EVQ3621-QQE-00A

48-Channel, Max 50mA/Ch, LED Driver with Independent Analog and PWM Dimming Evaluation Board, AEC-Q100

DESCRIPTION

The EVQ3621-QQE-00A evaluation board is designed to demonstrate the capabilities of the MPQ3621, a 48-channel LED driver with a 12V voltage rating and maximum 50mA current sources. It is designed to drive the LED arrays as local dimming backlighting in automotive LCD panels.

The MPQ3621 employs low headroom to regulate the LED current (I_{LEDx}, where x = 1–48). The adaptive voltage feedback function optimizes the LED voltage, which achieves higher system efficiency.

The MPQ3621 supports independent 16-bit pulse-width modulation (PWM) and 7-bit analog dimming for each channel via the serial interface. The configurable internal registers provide reliable and flexible application. The 25MHz serial interface clock guarantees a high data transfer rate for multiple devices operating in a daisy chain application.

Robust protections are included to guarantee safe operation of the device. Protection modes include LED open protection, LED short protection, and over-temperature protection (OTP). All fault statuses can be read through the serial interface.

The MPQ3621 is available in a QFN-68 (8mmx8mm) package. It is available in AEC-Q100 Grade 0.

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		3.5V to 11V
LED channels	Each channel can be enabled and disabled via the SPI interface	48 channels
Maximum LED current (I_{LEDx}, where x = 1–48)	IMAX[2:0] = 100b	50mA per channel
PCLK frequency (f_{PCLK})	CLKM pin floating, PCLK pin has clock input	≤30MHz
	PCLK pin floating, CLKM pin has a resistor	Selectable (5MHz, 10MHz, or 20MHz)
SPI clock frequency (f_{SCLK})		≤25MHz

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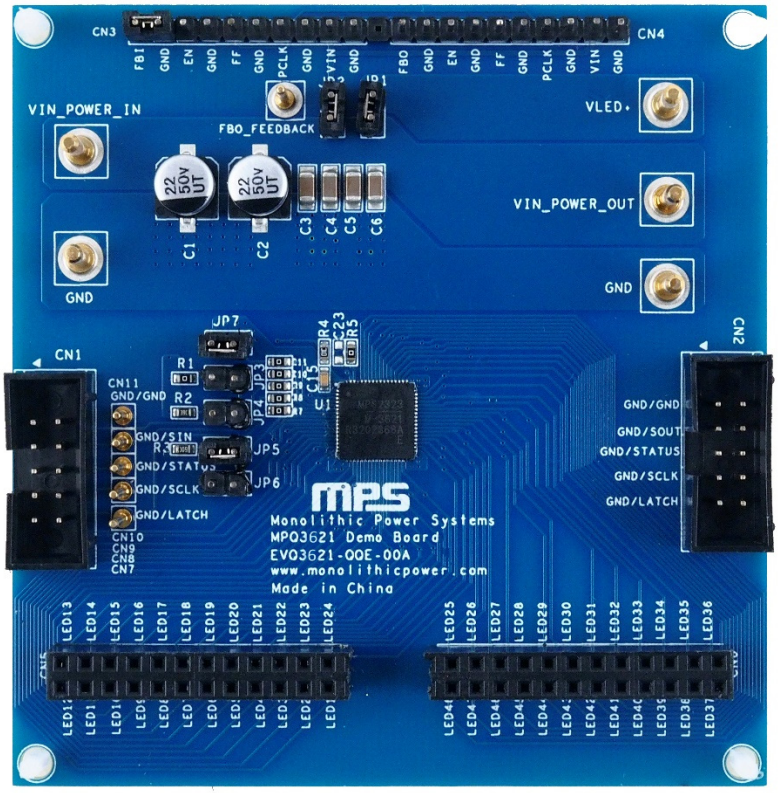
EVQ3621-QQE-00A EVALUATION BOARD



LxWxH (8.1cmx8.3cmx2cm)

Board Number	MPS IC Number
EVQ3621-QQE-00A	MPQ3621GQQE-AEC1

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QUICK START GUIDE

The EVQ3621-QQE-00A evaluation board is easy to set up and use to evaluate the performance of the MPQ3621. To use the evaluation board, follow the steps below:

1. Short JP2 to connect VIN_POWER_IN to the IC's VIN pin.
2. Short one of the jumpers (JP3, JP4, or JP5) to use the internal PCLK. Short the jumper to enable the target internal PCLK:
   a. JP3: 5MHz
   b. JP4: 10MHz
   c. JP5: 20MHz
3. Short JP6 to set the IC to leader mode if the adaptive feedback control (AFC) function is enabled.
4. Short JP7 to connect the IC's SOUT pin to the host's MISO pin.
5. Connect the LED load terminals (48 strings) (1) to:
   a. Positive (+): VIN_POWER_OUT
   b. Negative (-): LED1~LED48
6. Preset the voltage source placed between the VIN_POWER_IN and GND terminals to be between 3V and 12V, according to the LED load condition.
7. Pull the EN pin high to enable the device.
8. Connect the SIN, SCLK, LATCH, SOUT, and GND pins of the evaluation board to the MOSI, SCK, CS, MISO, and GND pins of the serial peripheral interface (SPI) communication kit, respectively. (1)
9. Configure the registers by using the MPQ3321's GUI via the SPI interface. (2)

Notes:

1) Contact an MPS FAE to obtain the LED load board and SPI communication kit.
2) Use the MPQ3321 GUI to control the MPQ3621. For more details on configuring the registers during evaluation, contact an MPS FAE to obtain the MPQ3321 GUI configuration tool.

