

Fixed Input, Isolated 2W Single Output DC/DC Converters



FEATURES

- ◆RoHS compliant
- ◆I/O isolation voltage 1000VDC
- ◆Operating Temperature: -40°C ~ + 85°C
- ◆High efficiency up to 81%
- ◆Fully encapsulated toroidal magnetics
- ◆Internal SMD construction
- ◆Power density up to 0.85W/cm³
- ◆No electrolytic or tantalum capacitors
- ◆5V,9V,12V and 15V output
- ◆No heat sink required
- ◆Dual output from a single input rail
- ◆UL 94V-0 package material
- ◆No external components required
- ◆Industry standard pinout
- ◆Power sharing on output
- ◆MTTF up to 3.9 million hours

MODEL SELECTION

2B^①05^②05^③X^④S^⑤

- ① Product Series
- ② Input Voltage
- ③ Output Voltage
- ④ Fixed Input
- ⑤ SIP Package

APPLICATIONS

The 2B-X(S)D series of DC/DC converters is particularly suited to isolating and/or converting DC power rails. The galvanic isolation allows the device to be configured to provide an isolated negative rail in systems where only positive rails exist. The wide temperature range guarantees startup from -40°C and full 2 watt output at 85°C. Pin compatibility with the B_XLS series ensures ease of upgradeability.



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SELECTION GUIDE

Order code	Input Voltage (V)	Output Voltage (V)	Output Current (mA)	Input Current (Rated Load) (mA)	Efficiency (%)	Isolation Capacitance (PF)	MTTF ¹ (KHRS)
2B0503XS	5	3.3	400	470	85	30	3988
2B0505XS	5	5	400	470	81	33	3956
2B0505XD	5	5	400	470	81	33	3956
2B0509XS	5	9	222	455	84	40	3682
2B0509XD	5	9	222	455	84	40	3682
2B0512XS	5	12	167	450	84	40	3299
2B0512XD	5	12	167	450	84	40	3299
2B0515XS	5	15	133	450	84	40	2833
2B0515XD	5	15	133	450	84	40	2833
2B0524XS	5	24	83	442	82	40	2766
2B0524XD	5	24	83	442	84	40	2766
2B1205XS	12	5	400	200	81	40	2519
2B1205XD	12	5	400	200	81	40	2519
2B1209XS	12	9	222	190	83	61	2405
2B1209XD	12	9	222	190	83	61	2405
2B1212XS	12	12	167	190	85	74	2235
2B1212XD	12	12	167	190	85	74	2235
2B1215XS	12	15	133	185	85	68	2011
2B1215XD	12	15	133	185	85	68	2011
2B1224XS	12	24	83	99	84	68	1800
2B1224XD	12	24	83	99	83	69	1789
2B1515XS	15	15	133	185	85	68	2012
2B1515XD	15	15	133	185	85	70	2015
2B2405XS	24	5	400	104	80	60	2000
2B2406XS	24	6	333.3	102	82	58	1850
2B2409XS	24	9	222	100	83	65	1980
2B2412XS	24	12	167	99	84	78	1800
2B2415XS	24	15	133	99	84	58	1760
2B2424XS	24	24	83	99	84	68	1800
2B2405XD	24	5	400	104	80	60	1850
2B2409XD	24	9	222	100	83	65	1886
2B2412XD	24	12	167	99	84	78	1886
2B2415XD	24	15	133	99	84	58	1801
2B2424XD	24	24	83	99	84	68	1850

add Suffix "P" for Continuous Short Circuit Protection, e.g. 2B0505XD^P

Input Characteristics

Parameter	Conditions	Min	Typ	Max.	Units
Voltage range	Continuous operation, 5V input types	4.5	5	5.5	V
	Continuous operation, 12V input types	10.8	12	13.2	
	Continuous operation, 24V input types	21.6	24	26.4	
Reflected ripple current			7.5	15	mA p-p

Absolute Maximum Ratings

Short-circuit protection ²	1 second
Lead temperature 1.5mm from case for 10 seconds	300°C
Internal power dissipation	550mW
Input voltage VIN, B05 types	7V
Input voltage VIN, B12 types	15V

1. Calculated using MIL-HDBK-217FN2 calculation model with nominal input voltage at full load.

2. Supply voltage must be disconnected at the end of the short circuit duration.

All specifications typical at TA=25°C, nominal input voltage and rated output current unless otherwise specified.

