EVQ3322-QKE-00A

24-Channel, Max 100mA/Ch, LED Driver with Independent PWM and Analog Dimming Evaluation Board, AEC-Q100

DESCRIPTION

The EVQ3322-QKE-00A evaluation board is designed to demonstrate the capabilities of the MPQ3322, a 24-channel LED driver with a 24V voltage rating and maximum 100mA current source. It is designed to drive the LEDs as backlighting, RGB lighting, and interior ambient lighting in automotive LCD panels and lamps.

The MPQ3322 employs a low headroom voltage to regulate the LED current (I_{LED}), and provides the feedback voltage (V_{FB}) for previous power stages to optimize the output voltage (V_{OUT}) for LED strings, which help achieve higher system efficiency.

The MPQ3322 supports independent 12-bit pulses-width modulation (PWM) and 6-bit analog dimming for each channel via a based-CAN differential interface. The resistor on the ISET pin (R_{ISET}) configures the maximum I_{LED} amplitude.

Robust protections are included to guarantee safe device operation. These protections include LED open protection, LED short protection (threshold configurable via internal registers), and over-temperature protection (OTP). All fault statuses can be read via the CAN interface. Additionally, the failsafe function ensures that MPQ3322 remains operating in a preset state if communication information is lost.

The FF pin and single lamp mode (SLM) support single-IC and multi-IC applications for two fault statuses. In the event of a failure, the IC either turns off only the failed LED string or shuts down all channels if one channel has failed.

The MPQ3322 is available in a QFN-40 (6mmx6mm) package, and 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_IC}) range		3.5V to 22V
Buck input voltage (V_{IN_BUCK}) range		10V to 36V
LED channels	Each channel can be enabled/disabled via the CAN interface	24 channels
Maximum LED current (I_{LED})	R_{ISET} = 100kΩ	20mA per channel

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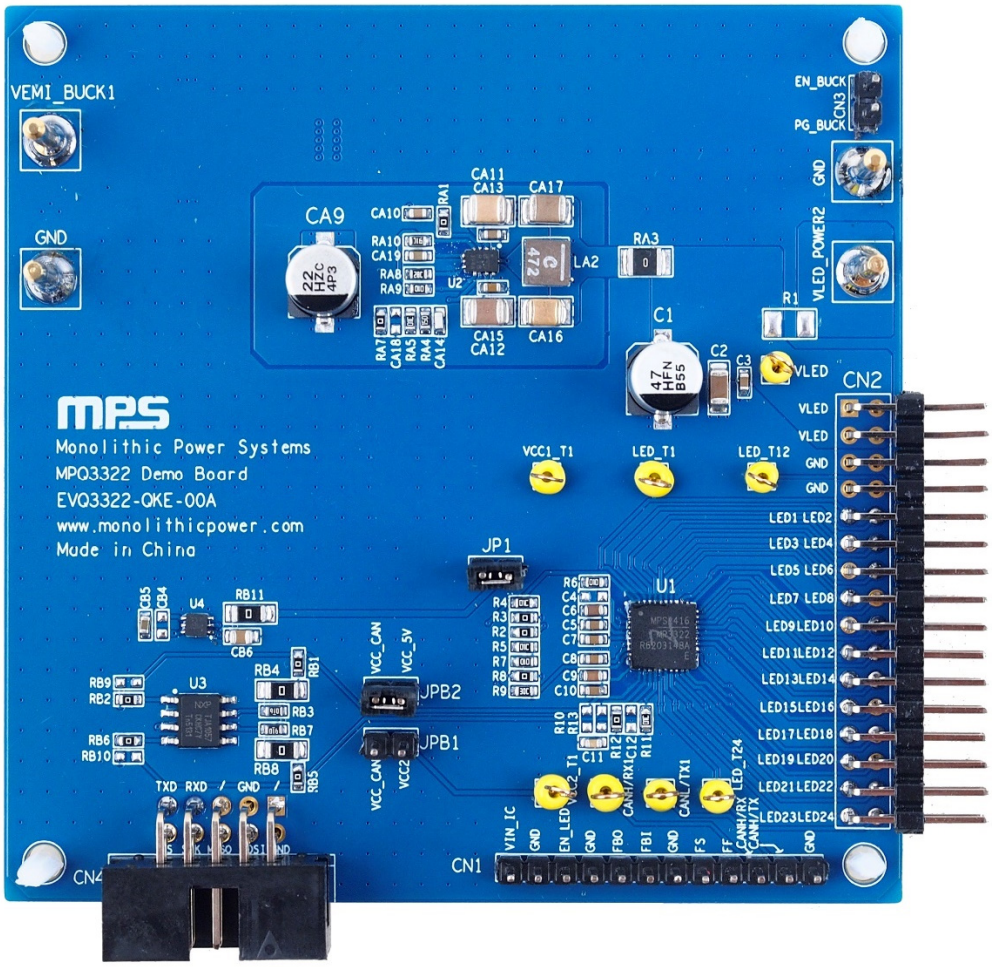
EVQ3322-QKE-00A EVALUATION BOARD



LxWxH (8.1cmx8.3cmx2cm)

Board Number	MPS IC Number
EVQ3322-QKE-00A	MPQ3322GQKE-0000-AEC1

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QUICK START GUIDE

The EVQ3322-QKE-00A evaluation board is easy to set up and use to evaluate the performance of the MPQ3322. To use the evaluation board, follow the steps below:

1. Short JPB2 to connect VCC_5V to the CAN transceiver's VCC pin.
2. If VLED is selected as MPQ3322's power source, short JP1. Otherwise, provide an independent 6V to 22V power supply to the MPQ3322's input voltage (V_{IN_IC}).
3. If the LED string is powered by an external source instead of using the board's built-in buck converter, install a 0Ω resistor on R1 and pull the EN_BUCK pin low. If the board's built-in buck converter is used, provide a 10V to 36V power supply between the VEMI_BUCK1 and GND1 pins.
4. Connect the LED load terminals (24 strings) to: (1)
   a. Positive (+): VLED
   b. Negative (-): LED1~LED24
5. Set the voltage source between VIN_IC and GND to a value between 6V and 22V. If VIN_IC is powered with a supply below 6V, ensure that the CAN transceiver receives a stable 5V power supply.
6. Pull the EN pin high to enable the device.
7. Connect the evaluation board's CN4 ports to the serial peripheral interface (UART) communication kit, respectively. (2)
8. Configure the registers via the CAN interface using the MPQ3322 GUI. (3)

Notes:

1) Contact an MPS FAE to obtain the LED panel matched with the EVB.
2) Contact an MPS FAE to obtain the UART communication kit.
3) Contact an MPS FAE to obtain the MPQ3322 GUI configuration tool and for more details on configuring registers during evaluation.