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EVALUATION BOARD SCHEMATIC

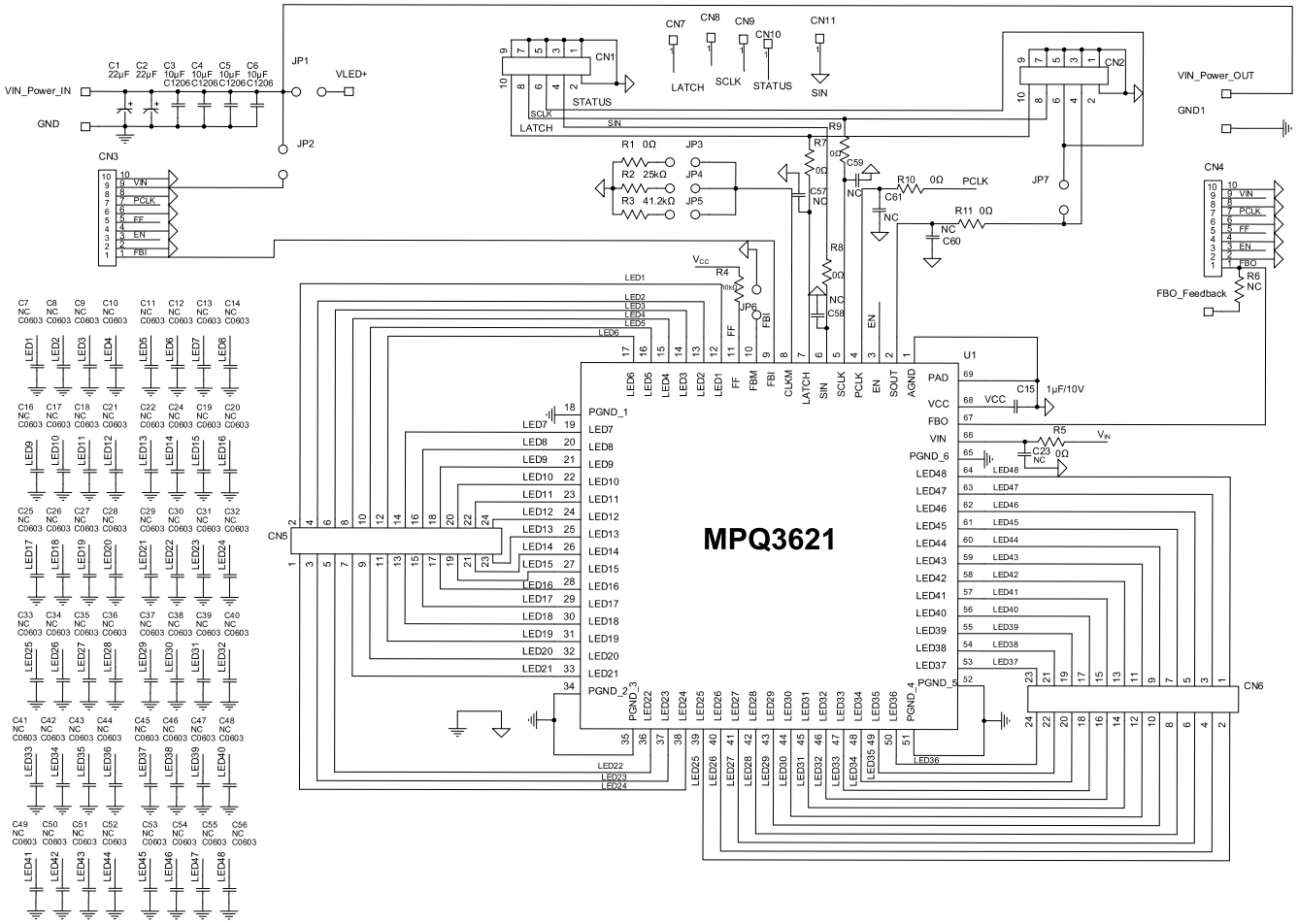

Figure 1: Evaluation Board Schematic

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EVQ3621-QQE-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
24	CN1, CN2, CN3, CN4, CN5, CN6, CN7, CN8, CN9, CN10, CN11, FBO_Feedback, GND1, VLED+, VIN_Power_OUT, VIN_Power_IN, GND, JP1, JP2, JP3, JP4, JP5, JP6, JP7	2.54mm	Connector, 180°	CONN/TP	Custom (3)	
2	C1, C2	22µF	Capacitor, 50V, SMD	SMD	Panasonic	EEHZC1H220P
4	C3, C4, C5, C6	10µF	Capacitor, 25V, X7R	1206	Wurth	885012208069
54	C7, C8, C9, C10, C11, C12, C13, C14, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61	NC				
1	C15	1µF	Capacitor, 10V, X7R	0603	Wurth	885012206026
7	R1, R5, R7, R8, R9, R10, R11	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R2	24.9kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0724K9L
1	R3	41.2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0741K2L
1	R4	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R6	NC	Film resistor, 1%	0603		
1	U1	MPQ3621-AEC1	48-channel, 50mA/ch LED driver	QFN-68 (8mmx 8mm)	MPS	MPQ3621GQQE-AEC1

Note:

3) MPS custom-produces these pins. Contact an MPS FAE for details.

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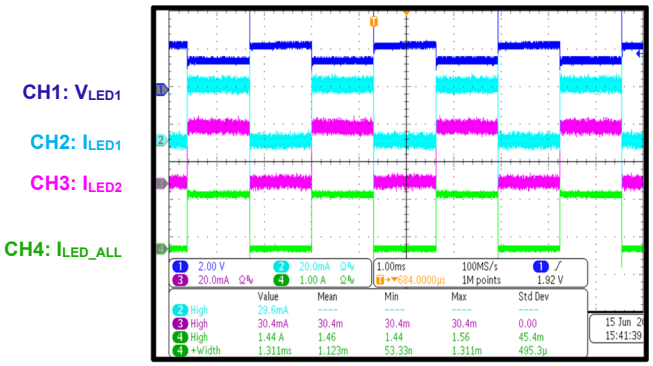
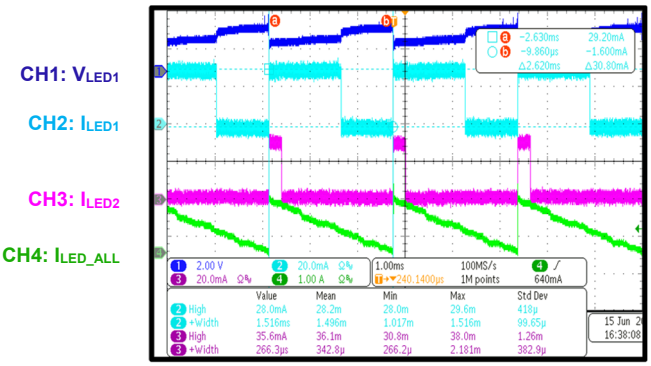
EVB TEST RESULTS

V_{IN} = 4V, f_{PCLK} = 25MHz, PDB = 16-bit, I_{MAX} = 30mA/ch, LED = 48P1S, T_A = 25°C, unless otherwise noted.

