REV.	Description	Date
S00	SPEC ISSUE	10/27/2017
S01	102A-17B155 ADD ADP-160FR AAD	11/30/2017
S02	102A-17C074 ADD ADP-160FR AA	12/29/2017
S03	102A-183090 ADD ADP-160FR AB	03/30/2018
S04	102A-184092 ADD ADP-160FR ABA	04/26/2018
00	102A-191045 Release mass production spec.	01/11/2019
01	102A-219168 ADD ADP-160FR ASA/ASB	10/05/2021

台達電子工業股份有限公司
DELTA ELECTRONICS, INC.

DESCRIPTION :
測試規格(Test Specification)

MODEL NO. :
ADP-160FR SERIES

Date	Drawn	Design (EE)	Design (ME)	DOCUMENT NAME. :	REV.
10/05/2021	邱美淳	王竹君	李昱緯	TS-160FR SERIES	01

MODEL LIST: ADP-160FR AAA/AAB/AAC/AAD/AA/AB/ABA/ASA/ASB

1 測試注意事項內容，未經工程師許可，不可任意變更。
Test Notice contents shall not be changed or revised without engineer permission.

2 此測試規格用於主線測試,所有項目均需被測試,因設備或線速限制無法全數測試時,
需測試 worst case, QC 需按抽樣標準測試所有 Item 不可只測試主線測試項目.
The production line shall perform all or worst test items/conditions, and QC shall follow the sampling plan to perform all items/conditions not just the worst condition as production did.

3 測試注意事項 :(以下為範例寫法請依據產品特性自行修正)

a. 功能測試時, 5VSB & 12V 電子負載需設定 Von 點為 0V.

b. 所有 ATS 測試時，須偵測 CONNECTOR 端之電壓。

c. 在測試時,治具上各組輸出須有加系統電容, 崩應時 12V 只需 4700uF, 5VSB 只需加 100uF,
風量為 6.4CFM。
12V : 22uF (Ceramic capacitor) + 4700uF
5VSB : 10uF (Ceramic capacitor) + 100uF

d. ATS 測試時須外加風扇，否則將造成 Power supply 過熱。

e. Case 未組裝前的各項測試,於測試完成後須對 BULK CAP 放電。

f. 5VSB & 12V 的 output peak load & 效率測試電壓量測需以測試板上為主。

g. 噪音測試量測 (帶 case 測試), 麥克風距離 case 出風口 5cm , 依照客戶指定負載如下,
(1) 5VSB:量測 0.03A , 0.33A, 12V OFF.
12V:量測 0.33A, 5V 0A.
(2) 此機種 case 有開孔, 定義為 open frame 機種:
(3) 測試頻率 0-15KHz.

階段	EVT	DVT&PVT	M/P FQC	M/P QE
測試距離	5cm	5cm	5cm	5cm
輸入電壓	100V & 230V	100V & 230V	100V & 230V	100V & 230V

標準	40 dB max.

h. For 客戶系統要求, 當 Vin@100Vac, 輸出 5VSB/1.5A, 12V/13A, 輸入電流要小於 2.5A.

