DATA SHEET

MPEG Multichannel

PNX7100
MPEG AVG CODEC

Objective specification
File under Integrated Circuits, IC02

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Philips
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MPEG AVG CODEC PNX7100

FEATURES

Interfaces

- 32-bit 133 MHz SDRAM interface supports up to two 256 Mbit devices including one SyncFlash memory
- PCI-XIO extension bus interface supports PCI-bus (rev. 2.2) and 8-bit NAND or NOR flash
- 8 or 16-bit IDE interface ATA-4 (master)
- I^2S-bus interface to basic engine (slave)
- Byte parallel MPEG TS output to IEEE 1394 link interface
- Byte parallel MPEG TS or DV input from IEEE 1394 link interface
- Four DMA UARTs
- Two I^2C-bus master or slave transceivers
- 32 GPIO pins
- RGB (YUV), YC and CVBS output (10-bit DAC) with Macrovision copy protection
- SMPTE 293M progressive digital video output interface
- ITU-R BT.656 digital video output interface
- ITU-R BT.656 digital video input interface
- Four serial two-channel audio outputs for multichannel and headphone (I^2S-bus format)
- Serial IEC 60958 or IEC 61937 audio output (SPDIF format)
- Serial two-channel audio input (I^2S-bus format)
- Two serial IEC 60958 or IEC 61937 audio inputs (SPDIF format).

Control

- High performance 133 MHz PR3940 RISC (32-bit MIPS-II and MIPS16 CPU) with 16 kbyte instruction cache, 8 kbyte data cache and 4 word write buffer
- Low-power mode including wake-up on interrupt
- Boot from NAND, NOR or SyncFlash memory or I^2C-bus
- Two 24-bit timers
- 24-bit watchdog timers.

System

- Single 4 MHz clock input, all necessary clocks generated on-chip
- Hardware based sector processor: DVD and VCD support
- CSS decryption module
- CPRM encryption and decryption module

MPEG Multichannel

- Hardware MPEG TS demultiplexer supports simultaneous record and playback
- Software MPEG PS demultiplexer
- Software controlled data stream manager assisted by scatter-gather DMA
- Software controlled MPEG TS, PS or PES multiplexer.

Video decoder

- MPEG-2 Main Profile at Main Level (MP@ML) decoder
- DV video decoder
- Software controlled trick play, assisted by hardware PES and ES pre-parser.

Graphics

- Region based linked list graphics
- 2, 4 or 8 bits per pixel with (24 + 6T)-bit CLUT
- 16 bits per pixel YUV
- 16 or 32 bits per pixel RGB
- Anti-flickering with 2 or 3 tap filter
- 64 levels alpha blending
- S-VCD RTG support
- DVD sub picture unit
- Two YUV 4 : 2 : 0 or 4 : 2 : 2 planes with flexible 2D scaling and positioning
- YUV 4 : 2 : 2 progressive display unit
- 4 bits per pixel hardware cursor with (14 + 2T)-bit CLUT.

Audio decoder

- MPEG-1 layer I and II, MPEG-2 layer II up to 5.1 channel
- Dolby®(1) Digital AC-3 up to 5.1 channel
- DTS up to 5.1 channel
- PCM up to 24 bits at 96 kHz
- MP3
- DV audio
- CD audio
- Baseband audio control
- Karaoke.

Video encoder

- MPEG-2 MP@ML encoder
- High quality input scaler from D1 to $^{2}/_{3}$D1, $^{1}/_{2}$D1 or SIF
- Millennium watermarking detector
- I, IP and IBP encoding at 1 to 15 Mbps
- CBR, CVBR and VBR
- Full motion vector search range
- Adaptive noise filter
- Scene change detection.

Audio encoder

- MPEG-1 layer II 2-channel
- Dolby Digital Consumer Encoding AC-3 2-channel
- Compressed audio bypass
- Sampling frequency 48 kHz
- Sample rate converter.

General

- EJTAG for board test and debug
- 3.3 V pad supply voltage
- 1.8 V core supply voltage
- BGA388 package (352 + 36 centre heat balls)
- 0.18 µm CMOS process.

APPLICATIONS

- Digital recording systems.

(1) **Dolby** - is a registered trademark of Dolby Laboratories Licensing Corporation.