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EVALUATION BOARD SCHEMATIC

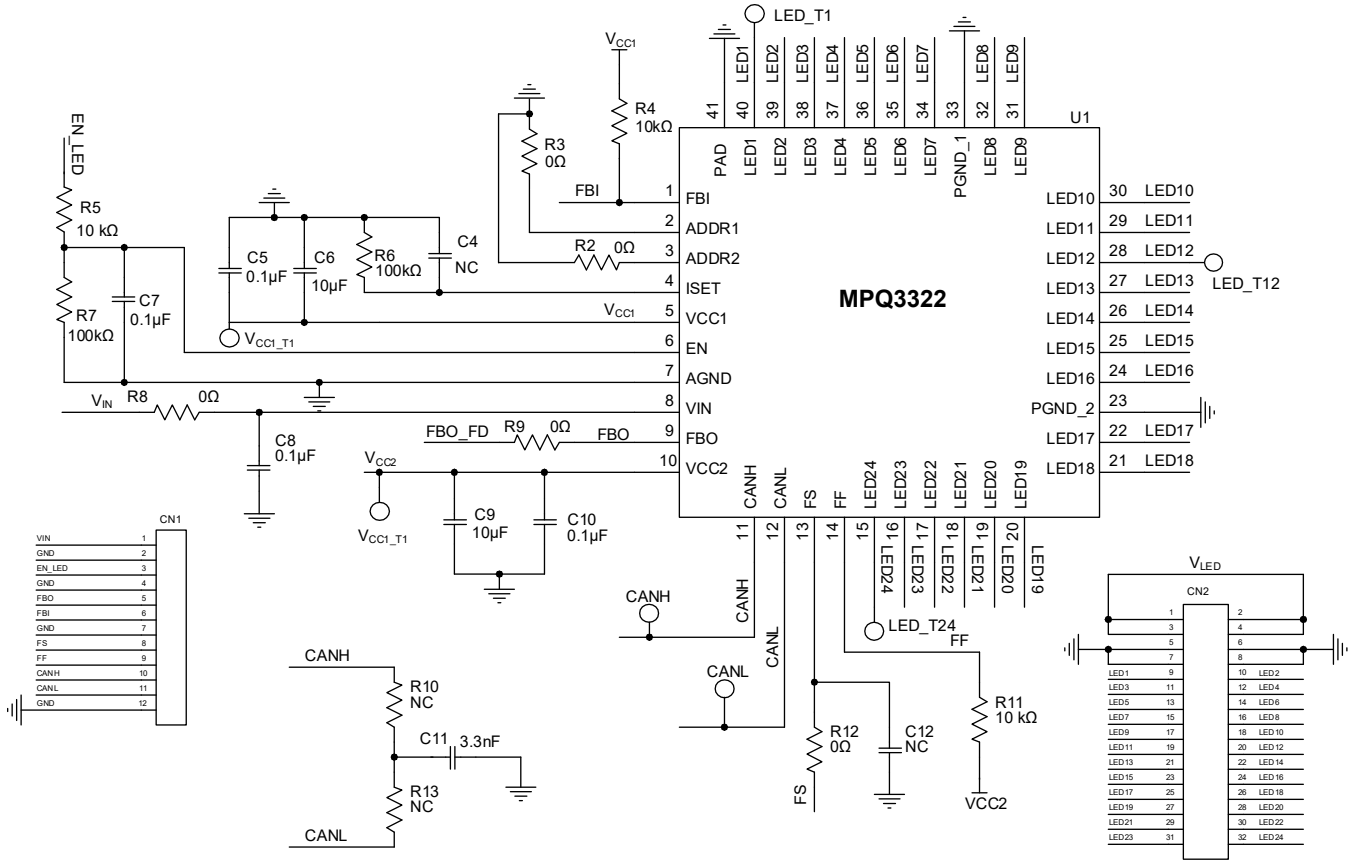

Figure 1: Evaluation Board Schematic

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EVALUATION BOARD SCHEMATIC *(continued)*

