光模組結構 The structure of flexible backlighting module	200810126096.0 PCT/CN2008/001290 097123808 12/990,068		中國 PCT 中華民國 美國
具有埋入式電容之發光二極體座體結構 The structure of LED slug with inserted capacitor	200810134641.0 PCT/CN2008/001453 097129740 13/003,702		中國 PCT 中華民國 美國
單透鏡下多顆發光二極體晶片之多域排列方法 The method of multi-zone permutation for multi-LED chips with single lens	200810161420.2 PCT/CN2008/001641 097135236 13/057,183		中國 PCT 中華民國 美國





## IP簡介 / Introduction of IP owned by HELIOPTO –(3)

專利名稱	申請案號	專利証號	申請國別
交流發光二極體結構 The structure of AC LED	200810148871.2		中國
	PCT/CN2008/001698		PCT
	097139050		中華民國
	200810145819.1		中國
	PCT/CN2008/001432		PCT
	097129738		中華民國
軸對稱發光二極體之製造方法 The method of manufacturing axial symmetric LED	13/003,714		美國
	200810211444.4		中國
	PCT/CN2008/001640		PCT
	097135238		中華民國
智慧型投射燈結構 The structure of intelligent spotlight	13/054,272		美國
	098301179		中華民國
	200920145778.6	1371253	中國
具有過載保護的交流發光二極管結構 The structure of AC LED with overloading protection	098205797	M365436	中華民國
	200910130391.8		中國
	PCT/CN2009/000378		PCT
用以產生白光之發光二極體結構 The structure of LED for white light	098111082		中華民國
	200910143010.X		中國
具有具孔隙之電路基板之發光二極體及其電路基板結構 The structure of printed circuit board with small openings for the LED	098116672		中華民國
	098125465		中華民國





## UL認證簡介及其優點 / Introduction of UL certification

- **UL認證是由美國Underwriters Laboratories公司所頒發**  
UL certifications are issued by US-based Underwriters Laboratories
- **海立爾之AC LED有UL認證**  
The AC LED package from Heliopto is UL certified.
- **海立爾之HV LED有UL認證**  
The HV LED package from Heliopto is UL certified.
- **海立爾之HV Ceramic系列集成封裝體即將有UL認證,所以可以確保球泡燈成品可以達到UL認證等各國安規需求**  
The HV Ceramic Series (COB package) from Heliopto is soon be UL certified. This can assure the Heliopto HV Bulb can pass all kinds of regulation in any country.





## HV產品規格 / Specs of HV products

- ✓ Saving energy and cost reduction from transformer
- ✓ UL certified
- ✓ Easy adaption for existing dimming circuit
- ✓ Compact design



### HV series

Product	Color	Luminous flux	CCT	CRI	Forward Current	Forward Voltage
HMD5-E1LW	White	100 lm / 140 lm	5000-10000K	70	20mA / 30mA	50V
HMD5-E1LV	Warm White	80 lm / 110 lm	2650-3650K	80	20mA / 30mA	50V
HMD6-E1LW	White	90 lm / 125 lm	5000-10000K	70	20mA / 30mA	60V
HMD7-E1LW	White	90 lm / 120 lm	5000-10000K	70	15mA / 20mA	70V

