1 pA Ultra-Low Input Bias Current RRIO Amplifier

Features

- Wide supply range: 1.4 V to 5.5 V
- Ultra-Low input bias current suitable for ultra-low power signal amplification:
  - 1 pA at 25°C
  - 5 pA maximum at 50°C
- Low quiescent current: 380 nA / per channel
- Unity-gain bandwidth: 5 kHz
- Low offset voltage:
  - ±3.5 mV Max. across temperature from -40°C to 125°C
  - Low input offset voltage drift: ±5 μV/°C
- Output slew rate: 3 V/ms
- Rail-to-rail input and output
- Wide operating temperature range: -40°C to 125°C
- Available in green package:
  SOIC-8, MSOP-8 and DFN-8

Applications

- Smart watch
- Portable medical
- Active filters
- Data acquisition
- Test equipment
- Broadband communication
- Process control
- Audio and video

Package Information

Part Number	Package	Body Size
DIO20182	SOIC-8	6.0mm × 4.9mm
	MSOP-8	4.9mm × 3.0mm
	DFN-8	1.6mm × 1.2mm

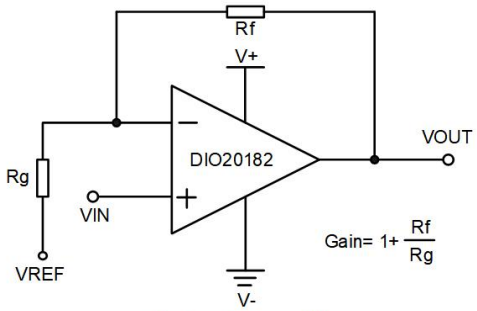
Description

The DIO20182 is a dual channel rail-to-rail CMOS input/output operational amplifier with 1 pA ultra-low input bias current, it is ideal for wearable such as smart watch, portable medical and any ultra-low power signal amplification, which is very sensitive to the current load.

The DIO20182 consumes 380 nA per channel ultra-low quiescent current, which makes DIO20182 suitable for battery-powered or portable equipment.

The DIO20182 simplify circuit design with enhanced features such as unity-gain stability, 1.4 V to 5.5 V wide operating supply voltage range and ±3.5 mV low offset voltage. -40°C to 125°C wide operating temperature range enable the DIO20182 to be used in the harshest environment applications.

Simplified Schematic



Simplified Schematic

Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T_A	Package	
DIO20182CS8	DIOVA8B	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO20182MP8	DIOVA8B	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO20182EN8	YW8B	1	Green	-40 to 125°C	DFN1.6*1.2-8	Tape & Reel, 5000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

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1. Pin Assignment and Functions

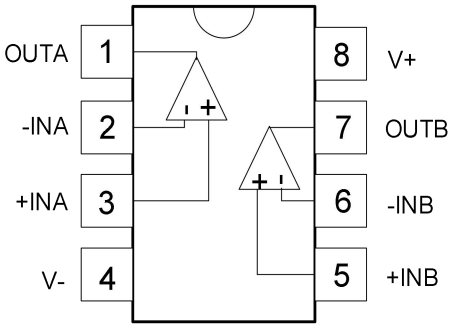


Figure 1. SOIC-8 / MSOP-8 (Top view)

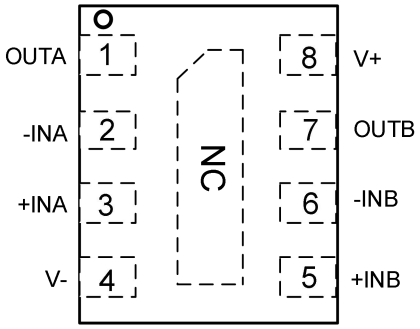


*Figure 2. DFN1.6*1.2-8 (Top view)*

Pin No.		Pin Name	Description
SOIC-8/MSOP-8	DFN1.6*1.2-8		
8	8	V+	Positive supply
4	4	V-	Negative supply
3, 5	3, 5	+INX	Positive input
2, 6	2,6	-INX	Negative input
1, 7	1,7	OUTX	Output
	Thermal pad	NC	Do not connected

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{CC}	Supply voltage (V+ – V-)	7	V
V_{IN}	Input voltage	(V-)-0.3 to (V+)+0.3	V
	Differential of input voltages	|V+ – V-|	V
T_{STG}	Storage temperature range	-65 to 150	°C
T_J	Junction temperature	150	°C
T_L	Lead temperature range	260	°C

