MINMAX®

ABF-04 Series

Electric Characteristic Note

ABF-04 Series EC Note

AC-DC Power Module 4W

Features

- **Fully Encapsulated Plastic Case for PCB Mounting**
- **Universal Input 85-264VAC, 47-440Hz**
- **I/O Isolation 3000VAC with Reinforced Insulation**
- **Operating Ambient Temp. Range -25℃ to +60℃**
- **No Min. Load Requirement**
- **Overload/Voltage and Short Circuit Protection**
- **EMI Emission EN55032 Class B Approved**
- **EMC Immunity EN 61000-4-2,3,4,5,6,8,11 Approved**
- **Eco Design, Compliant to Energy Star Specification and ErP Directive 2009/125/EC**
- **UL/cUL/IEC/EN (62368-1)60950-1 Safety Approval & CE Marking**

Applications

- Distributed power architectures
- Workstations
- Computer equipment
- Communications equipment

Product Overview

The MINMAX ABF-04 series is a range of fully encapsulated AC-DC power supply modules. They are designed for direct PCB mounting with solder pins. The product features EMI emission EN 55032 Class B approved and EMS compliance to the EN 61000-4 standard. This series comply with international standard pinout and input voltage range of 85-264VAC for worldwide markets. The ABF-04 series provides a better superior solution for many space critical applications in commercial and industrial electronic equipment.

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Model Selection Guide

Model Number	Output Voltage	Output Current	Input Current	Max. capacitive Load	Efficiency (typ.)
		Max.	@Max. Load		@Max. Load
	VDC	mA	mA(typ.)	µF	%
ABF-04S03	**3.3**	**1200**	82	1200	70
ABF-04S05	**5**	**800**	82	800	72
ABF-04S09	**9**	**444**	77	440	75
ABF-04S12	**12**	**333**	76	330	76
ABF-04S15	**15**	**267**	76	260	76
ABF-04S24	**24**	**167**	76	160	77
ABF-04D53	**+5**	**600**	72	5600	72
	+3.3	**150**		4700	
ABF-04D125	**+12**	**250**	72	330	75
	+5	**120**		4700	
ABF-04D12	**±12**	**±166**	76	# 330	77
ABF-04D15	**±15**	**±133**	76	# 260	77

For each output

Input Specifications

Parameter	Conditions / Model		Min.	Typ.	Max.	Unit
Input Voltage Range	All Models		85	---	264	VAC
Input Frequency Range			47	---	440	Hz
Input Voltage Range			120	---	370	VDC
No-Load Power Consumption			---	---	0.3	W
Inrush Current	115VAC	Cold Start at 25℃	---	---	15	A
	230VAC		---	---	25	A

Output Specifications

Parameter	Conditions / Model		Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy	Single and Dual Output Models		---	±1.0	±2.0	%Vnom.
	ABF-04D53 & ABF-04D125		---	±2.0	±5.0	%Vnom.
Line Regulation	Single and Dual Output Models		---	±0.5	±1.0	%
	ABF-04D53 & ABF-04D125	Vo1	---	±0.5	±1.0	%
		Vo2	---	±1.0	±3.0	%
Load Regulation	3.3VDC Output Model		---	±1.0	±1.5	%
	5~24VDC and Dual Output Models		---	±0.5	±1.0	%
	ABF-04D53 & ABF-04D125	Vo1	---	±0.5	±1.0	%
		Vo2	---	±2.5	±5.0	%
Ripple & Noise	0-20 MHz Bandwidth	3.3V & 5VDC Output Models	---	100	150	mV_{P-P}
		Other Output Models	---	0.8	1.0	$\%V_{PP}$ of Vo
Minimum Load	Single Output and Dual +/- Output Models		No min. Load required	---	---	%Inom.
	Dual +/+ Output Models		---	25	---	%Inom.
Over Voltage Protection	Zener diode clamp		---	120	---	% of Vo
Temperature Coefficient			---	±0.01	±0.02	%/℃
Overshoot			---	---	5	%Vout
Over Load Protection	Hiccup mode, auto-recovery (long term overload condition may cause damage)		105	---	---	%Inom.
Short Circuit Protection	Hiccup mode, Automatic Recovery					

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	Input to Output, 60 Seconds	3000	---	---	VAC
I/O Isolation Resistance	500 VDC	100	---	---	MΩ
Switching Frequency		---	130	---	kHz
Hold-up Time		---	20	---	ms
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	330,000			Hours
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate) , IEC/EN 60950-1(CB-report)				
	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	Without external components	Class B
	Radiation			
EMS	EN 55035			
	ESD	EN 61000-4-2 Air ± 8kV, Contact ± 4kV		B
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		B
	Surge	EN 61000-4-5 ±1kV		B
	Conducted immunity	EN 61000-4-6 10Vrms		B
	PFMF	EN 61000-4-8 30A/m		A
	Dips	EN 61000-4-11 30% 10ms		B
	Interruptions	EN 61000-4-11 >95% 5000ms		C

