Features

- RoHS compliant*
- HCMOS, CMOS and TTL compatible
- Compact package size
- High rotational cycle life
- Standard or high force push switch option
- Optional detent

BOURNS® PRO AUDIO

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EM14 - 14 mm Rotary Optical Encoder w/Switch

Electrical Characteristics

Electrical Output	2-bit quadrature code
Resolution	8 to 64 pulses per revolution (PPR)
Supply Voltage (VCC)	5.0 VDC ± 0.25 VDC
Supply Current (ICC)	26 mA maximum
Output Voltage	
Low (VCE(sat)), per Channel	800 mV maximum at I(SINK) = 25 mA
High (VO(HI)), per Channel	4.0 VDC minimum @ VCC = 4.75 VDC
Output Current I(SINK), per Channel	25 mA maximum
Rise/Fall Time	200 ns typical
Power Dissipation	167 mW maximum
Pulse Width (per Channel)	180 °e typical
Phase Angle (Channel A Leads Channel B, Clockwise Rotation)	90 °e ± 45 °e
Insulation Resistance @ 500 VDC	1,000 megohms minimum
Operating RPM	120 maximum
Switch Power Rating	12 VDC / 20 mA (600 ohms minimum load)
Switch Contact Resistance	200 ohms maximum

Environmental Characteristics

Operating Temperature Range @ 5.0 VDC	-40 °C to +70 °C (-40 °F to +158 °F)
Storage Temperature Range	-55 °C to +125 °C (-67 °F to +257 °F)
Vibration	15 G
Shock	50 G
Humidity	MIL-STD-202, Method 103, Condition B
Flammability	Conforms to UL 94HB
IP Rating	IP 54**

Mechanical Characteristics

Mechanical Angle	360 ° Continuous
Torque	
Starting/Running	1.06 N-cm (1.5 oz.-in.) maximum
Detent	1.2 N-cm (1.7 oz.-in.) typical
Rotational Life	
Non-detent (@ 30 RPM)	1,000,000 cycles (2,000,000 revolutions)
With detent (@ 30 RPM)	100,000 cycles (200,000 revolutions)
Switch Life	100,000 cycles
Switch Actuation Force	
Standard	250 gm (8.82 oz.) typical
High Force	850 gm (29.98 oz.) typical
Switch Travel	
Standard	0.04 in. typical
High Force	0.025 in. typical
Shaft Radial Play	0.005 in. maximum
Shaft Axial Structural Strength	35 lbs. minimum
Mounting Torque	2.0 N-m (18 lb.-in.) maximum

Materials and Finishes

Terminals	Sn plated PC pins
Soldering Condition	
Manual Soldering	96.5Sn/3.0Ag/0.5Cu solid wire or no-clean rosin cored wire 370 °C (700 °F) max. for 3 seconds
Wave Soldering	96.5Sn/3.0Ag/0.5Cu solder with no-clean flux 260 °C (500 °F) max. for 5 seconds
Wash processes	Not recommended
Mounting Hardware	
Nut	Black anodized brass, hex (metric)/Nickel-plated brass, hex (SAE)
Lockwasher	Nickel-plated spring steel, internal tooth
Marking	Manufacturer's symbol, model number, product code, terminal style and date code
Standard Packaging	Anti-static plastic tube (25 pcs./tube)

**When device is mounted by normal mounting means.

Additional Features

- Splashproof shaft seal
- Recommended for human/machine interface applications (HMI)
- Cable/connector option
- Optional bracket

EM14 - 14 mm Rotary Optical Encoder w/Switch   BOURNS®

Part Numbering System

E M 1 4 A 0 D - C 2 4 - L 0 3 2 S

MODEL NO. DESIGNATOR

Code	Description
EM14	14 mm Rotary Optical Encoder

BUSHING DESIGNATOR

Code	Description
A	3/8 " D x 3/8 " L Threaded
C	1/4 " D x 1/4 " L Threaded
R	10 mm D x 9.5 mm L Threaded

DETENT OPTION

Code	Description
0	No Detent
1	32 Detents (Available for 8 or 32 PPR only)

