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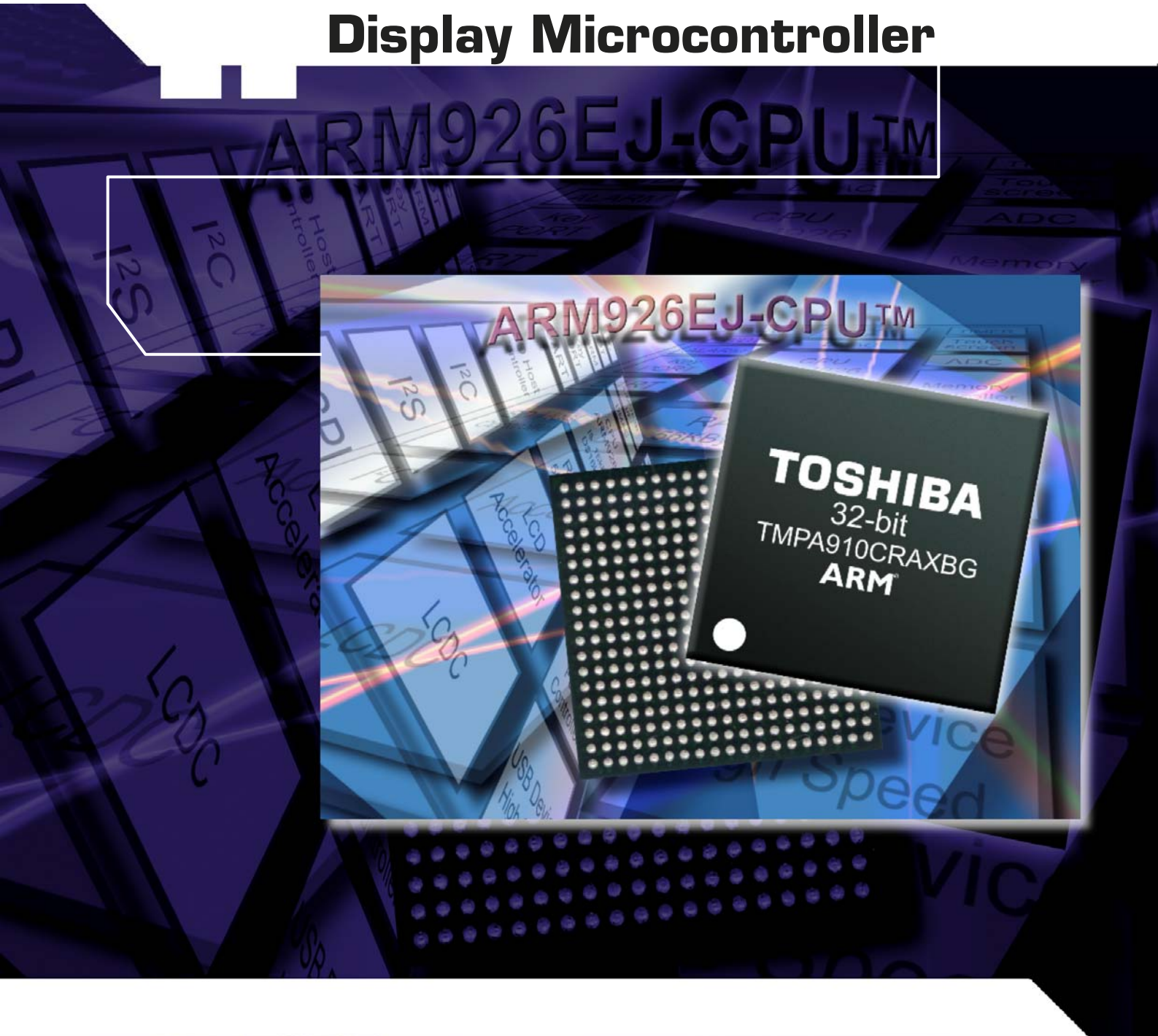
Leading Innovation

