InGaAs Avalanche Photodiode 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 – 100 MHz Preamplifier Module
- Spectral Response: 1050 – 1600 nm
- Low k-factor InGaAs APD
- Low Noise Equivalent Power (NEP)
- Fast Overload Recovery Circuitry
- High Quantum Efficiency
- Hermetically Sealed TO-8 Package
- ITAR-free
- ROHS compliant
- Optional: Fiber Receptacle

Applications

- Range Finding
- LiDAR
- Instrumentation
- Free-Space Communications
- Industrial
- Photometry

Table 1. Electro-Optical Characteristics for 200 µm Active Area

Unless otherwise specified: T_A = 25°C, V+ = 5 V, V- = -5 V, R_L = 100 Ω , λ = 1570 nm ± 10 nm (Externally AC coupled through 4.7 µF)

	264-339822-001 Fast recovery			264-339822-VAR Standard recovery			
Parameter	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Units**
Operating Voltage, V_{OP} (Note 1)	40	54	85	40	54	85	V
Temperature coefficient of V_{OP}		0.07			0.07		V/˚C
Responsivity		1.4			1.4		MV/W
Noise equivalent power (Note 2)							
1570 nm [T_{case}=25 °C]		70			70		fW/√Hz
1570 nm [T_{case}=85 °C]		240			180		fW/√Hz
Output impedance		10			10		Ω
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°C		645			645		mV
Sensor sensitivity		-1.9			-1.9		mV/°C
Overload recovery for optical power input signal: 1 mW, 20 ns pulse width:							
V_{out} → 200 ns after pulse start			250			250	mV
V_{out} → 1 µs after pulse start			40			40	mV
5 W, 20 ns pulse width (Note 4)		325			525		ns
Hybrid Supply current V_POS (pin 10)	25		35	25		35	mA
V_NEG (pin 11)	-20		-10	-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°C are by design and are for reference only. No test values provided on individual test reports. Integration of the noise calculation is based on minimum bandwidth.
3. Alternate thermal sensors (IC sensors or thermistance) are available upon request.
4. Not tested on all units.

Table 2. Electro-Optical Characteristics for 80 µm Active Area

Unless otherwise specified: T_A = 25°C, V+ = 5 V, V- = -5 V, R_L = 100 Ω AC, λ = 1570 nm ± 10 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/˚C
Responsivity		2.0		MV/W
Noise equivalent power (Note 2)				
1570 nm [T_{case}=25 °C]		50		fW/√Hz
1570 nm [T_{case}=85 °C]		80		fW/√Hz
Output impedance		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		mV
Sensor sensitivity		-1.9		mV/°C
Overload recovery for optical power input signal: 1 mW, 20 ns pulse width:				
V_{out} → 200 ns after pulse start			250	mV
V_{out} → 1 µs after pulse start			40	mV
5 W, 20 ns pulse width (Note 4)		525		
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°C are by design and are for reference only. No test values provided on individual test reports. Integration of the noise calculation is based on minimum bandwidth.
3. Alternate thermal sensors (IC sensors or thermistance) 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_POS (pin 4)] (Note 1)		105	V
Recommended overcurrent limit		100	µA
Input Voltage Positive Supply [V_POS (+5 V) (pin 12)]	+4.8	+6.0	V
Input Voltage Negative Supply [V_NEG (-5 V) (pin 3)]	-4.8	-6.0	V
Maximum Optical Power, CW		10	µW
Peak value, 20 ns pulses < 100 Hz		100	kW/cm^2
Temperature sensor fixed input current between Sensor V_{in} → TSensor ANODE (pin 8) Sensor output → TSensor CATHODE (pin 9)	1	10	mA
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).

