

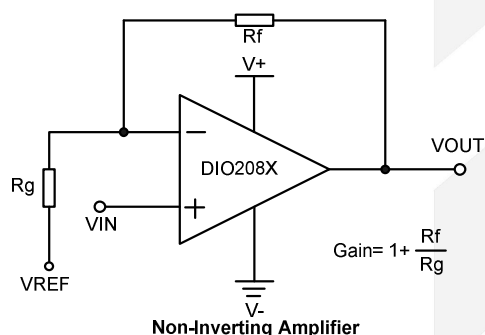
## DIO2081/2/4

### 600nA, Rail-to-Rail Input/ Output Low Power Amplifier

#### Features

- Ultra low power: 600nA per channel
- Unity Gain Stable
- Gain Bandwidth Product: 14kHz
- Wide supply range: 1.2V to 5.5V
- Available in SOT23-5, SOIC-8, MSOP-8 and SOIC-14 package
- Temperature Range:
  - Industrial: -40°C to +85°C
  - Extended: -40°C to +125°C

#### Typical Applications



#### Descriptions

DIO208x is a family of ultra low power operational amplifier, with rail-to-rail CMOS input/output and single/dual channels selectable. DIO208x family has a gain-bandwidth product of 14kHz, wide operating supply voltage from 1.2V to 5.5V and broad output voltage swing.

DIO208x consumes ultra low power, with each channel 600nA of bias current, which makes DIO208x be ideal for battery powered device, temperature-sense device, etc.

The DIO208x operational amplifier family is available in single (DIO2081), and dual (DIO2082), and quad (DIO2084) configurations. Furthermore, the DIO2081 is offered in the 5-lead SOT23 package. All types of amplifiers are fully specified over the extended -40°C to +125°C temperature range.

#### Applications

- Portable Equipment
- Active Filters
- Data Acquisition
- Portable Equipment
- Test Equipment
- Broadband Communication
- Process Control
- Audio and Video Processing

#### Ordering Information

| Order Part Number | Top Marking |               | T <sub>A</sub> |         | Package           |
|-------------------|-------------|---------------|----------------|---------|-------------------|
| DIO2081ST5        | YW(X)Z      | Green or RoHS | -40 to +125°C  | SOT23-5 | Tape & Reel, 3000 |
| DIO2081SO8        | DIO2081     | Green or RoHS | -40 to +125°C  | SOIC-8  | Tape & Reel, 2500 |
| DIO2081MP8        | DIO2081     | Green or RoHS | -40 to +125°C  | MSOP-8  | Tape & Reel, 3000 |
| DIO2082SO8        | DIO2082     | Green or RoHS | -40 to +125°C  | SOIC-8  | Tape & Reel, 2500 |
| DIO2082MP8        | DIO2082     | Green or RoHS | -40 to +125°C  | MSOP-8  | Tape & Reel, 3000 |
| DIO2084CS14       | DIO2084     | Green or RoHS | -40 to +125°C  | SOIC-14 | Tape & Reel, 2500 |

