深圳市天电光电科技有限公司 LIGHTNING OPTOELECTRONIC TECHNOLOGY（SZ）CO., LTD

EMC 系列 LED 产品使用指引

EMC Series LED Application Notes

简介

本LED使用指引，旨在说明天电光电EMC系列LED在产品清洁、存储、焊接到最终使用过程中的注意事项和操作指引，以期客户正确使用EMC系列LED产品。

Description

This application note details how to properly handle TDLED's EMC Series LED product while cleaning/storage/SMT the product to the application, in purpose of properly guiding customers and users in the application design thereof.

Prepared by: AE Department Date: 2014-5-29

Checked by: Date:

Approved by: Date:

Revision History

Version	Page	Content of Change	Date
1.0	1-7	Preliminary Document (Application Notes)	2014/5/27
1.1	5, 6	Update recommended soldering pad information	2014/5/29
1.2	8-12	Add attachment-1 and attachment-2	2014/6/11

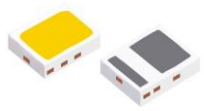
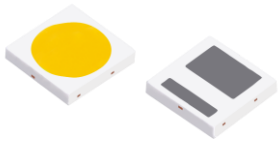
Features

The purpose of this document is to provide a clear understanding to the customers and users, on the ways how to use TDLED's EMC Series LED lamps properly.

Description

Generally, LED can be used the same way as other general-purpose semiconductors. When using TDLED's LED Lamps, the following precautions must be taken to protect the LED.

Product Coverage

EMC T20 Series -2016	EMC T3B Series-3014	EMC T34 Series -3020	EMC T3C Series-3030
			

1. Cleaning

✧ Don't use unspecified chemical liquids to clean the EMC LED; the chemical could harm the LED. When washing is necessary, please immerse the EMC LED in alcohol at room temperature for less than 1 minute and dry at room temperature for 15 minutes before use.

✧ The influence of ultrasonic cleaning on the EMC LED depending on factors such as ultrasonic power and the way EMC LED are mounted. Ultrasonic cleaning shall be pre-qualified to ensure this will not cause damage to the LED.

2. Moisture Proof Packing

✧ In order to prevent moisture absorption into EMC LED during the transportation and storage, the LED is packed in a moisture-barrier bag. Desiccants and a humidity indicator are packed together with the LED as the secondary protection. The indication of humidity indicator card provides the information of humidity within packing.

3. Storage

✧ The EMC LED product is qualified as Moisture Sensitive Level 3 per JEDEC J-STD-020D Precaution when handling this moisture sensitive product is important to ensure the reliability of the product.Shelf life in original sealed bag at storage condition of <30ºC and <90%RH is 12 months. Baking is required whenever shelf life is expired.

✧ Before opening the package, please check whether the bag leak air or not.

✧ After bag opening, the EMC LED must be stored under the condition < 30ºC and < 60%RH. Under this condition, the LED must be used (subject to reflow) within 24 hours after bag opening, and re-baking is required when

exceeding 24 hours.

✧ For baking, place EMC LED in the oven at temperature of60ºC and relative humidity <=10%RH, for at least 24 hours.

✧ Take out the material from packaging bag for re-bake. Do not open the door of oven frequently during the baking process.

4. Soldering

- **Manual soldering by soldering iron**

✧ The use of a soldering iron of less than 25W is recommended and the temperature of the iron must be kept at below 315ºC, with soldering time within 2 seconds.

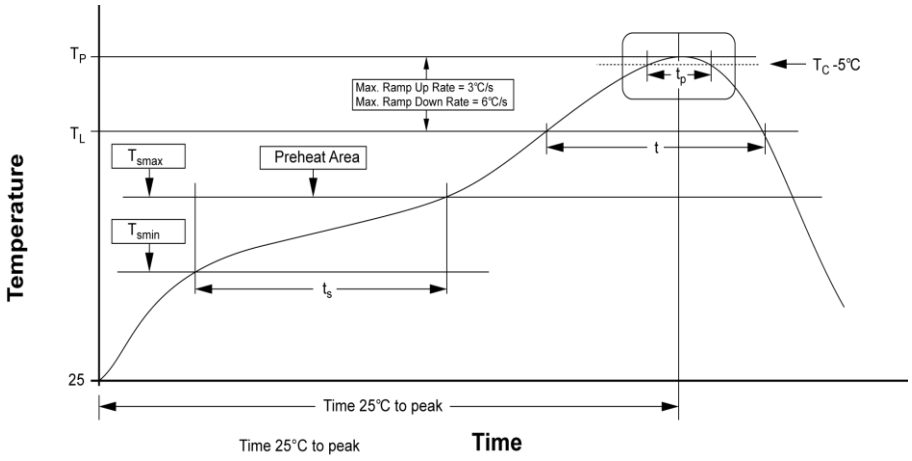
✧ The epoxy resin of the EMC LED should not be in contact with tip of soldering iron.

