BROADCOM®

Data Sheet

AEDR-9930

3-Channel Reflective Incremental Encoders Digital Output (397 LPI)

Description

The Broadcom® AEDR-9930 is a three-channel reflective optical encoder. The selectable and programmable options available are three-channel digital differential A, B, and I outputs.

The AEDR-9930 digital encoder mode offers two-channel (AB) quadrature digital outputs and a third channel digital index output. Being TTL compatible, the outputs of the AEDR-9930 encoder can be interfaced with most of the signal processing circuitries. Therefore, the encoder provides easy integration and flexible design-in into existing systems.

The AEDR-9930 encoder is designed to operate over –40°C to +125°C temperature range and is suitable for commercial, industrial, and automotive end applications.

The encoder houses an LED light source and a photo-detecting circuitry in a single package. The small size of 5.00 mm (L) × 5.00 mm (W) × 1.05 mm (H) allows it to be used in a wide range of miniature commercial applications, where size and space are primary concerns.

Features

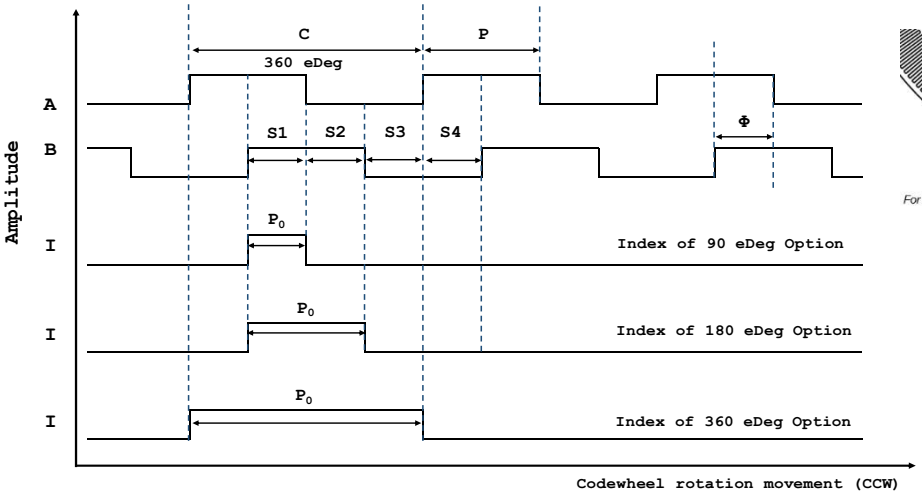
- Digital output option: 3-channel differential or TTL compatible; 2-channel quadrature (AB) digital outputs for direction sensing and a third channel, index digital output
- Wide selection of built-in interpolator with 1x, 2x, 3x to 20x, 25x, 32x, 64x, 128x to 512x selectable interpolation factors.
- SPI programmable interpolator from 1x to 1024x
- Surface-mount leadless package: 5.0 mm (L) × 5.0 mm (W) × 1.05 mm (H)
- Operating voltage of 3.3V and 5.0V supply
- Built-in LED current regulation
- Wide operating temperature range from –40°C to +125°C
- High encoding resolution: 397 LPI (lines/inch) or 15.63 LPmm (lines/mm)

Applications

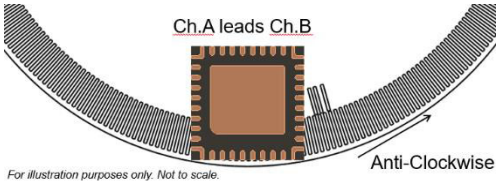
- Closed-loop stepper motors
- Small motors, actuators
- Industrial printers
- Robotics
- Card readers
- Pan-tilt-zoom (PTZ) camera
- Portable medical equipment
- Optometric equipment
- Linear stages

Output Waveform

Figure 1: Sample of Output Waveforms



Quadrature Signals A,B and I



Digital Parameter Definitions

Test	Parameter	Definition
Count	N	The number of bar and window pairs or counts per revolution (CPR) of the code wheel.
Cycle	C	360 electrical degrees (°e), 1 bar and window pair. One Shaft Rotation: 360 mechanical degrees, N cycles.
Cycle Error	ΔC	An indication of cycle uniformity. The difference between an observed shaft angle that gives rise to one electrical cycle, and the nominal angular increment of 1/N of a revolution.
Pulse Width (Duty) Error	ΔP	The deviation, in electrical degrees, of the pulse width from its ideal value of 180°e.
State	S	The number of electrical degrees between a transition in the output of channel A and the neighboring transition in the output of channel B. There are 4 states per cycle, each nominally 90°e.
Phase	φ	The number of electrical degrees between the center of the high state of channel A and the center of the high state of channel B. This value is nominally 90°e for quadrature output.
Optical Radius	R_{OP}	The distance from the code wheel's center of rotation to the optical center (O.C.) of the encoder module.
Index Pulse Width	P_0	The number of electrical degrees that an index is high during one full shaft rotation.

Absolute Maximum Ratings

Parameter	Symbol	Value
Storage Temperature	T_S	–40°C to 125°C
Operating Temperature	T_A	–40°C to 115°C
Supply Voltage	V_{CC}	7V

NOTE:

1. Proper operation of the encoder cannot be guaranteed if the maximum ratings are exceeded.
2. Exposure to extreme light intensity (such as from flashbulbs or spotlights) can cause permanent damage to the device.
3. Remove Kapton tape only after SMT reflow process and just before final assembly. Take precautions to keep the encoder ASIC clean at all times.
4. Some particles might be present on the surface of the encoder ASIC surface. The presence of these particles does not degrade the performance of the encoder.

CAUTION! Take anti-static discharge precautions when handling the encoder in order to avoid damage, degradation, or both, induced by ESD.

Recommended Operating Condition

Parameter	Sym.	Min.	Typ.	Max.	Unit	Notes
Operating Temperature	T_A	–40	25	125	°C	
Supply Voltage	V_{CC}	3.0	3.3	3.6	V	Ripple < 100 mVp-p
		4.5	5	5.5		
Current	I_{CC}	—	70	125	mA	Dependent on spatial position and rotation speed
Pin Current (All I/O Outputs)	I	–20	—	20	mA	
Max Output Frequency (External Pin Selectable)	F	—	—	0.2	MHz	At 1x Interpolation
		—	—	0.4	MHz	At 2x Interpolation
		—	—	0.8	MHz	At 4x Interpolation
		—	—	1.6	MHz	At 8x Interpolation
		—	—	3.2	MHz	At 16x Interpolation
		—	—	4.0	MHz	At 32x Interpolation
		—	—	4.0	MHz	At 64x Interpolation
		—	—	4.0	MHz	At 128x Interpolation
Max Output Frequency (SPI Programmable)	F	—	—	4.0	MHz	At ≥16x Interpolation
Radial Misalignment	ER	—	—	±0.5	mm	
Tangential Misalignment	ET	—	—	±0.3	mm	Based on R_{OP} 5.21 mm 360 CPR = ±0.20 mm 512 CPR = ±0.30 mm 1000 CPR = ±0.50 mm
Code Wheel Gap	G	0.55	0.75	0.95	mm	For 360 CPR
		0.45	0.75	1.05	mm	For ≥512 CPR

Power-Up Behavior

When AEDR-9930 is powered on, the A, B, and I digital outputs are invalid until after the initial first toggle state of either the Ch A or Ch B signal.

