DIO2022x
190 µA, 3 MHz RRIO CMOS Amplifier

Features

- Rail-to-rail input and output
- ±1 mV typical offset (V_{OS})
- V_{OSMAX} specificity: ±5 mV
- Low distortion
- Gain bandwidth product: 3 MHz
- Wide supply range: 2.5 V to 5.5 V
- 190µA/Amplifier typical supply current
- Slew rate: 1.7 V/µs
- Small size packaging best for portable applications.
- DIO20221: available in SC70-5, SOT23-5
  DIO20222: available in MSOP-8, SOIC-8
  DIO20224: available in SOIC-14 &TSSOP-14

Descriptions

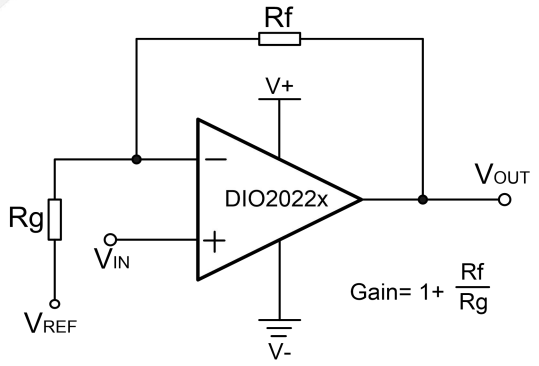
The DIO2022x is a rail-to-rail I/O operational amplifier which allows low load impedances to be driven. With a 3 MHz unity-gain frequency and low noise, low distortion and high output current capability, the DIO2022x provides excellent choice for high quality systems. The input common-mode voltage range includes ground, and the maximum input offset voltage is ±1 mV (guaranteed). They are also capable of comfortably driving large capacitive loads.

DIO2022x is offered in RoHS or Green package and ESD (HBM) 8 kV. It is specified over the extended -40 to 125°C

Applications

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

Typical Application



Non-Inverting Amplifier

Ordering Information

Order Part Number	Top Marking	RoHS	T_A	Package	
DIO20221SC5	YWXC	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO20221ST5	YWXC	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO20222MP8	DIO2022	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO20222SO8	DIO2022	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO20224CS14	DIO2024	Green	-40 to 125°C	SOIC-14	Tape & Reel, 2500
DIO20224CT14	DIO2024	Green	-40 to 125°C	TSSOP-14	Tape & Reel, 2500

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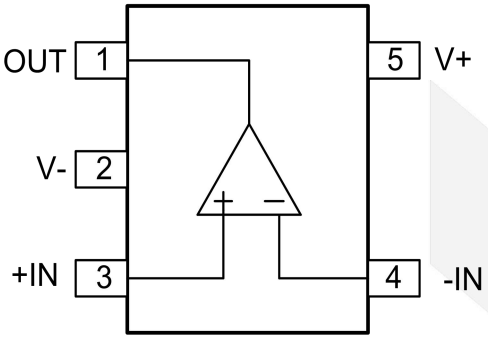
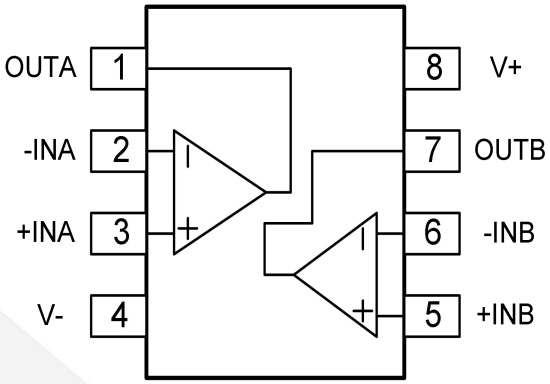
1. Pin Assignments

SOT23-5/SC70-5



MSOP-8/SOIC-8



TSSOP-14/SOIC-14

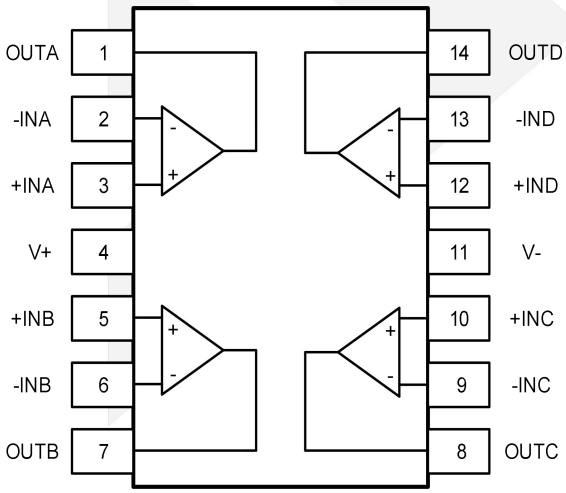


Figure 1. Pin assignment (top view)

Pin Description

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

2. 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 maxim rating conditions for extended periods may affect device reliability. DIOO does not recommend exceeding them or designing to Absolute Maximum Ratings.

