



SEOUL SEMICONDUCTOR



**Acrich**

**AC Outdoor Solution**

首尔半导体株式会社

# ○ **ACRICH AC Outdoor Solution**

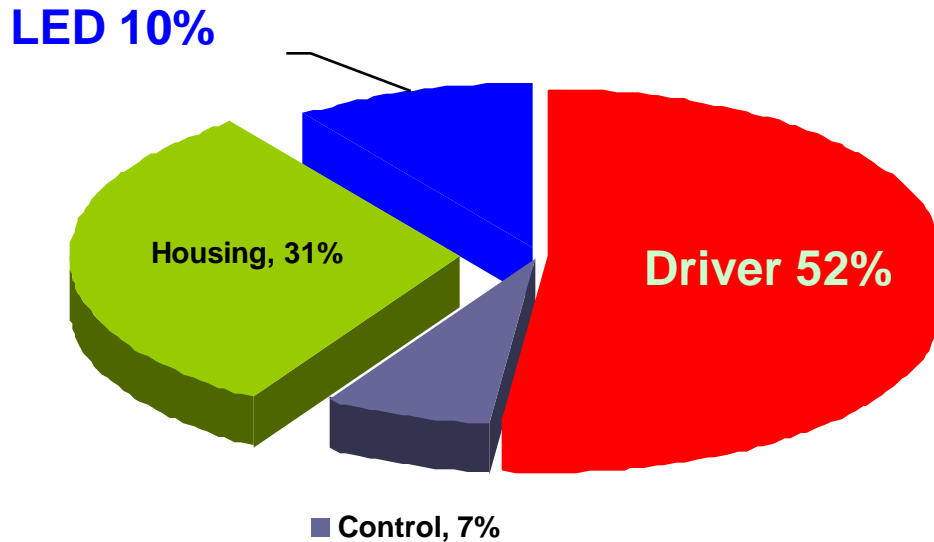
- **Outline of ACRICH Outdoor Solution**
- Introduction of MJT and AIC
- MJT LED for Outdoor Solution
- Principle of ACRICH 2+ Solution
- Acrich2+ Module of Outdoor Application
- Success Story



# ACRICH2 - Really no need of driver!!

According to study, **52% of Failure** comes from Driver

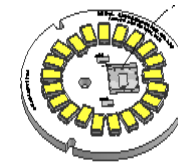
Failure Distribution



<Source : DoE workshop in July-2012>

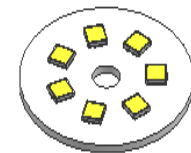
Life time

*Acrich solution DC solution*



50,000Hrs

87,000Hrs



50,000Hrs

15,000Hrs



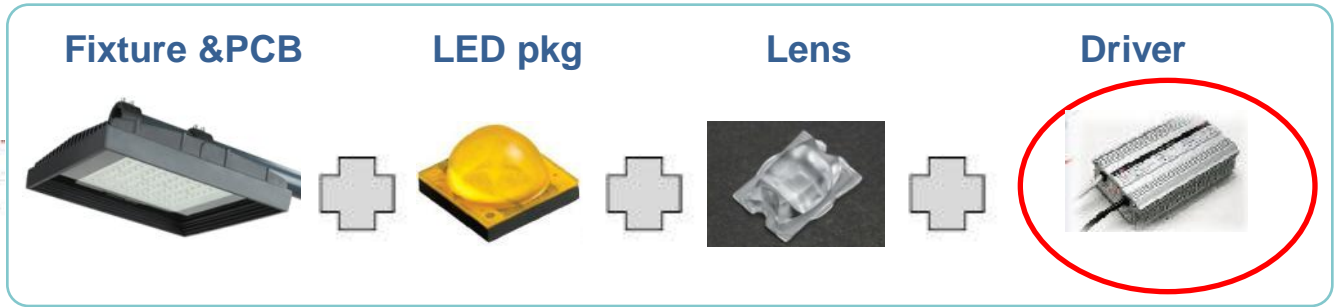
**System life time**

50,000 Hrs Vs. 15,000 Hrs

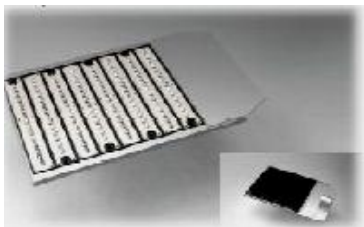
# ACRICH2 - Really no need of driver!!



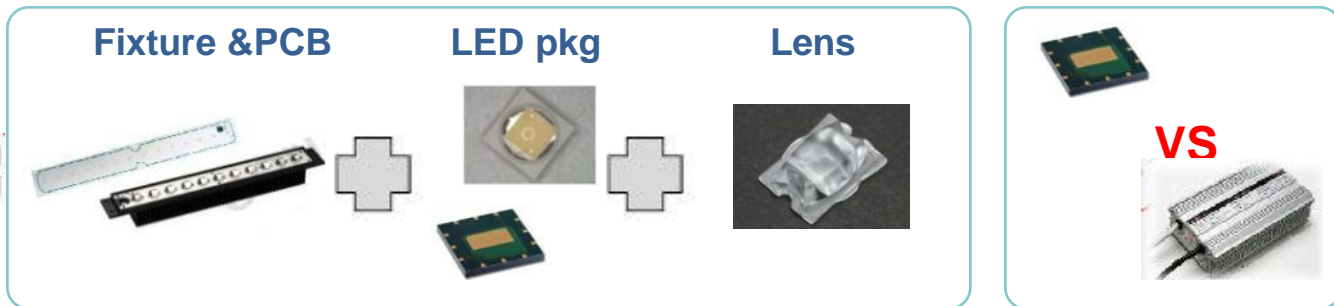
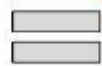
DC LED



Less weight **20%** ; small fixture **20%** ; longlife **x 2** ; Less cost **80%**



ACRICH



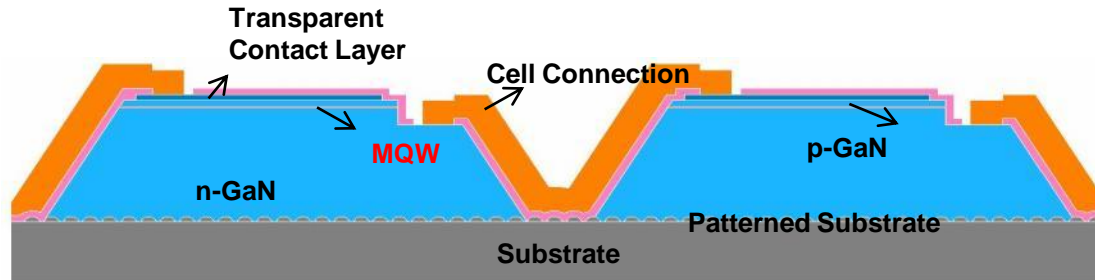
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# Introduction of MJT and AIC

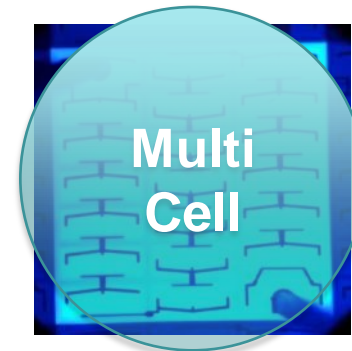
## “Acrich MJT” (Multi Junction Technology)



