SGM8422/4
2.4MHz, High Voltage, Rail-to-Rail I/O Operational Amplifiers

GENERAL DESCRIPTION

The SGM8422 (dual) and SGM8424 (quad) are low power, high voltage, rail-to-rail input and output operational amplifiers. These devices can operate from ±2.25V to ±15V dual power supplies or from +4.5V to +30V single supplies.

The SGM8422/4 have a gain-bandwidth product of 2.4MHz (TYP), while consuming only 0.72mA per amplifier. They also provide common mode input ability beyond the supply rails, as well as rail-to-rail output capability. This enables the SGM8422/4 to offer maximum dynamic range at any supply voltage.

The SGM8422/4 also feature fast slewing and settling times. These features make these amplifiers ideal for use as voltage reference buffers in Thin Film Transistor Liquid Crystal Displays (TFT-LCD). Other applications include battery power, portable devices, and anywhere low power consumption is important.

The SGM8422 comes in Green SOIC-8 and MSOP-8 packages. The SGM8424 is offered in Green TSSOP-14 and SOIC-14 packages. They are specified over the extended -40℃ to +85℃ temperature range.

FEATURES

- ±2.25V to ±15V Dual Power Supplies or +4.5V to +30V Single Supplies
- Gain-Bandwidth Product: 2.4MHz (TYP)
- Supply Current/Amplifier: 0.72mA
- High Slew Rate: 2V/µs
- Beyond the Rails Input Capability
- Rail-to-Rail Output Swing
- Small Packaging:
  SGM8422 Available in SOIC-8 and MSOP-8 Packages
  SGM8424 Available in TSSOP-14 and SOIC-14 Packages
- -40℃ to +85℃ Operating Temperature Range

APPLICATIONS

TFT-LCD Drive Circuits
Electronics Notebooks
Electronics Games
Touch-Screen Displays
Wireless LANs
Office Automation
Personal Communication Devices
Personal Digital Assistants (PDA)
Portable Instrumentation
A/D Converter Buffer
Active Filters
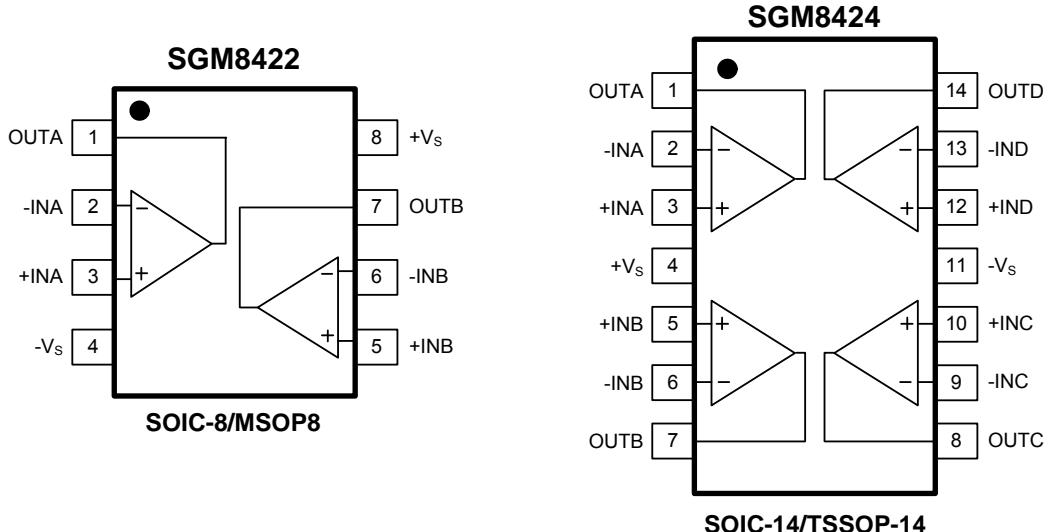
## PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8422	SGM8422YS8G/TR	SOIC-8	Tape and Reel, 2500	SGM 8422YS8 XXXXX
	SGM8422YMS8G/TR	MSOP-8	Tape and Reel, 3000	SGM8422 YMS8 XXXXX
SGM8424	SGM8424YS14G/TR	SOIC-14	Tape and Reel, 2500	SGM8424YS14 XXXXX
	SGM8424YTS14G/TR	TSSOP-14	Tape and Reel, 3000	SGM8424 YTS14 XXXXX

NOTE: **XXXXX** = Date Code and Vendor Code.

