



# SGM42500/SGM42501 3.6A Brushed DC Motor Drivers

## GENERAL DESCRIPTION

The SGM42500 and SGM42501 devices are brushed DC motor drivers. Two logic inputs control the H-bridge driver, which consists of four N-MOSFETs that can control motors bi-directionally with up to 3.6A peak current at 40V voltage.

The SGM42500 supports IN1/IN2 PWM interface and the SGM42501 supports PH/EN interface. Internal synchronous rectification control circuitry is provided to lower power dissipation during PWM operation. Customer can adjust PWM current limit or torque in real-time by VREF pin with a controller's DAC output or PWM signal after RC filter.

A number of protection features are provided in the device including over-current, short-circuit, under-voltage lockout, and thermal shutdown. When the fault condition is removed, the device automatically resumes normal operation.

The SGM42500 and SGM42501 are available in a Green SOIC-8 (Exposed Pad) package. They operate over an ambient temperature range of -40°C to +125°C.

## FEATURES

- **H-Bridge Motor Driver**
- **Operating Voltage Range: 6.5V to 40V**
- **Low On-Resistance: 0.43Ω (HS + LS) at +25°C**
- **Peak Current: 3.6A**
- **Interface**
  - ◆ **SGM42500: IN1/IN2**
  - ◆ **SGM42501: PH/EN**
- **Adjustable PWM Current Limit in Real-Time**
- **Low Power Standby Mode**
- **Integrated Protection Features**
  - ◆ **Over-Current Protection (OCP)**
  - ◆ **Under-Voltage Lockout (UVLO)**
  - ◆ **Thermal Shutdown (TSD)**
  - ◆ **Auto-Retry**
- **Available in a Green SOIC-8 (Exposed Pad) Package**

## APPLICATIONS

Printers  
Vacuum Cleaners Robotics  
Industrial Pumps and Valves

## TYPICAL APPLICATION

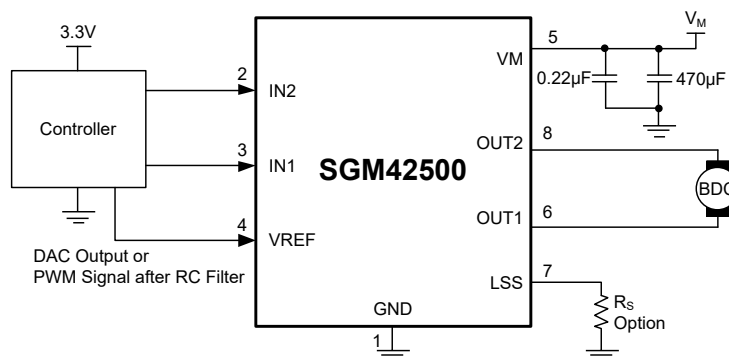


Figure 1. Typical Application Circuit

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42500	SOIC-8 (Exposed Pad)	-40°C to +125°C	SGM42500XPS8G/TR	SGM 42500XPS8 XXXXX	Tape and Reel, 4000
SGM42501	SOIC-8 (Exposed Pad)	-40°C to +125°C	SGM42501XPS8G/TR	SGM 42501XPS8 XXXXX	Tape and Reel, 4000

**MARKING INFORMATION**

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

**XXXXX**



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

Power Supply Voltage .....	50V
EN, PH, IN1, IN2.....	6V
VREF .....	5V
LSS.....	±500mV
Junction Temperature .....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s) .....	+260°C

**RECOMMENDED OPERATING CONDITIONS**

Power Supply Voltage .....	6.5V to 40V
Junction Temperature Range .....	-40°C to +150°C
Ambient Temperature Range.....	-40°C to +125°C

**OVERSTRESS CAUTION**

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

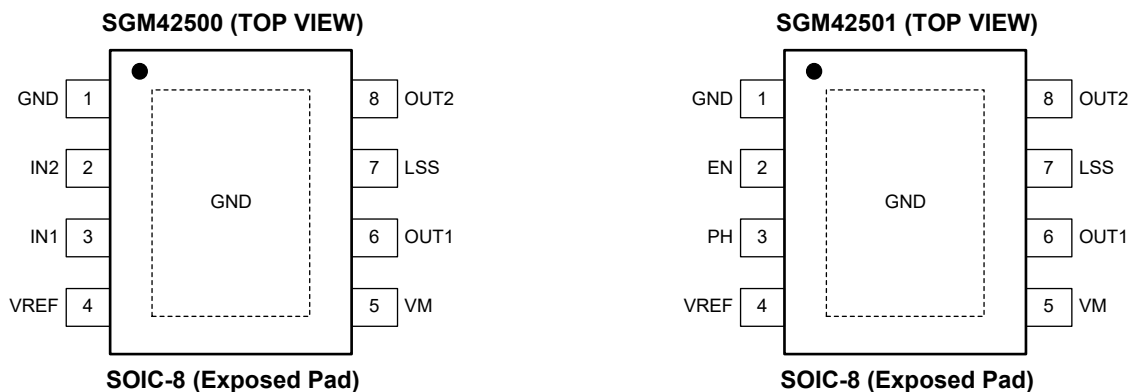
**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