OUTPUT CHARACTERISTICS

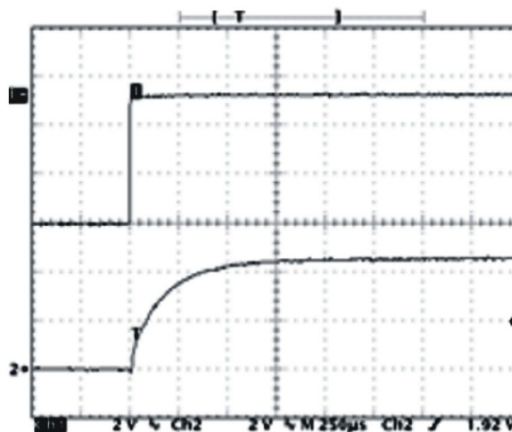
Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	TA=-40°C to 85°C	0.2		2	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High VIN to low VIN		1.05	1.2	%%
Load regulation 10% to 100% load	3.3V output		12	20	%
	5V output		12.8	15	%
	9V output		8.3	15	%
	12V output		6.8	15	%
	15V output		6.3	15	%
	24V output		6.0	15	%

Capacitive loading and start up

Typical start up times for this series, with a typical input voltage rise time of 2.2s and output capacitance of 10F, are saw in the table below. The product series will start into a capacitance of 47F with an increased start time, however, the maximum recommended output capacitances 10F

Typical Start-Up Wave Form

	Start-up time
	μs
2B0505XS	444
2B0509XS	1120
2B0512XS	1930
2B0515XS	3470
2B1205XS	409
2B1209XS	1320
2B1212XS	1320
2B1215XS	2270



Isolation Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage	Flash tested for 1 second	1000			VDC
Resistance	V _{iso} = 500VDC	1000			MΩ

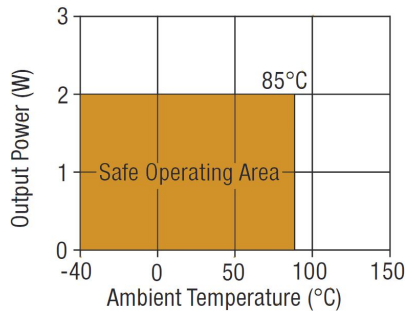
General Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency			60		kHz

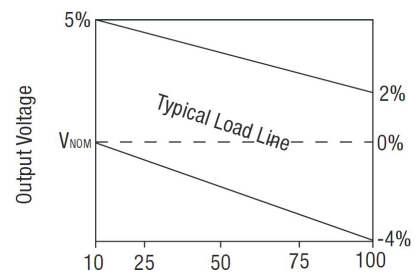
Temperature Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		125	
Case temperature above ambient	B0505XS output types			30	
	B1205XS output types			25	
	All other output types			20	

Temperature derating graph



Tolerance envelope



The voltage tolerance envelope shows typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to changes in output

OUTPUT RIPPLE REDUCTION

Output ripple reduction

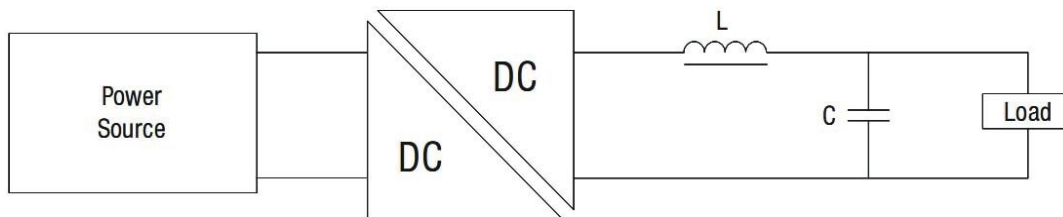
By using the values of inductance and capacitance stated, the output ripple at the rated load is lowered to 5mV p-p max.

