CTS Electrocomponents®

Precision, Long-life Compact 12mm Size Optical Encoder

Features

- Package Size (12 X 14 X 7 mm)
- 3 Million life cycles (No detent)
- 1 Million life cycles (With detent)
- Durable Metal Shaft & Bushing
- Optional momentary switch
- Multiple options for terminations, resolution, cables, voltage
- RoHS Compliant

Electrical and Mechanical Specifications

Encoder:

Operating Voltage
5.0 ± 0.25 VDC
3.3 ± 0.125 VDC

Supply Current
5.0 VDC @ 30mA maximum
3.3 VDC @ 24mA maximum

Output Code
2-Bit Quadrature
Channel A leads channel B by 90° electrically during clockwise rotation of the shaft

Minimum Sink Current
2.0 mA for 5.0 VDC
1.0 mA for 3.3 VDC

Power Consumption
150 mW maximum for 5.0 VDC
80 mW maximum for 3.3 VDC

Rotational Torque
Running: 20 ± 10 gf-cm
Detent: 140 ± 50 gf-cm (24 Detents)
100 ± 50 gf-cm (32 Detents)

Detent Options
0, 24, 32

Resolution
6, 8 Pulses per Revolution

Rotational Life (@30 RPM)
3 Million cycles (No detent)
1 Million cycles (With detent)

Temperature Range
Operating: - 40°C to 85°C
Storage: - 55°C to 100°C

Push-Pull Strength of Shaft
20 kg minimum for 10 seconds

Terminal Pull-out Strength
6 kg minimum for 10 seconds

Solder Heat Resistance
350°C for 5 seconds

Mechanical Vibration
15G, (MIL-STD-883F-2004)

Mechanical Shock
100G, (MIL-STD-883F-2004)

Note:
Consult CTS for other common standard features not listed.

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Electrical and Mechanical Specifications (continued)

Optional Momentary Switch:

Switch Contact Resistance
10 Ω maximum

Switch Rating
5 VDC @ 10 mA

Switch Travel
0.5 ± 0.25 mm

Actuation Force
510 ± 110 grams

Switch Life
Standard: 1 Million actuations minimum
Special: Consult CTS for custom life requirements.

TYPE 291V1   2-Bit Encoder Without Schmitt Trigger, 0.05" Pitch Pins Formed to Rear

