DIO2900X

Low-Power, RRIO, 400 kHz Operational Amplifier

Features

- Rail-to-rail input and output
- Max offset (V_{OS}): ±1.5 mV
- Unity gain stable
- Gain bandwidth product: 400 kHz
- Very low input bias currents: 10 pA
- Wide supply range: 1.65 V to 5.5 V
- Input voltage range: 0 V to 5 V
- Ultra-low power: 40 µA per channel
- Compact package best for portable applications:
  - DIO29001 (single channel): DFN0.8*0.8-4, SOT23-5, and SC70-5
  - DIO29002 (double channel): SOIC-8, MSOP-8, and TSOT23-8
  - DIO29004 (quad channel): SOP-14 and TSSOP-14

Descriptions

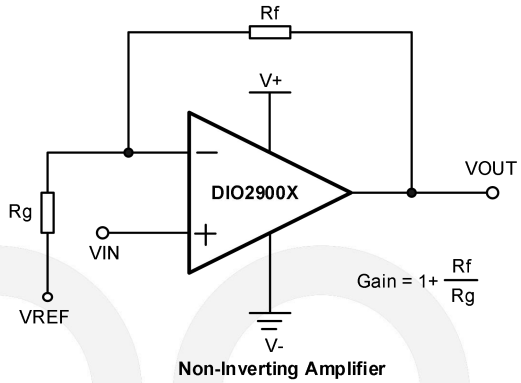
The DIO2900X is a rail-to-rail CMOS operational amplifiers with an ultra-low offset voltage. Features include wide input common-mode voltage range and broad output voltage swing with operating supply voltage from 1.65 V to 5.5 V. Products are fully specified over the extended -40 to +125°C temperature range.

The DIO2900X provides a 400 kHz bandwidth, consuming an ultra-low current of 40 µA per channel. Very low input bias currents of 10 pA make them ideal for integrators, photodiode amplifiers, and piezoelectric sensors.

Applications

- ASIC input or output amplifiers
- Sensor interfaces
- Piezoelectric transducer amplifiers
- Medical instrumentation
- Audio output
- Portable systems
- Smoke detectors
- Notebook PCs
- Battery-powered equipment

Typical Application

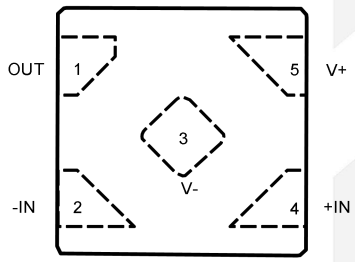


Non-Inverting Amplifier

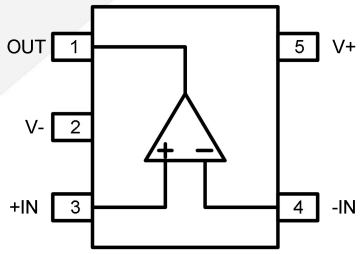
Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO29001CN4	A	Green	-40 to +125°C	DFN0.8*0.8-4	Tape & Reel, 5000
DIO29001SC5	YWVA	Green	-40 to +125°C	SC70-5	Tape & Reel, 3000
DIO29001ST5	YWVA	Green	-40 to +125°C	SOT23-5	Tape & Reel, 3000
DIO29002CS8	DBJVVB	Green	-40 to +125°C	SOIC-8	Tape & Reel, 2500
DIO29002MP8	DBJVVB	Green	-40 to +125°C	MSOP-8	Tape & Reel, 3000
DIO29002TST8	YWVB	Green	-40 to +125°C	TSOT23-8	Tape & Reel, 4000
DIO29004SO14	DBJVVD	Green	-40 to +125°C	SOP-14	Tape & Reel, 2500
DIO29004TP14	DBJVVD	Green	-40 to +125°C	TSSOP-14	Tape & Reel,2500

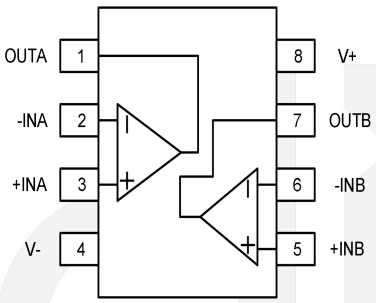
Pin Assignments



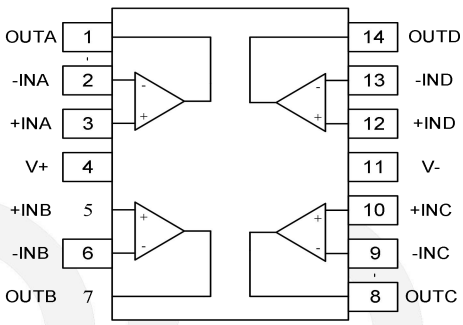
DIO29001
DFN0.8*0.8-4



DIO29001
SOT23-5/SC70-5



DIO29002
SOIC-8/MSOP-8/TSOT23-8



DIO29004
SOP-14/TSSOP-14

Figure 1. Pin assignment (Top view)

Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+IN	Positive input
-IN	Negative input
OUT	Output

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table 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
V_S	Supply voltage	6	V
V_{IN}	Input voltage	(V-) - 0.5 to (V+) + 0.5	V
T_{STG}	Storage temperature range	-65 to 150	°C
T_J	Junction temperature	150	°C
T_L	Lead temperature range	260	°C
ESD	HBM, JEDEC: JESD22-A114	2	kV

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
V_S	Supply voltage	1.65 to 5.5	V
T_A	Operating temperature range	-40 to 125	°C

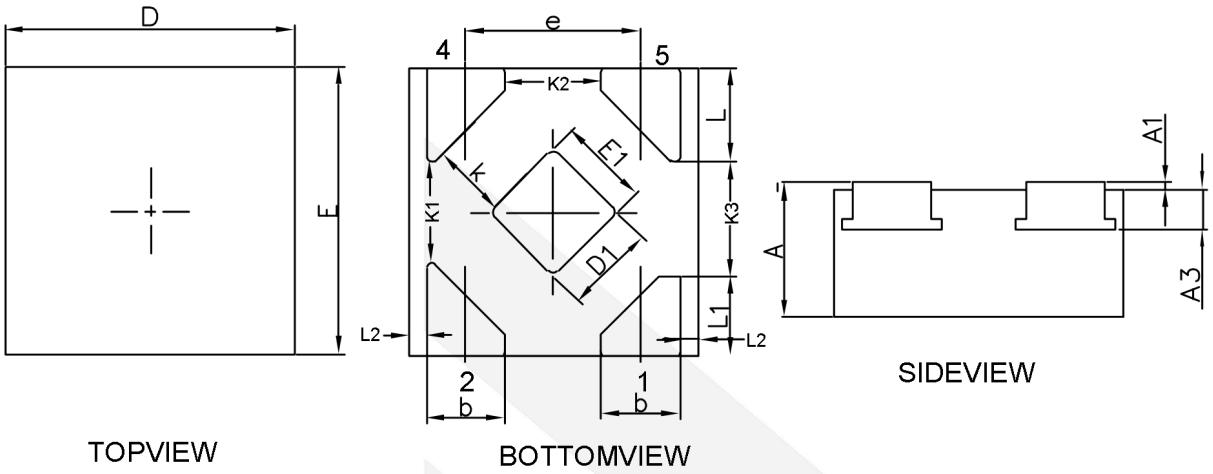
Electrical Characteristics

For V_S = (V+) - (V-) = 1.65 V to 5.5 V (±0.9 V to ±2.75 V), T_A = 25°C, R_L = 10 kΩ connected to V_S/2, and V_{CM} = V_{OUT} = V_S/2, unless otherwise specified.

