EV2980-R-00A

36V, 100W Synchronous Buck-Boost Controller with I²C and Current Monitor Evaluation Board

DESCRIPTION

The EV2980-R-00A Evaluation Board is designed to demonstrate the capabilities of MPS' MP2980.

The MP2980 is a synchronous, four-switch buck-boost controller to support USB PD3.0 power solutions.

MP2980 provides an I²C interface, making it suitable for USB power delivery (PD) design in USB Type-C power supplies. It uses valley-current control in buck mode and peak-current control in boost mode, providing fast load transient response and smooth buck-boost mode transient. It provides FCCM and programmable average current limit.

MP2980 also features hiccup OCP, hiccup OVP, programmable soft start, and programmable UVLO.

MP2980 is available in a QFN-32(4mmx4mm) package.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	VIN	6(1) – 36	V
Output Voltage(2)	VOUT	Default: 5	V
Output Current	IOUT	0 – 5	A

FEATURES

- 6V(1) to 36V Wide Startup Voltage Range
- Flexible I²C Interface Control for:
  - 3V to 20V Output with 10mV Steps
  - Selectable V_{OUT} Slew Rate
  - Programmable Constant Current Limit
- Output Current Monitor Function(IMON)
- Switching Frequency Spread Spectrum for EMI Optimization
- Integrated V_{OUT} Discharge Function
- Selectable 200kHz, 300kHz, 400kHz, and 600kHz Switching Frequency
- Forced CCM Operation Mode
- OCP, SCP, and OVP
- Interrupt Indicator for OCP, OVP, and PNG
- Available in a QFN-32(4mmx4mm) Package

APPLICATIONS

- USB Power Delivery
- Industrial PC Power Supplies
- Super-Capacitor Charging

NOTE:
(1) VIN must be 6V or higher to enable this board. After startup, it can work with 5V input voltage.
(2) Using I²C interface can get other output voltage.

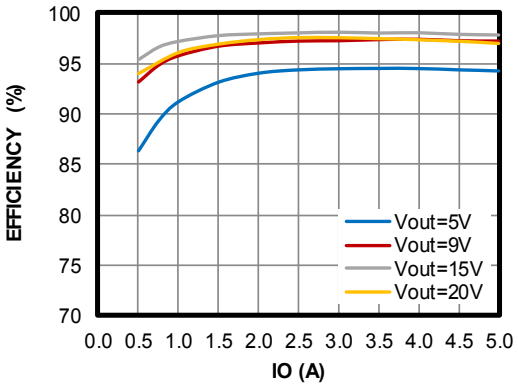
EV2980-R-00A EVALUATION BOARD

(L × W) 9.14cm x 6.6cm

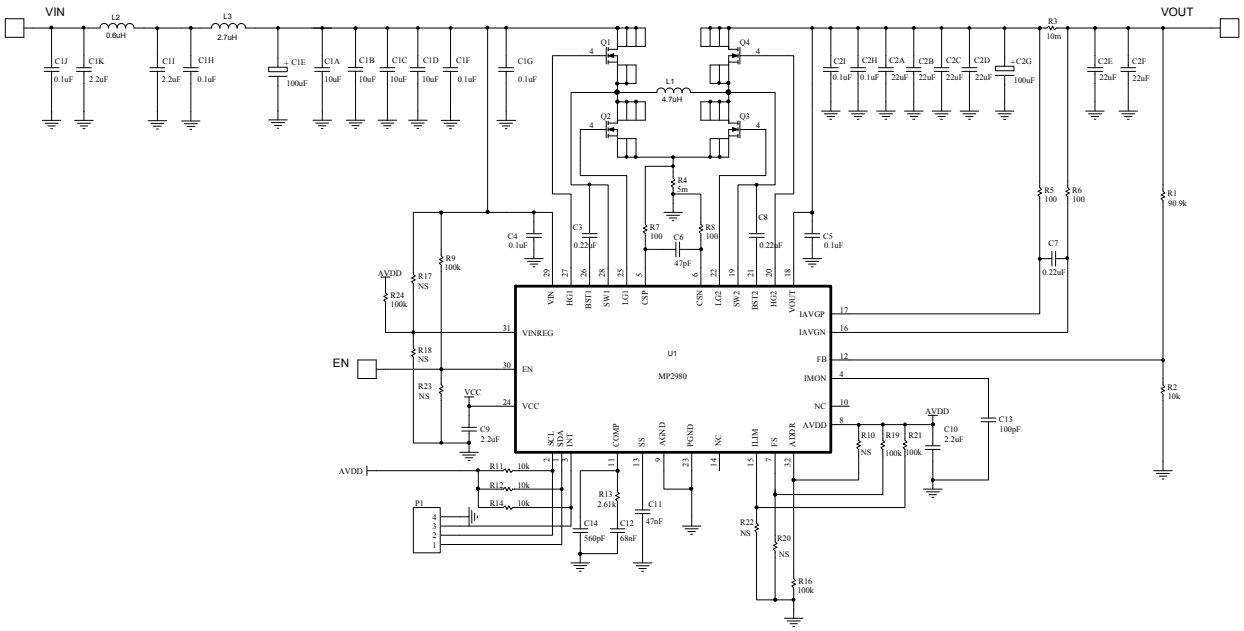
Board Number	MPS IC Number
EV2980-R-00A	MP2980GR

Efficiency vs. Load

V_{IN}=12V



EVALUATION BOARD SCHEMATIC



EV2980-R-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
8	C1G, C1F, C1J, C1H, C2I, C2H, C4, C5	100nF	Ceramic Cap, 50V, X7R	0603	Murata	GRM188R71H104KA93D
4	C1A, C1B, C1C, C1D	10µF	Ceramic Cap, 50V, X7R	1210	Murata	GRM32ER71H106KA12L
1	C1E	100µF	Alum-electrolytic Cap. 50V, 460mOhm	SMD	Wurth	865080653016
2	C1I, C1K	2.2µF	Ceramic Cap, 50V, X7R	1210	Murata	GRM32ER71H225KL
6	C2A, C2B, C2C, C2D, C2E, C2F	22µF	Ceramic Cap, 25V, X5R	0805	Murata	GRM32ER71H106KA12L
1	C2G	100µF	25V, Alum-Polymer Cap, ESR=24mOhm	SMD	Panasonic	25SVPF100M
3	C3, C7, C8	220nF	Ceramic Cap,16V, X7R	0603	Murata	GRM188R71C224KA01D
1	C6	47pF	Ceramic Cap, 50V, COG	0603	Murata	GRM1885C1H470JA01D
1	C9	2.2µF	Ceramic Cap,16V, X7R	0805	Murata	GRM21BR71C225KA12L
1	C10	2.2µF	Ceramic Cap,10V, X7R	0603	Murata	GRM188R71A225KE15D
1	C11	47nF	Ceramic Cap,16V, X7R	0603	Murata	GRM188R71C473KA01D
1	C12	68nF	Ceramic Cap,50V, X7R	0603	TDK	C1608X7R1H683KT000N
1	C13	100pF	Ceramic Cap, 50V, COG	0603	Murata	GRM1885C1H101JA01D
1	C14	560pF	Ceramic Cap, 50V, X7R	0603	YAGEO	CC0603KRX7R9BB561
1	L1	4.7µH			Coilcraft	XAL1010-472MED
1	L2	0.6µH	Inductor, DCR=4.11mΩ,Isat=19.8A	SMD	Coilcraft	XAL5030-601MEC
1	L3	2.7µH		SMD	Coilcraft	XEL6060-272MEC
1	P1	4PINS	4Pins,1 row,straight	DIP	WE	61300411121
2	Q1, Q2	AON7242	40V, 3.2mΩ, 50A, 26.5nC, N-channel Mosfet	DFN 3.3x3.3 EP	AOS	AON7242
2	Q3, Q4	AON7502	30V, 3.9mΩ, 30A,15.6nC, N-channel Mosfet	DFN 3x3 EP	AOS	AON7502

