DIO270X
High Voltage Rail-to-Rail Output Operational Amplifiers

Features

- Supply voltage range: 4.5 V to 32 V
- Low supply current:
  1.7mA/channel at V_S = 32 V
  1.4mA/channel at V_S = 4.5 V
- Input voltage range: -0.1 ~ (+V_S -1.5) V
- Low offset voltage: 3.5 mV (max)
- Rail-to-rail output: -V_S ~ +V_S
- 6 MHz high gain-bandwidth product
- High slew rate: 20 V/μs
- Settling time to 0.1% with 10 V step: 0.6 μs
- Overload recovery time: 0.2 μs
- Packages:
  DIO2701 available in: SOT23-5/SOIC-8
  DIO2702 available in:
  SOIC-8/MSOP-8/TSSOP-8
  DIO2704 available in: TSSOP-14/SOP-14

Descriptions

The DIO2701 (single), DIO2702 (dual) and DIO2704 (quad) are amplifiers with very low noise, low voltage, and low power. The DIO2701/2/4 has a high gain-bandwidth product of 6 MHz, a slew rate of 20 V/μs, and a quiescent current of 1.4 mA/amplifier at 4.5 V typically.

The DIO2701/2/4 is designed to provide optimal performance in low voltage and low noise systems. All these chips provide rail-to-rail output swing into heavy loads. The input common-mode voltage range includes ground, and the maximum input offset voltage is 3.5 mV for the DIO2701/2/4.

They are specified over the extended industrial temperature range -40°C to 125°C. The operating range is from 4.5 V to 32 V.

Applications

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

Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO2701ST5	YWBH	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO2701SO8	DIO71AH	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2702SO8	DIO72AH	Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO2702MP8	DIO72AH	Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO2702TP8	DIO72AH	Green	-40 to 125°C	TSSOP-8	Tape & Reel, 3000
DIO2704SO14	DIO74AH	Green	-40 to 125°C	SOP-14	Tape & Reel, 2500
DIO2704TP14	DIO74AH	Green	-40 to 125°C	TSSOP-14	Tape & Reel, 2500

Pin Assignments

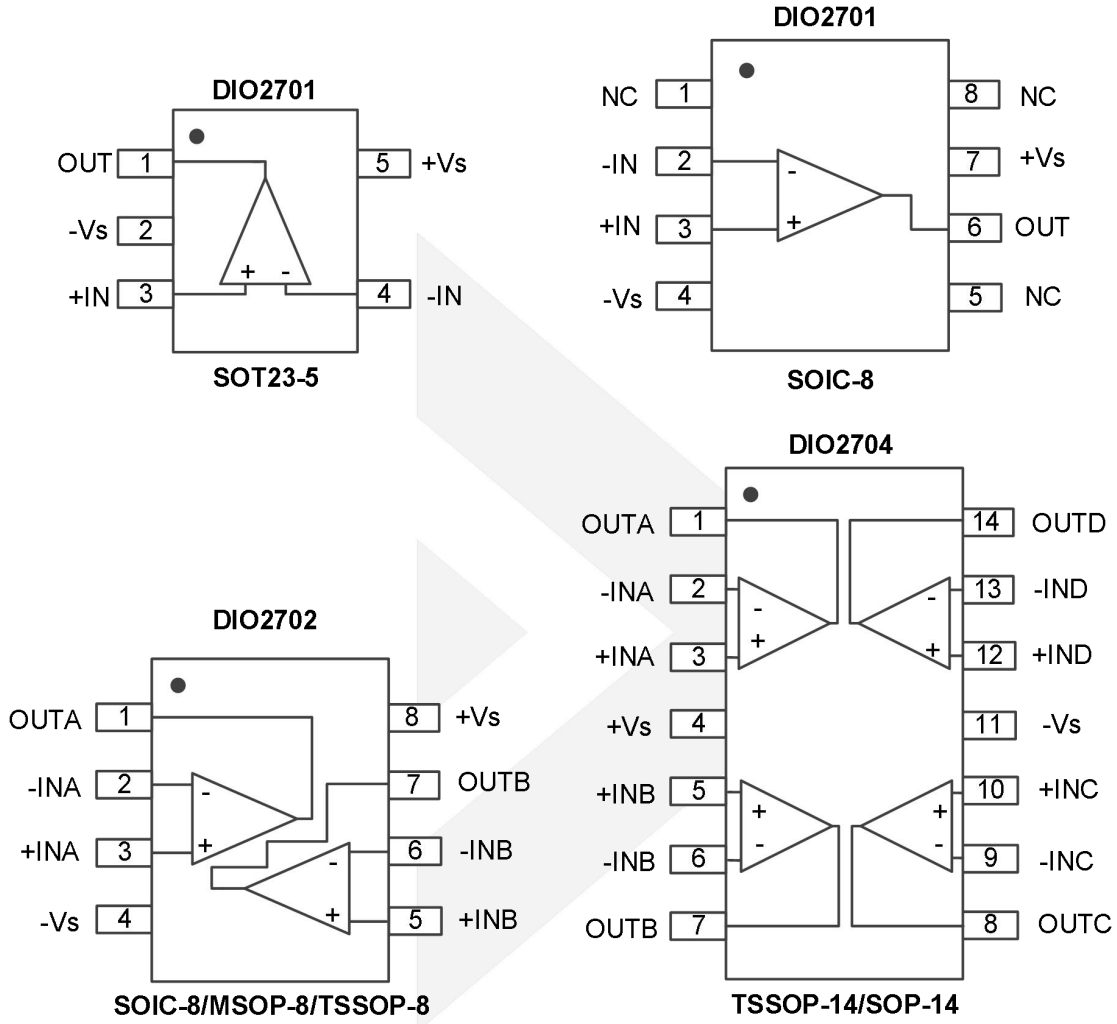


Figure 1. Pin assignment (Top view)

Pin Description

Pin name	Description
$+V_S$	Positive supply
$-V_S$	Negative supply
+IN (+INA/+INB/+INC/+IND)	Positive input (channel A/B/C/D)
-IN (-INA/-INB/-INC/-IND)	Negative input (channel A/B/C/D)
OUT (OUTA/OUTB/OUTC/OUTD)	Output (channel A/B/C/D)
NC	Do not connect.

