REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Prepared in accordance with ASME Y14.24

Vendor item drawing

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PMIC N/A	**PREPARED BY** RICK OFFICER	**DLA LAND AND MARITIME** **COLUMBUS, OHIO 43218-3990** **http://www.landandmaritime.dla.mil/**
Original date of drawing YY-MM-DD 16-06-03	**CHECKED BY** RAJESH PITHADIA	**TITLE** MICROCIRCUIT, LINEAR, PRECISION INSTRUMENTATION AMPLIFIER, MONOLITHIC SILICON
	APPROVED BY CHARLES F. SAFFLE	
	SIZE **A** / **CODE IDENT. NO.** **16236**	**DWG NO.** **V62/16619**
	REV	**PAGE** 1 **OF** 13

AMSC N/A

5962-V081-16

1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance precision instrumentation amplifier microcircuit, with an operating temperature range of -55°C to +125°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturer's PIN is the item of identification. The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation:

V62/16619	-	01	X	E
Drawing number		Device type (See 1.2.1)	Case outline (See 1.2.2)	Lead finish (See 1.2.3)

1.2.1 Device type(s).

Device type	Generic	Circuit function
01	AD8221-EP	Precision instrumentation amplifier

1.2.2 Case outline(s). The case outline(s) are as specified herein.

Outline letter	Number of pins	JEDEC PUB 95	Package style
X	8	MO-187-AA	Micro small outline

1.2.3 Lead finishes. The lead finishes are as specified below or other lead finishes as provided by the device manufacturer:

Finish designator	Material
A	Hot solder dip
B	Tin-lead plate
C	Gold plate
D	Palladium
E	Gold flash palladium
Z	Other

1.3 Absolute maximum ratings. 1/

Supply voltage range (V_S) ..... ±18 V
Internal power dissipation (P_D) ..... 200 mW
Output short circuit current ..... Indefinite
Input voltage (common mode) ..... $\pm V_S$
Differential input voltage ..... $\pm V_S$
Storage temperature range (T_{STG}) ..... -65°C to +150°C
Junction temperature range (T_J) ..... +150°C
Thermal resistance, junction to ambient (θ_{JA}) ..... 135°C/W

1/ 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 conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

1.4 Recommended operating conditions. 2/

Supply voltage range (V_S) ..... ±15 V
Operating free-air temperature range (T_A) ..... -55°C to +125°C

2. APPLICABLE DOCUMENTS

JEDEC Solid State Technology Association

JEDEC PUB 95 – Registered and Standard Outlines for Semiconductor Devices

(Copies of these documents are available online at http:/www.jedec.org or from JEDEC – Solid State Technology Association, 3103 North 10th Street, Suite 240–S, Arlington, VA 22201-2107).

3. REQUIREMENTS

3.1 Marking. Parts shall be permanently and legibly marked with the manufacturer's part number as shown in 6.3 herein and as follows:

A. Manufacturer's name, CAGE code, or logo
B. Pin 1 identifier
C. ESDS identification (optional)

3.2 Unit container. The unit container shall be marked with the manufacturer's part number and with items A and C (if applicable) above.

3.3 Electrical characteristics. The maximum and recommended operating conditions and electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.4 Design, construction, and physical dimension. The design, construction, and physical dimensions are as specified herein.

3.5 Diagrams.

3.5.1 Case outline. The case outline shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as shown in figure 2.

2/ Use of this product beyond the manufacturers design rules or stated parameters is done at the user's risk. The manufacturer and/or distributor maintain no responsibility or liability for product used beyond the stated limits.

TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Common mode rejection ratio (CMRR)							
CMRR DC to 60 Hz with 1 kΩ source imbalance		G = 1, V_{CM} = -10 V to +10 V	25°C	01	80		dB
		G = 10, V_{CM} = -10 V to +10 V			100		
		G = 100, V_{CM} = -10 V to +10 V			120		
		G = 1000, V_{CM} = -10 V to +10 V			130		
CMRR at 10 kHz		G = 1, V_{CM} = -10 V to +10 V	25°C	01	80		dB
		G = 10, V_{CM} = -10 V to +10 V			90		
		G = 100, V_{CM} = -10 V to +10 V			100		
		G = 1000, V_{CM} = -10 V to +10 V			100		
Noise		RTI noise = $\sqrt{(e_{NI}^2 + (e_{NO}/G)^2)}$ 3/					
Voltage noise, 1 kHz							
Input voltage noise	e_{NI}	V_{IN+}, V_{IN-}, V_{REF} = 0	25°C	01		8	nV / $\sqrt{Hz}$
Output voltage noise	e_{NO}	V_{IN+}, V_{IN-}, V_{REF} = 0	25°C	01		75	nV / $\sqrt{Hz}$
Referred to input (RTI)		G = 1, f = 0.1 Hz to 10 Hz	25°C	01	2 typical		μVp-p
		G = 10, f = 0.1 Hz to 10 Hz			0.5 typical		
		G = 100 to 1000, f = 0.1 Hz to 10 Hz			0.25 typical		
Current noise		f = 1 kHz	25°C	01	40 typical		fA / $\sqrt{Hz}$
		f = 0.1 Hz to 10 Hz			6 typical		pAp-p

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Voltage offset 4/							
Input offset	V_{OSI}	V_S = ±5 V to ±15 V	25°C	01		70	µV
			-55°C to +125°C			150	
Input offset average temperature coefficient	TC		-55°C to +125°C	01		0.9	µV/°C
Output offset	V_{OSO}	V_S = ±5 V to ±15 V	25°C	01		600	µV
			-55°C to +125°C			1.2	mV
Output offset average temperature coefficient	TC		-55°C to +125°C	01		9	µV/°C
Offset RTI versus supply (PSR)		G = 1, V_S = ±2.3 V to ±18 V	25°C	01	90		dB
					100 typical		
		G = 10, V_S = ±2.3 V to ±18 V			100		
					120 typical		
		G = 100, V_S = ±2.3 V to ±18 V			120		
					140 typical		
		G = 1000, V_S = ±2.3 V to ±18 V			120		
					140 typical		
Input current							
Input bias current	I_{IB}		25°C	01		2	nA
					0.5 typical		
			-55°C to +125°C			3.75	
Input bias current average temperature coefficient	TC		-55°C to +125°C	01	11 typical		pA/°C

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Input current – continued.							
Input offset current	I_{IO}		25°C	01		1	nA
					0.3 typical		
			-55°C to +125°C			2.25	
Input offset current average temperature coefficient	TC		-55°C to +125°C	01	7 typical		pA/°C
Reference input							
Input resistance	R_{IN}		25°C	01	20 typical		kΩ
Input current	I_{IN}	V_{IN+}, V_{IN-}, V_{REF} = 0	25°C	01		60	μA
					50 typical		
Voltage range			25°C	01	$-V_S$	$+V_S$	V
Gain to output			25°C	01	1 ± 0.0001 typical		V/V
Power supply							
Operating range		V_S = ±2.3 V to ±18 V	25°C	01	±2.3	±18	V
Quiescent current	I_Q		25°C	01		1	mA
					0.9 typical		
			-55°C to +125°C			1.2	
					1 typical		