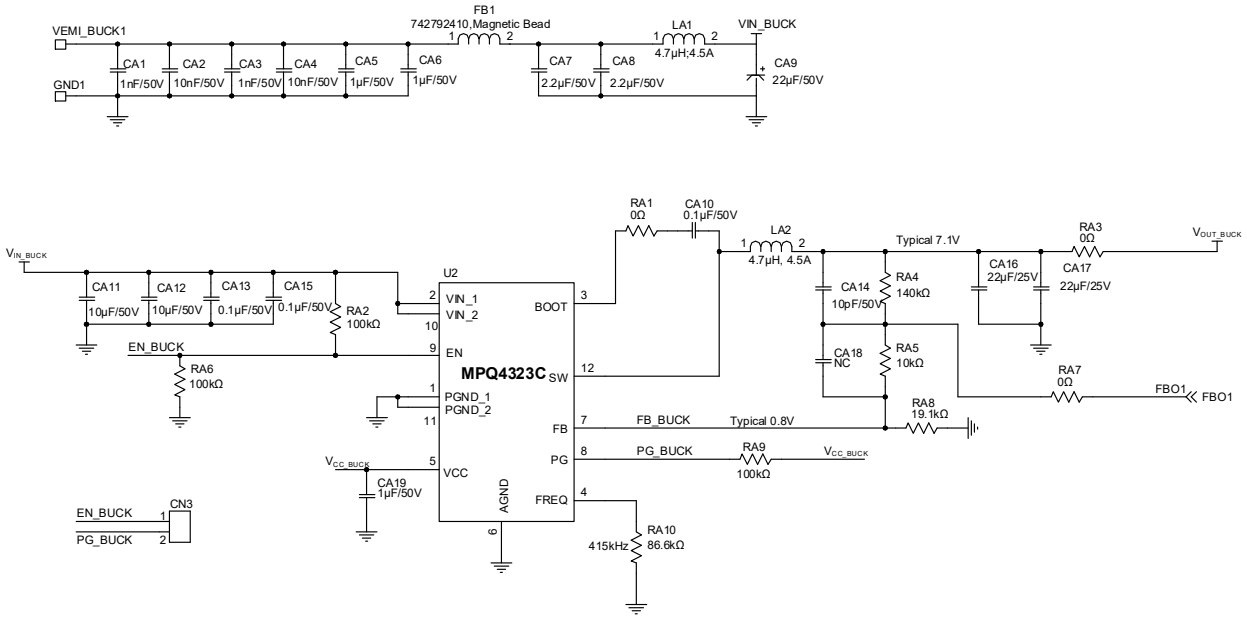

Figure 2: Evaluation Board Schematic (Buck)

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EVALUATION BOARD SCHEMATIC *(continued)*

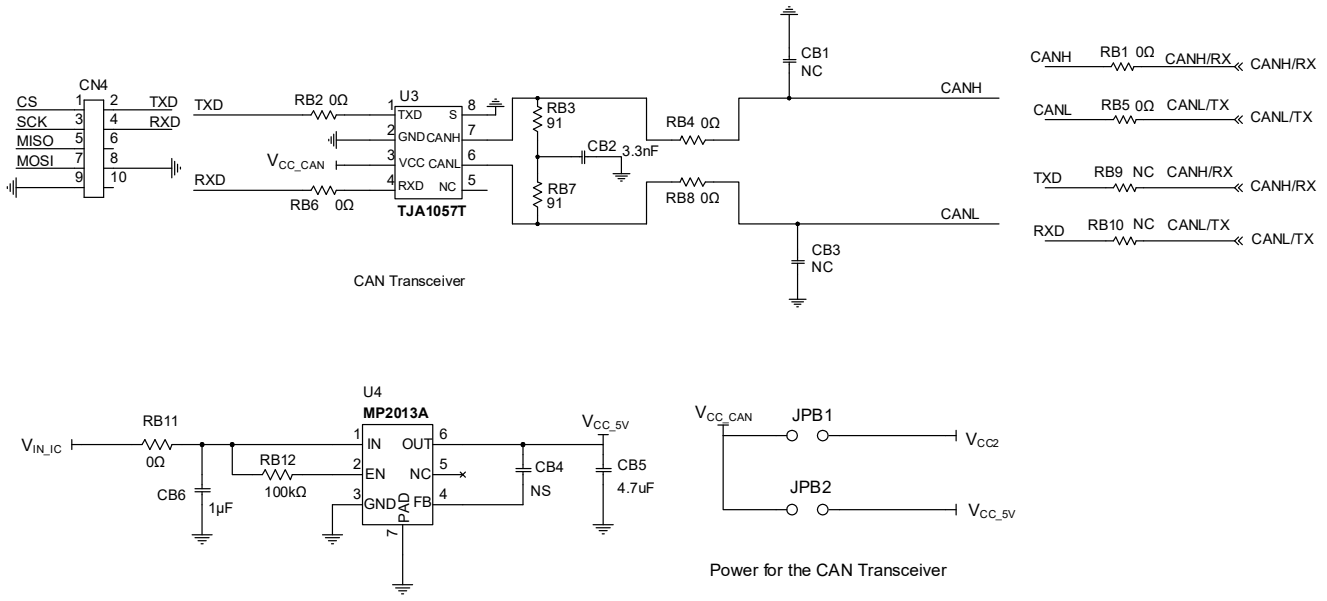

Figure 3: Evaluation Board Schematic (CAN Transceiver)

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EVQ3322-QKE-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	CA1, CA3	1nF	Capacitor, 50V, SMD	0603	Murata	GCM188R71H102KA37D
2	CA2, CA4	10nF	Capacitor, 50V, X7R	0603	Murata	GRM188R71H103KA01D
3	CA5, CA6, CB6	1μF	Capacitor, 50V, X7R	0805	Murata	GCM21BR71H105KA03L
3	C2, CA7, CA8	2.2μF	Capacitor, 10V, X7R	1206	Wurth	GCM31CR71H225KA55L
1	CA9	22μF	Capacitor, 50V	SMD	Panasonic	EEHZC1H220P
8	CA10, CA13, CA15, C3, C5, C7, C8, C10	0.1μF	Capacitor, 50V, X7R	0603	Murata	GCM188R71H104KA57D
2	CA11, CA12	10μF	Capacitor, 50V, X7R	1210	Murata	GRM32ER71H106KA12L
1	CA14	10pF	Capacitor, 50V, NP0	0603	Wurth	885012006051
2	CA16, CA17	22μF	Capacitor, 25V, X7R	1210	Murata	GRM32ER71E226KE15L
6	CA18, CB1, CB3, CB4, C4, C12	NC	Capacitor, 50V, X7R	0603		
1	CA19	1μF	Capacitor, 25V, X7R	0603	Murata	GCM188R71E105KA64D
2	CB2, C11	3.3nF	Capacitor, 50V, X7R	0603	Yageo	CC0603KRX7R9BB332
1	CB5	4.7μF	Capacitor, 10V, X5R	0603	Murata	GRM188R61A475KE15D
24	CLED1, CLED2, CLED3, CLED4, CLED5, CLED6, CLED7, CLED8, CLED9, CLED10, CLED11, CLED12, CLED13, CLED14, CLED15, CLED16, CLED17, CLED18, CLED19, CLED20, CLED21, CLED22, CLED23, CLED24	NC	Capacitor, 25V, X7R	0603	Custom (3)	
20	CN1, CN3, JPB1, JP1, JPB2	2.54mm	Connector	2.54mm	Custom (3)	
1	CN2	2.54mm	Connector	DIP	Custom (3)	
1	CN4	2.54mm	Connector	2.54mm	Custom (3)	
1	C1	47μF	Capacitor, 50V	SMD	Panasonic	EEEFN1H470XP
2	C6, C9	10μF	Capacitor, 10V, X7R	0603	Murata	GRM188Z71A106KA73D
1	FB1	6A	Magnetic bead	1806	Murata	BLM41PG600SN1L