3. Recommended Operating Condition

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{CC}	Supply voltage	1.4 to 5.5	V
V_{IN}	Input voltage	0 to 5	V
T_A	Operating temperature range	-40 to 125	°C

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition	Value	Unit
HBM	ESDA/JEDEC JS-001-2017	±2000	V
CDM	ESDA/JEDEC JS -002-2018	±2000	

5. Thermal Considerations

The thermal resistance determines the heat insulation property of a material. The higher the thermal resistance is, the lower the heat loss. Accumulation of heat energy degrades the performance of semiconductor components.

Symbol	Parameter	Value		Unit
		SOIC-8	MSOP-8	
$R_{\theta JA}$	Junction-to-air thermal resistance	130	210	°C/W

6. Electrical Characteristics

Typical value: V+ = 5 V, R_L = 1 MΩ to V+/2, V_{CM} = 1/2 V+, 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+ = 1.4 V to 5.5 V	-3.5		3.5	mV
I_S	Supply current per channel/amplifier			380		nA
I_B	Input bias current	V+ = 1.4 V to 5.5 V, T_A = 25°C		1		pA
		V+ = 1.4 V to 5.5 V, T_A = 50°C	-5		5	
I_{OS}	Input offset current	V+ = 1.4 V to 5.5 V, T_A = 25°C		1		pA
		V+ = 1.4 V to 5.5 V, T_A = 50°C	-5		5	
V_{CM}	Common mode voltage range		-0.1		(V+) +0.1	V
CMRR	Common mode rejection ratio	-40°C ≤ T_A ≤ 125°C	80			dB
A_{OL} (1)	Open loop voltage gain	R_L = 50 kΩ, V_O = 0.1 to (V+) -0.1	70	87		dB
$\Delta V_{OS}/\Delta_T$	Input offset voltage drift	-40°C ≤ T_A ≤ 125°C		±5		μV/ °C
Output characteristics						
V_{OH}	Output voltage high	R_L = 50 kΩ, -40°C ≤ T_A ≤ 125°C		4.992		V
V_{OL}	Output voltage low	R_L = 50 kΩ, -40°C ≤ T_A ≤ 125°C		3		mV
I_{SC}	Output short circuit current	Source I_{SC}, V+ = 5 V		24		mA
		Sink I_{SC}, V+ = 5 V		24		
Dynamic performance						
GBP	Gain bandwidth product	C_L = 60 pF		5		kHz
SR	Slew rate	G = 1, 2 V output step		3		V/ms
t_S	Settling time	G = 1, 20 mV output step		250		μs
θ_m(1)	Phase margin			60		Deg
t_r	Positive overload recovery time			1350		μs
	Negative overload recovery time			450		
Noise performance						
e_n	Voltage noise density	f = 1 kHz		110		nV/√Hz

Note:

(1) Guaranteed by design.

(2) Specifications subject to change without notice.

