

# DIO2331

## Ultra Low Vos, Low Power Amplifier

### Features

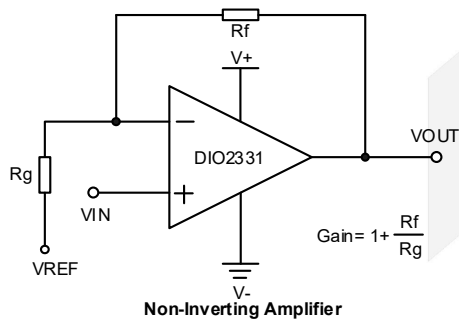
- Ultra low  $V_{OS}$ : 35 $\mu$ V(Max.)
- Low Power: 1.0 $\mu$ A(typ.)
- Unity Gain Stable
- Gain Bandwidth Product: 30kHz(typ.)
- Wide supply range: 1.8V to 5.5V
- Available in DFN1.5\*1.5-6 package
- Temperature Range: -40°C to 125°C

### Descriptions

DIO2331 is an ultra low  $V_{OS}$  operational amplifier. DIO2331 has a gain-bandwidth product of 30kHz(typ.), wide operating supply voltage from 1.8V to 5.5V and broad output voltage swing.

DIO2331 consumes ultra low power, with 1.0 $\mu$ A(typ.) bias current, which makes DIO2331 be ideal for battery powered device, temperature-sense device, etc.

### Typical Applications



### Applications

- Toll Booth Tags
- Wearable Products
- Battery Current Monitoring
- Sensor Conditioning
- Battery Powered

### Ordering Information

Order Part Number	Top Marking		$T_A$	Package
DIO2331LN6	W3	Green or RoHS	-40 to 125°C	DFN1.5*1.5-6 Tape & Reel, 3000

## Pin Assignments

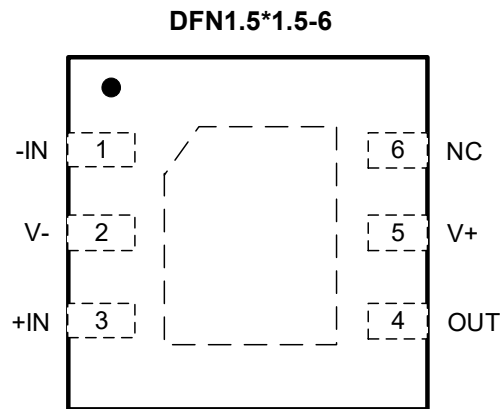


Figure 1 Top View

## 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
V+ – V-	7	V
Current at Input Pins	±2	mA
Input Voltage	(V-)-0.3V to (V+) 0.3V	V
Difference Input Voltage	V+ – V-	
Output Short-Circuit Current	Continuous	
Current at Output and Supply Pins	±30	mA
Storage Temperature	-65 to 150	°C
Maximum Junction Temperature(T <sub>J</sub> )	150	°C
ESD protection on all pins (HBM)	7.5	kV
Operating Temperature Range(T <sub>A</sub> )	-40~125	°C

