GT8111 GT8112 GT8114
18kHz, 750nA, Rail-to-Rail I/O CMOS Op Amps

1 Features

- **Gain bandwidth:18 kHz**
- **Rail-to-rail input and output**
- **Low supply current: 750 nA/amplifier at 5 V**
- **Input voltage range: -0.1 V to +5.6 V with V_S=5.5 V**
- **Supply range: +1.4 V to +5.5 V**
- **Operation temperature range: -40°C to +125°C**

2 Application

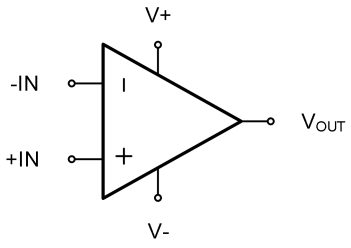
- **Sensors**
- **Photodiode amplification**
- **Wearable products**
- **Temperature measurement**
- **Battery powered system**

3 Description

The GT811X, families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (18kHz) and slew rate of 7.7V/ms. The op-amps are unity gain stable and feature an ultra-low input bias current.

The devices are ideal for sensor interfaces, active filters and portable applications. The GT811X families of operational amplifiers are specified at the full temperature range of −40°C to +125°C under single or dual power supplies of 1.4V to 5.5V.

Circuit Diagram



4 Device Summary, Pin and Packages

Table. 4-1. Device Summary(1)

Serial Name	Part Name	Package	Body Size (Nom)	Marking(2)	MSL(3)	Package Qty
GT8111	GT8111C5	SC70-5	2.10mm×1.25mm×1.00mm	GT8111 XXXXX	3	Tape and Reel,3000
	GT8111S5	SOT23-5	2.90mm×1.60mm×1.10mm	GT8111 XXXXX	3	Tape and Reel,3000
	GT8111BC5	SC70-5	2.10mm×1.25mm×1.00mm	GT8111B XXXXX	3	Tape and Reel,3000
	GT8111BS5	SOT23-5	2.90mm×1.60mm×1.10mm	GT8111B XXXXX	3	Tape and Reel,3000
	GT8111M8	MSOP8	3.00mm×3.00mm×1.10mm	GT8111 XXXXXXX	3	Tape and Reel,4000
	GT8111P8	SOP8	6.00mm×3.90mm×1.75mm	GT8111 XXXXXXX	3	Tape and Reel,4000
GT8112	GT8112M8	MSOP8	3.00mm×3.00mm×1.10mm	GT8112 XXXXXXX	3	Tape and Reel,4000
	GT8112T8	TSSOP8	3.00mm×4.40mm×1.10mm	GT8112 XXXXXXX	3	Tape and Reel,4000
	GT8112P8	SOP8	6.00mm×3.90mm×1.75mm	GT8112 XXXXXXX	3	Tape and Reel,4000
GT8114	GT8114TD	TSSOP14	5.00mm×4.40mm×1.20mm	GT8114 XXXXXXX	3	Tape and Reel,4000
	GT8114PD	SOP14	8.65mm×3.90mm×1.75mm	GT8114 XXXXXXX	3	Tape and Reel,4000

(1) For all available packages, please contact product sales.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXXX" in Marking will be appeared as the batch code.

4 Device Summary, Pin and Packages(Continued)

Top View

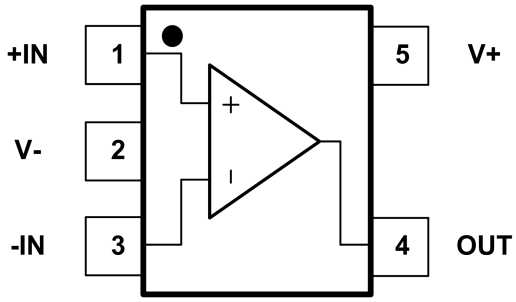


Fig.4-1. GT8111: C5 (SC70-5) Package
GT8111: S5 (SOT23-5) Package

Top View

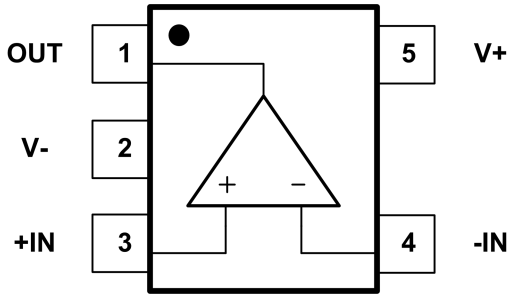


Fig.4-2. GT8111B: C5 (SC70-5) Package
GT8111B: S5 (SOT23-5) Package

Top View

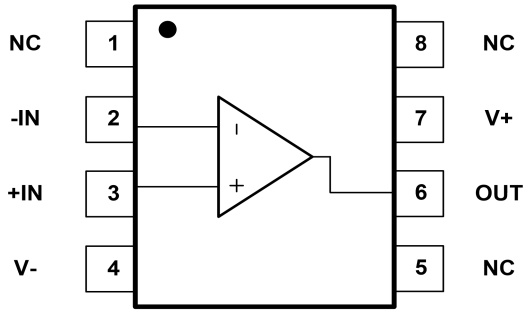


Fig.4-3. GT8111: M8 (MSOP8) Package
GT8111: P8 (SOP8) Package

Table. 4-2. Pin Definition

Pin				I/O	Description
Name	C5 S5	BC5 BS5	M8 P8		
-IN	3	4	2	I	Inverting input
+IN	1	3	3	I	Noninverting input
NC	-	-	1,5,8	-	No internal connection (can be left floating)
OUT	4	1	6	O	Output
V-	2	2	4	-	Negative (lowest) supply or ground (for single-supply operation)
V+	5	5	7	-	Positive (highest) supply

* It is suggested to leave the unconnected pins floating.

