1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

Reference Guide

RD211-RGUIDE-01

TOSHIBA ELECTRONIC DEVICES & STORAGE CORPORATION

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1. Introduction

This reference guide contains specifications, usage, and characteristics of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment (hereafter referred to as this power supply).

This power supply is a 1kW DC-DC converter which takes the typical communication infrastructures voltage of DC -48 V as input and produces output of DC 32 V or 54 V. By adopting a non-isolated inverting buck-boost topology and incorporating our latest-generation power MOSFET as switching devices, we have achieved high-efficiency with compact size. This power supply is published as reference design which provides different kind of design information and contributes to labor saving while designing according to actual specifications.

2. Specifications and Appearance

2.1. Power Supply Specifications

Table 2.1 lists the main specifications of this power supply.

Table 2.1 Specifications of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

Item	Conditions	Minimum	Typical	Maximum	Unit
Input Characteristics					
Input Voltage		-60	-54	-36	V
Input Current	When input is DC -36 V			31	A
Output Characteristics (32 V Output)					
Output Voltage		31	32	33	V
Output Current				32.2	A
Output Power				1000	W
Output Ripple Voltage				320	mV
Switching Frequency			150		kHz
Output Characteristics (54 V Output)					
Output Voltage		52.4	54	54.6	V
Output Current				19.1	A
Output Power				1000	W
Output Ripple Voltage				540	mV
Switching Frequency			150		kHz

2.2. Block Diagram

Fig. 2.1 shows the block diagram of this power supply.

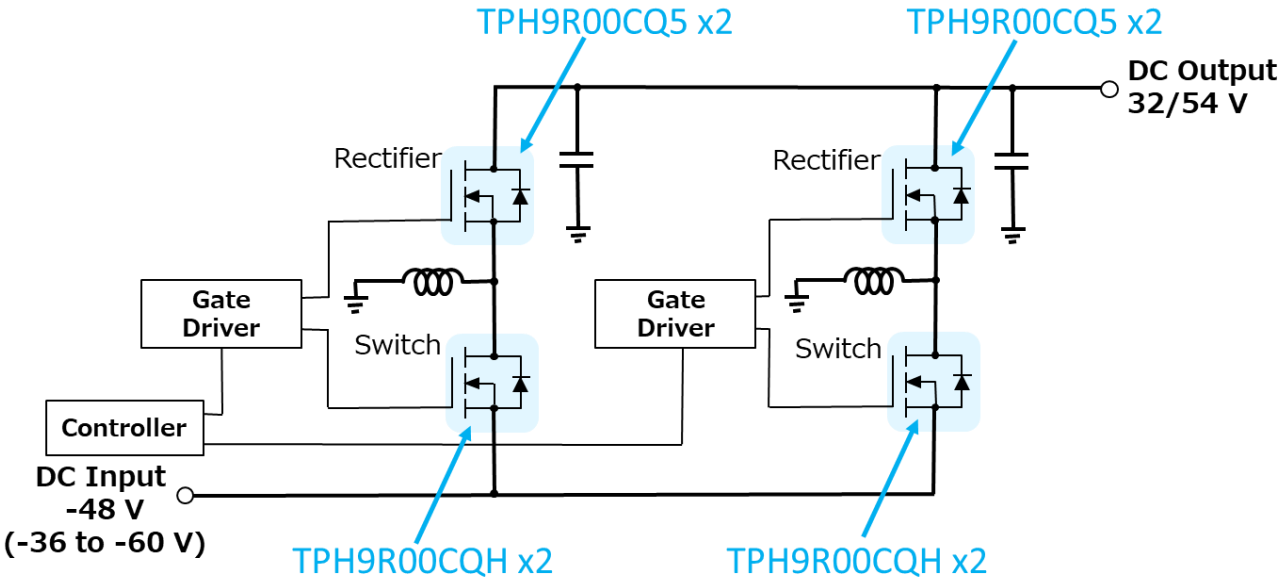


Fig. 2.1 Block Diagram of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

2.3. External Appearance

Fig. 2.2, Fig. 2.3 and Fig. 2.4 show the external appearance of this power supply.

