

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

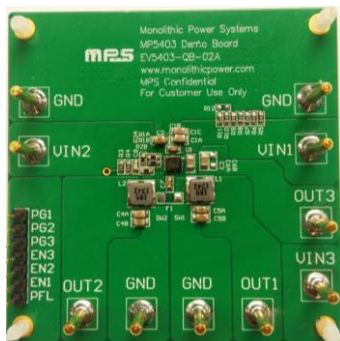
- Up to 6V Operating Input Range
- Low IQ: 85 μ A for Two Switchers Totally
- Two Buck Converters:
 - 3.5A with 55m Ω /20m Ω $R_{DS(on)}$
 - 2.5A with 65m Ω /22m Ω $R_{DS(on)}$
 - 1.5MHz Switching Frequency
- One Load Switch with 20m Ω R_{ON}
 - 3A with 20m Ω $R_{DS(on)}$
 - Soft Start and Output Discharge
 - 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

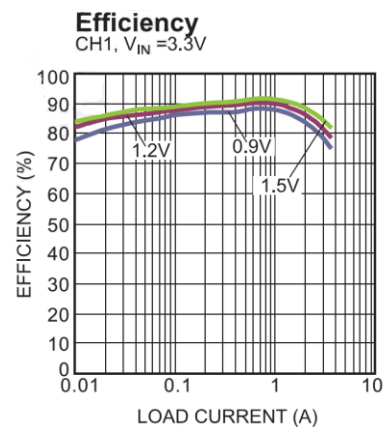
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EV5403-QB-02A EVALUATION BOARD

