

80 & 200 μ m InGaAs Avalanche Photodiode Preamplifier Module

MICROELECTRONICS

264-339757-VAR

Description

CMC Electronics' 264-339757-VAR are using a low noise InGaAs APD with an ionization ratio of 0.2 with a GaAs FET input transimpedance amplifier in a 12-lead TO-8 package. The amplifier internal feedback resistor is listed in the following characteristics table. Each amplifier has an overload input protection circuit for fast recovery. The output can be AC or DC coupled to a 100 ohm load.



Features:

- Low k of 0.2 (Low excess noise) APD
- High Quantum Efficiency 1000-1600nm
- Low noise (NEP) TIA
- Fast overload recovery
- Hermetically-Sealed TO-8 Package
- ITAR Free

Applications:

- Range Finding
- LIDAR
- Laser Profiling
- Free-Space Optical Communication Systems

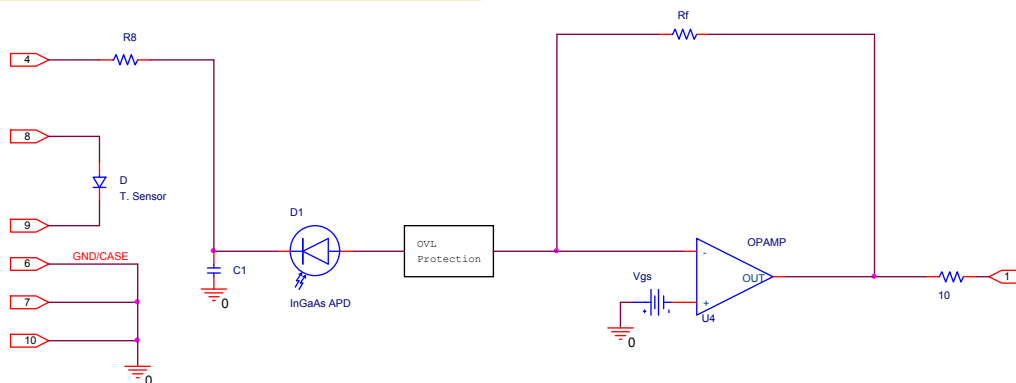


Figure 1: CMC 264-339757 SERIES BLOCK DIAGRAM

200 μ m InGaAs Avalanche Photodiode 50MHz Preamplifier Module

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264-339757-000/001

Electro-Optical Characteristics at $T_A=22^\circ\text{C}$

Unless otherwise specified: $V_+=5\text{V}$, $V_-=-5\text{V}$, V_R , $R_L=100\Omega$ AC.
(Externally AC coupled through 4.7 μ F)

	Min.	Typ.	Max.	Unit.
V_R for specified responsivity.....	25	NOTE 1	80	V
Temperature Coefficient of V_R	-	0.080	-	V/ $^\circ\text{C}$
I_d APD dark current		20	50	nA
Responsivity (R) 1060 nm, M=10	330	395	-	kV/W
1550 nm, M=10	455	580	-	kV/W
			-	
Noise Equivalent Power ($NEP = E_n/R$)				fW/ $\sqrt{\text{Hz}}$
1060 nm, M=10	-	150		fW/ $\sqrt{\text{Hz}}$
1550 nm, M=10	-	100	135	fW/ $\sqrt{\text{Hz}}$
Output Spectral Noise Voltage Density (E_n): Average over 100 kHz to 50Mhz ...	-	64	80	nV/ $\sqrt{\text{Hz}}$
Output Impedance	-	10	-	Ω
Bandwidth, f_{3dB}	50	65	-	MHz
Rise Time (10-90%)	-	5	7	ns
Fall Time t_F (90-10%)	-	5	7	ns
Linear Output Voltage Swing (Pulse)	1.5	2.5	-	V
Output Offset Voltage	-0.5	0	0.5	V
Recovery Time within 250mV of initial V_{oo}				
(-000) At 1mW, 15ns ovl pulse	-	-	200	ns
(-001) up to 10W, 5ns ovl pulse Fig-2	-	150	250	ns
TS (Temperature sensor, 1N914 diode) At 1mA bias	-	-2	-	mV/ $^\circ\text{C}$
Supply current V_+	-	25	40	mA
V_-	-	12	20	mA
Internal Components				
R8		10		k Ω
C1		10		nF
Rf		68		k Ω

Note : 1 - V_r as specified on datasheet of each module.

200 μm InGaAs Avalanche Photodiode 50MHz Preamplifier Module

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264-339757-000/001

Overload Recovery Time Data

As presented at Defense Security and Sensing in Orlando in April 2010:

B. Dion, N. Bélanger, J. Lauzon, P. Lepage and M. Tremblay, "Improved Performance Ladar Receiver" Proc. SPIE, Vol. 7684-04, (2010), doi:10.1117/12.850181

Faster recovery allowing shorter minimum distance and shorter discrimination distance for multi-target application.

