500 W Server Power Supply using TOLL Package DTMOS

Reference Guide

RD169-RGUIDE-01

TOSHIBA ELECTRONIC DEVICES & STORAGE CORPORATION

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1. Introduction

This reference guide describes the specifications, usage, and various characteristics of the 500 W Server Power Supply using TOLL Package DTMOS (hereafter referred as this power supply). This power supply can provide 500 W of power at DC 12 V output. Input AC power (90 V to 264 V) goes through CCM PFC circuitry and isolated half-bridge LLC circuitry to produce DC 12 V output. N+1 redundant operation, etc. can be performed with ORing circuitry of the output section. The use of a small surface-mount type TOLL package MOSFET for PFC circuits has reduced the circuit board area by 20 % compared to the conventional 500 W Server Power Supply using the self-supporting type TO-220SIS package MOSFETs. This results in an increase in power density, which is highly demanded in the marketplace. This power supply can be used in a variety of applications requiring high power density, including 1U server power supplies. Our high-speed power MOSFETs are used as switching elements, to achieve high-efficiency.

2. Specifications

2.1. Power Supply Specifications

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

Table 2.1 Specifications of 500 W Server Power Supply using TOLL Package DTMOS

Parameters	Conditions	Minimum	Typical	Maximum	Unit
Input Characteristics					
AC Input Voltage (rms)		90		264	V
AC Input Frequency		47		63	Hz
CCM PFC Circuit Output Characteristics (Internal Characteristics)					
Output Voltage			390		V
Switching Frequency			78.3		kHz
Output Characteristics (LLC Circuit)					
Output Voltage		11.4	12.0	12.6	V
Output Current				41.7	A
Output Power				500	W
Output Ripple Voltage	Ta = 25 ℃			120	mV

2.2. External View of Power Supply

Fig. 2.1 and Fig. 2.2 show the external appearance of this power supply.

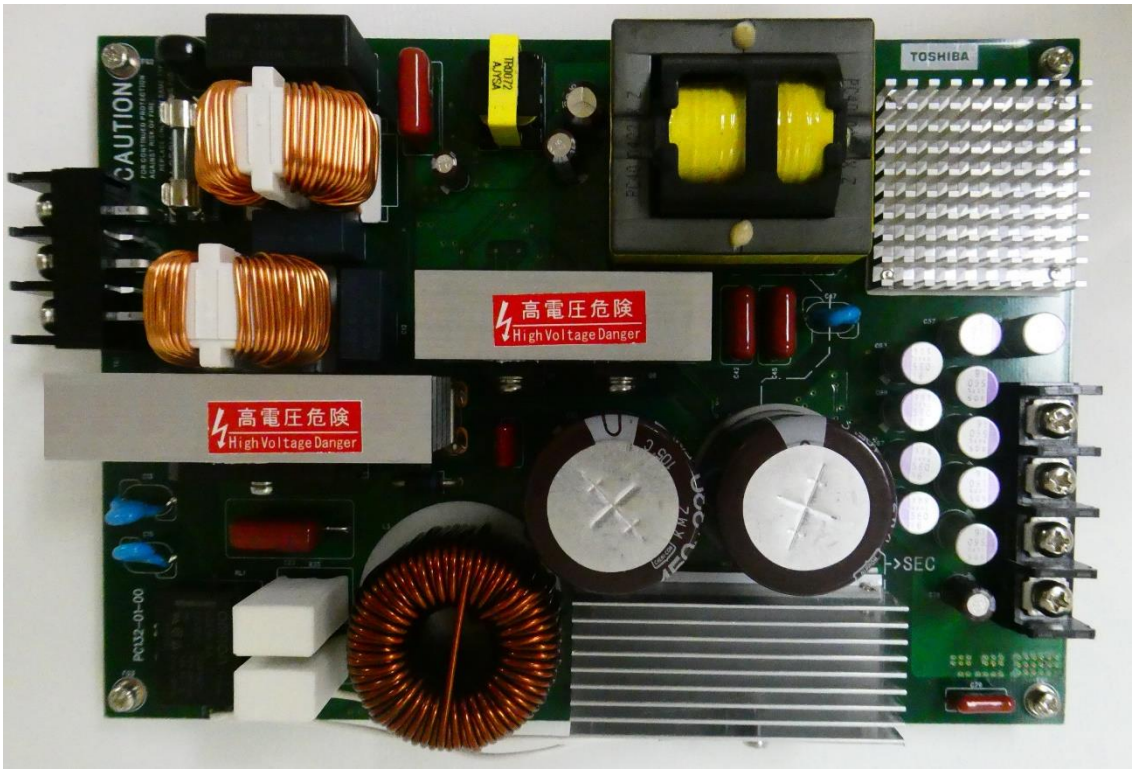

Fig. 2.1 500 W Server Power Supply using TOLL Package DTMOS (Front Side)

External Dimensions : 192 mm x 135 mm x 40 mm

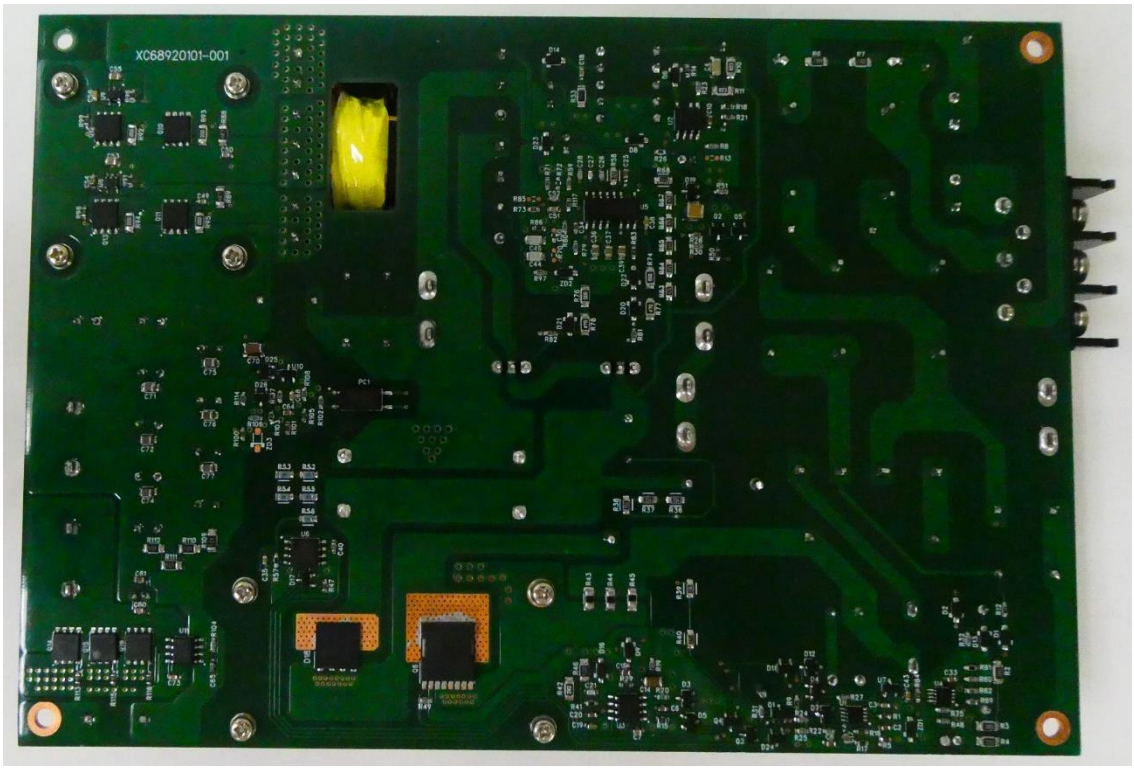

Fig. 2.2 500 W Server Power Supply using TOLL Package DTMOS (Back Side)

External Dimensions : 192 mm x 135 mm x 40 mm

2.3. Block Diagram

Fig. 2.3 shows a block diagram to understand the function operation.
Refer to RD169-BOM-01 and RD169-SCHEMATIC-01 for bill of materials and actual schematic.

