



EVQ4423C-L-00A

6A, 36V, Step-Down Converter for Automotive Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ4423C-L-00A evaluation board is designed for the MPQ4423C, a high-frequency, synchronous, rectified, step-down switch-mode converter with built-in power MOSFETs. The device offers a very compact solution to achieve 6A of peak output current with excellent load and line regulation across a wide input supply range. The MPQ4423C has synchronous mode operation for higher efficiency across the output current load range.

Current mode operation provides fast transient response and eases loop stabilization.

Fault protections include hiccup mode current limiting, output over-voltage protection (OVP), and thermal shutdown (TSD).

The device requires a minimal number of readily available, standard external components.

The MPQ4423C is available in a QFN-16 (3mmx4mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Typical input voltage	V_{IN}	12	V
Output voltage	V_{OUT}	5	V
Maximum output current	I_{OUT}	6	A

FEATURES

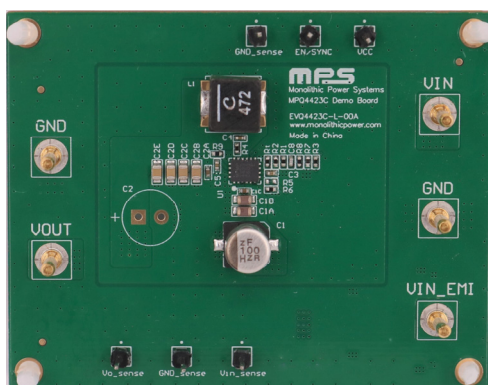
- 50mΩ/30mΩ Low $R_{DS(ON)}$ Internal Power MOSFETs
- 6A Peak Output Current
- Up to 2.2MHz Switching Frequency
- 420kHz or 2.2MHz Switching Frequency with Spread Spectrum
- OUT to VCC Switch-Over LDO Improves Efficiency
- Synchronizes to a 200kHz to 2.2MHz External Clock
- Adjustable Forced PWM Mode or Automatic PFM/PWM Mode
- Passive Output Discharge
- Output Over-Voltage Protection (OVP)
- Over-Current Protection (OCP) and Hiccup Mode
- Thermal Shutdown Protection
- Available in a QFN-16 (3mmx4mm) Package
- AEC-Q100 Grade 1

APPLICATIONS

- Automotive Infotainment
- Wireless Charging
- USB PDs

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EVQ4423C-L-00A EVALUATION BOARD

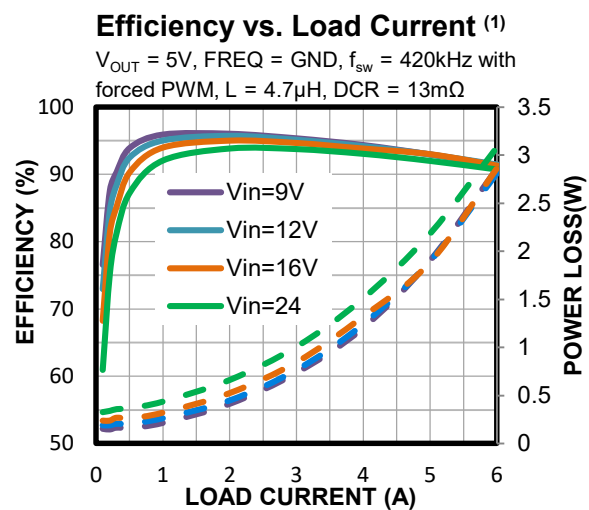


LxWxH (7cmx5.5cmx1.3cm)

Board Number	MPS IC Number
EVQ4423C-L-00A	MPQ4423CGLE-AEC1

Notes:

- The efficiency is measured from the VIN pin. The input EMI filter's power loss is not included.



QUICK START GUIDE

1. Connect the load terminals to:
 - a. Positive (+): VOUT
 - b. Negative (-): GND
2. Preset the power supply output to 12V, then turn the power supply off.
3. Connect the power supply output terminals to:
 - a. Positive (+): VIN
 - b. Negative (-): GND

Note that VIN_EMI is the MPQ4423C's input if there is an EMI filter.