Figure 1. Typical Normalized Responsivity at 25°C

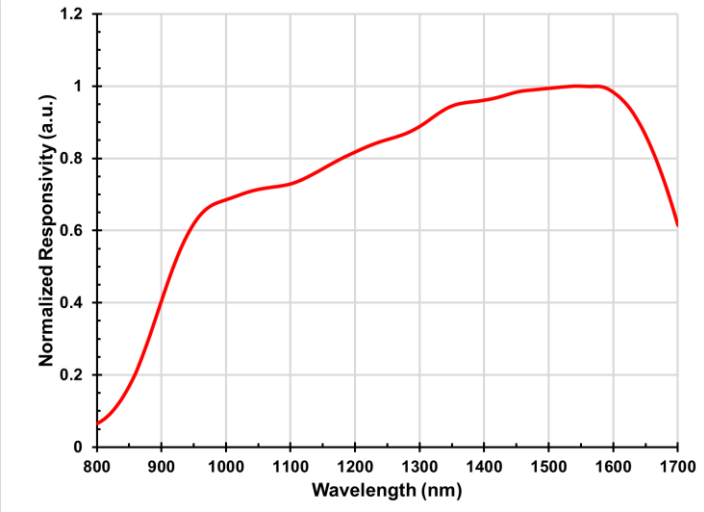


Figure 2. Typical Normalized Frequency Response

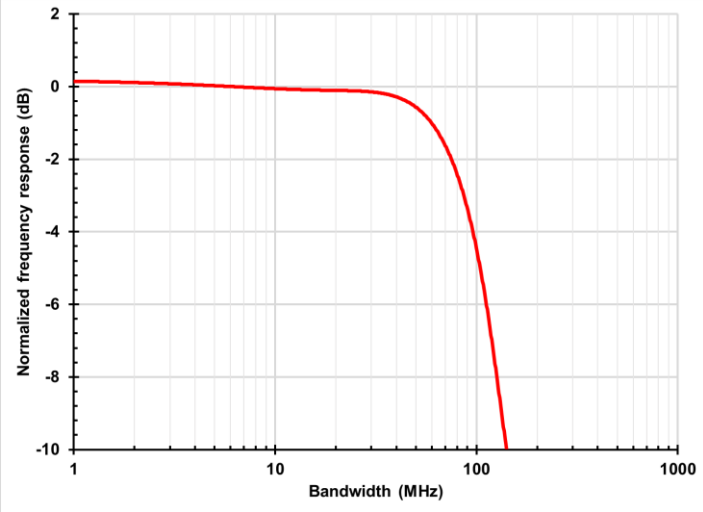


Figure 3. Typical Responsivity and NEP (-001)
λ = 1570 nm ± 10 nm, Active Area = 200 µm

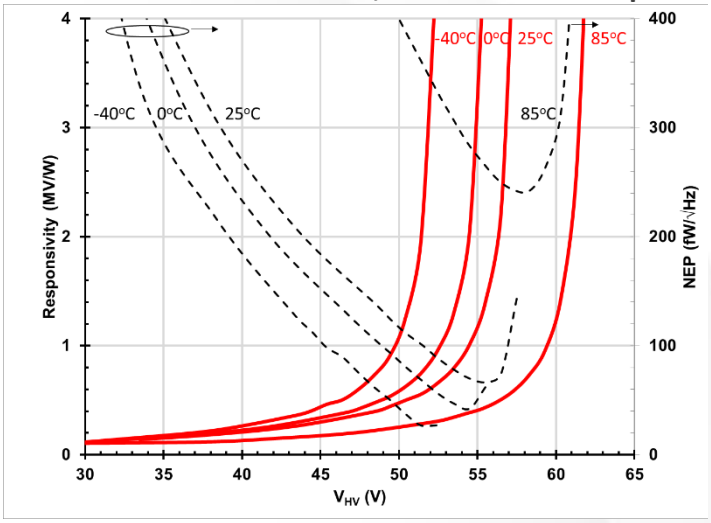


Figure 4. Typical Responsivity and NEP (-VAR)
λ = 1570 nm ± 10 nm, Active Area = 80 µm

