

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 $V_S = 32\text{ V}$
 - 1.4mA/channel at $V_S = 4.5\text{ V}$
- Input voltage range: $-0.1 \sim (+V_S - 1.5)\text{ V}$
- Low offset voltage: 3.5 mV (max)
- Rail-to-rail output: $-V_S \sim +V_S$
- 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

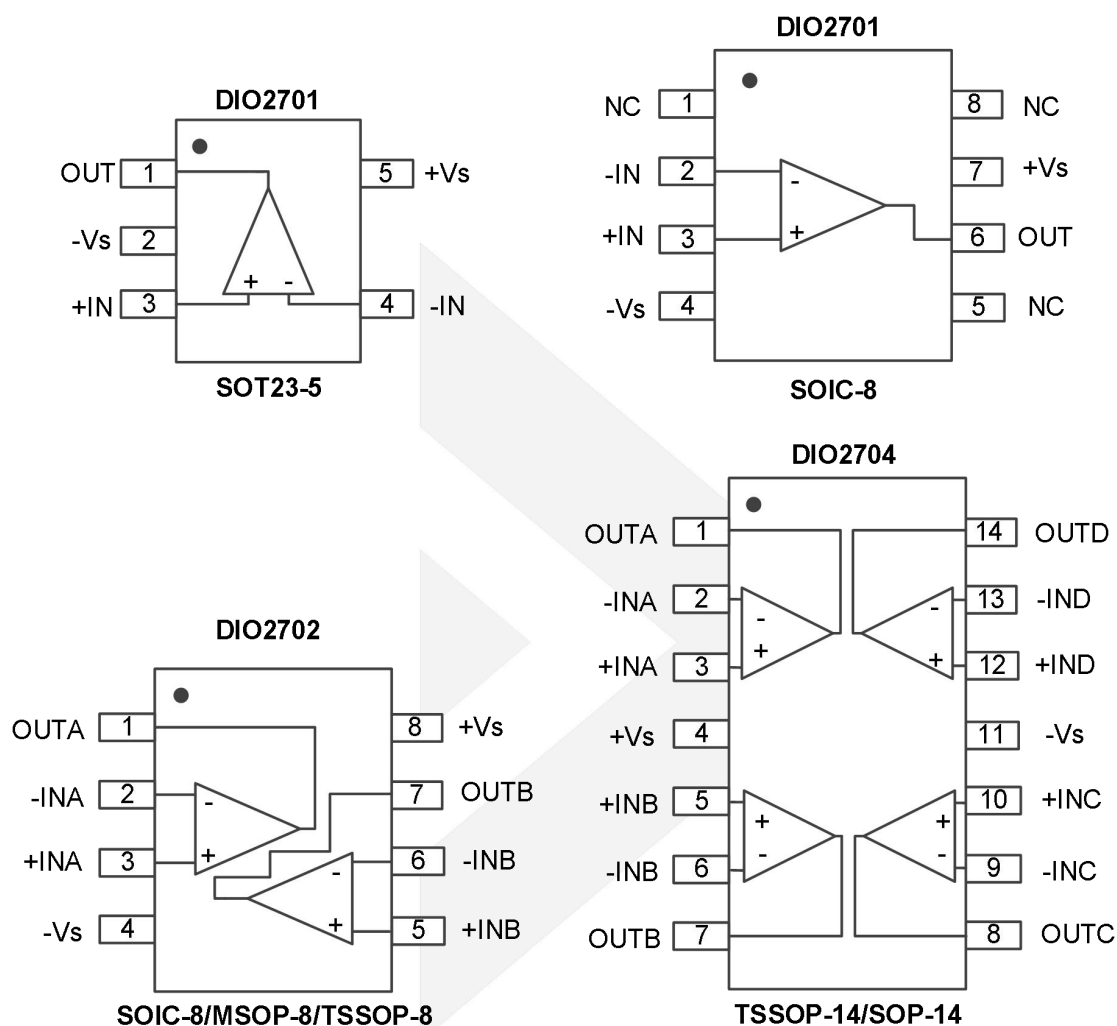


Figure 1. Pin assignment (Top view)

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: $T_A = 25^\circ\text{C}$, $+V_S = 30\text{ V}$, $-V_S = 0\text{ V}$, $R_L = 10\text{ k}\Omega$, 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
ΔV _{OS} /ΔT	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