Simple Solutions for advanced Display Applications

Display Microcontroller



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LCD drivers get on board

Integrated display drivers now offered across 8-, 16- and 32-bit micros

As the technology has improved, production volumes increased and prices fallen it has become increasingly practical and cost-effective to integrate different types of LCDs into a host of modern electronic applications. As a result we have become used to finding LCDs on everything from utility meters to washing machines. What's more, a growing number of these are colour displays that significantly enhance the man machine interface (MMI) – think of automotive infotainment and navigation systems, consumer electronics products such as MP3 players, industrial control and security systems, portable test and monitoring equipment and even the latest web-enable refrigerators. Indeed, there is hardly an application area that into which the LCD has not made its way.

For the engineer, choosing the optimum LCD product from the wide variety of options on the market is only one part of the challenge. To ensure that the necessary MMI functionality is delivered within time-to-market, budget, power and space constraints also requires careful consideration of the technology that will be driving the display. And it is to address these requirements that microcontroller manufact-urers have been developing devices that speed development times and minimise BoM, footprint, power consumption and cost through the integration of on-board LCD driver functionality.

The sheer range of potential applications - and, therefore, processing requirements – that are now open to the integration of LCD technology has driven the integration of driver functionality into microcontrollers at all levels. As a result, embedded LCD drivers can be found across 8-, 16- and 32-bit devices, allowing designers to support the smallest to the largest LCD modules from a single chip.

The range of products from Toshiba, which features an 8-bit to 32-bit line-up capable of driving everything from the simplest 24x4 to 80x32 segment LCD up to WVGA 800x480 pixel full colour graphics modules. This range encompasses every possible microcontroller option, from high-performance 200MHz 32-bit devices to low power 8-bit parts with µA power down modes.

Line-up of Focus Products

Originally developed to support the pocket electronic dictionaries popular in Asian markets, Toshiba's TMP92CZ26 MCU provides a good example of the state-of-the-art of high-performance devices with integrated LCD driver. This high-performance, low-power consumption 32-bit device combines high-level processing, high-capacity memory, and integrated colour LCD controller in a compact 20mm x 20mm package.

Running at up to 80MHz internally, the TMP92CF29FG keeps power consumption during operation to just 80mW. The MCU combines 144Kbytes of on-board RAM with a 65K colour TFT/262K colour STN LCD controller, a number of on-board peripherals, and a variety of connectivity options - including a touch screen interface. Use of an LQFP package - rather than the BGA package typical of devices with this level of functionality - allows further cost reduction by simplifying PCB design.

The TMP92CZ26 TMP92CF29 are based on Toshiba's TLCS-900/H1 32-bit CISC core, which can accommodate 47 interrupts and provides three HALT modes plus a 'key on wakeup' facility to minimise power consumption during standby.
With the latest generation a new Core (ARM9) has been introduced. The first product is the TMPA910CRAXBG