## Pin Assignments

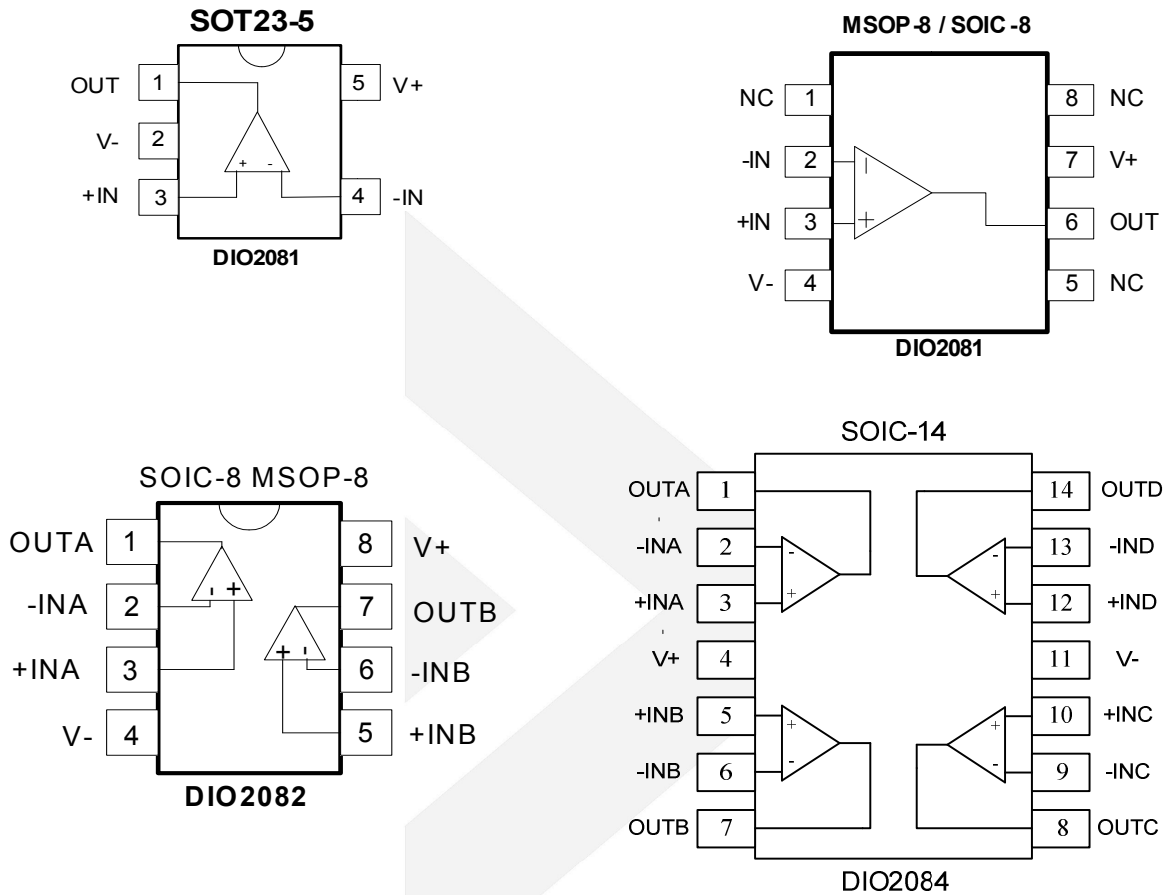


Figure 1 Top View

## Pin Description

| Pin name | Description     |
|----------|-----------------|
| V+       | Positive supply |
| V-       | Negative supply |
| +INX     | Positive Input  |
| -INX     | Negative Input  |
| OUTX     | Output          |

## Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Parameter                 |                         | Rating                 | Unit |
|---------------------------|-------------------------|------------------------|------|
| Supply Voltage ( V+ – V-) |                         | 7                      | V    |
| Input Voltage             |                         | (V-)-0.3V to (V+)+0.3V | V    |
| Difference Input Voltage  |                         | V+ – V-                | V    |
| Storage Temperature Range |                         | -65 to 150             | °C   |
| Junction Temperature      |                         | 150                    | °C   |
| Lead Temperature Range    |                         | 260                    | °C   |
| ESD                       | HBM, JEDEC: JESD22-A114 | 8                      | kV   |
|                           | CDM, JEDEC: JESD22-C101 | 2                      |      |

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Parameter                   |  | Rating     | Unit |
|-----------------------------|--|------------|------|
| Supply Voltage              |  | 1.2 to 5.5 | V    |
| Input Voltage               |  | 0 to 5     | V    |
| Operating Temperature Range |  | -40 to 125 | °C   |

## Electrical Characteristics

Typical value:  $V_+ = 5V$ ,  $R_L = 1M\Omega$  to  $V_+/2$ ,  $V_{CM} = 1/2V_+$ ,  $T_A = 25^\circ C$ , unless otherwise specified.