Encoder Pinout

Figure 2: Encoder Pinout

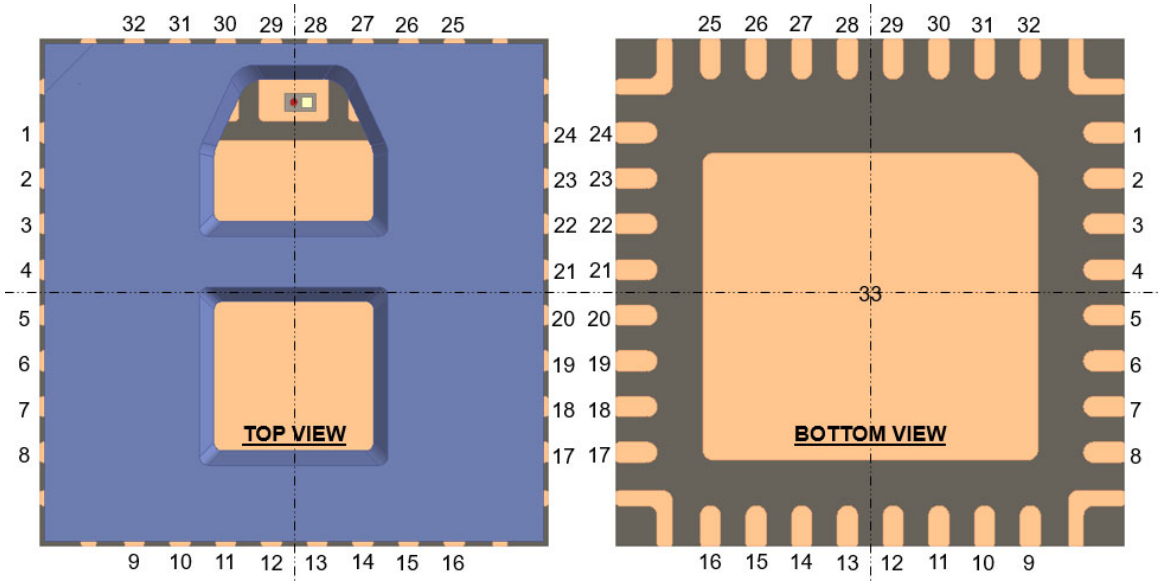


Table 1: AEDR-9930 Pinout

Pin	Name[a]	Function
1	CH_A+	Digital A+
2	CH_A– / SPI_DIN	Digital A– / SPI Data In
3	VDD 5V	Digital Supply Voltage
4	VSSD	Digital Ground
5	CH_B+	Digital B+
6	CH_B– / SPI_CLK	Digital B– / SPI Clock
7	CH_I+ / SPI_DOUT	Digital I+ / SPI Data Out
8	CH_I– / CLK100K	Digital I– / CLK 100k
9	N.C.	—
10	N.C.	—
11	N.C.	—
12	N.C.	—
13	N.C.	—
14	N.C.	—
15	N.C.	—
16	N.C.	—
17	CAL	Autocalibration

Pin	Name	Function
18	INDEX_SEL	Index Selection
19	SEL1	Mode Selection 1
20	SEL2	Mode Selection 2
21	SEL3	Mode Selection 3
22	VSSA	Analog Ground
23	VDDA	Analog Supply Voltage
24	LED REG	LED Regulation
25	N.C.	—
26	N.C.	—
27	LED CATHODE	LED Cathode
28	LED ANODE	LED Anode
29	LED ANODE	LED Anode
30	N.C.	—
31	VSSA	Analog Ground
32	N.C.	—
33	VSSA	Analog Ground

a. N.C. = No connect.

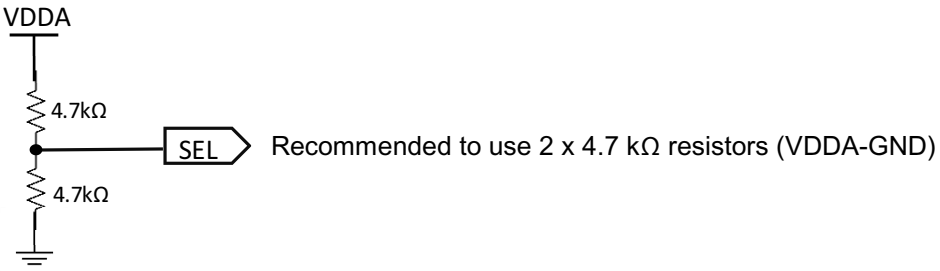
Select Options – Encoder Built-in Interpolation

No.	SEL1	SEL2	SEL3	Interpolation Factor	IND SEL	Index
1	Low	Low	Low	1X	Low	Interpolation 1X - Index Gated 90°
					High	Interpolation 1X - Index Gated 180°
					Open	Interpolation 1X - Index Raw (Ungated)
2	High	Low	Low	2X	Low	Interpolation 2X - Index Gated 90°
					High	Interpolation 2X - Index Gated 180°
					Open	Interpolation 2X - Index Gated 360°
3	Open[a]	Low	Low	3X	Low	Interpolation 3X - Index Gated 90°
					High	Interpolation 3X - Index Gated 180°
					Open	Interpolation 3X - Index Gated 360°
4	Low	High	Low	4X	Low	Interpolation 4X - Index Gated 90°
					High	Interpolation 4X - Index Gated 180°
					Open	Interpolation 4X - Index Gated 360°
5	High	High	Low	5X	Low	Interpolation 5X - Index Gated 90°
					High	Interpolation 5X - Index Gated 180°
					Open	Interpolation 5X - Index Gated 360°
6	Open[a]	High	Low	6X	Low	Interpolation 6X - Index Gated 90°
					High	Interpolation 6X - Index Gated 180°
					Open	Interpolation 6X - Index Gated 360°
7	Low	Open[a]	Low	7X	Low	Interpolation 7X - Index Gated 90°
					High	Interpolation 7X - Index Gated 180°
					Open	Interpolation 7X - Index Gated 360°
8	High	Open[a]	Low	8X	Low	Interpolation 8X - Index Gated 90°
					High	Interpolation 8X - Index Gated 180°
					Open	Interpolation 8X - Index Gated 360°
9	Open[a]	Open[a]	Low	9X	Low	Interpolation 9X - Index Gated 90°
					High	Interpolation 9X - Index Gated 180°
					Open	Interpolation 9X - Index Gated 360°
10	Low	Low	High	10X	Low	Interpolation 10X - Index Gated 90°
					High	Interpolation 10X - Index Gated 180°
					Open	Interpolation 10X - Index Gated 360°
11	High	Low	High	11X	Low	Interpolation 11X - Index Gated 90°
					High	Interpolation 11X - Index Gated 180°
					Open	Interpolation 11X - Index Gated 360°
12	Open[a]	Low	High	12X	Low	Interpolation 12X - Index Gated 90°
					High	Interpolation 12X - Index Gated 180°
					Open	Interpolation 12X - Index Gated 360°
13	Low	High	High	13X	Low	Interpolation 13X - Index Gated 90°
					High	Interpolation 13X - Index Gated 180°
					Open	Interpolation 13X - Index Gated 360°

