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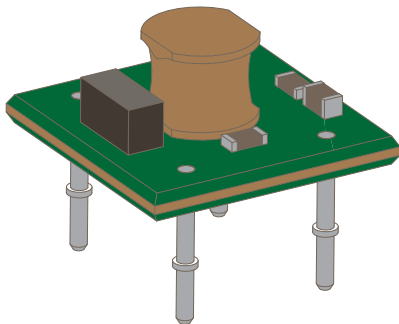


## 3.3 V, 1 A Non-Isolated Step Down DC/DC Converter Module

### Features and Benefits

- Input voltage range 8 to 30 VDC
- Circuit topology: step-down chopper
- Switching frequency: 350 kHz
- Output: 3.3 V, 1 A, 3.3 W
- Module footprint: 14 × 14 × 10 mm (W × D × H)
- Weight: 1.6 g
- All in one
- Design-free
- High efficiency: 87% (typ) at  $V_{IN} = 8\text{ V}$ ,  $I_O = 0.6\text{ A}$
- Miniaturizes space required, by using high-frequency switching technology
- Protection functions:
  - Overcurrent Protection function (OCP), with auto restart
  - Thermal Shutdown Protection function (TSD), with auto restart

### Package: Module



14 × 14 mm (11 mm height mounted)

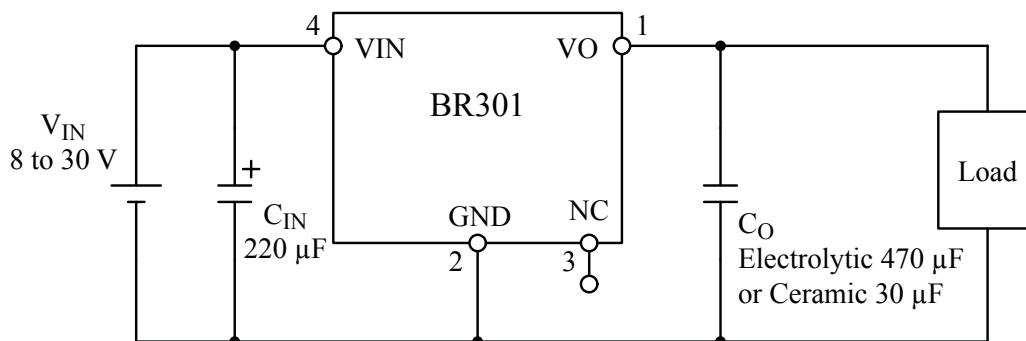
### Description

The BR301 is non-isolated step down type DC/DC converter module. The single module includes: a control IC, inductor, ceramic capacitor, and standoff pins. This provides a complete DC / DC converter solution, requiring few external components. It can be configured easily, reducing overall design time, allowing reuse of designs, and saving space on the application PCB.

### Applications:

- Factory Automation
- Communication devices
- Consumer electronics
- Other low power conversion

### Typical Application Circuit



**Selection Guide**

| Part Number |
|-------------|
| BR301       |

The polarity value for current specifies a sink as "+," and a source as "–," referencing the IC.

**Absolute Maximum Ratings**, valid at  $T_A = 25^\circ\text{C}$ 

| Characteristic              | Symbol   | Notes   | Pins  | Rating     | Unit             |
|-----------------------------|----------|---|-------|------------|------------------|
| Input Voltage               | $V_{IN}$ |   | 4 – 2 | –0.3 to 35 | V                |
| Operating Temperature Range | TOP      | See the derating curve  | –     | –20 to 85  | $^\circ\text{C}$ |
| Operating Humidity Range    | HOP      | No condensation   | –     | 10 to 90   | %                |
| Storage Temperature Range   | TSTG     |   | –     | –20 to 85  | $^\circ\text{C}$ |
| Storage Humidity Range      | HSTG     | No condensation   | –     | 5 to 95    | %                |
| Vibration (non-operation)   |          |   |       |            |                  |
| Frequency                   | –        |   | –     | 10 to 55   | Hz               |
| Acceleration                | –        |   | –     | 19.6       | $\text{m/s}^2$   |
| Sweep Time                  | –        |   | –     | 1          | minute           |
| Vibration                   | –        |   | –     | 1.5        | mm               |
| Vibration Direction         | –        |   | –     | X,Y,Z      | –                |
| Vibration Time              | –        |   | –     | 2          | hour             |
| Shock Capability            | –        | Dropped from 50 mm height to a concrete surface, five times each on left and right sides. | –     | No failure | –                |

