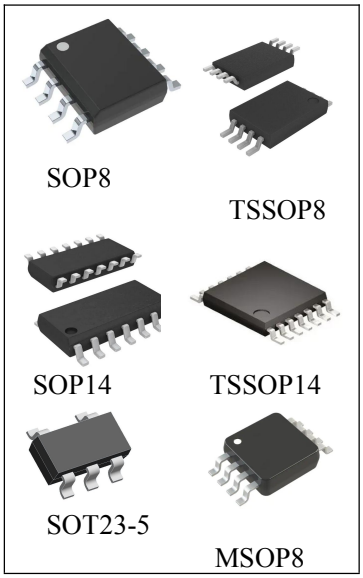
D8541/2/4

1MHz, 40μA, Rail-to-Rail I/O, CMOS Operational Amplifiers

General Description

The D8541(single), D8542(dual) and D8544(quad) are rail-to-rail input and output voltage feedback amplifiers offering low cost. They have a wide input common-mode voltage range and output voltage swing, and take the minimum operating supply voltage down to 1.8V and the maximum recommended supply voltage is 5.5 V. All are specified over the extended – 40°C to +125°C temperature range.



The D8541/2/4 provide 1MHz bandwidth at a low current consumption of 40μA per amplifier. Very low input bias currents of 10pA, enable D8541/2/4 to be used for integrators, photodiode amplifiers, and piezoelectric sensors. Rail-to-rail inputs and outputs are useful to designers buffering ASIC in single-supply systems.

Applications for the series amplifiers include safety monitor, portable equipment, battery and power supply control, and signal conditioning and interfacing for transducers in very low power systems

The D8541 is available in SOT23-5 and SOP8 package.

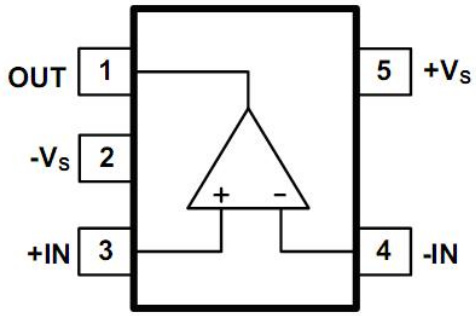
The D8542 is available in SOP8, MSOP8 and TSSOP8 package.

The D8544 is available in SOP14 and TSSOP14 package.

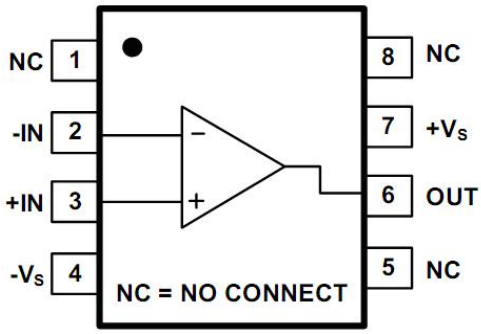
Features

- Low Cost
- Rail-to-Rail Input and Output
- Input Offset Voltage: 0.8mV(Type)
- Unity Gain Stable
- Gain Bandwidth Product: 1MHz
- Very Low Input Bias Currents: 10pA
- Operates on 1.8 V to 5.5 V Supplies
- Input Voltage Range: -0.1 V to +5.6 V with V_S = 5.5 V
- Low Supply Current: 40μA/Amplifier

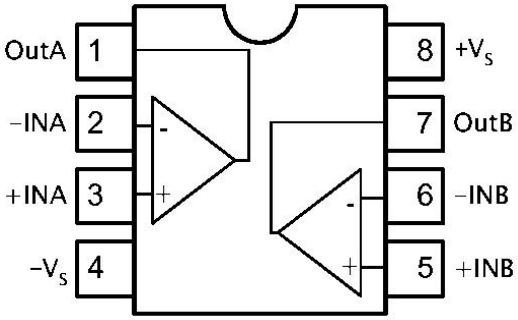
Block Diagram and Pin Configuration



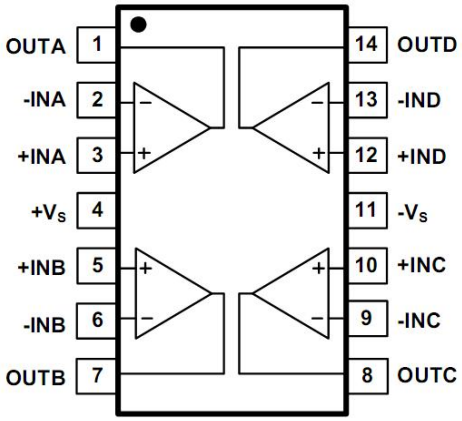
D8541(SOT23-5)



