ISL6730AEVAL1Z, ISL6730CEVAL1Z

Boost CCM PFC for 90W Universal Input Adaptors

AN1830
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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 date centers, brick converters for telecom, flat-panel TVs, etc.

Design Specifications

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

Figure 3 on page 2 shows the test setup.

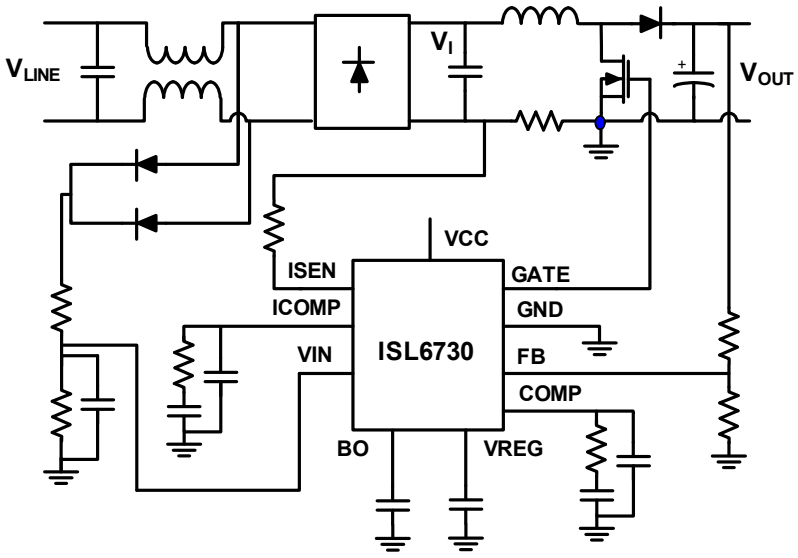

FIGURE 1. SIMPLIFIED SCHEMATIC

FIGURE 2. TOP VIEW OF THE EVALUATION BOARD

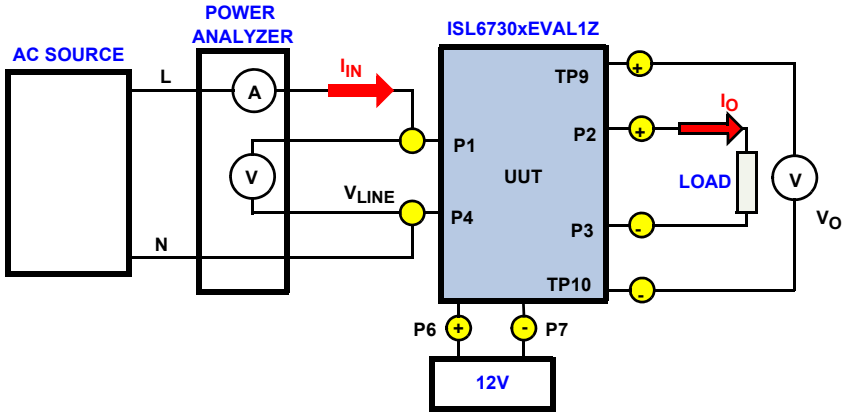

