



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

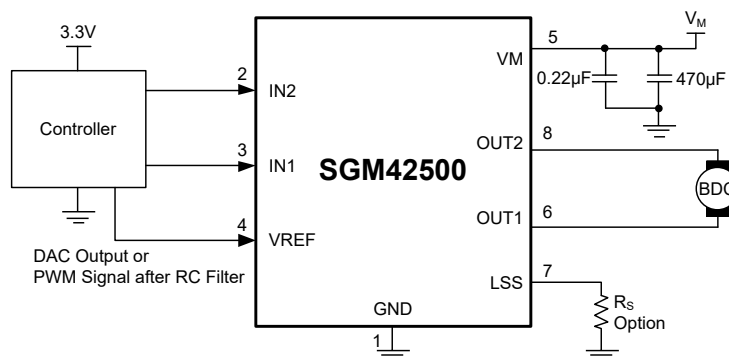


Figure 1. Typical Application Circuit

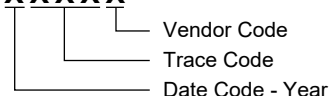
PACKAGE/ORDERING INFORMATION

| 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.

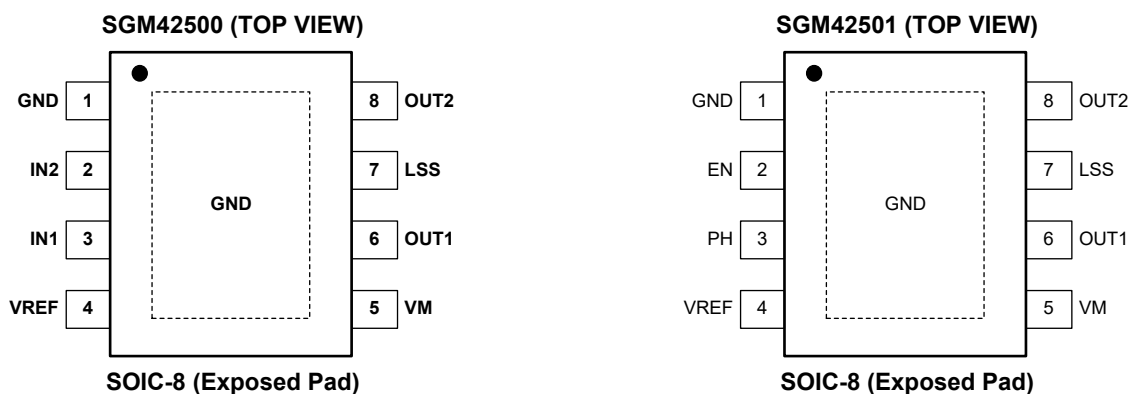
ESD SENSITIVITY CAUTION

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_A = +25°C, unless otherwise noted.)

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

NOTE: 1. t_{ON} 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 |

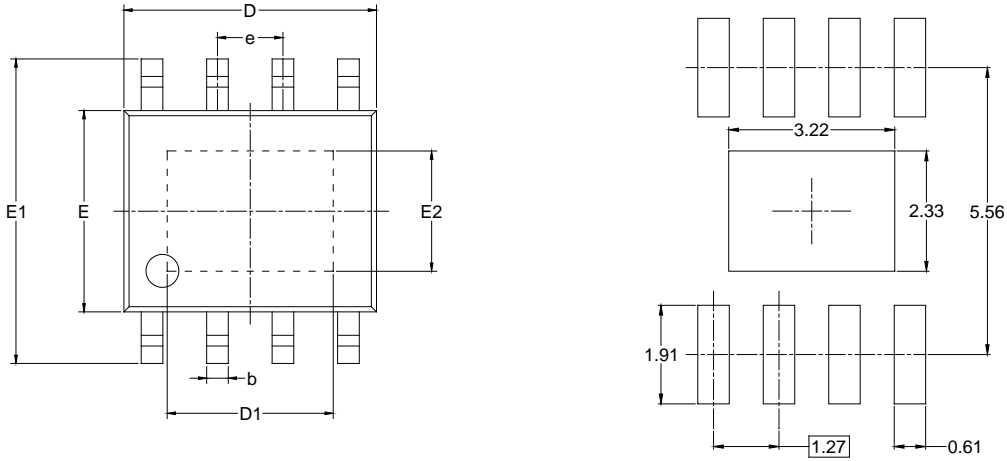
Table 2. SGM42501 PH/EN Control Truth Table

