

## Advance Product Information VSC7809

Photodetector/Transimpedance Amplifier  
Family for Optical Communication

### Features

- Integrated Photodetector/Transimpedance Amplifier Optimized for High Speed Optical Communications Applications
- Fibre Channel/Gigabit Ethernet Compatible
- High Bandwidth
- Low Input Noise Equivalent Power
- Large Optically Active Area
- Single 3.3V Power Supply

| Part Number | Data Rate | Bandwidth (MHz) | Input Noise ( $\mu W_{rms}$ ) | Optically Active Area ( $\mu m$ diameter) |
|-------------|-----------|-----------------|-------------------------------|-------------------------------------------|
| VSC7809     | 1.25 Gb/s | 800             | 1.4                           | 100                                       |

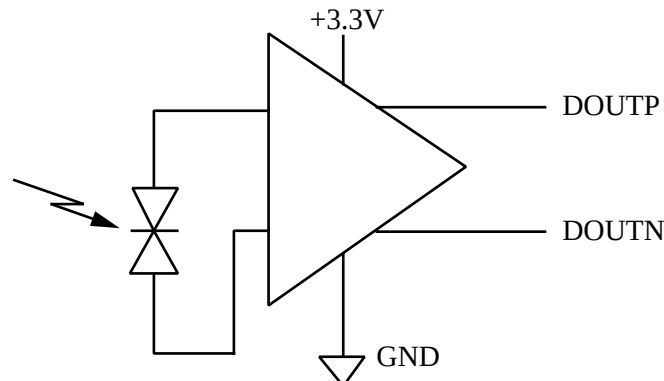
### General Description

The VSC7809 integrated Photodetector/Transimpedance Amplifier provides a highly integrated solution for converting light from a fiber optic communications channel into a differential output voltage. The benefits of Vitesse Semiconductor's Gallium Arsenide H-GaAs process are fully utilized to provide very high bandwidth and low noise in a product with a large optically active area for easy alignment. The sensitivity, duty cycle distortion and jitter meet or exceed all Fibre Channel and Gigabit Ethernet application requirements. Parts are available in either die form, flat-windowed packages or in ball-lens packages.

By using a metal-semiconductor-metal (MSM) photodetector with a monolithic integrated transimpedance amplifier, the input capacitance is lowered which allows for a larger optically active area than in discrete photodetectors. Integration also allows superior tracking over process, temperature and voltage between the photodetector and the amplifier, resulting in higher performance. This part can easily be used in developing Fibre Channel Electro-Optic Receivers which exhibit very high performance and ease of use.

### VSC7809 Block Diagram

#### Photodetector/Transimpedance Amplifier



Both DOUTP and DOUTN are back-terminated to  $25\Omega$ .

