ASUS PD 3.0 65W Low Cost ADAPTER SPEC

0. History:

REV	Description	Issue Day	Prepared By	Checked By	Approved By
00	Draft	2023/3/14	Roger Hung		
01	Update 2.1.8 Primary Aluminum Capacitor Update 2.2.1 Electrical Update 2.2.12 Voltage Dips Update 2.3.4 Over Temperature Protection (OTP) Update 7.1/7.2 Power unit Dimension	2023/4/20	Roger Hung		
02	Update 2.2.1 Electrical Update 2.3.1 Over Current Protection (OCP) Update 12.1 Provide Manufacturing Information	2023/5/31	Roger Hung		
03	Fix 2.2.6 Turn On Delay Time Update 5.4 Acoustic test Update 12.1 Provide Manufacturing Information	2023/6/12	Roger Hung		
04	Update 2.2.12 Voltage Dips Update 3.2 Life/Power On Hours Update 4.5 Surge & Impulse Test	2023/9/26	Roger Hung		

1. Introduction:

This specification define the input, output, performance characteristics, environment, noise and safety requirements for the power supply.

2. Electrical Requirements:

2.1 Input Requirements:

2.1.1 Input Voltage

-Normal voltage: 100~240Vrms

-Voltage Range: 90~264Vrms

2.1.2 Input Frequency

-Normal Frequency: 50~60Hz

-Frequency Range: 47~63Hz

2.1.3 Input Current

-Under **1.5A** Irms at 100Vac & Max. load

2.1.4 Configuration

-2 Conductors (Line, Neutral)

-3 Conductors (Line, Neutral, Ground)

2.1.5 Input Fuse

-An adequate internal fuse on the AC input line shall be provided.

2.1.6 Inrush Current

-The inrush current of the power supply shall be less than the rating of its critical components (include bridge diode, surge limiting device) for all condition of line voltage of 2.1.1

-The I^2t shall less than 22% of the fuse, surge limiting device and bridge diode rating.

2.1.7 Efficiency

-The power supply shall meet DOE VI + 1% / COC V5 Tier 2 measuring at the cable end.

2.1.8 Primary Aluminum Capacitor

- 450Vdc (min.) for both WM & DT Type
- The voltage stress of anode foil must be larger than 620V for WM & DT Type.

2.2 Output Requirements:

2.2.1 Electrical

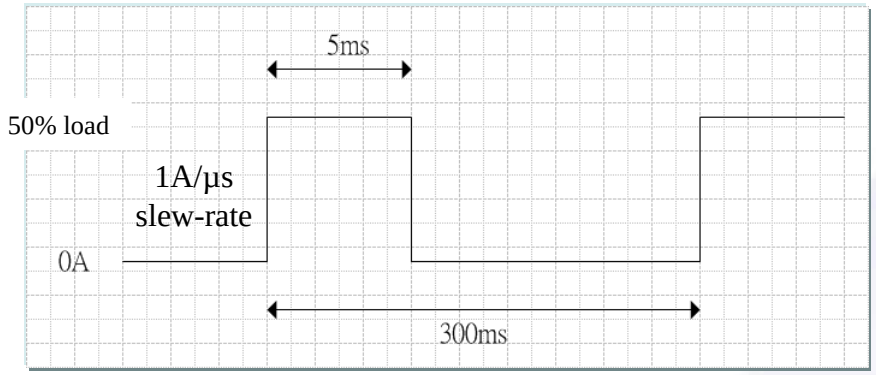
Item	Content	Specification			
Safety Rating		5V=3A, 9V=3A, 15V=3A, 20V=3.25A, 5V-21V=3.25A , 65W Max			
PD Mode	PDO	5V Fixed	9V Fixed	15V Fixed	20V Fixed
	Output Voltage Range	4.85~5.5V	8.55V~9.45V	14.25~15.75V	19~21V
	Output Voltage Ripple	180mV	200mV	300mV	300mV
	Output Current Range	0~3A	0~3A	0~3A	0~3.25A
	Output Current Ripple	100mA	N/A	N/A	N/A
	PDO Peak Current (Bit 21…20)	00	00	11	11
PPS Mode	APDO	5-21V Prog			
	Programmable Voltage Range	5.0 ~ 21.0V			
	Programmable Current Range	0 ~ 3.25A			
	CC Curve Setting Tolerance	+/- 100 mA			
	CC Curve Current Ripple (1)(2)	50mA			
	APDO PPS Power Limited (Bit 27)	1			
*Transient for 15V/20V	Transient Current Range	0.05A ~ Full Load			
	Transient Frequency	100Hz ~ 100KHz			
	Slew rate	2.5A/us			
	Criteria	Output voltage regulation shall be less than ± 5%			

(1) Ripple noise measured by **20M** Hz bandwidth in oscilloscope and applied **0.1uF** high frequency capacitor and **10uF** electrolytic capacitor across output connector terminals.

