1S4AE_1.5UP series

1W, Fixed input voltage, isolated & unregulated single output DC-DC Converter

3.3Vin DC-DC Converter 1 Watt

- Continuous short-circuit protection
- No-load input current as low as 8mA
- Operating ambient temp. range: -40°C to +105°C
- High efficiency up to 80%
- I/O isolation test voltage 1.5kVDC
- Industry standard pin-out

The 1S4AE_1.5UP series is especially designed for distributed power supply systems where an isolated voltage is required. They are suitable for occasions of: pre-interference isolation, ground interference elimination, pure digital circuit, voltage isolation conversion, general low frequency analog circuit, relay drive circuit, etc.

Common specifications

Short Circuit Protection	Continuous, self-recovery	
Operating Temperature	-40 ~ 105°C; Derating if the temperature ≥85°C, (see Fig. 2)	
Storage Temperature	-55 ~ 125°C	
Casing Temperature Rise	Ta=25°C; 25 °C	
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	300°C
Storage Humidity	Non-condensing	95 %RH
Switching Frequency	100% load, nominal input voltage	20KHz
MTBF	3500,000h (MIL-HDBK-217F@25 °C)	
Casing Material	Black flame-retardant and heat-resistant plastic (UL94 V-0)	
Package Dimensions	11.60x6.00x10.16mm	
Weight	1.3g(Typ.)	
Cooling methods	Free air convection	

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage	Input-output electric strength test for l minute with a leakage current of l mA max.	1500			VDC
Isolation resistance	Input-output resistance at 500VDC	1000			MΩ
Isolation capacitance	Input-output capacitance at l00kHz/0. l V		20		pF

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input current (full load / no-load)	• 3.3/5VDC output • Others output		405/8 379/8	427/- 399/-	mA mA
Reflected ripple current*			30		mA
Surge Voltage (1sec. max.)		-0.7		5	VDC
Input filter	Capacitor filter				
Hot plug	Unavailable				

* Refer to DC-DC Converter Application Notes for detailed description of reflected ripple current test method.

Output specifications

Item	Test condition	Min	Typ	Max	Units
Output voltage accuracy	See output regulation curve (Fig. l)				
Line regulation	Input voltage change: ±1% • 3.3VDC output • Others			1.5 1.2	% %
Load regulation	10% to 100% load • 3.3VDC output • Others		30 50	75 100	% %
Ripple & Noise*	20MHz Bandwidth • 3.3/5/9/l2/5VDC output • 24VDC output		30 50	75 100	mVp-p mVp-p
Temperature Drift Coefficient	100% load		±0.02		%/°C

Note: • The ‚parallel cable' method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information.

EMC specifications

Emissions	CE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
Emissions	RE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
Immunity	ESD	IEC/EN61000-4-2	Contact ±6kV perf. Criteria B

Example:

1S4AE_ 0305S1.5UP

1 = 1Watt; S4 = SIP4; A = Pinning; E = Cost effective; 3 = 3.3Vin; 05 = 5Vout; S = Single Output; 1.5 = 1.5kVDC; U = Unregulated output; P = Short circuit protection

Note:

1. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta = 25°C, humidity <75%RH with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on our Company's corporate standards;
4. 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. Classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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Product Selection Guide

Part Number	Certification	Input Voltage [VDC] Nominal	Input Voltage [VDC] Range	Output Voltage [VDC]	Output Current [mA, Max./Min]	Efficiency(2) [%, Min./Typ.] @ Full Load	Capacitive load [µF, Max]
1S4AE_0303S1.5UP		3.3	2.97-3.63	3.3	303/30	71/75	2400
1S4AE_0305S1.5UP		3.3	2.97-3.63	5	200/20	76/80	2400
1S4AE_0312S1.5UP		3.3	2.97-3.63	9	111/12	76/80	1000
1S4AE_0312S1.5UP		3.3	2.97-3.63	12	83/8	76/80	560
1S4AE_0315S1.5UP		3.3	2.97-3.63	15	67/7	76/80	560
1S4AE_0324S1.5UP		3.3	2.97-3.63	24	42/4	76/80	220

