

## DIO236X

### Ultra Low $V_{OS}$ , Low Power Amplifier

#### Features

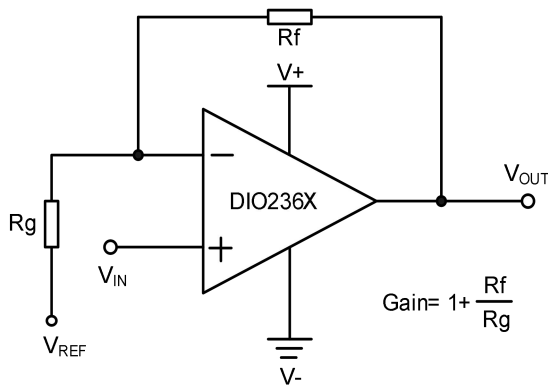
- Ultra low  $V_{OS}$ : DIO2361A/2A: 10  $\mu V$  (Max)  
DIO2361B/2B: 20  $\mu V$  (Max)  
DIO2361/2: 40  $\mu V$  (Max)  
DIO2361M/2M: 65  $\mu V$  (Max)
- Low power: 17  $\mu A$  (Typ)
- Unity gain stable
- Gain bandwidth product: 300 kHz (Typ)
- Wide supply range: 2.5 V to 5.5 V
- Available in SOT23-5, SC70-5, SOIC-8, MSOP-8, DFN2\*2-8 and DFN3\*3-8 packages
- Temperature range:
  - Industrial: -40°C to 85°C
  - Extended: -40°C to 125°C

#### Descriptions

The DIO236X is a family of ultra low  $V_{OS}$  operational amplifier, with rail-to-rail CMOS input/output and single/dual channels selectable. The DIO236X family has a gain-bandwidth product of 300 kHz (Typ), wide operating supply voltage from 2.5 V to 5.5 V and broad output voltage swing.

The DIO236X consumes ultra low power, with each channel 17  $\mu A$  (Typ) of current, which makes DIO236X be ideal for battery powered device, temperature-sense device, etc.

#### Typical Applications



Non-Inverting Amplifier

$$\text{Gain} = 1 + \frac{R_f}{R_g}$$

#### Applications

- Active filters
- Data acquisition
- Portable equipment
- Test equipment
- Broadband communication
- Process control
- Audio and video processing

## Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T <sub>A</sub>	Package	
DIO2361ASC5	W361	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361AST5	W361	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361ASO8	DIO2361	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361AMP8	DIO2361	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361BSC5	W361	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361BST5	W361	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361BSO8	DIO2361	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361BMP8	DIO2361	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361SC5	W361	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361ST5	W361	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361SO8	DIO2361	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361MP8	DIO2361	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361MSC5	W361	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361MST5	W361	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361MSO8	DIO2361	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361MMP8	DIO2361	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362ACN8	2362	3	Green	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362ACD8	D2362	3	Green	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362ASO8	DIO2362	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362AMP8	DIO2362	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362BCN8	2362	3	Green	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362BCD8	D2362	3	Green	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362BSO8	DIO2362	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362BMP8	DIO2362	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362CN8	2362	3	Green	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362CD8	D2362	3	Green	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362SO8	DIO2362	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362MP8	DIO2362	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362MCN8	2362	3	Green	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362MCD8	D2362	3	Green	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362MSO8	DIO2362	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362MMP8	DIO2362	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000

## Ordering Information Complementary Note

Ordering Code = Part No. + Package Code

DIO2361A/2A  
DIO2361B/2B  
DIO2361/2  
DIO2361M/2M

SC5: stands for SC70-5  
ST5: stands for SOT23-5  
SO8: stands for SOIC-8  
MP8: stands for MSOP-8  
CN8: stands for DFN2\*2-8  
CD8: stands for DFN3\*3-8

