SGM4030
12μA, Low Noise, Small Packages, Voltage Reference

GENERAL DESCRIPTION

The SGM4030 is a tiny size, precision, low power, low noise, low dropout voltage reference, which is designed for portable or battery-powered applications. The device consumes only 12μA typical quiescent current. On normal load conditions, the SGM4030 can operate on a power supply voltage higher than the specified output voltage of 0.2V, except for SGM4030-1.25, whose minimum power supply voltage is 1.7V.

The SGM4030 is available in Green UTQFN-1.5×1.5-8L and SOT-23 packages. It is specified over the extended industrial temperature range (-40℃ to +125℃).

FEATURES

- **Low Temperature Drift: 50ppm/℃ (MAX)**
- **High Initial Accuracy: ±0.15% (MAX)**
- **Low Noise: 32μV_{P-P} at 0.1Hz to 10Hz (SGM4030-2.048)**
- **Ultra-Low Dropout Voltage: 65mV (TYP)**
- **Fixed Output Voltage: 1.25V, 1.8V, 2.048V, 2.5V, 3.0V, 3.3V, 4.096V and 5.0V**
- **High Output Current: ±5mA**
- **Stable Output C_{LOAD} Range: 0.1μF to 10μF**
- **Low Quiescent Current: 12μA (TYP)**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green UTQFN-1.5×1.5-8L and SOT-23 Packages**

APPLICATIONS

Battery-Powered Equipment
Portable Devices
Smartphones and Tablet PCs
Precision Data-Acquisition Systems
Medical Instrumentation
Handheld Test Equipment
Sensor Modules
HD Drives

TYPICAL APPLICATION

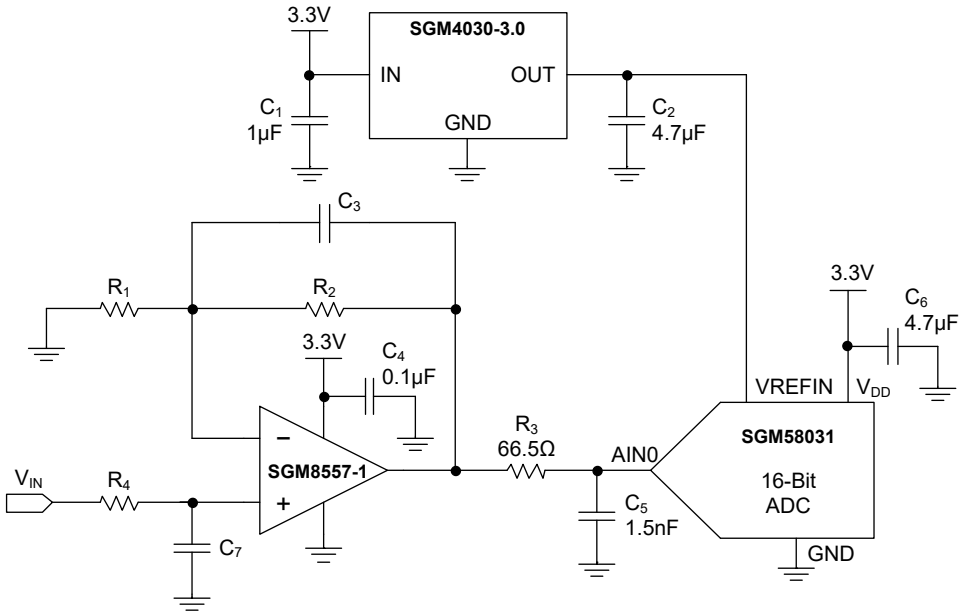


Figure 1. SGM4030-3.0 in an ADC Signal Chain

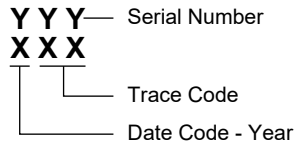
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4030-1.25	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-1.25XURO8G/TR	CI5 XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-1.25XN3LG/TR	1KPXX	Tape and Reel, 3000
SGM4030-1.8	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-1.8XURO8G/TR	1KL XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-1.8XN3LG/TR	1KQXX	Tape and Reel, 3000
SGM4030-2.048	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-2.048XURO8G/TR	1BZ XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-2.048XN3LG/TR	1BYXX	Tape and Reel, 3000
SGM4030-2.5	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-2.5XURO8G/TR	CI6 XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-2.5XN3LG/TR	1KRXX	Tape and Reel, 3000
SGM4030-3.0	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-3.0XURO8G/TR	CI7 XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-3.0XN3LG/TR	1KSXX	Tape and Reel, 3000
SGM4030-3.3	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-3.3XURO8G/TR	1KM XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-3.3XN3LG/TR	CI8XX	Tape and Reel, 3000
SGM4030-4.096	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-4.096XURO8G/TR	1KN XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-4.096XN3LG/TR	1KTXX	Tape and Reel, 3000
SGM4030-5.0	UTQFN-1.5×1.5-8L	-40℃ to +125℃	SGM4030-5.0XURO8G/TR	1KO XXX	Tape and Reel, 4000
	SOT-23	-40℃ to +125℃	SGM4030-5.0XN3LG/TR	1KUXX	Tape and Reel, 3000

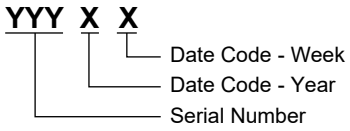
MARKING INFORMATION

NOTE: XX = Date Code. XXX = Date Code and Trace Code.