Typical Characteristic Curves

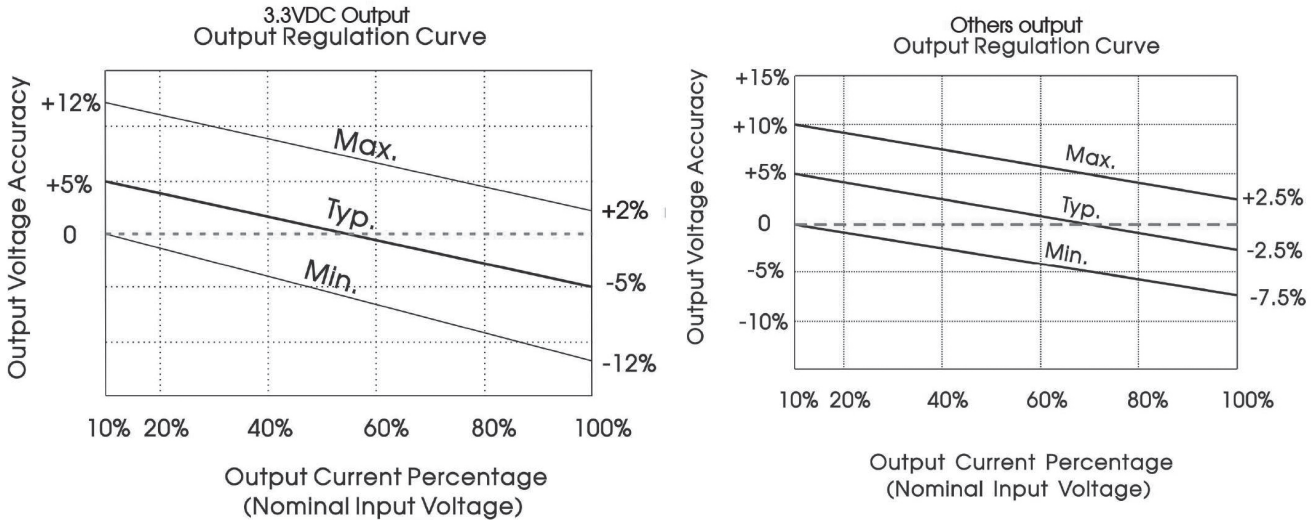


Fig.1

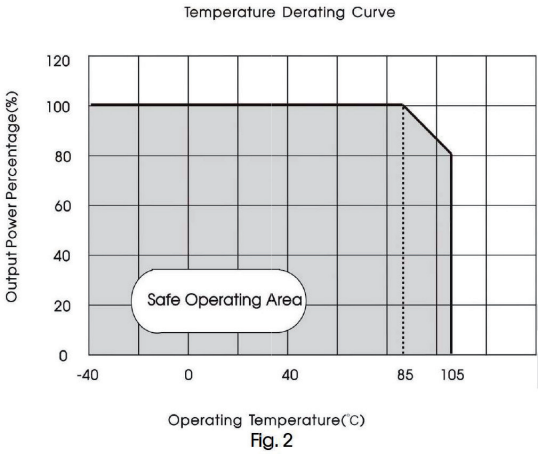


Fig. 2

Typical application

If it is required to further reduce input and output ripple, a filter capacitor can be connected to the input and output terminals, see Fig.3. Moreover, choosing suitable filter capacitor is very important, start-up problems may be caused by too large capacitance. To ensured the modules running well, the recommended capacitive load values as shown in Table 1.

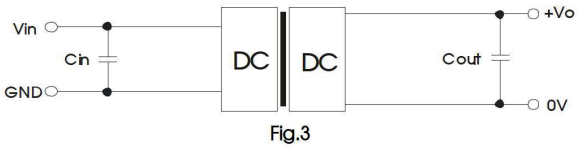


Fig.3

Recommended capacitive load value table (Table 1)

Vin (VDC)	Cin(μF)	Vout (VDC)	Cout (μF)
3.3	2.2μF/25V	3.3VDC/5VDC	10μF/l6V
		9VDC	2.2μF/l6V
		l2VDC	2.2μF/25V
		l5VDC	1μF/25V
		24VDC	1μF/50V

EMC solution-recommended circuit

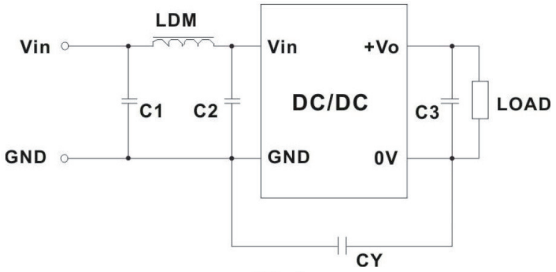
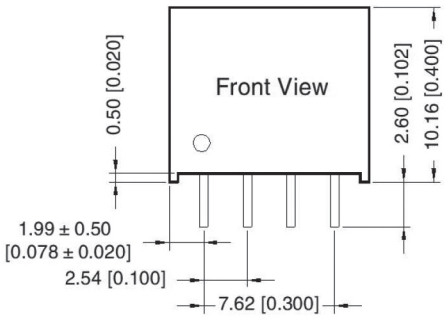


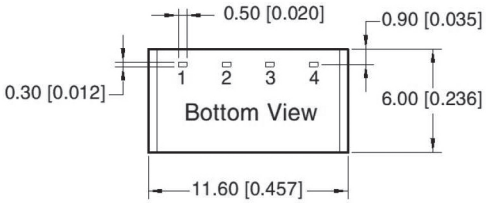
Fig. 4

Table 2: Recommended EMC filter values

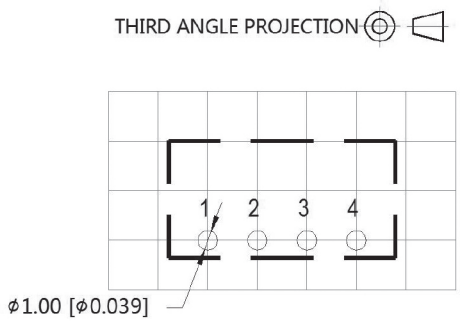
Emissions	C1/C2	4.7μF /50V
	C3	Refer to the Cout in Rg.3
	LDM	6.8μH
	CY	270pF /2kV