No.	SEL1	SEL2	SEL3	Interpolation Factor	IND SEL	Index
14	High	High	High	14X	Low	Interpolation 14X - Index Gated 90°
					High	Interpolation 14X - Index Gated 180°
					Open	Interpolation 14X - Index Gated 360°
15	Open[a]	High	High	15X	Low	Interpolation 15X - Index Gated 90°
					High	Interpolation 15X - Index Gated 180°
					Open	Interpolation 15X - Index Gated 360°
16	Low	Open[a]	High	16X	Low	Interpolation 16X - Index Gated 90°
					High	Interpolation 16X - Index Gated 180°
					Open	Interpolation 16X - Index Gated 360°
17	High	Open[a]	High	17X	Low	Interpolation 17X - Index Gated 90°
					High	Interpolation 17X - Index Gated 180°
					Open	Interpolation 17X - Index Gated 360°
18	Open[a]	Open[a]	High	18X	Low	Interpolation 18X - Index Gated 90°
					High	Interpolation 18X - Index Gated 180°
					Open	Interpolation 18X - Index Gated 360°
19	Low	Low	Open[a]	19X	Low	Interpolation 19X - Index Gated 90°
					High	Interpolation 19X - Index Gated 180°
					Open	Interpolation 19X - Index Gated 360°
20	High	Low	Open[a]	20X	Low	Interpolation 20X - Index Gated 90°
					High	Interpolation 20X - Index Gated 180°
					Open	Interpolation 20X - Index Gated 360°
21	Open[a]	Low	Open[a]	25X	Low	Interpolation 25X - Index Gated 90°
					High	Interpolation 25X - Index Gated 180°
					Open	Interpolation 25X - Index Gated 360°
22	Low	High	Open[a]	32X	Low	Interpolation 32X - Index Gated 90°
					High	Interpolation 32X - Index Gated 180°
					Open	Interpolation 32X - Index Gated 360°
23	High	High	Open[a]	64X	Low	Interpolation 64X - Index Gated 90°
					High	Interpolation 64X - Index Gated 180°
					Open	Interpolation 64X - Index Gated 360°
24	Open	High	Open[a]	128X	Low	Interpolation 128X - Index Gated 90°
					High	Interpolation 128X - Index Gated 180°
					Open	Interpolation 128X - Index Gated 360°
25	Low	Open[a]	Open[a]	256X	Low	Interpolation 256X - Index Gated 90°
					High	Interpolation 256X - Index Gated 180°
					Open	Interpolation 256X - Index Gated 360°
26	High	Open[a]	Open[a]	512X	Low	Interpolation 512X - Index Gated 90°
					High	Interpolation 512X - Index Gated 180°
					Open	Interpolation 512X - Index Gated 360°
27	Open[a]	Open[a]	Open[a]	SPI Mode	Low	SPI Mode: Program Selection
					High	SPI Mode: Output Enabled

a. Open selection must be connected to the middle of a voltage divider circuit.

Figure 3: Example of Voltage Divider Circuit



The digital interpolation factor above is used with the following equations to cater to various rotational speed (RPM) and count per revolution (CPR).

RPM = (Count Frequency × 60) / CPR

The CPR (at 1X interpolation) is based on the following equation, which is dependent on radius of operation (R_{OP}).

CPR = LPI × 2π × R_{OP} (inch) or CPR = LP mm × 2π × R_{OP} (mm)

NOTE: LP mm (lines per mm) = LPI / 25.4

Programmable Select Options

The AEDR-9930 digital encoder is programmable via the SPI with an interpolator factor from 1x to 1024x

1. Configure external selection to SPI Mode: Program Selection.
2. For signals output after configuration, set external selection to SPI Mode: Output Enabled.

SPI Communication Pinout (for Interpolation and Index Width Selection)

Table 2: Encoder Calibration Related Pinout

Pin	Name	Function
7	SPI DOUT	SPI Data Output
2	SPI DIN	SPI Data Input
6	SPI CLK	SPI Clock

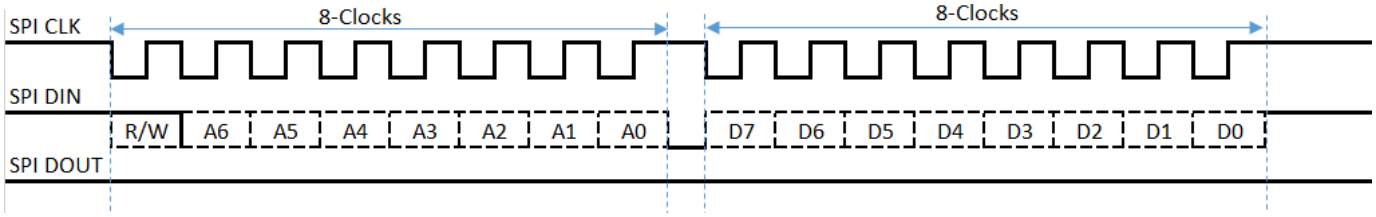
SPI Read and Write Timing Diagram (Maximum Clock Frequency 1 MHz)

Table 3: SPI Read and Write Memory Map

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Read	0	Address[6:0]							Data[7:0]							
Write	1	Address[6:0]							Data[7:0]							

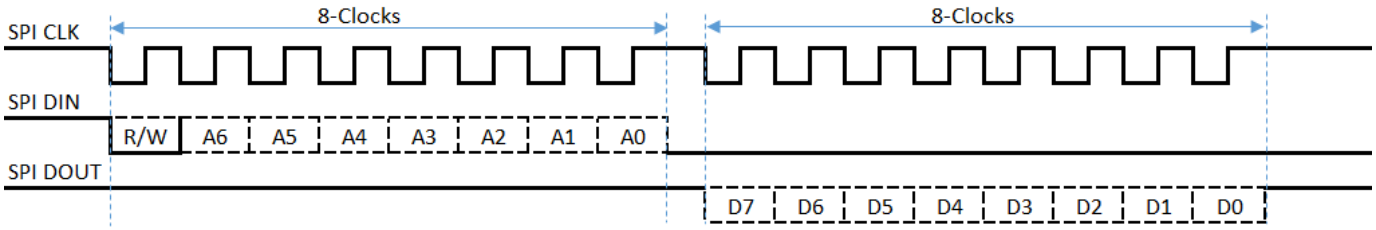
SPI Write: <Write Command = 1><7bits address><8bits data>

Figure 4: SPI Write Timing Diagram



SPI Read: <Read Command = 0><7bits address>

Figure 5: SPI Read Timing Diagram



Unlock Sequence

1. Write to SPI Address 0x10 with value AB (Hex) to unlock Level 1.
2. Write to SPI Address 0x14 with value 00 (Hex) to go to Page 0.

