

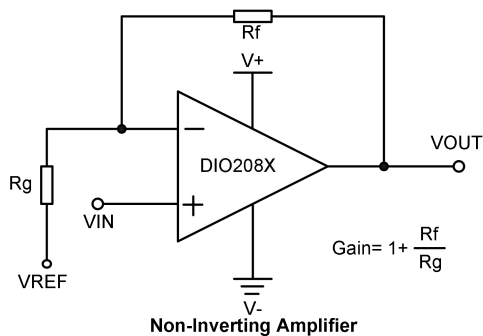
## DIO2081/2/4

# 750 nA, Rail-to-Rail Input/ Output Low Power Amplifier

### Features

- Ultra low power: 750 nA per channel when  $V_{CC} = 5\text{ V}$
- Unity gain stable
- Gain bandwidth product: 14 kHz
- Wide supply range: 1.2 V to 5.5 V
- Available in SOT23-5, SOIC-8, MSOP-8, SOP-14 and TSSOP-14 packages
- Temperature Range:
  - Industrial:  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
  - Extended:  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$

### Typical Applications



### Descriptions

DIO208x is a family of ultra low power operational amplifier, with rail-to-rail CMOS input/output and single/dual channels selectable. DIO208x family has a gain-bandwidth product of 14 kHz, wide operating supply voltage from 1.2 V to 5.5 V and broad output voltage swing.

DIO208x consumes ultra low power, with each channel 750 nA of bias current, which makes DIO208x be ideal for battery powered device, temperature-sense device, etc.

The DIO208x operational amplifier family is available in single (DIO2081), and dual (DIO2082), and quad (DIO2084) configurations. Furthermore, the DIO2081 is offered in the 5-lead SOT23 package. All types of amplifiers are fully specified over the extended  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  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	MSL	RoHS	$T_A$	Package	
DIO2081ST5	YWXL	3	Green	$-40$ to $125^{\circ}\text{C}$	SOT23-5	Tape & Reel, 3000
DIO2081SO8	DIO2081	3	Green	$-40$ to $125^{\circ}\text{C}$	SOIC-8	Tape & Reel, 2500
DIO2081MP8	DIO2081	3	Green	$-40$ to $125^{\circ}\text{C}$	MSOP-8	Tape & Reel, 3000
DIO2082SO8	DIO2082	3	Green	$-40$ to $125^{\circ}\text{C}$	SOIC-8	Tape & Reel, 2500
DIO2082MP8	DIO2082	3	Green	$-40$ to $125^{\circ}\text{C}$	MSOP-8	Tape & Reel, 3000
DIO2084CS14	DIO2084	3	Green	$-40$ to $125^{\circ}\text{C}$	SOP-14	Tape & Reel, 2500
DIO2084TP14	DIO2084	3	Green	$-40$ to $125^{\circ}\text{C}$	TSSOP-14	Tape & Reel, 2500

