EV5403-QB-02A

High Efficiency Dual Buck and One Load Switch Power Management Unit EV Board

NOT RECOMMENDED FOR NEW DESIGNS

DESCRIPTION

The EV5403-QB-02A Evaluation Board is designed to demonstrate the capabilities of MPS' MP5403. The MP5403 is a monolithic power management unit containing two high efficiency step-down switching converters and a load switch. The two regulators supply current up to 3.5A and 2.5A separately and the load switch supplies up to 3A load current with extremely low R_{ON} resistance. With the input range up to 6V, the MP5403 is ideal for powering ASIC and SOC for Solid-State Drive or other compact power systems.

The MP5403 requires a minimum number of readily available standard external components and is available in a small QFN20 (2.5mmx3mm) package.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN1}/ V_{IN2}	2.7 – 6	V
Output Voltage	V_{OUT1}/V_{OUT2}	1.2/1.2	V
Output Current	I_{OUT1}/I_{OUT2}	3.5/2.5	A

FEATURES

- Up to 6V Operating Input Range
- Low IQ: 85µA for Two Switchers Totally
- Two Buck Converters:
  - 3.5A with 55mΩ/20mΩ R_{DSON}
  - 2.5A with 65mΩ/22mΩ R_{DSON}
  - 1.5MHz Switching Frequency
- One Load Switch with 20mΩ R_{ON}
  - 3A with 20mΩ R_{DSON}
  - Soft Start and Output Discharge
  - Over Current Protection
- Input Power Good Indicator with Adjustable Threshold and Delay
- Thermal Shutdown
- Available in a QFN20 (2.5mmx3mm) Package

