EV4034-S-00C

85VAC~265VAC/50Hz, 40V/150mA
Non-Isolation Off-line LED Driver Evaluation Board

The Future of Analog IC Technology

DESCRIPTION

The EV4034-S-00C Evaluation Board is designed to demonstrate the capabilities of MP4034. The MP4034 can be used for non-isolated LED lighting controller.

The EV4034-S-00C typically drives a 6W LED string with a $40V_{TYP}$, 150mA LED load from 85VAC to 265VAC, at 50Hz.

The EV4034-S-00C has excellent efficiency and meets IEC61547 surge immunity and EN55015 conducted EMI requirements. It has multiple protections, including lamp open protection, short-circuit protection, a cycle-by-cycle current limit, and over-temperature protection.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	85 to 265	VAC
Output Voltage	V_{OUT}	40	V
LED Current	I_{LED}	150	mA
Output Power	P_{OUT}	6.0	W
Efficiency (full load)	η	>80	%

FEATURES

- No External Compensation Components
- Precise Constant Current (CC)
- Integrated 700V MOSFET with Minimal External Components
- Variable Off-Time Peak-Current Control
- 600μA High-Voltage Current Source
- Up to 6W Output Power
- Over-Voltage Protection (OVP)
- Over-Temperature Protecction (OTP)
- Lamp Open Protection
- Natural Frequency Dithering for Improved EMI Signature
- Low Cost and Simple External circuit
- Fits GU10 LED

APPLICATIONS

- Solid-State Lighting
- Industrial & Commercial Lighting
- Residential Lighting

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Warning: Although this board is designed to satisfy safety requirements, the engineering prototype has not been agency approved. Therefore, all testing should be performed using an isolation transformer to provide the AC input to the prototype board.

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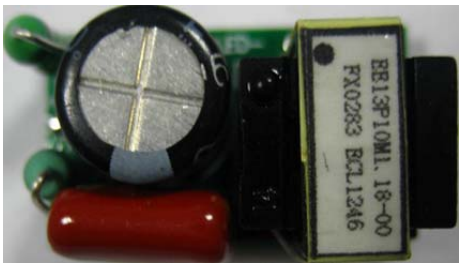
EV4034-S-00C EVALUATION BOARD



