

DIO321/DIO358/DIO324

1.4 MHz, 60 μ A, Rail-to-Rail I/O CMOS Amplifier

Features

- Rail-to-rail input and output
- Maxim offset (V_{os}):
DIO321/358/324 at ± 3.6 mV
- Unity gain stable
- Gain bandwidth product: 1.4 MHz
- Very low input bias currents: 5 pA
- Wide supply range: 2 V to 5.5 V
- Input Voltage Range:
-0.1 V to 5.6 V with $V^+ = 5.5$ V
- Ultra low power: 60 μ A per channel
- Compact package best for portable applications
DIO321: SOT23-5 and SC70-5
DIO358: SOIC-8 and MSOP-8
DIO324: SOP-14 and TSSOP-14

Applications

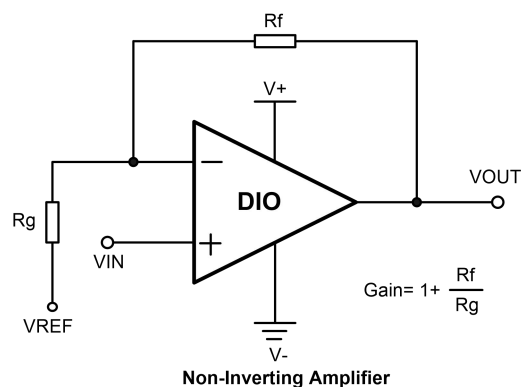
- ASIC input or output amplifier
- Sensor interface
- Piezo electric transducer amplifier
- Medical instrumentation
- Audio output
- Portable systems
- Smoke detectors
- Notebook PC
- Battery-powered equipment

Descriptions

DIO321 (single), DIO358 (dual) and DIO324 (quad) are rail-to-rail CMOS operational amplifiers with ultra low offset. Features include wide input common-mode voltage range and broad output voltage swing with operating supply voltage from 2 V to 5.5 V. Products are fully specified over the extended -40 to 125°C temperature range.

DIO321/358/324 provide 1.4 MHz bandwidth consuming ultra low current of 60 μ A per channel. Very low input bias currents of 5 pA enable them ideal for integrators, photodiode amplifiers, and piezoelectric sensors.

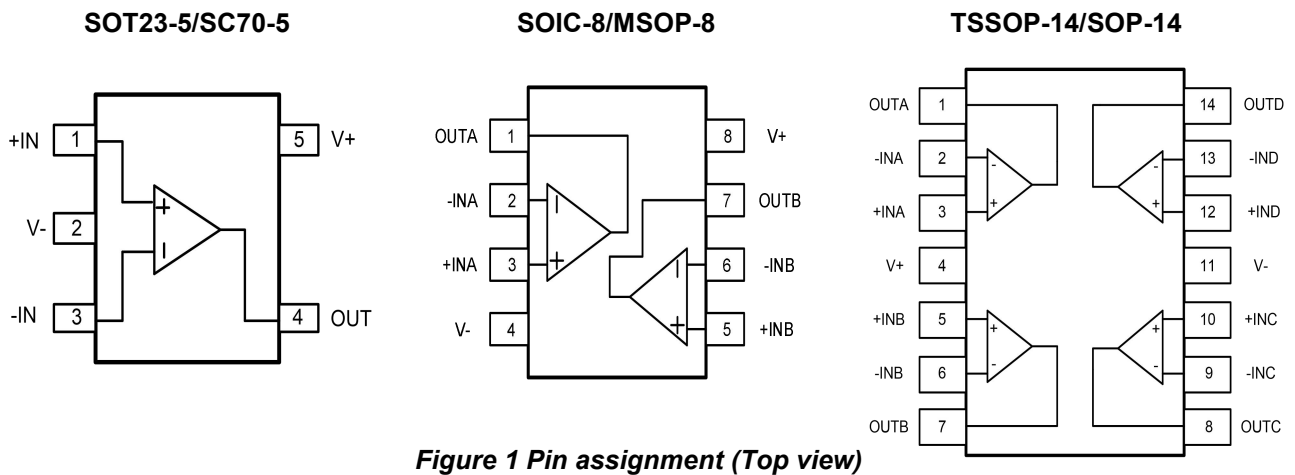
Typical Application



Ordering Information

Order Part Number	Top Marking	MSL	RoHS	T _A	Package	
DIO321ST5	YW(X)Z	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO321SC5	YW(X)Z	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO358MP8	DIO358	3	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO358SO8	DIO358	3	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO324TP14	DIO324	3	Green	-40 to 125°C	TSSOP-14	Tape & Reel, 2500
DIO324SO14	DIO324	3	Green	-40 to 125°C	SOP-14	Tape & Reel, 2500

Pin Assignments



Pin Description

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



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		7	V
Input voltage		(V-)-0.5 to 7	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	

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		2.0 to 5.5	V
Input voltage		± 0.1	V
Operating temperature range		-40 to 125	°C

