High Reliability Video LSIs
Features

1 Compatible with the major formats

LAPIS Semiconductor video decoders and display controllers support NTSC, PAL, and SECAM for universal compatibility.

Applicable models:
Video decoder: All models
Display Controller: ML86V820, ML86V8401TB

4 Multiple high quality image functions

A number of image functions are built in for superior image quality, such as adaptive 2D YC separation, 2 line non-linear I/P conversion, automatic brightness and hue adjustment, brightness/color difference/RGB gain-offset/contrast difference adjustment, edge enhancement, gamma correction, and multigradation processing.

Applicable models:
Video Decoder: All models
Display Controller: All models

5 Superior synchronous stability

High synchronous stability is ensured for stable imaging, even in poor signal areas, making them ideal for vehicle TV systems.

Applicable models:
Video Decoder: All models
Display Controller: ML86V820, ML86V8401TB

8 Various image correction functions

LAPIS Semiconductor image correction ICs integrate high performance 3D noise reduction along with a host of other features, including jagless output, low brightness/backlight correction, a frame synchronizer, digital cross-color reduction, and I/P conversion.

Applicable models:
Image Correction IC: All models

9 Compatible with a wide range of temperatures

The entire lineup (excluding image correction ICs) supports operation from −40°C to +85°C, ensuring compatibility with applications requiring high reliability such as automotive and outdoor surveillance systems.

Applicable models:
All models except Image Correction IC

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Today’s increasingly sophisticated video devices for the automotive, security, and consumer markets require 'greener' components that provide superior reliability with high efficiency for lower power consumption and reduced environmental impact. LAPIS Semiconductor offers a variety of video LSIs that deliver high quality imaging, high reliability operation, and low power consumption for high performance systems of all types.

2 Industry's smallest* video decoder, encoder

The ML86V76652HA (3.96 × 3.96mm) and ML86V76655HA (3.66 × 3.44mm) video decoders are available in an ultra-compact 36pin WCSP, while the ML86V76580HA (2.5 × 2.76mm) video encoder is offered in a 25pin WCSP, making them ideal for high-density portable applications such as mobile phones.

Applicable models:
Video Decoder : ML86V76652HA
Video Encoder : ML86V76580HA

3 World's lowest* power consumption

The ML86V76652HA and ML86V76655HA features a current consumption of only 57mW and can be driven from 1.8V, ensuring compatibility with battery-driven devices of all types.

Applicable models:
Video Decoder : ML86V76652HA

*LAPIS Semiconductor survey

6 On screen display function

LAPIS Semiconductor display controllers are capable of providing onscreen text-based display. Options include 2 font sizes (16/24 dots) and multiple colors (2/4/16 - including transparent). An OSD font building tool is also provided.

Applicable models:
Display Controller : ML86V8207TC, ML86V8209TC, ML86V8401TB

7 Numerous screen display modes

LAPIS Semiconductor display controllers scale the image based on panel size. Supports the following sizes: Normal (4:3), Zoom (16:9), Wide (16:9), Panorama (16:9).

Applicable models:
Display Controller : All models except ML86V810

*Photos are for illustrative purposes only

10 Multiple support tools

A variety of support tools are available, including evaluation boards, VAStudio, an I2C BUS register tool allowing GUI-based control of the LSI, and OSDBuilder, an OSD font building tool.

Applicable models:
Evaluation Board
OSDBuilder

*Apis-semi.com/en
LAPIS Semiconductor utilizes proprietary high reliability analog/digital mixed signal technologies along with high quality image processing expertise to develop products optimized for the most demanding applications, including the security and automotive sectors. Ideal solutions include video decoders that support NTSC/PAL/SECAM and ensure stable video quality even in poor environments, display controllers that provide scaling and timing control functionality along with OSD (On Screen Display), and unique high performance image correction ICs.

