CML Microcircuits
COMMUNICATION SEMICONDUCTORS

White Paper

A Knowledge Base document from CML Microcircuits

The Ultimate
ASSP, ASIC, Semi-custom and Custom,
Integrated Circuit Technology

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1 INTRODUCTION

The electronic equipment designer has a number of key decisions to make when embarking on a new product design. Important considerations are the target product size and, if battery powered, the maximum supply current consumption. In many instances a microcontroller will provide the control and management of the overall system. However, the core system technology direction needs to be chosen carefully; this is to ensure that the ultimate strategic and commercial project objectives are achieved. The standard core system technologies are as follows:

- Discrete components
- Application Specific Standard Product (ASSP)
- Application Specific Integrated Circuit (ASIC)
- Field Programmable Gate Array (FPGA)
- Digital Signal Processor (DSP)

Each of these technology routes has its own individual benefits and drawbacks. *FirmASIC*® technology has been developed to maximise the benefits of all these technology routes.

This document sets out to introduce FirmASIC® technology and how it can provide the optimum solution to many electronic product design applications, with its fast time-to-market, high flexibility, low risk and small footprint approach to electronic product design.

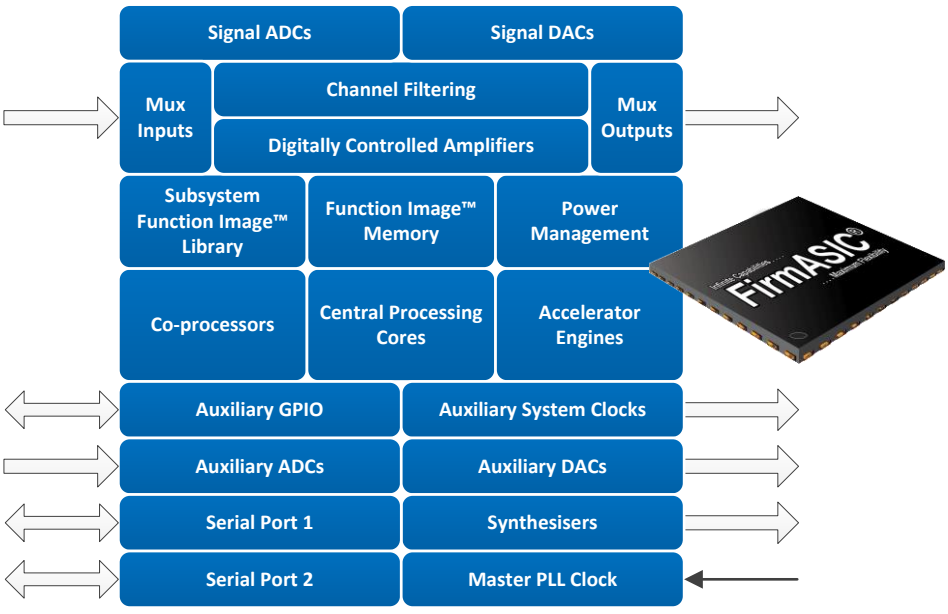

Figure 1: Typical *FirmASIC*® platform function block diagram

2 THE TECHNOLOGY

FirmASIC® is CML's (CML Microcircuits) proprietary component technology, 100% designed and developed in the UK. It has been successfully deployed in a wide range of standard and custom product offerings that are deployed world-wide. *FirmASIC*® provides the optimum combination of analogue, digital, firmware and memory technologies in an integrated platform approach. A growing family of approved and stable hardware platforms is available, each with a different mix of fixed and pre-defined functions. Specific operations of a *FirmASIC*® device are determined by a Function Image™; a small data file that is uploaded to the device during device initialisation.

The *FirmASIC*® design approach addresses the needs of small, medium and high quantity opportunities as well as standard, semi-custom and custom product directions. Platform families comprise:

- RAM based devices - providing the fastest time-to-market for development and small to medium production or where maximum flexibility is the key driver. RAM based devices support field reprogramming and upgrading.
- ROM based devices - fit, form and function equivalents to the RAM based platforms, enabling a fast and efficient transition to high quantity and lowest cost. Functionality is fixed but identical to that of the original Function Image™.

The whole essence of *FirmASIC*® is to deliver an integrated product with the correct feature mix, performance and cost, for a specific target application in the shortest possible time frame.

3 THE *FIRMASIC*® ADVANTAGE

Adopting the *FirmASIC*® approach provides the electronic product designer a number of key advantages through evaluation, the product development stage, pre-production/field trials stage and small, medium and large volume production.

