



## Eight Discipline Report (8D Report)

To:	8D report No.:
From: : Chicony Power Technology	RMA claim No.:
CC :	Chicony Power P/N: <b>A240A005P</b>
	Customer P/N:
Submit date: <b>11/20</b>	Product description: <b>240W</b>
Receive date: <b>11/20</b>	Defect D/C or Lot No.:
<b>Subject :</b> 客戶端反映有一台 240W 樣機沒有輸出 <b>(MOSFET, Surge)</b>	
<b>D1.) 問題解決成員:Use Team Approach</b> 主持者 (Team Leader) : 內部成員 (Internal Team Members): 外部成員 (External Team Member):	
<b>D2.) 問題說明:Problem Description:</b> <i>(Note: Use who, what, when, where, why, how, how many to specify the Customer's problem.)</i>	

**客戶端反映有一台 240W 樣機沒有輸出**

**維修紀錄查詢:**

**無維修紀錄**



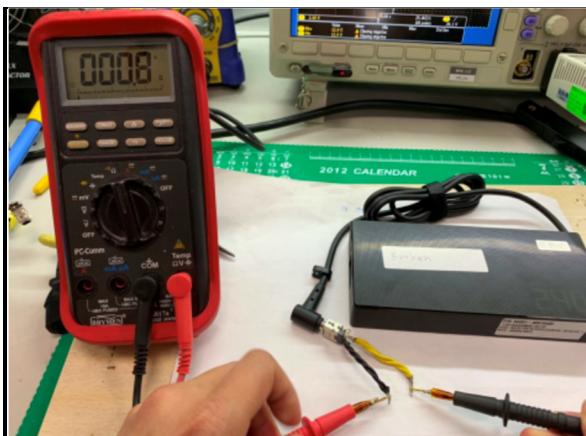
The screenshot shows a software interface for tracking work orders. At the top, there is a search bar with 'Serial Number' set to 'TBK36B3100072'. Below the search bar are two columns of data and three buttons: 'Query', 'Export', and 'Batch Exp'.

Work Order	TBK36B31	Serial Number	TBK36B3100072
Part No	A240A005PAX01X2	Customer SN	0A001-0097040003620003N
Version	N/A	QC LotNo	QCCPCQ_L1320090773700
SPEC1		Pallet No	PMK20C0400173
OutPut Time	2020/9/9 下午 03:42:58	Carton No	CTK36B3100002
Status	Complete	Box No	N/A

Below the table is a navigation bar with links: Travel, Repair, Quality Control, KeyParts, Rework, Work Order, Current, Burn In. The main area displays a grid of work order details:

Work Order	Serial Number	Customer SN	Custom	Version	Route Name	PDLine Name	Stage Name	Process Name	Terminal Name
TBK36B31	TBK36B3100072	MK24000X11234	N/A	N/A	Pilot run	CPCO_L02	FINAL ASSEM ASSY	ASSY02	
TBK36B31	TBK36B3100072	MK24000X11234	N/A	N/A	Pilot run	CPCO_L02	FINAL ASSEM ACT	ACT02	
TBK36B31	TBK36B3100072	MK24000X11234	N/A	N/A	Pilot run	CPCO_L02	FINAL ASSEM PRE-ATE	PRE-ATE02	
TBK36B31	TBK36B3100072	MK24000X11234	N/A	N/A	Pilot run	CPCO_L02	PACKING	HIPOT/GROUN	
TBK36B31	TBK36B3100072	MK24000X11234	N/A	N/A	Pilot run	CPCO_L02	PACKING	HIPOT/GROUN	
TBK36B31	TBK36B3100072	0A001-0097040003	N/A	N/A	Pilot run	CPCO_L03	FINAL-ATE	FINAL-ATE02	
TBK36B31	TBK36B3100072	0A001-0097040003	N/A	N/A	Pilot run	CPCO_L13	PACKING	PACKING01	
TBK36B31	TBK36B3100072	0A001-0097040003	N/A	N/A	Pilot run	CPCO_L13	QC	QC01	