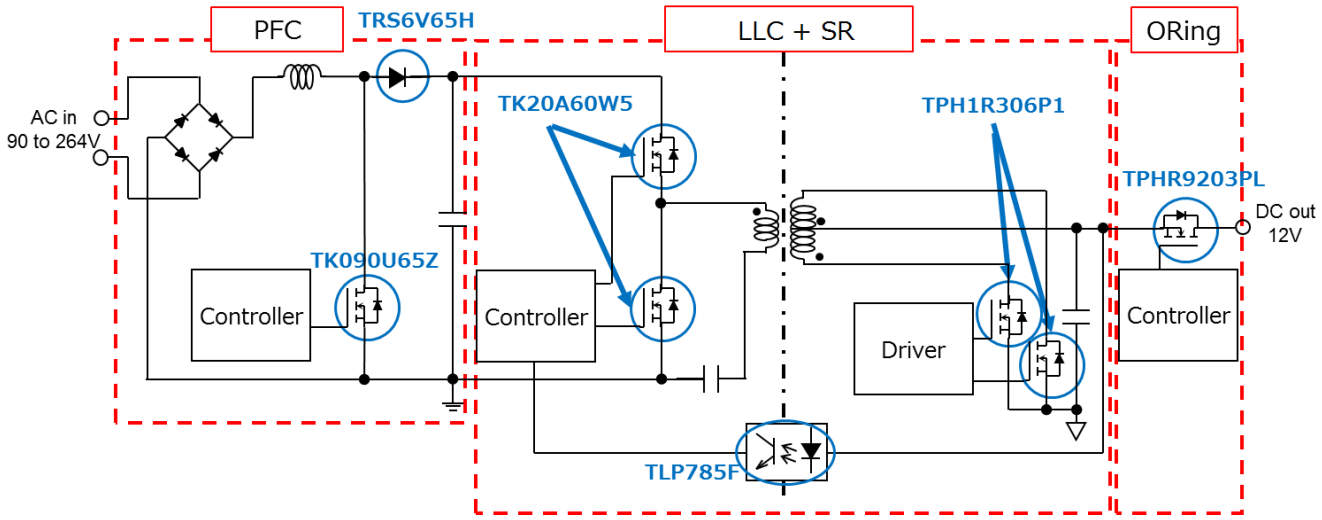

Fig. 2.3 Block Diagram

2.4. PCB Component Layout

Fig. 2.4 shows the component layout on the PCB (front side) of this power supply.

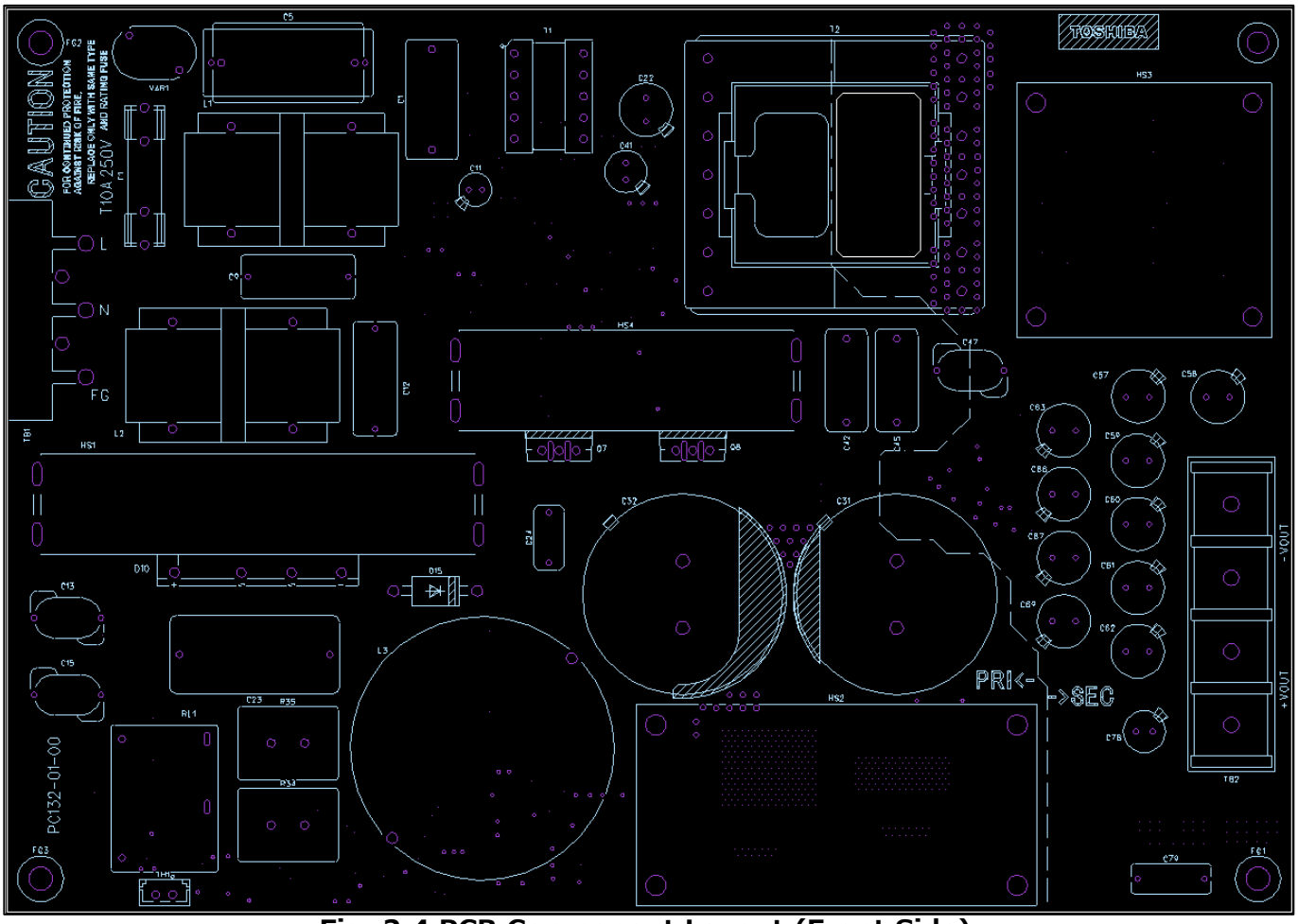

Fig. 2.4 PCB Component Layout (Front Side)

Fig. 2.5 shows the layout of the components on the PCB (rear side) of this power supply.

