RTKA223011DE0000BU

Evaluation Board

The RAA223011 evaluation board (RTKA223011DE0000BU) is a high voltage buck converter that is designed to demonstrate a low-cost high performance non-isolated AC/DC conversion from an universal input of $85V_{AC}$ to $265V_{AC}$, to a 12V output with the output current up to 300mA.

The RTKA223011DE0000BU has built-in overcurrent, short-circuit, input brownout, and over-temperature protection. The board is designed on a single side PCB with a single diode half-wave input rectification. It is pre-compliant with conducted and radiated EMI requirements by EN55022/CISPR 22.

RTKA223011DE0000BU comes with a RAA223011 in a 5 Ld TSOT23 package.

Key Features

- Universal input
- Single-side PCB with low cost external components
- EMI compliance for EN55022/CISPR22
- Standby power less than 10mW
- No audible noise

Specifications

This board is optimized for the following operating conditions:

- Input voltage: $85V_{AC}$ ~ $265V_{AC}$
- Output voltage: $12V_{DC}$
- Output current: 300mA max (at $230V_{AC}$ or higher)
- Output power: 3.6W
- Efficiency: >73% at 100% load; 80% at 50% load
- No-load power: 7mW at $120V_{AC}$; 9.6mW at $230V_{AC}$
- Load regulation: -2.4%, load range 10% to 100%
- Operating temperature: -45°C~65°C
- Board dimension: 40mm x 60mm

Ordering Information

Part Number	Description
RTKA223011DE0000BU	RAA223011 evaluation Board for the 5 Ld TSOT23 option

Related Literature

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

- RAA223011 device page

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1. Circuit Description

The RTKA223011DE0000BU is buck regulator implemented with a high-side float-switching topology, with switching frequency up to 30kHz. Its input has D1, D7 as a low-cost half-wave rectification (with an optional full-bridge rectifier foot-print). FR is a 1W fusible resistor providing input overcurrent protection and inrush current limiting. It also helps to absorb the input line surge energy together with DC buffer caps, C1 and C2.

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} is the buck converter. 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 40Ω and up, or an electronics load than can emulate a resistor load or current load up to 300mA.
- Multimeters 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 terminals of the RTKA223011DE0000BU. An optional power meter can be added in between the AC power supply output and input of the board.
3. Connect the load to the output terminals VOUT and GND.
4. Connect a voltagemeter to VOUT and GND and connect a current meter between board outputs and the load.
5. Turn on AC power supply.

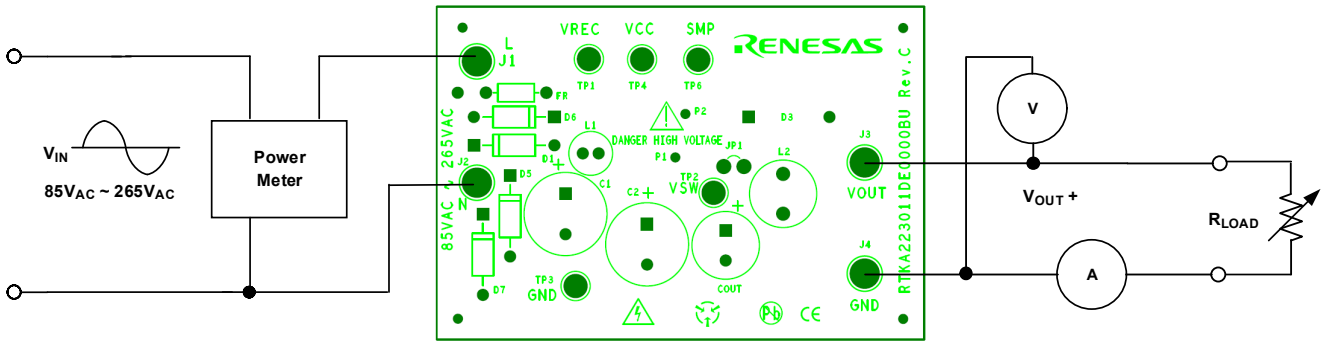


Figure 1. RTKA223011DE0000BU Connection Diagram

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2. PCB Layout Guidelines

For detailed PCB guidelines, see the RAA223011 datasheet.

