

# Silicon Photomultipliers (SiPM), RDM-Series 1 x 12 Monolithic Array



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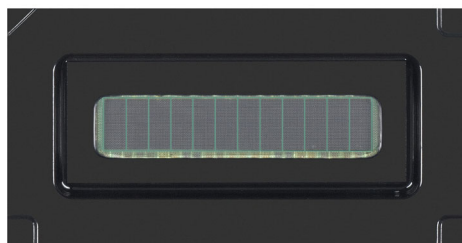
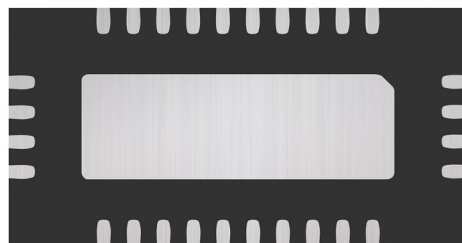
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## Advance Information ArrayRDM-0112A20-QFN

The ArrayRDM-0112A20-QFN is a monolithic 1 × 12 array of Silicon Photomultiplier (SiPM) pixels based on the market-leading RDM process. The RDM process has been specifically developed to create products that give high PDE at the NIR wavelengths used for LiDAR and 3D ranging applications.

In order to meet the requirements for automotive LiDAR applications, this product is qualified to AEC-Q102 and developed in accordance with IATF 16949.

An evaluation board (ArrayRDM-0112A20-GEVB) is also available for this product.



The ArrayRDM-0112A20-QFN28 Product  
Case 485FZ

### KEY SENSOR AND PACKAGE SPECIFICATIONS

Parameter	Value	Comments
Silicon Process	RDM	
Number of Pixels	12	
Array Configuration	1 × 12	Monolithic silicon array
Pixel Size	1.12 × 0.47 mm	
Pixel Pitch	0.49 mm	
Microcell Size	20 μm	
Number of Microcells per Pixel	806	
Package Size	5.2 × 10.0 × 1.85 mm	W × L × H (see case outline on page 5 for more details)
Output Type	Analog	Standard output per pixel

### PERFORMANCE SPECIFICATIONS

Typical values are measured at 21°C. Minimum and Maximum values take into account operation over the full temperature range of -40°C to 105°C. All measurements made at Vbr + 7.9 V.

Parameter	Min	Typ	Max	Unit	Comment
PDE at 905 nm	8	14	23	%	
Total Noise Rate	< 0.05	0.1	40	Mcps	Total noise rate is the count of all noise events arising from thermal noise, crosstalk and afterpulsing. It is measured by counting distinct event peaks per unit time with no incident light and minimum threshold set just above the electronic noise floor. Per pixel
Optical Crosstalk	23	28	33	%	
Gain	1.1 × 10 <sup>6</sup>	1.2 × 10 <sup>6</sup>	1.4 × 10 <sup>6</sup>		
Microcell Recovery Time Constant	24	34	45	ns	RC time constant
Microcell Rise Time	–	200	–	ps	
Terminal Capacitance	19	20	22	pF	Per pixel
Peak Pulsed Saturation Current	3.2	–	7.5	mA	Per pixel
Continuous Saturation Current	1.4	–	3.4	mA	Per pixel

This document contains information on a new product. Specifications and information herein are subject to change without notice.

# ArrayRDM-0112A20-QFN

## BIAS PARAMETERS

Parameter	Min	Typ	Max	Unit	Comment
Breakdown Voltage (Vbr)	19.8	21.6	25.5	V	See Figure 1 for a plot of typical breakdown voltages at different temperatures
Over Voltage (Vov)	-	7.9	12.0	V	Typical values recommended for operation and used for characterization
Operating Bias (Vop)	Vop = Vbr + Vov				
Temperature Coefficient of Vbr	Refer to Figure 1			mV/°C	

## ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit	Comment
Maximum Bias	37.5	V	
Maximum Current	20	mA	For whole array at typical Vop
Maximum Storage Temperature	125	°C	
Operating Temperature Range	-40 to +105	°C	Ambient temperature

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## PACKAGE SPECIFICATIONS

Parameter	Value	Unit	Comment
ESD - HBM	1	kV	Class 1C
ESD - CDM	500	V	Class 4C
$\theta_{JC}$	4	°C/W	
$\theta_{JA}$	150	°C/W	
MSL	3		For all part numbers

