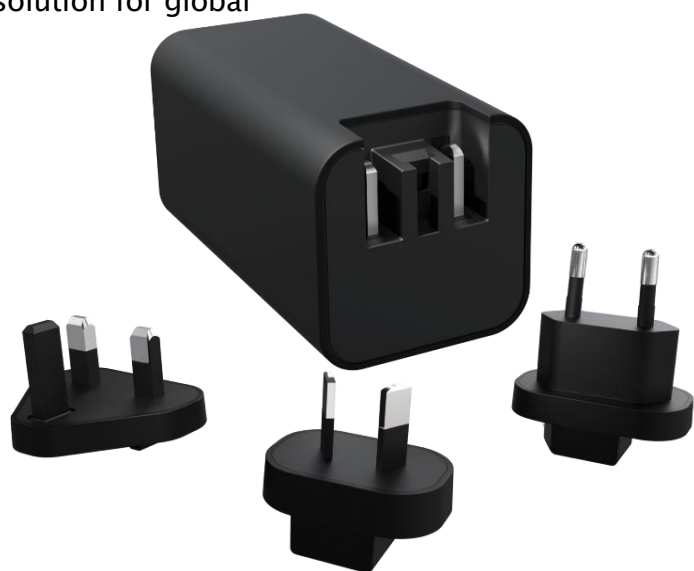


# TECHNICAL DATA SHEET

AQ65R-59FKA-R

## DESCRIPTION

This 65W GaN Series Interchangeable USB Type-C Adapter delivers efficient and reliable power in a compact design for laptops, monitors, networking devices, and other USB-C applications. Its interchangeable plug design and wide AC input range provide a versatile solution for global



## Technical Summary

| Parameters          | Value                                                                                              |
|---------------------|----------------------------------------------------------------------------------------------------|
| Input Voltage range | 90 VAC to 264 VAC                                                                                  |
| Output voltage      | 5Vdc/ 9Vdc/ 15Vdc/ 20Vdc                                                                           |
| Output power        | 65 Watt Max                                                                                        |
| Efficiency          | Avg Efficiency > 89% at 15V /3A & 20V /3.25A; > 87.30% at 9V /3A ,>81.84% at 5V /3A, DOE Level VII |
| Dimensions          | 31.5mm x 31.5mm x 60mm                                                                             |
| Weight              | 95g±5g<br>Clip* Weight:<br>AU:10g±1g<br>EU:15g±1g<br>UK:19g±1g                                     |

## Features

FCC Part 15 class B  
ICES-003 Issue 7 class B  
EN55035 class B  
US DoE Level VII Efficiency compliance  
Over-Voltage, Over-Current,  
Short Circuit &  
Over-Temperature Protection  
5,000 Meters Operating Altitude

## Applications

Networking Device | Monitor|  
Laptops

## Certifications & compliance

IEC/UL 62368-1  
EN 50075  
AS/NZS 3112+A1  
BS 1323+A1

\* Clips are sold separately



## TECHNICAL DATA

### AC Input

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AC input voltage rating | 100VAC ~ 240VAC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| AC input voltage range  | 90 VAC to 264 VAC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| AC input frequency      | 47Hz - 63 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| AC input current        | 1.6A (RMS) Max. at 90Vac                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| In-rush current         | Maximum inrush current, from power-on (with power on at any point on the AC sinewave), shall be limited to a 29% margin of the I2t rating of the input fuse and bridge rectifier:<br>1) Test condition: 265Vac/50Hz @full load and +/- 90 degrees phase (with Cold/Hot start)<br>2) Cold Start: Cool the disconnected power supply long enough to ensure that all components are within 3°C of the minimum (ambient operating air temperature at 25C)<br>3) Hot Start: Operate the power supply the maximum ambient operating air temperature at 35C for 15 minutes. |
| Leakage current         | 50uA Max. at 250Vac 50Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### DC Output

