



**ACBEL POLYTECH INC.**

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Specification for 400W  
Flex ATX Power Supply  
Production NO: FSE001-000G

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## 1. Input Requirements

### 1-1. Input condition:

Range Select	Nominal	Units
V <sub>in</sub>	100 - 240	VAC
Frequency	50 - 60	Hz
AC input current	6A / 115V <sub>AC</sub> , 3A / 230V <sub>AC</sub>	AMPS

### 1-2. Inrush Current

Maximum inrush current from power-on (with power on at any point on the AC sine) shall be limited to the peak surge current of the input line cord, bridge diode, fuse and EMI filter components according to I<sup>2</sup>t. Receptive ON/OFF cycling of the AC input voltage shall not damage the PSU or cause the input fuse to blow.

### 1-3. Efficiency

The minimum efficiency of power supply should be over than **87%** under the maximum and 20% load and should be over **90%** under the half load. Load measurements are performed at 115VAC/230Vac input.

The PF should be over than 0.9 under 20% load at 115VAC.

**It is better to meet the 80 plus requirement .as the web site as follow:**

<http://www.80plus.org/>

Efficiency test condition as below

**Table 1: Efficiency load condition**

Load	+5V	+3.3V	+12V	+5Vs	-12V	Total (W)
20% Load	2.15A	1.4A	5.2A	0.3A	0.06	80W
50% Load	5.46A	3.3A	13A	0.8A	0.15	200W
100% Load	11A	6.5A	26A	1.6A	0.3	400W

Note: The Efficiency should allow of 1% tolerance.

### 1-4 Harmonic Current Compliance With EN 61000-3-2

The power supply shall be passed 115V/60HZ and 230V/ 50HZ class D on EN61000-3-2.

**1-5. Energy Star (Compliance With (EU) No 617/2013)**

In standby mode, +5Vsb efficiency should perform as follow: (230V/50HZ)

**Table 2: Energy Star load condition**

Output	Efficiency
50 mA	≥ 50%
100 mA	≥ 50%
250 mA	≥ 60%
≥ 1A	≥ 70%

**1-6. Output Voltage and Ripple Noise Requirements**
**Table 3 Output Voltage and Ripple Noise Requirements**

Output Voltage	MIN	MAX	Regulation (%)	Ripple Max
+5V	4.75	5.25	+5% ~ -5%	50mV
+3.3V	3.135	3.465	+5% ~ -5%	50mV
+12V	11.4	12.6	+5% ~ -5%	120mV
+5Vs	4.75	5.25	+5% ~ -5%	50mV
-12V	10.8	13.2	+10% ~ -10%	120mV

- Note: 1). The output voltage should be measured at output connector terminals.  
 2). The output Ripple Noise should be tested with 10 μF of tantalum and 0.1 μF ceramic disk capacitors to simulate system loading.

**2. Output Requirements**
**2-1. DC Load Requirements**
**Table 4: DC Load Requirements**

Output Voltage	Minimum	Maximum	Combined	Total
5V	<b>0.2A</b>	<b>16A</b>	<b>386.4W</b>	<b>400W</b>
3.3V	<b>0.1A</b>	<b>10A</b>		
12V	<b>0.1A</b>	<b>32A</b>		
5VS	<b>0.05A</b>	<b>2A</b>	<b>10W</b>	
-12V	<b>0.05A</b>	<b>0.3A</b>	<b>3.6W</b>	

- Note: 1. The total continuous output power shall not exceed 400W.  
 2. The total output of 5V&3.3V should not exceed 100W.  
 3. The total output of main should not exceed 386.4W  
 4. The +12V peak current is 36A and the timing keep 12ms,  
 And output voltage tolerance is ±10% .

## 2-2. Cross Regulation

**Table 5: Cross Regulation**

The cross regulation is defined in the matrix below:

Load	+5V	+3.3V	+12V	+5Vs	-12V	Total
1	0.2	0.1	0.1	0.05	0.05	13.0
2	5.46	3.3	13	0.8	0.15	200.0
3	16	5.6	24	2	0.3	400.0
4	13.1	10	24	2	0.3	400.0
5	0.22	0.4	32	2	0.3	400.0

## 2-3. Output Transient Response

- ◆ The output voltage will remain within the regulation after applying following load changes.
- ◆ Simultaneous load step on the +5V, +3.3V, -12V, and +12V outputs. (all steps occurring in the same direction.)
- ◆ Load –changing repetition rate of 50Hz to 10KHz.

