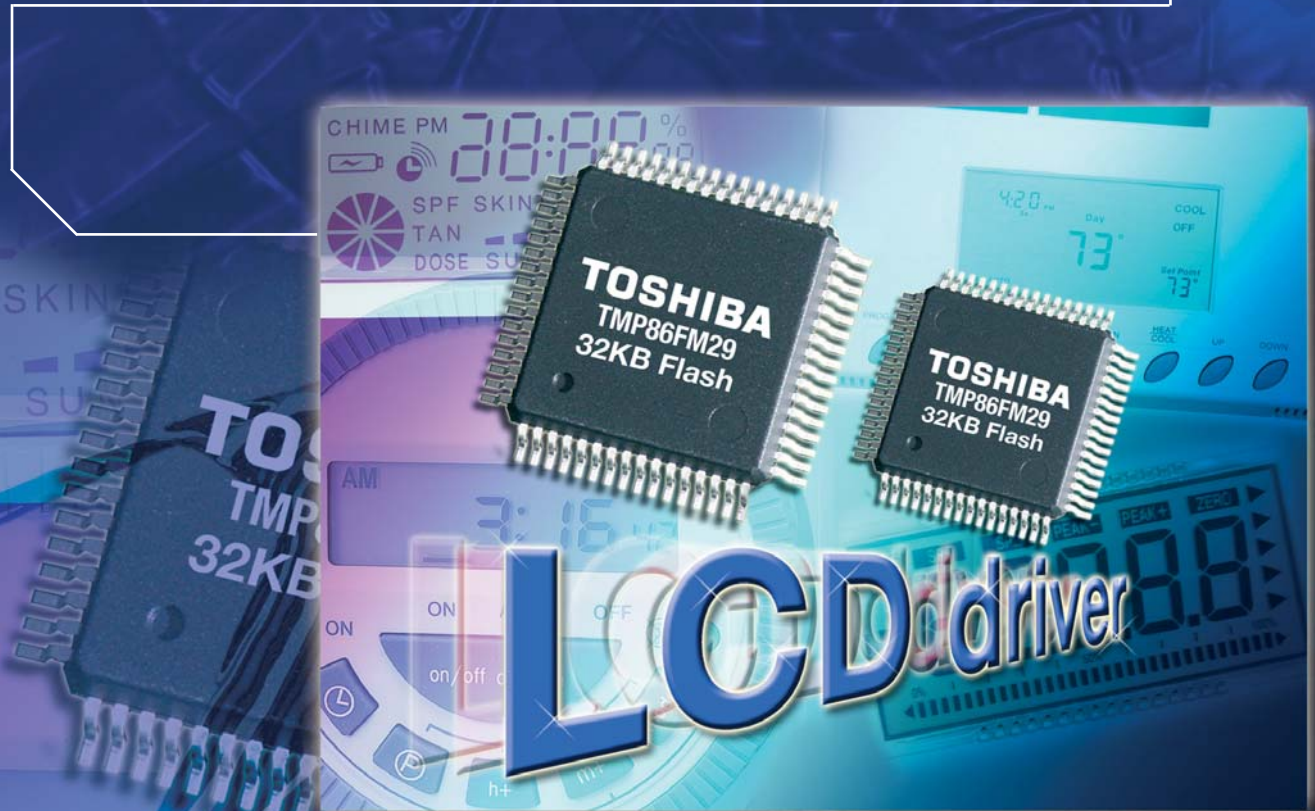


TOSHIBA

Selectable Performance
from 16MHz speed to
 μ a power down modes

LCD Driver MCU



LCD driver

LCD driver

Overview/Architecture

LCD driver MCUs for display applications

Toshiba offers a seamless 8-bit up to 32-bit MCU product line-up with embedded LCD driver, supporting driver sizes from 24x4 segments up to 640x480 pixel for colour graphic displays, eliminating the need for an extra LCD driver chip. The single chip concept is ideal for portable and other space-limited applications that demand minimum component count, flexible configurations, and high performance, low-power operation.

An on-board LCD driver with built-in voltage booster automatically creates the higher display voltage necessary for driving 3 V or 5 V LCD-glasses from a typical one or two cell battery design.

The implemented TLCS-870/C CPU core offers 731 basic instructions supporting the C-compiler to generate minimum code size. This core enables operation at up to 16 MHz with voltages between 1.8 V and 5.5 V. In addition to normal operation, three IDLE modes, a SLOW mode, two SLEEP modes and a STOP mode ensure minimum power consumption across a range of operating conditions. SLOW modes minimize current consumption down to 7 μA through the use of a low-frequency clock operating at 32.768 kHz, keeping the display operated, whereas STOP mode decreases current consumption below 1 μA .

