# RTKA223011DR0030BU

Demonstration Board

The RTKA223011DR0030BU demonstration board is a high voltage buck converter that demonstrates a low-cost high performance non-isolated AC/DC conversion from a universal input of $85V_{AC}$ ~ $265V_{AC}$ to a 24V output with an output current up to 200mA.

The board has built-in overcurrent, short-circuit, input brownout and over-temperature protections.

RTKA223011DR0030BU comes in a RAA223011 in 8 Ld SOIC package.

## Key Features

- Universal input
- Standby power less than 13mW
- No audible noise
- Low cost external components

## Specifications

This board is optimized for the following operating conditions:

- Input voltage: $85V_{AC}$ ~ $265V_{AC}$
- Output voltage: $24V_{DC}$
- Output current: 200mA max (at $230V_{AC}$ or higher)
- Efficiency: >75% at 100% load; 82% at 50% load
- No-load power: 11.9mW at $120V_{AC}$; 12.3mW at $230V_{AC}$
- Load regulation: -2.2%, load range 10% to 100%
- Operating temperature: -45°C ~ 70°C
- Board dimension: 29mm x 52mm

## Ordering Information

| Part Number | Description |
|---|---|
| RTKA223011DR0030BU | RAA223011 SO8 demonstration board |

## Related Literature

For a full list of related documents, visit our website:

- RAA223011 device page

# 1. Circuit Description

The RTKA223011DR0030BU is a buck regulator implemented with a high-side float-switching topology, with switching frequency up to 30kHz. Its input has D1, D5, D6, and D7 operating as a full-bridge rectifier. FR is a 1W fusible resistor providing input overcurrent protection and inrush current limiting.

C1, L1, and C2 consists of the input filter that provides the energy buffer after rectification and reduces conducted EMI noises to the input. L2, D2, and $C_{OUT}$ are the buck converter components. RFB1, RFB2, CFB2, and CFB1 provide the output feedback signal to the IC. D4 and R2 provide $V_{CC}$ biasing current after startup, to increase the efficiency. They can be optional for low-cost, low-power applications. $C_{VCC}$ is the IC supply capacitor.

## 1.1 Recommended Equipment

- AC power supply capable of generating AC voltage from $85V_{AC}$ to $265V_{AC}$ at 60Hz/50Hz, with at least 100mA output current capability.
- Load resistor box with adjustable value of 120Ω and up, or an electronics load that can emulate a resistor load or current load up to 200mA.
- Multi-meters to measure the output voltage and current.
- Power meter to measure the AC input power.

## 1.2 Quick Start Guide

1. Program the AC power supply with a voltage between $85V_{AC}$ and $265V_{AC}$ at the corresponding frequency of 60Hz or 50Hz.
2. While the AC power supply is off, connect the output cables of the AC power supply to the L and N terminal of the RTKA223011DR0030BU. An optional power meter can be added in between AC power supply output and the input of the board.
3. Connect the load to the output terminals VOUT and GND.
4. Connect a voltage meter to VOUT and GND and connect a current meter between board outputs and the load.
5. Turn on AC power supply.

