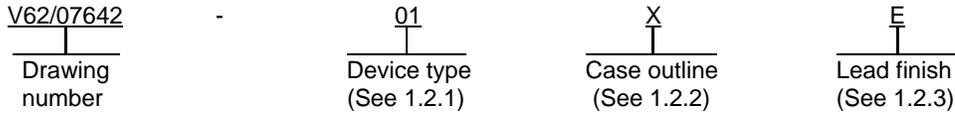


1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance 24 bit, 216 kHz sampling , analog-to-digital converter microcircuit, with an operating temperature range of -40°C to +85°C.

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



1.2.1 Device type(s).

<u>Device type</u>	<u>Generic</u>	<u>Circuit function</u>
01	PCM4202-EP	24 bit, 216 kHz sampling , analog-to-digital converter

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

<u>Outline letter</u>	<u>Number of pins</u>	<u>JEDEC PUB 95</u>	<u>Package style</u>
X	28	MO-150	Plastic surface mount

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

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

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 2

1.3 Absolute maximum ratings. 1/

Supply voltage range:

Analog power supply (V_{CC}) 6.0 V

Digital power supply (V_{DD}) 3.6 V

Ground voltage difference (any AGND to DGND) ±0.1 V

Digital input voltage:

FMT0, FMT1, S/ \overline{M} , FS0, FS1, FS2, SCKI, \overline{RST} , HPFD, BCK, LRCK pins -0.3 V to (V_{DD} + 0.3 V)

Analog input voltage:

V_{INL+}, V_{INL-}, V_{INR+}, V_{INR-} pins -0.3 V to (V_{CC} + 0.3 V)

Input current (any pin except supplies) ±10 mA

Junction temperature range (T_J) +150°C

Operating temperature range (T_A) -40°C to +85°C

Storage temperature range (T_{STG}) -65°C to +150°C

Thermal resistance, junction to ambient (θ_{JC}) 16.0°C/W

Thermal resistance, junction to ambient (θ_{JA}) 92.4°C/W

1.4 Recommended operating conditions. 2/

Supply voltage range:

(V_{CC}) 5.0 V

(V_{DD}) 3.3 V

- 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.
- 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.

<p>DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO</p>	<p>SIZE A</p>	<p>CODE IDENT NO. 16236</p>	<p>DWG NO. V62/07642</p>
		<p>REV A</p>	<p>PAGE 3</p>

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.

3.5.3 Block diagram. The block diagram shall be as shown in figure 3.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 4

TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions <u>2/</u>	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Resolution			25°C	01	24 typical		Bits
Audio data format section							
Linear pulse code modulation (PCM) word length			25°C	01	24 typical		Bits
Direct stream digital (DSD) output			25°C	01	1 typical		Bits
Digital characteristics section							
Input logic level	V _{IH}		25°C	01	0.7 x V _{DD}	V _{DD}	V
	V _{IL}				0	0.3 x V _{DD}	
Output logic level	V _{OH}	I _{OH} = -2 mA	25°C	01	0.8 x V _{DD}		V
	V _{OL}	I _{OL} = 2 mA					
Input current	I _{IH}	V _{IN} = V _{DD}	-40°C to +85°C	01		10	μA
	I _{IL}	V _{IN} = 0 V				-10	
Input current <u>3/</u>	I _{IH}	V _{IN} = V _{DD}	-40°C to +85°C	01		25	μA
	I _{IL}	V _{IN} = 0 V				-25	
Sampling frequency <u>4/</u>	f _S	Single rate	25°C	01	8	54	kHz
		Dual rate			54	108	
		Quad rate			108	216	
System clock duty cycle			25°C	01	45	55	%

See footnotes at end of table.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 5

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions <u>2/</u>	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Digital characteristics section - continued							
System clock <u>4/</u> frequency		Single rate, SCKI = 256f _S	25°C	01	2.048	13.824	MHz
		Single rate, SCKI = 384f _S			3.072	20.736	
		Single rate, SCKI = 512f _S			4.096	27.648	
		Single rate, SCKI = 768f _S			6.144	38.4	
		Dual rate, SCKI = 256f _S			13.824	27.648	
		Dual rate, SCKI = 384f _S			20.736	38.4	
		Quad rate, SCKI = 128f _S			13.824	27.648	
		Quad rate, SCKI = 192f _S			20.736	38.4	
Analog inputs section							
Input voltage, full scale		Differential input	25°C	01	6 typical		V _{PP}
Input impedance			25°C	01	3 typical		kΩ
Common mode rejection			25°C	01	85 typical		dB
DC performance section							
Output offset error		HPFD = 1	25°C	01	±4 typical		% of FSR
Gain error			25°C	01	±4 typical		% of FSR
Gain mismatch channel-to-channel			25°C	01	±3 typical		% of FSR