Interpolation Settings and Programming

1. Write to SPI Address 0x0B and 0x0C with the value shown in the following tables.
2. After finalizing the CPR settings, write to SPI Address 0x11 (Hex) with a value A1 (Hex) before proceeding to program the AEDR- 9930.

Table 4: List of Available Interpolation and Index Values in the AEDR-9930

Byte Address		Bit								
[Hex]	Page	7	6	5	4	3	2	1	0	Note
0x0B				Iwidth_digital[1:0]				INT[10:8]		INT: 0-1024
0x0C		INT[7:0]								

Interpolation INT	0x0B (Hex)	0x0C (Hex)
1	Bit 0 = 0	01
2	.	02
.	.	.
.	.	.
10	.	0A
11	.	0B
.	.	.
.	.	.
255	Bit 0 = 0	FF
256	Bit 0 = 1	00
257	Bit 0 = 1	01
.	.	.
.	.	.
512	Bit 1 = 1	00
.	.	.
.	.	.
1024	Bit 2 = 1	00

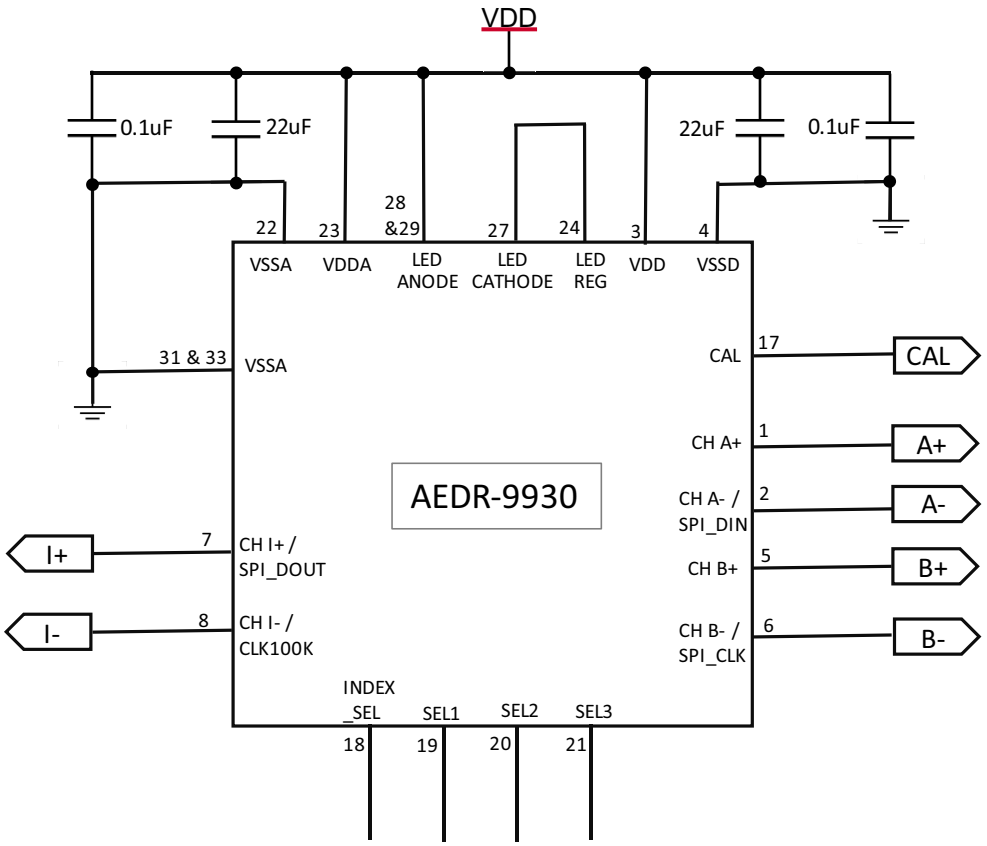
Iwidth_ Digital	IndexWidth
00	90°
01	180°
10	N/A
11	360°

Recommended Setup for the Power Supply Pins and General Routing

Both VDDA, VDD, and the respective grounds (VSSA and VSSD) are to be connected separately as shown in Figure 6. Be sure to follow these schematic design rules:

- Use a pair of 22-µF and 0.1-µF capacitors as bypass on VDD and VDDA. Place them in parallel as close as possible to the encoder ASIC package, in between the power and ground pins.
- Avoid routing the INDEX trace in parallel and close to the analog signal. This is to reduce the INDEX signal switching noise from coupling into the analog signal.
- Design separate VDD and VDDA traces.
- Minimize trace or cable length where possible.

Figure 6: Reference Schematic Diagram for AEDR-9930



NOTE:

1. Pin 33 is the center pad of the package and is labeled *AGND*.
2. Refer to the Select Options – Encoder Built-in Interpolation table for SEL1, SEL2, SEL3, and IND_SEL configurations.
3. VDDA and VDD ***must*** be the same voltage level.
4. VSSA and VSSD ***must*** be connected together.

Autocalibration Process

The AEDR-9930 has a built-in autocalibration process that can be triggered on power-up by shorting the CAL pad to VDDA (or VDD). The purpose of the calibration process is to align the center of the Index signal to the center of the channel B signal. The misalignment of the Index signal is due to potential spatial misalignment of the encoder ASIC to the code wheel after assembly.

Perform the autocalibration process even if the A, B, and I signals appear normal at the first power-on after the encoder assembly. The autocalibration process helps to optimize the internal encoder ASIC settings, hence enhancing the reliability and performance.

Autocalibration steps:

1. Spin the motor at a rotation speed between 500 rpm to 1500 rpm.
2. Short the CAL pad to VDDA or VDD line. Use a high value resistor such as 4.7 kΩ or 5.6 kΩ to do the shorting.
3. Turn on the power to the encoder. This will trigger the ASIC to start the autocalibration process.
4. Wait for at least 5 seconds. The Ch B+ state will change to high if the autocalibration is successful. The Ch B+ state will remain low if the autocalibration process is unsuccessful and Ch I+ will change from a high to a low state. Check on the spatial alignment between the encoder ASIC (PCB) to the code wheel position and repeat step 1 to 4.
5. Remove the short between Ch A+ to VDDA or VDD. Perform a power cycle, and the encoder ASIC will function as normal.

