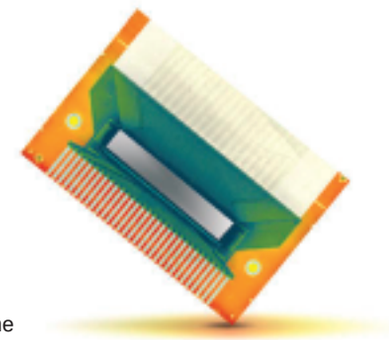
mobiledisplay

page

More than just a display,
it's our integrated display IC
technology that brings us
a better tomorrow.

mobile display

TFT LCD Driver Controller



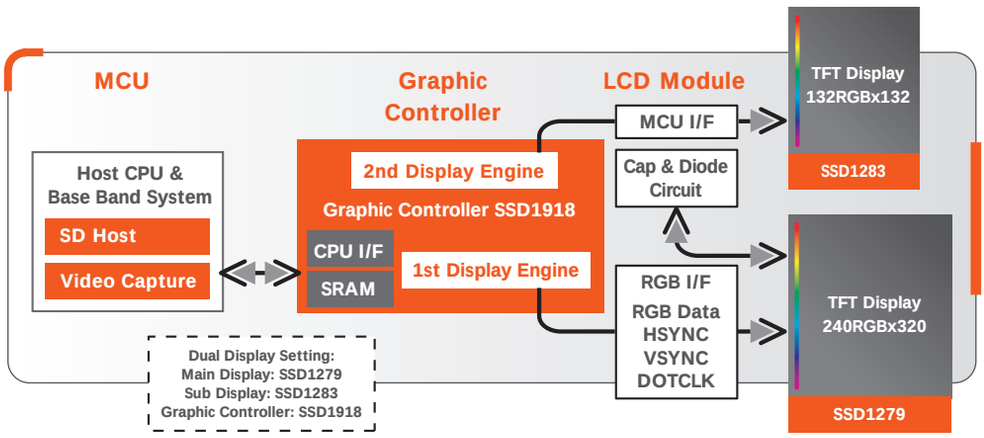
Solomon Systech offers a series of single chip **TFT LCD Driver Controllers** to support TFT mobile displays. All TFT drivers have an embedded source/gate driver, voltage generator and controller block supporting display resolutions from 132RGBx132 to 240RGBx320. These products offer not only a common parallel and serial interface, but also an RGB interface to support fast-moving pictures. For the smart phone design, the ICs support high resolution up to QCIF+ and QVGA with auxiliary video interface. They work with the advanced image processors in the smart phone systems to optimize the use of the CCD/CMOS camera when displaying high quality graphics and video. These highly integrated single chip solutions provide many features, such as low power consumption, minimal external components and up to 262K colors support.

Applications : Mobile phones, 3G phones, portable game consoles, PMP and etc.

Features

- 65K or 262K color depth
- Non-volatile memory for VCOM calibration
- Programmable gamma correction curve
- Low current sleep mode and 8-color display mode for power saving
- Reduced external component count
- SPI, 8080/6800 PPI, RGB interface
- On-Chip DC-DC converter
- On-Chip voltage generator
- Support Frame and Line inversion
- Source and Gate scan direction control
- Programmable common electrode voltage amplitude
- Support both Cs on gate or Cs on common TFT structure

Application Diagram



Application Example - Flip Phone System

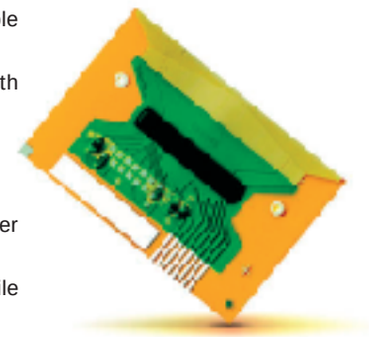
Selection Guide

Part Number	SSD1278	SSD1279	SSD1284	SSD1285	SSD1288	SSD1289
Display Size (Source x Gate)	176RGB x 220	240RGB x 320	132RGB x 132	128RGB x 160	176RGB x 220 (QCIF+)	240RGB x 320 (QVGA)
RAM size (Byte)	-	-	39204	46080	87120	172800
Max. Color Depth	262K	262K	262K	262K	262K	262K
Supply Voltage for logic	1.16 ~ 3.6V	1.4 ~ 3.6V	1.4 ~ 3.6V	1.4 ~ 3.6V	1.4 ~ 3.6V	1.4 ~ 3.6V
Supply Voltage for analog	2.5 ~ 3.6V	2.5 ~ 3.6V	2.5 ~ 3.6V	2.5 ~ 3.6V	2.5 ~ 3.6V	2.5 ~ 3.6V
Max. Gate Output Voltage	30Vpp	30Vpp	30Vpp	30Vpp	30Vpp	30Vpp
Internal DC-DC Converter	-5X ~ +6X	-6X ~ +6X	-6X ~ +6X	-6X ~ +6X	-6X ~ +6X	-6X ~ +6X
Graphic Controller Function	-	-	Yes	Yes	Yes	Yes
MCU Interface	RGB I/F, SPI	RGB I/F, SPI	PPI, SPI	SPI, PPI	RGB I/F, PPI, SPI	RGB I/F, SPI, PPI
8 Color Mode	Yes	Yes	Yes	Yes	Yes	Yes
Partial Display Mode	-	-	Yes	Yes	Yes	Yes
Vcom Adjustment	OTP	MTP	MTP	MTP	MTP	MTP
Scrolling	-	-	Yes	Yes	Yes	Yes
Operation Temperature	-20 ~ 70°C	-20 ~ 70°C	-20 ~ 70°C	-20 ~ 70°C	-20 ~ 70°C	-20 ~ 70°C
Package	COG	COG	COG	COG	COG	COG

