Desktop PC power supply PCSF-350P-X2S

Model	Description	Stock	Standard price (before Tax)
PCSF-350P-X2S	—	Standard stock	¥18, 500

■ Model name coding

PCSF – 350 P – X 2 S
① ② ③ ④ ⑤ ⑥

① Series name
② Output power
③ Peak power available
④ ATX output
⑤ +3.3V output equipped
⑥ Standard

Compact but High power

Features

- SFX power supply corresponding to APPENDIX C mounting surface
- microATX case corresponding SFX power supply with 350W
- +12V dual outputs to serve for CPU operation stability
- Stable operation even 0 (zero) A load as min. load for all outputs
- Output harness selection is at your discretion with connector system

Column 7

What is APPENDIX?

APPENDIX is a power supply dimension specification provided in SFX Power Supply Design Guide.
In SFX12V version 3.1, up to APPENDIX E have been provided.
APPENDIX A :100.0(W)×50.0(H)×125.0(D)
APPENDIX B :100.0(W)×63.5(H)×125.0(D)+FAN 80.0(W)×17.1(H)×80.0(D)
APPENDIX C :125.0(W)×63.5(H)×100.0(D)+FAN 80.0(W)×17.1(H)×80.0(D)
APPENDIX D :100.0(W)×63.5(H)×125.0(D)
APPENDIX E :150.0(W)×86.0(H)×101.4(D) (PS3 size)

Refer to B-B1 "Product page guideline" for icons.

Safety standard	UL	CSA	EN	CE	CCC
Reliability grade	HFA	FA	HOA	OA	

● Function

DC start | RS 232C | USB | TTL | PFC | Silence | 5VSB FAN | TSFC FAN | Connection | Fit for Pen4 | RoHS Directive

● Input

AC input	85V～264V (Worldwide range)

● Output

Output voltage	+3.3V	+5V	+12V1	+12V2	-12V	+5VSB
Max. current/ Max .power (continuous)	14A	16A	10A	16A	0.5A	2A
	Total 90W		total 220W			
	Total 250W					
Peak current/Peak power (within 0.5 sec for +12V2, 5 sec max. for others)	20A	21A	16A	22A	0.8A	3A
	Total 120W		total 270W			
	Total 350W					
Min. load	0A	0A	0A	0A	0A	0A

● Dimension

W×H×D(mm)	125×63.5×125 (SFX APPENDIX C mounting surface size)

● Optional output connectors

20 Pin | 24 Pin | AT | 12V | AUX | Processor | ×2 | ×1 | S-ATA ×4 | PCI-E ×1

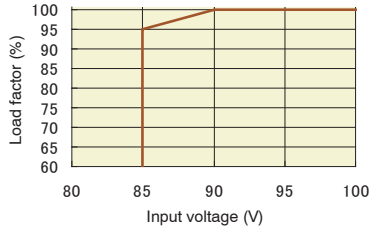
For more details, refer to B-E100 "Removable output harness."

General Specification (Items are provided at normal temperature and humidity unless otherwise specified.)

	Page	Items		Specification						Measurements, etc.
AC input	D-6(1)	Rated voltage		AC100-240V (AC85*-264V) Data on B-E103 Fig.12-13						Worldwide range * See <Fig.1> Low input voltage derating below. Or, load factor shall be 100% (within 10 sec) with 0.05 of duty ratio
	D-6(2)	Frequency		50/60Hz						47-63Hz
	D-6(3)	Efficiency		73% typical at AC 100V, 77% typical at AC 240V Data on B-E102 Fig.4						at Rated Input/Output
	D-6(4)	Power factor		96% typical at AC 100V, 90% typical at AC 240V Data on B-E102 Fig.5						
	D-6(5)	Inrush current		31A peak at AC 100V, 75A peak at AC 240V Data on B-E102 Fig.6						at Rated Input/Output and Cold start at 25℃
	D-6(6)	Input VA		3.4A max. at AC 100V, 1.4A max. at AC 240V Data on B-E102 Fig.5						at Rated Input/Output with Max. load
Output	—	Rated voltage		+3.3V	+5V	+12V1	+12V2	-12V	+5VSB	
	—	Rated current		8A	8A	6A	8A	0.5A	2A	
	D-6(8)	Max. Current/Power		14A	16A	10A	16A	0.5A	2A	Max. output power: 250W
				90W max.		220W max.				
				250W max.						
	D-6(9)	Peak Current/Power		20A	21A	16A	22A	0.8A	3A	Peak output power: 350W However, Peak power period shall be 5 sec. Max. and Duty cycle of repeating rated load shall be 10% max. See <Fig. 2> Duty ratio below.
				120W max.		270W max.				
				350W max.						
	D-6(10)	Min. load		0A	0A	0A	0A	0A	0A	Min. load to perform voltage regulation
	D-6 (11)-⑧	Total Voltage Accuracy (%)		±5 max.	±5 max.	±5 max.	±5 max.	±5 max.	±5 max.	Total accuracy of Temperature, Input, Load fluctuations, and deviation of setup voltage
	D-7(12)	Max. Ripple Voltage (mVp-p)		50 以下	50 max.	80 max.	80 max.	80 max.	50 max.	Connect two wires of 50cm max. in length to the output connector. Put a 47uF electrolytic capacitor and a 0.1uF ceramic capacitor together to measure with an oscilloscope with 20MHz frequency band. Data on B-E105 Fig.31)
	D-7(12)	Max. Spike Voltage (mVp-p)		100 max.	100 max.	200 max.	200 max.	200 max.	100 max.	
Protection	D-7(13)	Overcurrent Protection	OCP point (A)	21 min.	22 min.	17 min.	17 min.	Short circuit protection		All other outputs except +12V1 and +12V2 are no load.
			Method	All outputs other than +5VSB shutdown				All outputs shutdown		All other output are rated load.
			Recovery	Reclosing of AC input				Automatic recovery or Reclosing of AC input		Input reclosing interval shall be 60 sec. min.
	D-7(14)	Overvoltage Protection	OVP point (V)	3.76～4.3	5.74～7.0	13.4～15.6		—	6.4～7.5	Input reclosing interval shall be 60 sec. min.
			Method	All outputs other than +5VSB shutdown				—	Zener	
			Recovery	Reclosing of AC input				—	Clamp	
Environment	D-7(16)	Operating Temp. and Humidity		0-60℃*/10-90%						* Refer to <Fig. 3> Temp. derating below. No condensation
	D-7(17)	Storage Temp. and Humidity		-20-70℃/10-95%						
	D-7(18)	Vibration		To endure for one hour in each of X, Y, and Z direction under the following conditions: 19.6m/s² of acceleration, 10 to 55Hz of vibration frequency, and 3 minutes of sweep cycle.						JIS-C-60068-2-6 at no operation
	D-7(19)	Mechanical strength (surface dropping)		Lift one bottom edge of the unit up to 50mm high with the opposite edge placed on the table, and let it fall. Repeat 3 times for each of four bottom edges, and no malfunction shall be observed.						JIS-C-60068-2-31 at no operation
Insulation	D-7(20)	Dielectric Strength		AC 1500V for 1 minute between AC input and DC-output/FG						Cut-off current: 20mA
	D-7(21)	Insulation Resistance		50MΩ min. between AC input and DC-output/FG						At DC500V
	D-7(22)	Leakage Current		0.5mA max at AC 100V/1mA max at AC 240V						YEW. TYPE3226 (1kΩ) or equivalent
EMC	D-7(23)	Line Noise Immunity		±2000V (Pulse width: 100/1000ns, Cycle period: 10-50ms, Normal/Common mode, Positive/Negative polarity for 10 minutes each)						To be measured by INS-410 There shall be no DC-component fluctuation and no malfunction.
	D-7(24)	Electrostatic Discharge		EN61000-4-2 compliant						
	D-7(25)	Radiated, radio-frequency, electromagnetic field immunity		EN61000-4-3 compliant						
	D-7(26)	Fast Transient Burst		EN61000-4-4 compliant						
	D-7(27)	Lightning Surge		EN61000-4-5 compliant						
	D-7(28)	Conductive Radio-Frequency Electromagnetic Field		EN61000-4-6 compliant						
	D-7(29)	Power Frequency Magnetic Field Immunity		EN61000-4-8 compliant						
	D-8(30)	Voltage Dips and Fluctuation		EN61000-4-11 compliant Data on B-E104 Fig.24-25						
	D-8(31)	Conducted Emission		VCCI-A compliant						
	D-8(32)	Harmonic Current Regulation		IEC61000-3-2 Class D, N61000-3-2 Class D compliant Data on B-E102 Fig.8-9						at Rated Input/Output
Others	D-8[1-6]	Safety Standard		UL60950-1, CSA C22.2 No.60950-1(c-UL),and CE Marking(Low voltage directive)						
	D-8(34)	Cooling System		Forced air cooling						
	D-8(35)	Output GND Grounding		Connected to chassis (FG)*						* Customization to Capacitor grounding is available.
	D-8(38)	Output Hold-up Time		Hold-up time is 16ms min. before PWR_OK is delivered after AC turns off. Data on B-E104 Fig.22						at Rated Output
	F-3	Reliability Grade		FA (Industrial appliances grade to use double-sided PWBs with through-holes)						To follow our standard
	D-8(41)	MTBF		70,000 H min						To follow EIAJ RCR-9102
	—	Weight		1.2 kg typical						
	F-3	Warranty		Three years after delivery. However, if any faults belong to us, the defective unit shall be repaired or replaced at our cost.						Except when wrong operation is conducted out of product specification, etc.

