

ISL6730BEVAL1Z and ISL6730DEVAL1Z: Boost CCM PFC for 300W Universal Input Adaptors

Introduction

This application note describes the design and implementation of a 390V, 300W, Continuous Conduction Mode (CCM) Boost PFC converter using the ISL6730B, ISL6730D. The converter exhibits high power factor, Low THD and high conversion efficiency. The ISL6730B, ISL6730D are voltage mode power factor correction (PFC) controllers designed to drive cost-effective converters to meet input line harmonic regulations. The IC can be ISL6730B (Fixed Skip threshold) or ISL6730D (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_{AC}
- Output Voltage, V_O : 390V_{DC}
- Output Current, I_O : 0.77A (300W)
- Switching Frequency: 64kHz
- Efficiency: Full Load, 96% @ 115V_{AC}; 98% @ 230V
- PF: Full Load, 0.999 @ 115V_{AC}; 0.996 @ 230V_{AC}
- THD: Full Load, 2% @ 115V_{AC}, 2.5% @ 230V_{AC}
- Board Dimension: 124×92×43 mm³(L×W×H)

Figure 3 on page 2 shows the test setup.

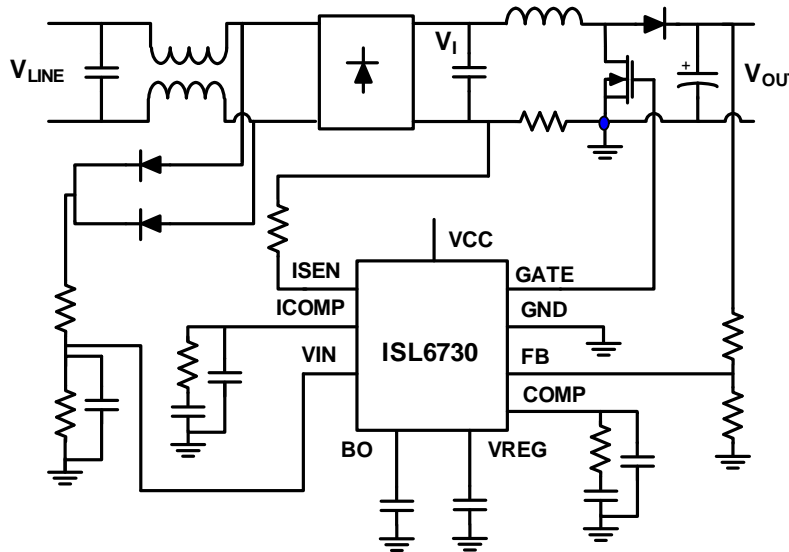


FIGURE 1. SIMPLIFIED SCHEMATIC

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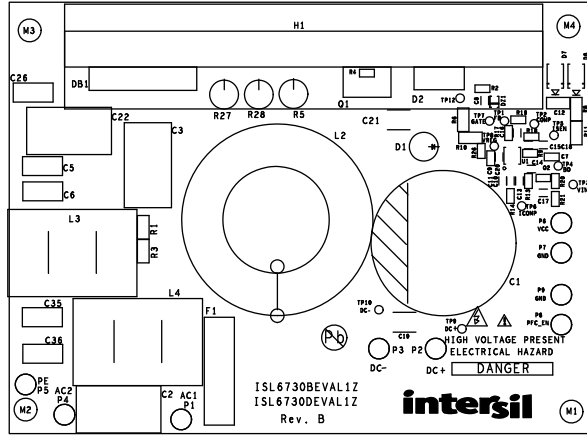