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. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
V_S	Supply voltage	35	V
V_{IN}	Input voltage	$(-V_S)$ - 0.3 to $(+V_S)$ + 0.3	V
T_{STG}	Storage temperature range	-65 to 150	°C
T_J	Junction temperature	150	°C
T_L	Lead temperature range	260	°C
ESD	Human body model:JEDEC JS-001	±4	kV
Latch up		200	mA

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.

Symbol	Parameter	Rating	Unit
V_S	Supply voltage	4.5 to 32	V
V_{IN}	Input voltage	-0.1 to $(+V_S)$ - 1.5	V
T_A	Operating temperature range	-40 to 125	°C

Electrical Characteristics

Typical value: T_A = 25°C, $+V_S$ = 30 V, $-V_S$ = 0 V, R_L = 10 kΩ, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Power supply						
V_S	Supply voltage range		4.5		32	V
PSRR	Power supply rejection ration			110		dB
I_Q	Supply current per channel/amplifier	V_S = 4.5 V		1.4		mA
		V_S = 24 V		1.6		mA
		V_S = 32 V		1.7		mA
Input characteristics						
V_{OS}	Input offset voltage	V_{CM} = $+V_S$ /2, T_A = 25°C	-3.5		3.5	mV
V_{CM}	Common mode voltage range		-0.1		$+V_S$ -1.5	V
CMRR	Common mode rejection ratio	-40°C ≤ T_A ≤ 125°C, $+V_S$ = 32 V, V_{CM} = 0.5 V to 28 V		90		dB
A_{OL}(1)	Open loop voltage gain			155		dB
V_O	Output swing high from supply rail	R_L = 50 kΩ, rising		20		mV
	Output swing low from supply rail	R_L = 50 kΩ, falling		15		mV
$\Delta V_{OS}/\Delta T$	Input offset voltage drift	-40°C ≤ T_A ≤ 125°C		5		μV/°C
Output characteristics						
I_{SC}	Output short-circuit current	Sink current		15		mA
		Source current		18		mA
Dynamic performance						
GBP	Gain bandwidth product	f = 1 kHz		6		MHz
SR	Slew rate	A_V =1, 10 V step		20		V/μs
t_S	Settling time	A_V = -1, 10 V step, 0.1%		0.6		μs
		A_V = -1, 10 V step, 0.01%		0.9		
t_{OR}	Overload recovery time			200		ns
Noise performance						
THD	Total harmonic distortion	f = 1 kHz, A_V = 1 V, R_L = 10 kΩ ,V_{OUT} = 3.5 V_{RMS}		0.0005		%
e_n	Input voltage noise density	f = 1 kHz		35		nV/√Hz
	Input voltage noise	f = 0.1 Hz to 10 Hz		3		μV_{RMS}
X_{talk}	Channel separation	f = 1 kHz, R_L = 1 kΩ		-100		dB

Note:

(1) Guaranteed by design.

(2) Specifications subject to change without notice.