7. Typical Characteristics

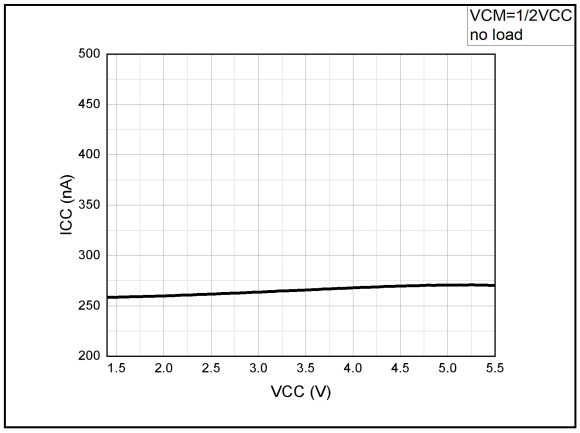


Figure 3. Supply current vs. Supply voltage per channel

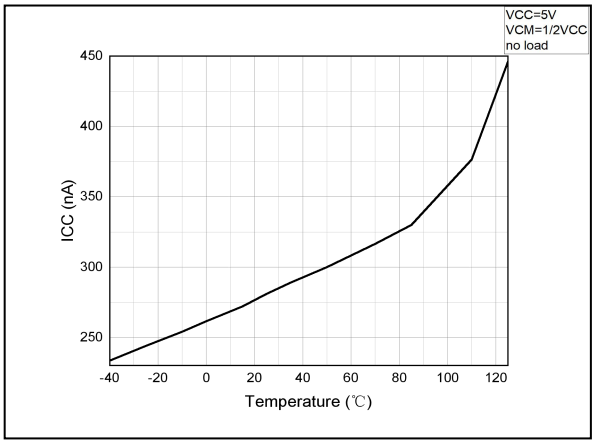


Figure 4. Supply current vs. Temperature

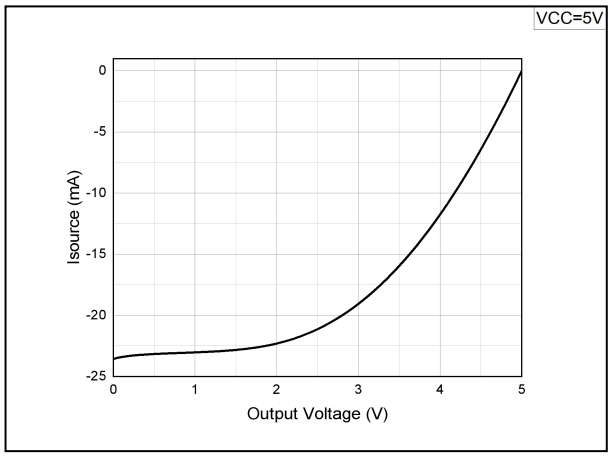


Figure 5. I_{SOURCE} vs. Output voltage

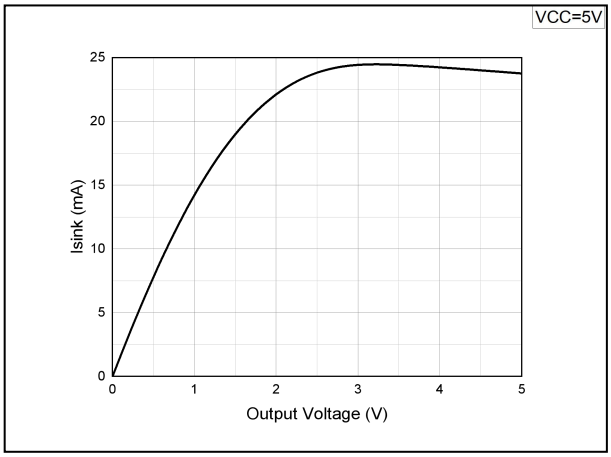


Figure 6. I_{SINK} vs. Output voltage

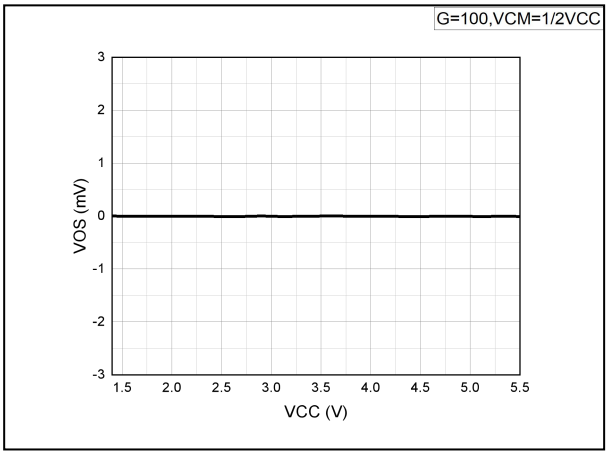


Figure 7. Input offset voltage vs. Supply voltage

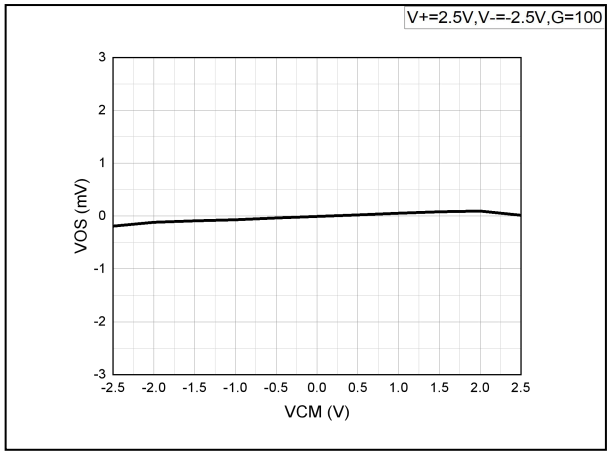