FIGURE 3. TEST SETUP

Performance Curves and Typical Waveforms

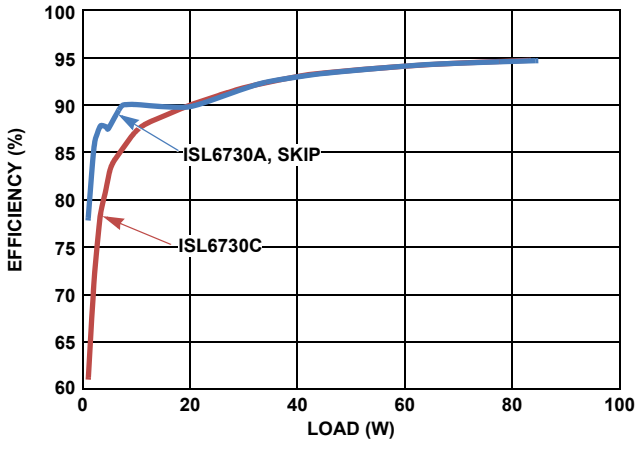

FIGURE 4. LOW LINE EFFICIENCY vs LOAD

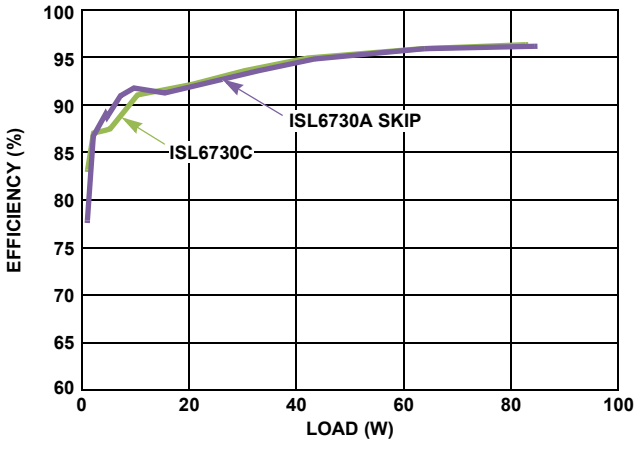

FIGURE 5. HIGH LINE EFFICIENCY vs LOAD

Performance Curves and Typical Waveforms (Continued)

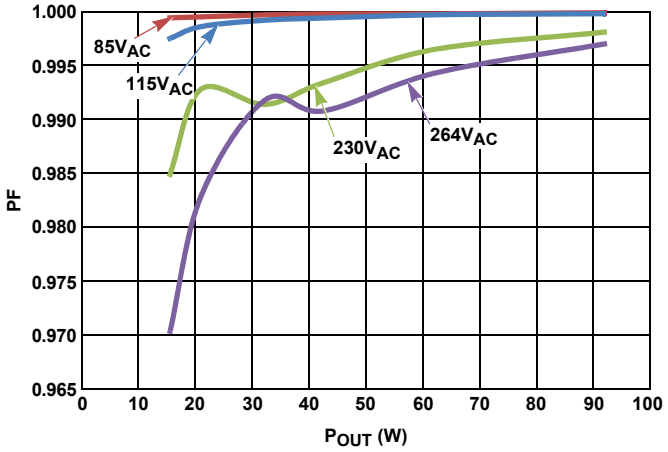

FIGURE 6. POWER FACTOR vs LINE VOLTAGE

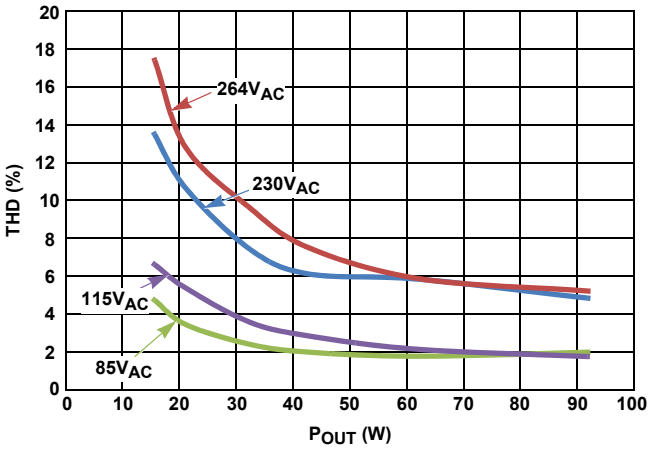

FIGURE 7. THD vs LINE VOLTAGE

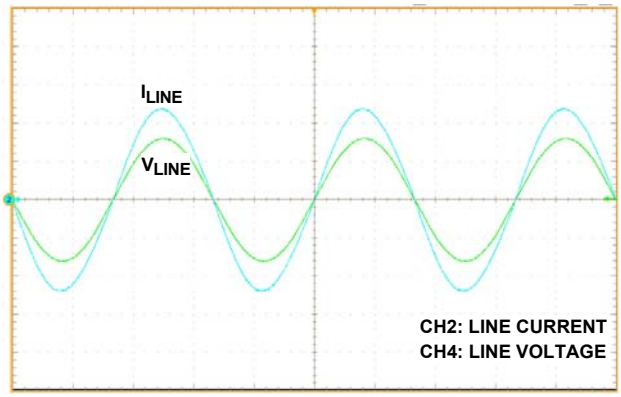

FIGURE 8. WAVEFORMS OF LINE CURRENT AND VOLTAGE (115V/96W)