✧ No mechanical stress should be exerted on the resin portion of the LED during soldering.

✧ Handling of EMC LED should be done when the package has been cooled down to below 40ºC or less. This is to prevent the EMC LED failures due to thermal-mechanical stress during the process.

- **Reflow Soldering**

✧ Recommended Reflow Profile for Pb-Free Process (Acc. to J-STD-020D):

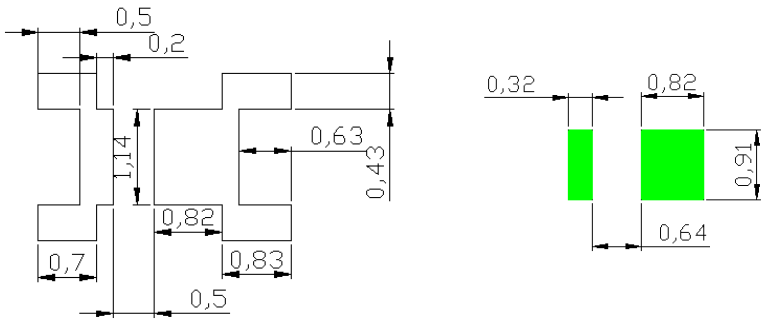


Parameters	Pb-Free Assembly
Ts_{min}	150 °C
Ts_{max}	200 °C
t_s(preheat from Ts_{min} to Ts_{max})	60-120 s
Average Ramp Up Rate (Ts_{max} to T_p)	<3 °C/s
T_L	217 °C

Time Duration within T_L (t)	60-150 s
T_p	260 °C
Time Duration within T_p±5°C(t_p)	< 10 s
Average Ramp Down Rate ($T_p$to Ts_{min})	<6 °C/s
Time 25°C to peak	< 8 min

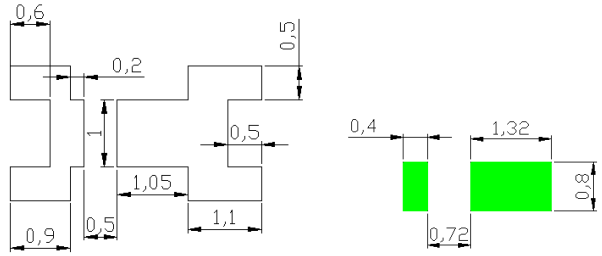
✧ Recommended solder pad design for heat dissipation (EMC T20 Series -2016)

Left Figure is recommended soldering pad for MCPCB; Right figure is the recommended stencil cutting



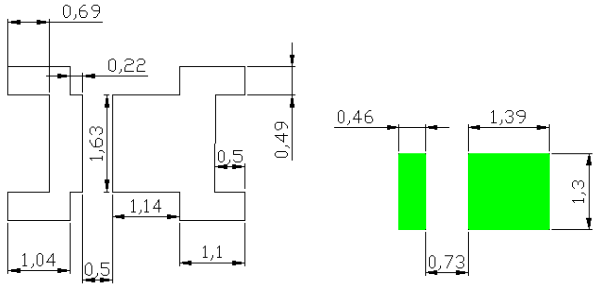
✧ Recommended solder pad design for heat dissipation (EMC T3B Series -3014)

Left Figure is recommended soldering pad for MCPCB; Right figure is the recommended stencil cutting



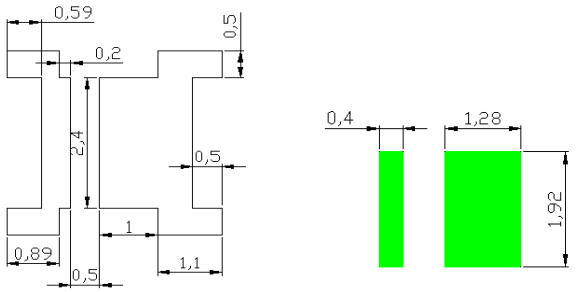
✧ Recommended solder pad design for heat dissipation (EMC T34 Series -3020)

