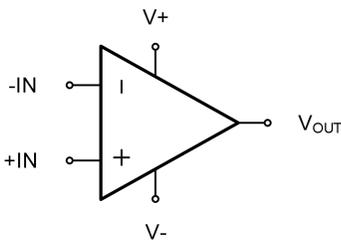# GT8341P GT8342P GT8344P
Low-Voltage, Low-Power, Rail-to-Rail I/O CMOS Op Amps

1 Features	2 Application
- High gain bandwidth:1.1 MHz - Rail-to-rail input and output - Low supply current: 40 µA/amplifier at 5 V - Input voltage range: -0.1 V to +5.6 V with V_S=5.5 V - Supply range: +2.2 V to +5.5 V - Operation temperature range: -40°C to +125°C	- Sensors - Photodiode amplification - Active filters - Test equipment - Driving A/D converters

3 Description	Circuit Diagram
The GT834XP 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 (1.1MHz) and slew rate of 0.4V/µs. 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 GT834XP families of operational amplifiers are specified at the temperature range of -40°C to +125°C under single or dual power supplies of 2.2V to 5.5V.	

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
GT8341P	GT8341PC5	SC70-5	2.10mm×1.25mm×1.00mm	GT8341P XXXXX	3	Tape and Reel,3000
	GT8341PS5	SOT23-5	2.90mm×1.60mm×1.10mm	GT8341P XXXXX	3	Tape and Reel,3000
	GT8341PBC5	SC70-5	2.10mm×1.25mm×1.00mm	GT8341PB XXXXX	3	Tape and Reel,3000
	GT8341PBS5	SOT23-5	2.90mm×1.60mm×1.10mm	GT8341PB XXXXX	3	Tape and Reel,3000
	GT8341PM8	MSOP8	3.00mm×3.00mm×1.10mm	GT8341P XXXXXXX	3	Tape and Reel,4000
	GT8341PP8	SOP8	4.90mm×3.90mm×1.75mm	GT8341P XXXXXXX	3	Tape and Reel,4000
GT8342P	GT8342PM8	MSOP8	3.00mm×3.00mm×1.10mm	GT8342P XXXXXXX	3	Tape and Reel,4000
	GT8342PP8	SOP8	4.90mm×3.90mm×1.75mm	GT8342P XXXXXXX	3	Tape and Reel,4000
GT8344P	GT8344PTD	TSSOP14	5.00mm×4.40mm×1.20mm	GT8344P XXXXXXX	3	Tape and Reel,4000
	GT8344PPD	SOP14	8.65mm×3.90mm×1.75mm	GT8344P XXXXXXX	3	Tape and Reel,4000
	GT8344PQE	QFN3×3-16L	3.00mm×3.00mm×0.75mm	GT8344P XXXXX	3	Tape and Reel,5000

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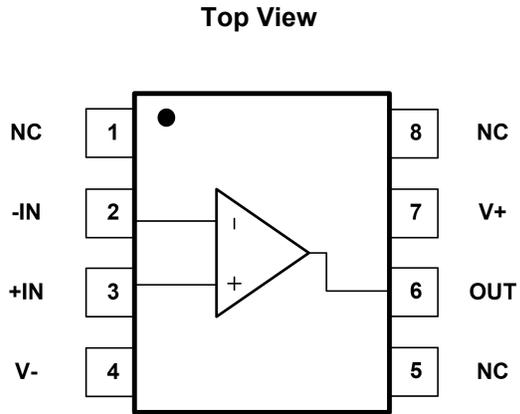
(4) "XXXXX" in Marking will be appeared as the batch code.

