

# InGaAs APD Preamplifier Module



CMC Electronics' 264-339822 series use an InGaAs APD with low k-factor of 0.2, with a built-in preamplifier enabling optimum signal-to-noise performance.

The APD is coupled to a GaAs FET input trans-impedance amplifier in a 12-lead TO-8 package.

The internal temperature can be monitored via an embedded thermal sensor located close to the APD. The module is designed with a 10  $\Omega$  output impedance and can be AC- or DC-coupled.

The amplifier has an overload input protection circuit which sustains high optical power exposure with an optional very high energy protection also available (-001).

Customizations such as bandwidth tuning, NEP screening, responsivity optimization and different temperature sensors are available upon request.

## Features

- 80 – 200  $\mu\text{m}$  InGaAs APD
- 50 – 200 MHz Preamplifier Module
- Spectral Response: 1050 – 1600 nm
- Low k-factor InGaAs APD
- Low Noise Equivalent Power (NEP)
- Hermetically Sealed TO-8 Package
- ITAR-Free
- ROHS compliant
- Optional:
  - Fast Overload Recovery Circuitry
  - Fiber Receptacle

## Applications

- Range Finding
- LiDAR
- Instrumentation
- Free-Space Communications
- Industrial
- Photometry
- Distributed Temperature Sensing (DTS)
- Distributed Acoustic Sensing (DAS)
- Structural Health Monitoring (SHM)

**Table 1. Electro-Optical Characteristics for 200  $\mu\text{m}$  Active Area (-001)**

Unless otherwise specified:  $T_A = 25^\circ\text{C}$ ,  $V_{\text{POS}} = 5.0\text{ V}$ ,  $V_{\text{NEG}} = -5.0\text{ V}$ ,  $R_L = 100\ \Omega$ ,  $\lambda = 1570\text{ nm} \pm 10\text{ nm}$   
(Externally AC coupled through 4.7  $\mu\text{F}$ )

| Parameter                                                                    | 264-339822-001<br>Fast recovery |       |      | 264-339822-VAR<br>Standard recovery |       |      | Units                  |
|------------------------------------------------------------------------------|---------------------------------|-------|------|-------------------------------------|-------|------|------------------------|
|                                                                              | Min.                            | Typ.  | Max. | Min.                                | Typ.  | Max. |                        |
| Operating Voltage, $V_{\text{OP}}$ (Note 1)                                  | 40                              | 54    | 85   | 40                                  | 54    | 85   | V                      |
| Temperature coefficient of $V_{\text{OP}}$                                   |                                 | 0.07  |      |                                     | 0.07  |      | V/ $^\circ\text{C}$    |
| Responsivity                                                                 |                                 | 1.4   |      |                                     | 1.4   |      | MV/W                   |
| Noise equivalent power (Note 2)                                              |                                 |       |      |                                     |       |      |                        |
| 1570 nm [ $T_{\text{case}} = 25^\circ\text{C}$ ]                             |                                 | 70    |      |                                     | 70    |      | fW/ $\sqrt{\text{Hz}}$ |
| 1570 nm [ $T_{\text{case}} = 85^\circ\text{C}$ ]                             |                                 | 240   |      |                                     | 180   |      | fW/ $\sqrt{\text{Hz}}$ |
| Output impedance, $R_{\text{out}}$                                           |                                 | 10    |      |                                     | 10    |      | $\Omega$               |
| Bandwidth                                                                    | 50                              | 60    |      | 50                                  | 60    |      | MHz                    |
| Rise time (10-90 %)                                                          |                                 | 6     |      |                                     | 6     |      | ns                     |
| Fall time (90-10 %)                                                          |                                 | 6     |      |                                     | 6     |      | ns                     |
| Linear output voltage swing (Pulse)                                          | 1.5                             | 2.5   | 4.0  | 1.5                                 | 2.5   | 4.0  | V                      |
| Output offset voltage                                                        | -0.75                           | -0.45 | 0    | -0.75                               | -0.45 | 0    | V                      |
| Thermal sensor (1N914 diode) (Note 3)                                        |                                 |       |      |                                     |       |      |                        |
| $I_f$ of 5 mA at $25^\circ\text{C}$                                          |                                 | 645   |      |                                     | 645   |      | mV                     |
| Sensor sensitivity                                                           |                                 | -1.9  |      |                                     | -1.9  |      | mV/ $^\circ\text{C}$   |
| Overload recovery for optical power input signal of 1 mW, 20 ns pulse width: |                                 |       |      |                                     |       |      |                        |
| $V_{\text{out}} \rightarrow 200\text{ ns}$ after pulse start                 |                                 |       | 250  |                                     |       | 250  | mV                     |
| $V_{\text{out}} \rightarrow 1\ \mu\text{s}$ after pulse start                |                                 |       | 40   |                                     |       | 40   | mV                     |
| 5 W, 20 ns pulse width (Note 4)                                              |                                 | 325   |      |                                     | 525   |      | ns                     |
| Hybrid Supply current                                                        |                                 |       |      |                                     |       |      |                        |
| $V_{\text{POS}}$ (pin 10)                                                    | 25                              |       | 35   | 25                                  |       | 35   | mA                     |
| $V_{\text{NEG}}$ (pin 11)                                                    | -20                             |       | -10  | -20                                 |       | -10  | mA                     |