FIGURE 2. TOP VIEW OF THE EVALUATION BOARD

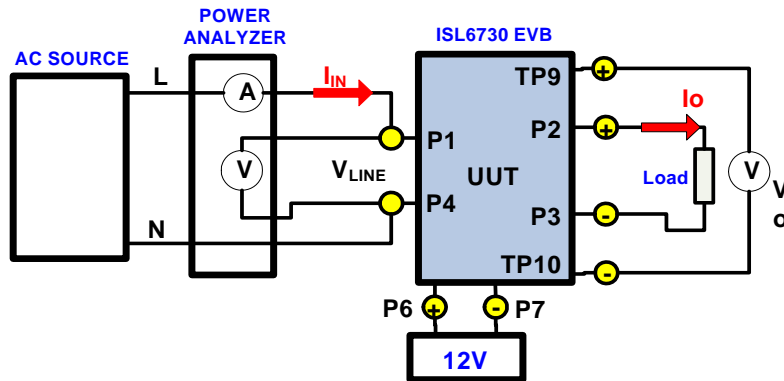


FIGURE 3. TEST SETUP

Performance Curves and Typical Waveforms

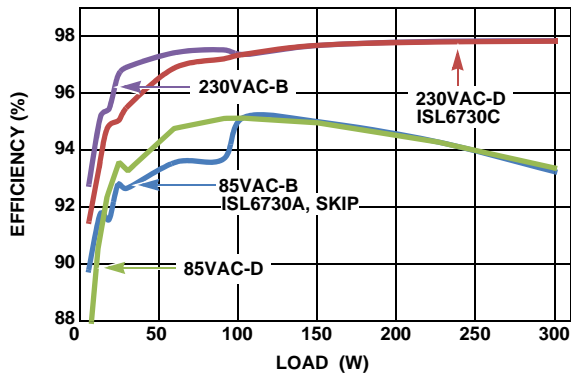


FIGURE 4. EFFICIENCY vs LOAD (85V, 230V)

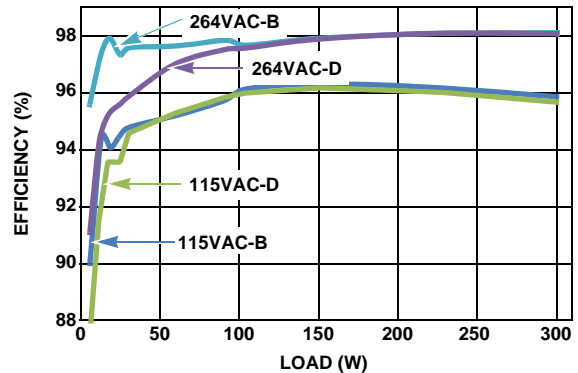


FIGURE 5. EFFICIENCY vs LOAD (115V, 264V)

Performance Curves and Typical Waveforms (Continued)