**輸出端檢查，量測輸出端正負極有短路現象**



開殼分析: 量測到 Q57 short & U201 的各 Pin 對 GND 阻抗偏低

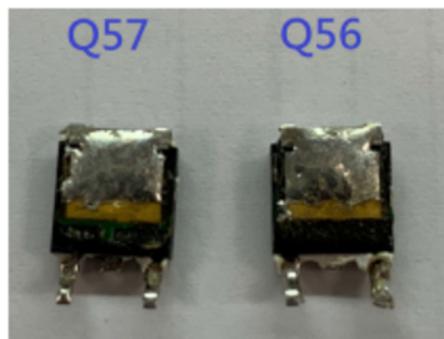


#### 零件分析

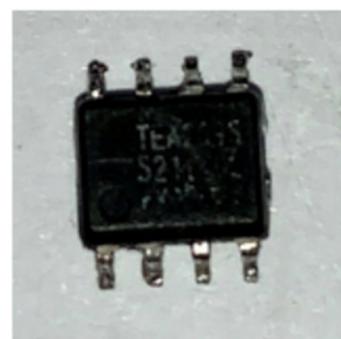
Components: Q56, Q57 and U201



IPD025N06N 正面



IPD025N06N 反面



U201

Failure Components: Q57

Failure Analysis:

Q57 D-S pin short & G-S pin low impedance(125ohm).

Q57, Q56 Vendor : INFINEON IPD025N06N



IPD025N06N不良品



Measurement Q57 D-S pin Vf

IPD025N06N良品



Measurement Q56 D-S pin Vf

Q57 元件規格



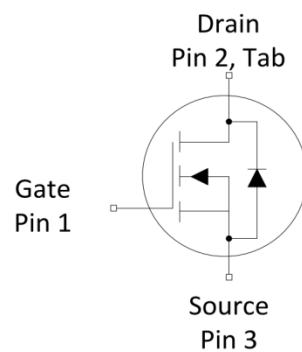
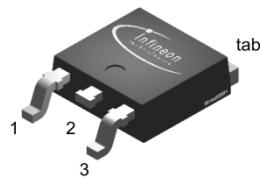
OptiMOS™ Power-Transistor, 60 V

IPD025N06N

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Drain-source breakdown voltage	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0$ V, $I_D=1$ mA

D-PAK



Failure Components: U201

Failure Analysis:

IC 各 Pin 對 GND 阻抗異常.

U201 Vendor :NXP TEA2095



Probe		Result(ohm)	
+	-	良品	不良品 U201
Pin1	GND	192K	5.23K
Pin3	GND	Open	645
Pin4	GND	99	94
Pin5	GND	101	484
Pin6	GND	Open	1.14K
Pin7	GND	44K	31.7
Pin8	GND	192K	103K

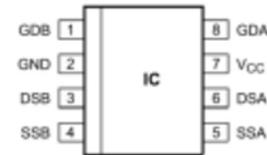
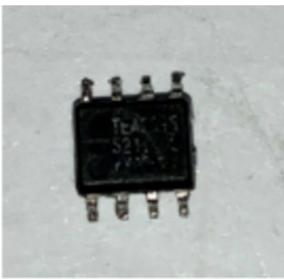