Mechanical dimensions and recommended layout





Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.25[± 0.010]



Note : Grid 2.54*2.54mm

Pin-Out	
Pin	Function
1	GND
2	Vin
3	0V
4	+Vo

1S4AE_1.5UP series

1W, Fixed input voltage, isolated & unregulated single output DC-DC Converter

5Vin DC-DC Converter 1 Watt

- Continuous short-circuit protection
- No-load input current as low as 5mA
- Operating temperature range: -40°C to +105°C
- High efficiency up to 85%
- Isolation voltage: 1.5kVDC/min, 3kVDC/1s
- International standard pin-out
- Compact SIP package
- UL62368, EN62368 approval

The 1S4AE_1.5UP series are specially designed for applications where an isolated voltage is required in a distributed power supply system. They are suitable for: pure digital circuits, low frequency analog circuits, relay-driven circuits and data switching circuits.

UL-62368-1 (E347551)

Common specifications

Short Circuit Protection	Continuous, self-recovery			
Operating Temperature	-40 ~ 105°C Derating if the temperature ≥85°C, (see Fig. 2)			
Storage Temperature	-55 ~ 125°C			
Casing Temperature Rise	Ta=25°C • 3.3VDC output • Other output	 25 15		 °C °C
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds		300°C	
Storage Humidity	Non-condensing		95 %RH	
Switching Frequency	100% load, nominal input voltage	270		KHz
MTBF	3500,000h (MIL-HDBK-217F@25)			
Casing Material	Black flame-retardant and heat-resistant plastic (UL94 V-0)			
Package Dimensions	11.60x6.00x10.16mm			
Weight	1.3g(Typ.)			
Cooling methods	Free air convection			

Output specifications

Item	Test condition	Min	Typ	Max	Units
Output voltage accuracy	See tolerance envelope curve(Fig. 1)				
Line regulation	Input voltage change: ±1% • 3.3VDC output • Others		 	 1.5 1.2	 % %
Load regulation	10% to 100% load • 3.3VDC output • 5VDC output • 9VDC output • 12VDC output • 15VDC output • 24VDC output		 15 10 8 7 6 5	 20 15 10 10 10 10	 % % % % % %
Ripple & Noise*	20MHz Bandwidth • Other output • 24VDC output		 30 50	 75 100	 mVp-p mVp-p
Temperature Drift Coefficient	100% load		±0.02		%/°C

Note: *Ripple and noise tested with "parallel cable" method, please see DC-DC Converter Application Notes for specific operation methods.

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage	Input-output, leak current lower than 1mA • 1 minute test time • 1 second test time	 1500 3000			 VDC VDC
Isolation resistance	IO, test at 500VDC	1000			MΩ
Isolation capacitance	IO , 100KHz/0.1V		20		pF

EMC specifications

Emissions	CE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
Emissions	RE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
Immunity	ESD	IEC/EN61000-4-2	Air ±8kV, Contact ±4kV perf. Criteria B

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input current (full load / no-load)	• 3.3/5VDC output • 9/12VDC output • 15/24VDC output		270/5 241/12 241/18	286/10 254/20 254/30	mA mA mA
Reflected ripple current*			15		mA
Surge Voltage (1sec. max.)		-0.7		9	VDC
Input filter	Capacitor filter				
Hot plug	Unavailable				

* Reflected ripple current testing method please see DC-DC Converter Application Notes for specific operation.

Example:
1S4AE_ 0505S1.5UP
1 = 1Watt; S4 = SIP4; A = Pinning; E = Cost effective; 05 = 5Vin; 05 = 5Vout; S = Single Output; 1.5 = 1.5kVDC; U = Unregulated output; P = Short circuit protection

Note:
1. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta = 25°C, humidity <75%RH with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on our Company's corporate standards;
4. 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. Classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

Product Selection Guide

Part Number	Certification	Input Voltage [VDC] Nominal	Input Voltage [VDC] Range	Output Voltage [VDC]	Output Current [mA, Max./Min]	Efficiency(2) [%, Min./Typ.] @ Full Load	Capacitive load [µF, Max]
1S4AE_0503S1.5UP	UL	5	4.5-5.5	3.3	303/30	70/74	2400
1S4AE_0505S1.5UP	UL	5	4.5-5.5	5	200/20	78/82	2400
1S4AE_0512S1.5UP	UL	5	4.5-5.5	9	111/12	79/83	1000
1S4AE_0512S1.5UP	UL	5	4.5-5.5	12	84/9	79/83	560
1S4AE_0515S1.5UP	UL	5	4.5-5.5	15	67/7	79/83	560
1S4AE_0524S1.5UP	UL	5	4.5-5.5	24	42/4	81/85	220