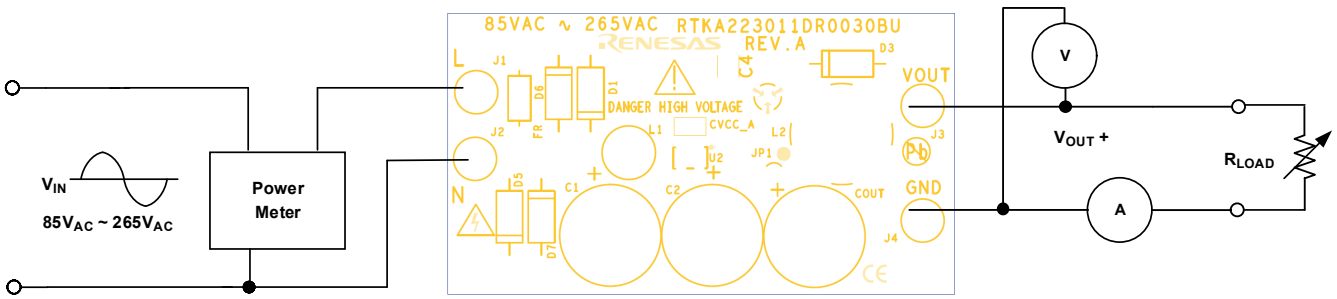


**Figure 1. RTKA223011DR0030BU Connection Diagram**

# 2. Board Design

## 2.1 PCB Layout Guidelines

For detailed PCB guidelines, see the RAA223011 datasheet.