Unique image processing core technologies ensure high quality imaging

Video LSI Series

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**LAPIS Semiconductor Video LSI Features**

**Feature 1**  
Market-proven reliability and performance (Automotive)

Making use of experience in providing video LSIs to a number of major domestic (Japan) car accessory makers for a long time, LAPIS Semiconductor has accumulated the technology for achieving high video quality while driving or in a hostile environment such as wide temperature variation. Recently, the demand for car-mounted LCD monitor has been increasing due to the spread of car-mounted cameras which was led by rising safety awareness. LCD monitors are now used for car audio and rearview mirror as well as car navigation system. For these applications LAPIS Semiconductor continues to work on LSI development mainly for video decoder, video encoder and display controller, in order to meet customer needs.

**Feature 2**  
High quality, high reliability analog-digital mixed signal image technology

LAPIS Semiconductor video decoders support NTSC/PAL/SECAM and ensures precise digitization of the original image (analog) with no color degradation. This is enabled by minimizing the quantization noise caused by analog-digital conversion via a 2D YC separation function and 4fsc (8fsc within the IC) color sub carrier (3.58MHz) sampling. Additional functions include auto-luminance/color/contrast/hue adjustment, brightness/color difference/RGB gain-offset adjustment, outline correction, and multi-gradation processing.

Precise digitization reduces quantization noise via 4fsc sampling

**Feature 3**  
Prompt, expert technical support reduces product development time

Evaluation boards and development tools are available for all LAPIS Semiconductor video LSIs. In particular, our unique VASTudio GUI-based I2C BUS register setting tool and OSDBuilder font creation tool shorten customer development time considerably. These, in addition to our renowned technical support system, result in optimized solutions.
### LAPIS Semiconductor Video LSI Lineup (by Applications)

#### Video Decoders
- **NTSC/PAL/SECAM**
  - **Input signal:** CVBS/S-video/Component (RGB)
  - **Output signal:** BT.656, YCbCr/16bit, RGB8/18bit
  - **Sampling:** PLL line locking sampling and asynchronous sampling
  - **Image adjustment functions:** 2D YC separation, auto-luminance, color/brightness, contrast/hue adjustment, outline correction
  - **Additional functions:** Multi-gradation processing, WCSP (Wafer-level Chip Size Package)

- **NTSC/PAL**
  - **Input signal:** BT.656, YCbCr/16/24bit, RGB24bit
  - **Output signal:** CVBS/S-video/Component (RGB)
  - **Image adjustment functions:** Luminance/color adjustment
  - **Additional functions:** IP-P/I conversion, no LPF required, WCSP (Wafer-level Chip Size Package)

#### Video Encoders
- **Built-in video decoder**
  - **Input signal:** BT.656, YCbCr/16/24bit, RGB18/24bit
  - **Output signal:** BT.656, YCbCr/16/24bit, RGB18/24bit
  - **Output pixels:** QVGA to XGA
  - **Scaler:** Zoom/wide/panorama
  - **Image adjustment functions:** Auto-luminance/color, hue adjustment, outline/gamma correction, brightness/color difference/RGB gain-offset and independent RB adjustment
  - **Additional functions:** OSD, LED controller, 8bit MCU, PIP, Multi-gradation processing, TCON

#### Display Controllers
- **2D/3D noise reduction with 8-bit frame memory (DRAM)**
  - **Input signal:** BT.656, YCbCr/16/1bit, 510H/760H
  - **Output signal:** BT.656, YCbCr/16/1bit
  - **Video encoder:** CVBS/S-video
  - **Image adjustment functions:** Low brightness/backlight correction
  - **Additional functions:** Jagless output, still imaging, frame synchronizer, cross-color reduction

#### Image Correction ICs

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**Consumer Electronics**
- **HDD recorders**
  - ML86101ATB

**Surveillance Equipments**
- **IP / Surveillance cameras**
  - ML86V7665 series
  - ML86V7665TB

**Automotive Systems**
- **Rear seat entertainment**
  - ML86V7674TB
- **Audio display**
  - ML86V765TB

**Video LSI Lineup (by Applications)**
- **Mini component stereo systems**
  - ML86V8401TB
  - ML86V8207TC
- **TVs**
  - 3D-NR: ML87V21077TB
  - 3D-NR: ML87V21077TB
- **PC boards**
  - 3D-NR: ML87V21077TB
- **TVs**
  - ML87V21077TB

