

### 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  $R_{DS(ON)}$
  - 2.5A with 65mΩ/22mΩ  $R_{DS(ON)}$
  - 1.5MHz Switching Frequency
- One Load Switch with 20mΩ  $R_{ON}$ 
  - 3A with 20mΩ  $R_{DS(ON)}$
  - 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

All MPS parts are lead-free and adhere to the RoHS directive. For MPS green status, please visit MPS website under Products, Quality Assurance page.

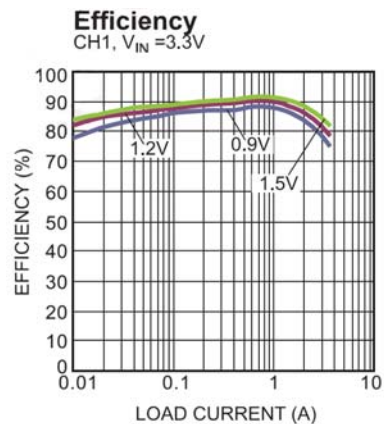
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### EV5403-QB-02A EVALUATION BOARD

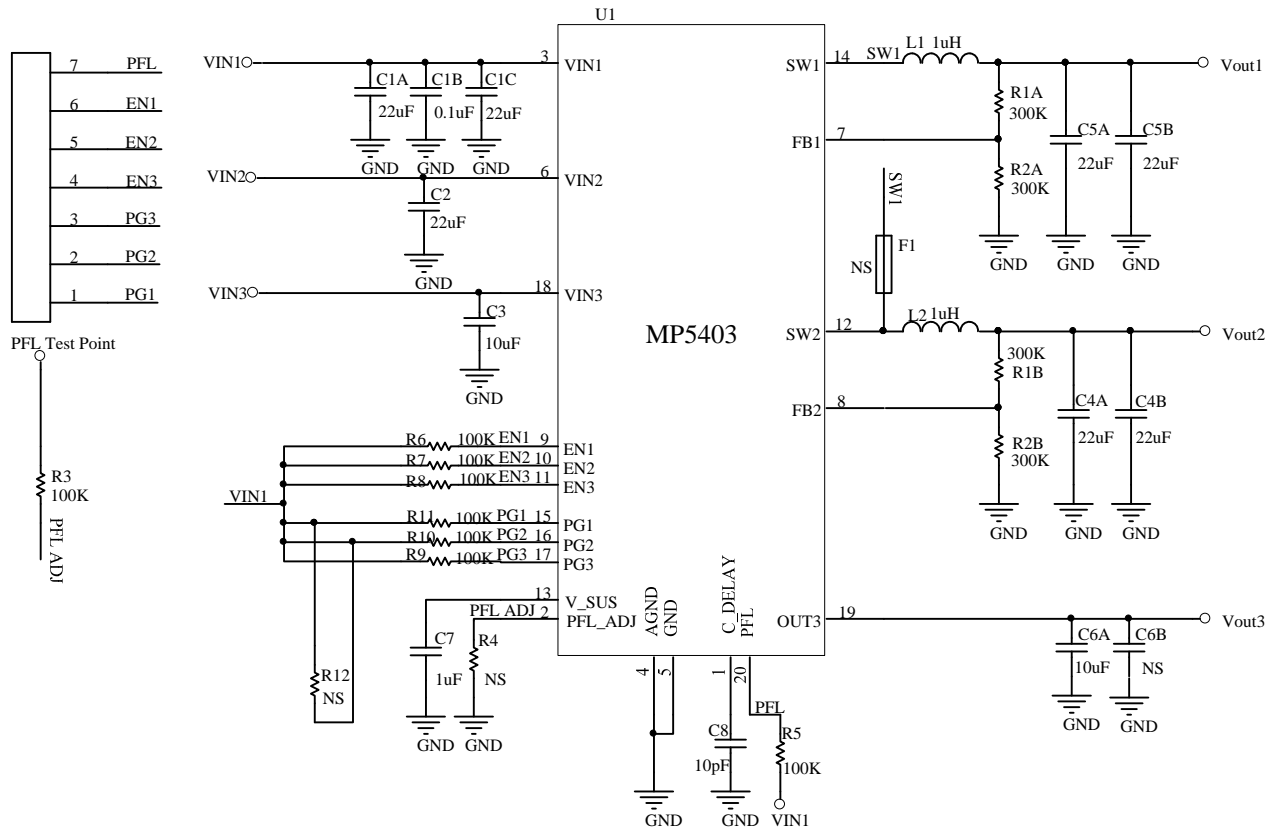


(L x W x H) 6.5cm x 6.5cm x 1.6cm

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

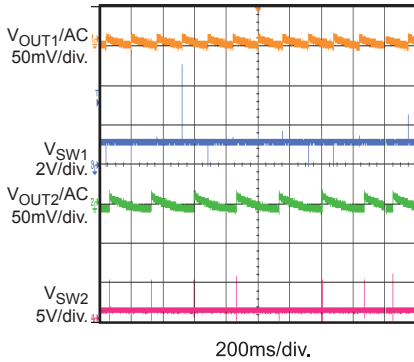
## EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.

$V_{IN1} = V_{IN2} = 5V$ ,  $V_{OUT1} = V_{OUT2} = 1.2V$ ,  $L1 = L2 = 1\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