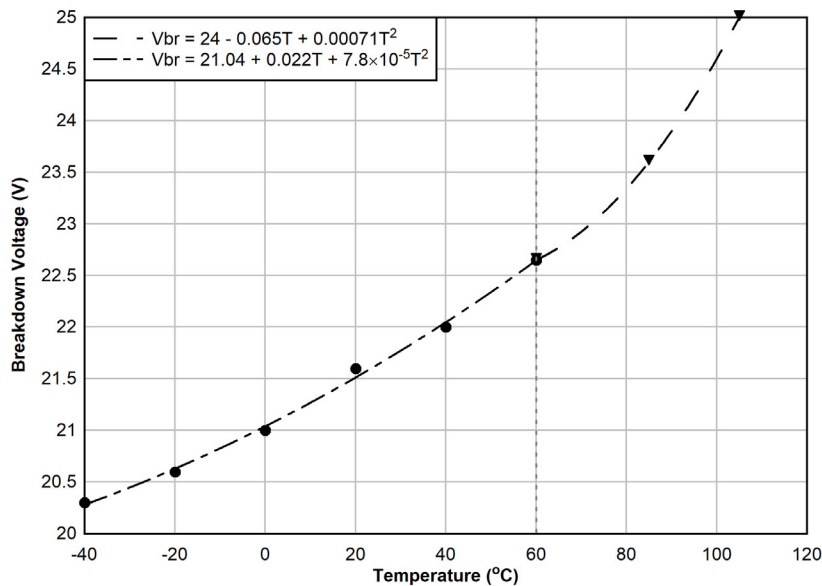
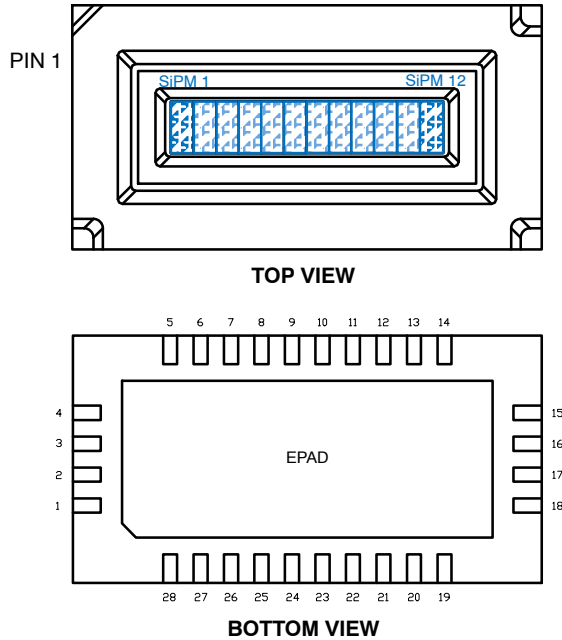


Figure 1. Breakdown Voltage vs Temperature

# ArrayRDM-0112A20-QFN

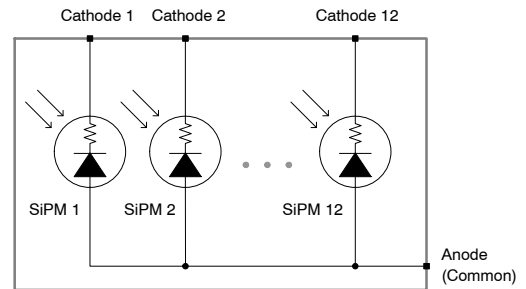
## PIN ASSIGNMENT



Pin #	Pin Name	Pin Function
1	Cathode 1	SiPM 1 standard output
28	Cathode 2	SiPM 2 standard output
27	Cathode 3	SiPM 3 standard output
26	Cathode 4	SiPM 4 standard output
25	Cathode 5	SiPM 5 standard output
24	Cathode 6	SiPM 6 standard output
23	Cathode 7	SiPM 7 standard output
22	Cathode 8	SiPM 8 standard output
21	Cathode 9	SiPM 9 standard output
20	Cathode 10	SiPM 10 standard output
19	Cathode 11	SiPM 11 standard output
18	Cathode 12	SiPM 12 standard output
EPAD	Anode	Common Anode
2-17	NC	No Connect

## APPLICATION ADVICE

The ArrayRDM-0112A20-QFN is formed of a linear array of 12 SiPM pixels. The QFN package provides a connection to each pixel cathode (for access to the individual signals) and a common anode. The common anode allows the provision of a single bias supply for all 12 pixels. The recommended test connections and biasing are as per the evaluation board that is detailed in the following section.