(2) There must be no swing or oscillate in voltage/current when operating in CC Curve and thus the current ripple must be small.

Transient for 5V/9V

condition1



For 5V Mode

Output voltage range:

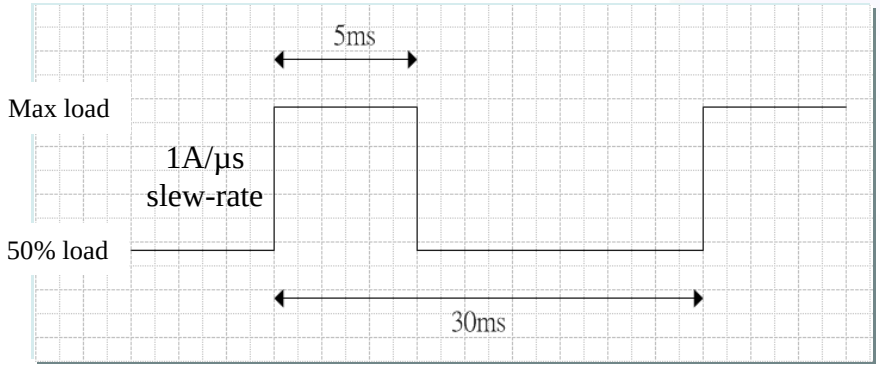
-Max. 5.8V

-Min. 4.6 V

For 9V Mode

Output voltage shall within +/-5%

condition2



2.2.2 Output Voltage Requirement

-The total output voltage regulation shall be meet the spec., including the effects of AC line voltage variation, load current, ripple and noise.

-The effect of transient load changes is included in this limit.

- Must comply with "Universal Serial Bus Power Delivery Specification Rev. 3.0".

2.2.3 Overshoot

-The output overshoot at turn on shall not exceed 10% of normal voltage value with or without the load connected.

2.2.4 Hold Up Time

-The power supply shall maintain voltage regulation within the specified limits in paragraph 2.2.1 for at least 5ms after lost of input voltage measured at 100Vac and maximum output load.

2.2.5 Output Rise Time

-At turn on the rise time of output voltage shall be less than 40ms.

＊Measured from the 10% point to the 90% point of the normal.

2.2.6 Turn On Delay Time

-The power supply shall reach voltage regulation within the specified limits in table 2.2.1 for 3sec max. after AC input applies to the power supply.

-The input voltage is measured at 100/240Vac and at maximum output load.

2.2.7 No Load Power Consumption

-Maximum no load power consumption is less than 0.075W at 115Vac/60Hz and 230Vac/50Hz

