

## MANUFACTURING TEST REQUIREMENT

PA-1650-40LS

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MODEL	REV	Written By	LITE-ON Electronics, Inc.
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## Revision History

REV. NO.	ITEM	DESCRIPTIONS OF CHANGE		CHANGED DATE :	REF. DOC. NO.
		BEFORE	AFTER		
X01			INITIAL	2020/11/18	
A			Released	2020/12/03	

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## 1. Input / Output Requirement

	MINIMUM	MAXIMUM	NORMAL(RATED)	Input Frequency
LOW RANGE	90VAC	137VAC	100~127VAC	50+/-3Hz
HIGH RANGE	180VAC	265VAC	200~240VAC	60+/-3Hz

DC Output	MIN	MAX	UNIT
20V	0	3.25	A
15V	0	3	A
9V	0	3	A
5V	0	3	A

## 2. Detail Description:

### 2.1. Inrush Current

20V output condition:

Test condition			Design Requirement
AC input	DC output		
100V/60Hz	+20V	3.25A	No component damage
240V/50Hz			No component damage

15V output condition:

Test condition			Design Requirement
AC input	DC output		
100V/60Hz	+15V	3A	No component damage
240V/50Hz			No component damage

9V output condition:

Test condition			Design Requirement
AC input	DC output		
100V/60Hz	+9V	3A	No component damage
240V/50Hz			No component damage

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### 5V output condition:

Test condition			Design Requirement
AC input	DC output		
100V/60Hz	+5V	3A	No component damage
240V/50Hz			No component damage

### 2.2. Rated Current

Test condition			Design Requirement
AC input	DC output		
90V/47Hz	+20V	3.25A	1.8A(max)
90V/47Hz	+15V	3A	1.8A(max)
90V/47Hz	+9V	3A	1.8A(max)
90V/47Hz	+5V	3A	1.8A(max)

### 2.3. Power Factor

Test condition			Design Requirement
AC input	DC output		
240V/50Hz	+20V	3.25A	REF

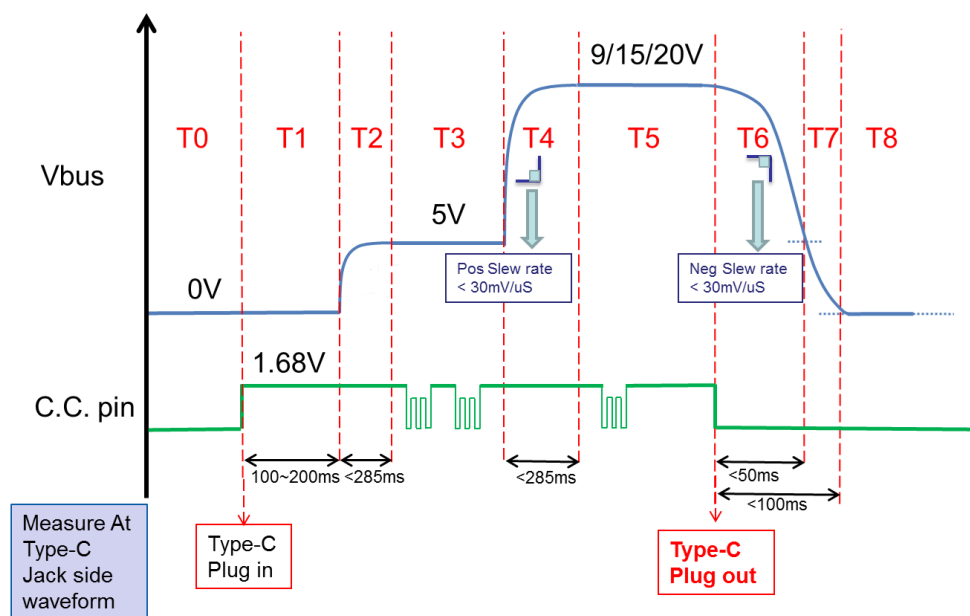
### 2.4. Turn-On Time

Test condition			Design Requirement
AC input	DC output		
100V/60Hz	+20V	3.25A	3 sec.(max)
240V/50Hz			
100V/60Hz	+15V	3A	3 sec.(max)
240V/50Hz			
100V/60Hz	+9V	3A	3 sec.(max)
240V/50Hz			
100V/60Hz	+5V	3A	3 sec.(max)
240V/50Hz			

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## 2.5.Plug in/out Sequence

Output voltage transition sequence form 5V to 9V/15V/20V.



