5ACFEW_3 series

5Watt AC-DC converter

AC-DC Converter 5 Watt

- Ultra-wide 85-305VAC & 70-430VDC input voltage range
- Accepts AC or DC input (dual-use of same terminal)
- Operating ambient temp. range -40°C to +85°C
- Multi application, flexible layout
- Compact size, high power density, green power Controllable life and adjustable cost
- No-load power consumption: 0.1W
- Output short circuit, over-current protection
- Designed to meet IEC/EN/UL62368, IEC/EN61558, IEC/EN60335 standards
- IEC/EN/UL62368 safety approval (Vertical mounting)
- EN62368 safety approval (Horizontal package)

5ACFEW_3 series is one of GAPTEC's highly efficient green power AC-DC Converter series. They feature wide input range accepting either AC or DC voltage, high reliability, low power consumption and reinforced isolation. All models are particularly suitable for industrial control, electric power, instrumentation and smart home applications which have high requirement for dimension and don't have high requirement on EMC. For extremely harsh EMC environment, we recommend using the application circuit show in Design Reference of this datasheet.

UL-62368-1 (E347551)

Common specifications

Short circuit protection:	Hiccup, continuous, self-recovery	
Operation temperature range:	-40°C to +85°C	
Storage temperature range:	-40°C to +105°C	
Storage humidity range:	< 95% RH	
Power derating:	+55°C to +85°C: 1.67%/°C MIN 85VAC - 100VAC: 1.33%/VAC MIN 277VAC - 305VAC: 0.72%/VAC MIN	
Safety standard:	IEC/EN/UL62368, IEC/EN60335, IEC/EN61558	
Safety Certification:	Vertical mounting Horizontal package	IEC/EN/UL62368 EN62368
Safety class:	Class II	
MTBF (MIL-HDBK-217F@25°C):	>1000,000 hours	
Cooling method:	Free air convection	
Dimension:	Vertical mounting Horizontal package	26.40 x 14.73 x 11.00 mm 27.84 x 11.60 x 17.60 mm
Weight:	Vertical mounting Horizontal package	5.2g (Typ.) 5.6g (Typ.)

Input specifications

Item	Operating Conditions	Min	Typ	Max	Units
Input voltage range	• AC Input • DC Input	85 70		305 430	VAC VDC
Input frequency		47		63	Hz
Input current	• 115VAC • 230VAC			0.2 0.1	A A
Inrush current	• 115VAC • 277VAC		20 40		A A
Recommended External Input Fuse	1A, slow-blow, required (The actual use needs to be selected according to the application enviroment)				
Hot Plug	Unavailable				

Isolation specifications

Item	Operating Conditions	Min	Typ	Max	Units
Isolation voltage (Input-output)	Electric Strength Test for 1min., leakage current < 5mA	3600 5000			VAC VDC

Output specifications

Item	Operating Conditions	Min	Typ	Max	Units
Output voltage accuracy*	10% - 100% load		±5		%
Line regulation	Rated load		±1.5		%
Load regulation	10% - 100% load		±3		%
Ripple & Noise*	20MHz Bandwidth (peak-peak value) 10% - 100% load		80	150	mV
Temperature drift	100% full load		±0.15		%/°C
Stand-by Power	230VAC		0.1	0.15	W
Over-current Protection	≥110% Io self-recovery				
Min. load		10			%

1. * The "parallel cable" method is used for ripple and noise test, please refer to AC-DC Converter Application Notes for specific information;
2. The product is able to work with 0%-10% load and with stable output.

Example:
5ACFEW_03S3
5 = 5Watt; AC = AC-DC; F = Open Frame; E = series; W = wide input
03 = 3Vout; S = single output; 3 = 3 kVAC isolation

Note:

1. External electrolytic capacitors are required to modules, more details refer to typical applications;
2. This part is open frame, at least 6.4mm creepage distance between the primary and secondary external components of the module is needed to meet the safety requirement, refer to the recommended welding hole design in the external dimension drawing;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta = 25°C, humidity <75%, nominal input voltage (115V and 230V) and rated output load;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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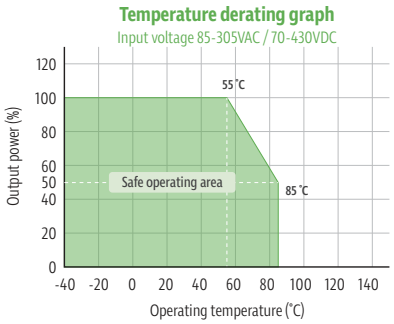
Electromagnetic Compatibility (EMC)				
Emissions	CE	CISPR32/EN55032 CLASS A (Application circuit 1, 4) CISPR32/EN55032 CLASS B (Application circuit 2, 3)		
Emissions	RE	CISPR32/EN55032 CLASS A (Application circuit 1, 4) CISPR32/EN55032 CLASS B (Application circuit 2, 3)		
Immunity	ESD	IEC/EN 61000-4-2	Contact ±6KV	perf. Criteria B
Immunity	RS	IEC/EN 61000-4-3	10V/m	perf. Criteria A
Immunity	EFT	IEC/EN 61000-4-4 IEC/EN 61000-4-4	± 2kV (see application circuit 1, 2) ± 4kV (see application circuit 3, 4)	perf. Criteria B perf. Criteria B
Immunity	Surge	IEC/EN 61000-4-5 IEC/EN 61000-4-5	line to line ±1KV (Application circuit 1, 2) line to line±2KV (Application circuit 3, 4)	perf. Criteria B perf. Criteria B
Immunity	CS	IEC/EN 61000-4-6	10 Vr.m.s	perf. Criteria A
Immunity	Voltage dip, short interruption and voltage variation	IEC/EN 61000-4-11	0%-70%	perf. Criteria B

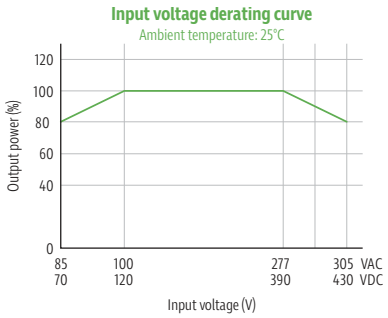
Product Selection Guide

Approval	Model	Power [W]	Output [Vo]	Output [Io]	Efficiency [%, typ]	Capacitive load [µF, max]
UL	5ACFEW_03S3	3.3	3.3V	1000mA	69	2200
UL	5ACFEW_05S3	5	5V	1000mA	76	1500
UL	5ACFEW_09S3	5	9V	560mA	77	680
UL	5ACFEW_12S3	5	12V	420mA	79	470
UL	5ACFEW_15S3	5	15V	340mA	79	330
UL	5ACFEW_24S3	5	24V	210mA	81	100

1. The nominal output voltage refers to the voltage applied to the load terminal after adding external circuits.
2. If the product is used in a severe vibration application, it needs to be glued and fixed.
3. Please add suffix „/L" for horizontal mounting version.

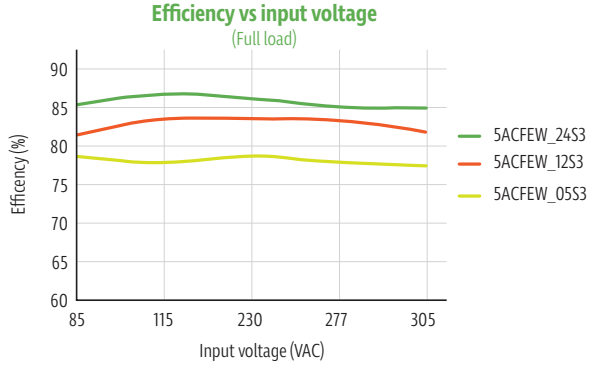
Product typical curve

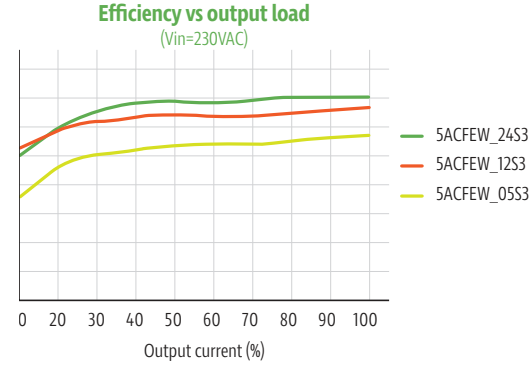




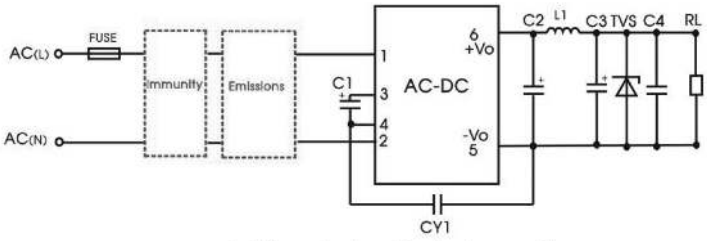
1. With an AC input between 85 -100VAC/277- 305VAC and a DC input between 70 - 120VDC/390 - 430VDC, the output power must be derated as per temperature derating curves;
2. This product is suitable for applications using natural air cooling; for applications in closed environment please consult us directly.