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**Icon descriptions**
- **Video LSI**
  - ML86101ATB
- **Video LSI**
  - ML86V7665
- **Video LSI**
  - ML86V7665TB
- **Video LSI**
  - ML86V8401TB
- **Video LSI**
  - ML86V8207TC
- **Video LSI**
  - ML87V21077TB
- **Video LSI**
  - ML87V21077TB

**Supporting Information**
- **Input signal:** BT.656 / YCbCr/RGB
- **Output signal:** CVBS/S-video/Component
- **Input:** 3D-NR: ML87V21077TB
- **Output:** 3D-NR: ML87V21077TB
- **Input:** ML87V21077TB
- **Output:** ML87V21077TB
- **Input:** 3D-NR: ML87V21077TB
- **Output:** 3D-NR: ML87V21077TB

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**www.lapis-semi.com/en**
### Video Decoders and Encoders Compatible with World’s Standard Formats

<table>
<thead>
<tr>
<th>Video Decoders</th>
<th>Video Encoders</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT.661 SQ</td>
<td>ML86V76652TB</td>
</tr>
<tr>
<td>ML86V76652HA</td>
<td>ML86V76655HA</td>
</tr>
<tr>
<td>ML86V7668ATB</td>
<td>ML86V7674TB</td>
</tr>
<tr>
<td>ML86V7675TB</td>
<td>ML86101ATB</td>
</tr>
<tr>
<td>ML86V7655TB</td>
<td>ML86V76580TB</td>
</tr>
<tr>
<td>ML86V76580HA</td>
<td></td>
</tr>
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</table>

### Display Controllers for Small- to Medium-sized TFT LCDs

<table>
<thead>
<tr>
<th>Video format</th>
<th>Input / Output format</th>
<th>Sampling frequency</th>
</tr>
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<tbody>
<tr>
<td>ML86V8101TB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML86V8102TB</td>
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<tr>
<td>ML86V8202CTB</td>
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<td>ML86V8207TC</td>
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<td>ML86V8201TB</td>
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### Image Correction ICs

<table>
<thead>
<tr>
<th>Noise reduction</th>
<th>Input / Output format</th>
<th>Internal frame memory</th>
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<tbody>
<tr>
<td>ML87V2103TB</td>
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<tr>
<td>ML87V2107TB</td>
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<tr>
<td>ML87V21071TB</td>
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<tr>
<td>ML87V21072TB</td>
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</table>
Video Decoders and Encoders Compatible with World's Standard Formats

The video decoders are LSIs that convert analog video signals into digital data. They are applicable to NTSC/PAL/SECAM of the world major formats and ideal for the worldwide video devices. As there are line-ups of the industry’s smallest class compact package and world’s lowest class low power consumption, they are also ideal for the mobile video devices. The video encoders are LSIs that convert digital video signals into analog video signals. They are applicable to NTSC/PAL/SECAM of the world major formats and can adapt the industry’s smallest class compact package being ideal for the mobile video devices.

### Video Decoders

<table>
<thead>
<tr>
<th>Video Decoders</th>
<th>Input format</th>
<th>Output format</th>
<th>Sampling frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7662TB</td>
<td>SQ</td>
<td>4sc</td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V76655HA</td>
<td>4sc</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7668ATB</td>
<td>4sc</td>
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</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7674TB</td>
<td>SQ</td>
<td></td>
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<tr>
<td>CVBS, S-video</td>
<td>ML86V7675TB</td>
<td>SQ</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86101ATB</td>
<td>SQ</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7655TB</td>
<td>SQ</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V76580TB</td>
<td>SQ</td>
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<td>CVBS, S-video</td>
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### Video Encoders