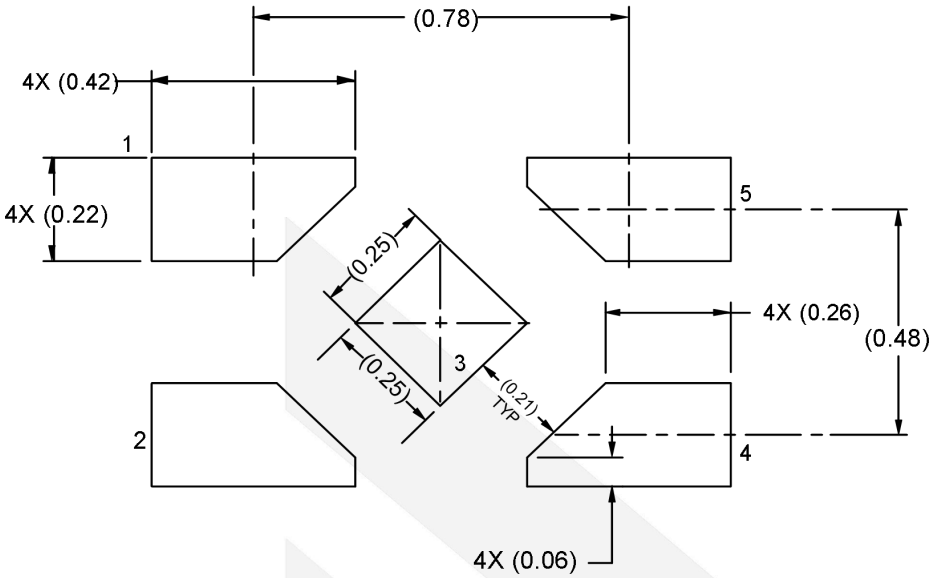
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Offset voltage						
V_{OS}	Input offset voltage	-40°C ≤ T_A ≤ 125°C, V_S = 5 V	-1.5		1.5	mV
dV_{OS}/dt	V_{OS} vs. temperature	T_A = -40°C ≤ T_A ≤ 125°C		2		µV/°C
PSRR	Power supply rejection ratio	V_S = 1.65 V to 5.5 V, V_{CM} = (V_S/2)	70			dB
Input voltage range						
V_{CM}	Common mode voltage range	No phase reversal, rail-to-rail input	-0.1		V_{CC} + 0.1	V
CMRR	Common mode rejection ratio	V_S = 5.5 V, (V-) – 0.1 V < V_{CM} < (V+) + 0.1 V, T_A = -40°C to 125°C		75		
Input bias current						
I_B	Input bias current	-40°C ≤ T_A ≤ 125°C, V+ = 1.65 V to 5 V		10		pA
I_{OS}	Input offset current	-40°C ≤ T_A ≤ 125°C, V+= 1.65 V to 5 V		1		pA
Noise						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz, V_S = 5 V		16.8		$µV_{PP}$
e_n	Input voltage noise density	f=1 kHz, V_S = 5 V		78		nV/√Hz
		f=10 kHz, V_S = 5 V		66		
Open-loop gain						
A_{OL}	Open loop voltage gain	V_S = 5.5 V, (V-) + 0.1 V < V_O < (V+) – 0.1 V, R_L = 10 kΩ	90	120		dB
Frequency response						
GBP	Gain bandwidth product	V_S = 5 V		0.4		MHz
$φ_m$	Phase margin	V_S = 5.5 V, G = 1		65		°
SR	Slew rate	V_S = 5 V		0.17		V/µs
t_S	Setting time	To 0.1%, V_S = 5 V, 2 V step, G = +1, C_L = 100 pF		14		µs
		To 0.01%, V_S = 5 V, 2 V step, G = +1, C_L = 100 pF		16		
t_{OR}	Overload recovery time	V_S = 5 V, V_{IN} × gain > V_S		6		µs
Output						
V_O	Voltage output swing from supply rails	V_S = 5.5 V, R_L = 10 kΩ		10		mV
		V_S = 5.5 V, R_L = 2 kΩ		35		
I_{SC}	Short-circuit current	V_S = 5.5 V		±40		mA
Z_O	Open-loop output impedance	V_S = 5 V, f = 100 kHz		700		Ω
Power supply						

V_S	Specified voltage range		1.65 (±0.9)		5.5 (±2.75)	V
I_Q	Quiescent current per amplifier	I_O = 0 mA, V_S = 5.5 V		40	51	µA
		I_O = 0 mA, V_S = 5.5 V, T_A = -40°C to 125°C			56	

