EVQ3359C-LE-00A

1/2/3/4-Channel, Max 160mA/Channel, Boost WLED Controller with High Dimming Ratio Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ3359C-LE-00A is an evaluation board designed to demonstrate the capabilities of the MPQ3359C and MP3359C, which are four-channel, step-up converters that drive white LED (WLED) arrays as backlighting for medium-sized LCD panels. The MPQ3359C will be used throughout this datasheet to refer to both, unless otherwise specified.

Peak current control is used as the pulse-width modulation (PWM) control architecture to regulate the boost converter. Four channel current sources are applied to the LED cathode to adjust LED brightness. This regulates the current in each LED string to the value set by an external current-setting resistor, with a 2.5% current regulation accuracy between strings.

The MPQ3359C's low headroom voltage improves efficiency and IC thermal performance. The switching frequency (f_{SW}) is configurable via a resistor or an external clock.

The MPQ3359C provides analog and PWM dimming via the EN/ADIM and PDIM pins, respectively. The device also has a fixed delay time between LED current (I_{LED}) channels to eliminate noise during PWM dimming.

Protection features include input over-current protection (OCP), over-voltage protection (OVP), over-temperature protection (OTP), LED string short protection, LED string open protection, output voltage (V_{OUT}) short-to-GND protection, and LEDx pin short-to-GND protection.

The EVQ3359C-LE-00A is a fully assembled evaluation board. The MP3359C and MPQ3359C are available in a QFN-20 (3mmx4mm) package, and the MPQ3359C is available in AEC-Q100 Grade 1.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN})		12V typical
LED strings	The over-voltage protection (OVP) threshold is 40.2V, so it is recommended for the output voltage (V_{OUT}) to be below 36V	4 strings, 12 LEDs for each string
LED current (I_{LED})	R_{ISET} = 10kΩ	120mA/string

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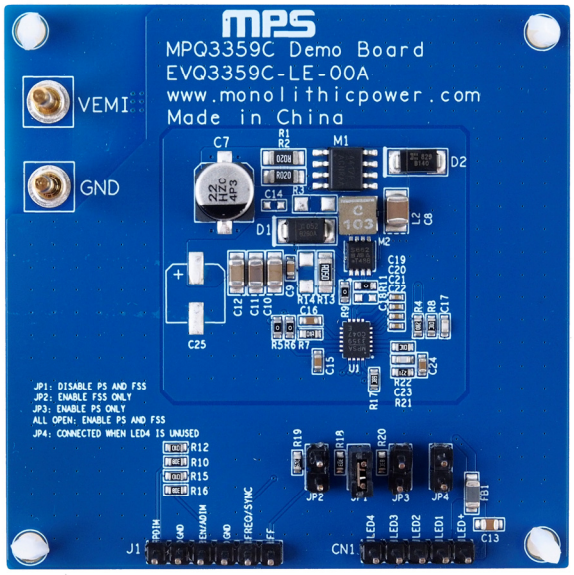
EVQ3359C-LE-00A EVALUATION BOARD



LxWxH (6.35cmx6.35cmx2cm)

Board Number	MPS IC Number
EVQ3359C-LE-00A	MPQ3359CGLE-AEC1 or MP3359CGLE

Note:

1) The default IC on the EVB is the MPQ3359CGLE-ACE1. If the MP3359CGLE is required, contact an MPS FAE to request this version.

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QUICK START GUIDE

1. Connect the LED load terminals (4 strings) to:
   a. Positive (+): LED+
   b. Negative (-): LED1, LED2, LED3, and LED4 (if LED4 is unused, just short JUMP JP4)
2. Connect the DC power supply (typically 12V) terminals to:
   a. Positive (+): VEMI
   b. Negative (-): GND
3. For pulse-width modulation (PWM) dimming, pull the EN/ADIM pin high to turn the MPQ3359C on, then apply a PWM signal with a minimum voltage below 0.5V and a maximum voltage exceeding 1.4V via the PDIM pin. It is recommended for the PWM signal frequency to be between 100Hz and 30kHz.
4. For analog dimming, pull the PDIM pin high and apply a PWM signal with a minimum voltage below 0.5V and a maximum voltage exceeding 1.4V via the EN/ADIM pin. It is recommended for the PWM signal frequency to be above 5kHz.

