

### GENERAL DESCRIPTION

The SGM43xL is a precision programmable shunt voltage reference that can be used in many applications. It is a three-terminal adjustable-output device that can keep stable under all capacitive loads. It requires two external resistors in application to set the output voltage to any value between 2.5V and 36V. SGM43xL has a maximum operating current of 100mA.

The SGM43xL features low dynamic impedance, low noise, and low temperature coefficient to ensure a stable output voltage over a wide range of operating temperatures and currents. These high performances make it very suitable for multiple applications, such as precision audio components and flyback switching power supplies.

The SGM431L is available in Green SOT-23 and XTDFN-1×1-4L packages. The SGM432L is available in a Green SOT-23 package.

### FEATURES

- **Adjustable Output Voltage: 2.5V to 36V**
- **Sink-Current Capability: 50μA to 100mA**
- **Reference Voltage Tolerance at +25°C: 0.5%**
- **Output Impedance: 0.1Ω (TYP)**
- **Temperature Drift: 4mV (TYP)**
- **High Stability under Capacitive Load**
- **Low Output Noise**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green Tiny Packages**  
**SGM431L: SOT-23 and XTDFN-1×1-4L Packages**  
**SGM432L: SOT-23 Package**

### APPLICATIONS

- Portable, Battery-Powered Equipment
- Voltage Monitoring
- Flyback Switching Power Supplies
- Instrumentation
- Product Testing
- Precision Audio Components

### TYPICAL APPLICATION

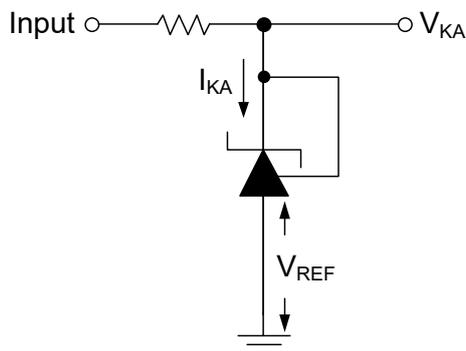


Figure 1. Typical Application Circuit

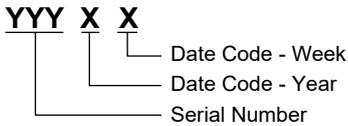
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM431L	SOT-23	-40°C to +125°C	SGM431LXN3LG/TR	1B6XX	Tape and Reel, 3000
	XTDFN-1×1-4L	-40°C to +125°C	SGM431LXXDH4G/TR	3C	Tape and Reel, 10000
SGM432L	SOT-23	-40°C to +125°C	SGM432LXN3LG/TR	1B5XX	Tape and Reel, 3000

**MARKING INFORMATION**

NOTE: XX = Date Code.

**SOT-23**



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**

Cathode Voltage <sup>(1)</sup> , V <sub>KA</sub> .....	40V
Continuous Cathode Current Range, I <sub>KA</sub> -100mA to +150mA	
Reference Input Current Range, I <sub>I(REF)</sub> .....	-5mA to +10mA
Package Thermal Resistance	
SOT-23, θ <sub>JA</sub> .....	192.9°C/W
SOT-23, θ <sub>JB</sub> .....	39.2°C/W
SOT-23, θ <sub>JC</sub> .....	81.2°C/W
XTDFN-1×1-4L, θ <sub>JA</sub> .....	171.7°C/W
XTDFN-1×1-4L, θ <sub>JB</sub> .....	116.1°C/W
XTDFN-1×1-4L, θ <sub>JC(TOP)</sub> .....	117.0°C/W
XTDFN-1×1-4L, θ <sub>JC(BOT)</sub> .....	107.8°C/W
Junction Temperature .....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s) .....	+260°C
ESD Susceptibility <sup>(1) (2)</sup>	
HBM.....	±4000V
CDM .....	±1000V

**NOTES:**

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

**RECOMMENDED OPERATING CONDITIONS**

Cathode Voltage, V <sub>KA</sub> .....	V <sub>REF</sub> to 36V
Cathode Current, I <sub>KA</sub> .....	50µA to 100mA
Operating Junction Temperature Range.....	-40°C to +125°C

**NOTE:**

1. All voltage values are with respect to ANODE, unless otherwise noted.

**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.

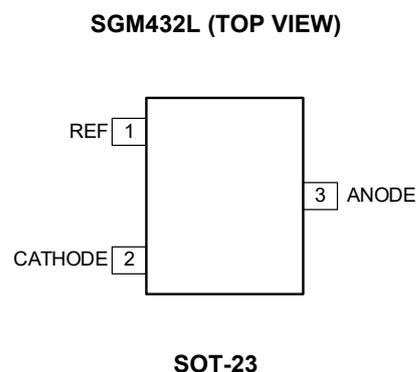
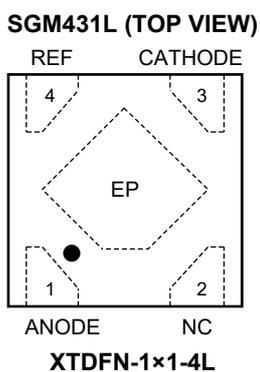
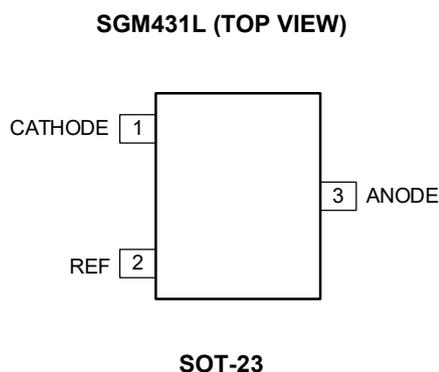
**ESD SENSITIVITY CAUTION**