2.1 RTKA223011DE0000BU Evaluation board



Figure 2. RTKA223011DE0000BU Evaluation Board (Top)

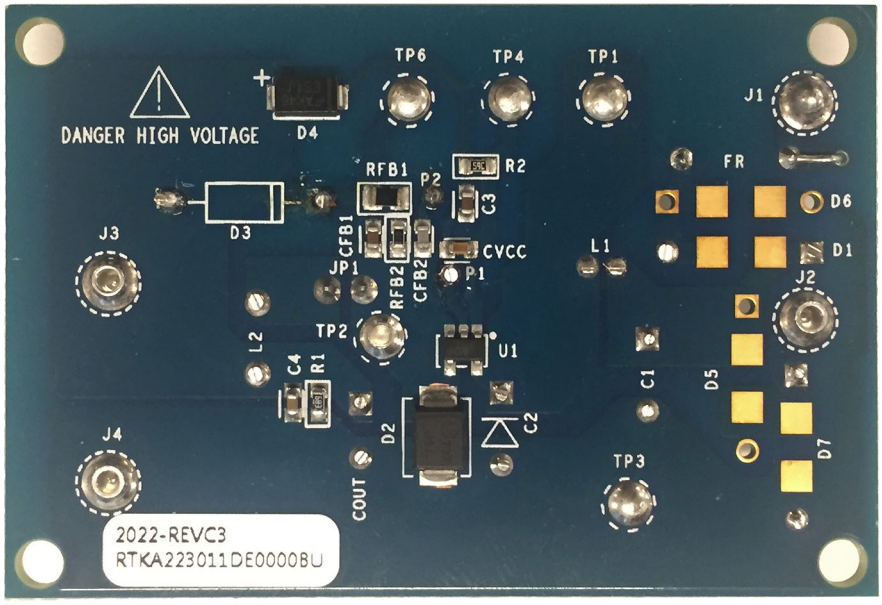


Figure 3. RTKA223011DE0000BU Evaluation Board (Bottom)

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2.2 RTKA223011DE0000BU Circuit Schematic