UTQFN-1.5×1.5-8L



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

Input Voltage 6V
Output Voltage ..... V_{IN}
Output Short-Circuit Current, I_{SC} ..... Continuous
Package Thermal Resistance
UTQFN-1.5×1.5-8L, θ_{JA} ..... 180℃/W
UTQFN-1.5×1.5-8L, θ_{JB} ..... 79.6℃/W
SOT-23, θ_{JA} ..... 190℃/W
SOT-23, θ_{JB} ..... 36.2℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
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

Supply Input Voltage Range, V_{IN} (1) ..... V_{OUT} + 0.2V to 5.5V
Output Current Range, I_{OUT} ..... -5mA to 5mA

NOTE:

1. For the SGM4030-1.25, the minimum supply voltage is 1.7V.

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

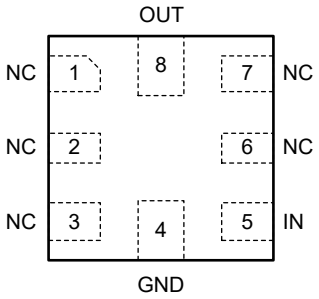
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

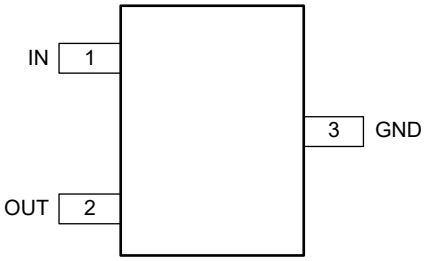
PIN CONFIGURATIONS

(TOP VIEW)



UTQFN-1.5×1.5-8L

(TOP VIEW)



SOT-23

PIN DESCRIPTION

PIN		NAME	FUNCTION
UTQFN-1.5×1.5-8L	SOT-23		
1, 2, 3, 6, 7	—	NC	Not Connected.
4	3	GND	Ground.
5	1	IN	Input Supply Voltage.
8	2	OUT	Reference Output Voltage.

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, V_{IN} = 5.5V, I_{LOAD} = 0mA, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SGM4030-1.8						
Output Voltage	V_{OUT}			1.8		V
Initial Accuracy			-0.15		0.15	%
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2V to 5.5V		33	95	ppm/V
		T_A = 0℃ to +70℃		36		
		T_A = -40℃ to +85℃		36		
		T_A = -40℃ to +125℃		40		
Output Voltage Noise		f = 0.1Hz to 10Hz		28		μV_{P-P}
SGM4030-2.048						
Output Voltage	V_{OUT}			2.048		V
Initial Accuracy			-0.15		0.15	%
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.25V to 5.5V		40	100	ppm/V
		T_A = 0℃ to +70℃		42		
		T_A = -40℃ to +85℃		42		
		T_A = -40℃ to +125℃		45		
Output Voltage Noise		f = 0.1Hz to 10Hz		32		μV_{P-P}
SGM4030-2.5						
Output Voltage	V_{OUT}			2.5		V
Initial Accuracy			-0.15		0.15	%
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.7V to 5.5V		45	135	ppm/V
		T_A = 0℃ to +70℃		45		
		T_A = -40℃ to +85℃		50		
		T_A = -40℃ to +125℃		52		
Output Voltage Noise		f = 0.1Hz to 10Hz		40		μV_{P-P}
SGM4030-3.0						
Output Voltage	V_{OUT}			3		V
Initial Accuracy			-0.15		0.15	%
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.2V to 5.5V		50	150	ppm/V
		T_A = 0℃ to +70℃		55		
		T_A = -40℃ to +85℃		55		
		T_A = -40℃ to +125℃		55		
Output Voltage Noise		f = 0.1Hz to 10Hz		48		μV_{P-P}
SGM4030-5.0						
Output Voltage	V_{OUT}			5		V
Initial Accuracy			-0.15		0.15	%
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 5.2V to 5.5V		50	265	ppm/V
		T_A = 0℃ to +70℃		140		
		T_A = -40℃ to +85℃		220		
		T_A = -40℃ to +125℃		305		
Output Voltage Noise		f = 0.1Hz to 10Hz		90		μV_{P-P}

ELECTRICAL CHARACTERISTICS (continued)

(At T_A = +25℃, V_{IN} = 5.5V, I_{LOAD} = 0mA, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SGM4030-1.8/2.048/2.5/3.0/5.0						
Load Regulation	$\Delta V_{OUT}/\Delta I_{LOAD}$	V_{IN} = V_{OUT} + 0.2V, I_{LOAD} = ±5mA		2.5	25	ppm/mA
		T_A = 0℃ to +70℃		3		
		T_A = -40℃ to +85℃		3		
		T_A = -40℃ to +125℃		4	40	
Output Voltage Temperature Drift (1)	$\Delta V_{OUT}/\Delta T$	T_A = -40℃ to +85℃		8	50	ppm/℃
		T_A = -40℃ to +125℃		9	50	
Long-Term Stability		I_{OUT} = 0mA, 0h to 1000h at +25℃		100		ppm
		I_{OUT} = 0mA, 1000h to 2000h at +25℃		25		
Thermal Hysteresis	dT	T_A = +25℃ to -40℃ to +125℃ to +25℃		150		ppm
Dropout Voltage	V_{IN} - V_{OUT}	I_{LOAD} = ±5mA		65	100	mV
		T_A = 0℃ to +70℃		82		
		T_A = -40℃ to +85℃		90		
		T_A = -40℃ to +125℃		120	200	
		I_{LOAD} = ±2mA, T_A = -40℃ to +125℃		25	70	
Short-Circuit Current	I_{SC}	Sourcing and sinking		32		mA
Capacitive Load	C_{LOAD}		0.1		10	μF
Turn-On Settling Time	t_S	To 0.1% with C_{LOAD} = 1μF		2		ms
Power Supply						
Specified Voltage Range (2)	V_{IN}		V_{OUT} + 0.2		5.5	V
Operating Voltage Range		I_{LOAD} = 0mA		V_{OUT} + 0.005	5.5	V
Quiescent Current	I_Q			12	20	μA
		T_A = -40℃ to +125℃			25	
Temperature						
Specified Range	T_A		-40		125	℃

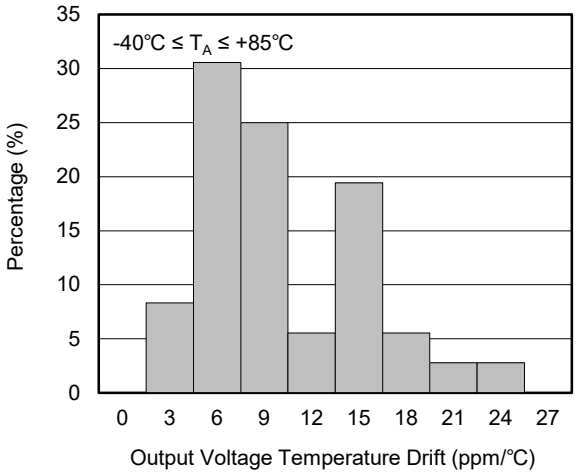
NOTES:

1. The way to determine temperature drift is using Box Method.
2. For the SGM4030-1.25, the minimum supply voltage is 1.7V.

