

ISL6731AEVAL1Z and ISL6731BEVAL1Z: 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 ISL6731A, ISL6731B. The converter exhibits high power factor, Low THD and high conversion efficiency. The ISL6731A, ISL6731B are voltage mode power factor correction (PFC) controllers designed to drive cost-effective converters to meet input line harmonic regulations. The IC can be ISL6731A (124kHz) or ISL6731B (64kHz).

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.

References

- [“ISL6731A, ISL6731B”](#) datasheet

Design Specifications

- Input Voltage, V_{IN} : 85V - 265V_{AC}
- Output Voltage, V_O : 390V_{DC}
- Output Current, I_O : 0.77A (300W)
- Switching Frequency: ISL6731A (124kHz) or ISL6731B (64kHz)
- Efficiency: Full Load, 95% @ 115V_{AC}; 97% @ 230V
- PF: Full Load, 0.999 @ 115V_{AC}; 0.996 @ 230V_{AC}
- THD: Full Load, 2% @ 115V_{AC}, 3% @ 230V_{AC}
- Board Dimension: 124×80×38 mm³(L×W×H)

Test Setup

- See the test set-up in Figure 3, on page 2

Ordering Information

PART NUMBER	DESCRIPTION
ISL6731AEVAL1Z	300W Boost CCM PFC, 124kHz
ISL6731BEVAL1Z	300W Boost CCM PFC, 64kHz

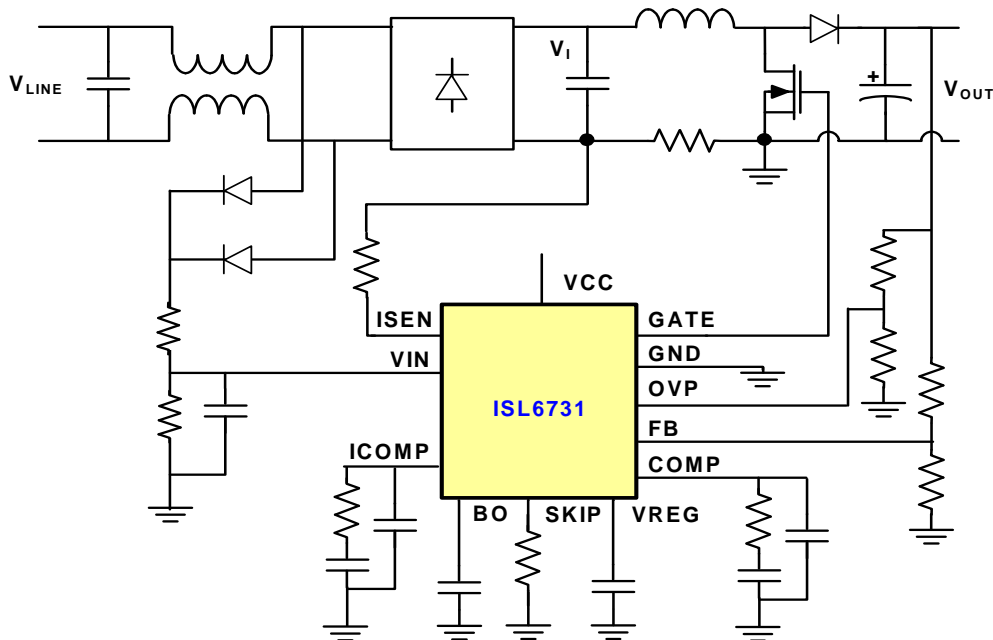


FIGURE 1. SIMPLIFIED SCHEMATIC

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FIGURE 2. PHOTO OF THE EVALUATION BOARD