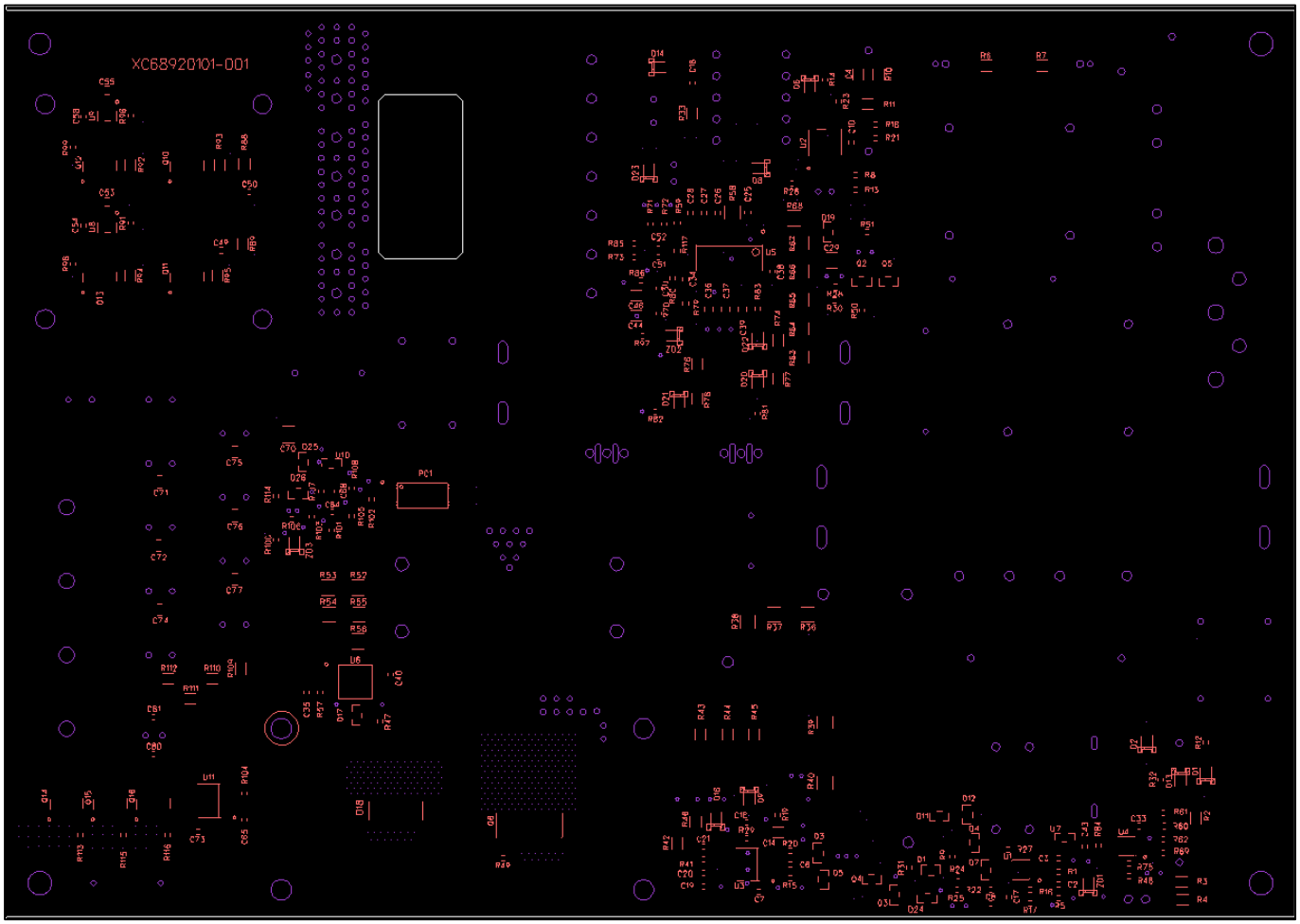

Fig. 2.5 PCB Component Layout (Back Side)

2.5. PCB Pattern

Fig. 2.6 shows Layer1 of the PCB.

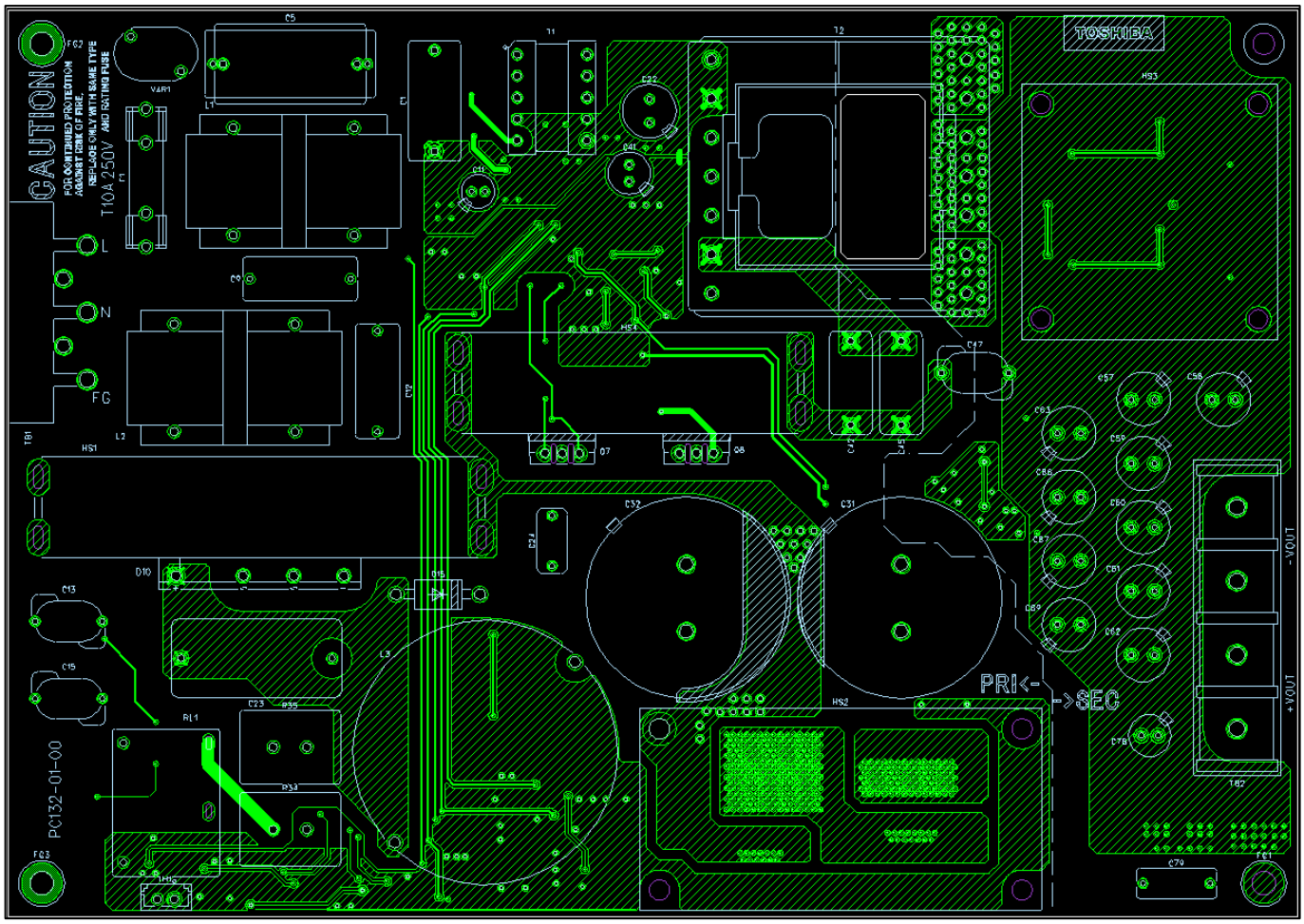

Fig. 2.6 Layer1

Fig. 2.7 shows Layer2 of the PCB.

