



# SGM42404A/SGM42404B

## Quad Channel Low-side Drivers with Serial Interface Option

### GENERAL DESCRIPTION

The SGM42404A and SGM42404B family consists of four identical low-side drivers with over-current protection. It has inductive clamp circuit to discharge the inductive load energy when the output is turned off such as unipolar stepper motors, DC motors, relays, solenoids or other loads.

External variable current limit: an external resistor connected to RCLIM pin is used to set the current limit threshold. Programmable over-current limit values are 1A, 1.5A, 2A, 3A (SGM42404B only). The SGM42404 provides a serial interface, which can read/write the data register/control register (configuring the energizing time & PWM duty cycle) through the serial interface, and also can diagnose the open-load or over-current fault condition. Multiple devices can be daisy-chain connected together to save the microcontroller resource.

The device has multiple protection functions, including open-load detection, over-temperature shutdown, over-current and short-circuit protections. Fault conditions are indicated on the SDO/nFAULT pin.

The SGM42404A is available in a Green TSSOP-16 (Exposed Pad) package and the SGM42404B is available in a Green TSSOP-20 (Exposed Pad) package.

### APPLICATIONS

Industrial Digital Outputs  
Relay and Solenoid Drivers  
Industrial PLCs  
DCS Systems  
Motor Control

### FEATURES

- **Supply Voltage Range: 5V to 50V**
- **Continuous Output Current:**
  - ◆ 2A (1-Channel On)
  - ◆ 1A/Channel (4-Channel On)
- **Integrated LDO Output**
- **Load Voltage Range: 5V to 48V**
- **Support SPI Mode or DIR Mode**
- **Programmable Inrush Load Current Mode (SGM42404B Only)**
- **Reduces Power and Heat Dissipation**
  - ◆ **On-Resistance: 300mΩ/Channel (TYP)**
  - ◆ **Supply Current: 1.4mA (TYP)**
  - ◆ **Settable Current Limit: 1A, 1.5A, 2A, 3A (SGM42404B Only)**
- **Robust Design Features**
  - ◆ **Each Channel with Independent Over-Current Protection and Open-Load Detection and Thermal Shutdown Protection**
  - ◆ **Data Output Can be Read Back for Reliable Verification**
  - ◆ **Short-Circuit Protection**
  - ◆ **Lighting Surge Protection**
  - ◆ **Electro-Static Discharge Protection**
- **nFAULT Indication:**
  - ◆ **Thermal Overload**
  - ◆ **Over-Current**
  - ◆ **Open-Load**
- **200kHz Switching Rates**
- **Support PWM Generation and Duty Cycle Settable**
- **±500V/42Ω, 8μs/20μs Surge Protection**
- **±8kV Contact and ±15kV Airgap ESD Protection**
- **16-Bit SPI for Diagnostics and Control**
- **Protection and Features Independent by Each Channel**
  - ◆ **Open-Load Detection Circuit in Output-Off State**
  - ◆ **3A Over-Current Protection (OCP) with 2A Current Foldback after TSD Event**
  - ◆ **Active Clamp Energy**
  - ◆ **Thermal Shutdown (TSD)**

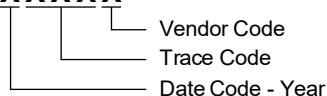
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42404A	TSSOP-16 (Exposed Pad)	-40°C to +125°C	SGM42404AXPTS16G/TR	SGM26G XPTS16 XXXXX	Tape and Reel, 4000
SGM42404B	TSSOP-20 (Exposed Pad)	-40°C to +125°C	SGM42404BXPTS20G/TR	SGM26HXPTS20 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**