4 Device Summary, Pin and Packages(Continued)

Top View
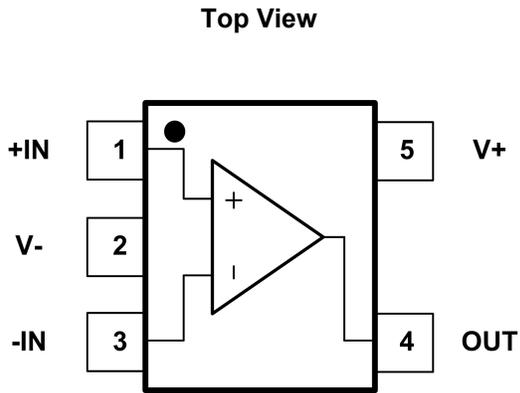
Fig.4-1. GT8341P: C5 (SC70-5) Package
GT8341P: S5 (SOT23-5) Package

Top View
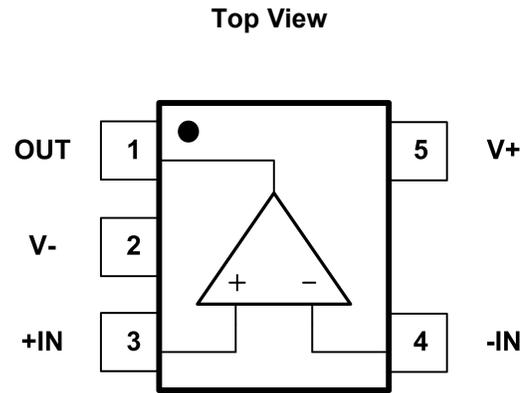
Fig.4-2. GT8341PB: C5 (SC70-5) Package
GT8341PB: S5 (SOT23-5) Package

Top View

Fig.4-3. GT8341P: M8 (MSOP8) Package
GT8341P: 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.GT8342P: M8(MSOP8) Package

GT8342P: P8(SOP8) Package

Table. 4-3. Pin Definition

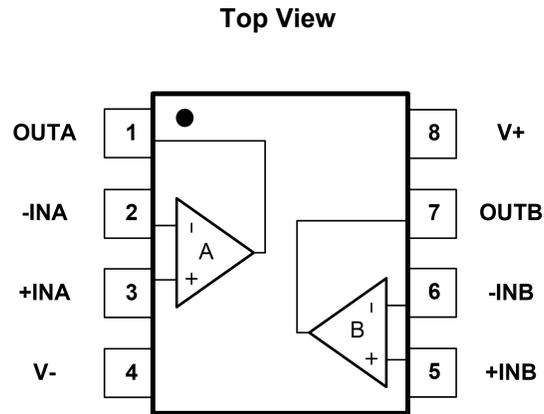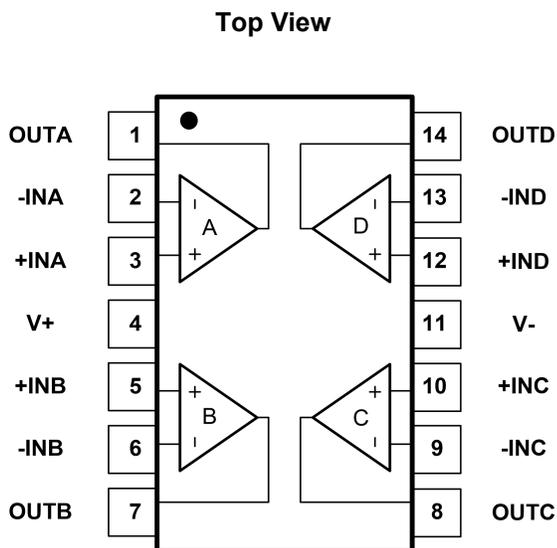| Pin		I/O	Description
Name	M8 P8		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	-	Negative (lowest) supply or ground (for single-supply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

* It is suggested to leave the unconnected pins floating.