ANTI-ROTATION LUG/BRACKET OPTION

Code	Description
A	A/R Lug
B	Bracket (No hardware/no cable or connector)
D	None

SHAFT STYLE (See Outline Drawing for Details)

Code	Description	Available w/ Bushing
B	1/4 " Dia. Slotted End	A
C	1/4 " Dia. Flatted End	A
E	1/8 " Dia. Slotted End	C
R	6 mm Dia. Slotted End	R
M	6 mm Dia. Flatted End	R

SHAFT LENGTH DESIGNATOR

Code	Length (FMS)	Available w/Bushing
24	3/4 "	A, C
28	7/8 "	A, C
20	20 mm	R, U
25	25 mm	R, U

SWITCH OPTION

Code	Description
S	Push Switch (Standard)
H	Push Switch (High Force)
N	No Switch

RESOLUTION (Pulses Per Revolution)

Code	Description
08	8 PPR
16	16 PPR
32	32 PPR
64	64 PPR

CABLE/CONNECTOR OPTION

| Code	Description
0	No Cable/Connector
1	6 " Cable with Female Connector and stripped/tinned leads
2	6 " Cable with Female Connector on both ends
3	12 " Cable with Female Connector and stripped/tinned leads
4	12 " Cable with Female Connector on both ends
5	3 " Cable with Female Connector and stripped/tinned leads
6	1.5 " Cable with Female Connector and stripped/tinned leads
7	2 " Cable with Female Connector and stripped/tinned leads
8	5 " Cable with Female Connector and stripped/tinned leads

For other cable and connector options, please contact the factory.

TERMINAL CONFIGURATION

Code	Description
L	Axial Multi-Purpose Pin
R	Radial Multi-Purpose Pin

EM14 - 14 mm Rotary Optical Encoder w/Switch

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Product Dimensions
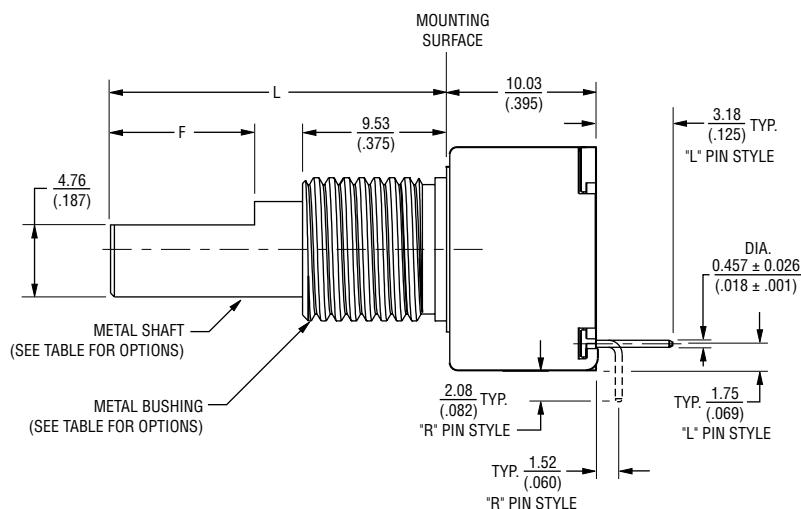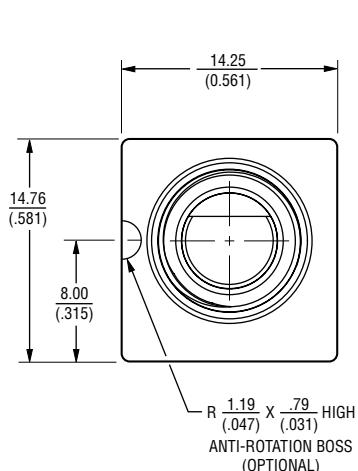
Shaft / Flat Length Dimensions

"A" Style Bushing - Flatted Shafts

3/8-32 UNEF-2A
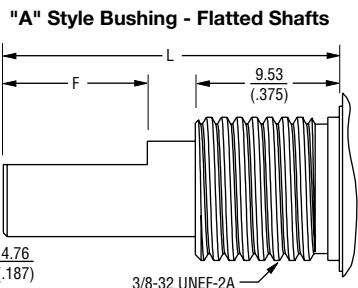
SHAFT DIA.	BUSHING DIA.	SHAFT LENGTH "L"	FLAT LENGTH "F"
6.35 (.250)	9.52 (.375)	19.05 (.750)	7.94 (.313)
		22.22 (.875)	9.52 (.375)