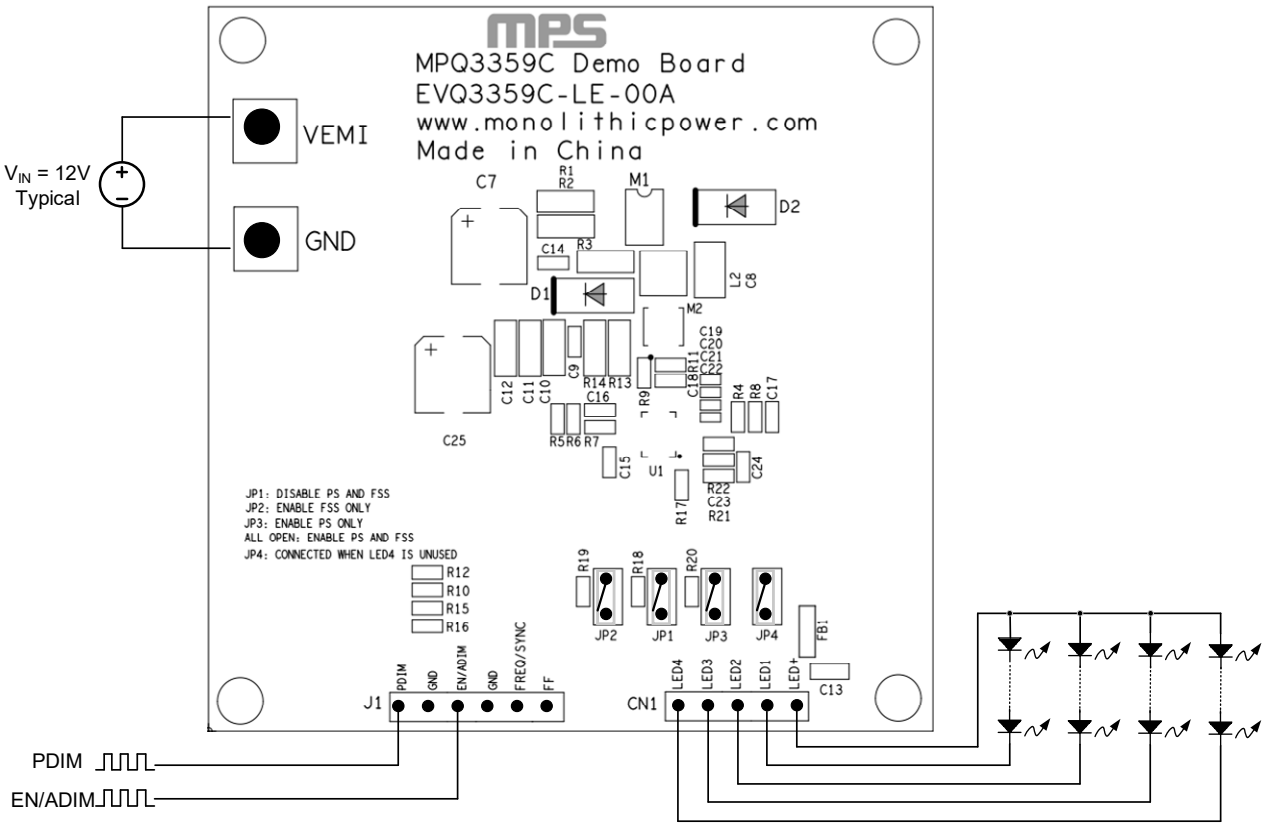

Figure 1: Measurement Equipment Set-Up

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EVALUATION BOARD SCHEMATIC

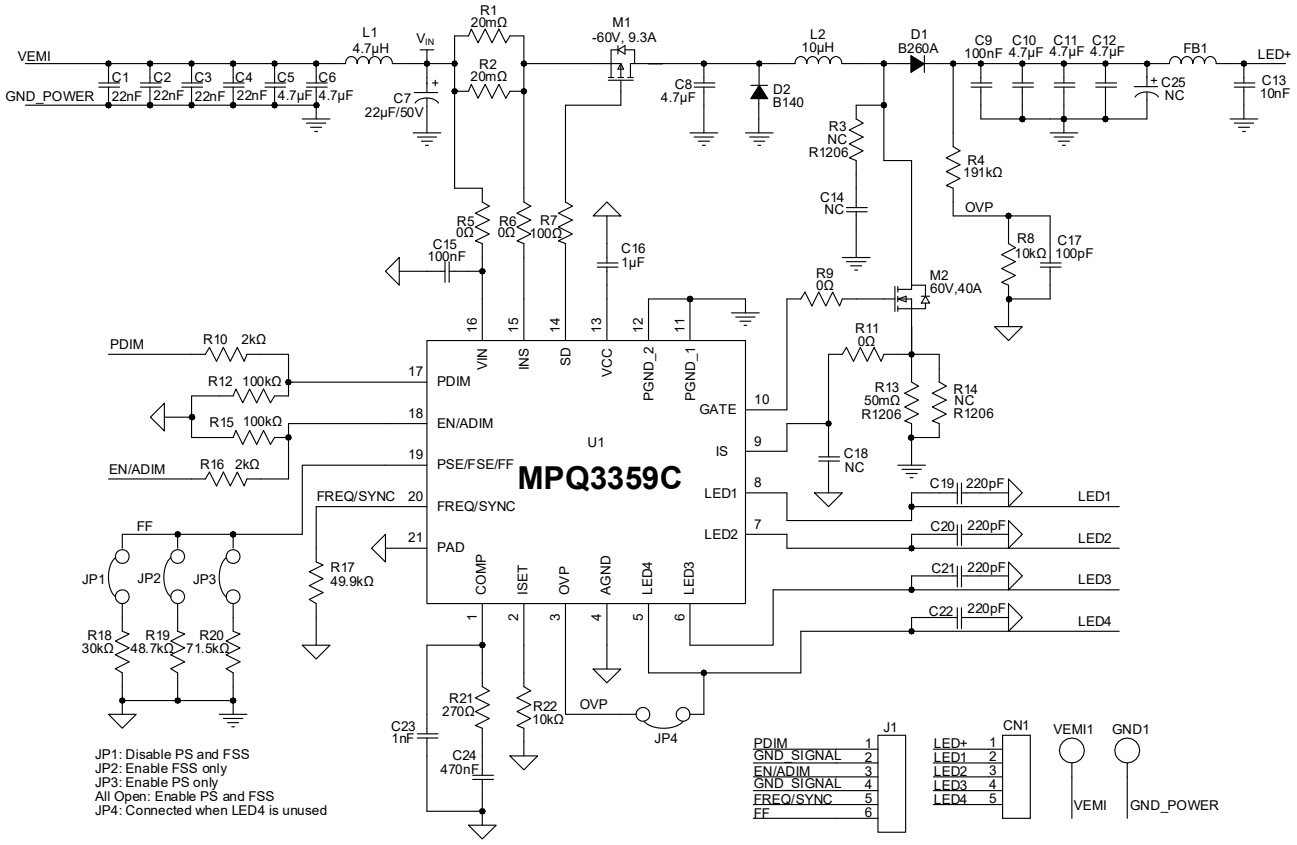

Figure 2: Evaluation Board Schematic

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EVQ3359C-LE-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
4	C1, C2, C3, C4	22nF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012206091
2	C5, C6	4.7µF	Ceramic capacitor, 50V, X7S	0805	Murata	GRM21BC71H475KE11L
1	C7	22µF	Electrolytic capacitor, 50V, SMD	SMD	Panasonic	EEHZC1H220P
1	C8	4.7µF	Ceramic capacitor, 50V, X7R	1210	Murata	GCM32ER71H475KA55L
2	C9, C15	100nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H104KA93D
3	C10, C11, C12	4.7µF	Ceramic capacitor, 50V, X7S	1206	Murata	GCM31CC71H475KA03L
1	C13	10nF	Ceramic capacitor, 50V, X7R	0805	TDK	C2012X7R1H103K
3	C14, C18, C25	NC				
1	C16	1µF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C105KA12D
1	C17	100pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H101JA01D
4	C19, C20, C21, C22	220pF	Ceramic capacitor, 50V, X7R	0402	Murata	GRM155R71H221KA01D