4 Device Summary, Pin and Packages(Continued)

Top View

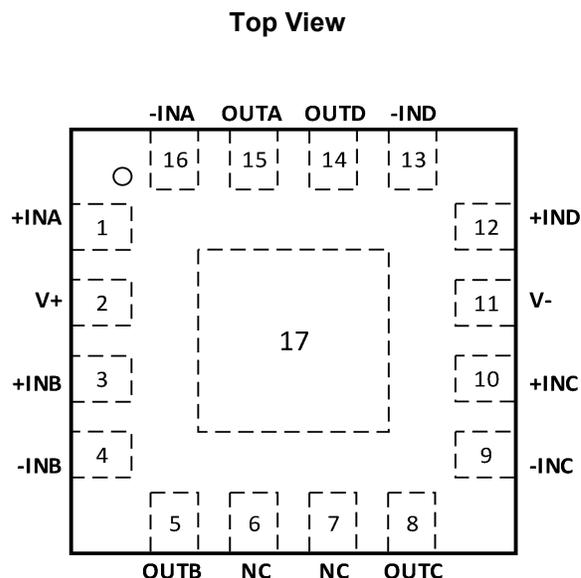Fig.4-5. GT8344P: TD (TSSOP14) Package

GT8344P: PD (SOP14) Package

Top View

Fig.4-6. GT8344P: QE (QFN3×3-16L) Package

Table. 4-4. Pin Definition

Pin			I/O	Description
Name	PD TD	QE		
-INA	2	16	I	Inverting input, channel A
+INA	3	1	I	Noninverting input, channel A
-INB	6	4	I	Inverting input, channel B
+INB	5	3	I	Noninverting input, channel B
-INC	9	9	I	Inverting input, channel C
+INC	10	10	I	Noninverting input, channel C
-IND	13	13	I	Inverting input, channel D
+IND	12	12	I	Noninverting input, channel D
OUTA	1	15	O	Output, channel A
OUTB	7	5	O	Output, channel B
OUTC	8	8	O	Output, channel C
OUTD	14	14	O	Output, channel D
V-	11	11	-	Negative (lowest) supply or ground (for single-supply operation)
V+	4	2	-	Positive (highest) supply
NC	/	6,7	-	No internal connection (can be left floating)

* It is suggested to leave the unconnected pins floating.

5 Voltage, Temperature, ESD and Thermal Ratings

5.1 Absolute Maximum Ratings[1]

Parameters	Min.	Max.	Unit
Supply Voltage Vs=(V+)-(V-)		6.5	V
Select Input Voltage[2]	(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)[1]	7.5 K	V
		Charged-Device Model (CDM)[2]	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	2.2	5.5	V
	Dual-supply	±1.1	±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
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=10kΩ, 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°C		40	60	µA
Operating Voltage Range	Vs			FULL	2.2		5.5	V
Power-supply Rejection Ratio	PSRR		5V	+25°C	65	87		dB
Offset Voltage								
Input Offset Voltage	Vos	GT8341P	5V	+25°C	-0.4		0.4	mV
		GT8342P			-0.4		0.4	
		GT8344P			-0.8		0.8	
Input Offset Voltage Average Drift	Vos TC	–40°C to +125°C	5V			±1		µV/°C
Input								
Common-mode Voltage Range	Vcm		5.5V	FULL	-0.1		5.6	V
Common-mode Rejection Ratio	CMRR	Vcm= -0.1V to 4V	5.5V	+25°C	65	80		dB
		Vcm= -0.1V to 5.6V		+25°C	60	75		
Input Bias Current	IB			+25°C		10		pA
Input Offset Current	Ios			+25°C		10		pA
Noise								
Input Voltage Noise(rms)	E_N	f=0.1Hz to 10Hz	5V	+25°C		1.4		µVrms
Input Voltage Noise Density	e_N	f=1kHz	5V	+25°C		23		nV/√Hz
		f=10kHz				20		
Output								
Open-loop Voltage Gain	AOL	RL=2KΩ, Vo=0.15V to 4.85V	5V	+25°C	80	95		dB
		RL=10KΩ, Vo=0.05V to 4.95V	5V	+25°C	85	110		
Output Swing From Rail	V_O	R_L=10kΩ	5V	+25°C		4.5		mV
		R_L=2kΩ				15		
Output Current	Iout		5V	+25°C		75		mA
Frequency Response								
Gain Bandwidth Product	GBP		5V	+25°C		1.1		MHz
Phase Margin	PM		5V	+25°C		64		°
Slew Rate	SR		5V	+25°C		0.4		V/µs