mobile display

STN/CSTN LCD Driver Controller

Whether a cellular phone, handheld game console or MP3 display design; whether content rich or simple but compact, Solomon Systech offers abundant choices of **STN/CSTN LCD Driver Controllers** with different display resolutions, in various package forms for any unique display style.



The STN/CSTN LCD driver controllers are all highly integrated single chip solutions, with low power consumption and minimal external components for high performance and compact design mobile display, from monochrome, gray scale to color.

Features

High integration for minimizing external components

- Single supply voltage
- On-chip oscillator
- On-chip bias divider
- On-chip DC-DC converter for LCD driving output voltage
- On-chip display data RAM
- On-chip capacitor
- On-chip OTP / MTP

Ultra low power consumption for system power saving

- Low current sleep mode
- Programmable bias ratio

Compatible for most popular MCUs

- 8/16-bit 68/80-series parallel interface and serial peripheral interface or I^2C-bus

Powerful command set for easy programming

- Re-mapping of row and column drivers
- Various powerful scrolling modes
- Internal contrast control
- Programmable partial display
- Programmable LCD driving voltage temperature coefficients
- Programmable Color Look Up Table

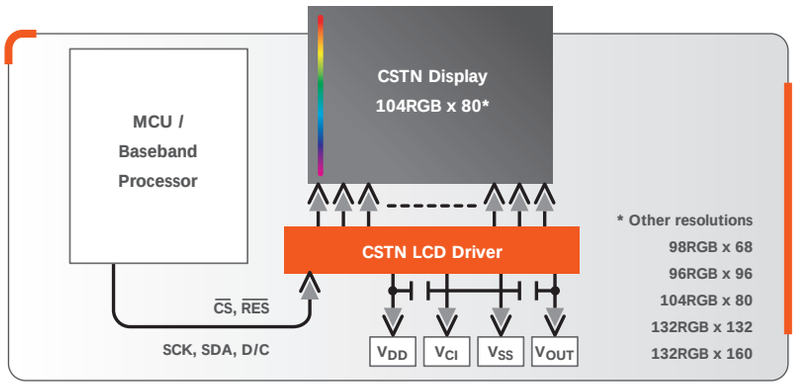
Advanced features

- Built-in graphic engine to speed up graphic animation
- Implemented MLA driving scheme to increase contrast ratio and speed up frame rate
- 8 color mode for power saving

Package

- Bare die, gold bump die, TAB and COF package

Application Diagram



Selection Guide

CSTN LCD Driver		
Part Number	**Display Size (Seg x Com)**	**Features**
SSD1776	98RGB x 68	65K Color Graphic, Built-in Divider Cap
SSD1778	98RGB x 68	65K Color Graphic, Built-in Cap
SSD1768	96RGB x 96	65K Color Graphic, Built-in Divider Cap
SSD1774	104RGB x 80 + 1 line icon	65K Color Graphic, Built-in Cap
SSD1779	132RGB x 132	65K Color Graphic
SSD1789A	132RGB x 132	65K / 262K Color Graphic
SSD1784	132RGB x 160	65K Color Graphic
SSD1783B	132RGB x 160	65K / 262K Color Graphic
SSD1793	132RGB x 160	65K / 262K Color Graphic, APT
Gray Scale LCD Driver		
Part Number	**Display Size (Seg x Com)**	**Features**
SSD1810	98 x 34 / 100 x 32 + 1 line icon	4 Gray Levels Graphic
SSD0858	104 x 64 + 1 line icon	4 Gray Levels Graphic, Built-in Cap, I^2C
SSD1858	104 x 64 + 1 line icon	4 Gray Levels Graphic, Built-in Cap
SSD1850	128 x 64 + 1 line icon	4 Gray Levels Graphic
SSD0856	104 x 80 + 1 line icon	4 Gray Levels Graphic, Built-in Cap, I^2C
SSD1856	104 x 80 + 1 line icon	4 Gray Levels Graphic, Built-in Cap
SSD1851	128 x 80 + 1 line icon	4 Gray Levels Graphic
SSD0859	128 x 80 + 1 line icon	4 Gray Levels Graphic, Built-in Cap, I^2C
SSD1859	128 x 80 + 1 line icon	4 Gray Levels Graphic, Built-in Cap
SSD1857	96 x 96	4 Gray Levels Graphic, Built-in Cap
SSD0852	128 x 128 + 1 line icon	4 Gray Levels Graphic, I^2C
SSD1852	128 x 128 + 1 line icon	4 Gray Levels Graphic
SSD1854	128 x 160	4 Gray Levels Graphic, MLA
Monochrome LCD Driver		
Part Number	**Display Size (Seg x Com)**	**Features**
SSD1800	80 x 16 + 1 line icon	16 x 2 Characters
SSD1801	80 x 24 + 1 line icon	16 x 3 Characters
SSD1828	96 x 64 + 1 line icon	Mono Graphic, Built-in Cap
SSD0817	104 x 64 + 1 line icon	Mono Graphic, I^2C
SSD1818A	104 x 64 + 1 line icon	Mono Graphic
SSD1815B	132 x 64 + 1 line icon	Mono Graphic
SSD1820A	128 x 64 + 1 line icon	Mono Graphic
SSD1809	160 x 64 + 1 line icon	Mono Graphic
SSD1805	132 x 68 / 64+1 line icon	Mono Graphic, Built-in Cap, OTP
SSD1821	128 x 80 + 1 line icon	Mono Graphic

