

### FEATURES

- UL60950-1 recognised
- EN60950-1 certified
- UL60335-1 recognition pending
- ANSI/AAMI ES60601-1, 1 MOPP/2 MOOP's recognition pending
- Wide input voltage range 85-264VAC/ 70-400VDC
- Operating temperature range -40°C to 85°C
- 4kVAC isolation 'Hi Pot Test'
- 5V, 12V & 24V single regulated outputs
- Short circuit protection
- No optocoupler
- Low standby power

### PRODUCT OVERVIEW

The BAC1 series is the first series release from the BAC family of board mount AC/DC converters. The BAC1 series operates over the wide industrial temperature range of -40°C to +85°C, supporting operation in still air for the most demanding environments. All models deliver full power to 85°C, and operate from -40°C. The BAC1 has ultra low standby power consumption for demanding energy and cost saving applications.



### SELECTION GUIDE

Order Code	Output Power W	Output Voltage V	Output Current A	Ripple & Noise		Efficiency				Isolation Capacitance pF	MTTF <sup>1</sup>	
				Min.	Typ.	115V		230V			MIL 217	Telecordia
						Min.	Typ.	Min.	Typ.			
				mVp-p		%					kHrs	
<b>BAC1S05SC</b>	1	5	0.2	50	120	70	74	69	73	11	1613	36180
<b>BAC1S12SC</b>	1	12	0.083	60	120	70	74	69	73	11	2038	44328
<b>BAC1S24SC</b>	1	24	0.042	85	120	68	73	67	71	11	1815	40463

### INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	All input types	85	115/230	264	VAC
	All input types	70		400	VDC
Input frequency		47	50/60	63	Hz
Switching frequency	Nominal Vin = 115VAC		50		kHz
	Nominal Vin = 230VAC		40		
Input current	Nominal Vin = 115VAC		25		mA
	Nominal Vin = 230VAC		17		
Inrush current	Nominal Vin = 115VAC		6		A
	Nominal Vin = 230VAC		9		
Input leakage current	230VAC		1		µA
Stand by power	BAC1S05SC	115V		19.5	mW
		230V		60.8	
	BAC1S12SC	115V		58.1	
		230V		67.8	
	BAC1S24SC	115V		25.7	
		230V		80.8	

### ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation test voltage	Production tested for 1 second	4000			VAC
	Qualification tested for 1 minute	4000			
Resistance	Viso = 1000VDC	100			MΩ

### OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Minimum load		5			%
Initial voltage accuracy	5V output types			±5	%
	All other output types			±4	
Line regulation	Low line to high line	5V output types		±0.3	%
		All other output types		±0.1	
Load Regulation	10% total load to 100% total load	12V output type	230VAC	±0.2	%
		All other output types		±0.1	
		115VAC & 230VAC		±1.5	
Total regulation	Includes line, load, temperature and drift			±5	%
Temperature coefficient				0.05	%/°C
Transient Response	Peak deviation - Single Output (50-75% & 75-50% swing)	BAC1S05SC		±4	%Vout
		BAC1S12SC		±3	
		BAC1S24SC		±2	
	Settling time (within 1% Vout Nom.)	24V output type		8	ms
		All other output types		6	
Current limit inception	Auto-recovery	150		280	%

1. Calculated using MIL-HDBK-217F FN2 and Telecordia SR-332 calculation model at TA=25°C with nominal input voltage at full load. All specifications typical at TA=25°C, nominal input voltage, rated output current and recommended components unless otherwise specified.

OUTPUT CHARACTERISTICS (continued)						
Parameter	Conditions		Min.	Typ.	Max.	Units
Hold up time	from power fail	115VAC		50		ms
		230VAC		240		

TEMPERATURE CHARACTERISTICS						
Parameter	Conditions		Min.	Typ.	Max.	Units
Operation	Sealed box with no air flow		-40		85	°C
Storage			-40		125	
Product temperature rise above ambient					16	

ABSOLUTE MAXIMUM RATINGS	
Short-circuit protection	Continuous
Lead temperature 1.0mm from case for 7 seconds (to JEDEC JESD22-B106 ISS E)	270°C