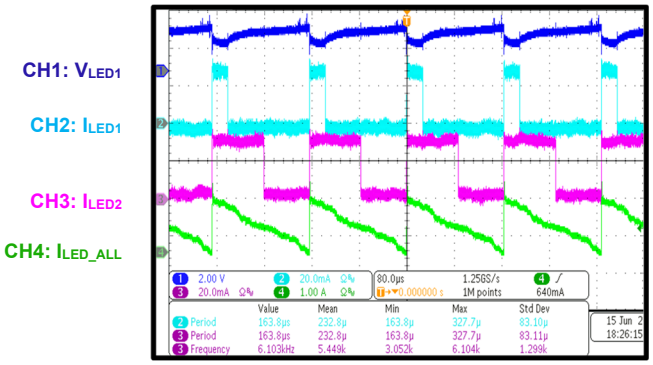
PWM Dimming
PWM duty cycle = 50% for each channel



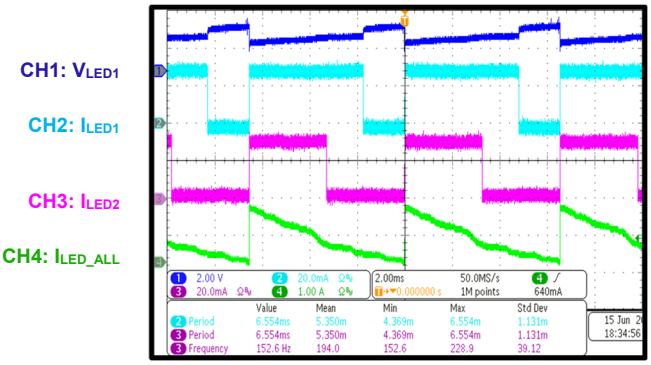
PWM Dimming
Random duty cycle for each channel



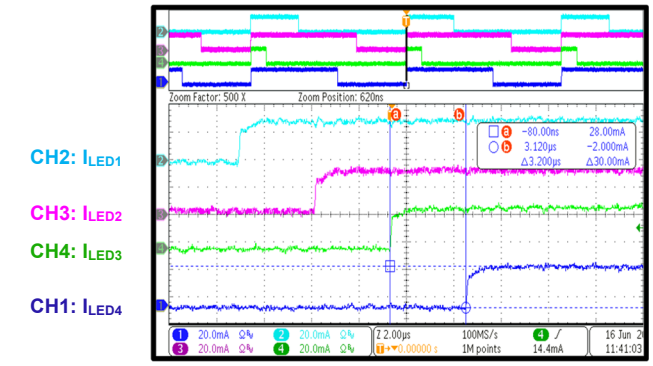
PWM Dimming
PDB = 12-bit, random duty for each channel



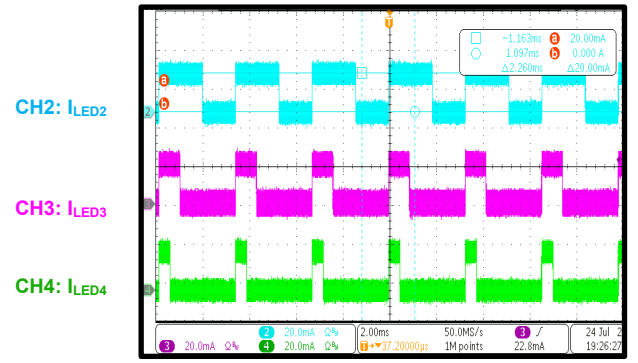
PWM Dimming
f_{PCLK} = 10MHz, random duty cycle for each channel



PWM Dimming
f_{PCLK} = 20MHz, phase shift = 64pclk, time delay = 3.2µs



Analog Dimming
I_{MAX} = 20mA/ch, I_{LED} = 100% for each channel



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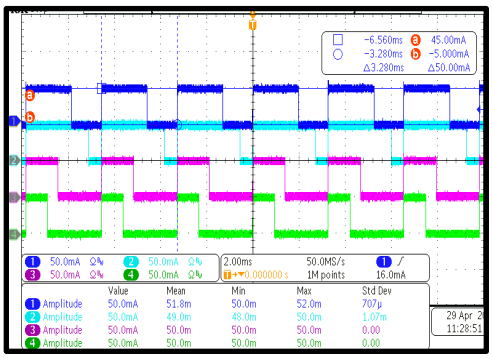
EVB TEST RESULTS *(continued)*

V_{IN} = 4V, f_{PCLK} = 25MHz, PDB = 16-bit, I_{MAX} = 30mA/ch, LED = 48P1S, T_A = 25°C, unless otherwise noted.