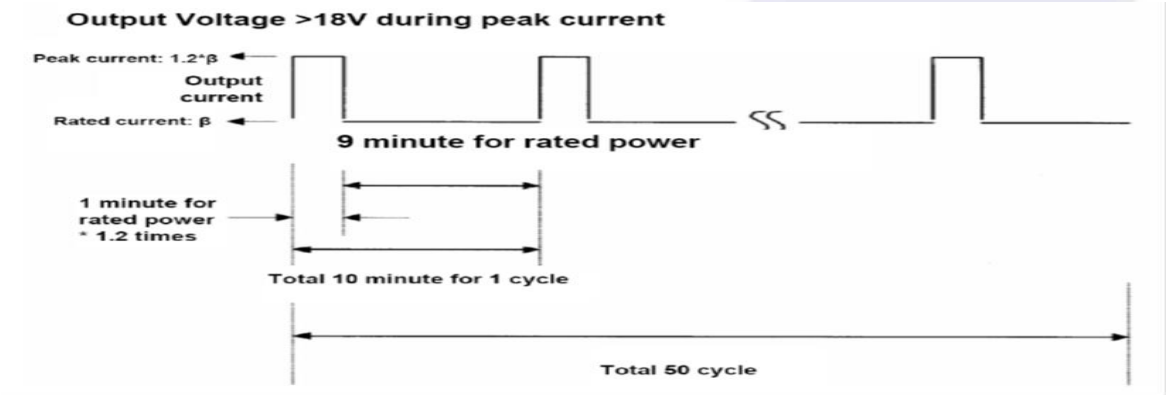
2.2.8 Power saving requirement

-Vin=115Vac/60Hz and 230Vac/50Hz

Output Power (W)	Pin Power (W)
18	< 21
11	< 14
5~6.5	Eff. > 80%
3	< 5
1.65	< 3
1.5	< 2.2
1	< 1.6
0.25	<0.47

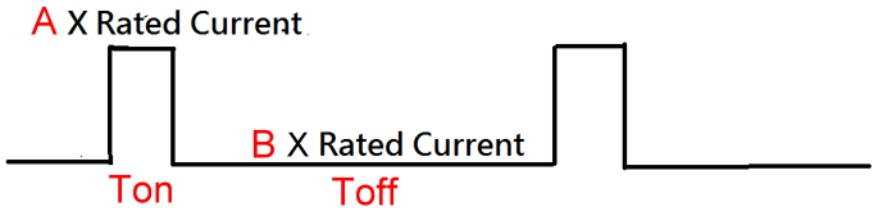
2.2.9 Surge load (For 20V/15V) :

The adapter shall support a surge load with 120% of maximum load for 1min, maximum load for 9min and output voltage shall be more than 18.5V/13.7V at 100-240Vac/50Hz-60Hz.



2.2.10 Peak load (For 20V/15V) :

The adapter shall support below loading condition without any damage, safety issues and protection happened. The output voltage shall be more than 18.1V (20V Mode) / 13.5V (15V Mode) at input voltage 100-240V/50Hz-60Hz.



Spec	Ton	Toff	A	B
1	2ms	18ms	200%	90%
2	250us	2.25ms	225%	87.5%

2.2.11 Hot Plugging

-Plugging a live AC adapter into the system with 100uF (for 5V Mode) and 1000uF (for 15V/20V Mode) capacitance shall not trigger any protections or cause the adapter to shut down.

2.2.12 Voltage Dips (for 20V Mode)

-Follow the test item " >95% reduction , 0.5 period " in IEC 61000-4-11 Standard.

-The output voltage shall be more than 14.5V at the below condition :

(a) AC Input = 100Vac/50Hz

(b) Load = 45W constant power (instead of constant current)

-Follow the test item " 30% reduction , 25 periods " in IEC 61000-4-11 Standard.

-Criteria : A

(a) AC Input = 100Vac/50Hz

(b) Load = 45W constant power (instead of constant current)

2.3 Power Output Protection:

2.3.1 Over Current Protection (OCP)

-The maximum constant current shall be less than 3.6A for Vo < 15V at 90Vac/264Vac.
-The maximum constant current shall be 3.9A ~ 5A for Vo ≥ 15V at 90Vac/264Vac.
-Meet LPS.
-The adapter shall be DC latch off and no component damaged.
-When fault condition is removed and re-plug in DC plug , the output voltage must return to the normal condition.
-The adapter cannot have any safety issue or be damaged when the load condition is before over current protection point (OTP is allowed).
-OCP deglitch time shall be more than 30ms.

2.3.2 Over Voltage Protection (OVP)

-Maximum output voltage can't be over 35% for Vo ≥ 15V and 50% for other Vo rating.
-The adapter shall be AC latch off and no component damaged.
-When fault condition is removed and re-plug in AC plug , the output voltage must return to the normal condition.

2.3.3 Short Circuit Protection (SCP)

-The adapter shall be DC latch off and no component damaged.

-When fault condition is removed and re-plug in DC plug , the output voltage must return to the normal condition.

2.3.4 Over Temperature Protection (OTP)

-The adapter shall be AC (primary protection) or DC (secondary protection) latch off and no component damaged.

-Must put a thermal sensor at the secondary side for PD IC to read/report temperature.

-If PD IC lacks OTP pin, it must have internal OTP and be able to report temperature.