Typical Characteristic Curves

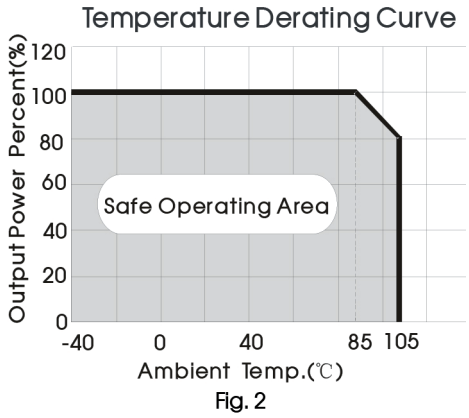
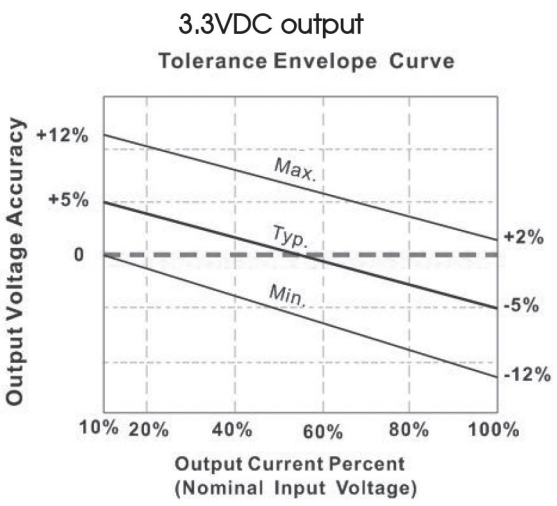
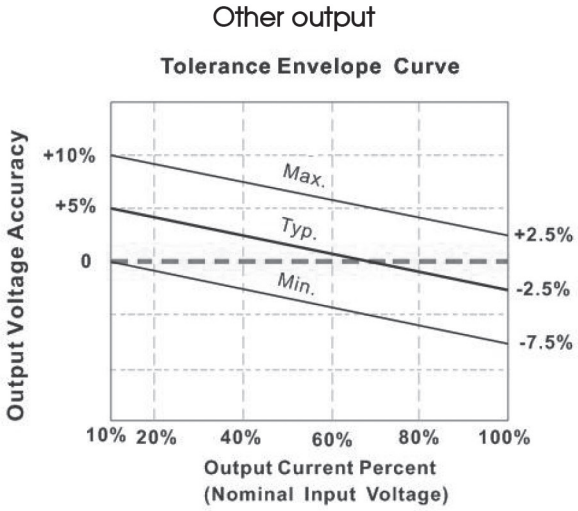
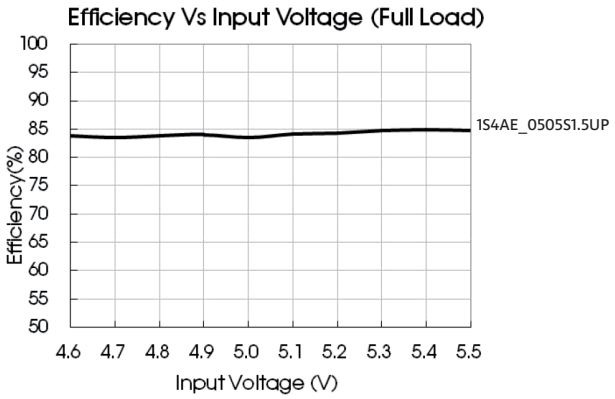


