CRD1680-7W
7 Watt Reference Design

Features

- Constant-current Output
- Flicker-free Dimming
- Line Voltage 12VAC/VDC, ±10%
- Rated Input Power: 7.0W
- Rated Output Power: 5.6W
- Output Voltage: <15V
- High Efficiency with Magnetic and Electronic Transformers
- Low Component Count
- Supports Cirrus Logic Product CS1680

General Description

The CRD1680-7W reference design demonstrates the performance of the CS1680 dimmable LED driver for low-voltage lighting with a target output of 430mA driving 4×LEDs in series. It provides exceptional single-lamp and multi-lamp transformer compatibility for non-dimmer systems and dimmer systems paired with electronic and magnetic low-voltage transformers. The form factor is targeted to fit into MR16 LED lamp applications.

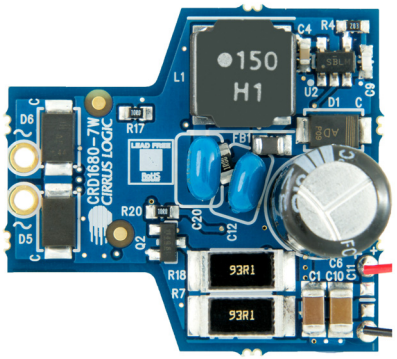
DIMENSIONS (OVERALL)

Length	Width	Height
1.102″(28*mm*) × 1.024″(26*mm*) × 0.672″(17*mm*)		

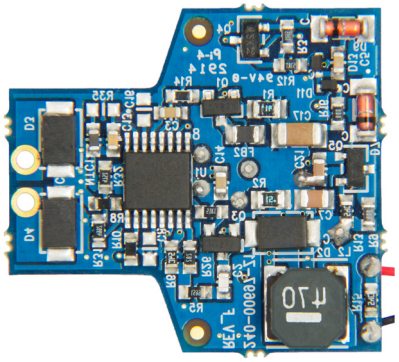
For more information, see Figure 3 on page 6.

ORDERING INFORMATION

CRD1680-7W-Z 7 Watt Reference Design Supports CS1680



Top



Bottom

IMPORTANT SAFETY INSTRUCTIONS

Read and follow all safety instructions prior to using this demonstration board.

This Engineering Evaluation Unit or Demonstration Board must only be used for assessing IC performance in a laboratory setting. This product is not intended for any other use or incorporation into products for sale.

This product must only be used by qualified technicians or professionals who are trained in the safety procedures associated with the use of demonstration boards.

DANGER Risk of Electric Shock

- The open and unprotected boards present a serious risk of electric shock and can cause serious injury or death. Extreme caution needs to be exercised while handling this board.
- Avoid contact with the exposed conductor or terminals of components on the board. High voltage is present on exposed conductor and terminals of any components.
- Dangerous voltages and/or currents may be internally generated and accessible at various points across the board.
- Charged capacitors store high voltage, even after the circuit has been disconnected from the power source.
- Make sure that the power source is off before wiring any connection. Make sure that all connectors are well connected before the power source is on.
- Follow all laboratory safety procedures established by your employer and relevant safety regulations and guidelines, such as the ones listed under, OSHA General Industry Regulations - Subpart S and NFPA 70E.

WARNING Suitable eye protection must be worn when working with or around demonstration boards. Always comply with your employer's policies regarding the use of personal protective equipment.

WARNING All components and metallic parts may be extremely hot to touch when electrically active.

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1. INTRODUCTION

The CS1680 is a cascade boost-buck dimmable LED controller IC. The CS1680 uses a Cirrus Logic proprietary intelligent digital control that provides exceptional single-lamp and multi-lamp transformer compatibility for non-dimmer systems and dimmer systems paired with electronic and magnetic low-voltage transformers. The CS1680 integrates a continuous conduction mode (CCM) boost converter that provides transformer compatibility and dimmer compatibility with a constant output current buck stage. An adaptive digital algorithm controls the boost stage and dimmer compatibility operation mode to enable flicker-free operation down to 5% output current with leading-edge and trailing-edge dimmers. For in-depth implementation of the CS1680, please consult documents in Further Reading on page 3 for IC and reference design details.

The CRD1680-7W board is optimized to deliver low system cost in a high-efficiency, flicker-free, phase-dimmable, solid-state lighting (SSL) solution for incandescent lamp replacement applications. The feedback loop is closed through an integrated digital control system within the IC. Protection algorithms such as output open/short, overcurrent detection, boost overvoltage, and overtemperature thermistors protect the system during abnormal conditions. Details of these features are provided in the CS1680 *Dimmable LED Driver IC for Low-voltage Lighting* data sheet.

The CRD1680-7W board demonstrates the performance of the CS1680. This reference board has been designed for an output load of 4×LEDs in series at a target output current of 430mA (12.0V typical).

This document provides the schematic for the board. It includes oscilloscope screen shots that indicate various operating waveforms. Graphs are also provided that document the performance of the board in terms of Efficiency vs. Line Voltage, Output Current vs. Line Voltage, and Output Current vs. Dim Angle for the CS1680 dimmable LED controller IC.

Extreme caution needs to be exercised while handling this board. This board is to be used by trained professionals only.

Further Reading

- Cirrus Logic, 2014. “Dimmable LED Driver IC for Low-voltage Lighting,” DS1055F1, AUG 2014.
- Cirrus Logic, 2014. “Design Guide for a CS1680 Dimmable LED Driver IC for Low-voltage Lighting,” AN379REV3, AUG 2014.

NOTE

If any other Cirrus Logic document contains information conflicting with the device data sheet, the device data sheet is considered to have the most current and correct data.

2. SCHEMATIC

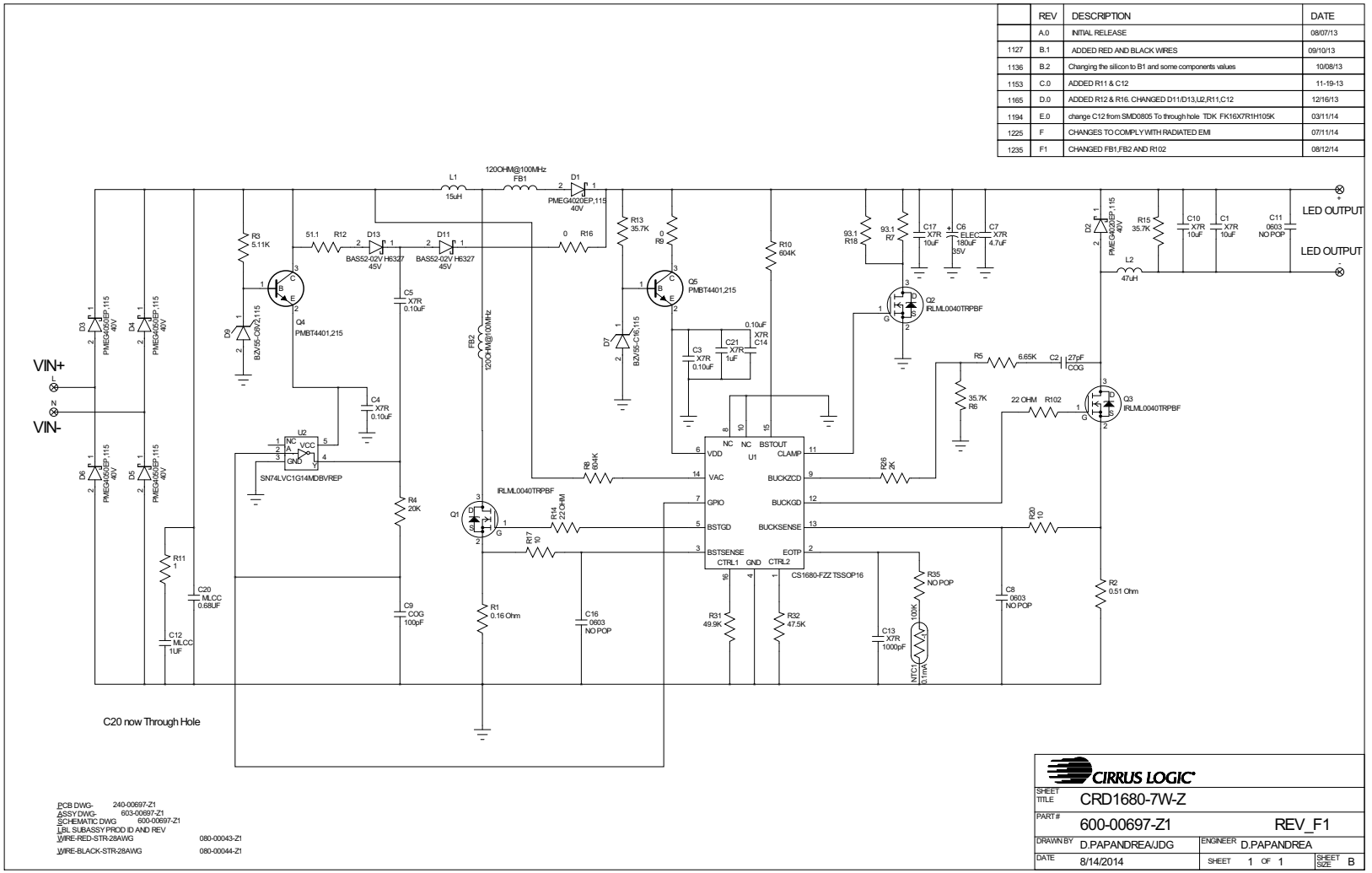

Figure 1. Schematic

3. BILL OF MATERIALS

BOM: CRD1680-7W-Z Rev: F1						
Date Generated: 08/14/2014						
Line Item	Description	Qty	UM	Reference Designator	Manufacturer	Manufacturer Part Number
0002	CAP 10uF ±10% 25V X7R NPb 1206	2	EA	C1 C10	TAIYO YUDEN	TMK316B7106KL-TD
0003	CAP 27pF ±5% 50V C0G NPb 0603	1	EA	C2	KEMET NIC COMPONENTS	C0603C270J5GAC NMC0603NPO270J50TRPF
0004	CAP 0.10uF 10% 25V X7RLESR NPb 0603	4	EA	C3 C4 C5 C14	MURATA	GRM188R71E104KA01D
0005	CAP 180uF ±20% 35V AL ELEC NPb RAD	1	EA	C6	PANASONIC PANASONIC	EEUFR1V181B EEUFR1V181
0006	CAP 4.7uF ±10% 35V X7R NPb 0805	1	EA	C7	TDK	C2012X7R1V475K125AC
0008	CAP 100pF ±5% 50V C0G NPb 0603	1	EA	C9	KEMET Walsin	C0603C101J5GAC 0603N101J500LT
0009	CAP 1uF ±10% 50V X7R NPb RAD	1	EA	C12	TDK	FK16X7R1H105K
0010	CAP 1000pF ±10% 50V X7R NPb 0603	1	EA	C13	KEMET KOA PANASONIC NIC COMPONENTS	C0603C102K5RAC X7R0603HTTD102K ECJ1VB1H102K NMC0603X7R102K50TRPF
0011	CAP 10uF ±10% 35V X7R MLC NPb 1206	1	EA	C17	TAIYO YUDEN	GMK316AB7106KL-TR
0012	CAP 0.68uF ±10% 50V X7R NPb RAD	1	EA	C20	TDK	FK16X7R1H684K
0013	CAP 1uF ±10% 25V X7R CER NPb 0603	1	EA	C21	TDK	CGA3E1X7R1E105K080AC
0014	DIODE SKY BARR 2A 40V NPb SOD128	2	EA	D1 D2	NXP	PMEG4020EP,115
0015	DIODE SKY BARR 5A 40V NPb SOD128	4	EA	D3 D4 D5 D6	NXP	PMEG4050EP,115
0016	DIODE ZENER 500mW 16V NPb SOD80C	1	EA	D7	NXP	BZV55-C16,115
0017	DIODE ZENER 500mW 6.2V NPb SOD80C	1	EA	D9	NXP	BZV55-C6V2,115
0018	DIODE SHKY 750mA 45V NPb SC79-2	2	EA	D11 D13	INFINEON	BAS52-02V H6327
0019	FE BEAD 3.0A 120ohm@100MHz NPb 0805	2	EA	FB1 FB2	WURTH ELECTRONICS	742792023
0021	IND PWR 15uH 2.4A ±20% SHLD NPb SM	1	EA	L1	TAIYO YUDEN	NRS8040T150MJGJ
0022	IND PWR 47uH 1.3A ±20% SHLD NPb SM	1	EA	L2	TAIYO YUDEN	NR6045T470M
0023	THERM 100K OHM ±5% 0.10mA NPb 0603	1	EA	NTC1	MURATA	NCP18WF104J03RB
0024	TRAN MOSFET N-CH 40V 3.6A NPb SOT23	3	EA	Q1 Q2 Q3	INTERNATIONAL RECTIFIER	IRLML0040TRPBF
0025	TRAN NPN SW 40V 600mA NPb SOT-23	2	EA	Q4 Q5	NXP	PMBT4401,215
0026	RES 0.16 OHM 1/4W ±1% NPb 0805	1	EA	R1	PANASONIC	ERJS6SFR16V
0027	RES 0.51 OHM 1/4W ±1% NPb 0805	1	EA	R2	PANASONIC	ERJS6QFR51V
0028	RES 5.11k OHM 1/10W ±1% NPb 0603	1	EA	R3	DALE KOA PANASONIC WALSIN	CRCW06035K11FKEA RK73H1JTTD5111F ERJ3EKF5111V WR06X5111FTL
0029	RES 20k OHM 1/10W ±5% NPb 0603 FILM	1	EA	R4	DALE KOA PANASONIC	CRCW060320K0JNEA RK73B1JTTD203J ERJ3GEYJ203V
0030	RES 6.65k OHM 1/10W ±1% NPb 0603	1	EA	R5	DALE	CRCW06036K65FKEA
0031	RES 35.7K OHM 1/10W ±1% NPb 0603	3	EA	R6 R13 R15	YAGEO	RC0603FR-0735K7L
0032	RES 93.1 OHM 1W ±1% FILM NPb 2512	2	EA	R7 R18	ROHM	MCR100JZHF93R1
0033	RES 604K OHM 1/10W ±1% NPb 0603	2	EA	R8 R10	YAGEO	RC0603FR-07604KL
0034	RES 0 OHM 1/10W ±5% NPb 0603 FILM	2	EA	R9 R16	DALE NIC COMPONENTS PANASONIC VENKEL WALSIN	CRCW06030000Z0EA NRC0606ZOTRF ERJ3EKF0R00V CR0603-10W-000T WR06X000PTL
0035	RES 1 OHM 1/4W ±1% NPb 0805	1	EA	R11	STACKPOLE	RNCP0805FTD1R00
0036	RES 51.1 OHM 1/10W±1% NPb 0603 FILM	1	EA	R12	DALE KOA PANASONIC VENKEL	CRCW060351R1FKEA RK73H1JTTD51R1F ERJ3EKF51R1V CR0603-10W-51R1FT
0037	RES 22.0 OHM 1/10W ±1% NPb 0603	2	EA	R14 R102	PANASONIC	ERJ3EKF22R0V
0038	RES 10 OHM 1/10W ±1% NPb 0603 FILM	2	EA	R17 R20	DALE VENKEL PANASONIC WALSIN	CRCW060310R0FKEA C0603-10W-10R0FT ERJ3EKF10R0V ER06X10R0FTL
0039	RES 2k OHM 1/10W ±5% NPb 0603 FILM	1	EA	R26	DALE KOA PANASONIC WALSIN	CRCW06032K00JNEA RK73B1JTTD202J ERJ3GEYJ202V WR06X202JTL
0040	RES 49.9k OHM 1/10W ±1% NPb 0603	1	EA	R31	DALE KOA PANASONIC WALSIN	CRCW060349K9FKEA RK73H1JTTD4992F ERJ3EKF4992V WR06X4992FTL
0041	RES 47.5k OHM 1/10W ±1% NPb 0603	1	EA	R32	DALE KOA PANASONIC WALSIN	CRCW060347K5FKEA RK73H1JTTD4752F ERJ3EKF4752V WR06X4752FTL
0043	IC CRUS TRIAC DIM LV 12V NPb TSOP16	1	EA	U1	CIRRUS LOGIC	CS1680-FZZ/B1
0044	IC INV SNGL SCHMIT-TRIG NPb SOT23-5	1	EA	U2	TEXAS INSTRUMENTS	SN74LVC1G14MDBVREP
0045	WIRE 28AWG PTFE INSULATED STRND RED	3	IN	W1	ANY SOURCE	080-00043-Z1
0046	WIRE 28AWG PTFE INSUL STRND BLACK	3	IN	W2	ANY SOURCE	080-00044-Z1