Environmental Specifications

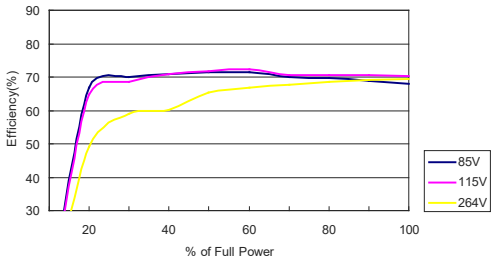
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating Ambient Temperature Range		-25	---	+60	℃
Power Derating	+50℃ to +60℃		0.3		W / ℃
Storage Temperature Range		-40	---	+85	℃
Thermal Shutdown	Shutdown, Internal IC Junction Temperature	---	142	---	℃
	Automatic Recovery, Internal IC Junction Temperature	---	67	---	℃
Humidity (non condensing)		---	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)		---	---	260	℃

Notes

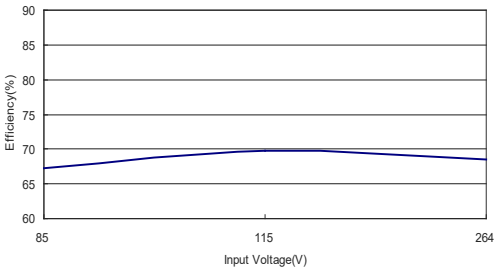
1. All specifications typical at Ta=+25℃, resistive load, 115VAC, 60Hz input voltage and after warm-up time rated output current unless otherwise noted.
2. These power modules require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage the power supplies however they may not meet all listed specifications.
3. We recommend to protect the converter by a slow blow fuse in the input supply line.
4. Other input and output voltage may be available, please contact MINMAX.
5. Specifications are subject to change without notice.

Characteristic Curves

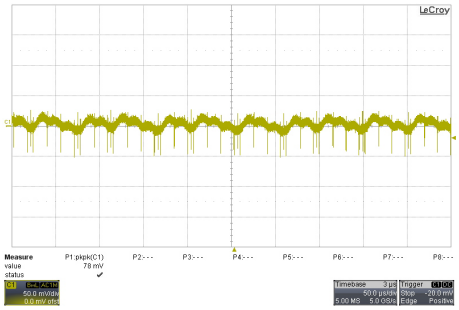
All test conditions are at 25℃ The figures are identical for ABF-04S03



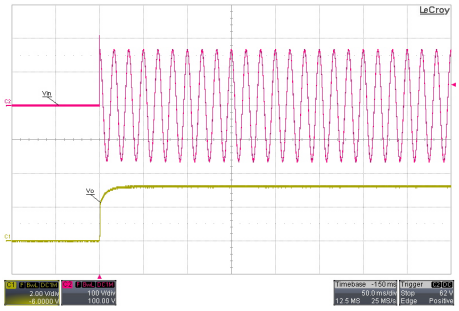
Efficiency Versus Output Current



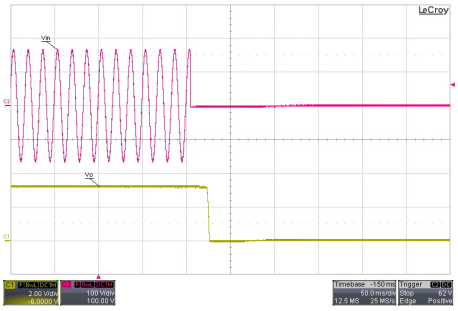
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



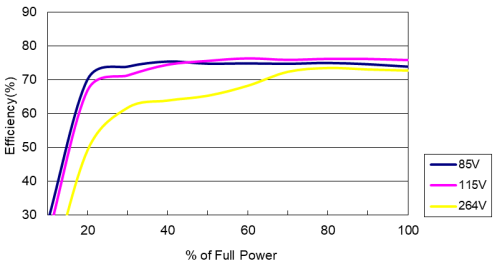
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



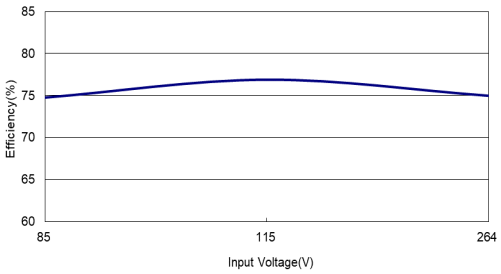
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

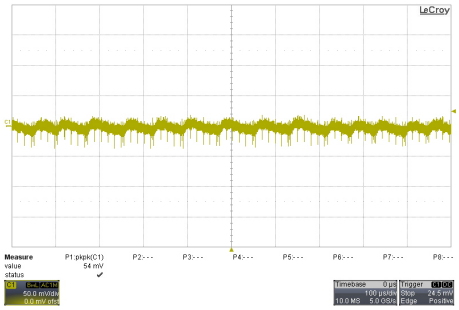
All test conditions are at 25°C The figures are identical for ABF-04S05



