1 kW Full-Bridge DC-DC Converter

Reference Guide

RD170-RGUIDE-01

TOSHIBA ELECTRONIC DEVICES & STORAGE CORPORATION

Contents

1. Introduction

This reference guide describes the specifications, usage, and efficiency properties of 1 kW full-bridge DC-DC converter (this power supply). This power supply is capable of supplying 1 kW power at the DC 54 V output. The input-voltage range is from DC -36 V to -60 V, and it can be used in applications including communication-related equipment, industrial equipment, and various other applications. This reference guide provides various design information including reference design, and contributes to reduction of effort required in designing according to actual specifications.

2. Specification

2.1. Specification

Table 2.1 lists the I/O characteristics of this power supply.

Table 2.1 Power Supply Specification

Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Characteristics					
AC input voltage (rms)		90		264	V
AC input current (rms)	VinAC = 90 V, Iout = 16.67 A			10	A
AC Input frequency		47		63	Hz
Semi-Bridgeless PFC Circuit Output Characteristics (Internal Characteristics)					
Output voltage			390		V
Output current	VinAC = 230 V		4.5		A
	VinAC = 115 V		2.2		
Switching frequency			60		kHz
Output Characteristics (PSFB Circuit)					
Output voltage		45.6	48.0	50.4	V
Output current	VinAC = 230 V			33.33	A
	VinAC = 115 V			16.67	A
Output power	VinAC = 230 V			1.6	kW
	VinAC = 115 V			0.8	kW
Output ripple voltage	Ta = 25 ℃			480	mV
Switching frequency			97.05		kHz

2.2. Outline

Fig. 2.1 shows an overview of this power supply.

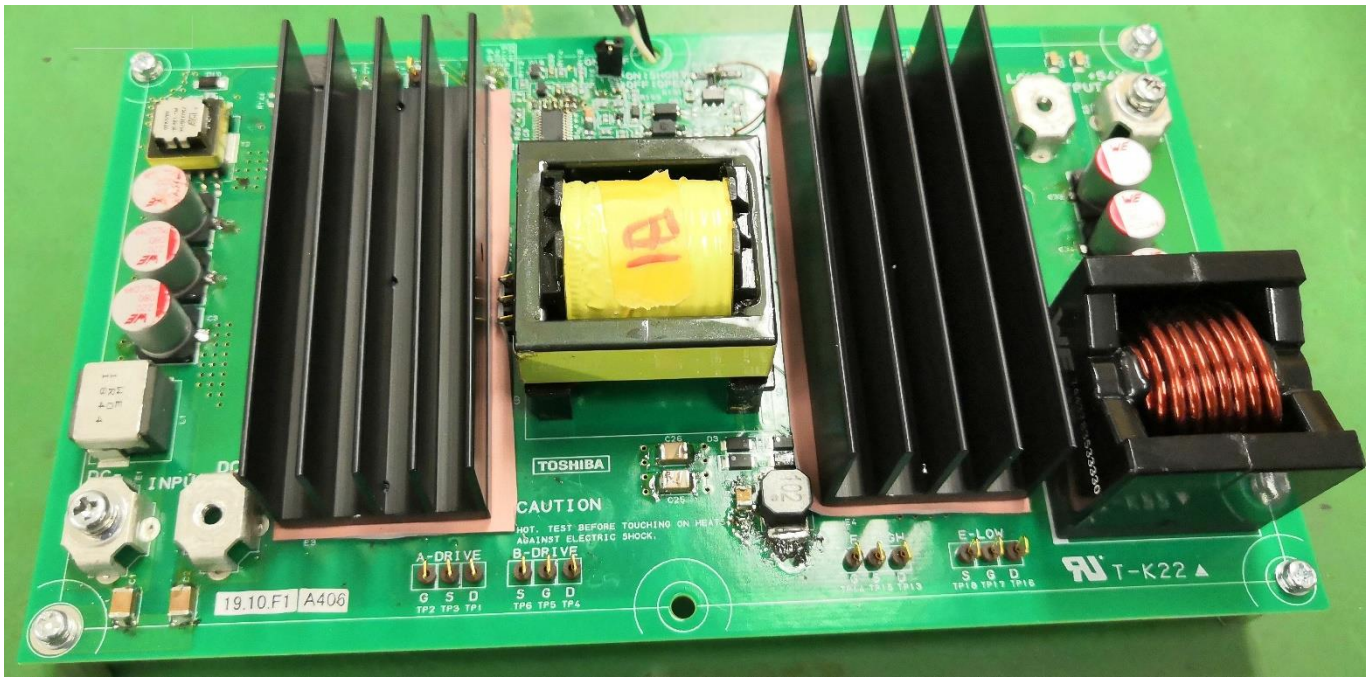

Fig. 2.1 External View of 1 kW Full-Bridge DC-DC Converter

Outline size

207 mm x 120 mm x 45 mm

2.3. Block Diagram

Fig. 2.2 shows a block diagram to describe the function operation. Refer to RD170-SCHEMATIC-01 for the actual schematic and to RD170-BOM-01 for the bill of materials.

