SGM8142
350nA, Dual Rail-to-Rail I/O Operational Amplifier

GENERAL DESCRIPTION

The SGM8142 is guaranteed to operate with a single-supply voltage as low as 1.4V, while drawing 350nA (TYP) of quiescent current per amplifier. This device is also designed to support rail-to-rail input and output operation. This combination of features supports battery-powered and portable applications.

The SGM8142 has a gain-bandwidth product of 5kHz (TYP) and is unity gain stable. These specifications make this operational amplifier appropriate for low frequency applications, such as battery current monitoring and sensor conditioning.

The SGM8142 is offered in dual configuration. It is specified over the -40℃ to +85℃ temperature range. The SGM8142 is available in Green SOIC-8 and MSOP-8 packages.

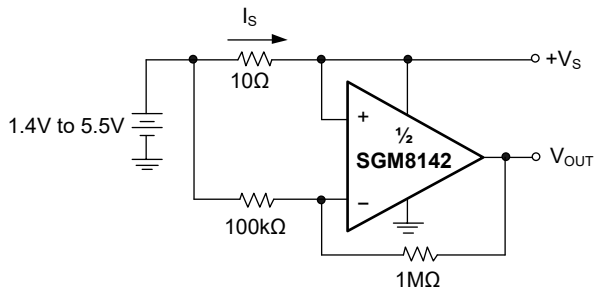
FEATURES

- **Low Quiescent Current: 350nA/Amplifier (TYP)**
- **Rail-to-Rail Input and Output**
- **Gain-Bandwidth Product: 5kHz at V_S = 5V (TYP)**
- **Wide Supply Voltage Range: 1.4V to 5.5V**
- **Unity Gain Stable**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green SOIC-8 and MSOP-8 Packages**

APPLICATIONS

Toll Booth Tags
Wearable Products
Temperature Measurement
Battery Powered Systems

TYPICAL APPLICATION

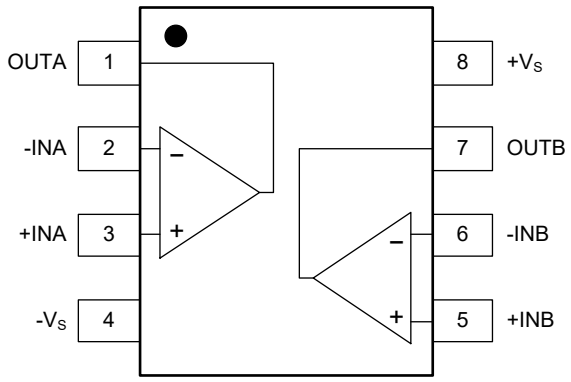


$$I_S = \frac{+V_S - V_{OUT}}{(10V/V) \cdot (10\Omega)}$$

High-side Battery Current Sensor

PIN CONFIGURATIONS

(TOP VIEW)



SOIC-8/MSOP-8

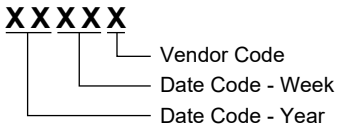
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8142	SOIC-8	-40℃ to +85℃	SGM8142YS8G/TR	SGM8142YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40℃ to +85℃	SGM8142YMS8G/TR	SGM8142 YMS8 XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

SOIC-8/MSOP-8



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) ..... $(-V_S)$ - 0.1V to $(+V_S)$ + 0.1V
Differential Input Voltage ..... $|(-V_S) - (+V_S)|$
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
MM 400V

RECOMMENDED OPERATING CONDITIONS

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

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 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, or specifications without prior notice.

