EVQ2026A-R-00A

40V, 300mA, Dual-Channel LDO with Pre-Boost, I²C, and ADC for Digital Diagnosis and Protection Evaluation Board, AEC-Q100

DESCRIPTION

The EVQ2026A-R-00A is an evaluation board designed to demonstrate the capabilities of the MPQ2026A, a dual-channel, low-dropout (LDO) regulator. It contains a boost pre-regulator operating at either 400kHz or 2.2MHz with an I²C interface, as well as one-time programmable (OTP) memory. The device provides phantom power to low-noise amplifiers (LNAs) for active antennas in automotive systems, and can work in 3V cold-crank conditions up to 40V load-dump conditions.

The MPQ2026A delivers up to 300mA per channel with excellent load and line regulation. When the battery is healthy during normal operation, meaning the input voltage (V_{IN}) exceeds the pre-boost turn-on threshold, the pre-boost regulator is completely turned off to reduce the quiescent current (I_Q). This makes the MPQ2026A well-suited for power supplies that are always turned on.

The pre-boost regulator provides an integrated MOSFET to further reduce the external component count and EMI. Both the LDO and boost outputs can be configured via the I²C interface. The pre-boost regulator's output voltage (V_{OUT_BOOST}) can be configured between 6.5V and 15.9V. The LDO output voltages (V_{OUT1} and V_{OUT2}) can be configured between 1V and 13.6V. This protects the LDO output during load dumps.

During bench evaluations, different configurations can be easily obtained via the I²C interface, instead of reworking external components. Once the optimal settings have been reached, the multi-page OTP memory can permanently store the settings.

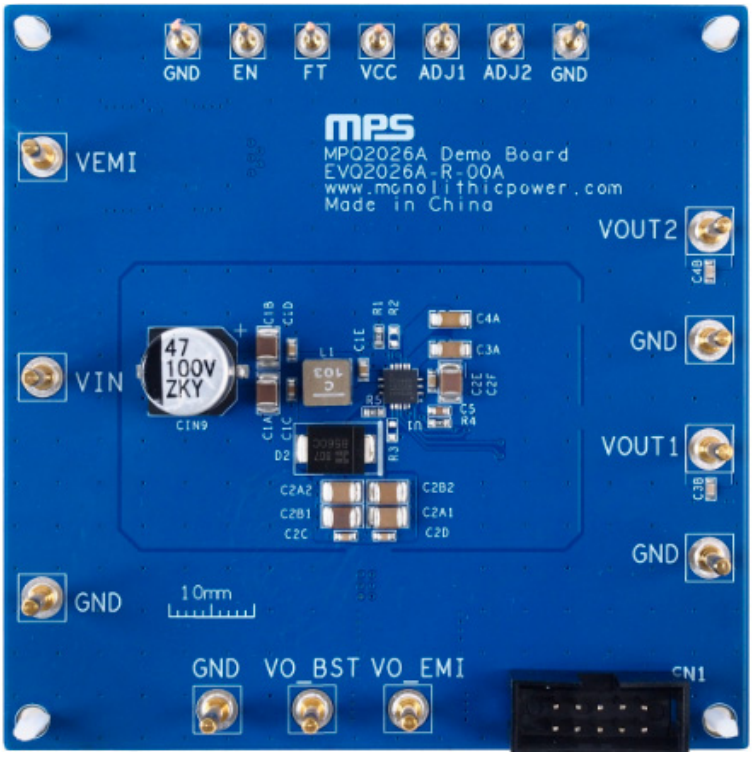
The EVQ2026A-R-00A is a fully assembled and tested evaluation board. The MPQ2026A is available in a QFN-16 (4mmx4mm) package.

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		3V to 40V
Output voltage (V_{OUT})	V_{IN} = 3V to 40V, V_{OUT_BOOST} = 12V, I_{OUT1}, I_{OUT2} = 0A	V_{OUT1}, V_{OUT2} = 9V
Maximum output current (I_{OUT})	V_{IN} = 3.5V to 40V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V	I_{OUT1}, I_{OUT2} = 0.3A
Typical efficiency	V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = disabled, I_{OUT_BOOST} = 0.6A	92%
Peak efficiency	V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = disabled, I_{OUT_BOOST} = 0.35A	92.5%
Switching frequency (f_{SW})		400kHz

EVQ2026A-R-00A EVALUATION BOARD



LxWxH (8.8cmx8.8cmx1cm)

Board Number	MPS IC Number
EVQ2026A-R-00A	MPQ2026AGRE-0000-AEC1

QUICK START GUIDE

The EVQ2026A-R-00A evaluation board is easy to set up and use to evaluate the MPQ2026A's performance. For proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

1. Preset the power supply (V_{IN}) between 3.5V and 40V, then turn off the power supply. Setting V_{IN} too high under a heavy load can trigger over-temperature protection.
2. Set the load current between 0A and 0.3A. Electronic loads represent a negative impedance to the regulator, and setting a current too high can trigger hiccup mode.
3. If longer cables (>0.5m total) are used between the source and the evaluation board, place a damping capacitor at the input terminals, especially when V_{IN} ≥ 24V.
4. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
5. Connect the load terminals to:
   a. Positive (+) channel 1: VOUT1
   b. Negative (-) channel 1: GND
   c. Positive (+) channel 2: VOUT2
   d. Negative (-) channel 2: GND
6. After making the connections, turn on the power supply.
7. To use the enable function, apply a digital input to the EN pin. Pull EN above 2.4V to turn the regulator on; pull EN below 2.2V to turn the regulator off. EN can be connected to VIN via a pull-up resistor (e.g. 100kΩ). EN has an internal, 3.3MΩ pull-down resistor. Float EN to disable the chip.

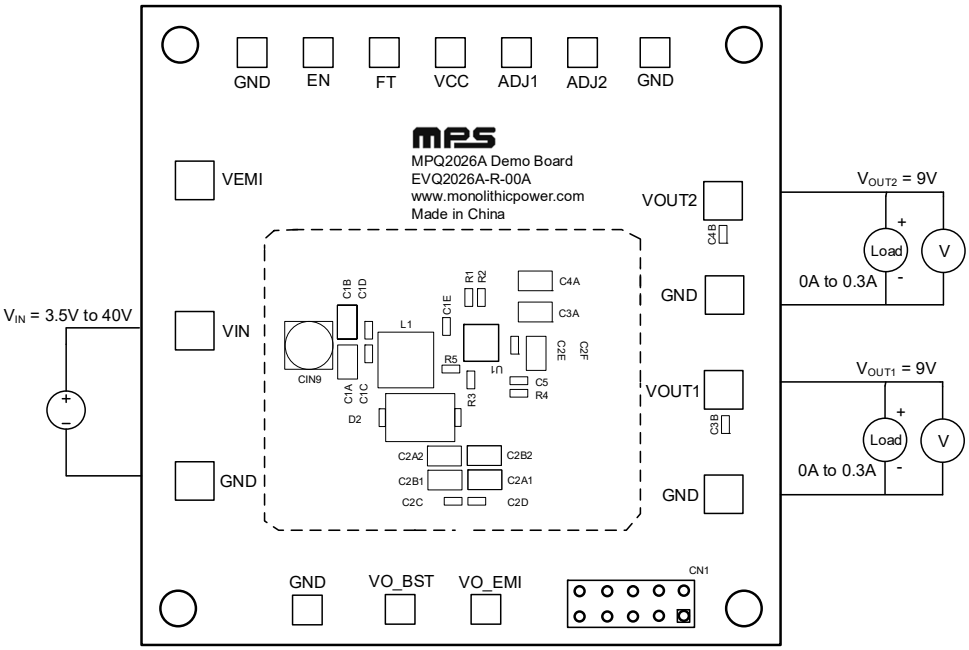
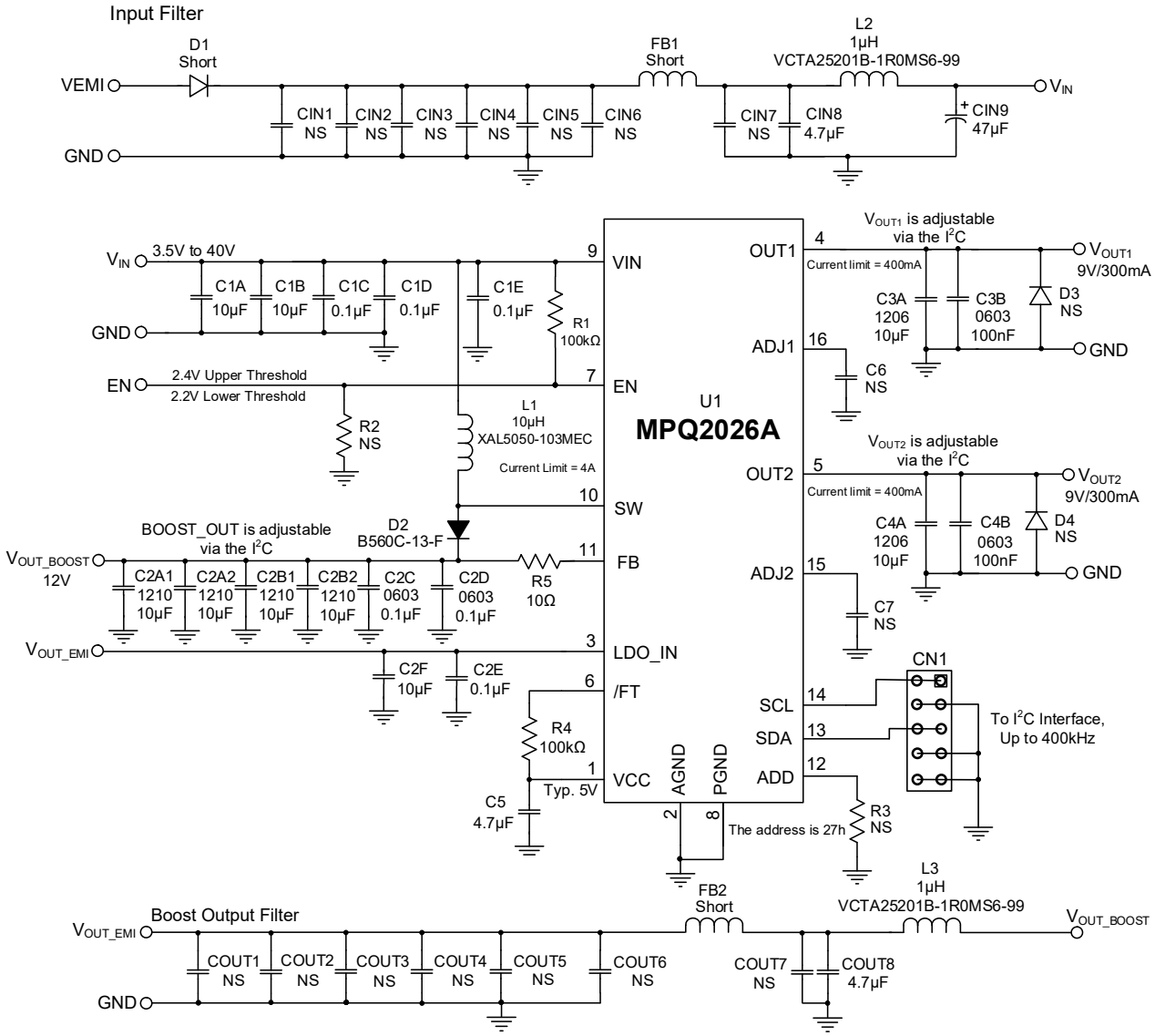