Figure 2. Bill of Materials

4. BOARD LAYOUT

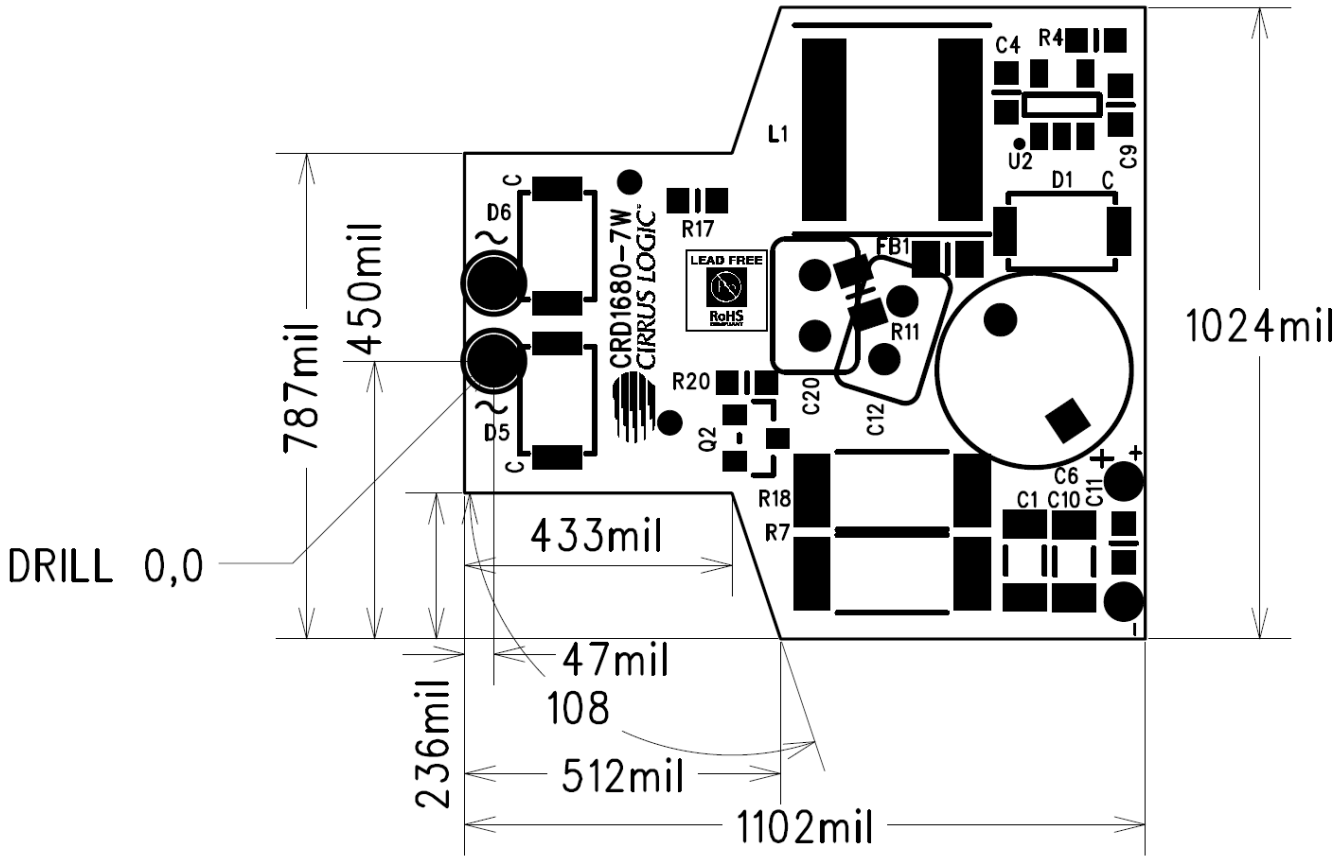

Figure 3. PCB Dimensions

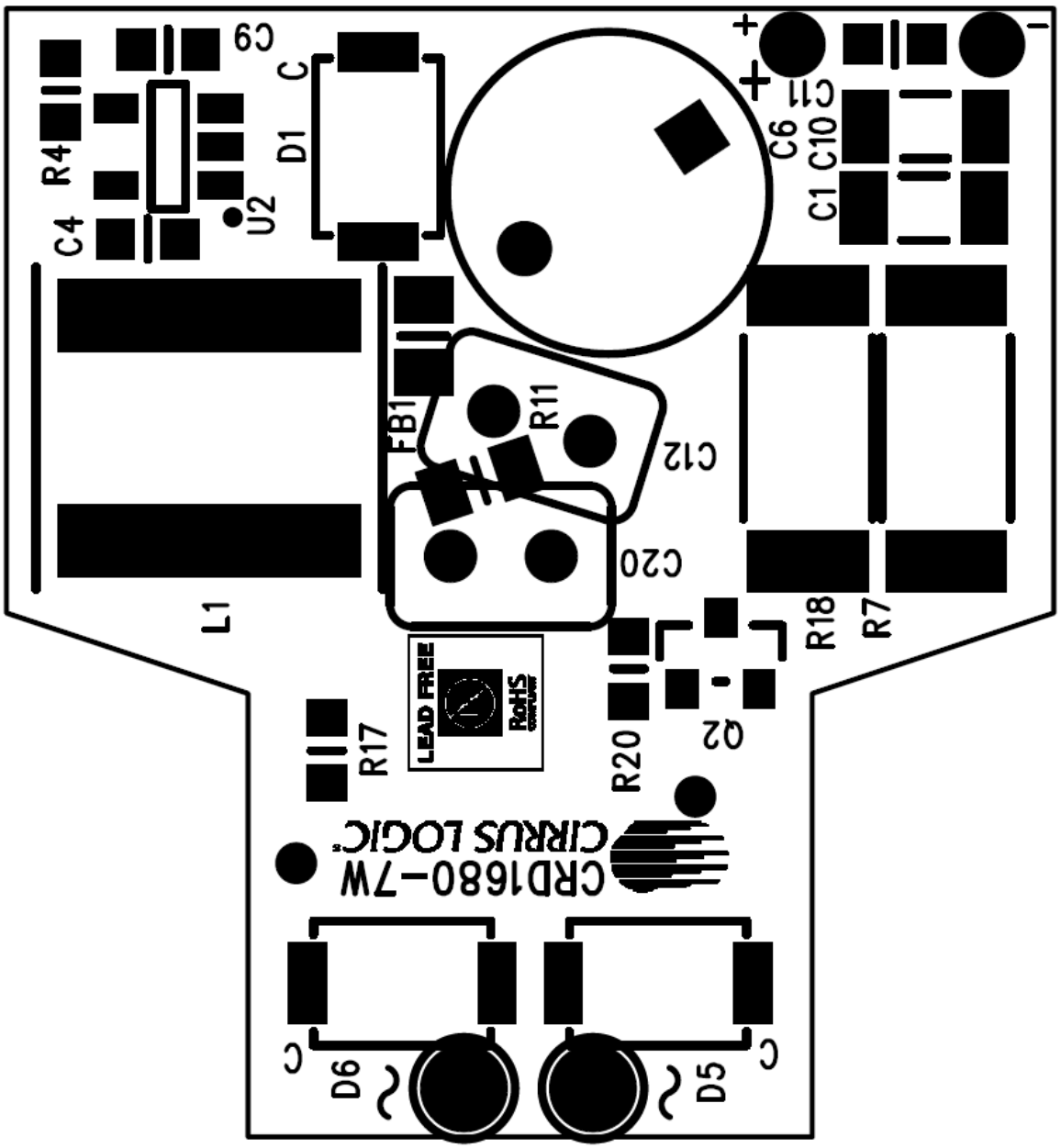

Figure 4. Top Silkscreen

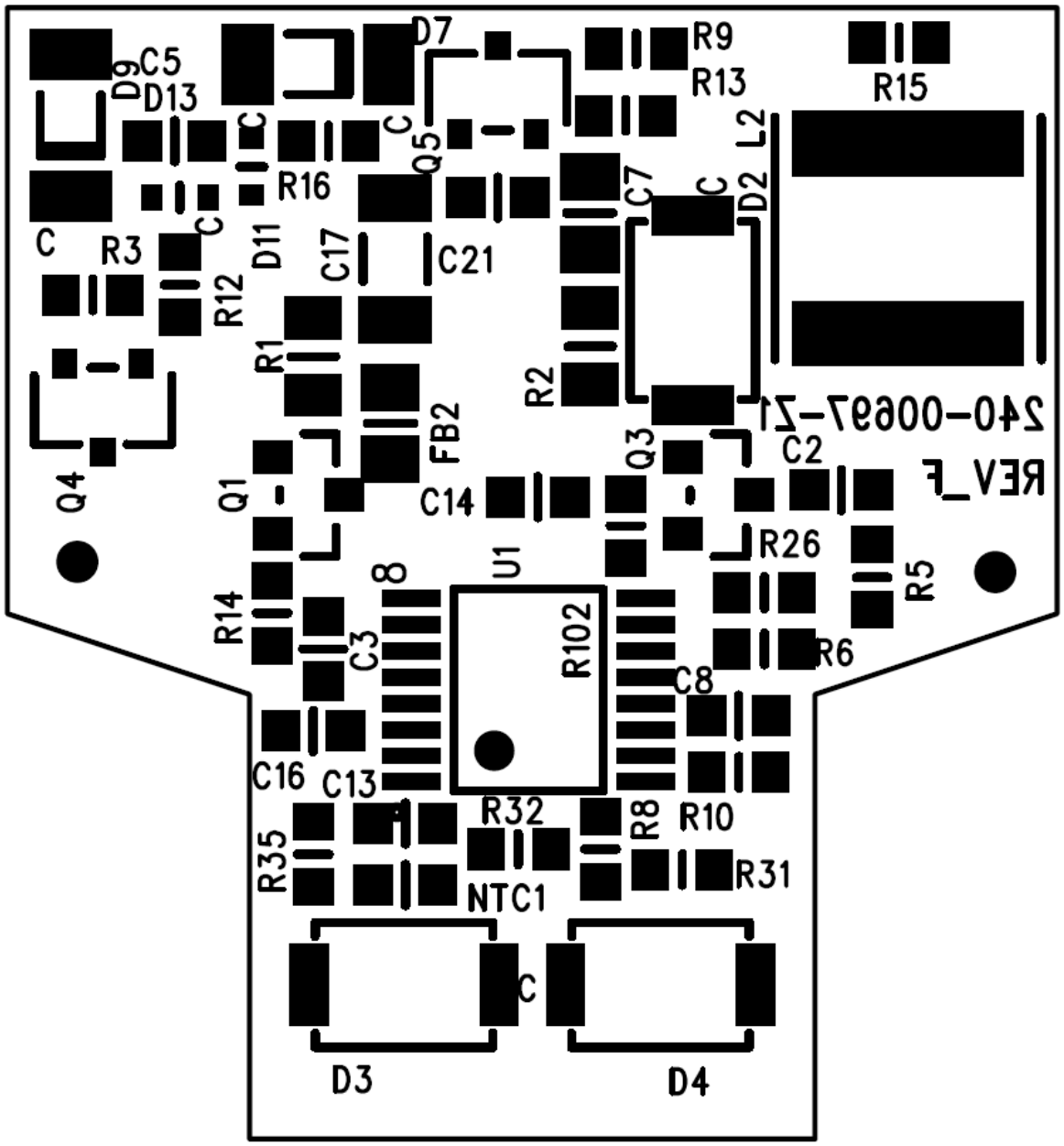

Figure 5. Bottom Silkscreen

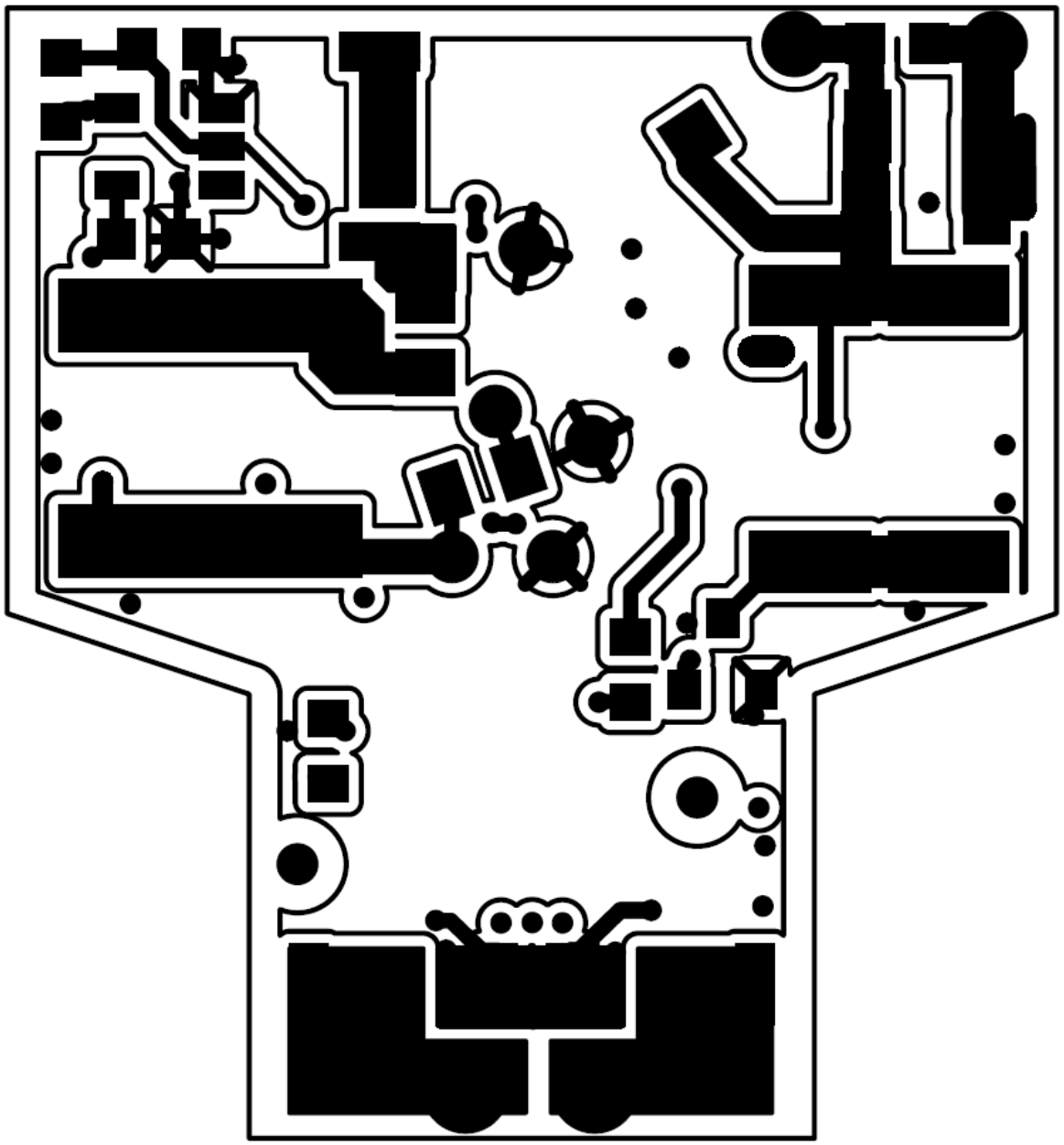

Figure 6. Top Routing, Layer 1

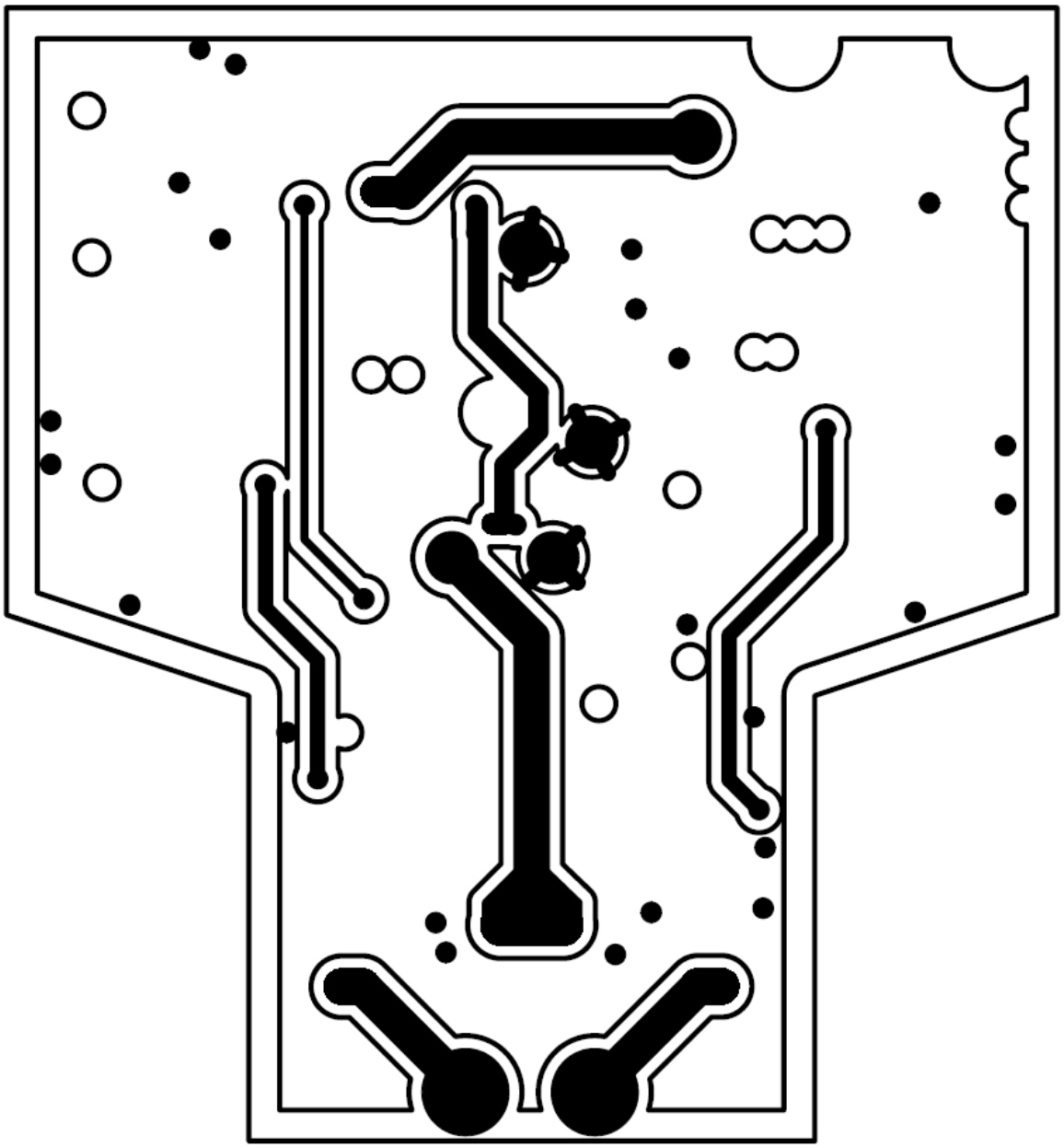

Figure 7. Power Plane, Layer 2

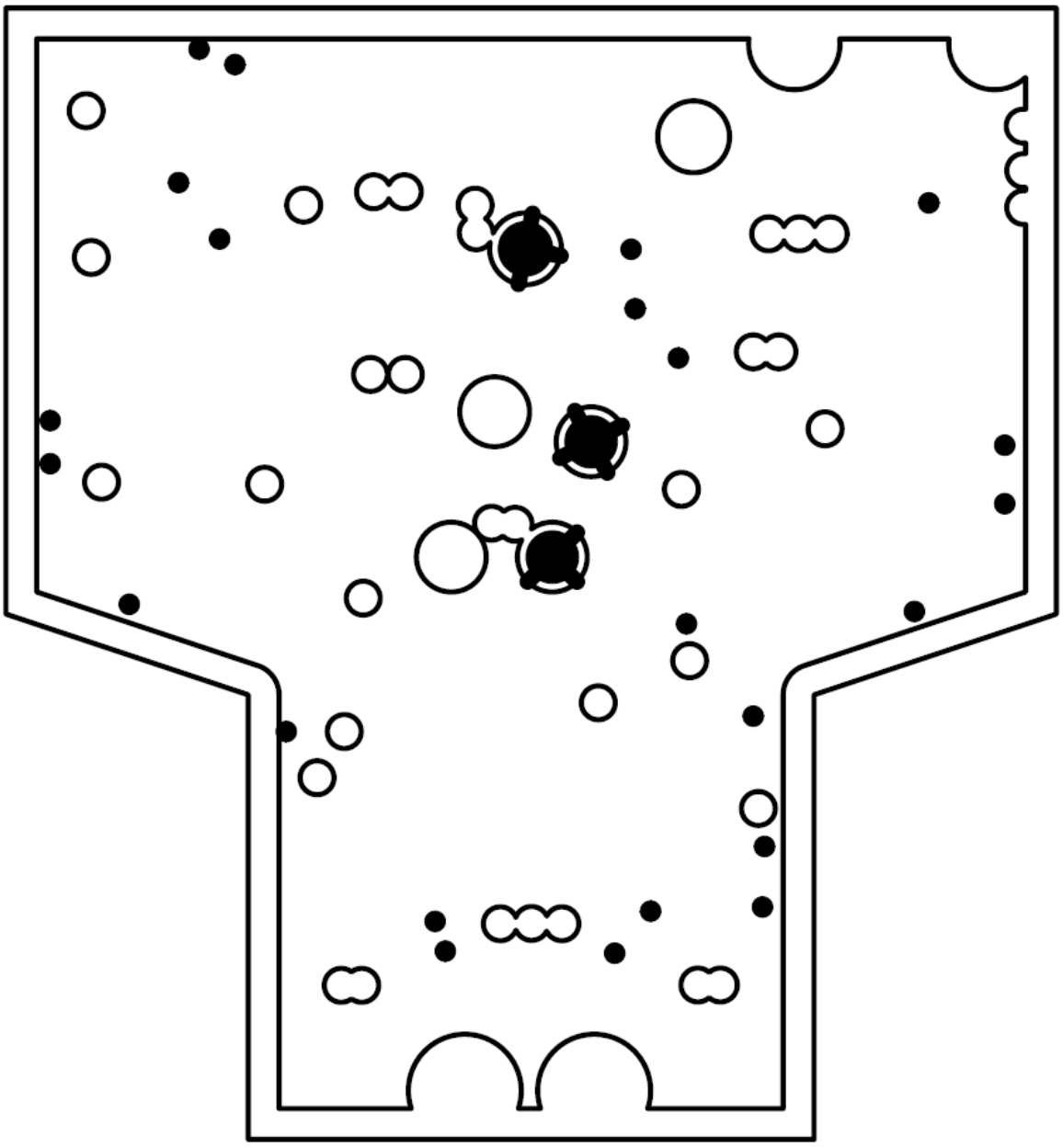

Figure 8. Ground Plane, Layer 3

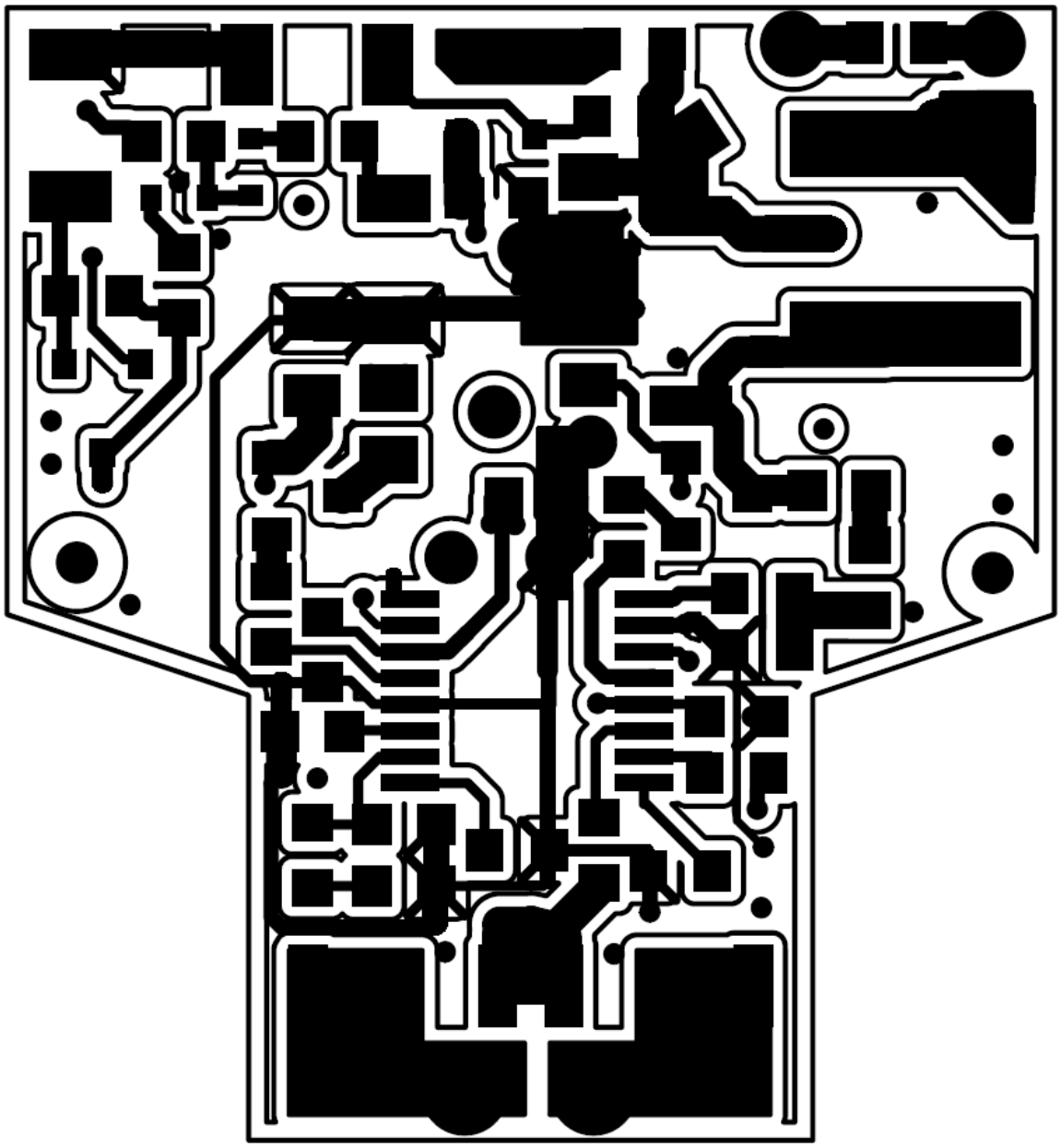

Figure 9. Bottom Routing, Layer 4

5. THERMAL IMAGING

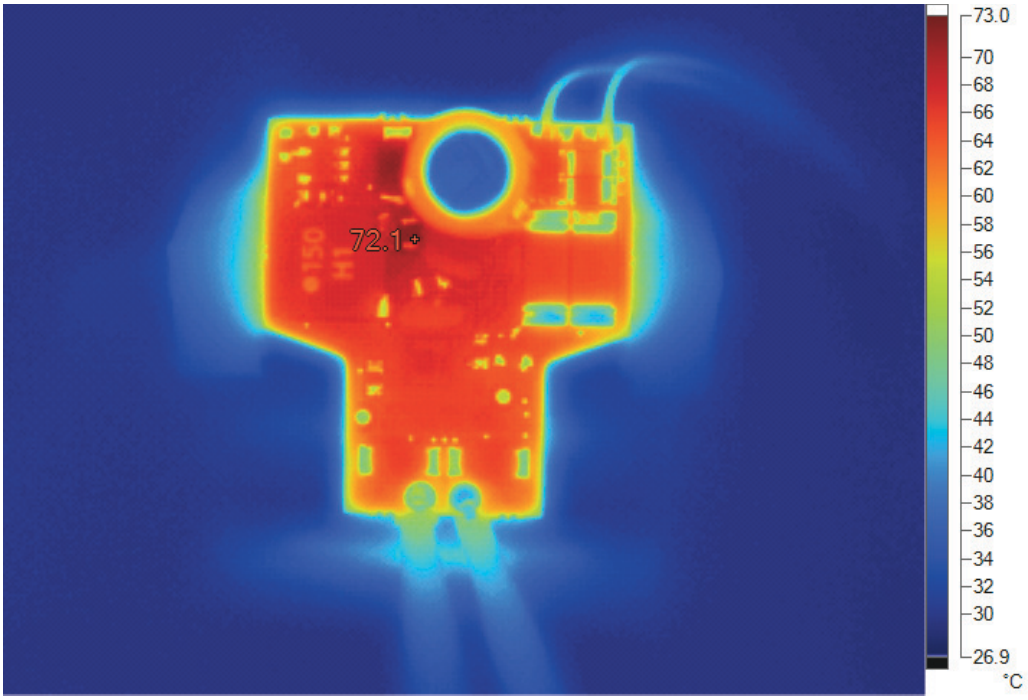

Figure 10. Top Thermal

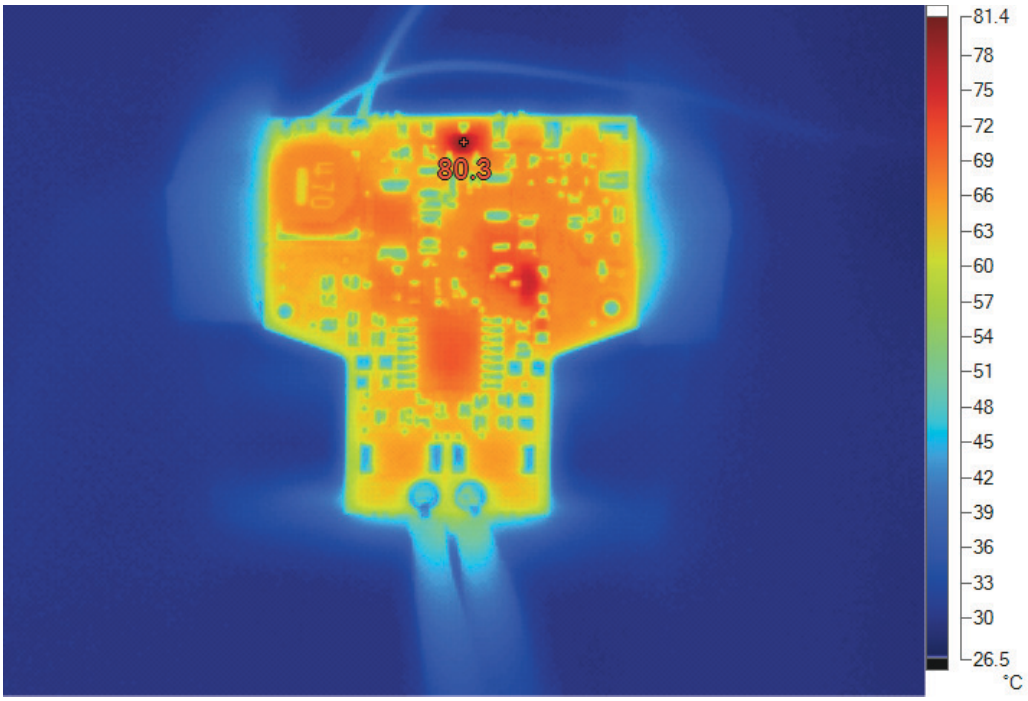

Figure 11. Bottom Thermal

6. DIMMER COMPATIBILITY

The boost stage is a low-side asynchronous boost converter. Once the CS1680 reaches its UVLO start threshold and begins normal operation, the CS1680 controller executes a dimmer switch detection algorithm to set the operating state of the IC. Table 1 summarizes the system operating state that produced the empirical dimmer compatibility results.

MR16 Lamp with a CS1680 (12VAC)			
Date	09/09/2013	**Power Factor[1,6]**	0.98
Vendor	Cirrus Logic	**IEC-61000-3-2 Compliant (Y/N)[3,6]**	Y
Input Voltage (RMS)	12	**EN55015 Compliant (Y/N)**	Y
Form Factor	MR16	**Nominal Input Power (W)[1,6]**	6.79
Model #	CRD1680-7W	**Maximum Input Power (W)[2,6]**	7.0
IC	CS1680	**Output Voltage (V)[1,4]**	12.27
Topology	Boost/Buck	**Output Current (mA)[1,4]**	424
Isolation (Y/N)	N	**Output Current Ripple ≤ 120Hz (mA)[1,5]**	0
Efficiency[7] (%)	76.6%	**Output Power (W)[1,6]**	5.21

Notes:
1. Tested at nominal input voltage, nominal input frequency and without a dimmer
2. Tested over input voltage tolerances for steady-state operation
3. Compliant with IEC 61000-3-2 Class C < 25W
4. Average
5. Peak-to-peak
6. Measured with Chroma 66202 Power Analyzer
7. MR16 lamp efficiency is dependent on LED output voltage V_{OUT}

6.1 120VAC Dimmer Compatibility

Table 1 reports the empirical dimmer compatibility results when detectable inputs to the dimmer compatibility circuit are generated using a 120VAC transformer paired with a leading-edge or trailing-edge dimmer.

Table 1: 120VAC, 60Hz Mains Power System

Dimmer[1]	Lutron DVLV-600P Leading Edge						Lutron DVELV-300P Trailing Edge						Lutron SELV-300P Trailing Edge						Levitron 6615 Trailing Edge					