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	DESCRIPTION
XTDFN-1x1-4L	SOT-23				
	SGM431L	SGM432L			
1	3	3	ANODE	O	Anode Pin. Connect to ground normally.
2	-	-	NC	-	Not Connected.
3	1	2	CATHODE	I/O	Cathode Pin. Voltage and shunts current input.
4	2	1	REF	I	REF Input Pin. Threshold Related to the voltage of ANODE Pin.
EP	-	-	-	-	Connect to ground or to a floating copper plane for mechanical stability.

NOTE: I = input, O = output, I/O = input or output.

FUNCTIONAL BLOCK DIAGRAM

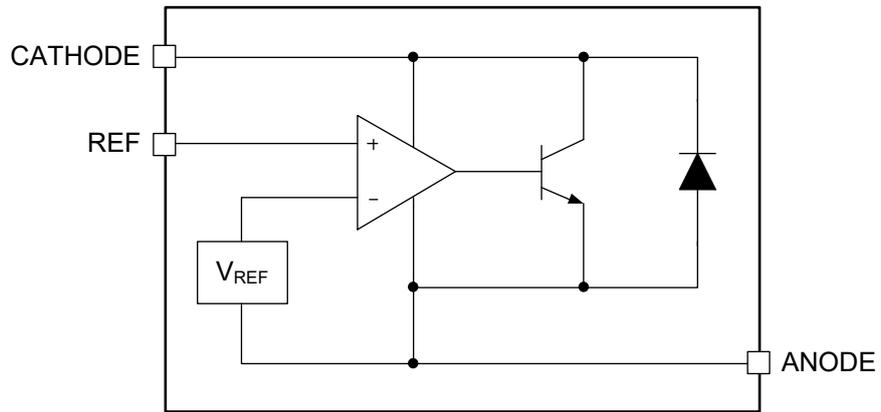


Figure 2. Equivalent Diagram

## ELECTRICAL CHARACTERISTICS

(Over recommended operating conditions,  $T_J = +25^\circ\text{C}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Reference Voltage	$V_{REF}$	$V_{KA} = V_{REF}, I_{KA} = 1\text{mA}$	2.487	2.500	2.513	V
Deviation of Reference Input Voltage over Full Temperature Range <sup>(1)</sup>	$V_{I(DEV)}$	$V_{KA} = V_{REF}, I_{KA} = 1\text{mA}$		4	15	mV
Ratio of Change in Reference Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA} = 1\text{mA}$		-0.1	-0.5	mV/V
				-0.01	-0.1	
Reference Input Current	$I_{REF}$	$I_{KA} = 1\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$		0.1	0.15	$\mu\text{A}$
Deviation of Reference Input Current over Full Temperature Range <sup>(1)</sup>	$I_{I(DEV)}$	$I_{KA} = 1\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$		0.02	0.1	$\mu\text{A}$
Minimum Cathode Current for Regulation	$I_{MIN}$	$V_{KA} = V_{REF}$		35	50	$\mu\text{A}$
Off-State Cathode Current	$I_{OFF}$	$V_{KA} = 36\text{V}, V_{REF} = 0\text{V}$		0.01	0.3	$\mu\text{A}$
Dynamic Impedance <sup>(2)</sup>	$ Z_{KA} $	$V_{KA} = V_{REF}, f = 0\text{Hz}, I_{KA} = 1\text{mA to } 100\text{mA}$		0.1	0.2	$\Omega$

## NOTES:

1.  $V_{I(DEV)}$  and  $I_{I(DEV)}$  refer to the difference between the maximum value and the minimum value obtained within the rated temperature range.  $\alpha_{VREF}$  is defined as:

$$|\alpha_{VREF}| \left( \frac{\text{ppm}}{^\circ\text{C}} \right) = \left| \frac{\left( \frac{V_{I(DEV)}}{V_{REF} \text{ at } 25^\circ\text{C}} \right) \times 10^6}{\Delta T_J} \right|$$

where,

$\Delta T_J$  is the rated operating junction temperature range of the device.

$\alpha_{VREF}$  is the average full-range temperature coefficient of the reference input voltage.

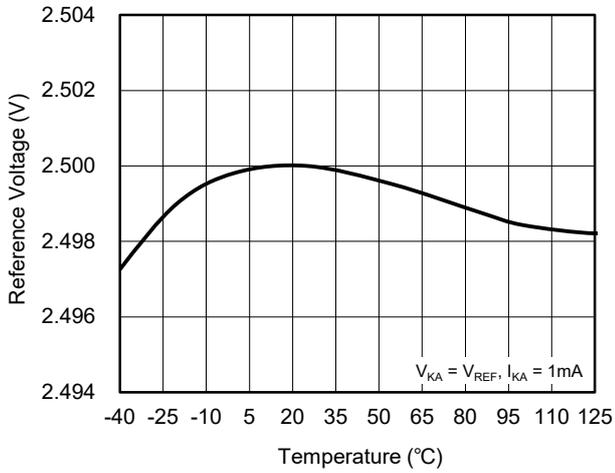
2.  $|Z_{KA}| = \Delta V_{KA} / \Delta I_{KA}$ , when the device is operating with two external resistors, the total dynamic impedance of the circuit is equal to

$$|Z| = \frac{\Delta V}{\Delta I}, \text{ which is approximately equal to } |Z_{KA}| \left( 1 + \frac{R_1}{R_2} \right).$$

