

DIO235X

12 μ V Vos, 1.2MHz, RRIO CMOS High-Precision Amplifier

Features

- Rail-to-Rail Input and Output
- Low offset (V_{OS}): 12 μ V typ.
- Input offset drift: 0.01 μ V/ $^{\circ}$ C
- Unity Gain Stable
- Gain Bandwidth Product: 1.2MHz
- Very low input bias currents: 20pA
- Wide supply range: 2.5V to 5.5V
- Single Supply Operation
- Low power: 0.73mA per channel
- Small size packaging best for portable applications:
DIO2351: SOT23-5, SOIC-8
DIO2352: SOIC-8, MSOP-8 and TSSOP-8
DIO2354: TSSOP-14

Applications

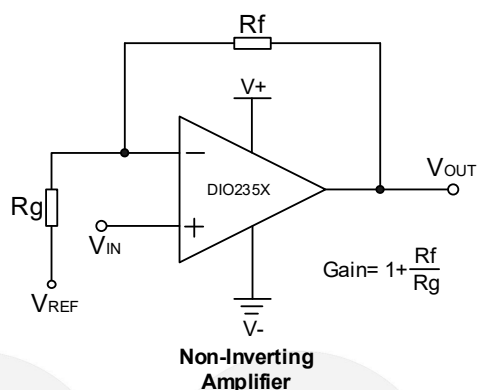
- Temperature measurement
- Pressure sensor
- Precision current sensing
- Strain Gage Amplifier
- Medical instrument
- Thermocouple amplifier
- Handheld Test Equipment

Descriptions

The DIO235X is an ultra-low offset voltage rail-to-rail input and output voltage feedback amplifier. They have a wide input common-mode voltage range and output voltage swing, and take the operating supply voltage is from 2.5 to 5.5V. They provide 1.2MHz bandwidth.

The DIO235X features an offset voltage of only 12 μ V and drift of 0.01 μ V/ $^{\circ}$ C, which makes the product perfect in applications of intolerant errors. Temperature/position/pressure sensors and medical equipment can benefit greatly from nearly zero drift over their operating temperature range.

Typical Application



Ordering Information

Order Part Number	Top Marking		T _A	Package	
DIO2351ST5	YWXM	Green/RoHS	-40 to 125 $^{\circ}$ C	SOT23-5	Tape & Reel, 3000
DIO2351SO8	DIO2351	Green/RoHS	-40 to 125 $^{\circ}$ C	SOIC-8	Tape & Reel, 2500
DIO2352MP8	DIO2352	Green/RoHS	-40 to 125 $^{\circ}$ C	MSOP-8	Tape & Reel, 3000
DIO2352SO8	DIO2352	Green/RoHS	-40 to 125 $^{\circ}$ C	SOIC-8	Tape & Reel, 2500
DIO2352TP8	DIO2352	Green/RoHS	-40 to 125 $^{\circ}$ C	TSSOP-8	Tape & Reel, 3000
DIO2354CT14	DIO2354	Green/RoHS	-40 to 125 $^{\circ}$ C	TSSOP-14	Tape & Reel, 2500