Parameter		Rating	Unit
Supply voltage		7.5	V
Input voltage		(V-)-0.5 to (V+)+0.5	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	

3. Recommended Operating Conditions

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

Parameter	Rating	Unit
Supply voltage	2.5 to 5.5	V
Input voltage	0 to 5	V
Operating temperature range	-40 to 125	°C

4. Electrical Characteristics

Typical value: V+ = 5 V, R_L = 100 kΩ to V+/2, T_A = 25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Input characteristics						
V_{OS}	Input offset voltage	-40°C ≤ T_A ≤ 125°C, V+ = 2.5 V to 5.5 V		±1.0	±5.0	mV
I_B	Input bias current	-40°C ≤ T_A ≤ 125°C, V+ = 2.5 V to 5.5 V		10		pA
I_{OS}	Input offset current	-40°C ≤ T_A ≤ 125°C, V+ = 2.5 V to 5.5 V		1.0	10	pA
V_{CM}	Common mode voltage range	V+ = 5.5 V	-0.1		(V+) +0.1	V
CMRR	Common mode rejection ratio	-40°C ≤ T_A ≤ 125°C, V_{CM} = -0.1 to 5.6 V, V+ = 5.5 V	80	120		dB
A_{OL}	Open loop voltage gain	R_L = 600 Ω, Vo = 0.1 to 4.9	90	120		dB
$\Delta V_{OS}/\Delta_T$	Input offset voltage drift	-40°C ≤ T_A≤ 125°C		2.5		μV/°C
Output characteristics						
	Output voltage swing from rail	R_L = 600 Ω, -40°C ≤ T_A ≤ 125°C			0.1	V
		R_L = 10k Ω, -40°C ≤ T_A ≤ 125°C			0.015	
I_{OUT}	Output current	V+ = 5V	80	85		mA
		V+ = 2.5V	5	15		
Ro	Closed loop output impedance	f = 100 kHz, G = +1, V+ = 5 V		2.0		Ω
		f = 100 kHz, G = +1, V+ = 2.5 V		4.2		
Power supply						
PSRR	Power supply rejection ratio		70	80		dB
I_S	Supply current per channel/amp	V+= 5 V , -40°C ≤ T_A ≤ 125°C		190	300	μA
		V+ = 2.5 V , -40°C ≤ T_A ≤ 125°C		160	280	
Dynamic performance						
GBP	Gain bandwidth product	R_L = 10 kΩ		3.0		MHz
SR	Slew rate	R_L = 600 Ω, G = 1, 2 V output step		1.7		V/μs
t_S	Setting time	R_L = 600 Ω, G = 1, 2 V output step			1.0	μs
X_{talk}	Channel separation	f = 1 kHz, R_L = 10 kΩ		110		dB
	Overload recovery time	V_{IN} × Gain = V+		1.0		μs
Noise performance						
THD	Total harmonic distortion	f = 10 kHz, 1 V output step, R_L = 600 Ω and 100 pF		0.015		%
e_n	Voltage noise density	f = 1 kHz, V+ = 5 V		27		nV/√Hz
		f = 10 kHz, V+= 5 V		18		

Note:

(1) Specifications subject to change without notice.