<table>
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<tr>
<td>CVBS, S-video</td>
<td>ML86V7662TB</td>
<td>SQ</td>
<td>4sc</td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V76655HA</td>
<td>4sc</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7668ATB</td>
<td>4sc</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V7674TB</td>
<td>SQ</td>
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<td>ML86V7675TB</td>
<td>SQ</td>
<td></td>
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<tr>
<td>CVBS, S-video</td>
<td>ML86V76580TB</td>
<td>SQ</td>
<td></td>
</tr>
<tr>
<td>CVBS, S-video</td>
<td>ML86V76580HA</td>
<td>SQ</td>
<td></td>
</tr>
</tbody>
</table>

### Video Decoders : Functional Block Diagram

- **Multiple sampling frequencies**: Provides the ideal sampling frequency for the customer’s system.
- **Superior synchronous stability**: Ensures stable imaging, even in poor signal environments.
- **Multi-gradiation processing results in high quality images**: Gray scale equivalent to 24bit RGB is possible on an 18bit RGB LCD. Applicable models: All video decoder models except ML86V7665ATB.
- **Numerous digital output formats**: Virtually any video processor or MCU can be connected downstream. The applicable video formats are: BT.656, YCbCr 8/16bit, and RGB 8/18bit.

**Compatible with the major formats**
- Supports the NTSC, PAL and SECAM analog video formats.
- CVBS: All models
- CVBS, S-video: ML86V7665ATB, ML86101ATB
- CVBS, S-video, Component: ML86V76580TB

**2D YC separation filter utilized for a clear color boundary**

The 2D YC separation filter integrates line memory and automatically selects a filter between the trap and comb filters in the horizontal and vertical directions, respectively. The result is a clear color boundary both horizontally and vertically.

**Internationally compliant pixel frequencies**: ITU-R BT.601 (13.5Mhz), EGA, WVGA, Square, and 4fsc

**Video Processor or MCU**

- Digital output IF
- H synchronization
- V synchronization
- Video data
- Clock

**Supports the NTSC, PAL and SECAM analog video formats.**

**CVBS**: All models

**CVBS, S-video**: ML86V7665ATB, ML86101ATB

**CVBS, S-video, Component**: ML86V76580TB

**Broad compatibility ensure support for a wide range of applications, from standard consumer equipment to automotive systems requiring ultra-high reliability.**

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Multi-gradation processing enables 24bit RGB imaging even on 18bit RGB LCDs

LAPIS Semiconductor’s advanced multi-gradation processing function performs 2bit simulated gradation correction with differing (intentionally randomized quantization errors) using FRC (Frame Rate Control). The 4 x 4 pixel dither patterns are varied in 4-frame periods to perform multi-gradation processing both spatially and temporally. This allows an 18bit LCDs to display images equivalent to 24bit RGB LCDs (253 tones, equivalent to 16,190,000 colors of RGB).

Applicable models: All models except ML86V76652H

Select between PLL line lock sampling and asynchronous sampling

Two video decoder sampling methods are offered: integrated PLL line lock sampling utilizing a crystal oscillator and asynchronous sampling requiring multiple external clocks. Six different clock frequencies can be selected (2 external crystal oscillators + 4 external clocks). PLL sampling maintains a constant number of pixels per line, while asynchronous sampling is compatible with various external clocks, including BT.601, NTSC square, PAL square, NTSC 4fsc, as well as crystal oscillators. In addition, this method features a pixel position correction function for jitter-free video.

Applicable models: All models except ML86V76652 H, ML86V7668ATB

Industry’s smallest* package with the lowest* power consumption

The ML86V76655HA is offered in an ultra-compact 36pin(3.66mm×3.44mm) WCSP(Wafer-level Chip Size Package) measuring just 3.96mm×3.96mm. Operation is possible from a single 1.8V power source, and power consumption is a minuscule 57mW. Additional models include the ML86V76580HA available in 25pin(2.5mm×2.7mm) WCSPs.

Applicable models: ML86V76655HA, ML86V76580HA

SRAM included for I/P conversion output

Both the ML86V76557TB offer I/P conversion functionality via built-in SRAM, making progressive scanning possible without external memory. Also, they have P/I conversion function. I/P Conversion:262.5 lines ~ 525 lines (NTSC), P/I Conversion:252 lines ~ 525 lines (NTSC).

