



MINMAX[®]

AAF-05 Series

Electric Characteristic Note

AAF-05 Series EC Note

AC-DC Power Module 5W

Features

- ▶ Ultra Compact Size 1.0 x 1.0 x 0.64"
- ▶ Fully Encapsulated Plastic Case for PCB and Chassis Mounting Version
- ▶ Universal Input 85-264VAC
- ▶ I/O Isolation 3000VAC with Reinforced Insulation
- ▶ No Min. Load Requirement
- ▶ Operating Ambient Temp. Range -25°C to +70°C
- ▶ Overload/Voltage and Short Circuit Protection
- ▶ EMI Emission EN 55032/14-1 Class B Approved
- ▶ EMS Immunity EN 61000-4-2,3,4,5,6,8,11 Approved
- ▶ Eco Design, No Load Input Power 300mW max.
- ▶ Safety Approval to UL/cUL/IEC/EN 62368-1(60950-1), TUV IEC/EN 60335-1 & CE Marking



Applications

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

Product Overview

The AAF-05 Series from MINMAX is a range of ultra-small, fully encapsulated 5 Watt AC-DC power supply modules. They are designed for easy PCB mounting with solder pins. The modules feature EMI emission EN 55032/14-1 Class B approved. EMC immunity complies with EN 61000-6-1. The low stand-by power consumption complies with European ErP Directive 2009/125/EC. This series comply with international standard pinout and input voltage range of 85-264VAC for worldwide markets. The AAF-05 power supplies provide a better solution for space critical applications in consumer appliances and instrumentation and communication equipment.

Table of contents

Model Selection Guide	P2	Package Specifications Chassis Mounting with screw terminal	P11
Input Specifications.....	P2	Recommended Pad Layout.....	P12
Output Specifications.....	P2	Packaging Information.....	P12
General Specifications.....	P2	Wave Soldering Considerations.....	P14
EMC Specifications.....	P3	Hand Welding Parameter	P14
Environmental Specifications	P3	Part Number Structure	P15
Characteristic Curves	P4	MTBF and Reliability	P15
Package Specifications PCB Mounting.....	P11		

Model Selection Guide

Model Number	Output Voltage VDC	Output Current		Input Current @Max. Load mA(typ.)	Max. Capacitive Load μF	Efficiency (typ.) @Max. Load %
		Max. mA	Peak ₍₁₎ mA			
		AAF-05S03	3.3	1515	1970	117
AAF-05S05	5	1000	1300	108	1000	80
AAF-05S09	9	555	721	106	300	82
AAF-05S12	12	416	540	106	160	82
AAF-05S15	15	333	433	104	100	83
AAF-05S24	24	208	270	104	43	83
AAF-05S48	48	104	135	102	10	85

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Voltage Range	All Models	85	---	264	VAC
Input Frequency Range		47	---	63	Hz
Input Voltage Range		120	---	370	VDC
No-Load Power Consumption		---	---	300	mW
Inrush Current (Cold Start at 25°C)	115VAC	---	---	20	A
	230VAC	---	---	40	A

Output Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy		---	---	±2.0	%Vnom.	
Line Regulation	Vin=Min. to Max. @Full Load	---	---	±1.0	%	
Load Regulation	Io=0% to 100%	---	---	±1.0	%	
Ripple & Noise	0-20 MHz Bandwidth	3.3V & 5VDC Output Models	---	---	60	mV _{P-P}
		Other Output Models	---	---	1	%V _{PP} of Vo
Minimum Load	No minimum Load Requirement					
Over Voltage Protection	Zener Diode Clamp	---	125	---	% of Vo	
Temperature Coefficient		---	---	±0.05	%/°C	
Overshoot		---	---	5	%Vout	
Over Load Protection	Hiccup mode, auto-recovery	135	150	---	%Inom.	
	(long term overload condition may cause damage)					
Short Circuit Protection	Hiccup mode, Automatic Recovery					

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	3000	---	---	VAC
I/O Isolation Resistance	500 VDC	100	---	---	MΩ
Switching Frequency		---	65	---	kHz
Hold-up Time	115VAC, Full Load	---	8	---	ms
	230VAC, Full Load	---	40	---	ms
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	520,000	---	---	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)				
	IEC/EN 60335-1 recognition(CB-report, TUV certificate)				

