



# SGM42403

## Quad Low-side Driver IC

### GENERAL DESCRIPTION

The SGM42403 consists of four identical low-side drivers with over-current protection. It has integrated diodes to clamp turn-off transients generated by inductive loads such as unipolar stepper motors, DC motors, relays, solenoids or other loads.

The SGM42403 can supply up to 1.5A (1-channel on) or 800mA/CH (4-channel on) continuous output current by the SOIC package at +25°C. And it can supply up to 2A (1-channel on) or 1A/CH (4-channel on) continuous output current by the TSSOP package at +25°C.

A number of protection features are provided in this device including over-current, short-circuit, under-voltage lockout and over-temperature shutdown. Over-current and over-temperature can be indicated by a fault output pin.

The SGM42403 is available in Green SOIC-20 and TSSOP-16 (Exposed Pad) packages.

### FEATURES

- **Power Supply Voltage Range: 8.2V to 60V**
- **Quad Low-side Driver**
  - ◆ **Parallel Interface**
  - ◆ **Four N-MOSFETs with Over-Current Protection**
  - ◆ **Integrated Inductive Clamp Diodes**
- **Continuous Output Current**
  - SOIC-20 Package:**
    - ◆ **1.5A (1-Channel On)**
    - ◆ **800mA/CH (4-Channel On)**
  - TSSOP-16 (Exposed Pad) Package:**
    - ◆ **2A (1-Channel On)**
    - ◆ **1A/CH (4-Channel On)**
- **Full Set of Protections**
  - ◆ **Internal Inductive Energy Clamp at 60V**
  - ◆ **Thermal Shutdown with Auto-Retry**
  - ◆ **Overload Protection**
  - ◆ **Short-Circuit Protection**
  - ◆ **Under-Voltage Lockout**

### SIMPLIFIED SCHEMATIC

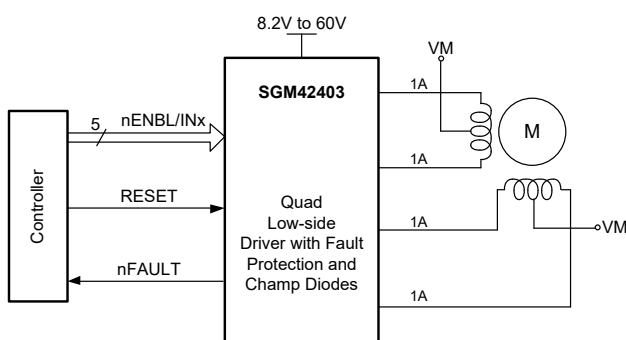


Figure 1. Simplified Schematic

### APPLICATIONS

Low-side Switch Applications  
 Unipolar Stepper Motor Drivers  
 Relay Drivers and Solenoid Drivers

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42403	TSSOP-16 (Exposed Pad)	-40°C to +125°C	SGM42403XPTS16G/TR		
	SOIC-20	-40°C to +125°C	SGM42403XS20G/TR		

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 Range,  $V_M$ ..... -0.3V to 65V  
 Output Voltage,  $V_{OUTx}$ ..... -0.3V to 65V  
 Output Clamp Voltage <sup>(1)</sup>,  $V_{CLAMP}$ ..... -0.3V to 65V  
 Output Current,  $I_{nFAULT}$ ..... < 20mA  
 Peak Clamp Diode Current..... < 2A  
 DC or RMS Clamp Diode Current..... < 1A  
 Digital Input Pin Voltage ..... -0.5V to 6V  
 Digital Output Pin Voltage,  $V_{nFAULT}$  ..... -0.5V to 6V  
 Peak Motor Drive Output Current,  $t < 1\mu s$ ... Internally Limited  
 Junction Temperature.....+150°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s).....+260°C

**RECOMMENDED OPERATING CONDITIONS**

Power Supply Voltage Range,  $V_M$ .....8.2V to 60V  
 Output Clamp Voltage <sup>(1)</sup>,  $V_{CLAMP}$  .....0V to 60V  
 Continuous Output Current,  $I_{OUTx}$   
 SOIC-20 ( $T_A = +25^\circ C$ )  
     1-Channel On..... 1.5A  
     4-Channel On.....0.8A  
 TSSOP-16 (Exposed Pad) ( $T_A = +25^\circ C$ )  
     1-Channel On.....2A  
     4-Channel On..... 1A

NOTE: 1.  $V_{CLAMP}$  is not a power supply and is only used to supply the power to clamp diodes.

