

DIO29001

Low-Power, RRIO, 400 kHz Operational Amplifier

Features

- Rail-to-rail input and output
- Max offset (V_{OS}): ± 1.5 mV
- Unity gain stable
- Gain bandwidth product: 400 kHz
- Very low input bias currents: 10 pA
- Wide supply range: 1.65 V to 5.5 V
- Input voltage range: 0 V to $V+$
- Ultra-low power: 40 μ A
- Compact package best for portable applications: DFN0.8*0.8-4, SOT23-5, and SC70-5

Descriptions

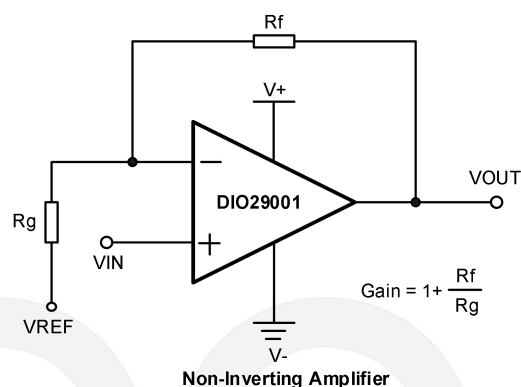
The DIO29001 is a rail-to-rail CMOS operational amplifiers with an ultra-low offset. Features include wide input common-mode voltage range and broad output voltage swing with operating supply voltage from 1.65 V to 5.5 V. Products are fully specified over the extended -40 to $+125^{\circ}\text{C}$ temperature range.

The DIO29001 provides a 400 kHz bandwidth, consuming an ultra-low current of 40 μ A. Very low input bias currents of 10 pA make them ideal for integrators, photodiode amplifiers, and piezoelectric sensors.

Applications

- ASIC input or output amplifiers
- Sensor interface
- Piezoelectric transducer amplifiers
- Medical instrumentation
- Audio output
- Portable systems
- Smoke detectors
- Notebook PCs
- Battery-powered equipment

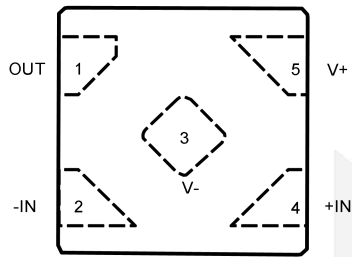
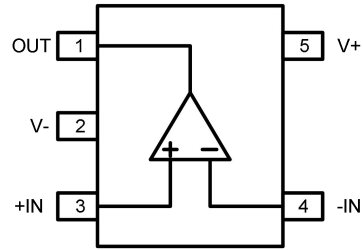
Typical Application



Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO29001CN4	A	Green	-40 to $+125^{\circ}\text{C}$	DFN0.8*0.8-4	Tape & Reel, 5000
DIO29001SC5	YWVA	Green	-40 to $+125^{\circ}\text{C}$	SC70-5	Tape & Reel, 3000
DIO29001ST5	YWVA	Green	-40 to $+125^{\circ}\text{C}$	SOT23-5	Tape & Reel, 3000

Pin Assignments

**DFN0.8*0.8-4****SOT23-5/SC70-5****Figure 1. Pin assignment (Top view)**

Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+IN	Positive input
-IN	Negative input
OUT	Output

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table 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. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
V_S	Supply voltage	6	V
V_{IN}	Input voltage	(V-) - 0.5 to (V+) + 0.5	V
T_{STG}	Storage temperature range	-65 to 150	°C
T_J	Junction temperature	150	°C
T_L	Lead temperature range	260	°C
ESD	HBM, JEDEC: JESD22-A114	±2	kV

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

Symbol	Parameter	Rating	Unit
V_S	Supply voltage	1.65 to 5.5	V
T_A	Operating temperature range	-40 to 125	°C