Left Figure is recommended soldering pad for MCPCB; Right figure is the recommended stencil cutting



✧ Recommended solder pad design for heat dissipation (EMC T3C Series -3030)

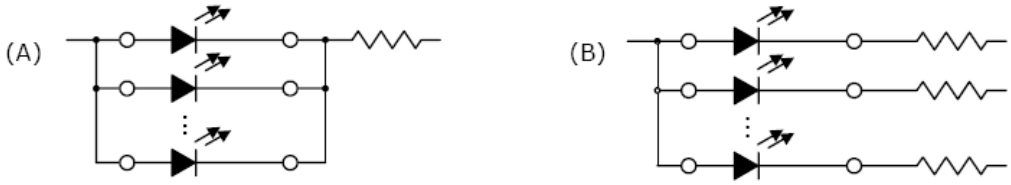
Left Figure is recommended soldering pad for MCPCB; Right figure is the recommended stencil cutting



Recommended Stencil Thickness: 0.08 - 0.1mm

5. Driving Method

✧ When designing a circuit, the current through each LED must not exceed the Absolute Maximum Ratings. LED is a constant-current driving device. In case of operating at a constant voltage, Circuit B is recommended, that is to say, it is recommended that a current limiting resistor beincorporated in the driving circuit, in series with each LED as shown in Circuit B; if using Circuit A, the current through the LEDs may vary due to the variation in forward voltage characteristics of the LEDs.



6. ESD (Electrostatic Discharge)and Surge Current

✧ Electrostatic discharge (ESD) or surge current (EOS) may damage SMD LED.

✧ Precautions such as ESD wrist strap, ESD shoe strap or antistatic gloves must be worn whenever handling of the EMC LED.

✧ Suggestions to prevent ESD damage:

- Use of a conductive wrist band or anti-electrostatic glove when handling these LEDs.
- All devices, equipment, and machinery must be properly grounded.
- Work tables, storage racks, etc. should be properly grounded.
- Use ion blower to neutralize the static charge which might have built up on surface of the LED'splastic lens as a result of friction between LEDs during storage and handling.
- It is recommended to perform electrical test to screen out ESD failures at final inspection.

✧ ESD-damaged LEDs will exhibit abnormal characteristics such as high reverse leakage current, lowforward voltage, or "no light up" at low currents.To verify for ESD damage, check for "light up" and Vf of the suspected LEDs at low current.The Vf of "good" LEDs should be >2.0V@0.1mA for InGaN product and >1.4V@0.1mA for AlInGaPproduct.

✧ It is important to eliminate the possibility of surge current during circuitry design

For details, see another separated TDLED's technical article named of "How to prevent the EOS"

7. Thermal Management

✧ Thermal management of the EMC LED must be taken into consideration during the design stage of the LED application. The current should be de-rated appropriately by referring to the de-rating curve attached on each product datasheet.

For details, see another separated TDLED's technical article named of "Thermal Management of the EMC LED"

8. Important Notes

✧ Some packaging sizes of the EMC LED products are very small and the resin is still soft after solidification. Users are required to handle with care, never touch the resin surface of the LED products.

✧ To avoid damaging the products surface and interior device, it is recommended to choose special Nozzle to pick up EMC LED products during the process of SMT production. If handling is necessary, it should take more careful to pick up these products. For Small EMC series, it is recommended to use rubber material Nozzle to pick up the products.

Below size for reference:
a.) Circular Nozzle: inner diameter: Ø1.8mm+/-0.05mm, outer diameter: Ø2.3mm+/-0.05mm.
b.) Rectangle Nozzle: inner size: 1.3mm x 2.3mm, outer size > SMD size.

Data is subject to change without prior notice.