**Table 6: Output Transient Response**

Low Step	High Step	Output	Output Range	Max Load Step	Slew Rate ( A/uS )	Min. Dynamic Capacitive load
Static Load (1)	Static Load (3)	+5V	0.2A to 16A	4.8A	1	10,000uF
Static Load (1)	Static Load (4)	+3.3V	0.1A to 10A	3A	1	10,000uF
Static Load (1)	Static Load (5)	+12V	0.1A to 32A	14A	0.5	3300uF
Static Load (1)	Static Load (4)	+5Vs	0.05A to 2A	0.6A	1	6000uF
Static Load (1)	Static Load (4)	-12V	0.05A to 0.3A	0.1A	0.1	350uF

The dynamic load transient response test must follow 2-2.

## 2-4. Output Closed-loop Stability

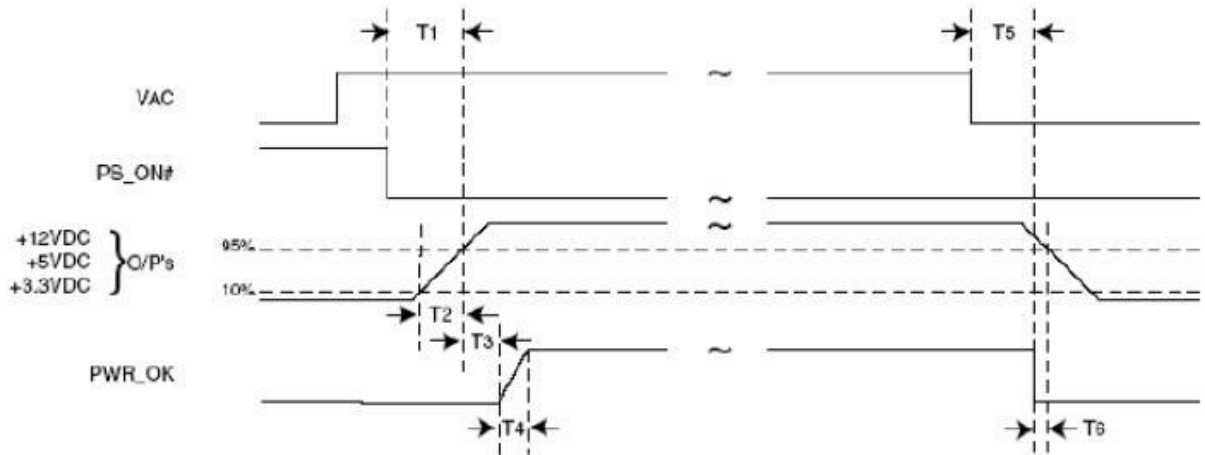
The power supply shall be unconditionally stable under all line/load/transient load conditions including capacitive loads. A minimum of 45 degrees phase margin and 6dB gain is recommended at both the maximum and minimum load.

## 2-5. Over Shoot

The output voltage overshoot upon the application or removal of the input voltage, or the assertion /de-assertion of PS\_ON#, under the condition specified in Section 1-6, shall be less than 10% above the nominal voltage. No voltage of opposite polarity shall be present on any output during turn-on or turn-off.

### 3. Timing

● **3-1. Power supply Time:**



**Table 7: Timing**

Parameter	Description	Value
T1	Power-on time	<500mS
T2	Rise time	0.2 – 20mS
T3	PWR_OK delay time	100 – 500mS
T4	PWR_OK rise time	<1mS
T5	AC loss to PWR_OK hold-up time	16mS
T6	Power-down warning	>1mS

NOTE: The power supply with 80% load at 115Vac/ 60Hz or 230V/50Hz for T5.

● **3-2. Hold-up Time**

The power supply with 80% load at 115Vac/ 60Hz or 230V/50Hz should supply regulated output for at least 16mS after the loss of the AC input voltage.

Test condition as below.

