High Bandwidth InGaAs APD Preamplifier Module with TEC

CMC Electronics' 264-339831 series use an InGaAs APD with a low k-factor of 0.2, with a built-in preamplifier and a thermoelectric cooler (TEC), enabling optimum signal-to-noise performance.

The APD is coupled to a GaAs FET input transimpedance amplifier (TIA) in a 12-lead TO-8 package, featuring a TEC that allows for temperature control of the APD and facilitates stabilization of gain and optimized sensitivity. The internal temperature can be monitored via an embedded thermal sensor close to the APD.

Customizations such as bandwidth tuning, NEP screening, responsivity optimization and different temperature sensors are available to fit your system design needs upon request.

Features

- 80 µm InGaAs APD
- 450 MHz Preamplifier Module
- Spectral Response: 1050 – 1600 nm
- Low k-factor of 0.2 InGaAs APD
- Low Noise Equivalent Power (NEP)
- High Efficiency TEC
- High Sensitivity
- Hermetically Sealed TO-8 Package
- ITAR-Free
- RoHS compliant
- Optional: Fiber Receptacle

Applications

- Free-Space Communications
- Decoding
- LiDAR
- Laser Microscopy
- Imaging Systems
- Industrial (Safety curtains)

Table 1. Electro-Optical Characteristics

Unless otherwise specified: T_{case} = 25 °C, V_POS = 5.0 V, V_NEG = -5.0 V, λ = 1570 nm ± 10 nm, Cooler OFF (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/˚C
Responsivity		400		kV/W
Noise equivalent power (Note 2)				
1570 nm [T_{case}=25 °C]		65		fW/√Hz
1570 nm [T_{case}=85 °C]		125		fW/√Hz
Output impedance, R_{out}		50		Ω
Bandwidth, f_{-3dB}		450		MHz
Rise time (10-90 %) & Fall time (90-10 %)		0.9		ns
Linear output voltage swing (Pulse)	0.75	1.25	2	V
Output offset voltage	-0.75	-0.45	0	V
Thermal sensor (Note 3)				
Voltage output		1.5740		V
Accuracy (at +30 °C)	±1.5		±4	°C
Accuracy (-55 °C to +130 °C)	±2.5		±5	°C
Non-linearity		±0.4		%
Overload recovery for optical power input signal of 1 mW, 20 ns pulse width:				
V_{out} → 200 ns after pulse start			125	mV
V_{out} → 1 µs after pulse start			20	mV
Hybrid Supply current V_POS (pin 10)	25		40	mA
Hybrid Supply current 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. Integration of the noise calculation is based on f_{-3dB} bandwidth.
3. Alternate thermal sensors (thermistance or diode) are available upon request.

Table 2. 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
TEC Current	-0.9	0.9	A
Temperature sensor (LM20) Sensor V_{in} (pin 4) Sensor output (pin 5)	 2.5 1 0.2	 5.0 10 2.5	 V mA V
Operating Temperature	-40	85	°C
Storage Temperature	-55	125	°C
Soldering Temperature (5 s, leads only)		250	°C

Note: 1. Absolute maximum over the product Temperature Operating Range (-40°C to +85°C).

To obtain the expected voltage from a specific temperature:

$$V_o = \left(-3.88x10^{-6}xT^2\right) + \left(-1.15x10^{-2}xT\right) + 1.8639$$

And to convert in Celsius the voltage measured at the sensor output:

$$T = -1481.96 + \sqrt{2.1962 \times 10^6 + \frac{1.8639 - V_o}{3.88 \times 10^{-6}}}$$

In the above formulas:

V_o is the voltage level of the temperature sensor (receiver PIN 5 - T_{sensor} V_{out})

T is the temperature expressed in Celsius.