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC



Address	Resistor (kΩ)	ADDR Min Voltage (mV)	ADDR Typical Voltage (mV)	ADDR Max Voltage (mV)
21h	0 (1%)	0	0	40
22h	6.98 (1%)	40	70	100
23h	15 (1%)	100	150	200
24h	30 (1%)	200	300	400
25h	54.9 (1%)	400	550	700
26h	95.3 (1%)	700	950	1200

Figure 2: Evaluation Board Schematic

EVQ2026A-R-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
16	CIN1, CIN2, CIN3, CIN4, CIN5, CIN6, CIN7, COUT1, COUT2, COUT3, COUT4, COUT5, COUT6, COUT7, C6, C7	NS				
2	CIN8, COUT8	4.7µF	Ceramic capacitor, 50V, X7R	1206	Murata	GRM31CR71H475KA12L
1	CIN9	47µF	Electrolytic capacitor, 50V, DIP	SMD	Jianghai	CD263-50V47
2	C1A, C1B	10µF	Ceramic capacitor, 50V, X7R	1210	Murata	GRM32ER71H106KA12L
6	C1C, C1D, C1E, C2C, C2D, C2E	0.1µF	Ceramic capacitor, 50V, X7R	0603	Samsung	CL10B104KB8NNNC
5	C2A1, C2B1, C2A2, C2B2, C2F	10µF	Ceramic capacitor, 50V, X7R	1210	Murata	GRM32ER71H106KA12L
2	C3A, C4A	10µF	Ceramic capacitor, 50V, X7R	1206	Murata	GRM31CD71H106KE11L
2	C3B, C4B	0.1µF	Ceramic capacitor, 50V, X7R	0603	Samsung	CL10B104KB8NNNC
1	C5	4.7µF	Ceramic capacitor, 25V, X5R	0603	Murata	GRM188R61E475KE11D
1	CN1	2.54mm	Connector, 180°, 2x5-pin	Custom (1)	Custom (1)	
1	D1	NS	Short D1 with solder paste			
1	D2	5A	Schottky diode, 60V	SMC	Diodes, Inc.	B560C-13-F
2	D3, D4	NS (2)				
2	FB1, FB2	NS (2)				
1	L1	10µH	Inductor, 22mΩ DCR, 4.9A	SMD	Coilcraft	XAL5050-103MEB
2	L2, L3	1µH	Inductor, 355mΩ DCR, 3.8A	SMD	Cyntec	VCTA25201B-1R0MS6-99
2	R1, R4	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
2	R2, R3	NS				
1	R5	10Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0710RL

EVQ2026A-R-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
10	VIN, VOUT_BST, VOUT_EMI, GND, VOUT1, VOUT2, GND, VEMI, GND, GND	2mm	Golden pin	Custom (1)	Custom (1)	
7	ADJ1, ADJ2, GND, EN, VCC, GND, FT	1mm	Golden pin	Custom (1)	Custom (1)	
1	U1	MPQ2026A	40V, dual-channel LDO with pre-boost and protection, AEC-Q100	QFN-16 (4mmx 4mm)	MPS	MPQ2026AGRE-0000-AEC1

Notes:

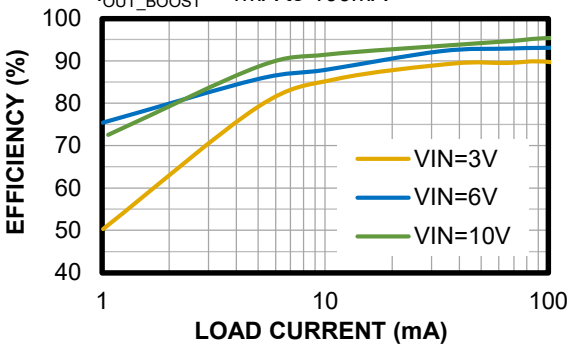
1) Contact an MPS FAE for more information regarding custom pins.
2) Short the NS pins using solder paste.

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, unless otherwise noted.

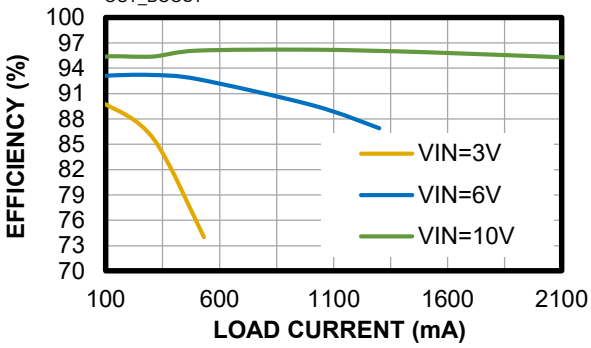
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 12V, f_{SW} = 400kHz, L = 10µH (DCR = 45mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 1mA to 100mA



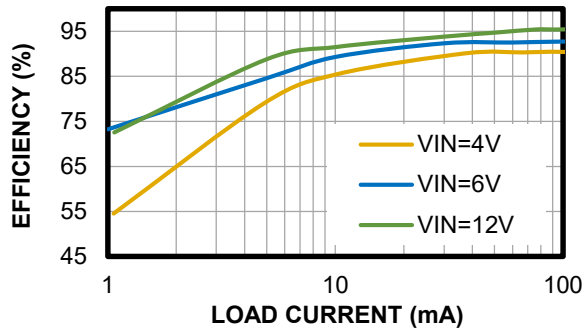
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 12V, f_{SW} = 400kHz, L = 10µH (DCR = 45mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 100mA to 2.1A



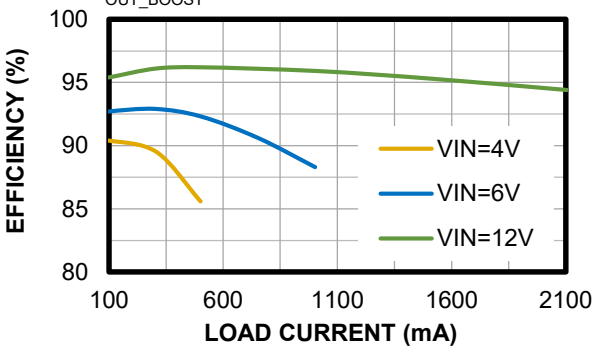
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 14V, f_{SW} = 400kHz, L = 10µH (DCR = 45mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 1mA to 100mA



