

## Advance Product Information VSC7709

1.25Gb/s Photodetector/Transimpedance  
Amplifier for Optical Communication

### Features

- High Bandwidth: 1100MHz
- Low Input Noise Equivalent Power: 0.5mW
- Single 3.3V Supply
- 1.25Gb/s Data Rate
- 75mm Optically Active Area (PIN diode)
- Integrated AGC
- Package: TO-46, TO-56, Bare Die

### Applications

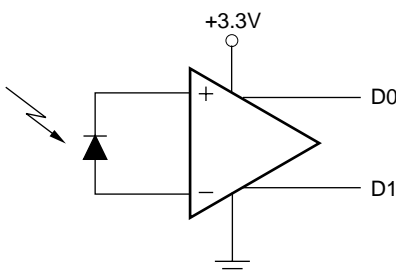
- Gigabit Ethernet Optical Receivers
- Fibre Channel Optical Receivers
- ATM Optical Receivers
- System Interconnect
- SONET/SDH

### General Description

The VSC7709 integrated PIN Photodetector/Transimpedance Amplifier provides a highly integrated solution for converting 1300 nm 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 a very high bandwidth and low noise amplifier. The PIN detector is 75 $\mu$ m in diameter. The detector bias is supplied internally eliminating the need for a separate bias connection. The sensitivity, duty cycle distortion and jitter meet or exceed all Fibre Channel and Gigabit Ethernet application requirements. The VSC7709 is available in flat-windowed or lensed packages. The transimpedance amplifier is also available in bare die form.

The use of a photodetector and transimpedance amplifier hybrid, reduces the input capacitance, resulting in higher sensitivity and bandwidth and improved speed of response. These parts can easily be used in developing Fibre Channel and Gigabit Ethernet electro-optic receivers for the 900nm-1600nm spectral range which exhibit very high performance and ease of use.

### Block Diagram



## Electrical Characteristics

Table 1: Electro-Optic Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$\lambda$	Wavelength	1270		1355	nm	
V <sub>DD</sub>	Power Supply Voltage	3.0		3.6	V	
I <sub>S</sub>	Power Supply Current		30		mA	
PSRR	Power Supply Rejection Ratio		TBD		dB	f = 0.3MHz to 40MHz. Hybrid differential with external filter.
BW	Optical Modulation Bandwidth		1000		MHz	See Measurements and Applications section
f <sub>C</sub>	Low Frequency Cutoff		2		MHz	See Measurements and Applications section
R <sub>D</sub>	Differential Responsivity		2.5		mV/μW	
T <sub>Z</sub>	Differential Transimpedance		2000		Ω	R <sub>L</sub> = 100Ω <sup>(1)</sup>
R <sub>O</sub>	Single-Ended Output Impedance		25		Ω	R <sub>L</sub> = 100Ω <sup>(2)</sup>
V <sub>N</sub>	Output Noise Voltage			1.2	mV rms	BW = 800MHz, P = 0mW
NEP <sub>O</sub>	Input Noise Equivalent Optical Power		0.5		μW rms	BW = 800MHz, P = 0mW
S	Sensitivity		-26		dBm	BER 10 <sup>-12</sup> , B = 1250Mb/s <sup>(3)</sup>
ΔV	Bias Offset Voltage			200	mV	P = -3dBm
V <sub>D</sub>	Differential Output Voltage	0.25			V	P = -3dBm, R = 100Ω
PDJ	Pattern Dependent Jitter		60		ps	P = -3dBm, ±10% voltage window
DCD	Duty Cycle Distortion		5		%	P = -3dBm
T <sub>R</sub> /T <sub>F</sub>	Rise and Fall Times			400	ps	20% to 80%, P = -3dBm

NOTES: (1) Applicable to packaged parts with assembled 1300nm photodetector with responsivity = 0.8A/W. (2) Applicable to bare dice. (3) By characterization. See Measurements and Application section.