MLA - Multi-line Addressing, IC manufactured under Motif License including US Patent No.5,420,604

I^2C-Bus - Phase of I^2C components of Solomon Systech Limited conveys a license under the Philips I^2C Patent Rights to use these components in an I^2C system, provided that the system conforms to the I^2C Standard Specification as defined by Philips.

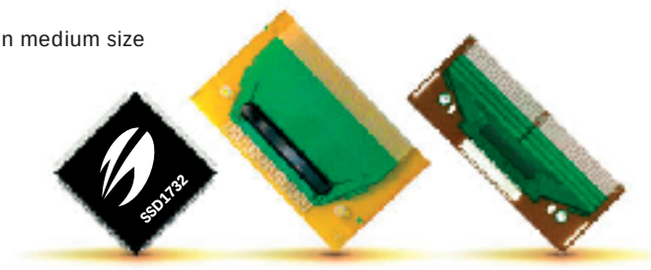
APT - Alt-Pleshko Technique

OTP - One Time Programming

mobile display

PDA Chipset
STN/CSTN LCD Driver

Enjoy freedom and optimized performance from Solomon Systech's chipset solutions for medium size display. From 160 x 160 to 320 x 240 display resolution, from monochrome, gray scale to color, Solomon Systech has a full range of **LCD Column Drivers, LCD Row Drivers and Power Chips**, for different combination in medium size STN/CSTN LCD displays.



Features

MLA CHIPSET with Four-Line Addressing

MLA Power Chip + MLA Column Driver + MLA Row Driver

SSD1732 MLA Power Chip

- Single supply operation, +2.4V to +3.6V
- Two step-up modes: 5X or 6X step-up mode by internal charge pump DC/DC converter
- Internal LCD voltage generator to generate all LCD voltages required for 4-line MLA driving
- External contrast control
- Equipped internally with an LCD polarity reverse signal generator
- Available in 48 pin QFP package

SSD1871/1873/1876 MLA Column Driver

- 160/320/480 segment outputs
- Supply voltage: logic system, +2.4V to +3.6V; LCD system, +4.8V to +7.2V
- On chip 160x240 / 320x240 / 480x240 bit display RAM
- Pin selectable for 4-bit / 8-bit display data input
- Selectable output sequence supported
- Cascading supported for higher resolution
- Non-biased display off function
- Available in TAB (Tape Automated Bonding) package

SSD1881/1882 MLA Row Driver

- 140 or 160 / 200 or 240 common outputs
- Supply voltage: logic system, +2.7V to +5.5V; LCD system, +14.0V to +30.0V
- Adjustable LCD power source offset bias
- Selectable output sequence supported
- Cascading supported for higher resolution
- Non-biased display off function
- Available in TAB (Tape Automated Bonding) package