Applicable models: ML86V7657TB

Specifications

<table>
<thead>
<tr>
<th>Part number</th>
<th>Power supply voltage(V)</th>
<th>Input format</th>
<th>Video format</th>
<th>Output format</th>
<th>Pixel frequency</th>
<th>Sampling frequency</th>
<th>I/P conversion support</th>
<th>Features</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML86V76652TB</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
<td>CVBS/2</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
<td>27MHz, 24.545454MHz, 29.5MHz</td>
<td>○</td>
<td>World's lowest* power consumption</td>
<td>TOFP48</td>
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<tr>
<td>ML86V76652HA</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
<td>CVBS/2</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
<td>27MHz, 24.545454MHz, 29.5MHz</td>
<td>○</td>
<td>Industry’s smallest* size</td>
<td>WCSP6E (9.96×3.96)</td>
</tr>
<tr>
<td>ML86V76655HA</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
<td>CVBS/2</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
<td>27MHz, 24.545454MHz, 29.5MHz</td>
<td>○</td>
<td>Automatic camera video signal detection</td>
<td>WCSP6P (9.66×3.44)</td>
</tr>
<tr>
<td>ML86V7668ATB</td>
<td>I/O 3.3 or 1.8 Core 2.5</td>
<td>CVBS/2, 3 Component/S-video/3</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
<td>27MHz, 24.545454MHz, 29.5MHz</td>
<td>○</td>
<td>Automatic camera video signal detection</td>
<td>WCSP6P (9.66×3.44)</td>
</tr>
<tr>
<td>ML86V76674TB</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
<td>CVBS/4, 4 Component/S-video/3</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
<td>27MHz, 24.545454MHz, 29.5MHz</td>
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<td>Supports EGA</td>
<td>TOFP64</td>
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<td>ML86V76675TB</td>
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<td>CVBS/4, 4 Component/S-video/3</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
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<td>Supports EGA to WVGA</td>
<td>TOFP64</td>
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<td>ML86101ATB</td>
<td>I/O 3.3 or 1.8 Core 1.5</td>
<td>CVBS/2</td>
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<td>TOFP64</td>
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<td>CVBS/2, 4 Component/S-video/2</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
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<td>ML86V76580TB</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
<td>CVBS/2, 4 Component/S-video/3</td>
<td>NTSC, SECAM</td>
<td>ITU-R BT.665 YCbCr 8bit</td>
<td>13.5MHz</td>
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<td>Supports EGA to WVGA</td>
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<td>ML86V76580HA</td>
<td>I/O 3.3 or 1.8 Core 1.8</td>
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<td>Supports EGA to WVGA</td>
<td>TOFP64</td>
</tr>
</tbody>
</table>
Display Controllers for Small- to Medium-sized TFT LCDs

These display controller LSIs are designed for small- to medium-sized LCDs. They support both analog and digital input, scale images to match display size, adjust video for optimum viewing. In addition, a timing controller is built in for direct connection with a variety of LCDs. Additional features include onscreen display, integrated MCU, and more.

LINEUP

<table>
<thead>
<tr>
<th>Video format</th>
<th>Input format</th>
<th>Output format</th>
<th>Sampling frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTSC, PAL, SECAM, and more</td>
<td>RGB (Digital), Component-video, CVBS, S-video, and more</td>
<td>RGB (Digital), Component-video, CVBS, S-video, and more</td>
<td>NTSC, PAL, SECAM, and more</td>
</tr>
</tbody>
</table>

**Display Controllers : Functional Block Diagram**

- **Component-video, S-video, CVBS, DVD, Camera**
- **RGB (Digital) for video decoder**
- **Scaler, Adjuster, LED Control, TCON**
- **MCU 8051, PLL, Video I/F, Oscillator Control**
- **2ch A/D for Key Scan**
- **PC BUS, RGB (Digital), LED (Digital) for TV**
- **240×320 to XGA (1024×768) Video output**
- **NTSC, PAL, SECAM Video formats**
- **RGB (Digital), Component-video, CVBS Video input**
- **8bit MCU included for standalone operation**
- **Spectral diffusion PLL for EMI noise reduction**

**Multiple adjustment functions result in clearer, more natural images**

- A variety of functions are integrated to ensure excellent image quality, including automatic brightness/hue adjustment, contrast adjustment, brightness/color difference/RGB gain-offset adjustment, edge enhancement, gamma correction, and multigradation processing.