Electrical Characteristics

Typical value: $V_+ = 5\text{ V}$, $R_L = 100\text{ k}\Omega$ to $V_+/2$, $T_A = 25^\circ\text{C}$, 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 V to 5 V	-3.6	0.5	3.6	mV
V _{CM}	Common mode voltage range		-0.1		(V ₊) +0.1	V
CMRR	Common mode rejection ratio	-40°C≤T _A ≤125°C, V _{CM} =-0.1 to (V ₊)+0.1	65	75		dB
A _{OL}	Open loop voltage gain ⁽¹⁾	R _L =5 kΩ, V _O = 0.1 to (V ₊)-0.1	80	100		dB
		R _L =200 kΩ, V _O = 0.1 to (V ₊)-0.1	90	110		
ΔV _{OS} /ΔT	Input offset voltage drift	-40°C≤T _A ≤125°C		3		μV/°C
Output characteristics						
V _{OH}	Output voltage high	R _L =100 kΩ, -40°C≤T _A ≤125°C		4.998		V
V _{OL}	Output voltage low	R _L =100 kΩ, -40°C≤T _A ≤125°C		2.5		mV
I _{SC}	Output short circuit current	Source I _{SC} , V ₊ =5 V		40		mA
		Sink I _{SC} , V ₊ =5 V		40		
Power supply						
PSRR	Power supply rejection ration		65	85		dB
I _S	Supply current per channel/amp	-40°C≤T _A ≤125°C		60		μA
Dynamic performance						
GBP	Gain bandwidth product	R _L =100 kΩ, C _L =100 pF		1.4		MHz
SR	Slew rate	G=1, 2 V output step		0.6		V/μs
t _s	Setting time	G=1, 2 V output step		2.4		μs
Noise performance						
THD	Total harmonic distortion	f=10 kHz, 2 V output step, R _L =10 kΩ		0.019		%
e _n	Voltage noise density ⁽¹⁾	f=1 kHz		45		nV/√Hz
		f=10 kHz		35		

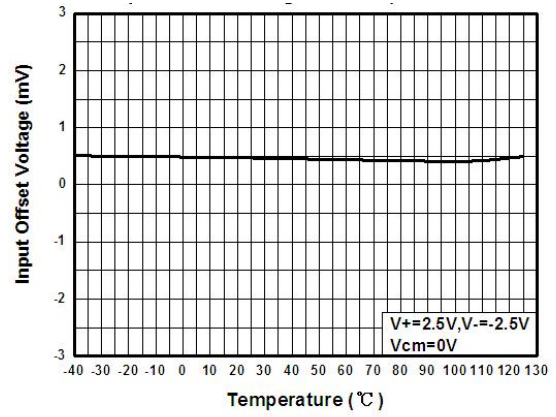
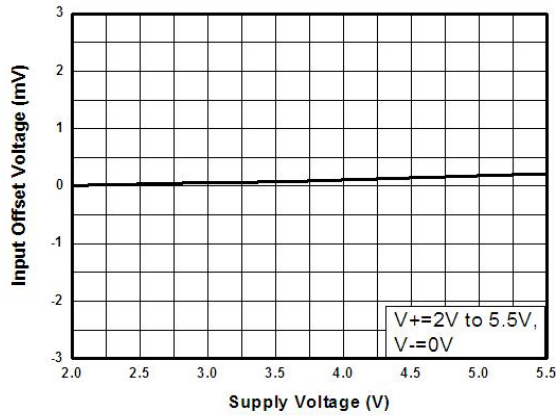
Note:

(1) Guaranteed by design.

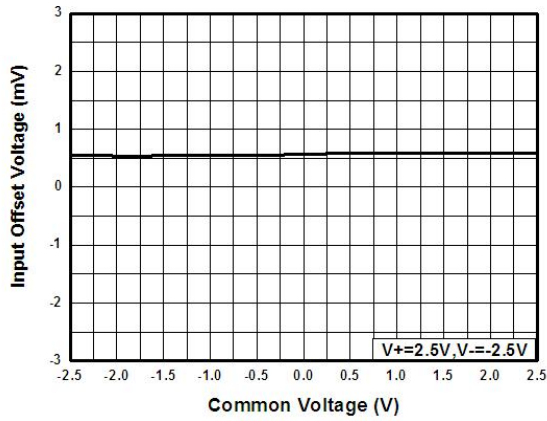
(2) Specifications subject to change without notice.

Typical Performance Characteristics

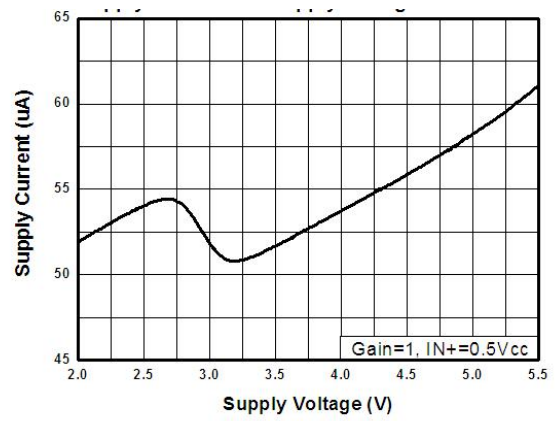
All typical value are at $V_+=2.5\text{ V}$, $V_-=-2.5\text{ V}$, $T_A=25^\circ\text{C}$, unless otherwise specified.