GENERAL TOLERANCE : $\frac{\pm .010 \text{ inch}}{\pm 0.25 \text{ mm}}$

DIMENSION: $\frac{inch}{mm}$
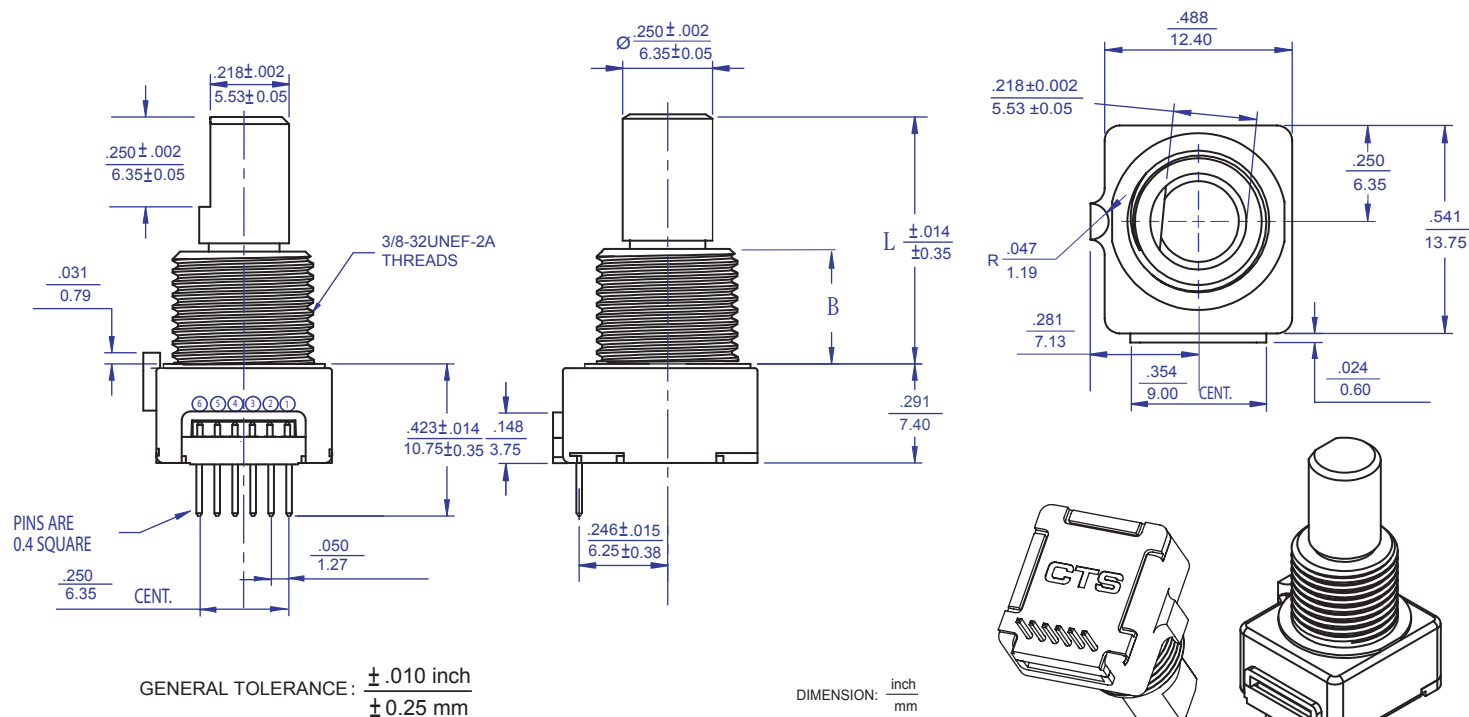
TYPE 291C   2-Bit Encoder Without Schmitt Trigger, with Cable and Connector