## Pin Assignments

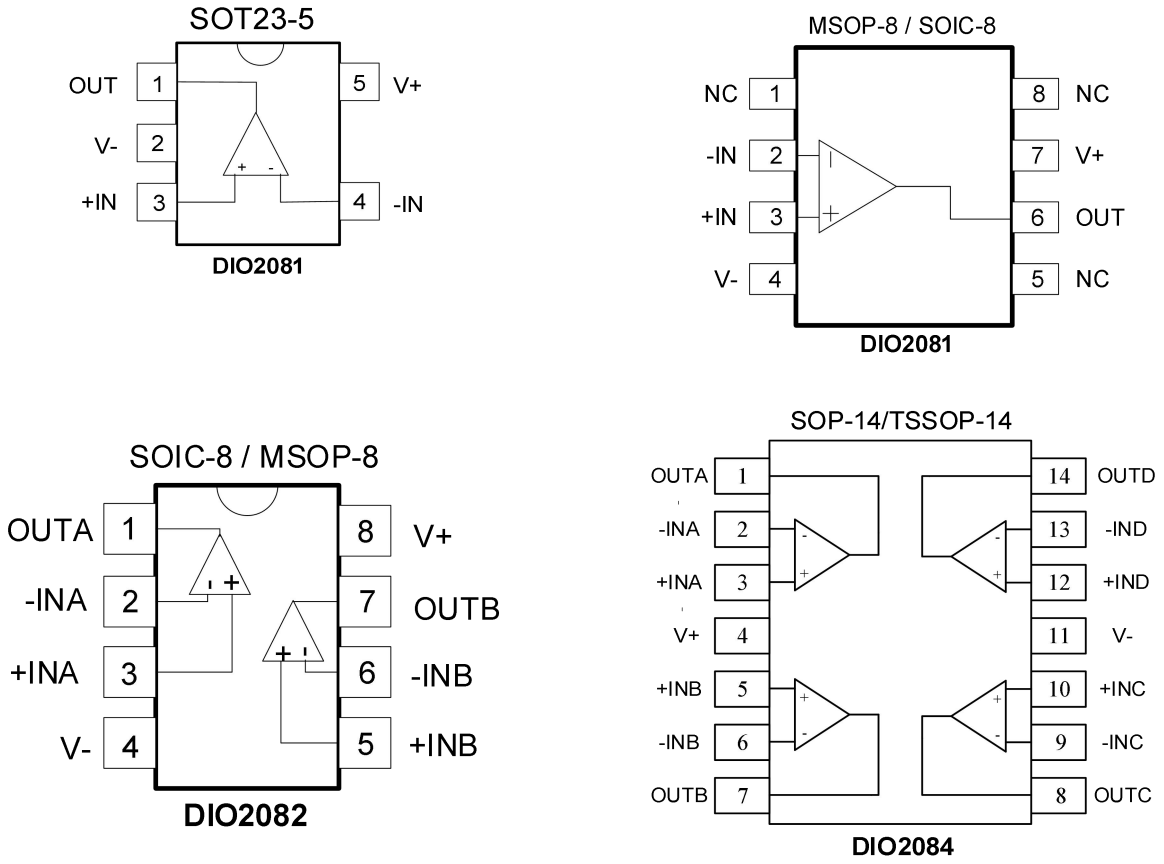


Figure 1 Top View

## Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+INX	Positive Input
-INX	Negative Input
OUTX	Output

## 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	1.2 to 5.5	V
Input voltage	0 to 5	V
Operating temperature range	-40 to 125	°C

## Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Input characteristics</b>						
$V_{OS}$	Input offset voltage	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ , $V_+ = 1.2\text{ V to } 5.5\text{ V}$	-2		+2	mV
$V_{CM}$	Common mode voltage range		-0.1		( $V_+$ ) +0.1	V
CMRR	Common mode rejection ratio	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ ,		85		dB
$A_{OL}$	Open loop voltage gain <sup>(1)</sup>	$R_L = 50\text{ k}\Omega$ , $V_O = 0.1\text{ to } (V_+) - 0.1$		85		dB
$\Delta V_{OS}/\Delta T$	Input offset voltage drift	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		$\pm 5$		$\mu\text{V}/^\circ\text{C}$
<b>Output characteristics</b>						
$V_{OH}$	Output voltage high	$R_L = 50\text{ k}\Omega$ $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		4.992		V
$V_{OL}$	Output voltage low	$R_L = 50\text{ k}\Omega$ $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		8	15	mV
$I_{SC}$	Output short circuit current	Source $I_{SC}$ , $V_+ = 5\text{V}$		30		mA
		Sink $I_{SC}$ , $V_+ = 5\text{V}$		30		
<b>Power supply</b>						
PSRR	Power supply rejection ration			80		dB
$I_S$	Supply current per channel/amp	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		750	1000	nA
<b>Dynamic performance</b>						
GBP	Gain bandwidth product	$C_L = 60\text{ pF}$		14		kHz
SR	Slew rate	$G = 1$ , 2V output step		3.5		V/ms
$t_s$	Setting time	$G = 1$ , 2V output step		150		$\mu\text{s}$
$\theta_M$	Phase margin <sup>(1)</sup>			49		Deg
$t_r$	tr+	Overload recovery time		200		$\mu\text{s}$
	tr-	Overload recovery time		40		$\mu\text{s}$
<b>Noise performance</b>						
THD	Total harmonic distortion <sup>(1)</sup>	$f = 100\text{ Hz}$ , $4\text{ V}_{PP}$ , $R_L = 50\text{ k}\Omega$ ,		0.09		%
$e_n$	Voltage noise density <sup>(1)</sup>	$f = 1\text{ kHz}$		190		$\text{nV}/\sqrt{\text{Hz}}$