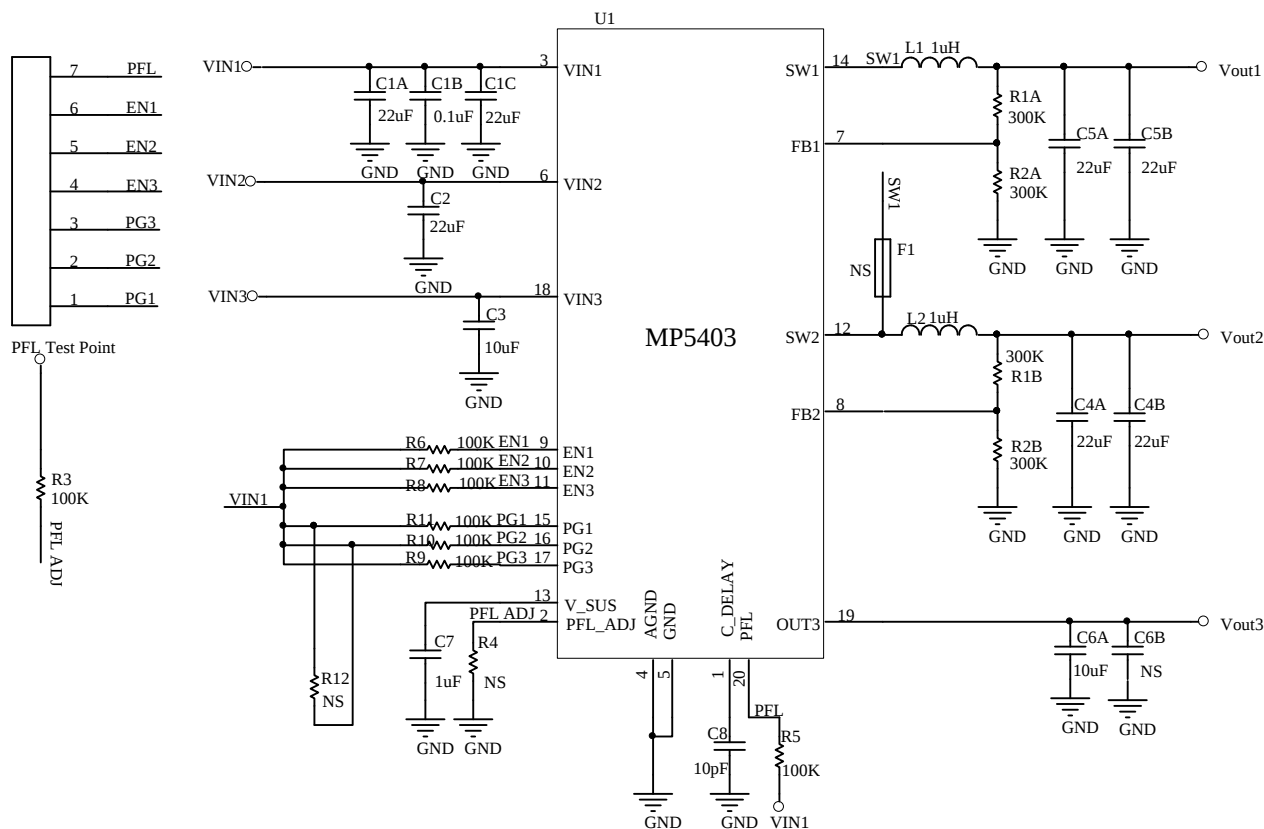


(L x W x H) 6.5cm x 6.5cm x 1.6cm

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

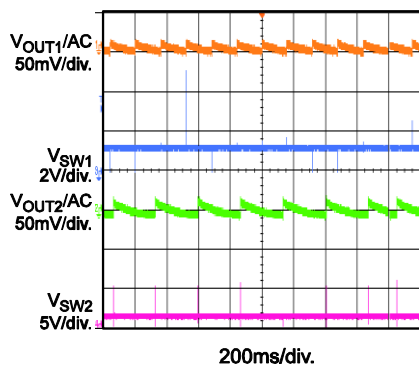
EVB TEST RESULTS

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.

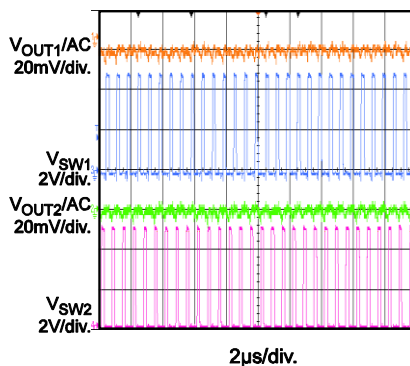
Output Ripple

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



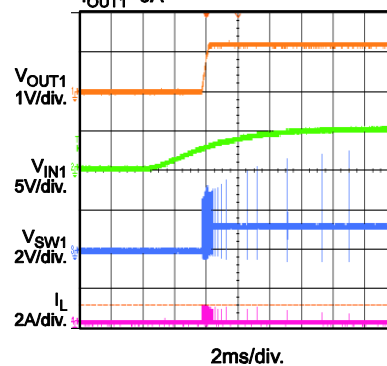
Output Ripple

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



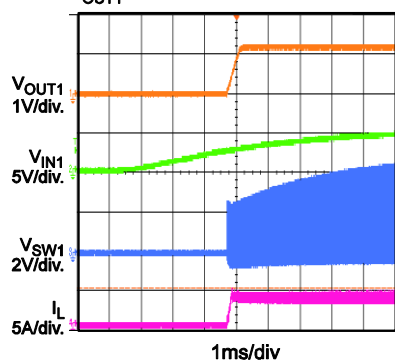
VIN Power Up without Load (CH1)

$I_{OUT1} = 0A$



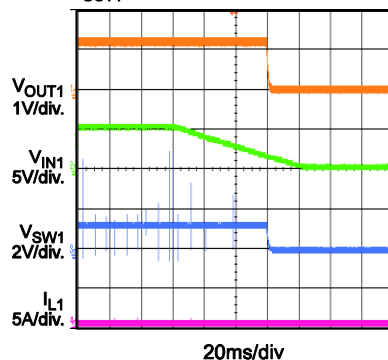
VIN Power Up with 3.5A Load (CH1)