**Figure 2. Array Schematic Showing Pixel Connections**

# ArrayRDM-0112A20-QFN

## EVALUATION BOARD

The ArrayRDM-0112A20-GEVB evaluation board consists of:

- ArrayRDM-0112A20-DFN SiPM array
- 12 U.FL connectors for access to each pixel cathode for signal readout
- An SMA connector for applying the bias to the common anode
- Bias filtering circuit
- Decoupling capacitors (12 x 10 nF and 4 x 100 nF decoupling capacitors from anode to ground – not shown)

This product allows users to quickly and easily set up an evaluation of the array product.

Note that a negative bias supply should be supplied via the SMA connector (J13) and the U.FL connectors (J1 to J12) should be 50 Ω terminated.

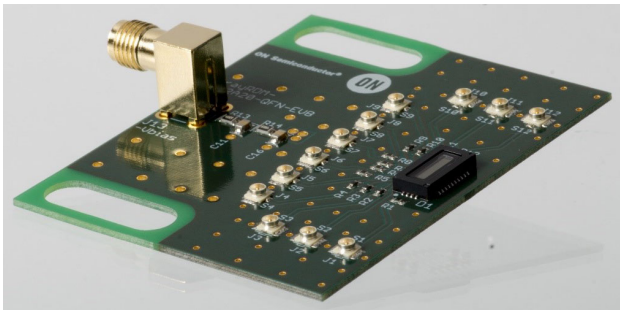


Figure 3. ArrayRDM-0112A20-GEVB Top Side View Showing the 1x12 Sensor

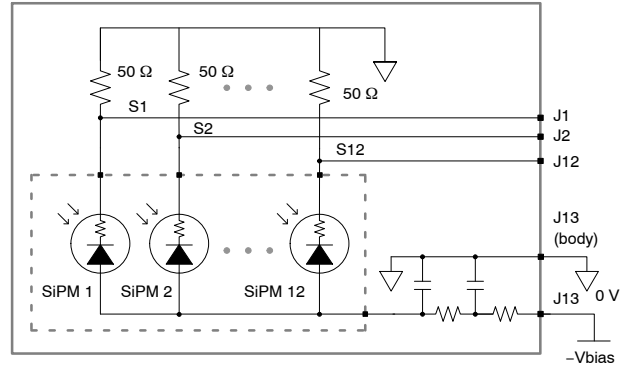


Figure 4. ArrayRDM-0112A20-GEVB Board Schematic

Connector	Style
J1-J12	U.FL Receptacle (Hirose U.FL-R-SMT)
J13	SMA Jack (F)

