



MicroE
Encoders

PRODUCT DATA SHEET

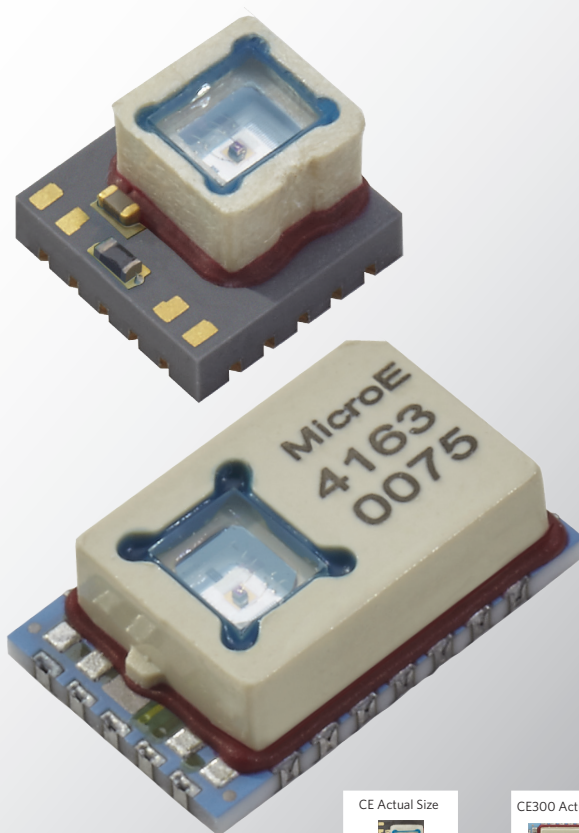
Nano

ChipEncoder Series

SMT Encoders for High Performance,
High Volume Designs

ChipEncoder models feature built-in interpolation and mount directly on your printed circuit board, providing significant space and cost savings through design integration.

> CELERAMOTION.COM

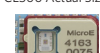


CE Actual Size



6 x 6 mm

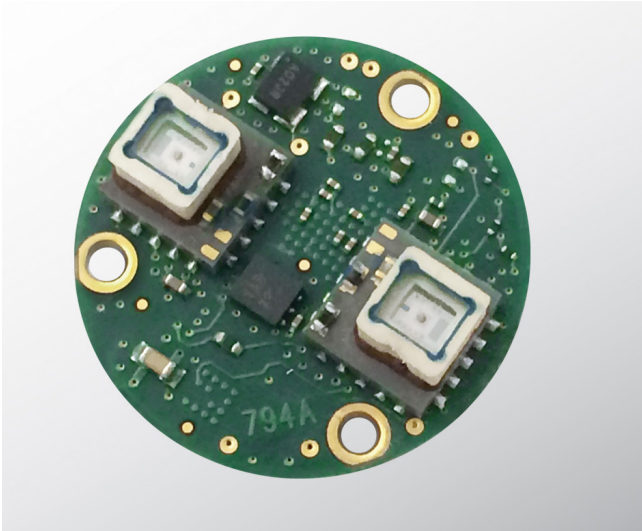
CE300 Actual Size



7 x 11 mm

ChipEncoder™ Series Encoders

SMT Encoders for High Performance, High Volume Designs



Small, Low Cost, High Resolution.

The CE300 and CE ChipEncoders are modular SMT kit encoder systems that combine small size with high resolution making high performance digital closed-loop motion control possible and affordable for your high volume product designs.

The optical, non-contact system consists of either a linear or rotary glass scale and a BGA packaged sensor head that you integrate into your own PCB design. Based on a 40 μm pitch diffractive scale, the system's integral interpolation electronics can deliver up to 1 μm linear resolution at high speed. The total cost of the ChipEncoder is low because it is integrated into your PC board for minimal systems parts count and automated pick and place manufacturing.

Benefits

- Integrates with other components on your PC board for lowest total system cost; designed for low cost automated PC board assembly
- High speed capability enhances motion system performance
- Non-contact design for high reliability
- High resolution with on-board interpolation and digital output improves motion system accuracy and stability
- Small size enables ultra-miniature, low cost motion control

Specifications

Dimensions:	6.1 x 6.1 x 3.9 mm (CE) 11.0 x 7.0 x 3.1 mm (CE300)
Interfaces:	A-quadr-B digital
Resolution:	10 μm or 1 μm (linear) 3,300 CPR – 327,680 CPR (rotary)
Accuracy Class:	$\pm 1 \mu\text{m}$ (linear glass) ± 2 arc-seconds (rotary)
Input Voltage:	5 VDC ± 0.5
Supply Current:	30 mA, unterminated outputs
Max Speed:	14 m/s
Index:	40 μm Window
Outputs:	A-quadr-B, Index
Operating Environment:	Atmospheric
Scale Pitch:	40 μm
Repeatability: (Hysteresis)	1 ± 1 LSB
Weight:	0.37 g (CE300), 0.25 g (CE)
Grating Compatibility:	Linear and Rotary (glass only)

RoHS

ChipEncoder™ Series Data Sheet

Specifications

System

Scales

ChipEncoders are compatible with ChipEncoder Linear and Rotary Glass Scales

Scale Pitch 40 μm

System Resolution

	CE300-4	CE300-40	CE-40GC
Linear Resolution:	10 μm	1 μm	1 μm
Rotary Resolution:		See Page 12	
Interpolation Depth:	x4	x40	x40

Accuracy

Linear Glass: $\pm 5 \mu\text{m}/\text{m}$
 Rotary Glass: ± 2 arc-seconds¹

Size and Weight

Dimensions (mm)	Width	Length	Height
CE300:	7.0	11.0	3.1
CE:	6.1	6.1	3.9
Weight			
CE300:	0.37 g		
CE:	0.25 g		

Operating and Electrical Specifications

Power Supply 5 $V_{\text{DC}} \pm 0.5 V_{\text{DC}}$
 Current Draw: 30 mA, unterminated outputs

Temperature
 Operating: 0°C to 70°C
 Storage: -20°C to 85°C (CE300)
 -20°C to 100°C (CE)