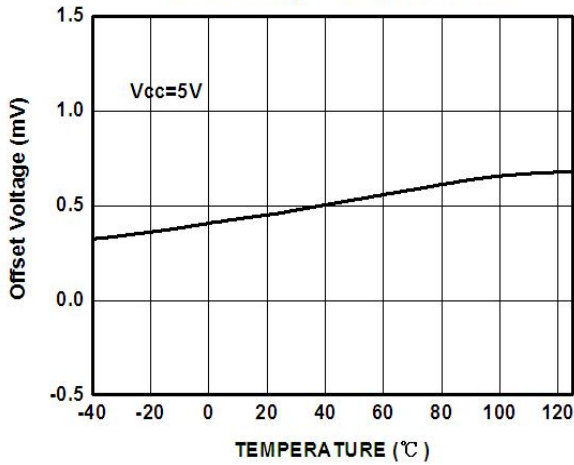
**Note:**

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

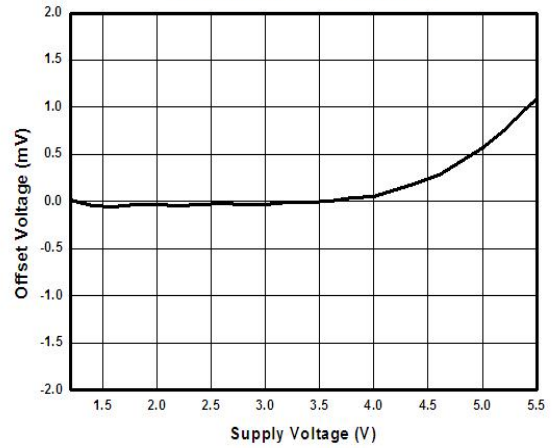
## Typical Performance Characteristics

All typical value are at  $V_{+}=5\text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ , unless otherwise specified.

