



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 VDC	Output Current		Input Current		Max. capacitive Load μF	Efficiency (typ.) @Max. Load, 115VAC %
		Max.	Peak ⁽¹⁾	115VAC, 60Hz	230VAC, 50Hz		
		mA	mA	@Max. Load mA(typ.)			
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)				

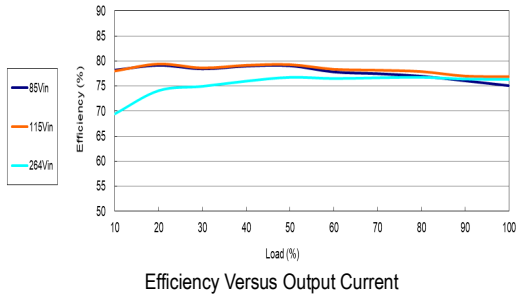
EMC Specifications				
Parameter	Standards & Level			Performance
EMI	Conduction	EN 55014-1, EN 55032	Without external components	Class B
	Radiation			
EMS	EN 55014-2, EN 55035			
	ESD	Direct discharge	Indirect discharge HCP & VCP	
		EN 61000-4-2 Air ± 8kV , Contact ± 6kV	Contact ± 6kV	
	Radiated immunity	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	°C
Power Derating	+55°C to +70°C	0.5		W / °C
Storage Temperature Range		-40	+85	°C
Humidity (non condensing)		---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)		---	260	°C

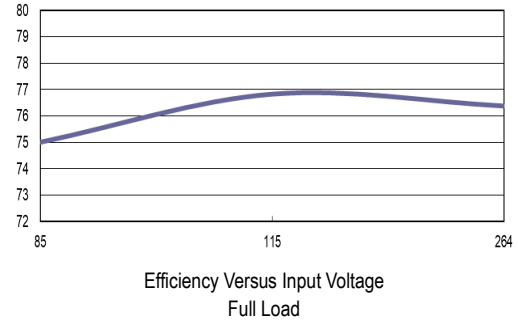
Notes	
1	Peak load lasting <30s with a maximum duty cycle of 10%, average output power not to exceed maximum power.
2	All specifications typical at Ta=+25°C, resistive load, 115VAC, 60Hz input voltage and after warm-up time rated output current unless otherwise noted.
3	We recommend to protect the converter 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.

Characteristic Curves

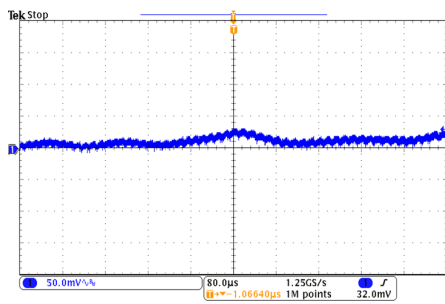
All test conditions are at 25°C The figures are identical for AGF-15S033



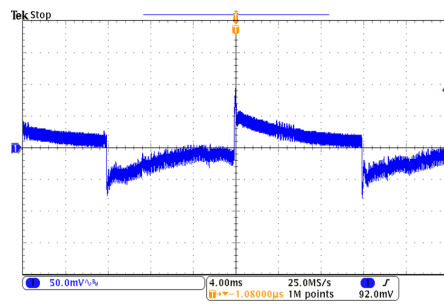
Efficiency Versus Output Current



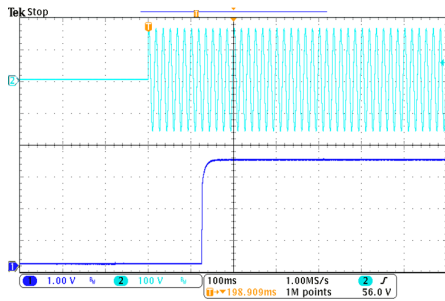
Efficiency Versus Input Voltage Full Load