Attachment-1（Source from 金鉴检测）:

LED 贴片焊接焊点内部会有微小空洞（气泡）现象。这些空洞是由回流焊在加热期间，焊锡中夹住的空气或助焊剂等化合物的膨胀所引起。空洞会导致焊锡的热阻增高、导热系数下降，并且在冷热冲击测试的环境下，引起气泡热涨冷缩，焊锡开裂，使得灯珠可靠性降低。

可以使用 X 射线透视仪无损伤检测手段，测试 SMT 回流焊焊接后，焊点中的空洞比，剔除不良品，确保灯珠热量有效导热至铝基板，从而确保灯具寿命达到设计要求。

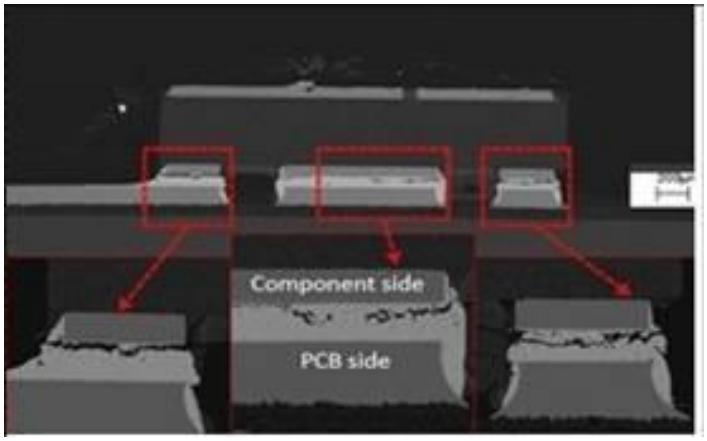
检测内容：
1.参考标准，给产品抽样建议

2.查找产品是否存在空洞，统计良品率

3.计算空洞的面积，评估危害级别。

4.提供第三方品质管理检测报告

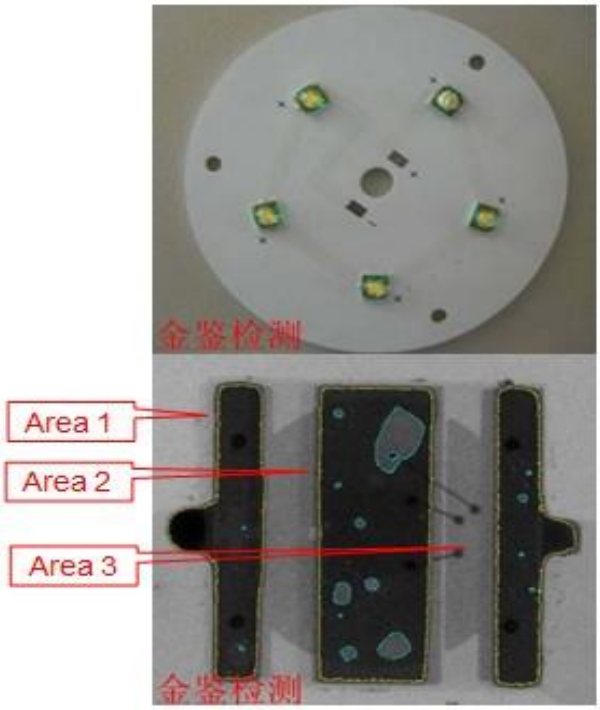
高空洞比导致的后果：



高空洞比会导致 LED 焊点在冷热冲击温度循环测试后产生裂纹，引起灯具疲劳失效。

案例分析:

某品牌灯珠代理商的业务员小邱兢兢业业地给公司的客户提供服务。某天客户采购部突然打电话过来说，“出现大面积死灯，概率超过 38%”，并要求他给出一份分析报告。在排除了驱动、散热器重量、散热器散热面积、导热胶、铝基板导热系数、电路是否短路等一系列问题之后，仍找不到死灯的原因。后来经朋友介绍，找到金鉴检测。金鉴在分析完前面情况后，发现回流焊的锡层没有做过检测。于是用 X-RAY 进行无损伤透视观察，发现烧掉的灯珠背后的锡层有空洞，孔面积普遍占焊盘面积 25%以上。小邱的客户后来接受金鉴检测的建议，每 100 个灯抽取 1 个出来做 x 射线透视检测，从而确保了该订单的持续性。