Max Lead-Free Reflow Temperature 260°C for <5 seconds

Humidity
 Operating: 10% to 90% RH, non-condensing

Vibration 30 G @ 20 Hz; EN60068-2-6

Shock 300 G (0.40, half sine) CE300
 100 G (11 ms, half sine) CE

Reliability (MTTF) 100,000 Hours

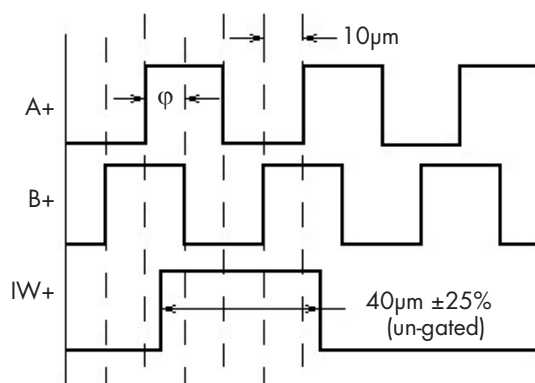
Outputs

Signals: CMOS/TTL
 Format: Digital - differential quadrature
 Output impedance per channel = 60 Ω

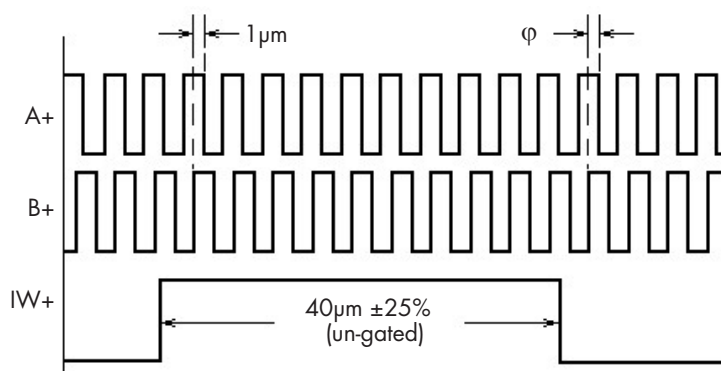
Note:¹ Excludes eccentricity

Output Signals

**CE300-4
(x4 interpolation)***



**CE300-40, CE-40GC
(x40 interpolation)***



* Negative phases omitted for clarity

ϕ = quadrature phasing = $90^\circ \pm 30\%$

ChipEncoder™ Series Data Sheet

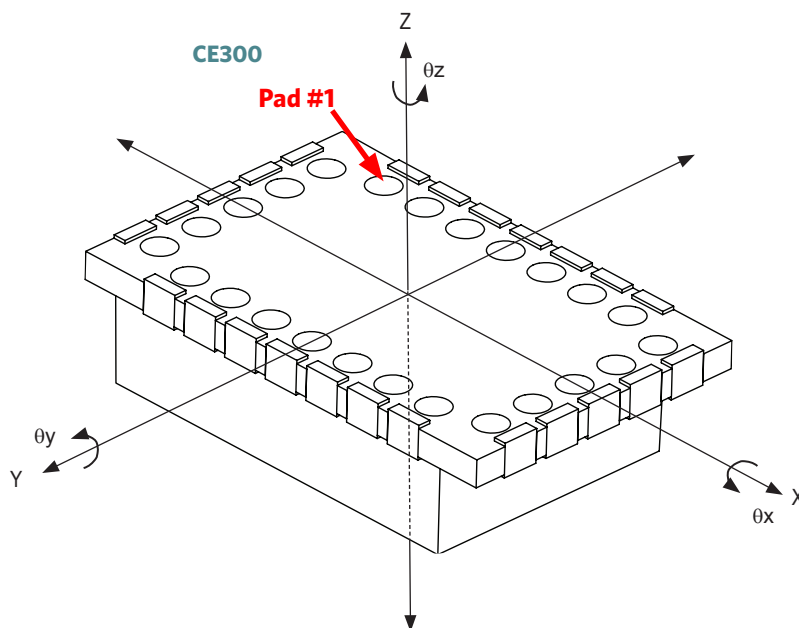
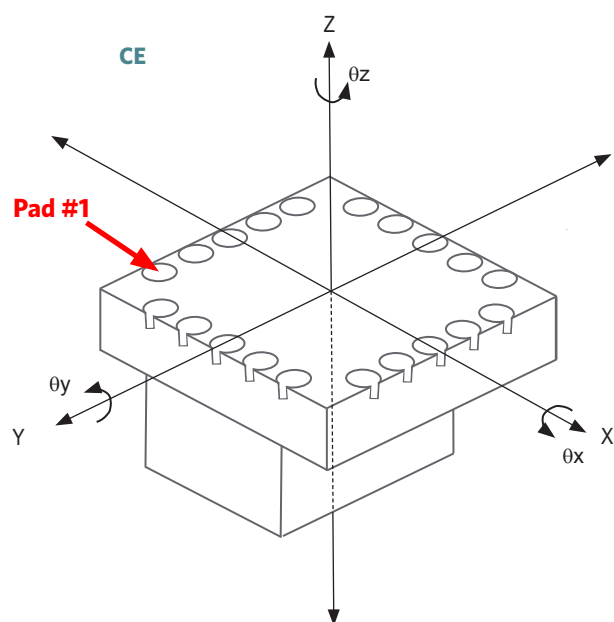
Alignment Tolerances

Broad alignment tolerances:

Encoder Mounting with Linear Scales	
Axis	Alignment Tolerances
X	Direction of motion
Y	$\pm 0.008"$ (0.20 mm)
Z	$\pm 0.010"$ (0.25 mm)
θ_x	$\pm 1.5^\circ$
θ_y	$\pm 1.5^\circ$
θ_z	$\pm 2.0^\circ$

Encoder Mounting with Rotary Scales	
Axis	Alignment Tolerances
X	$\pm 0.004"$ (0.10 mm)
Y	$\pm 0.004"$ (0.10 mm)
Z	$\pm 0.010"$ (0.25 mm)
θ_x	$\pm 1.5^\circ$
θ_y	$\pm 1.5^\circ$
θ_z	$\pm 2.0^\circ$

