



# SGM8042

## 670nA, Dual Rail-to-Rail I/O Operational Amplifier

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### GENERAL DESCRIPTION

The SGM8042 is a dual, high precision operational amplifier which can operate from 1.4V to 5.5V single supply, while consuming only 670nA/amplifier quiescent current. It provides rail-to-rail input and output operation. Therefore, the SGM8042 is suitable for use in portable instrumentation and battery-powered systems.

The SGM8042 is unity-gain stable, and features a 14.5kHz gain-bandwidth product. It is designed to provide optimal performance in low frequency systems, when monitoring battery current and conditioning sensor signal.

The SGM8042 is available in Green SOIC-8 and MSOP-8 packages. It is specified over the extended -40°C to +85°C temperature range.

### FEATURES

- **Low Quiescent Current: 670nA/Amplifier (TYP)**
- **Rail-to-Rail Input and Output**
- **Gain-Bandwidth Product: 14.5kHz at  $V_S = 5V$  (TYP)**
- **Wide Supply Voltage Range: 1.4V to 5.5V**
- **Unity-Gain Stable**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green SOIC-8 and MSOP-8 Packages**

### APPLICATIONS

Temperature Measurements  
Toll Booth Tags  
Battery-Powered Systems  
Wearable Products

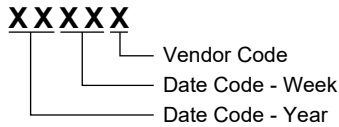
**SGM8042**

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8042	SOIC-8	-40°C to +85°C	SGM8042YS8G/TR	SGM8042YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8042YMS8G/TR	SGM8042 YMS8 XXXXX	Tape and Reel, 3000

**MARKING INFORMATION**

NOTE: 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.

**ABSOLUTE MAXIMUM RATINGS**

- Supply Voltage.....6V
- Analog Inputs (+IN, -IN)..... (-Vs) - 0.1V to (+Vs) + 0.1V
- Differential Input Voltage..... |(-Vs) - (+Vs)|
- Junction Temperature.....+150°C
- Storage Temperature Range.....-65°C to +150°C
- Lead Temperature (Soldering, 10s).....+260°C
- ESD Susceptibility
- HBM.....4000V
- MM.....400V

**RECOMMENDED OPERATING CONDITIONS**

- Operating Temperature Range.....-40°C to +85°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**

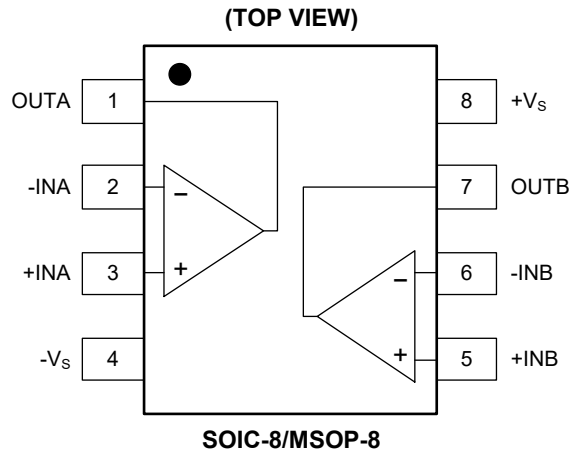
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures

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**



**ELECTRICAL CHARACTERISTICS**(At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 1.4\text{V}$  to  $5\text{V}$ ,  $-V_S = \text{GND}$ ,  $V_{\text{CM}} = +V_S/2$ ,  $V_{\text{OUT}} \approx +V_S/2$  and  $R_L = 1\text{M}\Omega$  to  $+V_S/2$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
<b>DC Electrical Characteristics</b>							
Input Offset Voltage	$V_{\text{OS}}$	$V_{\text{CM}} = +V_S/2$		0.4	2.5	mV	
Input Offset Voltage Drift	$\Delta V_{\text{OS}}/\Delta T$	$V_{\text{CM}} = +V_S/2$ , $-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$		2.5		$\mu\text{V}/^\circ\text{C}$	
Power Supply Rejection Ratio	PSRR	$+V_S = 1.4\text{V}$ to $5.5\text{V}$	77	80		dB	
Input Common Mode Voltage Range	$V_{\text{CMR}}$		$(-V_S) - 0.1$		$(+V_S) + 0.1$	V	
Common Mode Rejection Ratio	CMRR	$+V_S = 5.0\text{V}$ , $V_{\text{CM}} = -0.1\text{V}$ to $5.1\text{V}$	67	84		dB	
		$+V_S = 5.0\text{V}$ , $V_{\text{CM}} = 2.5\text{V}$ to $5.1\text{V}$	70	83			
		$+V_S = 5.0\text{V}$ , $V_{\text{CM}} = -0.1\text{V}$ to $2.5\text{V}$	66	78			
Large-Signal Voltage Gain	$A_{\text{VO}}$	$+V_S = 1.4\text{V}$ , $R_L = 50\text{k}\Omega$ , $V_{\text{OUT}} = (+V_S) - 0.1\text{V}$	75	80		dB	
		$+V_S = 2.5\text{V}$ , $R_L = 50\text{k}\Omega$ , $V_{\text{OUT}} = (+V_S) - 0.1\text{V}$		88			
		$+V_S = 5.0\text{V}$ , $R_L = 50\text{k}\Omega$ , $V_{\text{OUT}} = (+V_S) - 0.1\text{V}$	84	93			
Input Bias Current	$I_B$			1		pA	
Input Offset Current	$I_{\text{OS}}$			1		pA	
Maximum Output Voltage Swing	$V_{\text{OH}}$	$+V_S = 1.4\text{V}$ , $R_L = 50\text{k}\Omega$	1.390	1.395		V	
		$+V_S = 2.5\text{V}$ , $R_L = 50\text{k}\Omega$		2.497			
		$+V_S = 5.0\text{V}$ , $R_L = 50\text{k}\Omega$	4.990	4.997			
	$V_{\text{OL}}$	$+V_S = 1.4\text{V}$ , $R_L = 50\text{k}\Omega$			4.5	10	mV
		$+V_S = 2.5\text{V}$ , $R_L = 50\text{k}\Omega$			3.1		
		$+V_S = 5.0\text{V}$ , $R_L = 50\text{k}\Omega$			3.5	10	
Output Short-Circuit Current	$I_{\text{SC}}$	$+V_S = 2.5\text{V}$		5.5		mA	
		$+V_S = 5.0\text{V}$	22	24			
Supply Voltage	$V_{\text{CC}}$		1.4		5.5	V	
Quiescent Current/Amplifier	$I_Q$	$+V_S = 1.4\text{V}$		570		nA	
		$+V_S = 2.5\text{V}$		620			
		$+V_S = 5.0\text{V}$		670	1500		

