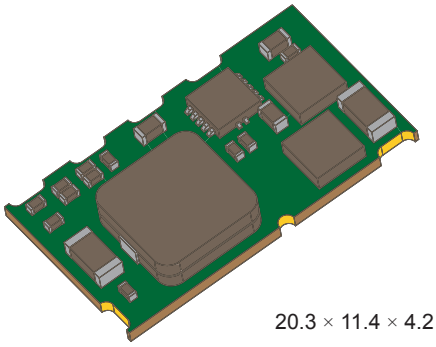
POL Converter Module for 12 V System Intermediate Bus

Features and Benefits

- Industry standard footprint
- Improved soldering: gold-plated pads and side notches
- Synchronized rectifying type stepdown chopper
- High power
- High efficiency: 89.9% at V_{IN} = 12 V, V_O = 1.5 V, I_O = 7 A
- Operating temperature range: –40°C to 85°C
- Input voltage range: 7 to 14 VDC
- Output voltage: 0.75 to 1.65 V
- Output current range: 0 to 10 A
- Operating frequency: 300 kHz
- Overcurrent protection function

Package: Module



20.3 × 11.4 × 4.2 mm

Description

The BR200 is thin type POL converter modules with an industry standard exterior shape and footprint, responsive to very high speed loads and compatible with ceramic capacitors.

This can be used as design-free POL converters for a 12 V system intermediate bus. This can be configured easily, reducing overall design time, and allowing reuse of designs.

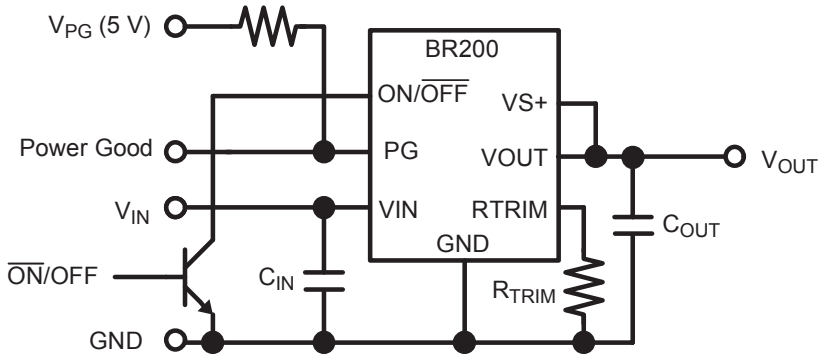
Miniaturization was achieved by high frequency switching technology, allowing saving space on the application PCB.

Soldering capability has been significantly improved by adoption of end face through holes.

Applications:

- Communication devices
- Computer server
- Other low power conversion

Typical Application Circuit



SANKEN ELECTRIC CO., LTD.
http://www.sanken-ele.co.jp/en/

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Selection Guide

Part Number	Output Voltage, V_{OUT} (V)	Operating Frequency, f_{OP} (kHz)
BR200	0.75 to 1.65	300

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

Absolute Maximum Ratings, valid at T_A = 25°C

Characteristic	Symbol	Notes	Pins	Rating	Unit
ON/$\overline{OFF}$ Pin Voltage	V_{ONOFF}		1	7	V
PG Pin Voltage	V_{PG}	Sink current 7 mA	9	7	V
Operating Temperature Range	T_A		–	–40 to 85	°C
Storage Temperature Range	T_{stg}		–	–40 to 85	°C
Operating Humidity Range	H_{OP}	No condensation	–	20 to 85	%
Storage Humidity Range	H_{stg}	No condensation	–	10 to 95	%

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Electrical Characteristics Unless specifically noted, T_A is 25°C