Analog Dimming

I_{MAX} = 50mA/ch, I_{LED} = 100% for each channel

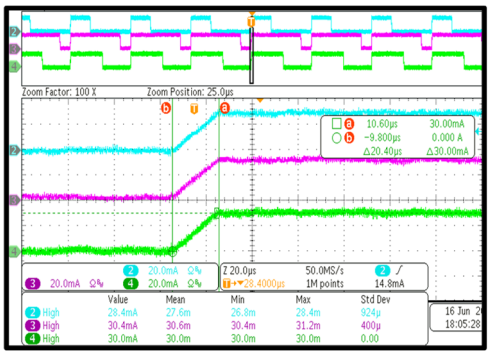
CH1: I_{LED1}
CH2: I_{LED2}
CH3: I_{LED3}
CH4: I_{LED4}



Analog Dimming

Slew rate = 4pclk/step

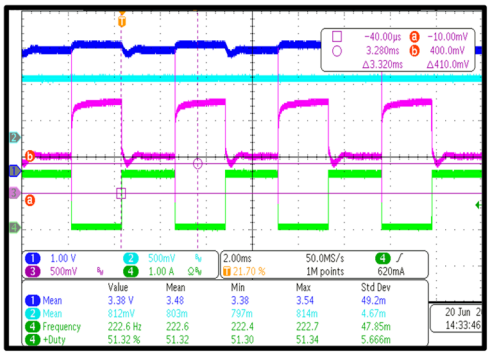
CH2: I_{LED1}
CH3: I_{LED2}
CH4: I_{LED3}



Adaptive Feedback Control (AFC)

Headroom = 300mV and
hysteresis = 200mV,
PWM duty cycle = 51.32%,
slew rate = 1pclk/step

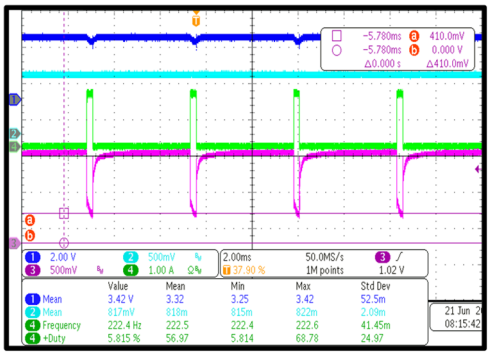
CH2: V_{FBO}
CH1: V_{LED}
CH3: V_{LED1}
CH4: I_{LED1}



Adaptive Feedback Control (AFC)

Headroom = 300mV and
hysteresis = 200mV,
PWM duty cycle = 5.82%,
phase shift = 1pclk

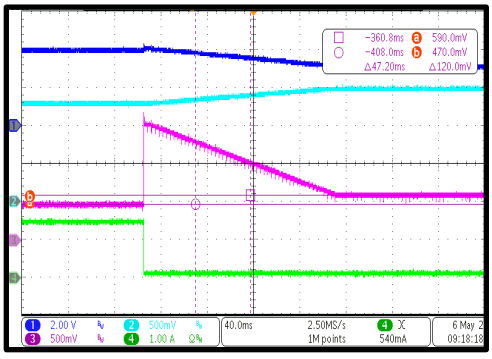
CH1: V_{LED}
CH2: V_{FBO}
CH4: I_{LED1}
CH3: V_{LED1}



Adaptive Feedback Control (AFC)

Headroom = 300mV and
hysteresis = 200mV,
I_{MAX} = 30mA/string, I_{LED} from 100% to 5%