EV2980-R-00A BILL OF MATERIALS *(continued)*

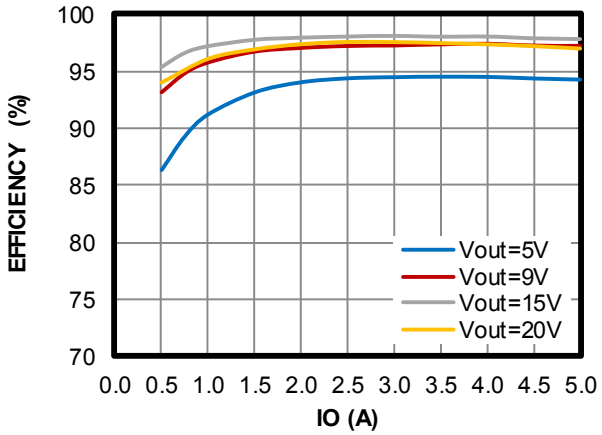
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	R1	90K9	Film Res,1%	0603	YAGEO	RC0603FR-0790K9L
4	R2,R12 R11, R14	10K	Film Res,1%	0603	YAGEO	RC0603FR-0710KL
1	R3	10m	1%, long side, 1W, current sensing resistor	L1508	Film Tech	RL3720WT-R010-F
1	R4	5m	1%, long side, 1W, current sensing resistor	L1508	Film Tech	RL3720WT-R005-F
4	R5, R6, R7, R8	100R	Film Res,1%	0603	YAGEO	RC0603FR-07100RL
5	R9, R16, R19, R21, R24	100K	Film Res,1%	0603	YAGEO	RC0603FR-07100KL
1	R13	2K61	Film Res,1%	0603	YAGEO	RC0603FR-072K61L
1	U1	MP2980	High Efficiency Synchronous Buck-Boost Controller with I²C	QFN-32 (4mmx4mm)	MPS	MP2980GR

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

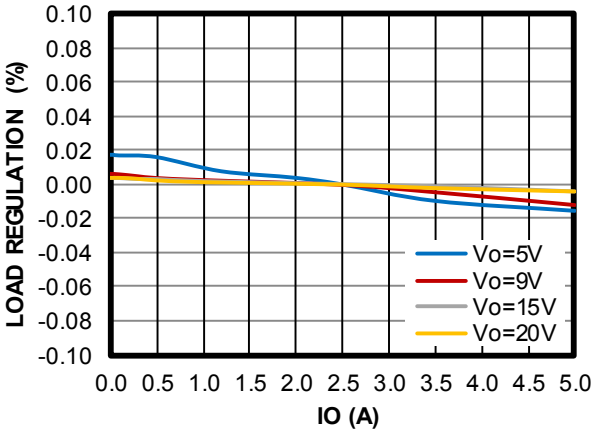
Efficiency vs. Load

V_{IN}=12V

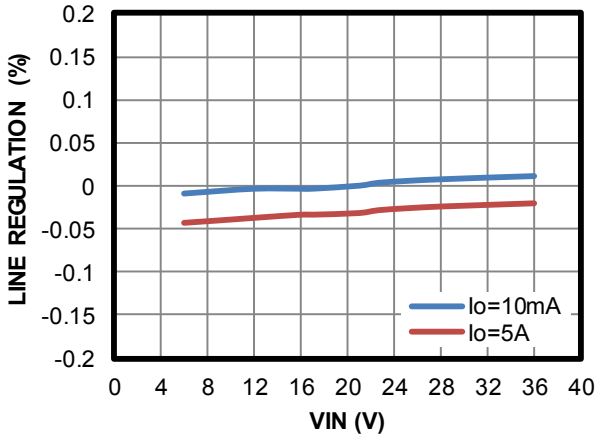


Load Regulation

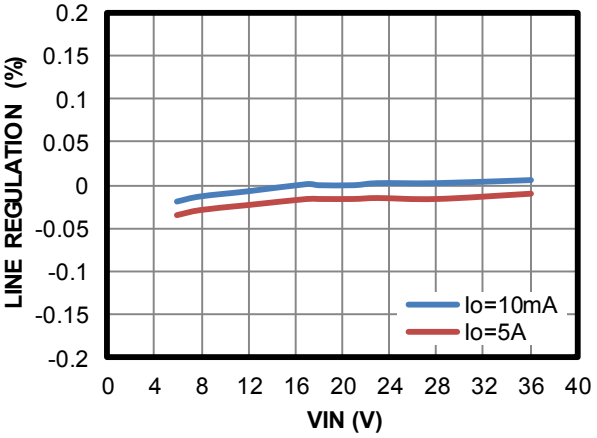
V_{IN}=12V



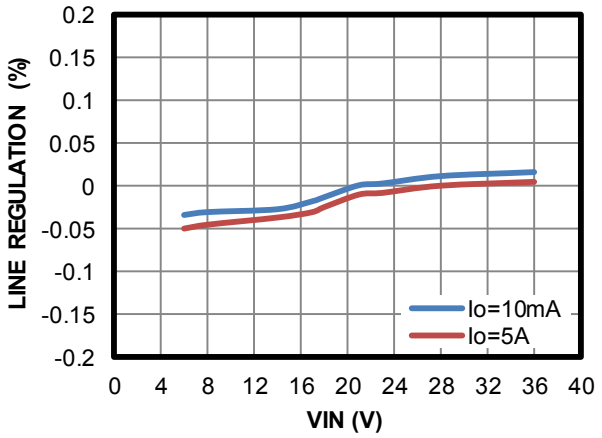
V_{OUT}=5V Line Regulation



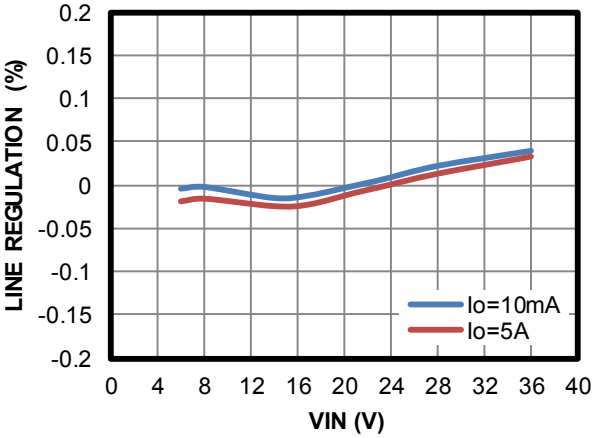
V_{OUT}=9V Line Regulation



V_{OUT}=15V Line Regulation



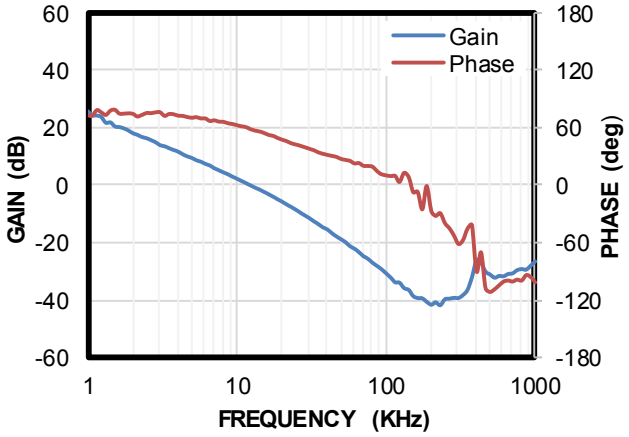
V_{OUT}=20V Line Regulation



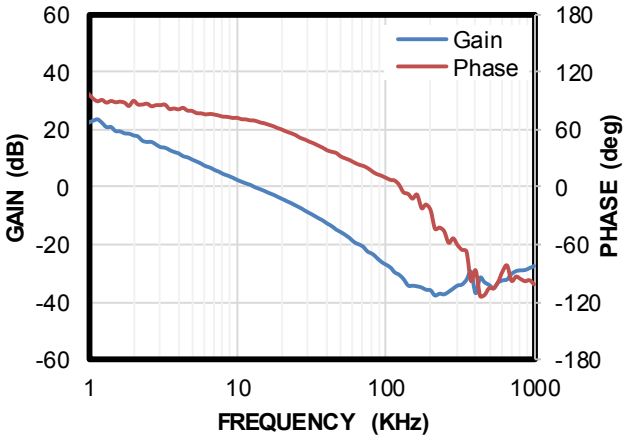
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