4. Turn the power supply on. The board should automatically start up.

EVALUATION BOARD SCHEMATIC

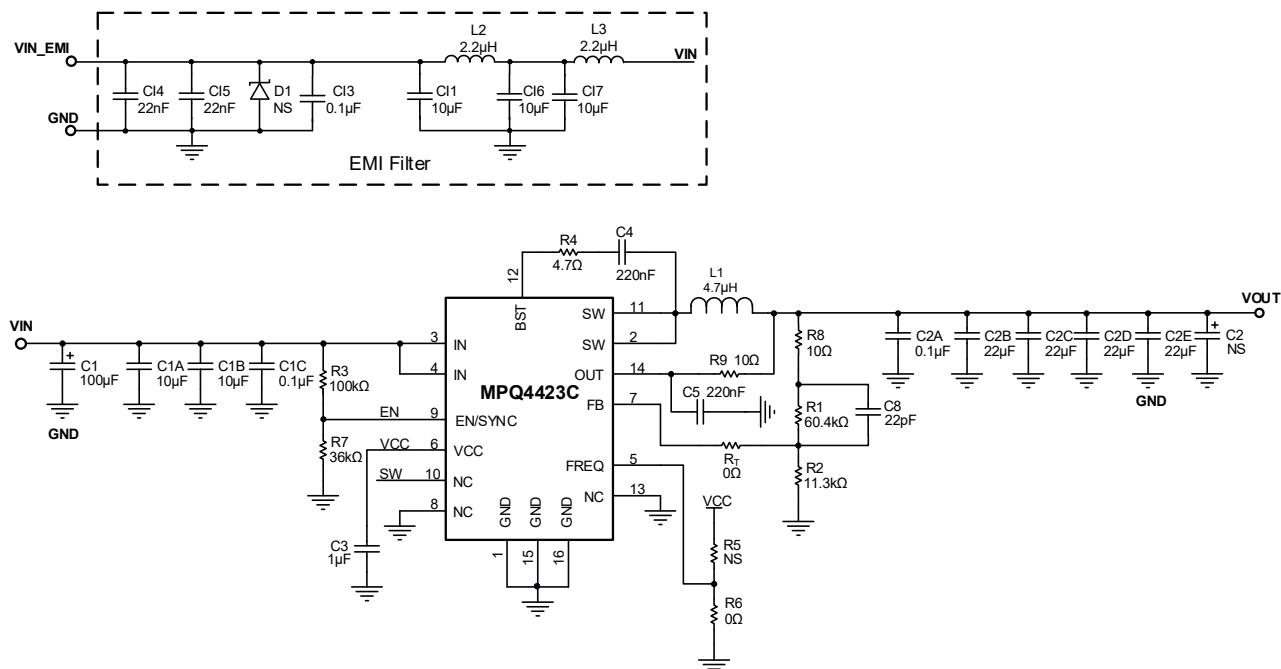


Figure 1: Evaluation Board Schematic (2) (3) (4)

Notes:

- 2) If FREQ = GND, the device operates at 420kHz with frequency spread spectrum in forced PWM mode.
- 3) FREQ = floating, the devices operates at 420kHz with frequency spread spectrum in automatic PFM/PWM mode.
- 4) If FREQ = VCC, the device operates at 2.2MHz with frequency spread spectrum in forced PWM mode.

EVQ4423C-L-00A BILL OF MATERIALS

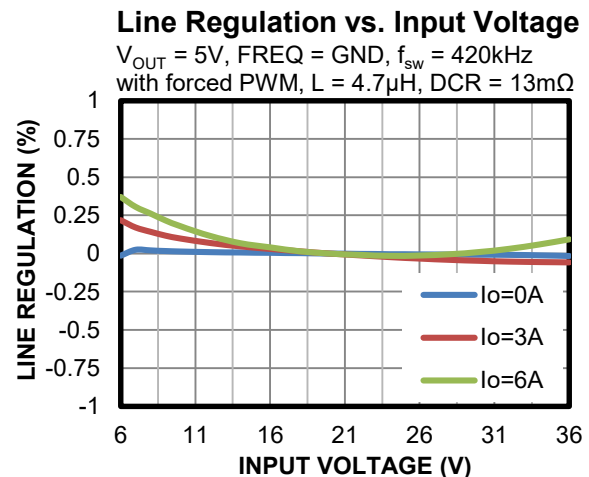
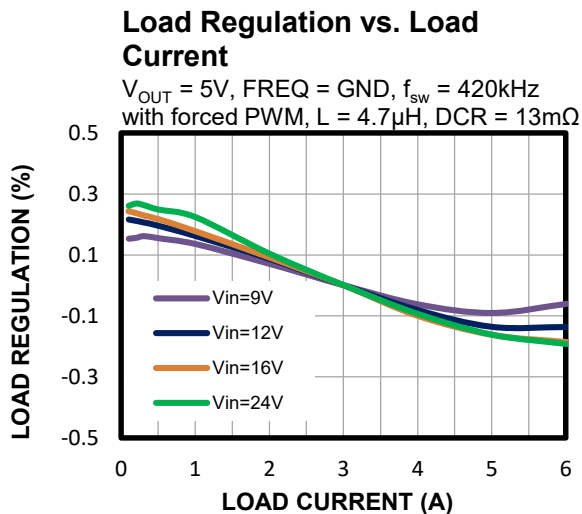
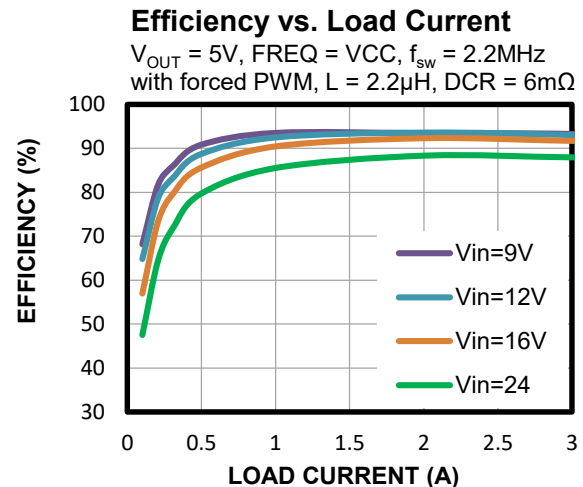
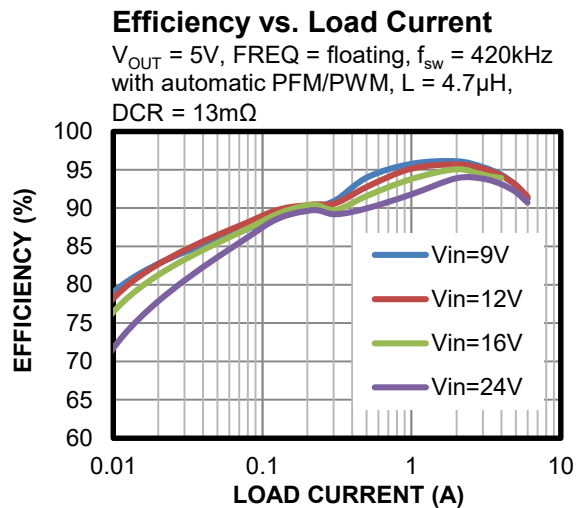
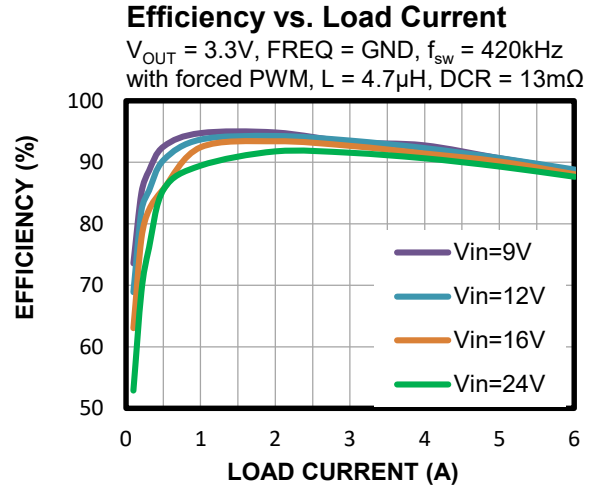
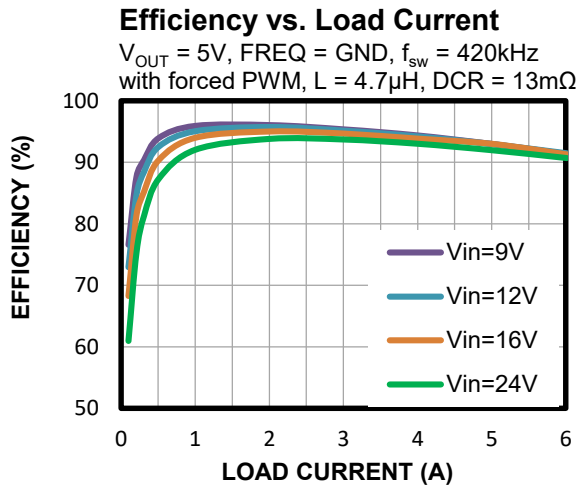
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
1	U1	MPQ4423C	Step-down switch-mode converter	QFN-16 (3mmx4mm)	MPS	MPQ4423CGLE-AEC1
3	CI1, CI6, CI7	10 μ F	Ceramic capacitor, 50V, X5R	0805	Murata	GRM21BR61H106KE43L
1	CI3	0.1 μ F	Ceramic capacitor, 50V, X7R	0805	Murata	GRM21BR71H104KA01L
2	CI4, CI5	22nF	Ceramic capacitor, 50V, X5R	0603	Murata	GRM188R71H223KA01D