See footnotes at end of table.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 6

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions <u>2/</u>	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Dynamic performance section <u>5/</u>							
Single rate, f _S = 40 kHz		BW = 20 Hz to 20 kHz					
Total harmonic distortion + noise	THD+N	V _{IN} = -0.5 dBFS, f _{IN} = 1 kHz	25°C	01		-95	dB
			-40°C to +85°C			-90	
Dynamic range		V _{IN} = -60 dBFS, f _{IN} = 1 kHz, A-weighted	25°C	01	112		dB
			-40°C to +85°C		108		
Dynamic range, no weighting		V _{IN} = -60 dBFS, f _{IN} = 1 kHz	25°C	01	116 typical		dB
Channel separation			-40°C to +85°C	01	100		dB
Dual rate, f _S = 96 kHz		BW = 20 Hz to 40 kHz					
Total harmonic distortion + noise	THD+N	V _{IN} = -0.5 dBFS, f _{IN} = 1 kHz	25°C	01	-105 typical		dB
Dynamic range		V _{IN} = -60 dBFS, f _{IN} = 1 kHz, A-weighted	25°C	01	118 typical		dB
Dynamic range, no weighting		V _{IN} = -60 dBFS, f _{IN} = 1 kHz	25°C	01	112 typical		dB
Channel separation			25°C	01	120 typical		dB
Quad rate, f _S = 192 kHz		BW = 20 Hz to 40 kHz					
Total harmonic distortion + noise	THD+N	V _{IN} = -0.5 dBFS, f _{IN} = 1 kHz	25°C	01	-103 typical		dB
Dynamic range		V _{IN} = 0 V _{RMS} , A-weighted	25°C	01	117 typical		dB
Dynamic range, no weighting		V _{IN} = 0 V _{RMS}	25°C	01	108 typical		dB
Channel separation			25°C	01	120 typical		dB

See footnotes at end of table.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 7

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions <u>2/</u>	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Dynamic performance section - continued. <u>5/</u>							
DSD output, 64 f _s rate		DSDBCK = 2.8224 MHz					
Total harmonic distortion + noise	THD+N	V _{IN} = -0.5 dBFS, f _{IN} = 1 kHz	25°C	01	-102 typical		dB
Dynamic range		V _{IN} = -60 dBFS, f _{IN} = 1 kHz, A-weighted	25°C	01	115 typical		dB
Channel separation			25°C	01	120 typical		dB
DSD output, 128 f _s rate		DSDBCK = 5.6448 MHz					
Total harmonic distortion + noise	THD+N	V _{IN} = -0.5 dBFS, f _{IN} = 1 kHz	25°C	01	-105 typical		dB
Dynamic range		V _{IN} = -60 dBFS, f _{IN} = 1 kHz, A-weighted	25°C	01	118 typical		dB
Channel separation			25°C	01	120 typical		dB
Digital decimation filter section							
Passband edge		Single and dual rate	25°C	01		0.453 f _s	Hz
Passband ripple		Single and dual rate	25°C	01		0.005	dB
Passband edge		Single and dual rate	25°C	01	0.547 f _s		Hz
Stop band attenuation		Single and dual rate	25°C	01	-100		dB
Group delay		Single and dual rate	25°C	01	37/f _s typical		second
Passband edge (-0.005 dB)		Quad rate	25°C	01		0.375 f _s	Hz
-3 dB cutoff frequency		Quad rate	25°C	01		0.490 f _s	Hz
Passband ripple		Quad rate	25°C	01		±0.005	dB
Passband edge		Quad rate	25°C	01	0.770 f _s		Hz

See footnotes at end of table.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 8

