

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 Ω 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 μm 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 μm 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 μF)

Parameter	Min.	Typ.	Max.	Units
Operating Voltage, V_{OP} (Note 1)	40	54	85	V
Temperature coefficient of V_{OP}		0.07		V/ $^\circ\text{C}$
Responsivity		1.4		MV/W
Noise equivalent power (Note 2)				
1570 nm [$T_{\text{case}} = 25^\circ\text{C}$]		70		fW/ $\sqrt{\text{Hz}}$
1570 nm [$T_{\text{case}} = 85^\circ\text{C}$] (-001)		240		fW/ $\sqrt{\text{Hz}}$
1570 nm [$T_{\text{case}} = 85^\circ\text{C}$] (-VAR)		180		fW/ $\sqrt{\text{Hz}}$
Output impedance, R_{out}		10		Ω
Bandwidth	50	60		MHz
Rise time (10-90 %)		6		ns
Fall time (90-10 %)		6		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°C		645		mV
Sensor sensitivity		-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	mV
$V_{\text{out}} \rightarrow 1\ \mu\text{s}$ after pulse start			40	mV
5 W, 20 ns pulse width (Note 4) (-001)		325		ns
5 W, 20 ns pulse width (Note 4) (-VAR)		525		ns
Hybrid Supply current				
V_{POS} (pin 10)	25		35	mA
V_{NEG} (pin 11)	-20		-10	mA

- Notes:**
- Each APD receiver will have its individual V_{OP} (provided on its production tests report).
 - 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.
 - Alternate thermal sensors (thermistance or diode) are available upon request.
 - Not tested on all units.

Table 2. Electro-Optical Characteristics for 80 μm 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 μF)

Parameter	Min.	Typ.	Max.	Units
Operating Voltage, V_{OP} (Note 1)	40	54	85	V
Temperature coefficient of V_{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_{out}		10		Ω
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°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_{POS} (pin 10)	25		35	mA
V_{NEG} (pin 11)	-20		-10	mA

- Notes:**
1. Each APD receiver will have its individual V_{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_{POSITIVE} (pin7)] (Note 1)		90	V
Recommended overcurrent limit		100	μA
Input Voltage Positive Supply [V_{POS} (+5V) (pin10)]	+4.8	+6.0	V
Input Voltage Negative Supply [V_{NEG} (-5V) (pin11)]	-4.8	-6.0	V
Maximum Optical Power, CW		10	μW
Peak value, 20ns pulses <100Hz		100	kW/cm ²
Temperature sensor (1N914 diode) fixed input current between			
Sensor $V_{\text{in}} \rightarrow$ TSensor ANODE (pin 8)	1	10	mA
Sensor output $\rightarrow$ 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°C to $+85^\circ\text{C}$).

Figure 1. Typical Normalized Responsivity (M=1)