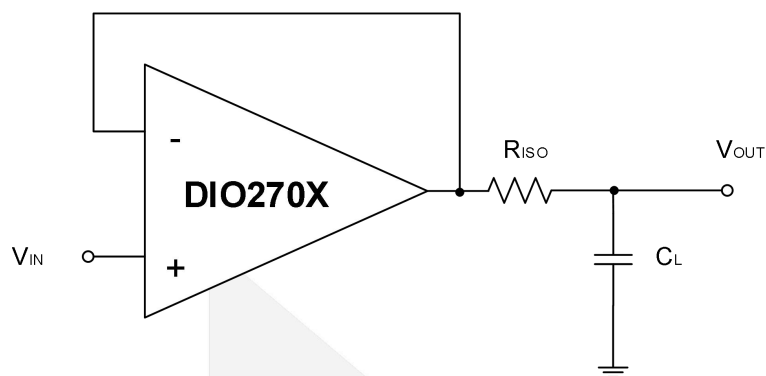


Figure 2. Indirectly driving heavy capacitive load

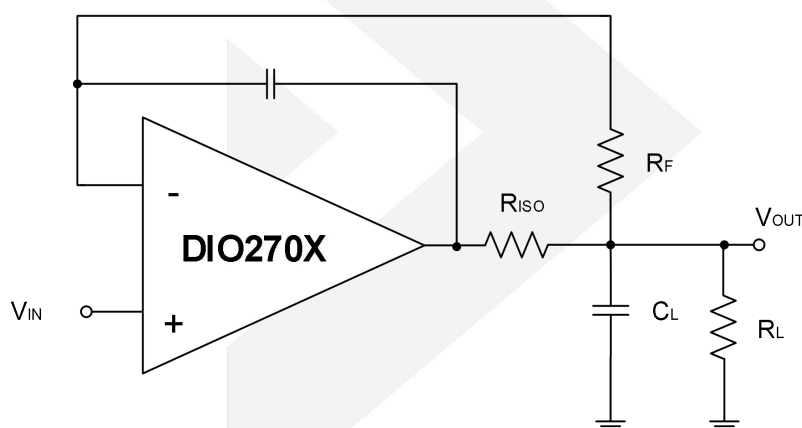


Figure 3. Indirectly driving heavy capacitive load with DC accuracy

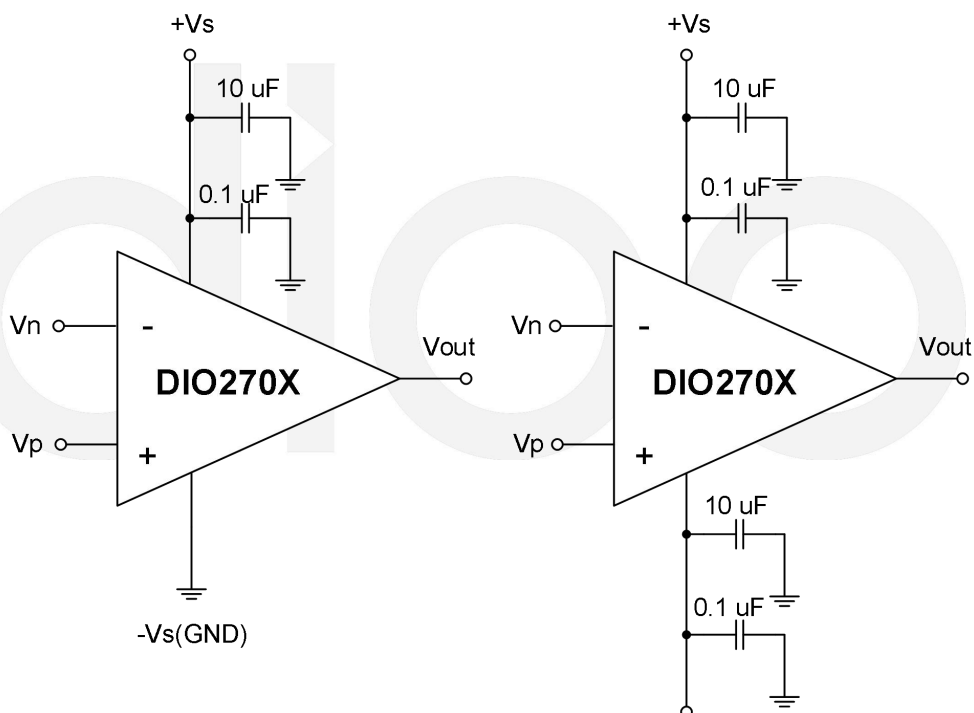


Figure 4. Amplifier with bypass capacitors

Typical Performance Characteristics

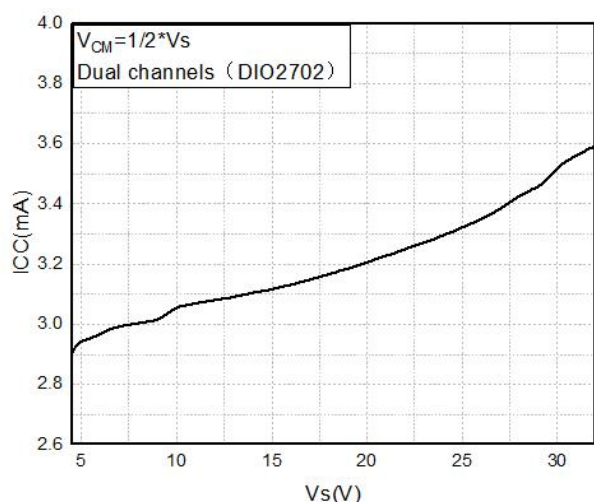