Table 5: Various Encoder Autocalibration Status Based on Pad State

Pad	CAL (Pin 17)	B+	I+	Status
Pad State	H	H	H	Pass
	H	H	L	Fail
	H	L	H	Autocalibration incomplete or error

Digital Encoder Characteristics (Code Wheel of R_{OP} at 5.21 mm, 512 CPR)

Table 6: Typical Ch A and Ch B Signal Dynamic Performance over Different Interpolation Values

Parameter		Dynamic Performance[a]								
		Typical[b]								
Interpolation Factor	Symbol	1X	2X	4X	8X	16X	32X	64X	128X	Unit
Cycle Error	ΔC	±7	±8	±9	±9	±11	±13	±16	±19	°e
Pulse Width (Duty) Error	ΔP	±4	±4	±5	±5	±8	±11	±13	±15	°e
Phase Error	Δϕ	±1	±2	±2	±3	±4	±6	±8	±9	°e
State Error	ΔS	±2	±2	±3	±4	±5	±10	±13	±13	°e
Index Pulse Width (Gated 90°)	Po	90								°e
Index Pulse Width (Gated 180°)	Po	180								°e
Index Pulse Width (Gated 360°)	Po	N/A	360							°e
Index Pulse Width (Raw Ungated)	Po	330	N/A							°e

a. The optimal performance of the encoder depends on the motor/system setup condition of the individual customer.

b. Typical values represent the average value of the encoder performance based on the factory setup conditions at 2-MHz frequency.

Electrical Characteristics

Characteristics over recommended operating conditions at 25°C.

Table 7: Typical Ch A and Ch B Signal Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
High Level Output Voltage	VOH	2.4	—	—	V	IOH = –20 mA
Low Level Output Voltage	VOL	—	—	0.4	V	IOH = +20 mA
Output Current Per Channel	Io	—	—	20	mA	
Rise Time	tr	—	<50	—	ns	CL ≤ 50 pF
Fall Time	tf	—	<50	—	ns	

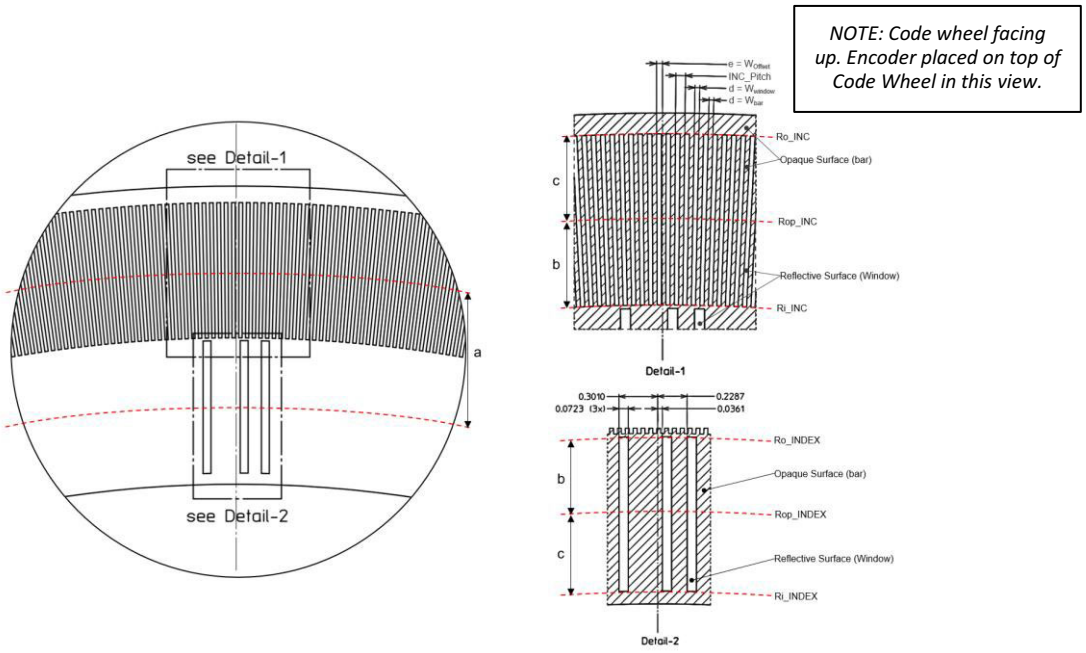
Code Wheel Design Guidelines

- The incremental and index window tracks are reflective surfaces.
- The incremental and index bar tracks are opaque surfaces.
- The number of incremental window and bar tracks depends on the CPR.
- There are three pairs of Index window tracks.

- The incremental window and bar width are denoted by W_{window} and W_{bar}, respectively.
- All incremental window and bar tracks have the same width value, d°.
- The incremental window offset from the center line is denoted by e°
- Incremental tracks are trapezoidal.

- All index window widths are 0.0723 mm.
- The index window offset from the center line is 0.3010 mm, 0.0361 mm, and 0.2287 mm, respectively.
- Index windows tracks are rectangular.

Figure 7: Code Wheel Design



Dimension	Formula	397 LPI
a (mm)	$R_{OP\_INC} - R_{OP\_INDEX}$	1.2076
b (mm)	(a/2) – 0.01	—
c (°)	$R_{O\_INC} - R_{OP\_INC}$ or $R_{OP\_INDEX} - R_{I\_INDEX}$	0.60
d (°)	(360/CPR)/2	—
e (°)	1.25 × d	—

Code Wheel Design Example

The following demonstrates a code wheel design for 397 LPI at 1250 CPR.

Determine R_{OP_INC}	(25.4/396.875) × (1250/2π)	≈ 12.7324 mm
Determine R_{OP_INDEX}	12.7324 – 1.2076	= 11.5248 mm
Determine R_{O_INC}	12.7324 + 0.60	= 13.3324 mm
Determine R_{I_INC}	12.7324 – (1.2076/2 – 0.01)	= 12.1386 mm
Determine R_{O_INDEX}	11.5248 + (1.2076/2 – 0.01)	= 12.1186 mm
Determine R_{I_INDEX}	11.5248 – 0.60	= 10.9248 mm
Determine W_{window} and W_{bar}	(360/1250) / 2	= 0.144°
Determine W_{offset}	1.25 × 0.144	= 0.180°

