SGM4822/SGM4823/SGM4825/SGM4826 Tiny, Low-Cost, Single/Dual-Input, Fixed-Gain Microphone Amplifiers with Integrated Bias

GENERAL DESCRIPTION

The SGM4822/SGM4825 (single-input) and SGM4823/SGM4826 (dual-input) are low noise, low power, fixed-gain microphone amplifiers. They offer tiny packaging and a low noise, integrated microphone bias, making them ideal for portable audio applications such as notebook computers, smart phones, and digital cameras. These amplifiers feature a 2.6MHz bandwidth, rail-to-rail outputs, an industry-leading and a very low 0.009% THD+N in active mode, forced shutdown mode that cuts the combined supply and bias currents to only 100nA. The SGM4822/SGM4823 power-saving features include automatic switching between low power monitor mode and low noise active mode, and also provide latched push-pull output to wake up external MCU in sleeping mode.

The SGM4823 and SGM4826 have two inputs allowing two microphones to be multiplexed to a single output.

The SGM4822/SGM4823 support wide power supply voltage from 3.3V to 5.5V and the SGM4825/SGM4826 support wide power supply voltage from 2.7V to 5.5V. The devices operate over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Very Low Noise: 30nV/$\sqrt{Hz}$ at 1kHz, Gain = 20dB**
- **Very Low THD+N: 0.009%, Gain = 20dB**
- **Wide Supply Voltage Range:**
  3.3V to 5.5V (SGM4822/SGM4823)
  2.7V to 5.5V (SGM4825/SGM4826)
- **Low Quiescent Current:**
  - **100nA at Forced Shutdown Mode**
  - **5μA at Monitor Mode (SGM4822/SGM4823)**
  - **0.66mA at Active Mode**
- **Low-Noise Microphone Bias Voltage: 2.3V**
- **Rail-to-Rail Outputs**
- **20dB Fixed-Gain**
- **Automatic Switching Between Low Power Monitor Mode and Low Noise Active Mode (SGM4822/SGM4823)**
- **Latched Push-Pull Output to Wake up External MCU in Sleeping Mode (SGM4822/SGM4823)**
- **-40℃ to +85℃ Operating Temperature Range**

APPLICATIONS

Notebook Computers
Smart Phones
Digital Cameras
Video Tape Recorders

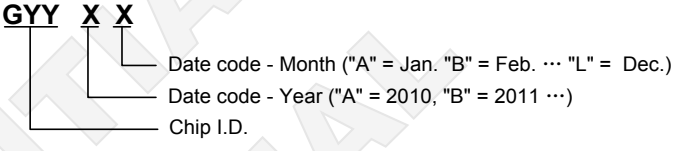
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4822B-23 (Gain = 20dB, V_{BIAS} = 2.3V)	SOT-23-8	-40℃ to +85℃	SGM4822B-23YN8G/TR	GTBXX	Tape and Reel, 3000
SGM4823B-23 (Gain = 20dB, V_{BIAS} = 2.3V)	MSOP-10	-40℃ to +85℃	SGM4823B-23YMS10G/TR	GX2 YMS10 XXXXX	Tape and Reel, 4000
SGM4825B-23 (Gain = 20dB, V_{BIAS} = 2.3V)	SOT-23-6	-40℃ to +85℃	SGM4825B-23YN6G/TR	GTCXX	Tape and Reel, 3000
SGM4826B-23 (Gain = 20dB, V_{BIAS} = 2.3V)	SOT-23-8	-40℃ to +85℃	SGM4826B-23YN8G/TR	GTDXX	Tape and Reel, 3000

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

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.

MARKING INFORMATION



For example: GTBHA (2017, January)

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND ..... -0.3V to +6V
All Other Pins ..... -0.3V to (V_{CC} + 0.3V)
Continuous Current (IN, $\overline{SHDN}$, IN1, WAKEUP, RESET, IN2, IN1/$\overline{IN2}$) ..... ±20mA
OUT, BIAS Short-Circuit Duration (to GND or V_{CC}) 100mA
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD SENSITIVITY CAUTION

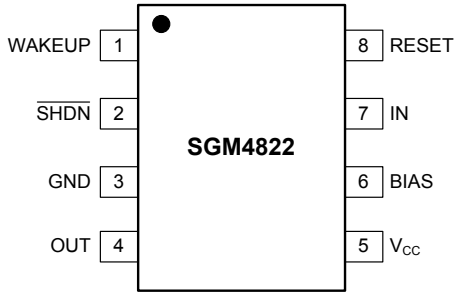
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