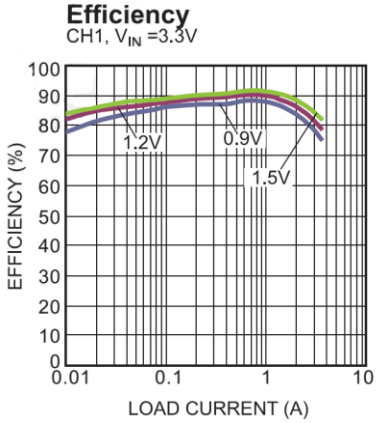
APPLICATIONS

- Solid-State Drive
- Portable Instruments
- Battery-Powered Devices

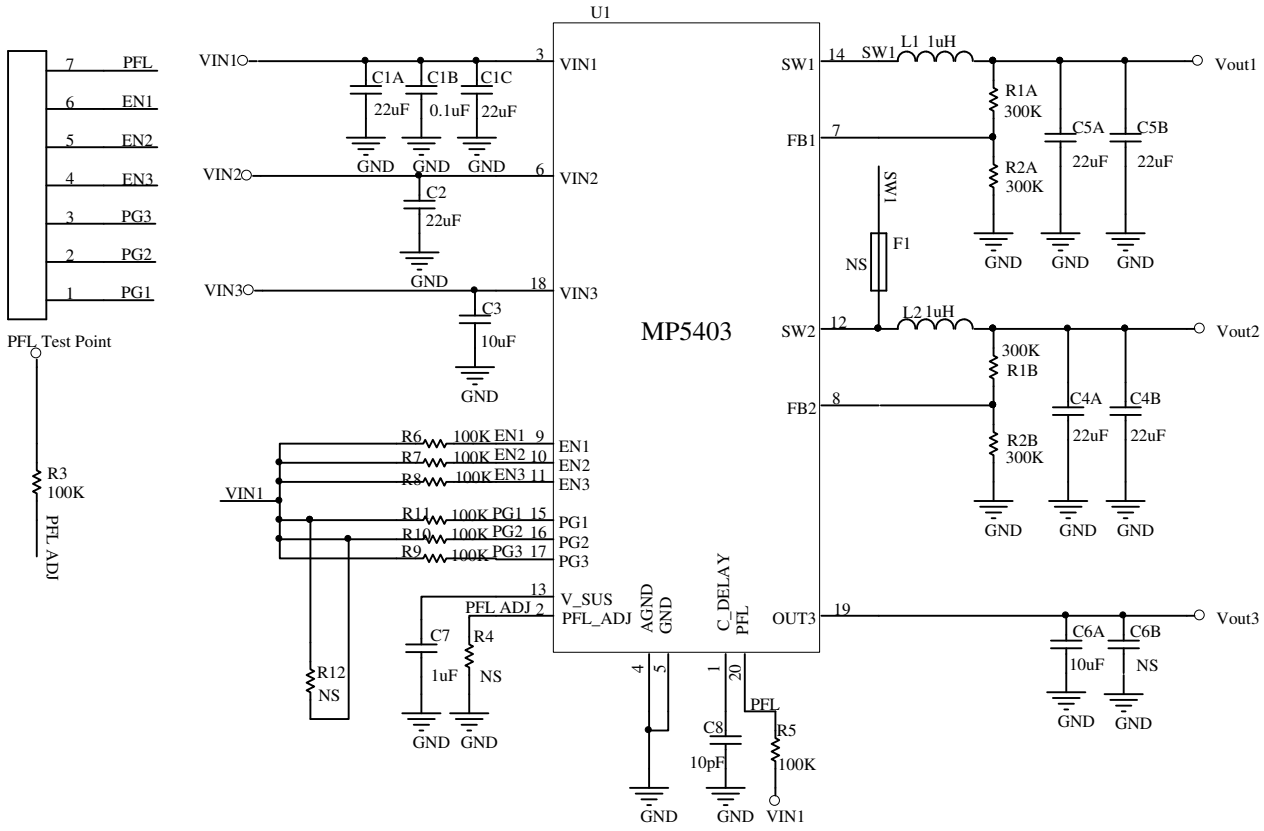
EV5403-QB-02A EVALUATION BOARD

(L x W x H) 6.5cm x 6.5cm x 1.6cm

Board Number	MPS IC Number
EV5403-QB-02A	MP5403



EVALUATION BOARD SCHEMATIC



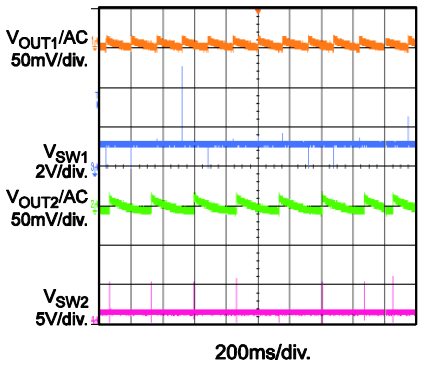
EV5403-QB-02A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
2	L1, L2	1μH	Inductor, ±20%	SMD	Wurth	744 373 240 10
7	C1A, C1C, C2, C4A, C4B, C5A, C5B	22μF	Ceramic Capacitor, 10V, X5R	0805	muRata	GRM21BR61A226ME51L
2	C3, C6A	10μF	Ceramic Capacitor, 10V, X5R	0805	muRata	GRM21BR61A106KE19L
1	C7	1μF	Ceramic Capacitor, 16V, X7R	0603	muRata	GRM21BR71C105KA01L
1	C1B	0.1μF	Ceramic Capacitor, 16V, X7R	0603	muRata	GRM219R71C104KA01D
1	C8	10pF	Ceramic Capacitor, 50V, COG	0603	muRata	GRM1885C1H100JA01D
4	R1A, R1B, R2A, R2B	300kΩ	Film Res,1%	0603	ROYAL	RL0603FR-07300KL
8	R3, R5, R6, R7, R8, R9, R10, R11	100kΩ	Film Res,5%	0603	Any	Any
1	U1	MP5403	Dual buck and one load switch PWIC	QFN20	MPS	MP5403
1	CN1		1X7 PINS, 2.54mm		Any	Any

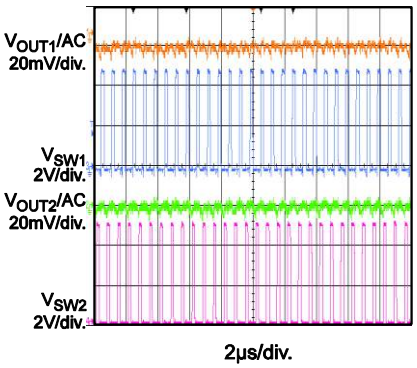
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN1} = V_{IN2}=5V, V_{OUT1} = V_{OUT2} =1.2V, L1 = L2 =1µH, T_A = 25ºC, unless otherwise noted.