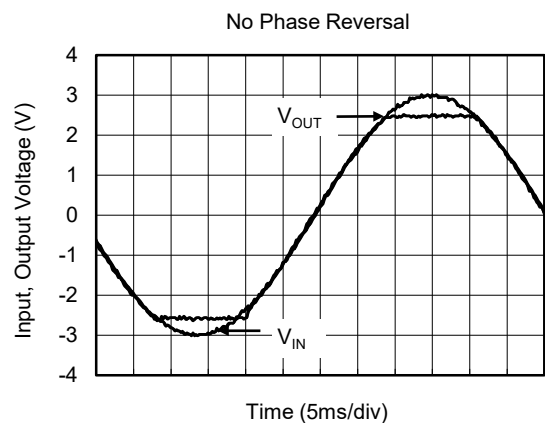
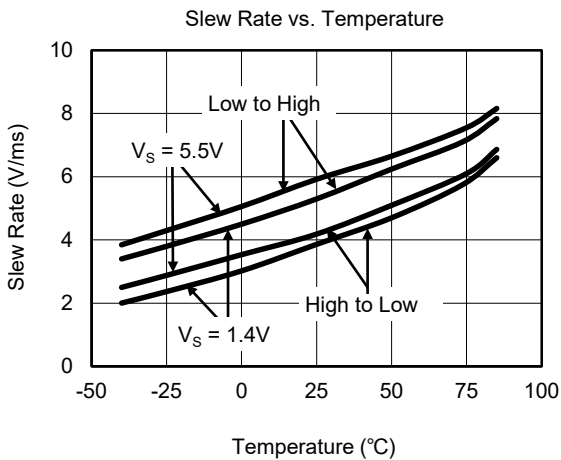
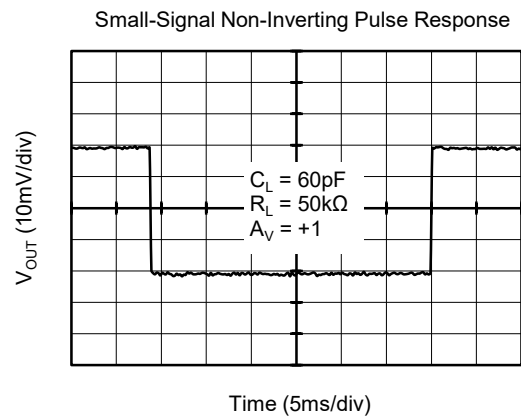
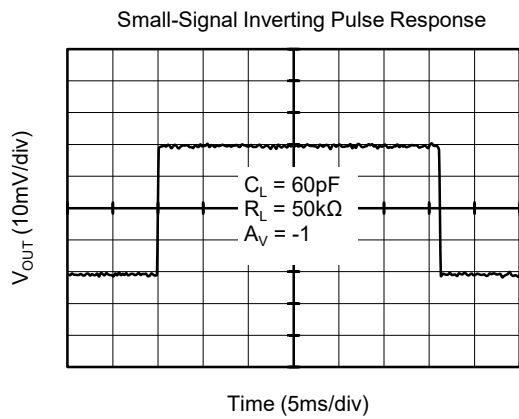
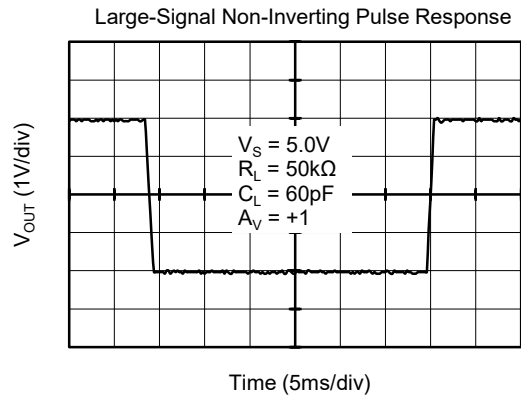
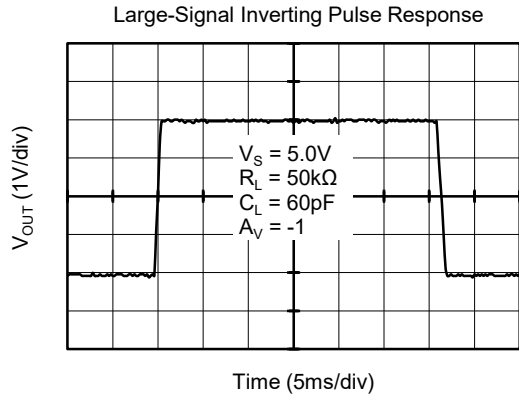
**ELECTRICAL CHARACTERISTICS (continued)**

(At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 1.4\text{V}$  to  $5\text{V}$ ,  $-V_S = \text{GND}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} \approx +V_S/2$  and  $R_L = 1\text{M}\Omega$  to  $+V_S/2$ ,  $C_L = 60\text{pF}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>AC Electrical Characteristics</b>						
Gain-Bandwidth Product	GBP	$+V_S = 1.4\text{V}$		12		kHz
		$+V_S = 2.5\text{V}$		13.5		
		$+V_S = 5.0\text{V}$		14.5		
Slew Rate	SR	$+V_S = 1.4\text{V}$ , $V_{OUT} = 1\text{V}$ Step		3.8		V/ms
		$+V_S = 2.5\text{V}$ , $V_{OUT} = 1\text{V}$ Step		4.0		
		$+V_S = 5.0\text{V}$ , $V_{OUT} = 2\text{V}$ Step		4.2		
Phase Margin	PM	$+V_S = 1.4\text{V}$ to $5.5\text{V}$		60		$^\circ$
Input Voltage Noise	$e_{n,P-P}$	$+V_S = 1.4\text{V}$ , $f = 0.1\text{Hz}$ to $10\text{Hz}$		3.7		$\mu\text{V}_{P-P}$
		$+V_S = 2.5\text{V}$ , $f = 0.1\text{Hz}$ to $10\text{Hz}$		3.2		
		$+V_S = 5.0\text{V}$ , $f = 0.1\text{Hz}$ to $10\text{Hz}$		3.2		
Input Voltage Noise Density	$e_n$	$+V_S = 1.4\text{V}$ , $f = 1\text{kHz}$		190		$\text{nV}/\sqrt{\text{Hz}}$
		$+V_S = 2.5\text{V}$ , $f = 1\text{kHz}$		180		
		$+V_S = 5.0\text{V}$ , $f = 1\text{kHz}$		180		