## Pin Assignments

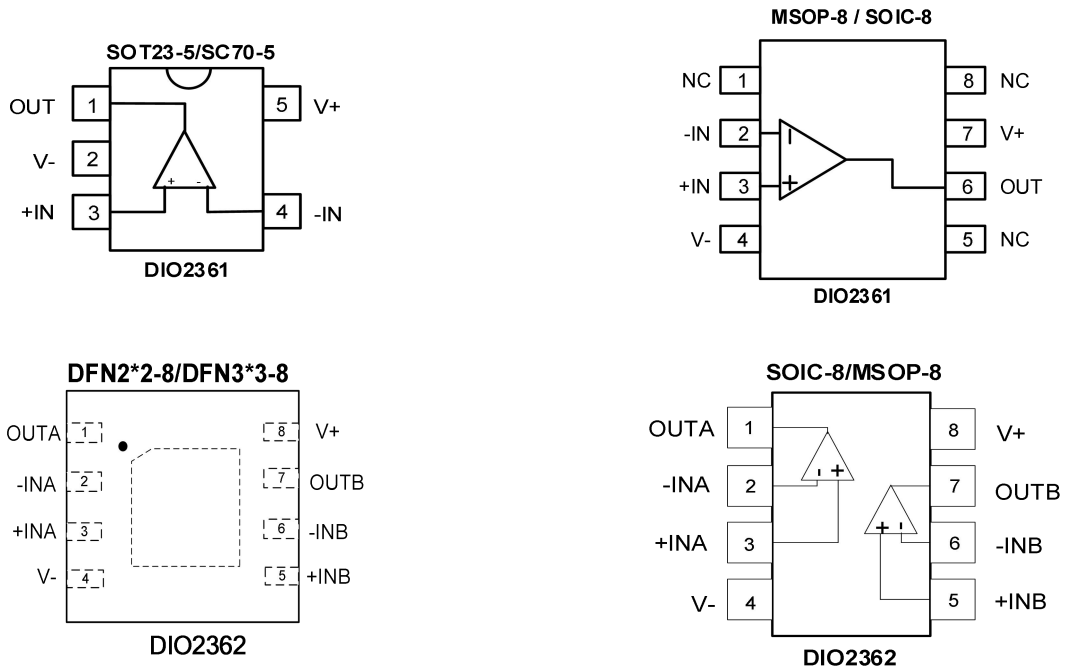


Figure 1. Top view

## Pin Description

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

Symbol	Parameter	Rating	Unit
	Supply voltage ( V+ – V-)	7	V
	Input voltage	(V-)-0.3 V to (V+) 0.3 V	V
	Differential input voltage	V+ – V-	V
T <sub>STG</sub>	Storage temperature range	-65 to 150	°C
T <sub>J</sub>	Junction temperature	150	°C
T <sub>L</sub>	Lead temperature range	260	°C
ESD	HBM, JEDEC: JESD22-A114	±8	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.

Symbol	Parameter	Rating	Unit
	Supply voltage	2.5 to 5.5	V
	Input voltage	0 to 5	V
T <sub>A</sub>	Operating temperature range	-40 to 125	°C

## Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Input characteristics</b>							
$V_{OS}$	Input offset voltage	$V_+ = 3.3\text{ V to } 5.5\text{ V}$	DIO2361A/2A	-10		10	$\mu\text{V}$
			DIO2361B/2B	-20		20	
			DIO2361/2	-40		40	
			DIO2361M/2M	-65		65	
$I_B$	Input bias current	$V_+ = 3.3\text{ V to } 5.5\text{ V}$		35		$\text{pA}$	
$V_{CM}$	Common mode voltage range		-0.1		$(V_+)+0.1$	$\text{V}$	
CMRR	Common mode rejection ratio	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		130		$\text{dB}$	
$A_{OL}^{(1)}$	Open loop voltage gain	$R_L = 50\text{ k}\Omega$ , $V_O = 0.1$ to $(V_+) - 0.1$	80	110		$\text{dB}$	
$\Delta V_{OS}/\Delta T$	Input offset voltage drift	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		0.05		$\mu\text{V}/^\circ\text{C}$	
<b>Output characteristics</b>							
$V_{OH}$	Output voltage high	$R_L = 50\text{ k}\Omega$ , $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		4.995		$\text{V}$	
$V_{OL}$	Output voltage low	$R_L = 50\text{ k}\Omega$ , $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		4.5		$\text{mV}$	
$I_{SC}$	Output short circuit current	Source $I_{SC}$ , $V_+ = 5\text{ V}$		34		$\text{mA}$	
		Sink $I_{SC}$ , $V_+ = 5\text{ V}$		32			
<b>Power supply</b>							
PSRR	Power supply rejection ratio		100			$\text{dB}$	
$I_S$	Supply current per channel/Amp	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		17	35	$\mu\text{A}$	
<b>Dynamic performance</b>							
GBP	Gain bandwidth product	$C_L = 100\text{ pF}$ , $R_L = 1\text{ M}\Omega$		300		$\text{kHz}$	
SR	Slew rate	$G = 1$ , 2 V output step		180		$\text{V/ms}$	
$t_s$	Settling time	$G = 1$ , 4 V output step		30		$\mu\text{s}$	
$\Theta_m^{(1)}$	Phase margin			62		$\text{Deg}$	
$t_r$	Overload recovery time			25		$\mu\text{s}$	
<b>Noise performance</b>							
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , 4 $V_{PP}$ , $R_L = 5\text{ k}\Omega$		0.1		$\%$	
$e_n$	Voltage noise density	$f = 1\text{ kHz}$		80		$\text{nV}/\sqrt{\text{Hz}}$	

