

# **TC-1000PD8G**

## **Switching Power Supply**

(1000W PS2 ATX12V )

# **SPECIFICATION**

Revision: 1.0

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## 1. General Description Scope

This is the specification of Model TC-1000PD8G; AC-line powered switching power supply with active PFC (Power Factor Correction) circuit meets EN61000-3-2 and has full range input features.

The specification below is intended to describe the functions and performance of the proposal power supply. Any comments or additional requirements to the specification from our customers will be highly appreciated and treated as new target for us to reach.

## 2. Reference Documents

The proposal power supply will meet the EMI requirements and obtain main safety approval as follows:

### 2.1 EMI Regulatory

- FCC Part 15 Subpart J, Class 'B' 115Vac operation.
- CISPR 22 Class 'B' 230Vac operation.

### 2.2 Safety

- NEMKO EN 60950
- TUV EN60950 OR VDE EN60950
- CSA-C22.2 NO. 60950
- IEC 60950
- UL 60950
- CE :  
EN 55022:1998+A1: 2000, Class B  
EN 61000-3-2: 2000  
EN 61000-3-3: 1995+A1: 2001  
CISPR22: 1997+A1: 2000, Class B  
AS/NZS CISPR 22: 2002, Class B

### 2.3 Input Line Current Harmonic Content

For sales in EU (European Union) or Japan the power supply shall meet the requirements of EN61000-3-2 Class D and the Guidelines for the Suppression of Harmonics in Appliances and General Use Equipment Class D for harmonic line current content at full rated power. See the following table for the harmonic limits.

Harmonic Order n	Per. EN 61000-3-2	Per. JEIDA MITI
	Maximum permissible Harmonic current at 230 VAC / 50 Hz in Amps	Maximum permissible Harmonic current at 100VAC / 50 Hz in Amps
	Odd harmonics	
3	2.3	5.29
5	1.14	2.622
7	0.77	1.771
9	0.4	0.92
11	0.33	0.759
13	0.21	0.483
15 ≤ n ≤ 39	0.15 x (15/n)	0.345 x (15/n)

### 3. Input Electrical Specifications

#### 3.1 AC Input

Parameter	Min	Nominal <sup>(1)</sup>	Max	Unit
V <sub>IN</sub> (115V <sub>AC</sub> )	90	115	135	V <sub>AC(RMS)</sub>
V <sub>IN</sub> (230V <sub>AC</sub> )	180	230	264	V <sub>AC(RMS)</sub>
V <sub>IN</sub> Frequency	47	-	63	Hz

◆ Nominal voltage for test purposes are considered to be within  $\pm 1.0V$  of nominal.

#### 3.2 Inrush Current

Maximum inrush current from power-on (with power on at any point on the AC sine) and including, but not limited to, three line cycles, shall be limited to a level below the surge rating of the input cord, AC switch if present, bridge rectifier, fuse, and EMI filter components. Repetitive ON/OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to blow.

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For Denmark and Switzerland international safety requirements, if the internal over-current protective devices exceed 8A for Denmark and 10A for Switzerland, then the power supply must pass international safety testing to EN60950 using a maximum 16A over-current protected branch circuit, and this 16A (time delay fuse) branch circuit protector must not open during power supply abnormal operation (output short circuit and component fault) testing.

#### 3.3 Input Line Current

115V <sub>AC</sub>	14A – Max rms
230V <sub>AC</sub>	8A – Max rms

#### 3.4 Efficiency

##### 3.4.1 General

Under the load conditions defined in Table 1 and Table 2. The loading condition for testing efficiency shown in Table 1 represents a fully loaded system, a~50% (typical) loaded system, and a~20% (light) loaded system.

Table 1. Loading Table for 80PLUS Efficiency Measurements

Loading	+5V	+3.3V	12V	-12V	+5Vsb
Full	16.33	16.33	70.32	0.68	2.54
Typical	8.16	8.16	35.16	0.34	1.27
Light	3.27	3.27	14.08	0.14	0.51

Table 2. Minimum Efficiency VS Load

Loading	Full load	Typical load	Light load
115V <sub>AC</sub> Required Minimum Efficiency	87%	90%	87%
230V <sub>AC</sub> Required Minimum Efficiency	87%	90%	87%

### 3.4.2 5V STBY Efficiency Requirements at Power OFF Mode

5Vsb efficiency is greater than 50% at power off mode (PS\_ON input at high state) which is comply with Eup Lot 6 year 2013 requirement. 5Vsb output efficiency requirements at remote off are as follows:

#### Requirement (1):

Efficiency  $\geq 50\%$

Output Load @ 45mA

Input Voltage @ 230Vac / 50Hz

PS\_ON Input Signal @ High State

#### Requirement (2):

Load Condition	2013 Efficiency Requirement
< 45mA	AC input power should be less than 0.45W at any output load less than 45mA condition, including no load condition.
45mA	$\geq 50\%$
100mA	$\geq 55\%$
250mA	$\geq 65\%$
$\geq 1A$	$\geq 70\%$

### 3.5 Mechanical Specifications

The proposal power supply is cooled by a self-contained 140×140mm fan on top side of case. Please refer to mechanical drawing of the proposal power supply which indicates the external form, location of the mounting holes, shapes of connectors, and other physical specifications.