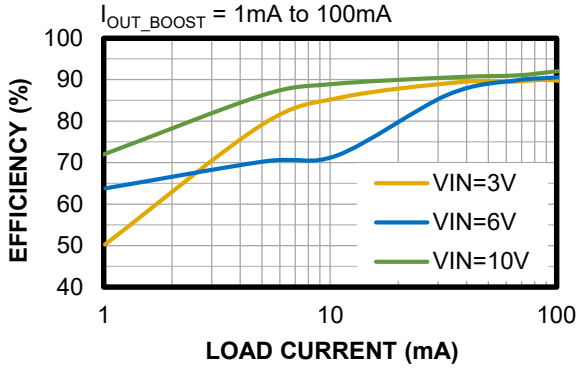
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 14V, f_{SW} = 400kHz, L = 10µH (DCR = 45mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 100mA to 2.1A



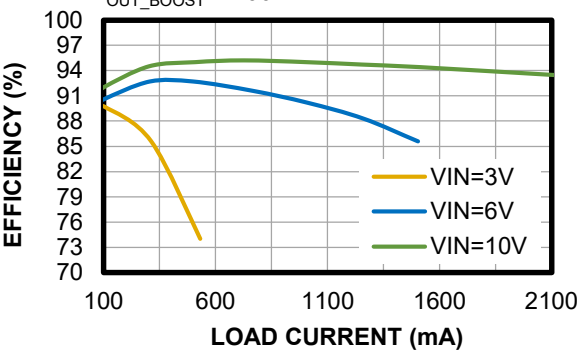
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 12V, f_{SW} = 2.2MHz, L = 2.2µH (DCR = 35.2mΩ), rectifier diode B350A-13-F, FSS on, I_{OUT_BOOST} = 1mA to 100mA



Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 12V, f_{SW} = 2.2MHz, L = 2.2µH (DCR = 35.2mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 100mA to 2.1A

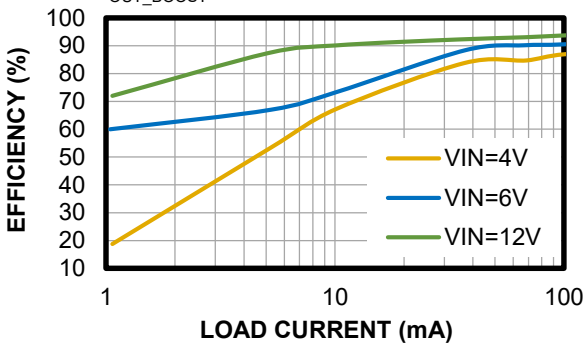


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, unless otherwise noted.

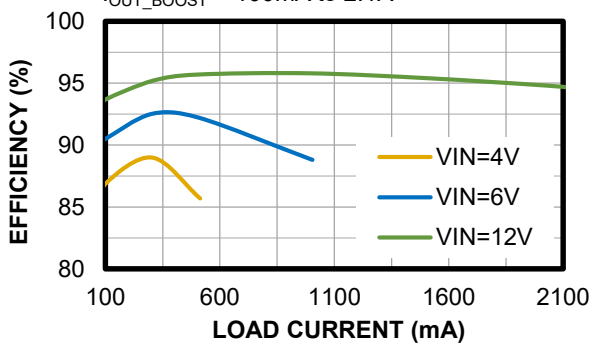
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 14V, f_{SW} = 2.2MHz, L = 2.2µH (DCR = 35.2mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 1mA to 100mA



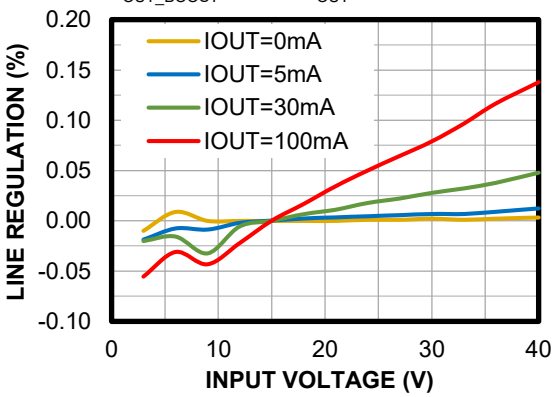
Boost Efficiency vs. Load Current

Dual LDO disabled, V_{OUT_BOOST} = 14V, f_{SW} = 2.2MHz, L = 2.2µH (DCR = 35.2mΩ), rectifier diode: B350A-13-F, FSS on, I_{OUT_BOOST} = 100mA to 2.1A



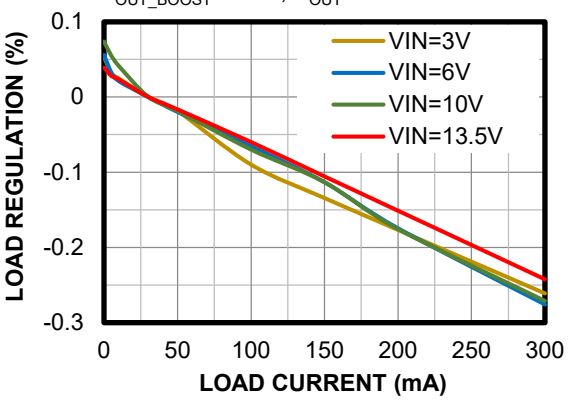
Line Regulation vs. Input Voltage

V_{OUT_BOOST} = 12V, V_{OUT} = 9V



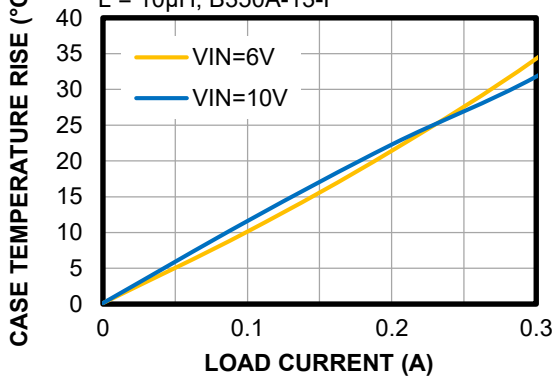
Load Regulation vs. Load Current

V_{OUT_BOOST} = 12V, V_{OUT} = 9V



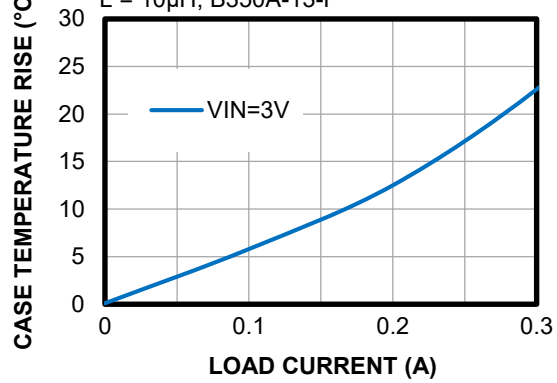
Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 9V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 12V, f_{SW} = 400kHz, L = 10µH, B350A-13-F



Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 5V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 6.5V, f_{SW} = 400kHz, L = 10µH, B350A-13-F

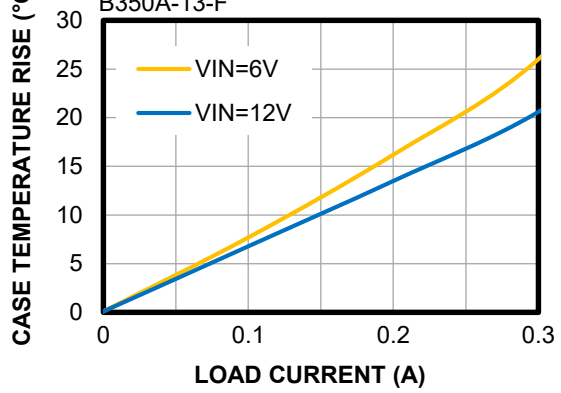


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, unless otherwise noted.