**Note:**

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

## Typical Performance Characteristics

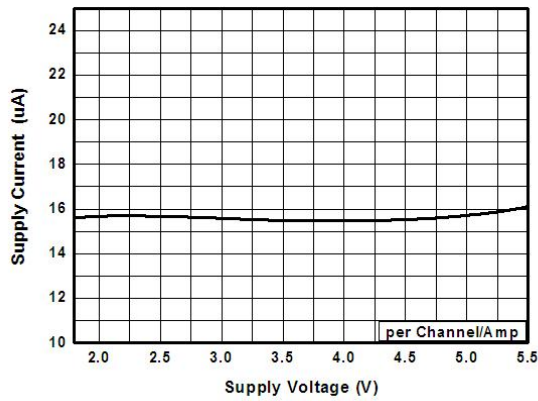


Figure 2.  $I_s$  vs.  $V_{CC}$

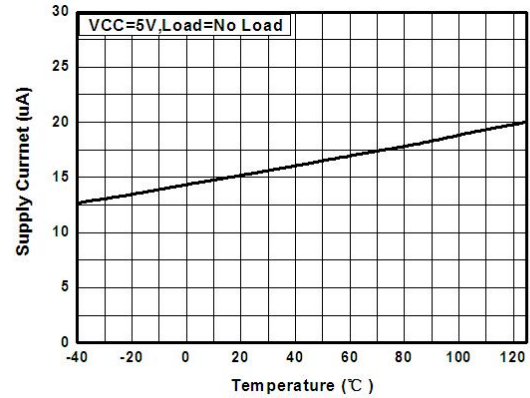


Figure 3.  $I_s$  vs. Temperature

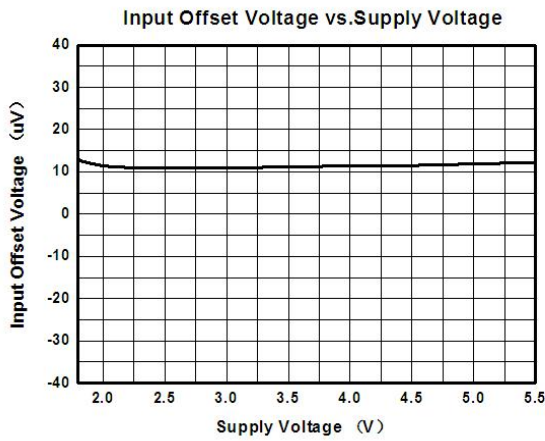


Figure 4.  $V_{OS}$  vs.  $V_{CC}$

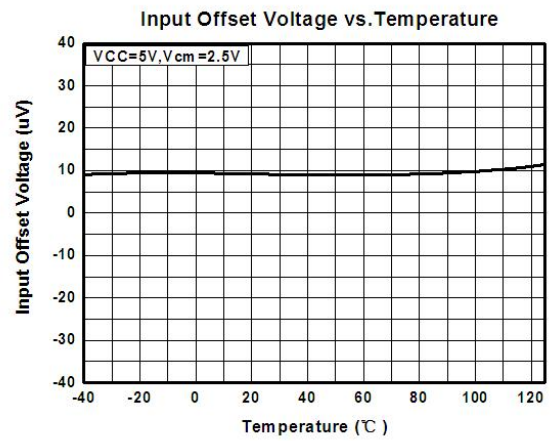
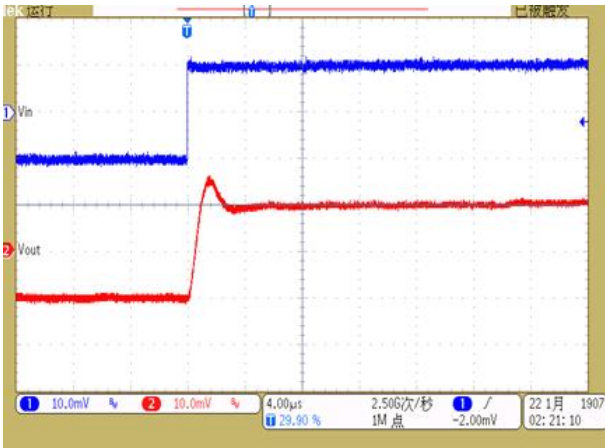