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EVQ3322-QKE-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
4	VEMI_BUCK1, GND1, VLED_POWER 2, GND2	2.0mm	Connector	2.0mm	Custom (3)	
2	LA1, LA2	4.7μH	Inductor, 44.1mΩ, 5.1A	SMD	Coilcraft	XEL4030-472MEB
3	RA1, RA7, R8	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
6	RA2, RA6, R6, R7, RA9, RB12	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	RA3	0Ω	Film resistor, 1%	1210	Yageo	RC1210JR-070RL
1	RA4	140kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07140KL
4	RA5, R4, R5, R11	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	RA8	19.1kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0719K1L
1	RA10	86.6kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0786K6L
7	RB1, RB2, R2, R3, RB5, RB6, R12	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
2	RB3, RB7	91Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0791RL
3	RB4, RB8, RB11	0Ω	Film resistor, 1%	1206	Yageo	RC1206FR-070RL
4	RB9, RB10, R10, R13	NC				
1	R1	NC				
1	R9	20kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0720KL
2	JP1, JPB2	2.54mm	Connector	2.54mm	Custom (3)	2.54mm
1	U3	5Mbps	High-speed CAN transceiver	SO8	NXP	TJA1057T
1	U1	MPQ3322-AEC1	24-channel, 100mA/channel, LED driver, AEC-Q100 qualified	QFN-40 (6mmx 6mm)	MPS	MPQ3322GQKE-0000-AEC1
1	U2	MPQ4323C-AEC1	42V load dump tolerant, 3A, synchronous step-down converter, AEC-Q100 qualified	QFN-12 (2mmx 3mm)	MPS	MPQ4323CGDE-AEC1
1	U4	MP2013A	40V, 150mA, low-quiescent current linear regulator	QFN-6 (2mmx 2mm)	MPS	MP2013AGG

Note:

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

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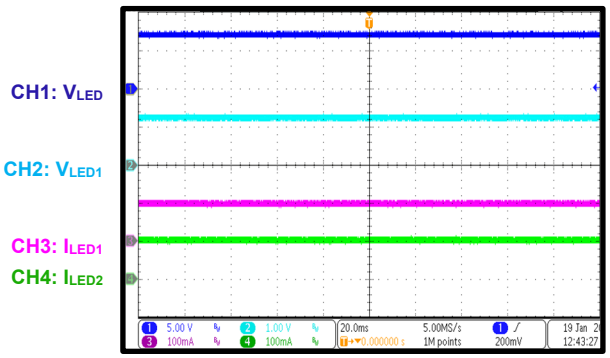
EVB TEST RESULTS

V_{IN_IC} = 12V, 2 LEDs in series (V_{LED} = 6.7V), 100mA/string, f_{PWM} = 200Hz, adaptive mode, T_A = 25°C, unless otherwise noted.