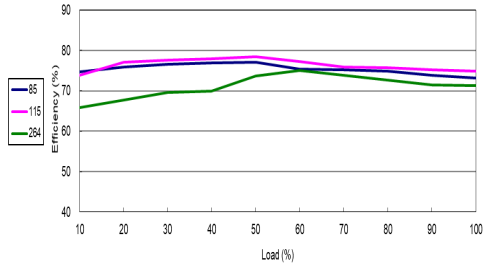
EMC Specifications				
Parameter	Standards & Level			Performance
EMI	Conduction	EN 55014-1, EN 55032	Without external components	Class B
	Radiation			
EMS	EN 55014-2, EN 55035			
	ESD	EN 61000-4-2 Air \pm 8kV, Contact \pm 4kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 \pm 2kV		A
	Surge	EN 61000-4-5 \pm 1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 30A/m		A
	Dips	EN 61000-4-11 30% 10ms		A
	Interruptions	EN 61000-4-11 >95% 5000ms		B

Environmental Specifications				
Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range		-25	+70	$^{\circ}$ C
Power Derating	+50 $^{\circ}$ C to +70 $^{\circ}$ C	0.125		W / $^{\circ}$ C
Storage Temperature Range		-40	+85	$^{\circ}$ C
Humidity (non condensing)		---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)		---	260	$^{\circ}$ C

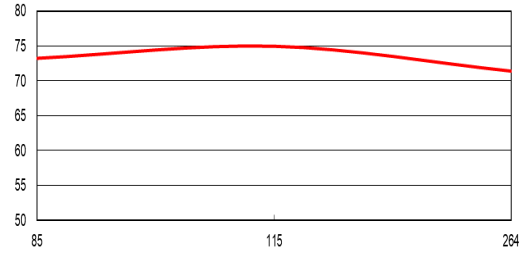
Notes	
1	Peak load lasting <30s with a maximum duty cycle of 10%, average output power not to exceed maximum power.
2	All specifications typical at Ta=+25 $^{\circ}$ C, resistive load, 115VAC, 60Hz input voltage and after warm-up time rated output current unless otherwise noted.
3	Ripple & Noise of PCB mounting type measured with a 1 μ F/100V MLCC.
4	We recommend to protect the converter by a slow blow fuse in the input supply line.
5	Other input and output voltage may be available, please contact MINMAX.
6	Specifications are subject to change without notice.

Characteristic Curves

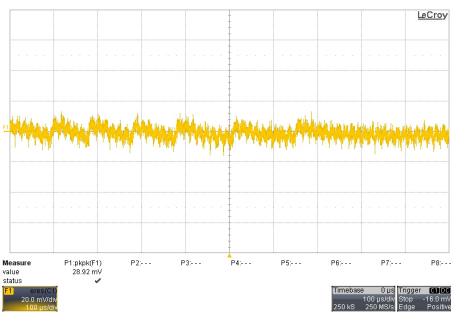
All test conditions are at 25°C The figures are identical for AAF-05S03



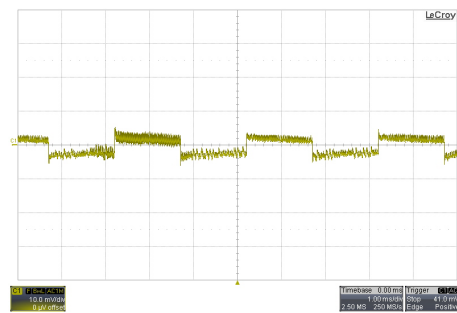
Efficiency Versus Output Current



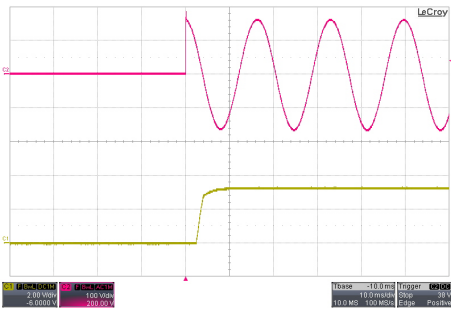
Efficiency Versus Input Voltage Full Load



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



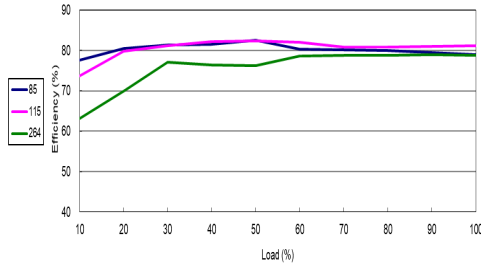
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



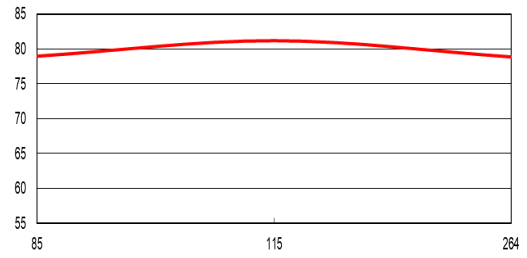
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