- 19~32V of Safety Extra-Low Voltage
- The major difference is whether it's Multi Cells or Multi Chips
- Less Process, Less Chip, Less Wire-> Better Yield
- Free to cover DC and AC by Patented Multi Cell Technology



VS



# Introduction of MJT and AIC

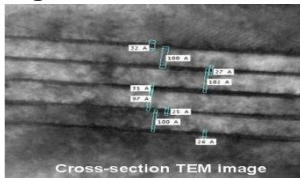
## Improvement on Chip

1. High IQE EPI Wafer
2. CIT (Cell Integration Technology)
3. High Extraction Efficiency
  - High Transparency Layer / High Reflectance / Low Voltage

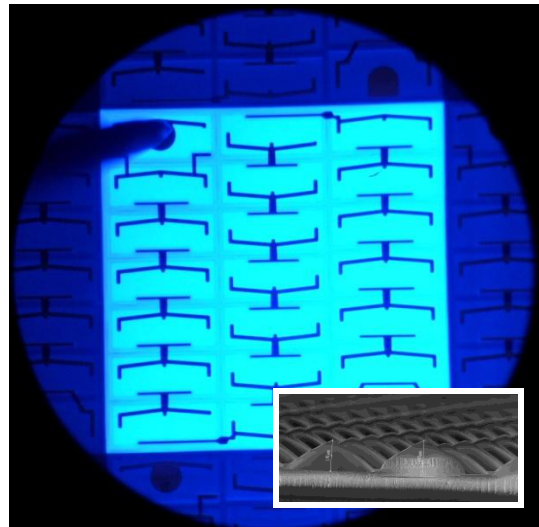
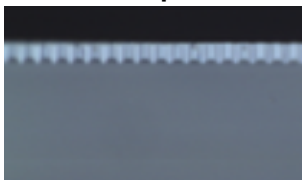
High Transparency Layer



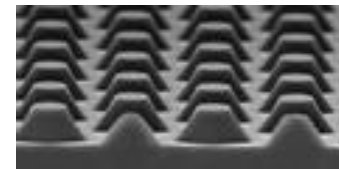
High IQE EPI Wafer



Extraction Optimization



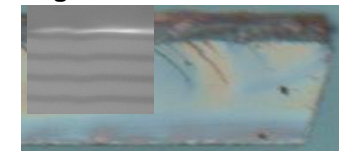
Extraction Efficiency



Low Voltage

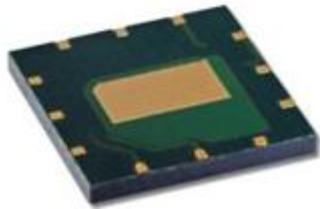


High Reflectance Material



# Introduction of MJT and AIC

**Acrich 2+ IC**



**External Bridge**



**MJT 4040 (21cell) -SAW09H0A**



IF : 20mA (max 40mA)  
VF : 64V (60-68V)  
CRI : >70  
Eff : 100/130lm/w



**MJT 5630 (7cell) -SAW8KG0B**



IF : 20mA (max 25mA)  
VF : 22V (20.7-23V)  
CRI : >80  
Eff : 105/113lm/w



**MJT 3528 (10cell) -SAW8WA2A**



IF : 40mA (max 45mA)  
VF : 32.5V (30-34.5V)  
CRI : >80  
Eff : 95/102lm/w



**MJT 2525 (7cell)**



IF : 40mA (max 60mA)  
VF : 23V  
CRI : >80  
Eff : 108lm/w



# Introduction of MJT and AIC

## Specifications

- Power Adjustable
- Bridge diode
- Power Factor
- Power efficiency
- Total harmonic distortion
- Switching step
- Dimming
- PLG Type & Size

1W —16W

External Bridge diode

>0.97

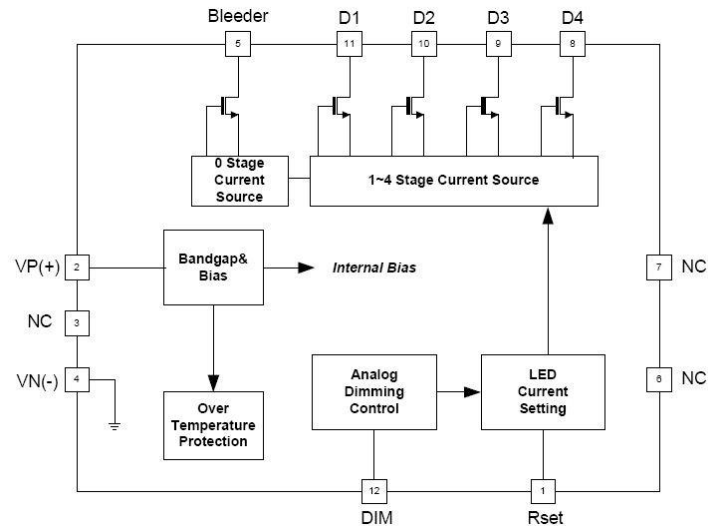
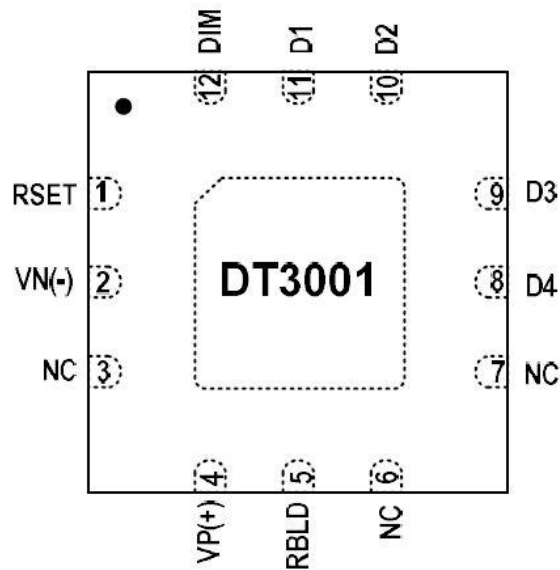
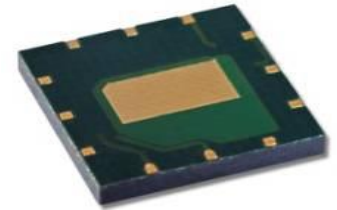
Typ 90%

<15%

4 switching steps

Embedded Analog Dimming Function

12 Lead QFN 6mm×6mm(T=1mm)



# Introduction of MJT and AIC

<b>Parameter</b>	<b>Symbol</b>	<b>Value</b>	<b>Unit</b>
VP(+) to VN(-), D1~D4, Bleeder to VN(-)	$V_{HV}$	-0.3 ~ +450	V
Dim to VN(-), Rset to VN(-)	$V_{LV}$	-0.3 ~ +6.5	V
Operating Ambient Temperature	$T_A$	-30~+100	°C
Storage Temperature	$T_{STG}$	-40 ~ +120	°C
Board Temperature	$T_B$	125	°C
Maximum Junction Temperature	$T_J$	-55~+150	°C
ESD (HBM)	$V_{HBMV}$	1.5	kV

<b>Parameter</b>	<b>Symbol</b>	<b>Value</b>	<b>Unit</b>
Junction to ambient thermal resistance	$\theta_{JA}$	34.65	°C/W
Junction to case thermal resistance	$\theta_{JC}$	11.25	°C/W
Junction to Board	$\theta_{JB}$	25.67	°C/W

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# LM-80 Report ( MJT5630; MJT3528 )