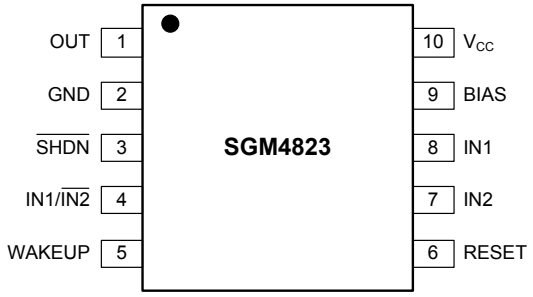
PIN CONFIGURATIONS

SGM4822 (TOP VIEW)



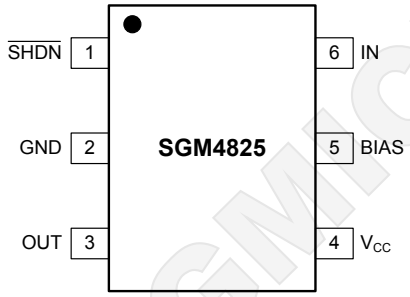
SOT-23-8

SGM4823 (TOP VIEW)



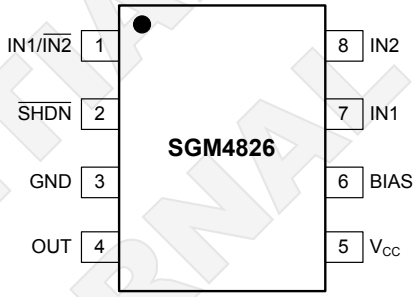
MSOP-10

SGM4825 (TOP VIEW)



SOT-23-6

SGM4826 (TOP VIEW)



SOT-23-8

PIN DESCRIPTION

PIN				NAME	FUNCTION
SGM4822	SGM4823	SGM4825	SGM4826		
1	5	–	–	WAKEUP	Output to Wake up External Equipment in Sleeping Mode.
2	3	1	2	$\overline{SHDN}$	Active-Low Shutdown Input. Connect $\overline{SHDN}$ to V_{CC} for normal operation. Connect $\overline{SHDN}$ to GND for shutdown. $\overline{SHDN}$ is a high-impedance input; do not leave unconnected.
3	2	2	3	GND	Ground.
4	1	3	4	OUT	Amplifier Output.
5	10	4	5	V_{CC}	Positive Supply. Bypass V_{CC} to GND with a 0.1μF capacitor.
6	9	5	6	BIAS	Low-Noise Microphone Bias Output.
7	–	6	–	IN	Amplifier Input.
8	6	–	–	RESET	Reset Latched Output of WAKEUP Pin.
–	8	–	7	IN1	Amplifier Input1.
–	7	–	8	IN2	Amplifier Input 2.
–	4	–	1	IN1/$\overline{IN2}$	Input Selector. When IN1/$\overline{IN2}$ is high, IN1 is selected. When IN1/$\overline{IN2}$ is low, IN2 is selected.

ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.3V to 5V, V_{GND} = 0V, R_L = open, $\overline{SHDN}$ = V_{CC}, typical values are at T_A = +25℃, unless otherwise noted.)

