



ON Semiconductor®

STR-ACF-12V100WPSU-GEVB Test Report



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Introduction

This Test Report describes an output power 100W, universal AC input (90 – 264Vac), constant output voltage power supply for industrial application and the power supply for which isolation from AC main is required.

Circuit Description

The feature of this power source is having combined the Boost follower PFC and Active Clamp Fly back utilizing ON Semiconductor's NCP1622 CrM VSFF PFC controller, NCP1568 ACF controller, NCP51530 high performance high / low side MOS FET driver, NCP4306 secondary side synchronous rectification driver, FCMT229N60 PFC switching FET, FCPF165N65S3L1 ACF switching FET and FDMT800150DC SR switching FET. Active Clamp Fly back topology effectively recycles the leakage energy. Another feature of this topology is the ZVS operation of the power MOSFETs.

The Strata software watches and detects the input of this power supply source and output side, and provides a display on a screen for the following value and graph by a telemetry system.

Input voltage (Vrms), Input current (Arms), Input (Active) power (W), Apparent power (VA), Reactive power (Var), Power factor, Line frequency (Hz), Loss (Pin-Pout)(W), Output voltage (V), Output current (A), Output power (W) and Efficiency (%). The display screen is below (this screen displays at case of no input and no output).



Figure 1 Screen image

This Test Report provides the performance test result for Output ripple voltage, Output voltage behavior of Rise time and Hold time, Dynamic load response, Line regulation, Load regulation, Efficiency, MOS switching waveform, etc. are shown in the pictures, charts and graphs below.

Specifications

- Input voltage: 90Vac – 264Vac
- Output voltage: 12V
- Output current: 0 - 8.5A
- Output Power: 102W
- Output Ripple: 100mVp-p max
- Input / Output isolation: 3kV
- PFC: Yes
- No load input consumption: <150mW
- Efficiency in full load: >86%
- Inrush limiting: 10 ohm NTC, 14A@100Vac, 32A@230Vac
- Fuse 3.15A / 250Vac
- Protection: OCP, OVP, SCP, TSD

Key features

- Low output ripple noise
- High efficiency at full load
- Universal input range, 90V – 264Vac line
- Auto re-start over current protection
- Latched output over voltage protection
- Over power protection
- Boost follower PFC control
- Active Clamp Fly back with peak current mode
- High frequency operation
- Board size 166mm x 103mm x 33mm
- Telemetry system by Strata solution
- PFC controller NCP1622
 - Critical Conduction Mode (CrM)
 - Valley Synchronized Frequency Fold-back (VSFF): Low frequency operation is forced at low current levels (9 pre-programmed settings)
 - Fast line / load transient compensation (Dynamic Response Enhancer)
- Active Clamp Fly back controller NCP1568
 - Active Clamp Fly back topology aids in ZVS
 - Proprietary Multi-Mode operation to enhance light load efficiency
 - Proprietary adaptive ZVS allows high frequency operation while reducing EMI
 - Inbuilt adaptive Dead-Time for both main and active clamp FETs
 - Peak current-mode control with Inbuilt slope compensation with options
 - Customer programmable optional transition to DCM - DCM and light load operation
 - Integrated frequency fold back with minimum frequency
 - Clamp for highest performance in standby mode
 - Minimum frequency clamp and Quiet Skip eliminates audible noise
- SR controller NCP4306
 - Self-contained control of Synchronous Rectifier in CCM, DCM and QR for Fly back or LLC applications
 - Precise true secondary zero current detection
 - Typically 15ns turn off delay from current sense input to driver
 - Rugged current sense pin (up to 200 V)
 - 7A / 2A Peak current sink / Source drive capability
 - Automatic light-load disable mode
 - Maximum operation frequency up to 1MHz

Applications

- Industrial use
- General-purpose power supply

BOARD IMAGES



Figure 2 Top view

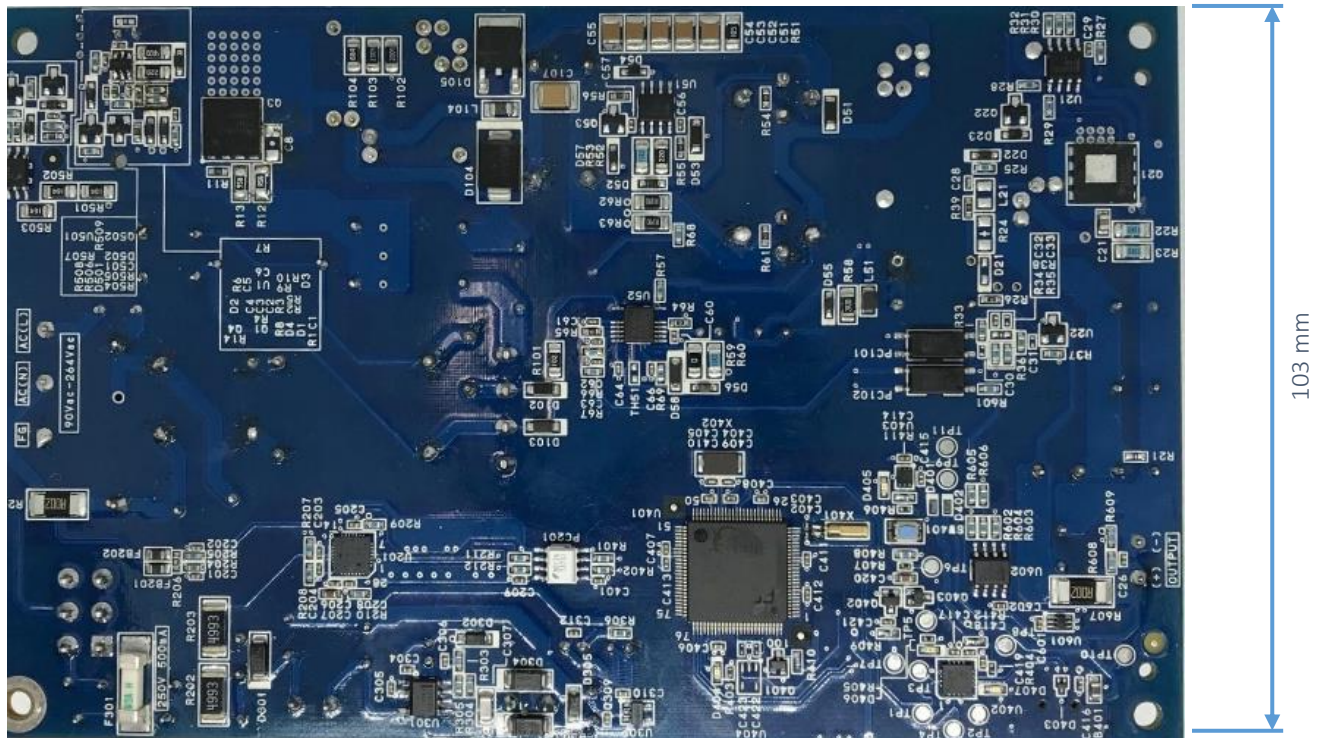


Figure 3 Bottom view

166 mm

103 mm

TEST RESULT

Output ripple



Figure 4-1 $V_{in}=100V_{ac}$, $V=50mV/div$, $H=20ms/div$
 V_{out} ripple= $50mV_{p-p}$, $P_{out}=0W$