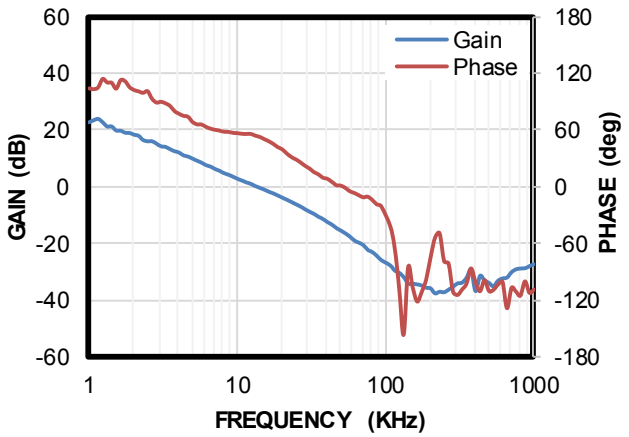
Bode Plot
V_{IN}=12V, V_{OUT}=5V, I_{OUT}=3A



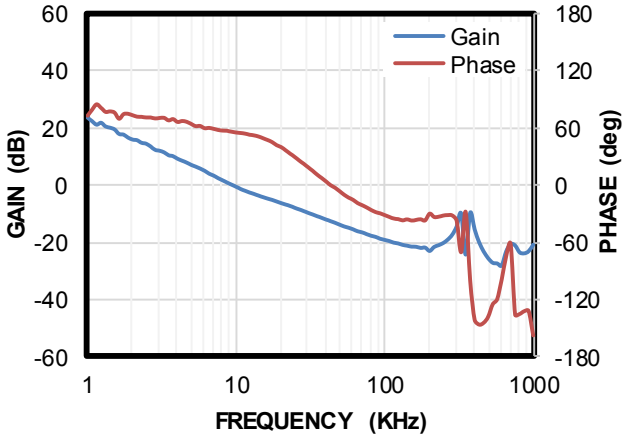
Bode Plot
V_{IN}=12V, V_{OUT}=9V, I_{OUT}=3A



Bode Plot
V_{IN}=12V, V_{OUT}=15V, I_{OUT}=3A



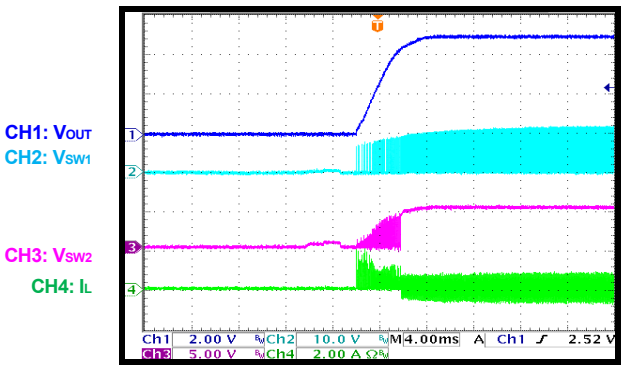
Bode Plot
V_{IN}=12V, V_{OUT}=20V, I_{OUT}=5A



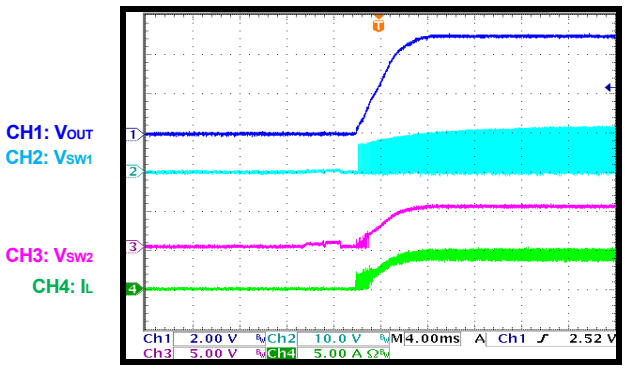
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

