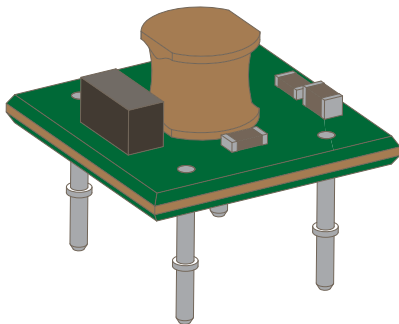


3.3 V, 1 A Non-Isolated Step Down DC/DC Converter Module

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)

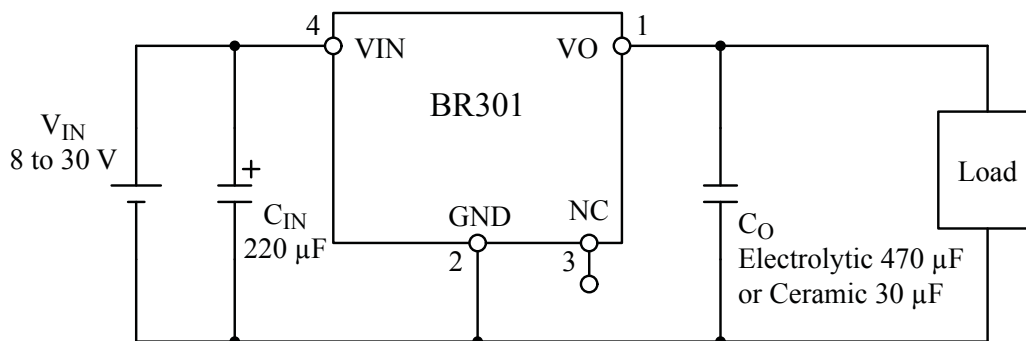
Description

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	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	–

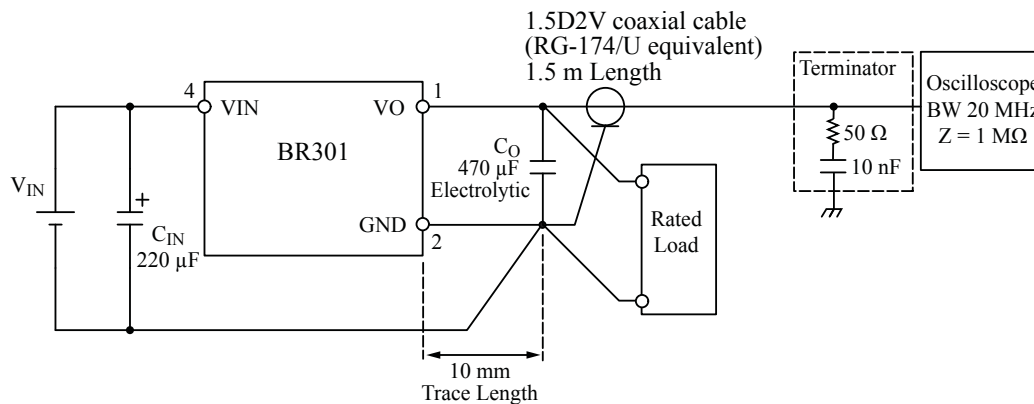
Recommended Operating Conditions, valid at $T_A = 25^\circ\text{C}$, unless otherwise specified

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

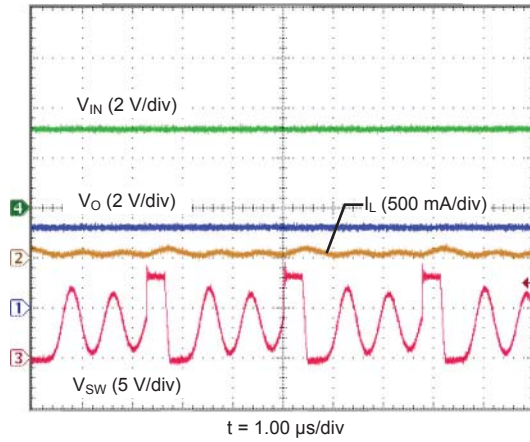
Characteristic	Symbol	Test Conditions	Pins	Min.	Typ.	Max.	Unit
Input Current	I_{IN}	$V_{IN} = 24\text{ V}$, $I_O = 1\text{ A}$	4-2	–	0.17	–	A
Standby Power	P_{STB}	$V_{IN} = 24\text{ V}$, $I_O = 1\text{ A}$	4-2	–	0.13	–	W
Output Voltage	V_O		1-2	–	3.30	–	V
Constant Voltage Accuracy	V_{ACC}		1-2	–3.0	–	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 _{P-P}
Output Voltage Noise*	V_{NOISE}	$V_{IN} = 24\text{ V}$, $I_O = 1\text{ A}$	1-2	–	50	–	mV _{P-P}
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 μF). 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 μF electrolytic capacitor was connected at 10 mm trace length from the output terminal.