Load	+5V	+3.3V	+12V	+5Vs	-12V	Total
80% Load	9.5A	5A	20.65A	1.3A	0.15A	320W



## 4. Power Good Signal

### 4-1. Power Good Signal

The power supply should provide a “Power-Good” signal to reset system logic, indicate proper operation of the power supply and give advance warning of impending loss of regulation at turn off.

It should be an up level during normal operation, or a down level when fault conditions occur or during turn off. When the power supply is turned off for a minimum of 3.0 sec. and then turned on the power good signal should be generated.

### 4-2. Power Good Signal Characteristics

Signal Type	+5V TTL compatible
Logic level low	< 0.4V while sinking 4mA
Logic level high	Between 2.4V and 5V output while sourcing 200uA
High-state output impedance	1k ohms from output to common
Max Ripple/Noise	400 mV pk-pk

## 5. Protections

### 5-1. Over Voltage Protection

OVP	Max.
12V	16.0V
5V	7.0V
3.3V	4.5V

### 5-2. Over Current Protection

The power supply should provide +5V, +3.3V and +12V OCP and should shutdown of each output power and no components damage. For testing purposes, the overload currents of each tested output rail should be ramped at a minimum rate of 10A/sec.

### 5-3. Short Circuit Protection

The short circuit placed on +3.3V, +5V, +12V, -12V and 5Vs output shall cause no damage and the power supply shall shut down or latch.

### 5-4. Protection Reset

When the power supply latches into shutdown condition due to a fault on output (Over-Current, Over-Voltage, Short circuit, OTP), the protection latch must reset within 7 seconds after the fault has been removed and the on/off signal has switched state.

## 6. No Load Operation

The power supply should be normal operation.





## **7. Fan Speed Control**

The power supply shall contain a thermal sensing circuitry capable of varying fan speed.

## **8. Environment**

### **8-1. Operating Temperature Range**

Operation ambient : 0 °C to + 50°C

Non-operating ambient : -40°C ~ +70°C

### **8-2. Thermal Shock (Shipping)**

Non-operating : -40 ~ 70°C (15°C/min ≤ dT/dt ≤ 30°C/min)

### **8-3. Altitude**

Operating To 5000 m

Non-operating To 15,000 m

### **8-4. Random Vibration**

Sine sweep, 5 Hz~200 Hz , 1g.

Sweep rate : 1 Oct/Min, three axes.

Dwell natural frequency, 2G , per point 15 minutes.(non-operating)

### **8-5. MTBF and Cap Life**

100,000 Hours “80% Load at 25°C, 115V / 60Hz or 230V / 50Hz” for MTBF.

26,280 Hours “80% Load at 25°C, 115V / 60Hz or 230V / 50Hz” for Capacitor life.

### **8-6. Mechanical Shock**

Square wave ,50G ; velocity 167 in/s per face three times. (non-operating)

## **9. Safety**

The power supply will have the following safety approvals with most current editions shipping:

9-1. UL/CAN/CSA

9-2. TUV/EN

9-3. IEC/CB

9-4. CE

9-5. FCC

9-6. BSMI

9-7. CCC

## **10. EMI Requirements**

The power supply shall comply with CISPR 22, Class B. Tests shall be conducted using a shielded DC output cable to a shielded load. The load shall be adjusted as follows condition: Test with system; Tests will be performed at 115VAC/60Hz, and 220VAC/50Hz.

**11. Electrostatic Discharge Requirement (ESD)**

The objective of ESD test is to determine the susceptibility and immunity of products to electrostatic discharge to which the products may be exposed, when operating under all potential environmental conditions.

**11-1. Air Discharge:**

Test Volt	Requirements
8KV	No allowed error
12.5KV	Restart & damage error are not allowed
15KV	Damage error is not allowed restart is allowed

**11-2. Contact Discharge :**

Test Volt	Requirements
2~4KV	No allowed error
6KV	Restart & damage error are not allowed
8KV	Damage error is not allowed restart is allowed

The above test discharge time is 1 time / sec and repeat each test ten times.

**12. Lightning Surge Immunity**

The purpose of lightning surge immunity test is to verify if the power supply can withstand lightning surge wave. This is to follow the norm of IEC61000-4-5 requirements.

**13. Hi-Pot test:**

100% production testing for Hi-pot and Ground continuity must be performed, Units passing these tests must be mark accordingly.

**14. Fan:**

Size: 40x20mm, speed: 13000rpm