i. Common noise follow 客戶測試方式及規範

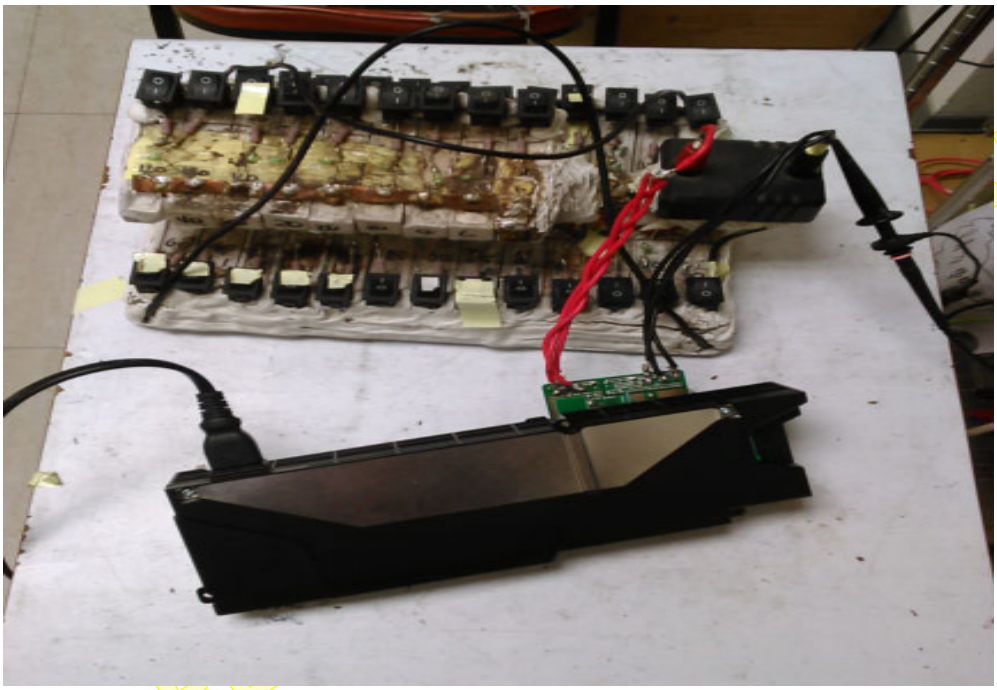
Vin:100Vac/50Hz, 230Vac/50Hz

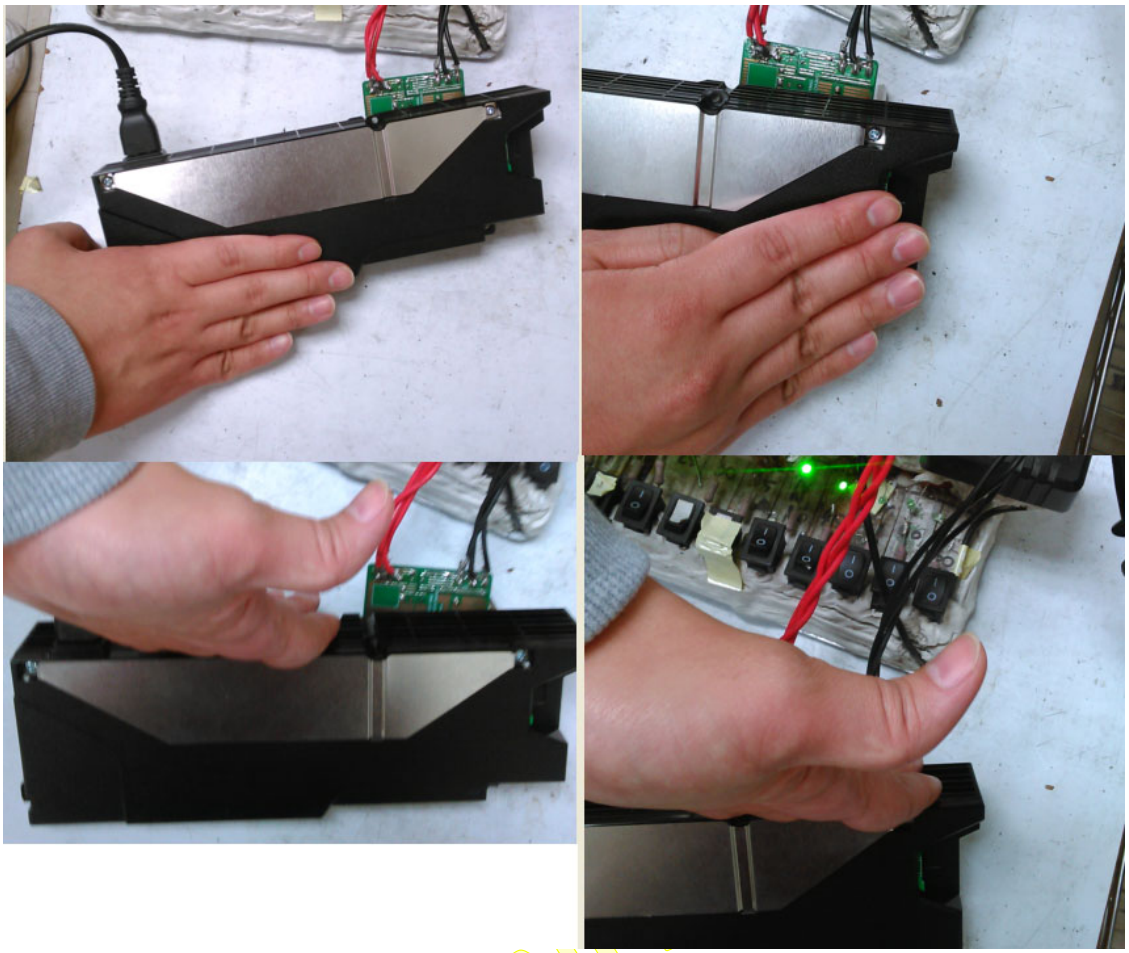
Vo:5VSB/0A,12V/6.3A

Spec:<-6dBm@100kHz~500kHz

治具設定:

1. PG1 &PG2 連接起來
2. 探棒勾在輸出 GND 上面
3. 輸出負載:5VSB/0A, 12V/6.3A & 12V/0.2A (接線方式如下圖所示)
4. 用手觸摸 PSU，但注意不可 touch 到 outside shielding





j. 考量 ATS 測試治具造成誤差, ATS 電壓定義如下:
12V/9.5A 時, ATS 輸出電壓定義為 11.3V~12.6V.
12V/16A 時, 輸出電壓定義為 11.17V~12.6V.
其他負載如有偏低問題, 須比對 ATS 及 sample 板上電壓誤差做調整.

k. 熱機效率測試依照規格定義做測試，冷機效率 12V 部分如下:
當負載為 13A 時，效率須大於 87%。
出貨測試與 5V 輸出電壓有關之項目，由於 5VSB 線損(壓降)太大因此測試時輸出電流

大於等於 rated load 時須符合客戶規格但不做 CPK(rated load,peak load,ocp)。

m.Drop out 測試時間若是超過客戶規格 40ms 時，不做 CPK。

n.Turn on delay time 2 會因為電容的殘餘電荷影響，須符合客戶規格，但不做 CPK。

4 手調測試站：(以下為範例寫法請依據產品特性自行修正)

