Excellent Integrated System Limited

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

Texas Instruments
LM9704SL

For any questions, you can email us directly:
sales@integrated-circuit.com

National Semiconductor

October 2002

LM9704 Real Time Digital Image Processor *(side margin)*

LM9704 Real Time Digital Image Processor

General Description

The LM9704 contains all functions needed to build an SXGA or VGA digital still and video camera. It incorporates a 16 bit RISC microprocessor, a flexible image processing pipeline, hardware JPEG compression, and the required peripheral modules in a single IC. This architecture allows a very fast click-to-click time and full resolution video without sacrificing image quality or cost; because the computation extensive operations are processed by circuitry dedicated to image processing. The highly optimized memory management provided by the LM9704 keeps the memory cost of the complete camera to a minimum.

A chip set comprising of the LM9704 and a National SXGA or VGA CMOS image sensor complemented by a lens, battery, compact flash, power management for the battery, and LCD (optional) yields a complete high performance cost effective digital still and/or video camera.

Features

- Embedded 16 bit RISC processor system
  - Up to 16M-bytes of external memory addressing space
  - 32K-bytes Internal RAM
  - 6 channel DMA
  - 8 channel versatile timer
  - Interrupt controller
  - 16 input wake up module
  - Full duplex USART
  - μwire/SPI serial port
  - 16 general purpose IOs (GPIO)
- Glueless CMOS image sensor interface
- ACCESS.bus serial interface for imager sensor control
- Integrated USB v1.1 for connection to PC
- Raw Image Data Processor
  - Defective pixel correction
  - Digital gain and brightness adjustment
  - Raw data statistics measurement engine
- Color Image processing
  - Bayer to RGB Interpolation
  - Fully programmable color correction
  - Image sharpening
  - Programmable gamma correction
  - Thumbnail generation
  - RGB to YCrCb conversion
  - Digital gain
- Hardware JPEG Compression for both video and snapshot.
- System management
  - Internal Clock generation from 12MHz Crystal
  - Power management
  - Reset generation
- JTAG based serial on-chip debug interface

Applications

- PC Cameras
- Dual Mode Cameras
- Digital Still Cameras
- Clip-on Cameras for PDA's, Cell Phones, etc.
- Embedded Cameras for PDA's, Cell Phones, etc.
- Industrial Cameras

Key Specifications

Array Formats	CIF, VGA, SXGA
Input Color Format	Bayer Pattern
Digital Image Processor	10 bit (12 bit internal)
Compression - Format - Ratio	Base Line JPEG Programmable
Video In Frame Rate	up to 15MHz pixel clock
Video Outputs - USART - USB	up to 921.6K-bits per second 960K-byte/s
External CR16C Memory - Memory Type - Address Space - Speed	SRAM, Flash, Compact Flash, EEPROM up to 16 Mbyte up to 36MHz
Serial Interfaces - ACCESS.bus - μwire/SPI	up to 400KHz up to 6.0 MHz
16 bit RISC Processor - MIPS - Internal Memory	up to 36 32K-bytes
Clock Speed	up to 60 Mhz from 12MHz Crystal
Power Supply - Core - IO	2.25 to 2.75 Volt 2.7 to 3.6 Volt
Average Power Dissipation	95mW
Package	128 Pin Laminated CSP
Operating temperature	$-10^{o}C$ to $+85^{o}C$