## 2.2 RTKA223011DR0030BU Evaluation Board

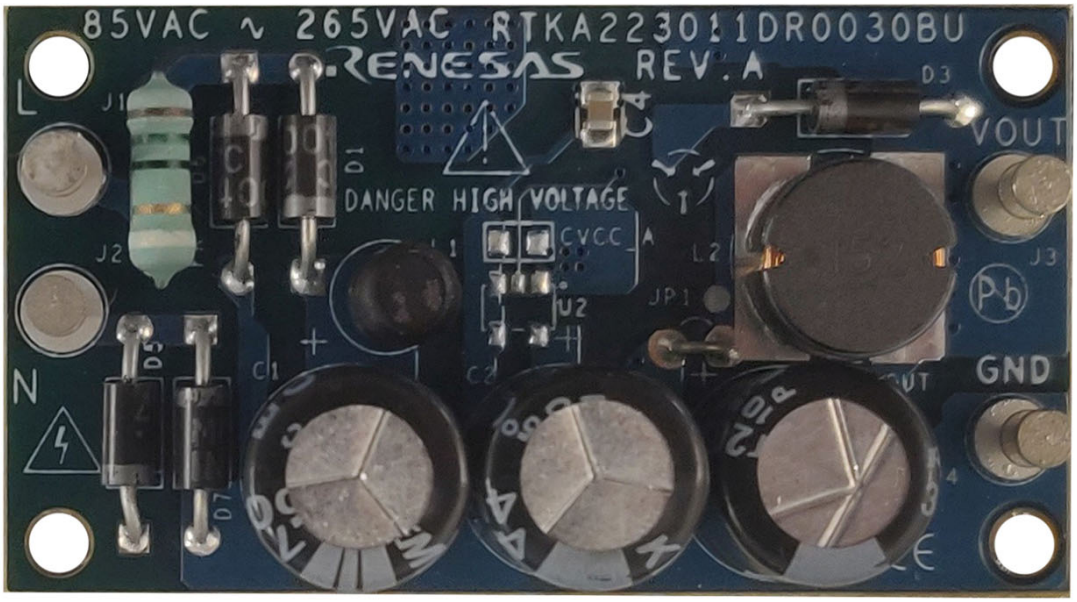


**Figure 2. RTKA223011DR0030BU Evaluation Board (Top)**

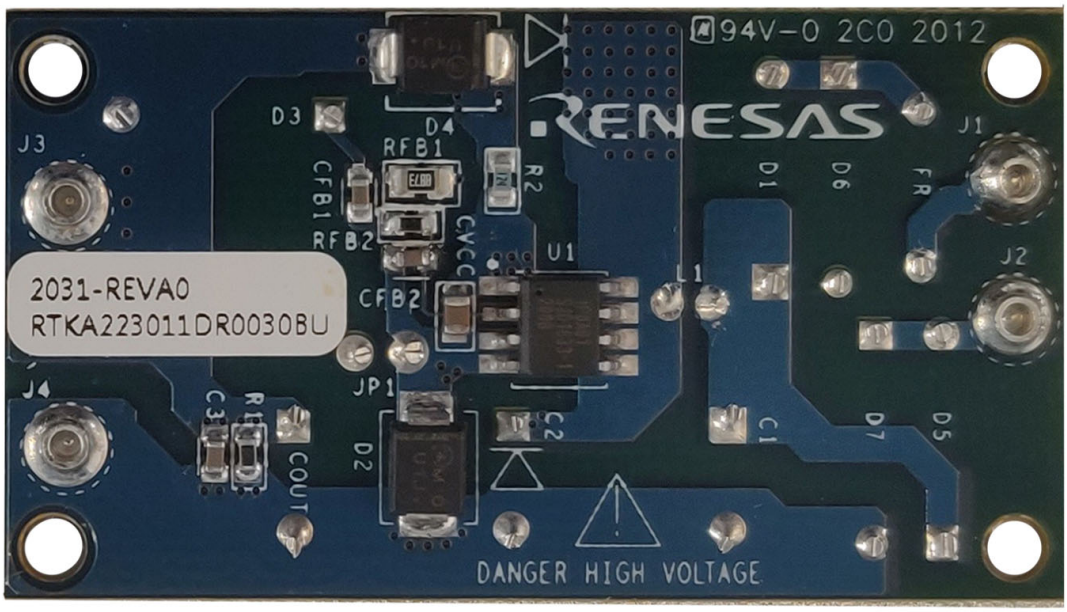


**Figure 3. RTKA223011DR0030BU Evaluation Board (Bottom)**

## 2.3 RTKA223011DR0030BU Circuit Schematic

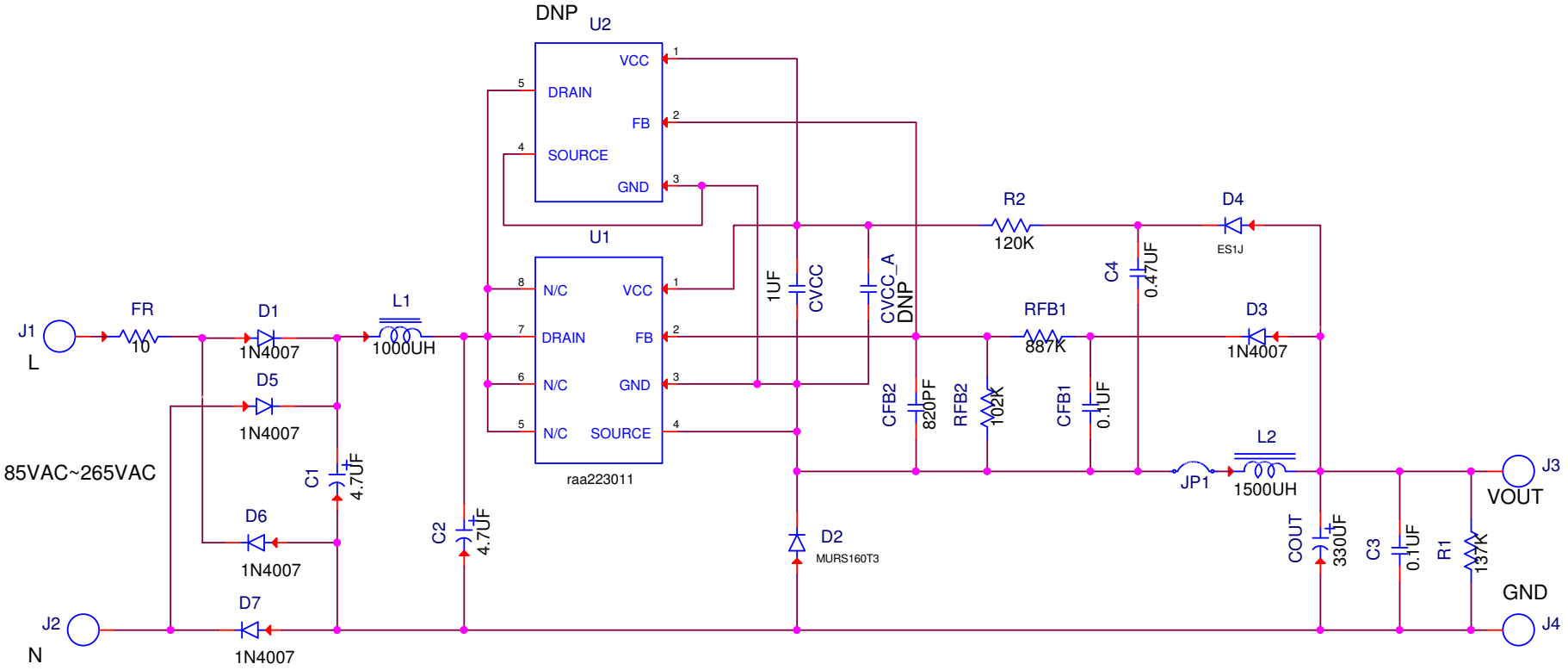


**Figure 4. RTKA223011DR0030BU Schematic**

## 2.4 Bill of Materials

| Qty | Ref Des | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| 5 | D1, D3, D5-D7 | Generic Diode, 1kV, 1A, DO41 | Various | 1N4007 |
| 1 | COUT | CAP ALUM 330µF 20% 35V RADIAL | Rubycon | 35ZLH330MEFCT810X12.5 |
| 1 | FR | Miniature Metal Film Resistor, 10Ω, 1W, Wirewound | Yageo | FKN1WSJR-52-10R |
| 2 | C1, C2 | CAP ALUM 4.7µF 20% 400V RADIAL | Kemet | ESG475M400AH2AA |
| 1 | CVCC | Multilayer Cap, 1µF, 50V, 10%, 0603 | Murata | Generic |
| 0 | CVCCA | Do Not Populate | | |
| 1 | CFB2 | Multilayer Cap, 820PF, 50V, 10%, 0603 | Generic | |