TOP VIEW

BOTTOM VIEW

(L x W x H) 27mm x 16mm x 16mm

Board Number	MPS IC Number
EV4034-S-00C	MP4034GS

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EVALUATION BOARD SCHEMATIC

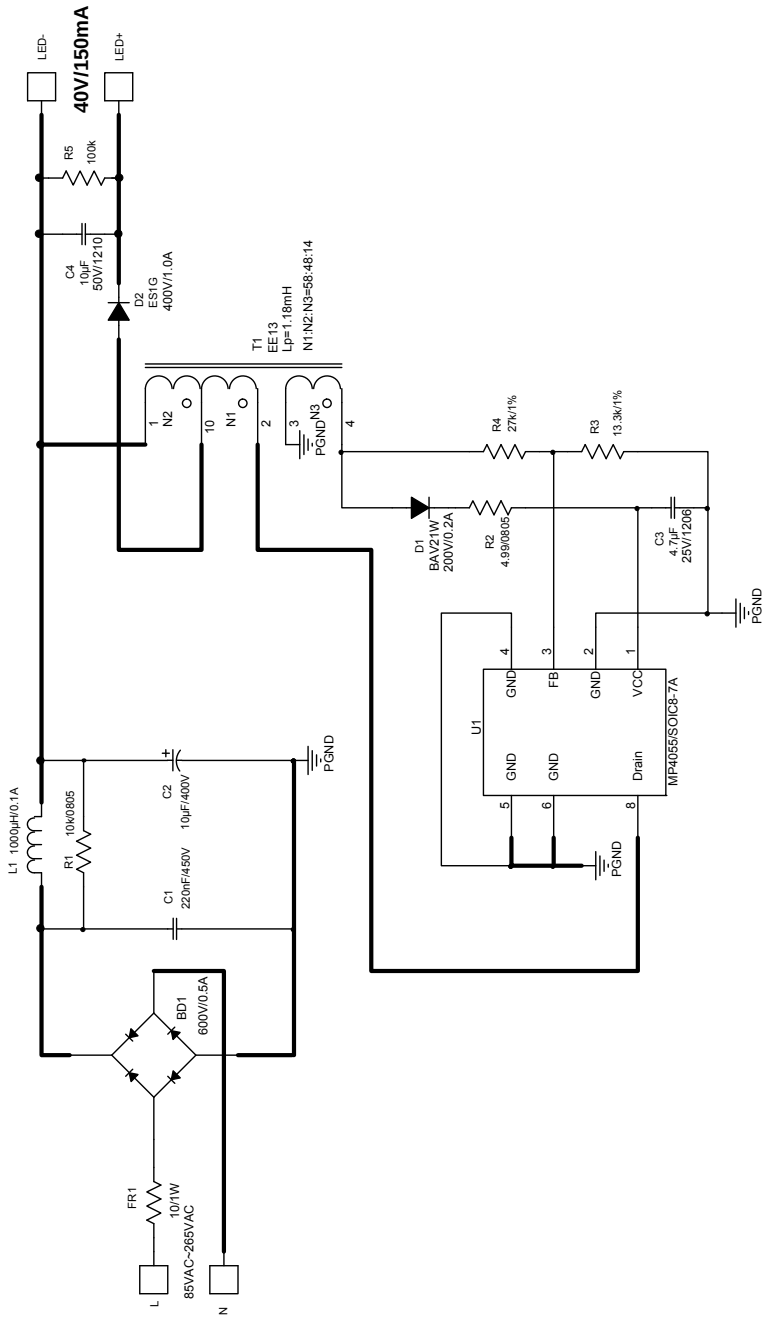

Figure 1—Schematic

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PCB LAYOUT (SINGLE-SIDED)