## PIN CONFIGURATIONS



## PIN DESCRIPTION

PIN	NAME		TYPE	FUNCTION
	SGM42500	SGM42501		
1	GND	GND	G	Ground.
2	IN2	-	I	Logic Input 2.
	-	EN	I	Enable Input. Logic low to place the H-bridge in brake mode or coast mode.
3	IN1	-	I	Logic Input 1.
	-	PH	I	Direction Input. Control the direction and speed of the H-bridge.
4	VREF	VREF	I	Analog Input. Analog input to set current limit.
5	VM	VM	P	Supply Voltage.
6	OUT1	OUT1	O	H-Bridge Output 1. Output of H-bridge driving stage.
7	LSS	LSS	O	Power Return. Sense resistor connection (option) or connect to power pad ground directly.
8	OUT2	OUT2	O	H-Bridge Output 2. Output of H-bridge driving stage.
Exposed Pad	GND	GND	-	Exposed Pad. Exposed pad for enhanced thermal dissipation.

NOTE: I: input, O: output, G: ground, P: power for the circuit.

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Power Supply (VM)</b>						
Power Supply Voltage	V <sub>M</sub>		6.5		40	V
Power Supply Current	I <sub>VM</sub>	V <sub>M</sub> = 12V		2.3		mA
Standby Mode Supply Current	I <sub>VMQ</sub>	V <sub>M</sub> = 12V		2.9		μA
<b>Logic Level Inputs</b>						
Input Logic Low Voltage	V <sub>IL</sub>			0.8		V
Input Logic High Voltage	V <sub>IH</sub>			1.15		V
Input Logic Hysteresis	V <sub>HYS</sub>			350		mV
Input Logic Low Current	I <sub>IL</sub>	V <sub>IN</sub> = 0V		0		μA
Input Logic High Current	I <sub>IH</sub>	V <sub>IN</sub> = 3.3V		25		μA
Pull-Down Resistance	R <sub>PD</sub>	To GND		130		kΩ
Propagation Delay	t <sub>PD</sub>	INx to OUTx change		0.7		μs
<b>Motor Driver Outputs (OUT1 and OUT2)</b>						
High-side FET On-Resistance	R <sub>DSON</sub>	V <sub>M</sub> = 24V, I <sub>OUT</sub> = 1A, f <sub>PWM</sub> = 25kHz		250		mΩ
Low-side FET On-Resistance		V <sub>M</sub> = 24V, I <sub>OUT</sub> = 1A, f <sub>PWM</sub> = 25kHz		180		mΩ
Body Diode Forward Voltage	V <sub>D</sub>	I <sub>OUT</sub> = 1A		0.8		V
<b>Timing</b>						
Turn-On Time <sup>(1)</sup>	t <sub>ON</sub>	V <sub>M</sub> > V <sub>UVLO</sub> with IN1 or IN2 high		150		μs
Crossover Delay	t <sub>COD</sub>			400		ns
VREF Input Voltage Range	V <sub>REF</sub>		0		4	V
VREF Current Gain	A <sub>V</sub>	V <sub>REF</sub> /V <sub>LSS</sub> , V <sub>REF</sub> = 4V		10		V/V
		V <sub>REF</sub> /V <sub>LSS</sub> , V <sub>REF</sub> = 2.5V		10		V/V
		V <sub>REF</sub> /V <sub>LSS</sub> , V <sub>REF</sub> = 1V		10		V/V
Constant Off-Time	t <sub>OFF</sub>			25		μs
Standby Timer	t <sub>ST</sub>	SGM42500: IN1 = IN2 < V <sub>IN_STANDBY</sub> , 10 × V <sub>LSS</sub> < V <sub>REF</sub>		1.15		ms
		SGM42501: EN = 0V, 10 × V <sub>LSS</sub> < V <sub>REF</sub>		1.15		ms
<b>Protection Circuits</b>						
VM Under-Voltage Lockout	V <sub>UVLO</sub>	V <sub>M</sub> falls until UVLO triggers		6		V
		V <sub>M</sub> rises until operation recovers		6.2		
VM Under-Voltage Hysteresis	V <sub>HYS</sub>	Rising to falling threshold		200		mV
Over-Current Protection Trip Level	I <sub>OCP</sub>			4		A
Over-Current Deglitch Time	t <sub>OCP</sub>			2		μs
Over-Current Retry Time	t <sub>RETRY</sub>			10		ms
Thermal Shutdown Temperature	T <sub>SD</sub>			160		°C
Thermal Shutdown Temperature Hysteresis	T <sub>HYS</sub>			20		°C