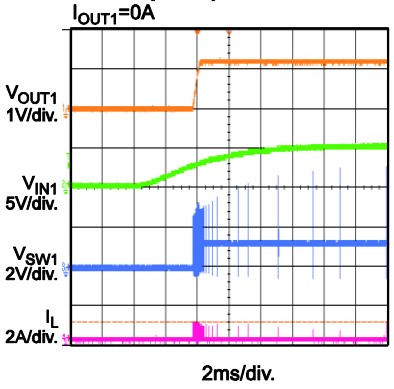
Output Ripple
I_{OUT1}=I_{OUT2}=0A



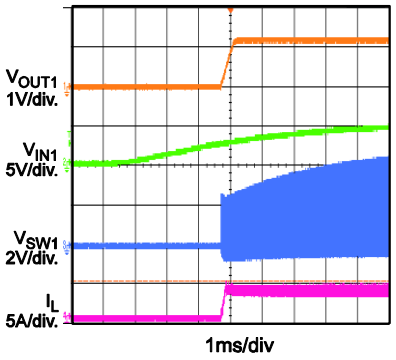
Output Ripple
I_{OUT1}=3.5A, I_{OUT2}=2.5A



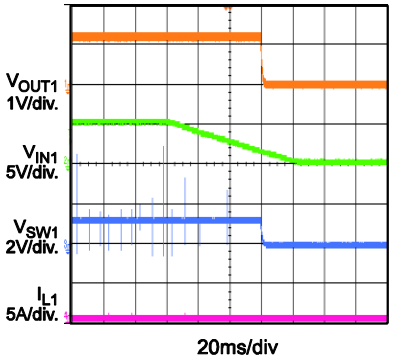
VIN Power Up without Load (CH1)
I_{OUT1}=0A



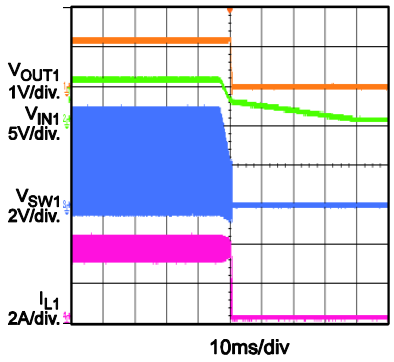
VIN Power Up with 3.5A Load (CH1)
I_{OUT1}=3.5A



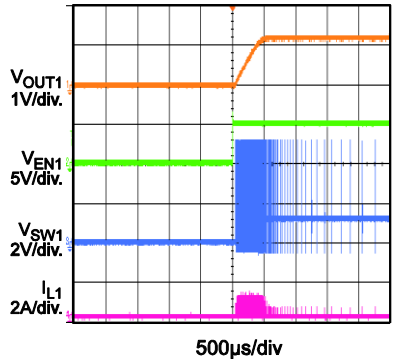
VIN Power Down without Load (CH1)
I_{OUT1}=0A



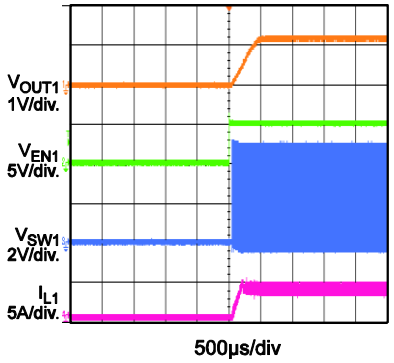
VIN Power Down with 3.5A Load(CH1)
I_{OUT1}=3.5A



