

# ISL6730AEVAL1Z and ISL6730CEVAL1Z: Boost CCM PFC for 90W Universal Input Adaptors

## Introduction

This application note describes the design and implementation of a 390V, 90W, Continuous Conduction Mode (CCM) Boost PFC converter using the ISL6730A, ISL6730C. The converter exhibits high power factor, Low THD and high conversion efficiency. The ISL6730A, ISL6730C are voltage mode power factor correction (PFC) controllers designed to drive cost-effective converters to meet input line harmonic regulations. The IC can be ISL6730A (Fixed Skip threshold) or ISL6730C (non-Skip). A detailed design procedure can be found in the datasheet ([FN8258](#)).

## Application

The pre-regulator for AC/DC adaptors, such as Desktop/laptop Computer adaptors, or ATX power supply for the servers of networks or data centers, brick converters for telecom, flat-panel TVs, etc.

## Design Specifications

- Input Voltage,  $V_{IN}$ : 85V - 265V<sub>AC</sub>
- Output Voltage,  $V_O$ : 390V<sub>DC</sub>
- Output Current,  $I_O$ : 0.23A (90W)
- Switching Frequency: 124kHz
- Efficiency: Full Load, 94.5% @ 115V<sub>AC</sub>; 96% @ 230V
- PF: Full Load, 0.999 @ 115V<sub>AC</sub>; 0.997 @ 230V<sub>AC</sub>
- THD: Full Load, 2% @ 115V<sub>AC</sub>, 5% @ 230V<sub>AC</sub>
- Board Dimension: 155mm×80mm×38mm<sup>3</sup>(L×W×H)

Figure 3 on page 2 shows the test setup.

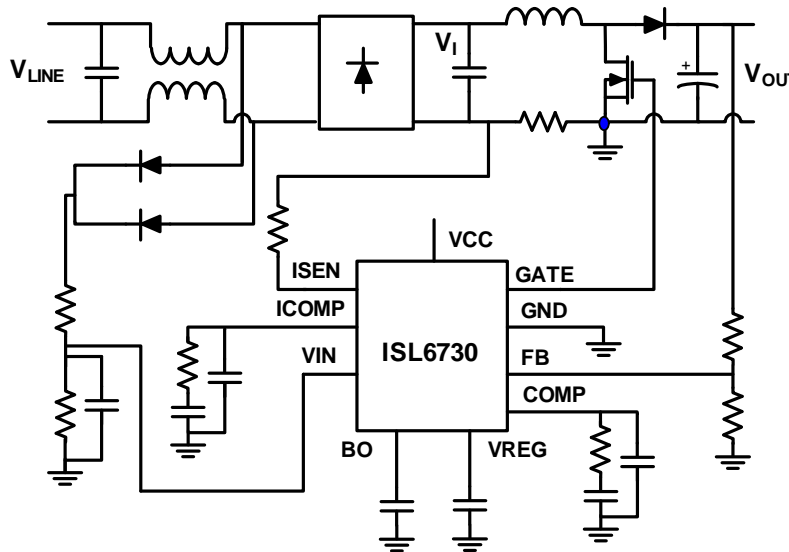


FIGURE 1. SIMPLIFIED SCHEMATIC

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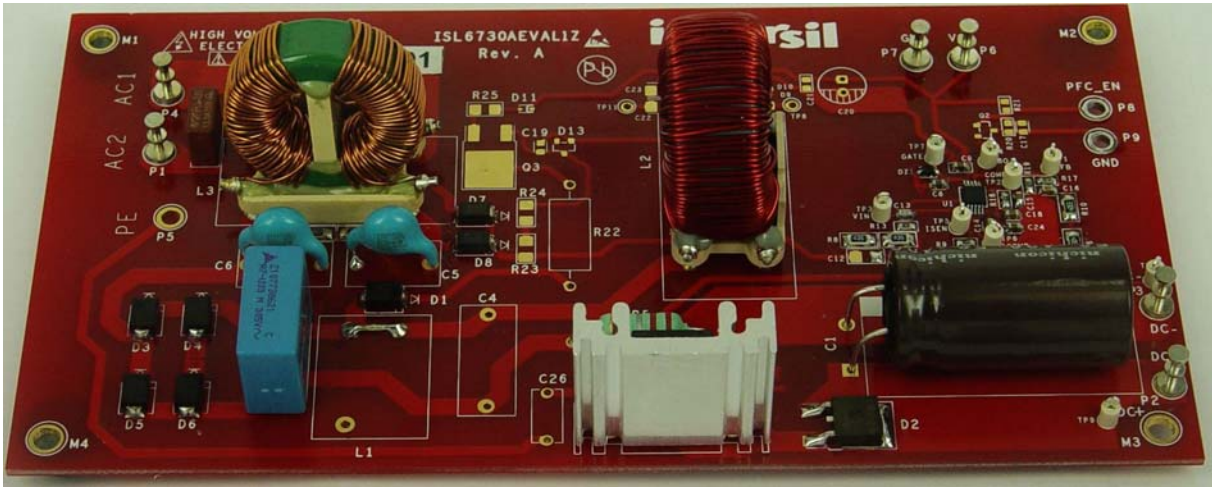