### HV Ceramic series

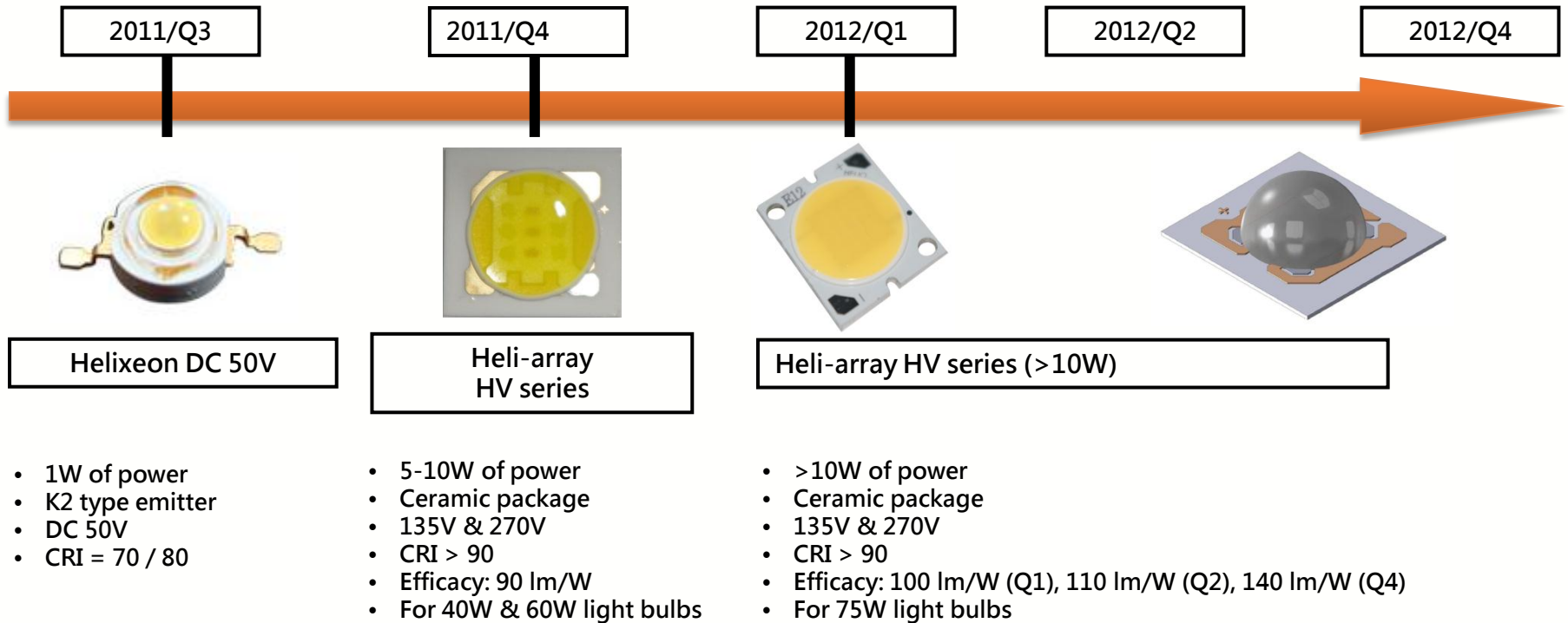
Products	Luminous flux	CCT	CRI	Forward Current	Forward Voltage	Suitable to Replace Incandescent Light Bulb
HAHV-2701	550 lm / 825 lm	2650-3650K	90	20mA / 30mA	270V	40W (460 lm)
HAHV-1352	540 lm / 750 lm	2650-3650K	90	40mA / 60mA	135V	40W (460 lm)
HAHV-1353	850 lm / 1120 lm	2650-3650K	90	60mA / 90mA	135V	60W (890 lm)
HAHV-2704	1200 lm / 1700 lm	2650-3650K	90	40mA / 60mA	270V	75W (1180 lm)







## HV產品發展計畫 / Roadmap of HV products





# UV產品發展計畫 / Roadmap of UV products

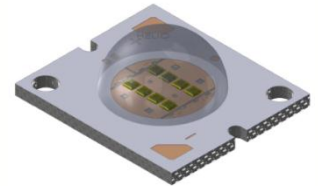
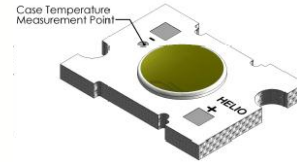
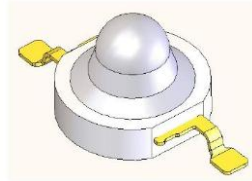
2011/Q2