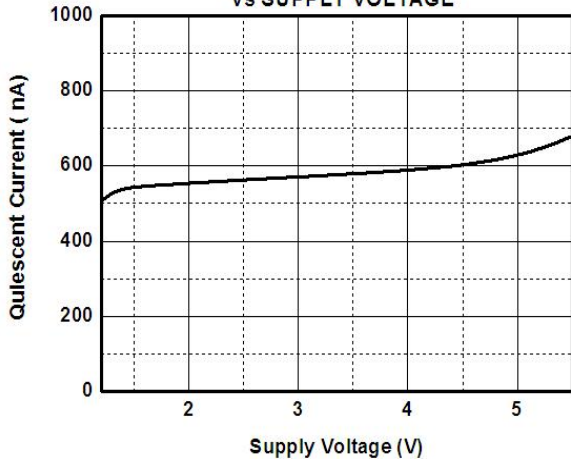
Offset Voltage vs. TEMPERATURE



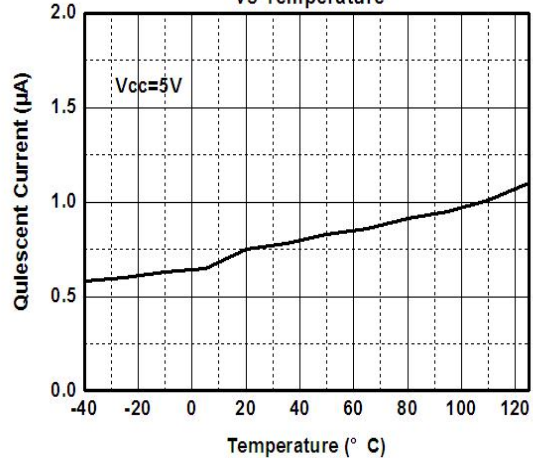
Offset Voltage vs. Supply Voltage



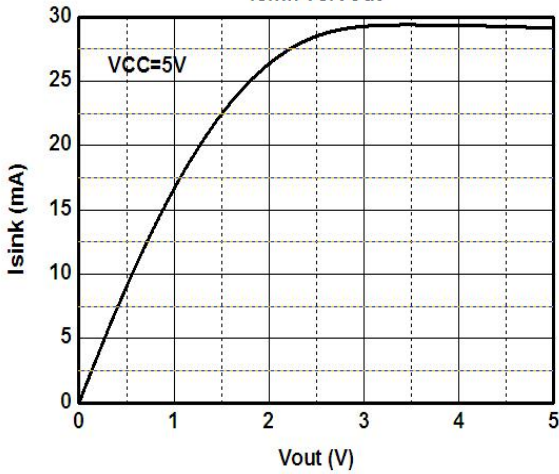
QUIESCENT CURRENT vs SUPPLY VOLTAGE



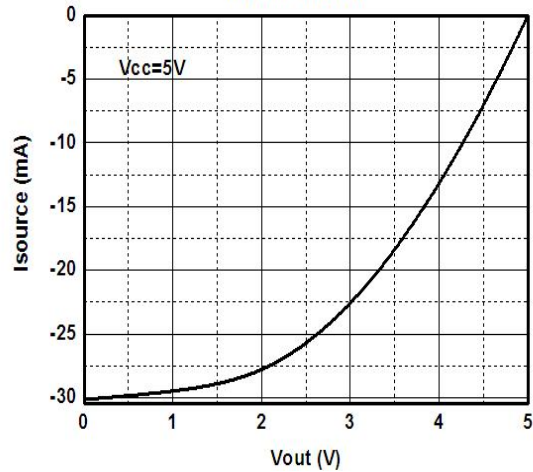
QUIESCENT CURRENT vs Temperature



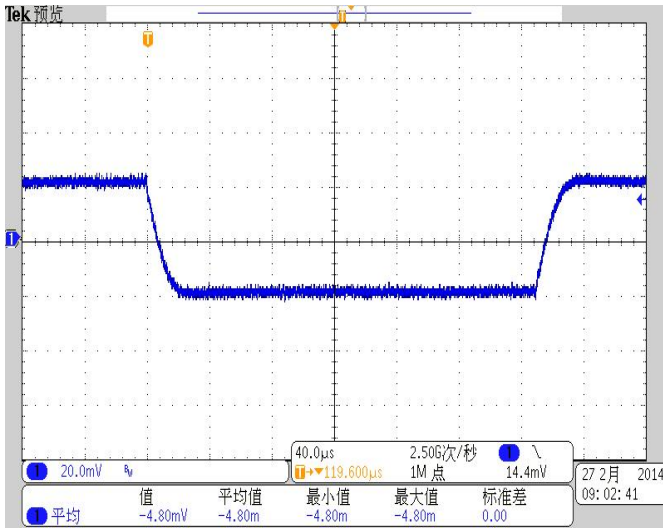