Note 1 : The slew rate of the positive and negative transition shall not exceed 30mv/us

Time interval	Description	PD SPEC
<b>T0</b>	Before ADP&KIT CC pin connected	---
<b>T1</b>	ADP&KIT CC pin connected,Vbus turn on delay time	100 ~ 200mS
<b>T2</b>	ADP N-Mos on, Vbus rising to 5V	T2 < 285mS
<b>T3</b>	CC pin communication	---
<b>T4</b>	Vbus rise to System request voltage	T4 < 285mS
<b>T5</b>	Vbus stable	---
<b>T6</b>	Cable plug out, Vbus is falling to 5V +5%(5.25V) regulation	T6 < 50mS
<b>T7</b>	Vbus is falling from Vsafe5V(5.25V) to Vsafe0V_max(0.8V)	T6+T7 < 100mS
<b>T8</b>	End	---
<b>T4/T6</b>	Max slew rate allowed for Positive	Rise < +30mV/us
	Negative voltage transitions	Fall < -30mV/us

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## 2.6. Power Supply Efficiency

### 20V/3.25A mode:

The adapter efficiency (watts output/watts input) shall be more than DOE:  
88.00% that is the average value of 25%, 50%, 75% and 100% load.

### 15V/3A mode:

The adapter efficiency (watts output/watts input) shall be more than DOE:  
87.73% that is the average value of 25%, 50%, 75% and 100% load.

### 9V/2A mode:

The adapter efficiency (watts output/watts input) shall be more than DOE:  
85.00% that is the average value of 25%, 50%, 75% and 100% load.

### 5V/2A mode:

The adapter efficiency (watts output/watts input) shall be more than DOE:  
78.70% that is the average value of 25%, 50%, 75% and 100% load.

Average Efficiency Requirement				
AC input	DC output	Requirement	Heat-up 30 minutes	Cold start
115V/60Hz & 230V/50Hz	20V/3.25A	Average	88.00%	87.00%
115V/60Hz & 230V/50Hz	15V/3A	Average	87.73%	86.00%
115V/60Hz & 230V/50Hz	9V/2A	Average	85.00%	83.00%
115V/60Hz & 230V/50Hz	5V/2A	Average	78.70%	76.00%

Note 1: Average Efficiency should be test after **B/I 30 min.**

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## 2.7. Tiny load & No Load Power Loss

Test condition			Design Requirement (Pin)		
AC input	DC output		heat-up 15minutes	cold start (idle on)	cold start (idle off)
115V/60Hz & 230V/50Hz	+20V	0.5W	< 1W	< 1.2W	< 1.2W
		0.25W	< 0.5W	< 0.65W	< 0.79W
115V/60Hz & 230V/50Hz	+15V	0.5W	< 1W	< 1.2W	< 1.2W
		0.25W	< 0.5W	< 0.65W	< 0.79W
115V/60Hz & 230V/50Hz	+9V	0.5W	< 1W	< 1.2W	< 1.2W
		0.25W	< 0.5W	< 0.65W	< 0.79W
115V/60Hz & 230V/50Hz	+5V	0W	< 0.15W	< 0.25W	< 0.3W

Note 1: Using the Power Meter of YOKOGAWA WT-210.

Note 2: Define the integral time and input power watt:

a. RD and DQE:

The integral time is 3 minutes, and heat-up 15minutes before test.

b. For 5V mode, the plug should be disconnected with the test tool.

## 2.8. Output Combine Regulation & Ripple/Noise test

Note 1: The ripple/noise voltage of the outputs shall be measured at the pins of the mating output connect.