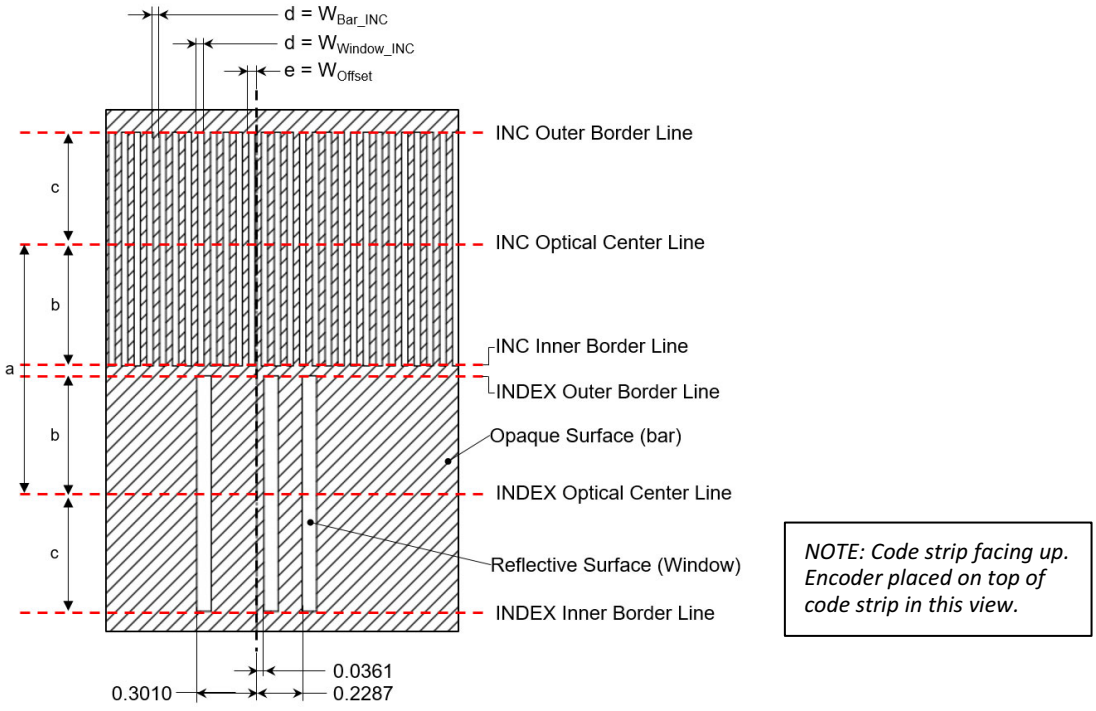
Code Strip Design Guidelines

- Similar to code wheel design, the incremental and index window tracks are reflective surfaces.
- The incremental and index bar tracks are opaque surfaces.
- There are three pairs index window tracks, but the number of incremental window and bar tracks depends on the CPR.

- The incremental window and bar width are denoted by W_{window} and W_{bar}, respectively.
- All incremental window and bar tracks have the same width value, d.
- The incremental window offset from the center line is denoted by e.

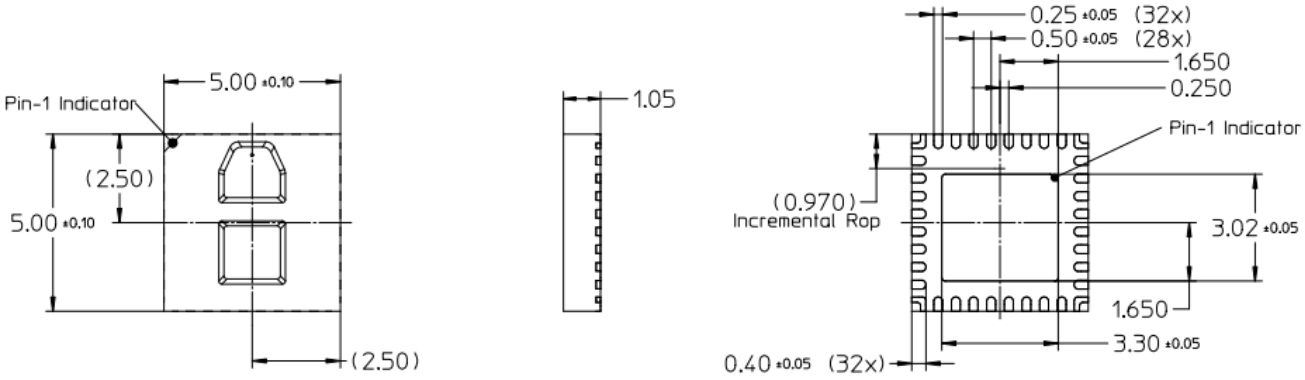
- All index window widths are 0.0723 mm.
- The index window offset from the center line is 0.3010 mm, 0.0361 mm, and 0.2287 mm, respectively.

Figure 8: Code Strip Design



Dimension	Formula	397 LPI
Pitch (mm)	25.4/396.875	0.064
a (mm)	—	1.2076
b (mm)	(a/2) – 0.01	—
c (mm)	—	0.600
d (mm)	Pitch/2	0.032
e (mm)	1.25 × d	0.040

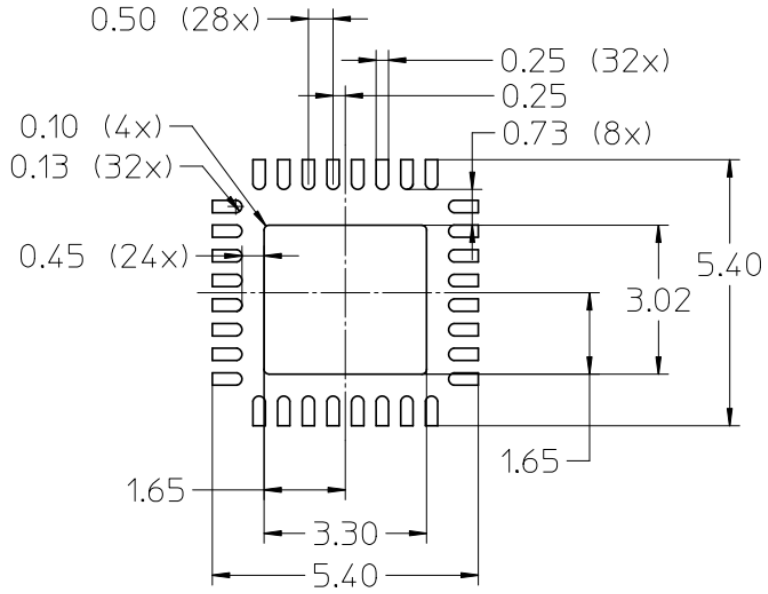
Package Outline Drawing



NOTE:

1. All dimensions are in millimeters (mm).
2. Unless otherwise specified, tolerance is x.xx ± 0.15 mm.

Recommended PCB Land Pattern



NOTE:

1. All dimensions are in millimeters (mm).
2. Unless otherwise specified, tolerance is x.xx ± 0.05 mm.

Encoder Placement Orientation, Position, and Direction of Movement

The AEDR-9930 is designed with both the emitter and detector dice placed in parallel to the code wheel window/bar orientation. The encoder package is mounted on top facing down onto the code wheel. When properly aligned, the detector side will be closer to the center of the code wheel than the emitter.