Output voltage

5Vdc/ 9Vdc/ 15Vdc/ 20Vdc

Output Voltage Regulation

Voltage

| Output Voltage | Regulation |        |
|----------------|------------|--------|
|                | Min        | Max    |
| 5V             | 4.75V      | 5.25V  |
| 9V             | 8.55V      | 9.45V  |
| 15V            | 14.25V     | 15.75V |
| 20V            | 19.0V      | 21.0V  |

Current

| Output Voltage | Load Current |       |
|----------------|--------------|-------|
|                | Min          | Max   |
| 5V             | 0A           | 3A    |
| 9V             | 0A           |       |
| 15V            | 0A           |       |
| 20V            | 0A           | 3.25A |

### Ripple and noise

| Input Voltage             | Output Voltage | Load Current |       | Ripple Noise |
|---------------------------|----------------|--------------|-------|--------------|
| 90Vac/47Hz<br>264Vac/63HZ | 5V             | 0A           | 3A    | <380m Vpk-pk |
|                           | 9V             |              |       |              |
|                           | 15V            |              |       |              |
|                           | 20V            |              | 3.25A |              |

1) Measurements shall be made with an oscilloscope with 10KHz to 20MHz Bandwidth.

2) Output should be bypassed at a connector with a 1uF ceramic capacitor and a 10uF electrolytic capacitor (Low ESR).

|                 |                                                                                  |
|-----------------|----------------------------------------------------------------------------------|
| Line Regulation | Must stay within specification [ output voltage range] over all line conditions. |
| Load Regulation | Must stay within specification [ output voltage range] over all line conditions. |

#### NOTE

All output parameters will be tested at the end of a 130mΩ type-C 2M cable.





## TECHNICAL DATA

### Overall Performance

|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|----------------|---------------------------------------------------------|
| Output Power                                                                                                        | 65 Watt Max                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                     |                |                                                         |
| Efficiency                                                                                                          | 5V /3A, DOE Level VII<br>Average Efficiency > 81.84%, 10% Load Efficiency > 72.48%<br>9V /3A, DOE Level VII<br>Average Efficiency > 87.30%, 10% Load Efficiency > 77.30%<br>15V /3A, DOE Level VII<br>Average Efficiency > 89%,     10% Load Efficiency > 79%<br>20V /3.25A, DOE Level VII<br>Average Efficiency > 89%,     10% Load Efficiency > 79%<br>Note:<br>Testing at 100%, 75%, 50%, 25% of rated current output and then computing the arithmetic average of these four values. Measure efficiency at 100%, 75%, 50%, 25% load after warm up with 100% load for 30 minutes. (Efficiency will be tested at the end of a 130mΩ type-C 2M cable.) |                |                     |                |                                                         |
| No Load/Light Load Power Consumption                                                                                | Input Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Output Load    | Maximum Input Power | Output Voltage |                                                         |
|                                                                                                                     | 115VAC /60Hz<br>230VAC /50Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0W             | 0.075W              | 5V             |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.15W          | 0.3W                | 20V            |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.5W           | 1.0W                |                |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.0W           | 1.7W                |                |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.5W           | 2.4W                |                |                                                         |
| Note:<br>The 100% load warm-up test should be conducted for 15 minutes at the end of a 130 mΩ Type-C 2-meter cable. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
| Turn on Delay Time                                                                                                  | < 5Sec. at full load @ only test 90Vac/47Hz. (Test AC turned on to 5V regulation completed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                     |                |                                                         |
| Rise time                                                                                                           | < 275ms. at full load and measured from 0% to 100% regulation<br>(1) 0V to 5V<br>(2) 5V to 9V<br>(3) 5V to 15V<br>(4) 5V to 20V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
| Overshoot                                                                                                           | 10ms Max. at full load, Output voltage 105% Maximum.<br>@90Vac/47Hz,264Vac/63Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
| Hold Up Time                                                                                                        | > 5ms at full load @ only test 115Vac/60Hz.<br>(5V/9V/15V/20V, Phase 90 degree)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
| Transient Load Step Response                                                                                        | TEST CONDITION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                     | REGULATION     |                                                         |
|                                                                                                                     | AC INPUT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | OUTPUT VOLTAGE | LOAD CURRENT        |                | DESIGN REQUIREMENT<br>(S/R=1A/US , 1Hz & 5kHz,50% DUTY) |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                | MIN                 | MAX            |                                                         |
|                                                                                                                     | 90 - 264Vac                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5V             | 0A                  | 1.5A           | 4.5V - 5.5V                                             |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                | 1.5A                | 3A             |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 9V             | 0A                  | 1.5A           | 8.1V - 9.9V                                             |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                | 1.5A                | 3A             |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 15V            | 0A                  | 1.5A           | 13.5V - 16.5V                                           |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                | 1.5A                | 3A             |                                                         |
|                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 20V            | 0A                  | 1.625A         | 18V - 22V                                               |
| 1.625A                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                | 3.25A               |                |                                                         |
| External system capacitance 100uF/50V shall be connected to the PSU output                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                     |                |                                                         |
| Audible Noise                                                                                                       | < 25 dBA at distance of 5cm.<br>Across all loading conditions, from all (5) directions.Test environment referred to ISO7779.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |                     |                |                                                         |
| Surge Load                                                                                                          | Adapter shall output at least 16V at 90Vac/60Hz<br>Test Condition:<br>a. Peak current equals 200% loc for 1ms @ 5% duty cycle (low current equals 95% loc for 19ms)<br>b. Peak current equals 175% loc for 2ms @ 10% duty cycle (low current equals 92% loc for 18ms)<br>c. Peak current equals 150% loc for 10ms @ 50% duty cycle (low current equals 50% loc for 10ms)                                                                                                                                                                                                                                                                                |                |                     |                |                                                         |