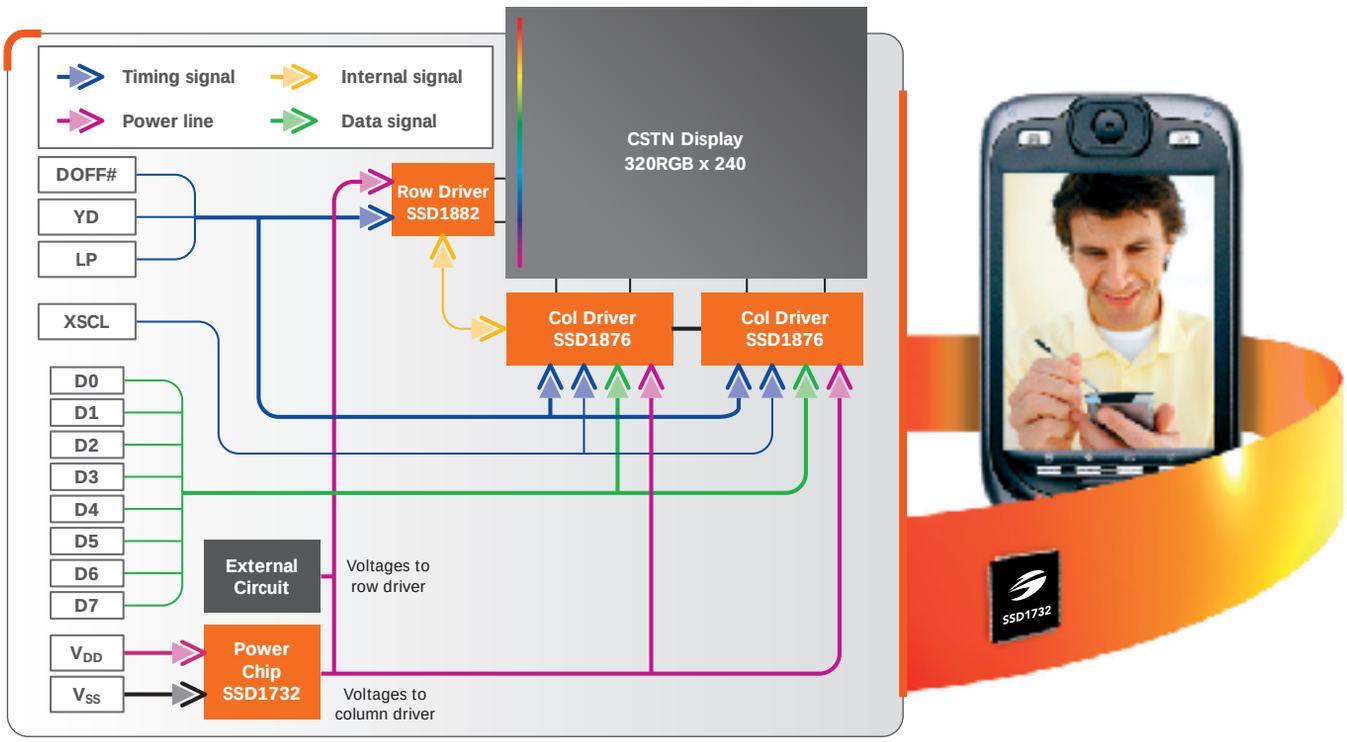
SLA CHIPSET

Generic Common/Segment Driver

SSD1701/1702/1703/1706 Common/Segment Driver

- 160/240/320/480 Common/Segment outputs
- Supple Voltage: logic system, +2.4V to +3.6V; LCD system, +15.0V to +30.0V
- Pin selectable between common and segment mode
- Pin selectable for single mode or dual mode
- Pin selectable 4-bit or 8-bit parallel data input mode
- Selectable output sequence supported
- Cascading supported for higher resolution
- Display on/off function
- Available in Gold-bump die and TAB package

Application Diagram



MLA Chipset Application Example

Selection Guide

	MLA Chipset						SLA Chipset			
Display Resolution	SSD1732 MLA Power Chip	SSD1871 160 Column Driver	SSD1873 320 Column Driver	SSD1876 480 Column Driver	SSD1881 160 Row Driver	SSD1882 240 Row Driver	SSD1701 160 Com/Seg Driver	SSD1702 240 Com/Seg Driver	SSD1703 320 Com/Seg Driver	SSD1706 480 Com/Seg Driver
Mono/Gray Scale										
160x160	1	1			1		2			
320x240	1		1			1		1	1	
320x320									2	
480x320									1	1
Color										
160RGBx160	1			1	1		1			1
320RGBx240	1			2		1		1		2
320RGBx320									1	2

IC Combination Examples for Mono/Gray Scale and Color STN Display Resolution

* Number indicates number of proposed IC used in applications

MLA- Multi-line Addressing, IC manufactured under Motif License including US Patent No.5,420,604

SLA - Single-line Addressing

mobile display

OLED Driver Controller

With the success of Solomon Systech's OLED driver technology, the mobile phone display industry is being transformed into first-response self-emissive video display.

Solomon Systech provides a full range product family of single chip **OLED Driver Controllers** for mono, area color, gray scale and full color OLED displays in different resolutions. The OLED drivers employ a proprietary driving scheme to reduce system power consumption and enhance display performance. They are ideal display solutions for portable devices.