a. Full Load Test: 檢查滿載輸出是否符合規格

b. Min. Load Test: 檢查輕載載輸出是否符合規格

Output	Output Voltage	
	Rated	Tolerance
5VSB	4.8V	4.608V~4.992V
12V	12V	11.52V~12.6V

c. OVP Test :

Load Condition : 0A

敘述測試方法,

5VSB 短路 OV1 to GND

檢查輸出電壓是否高於 5V

12V 短路 OV2 to GND

檢查輸出電壓是否動作高於 12.5V

OVP 動作模式為 Latch off.

Load Condition : 5VSB/1.5A,12V/13A

敘述測試方法,

5VSB 短路 OV1 to GND

檢查輸出電壓是否低於 2V

12V 短路 OV2 to GND

檢查輸出電壓是否低於 2V

OVP 動作模式為 Latch off.

d.AC On/Off:

Power supply 連續開關機 On= 2 秒, Off= 2 秒, 5 次後, 必須無損壞情形。

Function test (ATS) procedure：

Input Specification Table:

INPUT VOLTAGE	MINIMUM	MAXIMUM	NOMINAL(RATED)
LOW RANGE	85 VAC	132 VAC	100 VAC
HIGH RANGE	180V AC	276V AC	240V AC

Output Specification Table:

Output	Output Voltage	
	Rated	Tolerance
5VSB	4.8V	4.608V~4.992V
12V	12V	11.52V~12.6V