**Table 1: Electro-Optical Specifications<sup>(1)</sup>**

| Symbol           | Parameter                     | Min. | Typ. <sup>(2)</sup> | Max. | Units       | Conditions                                                                              |
|------------------|-------------------------------|------|---------------------|------|-------------|-----------------------------------------------------------------------------------------|
| V <sub>SS</sub>  | Supply Voltage                | 3.0  | 3.3                 | 3.6  | V           |                                                                                         |
| I <sub>DD</sub>  | Supply Current                | 14   | 23                  | 40   | mA          |                                                                                         |
| PSRR             | Power Supply Rejection Ratio  | ---- | -10                 | ---- | dB          | Frequencies up to 40MHz<br>Use external filter to get<br>PSRR of -35dB <sup>(3)</sup> . |
| $\lambda$        | Wavelength                    | 700  | 840                 | 850  | nm          |                                                                                         |
| F <sub>c</sub>   | Low Frequency Cutoff          | ---- | 1.8                 | 2.5  | MHz         | -3db, P <sup>(4)</sup> = -15 dBm @ 50 MHz                                               |
| BW               | Optical Modulation Bandwidth  | 800  | 1100                | ---- | MHz         | -3db,<br>P = -15 dBm @ 50 MHz                                                           |
| S                | Sensitivity                   | -20  | -21                 |      | dBm         | 1.25Gb/s, BER10 <sup>-12(5)</sup>                                                       |
| R <sub>o</sub>   | Single Ended Output Impedance | 20   | 25                  | 30   | $\Omega$    |                                                                                         |
| V <sub>d</sub>   | Differential Output Voltage   | 0.2  | 0.26                | 0.4  | V           | P = -5 dBm,<br>R <sub>load</sub> = 100 $\Omega$ differential                            |
| R <sub>d</sub>   | Differential Responsivity     | 0.8  | 1.2                 | ---- | mV/ $\mu$ W | R <sub>load</sub> = 100 $\Omega$<br>P = -15 dBm @ 50 MHz                                |
| V <sub>dc</sub>  | Output Bias Voltage           | 1.0  | ----                | ---- | V           |                                                                                         |
| $\Delta V_{dc}$  | Bias Offset Voltage           | ---- | ----                | 200  | mV          |                                                                                         |
| NEP <sub>o</sub> | Input Noise Equivalent Power  | ---- | 1                   | 1.4  | $\mu$ W rms | P = 0mW                                                                                 |
| V <sub>no</sub>  | Output Noise Voltage          | ---- | 1.0                 | 1.25 | mV rms      | P = 0mW                                                                                 |
| DCD              | Duty Cycle Distortion         | ---- | ----                | 4.5  | %           | P = -5 dBm                                                                              |
| I <sub>out</sub> | Output Drive Current          | 2.0  | 2.6                 | ---- | mA          | P = -5 dBm                                                                              |
| PDJ              | Pattern Dependent Jitter      | ---- | 35                  | 60   | ps          | P = -5 dBm<br>+/-10% Voltage Window                                                     |
| ----             | Optically Active Area         | ---- | 100                 | ---- | $\mu$ m     | Diameter                                                                                |
| PPJ              | PP Jitter                     | ---- | 190                 | 250  | ps          | P = -5 dBm                                                                              |
| T <sub>r</sub>   | Rise Time                     | ---- | ----                | 400  | ps          | 20-80% P = -5 dBm                                                                       |
| T <sub>f</sub>   | Fall Time                     | ---- | ----                | 400  | ps          | 20-80% P = -5 dBm                                                                       |

Notes: (1) Specified over 0°C (ambient) to 70°C (case).

(2) Typical conditions 25°C and 3.3V power supply.

(3) See Note 1 in Application Note 48

(4) P = Incident Optical Power

(5) See Note 2 In Application Note 48

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**Table 2: Absolute Maximum Ratings**

| <i>Symbol</i>    | <i>Parameter</i>                      | <i>Limits</i>                                                                                       |
|------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------|
| V <sub>SS</sub>  | Power Supply                          | 6V required                                                                                         |
| T <sub>stg</sub> | Storage Temperature                   | -55°C to 125°C (case temperature under bias)                                                        |
| H <sub>stg</sub> | Storage Humidity                      | 5 to 95%R.H. (including condensation)                                                               |
| H <sub>op</sub>  | Operating Humidity                    | 8 to 80%R.H. (excluding condensation)                                                               |
| P <sub>inc</sub> | Incident Optical Power                | +3 dBm                                                                                              |
| IS               | Impact Shock                          | 500 G, Half Sine Wave<br>Pulse Duration 1 +/-0.5 ms<br>3 blows in each direction                    |
| V <sub>ib</sub>  | Vibration                             | 20 > 2000 > 20 Hz, 10 Minutes<br>10 G, Peak Acceleration<br>4 Complete Cycles, 3 Perpendicular Axes |
| V <sub>ESD</sub> | ESD Voltage on DOUTP, DOUTN, VSS, GND | 1500V                                                                                               |