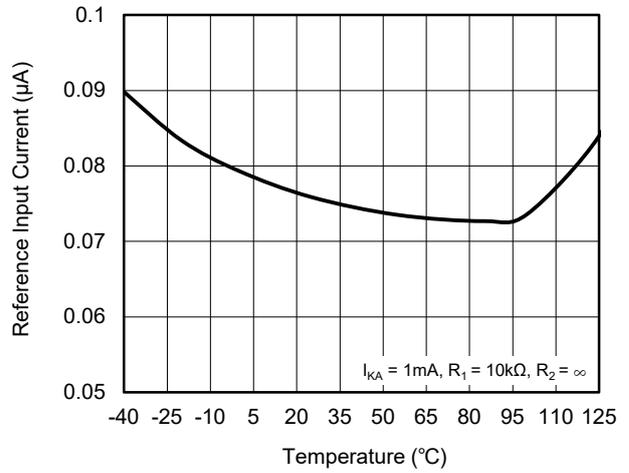
TYPICAL PERFORMANCE CHARACTERISTICS

T<sub>J</sub> = +25°C, unless otherwise noted.

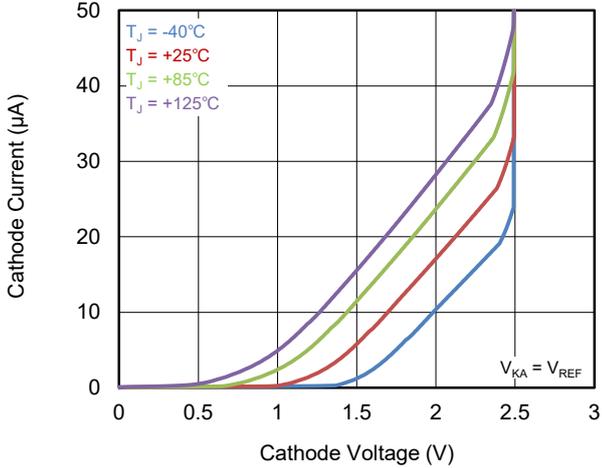
Reference Voltage vs. Temperature



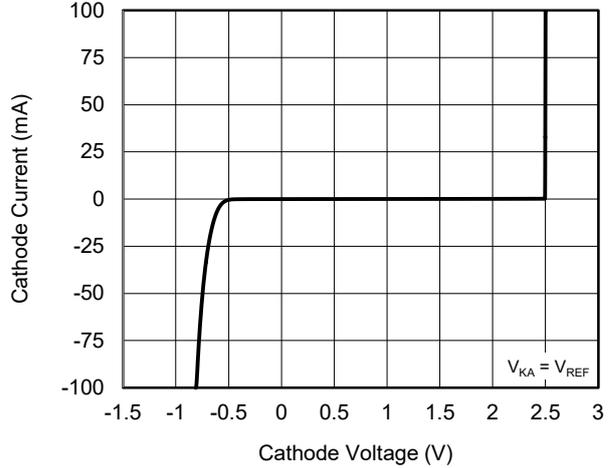
Reference Input Current vs. Temperature



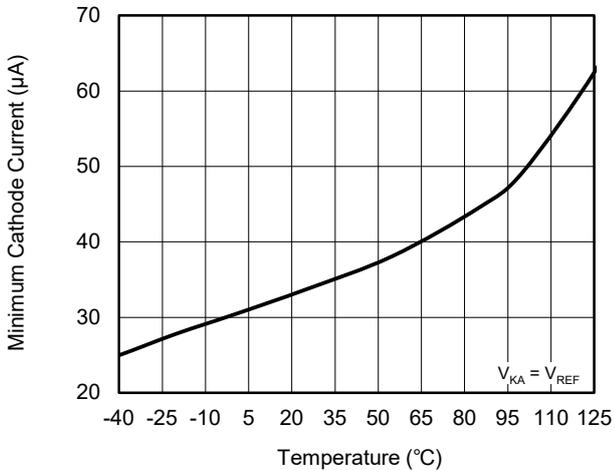
Cathode Current vs. Cathode Voltage