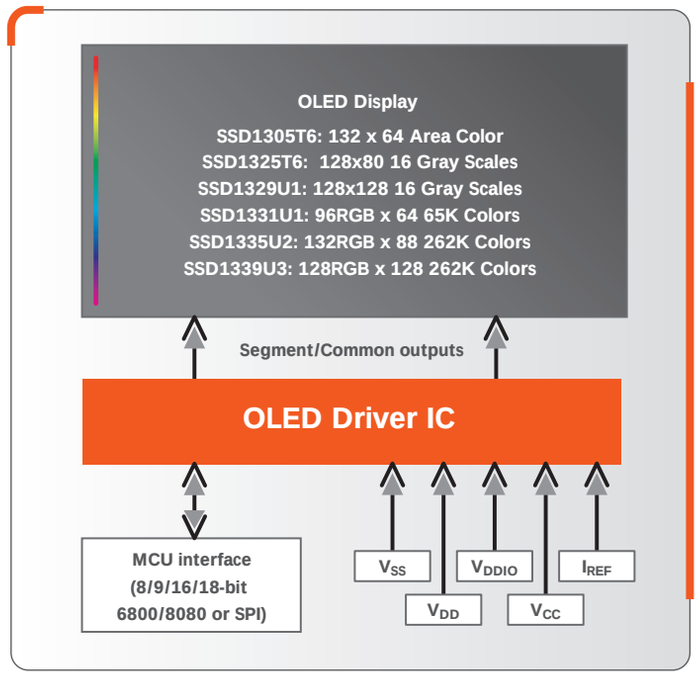
Applications : WAP/Communicators, mobile phones, 3G phones, consumer appliances, portable game consoles, MP3, instruments, etc.

Selection Guide

	Mono/Area Color	Gray Scale		Color
Part Number	**SSD1305**	**SSD1325**	**SSD1329**	**SSD1331**
Display Features				
- Maximum panel resolution	132 x 64	128 x 80	128 x 128, 64 hard icons	96RGB x 64
- Embedded SRAM display buffer	132 x 64 bits	128 x 80 x 4 bits	128 x 128 x 4 bits	96 x 64 x 16 bits
- Display color	Mono and 4 color selections for area color	16 gray scale	16 gray scale	65K colors
- Contrast control	256 steps	128 steps	256 steps	256 steps
DC Characteristics				
- Segment maximum source current	320uA	300uA	350uA	200uA
- Common maximum sink current	45mA	40mA	40mA	60mA
- MCU interface Voltage Supply (V_{DDIO})	1.6V to V_{DD}	-	1.7V to V_{DD}	1.6V to V_{DD}
- Logic Voltage Supply (V_{DD})	2.4V - 3.5V	2.4V - 3.5V	2.4V - 3.5V	2.4V - 3.5V
- High Voltage Supply (V_{CC})	8.0V - 15.0V	8.0V - 16.0V	9.0V - 18.0V	8.0V - 18.0V
MCU Host Interface Supported				
- 8-bit parallel interface	√	√	√	√
- 9-bit parallel interface	-	-	-	√
- 16-bit parallel interface	-	-	-	√
- 18-bit parallel interface	-	-	-	-
- Serial peripheral interface	√	√	√	√
Package Information				
- TAB	T6(132x64)	T1(128x64)	-	-
	-	T3(96x64)	-	-
	-	T6(128x80)	-	-
- COF	-	U(95x64)	U1(128x128)	U1(96x64)
	-	U2(128x64)	-	-
	-	-	-	-
- COG	Z(132x64)	Z(128x80)	Z(128x128)	Z(96x64)
High Integration Controller Function				
- On-chip oscillator	√	√	√	√
- On-chip DC-DC booster	√	√	for hard icon	√
- Programmable frame rate	√	√	√	√
- Programmable display MUX	√	√	√	√
- Row/Column re-mapping	√	√	√	√
- Horizontal scrolling	√	-	-	√
- Continuous Vertical scrolling	√	-	-	√
- Vertical scrolling by RAM	√	√	√	√
- Color swapping function	-	-	-	√
- Graphic acceleration command set: draw line & rectangle, copy & dim window, clear window, etc	-	-	-	√

Application Diagram

SSD1335	SSD1339
132RGB x 88	132RGB x 132
132 x 88 x 18 bits	132 x 132 x 18 bits
262K colors	262K colors
256 steps	256 steps
200uA	200uA
50mA	80mA
-	1.5V to V_{DD}
2.4V - 3.5V	2.4V - 3.5V
8.0V - 18.0V	7.0V - 18.0V
√	√
-	√
√	√
-	√
√	√
-	-
-	-
-	-
U1(101x82)	U3(128x128)
U2(132 x 88)	-
-	-
Z(132x88)	Z(132x132)
√	√
√	√
√	√
√	√
√	√
-	√
-	-
√	√
√	√
√	√