**TYPICAL PERFORMANCE CHARACTERISTICS**

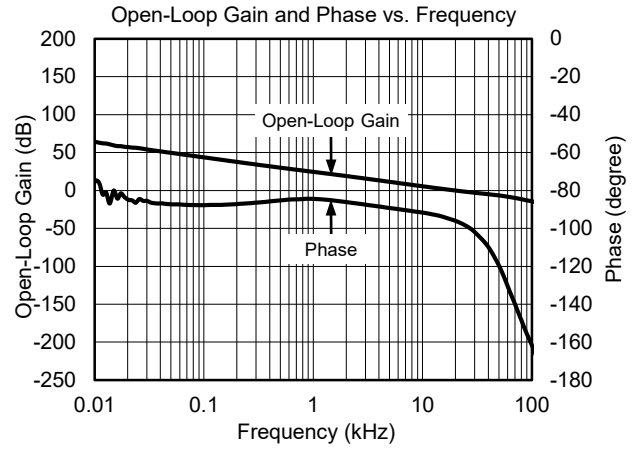
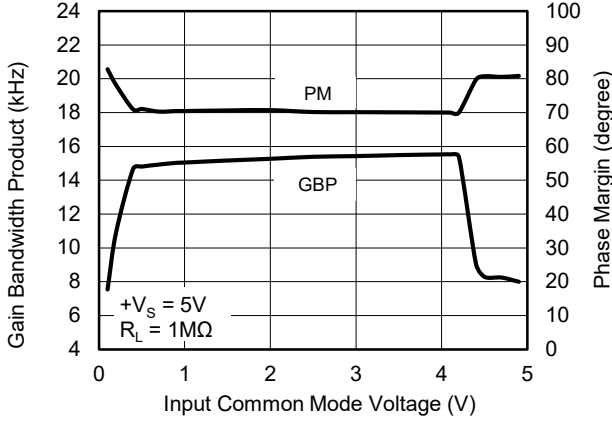
At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 1.4\text{V to } 5\text{V}$ ,  $-V_S = \text{GND}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} \approx +V_S/2$  and  $R_L = 1\text{M}\Omega$  to  $+V_S/2$ ,  $C_L = 60\text{pF}$ , unless otherwise noted.



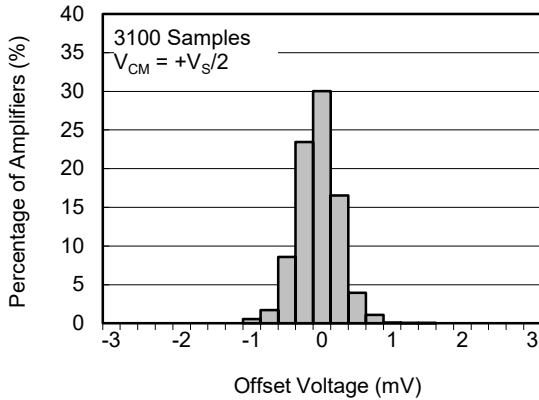
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 1.4\text{V to } 5\text{V}$ ,  $-V_S = \text{GND}$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} \approx +V_S/2$  and  $R_L = 1\text{M}\Omega$  to  $+V_S/2$ ,  $C_L = 60\text{pF}$ , unless otherwise noted.