Figure 8. Input offset voltage vs. Common voltage

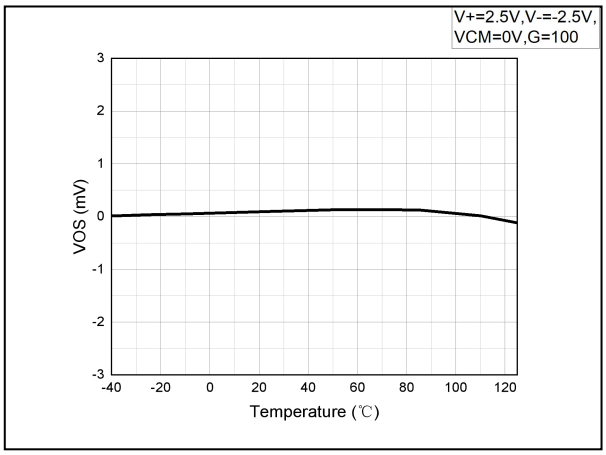


Figure 9. Input offset voltage vs. Temperature

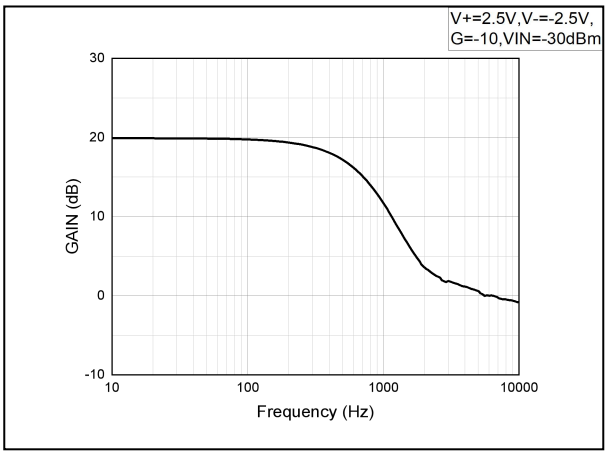
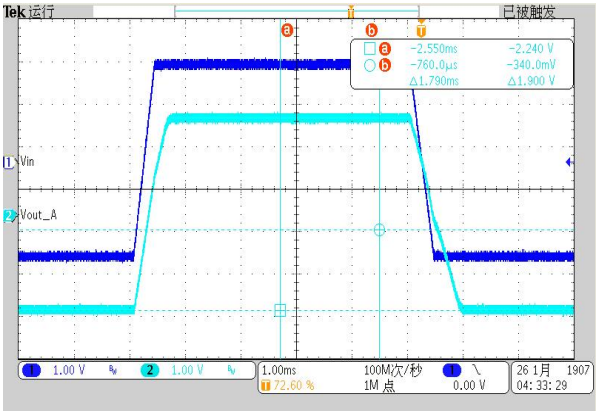


Figure 10. Gain vs. Frequency



$V+ = 5\ V,\ R_L = 1\ M\Omega$

Figure 11. Large-signal response

8. Application Information

Important notice: Validation and testing are the most reliable ways to confirm system functionality. The application information is not part of the specification and is for reference purposes only.