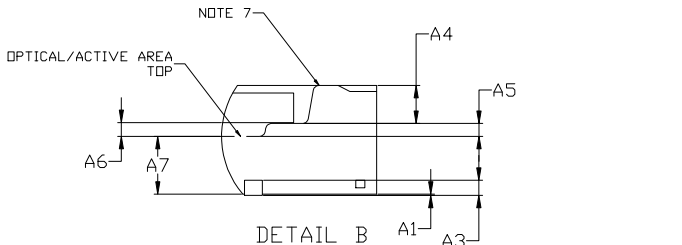
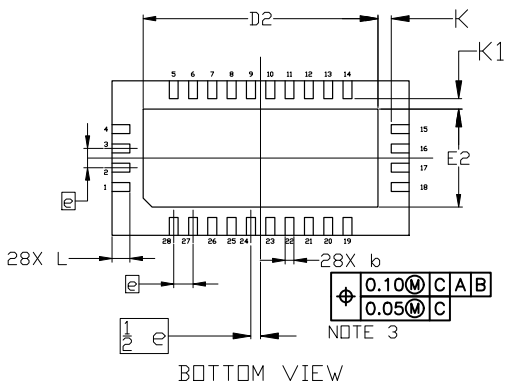
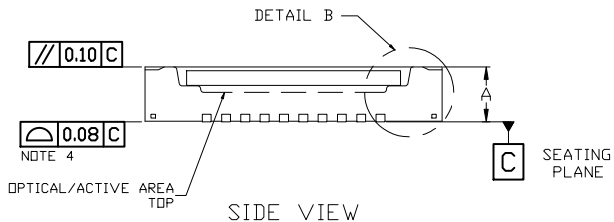
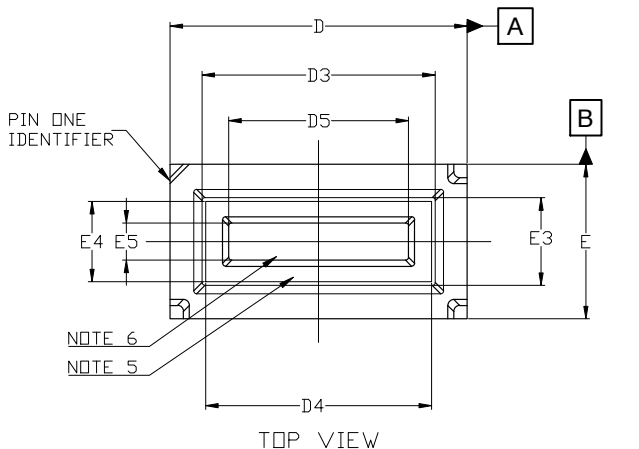
## ORDERING INFORMATION

Part Number	Product Description	Shipping Format
ArrayRDM-0112A20-QFN-TR	Monolithic 1 × 12 array of NiR sensitive SiPM pixels formed using the RDM process. Individual cathode connection per pixel and a common anode available via the 28-pin QFN package.	Tape and Reel
ArrayRDM-0112A20-QFN-TR1		Cut Tape
ArrayRDM-0112A20-QFN-TR-E	Unqualified prototype part of the ArrayRDM-0112A20-QFN-TR	Depends on Quantity Ordered
ArrayRDM-0112A20-GEVB	Evaluation board consisting of an ArrayRDM-0112A20-QFN mounted onto PCB. A U.FL connector gives access to each pixel output (cathode). The bias is supplied via an SMA connector to the common anode.	ESD Package

# ArrayRDM-0112A20-QFN

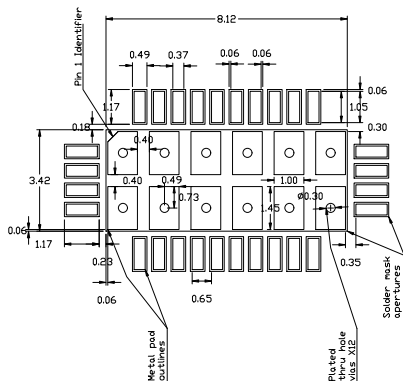
## PACKAGE DIMENSIONS

QFN28 10x5.2, 0.65P  
CASE 485FZ  
ISSUE D



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
  2. CONTROLLING DIMENSION: MILLIMETERS
  3. DIMENSION *b* APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
  4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
  5. GLASS LID AREA, 0.4mm THICKNESS. DEFINED BY D4 & E4.
  6. OPTICAL/ACTIVE AREA IS CENTERED.  
ALIGNMENT TO PACKAGE CENTER: +/- 0.05 mm  
ROTATION ALLOWED: +/- 0.5°
  7. MOLD INNER CAVITY RADIUS AT 0.1mm AT 10° DRAFT ANGLE.
  8. DIMENSION A6 MEASURES THE BOTTOM OF THE GLASS TO TOP OF DIE.
  9. DIMENSION A7 MEASURES THE BOTTOM OF THE PACKAGE TO TOP OF DIE.