Figure 5. Quiescent current vs. Supply voltage

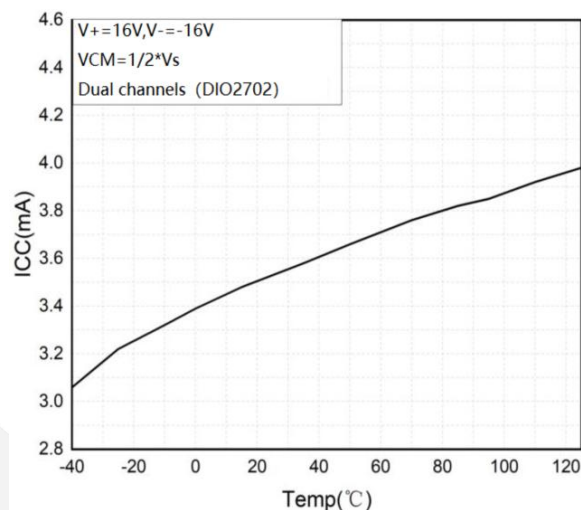


Figure 6. Quiescent current vs. Temperature

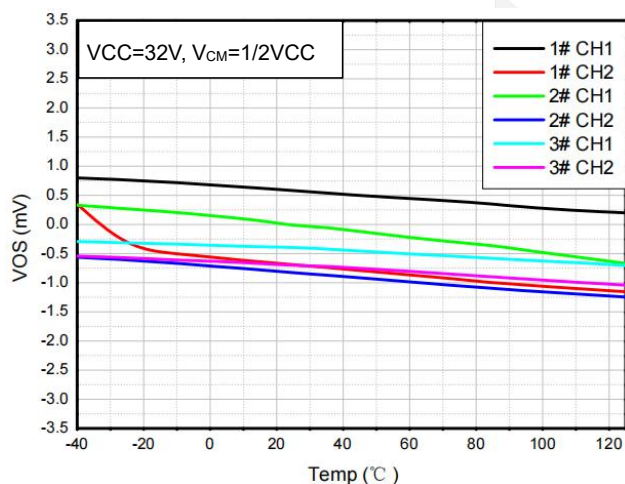


Figure 7. Vos vs. Temperature

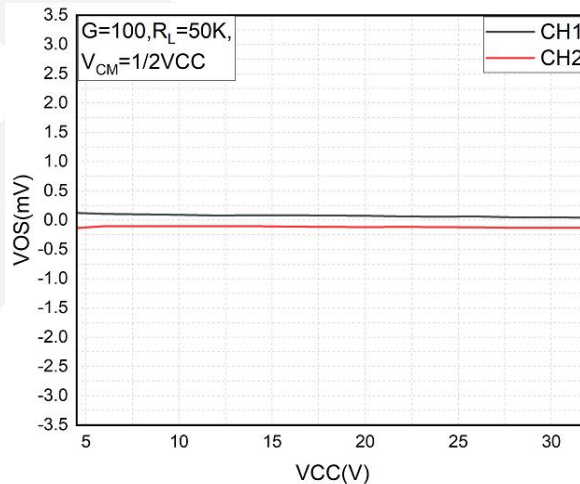
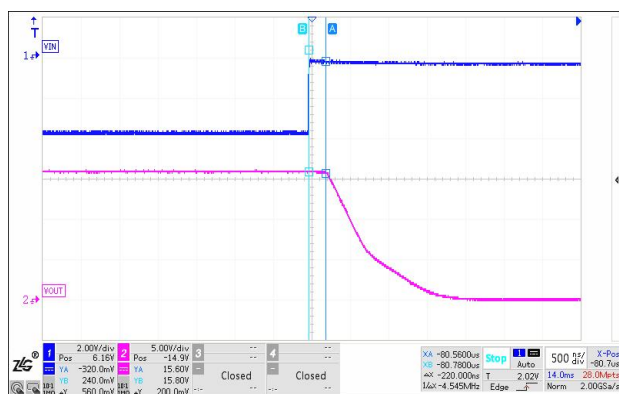
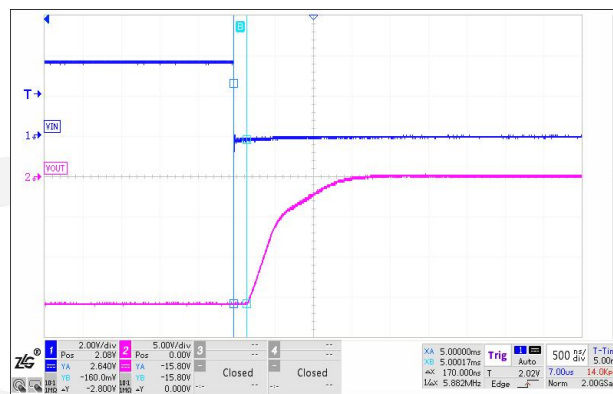