	Flicker Free[2] Steady-State			I_{out}(%)		Min / Max	Flicker Free[2] Steady-State			I_{out}(%)		Min / Max	Flicker Free[2] Steady-State			I_{out}(%)		Min / Max	Flicker Free[2] Steady-State			I_{out}(%)		Min / Max
Transformer[3]	# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps		
	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6
Hatch LS1250EN	Y	Y	Y	5.2	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				80	80	70				-	-	-				-	-	-				-	-	-
Lightech LET60	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	20	10	5.2
				100	100	100				100	100	90				100	100	80				100	100	100
Hatch RS12-80M	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	30	10	10
				100	100	100				100	100	100				100	100	80				100	100	100
Hatch VS12-60WD	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	10	5.2	5.2
				100	100	100				100	100	80				100	90	80				100	100	90
Osram ET-MZ 60	Y	Y	N	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	10	5.2	5.2
				100	100	100				100	100	70				100	90	70				100	100	80
Eurofase	Y	N	N	5.2	5.2	5.2	Y	Y	N	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	N	10	10	10
				100	90	70				100	100	80				100	100	70				100	100	90

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2. Flicker-free results are reported at different conduction angle ranges and dependent on transformer and dimmer pairing.
3. Empirical results are recorded only with a magnetic transformer paired with a lead-edge dimmer.

6.2 230VAC Dimmer Compatibility

Table 2 reports the empirical dimmer compatibility results when detectable inputs to the dimmer compatibility circuit are generated using a 230VAC transformer paired with a leading-edge or trailing-edge dimmer.

Table 2: 230VAC, 50Hz Mains Power System

Dimmer[1]	HPM CAT400L Leading Edge						Busch 2247U Leading Edge						HPM CAT400T Trailing Edge						Clipsal 32E450TM Trailing Edge					
	Flicker Free[2] Steady-State			I_{out}(%)		Min Max	Flicker Free[2] Steady-State			I_{out}(%)		Min Max	Flicker Free[2] Steady-State			I_{out}(%)		Min Max	Flicker Free[2] Steady-State			I_{out}(%)		Min Max
Transformer[3]	# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps			# of lamps		
	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6
Niko 320-00001	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-
				100	90	100				100	100	100				-	-	-				-	-	-
Osram Parrot 105	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	N	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2