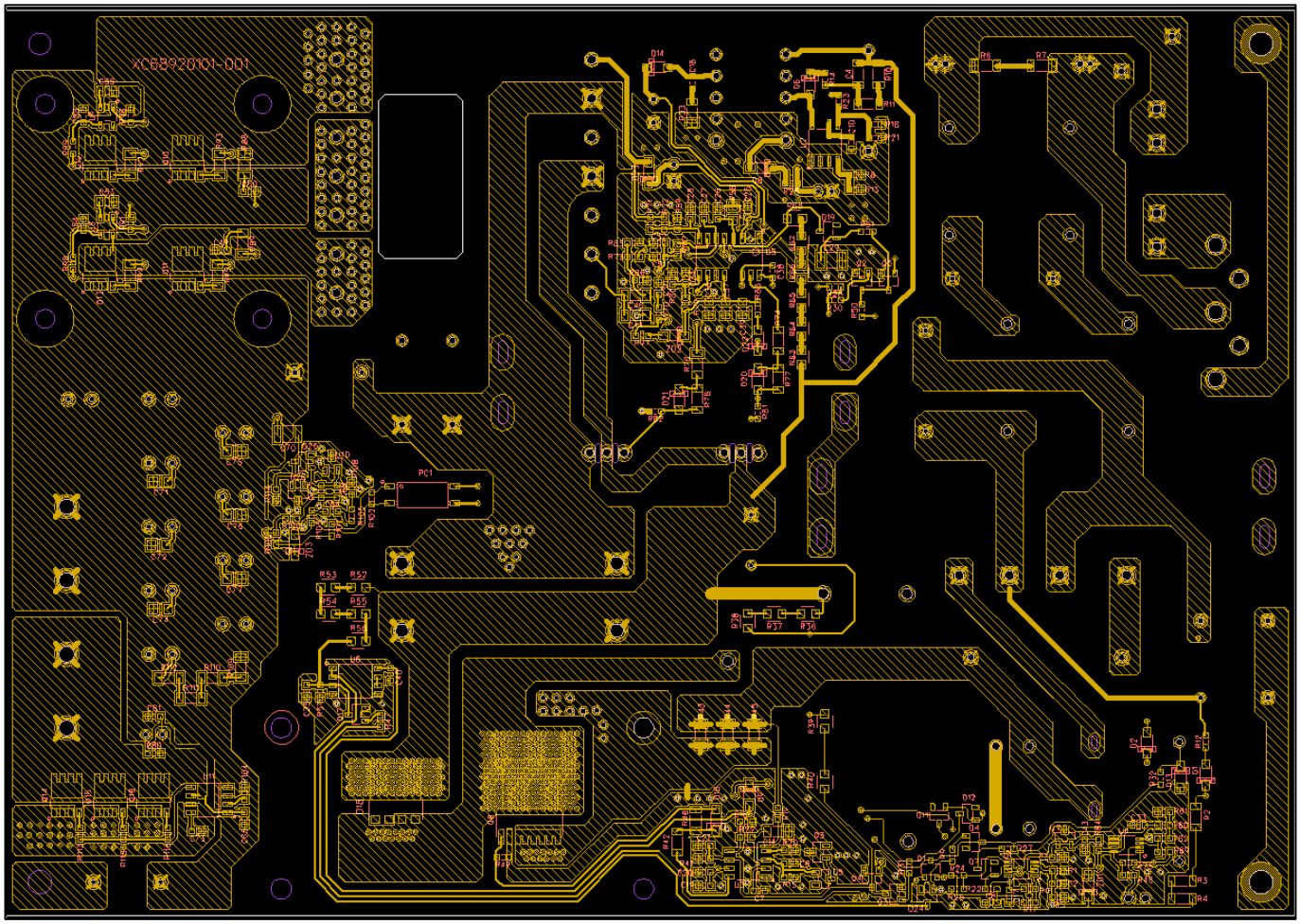

Fig. 2.7 Layer2

3. Operating Procedure

This section explains the operation procedure of this power supply.

3.1. Connecting to External Devices

Fig. 3.1 shows the external connection terminals. The area enclosed in red shows the input terminals. Connect an AC stabilized power supply to the Input (Live) terminal and Input (Neutral) terminal. Use power supplies, cables, leads, and connectors that satisfy 2.1 Power Supply Specifications. The part enclosed in blue shows the output terminal. Connect the load unit to the Output (VOUT+) terminal and Output (VOUT-) terminal. Use load devices, cables, and connectors that satisfy 2.1 Power Supply Specifications.2.1Power Supply Specifications2.1Power Supply Specifications