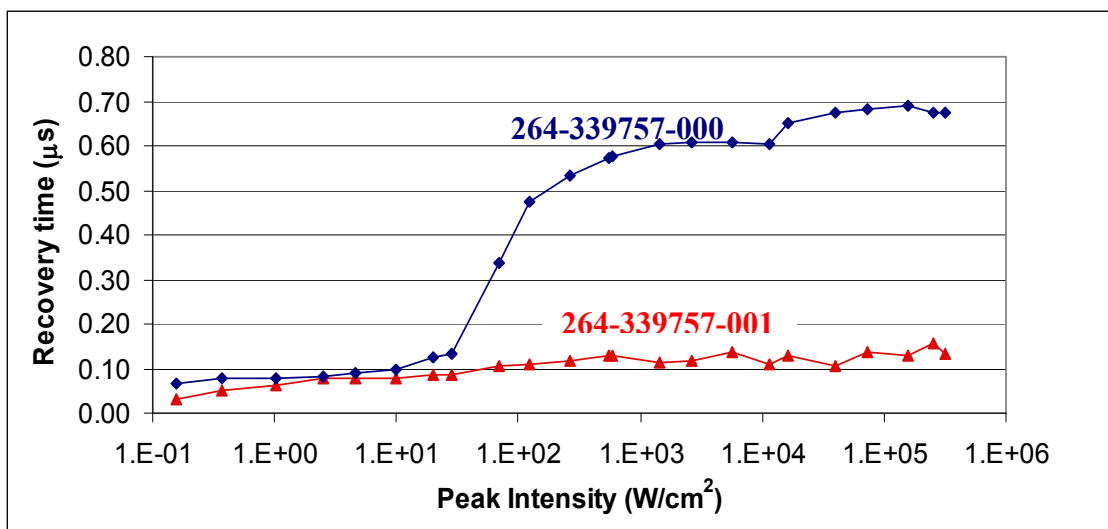


Figure 2: Overload Recovery Time Comparison

Saturation level vs Background/Backscattering.

The 264-339757-001 will allow operation in presence of high backscattering power normally observed in the first few kilometers with high power lasers. In the presence of high backscattering, the front end transimpedance (Z_t) is reduced to prevent saturation; however, within nanoseconds it returns to its original, higher value as the backscattering fades away.

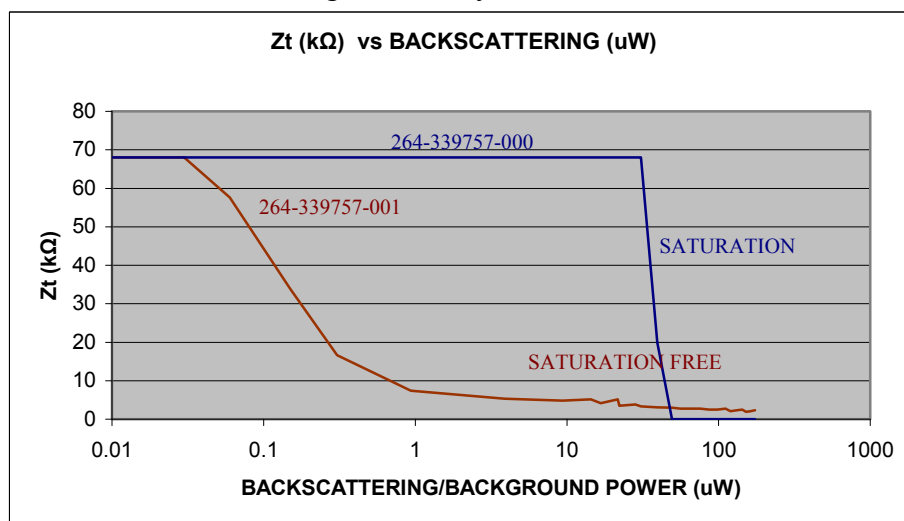


Figure 3: Zt vs Background/Backscattering Power

200 μ m InGaAs Avalanche Photodiode 250MHz Preamplifier Module

MICROELECTRONICS

264-339757-010

Electro-Optical Characteristics at $T_A=22^\circ\text{C}$

Unless otherwise specified: $V_+=5\text{V}$, $V_-=-5\text{V}$, V_R , $R_L=100\Omega$ AC.
(Externally AC coupled through 4.7 μ F)