Pin Assignments

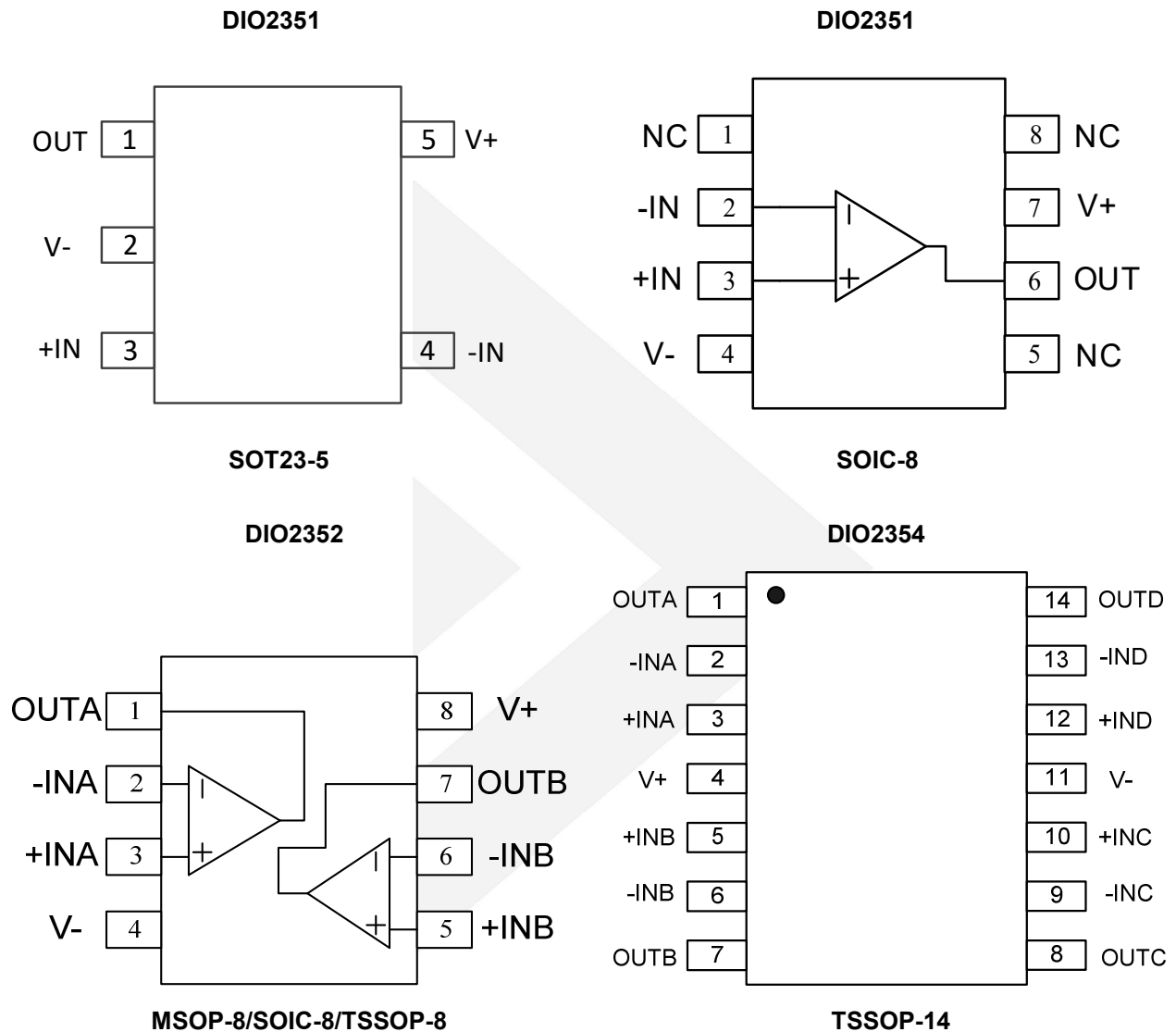


Figure 1 Pin Assignment

Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+IN(A/B/C/D)	Positive Input
-IN(A/B/C/D)	Negative Input
OUT(A/B/C/D)	Output



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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		7.5	V
Input Voltage		(-Vs)-0.3 to (+Vs) +0.3V	V
TSSOP-14 θ_{JA}		110	°C/W
Storage Temperature Range		-65 to 150	°C
Junction Temperature		150	°C
Lead Temperature Range		260	°C
ESD	HBM, JEDEC: JESD22-A114	7	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		2.5 to 5.5	V
Input Voltage		0 to 5	V
Operating Temperature Range		-40 to 125	°C

Electrical Characteristics

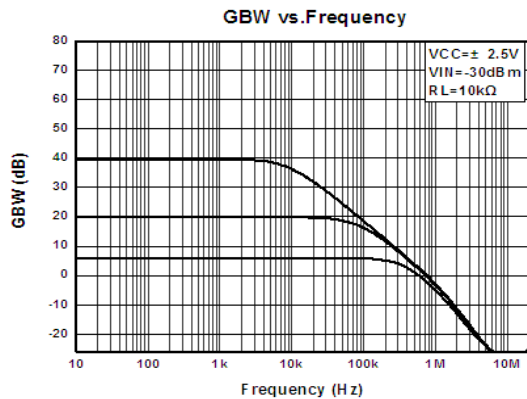
Typical value: $V_+ = 5V$, $R_L = 100k\Omega$ to $V_+/2$, $T_A = 25^\circ C$, unless otherwise specified.