- Notes:**
1. Each APD receiver will have its individual  $V_{\text{OP}}$  (provided on its production tests report).
  2. NEP values for  $+85^\circ\text{C}$  are by design and are for reference only. No test values are provided on individual test reports. Integration of the noise calculation is based on minimum bandwidth.
  3. Alternate thermal sensors (thermistance or diode) are available upon request.
  4. Not tested on all units.

**Table 2. Electro-Optical Characteristics for 80  $\mu\text{m}$  Active Area (VAR)**Unless otherwise specified:  $T_A = 25^\circ\text{C}$ ,  $V_{\text{POS}} = 5.0\text{ V}$ ,  $V_{\text{NEG}} = -5.0\text{ V}$ ,  $R_L = 100\ \Omega$ ,  $\lambda = 1570\text{ nm} \pm 10\text{ nm}$ (Externally AC coupled through 4.7  $\mu\text{F}$ )

| Parameter                                                                    | Min.  | Typ.  | Max. | Units                  |
|------------------------------------------------------------------------------|-------|-------|------|------------------------|
| Operating Voltage, $V_{\text{OP}}$ (Note 1)                                  | 40    | 54    | 85   | V                      |
| Temperature coefficient of $V_{\text{OP}}$                                   |       | 0.07  |      | V/ $^\circ\text{C}$    |
| Responsivity                                                                 |       | 2.0   |      | MV/W                   |
| Noise equivalent power (Note 2)                                              |       |       |      |                        |
| 1570 nm [ $T_{\text{case}}=25^\circ\text{C}$ ]                               |       | 50    |      | fW/ $\sqrt{\text{Hz}}$ |
| 1570 nm [ $T_{\text{case}}=85^\circ\text{C}$ ]                               |       | 80    |      | fW/ $\sqrt{\text{Hz}}$ |
| Output impedance, $R_{\text{out}}$                                           |       | 10    |      | $\Omega$               |
| Bandwidth                                                                    | 100   | 120   |      | MHz                    |
| Rise time (10-90 %)                                                          |       | 3     |      | ns                     |
| Fall time (90-10 %)                                                          |       | 3     |      | ns                     |
| Linear output voltage swing (Pulse)                                          | 1.5   | 2.5   | 4.0  | V                      |
| Output offset voltage                                                        | -0.75 | -0.45 | 0    | V                      |
| Thermal sensor (1N914 diode) (Note 3)                                        |       |       |      |                        |
| $I_f$ of 5 mA at $25^\circ\text{C}$                                          |       | 645   |      |                        |
| Sensor sensitivity                                                           |       | -1.9  |      | V                      |
| Overload recovery for optical power input signal of 1 mW, 20 ns pulse width: |       |       |      |                        |
| $V_{\text{out}} \rightarrow 200\text{ ns}$ after pulse start                 |       |       | 250  | mV                     |
| $V_{\text{out}} \rightarrow 1\ \mu\text{s}$ after pulse start                |       |       | 40   | mV                     |
| 5 W, 20 ns pulse width (Note 4)                                              |       | 525   |      | ns                     |
| Hybrid Supply current                                                        |       |       |      |                        |
| $V_{\text{POS}}$ (pin 10)                                                    | 25    |       | 35   | mA                     |
| $V_{\text{NEG}}$ (pin 11)                                                    | -20   |       | -10  | mA                     |

- Notes:**
1. Each APD receiver will have its individual  $V_{\text{OP}}$  (provided on its production tests report).
  2. NEP values for  $+85^\circ\text{C}$  are by design and are for reference only. No test values are provided on individual test reports. Integration of the noise calculation is based on minimum bandwidth.
  3. Alternate thermal sensors (thermistance or diode) are available upon request.
  4. Not tested on all units.