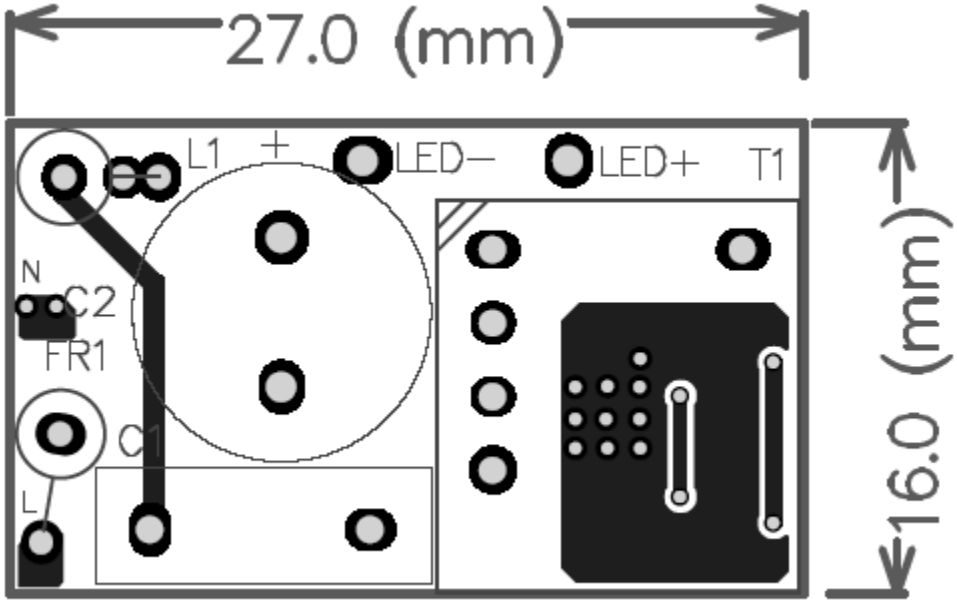

Figure 2—Top Layer

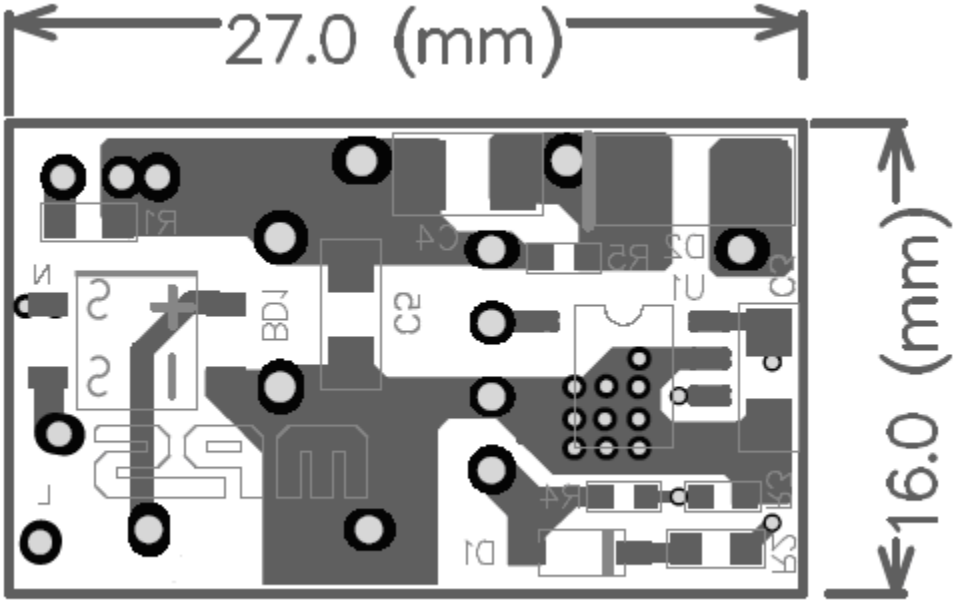

Figure 3—Bottom Layer

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CIRCUIT DESCRIPTION

The EV4034-S-00C is configured for non-isolation control topology, It can simplify the schematic and reduce BOM costs. It can also achieve an accurate LED current.

The input stage consists of FR1 and BD1. FR1 is protects against component failure or some excessive short events, and can restrain the inrush current.

The π filter (C1, L1 and C2) guarantees that the conducted EMI meets the EN55015 standard.

R2, C3 and D1 provide the VCC power supply.

The resistor divider (R3 and R4) provides lamp open protection by sampling the voltage on the auxiliary winding. When an open circuit occurs, the output voltage remains constant.

T1 is the power transformer, the structure of which is also very important to pass EMI test.

D2, C4 and R5 compose output circuit. D2 is a schottky diode for better efficiency. C4 is a ceramic capacitor for lower output voltage ripple and R5 is the dummy load for lamp open protection.

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EV4034-S-00C BILL OF MATERIALS

Qty	RefDes	Value	Description	Package	Manufacturer	Manufacturer_PN
1	BD1	MB6F	Diode;600V;0.5A	SOP-4	Bangdayuan	MB6F
1	C1	220nF	Capacitor;450V;CBB	DIP	Carli	TF224K2Y109L270D9R
1	C2	10μF	Electrolytic Capacitor; 400V	DIP	LiLong	RGA100M2G
1	C3	4.7μF	Ceramic Capacitor; 25V;X7R	1206	TDK	C3216X7R1E475K
1	C4	10μF	Ceramic Capacitor; 50V;X7R	1210	muRata	GRM32ER71H106KA12L
1	D1	BAV21W	Diode;200V;0.2A	SOD-123	Diodes	BAV21W-7-F
1	D2	ES1G	Diode;400;1A	SMA	Taiwan Semiconductor	ES1G
1	FR1	10Ω	Resistor;5%;1W	DIP	Yageo	FKN1WSJT-52-10R
1	L1	1000μH	Inductor;1000μH; 0.1A	DIP	Bangdayuan	CKL0410-102
1	R1	10kΩ	Film Resistor;1%	0805	Yageo	RC0805FR-0710KL
1	R2	4.99Ω	Film Resistor;1%	0805	Yageo	RC0805FR-074R99L
1	R3	13.3kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-0713K3L
1	R4	27kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-0727KL
1	R5	100kΩ	Film Resistor;5%	0603	Yageo	CR03T05NJ100K
1	T1	1.18mH	EE13; N1:N2:N3=58:48:14	DIP	Emei	FX0283
1	U1	MP4034	Primary-Side Regulator	SOIC8-7A	MPS	MP4034GS

