

## Operation Manual Evaluation Board for Shock Sensor

### PKGX-16-4021

### Photo



### Features

You can start to evaluate Shock Sensor easily with this evaluation board. Its features are;

- Wide bandwidth 100Hz~16.7kHz
- $\pm 10g$  measurement range at 5.0V supply voltage
- 2.7~5.0V supply voltage
- Analog out
- Size 17.0×12.5×4.0 mm (w×l×h)

### Applications

PKGX-16-4021 is targeted to detect vibration for applications with high frequency range requirements.

- Vibration monitoring for preventive maintenance
  - Abnormal bearing vibration detection
  - Abnormal motor vibration detection

### Overview

This document describes the operation manual for the evaluation board (PKGX-16-4021) for Shock Sensor produced by Murata Manufacturing Co., Ltd. Shock Sensor is one of the acceleration sensors based on piezo ceramic.

PKGX-16-4021 has wide bandwidth due to high resonance frequency of Shock Sensor based on Murata ceramic and process technology.

This board helps you to evaluate Shock Sensor.

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## TABLE OF CONTENT

<b>1. Introduction</b> .....	<b>3</b>
1.1 Functional Brock Diagram	
1.2 Functional Brock Layout Diagram	
<b>2. Evaluation Procedures</b> .....	<b>4</b>
<b>3. Electrical Specification and Board Information</b> .....	<b>5</b>
3.1 Input and Output Terminal	
3.2 Electrical Specification	
3.3 Circuit Diagram	
3.4 Bill of Materials	
3.5 External Dimension	
3.6 Board Layout	
<b>4. Precautions</b> .....	<b>13</b>
4.1 Precautions when in use	
4.2 Other precautions	

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## 1. Introduction

This document describes the evaluation board for Shock Sensor.

### 1.1 Functional Block Diagram

Fig.1 shows the functional block diagram of evaluation board

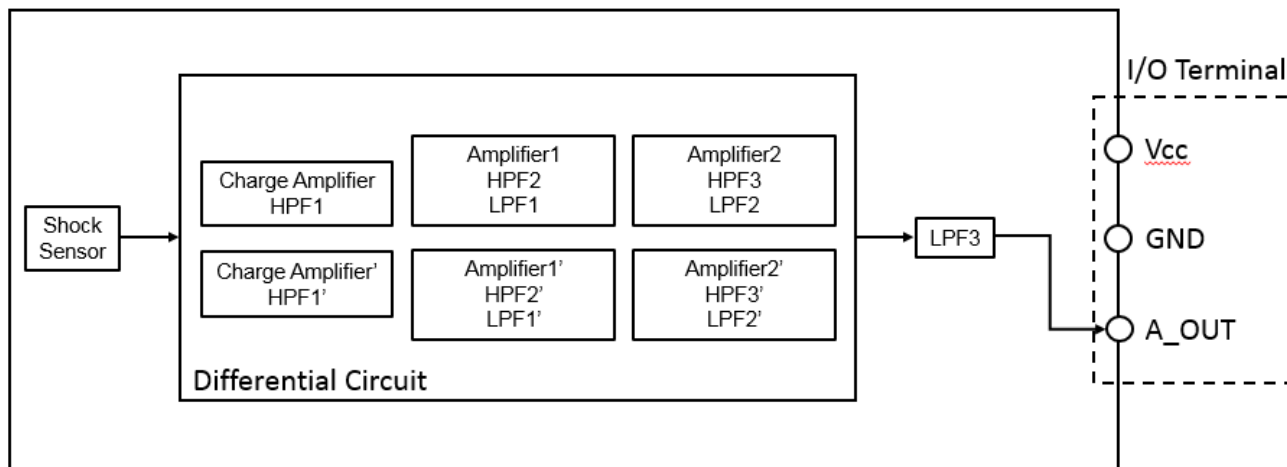


Fig.1 Functional Block Diagram

### 1.2 Functional Block Layout Diagram

Fig.2 shows the functional block layout of the evaluation board.