## EMC STANDARDS

Conducted input noise	EN55032, Class B with external X cap
Radiated noise	EN55032, Class B
ESD immunity	IEC/EN61000-4-2 level 3 perf criteria A
Conducted transient immunity	EN61000-4-6, 10 Vrms, perf criteria A
Conducted surge immunity	EN61000-4-5, Installation class 3, perf criteria A
EFT/Burst	EN61000-4-4, level 3, perf criteria A
Radiated field immunity	EN61000-4-3, 10 V/m, perf criteria A
Dips and interruptions	EN61000-4-11, 100% reduction for 20ms (A), 60% reduction for 200ms (A), 30% reduction for 500ms (A), 100% reduction for 5s (B)
Magnetic fields	EN61000-4-8 30A/m, perf criteria A

## TECHNICAL NOTES

### ISOLATION VOLTAGE

'Hi Pot Test', 'Flash Tested', 'Withstand Voltage', 'Proof Voltage', 'Dielectric Withstand Voltage' & 'Isolation Test Voltage' are all terms that relate to the same thing, a test voltage, applied for a specified time, across a component designed to provide electrical isolation, to verify the integrity of that isolation.

Murata Power Solutions BAC1 series of AC-DC converters are all 100% production tested at their stated isolation voltage. This is 4kVAC for 1 seconds.

A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?"

The BAC1 series has been recognised by Underwriters Laboratory to 264VAC for Reinforced Insulation.

The BAC1 series has been certified by Demko to 264VAC for Reinforced Insulation.

### REPEATED HIGH-VOLTAGE ISOLATION TESTING

It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. 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.

## SAFETY APPROVAL

### ANSI/AAMI ES60601-1

The BAC1 series is pending recognition by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 2 MOOP (Means Of Operator Protection) and 1 MOPP (means of patient protection) based upon a working voltage of 264VAC max., between Primary and Secondary. File number E202895 applies.

### EN60950-1

The BAC1 series has been certified by Demko (D) to EN60950 for reinforced insulation to a working voltage of 264VAC. File number E151252 applies.

### UL60950-1

The BAC1 series has been recognised by Underwriters Laboratory (UL) to UL60950 for reinforced insulation to a working voltage of 264VAC. File number E151252 applies.

Creepage and clearance 8mm  
Working altitude OVC II 5000m  
Working altitude OVC III 2000M

### UL60335-1

The BAC1 series is pending recognition by Underwriters Laboratory (UL) to UL60335-1.

### FUSING

As stated in the application notes, to meet datasheet specifications it is required that a 1W 10Ω fusible resistor is fitted.

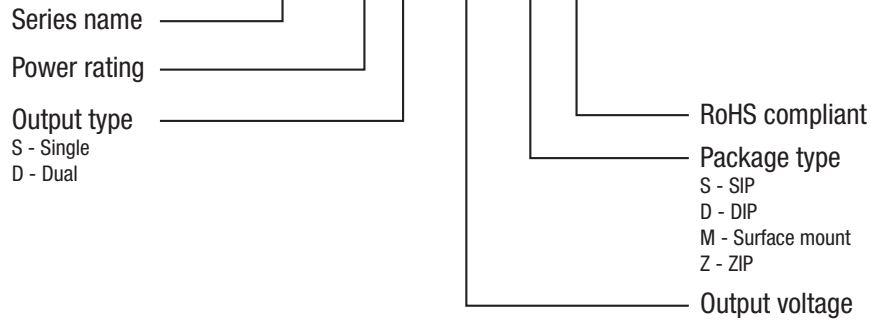
## RoHS COMPLIANCE INFORMATION



This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds based on JEDEC JESD22-A111-A. The pin termination finish on this product series is Hot Dipped over Matte Tin with Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems. For further information, please visit [www.murata-ps.com/rohs](http://www.murata-ps.com/rohs)

