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# SPECIFICATION



ESD16004358

SDA600

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# SPECIFICATION

## **SDA600**

**9PA6009300**



**Main Feature:  
High Efficiency  
Active PFC Circuit  
Full Range Input  
LLC Resonant**

**OCT 26, 2015  
REV : 00**



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## **MODEL: SDA600**

### **Revision History**

| <u>Rev</u> | <u>Description</u> | <u>Date</u> | <u>Author</u> |
|------------|--------------------|-------------|---------------|
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|            |                    |             |               |

## 1. General Description Scope

This is the specification of Model SDA600; 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<br>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.

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> | 7.0A – Max rms |
| 230V <sub>AC</sub> | 4.0A – Max rms |

#### 3.4 Power Factor Requirement

Under the load conditions defined in Table 3.4.1, the power factor in different AC input voltage should meet the requirements showing in Table 3.4.2.

Table 3.4.1. Loading Table for Power Factor Measurements

| Loading | +3.3V | +5V  | +12V  | -12V | +5Vsb |
|---------|-------|------|-------|------|-------|
| 100%    | 10.85 | 8.14 | 42.49 | 0.25 | 2.12  |

Table 3.4.2. Minimum Power factor V.S. Load

| Loading                   | 100%        |
|---------------------------|-------------|
| 115V <sub>AC</sub> / 60Hz | $\geq 0.95$ |
| 230V <sub>AC</sub> / 50Hz | $\geq 0.95$ |

#### 3.5 Efficiency

##### 3.5.1 General

Under the load conditions defined in Table 3.5.1, the testing efficiency in different AC input

voltage should meet the requirements showing in Table 3.5.2.

Table 3.5.1. Loading Table for 80PLUS Efficiency Measurements

| Loading | +3.3V | +5V  | +12V  | -12V | +5Vsb |
|---------|-------|------|-------|------|-------|
| 100%    | 10.85 | 8.14 | 42.49 | 0.25 | 2.12  |
| 50%     | 5.42  | 4.07 | 21.24 | 0.13 | 1.06  |
| 20%     | 2.17  | 1.63 | 8.5   | 0.05 | 0.42  |

Table 3.5.2. Minimum Efficiency V.S. Load

| Loading  | 100% | 50% | 20% |
|--|------|-----|-----|
| 115V <sub>AC</sub> Required Minimum Efficiency | 87%  | 90% | 87% |
| 230V <sub>AC</sub> Required Minimum Efficiency | 87%  | 90% | 87% |

### 3.5.2 5V STBY Efficiency Requirements at Power OFF Mode

5Vsb efficiency is greater than 50% at power off mode (PS\_ON input at high state) in requirement (2), which is comply with Eup Lot 6 year 2013 requirement. 5Vsb output efficiency requirements at remote off are as follows:

| Load Condition | 2013 Efficiency Requirement |
|----------------|-----------------------------|
| 45mA           | $\geq 45\%$                 |
| 550mA          | $\geq 55\%$                 |
| 1A             | $\geq 70\%$                 |
| 2.5A           | $\geq 70\%$                 |

## 3.5 Mechanical Specifications

The proposal power supply is cooled by a self-contained 80×80mm 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

Table 4.1.1 The voltage regulation of 10% load to 100% load

| Output | Voltage Range | Min.    | Normal  | Max.    | Ripple & Noise       |
|--------|---------------|---------|---------|---------|----------------------|
| +3.3V  | $\pm 5\%$     | 3.14V   | 3.30V   | 3.47V   | 50mV <sub>P-P</sub>  |
| +5V    | $\pm 5\%$     | 4.75V   | 5.00V   | 5.25V   | 50mV <sub>P-P</sub>  |
| +12V   | $\pm 5\%$     | 11.40V  | 12.00V  | 12.60V  | 120mV <sub>P-P</sub> |
| -12V   | $\pm 10\%$    | -10.80V | -12.00V | -13.20V | 120mV <sub>P-P</sub> |
| +5Vsb  | $\pm 5\%$     | 4.75V   | 5.00V   | 5.25V   | 50mV <sub>P-P</sub>  |

