
Features

- 650 nm and 780 nm Wavelengths Supported
- 150 MHz Data Channel Bandwidth
- Fast Settling Time
- 4 Configurable Gain Steps
- 12 Photo Diodes
- Low Offset Voltage
- Power-down Mode
- Pb-free Optical 16-pin Package

Applications

- DVD +RW with CD-RW Capability
- DVD -RW with CD-RW Capability
- DVD-RAM with CD-RW Capability
- DVD 18x Application
- Recordable Optical Data Storage Devices

1. Description

The ATR0874 is a Photo Detector Integrated Circuit (PDIC) for operation in high speed DVD applications like DVD-RAM and DVD+/-RW at a wavelength of 650 nm and CD-RW at a wavelength of 780 nm. It includes 10 channels with 4 different gain steps. The four channels A, B, C, D are high speed channels whereas the channels E1G1, E2G2, F1H1, F2H2 are high gain channels at average speed for tracking control, sector information etc.. The remaining two channels RF+ and RF- are RF paraphase outputs. Channels A to D are summed together at the RF outputs.

Setting of the gain and entering/exiting sleep mode is controlled using the two tri-state inputs SW1 and SW2.

All channels are set to tri-state during sleep mode.

Due to its small package size the ATR0874 is especially suited for application with low height requirements like SLIM and UltraSLIM drives.



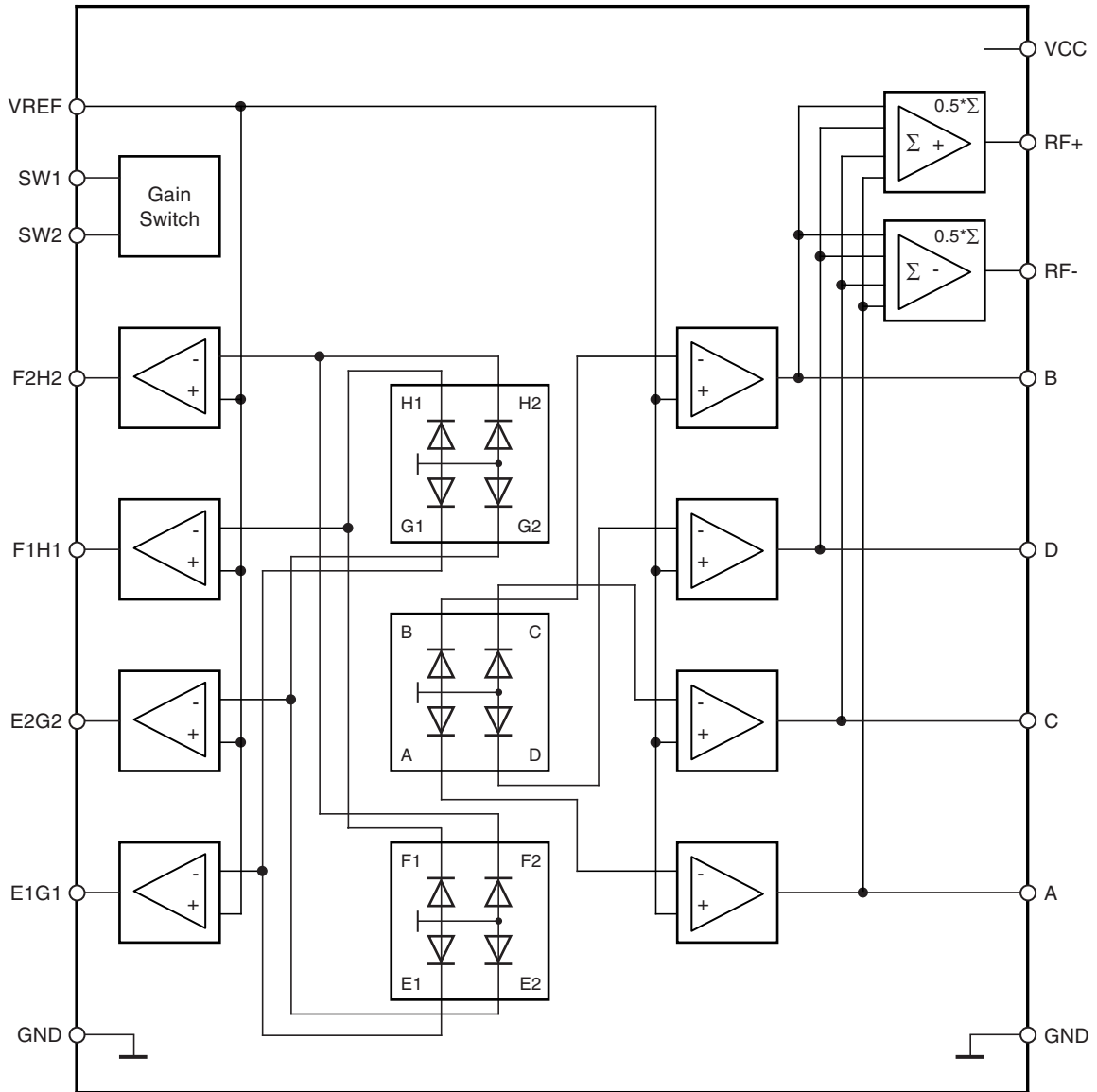
10-channel High Speed Photo Detector IC for DVD/CD

