

### DESCRIPTION

The SFA350 is a series of high efficiency, small form factor and single output AC-DC power supplies.

Offering 365 W of regulated DC power from an open frame, industry standard 3" x 5" x 1.4" form factor, the SFA350 series occupies 50% less space in a system.

The extremely high power density enable designers to integrate more advanced features into a system without compromising on its size.

By converting energy at 91% typical efficiency, the SFA350 generates less heat facilitating thermal management and space constrained integrations.

The series is available in five different high power output voltages at 12, 24, 32, 36 and 48 V, and are equipped with an auxiliary low power 12V and a stand by 5 V outputs.

The SFA350 range comply with the 2<sup>nd</sup> edition of the IEC 60950-1 and CAN/CSA-C22.2 No. 60950-1-08 safety standards for medical equipment.

The series meets the EN 55022 EMC limits of Class A for conducted and radiated emissions as well as the IEC/EN 61000-3 EMC standards.



### KEY FEATURES

- Universal input voltage range
- 365 W active PFC power supply
- Very small form factor (3 x 5 x 1.40) in
- High efficiency (91% typical)
- 12, 24, 32, 36, and 48V standard output variants
- Low heat leakage current
- Over temperature protection
- Over voltage protection
- Over load, and short circuit protections
- Stand-by + 5 V Output
- Auxiliary fan + 12 V output
- Remote enable signal
- DC power good signal
- RoHS-6 compliant (EU directive 2011/65/EU)

### MARKET SEGMENT AND APPLICATIONS

- Video Wall Display
- Communication
- Laboratory Equipment
- Test and Measurement

### MODELS CODING AND OUTPUT RATINGS

Model Number	V1 [V]	I1 <sup>1</sup> Convection [A]	I1 <sup>1</sup> Forced air [A]	V1 <sup>2</sup> Ripple [mV]	V2 [V]	I2 <sup>1</sup> Rated [A]	V2 <sup>2</sup> Ripple [mV]	5V <sub>SB</sub> [V]	I5V <sub>SB</sub> <sup>1</sup> Convection [A]	I5V <sub>SB</sub> <sup>1</sup> Forced air [A]	5V <sub>SB</sub> <sup>2</sup> Ripple [mV]
SFA350-US12	12	16.6	30.4	120	12	1	240	5	1	2	50
SFA350-US24	24	8.3	15.2	240	12	1	240	5	1	2	50
SFA350-US32	32	6.2	11.4	320	12	1	240	5	1	2	50
SFA350-US36	36	5.5	10.1	360	12	1	240	5	1	2	50
SFA350-US48	48	4.16	7.6	480	12	1	240	5	1	2	50

<sup>1</sup> The combined output power of V1, V2 and 5V<sub>SB</sub> must not exceed 200 W when natural convection cooled and 365 W when forced air cooled at typically 400 LFM, up to 50 °C ambient. Above 50 °C output de-rating applies (see details on the output specifications). In any case, the heat sink maximum temperature should not exceed +110 °C at 50 °C ambient temperature.

<sup>2</sup> Peak-to-Peak measured at 20 MHz Bandwidth.

## INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
<b>AC Input Voltage</b>	PS starts and operates at 90 V <sub>AC</sub> at all load conditions	90	100/240	264	V <sub>AC</sub>
<b>Input Frequency</b>		47	50/60	440	Hz
<b>Input Current</b>	RMS at 180 V <sub>AC</sub> , maximum load RMS at 90 V <sub>AC</sub> , maximum load	-	-	2.5 5	A
<b>Inrush Current</b>	230 V <sub>AC</sub> , cold start, no damage	-	-	-	A
<b>Fusing</b>	2X Time Lag 6.3 A, 250 V on both L and N 50% max rated load	90	-	6.3	A
<b>Efficiency</b>	20/100% max rated load Nominal V <sub>IN</sub> , all versions.	88	-	-	%
<b>Stand by Consumption</b>	Nominal Input voltages, no load At full rated load,	-	-	1	W
<b>Power Factor</b>	115 V <sub>AC</sub> , 60 Hz and 230 V <sub>AC</sub> , 50 Hz input voltages	0.95	-	-	-
<b>Harmonic Current Fluctuations and Flicker</b>	Complies with EN-61000-3-2 Class C at 230 V <sub>AC</sub> 50 Hz, load > 50 W. Complies with EN-61000-3-3 at nominal voltages and full load.				
<b>Leakage Current</b>	120 V <sub>AC</sub> , 60 Hz, normal condition 230 V <sub>AC</sub> , 60 Hz, normal condition	-	-	110 275	µA