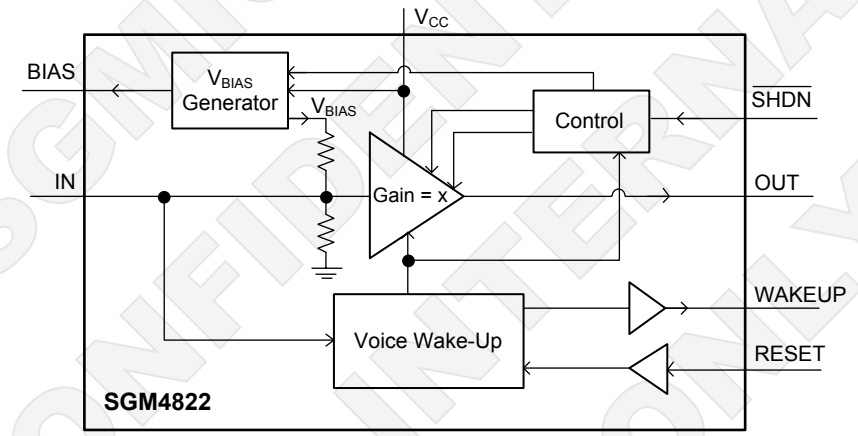
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
GENERAL							
Supply Voltage Range	V_{CC}	SGM4822/SGM4823		3.3		5.5	V
		SGM4825/SGM4826		2.7		5.5	
Supply Current	I_{CC}	In Shutdown, $\overline{SHDN}$ = GND			0.1		μA
		In Monitor Mode			5		μA
		In Active Mode			0.66		mA
Amplifier Output Bias Voltage	V_{OUT_DC}	V_{CC} = 3.3V			1.5		V
		V_{CC} = 5.0V			2.5		
Input Resistance	R_{IN}				115		kΩ
Voltage Gain	A_V				20		dB
Power Supply Rejection Ratio	$PSRR_{OUT}$	Input referred, T_A = +25℃			55		dB
Output Voltage Swing	V_{OH}	R_L = 10kΩ to V_{CC}/2			15		mV
		R_L = 1kΩ to V_{CC}/2			60		
	V_{OL}	R_L = 10kΩ to V_{CC}/2			5		
		R_L = 1kΩ to V_{CC}/2			20		
Output Short-Circuit Current	I_{OUT_SC}	Sinking or sourcing			95		mA
Small-Signal -3dB Bandwidth	BW	V_{OUT} = 10mV_{P-P}			2.6		MHz
Output Capacitive-Load Stability	C_L	No sustained oscillations			50		pF
Output Impedance	Z_{OUT}	f = 1kHz					Ω
Output Slew Rate	SR	V_{OUT} = 1V step			4.8		V/μs
Amplifier Input Voltage-Noise Density	e_n	Inputs at AC GND, f = 1kHz, Gain = 20dB			30		nV/√Hz
Total Integrated Input Noise	V_n	A-weighted, 22Hz to 22kHz BW, inputs at AC GND			2.3		$μV_{RMS}$
Off-Isolation		Input referred, SGM4823/SGM4826	1kHz		80		dB
			10kHz		72		
Total Harmonic Distortion + Noise	THD+N	f = 1kHz, R_L = 10kΩ to V_{CC}/2, BW = 22Hz to 22kHz, Gain = 20dB	V_{OUT} = 1V_{P-P}		0.009		%
BIAS							
Bias Output Voltage Range	V_{BIAS}				2.3		V
Bias Output Resistance	R_{BIAS}						Ω
Power Supply Rejection Ratio (V_{CC} to BIAS)	$PSRR_{BIAS}$	T_A = +25℃			55		dB
BIAS Current Limit	I_{BIAS_SC}	BIAS short to GND			75		mA
BIAS Capacitive-Load Stability	C_{BIAS}	No sustained oscillations			50		pF
Total Integrated BIAS Noise	V_n	A-weighted, 22Hz to 22kHz BW			30		$μV_{RMS}$
THRESHOLD OF COMPARATOR AT AUDIO MONITOR CIRCUIT (Internal Bias Voltage + V_{THA})							
Threshold of Audio Signal	V_{THA}	SGM4822/SGM4823			0.2		V

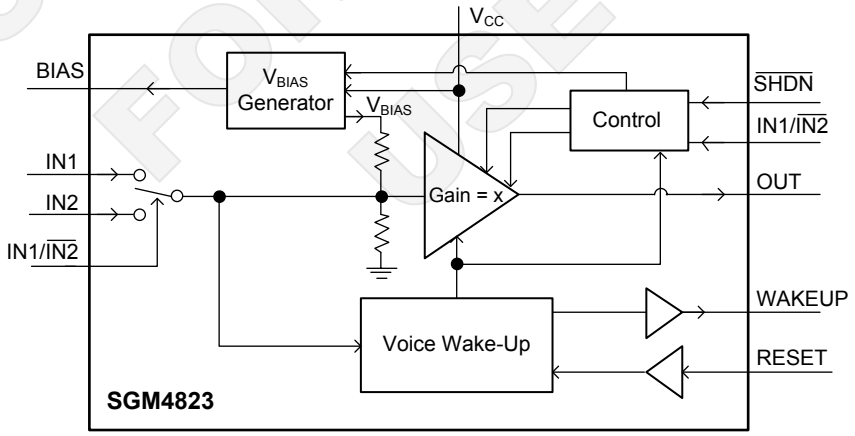
ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 3.3V to 5V, V_{GND} = 0V, R_L = open, $\overline{SHDN}$ = V_{CC}, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DIGITAL INPUTS (RESET, $\overline{SHDN}$, IN1/$\overline{IN2}$)						
Logic-Low Threshold	V_{IL}				0.8	V
Logic-High Threshold	V_{IH}		2			V
Logic Input Current	I_{IN}	$\overline{SHDN}$ = GND or V_{CC}			±1	μA
Shutdown Enable Time	$t_{\overline{SHDN\_ON}}$	95% of settled value		25		μs
Shutdown Disable Time	$t_{\overline{SHDN\_OFF}}$			100		ns
IN1/$\overline{IN2}$ Select Time	t_{SEL}			40		μs
WAKEUP OUTPUT						
Logic-Low Threshold	V_{IL}				0.4	V
Logic-High Threshold	V_{IH}		1.6			V