**Applicable models:** ML868V8101TB, ML868V8102TB, ML868V8202CTB, ML868V8207TC, ML868V8401TB

**High quality imaging via video adjustment function**

- Gamma correction, contrast/gain-offset adjustment, edge enhancement, and multigradation processing are included for superior imaging.

**LCD interface with TCON**

- Supports virtually any LCD panel, including small- to medium-sized LCDs without TCON.

**LED controller**

- No external LED controller is required, reducing costs.

**Onscreen display**

- The integrated OSD and topbar display functions enable onscreen display in different characters and patterns.

**Compatibility with major formats**

- Supports the NTSC, PAL, and SECAM analog video formats.

**Applicable models:** All models except ML868V8101TB

**Effective for EMI noise reduction**

- The integrated MCU 8051 enables standalone operation without an external MCU.

**Application models:** ML868V9401TB

**Supports a wide range of LCD sizes**

- The scaler adjusts the image to match the screen size. Supports QVGA (640×480) to XGA (1024×768).

**Applicable models:** All models except ML868V8101TB

**Independent RB adjustment allows greater customization of colors and image quality**

- Photos are for illustrative purposes only

Please refer to pgs. 5-6 for icon descriptions.

**Package**

- TQFP100
- TQFP64
- TQFP80
- LQFP176
- LQFP144
- LQFP116

**LAPIS Semiconductor**

- Please visit our website at www.lapis-semi.com/en for more information.

Applicable models: ML868V8101TB, ML868V8102TB, ML868V8202CTB, ML868V8207TC, ML868V8401TB

www.lapis-semi.com/en
Timing controller and multiple screen modes included for customized output and broad compatibility

The integrated timing controller (digital RGB output data clock, 1-4 horizontal/1-3 vertical control signals) enables direct connection to LCDs, while the multiple screen formats, including normal (4:3), zoom (16:9), wide (16:9), and panorama (16:9) allow for customized viewing.

Applicable models: All models except ML86V810TB

Built-in 8bit MCU enables standalone operation without the need for an external MCU

An 8bit MCU 8051 is integrated, providing a monolithic solution that replaces conventional 2-chip systems comprised of an individual 8bit MCU with display controller.

Applicable models: ML86V8401TB

OSD (On Screen Display) function enables adjustment of font size, characters, and patterns for optimum viewing

The built-in on screen display function allows for a high degree of customization with: 2 font sizes (16/24 dots), 2/4/16 colors (including translucent), up to 256 characters, and 16bit RGB bitmap display (requiring external Flash memory), in addition to on-screen display function enabling 1500 allocations.

Applicable models: ML86V8207TC, ML86V8209TC, ML86V8401TB

Multi-source composition

Up to 5 video / image sources, including still images and analog / digital video (stored in external ROM) can be combined and superimposed at the same time, along with OSD characters. The level of transparency for each source is adjustable as well.

Applicable models: ML86V8207TC

Automotive-grade temperature range

The products feature a wide operating range, from −40°C to +85°C, making them compatible with high reliability applications such as automotive and security systems.