## TECHNICAL DATA

### Protection

| <b>Output Short Circuit Protection</b> | No damage, Latch-function                                                                                                                                                                                                                                                                                                                                               |                |                   |     |       |     |          |    |          |    |         |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------|-----|-------|-----|----------|----|----------|----|---------|
| <b>Over Current Protection</b>         | Latch-function<br>115%~125%, @90Vac/47Hz,264Vac/63Hz.<br>for 5V/ 9V/15V (3.45A - 3.75A)<br>for 20V (3.74A – 4.06A)<br>(Note: Production line may verify OCP using a current close to the upper limit)                                                                                                                                                                   |                |                   |     |       |     |          |    |          |    |         |
| <b>Over Voltage Protection</b>         | Latch-function.<br>145% max, @90Vac/47Hz,264Vac/63Hz.<br>The output channel volts with a maximum duration of 250milliseconds<br><table><tr><th>Output Voltage</th><th>Over Voltage(Max)</th></tr><tr><td>20V</td><td>&lt; 29V</td></tr><tr><td>15V</td><td>&lt; 21.75V</td></tr><tr><td>9V</td><td>&lt; 13.05V</td></tr><tr><td>5V</td><td>&lt; 7.25V</td></tr></table> | Output Voltage | Over Voltage(Max) | 20V | < 29V | 15V | < 21.75V | 9V | < 13.05V | 5V | < 7.25V |
| Output Voltage                         | Over Voltage(Max)                                                                                                                                                                                                                                                                                                                                                       |                |                   |     |       |     |          |    |          |    |         |
| 20V                                    | < 29V                                                                                                                                                                                                                                                                                                                                                                   |                |                   |     |       |     |          |    |          |    |         |
| 15V                                    | < 21.75V                                                                                                                                                                                                                                                                                                                                                                |                |                   |     |       |     |          |    |          |    |         |
| 9V                                     | < 13.05V                                                                                                                                                                                                                                                                                                                                                                |                |                   |     |       |     |          |    |          |    |         |
| 5V                                     | < 7.25V                                                                                                                                                                                                                                                                                                                                                                 |                |                   |     |       |     |          |    |          |    |         |
| <b>Over Temperature Protection</b>     | Auto-function                                                                                                                                                                                                                                                                                                                                                           |                |                   |     |       |     |          |    |          |    |         |

