

## DIO236X

### Ultra Low Vos, Low Power Amplifier

#### Features

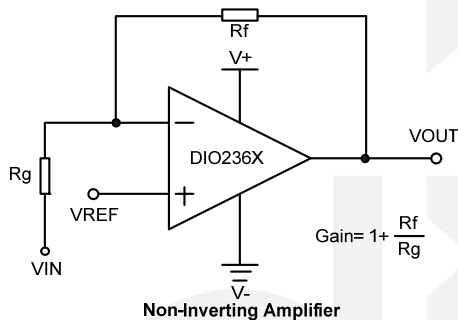
- Ultra low  $V_{OS}$ : DIO2361A/2A: 10 $\mu$ V(Max)  
DIO2361B/2B: 20 $\mu$ V(Max)  
DIO2361/2: 40 $\mu$ V(Max)  
DIO2361M/2M: 65 $\mu$ V(Max)
- Low Power: 17.0 $\mu$ A(typ.)
- Unity Gain Stable
- Gain Bandwidth Product: 300kHz(typ.)
- Wide supply range: 1.8V to 5.5V
- Available in SOT23-5, SC70-5, 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

DIO236x is a family of ultra low  $V_{OS}$  operational amplifier, with rail-to-rail CMOS input/output and single/dual channels selectable. DIO236x family has a gain-bandwidth product of 300kHz(typ.), wide operating supply voltage from 1.8V to 5.5V and broad output voltage swing.

DIO236x consumes ultra low power, with each channel 17.0 $\mu$ A(typ.) of bias current, which makes DIO236x be ideal for battery powered device, temperature-sense device, etc.

#### Typical Applications



#### Applications

- 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	
DIO2361ASC5	W361	Green or RoHS	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361AST5	W361	Green or RoHS	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361ASO8	DIO2361	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361AMP8	DIO2361	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361BSC5	W361	Green or RoHS	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361BST5	W361	Green or RoHS	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361BSO8	DIO2361	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361BMP8	DIO2361	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361SC5	W361	Green or RoHS	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361ST5	W361	Green or RoHS	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361SO8	DIO2361	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361MP8	DIO2361	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2361MSC5	W361	Green or RoHS	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO2361MST5	W361	Green or RoHS	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2361MSO8	DIO2361	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2361MMP8	DIO2361	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362ACN8	2362	Green or RoHS	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362ACD8	D2362	Green or RoHS	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362ASO8	DIO2362	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362AMP8	DIO2362	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362BCN8	2362	Green or RoHS	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362BCD8	D2362	Green or RoHS	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362BSO8	DIO2362	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362BMP8	DIO2362	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362CN8	2362	Green or RoHS	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362CD8	D2362	Green or RoHS	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362SO8	DIO2362	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362MP8	DIO2362	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2362MCN8	2362	Green or RoHS	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO2362MCD8	D2362	Green or RoHS	-40 to 125°C	DFN3*3-8	Tape & Reel, 5000
DIO2362MSO8	DIO2362	Green or RoHS	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2362MMP8	DIO2362	Green or RoHS	-40 to 125°C	MSOP-8	Tape & Reel, 3000