Figure 8. Vos vs. VCC



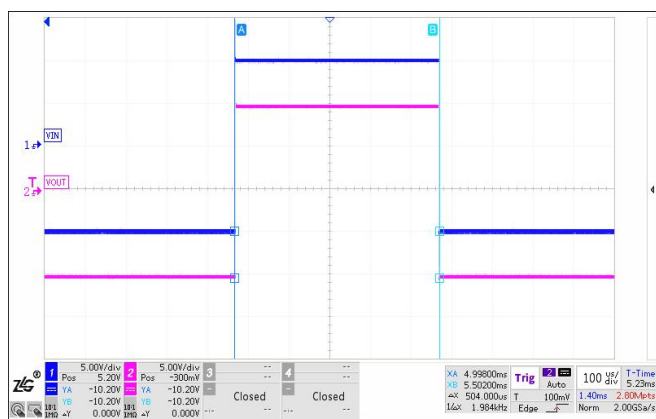
+Vs = 16 V, -Vs = -16 V, G = -10, RL = 2 kΩ, CL = 100 pF,
VIN = 3.8 Vpp at 1.9 VBIAS

Figure 9. Positive overload recovery



+Vs = 16 V, -Vs = -16 V, G = -10, RL = 2 kΩ, CL = 100 pF,
VIN = 3.8 Vpp at -1.9 VBIAS

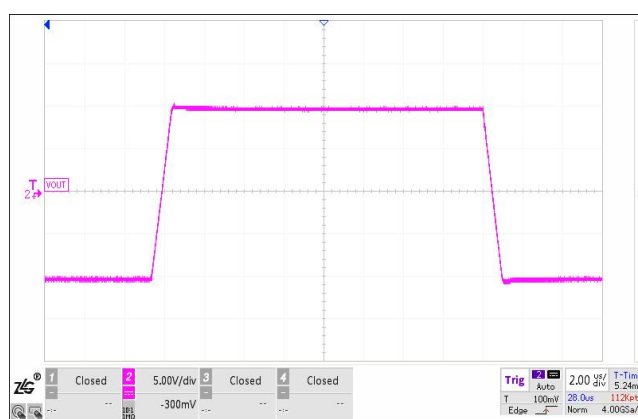
Figure 10. Negative overload recovery



$+V_S = 16\text{ V}$, $-V_S = -16\text{ V}$, $G = 1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$

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

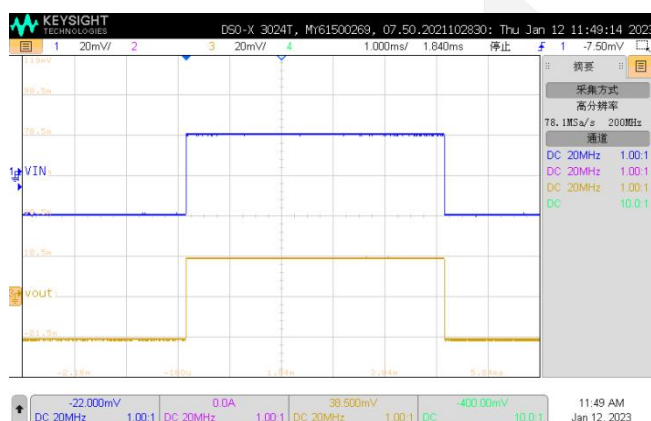
Figure 11. Signal step response



$+V_S = 16\text{ V}$, $-V_S = -16\text{ V}$, $G = 1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$

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

Figure 12. Signal step response



$+V_S = 16\text{ V}$, $-V_S = -16\text{ V}$, $G = 1$, $C_L = 100\text{ pF}$, $R_L = 2\text{ k}\Omega$,