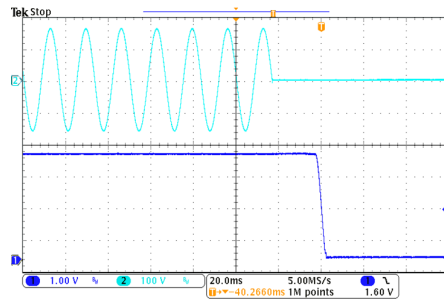
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



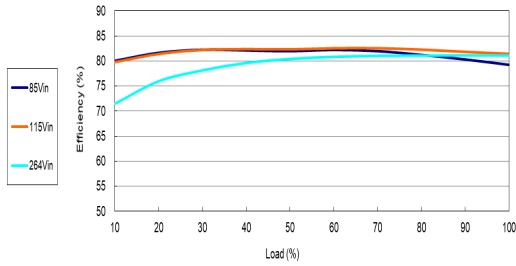
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



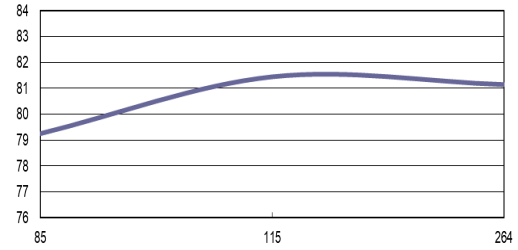
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

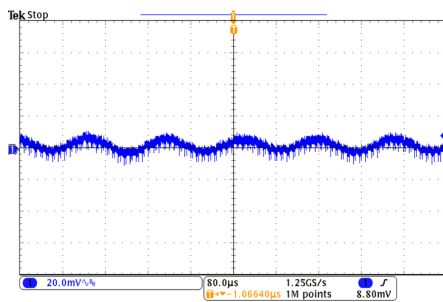
All test conditions are at 25°C The figures are identical for AGF-15S05



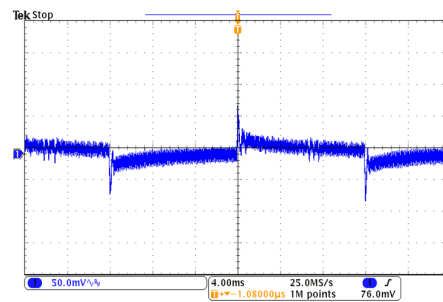
Efficiency Versus Output Current



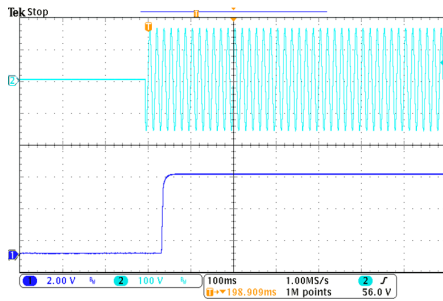
Efficiency Versus Input Voltage Full Load



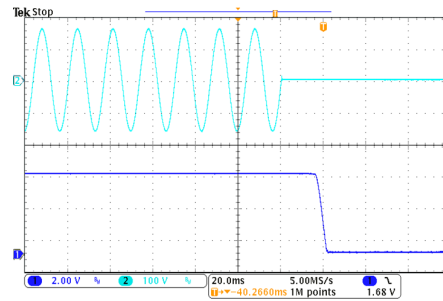
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



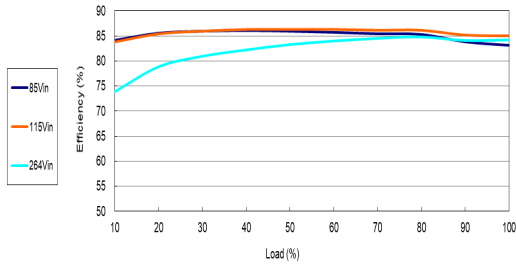
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



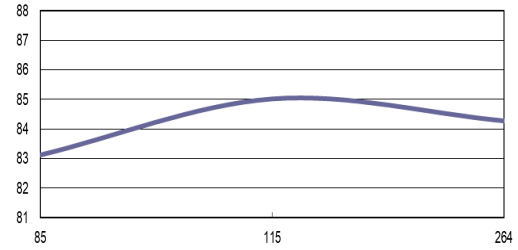
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