## Ordering Information Complimentary 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

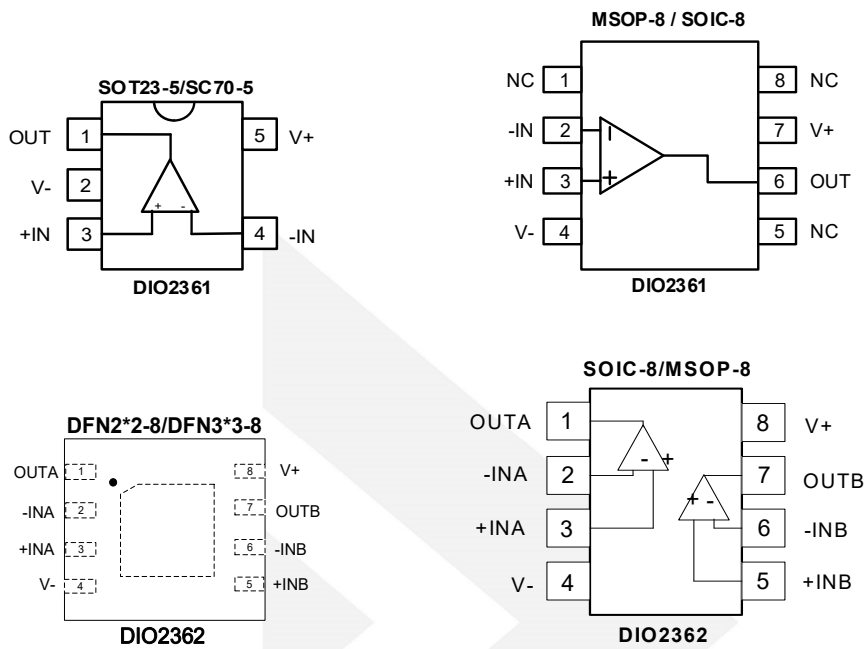


Figure 1 Top View

## 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.

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

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

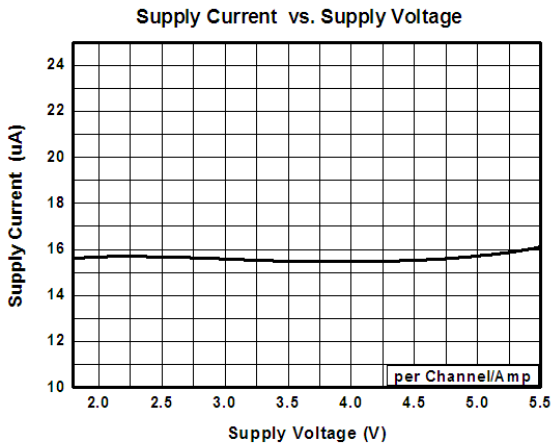
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
<b>INPUT CHARACTERISTICS</b>							
$V_{OS}$	Input Offset Voltage	$V_+=1.8V$ to $5.5V$	DIO2361A/2A	-10		10	$\mu V$
			DIO2361B/2B	-20		20	
			DIO2361/2	-40		40	
			DIO2361M/2M	-65		65	
$I_B$	Input Bias Current	$V_+=1.8V$ to $5.5V$		1		pA	
$I_{OS}$	Input 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	$R_L=50k\Omega$ , $V_O=0.1$ to $(V_+)-0.1$	80	110		dB	
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	$-40^\circ C \leq T_A \leq 125^\circ C$		0.05		$\mu V/^\circ C$	
<b>OUTPUT CHARACTERISTICS</b>							
$V_{OH}$	Output Voltage High	$R_L=50k\Omega$ $-40^\circ C \leq T_A \leq 125^\circ C$		4.992		V	
$V_{OL}$	Output Voltage Low	$R_L=50k\Omega$ $-40^\circ C \leq T_A \leq 125^\circ C$		8		mV	
$I_{SC}$	Output Short Circuit Current	Source $I_{SC}$ , $V_+=5V$		34		mA	
		Sink $I_{SC}$ , $V_+=5V$		34			
<b>POWER SUPPLY</b>							
PSRR	Power Supply Rejection Ration		100			dB	
$I_S$	Supply Current per Channel/Amp	$-40^\circ C \leq T_A \leq 125^\circ C$		17	27	$\mu A$	
<b>DYNAMIC PERFORMANCE</b>							
GBP	Gain Bandwidth Product	$C_L=100pF$ , $R_L=1M\Omega$		300		kHz	
SR	Slew Rate	$G=1$ , 2V Output Step		160		V/ms	
$t_s$	Setting Time	$G=1$ , 2V Output Step		1		ms	
$\Theta_m$	Phase Margin			62		Deg	
$t_r$	Overload Recovery Time			40		$\mu s$	
<b>NOISE PERFORMANCE</b>							
THD	Total Harmonic Distortion	$f=1kHz$ , $4V_{PP}$ , $R_L=5k\Omega$ ,		0.33		%	