Fig. 2.2 Side View of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

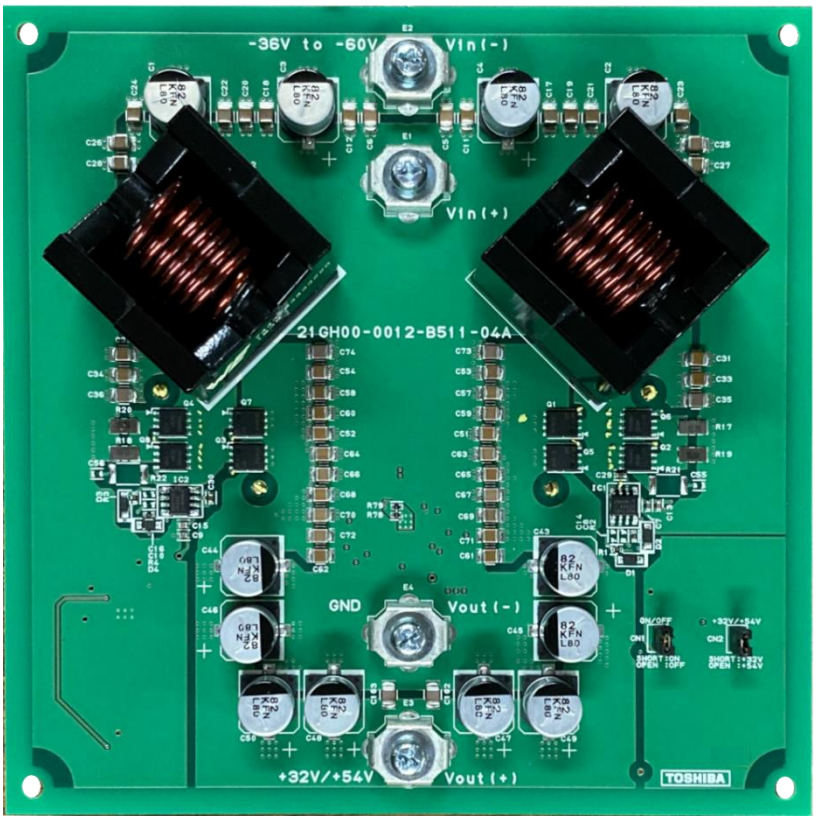


Fig. 2.3 Front View of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

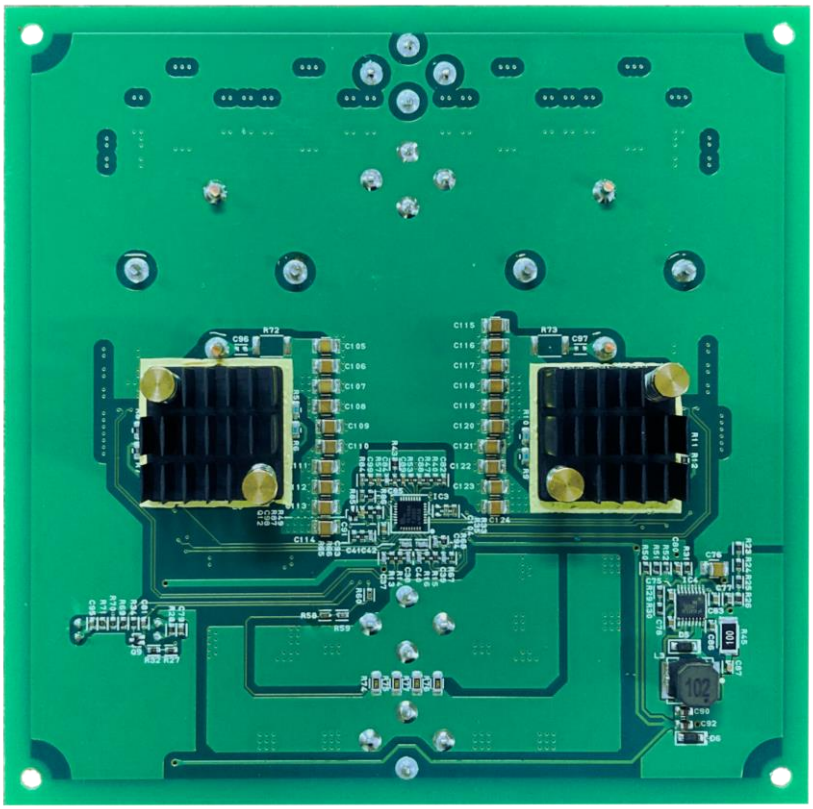
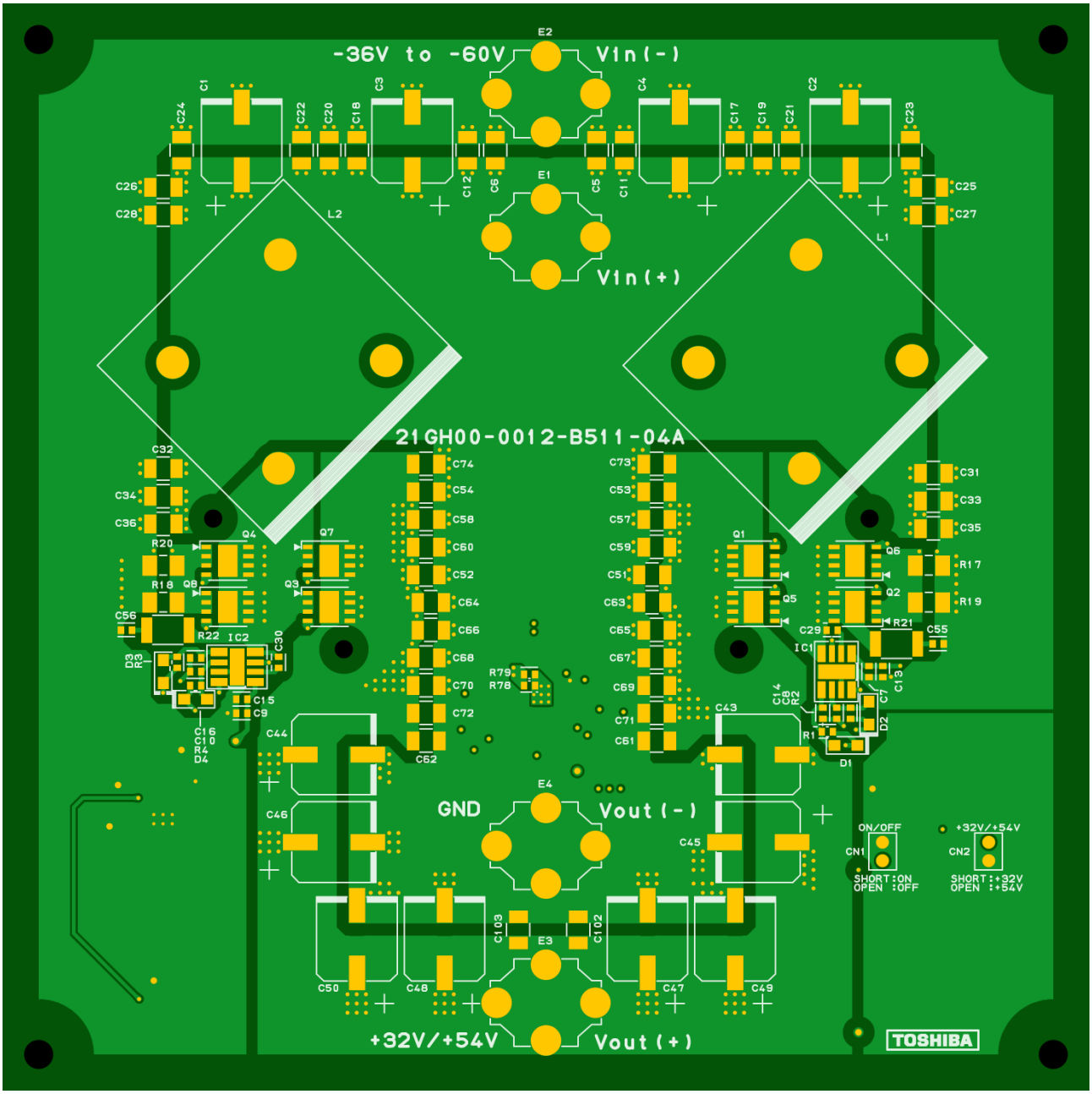