GENERAL TOLERANCE : $\frac{\pm .010 \text{ inch}}{\pm 0.25 \text{ mm}}$

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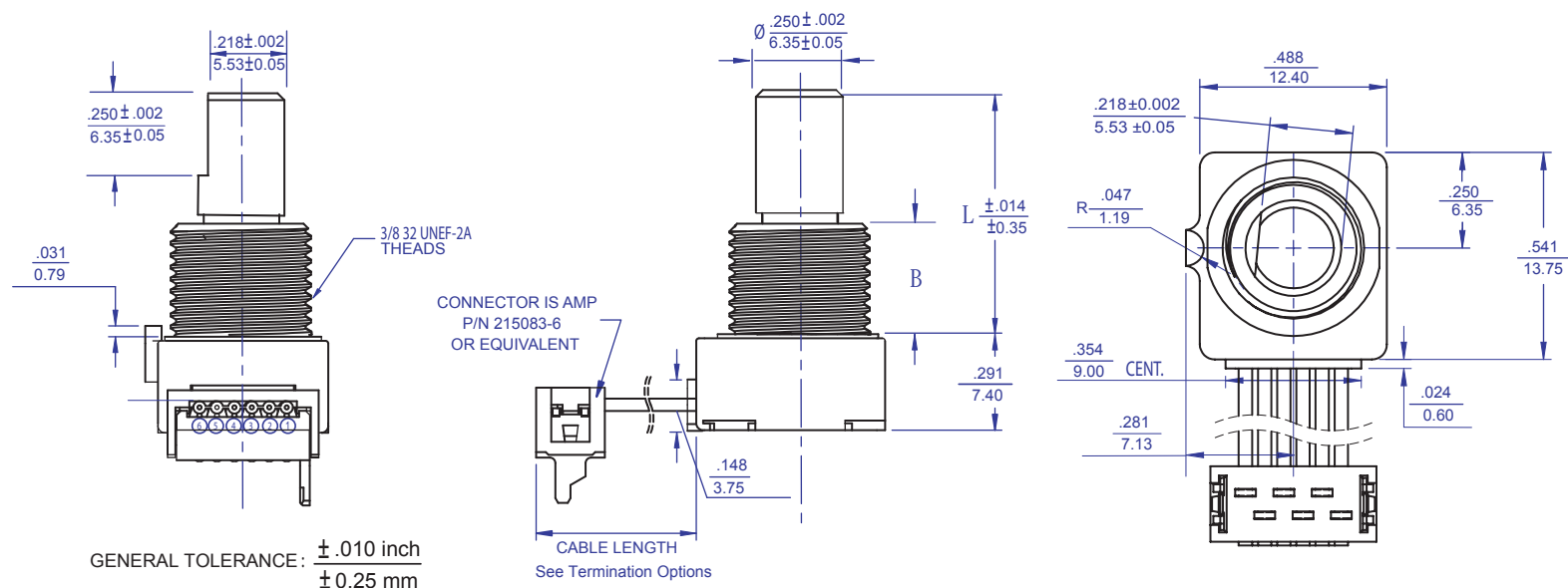
TYPE 291V1-S 2-Bit Encoder With Schmitt Trigger, 0.05" Pitch Pins Formed to Rear