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	V_{IN}		7.0	12.0	14.0	V
Output Voltage	V_{OUT}	Adjust with R_{TRIM}	0.75	–	1.65	V
Output Current	I_{OUT}	With temperature derating	0	–	10	A
Output Voltage Accuracy	Err_{VOUT}	V_{IN} = 7 to 14 V, I_{OUT} = 0 to I_{OUT}(max), Operating Temperature Range, R_{TRIM} =1% accuracy	–2.0	–	2.0	$\%V_{OUT}$
Ripple Voltage[1]	V_{rip}	BW = 20 MHz, V_{OUT} = 1.5 V, I_{OUT} = 0 to10 A, C_{OUT} = 400 µF	–	35	50	mV_{p-p}
Efficiency	η	V_{IN} = 12 V, I_{OUT} = 10 A, V_{OUT} = 1.5 V	–	88.5	–	%
Operating Frequency	f_{OP}		–	300	–	kHz
Overcurrent Protection Threshold	$I_{OUT(OCP)}$	Hiccup	–	24.5	–	A
Input Capacitor[2]	C_{IN}	When input voltage is an ideal voltage source	20	–	5000	µF
Output Capacitor[2]	C_{OUT}	When input voltage is an ideal voltage source	200	–	4000	µF
Startup Time	t_r	V_{OUT} from 10% to 90% points	–	1.5	–	ms
Start Delay Time	t_d	With the ON/$\overline{OFF}$ pin open, measured from the VIN pin switching high, to V_{OUT} reaching 10% of operating level (see figure 1)	–	2	–	ms
ON/$\overline{OFF}$ Start Delay Time	t_{rcd}	With the VIN pin high, measured from the ON/$\overline{OFF}$ pin switching open, to V_{OUT} reaching 10% of operating level (see figure 2)	–	2	–	ms
Interface Characteristics						
Power Good	P_{WGL}	Lower limit of Power Good	83.3	87.5	91.7	$\%V_{OUT}$
	P_{WGH}	Upper limit of Power Good	109.2	112.5	116.7	$\%V_{OUT}$
ON/$\overline{OFF}$ Pin High Voltage	V_{IH}	When the ON/OFF pin is set open, the BR200 converter is turned on	0.55	0.70	1.00	V
ON/$\overline{OFF}$ Pin Low Voltage	V_{IL}	When the ON/OFF pin is pulled down to GND, the BR200 converter is turned off	0.27	0.30	0.33	V

[1]See the Ripple Voltage Measuring Method section.
[2]Place bypass capacitors between the VIN and VOUT terminals and GND (see C_{IN} and C_{OUT} in the Typical Application Circuit diagram). Locate the capacitor as close as possible to the terminal.