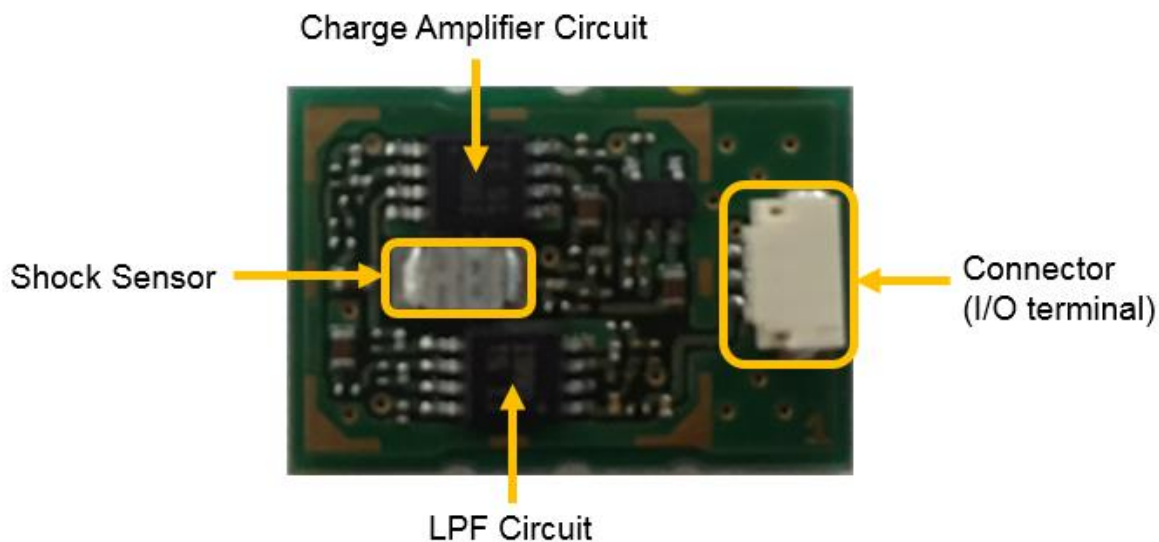


Fig.2 Functional Block Layout Diagram

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## 2. Evaluation Procedure

The following shows an example of the evaluation procedure to use this evaluation board.

- ① Attach this board to the target of measurement with superglue.

Note1: Put superglue on whole surface of back side evaluation board and put uniformly-flat, in order that the acceleration which you want to get can transact to the evaluation board.

Note2; If you want to remove this evaluation board from a target to use repeatedly, it is convenient to use a polyimide tape. Apply polyimide tape to a target and this evaluation board, and then apply superglue to the polyimide tape.

Note3: Do NOT use a double-sided tape because it can be a buffer.

- ② Supply predefined voltage (2.7~5.0V) to the board through Vcc and GND at I/O terminal.
- ③ Connect oscilloscope to AOUT.

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### 3 Specifications and Board Information

The following shows the electrical specification and the board information of the evaluation board when shipped.

#### 3.1 Input and Output Terminals

Fig. 7 shows detailed information of input-output terminals (I/O Terminal) on the evaluation board.