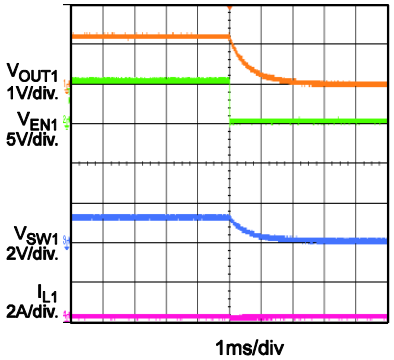
EN On without Load (CH1)
I_{OUT1}=0A



EN On with 3.5A Load (CH1)
I_{OUT1}=3.5A



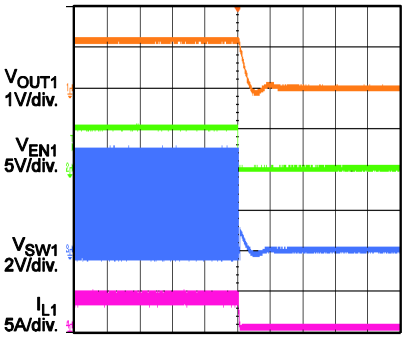
EN Down without Load (CH1)
I_{OUT1}=0A



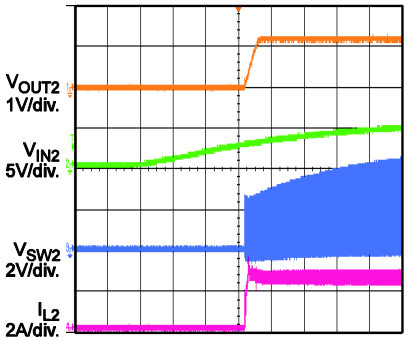
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN1} = V_{IN2}=5V, V_{OUT1} = V_{OUT2} =1.2V, L1 = L2 =1µH, T_A = 25ºC, unless otherwise noted.

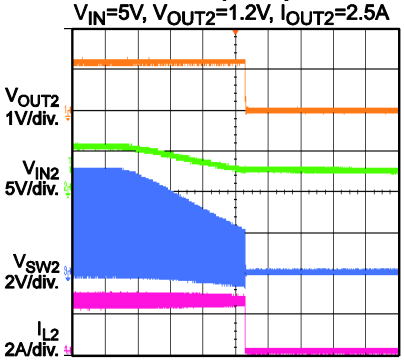
EN Down with 3.5A Load (CH1)
V_{IN}=5V, V_{OUT1}=1.2V, I_{OUT1}=3.5A



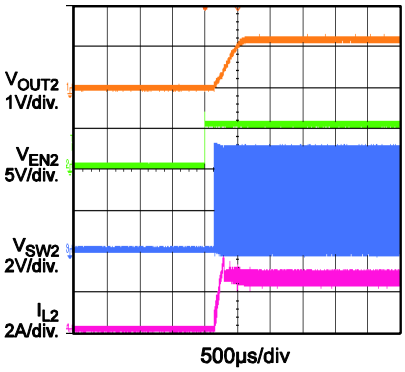
VIN Power On with 2.5A Load (CH2)
V_{IN}=5V, V_{OUT2}=1.2V, I_{OUT2}=2.5A



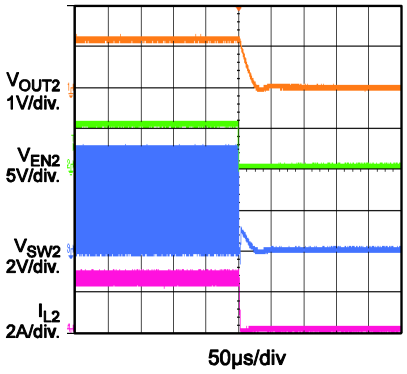
VIN Power Down with 2.5A Load (CH2)
V_{IN}=5V, V_{OUT2}=1.2V, I_{OUT2}=2.5A



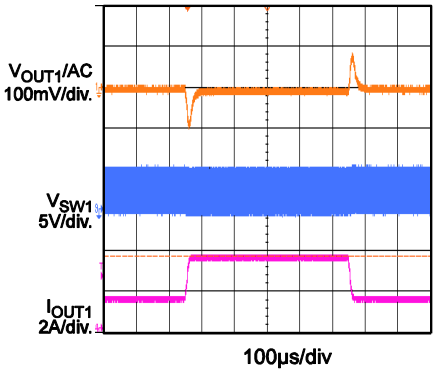
Enable On with 2.5A Load (CH2)
V_{IN}=5V, V_{OUT2}=1.2V, I_{OUT2}=2.5A