1	C1	100 μ F	100 μ F/50V	SMD	Nippon Chemi-Con	EMZR500ARA101MF80G
2	C1A,C1B	10 μ F	Ceramic capacitor, 50V, X5R	0805	Murata	GRM21BR61H106KE43L
4	C2B, C2C, C2D, C2E	22 μ F	Ceramic capacitor, 10V, X5R	0805	Murata	GRM21BR61A226ME51L
2	C1C, C2A	0.1 μ F	Ceramic capacitor, 100V, X5R	0402	Murata	GRM155R62A104KE14D
1	C3	1 μ F	Ceramic capacitor, 10V, X5R	0402	WE	885012105012
2	C4,C5	220nF	Ceramic capacitor, 50V, X5R	0402	Taiyo	UMK105BJ224KV-F
1	C8	22pF	Ceramic capacitor, 50V, C0G	0402	Murata	GRM1555C1H220JA01D
1	L1	4.7 μ H	Inductor, R _{DC} = 13m Ω , I _{SAT} = 15.2A	SMD	Coilcraft	XAL7070-472MEC
	L1	4.7 μ H	Inductor, R _{DC} = 13.1m Ω , I _{SAT} = 10.5A	SMD	Superworld	PIFQ0606LR4R7MN
2	L2, L3	2.2 μ H	Inductor, R _{DC} = 35m Ω , I _{SAT} = 6.2A	SMD	Würth	74438356022
	L2, L3	2.2 μ H	Inductor, R _{DC} = 38.7m Ω , I _{SAT} = 6A	SMD	Superworld	PIFQ0402A2R2MN
1	R1	60.4k Ω	Film resistor, 1%	0402	Yageo	RC0402FR-0760K4L
1	R2	11.3k Ω	Film resistor, 1%	0402	Yageo	RC0402FR-0711K3L
1	R3	100k Ω	Film resistor, 1%	0402	Yageo	RC0402FR-07100KL
1	R4	4.7 Ω	Film resistor, 1%	0402	Yageo	RC0402FR-074R7L
1	R7	36k Ω	Film resistor, 1%	0402	Yageo	RC0402FR-0736KL