Alignment Axes

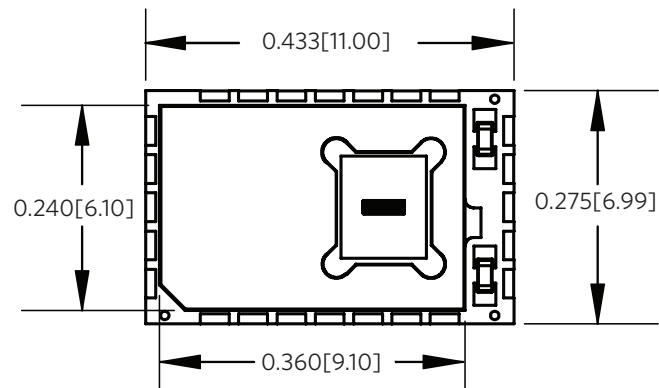


ChipEncoder™ Series Data Sheet

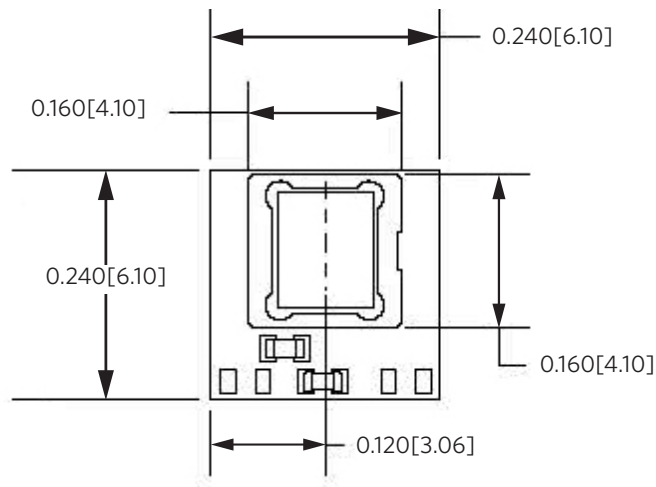
Component Dimensions

Units: inches [mm]

CE300



CE



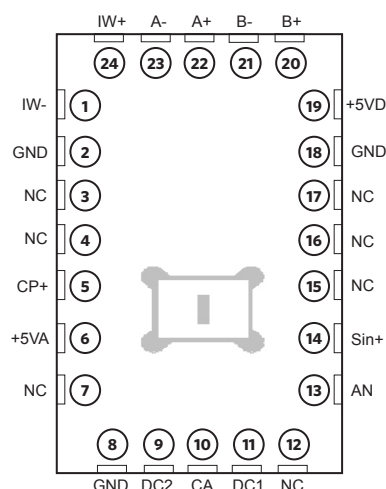
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Pad Configurations

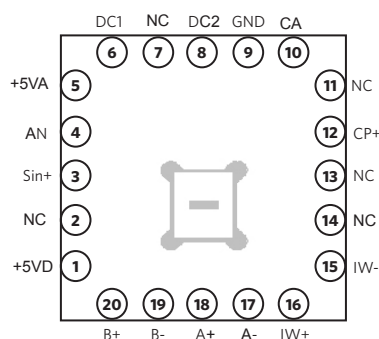
(Top view, through package)

CE300



CE300 Pad Configuration					
Pad Number	Signal	Function	Pad Number	Signal	Function
1	IW-	Index Window Channel	13	AN	Laser Anode
2	GND	Ground	14	Sin+*	Sinusoidal Alignment Reference
3	NC	No Connect	15	NC	No Connect
4	NC	No Connect	16	NC	No Connect
5	CP+	Raw Index Signal	17	NC	No Connect
6	+5VA	Supply Voltage	18	GND	Ground
7	NC	No Connect	19	+5VD	Supply Voltage
8	GND	Ground	20	B+	B Quadrature Channel
9	DC2	Reference Threshold 2	21	B-	B Quadrature Channel
10	CA	Laser Cathode	22	A+	A Quadrature Channel
11	DC1	Reference Threshold 1	23	A-	A Quadrature Channel
12	NC	No Connect	24	IW+	Index Window Channel

CE



CE Pad Configuration					
Pad Number	Signal	Function	Pad Number	Signal	Function
1	+5VD	Supply Voltage	11	NC	No Connect
2	NC	No Connect	12	CP+	Raw Index Signal
3	Sin+*	Sinusoidal Alignment Reference	13	NC	No Connect
4	AN	Laser Anode	14	NC	No Connect
5	+5VA	Supply Voltage	15	IW-	Index Window Channel
6	DC1	Reference Threshold 1	16	IW+	Index Window Channel
7	NC	No Connect	17	A-	A Quadrature Channel
8	DC2	Reference Threshold 2	18	A+	A Quadrature Channel
9	GND	Ground	19	B-	B Quadrature Channel
10	CA	Laser Cathode	20	B+	B Quadrature Channel

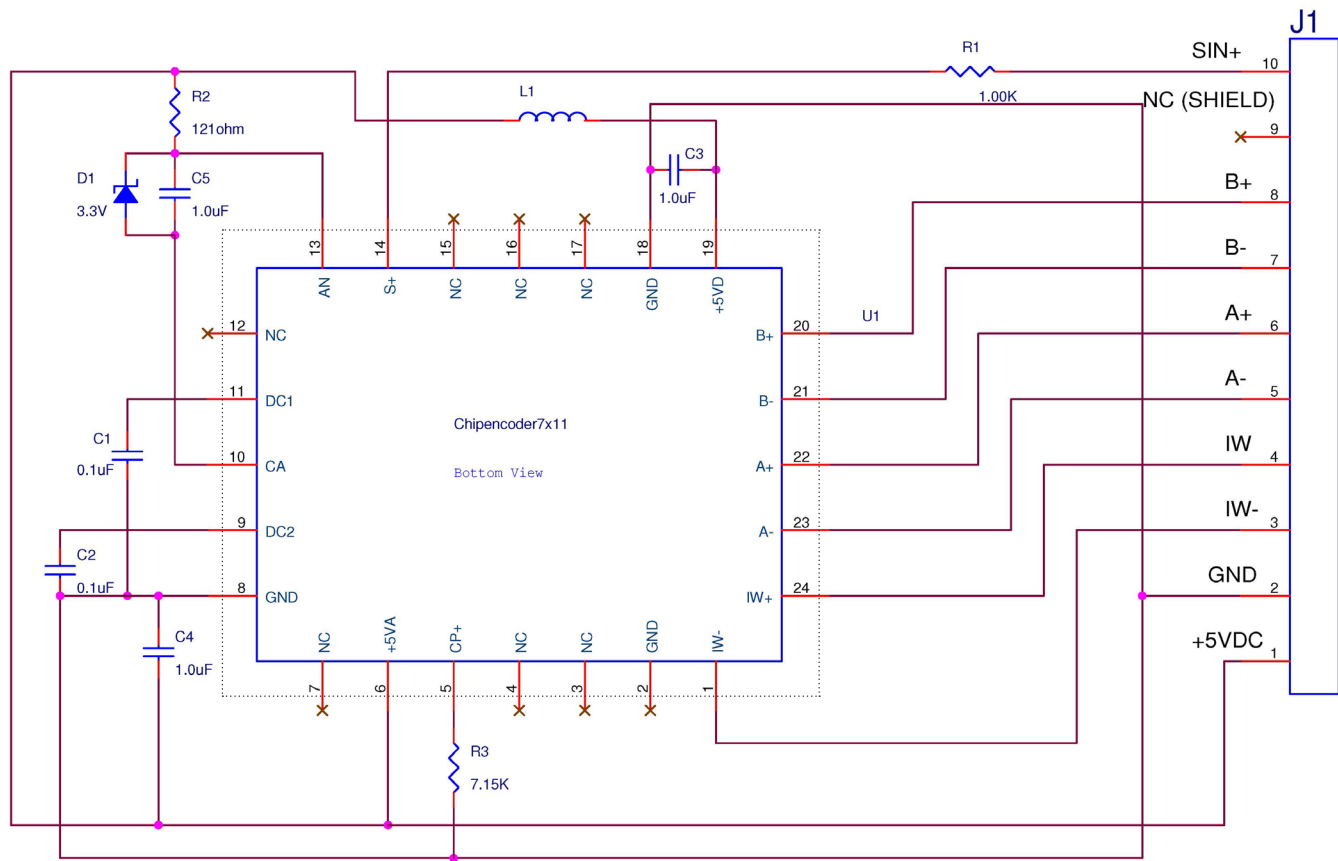
Note*: See **Technical Note 1104: Alignment of the ChipEncoder Series Product** for using Sin+ for optimal alignment.