The optical center of the encoder package must be aligned tangential to the code wheel's R_{OP}. The optimal gap setting recommended is 0.75 mm, with the range of 0.45 mm to 1.05 mm.

Channel A leads Channel B when the code wheel rotates anti-clockwise and vice versa.

Figure 9: Top Down View of AEDR-9930 with Respect to Code Wheel Positioning

For illustration purposes only. Not to scale.

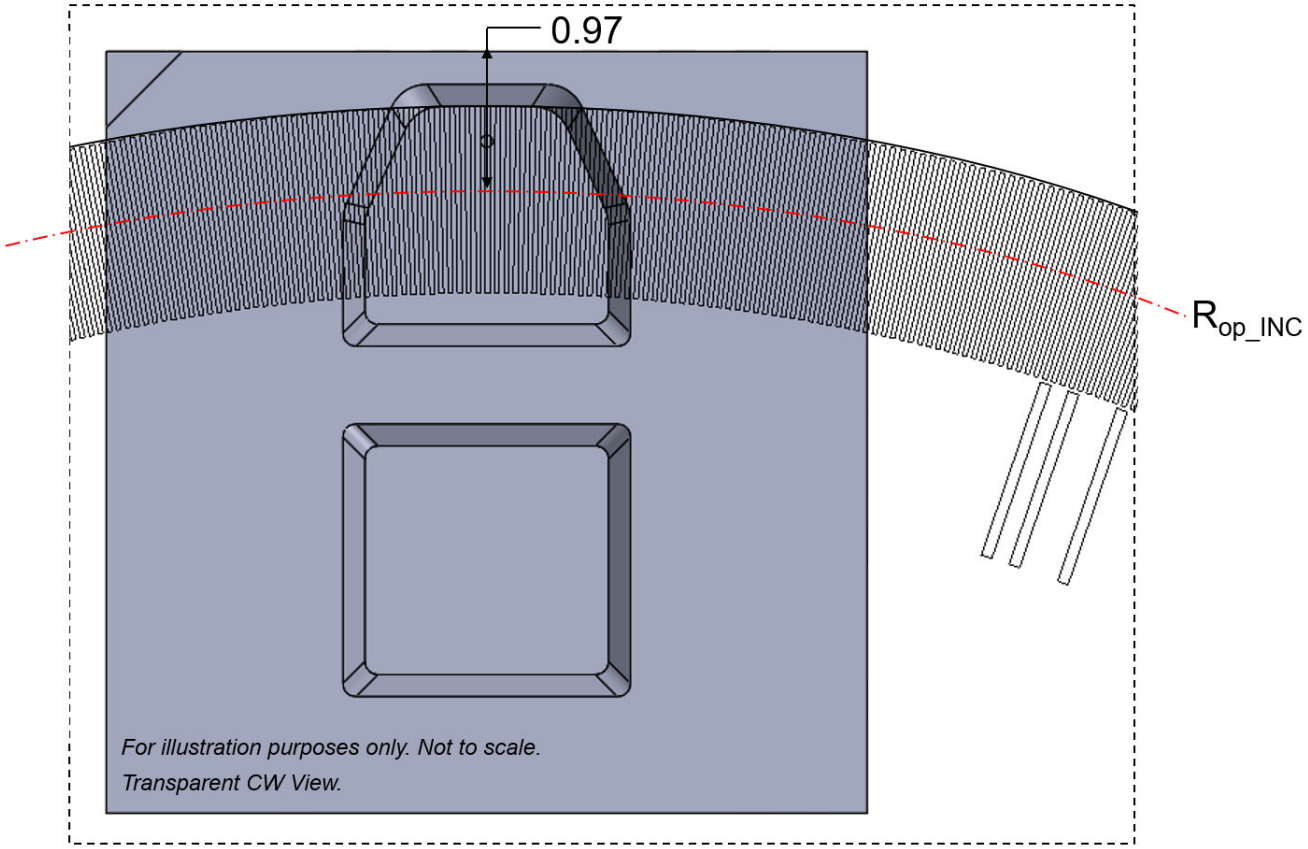
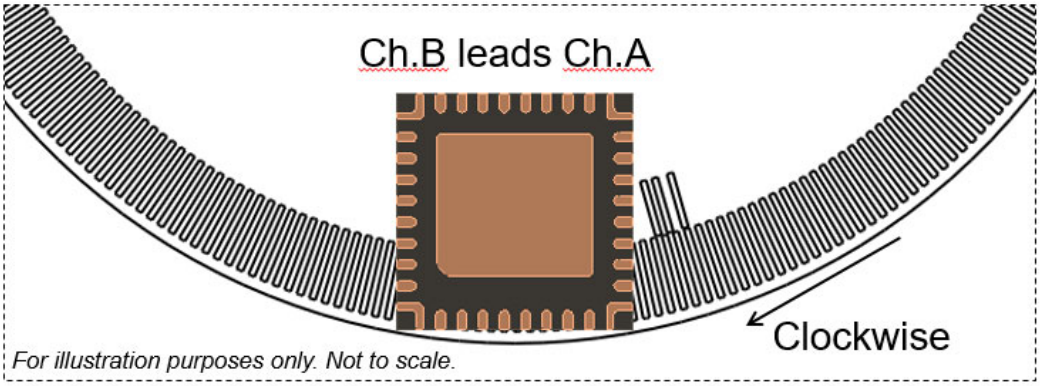
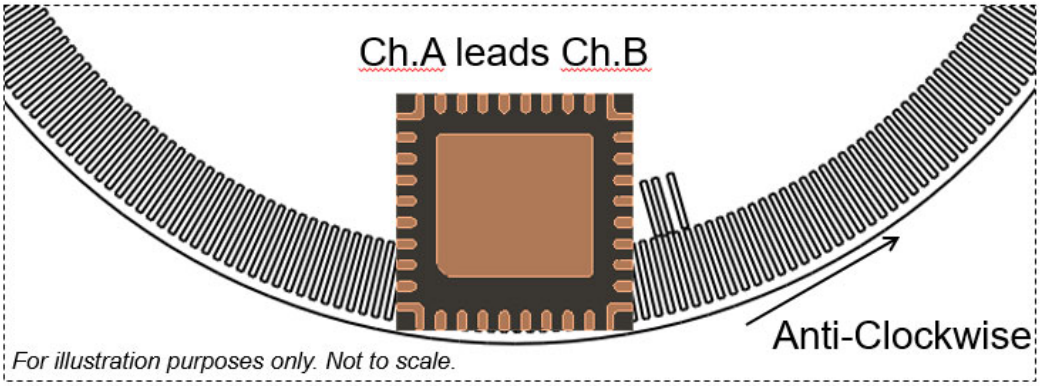


Figure 10: Channel A and Channel B Signal Output Sequence in with Respect to Code Wheel Rotational Direction





Moisture Sensitivity Level

The AEDR-9930 package is qualified to moisture sensitive level 3 (MSL 3). Precaution is required to handle this moisture sensitive product to ensure the reliability of the product.