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, $+V_S$ = 1.4V to 5.0V, $-V_S$ = GND, V_{CM} = $+V_S$/2, V_{OUT} ≈ $+V_S$/2 and R_L = 1MΩ to $+V_S$/2 (1), unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Electrical Characteristics						
Input Offset Voltage	V_{OS}	V_{CM} = $+V_S$/2		0.4	2.5	mV
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	V_{CM} = $+V_S$/2, -40℃ ≤ T_A ≤ +85℃		2		μV/℃
Power Supply Rejection Ratio	PSRR	$+V_S$ = 1.4V to 5.5V	69	80		dB
Input Common Mode Voltage Range	V_{CMR}		($-V_S$) - 0.1		($+V_S$) + 0.1	V
Common Mode Rejection Ratio	CMRR	$+V_S$ = 5.0V, V_{CM} = -0.1V to 5.1V	69	83		dB
		$+V_S$ = 5.0V, V_{CM} = 2.5V to 5.1V	67	82		
		$+V_S$ = 5.0V, V_{CM} = -0.1V to 2.5V	63	77		
Large-Signal Voltage Gain	A_{VO}	$+V_S$ = 1.4V, R_L = 50kΩ, V_{OUT} = ($+V_S$) - 0.1V	75	80		dB
		$+V_S$ = 2.5V, R_L = 50kΩ, V_{OUT} = ($+V_S$) - 0.1V		87		
		$+V_S$ = 5.0V, R_L = 50kΩ, V_{OUT} = ($+V_S$) - 0.1V	87	93		
Input Bias Current	I_B			1		pA
Input Offset Current	I_{OS}			1		pA
Maximum Output Voltage Swing	V_{OH}	$+V_S$ = 1.4V, R_L = 50kΩ	1.39	1.395		V
		$+V_S$ = 2.5V, R_L = 50kΩ		2.497		
		$+V_S$ = 5.0V, R_L = 50kΩ	4.99	4.996		
	V_{OL}	$+V_S$ = 1.4V, R_L = 50kΩ		4.6	10	mV
		$+V_S$ = 2.5V, R_L = 50kΩ		3.1		
		$+V_S$ = 5.0V, R_L = 50kΩ		3.6	10	
Output Short-Circuit Current	I_{SC}	$+V_S$ = 2.5V		5.6		mA
		$+V_S$ = 5.0V	22	24		
Supply Voltage	V_{CC}		1.4		5.5	V
Quiescent Current/Amplifier	I_Q	$+V_S$ = 1.4V		300		nA
		$+V_S$ = 2.5V		320		
		$+V_S$ = 5.0V		350	800	

ELECTRICAL CHARACTERISTICS (continued)

(At T_A = +25℃, $+V_S$ = 1.4V to 5.0V, $-V_S$ = GND, V_{CM} = $+V_S/2$, V_{OUT} ≈ $+V_S/2$ and R_L = 1MΩ to $+V_S/2$, C_L = 60pF (1), unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
AC Electrical Characteristics						
Gain-Bandwidth Product	GBP	$+V_S$ = 1.4V		4.3		kHz
		$+V_S$ = 2.5V		4.7		
		$+V_S$ = 5.0V		5		
Slew Rate	SR	$+V_S$ = 1.4V, V_{OUT} = 1V Step		1.3		V/ms
		$+V_S$ = 2.5V, V_{OUT} = 1V Step		1.5		
		$+V_S$ = 5.0V, V_{OUT} = 2V Step		1.6		
Phase Margin	PM	$+V_S$ = 1.4V to 5.5V		60		°
Input Voltage Noise	e_n p-p	$+V_S$ = 1.4V, f = 0.1Hz to 10Hz		4.4		μV_{P-P}
		$+V_S$ = 2.5V, f = 0.1Hz to 10Hz		3.9		
		$+V_S$ = 5.0V, f = 0.1Hz to 10Hz		4.0		
Input Voltage Noise Density	e_n	$+V_S$ = 1.4V, f = 1kHz		135		$nV/\sqrt{HZ}$
		$+V_S$ = 2.5V, f = 1kHz		140		
		$+V_S$ = 5.0V, f = 1kHz		130		

NOTE: 1. Refer to Figure 1 and Figure 2.

TEST CIRCUITS

The test circuits used for the DC and AC tests are shown in Figure 1 and Figure 2. The bypass capacitors are laid out according to the rules discussed in “Supply Bypass”.