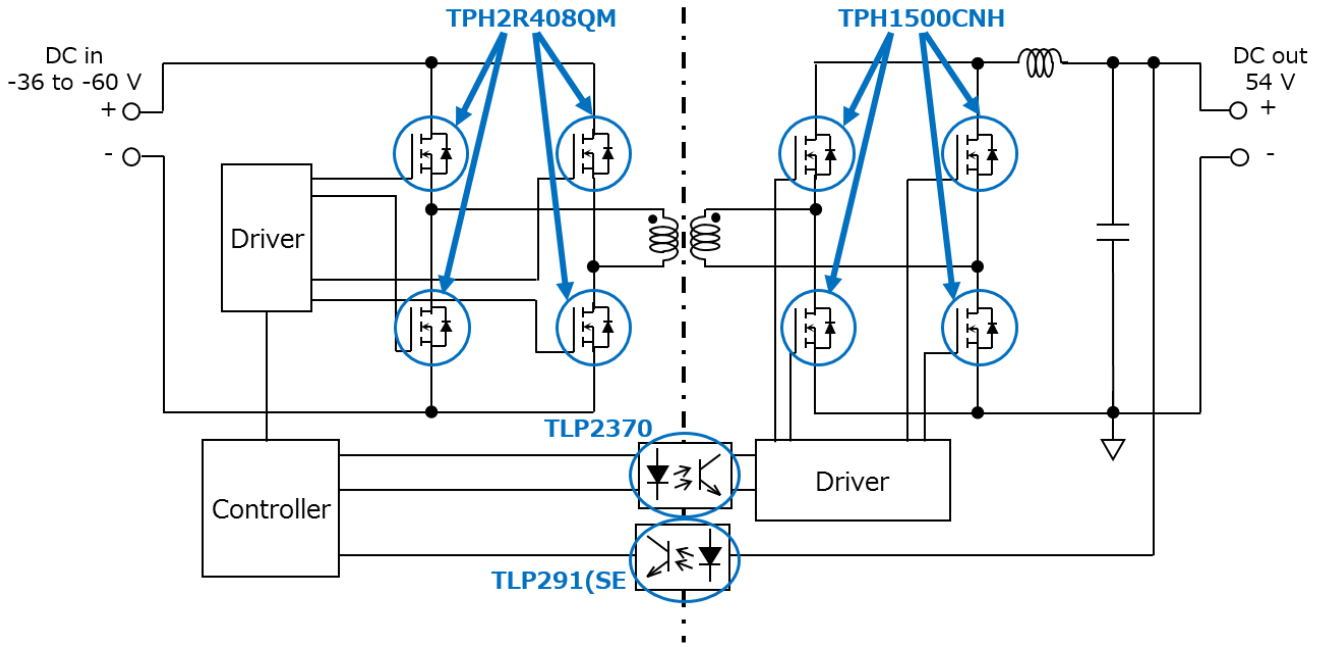

Fig. 2.2 Block Diagram

2.4. Component Placement

Fig. 2.3 and Fig. 2.4 show the layout of parts on the PCB of this power supply.

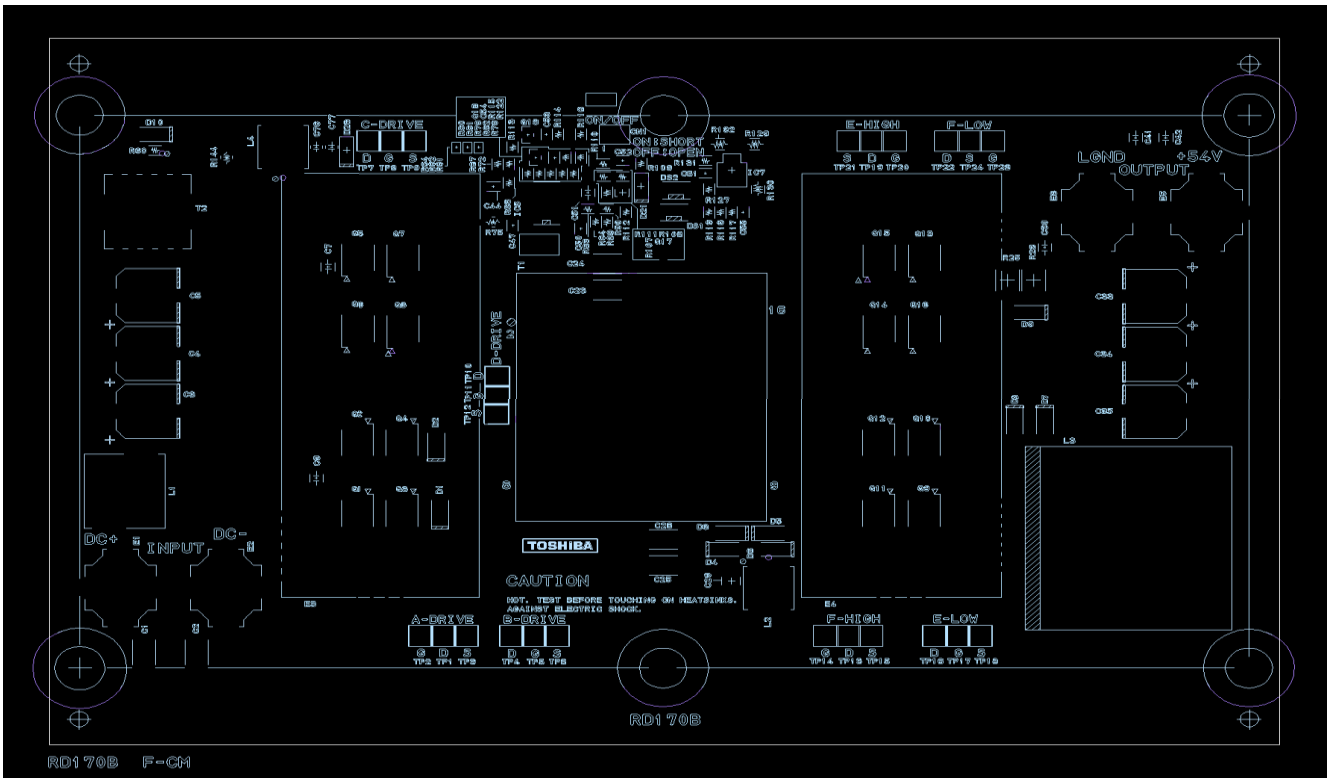

Fig. 2.3 PCB Component Placement (Front Side)