-No fire and no melted of the enclosure.

-When fault condition is removed and re-plug in AC or DC plug , the output voltage must return to the normal condition.

2.3.5 Output Pins Short Protection

- When any two pins (including signal pins) of the output plug short, there should be no damage to any components. (Protection is allowed)

3. Reliability:

3.1 MTBF:

-The power supply shall be designed and produced to have a MTBF of 150,000 operation hours at 90% confidence – level while operating under the following condition

-AC input voltage: 100 and 240Vrms

-Ambient Temp. : 25˚C

3.2 Life/Power On Hours

-The power supply must be designed to operate for 26,280 power on hours.

-AC input voltage: 100 and 240Vrms / DC output load : 95%

-Ambient Temp. : 25˚C

3.3 Burn-in Test Condition

- Follow *ASUS RD Test Plan for NB Adapter latest version.*

3.4 AC On/Off Test

- Follow *ASUS RD Test Plan for NB Adapter latest version.*

3.5 Surge Voltage (For 450V Type Only)

-Follow *ASUS RD Test Plan for NB Adapter latest version.*

4. Safety & EMC:

4.1 Safety Certificate

- The power supply unit shall follow the safety standard (IEC60950 , IEC62368)
- Certificate : Follow safety control table
- Trademark : ASUS

4.2 Insulation Resistance

- Insulation resistance shall be > 30M ohm at 500Vdc between primary Live, Neutral and secondary.

4.3 Hi-Pot Test

-Primary to Secondary : 3.0KVac or 4242Vdc for 1minute
-Primary to F.G :1.5KVac for 1minute

4.4 Leakage Current

-The power supply leakage current shall be less than 20 uA @240Vac/50Hz

-Test with AC cable 90cm (DT Type)

4.5 Surge & Impulse Test

-Lighting Surge : ±1.5KV (L-N) ; ± 2.5KV (L-FG; N-FG)

-Impulse Noise Test: 1KV

-Criteria A

4.6 EMI standard

-The power supply shall comply with a following RFI/EMI standards when tested in a system configuration.

-F.C.C part15

-PASS both CISPR 22 / CISPR 32 (different setup for DC cable)

-The limits shall be meet with a margin more than 6 dB with all system applicable.

4.7 Electrostatic Discharge (ESD)

This Adapter is capable to withstand ESD test voltage at any point around the enclosure as below.

±15KV air discharge Performance Criterion B

±12KV air discharge Performance Criterion A.

±8KV contact discharge Performance Criterion A.

4.8 Common Mode Noise (CMN)

-Follow *ASUS RD Test Plan for NB Adapter latest version*

5. Environment Requirements:

5.1 Temperature

- Operation: 0~40˚C ;Storage: -30~80˚C

5.2 Humidity (no condensing)

- Operation: 5~90% ; Storage: 5~95%

5.3 Surface Temperature rise

- Follow *ASUS RD Test Plan for NB Adapter latest version*

5.4 Acoustic test:

Input Condition : Vin: 90Vac~264Vac , Frequency : 47Hz to 63Hz

Load Condition:

Dynamic Load : Follow ASUS Transient Load Current Spec

Static Load :

- for 5V : 0.02A/step (No load to 2W), and 0.1A/step (2W to Full load)
- for 9V/15V : 0.01A/step (No load to 2W), and 0.1A/step (2W to Full load)
- for 20V : 0.005A/step (No load to 2W), and 0.1A/step (2W to Full load)

NB ADAPTER SPEC :

Static Load

WM Type : Microphone at a distance of 10cm from the surface and noise level is less than **20dB**

Desktop Type : Microphone at a distance of 5cm from the surface and noise level is less than **20dB**

Dynamic Load

WM Type : Microphone at a distance of 10cm from the surface and noise level is less than **25dB**

Desktop Type : Microphone at a distance of 5cm from the surface and noise level is less than **25dB**

6. Mechanical Requirements:

6.1 Bending test:

- 200g weight,90° angle to each side(Total angle 180°), 3000 & 10000 cycles of arbitrary direction, 40 cycles/min.
  Disconnection rate <= 10% / 100% between case to S/R for 3000 / 10000 cycles
  Disconnection rate <= 30% / 100% between plug to coil for 3000 / 10000 cycles
- Without damage to the insulations