**Table 3: Recommended Operating Conditions**

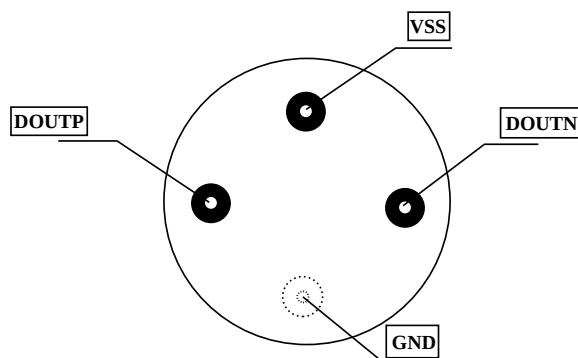
| <i>Symbol</i>    | <i>Parameter</i>      | <i>Limits</i>                 |
|------------------|-----------------------|-------------------------------|
| V <sub>SS</sub>  | Power Supply          | 3.0-3.6V (3.3V nominal)       |
| T <sub>op</sub>  | Operating Temperature | 0°C (ambient) to 70° C (case) |
| P <sub>max</sub> | Maximum Optical Power | 0 dBm                         |

**Table 4: Pin Table Specifications for ball lens packages, flat window packages and bare die.**

| Symbol | Description                                                           |
|--------|-----------------------------------------------------------------------|
| DOUTP  | Data output normal (with reference to incident light)                 |
| DOUTN  | Data output complement (inverting) (with reference to incident light) |
| VSS    | Power supply                                                          |
| GND    | Ground (package case)                                                 |

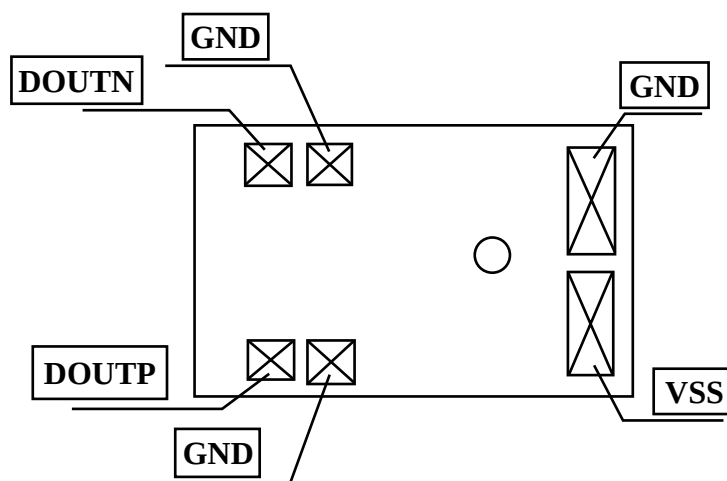
Note: Pin Diagram is identical for both TO-46 and TO-56 package styles.