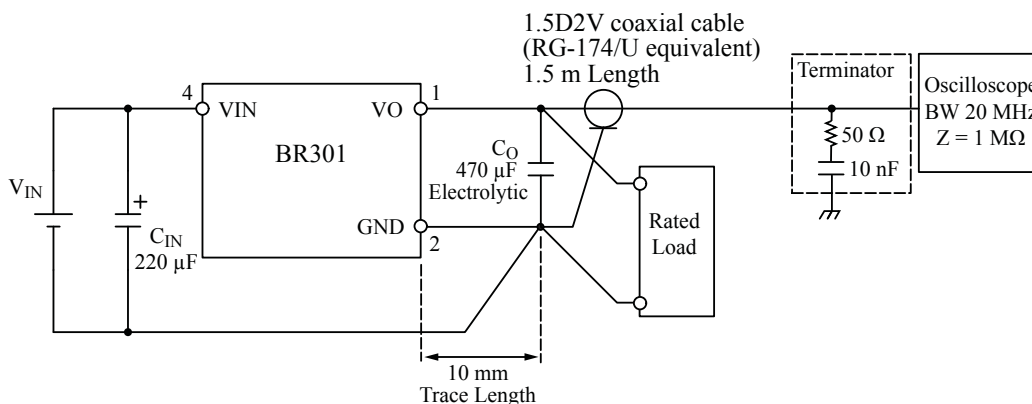
**Recommended Operating Conditions**, valid at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| Characteristic       | Symbol   | Conditions | Pins  | Min. | Max. | Unit |
|----------------------|----------|------------|-------|------|------|------|
| Input Voltage Range  | $V_{IN}$ |            | 4 – 2 | 8    | 30   | V    |
| Output Current Range | $I_O$    |            | 1 – 2 | 0    | 1    | A    |

**Electrical Characteristics** Unless specifically noted,  $T_A$  is 25°C

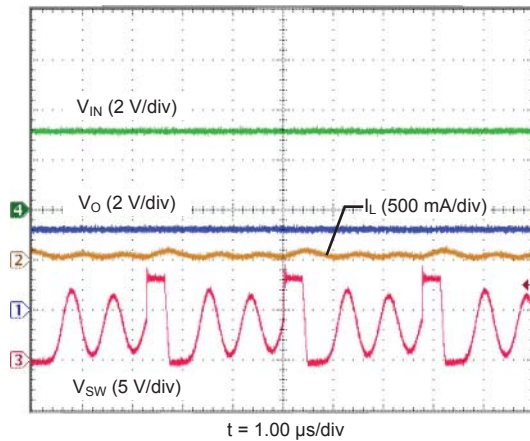
| Characteristic                | Symbol       | Test Conditions                             | Pins | Min. | Typ. | Max. | Unit              |
|-------------------------------|--------------|---|------|------|------|------|-------------------|
| Input Current                 | $I_{IN}$     | $V_{IN} = 24\text{ V}$ , $I_O = 1\text{ A}$ | 4-2  | –    | 0.17 | –    | A                 |
| Standby Power                 | $P_{STB}$    | $V_{IN} = 24\text{ V}$ , $I_O = 1\text{ A}$ | 4-2  | –    | 0.13 | –    | W                 |
| Output Voltage                | $V_O$        |   | 1-2  | –    | 3.30 | –    | V                 |
| Constant Voltage Accuracy     | $V_{ACC}$    |   | 1-2  | –3.0 | –    | 3.0  | %                 |
| Output Current                | $I_O$        |   | 1-2  | 0    | –    | 1.0  | A                 |
| Maximum Output Power          | $P_{O(MAX)}$ |   | 1-2  | –    | –    | 3.3  | W                 |
| Output Voltage Ripple*        | $V_{RIP}$    | $V_{IN} = 24\text{ V}$ , $I_O = 1\text{ A}$ | 1-2  | –    | 50   | –    | mV <sub>P-P</sub> |
| Output Voltage Noise*         | $V_{NOISE}$  | $V_{IN} = 24\text{ V}$ , $I_O = 1\text{ A}$ | 1-2  | –    | 50   | –    | mV <sub>P-P</sub> |
| Output Overcurrent Protection | $I_{OCP}$    |   | 1-2  | 1.1  | –    | –    | A                 |