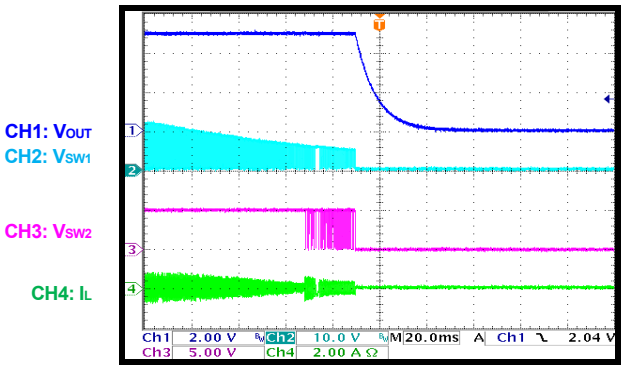
V_{IN} Startup
Load=0A



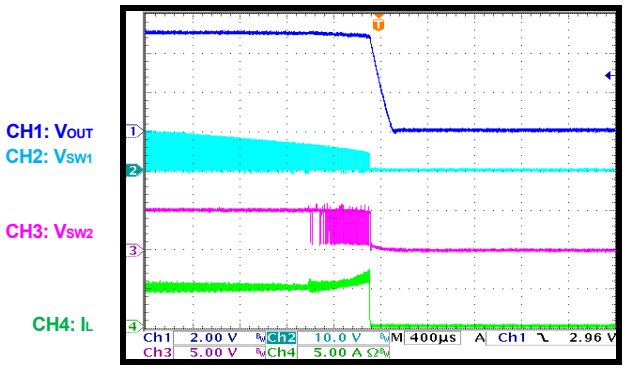
V_{IN} Startup
Load=5A



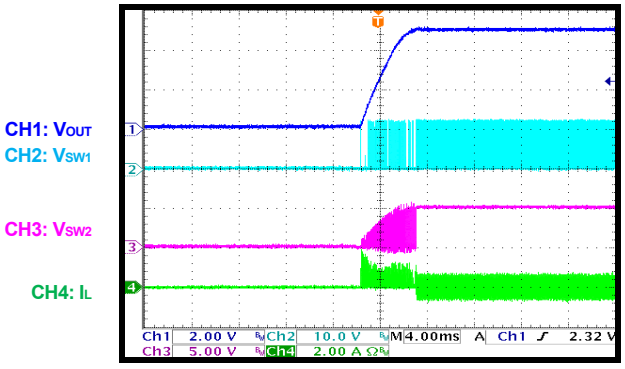
V_{IN} Shutdown
Load=0A



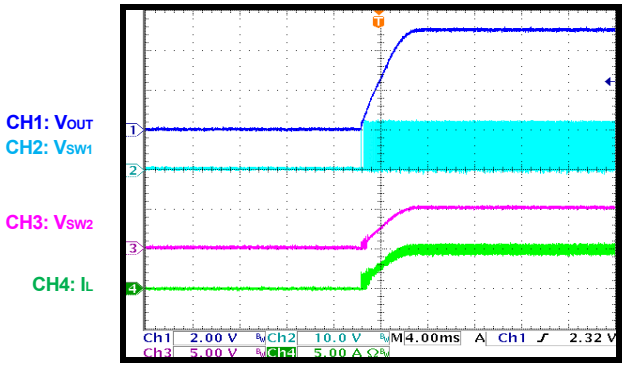
V_{IN} Shutdown
Load=5A



ENPWR Bit Enable through I²C Command
Load=0A



ENPWR Bit Enable through I²C Command
Load=5A

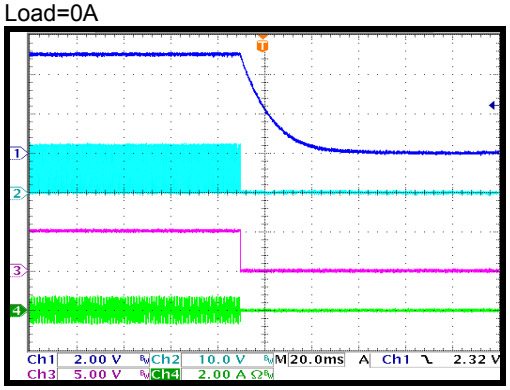


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

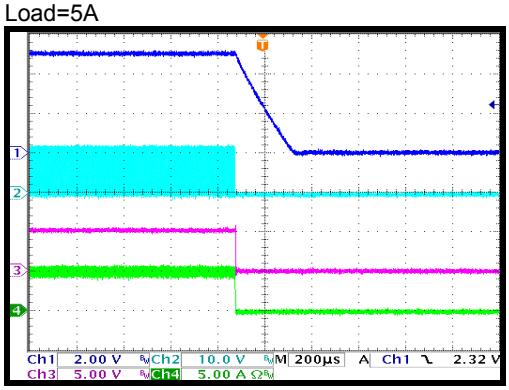
ENPWR Bit Disable through I²C Command

Load=0A



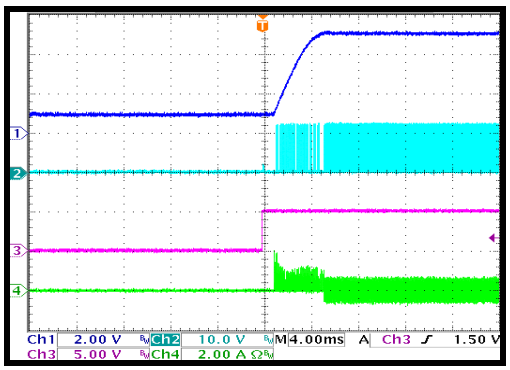
ENPWR Bit Disable through I²C Command

Load=5A



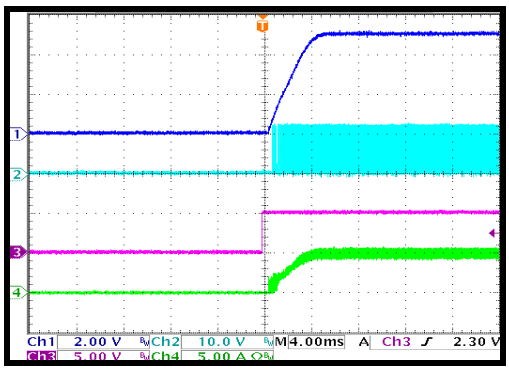
EN Enable through EN Pin

Load=0A



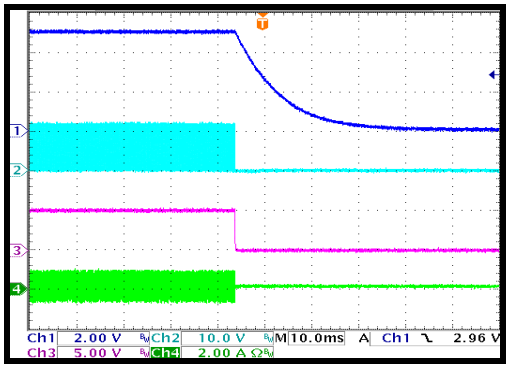
EN Enable through EN Pin

Load=5A



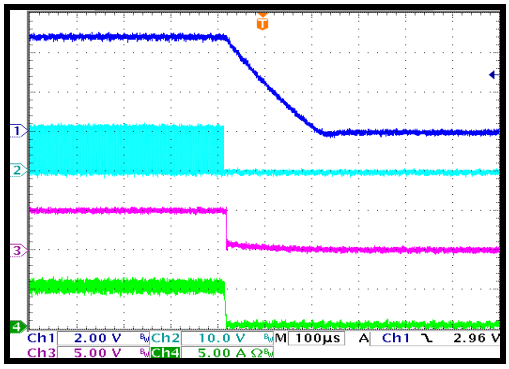
EN Disable through EN Pin

Load=0A



EN Disable through EN Pin

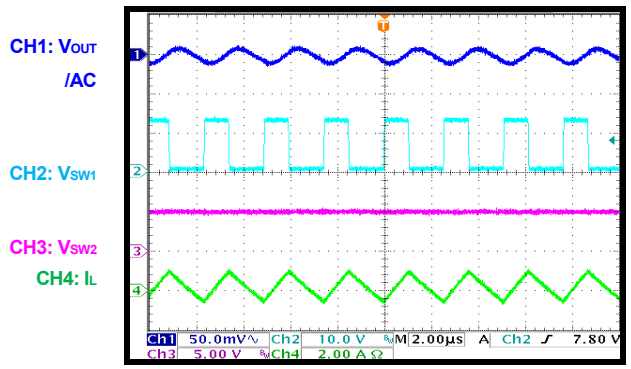
Load=5A



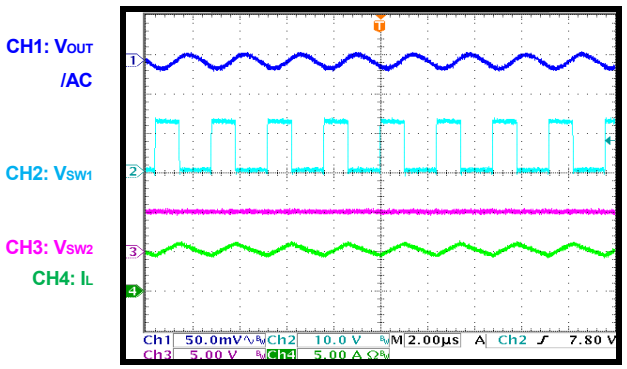
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