**Table 3. Absolute-Maximum Ratings, Limiting Values**

| Parameter                                                                 | Min. | Max. | Units                   |
|---------------------------------------------------------------------------|------|------|-------------------------|
| APD breakdown, Maximum voltage [ $HV_{\text{POSITIVE}}$ (pin7) ] (Note 1) |      | 90   | V                       |
| Recommended overcurrent limit                                             |      | 100  | $\mu\text{A}$           |
| Input Voltage Positive Supply [ $V_{\text{POS}}$ (+5V) (pin10) ]          | +4.8 | +6.0 | V                       |
| Input Voltage Negative Supply [ $V_{\text{NEG}}$ (-5V) (pin11) ]          | -4.8 | -6.0 | V                       |
| Maximum Optical Power, CW                                                 |      | 10   | $\mu\text{W}$           |
| Peak value, 20ns pulses <100Hz                                            |      | 100  | $\text{kW}/\text{cm}^2$ |
| Temperature sensor (1N914 diode) fixed input current between              |      |      |                         |
| Sensor $V_{\text{in}} \rightarrow \text{TSensor ANODE}$ (pin 8)           | 1    | 10   | mA                      |
| Sensor output $\rightarrow \text{TSensor CATHODE}$ (pin 9)                |      |      |                         |
| Operating Temperature                                                     | -40  | 85   | $^\circ\text{C}$        |
| Storage Temperature                                                       | -55  | 125  | $^\circ\text{C}$        |
| Soldering Temperature (5 s, leads only)                                   |      | 250  | $^\circ\text{C}$        |

**Note:** 1. Absolute maximum over the product Temperature Operating Range ( $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ ).

Figure 1. Typical Normalized Responsivity (M=1)