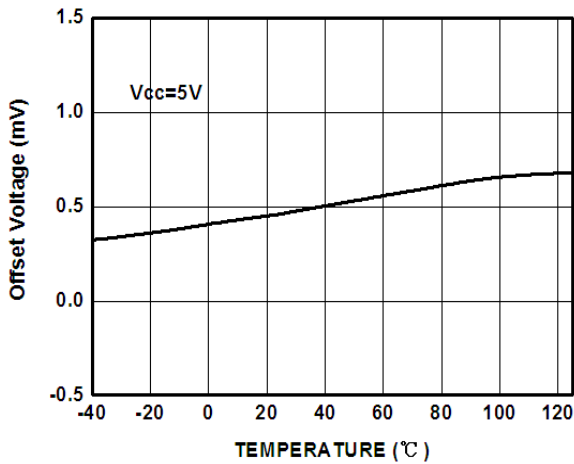
| Symbol                 | Parameter                      | Conditions                                                          | Min. | Typ.  | Max.                      | Unit   |
|------------------------|--------------------------------|---------------------------------------------------------------------|------|-------|---------------------------|--------|
| INPUT CHARACTERISTICS  |                                |                                                                     |      |       |                           |        |
| V <sub>OS</sub>        | Input Offset Voltage           | -40°C≤T <sub>A</sub> ≤125°C, V <sub>+</sub> =1.2V to 5.5V           | -2   |       | +2                        | mV     |
| I <sub>B</sub>         | Input Bias Current             | V <sub>+</sub> =1.2V to 5.5V                                        |      | 1     |                           | pA     |
| I <sub>OS</sub>        | Input Offset Current           | V <sub>+</sub> =1.2V to 5.5V                                        |      | 1     |                           | pA     |
| V <sub>CM</sub>        | Common Mode Voltage Range      |                                                                     | -0.1 |       | (V <sub>+</sub> )<br>+0.1 | V      |
| CMRR                   | Common Mode Rejection Ratio    | -40°C≤T <sub>A</sub> ≤125°C,                                        | 100  |       |                           | dB     |
| A <sub>OL</sub>        | Open Loop Voltage Gain         | R <sub>L</sub> =50kΩ, V <sub>O</sub> = 0.1 to (V <sub>+</sub> )-0.1 | 70   | 87    |                           | dB     |
| ΔV <sub>OS</sub> /ΔT   | Input Offset Voltage Drift     | -40°C≤T <sub>A</sub> ≤125°C                                         |      | ±5    |                           | μV/°C  |
| OUTPUT CHARACTERISTICS |                                |                                                                     |      |       |                           |        |
| V <sub>OH</sub>        | Output Voltage High            | R <sub>L</sub> =50kΩ -40°C≤T <sub>A</sub> ≤125°C                    |      | 4.992 |                           | V      |
| V <sub>OL</sub>        | Output Voltage Low             | R <sub>L</sub> =50kΩ -40°C≤T <sub>A</sub> ≤125°C                    |      | 8     | 15                        | mV     |
| I <sub>SC</sub>        | Output Short Circuit Current   | Source I <sub>SC</sub> , V <sub>+</sub> =5V                         |      | 30    |                           | mA     |
|                        |                                | Sink I <sub>SC</sub> , V <sub>+</sub> =5V                           |      | 30    |                           |        |
| POWER SUPPLY           |                                |                                                                     |      |       |                           |        |
| PSRR                   | Power Supply Rejection Ration  |                                                                     | 100  |       |                           | dB     |
| I <sub>S</sub>         | Supply Current per Channel/Amp | -40°C≤T <sub>A</sub> ≤125°C                                         |      | 600   | 1000                      | nA     |
| DYNAMIC PERFORMANCE    |                                |                                                                     |      |       |                           |        |
| GBP                    | Gain Bandwidth Product         | C <sub>L</sub> =60pF                                                |      | 14    |                           | kHz    |
| SR                     | Slew Rate                      | G=1, 2V Output Step                                                 |      | 3.5   |                           | V/ms   |
| t <sub>S</sub>         | Setting Time                   | G=1, 2V Output Step                                                 |      | 150   |                           | μs     |
| Θ <sub>m</sub>         | Phase Margin                   |                                                                     |      | 49    |                           | Deg    |
| t <sub>r</sub>         | Overload Recovery Time         |                                                                     |      | 110   |                           | μs     |
| NOISE PERFORMANCE      |                                |                                                                     |      |       |                           |        |
| THD                    | Total Harmonic Distortion      | f=100Hz, 4V <sub>PP</sub> , R <sub>L</sub> =50kΩ,                   |      | 0.09  |                           | %      |
| e <sub>n</sub>         | Voltage Noise Density          | f=1kHz                                                              |      | 190   |                           | nV/√Hz |

Specifications subject to change without notice.

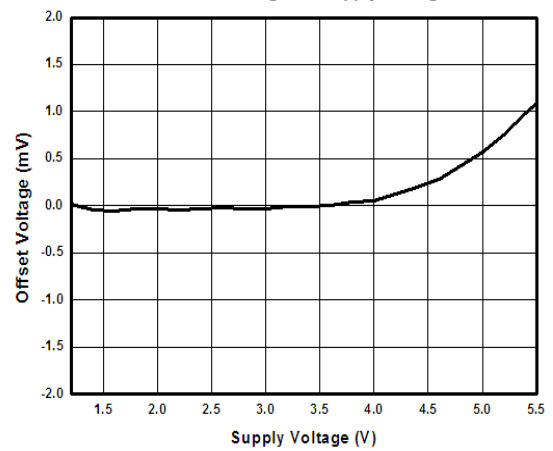
### Typical Performance Characteristics

All typical value are at  $V_{+}=5V$ ,  $T_A = 25^{\circ}C$ , unless otherwise specified.