				100	100	40				100	100	80				80	80	60				100	100	80
Philips S60	Y	Y	Y	5.2	5.2	5.2	Y	N	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2
				100	90	80				100	100	100				100	90	80				100	100	100
Primaline 105	Y	Y	Y	5.2	5.2	5.2	Y	Y	N	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2
				100	100	90				100	100	40				100	80	90				100	100	100
Tridonic Possum	Y	Y	Y	5.2	5.2	5.2	N	Y	Y	5.2	5.2	5.2	Y	Y	N	5.2	5.2	5.2	Y	Y	Y	5.2	5.2	5.2
				100	100	80				100	100	100				80	70	60				100	100	60

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2. Flicker-free results are reported at different conduction angle ranges and dependent on transformer and dimmer pairing.
3. Empirical results are recorded only with a magnetic transformer paired with a lead-edge dimmer.

7. INDUCTOR CONSTRUCTION

The CS1680 integrates a continuous conduction mode (CCM) boost converter that provides transformer compatibility and dimmer compatibility with a constant output current buck stage. The following sections describe the boost and buck inductors installed on the CRD1680-7W.

7.1 Boost Inductor

The CS1680 uses an adaptive digital algorithm to control the boost stage and dimmer compatibility operation mode, which enables flicker-free operation down to 5% output current with leading-edge and trailing-edge dimmers. Boost inductor L1 is selected to be a standard TAIYO YUDEN power inductor.

7.1.1 Electrical Specifications

Characteristics conditions:

- Operating temperature range: -25 °C to +125 °C (including coil heat)

Parameter		Condition	Symbol	Value	Unit
TAIYO YUDEN Boost Inductor #NRS8040T150MJGJ					
Inductance	(Note 1)	$f_{measured}$=100kHz		15 (±20%)	µH
DC Resistance	(Note 1)	Maximum		0.065	Ω
Saturation Current		Rated Current		2900	mA

Notes: 1. Measured across pins 1 and 2

7.2 Buck Inductor

The CS1680 buck stage is a constant current-regulated DC-DC converter capable of delivering the highest possible efficiency with constant current output while minimizing line frequency ripple. Buck inductor L2 is selected to be a standard TAIYO YUDEN power inductor.

7.2.1 Electrical Specifications

Characteristics conditions:

- Operating temperature range: -25 °C to +125 °C (including coil heat)

Parameter		Condition	Symbol	Value	Unit
TAIYO YUDEN Buck Inductor #NR6045T470M					
Inductance	(Note 1)	$f_{measured}$=100kHz		47 (±20%)	µH
DC Resistance	(Note 1)	t_{DCR}=20°C		0.286	Ω
Saturation Current		Rated Current		1300	mA