4 Device Summary, Pin and Packages(Continued)

Top View

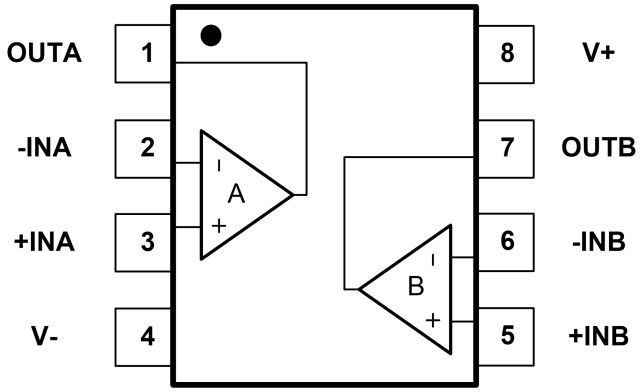


Fig.4-4.GT8112: M8(MSOP8) Package
GT8112: T8(TSSOP8) Package
GT8112: P8(SOP8) Package

Table. 4-3. Pin Definition

Pin		I/O	Description
Name	M8 T8 P8		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	-	Negative (lowest) supply or ground (for single-supply operation)
V+	8	-	Positive (highest) supply

* It is suggested to leave the unconnected pins floating.

4 Device Summary, Pin and Packages(Continued)

Top View

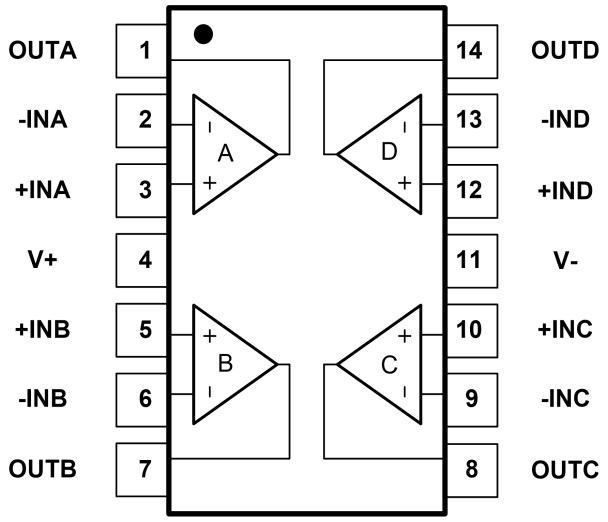


Fig.4-5. GT8114: TD (TSSOP14) Package

GT8114: PD (SOP14) Package

Table.4-4. Pin Definition

Pin		I/O	Description
Name	TD PD		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
-INC	9	I	Inverting input, channel C
+INC	10	I	Noninverting input, channel C
-IND	13	I	Inverting input, channel D
+IND	12	I	Noninverting input, channel D
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
OUTC	8	O	Output, channel C
OUTD	14	O	Output, channel D
V-	11	-	Negative (lowest) supply or ground (for single-supply operation)
V+	4	-	Positive (highest) supply

* It is suggested to leave the unconnected pins floating.

5 Voltage, Temperature, ESD and Thermal ratings

5.1 Absolute Maximum Ratings

Parameters	Min.	Max.	Unit
Supply Voltage Vs=(V+)-(V-)		6.5	V
Select Input Voltage	(V-)-0.5	(V+)+0.5	V
Maximum Junction Temperature	-55	150	°C
Storage Temperature Range	-55	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current- limited to 10mA or less.

5.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM)	5.5 K	V
		Charged-Device Model (CDM)	2 K	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameters	Min.	Max.	Unit
Supply Voltage Vs=(V+)-(V-)	Single-supply	1.4	5.5	V
	Dual-supply	±0.7	±2.75	
TA	Operating temperature	-40	125	°C

5.4 Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SC70-5	400	150	°C/W
SOT23-5	250	81	°C/W
MSOP8	210	45	°C/W
TSSOP8	191	44	°C/W
SOP8	158	43	°C/W
TSSOP14	180	35	°C/W
SOP14	120	36	°C/W

6 Electrical Specifications

Vcc=5.0V, Vcm=Vcc/2, Vo=Vcc/2, and R_L=10MΩ, FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

Parameters	Symbol	Conditions	V_{CC}	T_A	Min.	Typ.	Max.	Unit
Power Supply								
Quiescent Current/amplifier	IQ		5V	+25℃		750	850	nA
Operating Voltage Range	Vs			+25℃	1.4		5.5	V
Power-supply Rejection Ratio	PSRR		5V	+25℃	60	80		dB
Offset Voltage								
Input Offset Voltage	Vos		5V	+25℃	-3	0.7	3	mV
Input Offset Voltage Average Drift	Vos TC	–40°C to +125°C	5V			±1		μV/°C
Input								
Common-mode Voltage Range	Vcm		5.5V	+25℃	-0.1		5.6	V
Common-mode Rejection Ratio	CMRR	Vcm= -0.1V to 4V	5.5V	+25℃	60	80		dB
		Vcm= -0.1V to 5.6V		+25℃	60	75		
Input Bias Current	IB			+25℃		1	10	pA
Input Offset Current	Ios			+25℃		1	10	pA
Noise								
Input Voltage Noise Density	e_N	f=1kHz	5V	+25℃		180		nV/√Hz
Output								
Open-loop Voltage Gain	AOL	RL=50KΩ, V_O=V_S-0.1V	5V	+25℃	85	120		dB
				FULL	72			
Output Swing From Rail	V_O	R_L=100kΩ	5V	+25℃		3		mV
Output Current	Iout		5V	+25℃		50		mA
Frequency Response								
Gain Bandwidth Product	GBP		5V	+25℃		18		kHz
Phase Margin	PM		5V	+25℃		60		°
Slew Rate	SR		5V	+25℃		7.7		V/ms