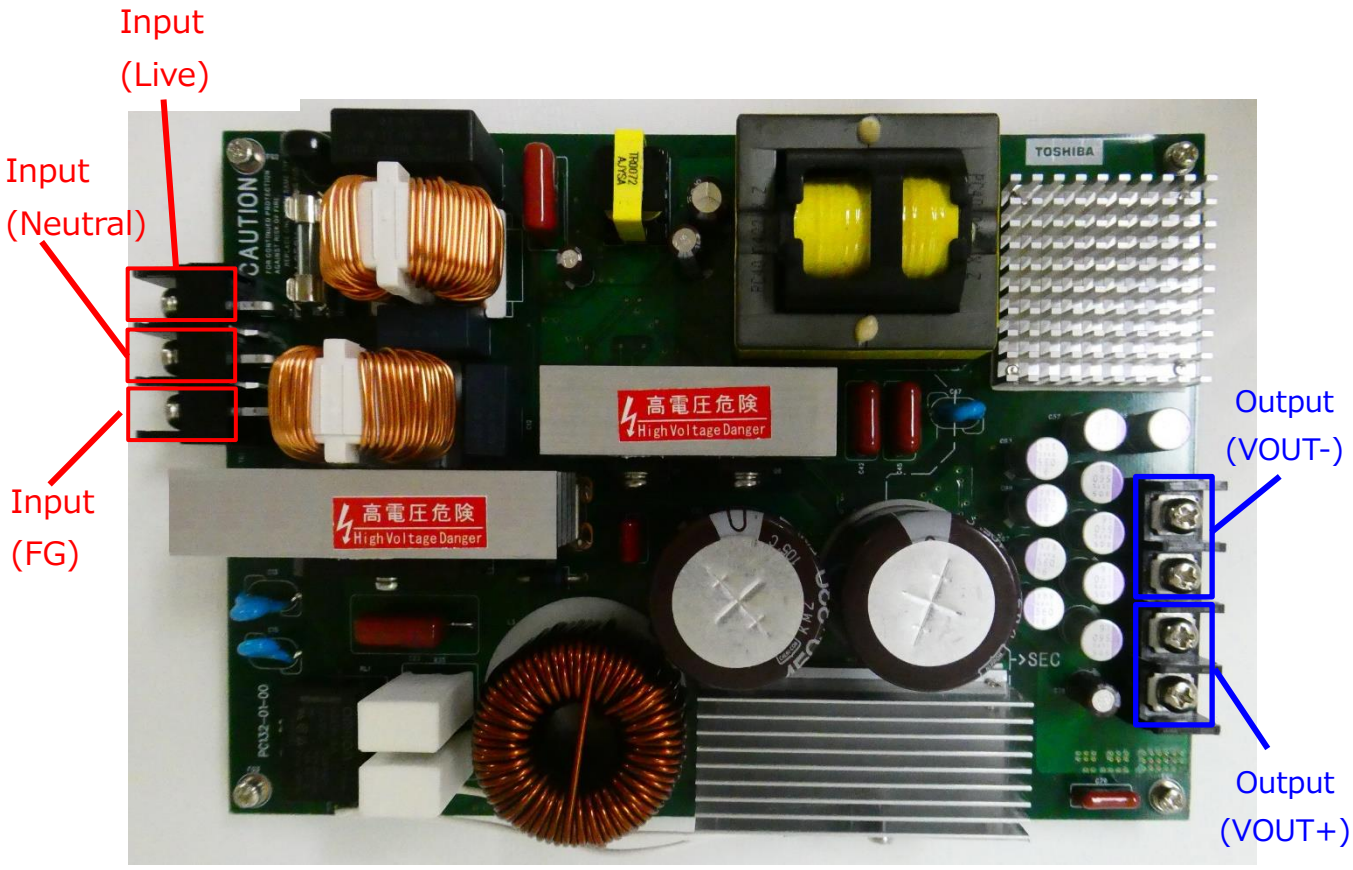

Fig. 3.1 External Connection Terminals

3.2. Start and Stop Procedures

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

[Startup Procedure]
Turn on the AC stabilized power supply.

[Stop Procedure]
Turn off the AC stabilized power supply.

3.3. Evaluation Precautions (to prevent Electric Shock, Hot Burns, etc.)

Be careful of electric shock when AC stabilized power supply is connected. Fig. 3.2 shows the primary and secondary areas of this power supply. Do not touch the primary area while the power is on. Be very careful when observing the waveform. Even after this power supply is stopped, there is a risk of electric shock due to the residual charge of various capacitors. Confirm that the voltage of each part has decreased sufficiently before touching the board.

In addition, semiconductors, transformers, etc. of this power supply generate heat according to the load current. Fig. 3.3 and 3.4 show parts and areas with high heat generation using a red broken line frame. Do not touch these areas while the power is on, as there is a risk of burns.

