



MINMAX[®]

AGF-15 Series

Electric Characteristic Note

AGF-15 Series EC Note

AC-DC Power Module 15W

Features

- ▶ Ultra Compact Size 2.06 x 1.07 x 0.93"
- ▶ Fully Encapsulated Module for PCB Mounting
- ▶ Universal Input 85-264VAC, 47-440Hz
- ▶ 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
- ▶ EMC Immunity EN 61000-4-2,3,4,5,6,8,11 Approved
- ▶ Eco Design, Low No Load Power Consumption < 100mW
- ▶ UL/cUL/IEC/EN 62368-1(60950-1), TUV IEC/EN 60335-1 Safety Approval & CE Marking



Applications

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

Product Overview

The AGF-15 Series is a range of ultra-small, fully encapsulated 15 Watt AC-DC power supply modules. They are designed for easy PCB mounting featuring measuring only 2.06"x1.07"x0.93". These series consists 7 models featuring universal AC input (85-264VAC) and fixed regulated single output voltage ranging from 3.3-48VDC; 3000VAC isolation with reinforced insulation; EMI emission EN 55032/14-1 Class B approved; EMC immunity EN 61000-4-2,3,4,5,6,8,11 approved; no minimum load requirement; short circuit / overload / overvoltage protection and low standby power consumption. For intelligent applications, the models for chassis mounting can also be supplied as an option with IEC/EN 60335-1 approval. The AGF-15 series also provides a better 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.)
				115VAC, 60Hz	230VAC, 50Hz		
		Max.	Peak ₍₁₎	@Max. Load			@Max. Load, 115VAC
	VDC	mA	mA	mA(typ.)		μF	%
AGF-15S033	3.3	3500	4550	258	167	5600	75
AGF-15S05	5	3000	3900	318	206	3300	79
AGF-15S09	9	1667	2160	310	201	1000	81
AGF-15S12	12	1250	1625	306	199	560	82
AGF-15S15	15	1000	1300	306	199	330	82
AGF-15S24	24	625	813	299	194	150	84
AGF-15S48	48	313	407	306	199	33	82

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		---	---	0.1	W
Inrush Current (Cold Start at 25°C)	115VAC	---	---	25	A
	230VAC	---	---	45	A

Output Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	±1.0	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	---	---	±0.5	%
Load Regulation	Io=0% to 100%	---	---	±1.0	%
Minimum Load	No minimum Load Requirement				
Ripple & Noise	0-20 MHz Bandwidth	3.3V & 5VDC Output Models	---	80	mV _{P-P}
		Other Output Models	---	1	%V _{PP} of Vo
Over Voltage Protection	Zener diode clamp	---	125	---	% of Vo
Temperature Coefficient		---	±0.01	±0.02	%/°C
Over Load Protection	Hiccup mode, auto-recovery (long term overload condition may cause damage)	---	150	---	%Inom.
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	1000	---	---	MΩ
Switching Frequency		---	115	---	kHz
Start-up Time	230VAC	---	---	1	s
Hold-up Time	115VAC, 60Hz	8	---	---	ms
	230VAC, 60Hz	40	---	---	ms
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	432,254	---	---	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(TUV certificata,CB-report)				

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	Direct discharge	Indirect discharge HCP & VCP	A
		EN 61000-4-2 Air ± 8kV , Contact ± 6kV		
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 30A/Mm		A
	Dips	EN 61000-4-11 30% 10ms		A
	Interruptions	EN 61000-4-11 >95% 5000ms		B

Environmental Specifications

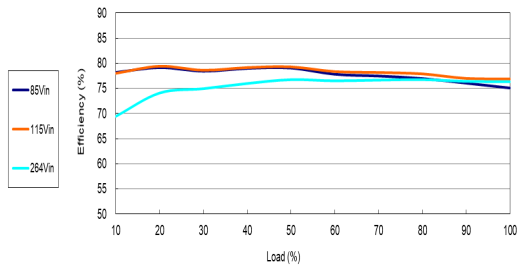
Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range		-25	+70	$^{\circ}\text{C}$
Power Derating	+55 $^{\circ}\text{C}$ to +70 $^{\circ}\text{C}$	0.5		W / $^{\circ}\text{C}$
Storage Temperature Range		-40	+85	$^{\circ}\text{C}$
Humidity (non condensing)		---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)		---	260	$^{\circ}\text{C}$