FUNCTIONAL BLOCK DIAGRAM





FUNCTIONAL BLOCK DIAGRAM (continued)

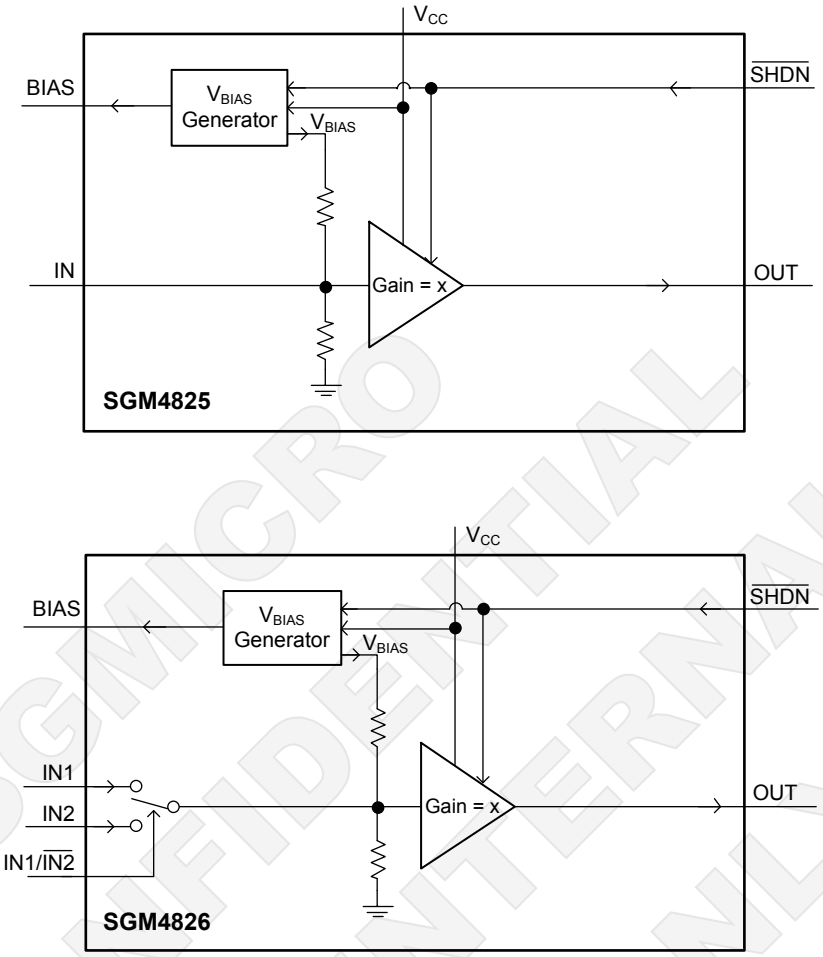


Figure 1. Block Diagram

DETAILED DESCRIPTION

The SGM4822/SGM4825/SGM4823/SGM4826 are low noise, low-power and fixed-gain microphone amplifiers available in a single- or dual-input configuration. The gain is set at 10V/V (20dB) with a 2.6MHz, -3dB bandwidth. They also feature a low noise, integrated microphone input bias voltage.

Single-/Dual-Input

The SGM4822/SGM4825 are single-input amplifier and the SGM4823/SGM4826 are dual-input amplifier. All devices typically have an input impedance of 115kΩ. The inputs to the dual version are controlled through a fast 2:1 mux, selectable through the IN1/$\overline{IN2}$ pin. Driving IN1/$\overline{IN2}$ high selects IN1 and driving the IN1/$\overline{IN2}$ low selects IN2. IN1/$\overline{IN2}$ is designed to be driven by a logic high of ≥2V and a logic low ≤0.8V. The IN1/$\overline{IN2}$ has a 40μs switching time from one channel to the other.

Low-Noise Microphone BIAS

The SGM4822/SGM4823/SGM4825/SGM4826 provide a low-noise voltage BIAS designed for biasing electret condenser microphone (ECM) cartridges. The BIAS output is regulated to typically 2.3V for the devices, the BIAS output can source up to 50mA.