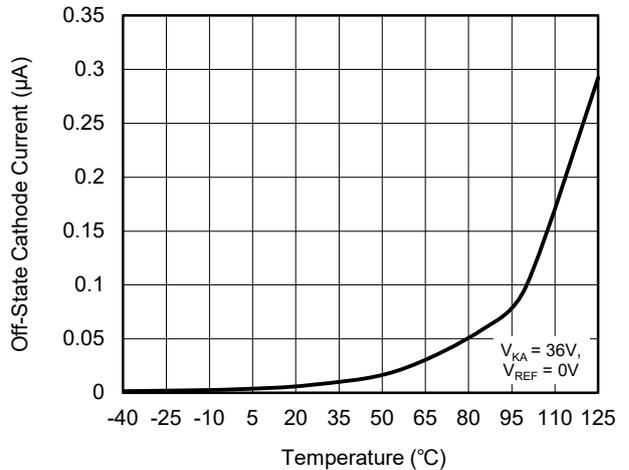
Cathode Current vs. Cathode Voltage



Minimum Cathode Current vs. Temperature

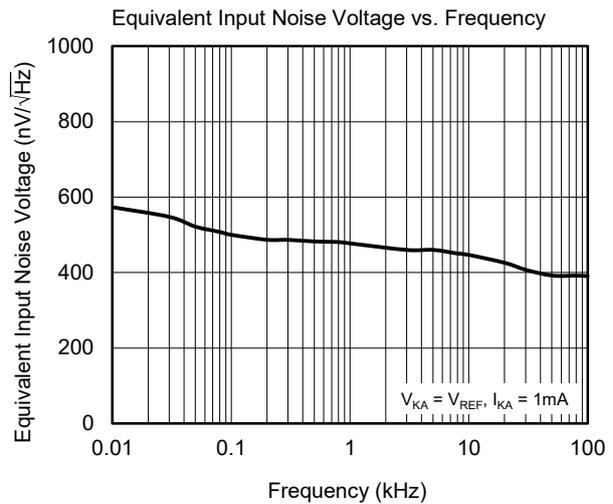
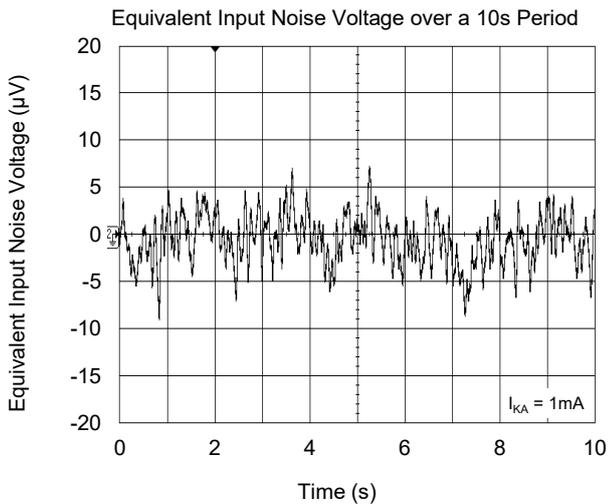
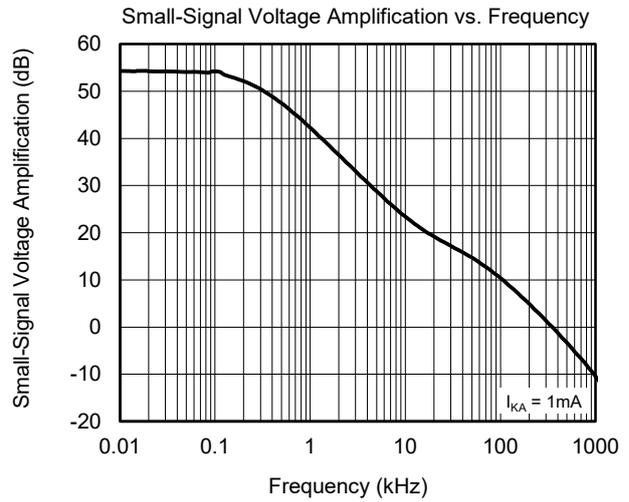
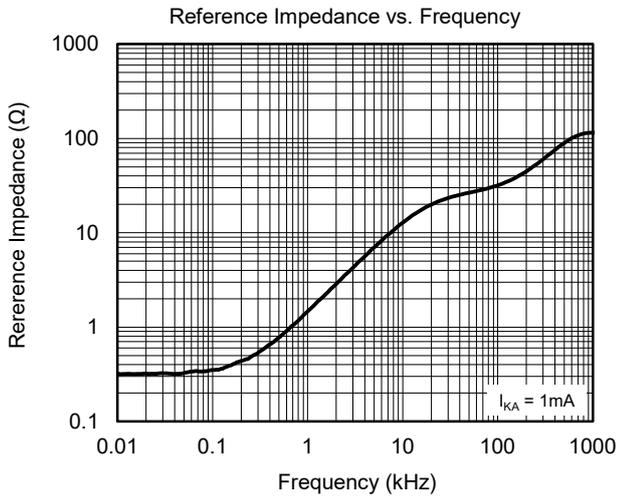
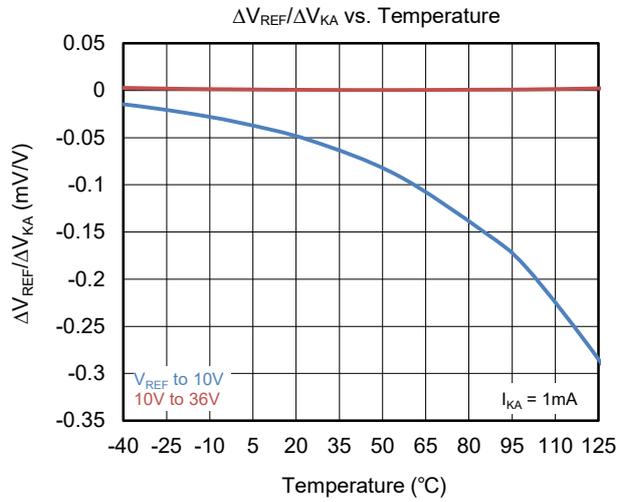
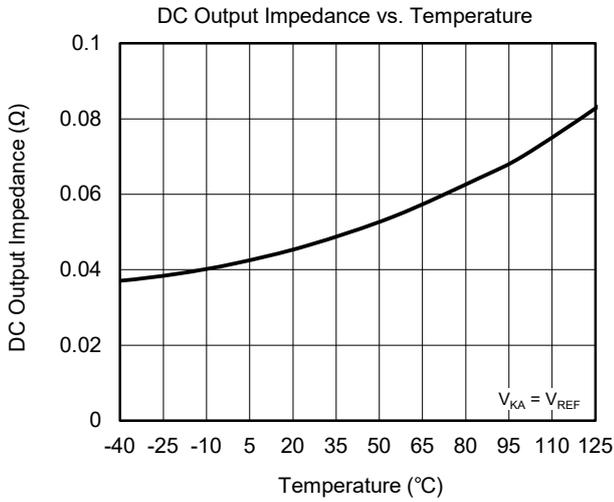