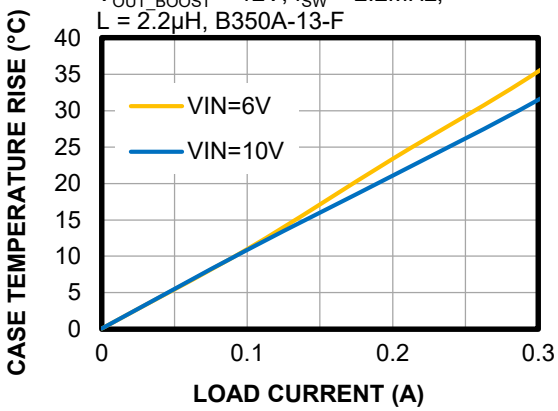
Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 12V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 14V, f_{SW} = 400kHz, L = 10µH, B350A-13-F



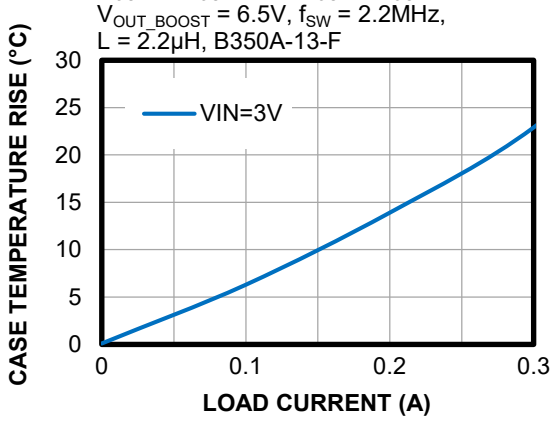
Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 9V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 12V, f_{SW} = 2.2MHz, L = 2.2µH, B350A-13-F



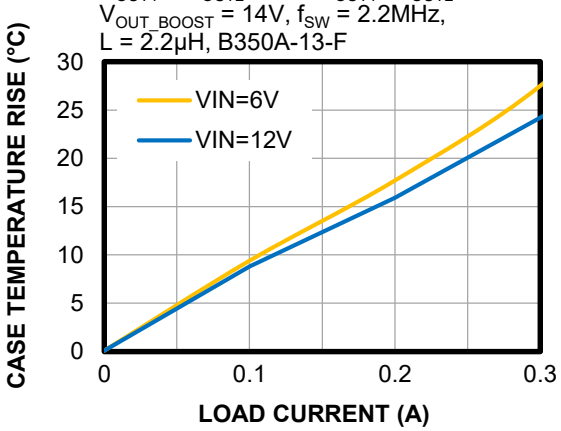
Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 5V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 6.5V, f_{SW} = 2.2MHz, L = 2.2µH, B350A-13-F



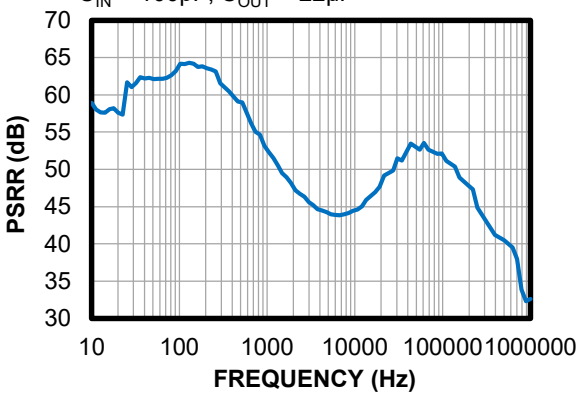
Case Temperature Rise vs. Load Current

V_{OUT1} = V_{OUT2} = 12V, I_{OUT1} = I_{OUT2} = load, V_{OUT_BOOST} = 14V, f_{SW} = 2.2MHz, L = 2.2µH, B350A-13-F



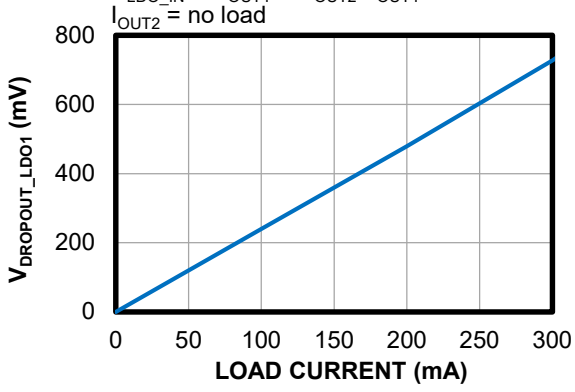
PSRR vs. Frequency

V_{IN} = 13.5V, V_{OUT} = 9V, I_{OUT} = 5mA, C_{IN} = 100pF, C_{OUT} = 22µF



LDO1 Dropout Voltage vs. Load Current

V_{LDO_IN} = V_{OUT1} = V_{OUT2}, I_{OUT1} = load, I_{OUT2} = no load

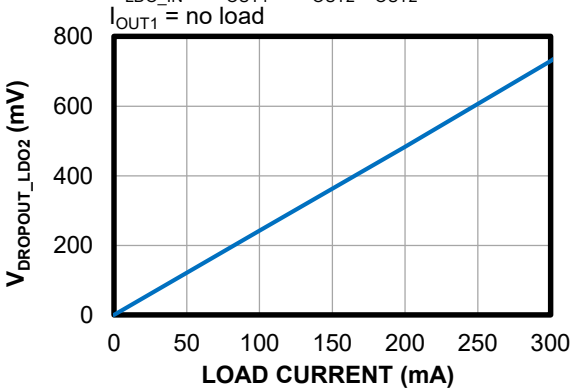


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, unless otherwise noted.

LDO2 Dropout Voltage vs. Load Current

V_{LDO_IN} = V_{OUT1} = V_{OUT2}, I_{OUT2} = load, I_{OUT1} = no load



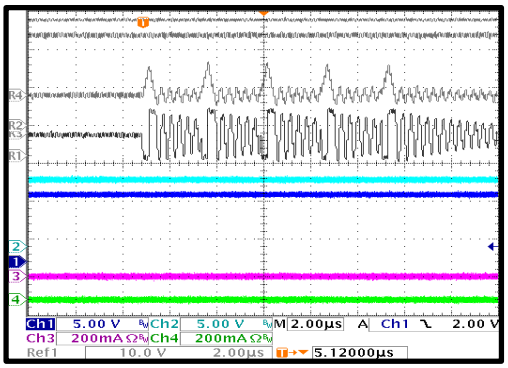
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: B350A-13-F, unless otherwise noted.

Steady State

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A

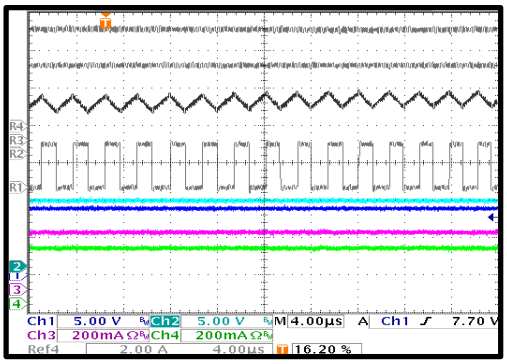
R4: I_L 200mA/div.
R2: V_{OUT_BOOST} 5V/div.
R3: V_{IN} 2V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Steady State

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A

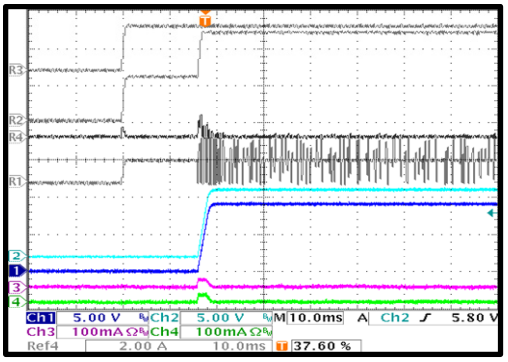
R4: I_L 2A/div.
R3: V_{IN} 2V/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Start-Up through VIN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A

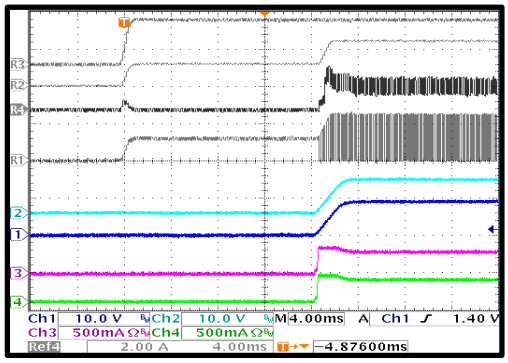
R3: V_{IN} 2V/div.
R2: V_{OUT_BOOST} 5V/div.
R4: I_L 2A/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Start-Up through VIN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A

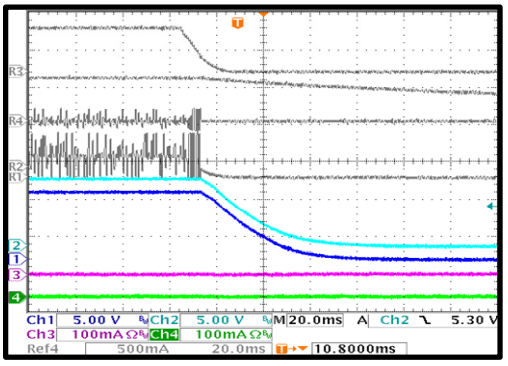
R3: V_{IN} 5V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 2A/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Shutdown through VIN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A