7 Typical Characteristics

Vcc=5.0V, Vcm=Vcc/2, Vo=Vcc/2, and R_L=10MΩ, FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

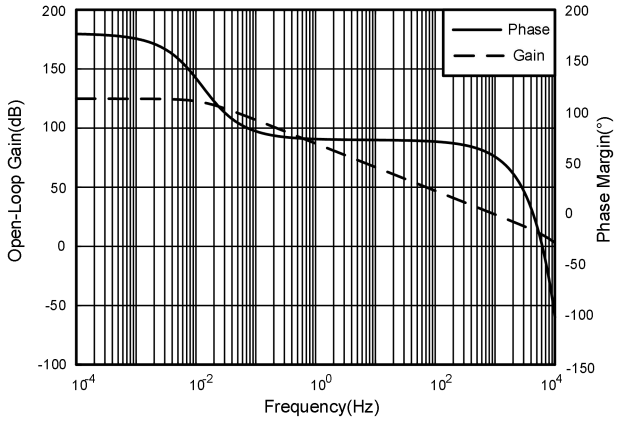


Fig.7-1. Open-Loop Gain and Phase vs Frequency

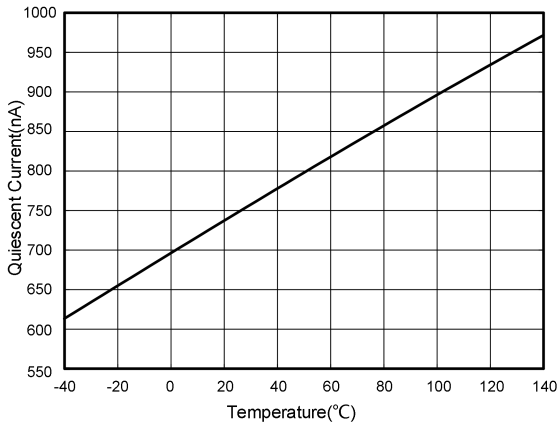


Fig.7-2. Quiescent Current vs Temperature

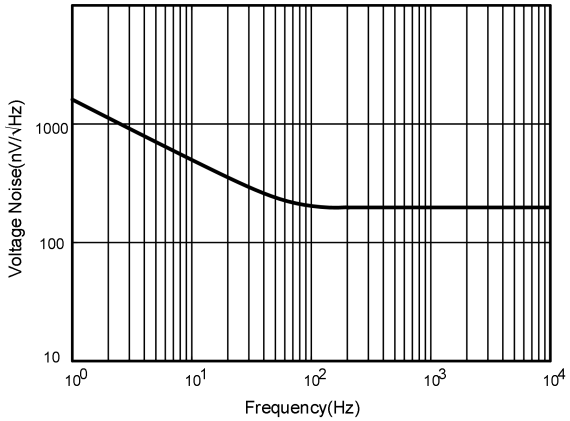


Fig.7-3. Voltage Noise vs Frequency

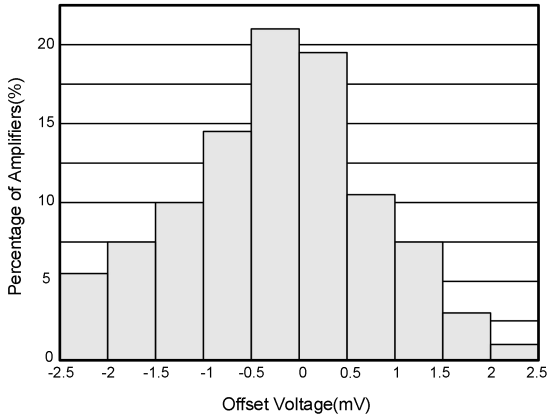


Fig.7-4. Offset Voltage Production Distribution

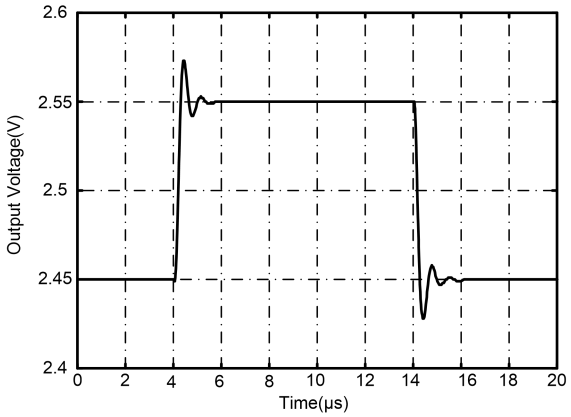


Fig.7-5. Small-Signal Step Response

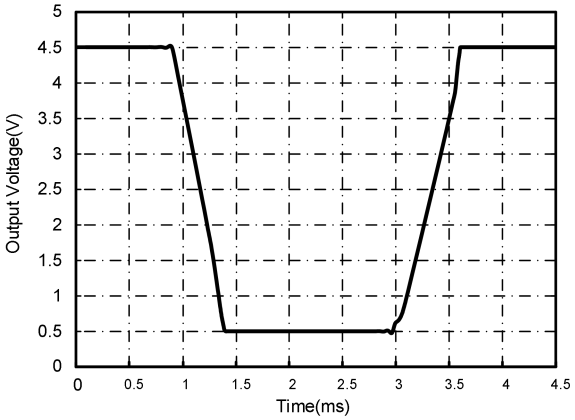


Fig.7-6. Large-Signal Step Response

8 Detailed Description

The GT811X families of products are rail-to-rail operational amplifiers that can be run from a single-supply voltage 1.4V to 5.5V (±0.7V to ±2.75V). Supply voltages higher than 6.5V (absolute maximum) can permanently damage the amplifier. Rail-to-rail input and output swing significantly increases dynamic range, especially in low-supply applications.

