Design through collaboration

DSL AMPIC

Design Proposal

Document No.	**:**	**107-035**
Issue	**:**	**1.1**
Date	**:**	**06/03/2015**
Author	**:**	**Kevin Kilford**

Datasound Laboratories Limited
4 Aylesford Court, Works Road,
Letchworth Garden City, Herts, SG6 1LP

Tel: +44 (0)1462 675530
Fax: +44 (0)1462 482461
Email: design@dsl-ltd.co.uk

bsi. ISO 9001 Quality Management
FM 38066

Contents

1 Disclaimer

All information contained in this proposal is believed to be accurate and reliable. However, DSL assumes no responsibility for its use. Since conditions of product use are outside our control, we make no warranties express or implied in relation thereto. We therefore cannot accept any liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or recommendation to infringe any patents.
Whilst every effort has been made to ensure that this document is correct; errors can occur. If you find any errors or omissions please let us know, so that we can put them right.

2 Purpose of Document

This document collates all the significant parameters which both the client & the designer consider of sufficient significance to enable a formal quotation to be provided.
Where pricing cannot be provided with any degree of certainty this will be clearly identified within the document.

3 Confidentiality

The enclosed information is submitted for the purpose of describing and detailing the requirements for AMPIC on behalf of DSL. The information included in this document, in its entirety is considered both confidential and proprietary to DSL and may not be copied or disclosed to any other party without the written consent of the appropriate authority at DSL.

4 Acknowledgments

5 Record of Amendments

DATE	ISSUE	DETAILS (Include changed section numbers and implications)
05-Oct-2012	1.0	Initial Release
06-Mar-2015	1.1	Updated to latest style Added supplier description (6) Updated to TIVA™ Cortex™-M4 processor (7) Changed Demonstration software description (7.1.2) Added ECR procedure description (8.2) Removed quotation detail: this is now separate (8, 9) Added notes section (8) Removed internal approvals section (10)

6 Supplier Description

6.1 Organisation

DSL is a U.K. based company located within the business technology park in Letchworth Garden City, Hertfordshire.

After designing its first embedded target platform in 1985 the company formally became Datasound Laboratories Ltd (DSL) in August 1991.

Growing organically year on year DSL has constantly been at the forefront of new technologies and is recognised as a leading specialist supplier of embedded computing solutions to the OEM market.

Contributing to our product range is a variety of products for PC/104, Eurocard, Half-Eurocard, SlotCard, ETX™ and other industry formats.

In satisfying the day to day demand for these products DSL distributes on behalf of established Taiwanese companies such as ICOP Technology and Aplex Technology.

Over sixty per cent of DSL's activity is the design and on-going supply of embedded solutions via performance optimised, cost-effective target platforms.

These tend to encompass a wide range of x86 architecture, Microchip® PIC® microprocessor, peripheral controllers and embedded systems.

6.2 The Design Service

The design service DSL provides encourages our OEM client's engineering teams to focus on their own core competencies, rather than learn new technologies which they may only employ perhaps once every 5 years.

Leveraging the expertise of DSL design engineers can significantly reduce the time-to-market and negate the obvious financial risks of hiring permanent or temporary staff which may require training and may well be underutilised in the gaps between new product developments.

Our engineers can work in parallel with the client and we have invested significantly in necessary tools and processes for successful hardware design, BIOS customisation, software (Operating System, Firmware & Application) design and industrial design integration.

All our design engineers are fully trained to recognised, IPC CID+, standards for circuit design and printed circuit board (PCB) design. This includes 'Design For eXcellence' (DFX), including 'Design for Manufacture' (DFM), 'Design for Test'

(DFT) and ‘Design for Assembly’ (DFA). Design for EMC and safety issues is given high priority by all of our design engineers.

Our designers have experience in radio frequency (RF) designs and analogue designs as well as digital designs (including FPGAs & DSPs).

As such all design elements are handled in-house and are tightly controlled to maintain the highest quality.

6.3 The Prototyping Service

If the client were to take on the responsibility of prototyping and the product malfunctions do they blame the design or the manufacture?
To avoid placing the client in this situation we insist on undertaking this phase of the project.

Proving the design is fit for purpose is essential, in addition component availability, longevity, footprint creation, XJTAG programming and proving the entire manufacturing process are all necessary parts of this service.

6.4 The Manufacturing Support Service

Once the design has been proven it is important to consider the on-going manufacturing.

The nature of DSL’s business activities means that it develops relationships with a number of sub-contractors, each with specialist skills, which, as a whole, complement DSL’s design expertise.

This arrangement has proven successful on a number of projects, where volumes in excess of fifteen thousand units per annum have been achieved.

As you might expect DSL have a specialist production team who oversee all aspects of production, testing and delivery to ensure it meets our clients JIT expectations.

Where required DSL can supply fully assembled and boxed product, pre-loaded with custom embedded OS and the clients application code, directly to the OEMs end clients.

This provides reduced OEM stock holding, improved cash flow as well as reduced unit costs and lead times.

DSL’s obsolescence management skills address impending parts availability issues ahead of production schedules, ensuring zero disruption to the client.