ChipEncoder™ Series Data Sheet

Electrical Interface

CE300

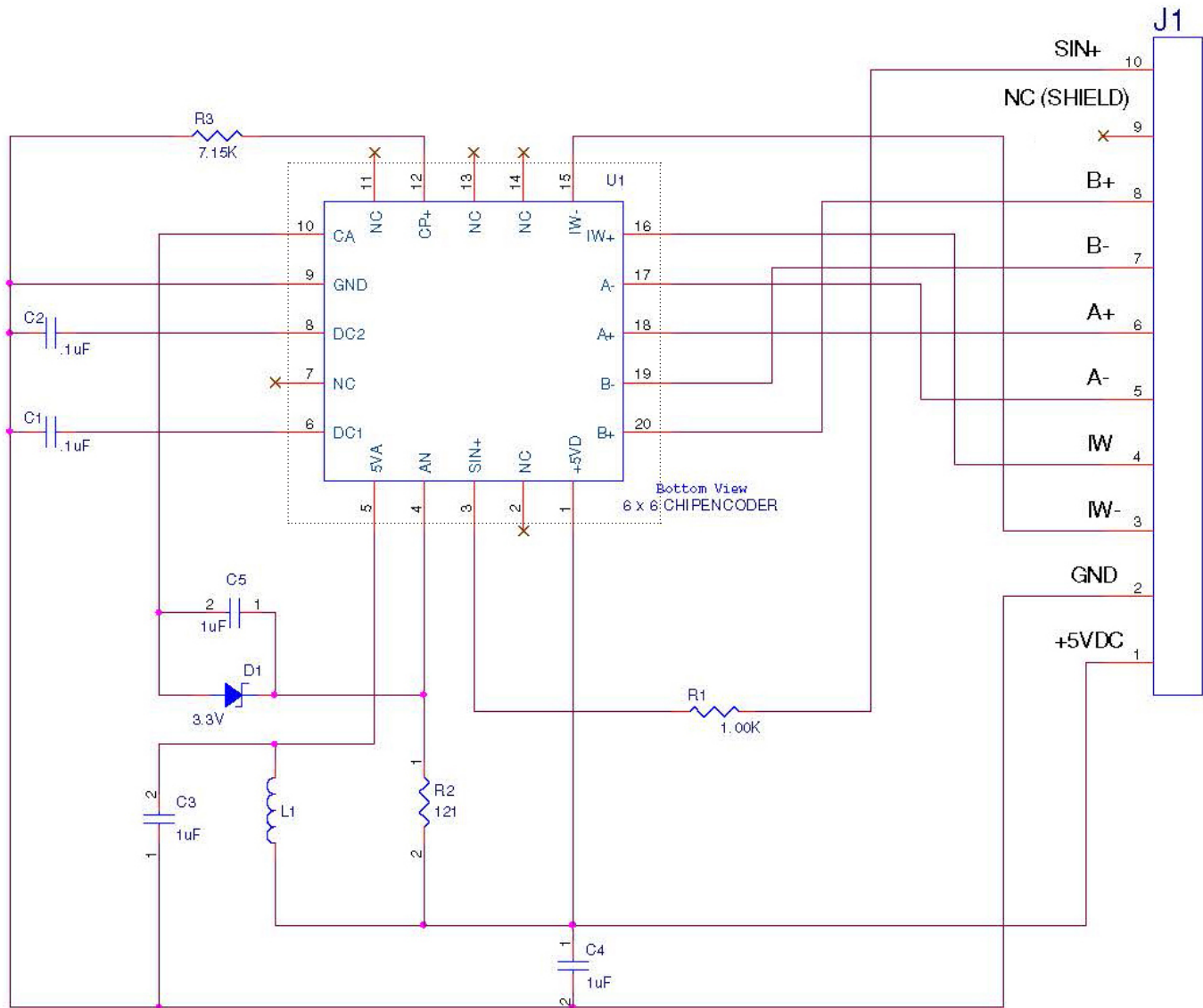
Recommended customer circuit with the CE300 ChipEncoder:



ChipEncoder™ Series Data Sheet

CE

Recommended customer circuit with the CE ChipEncoder:



ChipEncoder™ Series Data Sheet

Linear and Rotary Scales

Standard and Custom Designed for Your Application

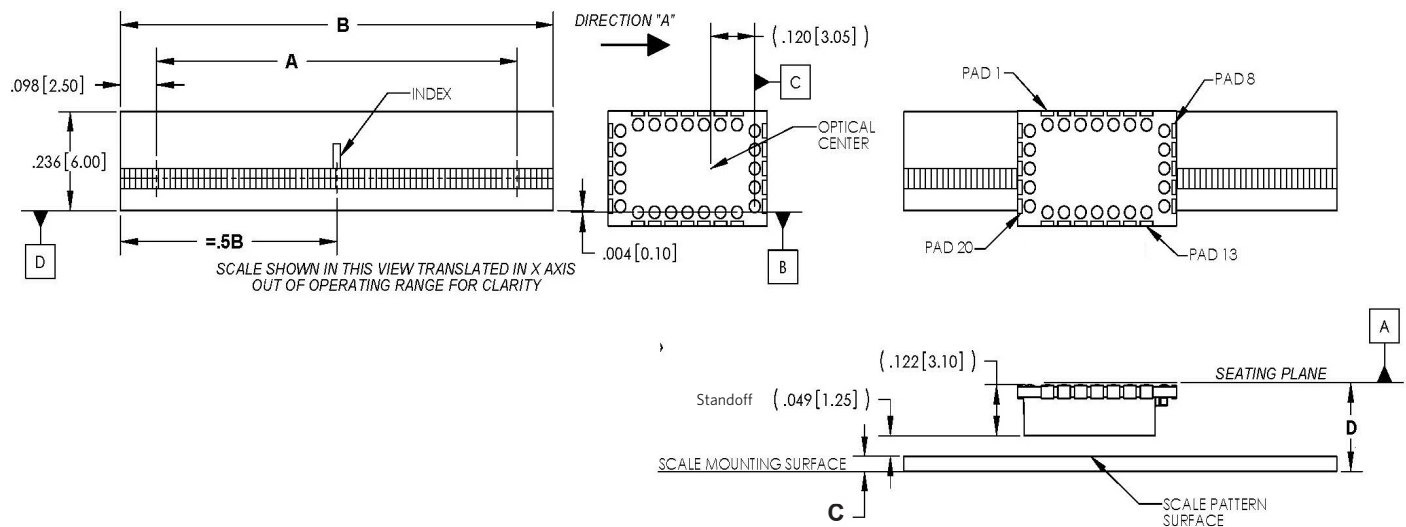
MicroE Systems offers a wide array of linear and rotary scales, all with built-in index marks. We also offer hubs for use with our rotary scales. If your application requires custom scales or hubs in OEM quantities, contact the factory for pricing and delivery.

Note: See interface drawings for more details.

CE300

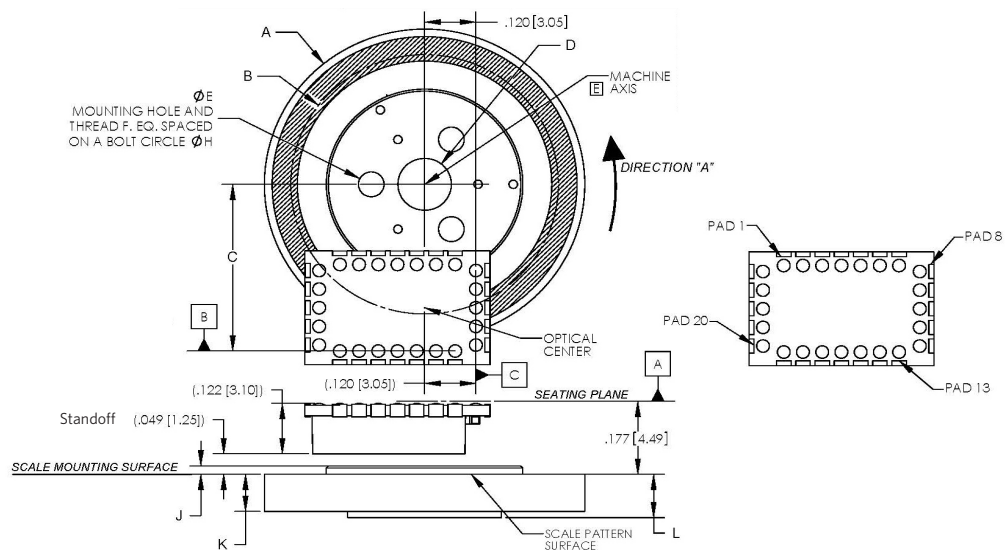
Linear Scale

(See table on page 11 for details needed to select linear scales.)



Rotary Scale

(See tables on page 12 for details needed to select rotary scales.)



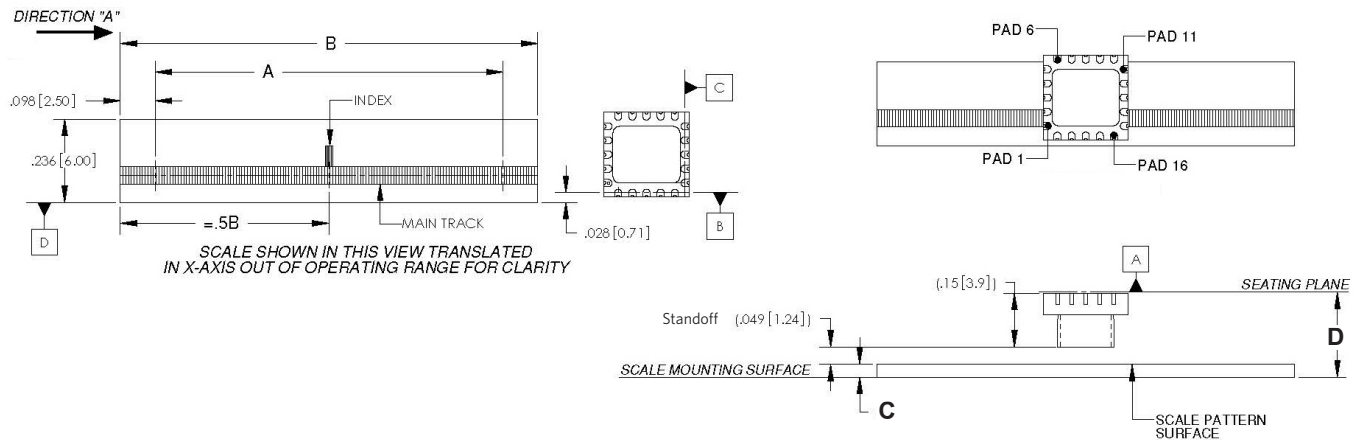
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CE