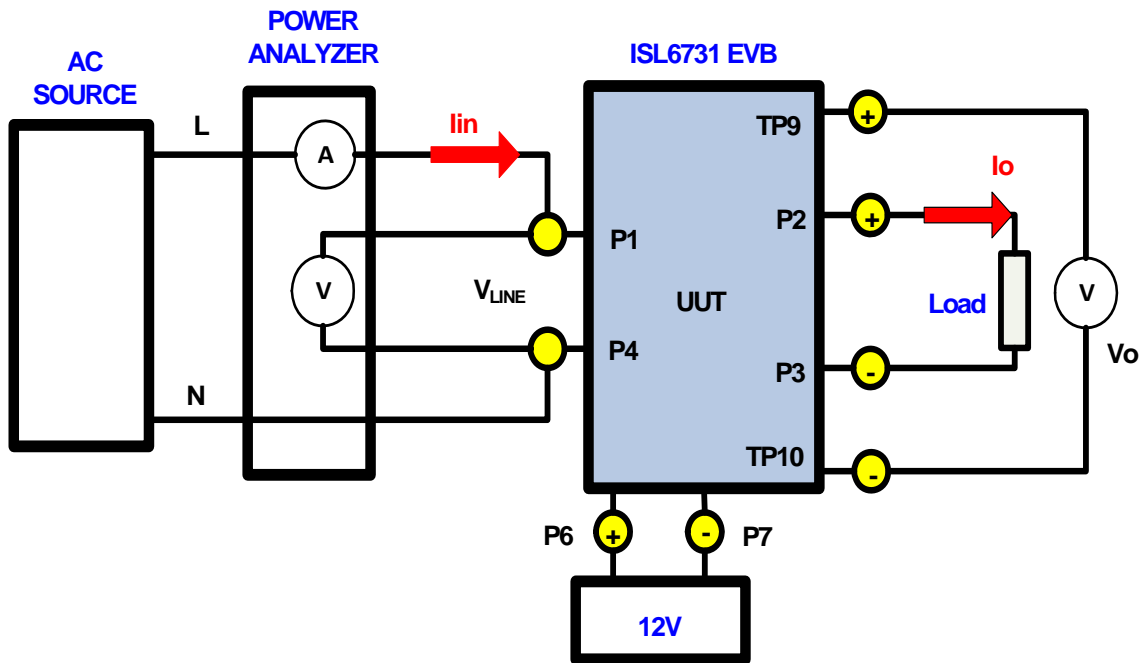


FIGURE 3. TEST SETUP

Schematic

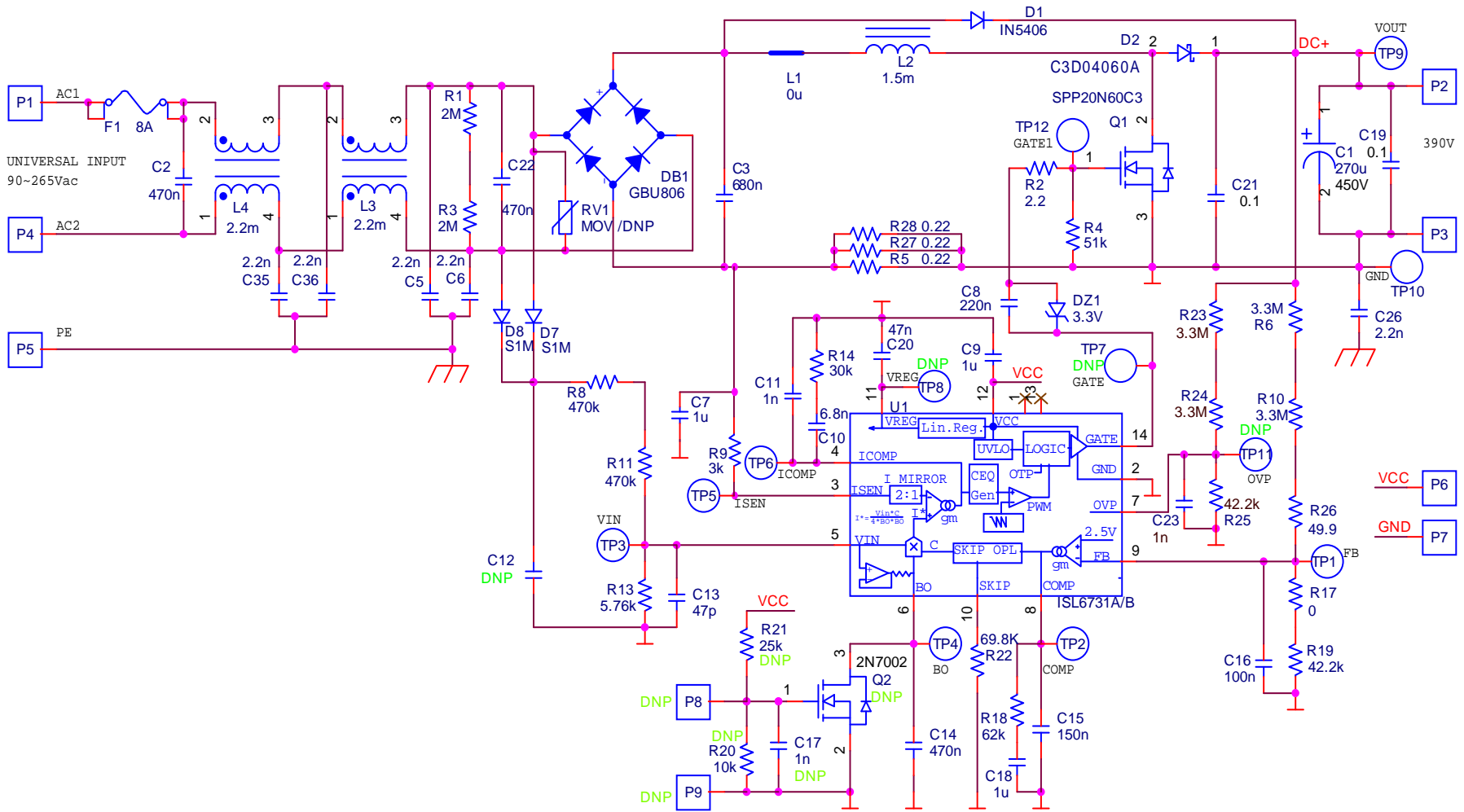


FIGURE 4. SCHEMATIC OF EVALUATION BOARD

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TABLE 1. BILL OF MATERIALS

QTY	REF DES	DESCRIPTION	MANUFACTURER	MFR. PART #
2	C2, C22	CAP-EMI, RADIAL, 18x9, 0.47μF, 630V, 20%, 15mmLS	EPCOS, INC	B32922C3474M
1	C18	CAP, SMD, 0603, 1.0μF, 16V, 10%, X7R		
5	C5, C6, C26, C35, C36	CAP, RADIAL DISK, 10.5x14.5mm, 2200pF, 250V, 20%, X1Y2	TDK	CS11-E2GA222MYNS
1	C3	CAP-FILM, RADIAL, 18.1x7.5, 0.68μF, 450V, 5%	PANASONIC	ECW-F2W684JA
2	C11, C23	CAP, SMD, 0603, 1000pF, 25V, 10%, X7R		
1	C16	CAP, SMD, 0603, 0.1μF, 50V, 10%, X7R		
2	C7, C9	CAP, SMD, 0603, 1μF, 50V, 10%, X5R		
1	C15	CAP, SMD, 0603, 0.15μF, 50V, 10%, X7R		
1	C8	CAP, SMD, 0603, 0.22μF, 25V, 10%, X7R		
1	C13	CAP, SMD, 0603, 47pF, 25V, 5%, NP0		
1	C20	CAP, SMD, 0603, .047μF, 25V, 10%, X7R		
1	C14	CAP, SMD, 0603, 0.47μF, 16V, 10%, X7R		
1	C10	CAP, SMD, 0603, 6800pF, 25V, 5%, COG		
2	C19, C21	CAP, SMD, 1812, 0.1μF, 630V, 10%, X7R	MURATA	GRM43DR72J104KW01L
1	L2	COIL-TOROID INDUCTOR, TH, 1.5mH, 3.9A, 20AWG, 110T	INTERSIL ENGINEERING	77552-A7-HT22-300W
1	C1	CAP, ALUM.ELEC, TH, 30x30mm, 270μF, 450V, 20%, 1.78A	PANASONIC	EET-UQ2W271DA
1	D1	DIODE, RECTIFIER, AXIAL, DO-201AD, 3A, 600V	DIODES, INC.	1N5406