D8541(SOP8)



D8542/(SOP8/MSOP8/TSSOP8)



D8544/(SOP14/TSSOP14)

Package Information

Part No.	Package Description	Package Marking	Package Option
D8541	SOT23-5	D8541 SXXXX	3000/Reel
D8541	SOP8	CHMC D8541 SXXXX	4000/Reel 100/Tube
D8542	SOP8/MSOP8/TSSOP8	CHMC D8542 SXXXX	4000/Reel 100/Tube
D8544	SOP14	CHMC SXXXX D8544	50/Tube 4000/Reel
D8544	TSSOP14	CHMC D8544 SXXXX	60/Tube 3000/Reel

CHMC:Trademark D8541/D8542/D8544:Part NO. SXXXX:Lot NO.

Recommended Operating Conditions

Parameter	Min	Max	Unit
Operating Temperature Range	-40	+125	°C
Power Supply Operating Range	1.8	5.5	V

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Power Supply Voltage	0	+7.5	V
Maximum Junction Temperature		+160	°C
Input Voltage Range	-Vs-0.5	+Vs+0.5	V
Operating Temperature Range	-40	+125	°C
Storage Temperature Range	-65	+150	°C
Lead Temperature, 10 seconds		+260	°C

Electrical Characteristics (Vs=5V, R_L=100kΩ to Vs/2, V_{Out}=Vs/2; unless otherwise noted)

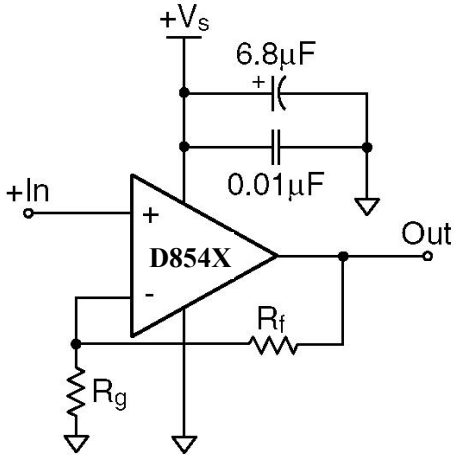
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
AC Performance						
Gain Bandwidth Product	GBP	C_L=100pF		1.0		MHz
Phase Margin	PM			52		Deg
Gain Margin	GM			17		dB
Slew Rate	SR	Vo=1Vpp		0.52		V/μs
Input Voltage Noise	e_n	>50kHz		36		nV/Hz
DC Performance						
Input Offset Voltage	V_{OS}			±0.8	±3.0	mV
Input Bias Current	I_B			10		pA
Input Offset Current	I_{OS}			10		pA
Power Supply Rejection Ratio	PSRR	Vs=+2.5V～+5.5V	60	82		dB
Supply Current (per)	I_Q			40	90	μA
Input Characteristics						
Input Common Mode Voltage Range	V_{CM}	Vs=5.5V	-0.1		5.6	V
Common Mode Rejection Ratio	CMRR	Vs=5.5V Vo=0.1～4.9V	56	68		dB
Output Characteristics						
Output Voltage Swing from Rail	Vo	R_L=100kΩ		0.008		V
Output Current	I_S	R_L=100kΩ	20	23		mA

Application Summary

Data Sheet

The D8541/2/4 family are single supply, general purpose, voltage-feedback amplifiers that are pin-for-pin compatible and drop in replacements with other industry standard D8541/2/4 amplifier. The D8541/2/4 is fabricated on a CMOS process, features a rail-to-rail output, and is unity gain stable.