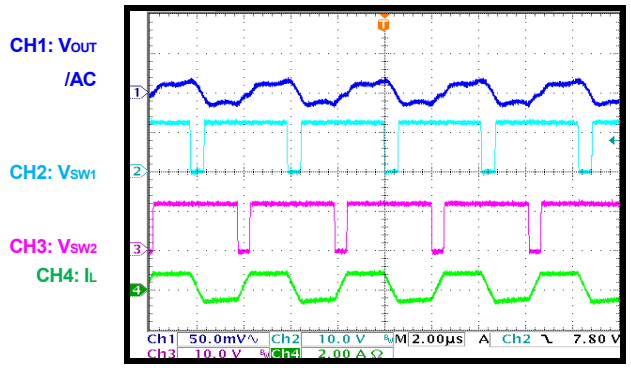
Steady State
V_{OUT}=5V, Load=0A



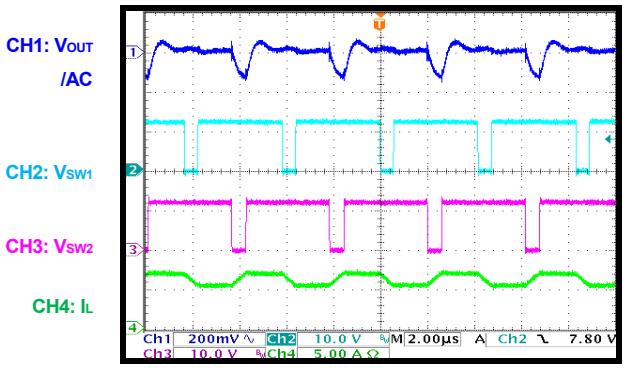
Steady State
V_{OUT}=5V, Load=5A



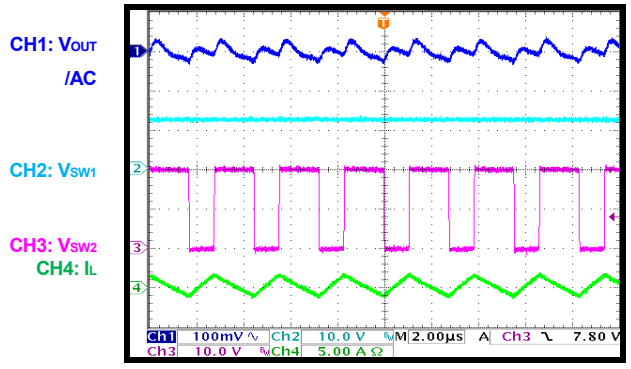
Steady State
V_{OUT}=12V, Load=0A, BB_Fsw bit=1



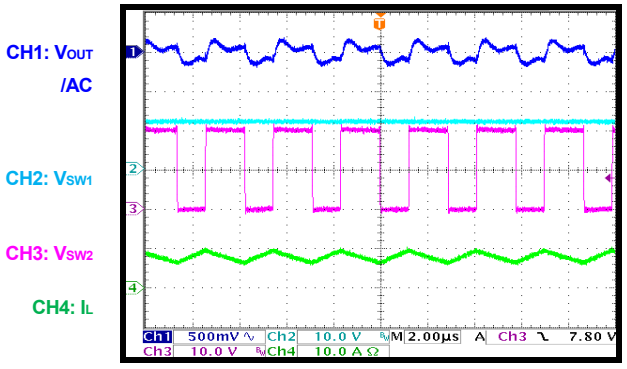
Steady State
V_{OUT}=12V, Load=5A, BB_Fsw bit=1