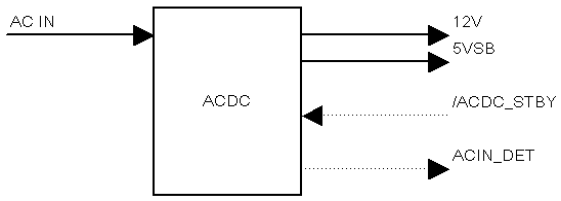
4.1 Input characteristics

	Item	Condition		Specification
1	Rated input voltage	-		100 ~ 240 Vac
2	Input voltage range	-		85 ~ 276Vac
3	Input current	5VSB/1.5A, 12V/13A @ 100Vac		Less than 2.5A
4	Rated input frequency	-		50Hz / 60Hz
5	Input frequency	-		47 ~ 63 Hz
6	Input inrush current	85 ~ 276 Vac Rated load. (Test with 3KV AC source).	Ta= 25°C Cold start	Less than 140A
			Ta= 40°C Repeat AC ON<=>OFF (5VSB: 120mA load, 12V OFF)	Less than 180A/2msec 以下

4.2 Output characteristics

Output System:

Control signal (input): 12V on/off by ACDC_STBY



Output Characteristics:

Below output capacitance (smallest capacity) should be satisfied

12V : 22uF (Ceramic capacitor)

5VSB : 10uF (Ceramic capacitor)

Output	Output Voltage		Output Current			Ripple & Nioise (at rated load)
	Rated	Tolerance	Peak	Rated	Min.	Ta= -5~40°C
5VSB	4.8V	+/- 4%	3A	1.5A	0A	50mVp-p,max
12V	12V	+ 5%,- 4%	19.5A/30msec	13A	0A	150mVp-p,max
5VSB	4.8V	+/- 10%	Rated load to Peak load.			
5VSB	4.8V	+/- 4%	Peak 3A, (stabilize)			

Output	OCP	OVP
5VSB	3 ~ 3.75A	6V,max
12V	19.5 ~ 24.375A	15.6V,max

Other characteristics:

	Item	Condition and Specification
1	No load operating	Input range: 85 ~ 276 Vac No function error, no damage, and output voltage should be within regulation.
2	Over / Undershoot	Input range: 85 ~ 276 Vac Output voltage should be within 10% of rated output voltage.

3	Start with capacitive load	Input range: 85 ~ 276 Vac Output should be in parallel with below capacitor : 12V : 4700uF 5VSB : 100uF The unit should be able to start stably.		
4	Protective function	OCP	Once the 5VSB has been detected abnormal (5VSB OC/OV), all output should be shut down. Once the 12V has been detected abnormal (12V OC/OV/OT/UV), 12V output should be shut down immediately, and pull ACIN_DET to low.	
		OVP		
		OTP		
		Protection functional operation (Signal and power output)		
5	Recovery from protection	Remove latch function after the AC OFF and within 3 minutes.		
6	Transient response	5VSB	Input range: 85 ~ 276 Vac [5VSB load change] Change range : 100%~60%, 90%~50%, 80%~40% Change frequency : 10Hz & 1kHz. Change rate : 0.01A/usec 12V load : 0A and 13A	Output voltage should be requlated within 4.8V +/-4%.
		12V	Input range: 85 ~ 276 Vac [12V load change] Change range : 100%~80%, 90%~70%, 80%~60% Change frequency : 10Hz & 1kHz. Change rate : 0.3A/use 5V load : 0A and 1.5A	Output voltage should be requlated within 12V + 5%,- 4%.

4.3 Control terminal characteristics

<table>
<tr><td>ACDC_STBY</td><td>Signal polarity
<table>
<tr><td></td><td colspan="2">ACDC_STBY</td></tr>
<tr><td></td><td>Hi</td><td>Low</td></tr>
<tr><td>5VSB</td><td>ON</td><td>ON</td></tr>
<tr><td>12V</td><td>ON</td><td>OFF</td></tr>
</table>
【 ACDC_STBY signal level 】
Vin_max : 3.465V
Vih : Min 2.2V
Vil : Max 0.6V
Iin_max : 0.15mA</td></tr>
<tr><td>ACIN_DET</td><td>【 ACIN_DET signal level 】
With the signal output which fills up below-mentioned Spec, on ACDC side the P-D resistant internal of 100kΩ.