## DC Electrical Characteristics

Unless otherwise indicated,  $V_+ = 1.8V$  to  $5.5V$ ,  $V_- = 0$ ,  $T_A = 25^\circ C$ ,  $V_{CM} = V_+/2$ ,  $R_L = 1M\Omega$  to  $V_{CM}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Input Offset</b>						
$V_{OS}$	Input Offset Voltage	$V_+ = 1.8 \sim 5.5V, V_{CM} = (V_+)/2$	-35		35	$\mu V$
$\Delta V_{OS}/\Delta T_A$	Input Offset Drift with Temperature	$T_A = -40^\circ C$ to $125^\circ C, V_+ = 1.8 \sim 5.5V, V_{CM} = (V_+)/2$		$\pm 0.15$		$\mu V/^\circ C$
PSRR	Power Supply Rejection Ratio	$V_{CM} = (V_+)/2$	100	110		dB
<b>Input Bias Current and Impedance</b>						
$I_B$	Input Bias Current	$T_A = 25^\circ C$		$\pm 1.0$		pA
		$T_A = 85^\circ C$		60		pA
		$T_A = 125^\circ C$		2000		pA
$I_{OS}$	Input Offset Current			$\pm 1.0$		pA
$Z_{CM}$	Common Mode Input Impedance			$10^{13}    6$		$\Omega    pF$
$Z_{DIFF}$	Differential Input Impedance			$10^{13}    6$		$\Omega    pF$
<b>Common Mode</b>						
$V_{CMR}$	Common Mode Input Voltage Range		(V <sub>-</sub> ) 0.1		(V <sub>+</sub> ) 0.1	V
CMRR	Common Mode Rejection Ratio	$V_{CM}$ from (V <sub>-</sub> )-0.1 to (V <sub>+</sub> )+0.1	100	110		dB
<b>Open-Loop Gain</b>						
$A_{OL}$	DC Open-Loop Gain (Large Signal)	$0.2V < V_{OUT} < (V_+ - 0.2V), R_L = 50k\Omega$ to $V_L$		120		dB
<b>Output</b>						
$V_{OL}$	Output Voltage Low	$V_+ = 5V, R_L = 50k$ to $V_+/2$		4.8		mV
$V_{OH}$	Output Voltage High	$V_+ = 5V, R_L = 50k$ to GND		4.994		V
$I_{SC}$	Output Short-Circuit Current	$V_+ = 1.8V$		3		mA
		$V_+ = 5V$		30		
<b>Power Supply</b>						
THD		$V_+ = 5V, V_{PP} = 2V, R_L = 50k,$ Frequency = 100Hz		0.13		%
		$V_+ = 5V, V_{PP} = 2V, R_L = 50k,$ Frequency = 200Hz		0.26		

		V+=5V, V <sub>PP</sub> =2V, R <sub>L</sub> =50k, Frequency=250Hz		0.33		
		V+=5V, V <sub>PP</sub> =2V, R <sub>L</sub> =50k, Frequency=500Hz		0.62		
V+	Supply Voltage		1.8		5.5	V
I <sub>Q</sub>	Quiescent Current per Amplifier	I <sub>O</sub> =0, V <sub>CM</sub> =(V+)/2, V+=5.0V		1.0		μA

Specifications subject to change without notice.

## AC Electrical Characteristics

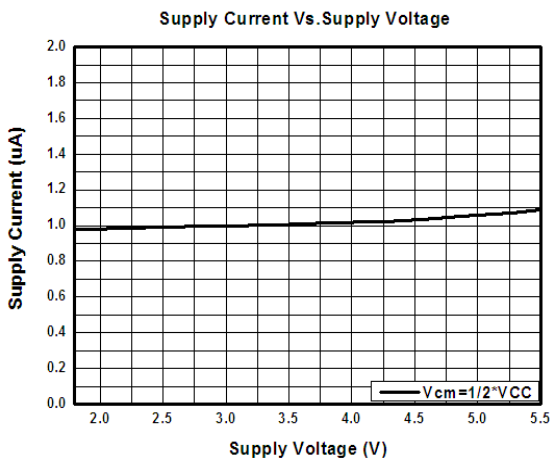
Unless otherwise indicated, T<sub>A</sub> =25°C, V+=1.8 to 5.5V, V-=0, V<sub>CM</sub>=V+/2, C<sub>L</sub>=60pF, R<sub>L</sub>=1MΩ to V<sub>CM</sub>.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>AC Response</b>						
GBWP	Gain Bandwidth Product			30		kHz
PM	Phase Margin	G=1V/V		65		°
SR	Slew Rate			10		V/ms
<b>Noise</b>						
E <sub>ni</sub>	Input Noise Voltage	f=0.1Hz to10Hz		3.9		μVp-p
e <sub>ni</sub>	Input Noise Voltage Density	f=1kHz		165		nV/√Hz
i <sub>ni</sub>	Input Noise Current Density	f=1kHz		0.6		fA/√Hz

