



# SGM8558-1/SGM8558-2/SGM8558-3/SGM8558-4

## 14MHz, 8.5V/ $\mu$ s, High-Output-Drive, Rail-to-Rail I/O

### High Precision, Low Noise Operational Amplifiers

## GENERAL DESCRIPTION

The SGM8558-1 (single), SGM8558-2 (dual), SGM8558-3 (single with shutdown) and SGM8558-4 (quad) high-output-drive CMOS operational amplifiers feature a peak output current of 232mA, rail-to-rail input and output capability from a single 2.7V to 5.5V supply. These amplifiers exhibit a high slew rate of 8.5V/ $\mu$ s and a gain-bandwidth product (GBP) of 14MHz. The SGM8558-1/2/3/4 can drive typical headset levels (32 $\Omega$ ), as well as bias an RF power amplifier in wireless handset applications.

These operational amplifiers are designed to be part of the power amplifier control circuitry, biasing RF power amplifiers in wireless headsets. The SGM8558-3 offers a shutdown feature that drives the output low. This ensures that the RF power amplifier is fully disabled when needed, preventing unconverted signals to the RF antenna.

The SGM8558-1/2/3/4 offer low input offset voltage, low input offset voltage drift, wide bandwidth and high-output drive.

The SGM8558-1 is available in Green SOIC-8 and SOT-23-5 packages. The SGM8558-2 is available in Green TDFN-3 $\times$ 3-8L, SOIC-8 and WLCSP-1.45 $\times$ 1.45-8B packages. The SGM8558-3 is available in Green SOT-23-6 package. The SGM8558-4 is available in Green SOIC-14 package. They operate over an ambient temperature range of -40 $^{\circ}$ C to +125 $^{\circ}$ C.

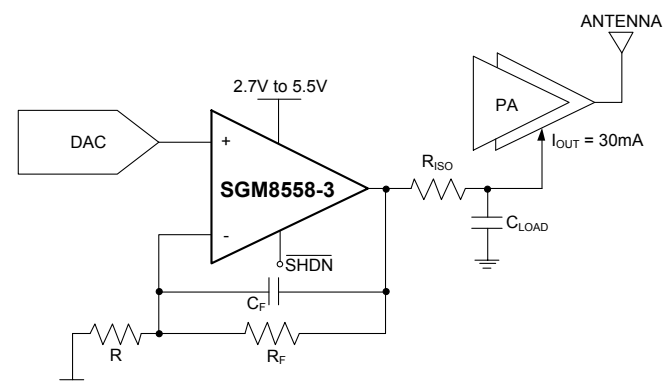
## APPLICATIONS

RF Power Amplifier Biasing Controls  
 Portable/Battery-Powered Audio Applications  
 Portable Headphone Speaker Drivers (32 $\Omega$ )  
 Audio Hands-Free Car Phones (Kits)  
 Laptop/Notebook Computers/TFT Panels  
 Sound Ports/Cards  
 Set-Top Boxes  
 Digital-to-Analog Converter Buffers  
 Transformer/Line Drivers  
 Motor Drivers

## FEATURES

- 232mA Output Drive Capability
- Rail-to-Rail Input and Output
- Low Input Offset Voltage: -5 $\mu$ V
- Low Noise: 7.5nV/ $\sqrt{\text{Hz}}$
- 232mA Current Limitation
- Over-Temperature Protection
- Supply Voltage Range: 2.7V to 5.5V
- Supply Current:
  - 0.85mA/Amplifier
  - 0.5 $\mu$ A Shutdown Current for SGM8558-3
- Gain-Bandwidth Product: 14MHz
- High Slew Rate: 8.5V/ $\mu$ s
- Voltage Gain ( $R_L = 2\text{k}\Omega$ ): 120dB
- Power Supply Rejection Ratio: 110dB
- No Phase Reversal for Overdriven Inputs
- Unity-Gain Stable for Capacitive Loads to 780pF
- Small Packaging:
  - SGM8558-1 Available in Green SOIC-8 and SOT-23-5 Packages
  - SGM8558-2 Available in Green TDFN-3 $\times$ 3-8L, SOIC-8 and WLCSP-1.45 $\times$ 1.45-8B Packages
  - SGM8558-3 Available in Green SOT-23-6 Package
  - SGM8558-4 Available in Green SOIC-14 Package