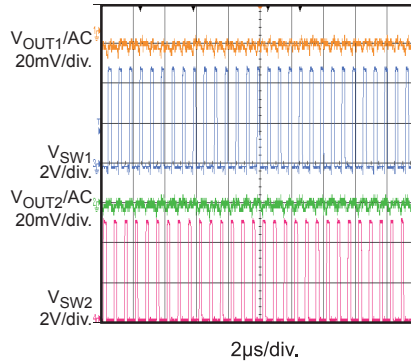
**Output Ripple**

$I_{OUT1} = I_{OUT2} = 0A$



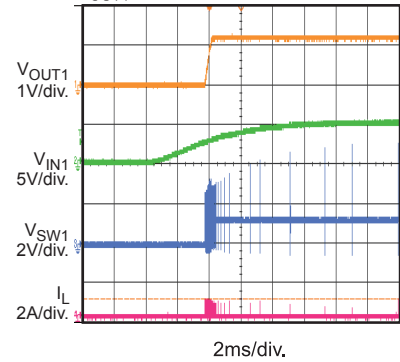
**Output Ripple**

$I_{OUT1} = 3.5A$ ,  $I_{OUT2} = 2.5A$



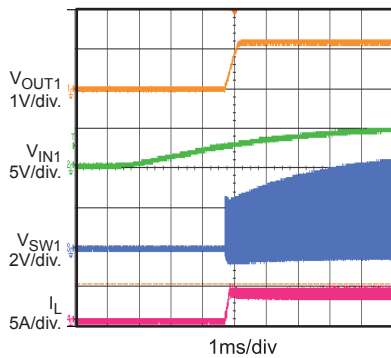
**VIN Power Up without Load (CH1)**

$I_{OUT1} = 0A$



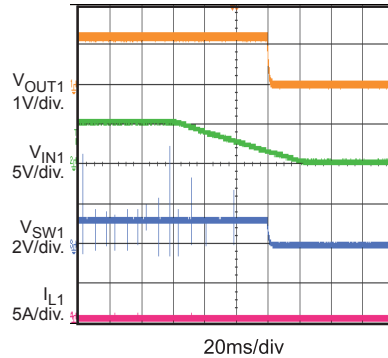
**VIN Power Up with 3.5A Load (CH1)**

$I_{OUT1} = 3.5A$



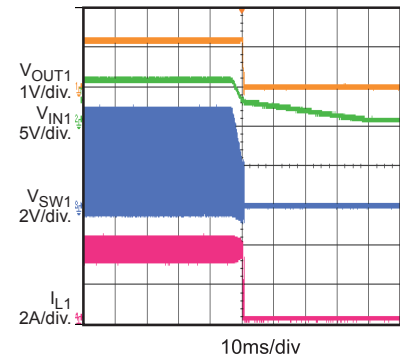
**VIN Power Down without Load (CH1)**

$I_{OUT1} = 0A$



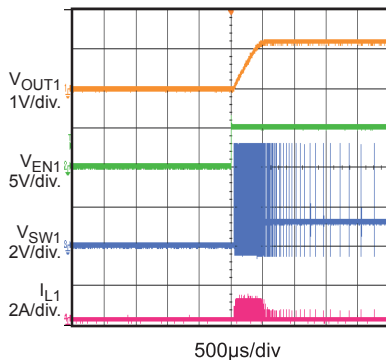
**VIN Power Down with 3.5A Load (CH1)**

$I_{OUT1} = 3.5A$



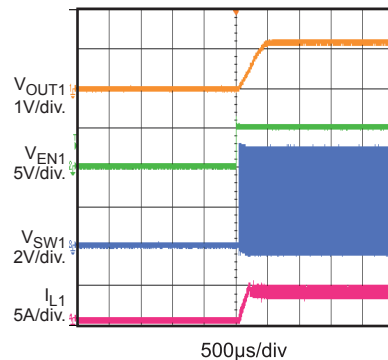
**EN On without Load (CH1)**

$I_{OUT1} = 0A$



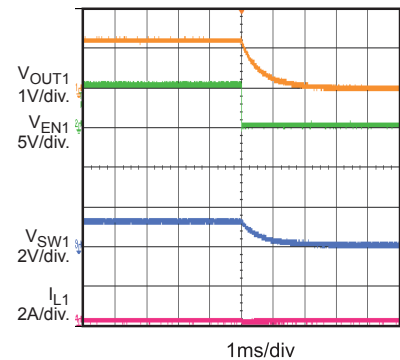
**EN On with 3.5A Load (CH1)**

$I_{OUT1} = 3.5A$



**EN Down without Load (CH1)**

$I_{OUT1} = 0A$



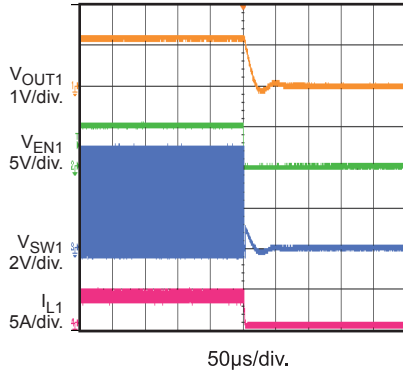
## EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board.

$V_{IN1} = V_{IN2} = 5V$ ,  $V_{OUT1} = V_{OUT2} = 1.2V$ ,  $L1 = L2 = 1\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