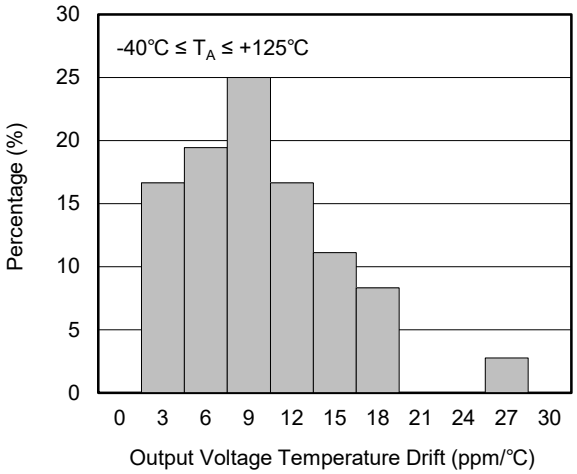
TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, V_{OUT} = 2.048V, unless otherwise noted.

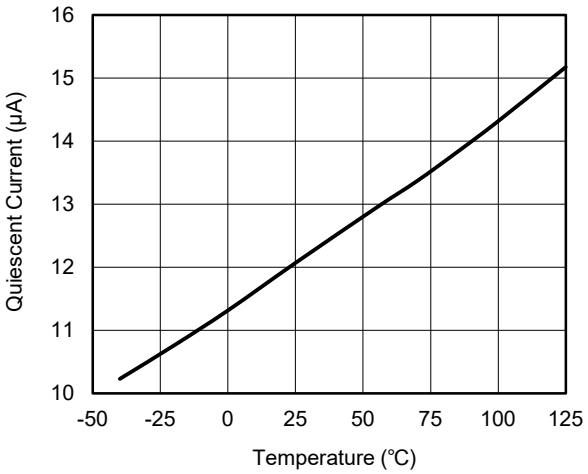
Temperature Drift Production Distribution



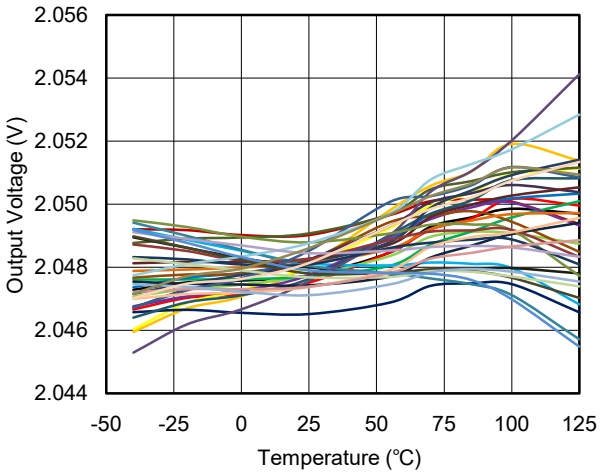
Temperature Drift Production Distribution