| 2 | C3, CFB1 | Multilayer Cap, 0.1µF, 50V, 10%, 0603 | Generic | |
| 1 | C4 | Multilayer Cap, 0.47µF, 50V, 10%, 0603 | Generic | |
| 1 | RFB2 | Thick Film Chip Resistor, 102k, 1/16W, 1%, 0603 | Generic | |
| 1 | R1 | Thick Film Chip Resistor, 137k, 1/16W, 1%, 0603 | Generic | |
| 1 | RFB1 | Thick Film Chip Resistor, 887k, 1/10W, 1%, 0603 | Generic | |
| 1 | D4 | 1A 600V Fast Rectifier Diode, DO214 | Fairchild | ES1J |
| 1 | D2 | Ultrafast Power Rectifier, 600V, 2A, SMB | On Semicondutor | MURS160T3 |
| 0 | U2 | Do Not Populate | | |
| 1 | U1 | 700V, AC/DC Buck Regulator, SO8 | Renesas | RAA2230114GSP#JA0 |
| 1 | R2 | Thick Film Chip Resistor, 120k, 1/16W, 1%, 0603 | Generic | Generic |
| 1 | L1 | RLB Series Radial Lead Inductor, 1mH, 10%, 100MA, Type2 | Bourns | RLB0608-102KL |
| 1 | L2 | Power Inductor, 1.5mH, 10%, 0.45A, SMD | Bourns | SDR1006-152KL |

## 2.5 Board Layout

To download our design files, visit our website.