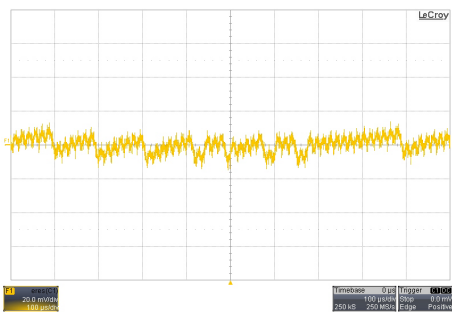
All test conditions are at 25°C. The figures are identical for AAF-05S05



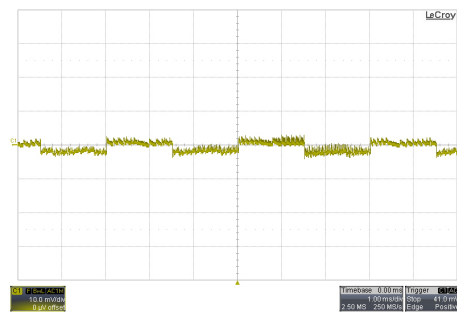
Efficiency Versus Output Current



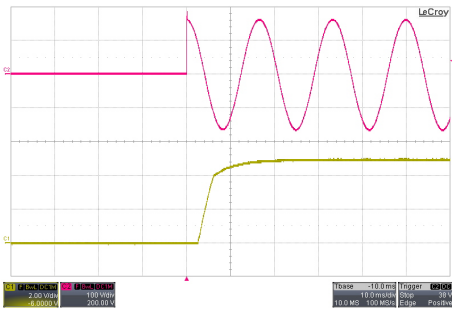
Efficiency Versus Input Voltage Full Load



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



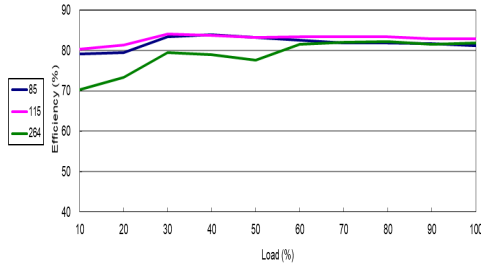
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



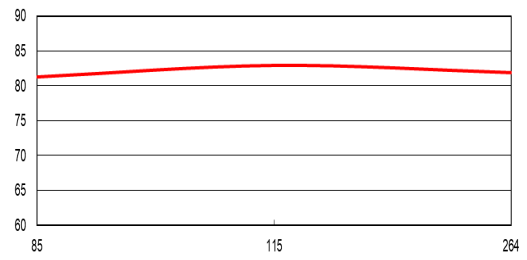
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

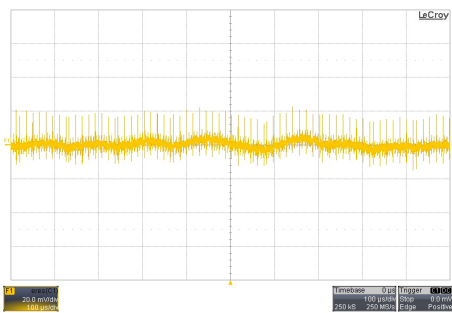
All test conditions are at 25°C The figures are identical for AAF-05S09



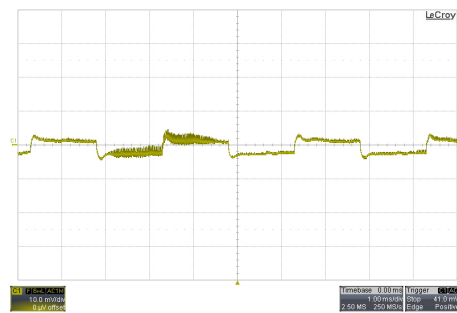
Efficiency Versus Output Current



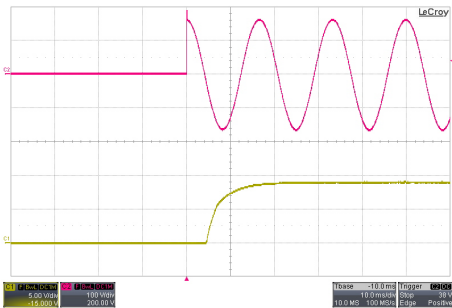
Efficiency Versus Input Voltage Full Load



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



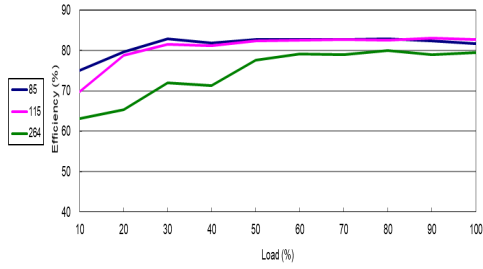
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



