Qormino® - Complex embedded design made quick, easy and enduring

A technical brief from Teledyne e2v

Qormino® is an ultra-compact, 64-bit multi-core, NXP QorIQ® processor-based module integrating DDR4 SDRAMs (double data rate, synchronous DRAMs) for high performance, communication intensive applications. Designed to aid fast time to market, it solves the thorny problem of premature product obsolescence. Thankfully, Qormino is supplied from Teledyne e2v's expert inventory management program, SLiM™. This offers an extended supply up to 15 years. Embedded designs based on Qormino are therefore guaranteed an extended time-in-market.

Qormino filling a gap in the embedded processor market

If it's your task to deliver high performance computing in challenging environments, especially in high reliability and industrial markets, the pace of technology advancement is doing you no favours. However, advanced electronics firm Teledyne e2v has a solution that eliminates some design complexities and provides access to the best of contemporary embedded processing whilst assuring you guaranteed long term product supply.

Qormino holds the key to this treasure trove of potential. It is a specialized embedded processor solution from proven high reliability component specialists, Teledyne e2v. The module combines the benefits of a powerful NXP QorIQ quad-core communications processor teamed with optimized DDR4 SDRAMs for a fast turn design, all contained in an ultra-compact, modular form factor. Furthermore, Teledyne e2v through its managed obsolescence program SLiM provides an all-important "time-in-market" guarantee, sorely missing from other high performance embedded solutions.

Figure 1- The Qormino QT1040-4GB module

Powerful communication processing and peripherals

Absorbing the feature list for QorIQ T1 series is a major undertaking in itself. These powerful NXP processors have already captured the imagination of a broad spectrum of commercial system designers by virtue of their shear breadth of features, low power, scalability and common pin-outs.

As system on chips (SOCs) go, the QorIQ family has communication processing needs pretty much sewn up. On its initial launch, the T1040 was the first 64-bit multi-core processor to boast an integrated Gigabit Ethernet switch. The inclusion of a DDR memory controller and a full suite of peripherals rounds out a comprehensive feature set. Surely it was only a matter of time before someone smart would see a benefit to packaging these key components on an ultra-tiny substrate. This is exactly what Teledyne e2v have done. Taking up approximately one quarter the area of a credit card, the Qormino provides a 50 % space reduction over alternatives (see figure 2).
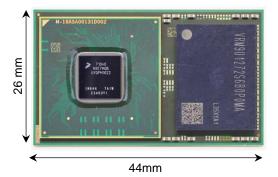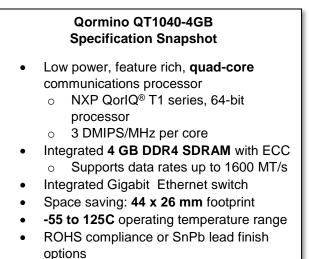

Figure 2- Qormino delivers significant real estate benefits

**Qormino QT1040-4GB
Specification Snapshot**

- Low power, feature rich, **quad-core** communications processor
  - NXP QorIQ® T1 series, 64-bit processor
  - 3 DMIPS/MHz per core
- Integrated **4 GB DDR4 SDRAM** with ECC
  - Supports data rates up to 1600 MT/s
- Integrated Gigabit Ethernet switch
- Space saving: **44 x 26 mm** footprint
- **-55 to 125C** operating temperature range
- ROHS compliance or SnPb lead finish options

Those strongly attracted to the QorIQ, based on its SWaP (Size, Weight and Power) benefits may still have concerns over some practical limitations. Two issues invariably emerge - both centre on the critical DDR memories needed to maintain high core performance. The first concerns practical DDR SDRAM interfacing (especially over a wide temperature range) given tiny timing and noise margins. The second is guarding against product obsolescence when key ICs are subject to consumer fads and short lived supply cycles. Handily, Qormino solves both these problems.

The DDR SDRAM interface challenge

DDR SDRAM provides a dense and fast local data memory to augment the core processor's on-chip caches for data handling. As such, DDR SDRAM ultimately places a maximum limit on the processing capabilities of the QorIQ core.
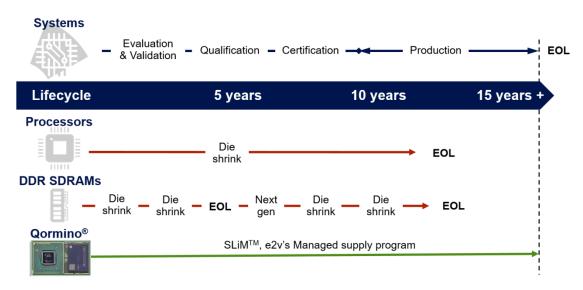

Figure 3 - System and product lifecycles vary considerably adding to the challenge of selecting key components in long life projects

DDR memory control design proves far from easy. Each memory block of a DDR4 chip is daisy chained to the next. On the plus side, this helps ensure that memory data lines are properly terminated. On the downside, a time skew is introduced between each block which must be countered by a specially modified memory controller using a technique called levelling.