1	DZ1	DIODE-ZENER, SMD, SOD-323, 3.3V, 300mW	NXP SEMICONDUCTOR	BZX384-B3V3,115
1	D2	DIODE-RECTIFIER, SCHOTTKY, TH, TO-220-2, 600V, 4A	CREE, INC	C3D04060A
1	DB1	DIODE-BRIDGE RECTIFIER, TH, 4P, 600V, 8A	DIODES, INC.	GBU806
2	D7, D8	DIODE-RECTIFIER, SMD, 2P, SMA, 1000V, 1A, 1.4W	FAIRCHILD	S1M
2	L3, L4	COIL-FILTER CHOKE, TOROID, TH, 27.5x18.5, 2.2mH, 30%, 6A, 250V	Würth Electronics	744824622
1	F1	FUSE-FAST ACTING, CARTRIDGE, 5x20mm, 8A, 250V	BEL FUSE INC.	5HF8-R
1	Q1	MOS, N-CHANNEL, TH, TO-220-3, 650V, 20.7A	INFINEON TECHNOLOGY	SPP20N60C3
1	R2	RES, SMD, 0603, 2.2Ω, 1/10W, 1%, TF		
1	R17	RES, SMD, 0603, 0Ω, 1/10W, TF		
1	R9	RES, SMD, 0603, 3k, 1/10W, 1%, TF		
1	R14	RES, SMD, 0603, 30k, 1/10W, 1%, TF		
2	R19, R25	RES, SMD, 0603, 42.2k, 1/10W, 1%, TF		
1	R26	RES, SMD, 0603, 49.9Ω, 1/10W, 1%, TF		
1	R4	RES, SMD, 0603, 51k, 1/10W, 1%, TF		
1	R13	RES, SMD, 0603, 5.76k, 1/10W, 1%, TF		
1	R18	RES, SMD, 0603, 62k, 1/10W, 1%, TF		
1	R22	RES, SMD, 0603, 69.8k, 1/10W, 1%, TF		
2	R1, R3	RES, SMD, 1206, 2M, 1/4W, 1%, TF		
4	R6, R10, R23, R24	RES, SMD, 1206, 3.3M, 1/4W, 1%, TF		
2	R8, R11	RES, SMD, 1206, 470k, 1/4W, 1%, TF		
3	R5, R27, R28	RES, TH, AXIAL, 0.22Ω, 1W, 5%, WW, 300ppm	YAGEO	KNP100JR-73-OR22
1	U1	IC-PFC CONTROLLER, 14P, SOIC	INTERSIL	ISL6731AFBZ or ISL6731BFBZ