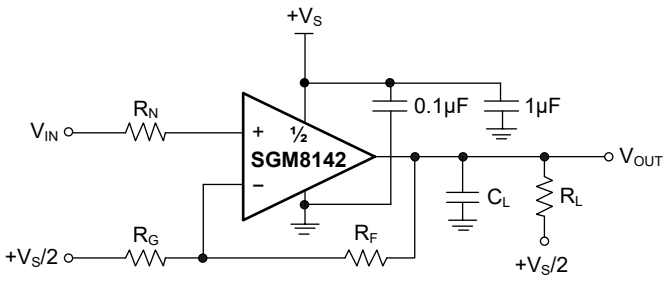


Figure 1. AC and DC Test Circuit for Most Non-Inverting Gain Conditions

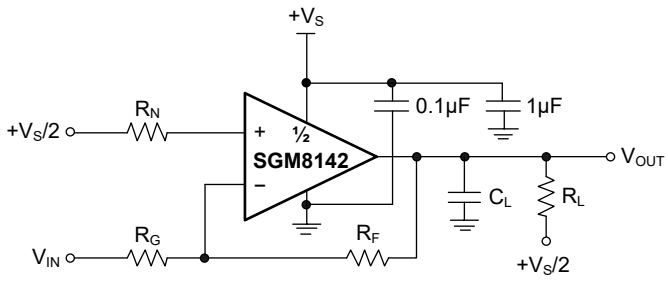
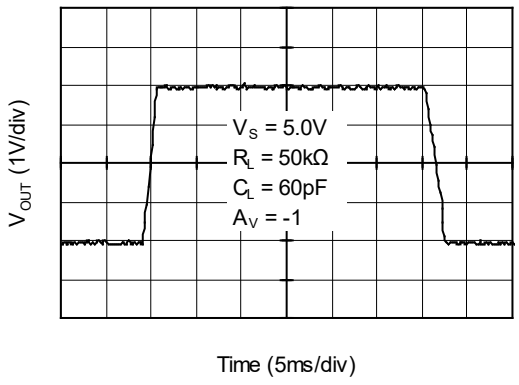


Figure 2. AC and DC Test Circuit for Most Inverting Gain Conditions

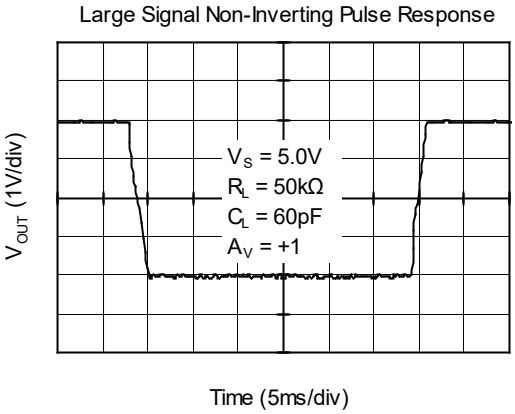
TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, $+V_S$ = 1.4V to 5.0V, $-V_S$ = GND, V_{CM} = $+V_S/2$, V_{OUT} ≈ $+V_S/2$ and R_L = 1MΩ to $+V_S/2$, C_L = 60pF, unless otherwise noted.