The typical non-inverting circuit schematic is shown in Figure below:

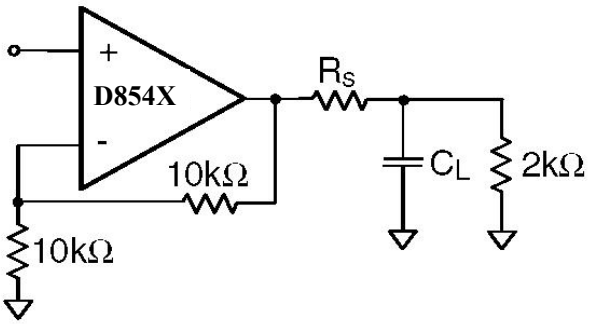


Typical Non-inverting configuration

Power Dissipation

The maximum internal power dissipation allowed is directly related to the maximum junction temperature. If the maximum junction temperature exceeds 150°C, some performance degradation will occur. If the maximum junction temperature exceeds 175°C for an extended time, device failure may occur.

Driving Capacitive Loads

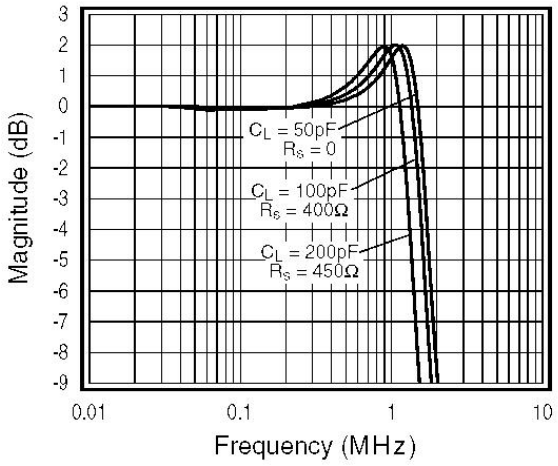


The Frequency Response vs C_L plot illustrates the response of the D8541/2/4 . A small series resistance (Rs) at the output of the amplifier, illustrated in Figure below, will improve stability and settling performance. Rs values in the Frequency Response vs C_L plot were chosen to achieve maximum bandwidth with less than 1dB of peaking. For maximum flatness, use a larger Rs. As the plot indicates, the D8541/2/4 family can easily drive a

200pF capacitive load without a series resistance.

Driving a capacitive load introduces phase-lag into the output signal, which reduces phase margin in the amplifier. The unity gain follower is the most sensitive configuration.

The response is illustrated in Figure below:



Frequency Response vs C_L for unity gain configuration

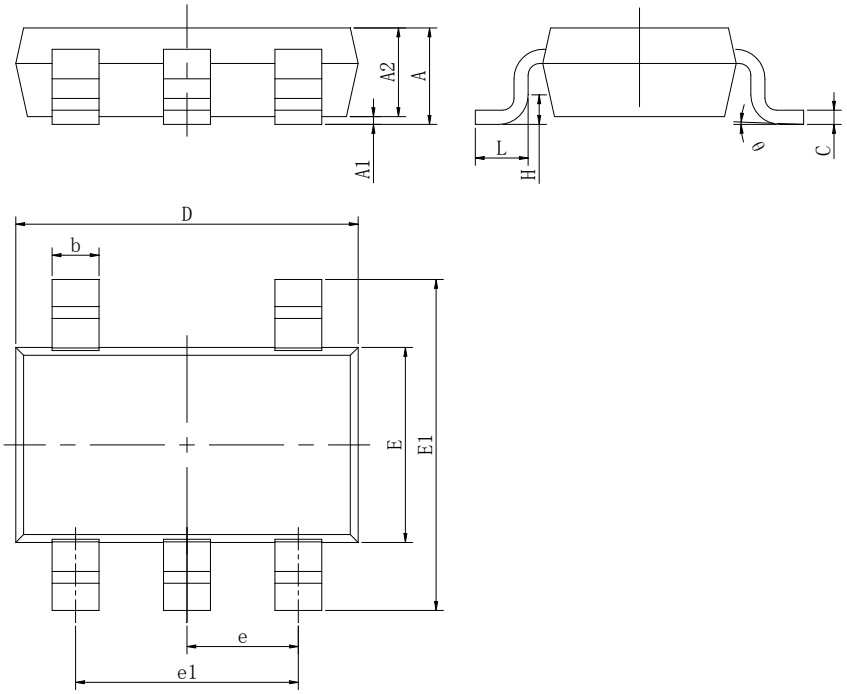
Layout Considerations

General layout and supply bypassing play major roles in high frequency performance. Follow the steps below as a basis for high frequency layout:

- Include 6.8μF and 0.01μF ceramic capacitors
- Place the 6.8μF capacitor within 0.75 inches of the power pin
- Place the 0.01μF capacitor within 0.1 inches of the power pin
- Remove the ground plane under and around the part, especially near the input and output pins to reduce parasitic capacitance
- Minimize all trace lengths to reduce series inductances

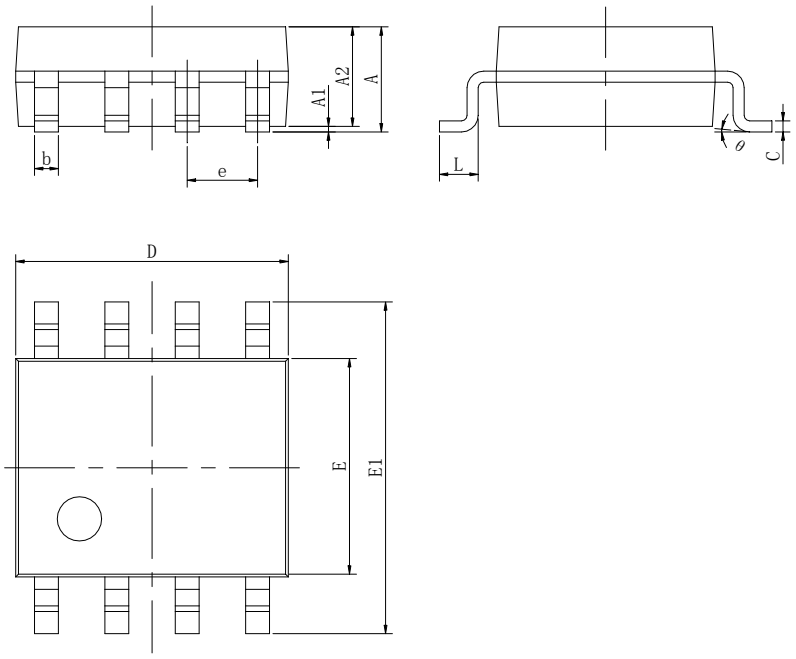
Outline Dimensions

SOT23-5 Unit: mm



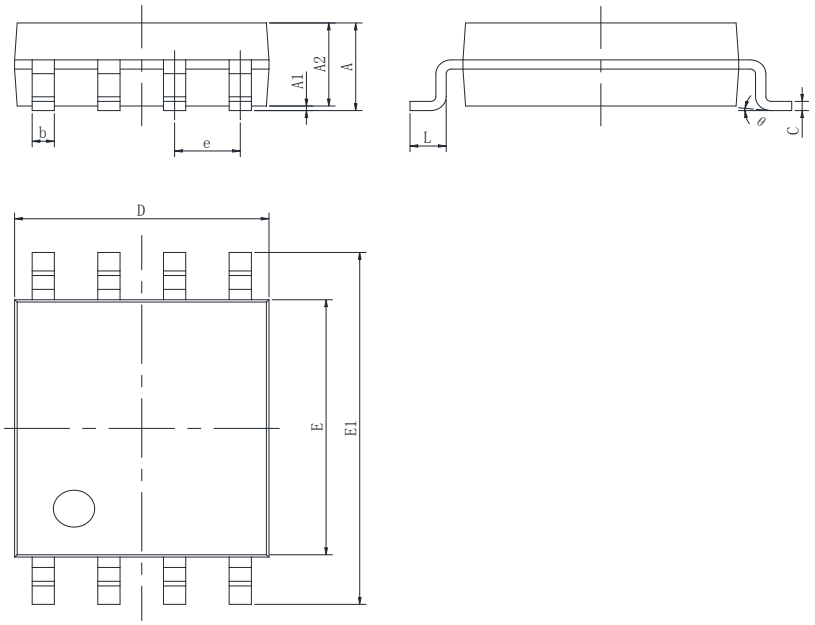
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	1.050	1.250	0.041	0.049
A1	0.000	0.130	0.000	0.005
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.95（BSC）		0.037(BSC)	
e1	1.90（BSC）		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOP8 Unit: mm