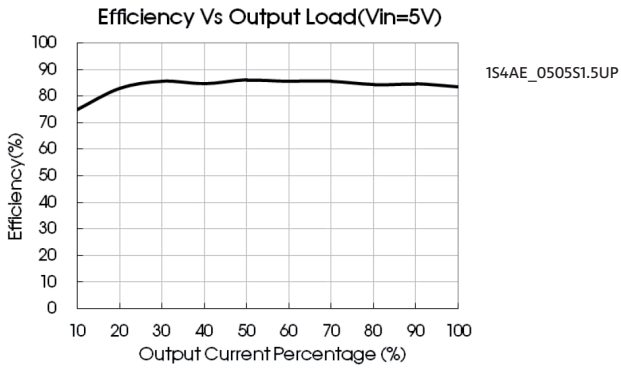
Fig. 2

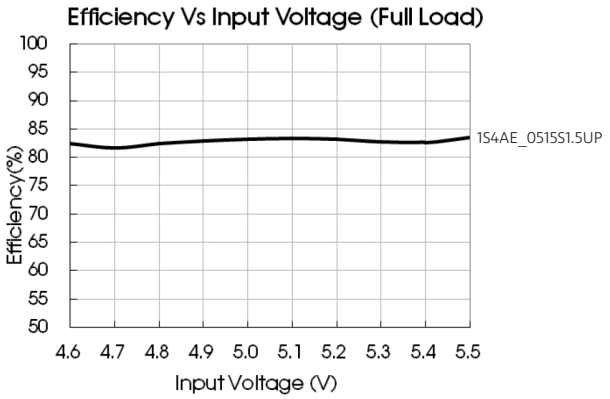


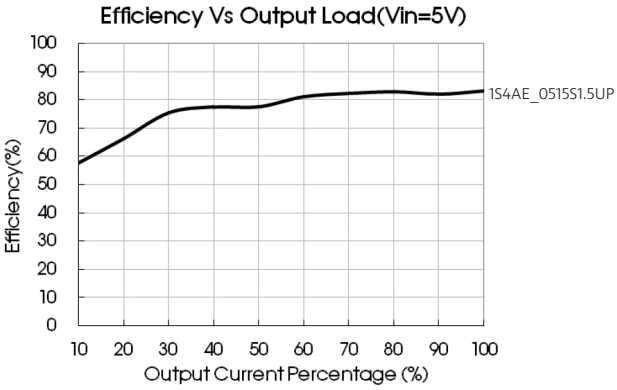


Efficiency curves









Typical application

If it is required to further reduce input and output ripple, a filter capacitor can be connected to the input and output terminals, see Fig.3. Moreover, choosing suitable filter capacitor is very important, start-up problems may be caused by too large capacitance. To ensured the modules running well, the recommended capacitive load values as shown in Table 1.

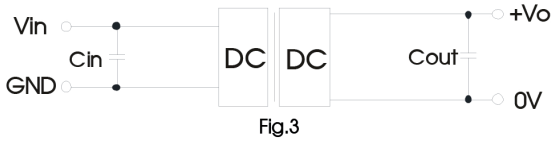


Fig.3

Recommended capacitive load value table (Table 1)

Vin (VDC)	Cin(μF)	Vout (VDC)	Cout (μF)
5	4.7	3.3/5	10
		9/12	2.2
		15/24	1

EMC solution-recommended circuit

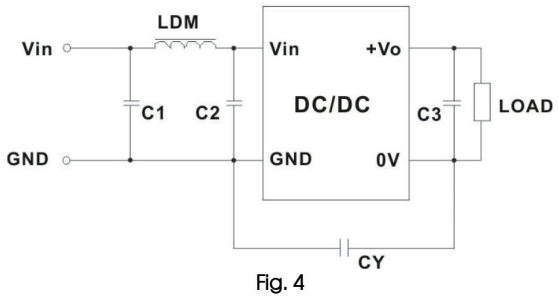


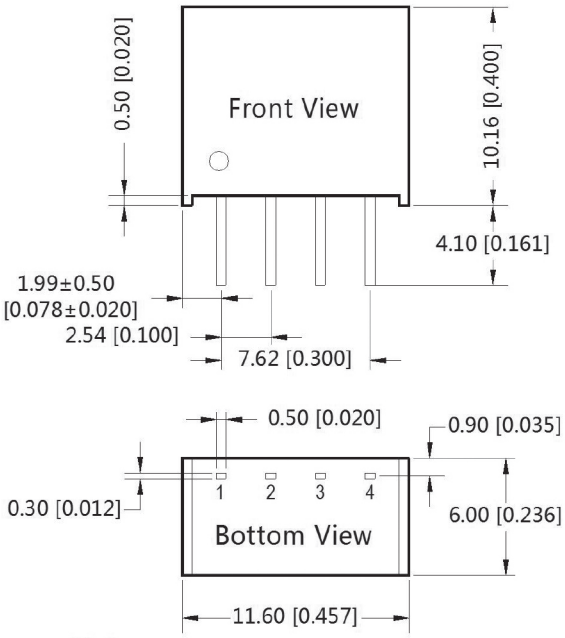
Fig. 4

EMC recommended circuit value table (Table 2)

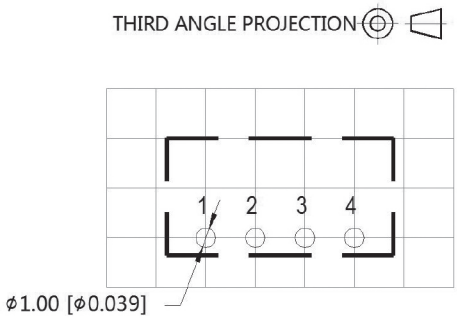
Input voltage 5VDC	Output voltage (VDC)		3.3/5/9	12/15/24
	EMI	C1/C2	4.7μF /25V	4.7μF /25V
		CY		1nF/4KVDC VISHAY HGZ102MBP TDK CD45-E2GA102M-GK
		C3	Refer to the Cout in table 1	
		LDM	6.8μH	6.8μH

Note:
In the case of actual use, the requirements for EMI are high, it is subject to CY.

Mechanical dimensions and recommended layout



Note:
Unit :mm[inch]
Pin section tolerances :±0.10[±0.004]
General tolerances:±0.25[±0.010]



Note : Grid 2.54*2.54mm

Pin-Out	
Pin	Function
1	GND
2	Vin
3	0V
4	+Vo

1S4AE_1.5UP series

1W, Fixed input voltage, isolated & unregulated single output DC-DC Converter

12/15/24Vin DC-DC Converter 1 Watt

- Continuous short-circuit protection
- No-load input current as low as 8mA
- Operating temperature range: -40°C to +105°C
- High efficiency up to 81%
- I/O isolation test voltage: 1.5kVDC
- Industry standard pin-out
- IEC62368, UL62368, EN62368 approved

The 1S4AE_1.5UP series are specially designed for applications where an isolated voltage is required in a distributed power supply system. They are suitable for: pure digital circuits, low frequency analog circuits, relay-driven circuits and data switching circuits