$\frac{.218\pm.002}{5.53\pm0.05}$

$\frac{.250}{6.35}$

3/8-32 UNEF-2A
THREADS

$\frac{.433 \pm.015}{11.01\pm0.38}$

$\frac{.142}{3.61}$

$\frac{.050}{1.27}$ TYP.

$\frac{.250}{6.35}$ CENT.

PINS ARE
0.40 SQUARE

$\phi\ \frac{.250\pm0.002}{6.35\pm0.05}$

L $\frac{\pm.014}{\pm0.35}$

B

$\frac{.291}{7.40}$

$\frac{.148}{3.75}$

$\frac{.350\pm0.015}{8.89\pm0.38}$

$\frac{.520}{13.20}$ CENT.

$\frac{.488}{12.40}$ CENT.

$\frac{.154\pm0.002}{3.90\pm0.05}$

$\frac{.066\pm0.002}{1.68\pm0.05}$

$\frac{.218\pm0.002}{5.53\pm0.05}$

$\frac{.250}{6.35}$

$\frac{.541}{13.75}$

$\frac{.417}{10.58}$

$\frac{.354}{9.00}$ CENT.

$\frac{.449}{11.40}$ CENT.
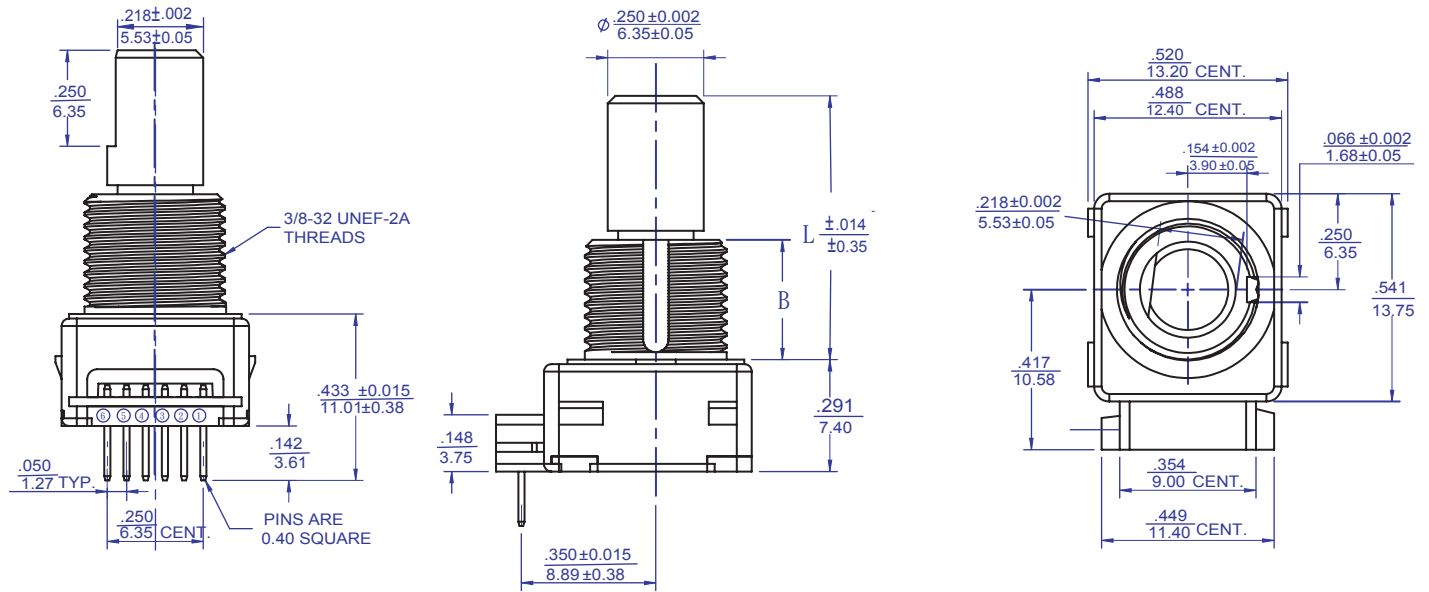
GENERAL TOLERANCE: $\frac{\pm.010\ inch}{\pm 0.25\ mm}$

