Description

The CAM622 ABN Board generates encoder-like ABN digital quadrature signals in response to movement of a contactless target. It connects to a Type B resonant inductive sensor designed by CambridgeIC. The sensor and target are both conventional PCBs.

Processing is done by CambridgeIC's CAM622 resonant inductive encoder IC. The CAM622 energises the sensor, detects signals induced in sensor coils by the target, and processes them to determine position every 30µs.

The CAM622 includes a synthesizer to generate real-time ABN signals which precisely follow target movement.

A switching power supply efficiently regulates 5V power to 3.3V for the CAM622. A line driver generates differential ABN outputs.

Please refer to the CAM622 datasheet for features and specifications of the CAM622, and to the appropriate sensor datasheet for sensor details and performance.

A Streaming Adapter is available to connect the CAM622 ABN Board to a PC over USB. CAM622 Configuration Tool PC software is available for configuring and viewing measurement results.

Performance

- 4.5V to 5.5V supply
- 90mA supply current from 5V
- Board operating temperature -40°C to +125°C
- Up to 16 bits of AB edge resolution

Product identification	
Part no.	**Description**
013-5042	CAM622 ABN Board
013-6019	6-way dual PicoBlade Sensor Cable
013-6020	PicoBlade SPI Cable
013-5040	Streaming Adapter

Features

- CAM622 Resonant Inductive Encoder IC
- Efficient regulator to supply 3.3V for CAM622
- iC-DL line driver for differential ABN out
- ABN fully programmable over SPI, non-volatile
- Status indication with LED

Applications

- Prototyping CAM622 based applications
- Optical encoder replacement with 5V in, ABN out
- CAM622 processor board with SPI interface
- Reference design for CAM622 circuitry

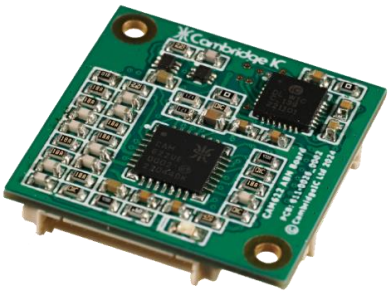

Figure 1 CAM622 ABN Board, Top

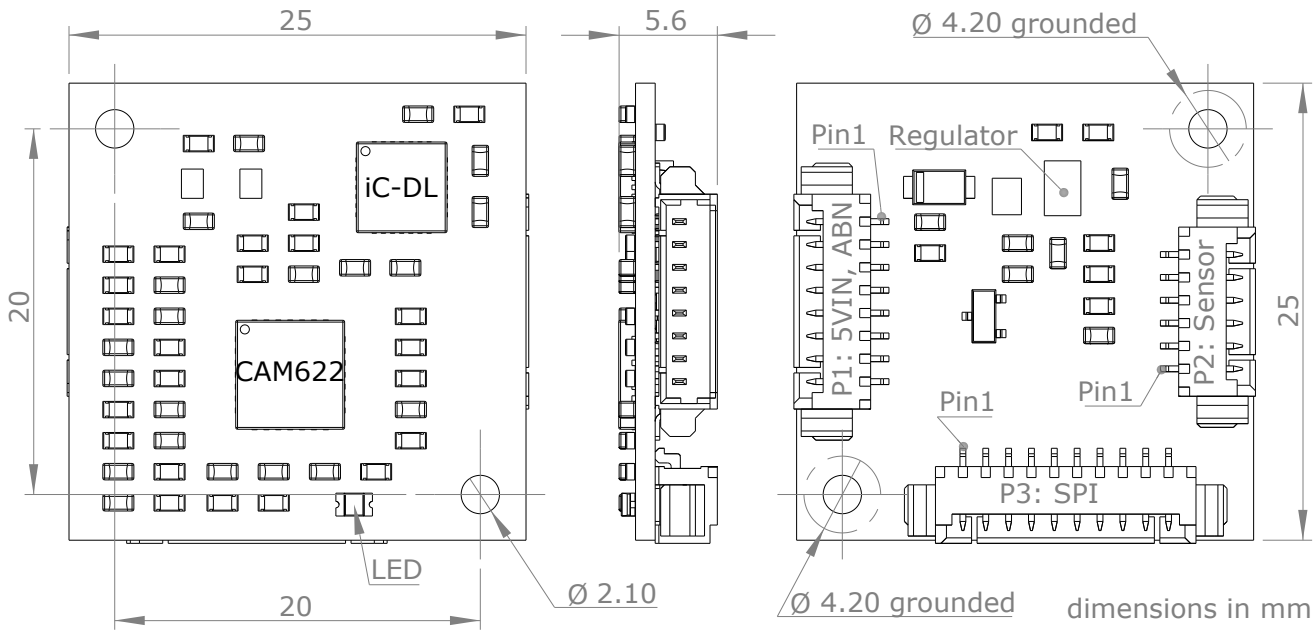

Figure 2 CAM622 ABN Board layout

1 Specifications

1.1 Electrical

Table 1 Electrical Specifications

Parameter	Min	Max	Comments
Supply voltage range, 5VIN	4.5V	5.5V	
Current draw from 5VIN		90mA	ABN edge rate 4.5MHz, no load

1.2 Thermal

The CAM622 ABN Board is designed to demonstrate the CAM622 operating across its full temperature range, see Table 2.