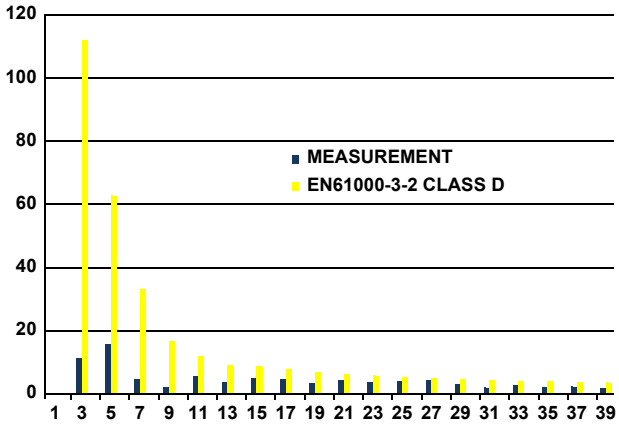

FIGURE 9. HARMONIC CURRENTS (115V/96W)

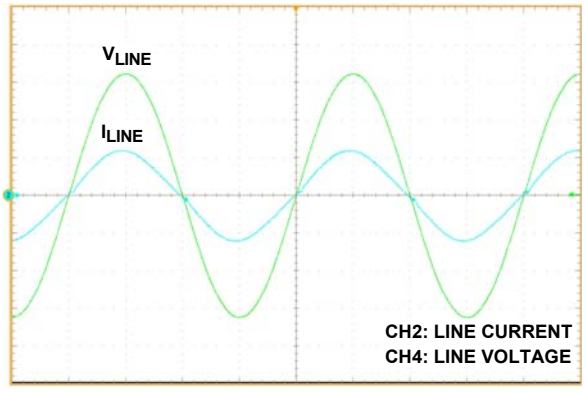

FIGURE 10. WAVEFORMS OF LINE CURRENT AND VOLTAGE (230V/96W)

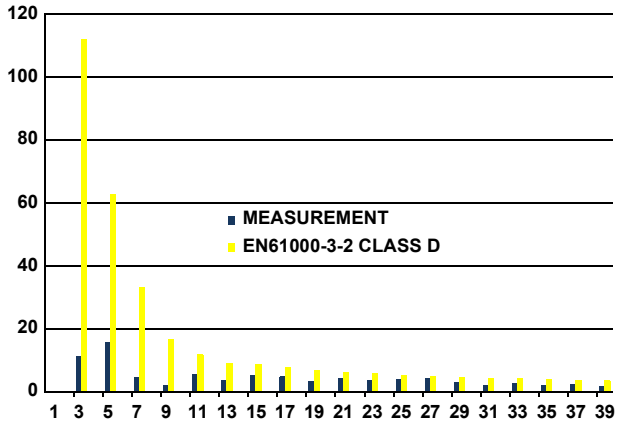

FIGURE 11. HARMONIC CURRENT OF LINE CURRENTS (230V/96W)

Performance Curves and Typical Waveforms (Continued)