EVQ4423C-L-00A BILL OF MATERIALS *(continued)*

2	R8, R9	10Ω	Film resistor, 1%	0402	Yageo	RC0402FR-0710RL
2	R6, R _T	0Ω	Film resistor, 1%	0402	Yageo	RC0402FR-070RL
0	R5, C2, D1	NS				

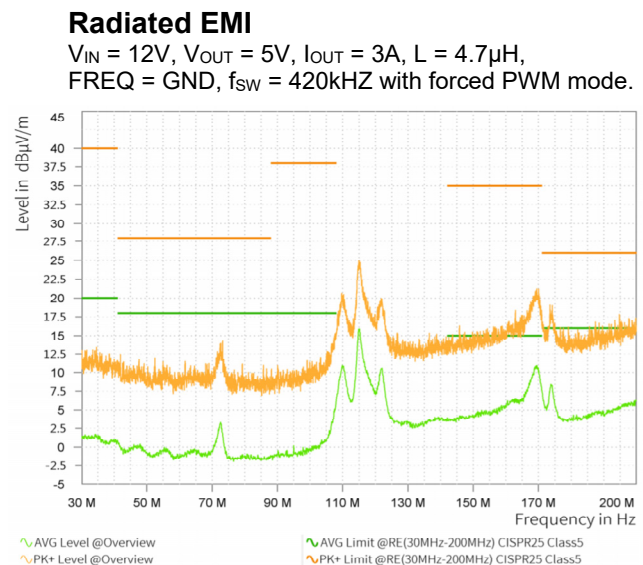
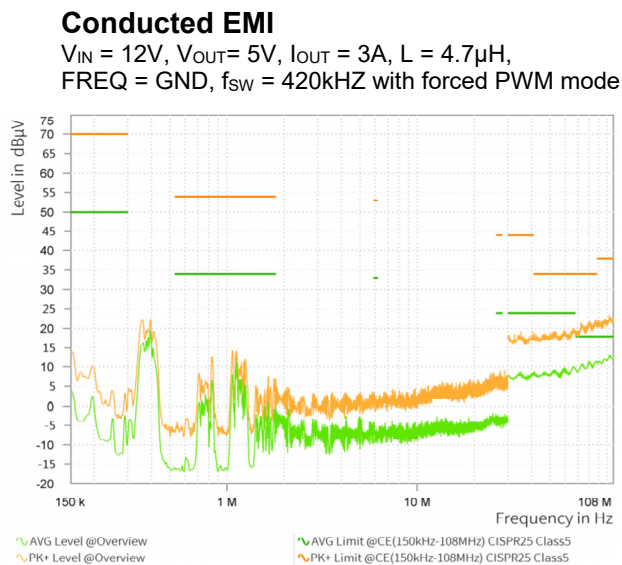
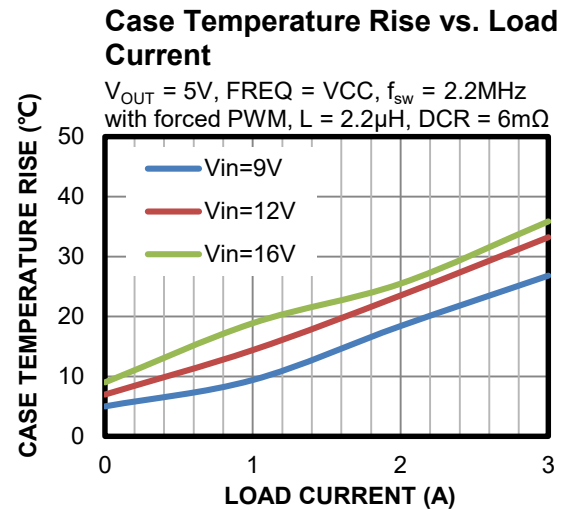
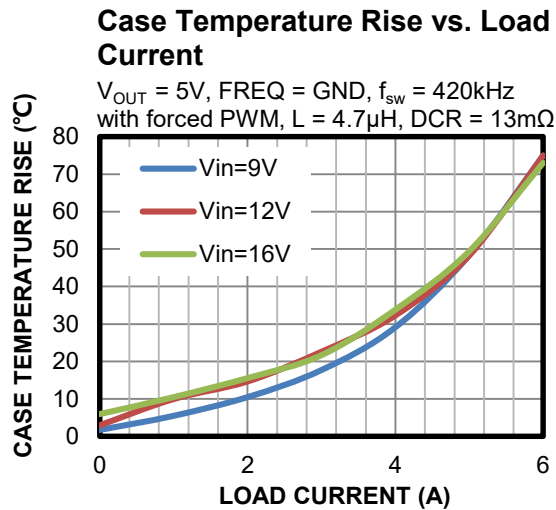
EVb TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.



EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.

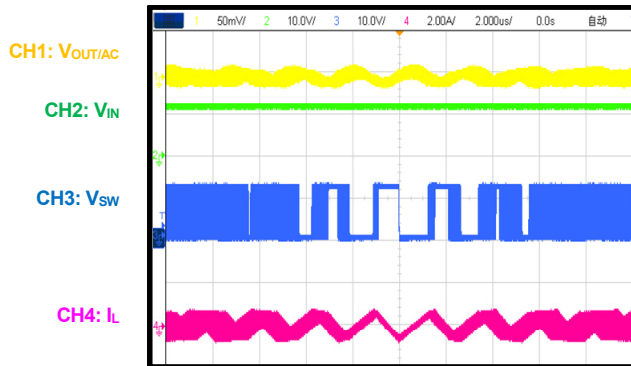


EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.