Figure 4-2 $V_{in}=230V_{ac}$, $V=50mV/div$, $H=20ms/div$
 V_{out} ripple= $74mV_{p-p}$, $P_{out}=0W$



Figure 4-3 $V_{in}=100V_{ac}$, $V=50mV/div$, $H=10ms/div$
 V_{out} ripple= $61mV_{p-p}$, $P_{out}=102W$

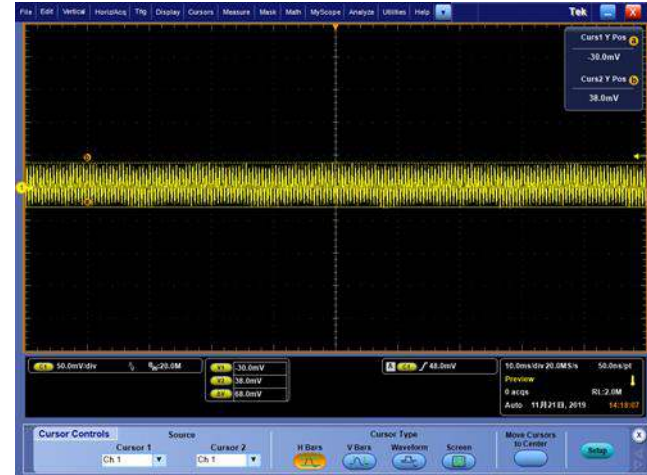


Figure 4-4 $V_{in}=230V_{ac}$, $V=50mV$, $H=10ms/div$
 V_{out} ripple= $68mV_{p-p}$, $P_{out}=102W$

Rise time (no-load by CR load mode)

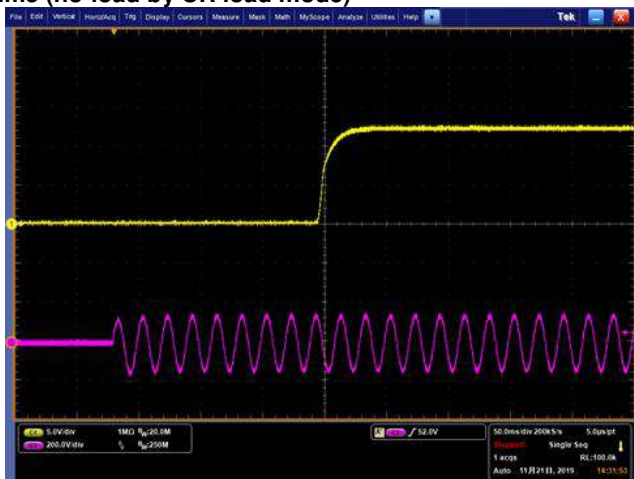


Figure 5-1 $V_{in}=100V_{ac}$, $V=5V/div$, $H=50ms/div$

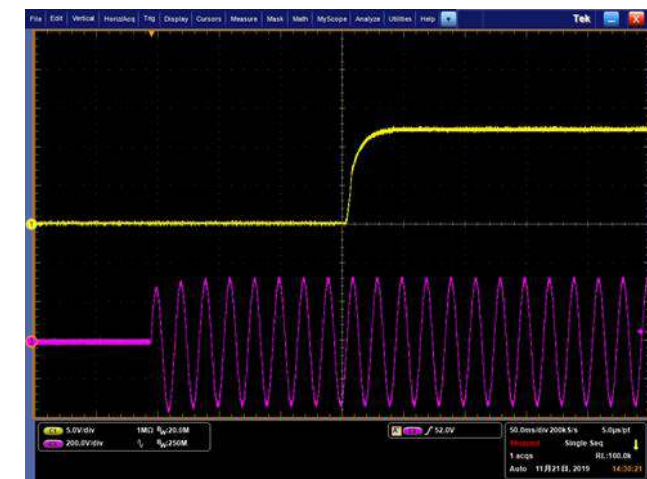


Figure 5-2 $V_{in}=230V_{ac}$, $V=5V/div$, $H=50ms/div$

Rise time (Full load by CR load mode)

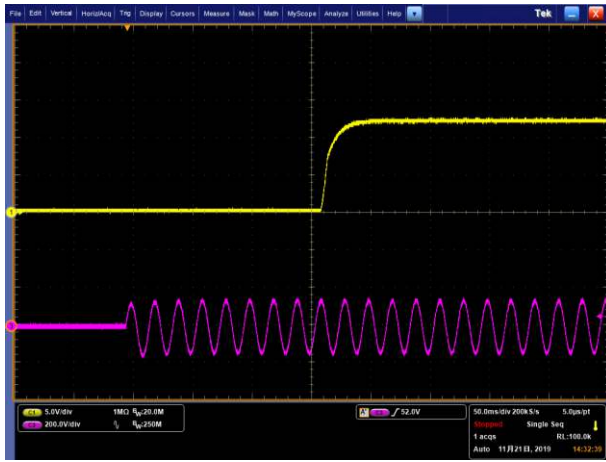


Figure 5-3 Vin=100Vac, V=5V/div, H=50ms/div

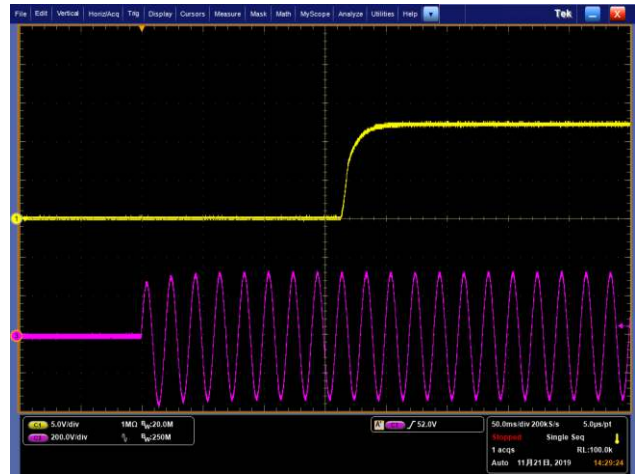


Figure 5-4 Vin=230Vac, V=5V/div, H=50ms/div

Hold time (Full load by CR load mode)