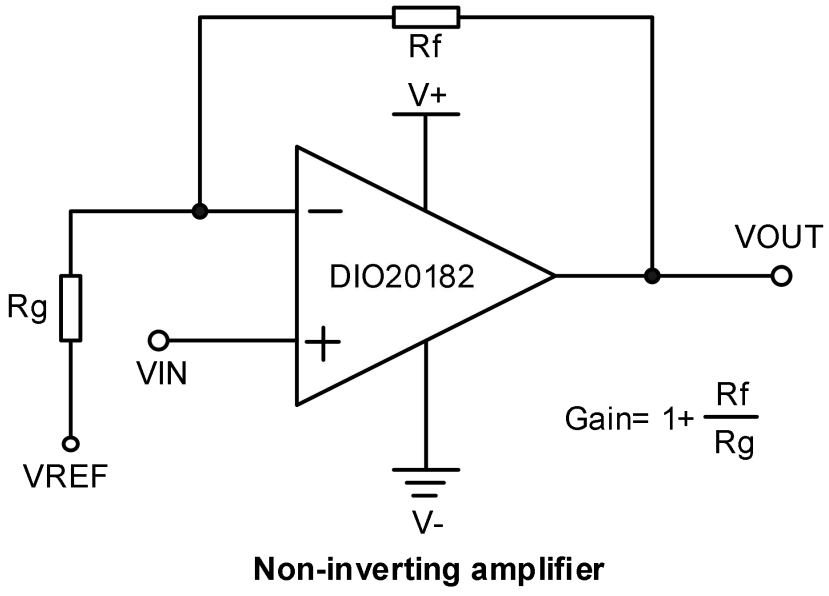
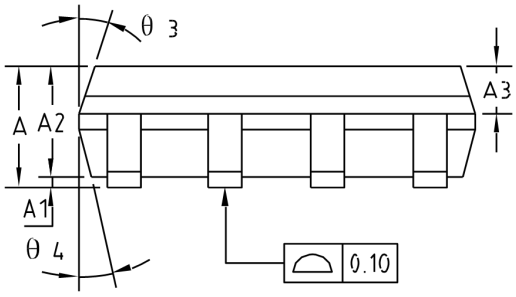
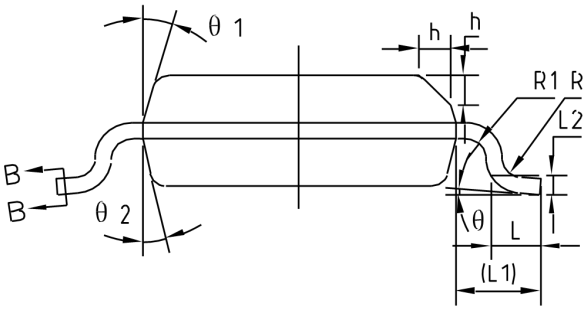