$e_n$	Voltage Noise Density	$f=1\text{kHz}$		70	$\text{nV}/\sqrt{\text{Hz}}$
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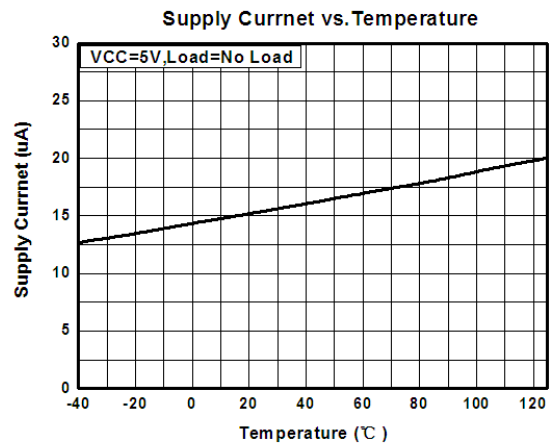
Specifications subject to change without notice.

## Typical Performance Characteristics

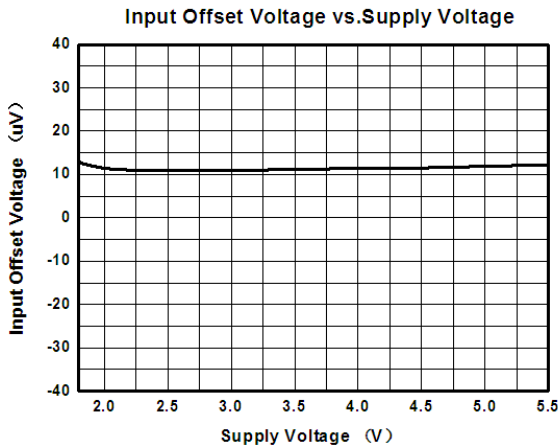
**$I_s$  vs.  $V_{CC}$**



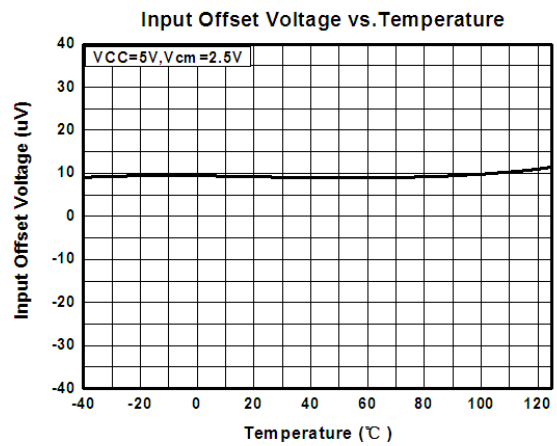
**$I_s$  vs. Temperature**



**$V_{os}$  vs.  $V_{CC}$**

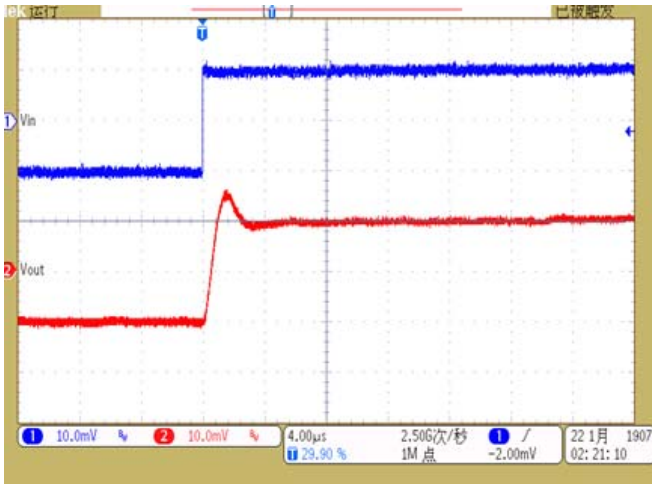