**Figure 1: Pin Diagram**



*Bottom View*

**Figure 2: Schematic View of Bare Die Pad Assignments**

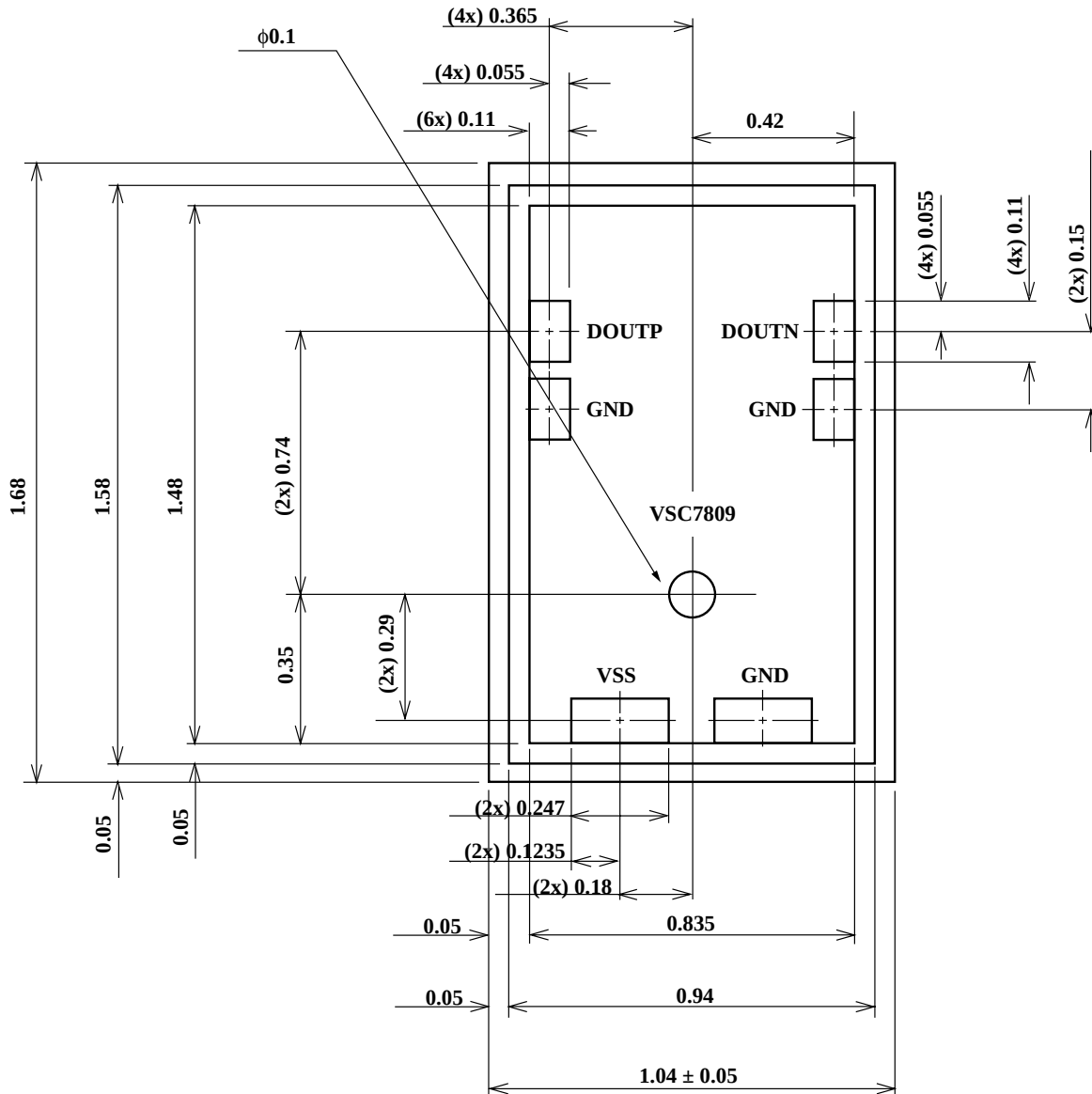