New

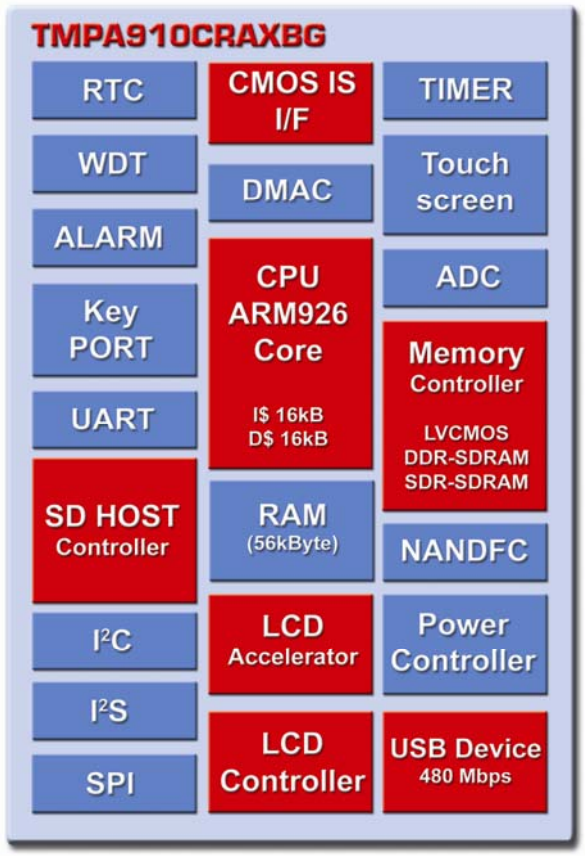
	TMP92CZ26AXBG	TMP92CF29FG	TMPA910CRAXBG
MCU Core	Toshiba 900/H1	Toshiba 900/H1	ARM926EJ-S
CLK(internal)	80MHz/1.5V	80MHz/1.5V	200 MHz/1.5V
Min instr.	12.5ns	12.5ns	5 ns
MAC (Multiply Accumulate Calculation unit)	1 ch.	1 ch.	Single-cycle
LCD-CTRL	Gray/Color 640*480max	Gray/Color 640*480max	TFT, STN panels 800x480 (max. 1024x1024)
LCD Process Accelerator	n/a	n/a	- Scaling - Filtering - Image Blending
10bit A/DC	6 ch.	6 ch.	6 ch.
ROM size	8kB (Boot)	8kB (Boot)	16kB (Boot)
RAM size	288kB (92CZ26A) 144kB (92CF26A)	144kB	56kB
DRAM-CTRL	SDRAM Program execute	SDRAM Program execute	LVCMOS DDR SDRAM/Mobile SDRAM
UART/SIO	1 ch.	2 ch.	2 ch.
IrDA1.0	1 ch.	2 ch.	1 ch.
SBI/I2CBUS	1 ch.	1 ch.	2 ch.
SPI	1 ch.	1 ch.	2 ch.
MMU	3.1 GB max.	2.1 GB max.	2.5 GB
8bit Timer	8 ch.	8 ch.	n/a
16bit Timer	2 ch.	2 ch.	6 ch.
USB-CTRL	USB 1.1	USB 1.1	USB 2.0 (480Mbps)
NANDF-Ctrl.	2 ch. (MLC)	2ch. (MLC)	2 ch. (MLC)
SD-Host Ctrl.	n/a	n/a	up to 32 GB
Package	228pin FBGA	176pin LQFP	361pin BGA (16x16)

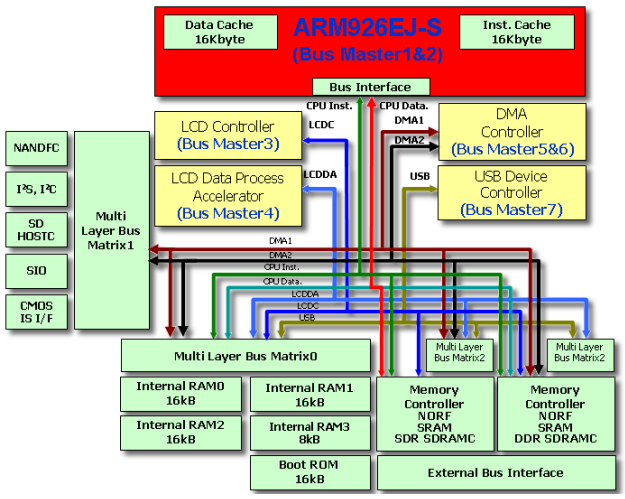
TMPA910CRAXBG

Microprocessor combines 32-bit ARM processor with graphics control and processing functionality to simplify Industrial, Consumer and Multimedia applications

Low power device features ARM926EJ-CPU™ core, LCD controller with image process accelerator, touch screen interface, CMOS image sensor input, High speed USB Device (480Mbps), SD Host Controller and comprehensive connectivity options.