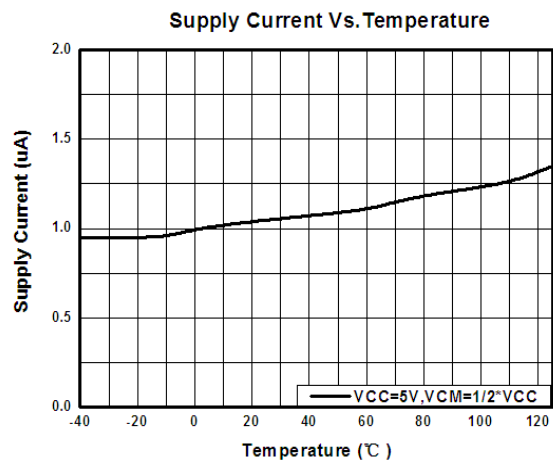
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## Typical Performance Characteristics

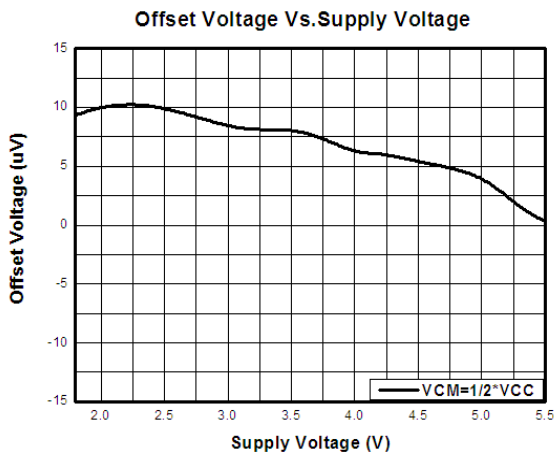
I<sub>CC</sub> VS V<sub>CC</sub>



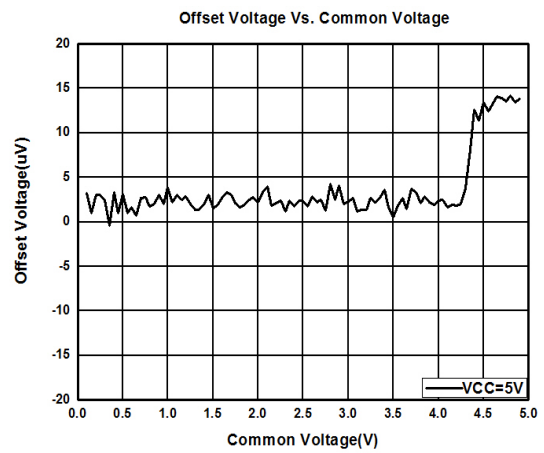
I<sub>CC</sub> VS TEMP



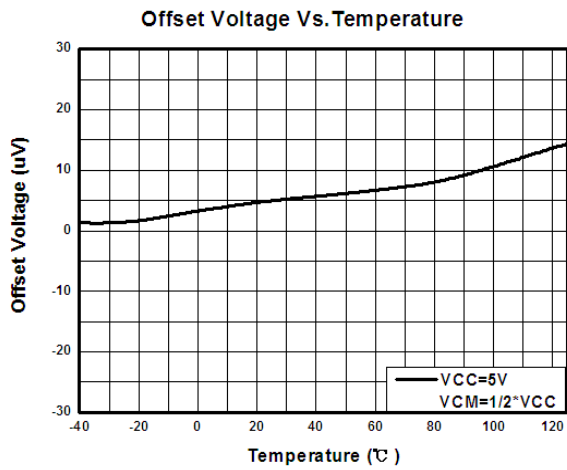
### V<sub>os</sub> VS V<sub>CC</sub>



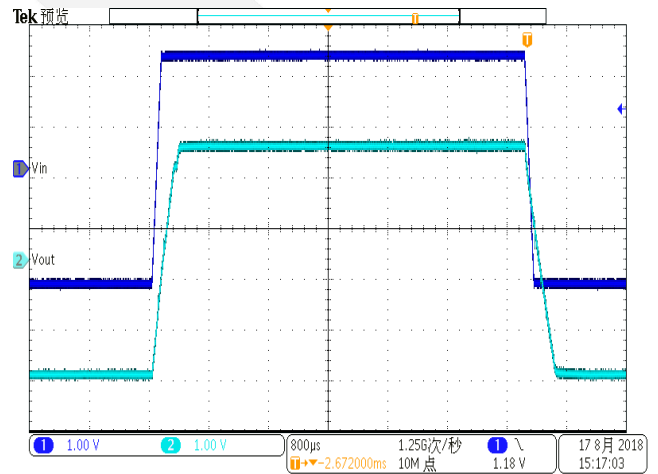
### V<sub>os</sub> VS V<sub>CM</sub>



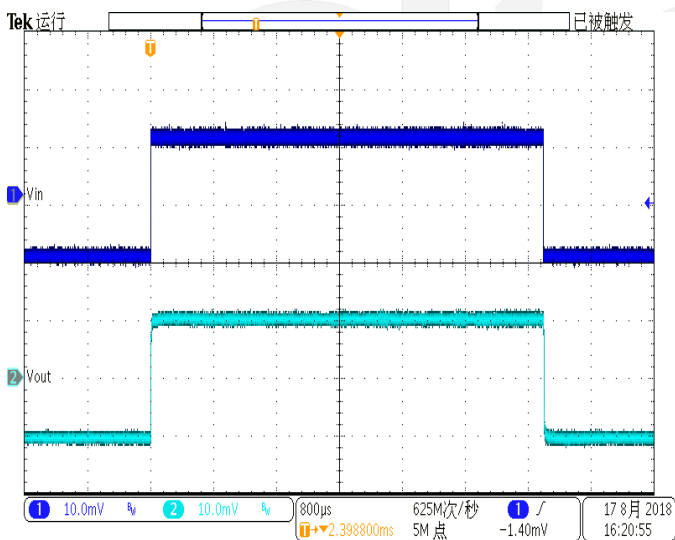