Fig. 2.4 Back View of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

2.4. Component Layout

Fig. 2.4 shows the layout of components of this power supply.



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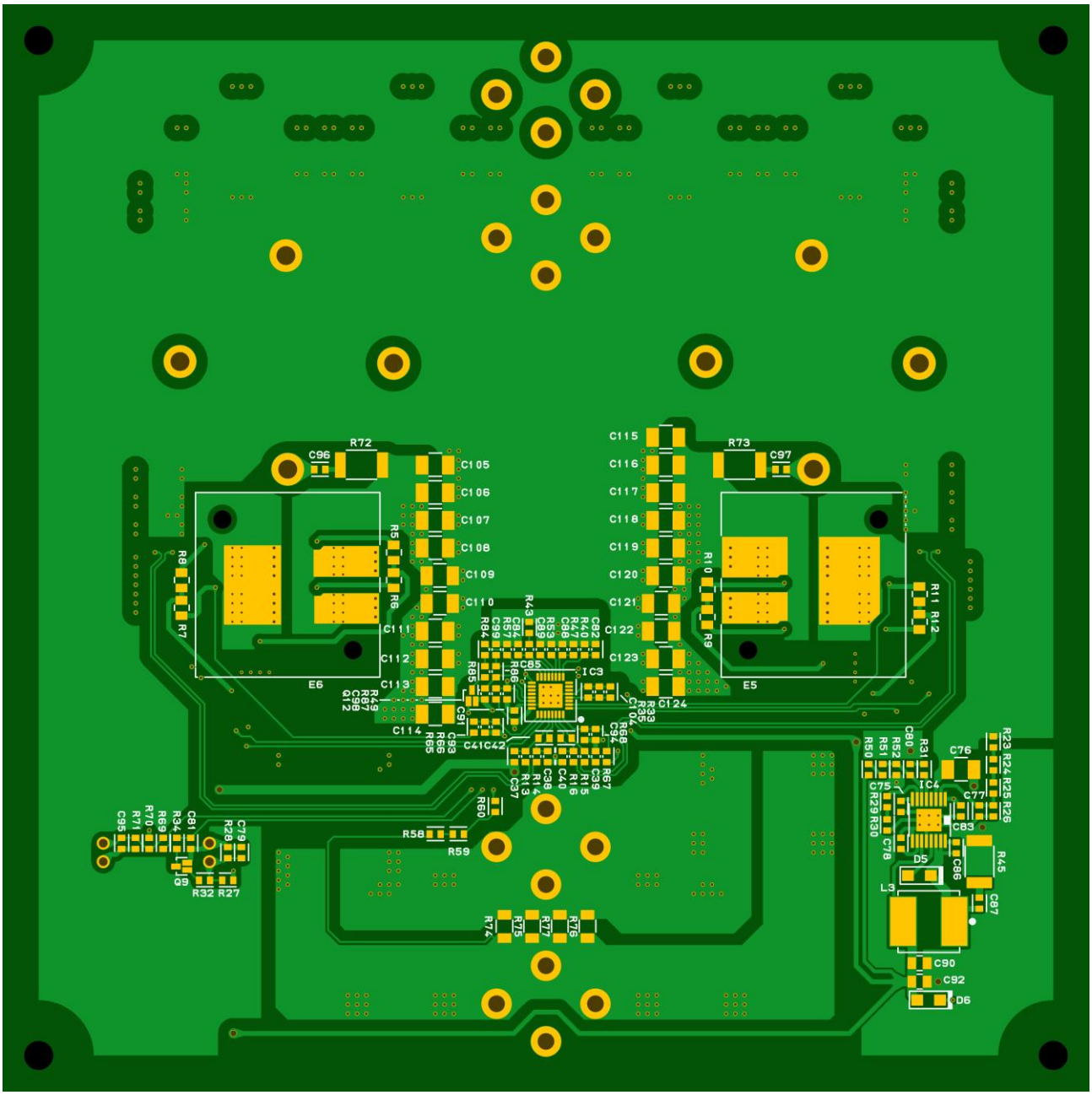