"R" Style Bushing - Flatted Shafts

M10 x 0.75-6 g
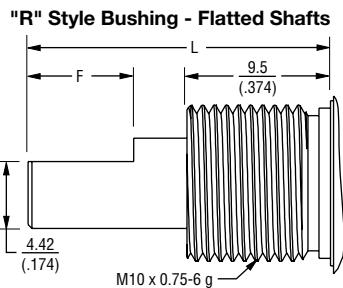
SHAFT DIA.	BUSHING DIA.	SHAFT LENGTH "L"	FLAT LENGTH "F"
6.0 (.236)	10.0 (.394)	20.0 (.787)	7.0 (.275)
		25.0 (.984)	12.0 (.472)

"C" Style Bushing - Slotted Shafts

1/4-32 UNEF-2A
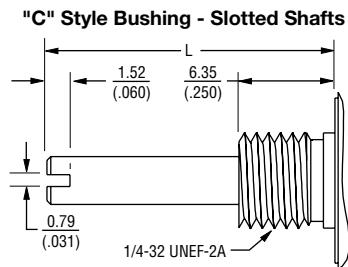
SHAFT DIA.	BUSHING DIA.	SHAFT LENGTH "L"
3.17 (.125)	6.35 (.250)	19.05 (.750)
		22.22 (.875)

"A" Style Bushing - Slotted Shafts

3/8-32 UNEF-2A
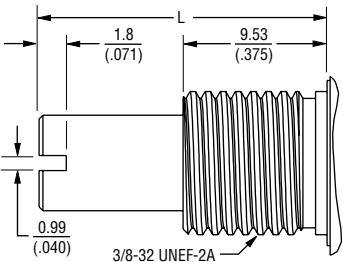
SHAFT DIA.	BUSHING DIA.	SHAFT LENGTH "L"
6.35 (.250)	9.52 (.375)	19.05 (.750)
		22.22 (.875)

"R" Style Bushing - Slotted Shafts

M10 x 0.75-6 g
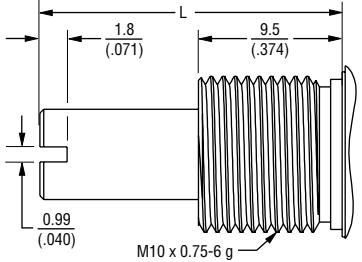
SHAFT DIA.	BUSHING DIA.	SHAFT LENGTH "L"
6.0 (.236)	10.0 (.394)	20.0 (.787)
		25.0 (.984)

DIMENSIONS: $\dfrac{MM}{(INCHES)}$

EM14 - 14 mm Rotary Optical Encoder w/Switch

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Cable/Connector Options

Cable Assembly, Connector on One End

STRIPPED AND TINNED
100 % MATTE TIN

RIBBON CABLE
6x28 AWG x 1.25 PITCH
(.049)

PIN 1 -
RED STRIPE

CONNECTOR $\frac{6.0}{(.236)}$ x $\frac{1.0}{(.039)}$
x $\frac{1.25}{(.049)}$ PITCH RECEPTACLE

REF. $\frac{8.0}{(.315)}$

FOR $\frac{.457}{(.018)}$ DIA. PINS

1 2 3 4 5 6

$\frac{2.54 \pm 0.4}{(.100 \pm .016)}$

$\frac{6.0 \pm 0.2}{(.236 \pm .008)}$

A

$\frac{8.75 \pm 0.2}{(.344 \pm .008)}$

$\frac{2.9}{(.114)}$

$\frac{3.5 \pm 0.2}{(.138 \pm .008)}$

Cable Assembly, Connector on Both Ends

RIBBON CABLE
6x28 AWG x 1.25 PITCH
(.049)

PIN 1 - RED STRIPE

2 x CONNECTOR $\frac{6.0}{(.236)}$ x $\frac{1.0}{(.039)}$
x $\frac{1.25}{(.049)}$ PITCH RECEPTACLE