Electrical Characteristics

For $V_S = (V+) - (V-) = 1.65\text{ V to }5.5\text{ V}$ ($\pm 0.825\text{ V to } \pm 2.75\text{ V}$), $T_A = 25^\circ\text{C}$, $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, and $V_{CM} = V_{OUT} = V_S/2$, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Offset voltage						
V_{OS}	Input offset voltage	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $V_S = 5\text{ V}$	-1.5		1.5	mV
dv_{OS}/dt	V_{OS} vs. temperature	$T_A = -40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		2		$\mu\text{V}/^\circ\text{C}$
PSRR	Power supply rejection ratio	$V_S = 1.65\text{ V to }5.5\text{ V}$, $V_{CM} = (V_S/2)$		70		dB
Input voltage range						
V_{CM}	Common mode voltage range	No phase reversal, rail-to-rail input	-0.1		$V_{CC} + 0.1$	V
CMRR	Common mode rejection ratio	$V_S = 5.5\text{ V}$, $(V-) - 0.1\text{ V} < V_{CM} < (V+) + 0.1\text{ V}$, $T_A = -40^\circ\text{C to }125^\circ\text{C}$		75		
Input bias current						
I_B	Input bias current	$T_A = 25^\circ\text{C}$, $V_+ = 1.65\text{ V to }5\text{ V}$		10		pA
I_{OS}	Input offset current	$T_A = 25^\circ\text{C}$, $V_+ = 1.65\text{ V to }5\text{ V}$		10		pA

Noise						
e_n	Input voltage noise (peak to peak)	$f = 0.1 \text{ Hz to } 10 \text{ Hz}, V_S = 5 \text{ V}$		25		μV_{PP}
	Input voltage noise density	$f = 1 \text{ kHz}, V_S = 5 \text{ V}$		85		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10 \text{ kHz}, V_S = 5 \text{ V}$		28		
Open-loop gain						
$A_{OL}^{(1)}$	Open loop voltage gain	$V_S = 5.5 \text{ V},$ $(V_-) + 0.1 \text{ V} < V_O < (V_+) - 0.1 \text{ V},$ $R_L = 10 \text{ k}\Omega$	90	120		dB
Frequency response						
GBP	Gain bandwidth product	$V_S = 5 \text{ V}$		0.4		MHz
$\Phi_m^{(1)}$	Phase margin	$V_S = 5.5 \text{ V}, G = 1, C_L = 100 \text{ pF}$		65		°
SR	Slew Rate	$V_S = 5 \text{ V}$		0.17		V/ μs
t_s	Settling time	To 0.1%, $V_S = 5 \text{ V}, 2 \text{ V step},$ $G = +1, C_L = 100 \text{ pF}$		14		μs
		To 0.01%, $V_S = 5 \text{ V}, 2 \text{ V step},$ $G = +1, C_L = 100 \text{ pF}$		16		
t_{OR}	Overload recovery time	$V_S = 5 \text{ V}, V_{IN} \times \text{gain} > V_S$		10		μs
Output						
V_O	Voltage output swing from supply rails	$V_S = 5.5 \text{ V}, R_L = 10 \text{ k}\Omega$		15		mV
		$V_S = 5.5 \text{ V}, R_L = 2 \text{ k}\Omega$		75		
I_{SC}	Short-circuit current	$V_S = 5.5 \text{ V}$		40		mA
$Z_O^{(1)}$	Open-loop output impedance	$V_S = 5 \text{ V}, f = 100 \text{ kHz}$		700		Ω
Power supply						
V_S	Specified voltage range		1.65 (± 0.825)		5.5 (± 2.75)	V
I_Q	Quiescent current	$I_O = 0 \text{ mA}, V_S = 5.5 \text{ V}, \text{Gain} = 1$		40	51	μA
		$I_O = 0 \text{ mA}, V_S = 5.5 \text{ V}, \text{Gain} = 1$ $T_A = -40^\circ\text{C to } 125^\circ\text{C}$			56	

Note:

- (1) Guaranteed by design.
- (2) Specifications subject to change without notice.