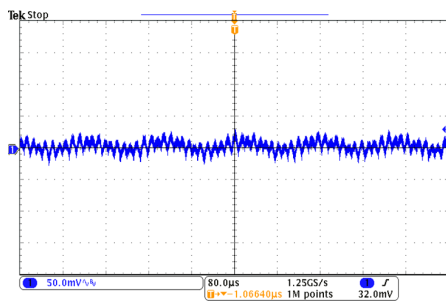
All test conditions are at 25°C The figures are identical for AGF-15S09



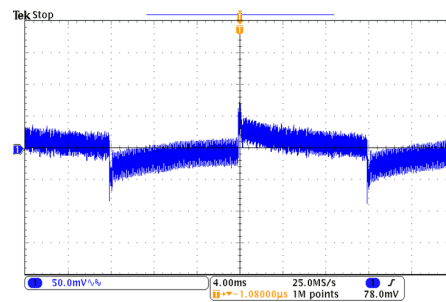
Efficiency Versus Output Current



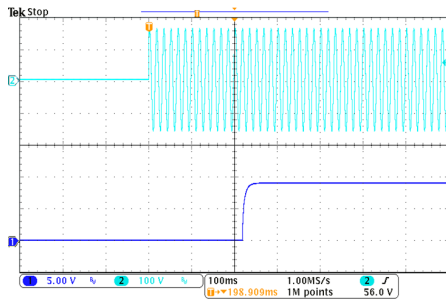
Efficiency Versus Input Voltage Full Load



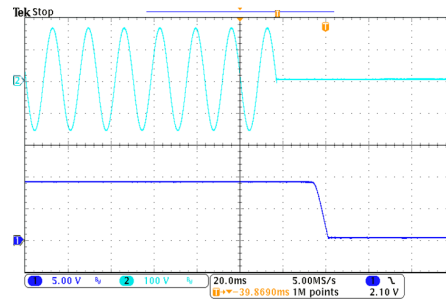
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



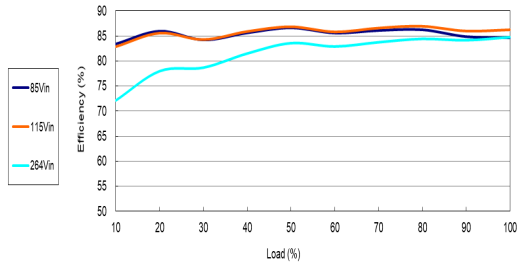
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



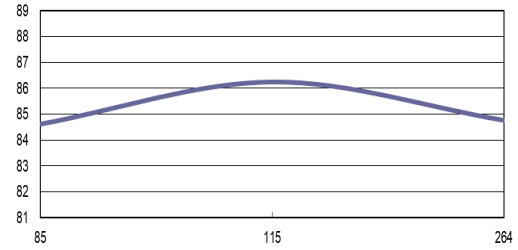
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

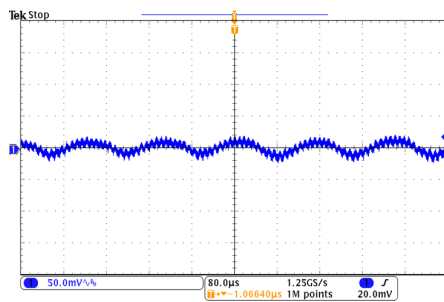
All test conditions are at 25°C The figures are identical for AGF-15S12



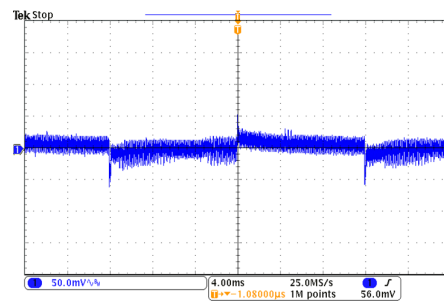
Efficiency Versus Output Current



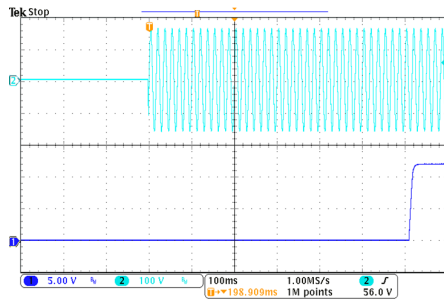
Efficiency Versus Input Voltage Full Load