## TYPICAL APPLICATION



**PACKAGE/ORDERING INFORMATION**

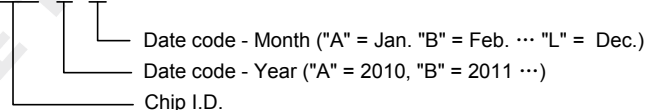
MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8558-1	SOIC-8	-40°C to +125°C	SGM8558-1XS8G/TR	SGM 85581XS8 XXXXX	Tape and Reel, 2500
	SOT-23-5	-40°C to +125°C	SGM8558-1XN5G/TR	GFBXX	Tape and Reel, 3000
SGM8558-2	TDFN-3x3-8L	-40°C to +125°C	SGM8558-2XTDB8G/TR	SGM 85582DB XXXXX	Tape and Reel, 4000
	SOIC-8	-40°C to +125°C	SGM8558-2XS8G/TR	SGM 85582XS8 XXXXX	Tape and Reel, 2500
	WLCSP-1.45x1.45-8B	-40°C to +125°C	SGM8558-2XG/TR	XXXXX 85582	Tape and Reel, 3000
SGM8558-3	SOT-23-6	-40°C to +125°C	SGM8558-3XN6G/TR	GFCXX	Tape and Reel, 3000
SGM8558-4	SOIC-14	-40°C to +125°C	SGM8558-4XS14G/TR	SGM85584XS14 XXXXX	Tape and Reel, 2500

NOTE: XX = Date Code. 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.

**MARKING INFORMATION**

**GYX X X**



For example: GFBFA (2015, January)

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage, +V<sub>S</sub> to -V<sub>S</sub> ..... 6V  
 All Other Pins..... (-V<sub>S</sub> - 0.3V) to (+V<sub>S</sub> + 0.3V)  
 Junction Temperature.....+150°C  
 Storage Temperature Range.....-65°C to +150°C  
 Lead Temperature (Soldering, 10s).....+260°C

**RECOMMENDED OPERATING CONDITIONS**

Operating Temperature Range.....-40°C to +125°C  
 Operating Supply Voltage Range .....2.7V to 5.5V