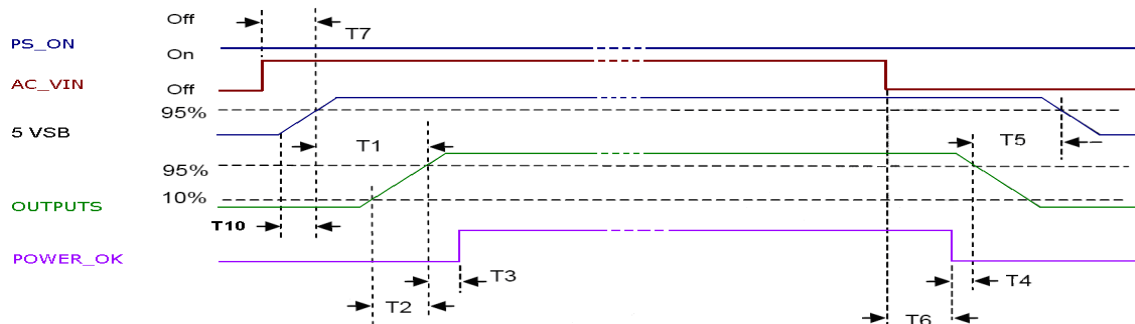
## OUTPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
<b>V1 Set Point Accuracy</b>			± 1	-	%
<b>V1 Output Power Rating</b>	All models, convection cooling All models forced air cooling (> 400 LFM)	-	-	200 365	W
<b>V2 Output Voltage</b>	All models (15% accuracy)	10.2	12	13.8	V
<b>V2 Output Current</b>	All models, natural convection cooling All models, > 400 LFM forced air cooling	-	-	0.5 1	A
<b>5V<sub>SB</sub> Output Voltage</b>	All models (5% set point accuracy)	4.75	5	5.25	V
<b>5V<sub>SB</sub> Output Current</b>	All models, natural convection cooling All models, > 400 LFM forced air cooling	-	-	1 2	A
<b>V1 Voltage Adjustment Range</b>		± 5	-	-	% V1
<b>V1 Load-Line-Cross Regulation</b>	V <sub>AC</sub> : 90 – 264 V <sub>RMS</sub> V1 Load: 0 – 100% rated V2 Load: 0 – 1 A 5V <sub>SB</sub> Load: 0 – 2 A	-	-	± 3	% V1
<b>5V<sub>SB</sub> Load-Line-Cross regulation</b>	V <sub>AC</sub> : 90 – 264 V <sub>RMS</sub> V1 Load: 0 – 100% rated V2 Load: 0 – 1 A 5V <sub>SB</sub> Load: 0 – 2 A	-	-	± 5	% 5V <sub>SB</sub>
<b>V1 Line Regulation</b>	V <sub>AC</sub> : 90 – 264 V <sub>RMS</sub>	-	-	± 0.1	% V1
<b>Transient Response (Voltage Deviation) V1, 5V<sub>SB</sub></b>	25% load changes at 1 A/µs 12V at 2200 µF Load / I <sub>OUT</sub> > 0.5 A 24 V at 1000 µF Load / I <sub>OUT</sub> > 0.5 A 32 V at 820 µF Load / I <sub>OUT</sub> > 0.5 A 36 V at 820 µF Load / I <sub>OUT</sub> > 0.5 A 48V at 560 µF Load / I <sub>OUT</sub> > 0.5 A 5V <sub>SB</sub> at 560 µF Load / I <sub>OUT</sub> > 0.1 A	-	-	± 5	% V1 % 5V <sub>SB</sub>
<b>V1 Ripple &amp; Noise</b>	All models, Peak-to-peak, 20 MHz BW. 470 pF ceramic and 22 µF tantalum caps at the load (resistive).	-	-	1	% V1
<b>Start-up Rise Time</b>	90 < V <sub>IN</sub> < 264, any load conditions.	5	-	85	ms
<b>Start-up Delay</b>	V1 in regulation after PS_ON is asserted V1 in regulation after AC is applied 5V <sub>SB</sub> in regulation after AC is applied	-	-	350 900 700	ms
<b>Turn-on Overshoot</b>	At 500 mA output current, V1 in regulation within 50 ms.	-	10 10 10	-	% V1 % V2 % V <sub>SB</sub>
<b>Hold-up Time</b>	At nominal V <sub>IN</sub> , 365 W, for all outputs	16	20	-	ms
<b>Minimum Load</b>	All models; V1, V2 and 5V <sub>SB</sub>	0	-	-	A
<b>Temperature Drift</b>		-	± 1.2	-	mV/°C