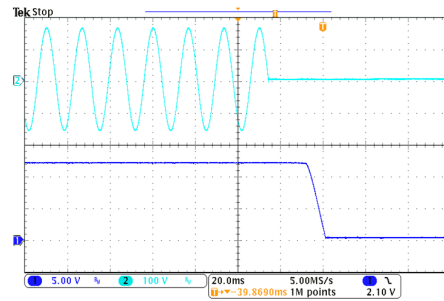
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



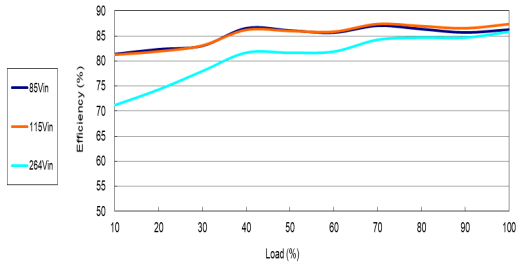
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



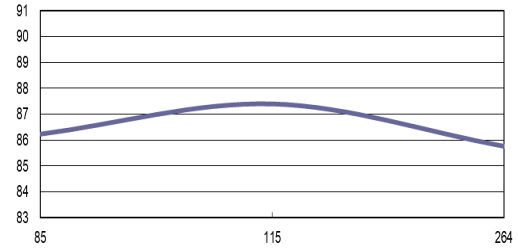
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

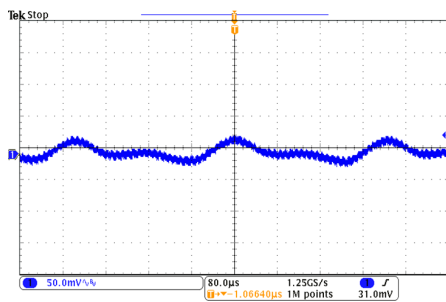
All test conditions are at 25°C The figures are identical for AGF-15S15



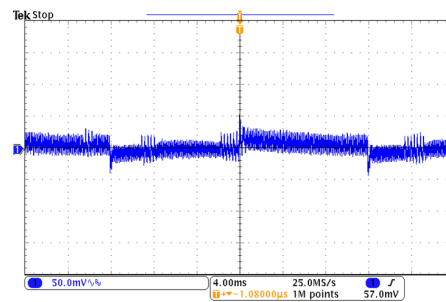
Efficiency Versus Output Current



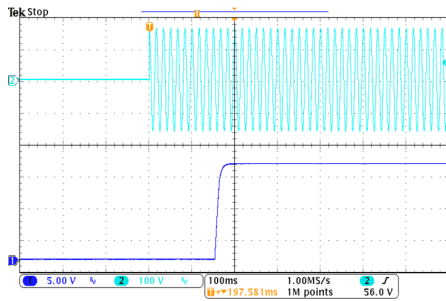
Efficiency Versus Input Voltage Full Load



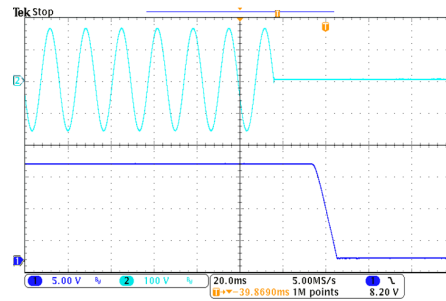
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



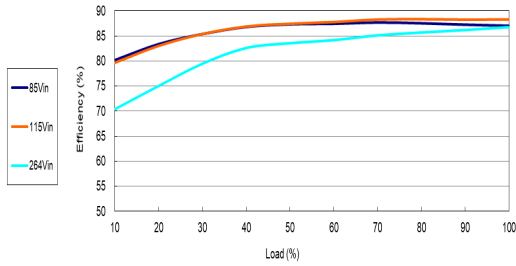
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