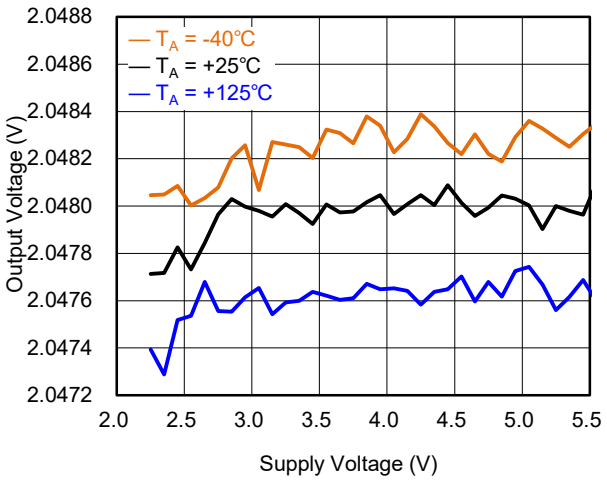
Quiescent Current vs. Temperature



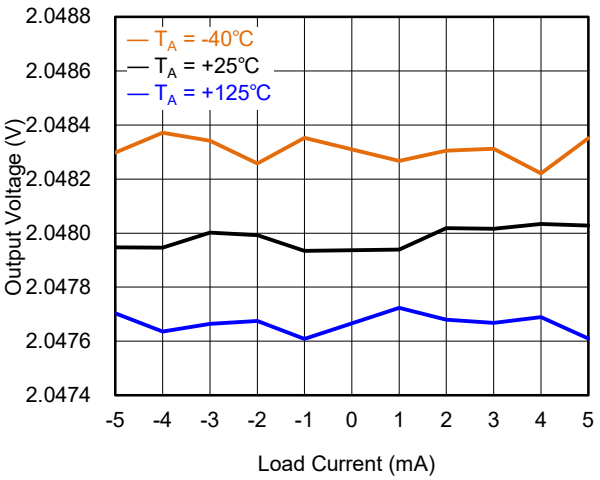
Output Voltage vs. Temperature



Output Voltage vs. Supply Voltage



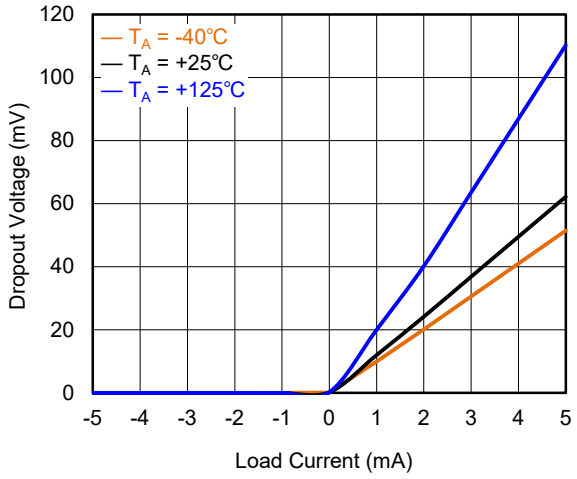
Output Voltage vs. Load Current



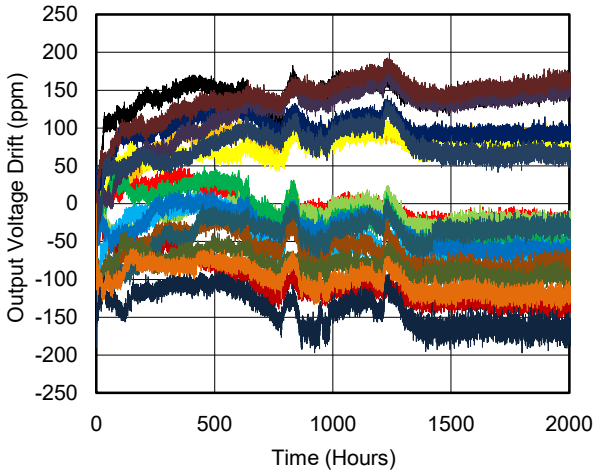
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_{OUT} = 2.048V, unless otherwise noted.

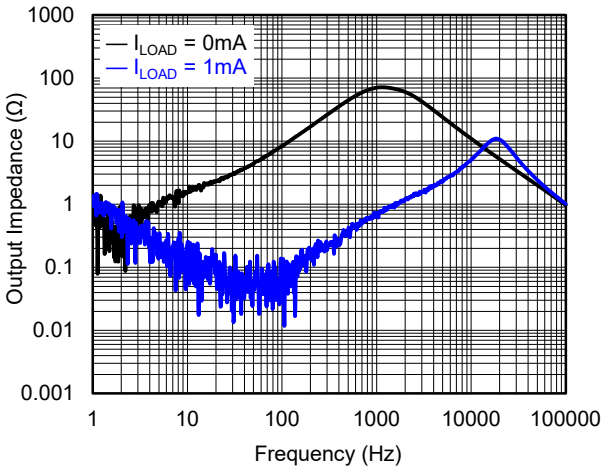
Dropout Voltage vs. Load Current



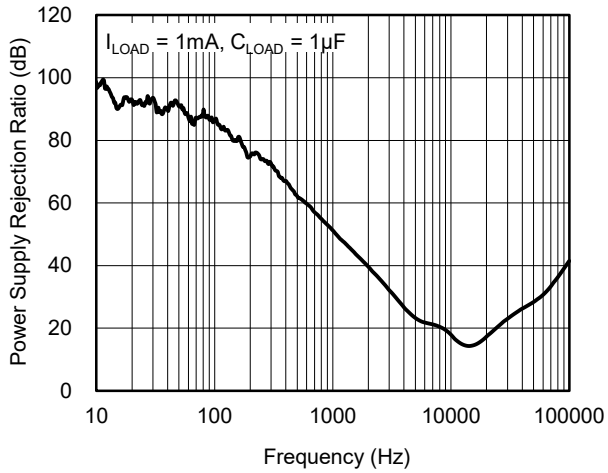
Long-Term Stability



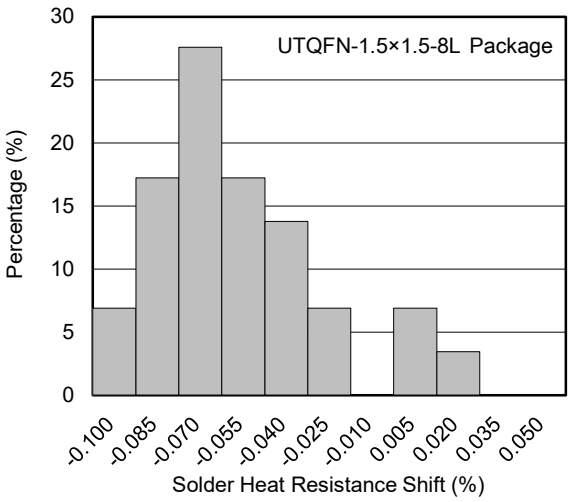
Output Impedance vs. Frequency



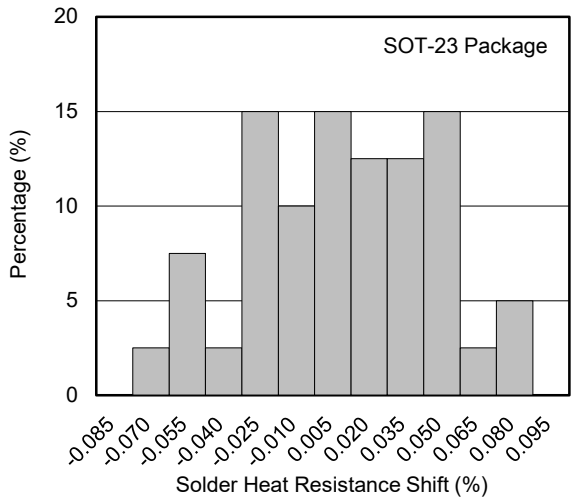
Power Supply Rejection Ratio vs. Frequency