Table 3. Pin description

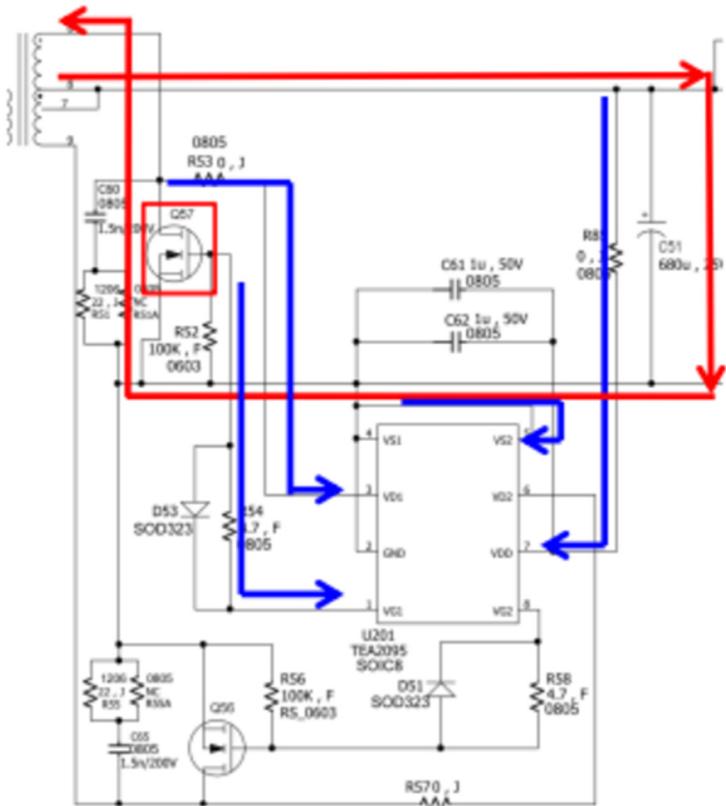
Symbol	Pin	Description
GDB	1	gate drive output MOSFET B
GND	2	ground
DSB	3	drain sense input for synchronous timing MOSFET B
SSB	4	source sense input MOSFET B
SSA	5	source sense input MOSFET A
DSA	6	drain sense input for synchronous timing MOSFET A
VCC	7	supply voltage
GDA	8	gate drive output MOSFET A