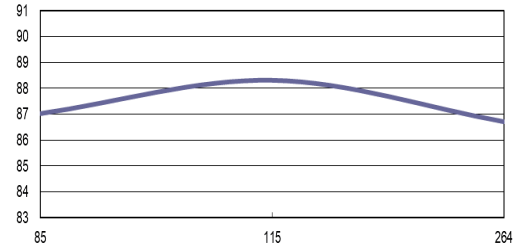
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

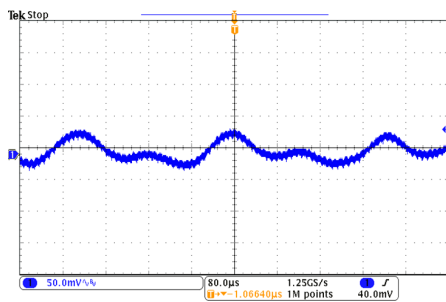
All test conditions are at 25°C The figures are identical for AGF-15S24



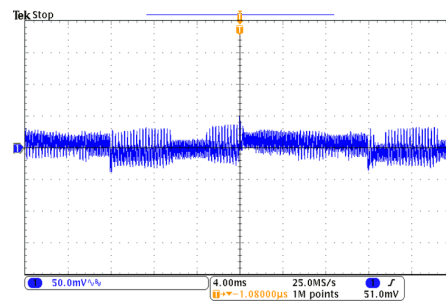
Efficiency Versus Output Current



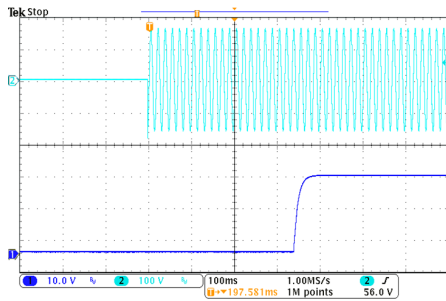
Efficiency Versus Input Voltage Full Load



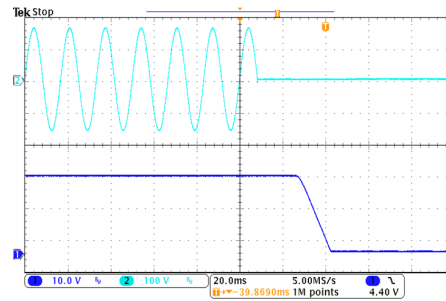
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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



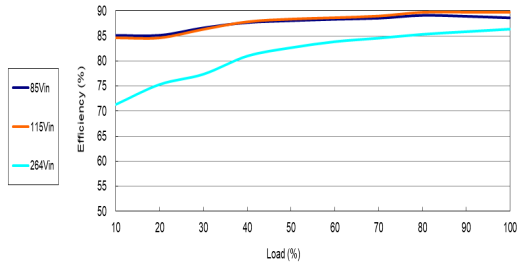
Typical Input Start-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



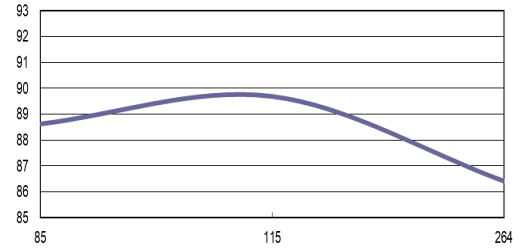
Typical Input Hold-up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load

Characteristic Curves

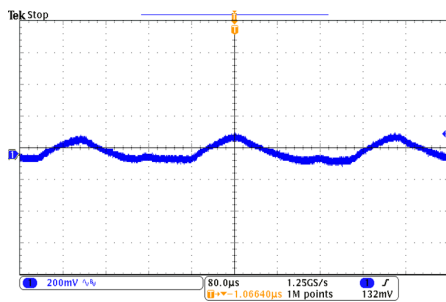
All test conditions are at 25°C The figures are identical for AGF-15S48