## Absolute Maximum Ratings<sup>(1)</sup>

Power Supply Voltage (V<sub>DD</sub>)..... +6V  
 Maximum Junction Temperature Range..... -55°C to +125°C  
 Storage Temperature Range..... -55°C to +125°C  
 Incident Optical Power (P<sub>INC</sub>)..... +3dBm

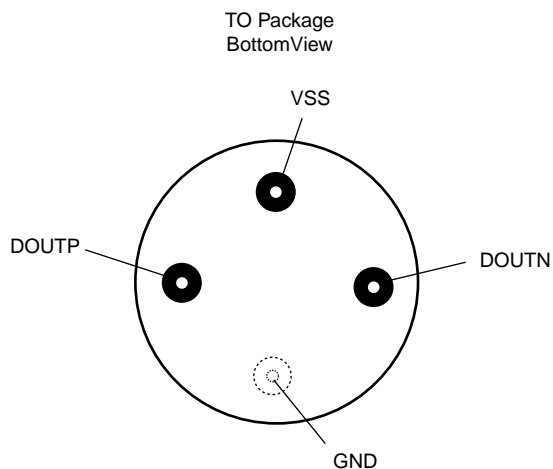
NOTE: (1) CAUTION: Stresses listed under “Absolute Maximum Ratings” may be applied to devices one at a time without causing permanent damage. Functionality at or above the values listed is not implied. Exposure to these values for extended periods may affect device reliability.

## Recommended Operating Conditions

Positive Voltage Rail (V<sub>DD</sub>)..... 3.0 to 3.6V  
 Negative Voltage Rail (GND)..... 0V  
 Operating Temperature Range (T<sub>A</sub>)..... 0°C Ambient to +85°C Case