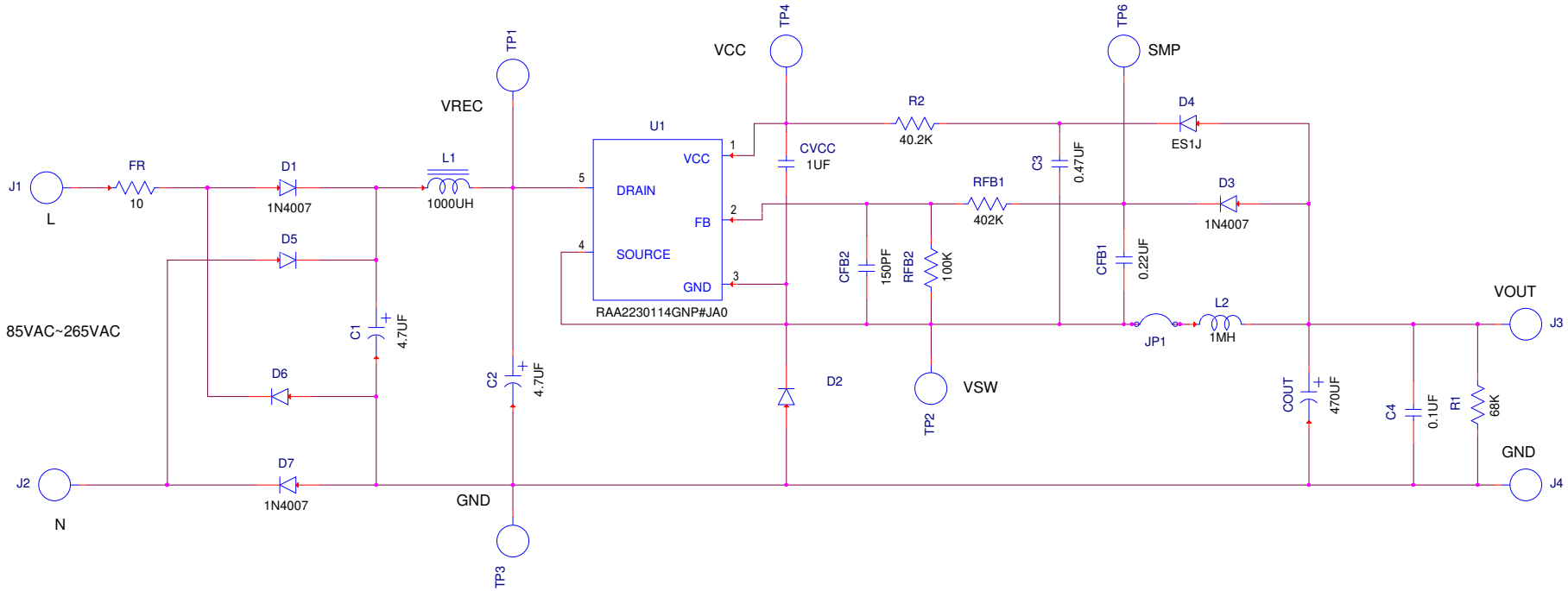


Figure 4. RTKA223011DE0000BU Schematic

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2.3 Bill of Materials

QTY	Reference Designator	Description	Manufacturer	Part Number
1	COUT	CAP ALUM 470µF 20% 16V Radial	Rubycon	16ZLH470MEFCT78X11.5
3	D1, D3, D7	Generic Diode, 1kV, 1A, DO41	MCC	1N4007
2	C3, C4	Multilayer CAP, 0.47µF, 16V, 10%, 0603	TDK	C1608X7R1C474K
1	FR	Miniature Metal Film Resistor, 10Ω, 1W, 1%, Axial	Yageo	FKN1WSJR-52-10R
1	D4	1A 600V Fast Rectifier Diode, SMA	Fairchild	ES1J
2	C1, C2	CAP ALUM 4.7µF 20% 400V Radial	Kemet	ESG475M400AH2AA
1	CFB2	Ceramic Chip Cap, 150pF, 5%, 50V, 0603	Murata	GRM1885C1H151JA01D
1	CFB1	Ceramic Chip Cap, 0.22µF, 10%, X7R, 25V, 0603	Murata	GRM188Z71E224KE43
1	CVCC	Multilayer Cap, 1µF, 10V, 10%, X7R, 0603	Murata	GRM188R71A105KA61D
1	RFB2	Thick Film Chip Resistor, 100k, 1%, 1/10W, 0603	Generic	
1	R2	Thick Film Chip Resistor, 40.2k, 1%, 1/10W, 0603	Generic	
1	R1	Thick Film Chip Resistor, 68k, 1%, 1/10W, 0603	Generic	
1	RFB1	Thick Film Chip Resistor, 402k, 1%, 1/8W, 0805	Generic	
1	D2	Ultrafast Power Rectifier, 600V, 2A, SMB	On Semiconductors	MURS160T3
1	U1	700V, 1W AC/DC Buck Regulator, TSOT23-5	Renesas	RAA2230114GP3#NA0
1	L2	Fixed Inductor, 1mH, 15%, 470mA, 1.915Ω, TH	Sumida	RCH8011NP-102L
1	L1	RLB Series Radial Lead Inductor, 1mH, 10%, 100mA, 11.5Ω, TH	Bourns	RLB0608-102KL