DSL take a fully flexible approach to enhance their client's engineering teams and can value with all tasks from product inception to final production.

6.5 Competence in the field

The solution DSL requires is well within the capabilities of DSL's design team.

DSL operates a Quality Management System which complies with the requirements of BS EN ISO 9001:2008.

7 Description of proposal

DSL are increasingly receiving requests for custom designs that require ARM® processors, or for designs that require lower performance and power consumption than the x86 based processors.

The low performance and consumption type of designs do not always need a full operating system, such as Microsoft® Windows®, Windows® Embedded Compact or Linux®, although they may require some real-time, deterministic, aspect.

There are, currently, three families of ARM® processors:

1. Cortex™-A series are application processors which have similar multimedia capabilities and overall performance comparable to the ICOP Vortex processors or Intel® processors used in other DSL distributed products.
2. Cortex™-R series have a similar performance to the mid-range Cortex-A processors but include hardware support for real-time operating systems with features such as deterministic interrupt performance.
3. Cortex™-M series have performance equivalent to the best microcontrollers, whilst being very energy efficient.

The Cortex™-M4 processors are general purpose, high performance, 32-bit, microcontroller type, processors with support for highly deterministic real-time applications.

Processors based on the ARM® Cortex™-M4 core are widely available, from manufacturers including NXP, Atmel, STMicro, Texas Instruments, Toshiba and Freescale.

Compilers with support for these processors are also widely available, from software houses including Keil, IAR systems, Mentor Graphics, Code Red, MikroElektronika and the processor manufacturers themselves.

It is proposed to create a sensor development kit, including an ARM® Cortex™-M4 based processor with a number of inputs, outputs and user interface hardware that are predicted to be required for sensor designs.

It is anticipated that clients could use this sensor development kit to fully develop and test a sensor design before requesting that DSL create a custom design for them.

7.1 Proposed solution (outline, preliminary design)

7.1.1 Hardware

The proposed solution will be based on a Texas Instruments TIVA ARM® Cortex™-M4 processor.

These processors have a cost of approximately $3-$11, dependent upon the amount of included flash, RAM, peripherals and the maximum processor clock speed.

Texas Instruments have a comprehensive suite of royalty free software, supporting all of the peripheral interfaces, to speed development, as well as a number of example programs that can be used as a starting point for new designs.
The software, provided to drive each interface can be incorporated into your own software or is available in ROM to free storage.
Texas Instruments also supply a free real-time operating system, with no run-time fees, that can be used stand-alone or with their own compiler.

The Texas Instruments TIVA™ ARM® Cortex™-M4 microcontrollers are also supported by all of the major ARM® compilers.

The proposed solution would include a thermocouple[1] connection, an on-board temperature sensor, 4-20mA inputs, analogue inputs and GPIO, to provide the inputs for the sensor.
The GPIO inputs will be organised in such a way that some can be configured for use as a PWM output.

A microSD connector will be included to provide potential data logging storage[2].

System connections will be delivered using 4-20mA outputs, CAN, USB and Ethernet.

One RS232 port and one RS422/RS485 port can be used as generic connections for system or sensor use.

An expansion port, including I2C, SPI and a TTL serial port will also be provided. Further connections, such as Bluetooth® and WiFi, can be added using AT modem modules from companies such as Multitech or U-blox.

[1] If a Maxim MAX31855 device was used, this provides a cold-junction compensated digital temperature output via SPI bus. This part is available for K, J, N, S, T, E and R-type thermocouples, allowing us to provide a connection for the most popular type in the development kit and support all of the other types for custom designs.
[2] This is not required for normal application storage.

The GPIO ports will connect to a 2-line character LCD, momentary push buttons and LEDs to provide a simple user interface, whilst inputs will be opto-isolated and outputs will have some change-over relays and some open collector outputs.

7.1.2 Example software

To demonstrate the use of the system, and to give clients a starting point with their projects, the sensor development kit will be supplied with a working example installed.
This will allow manipulation of all of the interfaces, providing the ability to test for compatibility with a client's external sensors as well as providing tested firmware functions for all on-board devices.

