InGaAs APD with Thermoelectric Cooler

CMC Electronics' 264-339839 series is an InGaAs APD with low k-factor of 0.2 and high responsivity, in a TO-hermetic package with a high-efficiency thermoelectric cooler (TEC).

The 264-339839 InGaAs APDs has a high Quantum Efficiency (QE) over the wavelength range of 1000 to 1600 nm.

With low leakage current, high dynamic range is maintained even at high operating temperatures, reducing the need for cooling.

Customizations such as detector size, noise, passband filter or responsivity screening are available upon request. Optional fiber receptacle option to ease coupling are also available.

Features

- Active area from 80 – 350 µm
- High gain above 100
- Low k-factor InGaAs APD
- Low Excess Noise Factor (F)
- Low Noise Equivalent Power (NEP)
- High dynamic range
  - ΔV ≈ 8 V (M = 10)
  - ΔV ≈ 4 V (M = 45)
  - ΔV ≈ 1 V (M = 100)
- Wide Operating Temp Range

Applications

- Optical Time-Domain Reflectometry (OTDR)
- LiDAR and Laser Range Finding (LRF)
- Distributed Temperature Sensing (DTS)
- Distributed Acoustic Systems (DAS)
- Structural Health Monitoring (SHM)

Table 1. Electro-Optical Common Characteristics

Conditions: T_A = 25°C, M = 10 unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Units
Breakdown Voltage	V_{BR}	45		80	V
Operating point from Breakdown Voltage (V_{BR} - V_{OP})	ΔV	7	8		V
Temperature Coefficient of V_{OP}	ΔV/ΔT		0.06		V/°C
Quantum Efficiency (1064-1550 nm)	QE	75	83		%
Responsivity at 1550 nm	R	8.5	9.4		A/W
Excess Noise Factor	F		3.2		
Recommended Operating Gain (Note 1)	M	10	65	100	
Thermal sensor (NTC Thermistor)	R	9	10	11	kΩ

Notes:

1. Noise increases with gain and depends on bulk and surface currents.
2. Each APD receiver will have its individual V_{OP} (provided on its production tests report).
3. To convert the thermal sensor resistance (R in Ohms) to a temperature (T in Kelvin), one may use the following formula:

$$\frac{1}{T} = A + B\ln(R) + C[\ln(R)]^3$$

where the Steinhart-Hart constants are

$A = 1.125161025848 \times 10^{-4}$

$B = 2.34721098632 \times 10^{-4}$

$C = 8.5877049 \times 10^{-8}$

Table 2. Electro-Optical Specific Characteristics

Conditions: T_A = 25°C, λ = 1550 nm ± 10 nm, TE Cooler OFF and M = 10 unless otherwise specified

Parameter	Symbol	350 µm DIA VAR -001		200 µm DIA VAR -002		80 µm DIA VAR -003		Units
		Typ.	Max.	Typ.	Max.	Typ.	Max.	
Dark current	I_d	30	150	10	50	2	10	nA
Capacitance	C_d	3.2	4.0	1.5	2.0	0.35	0.4	pF
Spectral Noise Current	i_n	0.7		0.36		0.18		pA/√Hz
Bandwidth	f_{-3dB}	0.6		1.0		2.0		GHz

Table 3. Absolute-Maximum Ratings, Limiting Values

Parameter	Symbol	Min.	Max.	Units
Forward Current	I_F		10	mA
Reverse Current	I_R		1	mA
Total Power Dissipation	P_{TOT}		20	mW
TEC Current	I_{TEC}	-0.9	0.9	A
Operating Temperature	T_{op}	-40	85	°C
Storage Temperature	T_{sto}	-55	125	°C
Soldering Temperature (5 seconds, leads only)	T_{solder}		250	°C

