

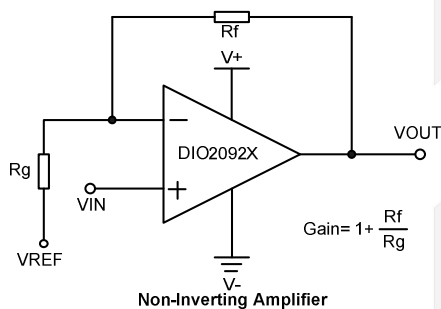
## DIO20921/1D/2/4

### 4 $\mu$ A, Rail-to-Rail Input/ Output Low Power Amplifier

#### Features

- Ultra low power: 4 $\mu$ A per channel
- Unity Gain Stable
- Gain Bandwidth Product: 150kHz
- Wide supply range: 1.8V to 5.5V
- Available in SOT23-5, SOT23-6, SOIC-8, MSOP-8, SOP-14 and TSSOP-14 packages
- Temperature Range:
  - Industrial: -40°C to +85°C
  - Extended: -40°C to +125°C

#### Typical Applications



#### Descriptions

DIO2092x is a family of ultra low power operational amplifier, with rail-to-rail CMOS input/output and single/dual channels selectable. DIO2092x family has a gain-bandwidth product of 150kHz, wide operating supply voltage from 1.8V to 5.5V and broad output voltage swing.

DIO2092x consumes ultra low power, with each channel 4 $\mu$ A of bias current, which makes DIO2092x be ideal for battery powered device, temperature-sense device, etc.

The DIO2092x operational amplifier family is available in single (DIO20921/1D), and dual (DIO20922), and quad (DIO20924) configurations. Furthermore, the DIO20921 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	
DIO20921ST5	W921	Green or RoHS	-40 to +125°C	SOT23-5	Tape & Reel, 3000
DIO20921SO8	D20921	Green or RoHS	-40 to +125°C	SOIC-8	Tape & Reel, 2500
DIO20921MP8	D20921	Green or RoHS	-40 to +125°C	MSOP-8	Tape & Reel, 3000
DIO20921DST6	W92D	Green or RoHS	-40 to +125°C	SOT23-6	Tape & Reel, 3000
DIO20921DSO8	D20921D	Green or RoHS	-40 to +125°C	SOIC-8	Tape & Reel, 2500
DIO20921DMP8	D20921D	Green or RoHS	-40 to +125°C	MSOP-8	Tape & Reel, 3000
DIO20922SO8	D20922	Green or RoHS	-40 to +125°C	SOIC-8	Tape & Reel, 2500
DIO20922MP8	D20922	Green or RoHS	-40 to +125°C	MSOP-8	Tape & Reel, 3000
DIO20924CS14	D20924	Green or RoHS	-40 to +125°C	SOP-14	Tape & Reel, 2500
DIO20924TP14	D20924	Green or RoHS	-40 to +125°C	TSSOP-14	Tape & Reel, 2500