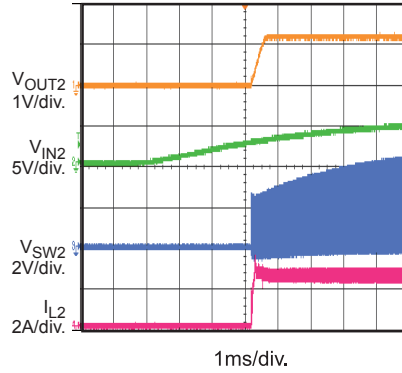
**EN Down with 3.5A Load (CH1)**

$V_{IN} = 5V$ ,  $V_{OUT1} = 1.2V$ ,  $I_{OUT1} = 3.5A$



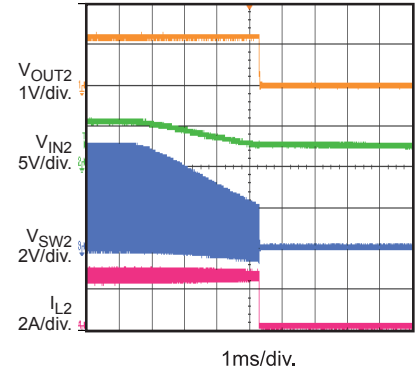
**VIN Power On with 2.5A Load (CH2)**

$V_{IN} = 5V$ ,  $V_{OUT2} = 1.2V$ ,  $I_{OUT2} = 2.5A$



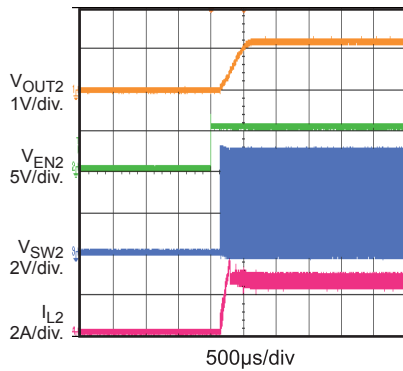
**VIN Power Down with 2.5A Load (CH2)**

$V_{IN} = 5V$ ,  $V_{OUT2} = 1.2V$ ,  $I_{OUT2} = 2.5A$



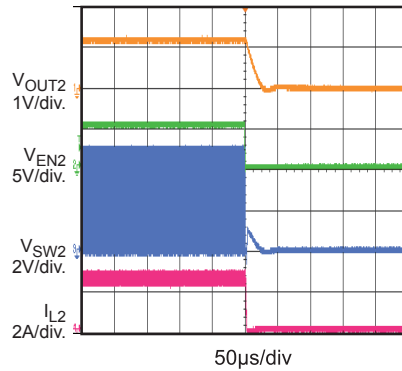
**Enable On with 2.5A Load (CH2)**

$V_{IN} = 5V$ ,  $V_{OUT2} = 1.2V$ ,  $I_{OUT2} = 2.5A$



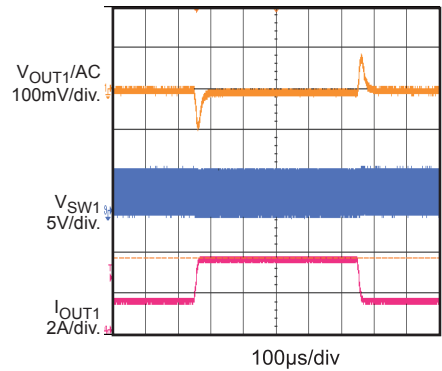