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions	Temperature, T _A	Device type	Limits		Unit	
					Min	Max		
Digital decimation filter section - continued								
Stop band attenuation		Quad rate	25°C	01	-135		dB	
Group delay		Quad rate	25°C	01	9.5/f _s typical		sec	
Digital high pass filter								
Frequency response (-3 dB)			25°C	01	f _s / 48000 typical		Hz	
Power supply section								
Voltage range	V _{CC}		25°C	01	4.75	5.25	V	
	V _{DD}				3	3.6		
Operating supply current	I _{CC}	f _S = 48 kHz, single rate, V _{CC} = 5 V, V _{DD} = 3.3 V	25°C	01		65	mA	
			-40°C to +85°C			70		
		f _S = 96 kHz, dual rate, V _{CC} = 5 V, V _{DD} = 3.3 V	25°C			65		
			-40°C to +85°C			70		
		f _S = 192 kHz, quad rate, V _{CC} = 5 V, V _{DD} = 3.3 V	25°C			65		
			-40°C to +85°C			70		
	I _{DD}	f _S = 48 kHz, single rate, V _{CC} = 5 V, V _{DD} = 3.3 V	-40°C to +85°C			12		
			-40°C to +85°C			25		
			-40°C to +85°C			15		
Power down mode current	I _{CC}	Clocks applied, $\overline{RST} = 0$, V _{CC} = 5 V, V _{DD} = 3.3 V	-40°C to +85°C	01		10	mA	
	I _{DD}					2		

See footnotes at end of table.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 9

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Power supply section - continued.							
Total power dissipation	P _D	f _S = 48 kHz, single rate, V _{CC} = 5 V, V _{DD} = 3.3 V	25°C	01		365	mW
		f _S = 96 kHz, dual rate, V _{CC} = 5 V, V _{DD} = 3.3 V				408	
		f _S = 192 kHz, quad rate, V _{CC} = 5 V, V _{DD} = 3.3 V				375	

- 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_{CC} = 5 V, V_{DD} = 3.3 V, and a measurement bandwidth from 20 Hz to 20 kHz. System clock frequency is equal to 256 f_S for single and dual rate sampling modes, and 128 f_S for quad rate sampling mode.
- 3/ Applies to the $\overline{\text{RST}}$ input, pin 19.
- 4/ Single, dual, and quad rate sampling modes are described within the manufacturer's data sheet.
- 5/ Dynamic performance parameters are measured using a audio precision system two cascade plus test system. The measurement bandwidth is limited by using the audio precision 22 Hz high-pass filter in combination with the audio precision 20 kHz, f_S/2, or a user defined 40 kHz low pass filter. All A-weighted measurements are performed using the audio precision A-weighting filter in combination with the previously mentioned filters.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 10