<Back>

Fig. 2.5 Component Layout of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

3. Schematic, Bill of Material, and PCB Pattern

3.1. Schematic

Refer to the following file for the schematic of this power supply.

RD211-SCHEMATIC-xx.pdf (xx is the revision number)

3.2. Bill of Material

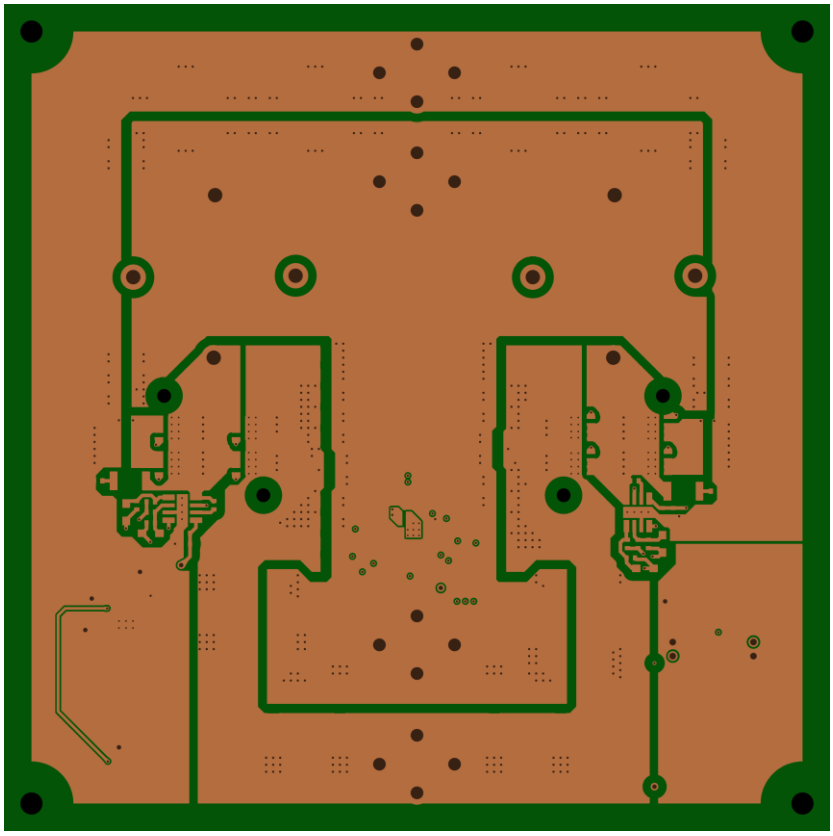
Refer to the following file for the Bill of Material (BOM) of this power supply.