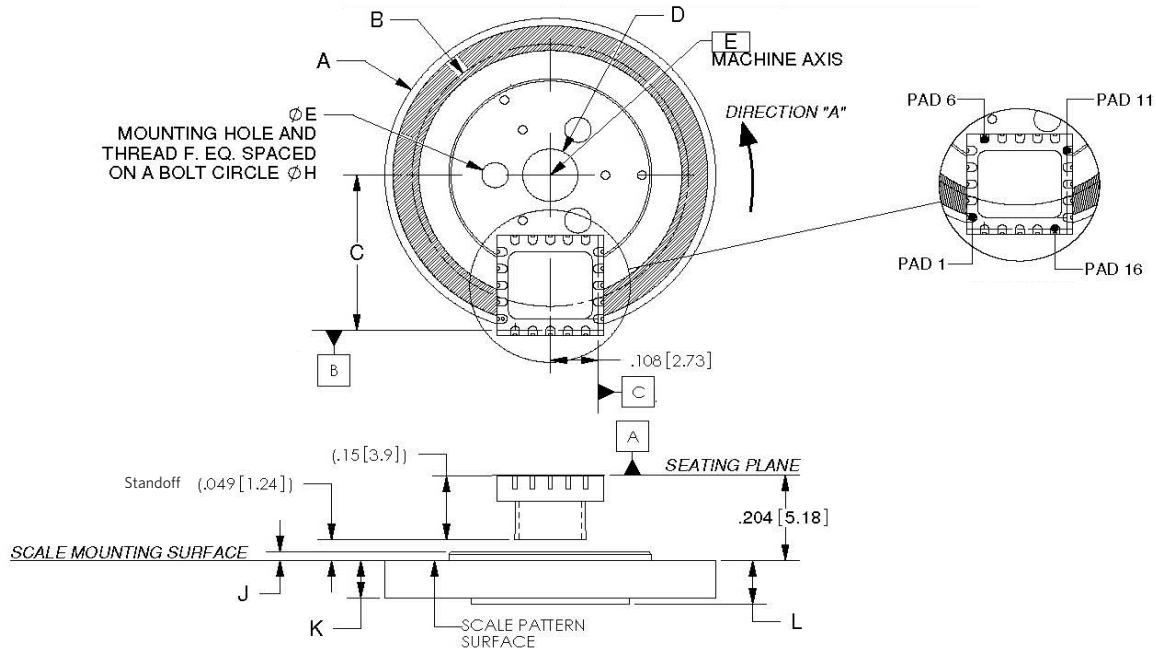
Linear Scale

(See table on page 11 for details needed to select linear scales.)



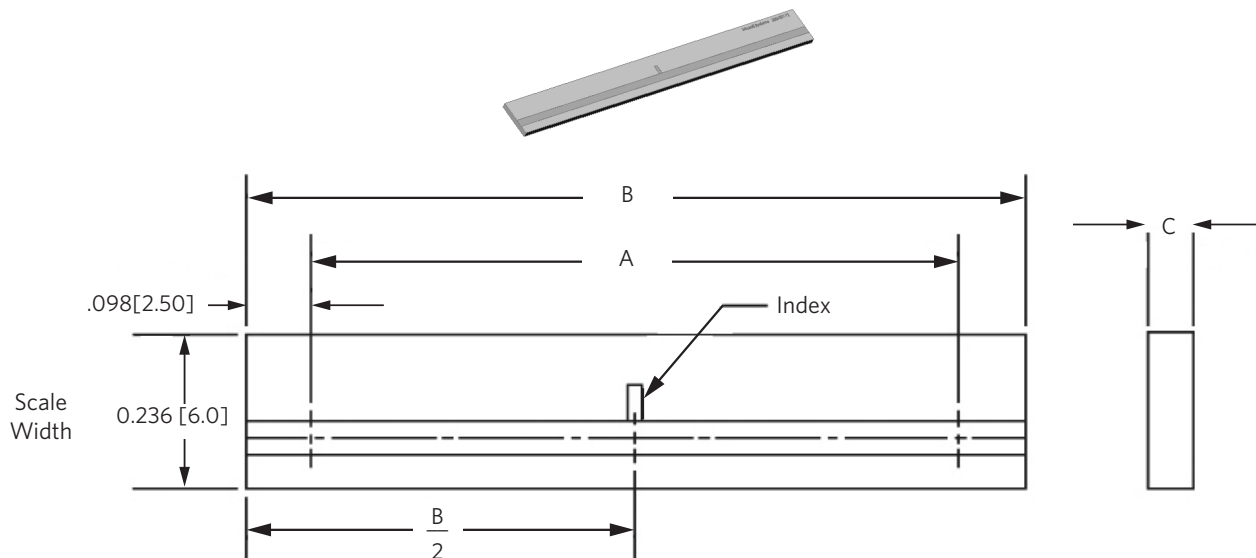
Rotary Scale

(See tables on page 12 for details needed to select rotary scales.)



ChipEncoder™ Series Data Sheet

Linear Scales



Linear Scale Identification and Size			
Scale Model	A Usable Measured Length	B Scale Length	C Scale Thickness
L18CE	Scale Length (mm) - 5mm = 13mm	0.709 (18.0)	0.036 (0.91)
L30CE	Scale Length (mm) - 5mm = 25mm	1.181 (30.0)	0.036 (0.91)
L55CE	Scale Length (mm) - 5mm = 50mm	2.165 (55.0)	0.036 (0.91)
L80CE	Scale Length (mm) - 5mm = 75mm	3.150 (80.0)	0.036 (0.91)
L130CE	Scale Length (mm) - 5mm = 125mm	5.118 (130.0)	0.036 (0.91)
L155CE	Scale Length (mm) - 5mm = 150mm	6.102 (155.0)	0.098 (2.50)
L325CE	Scale Length (mm) - 5mm = 320mm	12.795 (325.0)	0.098 (2.50)

inches (mm)