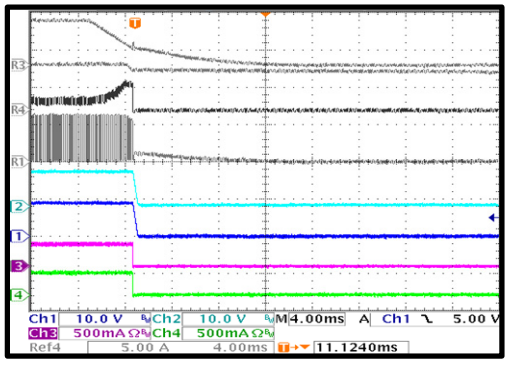
R3: V_{IN} 2V/div.
R4: I_L 500mA/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Shutdown through VIN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A

R3: V_{IN} 5V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 5A/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



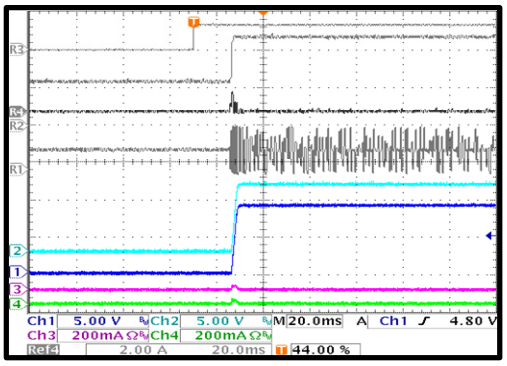
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: B350A-13-F, unless otherwise noted.

Start-Up through EN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A

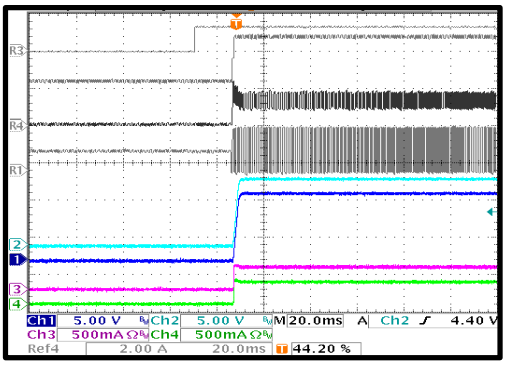
R3: V_{EN} 5V/div.
R4: I_L 2A/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Start-Up through EN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A

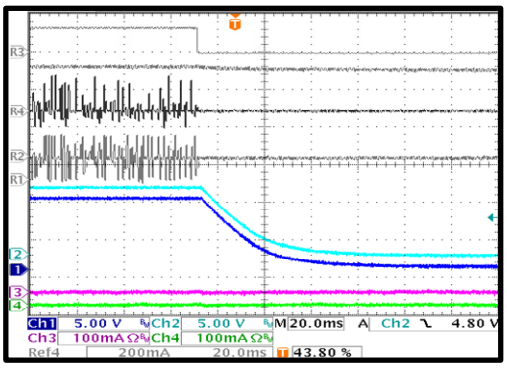
R3: V_{EN} 5V/div.
R2: V_{OUT_BOOST} 5V/div.
R4: I_L 2A/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Shutdown through EN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A

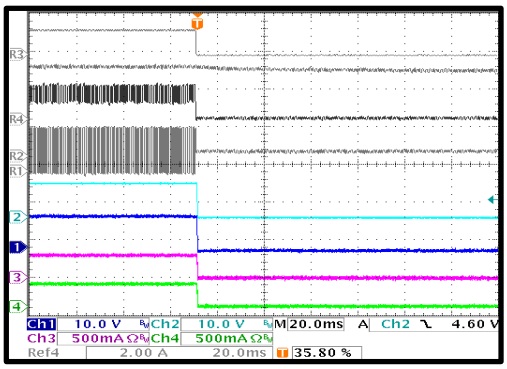
R3: V_{EN} 5V/div.
R4: I_L 200mA/div
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Shutdown through EN

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A

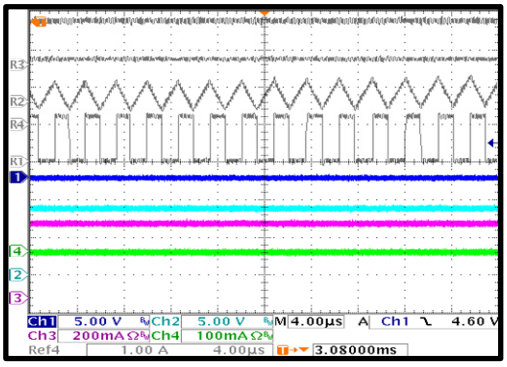
R3: V_{EN} 5V/div.
R4: I_L 2A/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



SCP Steady State

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A,
V_{OUT2} short to circuit

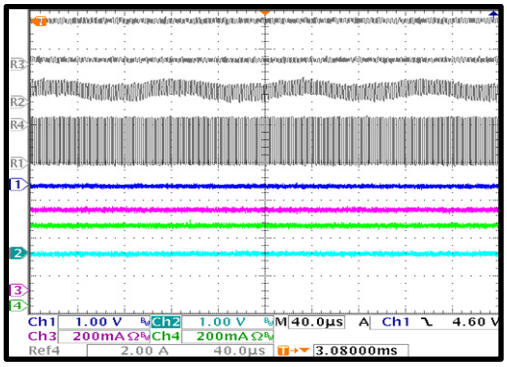
R3: V_{IN} 5V/div.
R2: V_{OUT_BOOST} 5V/div.
R4: I_L 1A/div.
R1: V_{SW} 10V/div.
CH1: V_{OUT2}
CH4: I_{OUT1}
CH2: V_{OUT1}
CH3: I_{OUT2}



SCP Steady State

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A,
V_{OUT1} and V_{OUT2} short to circuit

R3: V_{IN} 5V/div.
R2: V_{OUT_BOOST} 5V/div.
R4: I_L 1A/div.
R1: V_{SW} 10V/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}

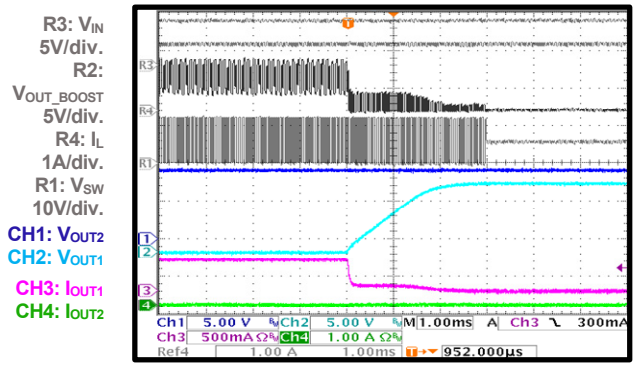


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: B350A-13-F, unless otherwise noted.

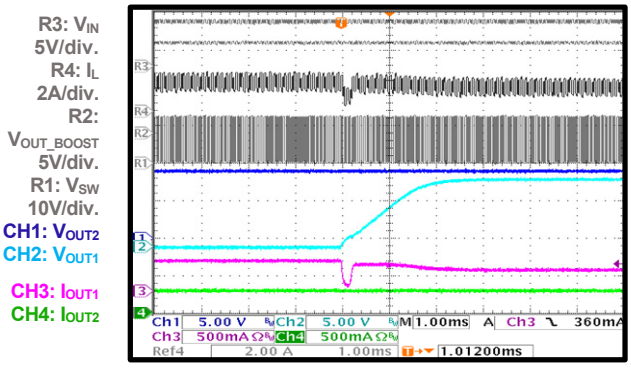
SCP Recovery

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A,
V_{OUT1} short circuit to I_{OUT1} = 0A



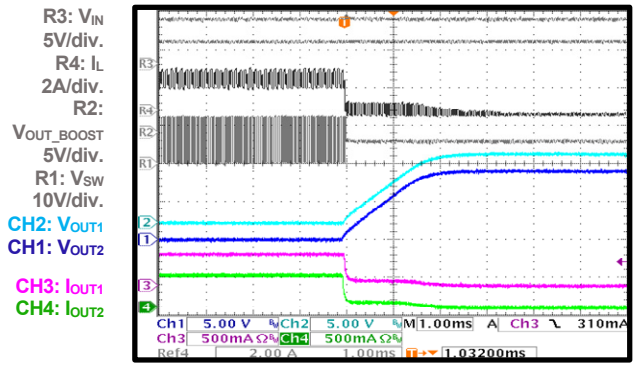
SCP Recovery

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT2} = 0.3A,
V_{OUT1} short circuit to I_{OUT1} = 0.3A