Table 2 Thermal Specifications

Parameter	Value	Comments
Minimum board operating temperature	-40°C	
Maximum board operating temperature	125°C	Board temperature, not ambient Connectors only rated to +105°C, may fail with long-term use at higher temperature LED only rated to +85°C, may fail with long-term use at higher temperature

For applications requiring continuous operation at high temperature, a customer may create their own design with alternative connectors and omit the LED, using the CAM622 ABN Board as a reference.

Note that the temperature extremes specified in Table 2 relate to board temperature and not ambient. If the board is to be used in an environment above 100°C then the board must be mounted to provide a good thermal contact with the environment, to prevent board temperature from exceeding the maximum specified.

1.3 Mechanical

Figure 2 shows the mechanical design of the CAM622 ABN Board.

The areas immediately around the mounting holes are connected to GND both sides of the PCB. The board should not be screwed to a metal object with metal (conductive) screws unless it is acceptable for that object to become connected to 0V / ground.

1.4 CAM622 Specifications

Please refer to the CAM622 datasheet for full details of the CAM622 including:

- Principle of operation
- Performance specifications
- Details of the ABN and SPI interfaces
- How to communicate with the CAM622 over SPI
- How to program the CAM622 for stand-alone operation over SPI

2 Connector Pin-Outs

The locations and identifiers for connectors and their pin numbering are shown in Figure 2. Table 3 lists details for these connectors to assist in specifying mating parts. Table 4, Table 5 and Table 6 list signal names and pinouts.

Table 3 Connector details

Identifier	Description	Manufacturer and part number
P1	8-way PicoBlade	MOLEX 53261-0871
P2	6-way PicoBlade	MOLEX 53261-0671
P3	10-way PicoBlade	MOLEX 53261-1071

Table 4 5VIN and ABN Connector (P1) pinout

Pin	Signal	Description
1	5VIN	Supply voltage input (5V)
2	0V	Ground, supply voltage return (0V)
3	A	Quadrature A signal, positive
4	nA	Quadrature A signal, negative
5	B	Quadrature B signal, positive
6	nB	Quadrature B signal, negative
7	N	Index pulse, positive
8	nN	Index pulse, negative

Table 5 Sensor Connector (P2) Pinout

Pin	Signal	Description
1	SINA	SINA sensor coil connection
2	VREF	Common return for all coils
3	COSA	COSA sensor coil connection
4	SINB	SINB sensor coil connection
5	COSB	COSB sensor coil connection
6	EX	Excitation coil connection

Table 6 SPI Connector (P3) Pinout

Pin	Signal	Description
1	VS3V3	Supply voltage input (3.3V)
2	5VEN	5V enable. Must be connected to 0V if 3.3V is applied to VS3V3.
3	SI	Sample indicator output
4	EXT	Configurable digital output
5	0V	Ground, supply voltage return (0V)
6	SDI	Serial Data In
7	nCS	Chip Select input
8	SCK	Serial Clock input
9	SDO	Serial Data Out
10	nRST	CAM622 Reset input

The SPI Connection is only used for programming or operation over SPI. It is disconnected when the CAM622 ABN Board is generating ABN outputs from a 5V supply in normal operation.

3 Electronic Design

The CAM622 ABN Board's schematic is shown in Figure 3. Figure 4 shows how components are arranged on the top of the PCB, and Figure 5 shows how components are arranged on the bottom of the PCB.

3.1 CAM622 Circuitry

The circuitry surrounding the CAM622 is as specified in its datasheet. This includes excitation circuitry for generating the EX signal for powering the sensor, and circuitry for low-pass filtering signals returned by the sensor.

3.2 Power Supply

The 5V to 3.3V step-down power supply is built around U1, the TPS628113HQWRWYRQ1 from Texas Instruments. This device achieves high efficiency with small external components.

Due to the relatively low current draw of the CAM622 ABN Board, U1 operates in its power save mode. When the VS3V3 output falls below a threshold value, it connects the SW output to VIN, raising the output voltage. It then connects SW to 0V while current in inductor L1 decays to zero. At that point SW is held open circuit until the output voltage falls below the threshold again. This mode of operation yields a variable switching frequency in the region of 250kHz.