V <sub>DD</sub> .....	-0.3V to 55V
Input Voltage, V <sub>DIR</sub> , V <sub>NDIR</sub> , V <sub>REN</sub> , V <sub>RESET</sub> .....	-0.3V to 6V
Digital Input Voltage, IN1/nCS, IN2/SDI, IN3/RST_B, IN4/SCK.....	-0.3V to 6V
nFAULT/SDO <sup>(1)</sup> .....	-0.3V to 5.5V
OUT1, OUT2, OUT3, OUT4 to PGND .....	-0.3V to V <sub>CLAMP</sub>
OUTx Load Current (Continues DC) .....	1A
Package Thermal Resistance	
TSSOP-16 (Exposed Pad), θ <sub>JA</sub> .....	33.7°C/W
TSSOP-16 (Exposed Pad), θ <sub>JB</sub> .....	13.3°C/W
TSSOP-16 (Exposed Pad), θ <sub>JC (TOP)</sub> .....	30.5°C/W
TSSOP-16 (Exposed Pad), θ <sub>JC (BOT)</sub> .....	2.1°C/W
TSSOP-20 (Exposed Pad), θ <sub>JA</sub> .....	28.4°C/W
TSSOP-20 (Exposed Pad), θ <sub>JB</sub> .....	10.2°C/W
TSSOP-20 (Exposed Pad), θ <sub>JC (TOP)</sub> .....	22.5°C/W
TSSOP-20 (Exposed Pad), θ <sub>JC (BOT)</sub> .....	2.1°C/W
Junction Temperature .....	+150°C
Storage Temperature Range .....	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility <sup>(2) (3)</sup>	
HBM.....	±4000V
CDM .....	±1000V

NOTES:

1. Recommended for use with 5V MCUs.
2. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
3. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

**RECOMMENDED OPERATING CONDITIONS**

V <sub>DD</sub> .....	5V to 50V
Operating Ambient Temperature Range.....	-40°C to +125°C
Operating Junction Temperature Range.....	-40°C to +150°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**

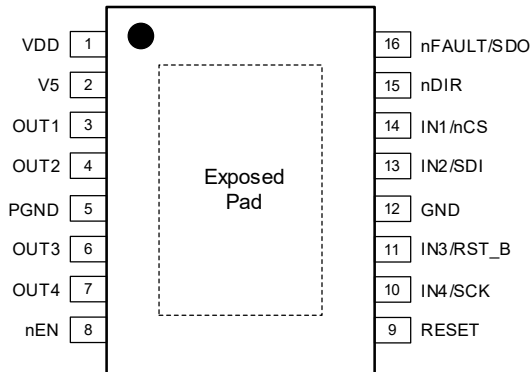
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