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TRANSFORMER SPECIFICATION

Electrical Diagram

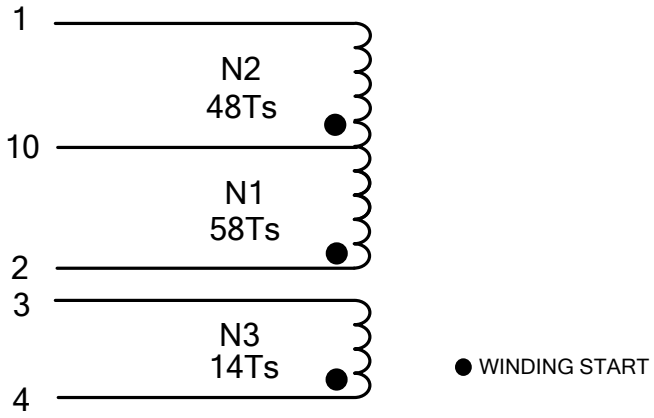

Figure 4—Transformer Electrical Diagram

Winding Diagram

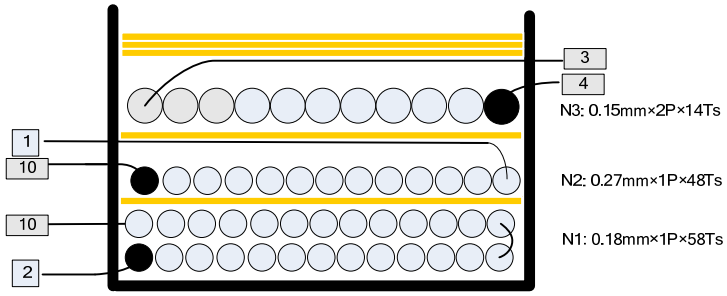

Figure 5—Winding Diagram

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Winding Order

Winding No.	Tape Layer Number	Start & End	Magnet WireΦ(mm)	Turns
N1	1	2→10	0.18mm * 1	58
N2	1	10→1	0.27mm * 1	48
N3	3	4→3	0.15mm * 2	14

Materials

Item	Description
1	Core: EE13, UI=2500±25%, AL=105nH/N^2±3% GAPPED, ACME P4 or equivalent
2	Bobbin: EE13, 5+5PIN 1 SECT TH, UL94V-0
3	Wire:Φ0.15mm, 2UEW, Class B
4	Wire: Φ0.18mm ,2UEW, Class B
5	Wire: Φ0.27mm ,2UEW, Class B
5	Tape: 6.0mm(W)×0.06mm(TH)
6	Tape: 8.0mm(W)×0.06mm(TH)
7	Varnish: JOHN C. DOLPH CO, BC-346A or equivalent
8	Solder Bar: CHEN NAN: SN99.5/Cu0.5 or equivalent

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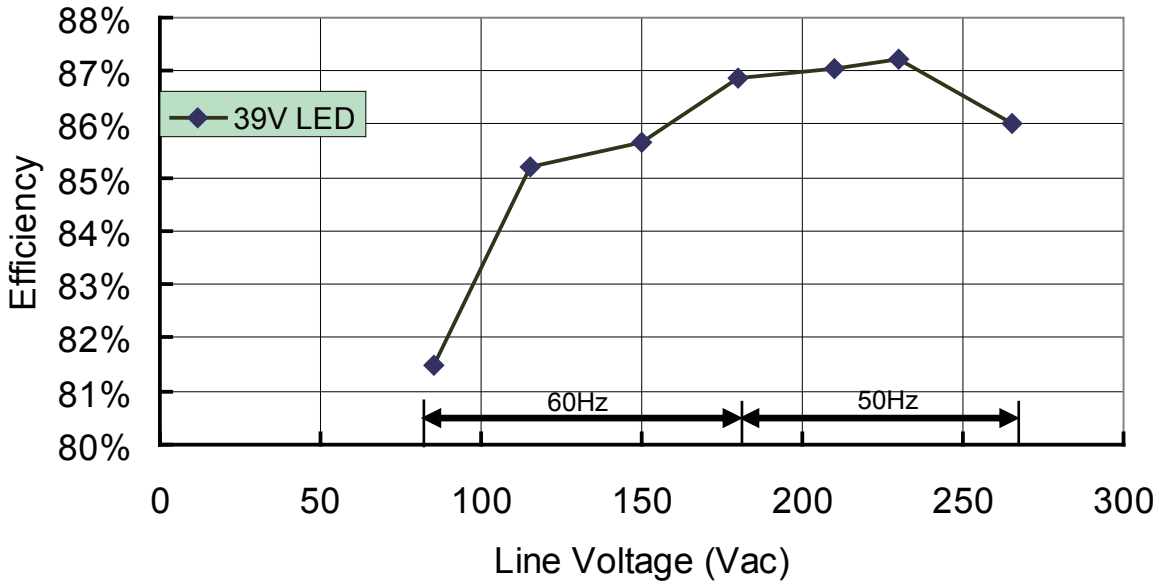
EVB TEST RESULTS

Performance Data

Efficiency

f (Hz)	Vin (VAC)	Pin (W)	Vout (V)	Iout (mA)	Pout (W)	Efficiency (%)
60	85	7.01	38.6	148	5.71	81.49
	115	6.75	38.6	149	5.75	85.21
	150	6.76	38.6	150	5.79	85.65
50	180	6.71	38.6	151	5.83	86.86
	210	6.74	38.6	152	5.87	87.05
	230	6.77	38.6	153	5.91	87.23
	265	6.91	38.6	154	5.94	86.03