I<sub>sink</sub> vs. V<sub>out</sub>



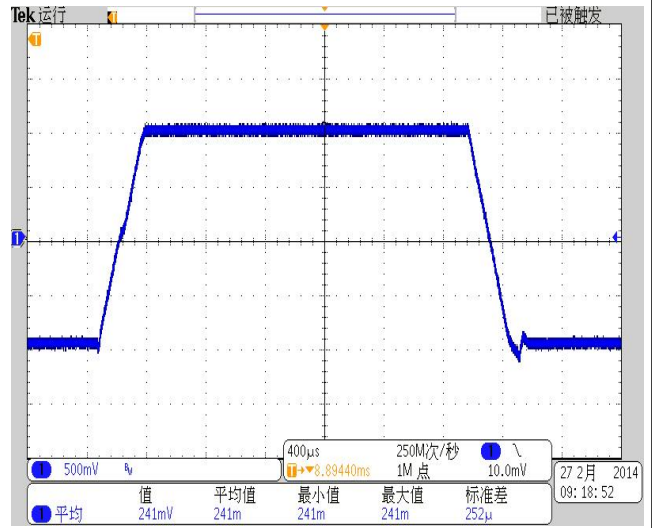
I<sub>source</sub> vs. V<sub>out</sub>



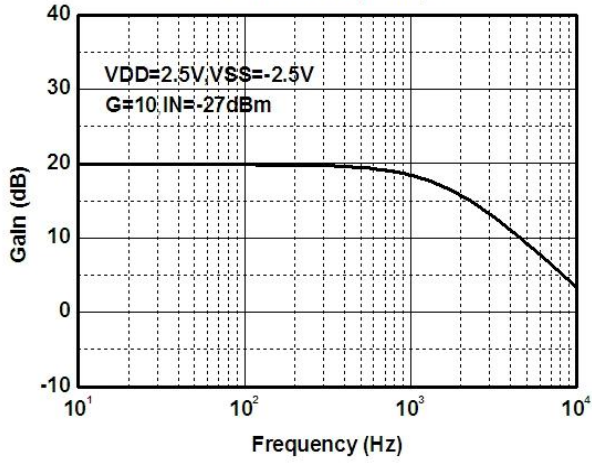
### Small Signal Response



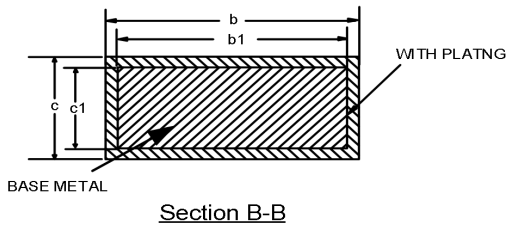
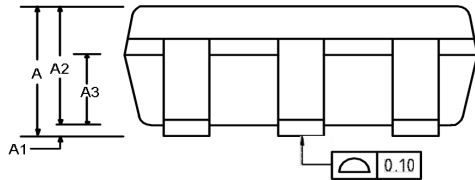
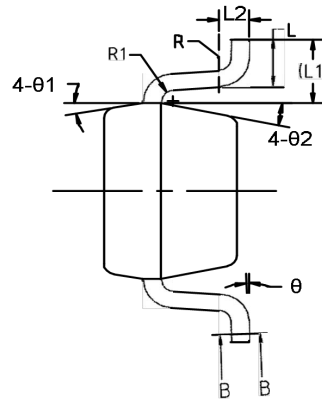
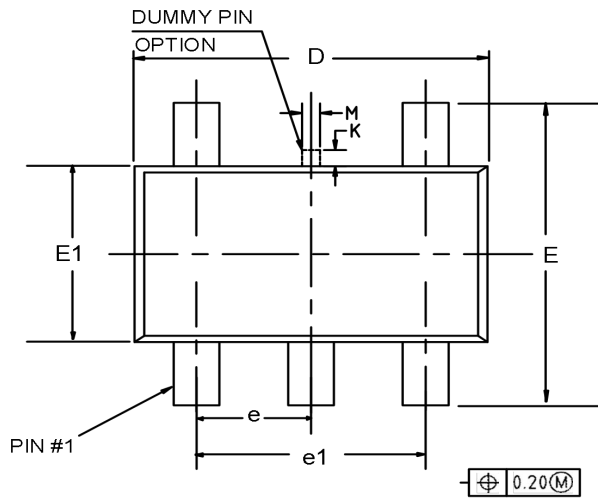
### Large Signal Response