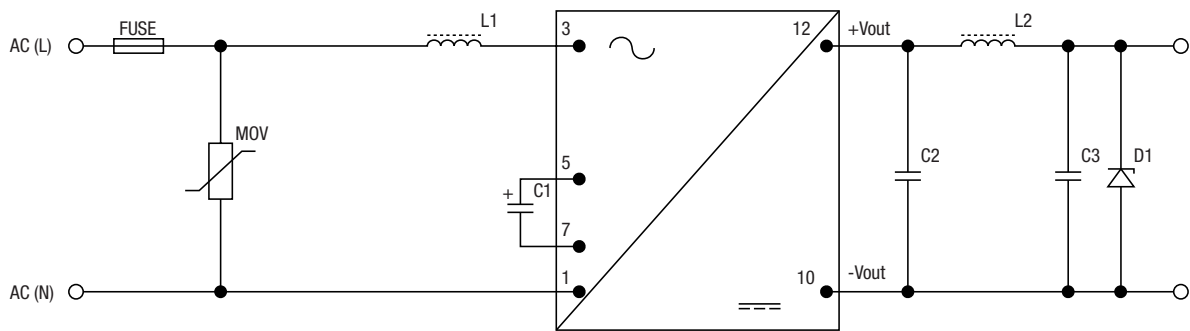
## PART NUMBER STRUCTURE

**BAC 1 S XX S C**



## APPLICATION NOTES

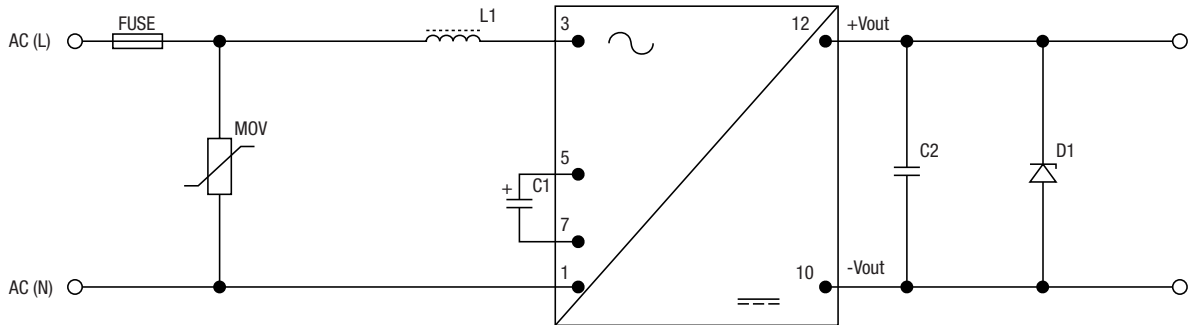
Components required to meet datasheet specifications - 5V output types



FUSE	1W 10Ω fusible resistor
MOV	Component fitted for compliance with EN61000-4-5, Installation class 3, perf criteria A
L1	330μH
C1	6.8μF 400V
C2	68μF 20mΩ low ESR polymer
L2	6.8μH 84682C
C3	22μF
D1	SMBJ7.0A transient voltage suppressor - component fitted for overshoot protection

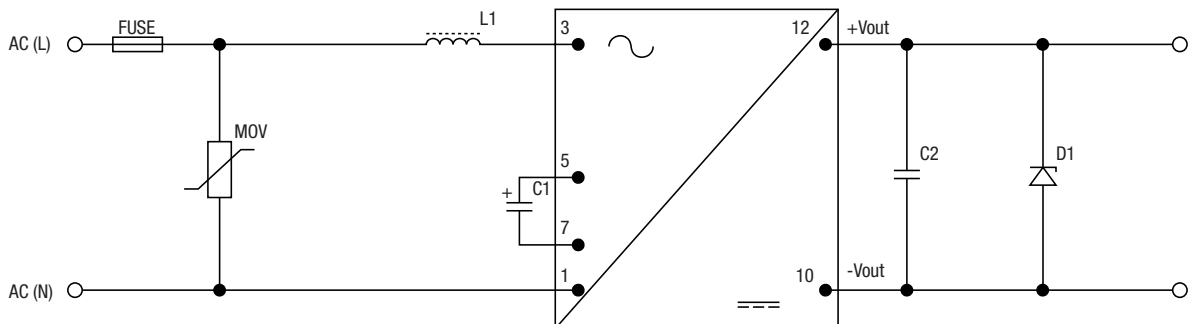
**APPLICATION NOTES (continued)**

Components required to meet datasheet specifications - 12V output types



FUSE	1W 10Ω fusible resistor
MOV	Component fitted for compliance with EN61000-4-5, Installation class 3, perf criteria A
L1	330μH
C1	6.8μF 400V
C2	68μF 20mΩ low ESR polymer
D1	SMBJ7.0A transient voltage suppressor - component fitted for overshoot protection

Components required to meet datasheet specifications - 24V output types



FUSE	1W 10Ω fusible resistor
MOV	Component fitted for compliance with EN61000-4-5, Installation class 3, perf criteria A
L1	330μH
C1	6.8μF 400V
C2	47μF 25mΩ low ESR polymer
D1	SMBJ30A transient voltage suppressor - component fitted for overshoot protection

**Advisory Notes**

The BAC1 series is not hermetically sealed, customers should ensure that parts are fully dried before input power application.