样本大小：200pcs

每个样本测量点：5

测量区域：正极、负极、散热盘

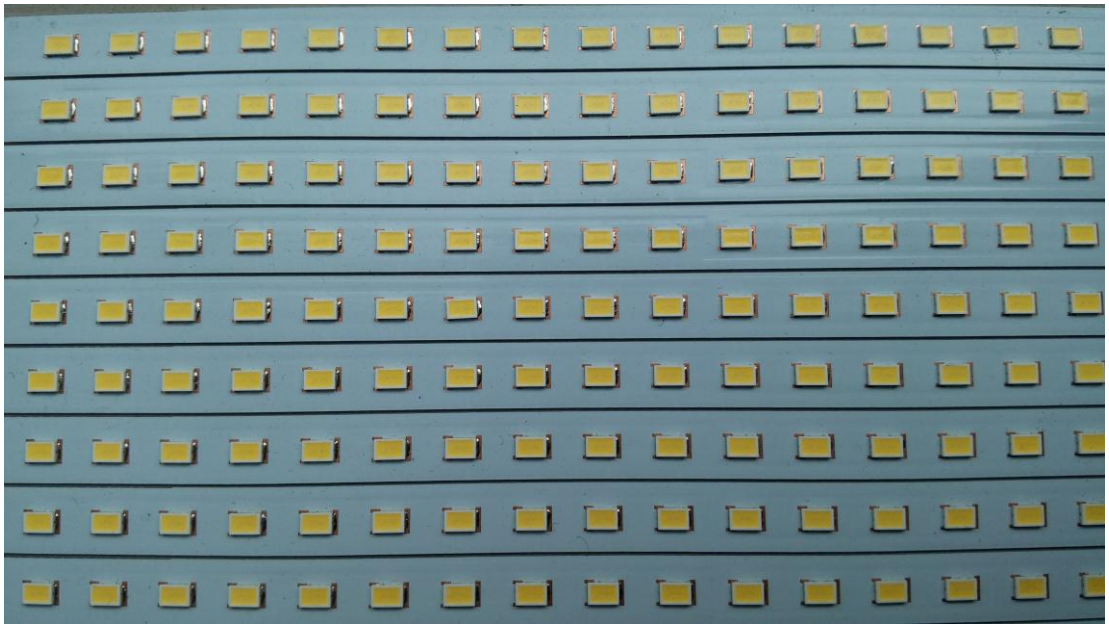
客户允许空洞标准：正上方观察，空洞面积不超过焊盘面积的 10%

测试数据

样品	Area 1		Area 2		Area 3	
	面积(㎜²)	空洞比(%)	面积(㎜²)	空洞比(%)	面积(㎜²)	空洞比(%)
#1-1	1.843	0.6	3.92	1.9	1.687	0.2
#1-2	1.832	1.1	3.871	5.4	1.675	1.1
#1-3	1.765	2.5	3.942	2.9	1.68	0.3
#1-4	1.812	0	3.895	1.8	1.692	1.4
#1-5	1.752	2	3.867	7	1.713	3.8
#2-1	1.834	0.6	3.875	1.9	1.685	0.8
#2-2	1.842	0.8	3.915	1	1.682	0.6
#2-3	1.845	0.9	3.932	1	1.689	0.3
#2-4	1.863	0.7	3.949	2.4	1.697	0
#2-5	1.847	0.1	3.954	10.3	1.687	0.3
金鉴检测..	…	…	…	…	…	…

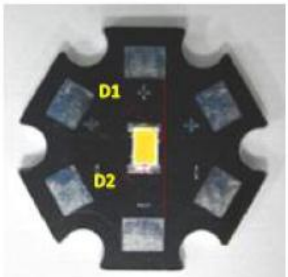
天电光电所建议的焊盘设计已经得到内部及客户使用批量验证，空焊及焊偏比例低，焊接良率高，客户成品良率也因此相应提升。