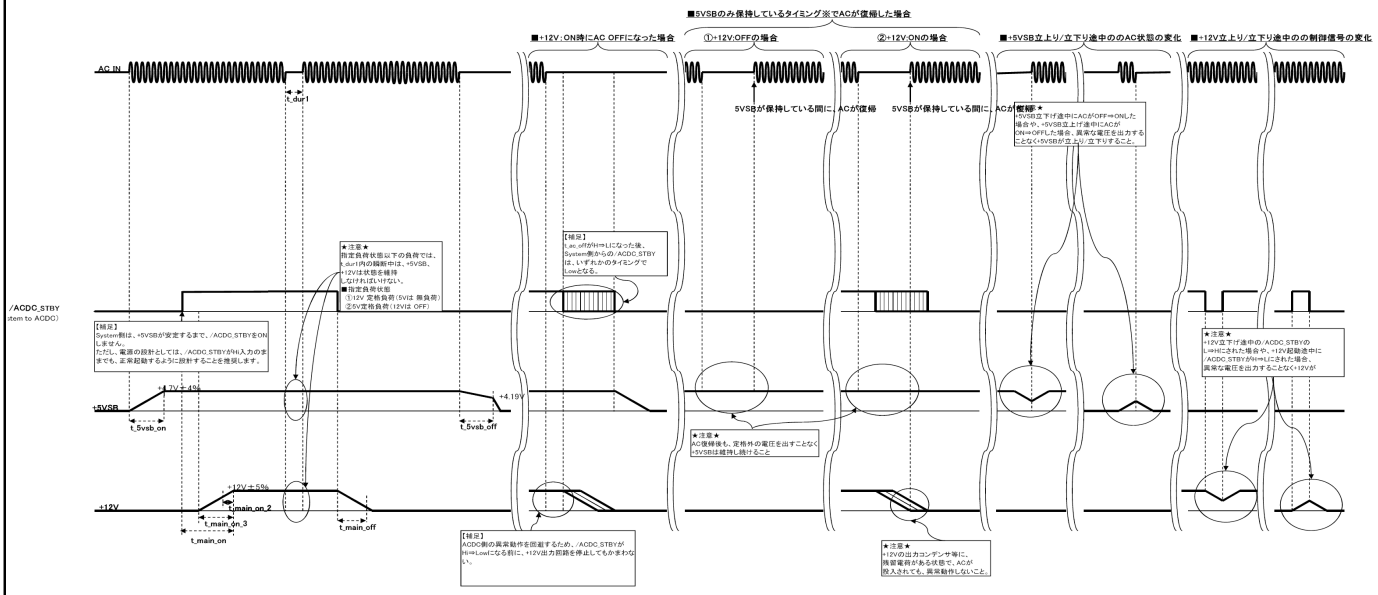
[AC ON]
ACIN_DET : Voh: Min=4.5V, Max=5.1V