40 mVpp at 0 V_{BIAS} , 100 Hz

Figure 13. Small-signal response

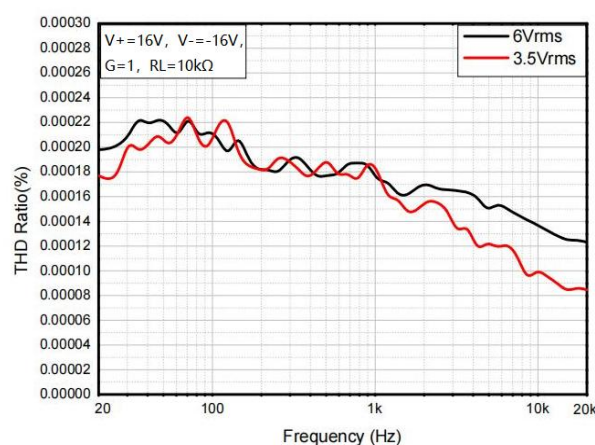


Figure 14. THD ratio vs. Frequency

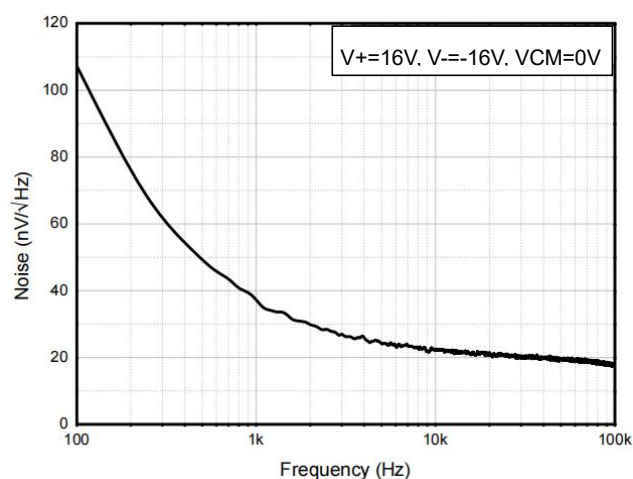
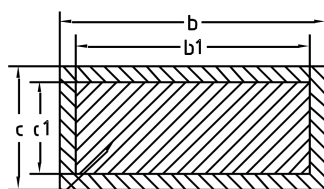
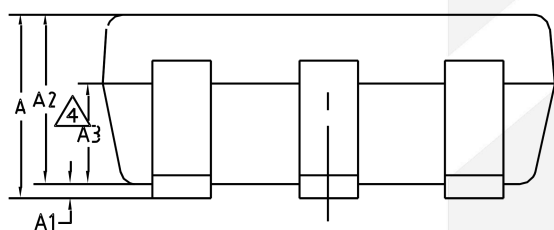
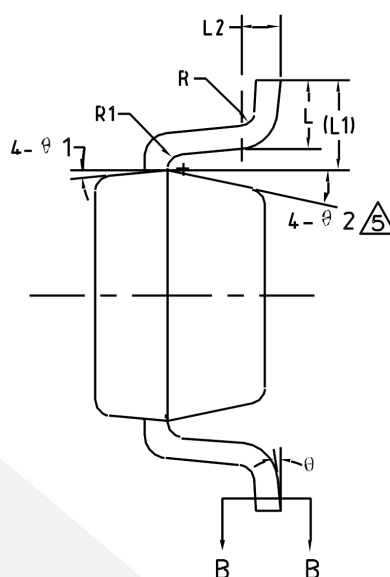
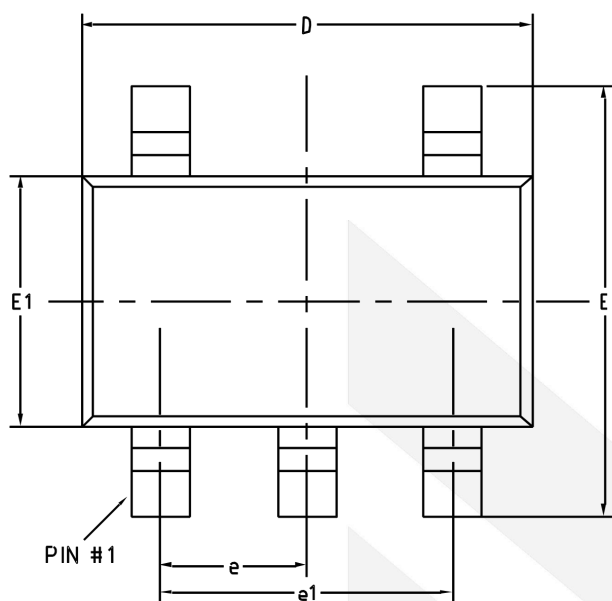