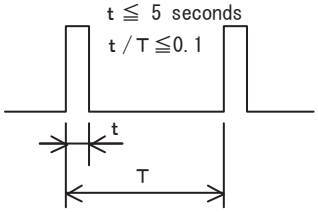
<Fig.1> Low input voltage derating

Follow the derating below to derate Rated current/ power, Max. current/power, and Peak current/Power when AC input voltage is 90V or lower.



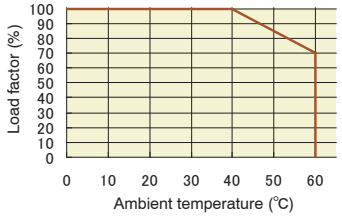
<Fig.2> Duty ratio

The Peak current and power shall be within 5 seconds, and its duty ratio shall be 10% max. in repeated use.

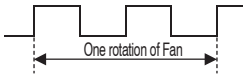


<Fig.3> Temperature derating

Follow the chart below to derate rated current/power, max. current/power and peak current/power when the ambient temperature in the vicinity of air intake opening exceeds 40℃.

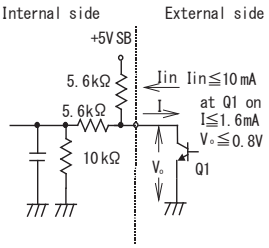


Signal Input/Output Specification (Items are provided at normal temperature and humidity unless otherwise specified.)

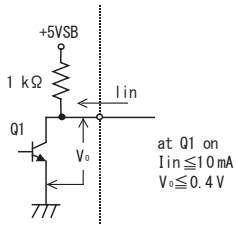
	Items	Specification	Note
Input signal	Output ON/OFF control signal (PS_ON#)	Upon receipt of 'H' or 'OPEN', +3.3V、+5V、+12V1、+12V2、and -12V shut down.	P1MAIN connector pin 16
	+3.3V SENSE	The terminal to detect +3.3V voltage. By connecting to the load end, the voltage drop of +side output cable only is compensated.	P1MAIN connector pin 1
Output signal	Normal output signal (PWR_OK)	'H' signal is delivered 100 to 500ms after +5V output reaches 95% or higher.	P1MAIN connector pin 8
	Fan monitoring signal FAN_M1、FAN_M2	2 cycle pulses per one rotation of the fan motor are delivered (Open collector output). Duty ratio of the pulse shall be 0.5 typical. (The slower the motor speed is, the longer the signal output interval is, and vice verse). The signal keeps 'L' or 'OPEN' when the fan stops due to malfunction.	P4SIG connector pin 1 and 2 

Signal Circuit

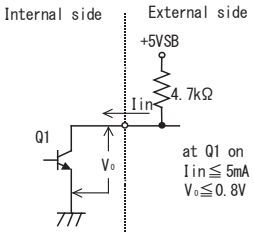
Input signal circuit (PS_ON#)



Output signal circuit (PWR_OK)



FAN_M1、FAN_M2 (Recommended)



Interior View

RoHS fully compliant

Amount of hazardous materials in PWBs, wires, electronic components, coils, chassis, and labels specified by International standard is lower than acceptable level.