Notes: 1. Measured across pins 1 and 2

8. PERFORMANCE PLOTS (120VAC)

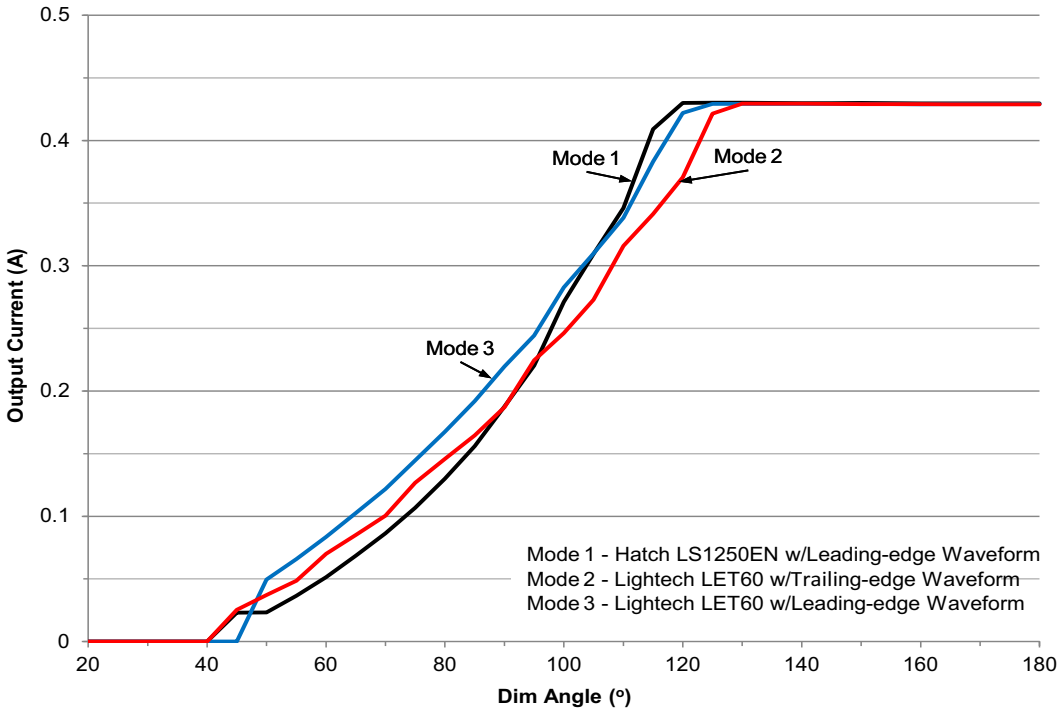

Figure 12. Typical CRD1680-7W Output Current vs. Dim Angle, 120VAC

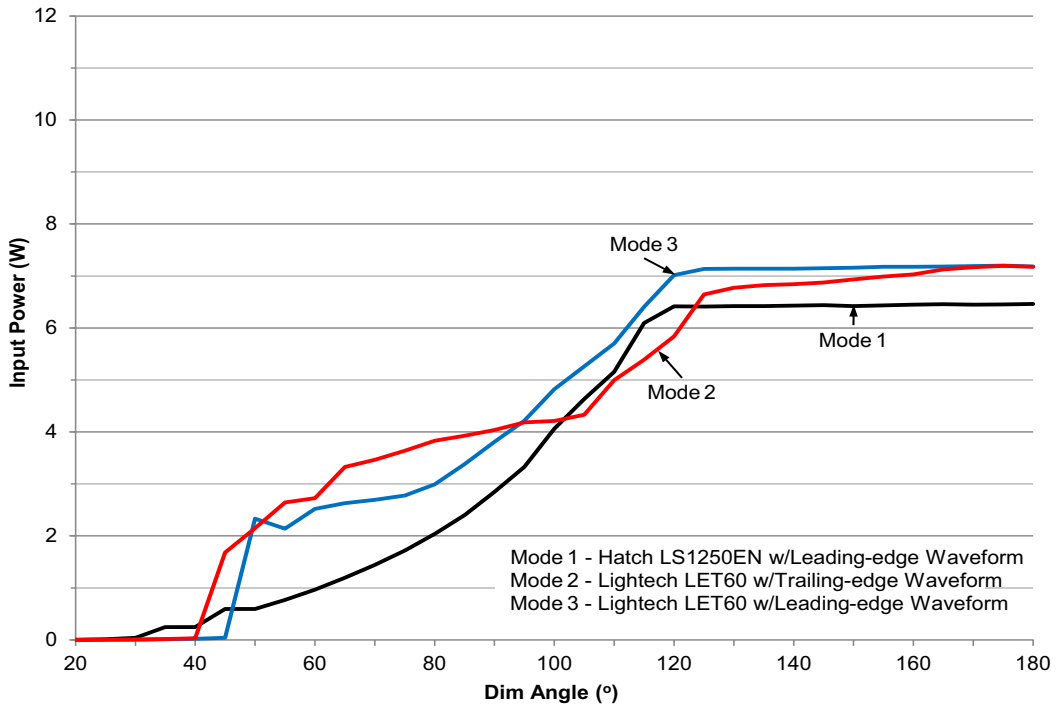

Figure 13. Typical CRD1680-7W Input Power vs. Dim Angle, 120VAC

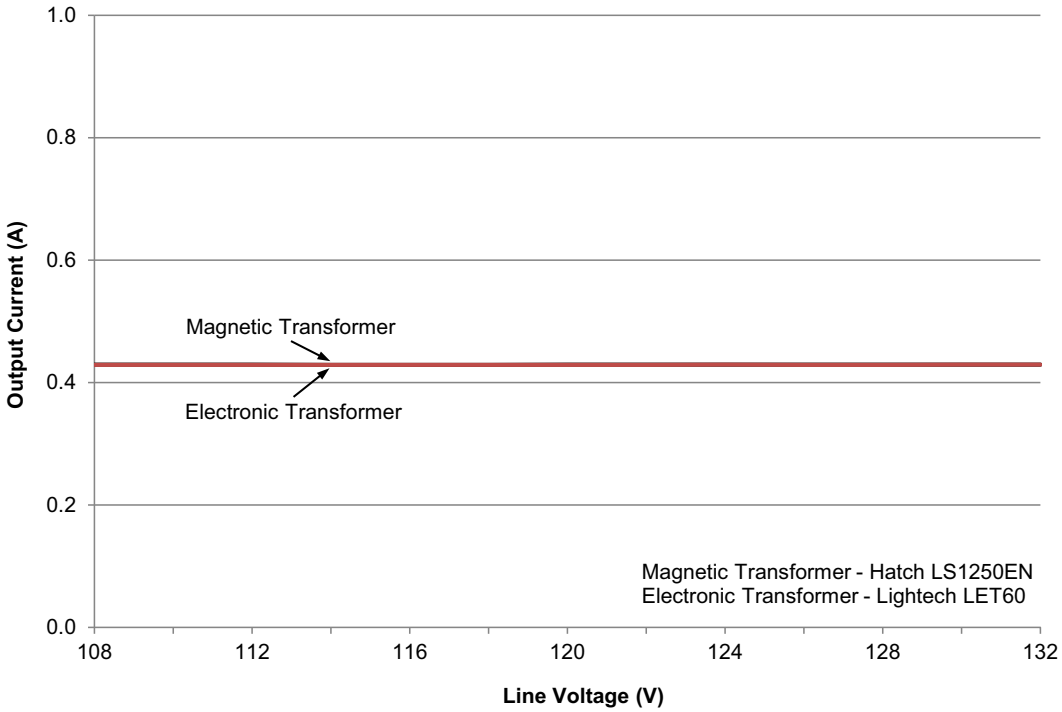

Figure 14. CRD1680-7W Output Current vs. Line Voltage, 108VAC to 132VAC

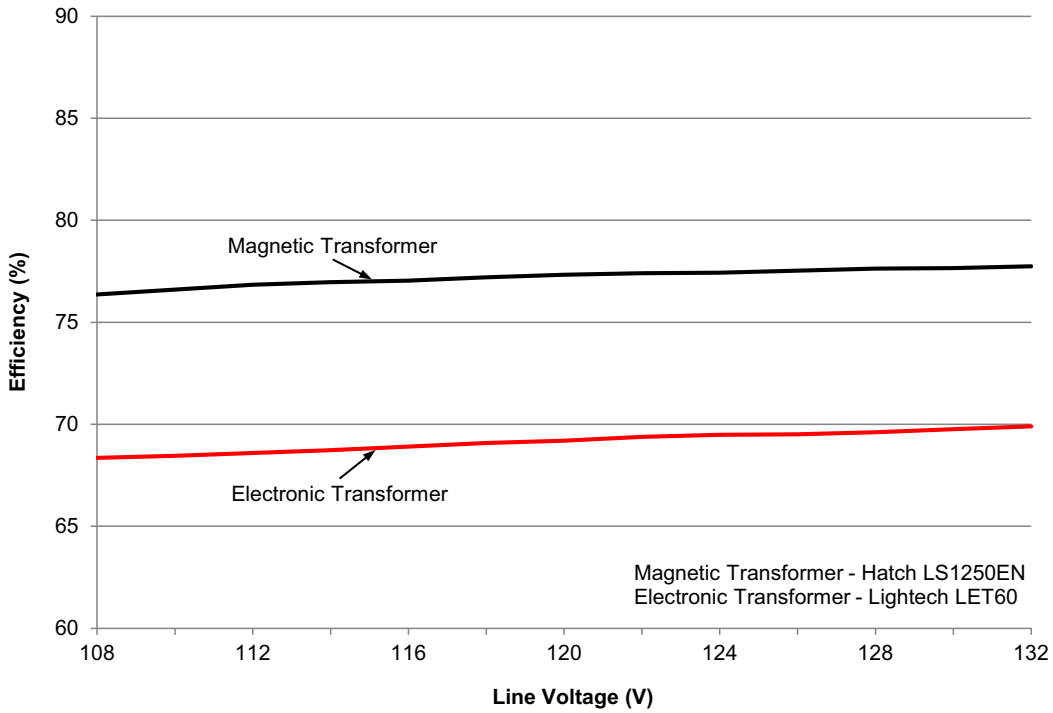

Figure 15. Typical CRD1680-7W Efficiency vs. Line Voltage, 108VAC to 132VAC

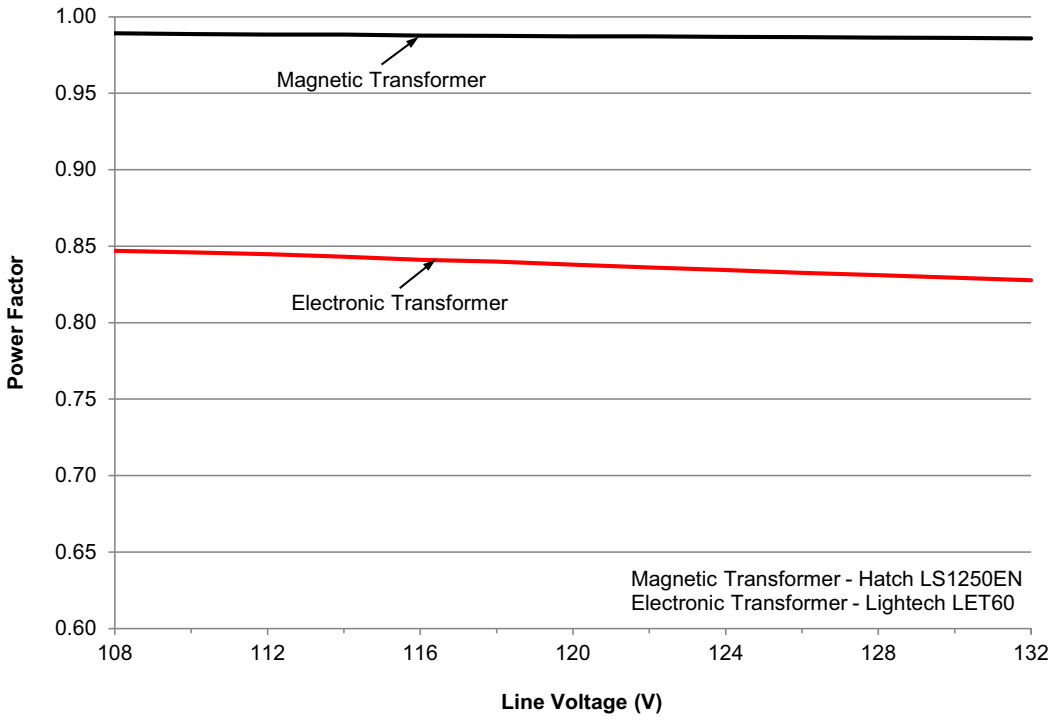

Figure 16. CRD1680-7W Power Factor vs. Line Voltage, 108VAC to 132VAC

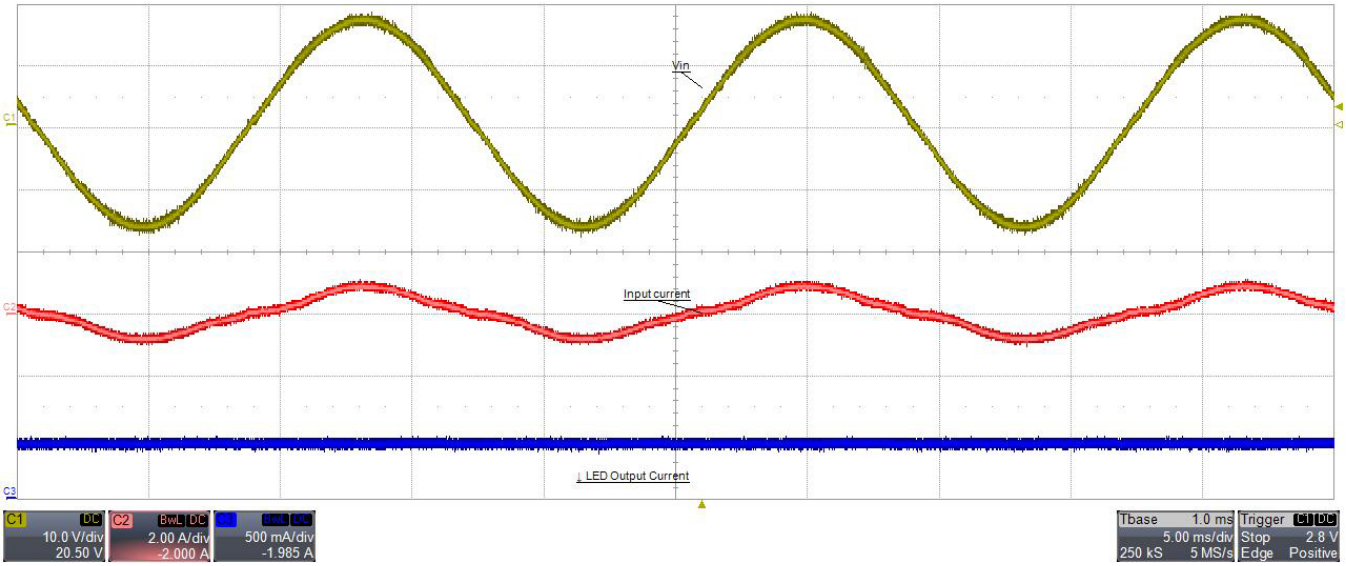

Figure 17. No-dimmer CRD1680-7W Output Mode1, Steady-state