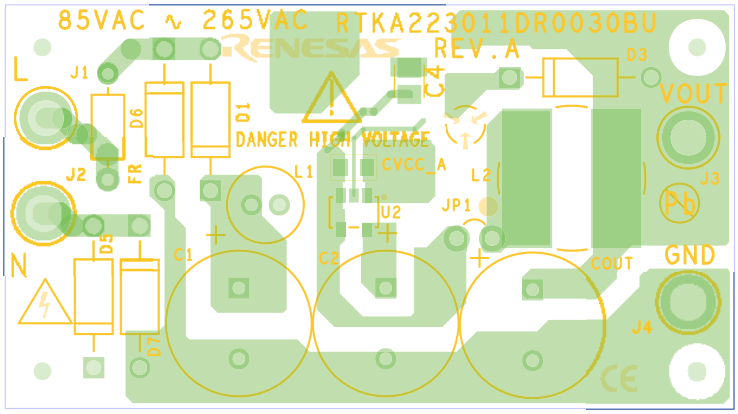


**Figure 5. Top Layer**

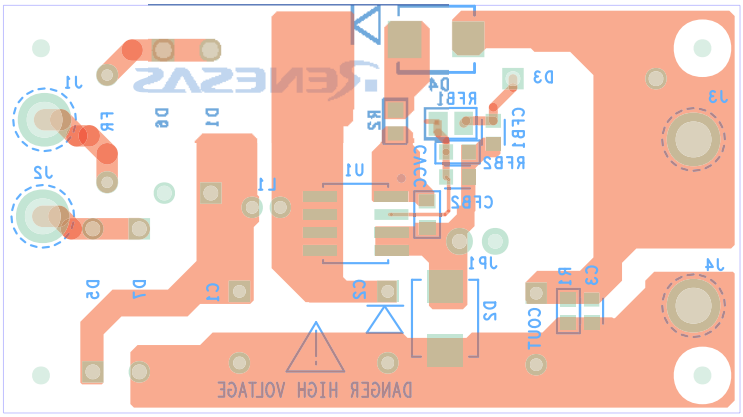


**Figure 6. Bottom Layer**

# 3. Typical Performance Curves

$V_{in}$ = 85$V_{AC}$ ~ 265$V_{AC}$, $V_{OUT}$ = 24V, $I_{OUT}$ = 200mA (maximum), $T_A$ = +25°C

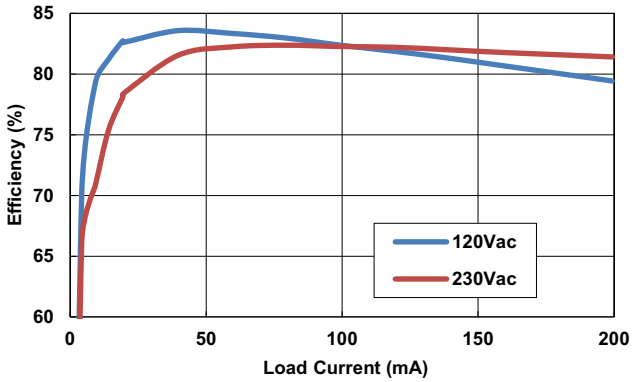


Figure 7. Efficiency Overload Current

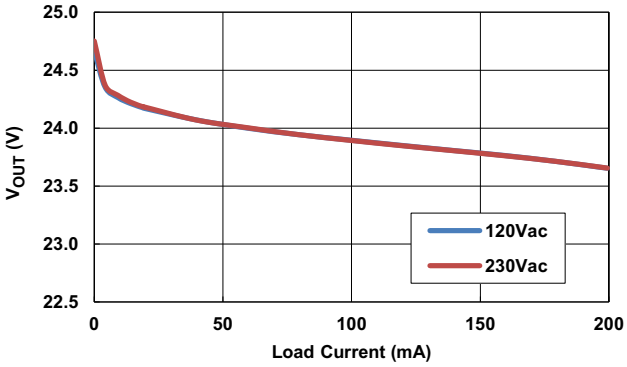


Figure 8. Load Regulation

Table 1. Typical No-Load Power Consumption

| Power Supply | Standby Power | Energy Star |
|---|---|---|
| 120$V_{AC}$/60Hz | 11.9mW | 300mW |
| 230$V_{AC}$/50Hz | 12.3mW | 300mW |

# 4. Revision History

| Revision | Date | Description |
|---|---|---|
| 1.0 | Feb 11, 2021 | Initial release |

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(Rev.1.0 Mar 2020)


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