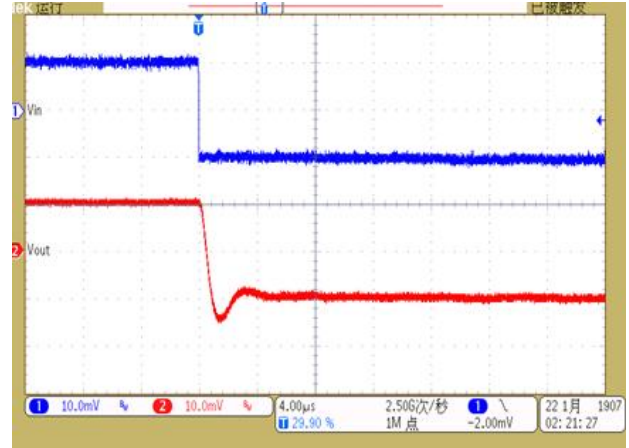
Figure 5.  $V_{OS}$  vs. Temperature

## Typical Performance Characteristics (Continued)



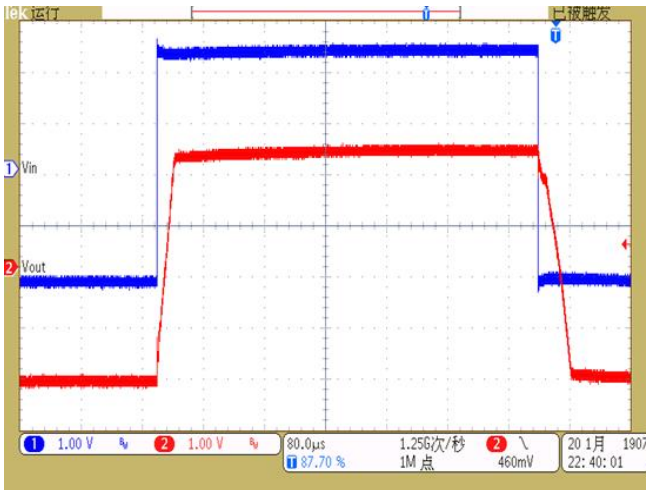
( $V_{CC} = 5\text{ V}$ ,  $C_L = 200\text{ pF}$ )

**Figure 6. Small-signal response**



( $V_{CC} = 5\text{ V}$ ,  $C_L = 200\text{ pF}$ )

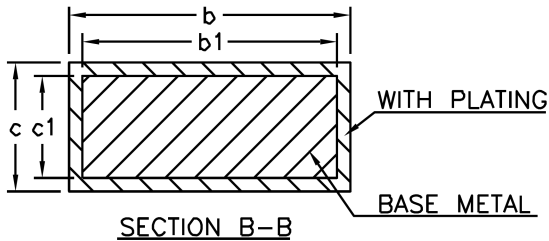
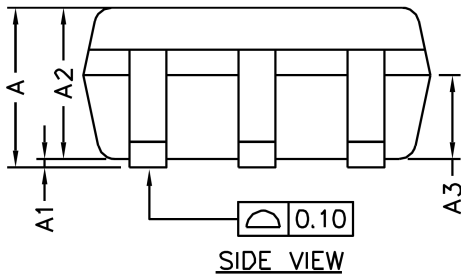
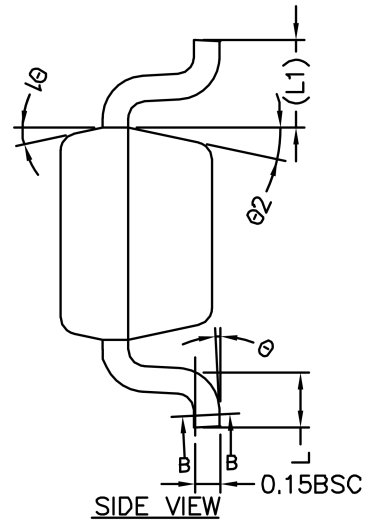
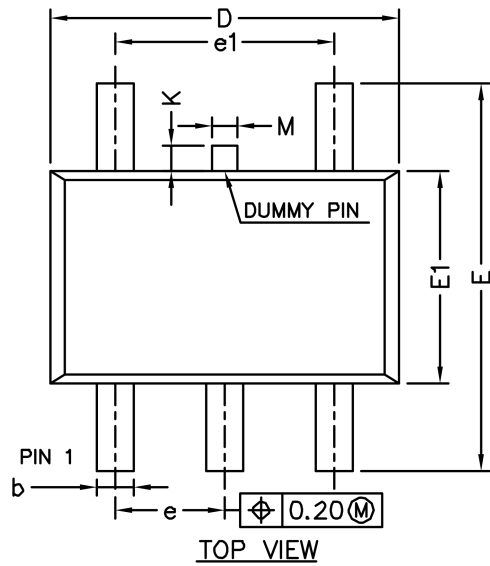
**Figure 7. Small-signal response**