### Other Specifications

|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental Requirements</b>                    | Operating Temperature 0°C to 35°C<br>Storage Temperature -20°C to 85°C<br>Operating Relative Humidity 20% - 95% RH<br>Storage Relative Humidity 5% - 95% RH<br>Operation Altitude 5000 M<br>E-Cap lifetime Usage profile 8h x 52 weeks x 3 yrs = 8,736 hours<br>100Vac/60Hz&230Vac/50Hz;20V@80% Load<br>Ambient temperature = 35°C<br>MTBF > 50K hours at 115Vac / 230Vac, Ambient=25°C/MIL-HDBK-217F<br>Burn In Burn-in shall be at 20V/3.25A @220Vac.<br>PP 100% burn in 24H/MP 100% burn in 2H. |
| <b>Case surface temperature</b>                      | 0 to 35 °C maximum temperature rise of any surface shall not exceed 52C when measured at 90Vac and at maximum load.                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Drop Test</b>                                     | Test condition<br>a. Height : 91cm<br>b. Material : Concrete<br>c. The product does not require thermal shock before testing<br>d. Orientation : Drop the unit one time for each face (6 faces),1 cycle<br>Acceptance criteria<br>a. Hi-pot pass<br>b. Allow small crack needed pass by test finger                                                                                                                                                                                                |
| <b>Tumbling Test<br/>(For EU &amp; AU &amp; UK )</b> | Test condition<br>a. EU: Height 0.5M / 500 times<br>b. AU: Height 0.5M / 500 times<br>c. UK: Height 0.5M / 50 times<br>Acceptance criteria<br>There must be no function damage after testing.                                                                                                                                                                                                                                                                                                      |