Typical Application

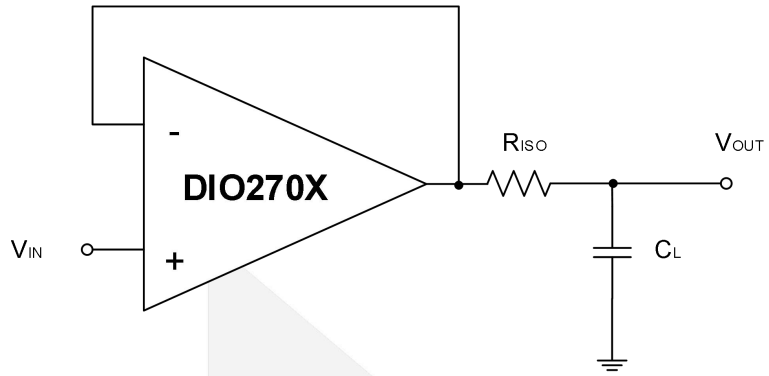


Figure 2. Indirectly driving heavy capacitive load

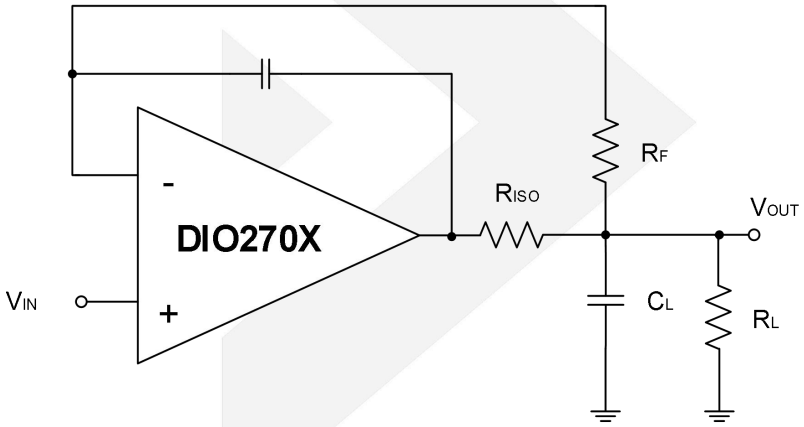


Figure 3. Indirectly driving heavy capacitive load with DC accuracy

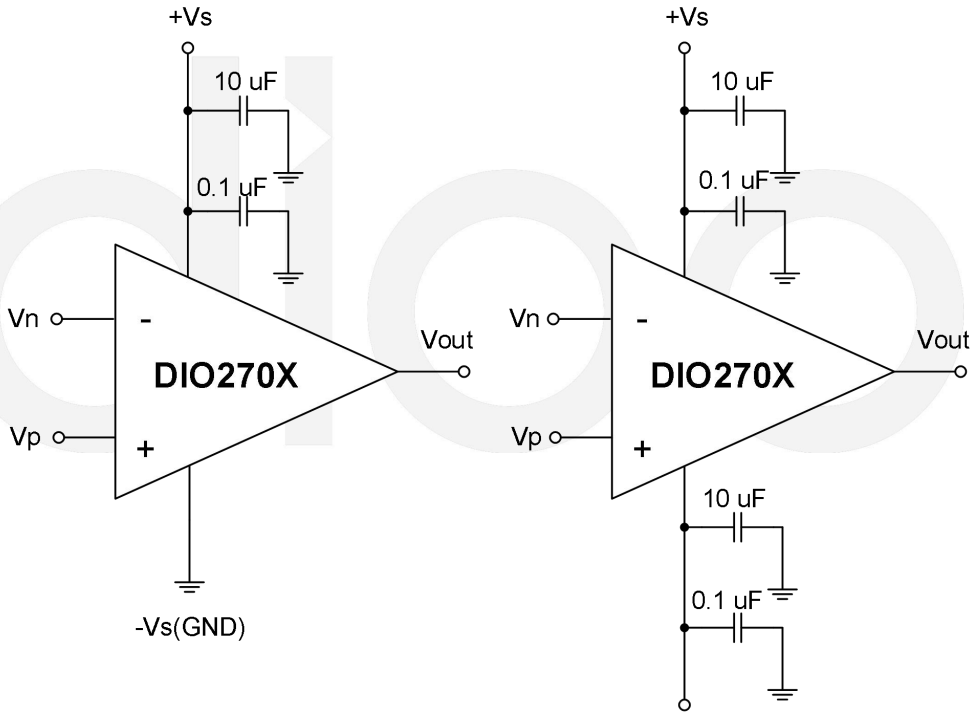


Figure 4. Amplifier with bypass capacitors

Typical Performance Characteristics

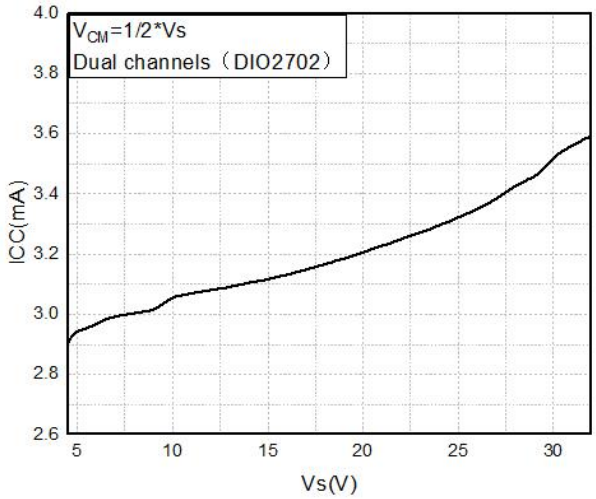


Figure 5. Quiescent current vs. Supply voltage

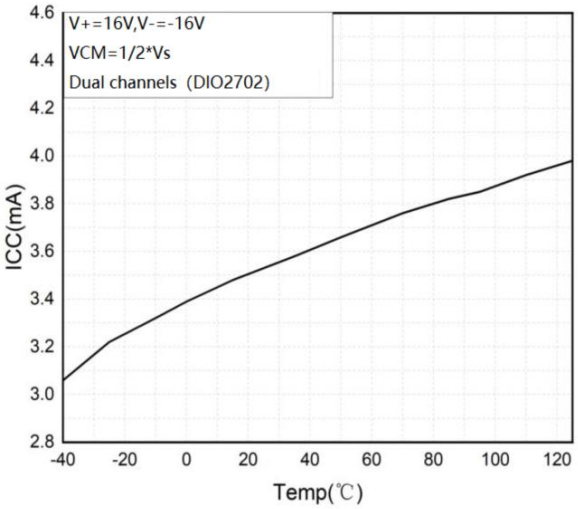


Figure 6. Quiescent current vs. Temperature

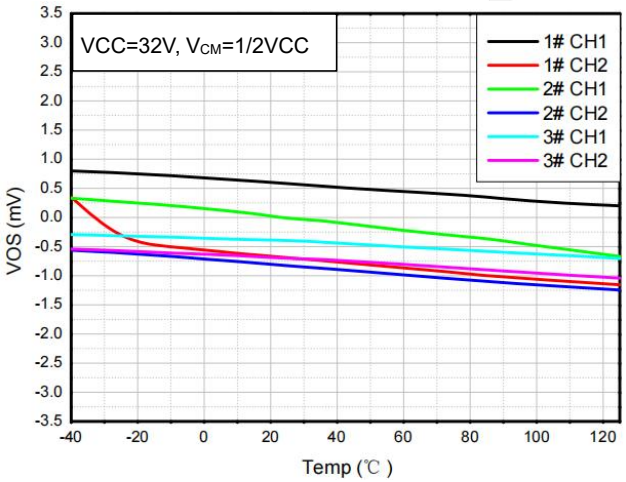


Figure 7. V_{OS} vs. Temperature

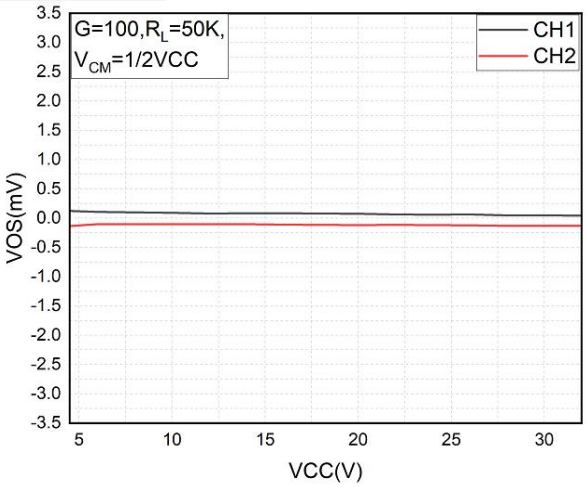
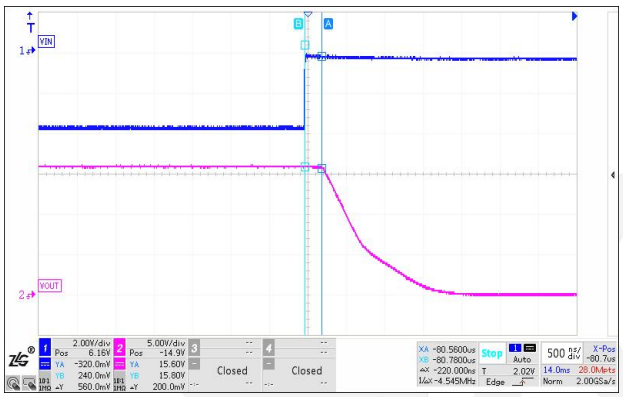