RD211-BOM-xx.pdf (xx is the revision number)

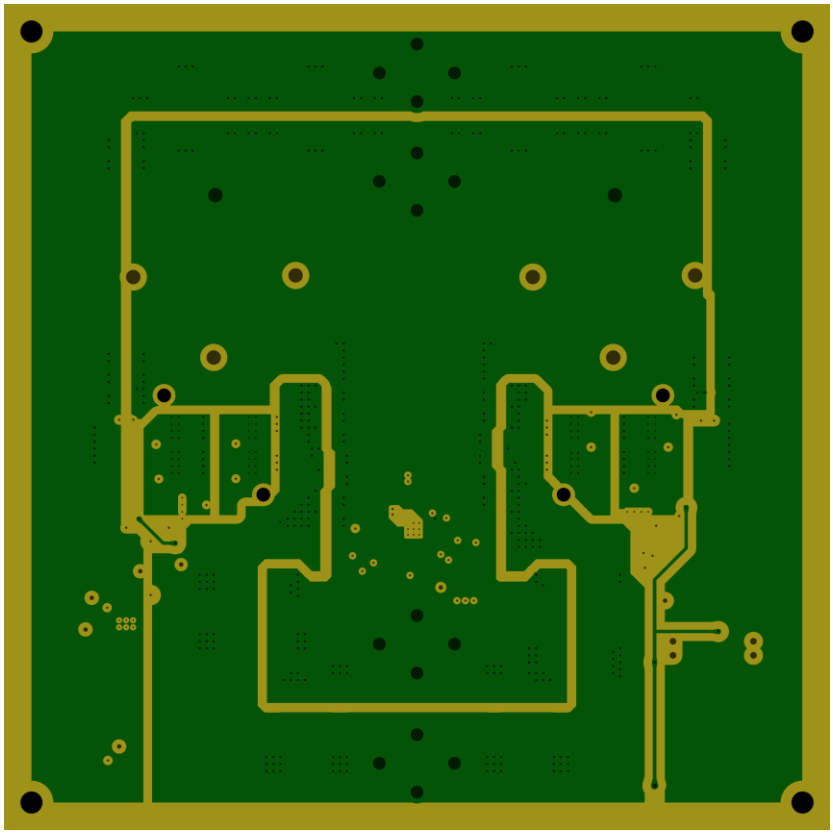
3.3. PCB Pattern

The PCB pattern of the circuit board of this power supply is shown in Fig. 3.1. Also refer to the following file.

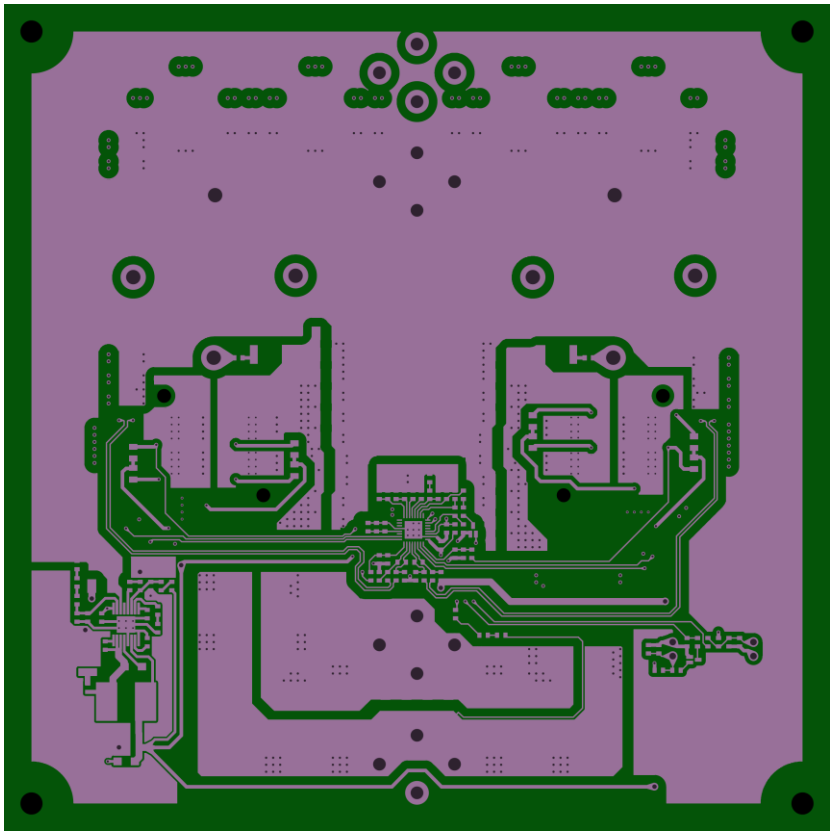
RD211-LAYER-xx.pdf (xx is the revision number)