FIGURE 2. TOP VIEW OF THE EVALUATION BOARD

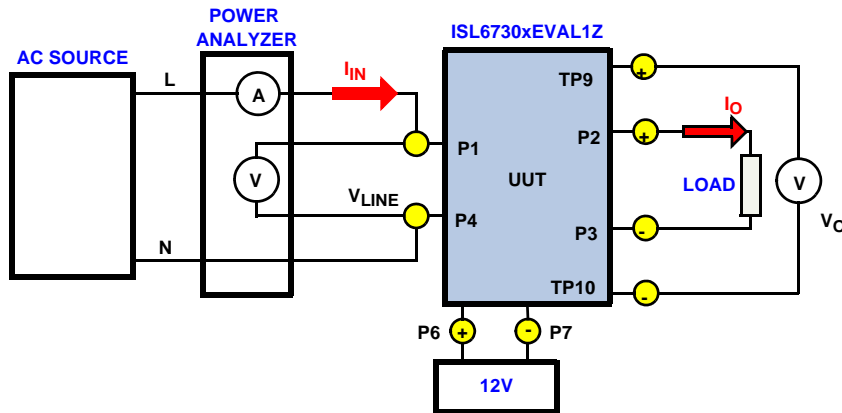


FIGURE 3. TEST SETUP

## Performance Curves and Typical Waveforms

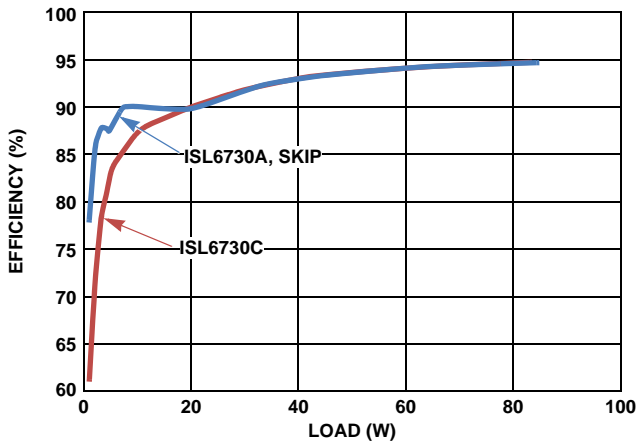


FIGURE 4. LOW LINE EFFICIENCY vs LOAD

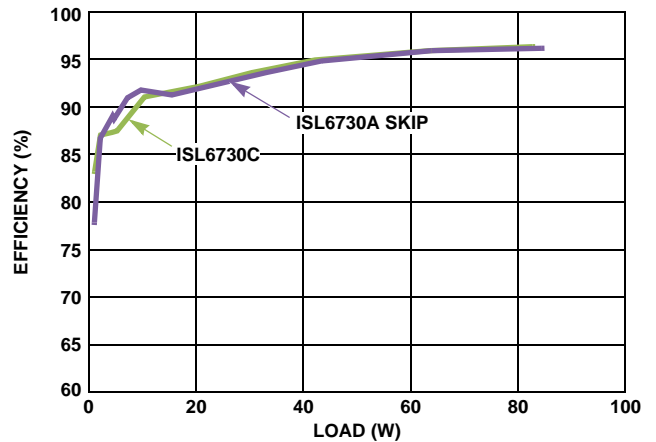


FIGURE 5. HIGH LINE EFFICIENCY vs LOAD

Performance Curves and Typical Waveforms (Continued)