Specifications

<table>
<thead>
<tr>
<th>Part number</th>
<th>Power supply voltage (V)</th>
<th>Operating temperature range (°C)</th>
<th>Analog video input</th>
<th>Digital video input</th>
<th>Digital video output</th>
<th>Resolution</th>
<th>OSD</th>
<th>MCU</th>
<th>Features</th>
<th>Package</th>
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</thead>
<tbody>
<tr>
<td>ML86V8101TB</td>
<td>3.0 to 3.6</td>
<td>−40 to +85</td>
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<td>—</td>
<td>RGB 18bit</td>
<td>RGB 18bit</td>
<td>VQGH to QHD</td>
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<td>Image adjustment function (Digital input only)</td>
</tr>
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<td>RGB 18bit</td>
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<td>Image adjustment function (Digital input only)</td>
</tr>
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<td>ML86V8202TB</td>
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<td>−40 to +85</td>
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<td>CVBS</td>
<td>RGB 18bit</td>
<td>RGB 18bit</td>
<td>VQGA to WVGA</td>
<td>—</td>
<td>—</td>
<td>OSD function for text/icons</td>
</tr>
<tr>
<td>ML86V8207TC</td>
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<td>−40 to +85</td>
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<td>CVBS</td>
<td>RGB 18bit</td>
<td>RGB 18bit</td>
<td>VQGA to WVGA</td>
<td>Text Line</td>
<td>—</td>
<td>OSD function for text/icons</td>
</tr>
<tr>
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<td>Text Line</td>
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<td>Picture in Picture function for video composition installed</td>
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<td>CVBS</td>
<td>RGB 18bit</td>
<td>RGB 18bit</td>
<td>VQGA to WVGA</td>
<td>Text Line</td>
<td>—</td>
<td>MCU built in for system control</td>
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<td>RGB 18bit</td>
<td>VQGA to WVGA</td>
<td>Text Line</td>
<td>—</td>
<td>Image adjustment function</td>
</tr>
</tbody>
</table>
Image Correction ICs

LAPIS Semiconductor image correction ICs effectively reduce CCD noise generated by surveillance cameras in dark environments. Frame memory is also integrated for strong noise reduction with virtually no ghosting. Additional features include low brightness correction and jagless image/video output. Noise reduction also helps reduce MPEG4 file size. Direct connection to a DSP is also supported, simplifying configuration.

LINEUP

<table>
<thead>
<tr>
<th>Noise reduction</th>
<th>Input format</th>
<th>Output format</th>
<th>Built-in frame memory</th>
<th>I/P conversion function</th>
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<td>ML87V2103TB</td>
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<td></td>
<td>TQFP100</td>
</tr>
<tr>
<td>Frame synchronizer</td>
<td>ML87V2107TB</td>
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<td></td>
<td>TQFP100</td>
</tr>
<tr>
<td>Digital cross-color reduction</td>
<td>ML87V21071TB</td>
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<td></td>
<td>TQFP100</td>
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<tr>
<td>Multi-functional 3D-NR for CCTV camera</td>
<td>ML87V21072TB</td>
<td></td>
<td></td>
<td>TQFP100</td>
</tr>
</tbody>
</table>

Other features - all models

- Automatic discrimination function - all models
- Up/down inversion - ML87V21072TB only
- Other functions - all models

Supports surveillance camera interfaces 510H/760H

With direct connection to surveillance camera DSP, re-sampling function converts it to the digital video standard signal. Applicable models: ML87V21072TB

Low brightness and backlight correction functions

Increases the brightness of darker regions independently. Applicable models: Low brightness, backlight correction - ML87V21072TB only

Clear, jagless video output

A frame median filter, along with integrated memory, eliminates blurring of fast-moving objects in photos and video. Applicable models: ML87V21072TB

2D/3D noise reduction results in high quality and more efficient image compression

3D noise reduction with integrated frame memory and 2D noise reduction with edge enhancement perform optimized noise reduction based on automatic discrimination of moving and still images under any conditions. The result is clearer viewing in surveillance systems, even in dark environments, and improved compression rates for smaller file sizes.

Industry-best noise reduction

Noise reduction also reduces data size (with variable bit rate MPEG)

Noise reduction processing

Compressed to about 1/3

NR OFF

NR ON

NR reduces MPEG file sizes significantly

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**Median filter ensures clear, blur-free video**

The median filter realizes both the high resolution of frame images achieved by the use of frame memory and the moving image characteristics of field images. It provides high resolution still images as well as blur-free video by converting from 60i to 30p and 50i to 25p.