## 電路分析

Q57 D-S Pin short 時，能量瞬間將 U201 擊穿

Blue line: 能量可能進入 U201 的路徑

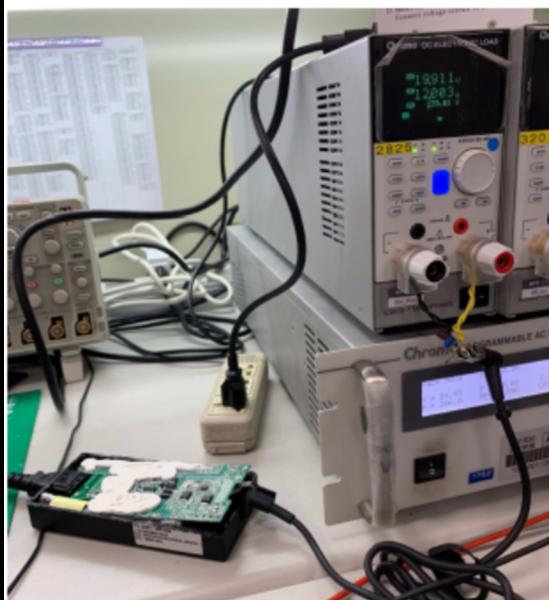
Red line: 正常 Q57 導通電流路徑





## 不良品修復

更換 Q56, Q57 and U201 後，不良樣機可正常開機



## Q57 波形量測確認

量測 Q57 在負載變動測試下的狀態，皆符合零件規格

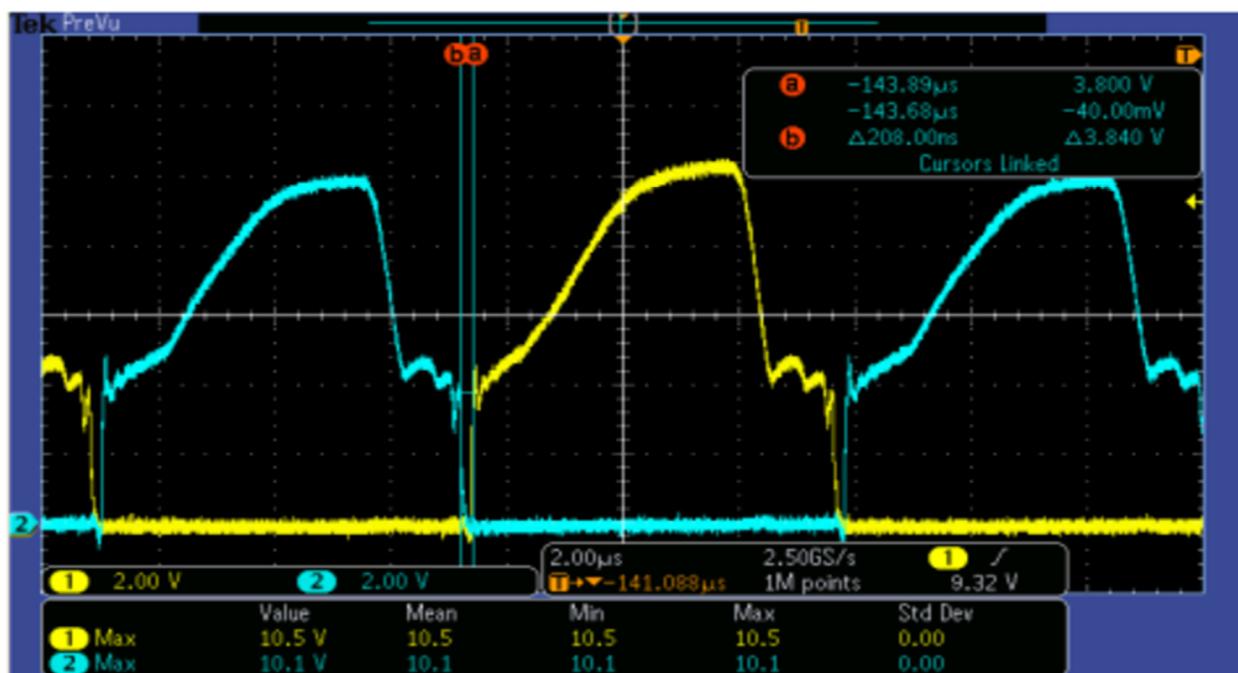
Component Description		Input Voltage	Output Load	Stress in Application		Dead Time
Location	Part No.	Vac	A	VDS(V)	VGS(V)	s
Q57	INFINEON(IPD025N06N)	230	12	51.2	11.6	208n
			24(2mS)→10.875(18mS)	52.8	12	211.6n
			27(1.5mS)→10.875(13.5mS)	53.6	12	203.2n
			3(0.01mS)→6(0.01mS)	53	5.2	201.6n
			3(0.05mS)→6(0.05mS)	53	5.4	201.6n
			3(0.5mS)→6(0.5mS)	53	6	201.6n
			3(5mS)→6(5mS)	53	6	201.6n

## Q56 & Q57 波形量測

確認 SR MOS Q56 & Q57 無 overlap 且 delay time 符合規格



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_d$	delay time	interlock delay time	-	200	-	ns



CH1: Q56 VGS CH2:Q57 VGS

### 模擬系統負載量測

### 參考客戶系統運作模式作負載變動測試

PSU	Input Voltage	Output Load	P <sub>H</sub>	Time	Result
P/N	Vac	A	W	Hour	
0018	230	3A(0.05mS)→8.5A(0.05mS)	124.3W	8	PASS
005A		3A(30mS)→5A(1.5S)	108.5W		PASS
005H		3A(30mS)→5A(25)	108.6W		PASS
002Z		3A(40mS)→8A(1.5S)	170.8W		PASS
0013		3A(40mS)→8A(25)	170.9W		PASS
0005		3A(40mS)→10A(1S)	212.3W		PASS
000T		3A(40mS)→10A(1.5S)	212.2W		PASS
000V		4A(40mS)→9A(120mS)	165.4W		PASS
001I		7A(12mS)→26A(2mS)	207.5W		PASS
006Q		10A(12mS)→26A(2mS)	261.7W		PASS