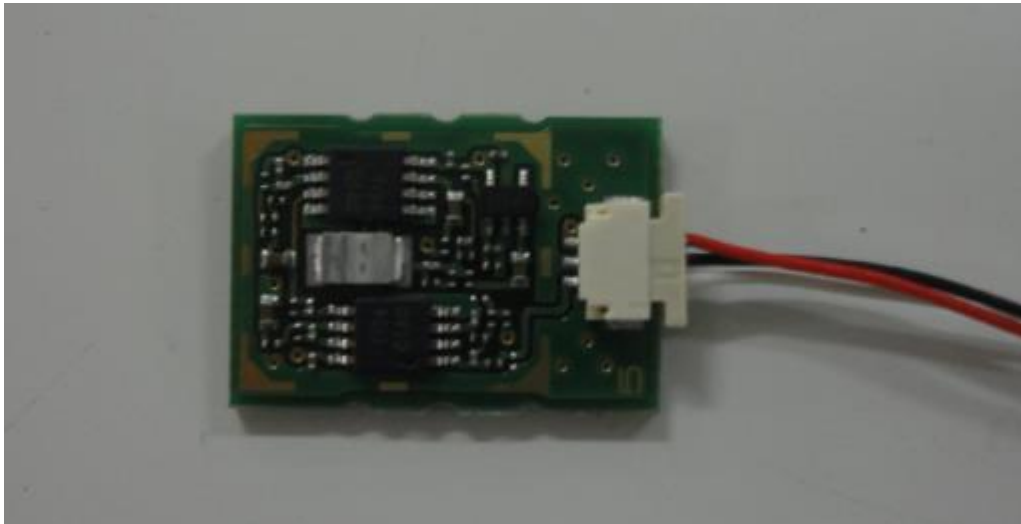


Fig.7 Appearance of Input-Output Terminals

Table 1. I/O Terminal List

Symbol	Wire Color	Description
V	Red	The power supplying terminal of evaluation board
G	Black	The ground terminal of evaluation board
A	White	The analog output terminal of evaluation board

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### 3.2 Electrical Specifications & Mechanical Specifications

The following shows the electrical and mechanical specifications of this evaluation board.

Table 2. Electrical Specifications

※Unless otherwise specified, temperature of measurement is 25°C and supply voltage 3.3V.

Parameters		Value			Unit
		Min.	Typ.	Max.	
Operating Temperature Range		-40	-	85	°C
V <sub>CC</sub> Input Voltage Range		2.5	-	5	V
A_OUT Output Voltage Range		0	-	V <sub>CC</sub>	V
Reference Voltage		T.B.D	V <sub>CC</sub> /2	T.B.D	V
Gain	Charge AMP		14.8		dB
	Charge AMP'		14.8		
	AMP 2		16.7		dB
	AMP 2'		16.7		
	AMP 3		20.8		
	AMP 3'		20.8		dB
Cutoff frequency(-3dB)	HPF 1		80		Hz
	HPF 1'		80		Hz
	HPF 2		33		Hz
	HPF 2'		33		Hz
	HPF 3		33		Hz
	HPF 3'		33		Hz
	LPF 1		15603		Hz
	LPF 1'		15603		Hz
	LPF 2		14109		Hz
	LPF 2'		14109		Hz
LPF 3		15251		Hz	
Current Consumption (Note 3)			3.2		mA

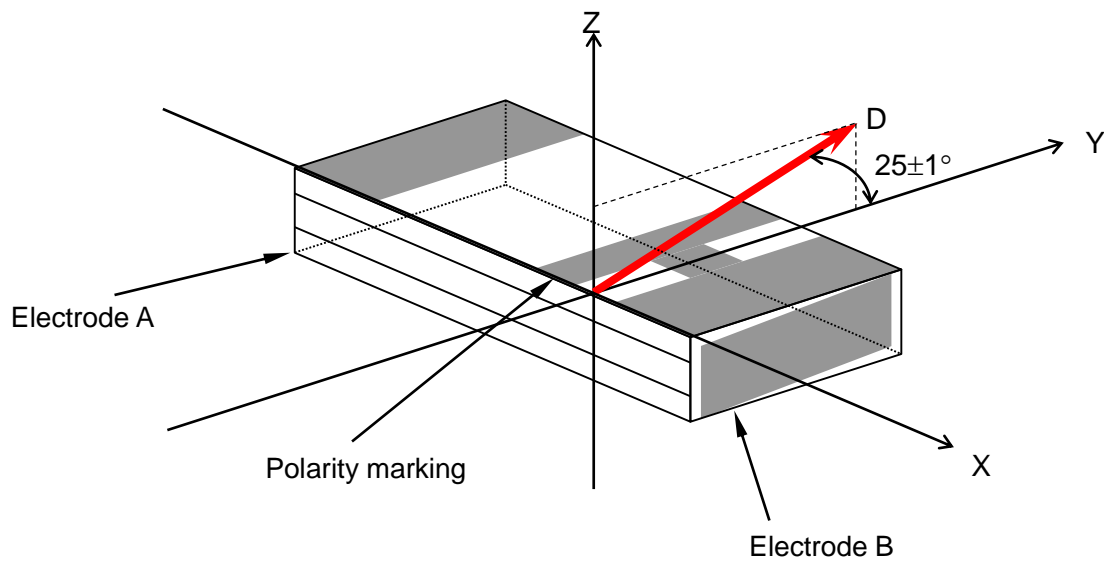
Note 3: Current Consumption is depending on Current Consumption of OP-AMP and Current Consumption generated of Reference Voltage portion.