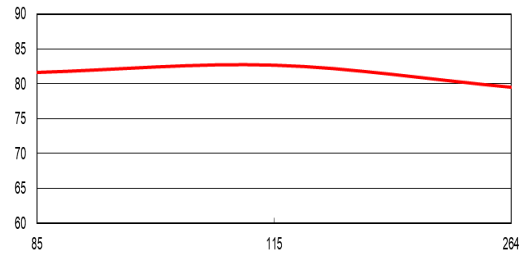
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

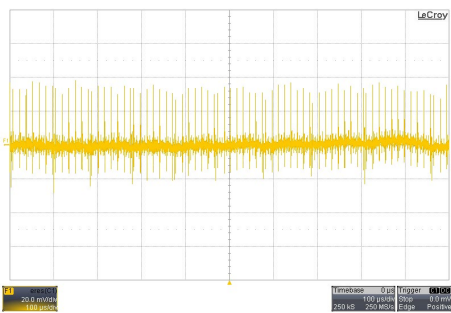
All test conditions are at 25°C The figures are identical for AAF-05S12



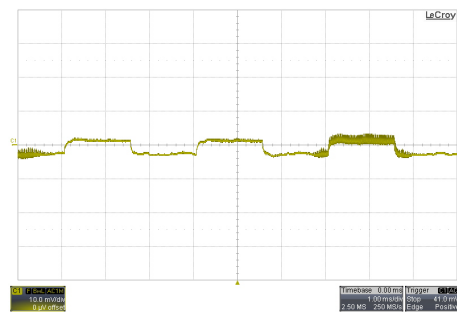
Efficiency Versus Output Current



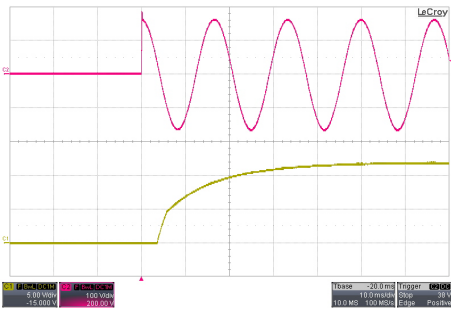
Efficiency Versus Input Voltage Full Load



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



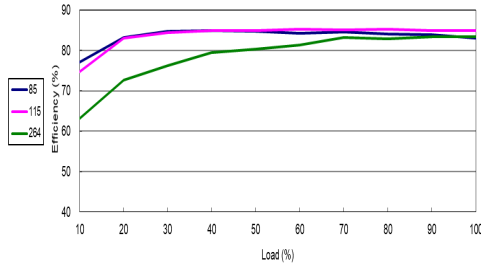
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



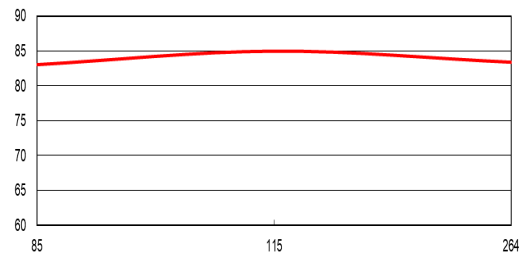
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

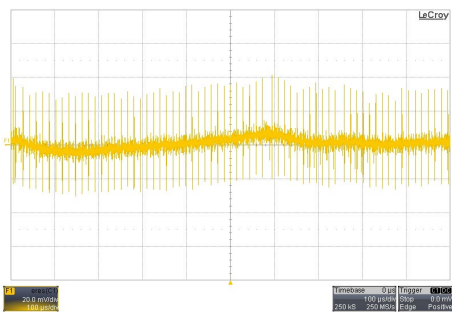
All test conditions are at 25°C The figures are identical for AAF-05S15



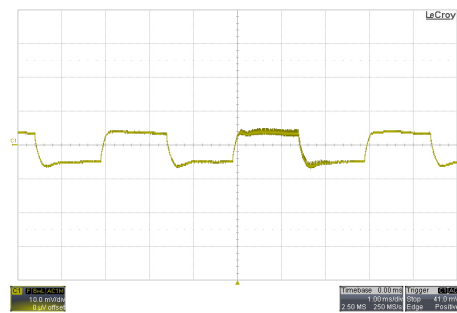
Efficiency Versus Output Current



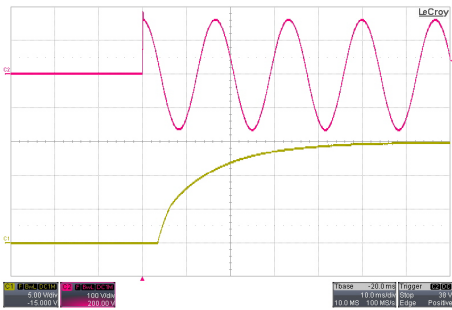
Efficiency Versus Input Voltage Full Load