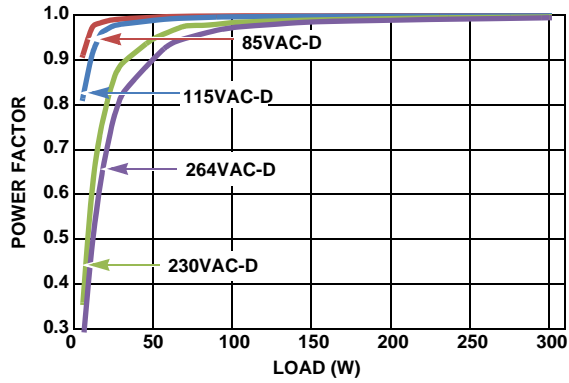


FIGURE 6. POWER FACTOR vs LOAD

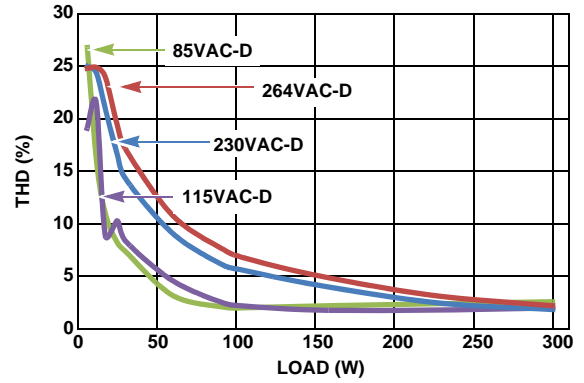


FIGURE 7. THD vs LOAD

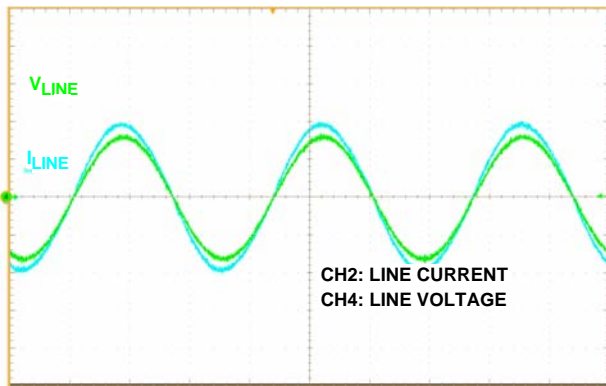


FIGURE 8. WAVEFORMS OF LINE CURRENT AND VOLTAGE (115V/300W)

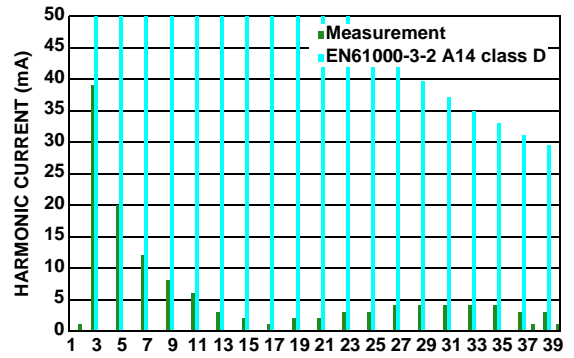


FIGURE 9. HARMONIC CURRENTS (115V/300W)

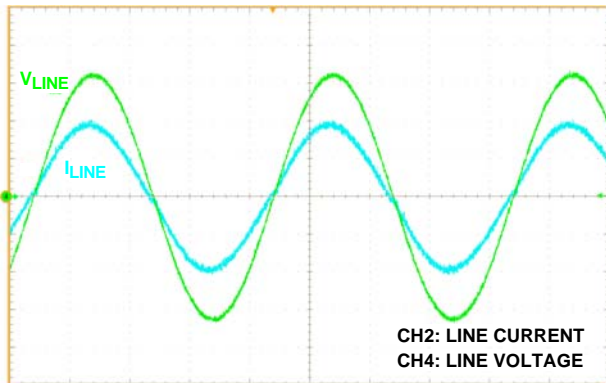


FIGURE 10. WAVEFORMS OF LINE CURRENT AND VOLTAGE (230V/300W)

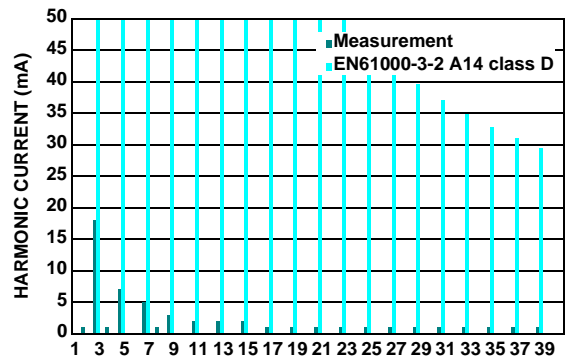


FIGURE 11. HARMONIC CURRENT OF LINE CURRENTS (230V/300W)