PCB Layout

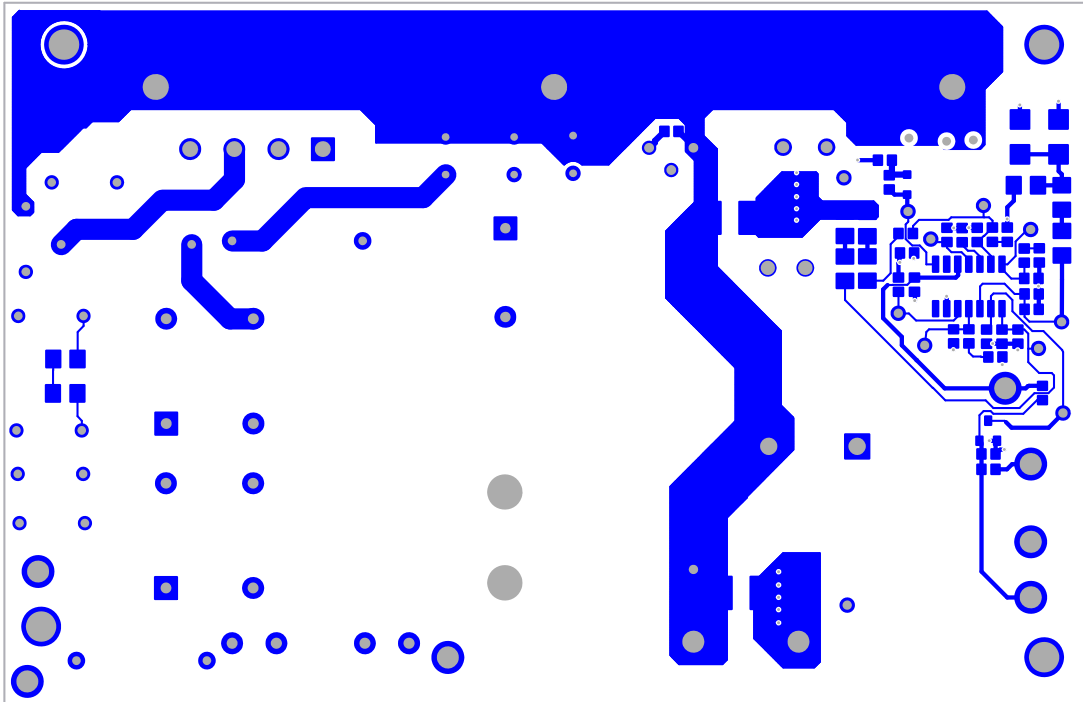


FIGURE 5. TOP LAYER

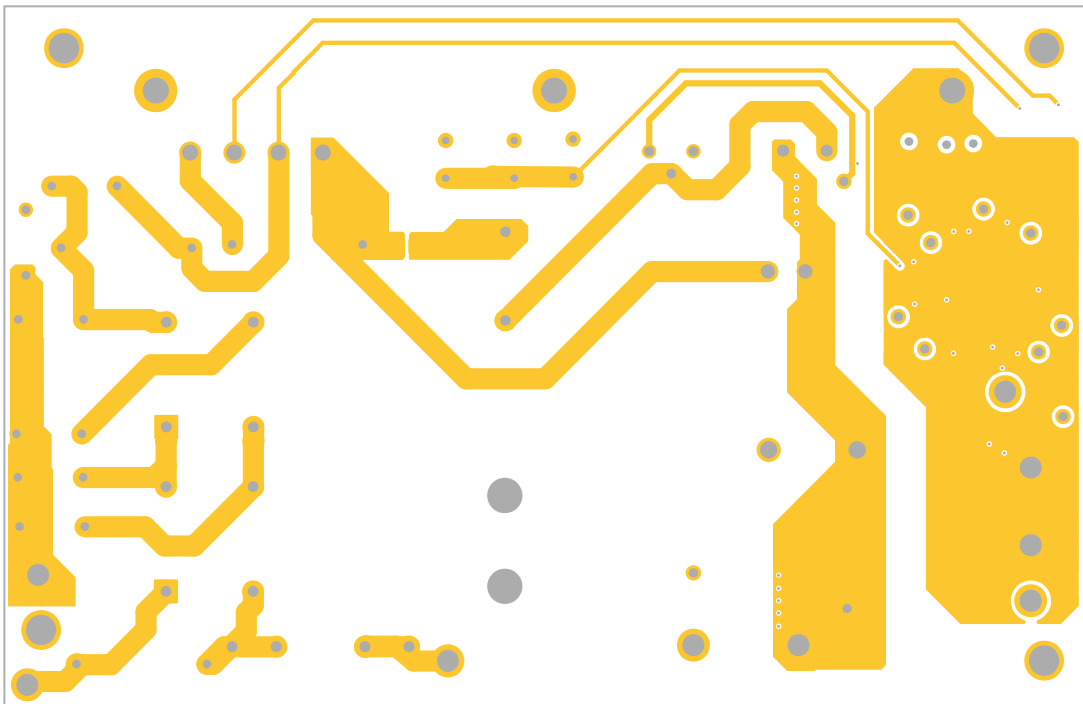


FIGURE 6. BOTTOM LAYER

Assembly Drawing

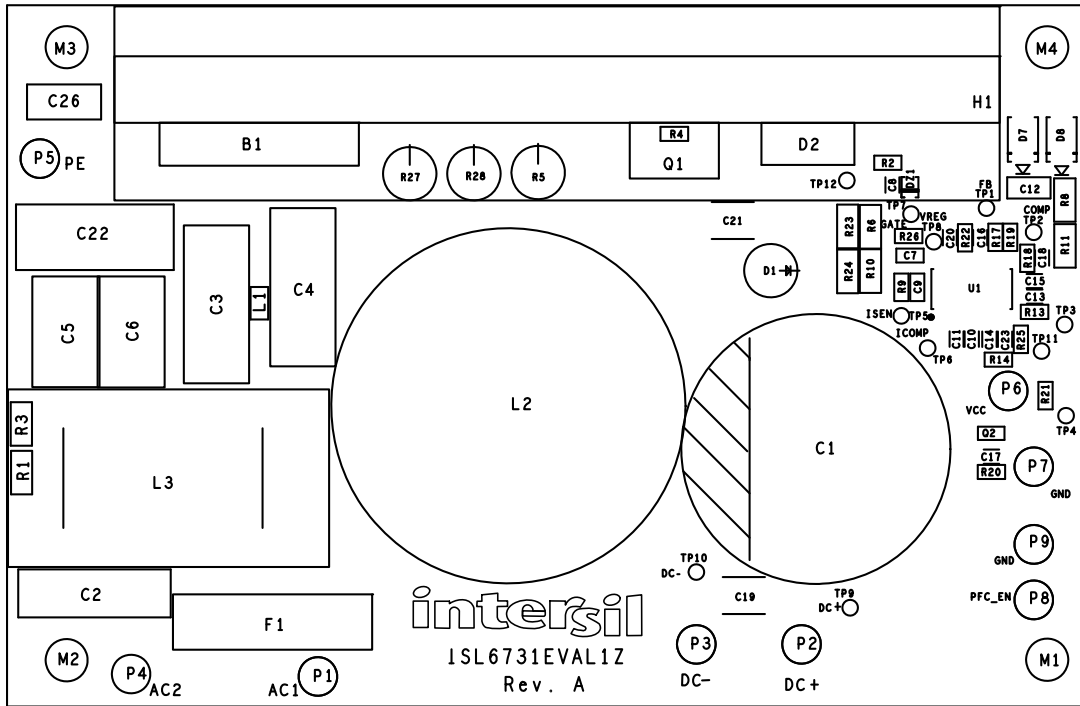


FIGURE 7. ASSEMBLY ON TOP

Performance Curves and Typical Waveforms

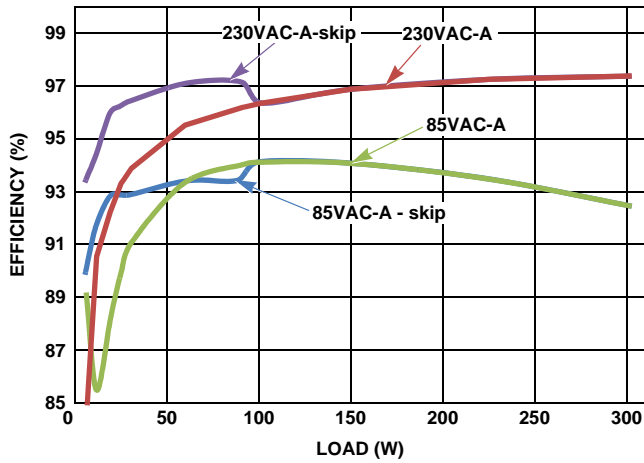