Input Offset Voltage Vs. Supply Voltage

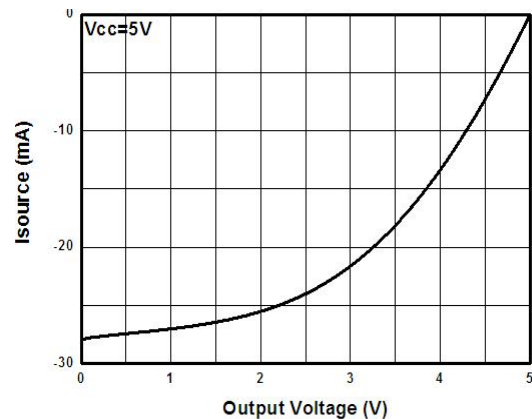
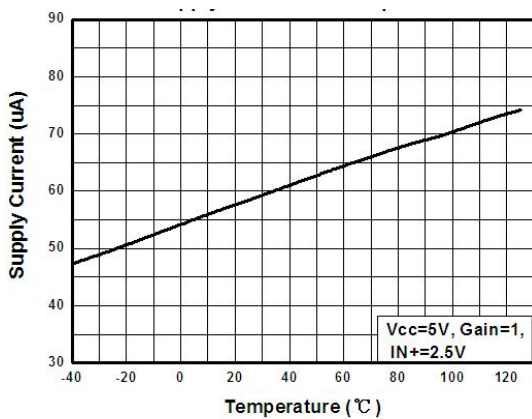


Input Offset Voltage Vs. Temperature



Input Offset Voltage Vs. Common Voltage

Supply Current Vs. Supply Voltage Per Channel

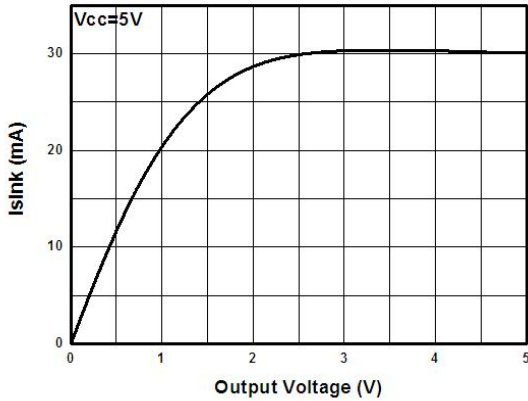


Supply Current Vs. Temperature

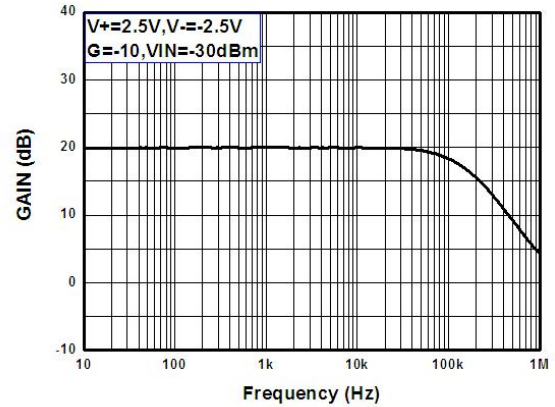
Isource Vs. Output Voltage

Typical Performance Characteristics(continued)

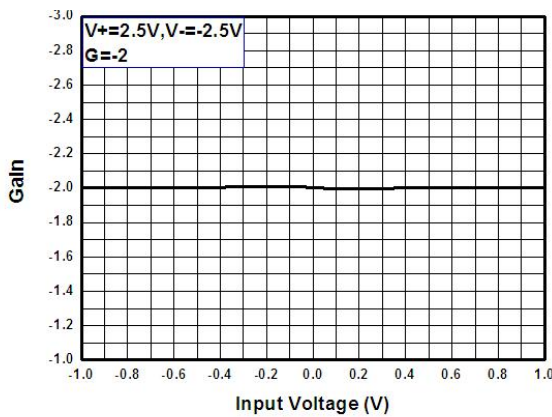
All typical value are at $V_+ = 2.5V$, $V_- = -2.5V$, $T_A = 25^\circ C$, unless otherwise specified.