TYPE 291P1 2-Bit Encoder With/Without Schmitt Trigger, 0.1" Pitch Pins Formed to Rear

$\frac{.218\pm.002}{5.53\pm0.05}$

$\frac{.250\pm.002}{6.35\pm0.05}$

3/8-32 UNEF-2A
THREADS

$\frac{.560\pm0.014}{14.21\pm0.35}$

$\frac{.236}{6.00}$

⑥ ⑤ ④ ③ ② ①

PINS ARE
0.64 SQUARE

$\phi\ \frac{.250\pm0.002}{6.35\pm0.05}$

L $\frac{\pm.014}{\pm0.35}$

B

$\frac{.291}{7.40}$

$\frac{0.450}{11.42}$

$\frac{0.520}{13.20}$

$\frac{.488}{12.40}$

$\frac{.154\ \pm0.002}{3.90\pm0.05}$

$\frac{.066\pm0.002}{1.68\pm0.05}$

$\frac{.218\pm0.002}{5.53\pm0.05}$

$\frac{.250}{6.35}$

$\frac{.541}{13.75}$

$\frac{.522}{13.26}$

$\frac{.100}{2.54}$ TYP.

$\frac{.500}{12.70}$ CENT.

$\frac{.602}{15.30}$ CENT.
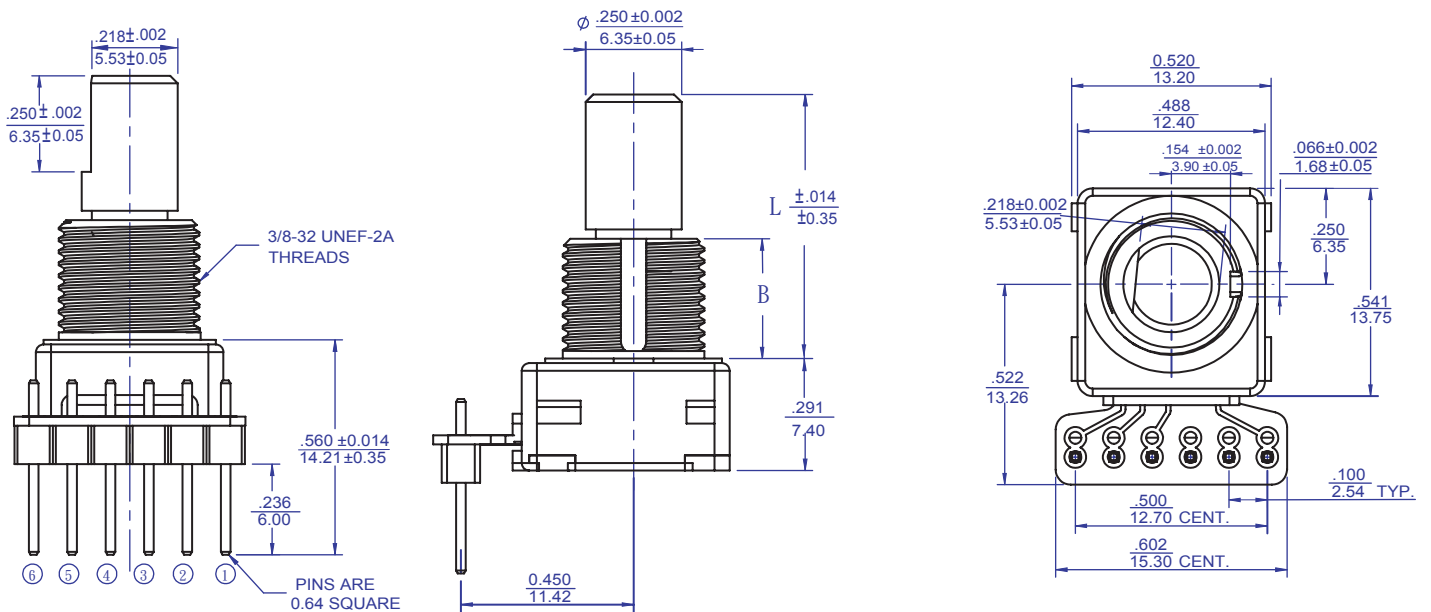
GENERAL TOLERANCE: $\frac{\pm.010\ inch}{\pm 0.25\ mm}$

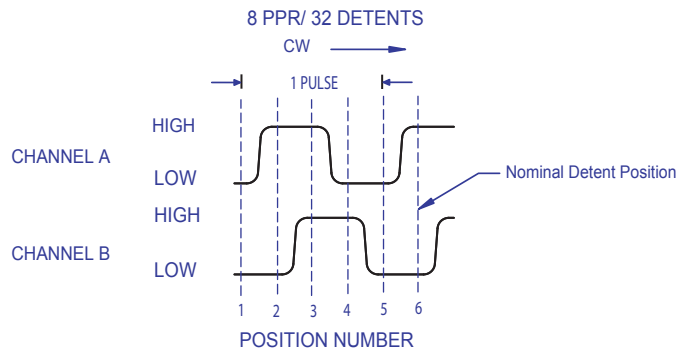## TYPE 291C-S   2-Bit Encoder With Schmitt Trigger, with Cable and Connector

.218±.002
5.53±0.05

.250
6.35

3/8-32 UNEF-2A
THREADS

CONNECTOR IS AMP
P/N215083-6
OR EQUIVALENT

GENERAL TOLERANCE : $\frac{\pm .010 \text{ inch}}{\pm 0.25 \text{ mm}}$

ø .250 ±0.002
6.35±0.05

L ±.014
±0.35

B

.144
3.65

.291
7.40

CABLE LENGTH
See Termination Options

.520
13.20 CENT.

.488
12.40 CENT.