Electronic components by major Japanese manufacturers

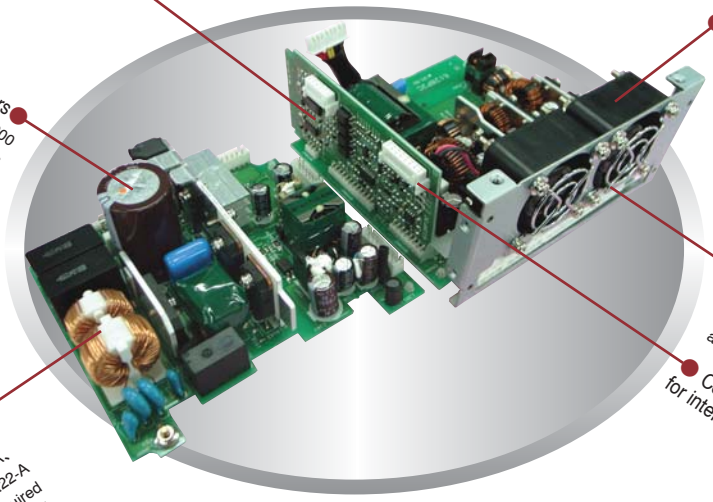
Electrolytic capacitors Japanese-made 105°C 2000 hours min. for all capacitors

Feedback noise measures FCC-A、VCCI-A、EN55022-A、CISPR22-A Leakage current required in Japan, 0.5mA max. at AC 100V, has been achieved.

Cooling Fan Two fans of ball bearing system with long life equipped. (Actual lifetime: 93000 hours at 45°C, Japanese-made) Rotation monitoring alarm in each fan

Removable Output harness system Fully applicable to the standard older than ATX12V Ver.1.3, to Ver.2.01 and also to EPS12V

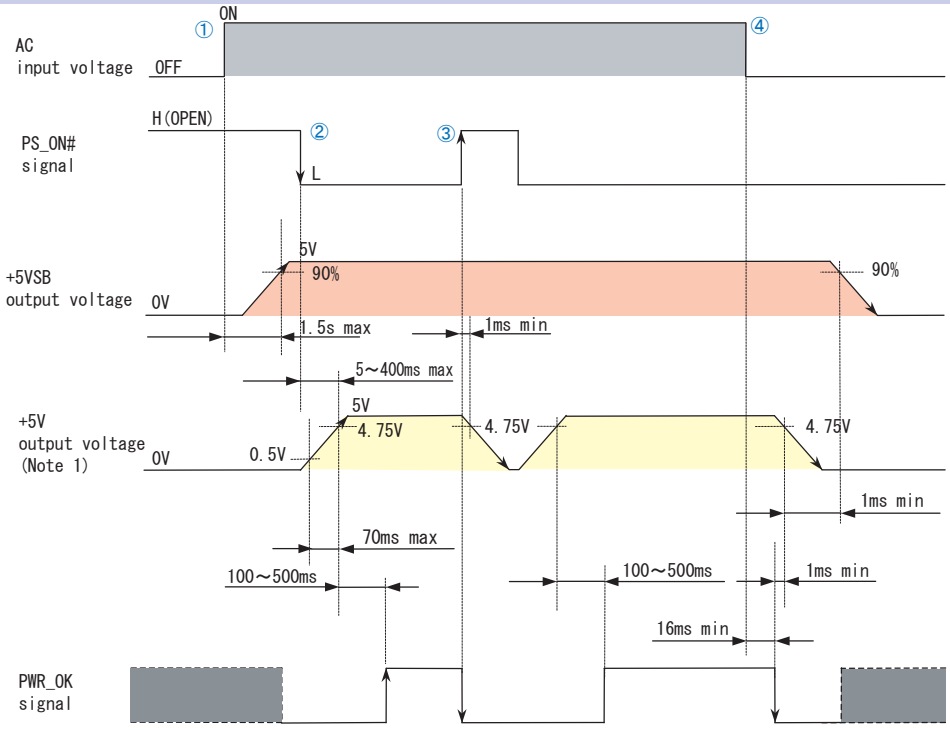
Connection system adopted for inter-unit connections



Simple layout design

Superior cooling and little inter-component interference layout design.

Sequence Timing Chart

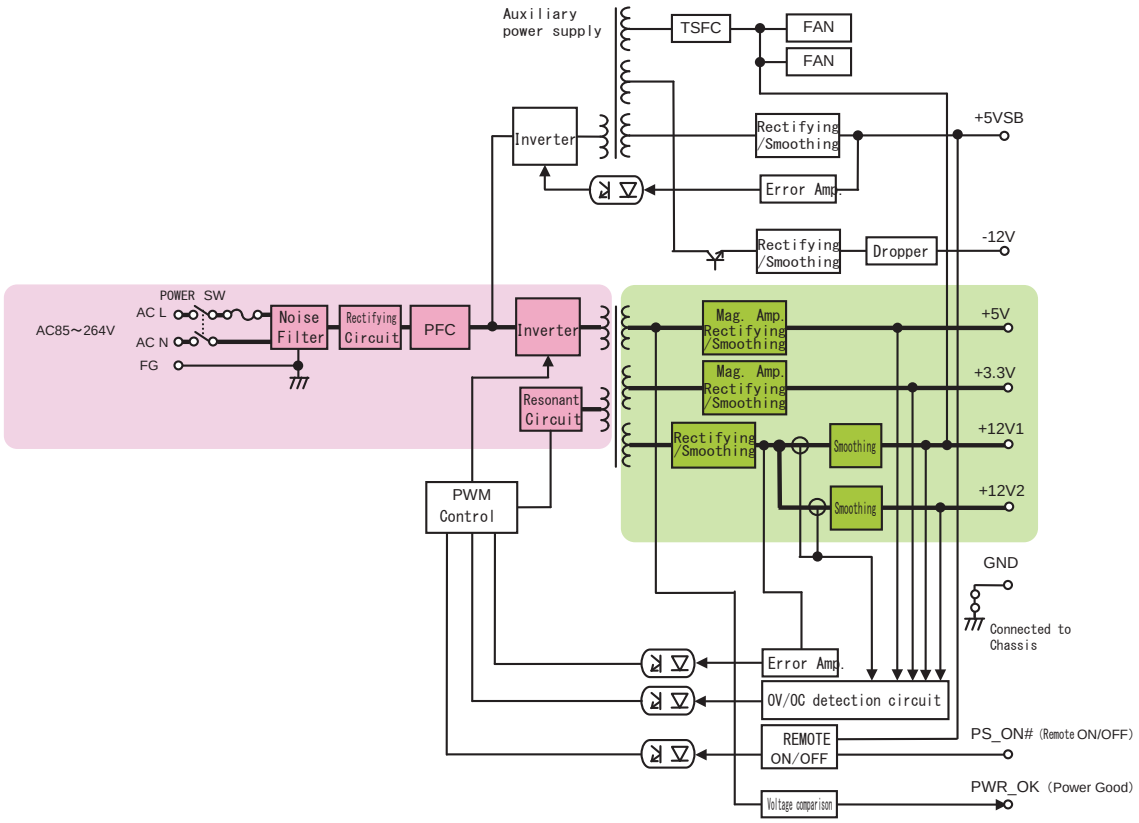


Note 1: All other outputs shall follow this timing except voltage values.
In addition, rising time difference among outputs shall be 50ms max.

