DIO2032X

350 µA, 6 MHz, Rail-to-Rail I/O CMOS Operational Amplifiers

Features

- Supply voltage range: 2.5 V to 5.5 V
- Low supply current: typically 350 µA
- Rail-to-rail input and output
- 6 MHz high gain-bandwidth product
- High slew rate: 3.6 V/µs
- Settling time to 0.1% with 2 V step: 0.6 µs
- Packages:
- DIO20321 available in: SOT23-5/SOIC-8
- DIO20322 available in: SOIC-8/MSOP-8/TSSOP-8
- DIO20324 available in: TSSOP-14/SOIC-14
- DIO2036 available in: QFN4*4-20

Applications

- Audio output
- Sensor interface
- Active filters
- A/D converters
- Cellular and cordless phones
- Laptops and PDAs
- Photodiode amplification
- Battery-powered instrumentation

Descriptions

The DIO20321 (single), DIO20322 (dual), DIO20324 (quad), and DIO2036 (sextuple) are amplifiers with very low noise, low voltage, and low power. The DIO2032X has a high gain-bandwidth product of 6 MHz, a slew rate of 3.6 V/µs, and a quiescent current of 350 µA/amplifier typically at 5 V.

The DIO2032X is designed to provide optimal performance in low-voltage and low-noise systems. All these chips provide rail-to-rail output swing for heavy loads. The input common-mode voltage range includes ground, and the maximum input offset voltage is 3.5 mV for DIO2032X.

They are specified over the extended industrial temperature range (-40°C to 125°C). The operating range is from 2.5 V to 5.5 V.

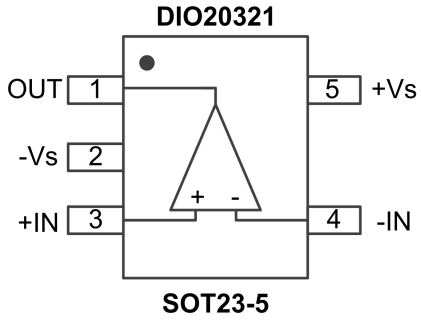
Ordering Information

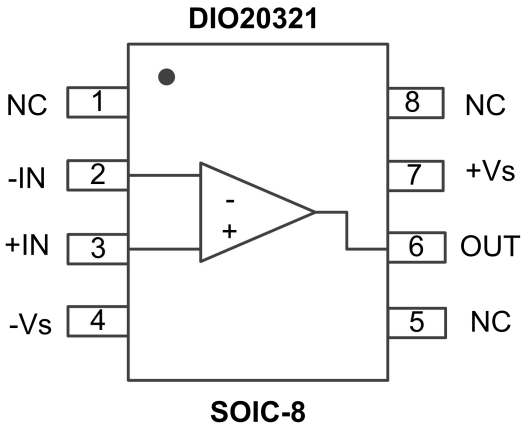
Part Number	Top Marking	MSL	RoHS	T_A	Package	
DIO20321ST5	YWXH	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO20321SO8	DIO2031	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO20322SO8	DIO2032	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO20322MP8	DIO2032	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO20322TP8	DIO2032	3	Green	-40 to 125°C	TSSOP-8	Tape & Reel, 3000
DIO20324SO14	DIO2034	3	Green	-40 to 125°C	SOIC-14	Tape & Reel, 2500
DIO20324TP14	DIO2034	3	Green	-40 to 125°C	TSSOP-14	Tape & Reel, 2500
DIO2036QN20	DIO2036	3	Green	-40 to 125°C	QFN4*4-20	Tape & Reel, 5000

