

### Isolated 1W Single Output MICRO SIP4 DC/DC Converters



## FEATURES

- ◆Footprint from 0.69cm<sup>2</sup>
- ◆I/O isolation voltage 1000VDC
- ◆Operating Temperature: -40°C ~ + 85°C
- ◆High efficiency up to 80%
- ◆Fully encapsulated toroidal magnetics
- ◆Internal SMD construction
- ◆Power density up to 0.85W/cm<sup>3</sup>
- ◆No electrolytic or tantalum capacitors
- ◆5V, 9V, 12V, 15V and 24V output
- ◆No heatsink 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 3.4 million hours

## MODEL SELECTION

**B<sup>①</sup>05<sup>②</sup>05<sup>③</sup>X<sup>④</sup>M<sup>⑤</sup>**

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

## APPLICATIONS

The B-XM 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 1 watt output at 85°C. For lower ripple, refer to output ripple reduction section.



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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 <sup>1</sup> (KHRS) |
|------------|-------------------|--------------------|---------------------|---------------------------------|----------------|----------------------------|--------------------------|
| B0505XM    | 5                 | 5                  | 200                 | 289                             | 69             | 30                         | 3415                     |
| B0509XM    | 5                 | 9                  | 111                 | 260                             | 77             | 37                         | 3078                     |
| B0512XM    | 5                 | 12                 | 83                  | 256                             | 78             | 33                         | 2205                     |
| B0515XM    | 5                 | 15                 | 66                  | 250                             | 80             | 40                         | 1532                     |
| B0524XM    | 5                 | 24                 | 42                  | 248                             | 80             | 48                         | 900                      |
| B1205XM    | 12                | 5                  | 200                 | 120                             | 69             | 33                         | 2493                     |
| B1209XM    | 12                | 9                  | 111                 | 116                             | 74             | 48                         | 2311                     |
| B1212XM    | 12                | 12                 | 83                  | 110                             | 76             | 55                         | 1780                     |
| B1215XM    | 12                | 15                 | 66                  | 111                             | 75             | 52                         | 1313                     |
| B1224XM    | 12                | 24                 | 42                  | 110                             | 80             | 48                         | 1002                     |
| B2405XM    | 24                | 5                  | 200                 | 60                              | 70             | 40                         | 201                      |
| B2409XM    | 24                | 9                  | 111                 | 55                              | 75             | 59                         | 185                      |
| B2412XM    | 24                | 12                 | 83                  | 52                              | 80             | 78                         | 163                      |
| B2415XM    | 24                | 15                 | 66                  | 52                              | 80             | 79                         | 136                      |
| B2424XM    | 24                | 24                 | 42                  | 52                              | 80             | 79                         | 125                      |
| B4805XM    | 48                | 5                  | 200                 | 30                              | 70             | 32                         | 213                      |
| B4809XM    | 48                | 9                  | 111                 | 28                              | 75             | 50                         | 194                      |
| B4812XM    | 48                | 12                 | 83                  | 26                              | 80             | 76                         | 164                      |
| B4815XM    | 48                | 15                 | 66                  | 26                              | 80             | 75                         | 140                      |
| B4824XM    | 48                | 24                 | 42                  | 25                              | 80             | 75                         | 138                      |

1. Calculated using MIL-HDBK-217F with nominal input voltage at full load.

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

## Input Characteristics

| Parameter                | Conditions                      | Min. | Typ. | Max. | Units  |
|--------------------------|---------------------------------|------|------|------|--------|
| Voltage range            | Continuous operation, 5V input  | 4.5  | 5    | 5.5  | VDC    |
|                          | Continuous operation, 12V input | 10.8 | 12   | 13.2 | VDC    |
|                          | Continuous operation, 15V input | 13.5 | 15   | 16.5 | VDC    |
|                          | Continuous operation, 24V input | 21.6 | 24   | 26.4 | VDC    |
|                          | Continuous operation, 48V input | 43.2 | 48   | 52.8 | VDC    |
| Reflected ripple current |                                 |      | 20   | 40   | mA p-p |