**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.

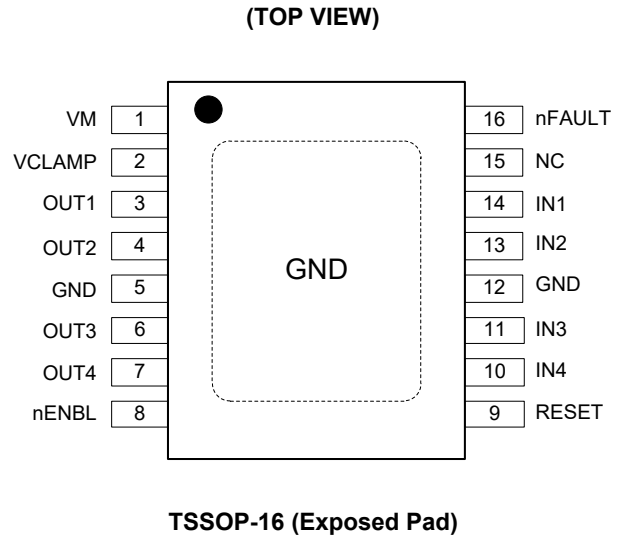
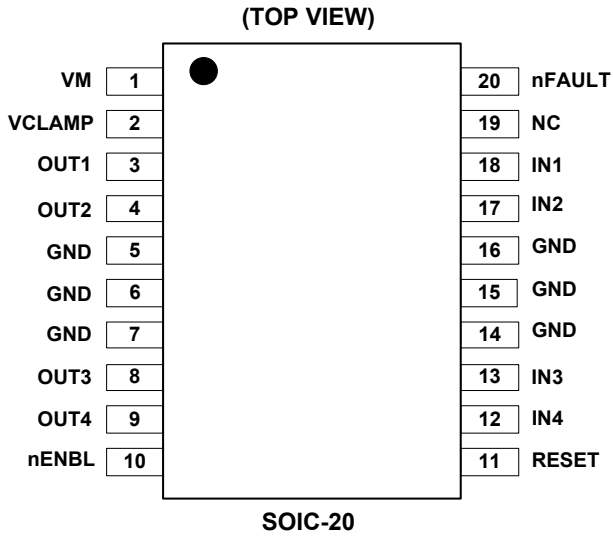
**ESD SENSITIVITY CAUTION**

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
SOIC-20	TSSOP-16 (Exposed Pad)			
1	1	VM	-	Power Supply.
2	2	VCLAMP	-	Output Clamp Voltage. Tie to $V_M$ supply, or Zener diode to $V_M$ supply.
3	3	OUT1	O	Output 1 of the device.
4	4	OUT2	O	Output 2 of the device.
5, 6, 7, 14, 15, 16	5, 12	GND	-	Ground.
8	6	OUT3	O	Output 3 of the device.
9	7	OUT4	O	Output 4 of the device.
10	8	nENBL	I	Enable Input Pin. A high DC signal on this pin will enable the device, internal pull-down.
11	9	RESET	I	Reset Input Pin. Logic high resets internal logic and over-current protection, internal pull-down.
12	10	IN4	I	Channel 4 Input. Active high drives OUT4 low, internal pull-down.
13	11	IN3	I	Channel 3 Input. Active high drives OUT3 low, internal pull-down.
17	13	IN2	I	Channel 2 Input. Active high drives OUT2 low, internal pull-down.
18	14	IN1	I	Channel 1 Input. Active high drives OUT1 low, internal pull-down.
19	15	NC	-	No Connection.
20	16	nFAULT	OD	Fault Flag Pin. Pull this pin low when the over-temperature or over-current occurs.
-	Exposed Pad	GND	-	Ground.

NOTE: I = input, O = output, OD = open-drain output.