1	C23	1nF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H102JA01D
1	C24	470nF	Ceramic capacitor, 16V, X7R	0603	Murata	GCM188R71C474KA55D
1	D1	60V	Schottky diode, 2A	SMA	Diodes	B260A-13-F
1	D2	40V	Schottky diode, 1A	SMA	Diodes	B140-13-F
1	FB1	6A	Magnetic bead	1206	Murata	BLM31PG330SN1L
1	L1	4.7µH	Inductor, 44.1mΩ, 5.1A	SMD	Coilcraft	XEL4030-472MEB
1	L2	10µH	Inductor, 84mΩ, 3.1A	SMD	Coilcraft	XAL4040-103MEB
1	M1	-60V	P-channel MOSFET, 23mΩ, 9.3A	SO-8	Analog Power	AM4417P-T1-PF
1	M2	60V	N-channel MOSFET, 8.5mΩ, 8.7nC, 40A	PowerPAK 1212-8	Vishay	SIS862DN-T1-GE3
2	R1, R2	20mΩ	Film resistor, 1%	1206	Yageo	RL1206FR-070R02L
2	R3, R14	NC				
1	R4	191kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07191KL
4	R5, R6, R9, R11	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R7	100Ω	Film resistor, 1%	0603	Yageo	RC0603FR-07100RL
2	R8, R22	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
2	R10, R16	2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-072KL
2	R12, R15	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R13	50mΩ	Film resistor, 1%	1206	Yageo	RL1206FR-070R05L