Typical Characteristics

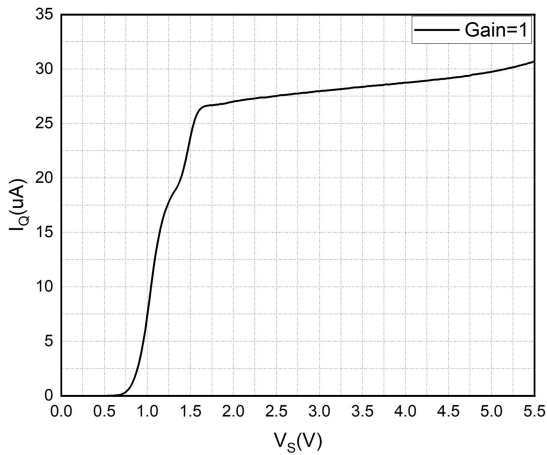


Figure 2. I_q vs. V_s

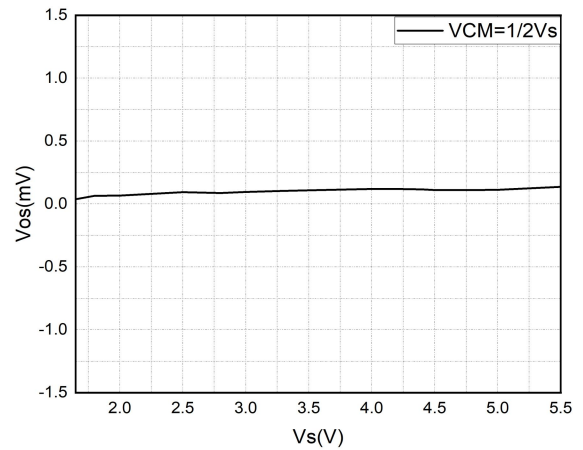


Figure 3. V_{os} vs. V_s

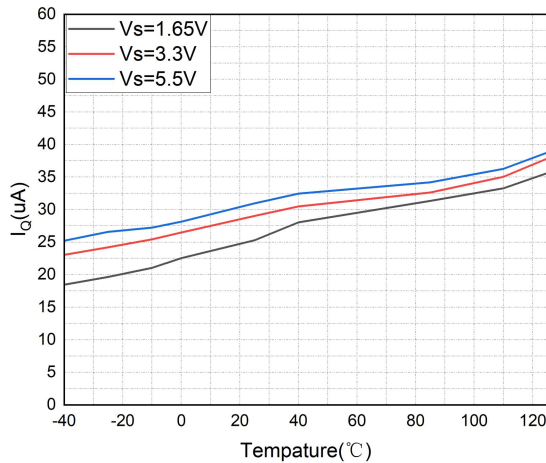


Figure 4. I_q vs. Temperature

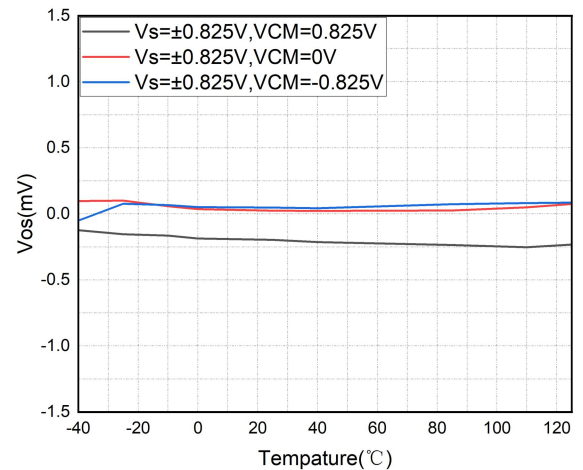
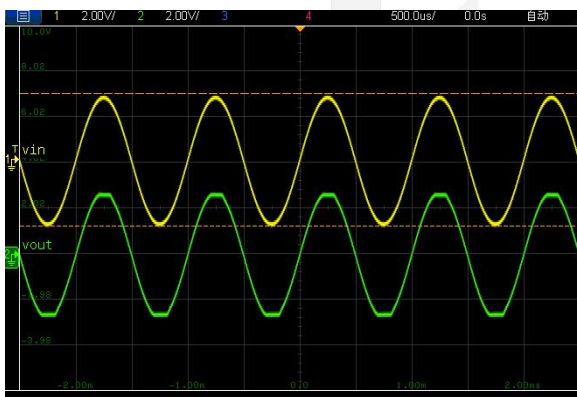


Figure 5. V_{os} vs. Temperature



$V_s = \pm 2.75\text{ V}$, $G = 1$, $V_{IN} = 5.6\text{V}_{PP}$, $R_L = 600\ \Omega$