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins. These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

9 Application Note

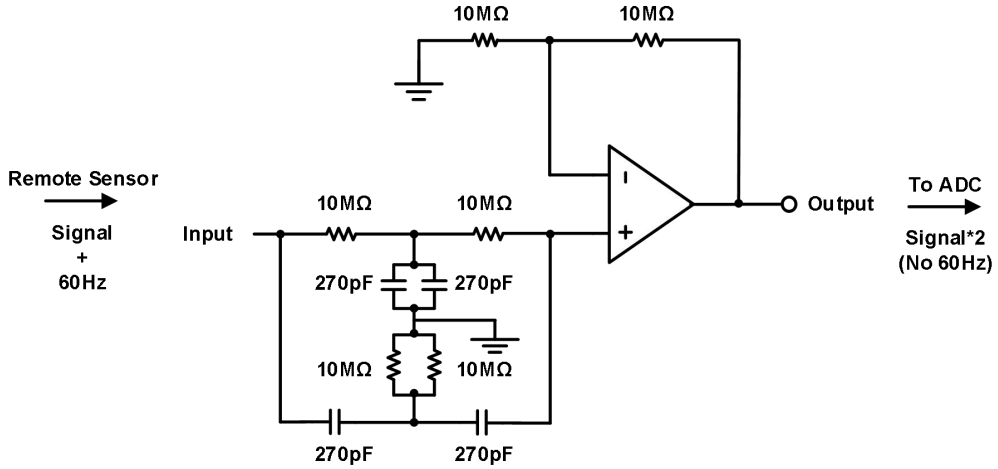


Fig.9-1. 60 Hz Twin "T" Notch Filter

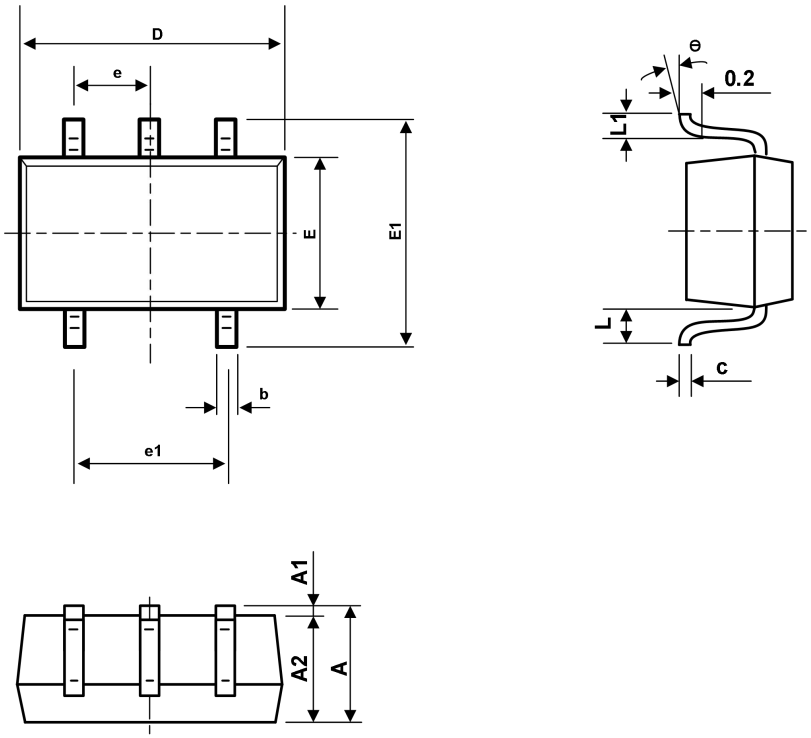
Small signals from transducers in remote and distributed sensing applications commonly suffer strong 60 Hz interference from AC power lines. The circuit of Fig.9-1. notches out the 60 Hz and provides a gain A_V = 2 for the sensor signal represented by a 1 kHz sine wave. Similar stages may be cascaded to remove 2nd and 3rd harmonics of 60 Hz. Thanks to the nA power consumption of the GT811X, even 5 such circuits can run for 9.5years from a small CR2032 lithium cell. These batteries have a nominal voltage of 3 V and an end of life voltageof 2 V. With an operating voltage from 1.6 V to 5.5 V the GT811X can function over this voltage range.

The notch frequency is set by: F0 = 1 / 2πRC.

To achieve a 60 Hz notch use R = 10 MΩ and C = 270 pF. If eliminating 50 Hz noise, which is common in European systems, use R = 11.8 MΩ and C = 270 pF.

10 Package Outline Dimension

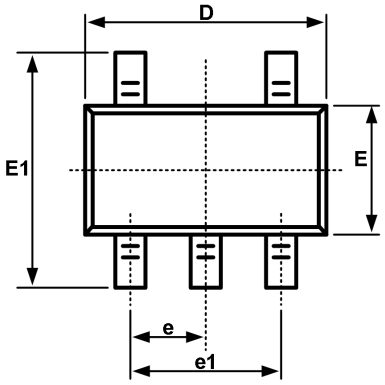
SC70-5

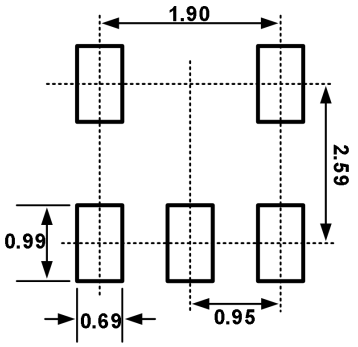


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650TYP		0.026TYP	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