Note 2: A high frequency 0.1 $\mu$ F & a electrolyte capacitor 10 $\mu$ F shall be used to terminate each output at the measurement point.

Note 3: The ripple frequencies greater than 1MHz shall be attenuated by the measurement system.

Note 4 : The adapter shall work normally from no load to maximum load.

Test condition			Design Requirement	
AC input	DC output		Item	Spec
90V/60Hz	+20V	0A	Ripple/Noise	<350mVp-p
			Regulation	19.5V~21V
		3.25A	Ripple/Noise	<350mVp-p
			Regulation	19.5V~21V
265V/50Hz		0A	Ripple/Noise	<350mVp-p
			Regulation	19.5V~21V
		3.25A	Ripple/Noise	<350mVp-p
			Regulation	19.5V~21V

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Test condition			Design Requirement	
AC input	DC output		Item	Spec
90V/60Hz	+15V	0A	Ripple/Noise	<350mVp-p
			Regulation	15.75V~14.25V
		3A	Ripple/Noise	<350mVp-p
			Regulation	15.75V~14.25V
265V/50Hz		0A	Ripple/Noise	<350mVp-p
			Regulation	15.75V~14.25V
		3A	Ripple/Noise	<350mVp-p
			Regulation	15.75V~14.25V
90V/60Hz	+9V	0A	Ripple/Noise	<350mVp-p
			Regulation	9.45V~8.55V
		3A	Ripple/Noise	<350mVp-p
			Regulation	9.45V~8.55V
265V/50Hz		0A	Ripple/Noise	<350mVp-p
			Regulation	9.45V~8.55V
		3A	Ripple/Noise	<350mVp-p
			Regulation	9.45V~8.55V
90V/60Hz	+5V	0A	Ripple/Noise	<350mVp-p
			Regulation	4.75-5.25V
		3A	Ripple/Noise	<350mVp-p
			Regulation	4.75-5.25V
264V/50Hz		0A	Ripple/Noise	<350mVp-p
			Regulation	4.75-5.25V
		3A	Ripple/Noise	<350mVp-p
			Regulation	4.75~5.25V

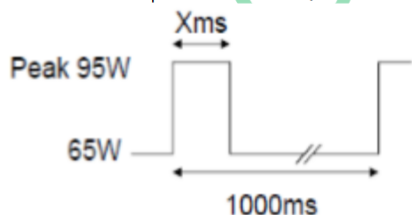
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## 2.9. Dynamic load

### For 20V output

Test Items	Output voltage	Input voltage	Slew-rate	Test load	Lenovo Spec
Dynamic Load	20V	100Vac / 240Vac	2.5A/us	On/off= 4ms/6ms On/off=50ms/50ms Dynamic-1: 0.00A ~ 3.25A Dynamic-2: 0.20A ~ 1.50A Dynamic-3: 1.00A ~ 2.50A Dynamic-4: 1.00A ~ 3.25A	18.6V~21.4V (+/-7%)
Dynamic Load (Peak power)	20V	90Vac/47Hz 264Vac/63Hz (cold start)	2.5A/us	On/off=1m/999ms 65W-95W	18.6V~21.4V (+/-7%)

Below is Peak power test on/off time. X=1ms(Example for 20V)



### For 15V output

Test Items	Output voltage	Input voltage	Slew-rate	Test load	Lenovo Spec
Dynamic Load	15V	100Vac / 240Vac	2.5A/us	0%~90% & 10%~100% On/Off=4ms/6ms, 50ms/50ms(1Hz~5kHz)	13.95V~16.0 5V(+/-7%)
Dynamic Load (Peak power)	15V	90Vac/47Hz 264Vac/63Hz (cold start)	2.5A/us	On/off=1m/999ms 45W-68W	13.95V~16.0 5V(+/-7%)