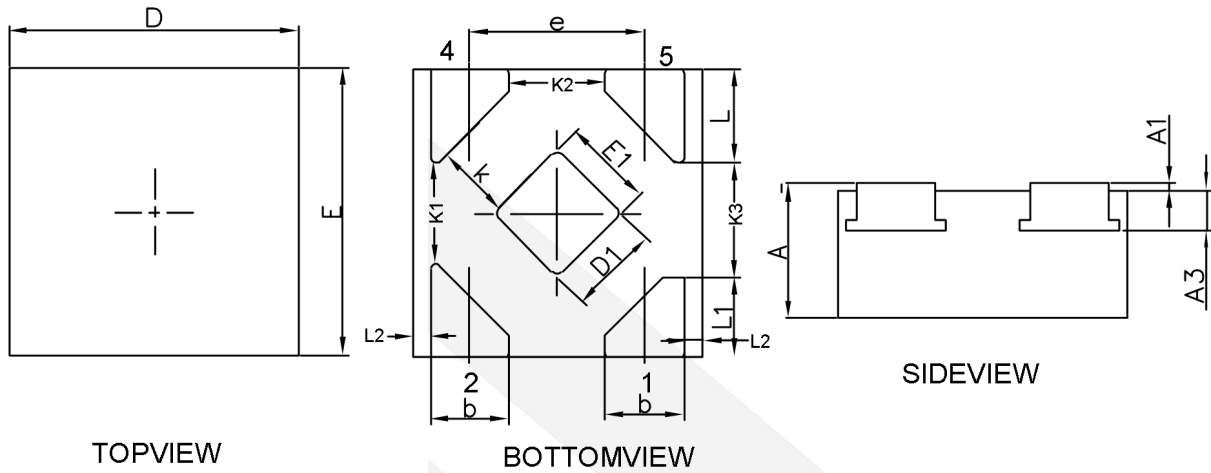
Figure 6. No phase reversal



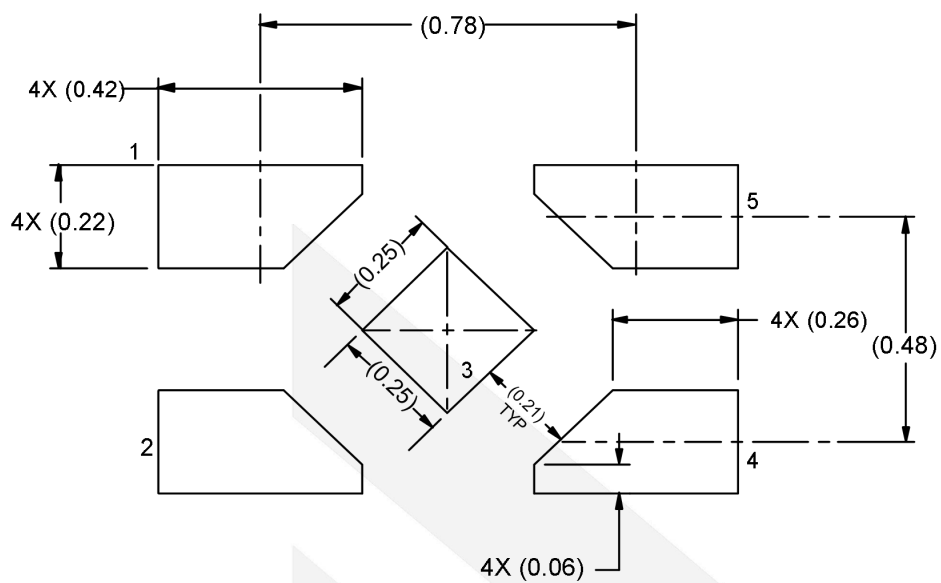
$V_s = 5\text{ V}$, $G = 1$, $C_L = 60\text{ pF}$, $V_{IN} = 20\text{mV}_{PP}$ at 10 kHz