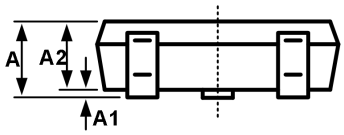
10 Package Outline Dimension(Continued)

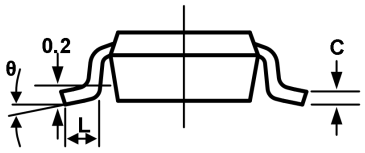
SOT23-5





Recommended Land Pattern (Unit: mm)

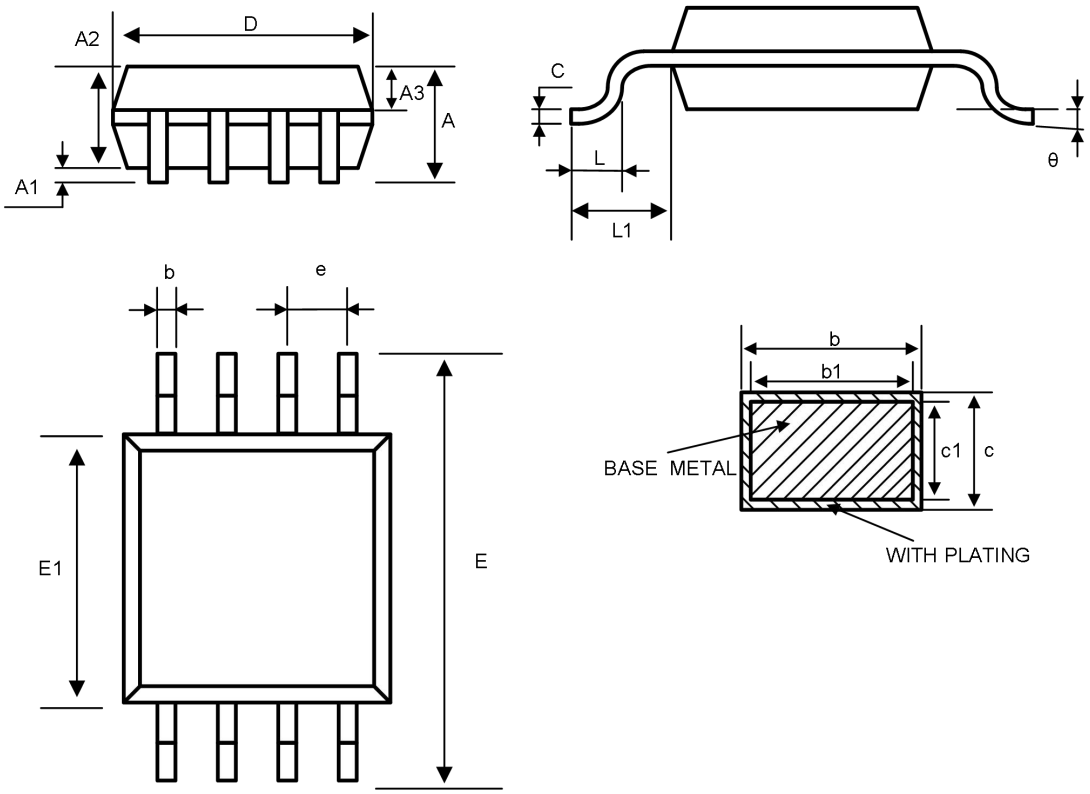




Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
L1	0.600REF		0.024REF	
θ	0°	8°	0°	8°