## APPLICATION NOTES (continued)

### Output Capacitance and start-up times

The recommended specified caps on page 4 and 5 can already meet datasheet specification, there is no need to add extra caps. However, if customers connects to load capacitance, the below load capacitance are max (additional to recommended specified caps) to ensure start up at minimum AC input.

Part No.	Maximum Load Capacitance (per output)	Start-up times (AC input)	Start-up times (DC input)
	$\mu\text{F}$	s	s
<b>BAC1S05SC</b>	220	0.5	5
<b>BAC1S12SC</b>	100	1	5
<b>BAC1S24SC</b>	100	1	5

### Minimum Load

The minimum load to meet full datasheet specification is 5% of the full rated load across the specified input voltage range.

### 24V output type - minimum input voltage requirements

At -40C the part is guaranteed to start into 100% load with a minimum input voltage of 115Vac; once the product is operating, the product will continue to operate at lower input voltages with higher output loading.

The product will start at -40C with 80% or lower load with an input voltage of 100VAC; once the product is operating, the product will continue to operate at lower input voltages with higher output loading.

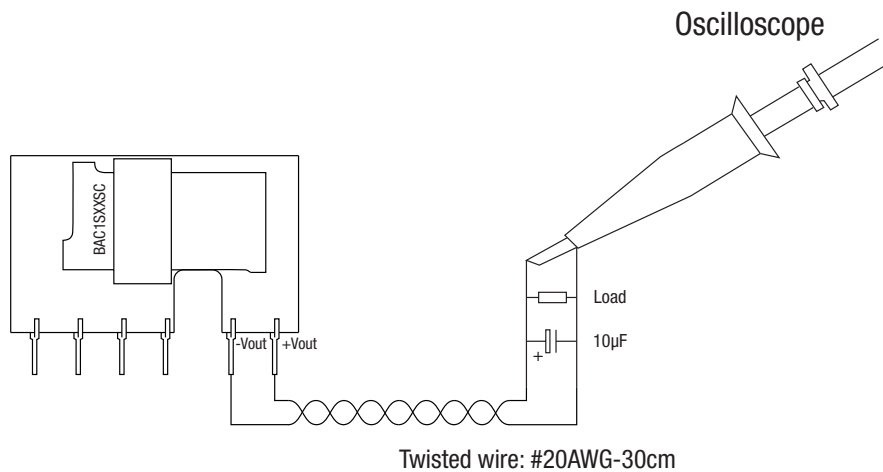
## CHARACTERISATION TEST METHODS

### Ripple & Noise Characterisation Method

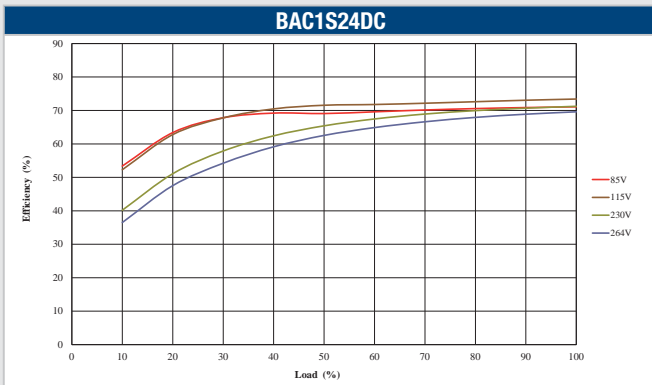
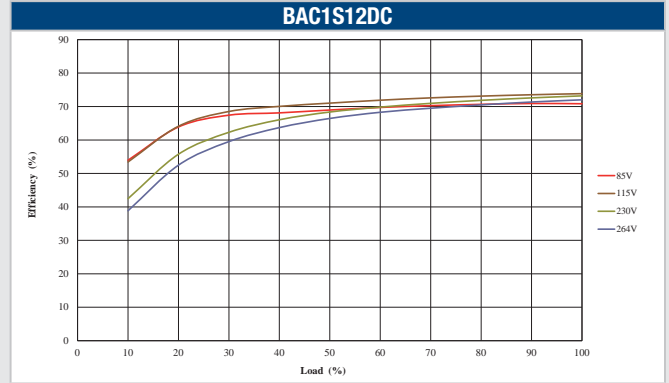
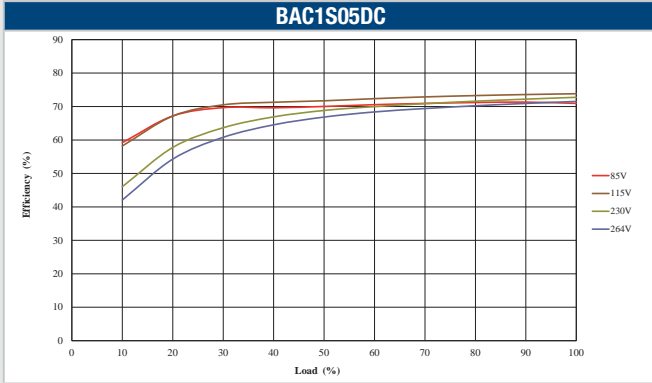
Ripple and noise measurements are performed with the following test configuration.