Physical Dimensions: DFN0.8*0.8-4

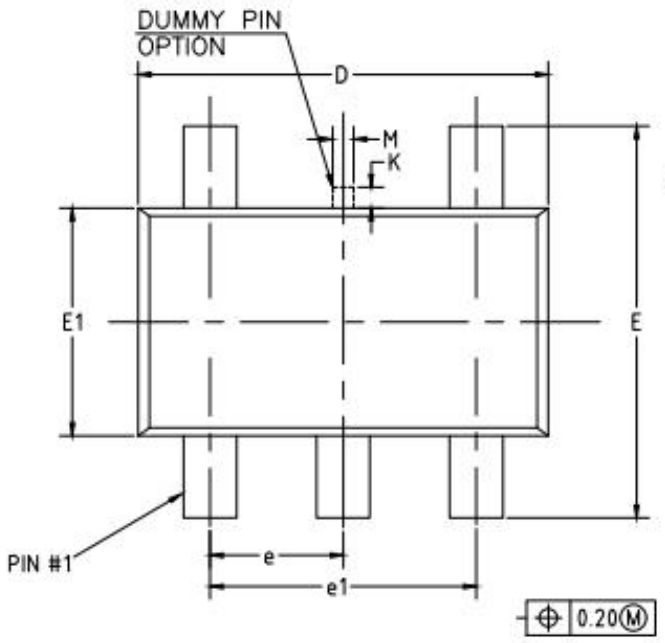


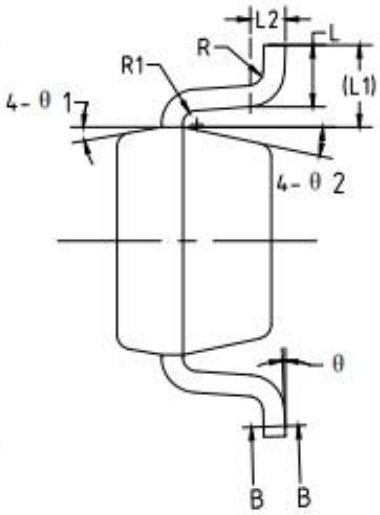
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.320	0.375	0.400
A1	0.000	0.020	0.050
A3		0.110 REF	
D	0.750	0.800	0.850
E	0.750	0.800	0.850
D1	0.200	0.250	0.300
E1	0.200	0.250	0.300
K		0.210 TYP	
K1		0.270 TYP	
K2		0.260 TYP	
K3		0.315 TYP	
b	0.170	0.220	0.270
e		0.480 TYP	
L	0.210	0.265	0.320
L1	0.170	0.220	0.270
L2		0.050 TYP	

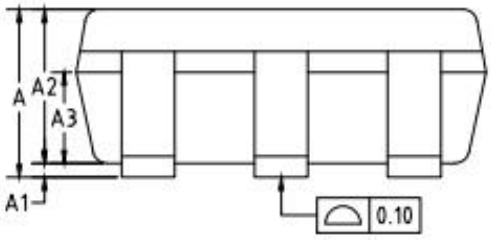


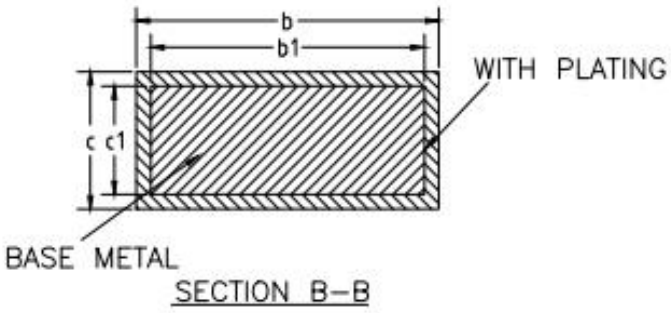
RECOMMENDED LAND PATTERN (Unit: mm)