Figure 7. Small-signal response

Physical Dimensions: DFN0.8*0.8-4

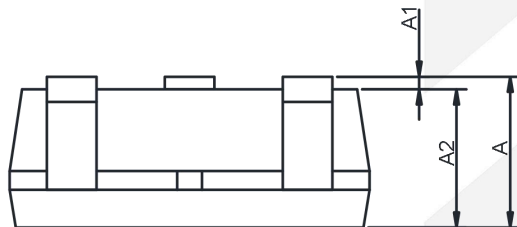
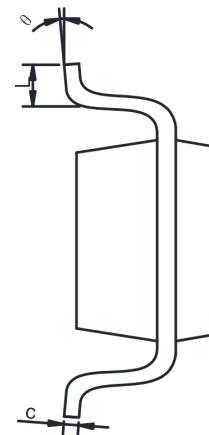
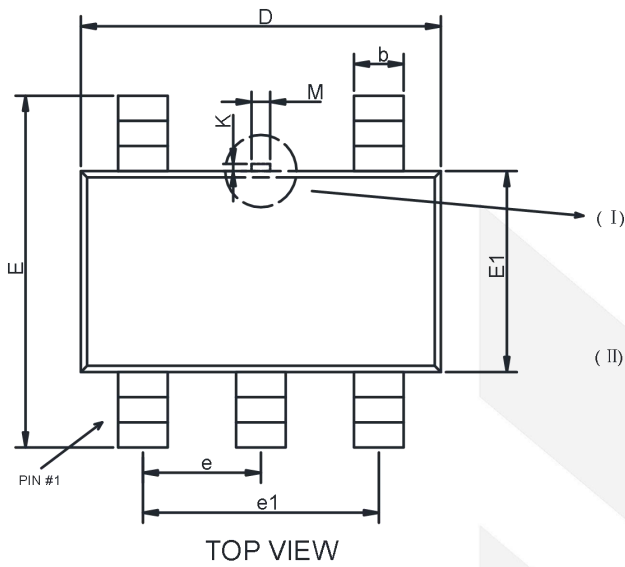


Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.320	0.375	0.400
A1	0.000	0.020	0.050
A3	0.110 REF		
D	0.750	0.800	0.850
E	0.750	0.800	0.850
D1	0.200	0.250	0.300
E1	0.200	0.250	0.300
K	0.210 TYP		
K1	0.270 TYP		
K2	0.260 TYP		
K3	0.315 TYP		
b	0.170	0.220	0.270
e	0.480 TYP		
L	0.210	0.265	0.320
L1	0.170	0.220	0.270
L2	0.050 TYP		



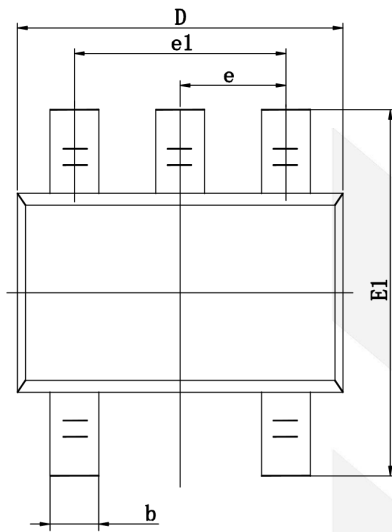
Recommended land pattern (Unit: mm)

Physical Dimensions: SOT23-5

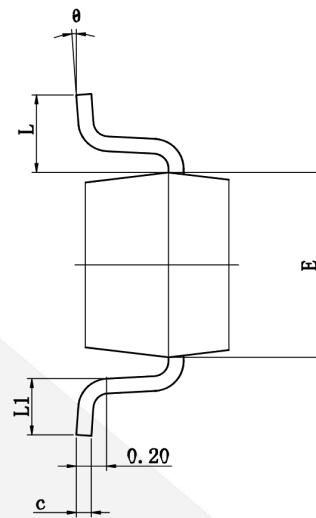


Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0.00	-	0.15
A2	1.00	1.10	1.20
b	0.36	-	0.50
c	0.14	-	0.20
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.30	-	0.60
θ	0°	-	8°
M	0.10	0.15	0.20
K	0.00	-	0.25

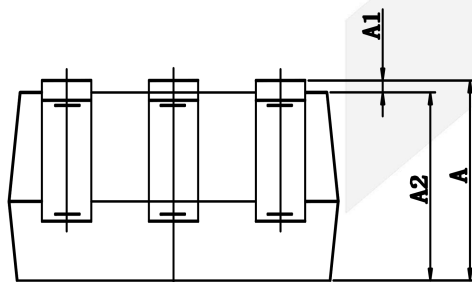
Physical Dimensions: SC70-5



TOP VIEW



SIDE VIEW



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)		
Symbol	Min	Max
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
c	0.110	0.175
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650 TYP	
e1	1.200	1.400
L	0.525 REF	
L1	0.260	0.460
theta	0°	8°

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 phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

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