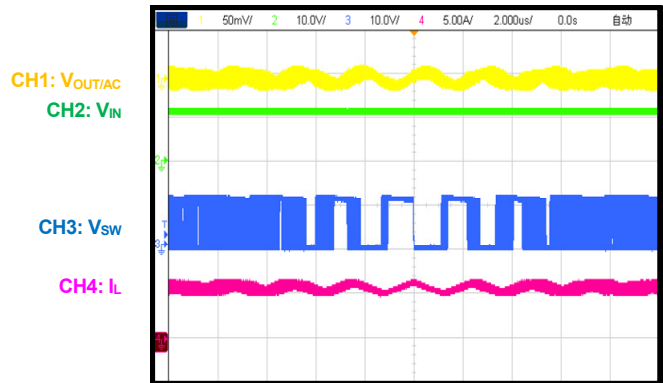
Steady State

FREQ = GND, $f_{SW} = 420kHz$ with forced PWM mode, $I_{OUT} = 0A$



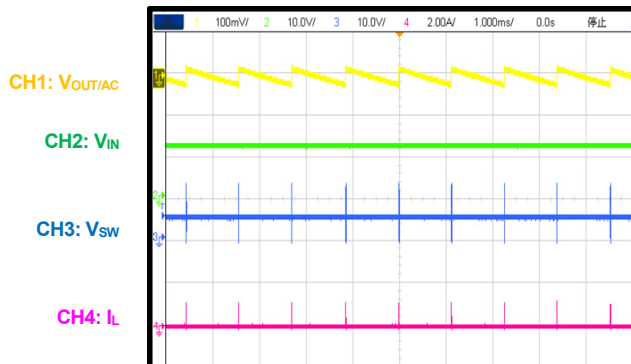
Steady State

FREQ = GND, $f_{SW} = 420kHz$ with forced PWM mode, $I_{OUT} = 6A$



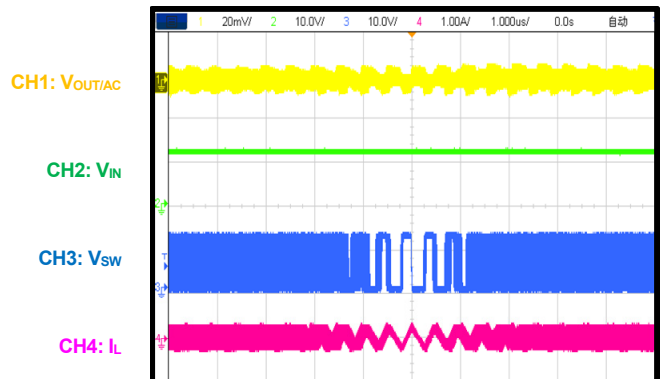
Steady State

FREQ = floating, $f_{SW} = 420kHz$ with automatic PFM/PWM mode, $I_{OUT} = 0A$



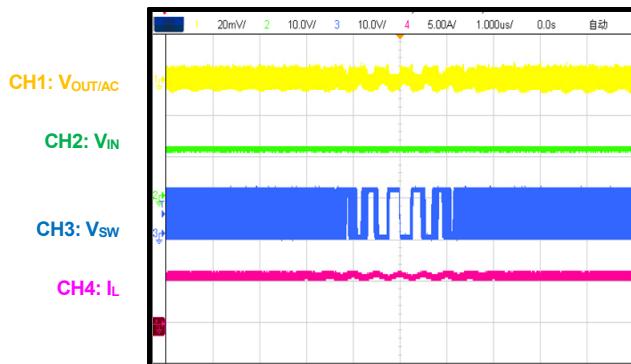
Steady State

FREQ = VCC, $L = 2.2\mu H$, $f_{SW} = 2.2MHz$ with forced PWM mode, $I_{OUT} = 0A$



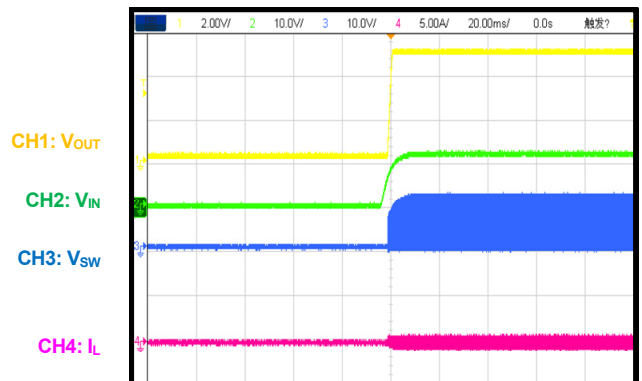
Steady State

FREQ = VCC, $L = 2.2\mu H$, $f_{SW} = 2.2MHz$ with forced PWM mode, $I_{OUT} = 6A$



Start-Up

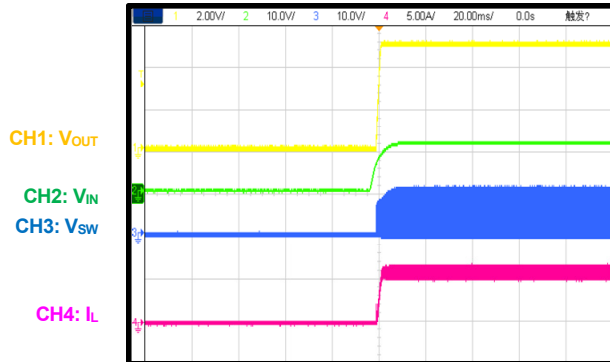
$I_{OUT} = 0A$



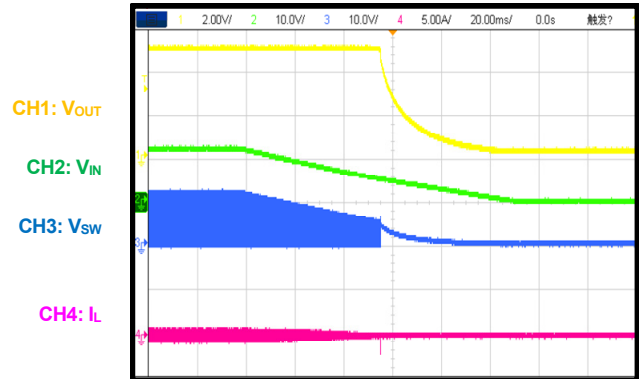
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.