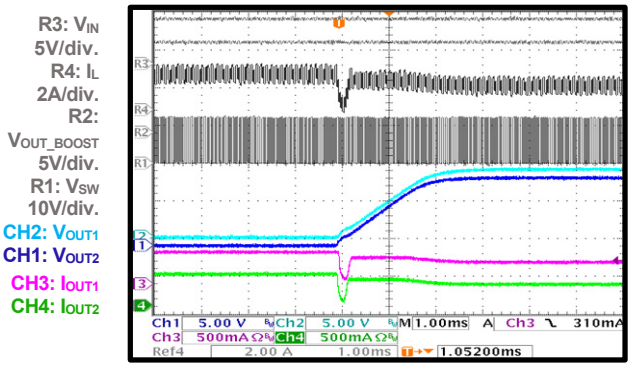
SCP Recovery

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, V_{OUT1} and V_{OUT2} short circuit to I_{OUT1} = I_{OUT2} = 0A



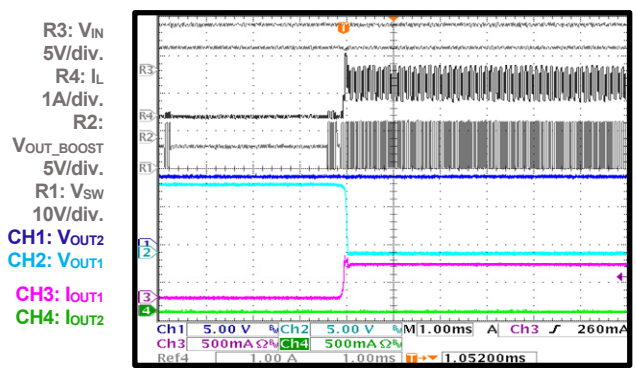
SCP Recovery

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, V_{OUT1} and V_{OUT2} short circuit to I_{OUT1} = I_{OUT2} = 0.3A



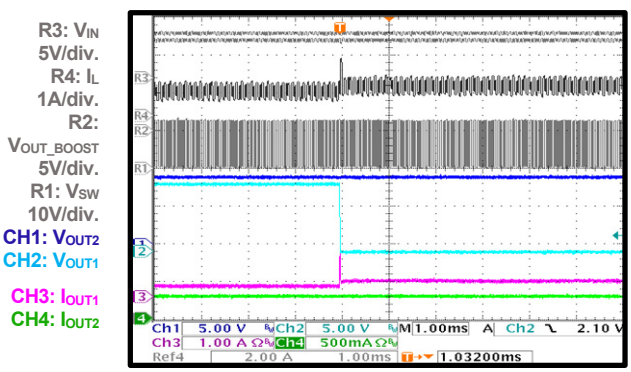
SCP Entry

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT2} = 0A, I_{OUT1} = 0A to short circuit



SCP Entry

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT2} = 0.3A, I_{OUT1} = 0.3A to short circuit



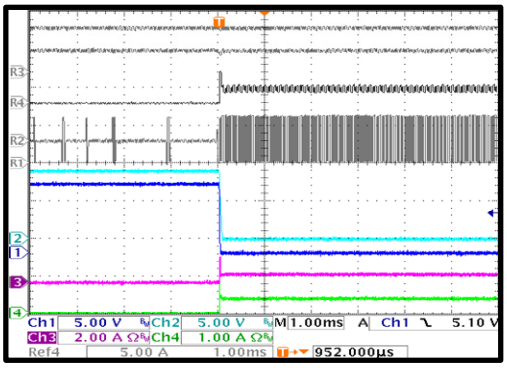
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: B350A-13-F, unless otherwise noted.

SCP Entry

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0A to short circuit

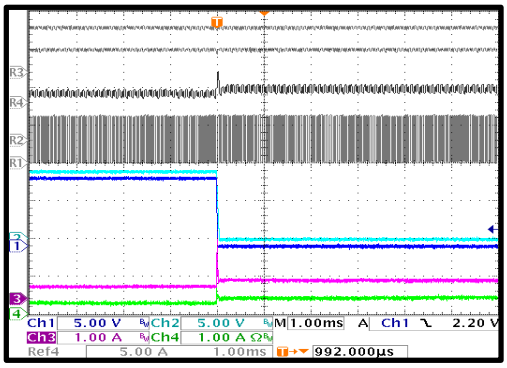
R3: V_{IN} 5V/div.
R4: I_L 5A/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



SCP Entry

V_{IN} = 6V, V_{OUT1} = V_{OUT2} = 9V,
V_{OUT_BOOST} = 12V, I_{OUT1} = I_{OUT2} = 0.3A to short circuit

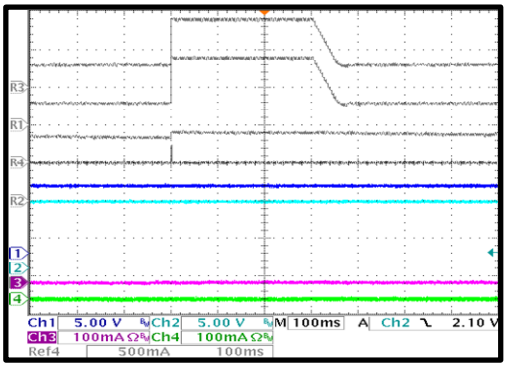
R3: V_{IN} 5V/div.
R4: I_L 5A/div.
R2: V_{OUT_BOOST} 5V/div.
R1: V_{SW} 10V/div.
CH2: V_{OUT1}
CH1: V_{OUT2}
CH3: I_{OUT1}
CH4: I_{OUT2}



Load Dump

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0A

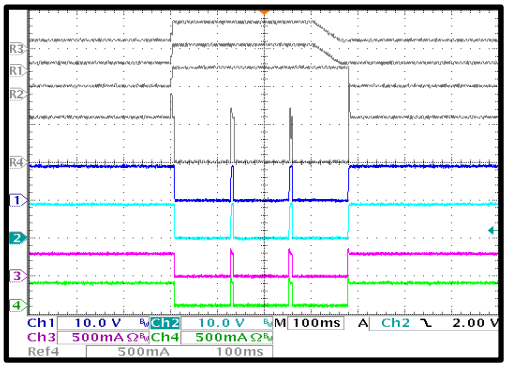
R3: V_{IN} 20V/div.
R1: V_{SW} 20V/div.
R4: I_L 500mA/div.
R2: V_{OUT_BOOST} 20V/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



Load Dump

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0.3A

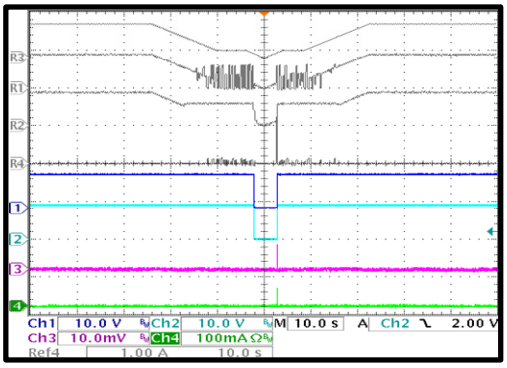
R3: V_{IN} 50V/div.
R1: V_{SW} 50V/div.
R2: V_{OUT_BOOST} 50V/div.
R4: I_L 500mA/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



V_{IN} Ramping Down and Up

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0A

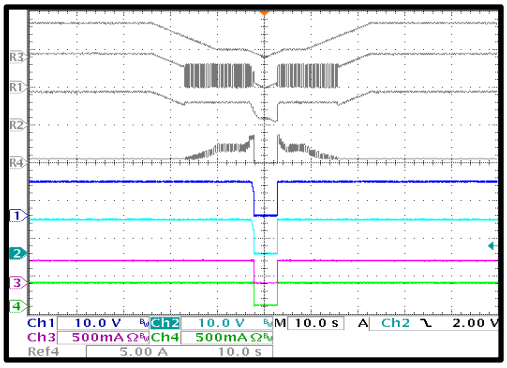
R3: V_{IN} 20V/div.
R1: V_{SW} 20V/div.
R2: V_{OUT_BOOST} 20V/div.
R4: I_L 1A/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



V_{IN} Ramping Down and Up

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0.3A

R3: V_{IN} 20V/div.
R1: V_{SW} 20V/div.
R2: V_{OUT_BOOST} 20V/div.
R4: I_L 5A/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



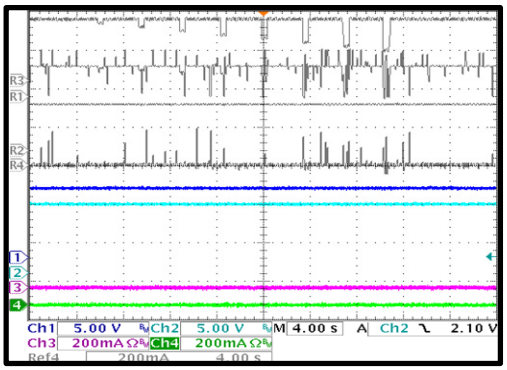
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, L = 10µH, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: B350A-13-F, unless otherwise noted.