**OVERSTRESS CAUTION**

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

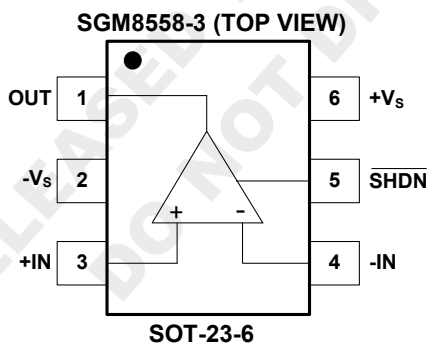
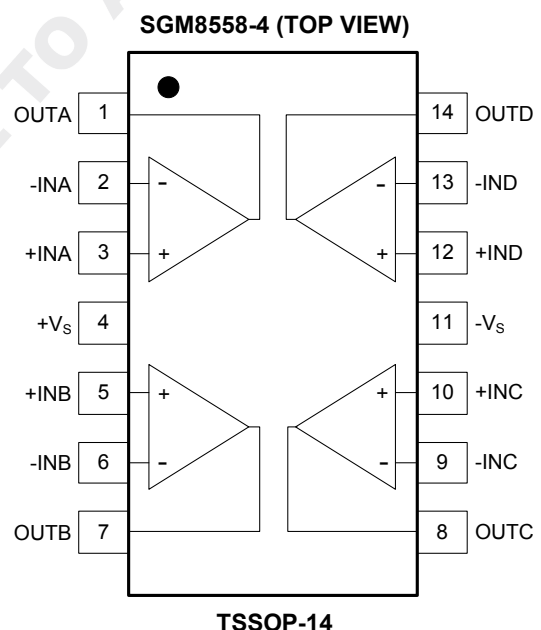
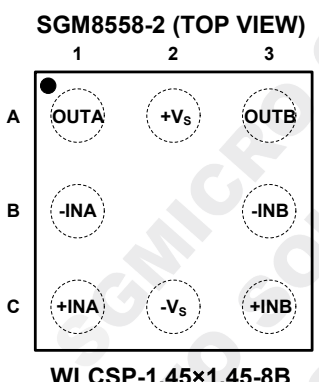
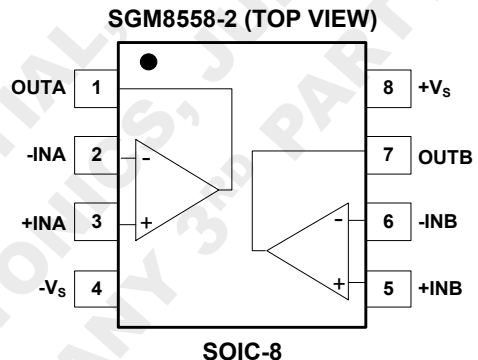
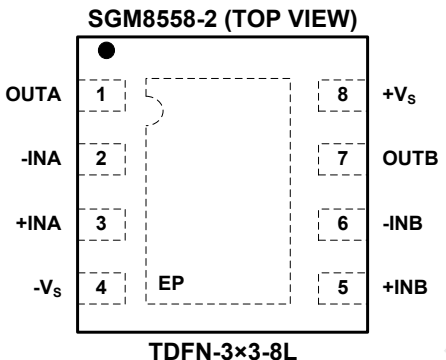
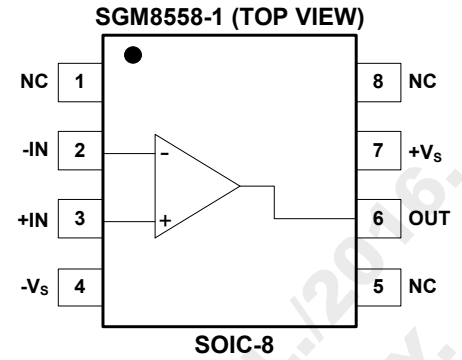
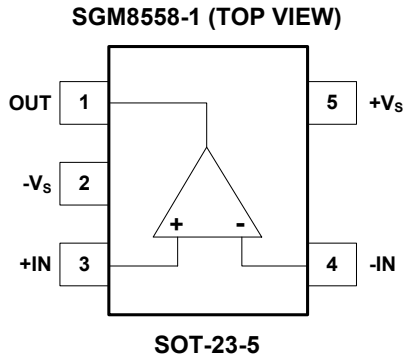
**ESD SENSITIVITY CAUTION**

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, specification or other related things if necessary without notice at any time.

**PIN CONFIGURATIONS**



NOTE: For all packages, connect thermal die pad to -Vs or floating. Soldering the thermal pad improves heat dissipation and provides specified performance.