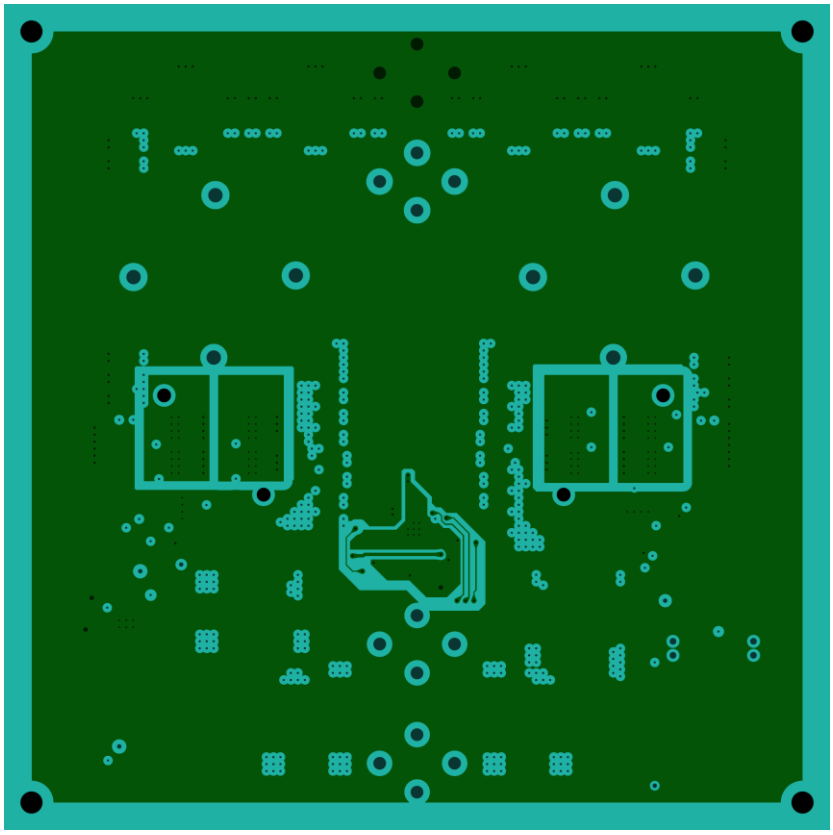
<Layer1 Front side, Front View>



<Layer2, Front View>



<Layer3, Front View>



<Layer4 Back side, Front View>

Fig. 3.1 PCB Pattern of 1 kW Non-Isolated Buck-Boost DC-DC Converter for Telecommunication Equipment

4. Operation Procedure

4.1. Connection to External Devices

Fig. 4.1 shows the terminals for external connection and setting of this power supply. The parts enclosed in red indicate the input terminals, the parts enclosed in blue indicate the output terminals, and the parts enclosed in orange indicate the jumpers for setting.

・Set the output-voltage selection jumper (CN2). When it is open, output is 54 V. When it is short, output is 32 V.

・Connect the + side of the load to Vout (+) terminal (E3), and the - side of the load (GND potential) to Vout (-) terminal (E4).

・Connect the + side (GND potential) of the regulated DC power supply to the Vin (+) terminal (E1), and the negative (-) side (negative potential) of the regulated DC power supply input to Vin (-) terminal (E2).

Use load units and cables that satisfy the specifications of this power supply described in Table 2.1.