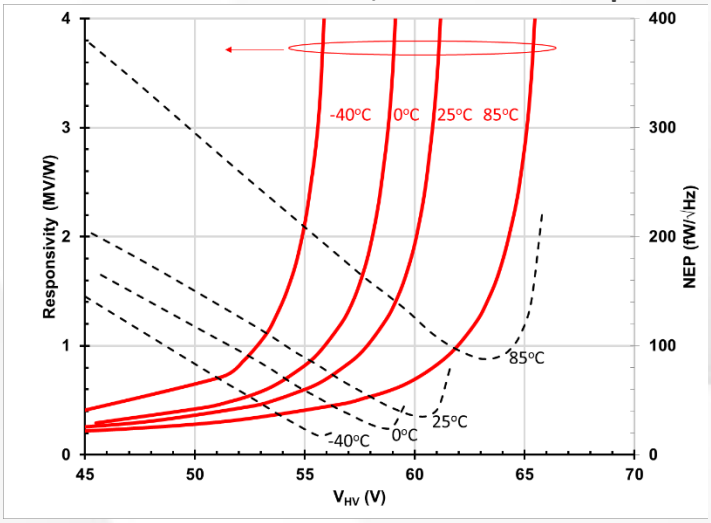


Figure 5. CMC 264-339822 Series block diagram

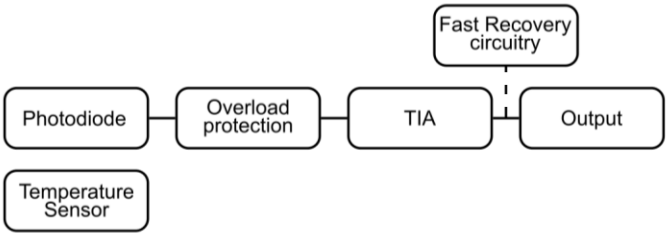
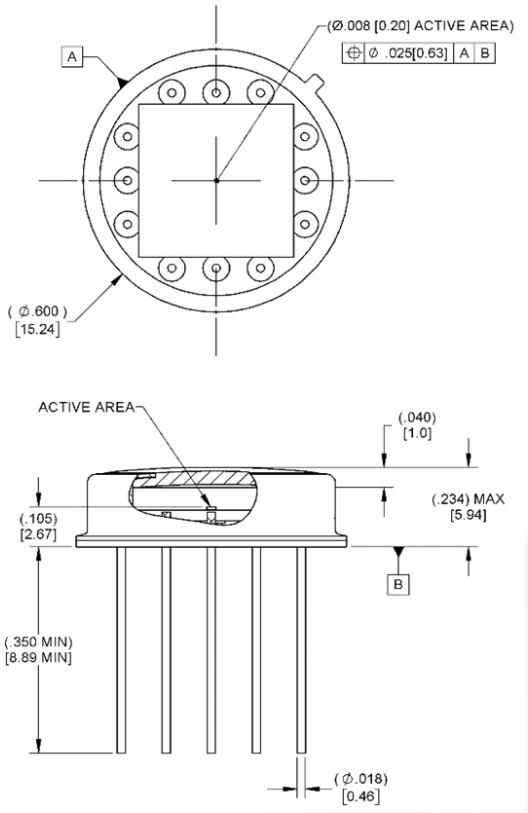
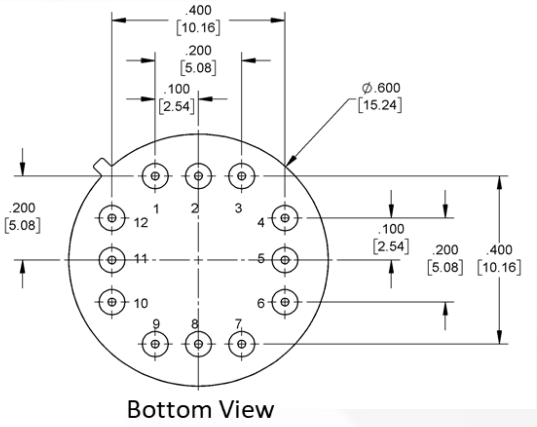


Figure 6. Package Dimension and Pinout

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





Bottom View

1	OUTPUT	7	GND
2	NC	8	TSensor ANODE
3	V_NEG (-5V)	9	Tsensor CATHODE
4	HV_POSITIVE	10	GND
5	NC	11	NC
6	GND	12	V_POS (+5V)

VAR Options

-001	InGaAs APD 200 µm, 50-100 MHz TIA, with fast recovery
-VAR	InGaAs APD 200 µm, 60-100 MHz TIA
-VAR	InGaAs APD 80 µm, 60-100 MHz TIA

For more information, visit www.cmcelectronics.ca/optoelectronics
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