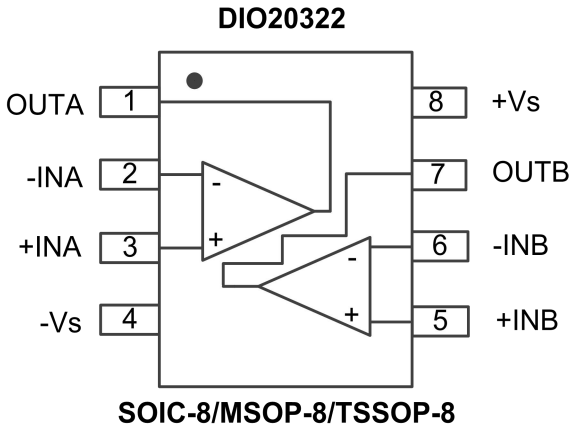
Table of Content

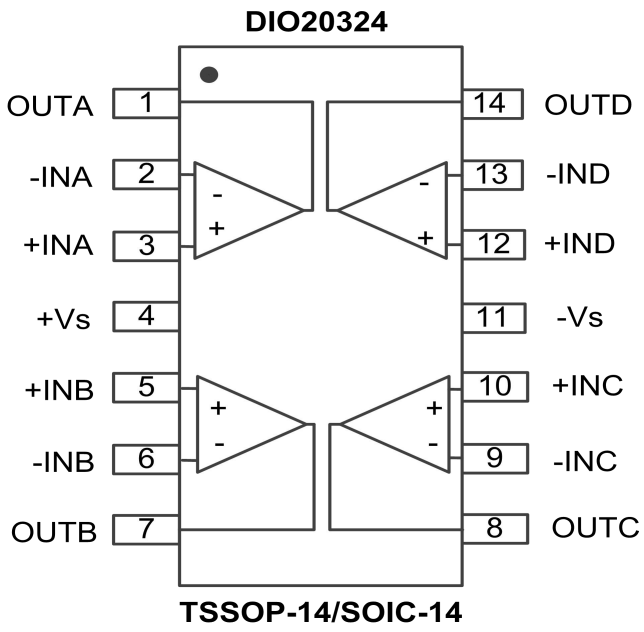
List of Figures

1. Pin Assignments









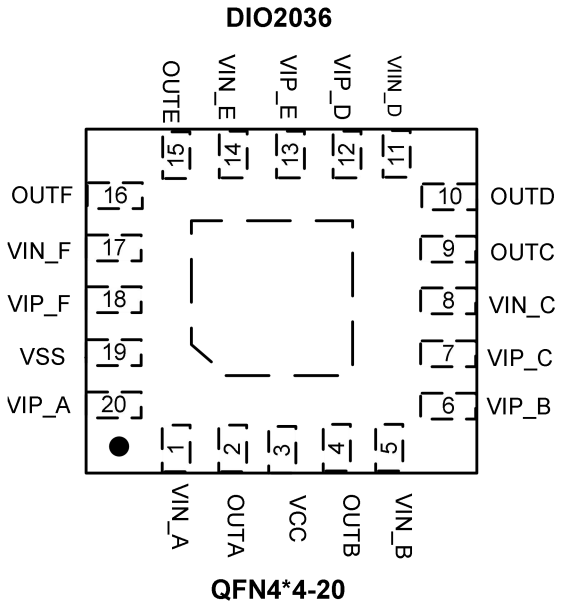


Figure 1 Pin assignment (Top view)

Pin Description

Pin name	Description
+Vs	Positive supply
-Vs	Negative supply
+IN (+INA/+INB/+INC/+IND/+INE/+INF)	Positive input (channel A/B/C/D/E/F)
-IN (-INA/-INB/-INC/-IND/-INE/-INF)	Negative input (channel A/B/C/D/E/F)
OUT (OUTA/OUTB/OUTC/OUTD/OUTE/OUTF)	Output (channel A/B/C/D/E/F)
NC	Not connect

2. 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_{CC}	Supply voltage	7.5	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
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. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding these conditions nor designing to Absolute Maximum Ratings.

Symbol	Parameter	Rating	Unit
V_{CC}	Supply voltage	2.5 to 5.5	V
V_{IN}	Input voltage	0 to 5	V
T_A	Operating temperature range	-40 to 125	°C

4. Electrical Characteristics

Typical value: V+ = 5 V, V_{CM} = 1/2V_{CC}, R_L = 100 Ω to V+/2, T_A = 25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Input characteristics						
V_{OS}	Input offset voltage	T_A = 25°C	-3.5	0.7	3.5	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		10		pA
V_{CM}	Common mode voltage range	V+ = 5.5 V	-0.1		5.6	V
CMRR	Common mode rejection ratio	-40°C ≤ T_A ≤ 125°C, Vs = 5.5 V, V_{CM} = -0.1 V to 4 V	75	90		dB
		-40°C ≤ T_A ≤ 125°C, Vs = 5.5 V, V_{CM} = -0.1 V to 5.6 V	66	90		dB
A_{OL}(2)	Open loop voltage gain	R_L = 600 Ω, Vo = 0.15 V to 4.85 V	92	100		dB
		R_L = 10 KΩ, Vo = 0.05 V to 4.95 V	100	110		dB
$\Delta V_{OS}/\Delta_T$	Input offset voltage drift	-40°C ≤ T_A ≤ 125°C		2.7		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+ = 5 V		80		mA
Ro	Closed loop output impedance	f = 100 kHz, G = +1		26		Ω
Power supply						
	Operating voltage range		2.5		5.5	V
PSRR	Power supply rejection ratio		70	94		dB
I_S	Supply current per channel/amp	V+ = 2.5 V, T_A = 25°C, no load		320		μA
		V+ = 5 V, T_A = 25°C, no load		350		
Dynamic performance						
GBP	Gain bandwidth product	R_L = 10 kΩ		6		MHz
SR	Slew rate	R_L = 600 Ω, G = 1, 2 V output step		3.6		V/μs
t_S	Settling time	R_L = 600 Ω, G = 1, 2 V output step		0.6	1	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		55		nV/√Hz
		f = 10 kHz, V+ = 5 V		19		

Note:

(1) Specifications subject to change without notice.

(2) Guaranteed by design.