| 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 |

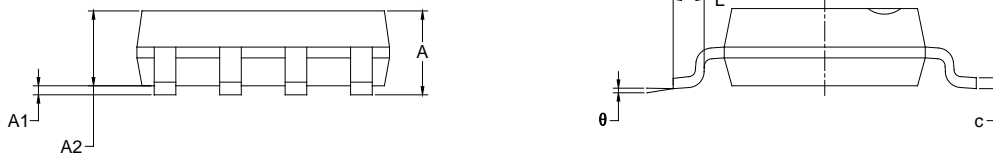
NOTE: Z = high-impedance.

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° |

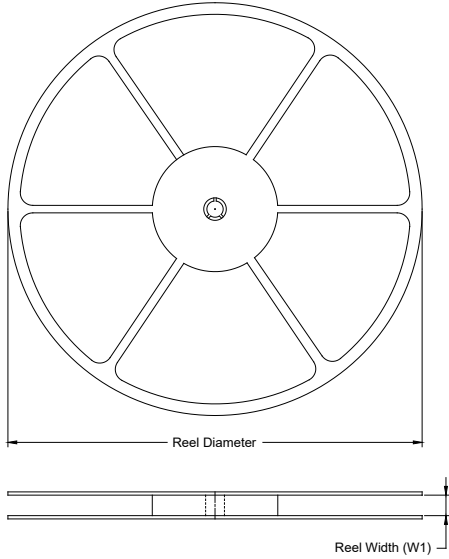
NOTES:

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

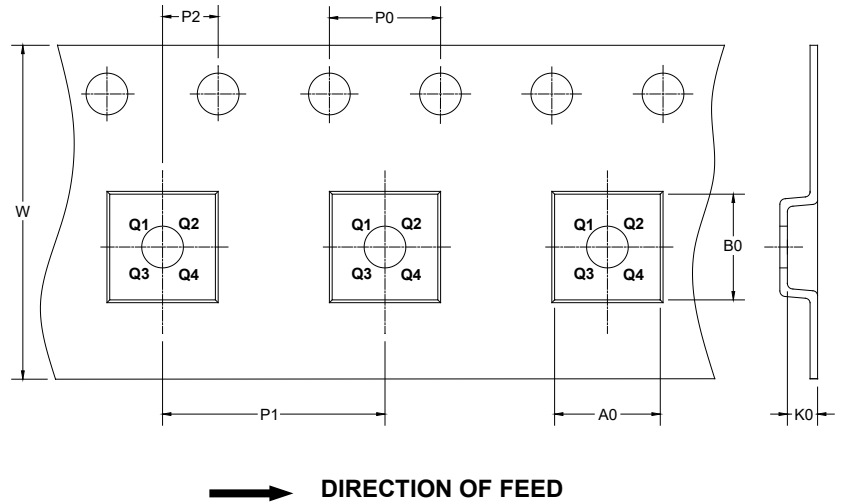
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

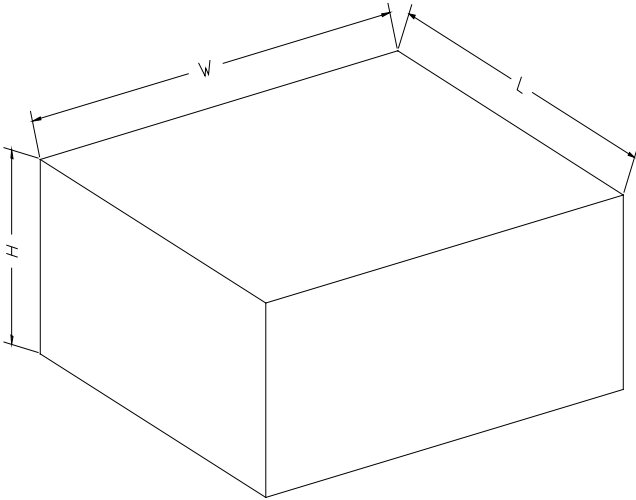
KEY PARAMETER LIST OF TAPE AND REEL

| 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