Off-State Cathode Current vs. Temperature



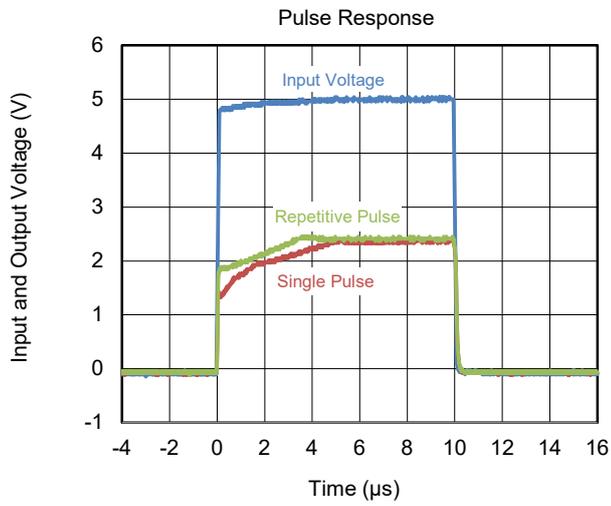
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T<sub>J</sub> = +25°C, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T<sub>J</sub> = +25°C, unless otherwise noted.



APPLICATION INFORMATION

SGM43xL Used as Comparator with Integrated Reference

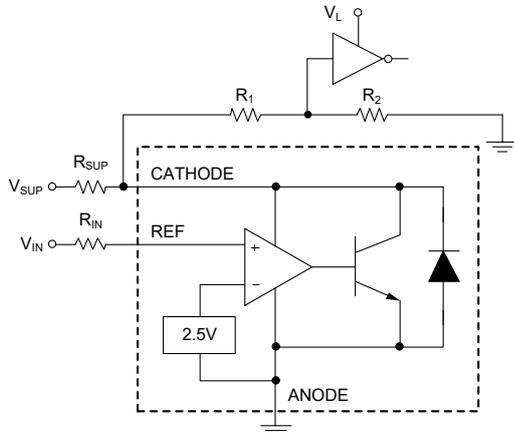


Figure 3. Comparator Application Schematic

Table 1. Design Parameters

Design Parameter	Example Value
Input Voltage Range	0V to 5V
Input Resistance ( $R_{IN}$ )	100k $\Omega$
Supply Voltage Range ( $V_{SUP}$ )	5V to 24V
Supply Resistance ( $R_{SUP}$ )	1k $\Omega$
Output Voltage Level	~ 2V (Logical "Low") ~ $V_{SUP}$ (Logical "High")

As shown in Figure 3, the SGM43xL is always used as a comparator with 2.5V integrated reference in application, for this design, the parameters are listed in Table 1. The REF pin voltage is compared with reference inside. Also, the SGM43xL responds fast if the operation current  $I_{KA}$  is large enough. The maximum cathode current of  $I_{MIN}$  is 50 $\mu$ A, any cathode current below this value will cause a low response (low open-loop gain) for the application of comparator.

The overdrive voltage is defined as the voltage over the internal reference voltage (2.5V). If the overdrive voltage is not large enough, the output response will be inaccurate and slow. On the contrary, the larger overdrive voltage provided at the REF pin, the faster the output response will be. Moreover, if the users

desire fast response, the overdrive voltage should be larger than 10% of the internal voltage reference.

The input resistance should be less than 100k $\Omega$  in order to minimize the voltage drop between  $V_{IN}$  and  $V_{REF}$ . The readability of the logic output of the comparator should be guaranteed so that it can be received by the next stage. The  $V_{OL}$  of the comparator logic is about 2V, which is sufficient for a 5V supply voltage. However, for the logic stage which is powered by 1.8V or 3.3V, the  $V_{OL}$  of the comparator is hard to be figured out. To accommodate this, a voltage divider should be taken into account. Due to the Open-Collector (OC) output stage, the  $V_{OH}$  of the comparator is equal to the voltage of its power supply. When the voltage divider is used to attenuate  $V_{OH}$  of the comparator, please make sure that the sum of  $R_1$  and  $R_2$  is greater than the resistance  $R_{SUP}$  to the power supply.

However, for this application, an external resistor  $R_{IN}$  is required to provide the  $I_{REF}$  and guarantee the normal operation of the SGM43xL. Also, because of the voltage drop across  $R_{IN}$ , so that the gap between  $V_{IN}$  and  $V_{REF}$  is the voltage drop of  $R_{IN}$ . To decrease the error, the selected  $R_{IN}$  should be small enough as the maximum  $I_{REF}$  is 0.15 $\mu$ A.