## TEST RESULT

## TEST RESULT

 Report No. : I-120130-1	Page
	( 2 ) / ( 5 )Pages

 Report No. : I-120614-3	Page
	( 2 ) / ( 8 )Pages

### 1. Information of Samples

Part Number : MJT 5630 (SAW8K2JB)  
Part Name : Seoul Semiconductor chip type warm white LED

### 1. Information of Samples

Part Number : SAW8WA2A  
Part Name : Seoul Semiconductor chip type warm white LED (2 700 K)

### 2. Data Summary

Item	Case Temperature of LM-80-08		
	55 °C	85 °C	100 °C
Total Test Time (h)	7 000	7 000	7 000
Average Luminous Flux (lm)*	37.9	38.3	38.2
Average Voltage (V)*	22.4	22.4	22.5
Average Color Temperature (K)*	2 833	2 837	2 831
Test Current (mA)	20	20	20
Sample Temperature [Ts] (°C)	55	85	100
Surrounding Air Temperature [Ta] (°C)	> 50	> 80	> 95
Average Lumen maintenance at 7 000 h (%)	97.26	96.56	91.22
Average Chromaticity shift at 7 000 h	0.002	0.002	0.003

(Note : Mark \* is initial value)

### 2. Data Summary

Item	Case Temperature of LM-80-08		
	55 °C	85 °C	105 °C
Total Test Time (h)	6 000	6 000	6 000
Average Luminous Flux (lm)*	108.0	106.4	105.5
Average Voltage (V)*	31.44	31.43	31.46
Average Color Temperature (K)*	2 853	2 678	2 643
Test Current (mA)	40	40	40
Sample Temperature [Ts] (°C)	55	85	105
Surrounding Air Temperature [Ta] (°C)	> 50	> 80	> 100
Average Lumen maintenance at 6 000 h (%)	96.63	95.67	89.75
Average Chromaticity shift at 6 000 h	0.003	0.003	0.004

(Note : Mark \* is initial value)

### 3. Uncertainty of Measurement

Uncertainty of Lumen maintenance : 7 % ( The confidence level is about 95 %,  $k = 2$  )  
Uncertainty of Chromaticity shift : 0.004 ( The confidence level is about 95 %,  $k = 2$  )

### 3. Uncertainty of Measurement

Uncertainty of Lumen maintenance : 6.95 % ( The confidence level is about 95 %,  $k = 2$  )  
Uncertainty of Chromaticity shift : 0.004 ( The confidence level is about 95 %,  $k = 2$  )

### 4. Equipments used for testing

#### 4.1 Test System

- DC Source : ODA DC Power supply
- Test Equipment : GTPS Temperature Oven

#### 4.2 LED Measurement System

- Spectrometer : Instrument System CAS-140CT
- Integration Sphere : Instrument System 12\*
- DC Source : Keithley DC Power supply

### 4. Equipments used for testing

#### 4.1 Test System

- DC Source : ODA DC Power supply
- Test Equipment : ZMOS Temperature Oven

#### 4.2 LED Measurement System

- Spectrometer : Instrument System CAS-140CT
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### 5. Photographs

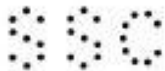


[LED temperature measurement point]

### 5. Photographs



[LED temperature measurement point]



Form No.-TQP-20-04 (0)



Form No.-TQP-20-04 (0)

# MJT LED for Outdoor Solution

## MJT 4040



Size : 4.0x4.0x2.2 [t]

### Advantages & Benefits

- High voltage operation (Typ. 62.5V)
- Energy Star Bin system
- Long Life Time

### LM80 schedule

- 08/08/2013 @ 3,000 Hrs (In progress)

Product Characteristics (Ta=25°C) → Watt : 1.25W

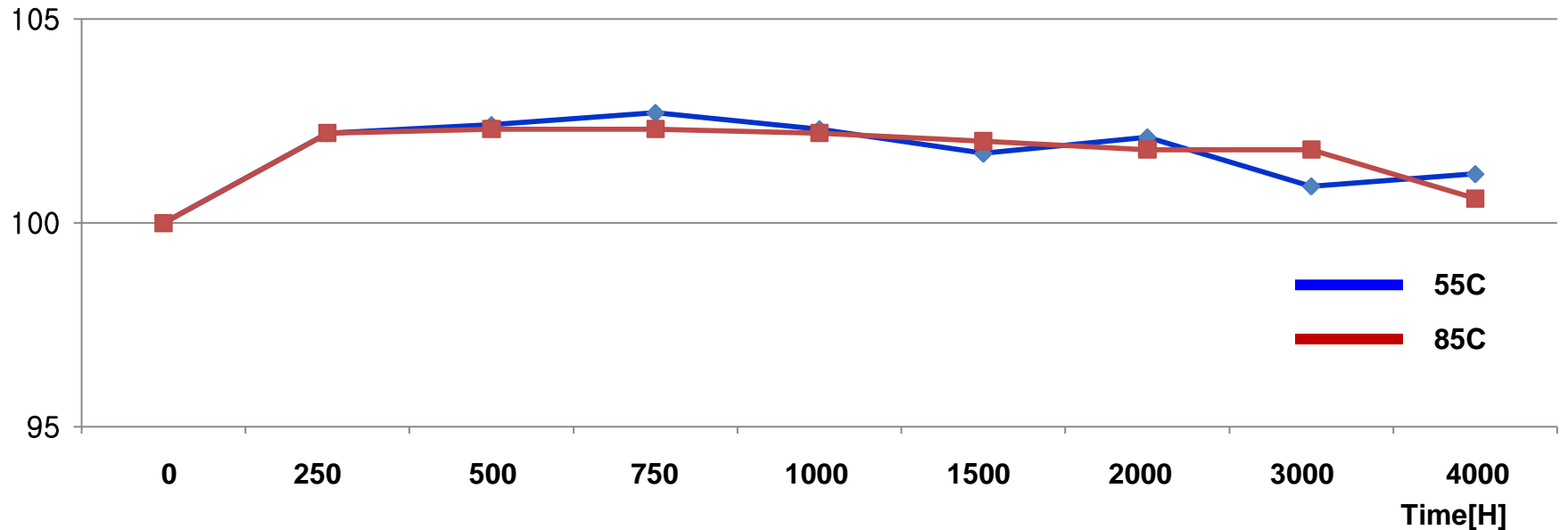
Part Number	CCT [K]	Typical Luminous Flux $\Phi_v$ [lm]	Efficiency [lm/W]	Typical Forward Voltage [V]	CRI, R <sub>a</sub>
	Typ.	20mA	20mA	20mA	Min.
SAW09H0A (Cool)	5300	180	144	62.5	70

# MJT LED for Outdoor Solution

## MJT 4040 test result

Time[h]	0	250	500	750	1000	1500	2000	3000	4000
55C[%]	100	102.2	102.4	102.7	102.3	101.7	102.1	100.9	101.2
85C[%]	100	102.2	102.3	102.3	102.2	102	101.8	101.8	100.6

### Flux Drop[%]



# MJT LED for Outdoor Solution

Table 1: Report at each LM-80 Test Condition

Description of LED Light Source Tested (manufacturer, model, catalog number)		MJT4040	
Test Condition 1 - 55°C Case Temp		Test Condition 2 - 85°C Case Temp	
Sample size	20	Sample size	20
Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	20	DUT drive current used in the test (mA)	20
Test duration (hours)	6,000	Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 4,000	Test duration used for projection (hour to hour)	1,000 - 4,000
Tested case temperature (°C)	55	Tested case temperature (°C)	85
$\alpha$	4.257E-06	$\alpha$	4.497E-06
B	1.027	B	1.027
Calculated L70(6k) (hours)	90,000	Calculated L70(6k) (hours)	85,000
Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000