## 4. DC Output Electrical Requirements

### 4.1 Output Voltage and Current Rating

Output	Voltage Range	Min.	Normal	Max.	Ripple	Ripple & Noise
+3.3V	±5%	3.14	3.30	3.47	75mV <sub>P-P</sub>	75mV <sub>P-P</sub>
+5V	±5%	4.75	5.00	5.25	75mV <sub>P-P</sub>	75mV <sub>P-P</sub>
+12V	±5%	11.40	12.00	12.60	120mV <sub>P-P</sub>	120mV <sub>P-P</sub>
-12V	±10%	-10.80	-12.00	-13.20	120mV <sub>P-P</sub>	120mV <sub>P-P</sub>
+5Vsb	±5%	4.75	5.00	5.25	75mV <sub>P-P</sub>	75mV <sub>P-P</sub>

Output	Min Current	Normal Current	Max Current	Peak Current
+3.3V	0.1A	18A	25A	
+5V	0.1A	18A	25A	
+12V	0.5A	62A	83A	
-12V	0.0A	0.5A	0.8A	
+5Vsb	0.1A	2.25A	3.0A	3.5A

- (1) +3.3V & +5V total output not exceed 160W.
- (2) Maximum combined current for the 12V outputs shall be 83A.
- (3) Total output power for the proposal power supply is 1000 watts

Ripple and noise are defined as periodic random signals over a frequency band of 10Hz to 20MHz. Measurements shall be made with an oscilloscope with 20MHz bandwidth outputs should be bypassed at the connector with a 0.1uF ceramic disk capacitor and a 47uF electrolytic capacitor to simulate system loading.

#### 4.1.1 Remote Sensing

The +3.3V output should have provisions to compensate remotely for excessive cable drops. The default sense should be connected to pin 13 of the main power connector. The power supply should draw no more than 10mA through the remote sense line to keep DC offset voltages to minimum one.

## 4.2 Load Capacity Specifications

The cross regulation are defined as follows, and the voltage regulation should be conformed to output voltage rating (4.1) included ripple & noise.

Load	+3.3V	+5V	+12V	-12V	+5Vsb
Full load	16.33	16.33	70.32	0.68	2.54
3.3V Max, others Min	25.0	1.0	1.0	0	0.1
5V Max, others Min	1.5	25.0	1.0	0	0.1
12V fit to Max current, others Min	1.5	1.0	83.0	0	0.5
12V fit to Max current, -12V Max, others Min	1.5	1.0	83.0	0.8	0.5
5Vsb Max, others Min	1.5	1.0	1.0	0	3.0
-12V Max, others Min	1.5	1.0	1.0	0.8	0.1
Min load	0.1	0.1	0.5	0	0.1
SLI Min load (No shut down)	0	0.5	0.1	0	0
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## 4.3 Output Transient Response

### 4.3.1 Dynamic Loading

Summarizes expected output transient step sizes for each output. The transient load slew rate is 1.0A/us.

#### *Transient Load Requirements*

Output	$\Delta$ Step Load Size	Load Slew Rate	Add Capacitor
+3.3V	30% of max load	1.0 A/ $\mu$ s	12000 $\mu$ F
+5V	30% of max load	1.0 A/ $\mu$ s	12000 $\mu$ F
+12V	50% of max load	1.0 A/ $\mu$ s	36000 $\mu$ F
-12V	20% of max load	1.0 A/ $\mu$ s	350 $\mu$ F
+5Vsb	25% of max load	1.0 A/ $\mu$ s	350 $\mu$ F

### 4.3.2 Capacitive Loading

#### *Capacitive Loading Conditions*

Output	Max
+3.3V	12000 $\mu$ F
+5V	12000 $\mu$ F
+12V	36000 $\mu$ F
-12V	350 $\mu$ F
+5Vsb	350 $\mu$ F

## 5. Timing

### 5.1 PWR\_OK

PWR\_OK is a “power good” signal. It should be asserted high by the power supply to indicate that the +12V<sub>DC</sub>, +5V<sub>DC</sub>, and +3.3V<sub>DC</sub> output are above the under-voltage thresholds listed in voltage table .Conversely, PWR\_OK should be de-asserted to a low state when any of the +12V<sub>DC</sub>, +5V<sub>DC</sub>, and +3.3V<sub>DC</sub> output voltages falls below its under-voltage threshold. Moreover, when main power has been removed for a long and sufficient time, the power supply operation cannot be guaranteed beyond the power down warning time.

