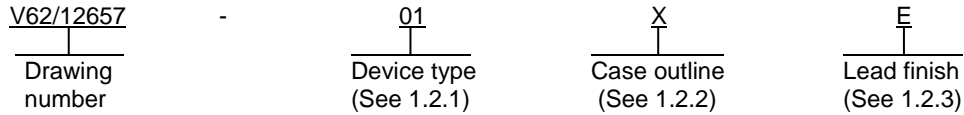


1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance 3-Axis, $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$ digital accelerometer microcircuit, with an operating temperature range of -55°C to $+105^{\circ}\text{C}$.

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:



1.2.1 Device type(s).

<u>Device type</u>	<u>Generic</u>	<u>Circuit function</u>
01	ADXL345-EP	3-Axis, $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$ digital accelerometer

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

<u>Outline letter</u>	<u>Number of pins</u>	<u>Package style</u>
X	14	Land Grid Array

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

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1.3 Absolute maximum ratings. 1/

Acceleration:

Any Axis, unpowered	10,000 g
Any Axis, powered	10,000 g
V _S	-0.3 V to +3.9 V
V _{DD I/O}	-0.3 V to +3.9 V
Digital pins	-0.3 V to V _{DD I/O} +0.3 V or 3.9 V whichever is less
All other pins	-0.3 V to +3.9 V
Output short circuit duration (Any pin to Ground)	Indefinite
Temperature range:	
Powered	-55°C to +105°C
Storage	-65°C to 150°C

1.4 Thermal characteristics.

Thermal resistance

Case outline	θ _{JA}	θ _{JC}	Device weight
Case X	150°C/W	85°C/W	30 mg

2. APPLICABLE DOCUMENTS.

There are no applicable documents.

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.

1/ Stresses beyond those listed under "absolute maximum ratings" 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.

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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 Terminal function. The terminal function shall be as shown in figure 3.

3.5.4 Functional block diagram. The functional block diagram shall be as shown in figure 4.

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TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Test conditions 2/	Limits			Unit
			Min	Typ 3/	Max	
Sensor input (Each axis)						
Measurement range		User selectable		±2, ±4, ±8, ±16		g
Nonlinearity		Percentage of full scale		±0.5		%
Inter axis alignment error				±0.1		Degrees
Cross axis sensitivity 4/				±1		%
Output resolution (Each axis)						
All g range		10 bit resolution		10		Bits
±2 g range		Full resolution		10		
±4 g range		Full resolution		11		
±8 g range		Full resolution		12		
±16 g range		Full resolution		13		
Sensitivity (Each axis)						
Sensitivity at X _{OUT} , Y _{OUT} , Z _{OUT}		All g ranges, full resolution	230	256	282	LSB/g
		±2 g, 10 bit resolution	230	256	282	
		±4 g, 10 bit resolution	115	128	141	
		±8 g, 10 bit resolution	57	64	71	
		±16 g, 10 bit resolution	29	32	35	
Sensitivity deviation from ideal		All g ranges		±1.0		%
Scale factor at X _{OUT} , Y _{OUT} , Z _{OUT}		All g ranges, full resolution	3.5	3.9	4.3	mg/LSB
		±2 g, 10 bit resolution	3.5	3.9	4.3	
		±4 g, 10 bit resolution	7.1	7.8	8.7	
		±8 g, 10 bit resolution	14.1	15.6	17.5	
		±16 g, 10 bit resolution	28.6	31.2	34.5	
Sensitivity change due to temperature				±0.01		%/°C
0 g Offset (Each axis)						
0 g Output for X _{OUT} , Y _{OUT}			-150	0	+150	mg
0 g Output for Z _{OUT}			-250	0	+250	
0 g Output deviation from Ideal, X _{OUT} , Y _{OUT}				±35		
0 g Output deviation from Ideal, Z _{OUT}				±40		
0 g Offset vs. temperature for X-, Y- Axes				±0.4		mg/°C
0 g Offset vs. temperature for Z- Axis				±1.2		
Noise						
X-, Y-Axes		ODR = 100 Hz for ±2 g, 10 bit resolution or all g ranges, full resolution		0.75		LSB rms
Z-Axis				1.1		
Output data rate bandwidth (User selectable)						
Output Data Rate (ODR) 5/ 6/ 7/			0.1		3200	Hz

See footnote at end of table.