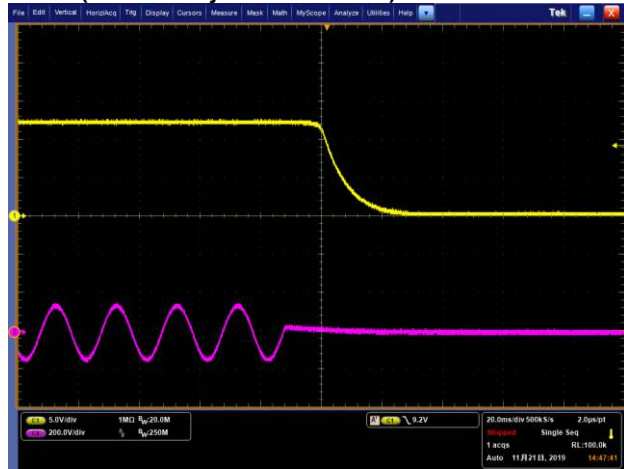


Figure 6-1 Vin=100Vac, V=5V/div, H=20ms/div

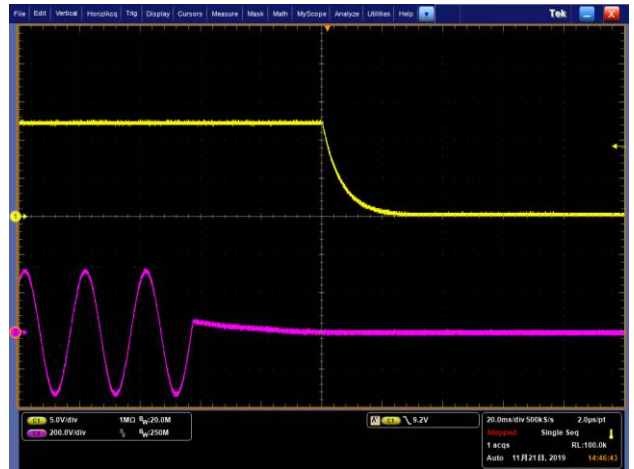


Figure 6-2 Vin=230V, V=5V/div, H=20ms/div

Dynamic load response (load 25% - 75%), CR mode

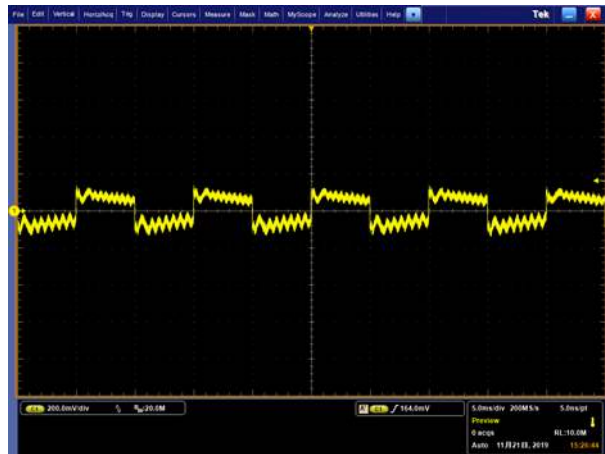


Figure 7-1 Vin=100Vac, V=200mV/div, H=5ms/div

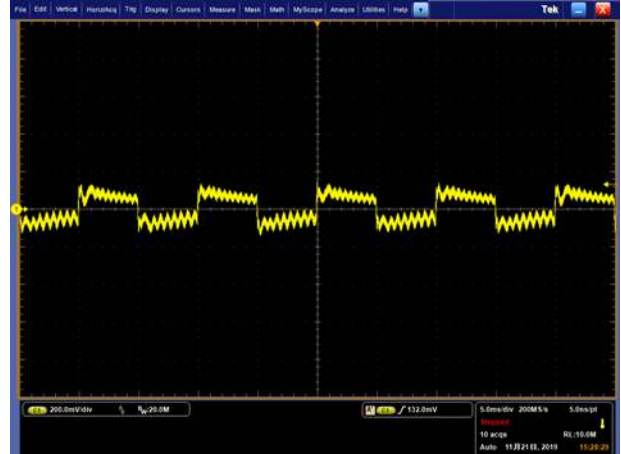


Figure 7-2 Vin=230Vac, V=200mV/div, H=5ms/div

Vsw Switching waveform @ input voltage=264Vac



Figure 8-1 No-load, V=100V/div, H=20ms/div, Skip mode, f=22.9 kHz



Figure 8-2 100% load, V=100V/div, H=5µs/div ACF mode. F=101 kHz, Vsw=516V

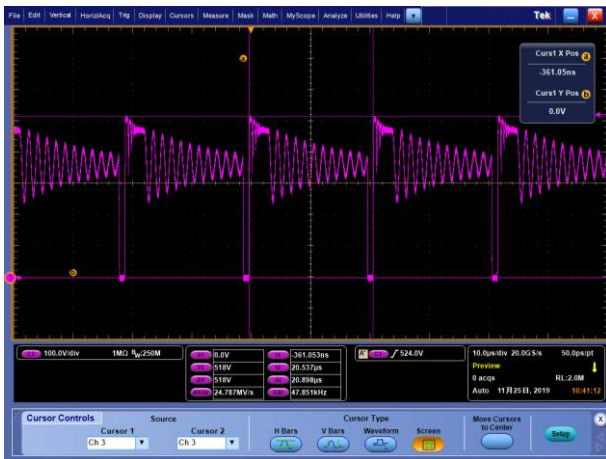


Figure 8-3 Max voltage of Vsw in DCM operation, V=100V/div, H=10µs/div, Vsw=518V/div, f=47.8 kHz

Behavior of transition DCM to ACF, ACF to DCM



Figure 9-1 DCM to ACF in 100Vac, V=50V/div, H=35µs/div



Figure 9-2 ACF to DCM in 100Vac, V=50V/div, H=40µs/div

Regulation by input voltage variation

Tested at the board end.