**Enable Down with 2.5A Load (CH2)**

$V_{IN} = 5V$ ,  $V_{OUT2} = 1.2V$ ,  $I_{OUT2} = 2.5A$



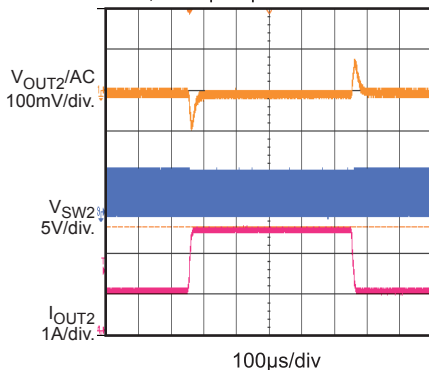
**CH1 Transient**

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



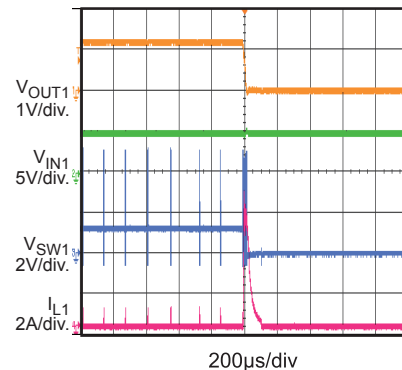
**CH2 Transient**

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



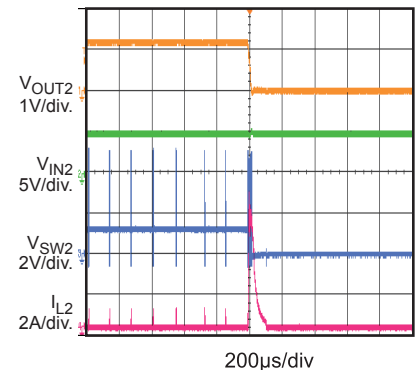
**CH1 Short Enter**

$V_{IN} = 5V$ ,  $V_{OUT1} = 1.2V$ ,  $I_{OUT1} = 0A$



**CH2 Short Enter**

$V_{IN} = 5V$ ,  $V_{OUT2} = 1.2V$ ,  $I_{OUT2} = 0A$



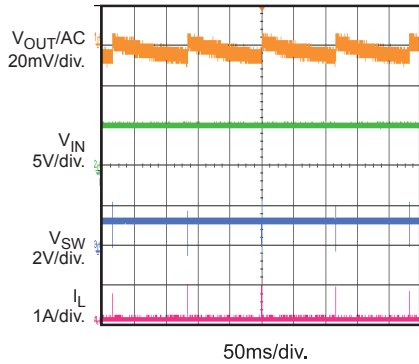
## EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board.