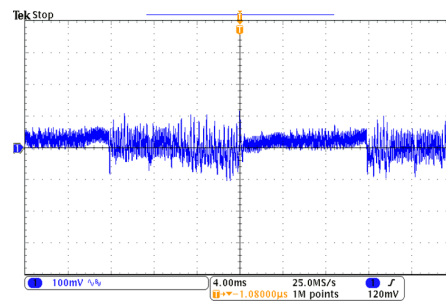
Efficiency Versus Output Current



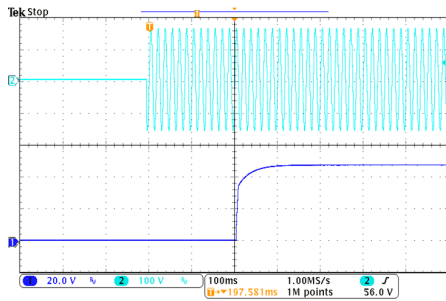
Efficiency Versus Input Voltage Full Load



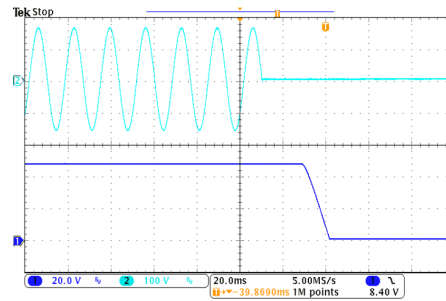
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