Notes

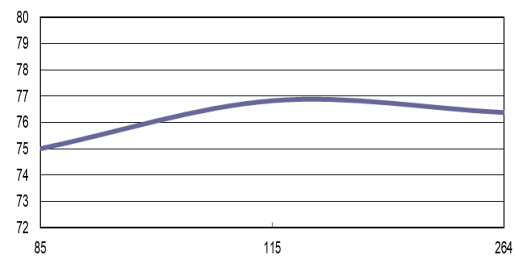
- 1 Peak load lasting <30s with a maximum duty cycle of 10%, average output power not to exceed maximum power.
- 2 All specifications typical at $T_a=+25^{\circ}\text{C}$, resistive load, 115VAC, 60Hz input voltage and after warm-up time rated output current unless otherwise noted.
- 3 We recommend to 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.
- 6 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Characteristic Curves

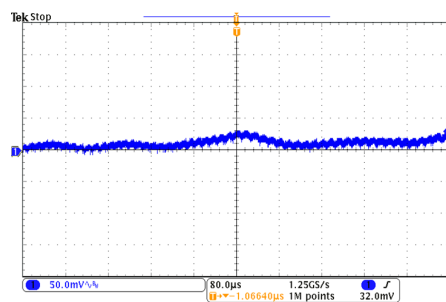
All test conditions are at 25°C The figures are identical for AGF-15S033



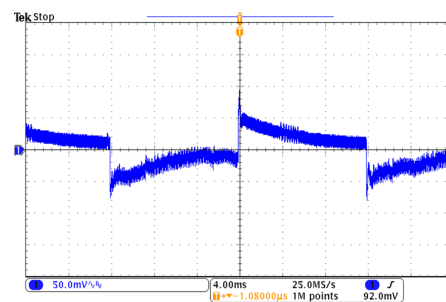
Efficiency Versus Output Current



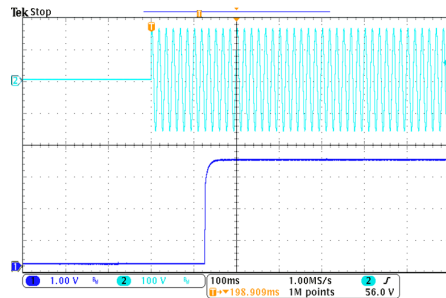
Efficiency Versus Input Voltage
Full Load



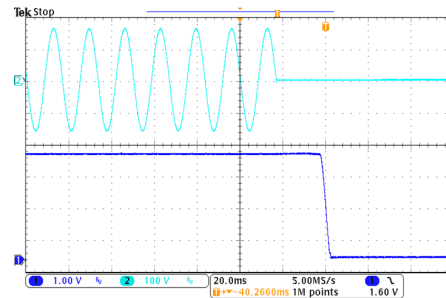
Typical Output Ripple and Noise
V_{in}=V_{in nom} ; Full Load



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



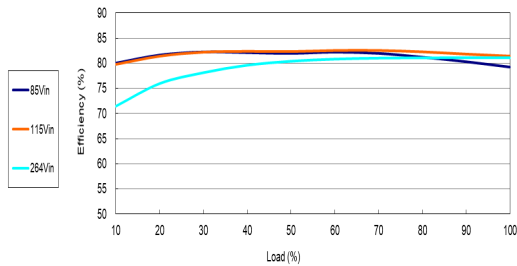
Typical Input Start-Up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load



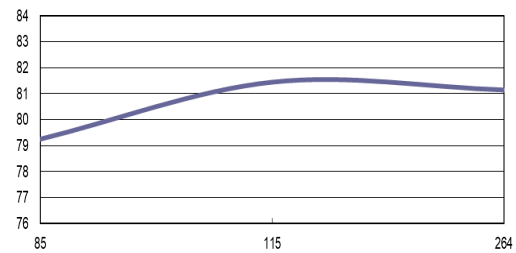
Typical Input Hold-up and Output Rise Characteristic
V_{in}=V_{in nom} ; Full Load