$I_{OUT1} = 3.5A$



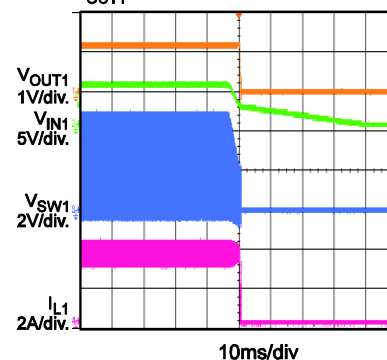
VIN Power Down without Load (CH1)

$I_{OUT1} = 0A$



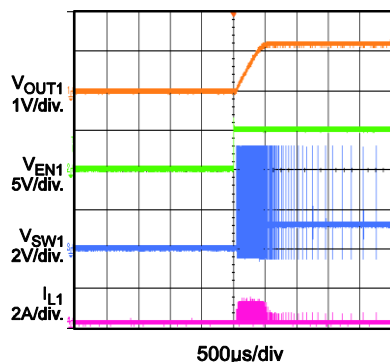
VIN Power Down with 3.5A Load (CH1)

$I_{OUT1} = 3.5A$



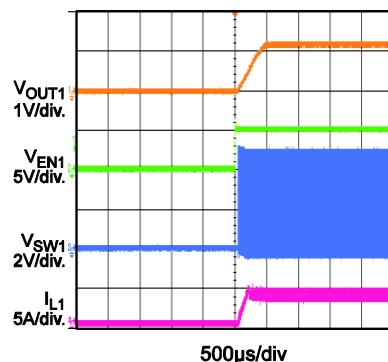
EN On without Load (CH1)

$I_{OUT1} = 0A$



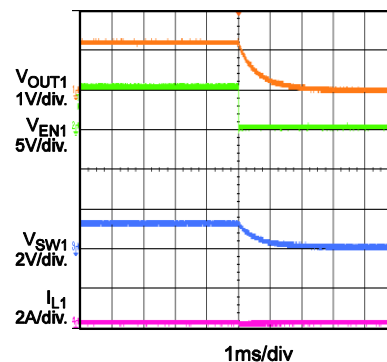
EN On with 3.5A Load (CH1)

$I_{OUT1} = 3.5A$



EN Down without Load (CH1)

$I_{OUT1} = 0A$



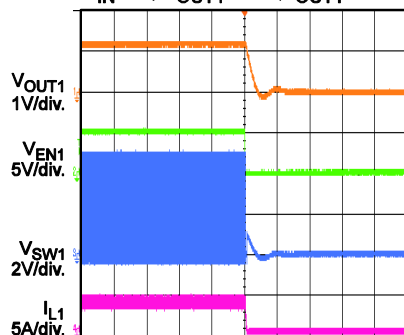
EVB TEST RESULTS (continued)

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)

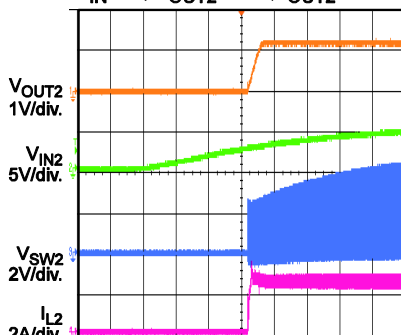
$V_{IN} = 5V$, $V_{OUT1} = 1.2V$, $I_{OUT1} = 3.5A$



50µs/div.

VIN Power On with 2.5A Load (CH2)

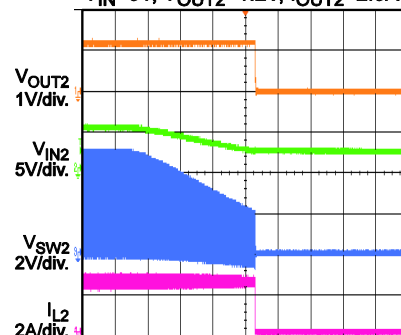
$V_{IN} = 5V$, $V_{OUT2} = 1.2V$, $I_{OUT2} = 2.5A$



1ms/div.