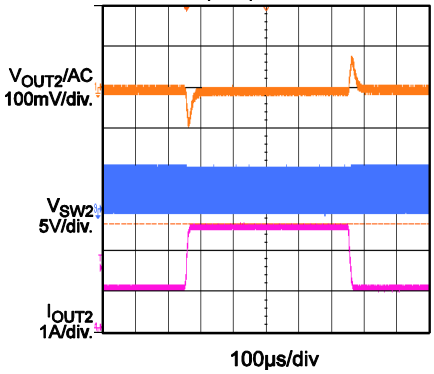
Enable Down with 2.5A Load (CH2)
V_{IN}=5V, V_{OUT2}=1.2V, I_{OUT2}=2.5A



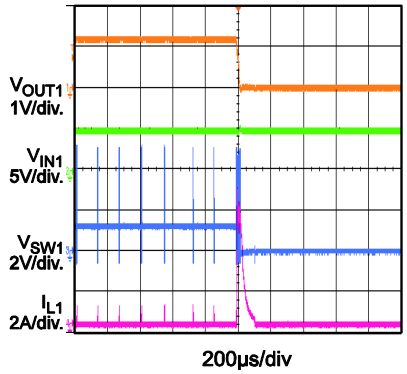
CH1 Transient
V_{IN}=5V, V_{OUT1}=1.2V, 1A Transient to 3.5A, 2.5A/µs Speed



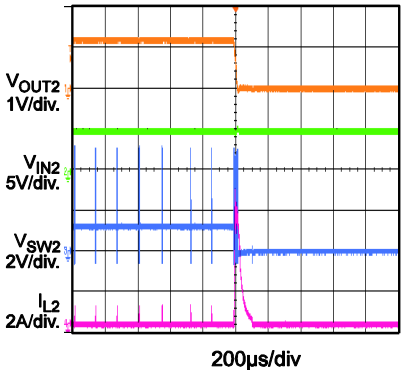
CH2 Transient
V_{IN}=5V, V_{OUT2}=1.2V, 1A Transient to 2.5A, 2.5A/µs Speed



CH1 Short Enter
V_{IN}=5V, V_{OUT1}=1.2V, I_{OUT1}=0A



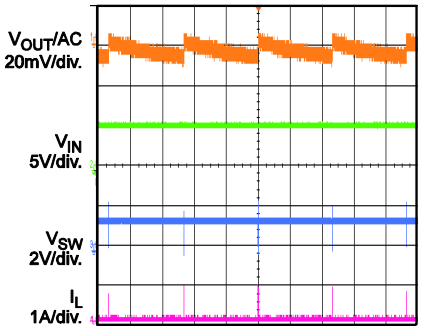
CH2 Short Enter
V_{IN}=5V, V_{OUT2}=1.2V, I_{OUT2}=0A



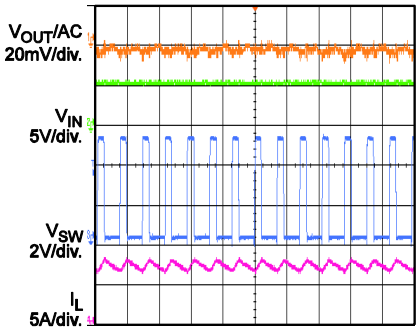
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN1} = V_{IN2}=5V, V_{OUT1} = V_{OUT2} =1.2V, L1 = L2 =1µH, T_A = 25ºC, unless otherwise noted.