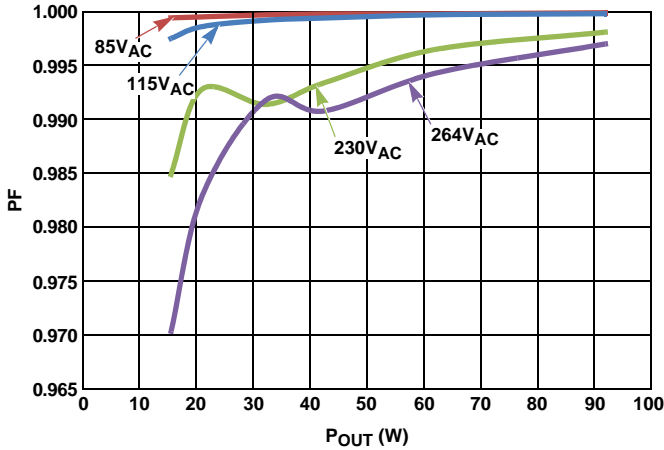


FIGURE 6. POWER FACTOR vs LINE VOLTAGE

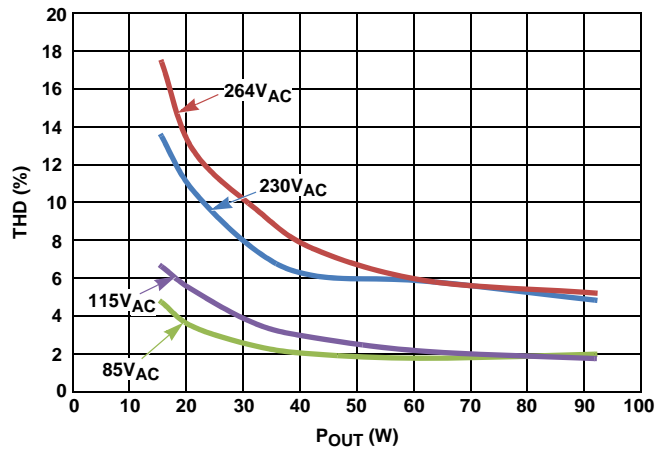


FIGURE 7. THD vs LINE VOLTAGE

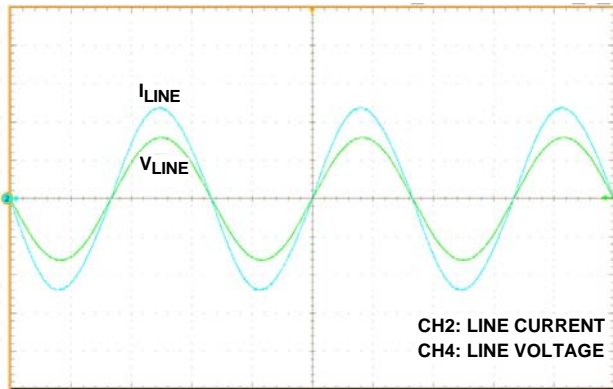


FIGURE 8. WAVEFORMS OF LINE CURRENT AND VOLTAGE (115V/96W)

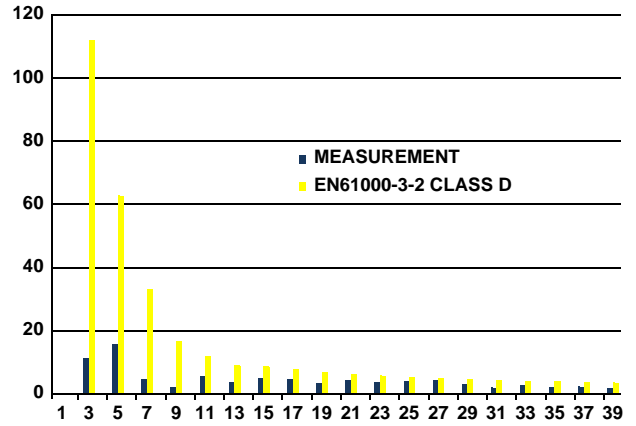


FIGURE 9. HARMONIC CURRENTS (115V/96W)

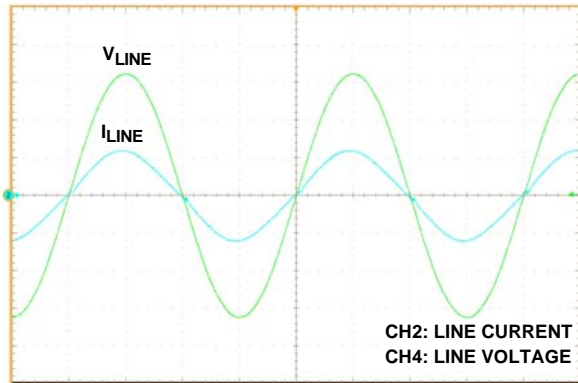


FIGURE 10. WAVEFORMS OF LINE CURRENT AND VOLTAGE (230V/96W)

