# Zero-Drift, Single-Supply, Rail-to-Rail Input/Output Operational Amplifiers

## ■ General Description

The LN8551, LN8552 and LN8554 are single, dual and quad amplifiers featuring rail-to-rail input and output swings, which has ultralow offset, drift and bias current. All are guaranteed to operate from +2.7 V to +5 V single supply.

With an offset voltage of only 3 μV and drift of 20 nV/°C, the LN8551 is perfectly suited for applications where error sources cannot be tolerated. Temperature, position and pres-sure sensors, medical equipment and strain gage amplifiers benefit greatly from nearly zero drift over their operating temperature range. The rail-to-rail input and output swings provided by the LN855X family make both high-side and low- side sensing easy.

The LN855X series is specified for the extended industrial/automotive (–40°C to +125°C) temperature range. The LN8551 single is available in 5-lead SOT and 8-lead SOP/MSOP packages. The LN8552 dual amplifier is available in 8-lead SOP/MSOP packages. The LN8554 quad is available in narrow 14-lead SOP and 14-lead TSSOP packages.

## ■ Applications

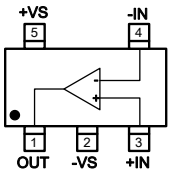
- Temperature Measurements
- Pressure Sensors
- Precision Current Sensing
- Electronic Scales
- Strain Gage Amplifiers
- Medical Instrumentation
- Thermocouple Amplifiers
- Handheld Test Equipment

## ■ Features

- Low Offset Voltage: 3μV (TYP)
- Rail-to-Rail Input and Output Swing
- 2.7V to 5.0V Single Supply Operation
- Voltage Gain: 145dB (TYP)
- PSRR: 115dB (TYP)
- CMRR: 110dB (TYP)
- Low Input Bias Currents: 130pA
- Low Supply Current: 450μA/Channel
- Overload Recovery Time: 0.1ms
- No External Capacitors Required
- -40℃ to +125℃ Operating Temperature Range
- Small Packaging:
  LN8551 Available in Green SOT-23-5L, SOP8 and MSOP8
  LN8552 Available in Green SOP8 and MSOP8
  LN8554 Available in Green SOP14

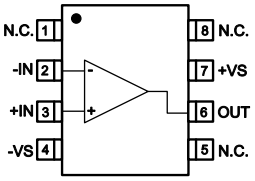
## ■ Package

LN8551MR



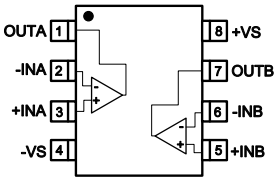

(SOT-23-5L)

LN8551SR/LN8551MMR



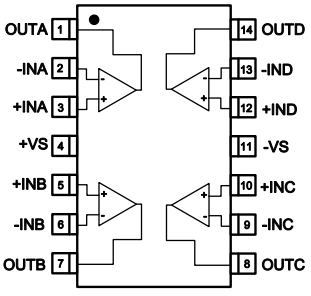

(SOP-8/MSOP-8)

LN8552SR/LN8552MMR




(SOP-8/MSOP-8)

LN8554SSR/LN8554TSR




(SSOP-14/TSSOP-8)

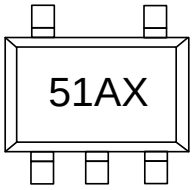
## ■ Ordering Information

**LN855 ①②③**

| Designator | Symbol | Description |
|---|---|---|
| ① | | **Product No.** |
| | 1 | LN8551 |
| | 2 | LN8552 |
| | 4 | LN8554 |
| ② | — | **Package** |
| | M | SOT-23-5 |
| | S | SOP-8 |
| | MM | MSOP-8 |
| | SS | SSOP-14 |
| | TS | TSSOP-14 |
| ③ | — | **Device Orientation** |
| | R | Embossed Tape: Standard Feed |
| | L | Embossed Tape: Reverse Feed |