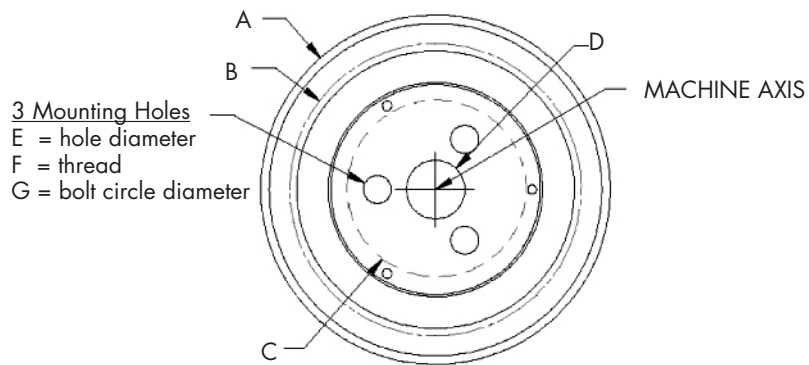
Features

- 40 μm diffraction pattern
 - 10 μm resolution with CE300-4
 - 1 μm resolution with CE300-40 and CE-40GC
- Maximum speed = 14.4 m/s
- Center index mark
- Scales are chrome patterns printed on soda lime glass (CTE = 9.4 ppm/°C)
- Usable measuring length is 5 mm less than total length
- Temporary clamp kits to facilitate epoxy mounting
- Optional pressure sensitive adhesive tape for permanent mounting
- Custom scale lengths, materials, and index locations are available

ChipEncoder™ Series Data Sheet

Rotary Scales

Scale	Fundamental CPR	Max Speed RPM	Resolution CE300-40, CE-40GC			Resolution CE300-4		
			CPR	μrad	arc-sec	CPR	μrad	arc-sec
R1206CE	825	26,200	33,000	190.0	39.3	3,300	1,900	393.0
R1506CE	1,024	21,100	40,960	153.0	31.6	4,096	1,530	316.0
R1910CE	1,250	17,280	50,000	126.0	25.9	5,000	1,260	259.0
R3213CE	2,048	10,550	81,920	76.7	15.8	8,192	767	158.0
R5725CE	4,096	5,270	163,840	38.3	7.9	16,384	383	79.1
R10851CE	8,192	2,640	327,680	19.2	4.0	32,768	192	39.6



Rotary Scale Identification and Size									
Scale Only	A (Glass OD)	B (Optical Dia.)	C (Glass ID)	Glass Thickness	Scale with Optional Hub	D (Hub ID)	E (Dia.)	F (Thread)	G (BCD)
R1206CE	0.472 (12.00)	0.414 (10.50)	0.250 (6.35)	0.036 (0.91)	R1206CE-HF	0.125 (3.18)	N/A	N/A	N/A
R1506CE	0.571 (14.50)	0.513 (13.04)	0.250 (6.35)	0.036 (0.91)	R1506CE-HF	0.125 (3.18)	N/A	N/A	N/A
R1910CE	0.750 (19.05)	0.627 (15.92)	0.375 (9.53)	0.092 (2.34)	R1910CE-HG	0.125 (3.18)	0.047 (1.19)	0-80	0.250 (6.35)
R3213CE	1.250 (31.75)	1.027 (26.08)	0.500 (12.70)	0.092 (2.34)	R3213CE-HH	0.250 (6.35)	0.070 (1.78)	2-56	0.370 (9.40)
R5725CE	2.250 (57.15)	2.053 (52.15)	1.000 (25.40)	0.092 (2.34)	R5725CE-HC	0.500 (12.70)	0.136 (3.45)	8-32	0.750 (19.05)
R10851CE	4.250 (107.95)	4.106 (104.30)	2.000 (50.80)	0.092 (2.34)	R10851CE-HD	1.000 (25.40)	0.136 (3.45)	8-32	1.375 (34.80)

inches (mm)

Features

- Scales are chrome patterns printed on soda lime glass (CTE = 9.4 ppm/°C)
- Optional hubs are 303/304 stainless steel (CTE = 17 ppm/°C)
- For factory mounted scales, optical patterns are centered to within 0.002" of the hub ID
- Custom OD, ID, CPR, and materials are available



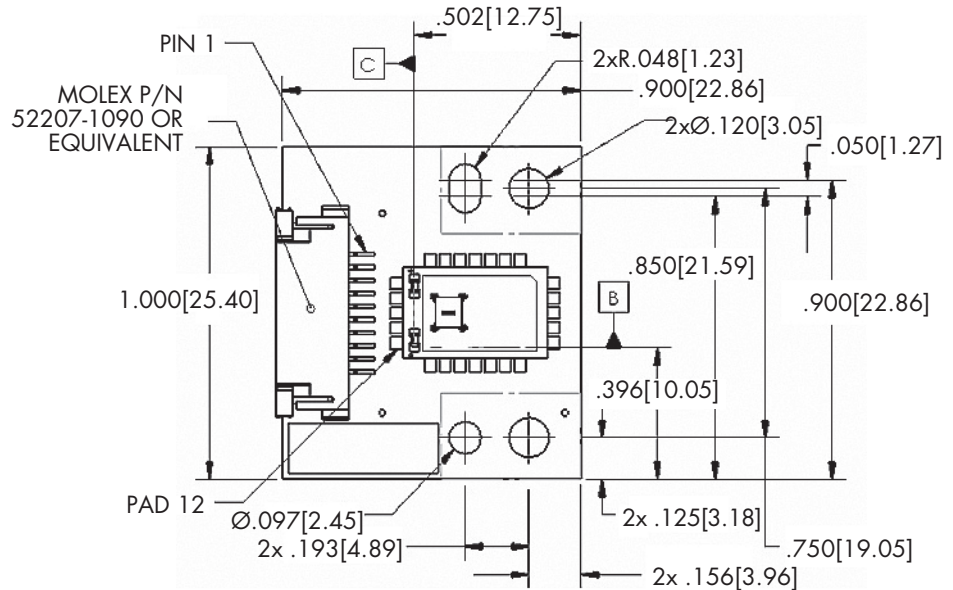
ChipEncoder™ Series Data Sheet

Evaluation PCB

The Evaluation PCB is available in limited quantity to aid in engineering development and is not intended for use in OEM products.