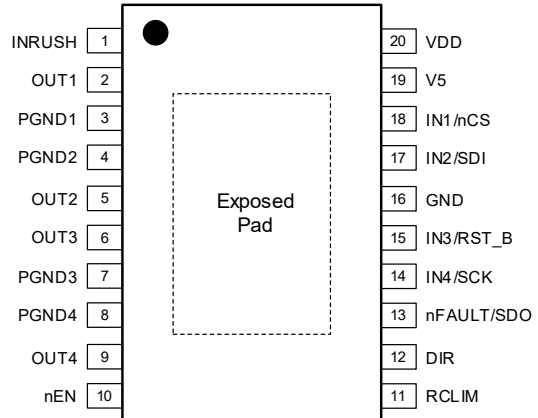
**PIN CONFIGURATIONS**

**SGM42404A (TOP VIEW)**



**TSSOP-16 (Exposed Pad)**

**SGM42404B (TOP VIEW)**



**TSSOP-20 (Exposed Pad)**

**PIN DESCRIPTION**

PIN		NAME	FUNCTION
TSSOP-16 (Exposed Pad)	TSSOP-20 (Exposed Pad)		
<b>Power Supply</b>			
1	20	VDD	Power Supply. Connect a 0.1μF bypass capacitor and a 10μF ceramic capacitor between VDD and GND pins.
5	-	PGND	Power Ground. Connect to exposed pad (EP).
-	3, 4, 7, 8	PGND1, 2, 3, 4	Channel Power Ground. Connect to exposed pad (EP).
12	16	GND	Analog Ground. Connect to exposed pad (EP).
<b>Switch Control</b>			
14	18	IN1/nCS	SPI Enable Input (nDIR = H for SGM42404A/DIR = L for SGM42404B)/Switch 1 Control Logic Input. SGM42404A: Pull up at nDIR = H, pull down at nDIR = L. SGM42404B: Pull up at DIR = L, pull down at DIR = H.
13	17	IN2/SDI	Serial Data Input (nDIR = H for SGM42404A/DIR = L for SGM42404B)/Switch 2 Control Logic Input. Internal pull-down.
11	15	IN3/RST_B	Reset Terminal (nDIR = H for SGM42404A/DIR = L for SGM42404B)/Switch 3 Control Logic Input. Internal pull-down.
10	14	IN4/SCK	Serial Clock (nDIR = H for SGM42404A/DIR = L for SGM42404B)/Switch 4 Control Logic Input. Internal pull-down.
<b>Switch Output</b>			
3	2	OUT1	Low-side Switch 1 Output.
4	5	OUT2	Low-side Switch 2 Output.
6	6	OUT3	Low-side Switch 3 Output.
7	9	OUT4	Low-side Switch 4 Output.
<b>Configuration</b>			
-	12	DIR	DIR = L, SPI mode. DIR = H, DIR mode.
15	-	nDIR	nDIR = L, DIR mode. nDIR = H, SPI mode.
-	1	INRUSH	Inrush Enable Logic Input. Pull Up to enable higher current limit. Drive INRUSH low for no inrush current.
-	11	RCLIM	Adjustable Current Limit. Connect respective resistor to GND to set the current limit foldback level. If the current limit foldback function is not used, short this pin to GND.
8	10	nEN	Enable Input Pin. A low DC signal on this pin will enable the device, internal pull-down.
9	-	RESET	Reset Input Pin. Logic high resets internal logic and over-current protection, internal pull-down.
<b>Diagnostics Signaling</b>			
16	13	nFAULT/SDO	Global Overload Open-Drain Output/Serial Data Output Terminal (nDIR = H for SGM42404A/DIR = L for SGM42404B). It is a fault flag pin when DIR mode. This pin is pulled low when over-temperature, over-current or open-load occurs. Connect a pull-up resistor to logic voltage. ((nDIR = L for SGM42404A/DIR = H for SGM42404B).
2	19	V5	5V LDO Output. Connect a 0.1μF bypass capacitor to GND.
Exposed Pad		-	Exposed Pad. Connect with Ground.