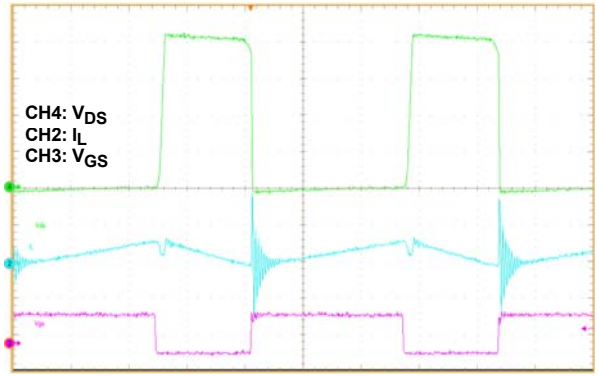

FIGURE 12. SWITCHING WAVEFORMS

Schematic

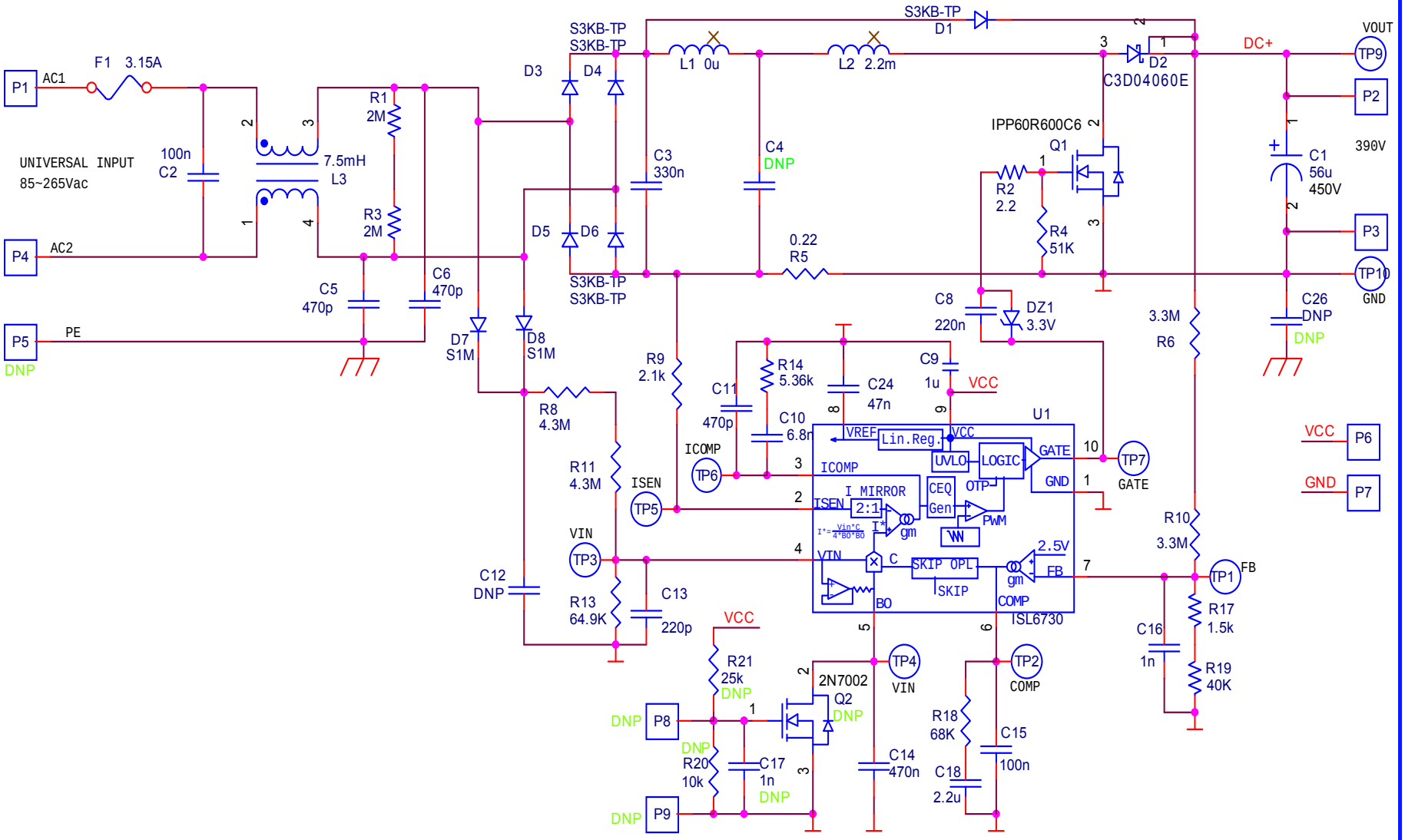

FIGURE 13. SCHEMATIC OF EVALUATION BOARD

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-73-0R33
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