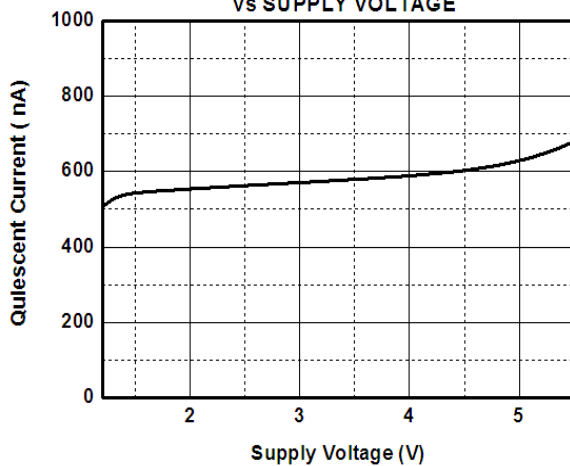
Offset Voltage vs. TEMPERATURE



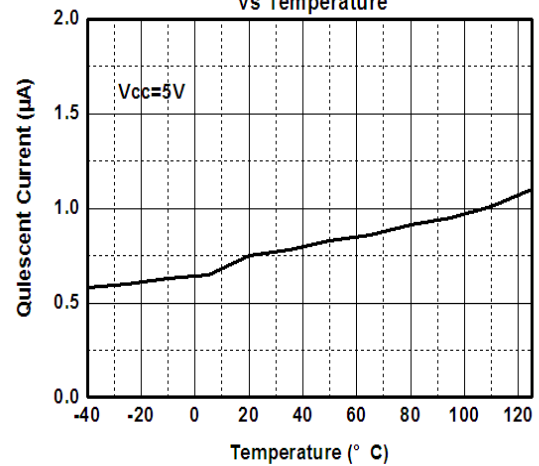
Offset Voltage vs. Supply Voltage



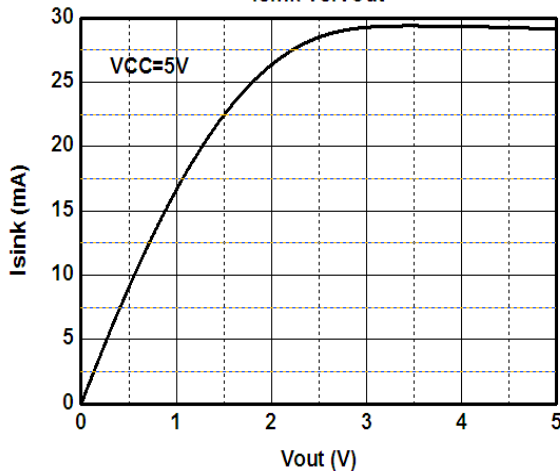
QUIESCENT CURRENT  
vs SUPPLY VOLTAGE



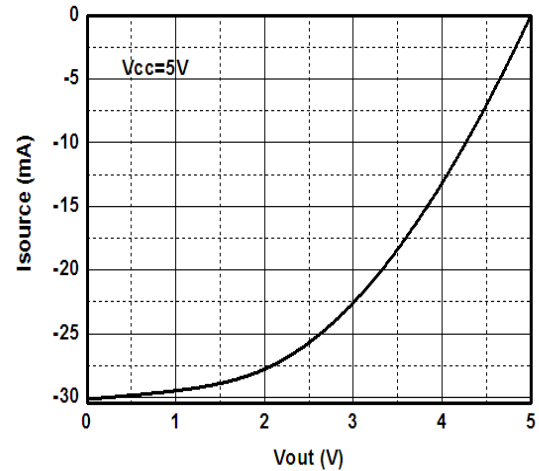
QUIESCENT CURRENT  
vs Temperature



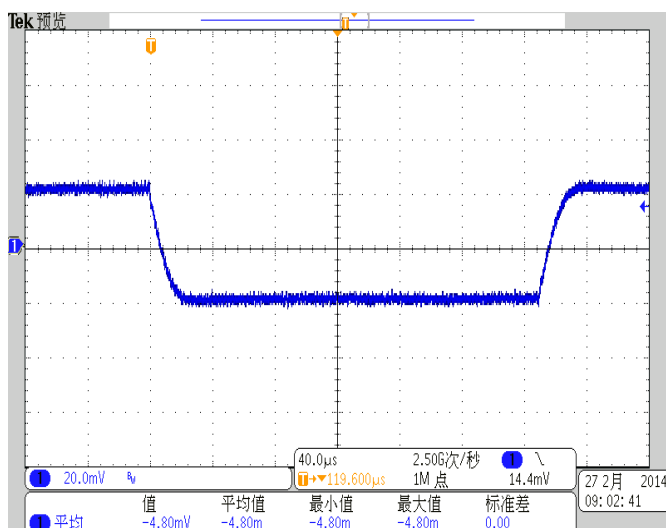