### V<sub>os</sub> VS TEMP



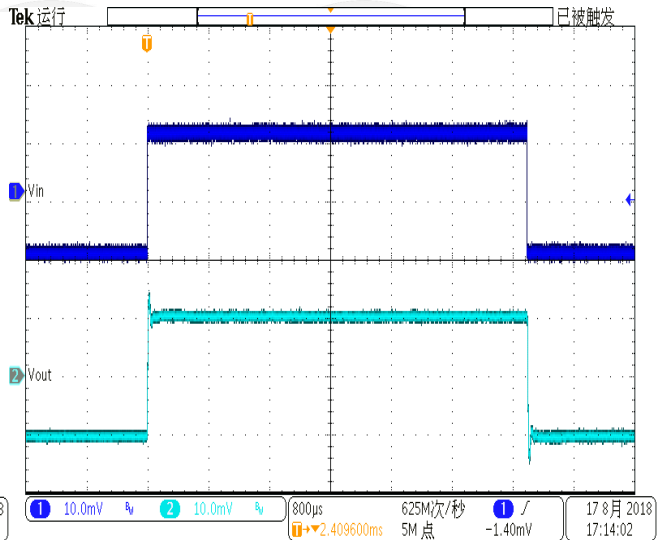
### Large-Signal Response



### Small-signal response (CL=No Cap)



### Small-signal response (CL=200p Cap)



## CONTACT US

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

A large, light gray watermark of the Dioo logo is centered on the page. It consists of a stylized arrow pointing right followed by the word "dioo" in a lowercase, sans-serif font.