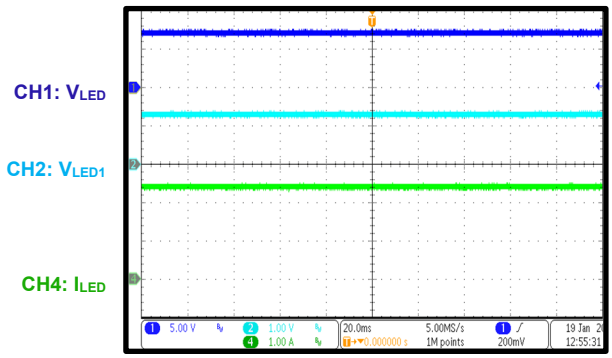
Steady State

CH1 duty cycle = 100%,
CH2 duty cycle = 100%



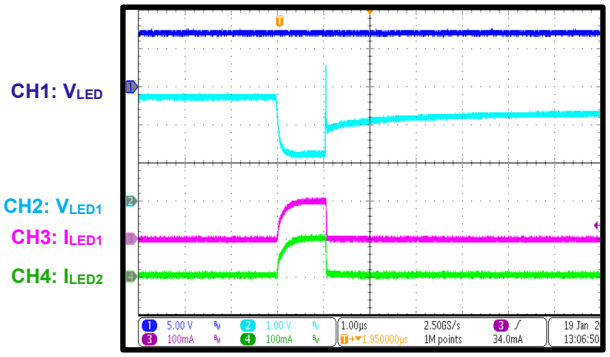
Steady State

All channels duty cycle = 100%



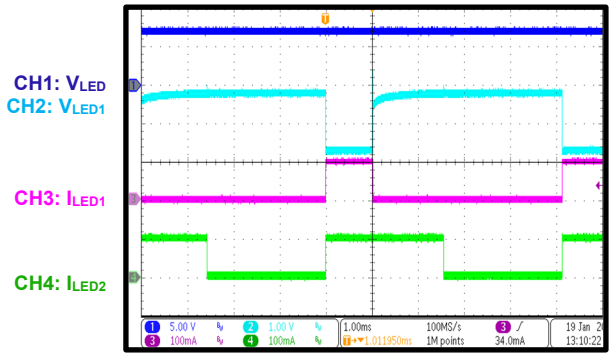
PWM Dimming

CH1 duty cycle = 0.024%,
CH2 duty cycle = 0.024%



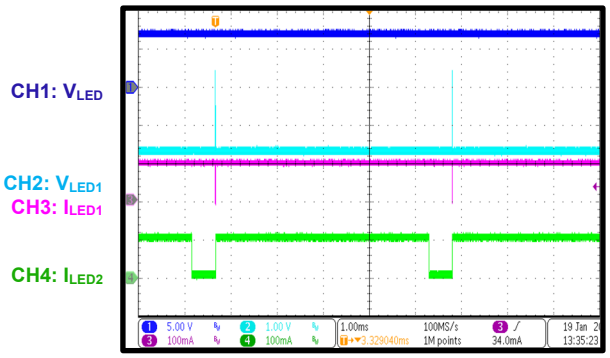
PWM Dimming

CH1 duty cycle = 20%, CH2 duty cycle = 50%



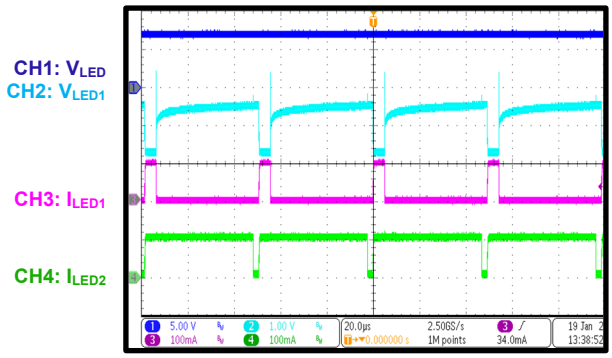
PWM Dimming

CH1 duty cycle = 99.878%,
CH2 duty cycle = 89.988%



PWM Dimming

f_{PWM} = 20.8kHz, CH1 duty cycle = 10%,
CH2 duty cycle = 95%



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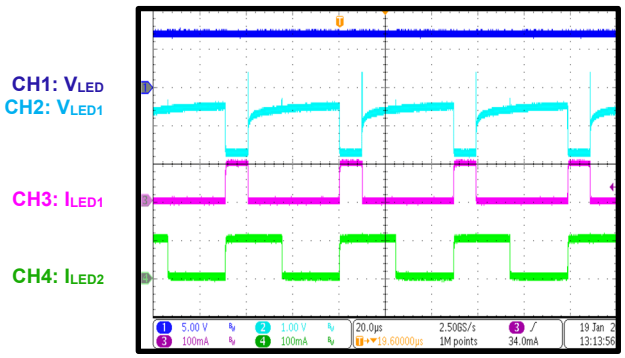
EVB TEST RESULTS *(continued)*

V_{IN_IC} = 12V, 2 LEDs in series (V_{LED} = 6.7V), 100mA/string, f_{PWM} = 200Hz, adaptive mode, T_A = 25°C, unless otherwise noted.

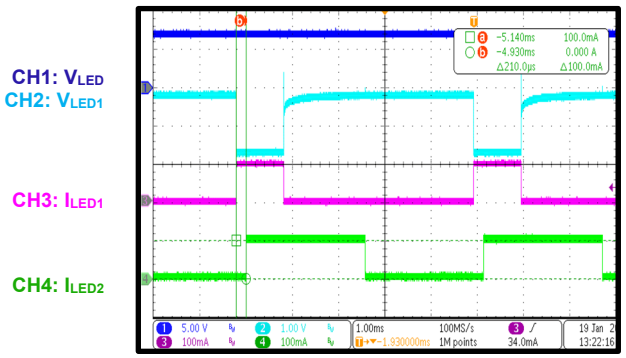
PWM Dimming

f_{PWM} = 20.8kHz, CH1 duty cycle = 20%,
CH2 duty cycle = 50%



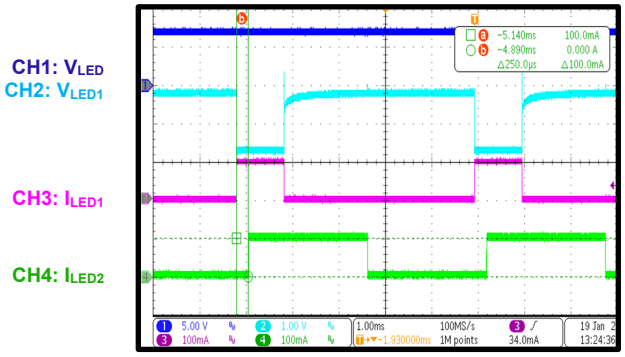
PWM Dimming

Phase shift enabled, CH1 duty cycle = 20%,
CH2 duty cycle = 50%



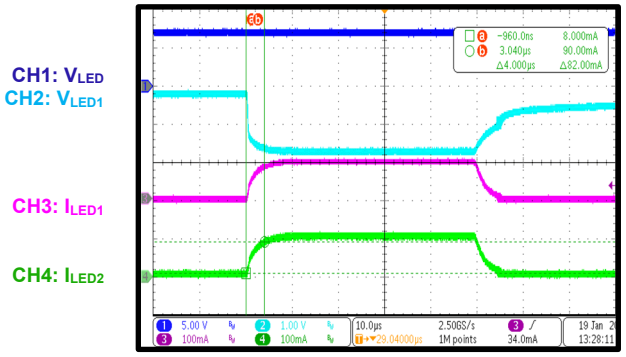
PWM Dimming

Phase shift enabled, CH21~24 disabled,
CH1 duty cycle = 20%,
CH2 duty cycle = 50%