PIN CONFIGURATIONS (TOP VIEW)

SGM8422

SOIC-8/MSOP8

SGM8424

SOIC-14/TSSOP-14

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $+V_S$ to $-V_S$……………………….…………..…32V
Input Common Mode Voltage Range
…………………………………………($-V_S$) - 0.1V to ($+V_S$) + 0.1V
Input/Output Voltage Range…..……. ($-V_S$) - 0.3V to ($+V_S$) + 0.3V
Storage Temperature Range……………………-65℃ to +150℃
Junction Temperature……….……………………………….150℃
Operating Temperature Range……….………..-40℃ to +85℃
Lead Temperature (Soldering 10sec)
…………………………………………………………….……260℃
ESD Susceptibility
HBM (SGM8422)...3000V
HBM (SGM8424)...4000V
MM (SGM8422)... 150V
MM (SGM8424)...250V

NOTE:
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

ELECTRICAL CHARACTERISTICS: V_S = +5V

(At T_A = +25℃, R_L = 2kΩ connected to V_S/2, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		1.5	5.8	mV
		-40℃ ≤ T_A ≤ +85℃			6.1	
Input Offset Current (I_{OS})				10		pA
Input Bias Current (I_B)				10		pA
Common Mode Rejection Ratio (CMRR)		V_{CM} = -0.1V to +5.1V	54	65		dB
		-40℃ ≤ T_A ≤ +85℃	51			
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = +0.5V to +4.5V	80	105		dB
		-40℃ ≤ T_A ≤ +85℃	77			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	I_{OUT} = 70mA		1.12	1.46	V
		-40℃ ≤ T_A ≤ +85℃			1.79	
		R_L = 2kΩ		21	38	mV
		-40℃ ≤ T_A ≤ +85℃			43	
	V_{OL}	I_{OUT} = -70mA		1.09	1.43	V
		-40℃ ≤ T_A ≤ +85℃			1.87	
		R_L = 2kΩ		21	36	mV
		-40℃ ≤ T_A ≤ +85℃			43	
Output Short-Circuit Current (I_{SC})	Sink	R_L = 10Ω to V_S/2		73.4		mA
	Source	R_L = 10Ω to V_S/2		67.8		
POWER SUPPLY						
Power Supply Rejection Ratio (PSRR)		V_S = +4.5V to +30V, V_{CM} = V_S/2	85	102		dB
		-40℃ ≤ T_A ≤ +85℃	82			
Quiescent Current/Amplifier (I_Q)		I_{OUT} = 0A		0.66	0.90	mA
		-40℃ ≤ T_A ≤ +85℃			1.07	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		2.3		MHz
Slew Rate (SR)		V_{OUT} = 2V_{PP} step, A_V = 1		2		V/μs
Gain Margin		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		-8.9		dB
Phase Margin		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		49		°
Crosstalk		f = 1MHz		-74		dB
NOISE PERFORMANCE						
Voltage Noise Density (e_n)		f = 1kHz, V_{CM} = V_S/2		80		nV/$\sqrt{Hz}$
		f = 10kHz, V_{CM} = V_S/2		40		

ELECTRICAL CHARACTERISTICS: V_S = +15V

(At T_A = +25℃, R_L = 2kΩ connected to V_S/2, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		1.5	6.3	mV
		-40℃ ≤ T_A ≤ +85℃			6.6	
Input Offset Current (I_{OS})				10		pA
Input Bias Current (I_B)				10		pA
Common Mode Rejection Ratio (CMRR)		V_{CM} = -0.1V to +15.1V	61	73		dB
		-40℃ ≤ T_A ≤ +85℃	58			
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = +0.5V to +14.5V	91	113		dB
		-40℃ ≤ T_A ≤ +85℃	88			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	R_L = 2kΩ		56	101	mV
		-40℃ ≤ T_A ≤ +85℃			114	
	V_{OL}	R_L = 2kΩ		59	90	mV
		-40℃ ≤ T_A ≤ +85℃			104	
Output Current (I_{OUT})				80		mA
POWER SUPPLY						
Quiescent Current/Amplifier (I_Q)		I_{OUT} = 0A		0.68	0.93	mA
		-40℃ ≤ T_A ≤ +85℃			1.10	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		2.4		MHz
Slew Rate (SR)		V_{OUT} = 2V_{PP} step, A_V = 1		2		V/µs
Gain Margin		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		-6.7		dB
Phase Margin		R_L = 2kΩ, C_L = 100pF, V_{CM} = V_S/2		46		°
Crosstalk		f = 1MHz		-73		dB
NOISE PERFORMANCE						
Voltage Noise Density (e_n)		f = 1kHz, V_{CM} = V_S/2		73		nV/$\sqrt{Hz}$
		f = 10kHz, V_{CM} = V_S/2		40		