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2.4 Board Layout

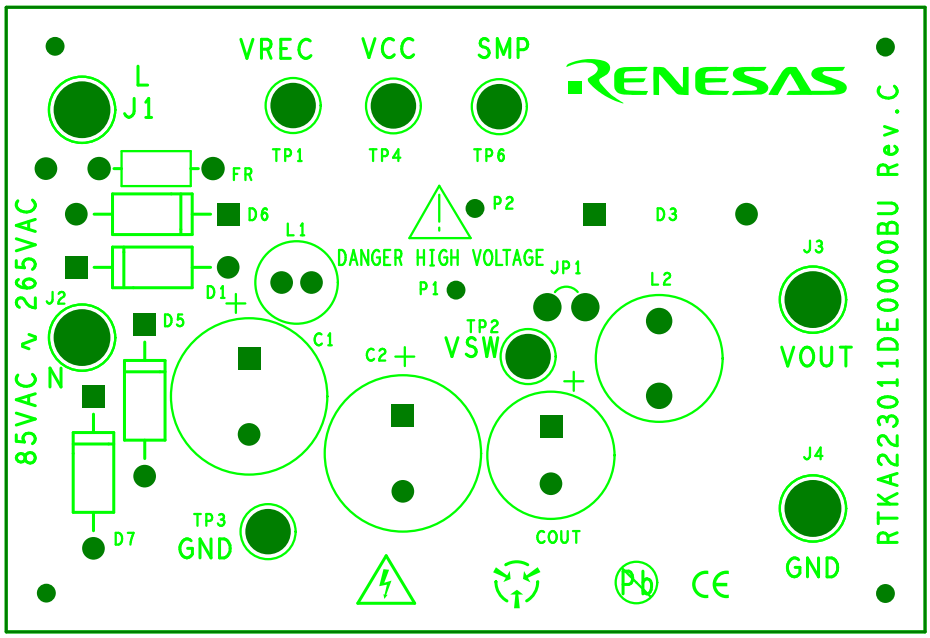


Figure 5. Top Layer

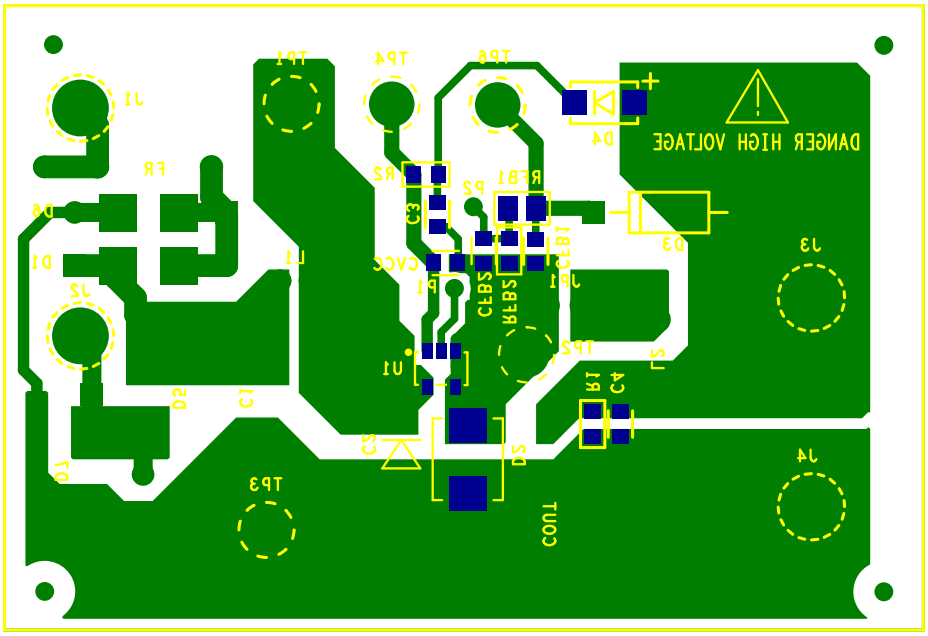


Figure 6. Bottom Layer

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3. Typical Performance Curves

V_{in} = 85V_{AC}~265V_{AC}, V_{OUT} = 12V, I_{OUT} = 300mA (maximum), T_A = +25°C

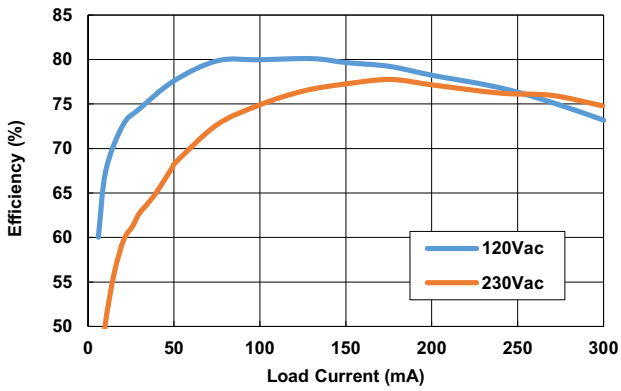


Figure 7. Efficiency Overload Current, V_{OUT} = 12V

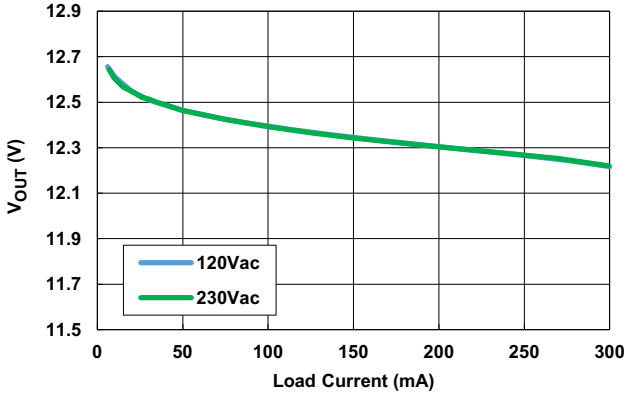


Figure 8. Load Regulation

Table 1. Typical No-Load Power Consumption

Power Supply	Standby Power	Energy Star
120V_{AC}/60Hz	7mW	300mW
230V_{AC}/50Hz	9.5mW	300mW

3.1 EMI Test Results

RTKA223011DE0000BU is compliant to the conducted EMI requirements of FCC Part15 and CISPR22.