Reset Behavior

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0A

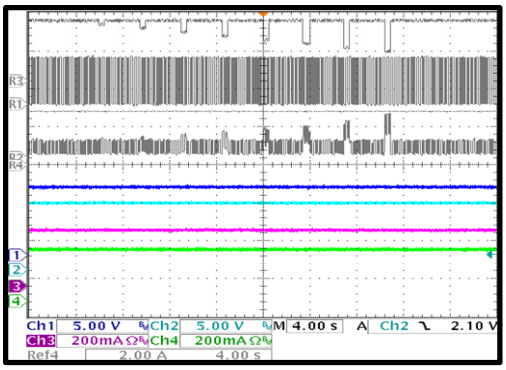
R3: V_{IN} 5V/div.
R1: V_{SW} 10V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 200mA/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



Reset Behavior

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0.3A

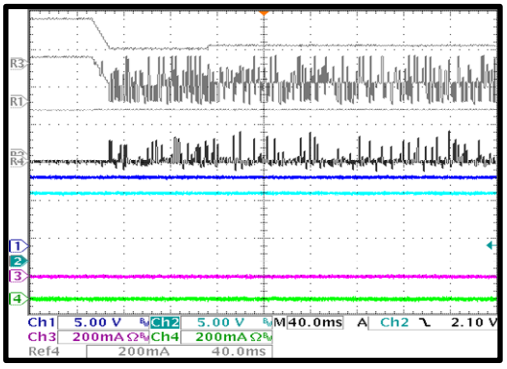
R3: V_{IN} 5V/div.
R1: V_{SW} 10V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 2A/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



Cold Crank

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0A

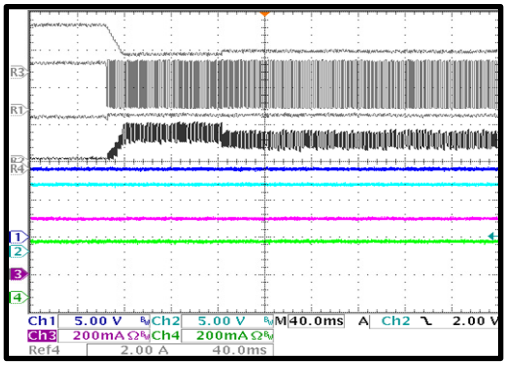
R3: V_{IN} 10V/div.
R1: V_{SW} 10V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 200mA/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}



Cold Crank

V_{OUT1} = V_{OUT2} = 9V, V_{OUT_BOOST} = 12V,
I_{OUT1} = I_{OUT2} = 0.3A

R3: V_{IN} 10V/div.
R1: V_{SW} 10V/div.
R2: V_{OUT_BOOST} 10V/div.
R4: I_L 2A/div.
CH1: V_{OUT2}
CH2: V_{OUT1}
CH3: I_{OUT1}
CH4: I_{OUT2}

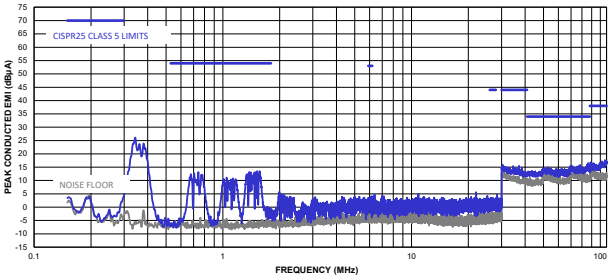


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, I_{OUT1}, I_{OUT2} = 0.3A, L = 10µH, f_{SW} = 400kHz, FSS on, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: DFLS240-7-F, unless otherwise noted. (3)

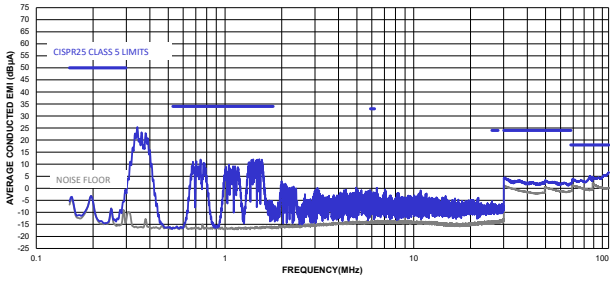
CISPR25 Class 5 Peak Conducted Emissions

150kHz to 108MHz



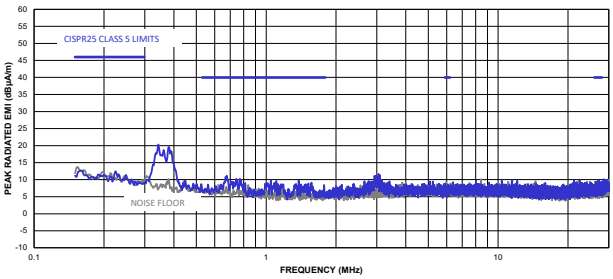
CISPR25 Class 5 Average Conducted Emissions

150kHz to 108MHz



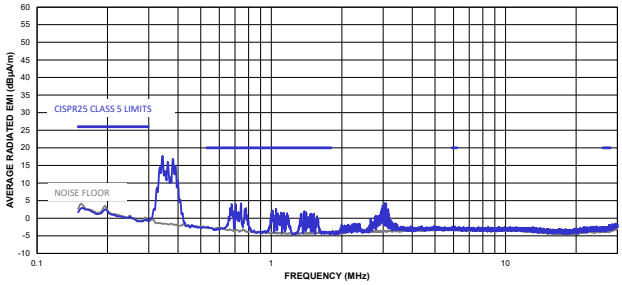
CISPR25 Class 5 Peak Radiated Emissions

150kHz to 30MHz



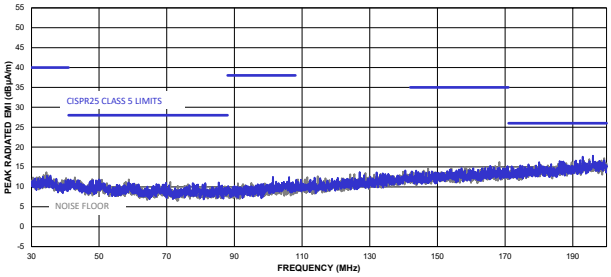
CISPR25 Class 5 Average Radiated Emissions

150kHz to 30MHz



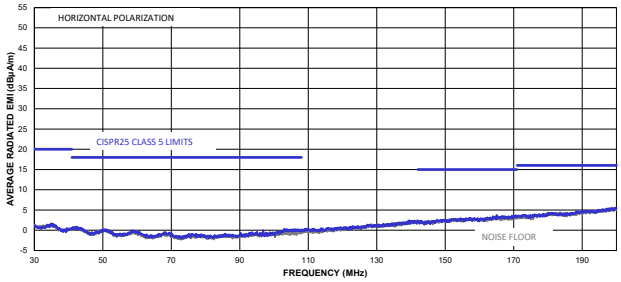
CISPR25 Class 5 Peak Radiated Emissions

Horizontal, 30MHz to 200MHz



CISPR25 Class 5 Average Radiated Emissions

Horizontal, 30MHz to 200MHz

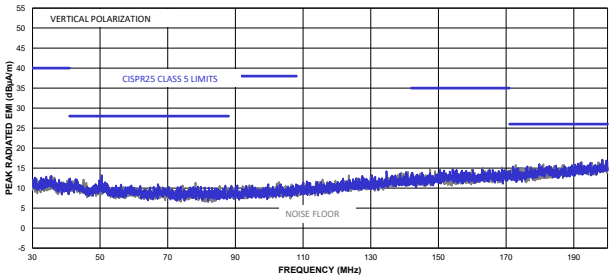


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 6V, V_{OUT_BOOST} = 12V, V_{OUT1}, V_{OUT2} = 9V, I_{OUT1}, I_{OUT2} = 0.3A, L = 10µH, f_{SW} = 400kHz, FSS on, C_{OUT1} = C_{OUT2} = 10µF, C_{OUT_BOOST} = 40µF, T_A = 25°C, rectifier diode: DFLS240-7-F, unless otherwise noted. (3)

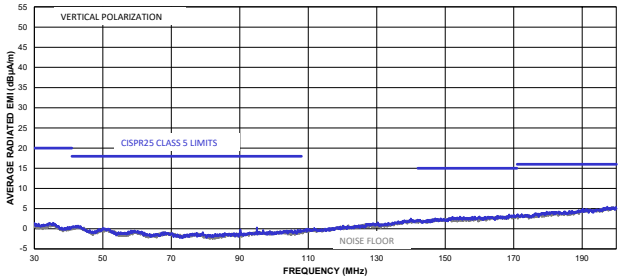
CISPR25 Class 5 Peak Radiated Emissions

Vertical, 30MHz to 200MHz



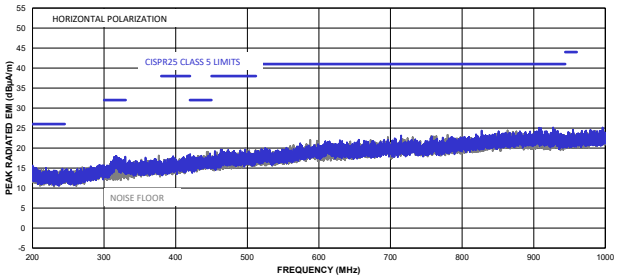
CISPR25 Class 5 Average Radiated Emissions