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EVQ3359C-LE-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	R17	49.9kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0749K9L
1	R18	30kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0730KL
1	R19	48.7kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0748K7L
1	R20	71.5kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0771K5L
1	R21	270Ω	Film resistor, 1%	0603	Yageo	RC0603FR-07270RL
6	CN1, J1, JP1, JP2, JP3, JP4	2.54mm	Connector header, 180°	DIP	Any	
2	VEMI1, GND1	2mm	Golden pin	DIP	Any	
1	U1	MPQ3359C-AEC1 or MP3359C	1/2/3/4-channel, step-up boost WLED controller, AEC-Q100 available	QFN-20 (3mmx 4mm)	MPS	MPQ3359CGLE-AEC1 or MP3359CGLE

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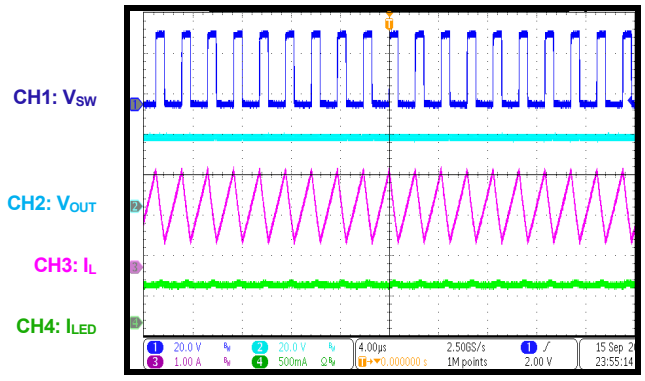
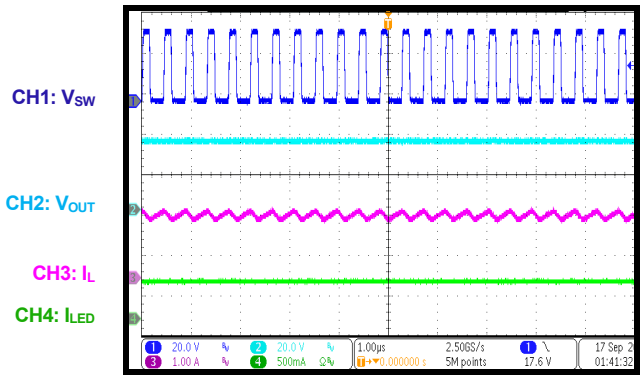
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. V_{IN} = 12V, 4 strings, 12 LEDs in series, 120mA/string, L = 15µH, f_{SW} = 440kHz, T_A = 25°C, unless otherwise noted.