Efficiency vs. Input Line Voltage



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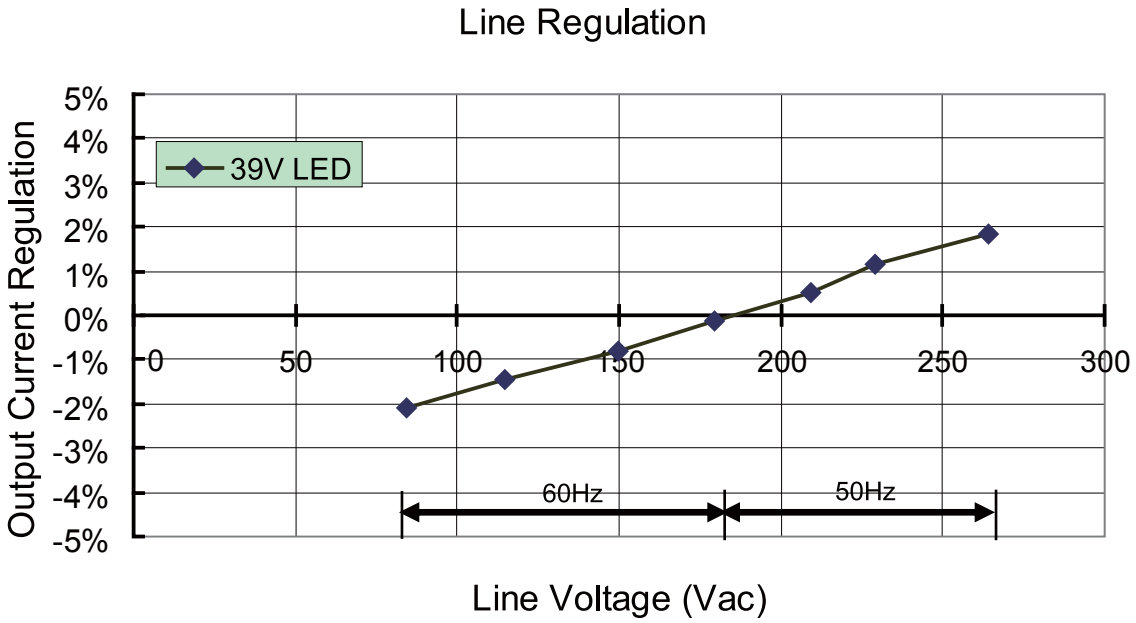
Line Regulation



Surge Test

Line-to-Line 500V surge testing was completed according to IEC61547.
Input voltage was set at 230VAC/50Hz. Output was loaded at full load and operation was verified following each surge event.

Surge Level (V)	Input Voltage (VAC)	Injection Location	Injection Phase (°)	Test Result (Pass/Fail)
+/-500	230	L to N	0	Pass
+/-500	230	L to N	90	Pass
+/-500	230	L to N	180	Pass
+/-500	230	L to N	270	Pass

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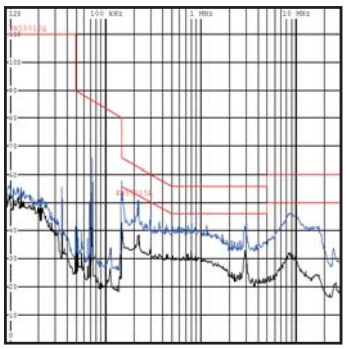
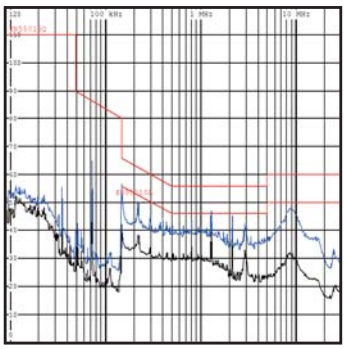
Conducted EMI Test

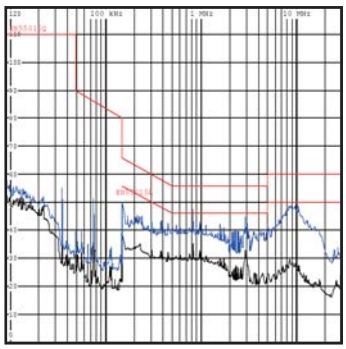
Conducted EMI Test
110Vac, 60Hz, Maximum Load,
L Line, EN55015 Limits