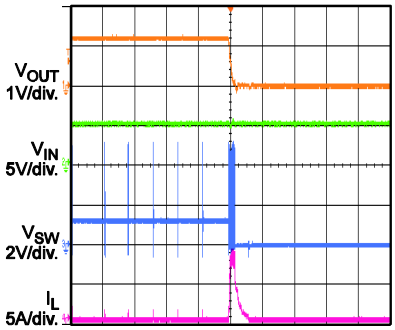
Output Ripple (Parallel)
V_{IN}=5V, V_{OUT}=1.2V, I_{OUT}=0A



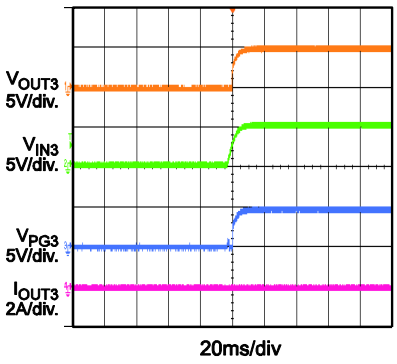
Output Ripple (Parallel)
V_{IN}=5V, V_{OUT}=1.2V, I_{OUT}=7A



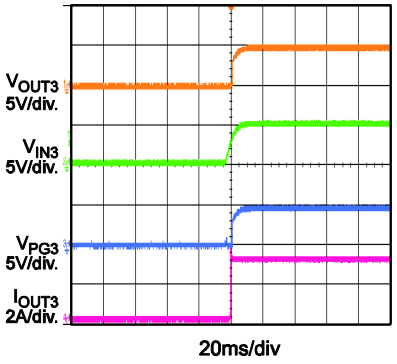
Short Enter (Parallel)
V_{IN}=5V, V_{OUT}=1.2V, I_{OUT}=0A



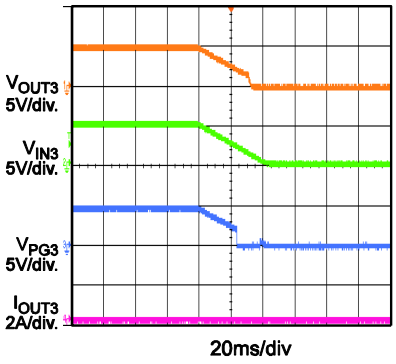
VIN Startup (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=0A



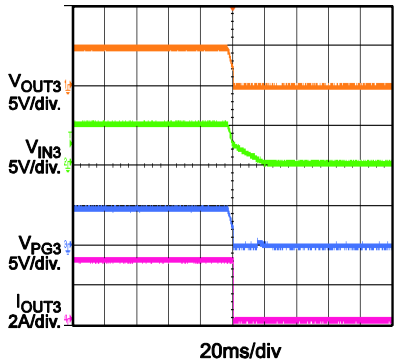
VIN Startup (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=3A



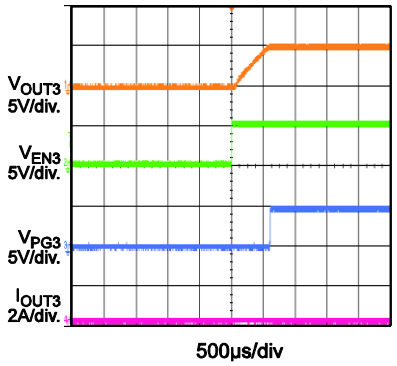
VIN Shutdown (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=0A



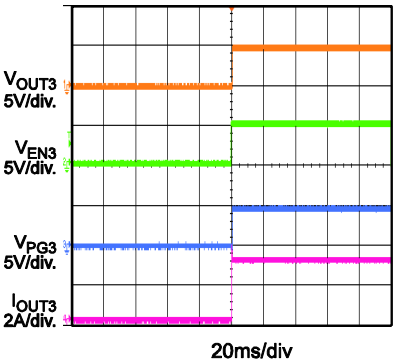
VIN Shutdown (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=3A