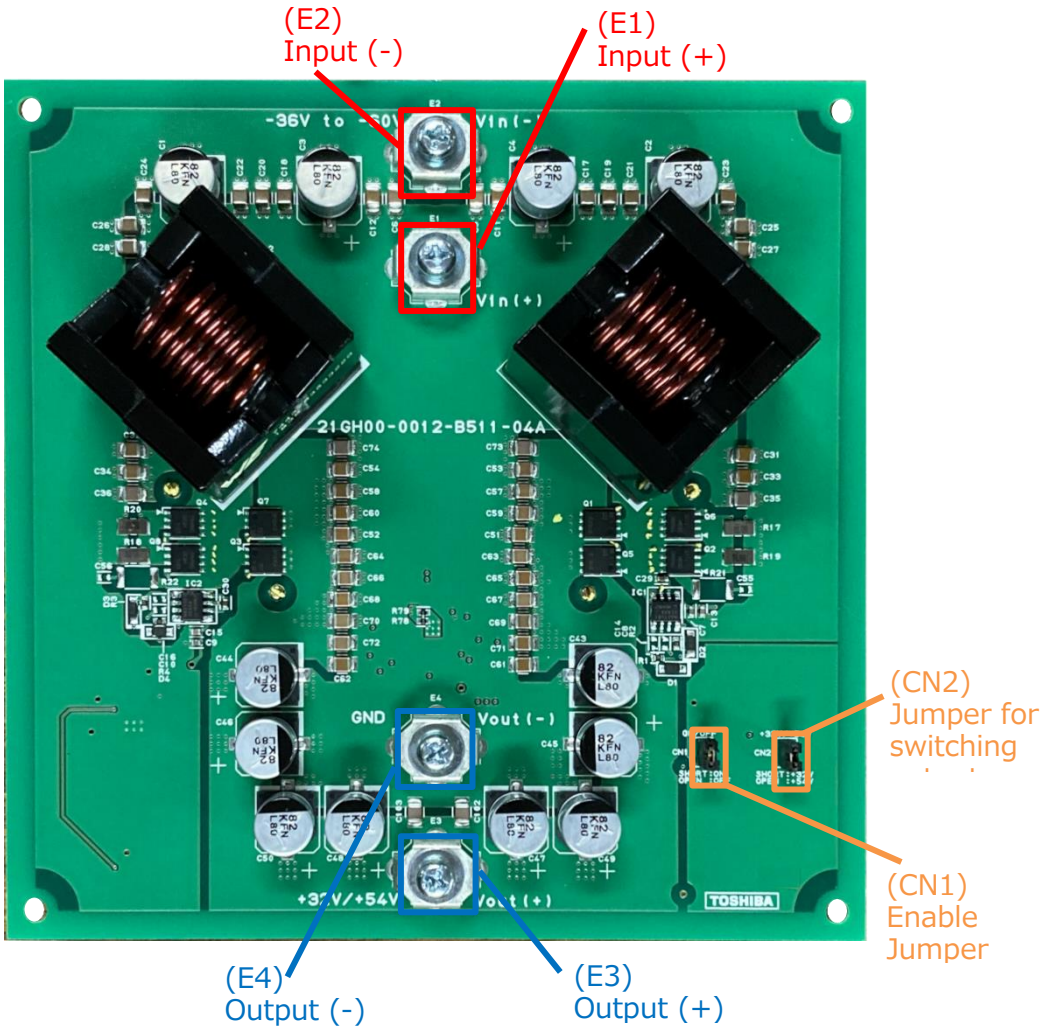


Fig. 4.1 Terminals for External Connection and Setting

4.2. Start Procedure and Stop Procedure

Make sure that all E1, E2, E3 and E4 terminals are 0 V before starting.

[Start procedure]

1. Select the desired output voltage using CN2 jumper.
2. Turn on the regulated DC power supply connected to E1, E2.
3. Short-circuit the Enable Jumper (CN1) (the power supply is activated, and the desired voltage is output).

[Stop Procedure]

1. Open the Enable Jumper (CN1). (Power off)
2. Turn off the regulated DC power supply.

4.3. Precautions for Evaluation (To Prevent Electric Shock, Burn Injury, etc.)

Be careful of electric shock when connecting the power supply. Do not touch any component of the power supply directly while it is in operation. Be very careful when capturing waveforms. Even after this power supply is shut down, there is a danger of electric shock due to residual charge of various capacitors. Make sure that the voltage of each component has dropped sufficiently before touching the board.

In addition, the semiconductor devices and inductors of this power supply generate heat according to the load current. This power supply assumes forced air cooling. Use an air-cooling device that keeps the heat-generating components within the rated temperature range under high load. The structure of inductor used in this design allows the air flow from only two sides shown by red circle in following image. When cooling with air, make sure to provide an air flow through this area to provide maximum cooling to inductors. Do not touch any component of the power supply while the power supply is in operation as it may cause burns.

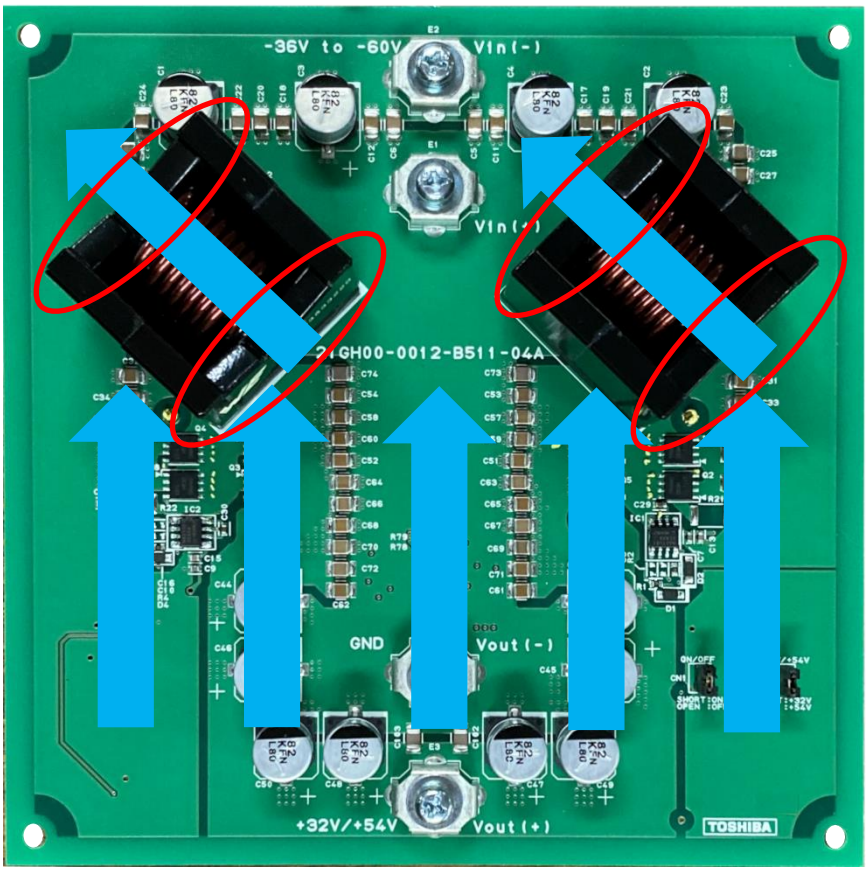


Fig. 4.2 Recommended Air Flow for Inductor

5. Power Supply Characteristics

This section shows the power supply efficiency measurement results of this power supply.