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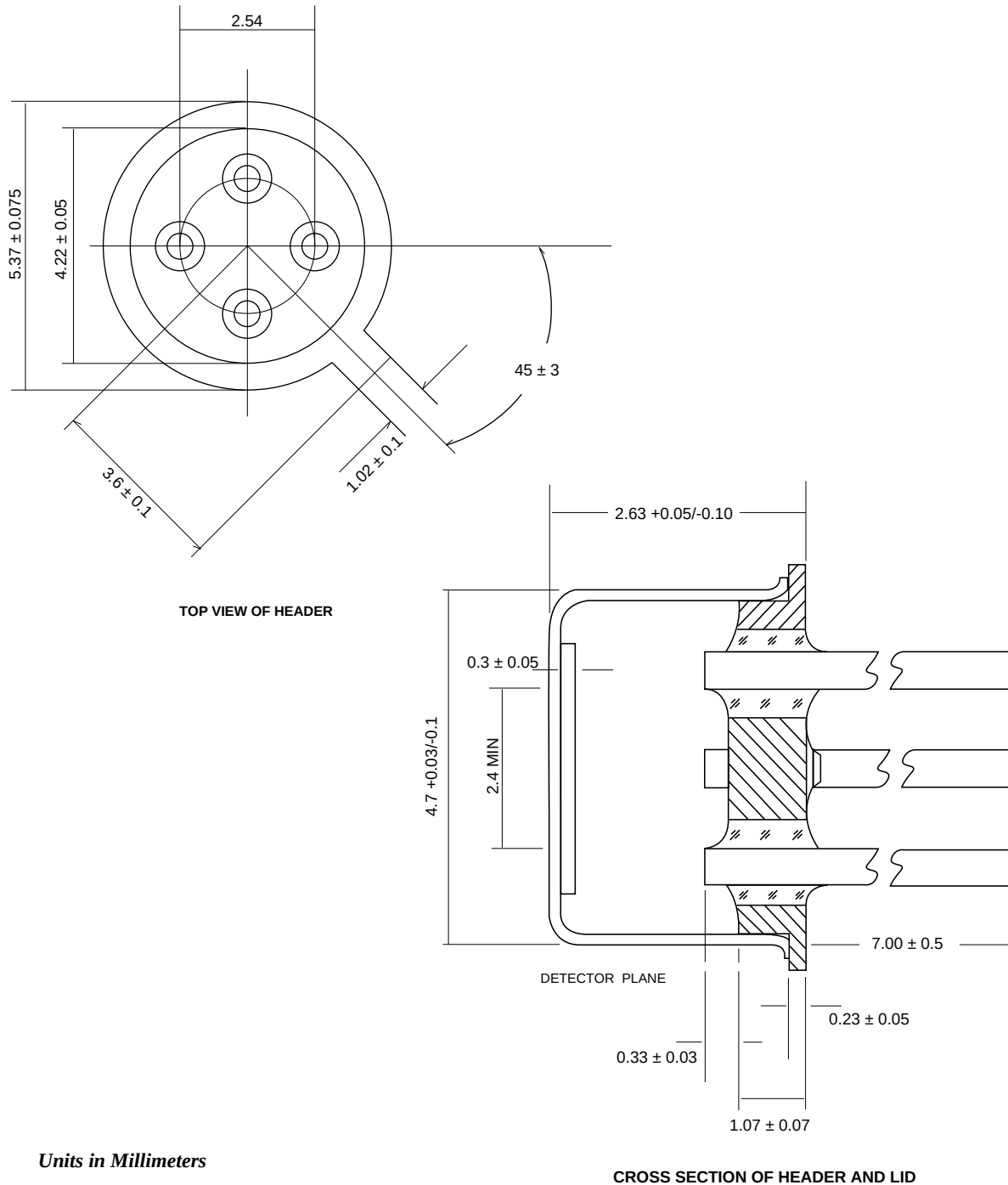
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### Mechanical Specification