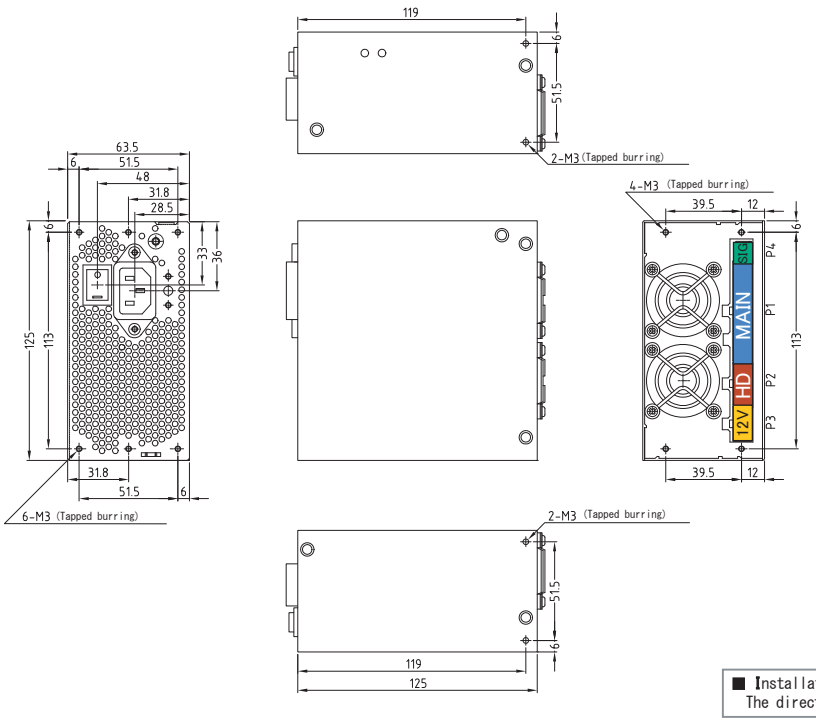
Undefined

① Only +5VSB starts up with PS_ON#'H' (OPEN) when AC input is turned on.
② +5VSB output starts up with PS_ON#'L'. Also, PWR_OK'H' is delivered 100 to 500ms after +5VSB has started up.
③ +5V output shuts down upon receipt of PS_ON#"H" signal.
④ PWR_OK goes to 'L' 16ms or later after blackout. +5V and +5VSB outputs shut down 1ms or later after that.

Block Diagram



Outline Drawing



P1 MAIN Output

ピン Pin	信号 Signal	定格 Rating
1	+3.3 V DC	6 A
2	+3.3 V DC	6 A
3	COM	6 A
4	+5 V DC	6 A
5	COM	6 A
6	+5 V DC	6 A
7	COM	6 A
8	PWR_OK	10 mA
9	+5 VSB	3 A
10	+12 V1 DC	6 A
11	+12 V1 DC	6 A
12	+3.3 V DC	6 A
13	+3.3 V Sense	6 A
14	-12 V DC	6 A
15	COM	6 A
16	PS_ON#	10 mA
17	COM	6 A
18	COM	6 A
19	COM	6 A
20	(NC)	
21	+5 V DC	6 A
22	+5 V DC	6 A
23	+5 V DC	6 A
24	COM	6 A

P2 Peripheral,Floppy Drive, Serial ATA Power Connector Output

ピン Pin	信号 Signal	定格 Rating
1	+3.3 V DC	6 A
2	+5 V DC	6 A
3	COM	6 A
4	COM	6 A
5	+12 V1 DC	6 A
6	+3.3 V DC	6 A
7	+5 V DC	6 A
8	COM	6 A
9	COM	6 A
10	+12 V1 DC	6 A

P3 12V Output

ピン Pin	信号 Signal	定格 Rating
1	COM	6 A
2	COM	6 A
3	COM	6 A
4	COM	6 A
5	+12 V2 DC	6 A
6	+12 V2 DC	6 A
7	+12 V2 DC	6 A
8	+12 V2 DC	6 A

P4 SIG Output

ピン Pin	信号 Signal	定格 Rating
1	FAN-M1	-
2	FAN-M2	-
3	(NC)	-

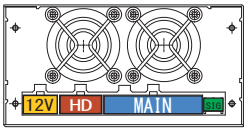
■ Installation direction
The direction is unlimited.

Output Harness

This product has adopted connector output system in bid to meet a variety of output connectors.
Output harnesses are optional.

Optional Components (Sold separately)

Page	Model	Description	Acceptable cable(s)	Connection Port	Power supply port allocation
Removable output harness					
Main power cable MAIN					
B-G32	WH-M2024-500	500±15 → 20Pin	1 pc. (1 type)	MAIN	
B-G30	WH-M2424-500	500±15 → 24Pin			
12V power cable 12V					
B-G36	WH-V0808-500	500±15 → 12V 8Pin	1 pc. (1 type)	12V	
B-G35	WH-V0408-500	500±15 → 12V 4Pin			
B-G35	WH-VG208-500	500±15 → 12V 4Pin; 500±15 → PCI-E 6Pin			
HD power cable HD					
B-G37	WH-PP610-850	550±15; 150±15; 150±15 → peripheral (HD)	1 pc. (1 type)	HD	
B-G37	WH-PS610-850	550±15; 150±15; 150±15 → FD			
B-G38	WH-PS710-850	550±15; 150±15; 150±15 → S-ATA; 850±15			
SIG cable SIG					
B-G41	WH-S0603-500	500±15 → SIG-2	1 pc. (1 type)	SIG	
B-G42	WH-S0303-500	500±15 → SIG-3			
Harness set					
B-G44	WHS2828	【Set description】・WH-M2024-500:1 pcs ・WH-M2424-500:1 pcs ・WH-V0808-500:1 pcs ・WH-VG208-500:1 pcs ・WH-PP610-850:1 pcs ・WH-PS610-850:2 pcs			



Optional Components (Sold separately)