Symbol	Parameter		Conditions	Min.	Typ.	Max.	Unit
INPUT CHARACTERISTICS							
V _{OS}	Input Offset Voltage			-30	12	30	μV
I _B	Input Bias Current				20		pA
CMRR	Common Mode Rejection Ratio		V _{CM} =-0.1 to (V ₊)+0.1		80		dB
A _{OL}	Open Loop Voltage Gain		R _L =10kΩ, V _O = 0.1 to (V ₊)-0.1		150		dB
ΔV _{OS} /ΔT	Input Offset Voltage Drift		-40°C≤T _A ≤125°C		0.01		μV/°C
OUTPUT CHARACTERISTICS							
V _{OH}	Output Voltage High		R _L =100kΩ, -40°C≤T _A ≤125°C		4.998		V
			R _L =10kΩ, -40°C≤T _A ≤125°C		4.99		
V _{OL}	Output Voltage Low		R _L =100kΩ, -40°C≤T _A ≤125°C		1.2		mV
			R _L =10kΩ, -40°C≤T _A ≤125°C		7.3		
I _O	Output Current	Source Current			55		mA
		Sink Current			55		
POWER SUPPLY							
PSRR	Power Supply Rejection Ration		V _S =2.7V to 5.5V		105		dB
I _S	Supply Current per Channel/Amp		-40°C≤T _A ≤125°C		730		μA
DYNAMIC PERFORMANCE							
GBP	Gain Bandwidth Product				1.2		MHz
SR	Slew Rate		G=1, 2V Output Step		1		V/μs
	Overload Recovery Time				8		μs
t _s	Setting Time		G=1, 2V Output Step		2		μs
NOISE PERFORMANCE							
THD	Total Harmonic Distortion		f=1kHz, 2V Output Step, R _L =10kΩ,		0.0014		%
e _n	Voltage Noise Density		f=1kHz		40		nV/√Hz

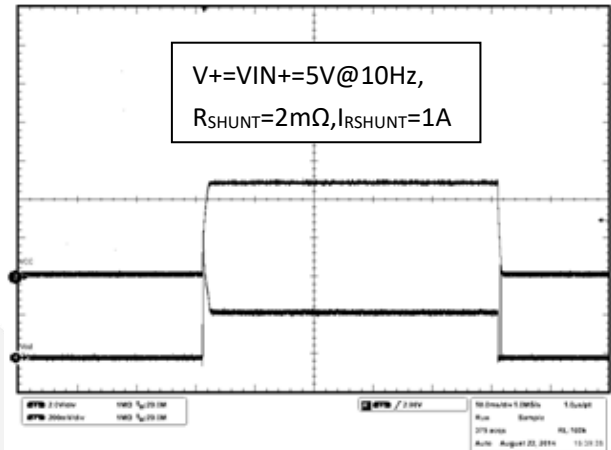
Specifications subject to change without notice.

Typical Performance Characteristics

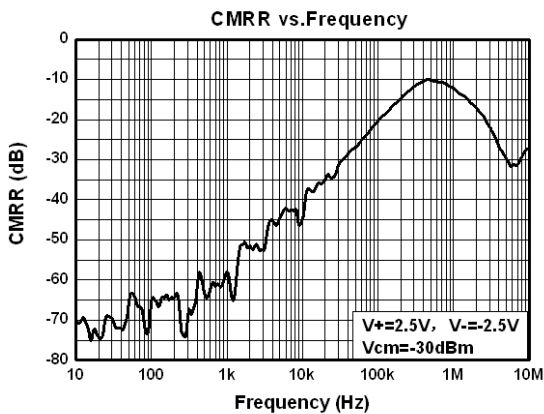
All typical value are at $V_+ = 5V$, $R_L = 200k\Omega$ to $V_+/2$, $T_A = 25^\circ C$, unless otherwise specified.