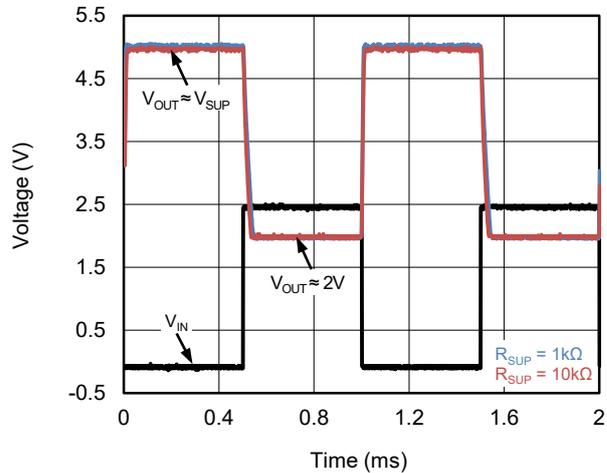


Figure 4. Output Response with Various Cathode Current

APPLICATION INFORMATION (continued)

Shunt Regulator/Reference

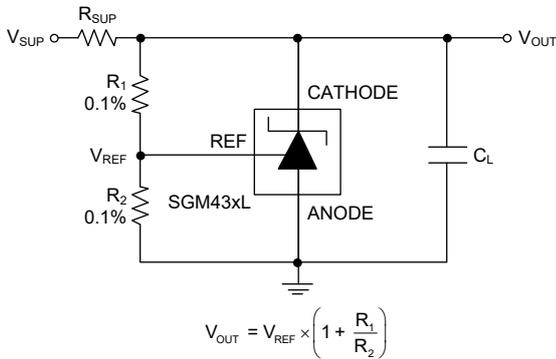


Figure 5. Shunt Regulator Schematic

As shown in Figure 5, for this design, the input parameters are listed in Table 2.

Table 2. Design Parameters

Design Parameter	Example Value
Supply Voltage	40V
Cathode Current ( $I_{KA}$ )	5mA
Output Voltage Range	2.5V to 36V
Load Capacitance	100nF
Feedback Resistor Values and Accuracy ( $R_1$ and $R_2$ )	10kΩ (0.1%)

Programming Output Voltage

The output/cathode voltage of the SGM43xL is programmed by resistor  $R_1$  and  $R_2$ . The following equation shows the relationship between  $V_{REF}$  and  $V_{OUT}$ . In accurate applications, the error caused by  $I_{REF}$  should also be taken into account:

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R_1}{R_2}\right) + I_{REF} \times R_1$$

And the users need to ensure that the SGM43xL is fully biased, so that this error can be decreased significantly by the enough open-loop gain. This can be qualified by satisfying the minimum cathode current  $I_{MIN}$  in Electrical Characteristics.

Total Accuracy

When the output voltage is set higher than unity gain (2.5V), the behavior of the SGM43xL will be influenced by the following possible errors:

- The accuracy of both  $R_1$  and  $R_2$ .
- The internal reference voltage will be changed by the temperature.
- $\Delta V_{REF}/\Delta V_{KA}$ : The change of internal reference voltage will affect the output voltage.
- $|Z_{KA}|$ : This impedance will be affected by the cathode current.

The above possible errors are the worst cases for the operation of the SGM43xL.

Stability

For traditional 431/432 devices, the reference output stability is affected by output decoupling capacitor which must be selected in a limited range in order to keep 431/432 devices stable in applications. However, the SGM43xL is different from the others. The SGM43xL uses a special design to greatly improve output stability when it drives capacitive load. From the curve of the Cathode Current vs. Load Capacitance in Figure 6, the output of the SGM43xL is stable in a wider range of capacitive load. If the SGM43xL is used as a linear regulator, a bigger decoupling capacitor can be used to improve regulator's load transient or reduce the noise of power supply. If the SGM43xL is used to replace the others, the SGM43xL will be stable and there is no need to change the output decoupling capacitor in the original design.

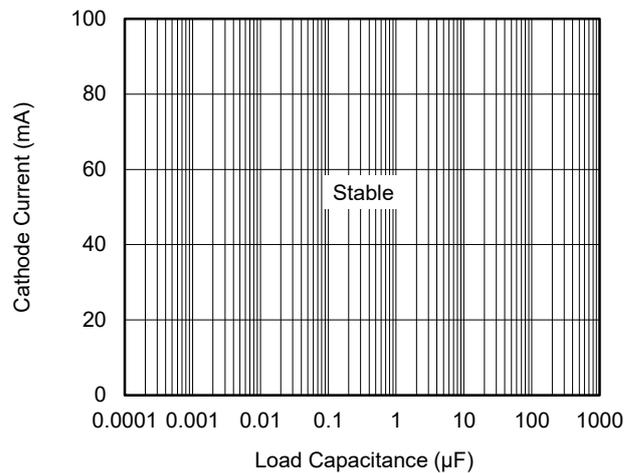


Figure 6. Cathode Current vs. Load Capacitance

APPLICATION INFORMATION (continued)

Start-Up Time

As shown in Figure 7, the SGM43xL is suitable for many clamp applications with the fast response.