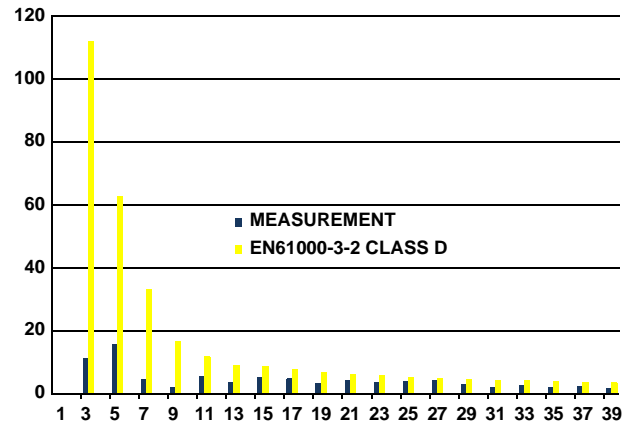


FIGURE 11. HARMONIC CURRENT OF LINE CURRENTS (230V/96W)

Performance Curves and Typical Waveforms (Continued)

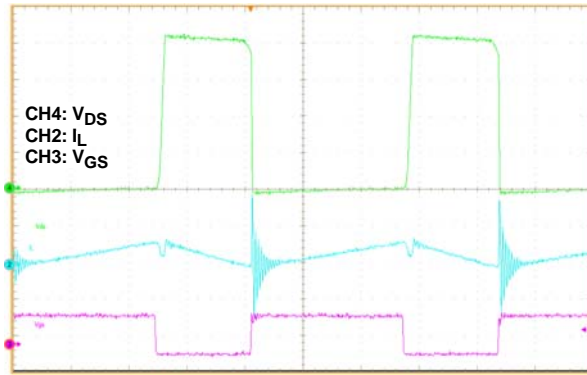


FIGURE 12. SWITCHING WAVEFORMS

# Schematic

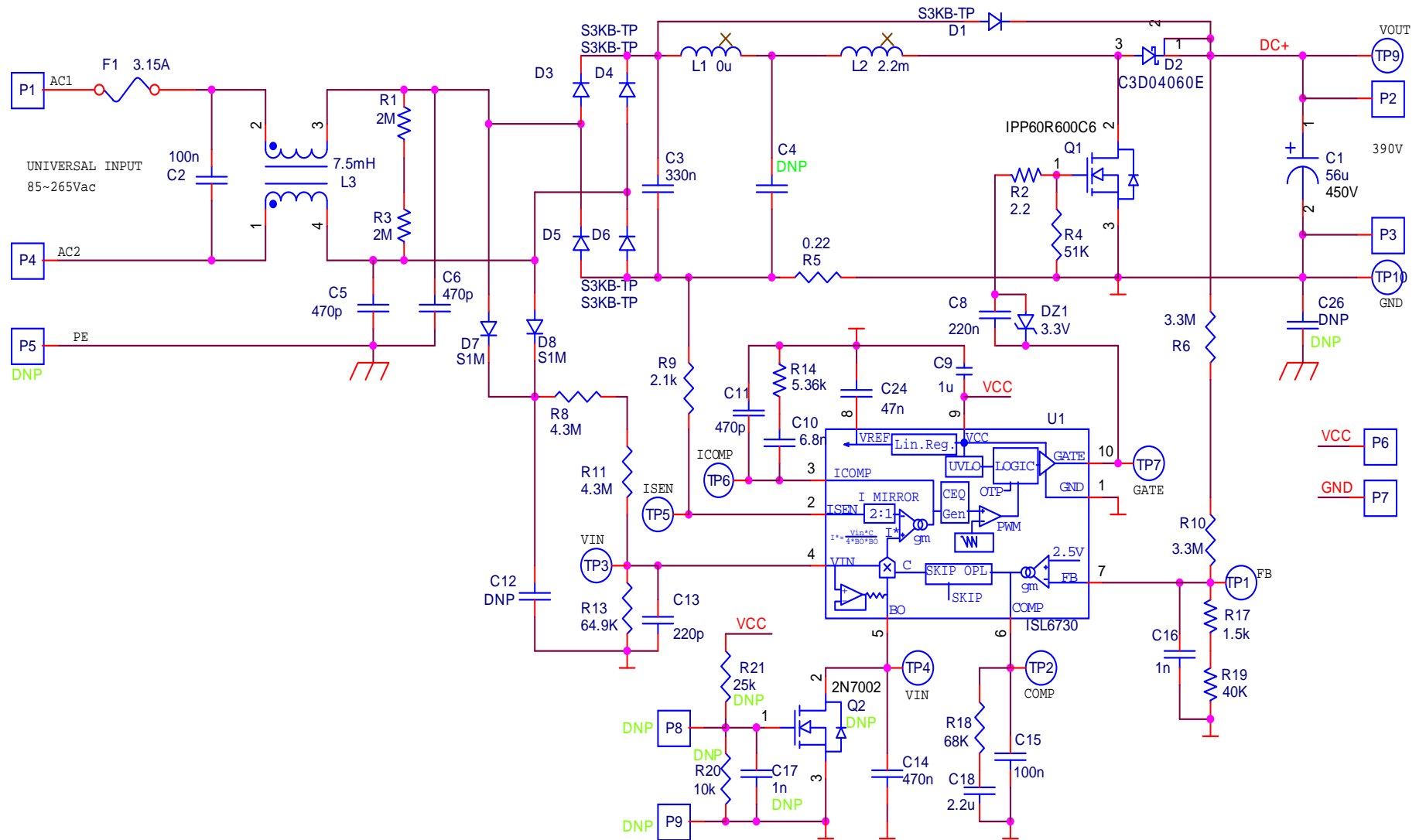


FIGURE 13. SCHEMATIC OF EVALUATION BOARD

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**TABLE 1. BILL OF MATERIALS**