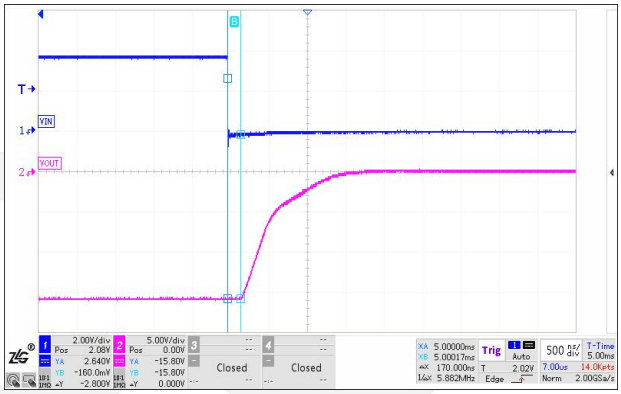
Figure 8. V_{OS} vs. V_{CC}



$+V_S$ = 16 V, $-V_S$ = -16 V, G = -10, R_L = 2 kΩ, C_L = 100 pF,

V_{IN} = 3.8 Vpp at 1.9 V_{BIAS}

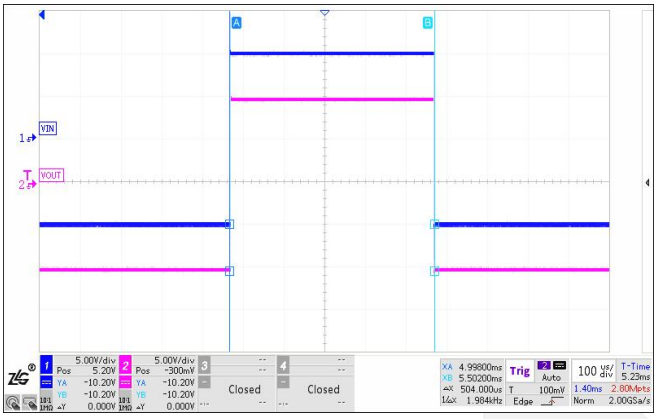
Figure 9. Positive overload recovery



$+V_S$ = 16 V, $-V_S$ = -16 V, G = -10, R_L = 2 kΩ, C_L = 100 pF,

V_{IN} = 3.8 Vpp at -1.9 V_{BIAS}

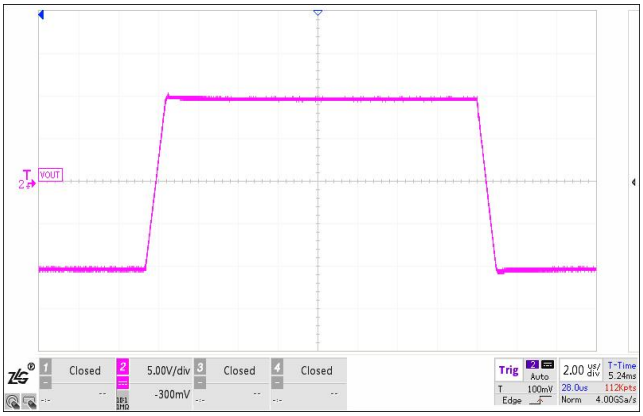
Figure 10. Negative overload recovery



$+V_S$ = 16 V, $-V_S$ = -16 V, G = 1, R_L= 2 kΩ, C_L = 100 pF

V_{IN} = 20 Vpp at 1 kHz, 0 V_{BIAS}

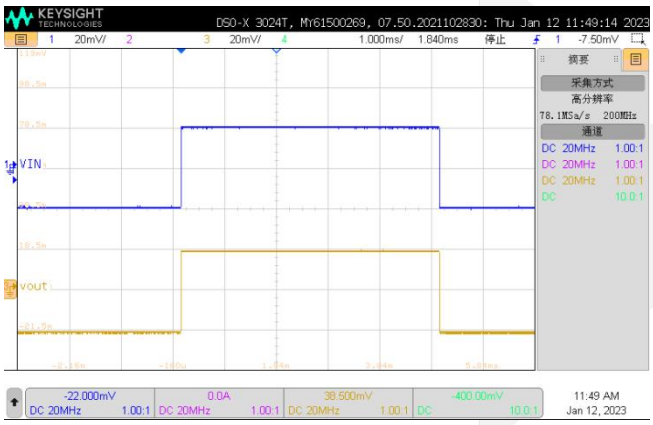