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Characteristic Definitions

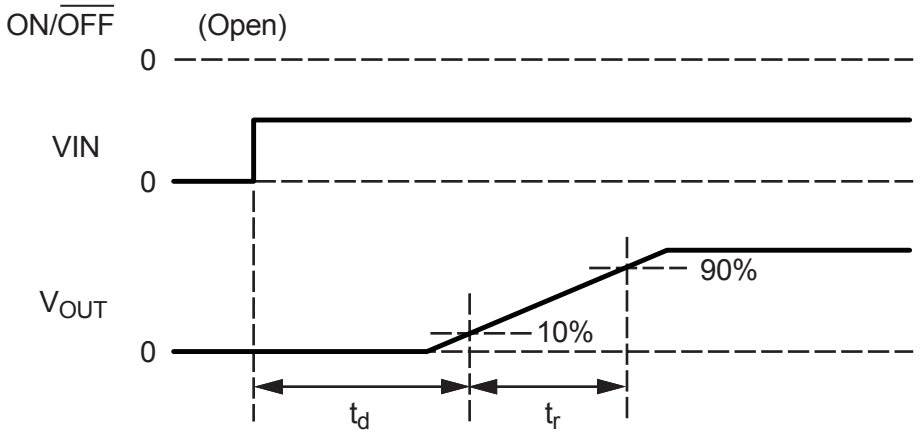


Figure 1. Start Delay Time, t_d, definition

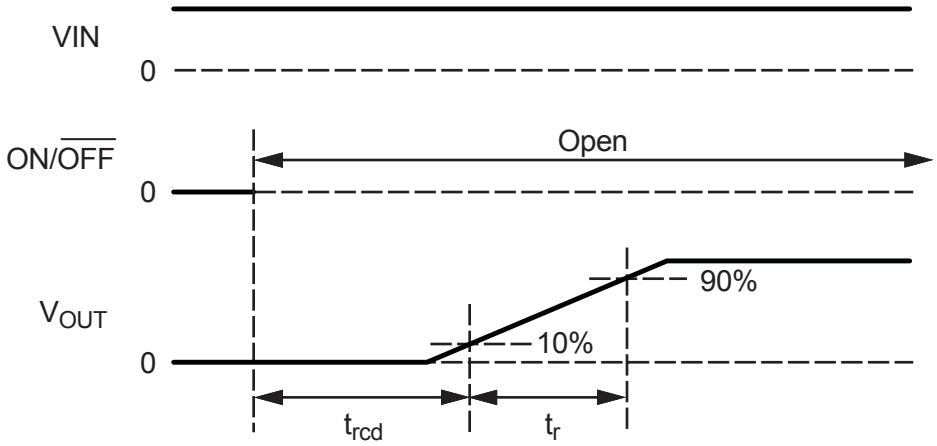


Figure 2. ON/$\overline{\text{OFF}}$ Start Delay Time, t_{rcd}, definition

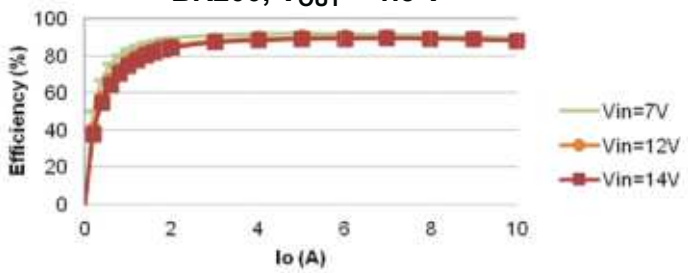
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Performance Characteristics

T_A = 25°C

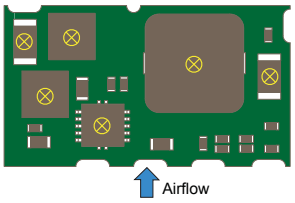
Efficiency versus Output Current

BR200, V_{OUT} = 1.5 V



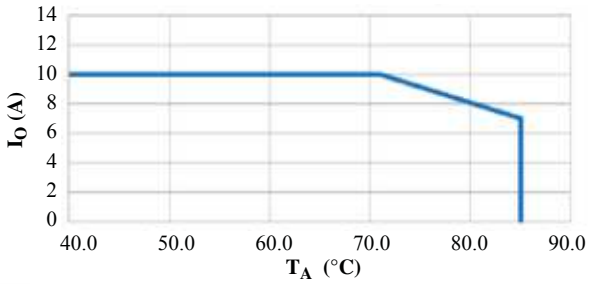
Temperature Derating

Measuring condition:
Product soldered directly to 101.6 ×101.6 mm, 1.6 mm thick, 6-layer PCB
PCB is mounted vertically during measurement

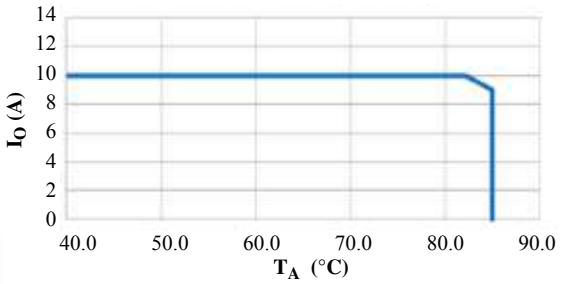


Measuring locations
(Centers of top surface of major components)

BR200, V_{OUT} = 1.5 V, V_{IN} = 12 V
In Still Air



BR200, V_{OUT} = 1.5 V, V_{IN} = 12 V
1.5 m/s Airflow



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Functional Description

Power Good (PG) Operation

When output voltage, V_{OUT}, is within the Power Good detection range, the PG pin is disconnected internally by the MOSFET switch. The signal at the Power Good node is pulled up to 5 V. If V_{OUT} falls out of the Power Good detection range, the MOSFET switch connects PG to GND, and the signal at the Power Good node is pulled low. The PG peripheral circuit is shown in figure 3.

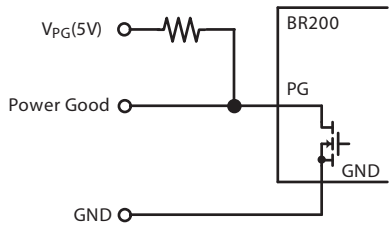


Figure 3. PG peripheral circuit

Output Sensing (VS+) and Compensation

Reduction in output voltage can be compensated by connecting the output sense terminal, VS+, to the load. When using LC filter, the proper connection is shown in panel A of figure 4. Note: Do not connect the output sense terminal to the output of the LC filter. It may not operate normally.