System Block Diagram
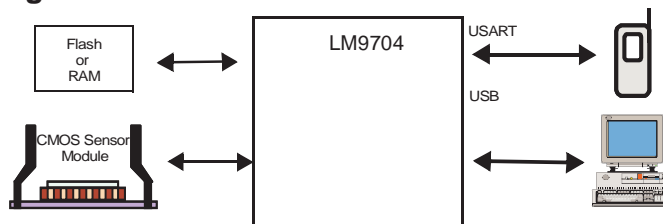
Overall Chip Block Diagram
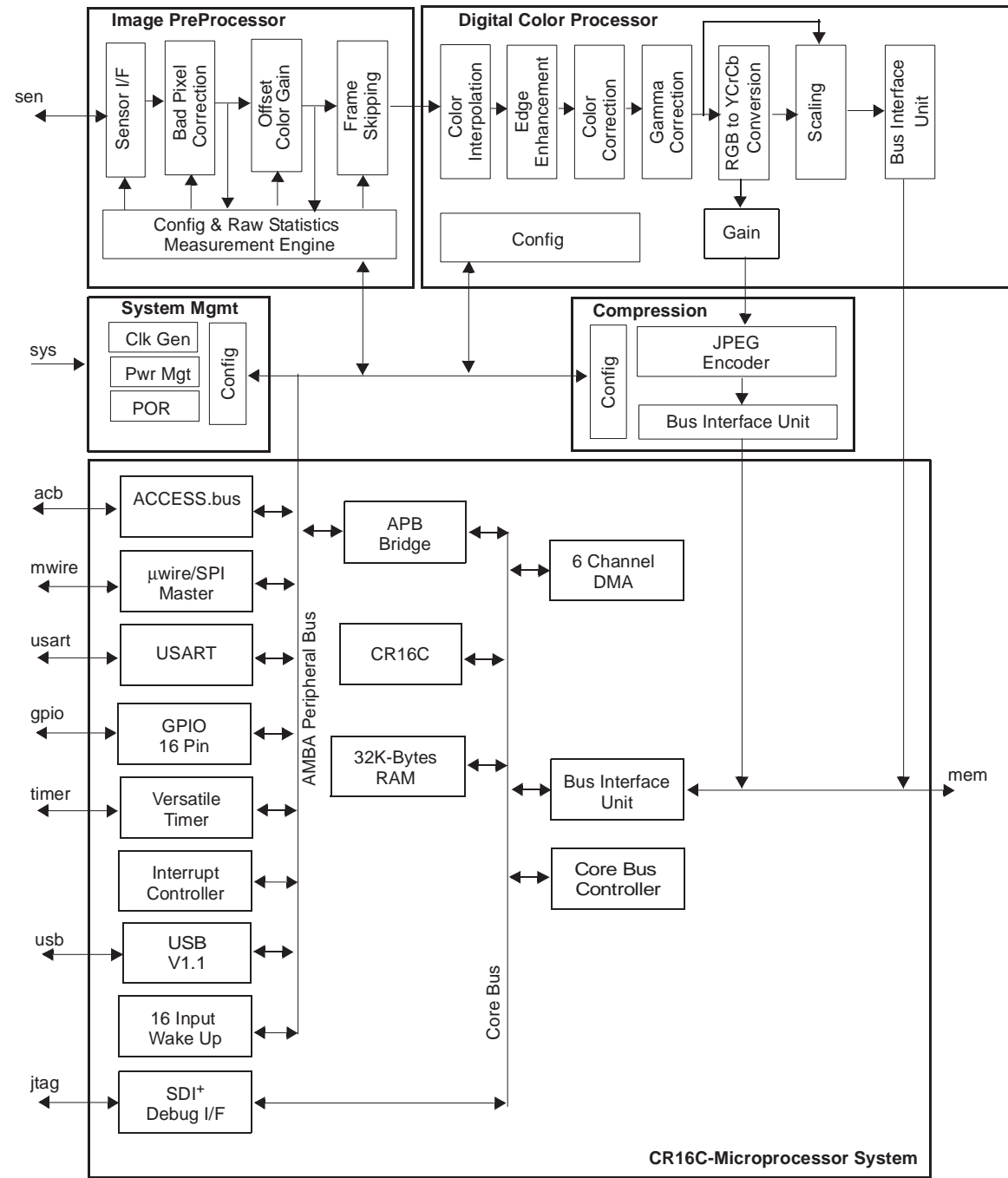
Chip Block Diagram
Figure 1.