10 Package Outline Dimension(Continued)

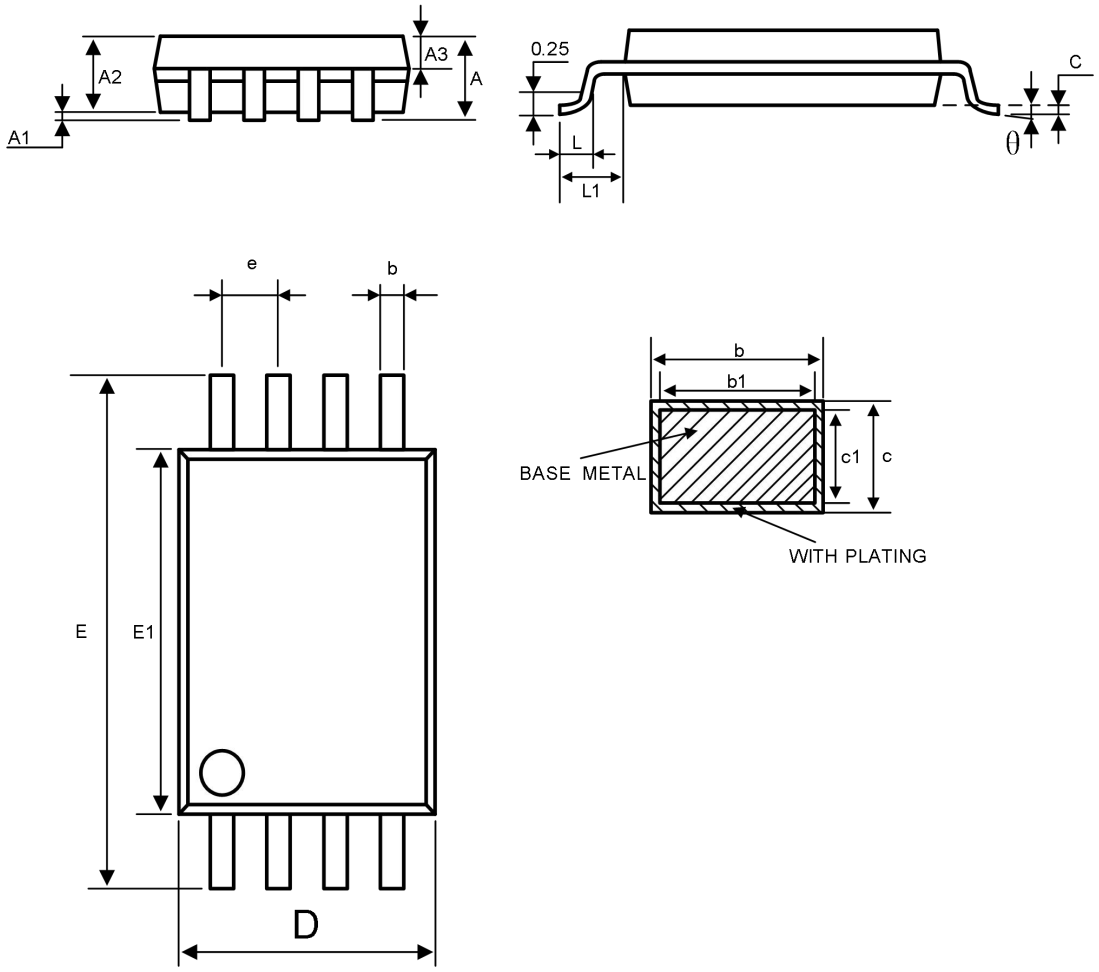
MSOP8



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.10	—	—	0.043
A1	0.05	—	0.15	0.002	—	0.006
A2	0.75	0.85	0.95	0.030	0.033	0.037
A3	0.30	0.35	0.40	0.012	0.014	0.016
b	0.28	—	0.36	0.011	—	0.014
b1	0.27	0.30	0.33	0.011	0.012	0.013
c	0.15	—	0.19	0.006	—	0.007
c1	0.14	0.15	0.16	0.006	0.006	0.006
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.70	4.90	5.10	0.185	0.193	0.201
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	0.65BSC			0.026BSC		
L	0.40	—	0.70	0.016	—	0.028
L1	0.95REF			0.037REF		
θ	0	—	8°	0	—	8°

10 Package Outline Dimension(Continued)

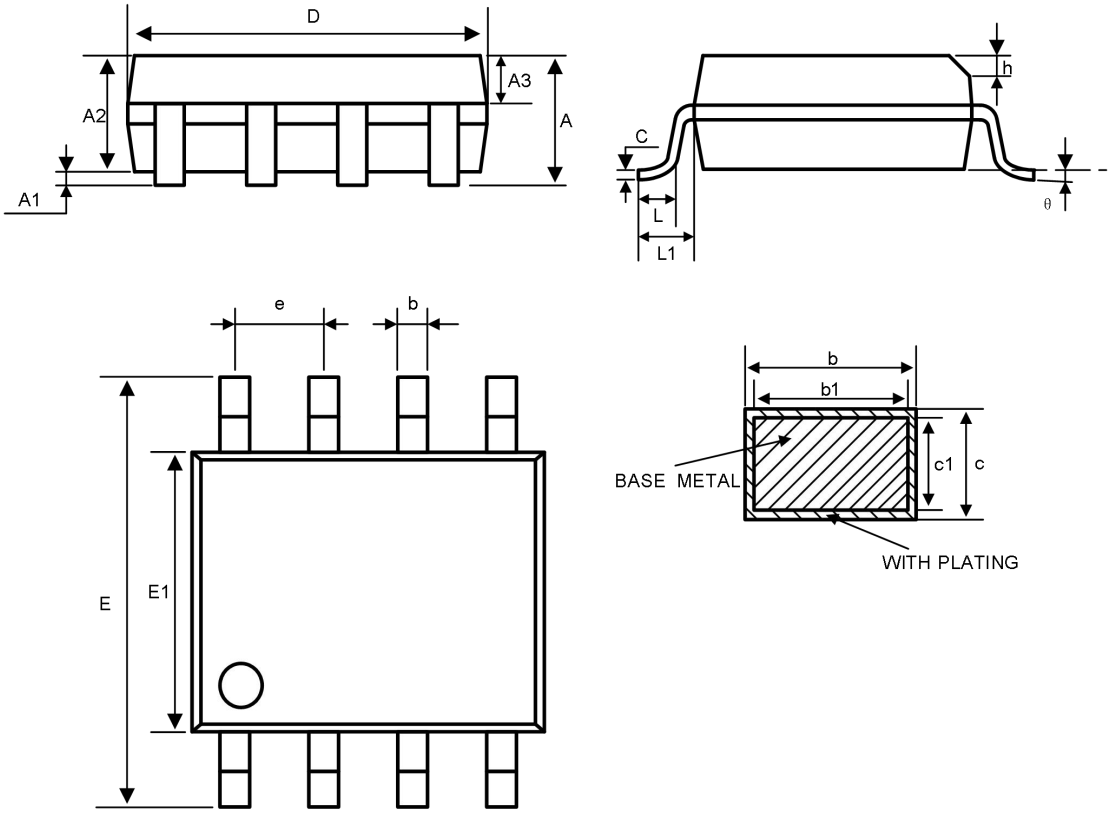
TSSOP8



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.20	—	—	0.047
A1	0.05	—	0.15	0.002	—	0.006
A2	0.90	1.00	1.05	0.035	0.039	0.041
A3	0.39	0.44	0.49	0.015	0.017	0.019
b	0.20	—	0.28	0.008	—	0.011
b1	0.19	0.22	0.25	0.007	0.009	0.010
c	0.13	—	0.17	0.005	—	0.007
c1	0.12	0.13	0.14	0.005	0.005	0.006
D	2.90	3.00	3.10	0.114	0.118	0.122
E1	4.30	4.40	4.50	0.169	0.173	0.177
E	6.20	6.40	6.60	0.244	0.251	0.260
e	0.65BSC			0.026BSC		
L	0.45	—	0.75	0.018	—	0.030
L1	1.00REF			0.039REF		
θ	0	—	8°	0	—	8°