**FUNCTIONAL BLOCK DIAGRAM**

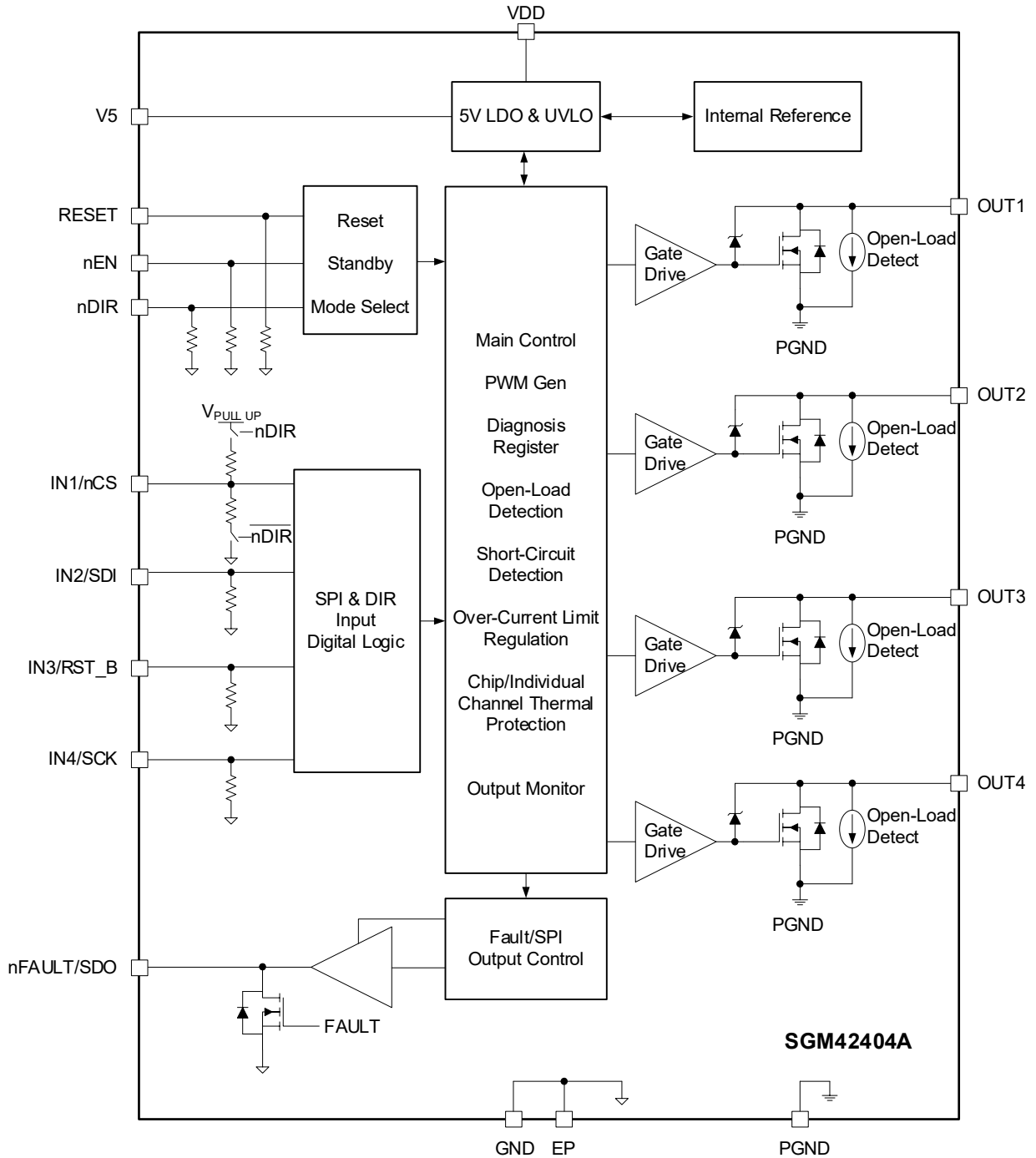
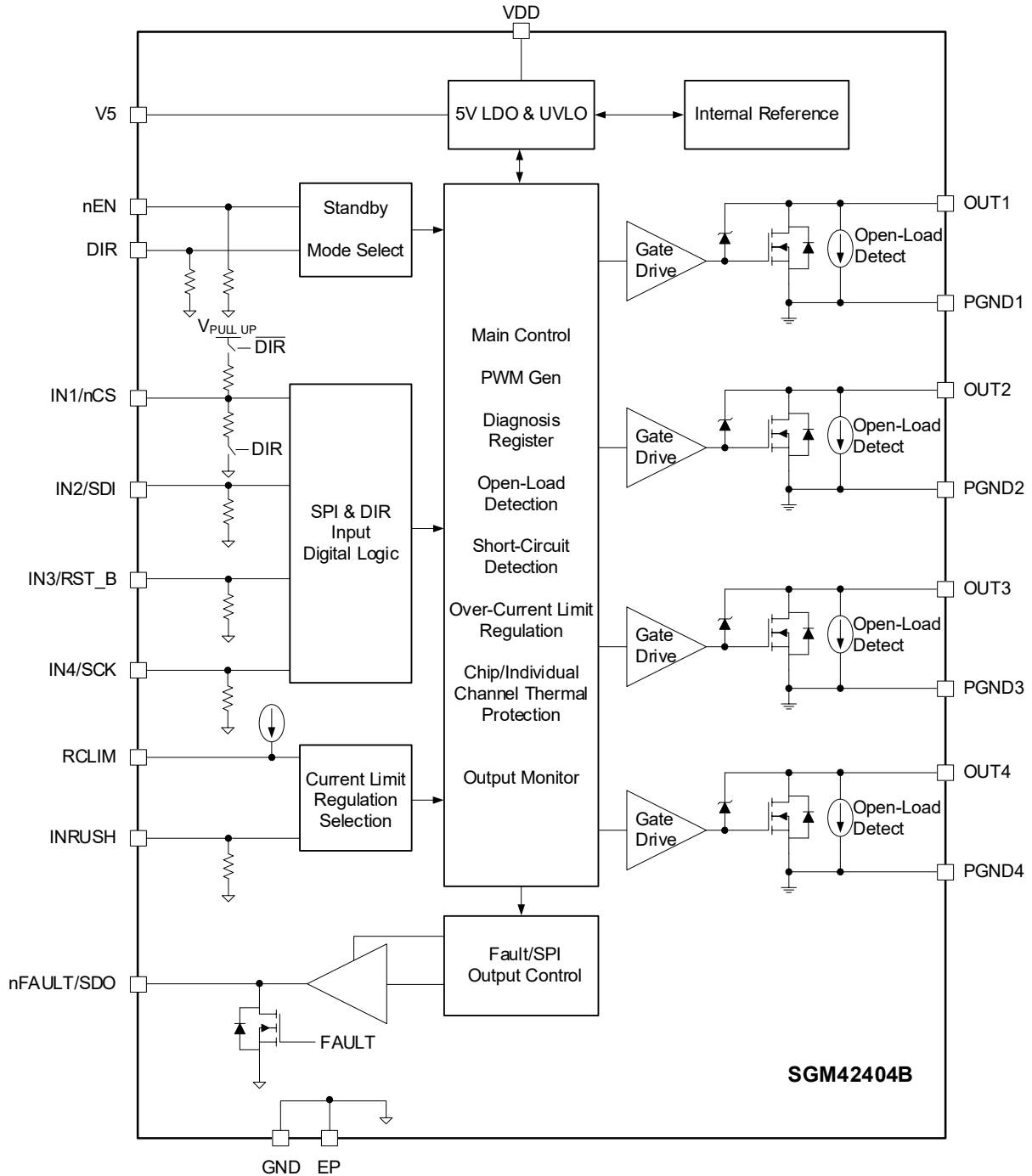