Schematic

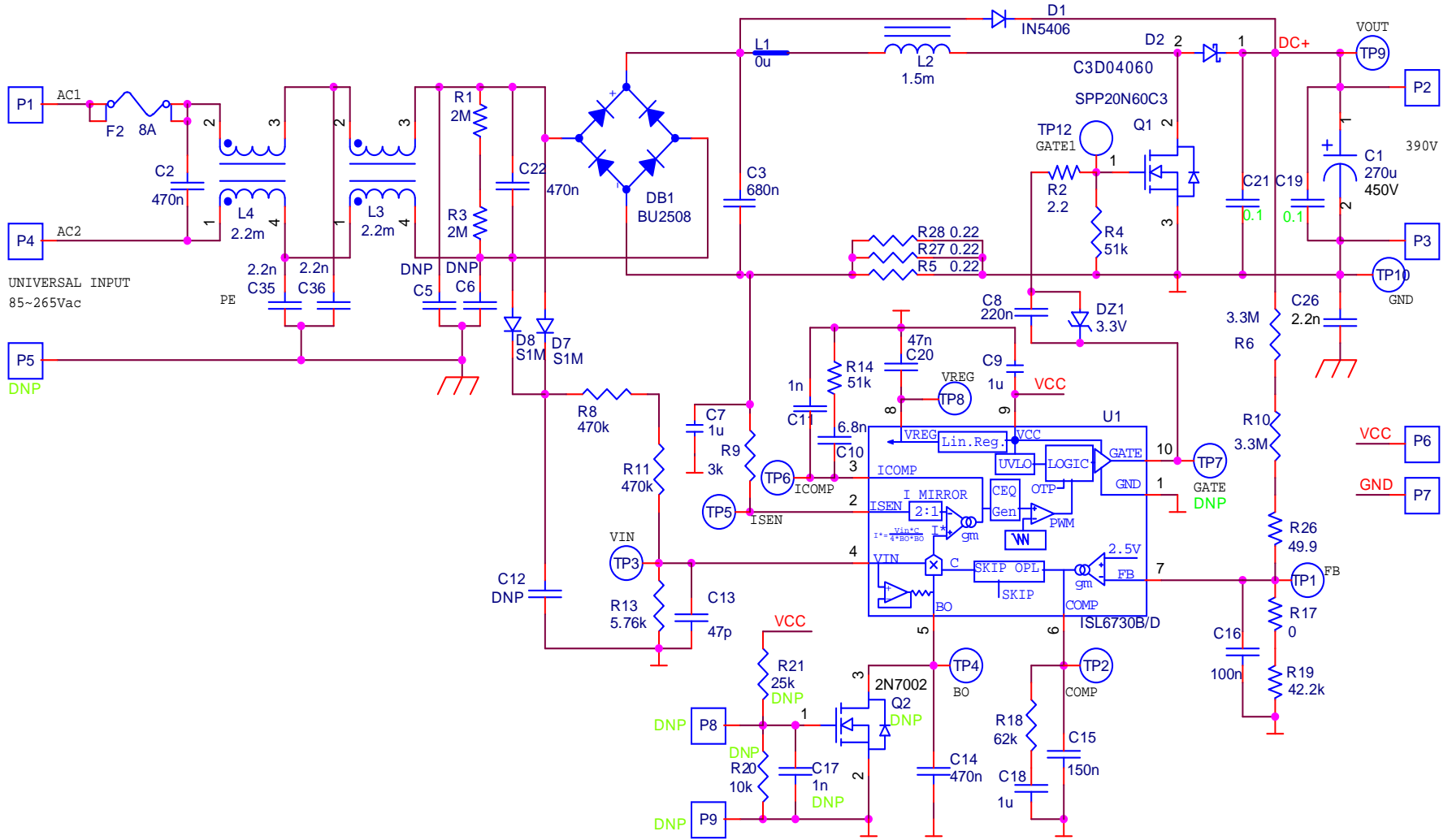


FIGURE 12. SCHEMATIC OF EVALUATION BOARD

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TABLE 1. BILL OF MATERIALS

QTY	REFERENCE DESIGNATOR	TYPE/PACKAGE	VALUE	VOL/TOL/MAT	MANUFACTURER	MANUFACTURER PART #
1	C1	Cap, TH	270μ	450V, 20%, ELECT, Aluminum	Panasonic	EETUQ2W271DA
2	C2, C22	Cap, TH, Radial	470n	X2, 20%, EMI, X2-class	EPCOS	B32922C3474M
1	C3	Cap, TH, Radial	680n	450V, 20%, Metallized Polyester Film	EPCOS	B32672P4684K
5	C5, C6, C35, C36, C26	Cap, TH, Radial	2.2n	Y1, 20%, EMI, Y1-class	TDK	CS11-E2GA222MYNS
2	C7,C9	Cap, SM, 0603	1μ	50V, 20%, X7R	TDK	
1	C8	Cap, SM, 0603	220n	25V, 20%, X7R	TDK	
1	C10	Cap, SM, 0603	6.8n	25V, 10%, X7R	TDK	
1	C11	Cap, SM, 0603	1n	25V, 10%, X7R	TDK	
1	C13	Cap, SM, 0603	47p	16V, 5%, NPO	TDK	
1	C14	Cap, SM, 0603	470n	16V, 10%, X7R	TDK	
1	C15	Cap, SM, 0603	150n	50V, 10%, X7R	TDK	
1	C16	Cap, SM, 0603	100n	50V, 10%, X7R	TDK	
1	C18	Cap, SM, 0603	1μ	16V, 10%, X7R	TDK	
2	C19, C21	Cap, SM, SM1812	0.1	630V, 10%	Murata	GRM43DR72J104KW01L
1	C20	Cap, SM, 0603	47n	25V, 10%; X7R	TDK	
1	DB1	Diode, SM	BU2508		Diodes Inc	
1	DZ1	Zener, SM, SOD323	3.3V	5%, Zener	NXP	BZX384-B3V3
1	D1	Diode, SM, DO-201AD	IN5406	800V, 3A, Standard Recovery	Micro Commercial Co	IN5406-TP