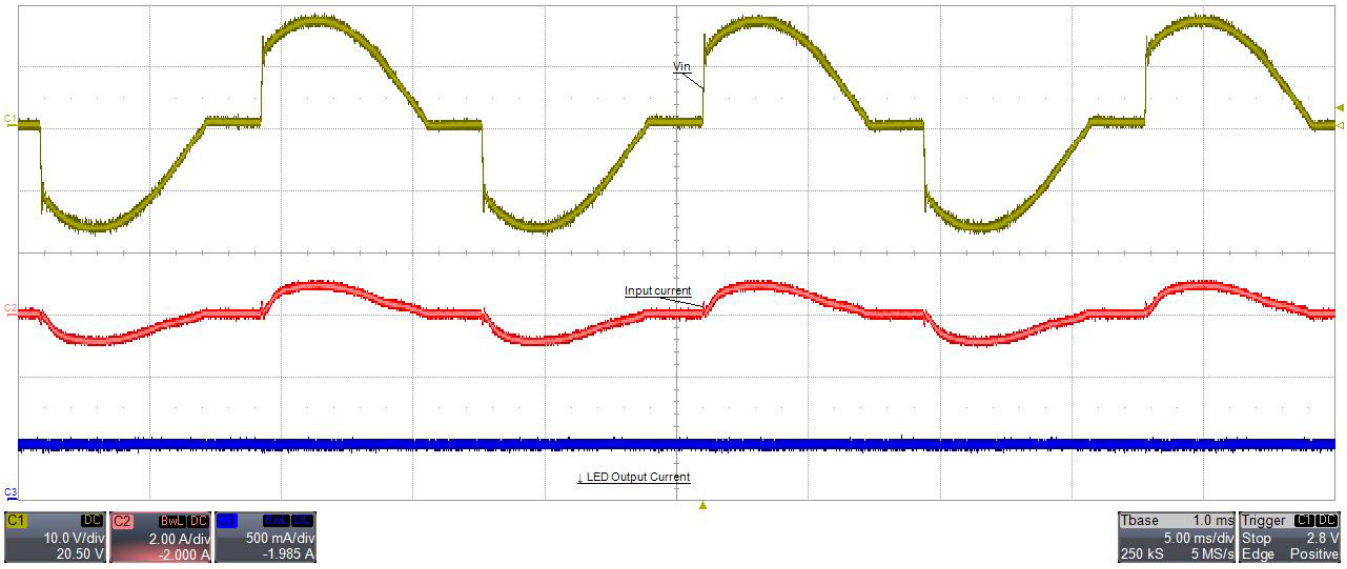

Figure 18. Maximum CRD1680-7W Output Mode1, Steady-state

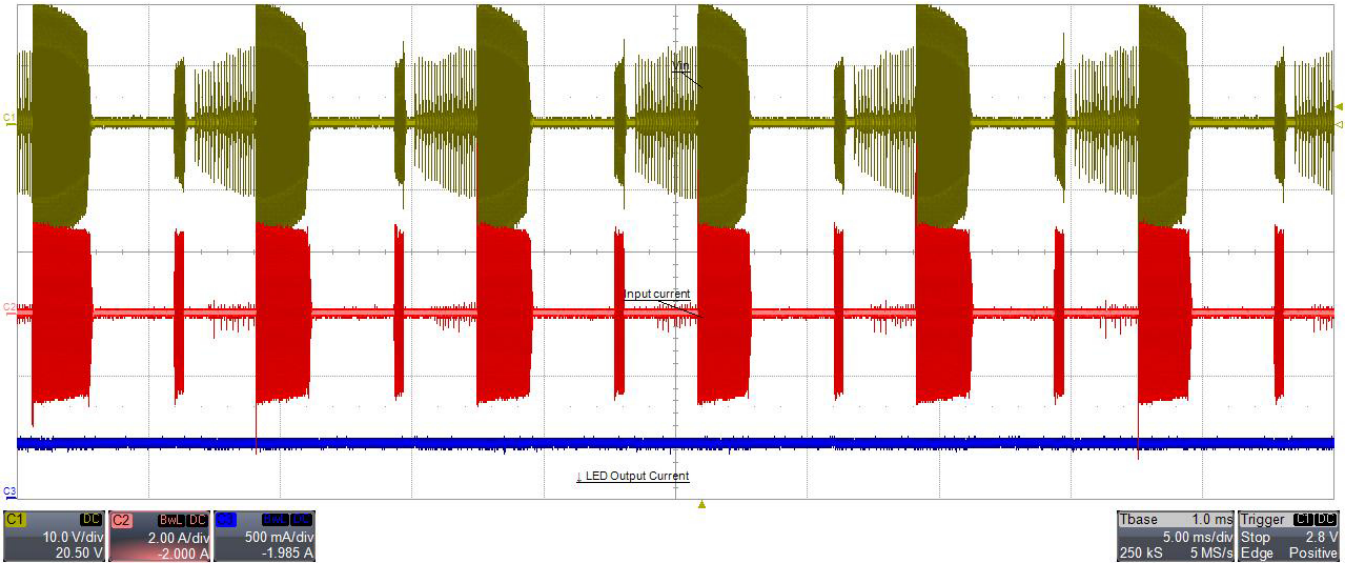

Figure 19. Maximum CRD1680-7W Output Mode2, Steady-state

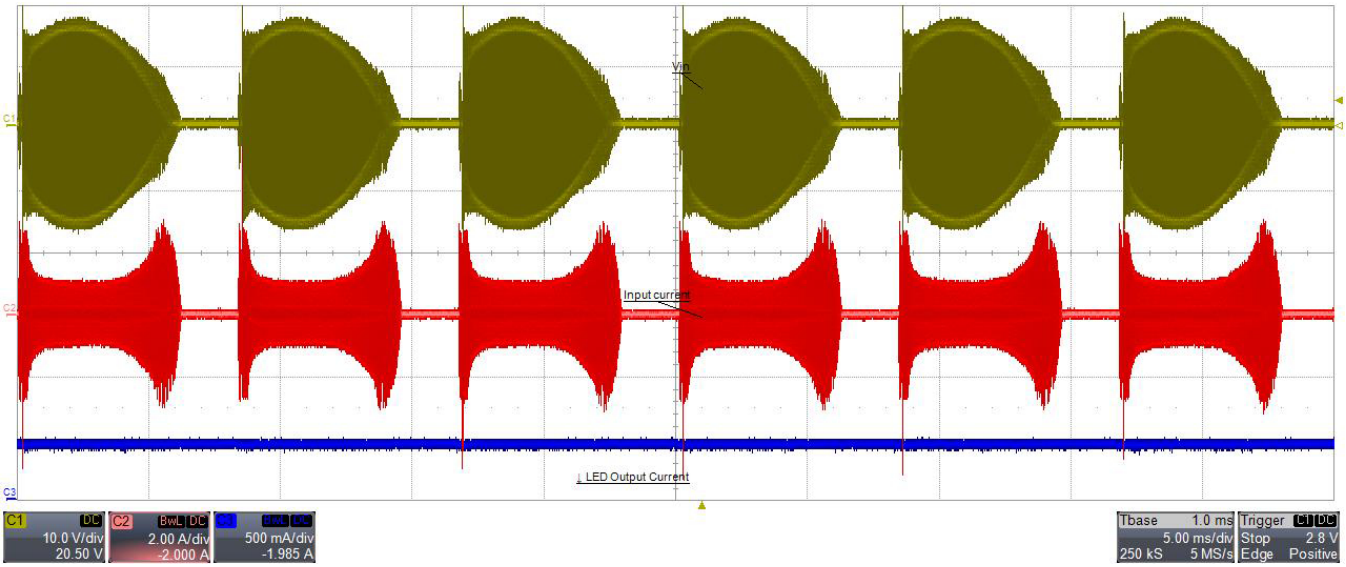

Figure 20. Maximum CRD1680-7W Output Mode3, Steady-state

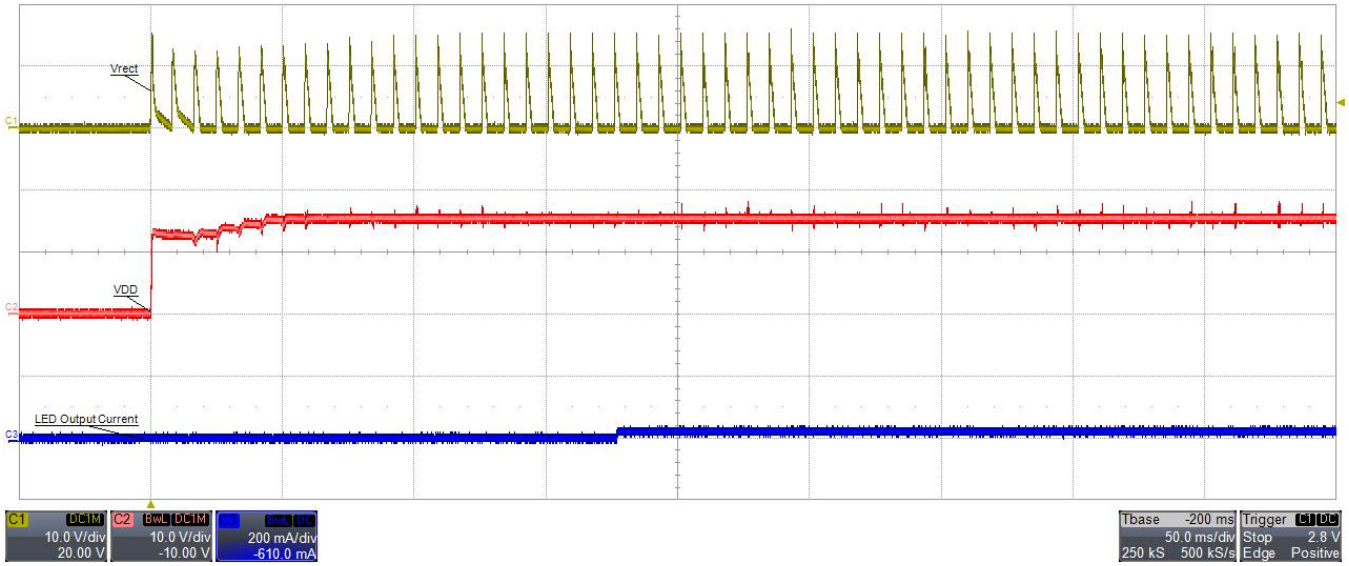

Figure 21. CRD1680-7W Output Current at Minimum Dim Angle, Mode1, Turn-on Waveforms

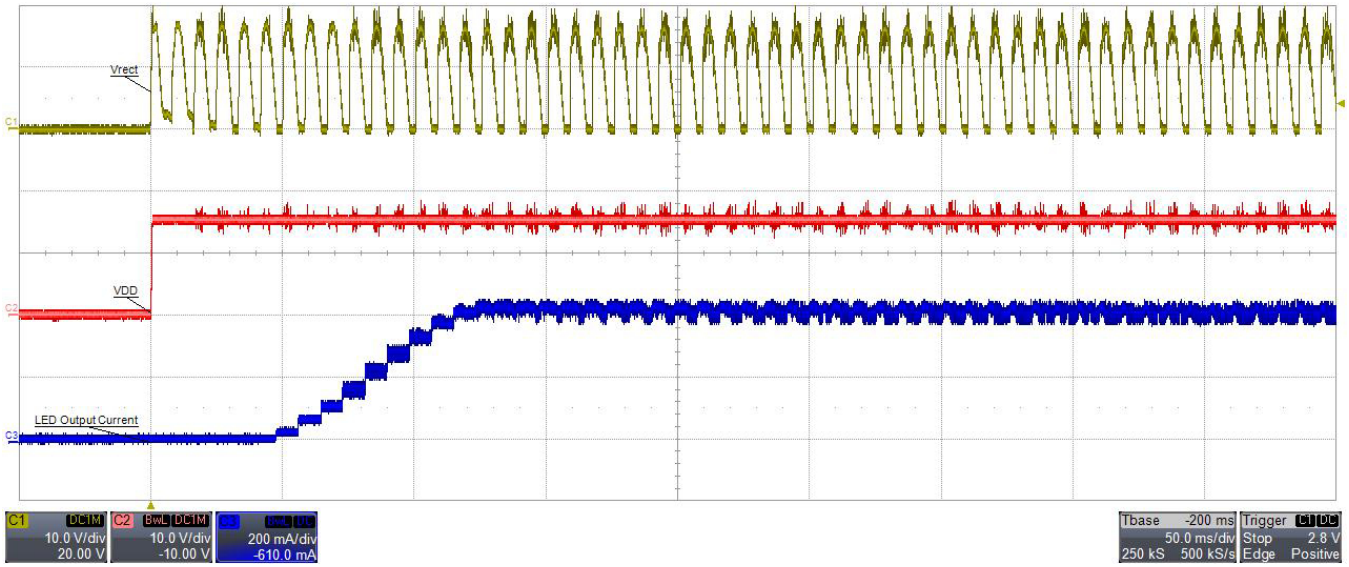

Figure 22. CRD1680-7W Output Current at Maximum Dim Angle, Mode1, Turn-on Waveforms

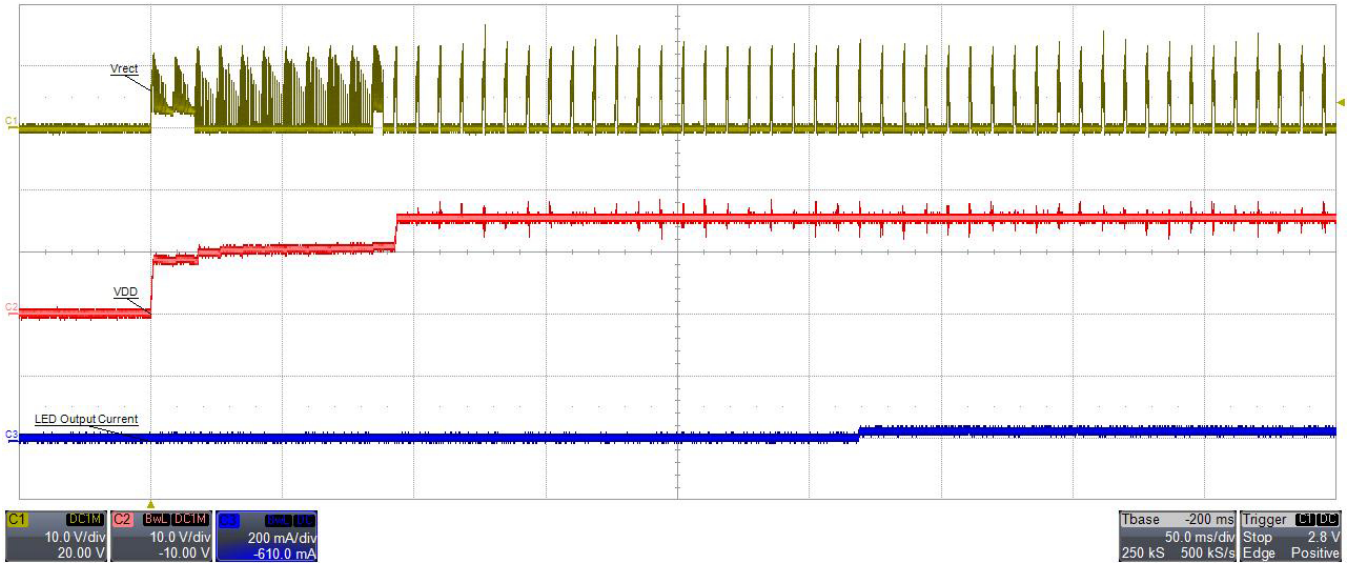

Figure 23. CRD1680-7W Output Current at Minimum Dim Angle, Mode2, Turn-on Waveforms