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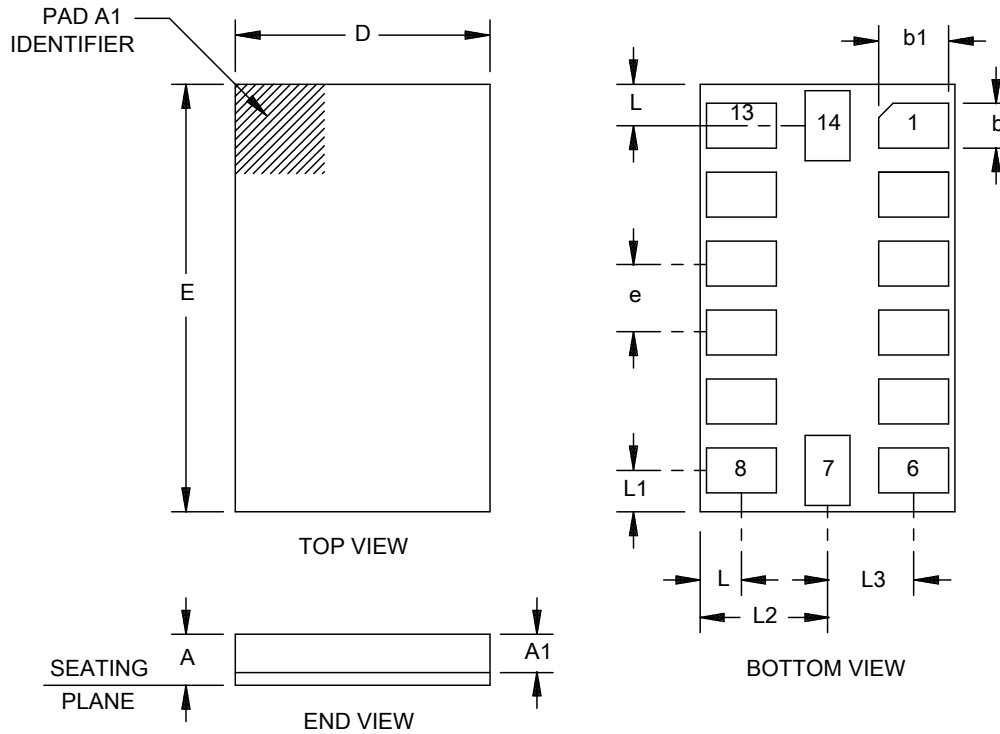
TABLE I. Electrical performance characteristics - Continued. 1/

Test	Symbol	Test conditions <u>2/</u>	Limits			Unit
			Min	Typ <u>3/</u>	Max	
Self-test <u>8/</u>						
Output change in X-axis			0.20		2.10	g
Output change in Y-axis			-2.10		-0.20	
Output change in Z-axis			0.30		3.40	
Power supply						
Operating voltage range	V _S		2.0	2.5	3.6	V
Interface voltage range	V _{DD I/O}		1.7	1.8	V _S	V
Supply current		ODR ≥ 100 Hz		140		μA
		ODR < 10 Hz		23		
Standby mode leakage current				0.1		
Turn-on and wake up time <u>9/</u>		ODR = 3200 Hz		1.4		ms
Temperature						
Operating temperature range			-55		+105	°C
Weight						
Device weight				30		mg

- 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/ T_A = 25°C, V_S = 2.5 V, V_{DD I/O} = 1.8 V, acceleration = 0 g, C_S = 10 μF tantalum, C_{I/O} = 0.1 μF, Output Data Rate (ODR) = 800 Hz, unless otherwise noted. All minimum and maximum specification are guaranteed. Typical specifications are not guaranteed.
- 3/ The typical specifications shown are for at least 68% of the population of parts and are based on the worst case of mean ±1 σ, except for 0 g output and sensitivity, which represents the target value. For 0 g output and sensitivity, the deviation from the ideal describes the worst case of mean ±1 σ.
- 4/ Cross axis sensitivity is defined as coupling between any two axes.
- 5/ Bandwidth is the -3 dB frequency and is defined as half the output data rate, bandwidth = ODR/2.
- 6/ The output format for the 3200 Hz and 1600 Hz ODR is different from the output format for the remaining ODRs. This difference is described in the manufacturer data sheet.
- 7/ Output data rates below 6.25 Hz exhibit additional offset shift with increased temperature, depending on selected output data rate. Refer manufacturer data sheet.
- 8/ Self-test change is defined as the output (g) when the SELF_TEST bit = 1 (in the DATA_FORMAT register, Address 0x31) minus the output (g) when the SELF_TEST bit = 0. Due to device filtering, the output reaches its final value after 4 x T when enabling or disabling self-test, where T = 1/(data rate). The part must be in normal power operation (LOW_POWER bit = 0 in the BW_RATE register, Address 0x2C) for self-test to operate correctly.
- 9/ Turn on and wake up times are determined by the user defined bandwidth. At a 100 Hz data rate, the turn-on and wake-up times are each approximately 11.1 ms. For other data rates, the turn on and wake up times are each approximately T + 1.1 in milliseconds, where T = 1/(data rate).

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Case X



Dimensions					
Symbol	Millimeters		Symbol	Millimeters	
	Min	Max		Min	Max
A	0.85	1.00	e	0.80 BSC	
A1	0.69	0.79	L	0.49 TYP	
b	0.50 TYP		L1	0.50 TYP	
b1	0.813 TYP		L2	1.50 TYP	
D	3.00 BSC		L3	1.01 TYP	
E	5.00 BSC				

NOTES:

1. All linear dimensions are in millimeters.

FIGURE 1. Case outline.