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Dynamic response.							
Small signal –3 dB bandwidth	SSBW	G = 1	25°C	01	825 typical		kHz
		G = 10			562 typical		
		G = 100			100 typical		
		G = 1000			14.7 typical		
Settling time 0.01%	t_S	10 V step, G = 1 to 100	25°C	01	10 typical		µs
		10 V step, G = 1000			80 typical		
Settling time 0.001%	t_S	10 V step, G = 1 to 100	25°C	01	13 typical		µs
		10 V step, G = 1000			110 typical		
Slew rate	SR	G = 1	25°C	01	1.5		V/µs
					2 typical		
		G = 5 to 100			2		
					2.5 typical		
Gain		G = 1 + (49.4 kΩ/R_G)					
Gain range			25°C	01	1	1000	V/V
Gain error		G = 1, V_{OUT} = ±10 V	25°C	01		0.1	%
		G = 10, V_{OUT} = ±10 V				0.3	
		G = 100, V_{OUT} = ±10 V				0.3	
		G = 1000, V_{OUT} = ±10 V				0.3	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Gain - continued.							
Gain nonlinearity		G = 1 to 10, R_L = 10 kΩ, V_{OUT} = -10 V to +10 V	25°C	01		15	ppm
					5 typical		
		G = 100, R_L = 10 kΩ, V_{OUT} = -10 V to +10 V				20	
					7 typical		
		G = 1000, R_L = 10 kΩ, V_{OUT} = -10 V to +10 V				50	
					10 typical		
		G = 1 to 100, R_L = 2 kΩ, V_{OUT} = -10 V to +10 V				100	
					15 typical		
Gain versus temperature		G = 1	25°C	01		10	ppm/°C
					3 typical		
		G > 1 3/				-50	
Input							
Differential input impedance		5/	25°C	01	100||2 typical		GΩ||pF
Common mode input impedance		5/	25°C	01	100||2 typical		GΩ||pF
Input operating 6/ voltage range		V_S = ±2.3 V to ±5 V	25°C	01	$-V_S$ + 1.9	$+V_S$ – 1.1	V
			-55°C to +125°C		$-V_S$ + 2.0	$+V_S$ – 1.2	
Input operating voltage range		V_S = ±5 V to ±18 V	25°C	01	$-V_S$ + 1.9	$+V_S$ – 1.2	V
			-55°C to +125°C		$-V_S$ + 2.0	$+V_S$ – 1.3	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions 2/	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Output		R_L = 10 kΩ					
Output swing		V_S = ±2.3 V to ±5 V	25°C	01	$-V_S$ + 1.1	$+V_S$ – 1.2	V
			-55°C to +125°C		$-V_S$ + 1.4	$+V_S$ – 1.3	
Output swing		V_S = ±5 V to ±18 V	25°C	01	$-V_S$ + 1.2	$+V_S$ – 1.4	V
			-55°C to +125°C		$-V_S$ + 1.6	$+V_S$ – 1.5	
Short circuit current	I_{OS}		25°C	01	18 typical		mA
Temperature range specified performance				01	-55	+125	°C

1/ Testing and other quality control techniques are used to the extent deemed necessary to assure product performance over the specified temperature range. Product may not necessarily be tested across the full temperature range and all parameters may not necessarily be tested. In the absence of specific parametric testing, product performance is assured by characterization and/or design.

2/ Unless otherwise specified, V_S = ±15 V, V_{REF} = 0 V, G = 1, and R_L = 2 kΩ.

3/ Does not include the effects of external resistor R_G.

4/ Total RTI V_{OS} = (V_{OSI}) + (V_{OSO}/G).

5/ The || symbolizes that the input impedance is being represented as the resistance value is in parallel with the capacitance.

6/ One input grounded. G = 1.