$I_{sink}$  vs.  $V_{out}$



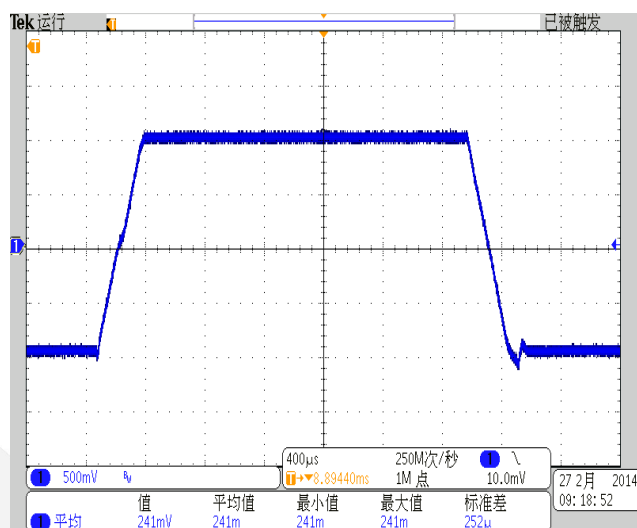
$I_{source}$  vs.  $V_{out}$



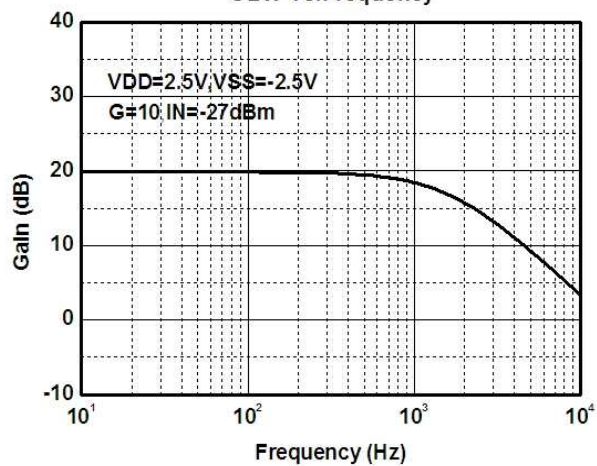
### Small Signal Response



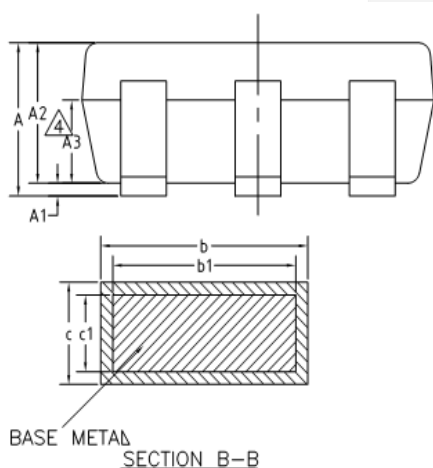
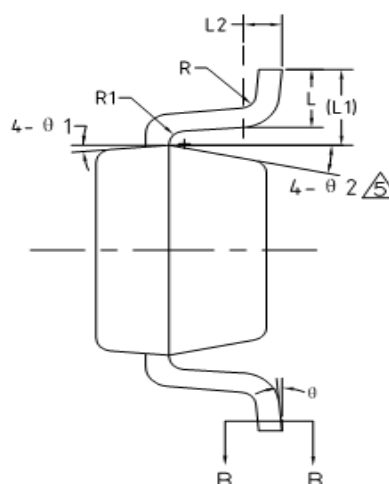
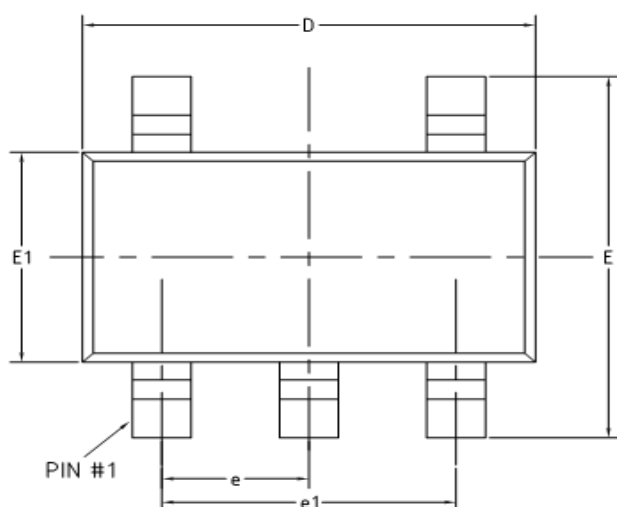
### Large Signal Response