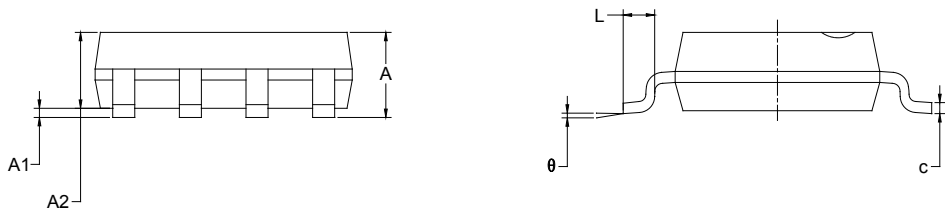
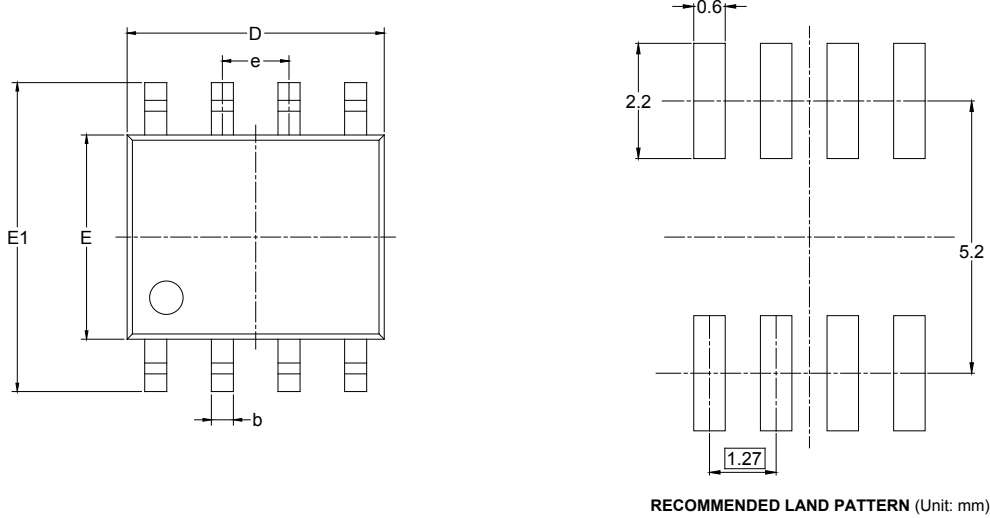
## ELECTRICAL CHARACTERISTICS

( $+V_S = 2.7V$ ,  $-V_S = 0V$ ,  $V_{CM} = +V_S/2$ ,  $V_{OUT} = +V_S/2$ ,  $R_L = \infty$  connected to  $+V_S/2$ ,  $V_{\overline{SHDN}} = +V_S$ . Typical values are at  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage Range	$+V_S$	Inferred from PSRR test		2.7		5.5	V
Input Offset Voltage	$V_{OS}$				-5		$\mu$ V
Input Bias Current	$I_B$	$V_{CM} = +V_S/2$			40		pA
Input Offset Current	$I_{OS}$	$V_{CM} = +V_S/2$			40		pA
Input Resistance	$R_{IN}$				1000		M $\Omega$
Input Common Mode Voltage Range	$V_{CM}$	Inferred from CMRR test		$-V_S$		$+V_S$	V
Common Mode Rejection Ratio	CMRR	$-V_S < V_{CM} < +V_S$			100		dB
Power Supply Rejection Ratio	PSRR	$+V_S = 2.7V$ to 5.5V			110		dB
Large-Signal Voltage Gain	$A_{VOL}$	$-V_S + 0.2V < V_{OUT} < +V_S - 0.2V$ , $R_L = 2k\Omega$			120		dB
Output Voltage Swing	$V_{OUT}$	$R_L = 2k\Omega$	$+V_S - V_{OH}$		5		mV
			$V_{OL} - (-V_S)$		4.6		
Output Source/Sink Current	$I_{OUT}$	$+V_S = 2.7V$			116		mA
		$+V_S = 5V$			232		
Output Voltage		$I_L = 10mA$	$+V_S = 2.7V$	$+V_S - V_{OH}$		72	mV
				$V_{OL} - (-V_S)$		68	
Quiescent Supply Current/Amplifier	$I_Q$	$+V_S = 5V$ , $V_{CM} = +V_S/2$			0.85		mA
		$+V_S = 2.7V$ , $V_{CM} = +V_S/2$			0.82		
Gain-Bandwidth Product	GBP	$+V_S = 5V$ , $V_{CM} = +V_S/2$			14		MHz
Slew Rate	SR	$+V_S = 5V$ ,			8.5		V/ $\mu$ s
Total Harmonic Distortion + Noise	THD+N	$+V_S = 5V$ , $f = 10kHz$ , $V_{OUT} = 2V_{P-P}$ , $A_{VCL} = 1V/V$			0.0015		%
Input Capacitance	$C_{IN}$	$+V_S = 5V$ ,			20		pF
Input Voltage Noise Density	$e_n$	$+V_S = 5V$ , $f = 1kHz$			7.5		nV/ $\sqrt{Hz}$
		$+V_S = 5V$ , $f = 10kHz$			8.5		
Channel-to-Channel Isolation		$+V_S = 5V$ , $f = 1kHz$ , $R_L = 100k\Omega$			125		dB
Capacitive-Load Stability		$+V_S = 5V$ , $A_{VCL} = 1V/V$ , no sustained oscillations			780		pF
Power-Up Time	$t_{ON}$	$+V_S = 5V$ ,			50		$\mu$ s
<b>POWER-DOWN DISABLE (SGM8558-3 Only)</b>							
Shutdown Supply Current	$I_{Q(SHDN)}$	$V_{\overline{SHDN}} = 0V$ , $R_L = \infty$		$+V_S = 5V$		0.5	$\mu$ A
				$+V_S = 2.7V$		0.1	
$\overline{SHDN}$ Logic Threshold	$V_{IL}$	Shutdown Mode				0.8	V
	$V_{IH}$	Normal Mode			$+V_S \times 0.57$		
$\overline{SHDN}$ Input Bias Current		$-V_S < V_{\overline{SHDN}} < +V_S$			50		pA
Shutdown Output Impedance	$R_{OUT}$	$V_{\overline{SHDN}} = 0V$			10		$\Omega$
Output Voltage in Shutdown	$V_{OUT(SHDN)}$	$V_{\overline{SHDN}} = 0V$ , $R_L = 200\Omega$			10		mV
Shutdown Time	$t_{SHDN}$				7		$\mu$ s
Enable Time	$t_{ENABLE}$				10		$\mu$ s
Power-Up Time	$t_{ON}$				50		$\mu$ s