Characteristic Curves

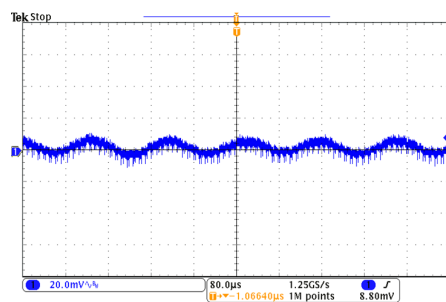
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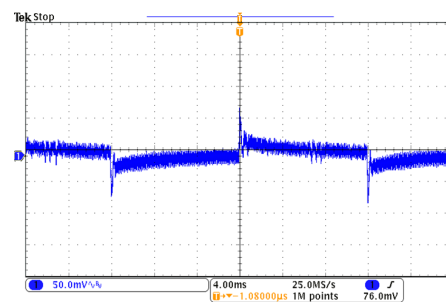
Efficiency Versus Output Current



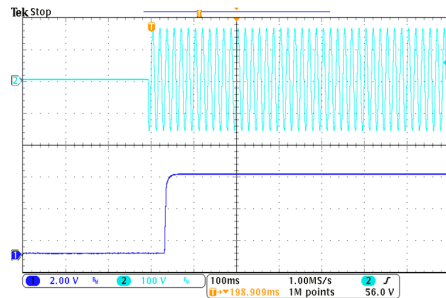
Efficiency Versus Input Voltage
Full Load



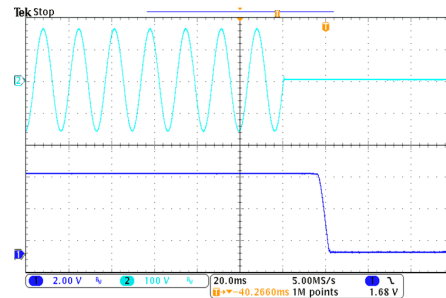
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



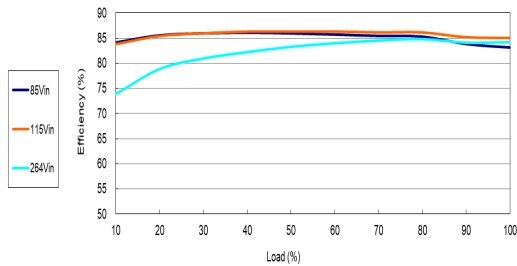
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



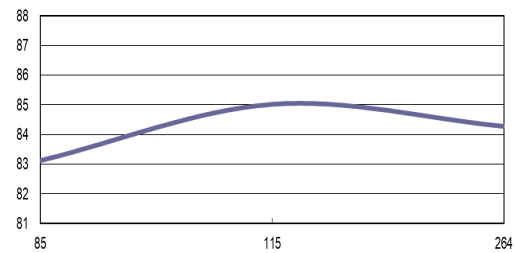
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

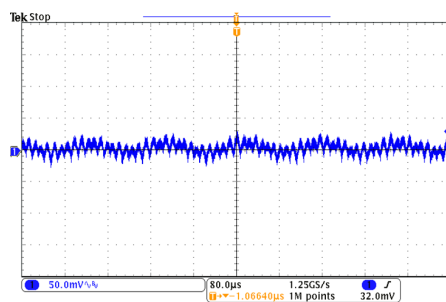
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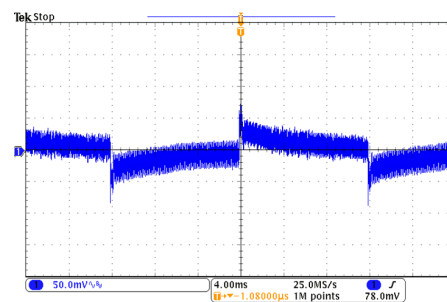
Efficiency Versus Output Current



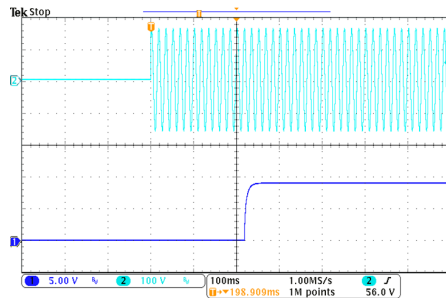
Efficiency Versus Input Voltage
Full Load