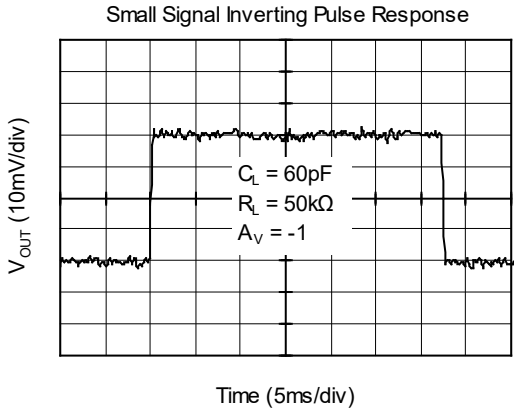
Large Signal Inverting Pulse Response



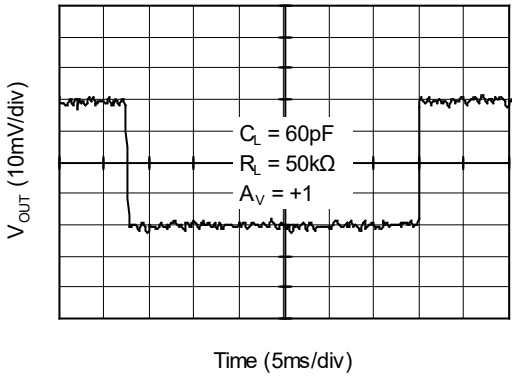
Large Signal Non-Inverting Pulse Response



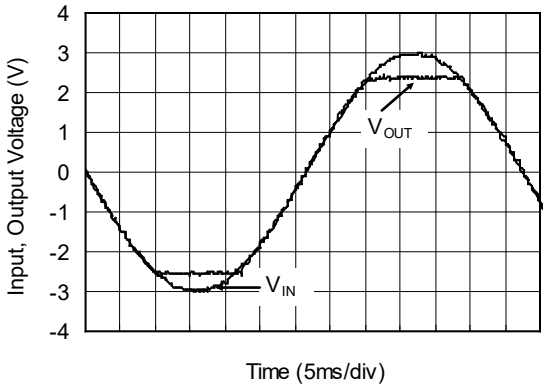
Small Signal Inverting Pulse Response



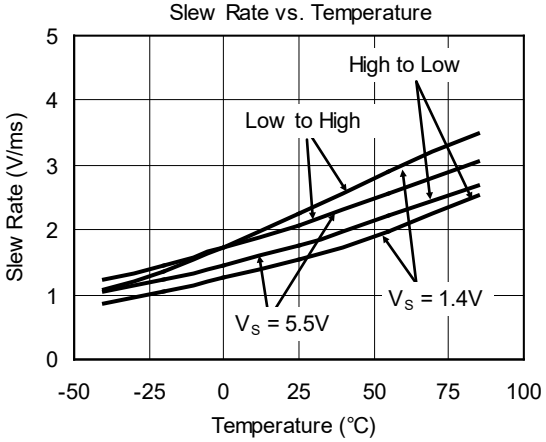
Small Signal Non-Inverting Pulse Response



No Phase Reversal

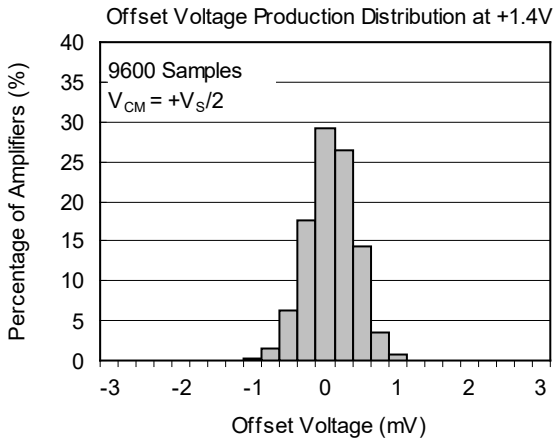


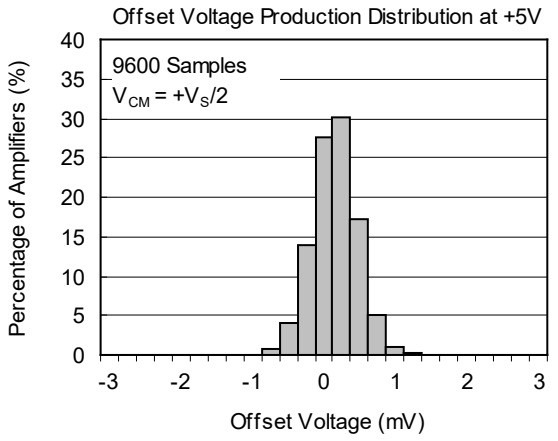
Slew Rate vs. Temperature



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, $+V_S$ = 1.4V to 5.0V, $-V_S$ = GND, V_{CM} = $+V_S/2$, V_{OUT} ≈ $+V_S/2$ and R_L = 1MΩ to $+V_S/2$, C_L = 60pF, unless otherwise noted.