PACKAGE OUTLINE DIMENSIONS

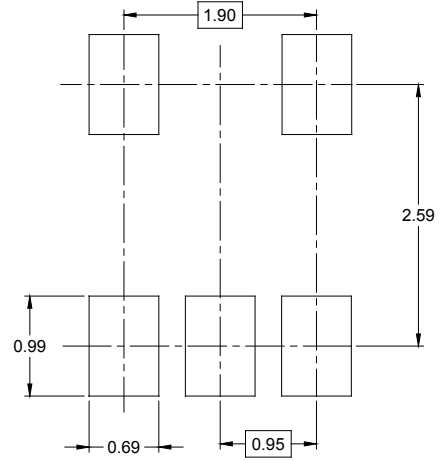
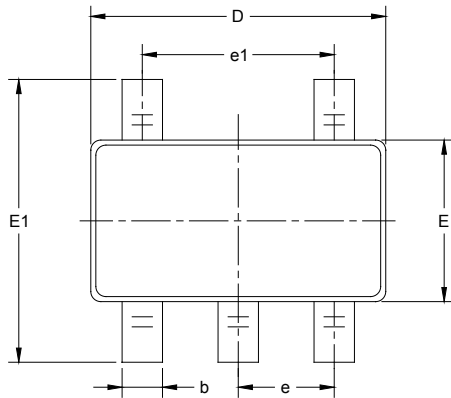
SOIC-8



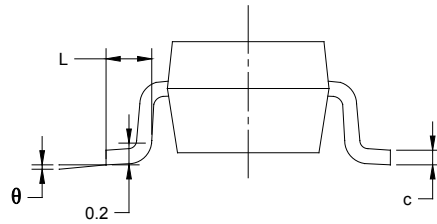
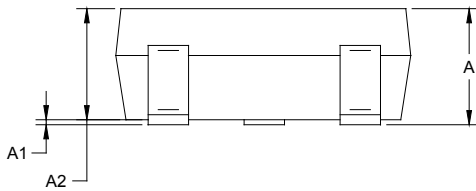
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