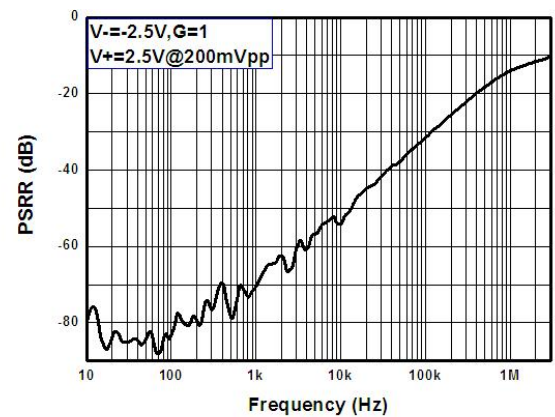
Isink Vs. Output Voltage



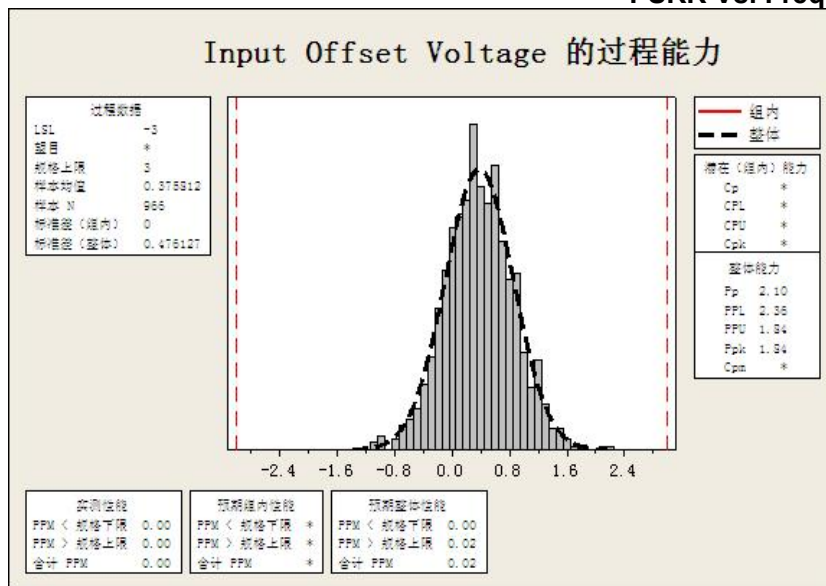
Gain Vs. Frequency



Gain Linearity Vs. Input Voltage



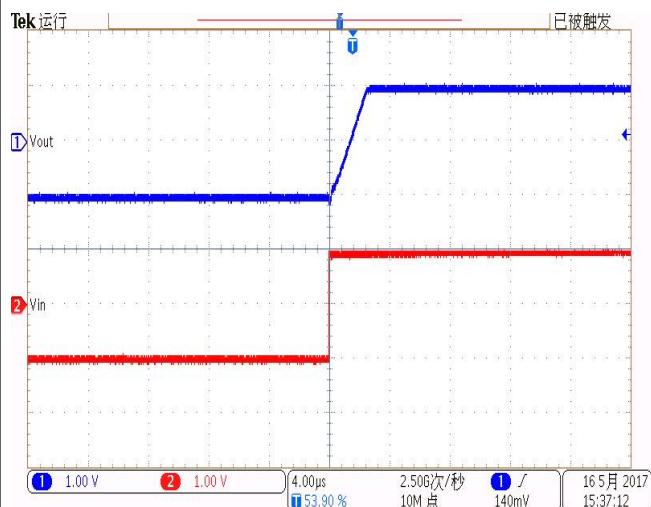
PSRR Vs. Frequency



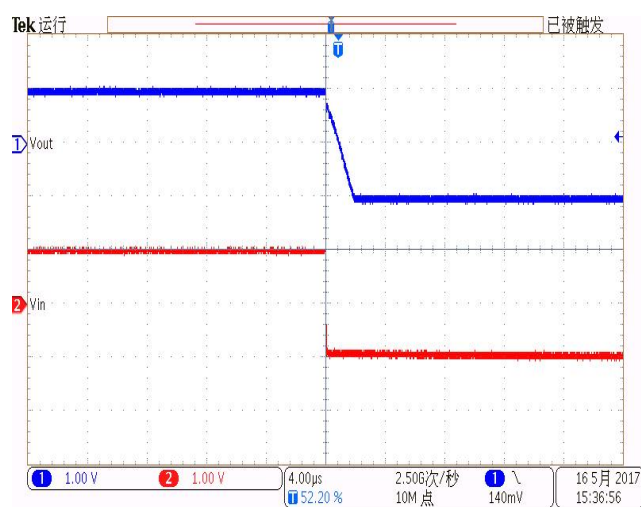
Input Offset Voltage Statistics

Typical Performance Characteristics (continued)

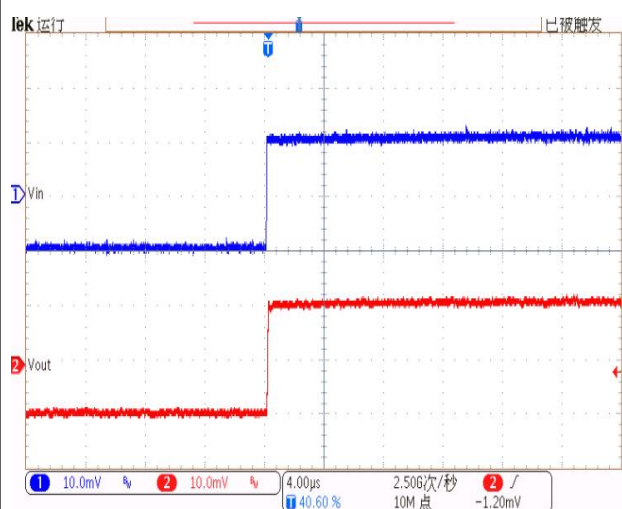
All typical value are at $V_+ = 2.5V$, $V_- = -2.5V$, $G = 1$, $R_L = 1M\Omega$, $T_A = 25^\circ C$, unless otherwise specified.