Cable				
Page	Photo	Model	Category	Description
B-G46		WH2753	AC power cable	AC125V 12A 【PSE】

Other options					
Page	Model	Description	Page	Model	Description
B-G52	ACC2637	Automatic Startup Unit	B-G50	WH5105	12V 4-pin connector conversion harness (80mm)
B-G49	WH2820	20-pin extension harness (600mm)	B-G50	WH5105-02	12V 4-pin connector conversion harness (320mm)
B-G49	WH2747	20-pin extension harness (450mm)	B-G47	WH5055	AT connector conversion harness
B-G49	WH2892-02	20-pin extension harness (200mm)	B-G47	ACC5046	PS_ON switch equipped harness
B-G51	WH2812	PCI-E 6-pin connector conversion harness	B-G48	ACC5077	PS_ON terminal shorting connector
			B-G48	WH5073	PS_ON terminal shorting 20-pin harness

Column 17

Mag. Amp. voltage regulator

Generally, for power supplies called PC power supply whose loads are CPU board, memory card, Optical driver, Graphic board, and so on, various types of output voltage regulator are required. To obtain multiple regulated outputs by single converter, voltage control circuit in the secondary side is required. Mag. Amp. circuit is one of them in switched mode power supply, and it controls output voltage utilizing magnetic pulse modulation by oversaturated core located in the secondary side of main transformer.

Saturable reactor shows high impedance (switch-off status) in unsaturated region, but moves to low impedance (switch-on status) when biased by DC current so that output voltage is regulated by ON-OFF control.

Operating principle of saturable reactor D

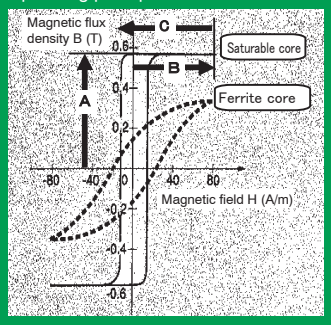


Diagram on the left shows hysteresis loop, or B-H curve, of core characteristics.

Unlike general ferrite core, saturable reactor has B-H curve that is upright as shown in the diagram.
Region A is OFF period, and region B is ON period in actual operation. in actual operation.

Switching timing is controlled, as shown at region C, by changing the amount of exciting energy to the direction against saturation.

Mag. Amp. method circuit diagram

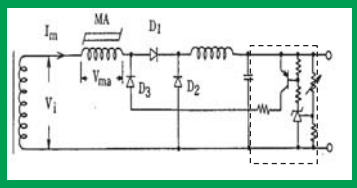


Diagram on the left is an example of actual circuit. The control circuit is shown in dotted line, and just a Mag. Amp. (saturable reactor) is inserted at smoothing circuit of the secondary side of converter.

Thus, Mag. Amp. requires much less components known as one of its features.

Advantages of Mag. Amp. power supply

Mag. Amp. method gives definite advantage in comparison with semi-conductor method, especially , and firstly in robustness, as it controls output voltage utilizing coils.
Secondarily, as described above, the circuit structure is very simple.
Thirdly, it has reverse recovery current depression effect of secondary diode (D2) to materialize low noise.
As one of other features that coil has, compact, high efficiency and low noise is realized widely in simple circuit design for multiple output power supplies such as PC power supply as the reactor can be smaller by higher frequency and core materials.

Characteristics Data (Examples of actual measurement)