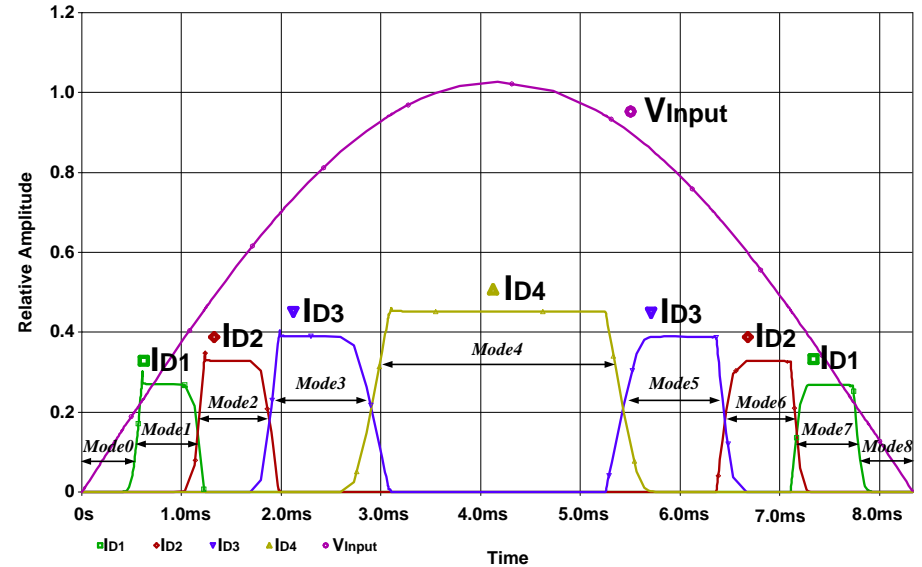
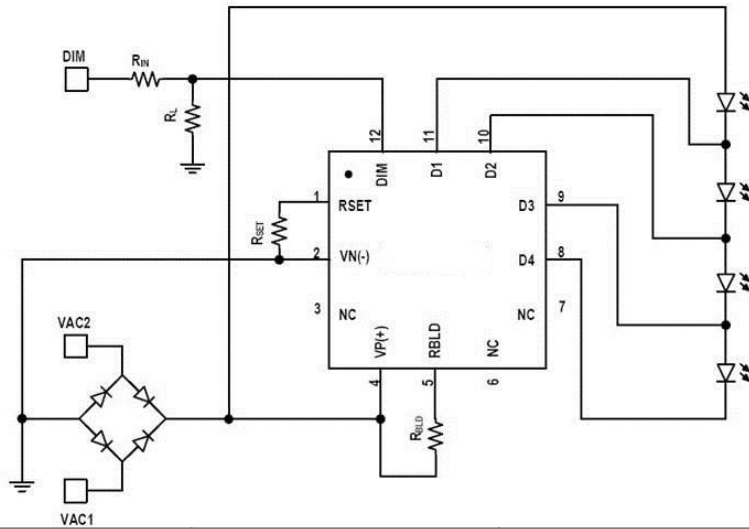
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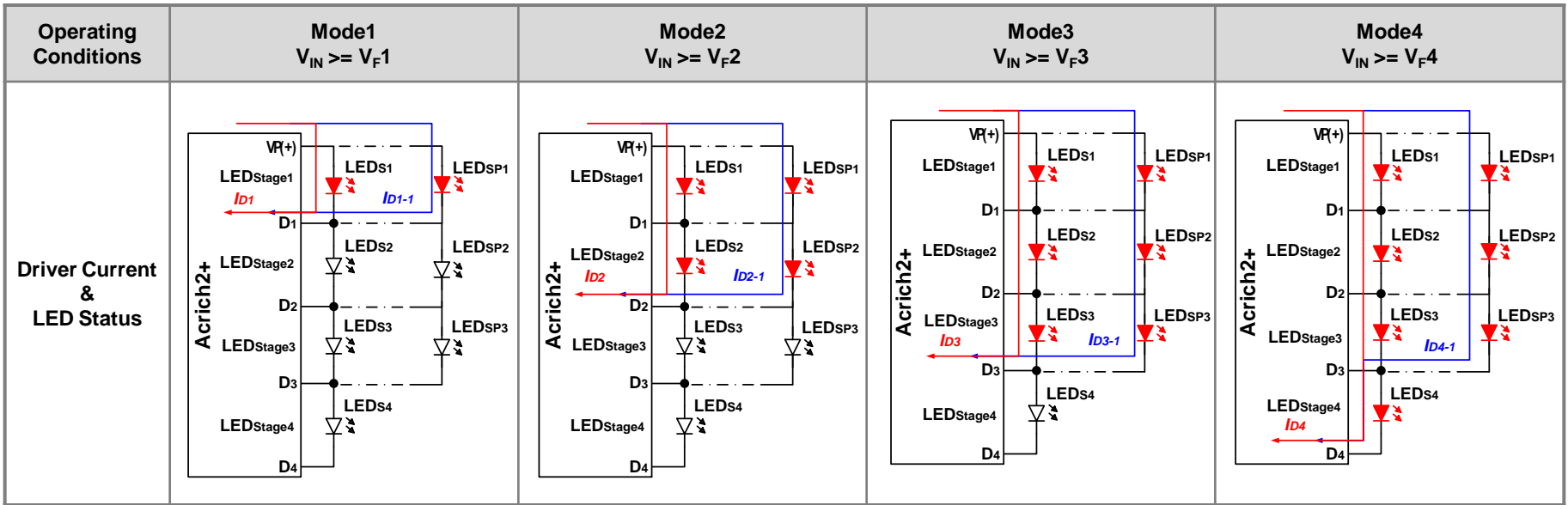


# Principle of ACRICH 2+ Solution



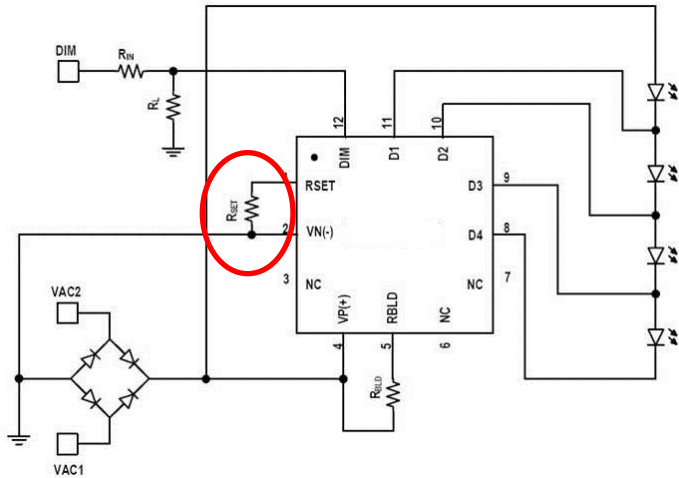
Operating Conditions	Mode0 & Mode8 ( $V_{IN} < V_{F1}$ )	Mode1 & Mode7 ( $V_{IN} \geq V_{F1}$ )	Mode2 & Mode6 ( $V_{IN} \geq V_{F2}$ )	Mode3 & Mode5 ( $V_{IN} \geq V_{F3}$ )	Mode4 ( $V_{IN} \geq V_{F4}$ )
Driver Current & LED Status					