Figure 1. Typical Normalized Responsivity (M=1)

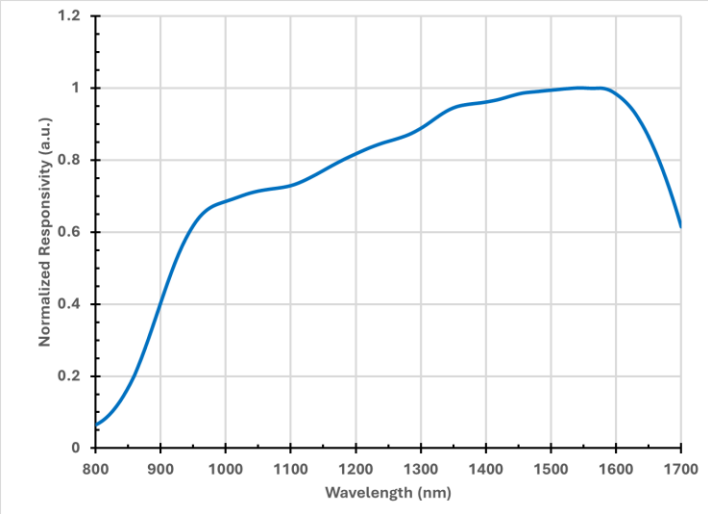


Figure 2. Normalized Frequency Response

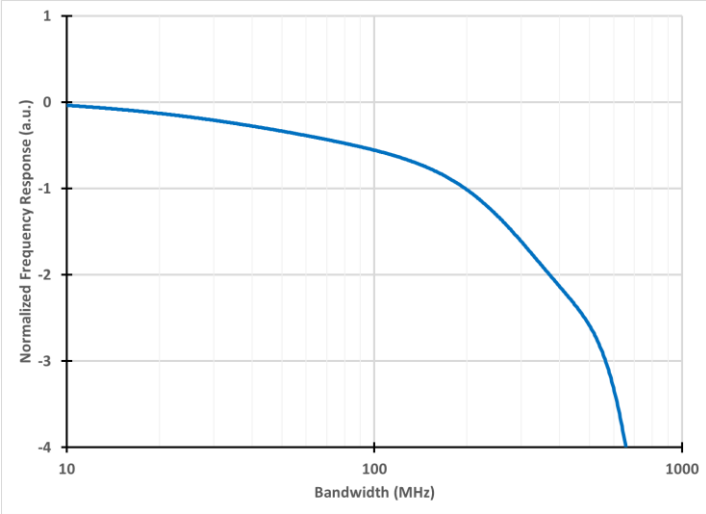


Figure 3. Typical Responsivity

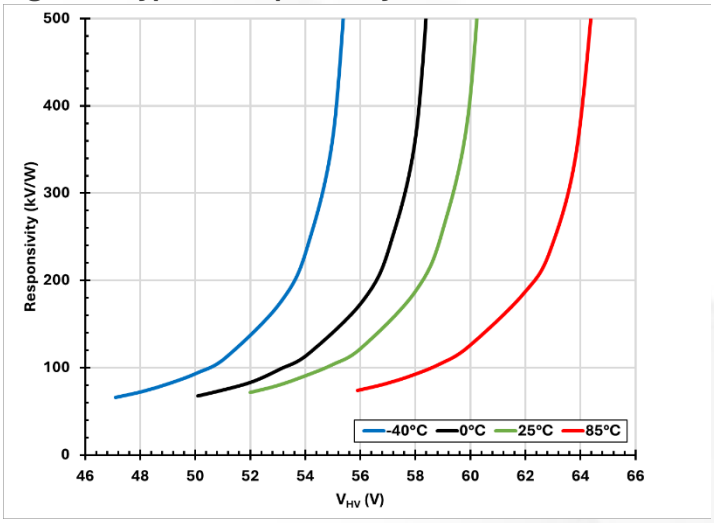


Figure 4. Typical NEP

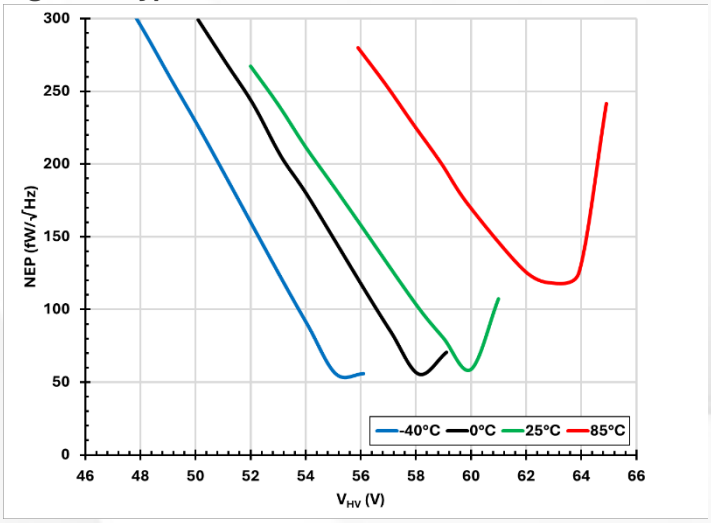
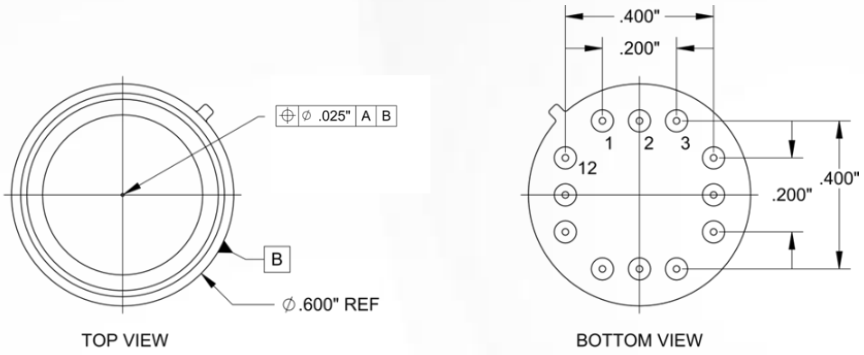
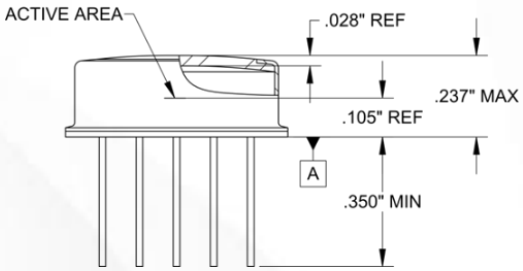


Figure 5. Package Dimension and Pinout





1	NC	7	HV_POSITIVE
2	TEC -	8	GND
3	TEC +	9	OUTPUT
4	T sensor VS+	10	V_POS (+5V)
