

## DESCRIPTION

The EV6509GF-00A is an evaluation board for the MP6509GF, a bipolar stepper motor driver with dual, built-in full-bridges consisting of N-channel power MOSFETs.

It operates from a supply voltage range of 2.7V to 18V, and can deliver output current up to 1.2A per channel. The safety features include sinking and sourcing current limits implemented with external sensors, under-voltage lockout and thermal shutdown. An over-temperature output flag is available to indicate thermal shutdown.

The EV6509GF-00A is a fully assembled and tested PCB. The input control signals for the MP6509GF are applied through the connector or generated on board. It can drive a bipolar stepper motor with both full step and half step mode. It also can drive two independent DC motors.

## ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	$V_{IN}$	2.7 – 18	V
Output Current	$I_{OUT}$	1.2	A

## FEATURES

- Wide 2.7V to 18V Input Voltage Range
- Over-Current and Over-Temperature Indication
- Alternative Input Control Signals (External or Generated on Board)
- Four Selectable Current Attenuation Modes

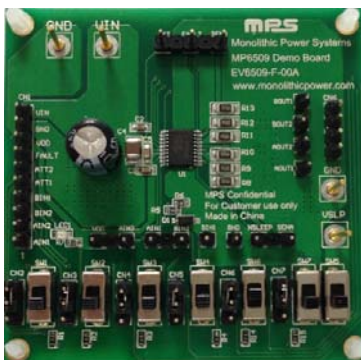
## APPLICATIONS

- POS Printers
- Video Security Camera
- Battery Powered Devices
- USB Powered Devices

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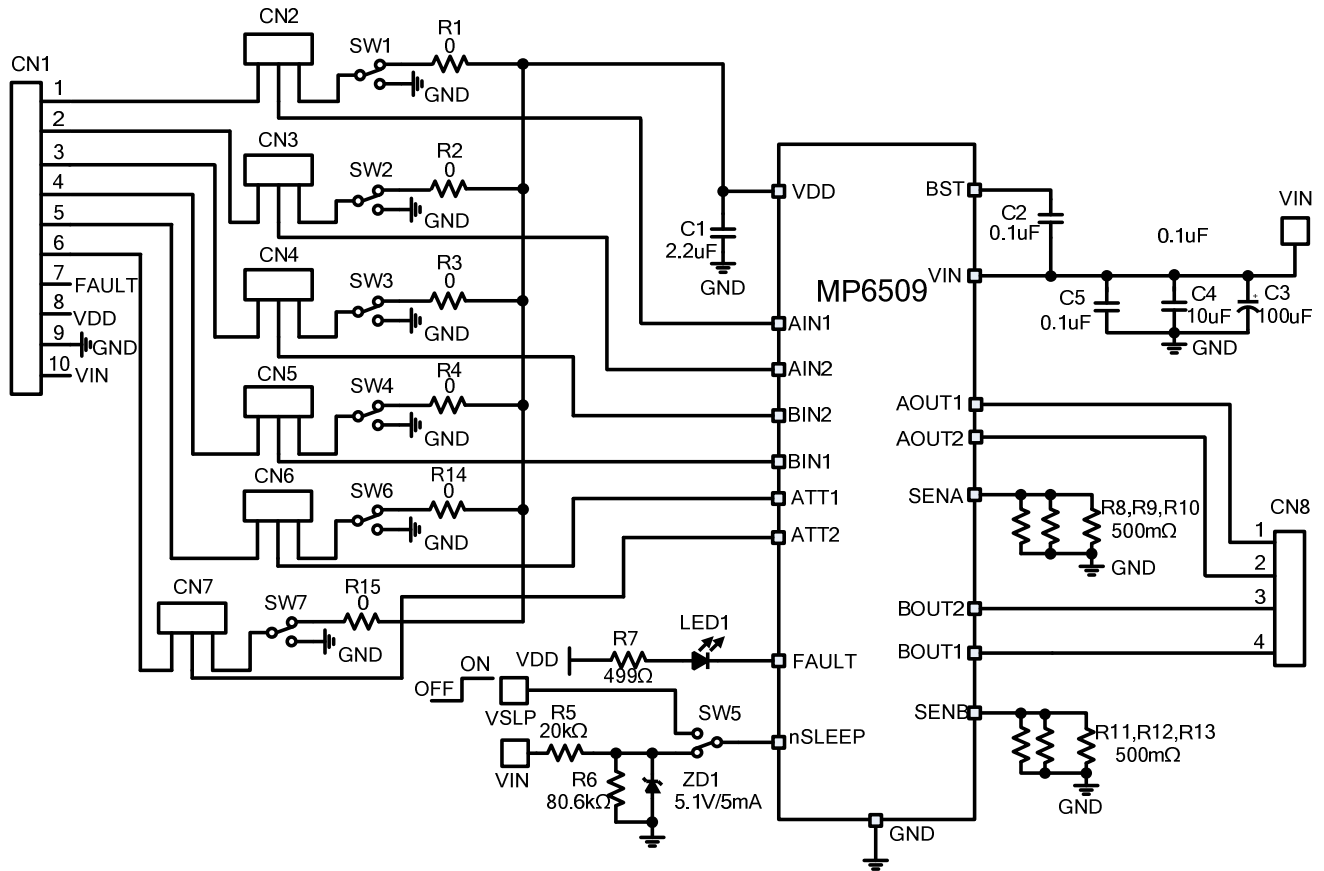
## EV6509GF-00A EVALUATION BOARD