## Package Descriptions

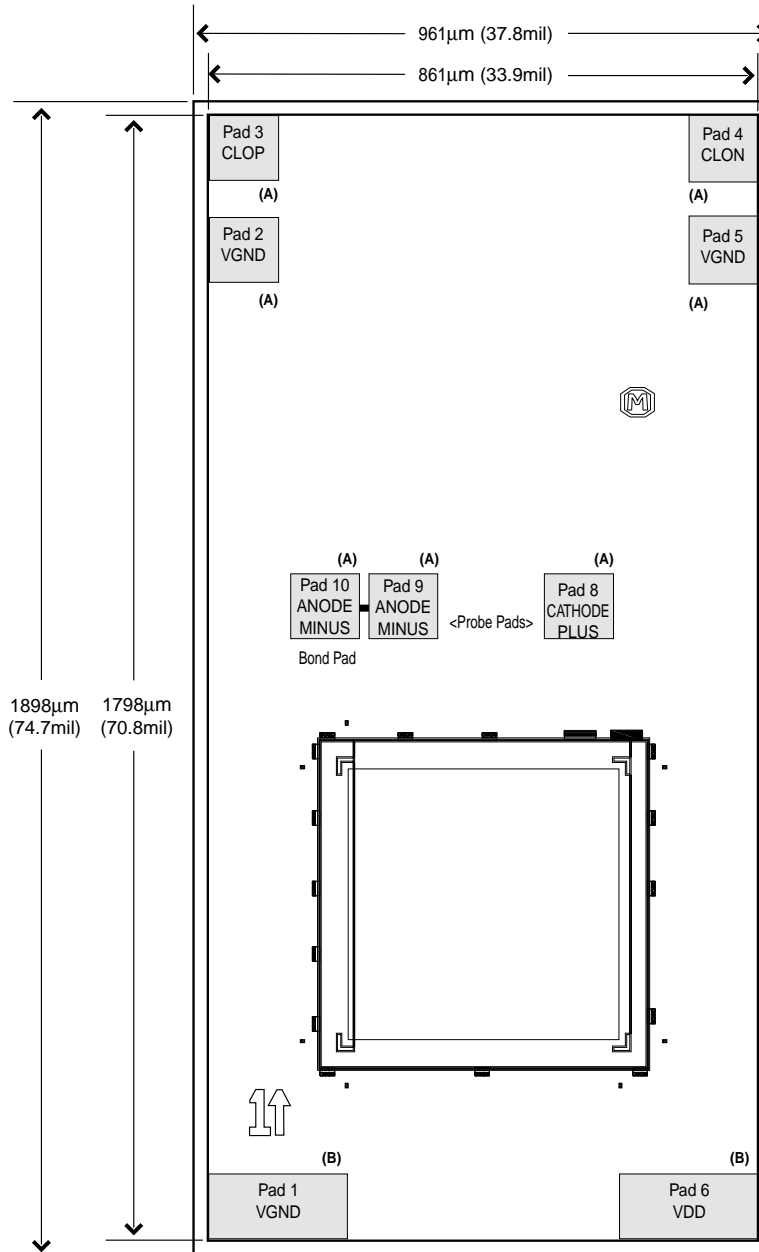
**Figure 1: Pin Diagram**



**Table 2: Pin Identification for TO-46 (ball lens) and Bare Die**

<i>Symbol</i>	<i>Description</i>
D <sup>+</sup> OUT	Data output normal (with reference to incident light)
D <sup>-</sup> OUT	Data output complement (inverting, with reference to incident light)
VDD	Power supply
GND	Ground (package case)

**Figure 2: Pad Assignments**



Die Size: 861µm x 1798µm (33.9mil x 70.8mil)  