5. Typical Performance Characteristics

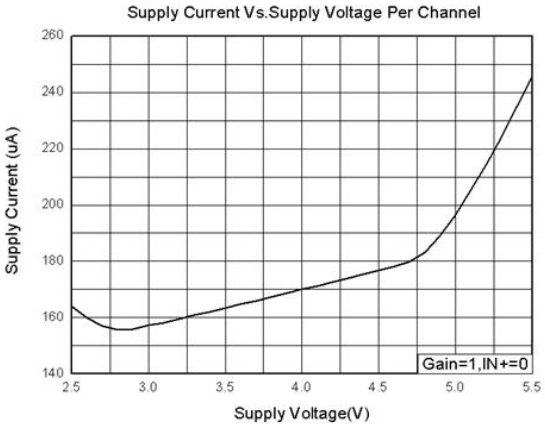


Figure 2 Supply current vs. Supply voltage per channel

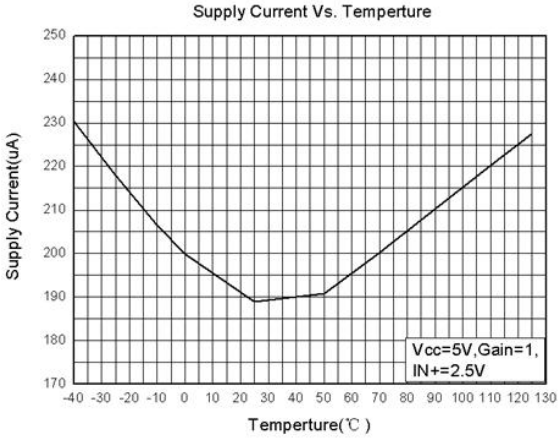


Figure 3 Supply current vs Temperature

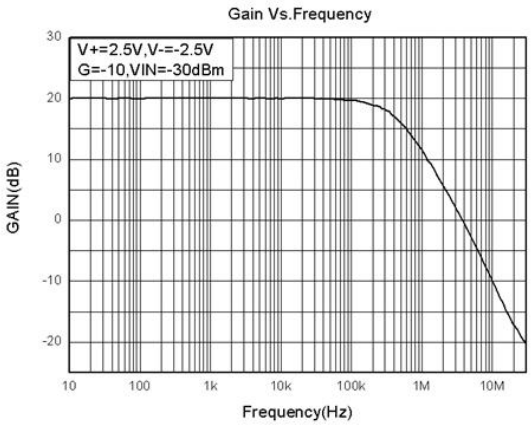


Figure 4 Gain vs. Frequency

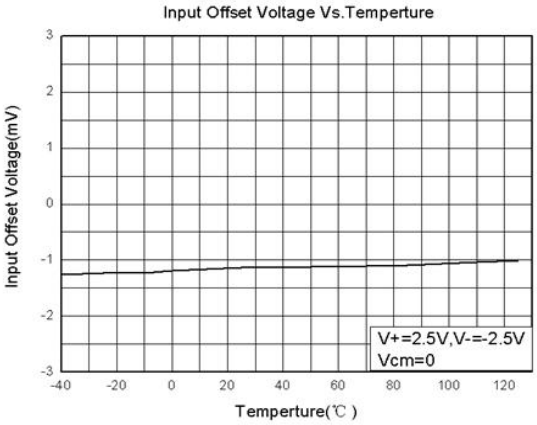


Figure 5 Input offset voltage vs. Temperature