(L x W x H) 2.54" x 2.54" x 0.4"  
(6.35cm x 6.35cm x 1cm)

Board Number	MPS IC Number
EV6509GF-00A	MP6509GF

## EVALUATION BOARD SCHEMATIC



## EV6509GF-00A BILL OF MATERIALS

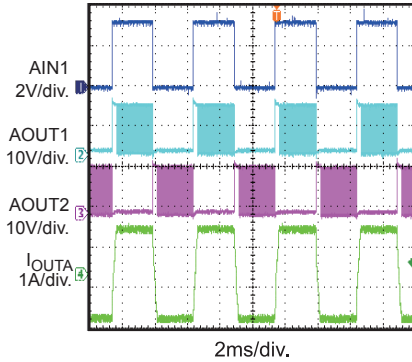
Qty	Ref	Value	Description	Package	Manufacturer	Part Number
1	C1	2.2μF	Ceramic Capacitor, 10V, X7R	0603	Murata	GRM188R71A225KE15D
2	C2,C5	0.1μF	Ceramic Capacitor, 25V, X7R	0603	Murata	GRM188R71E104KA01D
1	C3	100μF	Electrolytic Capacitor, 50V, X5R	DIP	Jianghai	CD287-50V100
1	C4	10μF	Ceramic Capacitor. 50V, X7R	1206	Murata	GRM32ER71H106KA12L
6	R1,R2 R3,R4 R14,R15	0Ω	Film Resistor, 5%	0603	Royalohm	0603J0000T5E
1	R5	20kΩ	Film Resistor, 1%	0603	Yageo	RC0603FR-0720KL
1	R6	80.6kΩ	Film Resistor, 1%	0603	Yageo	RC0603FR-0780K6L
1	R7	499Ω	Film Resistor, 1%	0603	Yageo	RC0603FR-07499RL
6	R8,R9, R10,R11, R12,R13	500mΩ	Film Resistor, 1%	1206	Yageo	RL1206FR-070R5L
1	ZD1		Zener Diode, 5.1V, 5mA, 500mW	SOD-123	Diodes	BZT52C5V1
1	LED1		LED. Red	0805	Bright LED	BL-HUF35A-TRB
7	SW1-SW7		Switch (2 Bit)			SS-12D01EG4
1	CN1		10PIN, 2.54mm			
6	CN2-CN7		3PIN, 2.54mm (with Short Jumper)			
1	CN8		4PIN, 2.54mm			
1	U1		Stepper Motor Driver	TSSOP-20 EP	MPS	MP6509GF

## EVB TEST RESULTS

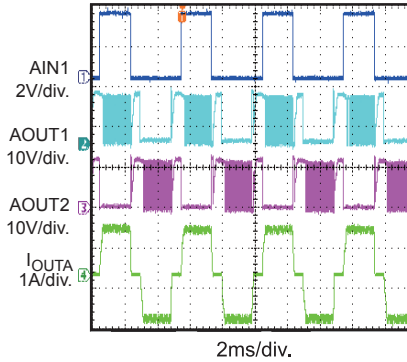
Performance waveforms are tested on the evaluation board.

$V_{IN}=12V$ ,  $I_{OUT}=1.2A$ ,  $ATT1=ATT2=L$ ,  $F_{step}=200Hz$ , R+L Load:  $L=1.5mH$ ,  $R=3.3\Omega$ ,  $T_A=25^\circ C$ , unless otherwise noted.