Fig.4 Efficiency/Input Current Vs. Output Power

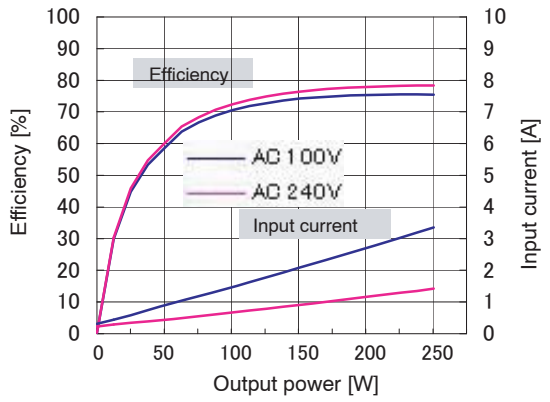


Fig.5 Power Factor/Input VA Vs. Output Power

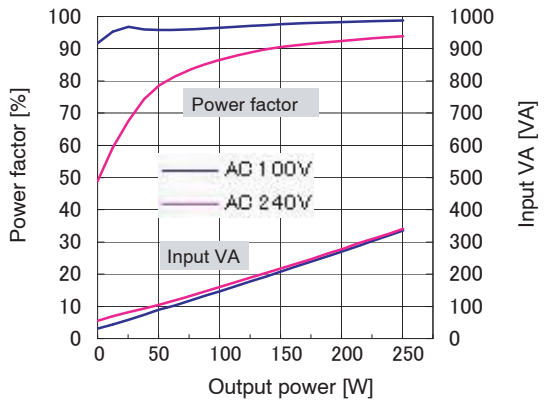


Fig.6 Inrush Current

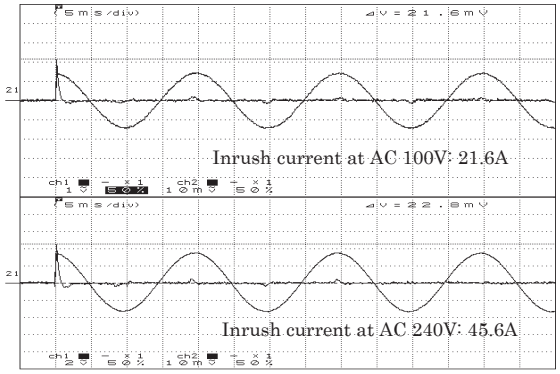


Fig.7 Leakage Current

Input : AC100, 240V
Load : Rated load and Min. load

	Rated load	Min. load
AC 100V	0.33mA	0.30mA
AC 240V	0.80mA	0.80mA

Fig.8 Harmonic Current At AC 100V

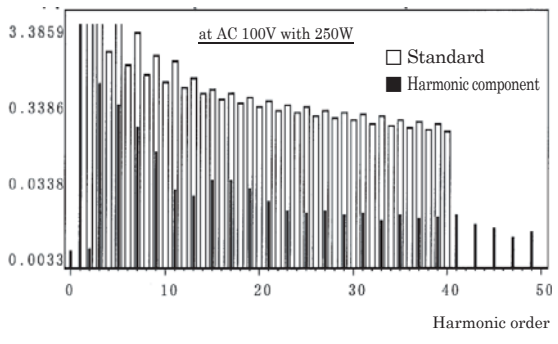


Fig.9 Harmonic Current At AC 240V

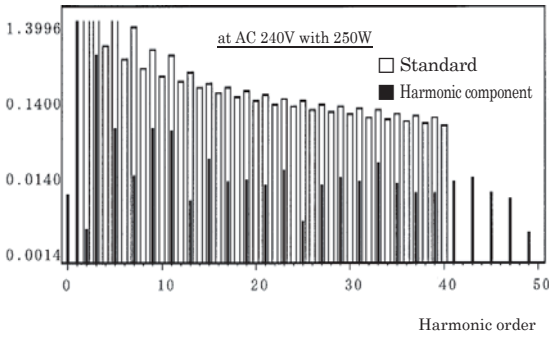


Fig.10 Conducted Emission At 100V

Input : AC100V
Load : Rated
Mode : Peak

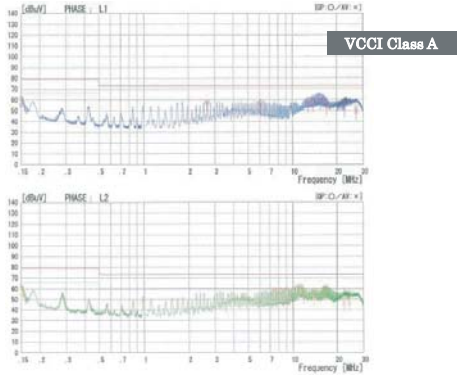
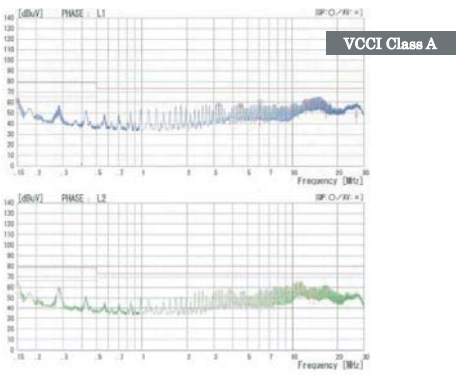


Fig.11 Conducted Emission At 240V

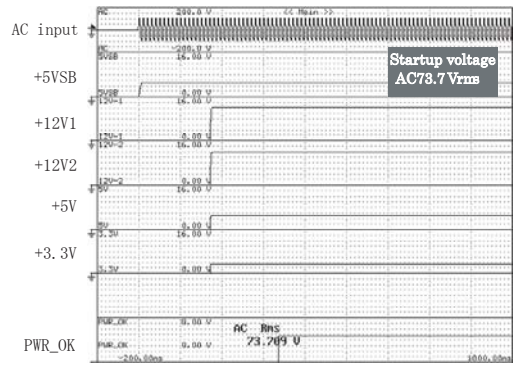
Input : AC240V
Load : Rated
Mode : Peak



Characteristics Data (Examples of actual measurement)

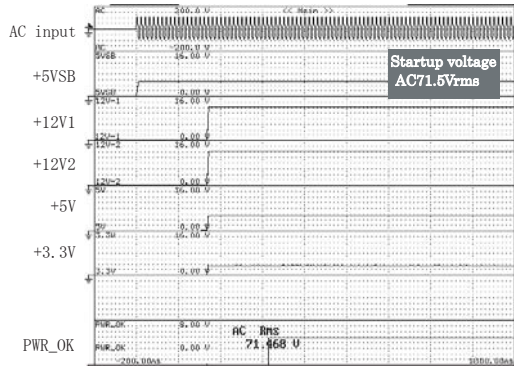
● Fig.12 AC Startup Voltage (Rated load)

Load : Rated
Time axis : 200ms/DIV



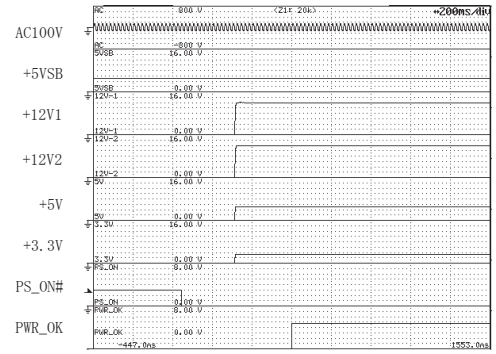
● Fig.13 AC Startup Voltage (Min. load)

Load : Min. load
Time axis : 200ms/DIV



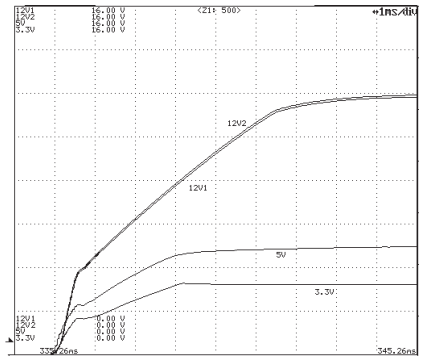
● Fig.14 Rising Sequence At AC 100V

Input : AC100V
Load : Rated
Time axis: 200ms/DIV



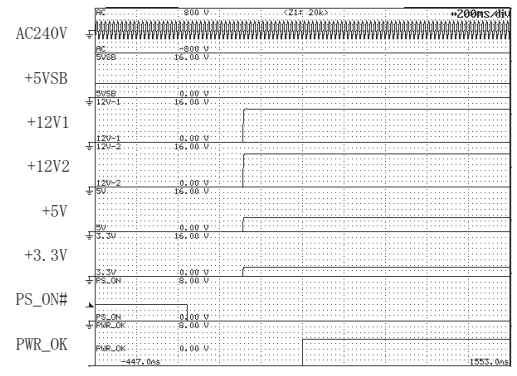
● Fig.15 Rising Characteristics At AC 100V