7 Typical Characteristics

Vcc=5.0V, Vcm=Vcc/2, Vo=Vcc/2, and R_L=10kΩ, FULL=−40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)
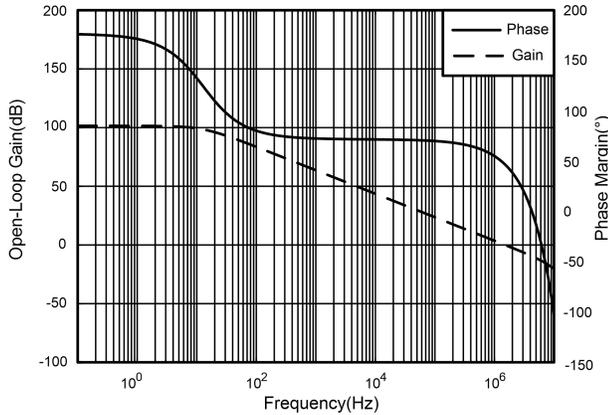
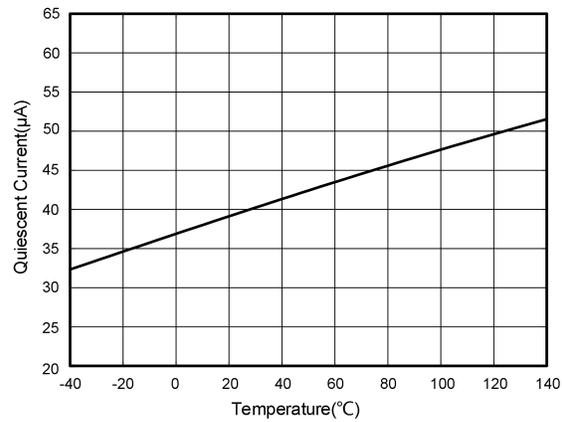Fig.7-1. Open-Loop Gain and Phase vs Frequency
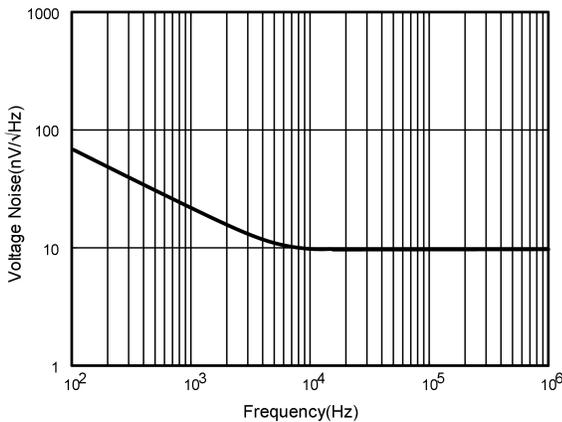
Fig.7-2. Quiescent Current vs Temperature

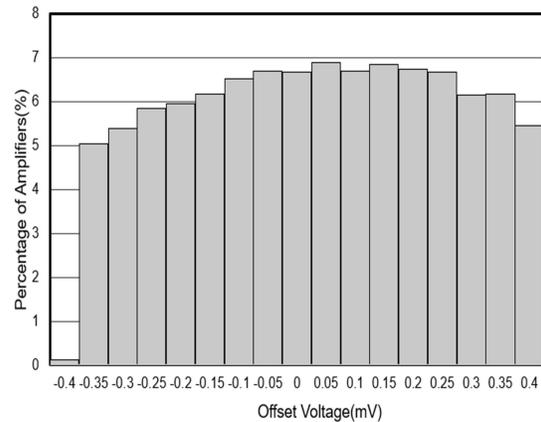Fig.7-3. Voltage Noise vs Frequency

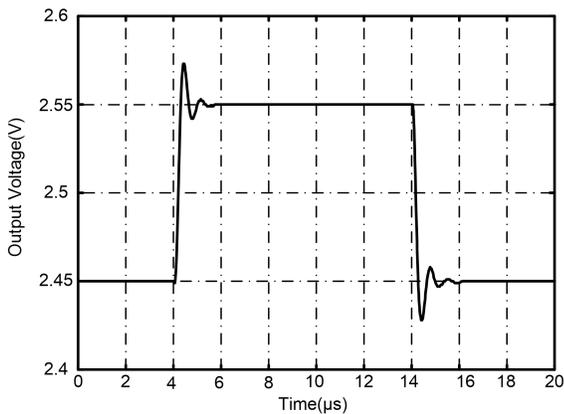Fig.7-4. Offset Voltage Production Distribution(GT8342P)