**$V_{os}$  vs. Temperature**

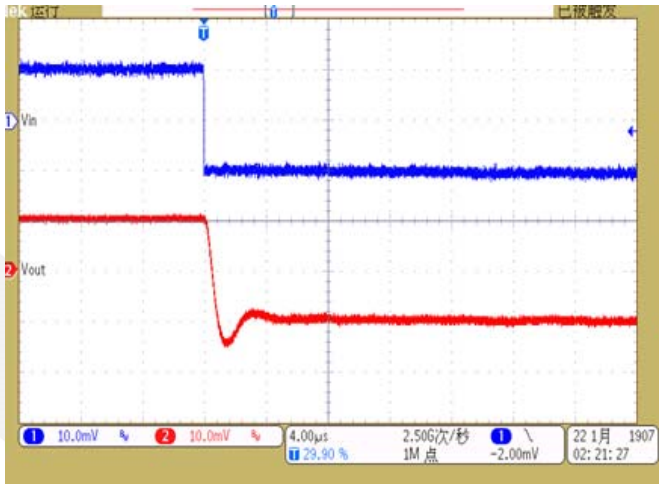


## Typical Performance Characteristics (Continue)

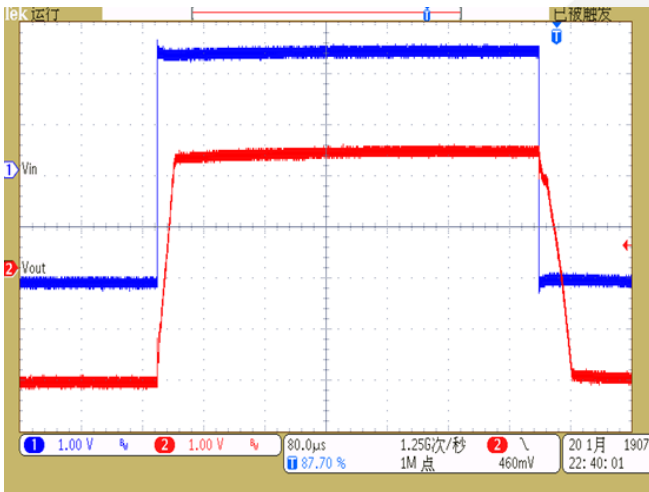
Small-signal Response  
( $V_{CC}=5V$ ,  $C_L=200pF$ )



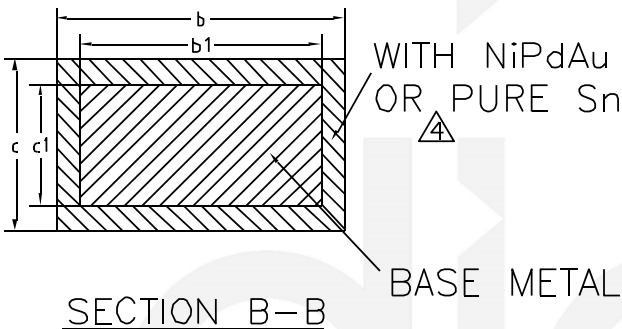
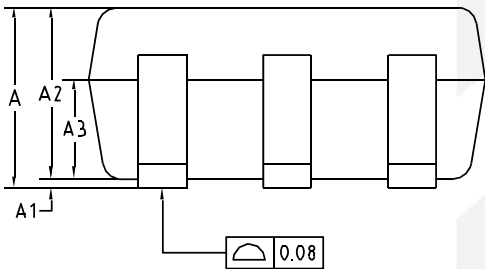
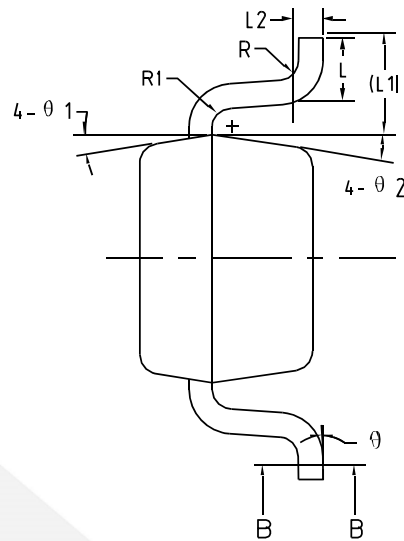
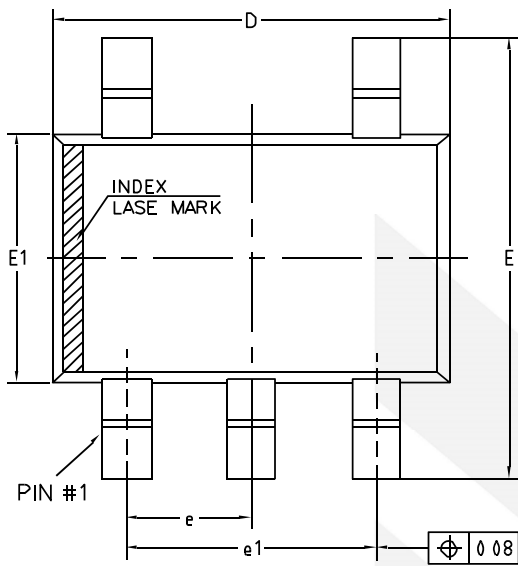
Small-signal Response  
( $V_{CC}=5V$ ,  $C_L=200pF$ )