FOR $\frac{.457}{(.018)}$ DIA. PINS

6 5 4 3 2 1

1 2 3 4 5 6

A
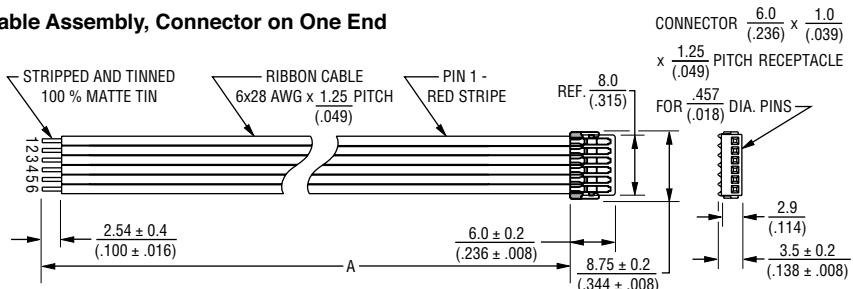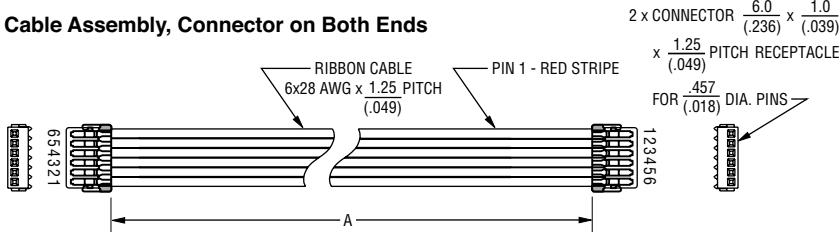
HDW. NO.	DESCRIPTION	"A" DIM.
H-290-1	CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS	$\frac{152.4 \pm 5.0}{(6.0 \pm .197)}$
H-290-2	CABLE ASSEMBLY, CONNECTOR ON ONE END	$\frac{304.8 \pm 5.0}{(12.0 \pm .197)}$
H-290-3	CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS	$\frac{304.8 \pm 5.0}{(12.0 \pm .197)}$
H-290-4	CABLE ASSEMBLY, CONNECTOR ON ONE END	$\frac{152.4 \pm 5.0}{(6.0 \pm .197)}$
H-290-5	RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END	$\frac{76.2 \pm 5.0}{(3.0 \pm .197)}$
H-290-6	RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END	$\frac{38.1 \pm 5.0}{(1.5 \pm .197)}$
H-290-7	RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END	$\frac{50.8 \pm 5.0}{(2.0 \pm .197)}$
H-290-8	RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END	$\frac{127 \pm 5.0}{(5.0 \pm .197)}$

Terminal Configurations

Radial (shown with optional mounting bracket)
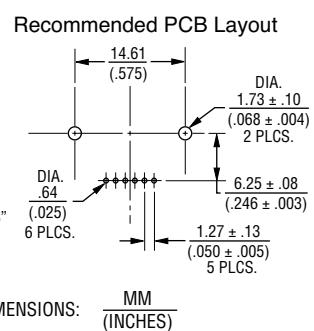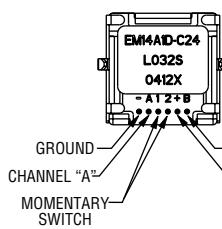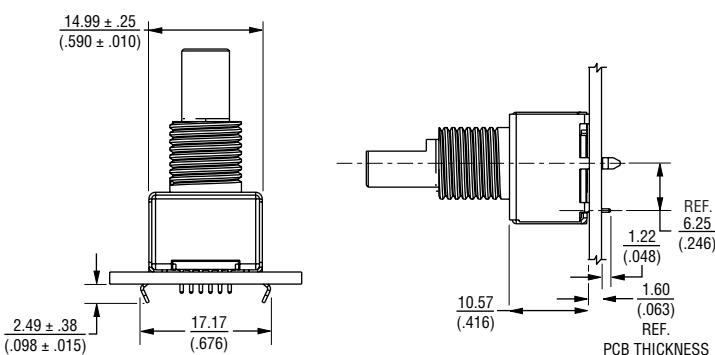
$\frac{14.99 \pm .13}{(.590 \pm .005)}$

$\frac{14.76 \pm .25}{(.581 \pm .010)}$

$\frac{15.16 \pm .25}{(.597 \pm .010)}$

$\frac{2.62 \pm .38}{(.103 \pm .015)}$

$\frac{17.17}{(.676)}$ REF.