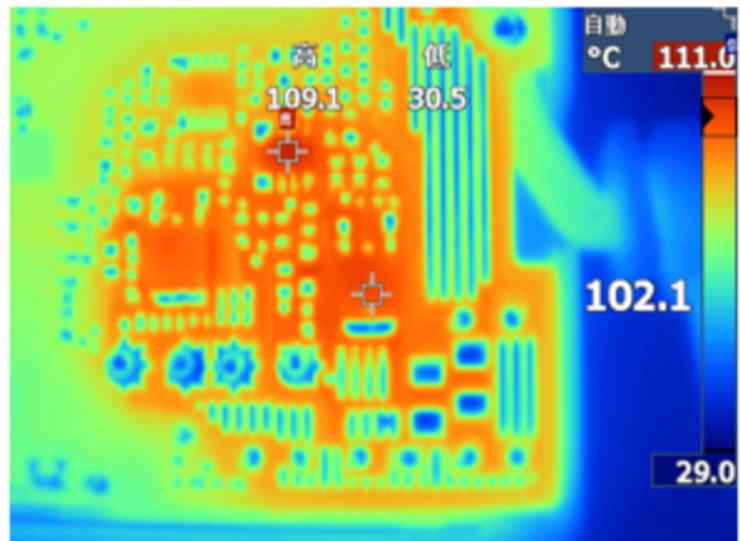
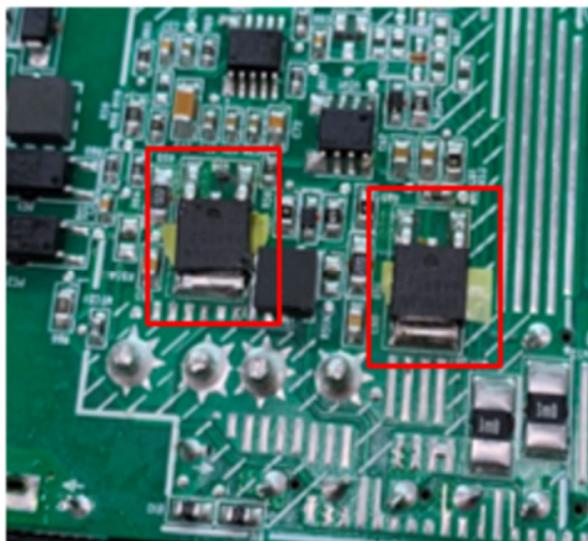


## 模擬 Q56 & Q57 晶體背部吃錫不良

將晶體背部部分以黃膠帶覆蓋後再吃少量錫，在輸出 peak load 條件下燒機，紅外線熱像儀量測零件溫度：

Q57=102.1°C, U201=109.1°C, 符合零件規格

PSU	Input Voltage	Output Load	Time	Result
P/N	Vac	A	Hour	
0019	230	10A(8m5)→27A(2m5)	4	PASS



## U201 失效分析

Item/ Function	Potential Failure Mode	Potential Effect of Failure
U201	U201 open (開路後開機)	pin1: 燒機30分後觸發二次側OTP，Q57=160度、Q56=142度 pin2: 燒機10分後PSU正常動作，U201=90度、Q56=Q57=87.2度 pin3: 燒機42分後觸發二次側OTP，Q57=157度、Q56=130度 pin4: 燒機30分後PSU正常動作，U201=103度、Q56=Q57=92度 pin5: 燒機30分後PSU正常動作，U201=106度、Q56=Q57=94度 pin6: 燒機14分後觸發二次側OTP，Q56=145度 pin7: 燒機5分後觸發二次側OTP，Q57=156度、Q56=148度、U201=104度 pin8: 燒機13分後觸發二次側OTP，Q57=108度、Q56=152度、U201=113度



Item/ Function	Potential Failure Mode	Potential Effect of Failure
	U201 short (短路後開機)	pin1-2:燒機10分鐘後觸發二次側OTP，Q57=160度、Q56=135度、U201=250度 pin2-3:PSU no output pin3-4:PSU no output pin5-6:燒機4分鐘後觸發二次側OTP，Q57=160度、Q56=156度、U201=110度 R57 阻值異常( $0\Omega \rightarrow 20K\Omega$ ) pin6-7:燒機16分鐘後觸發二次側OTP，Q56=148度、Q57=104度、U201=110度 pin7-8:PSU no output
U201	U201 short (開機後短路)	pin1-2:燒機10分鐘後觸發二次側OTP，Q57=164度、Q56=140度、U201=240度 pin2-3:PSU no output，Q57 damage pin3-4:PSU no output，Q57 damage、R53阻值異常( $0\Omega \rightarrow 30K\Omega$ )、 U201溫度異常(開機20秒溫度到120度) pin5-6:燒機9分鐘後觸發二次側OTP，Q57=160度、Q56=165度、U201=100度、 R57阻值異常( $0\Omega \rightarrow 40K\Omega$ )、重啟後PSU no output，U201 damage pin6-7:PSU no output，R85阻值異常( $0\Omega \rightarrow open$ )、U201 damage pin7-8:PSU no output