Large-signal Response  
( $V_{CC}=5V$ ,  $R_L=5.1k\Omega$ )



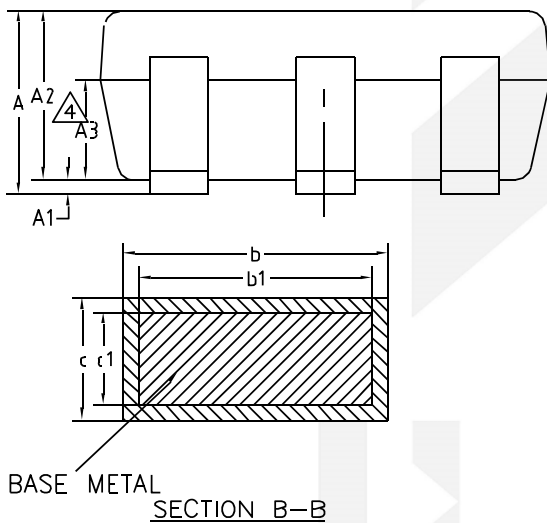
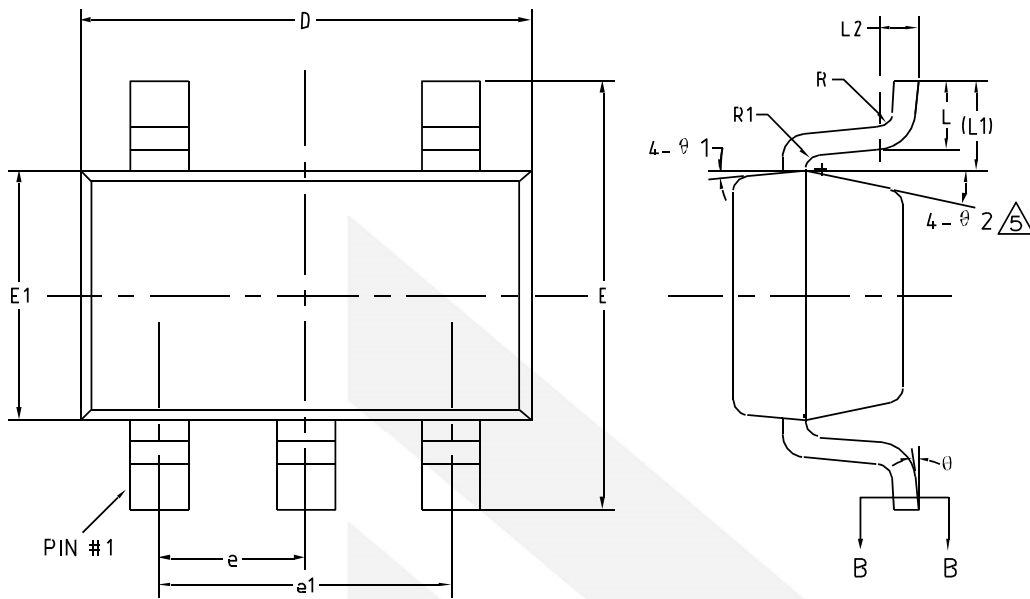
## Physical Dimensions: SC70-5



COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	0.85	-	1.05
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
b	0.23	-	0.33
b1	0.22	0.25	0.28
c	0.12	-	0.18
c1	0.115	0.13	0.14
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.25	1.30	1.35
e	0.65BSC		
e1	1.30BSC		
L	0.28	0.33	0.38
L1	0.50REF		
L2	0.15BSC		
R	0.10	-	-
R1	0.10	-	0.25
θ	0°	-	8°
θ1	6°	9°	12°
θ2	6°	9°	12°

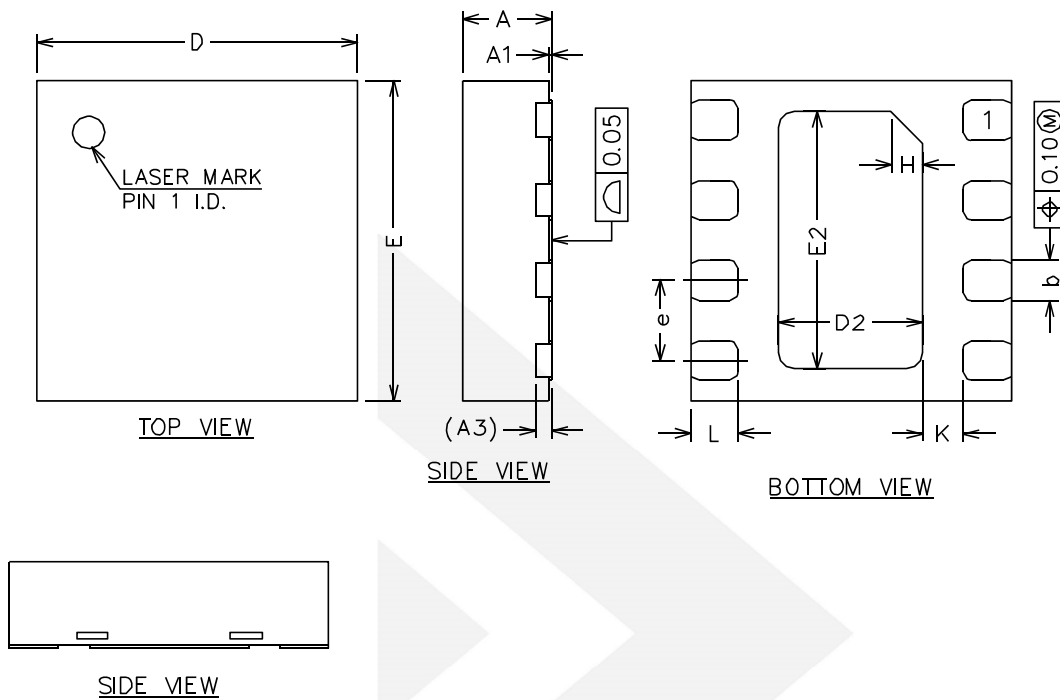


## Physical Dimensions: SOT23-5



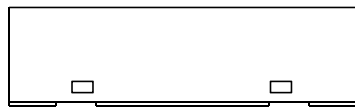
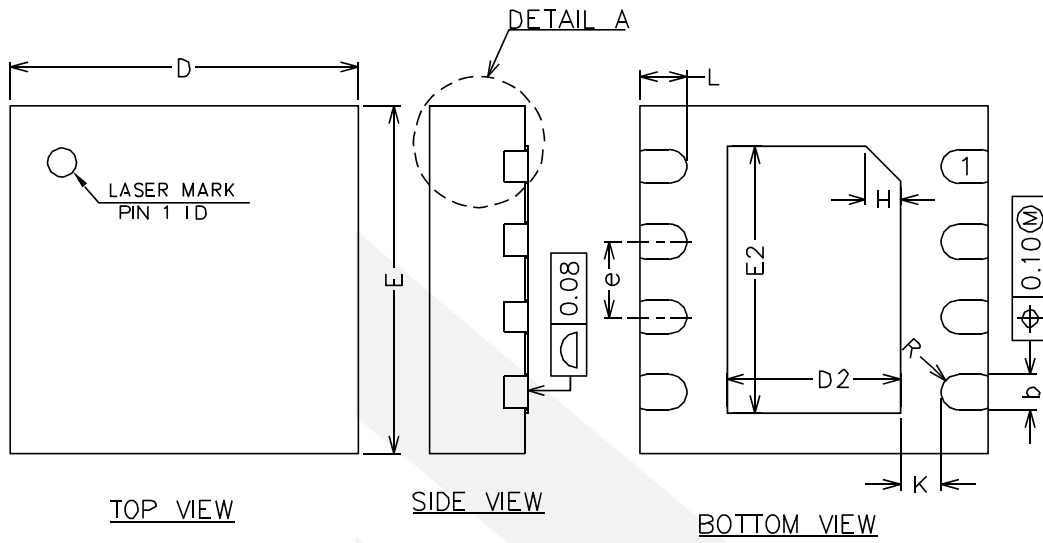
COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