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

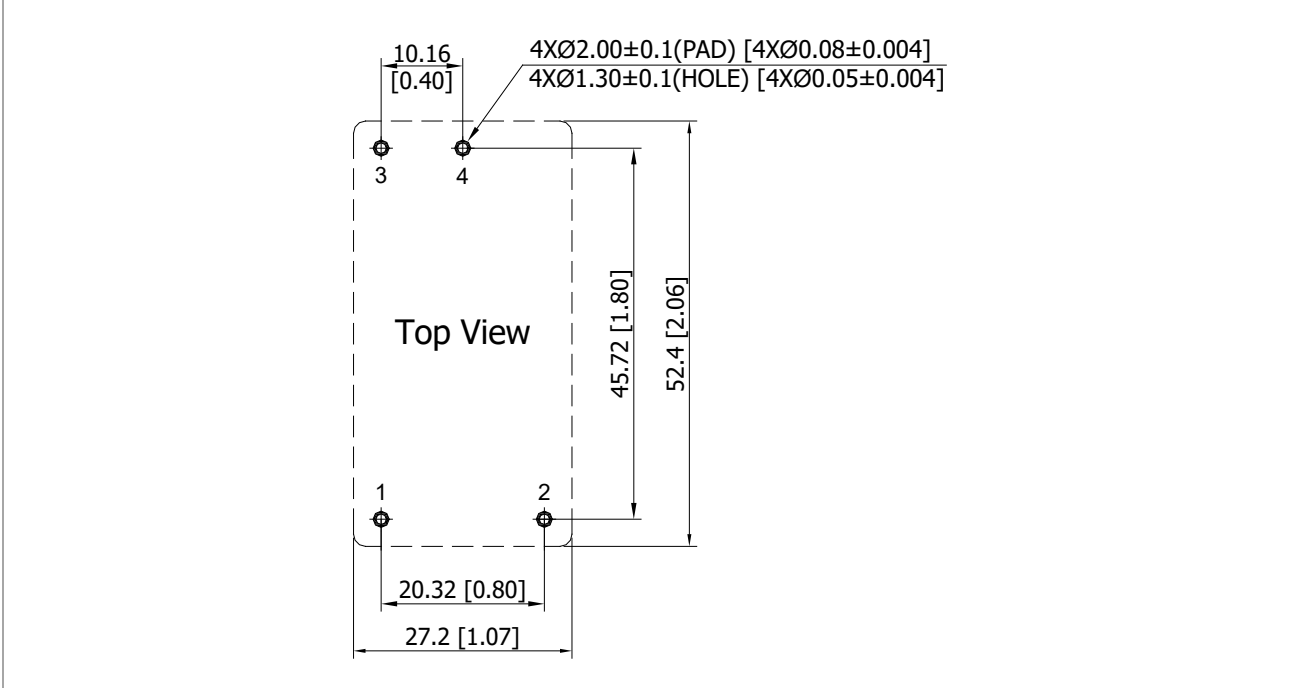
Package Specification

Mechanical Dimensions		Pin Connections																
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Pin</th> <th>Function</th> <th>Diameter mm (inches)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>AC(N)</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>2</td> <td>AC(L)</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>3</td> <td>+Vout</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>4</td> <td>-Vout</td> <td>∅ 1.0 [0.04]</td> </tr> </tbody> </table>	Pin	Function	Diameter mm (inches)	1	AC(N)	∅ 1.0 [0.04]	2	AC(L)	∅ 1.0 [0.04]	3	+Vout	∅ 1.0 [0.04]	4	-Vout	∅ 1.0 [0.04]	
Pin	Function	Diameter mm (inches)																
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3	+Vout	∅ 1.0 [0.04]																
4	-Vout	∅ 1.0 [0.04]																
		<ul style="list-style-type: none"> ▶ All dimensions in mm (inches) ▶ Tolerance: ±0.5 (±0.02) ▶ Pin diameter tolerance: X.X±0.1 (X.XX±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

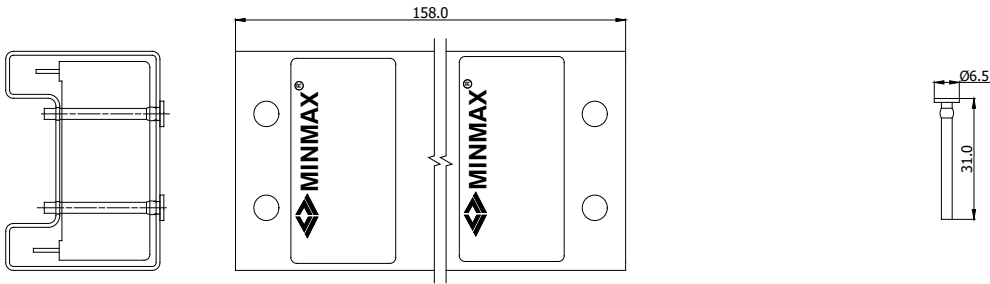
Recommended Pad Layout for Single & Dual Output Converter