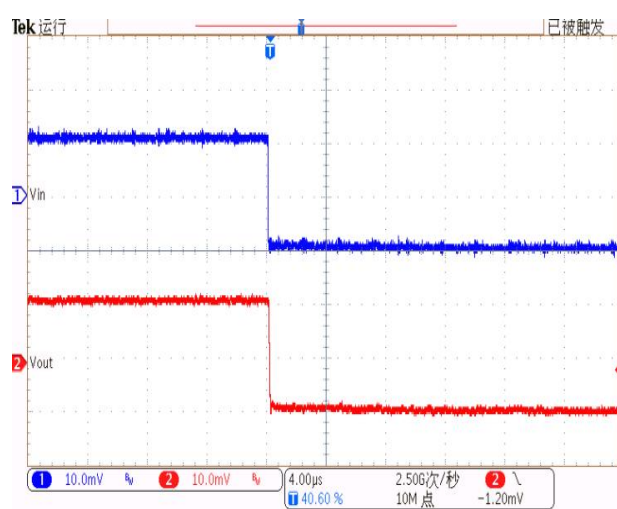
Slew Rate(+)



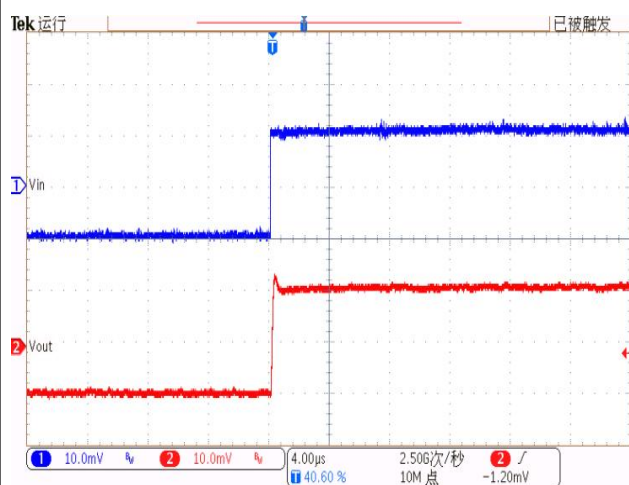
Slew Rate(-)



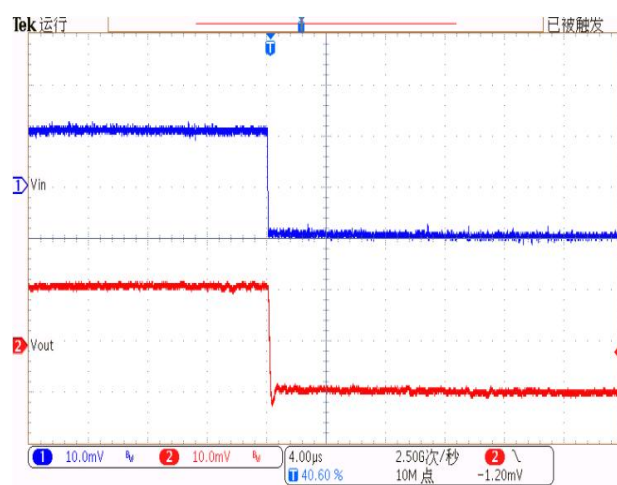
Small-Signal Response Rise ($C_L = \text{No Load}$)



Small-Signal Response Fall ($C_L = \text{No Load}$)

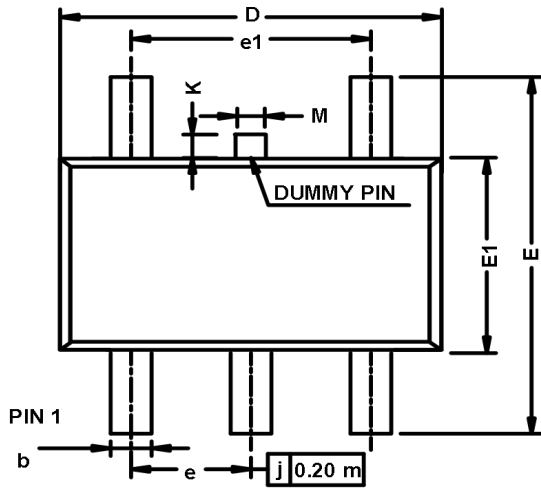


Small-Signal Response Rise ($C_L = 200pF$)

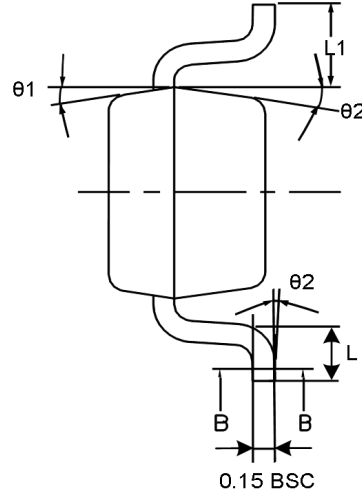


Small-Signal Response Fall ($C_L = 200pF$)