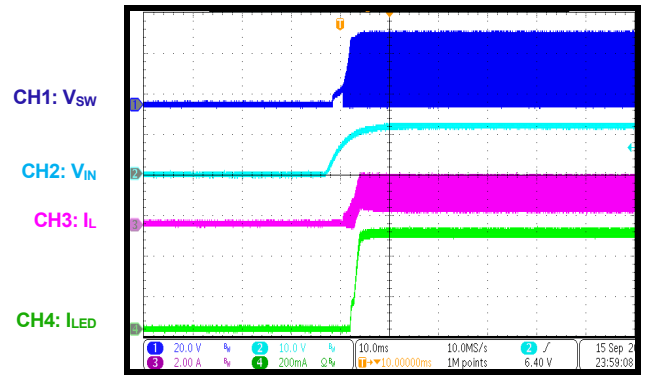
Steady State
f_{SW} = 440kHz



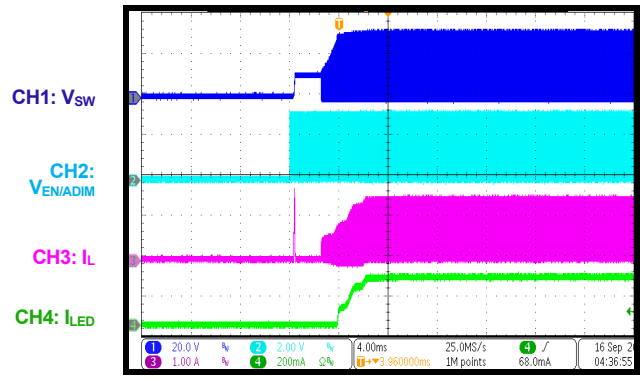
Steady State
f_{SW} = 2.2MHz



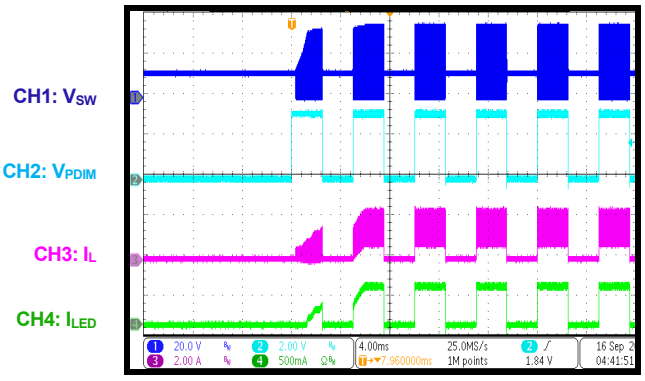
Start-Up through VIN



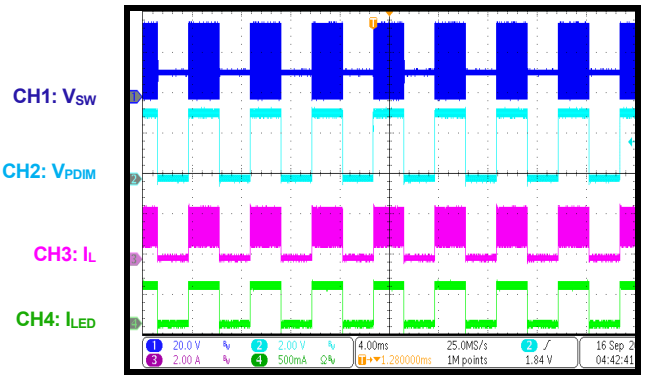
Start-Up through EN/ADIM
$f_{EN/ADIM}$ = 10kHz, $D_{EN/ADIM}$ = 50%



Start-Up through PDIM
f_{PDIM} = 200Hz, D_{PDIM} = 50%



PWM Dimming
f_{PDIM} = 200Hz, D_{PDIM} = 50%



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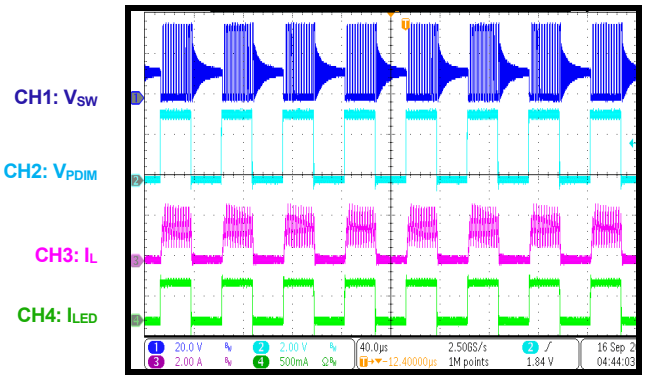
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 12V, 4 strings, 12 LEDs in series, 120mA/string, L = 15µH, f_{SW} = 440kHz, T_A = 25°C, unless otherwise noted.