### GBW vs. Frequency

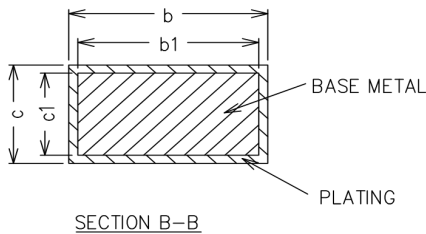
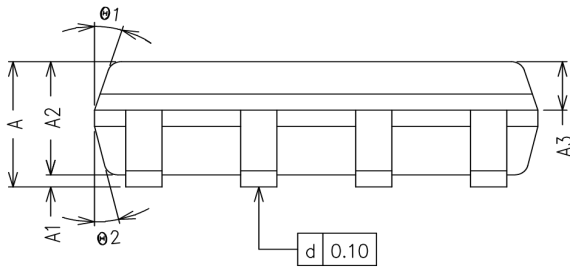
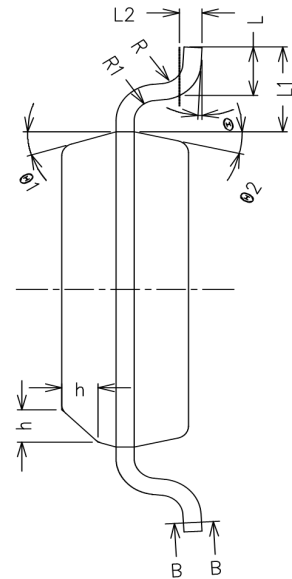
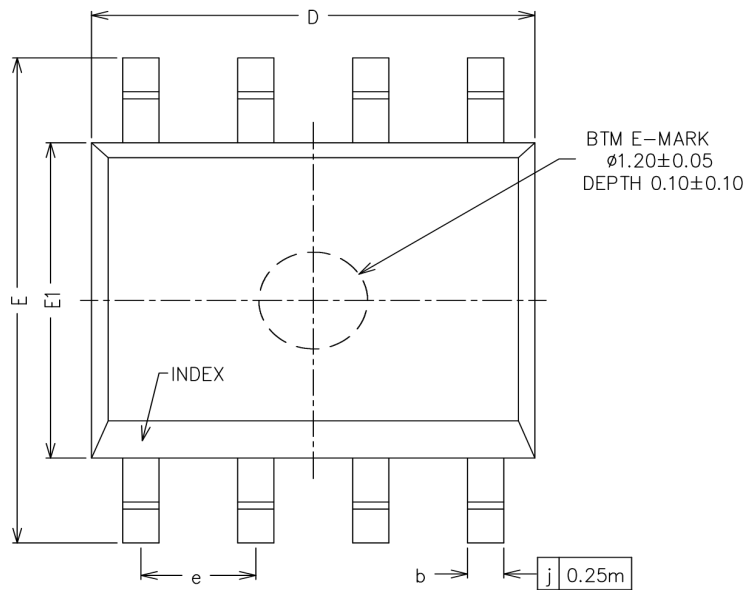


### Physical Dimensions: SOT23-5



Common Dimensions (Units of measures = 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	-	0.45
b1	0.35	0.38	0.41
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
K	0	-	0.25
L	0.30	0.40	0.60
L1	0.59 REF		
L2	0.25 BSC		
M	0.10	0.15	0.25
R	0.05	-	0.20
R1	0.05	-	0.20
θ	0°	-	8°
θ1	8°	10°	12°
θ2	10°	12°	14°