| QTY | REFERENCE DESIGNATOR                         | TYPE/PACKAGE        | VALUE       | VOL/TOL/MAT                          | MANUFACTURER        | MFR. PART #                |
|-----|--|---------------------|-------------|--------------------------------------|---------------------|----------------------------|
| 1   | C1   | CAP; TH             | 56u         | 450V; 20%; ELECT, Aluminum           | Nichion             | UPTW6560MHD                |
| 1   | C2   | CAP; TH; Radial     | 100n        | X2; 20%; EMI, X2-class               | EPCOS               | B32922C3104M               |
| 1   | C3   | CAP; TH; Radial     | 330n        | 450V; 10%; Metallized Polyester Film | Panasonic-ECG       | ECQ-E2W474KH               |
| 2   | C5, C6                                       | CAP; TH; Radial     | 470p        | Y1; 10%; EMI, Y1-class               | Murata              | DE1B3KX471KA5B             |
| 1   | C8   | CAP; SM; 0603       | 220n        | 25V; 20%; X7R                        | TDK                 |                            |
| 1   | C9   | Cap; SM; 0603       | 1u          | 50V; 20%; X7R                        | TDK                 |                            |
| 1   | C10  | CAP; SM; 0603       | 6.8n        | 25V; 10%; X7R                        | TDK                 |                            |
| 1   | C11  | CAP; SM; 0603       | 470p        | 25V; 10%; X7R                        | TDK                 |                            |
| 1   | C13  | CAP; SM; 0603       | 220p        | 16V; 5%; NPO                         | TDK                 |                            |
| 1   | C14  | CAP; SM; 0603       | 470n        | 16V; 10%; X7R                        | TDK                 |                            |
| 1   | C15  | CAP; SM; 0603       | 100n        | 50V; 10%; X7R                        | TDK                 |                            |
| 1   | C16  | CAP; SM; 0603       | 1n          | 50V; 10%; X7R                        | TDK                 |                            |
| 1   | C18  | CAP; SM; 0603       | 2.2u        | 16V; 10%; X7R                        | TDK                 |                            |
| 1   | C24  | CAP; SM; 0603       | 47n         | 25V; 10%; X7R                        | TDK                 |                            |
| 1   | DZ1  | Zener; SM; SOD323   | 3.3V        | 5%; Zener                            | NXP                 | BZX384-B3V3                |
| 5   | D1, D3, D4, D5, D6                           | Diode; SM; SMB      | S3KB-TP     | 800V; 3A; Standard Recovery          | Micro Commercial Co | S3KB-TP                    |
| 1   | D2   | Diode; SM; DPAK     | C3D04060E   | 600V; 3A; SiC Schottky               | Cree                | C3D04060E                  |
| 2   | D7, D8                                       | Diode; SM; SMA      | S1M         | 1kV; 1A; Standard Recovery           | Diodes Inc          | S1M-13-F                   |
| 1   | F1   | Fuse; TH; TE5       | 3.15A       | 250V;                                | Littelfuse          | 39213150000                |
| 1   | L1   | Ind; TH             | 0u          | bar wire                             |                     |                            |