Physical Dimensions: SOT23-5



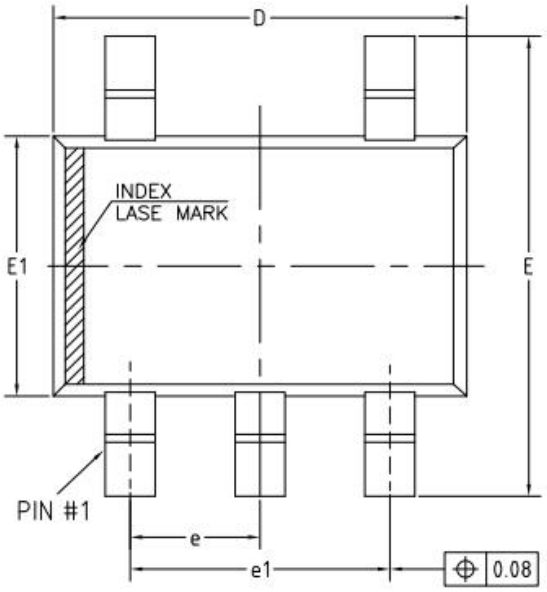


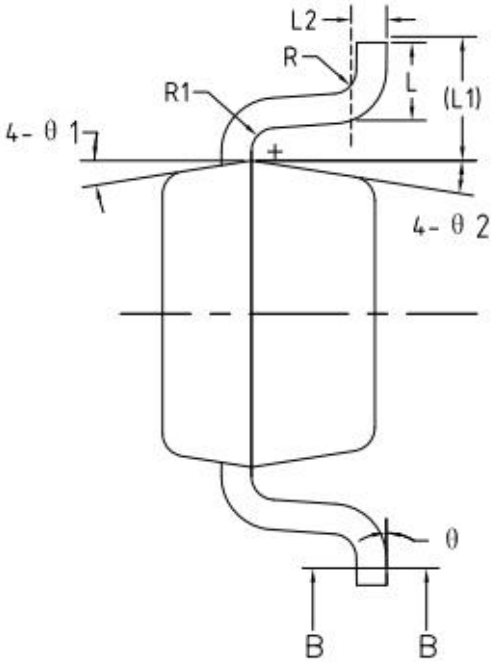


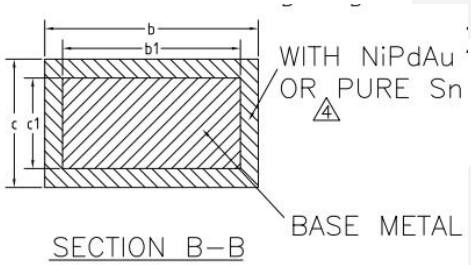


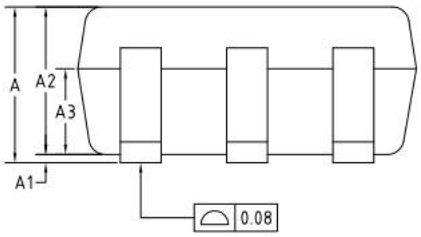
Dimensions in Millimeters(mm)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.25
A1	0.00	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
K	0	-	0.25
L	0.30	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: SC70-5



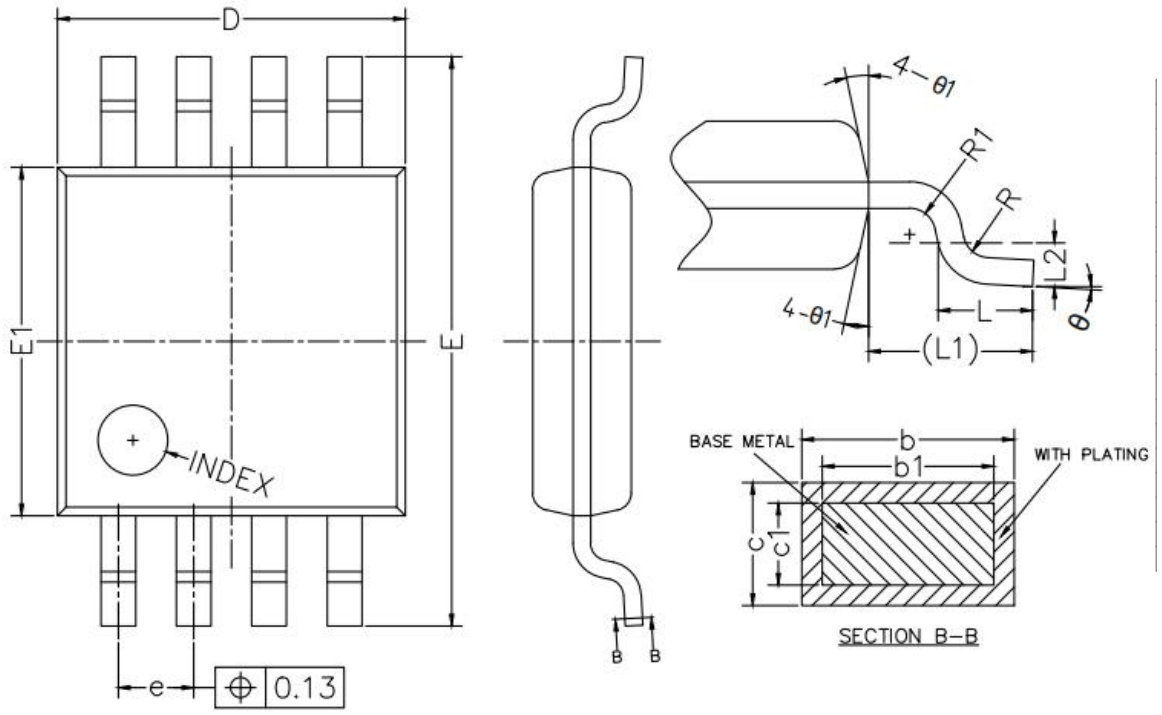


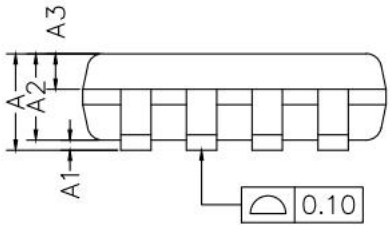




Dimensions in Millimeters(mm)				
Symbol		Min	Typ	Max
A		0.85	-	1.05
A1		0	-	0.10
A2		0.80	0.90	1.00
A3		0.47	0.52	0.57
b	NiPdAu	0.22	-	0.29
	PURE Sn	0.23	-	0.33
b1		0.22	0.25	0.28
c	NiPdAu	0.115	-	0.15
	PURE Sn	0.12	-	0.18
c1		0.115	0.13	0.14
D		2.02	2.07	2.12
E		2.20	2.30	2.40
E1		1.25	1.30	1.35
e		0.60	0.65	0.70
e1		1.20	1.30	1.40
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°