5. Typical Application

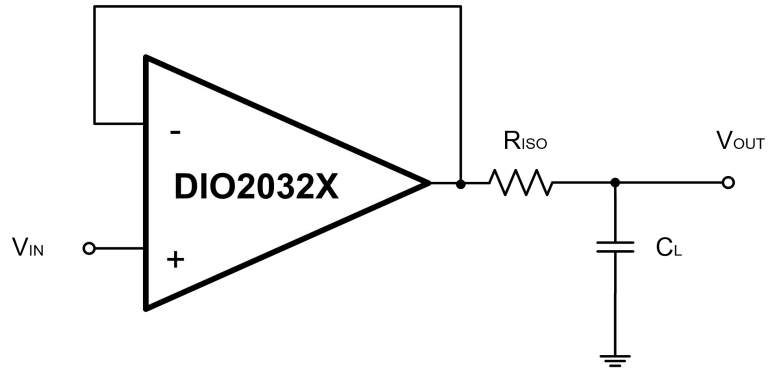


Figure 2 Indirectly driving heavy capacitive load

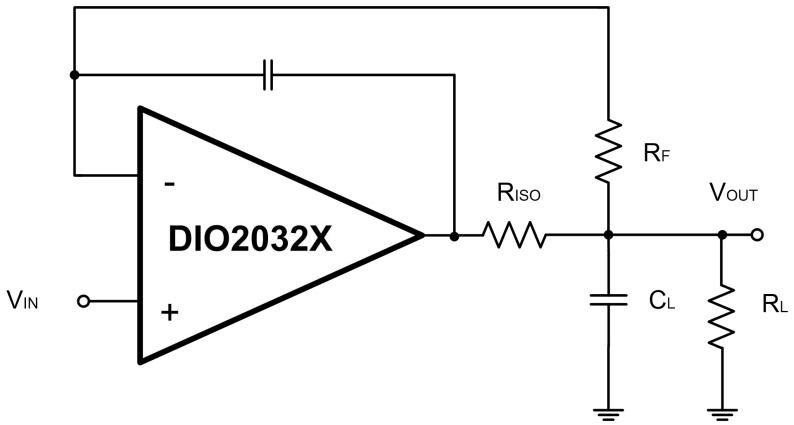


Figure 3 Indirectly driving heavy capacitive load with DC accuracy

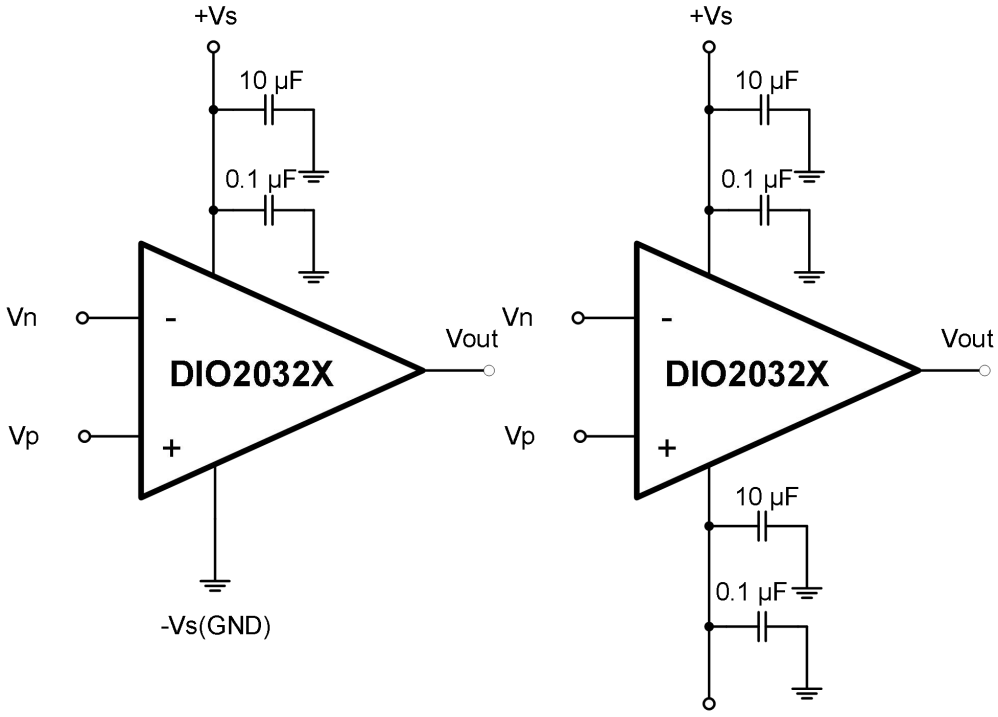


Figure 4 Amplifier with bypass capacitors

6. Typical Performance Characteristics

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

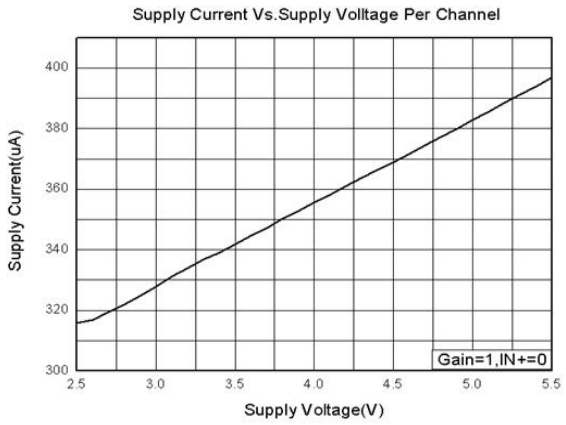


Figure 5 Supply current vs. Supply voltage per channel