C1 10 $\mu\text{F}$  electrolytic capacitor

### Differential Mode Noise Test Schematic



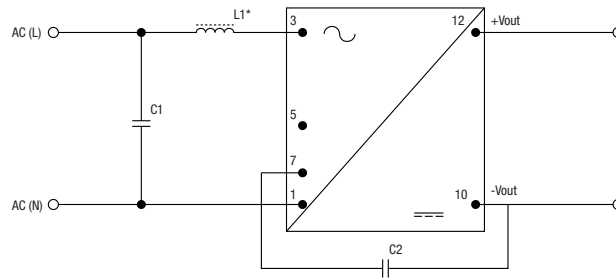
**EFFICIENCY VS LOAD**



**EMC FILTERING AND SPECTRA**

**FILTERING**

The following filter circuit and filter table shows the input filters typically required to meet EN55032 Quasi-Peak (green line) Curve B limit vs peak conducted emissions.

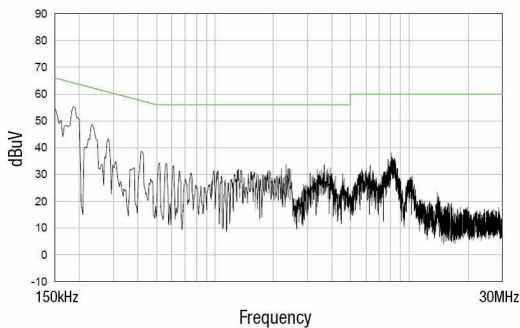


**5V and 12V output types**

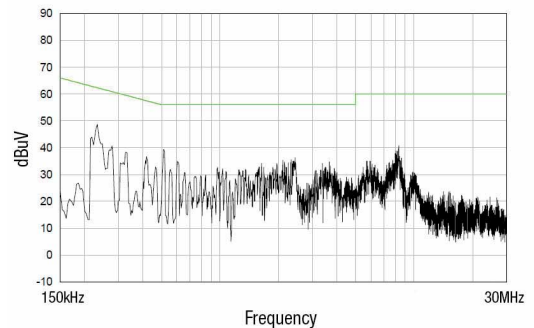
Component	Description
<b>C1</b>	68nF 275VAC
<b>L1</b>	refer to "components required to match datasheet specifications"
<b>C2</b>	100pF Y-cap

Components marked with an asterisk are already fitted and should not be duplicated