Case X

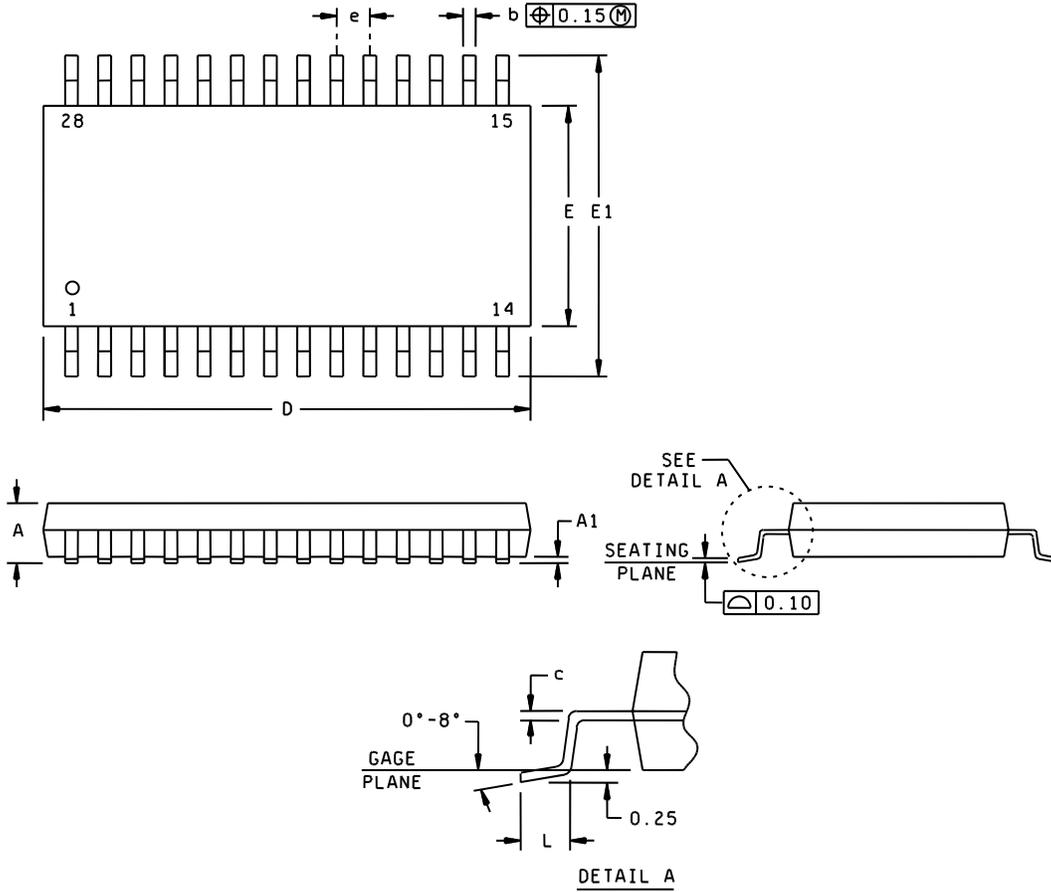


FIGURE 1. Case outline.

<p>DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO</p>	<p>SIZE A</p>	<p>CODE IDENT NO. 16236</p>	<p>DWG NO. V62/07642</p>
		<p>REV A</p>	<p>PAGE 11</p>

Case X - continued

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	---	.078	---	2.00
A1	.001	---	0.05	---
b	.008	.014	0.22	0.38
c	.003	.009	0.09	0.25
D	.389	.413	9.90	10.50
E	.196	.220	5.00	5.60
E1	.291	.322	7.40	8.20
e	.025 nominal		0.65 nominal	
L	.021	.037	0.55	0.95

NOTES:

1. All linear dimensions are in millimeters, inch equivalents are given for general information only.
2. Body dimensions do not include mold flash or protrusion, not to exceed 0.15 millimeter (.006 inch)
3. Fall within JEDEC MO-150.

FIGURE 1. Case outline – Continued.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 12

Device type	01
Case outline	X
Terminal number	Terminal symbol
1	V _{REFL}
2	AGNDL
3	V _{COML}
4	V _{INL+}
5	V _{INL-}
6	FMT0
7	FMT1
8	S/ \bar{M}
9	FS0
10	FS1
11	FS2
12	HPFD
13	DGND
14	V _{DD}
15	DATA or DSDR
16	BCK or DSDL
17	LRCK or DSDBCK
18	SCKI
19	\bar{RST}
20	CLIPR
21	CL IPL
22	V _{CC}
23	AGND
24	V _{INR-}
25	V _{INR+}
26	V _{COMR}
27	AGNDR
28	V _{REFR}

FIGURE 2. Terminal connections.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 13

Terminal number	Terminal symbol	I / O	Description
1	V _{REFL}	Output	Left channel voltage reference
2	AGNDL	Ground	Left channel reference ground
3	V _{COML}	Output	Left channel DC common mode voltage, 2.5 V typical
4	V _{INL+}	Input	Left channel non-inverting analog input
5	V _{INL-}	Input	Left channel inverting analog input
6	FMT0	Input	Audio data format selection
7	FMT1	Input	Audio data format selection
8	S/ \bar{M}	Input	Audio serial port slave / master mode selection (0 = master, 1 = slave)
9	FS0	Input	Sampling mode selection
10	FS1	Input	Sampling mode selection
11	FS2	Input	Sampling mode selection
12	HPFD	Input	High pass filter disable (active high)
13	DGND	Ground	Digital ground
14	V _{DD}	Power	Digital power supply, 3.3 V

FIGURE 2. Terminal connections – Continued.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 14

Terminal number	Terminal symbol	I / O	Description
15	DATA or DSDR	Output	Audio serial port left and right channel pulse code modulation (PCM) data or right channel direct stream digital (DSD) data.
16	BCK or DSDL	I / O	Audio serial port bit (or data) clock or left channel DSD data output.
17	LRCK or DSDBCK	I / O	Audio serial port left / right (or word) clock or DSD data clock output.
18	SCKI	Input	System clock
19	$\overline{\text{RST}}$	Input	Reset / power down, (active low with internal pull up).
20	CLIPR	Output	Right channel clipping flag, (active high).
21	CLIPL	Output	Left channel clipping flag, (active high)
22	V _{CC}	Power	Analog power supply, 5 V
23	AGND	Ground	Analog ground.
24	V _{INR-}	Input	Right channel inverting analog input.
25	V _{INR+}	Input	Right channel non-inverting analog input.
26	V _{COMR}	Output	Right channel DC common mode voltage, 2.5 V typical.
27	AGNDR	Ground	Right channel reference ground.
28	V _{REFR}	Output	Right channel voltage reference.