## SIGNALS/CONTROLS

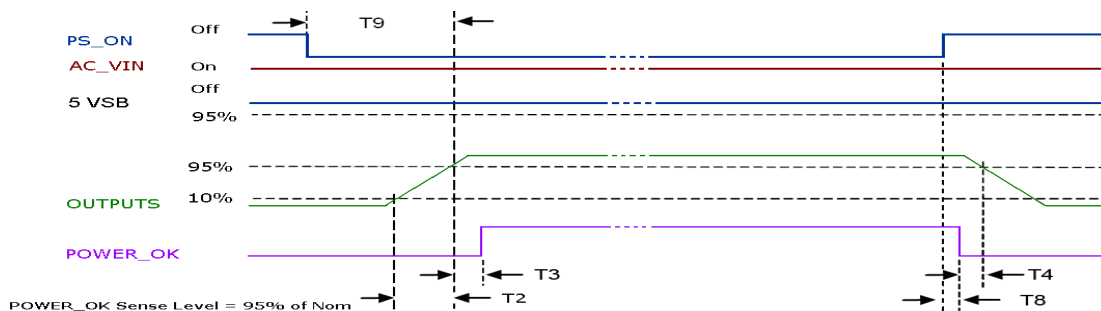
Signal	Notes	Min	Typ	Max	Unit
<b>PS_ON</b>	Active low, +5 V TTL signal compatible. Input low voltage	0	-	2.	V
	Input high voltage ( $I_{IN}=200\mu A$ )	2.5	-	-	V
	V1 and V2 disabled when PS_ON is open				
	5V <sub>SB</sub> not affected by PS_ON				
<b>P_OK</b>	V1 and V2 enabled with PS_ON connected to RTN				
	+5 V TTL compatible				
	Logic level low (<10 mA sinking)	-	-	0.4	V
	Logic level high (100 $\mu A$ sourcing)	2.4	-	5	V
	Low to high time after V1 in regulation	0.1	-	0.5	s
<b>5V<sub>SB</sub> output</b>	Power down warning time	1	-	-	ms
	Active and in regulation after a $90 < V_{AC} < 264$ is applied	-	-	700	ms
	5V <sub>SB</sub> not affected by PS_ON				

## SIGNAL TIMINGS



Above waveforms are expected with AC Input ON/ OFF:

Standby on - Main outputs on	$1\text{ ms} \leq T1 \leq 200\text{ ms}$
Main output Rise Time	$0.2\text{ ms} \leq T2 \leq 20\text{ ms}$
5 VSB Rise Time	$4\text{ ms} \leq T10 \leq 20\text{ ms}$
Main outputs On – P_OK delay	$100\text{ ms} \leq T3 \leq 500\text{ ms}$
Power down warning <sup>1</sup>	$T4 \geq 1\text{ ms}$ (converter off)
Main Output off – Standby off <sup>2</sup>	$T5 \geq 1\text{ ms}$
Hold-up time (AC off – P_OK low)	$T6 \geq 20\text{ ms}$ (115/ 230 V <sub>AC</sub> )
AC_ON - Standby turn on time	$T7 \leq 700\text{ ms}$



Above waveforms are expected with PS\_ON Signal ON/ OFF state change:

Main Output Rise Time	$0.2\text{ ms} \leq T2 \leq 20\text{ ms}$
Main Outputs on – P_OK delay	$100\text{ ms} \leq T3 \leq 500\text{ ms}$
Power down warning <sup>1</sup>	$T4 \leq 1\text{ ms}$ (converter off)
PS_ON - Main Output (off) Timing	$T8 \leq 60\text{ ms}$
PS_ON - Main Output (on) Timing	$T9 \leq 350\text{ ms}$

<sup>1</sup> T4 parameter measurement setup will assume at least 10% of the maximum load on each output.

<sup>2</sup> T5 parameter measurement setup will assume at least 50% of the maximum load on main output.

## PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
<b>Input Under Voltage Lockout</b>	Auto Recovery, Hiccup Mode	60	75	-	V <sub>AC</sub>
<b>Input Fuse</b>	2X Time Lag 6.3 A, 250 V on L and N	-	-	6.3	A
<b>Over Current</b>	At nominal input voltages, any load, max. 1 minute. Hiccup mode with auto recovery	-	-	150	% I <sub>1 MAX</sub>
<b>Short Circuit Over Voltage</b>	Hiccup mode, auto-recovering.				
	12V				
	24V				
	32V	110	-	125	% V <sub>NOM</sub>
	36V				
	48V				
	5V <sub>SB</sub>	110	-	130	
	Unit shut down and latch off				
<b>Over Temperature</b>	Hiccup mode with auto recovery				
<b>Isolation Primary to Secondary</b>	Reinforced	4000	-	-	V <sub>AC</sub>
<b>Isolation Input to Earth</b>	Basic	1500	-	-	V <sub>AC</sub>
<b>Isolation V1/ V2</b>		100	-	-	V <sub>DC</sub>
<b>Isolation Output to Earth</b>		500	-	-	V <sub>DC</sub>

## ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
<b>Operating Temperature Range</b>	No de-rating up to 50 °C	-20	-	50	°C
<b>De-rated Operating Temperature Range</b>	Linearly de-rate from full load at 50 °C to half load at 70 °C	-	-	70	°C
<b>Storage Temperature Range</b>		-40	-	80	°C
<b>Humidity</b>	RH, Non-condensing Operating	-	-	90	%
	Non-operating	-	-	95	%
<b>Operating Altitude</b>		-	-	3000	m
<b>Shock</b>	<u>Operating</u> 10 g, 11 ms, half sine, one shock input in each axes, for a total of six shock inputs. <u>Non-Operating</u> 140 g, 2 ms, half sine, one shock input in each direction of each axes, for a total of six shock inputs.				
<b>Vibration</b>	<u>Operating</u> Sinusoidal: 0.5 g peak-to-peak, 10-300 Hz, 0.25 octaves/minute, one cycle, 10-300 to 10 Hz per axis in each of three mutually perpendicular axes for a total of three cycles. <u>Non-Operating</u> Sinusoidal: 1.5 g peak-to-peak, 10-500 Hz, 0.5 octaves/minute, one cycle, 10-500 to 10 Hz per axis in each of three mutually perpendicular axes for a total of three cycles.				
<b>MTBF</b>	75% Full Load, Nominal V <sub>AC</sub> , 35 °C MIL-HDBK-217-E-1	250000	-	-	Hours
<b>Cooling</b>	Natural Convection (200 W)	10	-	-	LFM
	Forced air cooling (365 W)	400	-	-	

## ELECTROMAGNETIC COMPATIBILITY (EMC) - EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/ Performance Class
<b>Conducted</b>	115 V <sub>RMS</sub> , 230 V <sub>RMS</sub> . Maximum load. 4 dB minimum margin	EN 55022 (ITE)	A
<b>Radiated</b>	At 10 m distance	EN 55022 (ITE)	A
<b>Line Voltage Fluctuation and Flicker</b>	At 20%, 50% and 100% maximum load. Nominal input voltages.	EN 61000-3-3	
<b>Harmonic Current Emission</b>	Nominal input voltages. All load conditions.	EN 61000-3-2	A

## ELECTROMAGNETIC COMPATIBILITY (EMC) - IMMUNITY

Phenomenon	Conditions / Notes	Standard	Test Level	Performance criteria
<b>ESD</b>	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
<b>Radiated Field</b>	3 V/m, 80-1000 MHz, 1 KHz/2 Hz 80% AM. Dwell time is 3 sec for 2 Hz modulation Dwell time is 1 sec for 1KHz modulation	EN 61000-4-3	3	A
<b>Electric Fast Transient Surge</b>	±2 kV on AC power port for 1 minute; ±1 kV on signal/control lines	EN 61000-4-4	3	A
	±2 kV line to line; ±4 kV line to earth; on AC power port; ±0.5 kV for outdoor cables	EN 61000-4-5	3	B
<b>Conducted RF Immunity</b>	3 V <sub>RMS</sub> , 0,15-80 MHz, 1 KHz/2 Hz 80% AM	EN 61000-4-6	3	A
<b>Dips and Interruptions</b>	Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 5% for 10 ms Interrupts > 95% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11		B B B C

## SAFETY AGENCIES APPROVAL

Certification Body	Safety Standards and file numbers	Category
<b>CSA/ UL</b>	CSA C22.2 No. 60950-1, UL 60950-1; 2007, 2 <sup>nd</sup> edition	Information Technology Eq.
<b>IEC IECCE CB Certification</b>	IEC/EN 60950-1 2 <sup>nd</sup> edition	Information Technology Eq.
<b>CE</b>	Low Voltage Directive (LDV) 2006/95/EC	Information Technology Eq.