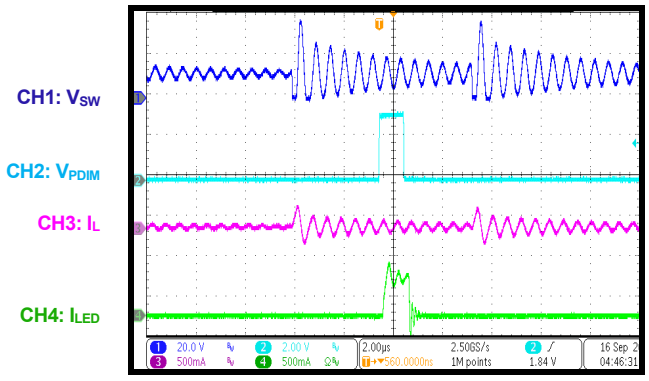
PWM Dimming

f_{PDIM} = 20kHz, D_{PDIM} = 50%



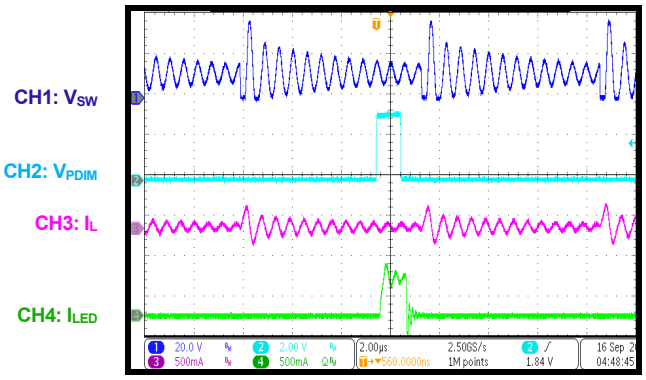
PWM Dimming

f_{PDIM} = 200Hz, D_{PDIM} = 0.02%



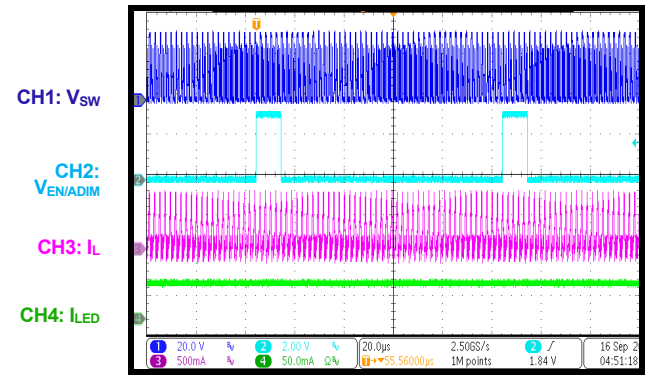
PWM Dimming

f_{PDIM} = 100Hz, D_{PDIM} = 0.01%



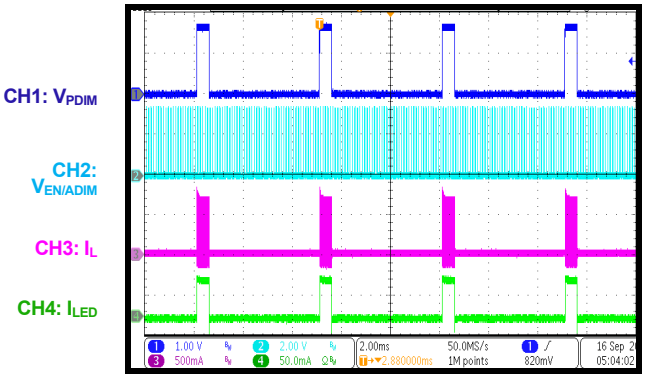
Analog Dimming

$f_{EN/ADIM}$ = 10kHz, $D_{EN/ADIM}$ = 10%



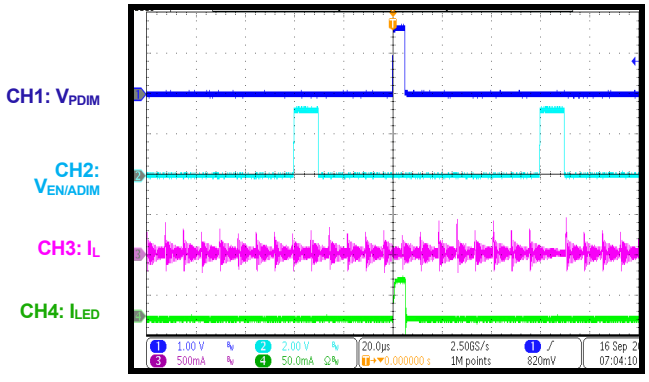
Both PWM Dimming and Analog Dimming

f_{PDIM} = 200Hz, D_{PDIM} = 10%, $f_{EN/ADIM}$ = 10kHz, $D_{EN/ADIM}$ = 10%



Both PWM Dimming and Analog Dimming

f_{PDIM} = 200Hz, D_{PDIM} = 0.1%, $f_{EN/ADIM}$ = 10kHz, $D_{EN/ADIM}$ = 10%



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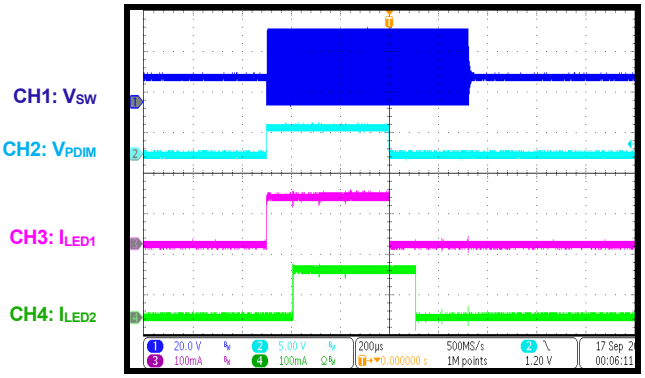
EVB TEST RESULTS *(continued)*

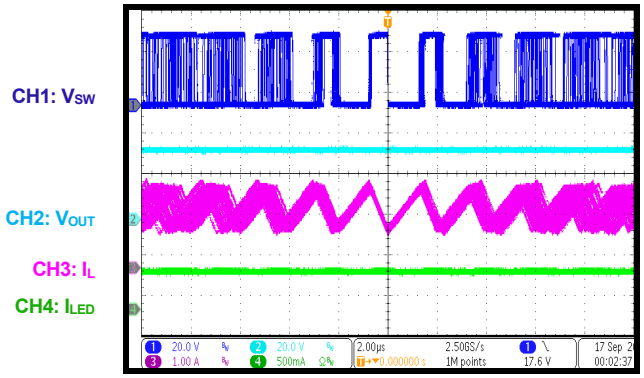
Performance waveforms are tested on the evaluation board. V_{IN} = 12V, 4 strings, 12 LEDs in series, 120mA/string, L = 15µH, f_{SW} = 440kHz, T_A = 25°C, unless otherwise noted.