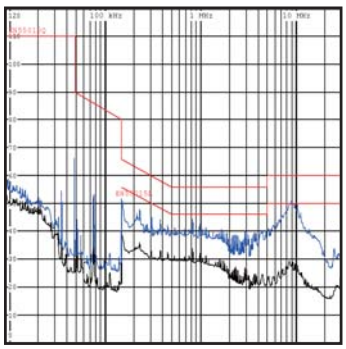
Conducted EMI Test
110Vac, 60Hz, Maximum Load,
N Line, EN55015 Limits



Conducted EMI Test
220Vac, 50Hz, Maximum Load,
L Line, EN55015 Limits



Conducted EMI Test
220Vac, 50Hz, Maximum Load,
N Line, EN55015 Limits



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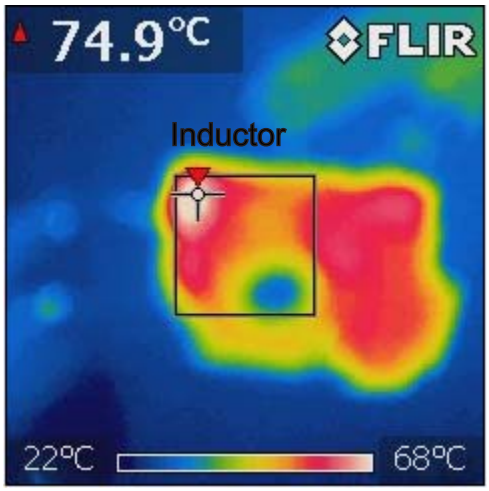
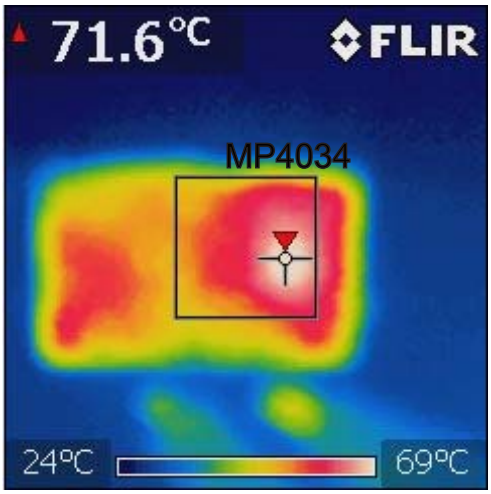
Thermal Test

Test with 85Vac input and full load condition (T_A=25°C)



Top Layer



Bottom Layer

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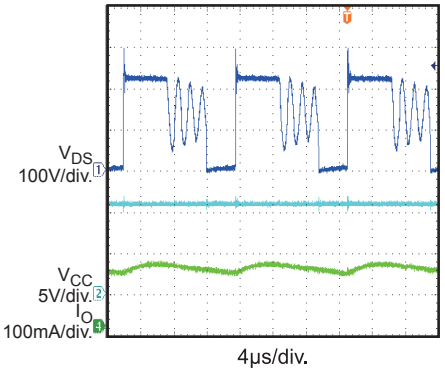
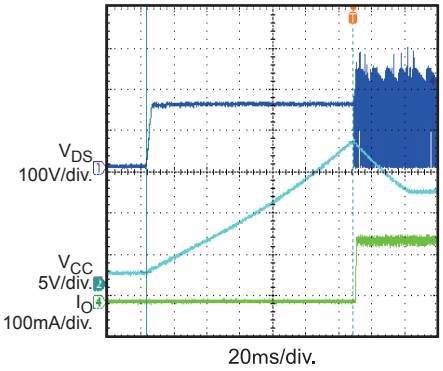
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN}=110VAC/60Hz, 13 LEDs in series, I_{LED}=150mA, V_{OUT}=39V, L_P=1.18mH, N_1:N_2:N_3 =58:48:14