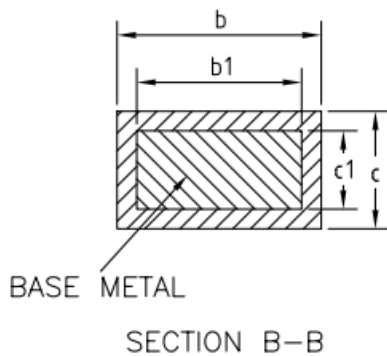
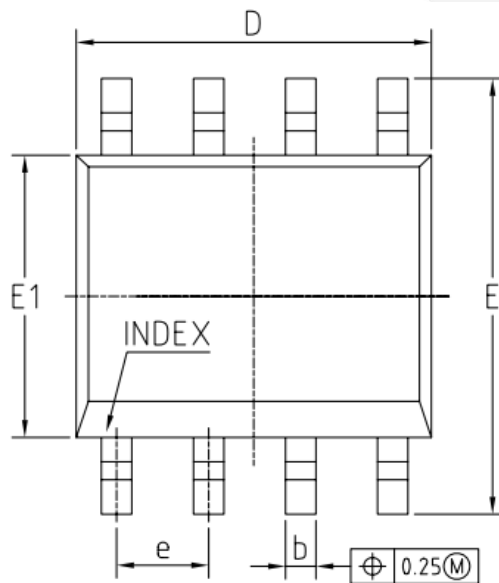
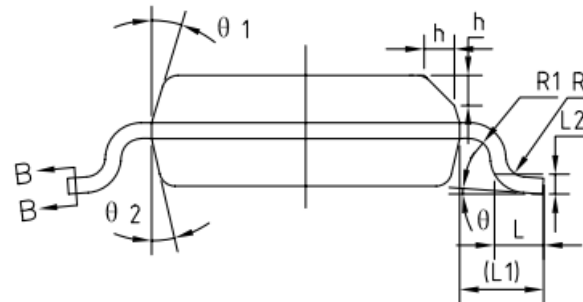
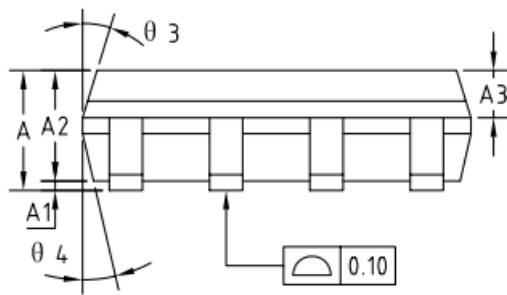
### GBW vs.Frequency



## Physical Dimensions: SOT-23-5



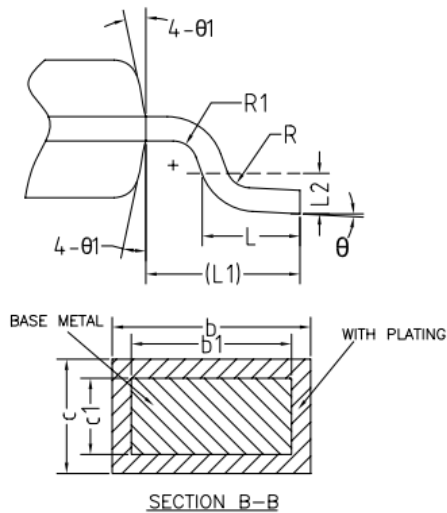
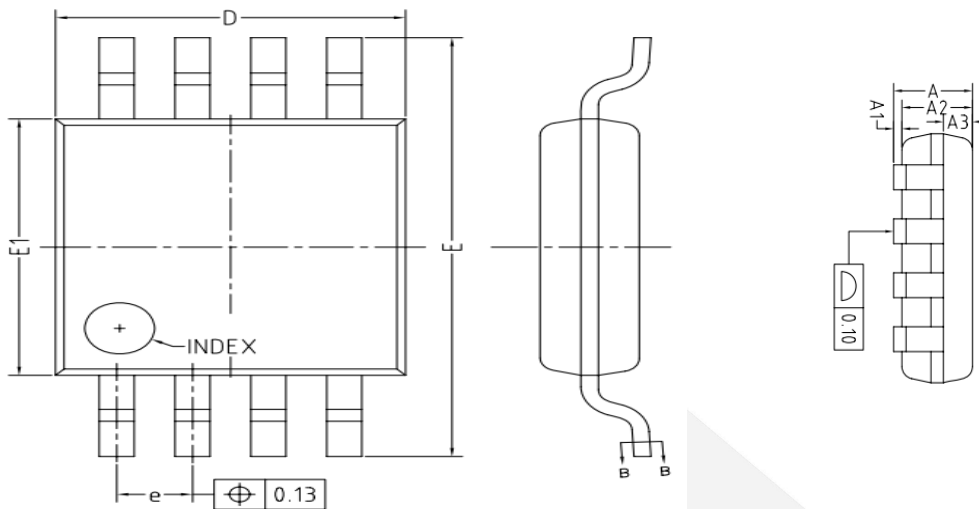
| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |         |       |       |
|----------------------------------------------------|---------|-------|-------|
| Symbol                                             | MIN     | NOM   | MAX   |
| A                                                  | -       | -     | 1.25  |
| A1                                                 | 0       | -     | 0.15  |
| A2                                                 | 1.00    | 1.10  | 1.20  |
| A3                                                 | 0.60    | 0.65  | 0.70  |
| b                                                  | 0.36    | -     | 0.50  |
| b1                                                 | 0.36    | 0.38  | 0.45  |
| c                                                  | 0.14    | -     | 0.20  |
| c1                                                 | 0.14    | 0.15  | 0.16  |
| D                                                  | 2.826   | 2.926 | 3.026 |
| E                                                  | 2.60    | 2.80  | 3.00  |
| E1                                                 | 1.526   | 1.626 | 1.726 |
| e                                                  | 0.90    | 0.95  | 1.00  |
| e1                                                 | 1.80    | 1.90  | 2.00  |
| L                                                  | 0.35    | 0.45  | 0.60  |
| L1                                                 | 0.59REF |       |       |
| L2                                                 | 0.25BSC |       |       |
| R                                                  | 0.10    | -     | -     |
| R1                                                 | 0.10    | -     | 0.25  |
| Θ                                                  | 0°      | -     | 8°    |
| Θ1                                                 | 3°      | 5°    | 7°    |
| Θ2                                                 | 6°      | -     | 14°   |