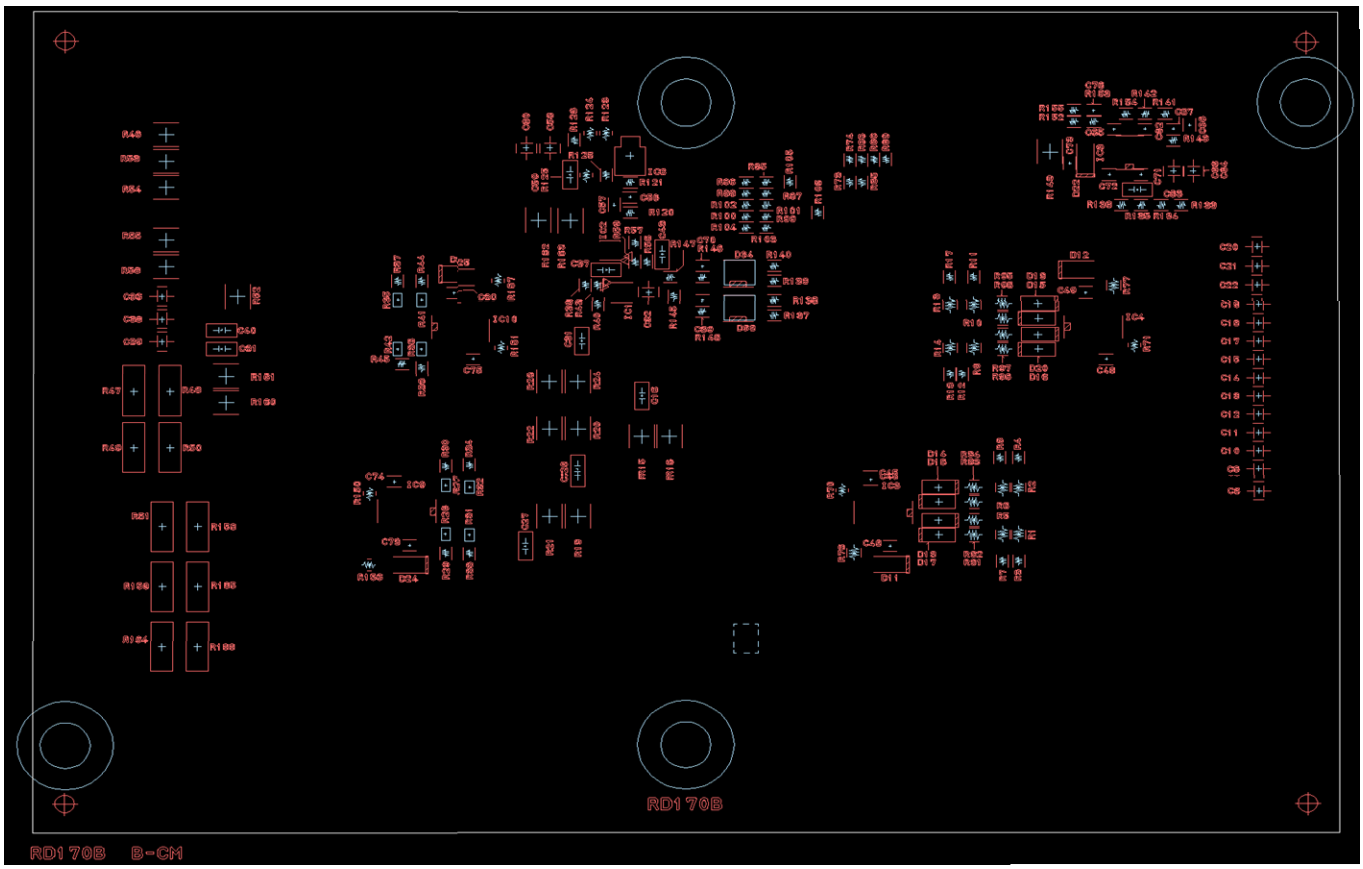

Fig. 2.4 PCB Component Placement (Back Side)

2.5. PCB Pattern

PCB design data of this power supply is compatible with various EDA (Electronic Design Automation) tools. Please refer to webpage for more information.