$\frac{1.60}{(.063)}$ REF. PCB THICKNESS

$\frac{1.5}{(.059)}$ WIDE

X $\frac{0.381}{(.015)}$ THICK

$\frac{7.87}{(.310)}$ REF.

$\frac{1.24}{(.049)}$

EM14A1D-C24
L032S
0412X
= A 1 2 + B

GROUND
CHANNEL "A"
MOMENTARY SWITCH
CHANNEL "B"
POWER

Recommended PCB Layout

DIA. $\frac{1.73 \pm .10}{(.068 \pm .004)}$ 2 PLCS.

DIA. $\frac{.64}{(.025)}$ 6 PLCS.

$\frac{7.87 \pm .08}{(.310 \pm .003)}$

$\frac{1.27 \pm .13}{(.050 \pm .005)}$ 5 PLCS.

Axial (shown with optional mounting bracket)

$\frac{14.99 \pm .25}{(.590 \pm .010)}$

$\frac{2.49 \pm .38}{(.098 \pm .015)}$

$\frac{17.17}{(.676)}$

$\frac{10.57}{(.416)}$

$\frac{1.22}{(.048)}$

$\frac{1.60}{(.063)}$ REF. PCB THICKNESS

REF. $\frac{6.25}{(.246)}$

EM14A1D-C24
L032S
0412X
= A 1 2 + B

GROUND
CHANNEL "A"
MOMENTARY SWITCH
CHANNEL "B"
POWER

Recommended PCB Layout

$\frac{14.61}{(.575)}$

DIA. $\frac{1.73 \pm .10}{(.068 \pm .004)}$ 2 PLCS.

DIA. $\frac{.64}{(.025)}$ 6 PLCS.

$\frac{6.25 \pm .08}{(.246 \pm .003)}$

$\frac{1.27 \pm .13}{(.050 \pm .005)}$ 5 PLCS.

DIMENSIONS: $\frac{MM}{(INCHES)}$

EM14 - 14 mm Rotary Optical Encoder w/Switch

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Electrical Block Diagram
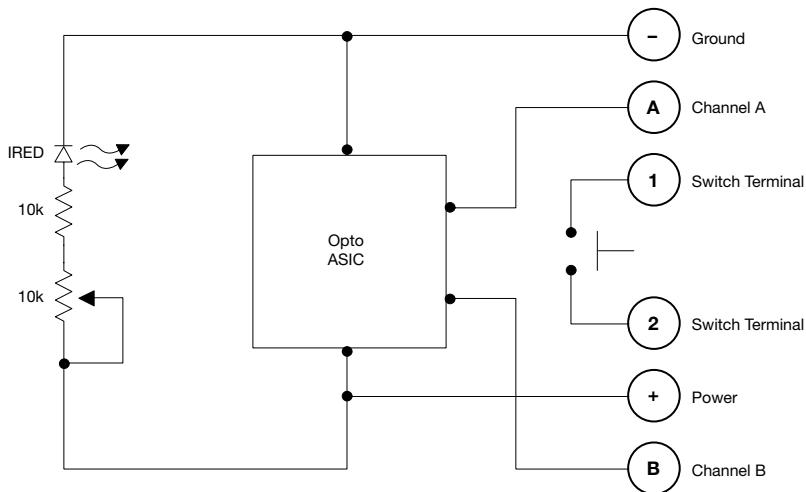
Quadrature Output