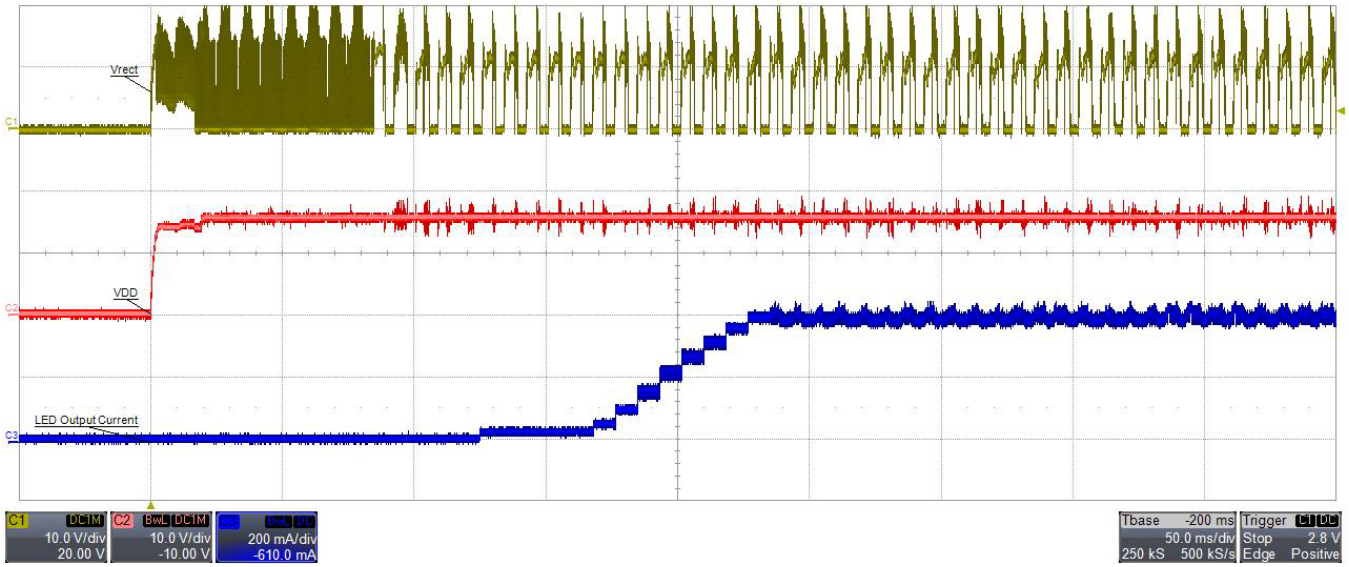

Figure 24. CRD1680-7W Output Current at Maximum Dim Angle, Mode2, Turn-on Waveforms

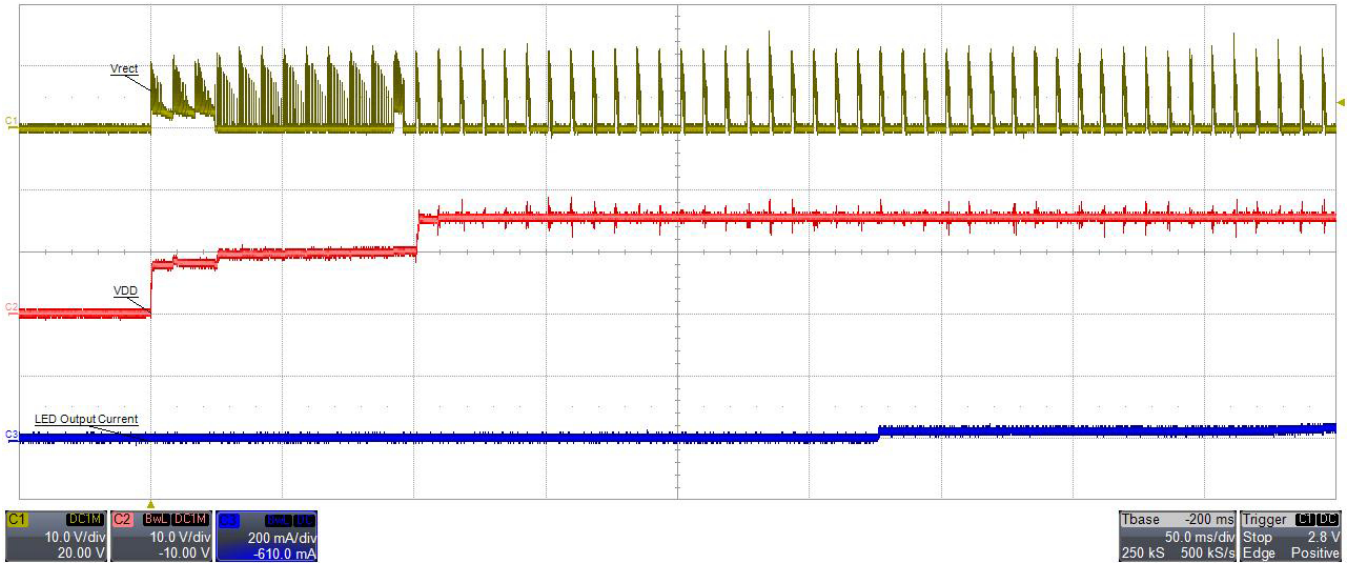

Figure 25. CRD1680-7W Output Current at Minimum Dim Angle, Mode3, Turn-on Waveforms

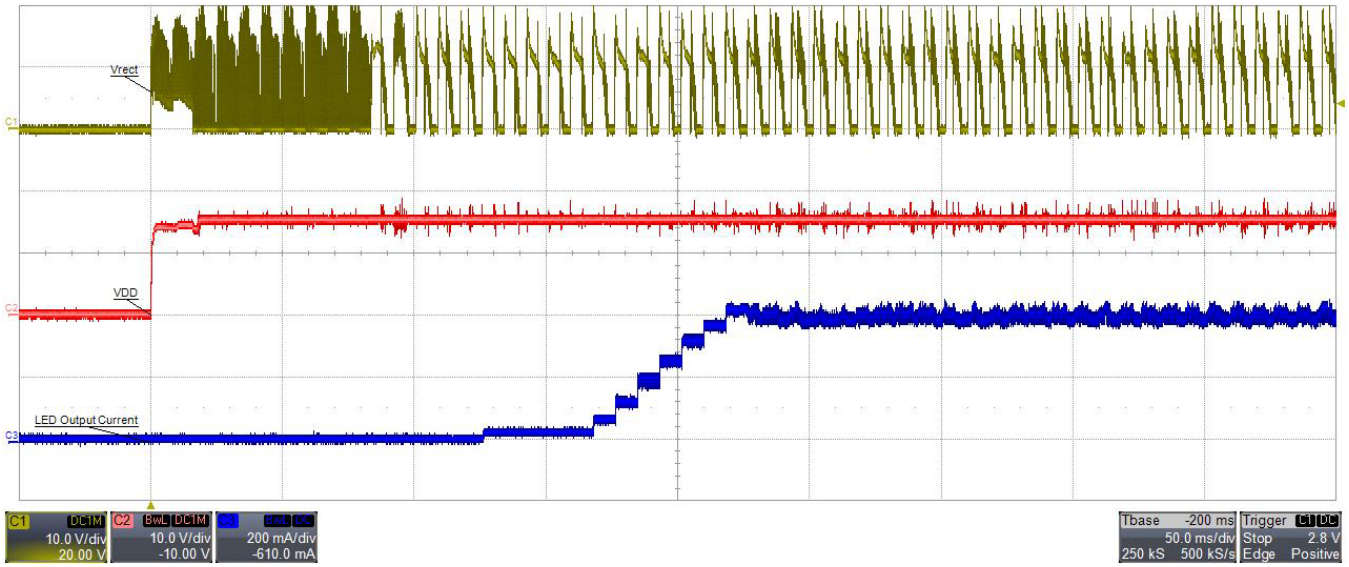

Figure 26. CRD1680-7W Output Current at Maximum Dim Angle, Mode3, Turn-on Waveforms