## Absolute Maximum Ratings

| Parameter                                       | Conditions |
|-------------------------------------------------|------------|
| Lead temperature 1.5mm from case for 10 seconds | 300°C      |
| Internal power dissipation                      | 700mW      |
| Input voltage V <sub>in</sub> , B05 types       | 7V         |
| Input voltage V <sub>in</sub> , B12 types       | 15V        |
| Input voltage V <sub>in</sub> , B15 types       | 18V        |
| Input voltage V <sub>in</sub> , B24 types       | 28V        |
| Input voltage V <sub>in</sub> , B48 types       | 54V        |

### Output Specifications

| Parameter                                | Conditions                                     | Min. | Typ. | Max. | Units  |
|------------------------------------------|------------------------------------------------|------|------|------|--------|
| Rated Power                              | TA= -40°C to 120°C                             |      |      | 1.0  | W      |
| Rated Power(B24, B48)                    | TA=0°C to 70°C                                 |      |      | 1.0  | W      |
| Voltage Set Point Accuracy               | See tolerance envelope                         |      |      |      |        |
| Line regulation                          | High VIN to low VIN                            |      | 1.0  | 1.2  | %%     |
| Line regulation(B24, B48)                | High VIN to low VIN                            |      |      | 1.2  | %%     |
| Load regulation(B24, B48)                | 10% load to rated load, 5V output types        |      |      | 15   | %      |
|                                          | 10% load to rated load, all other output types |      |      | 10   | %      |
| Load regulation(5Vin input, 12Vin input) | 10% load to rated load, 5V output types        |      | 10   | 12.5 | %      |
|                                          | 10% load to rated load, 9V output types        |      | 9    | 10   | %      |
|                                          | 10% load to rated load, 12V output types       |      | 6.5  | 7.5  | %      |
|                                          | 10% load to rated load, 15V output types       |      | 6    | 7.0  | %      |
|                                          | 10% load to rated load, 15V output types       |      | 6    | 7.0  | %      |
| Load regulation(15V input)               | 10% load to rated load, 5V output types        |      | 5.5  | 10   | %      |
|                                          | 10% load to rated load, 12V output types       |      | 2.6  | 3.0  | %      |
|                                          | 10% load to rated load, 15V output types       |      | 2.3  | 3.0  | %      |
| Ripple & Noise(B24, B48)                 | BW=DC to 20MHz, all input types                |      |      | 150  | mV p-p |
| Ripple & Noise                           | BW=DC to 20MHz, 5V output types                |      | 10   | 20   | mV p-p |
|                                          | BW=DC to 20MHz, 9V output types                |      | 7    | 15   | mV p-p |
|                                          | BW=DC to 20MHz, 12V output types               |      | 7.5  | 15   | mV p-p |
|                                          | BW=DC to 20MHz, 15V output types               |      | 8    | 15   | mV p-p |
|                                          | BW=DC to 20MHz, 15V output types               |      | 8    | 15   | mV p-p |

### Isolation Characteristics

| Parameter            | Conditions                | Min. | Typ. | Max. | Units |
|----------------------|---------------------------|------|------|------|-------|
| Isolation voltage    | Flash tested for 1 second | 1000 |      |      | VDC   |
| Resistance           | Viso= 1000VDC             |      | 10   |      | GΩ    |
| Resistance(B24, B48) | Viso= 500VDC              | 10   |      |      | GΩ    |