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Case outline X			
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	V _{DD I/O}	14	SCL/SCLK
2	GND	13	SDA/SDI/SDIO
3	RESERVED	12	SDO/ALT ADDRESS
4	GND	11	RESERVED
5	GND	10	NC
6	V _S	9	INT2
7	\overline{CS}	8	INT1

FIGURE 2. Terminal connections.

Case outline X		
Terminal number	Mnemonic	Description
1	V _{DD I/O}	Digital interface supply voltage
2	GND	This pin must be connected to ground.
3	RESERVED	Reserved. This pin must be connected to V _S or left open.
4	GND	This pin must be connected to ground.
5	GND	This pin must be connected to ground.
6	V _S	Supply voltage
7	\overline{CS}	Chip select
8	INT1	Interrupt 1 Output.
9	INT2	Interrupt 2 Output.
10	NC	Not internally connected.
11	RESERVED	Reserved. This pin must be connected to ground or left open.
12	SDO/ALT ADDRESS	Serial data output (SPI 4-Wire)/Alternate I ² C address select (I ² C).
13	SDA/SDI/SDIO	Serial data (I ² C)/Serial data input (SPI 4-Wire)/Serial data input and output (SPI 3-Wire).
14	SCL/SCLK	Serial Communications clock, SCL is the clock for I ² C, and SCLK is the clock for SPI

FIGURE 3. Terminal function.

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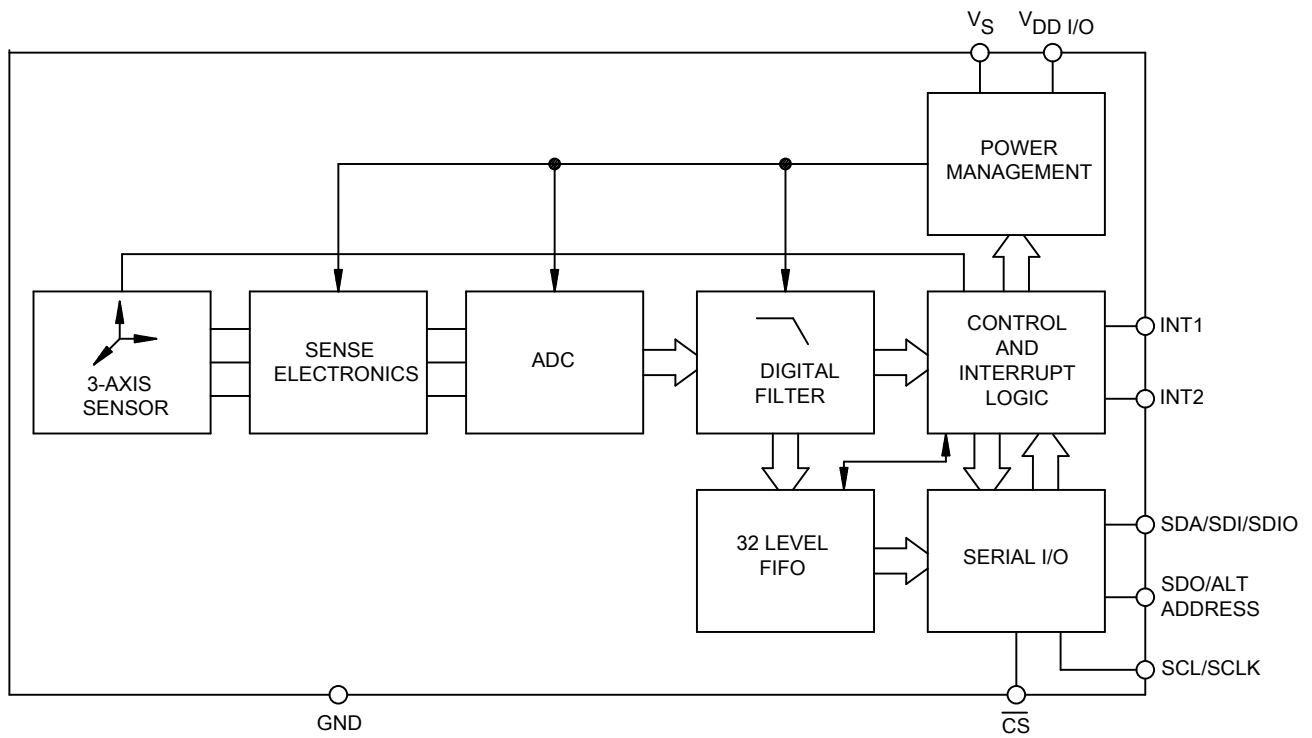


FIGURE 4. Functional block diagram.

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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	Vendor part number
V62/12657-01XE	24355	ADXL345TCCZ-EP

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

CAGE code

24355

Source of supply

Analog Devices
 1 Technology Way
 P.O. Box 9106
 Norwood, MA 02062-9106

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