Efficiency





Typical application circuit



additional circuits design reference

Additional components selection guide (No EMC devices)

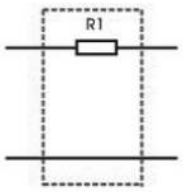
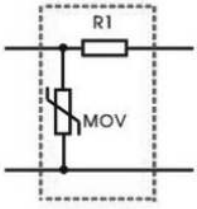
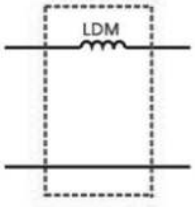
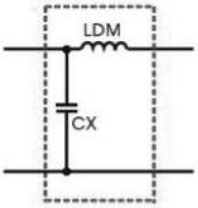
Model	C1 (required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
5ACFEW_03S3	10μF/450V (-25°C to +85°C, 85-305VAC input; -40°C to +85°C, 165-305VAC input) 22μF/450V (-40°C to +85°C, 85-305VAC input)	820μF/6.3V (solid-state capacitor)	4.7uH/60mΩ	100μF/35V	0.1μF/ 50V	1.0nF/ 400VAC	SMBJ7.0A
5ACFEW_05S3		470μF/16V (solid-state capacitor)					
5ACFEW_09S3		270μF/16V (solid-state capacitor)		47μF/35V			SMBJ12A
5ACFEW_12S3							SMBJ20A
5ACFEW_15S3		220uF/35V					
5ACFEW_24S3							SMBJ30A

Note:
1. C1 is used as filter capacitor with AC input (must be connected externally) and as EMC filter capacitor with DC input (must be connected), and it is recommended to use the capacitor with ripple current >200mA@100KHz.
2. We recommend using an electrolytic capacitor with high frequency and low ESR (ESR of C3 at low temperature of -40 ≤1.1Ω) rating for C3 (refer to manufacture's datasheet), electrolytic capacitor can be used for C2 when applied in normal and high temperature environments. Combined with C2, L1, they form a pi-type filter circuit. Choose a capacitor voltage rating with at least 20% margin, in other words not exceeding 80%. C4 is a ceramic capacitor, used for filtering high frequency noise.
3. A suppressor diode (TVS) is recommended to protect the application in case of converter failure and specification should be 1.2 times of the output voltage.
4. LDM (1.2mH, P/N: 12050373; 4.7mH, P/N: 12050305), L1 (4.7uH, P/N: 12050181).

Environmental Application EMC Solution

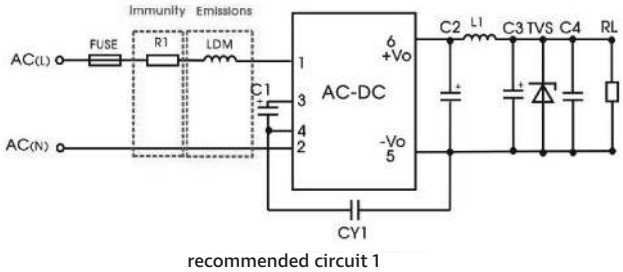
Environmental application EMC solution selection table

Recommended circuit	Application environmental	Typical industry	Input voltage range	Environment temperature (℃)	Emissions	Immunity
1	Basic application	None	85 ~ 305VAC	-40 to +85	CLASS A	CLASS III
2	Indoor civil environment	Smart home/Home appliances (2Y)		-25 to +55	CLASS B	CLASS III
	Indoor general environment	Intelligent building/Intelligent agriculture				
3	Indoor industrial environment	Manufacturing workshop		-25 to +55	CLASS B	CLASS IV
4	Outdoor general environment	ITS/Video monitoring/Charging point/Communication/Security and protection		-40 to +85	CLASS A	CLASS IV