GENERAL DESCRIPTION

The PNX7100 is a single-chip MPEG-2 audio and video encoder and decoder with associated multiplexing and demultiplexing functionality, targeted for digital recording systems.

The PNX7100 has a unified memory architecture that allows the MPEG subsystem, graphics and CPU to share the external SDRAM. External memory mapped peripherals can be connected to the PCI-XIO bus interface.

Besides an MPEG encoder and decoder, the PNX7100 includes a high performance MIPS CPU core, running synchronously with the on-chip SDRAM memory controller at 133 MHz, with peripherals for embedded and system control, various data streaming units for interfacing to data sources and sinks, two graphics engines for graphics interface and DVD graphics, two video display units to display the decoded MPEG stream and captured input video and a mixer to blend the graphics and video planes.

Data sources and sinks can be connected to an $I^{2}S$-bus optical basic engine interface, an interface and an IEEE 1394 link interface.

The decoder function includes a sector processor, a CSS decryption block, an MPEG PS and TS demultiplexer, an MPEG video decoder, a DV decoder, a multi-format audio decoder and a DVD sub-picture decoder.

The encoder function includes a video input processor, a video encoder, an audio encoder, an IEEE 1394 interface and a software multiplexer. A watermarking detector monitors the encoder input data to detect ‘copy never’ input data. If such data is detected, the encoder is disabled to prohibit illegal copies.

The PNX7100 can be cascaded to form a DV-to-MPEG, or a MPEG-to-MPEG transcoder. MPEG data is passed from decoder to encoder to aid in achieving a high quality transcoder.

The video output stage comprises two independent mixing paths: one path is YUV and the second path can be RGB or YUV. The mixer resolution is 4 : 4 : 4. Each mixer path has as input the following planes (the order is from bottom to top):

- Background colour
- Display unit 1
- Display unit 2
- Sub picture unit
- OSD graphics
- Cursor.

The mixer result can be output as digital ITU-R BT.656 data and as analog RGB (or YUV), CVBS and YC. All six analog outputs support Macrovision copy protection (v7.1). One of the mixer outputs can be captured to SDRAM.

An additional unit performances de-interlacing to provide progressive output to a SMPTE 293M digital interface. Different de-interlacing filters can be chosen: line-averaging, field insert, median filter or a majority selection of the 3 above mentioned filters.

The PNX7100 has a scatter-gather type DMA based stream manager. This enables complex high-speed data streaming under software control with little software overhead.

Advanced software debug is made easier via an on-chip EJTAG interface and debug support unit.

To support advanced board testing facilities, the PNX7100 includes boundary scan test hardware, according to the JTAG standard.

Patent notice

Use of the Macrovision anticopy process in the device is licensed for non-commercial home use only. Reverse engineering or disassembly is prohibited. Please contact your nearest Philips Semiconductors sales office for more information.

Notice is herewith given that this integrated circuit uses one or more of the following US patents and that each of these patents may have corresponding patents in other jurisdictions: US 4631603, US 4577216 and US 4819098.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PNX7100E	BGA388	plastic ball grid array package; 388 balls; body 35 × 35 × 1.75 mm	SOT532-1