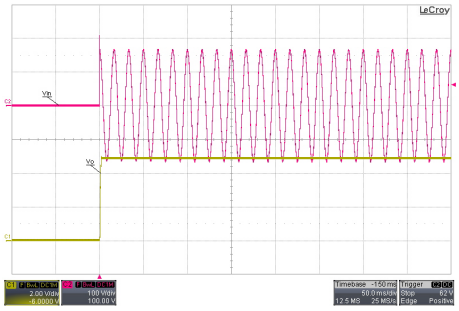
Efficiency Versus Output Current



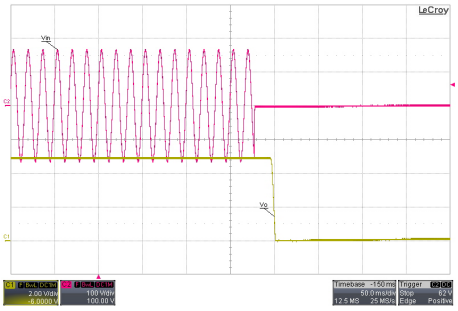
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



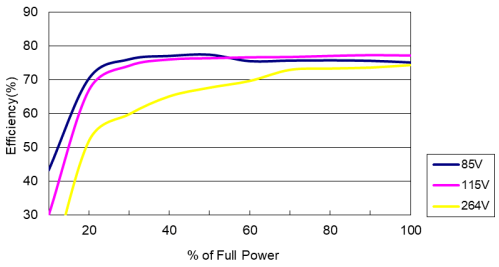
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



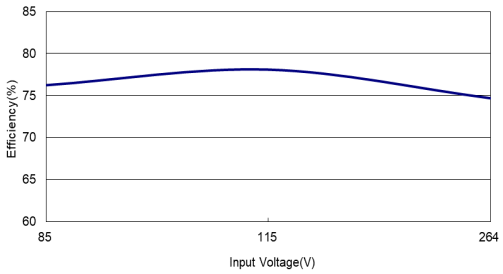
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

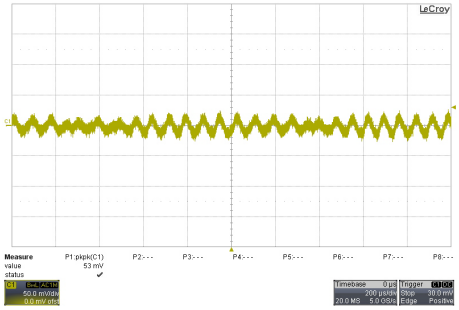
All test conditions are at 25°C The figures are identical for ABF-04S09



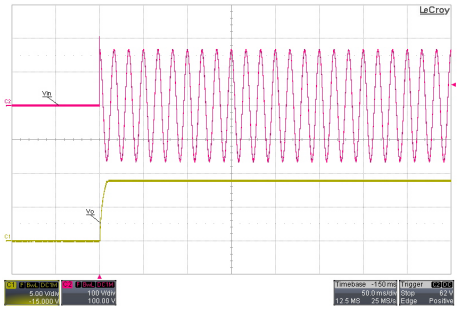
Efficiency Versus Output Current



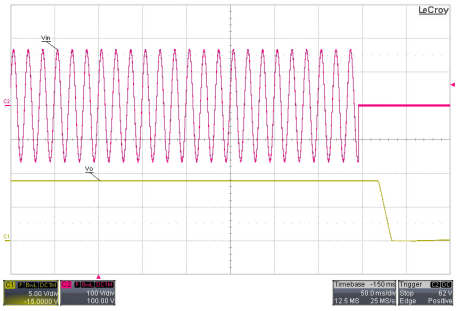
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



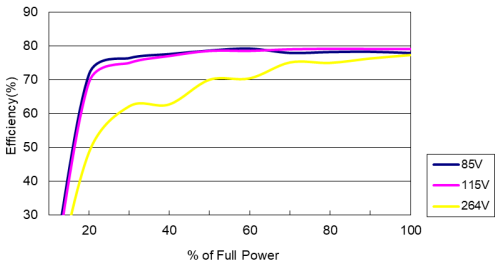
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



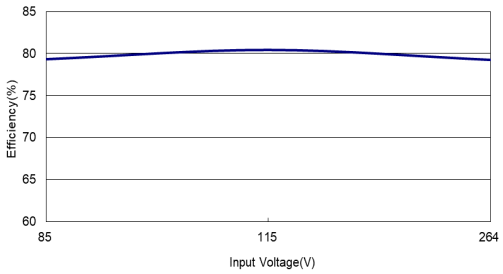
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

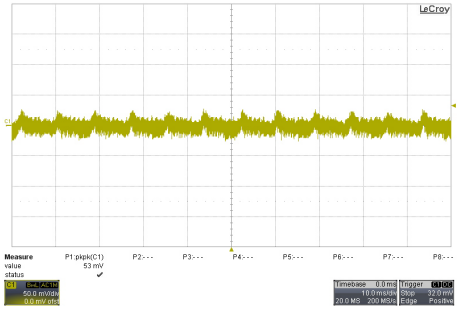
All test conditions are at 25°C The figures are identical for ABF-04S12