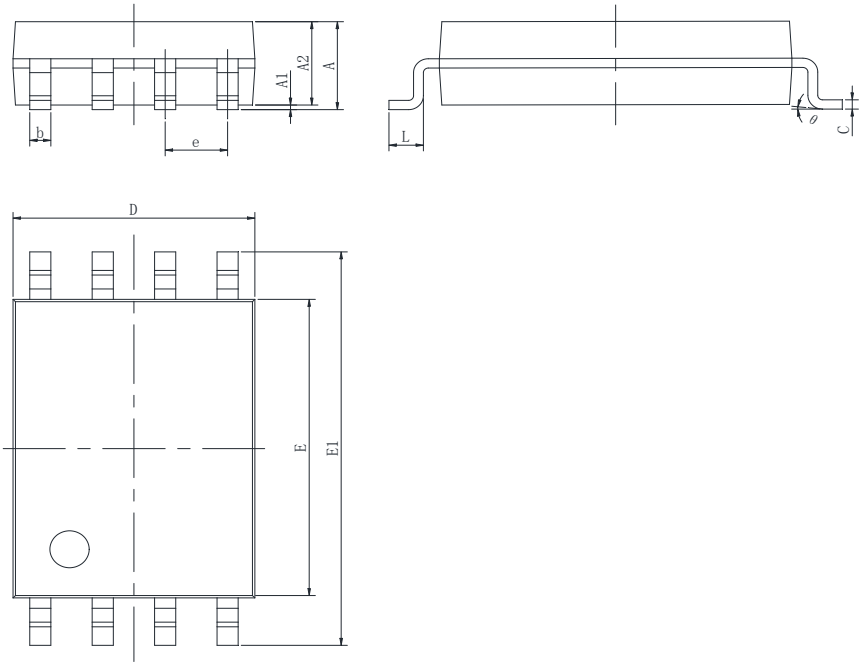
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.800	0.053	0.071
A1	0.000	0.250	0.000	0.010
A2	1.250	1.550	0.053	0.061
b	0.300	0.510	0.011	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

MSOP8 Unit: mm



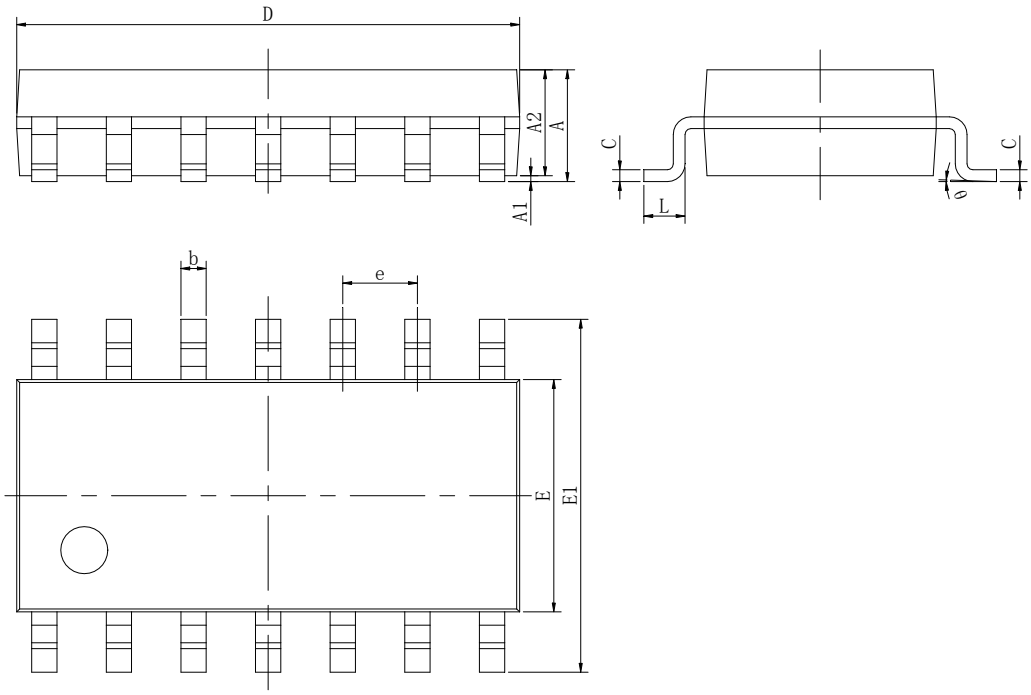
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650(BSC)		0.026(BSC)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