\*The ripple measurement is made at both ends of the electrolytic capacitor  $C_O$  (470  $\mu\text{F}$ ). For the capacitor  $C_{IN}$ , a YXF type made by Rubycon for switching power supplies, or equivalent, is recommended. For  $C_O$ , a low impedance ZL type made by Rubycon for switching power supplies, or equivalent, is recommended. In this case, a 470  $\mu\text{F}$  electrolytic capacitor was connected at 10 mm trace length from the output terminal.

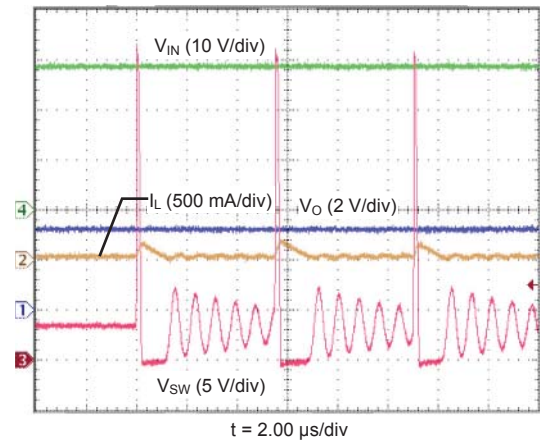
**Ripple Current Measurement Circuit**

Performance Characteristics  
at  $V_O = 3.3\text{ V}$

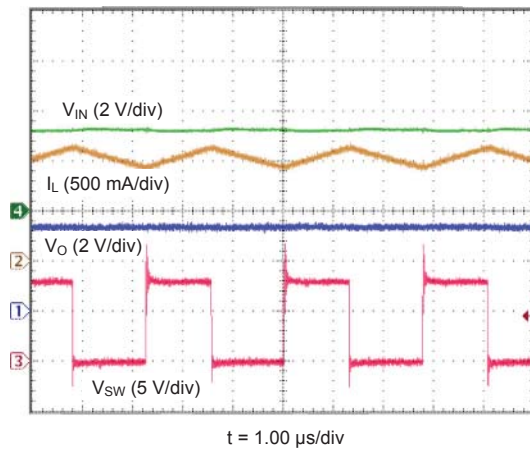
$V_{IN} = 8\text{ V}, I_O = 0\text{ A}$



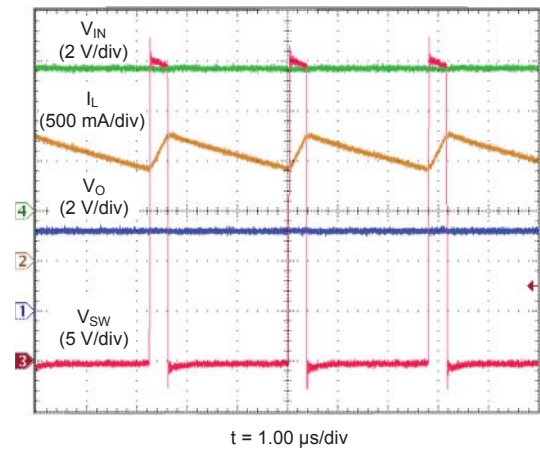
$V_{IN} = 30\text{ V}, I_O = 0\text{ A}$