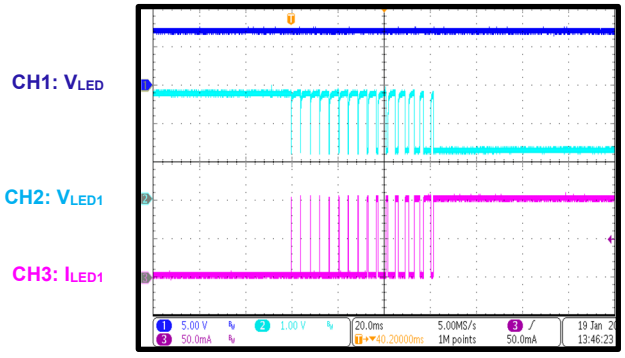
PWM Dimming

Slew rate enabled: 4µs,
CH1 duty cycle = 0.977%,
CH2 duty cycle = 0.977%



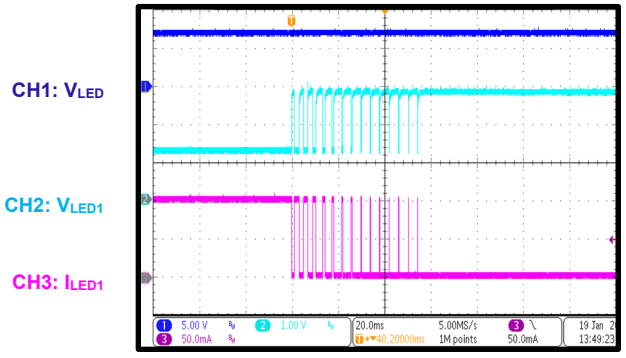
Auto-PWM Dimming

f_{PWM} = 250Hz, 4 points/cycle,
CH1 duty cycle = 0% to 100%



Auto-PWM Dimming

f_{PWM} = 250Hz, 4 points/cycle,
CH1 duty cycle = 100% to 0%



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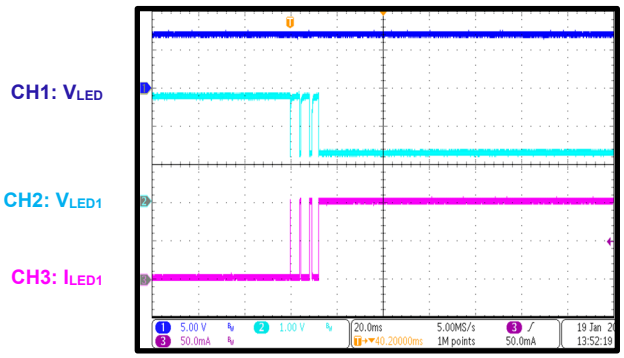
EVB TEST RESULTS *(continued)*

V_{IN_IC} = 12V, 2 LEDs in series (V_{LED} = 6.7V), 100mA/string, f_{PWM} = 200Hz, adaptive mode, T_A = 25°C, unless otherwise noted.

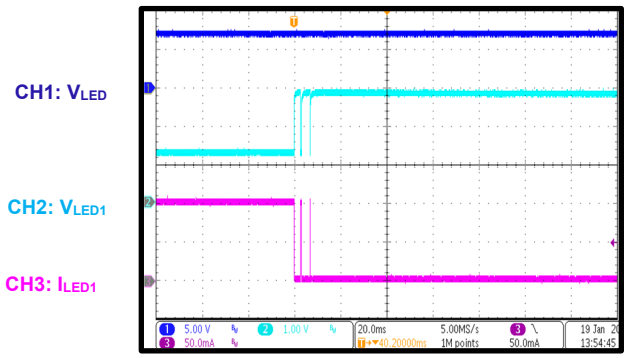
Auto-PWM Dimming

f_{PWM} = 250Hz, 16 points/cycle,
CH1 duty cycle = 0% to 100%



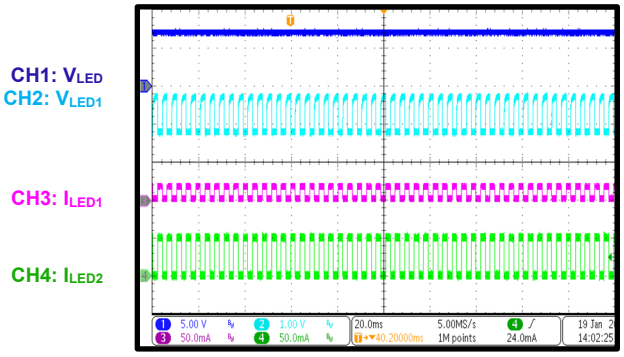
Auto-PWM Dimming

f_{PWM} = 250Hz, 16 points/cycle,
CH1 duty cycle = 100% to 0%



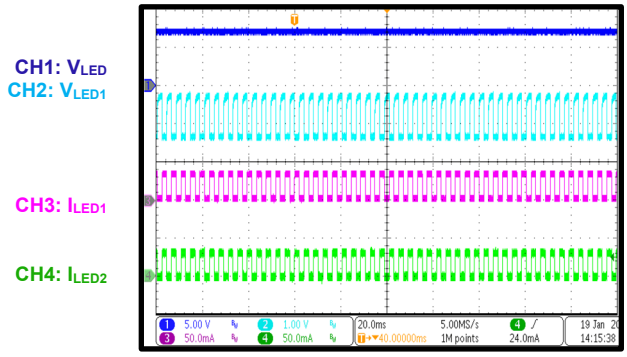
Analog Dimming

CH1 duty cycle = 50%,
CH2 duty cycle = 50%, I_{SET1} = 15.8mA,
I_{SET2} = 50mA

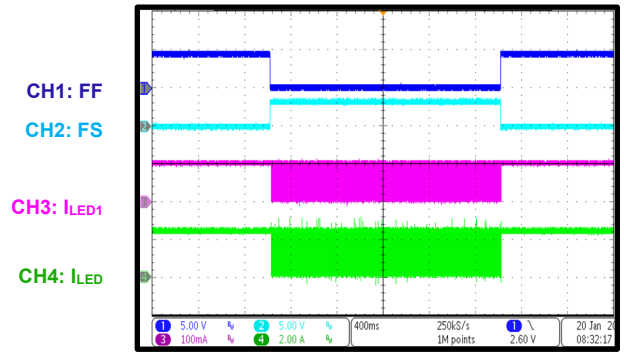


Analog Dimming

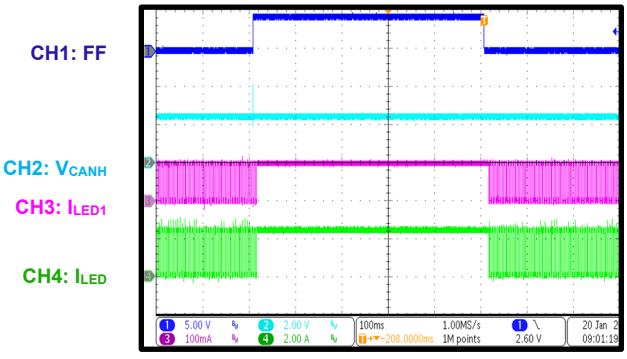
CH1 duty cycle = 50%,
CH2 duty cycle = 50%, I_{SET1} = 31.74mA,
I_{SET2} = 31.74mA