CAUTION: When the output sense terminal is not used, it must be connected directly to the VOUT output terminal. This is shown in panel B of figure 4.

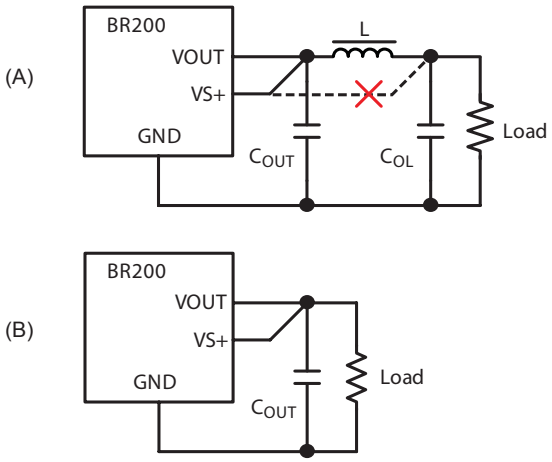


Figure 4. VS+ peripheral circuit

External On/Off Output Control (ON/$\overline{\text{OFF}}$)

Operation of the output of the product can be turned on and off by using the On/Off function, irrespective of input voltage connection.

This is enabled by connection of the ON/$\overline{\text{OFF}}$ pin (pin 1) (refer to figure 5):

- When the ON/$\overline{\text{OFF}}$ pin is open, the output voltage is on
- When the ON/$\overline{\text{OFF}}$ pin is connected to GND, the output voltage is off

The ON/$\overline{\text{OFF}}$ pin is also used as a soft-start function. Do not connect the ON/$\overline{\text{OFF}}$ pin to the other pins in parallel, and be sure to connect the ON/$\overline{\text{OFF}}$ pin to a single switch device such as a FET (see figure 5). Do not pull-up the ON/$\overline{\text{OFF}}$ pin from the external voltage source.

CAUTION:

- The ON/OFF pin is pulled-up inside the BR200 converter. Therefore, a voltage of 6.5 V is output to the ON/OFF pin.
- Do not feed voltage to the ON/OFF pin from outside BR200 converter.

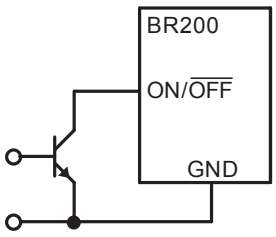


Figure 5. ON/$\overline{\text{OFF}}$ peripheral circuit

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R_{TRIM} Constant Reference Value for Output Voltage

The output voltage level is set by the value of a resistance connected to the RTRIM pin. The relationship is:

BR200: R_{TRIM} (Ω) = (0.6 × 10,000) / (V_{OUT} (V) – 0.6)

The following table provides representative values for R_{TRIM} to generate voltages within the specified V_{OUT} ranges:

BR200

V_{OUT} (V)	R_{TRIM} (Ω)
1.65	5714
1.5	6666
1.2	10000
1	15000
0.95	17142
0.9	20000
0.75	40000

Reset Conditions

There are two methods for resetting all functions in the BR200 (refer to figure 6):

- Set VIN pin voltage to 0.5V or lower for a minimum of 100 ms, or
- Set the ON/$\overline{OFF}$ pin voltage to 0.27 V or lower for a minimum of 10 ms

