

# DIO20991

## Ultra Low Vos, Low Power Amplifier

### Features

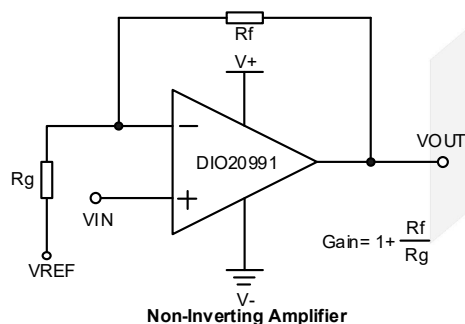
- Ultra low  $V_{OS}$ : 60 $\mu$ V(Max)
- Low Power: 7.0 $\mu$ A(typ.)
- Unity Gain Stable
- Gain Bandwidth Product: 110kHz(typ.)
- Wide supply range: 1.8V to 5.5V
- Available in DFN1.2\*1.2-6 package
- Temperature Range:
  - Industrial: -40°C to 85°C
  - Extended: -40°C to 125°C

### Descriptions

DIO20991 is an ultra low  $V_{OS}$  operational amplifier, with rail-to-rail CMOS input/output. DIO20991 has a gain-bandwidth product of 110kHz(typ.), wide operating supply voltage from 1.8V to 5.5V and broad output voltage swing.

DIO20991 consumes ultra low power, with 7.0 $\mu$ A(typ.) of bias current, which makes DIO20991 be ideal for battery powered device, temperature-sense device, etc.

### Typical Applications



### Applications

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

### Ordering Information

| Order Part Number | Top Marking |               | $T_A$        | Package      |                   |
|-------------------|-------------|---------------|--------------|--------------|-------------------|
| DIO20991PN6       | W1          | Green or RoHS | -40 to 125°C | DFN1.2*1.2-6 | Tape & Reel, 5000 |

### Pin Assignments

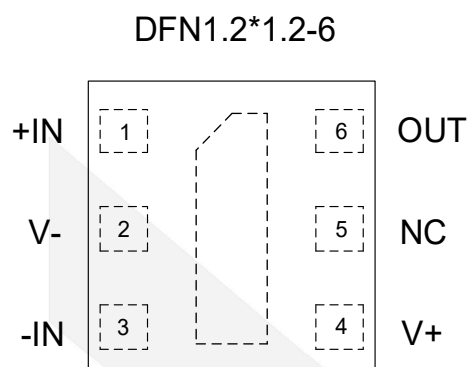


Figure 1 Top View

### Pin Description

| Pin name | Description     |
|----------|-----------------|
| V+       | Positive supply |
| V-       | Negative supply |
| +IN      | Positive Input  |
| -IN      | Negative Input  |
| OUT      | Output          |
| NC       | No connect      |

## 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   |

## 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              |  | 1.8 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             | V <sub>+</sub> =1.8V to 5.5V                                       | -60  |       | 60                        | μV    |
| I <sub>B</sub>         | Input Bias Current               | V <sub>+</sub> =1.8V to 5.5V                                       |      | 1     |                           | pA    |
| I <sub>OS</sub>        | Input Offset Current             | V <sub>+</sub> =1.8V 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                                        |      | 130   |                           | 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 | 80   | 110   |                           | dB    |
| ΔV <sub>OS</sub> /ΔT   | Input Offset Voltage Drift       | -40°C≤T <sub>A</sub> ≤125°C                                        |      | 0.02  |                           | 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     |                           | mV    |
| I <sub>SC</sub>        | Output Short Circuit Current     | Source I <sub>SC</sub> , V <sub>+</sub> =5V                        |      | 34    |                           | mA    |
|                        |                                  | Sink I <sub>SC</sub> , V <sub>+</sub> =5V                          |      | 34    |                           |       |
| 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                                        |      | 7     | 11                        | μA    |
| DYNAMIC PERFORMANCE    |                                  |                                                                    |      |       |                           |       |
| GBP                    | Gain Bandwidth Product           | C <sub>L</sub> =100pF, R <sub>L</sub> =1MΩ                         |      | 110   |                           | kHz   |
| SR                     | Slew Rate                        | G=1, 2V Output Step                                                |      | 80    |                           | V/ms  |
| t <sub>S</sub>         | Setting Time                     | G=1, 2V Output Step                                                |      | 2     |                           | ms    |
| ∅ <sub>m</sub>         | Phase Margin                     |                                                                    |      | 70    |                           | Deg   |
| t <sub>r</sub>         | Overload Recovery Time           |                                                                    |      | 3.9   |                           | ms    |
| NOISE PERFORMANCE      |                                  |                                                                    |      |       |                           |       |
| THD                    | Total Harmonic Distortion        | f=1kHz, 4V <sub>PP</sub> , R <sub>L</sub> =5kΩ                     |      | 0.33  |                           | %     |
| e <sub>nP-P</sub>      | Peak-to-Peak Input Noise Voltage | f= 0.1 to 10 Hz, V <sub>S</sub> = 5 V                              |      | 4     |                           | uV    |