Ripple on VS3V3 is filtered further by the combination of R3 and C11 to yield the CAM622 power supply voltage VDD. It is then filtered again by R10 and C10 to yield the analog supply voltage AVDD.

U1's enable input EN is connected to the 5VEN net. When the CAM622 ABN Board is operating autonomously from the 5V supply with nothing connected to the SPI connector (P3), 5VEN is pulled high so that U1 regulates 5V to 3.3V as normal. When SPI signals are connected to P3 for programming or for communication with the CAM622 over SPI, there is an option for the SPI connector to connect an external 3.3V supply to VS3V3. In this case 5VEN must be pulled low. Alternatively VS3V3 and 5VEN may remain unconnected, providing 5V is applied to P1's 5VIN.

3.3 Line Driver

An iC-DL ET part from iC-Haus generates differential ABN outputs from LA, LB and LN. These are 3.3V single ended low-current outputs from the CAM622. The iC-DL boosts output current capacity and voltage, and provides termination and protection circuitry suitable for driving signals over cable.

The CAM622's A0 output is wired to the iC-DL's OEN input. This is an active high enable signal, so the CAM622's A0 output must be configured to logic 1 for standalone ABN operation.

If the ABN signals are not required because SPI is being used as the primary interface then configure the CAM622's A0 output to logic 0.

The CAM622's A1 output is wired to the iC-DL's DIFF input. This must be configured to 1 for differential output.

3.4 LED

The CAM622's EXT output drives an LED to provide an indication of status. To use the LED, configure EXT for LED control and active high, and set an appropriate LEDTHRESHOLD.

The CAM622 measures the amplitude of the detected signal, the measurement AmplitudeA. The LED will activate constantly for AmplitudeA values above LEDTHRESHOLD, and flash for lower values. If the target is out of range (not VALID) then the LED will be off.

As noted in section 1.2 the LED has a relatively low maximum operating temperature, in common with most LEDs. It is not intended for long-term operation at very high temperature. If it does fail, the rest of the CAM622 ABN Board will continue to operate normally.