1	D2	Diode, SM, DPAK	C3D04060	600V, 3A, SiC Schottky	Cree	
2	D7, D8	Diode, SM, SMA	S1M	1kV, 1A, Standard Recovery	Diodes Inc	S1M-13-F
1	F2	Fuse, TH, 5x20mm	8A	250V, fast acting, ceramic	Bel Fuse	5HF8-R
1	L1	Bare Wire				
1	L2	Ind, TH	1.5m	Core: Magmetics 0077071-A7 HT22, Wire: AWG20(or 0.8mm) 110T		Customized
2	L3, L4	CMC, TH	2.2m	Common Mode Choke	Würth	744824622
7	P1, P2, P3, P4, P5, P6, P7	TP, TH			KEYSTONE	1514-2
1	Q1	MOSFET, TH, to220_std	SPP20N60C3	600V, N-Chan	Infineon	
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	
2	R4, R14	Res, SM, 0603	51k	1%, Thick Film	Yageo	
3	R5, R27, R28	Res, TH, Axial	0.22	1W, 5%, metal oxide	Yageo	KNP100JR-73-0R22
2	R6, R10	Res, SM, 1206	3.3M	1%, Thick Film	Yageo	RC1206FR-073M3L
2	R8, R11	Res, SM, 1206	470k	1%, Thick Film	Yageo	
1	R9	Res, SM, 0603	3k	1%, Thick Film	Yageo	
1	R13	Res, SM, 0603	5.76k	1%, Thick Film	Yageo	
1	R17	Res, SM, 0603	0	1%, Thick Film	Yageo	
1	R18	Res, SM, 0603	62k	1%, Thick Film	Yageo	
1	R19	Res, SM, 0603	42.2k	1%, Thick Film	Yageo	
1	R26	Res, SM, 0603	49.9	1%, Thick Film	Yageo	
10	TP1~6, TP8~10, TP12	Pole, TH			KEYSTONE	5007
1	U1	IC, SM, MSOP10	ISL6730B/D	CCM PFC Controller	Intersil	ISL6730BFUZ or ISL6730DFUZ
0	C12, TP7; C17, R20, R21, P8, P9, Q2		DNP			