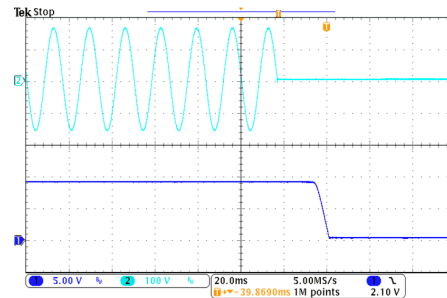
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



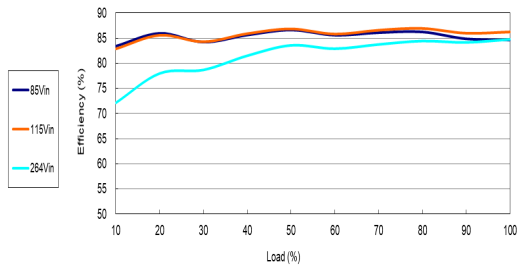
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



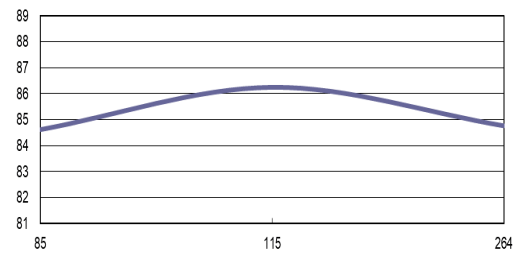
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

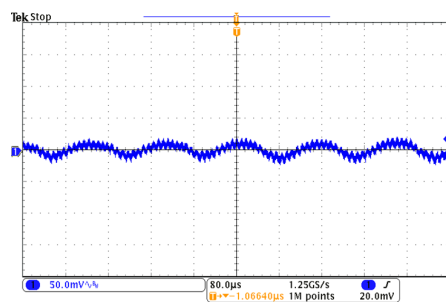
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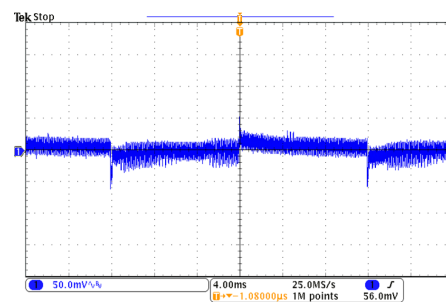
Efficiency Versus Output Current



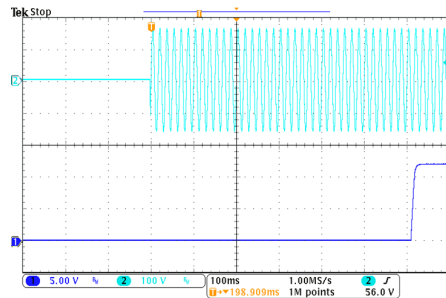
Efficiency Versus Input Voltage
Full Load



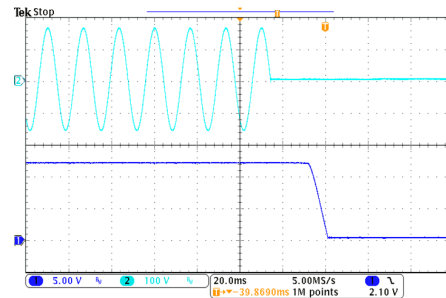
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



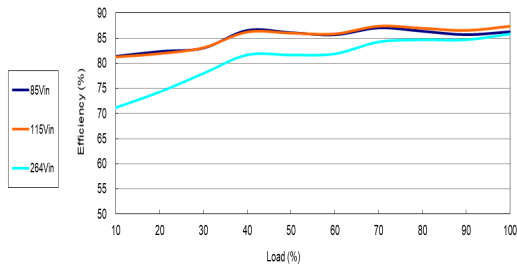
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



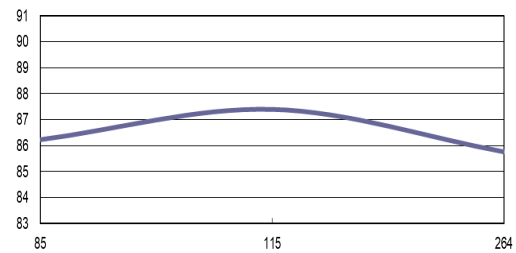
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