PWM Dimming with 100µs Delay Time Function

f_{PDIM} = 200Hz, D_{PDIM} = 10%

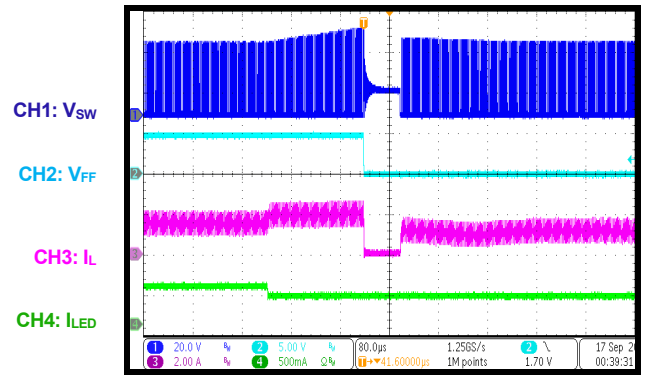


Frequency Spread Spectrum



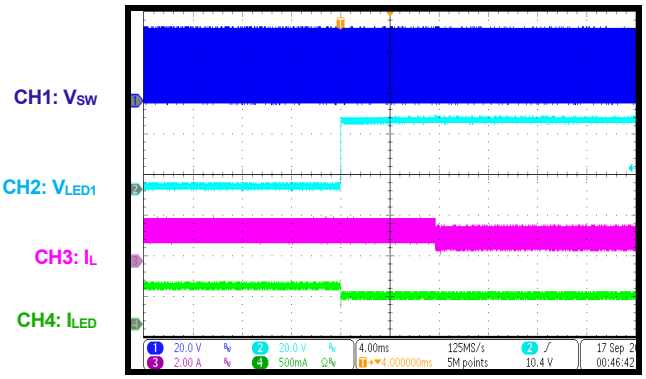
LED Open Protection

Open LED1 under normal operation



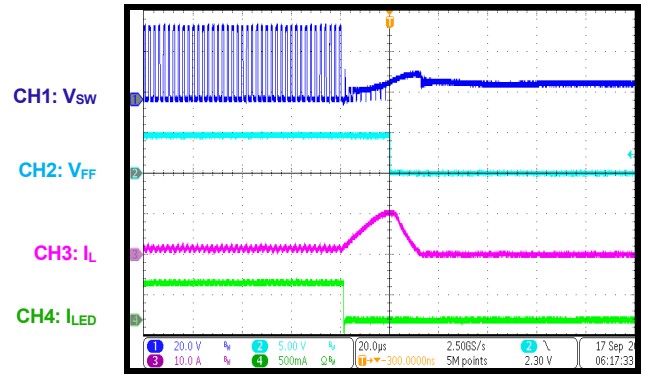
LED Short Protection

Short LED1 under normal operation

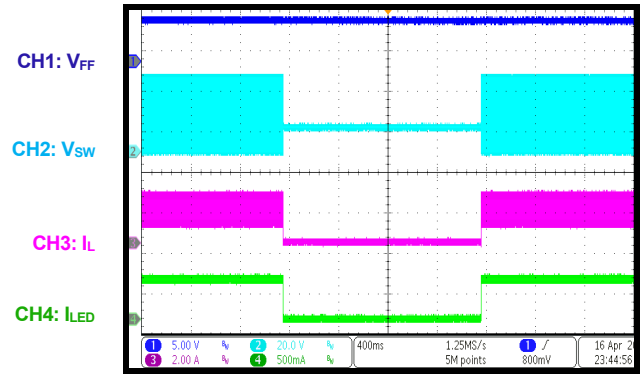


Short VOUT to GND Protection

Set the input OCP threshold = 10A



Over-Temperature Protection