[AC OFF]
ACIN_DET : Vol: Min=0V, Max=0.3V</td></tr>
</table>

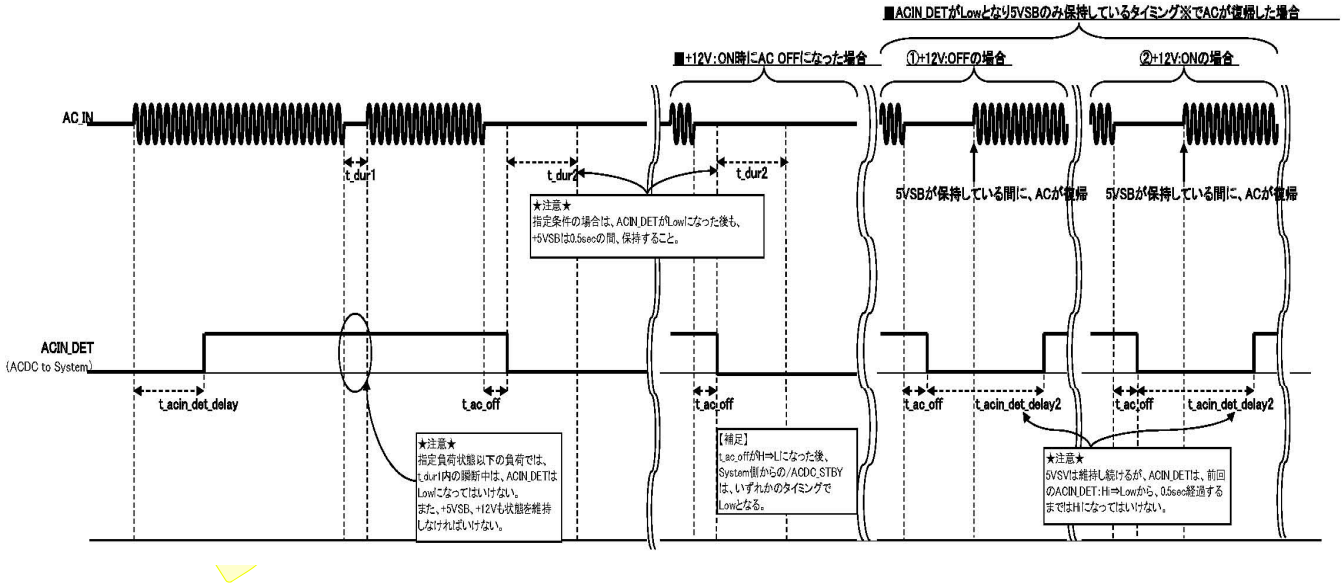
4.4 Power ON/OFF (Sequential control & Timing)

Item	Condition	Specification
5VSB turn on time (t_5vsb_on)	ACDC_STBY: Low	5VSB output voltage should be regulated to 4.8V+/-4% within 300mS.
12V turn on time (t_main_on)	ACDC_STBY on to 12V rise time.	12V output voltage can be regulated to 12V+ 5%, - 4% within 400mS.
12V turn on rise time (t_main_on_2)	10V to 12V rise time.	12V output voltage from 10V rise to 12V within 150msec.
12V turn on rise time (t_main_on_3)	0V to 12V rise time	12V output voltage from 0V rise to 12V within 2~20msec.
12V turn off time (t_main_off)	5VSB: rated load 12V : 8A load ACDC_STBY: Hi to Low	12V output voltage from 100%(avg voltage before change state) drop to 10% within 250mS.
ACIN_DET turn on delay time (t_acin_det_delay)	AC input: OFF to ON	ACIN_DET: Low to Hi Turn on after 5VSB output has stabilized.
ACIN_DET turn on delay time 2 (t_acin_det_delay2)	AC input: ON to OFF then ON again.	Once ACIN_DET from Hi to Low, and if turn Hi again, it should be wait for 10ms or more.
ACIN_DET turn off delay time (t_ac_off)	5VSB : no load ACDC_STBY: Low	more than 40msec
	ACDC_STBY: Hi	ACIN_DET should be turn low while 12V output drop between 12V to 0V.
Line cycle dropout (t_dur1)	Refer to item 5-7.	
Hold up time(t_dur2)		

■シーケンス



■シーケンス



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4.5 Common specifications

	Item		Condition	Specification
1	Switching frequency		100Vac input. Rated load.	-
2	Power factor		-	IEC61000-3-2.
3	Life		Rated input voltage. Ambient temperature, constant humidity.	70,000Hr or more with thermal test BOX. => 20,000Hr, 12V/5VSB rated load (FAN cooling). => 50,000Hr, 12V OFF, 5VSB/rated load (air convection).
4	Efficiency	5VSB (12V OFF)	Rated input voltage, load (0.03A)	55.5%
			Rated input voltage, load (0.05A)	63.0%
			Rated input voltage, load (0.06A)	66.5%
			Rated input voltage, load (0.1A)	71.5%
			Rated input voltage, load (0.3A)	78%
			Rated input voltage, load (0.37A)	78%
			Rated input voltage, load (0.6A).	79.5%
			Rated input voltage, load (0.75A).	80.0%
			Rated input voltage, load (1A)	80.5%
			Rated input voltage, load (1.5A)	80%
		12V (5VSB: 0A)	Rated input voltage, load (0.2A).	52%
			Rated input voltage, load (0.3A).	60.0%
			Rated input voltage, load (1A).	75.0%
			Rated input voltage, load (2A).	84.0%
			Rated input voltage, load (3A).	87.5%
			Rated input voltage, load (4A).	89.0%
			Rated input voltage, load (5A).	89.5%
			Rated input voltage, load (6A).	90.0%
			Rated input voltage, load (7A).	90.5%
			Rated input voltage, load (8A).	90.0%
			Rated input voltage, load (9A).	90.0%
			Rated input voltage, load (11A).	89.5%
			Rated input voltage, load (13A).	89.0%
5	Idle power consumption		Rated input voltage 12V OFF 5VSB: 0A load	**0.085W**(max)
			Rated input voltage 12V 0A load 5VSB: 0A load	0.9~1.7W
6	Internal components temperature rise		Rated input voltage. Thermal test BOX. Ta=40ºC	There is enough de-rating of temperature for all components. No component over derating before OTP trigger.
7	Line cycle dropout (瞬停保証時間) -	t_dur1	Rated input voltage 1. 12V: 6.5A(5VSB 0A)	50Hz 2 cycle(=40ms). Output voltage shall be satisfying electric characteristic.