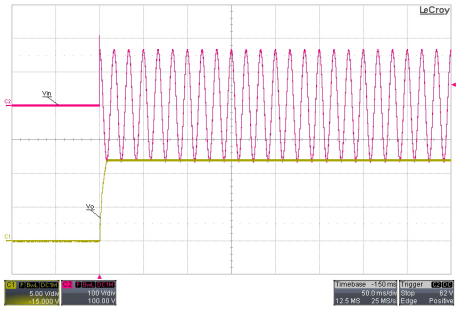
Efficiency Versus Output Current



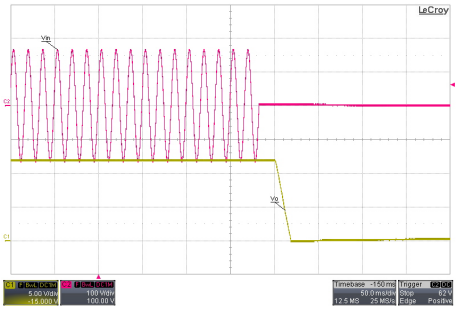
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



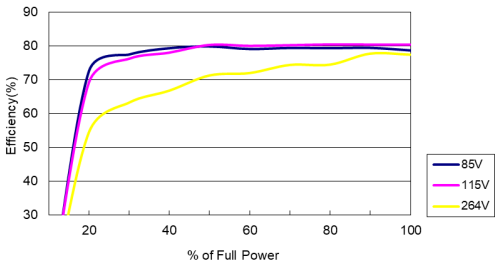
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



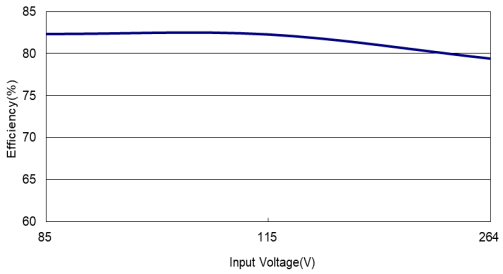
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

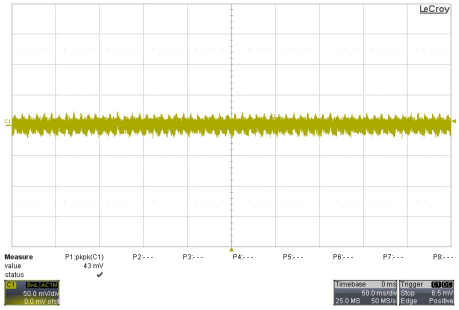
All test conditions are at 25℃ The figures are identical for ABF-04S15



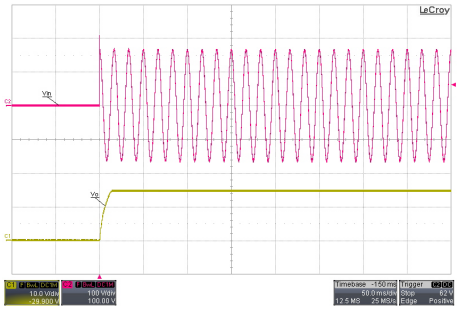
Efficiency Versus Output Current



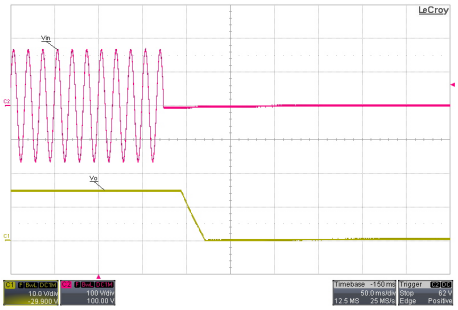
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



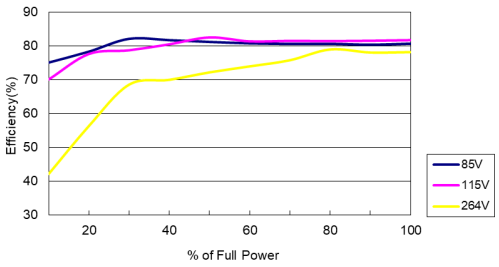
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



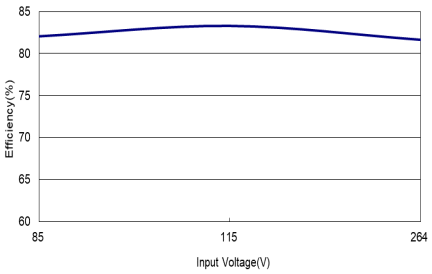
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

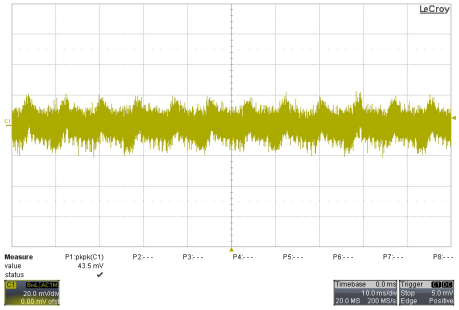
All test conditions are at 25°C The figures are identical for ABF-04S24