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## For 9V output

Test Items	Output voltage	Input voltage	Slew-rate	Test load	Lenovo Spec
Dynamic Load(IEC requirement)	9V	100Vac / 240Vac	2.5A/us	0%~90% & 10%~100% On/Off=4ms/6ms, 50ms/50ms(1Hz~5kHz)	8.37V~9.63V (+/-7%)
Dynamic Load (Peak power)	9V	90Vac/47Hz 264Vac/63Hz (cold start)	2.5A/us	On/off=1m/999ms 27W-40.5W	8.37V~9.63V (+/-7%)

## For 5V output

Test Items	Output voltage	Input voltage	Slew-rate	Test load	Lenovo Spec
Dynamic Load(IEC requirement)	5V	100Vac / 240Vac	2.5A/us	0%~90% & 10%~100% On/Off=4ms/6ms, 50ms/50ms(1Hz~5kHz)	4.1V~5.5V
Dynamic Load(Peak power)	5V	90Vac/47Hz 264Vac/63Hz (cold start)	2.5A/us	On/off=1m/999ms 15W-22.5W	4.1V~5.5V

## 2.10.Step Load Test

Test condition					Design Requirement
AC input	OUTPUT VOLTAGE	Load	Slew rate	On/off time	Vo
90V/60Hz & 265V/50Hz	20V	0 ~ 1A 1 ~ 2A 2 ~ 3.25A	Rise time:100us, (=Slew Rate:0.01A/uS)	0.5ms/0.5ms (1KHz)	+19.5 ~ +21V
	15V	0 ~ 1A 1 ~ 2A 2 ~ 3A			+14.25V ~ +15.75V

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Test condition					Design Requirement
90V/60Hz & 265V/50Hz	9V	0 ~ 1A 1 ~ 2A 2 ~ 3A	Rise time:100us, (=Slew Rate:0.01A/uS)	0.5ms/0.5ms (1KHz)	+8.55V ~ 9.45V
	5V	0 ~ 0.75A 0.75 ~ 1.5A 1.5 ~ 2.25A 2.25 ~ 3A	Rise :2.5A/uS Fall :2.5A/uS		+4.4V ~ +5.45V

### 3. Protection

#### 3.1.Over Voltage Protection

NOMINAL OUTPUT VOLTAGE (V)	OVER VOLTAGE
	MAX.
20V	26V
15V	19.5V
9V	11.7V
5V	6.5V

The power supply is latched and power on reset is required

#### 3.2.Over Current Protection

Test condition		Design Requirement(range)
AC input	DC output	
90V/60Hz	Auto	4.5 A max (both for 20V/15V/9V/5V)
100V/60Hz		
240V/50Hz		
265V/50Hz		

The power supply will be shut down and auto-restart.

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## 3.3. Short Circuit Protection

Test condition		Design Requirement
AC input	DC output	
90V/60Hz	Short output terminal of DC plug + and - .	.No damage shall occur. .Shutdown and Auto-recovery .Output RMS power < 5W
100V/60Hz		
240V/50Hz		
265V/50Hz		

The power supply will be shut down and auto-restart.

## 4. HI-POT test

Apply DC 4242V on primary to secondary 1sec. No component, no arcing, no noise, and the cut off current shall below 10mA.

PRI to SEC : 4242VDC (Actual Output Voltage)/1mA/1sec.

## 5. Insulation Resistance

Apply DC 500V on primary to secondary and measured the resistance shall be large than 100M ohms.

## 6. PD IC RT7202KF Firmware Version Confirm (use Check sum reader )

The firmware version should be confirm by **check sum reader** and the value display “0XXXXXXXXX” is stand for correct version at this stage.

*(Please reference RD's mail or SR remark)*

## 7. Output DC Plug Test

USB Type-C plug shell must be connected to ground.

PIN ASSIGNMENT	
AWG WIRE	USB PIN
Vo(RED)	A4, A9, B4, B9
GND(BLACK) (DRAIN+SPIRALS)	A1, A12, B1, B12
CC(BLUE)	A5
D+/D-	A6, A7 SHORTED

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**8. Grounding Continuity Test**

Grounding continuity test	Test
From primary FG to secondary GND resistance test	Test resistance 1.0Mohm±5.0%

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