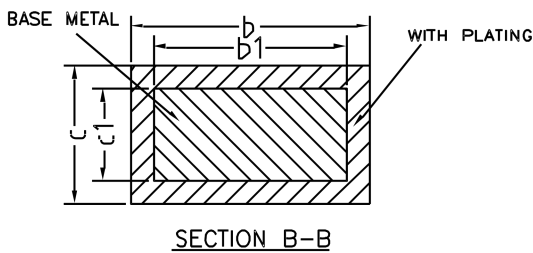
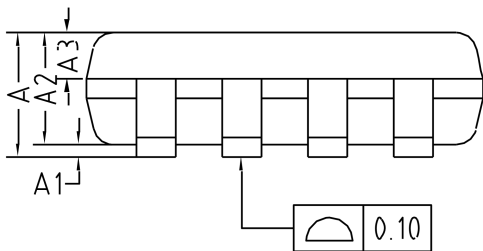
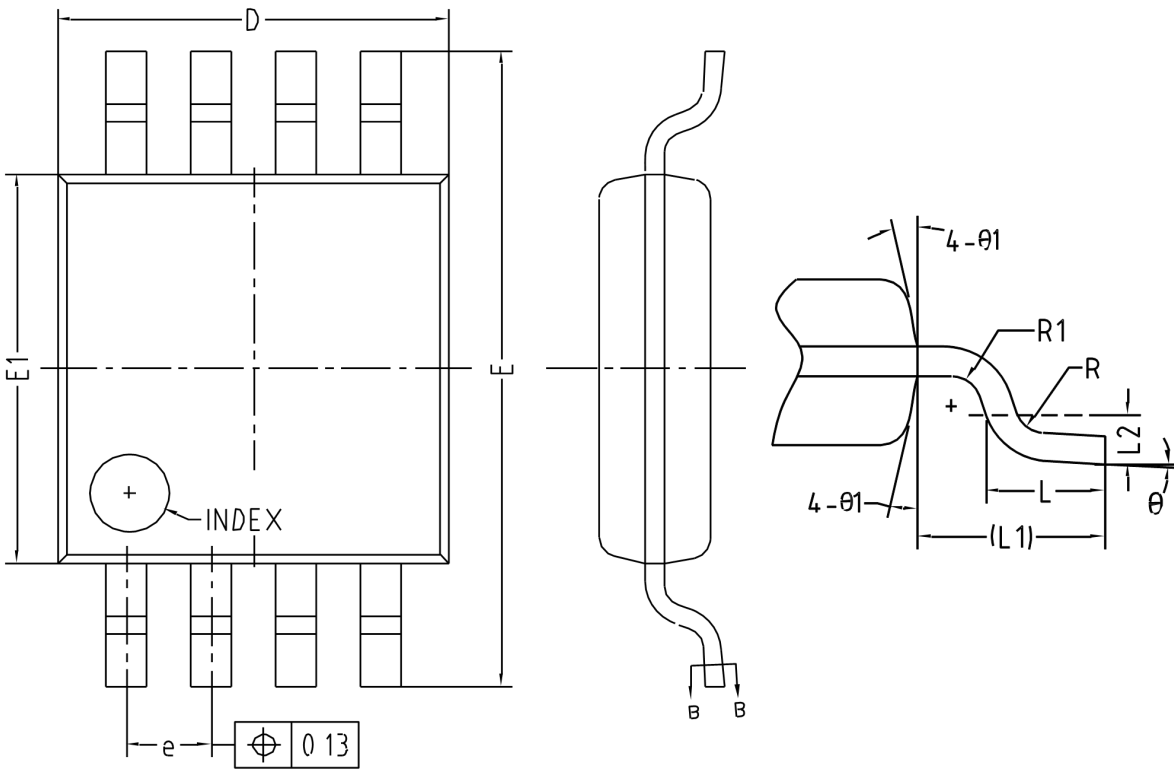
Physical Dimensions: SOIC-8



Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	1.35	1.55	1.75
A1	0.10	-	0.25
A2	1.30	1.40	1.50
A3	0.50	0.60	0.70
b	0.38	-	0.47
b1	0.37	0.40	0.43
c	0.17	0.20	0.23
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	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
$\theta$	0°	-	8°
$\theta 1$	15°	17°	19°
$\theta 2$	11°	13°	15°

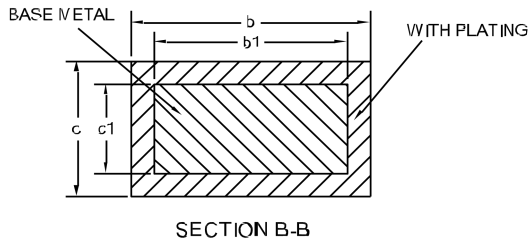
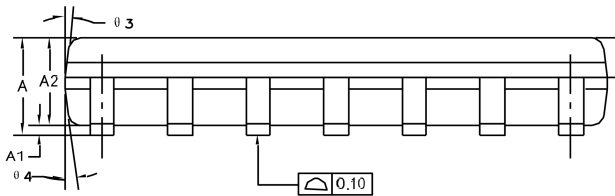
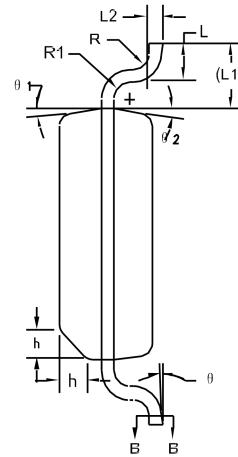
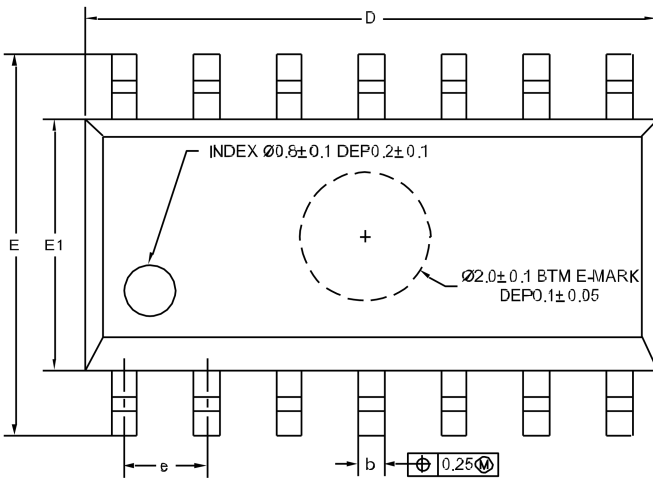