2011/Q3

2011/Q4

2012/Q2

2012/Q4



HMEP-E1LU

HMEP-C1LU

HMEP-E1FU

HV UV COB

HV UV COB

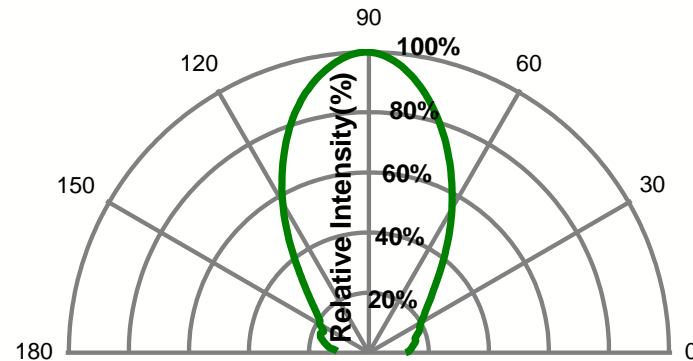
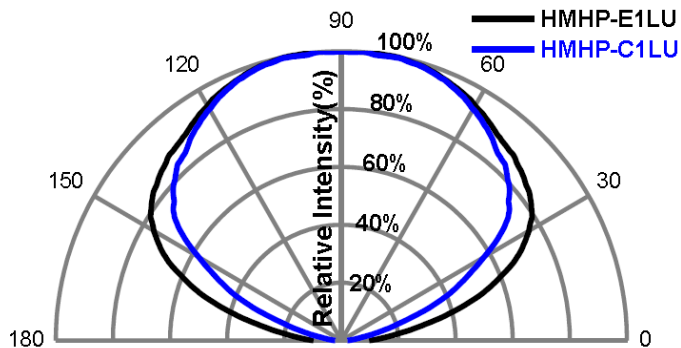
View angle: 155°

View angle: 120°

View angle: 70°

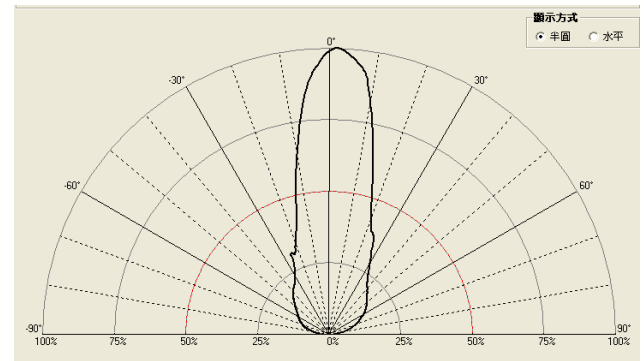
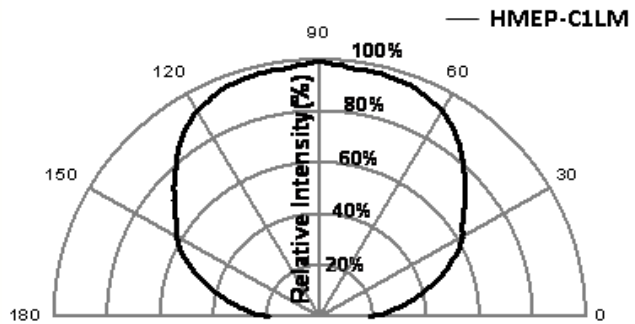
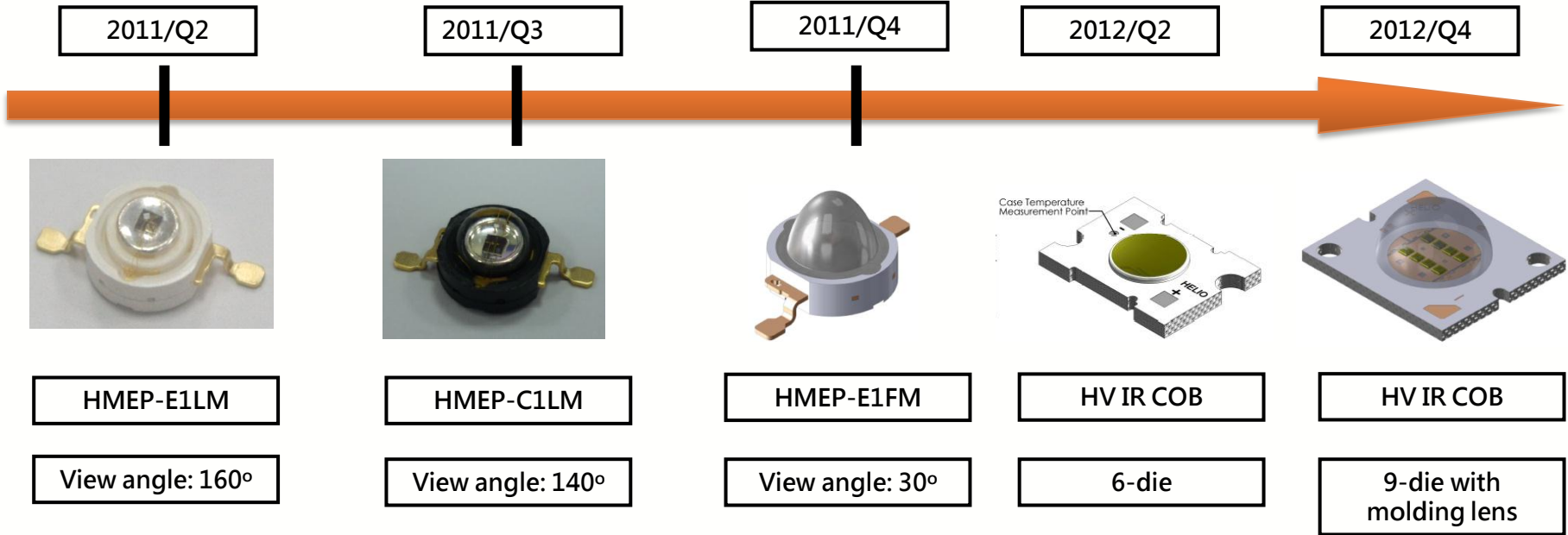
6-die