Component selection

Capacitor: Ceramic chip capacitors are recommended. It is required that the ESR(Equivalent Series Resistance)should be as low as possible.X7R types are recommended.

The voltage rating should be at least twice(except for 15V output),the rated output voltage of the DC/DC converter.

Inductor: The rated current of the inductor should not be less than of the output of the DC/DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC/DC converter. The SRF(Self Resonant Frequency) should be >20MHz.



CHARACTERISATION TEST METHODS

Ripple & Noise Characterization Method

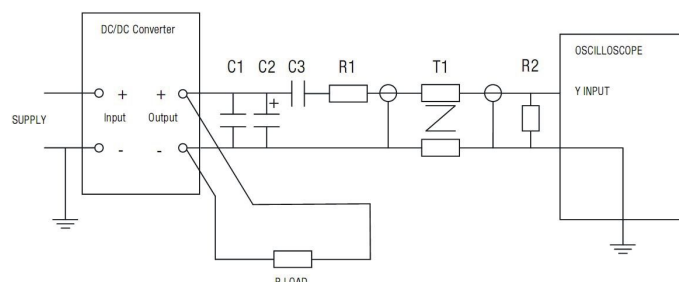
All measurement to be taken with the following components connected to the UUT as detailed below. 50 Ohm coax cable, solder connections one end, BNC plug at the other end.

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

C1	1 μ F X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter
C2	10 μ F tantalum capacitor, voltage rating to be a minimum of 1.5 times the output voltage of the DC/DC converter with an ESR of less than 100m Ω at 100 KHz
C3	100nF multilayer ceramic capacitor, general purpose
R1	450 Ω resistor, carbon film, \pm 1% tolerance
R2	50 Ω BNC termination
T1	3T of the coax cable through a ferrite toroid
RLOAD	Resistive load to the maximum power rating of the DC/DC converter. Connections should be made via twisted wires

Measured values are multiplied by 10 to obtain the specified values.

Differential Mode Noise Test Schematic



Technical notes

ISOLATION VOLTAGE

"Hi Pot Test", "Flash Tested", "Withstand 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. Professional Power Module B series of DC/DC converters are all 100% production tested at their stated isolation voltage. This is 1KVDC for 1 second.

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

The B_X(S)D series has been recognized by Underwriters Laboratory for functional insulation. Both input and output should normally be maintained within SELV limits i.e. less than 42.4V peak, or 60VDC. The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an element of a safety isolation system. The part could be expected to function correctly with several hundred volts offset applied continuously across the isolation barrier, but then the circuitry on both sides of the barrier must be regarded as operating at an unsafe voltage and further isolation/insulation systems must form a barrier between these circuits and any user-accessible circuitry according to safety standard requirements.

REPEATED HIGH-VOLTAGE ISOLATION TESTING

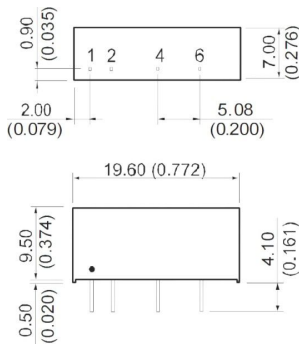
It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials. Construction and environment. The B series has toroidal isolation transformers, with no additional insulation between primary and secondary windings of enameled wire. While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the wire insulation. Any material, including this enamel (typically polyurethane) 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.

This consideration equally applies to agency recognized parts for better than functional isolation where the wire enamel insulation is always supplemented by a further insulation system of physical spacing or barriers.