 Actual Die Size: 961µm x 1898µm (37.8mil x 74.7mil)  
 Die Thickness: 254µm (10mil)  
 Pad Size (A): 110µm x 110µm (4.3mil x 4.3mil)  
 Pad Passivation Opening (A): 86µm x 86µm (3.3mil x 3.3mil)  
 Pad Size (B): 220µm x 110µm (8.6mil x 4.3mil)  
 Pad Passivation Opening (B): 196µm x 86µm (7.7mil x 3.3mil)

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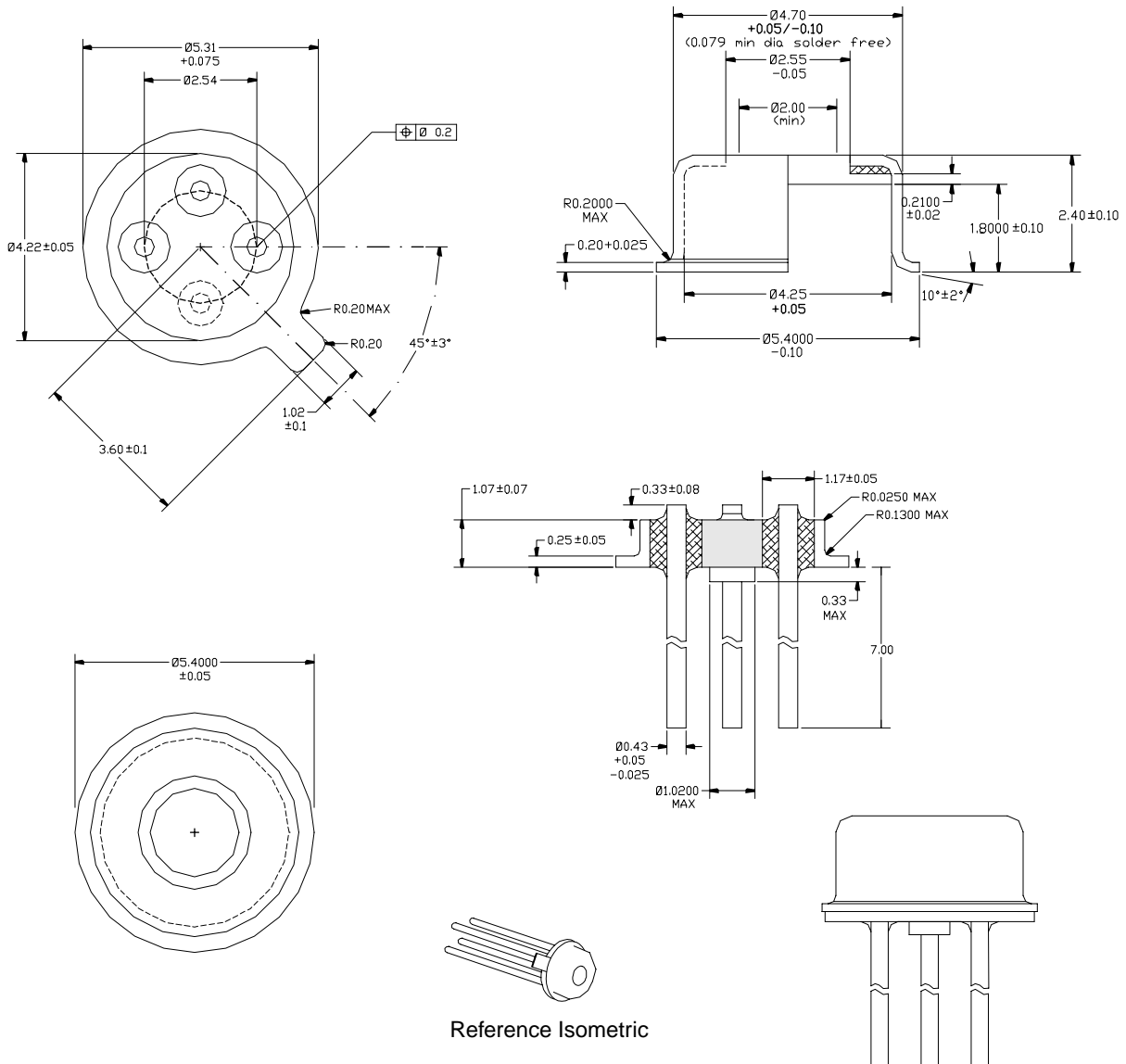
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**Table 3: Pad Coordinates**