	Min.	Typ.	Max.	Unit.
V_R for specified responsivity.....	25	NOTE 1	80	V
Temperature Coefficient of V_R	-	0.080	-	$\text{V}/^\circ\text{C}$
I_d APD dark current		20	50	nA
Responsivity (R) 1060 nm, M=10	50	60	-	kV/W
1550 nm, M=10	85	100	-	kV/W
Noise Equivalent Power ($NEP = E_n/R$)				
1060 nm, M=10	-	450	-	$\text{fW}/\sqrt{\text{Hz}}$
1550 nm, M=10	-	300	400	$\text{fW}/\sqrt{\text{Hz}}$
1550 nm, M=20	-	225	-	$\text{fW}/\sqrt{\text{Hz}}$
Output Spectral Noise Voltage Density (E_n): Average over 100 kHz to 250Mhz ...	-	30	50	$\text{nV}/\sqrt{\text{Hz}}$
Output Impedance	-	10	-	Ω
Bandwidth, f_{3dB}	250	300	-	MHz
Rise Time (10-90%)	-	1.1	1.8	ns
Fall Time t_F (90-10%)	-	1.1	1.8	ns
Linear Output Voltage Swing (Pulse)	0.75	1.0	-	V
Output Offset Voltage	-0.5	0	0.5	V
Recovery Time within 250mV of initial V_{oo} At 1mW, 50ns ovl pulse	-	65	200	ns
up to 10W, 5ns ovl pulse Fig-2	-	250	400	ns
TS (Temperature sensor, 1N914 diode) At 1mA bias	-	-2	-	$\text{mV}/^\circ\text{C}$
Supply current V_+	-	20	30	mA
V_-	-	14	20	mA
Internal Components				
R8		10		k Ω
C1		10		nF
Rf		22		k Ω

Note : 1 - V_r as specified on datasheet of each module.

80μm InGaAs Avalanche Photodiode 50MHz Preamplifier Module

MICROELECTRONICS

264-339757-100

Electro-Optical Characteristics at $T_A=22^\circ\text{C}$

Unless otherwise specified: $V_+=5\text{V}$, $V_-=-5\text{V}$, V_R , $R_L=100\Omega$ AC.

(Externally AC coupled through 4.7μF)

	Min.	Typ.	Max.	Unit.
V_R for specified responsivity.....	25	NOTE 1	80	V
Temperature Coefficient of V_R	-	0.080	-	V/°C
Id APD dark current		10	50	nA
Responsivity (R) 1550 nm, M=10	3.5	4.0	-	MV/W
Noise Equivalent Power (NEP = E_n/R) 1550 nm, M=10	-	45	60	fW/√Hz
Output Spectral Noise Voltage Density (E_n): Average over 100 kHz to f_{3dB} ...	-	200	-	nV/√Hz
Output Impedance	-	10	-	Ω
Bandwidth, f_{3dB}	50	60		MHz
Rise Time (10-90%)	-	5	7	ns
Fall Time t_F (90-10%)	-	5	7	ns
Linear Output Voltage Swing (Pulse)	1.5	2.5	-	V
Output Offset Voltage	-0.5	0	0.5	V
Recovery time within 250mV of initial V_{oo} For 1mW, 15ns pulse overload	-	-	200	ns
TS (Temperature sensor, 1N914 diode) At 1mA bias	-	-2	-	mV/°C
Supply current V_+	-	25	40	mA
V_-	-	12	20	mA
Internal Components				
R8		10		kΩ
C1		10		nF
Rf		470		kΩ

Note : 1 - V_r as specified on datasheet of each module.

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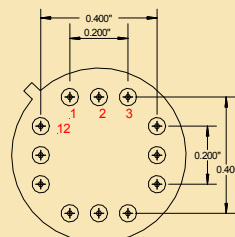
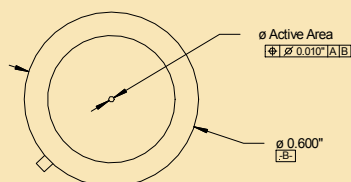
264-339757-VAR

Absolute-Maximum Ratings, Limiting Values

Photodiode Total Current (All temp.)		Preamplifier Voltage:	
Average	100 uA	V+ Max	6 V
Peak (1s).....	1 mA	V- Max	6 V
Incident Radiant Flux, \ddot{O}_M		Ambient Temperature:	
Average value	10 uW	Storage, T_{stg}	-55 to +125 °C
Peak value, 20ns pulses < 100Hz	100 kW/cm ²	Operating, T_A	-40 to + 85 °C

PACKAGE OUTLINE and PINOUT

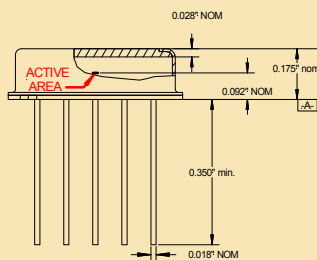
TO-8 Style, 12 pins, Gold plated



BOTTOM VIEW

Pinout:

- | | |
|-------|--------------|
| 1 O/P | 7 GND |
| 2 NC | 8 TS Anode |
| 3 -5V | 9 TS Cathode |
| 4 HV+ | 10 GND |
| 5 NC | 11 NC |
| 6 GND | 12 V+ |



VAR options:

- 000 200µm APD, 50 MHz TIA
- 001 200µm APD, 50 MHz TIA, fast recovery
- 010 200µm APD, 250 MHz TIA
- 100 80µm APD, 50 MHz TIA

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