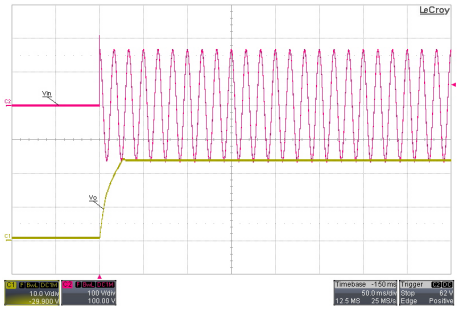
Efficiency Versus Output Current



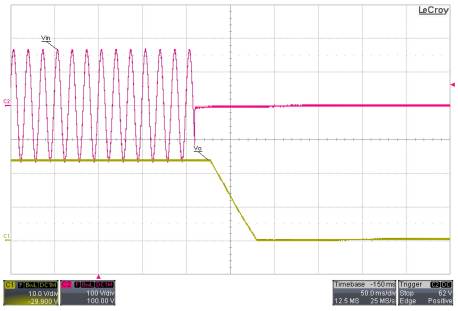
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



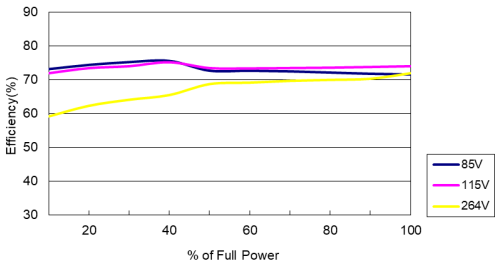
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



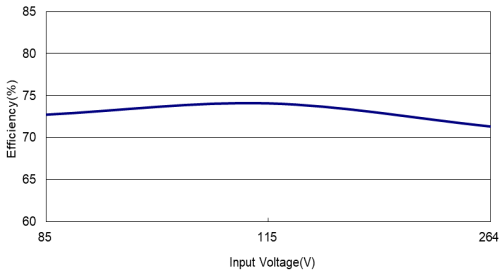
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

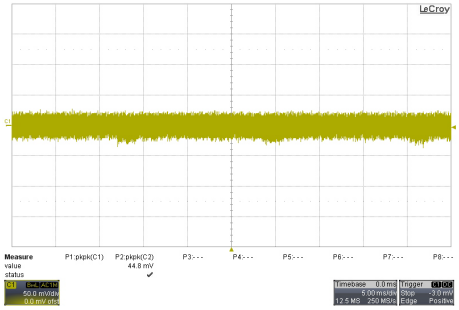
All test conditions are at 25℃ The figures are identical for ABF-04D53



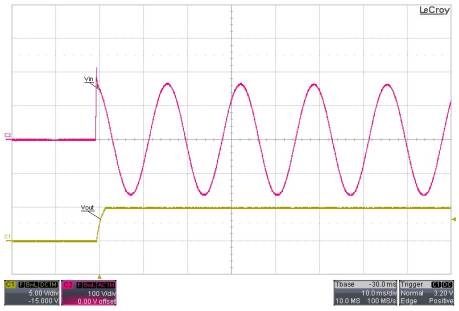
Efficiency Versus Output Current



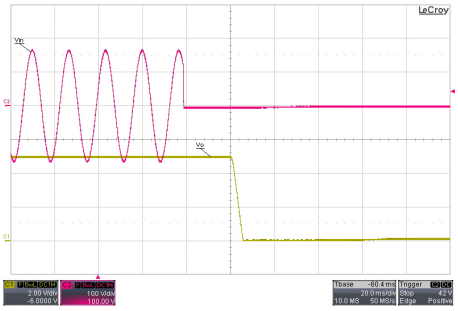
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



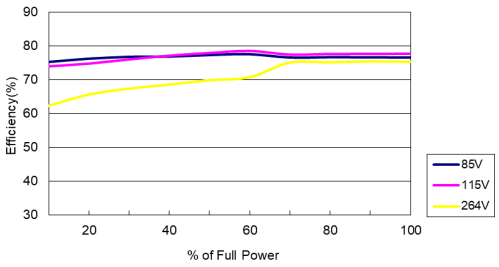
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



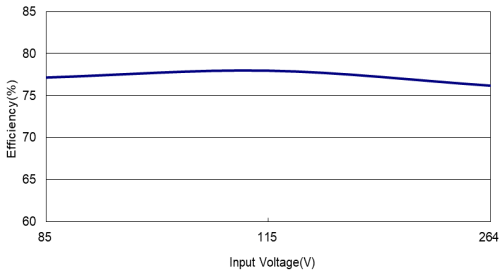
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

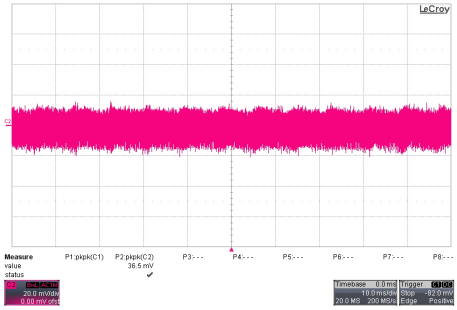
All test conditions are at 25℃ The figures are identical for ABF-04D125