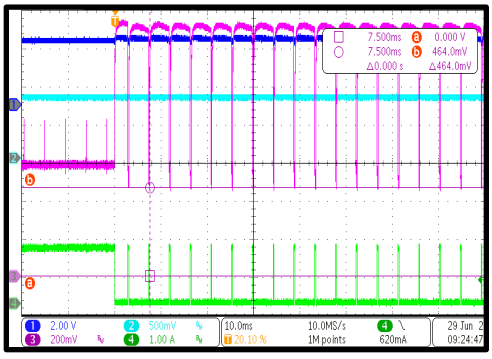
CH1: V_{LED}
CH2: V_{FBO}
CH3: V_{LED1}
CH4: I_{LED_TOTAL}



Adaptive Feedback Control (AFC)

I_{MAX} = 30mA/string, PWM duty cycle from 100% to 5%, I_{LED} = 100%

CH1: V_{LED}
CH2: V_{FBO}
CH3: V_{LED1}
CH4: I_{LED_TOTAL}



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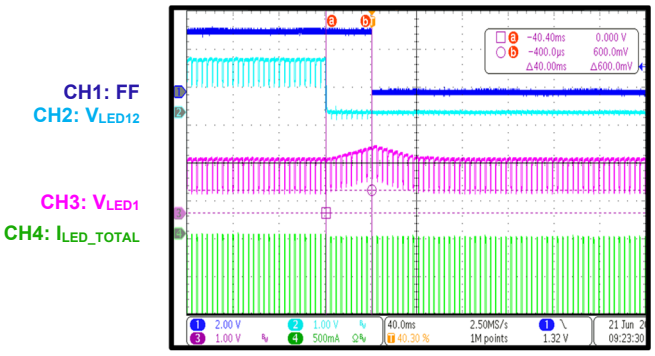
EVB TEST RESULTS *(continued)*

V_{IN} = 4V, f_{PCLK} = 25MHz, PDB = 16-bit, I_{MAX} = 30mA/ch, LED = 48P1S, T_A = 25°C, unless otherwise noted.