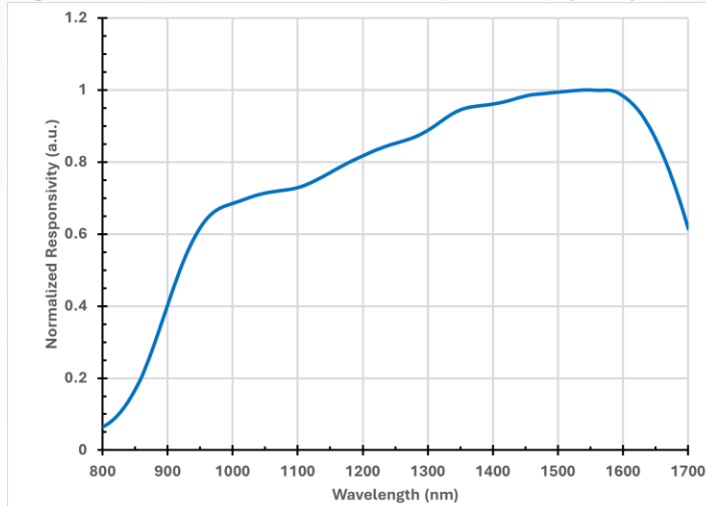


Figure 2. Typical Normalized Frequency Response

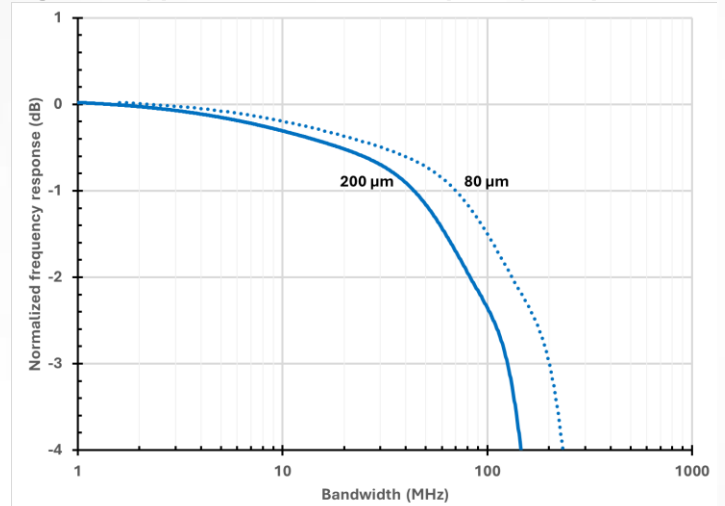


Figure 3. Typ. Responsivity, $R_L = 100 \Omega$ Area = 200 μm

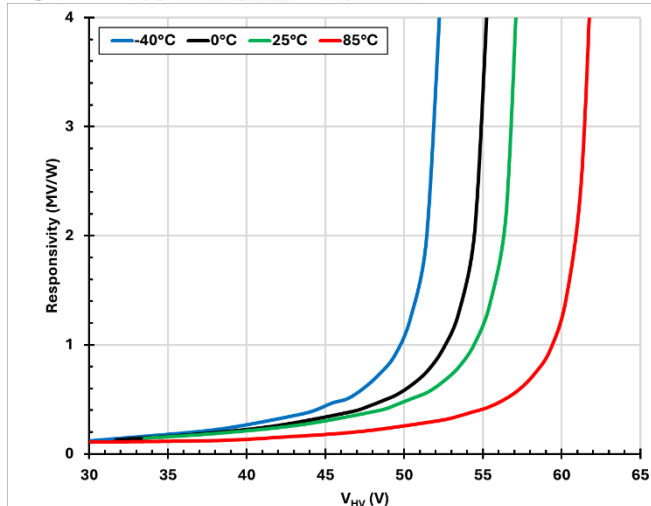


Figure 4. Typ. NEP, $R_L = 100 \Omega$, Area = 200 μm

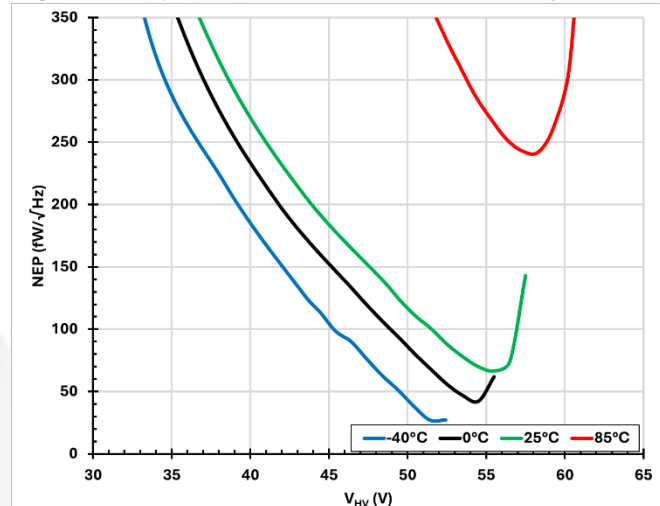


Figure 5. Typ. Responsivity, $R_L = 100 \Omega$ Area = 80 μm

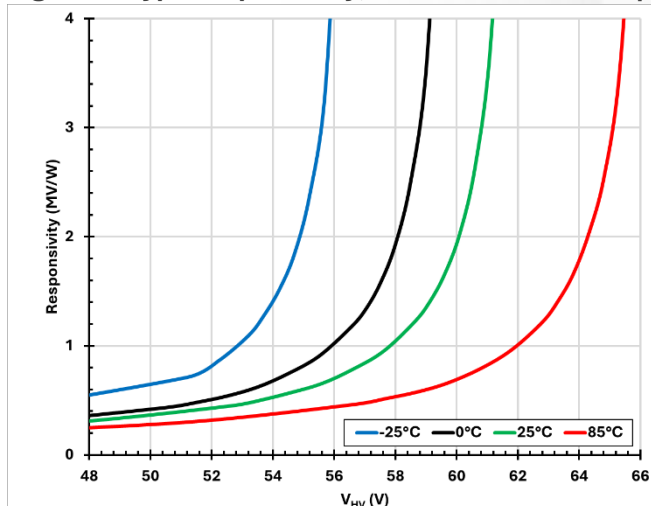


Figure 6. Typ. NEP, $R_L = 100 \Omega$ Area = 80 μm

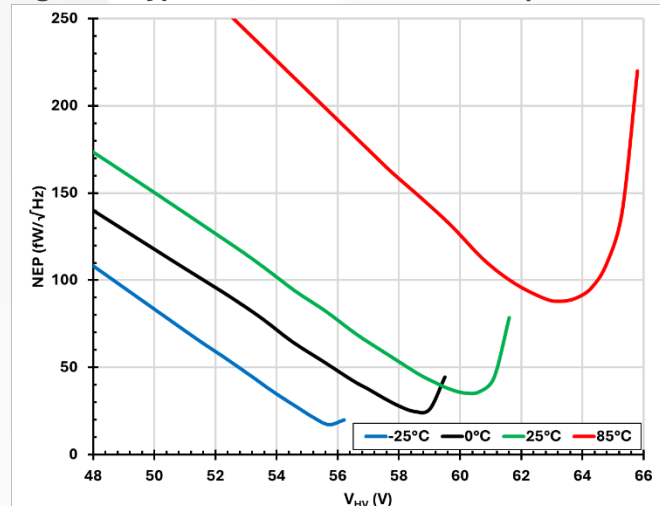
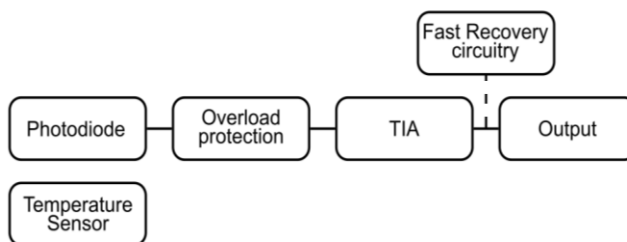
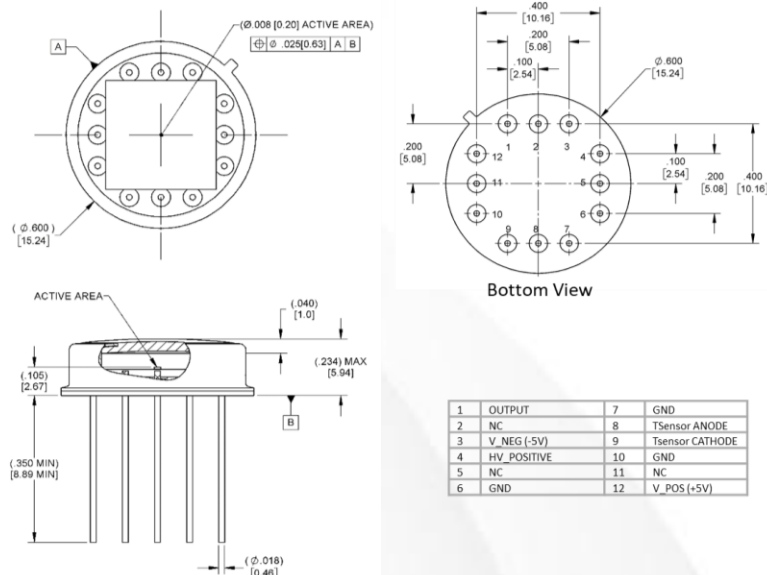
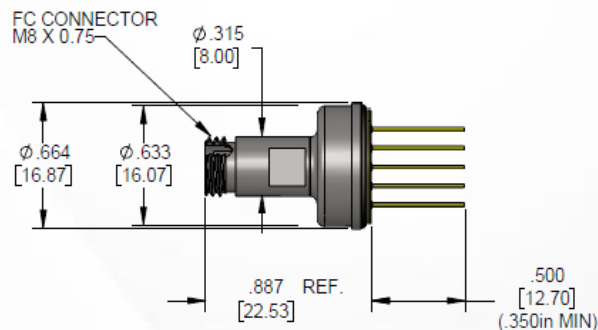


Figure 6. CMC 264-339822 Series block diagram**Figure 7. Package Dimension and Pinout****Figure 8. FC connector (617-339822)**

Unless otherwise specified, dimensions are in inches (mm) and are for reference only.

VAR Options

VAR

264-339822-VAR

-001 InGaAs APD 200 μ m, 60 MHz TIA, with fast recovery

-VAR InGaAs APD 200 μ m, 60 MHz TIA

-VAR InGaAs APD 80 μ m, 100 MHz TIA



For more information, visit www.cmcelectronics.ca/optoelectronics
or email us at opto@cmcelectronics.ca

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