		t_dur2	Input voltage range 1. 5VSB: 1.5A load 2. 12V: OFF & ON	5VSB shall be low after ACIN_DET low
8	入力片切 test		AC ON→ Line OPEN→Line SHORT. AC ON→Neutral OPEN→Neutral SHORT.	Same as AC ON→ AC OFF→ AC ON Same as AC ON→ AC OFF→ AC ON
9	Leakage current		Rated input voltage.	100uArms or less.
10	AC input discharge time		Input 121V or less, from AC power OFF to 37% rated.	1 sec or less.
			Input 122V or more, from AC power OFF to 45V.	1 sec or less.
11	400V input protection		400Vac input / 2sec.	No safety hazard.

Note 1: After completes required DVT test matrix, identifies and selects the worst case condition for the Production MTR. It is not required that all test conditions be tested. Example: If worst case condition for Output Ripple is minimum input voltage and maximum dc load, then that is the test condition to be used.

5. Safety

5.1Hi-POT test：

1	HI-POT	Input between primary and secondary. Primary 是 L,N, Second 是 CN101 12V & GND CN121 5VSB & GND, ACDC_STBY 為訊號 pin PG1 & PG2 需連接在一起. QA (sampling) : 3.0kVac 50/60Hz 60sec Production line (all): 3.1kVac 50/60Hz 3sec, Lo limit current 1.4mA(一旦 Lo limit current fail 請確認接觸端子是否接觸不良)。	IEC60950-1 item 5.2 Sense current : 10mA or less. Without damage to parts. Arcing sense level 5
2	Insulation resistance	500 Vdc input between primary and secondary.	10 Mohm or more.
3.	RFI	AC 線需垂直於地面	

6. Other

6.1 此機種為內藏 power，客戶無此應用，不需測試電源產品於過電流保護前重載(OCP 點的 95% or OCP 點減 0.2A)崩應 4 小時,其結果允許保護當機但不能 Damage。----- BU head wave.

6.2 12V 測試 dynamic load 的時候需按照客戶規格 20% load 切換做測試，不做 0%到 100% load 切換.

6.3 不測手機干擾測試. ----- BU head wave.