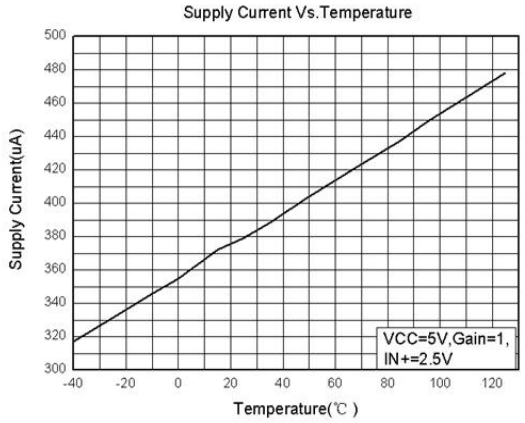


Figure 6 Supply current vs. Temperature

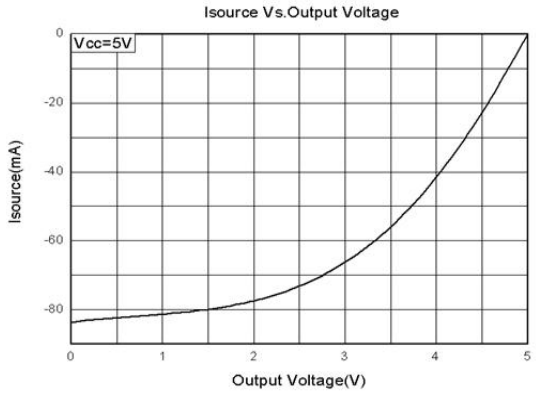


Figure 7 I_{SOURCE} vs. Output voltage

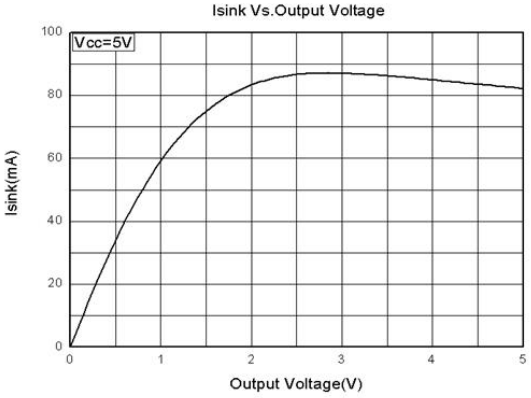


Figure 8 I_{SINK} vs. Output voltage

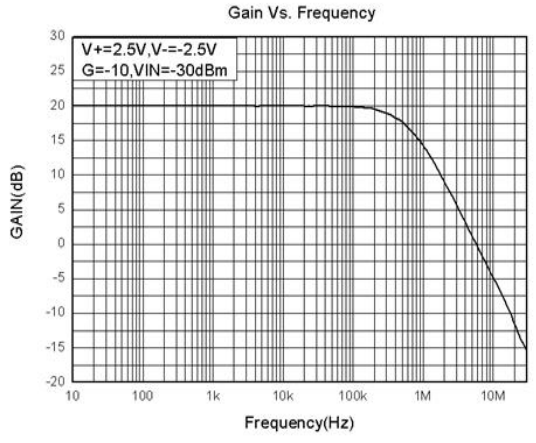


Figure 9 Gain vs. Frequency

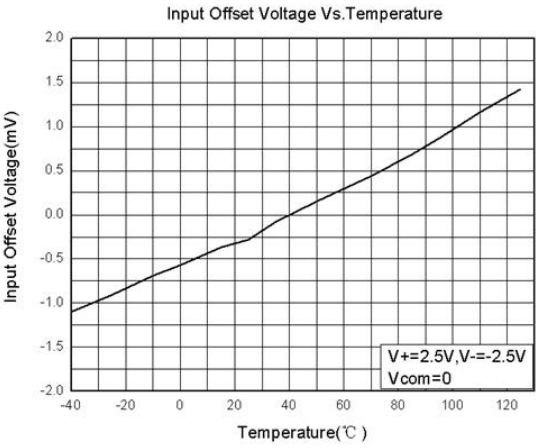


Figure 10 Input offset voltage vs. Temperature

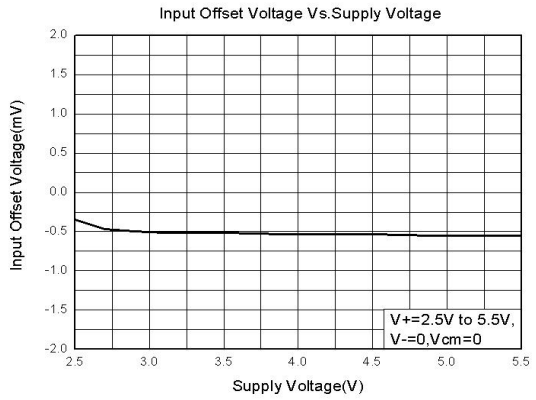


Figure 11 Input offset voltage vs. Supply voltage