Key Features

- Integrated LCD driver
- Stable display contrast through internal voltage booster
- Low power consumption
- Low noise
- Integrated MAC unit
 - 16-bit multiplication
 - 32-bit addition

Applications

- Heating control system
- Thermostat
- IEC61036 Class 1 compliant utility meter
- Industrial automation
- Portable equipment
- Home appliances
- White goods

Operating Mode			Oscillator		CPU core	TBT (Time Base Timer)	Other periphera	Machine cycle
			High freq.	Low freq.				
Single Clock	RESET		Oscillation	Stop	Reset	Reset	Reset	4/ fc (s)
	NORMAL	5,3 mA			Operate	Operate	Operate	
	IDLE1	3,1 mA			Halt			
	IDLE0	2,2 mA						
	STOP	0,5 μA	Stop		Halt	Halt		
Dual Clock	NORMAL2	5,3 mA	Oscillation	Oscillation	Operate with high freq.	Operate	Operate	4/ fc (s)
	IDLE2	3,1mA			Halt			
	SLOW2	3,1mA			Operate with low freq.			
	SLEEP2	3,1mA			Halt			
	SLOW1	7 μA	Stop	Stop	Operate with low freq.	Halt	Halt	4/ fs (s)
	SLEEP1	5,5 μA						
	SLEEP0	4,5 μA						
	STOP	0,5 μA						

Flash

Customers participate from the latest Flash MCU developments with Toshiba as one of the leading Flash manufacturer worldwide. Single voltage, high-speed Flash, in-application programming, the flexibility to take any MCU interface for the programming process, and different protection mechanisms against code-readout became standard with Toshiba Flash Microcontroller.

Tools

Either Hardware or Software, Toshiba provides the complete development tool-chain with a distinct support interface to assist customers during the design-in phase. The development platform usually comprises the Emulator and the IDE. Middleware, RTOS, application notes and IP-software are available in addition.

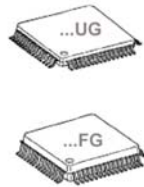
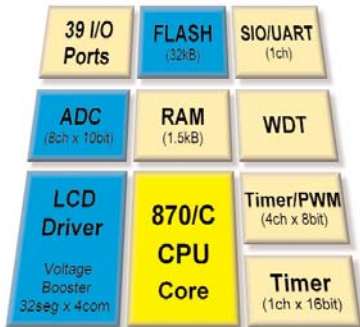
Mask

For price sensitive projects Toshiba supports customers with the alternative to release a masked ROM Microcontroller. This service is offered from a total project quantity of already 5000 pcs onwards. The complete mask ROM process takes only 6 weeks in average until first silicon is provided.

MCU Examples

32seg x 4com

86FM29: 128 Segments LCD driver MCU in 64-pin package



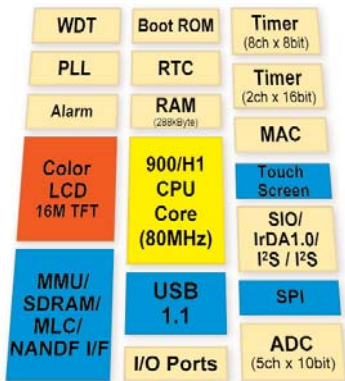
Memory variations:

Type	ROM/RAM [kB]
Mask	8/0.5
Mask	16/1.5
Mask	32/1.5
OTP	32/1.5
Flash	32/1.5

- TLCS 870/C core
 - 0,25µs @ 16MHz/2.7V – 3.6V
 - 0,50µs @ 8MHz/1.8V – 3.6V
 - 122µs @ 32kHz/1.8V – 3.6V
- Package
 - 64-pin LQFP (10x10mm)
 - 64-pin QFP (14x14mm)
- LCD driver/controller
 - Built-in voltage booster for LCD driver
 - With display memory
 - LCD direct drive capability (32seg x 4com max.)
 - 1/4, 1/3, 1/2 duties or static drive
- Power consumption
 - Normal (16MHz), 5.0mA (Flash)
 - Slow (32kHz), 850µA(Flash) or 7µA(RAM)
 - Standby (Stop), 0.25µA to 0.5µA