# Principle of ACRICH 2+ Solution



Mode	LEDStage1 (peak current per pkg.)	LEDStage2 (peak current per pkg.)	LEDStage3 (peak current per pkg.)	LEDStage4 (peak current per pkg.)
Mode1	$I_{PeakCurrent} = \frac{I_{D1}}{2}$	OFF	OFF	OFF
Mode2	$I_{PeakCurrent} = \frac{I_{D2}}{2}$	$I_{PeakCurrent} = \frac{I_{D2}}{2}$	OFF	OFF
Mode3	$I_{PeakCurrent} = \frac{I_{D3}}{2}$	$I_{PeakCurrent} = \frac{I_{D3}}{2}$	$I_{PeakCurrent} = \frac{I_{D3}}{2}$	OFF
Mode4	$I_{PeakCurrent} = \frac{I_{D4}}{2}$	$I_{PeakCurrent} = \frac{I_{D4}}{2}$	$I_{PeakCurrent} = \frac{I_{D4}}{2}$	$I_{PeakCurrent} = I_{D4}$

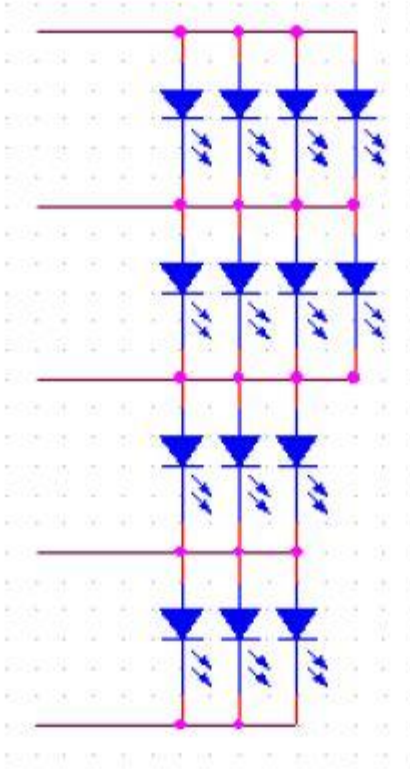
# Principle of ACRICH 2+ Solution



$V_{AC}$	Power dissipation	$R_{SET}$ [k $\Omega$ ]
100V	4W	0.75
	8W	1.68
	12W	2.84
	16W	4.32
120V	4W	0.62
	8W	1.35
	12W	2.23
	16W	3.29
220V	4W	0.32
	8W	0.67
	12W	1.07
	16W	1.49

IC 型号	输入电压	输出电流	功率 [W]	Rset [K $\Omega$ ]	输入电压	输出电流	功率 [W]	Rset[K $\Omega$ ]
B-Version (DT3001B)	220	73.24	16	1.65	120	134.27	16	3.96
		68.66	15	1.45		125.88	15	3.58
		64.08	14	1.35		117.49	14	3.20
		59.51	13	1.29		109.10	13	2.87
		54.93	12	1.14		100.70	12	2.56
		50.35	11	1.07		92.31	11	2.27
		45.77	10	0.94		83.92	10	2.00
		41.20	9	0.83		75.53	9	1.75
		36.62	8	0.74		67.14	8	1.52
		32.04	7	0.65		58.74	7	1.29
		27.46	6	0.57		50.35	6	1.09
		22.89	5	0.48		41.96	5	0.90
		18.31	4	0.39		33.57	4	0.72

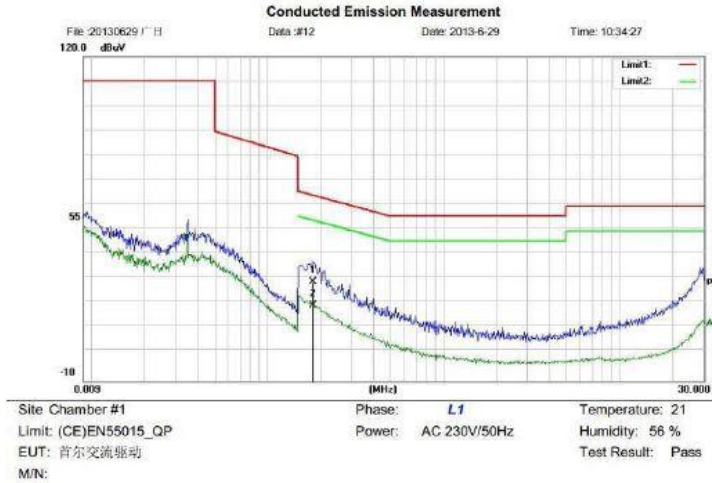
# Principle of ACRICH 2+ Solution



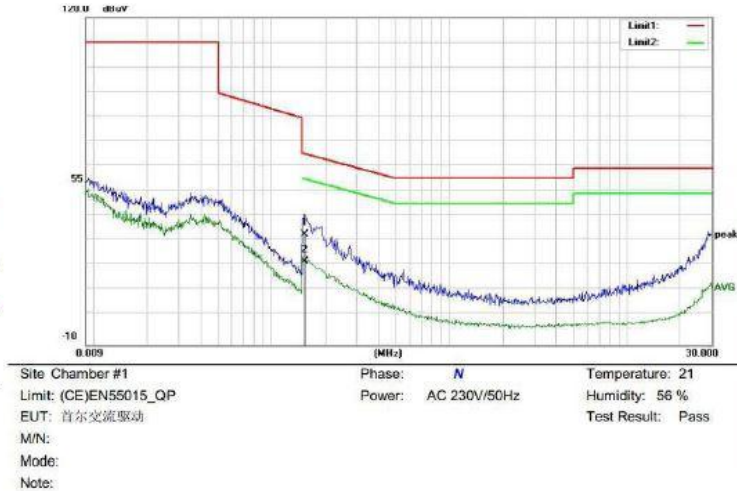
Input voltage	Input Po	LED QTY	Efficiency	IC Po	LED Po Total	1 step Total (/ LED)	2 step Total (/ LED)	3 step Total (/ LED)	4 step Total (/ LED)
200V	14.02	14 EA	93.44%	0.92	13.10	3.84 (0.96)	3.67 (0.92)	3.26 (1.09)	2.33 (0.78)
220V	16.07		88.92%	1.78	14.29	4.06 (1.02)	3.90 (0.98)	3.55 (1.18)	2.78 (0.93)
240V	18.04		84.20%	2.85	15.19	4.23 (1.06)	4.07 (1.02)	3.77 (1.26)	3.12 (1.04)
260v	19.95		79.75%	4.04	15.91	4.36 (1.09)	4.22 (1.06)	3.95 (1.32)	3.38 (1.13)
280V	21.84		75.46%	5.36	16.48	4.47 (1.12)	4.33 (1.08)	4.10 (1.37)	3.58 (1.19)