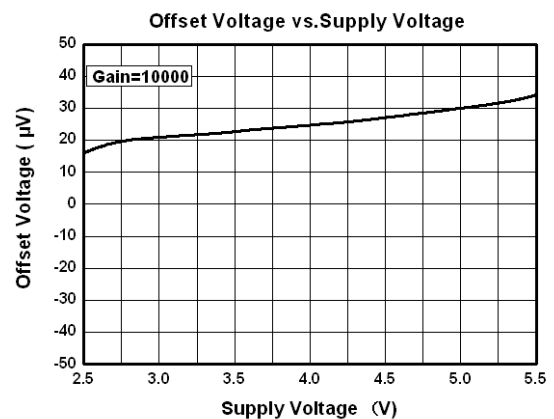
GBW vs. Frequency



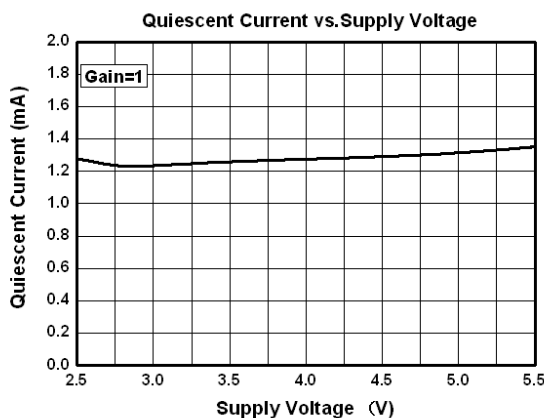
Start Off Recovery



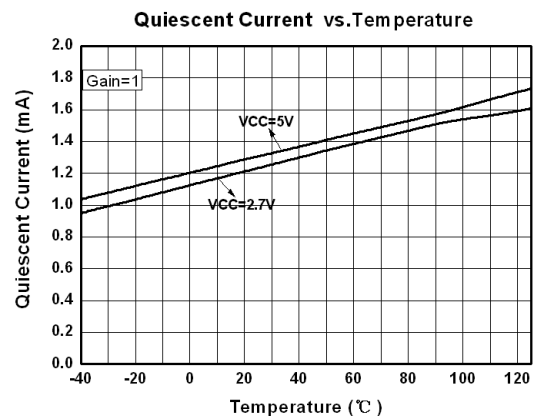
CMRR vs. frequency



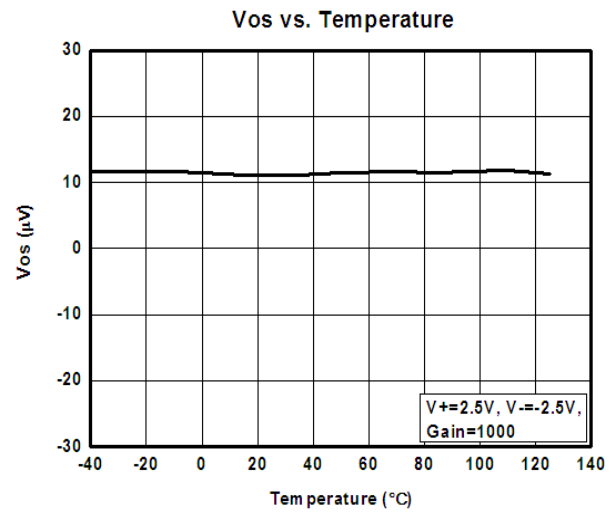
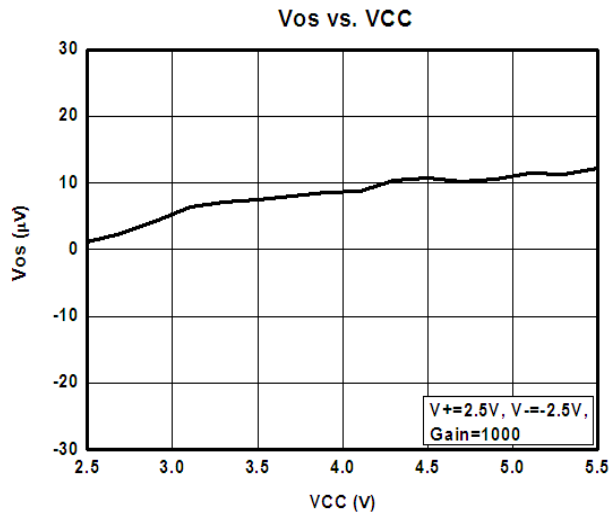
Offset Voltage vs. Supply Voltage