Figure 3: Individual Die



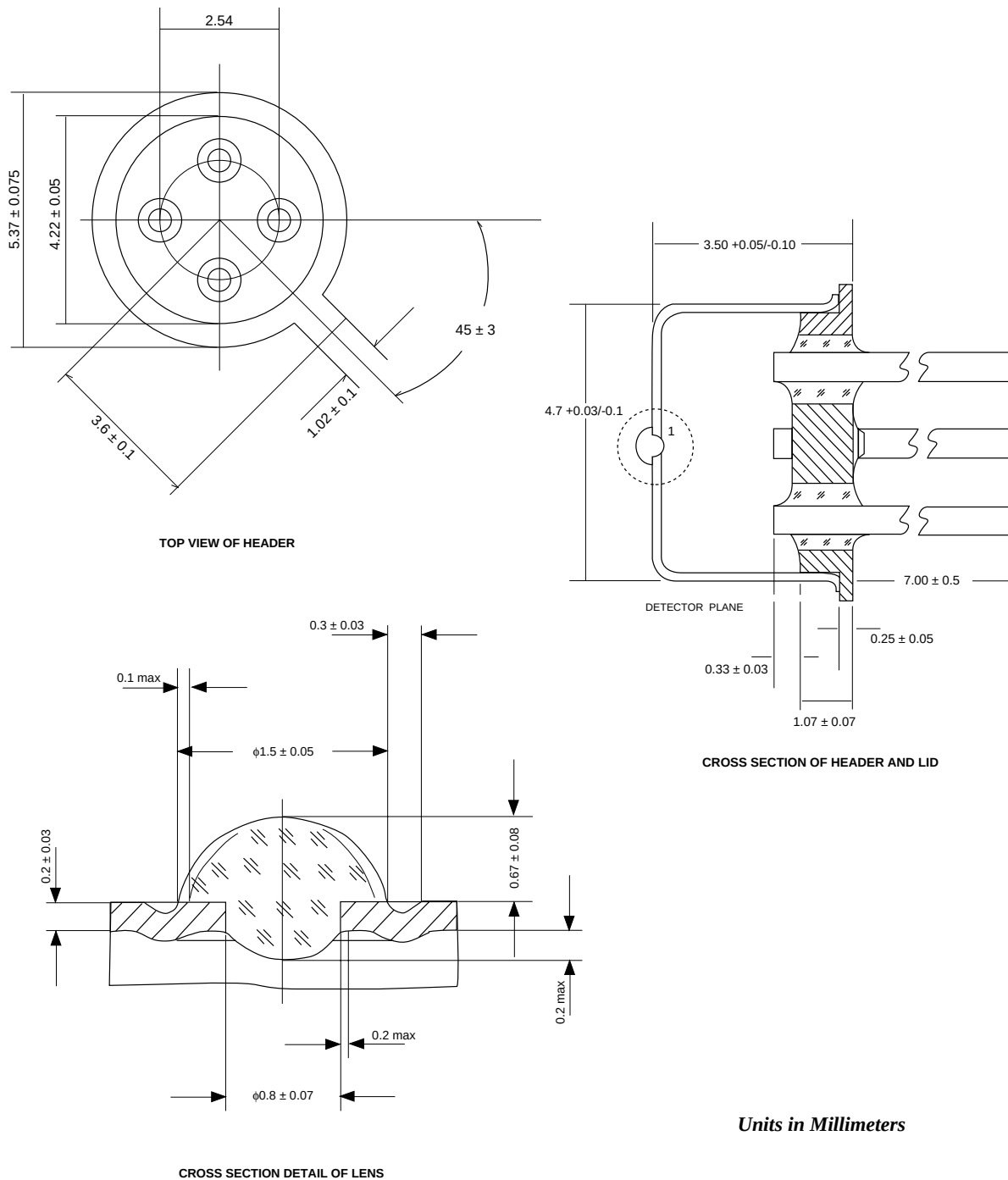
**Figure 4: Mechanical Package Specifications (TO-46 Flat Window)**