6.2 Winding test:

-200g weight,1080° angle on X-axis and Y-axis ,500 cycles of each direction 4 cycles/min.
Disconnection rate of the wire shall be less than 30%

6.3 Drop Test

Drop 8 times (**6 faces and 2 AC plug corners**) on each cycles from a height of 1.0M onto a **concrete surface.** Increase the height in steps of 0.2M until the case is broken. Must has 10cm margin during design stages

Electrical

- The unit should meet all specification and no function error after test.1.1M testing

Mechanical

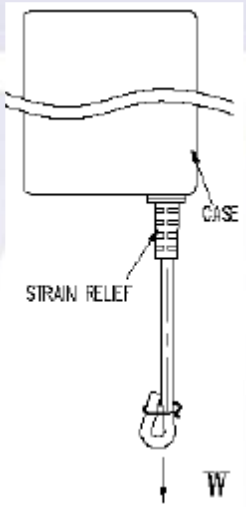
- There shall be no visual damage and safety concern after 1.5M testing

6.4 Tensile Test :

Load : 10Kgf at Plug end and Bushing each for 1minute

Angle: 90° /180°

Criteria: The withdrawal of cord should be less than 2mm or without disconnection of cord



6.5 DC Power Cord Wire Push Test

Test condition : a) Fixture: 6mm, 10.5mm & 20mm aluminum block and ψ12mm aluminum bar

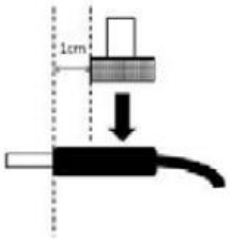
b) Increase pressure by speeding up 2 mm per minute on the tested item until maximum force reached to 130 kg

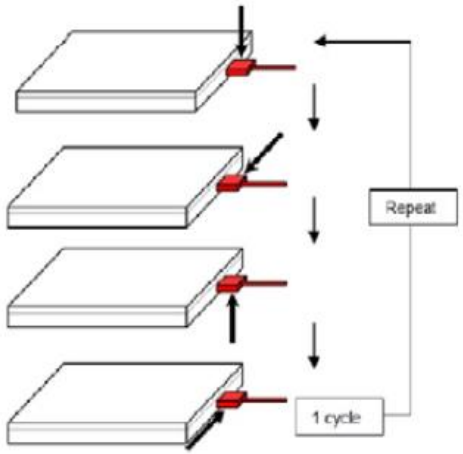
Criteria: After testing the V+ wire and Ground wire can't short

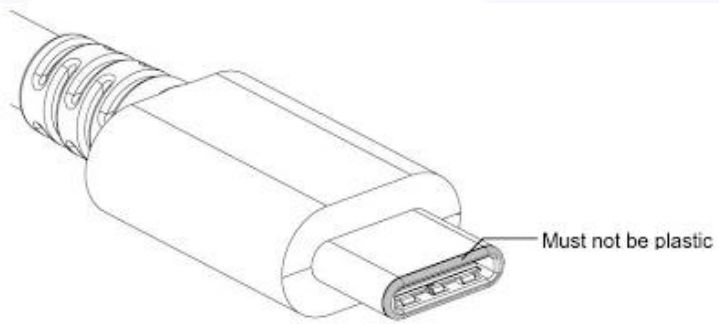
6.6 Type C Plug Requirements

Type-C plugs for use with devices must comply with the USB Type C standard, with the following exceptions:

- Must demonstrate a minimum strength of 1.75 Nm in all 4 orientations, rather than 0.75 Nm as defined in section 3.8.1.7 (refer to USB Type C Spec)
- Can exceed the maximum plug strength of 2.0 and 3.5 Nm as defined in section 3.8.1.7
- Transverse overload force in all 4 orientations should meet 9Kg/1cm/50 cycles (as below)