2.4MHz, High Voltage, Rail-to-Rail I/O Operational Amplifiers

ELECTRICAL CHARACTERISTICS: V$_S$ = ±15V
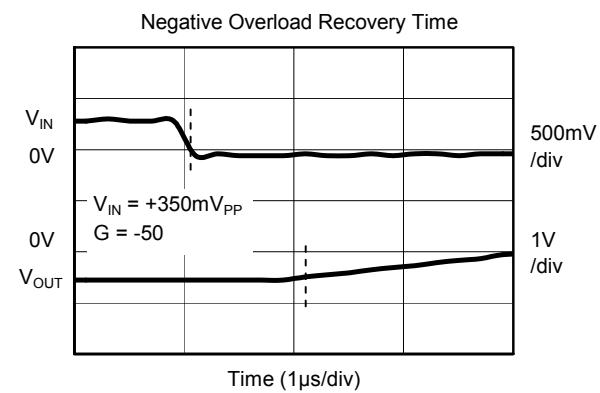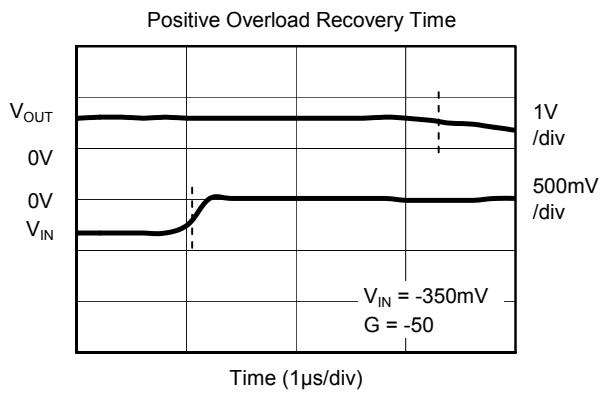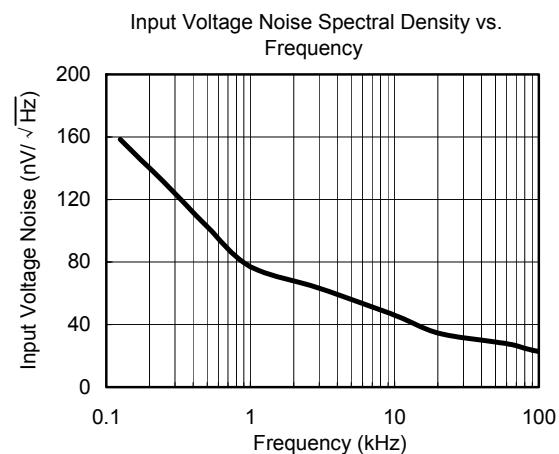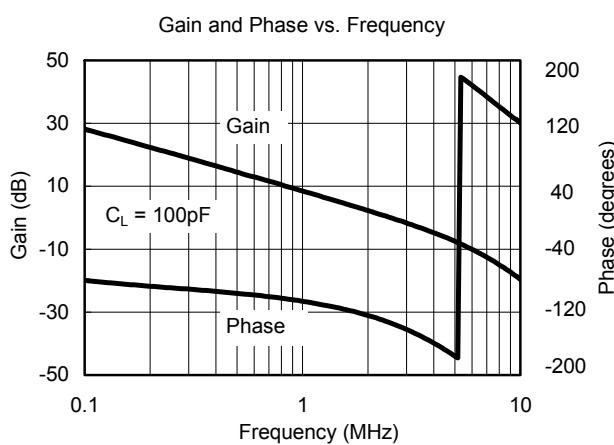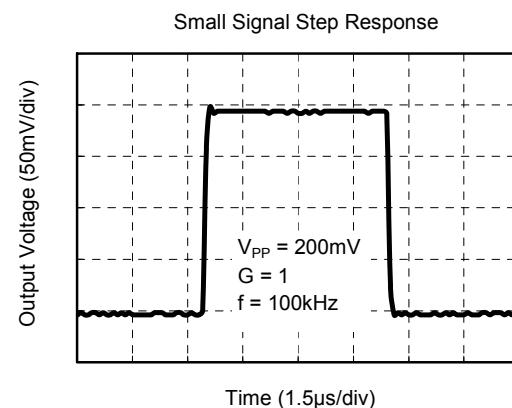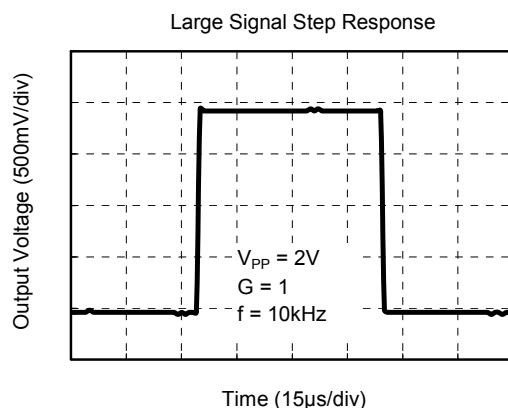
(At T$_A$ = +25℃, R$_L$ = 2kΩ connected to 0V, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V$_{OS}$)		V$_{CM}$ = 0V		1.5	6	mV
		-40℃ ≤ T$_A$ ≤ +85℃			6.3	
Input Offset Current (I$_{OS}$)				10		pA
Input Bias Current (I$_B$)				10		pA
Common Mode Rejection Ratio (CMRR)		V$_{CM}$ = -15.1V to +15.1V	69	81		dB
		-40℃ ≤ T$_A$ ≤ +85℃	66			
Open-Loop Voltage Gain (A$_{OL}$)		V$_{OUT}$ = -14.5V to +14.5V	94	115		dB
		-40℃ ≤ T$_A$ ≤ +85℃	91			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V$_{OH}$	R$_L$ = 2kΩ		129	195	mV