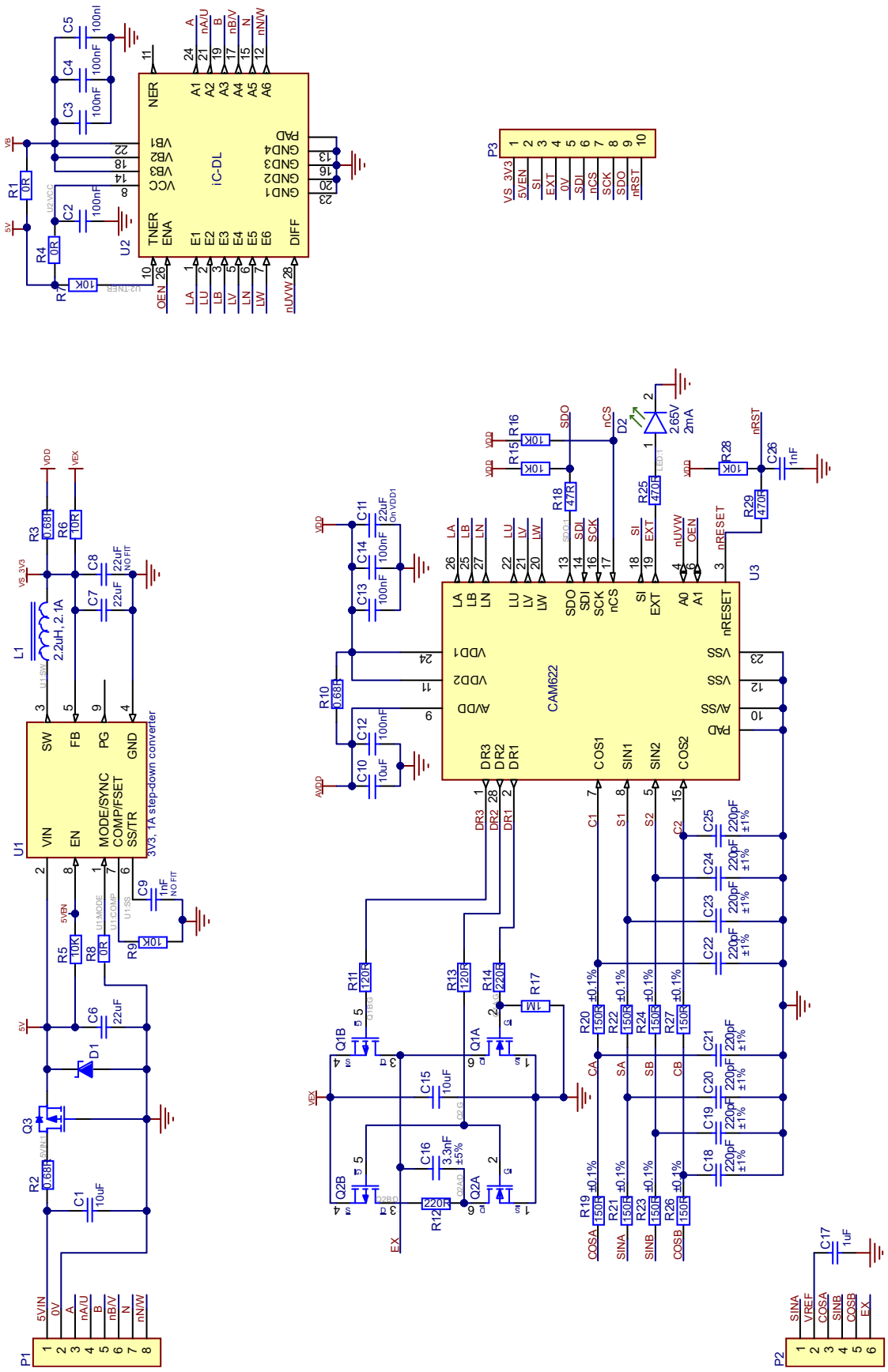

Figure 3 CAM622 ABN Board Schematic

3.5 Component Placement

The top of the PCB includes the CAM622 and line driver circuitry.

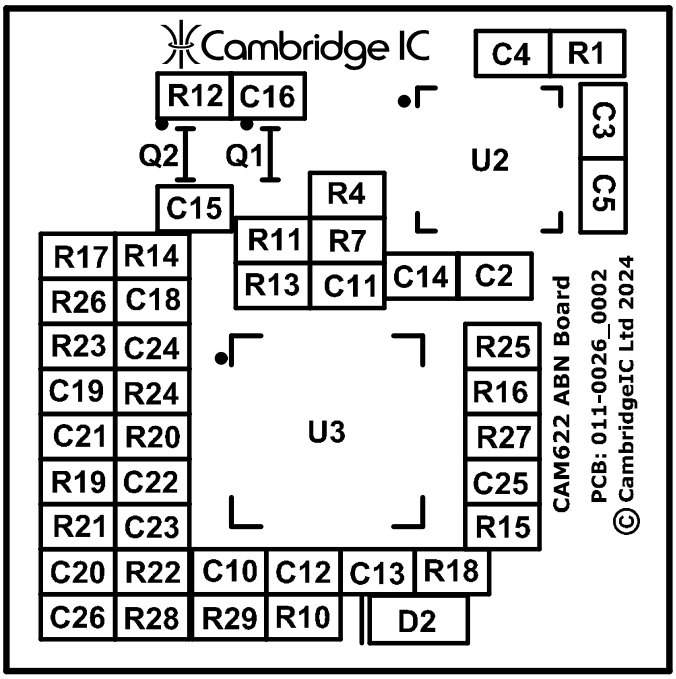

Figure 4 CAM622 ABN Board Component Placement, Top

The bottom of the PCB includes the 3 connectors, power supply circuitry and C17 from the CAM622 circuitry.

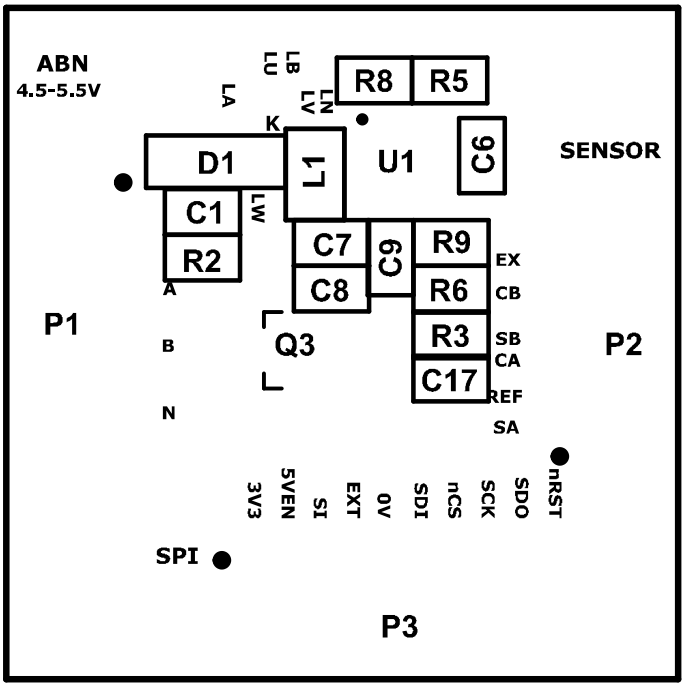

Figure 5 CAM622 ABN Board Component Placement, Bottom

4 Document History

Revision	Date	Reason
0001	17 Oct 2024	First draft

5 Contact Information

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