Input : AC100V
Load : Rated
Time axis: 1ms/DIV



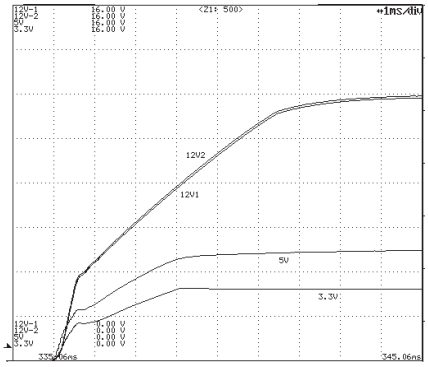
● Fig.16 Rising Sequence At AC 240V

Input : AC240V
Load : Rated
Time axis :200ms/DIV



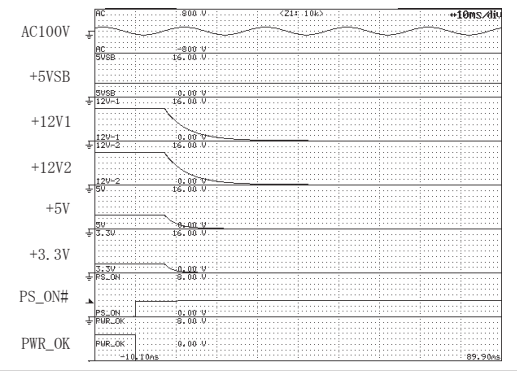
● Fig.17 Rising Characteristics At AC 240V

Input : AC240V
Load : Rated
Time axis: 1ms/DIV



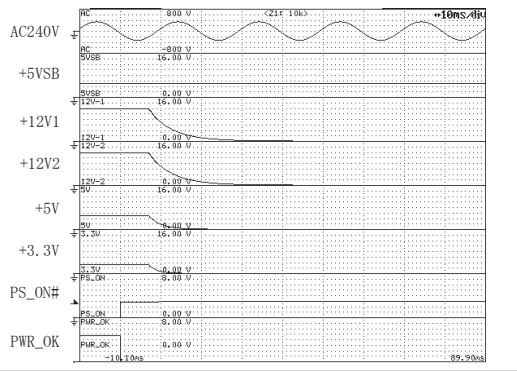
● Fig.18 Falling Characteristics At AC 100V When REMOTE Is Off

Input : AC100V
Load : Rated
Time axis : 10ms/DIV



● Fig.19 Falling Characteristics At AC 240V When REMOTE Is Off

Input : AC240V
Load : Rated
Time axis : 10ms /DIV



Characteristics Data (Examples of actual measurement)

Fig.20 Falling Characteristics At AC 100V When AC Goes Off

Input : AC100V
Load : Rated
Time axis : 10ms/DIV

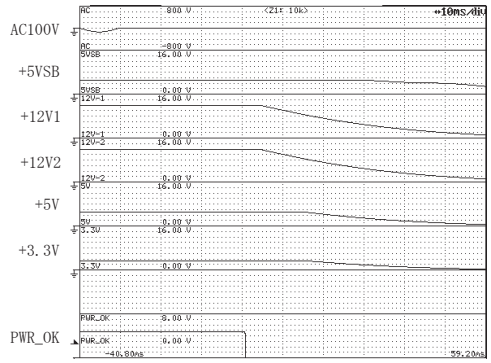


Fig.21 Falling Characteristics At AC 240V When AC Goes Off

Input : AC240V
Load : Rated
Time axis : 10ms/DIV

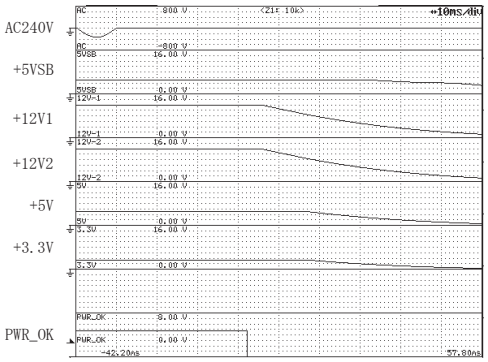


Fig.22 Output Hold-up Time Vs. Output Power

PWR_OK : the point that PWR_OK signal goes to "L".
Output voltage: the point that any output except 5VSB falls down to 95%.

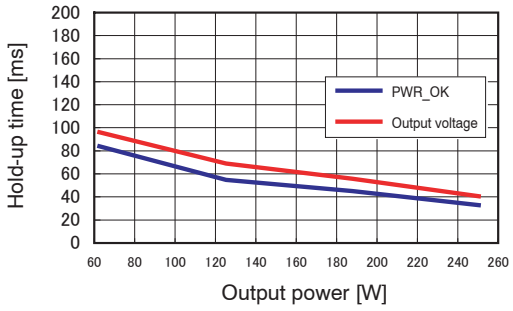


Fig.23 Instantaneous Blackout

Input : AC100V
Load : Rated
Instantaneous blackout period: 31ms
Time axis :20ms/DIV

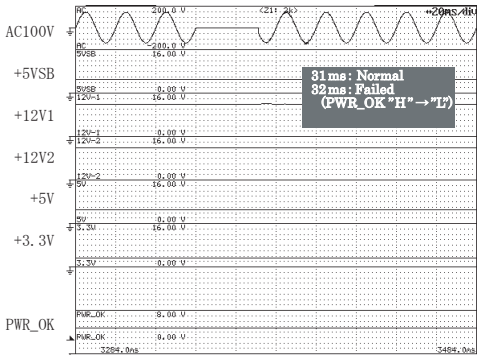


Fig.24 Voltage Dips By 60%

Input : AC100V⇌AC40V
Load : Rated
Dipping period : 48ms
1 cycle : 20ms
Time axis : 20ms/DIV

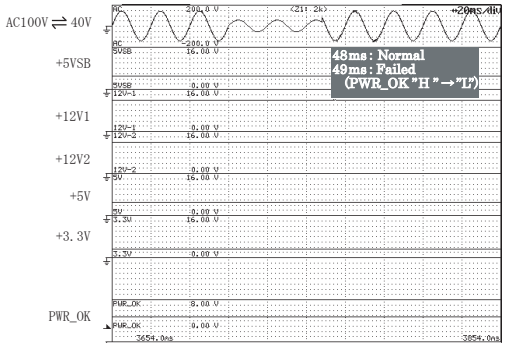


Fig.25 Voltage Dips By 30%

Input : AC100V⇌AC70V
Load : Rated
Dipping time : 1000ms
1 cycle : 20ms
Time axis : 500ms/DIV

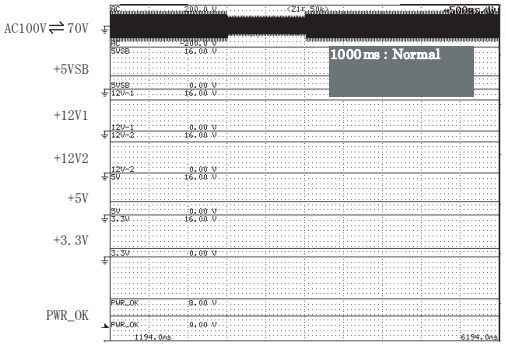


Fig.26 AC Input Voltage Slow Fluctuation Vs. Output Shutdown

Slow fluctuation period : 10V/1s (1s /DIV)