Figure 11. Signal step response



$+V_S$ = 16 V, $-V_S$ = -16 V, G = 1, R_L = 2 kΩ, C_L = 100 pF

V_{IN} = 20 Vpp at 30 kHz, 0 V_{BIAS}

Figure 12. Signal step response



$+V_S$ = 16 V, $-V_S$ = -16 V, G = 1, C_L = 100 pF, R_L= 2 kΩ,

40 mVpp at 0 V_{BIAS}, 100 Hz

Figure 13. Small-signal response

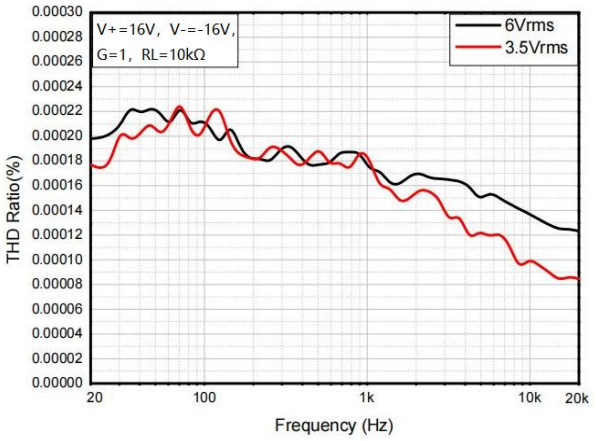


Figure 14. THD ratio vs. Frequency

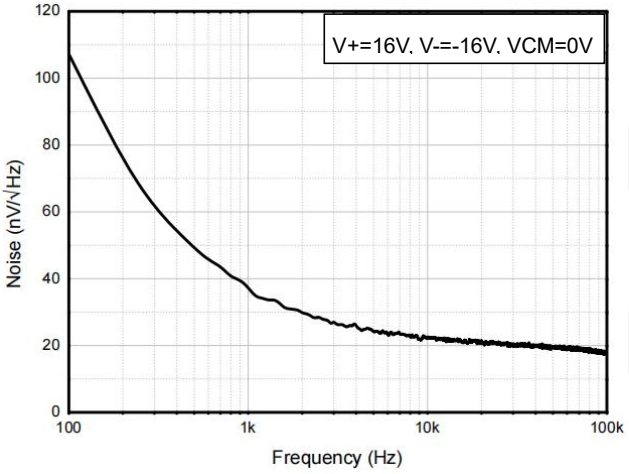
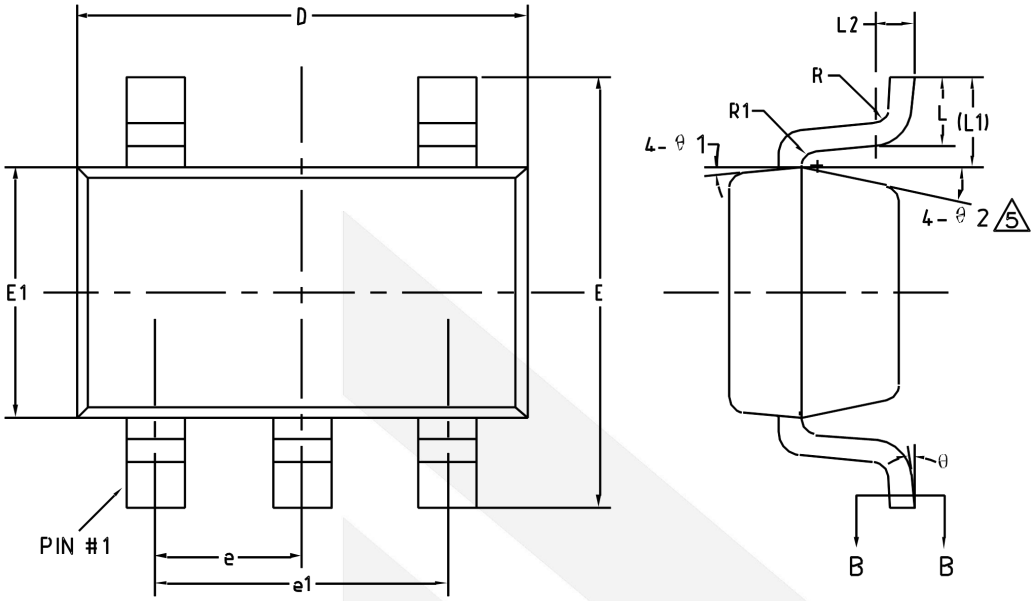
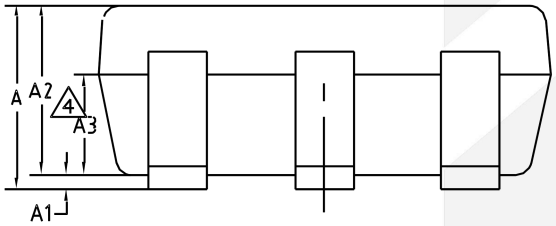
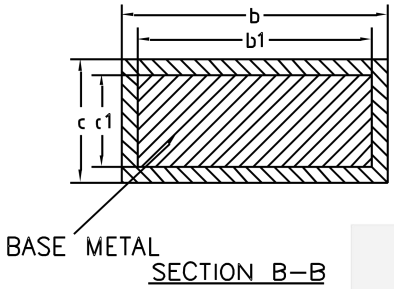