VIN Power Down with 2.5A Load (CH2)

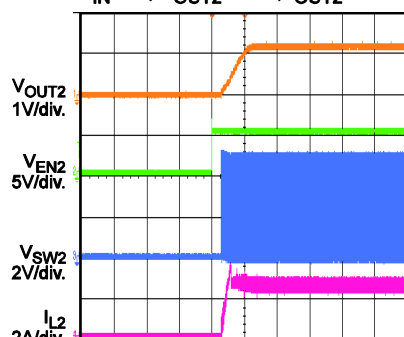
$V_{IN} = 5V$, $V_{OUT2} = 1.2V$, $I_{OUT2} = 2.5A$



1ms/div.

Enable On with 2.5A Load (CH2)

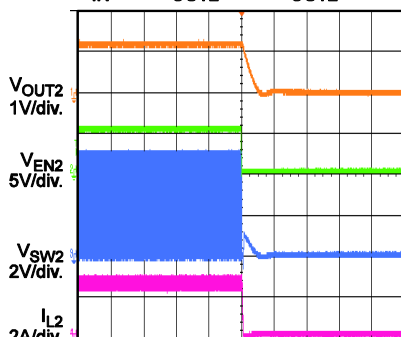
$V_{IN} = 5V$, $V_{OUT2} = 1.2V$, $I_{OUT2} = 2.5A$



500µs/div

Enable Down with 2.5A Load (CH2)

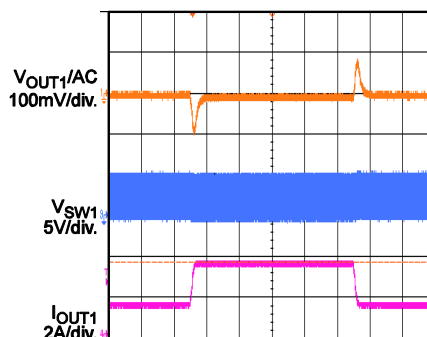
$V_{IN} = 5V$, $V_{OUT2} = 1.2V$, $I_{OUT2} = 2.5A$



50µs/div

CH1 Transient

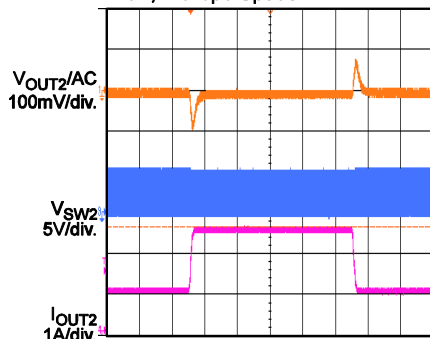
$V_{IN} = 5V$, $V_{OUT1} = 1.2V$, 1A Transient to 3.5A, 2.5A/µs Speed



100µs/div

CH2 Transient

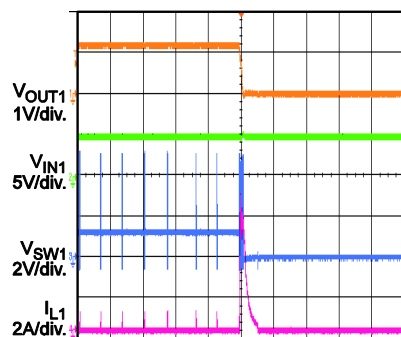
$V_{IN} = 5V$, $V_{OUT2} = 1.2V$, 1A Transient to 2.5A, 2.5A/µs Speed



100µs/div

CH1 Short Enter

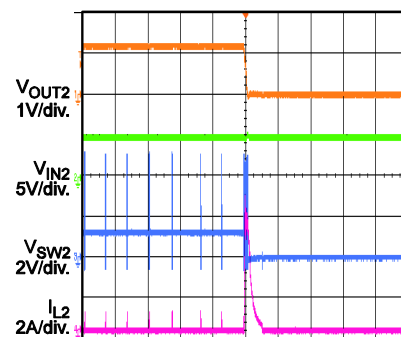
$V_{IN} = 5V$, $V_{OUT1} = 1.2V$, $I_{OUT1} = 0A$



200µs/div

CH2 Short Enter

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



200µs/div

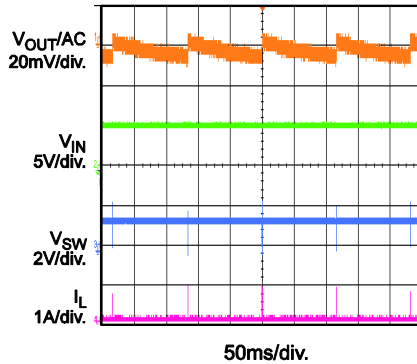
EVB TEST RESULTS (continued)

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.