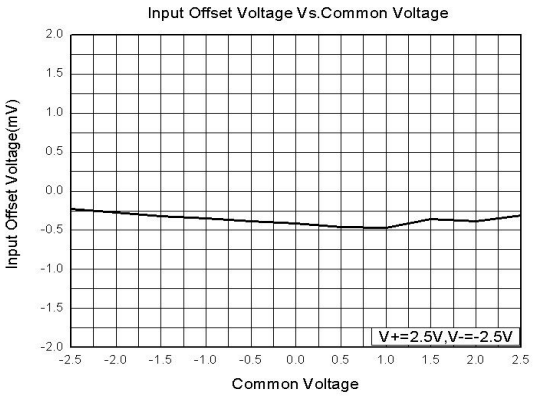
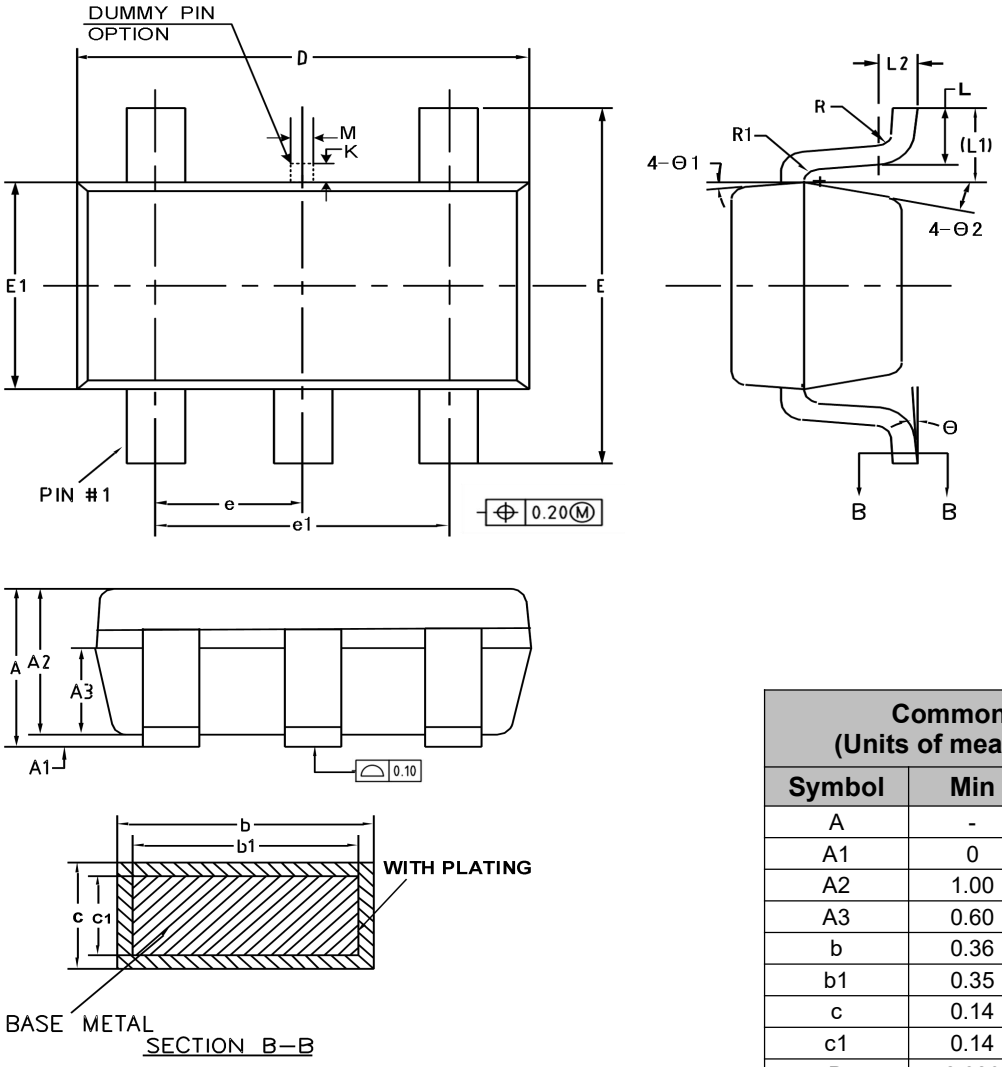


Figure 12 Input offset voltage vs. Common voltage

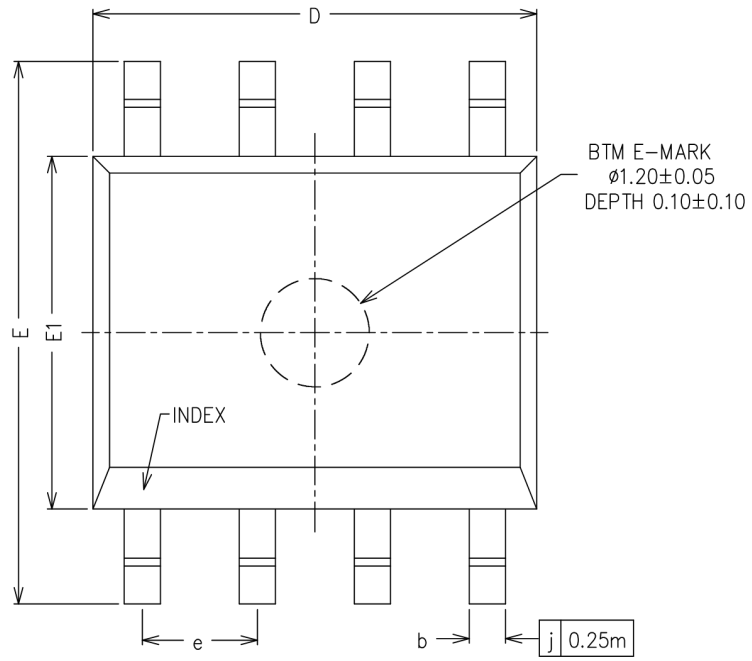
7. Physical Dimensions

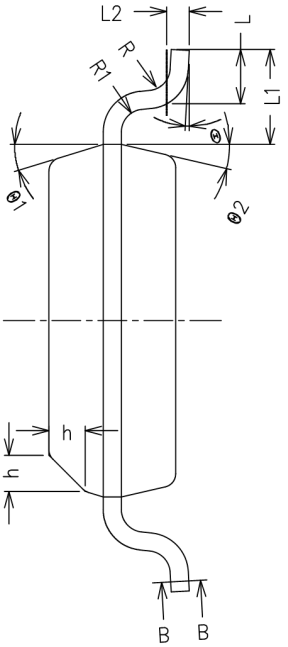
7.1 SOT23-5

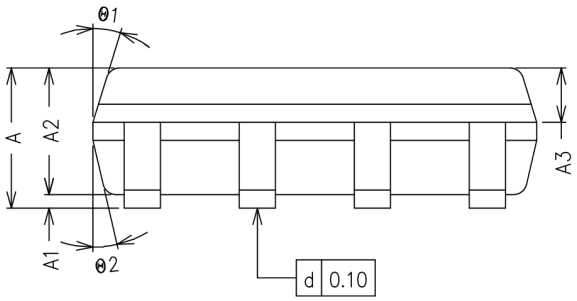


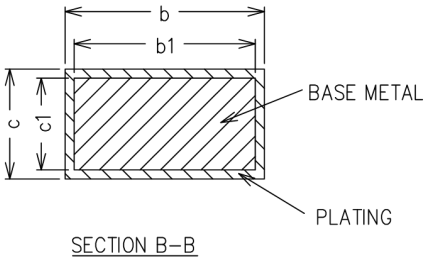
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
K	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
Θ	0°	-	8°
Θ1	8°	10°	12°
Θ2	10°	12°	14°