Fig.7-5. Small-Signal Step Response
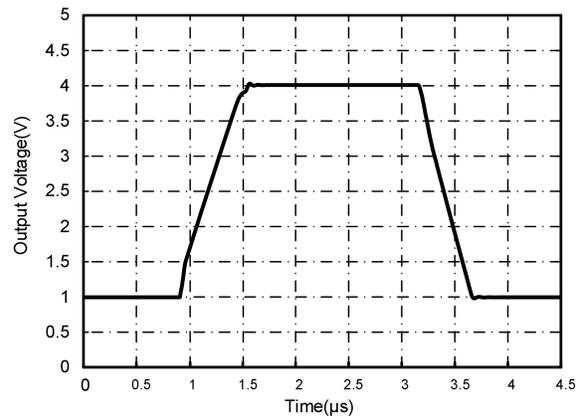
Fig.7-6. Large-Signal Step Response

8 Detailed Description

The GT834XP families of products are rail-to-rail operational amplifiers that can be run from a single-supply voltage 2.2V to 5.5V (±1.1V 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
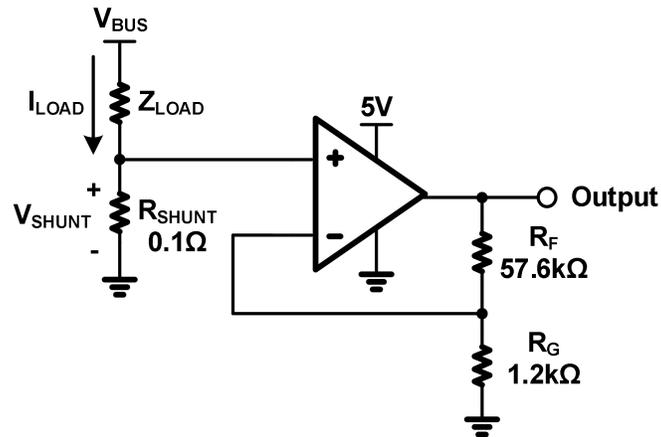
Fig.9-1. A Low-Side, Current-Sensing Application

Fig.9-1 shows the GT834XP configured in a low-side current sensing application..

Use the following parameters for this design example:

- Load current: 0 A to 1 A

- Output voltage: 4.9 V

- Maximum shunt voltage: 100 mV

10 Package Outline Dimension

SC70-5
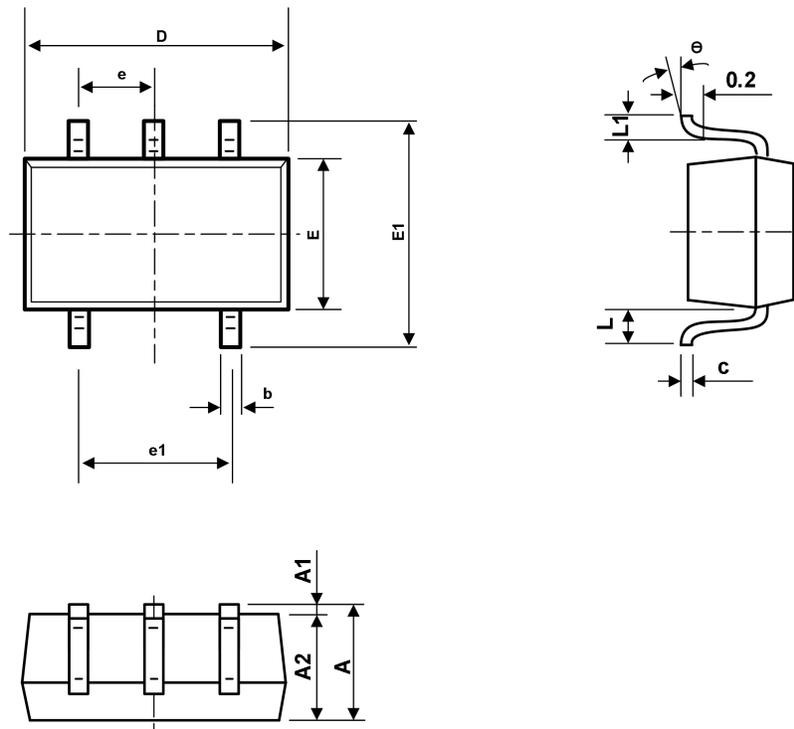
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650TYP		0.026TYP	
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)
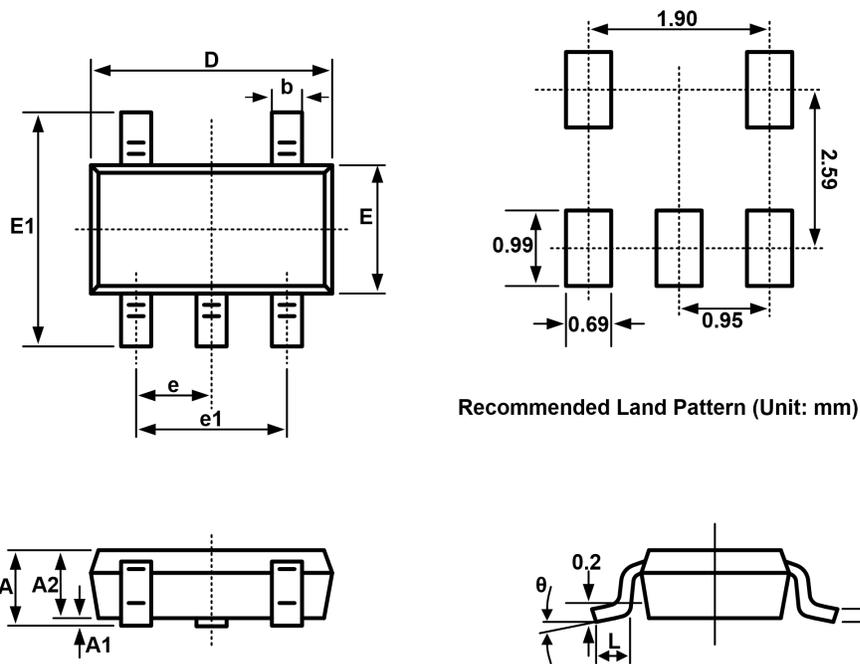
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		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
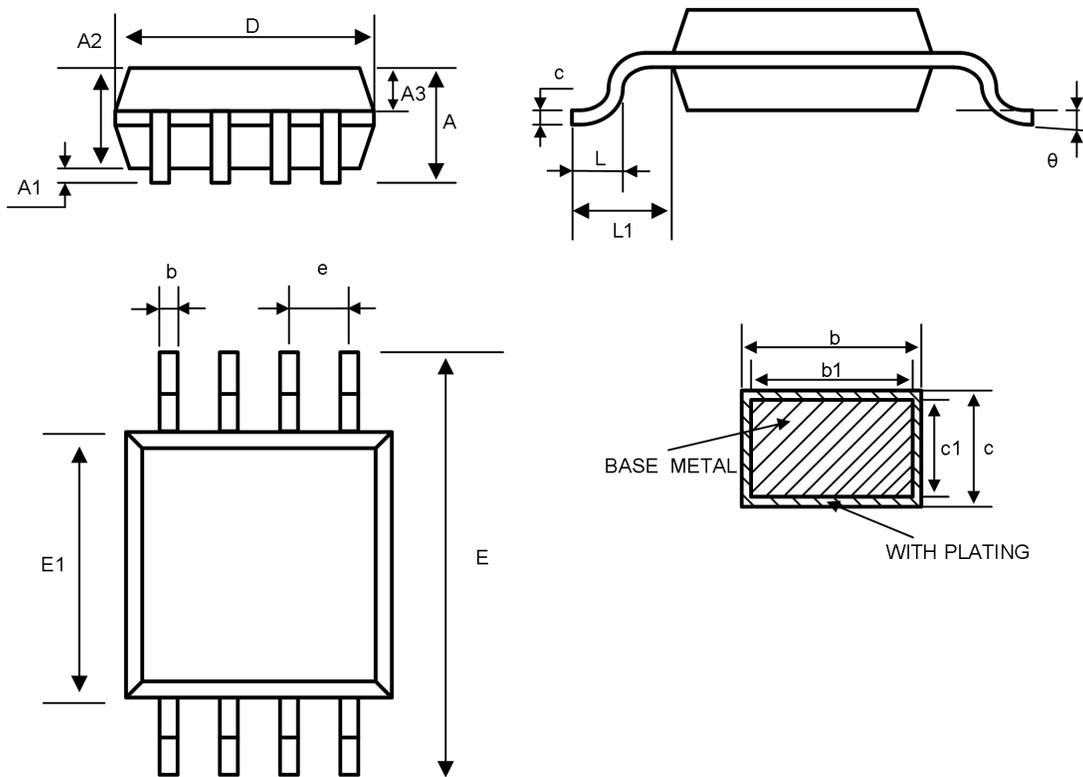
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.10	—	—	0.043
A1	0.05	—	0.15	0.002	—	0.006
A2	0.75	0.85	0.95	0.030	0.033	0.037
A3	0.30	0.35	0.40	0.012	0.014	0.016
b	0.28	—	0.36	0.011	—	0.014
b1	0.27	0.30	0.33	0.011	0.012	0.013
c	0.15	—	0.19	0.006	—	0.007
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	—	0.24	0.008	—	0.009
c1	0.19	0.20	0.21	0.007	0.008	0.008
D	4.80	4.90	5.00	0.189	0.193	0.197
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