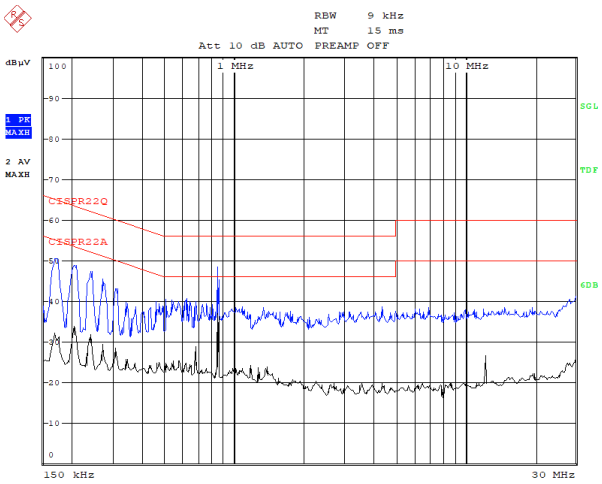


Figure 9. Line, 120V_{AC}

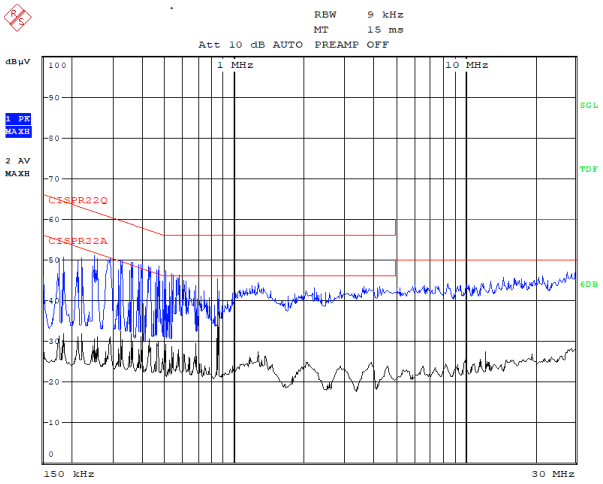


Figure 10. Line, 230V_{AC}

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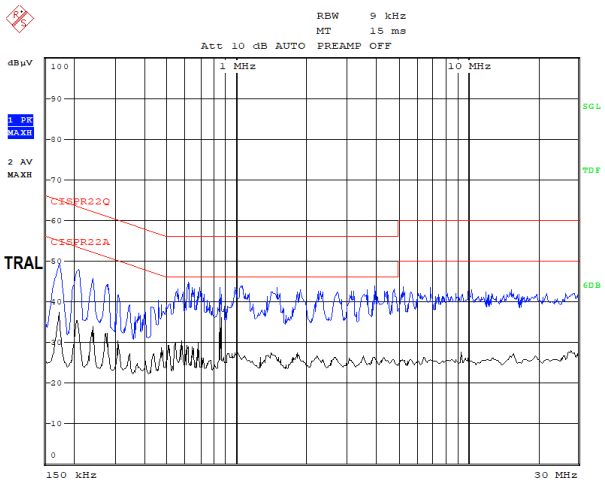


Figure 11. Neutral, 120V_{AC}

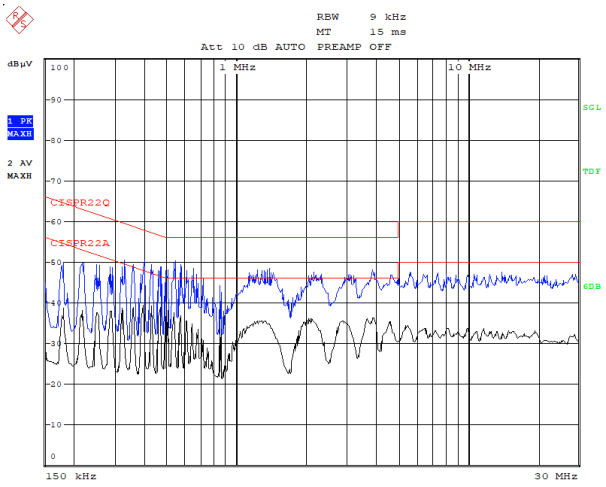


Figure 12. Neutral, 230V_{AC}

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4. Revision History

Rev.	Date	Description
1.00	Jan.27.21	Initial release

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