$V_{IN1} = V_{IN2} = 5V$ ,  $V_{OUT1} = V_{OUT2} = 1.2V$ ,  $L1 = L2 = 1\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

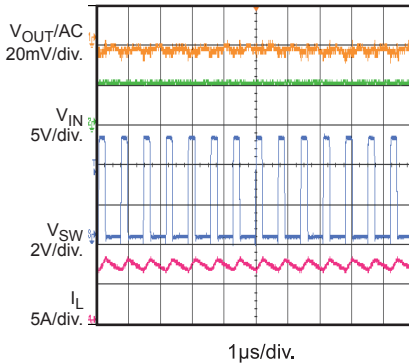
**Output Ripple (Parallel)**

$V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ ,  $I_{OUT} = 0A$



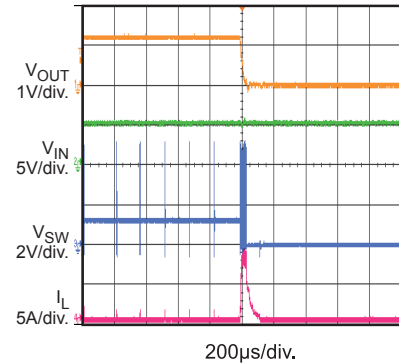
**Output Ripple (Parallel)**

$V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ ,  $I_{OUT} = 7A$



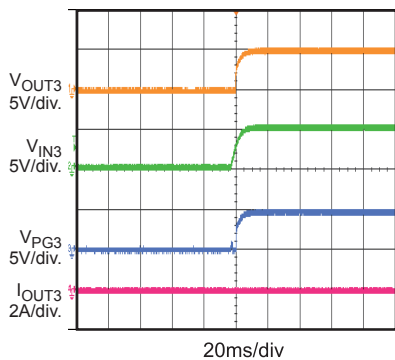
**Short Enter (Parallel)**

$V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ ,  $I_{OUT} = 0A$



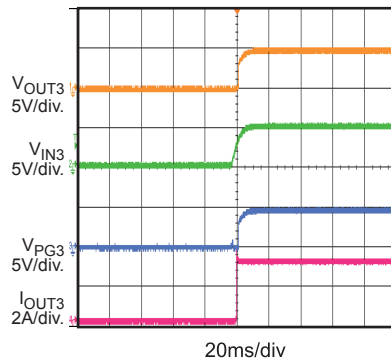
**VIN Startup (Load Switch)**

$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 0A$



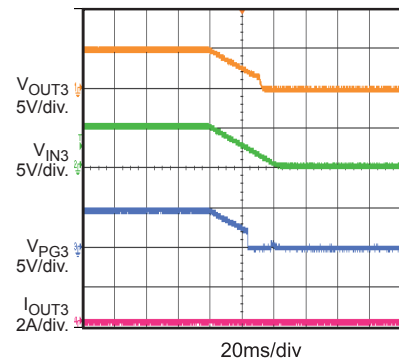
**VIN Startup (Load Switch)**

$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 3A$



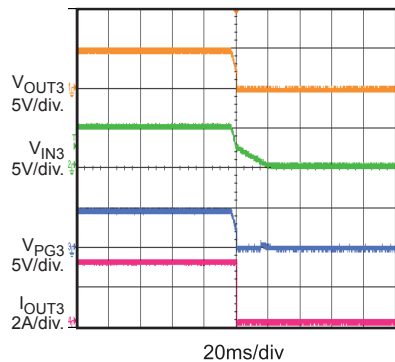
**VIN Shutdown (Load Switch)**

$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 0A$



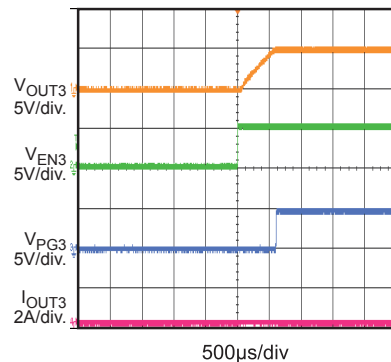
**VIN Shutdown (Load Switch)**

$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 3A$