Changing Between Monitor and Active Mode

For SGM4822/SGM4823, after power-up, the low power signal monitor circuit always works if $\overline{SHDN}$ = "High", if amplified and filtered microphone signal is larger than 0.2V, it will trigger WAKEUP pin from "Low" to "High", WAKEUP signal is always used to wake up MCU which is in sleeping mode, at the same time, SGM4822/4823 will enter into active mode, the low noise amplifier is enabled, it amplifies the external microphone signal and outputs it at OUT pin. When external MCU thinks there is no audio signal input any more, DSP will reset the latched WAKEUP output, WAKEUP status changes from "High" to "Low", and SGM4822/4823 enter into monitor mode again.

Output Stage

The SGM4822/SGM4823/SGM4825/SGM4826 rail-to-rail output (OUT) typically swings to within 20mV of the rails when driving 10kΩ. The output DC bias point is set to 1.5V when V_{CC}= 3.3V and 2.5V when V_{CC} = 5.0V.

Shutdown Mode

Driving $\overline{SHDN}$ low forces a low-power (100nA) shutdown mode. In this mode, the OUT pin is set to a high-impedance state and the BIAS pin is pulled-down. Driving $\overline{SHDN}$ high enables the SGM4822/SGM4823/SGM4825/SGM4826. $\overline{SHDN}$ is a high-impedance input and cannot be left unconnected.

Driving Capacitive Loads

The SGM4822/SGM4823/SGM4825/SGM4826 output can drive up to 50pF of capacitance without sustained oscillations.

APPLICATION INFORMATION

Figure 2, Figure 3 and Figure 4 show the SGM4822/SGM4823 and SGM4825/SGM4826 used as a low noise preamplifier in audio system to increase SNR and microphone receive sensitivity. In Figure 2, internal microphone will be switched to external microphone when headset is inserted into audio jack automatically.