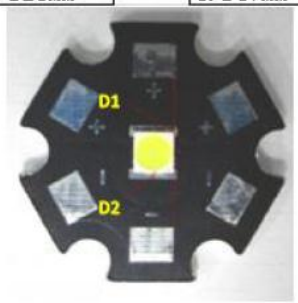
灯珠焊板后外观：



灯珠焊板后偏差测量

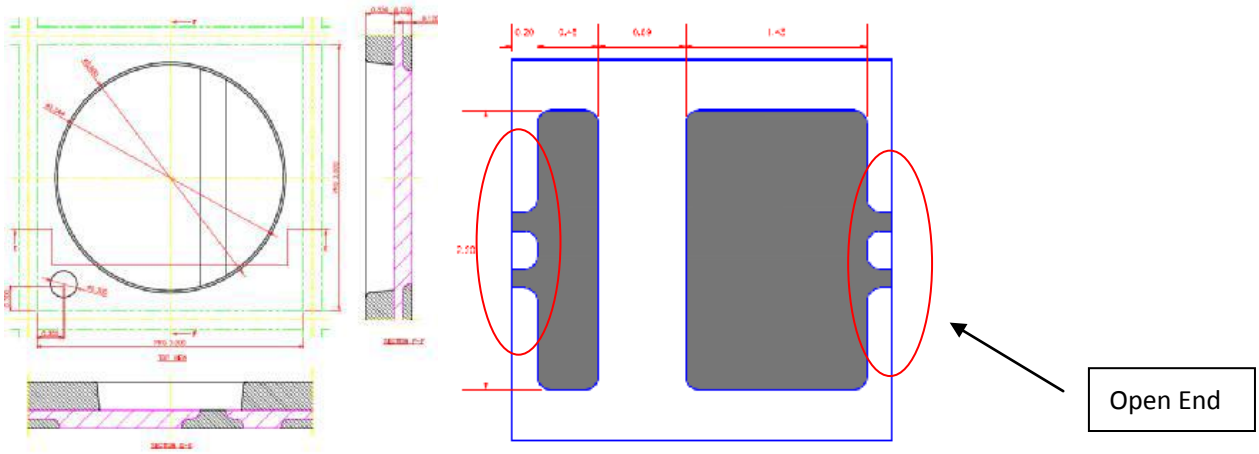
	D	左右距离D1	偏移△D1	上下距离D2	偏移△D2	左右标准值		上下标准值
3020-B	1	0.541	-0.110	4.285	0.181	0.651mm		4.104mm
	2	0.597	-0.054	4.220	0.116			
	3	0.654	0.003	4.270	0.166			
	4	0.603	-0.048	4.281	0.177			
	5	0.625	-0.026	4.259	0.155			
	6	0.694	0.042	4.273	0.169			
	7	0.673	0.021	4.229	0.125			
	8	0.694	0.043	4.315	0.211			
	9	0.653	0.002	4.241	0.137			
	10	0.700	0.048	4.234	0.130			
	平均值	0.643	-0.008	4.261	0.157			
3030-B	D	左右距离D1	偏移△D1	上下距离D2	偏移△D2	左右标准值		上下标准值
	1	0.129	0.000	4.221	0.074	0.128mm		4.147mm
	2	0.177	0.049	4.222	0.075			
	3	0.119	-0.009	4.219	0.072			
	4	0.169	0.041	4.221	0.074			
	5	0.107	-0.021	4.222	0.075			
	6	0.089	-0.040	4.253	0.106			
	7	0.120	-0.009	4.218	0.071			
	8	0.150	0.022	4.255	0.108			
	9	0.146	0.018	4.204	0.057			
	10	0.133	0.005	4.245	0.098			
	平均值	0.134	0.005	4.228	0.081			