Solder Heat Resistance Shift Distribution



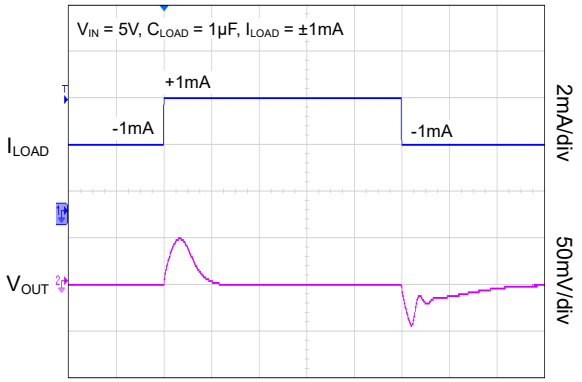
Solder Heat Resistance Shift Distribution



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

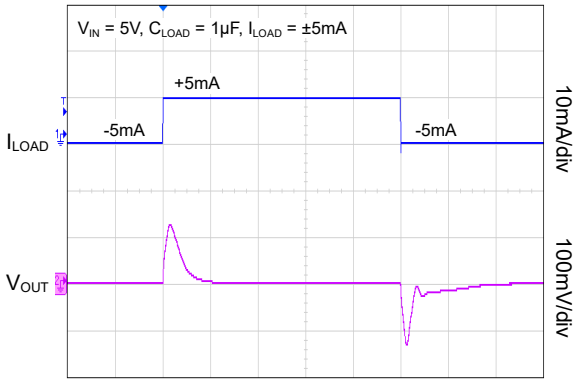
At T_A = +25℃, V_{OUT} = 2.048V, unless otherwise noted.

Load Transient



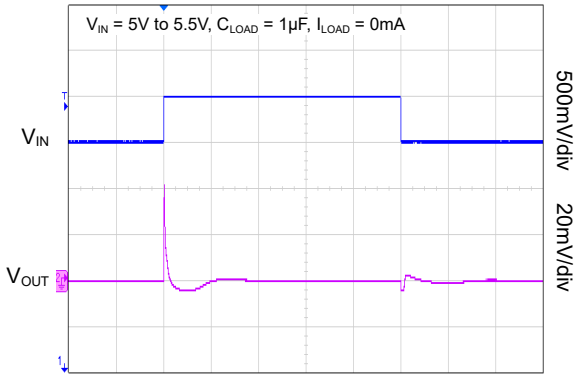
Time (200μs/div)

Load Transient



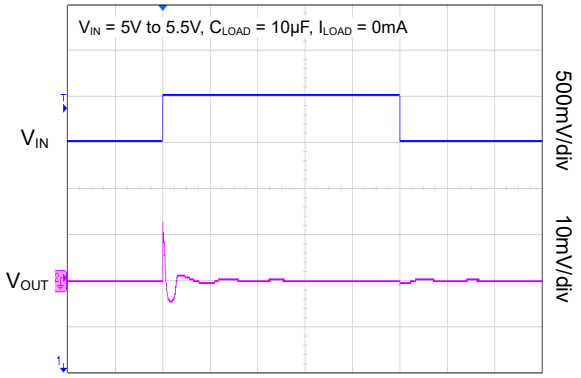
Time (200μs/div)

Line Transient



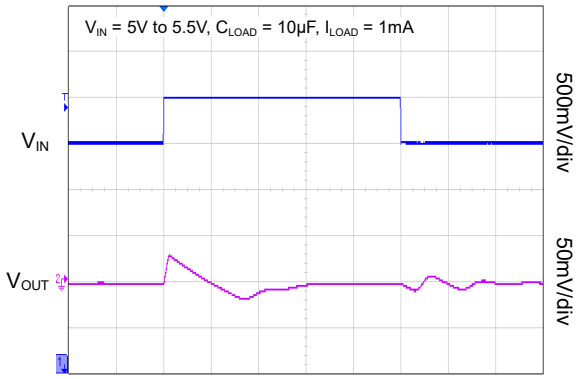
Time (1ms/div)

Line Transient



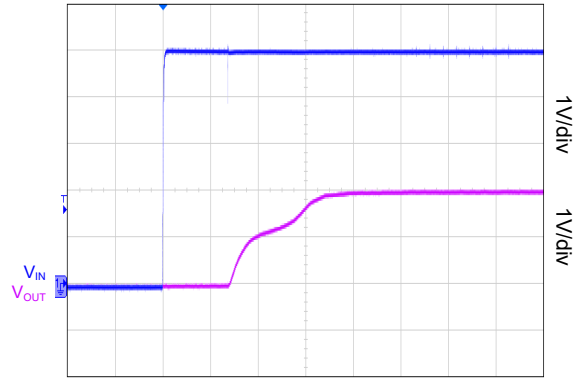
Time (5ms/div)

Line Transient



Time (200μs/div)

Step Response

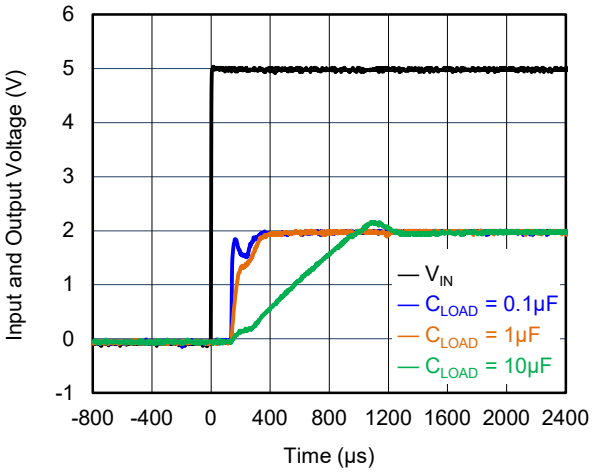


Time (100μs/div)

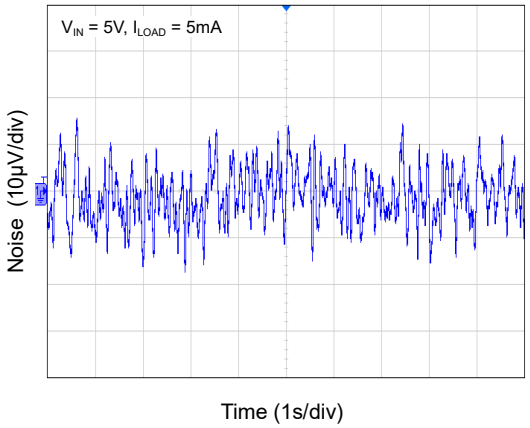
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_{OUT} = 2.048V, unless otherwise noted.