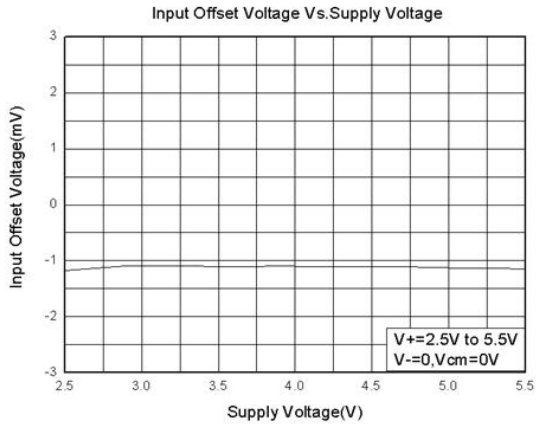


Figure 6 Input offset voltage vs. Supply voltage

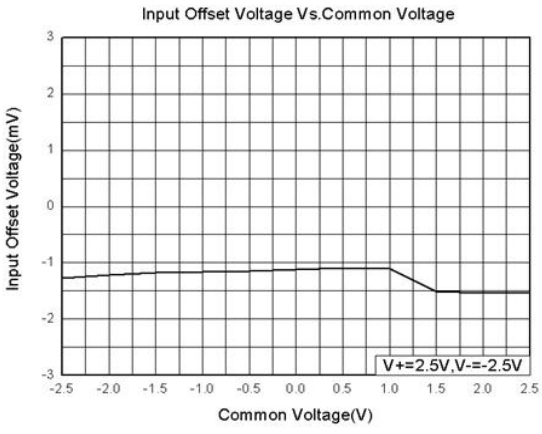


Figure 7 Input offset voltage vs. Common voltage

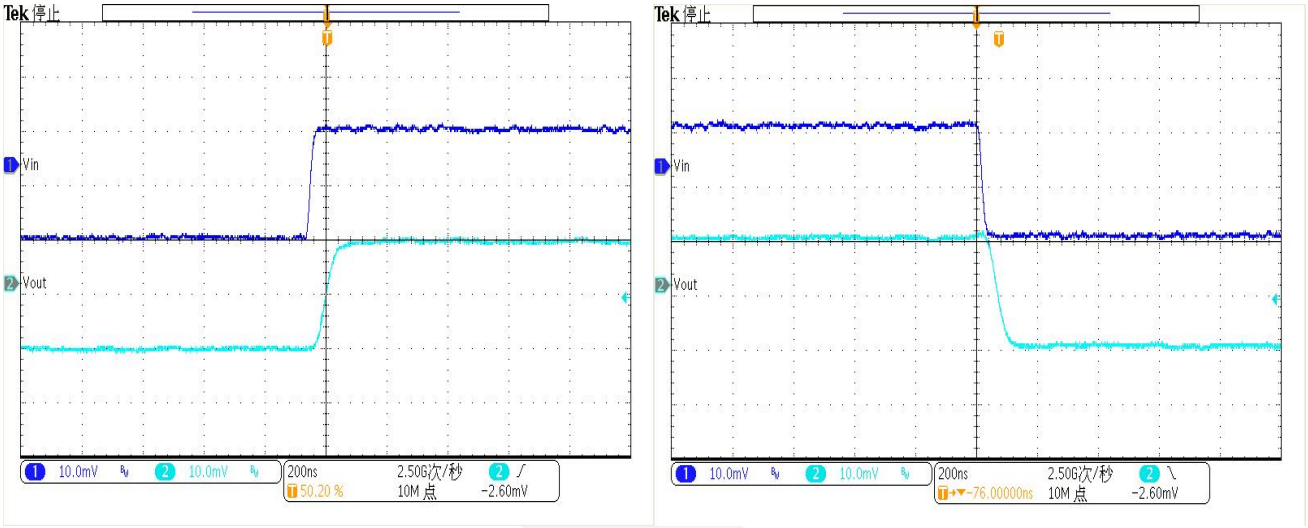


Figure 8 Small-signal response (V+ = 5 V, C_L = 200 pF)

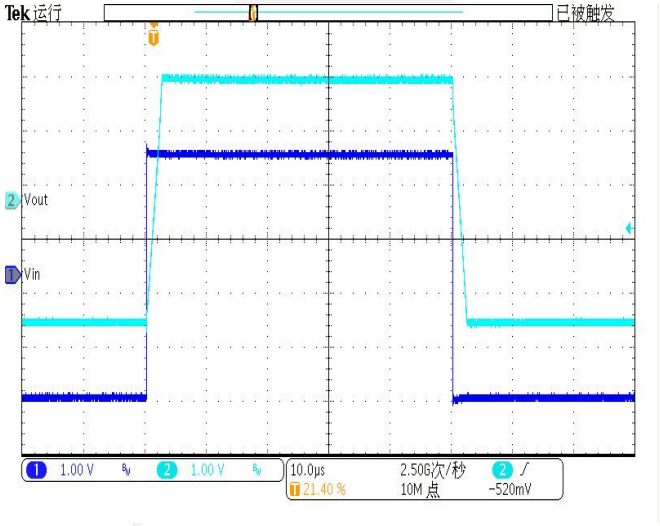
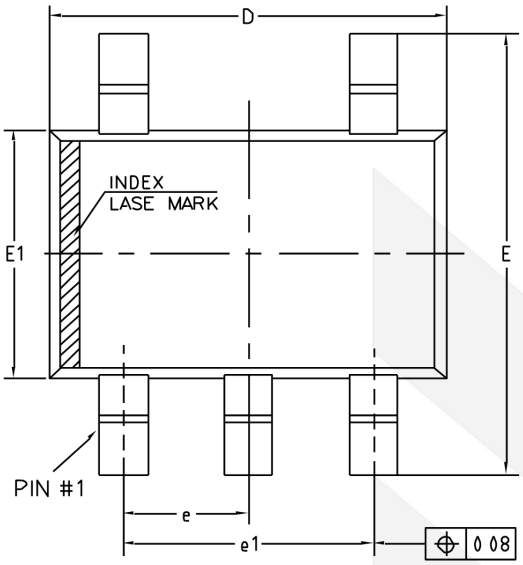
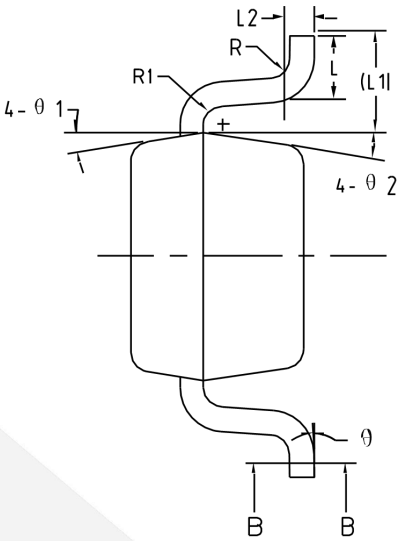