FIGURE 8. EFFICIENCY vs LOAD (85V, 230V), ISL6731AEVAL1Z

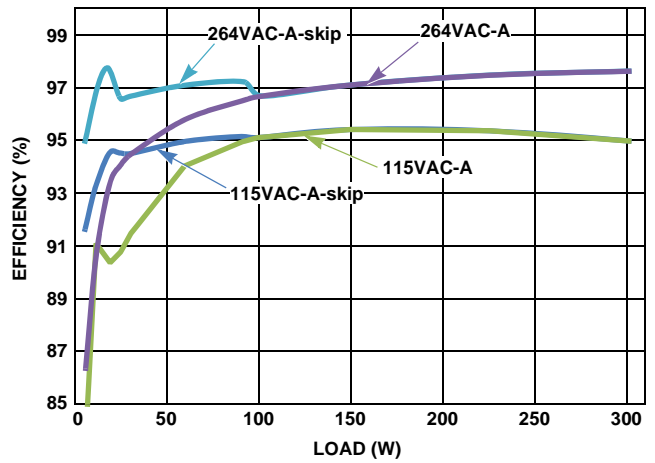


FIGURE 9. EFFICIENCY vs LOAD (115V, 264V), ISL6731AEVAL1Z

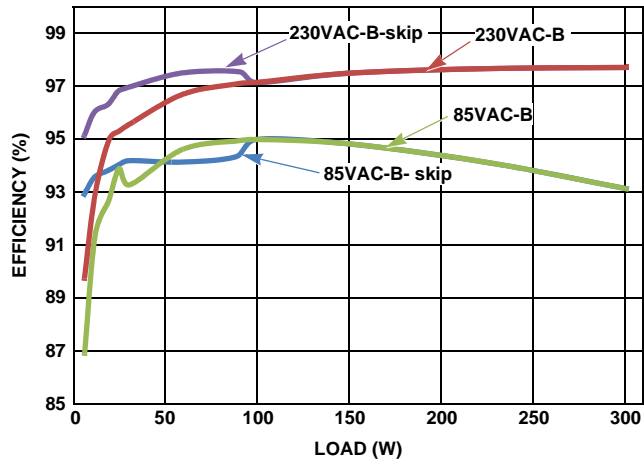


FIGURE 10. EFFICIENCY vs LOAD (85V, 230V), ISL6731BEVAL1Z