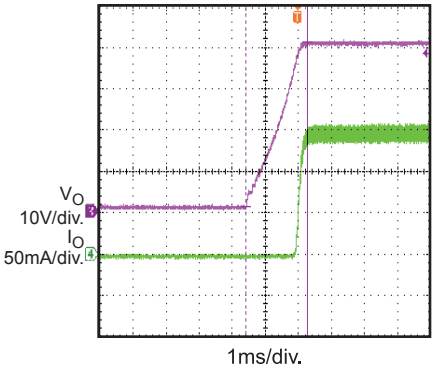
Steady State



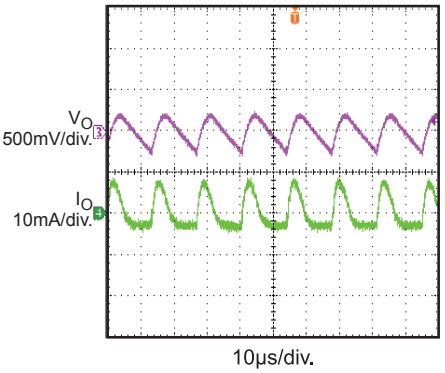
Turn On Delay



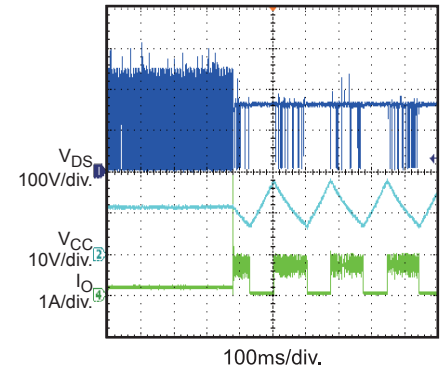
Output Rise Time



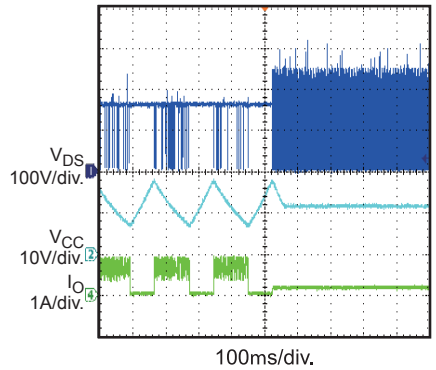
Output Ripple



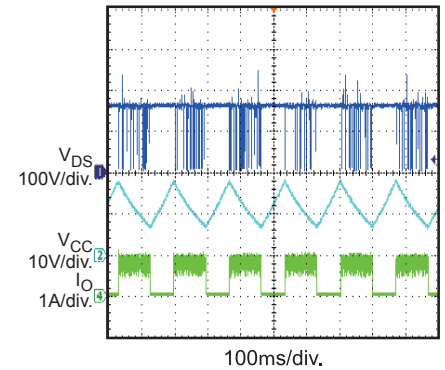
SCP Enter



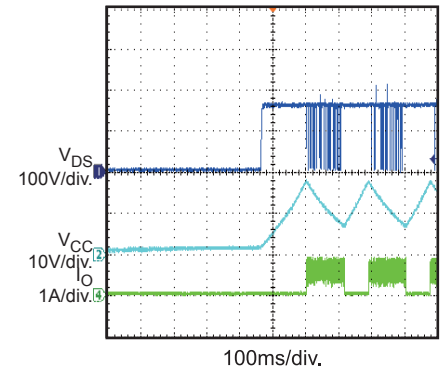
SCP Recovery



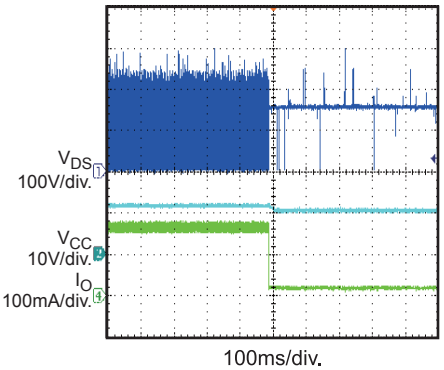
SCP Steady State



SCP Start Up



Lamp Open Protection



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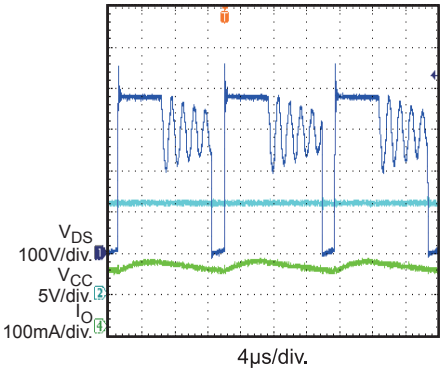
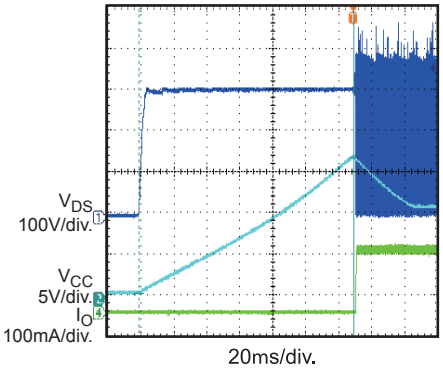
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN}=220VAC/50Hz,13 LEDs in series, I_{LED}=150mA, V_{OUT}=39V, L_P=1.18mH, N_1:N_2:N_3 =58:48:14