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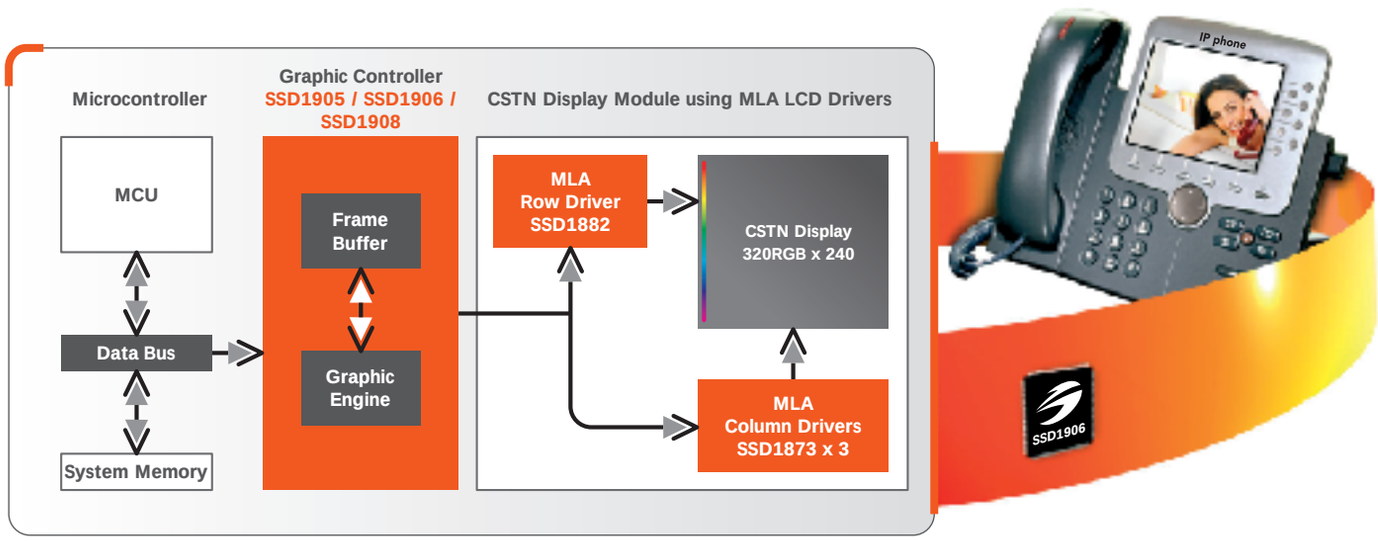
Graphic Controller

Electronic displays interconnect with the information world. Increase in display size, higher resolution and graphic manipulation tend to be demanding factors in consumer products. To keep pace with this flourishing technology, Solomon Systech proudly offers a series of **Graphic Controllers**.

As a single chip, Solomon Systech's SSD1905/1906/1908 LCD Graphic Controllers handle the entire image rendering and STN/TFT display interfaces, providing a content rich display. Both SSD1906 and SSD1908 are possible to drive low-cost analog TFT displays. They interface with almost any kind of MCU, even low-cost 8-bit MCUs. An embedded SRAM frame buffer memory of 80K bytes (for SSD1905) / 256K bytes (for SSD1906/SSD1908) can support from 1 bit-per-pixel with 2 gray shades up to 16 bit-per-pixel colors with 64 gray shades. To reduce software manipulation for animation display, the on-chip graphic engine provides command type graphic manipulation such as display rotation, window mode, cursor mode, and so on. In particular, SSD1908 has a Horizontal Resolution Doubling feature.

Applications : SSD1905/1906/1908 Graphic Controllers are suitable for any handheld devices with LCD panel such as GPSs, multi-functional printers, digital photo frames, IP phones, electronic dictionaries and etc.

Application Diagram



CSTN display system with graphic controller and MLA LCD drivers

Selection Guide

Part Number	SSD1905	SSD1906	SSD1908	SSD1918
Embedded Display Buffer Memory	80KB	256KB	256KB	174KB
MCU Interface				
- Control pins	Enhanced 6800, 8080, generic #1, generic #2, control interface, with wait option			6800, 8080, 3/4 wire SPI, with wait option
- Data bus	8 or 16 bit options			8, 9, 16 or 18 bit options
- Address bus	Separated bus required			Not required, internal auto increment
Panels Support				
Main				
- Panel types	STN or TFT (mono or color) Mono, Gray Scale, Color (STN) 4-bit / 8-bit driver bus (STN) 9-bit, 12-bit or 18-bit digital RGB (TFT, HR-TFT, AD-TFT)		All panels supported by SSD1906, with addition of Analog TFT panels support	Generic TFT panel 9-bit, 12-bit or 18-bit digital RGB
- Color depth	1/2/4/8/16 bits-per-pixel (bpp)			8/16/18 bpp
- Resolution	Programmable according to frame buffer memory			Within 320x240 (QVGA)
Sub	NONE (only 1 main panel supported)			Almost any driver controllers with 8 bit or 9 bit 6800, 8080 or 3/4 wires SPI; separated programmable RESET pin available
Display Features				
- Display rotation	√		√	√
- Display color invert	√		√	√
- Multi-page buffering	√		√	2 pages (QCIF+), 1 page (QVGA)
- Horizontal Resolution doubling	X		√	X
- Color look-up-table	√		√	X
- Floating window	√		√	X
- Virtual display	√		√	X
- Hardware cursors	2		2	0
Power				
- MCU interface	3.0V - 3.6V			1.6V - 3.6V
- Main panel interface	3.0V - 3.6V			1.6V - 3.6V
- Sub-panel interface	N.A.			1.6V - 3.6V
- Core voltage	2.5V (by internal regulator)			1.8V (selectable internal regulator)
- Power consumption	~ 2mW to 50mW depends on screen, color and resolution			~ 2mW to 6mW typically
Misc				
- GPIO pins	√			√
- PWM and CV	√			√
- Frame synchronisation signal to MCU	X			√
- Package	TQFP-100	TQFP-100 / TFBGA-100		Gold bump die / LGA-112

mobile display

Image Processor

Whether in a cellular phone or a portable consumer product, today a high expectation exists for rich content display. This expectation varies from colorful JPEG photo displays, fancy multi-media interfaces, to DVD video playback capabilities.