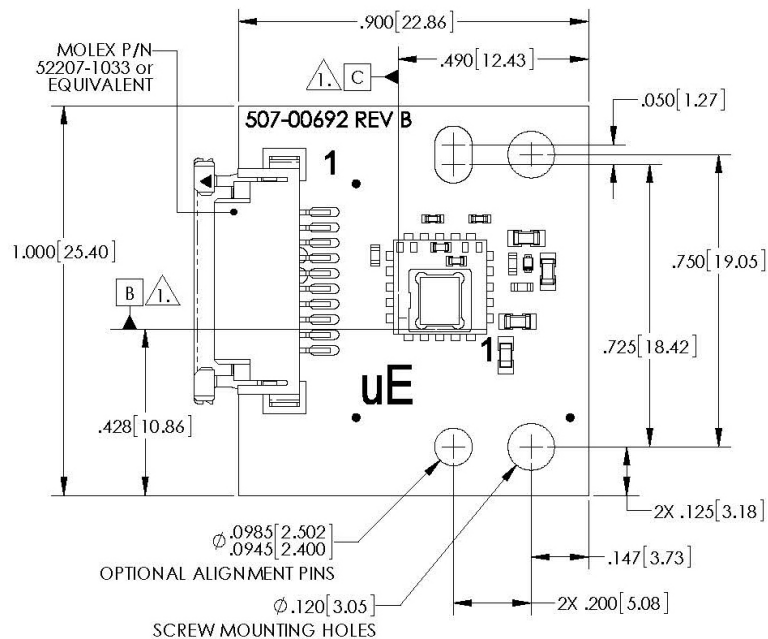
CE300

10 Pin ZIF Connector	
Pinouts	
1	+5VDC
2	Gnd
3	IW-
4	IW+
5	A-
6	A+
7	B-
8	B+
9	NC
10	Sin+



CE

10 Pin ZIF Connector	
Pinouts	
1	+5VDC
2	Gnd
3	IW-
4	IW+
5	A-
6	A+
7	B-
8	B+
9	NC
10	Sin+



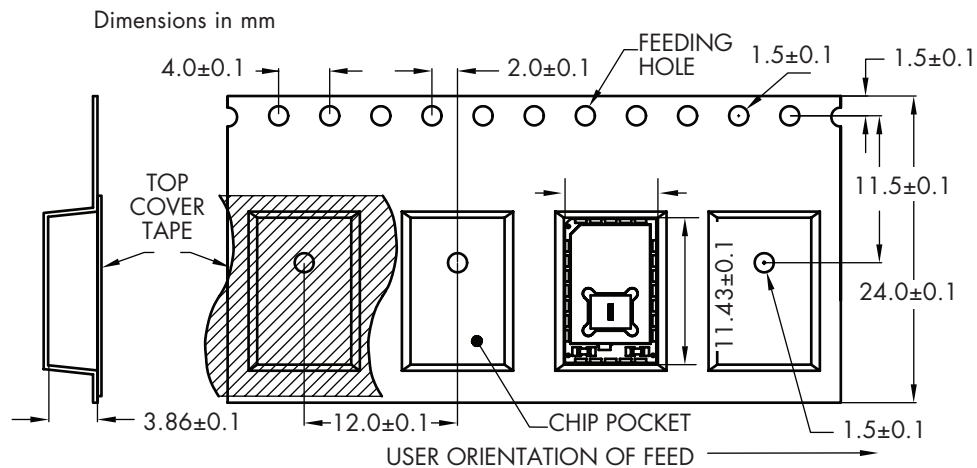
ChipEncoder™ Series Data Sheet

Packaging

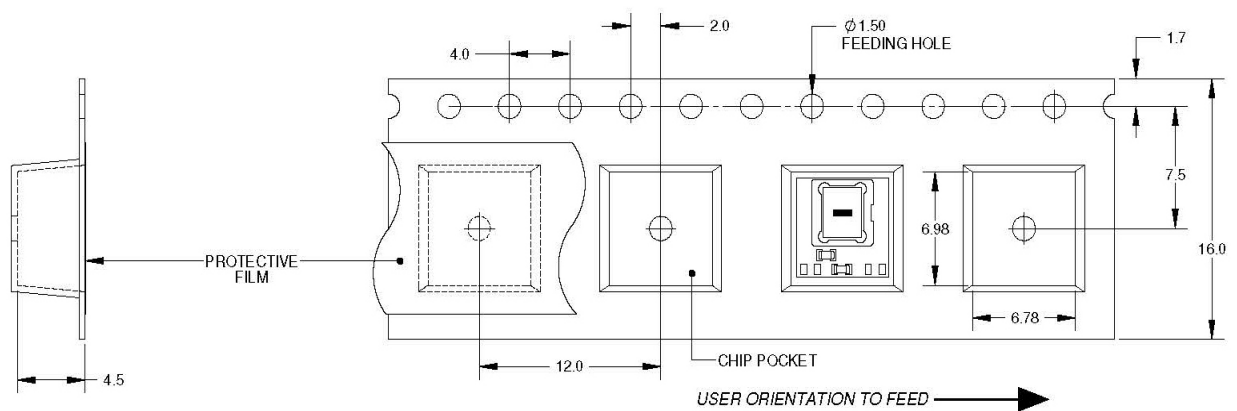
ChipEncoder Components are provided in SMT tape in all quantities.

- For orders, 100 pieces are supplied on a reel with a 100mm leader (250 pieces per reel maximum).
- See the Installation Manual for important ESD handling precautions.

CE300



CE



ChipEncoder™ Series Data Sheet

How to Order

Sensor

CE300-40-PCB (example)

Eval PCB
PCB=mounted to evaluation PCB¹
Blank=unmounted chips

Interpolation
4=x4 (Model CE300 only)
40=x40 (Model CE300 only)
40GC= x40 (Model CE only)

Model
CE300
CE

Scales

R5725-HC (example)

Scale Mounting
For Linear Scales:
T=Tape
C1=3 clamps²
C2=10 clamps³

For Rotary Scales:
NH=No hub
HF=Standard hub (only valid for R1206CE and R1506CE)
HG=Standard hub (only valid for R1910CE)
HH=Standard hub (only valid for R3213CE)
HC=Standard hub (only valid for R5725CE)
HD=Standard hub (only valid for R10851CE)

Scale Model
Linear:
L18CE=18 mm linear
L30CE=30 mm linear
L55CE=55 mm linear
L80CE=80 mm linear
L130CE=130 mm linear
L155E=155 mm linear
L325CE=325 mm linear

Rotary:
R1206CE=12 mm OD rotary
R1506CE=14.5 mm OD rotary
R1910CE=19.05 mm OD rotary
R3213CE=31.75 mm OD rotary
R5725CE=57.15 mm OD rotary
R10851CE=107.95 mm OD rotary

Notes:

1. Quantities of 1 - 9 only
2. 3 clamps for scales up to 130 mm
3. 10 clamps for scales 155 mm or longer