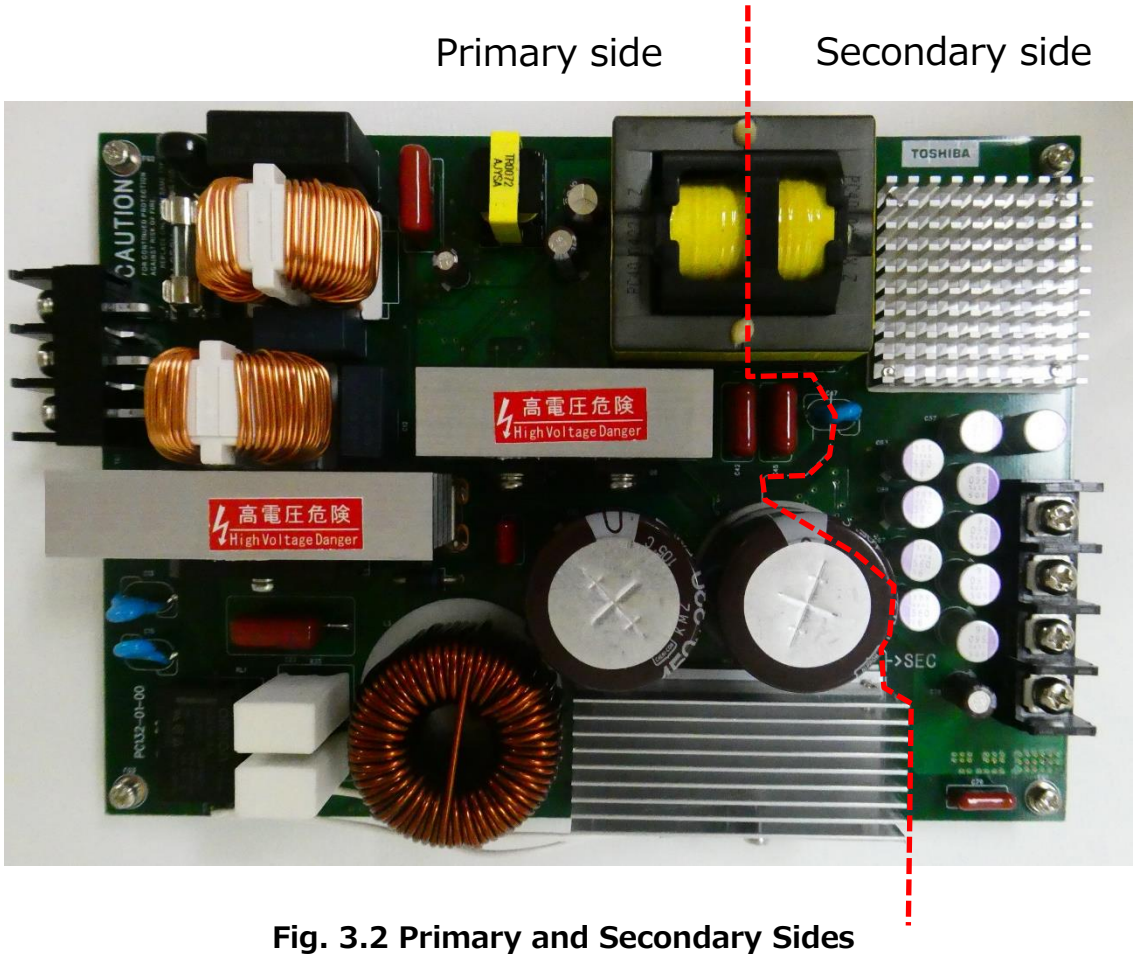

Fig. 3.2 Primary and Secondary Sides

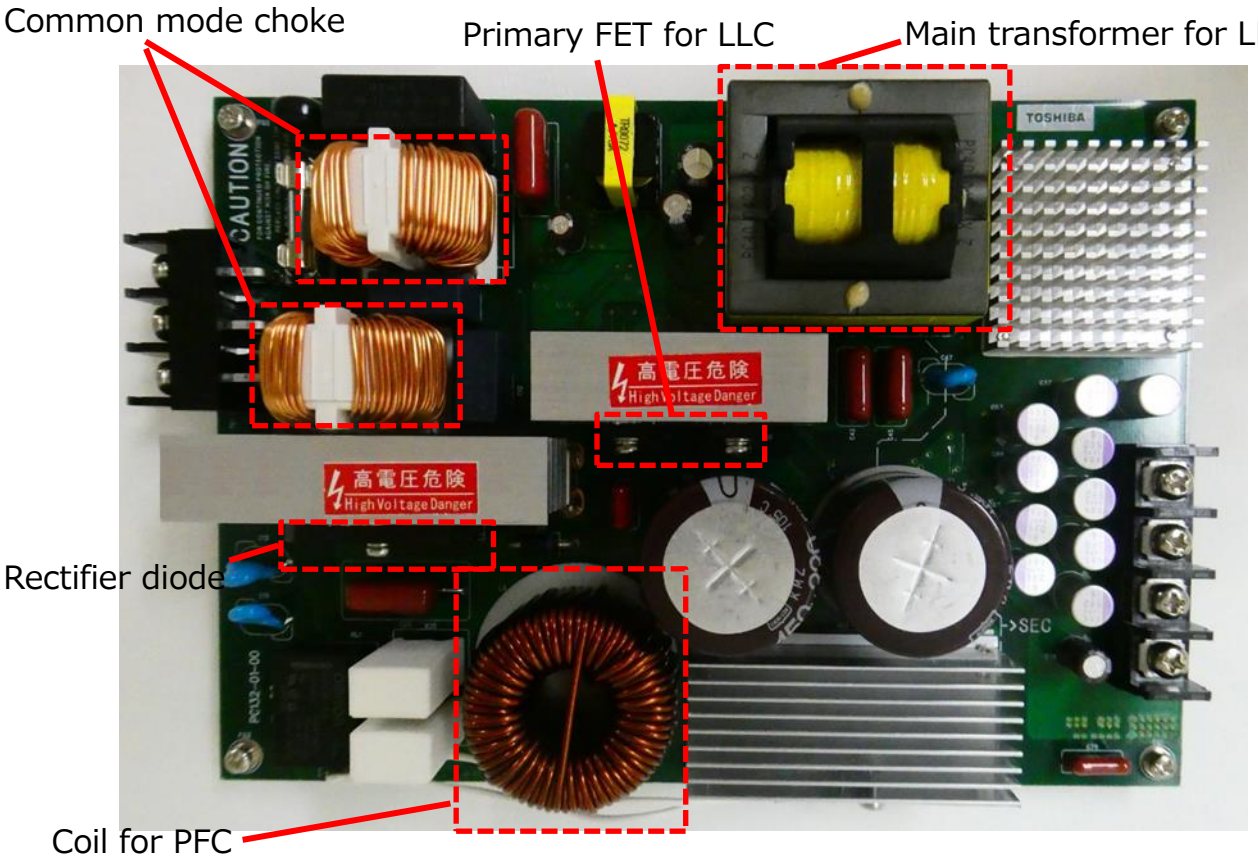

Fig. 3.3 Parts and Areas with High Heat Generation (Front Side)

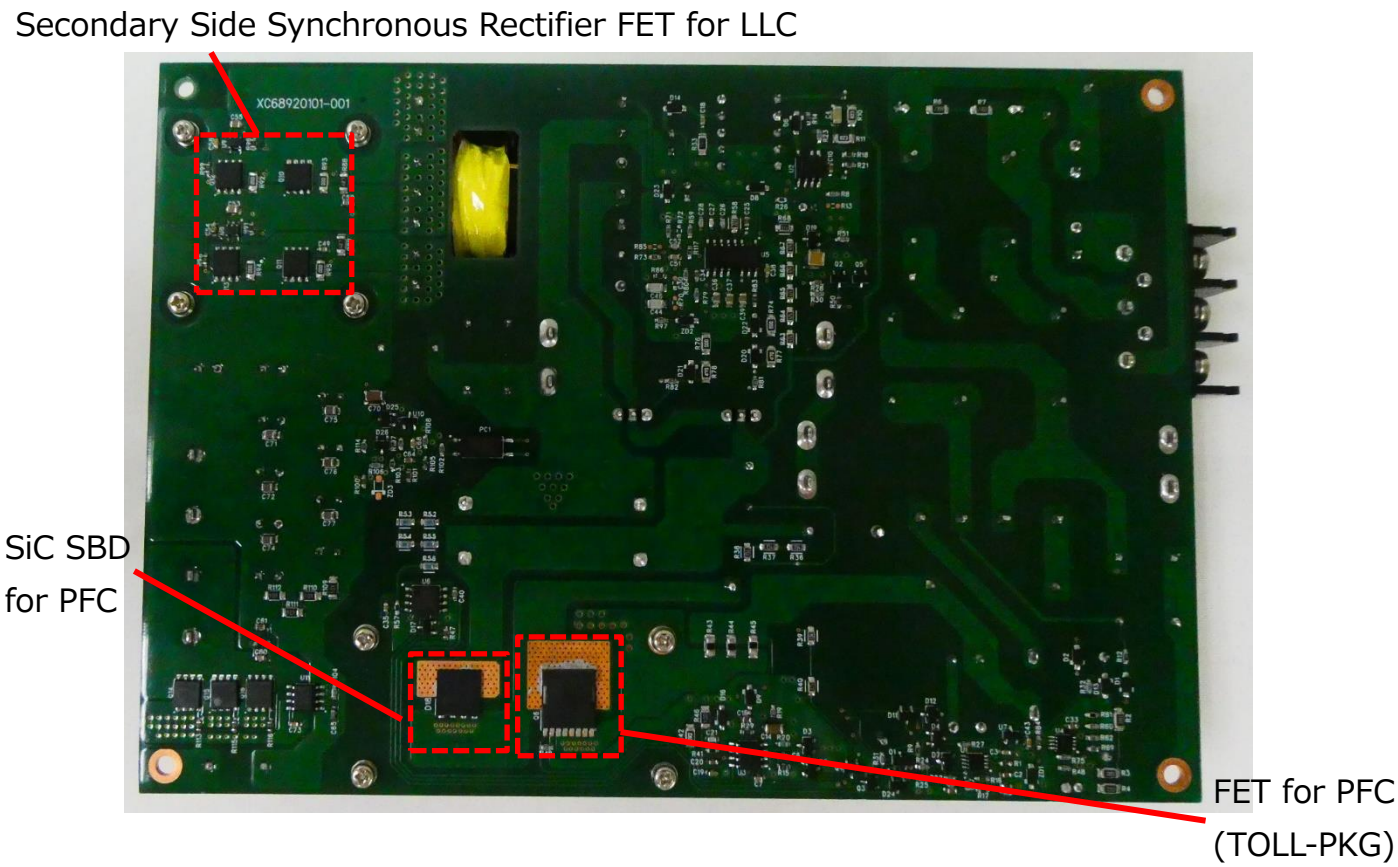

Fig. 3.4 Parts Area with High Heat Generation (Back Side)

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 output voltage of the AC stabilized power supply is set to 115 V or 230 V for measurement. This power supply achieves high efficiency, as the efficiency at the load power of 100 % is 91.4 % for 115 V input and 93.2 % for 230 V input. This power supply is equipped with ORing circuitry in the output section. If ORing circuitry is deleted, the power supply efficiency of this power supply is considered to improve.