Fig. 2.5 shows Layer1 of the PCB

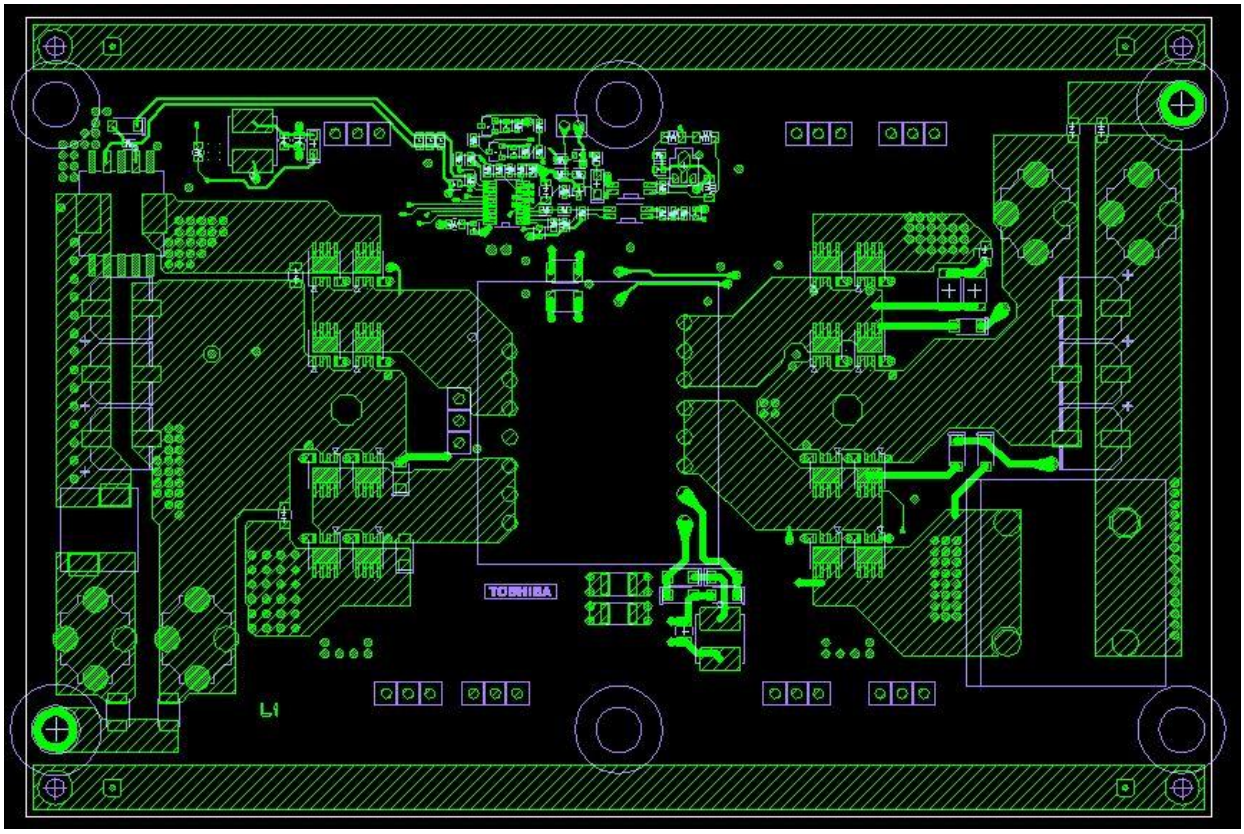

Fig. 2.5 Layer1

Fig. 2.6 shows Layer2 of the PCB

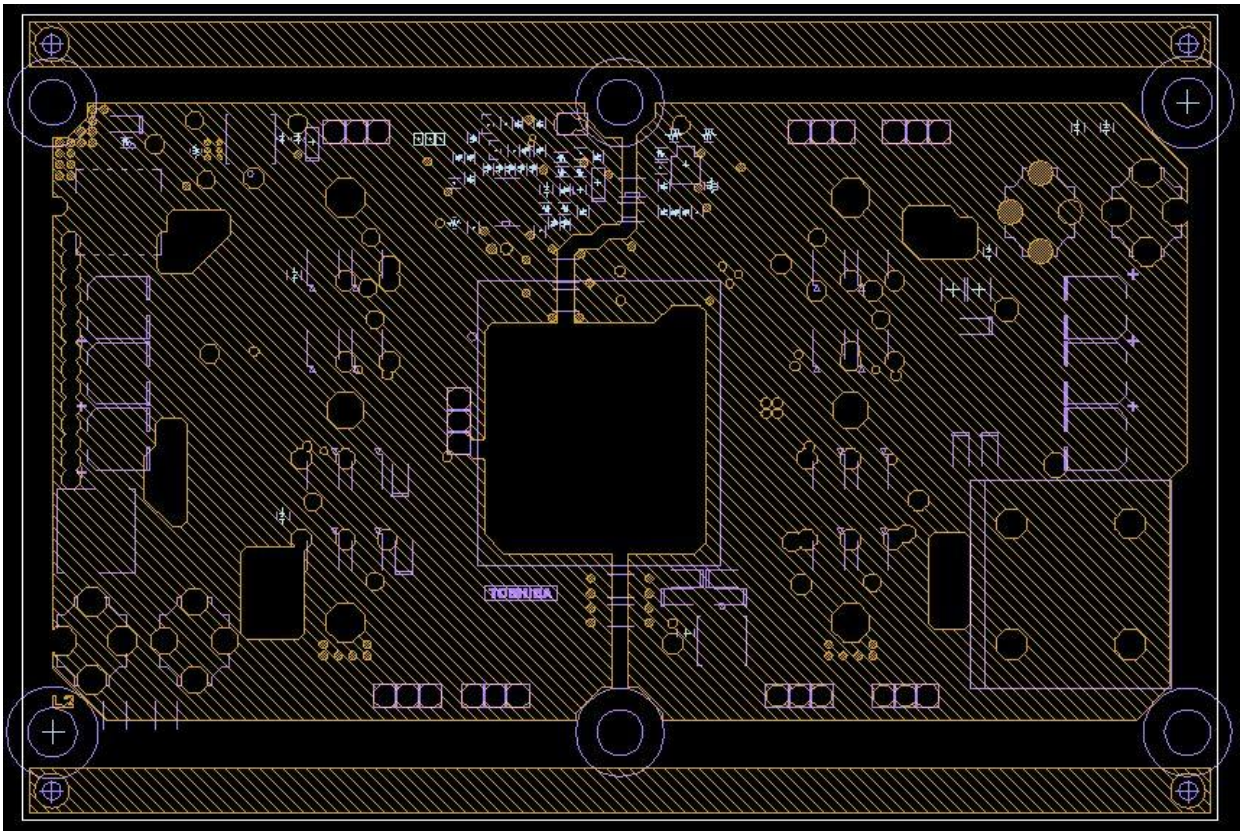

Fig. 2.6　Layer2

Fig. 2.7 shows Layer3 of the PCB

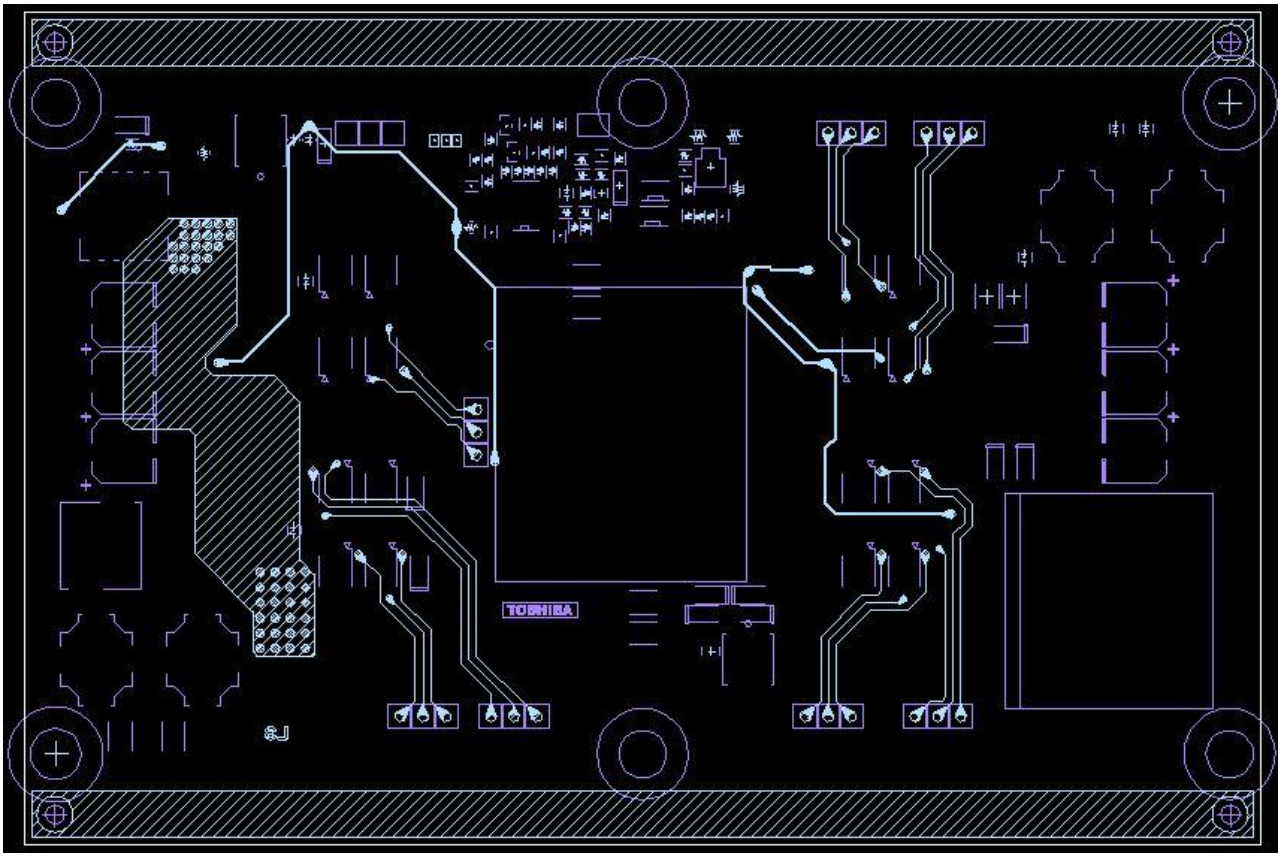

Fig. 2.7　Layer3

Fig. 2.8 shows Layer4 of the PCB

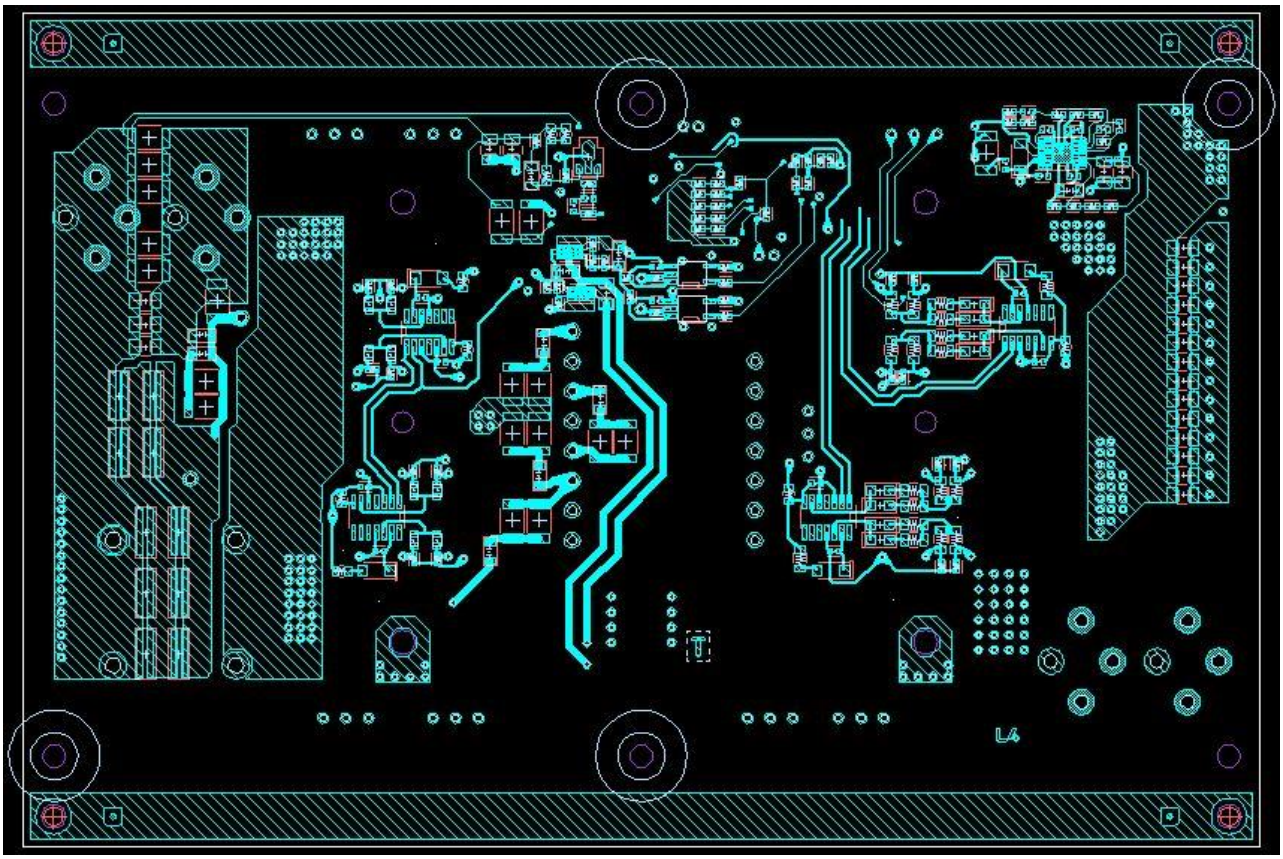

Fig. 2.8 Layer4

3. Operating Procedure

This section describes the operting procedure of this power supply.

3.1. Connection with External Equipment

Fig. 3.1 shows the external connection pins.

The parts enclosed in red are the input terminals. Connect a stabilized DC power supply to the Input (+) and Input (-) terminals. The power supply, cables, leads, and connectors to be connected must satisfy 2.1 Power Supply Specifications. The parts enclosed in blue are the output terminals. Connect the load unit to the Output (+) and Output (-) terminals. Load units, cables, and connectors to be connected must satisfy 2.1 Power Supply Specifications.