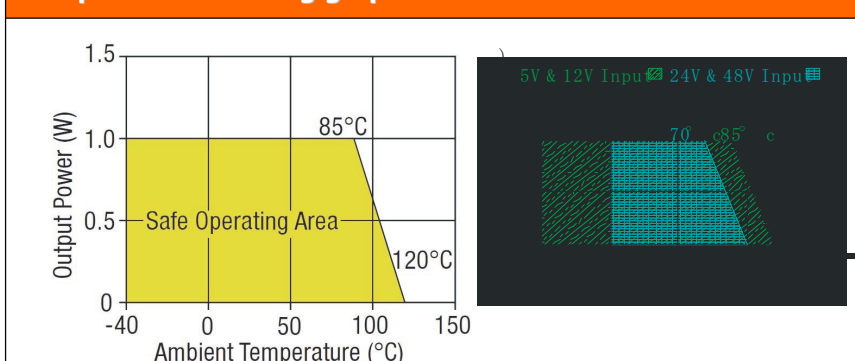
### General Characteristics

| Parameter                     | Conditions      | Min. | Typ. | Max. | Units |
|-------------------------------|-----------------|------|------|------|-------|
| Switching frequency           | 5V input types  |      | 110  |      | kHz   |
|                               | 12V input types |      | 140  |      | kHz   |
|                               | 15V input types |      | 90   |      | kHz   |
| Switching frequency(B24, B48) | All input types |      | 100  |      | kHz   |

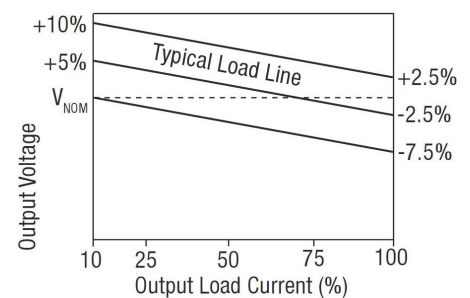
### Temperature Characteristics

| Parameter             | Conditions                    | Min. | Typ. | Max. | Units |
|-----------------------|-------------------------------|------|------|------|-------|
| Specification         | B05, B12, B15                 | -40  |      | 85   | °C    |
| Specification         | B24, B48                      | 0    |      | 70   | °C    |
| Storage               | B05, B12, B15                 | -50  |      | 130  | °C    |
| Storage               | B24, B48                      | -55  |      | 150  | °C    |
| Case temperature rise | 0505,1205                     |      | 33   |      | °C    |
|                       | 0509,0512,0515,1209,1212,1215 |      | 28   |      | °C    |
|                       | 1505                          |      | 26   |      | °C    |
|                       | 1512,1515                     |      | 17   |      | °C    |
| Cooling               | Free air convection           |      |      |      |       |

### Temperature derating graph



### Tolerance envelope



### 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?"

For a part holding no specific agency approvals, such as the B series, 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.

### Technical notes

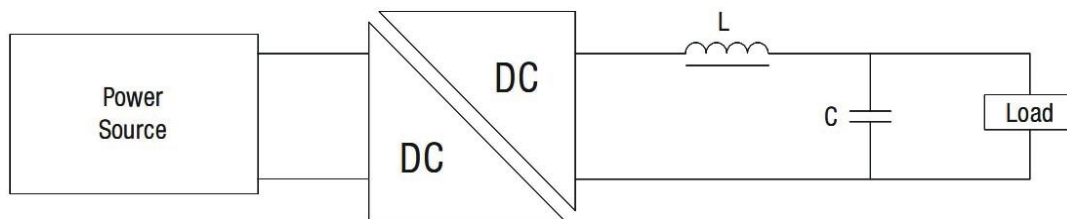
#### Output ripple reduction

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.



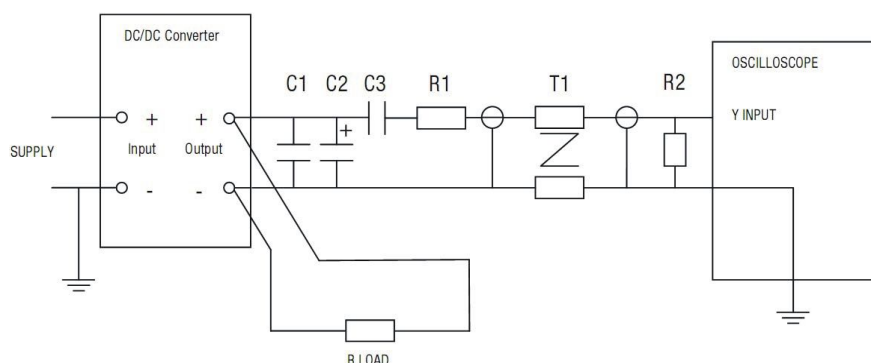
#### Ripple & Noise Characterisation Method