## Pin Assignments

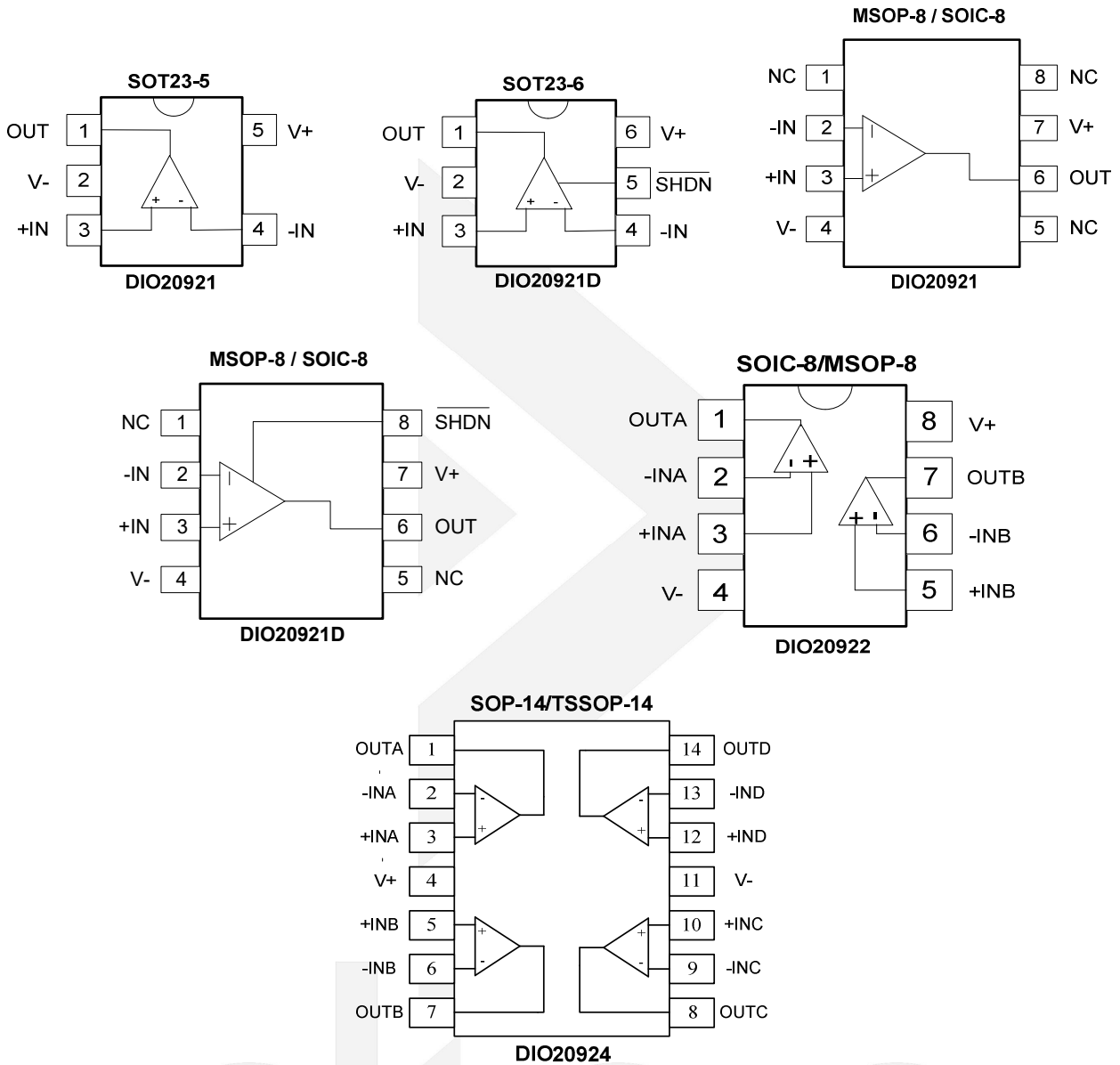


Figure 1 Top View

## Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+INX	Positive Input
-INX	Negative Input
OUTX	Output
SHDN	Active Low Shutdown

## 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	1.8 to 5.5	V
Input Voltage	0 to 5	V
Operating Temperature Range	-40 to 125	°C