<i>Signal Name</i>	<i>Pad Number</i>	<i>Coordinates (μm)</i>		<i>Description</i>
		<i>X</i>	<i>Y</i>	
VGND	1	110.00	55.00	Ground
VGND	2	55.00	1582.40	Ground
CLOP	3	55.00	1742.70	Data Output, True (with reference to incident light)
CLON	4	806.00	1742.70	Data Output, Complement (inverting, with reference to incident light)
VGND	5	806.00	1582.40	Ground
VDD	6	751.00	55.00	Power Supply
CATHODE/PLUS	7	482.50	530.50	Photodetector Cathode Connection
CATHODE/PLUS	8	576.50	999.50	Photodetector Cathode Connection
ANODE/MINUS	9	301.50	999.50	Photodetector Anode Connection
ANODE/MINUS	10	181.50	999.50	Photodetector Anode Connection

## Package Information

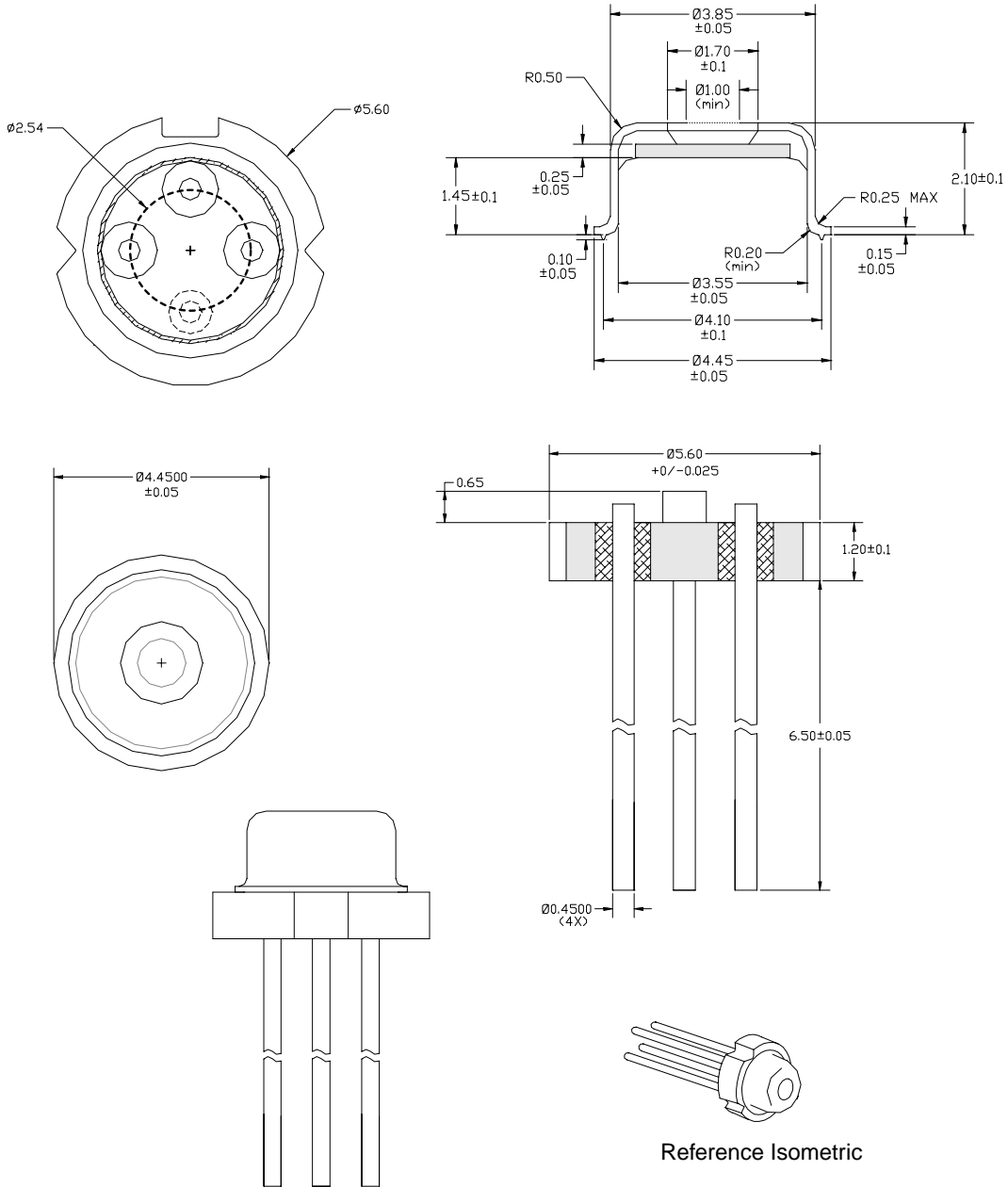
### TO-46 Flat Window Package



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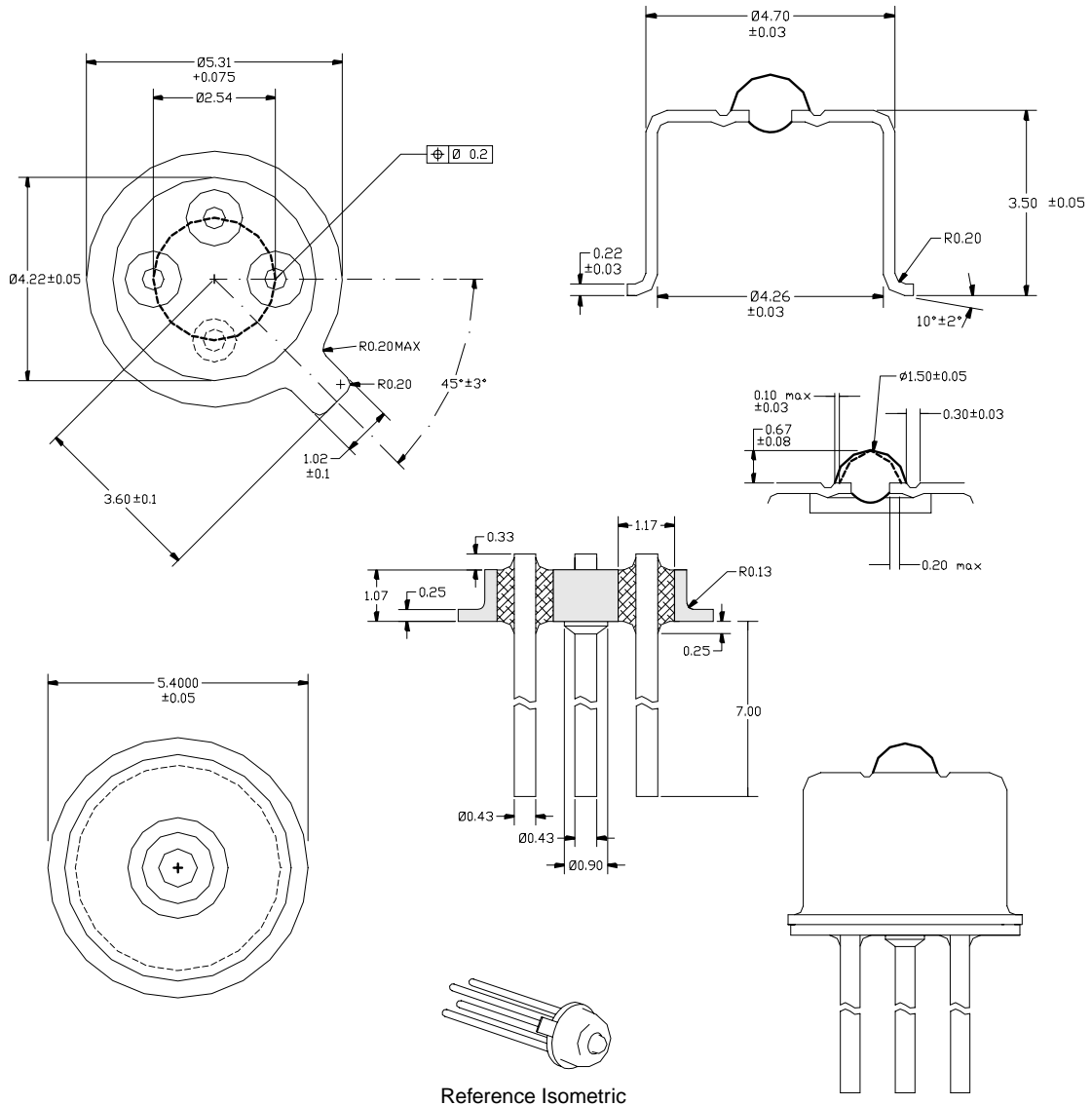
### TO-56 Flat Window Package



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**TO-46 Ball Lens Package—7mm Lead Length**