| 1   | L2   | Ind; TH             | 2.2m        | Inductor                             | CoilCraft           | CT8494-AL                  |
| 1   | L3   | Txfmr; TH           | 7.5mH       | Common Chock                         | CoilCraft           | CMT1-7.5-2                 |
| 6   | P1, P2, P3, P4, P6, P7                       | TP; TH              | -           | -                                    | KEYSTONE            | 1514-2                     |
| 1   | Q1   | MOSFET; TH; TO-220F | IPP60R600C6 | 600V; ; N-Chan                       | Infineon            | IPP60R600C6                |
| 2   | R1, R3                                       | Res; SM; 1206       | 2M          | 5%; Thick Film                       | Panasonic-ECG       | ERJ-8GEYJ205               |
| 1   | R2   | Res; SM; 0603       | 2.2         | 1%; Thick Film                       | Yageo               |                            |
| 1   | R4   | Res; SM; 0603       | 51K         | 1%; Thick Film                       | Yageo               |                            |
| 1   | R5   | Res; TH; Axial      | 0.22        | 1W; 1%; Wire Wounded                 | Yageo               | KNP100JR-73-OR33           |
| 2   | R6, R10                                      | Res; SM; 1206       | 3.3M        | 1%; Thick Film                       | Yageo               | RC1206FR-073M3L            |
| 2   | R8, R11                                      | Res; SM; 1206       | 4.3M        | 1%; Thick Film                       | Yageo               | RC1206FR-074M3L            |
| 1   | R9   | Res; SM; 0603       | 2.1k        | 1%; Thick Film                       | Yageo               |                            |
| 1   | R13  | Res; SM; 0603       | 64.9K       | 1%; Thick Film                       | Yageo               |                            |
| 1   | R14  | Res; SM; 0603       | 5.36k       | 1%; Thick Film                       | Yageo               |                            |
| 1   | R17  | Res; SM; 0603       | 1.5k        | 1%; Thick Film                       | Yageo               |                            |
| 1   | R18  | Res; SM; 0603       | 68K         | 1%; Thick Film                       | Yageo               |                            |
| 1   | R19  | Res; SM; 0603       | 40K         | 1%; Thick Film                       | Yageo               |                            |
| 9   | TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP9, TP10 | Pole; TH            | -           | -                                    | KEYSTONE            | 5007                       |
| 1   | U1   | SM; MSOP10          | ISL6730     | -                                    | Intersil            | ISL6730AFUZ or ISL6730CFUZ |
| 0   | C4, C12, C16                                 |                     | DNP         |                                      |                     |                            |
| 0   | R20, R21, P5, P8, P9, C17, Q2                |                     | DNP         |                                      |                     |                            |
| 0   | C19~23, D9~13, Q3, R22~25, TP8, TP11         |                     | DNP         |                                      |                     |                            |