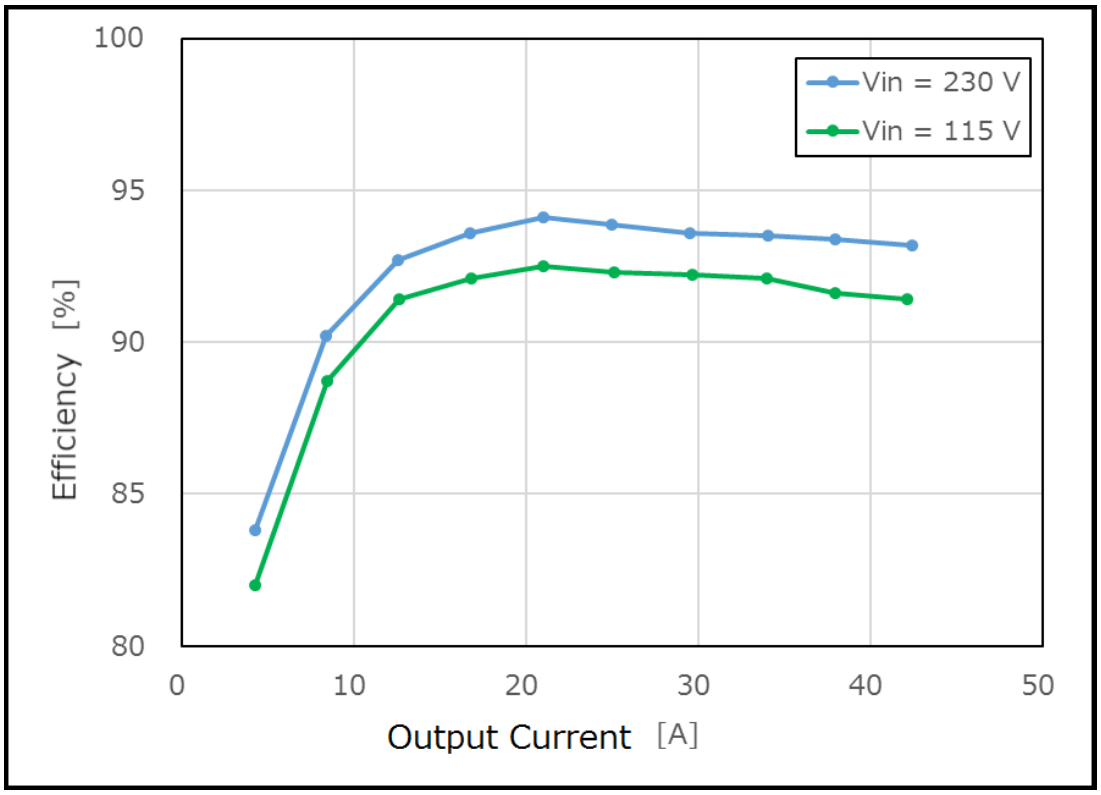

Fig. 4.1 Efficiency Measurement Results (Vin = 115 V, Vin = 230 V)

For reference, Fig. 4.2 to Fig. 4.5 show the measured power-efficiency of this power supply and the 80 PLUS standard. 80 PLUS standard data in the figures are as of August 2021. The standard data may get updated. Please check it every time.

This power supply is not certified for 80 PLUS. It is necessary to measure the power supply efficiency using the equipment that will be the final product and acquire the certification.

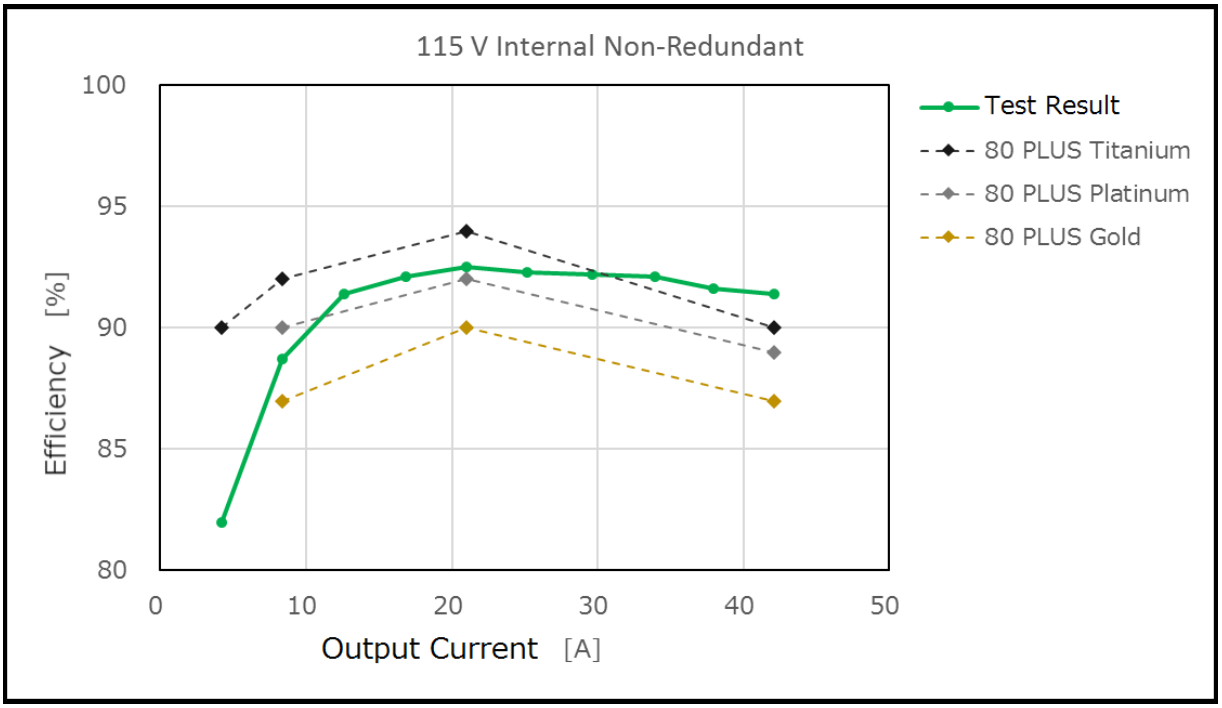

Fig. 4.2 Efficiency (80 PLUS: 115 V Internal Non-Redundant)