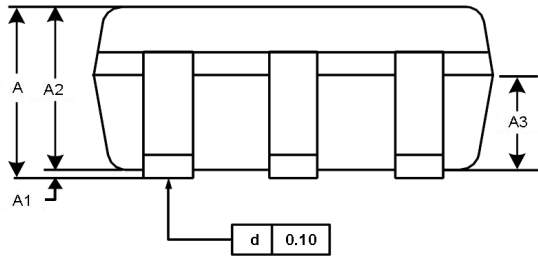
Physical Dimensions: SC70-5



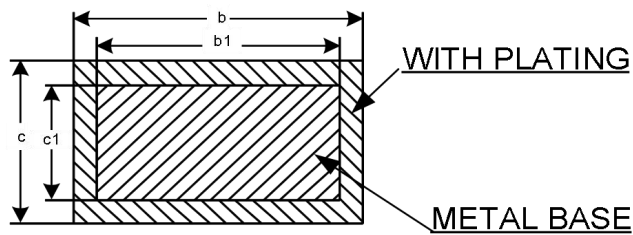
TOP VIEW



SIDE VIEW



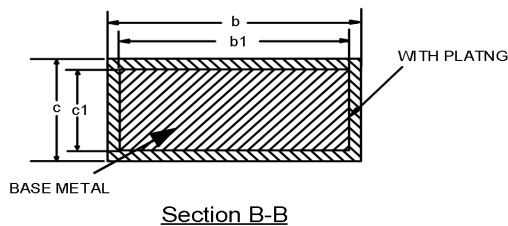
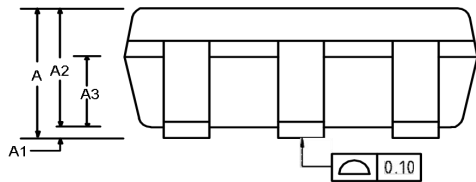
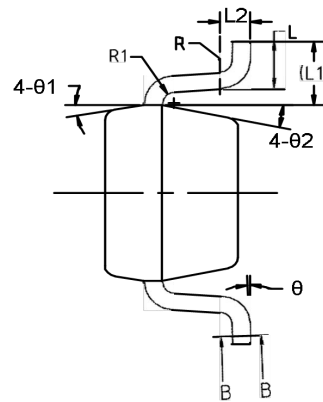
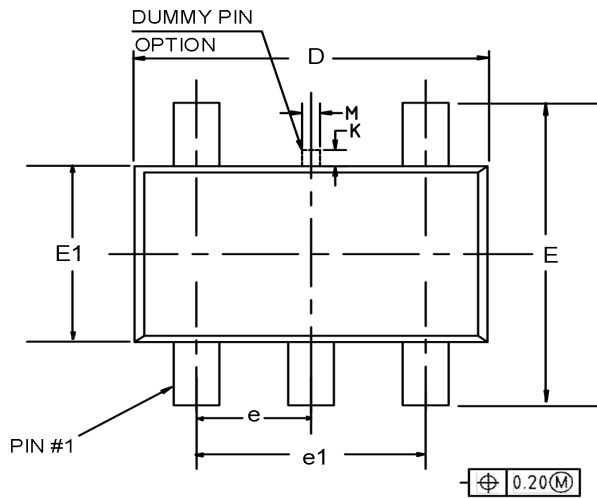
SIDE VIEW