One quickly appreciates the raw challenge of optimal DDR4 timing design by understanding the timing skew specifications. Skew between DQS (data queue strobe) and DM (data mask) signals is specified as a maximum of ± 10 picoseconds - that's a tiny 1 trillionth of a second! At the PC board level, that works out as a mere 50 mils (or 1.27mm) of trace length difference on an FR4 PCB. That's a real challenge to meet with today's fine pitch PCBs. How helpful then that Qormino eliminates this consideration entirely by including the DDR4 memory on the module. The QT1040-4GB Qormino applies 4 GB of DDR4 SDRAM.

Managed obsolescence planning

As shown on figure 3, memory developments have easily outpaced successive processor generations, which in turn have outpaced system development and life time cycles in certain markets. Competitive

pressures force SDRAM vendors to focus on rapid migration to further die shrinks to maintain profitability. Products quickly reach end of life (EOL) and disappear from market. Long-term focused customers face continual re-design headaches driven purely by external market forces. In the gap between embedded processor choice and the paired memory lies a major supply chain problem.

Designed for long term product availability, Semiconductor Lifecycle Management (SLiM™) at Teledyne e2v is a program focused solely on supporting clients eager to find a stock management system that extends product availability over the project lifetimes demanded by sophisticated customers including governments. SLiM provides a minimum of fifteen years of component supply security. Though semiconductor supply chains are agile, they remain highly profit focused and are designed to support consumer product cycles that run between 6 to 18 months in duration. Aerospace, military and even some industrial programs cannot afford strategic silicon disappearing that quickly; especially when end customers demand component spares and maintenance supplies that must remain available for as long as twenty years.

The SLiM program functions around four primary capabilities:

- Centrally managed, secured supply of original manufacturer's components
- Protected wafer-bank stores, matched to customer's lifetime demand profile
- Vendor accredited, final manufacturing (package and test) capabilities
- Trusted re-engineering and re-design capabilities to pre-empt supply chain weaknesses

The benefits arising from SLiM include:

- Guaranteed supply longevity
- Prevention against counterfeiting
- Improved supply integrity – sole supplier
- Significantly reduced supply cost risk

Qormino offers a new approach to rapid, low risk embedded design without the traditional headaches of managing the separate, disconnected processor and memory supply chains.

Qormino availability

- **QT1040-4GB**, based on T1040 Quad e5500 Core, implementing 4GB of DDR4 SDRAM is in mass production today, available in military and industrial grade versions with lead and RoHS finish options.

- **QLS1046-4GB** is based on NXP LS1046 Quad ARM® Cortex® A72, and implements 4GB DDR4 SDRAM. Teledyne e2v is supporting customers starting their designs on QLS1046-4GB.

- **QLS1046-4GB-Space**, also based on NXP LS1046 Quad ARM® Cortex® A72 and 4GB of DDR4 SDRAM, is a specific version for Space applications, currently under feasibility assessment.

Figure 4 – Qormino QLS1046-4GB

As accredited partners, Teledyne e2v are committed to a Qormino roadmap tracking the latest developments in NXP's processor family. Future options will also expand the amount of DDR SDRAM provisioned, matching specific needs of each individual processor.

Speed up and SLiM down your embedded designs

Qormino has eliminated two key risks when selecting complex core processors and memory components used in long lifecycle projects across military, aerospace, medical and even industrial markets. Customers alleviate supply chain risks associated with the strategic processors and the SDRAM memories with which they are teamed. Long term module availability is guaranteed under Teledyne e2v's proven SLiM program.

Furthermore, users don't have to involve themselves with the complex memory design, saving significant time and effort. They obtain a SDRAM memory system guaranteed over the operating temperature range of the module. The tiny real estate demands of the Qormino substrate means designers can simply drop it onto their board design to instantly access the myriad SWaP benefits of QorIQ processors.

So finally, a highly capable communication processor is paired with optimal memory and supplied as a single, guaranteed component. Now even the most risk averse projects can rapidly deploy powerful QorIQ embedded computing, safe in the knowledge of a secured supply chain. One provided by Teledyne e2v, a trusted advanced electronics supplier.

To learn more, visit Teledyne e2v's website at: https://www.teledyne-e2v.com/products/semiconductors/qormino/.

Alternatively, request a call by contacting our representative: Thomas.GUILLEMAIN@teledyne-e2v.com