9-die with molding lens





# IR產品發展計畫 / Roadmap of IR products





## Chips & Engine / 晶片與模組

- 透過海立爾,我們將可滿足貴司在照明市場上所需要的任何特定應用需求. 如果海立爾現有的產品無法完全滿足貴司的應用需求,我們可以提供客製化服務在晶片端,封裝體端,模組端,或是成品端上與海立爾的策略夥伴合作來完成您的需求.

With Helipto Lighting Solution Service, you partner with Helipto and we may actualize your need in any particular application need in lighting. If the current off-the-shelf products offered from Helipto cannot meet your demand, we may develop the LED package, light engine module, or finished products as per ODM project to serve you.

- 在比較極端的情況下,如果市場現有之LED晶片無法滿足您的應用需求,我們可以進行NRE以及採購協議的方式來進行開案. 不同於其他的LED封裝廠,海立爾並不自限於僅提供封裝產品服務,因為我們有紮實的研發實力在LED晶片設計,螢光粉,封裝製程,基板,被動元件及光機熱電整合元件

To go to the extreme case, if the current LED chips available cannot meet your application need, with your commitment in the form of NRE agreement, and perhaps purchase agreement, we may initiate a customized chip design and manufacturing project to fulfill your demand. None like any other LED package supplier, Helipto can answer any kind of customization request from you because we possess solid in-house know-how for the whole supply chain and even owns significant patents in chip design, phosphor, encapsulant, substrate, passive component and even the future trend OEIC.