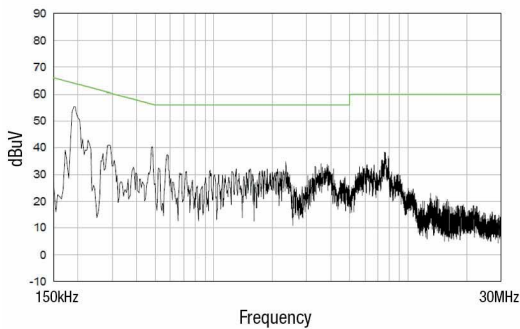
**BAC1S05SC (110V) - Live**



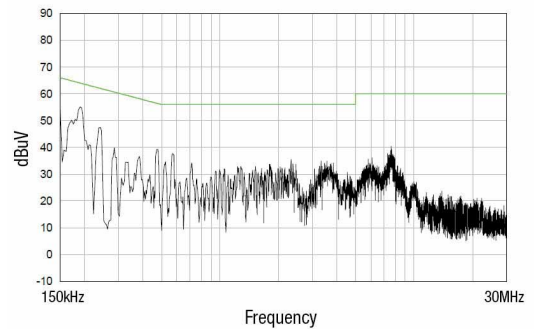
**BAC1S05SC (110V) - Neutral**



**BAC1S12SC (110V) - Live**



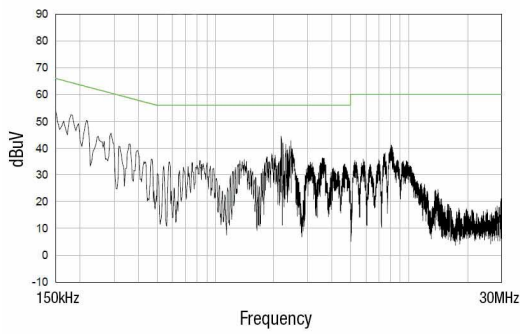
**BAC1S12SC (110V) - Neutral**



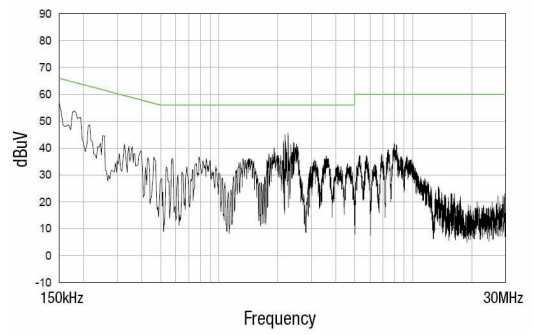


**EMC FILTERING AND SPECTRA (continued)**

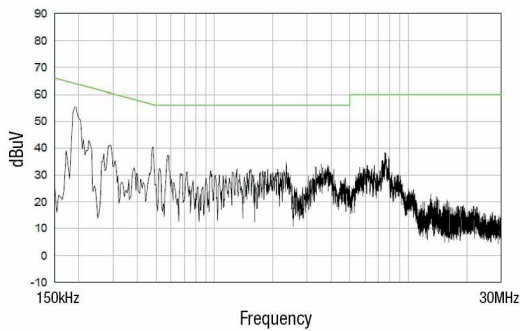
**BAC1S05SC (230V) - Live**



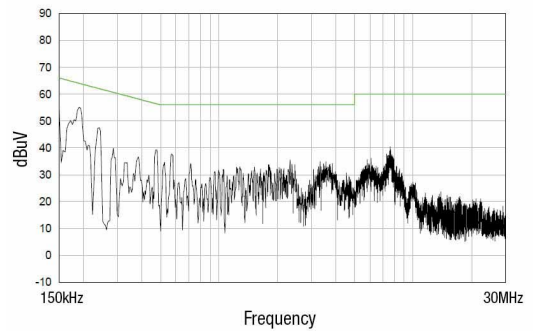
**BAC1S05SC (230V) - Neutral**



**BAC1S12SC (230V) - Live**



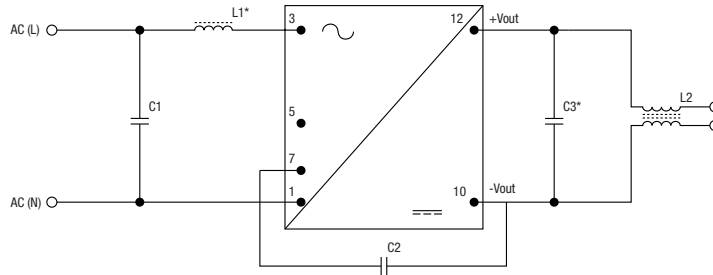
**BAC1S12SC (230V) - Neutral**



**EMC FILTERING AND SPECTRA (continued)**

**FILTERING**

The following filter circuit and filter table shows the input filters typically required to meet EN55032 Quasi-Peak (green line) Curve B peak conducted emissions.