Figure 15. Voltage noise spectral density vs. Frequency

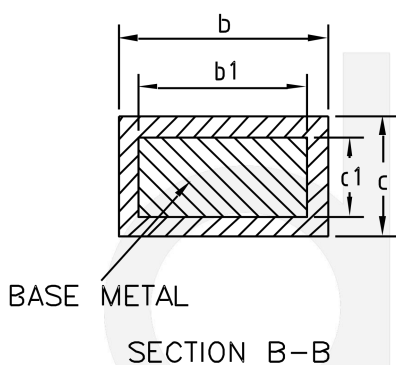
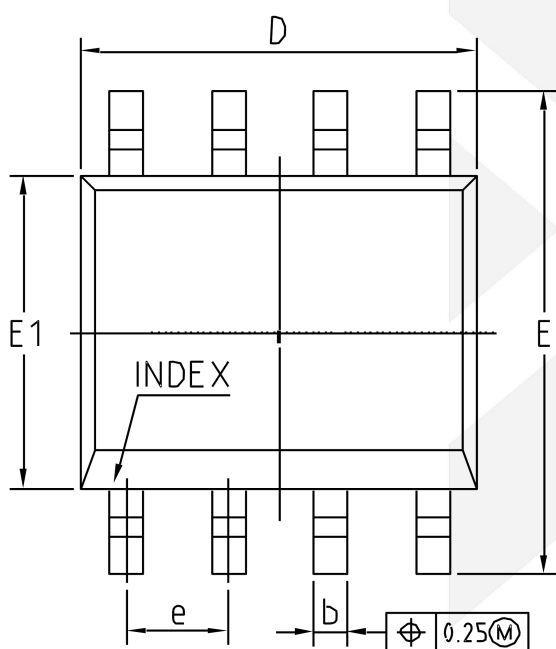
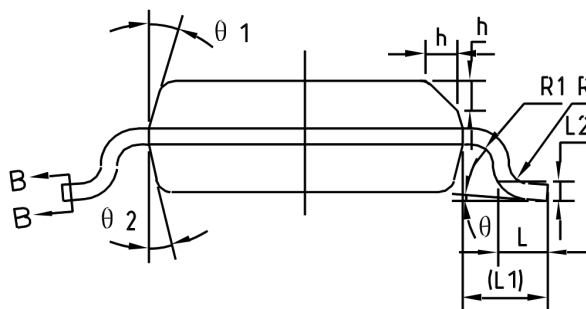
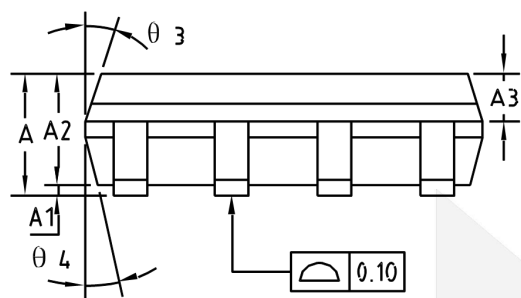
Physical Dimensions: SOT23-5



BASE METAL
SECTION B-B

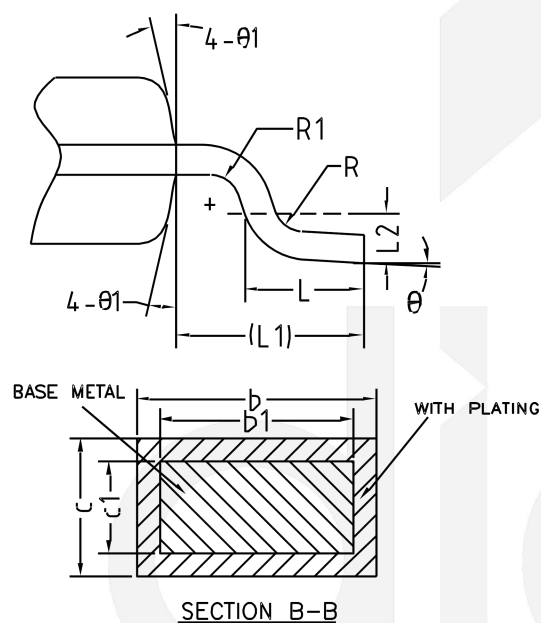
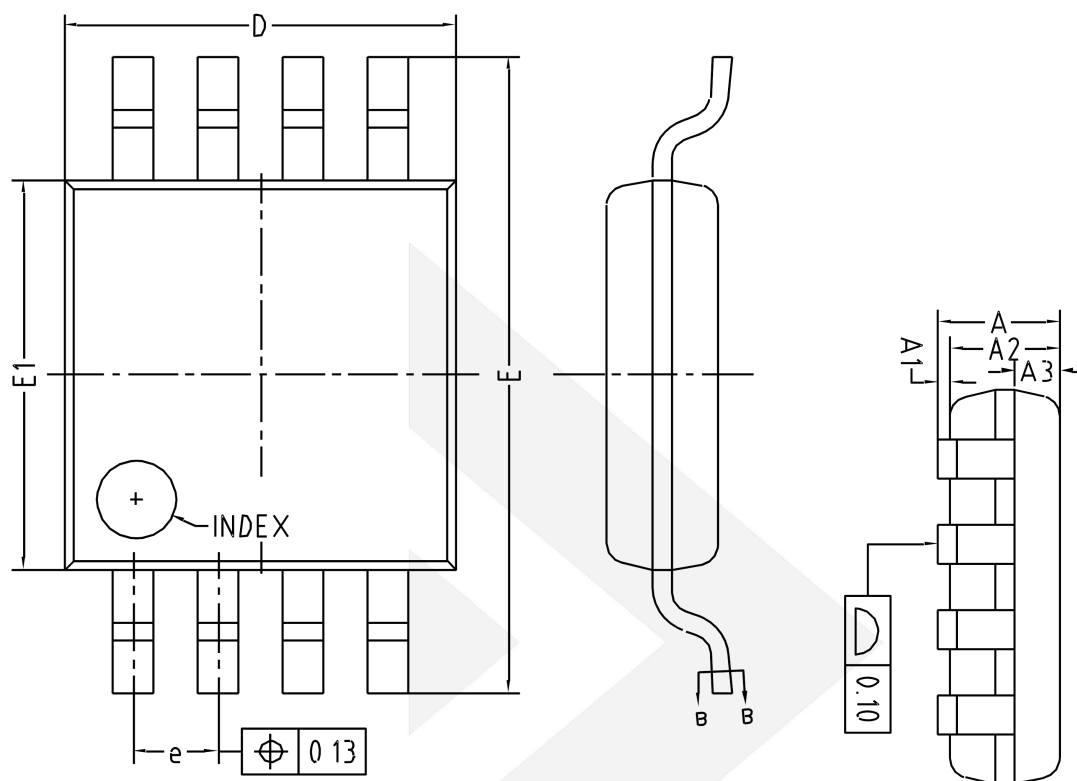
Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
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