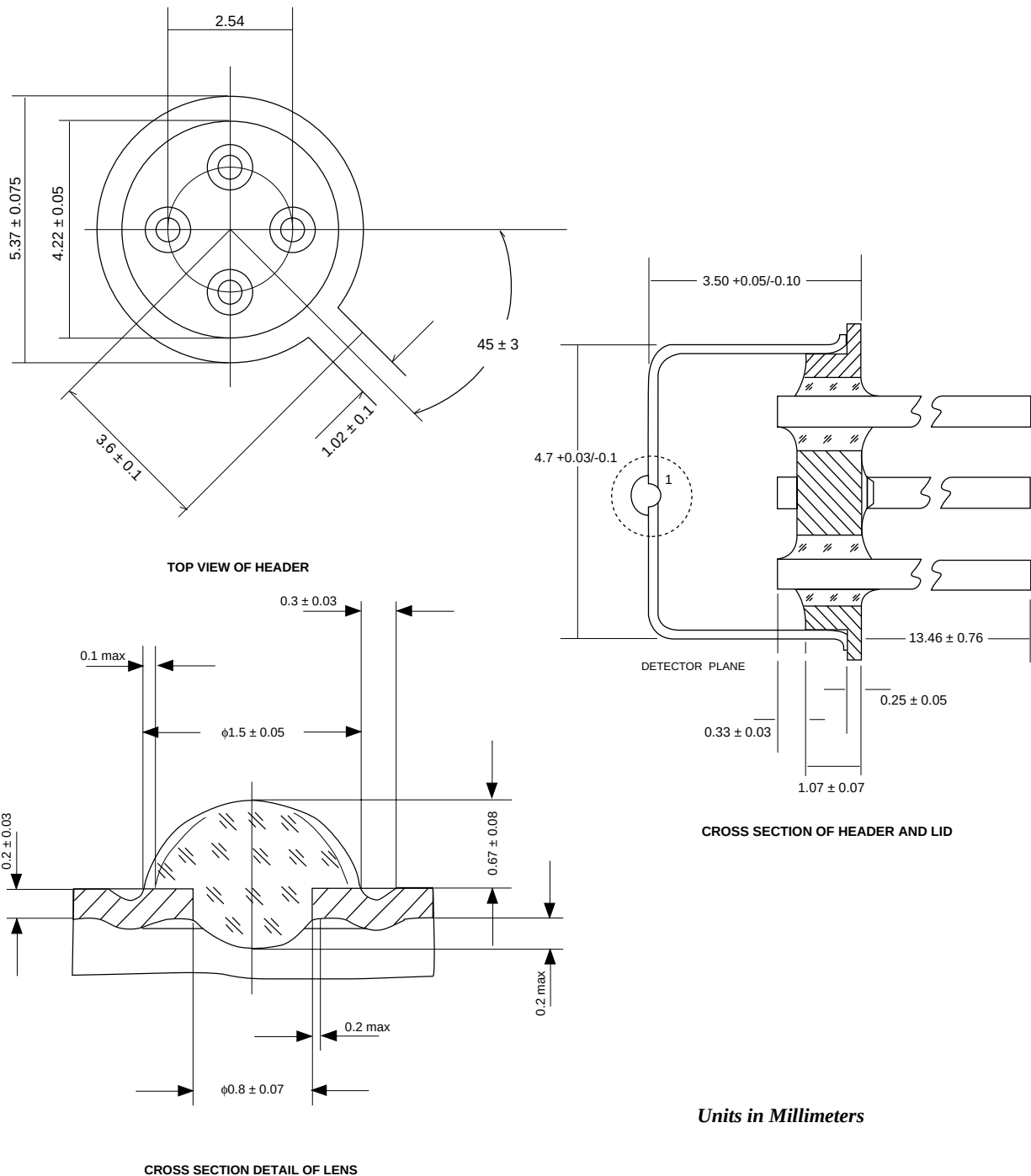
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Figure 5: Mechanical Package Specifications (TO-46 Ball Lens Package with 7mm lead length)