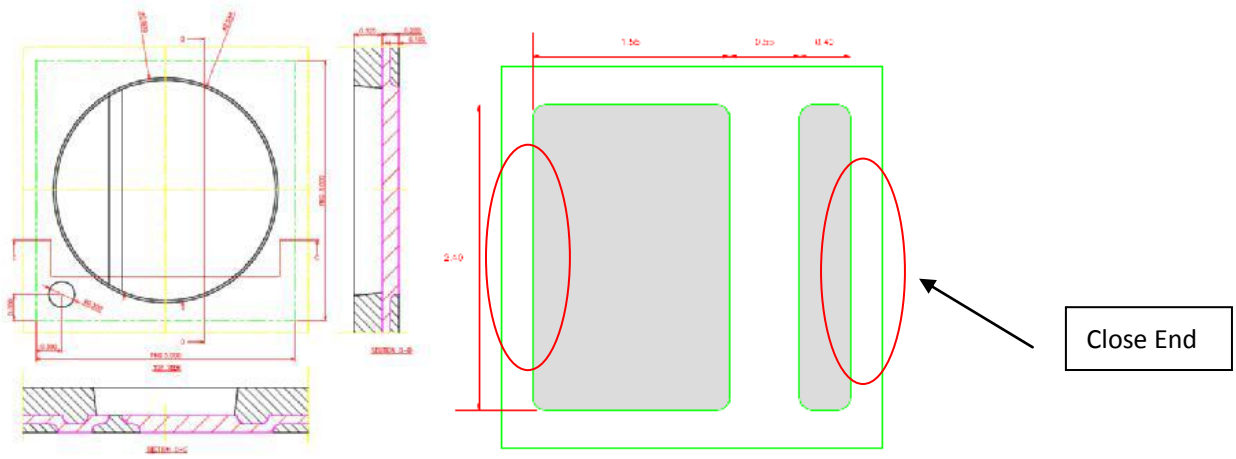


Attachment-2: EMC系列产品支架焊盘变更补充说明

以3030产品为例，旧支架正面及背面示意图如下（NOT TO SCALE）：

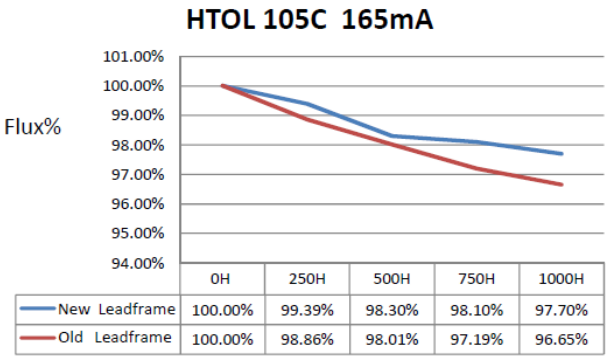


新支架正面及背面示意图如下（NOT TO SCALE）：

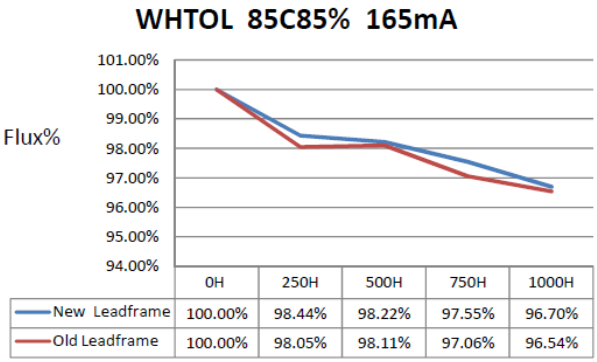


我们针对此项变更，提出新支架相比旧支架产品可靠性表现及气密性表现更佳，具体参看以下对比。

a)3030新旧支架光衰（高温高湿双85老化及高温105度老化测试数据）对比：

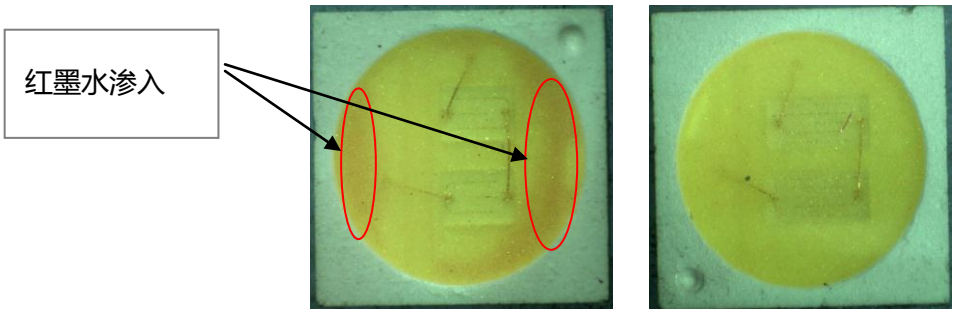


	0H	250H	500H	750H	1000H
New Leadframe	100.00%	99.39%	98.30%	98.10%	97.70%
Old Leadframe	100.00%	98.86%	98.01%	97.19%	96.65%



	0H	250H	500H	750H	1000H
New Leadframe	100.00%	98.44%	98.22%	97.55%	96.70%
Old Leadframe	100.00%	98.05%	98.11%	97.06%	96.54%

b)3030新旧支架产品气密性对比（90℃红墨水浸泡8小时）：



旧支架（有渗入）　　新支架（无渗入）

综上结论：新支架产品可靠性表现优于旧支架产品，可为客户终端产品进一步提升竞争力。