Ordering Information

| Item	Description	Part Number
LM9704	LM9704 Real Time Digital Image Processor	LM9704SL

Related Products

Item	Description	Part Number
Development Kit	LM9704 digital image processor camera development kit. This kit includes the above mentioned camera base board, a power supply board, status LCD board, power adapter, windows application software SNAPS DEV.	LM9704DEV-KIT
Camera Board	LM9704/02 digital image processor camera base board.	LM9704CAMBOARD LM9702CAMBOARD
Software Devlopment Kit	This kit includes CR16C software development tools, National's Camera Operating System (NCOS) & an iTAG emulator.	CR16-IM04-00
Compact-Flash Adaptor	This is a small 16 bit CompactFlash adaptor board that can be attached to the LM9704CamBoard/LM9702CamBoard allowing CompactFlash cards to be connected to the main system memory bus	LM97COMPACFLASH
SD/MMC Adaptor	This is a small SD/MMC adaptor board that can be attached to the LM9704CamBoard/LM9702CamBoard allowing SD and MMC cards to be connected to the LM9702/LM9704 digital image processor	LM97SDCARD
Head Boards	VGA color sensor LM9627 VGA monochrome sensor LM9617 VGA color sensor LM9628 VGA monochrome sensor LM9618 128x100 monochrome sensor LM9630 VGA monochrome sensor LM9637 VGA color sensor LM9647 SXGA monochrome sensor LM9638 SXGA color sensor LM9648	LM9627HEADBOARD LM9617HEADBOARD LM9628HEADBOARD LM9618HEADBOARD LM9630HEADBOARD LM9637HEADBOARD LM9647HEADBOARD LM9638HEADBOARD LM9648HEADBOARD
Lens Kits	1/3" lens kit for the LM9627, LM9617, LM9628 or LM9618 1/5" lens kit for the LM9630 1/4" lens kit for the LM9647, LM9637 1/2" lens kit for the LM9648, LM9638	LM96-1/3LENSKIT LM96-1/5LENSKIT LM96-1/4LENSKIT LM96-1/2LENSKIT

Packaging Information
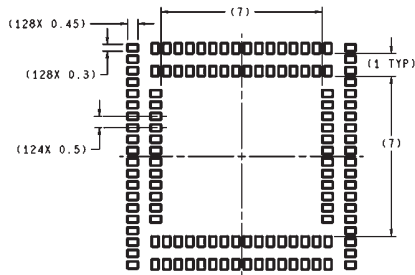
RECOMMENDED LAND PATTERN
1:1 RATIO WITH PACKAGE SOLDER PADS

DIMENSIONS ARE IN MILLIMETERS
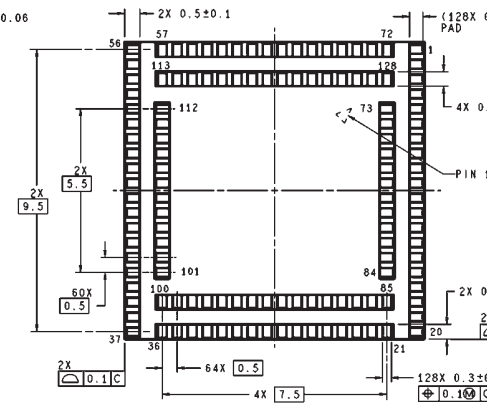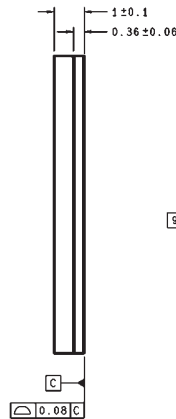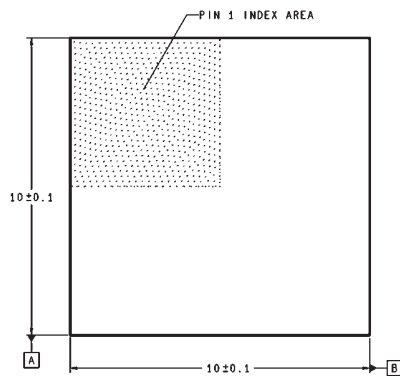
LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.