BASE METAL

WITH PLATING

SECTION B-B

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

BASE METAL

WITH PLATING

SECTION B-B

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°

10 Package Outline Dimension(Continued)

QFN3×3-16L

Top View

Bottom View

Side View
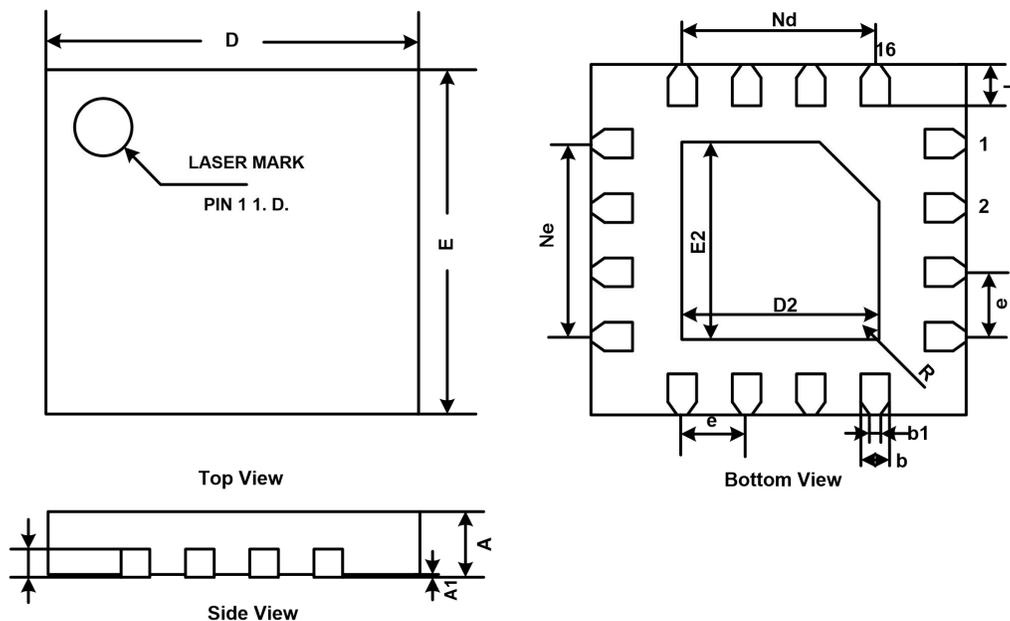
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Min.
A	0.700	0.800	0.028	0.032
A1	0.000	0.050	0.000	0.002
b	0.200	0.300	0.008	0.012
b1	0.230REF		0.009REF	
c	0.203REF		0.008REF	
D	2.900	3.100	0.116	0.124
D2	1.600	1.700	0.064	0.068
e	0.500BSC		0.020BSC	
Nd	1.500BSC		0.060BSC	
Ne	1.500BSC		0.060BSC	
E	2.900	3.100	0.116	0.124
E2	1.600	1.700	0.064	0.068
L	0.350	0.450	0.014	0.018
h	0.250	0.350	0.010	0.014
K	0.225	0.325	0.009	0.013
R	0.075REF		0.003REF	