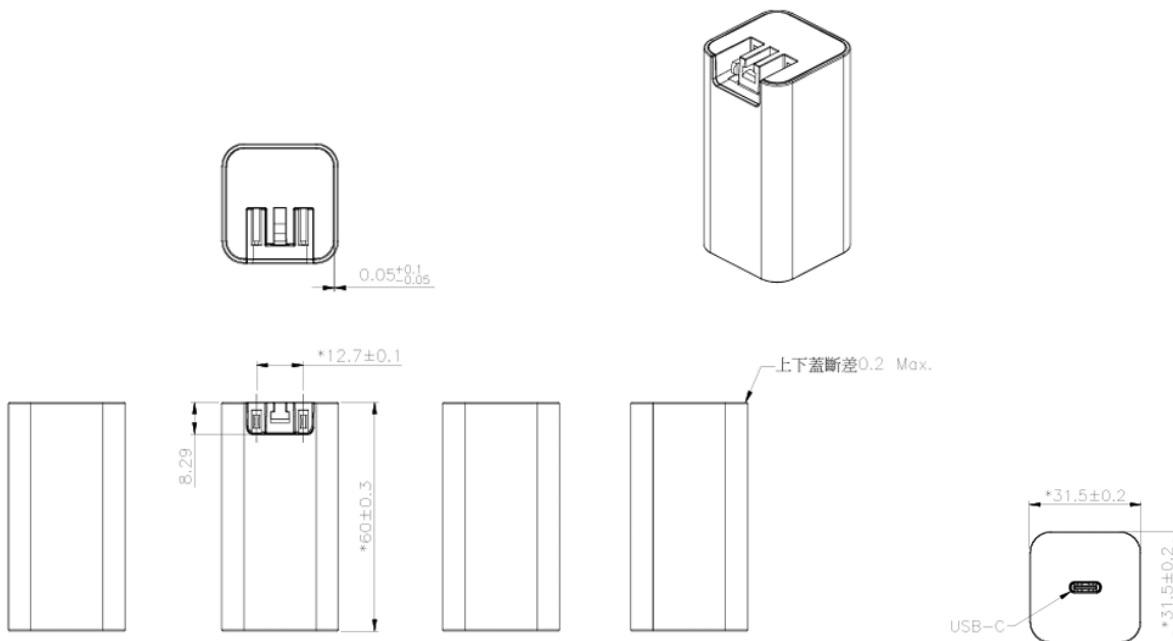


## TECHNICAL DATA

### Safety and EMC

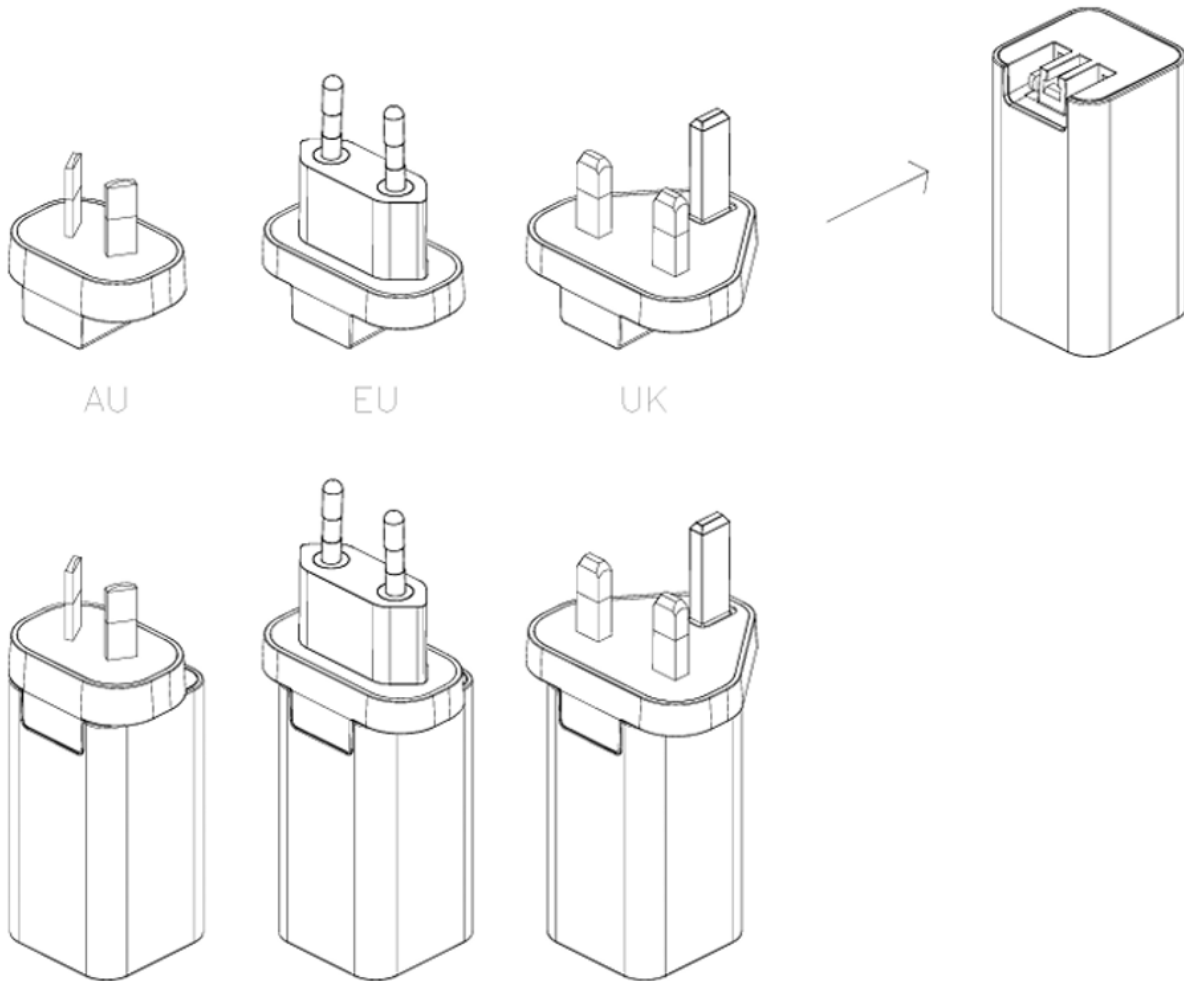
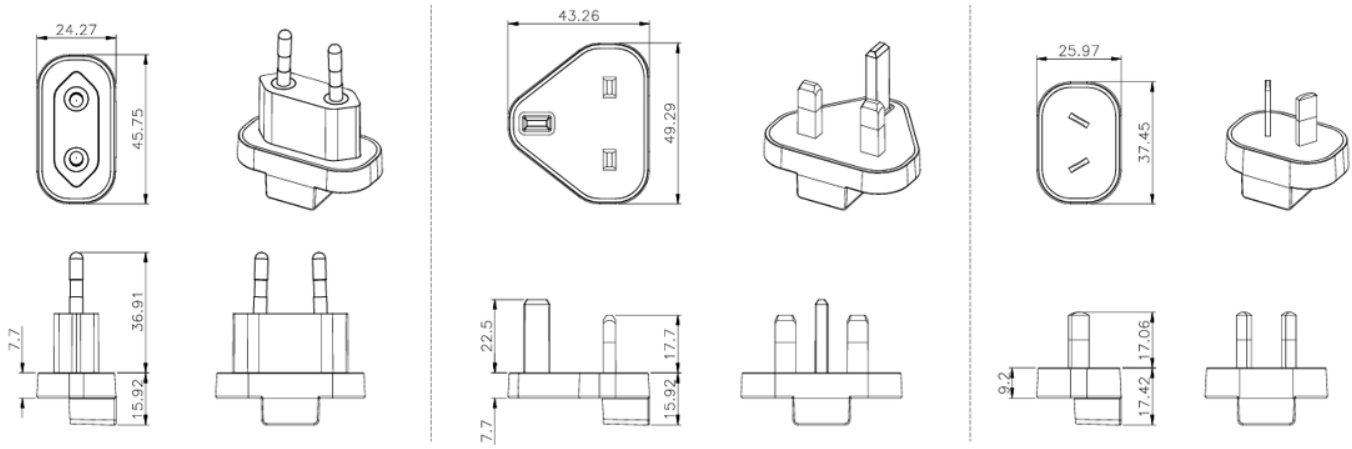
|                                  |                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMC                              | EMI                                                                                                                        | FCC part15 Class B<br>EN55032 Class B<br>ICES-003 issue 7 Class B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                  | EMS:                                                                                                                       | EN 55035<br>ESD : IEC 61000-4-2(ESD)<br>Contact discharges: $\pm 2\text{KV}$ , $\pm 4\text{KV}$ , $\pm 8\text{KV}$ Criterion A.<br>Air discharges: $\pm 2\text{KV}$ , $\pm 4\text{KV}$ , $\pm 8\text{KV}$ , $\pm 15\text{KV}$ Criterion A.<br>Radiated Immunity: IEC 61000-4-3 (RS)<br>80-1000MHz, 3V/m, 80% AM (1 KHz), Criterion A.<br>Electrical Fast Transients: IEC 61000-4-4 (EFT)<br>2kV, Repetition Rate 5kHz, Criterion A.<br>Surge: IEC 61000-4-5 (Surge) .Line to Line 2.5KV; Line to FG 2.5KV, Criterion A.<br>Conducted Disturbances:<br>IEC 61000-4-6 (CS), 0.15-80MHz, 3V, 80% AM (1 kHz), Criterion A.<br>Magnetic Field Immunity:<br>IEC 61000-4-8 (MS), 50 or 60Hz, 1A/m (rms), Criterion A.<br>Voltage Dips and interruptions: IEC 61000-4-11 (DIP), Criterion B |
| Harmonics                        | Meet EN IEC 61000-3-2 requirement                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Voltage Fluctuations and Flicker | Meet EN 61000-3-3 / IEC 61000-3-3 requirement                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| HI-POT test                      | Pri. to Sec. 4000VDC $\leq 10\text{mA}$ for 1 Minute.<br>(Note: Production line test: 4242VDC $\leq 10\text{mA}$ for 3sec) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Insulation Resistance            | Pri. to Sec. > 200 M ohm 1000Vdc<br>(Note: Production line test: > 200 M ohm 1000Vdc for 3sec)                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Safety                           | IEC/UL 62368-1<br>EN 50075<br>AS/NZS 3112+A1<br>BS 1323+A1                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### Mechanical Outline Drawing