## Electrical Characteristics

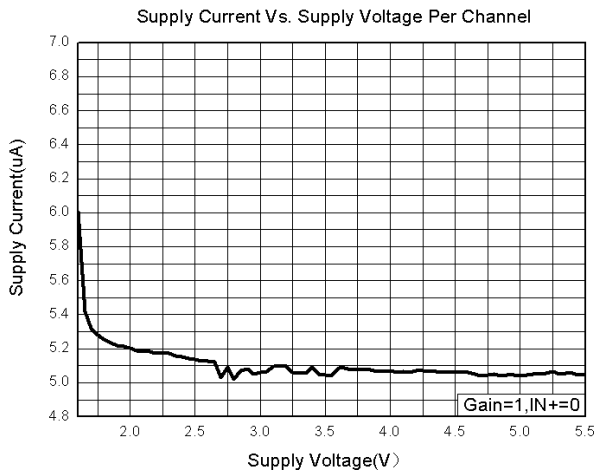
Typical value:  $V_+ = 5V$ ,  $R_L = 100k\Omega$  to  $V_+/2$ ,  $V_{CM} = 1/2V_+$ ,  $T_A = 25^\circ C$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>INPUT CHARACTERISTICS</b>						
$V_{OS}$	Input Offset Voltage	$-40^\circ C \leq T_A \leq 125^\circ C$ , $V_+ = 1.8V$ to $5.5V$	-5		+5	mV
$I_B$	Input Bias Current	$V_+ = 1.8V$ to $5.5V$		1		pA
$I_{OS}$	Input Offset Current	$V_+ = 1.8V$ to $5.5V$		1		pA
$V_{CM}$	Common Mode Voltage Range		-0.1		( $V_+$ ) +0.1	V
CMRR	Common Mode Rejection Ratio	$-40^\circ C \leq T_A \leq 125^\circ C$ ,		130		dB
$A_{OL}$	Open Loop Voltage Gain	$R_L = 100k\Omega$ , $V_O = 0.1$ to $(V_+) - 0.1$	70	105		dB
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	$-40^\circ C \leq T_A \leq 125^\circ C$		$\pm 5$		$\mu V/^\circ C$
<b>OUTPUT CHARACTERISTICS</b>						
$V_{OH}$	Output Voltage High	$R_L = 100k\Omega$ $-40^\circ C \leq T_A \leq 125^\circ C$		4.995		V
$V_{OL}$	Output Voltage Low	$R_L = 100k\Omega$ $-40^\circ C \leq T_A \leq 125^\circ C$		5		mV
$I_{SC}$	Output Short Circuit Current	Source $I_{SC}$ , $V_+ = 5V$		24		mA
		Sink $I_{SC}$ , $V_+ = 5V$		24		
<b>POWER SUPPLY</b>						
PSRR	Power Supply Rejection Ration		100			dB
$I_Q$	Supply Current per Channel/Amp	$-40^\circ C \leq T_A \leq 125^\circ C$		4		$\mu A$
$I_{Q(off)}$	Supply Current in Shutdown	$V_{SHDN} = 0V$		3		nA
$I_{SHDN}$	Shutdown Pin Current			-10		pA
$I_{LEAK}$	Output Leakage Current in Shutdown	$V_{SHDN} = 0V$		3.6		pA
$V_{IL}$	SHDN Input Low Voltage	Disable			0.5	V
$V_{IH}$	SHDN Input High Voltage	Enable	1.1			V
<b>DYNAMIC PERFORMANCE</b>						
GBP	Gain Bandwidth Product	$C_L = 100pF$		150		kHz
SR	Slew Rate	$G = 1$ , 2V Output Step		70		V/ms
$t_s$	Setting Time	$G = 1$ , 2V Output Step		20		$\mu s$
$\Theta_m$	Phase Margin			60		Deg
$t_r$	Overload Recovery Time			166		$\mu s$
<b>NOISE PERFORMANCE</b>						
THD	Total Harmonic Distortion	$f = 100Hz$ , $4V_{PP}$ , $R_L = 100k\Omega$ ,		0.09		%
$e_n$	Voltage Noise Density	$f = 1kHz$		103		$nV/\sqrt{Hz}$

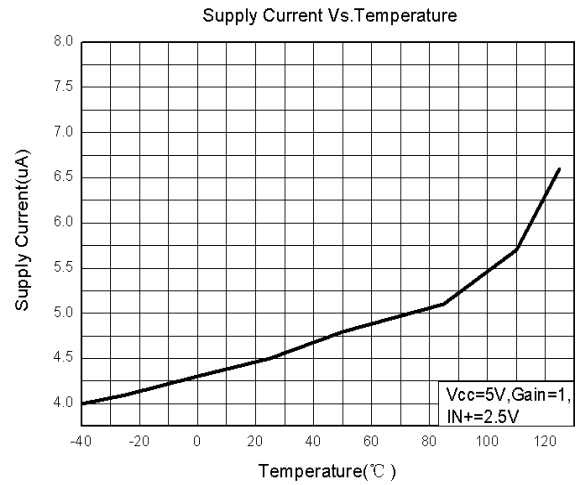
Specifications subject to change without notice.

## Typical Performance Characteristics

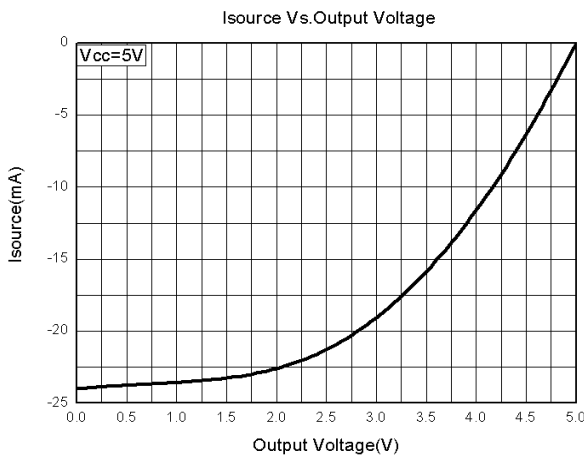
**Supply Current vs. Supply Voltage Per Channel**