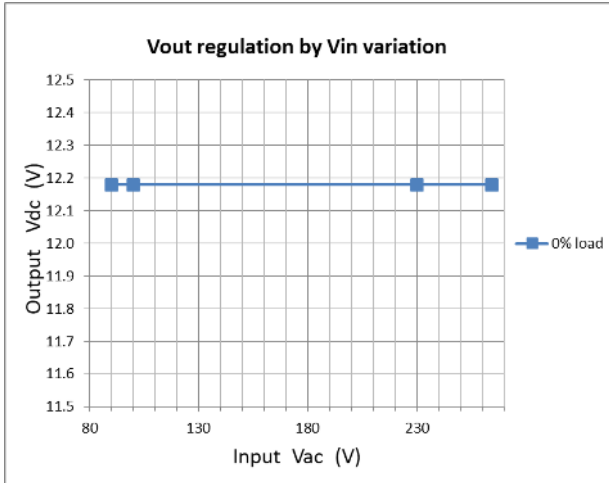


Figure 10-1 No-load (12V, 0A)

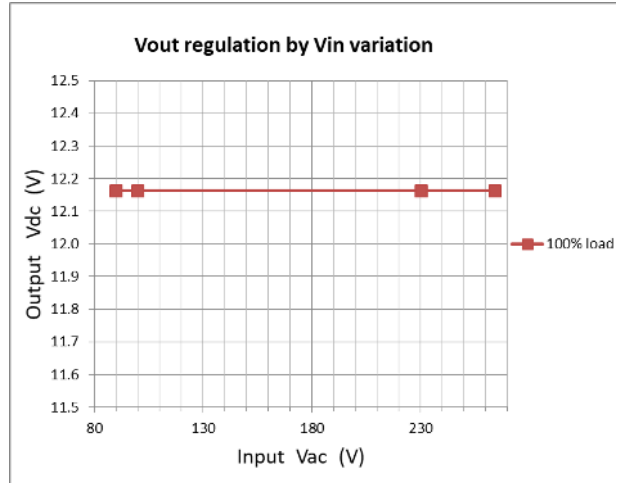


Figure 10-2 Full load (12V, 8.5A)

Regulation by load current

Tested at the board end.

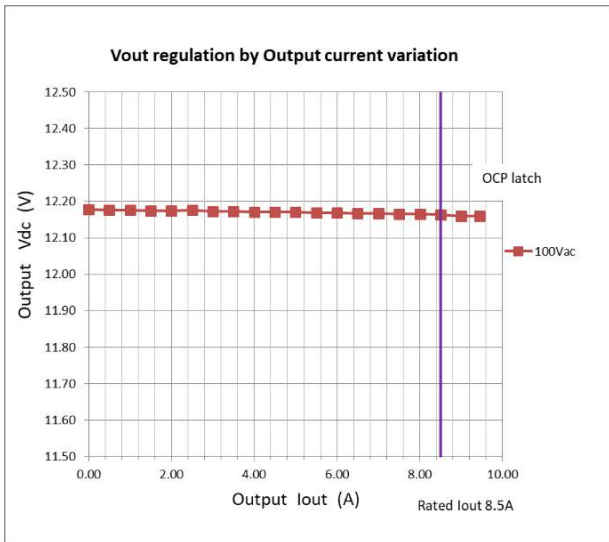


Figure 11-1 Input voltage=100Vac

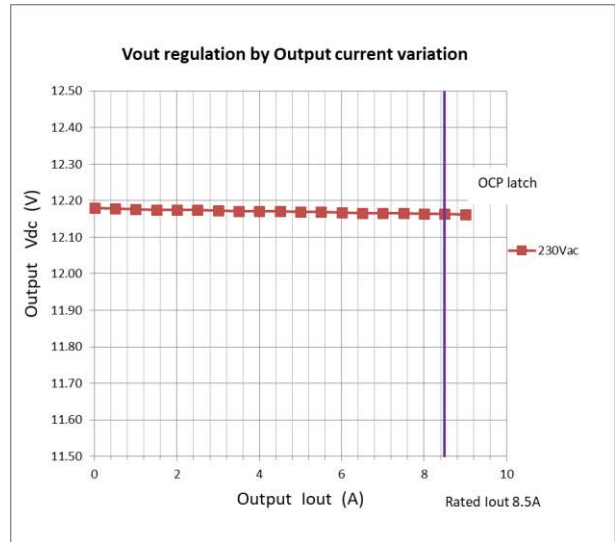


Figure 11-2 Input voltage=230Vac

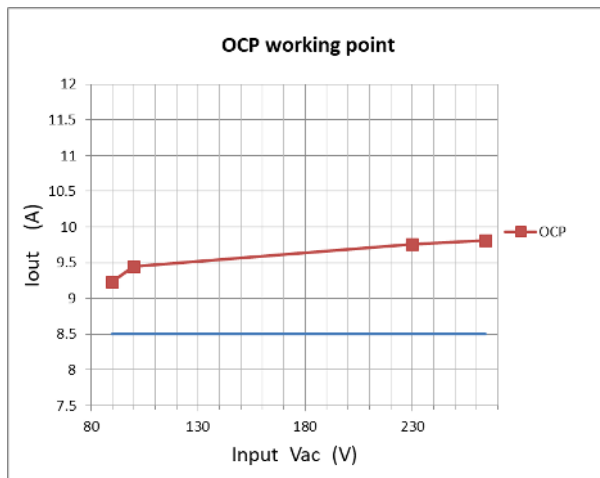


Figure 11-3 OCP working point

Efficiency Vin=100Vac
 Tested at the board end.