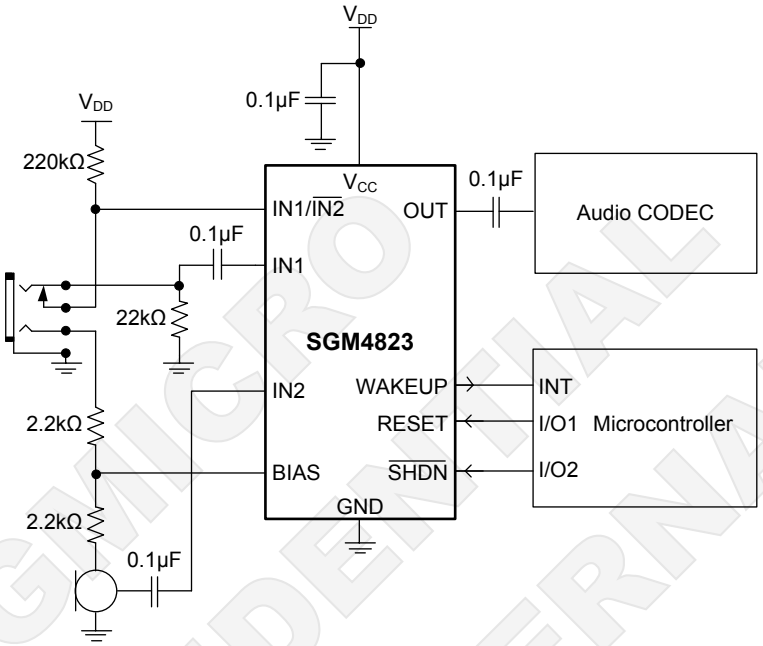


Figure 2. Typical Application Circuit of SGM4823

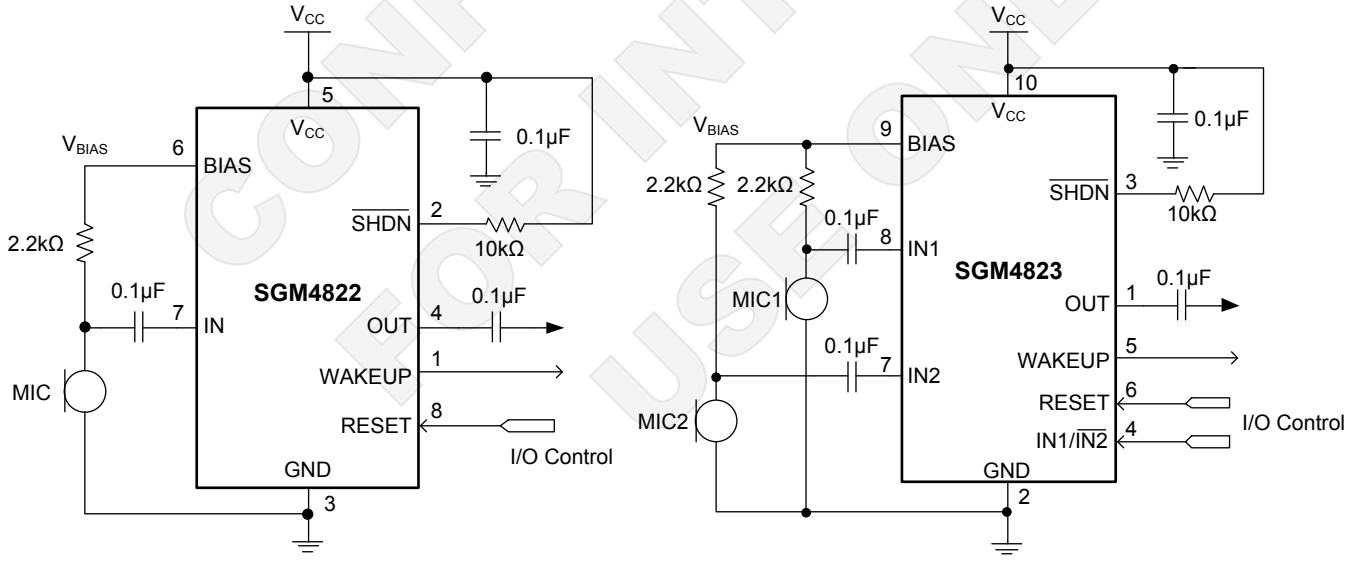


Figure 3. Typical Application Circuits of SGM4822/SGM4823

APPLICATION INFORMATION (continued)

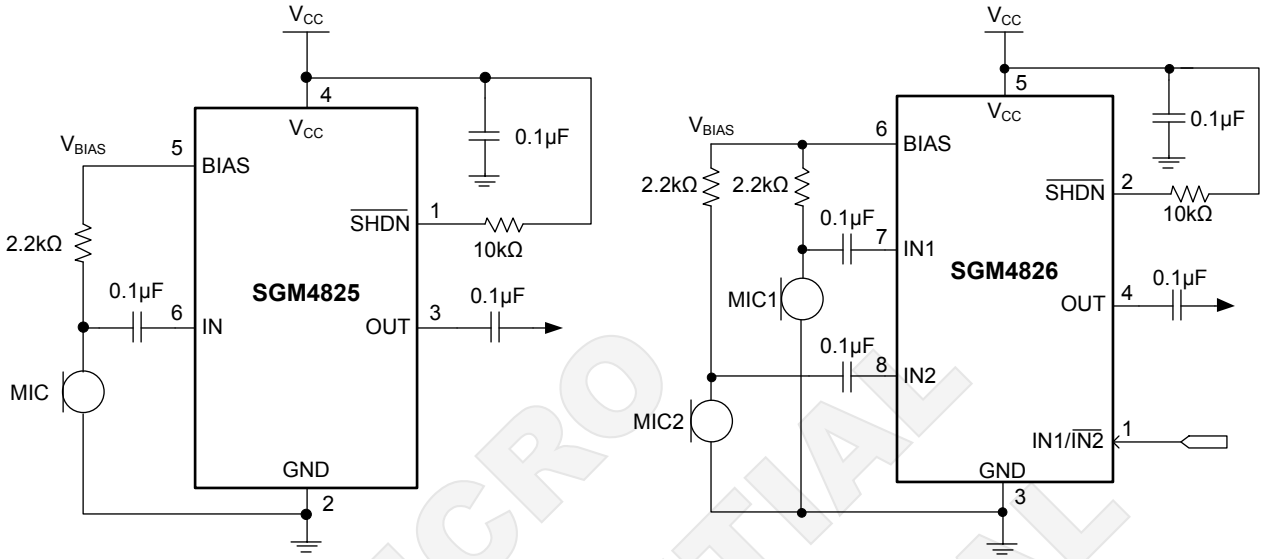
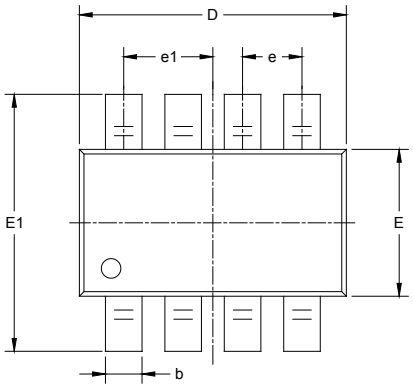
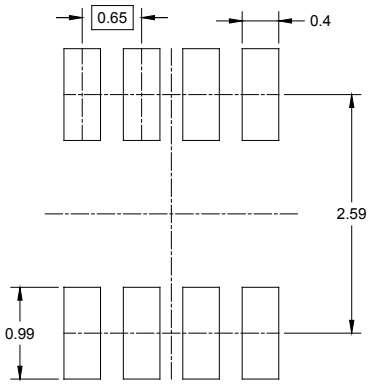