5.1. Efficiency

Fig. 5.1 and Fig. 5.2 shows the measured power supply efficiency of this power supply when the output is 32 V and 54 V respectively. Measurement is done with the input voltage set to -36 V, -48 V, and -60 V.

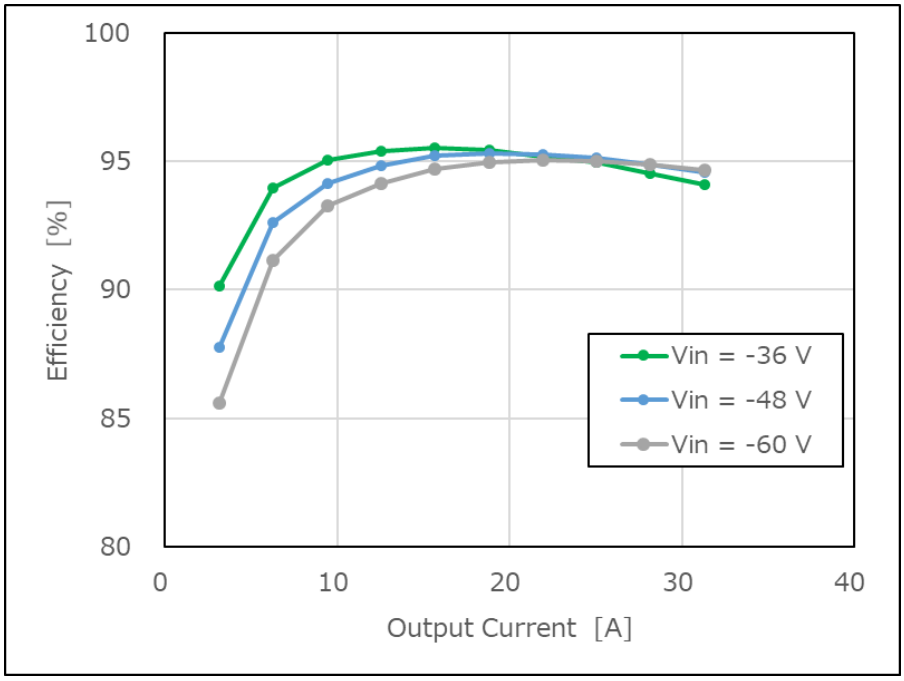


Fig. 5.1 Efficiency Measurement (when output is 32 V)

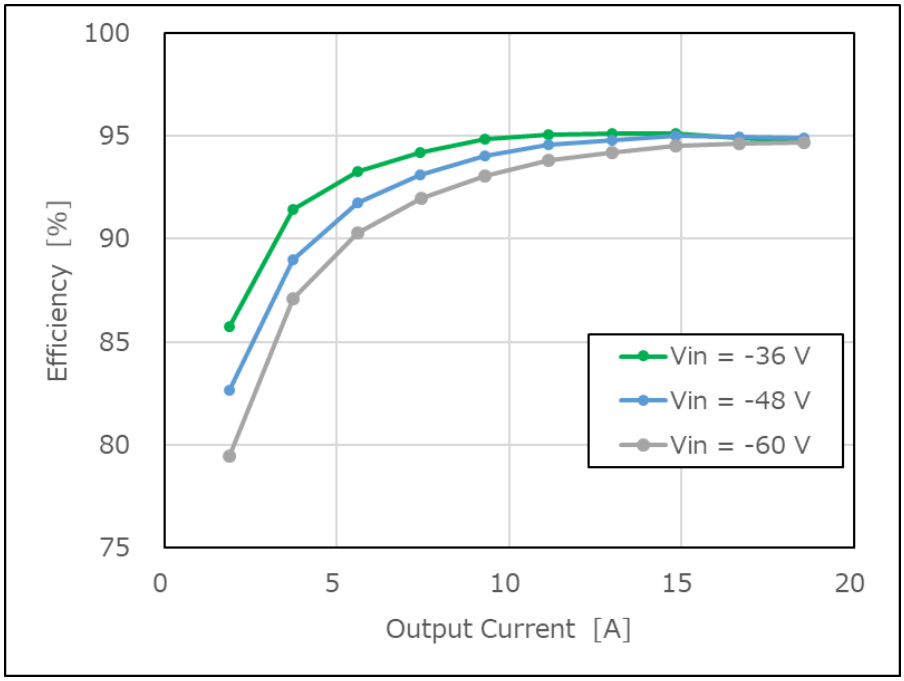


Fig. 5.2 Efficiency Measurement (when output is 54 V)

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