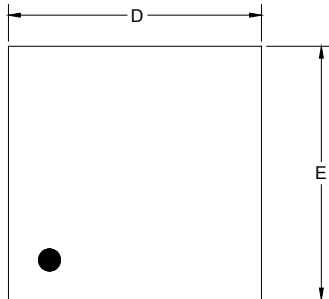
RECOMMENDED LAND PATTERN (Unit: mm)



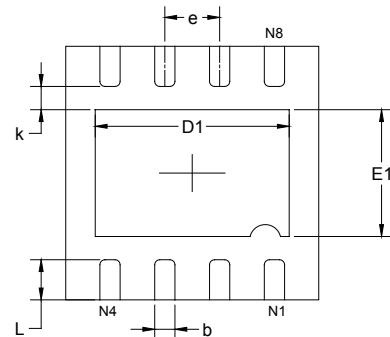
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

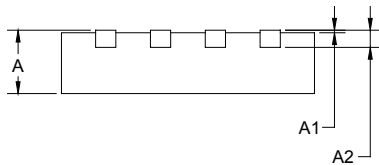
TDFN-3x3-8L



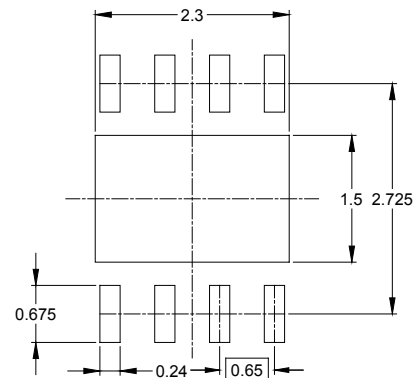
TOP VIEW



BOTTOM VIEW



SIDE VIEW

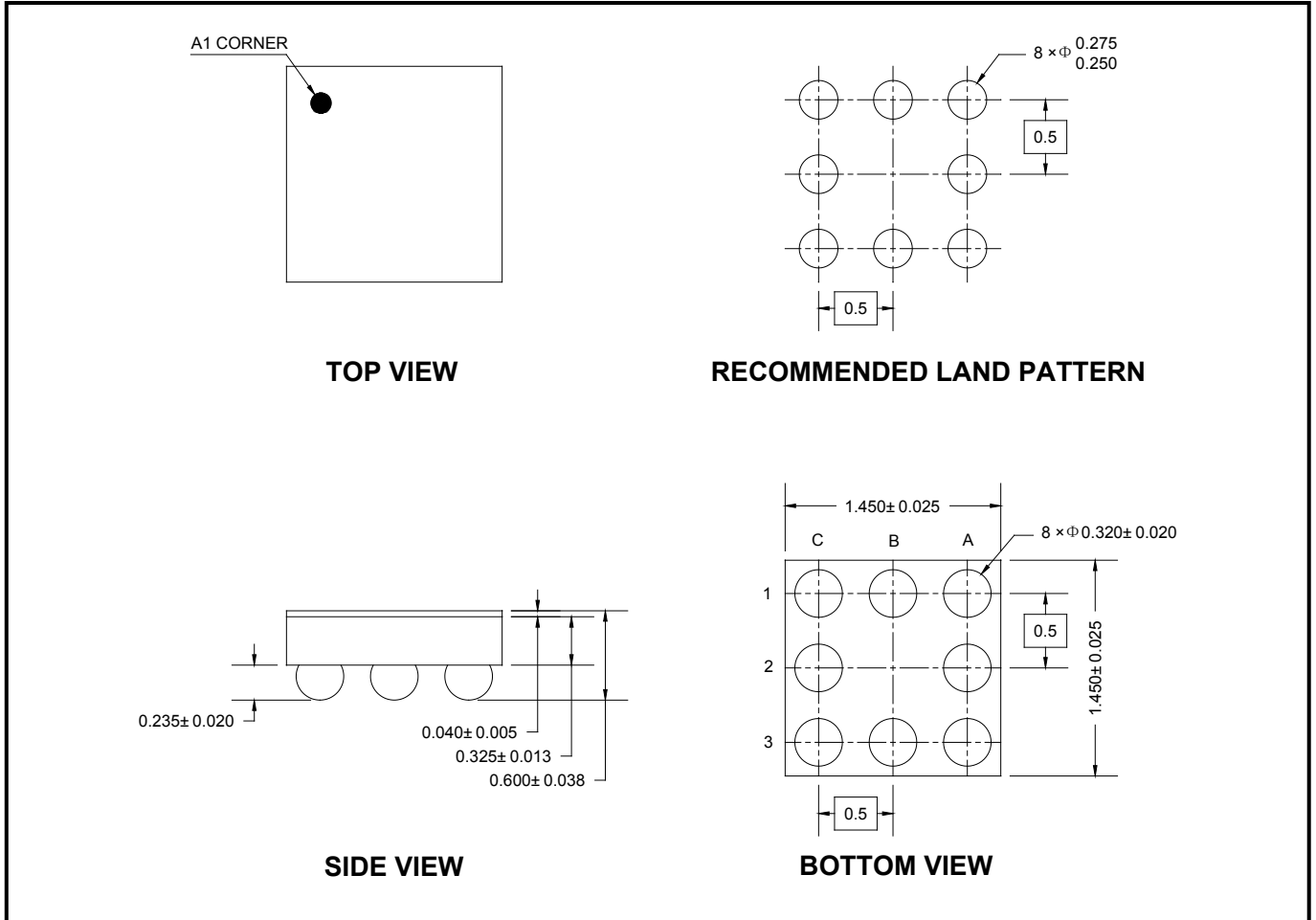


RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.200	2.400	0.087	0.094