Figure 4. Typical Application Circuits of SGM4825/SGM4826

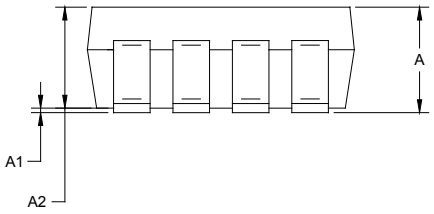
PACKAGE OUTLINE DIMENSIONS

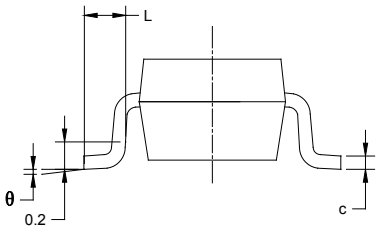
SOT-23-8





RECOMMENDED LAND PATTERN (Unit: mm)

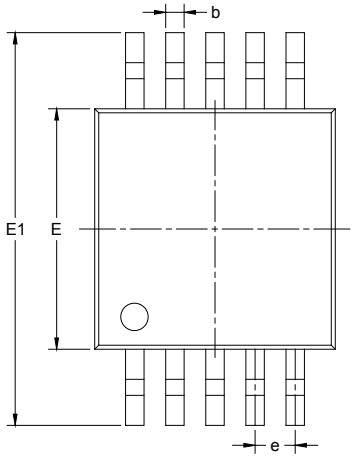


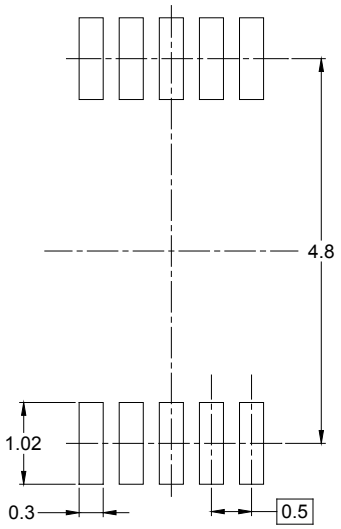


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.650 BSC		0.026 BSC	
e1	0.975 BSC		0.038 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

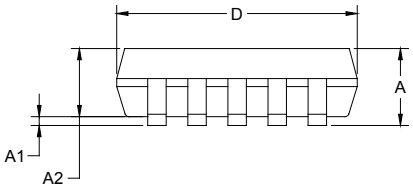
PACKAGE OUTLINE DIMENSIONS

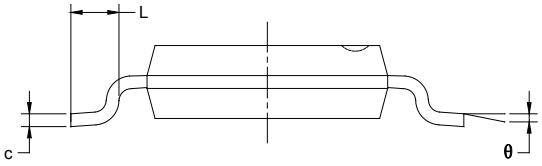
MSOP-10





RECOMMENDED LAND PATTERN (Unit: mm)