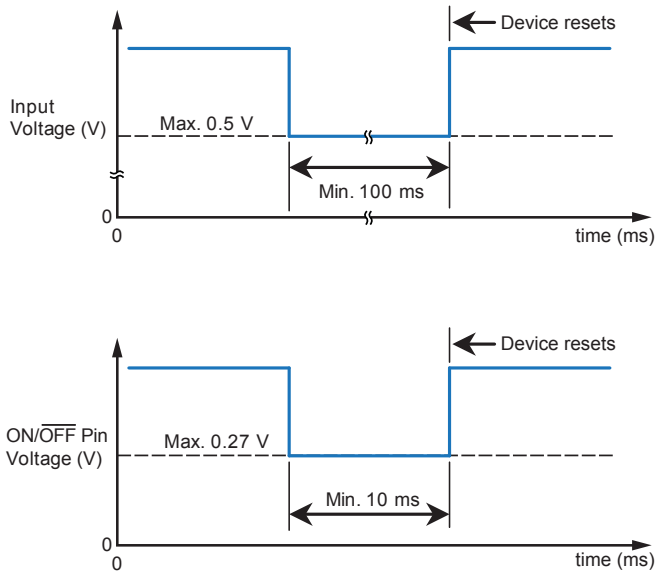


Figure 6. Reset conditions timing diagrams

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Application Information

Test Measuring Circuit

The test measuring circuit used for establishing the BR200 electrical characteristics is is shown in figure 7.

The decoupling capacitors, C_{IN} and C_{OUT} , should be ceramic capacitors, placed near the I/O terminals of the BR200.

Ripple Voltage Measuring Method

Figure 8 provides the test measurement circuit used for establishing voltage ripple.