		-40℃ ≤ T$_A$ ≤ +85℃			225	
	V$_{OL}$	R$_L$ = 2kΩ		125	180	mV
		-40℃ ≤ T$_A$ ≤ +85℃			215	
Output Current (I$_{OUT}$)				80		mA
POWER SUPPLY						
Quiescent Current/Amplifier (I$_Q$)		I$_{OUT}$ = 0A		0.72	0.96	mA
		-40℃ ≤ T$_A$ ≤ +85℃			1.14	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R$_L$ = 2kΩ, C$_L$ = 100pF, V$_{CM}$ = 0V		2.4		MHz
Slew Rate (SR)		V$_{OUT}$ = 2V$_{PP}$ step, A$_V$ = 1		2		V/µs
Gain Margin		R$_L$ = 2kΩ, C$_L$ = 100pF, V$_{CM}$ = 0V		-8.6		dB
Phase Margin		R$_L$ = 2kΩ, C$_L$ = 100pF, V$_{CM}$ = 0V		48		°
Crosstalk		f = 1MHz		-73		dB
NOISE PERFORMANCE						
Voltage Noise Density (e$_n$)		f = 1kHz, V$_{CM}$ = 0V		74		nV/$\sqrt{Hz}$
		f = 10kHz, V$_{CM}$ = 0V		46		
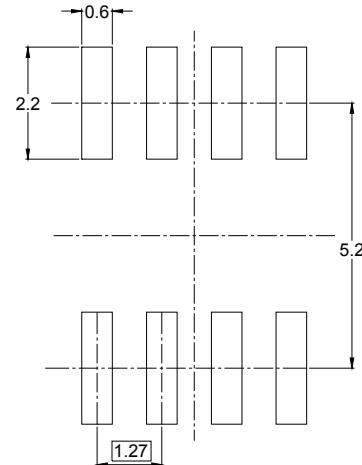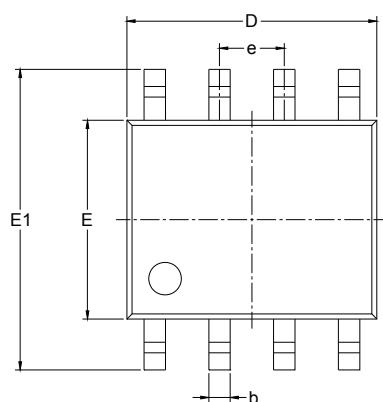
TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, V_S = ±15V, R_L = 2kΩ connected to 0V, unless otherwise noted.