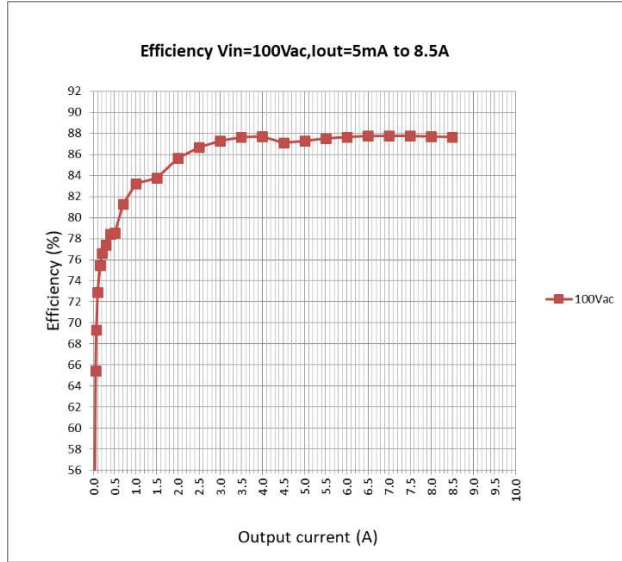


Figure 12-1 Output current = 5mA to 8.5A

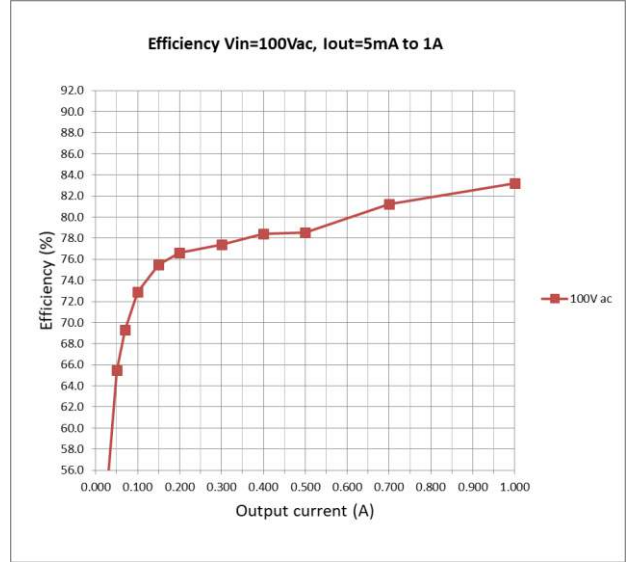


Figure 12-2 (Detailed) Output current = 5mA to 1A

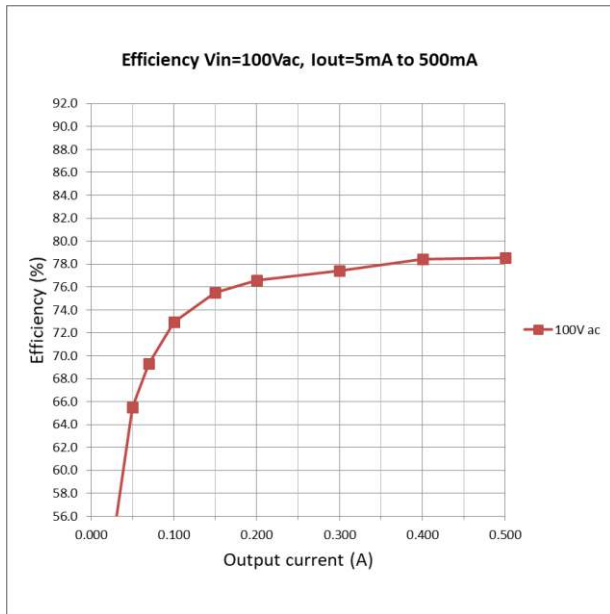


Figure 12-3 (Detailed) Output current = 5mA to 0.5A

Efficiency Vin=230Vac
 Tested at the board end.

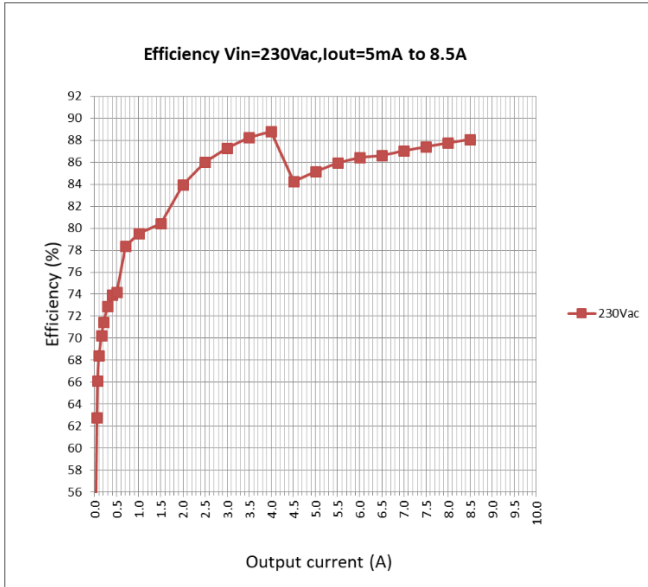


Figure 13-1 Output current = 5mA to 8.5A

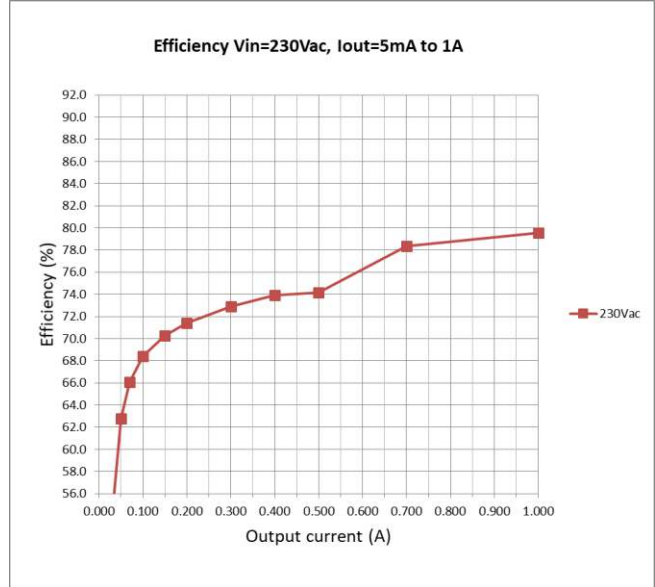


Figure 13-2 (Detailed) Output current = 5mA to 1A

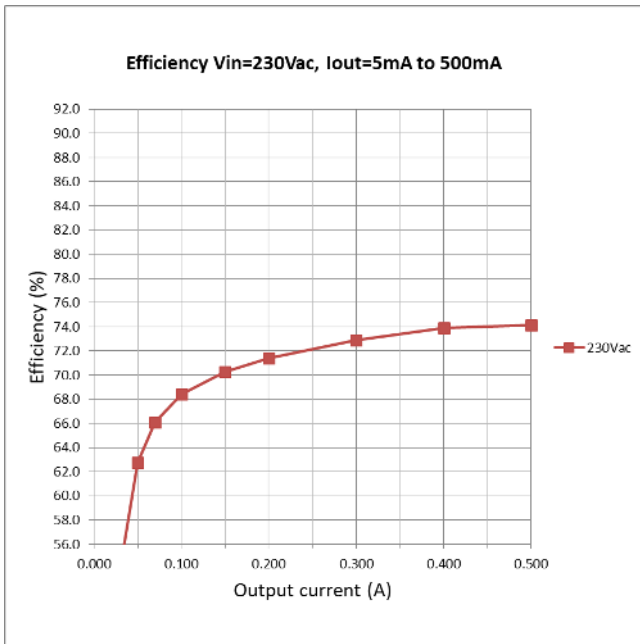


Figure 13-3 (Detailed) Output current = 5mA to 0.5A

MAGNETICS DESIGN DATA SHEET (Transformer)