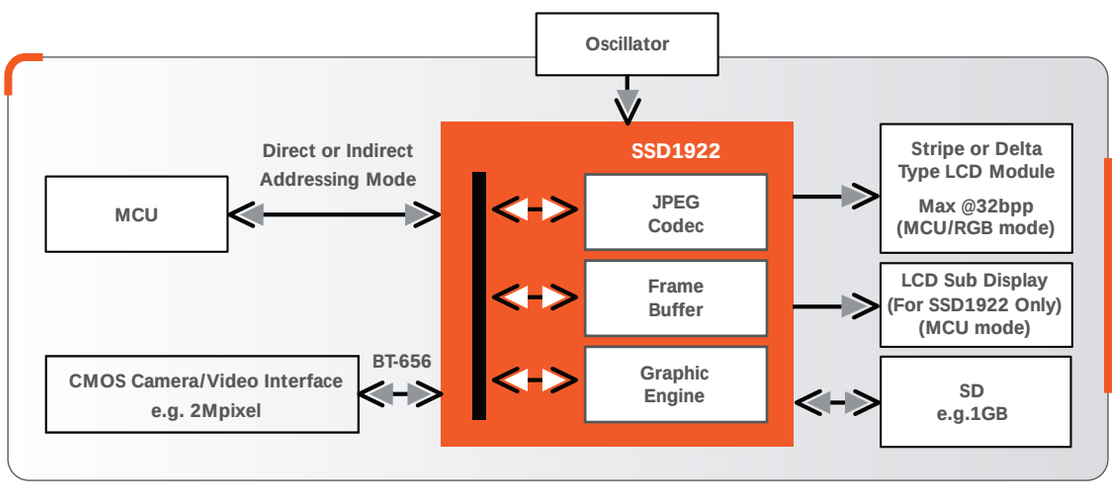
Solomon Systech **Image Processor**, the SSD1921/22, is a powerful imaging engine that brings this dream to a reality. SSD1921 and SSD1922 are essential graphic tools for different derivatives of end products. The tiny BGA package, camera BT656 interface and sub-panel support feature benefit SSD1922 in the camera handset market, while SSD1921 allows video display capabilities in the booming car entertainment systems.

Applications : Camera phones, 3G phones, electronic dictionaries, car AVs, game consoles and digital photo frames.

Features

- Support MCU interface with both direct and indirect addressing
- 256KB frame buffer can drive up to 24bpp panel
- Enhanced 2D graphic engine, e.g. BitBLT, alpha blending
- MCU bused sub-panel support (SSD1922)
- Embedded JPEG encoder/ decoder
- Video capture for BT656/BT601 input (up to 1.3M pixels)
- LQFP-144 (SSD1921), BGA-144 (SSD1922) package available

Application Diagram



Selection Guide

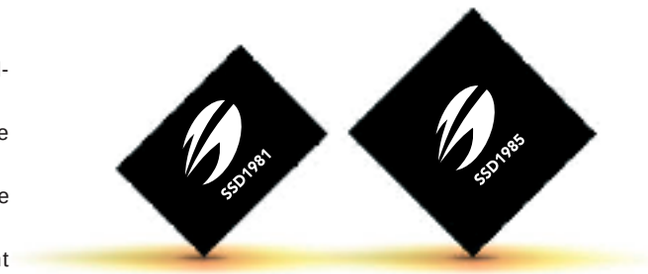
Part Number			SSD1921	SSD1922
Host MCU Interface	Direct Addressing	8bit I/F	√	√
		16bit I/F	√	√
	Indirect Addressing	8bit I/F	√	√
		16bit I/F	√	√
Internal RAM size			256KB	256KB
Camera / Video Interface (BT-656)	Camera I/F		√	√
	Camera Resolution		2Mpx	2Mpx
	I^2C Master		√	√
	YUV/raw Data Capture		√	√
	Resize(view/capture)		√	√
Display Feature	GC (SSD1906) Functions support (Display rotation, color invert; multi-page buffering; color LUT; overlay window; 2 hardware cursors)		√	√
	Color Depth		1,2,4,8,16,32 bpp	1,2,4,8,16,32 bpp
	YUV <--> RGB		√	√
	P-in-P+		√	√
	Fractional Shrink		√	√
	Fractional Zoom		√	√
	Mirror Display		√	√
Graphic Accelerations	JPEG encoder		1.3Mpx	1.3Mpx
	JPEG decoder		Up to 16M (4K x 4K)	Up to 16M (4K x 4K)
	JPEG Animation Frame Rate		196fps (240x160)	196fps (240x160)
	Motion JPEG		√	√
	BitBLT		√	√
	Draw lines		√	√
	Draw circles		√	√
	Color fill		√	√
	Color expansion		√	√
Panels Support	By-pass Access		Main panel	Main/Sub panel
	Main panel		MCU mode or RAM-less driver mode	
	STN or CSTN (4bit / 8bit) / TFT (parallel or serial RGB) with additional TCON timing		√ (Up to 18bit TFT I/F)	√ (Up to 24bit TFT I/F)
	Typical resolution		320x240 /16bpp	320x240 /16bpp
	Maximum resolution / Color depth		320x200 / 32bpp	800x600 / 2bpp
	Sub-panel support		X	√ (MCU mode)
Miscellaneous	Clock Source		1 clock input	1 clock input
	Power Save Mode		√	√
	GPIO Pins		√	√
	SD Card I/F		√	√
	Core Voltage		1.8V +/- 10%	1.8V +/- 10%
	Host I/O Voltage		3.0V +/- 10%	3.0V +/- 10%
	Panel I/F Voltage		3.0V +/- 10%	3.0V +/- 10%
	Package		144TQFP	144TFBGA