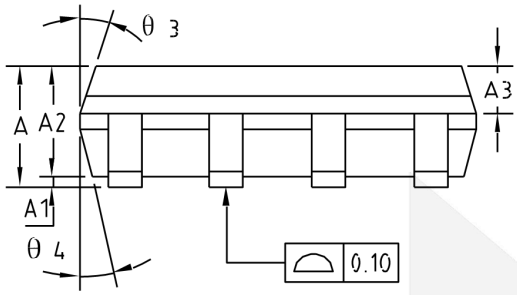
Physical Dimensions: MSOP-8

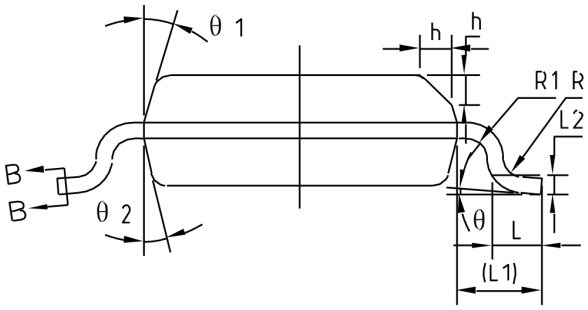


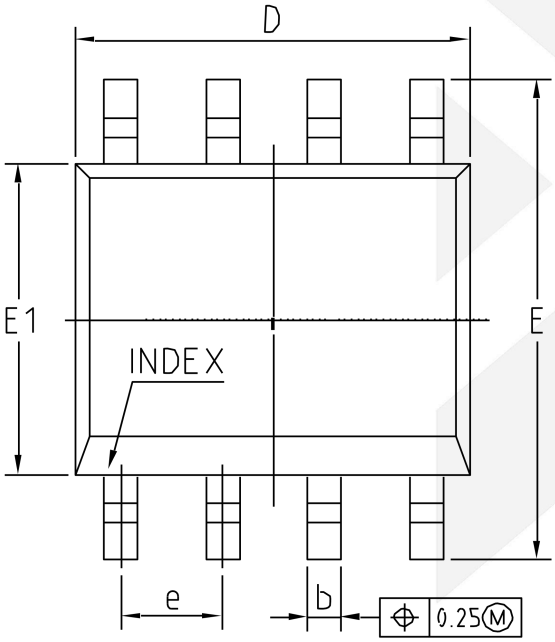


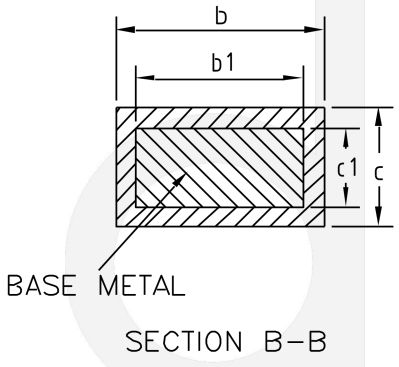
Dimensions in Millimeters(mm)			
Symbol	**Min**	**Typ**	**Max**
A	-	-	1.10
A1	0.05	0.10	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.25	-	0.38
b1	0.24	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.75	4.90	5.05
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.55	0.70
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
Θ	0°	-	8°
Θ1	9°	12°	15°