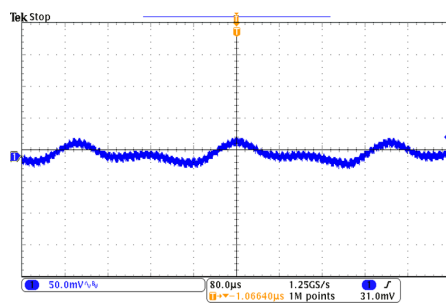
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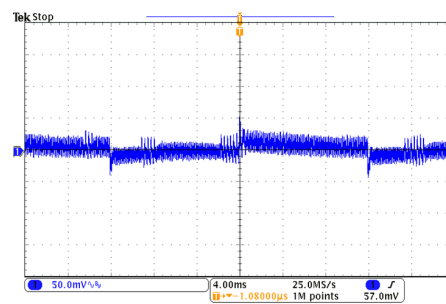
Efficiency Versus Output Current



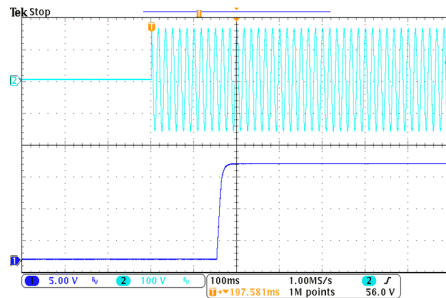
Efficiency Versus Input Voltage
Full Load



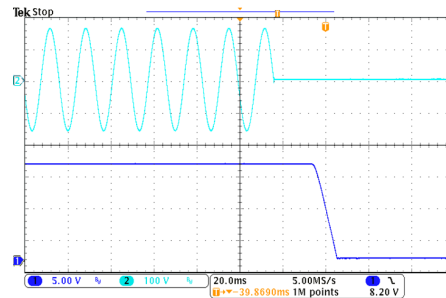
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



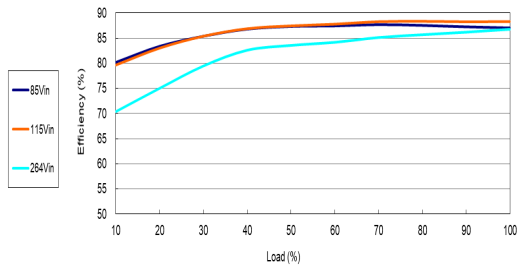
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



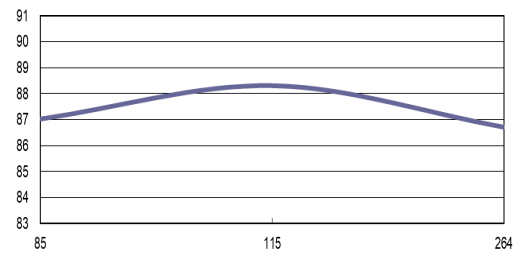
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

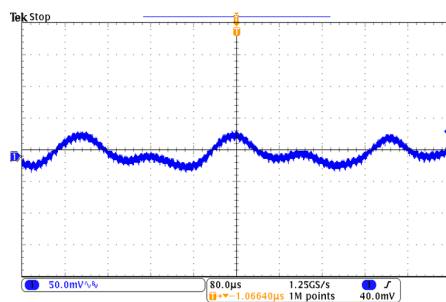
All test conditions are at 25°C The figures are identical for AGF-15S24



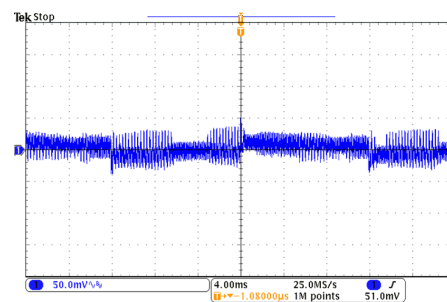
Efficiency Versus Output Current



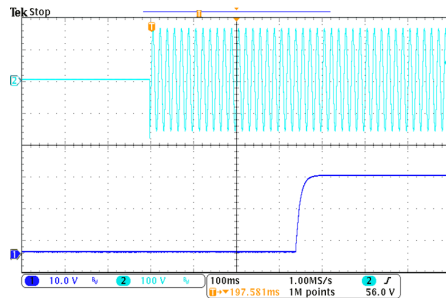
Efficiency Versus Input Voltage
Full Load