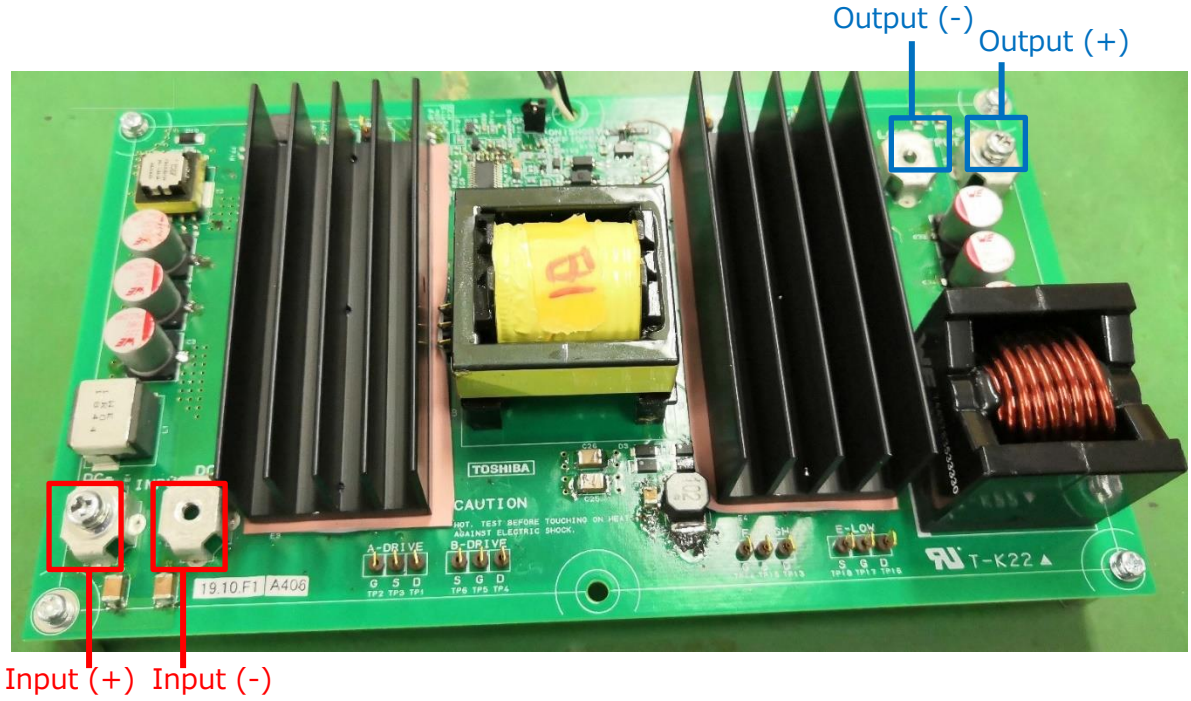

Fig. 3.1 External Connection Terminals

3.2. Start and Stop Procedures

Before starting the power supply, check that all of the following pin voltages are 0V.
Input (+) terminal, Input (-) terminal, Output (+) terminal, and Output (-) terminal.

[Startup Procedure]

Turn On the output of external stabilized DC power supply.

[Stop Procedure]

Turn Off the output of external stabilized DC power supply.

3.3. Precautions for Evaluation (Electric Shock, Burn Injury, etc.)

Fig. 3.2 shows the input and output side areas of this power supply. After this power supply is stopped, there is a risk of electric shock due to the residual charge present in various capacitors. Before touching the board, check that the voltage of each component has decreased sufficiently.

In addition, semiconductors, transformers, etc. of this power supply generate heat according to the load current. Fig. 3.3 shows the parts with high heat generation with red broken line frames. This power supply is designed to work with forced air-cooling. Use an air-cooling device that ensures that the temperature of these component remain within the rated temperature range at high loads. Also, do not touch these parts while the power supply is running, as there is a risk of burns.