# EMC 测试

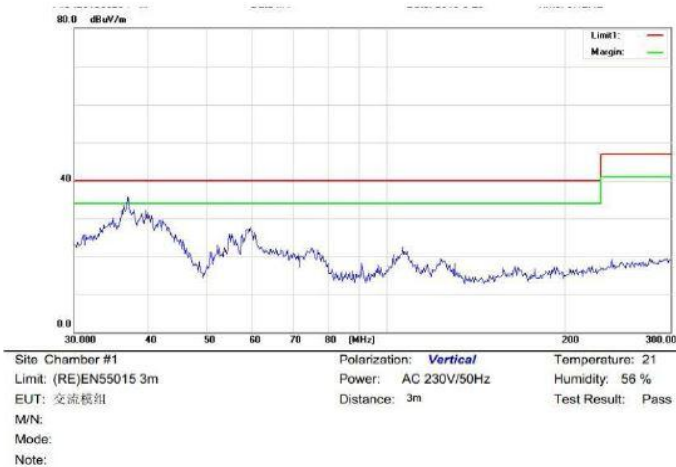
## L线



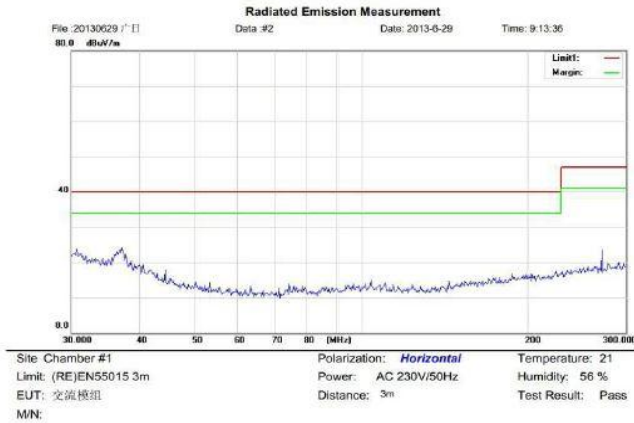
## N线



## V方向



## H方向



# ACRICH2+ Dimming Solution-Analog

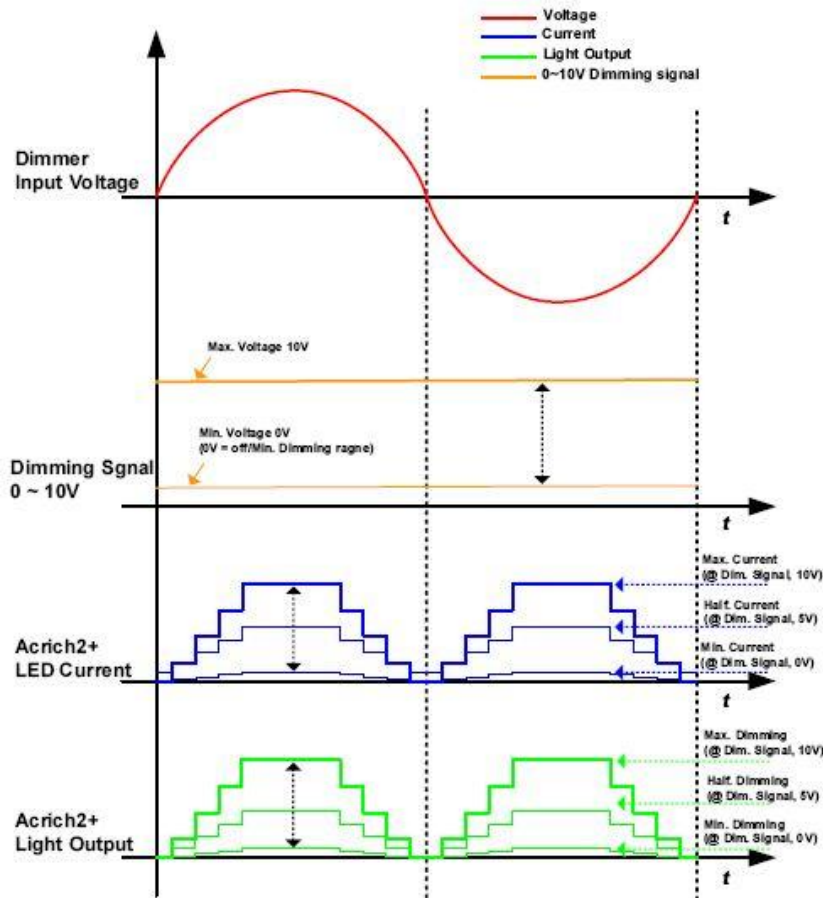


Figure 1. Analog Dimming Timing chart

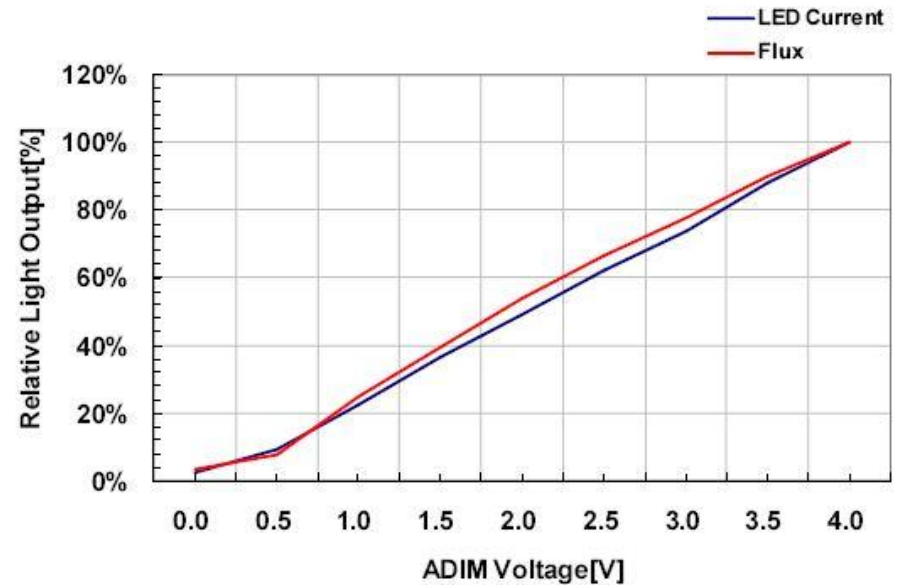
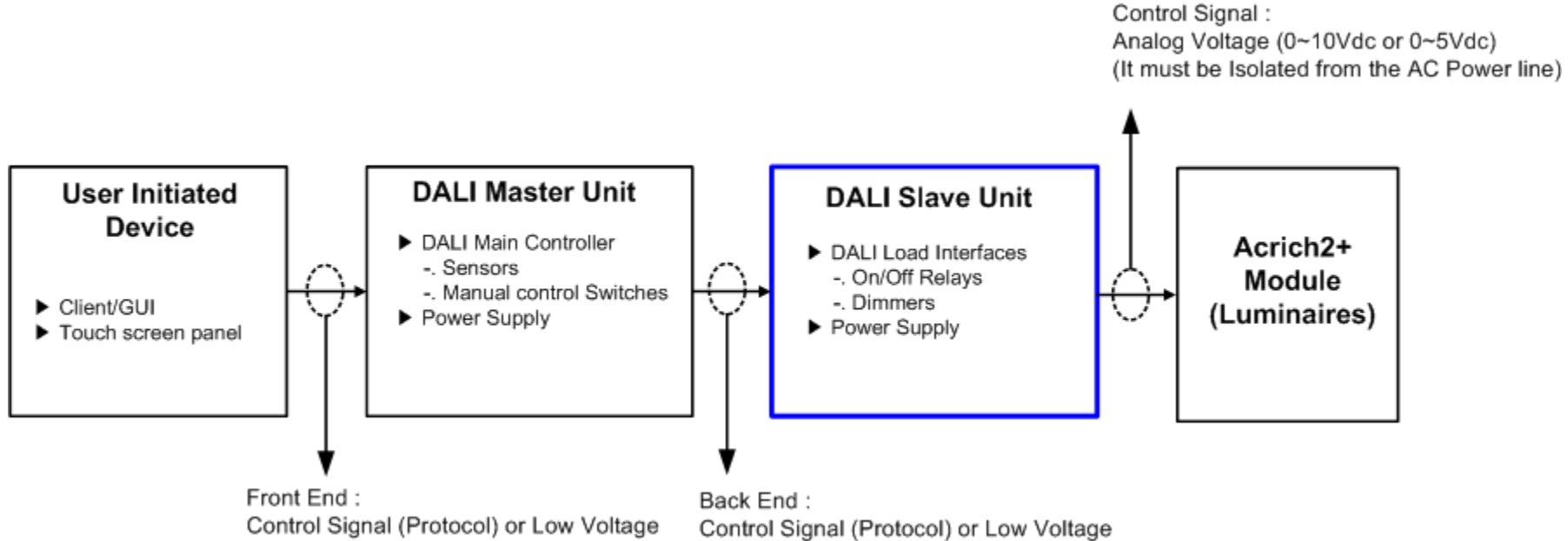