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



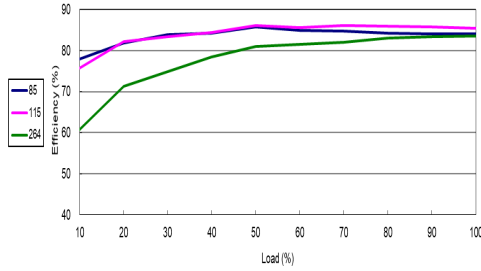
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



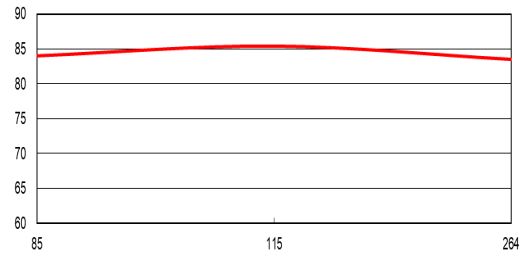
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

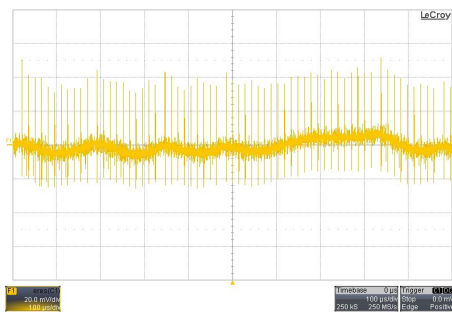
All test conditions are at 25°C. The figures are identical for AAF-05S24



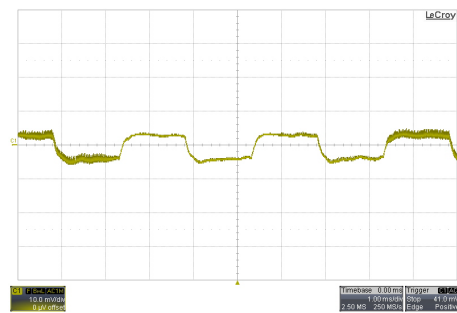
Efficiency Versus Output Current



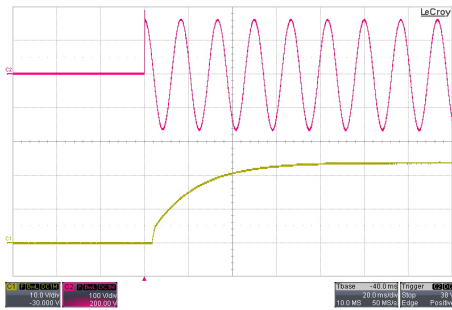
Efficiency Versus Input Voltage
Full Load



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



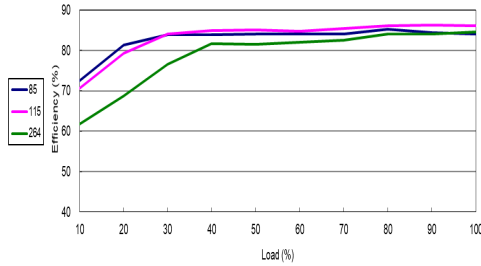
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load; $V_{in}=V_{in\ nom}$



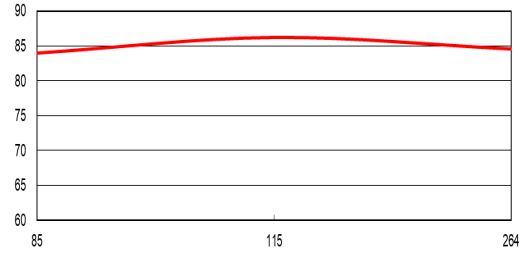
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

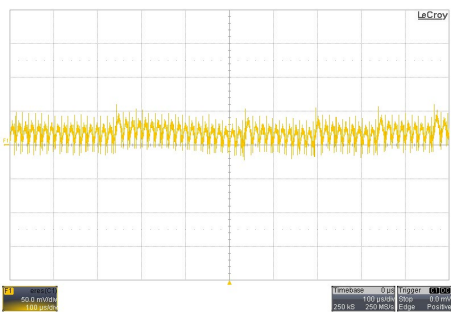
All test conditions are at 25°C The figures are identical for AAF-05S48