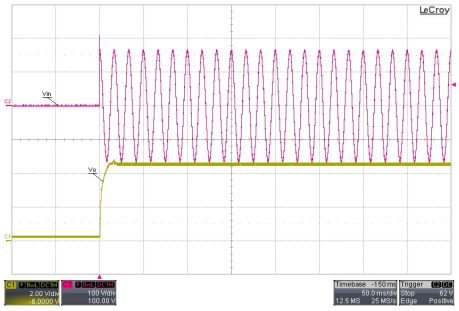
Efficiency Versus Output Current



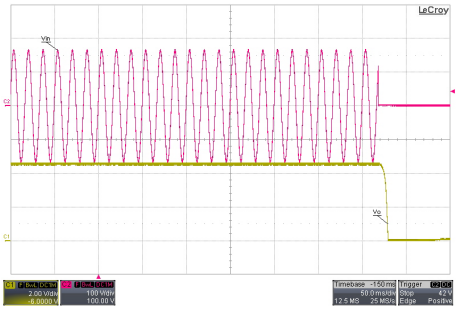
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



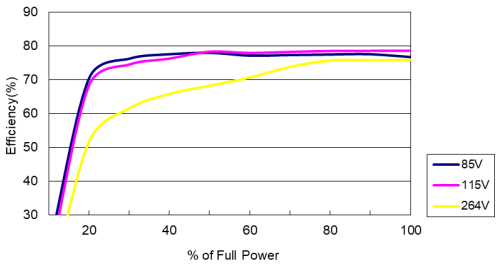
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



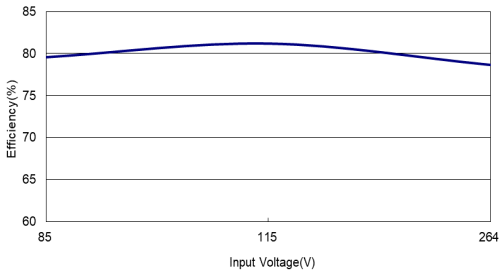
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

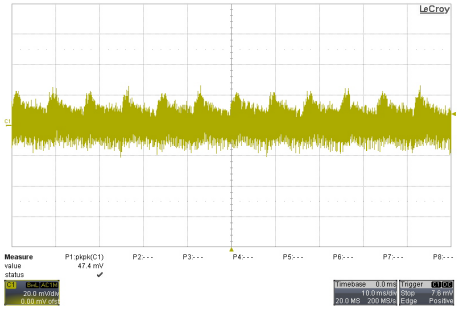
All test conditions are at 25℃ The figures are identical for ABF-04D12



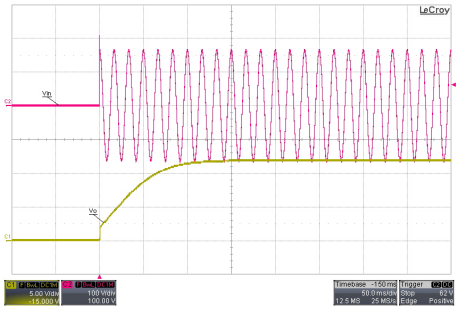
Efficiency Versus Output Current



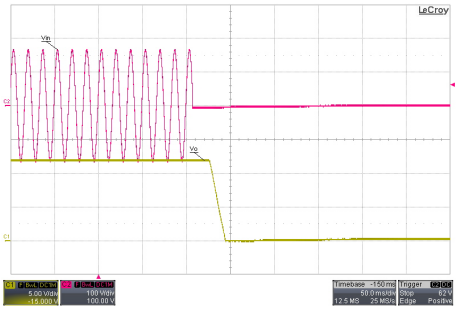
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



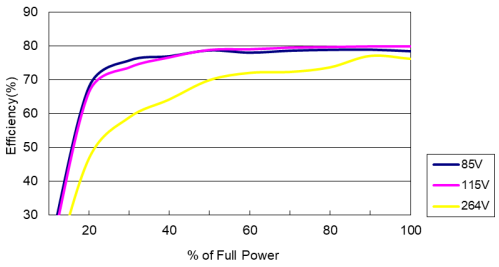
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



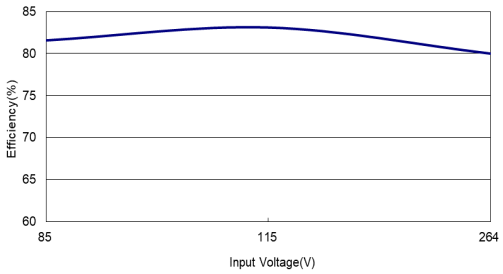
Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Characteristic Curves