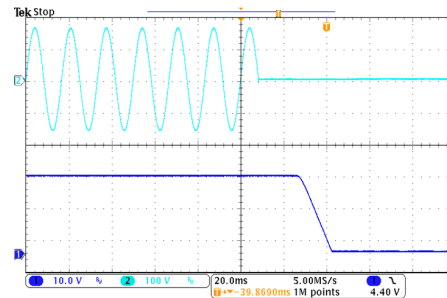
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



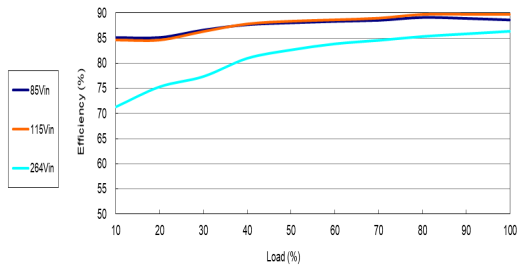
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



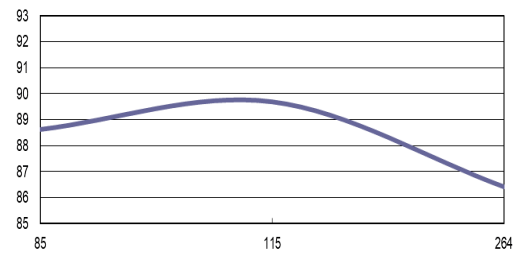
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

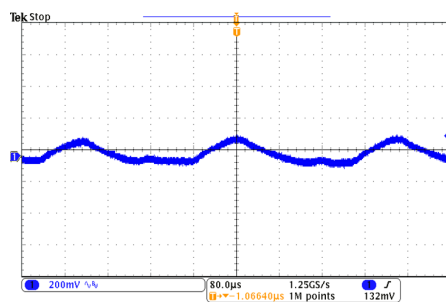
All test conditions are at 25°C The figures are identical for AGF-15S48



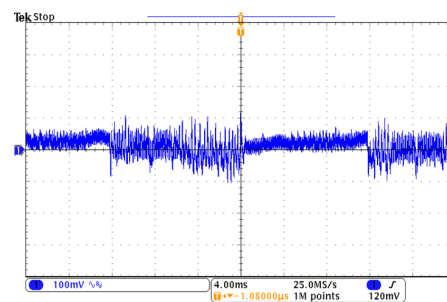
Efficiency Versus Output Current



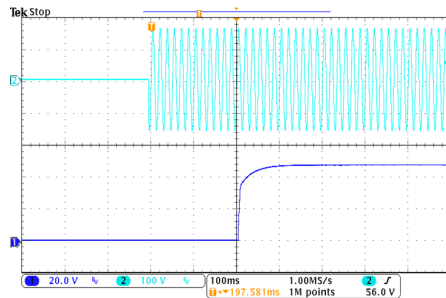
Efficiency Versus Input Voltage
Full Load



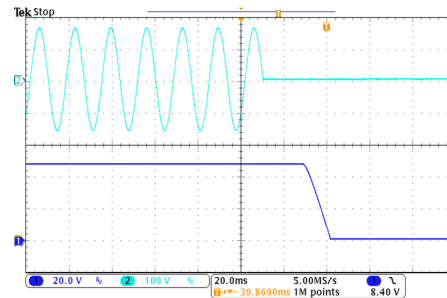
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



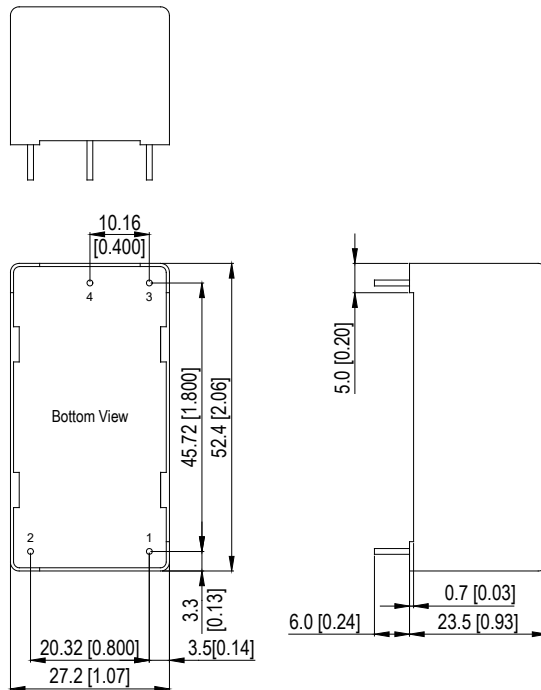
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