Figure 2. Analog Dimming Curve  
(Measurements performed at 16W Module)

## Specification of ADIM

Input Signal	DC Voltage [V]	PWM (Pulse Width Module)	Relative Light Output [%]
Minimum	0	Max. Amplitude : 10V Duty Ratio : 0~100% (@50kHz)	2~5 (Typ. 5%)
Maximum	10		100

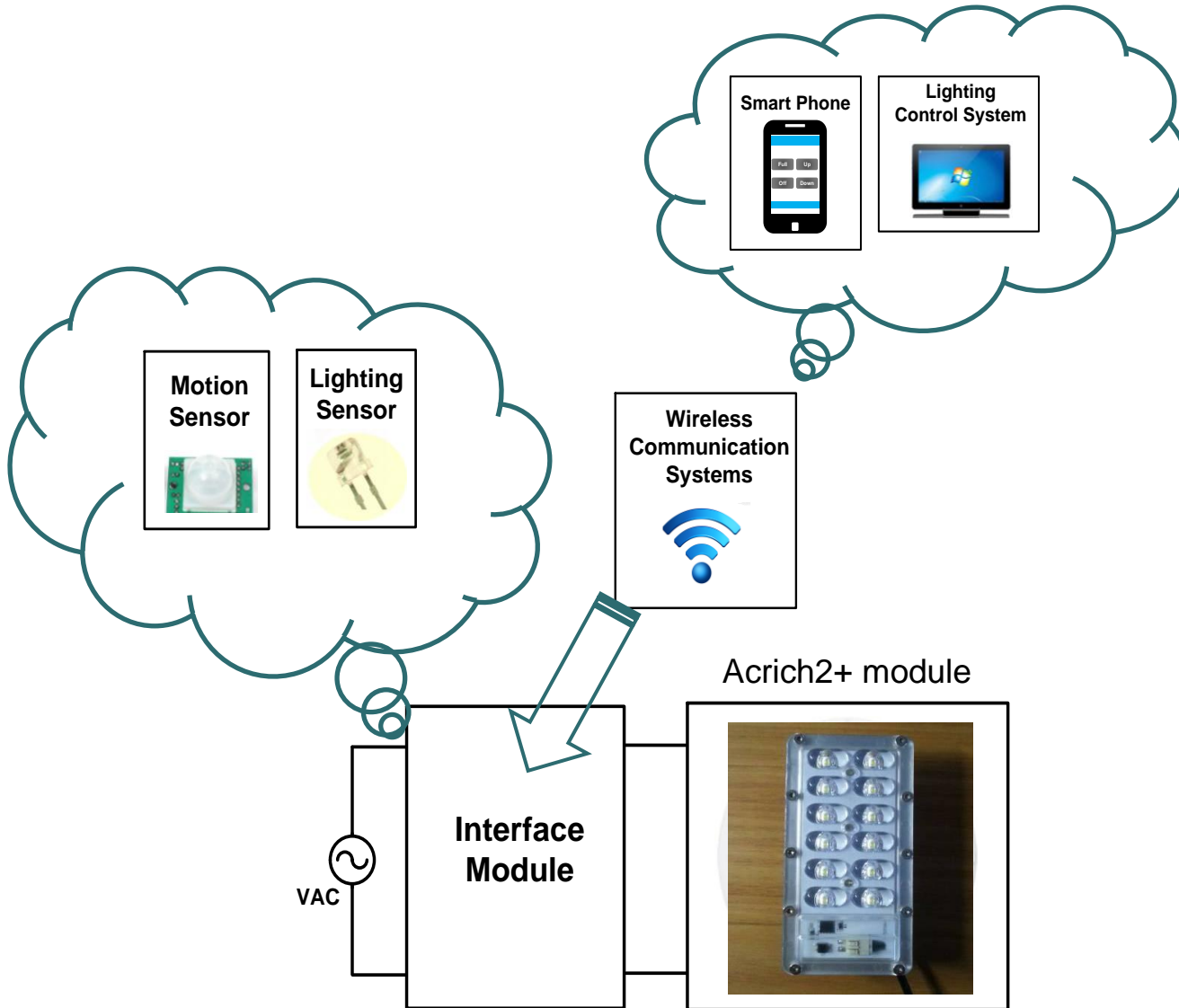
# ACRICH intelligent control-DALI



## Acrich2+DALI instruction of system control:

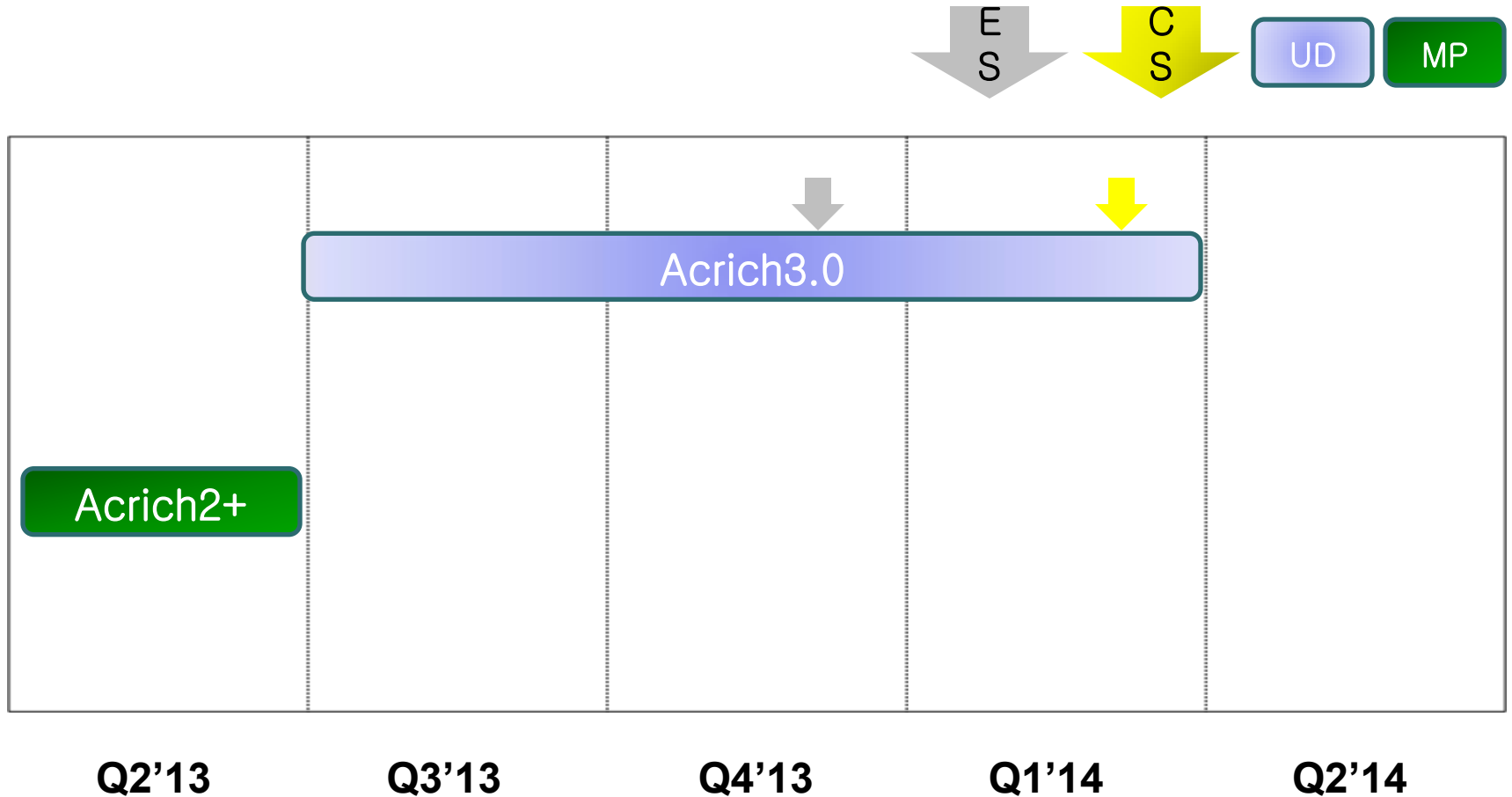
- control commands are sent by central computer
- control commands are transferred by host to client
- control signals are sent to lamps by client which can be switching and dimming
- according to different commands, the programs should be researched by SSC and DALI provider

# ACRICH intelligent control





# Update of the AIC



# Update of the AIC

Content	Acrich2+	Acrich3.0
status	MP	Developing
Input Voltage	90V ~ 144V 200V~264V	90 ~ 300V
Range of Power	~ 16W (Typ.)	A、 1~ 16W B、 1~ 30W
Variation of the Power	$\pm 12\sim 14\%$ @ Vac(Typ.) $\pm 10\%$	$\pm 5\%$ @ 90~300V
Range of Analog Dim	Support. 5~100%	Support. 0~100%
Pf	>0.97	> 0.96
IC Size	QFN. 6mmX6mm	T.B.D.

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# ○ Acrich2+ Module of Outdoor Application



< SMJE-3V08W2P4 >

<b>Application</b>	Wall sconce lighting
<b>Acrich product</b>	Acrich2+ Eco 8W
<b>USP</b>	<ol style="list-style-type: none"><li>1. Dimming compatibility (with photo sensor)</li><li>2. Competitive Price</li></ol>

# ○ Acrich2+ Module of Outdoor Application



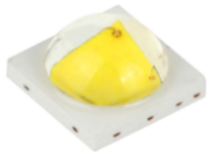
**< SMJL-XX000V24 >**

<b>Application</b>	Warehouse lighting (High bay)
<b>Acrich product</b>	Acrich 2 24W (Custom module) - 120V, 277V
<b>USP</b>	1. New entry of 277V 2. No extra AC-DC converter space

# ○ Acrich2+ Module of Outdoor Application



**30W LED Engine**

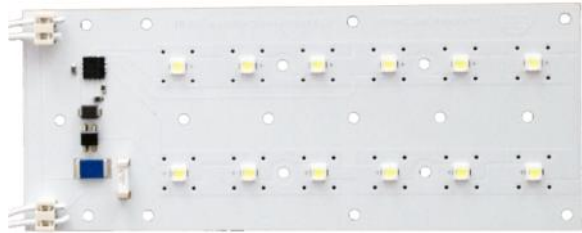