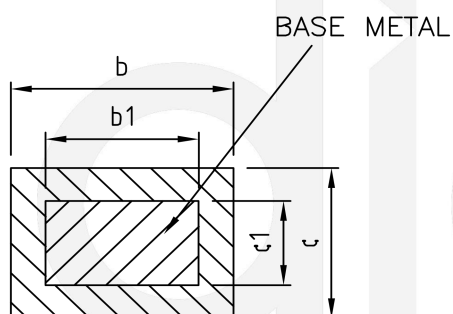
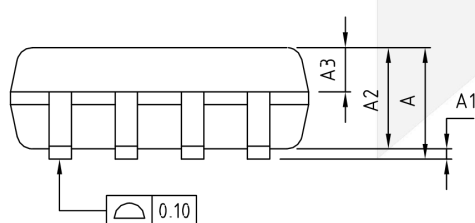
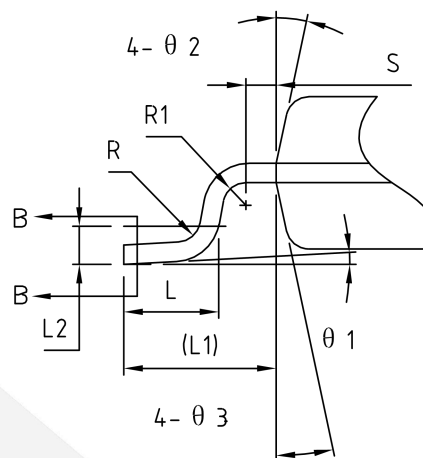
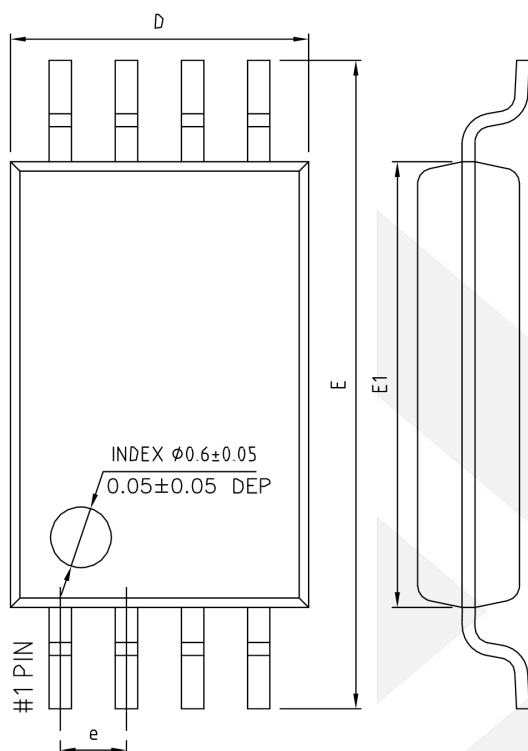
Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
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°