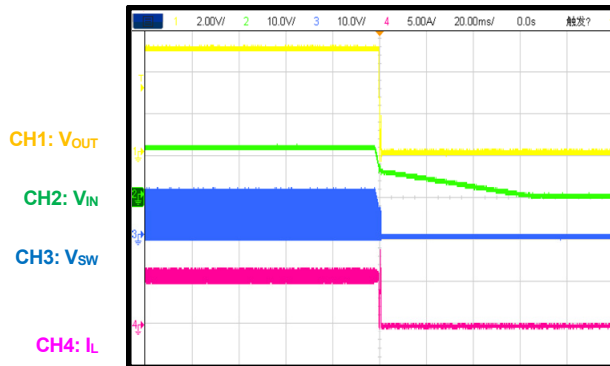
Start-Up

 $I_{OUT} = 6A$


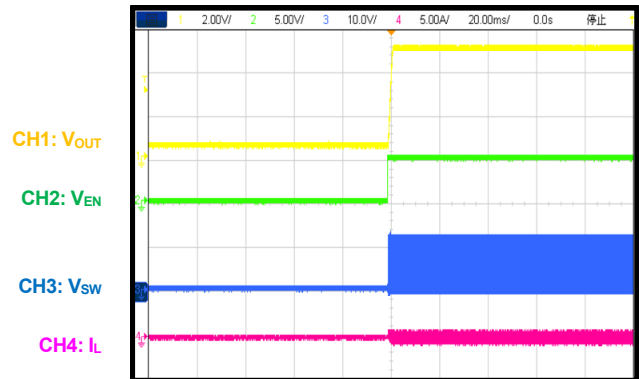
Shutdown

 $I_{OUT} = 0A$


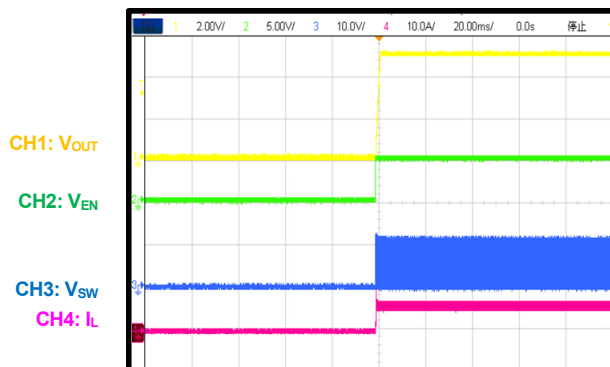
Shutdown

 $I_{OUT} = 6A$


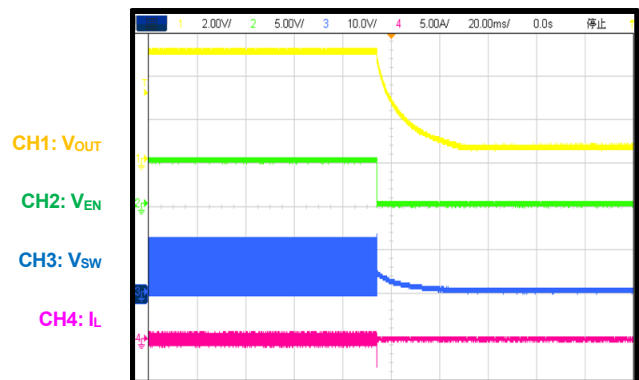
Start-Up through EN

 $I_{OUT} = 0A$


Start-Up through EN

 $I_{OUT} = 6A$


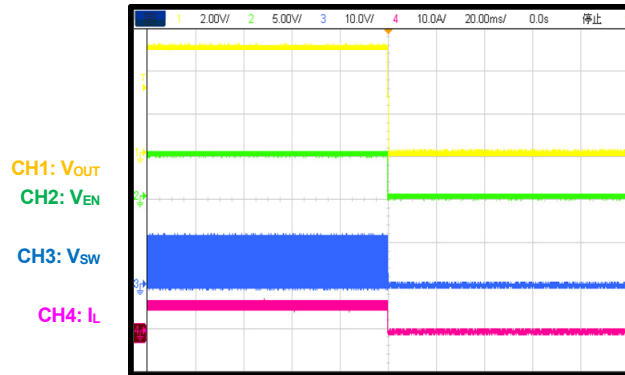
Shutdown through EN

 $I_{OUT} = 0A$


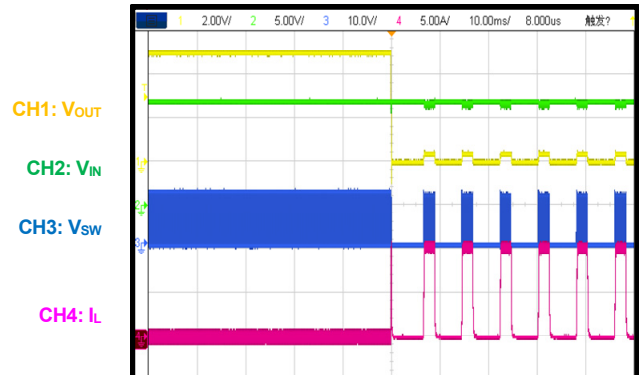
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.