Start-Up



0.1Hz to 10Hz Noise



FUNCTIONAL BLOCK DIAGRAM

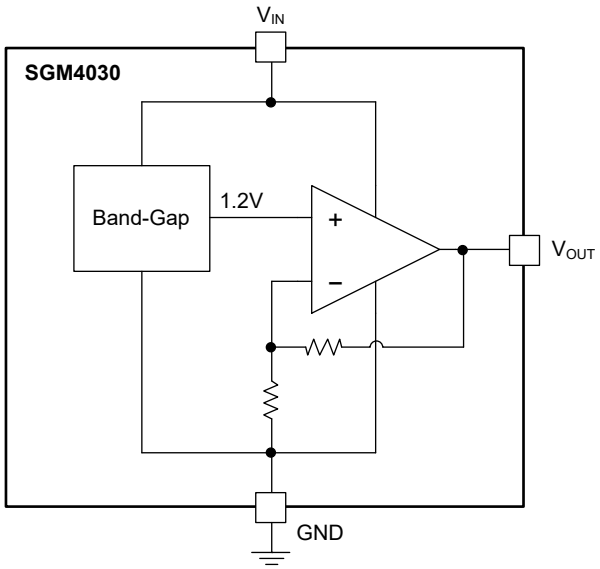


Figure 2. Block Diagram

DETAILED DESCRIPTION

The SGM4030 is a precision, low power, low noise band-gap voltage reference, which features ultra-low dropout voltage, high initial voltage accuracy and high output current. The above block diagram indicates the internal structure of SGM4030.

Feature Description

Start-Up Time

There is a high-performance start-up circuit inside the SGM4030. The settling time of the output voltage is limited within 2ms.

Low Temperature Drift

The drift error for SGM4030 is significantly small, and the change of output voltage illustrates the drift of error. The Box Method is used to evaluate the temperature drift as shown in Equation 1.

$$\text{Drift} = \left(\frac{V_{OUTMAX} - V_{OUTMIN}}{V_{OUT} \times \text{Temp Range}} \right) \times 10^6 (\text{ppm}) \quad (1)$$

Thermal Hysteresis

To measure the thermal hysteresis, the V_{OUT} of the device should be measured at the temperature of +25℃. After finishing this, the SGM4030 will be cycled to the other temperatures, and then return it back to +25℃ and measure the V_{OUT} again. In conclusion, this voltage difference is the hysteresis of temperature.

$$V_{HYST} = \frac{|V_{PRE} - V_{POST}|}{V_{NOM}} \times 10^6 (\text{ppm}) \quad (2)$$

where:

V_{HYST} is the thermal hysteresis.

V_{PRE} is the output voltage measured at +25℃ before the device is removed to the temperature range of -40℃ to +125℃.

V_{POST} is the output voltage measured at +25℃ after the device is removed to the temperature range of -40℃ to +125℃.

V_{NOM} is the output voltage which is specified.

Power Dissipation

Within the specification of the supply voltage range, the load current of SGM4030 is specified to ±5mA. The following equation illustrates how the temperature changes with the increasing of temperature.

$$T_J = T_A + P_D \times \theta_{JA} \quad (5)$$

where:

T_J is the junction temperature (℃).

T_A is the ambient temperature (℃).

P_D is the power dissipated (W).

θ_{JA} is the junction-to-ambient thermal resistance (℃/W).

The junction temperature of SGM4030 must be lower than +125℃, which is the maximum acceptable temperature of this voltage reference.

Noise Performance

For the frequency within 0.1Hz to 10Hz, it is guaranteed that the noise level is below 32μV_{P-P} (SGM4030-2.048). The external temperature and V_{OUT} can increase the noise level. The technology of filtering can be taken into account to decrease the level of noise. However, this may increase the output impedance of SGM4030 and degrade the performance of AC output signal.

Device Functional Modes

Supply Voltage

For normal operation, the minimum supply voltage should be 0.2V larger than the output voltage, except for SGM4030-1.25, whose minimum power supply voltage is 1.7V. The maximum input voltage for the SGM4030 is 5.5V.

Basic Connections

For typical connection which is shown in Figure 3, it is recommended that a supply bypass capacitor from 1μF to 10μF should be connected at the power supply pin. For the condition of capacitive load, a capacitor from 0.1μF to 10μF should be connected to the output pin for stability.

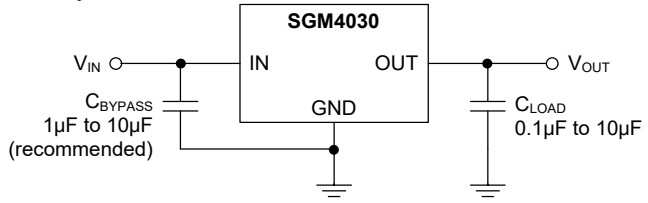


Figure 3. Basic Connections

APPLICATION INFORMATION

The SGM4030 is a precision, low power, low noise band-gap voltage reference, which features ultra-low dropout voltage, high initial voltage accuracy and high output current. The device is packaged in two tiny packages (UTQFN-1.5×1.5-8L and SOT-23), so it is suitable for the space-restricted applications.

Configuration for Bipolar Signal Chain

This circuit is used for providing a proper common mode voltage for the 16-bit sigma delta ADC. To explain, the output of SGM4030-1.25 is attenuated by R_7 and R_8 to supply AIN1 as the half point of VREFIN. The input signal is level shifted and attenuated by a low power and zero-drift operational amplifier.