## Q56 失效分析

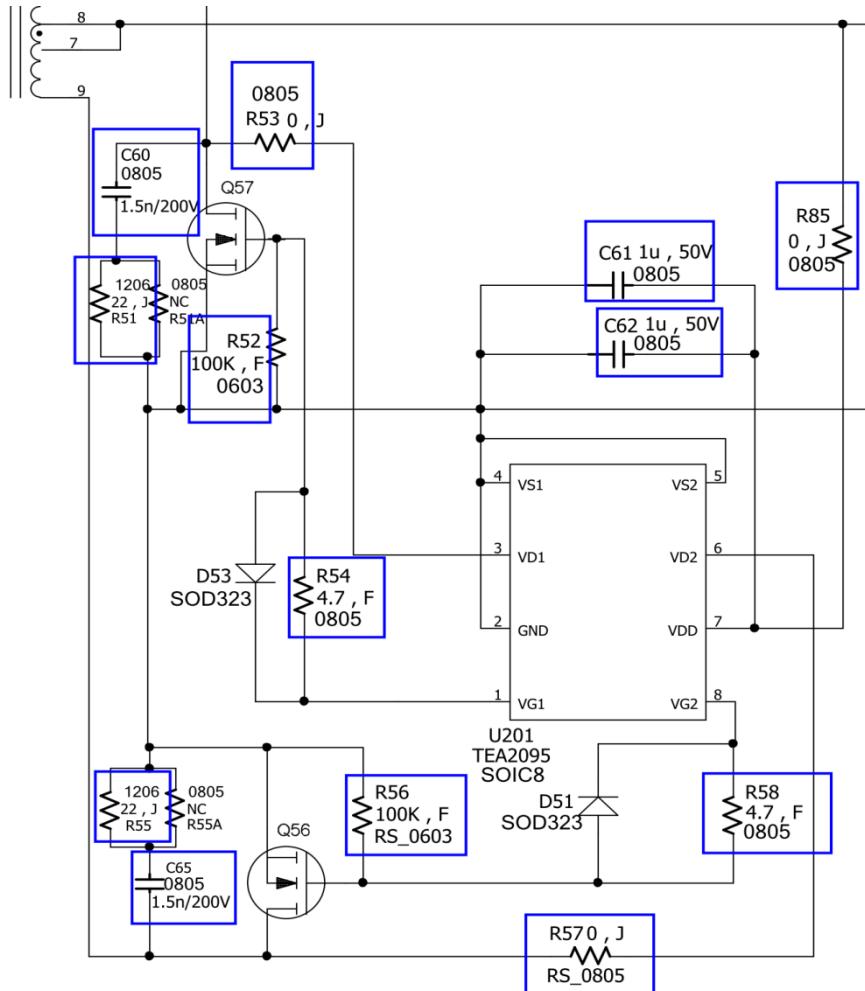
Item/ Function	Potential Failure Mode	Potential Effect of Failure
Q56	Q56 short (開機後短路)	G-D:PSU no output，Q56 damage D-S:PSU no output，Q56 damage G-S:燒機15分鐘後觸發二次側OTP，Q57=130度、Q56=146度、U201=224度 重啟後PSU no output，U201 damage

## Surge Test To Fail

- Surge Test Common Mode ( $12\Omega$ )  $\pm 4.4KV$  後產品輸出電壓掉至 18.7V  
→再測試 Common Mode ( $12\Omega$ )  $\pm 6KV$  打第二下後產品無輸出
- 量測到 Q57 short & U201 的各 Pin 對 GND 阻抗異常
- Components: Q56, Q57 and U201