FIGURE 2. Terminal connections – Continued.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 15

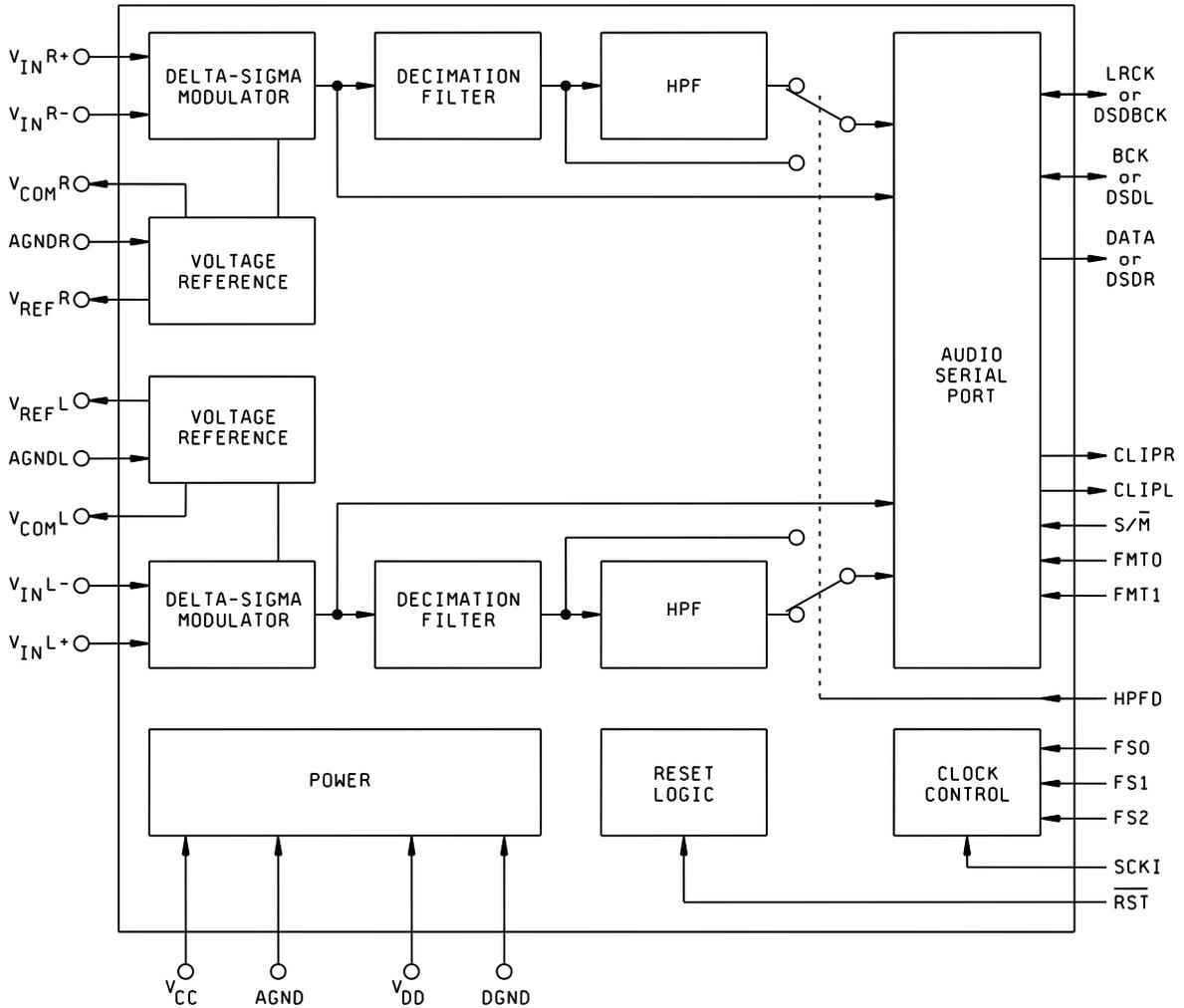


FIGURE 3. Block diagram.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 16

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 <u>1/</u>	Device manufacturer CAGE code	Package <u>2/</u>	Top side marking	Vendor part number
V62/07642-01XE	01295	Tape and Reel of 1000	PCM4202EP	PCM4202IDBREP

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

2/ For the most current package and ordering information, see the package option addendum at the end of the manufacturer's datasheet, or at website www.ti.com.

CAGE code

01295

Source of supply

Texas Instruments, Inc.
 Semiconductor Group
 8505 Forest Ln.
 PO Box 660199
 Dallas, TX 75243
 Point of contact: U.S. Highway 75 South
 P.O. Box 84, M/S 853
 Sherman, TX 75090-9493

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/07642
		REV A	PAGE 17