Offset Voltage vs. Supply Voltage



Quiescent Current vs. Temperature

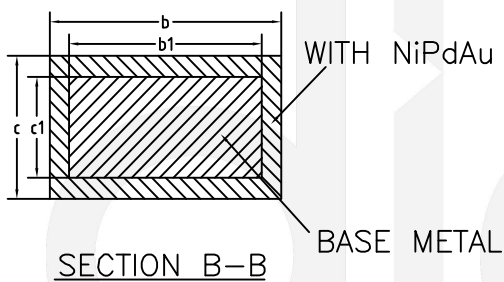
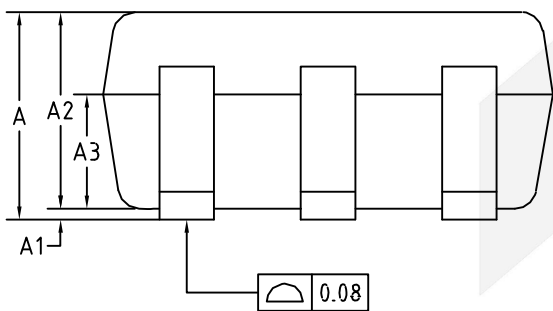
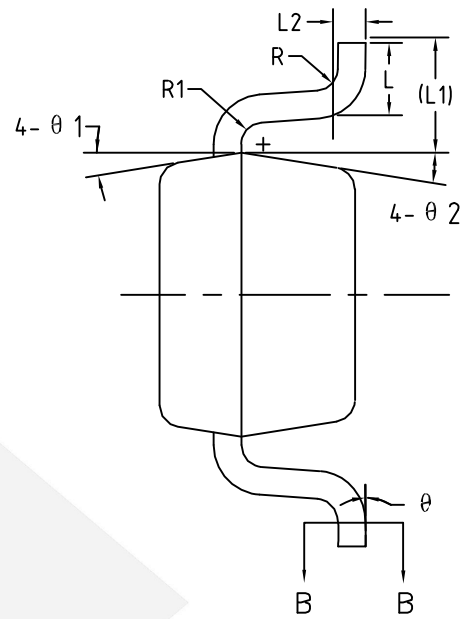
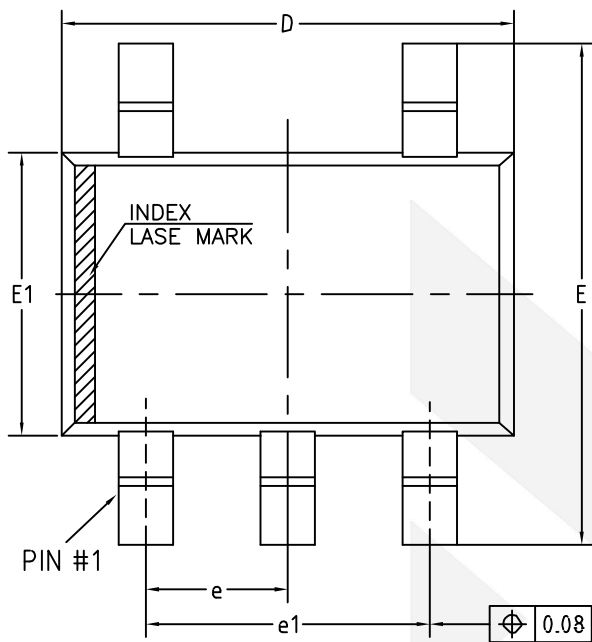


V_{OS} vs. VCC

V_{OS} vs. Temperature

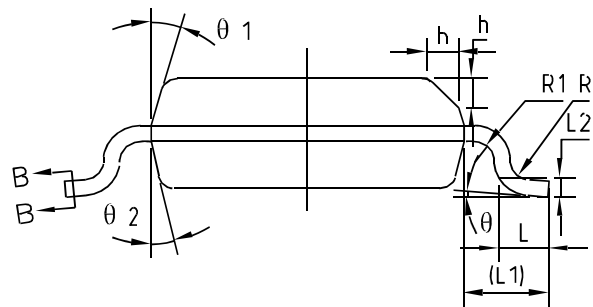
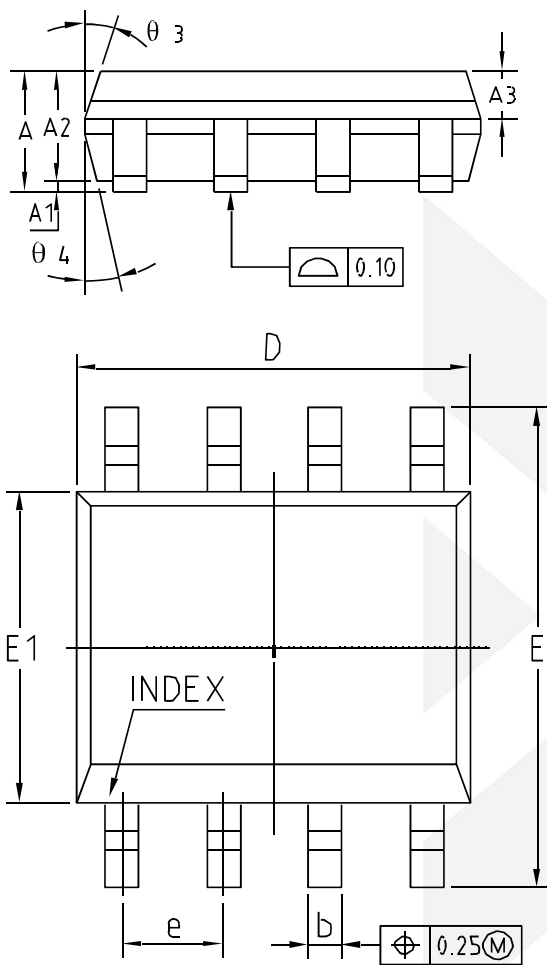
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Physical Dimensions: SOT23-5