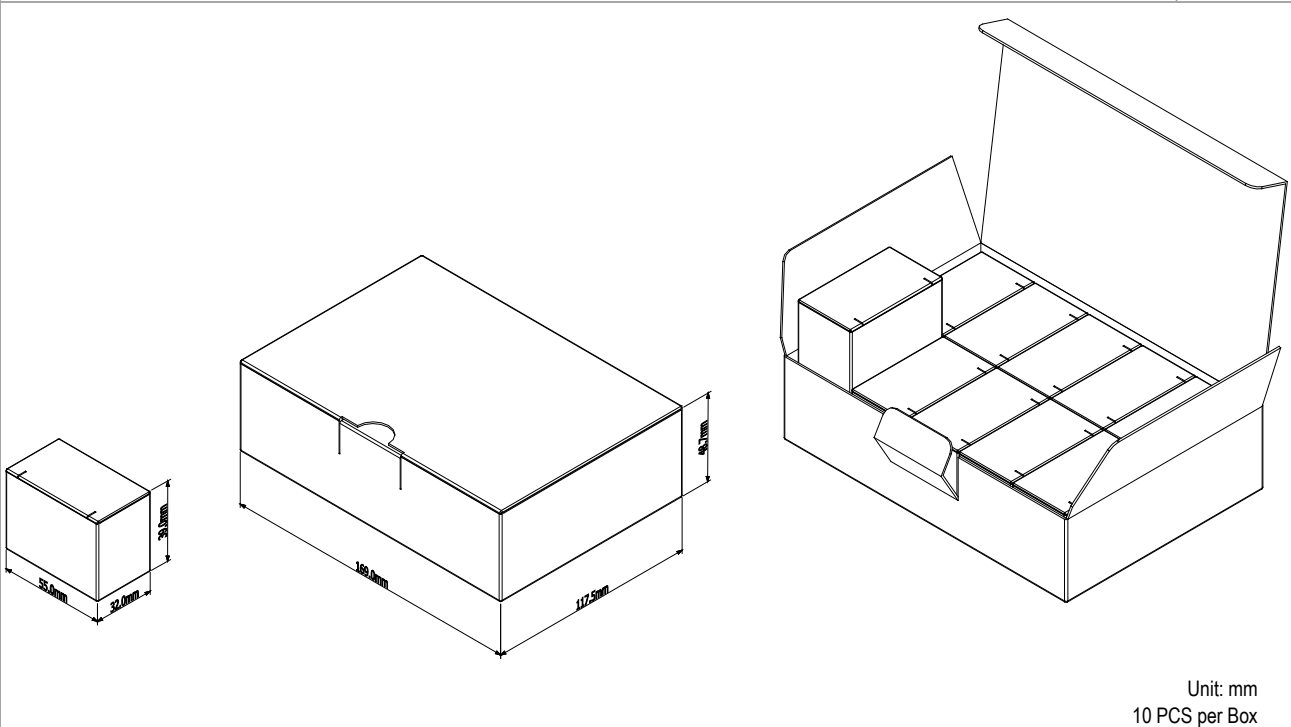
Packaging Information

Tube

Nail



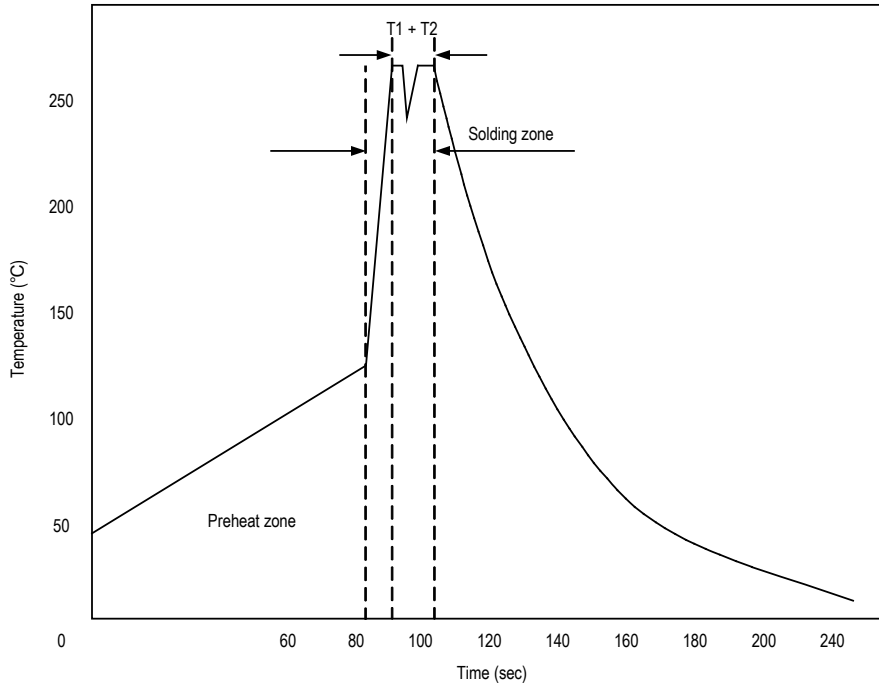
Unit: mm
5 PCS per TUBE



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																											
<u>AGF</u>	-	<u>15</u>	<u>S</u>																								
		Output Power 15 Watt	Output Quantity S: Single																								
			<table border="1"> <thead> <tr> <th colspan="3">Output Voltage</th> </tr> </thead> <tbody> <tr><td>033:</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> </tbody> </table>	Output Voltage			033:	3.3	VDC	05:	5	VDC	09:	9	VDC	12:	12	VDC	15:	15	VDC	24:	24	VDC	48:	48	VDC
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	