$V_{IN} = 8\text{ V}, I_O = 1\text{ A}$



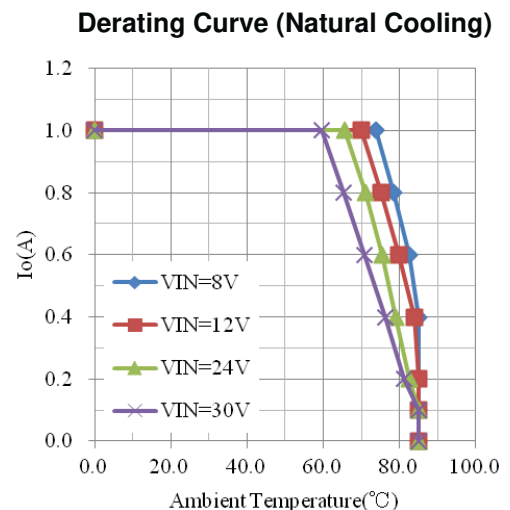
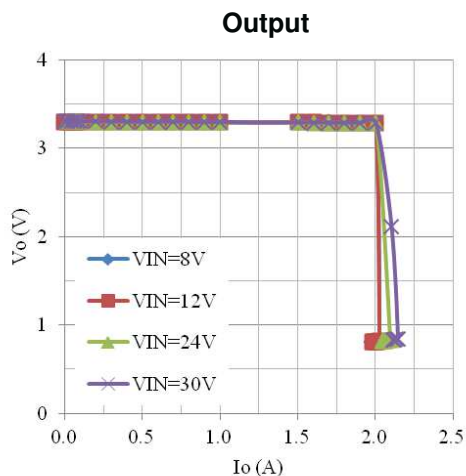
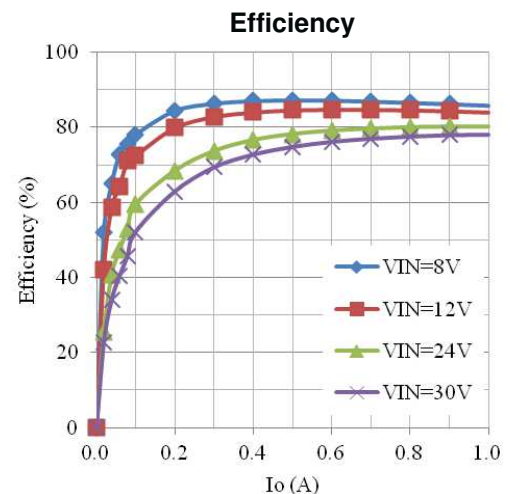
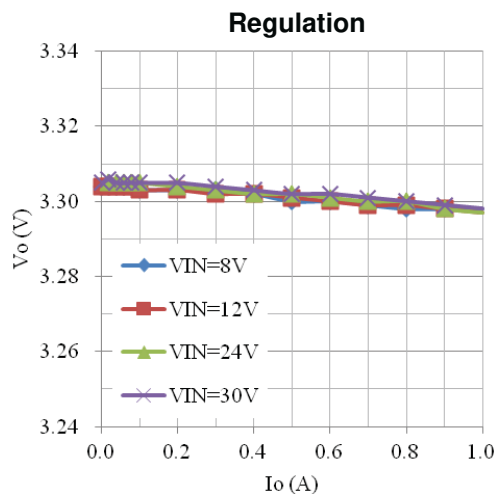
$V_{IN} = 30\text{ V}, I_O = 1\text{ A}$