Immunity design circuits for reference		Emissions design circuits for reference	
CLASS III	CLASS IV	CLASS A	CLASS B
			

Electromagnetic compatibility solution-recommended circuit

1. Application circuit 1 - Basic application

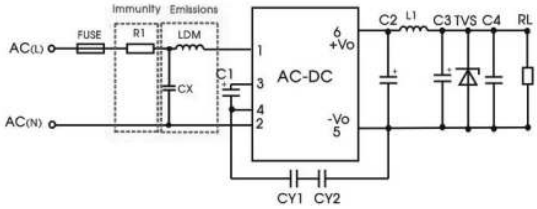


recommended circuit 1

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Basic application	-40°C to +85°C	CLASS III	CLASS A

Component	Recommended value
FUSE (required)	1A/300V, slow-blow
R1 (wire-wound resistor, required)	12Ω/3W
LDM	4.7mH/Max: 15Ω/Min: 0.2A
Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.	

2. Application circuit 2 - Indoor civil / Universal system recommended circuits for general environment



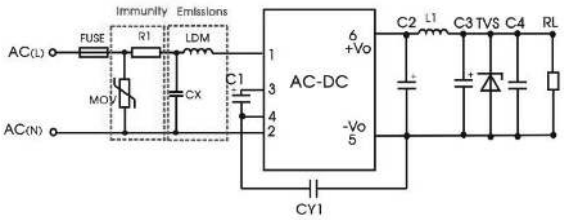
recommended circuit 2

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Indoor civil /general	-25°C to +55°C	CLASS III	CLASS B

Component	Recommended value
R1 (wire-wound resistor, required)	12Ω/3W
LDM	1.2mH/Max: 4.0Ω/Min: 0.2A
CX	0.1μF/310VAC
FUSE (required)	1A/300V, slow-blow

Note
1: In the home appliance application environment, the two Y capacitors of the primary and secondary need to be externally connected (CY1/CY2, value at 2.2nF/250VAC), which can meet the EN60335 certification.
2: According to the certification requirements, the X capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8MΩ, and the actual need to be selected according to the certification standard.
3: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.

3. Application circuit 3 - Universal system recommended circuits for indoor industrial environment



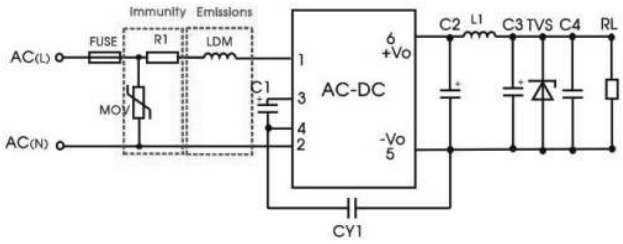
recommended circuit 3

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Indoor industrial	-25°C to +55°C	CLASS IV	CLASS B

Component	Recommended value
MOV	S14K350
CX	0.1μF/310VAC
LDM	1.2mH/Max: 4.0Ω/Min: 0.2A
R1 (wire-wound resistor, required)	12Ω/3W
FUSE (required)	1A/300V, slow-blow

Note
1: According to the certification requirements, the X capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8MΩ, and the actual need to be selected according to the certification standard.
2: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.