ATR0874

Preliminary



Figure 1-1. Block Diagram



2. Pin Configuration

Figure 2-1. Pinning QFN16L

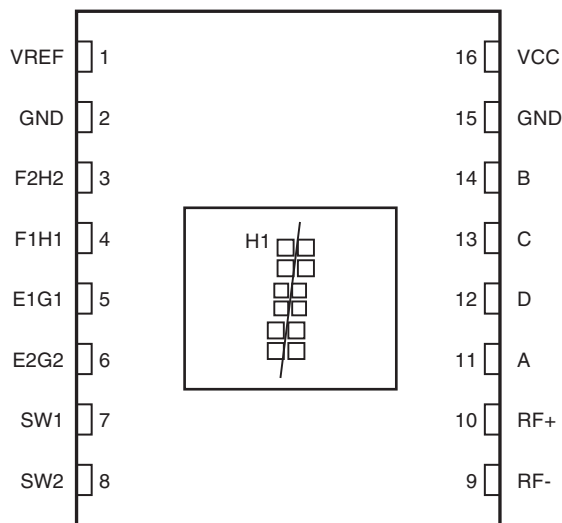


Table 2-1. Pin Description

Pin	Symbol	Type	Function
1	VREF	Analog	Reference voltage
2	GND	Supply	Ground
3	F2H2	Analog	Output channel F2H2
4	F1H1	Analog	Output channel F1H1
5	E1G1	Analog	Output channel E1G1
6	E2G2	Analog	Output channel E2G2
7	SW1	Tri-state	Gain switch
8	SW2	Tri-state	Gain switch
9	RF-	Analog	Output RF-
10	RF+	Analog	Output RF+
11	A	Analog	Output channel A
12	D	Analog	Output channel D
13	C	Analog	Output channel C
14	B	Analog	Output channel B
15	GND	Supply	Ground
16	VCC	Supply	Supply voltage

3. Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameters	Symbol	Value	Unit
Supply voltage	VCC	-0.5 to +6.0	V
Input voltage at any input	Vin	-0.5 to VCC - 0.5	V
Storage temperature	Tstg	-40 to +100	°C
Soldering temperature COB package	Tsol	235	°C
Soldering temperature QFN_Open package	Tsol	260	°C

4. Recommended Operating Conditions

Parameters	Symbol	Value	Unit
Supply voltage	VCC	4.5 to 5.5	V
Reference voltage	V _{REF}	1.5 to 2.3	V
Operating temperature range	T _{amb}	0 to +80	°C

5. Electrical Characteristics: General

V_{CC} = 5V, T_{amb} = 25°C, V_{REF} = 1.85V

Output load: R_{load} = 10 kΩ, C_{load} = 15 pF (max. 20 pF)