Applicable models: ML87V21072TB

**Converts 510H/760H/BT.656 digital signals to standard video via re-sampling function**

The ML87V21072TB supports surveillance camera standards 510H and 760H and can be directly connected to the camera DSP. In addition, a re-sampling function is included that converts to 8bit YCbCr and BT.656 for composite and S-video use.

Applicable models: ML87V21072TB

**Automatically lumiance gain and color difference correction compensates for backlight-induced low brightness and underexposure**

The automatic correction functions adjusts the brightness and color for optimum viewing even in harshly backlight environments.

Applicable models: ML87V21072TB

**Frame synchronization**

The built-in frame memory stores a previous frame and ensures stable video by outputting stored images when a blurry image is input.

Applicable models: ML87V21072TB

**Cross-color reduction**

Cross-color reduction is performed by analyzing the differences between a current and a previous image and separating brightness and color components.

Applicable models: ML87V21071TB

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### Specifications

<table>
<thead>
<tr>
<th>Part number</th>
<th>Power supply voltage(V)</th>
<th>Input format</th>
<th>Output format</th>
<th>Noise reduction</th>
<th>Still image</th>
<th>Encoder</th>
<th>Features</th>
<th>Package</th>
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<tbody>
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<td>ITU-R BT.656 YCbCr 8/16bit</td>
<td>YCbCr 16bit</td>
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<td>ML87V2107TB</td>
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<td>ITU-R BT.656 YCbCr 8/16bit</td>
<td>ITU-R BT.656 YCbCr 8/16bit</td>
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<td>Frame synchronizer</td>
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<td>ITU-R BT.656 YCbCr 8/16bit</td>
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<td>○</td>
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*Photos are for illustrative purposes only*
**Evaluation Board Support**

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<th>Name</th>
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<th>Notes</th>
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<td>Video Decoder</td>
<td>ML86V76652TB Evaluation board</td>
<td>Evaluation board x1, Power cable x1, Serial cable x1, CD-ROM x1</td>
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<tr>
<td></td>
<td>ML86V76652HA Evaluation board</td>
<td>(VASStudio register-setting tool for I2C BUS communication)</td>
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<tr>
<td></td>
<td>ML86V7655HA Evaluation board</td>
<td>Evaluation board manual and circuit diagram</td>
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<tr>
<td></td>
<td>ML86V7675TB Evaluation board</td>
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<td>Video Encoder</td>
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<td>Display Controller</td>
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<tr>
<td></td>
<td>ML86V8209TC Evaluation board</td>
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<tr>
<td>Image Correction IC</td>
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<td>with Integrated Video Memory</td>
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<tr>
<td></td>
<td>ML87V21072TB Evaluation board</td>
<td>Evaluation board x1, CD-ROM x1, CD-SP x1</td>
<td></td>
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</tbody>
</table>

ML86V8401TB Display Controller with Integrated MCU: Evaluation Board Example

**Features**
- Compatible with NTSC/PAL/SECAM composite video, S-video, or digital video input
- Enables still image display from external Flash and data input/output to/from SPI-Flash
- LED backlight control for external LCD panel can be verified
- Two types of panel interface connectors : 40pin and 50pin
- Compatible with SPI, I2C BUS, and UART I/Fs
- Allows onscreen adjustment of the internal register via PC
- OSD (On Screen Display) is easily provided via the included development support software

**ML86V8401TB Evaluation board configuration**
- Register-setting tool for I2C BUS communication
- Display controller ML86V8401TB
- OSD font building support tool
- Characters situated and checked easily

**Other evaluation boards**
- ML86V8209TC: Display controller board
- ML86V7665HA: Video decoder/encoder board
- ML86V7655TB: Image correction IC board
- ML87V21072TB: Evaluation board with CCD camera

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VASstudio is a LAPIS Semiconductor's register setting tool for I2C BUS communication.

OSDBuilder is a LAPIS Semiconductor's OSD font building support tool.