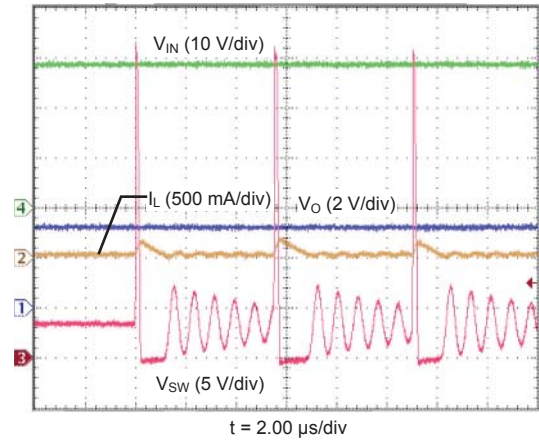
Ripple Current Measurement Circuit

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

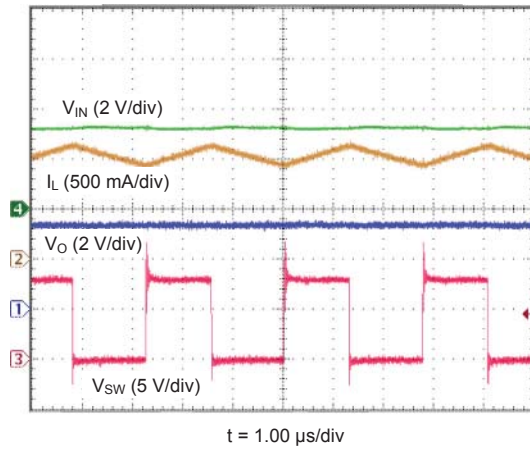
$V_{IN} = 8\text{ V}, I_O = 0\text{ A}$



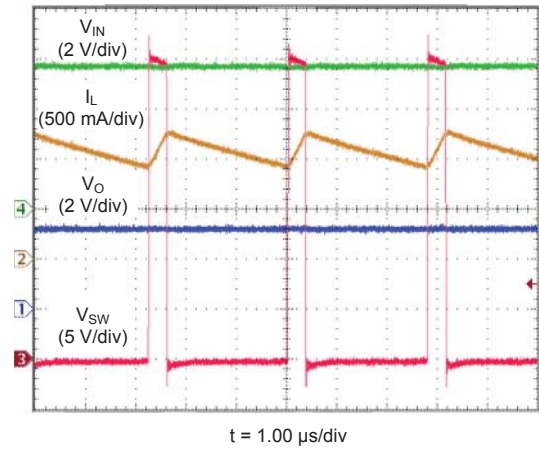
$V_{IN} = 30\text{ V}, I_O = 0\text{ A}$