7.2 SOIC-8





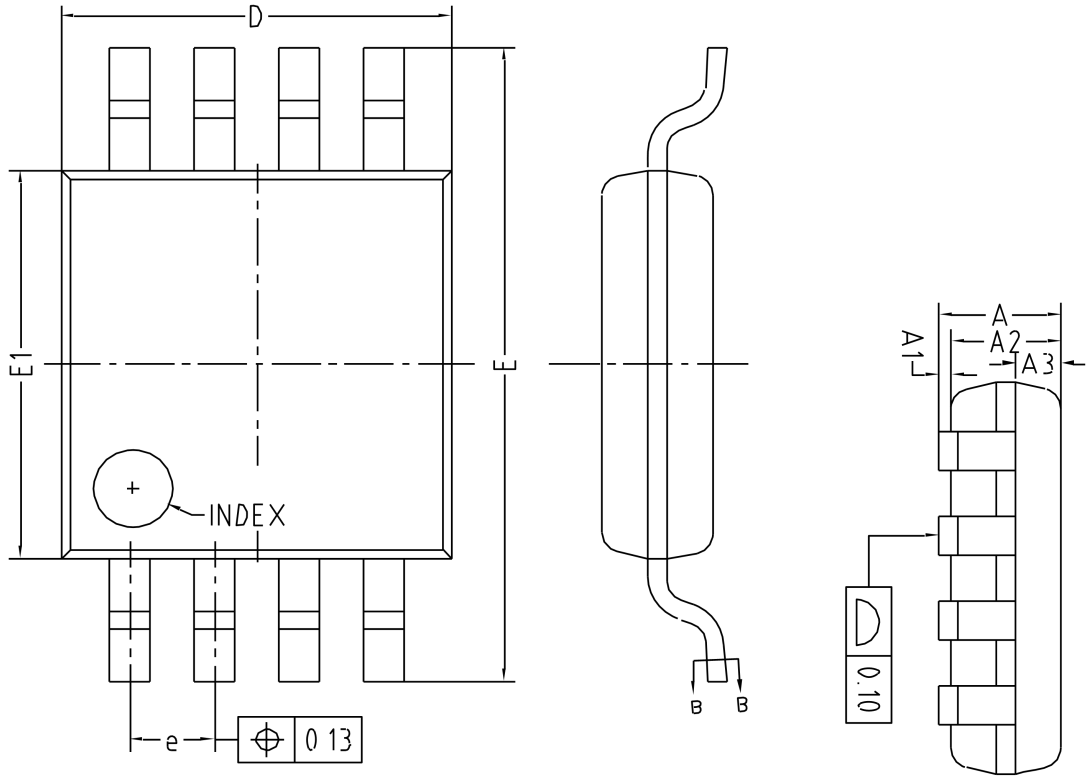


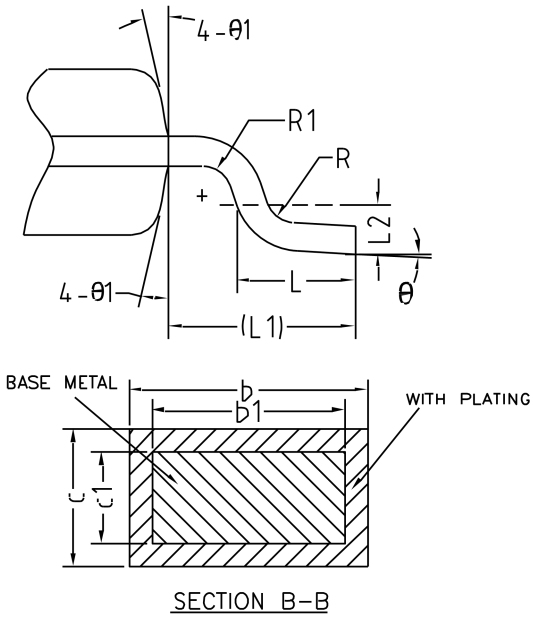


SECTION B–B

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	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
θ	0°	-	8°
θ1	15°	17°	19°
θ2	11°	13°	15°