( $V_{CC} = 5\text{ V}$ ,  $R_L = 5.1\text{ k}\Omega$ )

**Figure 8. Large-signal response**

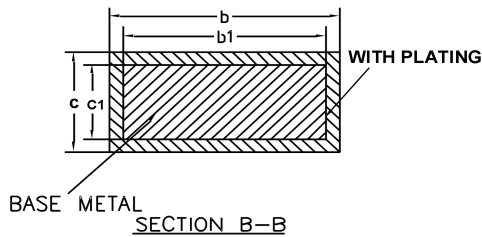
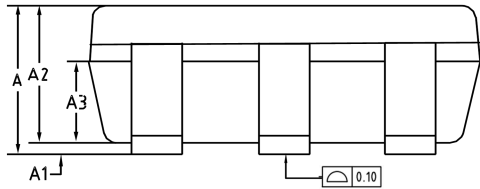
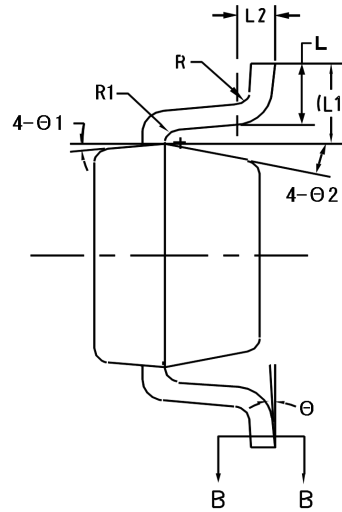
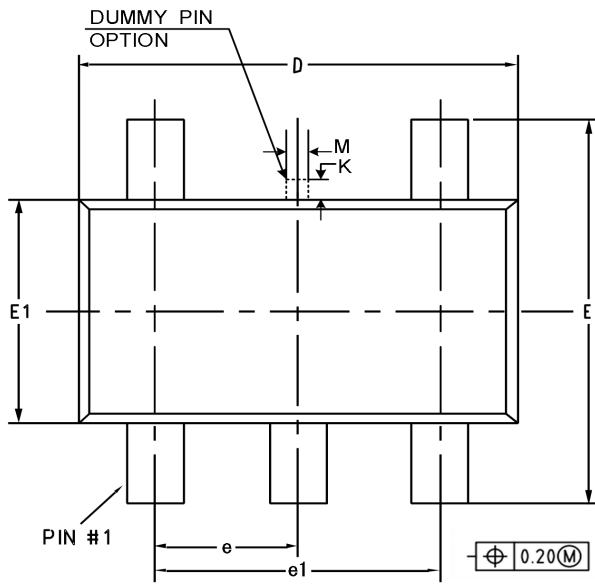
## Physical Dimensions: SC70-5



Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.80	-	1.10
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.40	0.50	0.60
b	0.17	-	0.30
b1	0.17	0.22	0.25
c	0.12	-	0.20
c1	0.12	0.15	0.16
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.21	1.26	1.31
e	0.60	0.65	0.70
e1	1.20	1.30	1.40
L	0.26	0.33	0.46
L1	0.52 REF		
M	0.10	0.15	0.20
K	0	-	0.20
θ	0°	-	8°
θ1	10°	12°	14°
θ2	10°	12°	14°