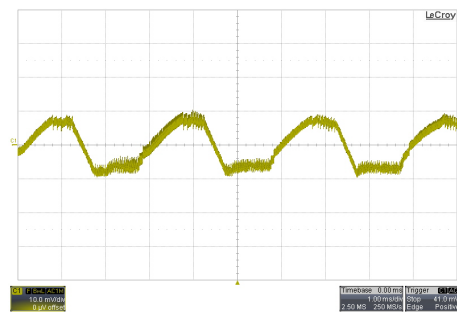
Efficiency Versus Output Current



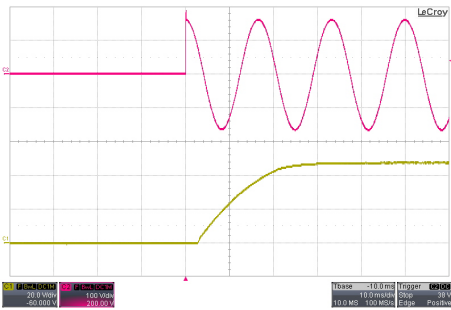
Efficiency Versus Input Voltage Full Load



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

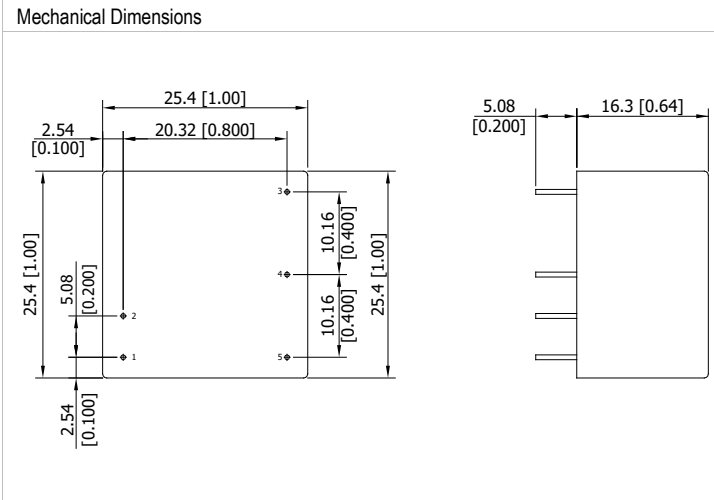


Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



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

Package Specifications PCB Mounting



Pin Connections

Pin	Function	Diameter mm (inches)
1	AC (N)	∅ 0.6 [0.02]
2	AC (L)	∅ 0.6 [0.02]
3	NC	∅ 0.6 [0.02]
4	-Vout	∅ 0.6 [0.02]
5	+Vout	∅ 0.6 [0.02]

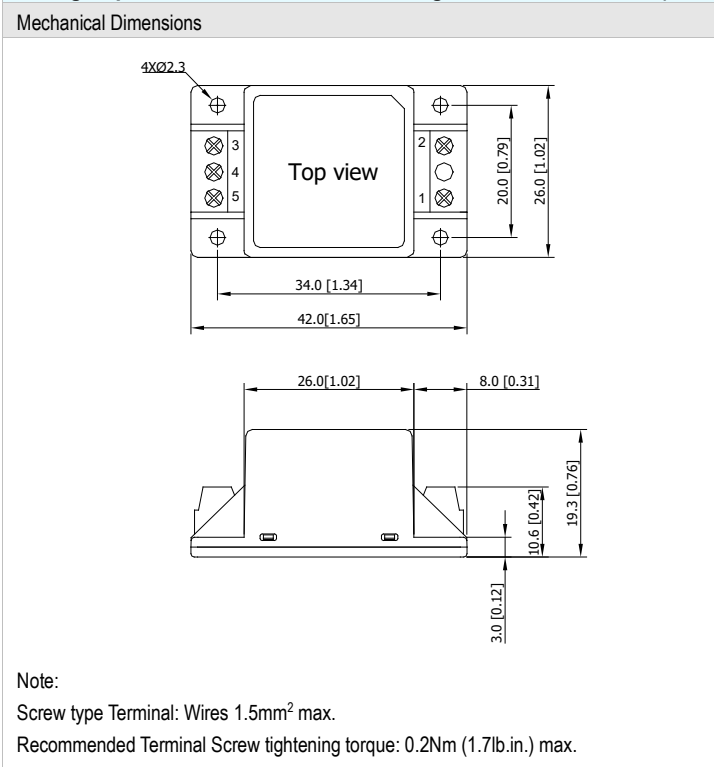
NC: No Connection

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: ± 0.5 (± 0.02)
- ▶ Pin pitch tolerance: ± 0.25 (± 0.01)
- ▶ Pin diameter tolerance: $X.X \pm 0.1$ ($X.XX \pm 0.004$)

Physical Characteristics

Case Size	: 25.4x25.4x16.3mm (1.0x1.0x0.64 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Copper Alloy
Weight	: 19.7g

Package Specifications Chassis Mounting with screw terminal (order code suffix C)