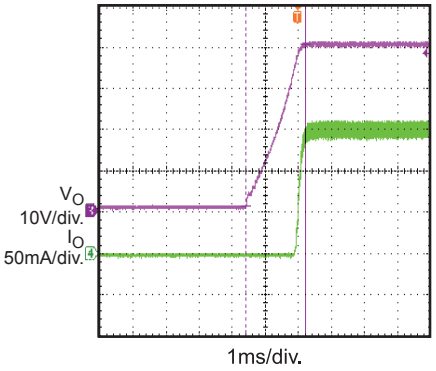
Steady State



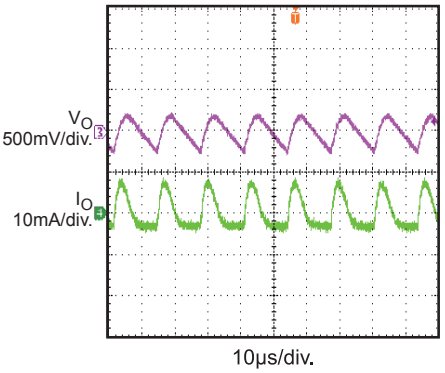
Turn On Delay



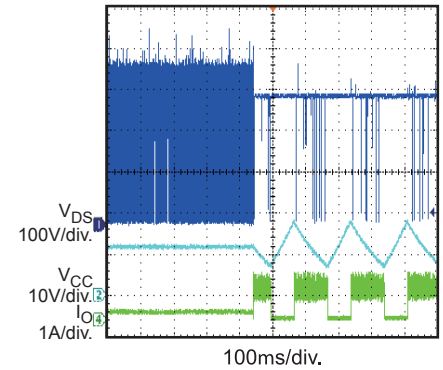
Output Rise Time



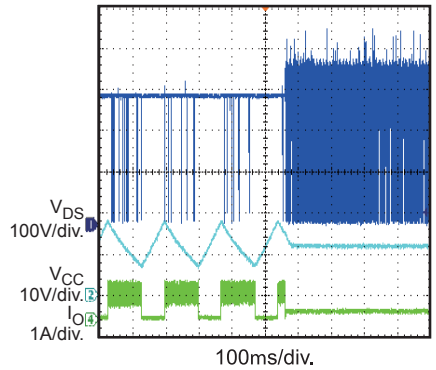
Output Ripple



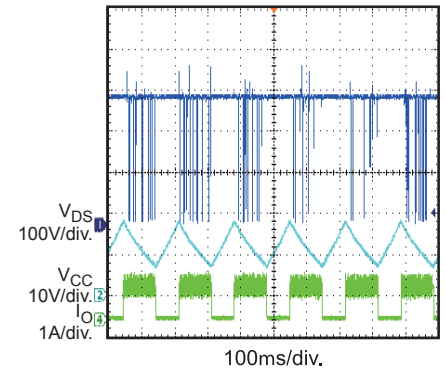
SCP Enter



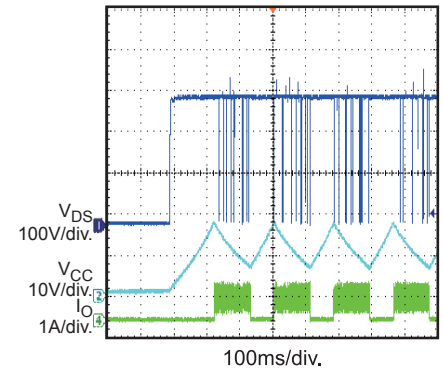
SCP Recovery



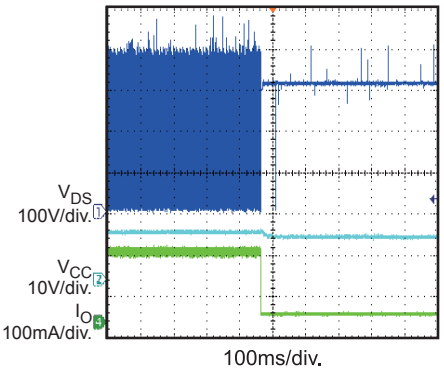
SCP Steady State



SCP Start Up



Lamp Open Protection



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QUICK START GUIDE

1. Preset AC Power Supply to 85VAC ≤ V_{IN} ≤265VAC.
2. Turn Power Supply off.
3. Connect the LED string between “LED+” (anode of LED string) and “LED-” (cathode of LED string).
4. Connect Power Supply terminals to AC V_{IN} terminals as shown on the board.
5. Turn AC Power Supply on after making connections.

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