9. PERFORMANCE PLOTS (230VAC)

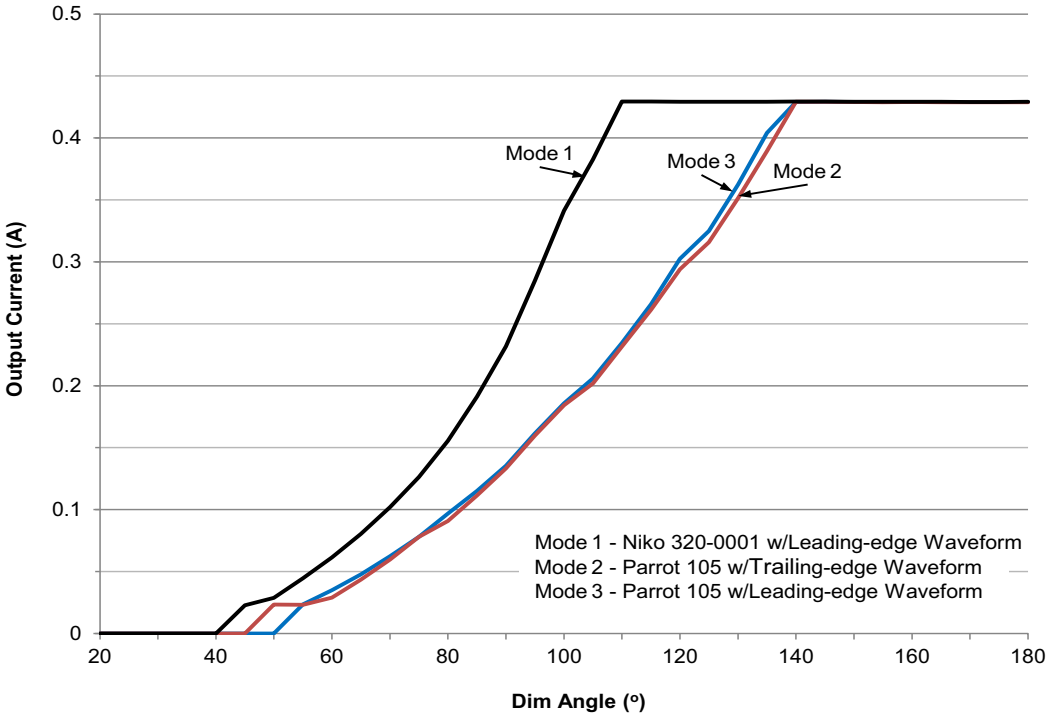

Figure 27. Typical CRD1680-7W Output Current vs. Dim Angle, 230VAC

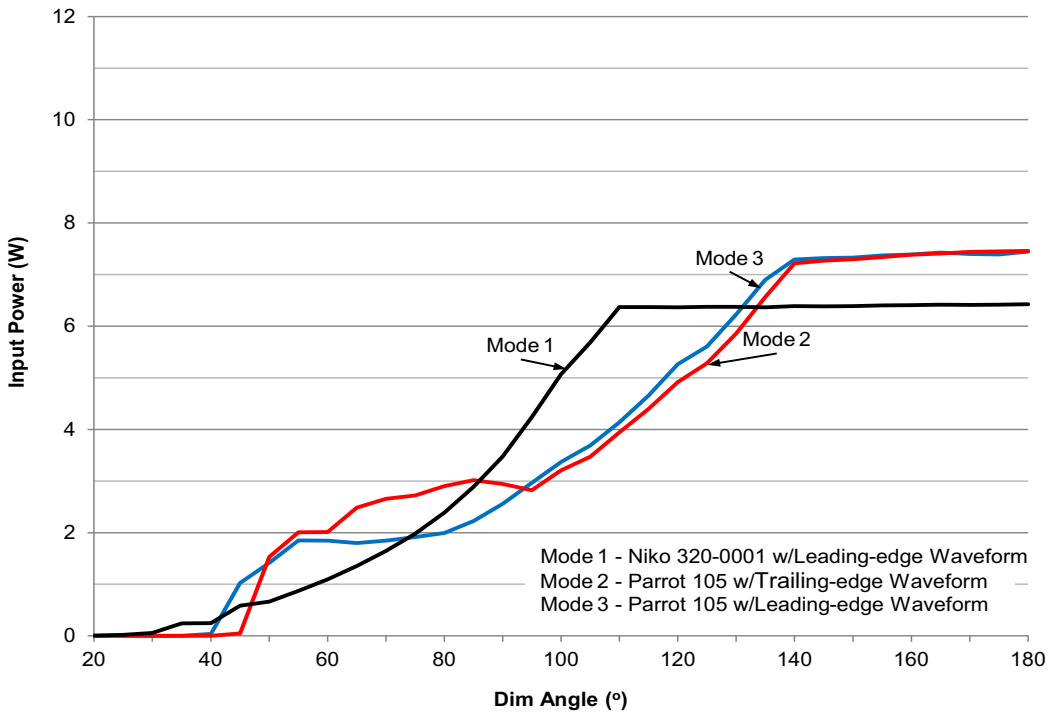

Figure 28. Typical CRD1680-7W Input Power vs. Dim Angle, 230VAC

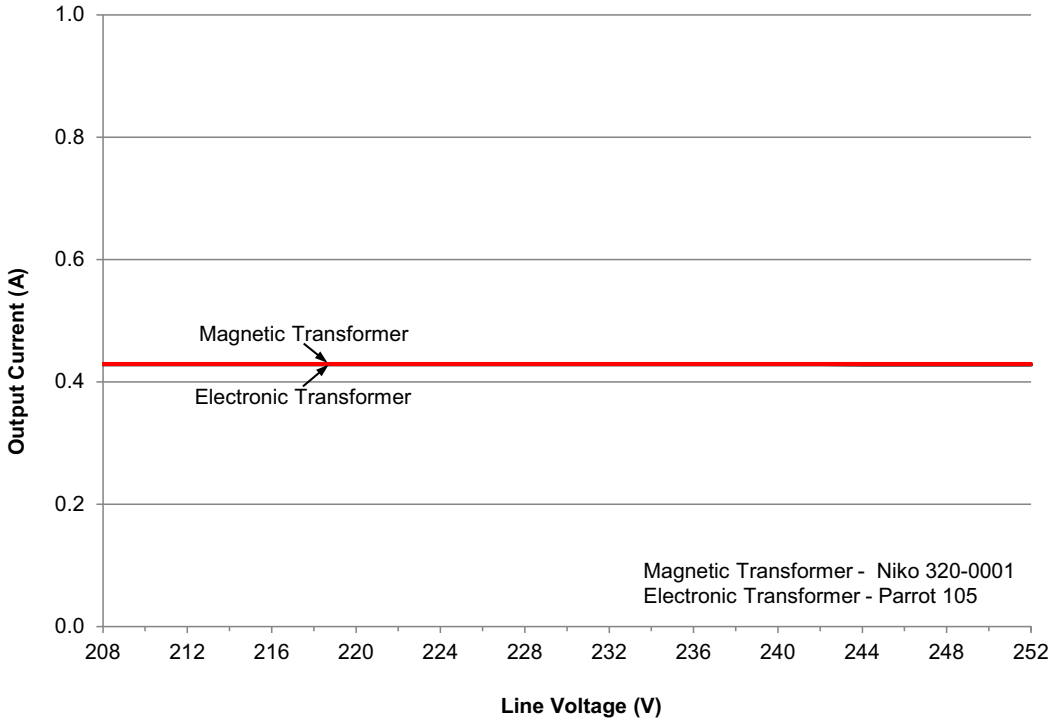

Figure 29. CRD1680-7W Output Current vs. Line Voltage, 208VAC to 252VAC

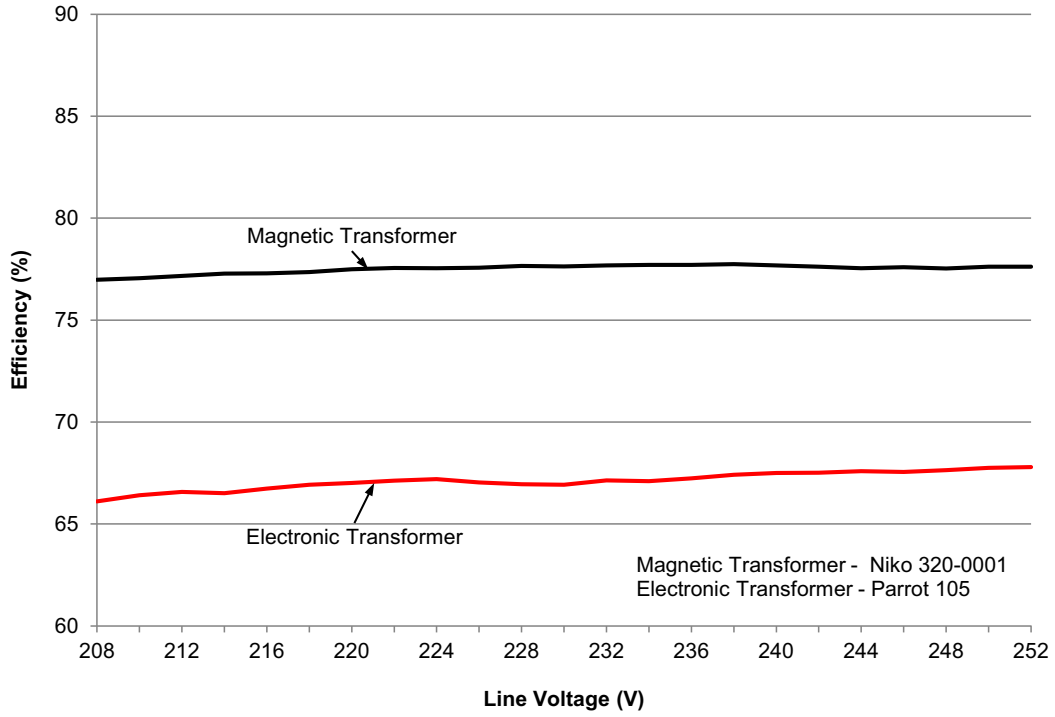

Figure 30. Typical CRD1680-7W Efficiency vs. Line Voltage, 208VAC to 252VAC

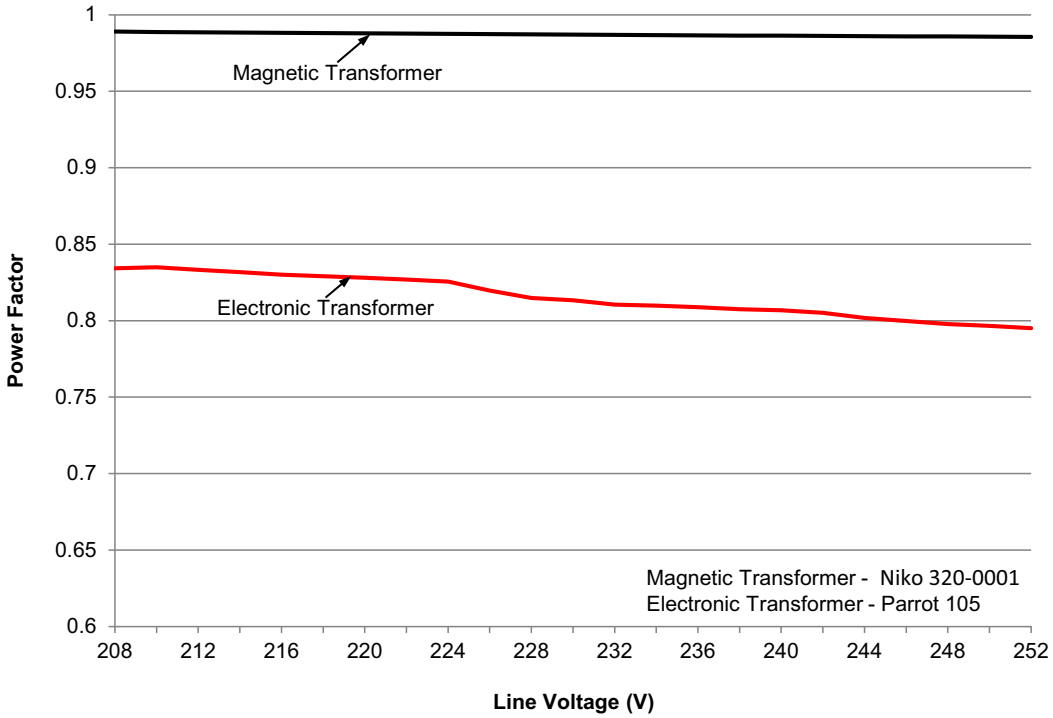

Figure 31. CRD1680-7W Power Factor vs. Line Voltage, 208VAC to 252VAC

10. CONDUCTED EMI

Device Under Test: CRD1680-7W-Z
Operating Conditions: 230V 50Hz
Test Specification: IEC 61000-3-2
Operator Name: DLP

Scan Settings (1 Range)

Frequencies			Receiver Settings			
Start	***Stop***	***Step***	***Res BW***	***M-Time***	***Atten***	***Preamp***
150kHz	30MHz	4.5kHz	9kHz (6dB)	50ms	Auto	Off

Final Measurement

Detectors: PK+, AV **Peaks:** 8 **Meas Time:** 1s **Acc. Margin:** 12dB

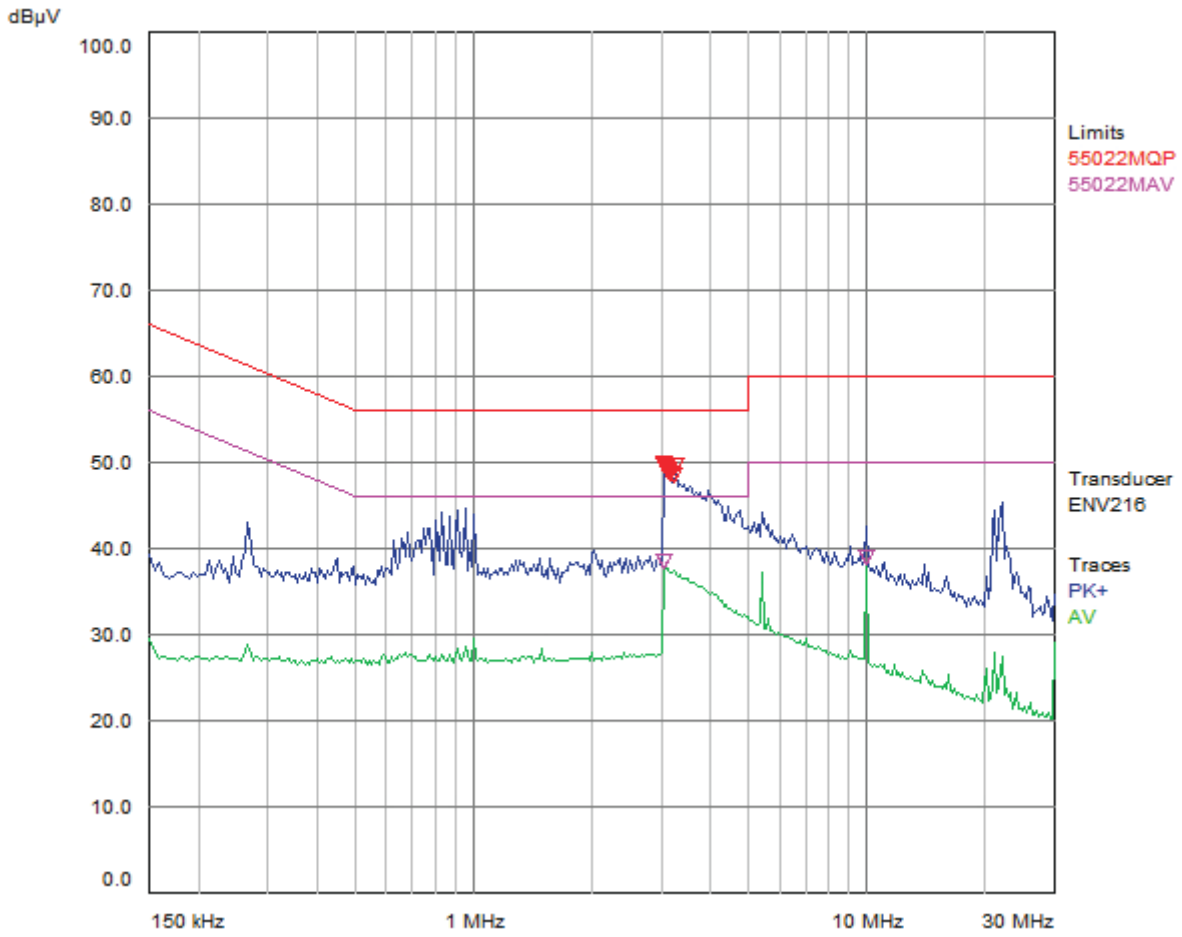

Figure 32. CRD1680-7W Conducted EMI

11. RADIATED EMI

Device Under Test: CRD1680-7W-Z
Operator Name: DLP
Test Specification: CISPR 16-1-4:2007
EN55022 Compliant (Y/N): Y
Antenna Orientation: Horizontal/Vertical
Frequency Range: 30MHz to 1GHz
EUT Line Voltage: 230 VAC
EUT Power Frequency: 50Hz

Final Measurement

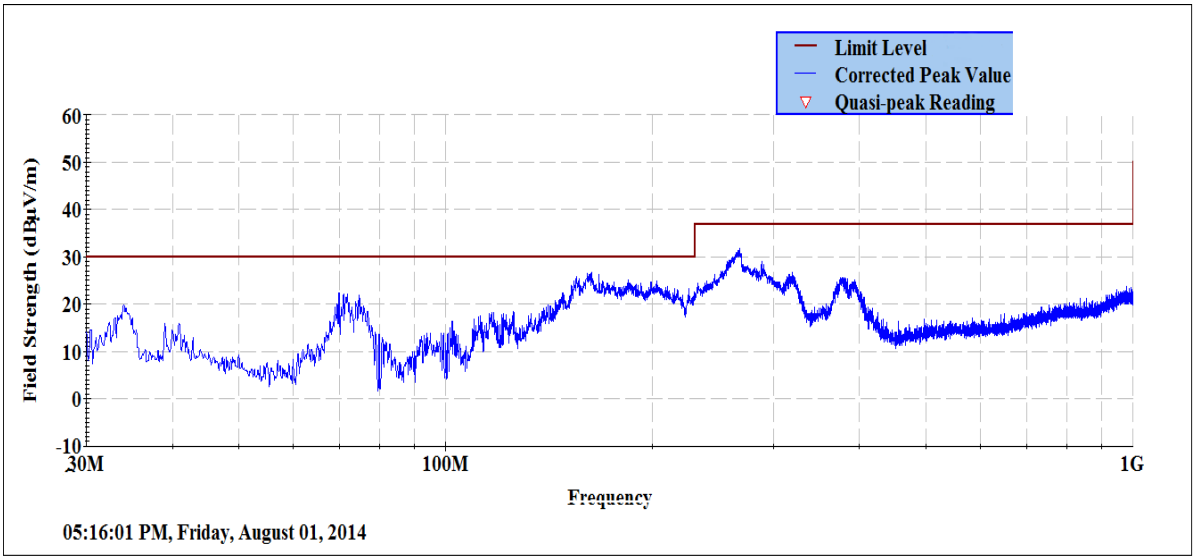

Figure 33. CRD1680-7W Radiated EMI - Horizontal Polarity

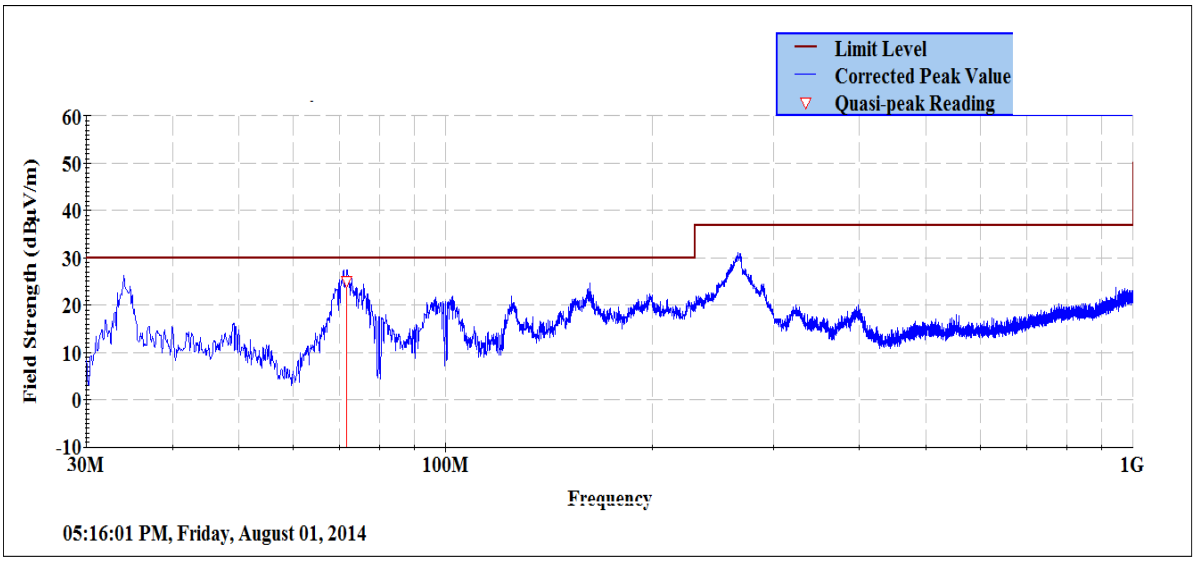

Figure 34. CRD1680-7W Radiated EMI - Vertical Polarity

12. REVISION HISTORY

Revision	Date	Changes
RD1	SEP 2013	Initial release
RD2	NOV 2013	Content addition and clarification for revision B silicon
RD3	JAN 2014	Content clarification for PCBA revision D
RD4	SEP 2014	Content addition

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