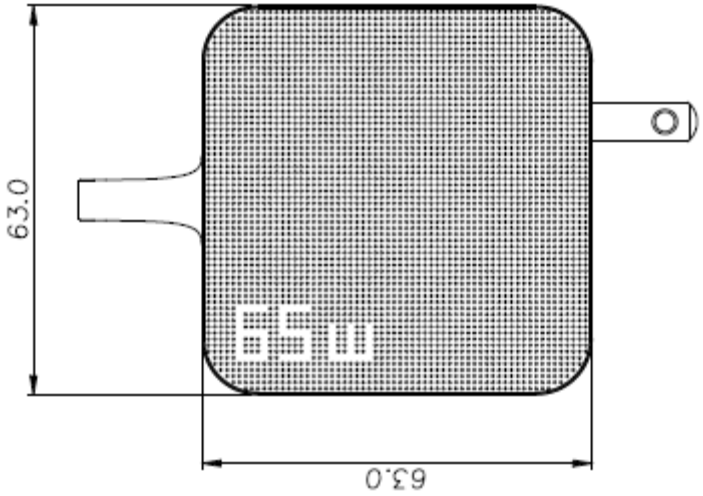


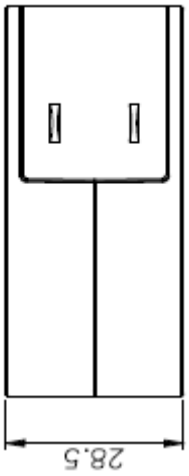


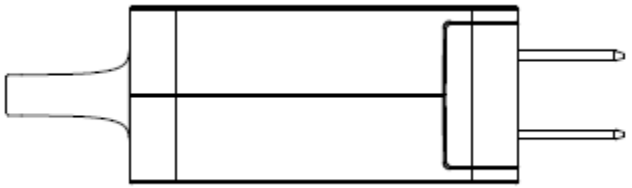


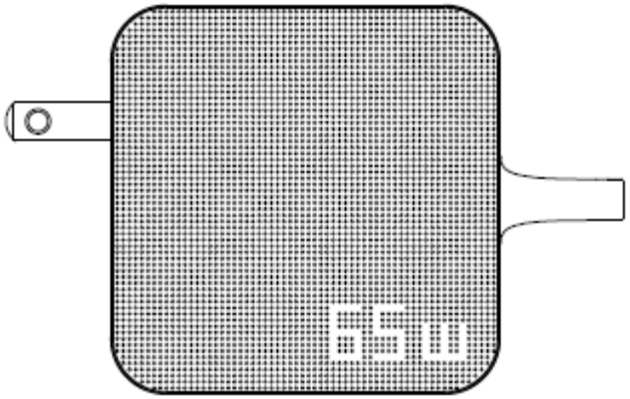
7.1 Power unit Dimension: (Wall Mount Type)