Figure 1. SGM42404A Block Diagram

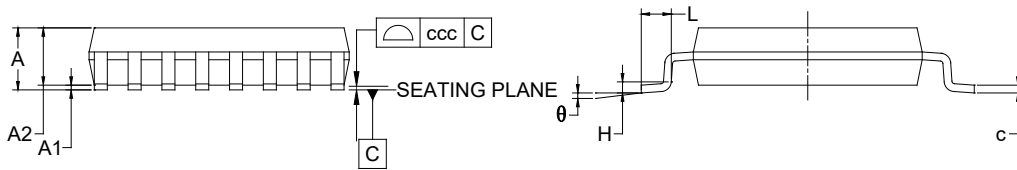
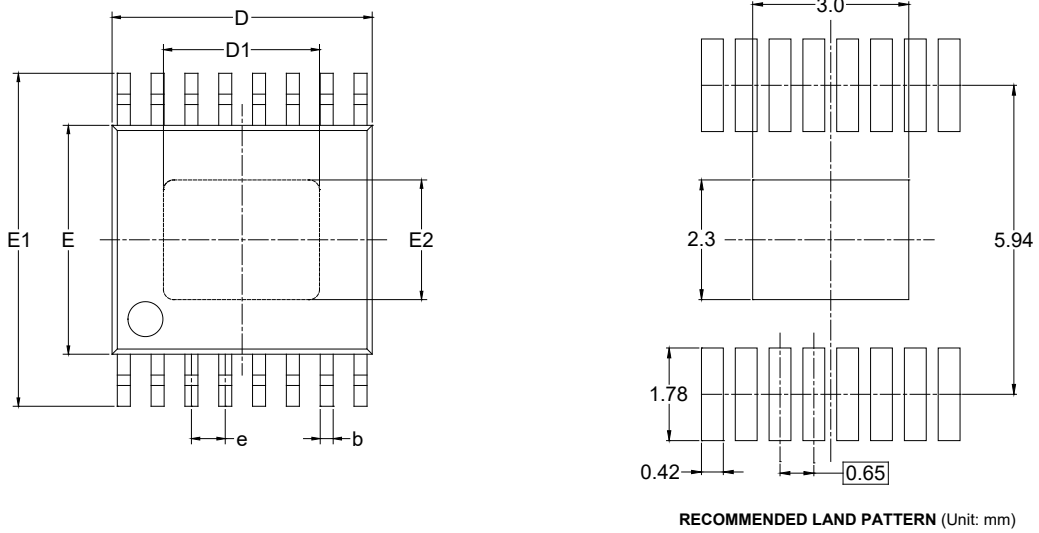
**FUNCTIONAL BLOCK DIAGRAM (continued)**