Steady State
V_{OUT}=20V, Load=0A



Steady State
V_{OUT}=20V, Load=5A

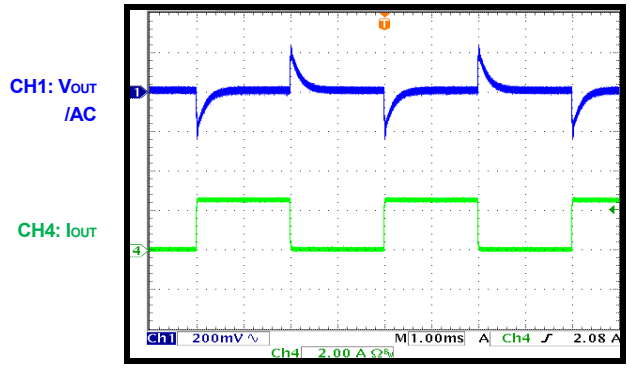


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

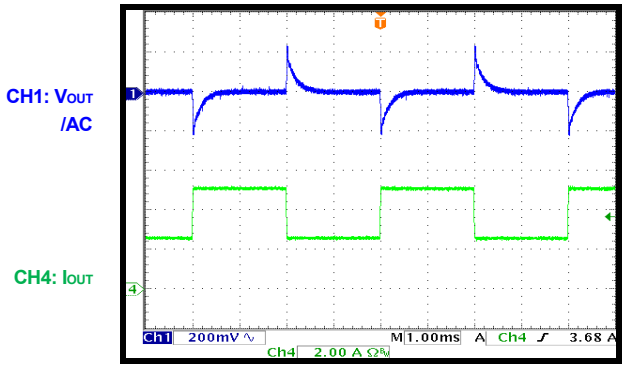
Load Transient

V_{IN}=12V, V_{OUT}=5V, Load=0A to 2.5A, 150mA/us



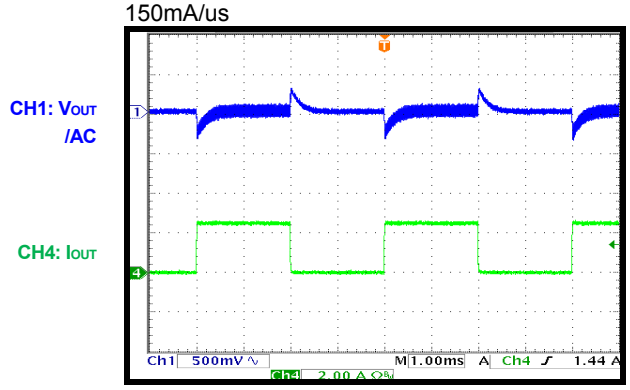
Load Transient

V_{IN}=12V, V_{OUT}=5V, Load=2.5A to 5A, 150mA/us



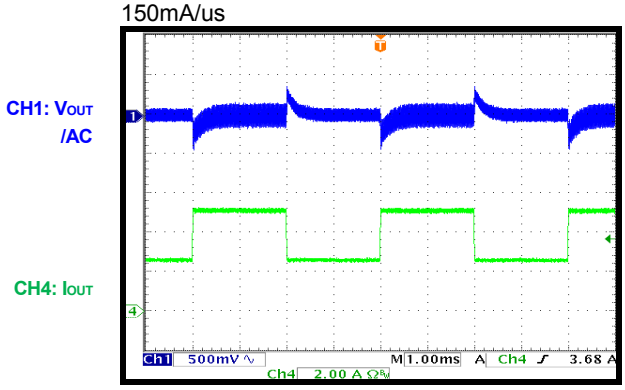
Load Transient

V_{IN}=12V, V_{OUT}=20V, Load=0A to 2.5A, 150mA/us



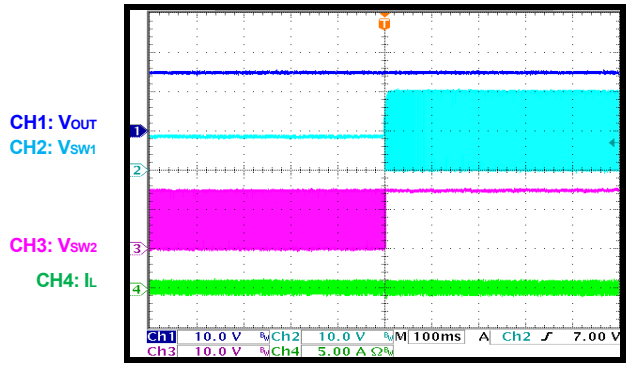
Load Transient

V_{IN}=12V, V_{OUT}=20V, Load=2.5A to 5A, 150mA/us



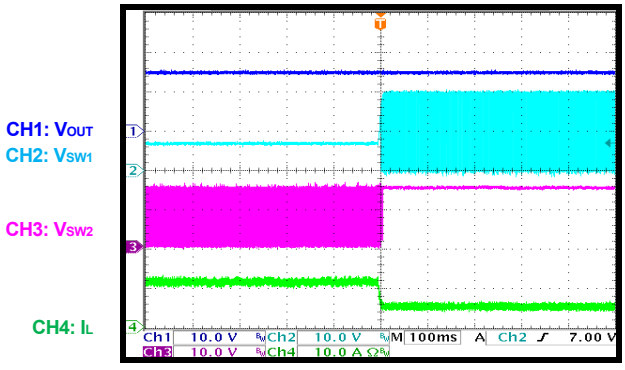
Input Voltage Transient

V_{IN}=9V to 20V, V_{OUT}=15V, Load=0A



Input Voltage Transient

V_{IN}=9V to 20V, V_{OUT}=15V, Load=5A

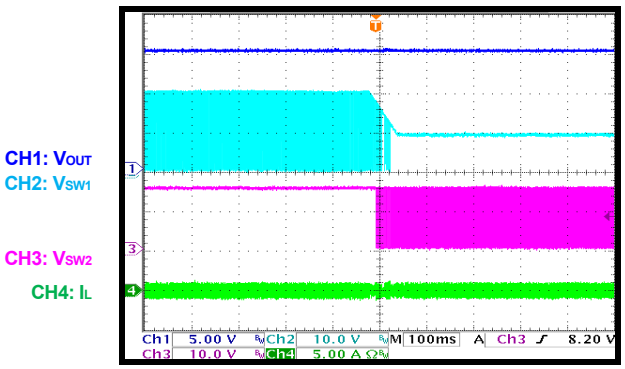


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

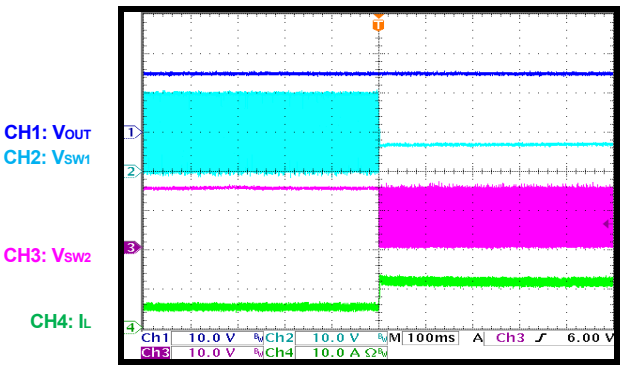
Input Voltage Transient

V_{IN}=20V to 9V, V_{OUT}=15V, Load=0A



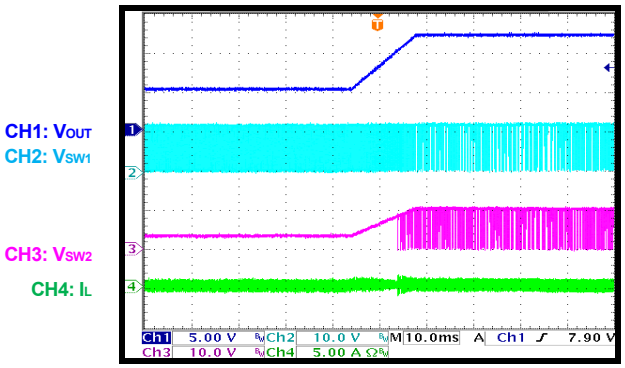
Input Voltage Transient

V_{IN}=20V to 9V, V_{OUT}=15V, Load=5A