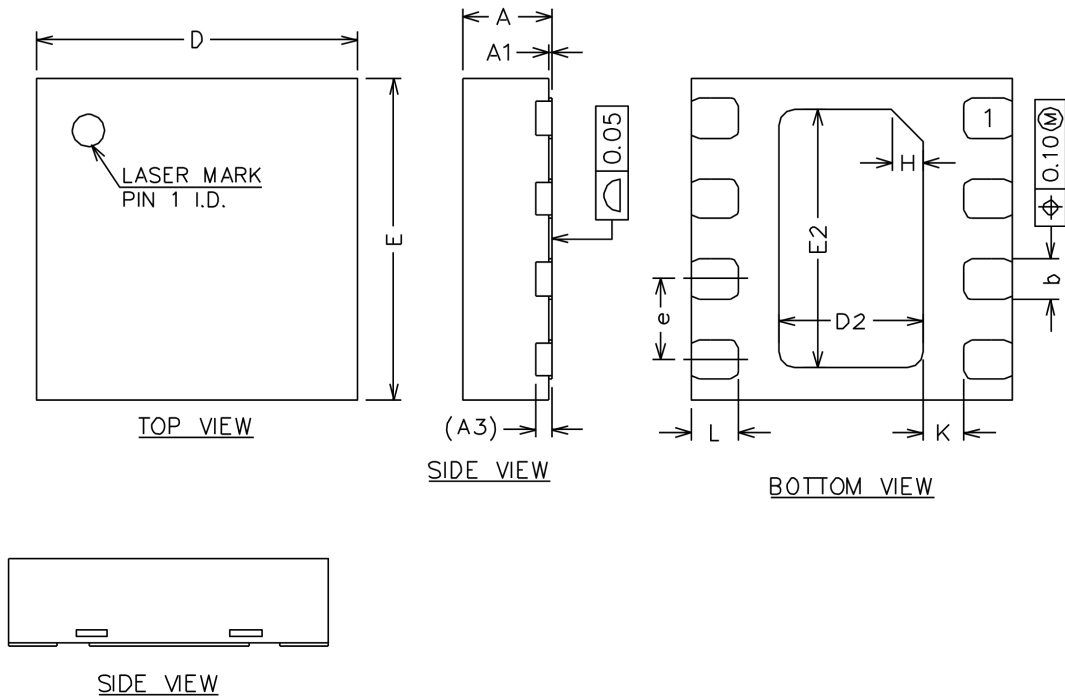


## Physical Dimensions: SOT23-5



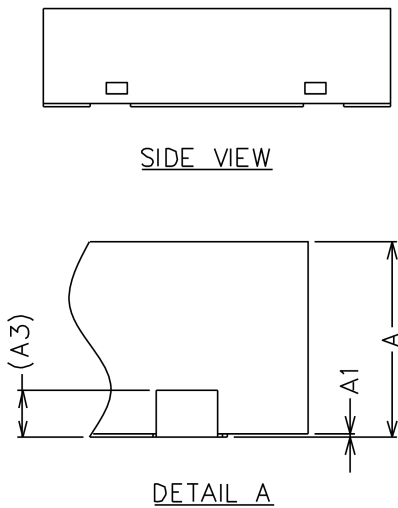
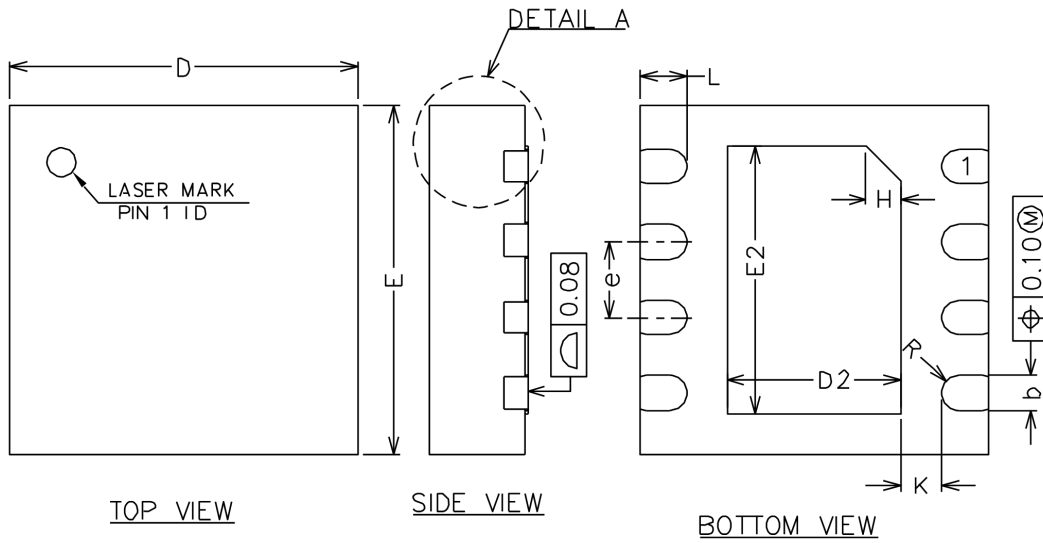
Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
K	0	-	0.25
L	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
$\theta$	0°	-	8°
$\theta_1$	8°	10°	12°
$\theta_2$	10°	12°	14°