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



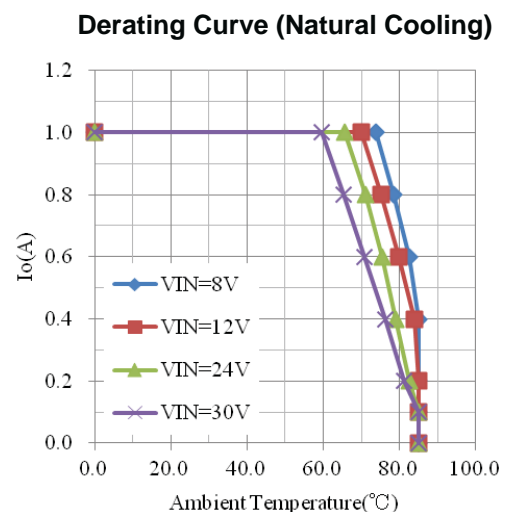
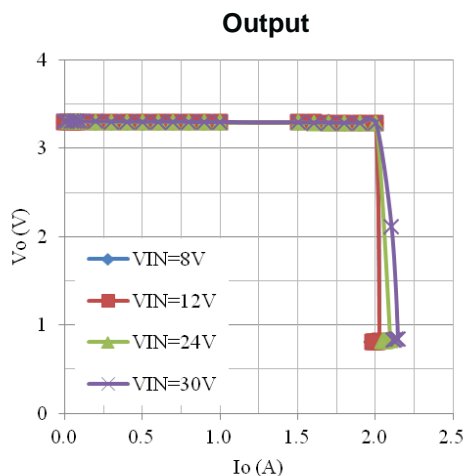
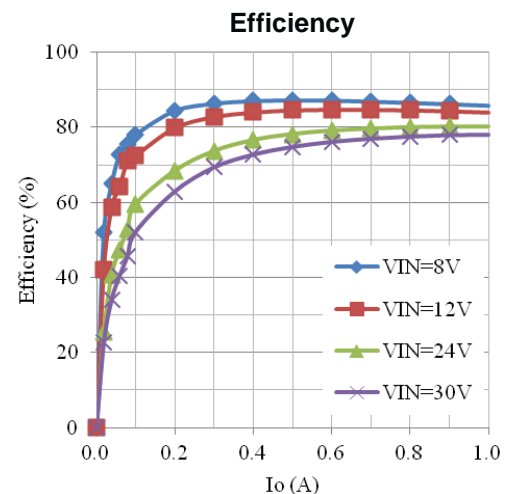
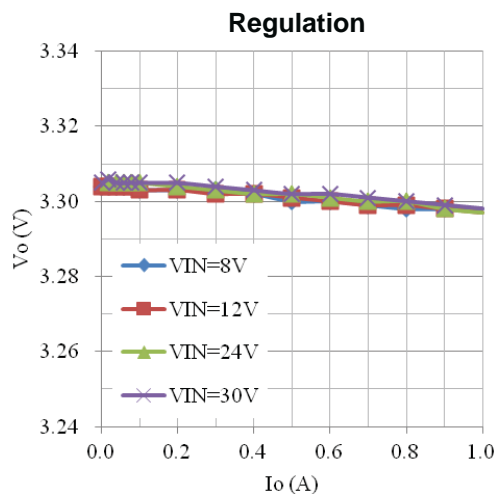
$V_{IN} = 30\text{ V}, I_O = 1\text{ A}$



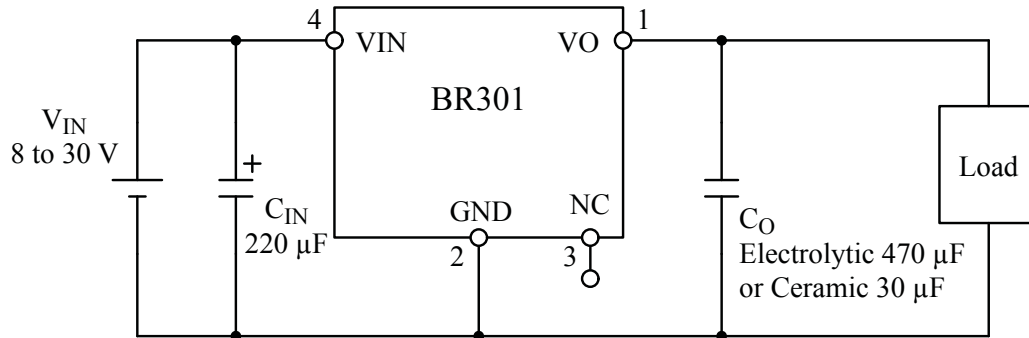
Performance Characteristics

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	—



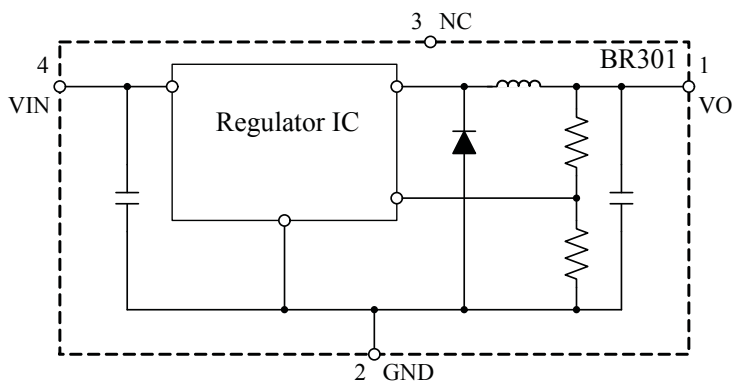
Typical Application



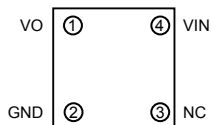
Typical application circuit example

- An input electrolytic capacitor, C_{IN} , of approximately 220 μF 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 μF or ceramic of approximately 30 μF 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