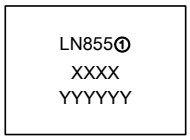
## ■ Marking

LN8551MR




51----LN8551MR
A-----die code
X-----process code

LN855①②③




LN855①----LN8551 or LN8552 or LN8554
XXXX--------process code
YYYYYY----lot code

## ■ Absolute Maximum Ratings

- ✧ Supply Voltage……...6V
- ✧ Input Voltage……-VS+0.3V—+VS+0.3V
- ✧ Differential Input Voltage……..-5.0V to +5.0V
- ✧ Package Thermal Resistance @ TA = 25℃
  SOT-23-5L……...190℃/W
  MSOP-8……216℃/W
  SOP-8……...125℃/W
  SSOP-14……..120℃/W
  TSSOP-14……180℃/W
- ✧ Storage temperature range……..…-65℃ to 150℃
- ✧ Operating junction temperature.....-40℃ to 125℃
- ✧ ESD Human Model……..4000V
- ✧ Lead Temperature Range (Soldering 10 sec)
  ……260℃

## ■ Electrical Characteristics

（VS = +5V, VCM = +2.5V, VO = +2.5V, TA = +25℃, unless otherwise noted.)

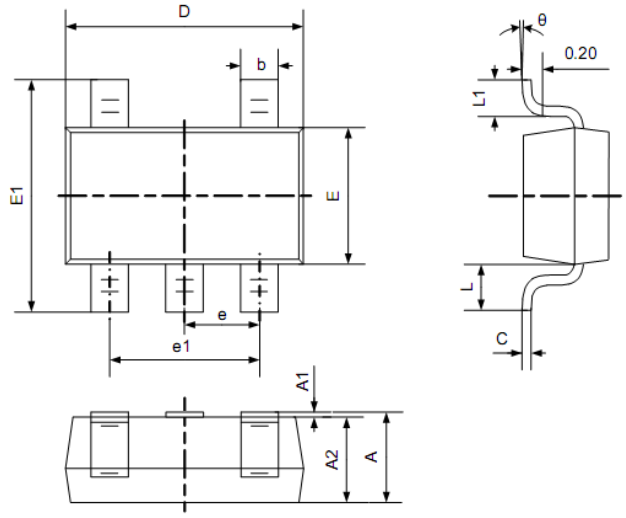
| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **INPUT CHARACTERISTICS** | | | | | | |
| $V_{OS}$ | Input Offset Voltage | | — | 3 | 10 | μV |
| $I_B$ | Input Bias Current | | | 100 | | pA |
| $I_{OS}$ | Input Offset Current | | | 10 | | pA |
| CMRR | Common-Mode Rejection Ratio | $V_{CM}$ = 0V to 5V | | 110 | | dB |
| $A_{VO}$ | Large Signal Voltage Gain | $R_L$ = 10kΩ $V_O$=0.3V~4.7V | | 145 | | dB |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift | | | 20 | | nV/℃ |
| **OUTPUT CHARACTERISTICS** | | | | | | |
| $V_{OH}$ | Output Voltage High | RL = 100kΩ to -VS | | 4.998 | | V |
| | | RL = 10kΩ to -VS | | 4.994 | | V |
| $V_{OL}$ | Output Voltage Low | RL = 100kΩ to +VS | | 2 | | mV |
| | | RL = 10kΩ to +VS | | 5 | | mV |
| $I_{SC}$ | Short Circuit Limit | RL =10Ω to -VS | | 43 | | mA |
| $I_O$ | Output Current | | | 30 | | mA |
| **POWER SUPPLY** | | | | | | |
| PSRR | Power Supply Rejection Ratio | VS = 2.7V to 5.5V | | 115 | | dB |
| $I_Q$ | Quiescent Current | VO = 0V, RL = 0Ω | | 450 | | μA |
| **DYNAMIC PERFORMANCE** | | | | | | |
| GBP | Gain-Bandwidth Product | G = +100 | | 1.44 | | MHz |
| SR | Slew Rate | RL = 10kΩ | | 0.84 | | V/μs |
| $T_{OR}$ | Overload Recovery Time | | | 0.10 | | ms |
| **NOISE PERFORMANCE** | | | | | | |
| $e_n$ p-p | Voltage Noise | 0Hz to 10Hz | | 0.81 | | μVp-p |
| $e_n$ | Voltage Noise Density | f = 1kHz | | 49 | | nV/$\sqrt{Hz}$ |