**Physical Dimensions: SOIC-8**


| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |         |      |      |
|----------------------------------------------------|---------|------|------|
| Symbol                                             | MIN     | NOM  | MAX  |
| A                                                  | 1.35    | 1.55 | 1.75 |
| A1                                                 | 0.10    | 0.15 | 0.25 |
| A2                                                 | 1.25    | 1.40 | 1.65 |
| A3                                                 | 0.50    | 0.60 | 0.70 |
| b                                                  | 0.38    | -    | 0.51 |
| b1                                                 | 0.37    | 0.42 | 0.47 |
| c                                                  | 0.17    | -    | 0.25 |
| c1                                                 | 0.17    | 0.20 | 0.23 |
| D                                                  | 4.80    | 4.90 | 5.00 |
| E                                                  | 5.80    | 6.00 | 6.20 |
| E1                                                 | 3.80    | 3.90 | 4.00 |
| e                                                  | 1.27BSC |      |      |
| L                                                  | 0.45    | 0.60 | 0.80 |
| L1                                                 | 1.04REF |      |      |
| L2                                                 | 0.25BSC |      |      |
| R                                                  | 0.07    | -    | -    |
| R1                                                 | 0.07    | -    | -    |
| h                                                  | 0.30    | 0.40 | 0.50 |
| θ                                                  | 0°      | -    | 8°   |
| θ1                                                 | 15°     | 17°  | 19°  |
| θ2                                                 | 11°     | 13°  | 15°  |
| θ3                                                 | 15°     | 17°  | 19°  |
| θ4                                                 | 11°     | 13°  | 15°  |