10 Package Outline Dimension(Continued)

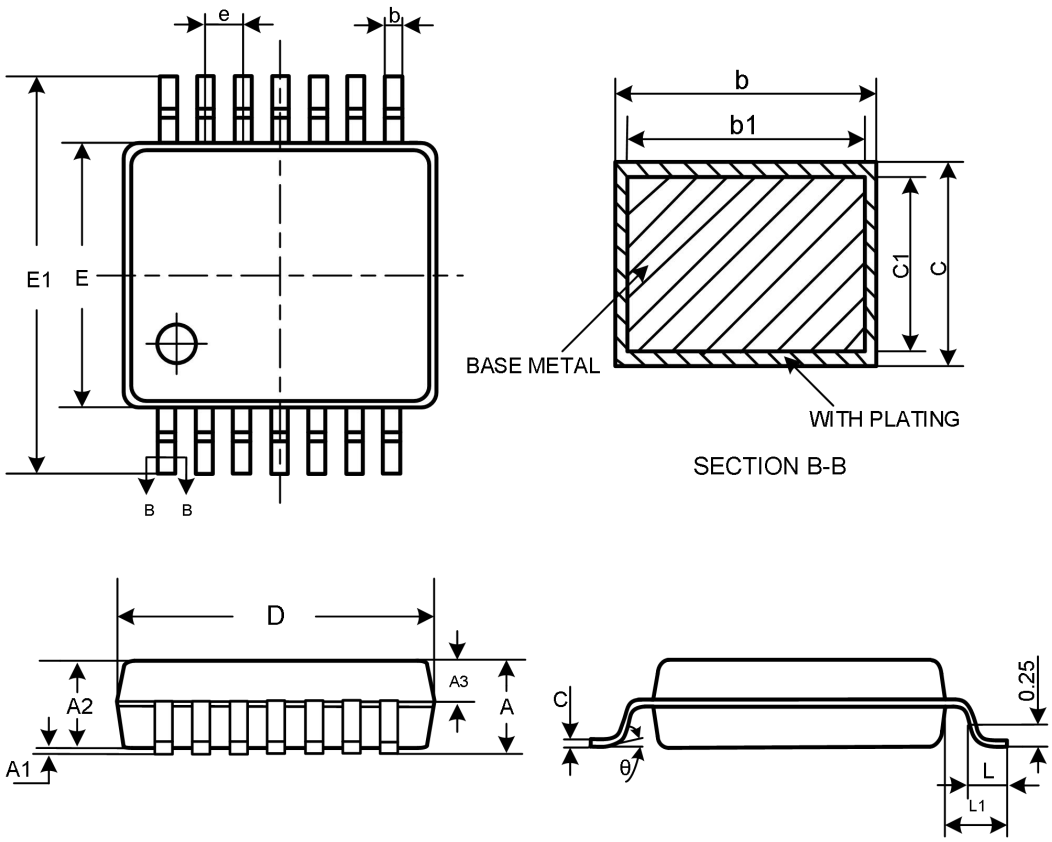
SOP8



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.75	—	—	0.069
A1	0.10	—	0.225	0.004	—	0.009
A2	1.30	1.40	1.50	0.051	0.055	0.059
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39	—	0.47	0.015	—	0.019
b1	0.38	0.41	0.44	0.015	0.016	0.017
c	0.20	—	0.21	0.008	—	0.008
c1	4.80	4.90	5.00	0.189	0.193	0.197
D	5.80	6.00	6.20	0.228	0.236	0.244
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e	1.27BSC			0.05BSC		
h	0.25	—	0.50	0.010	—	0.020
L	0.50	—	0.80	0.020	—	0.031
L1	1.05REF			0.041REF		
θ	0	—	8°	0	—	8°