Table 4.1.3 The Min and Max current rating

| Output | Min Current | Normal Current | Max Current | Peak Current |
|--------|-------------|----------------|-------------|--------------|
| +3.3V  | 0A          | 10A            | 20A         |              |
| +5V    | 0.1A        | 7A             | 15A         |              |
| +12V   | 0.2A        | 20A            | 50A         |              |
| -12V   | 0A          | 0.2A           | 0.3A        |              |
| +5Vsb  | 0A          | 1.5A           | 2.5A        |              |

- (1) +3.3V & +5V total output not exceed 90W.
- (2) Maximum combined current for the 12V outputs shall be 50A.
- (3) Total output power for the proposal power supply is 600 watts.
- (4) The allowed peak power for 20ms is 720 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

Load conditions of cross regulation are defined as follows. The voltage regulation and ripple noise should meet the table 4.1.2.

| Item | Load | +3.3V | +5V   | +12V  | -12V | +5Vsb |
|------|------|-------|-------|-------|------|-------|
| (1)  | CR1  | 0A    | 0.1A  | 48.6A | 0.3A | 2.5A  |
| (2)  | CR2  | 4.5A  | 15A   | 41.1A | 0.3A | 2.5A  |
| (3)  | CR3  | 20A   | 4.8A  | 41.1A | 0.3A | 2.5A  |
| (4)  | CR4  | 5A    | 5A    | 45A   | 0.1A | 0.5A  |
| (5)  | CR5  | 4.5A  | 15A   | 15A   | 0.1A | 0.5A  |
| (6)  | CR6  | 20A   | 9.0A  | 10A   | 0.1A | 0.5A  |
| (7)  | CR7  | 5.0A  | 8.0A  | 8.0A  | 0.3A | 0.5A  |
| (8)  | CR8  | 0A    | 0.10A | 0.20A | 0.3A | 2.50A |
| (9)  | CR9  | 0A    | 0.10A | 0.20A | 0A   | 0A    |

## 4.3 Output Transient Response

### 4.3.1 Output Voltage Range

| Output | Voltage Range | Min.   | Normal | Max.   |
|--------|---------------|--------|--------|--------|
| +3.3V  | ±5%           | 3.14   | 3.30   | 3.47   |
| +5V    | ±5%           | 4.75   | 5.00   | 5.25   |
| +12V   | ±5%           | 11.4   | 12.00  | 12.6   |
| -12V   | ±10%          | -10.80 | -12.00 | -13.20 |
| +5Vsb  | ±5%           | 4.75   | 5.00   | 5.25   |

### 4.3.2 Dynamic Loading

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

#### *Transient Load Requirements*

| Output | ΔStep Load Size | Load Slew Rate | Add Capacitor |
|--------|-----------------|----------------|---------------|
| +3.3V  | 50% of max load | 1.0 A/μs       | 10000μF       |
| +5V    | 50% of max load | 1.0 A/μs       | 10000μF       |
| +12V   | 50% of max load | 1.0 A/μs       | 10000μF       |
| -12V   | 0.1A            | 1.0 A/μs       | 350μF         |
| +5Vsb  | 0.5A            | 1.0 A/μs       | 10000μF       |

### 4.3.2 Capacitive Loading

#### *Capacitive Loading Conditions*

| Output | Max     |
|--------|---------|
| +3.3V  | 10000μF |
| +5V    | 10000μF |
| +12V   | 10000μF |
| -12V   | 350μF   |
| +5Vsb  | 10000μF |