## TECHNICAL DATA





## TECHNICAL DATA

### Test Items In Production Line

\* At CPK > 1.33

| 5V Output  | TEST CONDITION   | MEASURE                          | SPECIFICATION    |
|------------|------------------|----------------------------------|------------------|
|            | Input: 90V/60Hz  | Output Voltage(5V,3A) *          | 4.75V~5.25V      |
|            |                  | Output Ripple & Noise(5V,3A)     | 380 mVp-p max    |
|            | Input: 264V/50Hz | Output Voltage(5V,0A) *          | 4.75V~5.25V      |
|            |                  | Output Ripple & Noise(5V,0A)     | 380 mVp-p max    |
|            |                  | OCP                              | 3.45A~3.75A max. |
| 9V Output  | TEST CONDITION   | MEASURE                          | SPECIFICATION    |
|            | Input: 90V/60Hz  | Output Voltage(9V,3A) *          | 8.55V~9.45V      |
|            |                  | Output Ripple & Noise(9V,3A)     | 380 mVp-p max    |
|            | Input: 264V/50Hz | Output Voltage(9V,0A) *          | 8.55V~9.45V      |
|            |                  | Output Ripple & Noise(9V,0A)     | 380 mVp-p max    |
|            |                  | OCP                              | 3.45A~3.75A max. |
| 15V Output | TEST CONDITION   | MEASURE                          | SPECIFICATION    |
|            | Input: 90V/60Hz  | Output Voltage(15V,3A) *         | 14.25V~15.75V    |
|            |                  | Output Ripple & Noise(15V,3A)    | 380 mVp-p max    |
|            | Input: 264V/50Hz | Output Voltage(15V,0A) *         | 14.25V~15.75V    |
|            |                  | Output Ripple & Noise(15V,0A)    | 380 mVp-p max    |
|            |                  | OCP                              | 3.45A~3.75A max. |
| 20V Output | TEST CONDITION   | MEASURE                          | SPECIFICATION    |
|            | Input: 90V/60Hz  | Output Voltage(20V,3.25A) *      | 19V~21V          |
|            |                  | Output Ripple & Noise(20V,3.25A) | 380 mVp-p max    |
|            | Input: 115V/60Hz | Efficiency at load (20V,3.25A)   | > 88%            |
|            | Input: 264V/50Hz | Output Voltage(20V,0A) *         | 19V~21V          |
|            |                  | Output Voltage(20V,3.25A) *      | 19V~21V          |
|            |                  | Output Ripple & Noise(20V,0A)    | 380 mVp-p max    |
|            |                  | OCP                              | 3.74A~4.06A max. |

Note: Production line efficiency measurements are performed in accordance with ISO PHG-Q3-PE04 "1.5.4.2.4 Energy Efficiency Testing".

\*Hi-pot test: 4242VDC  $\leq$  10mA for 3sec

## PHIHONG 50 YEARS OF HISTORY IN THE POWER SUPPLIES INDUSTRY

Since its founding in 1972, Phihong has emerged as a prominent power supply company, serving as a key supplier of solutions for consumer, mobile/portable, enterprise, telecom, datacom, and industrial applications.