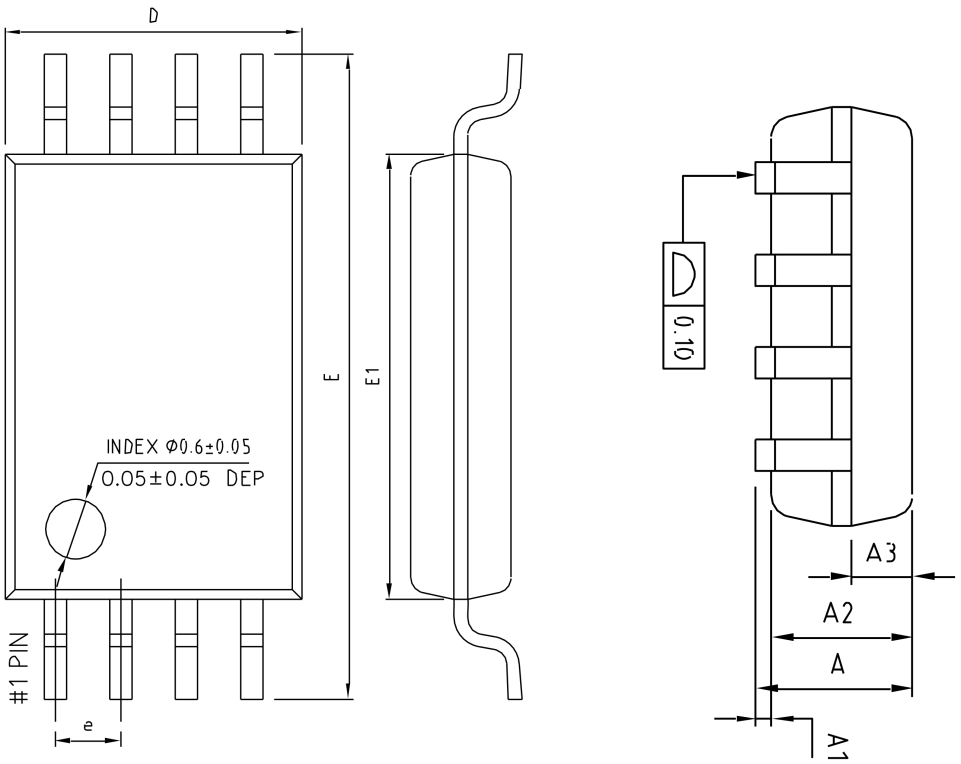
7.3 MSOP-8

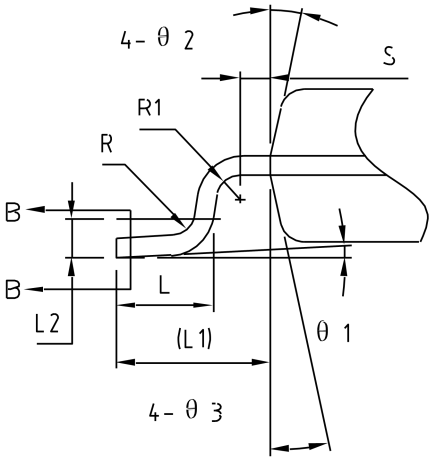


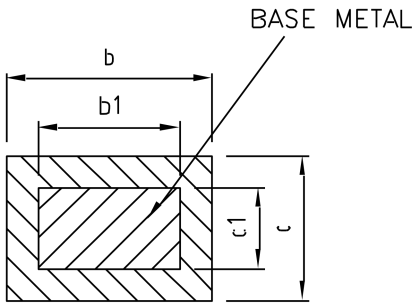


Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.10
A1	0.05	0.10	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.25	-	0.38
b1	0.24	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.75	4.90	5.05
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.55	0.70
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

7.4 TSSOP-8

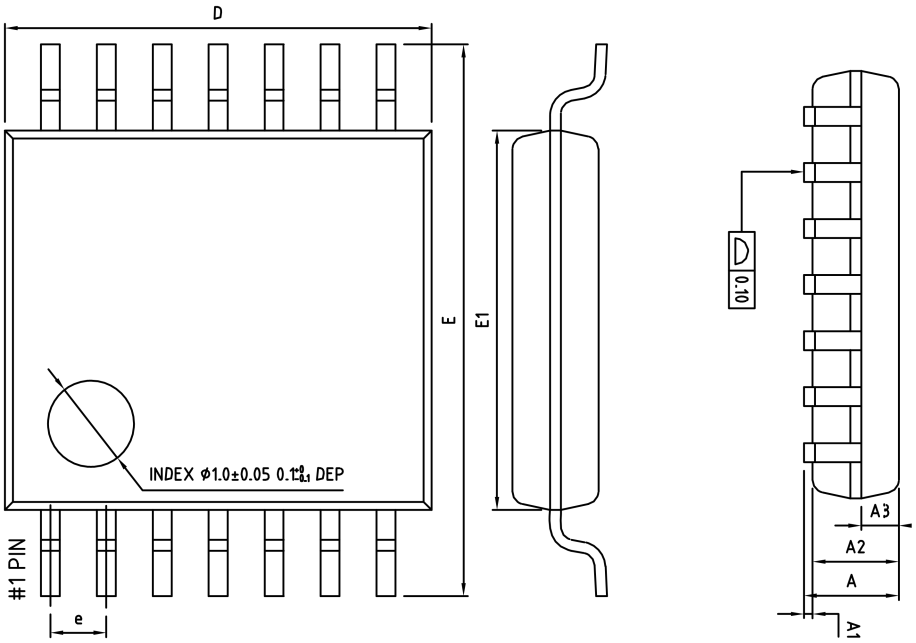


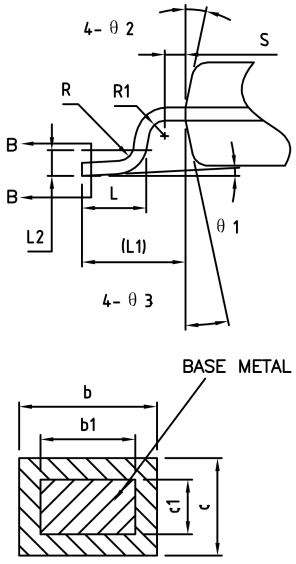




Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	2.83	2.93	3.03
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e		0.65 BSC	
L	0.45	0.60	0.75
L1		1.00 REF	
L2		0.25 BSC	
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
θ1	0°	-	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