SECTION B-B

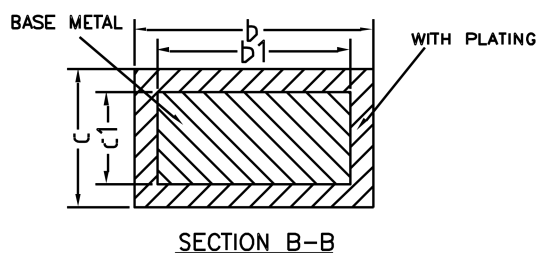
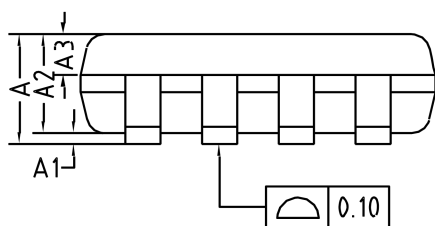
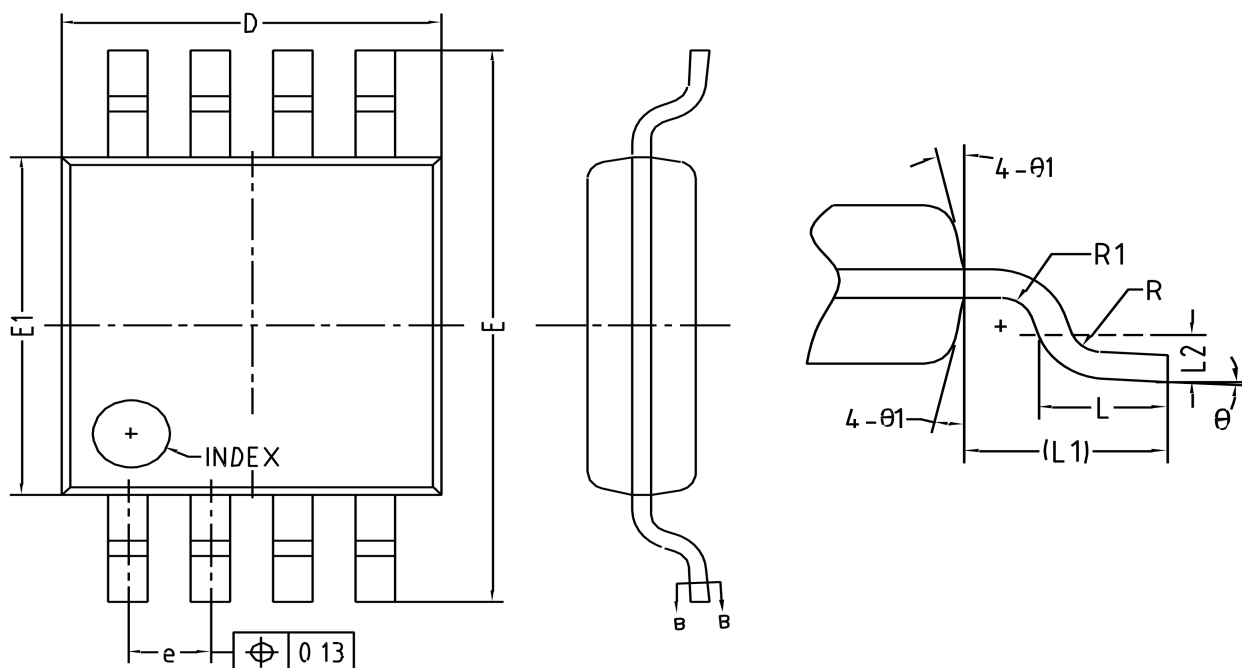
Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	0.80	-	1.10
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.40	0.50	0.60
b	0.17	-	0.30
b1	0.17	0.22	0.25
c	0.12	-	0.20
c1	0.12	0.15	0.16
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.21	1.26	1.31
e	0.60	0.65	0.70
e1	1.20	1.30	1.40
L	0.26	0.33	0.46
L1	0.52 REF		
M	0.10	0.15	0.20
K	0	-	0.20
θ	0°	-	8°
θ1	10°	12°	14°
θ2	10°	12°	14°

Physical Dimensions: SOT23-5



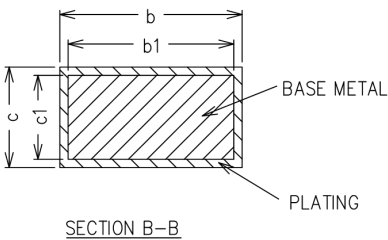
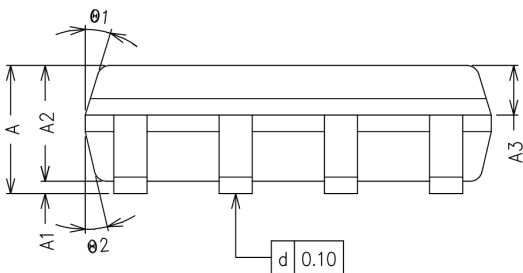
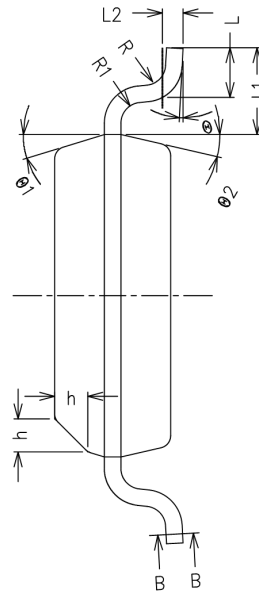
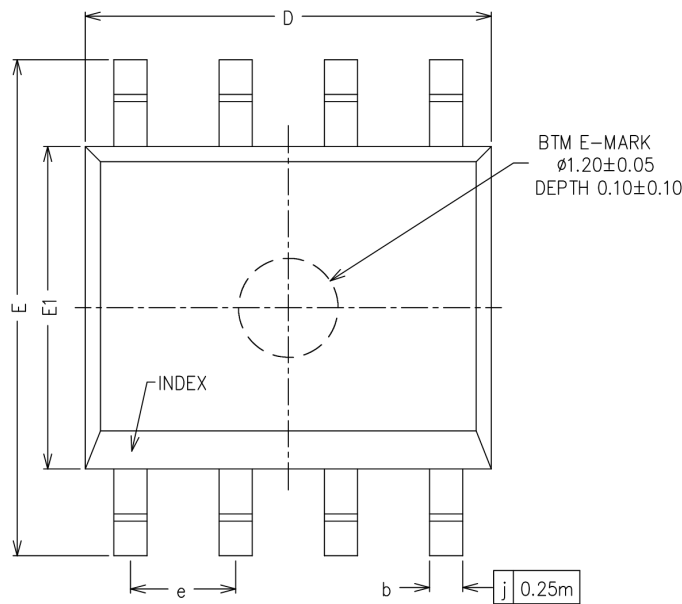
Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
K	0	-	0.25
L	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°