(VS = +2.7V, VCM = +1.35V, VO = +1.35V, TA = +25℃, unless otherwise noted.)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **INPUT CHARACTERISTICS** | | | | | | |
| $V_{OS}$ | Input Offset Voltage | | — | 3 | 10 | μV |
| $I_B$ | Input Bias Current | | | 75 | | pA |
| $I_{OS}$ | Input Offset Current | | | 5 | | pA |
| CMRR | Common-Mode Rejection Ratio | $V_{CM}$ = 0V to 2.7V | | 110 | | dB |
| $A_{VO}$ | Large Signal Voltage Gain | $R_L$ = 10kΩ $V_O$=0.3V~2.4V | | 140 | | dB |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift | | | 20 | | nV/℃ |
| **OUTPUT CHARACTERISTICS** | | | | | | |
| $V_{OH}$ | Output Voltage High | RL = 100kΩ to -VS | | 2.699 | | V |
| | | RL = 10kΩ to -VS | | 2.697 | | V |
| $V_{OL}$ | Output Voltage Low | RL = 100kΩ to +VS | | 1 | | mV |
| | | RL = 10kΩ to +VS | | 2 | | mV |
| $I_{SC}$ | Short Circuit Limit | RL =10Ω to -VS | | 26 | | mA |
| $I_O$ | Output Current | | | 10 | | mA |
| **POWER SUPPLY** | | | | | | |
| PSRR | Power Supply Rejection Ratio | VS = 2.7V to 5.5V | | 115 | | dB |
| $I_Q$ | Quiescent Current | VO = 0V, RL = 0Ω | | 450 | | μA |
| **DYNAMIC PERFORMANCE** | | | | | | |
| GBP | Gain-Bandwidth Product | G = +100 | | 1.43 | | MHz |
| SR | Slew Rate | RL = 10kΩ | | 0.84 | | V/μs |
| $T_{OR}$ | Overload Recovery Time | | | 0.04 | | ms |
| **NOISE PERFORMANCE** | | | | | | |
| $e_n$ p-p | Voltage Noise | 0Hz to 10Hz | | 0.90 | | μVp-p |
| $e_n$ | Voltage Noise Density | f = 1kHz | | 53 | | nV/$\sqrt{Hz}$ |