#### PWR\_OK Signal Characteristics

Signal Type	+5 V TTL compatible
Logic level low	< 0.4 V while sinking 4 mA
Logic level high	Between 2.4 V and 5 V output while sourcing 200 $\mu$ A
High-state output impedance	1 k $\Omega$ from output to common
PWR_OK delay	100 ms < T <sub>3</sub> < 500 ms
PWR_OK risetime	T <sub>4</sub> $\leq$ 10 ms
AC loss to PWR_OK hold-up time	T <sub>5</sub> $\geq$ 16 ms
Power-down warning	T <sub>6</sub> $\geq$ 1 ms

Note: T3~T6 defined above refer to the timing diagram of 5.1.5.

#### Power Signal

Power Good @ 115/230V <sub>AC</sub> , Full Load	100 ~ 500 ms
Power Fail @115/230V <sub>AC</sub> , Full Load	1ms Min

#### 5.1.1 Hold-up Time (@ 75% Load)

115V<sub>AC</sub> / 60Hz : 17ms Min.

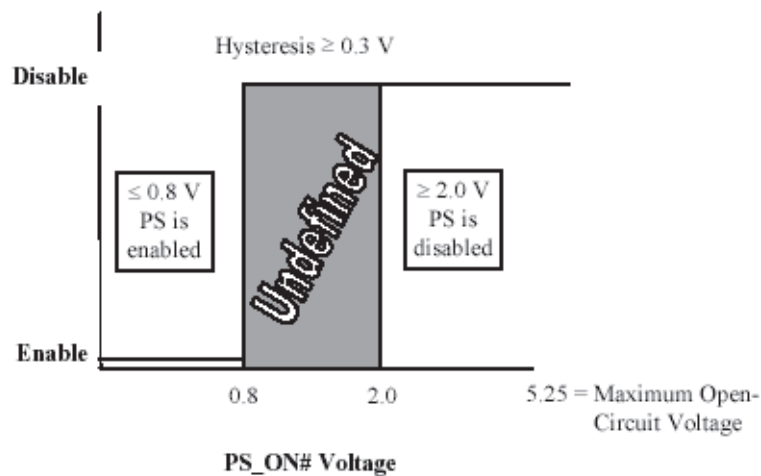
230V<sub>AC</sub> / 50Hz : 17ms Min.

The output voltage will remain within specification, in the event that the input power is removed or interrupted, for the duration of one cycle of the input frequency. The interruption may occur at any point in the AC voltage cycle. The power good signal shall remain high during this test.

### 5.1.2 PS\_ON

#### PS\_ON# Signal Characteristics

	Min.	Max.
V <sub>IL</sub> , Input Low Voltage	0.0 V	0.8 V
I <sub>IL</sub> , Input Low Current (V <sub>in</sub> = 0.4 V)		-1.6 mA
V <sub>IH</sub> , Input High Voltage (I <sub>in</sub> = -200 μA)	2.0 V	
V <sub>IH</sub> open circuit, I <sub>in</sub> = 0		5.25 V



#### PS\_ON# Signal Characteristics

### 5.1.3 Output Rise Time

10% to 95% of final output value, @ Full Load

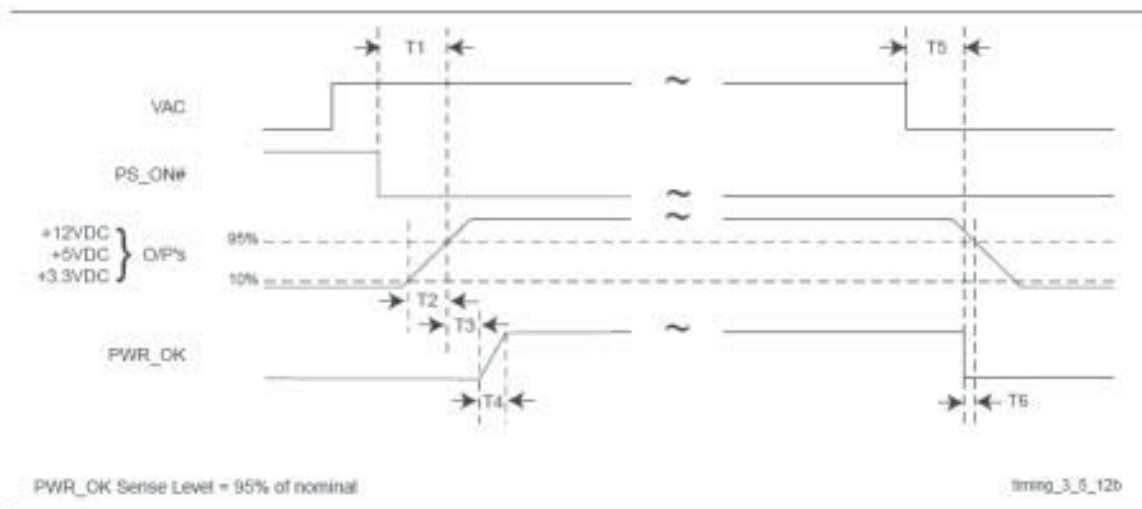
115Vrms or 230Vrms	+5V <sub>DC</sub> & +3.3V <sub>DC</sub> : within 0.1ms to 20ms
115Vrms or 230Vrms	+12V <sub>DC</sub> : within 0.1ms to 20ms
115Vrms or 230Vrms	+5V <sub>sb</sub> : within 0.1ms to 20ms
115Vrms or 230Vrms	-12V <sub>DC</sub> : within 0.1ms to 20ms