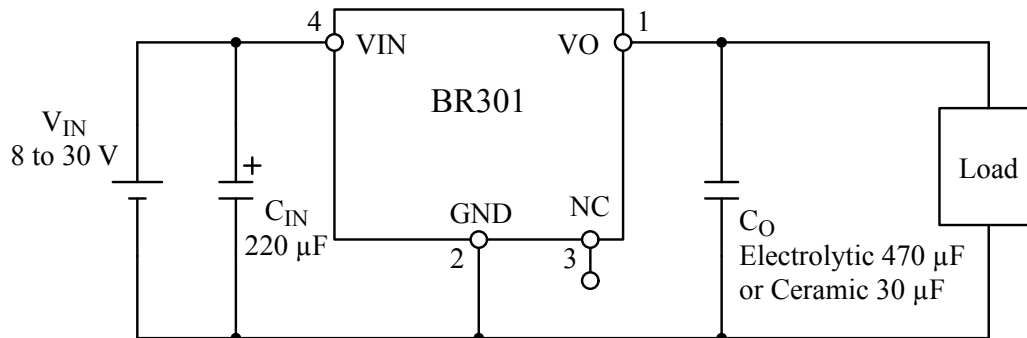
## Performance Characteristics

Temperature Rise At  $V_{IN}=30\text{ V}$ ,  $V_O=3.3\text{ V}$ ,  $I_O=1\text{ A}$ 

| Measurement Points       |        | Temperature (°C) | Temperature Rise (°C) |
|--------------------------|--------|------------------|-----------------------|
| Inductor                 | Top    | 68.5             | 41.2                  |
| Diode                    | Top    | 71.5             | 44.2                  |
| Ceramic capacitor        | Top    | 58.7             | 31.4                  |
| IC                       | Bottom | 74.8             | 47.5                  |
| Input ceramic capacitor  | Bottom | 64.2             | 36.9                  |
| Output ceramic capacitor | Bottom | 62.2             | 34.9                  |
| Ambient temperature      | —      | 27.3             | —                     |



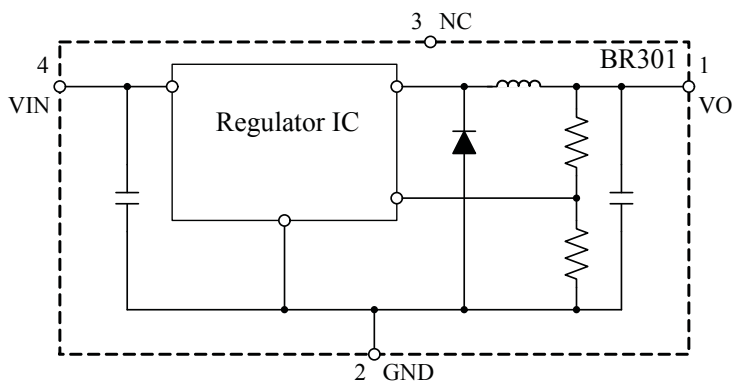
## Typical Application



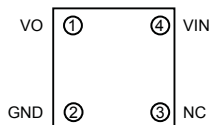
Typical application circuit example

- An input electrolytic capacitor,  $C_{IN}$ , of approximately 220  $\mu\text{F}$  should be connected to the input side of the BR301. If the input voltage is stable, it is not required.
- An output capacitor,  $C_O$ , either electrolytic of approximately 470  $\mu\text{F}$  or ceramic of approximately 30  $\mu\text{F}$  should be connected to the output side of the BR301.
- For  $C_{IN}$ , a YXF type made by Rubycon for switching power supplies or equivalent is recommended.
- For  $C_O$ , either a low impedance ZL type made by Rubycon, or three ceramic capacitors connected in parallel (GRM31CR71E106KA12 made by Murata), for switching power supplies or equivalent are recommended.
- Depending on PCB layout, output voltage ripple could be amplified. Please check the output voltage ripple in the actual application.