Connections

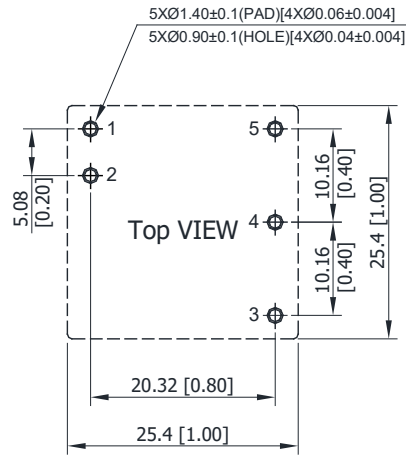
Pin	Function
1	AC (N)
2	AC (L)
3	NC
4	-Vout
5	+Vout

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: ± 0.5 (± 0.02)

Physical Characteristics

Case Size	: 42.0x26.0x19.3mm (1.65x1.02x0.76 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Weight	: 23.9g

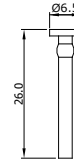
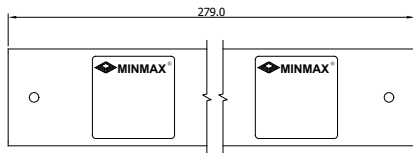
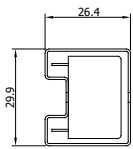
Recommended Pad Layout



Packaging Information

Tube

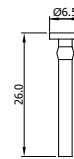
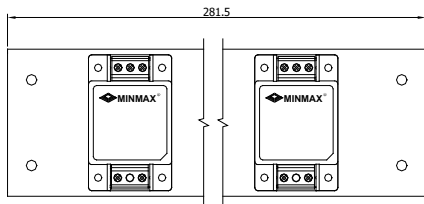
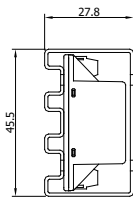
Nail



Unit: mm
AAF-05 PCB Mounting 10 PCS per TUBE

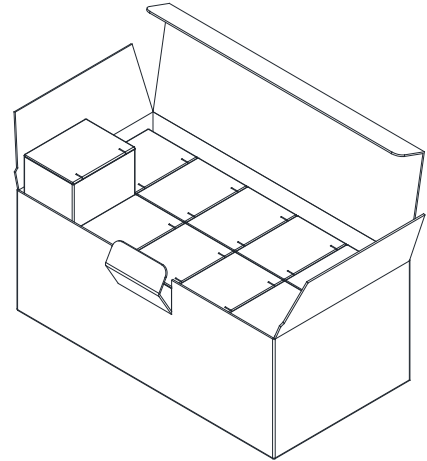
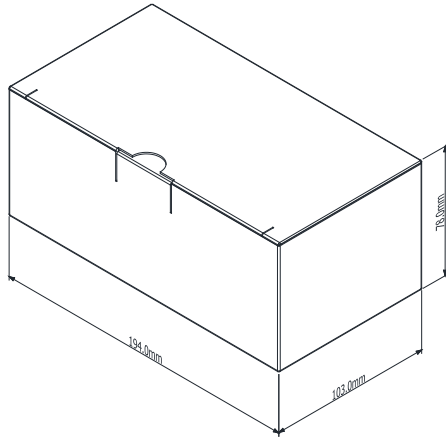
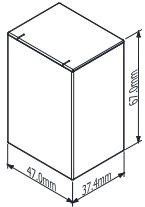
Tube

Nail

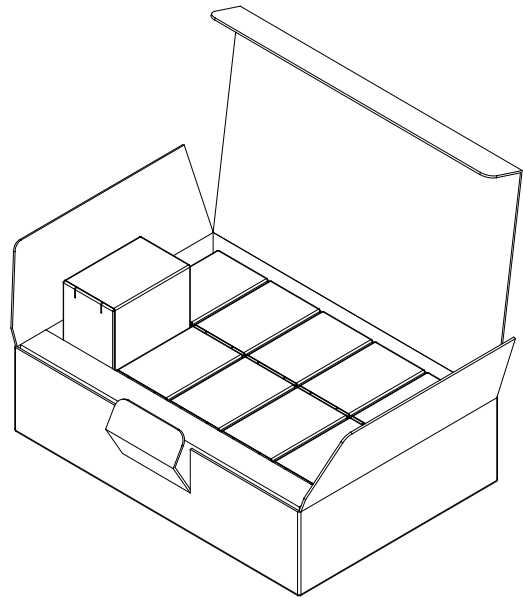
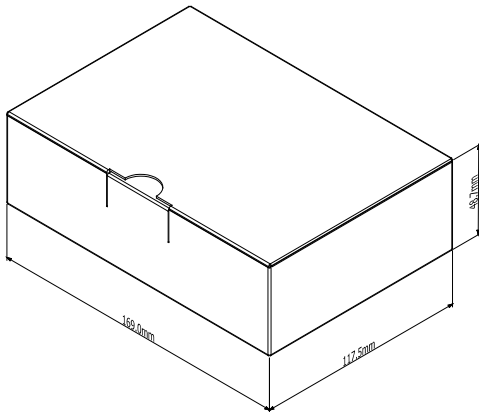
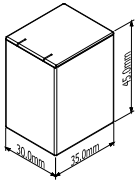