- 量測 U201 周邊零件在各種條件下 Stress 是否能符合規格



Input Voltage : 230Vac

Output Load : 0A

Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Resistance(Ω)	Power(W)	Vrms(V)	Power(W)	Vrms(V)	Power Ratio	Vrms Ratio	Power	Vrms	OK?
R51	1206	22	0.25	200	0.03	0.784	11%	<1%	58%	90%	Yes
R52	0603	100000	0.1	50	0.00	0.395	<1%	1%	55%	90%	Yes
R54	0805	4.7	0.125	150	0.00	0.079	1%	<1%	47%	90%	Yes
R55	1206	22	0.25	200	0.02	0.699	9%	<1%	58%	90%	Yes
R56	0603	100000	0.1	50	0.00	0.329	<1%	1%	55%	90%	Yes
R58	0805	4.7	0.125	150	0.00	0.082	1%	<1%	47%	90%	Yes
R53	0805	0	0.1	150	-	0.078	-	<1%	-	90%	Yes
R57	0805	0	0.1	150	-	0.087	-	<1%	-	90%	Yes
R85	0805	0	0.1	150	-	0.177	-	<1%	-	90%	Yes
Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Cap.(μF)	Vmax(V)	Max.(°C)	Vmax(V)		Vmax Ratio		Vmax		OK?
C60	0805	0.0015	200	125	43.6		21.8%		90%		Yes
C61	0805	1	50	125	21.2		42.4%		90%		Yes
C62	0805	1	50	125	21.2		42.4%		90%		Yes
C65	0805	0.0015	200	125	42.8		21.4%		90%		Yes


**Input Voltage : 230Vac**
**Output Load : 5A**

Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Resistance(Ω)	Power(W)	Vrms(V)	Power(W)	Vrms(V)	Power Ratio	Vrms Ratio	Power	Vrms	OK?
R51	1206	22	0.25	200	0.12	1.62	48%	1%	58%	90%	Yes
R52	0603	100000	0.1	50	0.00	3.49	<1%	7%	55%	90%	Yes
R54	0805	4.7	0.125	150	0.00	0.091	3%	<1%	47%	90%	Yes
R55	1206	22	0.25	200	0.10	1.47	39%	1%	58%	90%	Yes
R56	0603	100000	0.1	50	0.00	3.79	<1%	8%	55%	90%	Yes
R58	0805	4.7	0.125	150	0.00	0.097	2%	<1%	47%	90%	Yes
R53	0805	0	0.1	150	-	0.173	-	<1%	-	90%	Yes
R57	0805	0	0.1	150	-	0.209	-	<1%	-	90%	Yes
R85	0805	0	0.1	150	-	0.196	-	<1%	-	90%	Yes
Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Cap.(μF)	Vmax(V)	Max.(°C)	Vmax[V]		Vmax Ratio		Vmax		OK?
C60	0805	0.0015	200	125	45.2		22.6%		90%		Yes
C61	0805	1	50	125	21.6		43.2%		90%		Yes
C62	0805	1	50	125	21.6		43.2%		90%		Yes
C65	0805	0.0015	200	125	43.2		21.6%		90%		Yes

**Input Voltage : 230Vac**
**Output Load : 12A**

Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Resistance(Ω)	Power(W)	Vrms(V)	Power(W)	Vrms(V)	Power Ratio	Vrms Ratio	Power	Vrms	OK?
R51	1206	22	0.25	200	0.13	1.66	50%	1%	58%	90%	Yes
R52	0603	100000	0.1	50	0.00	7.01	<1%	14%	55%	90%	Yes
R54	0805	4.7	0.125	150	0.00	0.123	3%	<1%	47%	90%	Yes
R55	1206	22	0.25	200	0.12	1.63	48%	1%	58%	90%	Yes
R56	0603	100000	0.1	50	0.00	6.91	<1%	14%	55%	90%	Yes
R58	0805	4.7	0.125	150	0.00	0.116	2%	<1%	47%	90%	Yes
R53	0805	0	0.1	150	-	0.192	-	<1%	-	90%	Yes
R57	0805	0	0.1	150	-	0.239	-	<1%	-	90%	Yes
R85	0805	0	0.1	150	-	0.199	-	<1%	-	90%	Yes
Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Cap.(μF)	Vmax(V)	Max.(°C)	Vmax[V]		Vmax Ratio		Vmax		OK?
C60	0805	0.0015	200	125	46.8		23.4%		90%		Yes
C61	0805	1	50	125	21.6		43.2%		90%		Yes
C62	0805	1	50	125	21.6		43.2%		90%		Yes
C65	0805	0.0015	200	125	43.6		21.8%		90%		Yes