.154±0.002
3.90±0.05

.066 ±0.002
1.68 ±0.05

.218±0.002
5.53±0.05

.250
6.35

.541
13.75

.417
10.58
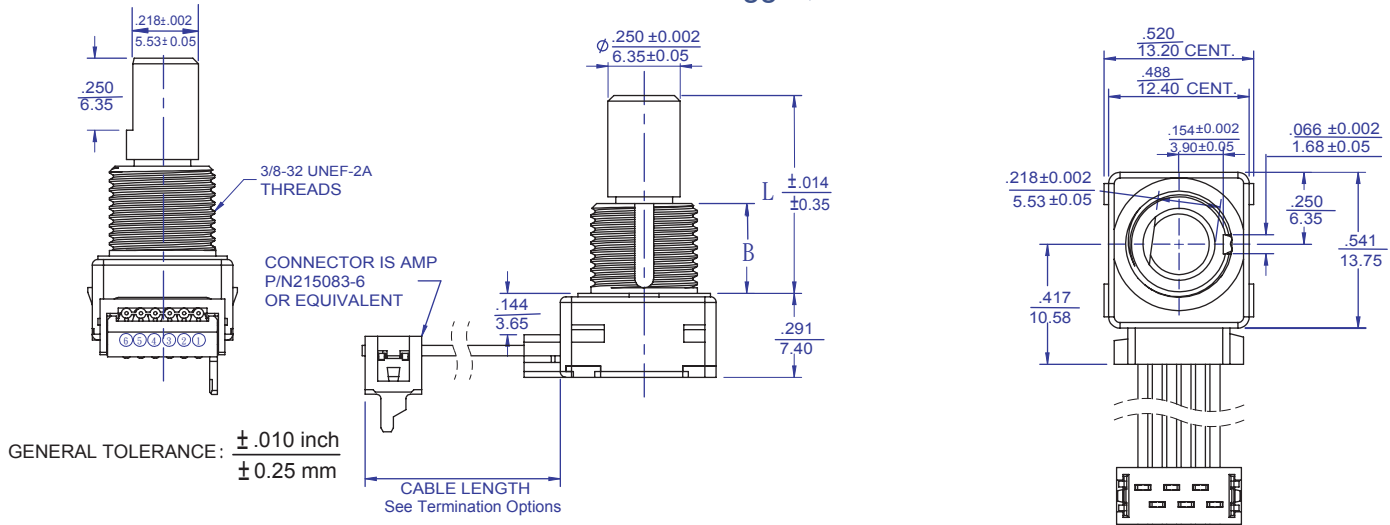
ELECTRIC CIRCUIT AND WAVEFORM
(WITHOUT SCHMITT TRIGGER DESIGN)

PIN#

POWER — 6
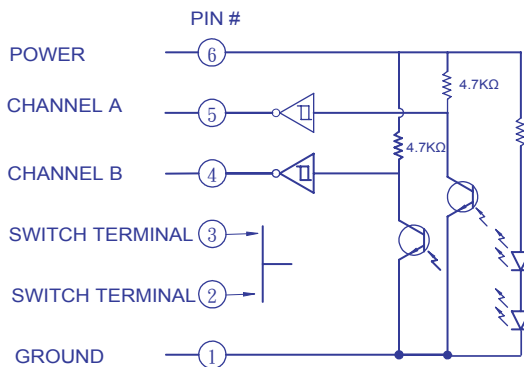CHANNEL A — 5
CHANNEL B — 4
SWITCH TERMINAL — 3
SWITCH TERMINAL — 2
GROUND — 1

R*
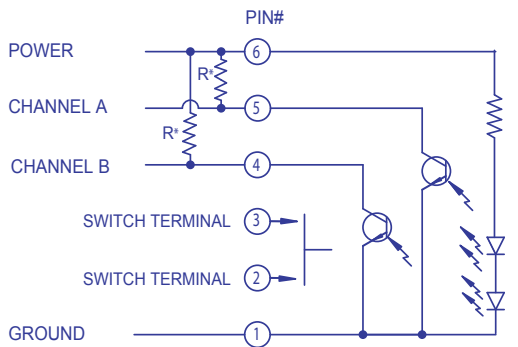
* Require pull-up resistors (2.2K or 4.7K Ω) for application circuit

Standard Quadrature 2-Bit Code

8 PPR/ 32 DETENTS

CW

1 PULSE

CHANNEL A   HIGH / LOW
CHANNEL B   HIGH / LOW

Nominal Detent Position

1 2 3 4 5 6
POSITION NUMBER

1. 8 PPR/32 detents is shown
2. Code repeats every 4 positions
3. Channel A Leads Channel B in CW direction
   and lags in CCW direction

ELECTRIC CIRCUIT AND WAVEFORM
(WITH SCHMITT TRIGGER DESIGN)

PIN #

POWER — 6
CHANNEL A — 5
CHANNEL B — 4
SWITCH TERMINAL — 3
SWITCH TERMINAL — 2
GROUND — 1

4.7KΩ
4.7KΩ

* Schmitt triggers and pull-up resistors (4.7KΩ) are integrated inside
  CTS optical encoder, so it's not necessary to have external pull-up
  resistors for application circuit.