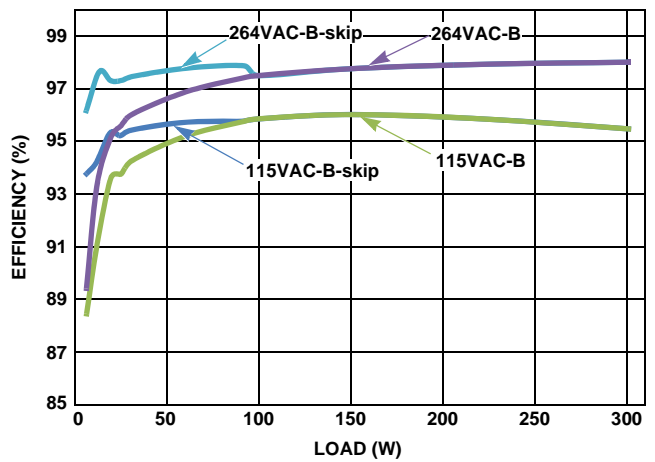


FIGURE 11. EFFICIENCY vs LOAD (115V, 264V), ISL6731BEVAL1Z

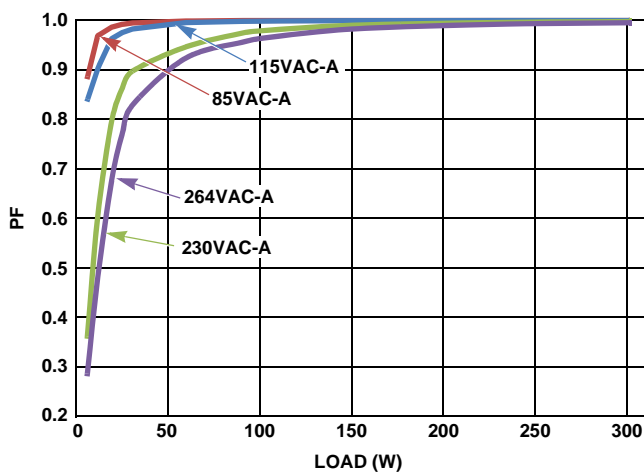


FIGURE 12. POWER FACTOR vs LOAD, ISL6731AEVAL1Z

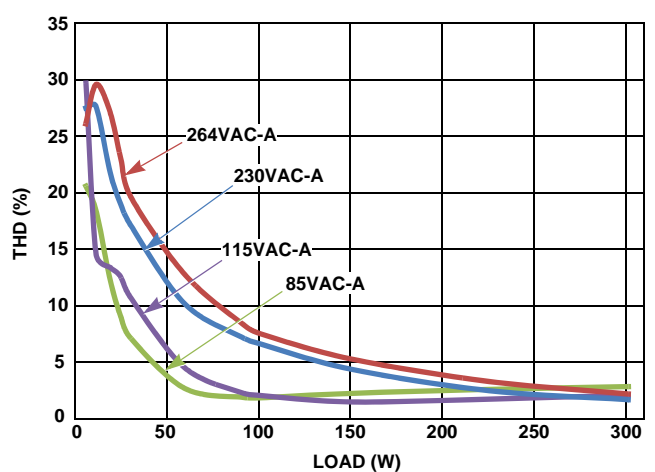


FIGURE 13. THD vs LOAD, ISL6731AEVAL1Z

Performance Curves and Typical Waveforms (Continued)