3.1 Low Risk

FirmASIC® was first conceived in 1999 and initially used as an internal design technology for CML's standard plug-and-play products. Shortly afterwards, *FirmASIC*® technology was then offered more widely to the market place providing its full benefits to the electronic designer and end customer. Since then, a growing number of CML's product releases have successfully followed this design route. The technology has continued to evolve with new platform families being released having advanced combinations of hard and soft functionality. All platform family devices are thoroughly characterised and have been successfully deployed in numerous target end products: standard, semi-custom and custom offerings, world-wide.

3.2 Highly Flexible

From the initial release of a product to a customer, through to their own field trials and even during series production, performance and operation changes can normally be accommodated by minor changes to the Function Image™ data file. Any modifications to the Function Image™ are thoroughly evaluated and passed through a series of regression tests at CML to ensure conformance and that the updated Function Image™ is fully backward compatible. This ensures that the customer has a clean upgrade path with equipment in the field.

Customer-specific variants can also be accommodated in the form of semi-custom or custom device offerings. Semi-custom and custom Function Images are managed via a private Technical Portal with access granted only to the specific customer.

3.3 Fast Time-to-Market

The *FirmASIC*® RAM based product can be made available with a Function Image™ in just a few months from the initial definition of the product being approved. At this point the customer can start building equipment based on this device knowing that any changes needed can be managed by a Function Image™ update in the field, if necessary. From the initial device release CML's emphasis is on maximum support. Evaluation and

demonstration tools are available with all platforms supported by a comprehensive suite of application scripts and technical support that is second-to-none.

3.4 Small Package Footprint

FirmASIC® can embed an entire system's analogue to digital and digital to analogue conversion requirements - signal and auxiliary paths, GPIO and system clocks, alleviating the need for additional support devices. This enables a very small PCB area to be realised, typical packaged *FirmASIC*® solutions are packaged in a 32 pin to 64 pin VQFN, similar to what would be achieved with a full custom ASIC approach.

3.5 Route to High Quantity/Low Cost

FirmASIC® technology enables an easy transition from a fully flexible RAM based solution to a ROM based plug-and-play device. Both devices being 100% fit, form and function compatible, guaranteeing a smooth changeover.

	ASIC	FPGA	DSP	*FirmASIC*®
Small/medium project	No High NRE	Yes	Yes	Yes
Large project	Yes	No	Yes	Yes
Small unit size	Yes	No	No	Yes
Fast time to market	No Long development	Yes Long regression testing	Yes Long regression testing	Yes
Field upgradable	No	Yes Long regression testing	Yes Long regression testing	Yes
Embedded analogue functionality	Yes	No	No	Yes
Low overall solution cost	Yes Only for high qty	No	No	Yes

Figure 2: The electronic product designers' selection matrix

4 POSITIONING AND DEPLOYMENT

FirmASIC® addresses a wide selection of applications in communication market segments world-wide and enables access to a high level of integration. The key market areas are as follows:

- Software Defined Radios (SDR)
- Digital and analogue two-way radio
- Satellite voice and data communications
- Multi-mode wireless data systems
- Industrial control systems
- Wireless data modems
- Asset tracking telemetry systems
- Marine voice and data communications
- Security/alarm systems
- Digital voice storage/encryption
- Remote metering
- Wireline communications

FirmASIC® technology is deployed widely within the digital and analogue two-way radio industry. It provides a unique proposition: true universal operation across analogue, multi-digital FDMA/TDMA systems from a single platform device. Comprehensive functionality includes baseband processing and inclusion of air interface protocol, leaving little for the host microcontroller to manage.

Wireless data /telemetry is also a key market area, with numerous modulation schemes available, including robust over-air coding and forward error checking. *FirmASIC*® brings another dimension to this market, with a platform device not just supporting the current modulation schemes, it has the capability of being updated via a new Function Image™ to address future, more advance modulation and coding schemes, all without a hardware/PCB change.

All this is backed up with off-the-shelf evaluation, demonstration and support tools and the highest level of technical support available on the market via CML's dedicated applications teams.

5 SOLUTION PROVIDING

The whole essence of *FirmASIC*® can be summed up in two words: ' Solution Providing'. This is further enhanced in the case of radio based systems by the inherent connectivity to RF front end chip based ICs, providing overall, the highest integration solution.

Figure 3 below shows a typical digital/analogue radio requirement based on a DSP/FPGA approach, with multiple support components, generally providing a complex implementation to manufacture.

Figure 4 below clearly shows how CML's chipset solution, combining CMX994 (RF Direct Conversion Receiver IC) and CMX7241 or CMX7341 (*FirmASIC*® platform with system specific Function Images) soaks up many of the peripheral functions and components. This provides for a very compact overall solution with a small bill of materials (BOM), minimal setup and trimming, that can easily transition to series production.