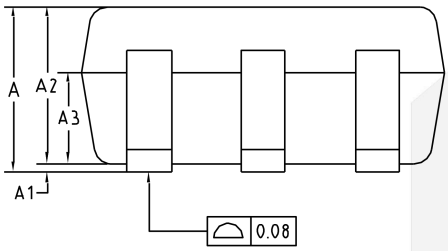
Figure 9 Large-signal response (V+ = 5 V, R_L = 1 MΩ)

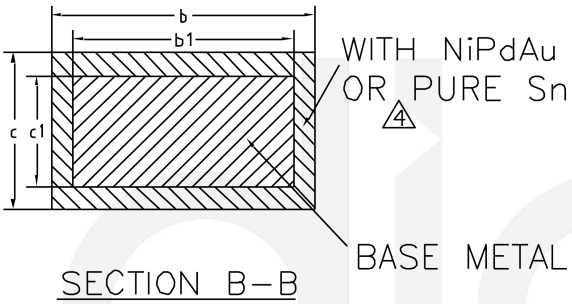
6. Physical Dimensions

6.1 SC70-5



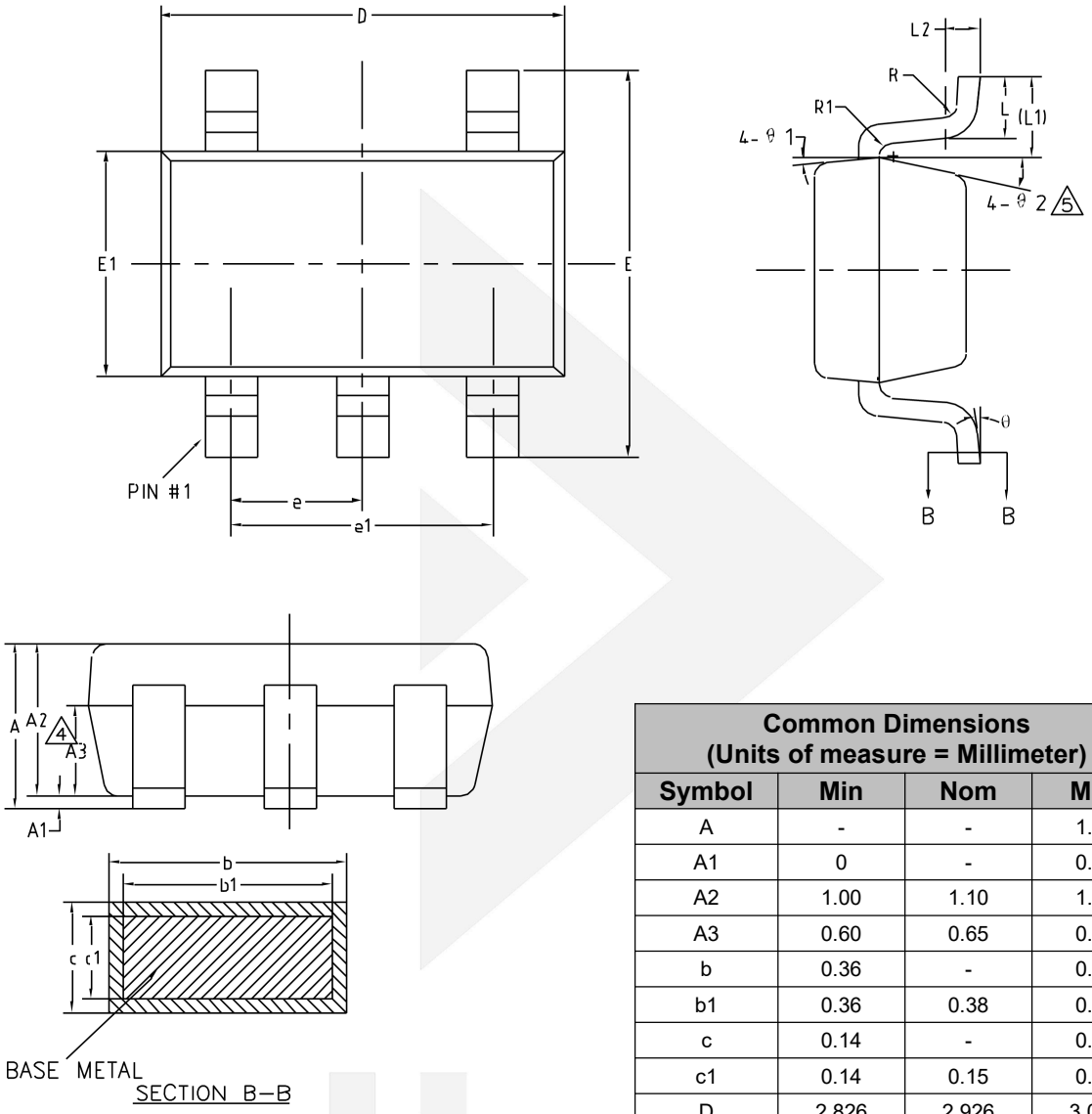






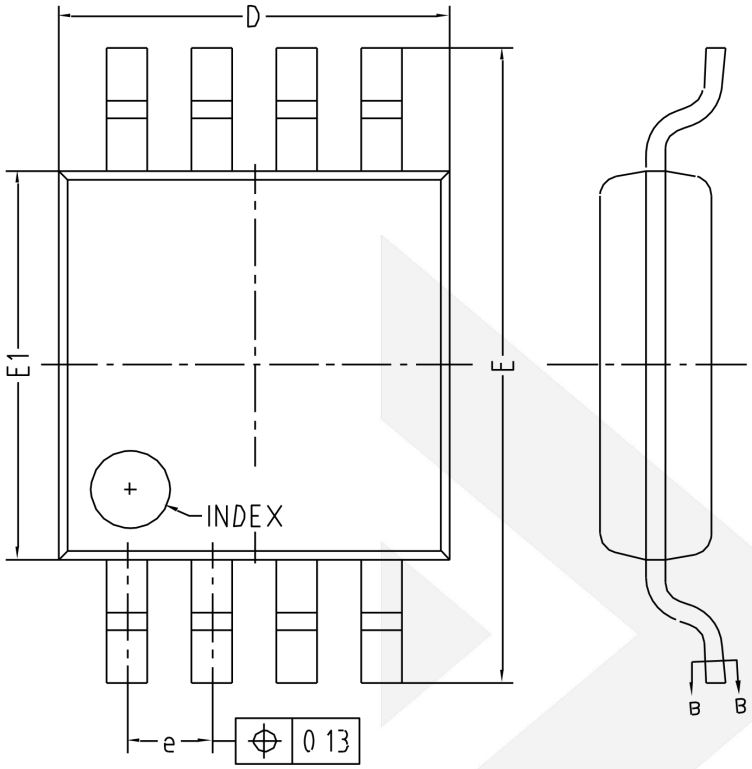
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.85	-	1.05
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
b	0.22	-	0.29
b1	0.22	0.25	0.28
c	0.115	-	0.15
c1	0.115	0.13	0.14