**Figure 6: Mechanical Package Specifications (TO-46 Ball Lens Package with 13mm lead length)**

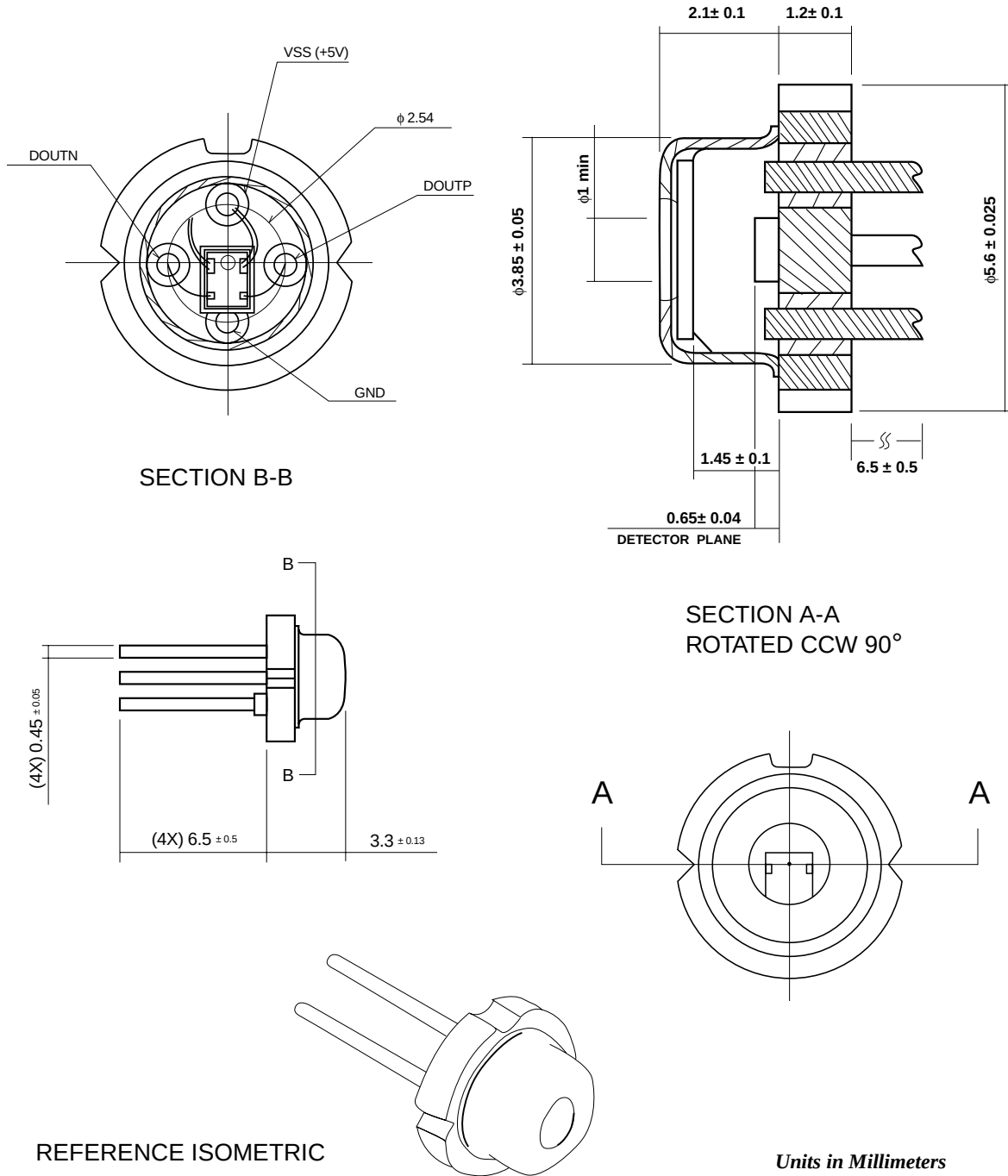




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Figure 7: Mechanical Package Specifications



## Ordering Information

Part Numbering Scheme:

### VSC78XXYY

|    |                                                   |
|----|---------------------------------------------------|
| YY | Package Style                                     |
| X  | Individual Die                                    |
| WA | TO-46 Package with Flat Window                    |
| WC | TO-46 Package with Ball Lens and 7mm lead length  |
| WD | TO-46 Package with Ball Lens and 13mm lead length |
| WB | 5.6mm Package                                     |

## Notice

This document contains information about a product during its fabrication or early sampling phase of development. The information contained in this document is based on design targets, simulation results or early prototype test results. Characteristic data and other specifications are subject to change without notice. Therefore the reader is cautioned to confirm that this data sheet is current prior to design or order placement.

## Warning

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