NOTE: 1. t<sub>ON</sub> applies when the device initially powers up, and when it exits standby mode.

## PWM CONTROL TIMING DIAGRAM

Table 1. SGM42500 PWM Control Truth Table

IN1	IN2	$10 \times V_{LSS} > V_{REF}$	OUT1	OUT2	Function
0	1	False	L	H	Reverse
1	0	False	H	L	Forward
0	1	True	H/L	L	Chop (Mixed Decay), Reverse
1	0	True	L	H/L	Chop (Mixed Decay), Forward
1	1	False	L	L	Brake (Slow Decay)
0	0	False	Z	Z	Coast, enter in the low power standby mode after 1.15ms

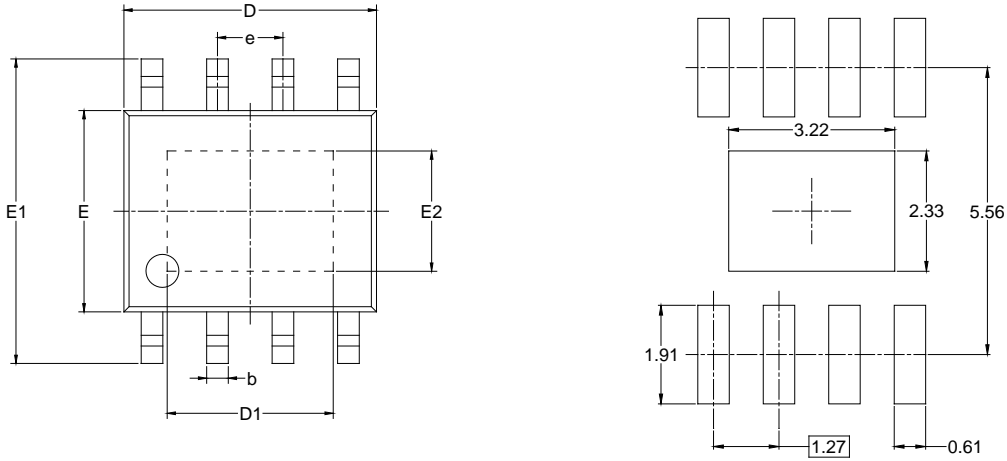
Table 2. SGM42501 PH/EN Control Truth Table

PH	EN	$10 \times V_{LSS} > V_{REF}$	OUT1	OUT2	Function
0	1	False	L	H	Reverse
1	1	False	H	L	Forward
0	1	True	H/L	L	Chop (Mixed Decay), Reverse, Adjust Speed
1	1	True	L	H/L	Chop (Mixed Decay), Forward, Adjust Speed
1	0		L	L	Brake (Slow Decay)
0	0		Z	Z	Coast, enter in the low power standby mode after 1.15ms

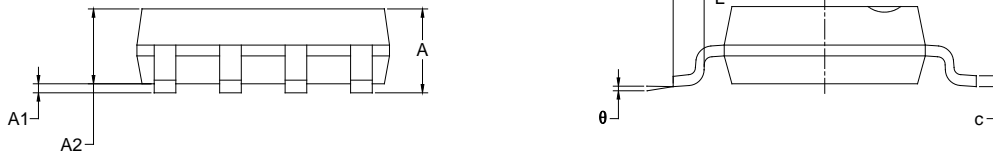
NOTE: Z = high-impedance.

PACKAGE OUTLINE DIMENSIONS

SOIC-8 (Exposed Pad)



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.700
A1	0.000	-	0.150
A2	1.250	-	1.650
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
D1	3.020	-	3.420
E	3.800	-	4.000
E1	5.800	-	6.200
E2	2.130	-	2.530
e	1.27 BSC		
L	0.400	-	1.270
θ	0°	-	8°

NOTES:

1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-8 (Exposed Pad)	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

DD0001

# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13"	386	280	370	5

DD0002