6.4 Idle power consumption(穩定後)

Rated input voltage 12V OFF/ 5VSB :0A load pin < 0.085W

Rated input voltage 12V 0A load/ 5VSB :0A load pin : 0.9W~1.7W

6.5 ESD 按規格不做加嚴測試

6.6 5V 輸出電壓，full load 切換到 peak load 瞬間，屬於 undershoot，規格為-4.32V。

6.7 測試 ripple 的時候要先等電路穩定，所以需等 10 分鐘後再行測試。

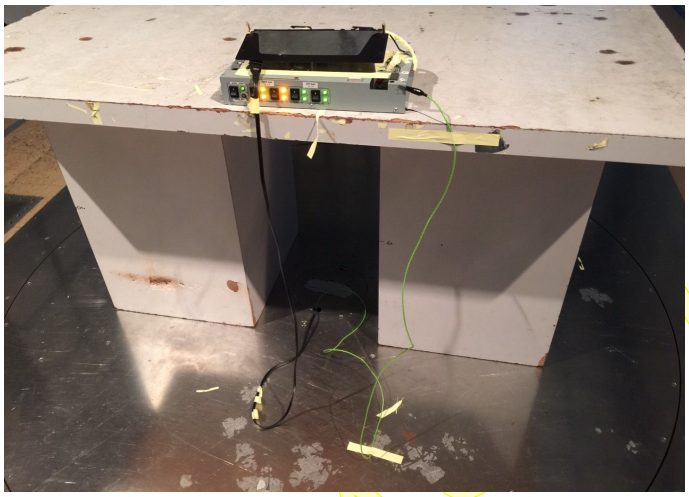
6.8 Ripple voltage (5V) :

測試 5V ripple voltage 時，因規格較嚴，只能勾一支探棒在 5VSB 端，不可以同時勾 12V，避免干擾。

6.9 CR-BOX

測試時測試電壓設定為 4KV，此測試電壓測試結果與客戶系統搭配測試結果最相近,故以此電壓做測試.,

6.10 RFI 使用客戶系統載測試(75%load） 測試方式如下圖,



6.11 測試方式為，每打一次 ESD，對治具放一次電。

6.12 效率測試

Burn in 完後，各負載需等讀值穩定後，才能開始記錄.

輸出電壓需用萬用表量測板端電壓.

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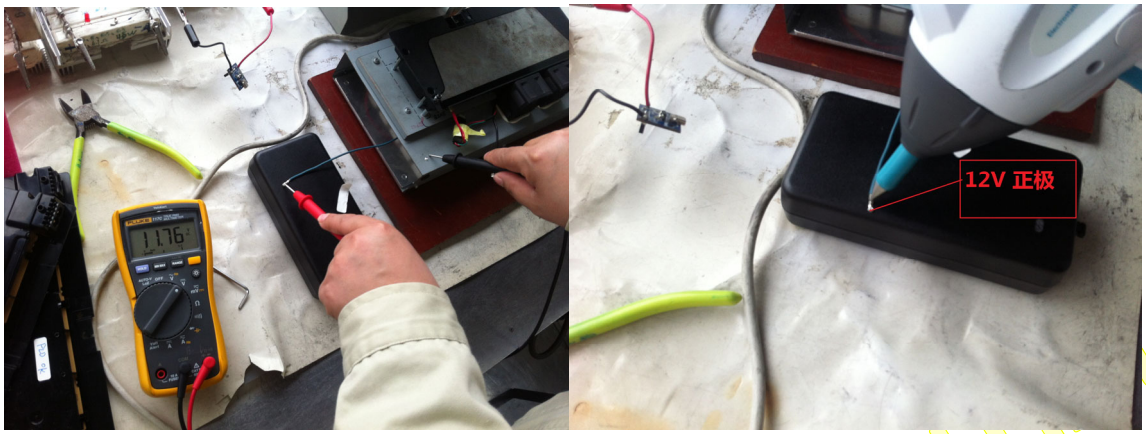
測試 0A 及 0.03A 時，因 power 很小, meter 需用較高精度的 meter 測試 (使用測試 power saving 的儀器).

6.13 ESD test

測試 ESD 12V 正端 ，須由 dummy load 引線測試，因為此測試結果與客戶搭配系統結果結果最相近. 引線方式如下



6.14 loop gain

測試 loop gain 需要加系統電容測試.

6.15. OCP

高溫測試 OCP 時，其最後測試結果為 latch，即符合規格判定 PASS.

6.16 系統載測試，Vin=220Vac/50Hz，5VSB/0.321A, 12V/6.16A 帶載啟動，5VSB/12V/ACIN_DET 輸出電壓須符合規格。

6.17 For ATS test, ACIN_DET 需修改成 30mS ~ 110mS.

6.18 For Idle power consumption (for 生產線) **需 100% 測試**

測試條件: Rated input voltage , 12V 0A load ; 5VSB: 0A load

Spec : 0.9W~2.0W