Case X

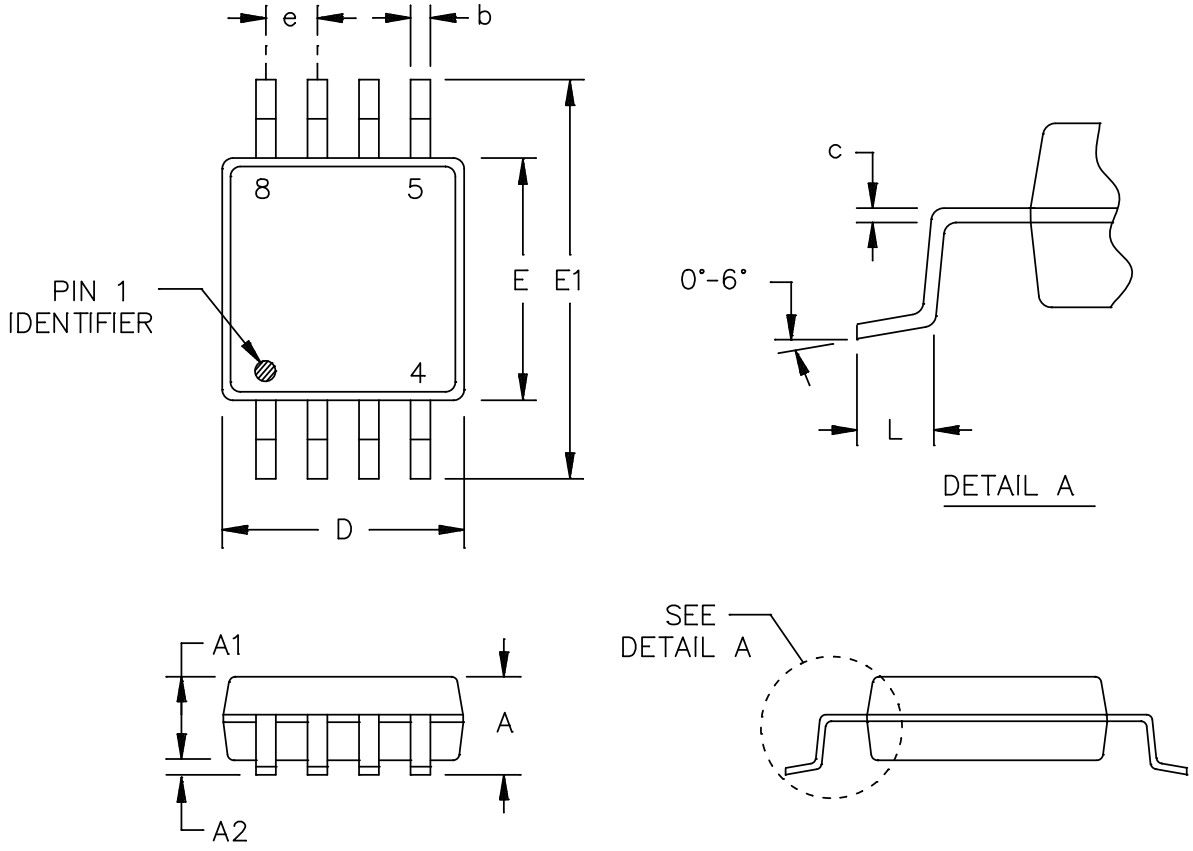

FIGURE 1. Case outline.

DLA LAND AND MARITIME COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/16619
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Case X

Symbol	Dimensions					
	Inches			Millimeters		
	Minimum	Medium	Maximum	Minimum	Medium	Maximum
A	---	---	.043	---	---	1.10
A1	.029	.033	.037	0.75	0.85	0.95
A2	.001	---	0.006	0.05	---	0.15
b	.010	---	.015	0.25	---	0.40
c	.003	---	.009	0.09	---	0.23
D	.110	.118	.125	2.80	3.00	3.20
E	.110	.118	.125	2.80	3.00	3.20
E1	.183	.192	.202	4.65	4.90	5.15
e	0.026 BSC			0.65 BSC		
L	0.015	.021	.031	0.40	0.55	0.80

NOTES:
1. Controlling dimensions are millimeter, inch dimensions are given for reference only.
2. Falls with JEDEC MO-187-AA.

FIGURE 1. Case outline - Continued.

Device type	01	
Case outline	X	
Terminal number	Terminal symbol	Description
1	-IN	Negative input terminal.
2	R_G	Gain settling terminal. Place resistor across the R_G pins to set the gain. G = 1 + (49.4 kΩ/R_G).
3	R_G	Gain settling terminal. Place resistor across the R_G pins to set the gain. G = 1 + (49.4 kΩ/R_G).
4	+IN	Positive input terminal.
5	$-V_S$	Negative power supply terminal.
6	REF	Reference voltage terminal. Drive this terminal with a low impedance voltage source to level shift the output.
7	V_{OUT}	Output terminal.
8	$+V_S$	Positive power supply terminal.

FIGURE 2. Terminal connections.

4. VERIFICATION

4.1 Product assurance requirements. The manufacturer is responsible for performing all inspection and test requirements as indicated in their internal documentation. Such procedures should include proper handling of electrostatic sensitive devices, classification, packaging, and labeling of moisture sensitive devices, as applicable.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Preservation, packaging, labeling, and marking shall be in accordance with the manufacturer's standard commercial practices for electrostatic discharge sensitive devices.

6. NOTES

6.1 ESDS. Devices are electrostatic discharge sensitive and are classified as ESDS class 1 minimum.

6.2 Configuration control. The data contained herein is based on the salient characteristics of the device manufacturer's data book. The device manufacturer reserves the right to make changes without notice. This drawing will be modified as changes are provided.

6.3 Suggested source(s) of supply. Identification of the suggested source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item. DLA Land and Maritime maintains an online database of all current sources of supply at http://www.landandmaritime.dla.mil/Programs/Smcr/.

Vendor item drawing administrative control number 1/	Device manufacturer CAGE code	Mode of transportation and quantity	Vendor part number
V62/16619-01XE	24355	Tray, 50 units	AD8221TRMZ-EP
V62/16619-01XE	24355	7 inch reel, 1000 units	AD8221TRMZ-EP-R7

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.

CAGE code	Source of supply
24355	Analog Devices Route 1 Industrial Park P.O. Box 9106 Norwood, MA 02062 Point of contact: Raheen Business Park Limerick, Ireland