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Table 3. Mechanical Specifications

Parameters	Value			Unit
	Min.	Typ.	Max.	
Circuit Sensitivity	T.B.D	0.25	T.B.D	V/G
Sensor Resonance Frequency	34	42		kHz
Number of Axis		1		
Inclination Angle of Sensor Shaft	24	25	26	°



Axis D : This axis (Inclination) is an acceleration applied direction, when electric charge sensitivity is checked. Its tolerance is within  $\pm 1^\circ$ .

Fig.8 Inclination of Shock Sensor Shaft (PKGS-25WXP1-R)

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### 3.3 Circuit Diagram

Following shows the circuit diagram of this evaluation board.

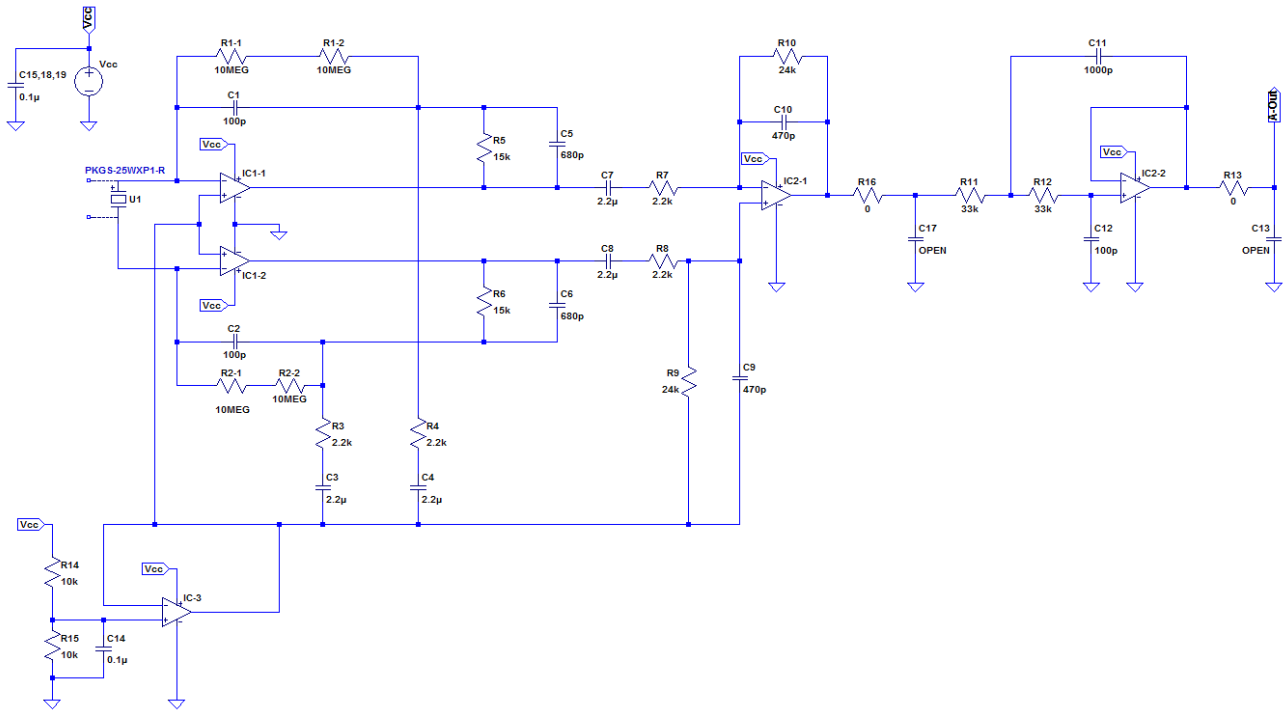


Fig 9. Circuit Diagram

(Formulas Descriptions)