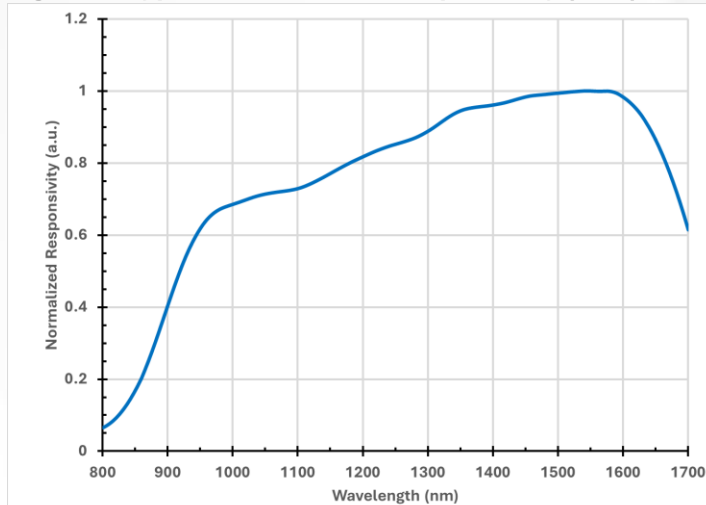
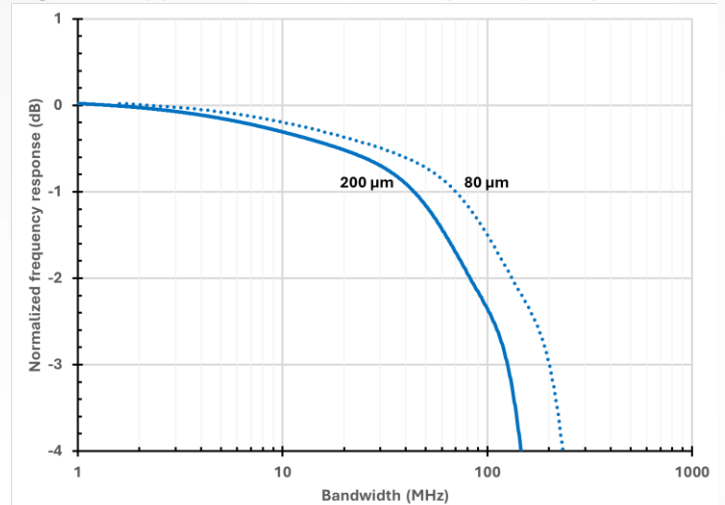
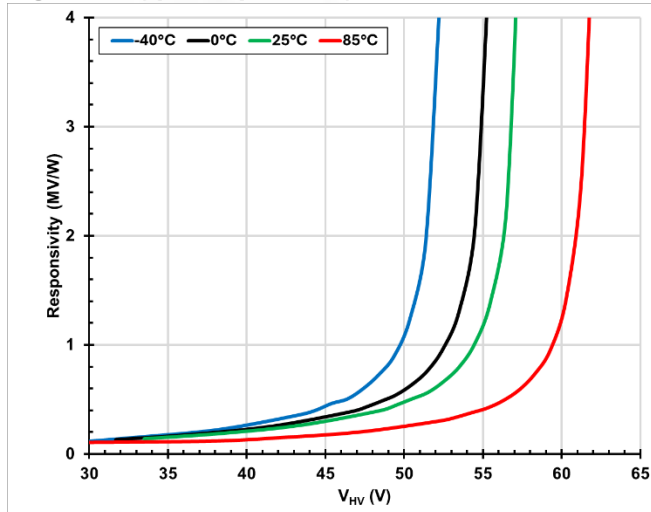
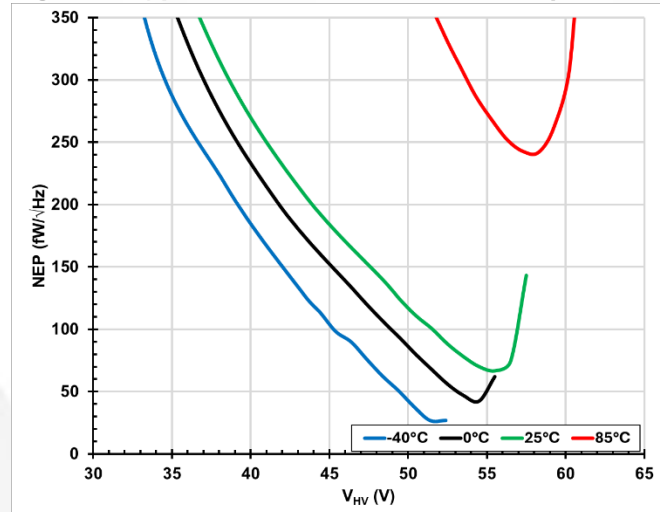
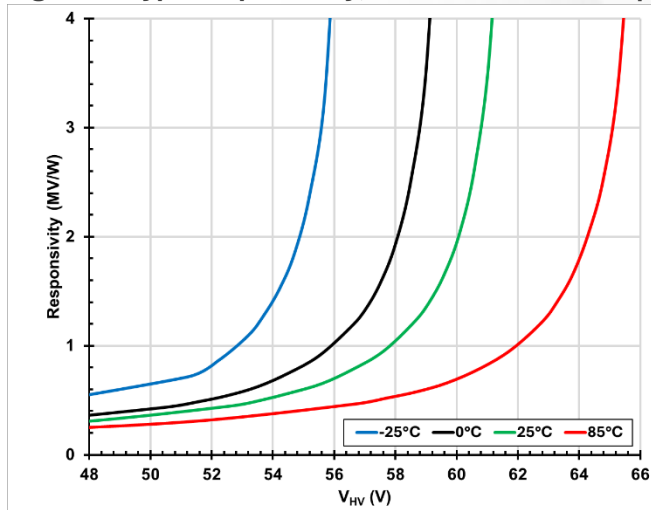
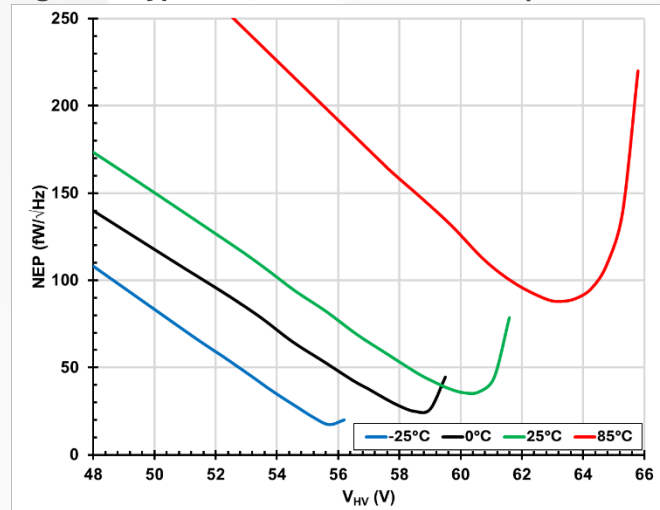