EN Startup (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=0A



EN Startup (Load Switch)
V_{IN3}=5V, V_{OUT3}=5V, I_{OUT3}=3A



PRINTED CIRCUIT BOARD LAYOUT

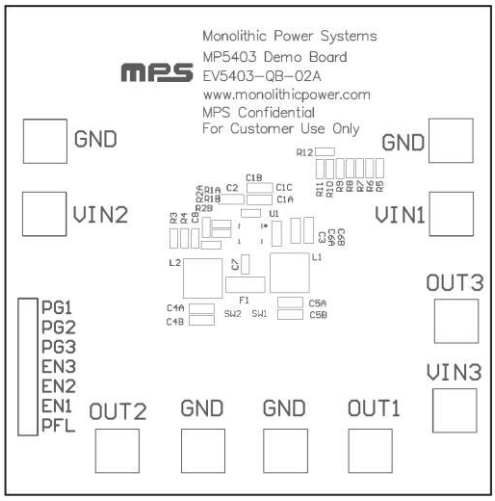


Figure 1—Top Silk Layer

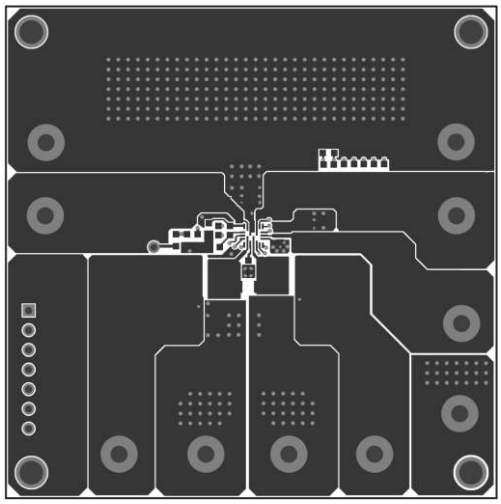


Figure 2—Top Layer

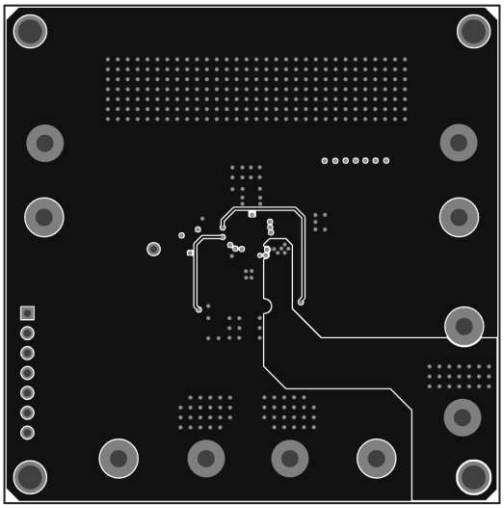


Figure 3—Bottom Layer

QUICK START GUIDE

The output voltage of this board is set externally by operating from +2.7V to +6V for V_{IN1}, +2V to +6V for V_{IN2}(if V_{IN1}>2.7V) and +0.5V to +6V for V_{IN3}(if V_{IN1}>2.7V). The default output voltage of this board is set to V_{OUT1}=1.2V, V_{OUT2}=1.2V.

1. Preset Power Supply to 2.7V ≤ V_{IN1} ≤ 6V, 2V ≤ V_{IN2} ≤ 6V, 0.5V ≤ V_{IN3} ≤ 6V.
2. Turn Power Supply off.
3. Connect Power Supply terminals to:
    a. Positive (+): V_{IN1}, V_{IN2}, V_{IN3}(connect to V_{IN1} or V_{IN2} or external power)
    b. Negative (–): GND
4. Connect Load to:
    a. Positive (+): VOUT1
    b. Negative (–): GND
    c. Positive (+): VOUT2
    d. Negative (–): GND
    e. Positive (+): VOUT3
    f. Negative (–): GND
5. Turn Power Supply on after making connections.
6. To enable the MP5403, apply a voltage, 1.3V ≤ V_{EN} ≤ 6V, to the EN pin. To disable the MP5403, apply a voltage, V_{EN} <0.4V, to the EN pin. The EN pin can be connected to V_{IN} with a 100kΩ resistor for automatic startup.
7. The output voltage V_{OUT} can be changed by varying R2A or R2B. Calculate the new value by formula:

$$R2A(orR2B) = \frac{R1A(orR1B)}{\frac{V_{OUT}}{0.6V} - 1}$$

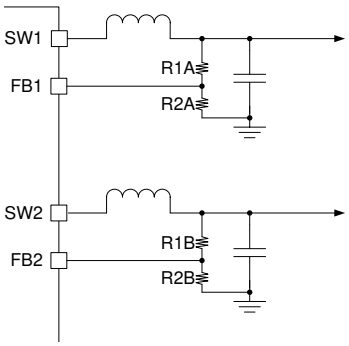


Figure 4