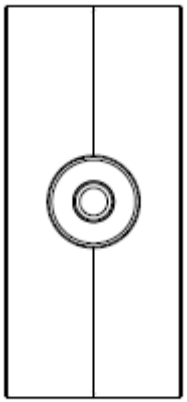
-Dimension **63.0 x 63.0 x 28.5mm**

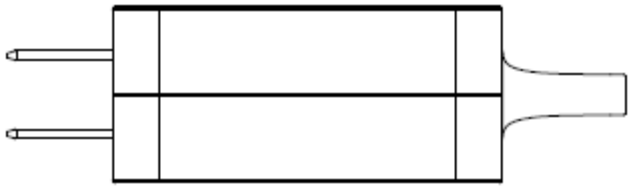






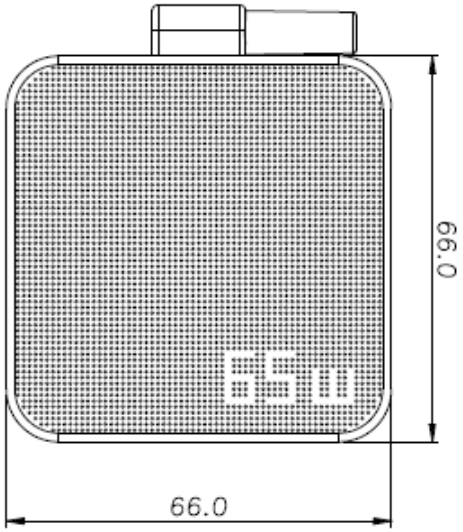


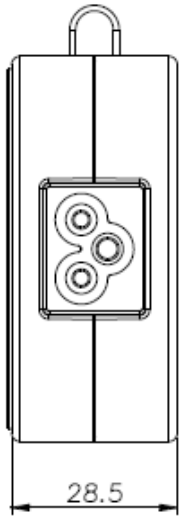


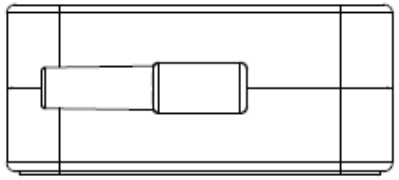


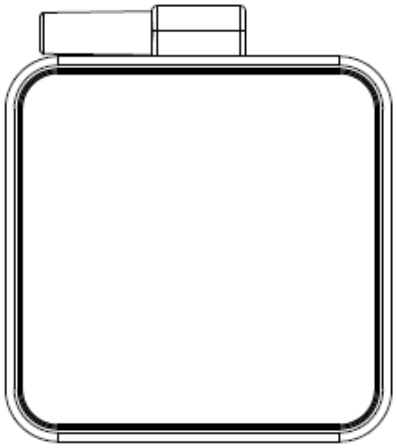
7.2 Power unit Dimension: (Desktop Type)

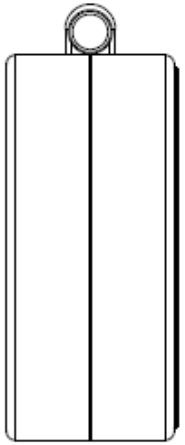
-Dimension **66.0 x 66.0 x 28.5mm**

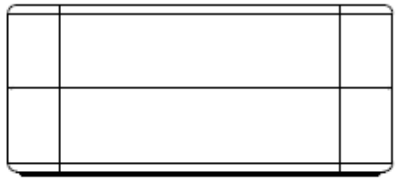












8. Input AC Inlet:

- For WM Type : Fixed Pin US/EU/CCC (AC plug material cannot include ferrous alloy)
- For Desktop Type : Socket C6 Type

9. Output Cable:

- For WM Type : 2000mm (±50mm) (ID design by ASUS)
- For Desktop Type : 1600mm (±50mm) (ID design by ASUS)

10. Output Plug:

- TYPE C
- Vendor P/N : LOTES ABA-USB-896-P01
- Should support BC1.2 DCP to allow charging older devices through legacy cable (D+/D- should be short at connect side)

11. Environmental Laws and Regulations

- Meet the deduct 50% condition of Swedish "Law (2016:1067) about tax on chemicals in certain electronic products".
- Meet TCO 9.0 regulation
- Meet EPEAT 2018 Item 4.1.1.1 / 4.1.2.1 / 4.1.4.1 / 4.1.5.2 (1 point) / 4.1.6.1 / 4.1.8.1 (1 point) / 4.1.9.1 / 4.1.9.2 / 4.1.9.3 (2 points) / 4.5.1.4 / 4.7.1.1

12. Power Delivery Additional Function

12.1 Provide Manufacturing Information

- Allow Sink to use *Get_Source_Cap_Extended* to read the information below.
- Allow Sink to use *Discover Identity* to read **VID & PID** in VDM mode.

Source_Cap_Ext.	Value	Remark
VID	0x0B05	ASUS VID
PID	0x1322 0x1323 0x1332 0x1333	Chicony WM Chicony DT PIE WM PIE DT
XID	0x0000	w/o USB Certification
FW Version	0x01	To 0x02, 0x03…if modified after MP.
HW Version	0x01	
Compliance	0x05	LPS = 1 / PS2 = 1
Peak Current 1	0x9034	Peak = 200% / Period = 20ms / Duty = 10% / Vbus droop = 1
Source PDP Rating	0x41	65W

12.2 Provide Temperature & Protection Flags

- Allow Sink to use *Get_Status* to read the real-time temperature & protection flags (OCP/OTP/OVP event) of the adapter.

12.3 Set Protection Flags & Send Alert

- The adapter shall set OCP/OTP/OVP event flag to 1 immediately when the corresponding protection condition is triggered, and send *Alert* to Sink simultaneously.
- The adapter shall delay N ms to turn off the Vbus switch when condition is triggered. (The deglitch time for triggering OCP/OTP/OVP condition is not affected)
- The adapter **shall only** clear the event flag after sending *Status* in response to *Get_Status* from Sink.

Protection	Delay N ms
OCP	10ms
OTP	100ms
OVP	No delay

Thank You!