



SERIES 3501 & 3503

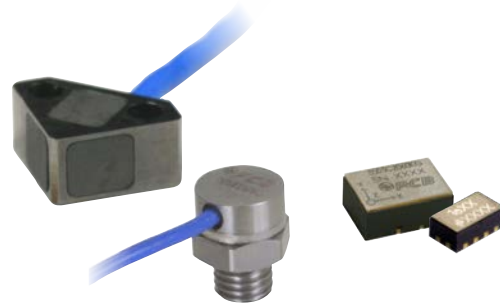
# MEMS HIGH-G SHOCK ACCELEROMETERS

- Packaged and SMT configurations
- Single axis and triaxial
- Mechanical over-range stops improve survivability
- Slight damping reduces resonance amplification
- Excellent amplitude linearity
- Low power consumption

## TYPICAL APPLICATIONS

- Metal-to-metal impact & pyroshock
- Data recorders, penetrator & launch tests
- Consumer electronics drop testing
- Sporting goods and impact tool testing
- Blast loading & survivability of structures
- Fuze, safe and arm

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## STATE-OF-THE-ART MEMS DESIGN AND FABRICATION

Series 3501 and 3503 Piezoresistive MEMS high-amplitude shock accelerometers represent state-of-the-art industry technology for miniature, high amplitude, DC response sensors. This series is capable of measuring long duration transient motion as well as responding to and surviving extremely fast rise times, typical of a high-g shock event as found in explosive, gun and impact testing. Both packaged and OEM configurations are offered, to fulfill a variety of installation requirements.

The hermetically sealed sensing element is air-damped with over range stops intended to improve survivability and is a full active Wheatstone bridge with high input resistance for low power consumption. It is micromachined from single crystal silicon and manufactured with the latest advances in etching techniques and equipment using deep reactive ion etching (DRIE).

| SERIES 3501 AND 3503                                  | SURFACE MOUNT   |   | INTEGRAL STUD   | THROUGH HOLES (2)   |
|---|---|---|---|---|
|   |  |  |  |  |
| <b>20 KG</b>  |   |   |   |   |
| <b>Model Number</b>                                   | <b>3501A2020KG</b>  | <b>3503C2020KG</b>  | <b>3501B1220KG</b>  | <b>3503A1120KG</b>  |
| <b>Performance</b>                                    |   |   |   |   |
| Sensitivity (±50%) (at 10VDC)                         | 0.010 mV/g<br>0.001 mV/(m/s <sup>2</sup> )  | 0.005 mV/g<br>0.0005 mV/(m/s <sup>2</sup> )                                       | 0.010 mV/g<br>0.001 mV/(m/s <sup>2</sup> )  | 0.010 mV/g<br>0.001 mV/(m/s <sup>2</sup> )  |
| Sensitivity (raw)                                     | 0.001 mV/V/g<br>0.0001 mV/V/(m/s <sup>2</sup> )                                   | 0.001 mV/V/g<br>0.0001 mV/V/(m/s <sup>2</sup> )                                   | 0.001 mV/V/g<br>0.0001 mV/V/(m/s <sup>2</sup> )                                     | 0.001 mV/V/g<br>0.0001 mV/V/(m/s <sup>2</sup> )                                     |
| Measurement Range                                     | ±20000 g<br>±196100 m/s <sup>2</sup> pk   | ±20000 g<br>±196100 m/s <sup>2</sup> pk   | ±20000 g<br>±196100 m/s <sup>2</sup> pk   | ±20000 g<br>±196100 m/s <sup>2</sup> pk   |
| Frequency Range (1dB)                                 | 0-10000 Hz  | 0-10000 Hz  | 0-10000 Hz  | 0-10000 Hz  |
| Resonant Frequency                                    | >60 kHz   | >60 kHz   | >60 kHz   | >60 kHz   |
| Damping Ratio   | 5 % Critical  | 5 % Critical  | 5 % Critical  | 5 % Critical  |
| Non-Linearity (per 10000 g (98100 m/s <sup>2</sup> )) | ±1 %  | ±1 %  | ≤1 %  | ±1 %  |
| Transverse Sensitivity                                | ≤3 %  | ≤3 %  | ≤3 %  | ≤3 %  |
| <b>Environmental</b>                                  |   |   |   |   |
| Temperature Range (Operating)                         | -65-250 °F<br>-54-121 °C  | -65-150 °F<br>-54-65 °C   | -65-250 °F<br>-54-121 °C  | -65-250 °F<br>-54-121 °C  |
| <b>Electrical</b>                                     |   |   |   |   |
| Excitation Voltage (Maximum)                          | 15.0 VDC  | 15.0 VDC  | 12.0 VDC  | 15.0 VDC  |
| <b>60 KG</b>  |   |   |   |   |
| <b>Model Number</b>                                   | <b>3501A2060KG</b>  | <b>3503C2060KG</b>  | <b>3501B1260KG</b>  | <b>3503A1160KG</b>  |
| <b>Performance</b>                                    |   |   |   |   |
| Sensitivity (±50%) (at 10 VDC)                        | .003 mV/g<br>.0003 mV/(m/s <sup>2</sup> )   | 0.0015 mV/g<br>0.00015 mV/(m/s <sup>2</sup> )                                     | 0.003 mV/g<br>0.0003 mV/(m/s <sup>2</sup> )   | 0.003 mV/g<br>.0003 mV/(m/s <sup>2</sup> )  |
| Sensitivity (raw)                                     | 0.0003 mV/V/g<br>0.00003 mV/V/(m/s <sup>2</sup> )                                 | 0.0003 mV/V/g<br>0.00003 mV/V/(m/s <sup>2</sup> )                                 | 0.0003 mV/V/g<br>0.00003 mV/V/(m/s <sup>2</sup> )                                   | 0.0003 mV/V/g<br>0.00003 mV/V/(m/s <sup>2</sup> )                                   |
| Measurement Range                                     | ±60000 g<br>±588400 m/s <sup>2</sup> pk   | ±60000 g<br>±588400 m/s <sup>2</sup> pk   | ±60000 g<br>±588400 m/s <sup>2</sup> pk   | ±60000 g<br>±588400 m/s <sup>2</sup> pk   |
| Frequency Range (1dB)                                 | 0-20000 Hz  | 0-10000 Hz  | 0-20000 Hz  | 0-10000 Hz  |
| Resonant Frequency                                    | >120 kHz  | >150 kHz  | >120 kHz  | ≥120 kHz  |
| Damping Ratio   | 2 % Critical  | 2 % Critical  | 2 % Critical  | 2 % Critical  |
| Non-Linearity (per 10000 g (98100 m/s <sup>2</sup> )) | ±1 %  | ±1 %  | ≤1 %  | ±1 %  |
| Transverse Sensitivity                                | ≤3 %  | ≤3 %  | ≤3 %  | ≤3 %  |
| <b>Environmental</b>                                  |   |   |   |   |
| Temperature Range (Operating)                         | -65-250 °F<br>-54-121 °C  | -65-150 °F<br>-54-65 °C   | -65-250 °F<br>-54-121 °C  | -65-250 °F<br>-54-121 °C  |
| <b>Electrical</b>                                     |   |   |   |   |
| Excitation Voltage (Maximum)                          | 15.0 VDC  | 12.0 VDC  | 15.0 VDC  | 15.0 VDC  |