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

Package Specification

Mechanical Dimensions



Pin Connections

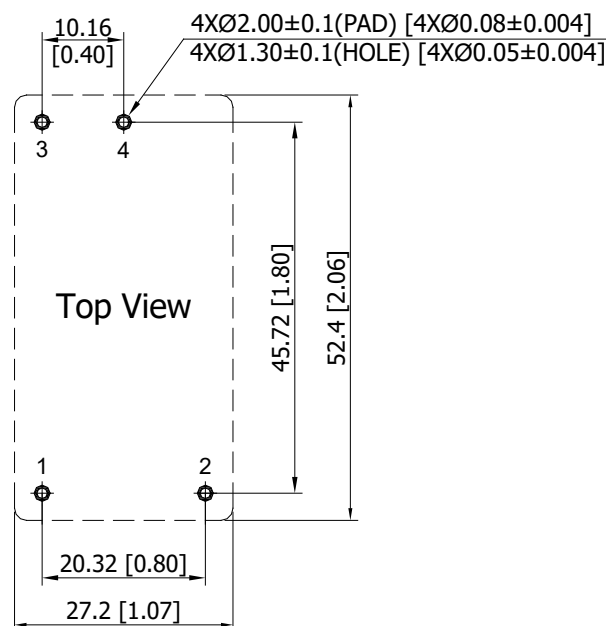
Pin	Function	Diameter mm (inches)
1	AC(N)	Ø 1.0 [0.04]
2	AC(L)	Ø 1.0 [0.04]
3	+Vout	Ø 1.0 [0.04]
4	-Vout	Ø 1.0 [0.04]

- ▶ 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	: 52.4x27.2x23.5mm (2.06x1.07x0.93 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Copper Alloy
Weight	: 60g