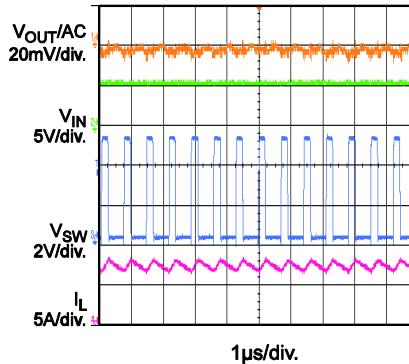
Output Ripple (Parallel)

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



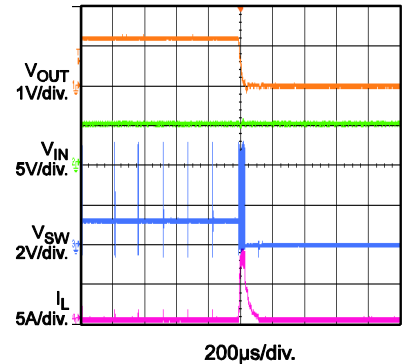
Output Ripple (Parallel)

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



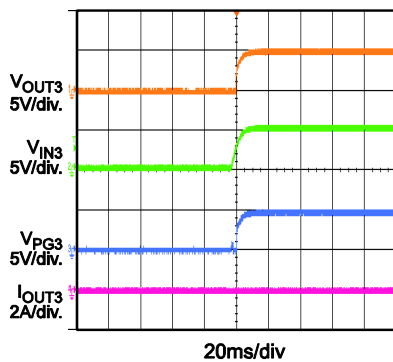
Short Enter (Parallel)

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



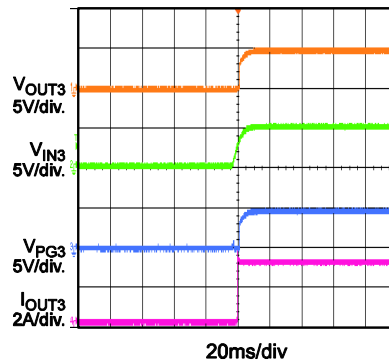
VIN Startup (Load Switch)

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



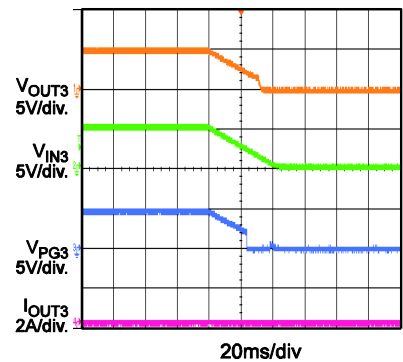
VIN Startup (Load Switch)

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



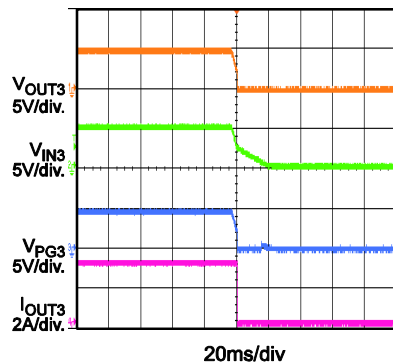
VIN Shutdown (Load Switch)

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



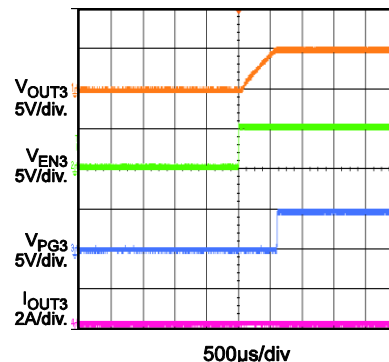
VIN Shutdown (Load Switch)