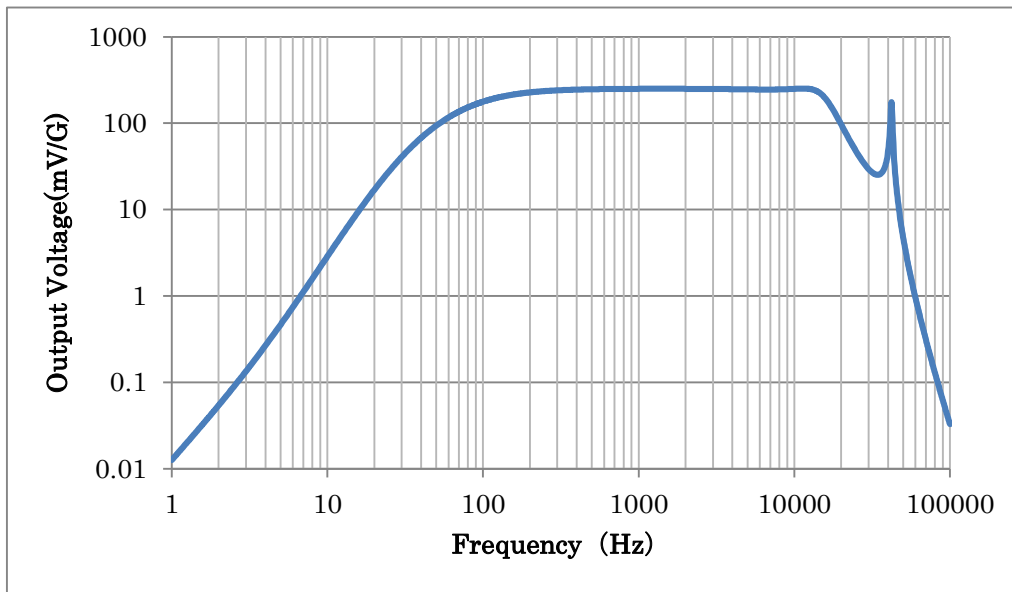
Charge AMP	= $20\log_{10} (Cf/C1)$	[dB]	(In case of PKGS-25WXP1-R, Cf=550pF)
Charge AMP	= $20\log_{10} (Cf/C1)$	[dB]	(In case of PKGS-25WXP1-R, Cf=550pF)
AMP2	= $20\log_{10} (R3/R2)$	[dB]	
AMP2	= $20\log_{10} (R3/R2)$	[dB]	
AMP3	= $20\log_{10} (R5/R4)$	[dB]	
AMP3	= $20\log_{10} (R3/R2)$	[dB]	
HPF1	= $1/(2 \times \pi \times C1 \times R1)$	[Hz]	
HPF1	= $1/(2 \times \pi \times C4 \times R4)$	[Hz]	
HPF2	= $1/(2 \times \pi \times C1 \times R1)$	[Hz]	
HPF2'	= $1/(2 \times \pi \times C4 \times R4)$	[Hz]	
HPF3	= $1/(2 \times \pi \times C1 \times R1)$	[Hz]	
HPF3'	= $1/(2 \times \pi \times C4 \times R4)$	[Hz]	
LPF1	= $1/(2 \times \pi \times C3 \times R3)$	[Hz]	
LPF1'	= $1/(2 \times \pi \times C5 \times R5)$	[Hz]	
LPF2	= $1/(2 \times \pi \times C2 \times R6)$	[Hz]	
LPF2'	= $1/(2 \times \pi \times C1 \times R1)$	[Hz]	
LPF3	= $1/(2 \times \pi \times \sqrt{C4 \times R4})$	[Hz]	

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Below is the simulated frequency response curve of above circuitry (Fig.9).



Note 4: This Frequency Response Curve serves as referencing purpose only. In this simulation, the frequency response ranges from 99 Hz to 16,700 Hz (-3dB points). Actual frequency response curve varies according to the actual characteristics of circuitry and components.

Fig 10. Frequency Response Curve of PKGX-16-4021

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### 3.4 Bill of Material

The following show the bill of materials of the evaluation module when shipped.