**Input Voltage : 230Vac**
**Output Load : 27A(1.5ms)→10.875A(13.5ms)**

Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Resistance(Ω)	Power(W)	Vrms(V)	Power(W)	Vrms(V)	Power Ratio	Vrms Ratio	Power	Vrms	OK?
R51	1206	22	0.25	200	0.12	1.64	49%	1%	58%	90%	Yes
R52	0603	100000	0.1	50	0.00	6.71	<1%	13%	55%	90%	Yes
R54	0805	4.7	0.125	150	0.00	0.104	2%	<1%	47%	90%	Yes
R55	1206	22	0.25	200	0.13	1.67	51%	1%	58%	90%	Yes
R56	0603	100000	0.1	50	0.00	6.32	<1%	13%	55%	90%	Yes
R58	0805	4.7	0.125	150	0.00	0.096	2%	<1%	47%	90%	Yes
R53	0805	0	0.1	150	-	0.193	-	<1%	-	90%	Yes
R57	0805	0	0.1	150	-	0.24	-	<1%	-	90%	Yes
R85	0805	0	0.1	150	-	0.186	-	<1%	-	90%	Yes
Component Description		Component Specifications			Stress in Application		Calculated Stress Factors		Stress Ratio Spec.		Stress
Location	Type	Cap.(μF)	Vmax(V)	Max.(°C)	Vmax[V]		Vmax Ratio		Vmax		OK?
C60	0805	0.0015	200	125	46.8		23.4%		90%		Yes
C61	0805	1	50	125	21.6		43.2%		90%		Yes
C62	0805	1	50	125	21.6		43.2%		90%		Yes
C65	0805	0.0015	200	125	43.6		21.8%		90%		Yes



**D3.)**內部或客戶的暫時解決辦法及實施日期:Implement and Verify Containment Action:

(Note: Internal / external containment action effectiveness and date.)

安排工廠端作對策驗證，驗證數量 10 台

Date:2020/11/20

**D4.)**不良原因確認: Define and Verify Root Causes:

(Note: Identify and verify all suspect causes, which needs explain why the problem occurred.)

- 產品無輸出，不良原因為 Q57 short，U201 阻抗異常導致
- 驗證 10pcs samples，模擬搭配系統充電，Dynamic Load 測試 8 小時，無任何異常發生。
- 量測 MOSFET Gate 與 VDS 耐壓均符合 De-rating 要求。
- 確認 SR IC 控制時序，MOSFET 無 Overlap 現象，dead time 符合 Spec 200nS。
- 確認二次側 SR 周邊元件 de-rating 在不同負載模式下均符合 component de-rating。
- Surge test to Fail (6KV)可成功複製出 U201 與 Q57 Damage 現象。

**D5.)**改善措施:Corrective Action Verification:

(Note: Be make sure the corrective actions is effective in process as well as able to fix the customer complaint problem)

無

Date:2020/11/20

**D6.)**改善措施實施日期:Implement Permanent Corrective Actions:

(Note: Be provide the phase-in date or lot# of corrective actions implementation in process)

Immediately

**D7.)**預防再發生措施:Prevent Recurrence:

(Note: Modified the management, operating systems, practices, and procedures to prevent recurrence for the problems as well as lessons learned cases.)

Same as D5



**D8.) 確認並感謝問題解決成員 :Check and Congratulate the Team:**

**(Note: Recognize the collective efforts of the team.)**

**Thanks to you all ! ! !**

<b>Signature</b>	<b>Arthur Wu</b>
<b>Team Leader:</b>	Name – Title
<b>Signature by Approver:</b>	<b>Mark Meng</b>
	Name-Title