## PCB Layout

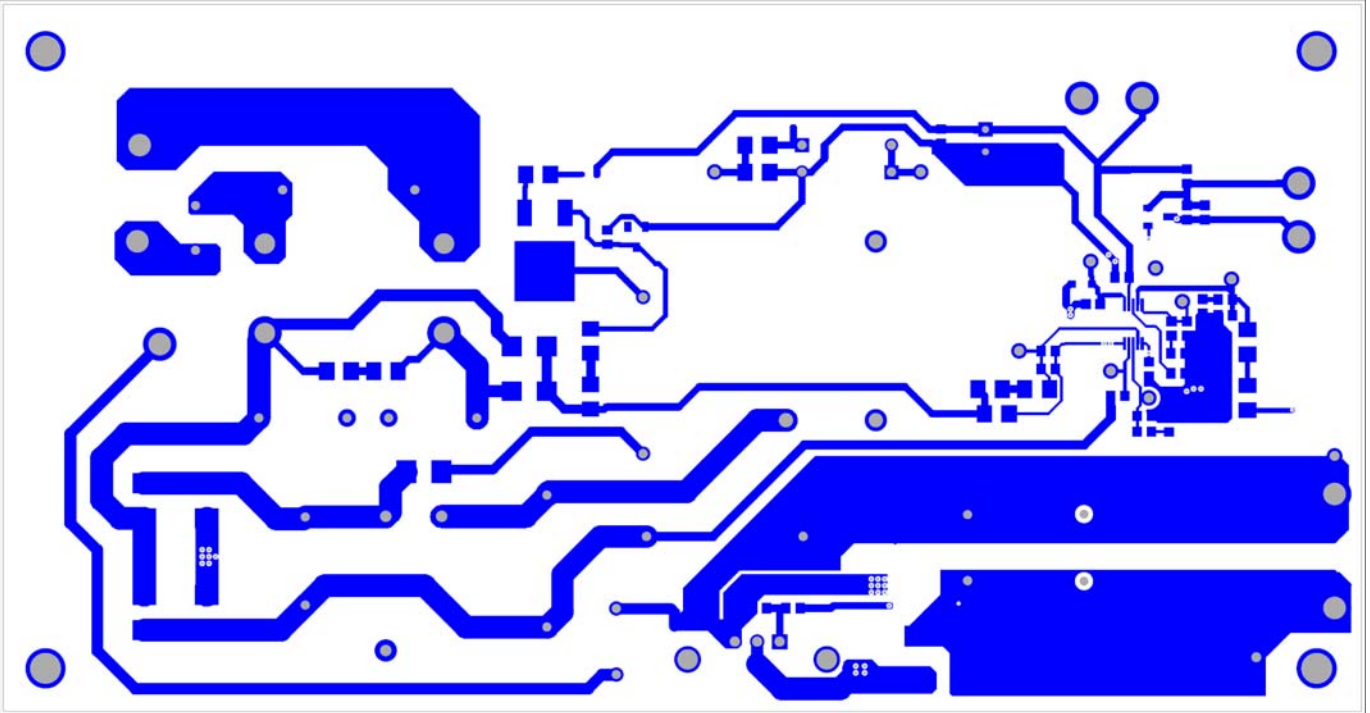


FIGURE 14. TOP LAYER

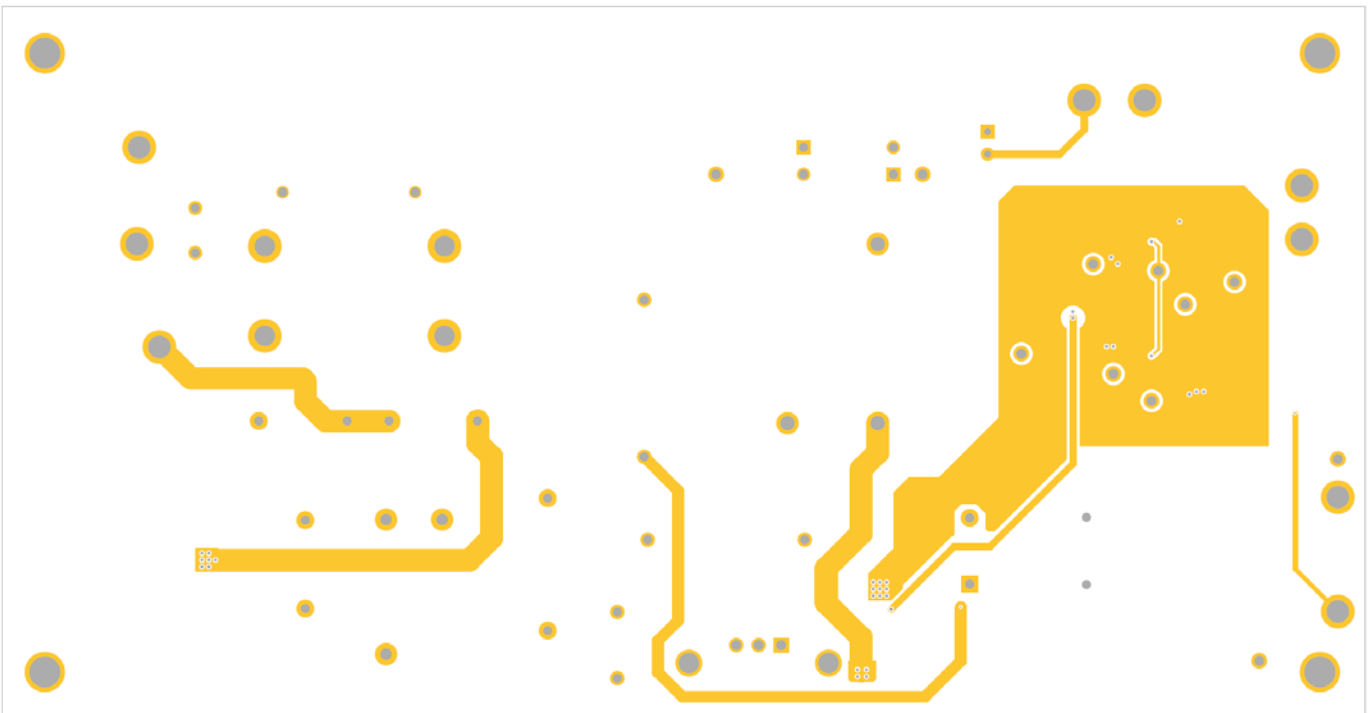


FIGURE 15. BOTTOM LAYER