TSSOP8 Unit: mm



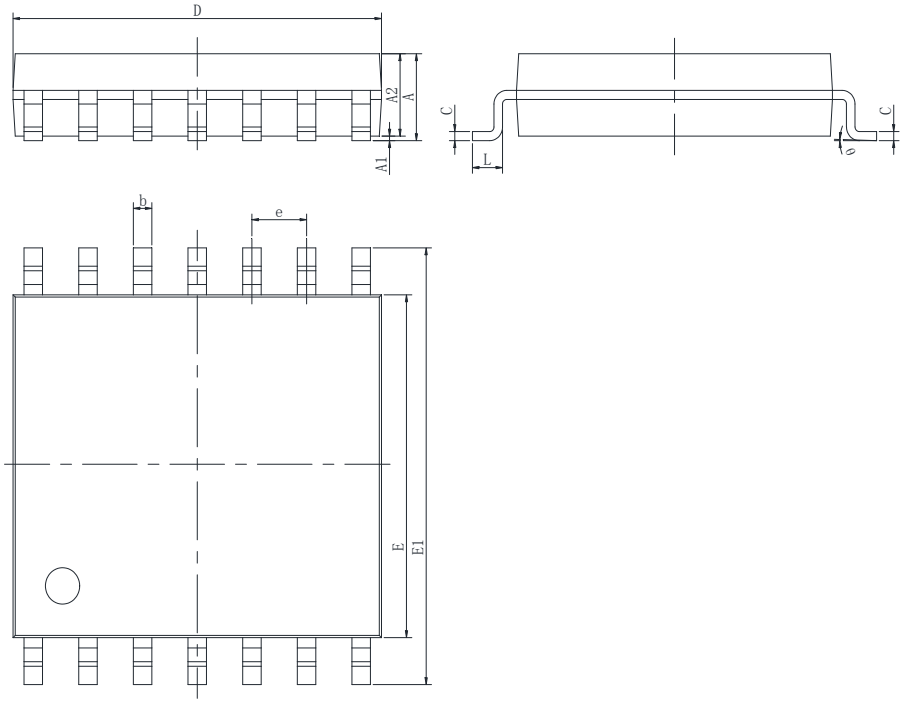
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.100		0.043
A1	0.020	0.150	0.001	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
θ	0°	8°	0°	8°

SOP14 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	0.007	0.010
D	8.360	8.760	0.329	0.345
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

TSSOP14 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.035	0.041
b	0.200	0.280	0.007	0.011
c	0.130	0.170	0.005	0.006
D	4.900	5.100	0.192	0.200
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.259
e	0.650(BSC)		0.025(BSC)	
L	0.450	0.750	0.017	0.029
θ	0°	8°	0°	8°

Statements

- Silicore Technology reserves the right to make changes without further notice to any products or specifications herein. Before customers place an order, customers need to confirm whether datasheet obtained is the latest version, and to verify the integrity of the relevant information.

- Failure or malfunction of any semiconductor products may occur under particular conditions, customers shall have obligation to comply with safety standards when customers use Silicore Technology products to do their system design and machine manufacturing, and take corresponding safety measures in order to avoid potential risk of failure that may cause personal injury or property damage.

- The product upgrades without end, Silicore Technology will wholeheartedly provide customers integrated circuits that have better performance and better quality.