Storage before use:

- Unopened moisture barrier bag (MBB) can be stored at <40°C/90% RH for 12 months.
- Open the MBB just prior to assembly.

Control after opening the MBB:

- The encoder that will be subjected to SMT reflow must be mounted within 168 hours of factory conditions of <30°C/60% RH.

Control for unfinished reel:

- Store a sealed MBB with desiccant or desiccators at <5%RH condition.

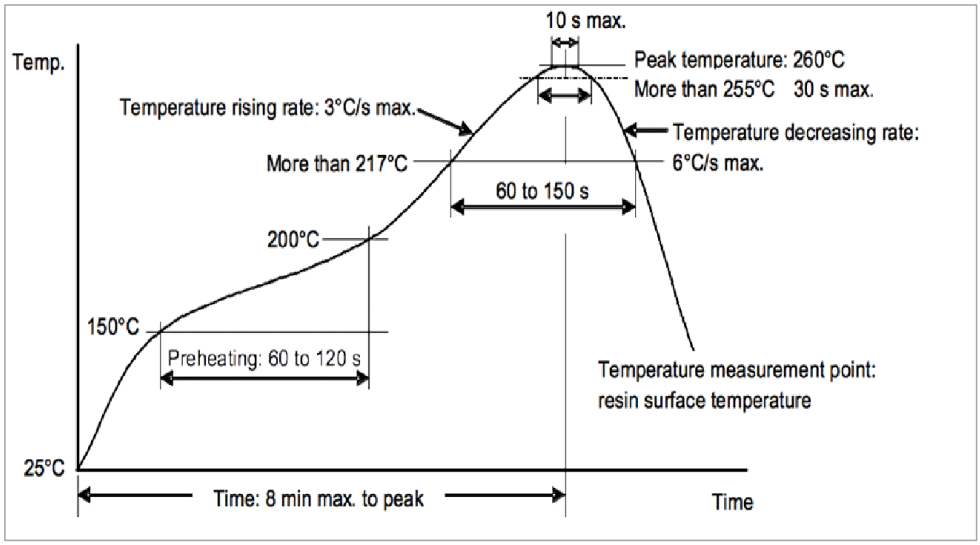
Baking is required if:

- The humidity indicator card (HIC) is >10% when read at 23 ± 5°C.
- The encoder floor life exceeded 168 hours after opening moisture barrier bag.

Recommended baking condition:

- 65°C ± 5°C for 20 hours (tape and reel) or 125°C ± 5°C for 8 hours (loose units).

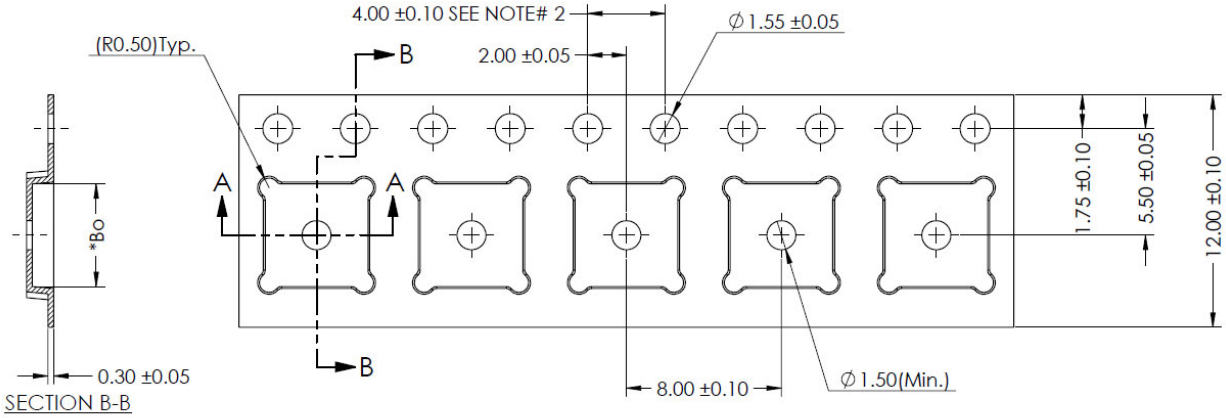
Figure 11: Typical Lead-Free Solder Reflow Profile



CAUTION! Use care when handling the encoder ASIC because it is a sensitive optical device. Remove the protective Kapton tape only after the reflow process and just before final assembly.

Tape and Reel Information

Figure 12: AEDR-9930 Carrier Tape Dimensions



DIM.	mm
Ao:	5.30+/-0.10
Bo:	5.30+/-0.10
Ko:	1.10+/-0.10
K1:	-
Pitch:	8.00+/-0.10
Widht:	12.00+/-0.10

Ordering Information

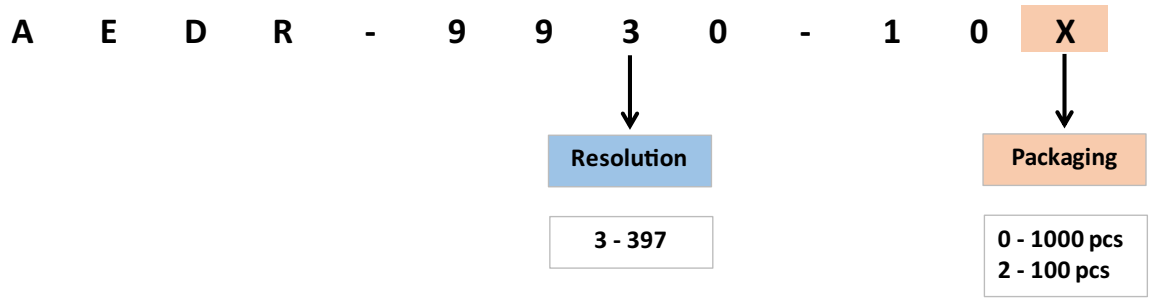


Table 8: Relevant Part Numbers Ordering Information

Ordering Info	Type
AEDR-9930-100	AEDR-9930, 397 LPI Incremental Encoder, 1000 pcs
AEDR-9930A-100	AEDR-9930A, Automotive, 397 LPI Incremental Encoder, 1000 pcs
AEDR-9930-102	AEDR-9930, 397 LPI Incremental Encoder, 100 pcs
AEDR-9930A-102	AEDR-9930A, Automotive, 397 LPI Incremental Encoder, 100 pcs
HEDS-9930EVB	AEDR-9930 Evaluation Board 397 LPI Eval Board and Code Wheel
HEDS-9930PRGEVB	AEDR-9930 Programming Kit, Include Eval Board and Code Wheel