Figure 1. Typical Quantum Efficiency

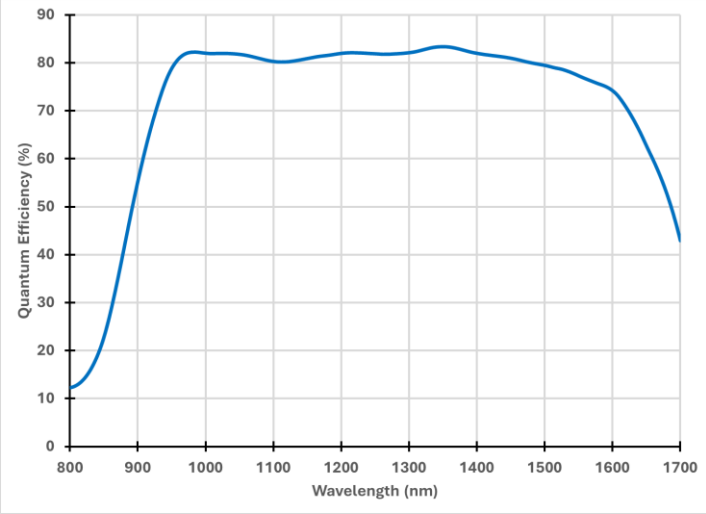


Figure 2. Typical Normalized Responsivity (M=1)