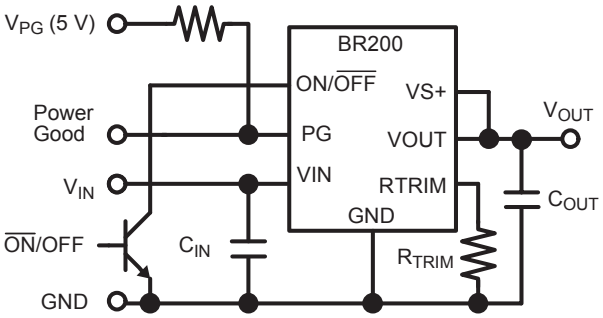


Figure 7. Test circuit for electrical characteristics

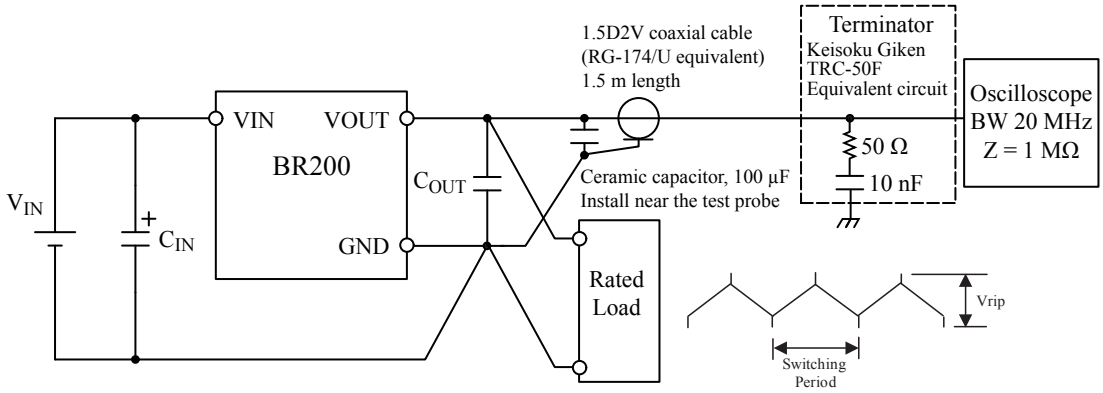
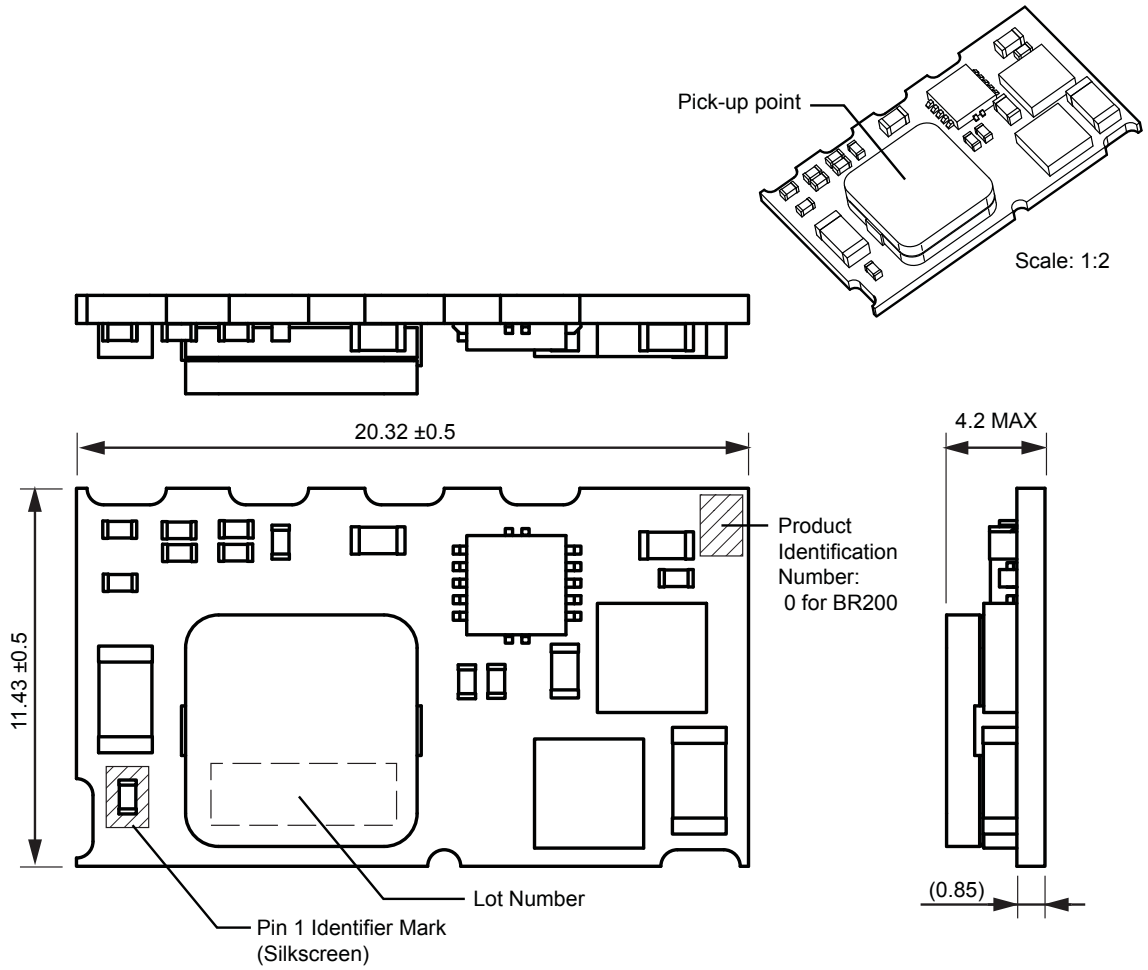