92CZ26: VGA LCD controller MCU in 228-pin package

640 x 480 pixel

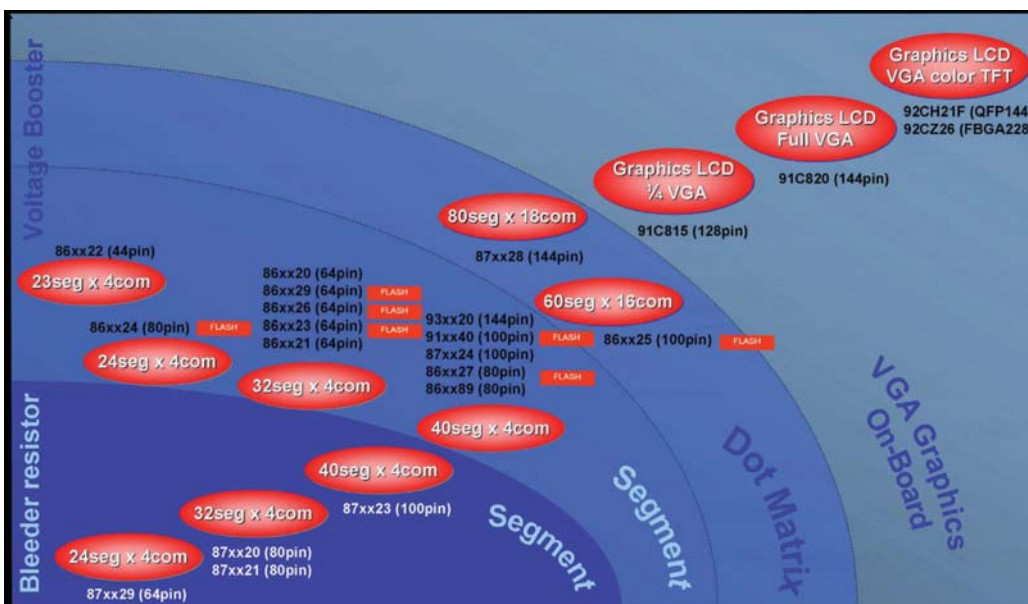


Software IPs:

- mITRON OS
- TCP/IP Stack
- HTTP Server
- PPP Client
- SMTP Client
- FAT File System
- Smart Media Driver
- CF / SD Card Driver

- TLCS 900/H1 core
 - 80MHz / 3.0V ~ 3.6V
 - 288k byte RAM; 8k byte Boot ROM
- Package
 - 228-pin FBGA (15x15mm)
- Features
 - 4k-STN/16M-TFT color LCD controller
 - DMA Controller
 - MAC (32x32+64=64)
 - MLC NANDF I/F
 - SD Card I/F (Only SPI)
 - USB1.1 (Full Speed)
 - SIO / UART / I²C / I²S
 - RTC, Touch screen I/F
 - 10bit A/D converter

Roadmap

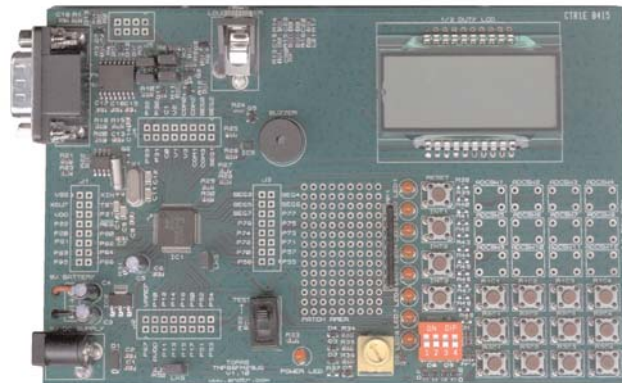


Starter Kit

LCD driver MCU Starter Kit

To simplify development and support, Toshiba has created a Starter Kit for display applications. The TOPAS Starter Kit series combines a hardware development board with debugging and development software, a flash memory programmer, and extensive software libraries, examples, and application notes. In addition to the LCD driver MCU itself, the development board incorporates an LCD glass, a keypad, trigger buttons, status LEDs, a serial EEPROM device, a buzzer, a loudspeaker connector, and a variety of interfaces including RS232, and I2C.

The supplied IDE provides everything needed for debugging, program building, editing and programming, and simulation. The incorporated simulator provides full core and peripheral simulation. The ROM monitor offers a number of debug and editing functions, allowing designers to use the Starter Kit in place of an in-circuit emulator.



Starter Kit Features

- Many on-board components
- Extended debugging functions
 - Simulator & Debugger
 - ROM monitor for core & peripheral debugging
- IDE, Compiler & Project manager
- Flash programmer
- Extensive software libraries
 - Application notes
 - Software IPs
 - Tutorials & Examples

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