Figure 15. Voltage noise spectral density vs. Frequency

Physical Dimensions: SOT23-5

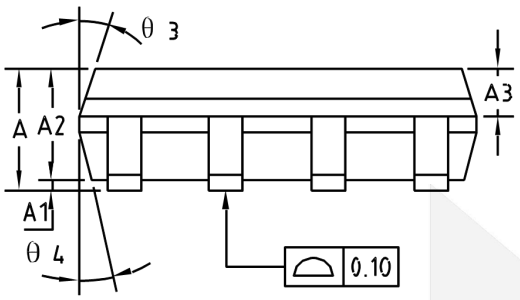


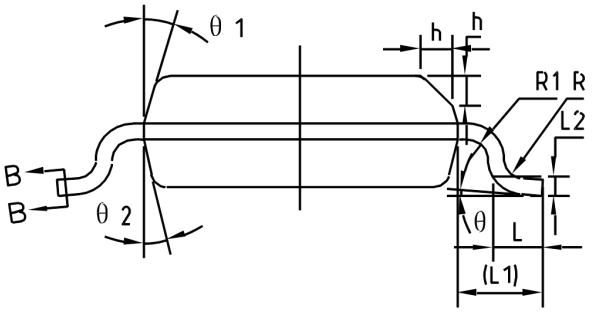


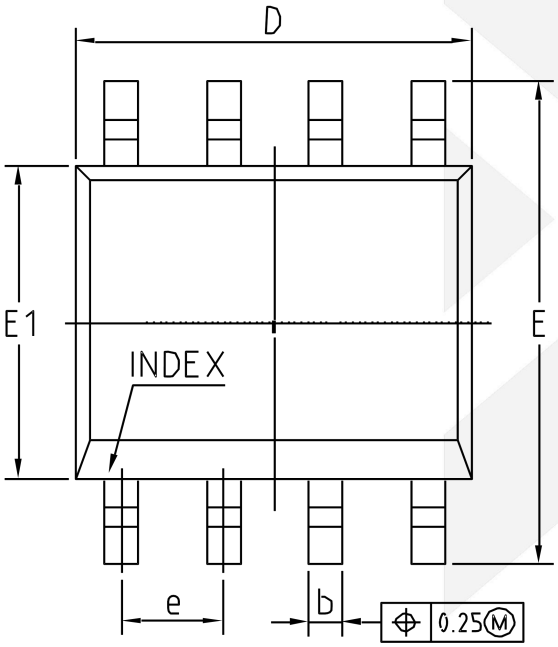


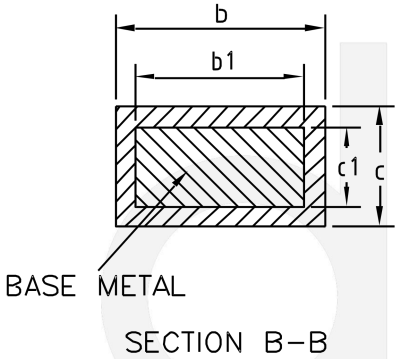
Common Dimensions (Units of measure = Milimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L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