Ref.	Part No.	Description	Mfg.
C1	GRM0332C1H101GA01#	100 p F/50V/CH	Murata
C2	GRM0332C1H101GA01#	100 p F/50V/CH	Murata
C3	GRM155B30J225KE95#	2.2μF/6.3V/B	Murata
C4	GRM155B30J225KE95#	2.2μF/6.3V/B	Murata
C5	GRM0332C1E681GA01#	680 p F/25V/CH	Murata
C6	GRM0332C1E681GA01#	680 p F/25V/CH	Murata
C7	GRM155B30J225KE95#	2.2μF/6.3V/B	Murata
C8	GRM155B30J225KE95#	2.2μF/6.3V/B	Murata
C9	GRM0332C1E471GA01#	470 p F/25V/CH	Murata
C10	GRM0332C1E471GA01#	470 p F/25V/CH	Murata
C11	GRM0332C1E102GA01#	1000 p F/25V/CH	Murata
C12	GRM0332C1H101GA01#	100 p F/50V/CH	Murata
C13	OPEN		-
C14	GRM033B31A104KE84#	0.1uF/10V/B	Murata
C15	GRM033B31A104KE84#	0.1uF/10V/B	Murata
C17	OPEN	-	-
C18	GRM033B31A104KE84#	0.1uF/10V/B	Murata
C19	GRM033B31A104KE84#	0.1uF/10V/B	Murata
CN1	SM03B-SURS-TF	Connector	JST
IC1	OPA2377AIDGKT	Op-Amplifier	TI
IC2	OPA2377AIDGKT	Op-Amplifier	TI
IC3	TLV6001IDCKT	Op-Amplifier	TI
R1-1	MCR006YLPF106	10Mohm±1.0%	R O H M
R1-2	MCR006YLPF106	10Mohm±1.0%	R O H M
R2-1	MCR006YLPF106	10Mohm±1.0%	R O H M
R2-2	MCR006YLPF106	10Mohm±1.0%	R O H M
R3	MCR006YLPD222	2.2kohm±0.5%	R O H M
R4	MCR006YLPD222	2.2kohm±0.5%	R O H M
R5	MCR006YLPD153	15kohm±0.5%	R O H M
R6	MCR006YLPD153	15kohm±0.5%	R O H M
R7	MCR006YLPD222	2.2kohm±0.5%	R O H M
R8	MCR006YLPD222	2.2kohm±0.5%	R O H M
R9	MCR006YLPD243	24kohm±0.5%	R O H M
R10	MCR006YLPD243	24kohm±0.5%	R O H M
R11	MCR006YLPD333	33kohm±0.5%	R O H M
R12	MCR006YLPD333	33kohm±0.5%	R O H M
R13	SHORT	0	-
R14	MCR006YLPD103	10kohm±0.5%	R O H M
R15	MCR006YLPD103	10kohm±0.5%	R O H M
R16 :	SHORT	0	-
U1	PKGS-25WXP1-R	Shock Sensor	Murata