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.25	1.30	1.35
e	0.65 BSC		
e1	1.30 BSC		
L	0.28	0.33	0.38
L1	0.50 REF		
L2	0.15 BSC		
R	0.10	-	-
R1	0.10	-	0.25
Θ	0°	-	8°
Θ1	6°	9°	12°
Θ2	6°	9°	12°

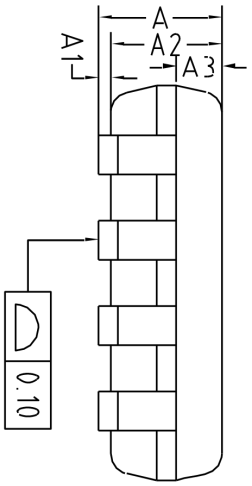
6.2 SOT23-5

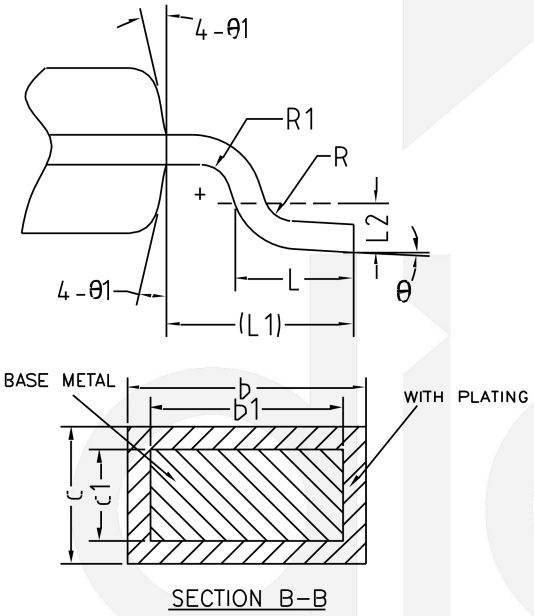


Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1		0.59 REF	
L2		0.25 BSC	
R	0.10	-	-
R1	0.10	-	0.25
Θ	0°	-	8°
Θ1	3°	5°	7°
Θ2	6°	-	14°