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PCB LAYOUT

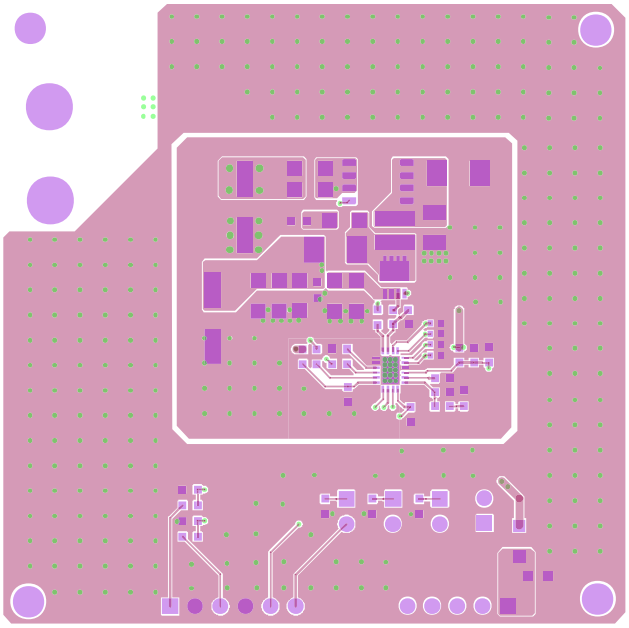

Figure 3: Top Layer

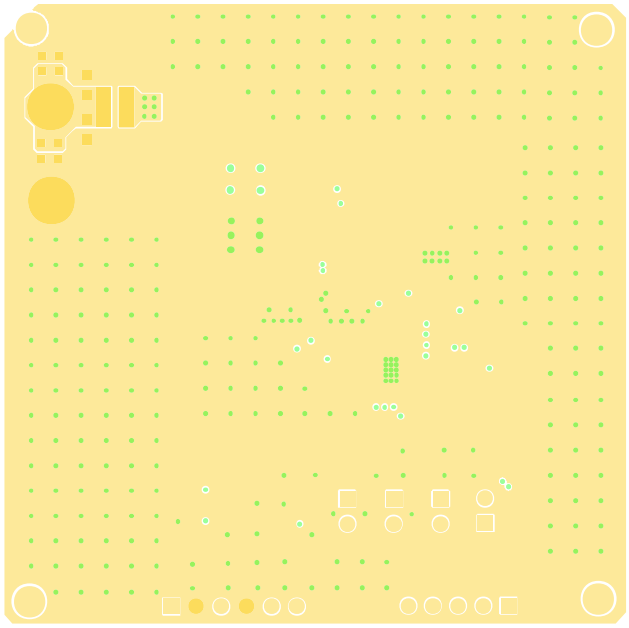

Figure 4: Mid-Layer 1

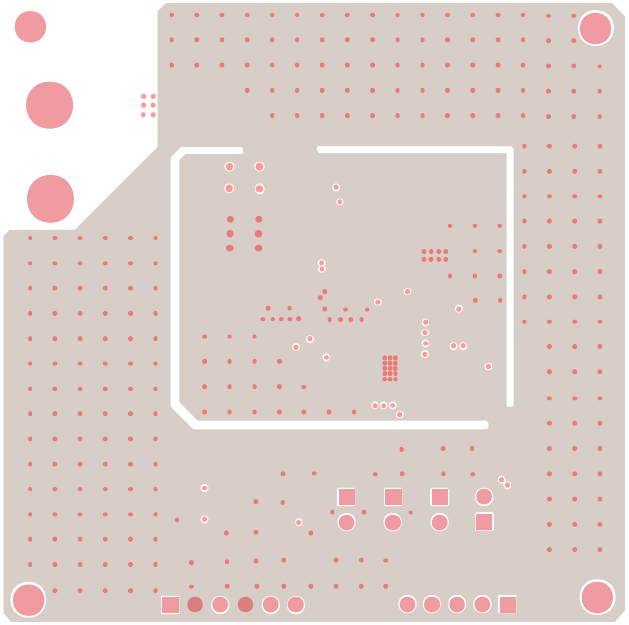

Figure 5: Mid-Layer 2

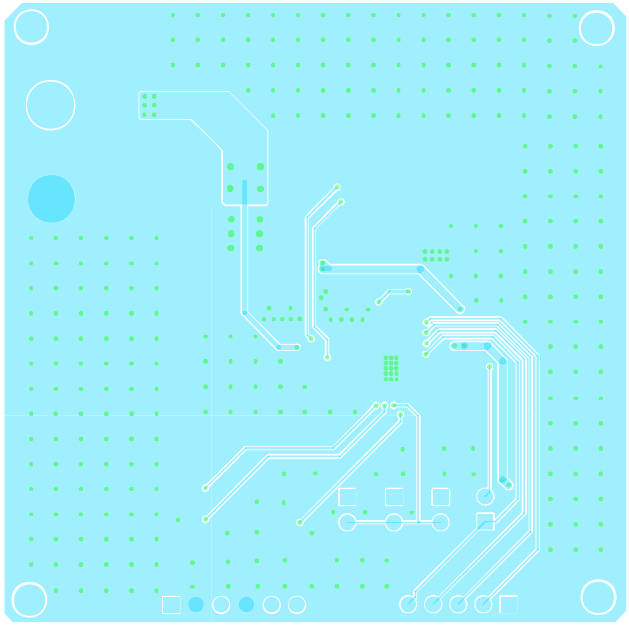

Figure 6: Bottom Layer

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	12/12/2025	Initial Release	-

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