Unit: mm
AAF-05 Chassis Mounting 10 PCS per TUBE

Packaging Information



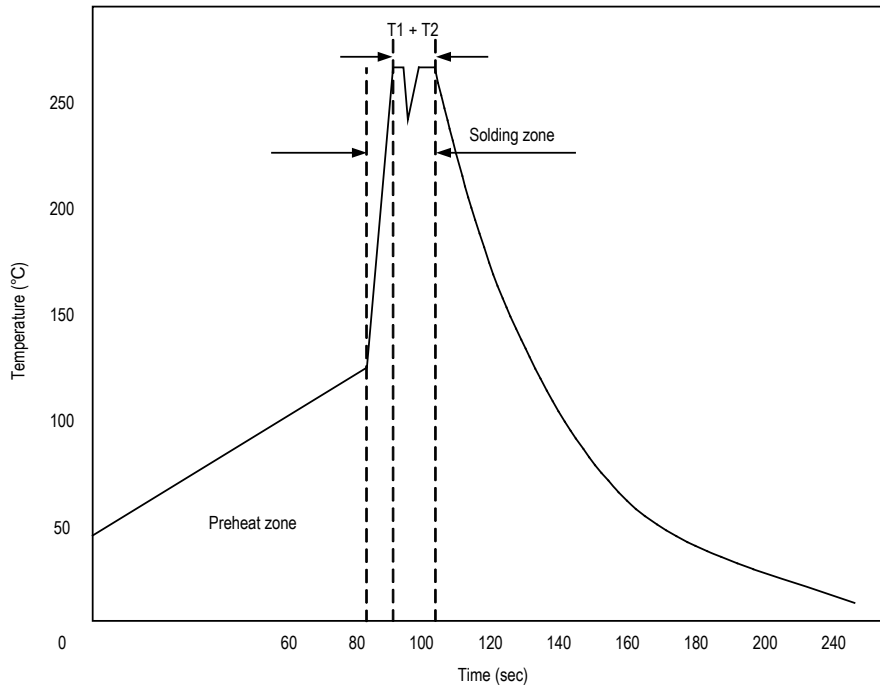
Unit: mm
AAF-05 PCB Mounting 10 PCS per Box



Unit: mm
AAF-05 Chassis Mounting 10 PCS per Box

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed : 3°C/sec max.
zone	Preheat temp. : 100~130°C
Actual	Peak temp. : 250~260°C
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°C

Part Number Structure

AAF	-	05	S	03																												
		<table border="1"> <tr> <td>Output Power</td> </tr> <tr> <td>5 Watt</td> </tr> </table>	Output Power	5 Watt	<table border="1"> <tr> <td>Output Quantity</td> </tr> <tr> <td>S: Single</td> </tr> </table>	Output Quantity	S: Single	<table border="1"> <tr> <td colspan="3">Output Voltage</td> </tr> <tr> <td>03:</td> <td>3.3</td> <td>VDC</td> </tr> <tr> <td>05:</td> <td>5</td> <td>VDC</td> </tr> <tr> <td>09:</td> <td>9</td> <td>VDC</td> </tr> <tr> <td>12:</td> <td>12</td> <td>VDC</td> </tr> <tr> <td>15:</td> <td>15</td> <td>VDC</td> </tr> <tr> <td>24:</td> <td>24</td> <td>VDC</td> </tr> <tr> <td>48:</td> <td>48</td> <td>VDC</td> </tr> </table>	Output Voltage			03:	3.3	VDC	05:	5	VDC	09:	9	VDC	12:	12	VDC	15:	15	VDC	24:	24	VDC	48:	48	VDC
Output Power																																
5 Watt																																
Output Quantity																																
S: Single																																
Output Voltage																																
03:	3.3	VDC																														
05:	5	VDC																														
09:	9	VDC																														
12:	12	VDC																														
15:	15	VDC																														
24:	24	VDC																														
48:	48	VDC																														

MTBF and Reliability

The MTBF of AAF-05 series of AC-DC Power Module has been calculated using

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

Model	MTBF	Unit
AAF-05S03	520,000	Hours
AAF-05S05		
AAF-05S09		
AAF-05S12		
AAF-05S15		
AAF-05S24		
AAF-05S48		