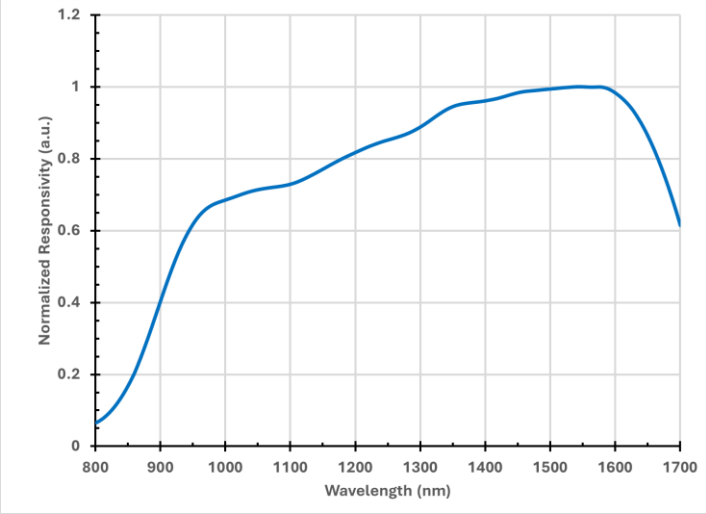


Figure 3. Typical APD Gain

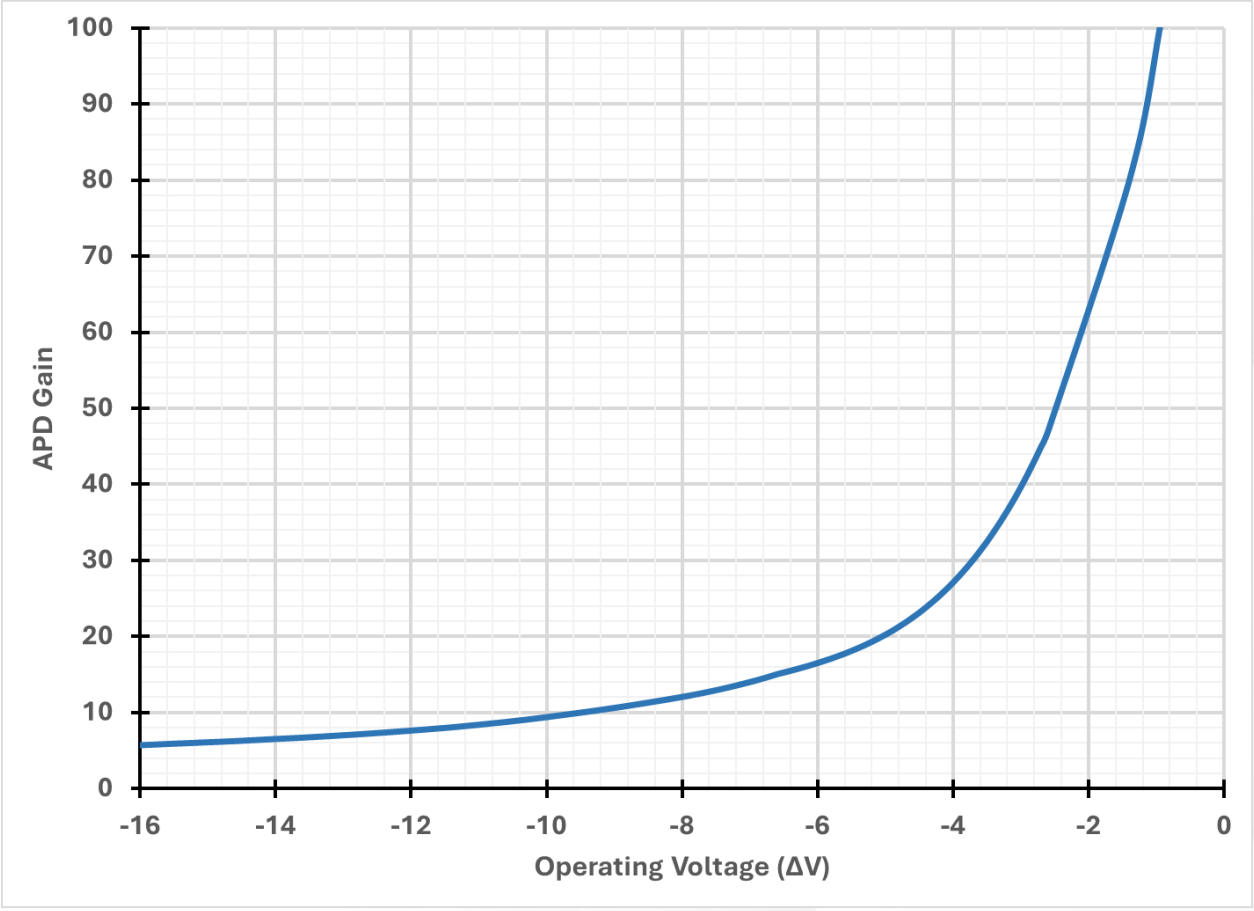
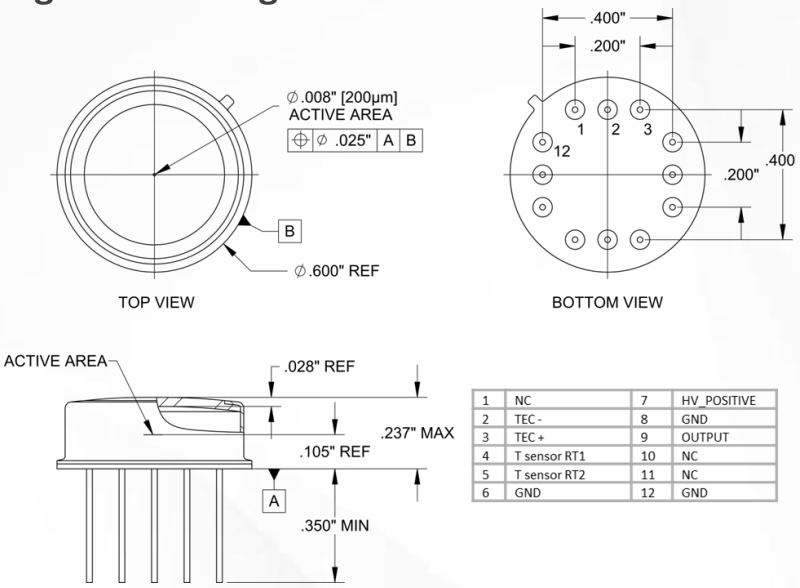
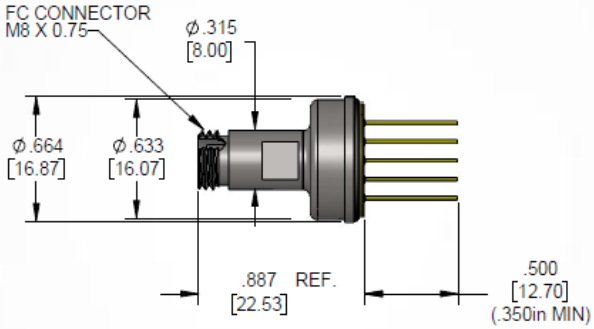


Figure 4. Package Dimension and Pinout



1	NC	7	HV_POSITIVE
2	TEC -	8	GND
3	TEC +	9	OUTPUT
4	T sensor RT1	10	NC
5	T sensor RT2	11	NC
6	GND	12	GND

Figure 3. FC connector (617-339839)



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

VAR Options

-001	InGaAs APD, 350 µm, TEC
-002	InGaAs APD, 200 µm, TEC
-003	InGaAs APD, 80 µm, TEC

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