Failsafe Mode Entry/Recovery with FS Pin Input



Failsafe Entry/Recovery with CAN Difference



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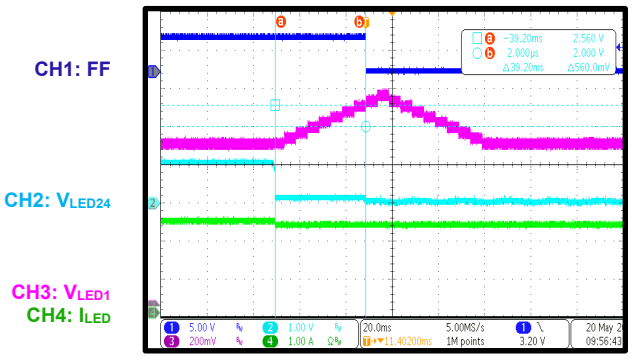
EVB TEST RESULTS *(continued)*

V_{IN_IC} = 12V, 2 LEDs in series (V_{LED} = 6.7V), 100mA/string, f_{PWM} = 200Hz, adaptive mode, T_A = 25°C, unless otherwise noted.

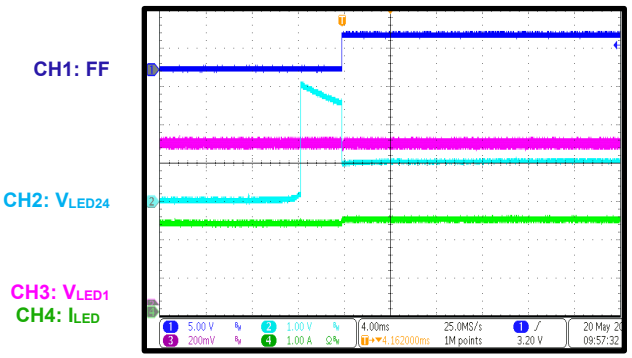
Open Protection

Channel 24 open under normal operation, hiccup mode, T_OPS[2:0] = 3'b011



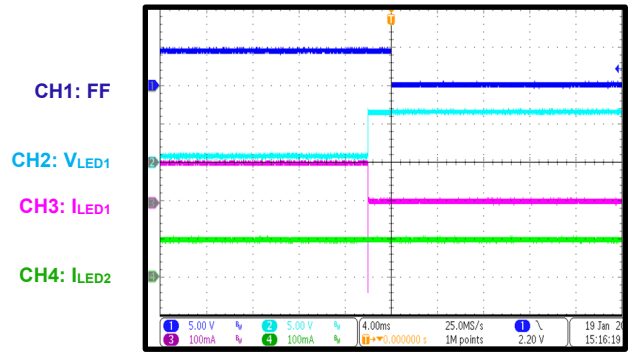
Open Protection

Channel 24 recovery, hiccup mode



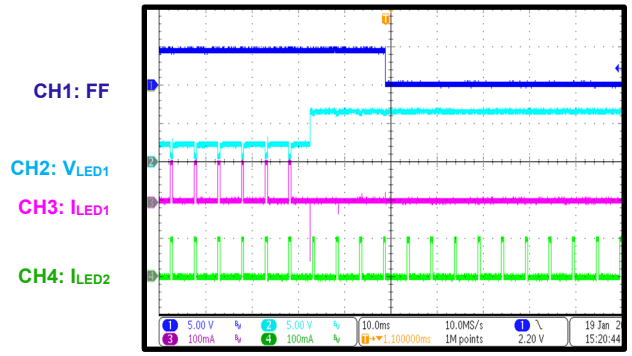
Short Protection

Channel 1 shorts under normal operation, latch-off mode

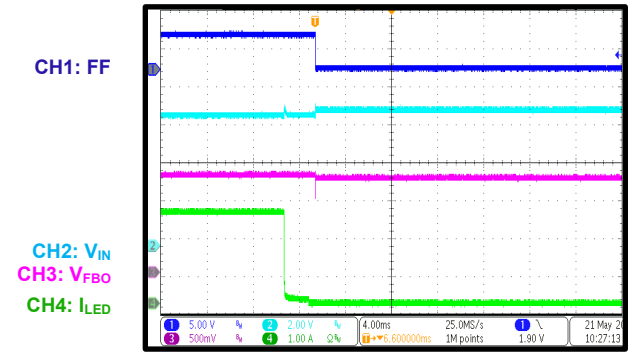


Short Protection

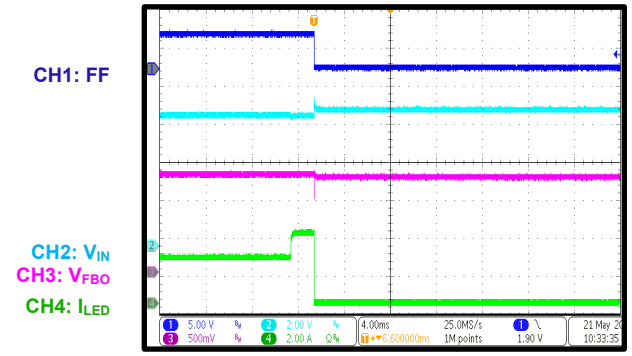
Channel 1 shorts under normal operation, latch-off mode



ISET Pin Open Protection



ISET Pin Short Protection



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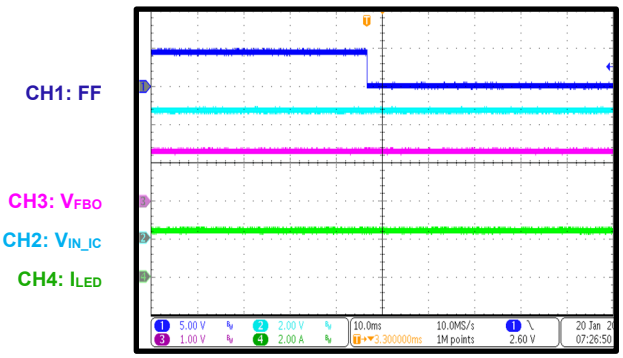
EVB TEST RESULTS *(continued)*

V_{IN_IC} = 12V, 2 LEDs in series (V_{LED} = 6.7V), 100mA/string, f_{PWM} = 200Hz, adaptive mode, T_A = 25°C, unless otherwise noted.