7.5 TSSOP-14

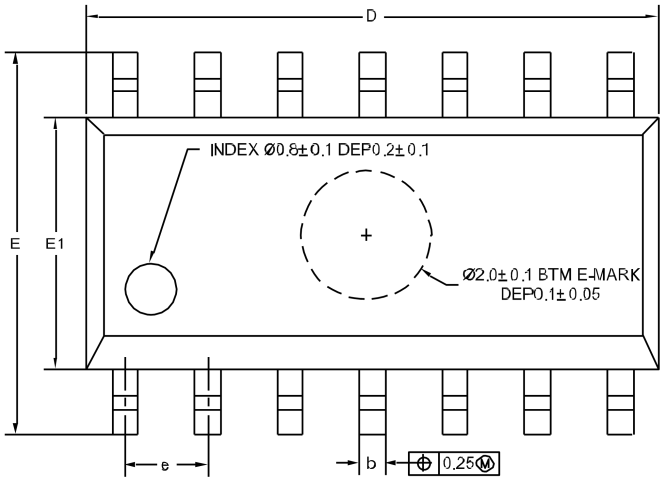


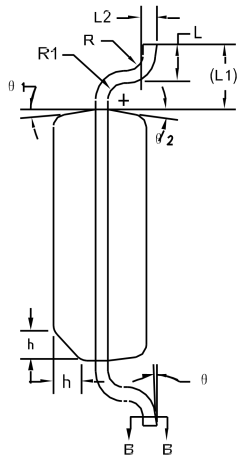


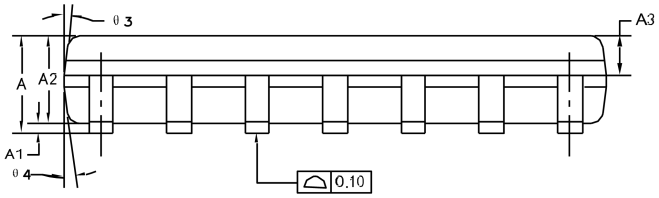
SECTION B–B

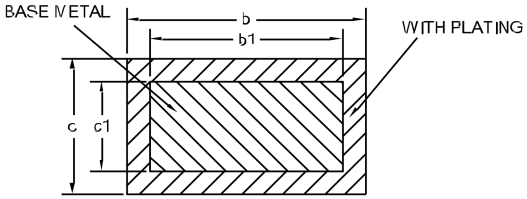
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
θ1	0°	-	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

7.6 SOIC-14





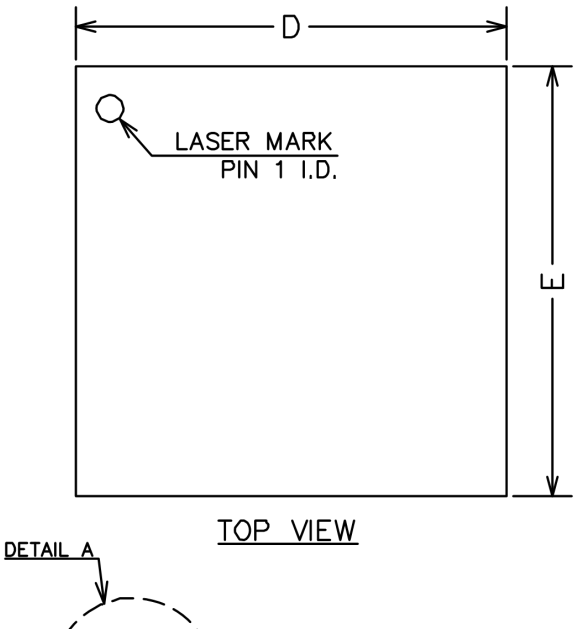


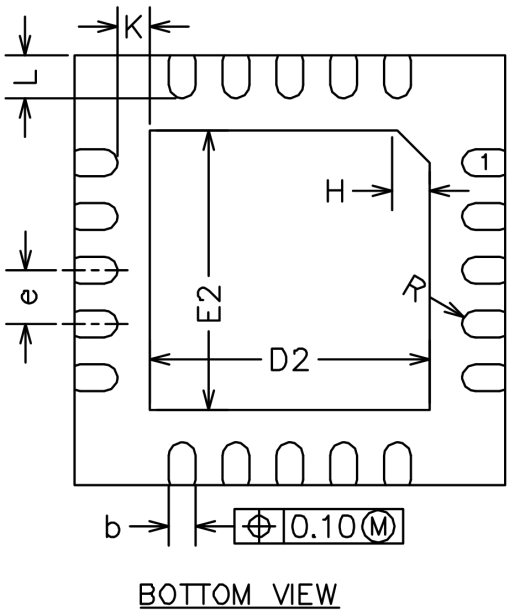


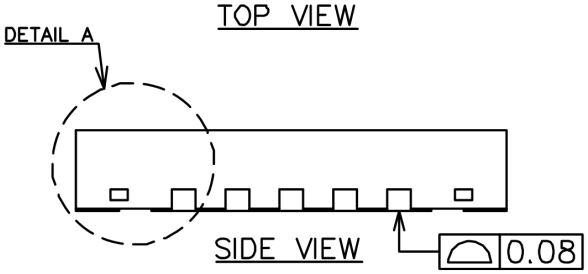
SECTION B-B

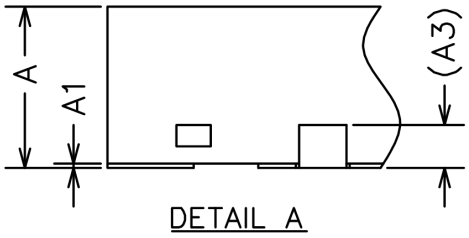
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36	-	0.49
b1	0.35	0.40	0.45
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
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°

7.7 QFN4*4-20









Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20 REF	
b	0.20	0.25	0.30
D	3.90	4.00	4.10
E	3.90	4.00	4.10
D2	2.50	2.60	2.70
E2	2.50	2.60	2.70
e	0.40	0.50	0.60
H		0.30 REF	
K	0.20	-	-
L	0.35	0.40	0.45
R	0.10	-	-

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.

For additional product information or full datasheet, please contact our sales department or representatives.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

DIOO:

DIO20321ST5