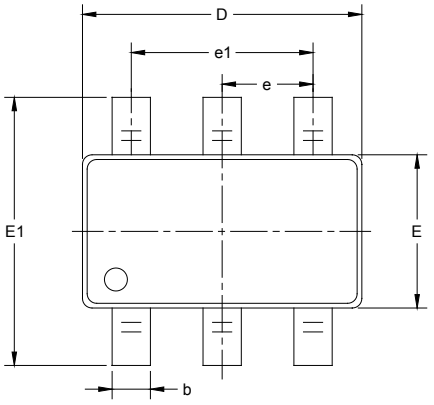


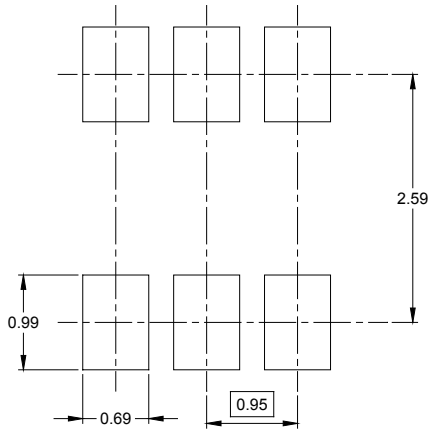


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

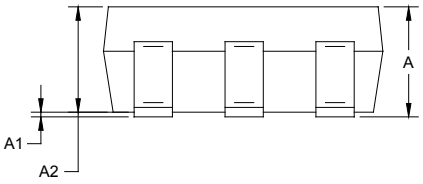
PACKAGE OUTLINE DIMENSIONS

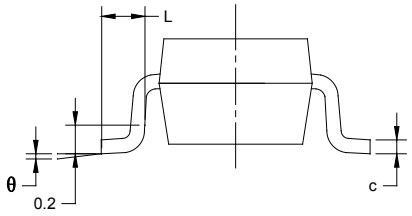
SOT-23-6





RECOMMENDED LAND PATTERN (Unit: mm)

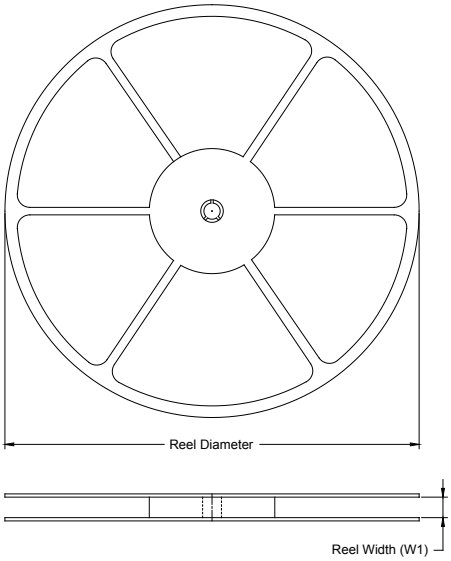




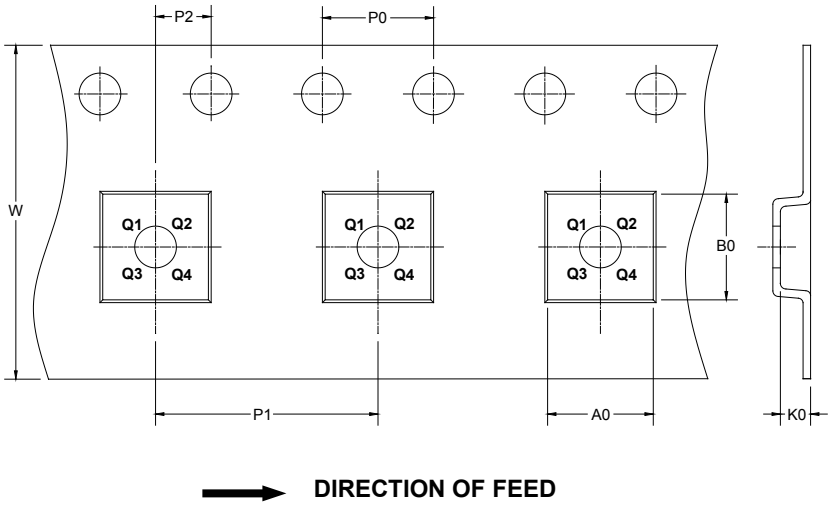
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



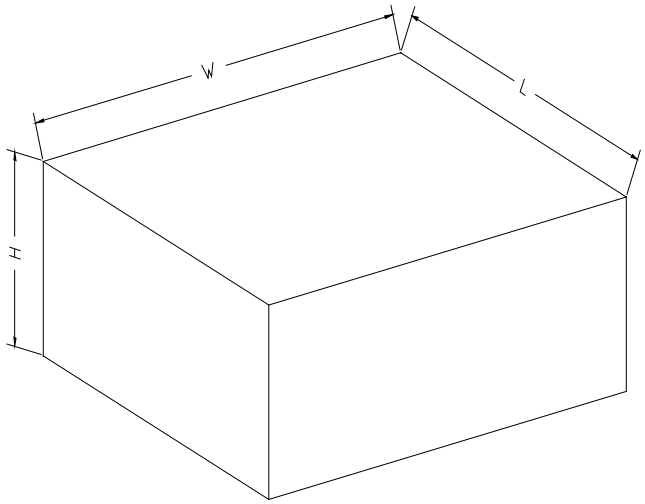
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-23-8	7″	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
MSOP-10	13″	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1
SOT-23-6	7″	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3

DD0001

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
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002