High Sensitivity InGaAs Avalanche Photodiode Preamplifier Module with Thermoelectric Cooler

CMC Electronics' 264-339835 series use an InGaAs APD with a low k-factor of 0.2, featuring a built-in preamplifier and a thermoelectric cooler (TEC), tuned for remarkably high sensitivity in the most demanding sensing applications, thereby 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 with an integrated thermoelectric cooler (TEC) allowing temperature control of the APD and easing stabilization of gain and optimized sensitivity.

The internal temperature can be monitored via an embedded thermal sensor 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 that sustains high optical power exposure with a very fast recovery time.

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

Features

- 200 µm InGaAs APD
- 1 MHz Preamplifier Module
- Spectral Response: 1050 – 1600 nm
- Low k-factor 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

- Fluorescence
- Instrumentation
- Remote Sensing

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

Unless otherwise specified: T_A = 25 °C, V_POS = 5.0 V, V_NEG = -5.0 V, R_L = 100 Ω, 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			100		MV/W
Noise equivalent power (Note 2)					
1570 nm [T_{case}=25 °C]			30		fW/√Hz
1570 nm [T_{case}=85 °C]			90		fW/√Hz
Output impedance, R_{out}			10		Ω
Bandwidth		0.7	1		MHz
Rise time (10-90 %)			350		ns
Fall time (90-10 %)			350		ns
Linear output voltage swing (Pulse)		1.5	2.5	4.0	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
	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 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.

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)	2.5	5.0	V
	1	10	mA
Sensor output (pin 5)	0.2	2.5	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:

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

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. CMC 264-339832 Series block diagram

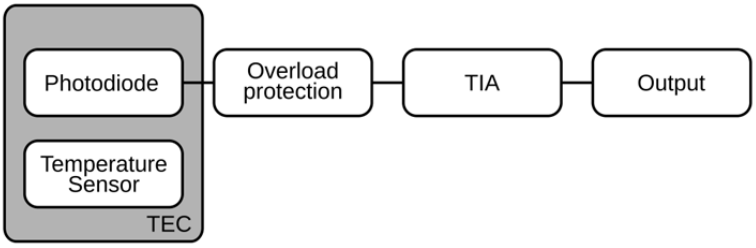
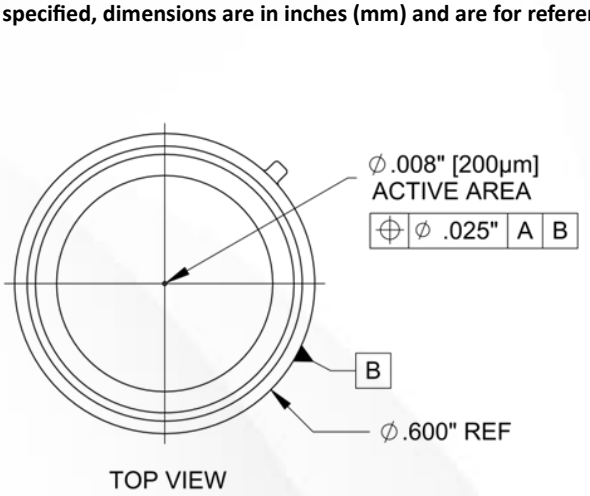
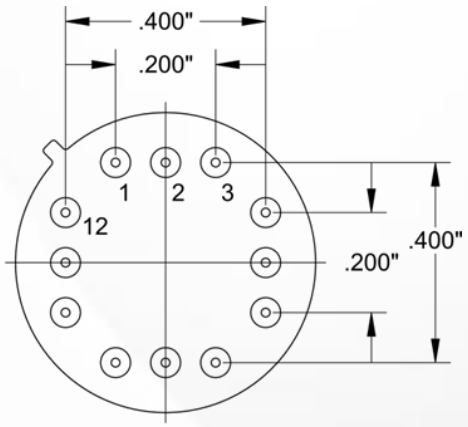


Figure 2. Package Dimension and Pinout

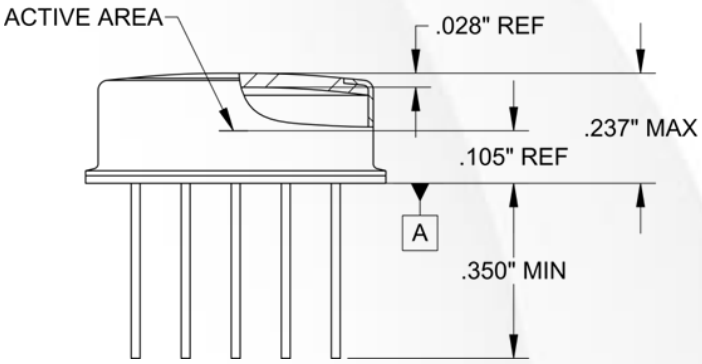
Unless otherwise specified, dimensions are in inches (mm) and are for reference only.



TOP VIEW



BOTTOM VIEW



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

VAR Options

-VAR	InGaAs APD 200 µm, 1 MHz TIA, TEC

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

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