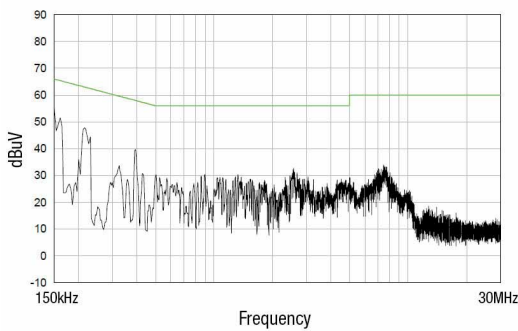


**BAC1S24SC**

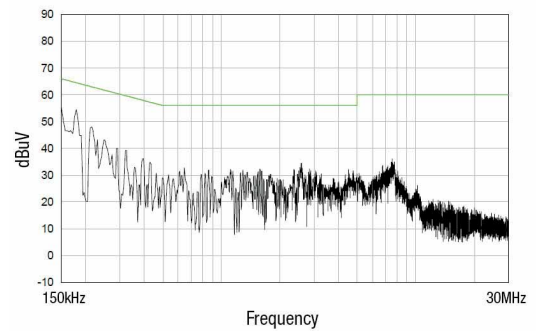
Component	Description
<b>C1</b>	68nF 275VAC
<b>L1</b>	refer to "components required to match datasheet specifications"
<b>C2</b>	100pF Y-cap
<b>C3</b>	refer to "components required to match datasheet specifications"
<b>L2</b>	DLW21SN261SQ2L

Components marked with an asterisk are already fitted and should not be duplicated