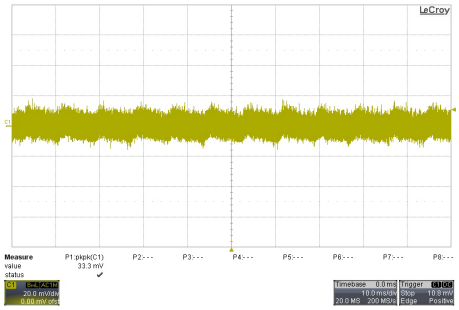
All test conditions are at 25℃ The figures are identical for ABF-04D15



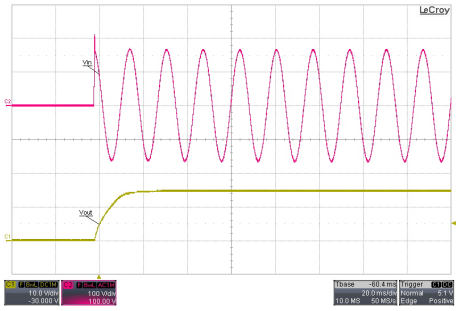
Efficiency Versus Output Current



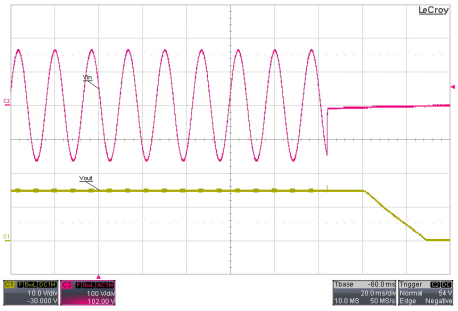
Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



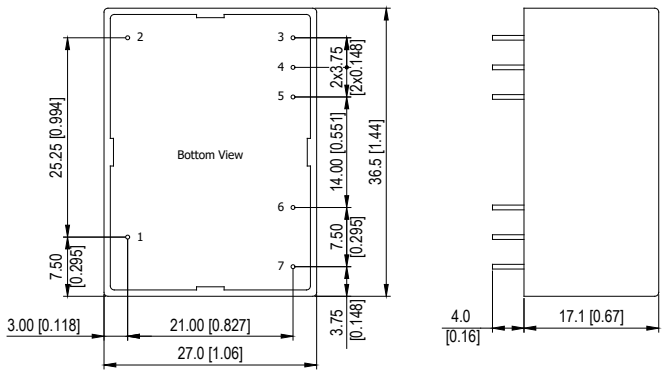
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



Typical Input Hold-up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load

Package Specifications

Mechanical Dimensions



Pin Connections

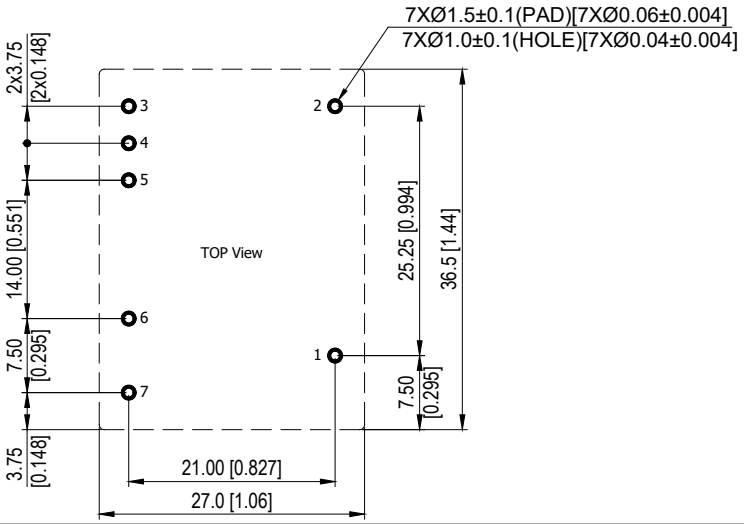
Pin	Single Output	D12/D15	D53/D125	Diameter mm (inches)
1	NC			Ø 0.6 [0.02]
2	NC			Ø 0.6 [0.02]
3	+Vout	+Vout	+Vout1	Ø 0.6 [0.02]
4	-Vout	Common	Common	Ø 0.6 [0.02]
5	No Pin	-Vout	+Vout2	Ø 0.6 [0.02]
6	AC(N)			Ø 0.6 [0.02]
7	AC(L)			Ø 0.6 [0.02]

- All dimensions in mm (inches)
- Tolerance: ±0.5 (±0.01)
- Pin pitch tolerance: ±0.25 (±0.01)
- Pin diameter tolerance: X.X±0.1 (X.XX±0.004)

Physical Characteristics

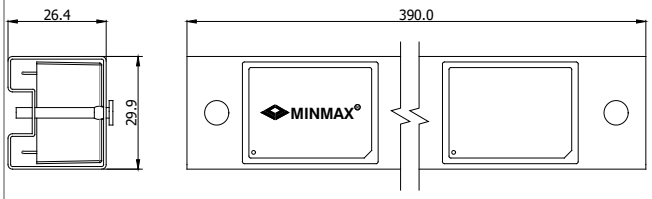
Case Size	:	36.5x27.0x17.1mm (1.44x1.06x0.67 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	30g