## MODEL NUMBERING SYSTEM FOR SERIES 3501 AND 3503 MEMS HIGH-AMPLITUDE SHOCK ACCELEROMETERS

### Single Axis Series 3501

|  |   |  |  |  |
|--|---|--|--|--|
| 3501   | Single axis, MEMS DC response shock accelerometer   |  |  |  |
| 1) Configurations  |   |  |  |  |
| B12<br>A20   | Titanium housing, mounted with integral 1/4-28 thread stud, side cable exit<br>Housed in a SMT leadless chip carrier to facilitate surface mount installation |  |  |  |
| 2) Measurement Range   |   |  |  |  |
| 20KG<br>60KG   | ±20000 G<br>±60000 G  |  |  |  |
| 3) Integral Cable Length for configuration 3501B12XXG (add only if other than standard length shown above) |   |  |  |  |
| / XXX  | Specify XXX, as desired in feet   |  |  |  |
| 4) Cable Termination (add only if selecting other than pigtail connection)                                 |   |  |  |  |
| LN   | Mini 8-pin DIN connector  |  |  |  |
| AY   | 4-pin plug  |  |  |  |
| CA   | 4-pin jack  |  |  |  |

### Triaxial Series 3503 (Q309)

|   |  |  |  |  |
|---|--|--|--|--|
| 3503  | Triaxial, MEMS DC response shock accelerometer   |  |  |  |
| 1) Configurations   |  |  |  |  |
| A11<br>C20  | Titanium housing, two through-holes for 4-40 mounting bolts<br>Triaxial MEMS accelerometer, surface mount technology |  |  |  |
| 2) Measurement Range  |  |  |  |  |
| 20KG<br>60KG  | ±20000 G<br>±60000 G   |  |  |  |
| 3) Integral Cable Length for configuration 3503A11XXG only (add only if other than standard length shown above) |  |  |  |  |
| / XXX   | Specify XXX, as desired in feet  |  |  |  |
| 4) Cable Termination (add only if selecting other than pigtail connection)                                      |  |  |  |  |
| LY  | (3) LN Mini 8-pin DIN connectors in a triple splice  |  |  |  |