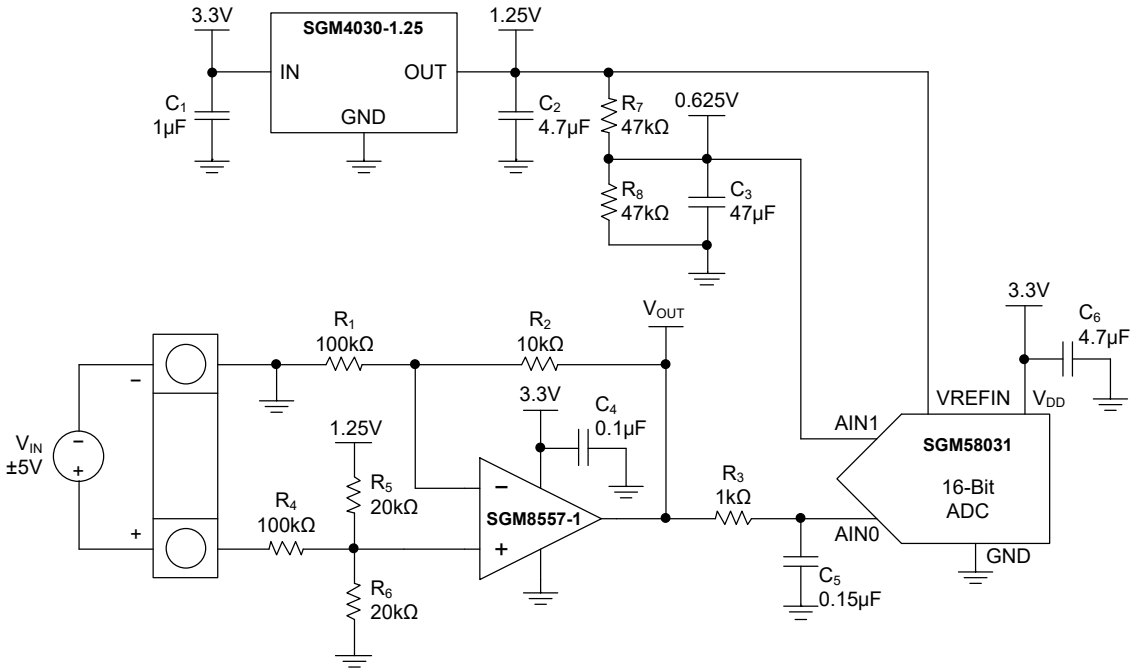


Figure 4. Bipolar Signal-Chain Configuration with SGM4030-1.25

Power Supply Recommendations

The dropout voltage for the SGM4030 is significantly low except for the SGM4030-1.25. The other SGM4030s can operate with a supply voltage that is 0.2V higher than the output voltage, under a 5mA load.

Layout

Some key considerations of printed-circuit board (PCB) layout using the SGM4030 are:

◆ A low ESR bypass capacitor with 1μF should be added at the input, and a 0.1μF to 10μF ceramic capacitor should be added at the output of the SGM4030 for stability.

◆ A solid ground plane should be taken into account to decrease EMI and distribute heat.

◆ The external passive devices should be added as close as possible to SGM4030 in order to reduce the error which is from the parasitic parameter.

◆ The length of trace in PCB for the connections of ADC should be as short as possible to decrease any possible noise.

◆ The analog trace should not be parallel with the digital trace to prevent the crosstalk. If the PCB is complicated and the crossing of these two traces cannot be avoided, then please make them on different layers and keep them perpendicular.

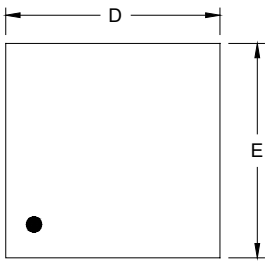
REVISION HISTORY

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

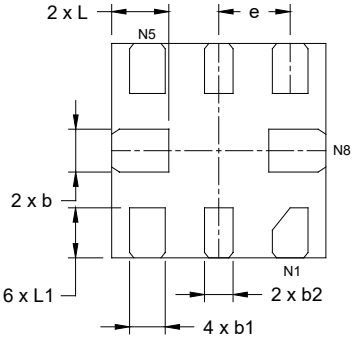
Changes from Original to REV.A (DECEMBER 2025)	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

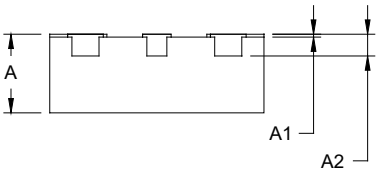
UTQFN-1.5×1.5-8L



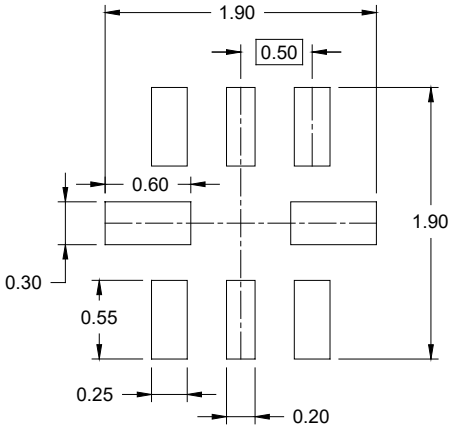
TOP VIEW



BOTTOM VIEW



SIDE VIEW



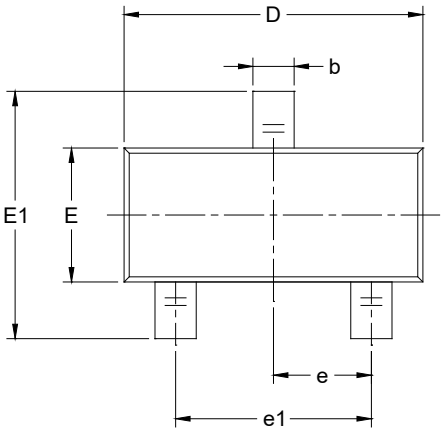
RECOMMENDED LAND PATTERN (Unit: mm)

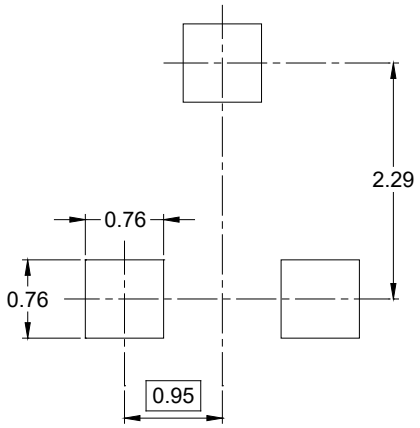
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A2	0.152 REF		
b	0.25	0.30	0.35
b1	0.20	0.25	0.30
b2	0.15	0.20	0.25
D	1.50 BSC		
E	1.50 BSC		
e	0.50 BSC		
L	0.35	0.40	0.45
L1	0.30	0.35	0.40

NOTE: This drawing is subject to change without notice.