11 Tape and Reel Information

Reel Dimensions

Reel Dimensions

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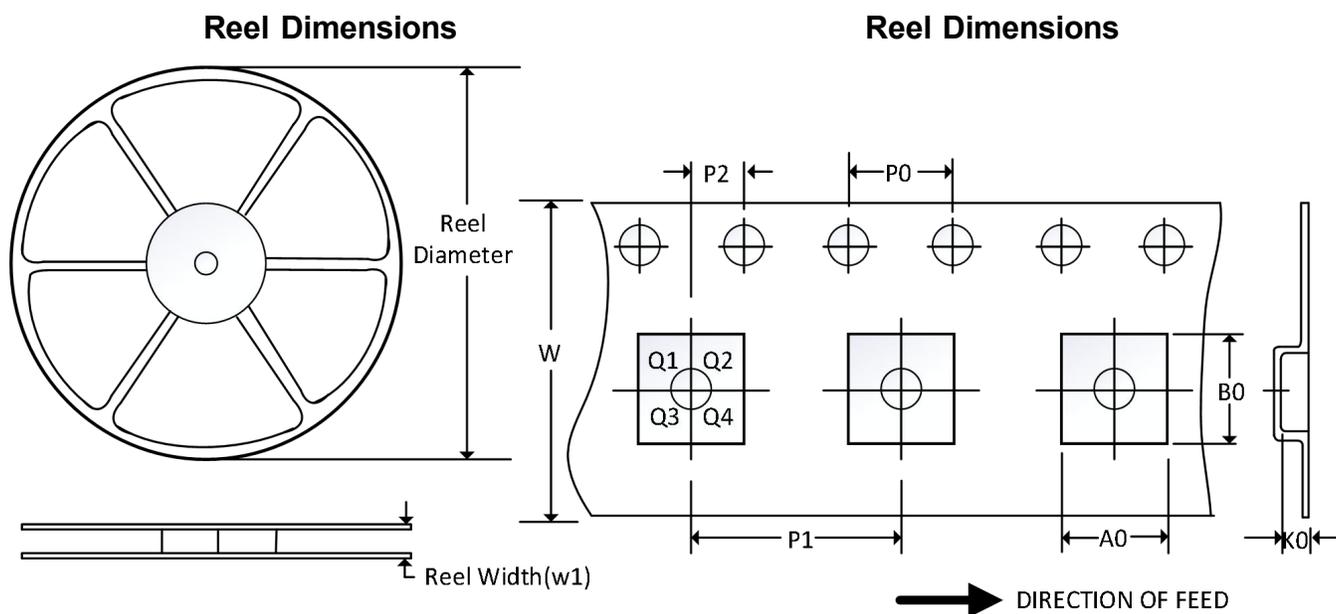
NOTE: The picture is only for reference. Please make the object as the standard.

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
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
QFN3×3-16L	7''	12.0	3.23	3.23	1.05	4.0	4.0	2.0	12.0	Q1

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