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: DFN2\*2-8

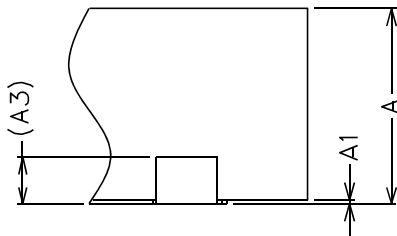


COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	0.50	0.55	0.65
A1	0.00	0.02	0.05
A3	0.10REF		
b	0.20	0.25	0.30
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.80	0.90	1.00
E2	1.50	1.60	1.70
e	0.40	0.50	0.60
H	0.20REF		
K	0.15	0.25	0.35
L	0.25	0.30	0.35

## Physical Dimensions: DFN3\*3-8



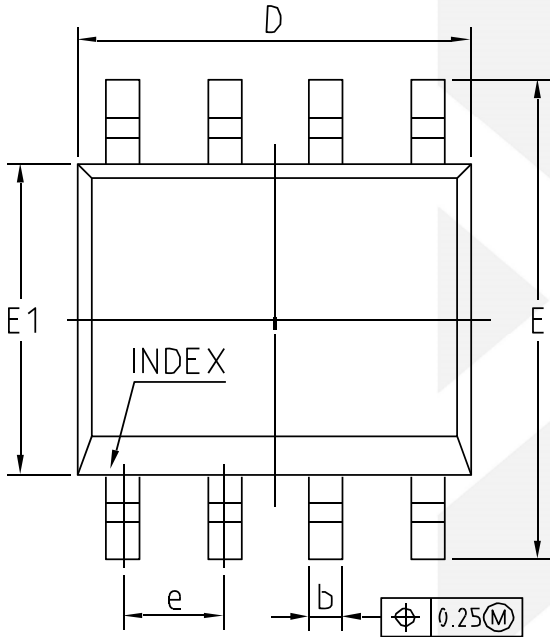
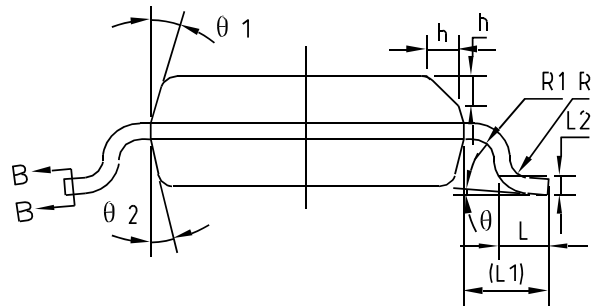
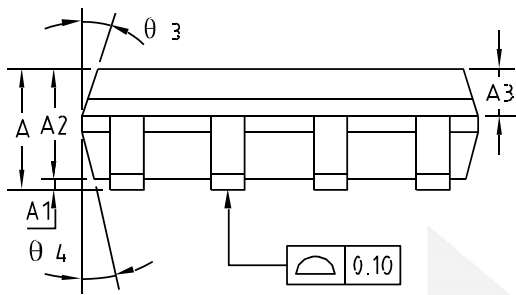
SIDE VIEW