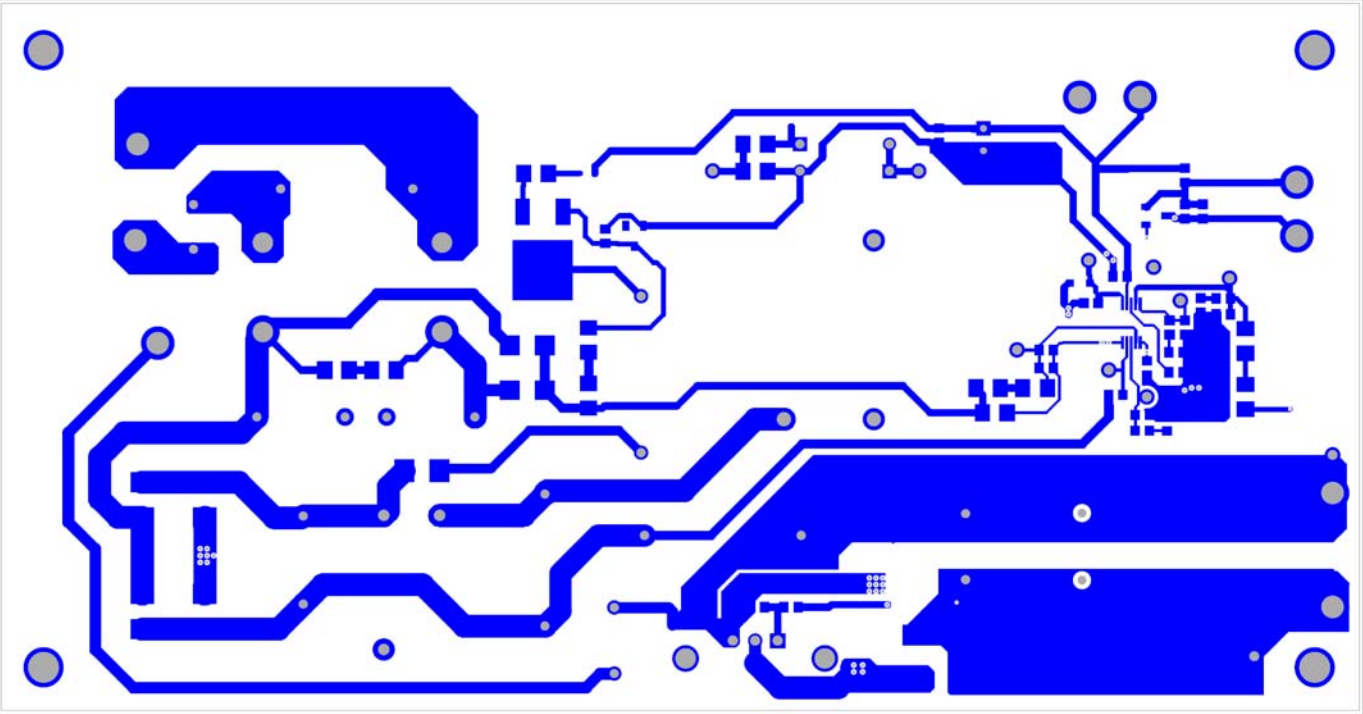

FIGURE 14. TOP LAYER

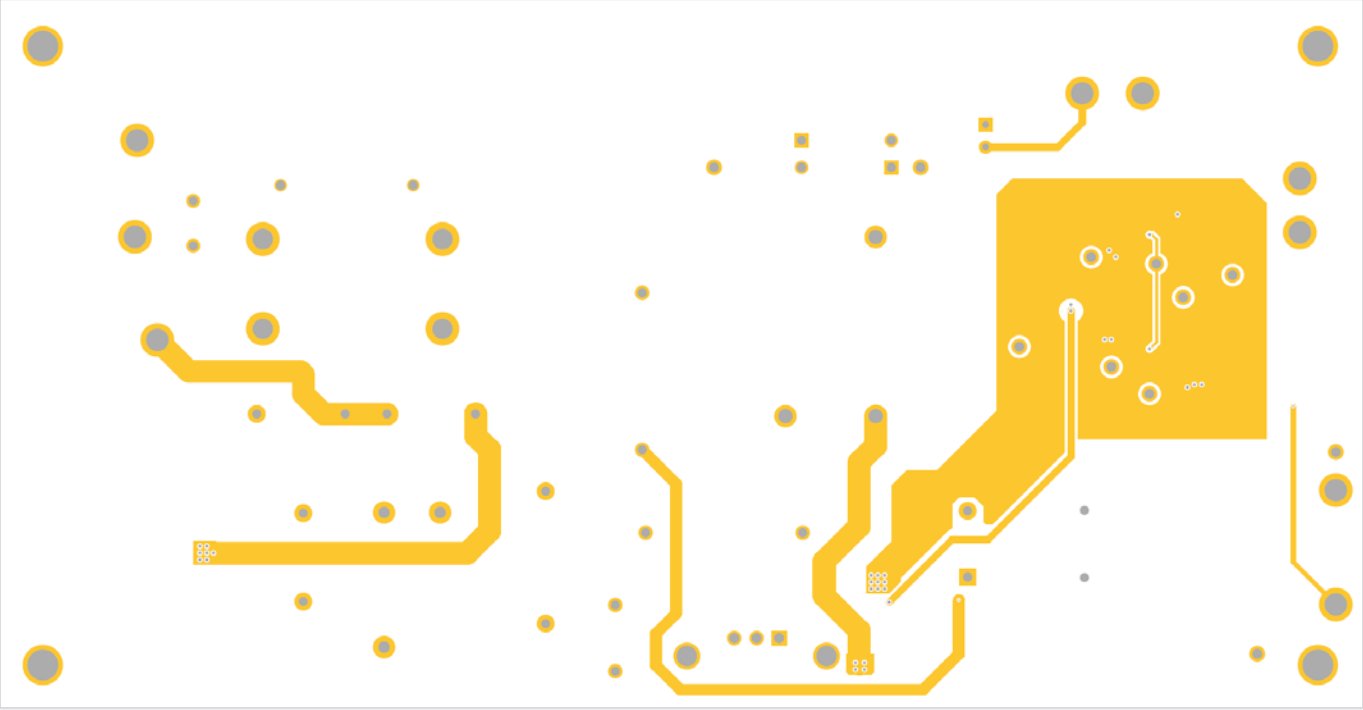

FIGURE 15. BOTTOM LAYER