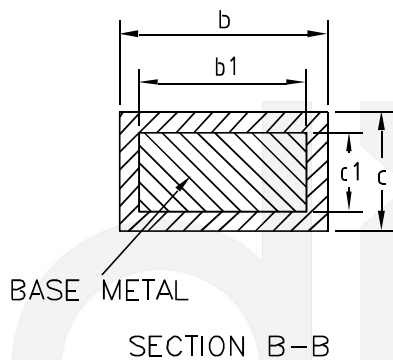


COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
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: SOLC-8

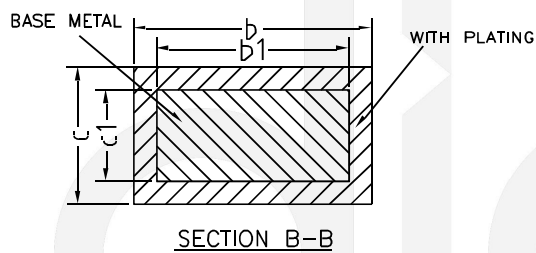
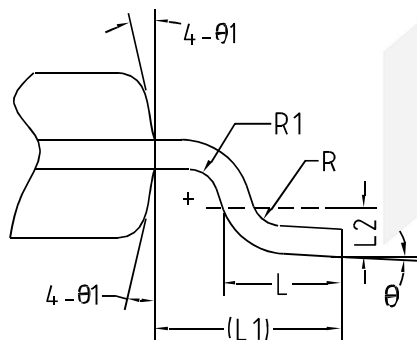
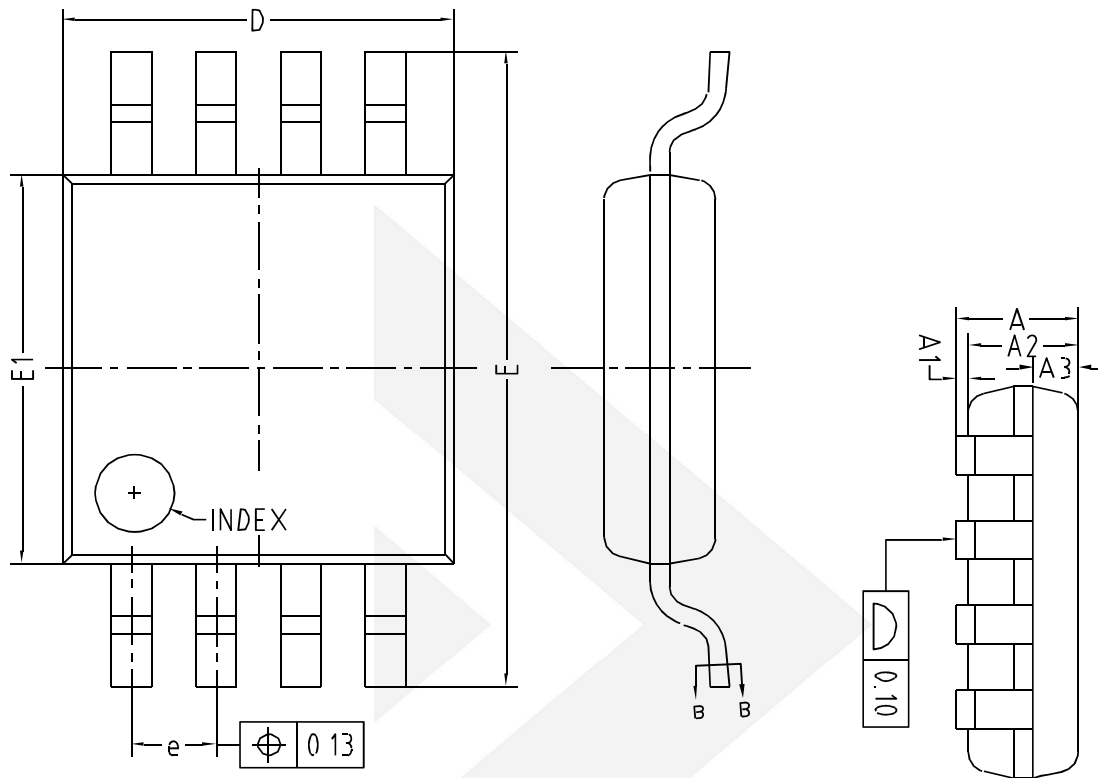


COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.40	0.60	0.80
L1	1.04REF		
L2	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°



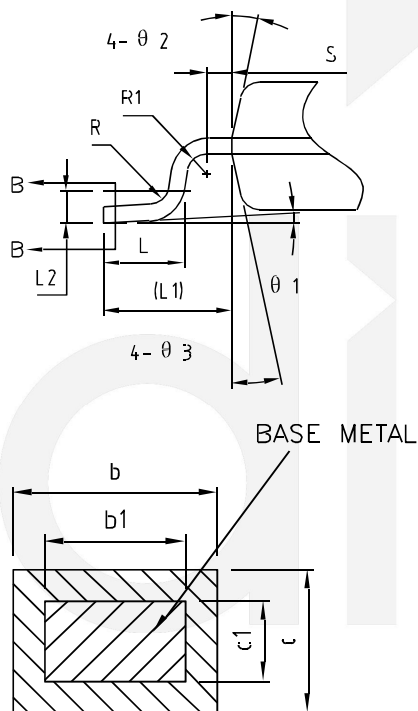
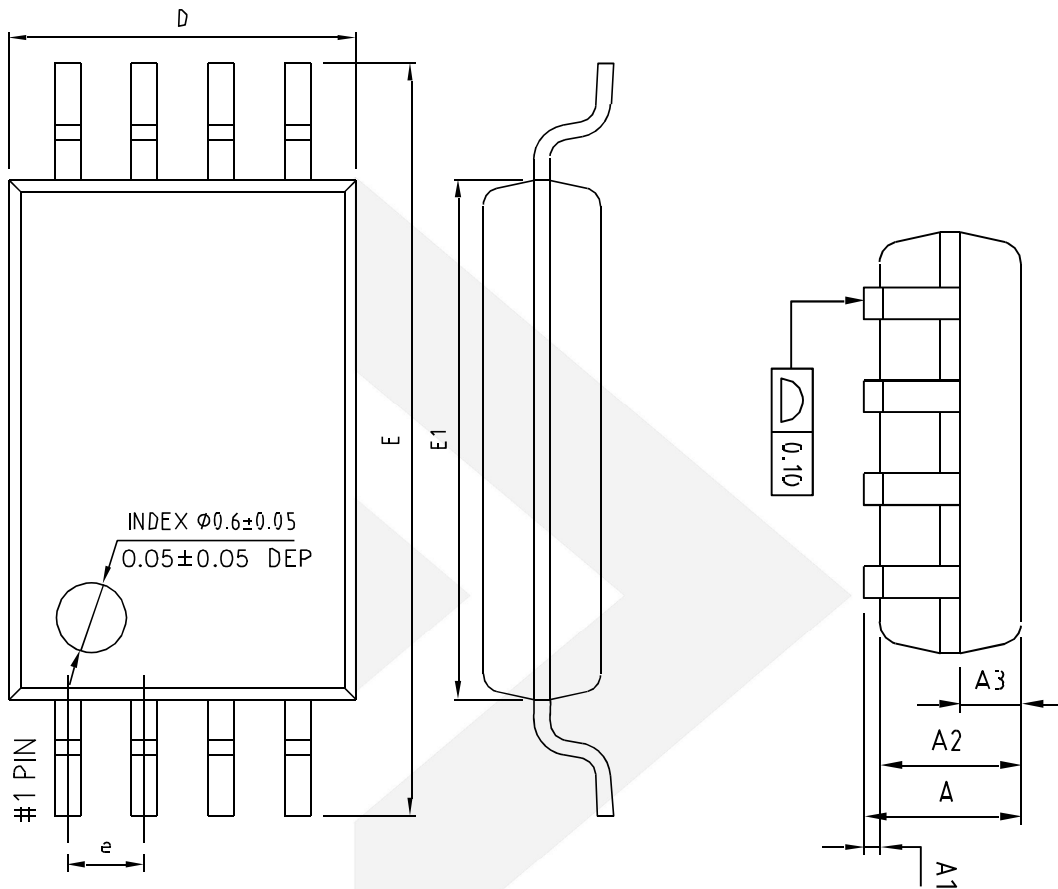
12μV Vos, 1.2MHz, RRIO CMOS High-Precision Amplifier