BLOCK DIAGRAM

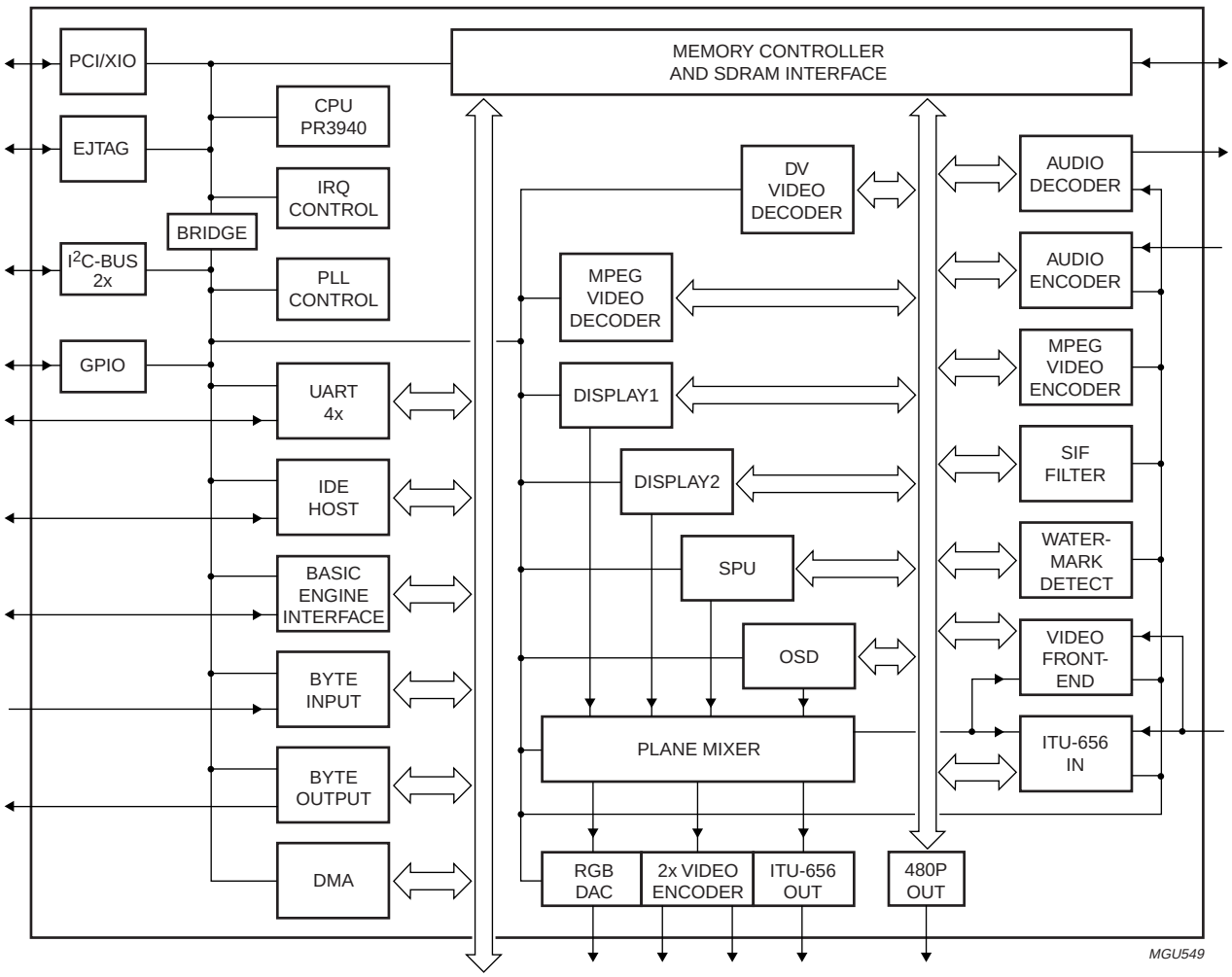
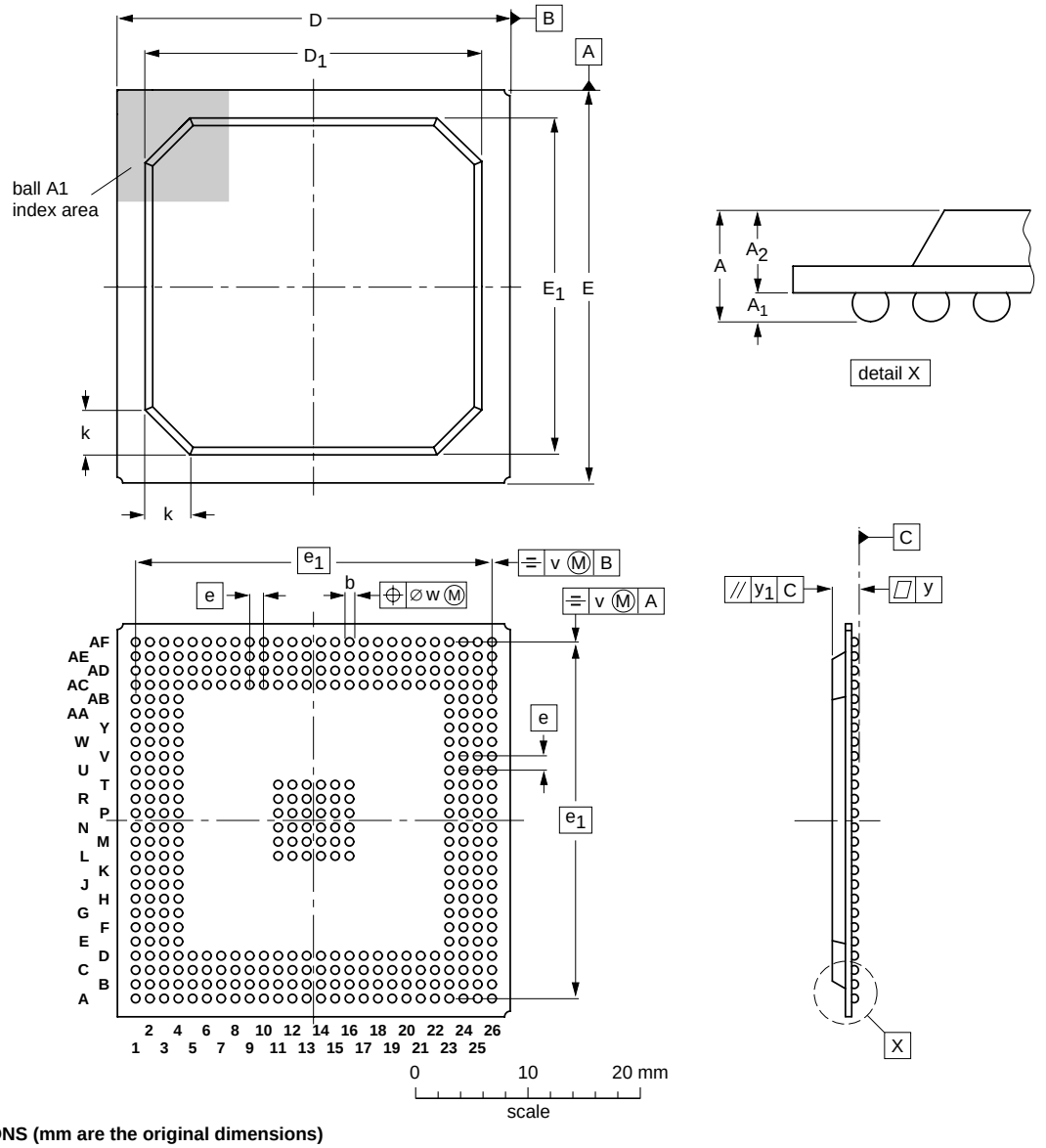