### 5.1.4 Overshoot at Turn-on/Turn-off

The output voltage overshoot upon the application or removal of the input voltage, or the assertion/de-assertion of PS\_ON, under the conditions specified in voltage table, 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.



### 5.1.5 Power supply timing



## 5.2 Output Protection

### 5.2.1 Over-Voltage Protection

Voltage Source	Protection Point
+3.3V <sub>DC</sub>	3.6~4.8V
+5V <sub>DC</sub>	5.6~7.0V
+12V <sub>DC</sub>	13.0~15.6V

### 5.2.2 Over-Current Protection

Output Voltage	Max Over-current Limit
+3.3V	50A
+5V	50A
+12V	140A

### 5.2.3 Short Circuit Protection

Output short circuit is defined to be a short circuit load of less than 0.1 ohm. In the event of an output short circuit condition on +3.3V, +5V, and +12V output, the power supply will shutdown and latch off without damage to the power supply. The power supply shall return to normal operation after the short circuit has been removed and the power switch has been turned off for no more than 2 seconds. In the event of an output short circuit condition on -12V output, the power supply will not be damaged. The power supply shall return to normal operation as soon as the short circuit has been removed and the power switch has been turned off for no more than 2 seconds.

#### 5.2.4 No-load Operation

No damage or hazardous condition should occur with all the DC output connectors disconnected from the load. The power supply may latch into the shutdown state.

#### 5.2.5 Over-temperature Protection

The power supply may include an over-temperature protection sensor, which can trip and shut down the power supply at a preset temperature point. Such an overheated condition is typically the result of internal current overloading or a cooling fan failure. If the protection circuit is non-latching, then it should have the hysteresis function built in to avoid intermittent tripping.

#### 5.2.6 Reset after shutdown

If the power supply latches into a shutdown state because of a fault condition on its outputs, the power supply shall return to normal operation only after the fault has been removed and the PS\_ON(or AC input) has been OFF/ON with a minimum OFF time of 1 second.

### 6. Environmental Requirements

The power supply will be compliant with each item in this specification for the following environmental conditions.

#### 6.1 Temperature Range

Operating	0 to 40 deg. C
Storage	-20 to 80 deg. C

#### 6.2 Humidity

Operating	5 ~ 95% RH, Non-condensing
Storage	5 ~ 95% RH, Non-condensing

#### 6.3 Vibration

The subject power supply will withstand the following imposed conditions without experiencing non-recoverable failure or deviation from specified output characteristics.

Vibration Operating – Sine wave excited, 0.25 G maximum acceleration, 10~250 Hz swept at one octave/min. Fifteen minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times large than non-resonant excursions.

Plane of vibration to be along three mutually perpendicular axes.

#### **6.4 Ground Leakage Current**

The power supply ground leakage current shall be less than 3.5mA.

#### **6.5 Reliability**

The power supply reliability, when calculated by MIL-HDBK-217; latest revision, are exceed 100,000 hours with all output at maximum load and an ambient temperature of 25°C .

#### **6.6 Dielectric Strength**

Primary to Frame Ground: 1800V<sub>AC</sub> for 3 sec.

Primary to Secondary: 1800V<sub>AC</sub> for 3 sec

#### **6.7 Insulation Resistance**

Primary to Frame Ground: 20 Mega ohms Minimum

Primary to Secondary: 20 Mega ohms Minimum

### **7. Labeling**

Label marking will be permanent, legible and complied with all agency requirements.

#### **7.1 Model Number Label**

Labels will be affixed to the sides of the power supply showing the following:

- Manufacturer's name and logo.
- Model no., serial no., revision level, location of manufacturer.
- The total power output and the maximum load for each output.
- AC input rating.