PCB Layout

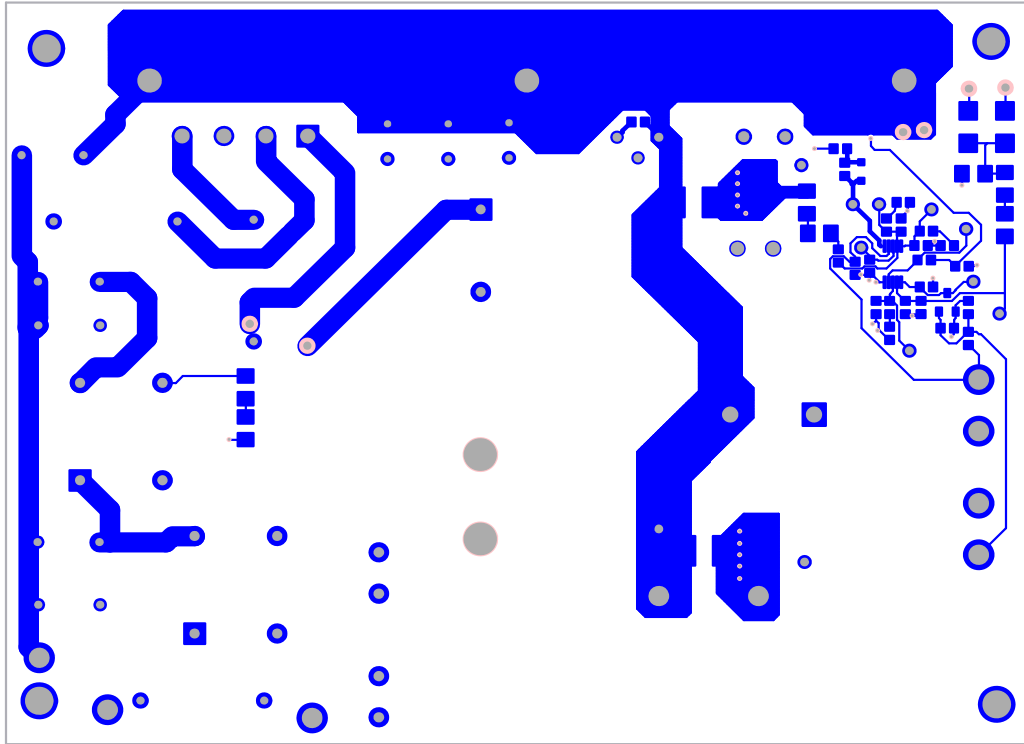


FIGURE 13. TOP LAYER

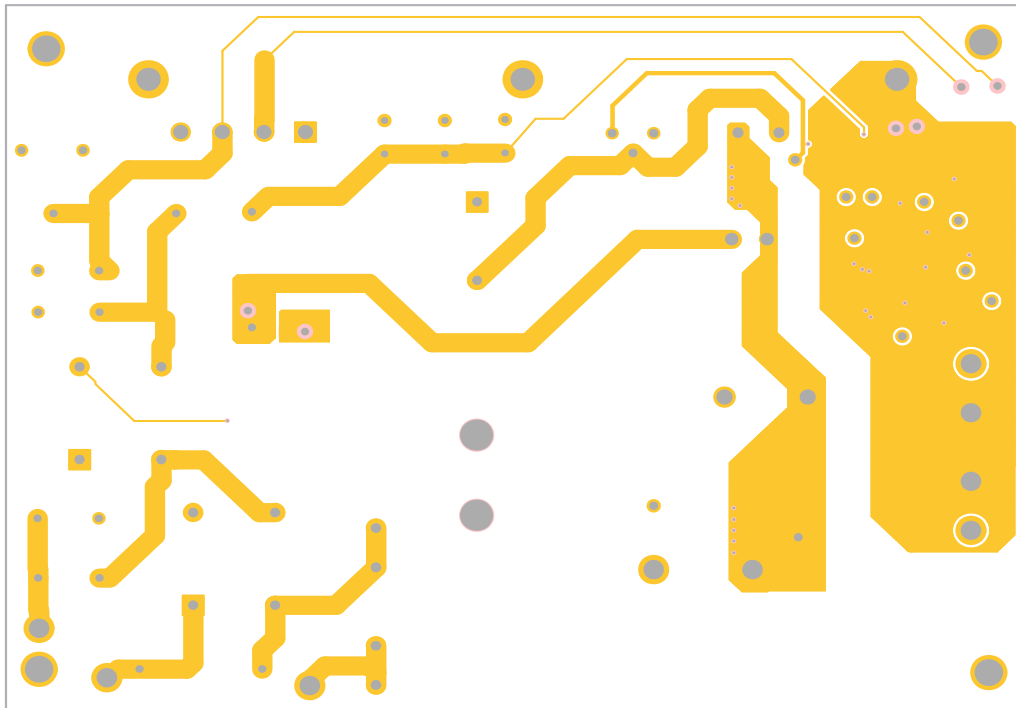


FIGURE 14. BOTTOM LAYER