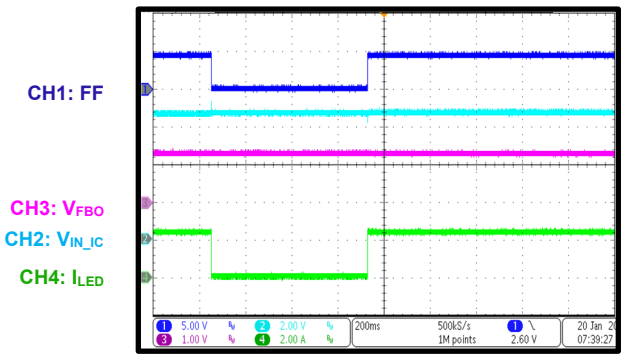
VIN Low-Voltage Detection

V_{IN_IC} goes from 9.5V to 9V in 0.1V steps



Over-Temperature Protection

The IC heats, then recovers



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PCB LAYOUT

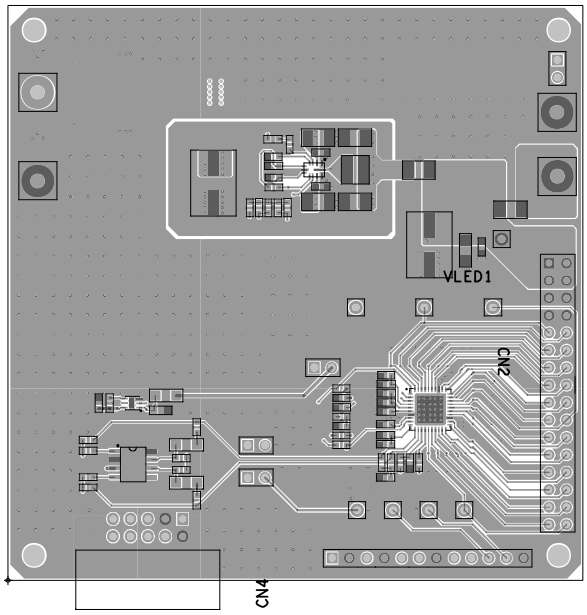

Figure 4: Top Layer

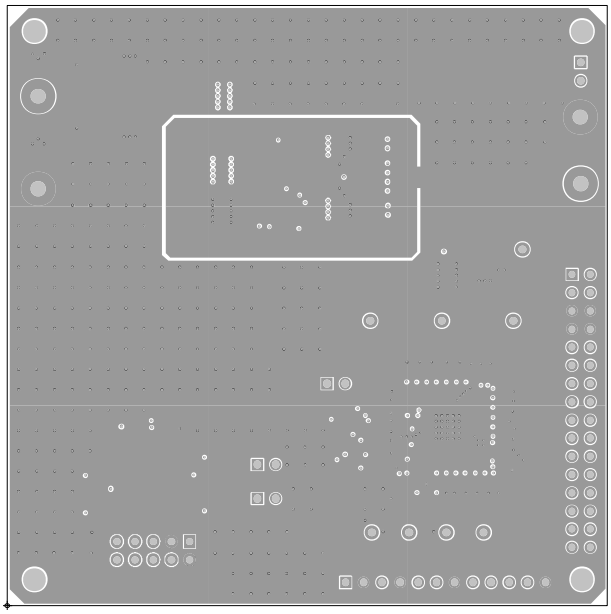

Figure 5: Mid-Layer 1

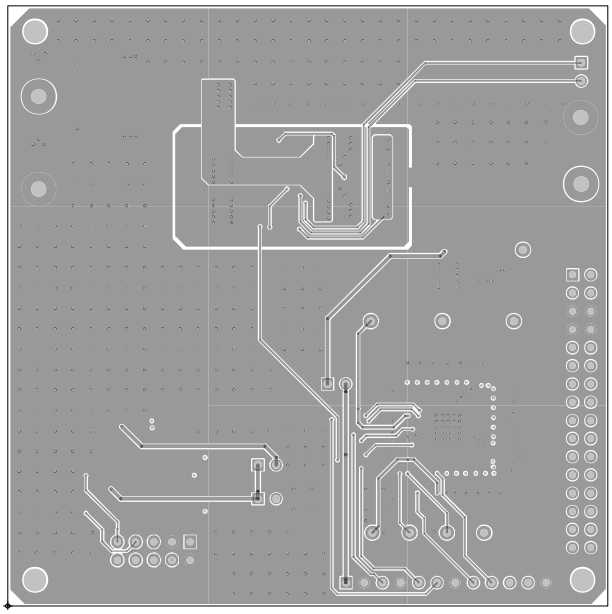

Figure 6: Mid-Layer 2

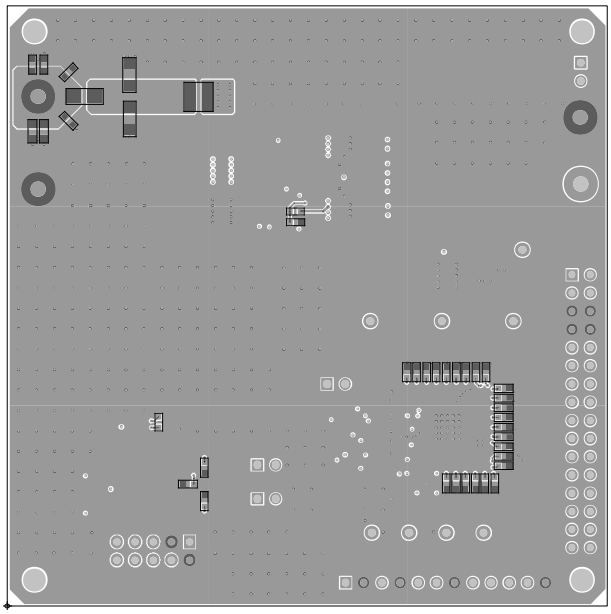

Figure 7: Bottom Layer

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	12/18/2025	Initial Release	-

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