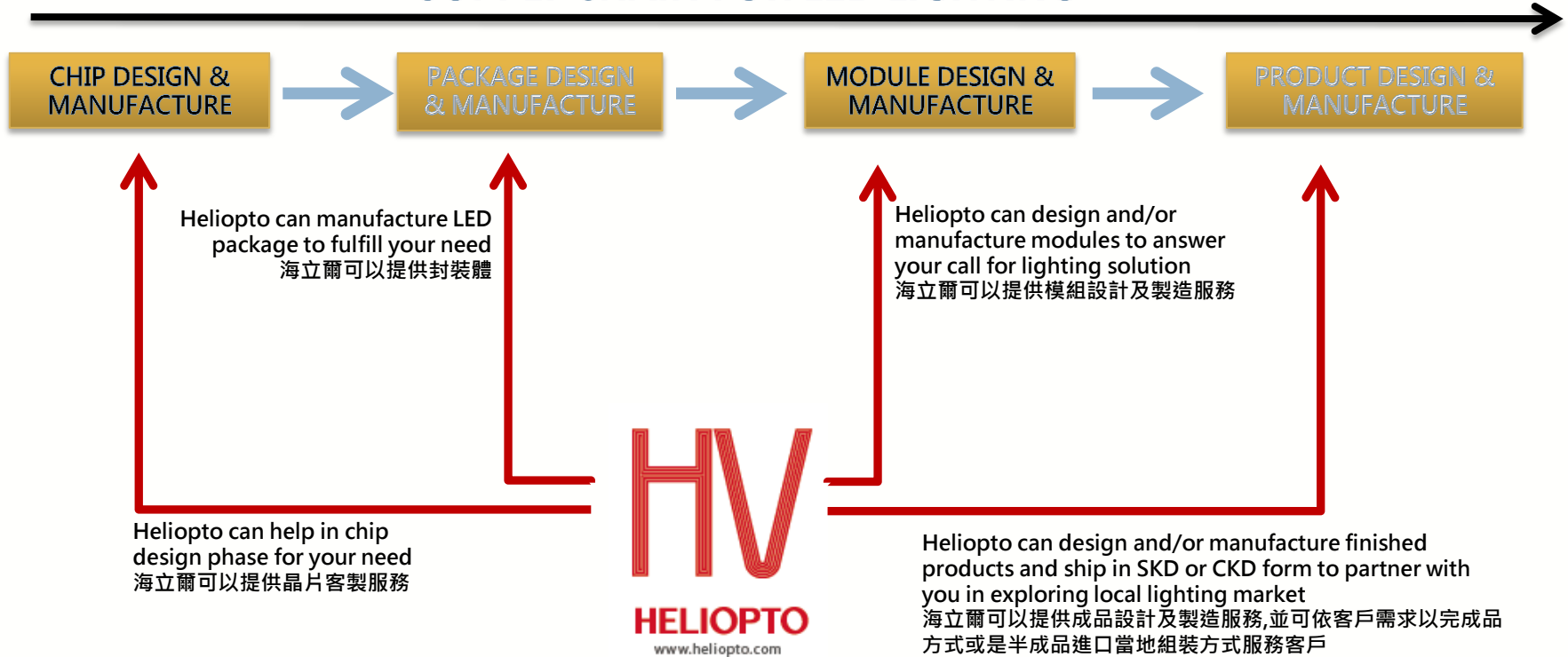
- 海立爾的策略夥伴包含第一流的HV晶片供應商及模組設計公司以提供客戶端最完整的HV應用產品服務  
Helipto has first class partners in HV chips and module design and manufacture to ensure you the best products in lighting applications.





## Business model / 商業合作模式

### SUPPLY CHAIN FOR LED LIGHTING



At Helipto, we can provide you the lighting solution to fit your need at any phase of product development, whether it is at chip phase, package phase, module phase or finished product phase. With Helipto, you literally have your own supply chain in LED lighting that can answer the call from your market. Let us work together to fight against the giants. With your commitment, together we can win it big time!