**ELECTRICAL CHARACTERISTICS**(Typical values are at  $T_J = +25^\circ\text{C}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Power Supplies</b>						
Power Supply Current	$I_{VM}$	$V_M = 24\text{V}$		0.56		mA
Under-Voltage Lockout Voltage	$V_{UVLO}$	$V_M$ rising		7.8		V
<b>Logic Level Inputs (Schmitt Trigger Inputs with Hysteresis)</b>						
Input Logic Low Voltage	$V_{IL}$			1.2		V
Input Logic High Voltage	$V_{IH}$			1.6		V
Input Logic Hysteresis	$V_{HYS}$			400		mV
Input Logic Low Current	$I_{IL}$	$V_{IN} = 0\text{V}$		0.1		$\mu\text{A}$
Input Logic High Current	$I_{IH}$	$V_{IN} = 3.3\text{V}$		14		$\mu\text{A}$
Pull-Down Resistance	$R_{PD}$			240		k $\Omega$
<b>nFAULT Output (Open-Drain Output)</b>						
Output Low Voltage	$V_{OL}$	$I_O = 5\text{mA}$		0.3		V
Output High Leakage Current	$I_{OH}$	$V_O = 3.3\text{V}$		0.01		$\mu\text{A}$
<b>Low-side FETs</b>						
FET On-Resistance	$R_{DSON}$	$V_M = 24\text{V}, I_O = 700\text{mA}, T_J = +25^\circ\text{C}$		0.34		$\Omega$
		$V_M = 24\text{V}, I_O = 700\text{mA}, T_J = +85^\circ\text{C}$		0.45		
Off-State Leakage Current	$I_{OFF1}$			5		$\mu\text{A}$
<b>High-side Diodes</b>						
Diode Forward Voltage	$V_F$	$V_M = 24\text{V}, I_O = 700\text{mA}, T_J = +25^\circ\text{C}$		1		V
Off-State Leakage Current	$I_{OFF2}$	$V_M = 24\text{V}, T_J = +25^\circ\text{C}$		15		$\mu\text{A}$
<b>Outputs</b>						
Rise Time	$t_R$	$V_M = 24\text{V}, I_O = 700\text{mA},$ resistive load		75		ns
Fall Time	$t_F$	$V_M = 24\text{V}, I_O = 700\text{mA},$ resistive load		100		ns
<b>Protection Circuits</b>						
Over-Current Protection Trip Level	$I_{OCP}$			2.9		A
Over-Current Protection Deglitch Time	$t_{OCP}$			3.5		$\mu\text{s}$
Over-Current Protection Retry Time	$t_{RETRY}$			10		ms
Thermal Shutdown Temperature	$T_{SD}$	Die temperature		160		$^\circ\text{C}$

## TIMING PARAMETERS AND REQUIREMENTS

(Typical values are at  $T_J = +25^\circ\text{C}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Enable Time	$t_{nENBL}$	nENBL to output low		220		ns
Propagation Delay Time	$t_{PD\_L-H}$	INx to OUTx, low to high		185		ns
	$t_{PD\_H-L}$	INx to OUTx, high to low		180		ns
RESET Pulse Width	$t_{RESET}$		20			$\mu\text{s}$

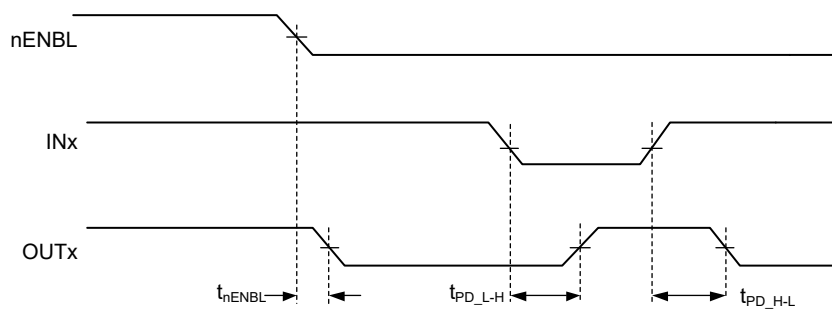
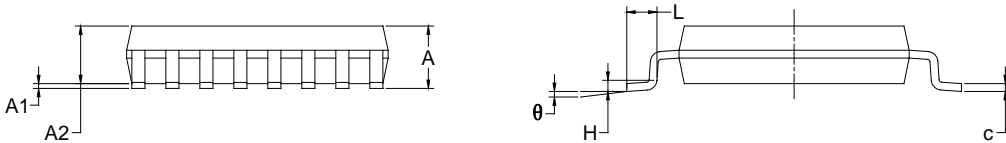
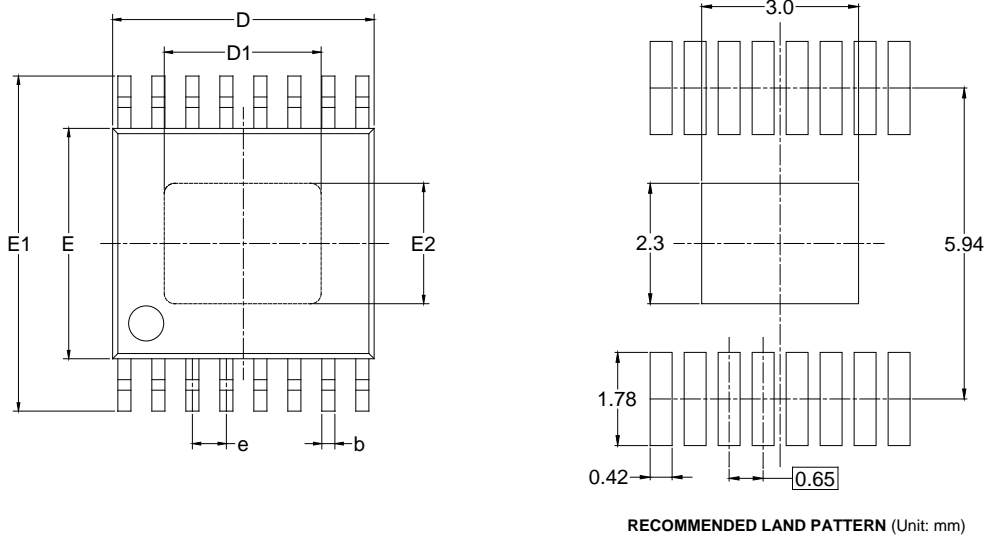