5	T sensor Vout	11	V_NEG (-5V)
6	GND	12	GND

Figure 6. CMC 264-339831 Series block diagram

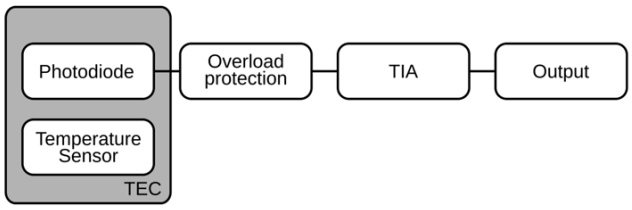
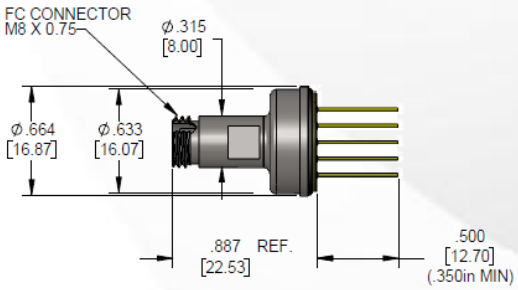


Figure 7. FC connector (617-339831)



Unless otherwise specified, dimensions are in inches [mm] and are for reference only.

Table 3. Ordering Guide

VAR	Typical Bandwidth	Active Diameter	Comments
264-339831-001	450 MHz	80 µm	
617-339831-001			with FC connector

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

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