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
1	DC Specifications, Power Supply								
1.1	Supply current		16	I _{CC}		36	46	mA	A
1.2	Current V _{REF}		1	I _{VREF}		2.5		mA	A
1.3	Output voltage Center channels, Satellite channels	A to D, E1G1 to F2H2	3-6, 9, 10-14	V _{out}	1.95			V _{pp}	C
1.4	Max output RF+	V _{RF+} - V _{REF}	1, 10	V _{maxRF}	1.1			V _{pp}	C
1.5	Max output RF-	V _{REF} - V _{RF-}	1, 9	V _{minRF}	1.1			V _{pp}	C
1.6	Max output RF-	V _{REF} - V _{RF-} , V _{REF} = 1.5V	1,9	V _{minRF}	0.6			V _{pp}	C
1.7	Max voltage	A to D, E1G1 to F2H2	3-6, 9, 10-14	V _{outmax}	3.8			V	C
1.8	Power down mode		16	I _{PDOWN}			2	mA	A
1.9	Power supply rejection ratio	Low freq. (10 kHz), application: L _{VCC} = 100 nH, C _{VCC} = 100 nF at pin 16	3-6, 9, 10, 11-14	PSRR	-40			dB	C
1.10	Power supply rejection ratio	High freq. (100 kHz), application: L _{VCC} = 100 nH, C _{VCC} = 100 nF at pin 16	3-6, 9, 10, 11-14	PSRR	-20			dB	C

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

5. Electrical Characteristics: General (Continued)

$V_{CC} = 5V$, $T_{amb} = 25^{\circ}C$, $V_{REF} = 1.85V$

Output load: $R_{load} = 10\text{ k}\Omega$, $C_{load} = 15\text{ pF}$ (max. 20 pF)

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
2 Output Offset Voltage (Reference to Output Voltage, $1.5V \leq V_{REF} \leq 2.3V$)									
2.1	Output offset	$V_{REF} - V_A, V_{REF} - V_B,$ $V_{REF} - V_C, V_{REF} - V_D$	1, 11-14	V_{OFF1}	-25	0	+25	mV	C
2.2	Output offset	$V_{REF} - V_{E1G1},$ $V_{REF} - V_{E2G2},$ $V_{REF} - V_{F1H1},$ $V_{REF} - V_{F2H2}$	1, 3-6	V_{OFF2}	-25	0	+25	mV	C
2.3	Output offset	$V_{REF} - V_{RF+},$ $V_{REF} - V_{RF-}$	1, 9, 10	V_{OFF2}	-25	0	+25	mV	C
2.4	Offset drift			dV_{OFF}/dT	-30	+10	+30	$\mu V/^{\circ}$	C
3 Sensitivity									
Gain = Read High									
3.1	Center channels	A to D	11-14	S_{A40} to S_{D40}	7.68	9.6	12.0	mV/ μW	A
3.2	RF channels (differential)	RF+ – RF-	9,10	S_{RF40}	7.68	9.6	12.0	mV/ μW	A
3.3	Satellite channels	E1G1 to F2H2	3, 4, 5, 6	$S_{E1G1-40}$ to $S_{F2H2-40}$	30.72	38.4	48.0	mV/ μW	A
Gain = Read Low									
3.4	Center channels	A to D	11, 12, 13, 14	S_{A13} to S_{D13}	2.56	3.2	4.0	mV/ μW	A
3.5	RF channels	RF+ – RF-	9, 10	S_{RF13}	2.56	3.2	4.0	mV/ μW	A
3.6	Satellite channels	E1G1 to F2H2	3, 4, 5, 6	$S_{E1G1-13}$ to $S_{F2H2-13}$	10.24	12.8	16.0	mV/ μW	A
Gain = Write High									
3.7	Center channels	A to D	11, 12, 13, 14	S_{A3} to S_{D3}	0.58	0.72	0.90	mV/ μW	A
3.8	RF channels	RF+ – RF-	9, 10	S_{RF3}	0.58	0.72	0.90	mV/ μW	A
3.9	Satellite channels	E1G1 to F2H2	3, 4, 5, 6	S_{E1G1-3} to S_{F2H2-3}	2.30	2.88	3.60	mV/ μW	A
Gain = Write Low									
3.10	Center channels	A to D	11, 12, 13, 14	S_{A1} to S_{D1}	0.19	0.24	0.30	mV/ μW	A
3.11	RF channels	RF+ – RF-	9, 10	S_{RF1}	0.19	0.24	0.30	mV/ μW	A
3.12	Satellite channels	E1G1 to F2H2	3, 4, 5, 6	S_{E1G1-1} to S_{F2H2-1}	0.77	0.96	1.20	mV/ μW	A
AC Specifications (Total optical power per central segment in read mode: $P_{opt} \sim 20\text{ }\mu W$)									
4 Frequency Response									
4.1	f-1dB, center channels, RF channels, CD mode	Gain mode: read high, Read Low	9-15	b_{-1dB}	50			MHz	C
4.2	f-1dB, center channels, RF channels, DVD mode	Gain mode: read high, read low	9-15	b_{-1dB}	75			MHz	C