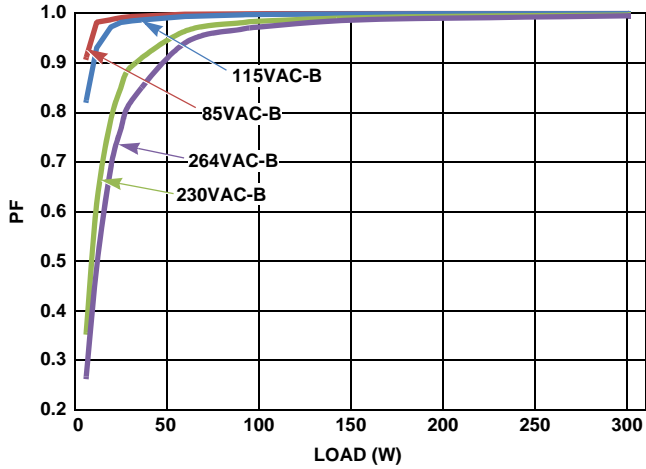


FIGURE 14. POWER FACTOR vs LOAD, ISL6731BEVAL1Z

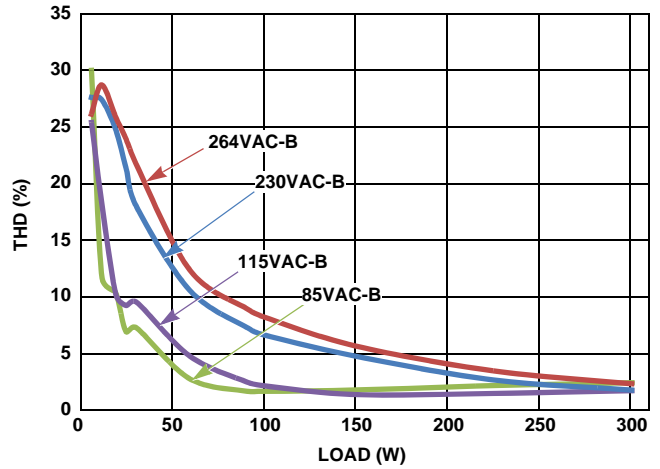


FIGURE 15. THD vs LOAD, ISL6731BEVAL1Z

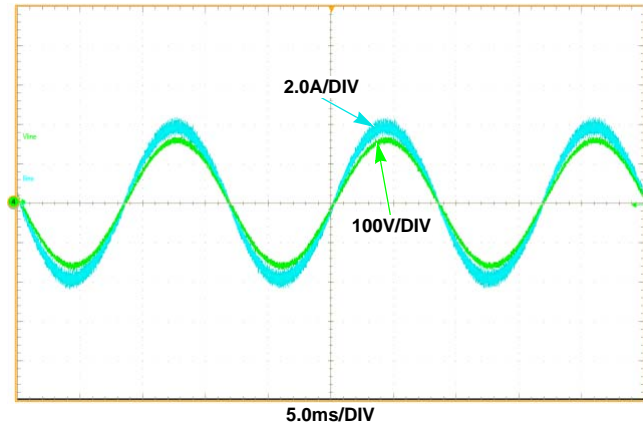


FIGURE 16. WAVEFORMS OF LINE CURRENT AND VOLTAGE (115V/300W)