#### Attention:

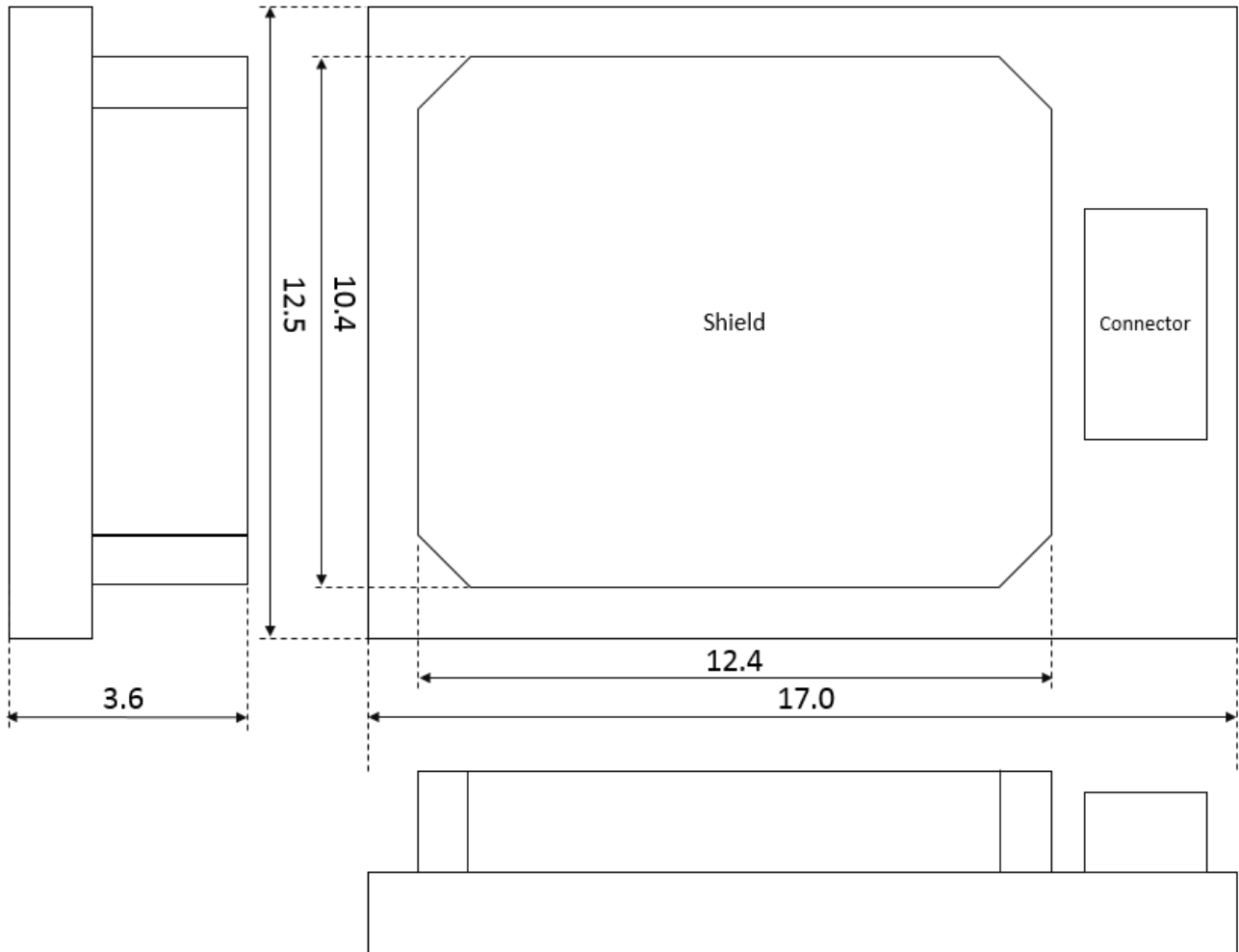
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### 3.5 External Dimensions

The outline dimensions of the evaluation module are shown in the drawing below.

Table 5. External Dimensions (Typical)

External Dimensions (Length × Width × Height) [mm]
17.0×12.5×3.6



Note 4. The height of Connector's portion is 3.55mm.

Fig11. External Dimension Drawing

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## 4. Precautions

### 4.1 Precautions when in use

- This evaluation board cannot detect gravitational acceleration and free fall.
- Please take off direct sunlight and moisture during storage of this evaluation board. There is a possibility of corrosion on the connector.
- Due to change of atmospheric pressure, the characteristics of this evaluation board may change. Please do not use in conditions where atmospheric pressure is vastly different from ground level (e.g. vacuum and water etc).
- Please do not store the evaluation board in environments which is exposed to dust, oil, corrosive gases, acid and alkaline.
- When exposed to sudden changing temperature, this evaluation board may extemporarily generate output even when there is no applying acceleration. The output is affected by different conditions of stress and individual differences of sensor. Please evaluate deeply influence of temperature change which you expect by your set.
- Depending on the environment of usage, evaluation board may be susceptible to external electrical noise. In this case, please use the shield cover provided for noise reduction.
- Mounting of provided shield cover on this evaluation board will be performed by users as needed. Please be extreme caution not to cause short circuit during the installation of shielding.
- This evaluation module detects acceleration that is transmitted through your housing and your mounting board. Please use this module after considering characteristics of mechanical acceleration transmission in your set deeply.
- Depending on the mounting conditions of the evaluation module internal resonance of set and interferences from inherited frequencies of each component, there is a possibility that acceleration is not transmitted from this product as intended by user.

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