* It can work well if application circuit still adopts external pull-up resistors (2.2KΩ).

Standard Quadrature 2-Bit Code

8 PPR/ 32 DETENTS

CW

1 PULSE

CHANNEL A   HIGH / LOW
CHANNEL B   HIGH / LOW

Nominal Detent Position

1 2 3 4 5 6
POSITION NUMBER

1. 8 PPR/32 detents is shown
2. Code repeats every 4 positions
3. Channel A Leads Channel B in CW direction
   and lags in CCW direction

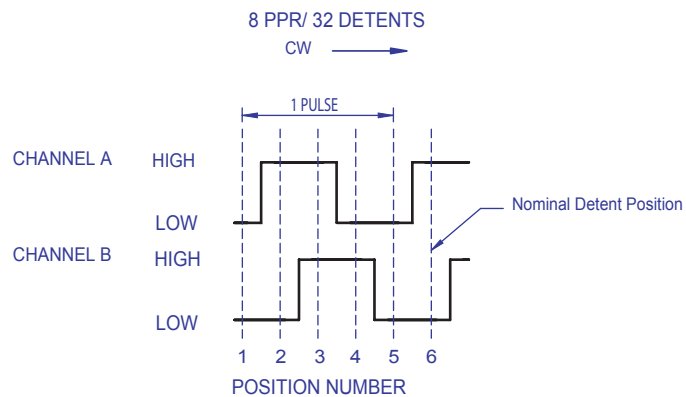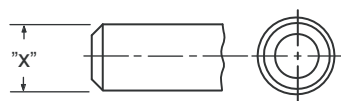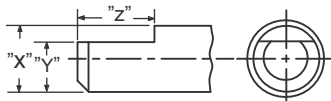## Shaft Trim

R - ROUND

	X
Imperial Shaft	.250"
Metric Shaft	6.35

F - FLATTED

	X	Y	Z
Imperial Shaft	.250"	.218"	.250"
Metric Shaft	6.35	5.53	6.35

DIMENSION: $\frac{inch}{mm}$

Ordering Information

291 V1 0 22 F 832 A B S

TERMINATION

V1 - .050" Pitch Center Pins Formed to Rear with .144 length

P1 - .10" Pitch Center Pins Formed to Rear with .236 length

C4 - .050" Pitch Center 4" Ribbon Cable with Connector

C5 - .050" Pitch Center 5" Ribbon Cable with Connector

C6 - .050" Pitch Center 6" Ribbon Cable with Connector

(Connector is AMP P/N 215083-6 or Equivalent)

SHAFT TRIM

R - ROUND
F - FLATTED

OPERATING VOLTAGE

A - 5.0V
B - 3.3V

SWITCH

A - NONE
B - MOMENTARY

SCHMITT TRIGGER

S - WITH SCHMITT TRIGGER
BLANK - WITHOUT

"L" SHAFT LENGTH

mm	inch
A5 - 15mm	**20** - .625"
B0 - 20mm	**22** - .688"
B5 - 25mm	**24** - .750"
C0 - 30mm	**28** - .875"
	32 - 1.000"
ALL 6.35mm Dia.	ALL .250" Dia.

OUTPUT COMBINATION

832 - 8PPR, 32-DETENTS
624 - 6PPR, 24-DETENTS
800 - 8PPR, NO DETENTS
600 - 6PPR, NO DETENTS

"B" BUSHING LENGTH

mm	inch
D - 9.53mm	**2** - .250"
	3 - .375"
	0 - .312"
M9X.75P	3/8-32 UNEF-2A

Note:

Consult CTS for other common standard features not listed.

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