**600mA` Rail-to-Rail Input/ Output Low Power Amplifier**

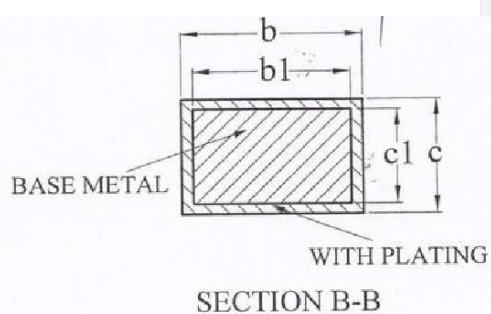
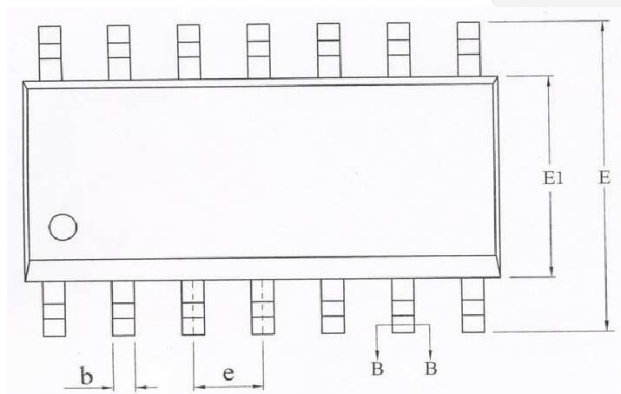
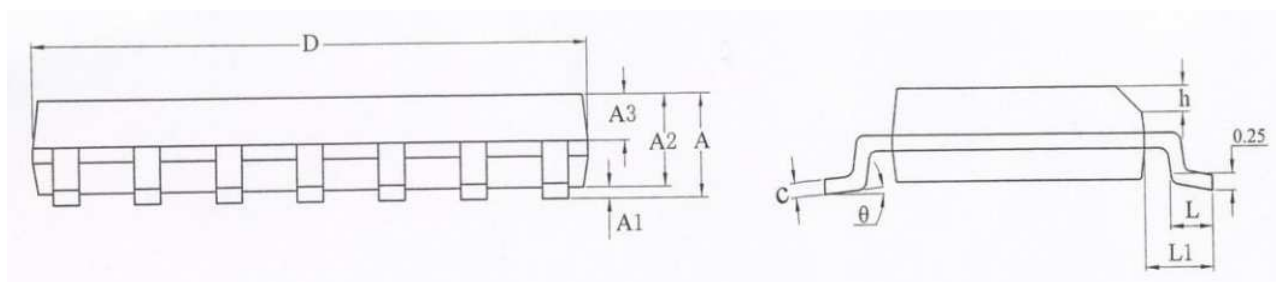
## Physical Dimensions: MSOP-8



| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |         |      |      |
|----------------------------------------------------|---------|------|------|
| Symbol                                             | MIN     | NOM  | MAX  |
| A                                                  | -       | -    | 1.10 |
| A1                                                 | 0       | -    | 0.15 |
| A2                                                 | 0.75    | 0.85 | 0.95 |
| A3                                                 | 0.25    | 0.35 | 0.39 |
| b                                                  | 0.28    | -    | 0.37 |
| b1                                                 | 0.27    | 0.30 | 0.33 |
| c                                                  | 0.15    | -    | 0.20 |
| c1                                                 | 0.14    | 0.15 | 0.16 |
| D                                                  | 2.90    | 3.00 | 3.10 |
| E                                                  | 4.70    | 4.90 | 5.10 |
| E1                                                 | 2.90    | 3.00 | 3.10 |
| e                                                  | 0.55    | 0.65 | 0.75 |
| L                                                  | 0.45    | 0.60 | 0.80 |
| L1                                                 | 0.95REF |      |      |
| L2                                                 | 0.25BSC |      |      |
| R                                                  | 0.07    | -    | -    |
| R1                                                 | 0.07    | -    | -    |
| θ                                                  | 0°      | -    | 8°   |
| θ1                                                 | 9°      | 12°  | 15°  |

## Physical Dimensions: SOIC-14

600mA Rail-to-Rail Input/ Output Low Power Amplifier



| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |           |      |        |
|----------------------------------------------------|-----------|------|--------|
| Symbol                                             | MIN       | NOM  | MAX    |
| A                                                  | -         | -    | 1.75   |
| A1                                                 | 0.05      | -    | 0.225  |
| A2                                                 | 1.30      | 1.40 | 1.50   |
| A3                                                 | 0.60      | 0.65 | 0.70   |
| b                                                  | 0.39      | -    | 0.48   |
| b1                                                 | 0.38      | 0.41 | 0.43   |
| c                                                  | 0.21      | -    | 0.26   |
| c1                                                 | 0.19      | 0.20 | 0.21   |
| D                                                  | 8.45      | 8.65 | 8.85   |
| E                                                  | 5.80      | 6.00 | 6.20   |
| E1                                                 | 3.70      | 3.90 | 4.10   |
| e                                                  | 1.27BSC   |      |        |
| h                                                  | 0.25      | -    | 0.50   |
| L                                                  | 0.50      | -    | 0.80   |
| L1                                                 | 1.05BSC   |      |        |
| θ                                                  | 0°        | -    | 8°     |
| L/F 载体尺寸 (mil)                                     | 70*70     |      | 90*110 |
|                                                    | 98*150    |      |        |
|                                                    | 100.4*210 |      |        |

## CONTACT US

**Dioo** is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as, cell phone, handheld products, laptop, and medical equipments and so on. Dioo's product families include analog signal processing and amplifying, LED drivers and charger IC. Go to <http://www.dioo.com> for a complete list of Dioo product families.

For additional product information, or full datasheet, please contact with our Sales Department or Representatives.