Assembly Drawing

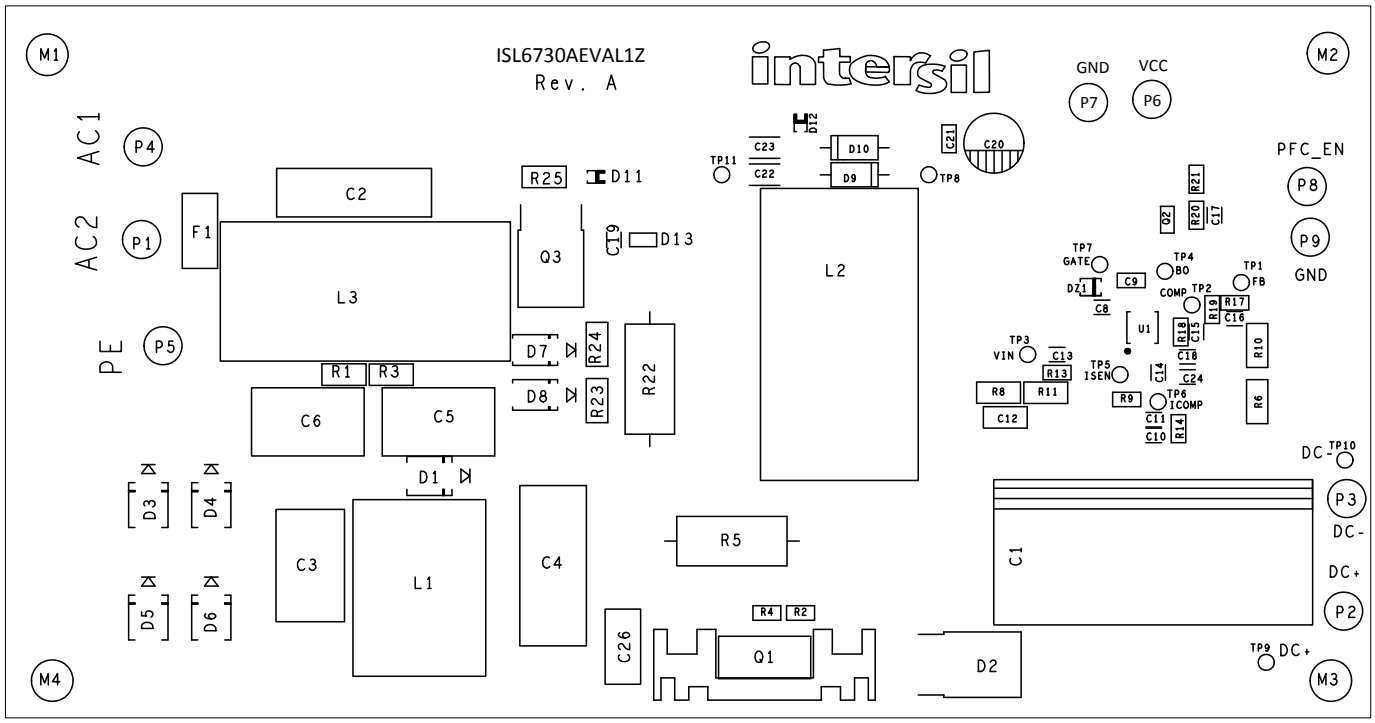

FIGURE 16. ASSEMBLY ON TOP

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