### Physical Dimensions: MSOP-8



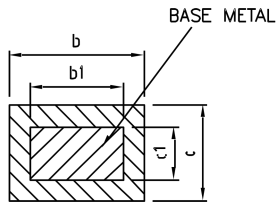
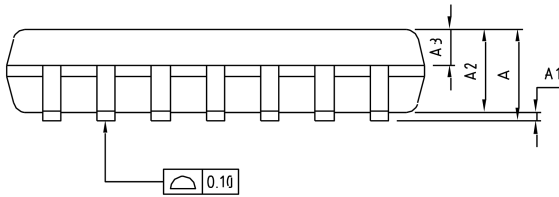
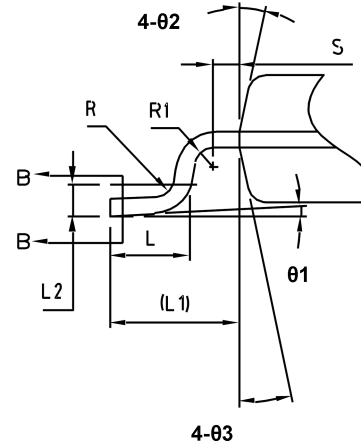
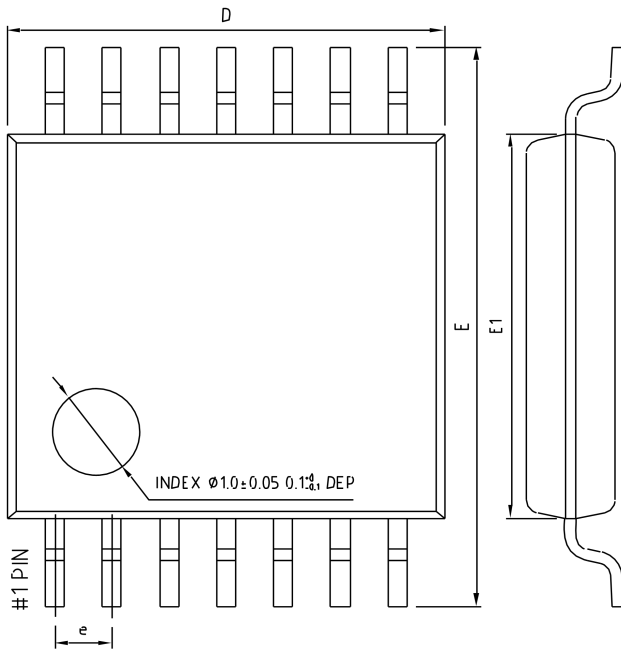
Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.10
A1	0.05	0.10	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.25	-	0.38
b1	0.24	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.75	4.90	5.05
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.55	0.70
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

Physical Dimensions: SOP-14



Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36	-	0.49
b1	0.35	0.40	0.45
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	8.45	8.65	8.85
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27 BSC		
h	0.25	-	0.50
L	0.45	0.60	0.80
L1	1.05 BSC		
$\theta$	0°	-	8°

### Physical Dimensions: TSSOP-14



SECTION B-B

Common Dimensions (Units of measures = 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	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
θ1	0°	-	8°
θ2	10°	12°	14°
θ3	10°	12°	14°



DIO2081/2/4

750 nA ` Rail-to-Rail Input/ Output Low Power Amplifier

## 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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