10 Package Outline Dimension(Continued)

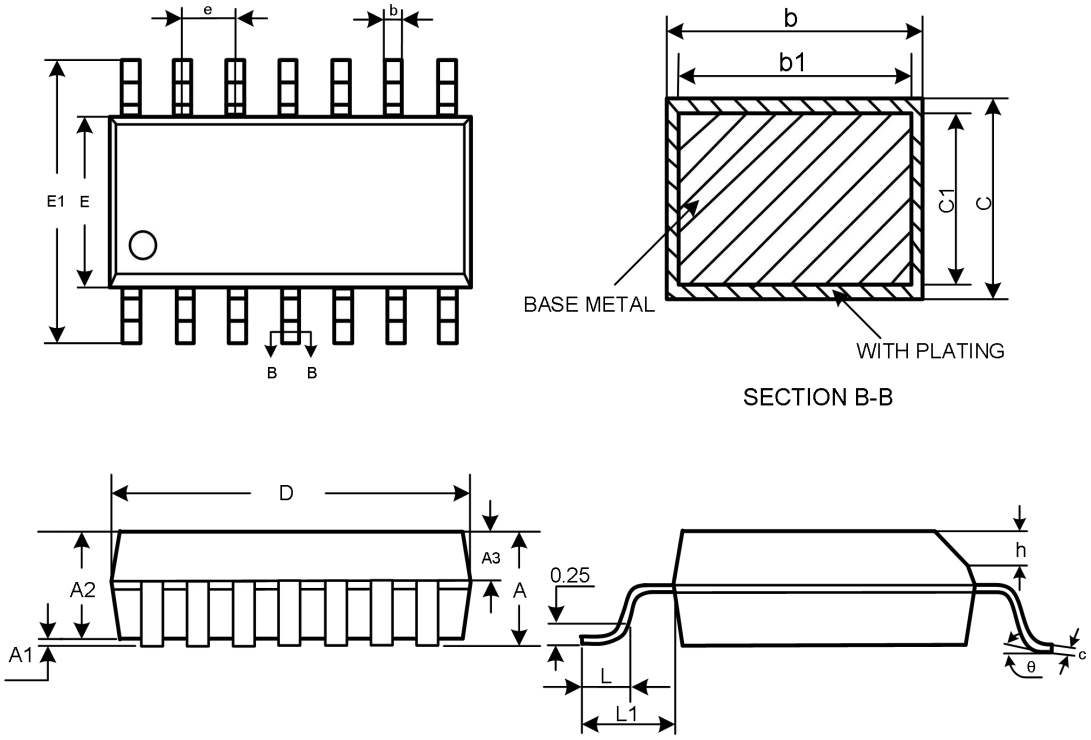
TSSOP14



SYMBOL	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	——	——	1.20	——	——	0.047
A1	0.05	——	0.15	0.002	——	0.006
A2	0.90	1.00	1.05	0.035	0.039	0.041
A3	0.39	0.44	0.49	0.015	0.017	0.019
b	0.20	——	0.28	0.008	——	0.011
b1	0.19	0.22	0.25	0.007	0.009	0.010
c	0.13	——	0.17	0.005	——	0.007
c1	0.12	0.13	0.14	0.005	0.005	0.006
D	4.90	5.00	5.10	0.193	0.197	0.201
E	4.30	4.40	4.50	0.169	0.173	0.177
E1	6.20	6.40	6.60	0.244	0.252	0.260
e		0.65BSC			0.026BSC	
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00BCS			0.039BSC	
θ	0	——	8°	0	——	8°

10 Package Outline Dimension(Continued)

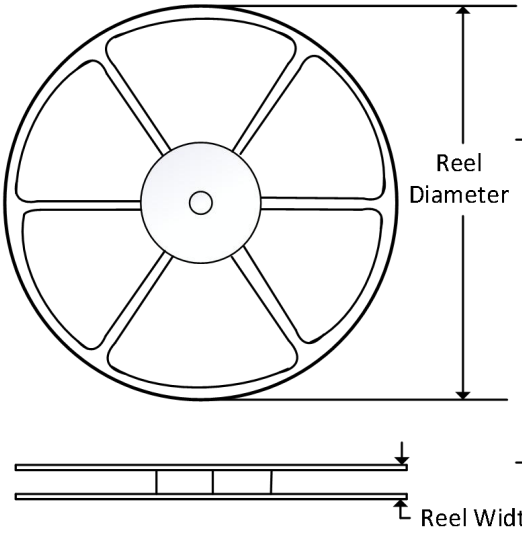
SOP14



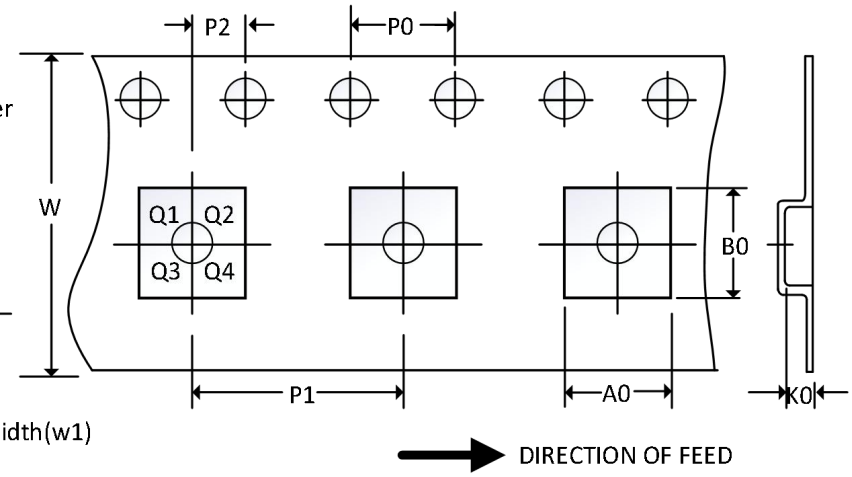
SYMBOL	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	——	——	1.75	——	——	0.069
A1	0.10	——	0.225	0.004	——	0.009
A2	1.30	1.40	1.50	0.051	0.055	0.059
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39	——	0.47	0.015	——	0.019
b1	0.38	0.41	0.44	0.015	0.016	0.017
c	0.20	——	0.24	0.20	——	0.24
c1	0.19	0.20	0.21	0.007	0.008	0.008
D	8.55	8.65	8.75	0.337	0.341	0.344
E1	5.80	6.00	6.20	0.228	0.236	0.244
E	3.80	3.90	4.00	0.150	0.154	0.157
e	1.27BSC			0.05BSC		
h	0.25	——	0.50	0.010	——	0.020
L	0.50	——	0.80	0.020	——	0.031
L1	1.05REF			0.041REF		
θ	0	——	8°	0	——	8°

11 Tape and Reel Information

Reel Dimensions



Reel 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 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-5	7''	9.5	2.25	2.55	1.20	4.0	4.0	2.0	8.0	Q3
SOT23-5	7''	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
MSOP8	13''	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
TSSOP8	13''	12.4	6.90	3.45	1.65	4.0	8.0	2.0	12.0	Q1
SOP8	13''	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
TSSOP14	13''	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1
SOP14	13''	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.