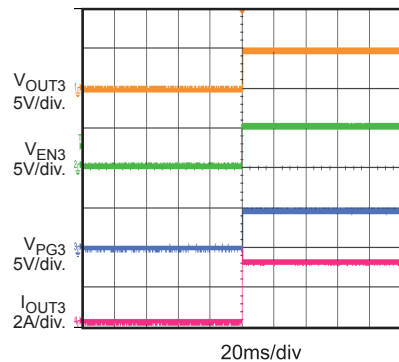
**EN Startup (Load Switch)**

$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 0A$

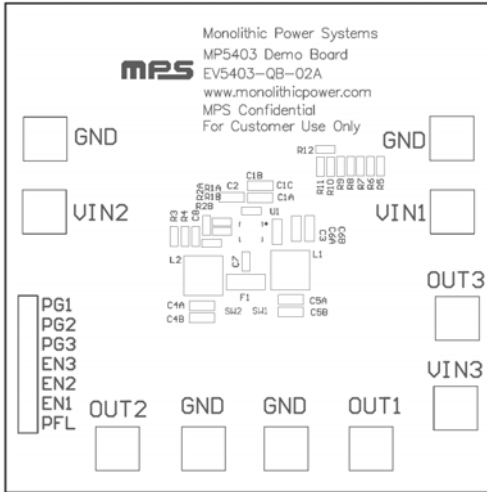


**EN Startup (Load Switch)**

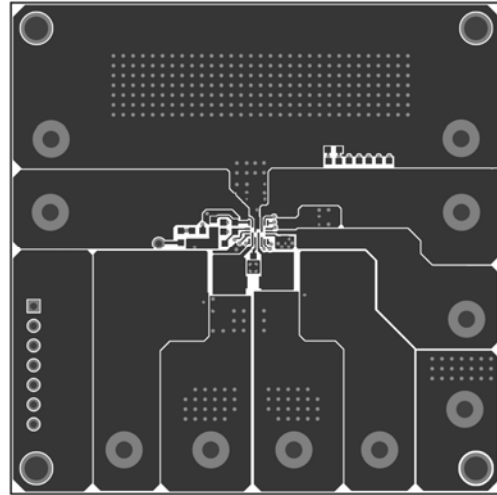
$V_{IN3} = 5V$ ,  $V_{OUT3} = 5V$ ,  $I_{OUT3} = 3A$



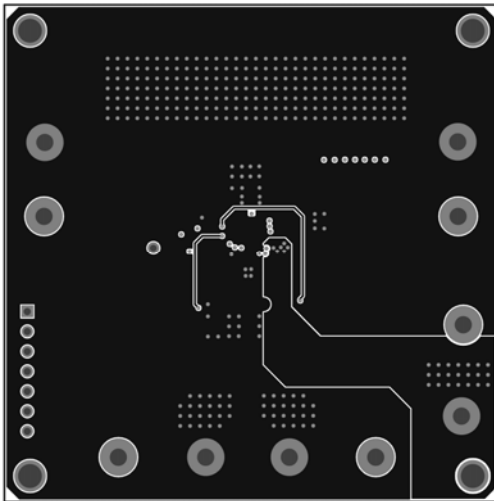
**PRINTED CIRCUIT BOARD LAYOUT**



**Figure 1—Top Silk Layer**



**Figure 2—Top Layer**



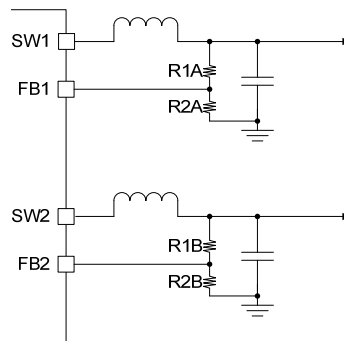
**Figure 3—Bottom Layer**

## 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  $2.7V \leq V_{IN1} \leq 6V$ ,  $2V \leq V_{IN2} \leq 6V$ ,  $0.5V \leq V_{IN3} \leq 6V$ .
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,  $1.3V \leq V_{EN} \leq 6V$ , 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 100k $\Omega$  resistor for automatic startup.
7. The output voltage  $V_{OUT}$  can be changed by varying R2A or R2B. Calculate the new value by formula:

$$R2A(\text{or}R2B) = \frac{R1A(\text{or}R1B)}{\frac{V_{OUT}}{0.6V} - 1}$$



**Figure 4**

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