SHORT CIRCUIT PROTECTED · 100% RoHS Compliant · c UL us UL-62368-1 (E347551)

Output specifications

Item	Test condition	Min	Typ	Max	Units
Short Circuit Protection		Continuous, self-recovery			
Operating Temperature	Derating if the temperature ≥85°C, (see Fig. 2)	-40		105	°C
Storage Temperature		-55		125	°C
Casing Temperature Rise	Ta=25°C, nominal input, full load output		25		°C
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10s			300	°C
Storage Humidity	Non-condensing	5		95	%RH
Vibration	10-150Hz, 5G, 0.75mm. along X, Y and Z				
Switching Frequency	Full load, nominal input voltage		260		KHz
MTBF	MIL-HDBK-217F@25	3500,000			h
Casing Material	Black plastic; flame-retardant and heat-resistant (UL94 V-0)				
Package Dimensions	11.60*6.00*10.16mm				
Weight	1.3g (Typ.)				
Cooling methods	Free air convection				

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input current (full load / no-load)	12V input				
	• 3.3VDC output		112/8	118	mA
	• 5/9/12VDC output		105/8	110	mA
	• 15/24VDC output		103/8	109	mA
	15V input				
	• 5/9/12VDC output		84/8	88	mA
	• 15/24VDC output		83/8	87	mA
	24V input				
	• 3.3VDC output		56/8	61	mA
	• 5VDC output		53/8	58	mA
	• 9VDC output		53/8	57	mA
	• 12/15/24VDC output		52/8	56	mA
Reflected ripple current			15		mA
Surge Voltage (1sec. max.)	• 12VDC input	-0.7		18	VDC
	• 15VDC input	-0.7		21	VDC
	• 24VDC input	-0.7		30	VDC
Input filter	Capacitor filter				
Hot plug	Unavailable				

* Reflected ripple current testing method please see DC-DC Converter Application Notes for specific operation.

Output specifications

Item	Test condition	Min	Typ	Max	Units
voltage accuracy	See output regulation curves (Fig. 1)				
Line regulation	Input voltage change: ±1%				
	• 3.3VDC output			1.5	%
	• 5/9/12/15/24VDC output			1.2	%
Load regulation	10% to 100% load				
	• 3.3VDC output		8	20	%
	• 5VDC output		5	15	%
	• 9VDC output		3	10	%
	• 12VDC output		3	10	%
	• 15VDC output		3	10	%
	• 24VDC output		2	10	%
Ripple & Noise*	20MHz Bandwidth				
	• 3.3/5/9/12C/15VDC output		30	75	mVp-p
	• 24VDC output		50	100	mVp-p
Temperature Drift Coefficient	Full load		±0.02		%/°C

* The "parallel cable" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information.

Example:
1S4AE_ 1203S1.5UP
1 = 1Watt; S4 = SIP4; A = Pinning; E = Cost effective; 12 = 12Vin; 03 = 3Vout; S = Single Output; 1.5 = 1.5kVDC; U = Unregulated

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage	I/O, test for 1 minute, leak current of 1mA	1500			VDC
Isolation resistance	IO, test at 500VDC	1000			MΩ
Isolation capacitance	IO , 100KHz/0.1V		20		pF

EMC specifications

EMI	CE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
EMI	RE	CISPR32/EN55032	CLASS B (EMC recommended circuit)
EMS	ESD	IEC/EN61000-4-2	Air ±8kV, Contact ±4kV perf. Criteria B

Note:
1. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta = 25°C, humidity <75%RH with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on our Company's corporate standards;
4. 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. Classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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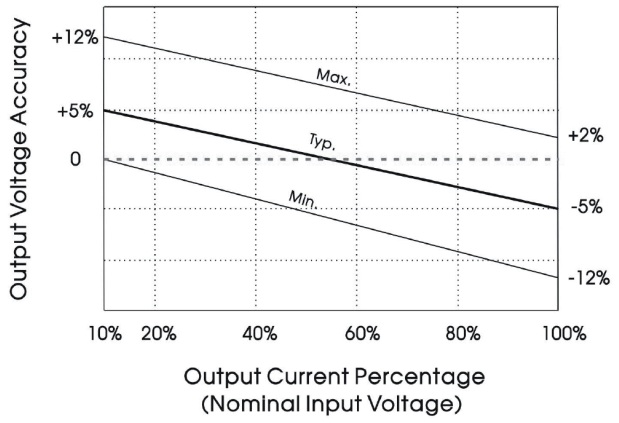
Product Selection Guide