E	2.900	3.100	0.114	0.122
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.375	0.575	0.015	0.023

PACKAGE OUTLINE DIMENSIONS

WLCSP-1.45×1.45-8B

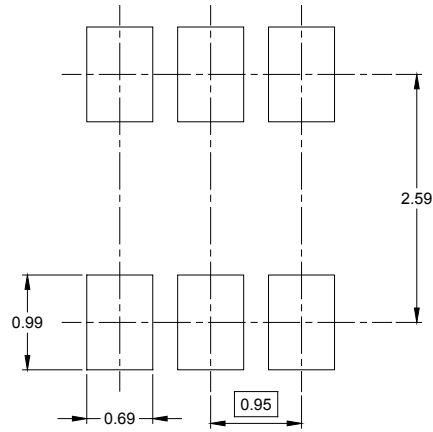
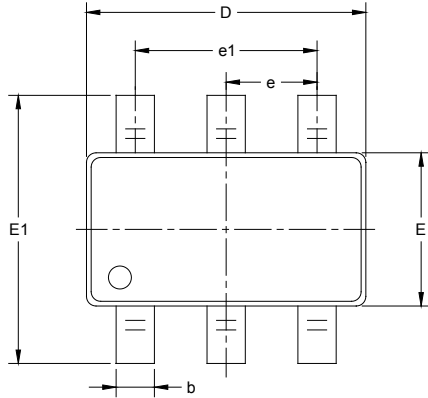


NOTE: All linear dimensions are in millimeters.

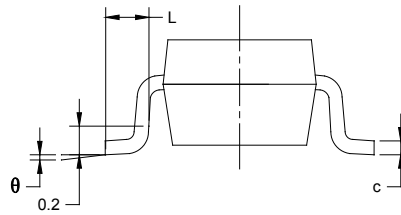
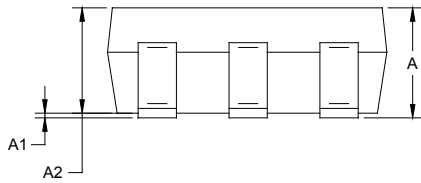