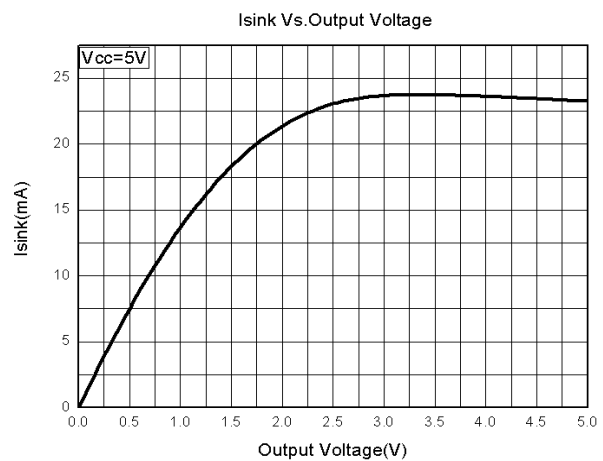
**Supply Current vs. Temperature**



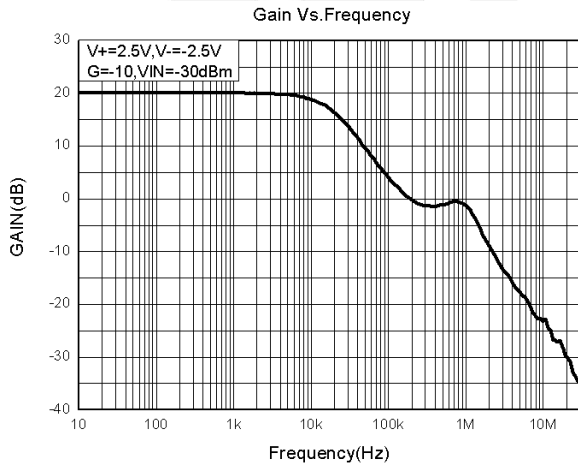
**I<sub>SOURCE</sub> vs. Output Voltage**