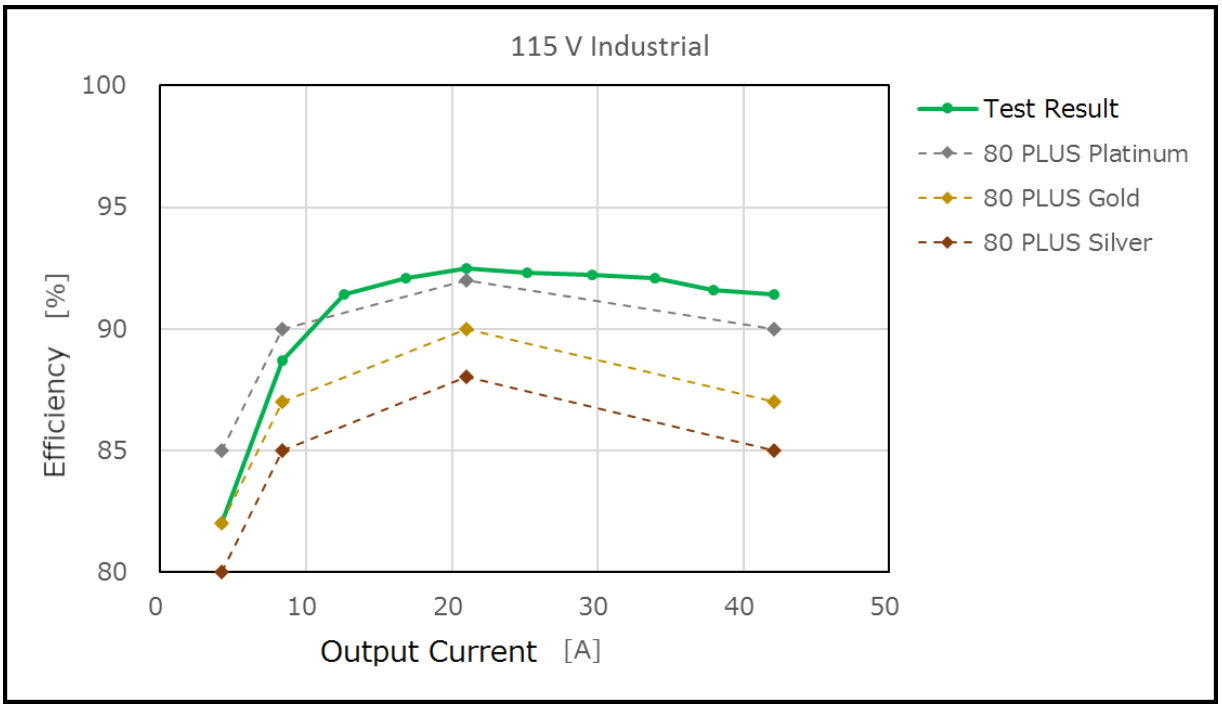

Fig. 4.3 Efficiency (80 PLUS: 115 V Industrial)

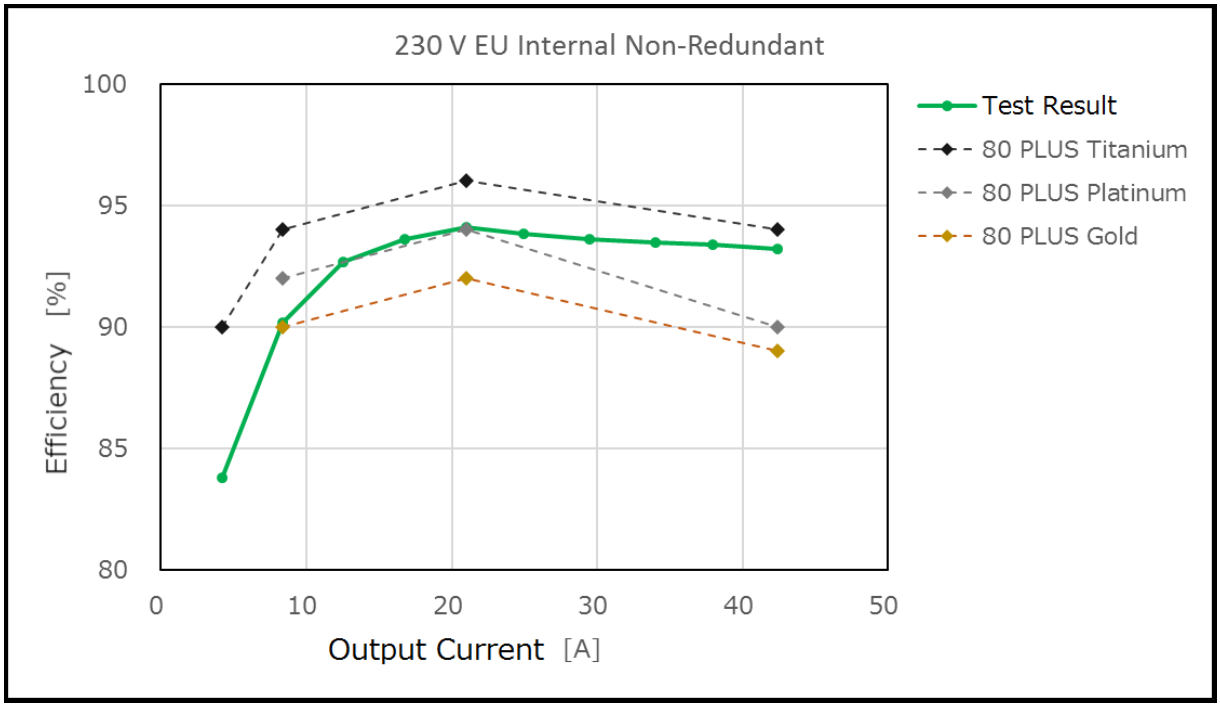

Fig. 4.4 Efficiency (80 PLUS: 230 V EU Internal Non-Redundant)

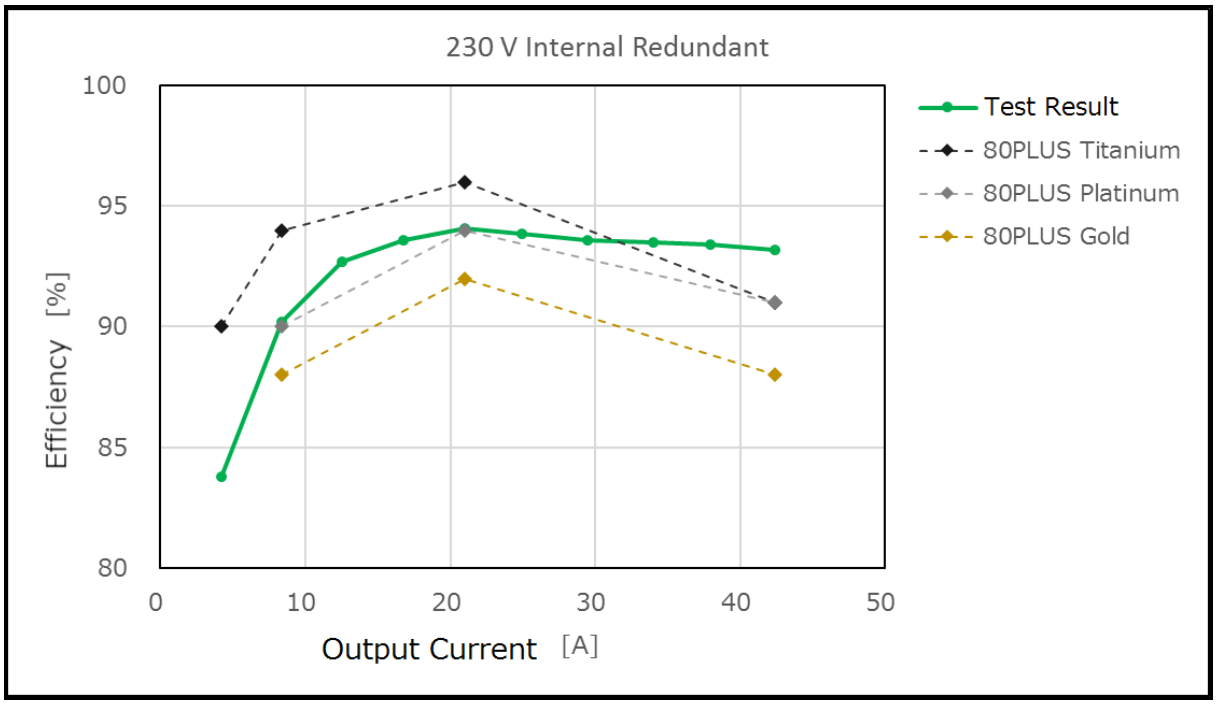

Fig. 4.5 Efficiency (80 PLUS: 230 V Internal Redundant)

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