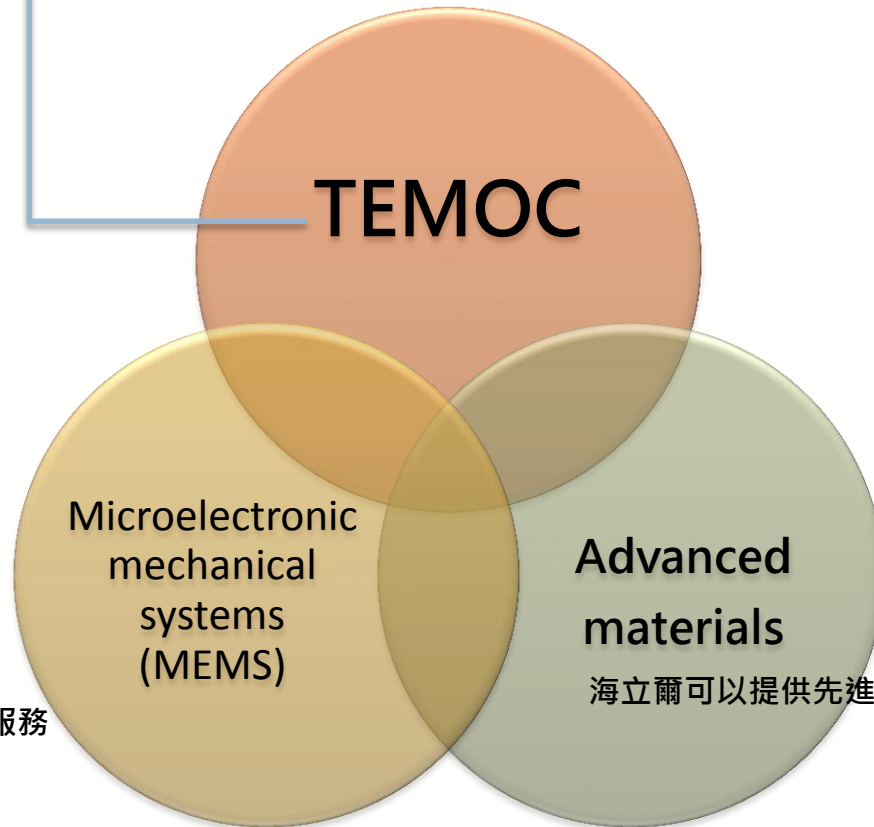




## Chips & Engine / 晶片與模組

Thermo management, Electrical scheme,  
**M**echanical refinement, **O**ptical optimization,  
and IC **C**ontrol

海立爾可以提供光機熱電及控制之整合服務



海立爾可以提供微機電系統設計服務

海立爾可以提供先進材料應用製程服務





## 與他家產品比較 / Comparison to others –(1)

### Red/Amber/Green/Blue 單色光

- 350mA & 700mA (able to drive up to 1A)

### IR (730nm/850nm/940nm) 紅外光

- 550mW, rival to 歐司朗 Osram (艾笛森 Edison: 300mW)
- Capable of overdrive to 1.5A (艾笛森 Edison: up to 700mA)

### UV (395~410nm) 紫外光

- 350mW, rival to 日亞化學 Nichia & 三菱 Mitsubishi (台廠平均TW avg. 175~200mW)

### AC (100V~240V)

- 2<sup>nd</sup> in the world to get UL certification (after Seoul Semiconductor) 在漢城半導體後全球第二取得UL認證

### HV (50V/55V/60V/70V)

- 50V – 100 lm/W (飛利浦 Philips: 80 lm/W), CCT: 5000K-plus, 20mA
- UL certified in package & light engine form / 封裝體及光模組通過UL認證
- Ceramic series (135V/270V) soon to be UL certified in COB module form
- Warm-white – CCT: 2650K~3650K, CRI: 90, Luminous Efficacy>90 lm/W,



## 與他家產品比較 / Comparison to others –(2)

- 能提供最完整的光譜波長及光形分布給客戶選擇  
Able to provide the most product coverage in terms of wavelength spectrum and typical spatial distribution for view angle.
- 海立爾的HV及AC封裝體有UL認證,他家則無  
UL certified in HV and AC package while others do not have the UL certification.
- 海立爾在HV封裝測試方面掌握許多億光及艾笛森沒有的知識  
HV package requires unique know-how in packaging & testing phases because HV chips adopts different processes to make while Everlight & Edison do not possess such knowledge.
- 海立爾的研發團隊了解晶片設計,封裝技術,模組設計,與成品開發可提供客戶端最完整的HV應用產品服務  
Possess the know-how in chip design, package design, module design, and product design to fulfill any need for customization, a unique service called Helipto Lighting Solution Service.
- 海立爾可因應各地客戶之當地電壓需求開發獨特產品  
Can help clients to customize LED chip to meet specific voltage requirement in difference local market.







## 與他家產品比較 / Comparison to others –(3)

- 能協助客戶客製各式光形分布以因應特定照明應用  
Can help client to customize any spectral power distribution to meet specific requirement for any application.
- 飛利浦有專利及高發光效率,但在光型分布及微型透鏡上較弱  
Philips Lumileds has IP and good efficacy, but not so good at relative spectral power distribution and weak at micro lens.
- 普瑞在微型透鏡技術上不錯,但尚無HV產品  
Bridgelux is good at micro lens, but does not offer HV solution yet.