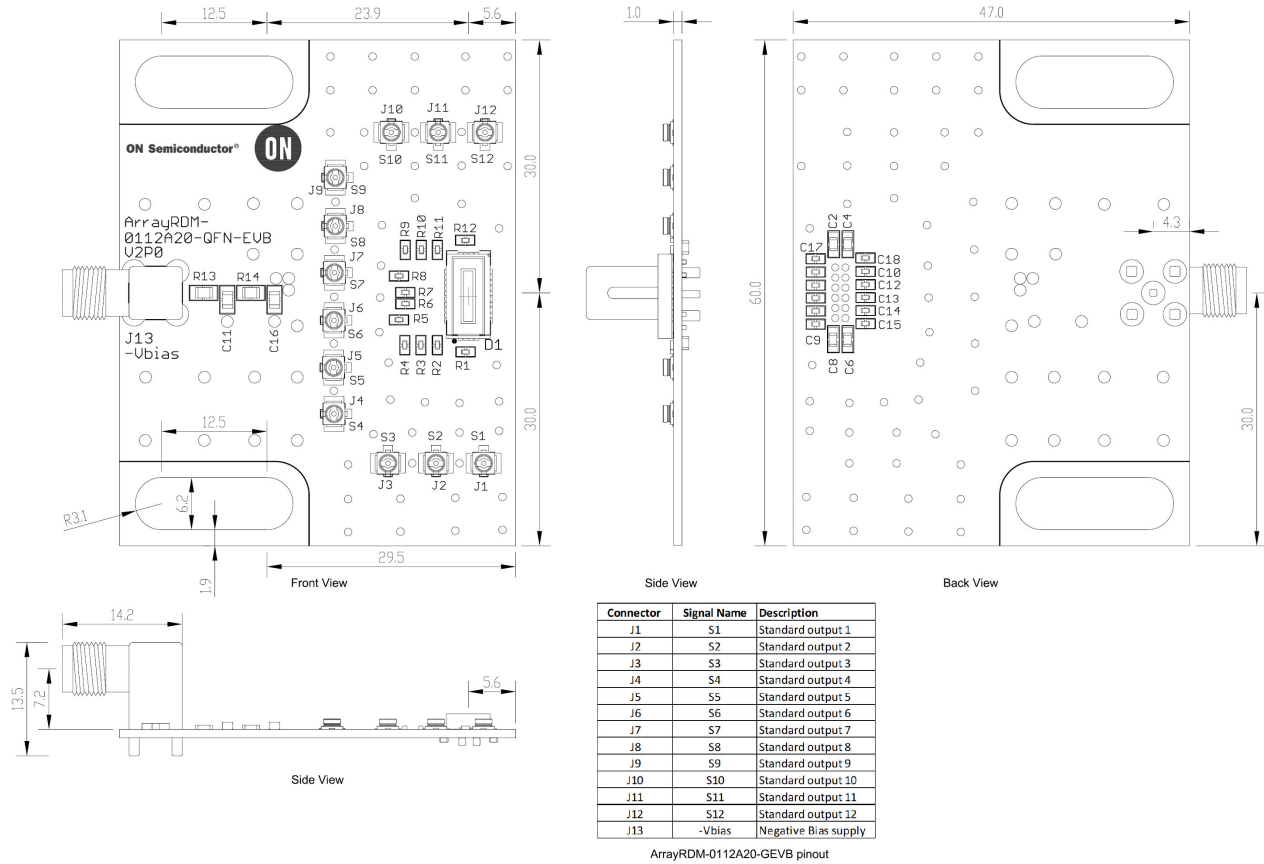
DIM	MILLIMETERS			DIM	MILLIMETERS		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	1.75	1.85	1.95	D4	7.32 REF		
A1	0.00	---	0.05	D5	6.40 REF		
A3	0.254 REF			E	5.10	5.20	5.30
A4	0.594 REF			E2	3.20	3.30	3.40
A5	0.256 REF			E3	2.67 REF		
A6	0.28 REF			E4	2.42 REF		
A7	0.969	1.004	1.029	E5	1.50 REF		
<i>b</i>	0.25	0.30	0.35	<i>e</i>	0.65 BSC		
D	9.90	10.00	10.10	K	0.45 REF		
D2	7.80	7.90	8.00	K1	0.35 REF		
D3	7.57 REF			L	0.55	0.60	0.65



\* For additional information on our Pb-Free strategy and soldering details, please download the *ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.*

# ArrayRDM-0112A20-QFN

## EVALUATION BOARD DRAWING



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