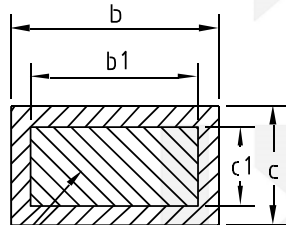
DETAIL A

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	0.20REF		
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	0.30REF		
K	0.25	0.35	0.45
L	0.35	0.40	0.45
R	0.13	-	-

## Physical Dimensions: SOIC-8



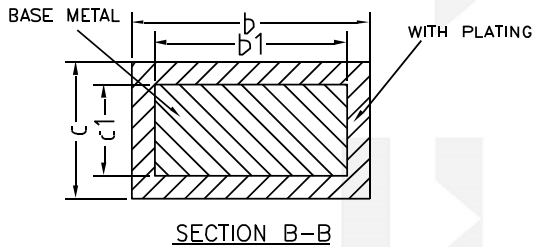
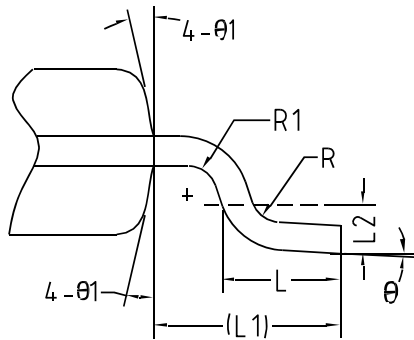
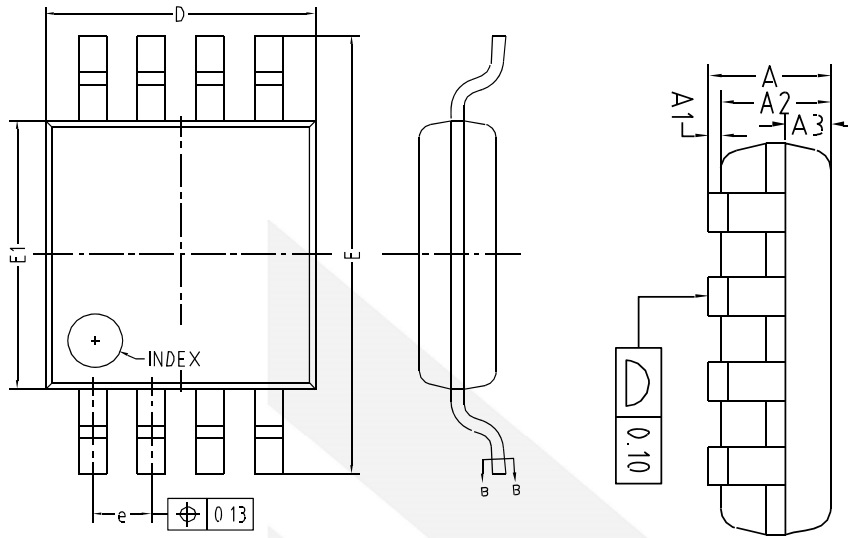
COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
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°
theta 3	15°	17°	19°
theta 4	11°	13°	15°



BASE METAL

SECTION B-B

## 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	-	-
theta	0°	-	8°
theta1	9°	12°	15°

## 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.