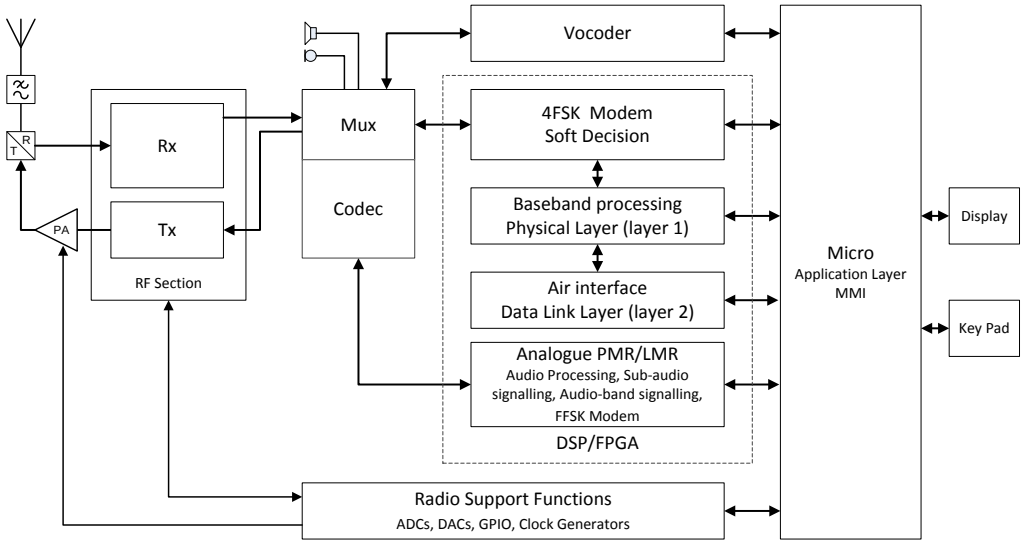

Figure 3: Typical digital/analogue radio system based on a DSP/FPGA design approach

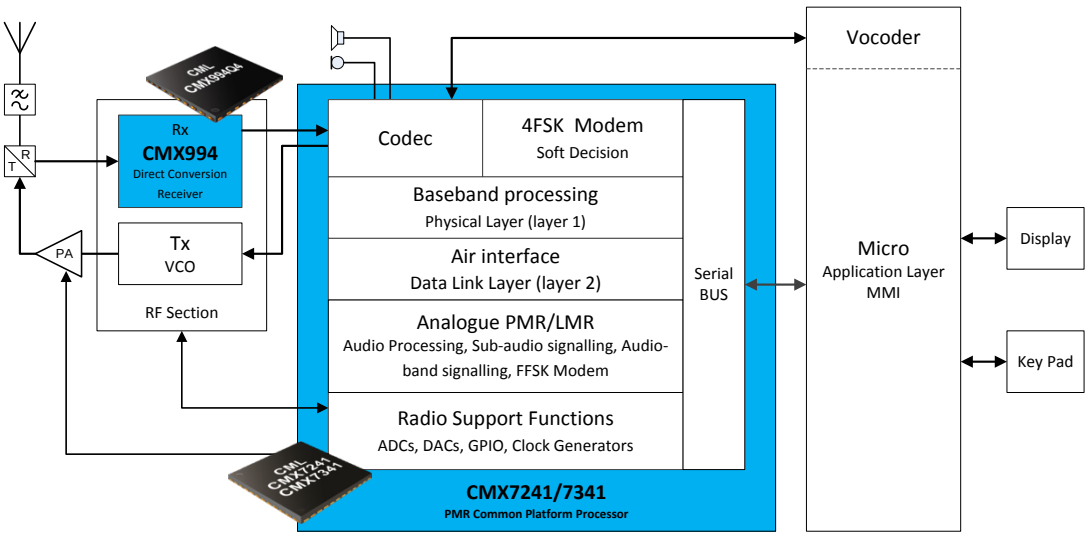

Figure 4: Typical digital/analogue radio system based around the *FirmASIC*® approach

6 ABOUT CML MICROCIRCUITS

CML Microcircuits (CML) comprises three member companies of the CML Microsystems Plc group: CML Microcircuits (UK) Ltd, CML Microcircuits (USA) Inc. and CML Microcircuits (Singapore) Pte Ltd. Founded in 1968, CML Microcircuits has developed to become a world-leader in the design, development and supply of low-power analogue, digital and mixed-signal semiconductors for communications systems worldwide. CML has three designs centres covering silicon based products, RF, software and systems and, provides sales and technical support on three continents.

CML's expertise in the small geometry CMOS process allows it to produce highly integrated circuits with high performance, ultra-low power consumption and small form factor. CML's semiconductor products are available throughout the world via an extensive network of distributors and representatives. Further information on CML's distribution network is available from the CML website. CML is supportive of conserving the natural environment and aims to manage its operations in ways that are environmentally friendly and economically viable. CML provides RoHS compliant, lead-free (Pb-free) products. CML's Environmental Policy can be found on the CML website (www.cmlmicro.com).