Vertical, 30MHz to 200MHz



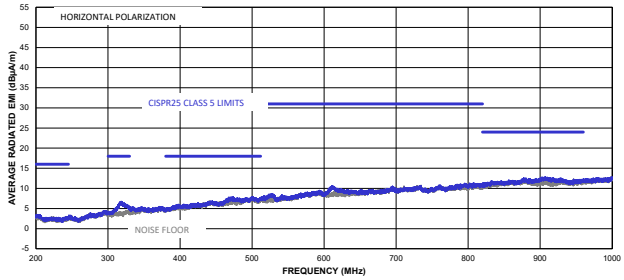
CISPR25 Class 5 Peak Radiated Emissions

Horizontal, 200MHz to 1GHz



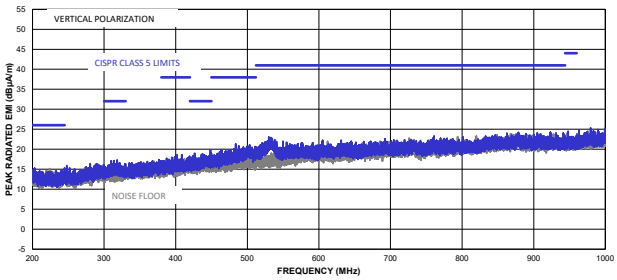
CISPR25 Class 5 Average Radiated Emissions

Horizontal, 200MHz to 1GHz



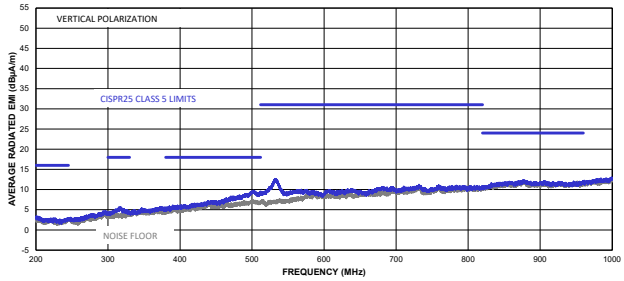
CISPR25 Class 5 Peak Radiated Emissions

Vertical, 200MHz to 1GHz



CISPR25 Class 5 Average Radiated Emissions

Vertical, 200MHz to 1GHz



Note:

3) All EMC test results are based on the evaluation board schematic with EMI filters (see Figure 2 on page 4).

PCB LAYOUT (4)

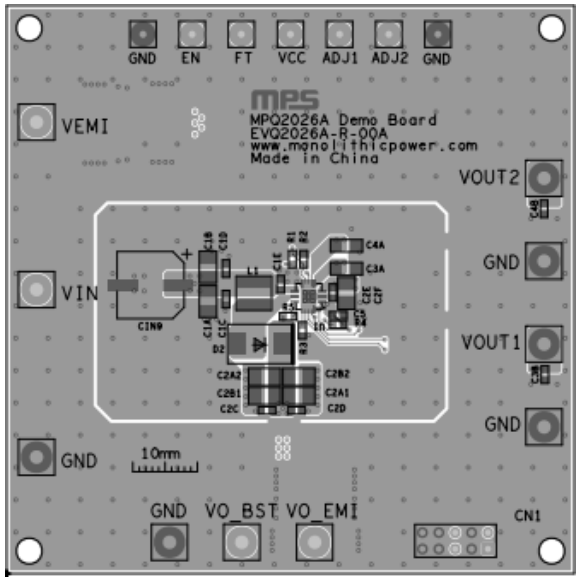


Figure 3: Top Silk

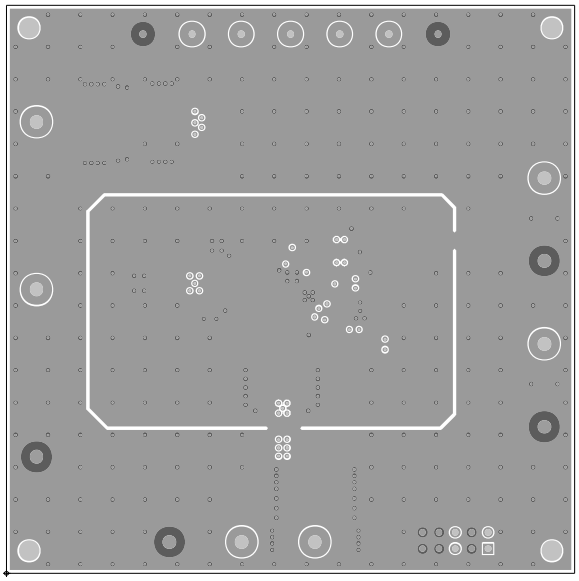


Figure 4: Mid-Layer 1

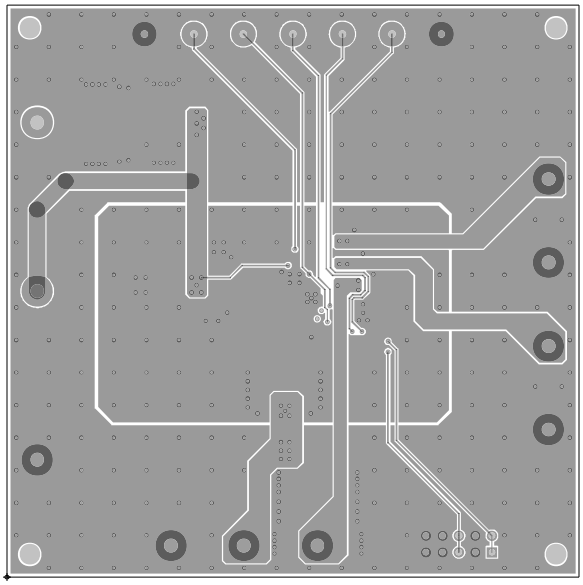


Figure 5: Mid-Layer 2

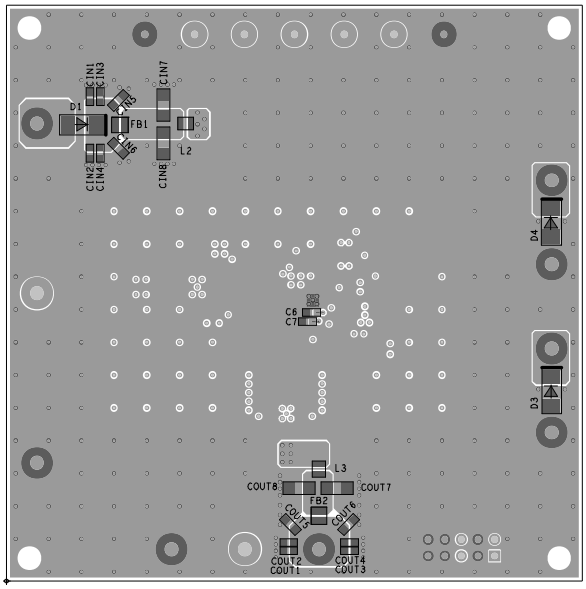


Figure 6: Bottom Layer

Note:

4) EVQ2026A-R-00A, 4-layer, 2oz copper thickness PCB (8.8cmx8.8cm).

MPQ2026A-0000 DEFAULT REGISTER VALUES

Register Index	Default Value	Description
04h	E1h	Pre-boost enabled, LDO1 and LDO2 enabled. Fault handling: Hiccup mode f_{SW} = 400kHz
09h	68h	OUT1 = 9V
0Ah	68h	OUT2 = 9V
0Bh	78h	OUT_BOOST = 12V
0Ch	9Ch	Pre-boost turn-on threshold: 11V Pre-boost over-voltage (OV) rising threshold: 130% of V_{REF} Pre-boost under-voltage (UV) rising threshold: 70% of V_{REF}
0Dh	00h	V_{OUT1} OV threshold: 115% of the set V_{OUT1} V_{OUT1} UV threshold: 75% of the set V_{OUT1} V_{OUT2} OV threshold: 115% of the set V_{OUT2} V_{OUT2} UV threshold: 75% of the set V_{OUT2} VOUT1_PG_H_THR: 105% of the set voltage VOUT1_PG_L_THR: 90% of the set voltage VOUT2_PG_H_THR: 105% of the set voltage VOUT2_PG_L_THR: 90% of the set voltage
0Eh	10h	LDO1 current limit: 400mA
0Fh	10h	STB detection window: 15ms LDO2 current limit: 400mA

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	5/18/2023	Initial Release	-