Large Signal Step Response

V_{PP} = 2V
G = 1
f = 10kHz

Output Voltage (500mV/div)

Time (15µs/div)

Small Signal Step Response

V_{PP} = 200mV
G = 1
f = 100kHz

Output Voltage (50mV/div)

Time (1.5µs/div)

Gain and Phase vs. Frequency

Gain

Phase

C_L = 100pF

Gain (dB)

Phase (degrees)

Frequency (MHz)

Input Voltage Noise Spectral Density vs.
Frequency

Input Voltage Noise (nV/ $\sqrt{Hz}$)

Frequency (kHz)

Positive Overload Recovery Time

V_{OUT}

0V

0V

V_{IN}

1V
/div

500mV
/div

V_{IN} = -350mV
G = -50

Time (1µs/div)

Negative Overload Recovery Time

V_{IN}

0V

0V

V_{OUT}

500mV
/div

1V
/div

V_{IN} = +350mV_{PP}
G = -50

Time (1µs/div)

PACKAGE OUTLINE DIMENSIONS

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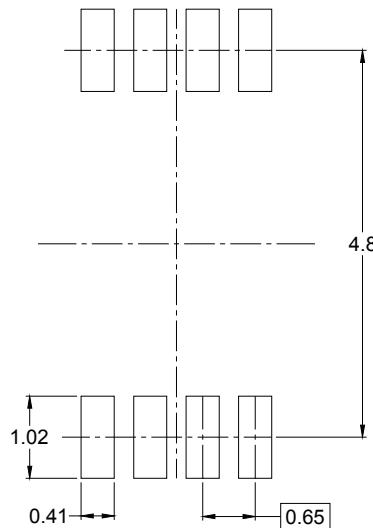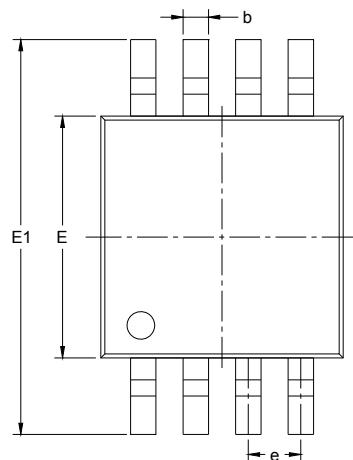
RECOMMENDED LAND PATTERN (Unit: mm)
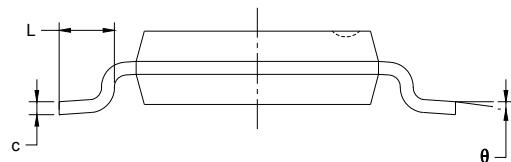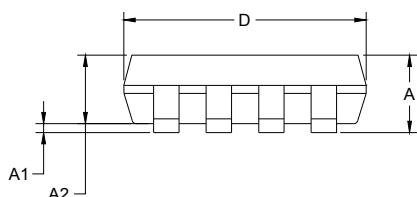
| Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8
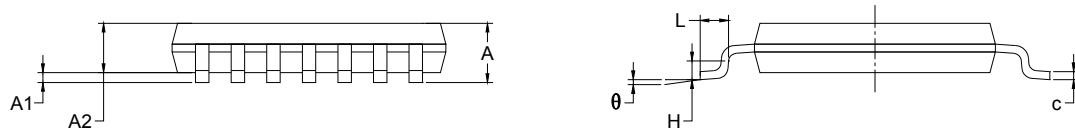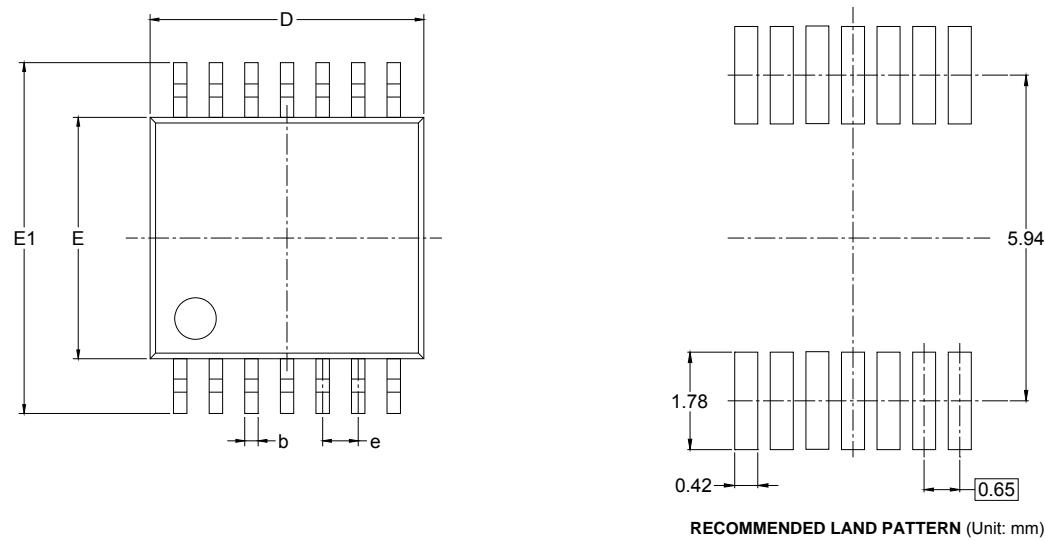
RECOMMENDED LAND PATTERN (Unit: mm)