## Functional Block Diagram



## Pin-out Diagram

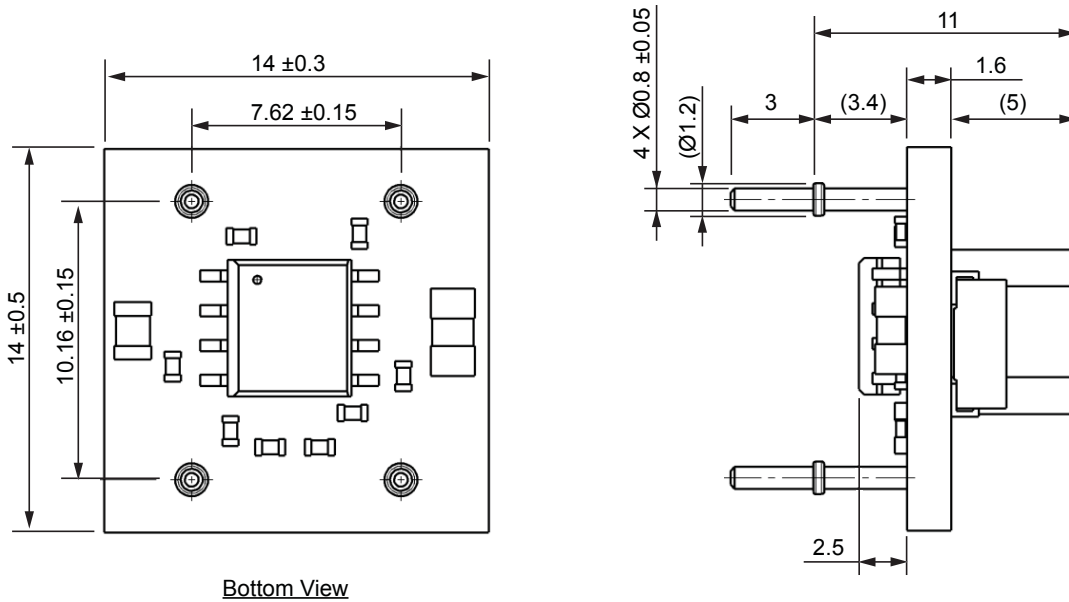


## Pin List Table

| Number | Name | Function  |
|--------|------|---|
| 1      | VO   | Output terminal of the positive electrode of the DC / DC converter. The output load can be taken from this pin and the GND pin                        |
| 2      | GND  | Ground terminal of the DC / DC converter. The output load can be taken from this pin and the VO pin   |
| 3      | NC   | Not connected. Do not use this pin.   |
| 4      | VIN  | Input terminal of the positive electrode of the DC / DC converter. The input voltage of 8 to 30 VDC can be supplied between this pin and the GND pin. |



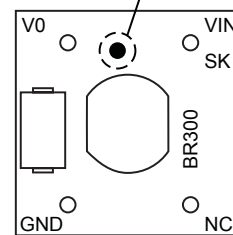
Package Outline Drawing



Bottom View

- All dimensions are in millimeters
- The tolerance is  $\pm 0.3$ mm unless otherwise specified.
- Dimensions shown in parentheses are reference dimensions.
- Pb-free. Device composition compliant with the RoHS directive
- Product Weight 1.6 g
- Product Outline 14 x 14 x 10 mm (W x D x H)

The BR301 type is indicated by a red ink dot on the top side, at this location



Type Indicator View



Pb-free, compliant with the RoHS Directive.

RoHS Directive Compliance:

Lead, cadmium, mercury, hexavalent chromium and PBB, PBDE meet the specified criteria on the basis of EU Directive 2002/95/EC, except for nonrestricted materials.

## OPERATING PRECAUTIONS

Because reliability can be affected adversely by improper storage environments and handling methods, please observe the following cautions.

### Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5°C to 35°C) and the standard relative humidity (around 40% to 75%); avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust on leads and solderability of products that have been stored for a long time.

### Cautions for Testing and Handling

When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing products, shorts between the product pins, and wrong connections. In addition, avoid tests exceeded ratings.

### Soldering

- When soldering the products, please be sure to minimize the working time, within the following limits.
- 260 ±5°C      10 ±1 s (Flow, 2 times)
- 350 ±5°C      3.0 ±0.5 s (Soldering iron, 1 time)

At a distance of 3.4 mm from the main body of the products.

### Electrostatic Discharge

- When handling the products, the operator must be grounded. To prevent shock hazard, grounded wrist straps should be used and at least 1 MΩ of resistance from the operator to ground should be placed near the operator.
- Workbenches where the products are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should be grounded.
- When soldering the products, the head of a soldering irons or the solder bath must be grounded in order to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in Sanken shipping containers or conductive containers, or be wrapped in aluminum foil.

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In addition, it should be noted that since power devices or IC's including power devices have large self-heating value, the degree of derating of junction temperature affects the reliability significantly.

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