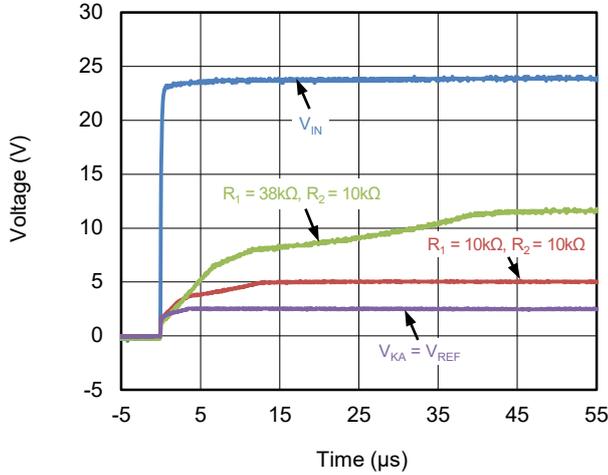


Figure 7. SGM43xL Start-Up Response

Power Supply Recommendations

When the SGM43xL is used as a shunt regulator, it is necessary to use a bypass capacitor on the CATHODE pin.

Limiting the current of the power supply is necessary for the SGM43xL to operate within the maximum cathode current. Also, the current of the REF pin should be limited as well.

When the device shunts high current, adjusting the width and length of traces on the CATHODE pin and ANODE pin is necessary in the PCB board to have a proper density of current.

Layout

Please make sure that the bypass capacitor is close enough to the part. The width of trace on the PCB should be fit for its amount of current flowing. For the SGM43xL, these currents will not be large.

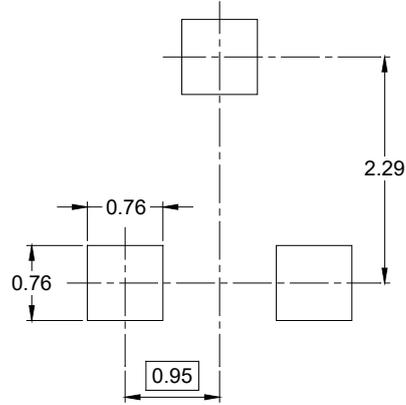
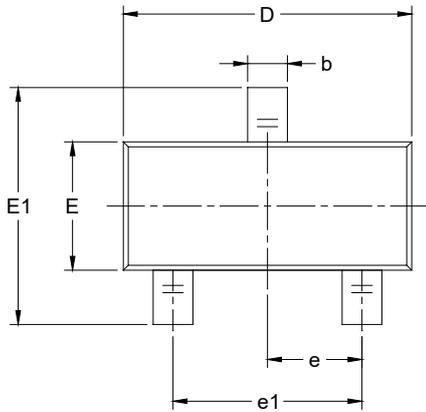
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

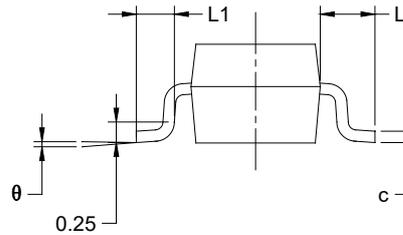
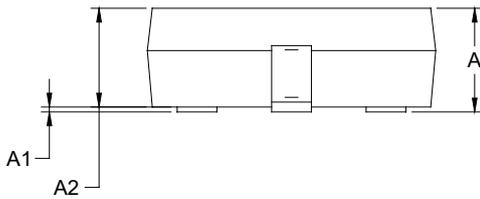
Changes	Page
<b>FEBRUARY 2026 – REV.A to REV.A.1</b>	
Added XTDFN-1×1-4L package to SGM431L.....	All
<b>Changes from Original to REV.A (AUGUST 2025)</b>	
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SOT-23



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.89	1.12	0.035	0.044
A1	0.01	0.10	0.000	0.004
A2	0.88	1.02	0.035	0.040
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.04	0.110	0.120
E	1.20	1.40	0.047	0.055
E1	2.10	2.64	0.083	0.104
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.54 REF		0.021 REF	
L1	0.40	0.60	0.016	0.024
$\theta$	0°	8°	0°	8°

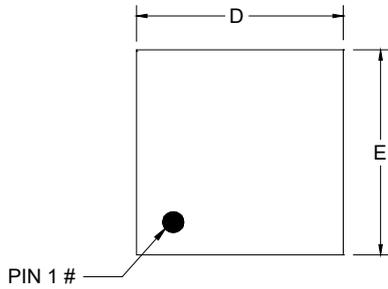
NOTES:

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

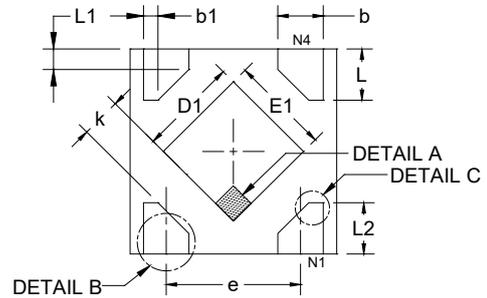
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