6.3 MSOP-8

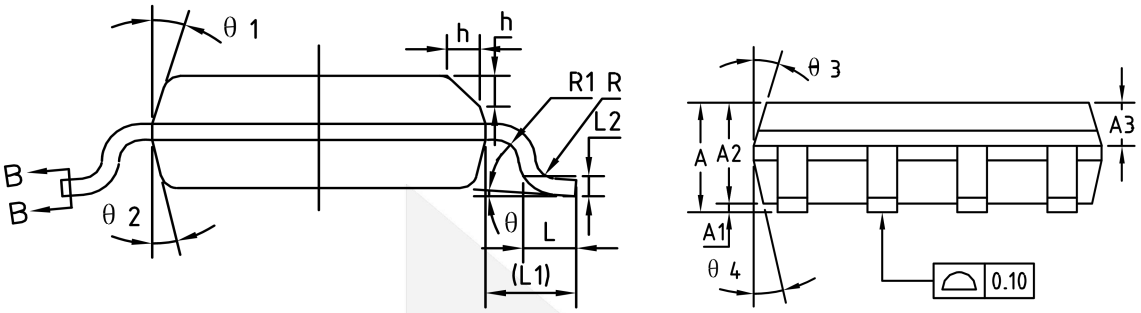


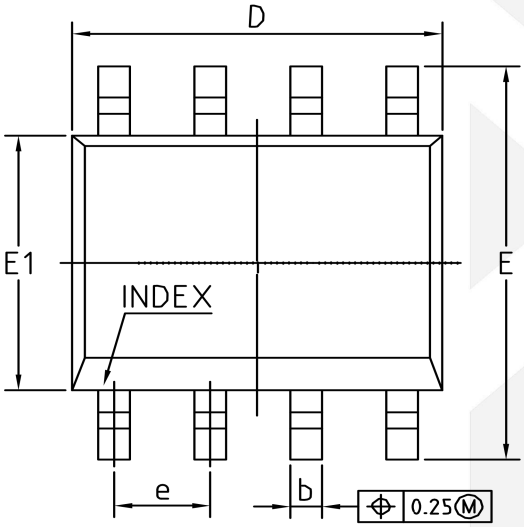


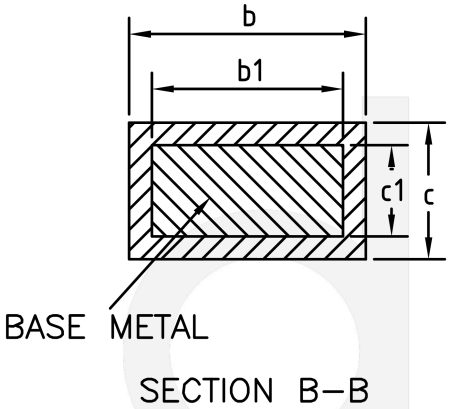


Common Dimensions (Units of Measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.10
A1	0	-	0.15
A2	0.75	0.85	0.95
A3	0.25	0.35	0.39
b	0.28	-	0.37
b1	0.27	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.45	0.60	0.80
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
Θ	0°	-	8°
Θ1	9°	12°	15°