32 DETENT / 8 PPR
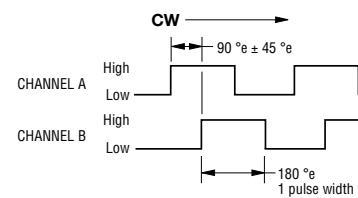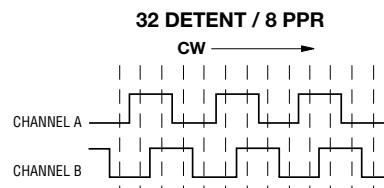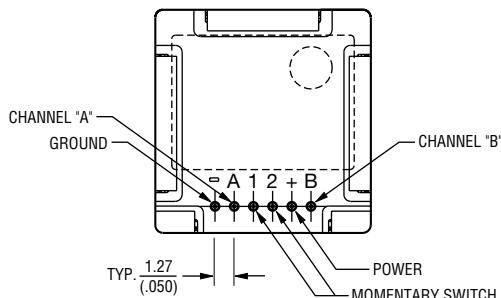
### 32 DETENT / 32 PPR
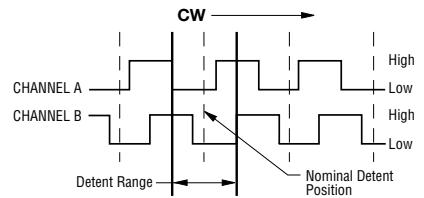
1. Nominal detent position occurs when both Channel A and B are in low states.

2. Channel A leads Channel B in CW direction and lags in CCW direction.

Terminal Diagram

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Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

  EM14C0D-E24-L032S   EM14C0D-E24-L016S   EM14A0D-C24-L064N   EM14A0A-C24-L064S   EM14A0D-B28-L064N
EM14A1A-B24-R032N   EM14A1A-C24-L032S   EM14A1D-B24-L032S   EM14A1D-C24-L008S   EM14A1D-C24-L032N
EM14A1D-C24-L032S   EM14A1D-C28-L032S   EM14C1D-E24-L032S   EM14R0D-M20-L064S   EM14R1D-M20-L032S
EM14R1D-M25-L032S   EM14R1D-R20-L032N   EM14R1D-R20-L032S   EM14R1D-R25-L032S   EM14A0D-C24-L008N
EM14C0D-E24-L064S   EM14A0D-C24-L032N   EM14A1B-C24-L032S   EM14A0A-B24-L064S   EM14A1B-C24-R032S
EM14C0D-E24-L064N   EM14A0D-B28-L008S   EM14A0D-B24-L032S   EM14A0D-B28-L032S   EM14A0D-C24-L064S
EM14C0D-E28-L016N   EM14C0D-E28-L064N   EM14R0D-M20-L016N   EM14R0D-R20-L032N   EM14R0D-R20-L032S
EM14R0D-R20-L064S   EM14R0D-R20-R016S   EM14A0B-B28-R064N   EM14A0D-C24-L032S   EM14R1D-M20-R008N
EM14A1A-B24-L008N   EM14C0D-E24-L264N   EM14R1A-R20-L008N   EM14R1D-R25-R032N   H-290-4   H-290-1   H-290-3   H-290-2   EM14R0A-M20-R064N   EM14R1A-M20-L032S   EM14A1D-C24-L132N   EM14A0D-B24-L064S
EM14A0D-B28-L064S   EM14A0D-C28-L032N   EM14A0D-C28-L032S   EM14A0D-C28-L064N   EM14C0D-E28-L064S
EM14R0D-M20-L064N   EM14R0D-M25-L064N   EM14A0A-B24-L164N   EM14A0D-C24-L016S   EM14A1D-C24-L232S
EM14A0A-B24-L064N   EM14A1A-B24-R032S   EM14C1D-E24-L008S   EM14R0D-M25-L064S   EM14R1D-M20-L008S
EM14A0D-C24-L132S   EM14R0D-M20-R464N   EM14A1D-C24-L108S   EM14R1B-M20-L032S   EM14R0B-M25-L064S
EM14R0A-M25-R064N   EM14R0D-R20-R032N   EM14C0A-E24-L064S   EM14C1D-E28-L032S   EM14R1D-M20-L208S
EM14A0D-C24-L216S   EM14R0D-M20-L132S   EM14A1B-C24-R008N   EM14A1B-C24-L008N   EM14R0B-R20-R064S
EM14A1A-B28-L032N   EM14A1D-C24-L008N   EM14C1A-E24-L008N   EM14R0B-M20-L064N