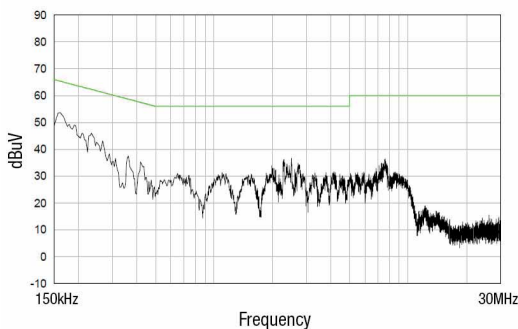
**BAC1S24SC (110V) - Live**



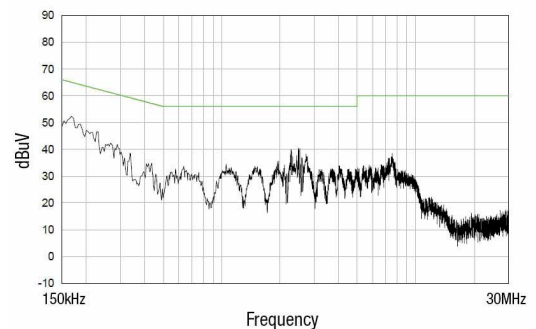
**BAC1S24SC (110V) - Neutral**



**BAC1S24SC (230V) - Live**

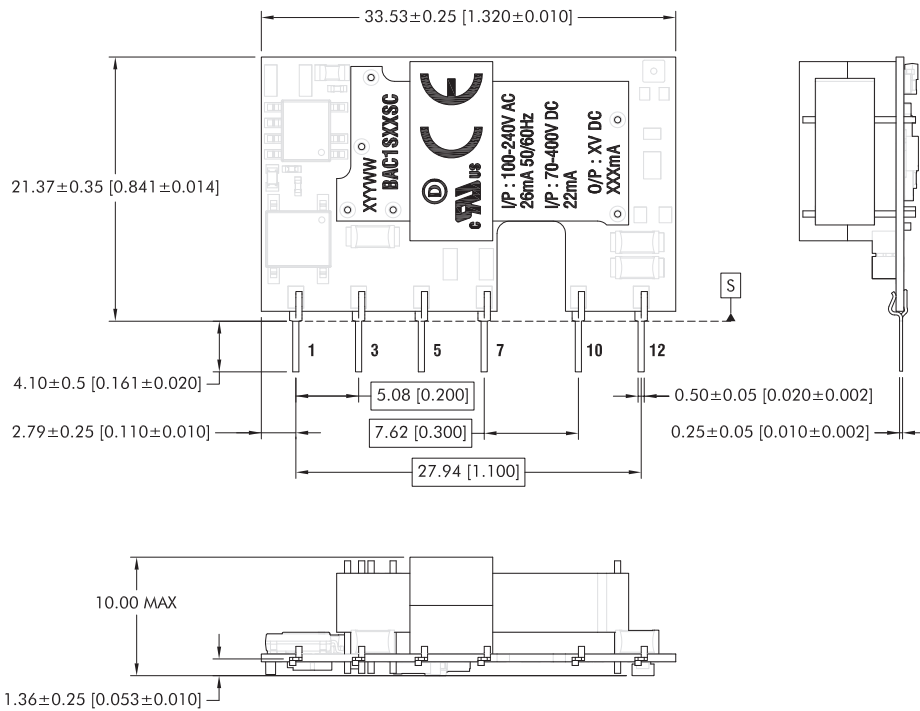


**BAC1S24SC (230V) - Neutral**



## PACKAGE SPECIFICATIONS

### MECHANICAL DIMENSIONS



All dimensions in mm (inches) Controlling dimension is mm.  
All pins on a 2.54 (0.100) pitch and within ±0.1 (0.004) of true position from pin 1 at seating plane 'S'

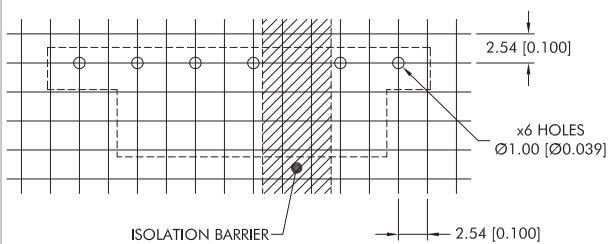
Weight:6.2g

### PIN CONNECTIONS

#### Pin Output

Pin	Function
1	AC (N)
3	AC (L)
5	+Vin
7	-Vin
10	-Vout
12	+Vout

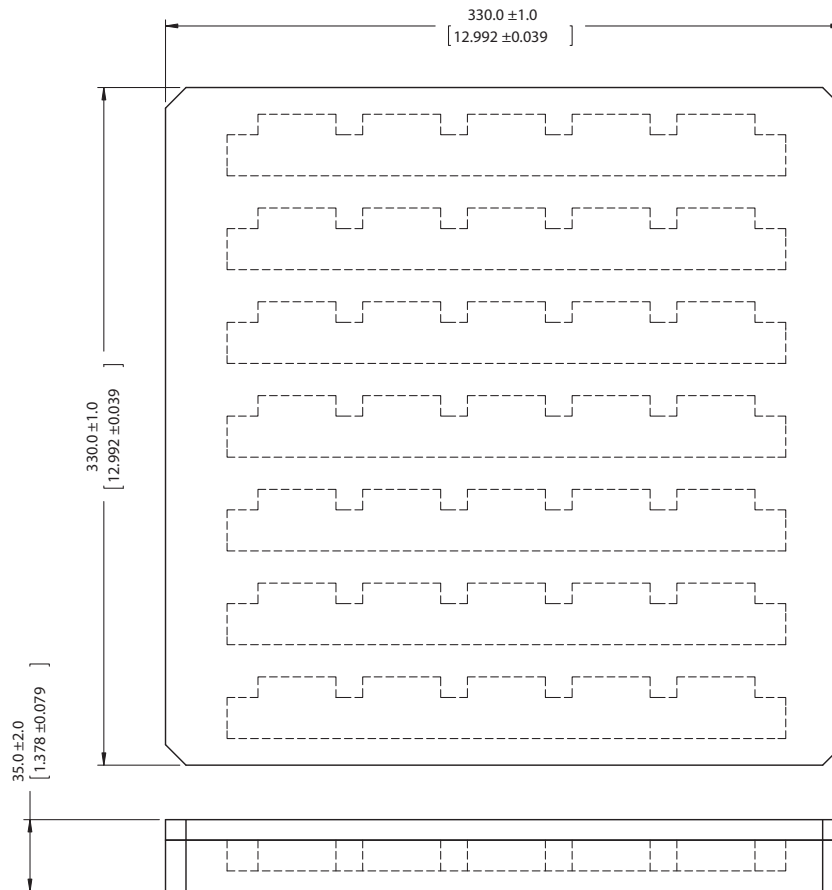
### RECOMMENDED FOOTPRINT DETAILS



All dimensions in mm ±0.25mm (inches ±0.01).

**PACKAGING SPECIFICATIONS (continued)**

TRAY OUTLINE DIMENSIONS



EPE Tray/Lid  
Quantity: 35

All dimensions in mm (inches) Controlling dimension is mm.



This product is subject to the following **operating requirements** and the **Life and Safety Critical Application Sales Policy**:

Refer to: <http://www.murata-ps.com/requirements/>

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