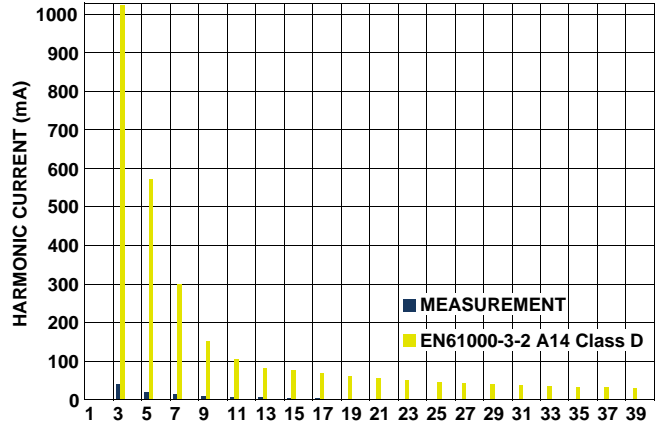


FIGURE 17. HARMONIC CURRENTS (115V/300W)

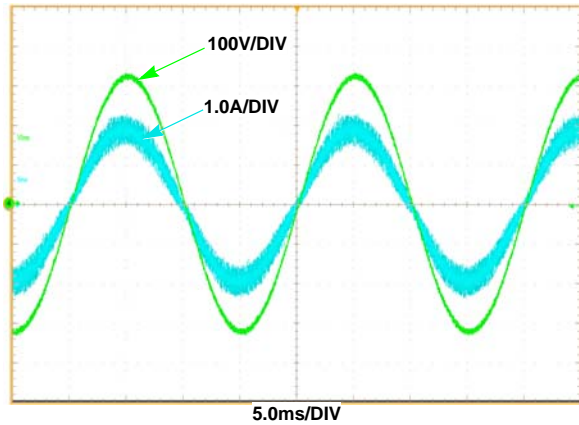


FIGURE 18. WAVEFORMS OF LINE CURRENT AND VOLTAGE (230V/300W)

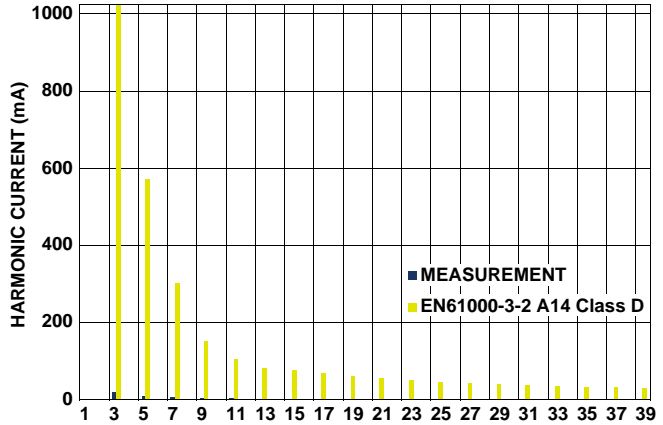


FIGURE 19. HARMONIC CURRENT OF LINE CURRENTS (230V/300W)

Performance Curves and Typical Waveforms (Continued)

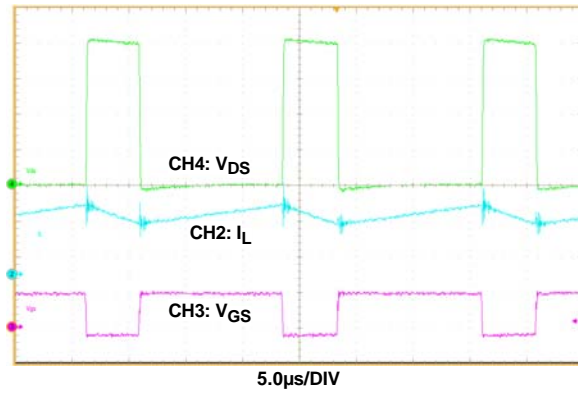


FIGURE 20. SWITCHING WAVEFORMS

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