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



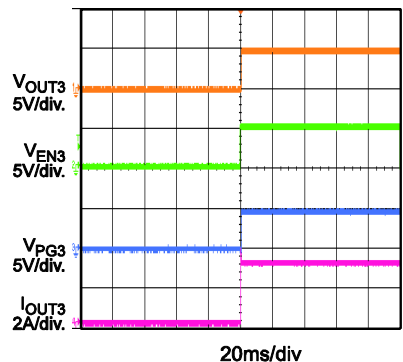
EN Startup (Load Switch)

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



EN Startup (Load Switch)

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



PRINTED CIRCUIT BOARD LAYOUT

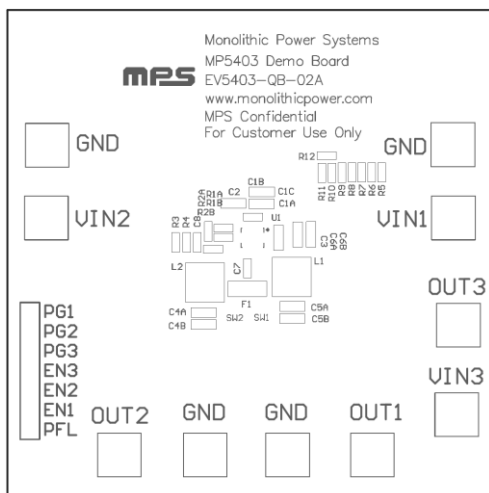


Figure 1—Top Silk Layer

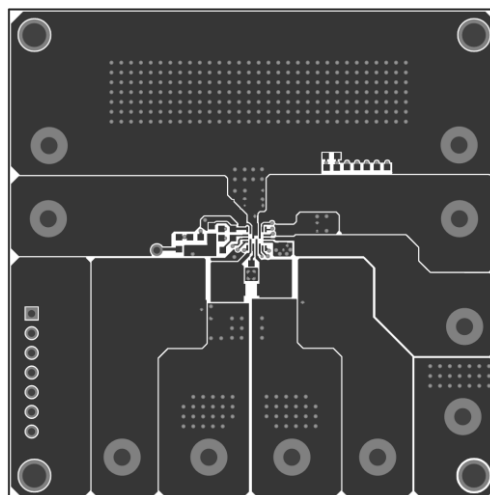


Figure 2—Top Layer

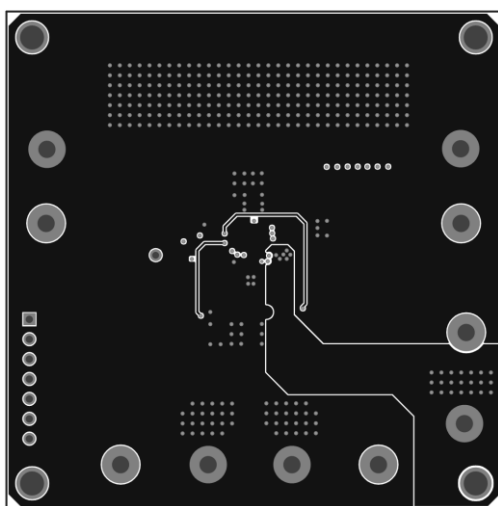


Figure 3—Bottom Layer

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 (+): V_{OUT1}
 - b. Negative (-): GND
 - c. Positive (+): V_{OUT2}
 - d. Negative (-): GND
 - e. Positive (+): V_{OUT3}
 - 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 Ω resistor for automatic startup.
7. The output voltage V_{OUT} can be changed by varying R2A or R2B. Calculate the new value by formula:

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

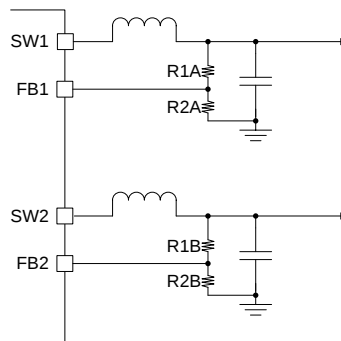


Figure 4

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