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°

# PACKAGE OUTLINE DIMENSIONS

TSSOP-14

RECOMMENDED LAND PATTERN (Unit: mm)
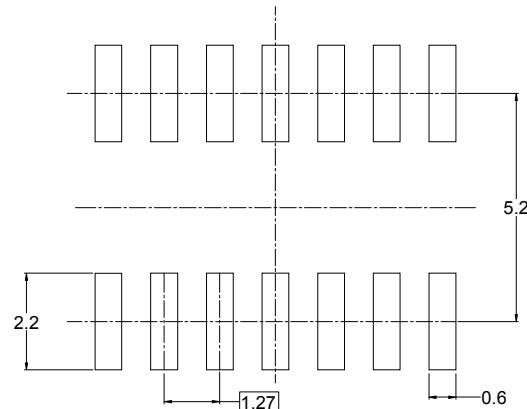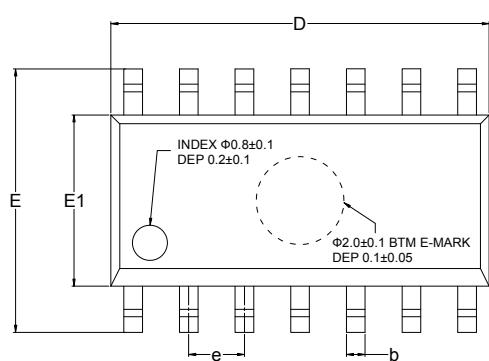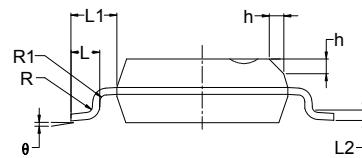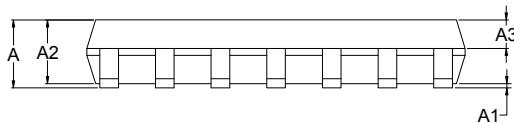
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