REVISION HISTORY

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

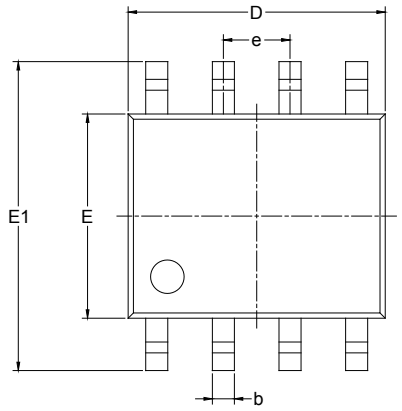
JANUARY 2013 – REV.A.1 to REV.A.2	Page
Added Tape and Reel Information section	9~10

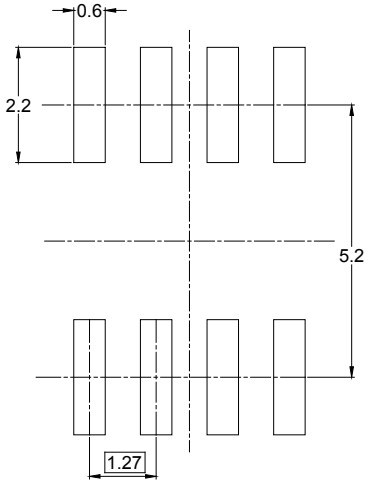
MAY 2011 – REV.A to REV.A.1	Page
Updated Package Description	All

Changes from Original (APRIL 2010) to REV.A	Page
Changed from product preview to production data	All

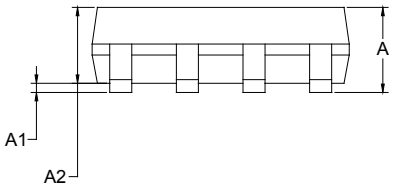
PACKAGE OUTLINE DIMENSIONS

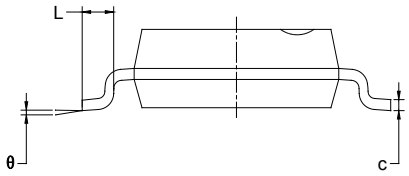
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

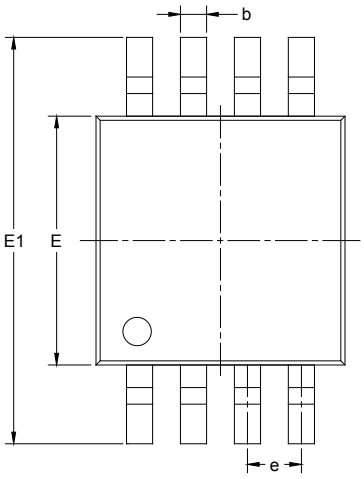


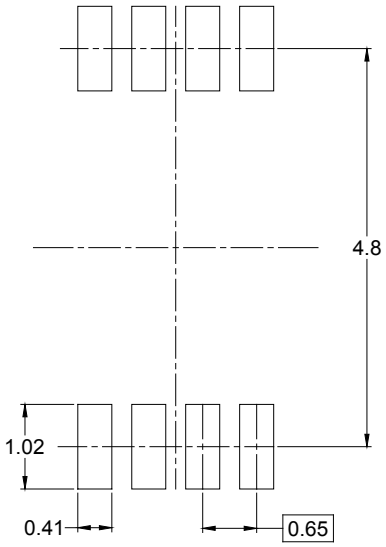


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

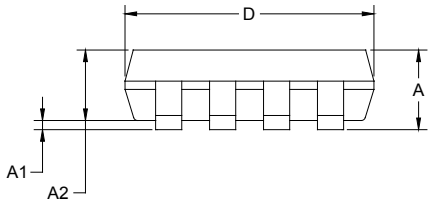
PACKAGE OUTLINE DIMENSIONS

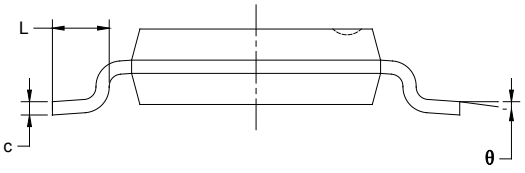
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