Physical Dimensions: SOIC-8



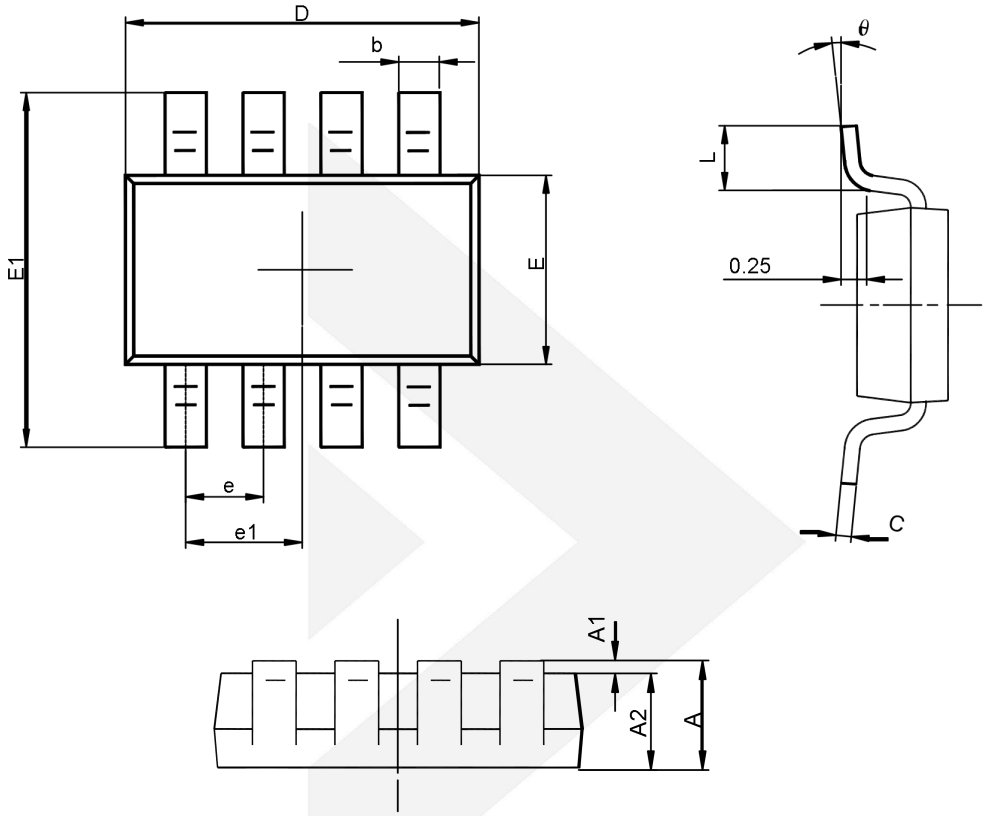






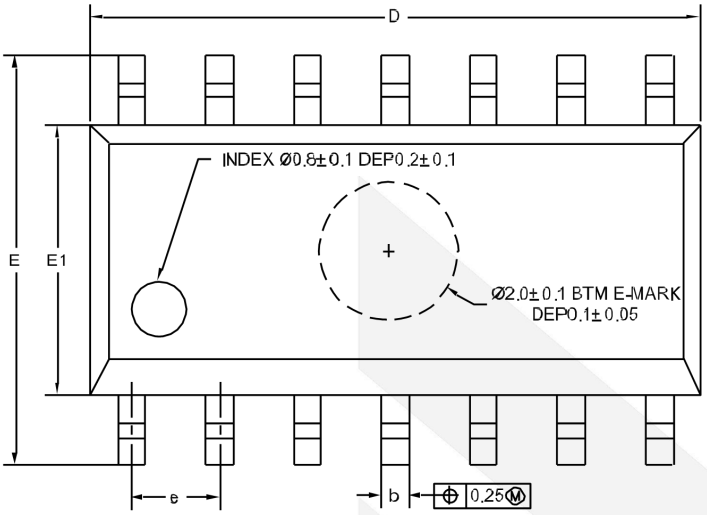
Common Dimensions (Units of measure = mm)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27BSC	
L	0.45	0.60	0.80
L1		1.04REF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

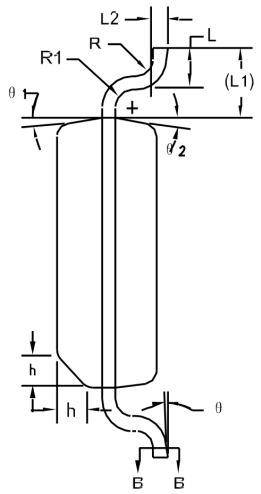
Physical Dimensions: TSOT23-8

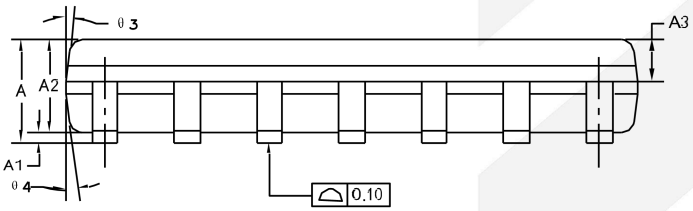


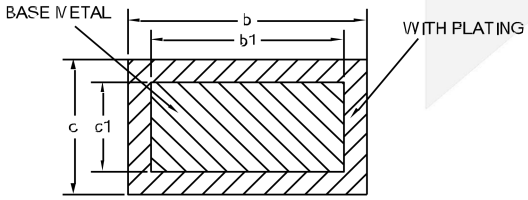
Symbol	Dimensions Millimeters	
	Min	Max
A	0.700	0.900
A1	0.000	0.100
A2	0.700	0.800
b	0.300	0.500
C	0.080	0.200
D	2.820	3.020
E	1.600	1.700
E1	2.650	2.950
e	0.65(BSC)	
e1	0.975(BSC)	
L	0.300	0.600
Θ	0°	8°