4. Application circuit 4 - Universal system recommended circuits for outdoor general environment



recommended circuit 4

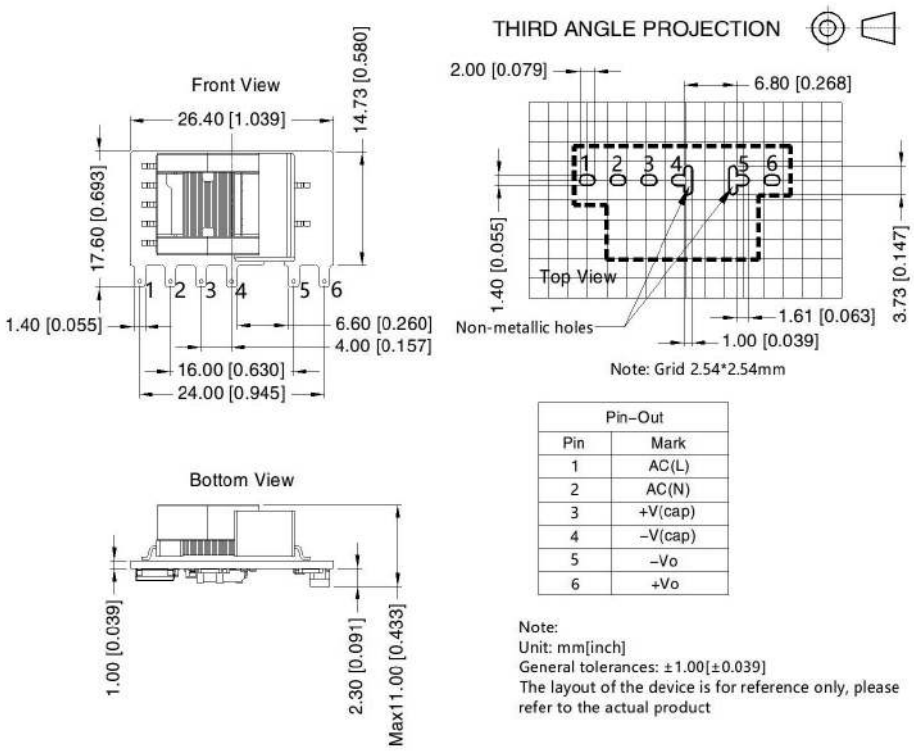
Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Outdoor general environment	-40°C to +85°C	CLASS IV	CLASS A

Component	Recommended value
MOV	S14K350
LDM	4.7mH/Max: 15Ω/Min: 0.2A
R1 (wire-wound resistor, required)	12Ω/3W
FUSE (required)	2A/300V, slow-blow

Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.

Mechanical dimensions

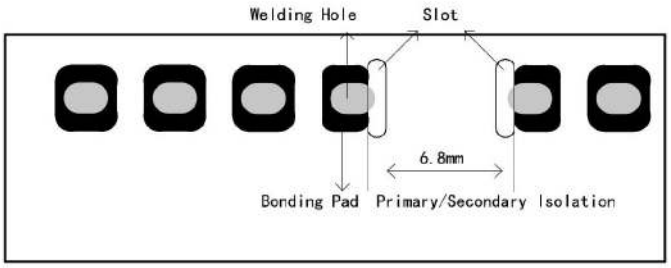
5ACFW_xxS3 series



Pin-Out	
Pin	Mark
1	AC(L)
2	AC(N)
3	+V(cap)
4	-V(cap)
5	-Vo
6	+Vo

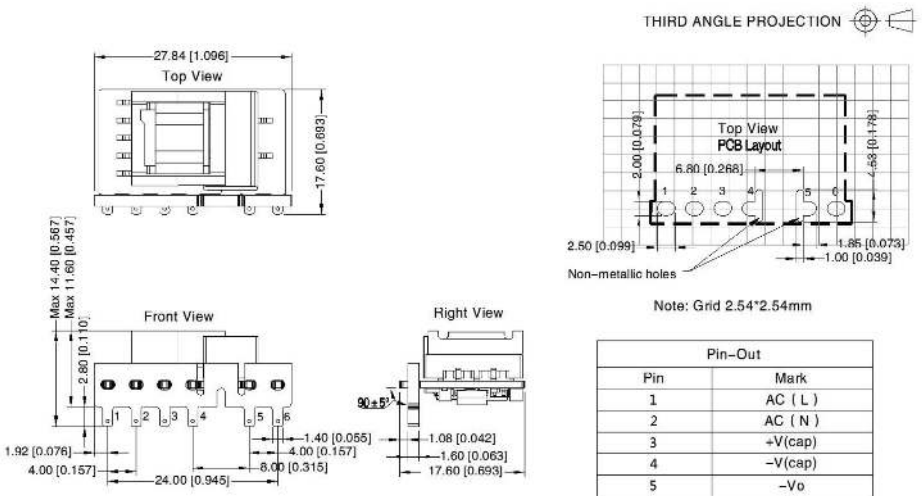
Note:
Unit: mm[inch]
General tolerances: ±1.00[±0.039]
The layout of the device is for reference only, please refer to the actual product

recommended pad



Mechanical dimensions (horizontal package)

5ACFW_xxS3 series



Note: Grid 2.54*2.54mm

Pin-Out	
Pin	Mark
1	AC (L)
2	AC (N)
3	+V(cap)
4	-V(cap)
5	-Vo
6	+Vo

Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 1.0[± 0.040]
The layout of the device is for reference only,
please refer to the actual product

recommended pad