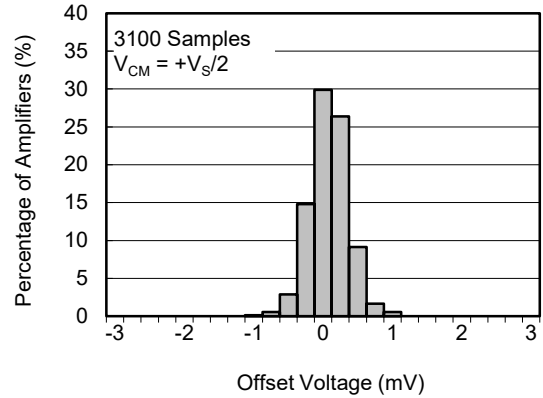
Gain-Bandwidth Product and Phase Margin vs. Input Common Mode Voltage



Offset Voltage Production Distribution at +5V



Offset Voltage Production Distribution at +1.4V



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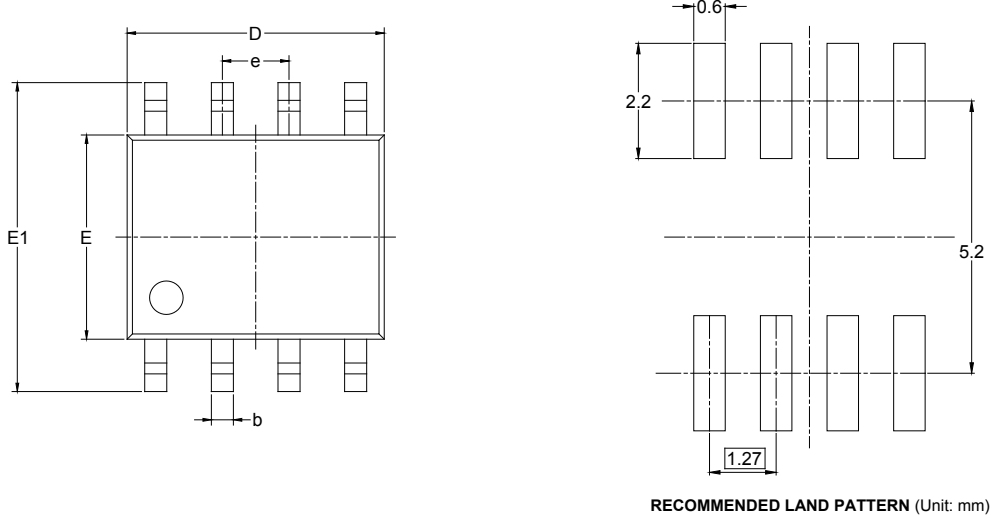
**REVISION HISTORY**

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

	<b>Page</b>
<hr/>	
<b>OCTOBER 2017 – REV.A.2 to REV.A.3</b>	
Updated Typical Performance Characteristics section .....	6
<hr/>	
<b>JANUARY 2013 – REV.A.1 to REV.A.2</b>	<b>Page</b>
Added Tape and Reel Information section .....	9~10
<hr/>	
<b>MAY 2011 – REV.A to REV.A.1</b>	<b>Page</b>
Updated Package Description .....	All
<hr/>	
<b>Changes from Original (APRIL 2010) to REV.A</b>	<b>Page</b>
Changed from product preview to production data .....	All
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PACKAGE OUTLINE DIMENSIONS