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

5. Electrical Characteristics: General (Continued)

$V_{CC} = 5V$, $T_{amb} = 25^{\circ}C$, $V_{REF} = 1.85V$

Output load: $R_{load} = 10\ k\Omega$, $C_{load} = 15\ pF$ (max. 20 pF)

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
4.3	f-3dB, center channels, RF channels, CD mode	Gain mode: read high, read low	9-15	b_{-3dB}	100			MHz	C
4.4	f-3dB, center channels, RF channels, DVD mode	Gain mode: read high, read low	9-15	b_{-3dB}	108			MHz	C
4.5	f-3dB, center channels, RF channels	Gain mode: write high, write low	9-15	b_{-3dB}	30			MHz	C
4.6	f-3dB, satellite channels	All gain steps	3-6	b_{-3dB}	30			MHz	C
4.7	BW flatness center channels, RF channels, CD mode	Gain mode: read high, read low, 1 MHz to 100 MHz	9-15	BW fl	-3		+3	dB	C
4.8	BW flatness center channels, RF channels, DVD mode	Gain mode: read high, read low, 1 MHz to 108 MHz	9-15	BW fl	-3		+3	dB	C
5	Group Delay Error								
5.1	Center channels RF channels	1 MHz to 81 MHz	9-15	gd	-1.0	+0.1	+1.0	ns	C
6	Settling Time (Optical Power to Get Pulse Height = 1 Vpp; Measure Time Interval Start Pulse to 1% or 2% Off Final Value)								
6.1	Center channels RF channels	Gain mode: read high, read low, write high CD mode; 2% off	9-15	t_{set12}			14	ns	C
6.2	Center channels RF channels	Gain mode: write low CD mode; 2% off	9-15	t_{set12}			16	ns	C
6.3	Satellite channels	E1G1 to F2H2 CD mode; 2% off	3-6	t_{set22}			30	ns	C
6.4	Center channels RF channels	Gain mode: read high, read low, write high CD mode; 1% off	9-15	t_{set11}			20	ns	C
6.5	Center channels RF channels	Gain mode: write low CD mode; 1% off	9-15	t_{set11}			25	ns	C
6.6	Satellite channels	E1G1 to F2H2 CD mode; 1% off	3-6	t_{set21}			35	ns	C
6.7	Center channels RF channels	Gain mode: read high, read low, write high DVD mode; 2% off	9-15	t_{set12D}			10	ns	C
6.8	Center channels RF channels	Gain mode: write low DVD mode; 2% off	9-15	t_{set12D}			16	ns	C
6.9	Satellite channels	E1G1 to F2H2 DVD mode; 2% off	3-6	t_{set22D}			30	ns	C
6.10	Center channels RF channels	Gain mode: read high, read low, write high DVD mode; 1% off	9-15	t_{set11D}			20	ns	C
6.11	Center channels RF channels	Gain mode: write low DVD mode; 1% off	9-15	t_{set11D}			25	ns	C

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

5. Electrical Characteristics: General (Continued)

V_{CC} = 5V, T_{amb} = 25°C, V_{REF} = 1.85V

Output load: R_{load} = 10 kΩ, C_{load} = 15 pF (max. 20 pF)

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
6.12	Satellite channels	E1G1 to F2H2 DVD mode; 1% off	3-6	t _{set21D}			35	ns	C
7	Saturation Recovery Time (Output Swing 1.95Vp Ref. to V_{REF}: Measure Fall Time: V_{out} = 1.5V to 0.1V Ref. to V_{REF})								
7.1	Center channels RF channels	Gain mode: read high, read low, CD mode	9-15	t _{satur}		6	12.5	ns	C
7.2	Center channels RF channels	Gain mode: write high, write low, CD mode	9-15	t _{satur}		6	12.5	ns	C
7.3	Center channels RF channels	Gain mode: read high, read low, DVD mode	9-15	t _{satur}		6	12.5	ns	C
7.4	Center channels RF channels	Gain mode: write high, write low, DVD mode	9-15	t _{satur}		6	12.5	ns	C
8	Output Noise Level								
8.1	Center channels RF channels	Gain mode: read High, read Low	9-15	V _{noise}		-80	-76	dBm	C
9	Switching Time								
9.1	Gain switching time	Gain mode: read high – Write high/read low – Write low and vice versa	7, 8	t _{gs}		50		ns	C