Part Number	Certification	Input Voltage [VDC] Nominal	Range	Output Voltage [VDC]	Output Current [mA, Max./Min]	Full Load Efficiency [%, Min./Typ.]	Capacitive load [µF, Max]
1S4AE_1203S1.5UP	UL	12	(10.8-13.2)	3.3	303/30	71/75	2400
1S4AE_1205S1.5UP	UL	12	(10.8-13.2)	5	200/20	76/80	2400
1S4AE_1209S1.5UP	UL	12	(10.8-13.2)	9	111/12	76/80	1000
1S4AE_1212S1.5UP	UL	12	(10.8-13.2)	12	83/9	76/80	560
1S4AE_1215S1.5UP	UL	12	(10.8-13.2)	15	67/7	77/81	560
1S4AE_1224S1.5UP	UL	12	(10.8-13.2)	24	42/5	77/81	220
1S4AE_1505S1.5UP	UL	15	(13.5-16.5)	5	200/20	76/80	2400
1S4AE_1509S1.5UP	UL	15	(13.5-16.5)	9	111/12	76/80	1000
1S4AE_1512S1.5UP	UL	15	(13.5-16.5)	12	83/9	76/80	560
1S4AE_1515S1.5UP	UL	15	(13.5-16.5)	15	67/7	77/81	560
1S4AE_1524S1.5UP	-	15	(13.5-16.5)	24	42/5	77/81	220
1S4AE_2403S1.5UP	UL	24	(21.6-26.4)	3.3	303/30	71/75	2400
1S4AE_2405S1.5UP	UL	24	(21.6-26.4)	5	200/20	76/80	2400
1S4AE_2409S1.5UP	UL	24	(21.6-26.4)	9	111/12	76/80	1000
1S4AE_2412S1.5UP	UL	24	(21.6-26.4)	12	83/9	76/80	560
1S4AE_2415S1.5UP	UL	24	(21.6-26.4)	15	67/7	77/81	560
1S4AE_2424S1.5UP	UL	24	(21.6-26.4)	24	42/5	77/81	220

Typical Characteristic Curves

3.3VDC output

Output Regulation Curve



5VDC/9VDC/12VDC/15VDC/24VDC output

Output Regulation Curve

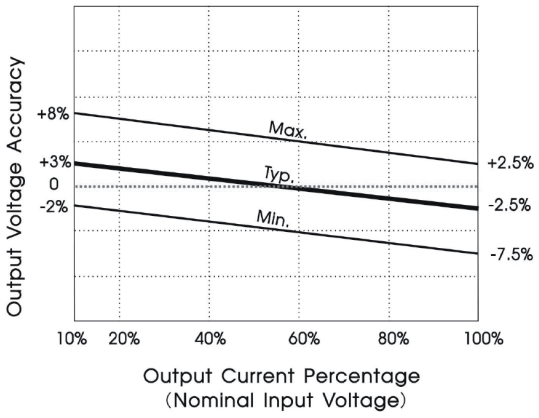


Fig. 1

Temperature Derating Curve

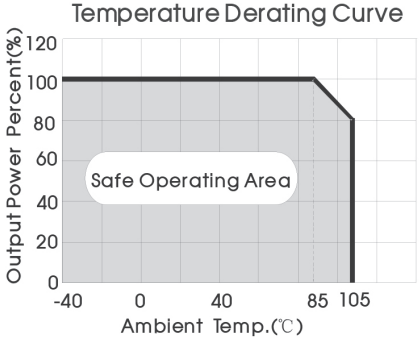
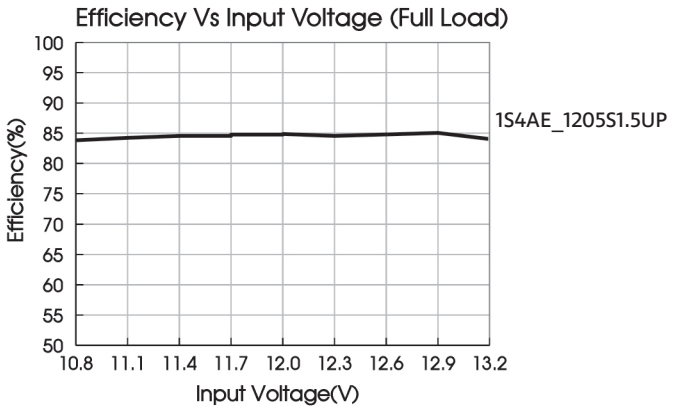
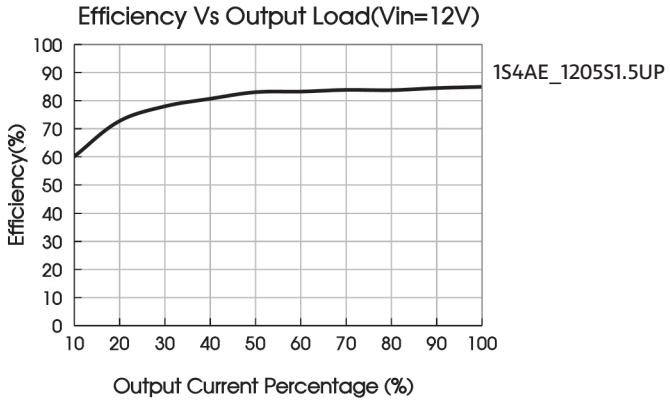
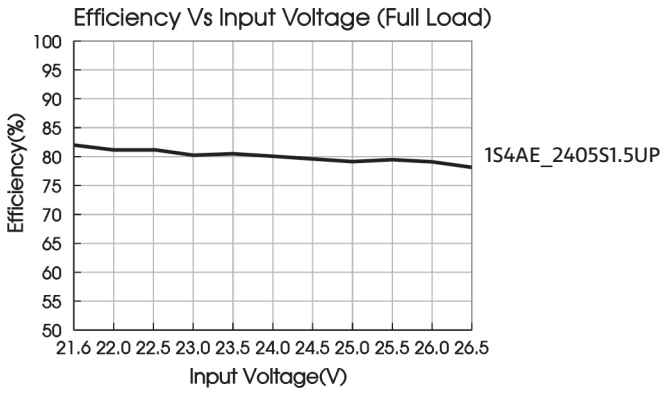