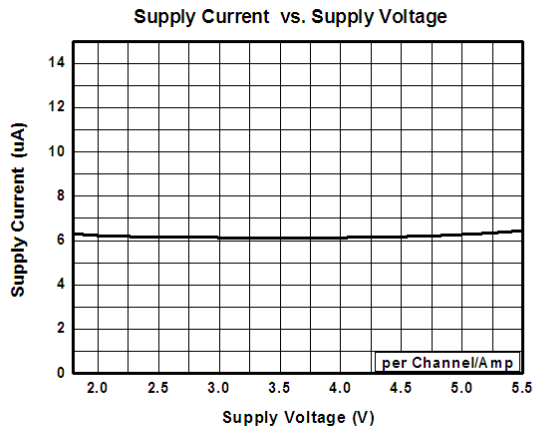
| $e_n$ | Voltage Noise Density | $f=1\text{kHz}, V_S = 5\text{ V}$ |  | 90 |  | $\text{nV}/\sqrt{\text{Hz}}$ |
|-------|-----------------------|-----------------------------------|--|----|--|------------------------------|
|-------|-----------------------|-----------------------------------|--|----|--|------------------------------|

Specifications subject to change without notice.

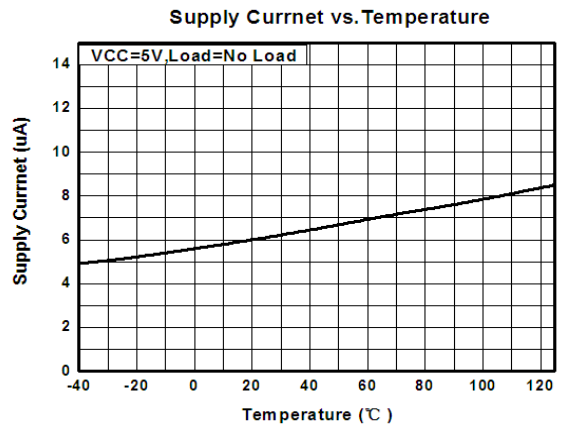


### Typical Performance Characteristics

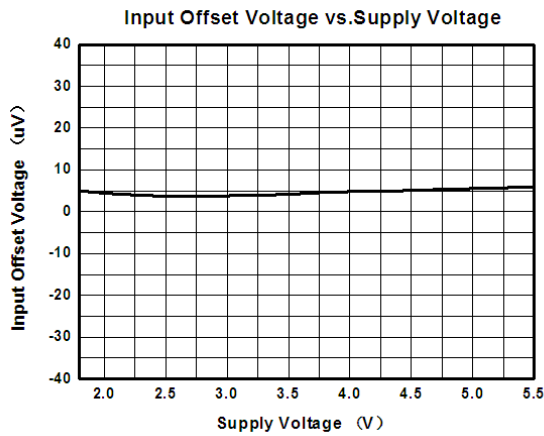
$I_S$  vs.  $V_{CC}$