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

|       |                                                                                                                                                                        |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C1    | 1 $\mu$ F X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter                                        |
| C2    | 10 $\mu$ 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 $\Omega$ at 100 KHz |
| C3    | 100nF multilayer ceramic capacitor, general purpose                                                                                                                    |
| R1    | 450 $\Omega$ resistor, carbon film, $\pm 1\%$ tolerance                                                                                                                |
| R2    | 50 $\Omega$ 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                                                        |
| R3    | 50 $\Omega$ resistor, carbon film, $\pm 1\%$                                                                                                                           |

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

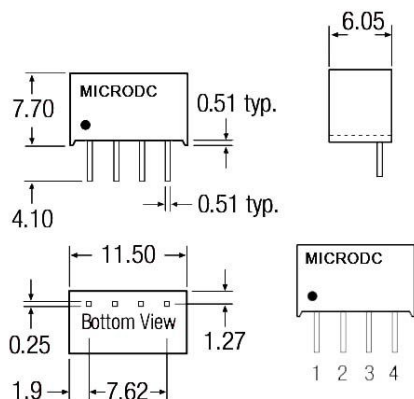
#### Differential Mode Noise Test Schematic



## OUTLINE DIMENSIONS & FOOTPRINT DETAILS

## MECHANICAL DIMENSIONS

## MICRO SIP4 Package



All dimensions in inches  $\pm 0.01$ (mm $\pm 0.25$ mm).All pins on a 0.1(2.54) pitch and within  $\pm 0.01$ (0.25) of true position.  
Weight: 1.30g (SIP)

## FOOTPRINT DETAILS

-4 PIN SIP

| Pin | Function |
|-----|----------|
| 1   | -Vin     |
| 2   | +Vin     |
| 3   | -Vout    |
| 4   | +Vout    |

**Specifications can be changed any time without notice.**

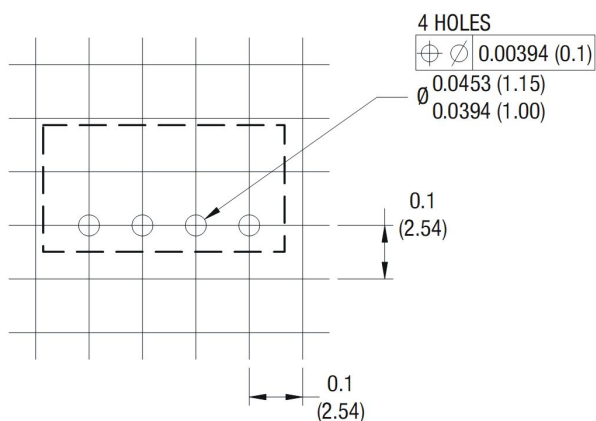
**No parallel connection or plug and play.**

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.

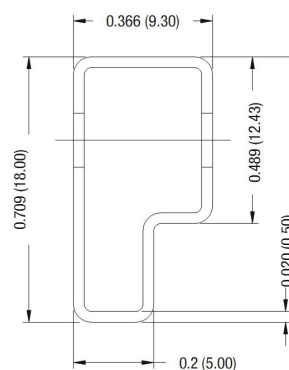
## Recommended footprint details

### 4 PIN SIP Package



## TUBE OUTLINE DIMENSIONS

## 4 PIN SIP Tube



Unless otherwise stated all dimensions in inches (mm)  $\pm 0.5$ mm

Tube length (4 Pin SIP) : 20.47 (520mm  $\pm$ 2mm).

Tube Quantity :25