Figure 8. Test circuit for ripple voltage measurement

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Package Outline Drawing

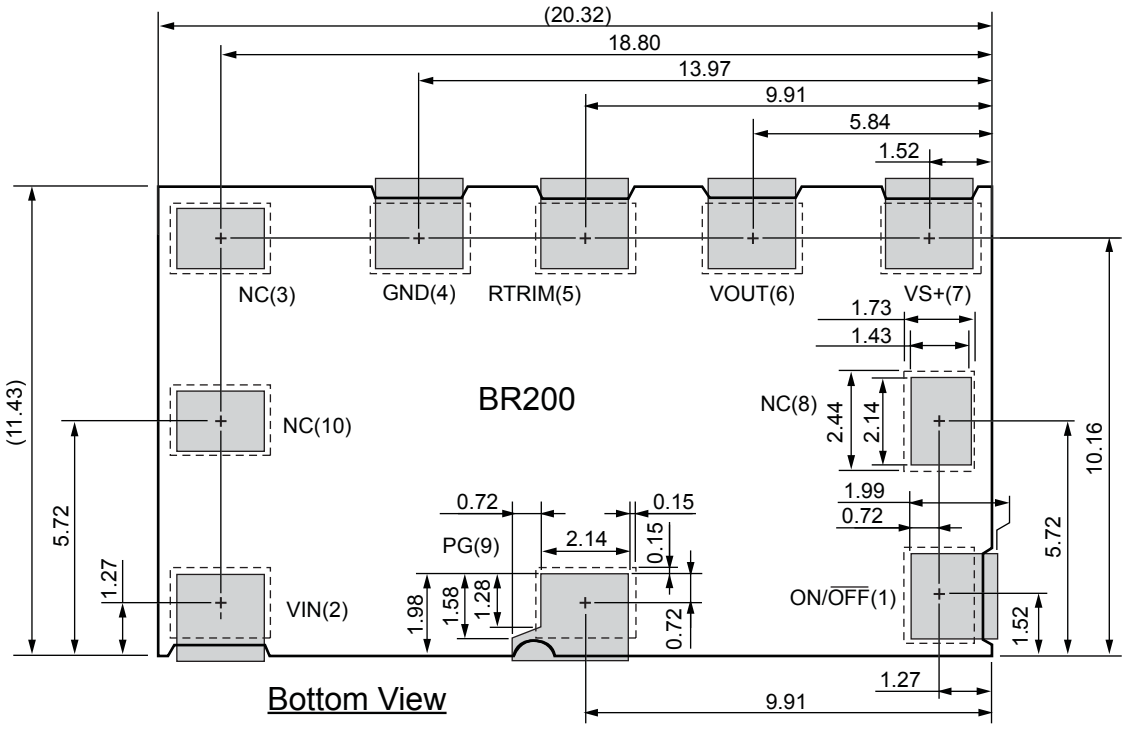


- All dimensions are in millimeters
- Dimensions shown in parentheses are reference dimensions.
- Product Weight 1.5 g
- Product Outline 20.3 x 11.4 x 4.2 mm (W × D × H) tolerance includes burrs and protrusions remaining from splitting the printed circuit board
- Coplanarity 0.1 mm (max)

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.

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PCB Board Layout and Pin-out Diagram



- The tolerance for all dimensions shown is ±0.1 mm.
- There are lands of the module, pattern, and through holes. Please give consideration to providing sufficient creepage distance when designing the pattern (the traces of different potentials are placed for a creepage distance of 0.25 mm from the land boundaries indicated by the dotted lines).
- The shaded areas indicate dimensions of lands (copper foil dimensions) on the PCB. (1.43 mm x 2.14 mm are the dimensions of a land / footprint.) Dimensions of a footprint do not include tolerance. Dimensions include only an assumed mounting variance of 0.15 mm for both vertical and horizontal directions.
- In actual use of a module, please consider actual mounting variances and adjust footprint dimensions.
- A dotted line indicates a pad of a module. The area which exceeds the footprint dimensions of 1.43 mm x 2.14 mm is the extended pad. When a user requires improvement in power dissipation and to maximize soldered area, it is recommended to cover the whole shaded area. But if a user does not require the improvement, please use the module with minimum pad area, 1.43 mm x 2.14 mm.

Pin List Table

Number	Name	Function
1	ON/$\overline{\text{OFF}}$	Input for external control of output
2	VIN	Supply for device
3, 8,10	NC	No connection
4	GND	Device ground terminal
5	RTRIM	Output voltage level setting terminal, connect to external resistor R_{TRIM}
6	VOUT	Output voltage terminal
7	VS+	Output feedback sense terminal
9	PG	Power Good flag output

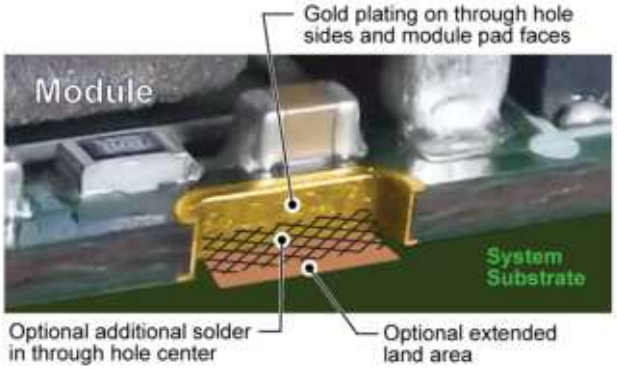


Figure 9. Optional edge soldering at through hole centers

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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.

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.

Cautions for Use

- Do not use the power modules under overload conditions as that will damage the module and cause a malfunction or failures.
- Use the products within the specified input voltage range.

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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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