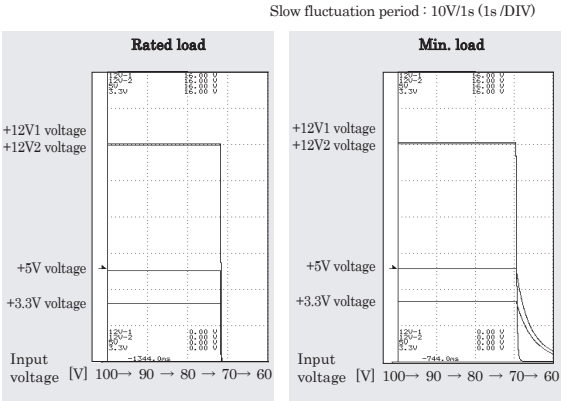


Fig.27 Dynamic Load Fluctuation Characteristics At 10kHz

Input : AC100V
Load : Rated
Time axis : 20 μ s /DIV

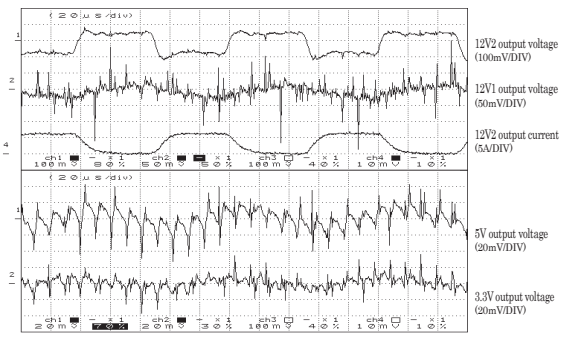


Fig.28 Dynamic Load Fluctuation Characteristics At 1kHz

Input : AC100V
Load : Rated
Time axis : 200 μ s /DIV

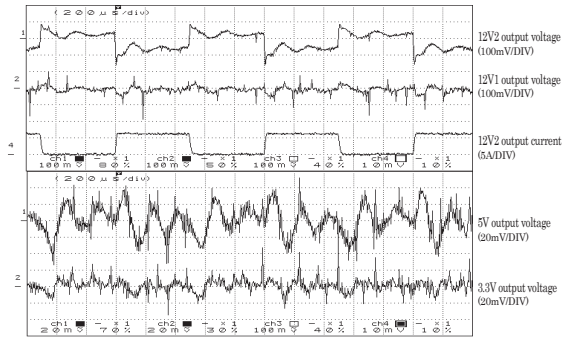


Fig.29 Dynamic Load Fluctuation Characteristics At 100Hz

Input : AC100V
Load : Rated
Time axis : 2ms/DIV

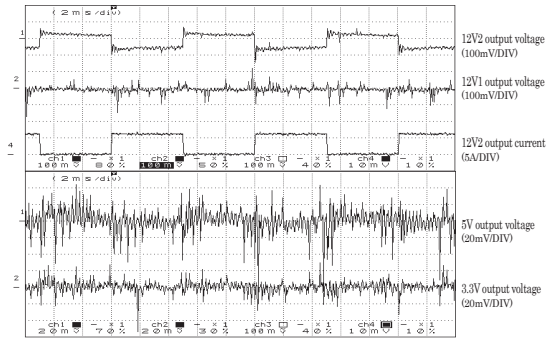


Fig.30 Output Voltage Regulation

SPEC.	Min. load	Rated load	Peak load
12V1 load	0A	10A	16A
12V2 load	0A	16A	22A
5V load	0A	16A	21A
3.3V load	0A	14	20A

AC input	AC 85V	AC 100V	AC 132V	AC 176V	AC 240V	AC 264V
12V load (min.)	12.121 V	12.121 V	12.119 V	12.119 V	12.118 V	12.117 V
12V load (Rated)	12.052 V	12.049 V	12.049 V	12.048 V	12.048 V	12.048 V
12V load (Peak)	11.869 V	11.866 V	11.866 V	11.865 V	11.864 V	11.863 V
12V2 load (min.)	12.113 V	12.113 V	12.111 V	12.109 V	12.110 V	12.109 V
12V2 load (Rated)	11.954 V	11.952 V	11.952 V	11.951 V	11.951 V	11.949 V
12V2 load (Peak)	11.910 V	11.910 V	11.910 V	11.910 V	11.910 V	11.910 V
5V load (min.)	5.165 V	5.165 V	5.164 V	5.164 V	5.163 V	5.163 V
5V load (Rated)	5.065 V	5.064 V	5.063 V	5.062 V	5.062 V	5.062 V
5V load (Peak)	4.960 V	4.956 V	4.953 V	4.952 V	4.951 V	4.950 V
3.3V load (min.)	3.344 V	3.344 V	3.344 V	3.344 V	3.344 V	3.344 V
3.3V load (Rated)	3.277 V	3.276 V	3.276 V	3.276 V	3.276 V	3.276 V
3.3V load (Peak)	3.228 V	3.227 V	3.227 V	3.227 V	3.227 V	3.227 V

Fig.31 Ripple and Spike Voltage

Input : AC100V
Load : Rated
Time axis : 2 μ s/DIV

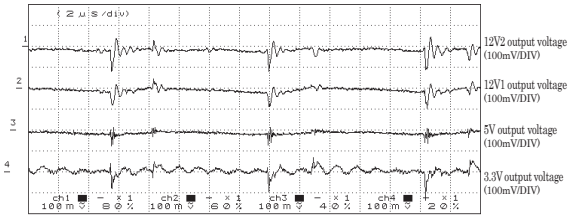
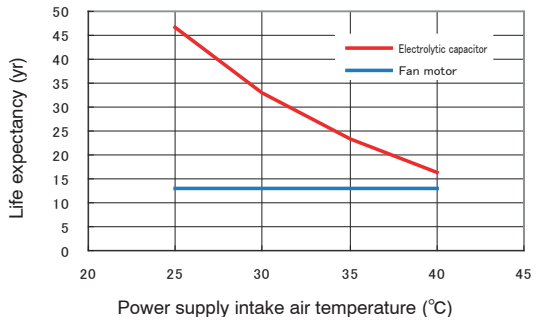


Fig.32 Intake Air Temperature vs. Lifetime expectancy

Input : AC100V
Load : Rated



※ Life expectancy of electrolytic capacitors shall be 15 years max. due to deterioration of sealing valves.

Fig.33 Intake Air Temperature Vs. Fan Speed