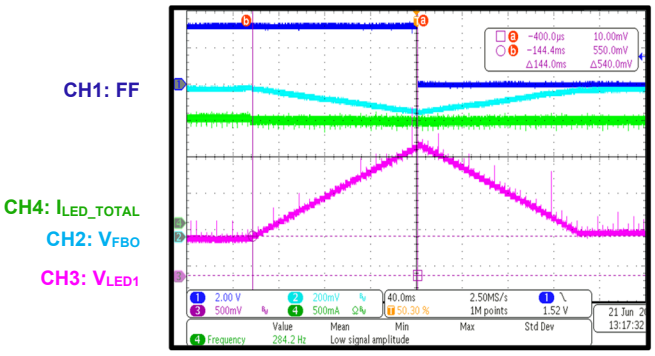
LED Open Protection

OPS = 8 steps, open channel 12



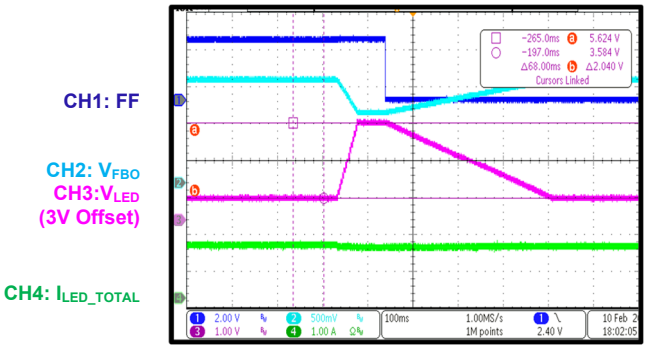
LED Open Protection

OPS = 32 steps, open channel 12



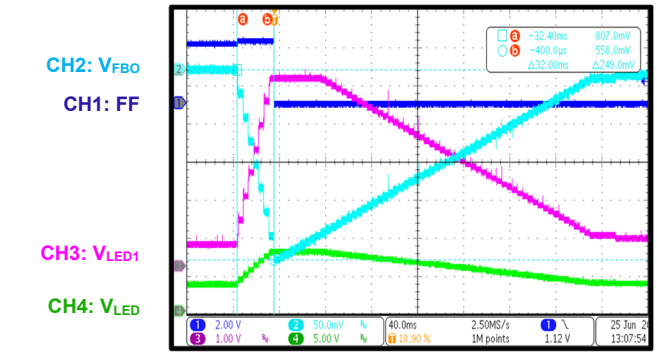
LED Open Protection

OVP = 5.5V, open channel 6



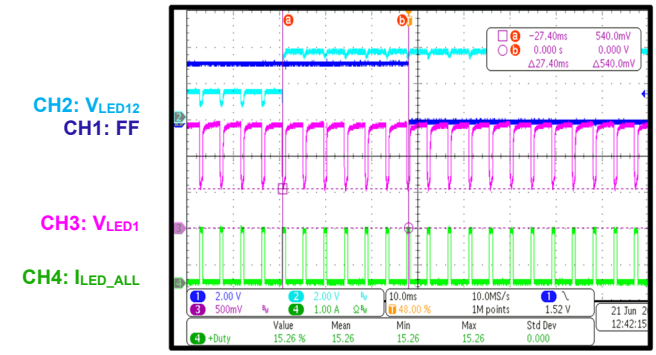
LED Open Protection

Step up = 8 steps, open channel 12

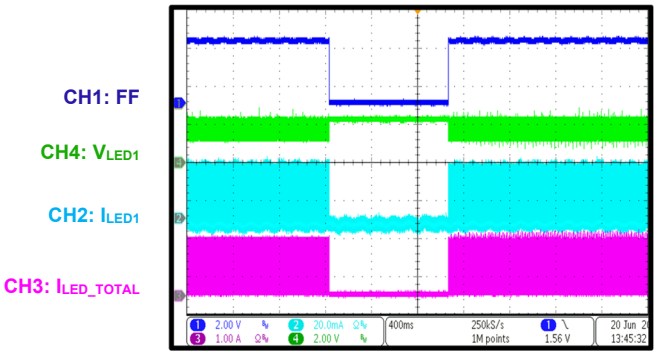


LED Short Protection

Short channel 12



Over-Temperature Protection



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PCB LAYOUT

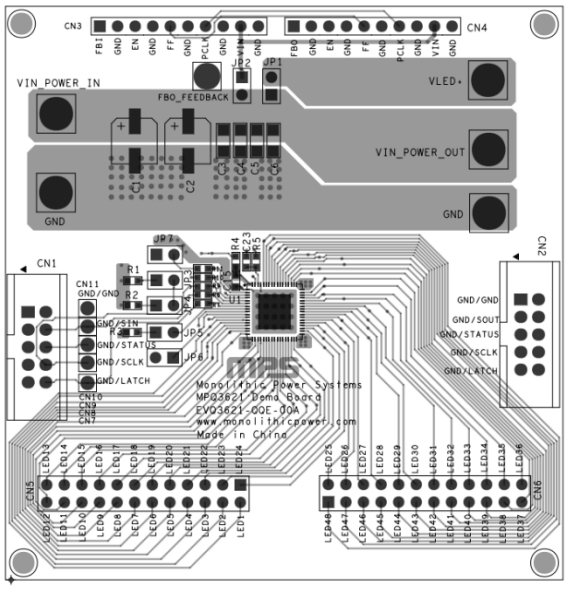

Figure 2: Top Layer

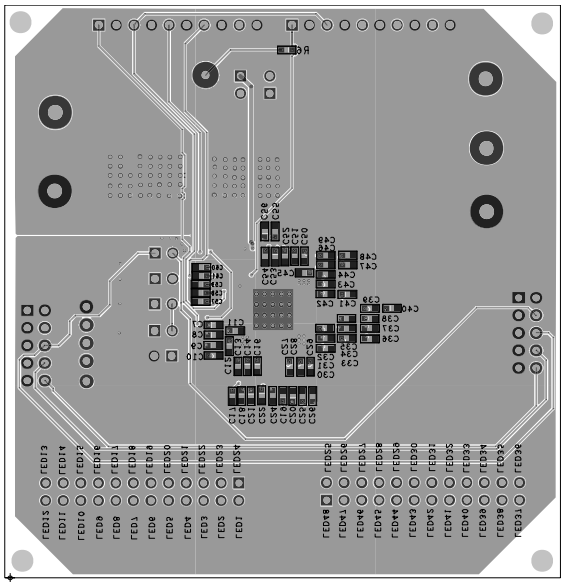

Figure 3: Bottom Layer

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	12/1/2025	Initial Release	-

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