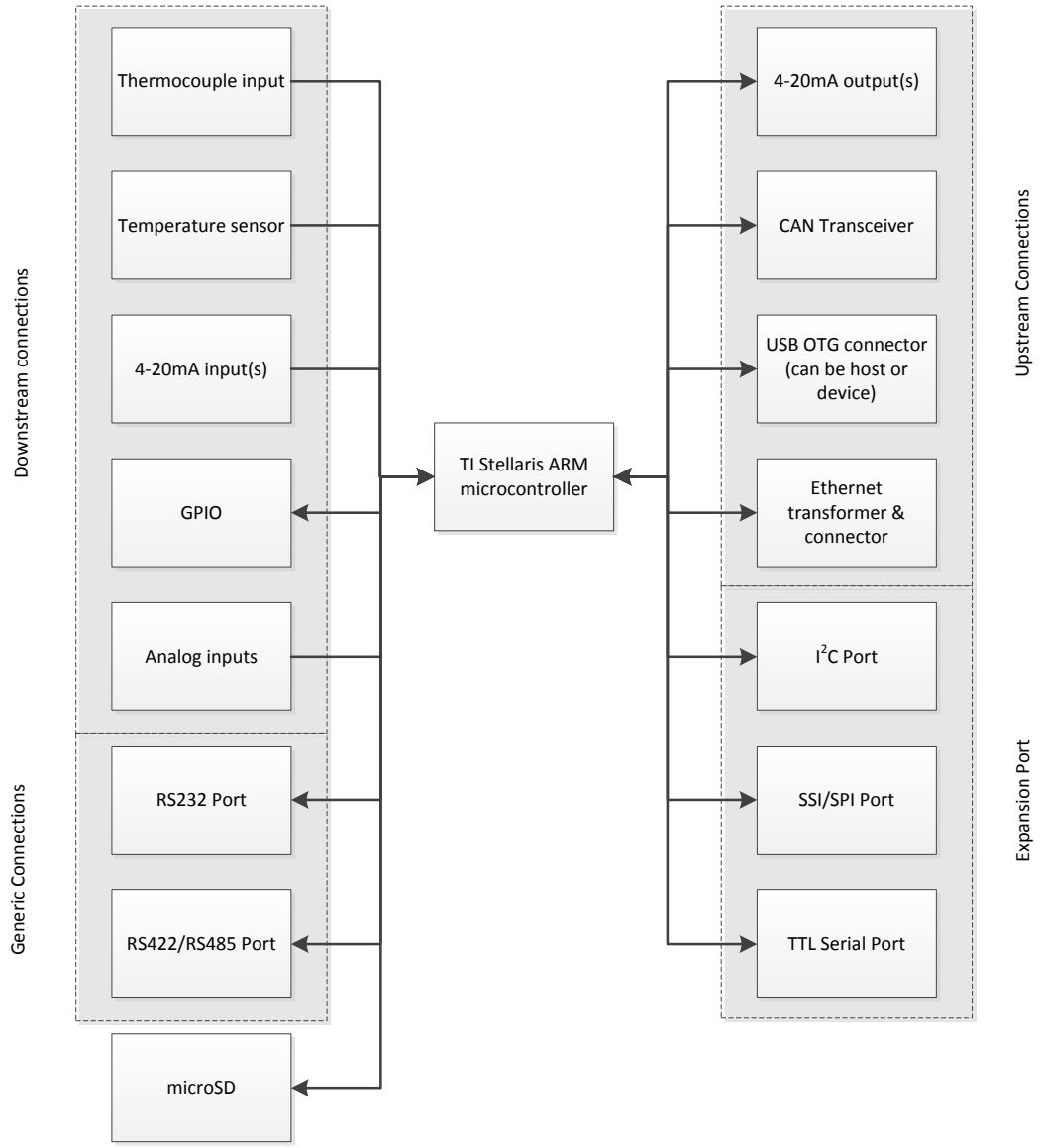
The GUI elements, including the LCD, push buttons and an optional USB keyboard will be used to control an intuitive menu system allowing control of the on-board peripherals.

The on-board storage will be utilised in the same manner envisaged for finished applications: NVRAM to store working parameters that persist across power outages, E^2PROM to store configuration parameters and microSD Card for logging.

The sensor input states, such as Digital and analogue input states, temperature sensors and 4-20mA receiver values will be viewable.
This will also allow the digital outputs and 4-20mA driver values to be set.

The serial and CAN bus interfaces will respond in a predetermined fashion to demonstrate their usage within the firmware whilst the 10/100 Ethernet port will utilise the open source lwIP functions to connect to a network and communicate with a DHCP server.

7.1.3 Block diagram



8 Development plan

8.1 Support for the development

Every step of the design process, as described in DSL's Quality Management System, which complies with the requirements of BS EN ISO 9001:2008, is verified to assure process quality.

- A design specification, produced to fully describe the system to be designed and written to be easily understandable, is initially produced. This document is verified by the client and, in effect, becomes the design contract.
- Schematics from the system will then be designed. These are subject to internal review to assure their suitability, their accuracy to the design specification and to verify component choice.
- Any component footprints, not already within DSL's extensive library, required for the design will be created. These are subject to internal review. This review is important to guarantee prototype PCBs will correctly accept the selected components.
- PCB component layout can then be performed. This is internally reviewed and may also be reviewed by the client, where he has specific needs.
- With all of the relevant information collated and verified PCB routing can be performed. This is internally reviewed.
- Prototypes can then be produced.
- These are fully tested in-house before shipping to the client for design verification.
- Any changes necessary are then made to the design files, subject to the relevant reviews, and manufacturing files can be generated and released.

8.2 Design and Development Changes

Changes which occur during the development process, due to alterations to the requirements, will be subject to the design change procedure as described in DSL's Quality Management System.

- All changes must be documented and justified.
- All changes will be evaluated for their consequences to the project.
- These consequences will be reviewed with the client and any contract amendments agreed where necessary.
- If approved the design change may then be implemented.

NOTES:

- DSL Terms & Conditions apply.
- Test requirements will be set during the design specification stage.
- As the electronic units to be designed will form part of a larger system EMC testing is not included, although EMC requirements will be fully considered throughout all design stages.