Assembly Drawing

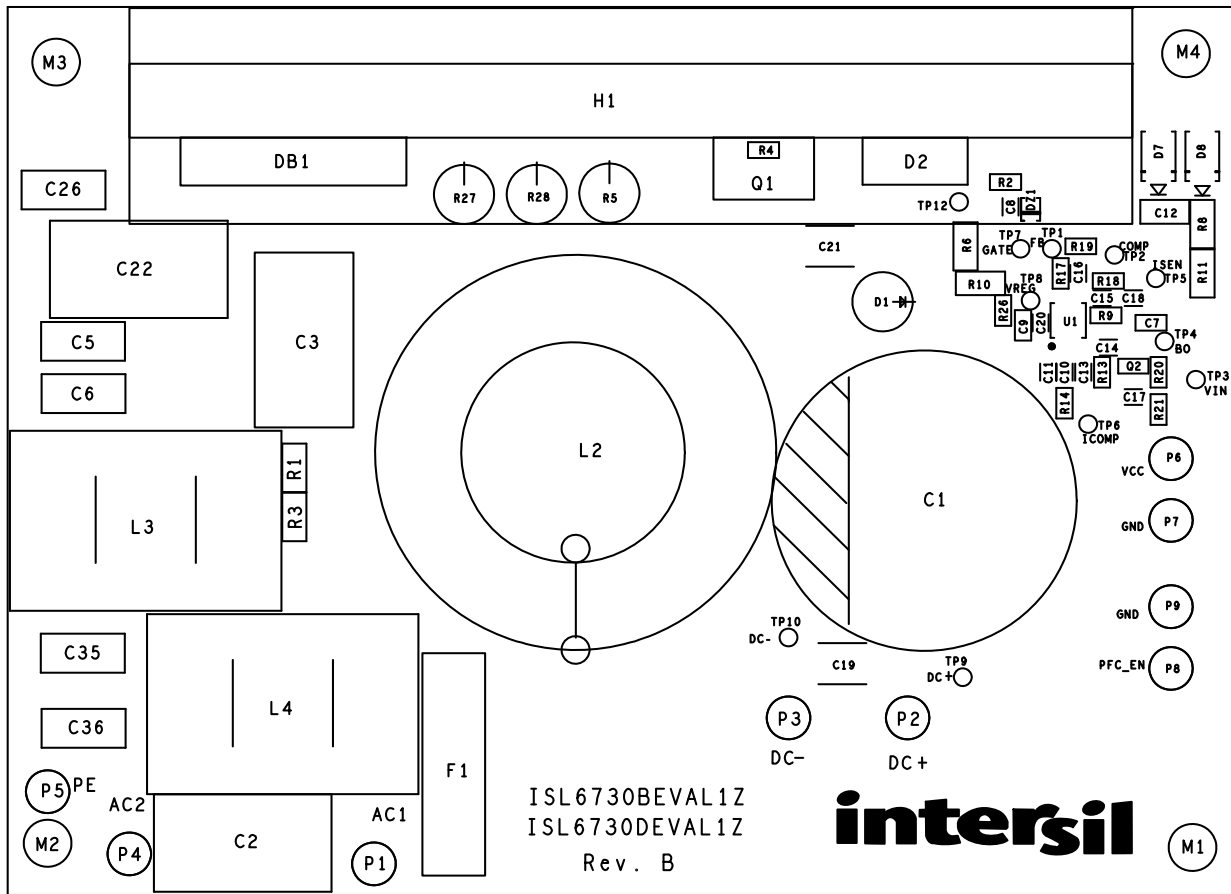


FIGURE 15. ASSEMBLY ON TOP

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