Project / Customer: ON Semiconductor – 100 watt, Single output NCP1568 ACF (optional NCP1622)

Part Description: 100 watt ACF transformer, single output (12V), 100 kHz

Schematics ID: T1, Bobbin Type: 10 pin for RM10

Core Type: RM10 ferrite core

Inductance: 150uH total (+/- 10%) measured between 2pin and 3pin

Manufacture: Wurth Elektronik Part No: 750344192

CUSTOMER TERMINAL	RoHS	LEAD(Pb)-FREE	
Sn 96%, Ag 4%	Yes	Yes	more than you expect

PART MUST INSERT FULLY TO SURFACE A IN RECOMMENDED GRID

TERM. NO.'S FOR REF. ONLY

LOT CODE & DATE CODE

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER	TEST CONDITIONS	VALUE
D.C. RESISTANCE	3-2 @20°C	0.150 ohms max.
D.C. RESISTANCE	7-4 @20°C	0.005 ohms max.
D.C. RESISTANCE	5-6 @20°C	0.150 ohms max.
D.C. RESISTANCE	9-10 @20°C	0.210 ohms max.
INDUCTANCE	3-2 100kHz, 100mV, Ls	150.00µH ±10%
SATURATION CURRENT	3-2 20% rolloff from initial	5A
LEAKAGE INDUCTANCE	3-2 tie(4+5+6+7+9+10), 100kHz, 100mV, Ls	6µH max.
DIELECTRIC	3-4 tie(1+10,4+5), 3750VAC, 1 second	3000VAC, 1 minute
DIELECTRIC	7-CORE tie(4+5), 3750VAC, 1 second	3000VAC, 1 minute
DIELECTRIC	1-10 625VAC, 1 second	
URNS RATIO	(3-2):(7-4)	8.67:1, ±2%
URNS RATIO	(3-2):(5-6)	8.67:1, ±2%
URNS RATIO	(3-2):(9-10)	6.5:1, ±2%

RECOMMENDED P.C. PATTERN, COMPONENT SIDE

GENERAL SPECIFICATIONS:

OPERATING TEMPERATURE RANGE: -40°C to +125°C including temp rise.

Designed to comply with the following requirements as defined by IEC60950-1, EN60950-1, UL60950-1/CSA60950-1 and AS/NZS60950.1:

- Reinforced insulation for a primary circuit at a working voltage of 265Vrms, 400Vpeak, Overvoltage Category II, Pollution Degree 2.

Wire insulation & RoHS status not affected by wire color. Wire insulation color may vary depending on availability.

DFM	Packaging Specifications	<p>CONVENTION PLACEMENT</p>	Tolerances unless otherwise specified: Angles: ±1° Decimals: ±.005 [.13] Fractions: ±1/64 Footprint: ±.001 [.03]	DRAWING TITLE	PART NO.	
DATE	Method: Tray		<p>This drawing is dual dimensioned. Dimensions in brackets are in millimeters.</p>	<p>TRANSFORMER</p>	<p>750344192</p>	
ENG	IYU					
REV.	01					
DATE	3/20/2019				SPECIFICATION SHEET 1 OF 1	

MAGNETICS DESIGN DATA SHEET (Inductor)

Project / Customer: ON Semiconductor – 100 watt, PFC stage with NCP1622


Part Description: 100 watt PFC inductor, 200 kHz

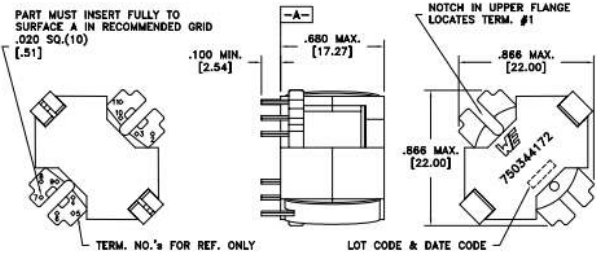
Schematics ID: L103, Bobbin Type: 12 pin for RM8

Core Type: RM8 ferrite core

Inductance: 100uH total (+/- 10%) measured between 3pin and 10pin

Manufacture: Wurth Elektronik Part No: 750344172

CUSTOMER TERMINAL	RoHS	LEAD(Pb)-FREE	more than you expect	
Sn96%, Ag4%	Yes	Yes		



PART MUST INSERT FULLY TO SURFACE A IN RECOMMENDED GRID .020 SQ.(10) [.51]

TERM. NO.'s FOR REF. ONLY

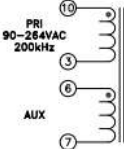
LOT CODE & DATE CODE

NOTCH IN UPPER FLANGE LOCATES TERM. #1

750344172

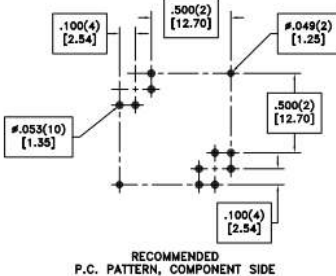
ELECTRICAL SPECIFICATIONS @ 25°C unless otherwise noted:

PARAMETER	TEST CONDITIONS	VALUE
D.C. RESISTANCE	10-3 @20°C	0.260 ohms max.
D.C. RESISTANCE	6-7 @20°C	0.210 ohms max.
INDUCTANCE	10-3 200kHz, 100mVAC, Is	100.00uH ±10%
SATURATION CURRENT	10-3 20% rolloff from initial	5A
DIELECTRIC	10-Core tie(3+6), 825VAC, 1 second	-
URNS RATIO	(10-3):(6-7)	10:1, ±2%





PRI
90-264VAC
200kHz

AUX



RECOMMENDED P.C. PATTERN, COMPONENT SIDE

Wire insulation & RoHS status not affected by wire color.
Wire insulation color may vary depending on availability.