Fig.1 Block diagram.

PACKAGE OUTLINE

BGA388: plastic ball grid array package; 388 balls; body 35 x 35 x 1.75 mm **SOT532-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	b	D	D_1	E	E_1	e	e_1	k	v	w	y	y_1
mm	2.54	0.7 0.5	1.84 1.62	0.9 0.6	35.2 34.8	30.70 29.95	35.2 34.8	30.70 29.95	1.27	31.75	4.1 3.9	0.3	0.1	0.15	0.35

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT532-1						~~00-02-29~~ 00-03-04

SOLDERING

Introduction to soldering surface mount packages

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

There is no soldering method that is ideal for all surface mount IC packages. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended.

Reflow soldering

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250 °C. The top-surface temperature of the packages should preferable be kept below 220 °C for thick/large packages, and below 235 °C for small/thin packages.

Wave soldering

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
  - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

  The footprint must incorporate solder thieves at the downstream end.
- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time is 4 seconds at 250 °C.
A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Manual soldering

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

Suitability of surface mount IC packages for wave and reflow soldering methods

PACKAGE	SOLDERING METHOD	
	WAVE	REFLOW(1)
BGA, HBGA, LFBGA, SQFP, TFBGA	not suitable	suitable
HBCC, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, HVQFN, SMS	not suitable(2)	suitable
PLCC(3), SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended(3)(4)	suitable
SSOP, TSSOP, VSO	not recommended(5)	suitable

Notes

1. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the *"Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods"*.
2. These packages are not suitable for wave soldering. On versions with the heatsink on the bottom side, the solder cannot penetrate between the printed-circuit board and the heatsink. On versions with the heatsink on the top side, the solder might be deposited on the heatsink surface.
3. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.
4. Wave soldering is only suitable for LQFP, TQFP and QFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
5. Wave soldering is only suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

DATA SHEET STATUS

DATA SHEET STATUS(1)	PRODUCT STATUS(2)	DEFINITIONS
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For sales offices addresses send e-mail to: **sales.addresses@www.semiconductors.philips.com**.

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