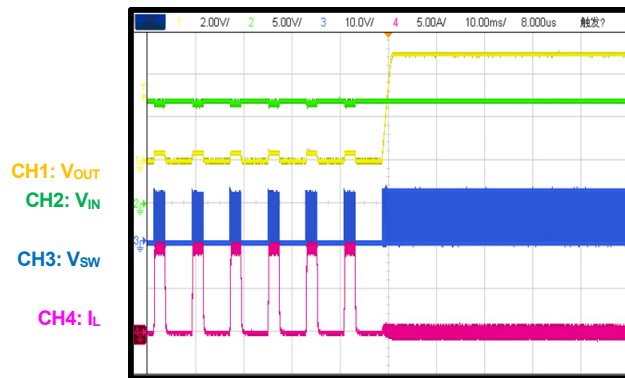
Shutdown through EN

 $I_{OUT} = 6A$


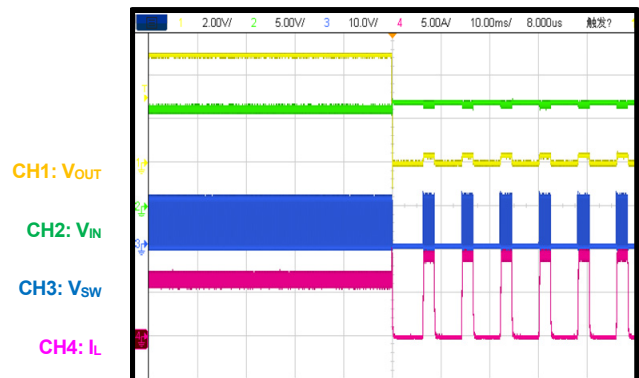
SCP Entry

 $I_{OUT} = 0A$


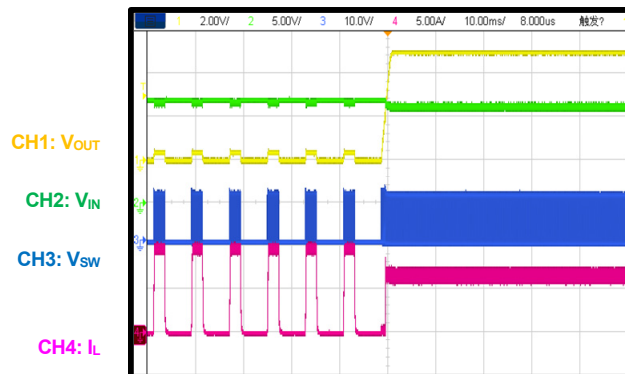
SCP Recovery

 $I_{OUT} = 0A$


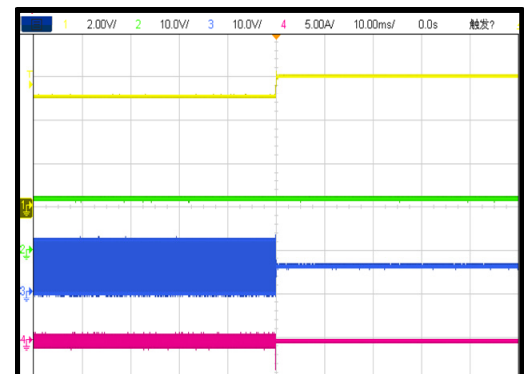
SCP Entry

 $I_{OUT} = 6A$


SCP Recovery

 $I_{OUT} = 6A$


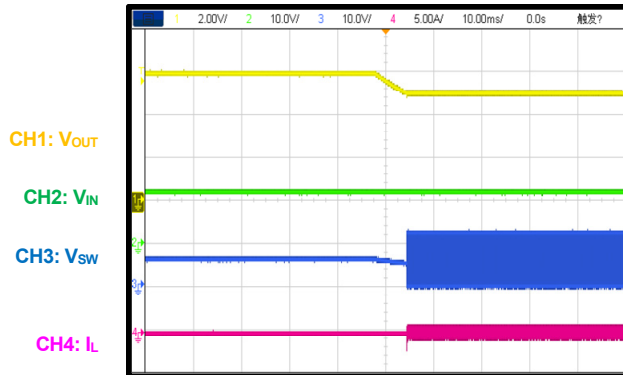
OVP Entry



EVB TEST RESULTS

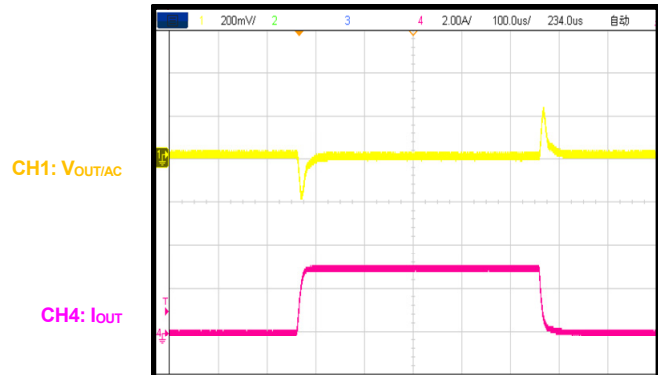
Performance curves and waveforms are tested on the evaluation board, $V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, forced PWM mode, $T_A = 25^\circ C$, unless otherwise noted.