PACKAGE OUTLINE DIMENSIONS

SOT-23-6



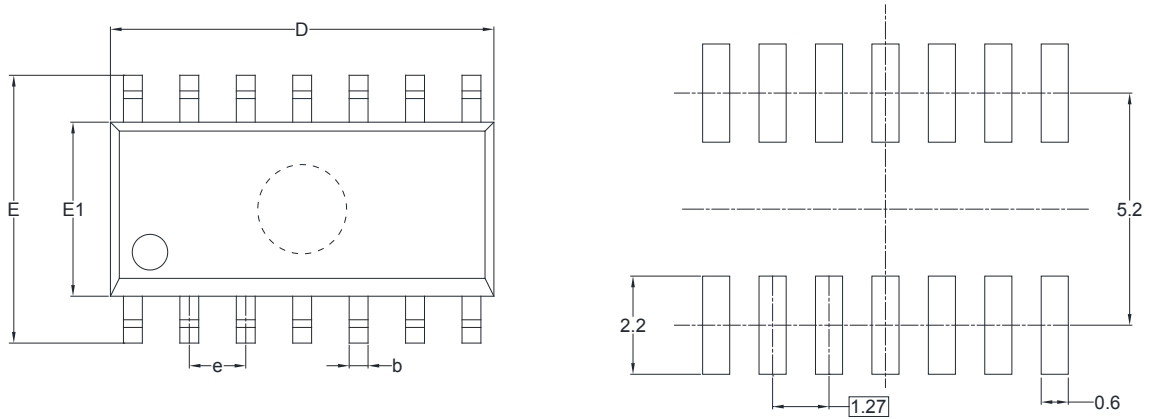
RECOMMENDED LAND PATTERN (Unit: mm)



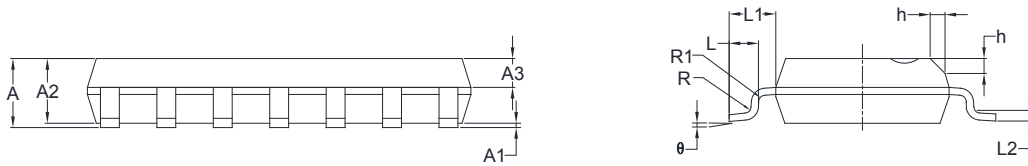
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	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°

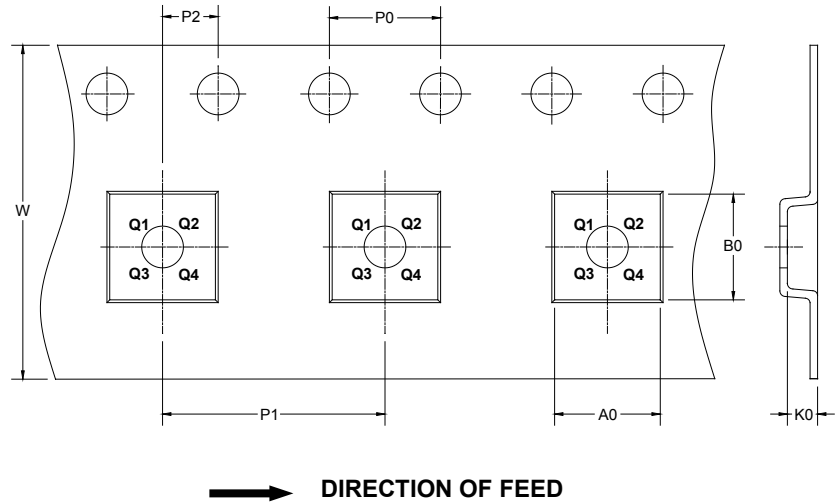
# PACKAGE INFORMATION

## 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
SOT-23-5	7"	9.5	3.2	3.2	1.4	4.0	4.0	2.0	8.0	Q3
SOT-23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
SOIC-8	13"	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1
TDFN-3×3-8L	13"	12.4	3.35	3.35	1.13	4.00	8.00	2.00	12.00	Q1
WLCSP-1.45×1.45-8B	7"	9.5	1.61	1.61	0.7	4	4	2	8	Q1
SOIC-14	13"	16.4	6.6	9.3	2.1	4.0	8.0	2.0	16.0	Q1

D00001

# 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
13"	386	280	370	5

DD0002