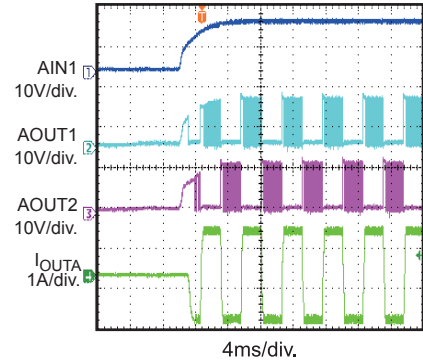
Steady State-Full Step



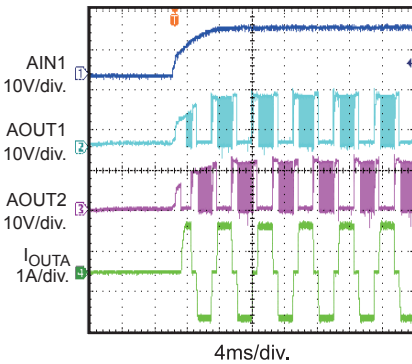
Steady State-Half Step



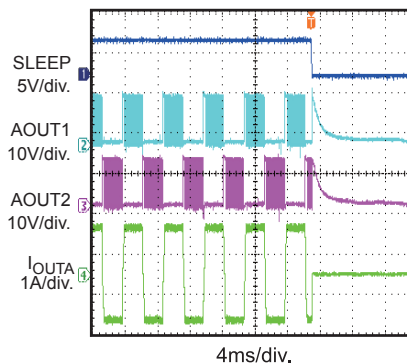
Power Ramp Up-Full Step



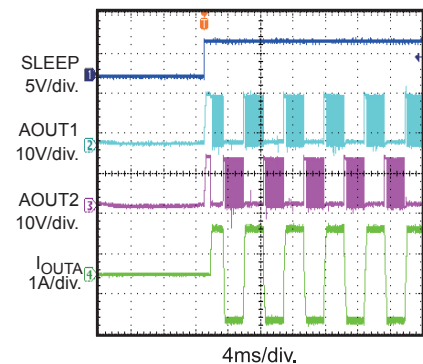
Power Ramp Up-Half Step



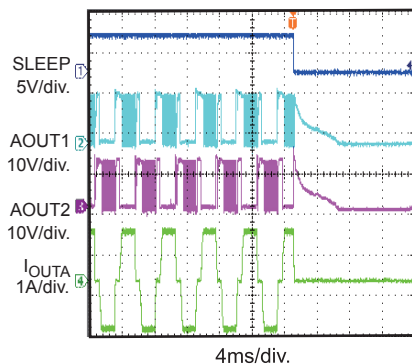
Sleep Entry-Full Step



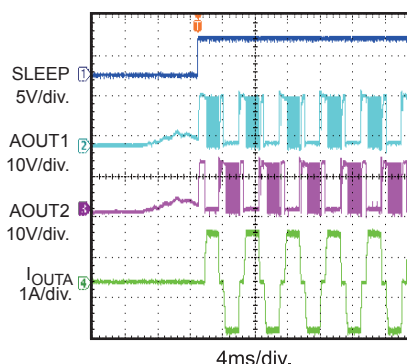
Sleep Recovery-Full Step



Sleep Entry-Half Step

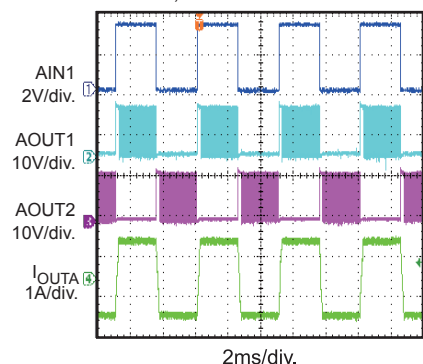


Sleep Recovery-Half Step



80% Current Attenuation -Full Step

$ATT1=H$ ,  $ATT2=L$



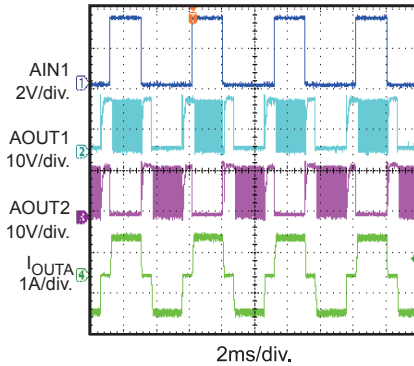
## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN}=12V$ ,  $I_{OUT}=1.2A$ ,  $ATT1=ATT2=L$ ,  $F_{step}=200Hz$ , R+L Load:  $L=1.5mH$ ,  $R=3.3\Omega$ ,  $T_A=25^\circ C$ , unless otherwise noted.