REV.	DATE	Packaging Specifications		Tolerances unless otherwise specified: Angles: ±1° Fractions: ±1/64	DRAWING TITLE INDUCTOR	PART NO. 750344172
		Method: Tray PKG-0002 www.we-online.com/midcom	COMPONENT PLACEMENT	Decimals: ±.005 [.13] Footprint: ±.001 [.03]		
6A	11/19	SEE REVISION SHEET FOR REVISION LEVEL		This drawing is dual dimensioned. Dimensions in brackets are in millimeters.	e!Sos p/n: 750344172	 SPECIFICATION SHEET 1 OF 1

PCB information

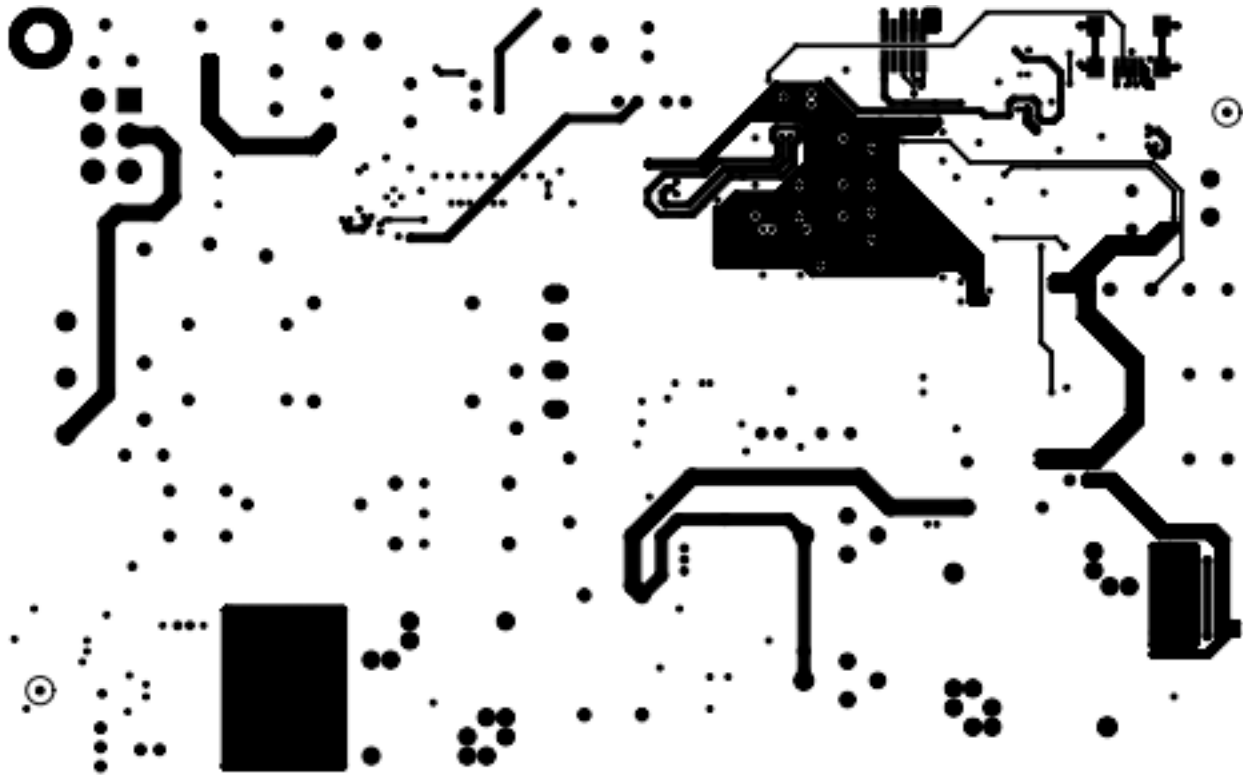


Figure 14-1 Top view of layer 1

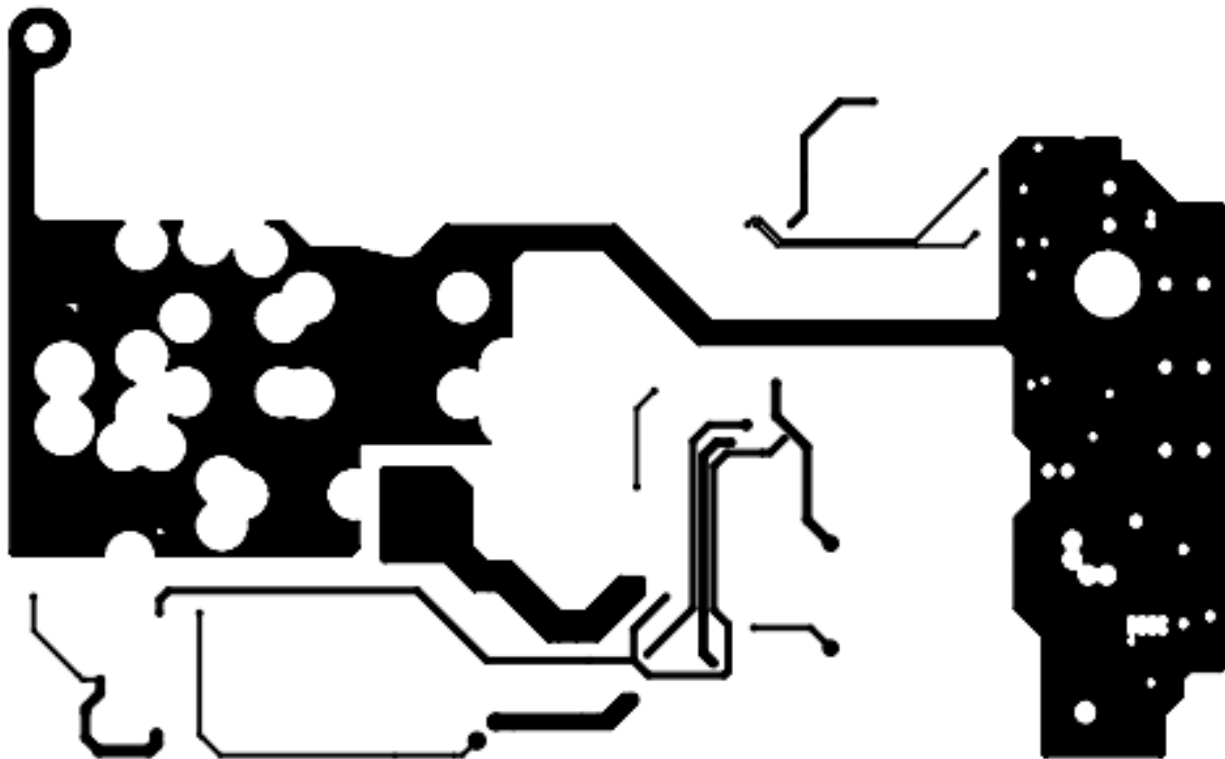


Figure 14-2 Top view of layer 2 (inner signal)