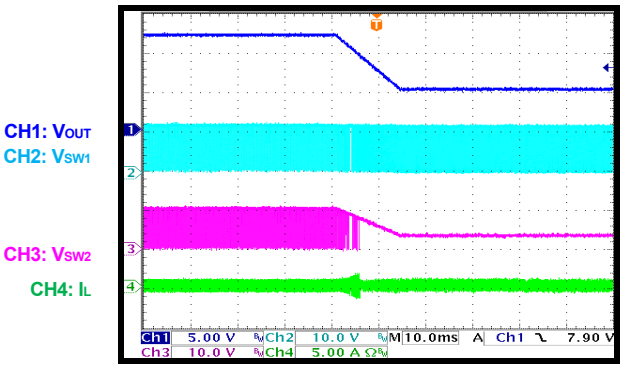
Output Voltage Transient

V_{OUT}=5V to 12V, I_{OUT}=0A



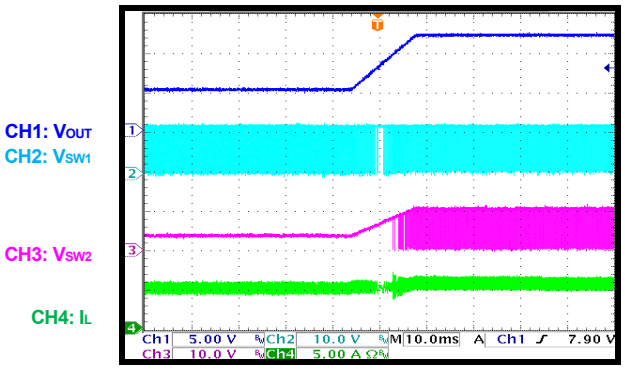
Output Voltage Transient

V_{OUT}=12V to 5V, Load=0A



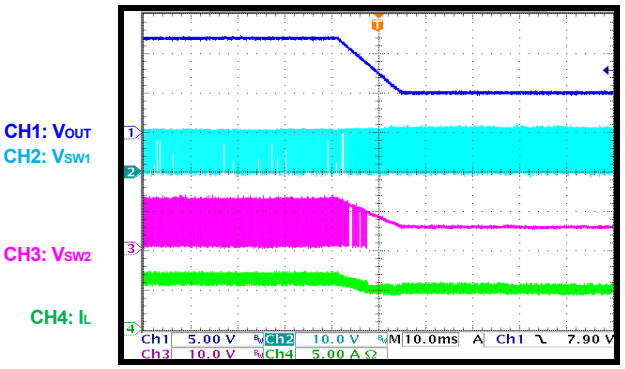
Output Voltage Transient

V_{OUT}=5V to 12V, I_{OUT}=5A



Output Voltage Transient

V_{OUT}=12V to 5V, I_{OUT}=5A

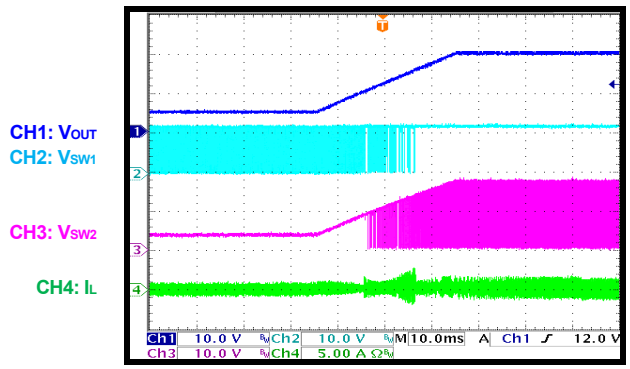


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

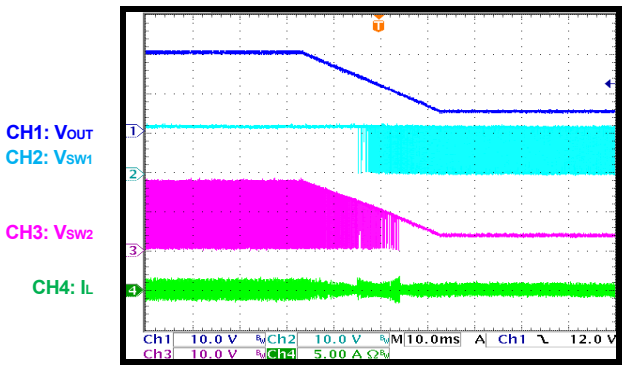
Output Voltage Transient

V_{OUT}=5V to 20V, Load=0A



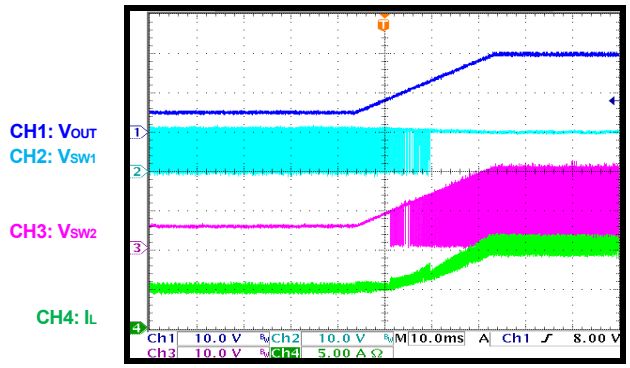
Output Voltage Transient

V_{OUT}=20V to 5V, Load=0A



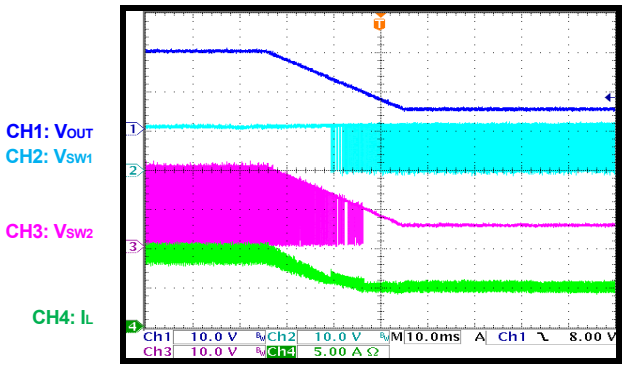
Output Voltage Transient

V_{OUT}=5V to 20V, Load=5A

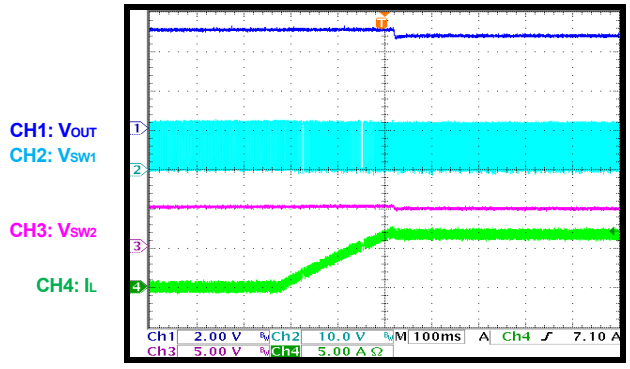


Output Voltage Transient

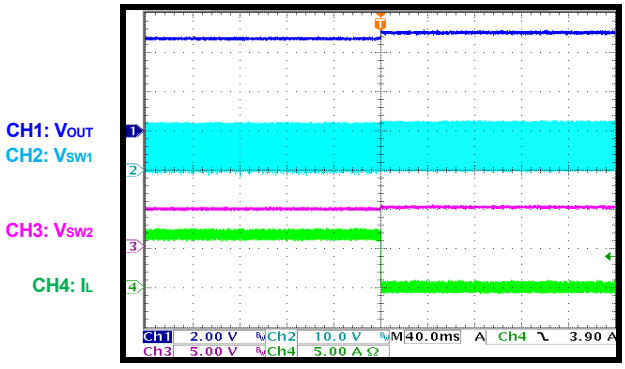
V_{OUT}=20V to 5V, Load=5A



OCP Enter



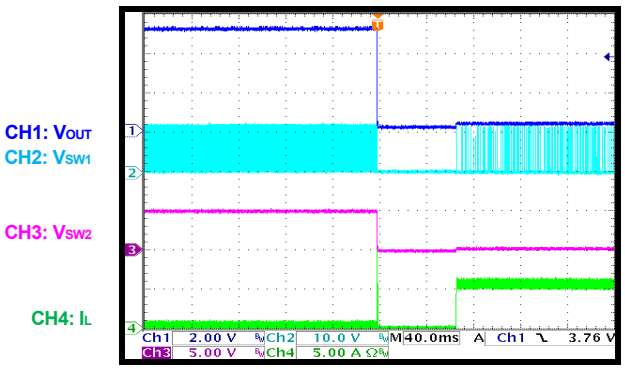
OCP Recover



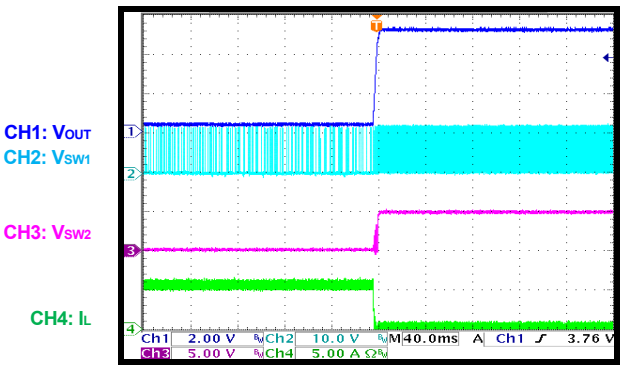
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, T_A = +25°C, unless otherwise noted.