## Physical Dimensions: DFN2\*2-8



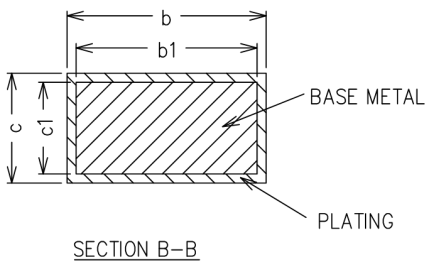
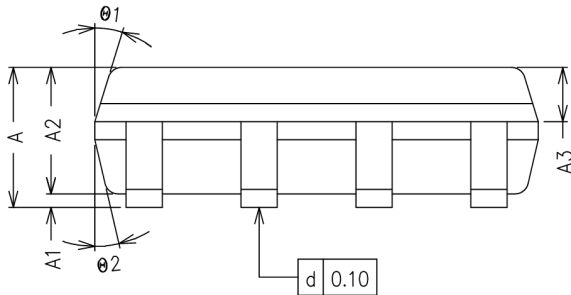
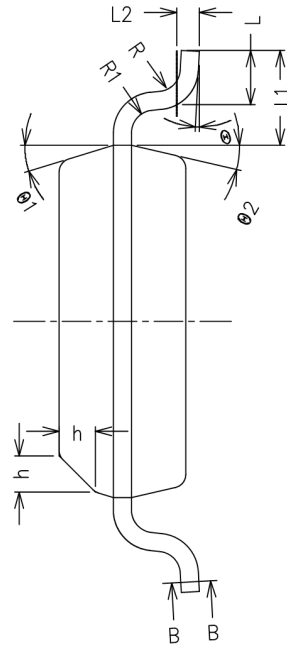
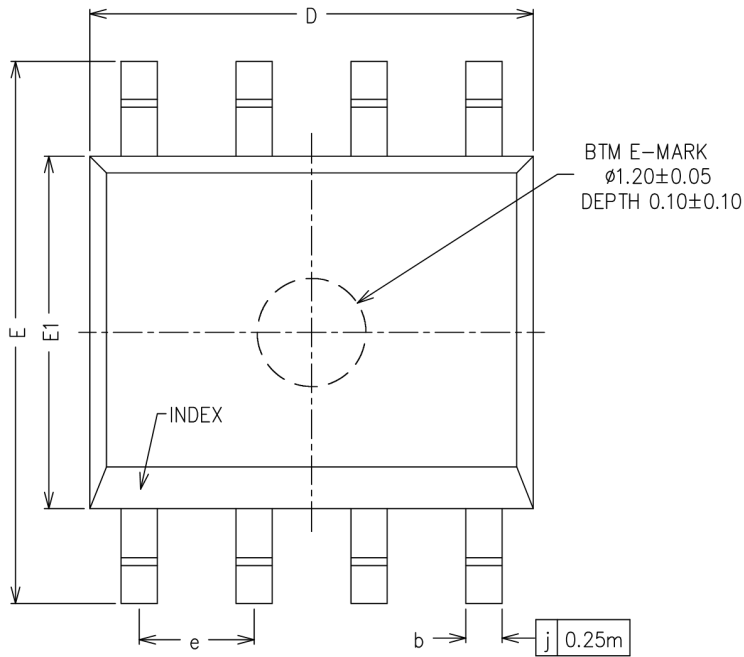
Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.50	0.55	0.65
A1	0.00	0.02	0.05
A3	0.10 REF		
b	0.20	0.25	0.30
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.80	0.90	1.00
E2	1.50	1.60	1.70
e	0.40	0.50	0.60
H	0.20 REF		
K	0.15	0.25	0.35
L	0.25	0.30	0.35