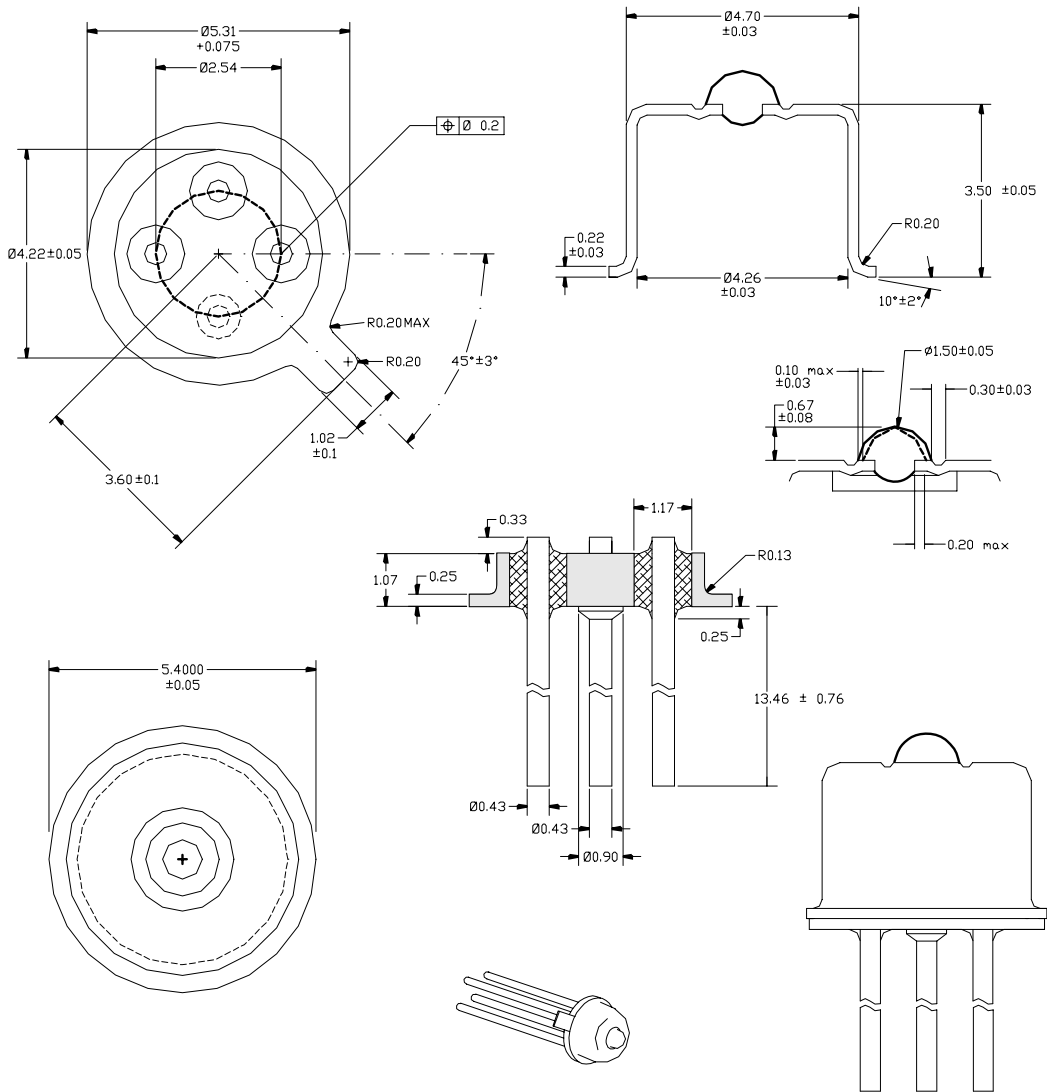




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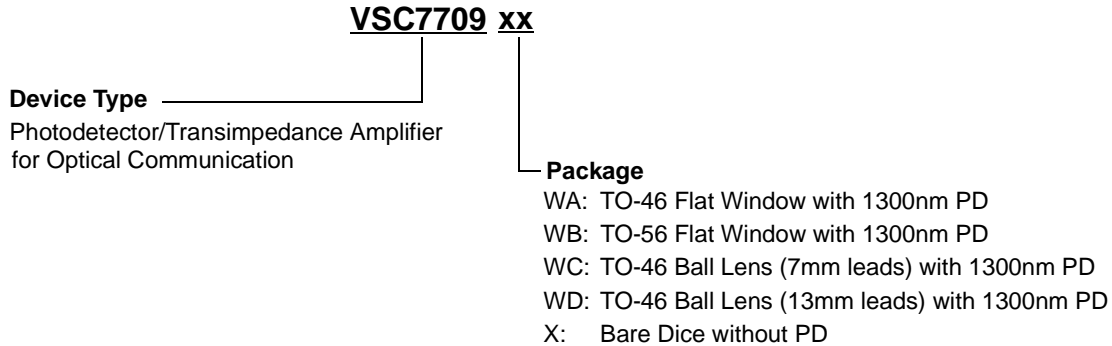
### TO-46 Ball Lens Package—13mm Lead Length



Reference Isometric

## Ordering Information

The order number for this product is formed by a combination of the device type and package type.



Note: PD = 75µm photodetector

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