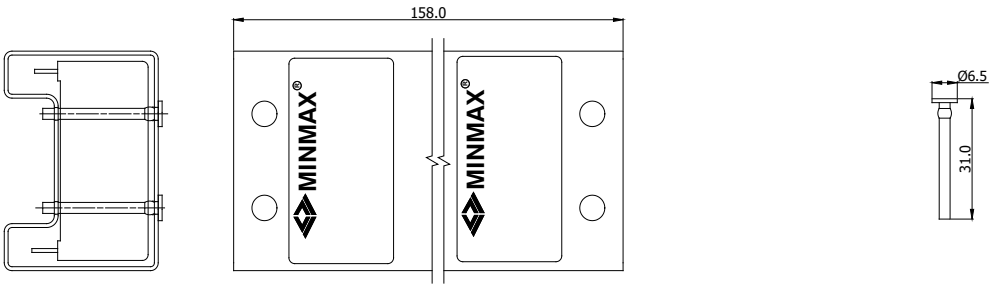
Recommended Pad Layout



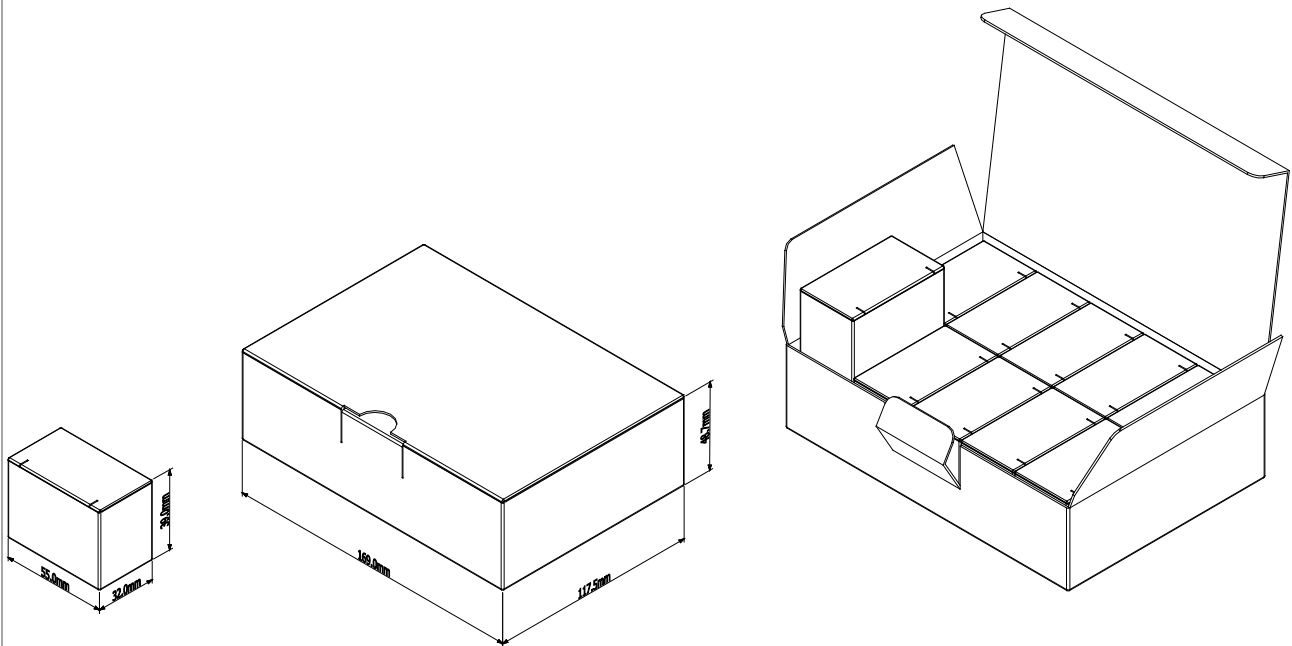
Packaging Information

Tube

Nail



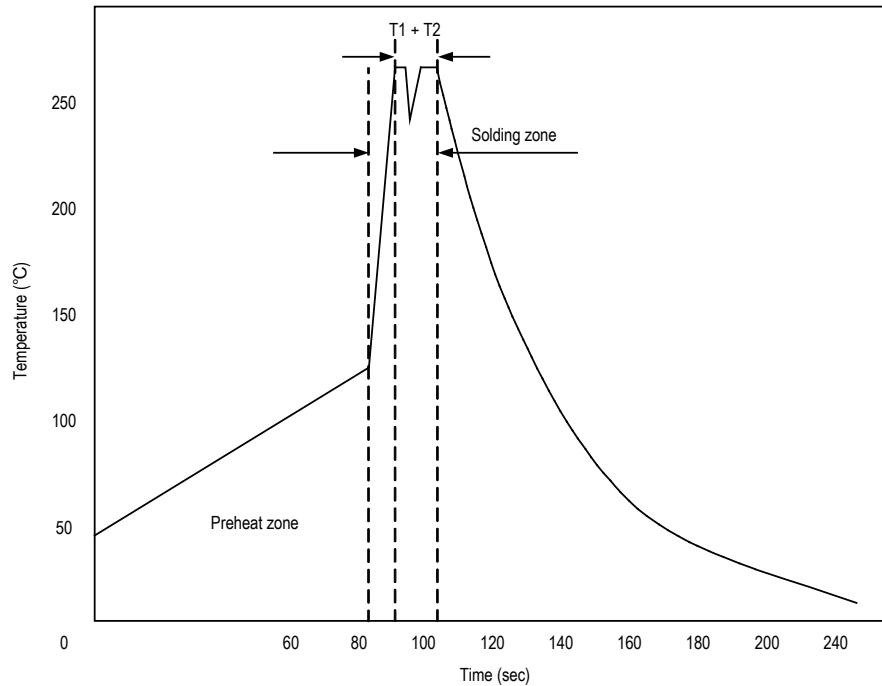
Unit: mm
5 PCS per TUBE



Unit: mm
10 PCS per Box

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed : 3°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

AGF	-	15	S	033
		Output Power 15 Watt	Output Quantity S: Single	Output Voltage 033: 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 AGF-15 series of AC-DC Power Module has been calculated using

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

Model	MTBF	Unit
AGF-15S033	452,916	Hours
AGF-15S05	469,582	
AGF-15S09	564,573	
AGF-15S12	606,988	
AGF-15S15	604,913	
AGF-15S24	614,998	
AGF-15S48	595,110	