Physical Dimensions: SOIC-8



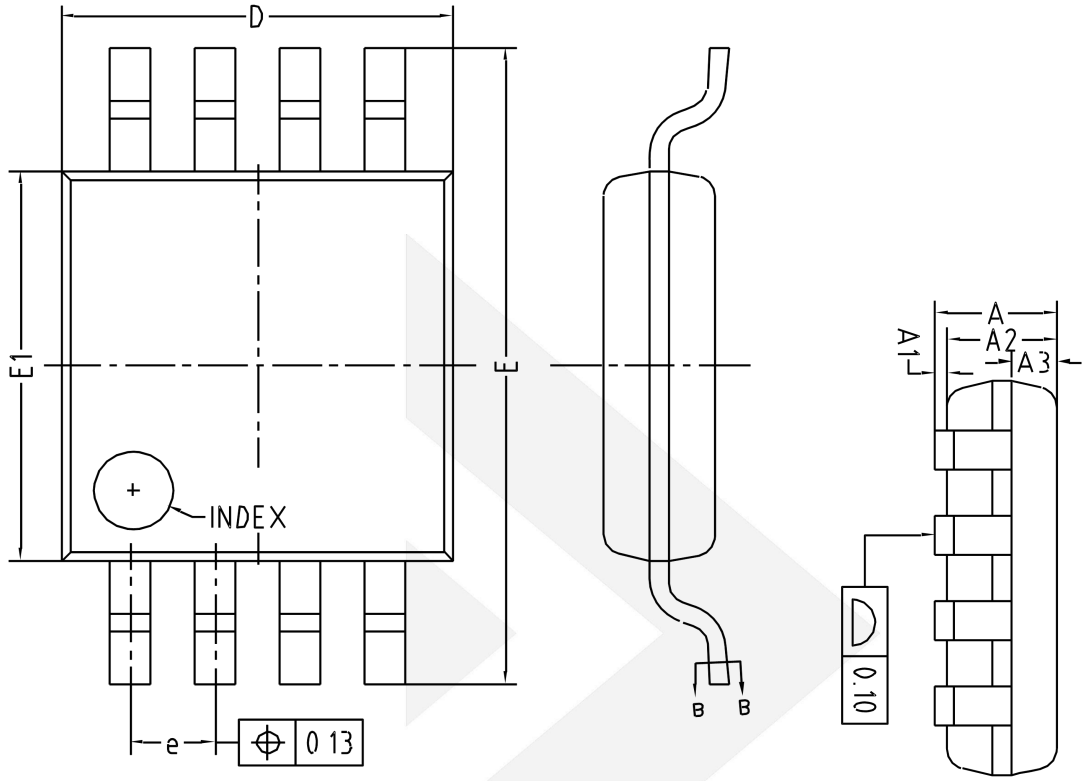


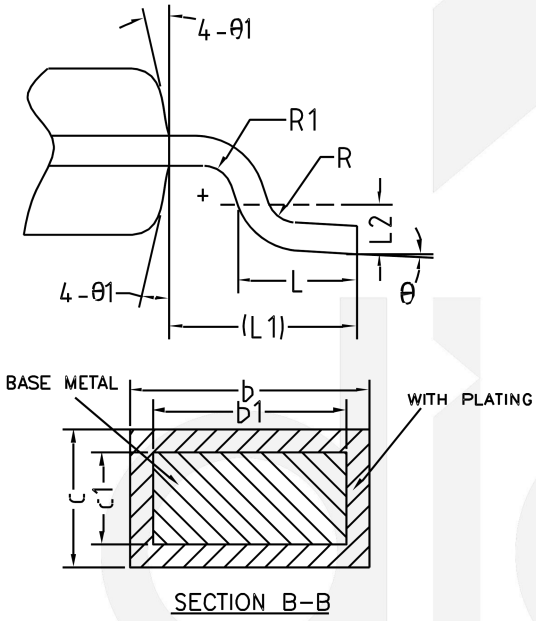




Common Dimensions (Units of measure = mm)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
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°

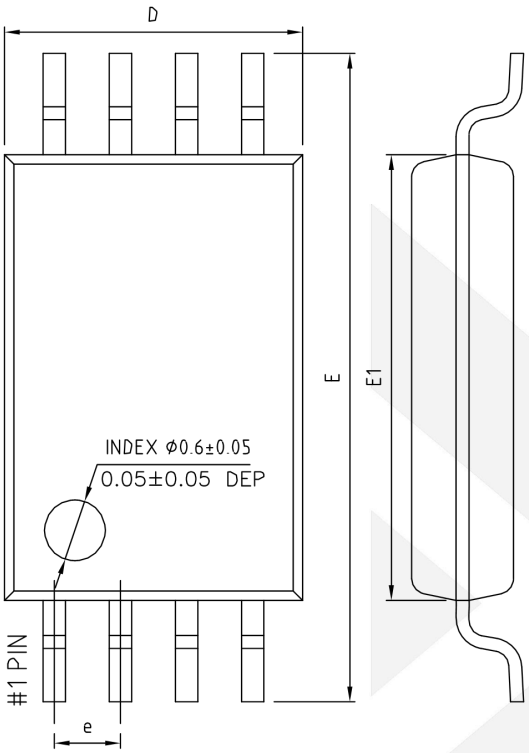
Physical Dimensions: MSOP-8

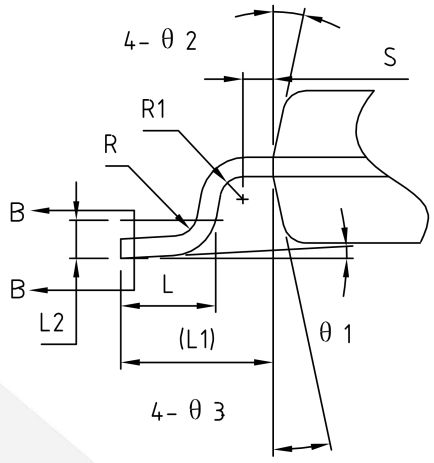


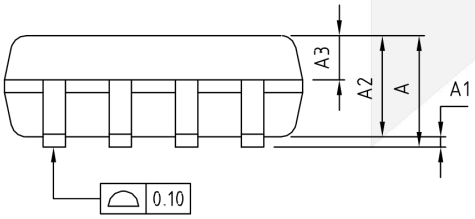


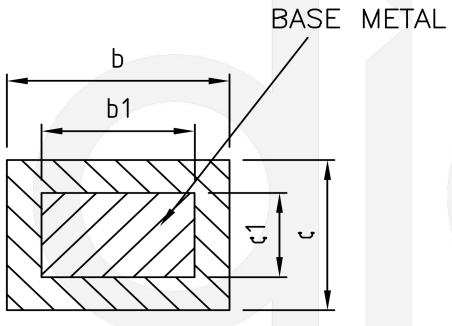
Common Dimensions (Units of measure = mm)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.10
A1	0	-	0.15
A2	0.75	0.85	0.95
A3	0.25	0.35	0.39
b	0.28	-	0.37
b1	0.27	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.40	0.60	0.80
L1		0.95REF	
L2		0.25BSC	
R	0.07	-	-
R1	0.07	-	-
Θ	0°	-	8°
Θ1	9°	12°	15°