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

6. Gain Setting

Mode	Rel. Gain	SW1	SW2
Read high	40	1	1
Read low	13	1	0
Write high	3	0	1
Write low	1	0	0
Power down	-	Hi-Z	Hi-Z

Note: 1. All gain switches have tri-state inputs

7. Gain Switching

Logical State	Level Min.	Level Max.	Unit
low	0	0.7	V
Hi-Z	1.3	1.9	V
high	2.5	VCC	V

8. Applications Recommendation

To achieve the best performance both pins VCC and VREF need to be blocked using a high quality capacitors (C = 100 nF) as close to device or pins as possible.

We recommend placing a GND-plane on the flexboard below the center of the package (shielding, etc.).



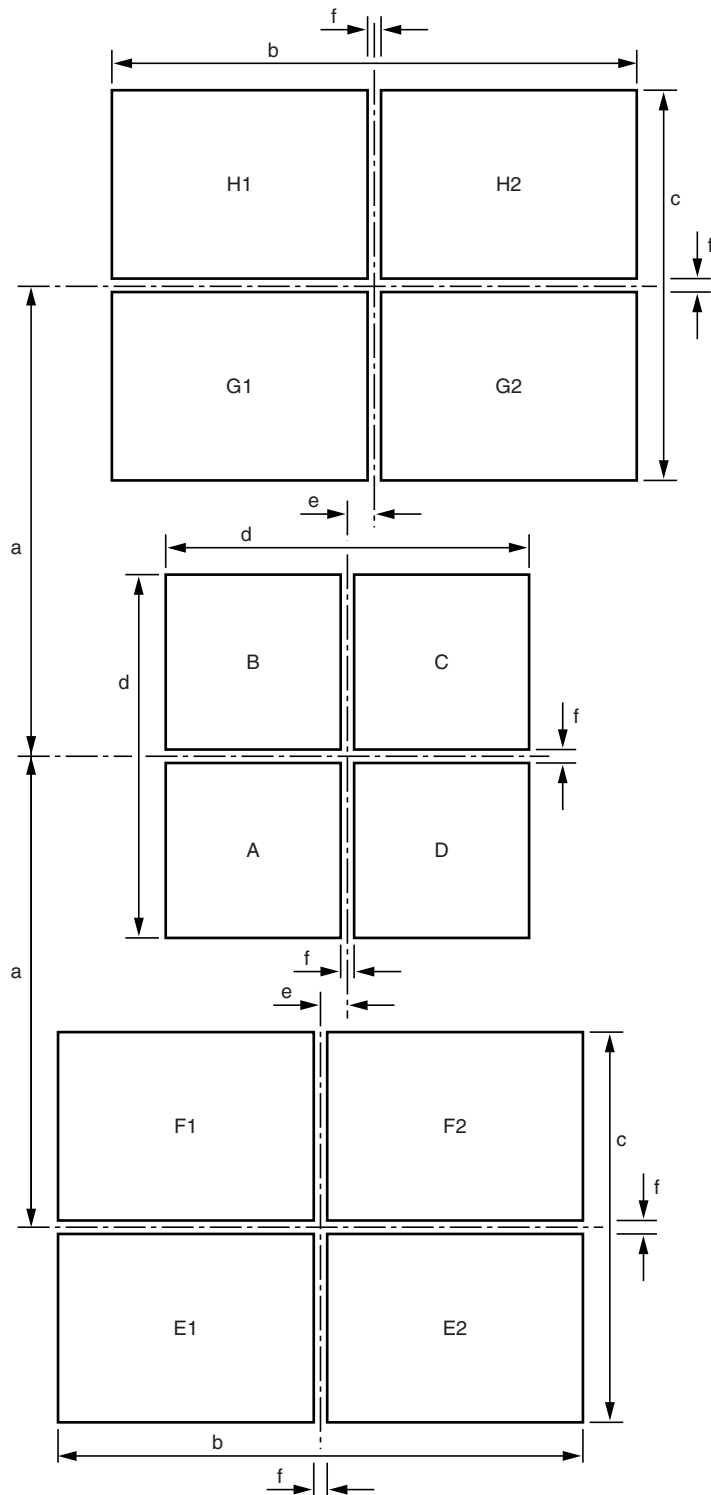