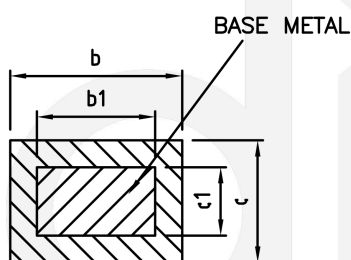
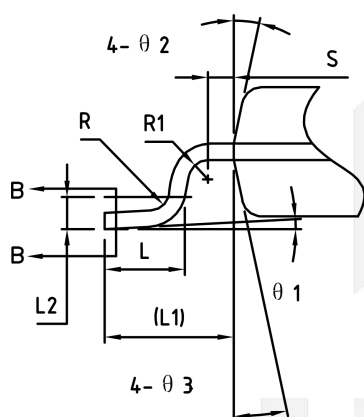
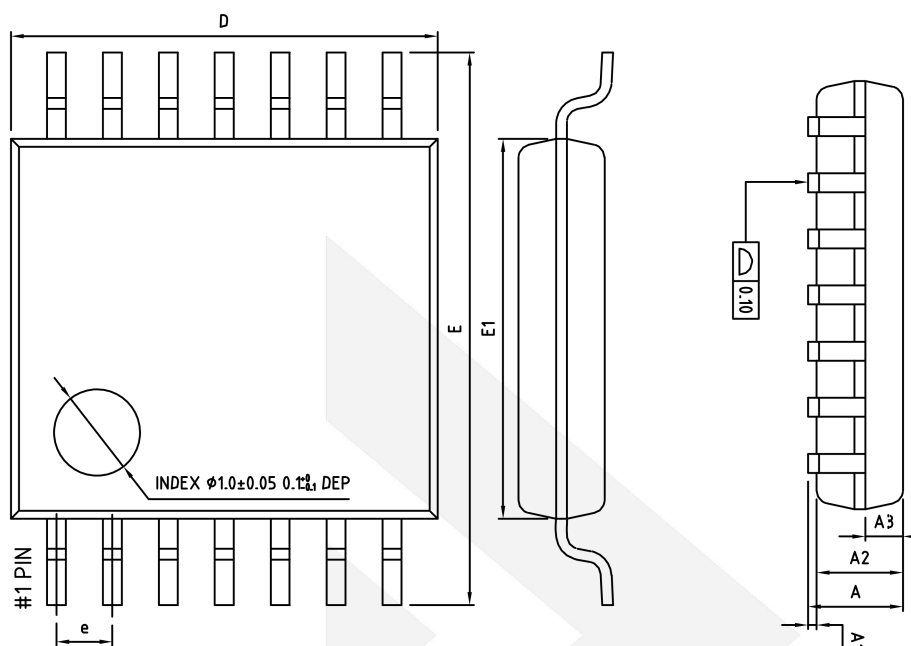
Physical Dimensions: TSSOP-8



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°

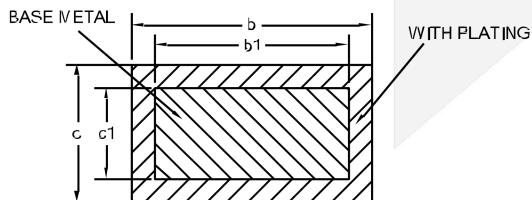
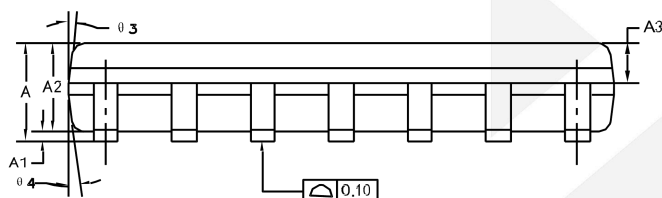
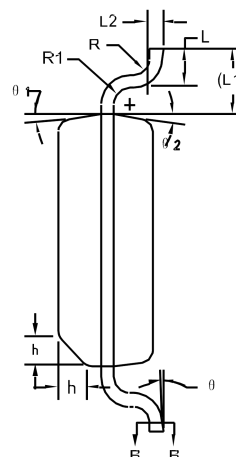
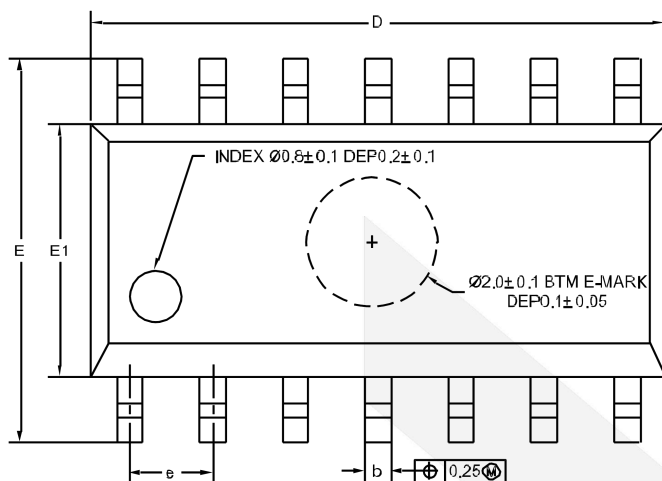
Physical Dimensions: TSSOP-14



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	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
Ø	0°	-	8°
Ø1	6°	8°	10°
Ø2	6°	8°	10°
Ø3	5°	7°	9°
Ø4	5°	7°	9°

CONTACT US

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