Figure 2. SGM42403 Timing Definition

PACKAGE OUTLINE DIMENSIONS

TSSOP-16 (Exposed Pad)

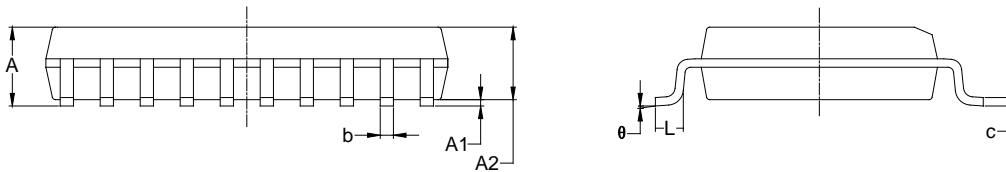
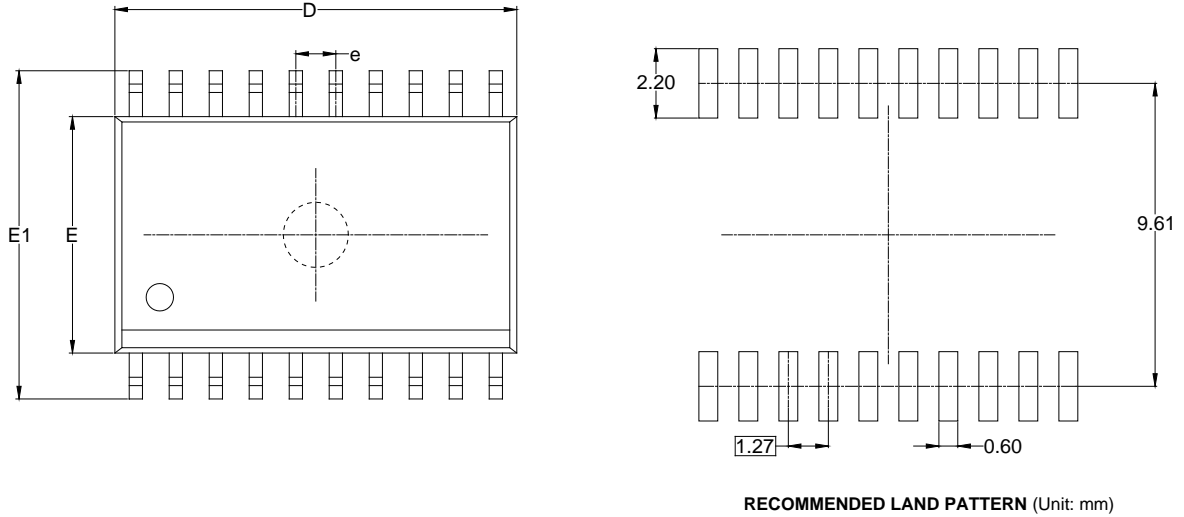


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
D1	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
E2	2.200	2.400	0.087	0.094
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

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

PACKAGE OUTLINE DIMENSIONS

SOIC-20

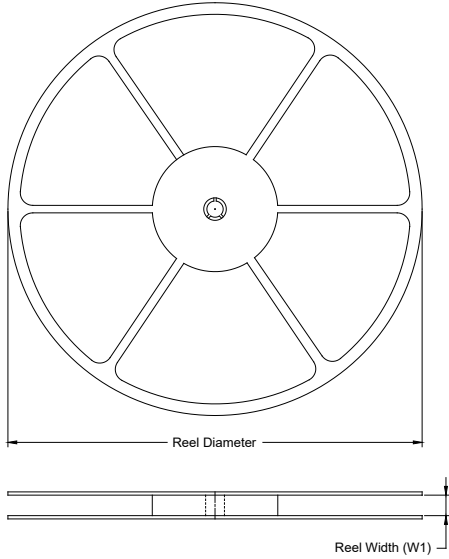


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.100	2.500	0.083	0.098
b	0.330	0.510	0.013	0.020
c	0.204	0.330	0.008	0.013
D	12.520	13.000	0.493	0.512
E	7.400	7.600	0.291	0.299
E1	10.210	10.610	0.402	0.418
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

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

## 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
TSSOP-16 (Exposed Pad)	13"	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1
SOIC-20	13"	24.4	10.90	13.30	3.00	4.0	12.0	2.0	24.0	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