SOIC-8

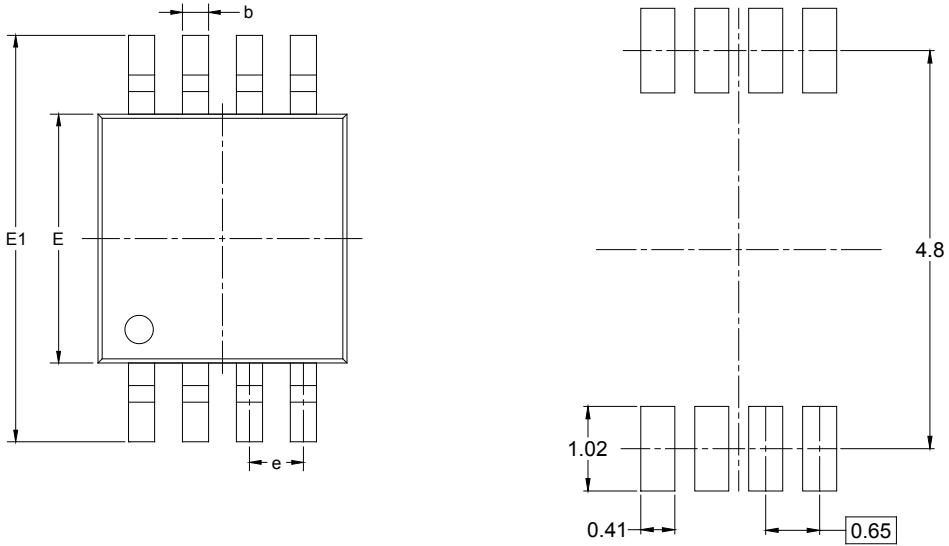


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

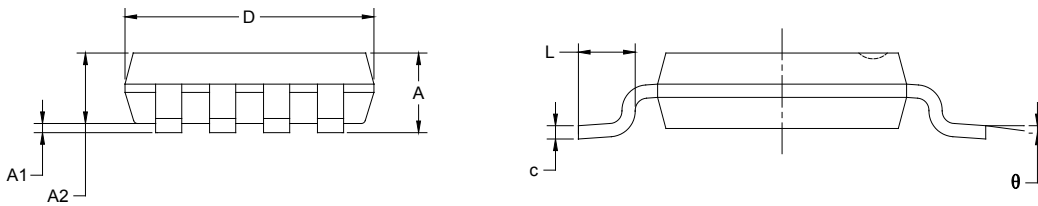


PACKAGE OUTLINE DIMENSIONS

MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)

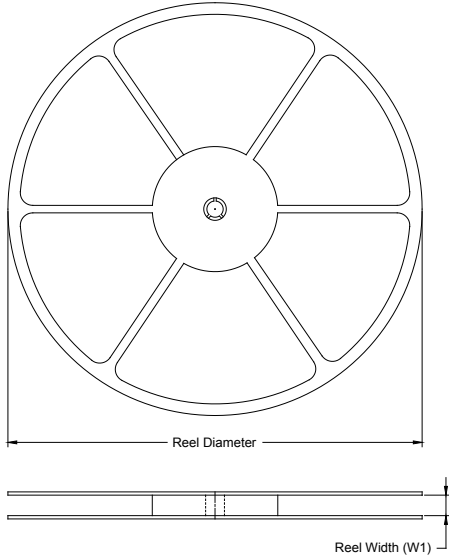


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

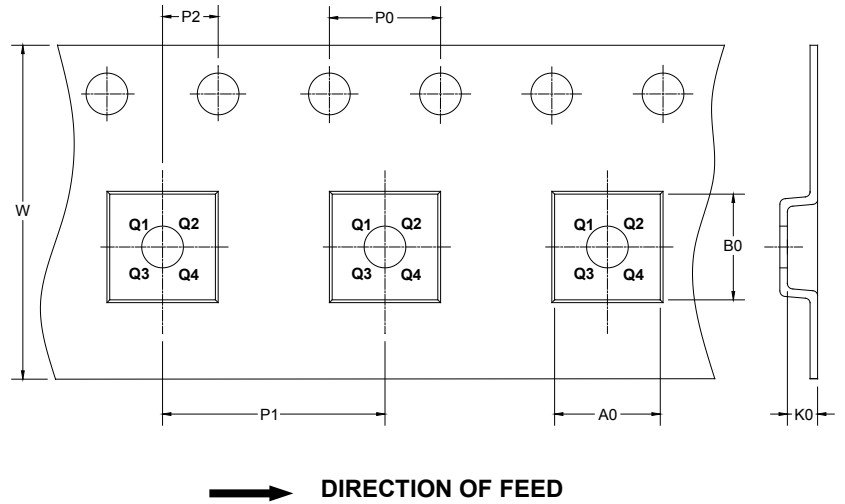
# PACKAGE INFORMATION

## 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
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	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