- **CPU Core**
  - ARM926EJ-S I$16kB/D$16kB
  - Multi-Layer (7 Layer)
  - Operating Frequency 200MHz
  - Operating Voltage
    - Internal Circuit 1.5V +/- 0.1V
    - External I/O 1.7V to 1.9V
    - External I/O 3.0V to 3.6V
- **Features**
  - STN/TFT color LCD controller
    - Supports 800x480
    - 16-/24-bit color
  - LCD Data Process Accelerator
    - Scaling function (expansion/reduction)
    - Filter function (bi-cubic convolution)
    - Image blending function (font blending)
  - DMA Controller
  - CMOS Image Sensor I/F
  - Memory Controller:
    LVCMOS SDR/DDR-SDRAM/NORFLASH/NANDFLASH
  - SD Host Controller 50MHz, 32GB
  - USB Device (High Speed 480Mbps)
  - 2 ch. of: SPI / UART / I²C / I²S
  - RTC
  - 16-bit Timer (6x)
  - Touch screen I/F
  - 6 ch. 10bit A/D converter (3.0V to 3.6V)
- **Package**
  - BGA361 (16mm x 16mm) 0.8mm pitch ball





Multi Layer (7):

1.CPU Data 2.CPU Instruction 3.LCD Controller
4.LCD Accelerator 5.DMA Ctrl. 1 6.DMA Ctrl. 2
7.USB

Scaling

α-Blending and Font Mix Support

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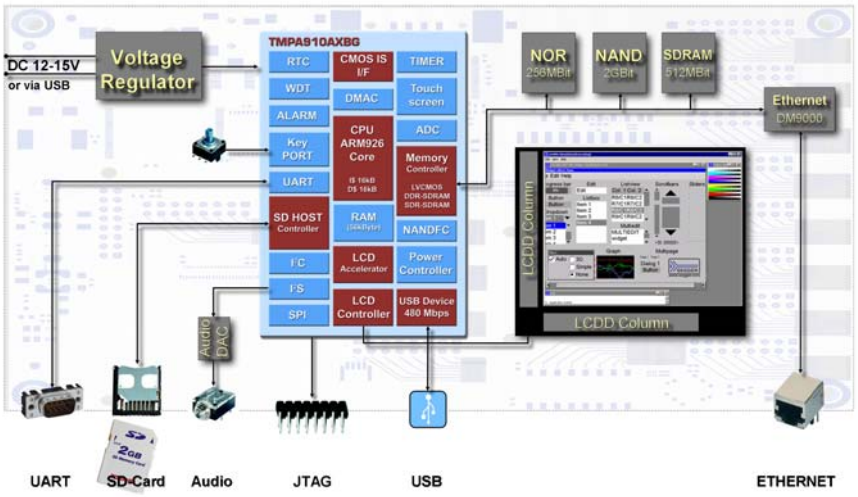
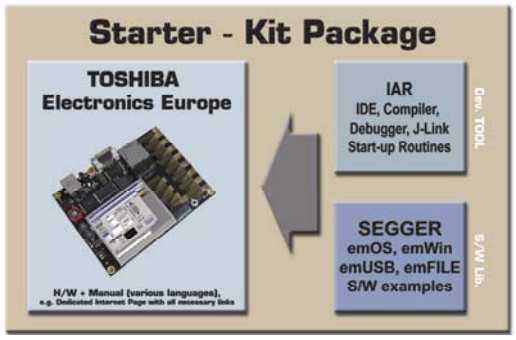
TMPA910 Starter Kit

- **Compact size (11cm x 15cm)**
- **Supported MCU**
  - Toshiba TMPA910CRAXBG (ARM9)
- **Features**
  - Includes a 3,5“ Display with Touch Screen
  - J-Link Interface
  - Ethernet Connection
  - USB 2.0 (480MBps), RS232
  - Excellent Sound (Audio DAC via I²S))
  - SD-Card Socket
  - JTAG Interface
  - Memory:
    - 512 MBit SDRAM
    - 256 MBit NOR Flash
    - 2 GBit NAND Flash
  - Single Power Supply

- Extensive Software Support
  - E.g. Segger for emWin, emOS etc.
  - Many Software examples available
- Plug & Play! Excellent Tool for fast Prototyping
- Schematics and Layout Data provided by Toshiba



System Configuration



Partner Package

On-Line Support

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