Physical Dimensions: TSSOP-8





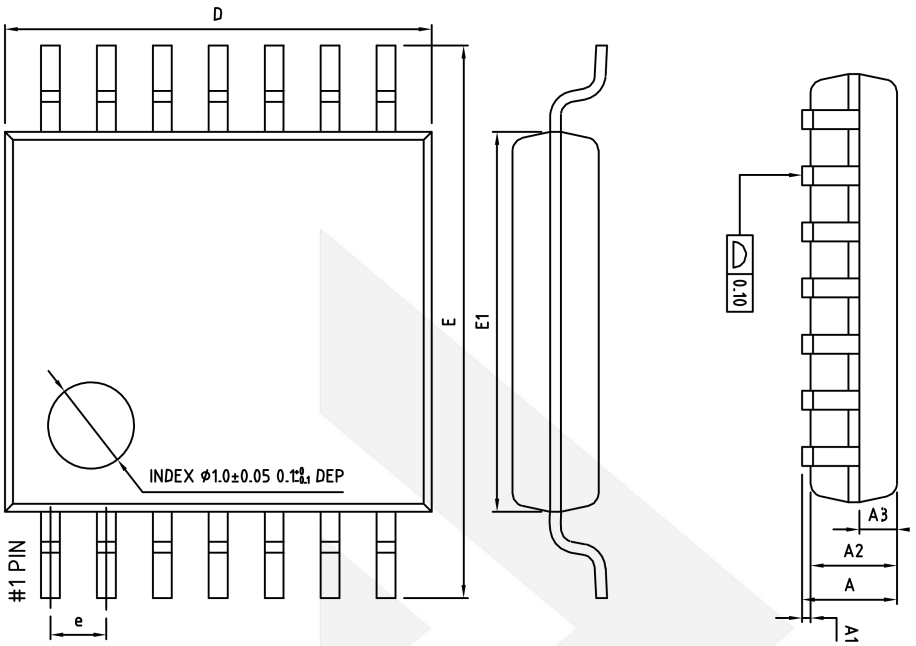


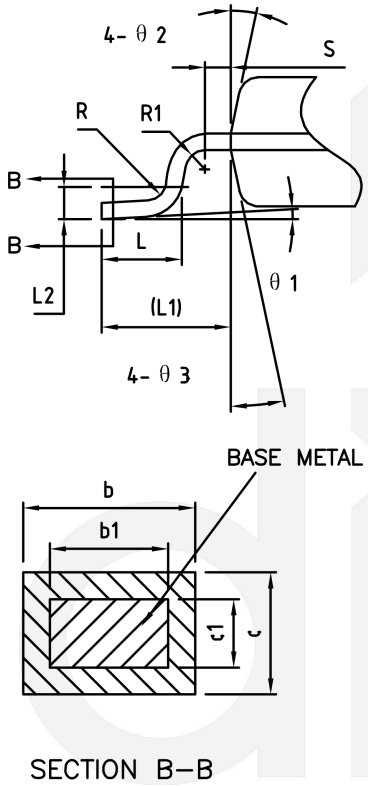


SECTION B–B

Common Dimensions (Units of measure = mm)			
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	0.65BSC		
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°

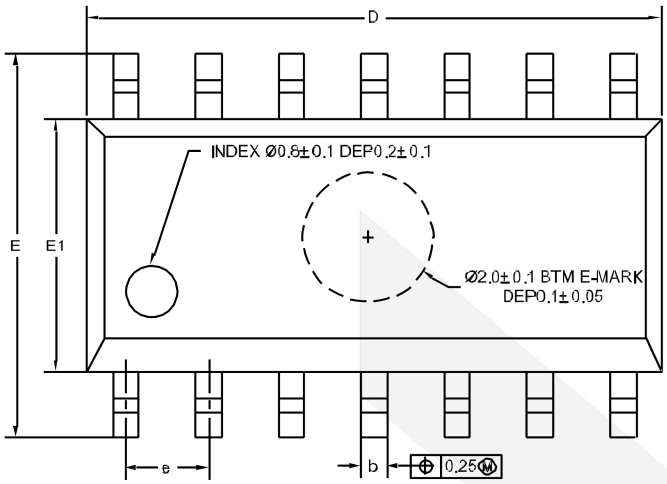
Physical Dimensions: TSSOP-14

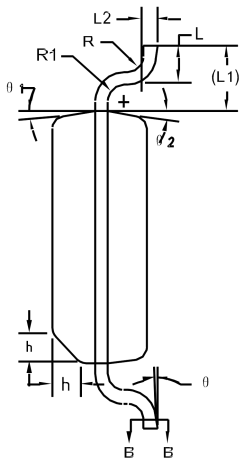


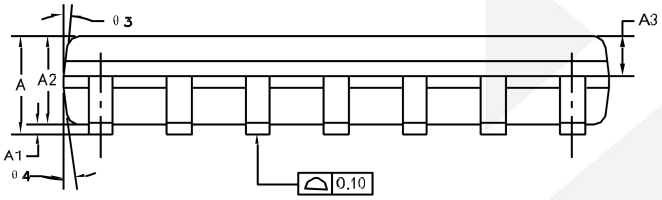


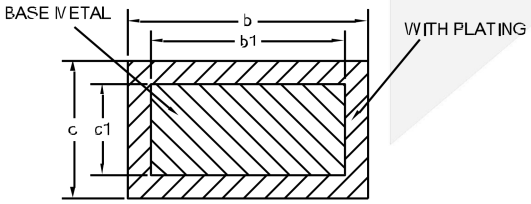
Common Dimensions (Units of measure = mm)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e		0.65BSC	
L	0.45	0.60	0.75
L1		1.00REF	
L2		0.25BSC	
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
Θ1	0°	-	8°
Θ2	10°	12°	14°
Θ3	10°	12°	14°

Physical Dimensions: SOP-14









SECTION B-B

Common Dimensions (Units of measure = mm)			
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°

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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