**Figure 2. SGM42404B Block Diagram**

PACKAGE OUTLINE DIMENSIONS

TSSOP-16 (Exposed Pad)



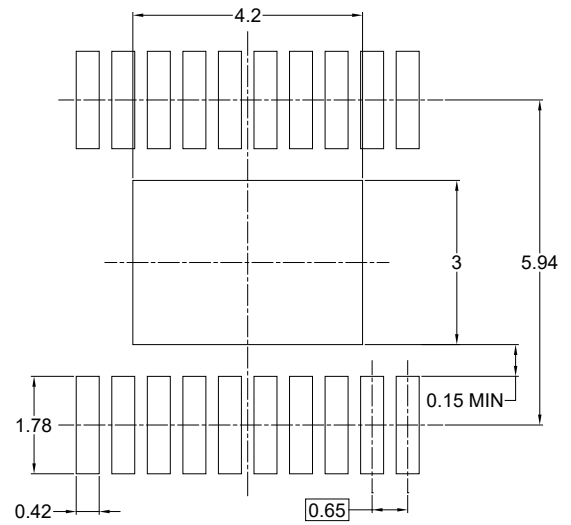
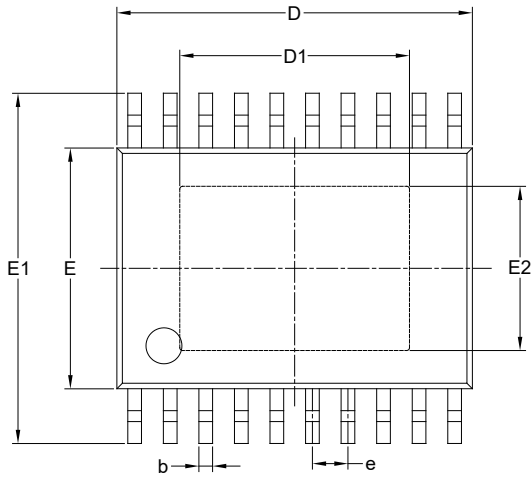
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
D1	2.900	-	3.400
E	4.300	-	4.500
E1	6.200	-	6.600
E2	2.200	-	2.980
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
$\theta$	0°	-	8°
ccc	0.100		

NOTES:

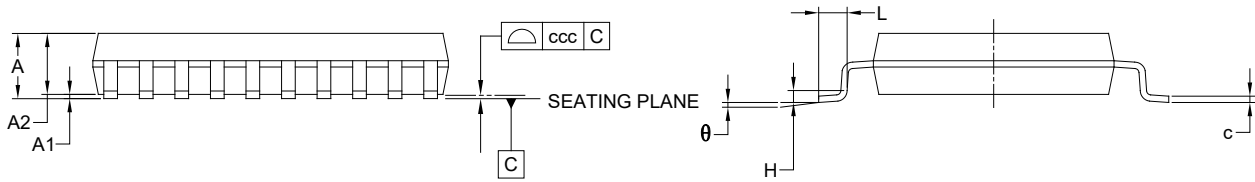
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions, or gate burrs.
3. Reference JEDEC MO-153.