## R&D人員背景 / Background of Helipto R&D heads



**Carter Chen**

General Manager (CEO)

HV LED Project Leader,  
Optoelectronics Research Lab,  
ITRI Taiwan  
經濟部工研院高壓LED計畫主持人



**Dr. W.T. Cheng**

Senior Advisor

▶ Vice President at UniLite  
▶ R&D Director at Walsin Lihwa 華新麗華



**Dr. C.J. Pan**

VP, R&D

▶ Department of Physics, National Central University  
國立中央大學





## 對市場看法 / Market analysis –(1)

- 過去鎢絲燈與節能燈多由奇異,飛利浦,歐司朗寡占. 現在最大LED燈具商也僅佔市場的10%,而非寡佔市場,所以大家都還有機會能一別高下

It will be possible to see large demand for LED general lighting market in next year. Incandescent, fluorescent and energy-saving lamp market was largely GE, Philips and OSRAM monopoly of a few other different suppliers, today the largest supplier of production of LED lamps lighting lamps represent only about 10% of the market, that is not LED general lighting market, a monopoly market, we all have a chance to play in it.

- 晶電預估在2011年取代60W鎢絲燈之LED球泡燈街頭價可能在美金9.90,甚或降至美金7.50. 全球照明市場增加1~2%應用LED燈具就是美金400億的商機

Epistar's speculation that by 2011 60W LED bulb will be USD\$9.90. and will drop to USD\$7.50, that would be about 5 times of the incandescent bulb with a penetration rate of 10%. The World's LED penetration increases 1-2% that will be approximately USD\$40B business.

- 目前狀況是暖白燈比冷白燈貴,而暖白燈比冷白燈少三成亮度,所以如何增加暖白燈的發光效率並降低成本會是具體增加LED照明應用之市場佔有率的關鍵

Current situation is that the current cost of warm white LED is higher than cold white, whereas warm white is 30% less bright as cold white. Therefore, the efficacy and cost of warm white over cold white is the key factor for a higher penetration of general light application.





## 對市場看法 / Market analysis –(2)

- 當LED球泡燈只是鎢絲燈價格之兩倍時,市場預期可大至25%的取代率

When the LED replacement bulb is just two times the price of incandescent, that the market to accept LED will be going up to 25% of adoption rate.

- LED通用照明市場將是今天LED TV市場的5~10倍

The market size of LED general lighting is expected to be 5 to 10 times of the LED TV.

- 高壓LED相比低壓LED有兩大明顯競爭優勢：第一，在同樣輸出功率下，高壓LED所需的驅動電流大大低於低壓LED，因此同樣輸出功率的高壓LED在工作時耗散的功率要遠低於低壓LED，這意味著散熱鋁外殼的成本可大大降低。第二，高壓LED可以大幅降低AC到DC轉換效率損失，輸入和輸出壓差越低，AC到DC的轉換效率就越高，可見如採用高壓LED，變壓器的效率就可以得到大大提高，從而可大幅降低AC到DC轉換時的功率損失，這一熱耗減少又可進一步降低散熱外殼的成本。

Two significant advantages for HV bulbs over DC bulbs. First, at the same power output, the driving current for HV bulb is a lot less than DC bulb, which means less power conversion loss and leads to lower cost in aluminum heat sink. Second, HV LED can greatly reduce the loss of power conversion from AC to DC because the difference between input voltage and output voltage is small. The transformer's power factor increases significantly and this also leads to lower cost on heat sink.





## 對市場看法 / Market analysis –(3)

- 由於散熱鋁外殼的成本是LED照明燈具的主要成本組成部分之一，鋁外殼成本有效降低也意味著整體LED照明燈具成本的有效降低。由此可見，高壓LED可以帶來LED照明燈具成本和重量的有效降低，但其更重要的意義是大幅降低了對散熱係統的設計要求，從而有力掃清了LED照明燈具進入室內照明市場的最大技術障礙。因此，高壓LED將主導未來的LED通用照明燈具市場。

Because the aluminum heat sink is one of the major component cost, lower cost on the heat also means lower weight of the bulb which can lead to lower transportation cost. Overall, the HV bulb can save cost and weight so we believe it can dominate the general lighting market.





## 與晶電之關係 / Relation to Epistar

- 晶元光電為海立爾之晶片代工廠

Epistar is the chip supplier for Helipto that can provide customization service.

## 徵求代理商 / Partners & distributors wanted

- 海立爾徵求世界各地的代理商以拓展當地市場

Helipto welcomes distributors in any country to join with us.

- 海立爾歡迎各地擁有通路之照明應用廠商加盟Helipto Lighting Solution Service

Helipto welcomes any lighting application provider that owns local channels to participate in Helipto Lighting Solution Service and partner with us.