Recommended Pad Layout

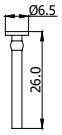


Packaging Information

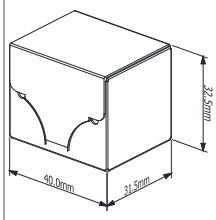
Tube

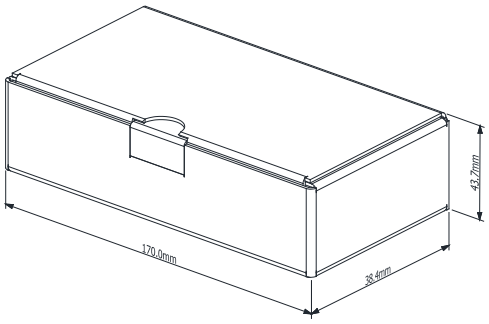


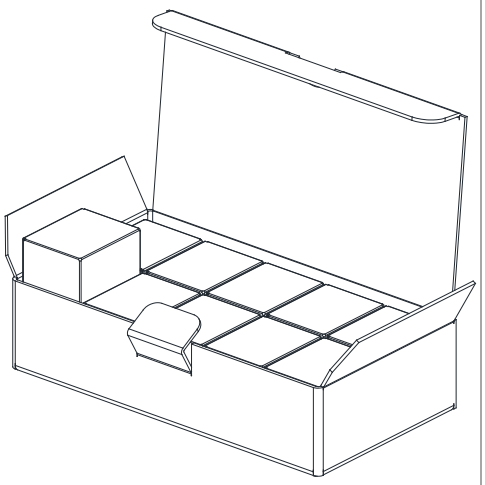
Nail



Unit: mm
10 PCS per TUBE



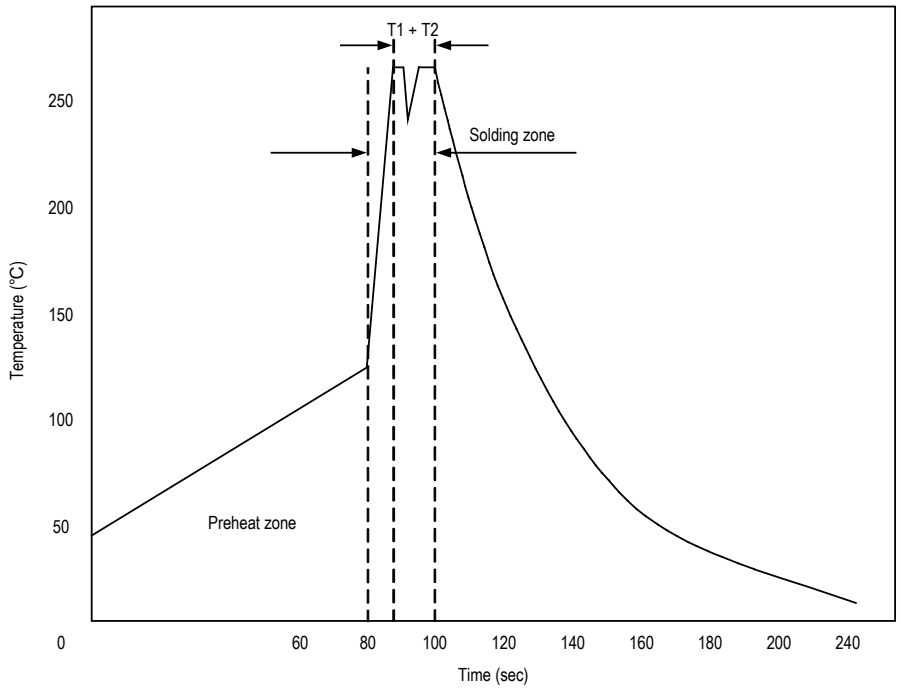




Unit: mm
10 PCS per Box

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed：3℃/sec max.
zone	Preheat temp.：100~130℃
Actual	Peak temp.：250~260℃
heating	Peak time(T1+T2)：4~6 sec

Hand Welding Parameter

Reference Solder: Sn-Ag-Cu：Sn-Cu：Sn-Ag

Hand Welding: Soldering iron：Power 60W

Welding Time: 2~4 sec

Temp.: 380~400℃

Part Number Structure

ABF	-	04	S	03

Output Power
4 Watt

Output Quantity

S:	Single
D:	Dual

Output Voltage

03:	3.3	VDC
05:	5	VDC
09:	9	VDC
12:	12	VDC
15:	15	VDC
24:	24	VDC
53:	5 / 3.3	VDC
125:	12 / 5	VDC

MTBF and Reliability

The MTBF of ABF-04 series of AC-DC Power Module has been calculated using

MIL-HDBK 217F NOTICE2, Operating Temperature 25℃, Ground Benign.

Model	MTBF	Unit
ABF-04S03	330,000	Hours
ABF-04S05		
ABF-04S09		
ABF-04S12		
ABF-04S15		
ABF-04S24		
ABF-04D53		
ABF-04D125		
ABF-04D12		
ABF-04D15		