Physical Dimensions: MSOP-8



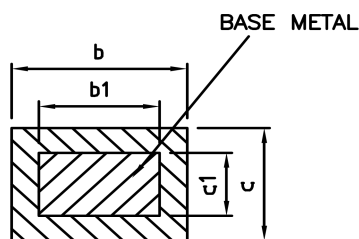
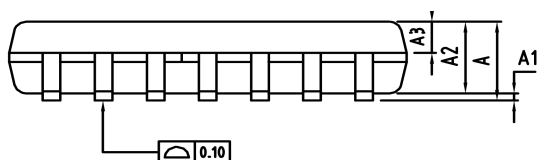
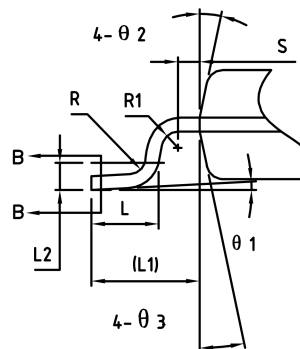
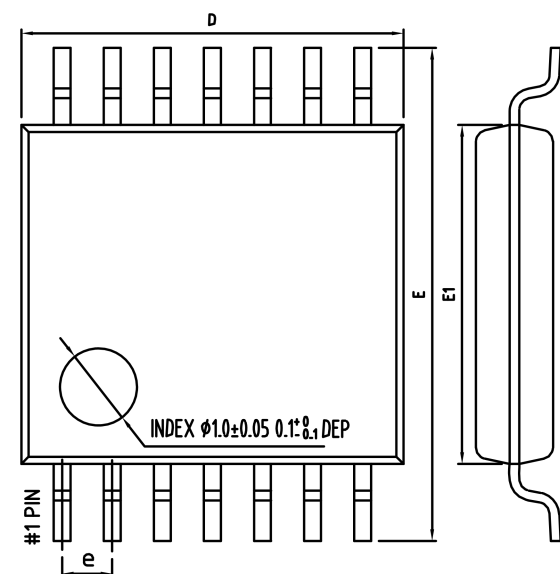
Common Dimensions (Units of measures = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.10
A1	0.05	0.10	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.25	-	0.38
b1	0.24	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.75	4.90	5.05
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.55	0.70
L1	0.95 REF	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

Physical Dimensions: SOIC-8



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

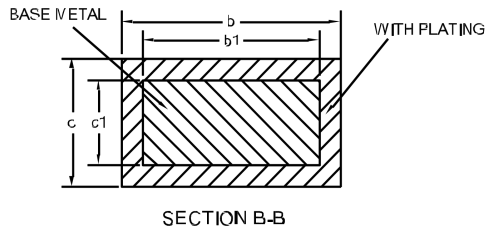
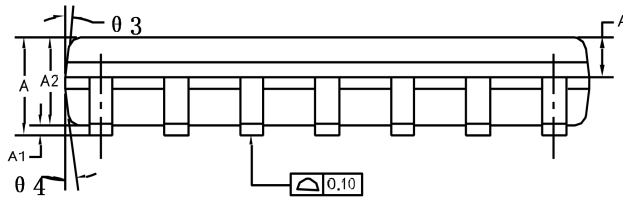
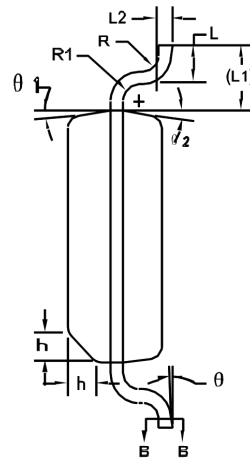
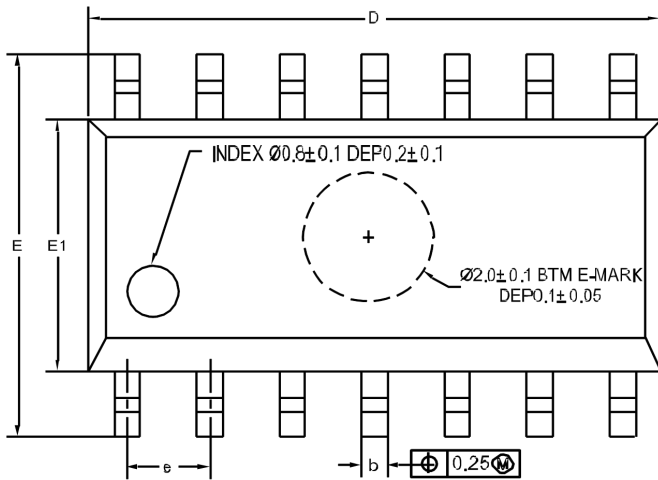
Physical Dimensions: TSSOP-14



SECTION B-B

Common Dimensions (Units of measures = 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°

Physical Dimensions: SOP-14



Common Dimensions (Units of measures = 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	8.45	8.65	8.85
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27 BSC		
h	0.25	-	0.50
L	0.45	0.60	0.80
L1	1.05 BSC		
θ	0°	-	8°



DIO321/324/358

1.4 MHz, 60 μ A, Rail-to-Rail I/O CMOS Amplifier

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.