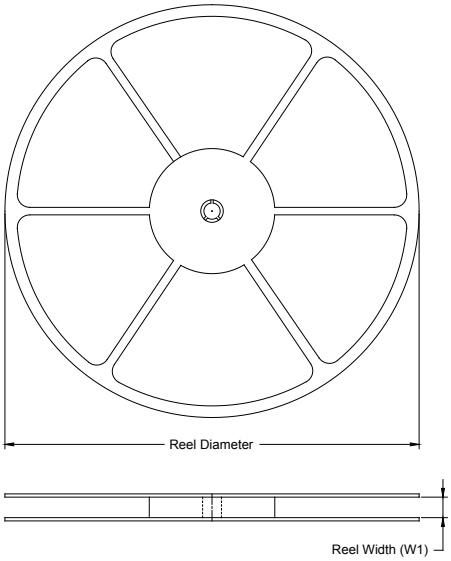




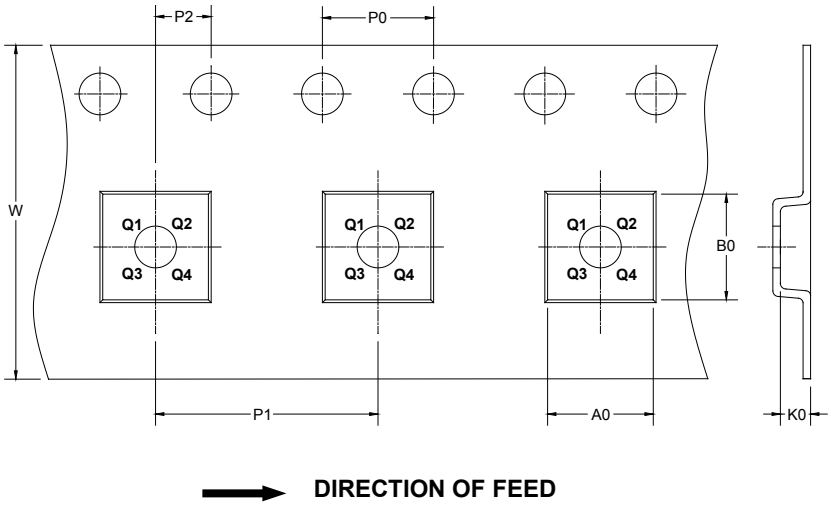
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



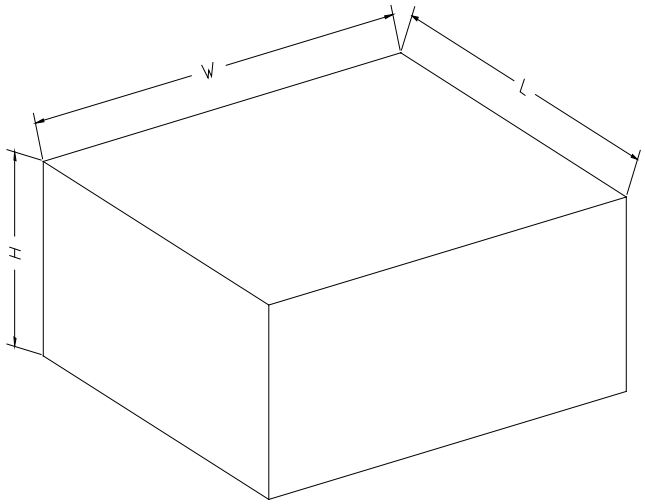
NOTE: The picture is only for reference. Please make the object as the standard.

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

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