## Physical Dimensions: DFN3\*3-8



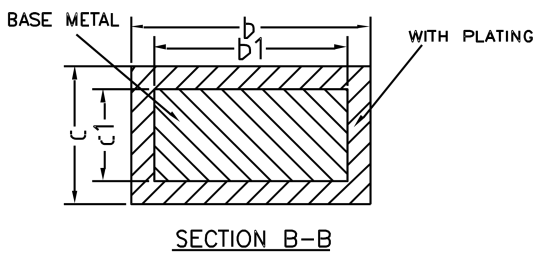
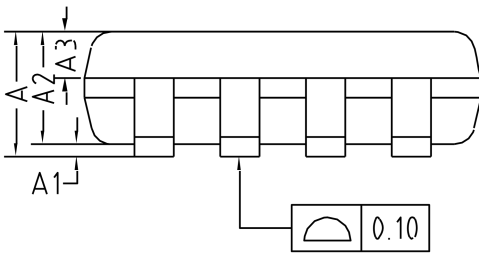
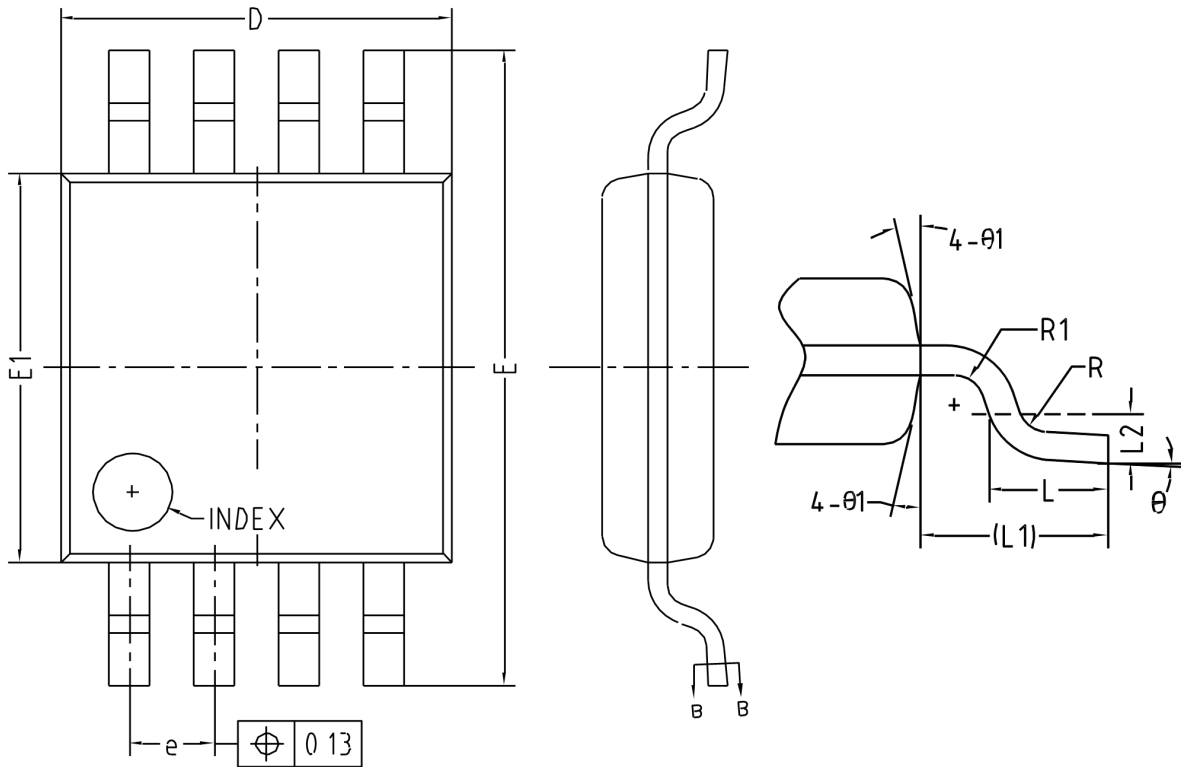
Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.25	0.30	0.35
D	2.90	3.00	3.10
E	2.90	3.00	3.10
D2	1.40	1.50	1.60
E2	2.20	2.30	2.40
e	0.55	0.65	0.75
H	0.30 REF		
K	0.25	0.35	0.45
L	0.35	0.40	0.45
R	0.13	-	-

## Physical Dimensions: SOIC-8



Common Dimensions (Units of measure = 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	-	0.25
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	1.17	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 measure = 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°



## DIO236X

Ultra Low Vos, 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.

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