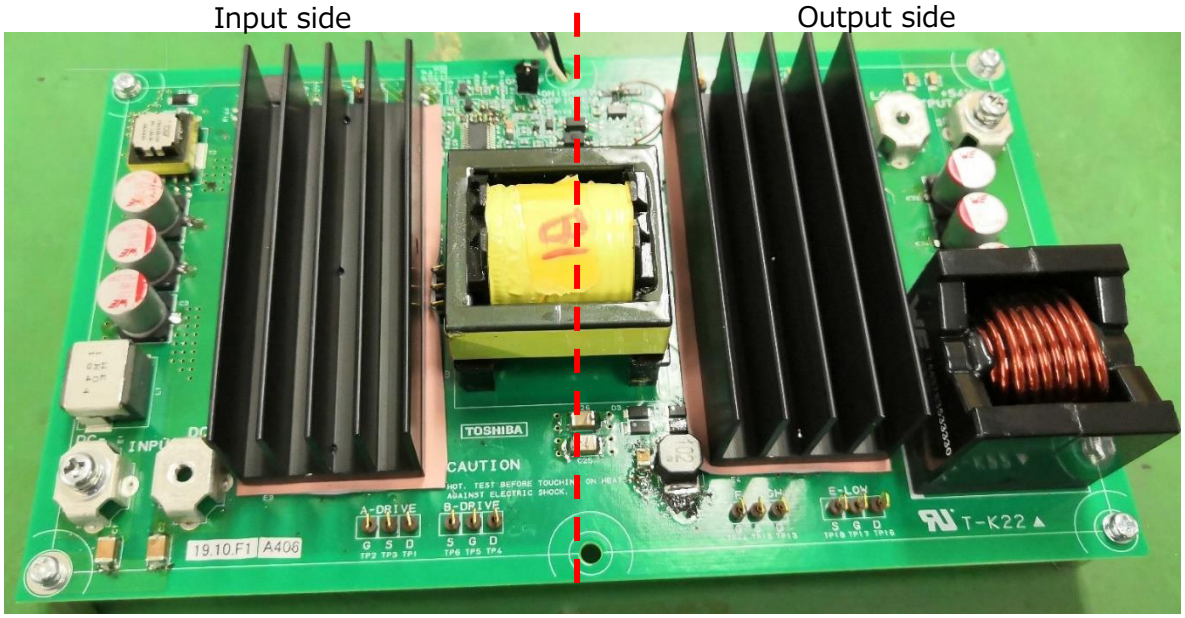

Fig. 3.2 Input and Output Side Areas

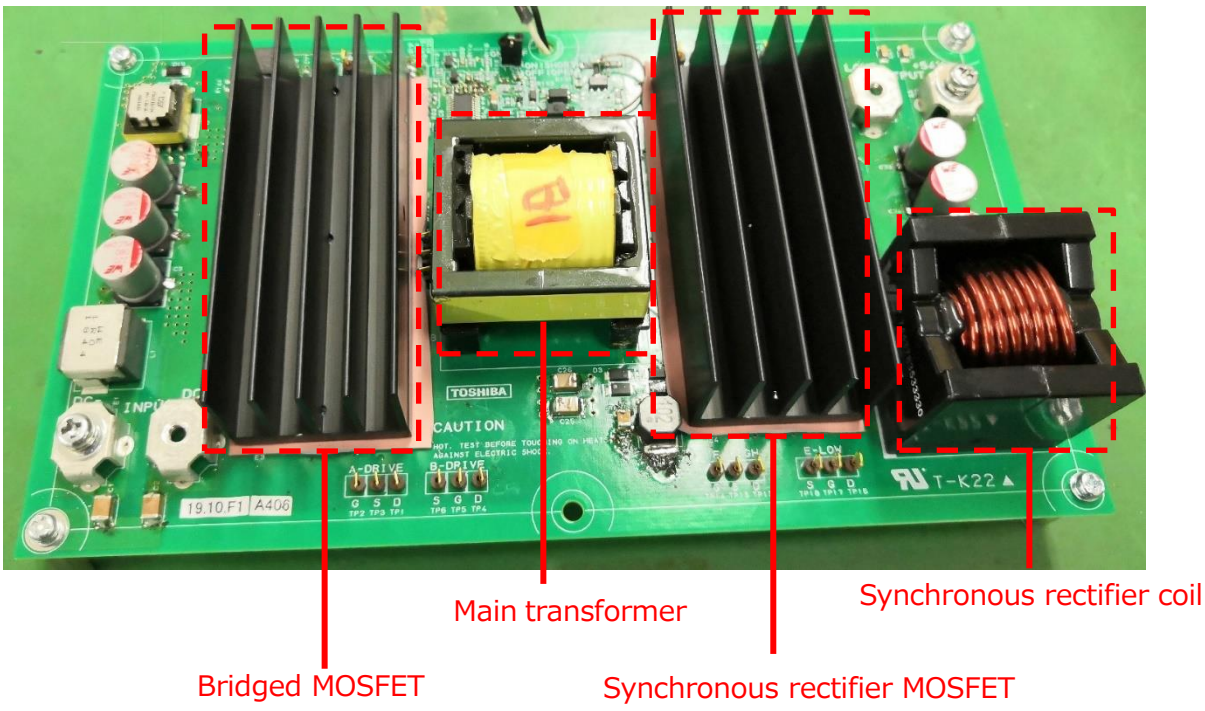

Fig. 3.3 Parts with High Heat Generation

4. Power Characteristics

The power supply efficiency measurement results of this power supply are described below.

4.1. Efficiency

Fig. 4.1 shows the power supply efficiency measurement results of this power supply. The input voltage is set to -48 V, -54 V and -60 V for measurement.

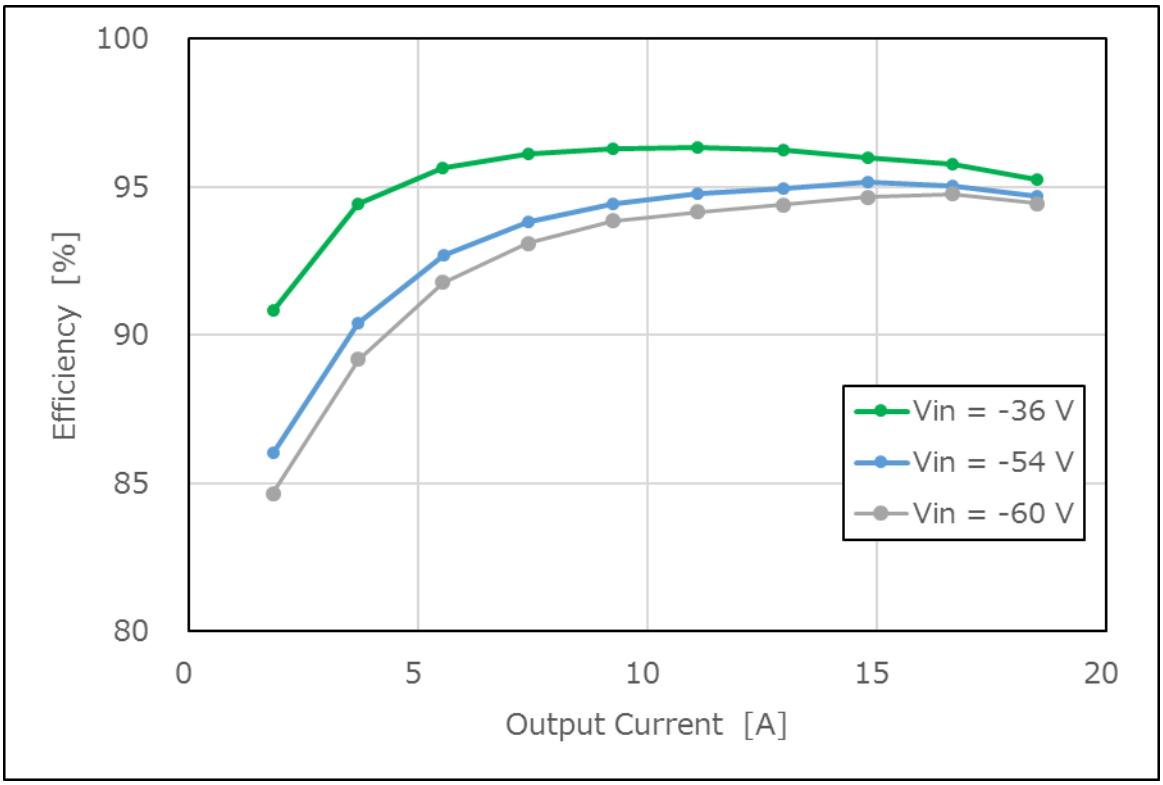

Fig. 4.1 Efficiency Measurement Results (Vin = -36 V, Vin = -54 V, Vin = -60 V)

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