9. Photo Diode Arrangement

Figure 9-1. Photo Diode Arrangement

	Dimensions	
a	150.0	μm
b	145.0	μm
c	115.0	μm
d	100.0	μm
e	5.0	μm
f	5.0	μm

Photo diode is symmetrically centered to the center of the chip and package

Symmetrical axis is parallel to the package

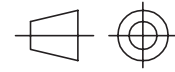


10. Ordering Information

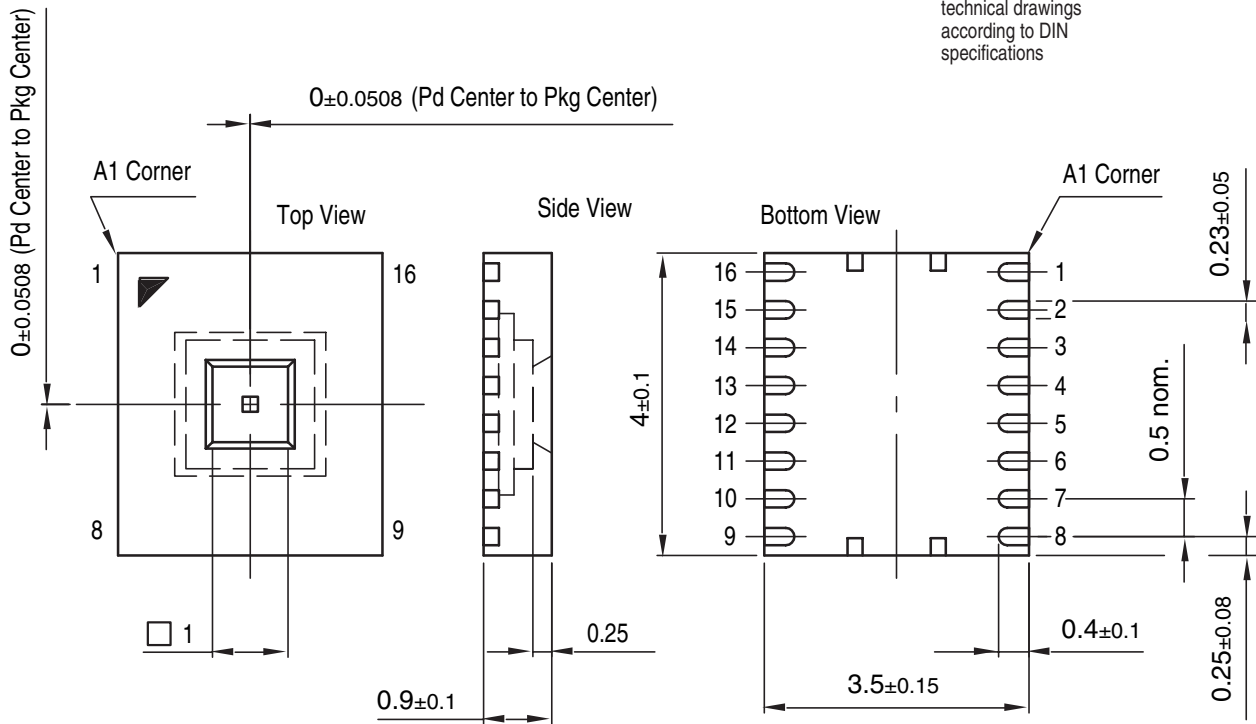
Extended Type Number	Package	Remarks
ATR0874-PZQW	QFN_OPEN_4x3.5_16L	Taped and reeled, Pb-free

11. Package Information

Package: QFN_OPEN_4x3.5_16L
 Dimensions in mm



technical drawings according to DIN specifications



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