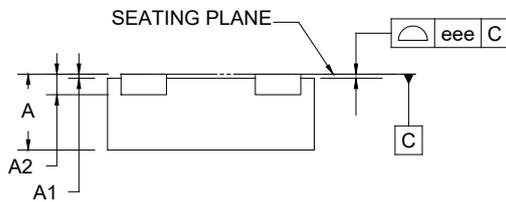
### XTDFN-1x1-4L



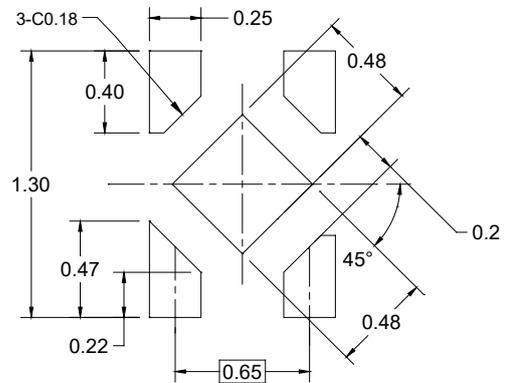
**TOP VIEW**



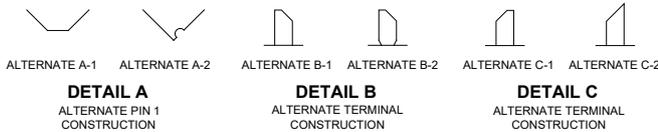
**BOTTOM VIEW**



**SIDE VIEW**



**RECOMMENDED LAND PATTERN (Unit: mm)**

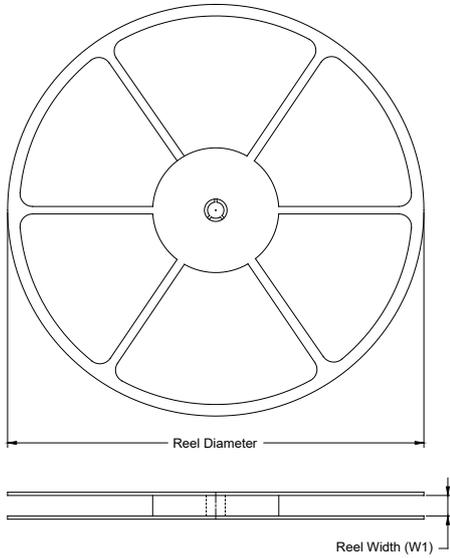


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.340	0.370	0.400
A1	0.000	0.020	0.050
A2	0.100 REF		
b	0.170	-	0.300
b1	0.068 REF		
D	0.950	1.000	1.050
E	0.950	1.000	1.050
D1	0.430	0.480	0.530
E1	0.430	0.480	0.530
L	0.200	0.250	0.300
L1	0.093 REF		
L2	0.200	-	0.370
e	0.650 BSC		
k	0.150	-	-
eee	-	0.050	-

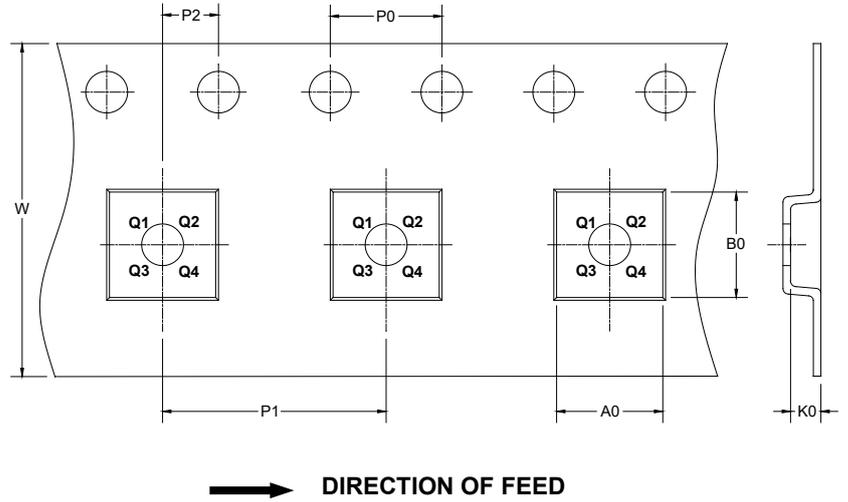
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

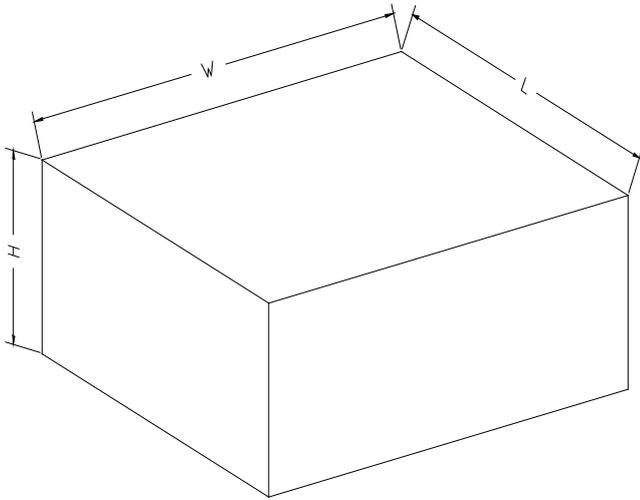
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23	7"	9.5	3.15	2.77	1.22	4.0	4.0	2.0	8.0	Q3
XTDFN-1×1-4L	7"	9.5	1.14	1.17	0.56	4.0	4.0	2.0	8.0	Q2

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
7" (Option)	368	227	224	8
7"	442	410	224	18

D00002