Physical Dimensions: SOP-14





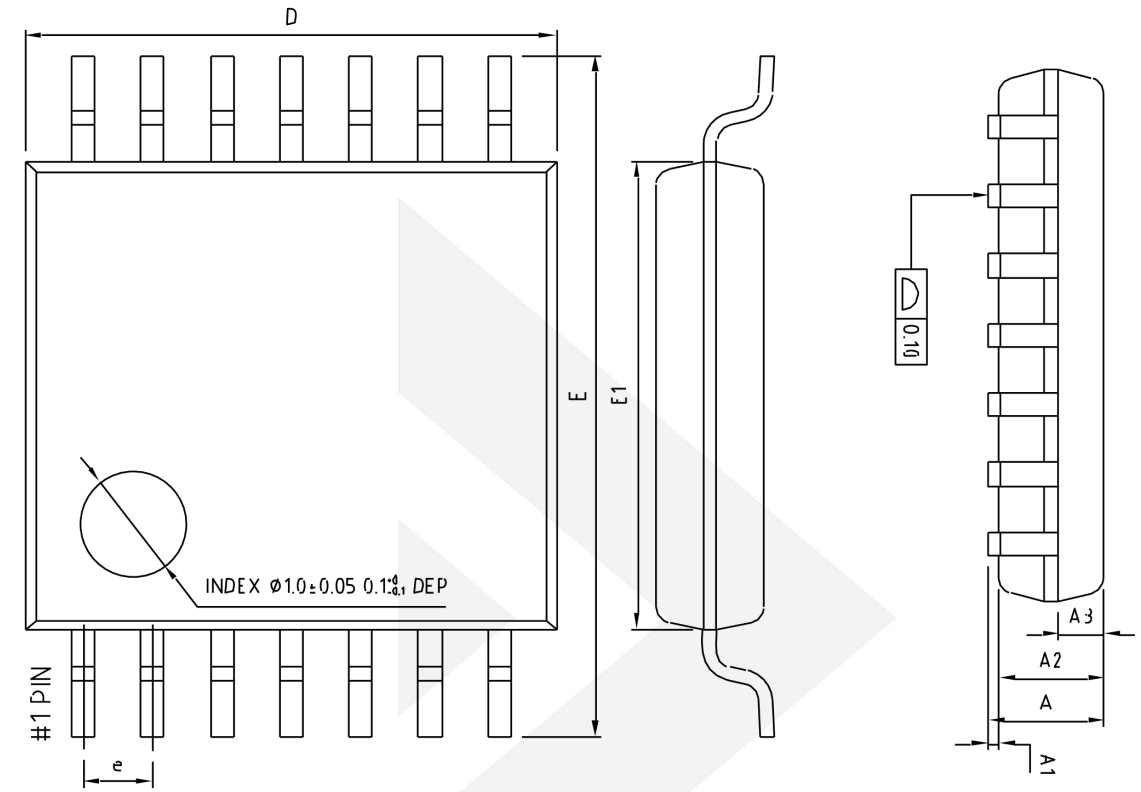


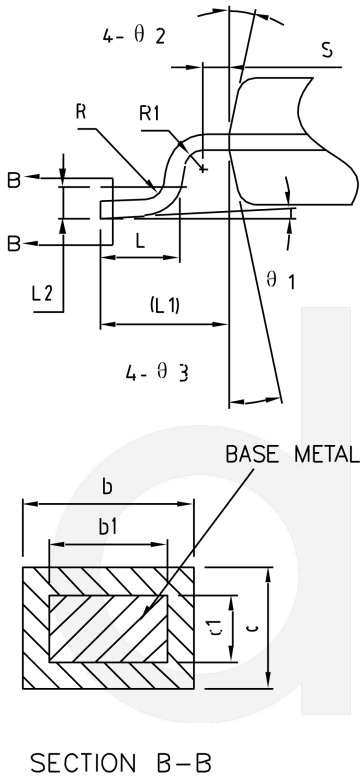


SECTION B-B

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	1.27BSC		
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
Θ	0°	-	8°
Θ1	6°	8°	10°
Θ2	6°	8°	10°
Θ3	5°	7°	9°
Θ4	5°	7°	9°

Physical Dimensions: TSSOP-14





SECTION B–B

Symbol	Dimensions in Millimeters		
	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	0.65BSC		
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°

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 phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to http://www.dioo.com for a complete list of Dioo product families.

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