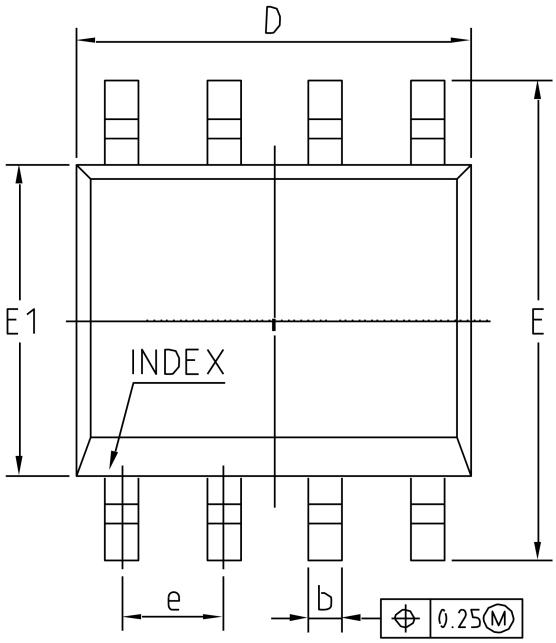
Figure 12. Typical application

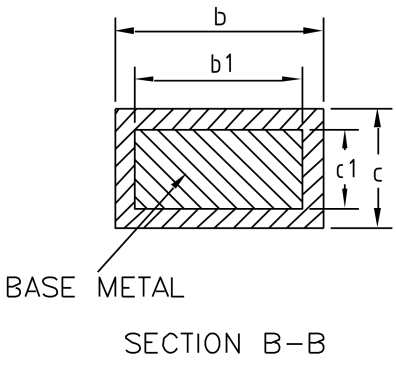
9. Physical Dimensions

9.1. SOIC-8





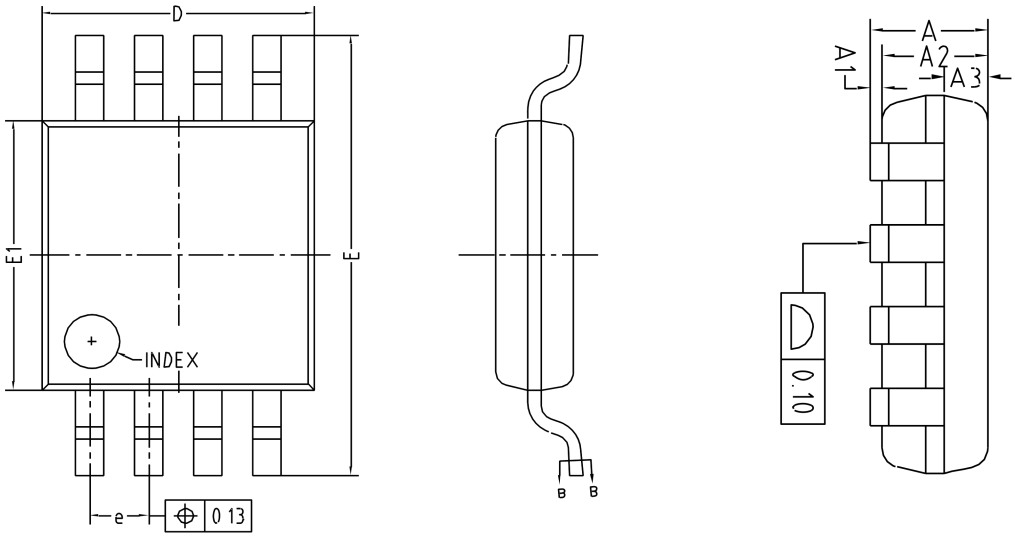


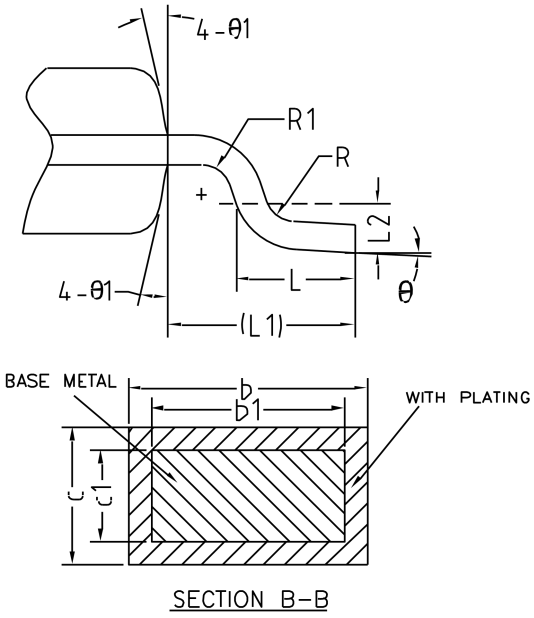


SECTION B–B

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	-	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°

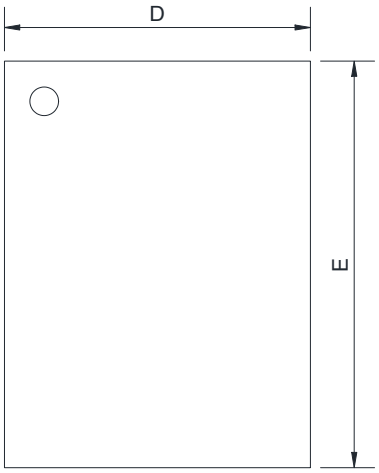
9.2. MSOP-8



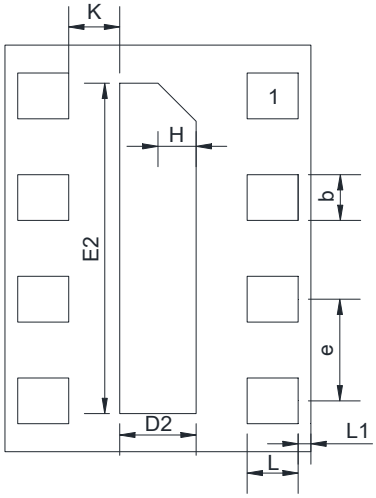


Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.10
A1	0	-	0.15
A2	0.75	0.85	0.95
A3	0.25	0.35	0.39
b	0.28	-	0.37
b1	0.27	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.60	0.80
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

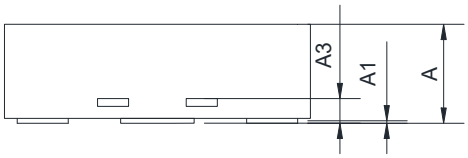
9.3. DFN1.6*1.2-8



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3		0.10 REF	
b	0.13	0.18	0.23
D	1.10	1.20	1.30
E	1.50	1.60	1.70
D2	0.25	0.30	0.35
E2	1.25	1.30	1.35
e	0.30	0.40	0.50
H		0.15 REF	
K	0.15	0.20	0.25
L	0.15	0.20	0.25
L1	0.00	0.05	0.10

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