OVP Recovery



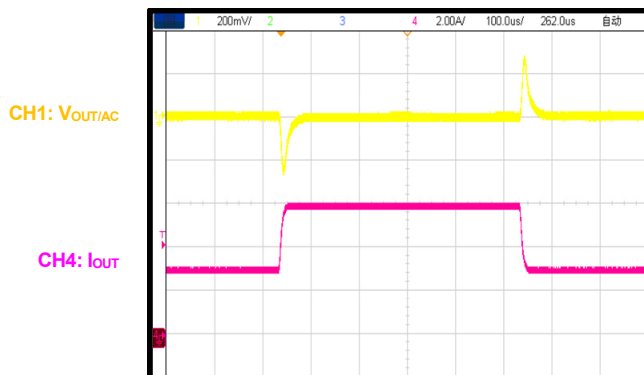
Load Transient

$I_{OUT} = 0$ to 3A, slew rate = $0.4A/\mu s$

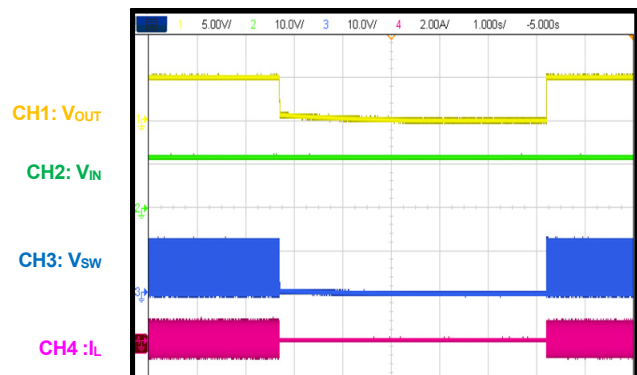


Load Transient

$I_{OUT} = 3$ to 6A, slew rate = $0.4A/\mu s$

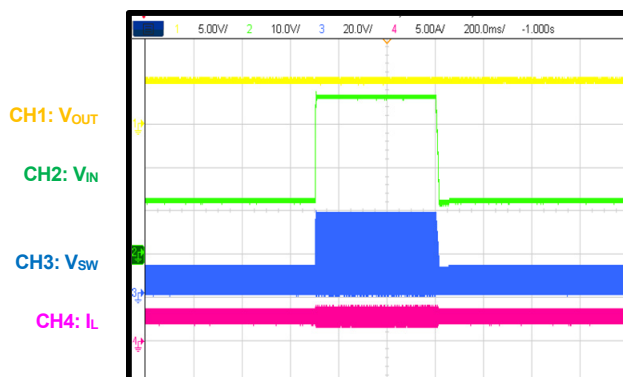


OTP Entry and Recovery



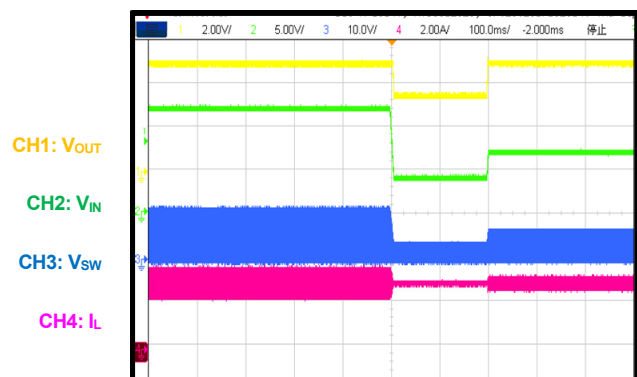
Load Dump

$V_{IN} = 12V$ to 36V, $I_{OUT} = 3A$



Cold-Crank Conditions

$V_{IN} = 12V$ to 4V to 7V, $I_{OUT} = 3A$



PCB LAYOUT

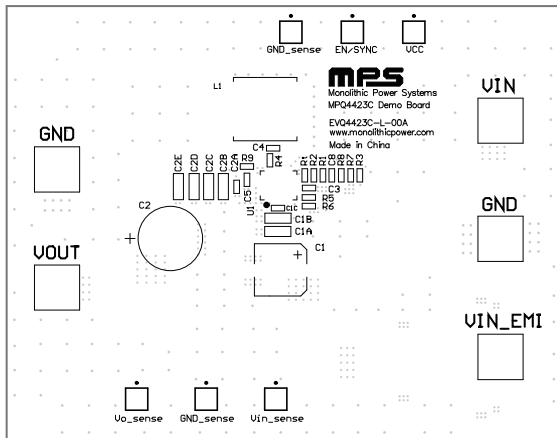


Figure 2: Top Silk Layer

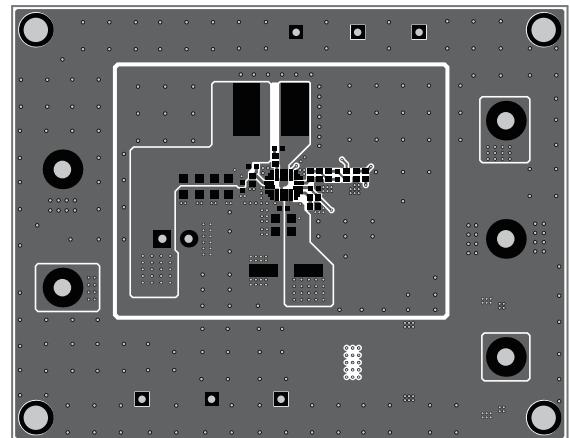


Figure 3: Top Layer

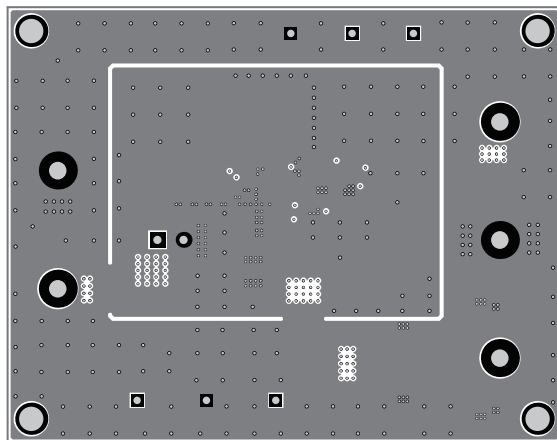


Figure 4: Middle Layer1

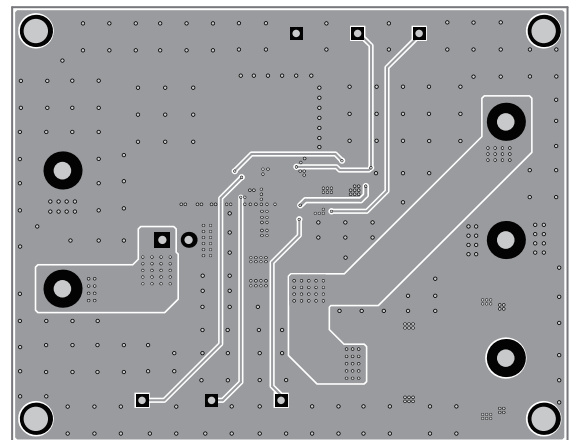


Figure 5: Middle Layer 2

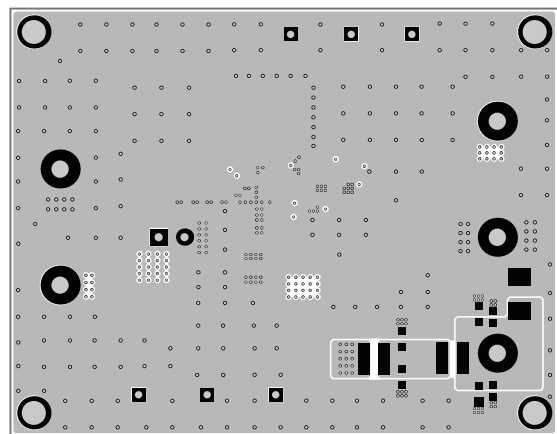


Figure 6: Bottom Layer

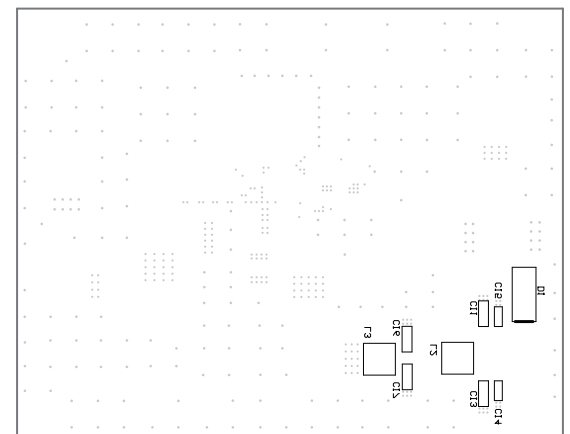


Figure 7: Bottom Silk Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	3/26/2021	Initial Release	-

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