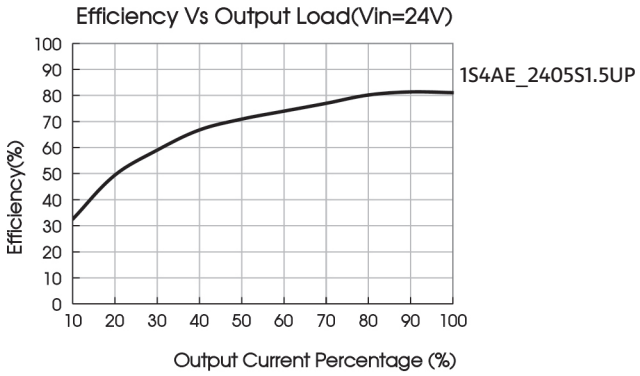
Fig. 2

Efficiency curves









Typical application

Input and/or output ripple can be further reduced, by connecting a filter capacitor from the input and/or output terminals to ground as shown in Fig.3. Choosing suitable filter capacitor values is very important for a smooth operation of the modules, particularly to avoid start-up problems caused by capacitor values that are too high. For recommended input and output capacitor values refer to Table 1.

Fig.3

Table 1: Recommended input and output capacitor values

Vin (VDC)	Cin(µF)	Vout (VDC)	Cout (µF)
12VDC	2.2µF/25V	3.3VDC	10µF/16V
15VDC	2.2µF/25V	5VDC	10µF/16V
24VDC	1µF/50V	9VDC	2.2µF/16V
		12VDC	2.2µF/25V
		15VDC	1µF/25V
		24VDC	1µF/50V

EMC solution-recommended circuit

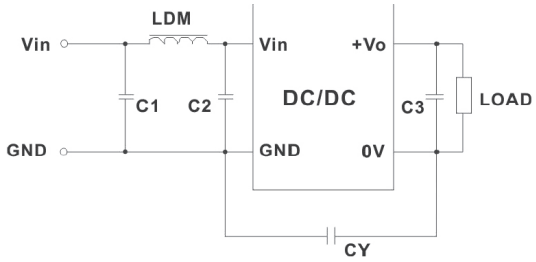
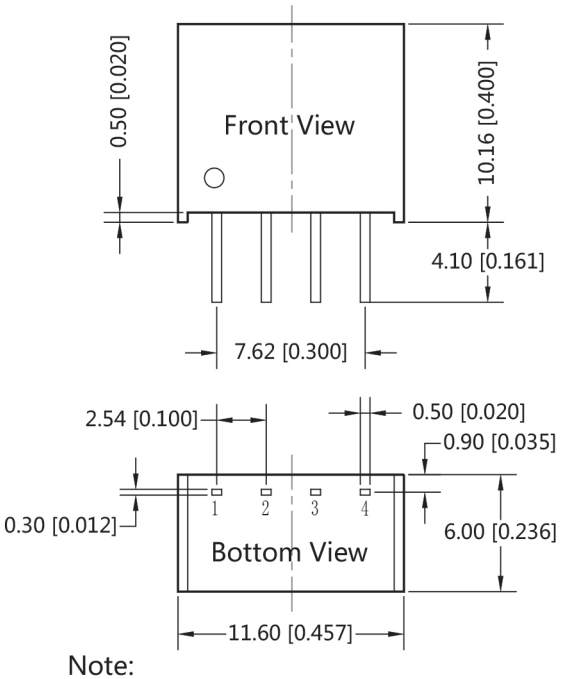


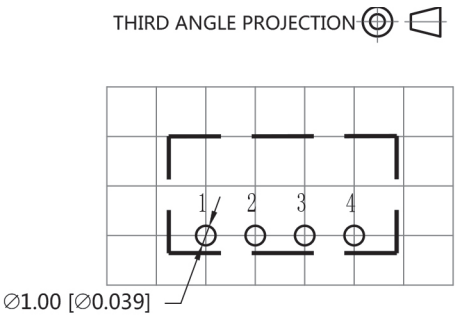
Fig. 4

Emissions	C1	4.7μF /50V
	C2	4.7μF /50V
	C3	Refer to the Cout in Fig.3
	LDM	6.8μH
	CY	270pF/2kV

Mechanical dimensions and recommended layout



Note:
Unit :mm[inch]
Pin section tolerances :±0.10[±0.004]
General tolerances:±0.25[±0.010]



Note : Grid 2.54*2.54mm

Pin-Out	
Pin	Function
1	GND
2	Vin
3	0V
4	+Vo