Figure 2. Typical Normalized Frequency Response

Figure 3. Typ. Responsivity,  $R_L = 100 \Omega$  Area = 200  $\mu\text{m}$ Figure 4. Typ. NEP,  $R_L = 100 \Omega$ , Area = 200  $\mu\text{m}$ Figure 5. Typ. Responsivity,  $R_L = 100 \Omega$  Area = 80  $\mu\text{m}$ Figure 6. Typ. NEP,  $R_L = 100 \Omega$  Area = 80  $\mu\text{m}$ 

264-339822 Series  
InGaAs Avalanche Photodiode Preamplifier Module  
Figure 6. CMC 264-339822 Series block diagram

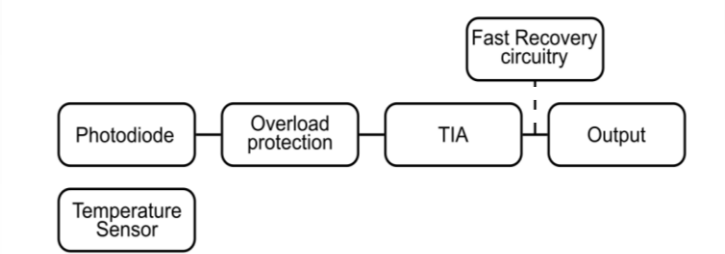
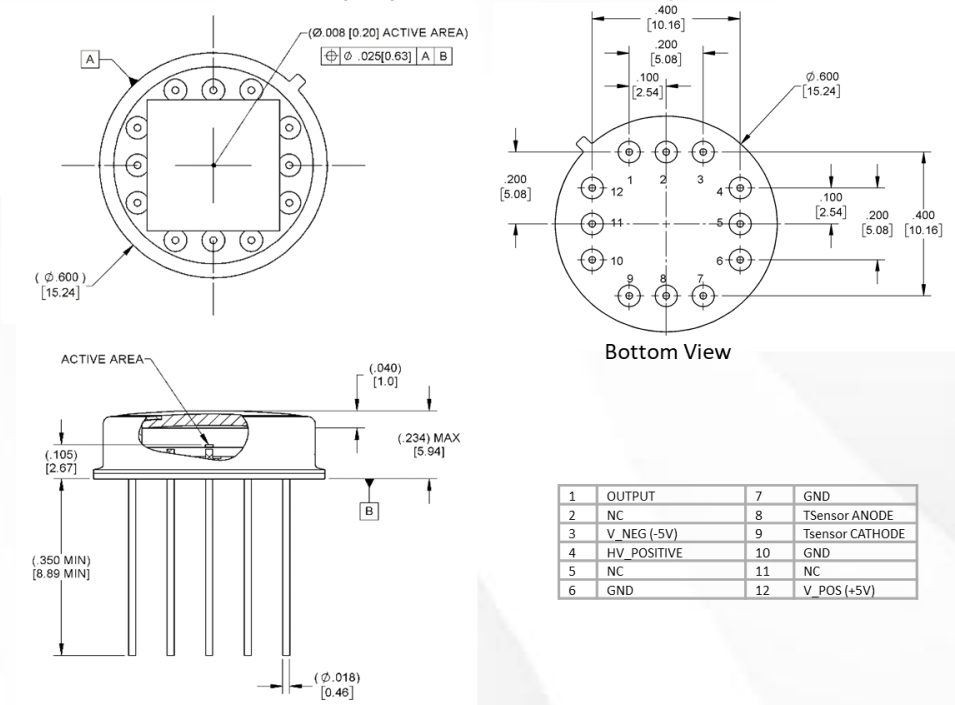


Figure 7. Package Dimension and Pinout  
Unless otherwise specified, dimensions are in inches (mm) and are for reference only.



VAR Options

| VAR  | 264-339822-VAR                                    |
|------|---------------------------------------------------|
| -001 | InGaAs APD 200 μm, 60 MHz TIA, with fast recovery |
| -VAR | InGaAs APD 200 μm, 60 MHz TIA                     |
| -VAR | InGaAs APD 80 μm, 100 MHz TIA                     |



For more information, visit [www.cmcelectronics.ca/optoelectronics](http://www.cmcelectronics.ca/optoelectronics)  
or email us at [opto@cmcelectronics.ca](mailto:opto@cmcelectronics.ca)

For information purposes only. To accommodate product improvements, specifications are subject to change without notice.

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED  
264-339822-VAR | Datasheet REV 01.2026