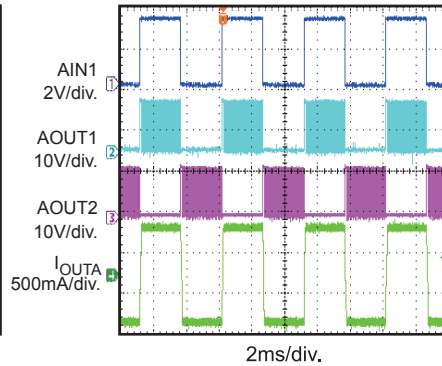
### 80% Current Attenuation -Half Step

$ATT1=H$ ,  $ATT2=L$



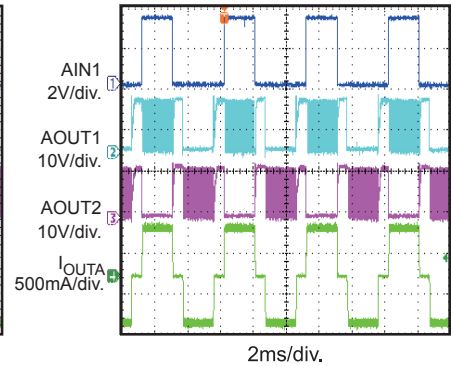
### 50% Current Attenuation -Full Step

$ATT1=L$ ,  $ATT2=H$



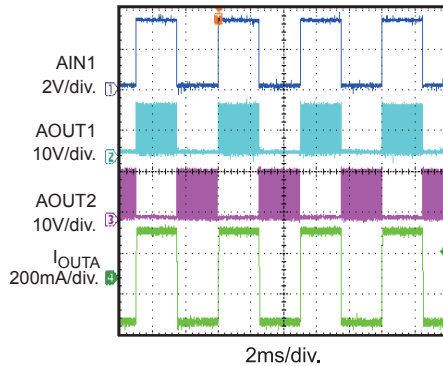
### 50% Current Attenuation -Half Step

$ATT1=L$ ,  $ATT2=H$



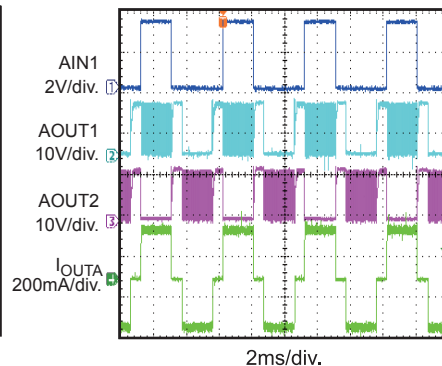
### 20% Current Attenuation -Full Step

$ATT1=H$ ,  $ATT2=H$

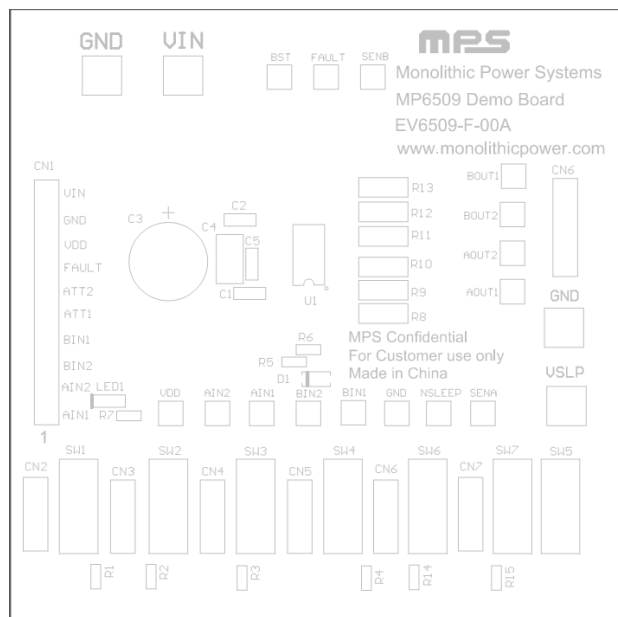


### 20% Current Attenuation -Half Step

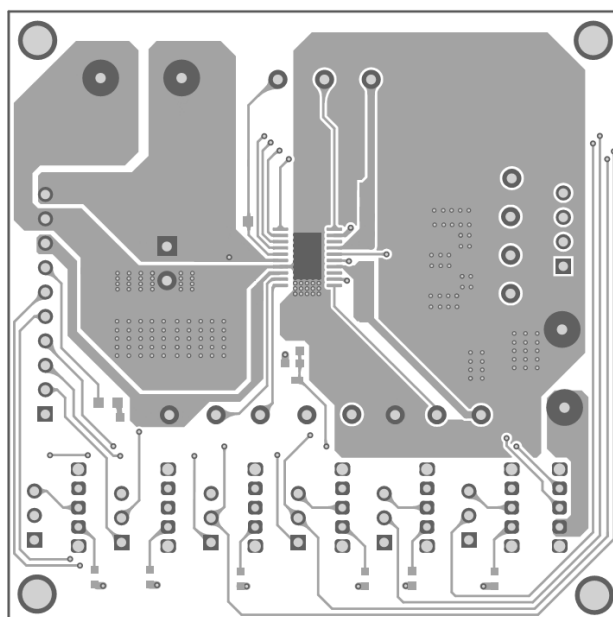
$ATT1=H$ ,  $ATT2=H$



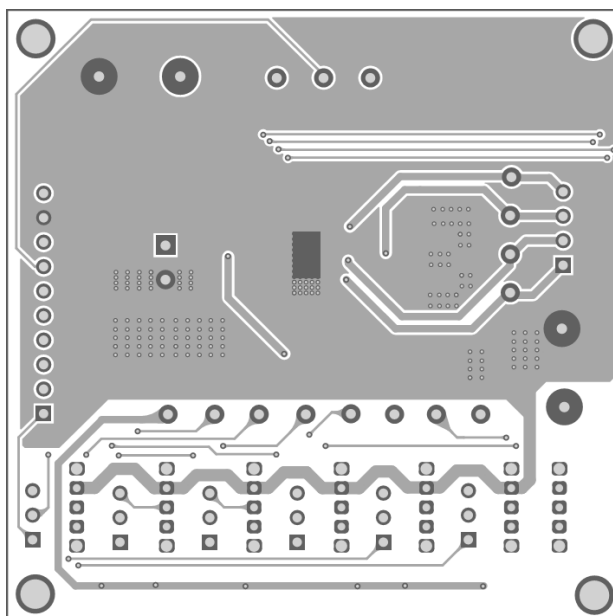
## PRINTED CIRCUIT BOARD LAYOUT



**Figure 1—Top Silk Layer**



**Figure 2—Top Layer**



**Figure 3—Bottom Layer**

## QUICK START GUIDE

1. The power and control signals for the MP6509GF are applied through the connector CN1. Each pin in the connector is labeled on the EVB. The control signals of AIN1, AIN2, BIN1 and BIN2 can be generated on board too. Refer the jumpers section (item5) for detailed information. The connector CN1 also outputs the FAULT signal and VDD (5V) from the IC.
2. Preset power supply of 2.7V to 18V between VIN and GND pins on CN1 or external VIN and GND terminals.
3. The connector CN6 should be connected to the motor winding terminals. Each pin in the connector is labeled on the EVB as AOUT1, AOUT2, BOUT1 and BOUT2. The polarity of these connections will affect the direction of the motor in the case of a DC motor. As for a stepper motor, one winding should be connected to AOUT1 and AOUT2, while the other should be connected to BOUT1 and BOUT2.