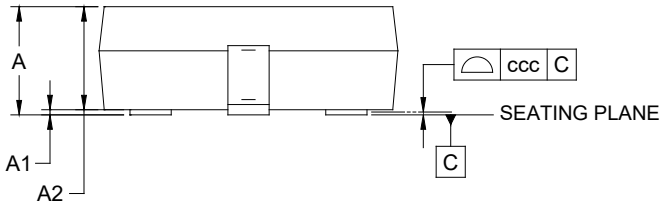
PACKAGE OUTLINE DIMENSIONS

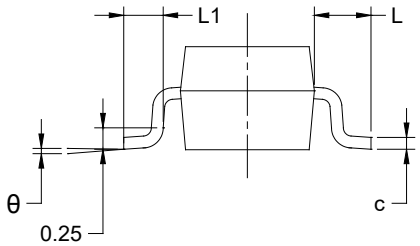
SOT-23





RECOMMENDED LAND PATTERN (Unit: mm)



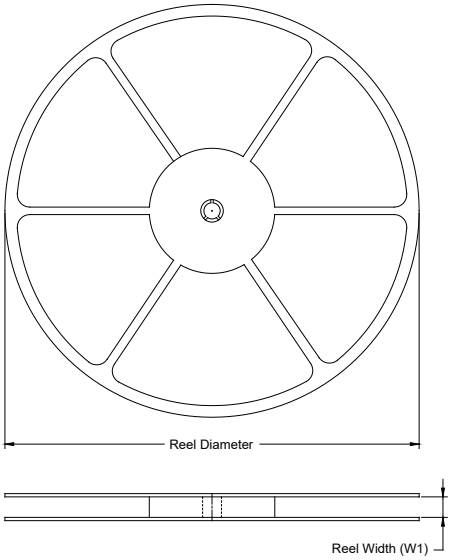


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.890	-	1.120
A1	0.010	-	0.100
A2	0.880	-	1.020
b	0.300	-	0.500
c	0.080	-	0.200
D	2.800	-	3.040
E	1.200	-	1.400
E1	2.100	-	2.640
e	0.950 BSC		
e1	1.900 BSC		
L	0.540 REF		
L1	0.400	-	0.600
θ	0°	-	8°
ccc	0.100		

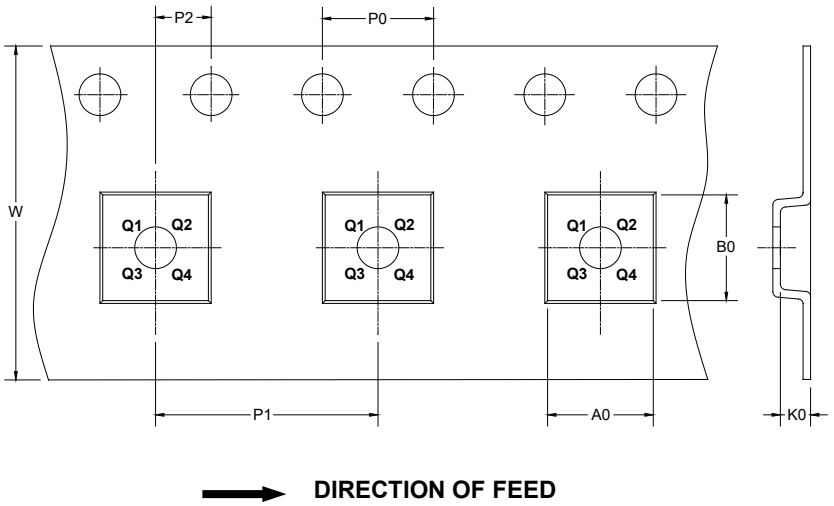
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC TO-236.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



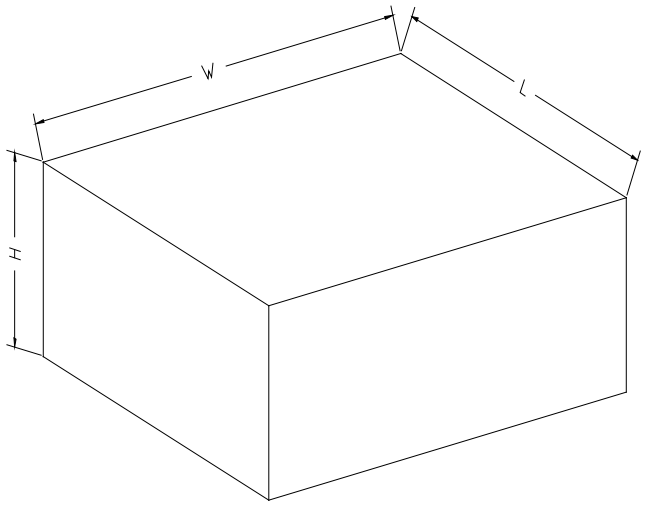
NOTE: The picture is only for reference. Please make the object as the standard.

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
UTQFN-1.5×1.5-8L	7"	9.5	1.70	1.70	0.75	4.0	4.0	2.0	8.0	Q2
SOT-23	7″	9.5	3.15	2.77	1.22	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

DD0002