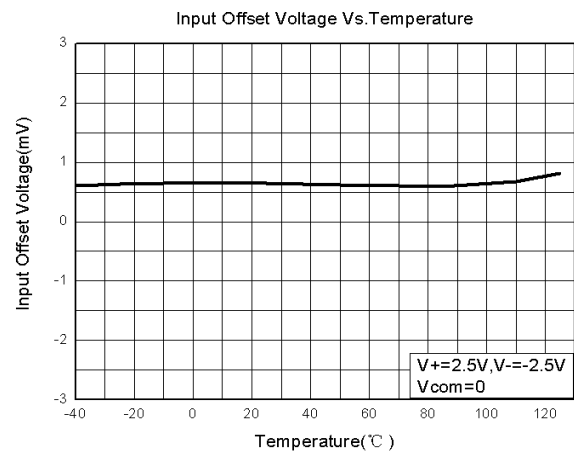
**I<sub>SINK</sub> vs. Output Voltage**



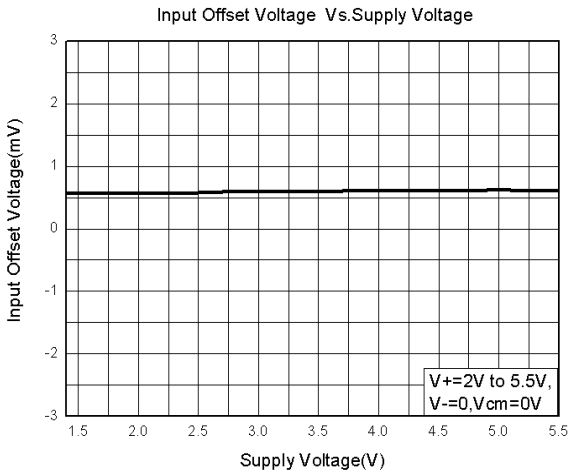
**Gain vs. Frequency**



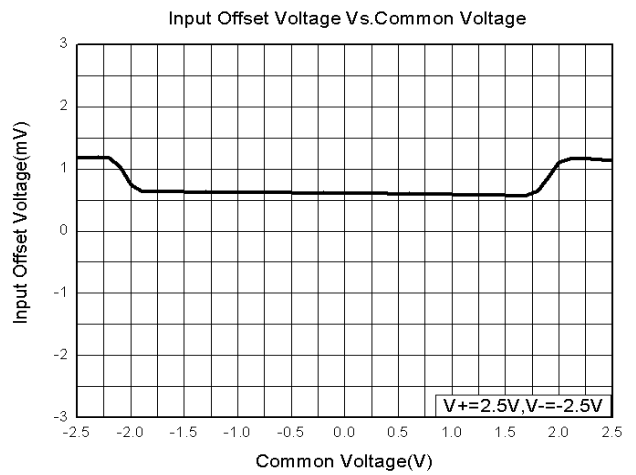
**Input Offset Voltage vs. Temperature**



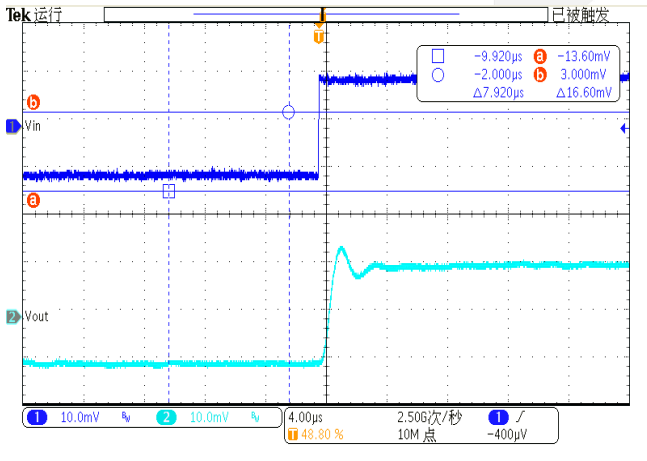
### Input Offset Voltage vs. Supply Voltage



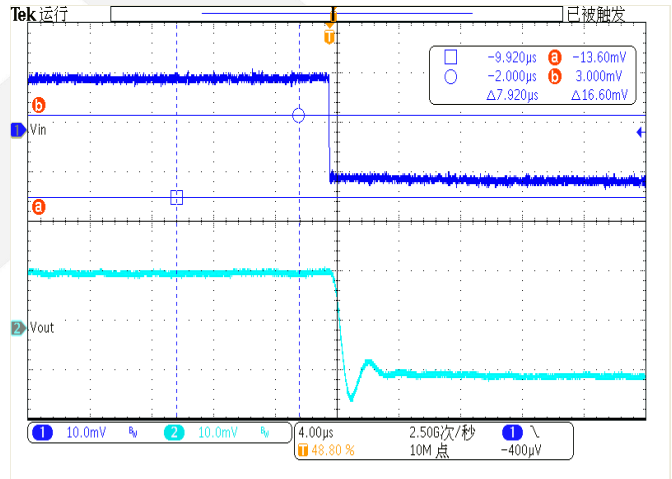
### Input Offset Voltage vs. Common Voltage



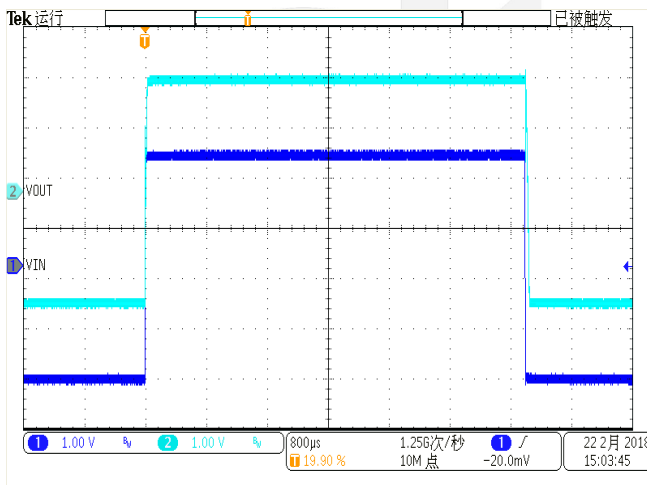
### Small-Signal Response (V+=5V, C<sub>L</sub>=200pF)



### Small-Signal Response (V+=5V, C<sub>L</sub>=200pF)



### Large-Signal Response (V+=5V, R<sub>L</sub>=1MΩ)



## 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.

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