4. If the SW5 is switched to the VIN position, SLEEP pin will be pulled up to the VIN by a voltage divider resistor. This ensures the part doesn't enter the SLEEP mode. If the SLEEP mode is controlled externally through any controller, then switches the SW5 to VSLP position and connects the SLEEP control signal from the external controller directly to the VSLP terminal.
5. Jumpers CN2, CN3, CN4, CN5, CN6 and CN7 are used to select the source of the control signals AIN1, AIN2, BIN2, BIN1, ATT1 and ATT2 respectively.

By placing a shunt between positions 1-2, the source of the control signals are routed to the connector CN1. This connection allows the user to control these signals through an external controller.

If the shunt is placed between positions 2-3, the source of the control signals are routed to the switches SW1, SW2, SW3, SW4, SW6 and SW7. These switches can be used to control the state of these input control signals. The state of the motor outputs for various input combinations can be inferred from the MP6509 datasheet.

6. The diode LED1 indicates the status of the FAULT pin. When over-current or over-temperature protection happens, FAULT pin is pulled down to a low level and this LED lights up.
7. R8-R10, R11-R13 are the current sense resistors directly connected to SENA and SENB respectively. The other sides of these resistors are connected to GND. These resistors control the current through the MP6509 to be 1.2A per channel. To change this value of output current, the resistor value must be changed according to the following formula:

$$I_{\text{lim-A}} = \frac{200mV}{R8 // R9 // R10} \quad I_{\text{lim-B}} = \frac{200mV}{R11 // R12 // R13}$$

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