Physical Dimensions: MSOP-8



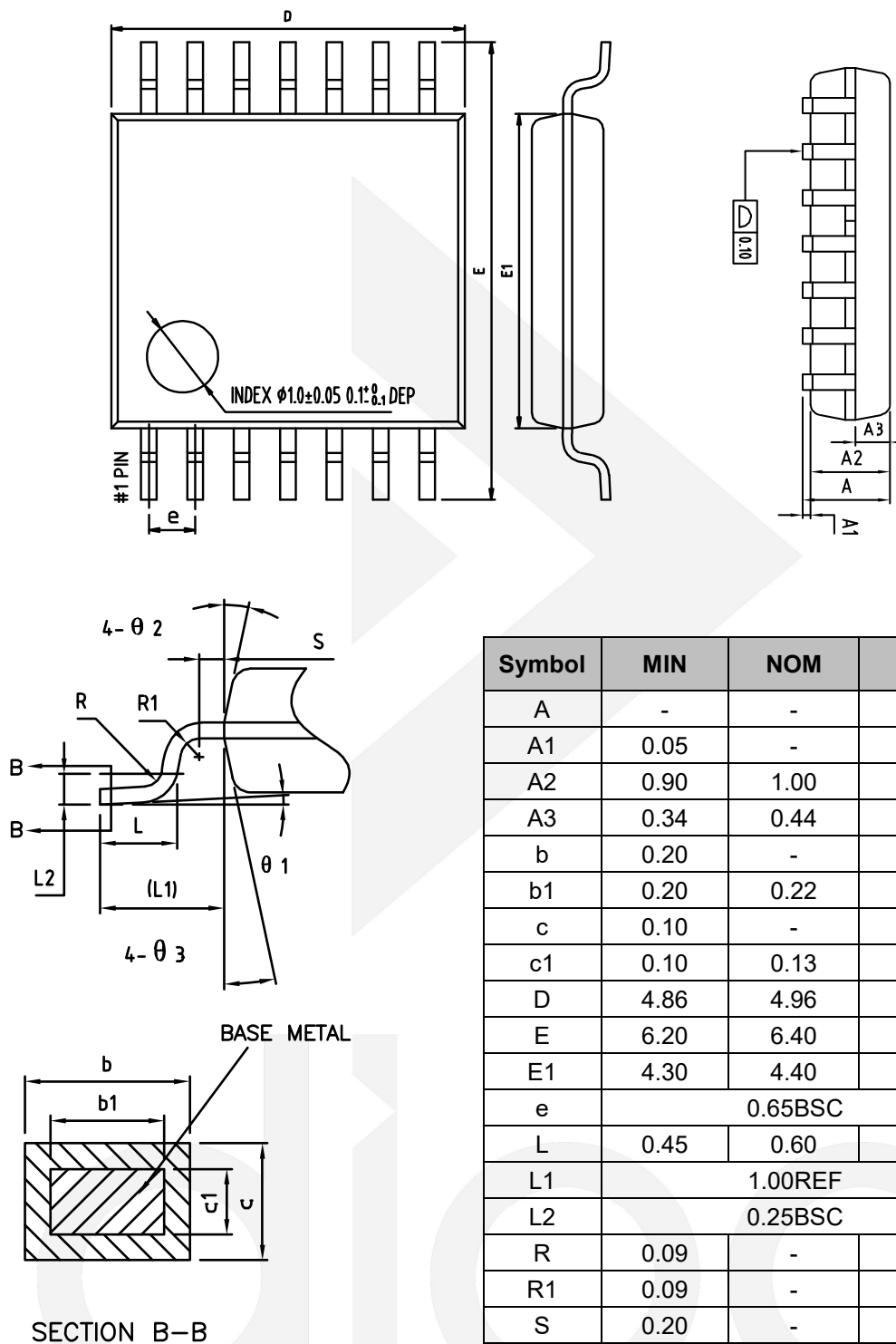
COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	-	-	1.10
A1	0	-	0.15
A2	0.75	0.85	0.95
A3	0.25	0.35	0.39
b	0.28	-	0.37
b1	0.27	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.60	0.80
L1	0.95REF		
L2	0.25BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

Physical Dimensions: TSSOP-8



COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	2.83	2.93	3.03
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
θ1	0°	-	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

Physical Dimensions: TSSOP-14



Symbol	MIN	NOM	MAX
A	-	-	1.2
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
$\theta 1$	0°	-	8°
$\theta 2$	10°	12°	14°
$\theta 3$	10°	12°	14°

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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