6.4 SOIC-8

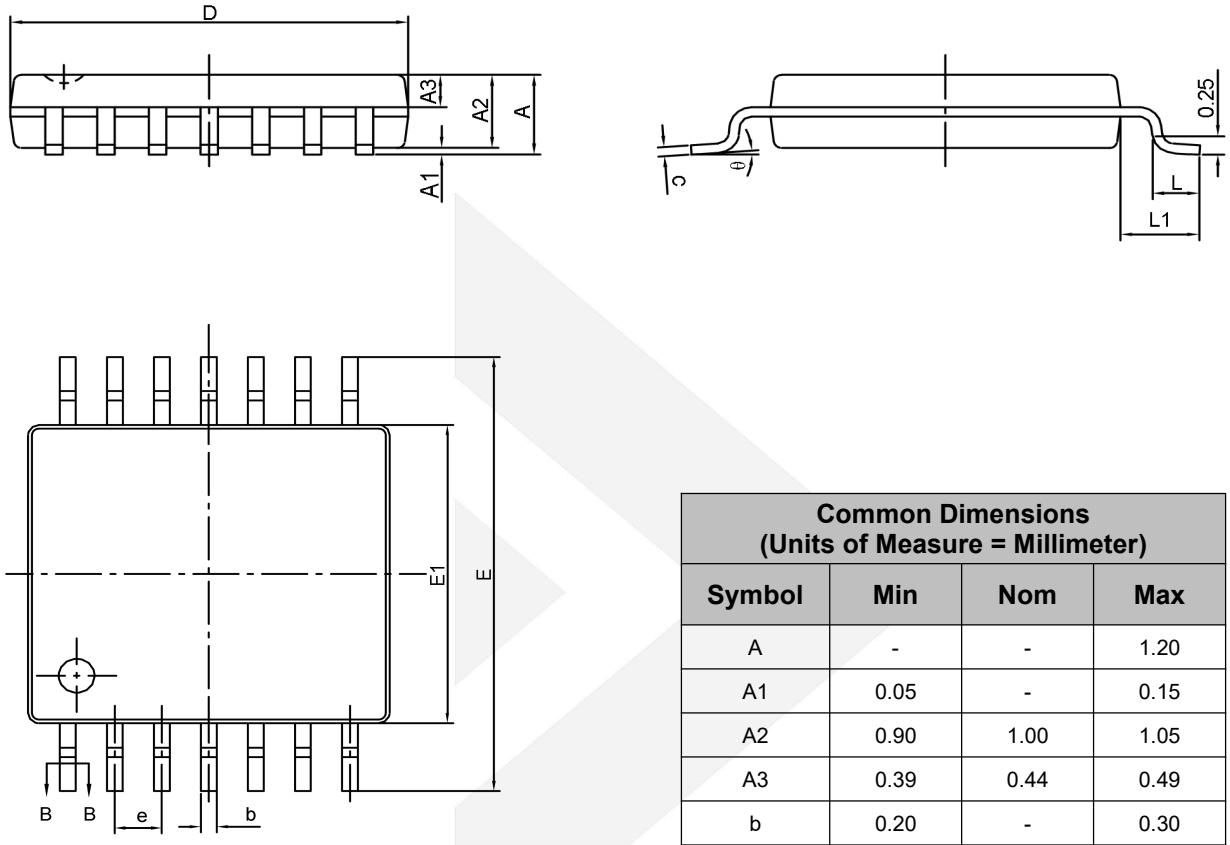






Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
Θ	0°	-	8°
Θ1	15°	17°	19°
Θ2	11°	13°	15°
Θ3	15°	17°	19°
Θ4	11°	13°	15°

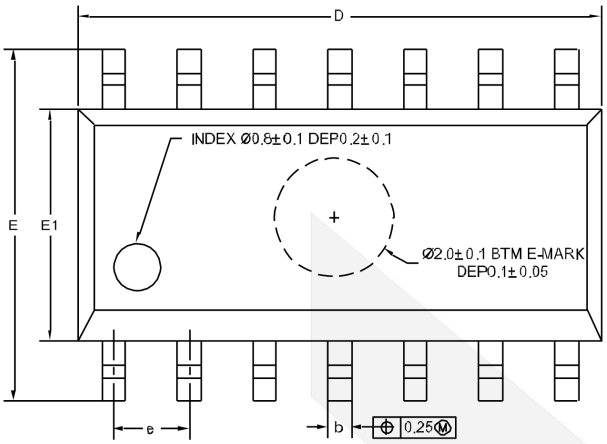
6.5 TSSOP-14

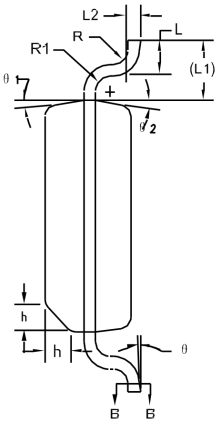


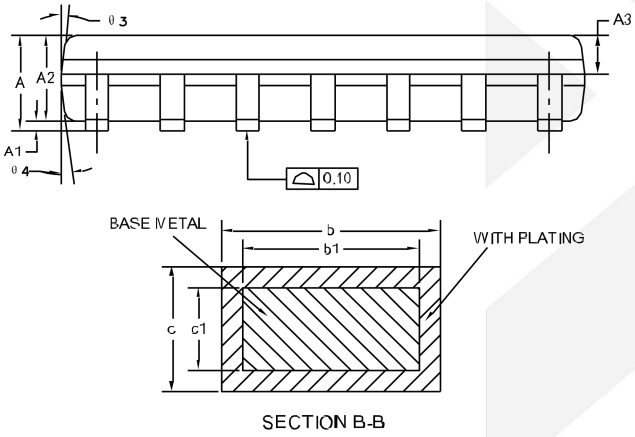
SECTION B-B

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	0.39	0.44	0.49
b	0.20	-	0.30
b1	0.19	0.22	0.25
c	0.13	-	0.19
c1	0.12	0.13	0.14
D	4.86	4.96	5.06
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65 BSC		
L	0.45	-	0.75
L1	1.00 BSC		
Θ	0°	-	8°

6.6 SOIC-14







SECTION B-B

Common Dimensions (Units of measure = 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	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27 BSC	
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
Θ	0°		8°
Θ1	6°	8°	10°
Θ2	6°	8°	10°
Θ3	5°	7°	9°
Θ4	5°	7°	9°

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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