PCB information (continued)

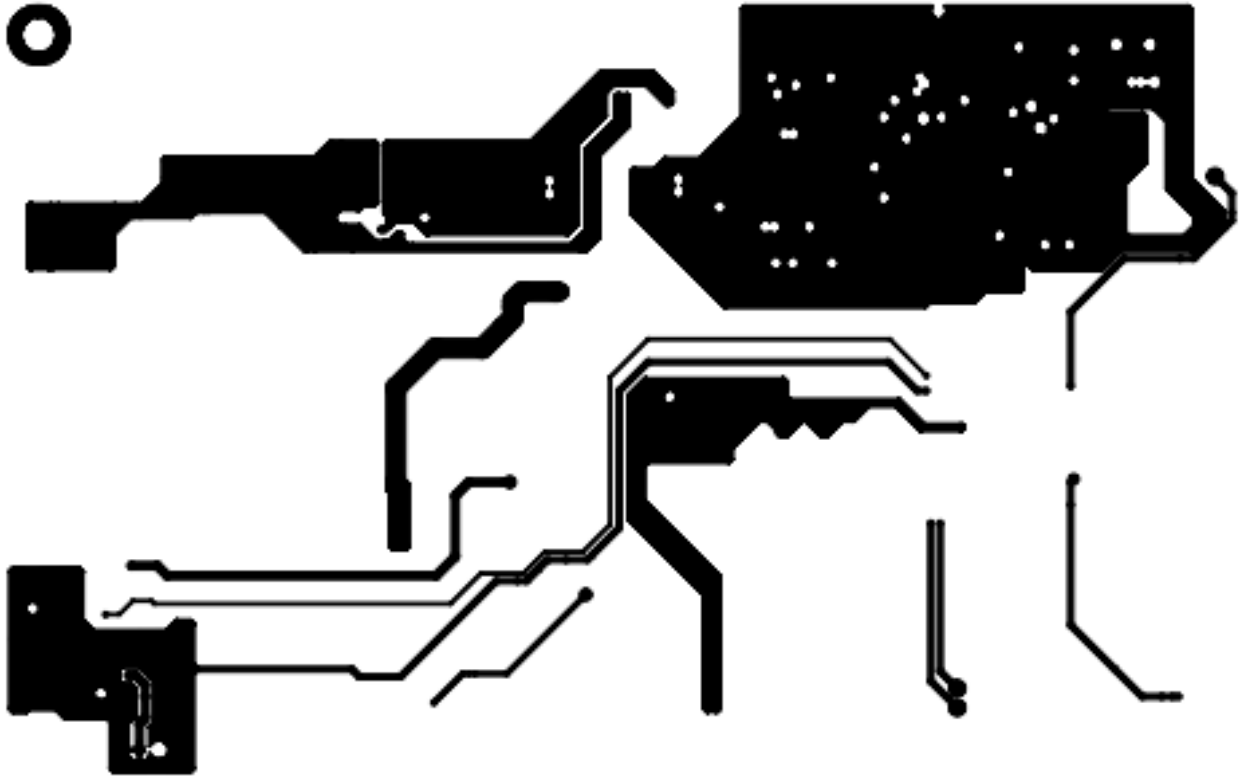


Figure 14-3 Top view of layer 3 (inner signal)

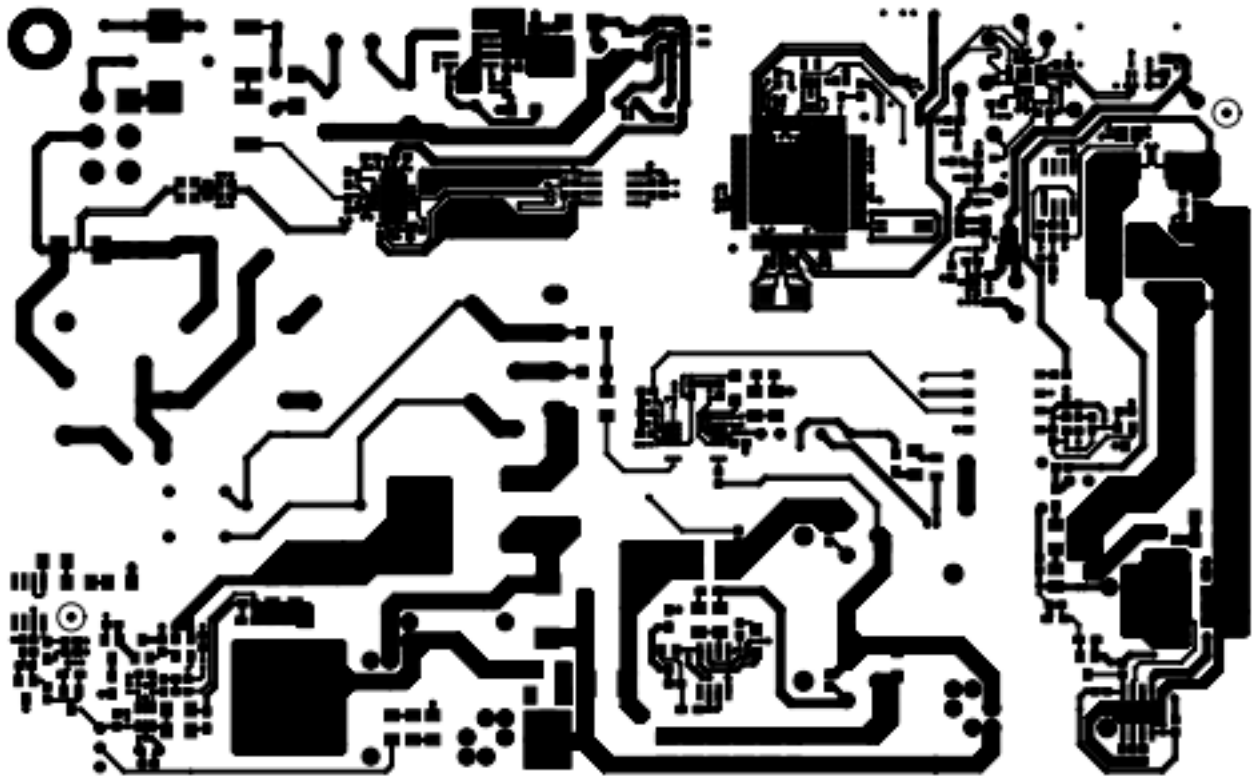


Figure 14-4 Top view of layer 4 (Bottom layer)

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