PACKAGE OUTLINE DIMENSIONS

TSSOP-20 (Exposed Pad)



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.000	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	6.400	-	6.600
D1	4.000	-	4.400
E	4.300	-	4.500
E1	6.200	-	6.600
E2	2.800	-	3.200
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
$\theta$	0°	-	8°
ccc	0.100		

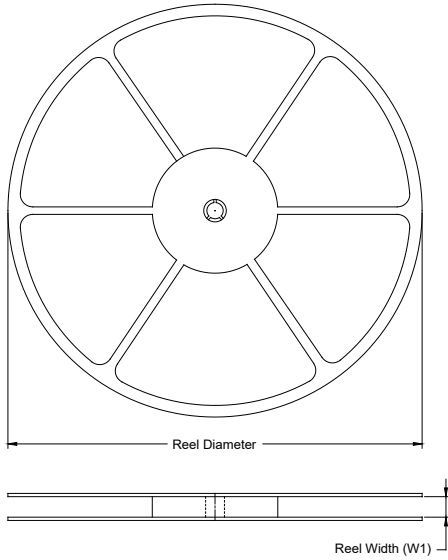
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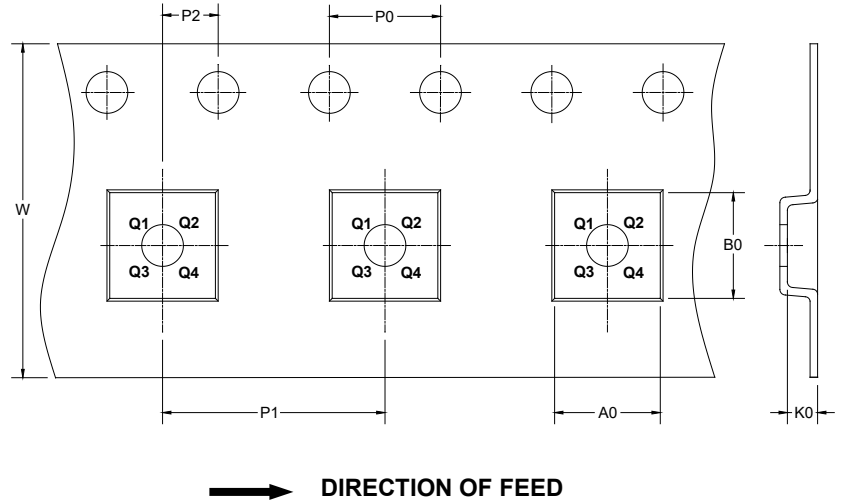
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

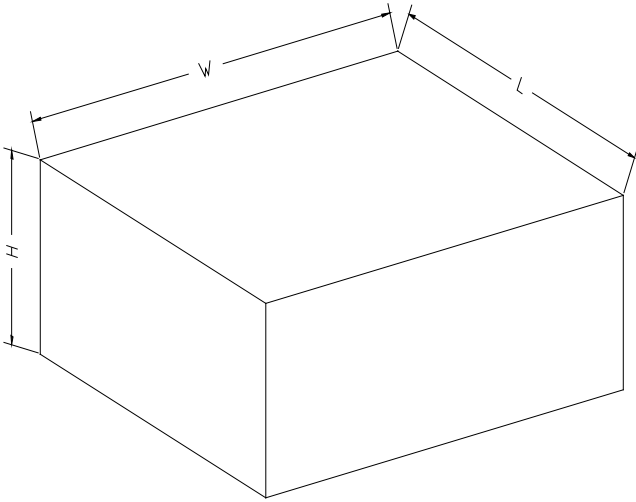
### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-16 (Exposed Pad)	13"	12.4	6.80	5.40	1.50	4.0	8.0	2.0	12.0	Q1
TSSOP-20 (Exposed Pad)	13"	16.4	6.80	6.90	1.50	4.0	8.0	2.0	16.0	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