PACKAGE OUTLINE DIMENSIONS

SOIC-14
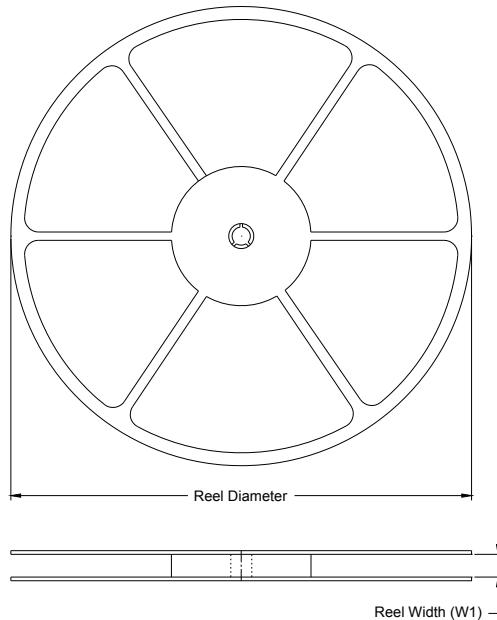
5.2

2.2

1.27

0.6

RECOMMENDED LAND PATTERN (Unit: mm)
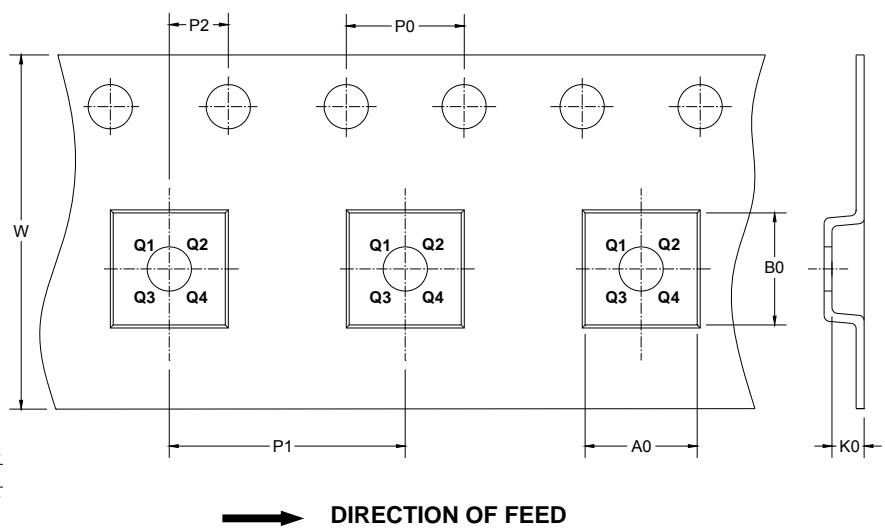
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	**MOD**	**MAX**	**MIN**	**MOD**	**MAX**
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.25		1.65	0.049		0.065
A3	0.55		0.75	0.022		0.030
b	0.36		0.49	0.014		0.019
D	8.53		8.73	0.336		0.344
E	5.80		6.20	0.228		0.244
E1	3.80		4.00	0.150		0.157
e		1.27 BSC			0.050 BSC	
L	0.45		0.80	0.018		0.032
L1		1.04 REF			0.040 REF	
L2		0.25 BSC			0.01 BSC	
R	0.07			0.003		
R1	0.07			0.003		
h	0.30		0.50	0.012		0.020
θ	0°		8°	0°		8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS
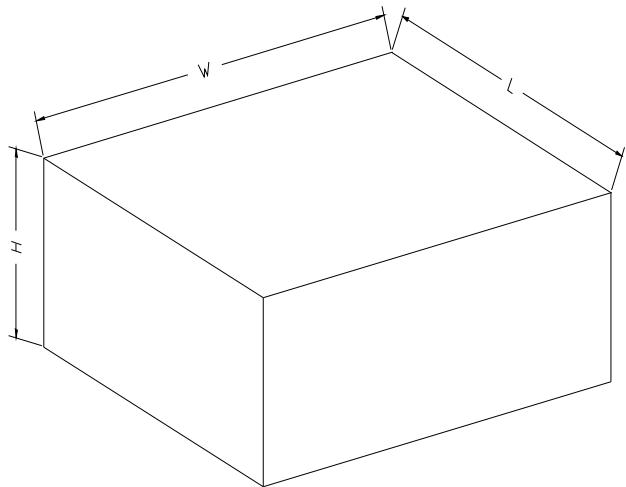
TAPE DIMENSIONS

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
SOIC-8	13″	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1
MSOP-8	13″	12.4	5.2	3.3	1.5	4.0	8.0	2.0	12.0	Q1
SOIC-14	13″	16.4	6.6	9.3	2.1	4.0	8.0	2.0	16.0	Q1
TSSOP-14	13″	12.4	6.95	5.6	1.2	4.0	8.0	2.0	12.0	Q1

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