## Assembly Drawing

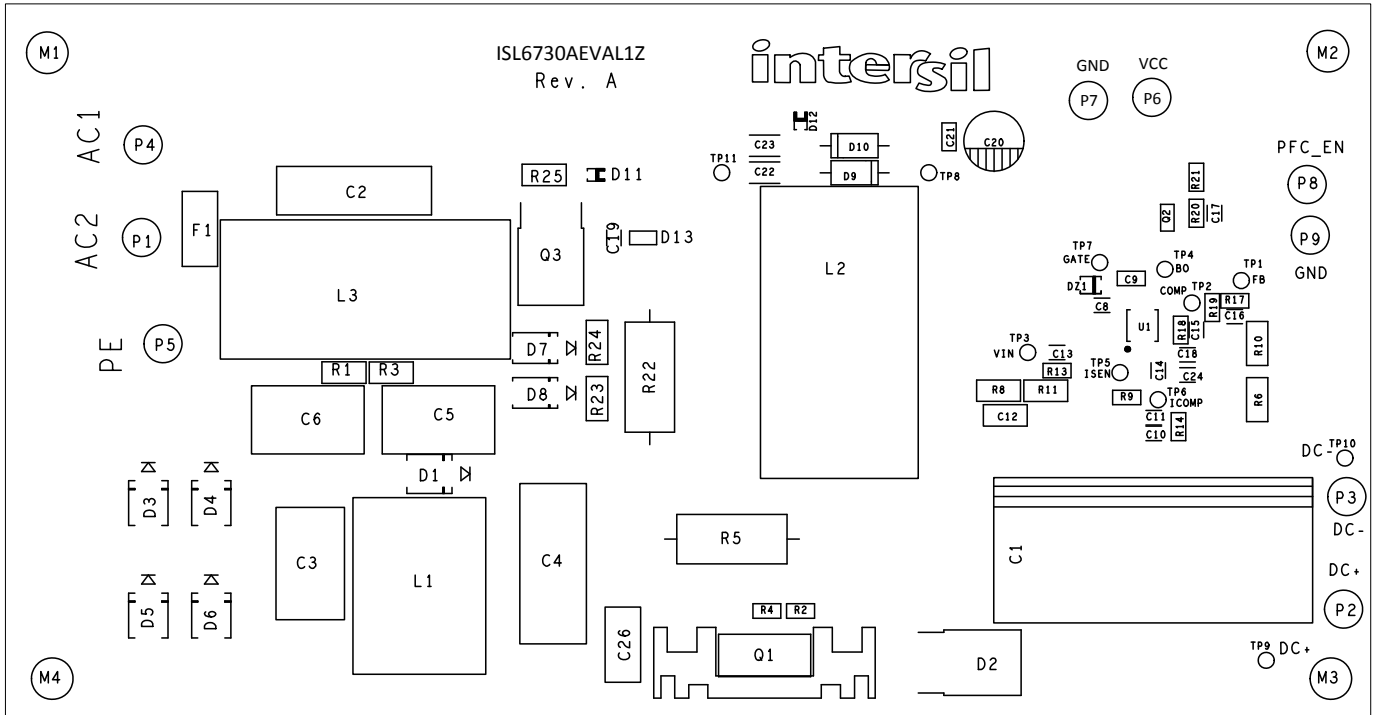


FIGURE 16. ASSEMBLY ON TOP

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