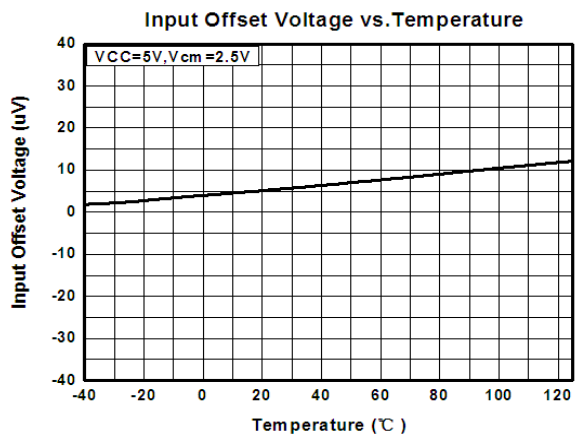
$I_S$  vs. Temperature



$V_{OS}$  vs.  $V_{CC}$

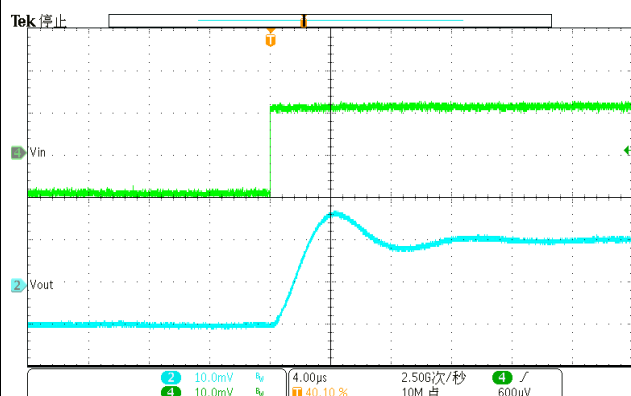


$V_{OS}$  vs. Temperature

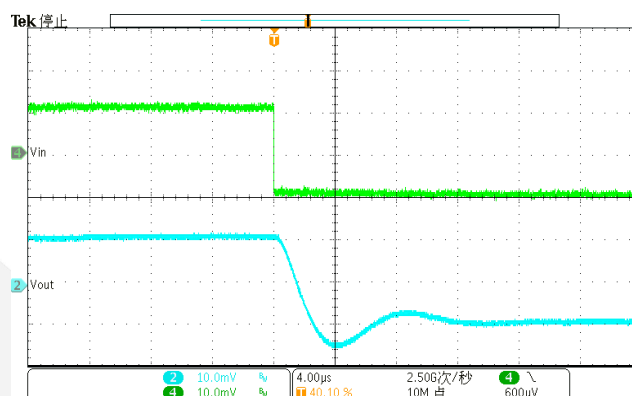


### Typical Performance Characteristics (Continue)

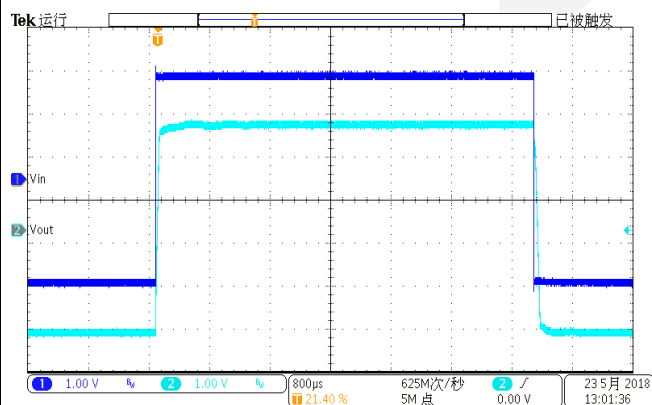
**Small-signal Response**  
( $V_{CC}=5V$ ,  $C_L=200pF$ )



**Small-signal Response**  
( $V_{CC}=5V$ ,  $C_L=200pF$ )



**Large-signal Response**  
( $V_{CC}=5V$ ,  $R_L=5.1k\Omega$ )



## 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 equipment 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.