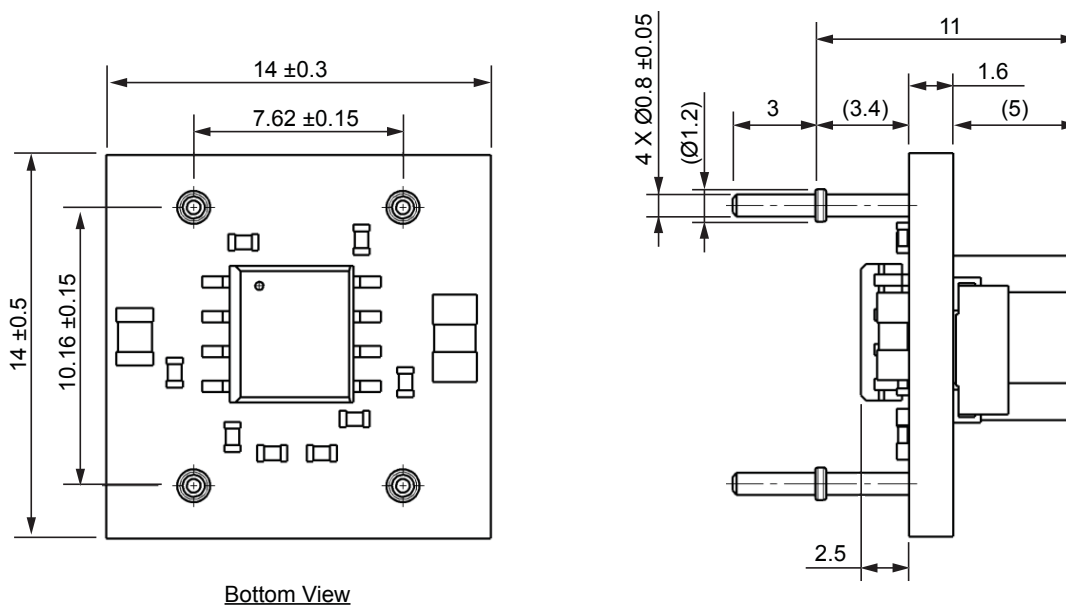
Pin-out Diagram



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.

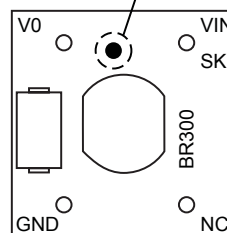
Package Outline Drawing



Bottom View

- All dimensions are in millimeters
- The tolerance is ± 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.

-
- The contents in this document are subject to changes, for improvement and other purposes, without notice. Make sure that this is the latest revision of the document before use.
 - Application and operation examples described in this document are quoted for the sole purpose of reference for the use of the products herein and Sanken can assume no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of Sanken or any third party which may result from its use.
 - Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to the society due to device failure or malfunction.
 - Sanken products listed in this document are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.).

When considering the use of Sanken products in the applications where higher reliability is required (transportation equipment and its control systems, traffic signal control systems or equipment, fire/crime alarm systems, various safety devices, etc.), and whenever long life expectancy is required even in general purpose electronic equipment or apparatus, please contact your nearest Sanken sales representative to discuss, prior to the use of the products herein.

The use of Sanken products without the written consent of Sanken in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.

- In the case that you use Sanken products or design your products by using Sanken products, the reliability largely depends on the degree of derating to be made to the rated values. Derating may be interpreted as a case that an operation range is set by derating the load from each rated value or surge voltage or noise is considered for derating in order to assure or improve the reliability. In general, derating factors include electric stresses such as electric voltage, electric current, electric power etc., environmental stresses such as ambient temperature, humidity etc. and thermal stress caused due to self-heating of semiconductor products. For these stresses, instantaneous values, maximum values and minimum values must be taken into consideration.

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.

- When using the products specified herein by either (i) combining other products or materials therewith or (ii) physically, chemically or otherwise processing or treating the products, please duly consider all possible risks that may result from all such uses in advance and proceed therewith at your own responsibility.
- Anti radioactive ray design is not considered for the products listed herein.
- Sanken assumes no responsibility for any troubles, such as dropping products caused during transportation out of Sanken's distribution network.
- The contents in this document must not be transcribed or copied without Sanken's written consent.