## 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 : 16ms Min.

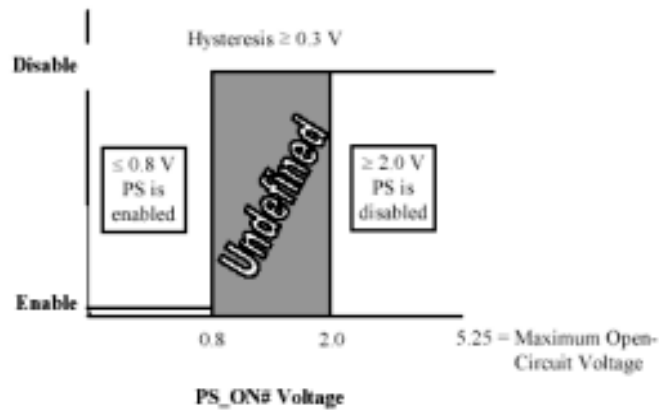
230V<sub>AC</sub> / 50Hz : 16ms Min.

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 $\mu$ A) | 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

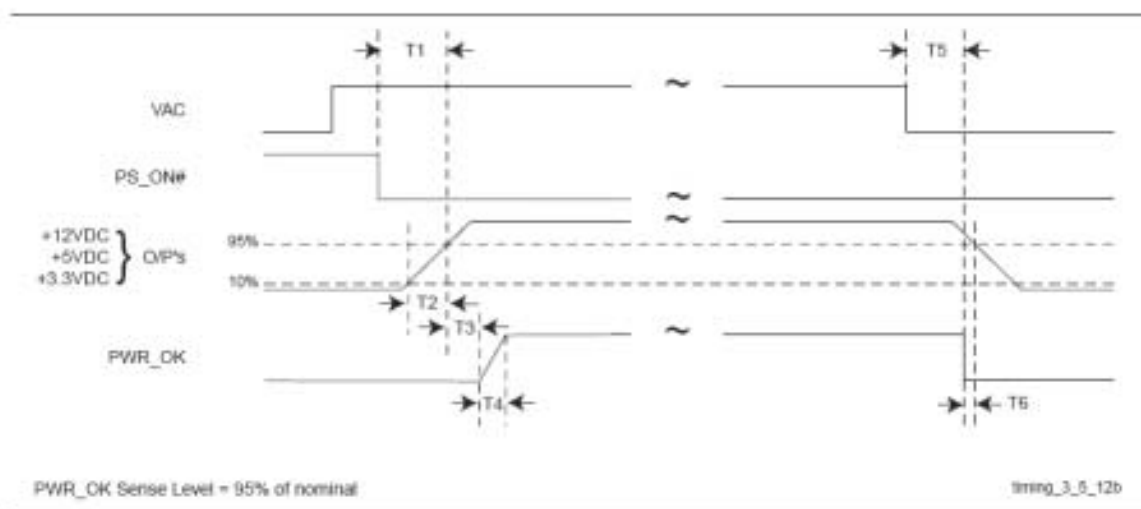
10% to 90% of final output value, @ Full Load

|                    |  |
|--------------------|--|
| 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 | +5Vsb : 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          | $\leq 4.7V$      |
| +5V            | $\leq 6.5V$      |
| +12V           | $\leq 14.5V$     |

### 5.2.2 Over Current Protection

| Output Voltage | Over Current Protection Range |
|----------------|-------------------------------|
| +3.3V          | 25A~ 35A                      |
| +5V            | 19A~29A                       |
| +12V           | 60A~80A                       |

### 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 (ambient 55 ~ 80°C). 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.

**REMARK: OTP SENSOR—NTCS701----attached on HS6**

### 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 Operation, 0.01g<sup>2</sup>/Hz at 5 Hz sloping to 0.02g<sup>2</sup>/Hz at 20 Hz, and maintaining 0.02g<sup>2</sup>/Hz from 20 Hz to 500 Hz. The area under the PSD curve is 3.13gRMS. The duration shall be 20 minutes per axis for all three axes on all samples.

### 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: 1800VAC for 3 sec.

Primary to Secondary: 3000VAC 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.