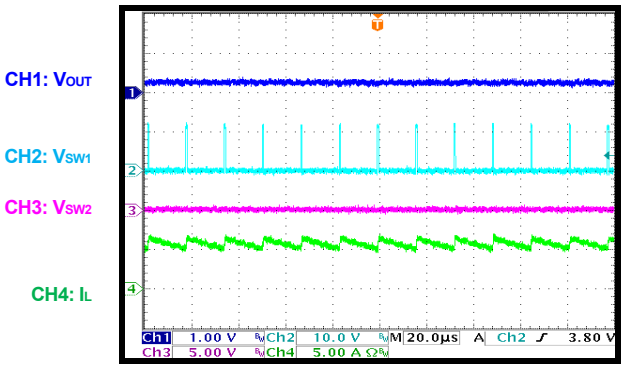
SCP Enter



SCP Recover



SCP Steady State



PRINTED CIRCUIT BOARD LAYOUT

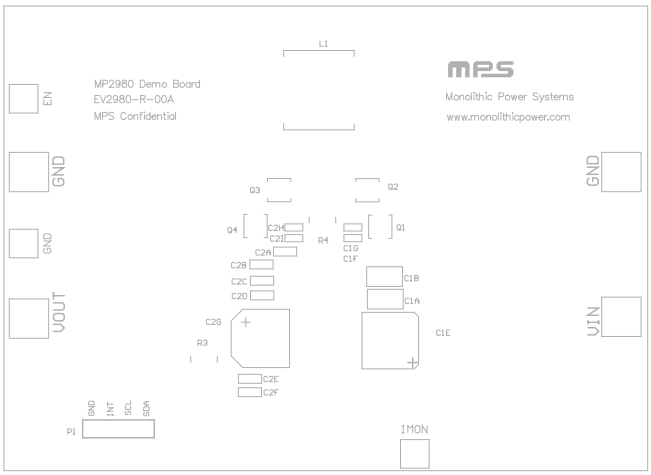


Figure 1: Top Silkscreen Layer

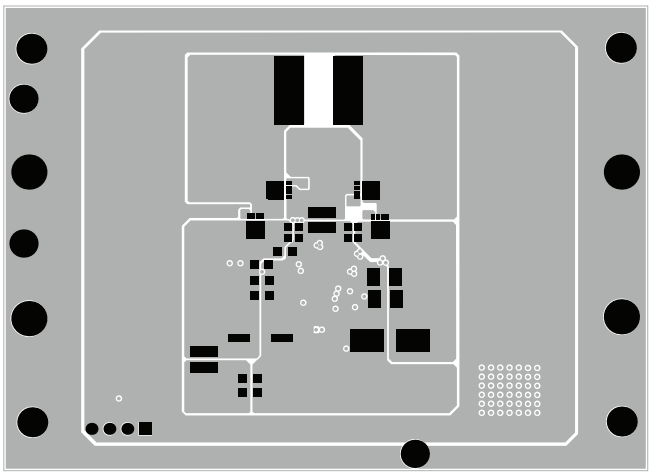


Figure 2: Top Layer

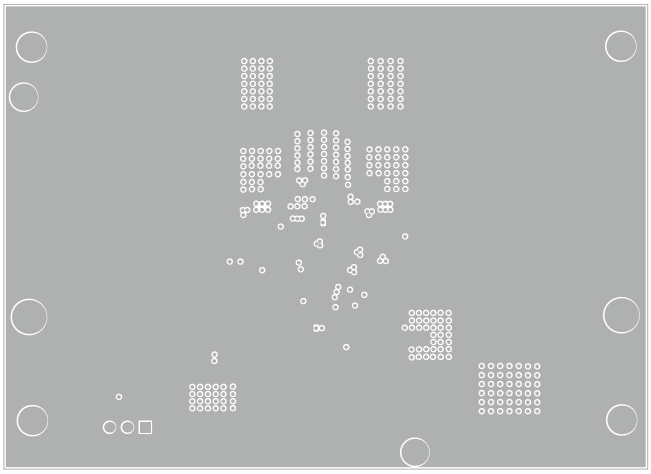


Figure 3: Middle Layer 1

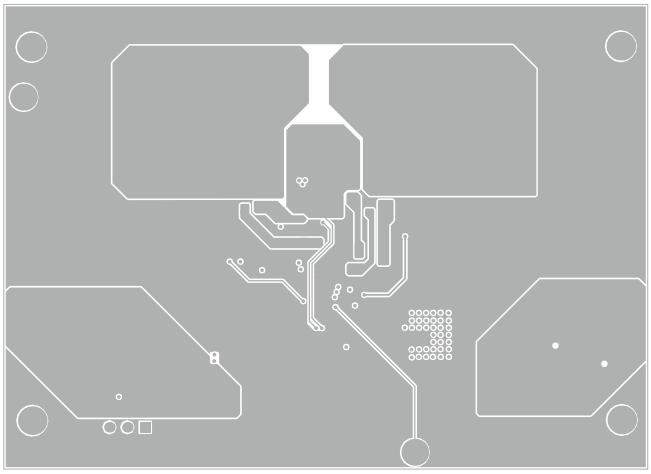


Figure 4: Middle Layer 2

PRINTED CIRCUIT BOARD LAYOUT *(continued)*

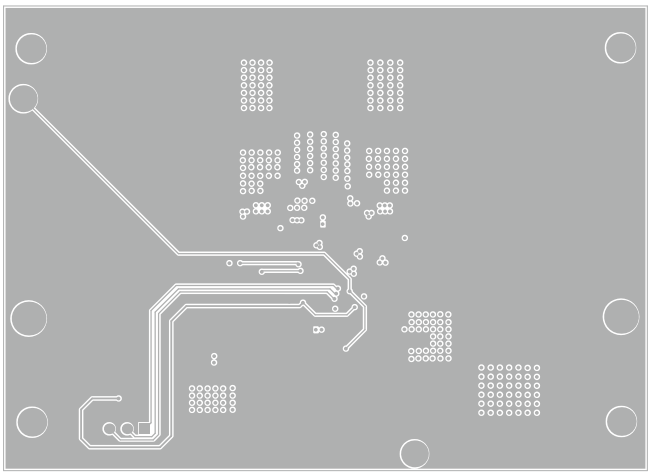


Figure 5: Middle Layer 3

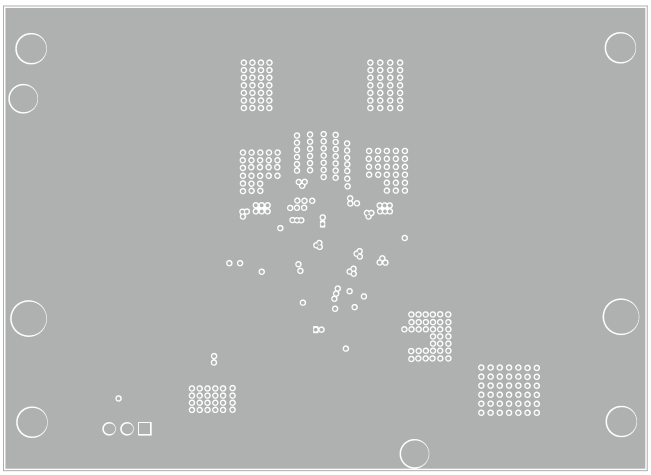


Figure 6: Middle Layer 4

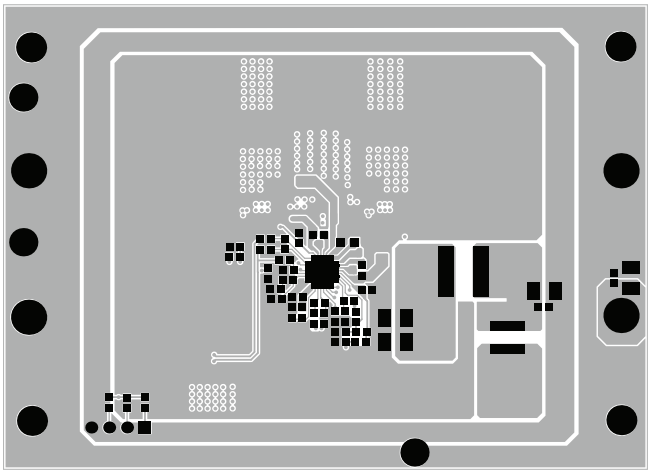


Figure 7: Bottom Layer

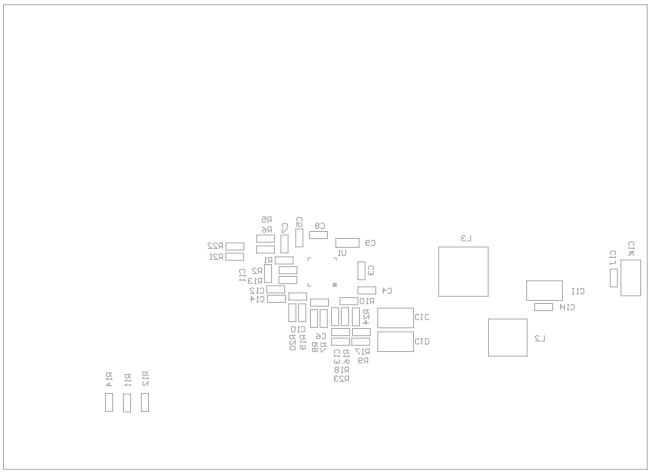


Figure 8: Bottom Silkscreen Layer

QUICK START GUIDE

1. Connect the positive and negative terminals of the load (≤5A) to the VOUT and GND pins, respectively.

2. Preset the power supply output voltage within the range 6V~36V, and then turn off the power supply.

3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively.

4. Turn on the power supply after making connections, the MP2980 will startup automatically. And the output voltage of this board is set to 5V.

Then set MP2980 registers through I²C in following step:

a. Connect I²C cable from host computer to the board, and then launch the MP2980 software.

b. Click Detect button on the GUI. Normally the GUI will indicate the connection is OK.

c. If other parameters like output voltage, dither, SR, etc. are required, set the corresponding register on MP2980 I²C GUI.