**< SAW09H0A + DT3001B >**



<b>Customer</b>	"C", China
<b>Application</b>	Street light
<b>Acrich product</b>	MJT4040 DT3001B * 2 PCS
<b>USP</b>	1. Easy, Simple 2. Competitive Price (Weight, No Converter, Reliability)

# ○ Acrich2+ Module of Outdoor Application



**12W LED module**



**30W LED module**



**< SAW09H0A + DT3001B >**

<b>Application</b>	Street light, Tunnel lamp
<b>Acrich product</b>	MJT4040 * 12 / 28 PCS DT3001B * 1 / 2 PCS
<b>USP</b>	1. Easy, Simple 2. Competitive Price (Weight, No Converter, Reliability)

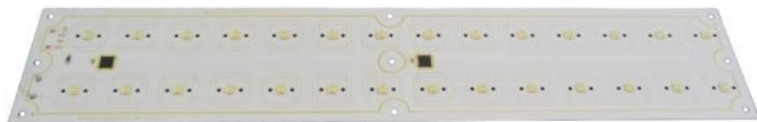
# ○ Acrich2+ Module of Outdoor Application



**30W LED Tunnel light**



**< 15W LED module >**



**< 30W LED module >**

<b>Application</b>	Tunnel lamp
<b>Acrich product</b>	MJT4040
<b>USP</b>	<ol style="list-style-type: none"> <li>1. Easy, Simple</li> <li>2. Competitive Price (Weight, No Converter, Reliability)</li> </ol>



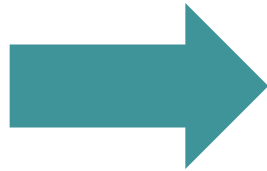
# Acrich2+ Module of Outdoor Application



30W LED Engine



15W LED Engine



Front view



Rear / Side view

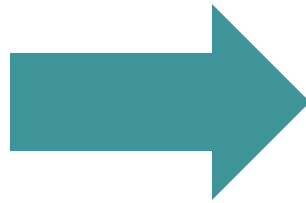
# ○ Acrich2+ Module of Outdoor Application



**30W LED Engine**



**15W LED Engine**



**Front view**



**Rear view**

# ○ **ACRICH AC Outdoor Solution**

- Outline of ACRICH Outdoor Solution
- Introduction of MJT and AIC
- MJT LED for Outdoor Solution
- Principle of ACRICH 2+ Solution
- Acrich2+ Module of Outdoor Application
- **Success Story**



# 成功案例

# 扬州—扬子江南路



功率：90W  
色温：5000K  
光通量：8000lm  
显色指数：72  
使用模组数量：6  
安装高度：11M  
安装数量：88盏



功率：195W  
色温：5000K  
光通量：17000lm  
显色指数：72  
使用模组数量;13  
安装高度：11M  
安装数量：88盏



# 成功案例

# 扬州—维扬路



功率：90W  
色温：5000K  
光通量：8000lm  
显色指数：72  
使用模组数量：6  
安装高度：9M  
安装数量：111盏



功率：150W  
色温：5000K  
光通量：13000lm  
显色指数：72  
使用模组数量;10  
安装高度：11M  
安装数量：111盏



# 成功案例

# 上海—Bao Steel



# 成功案例

# 上海—东海大桥