### Examples

|      |     |      |      |    |  |
|------|-----|------|------|----|--|
| 3501 | B12 | 60KG |      |    | Single axis, titanium housing, mounted with integral 1/4-28 thread stud, side cable exit, 60000 G range  |
| 3503 | A11 | 20KG | /020 | LY | Triaxial, titanium housing, two through-holes for 4-40 mounting bolts, 20000 G range, 20 ft (6.1m) cable terminating with (3) LN mini 8-pin DIN connectors |



### LN Mini 8-Pin DIN Connector

Bridge input mating connector

| MEMS SENSOR SIGNAL CONDITIONER   |  |  |
|--|--|--|
| Model Number   | 482C27   | 483C28   |
| Channels   | 4  | 8  |
| Sensor Input Types   | Differential & Single-ended MEMS/Bridge, ICP®, Voltage | Differential & Single-ended MEMS/Bridge, ICP®, Voltage     |
| Compatible Sensor Series   | 3501, 3503, 3711<br>3713, 3741, 3991                   | 3501, 3503, 3711<br>3713, 3741, 3991                       |
| Gain   | x0.1 to x2000;<br>x0.1 to x200 [1]                     | x0.1 to x2000;<br>x0.1 to x200 [1]                         |
| Gain Increment   | 0.1  | 0.1  |
| Output Range   | ±10 V  | ±10 V  |
| Frequency Response   | DC to 100k Hz (-3dB) [2]                               | DC to 100k Hz (-3dB) [2]                                   |
| Temperature Range (Operating)  | +32 to +120 °F<br>0 to +50 °C                          | +32 to +120 °F<br>0 to +50 °C                              |
| Excitation Voltage   | -12 VDC to +12 VDC [3]                                 | -12 VDC to +12 VDC [3]                                     |
| Computer Control   | Ethernet/RS-232  | Ethernet   |
| Power Required   | 9 to 18 VDC [4]  | 100 to 240 VAC (47 to 63 Hz)                               |
| Input Connectors   | (4) 8-socket mini DIN<br>(4) BNC Jacks                 | (8) 8-socket mini DIN<br>(8) BNC Jacks                     |
| Output Connectors  | BNC Jacks  | BNC Jacks  |
| Size (Height x Width x Depth)  | 3.2 in x 8.0 in x 5.9 in<br>8.1 cm x 20 cm x 15 cm     | 1.75 in x 19.0 in x 13.7 in<br>44.5 cm x 482.6 cm x 348 cm |
| Weight   | 2.5 lb<br>1.134 kg                                     | 7.0 lb<br>3.18 kg  |
| <b>Supplied Accessories</b>  |  |  |
| 482C27: (1) 017AXX Power Cord; (1) 488B14/NC Universal Power Adaptor;<br>(1) MCSC Control Software |  |  |
| 483C28: (1) 017AXX Power Cord; (1) MCSC Control Software   |  |  |
| <b>Additional Accessories</b>  |  |  |
| Auto Lighter Adaptor   | 488A13   | —  |
| <b>Notes</b>   |  |  |
| [1] Maximum gain for Bridge/MEMS input is x2000 and for ICP®/Voltage input is x200.                |  |  |
| [2] Low frequency response is 0.05 Hz when AC coupled.   |  |  |
| [3] In bipolar mode, +Vexc and -Vexc track each other. They are equal and opposite.                |  |  |
| [4] Supplied with 100 to 240 VAC, 50 to 60 Hz Universal Power Adaptor.                             |  |  |

Models 482C27 (4-channels, bench top) and 483C28 (8-channels, rack mount) are full-featured signal conditioners. They offer low noise operation and are simple to use. Each channel is selectable between several input types: MEMS/Bridge, MEMS/Single-ended, ICP® and Voltage.

The models offer a -12 VDC to +12 VDC excitation voltage for MEMS/Bridge and MEMS/Single-ended sensors. Additional features are incremental gain from x0.1 to x2000, auto zero, auto balance, AC/DC coupling, normalization and shunt calibration. The bridge inputs are compatible with full, half and quarter bridge sensors.

The ICP® inputs offer 24 VDC and 2 to 20 mA of constant current excitation for powering ICP® sensors and in-line ICP® charge convertors. Additional features are incremental gain from x0.1 to x200, normalization and AC/DC coupling.

The 482C27 is powered from 9 to 18 VDC, but is supplied with a universal AC power adaptor. An optional auto lighter adaptor is also available (model 488A13). The 483C28 is line powered only.



**Model 483C28**  
8-channel version, computer control only



**Model 482C27**  
Front Panel



**Model 482C27**  
Rear Panel