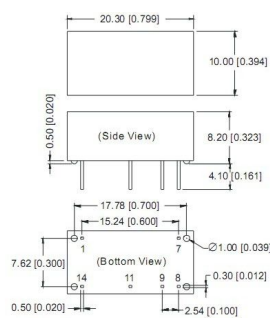
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

SIP Package



DIP Package



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

All pins on a 0.1(2.54) pitch and within ± 0.01 (0.25) of true position.

Weight: 2.8g(SIP) 4.2g(DIP)

FOOTPRINT

SIP7

FOOTPRINT

DIP14

PIN	Function	PIN	Function
1	+Vin	1	GND
2	-Vin	7	NC
4	-Vout	8	0V
6	+Vout	9	+V0
		11	No Pin
		14	Vin

NC No connection

Specifications can be changed any time without notice.

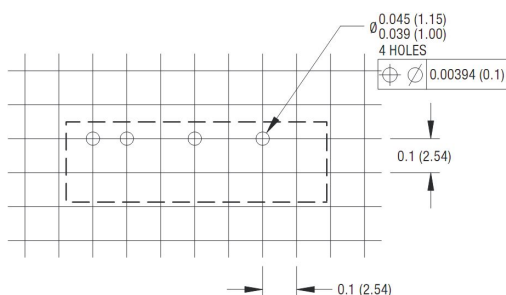
No parallel connection or plug and play.

Note:

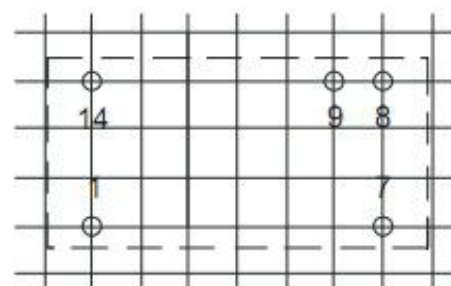
1. The load shouldn't be less than 10%, otherwise ripple will increase dramatically.
2. Operation under 10% load will not damage the converter; However, they may not meet all specification listed.
3. All specifications measured at $T_a=25^\circ\text{C}$, humidity < 75%, nominal input voltage and rated output load unless otherwise specified.
4. In this datasheet, all the test methods of indications are based on corporate standards.

RECOMMENDED FOOTPRINT DETAILS

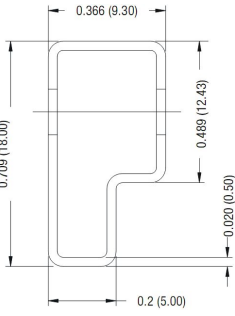
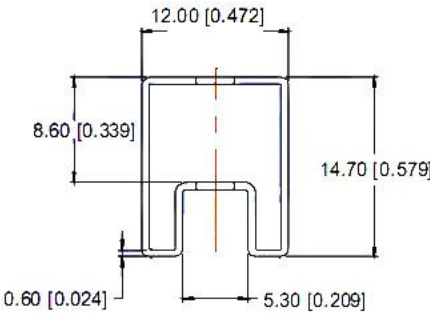
4 Pin SIP Package



14 Pin DIP Package



Unless otherwise stated all dimensions in inches (mm) 0.5mm

TUBE OUTLINE DIMENSIONS			
4 PIN SIP Tube		14 PIN DIP Tube	
			
<small>Unless otherwise stated all dimensions in inches (mm) ±0.5mm. Tube length (14 Pin DIP) : 20.47 (520mm ±2mm). Tube length (4 Pin SIP) : 20.47 (520mm ±2mm). Tube Quantity :25</small>			

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RoHS COMPLIANT INFORMATION

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 300°C for 10 seconds. The pin termination finish on the SIP package type is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The DIP types are Matte Tin over Nickel Preplate. Both types in this series are backward compatible with Sn/Pb soldering systems.



REACH COMPLIANT INFORMATION

This series has proven that this product does not contain harmful chemicals, it also has harmful chemical substances through the registration, inspection and approval.