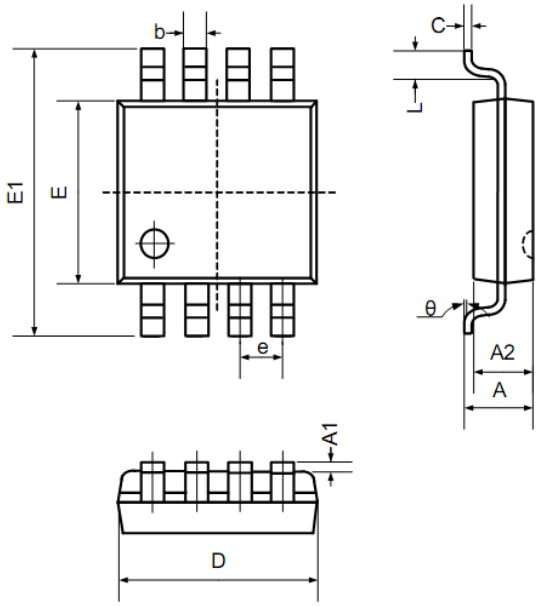
## ■ Package Information

### SOT-23-5L



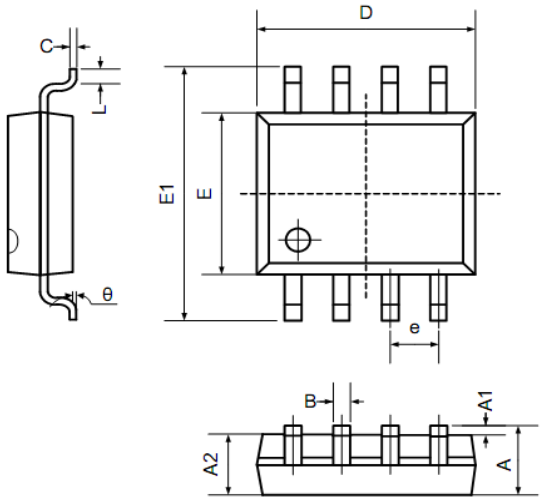

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.400 | 0.012 | 0.016 |
| C | 0.100 | 0.200 | 0.004 | 0.008 |
| 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 | 0.950TYP | | 0.037TYP | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.700REF | | 0.028REF | |
| L1 | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

### MSOP8



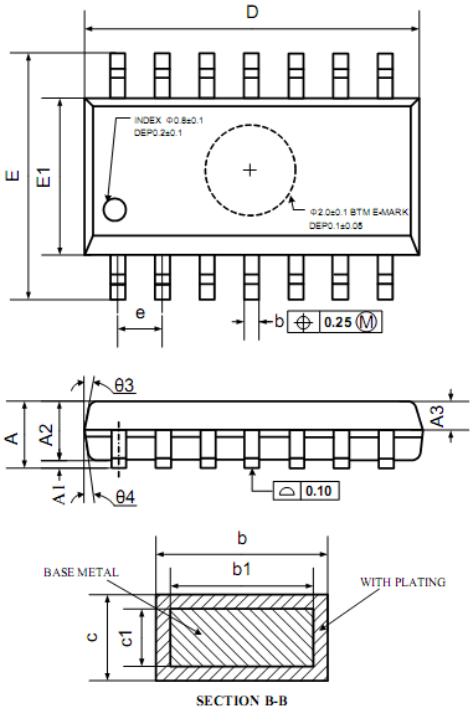

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.800 | 1.200 | 0.031 | 0.047 |
| A1 | 0.000 | 0.200 | 0.000 | 0.008 |
| A2 | 0.760 | 0.970 | 0.030 | 0.038 |
| b | 0.30 TYP | | 0.012 TYP | |
| C | 0.15 TYP | | 0.006 TYP | |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.65 TYP | | 0.026 TYP | |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 4.700 | 5.100 | 0.185 | 0.201 |
| L | 0.410 | 0.650 | 0.016 | 0.026 |
| θ | 0° | 6° | 0° | 6° |

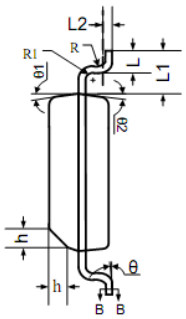
## SOP8




| 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 | 0.190 | 0.250 | 0.007 | 0.010 |
| D | 4.780 | 5.000 | 0.188 | 0.197 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.300 | 0.228 | 0.248 |
| e | 1.270TYP | | 0.050TYP | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

## SOP14




| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 1.35 | 1.60 | 1.75 |
| A1 | 0.10 | 0.15 | 0.25 |
| A2 | 1.25 | 1.45 | 1.65 |
| A3 | 0.55 | 0.65 | 0.75 |
| b | 0.36 | | 0.49 |
| b1 | 0.35 | 0.40 | 0.45 |
| c | 0.16 | | 0.25 |
| c1 | 0.15 | 0.20 | 0.25 |
| D | 8.53 | 8.63 | 8.73 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | 1.27 BSC | | |
| L | 0.45 | 0.60 | 0.80 |
| L1 | 1.04 REF | | |
| L2 | 0.25 BSC | | |
| R | 0.07 | | |
| R1 | 0.07 | | |
| h | 0.30 | 0.40 | 0.50 |
| θ | 0° | | 8° |
| θ1 | 6° | 8° | 10° |
| θ2 | 6° | 8° | 10° |
| θ3 | 5° | 7° | 9° |
| θ4 | 5° | 7° | 9° |