mobile display

Polyphonic Melody IC

Solomon Systech's **Polyphonic Melody ICs** enable the emergent evolution in ringtone, gaming music, and audio applications, from simple monotonous tone to true tones.

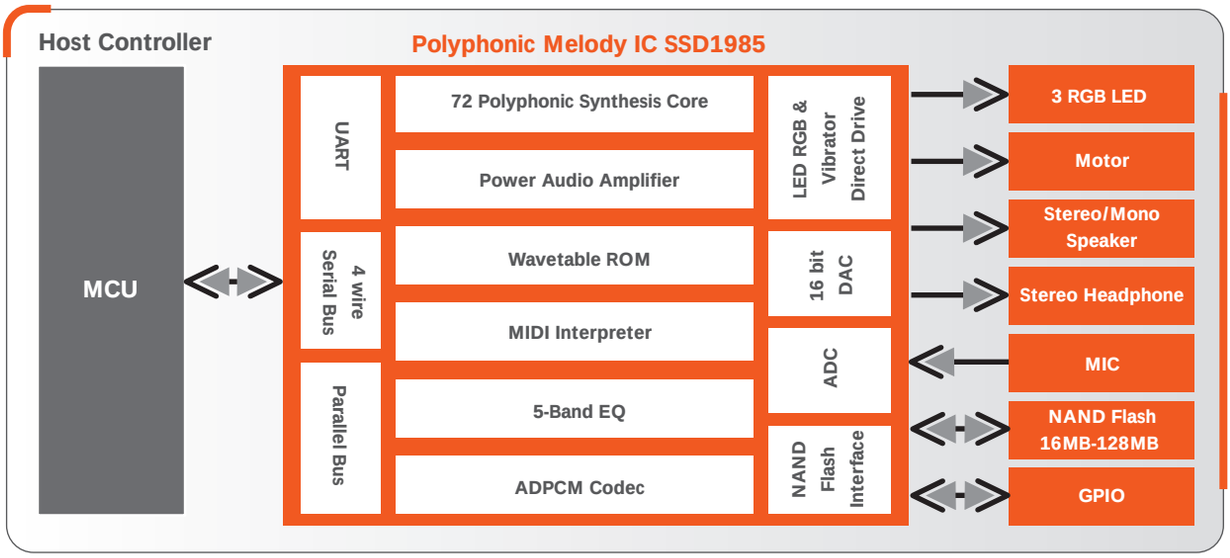
Applications : These ICs are applicable to all kinds of phones with valued-added distinct features, such as mobile, DECT, 3G phones and fixed line phones, as merely a few examples. In addition, these ICs can also be thoroughly utilized in melodies for mobile gaming, multi-media content and audio devices.



Features

- 72 polyphonic high quality wave-table melody
- 44.1KHz sampling rate
- Standard GM / standard SP-MIDI / MP3 ring-tone playback support
- Karaoke function - ADPCM voice recording and ADPCM/PCM playback
- 3 MCU host interfaces: UART, 4 wire serial, 8 bit parallel bus
- Direct drive RGB LEDs and vibrator, synchronized with melody / controlled by the host PWM data / MIDI event
- Mono / Stereo selectable output in QFN-48 and BGA-64
- Speaker phone function
- 5-band digital equalizer
- 16-bit stereophonic D/A converter
- Connection to speakers and earphones directly with on-chip audio amplifier
- NAND flash memory interface in BGA-64
- Low power, standby and power down mode
- Internal core digital power supply / PLL power supply (DVDD / PVDD): 2.7V to 3.3V (Typ 3.0V)
- Host interface digital power supply (IOVDD): 1.65V to DVDD
- Speaker power supply (SPVDD): 3.3V to 5V (Typ 3.6V)
- Available in QFN-32, QFN-48 and BGA-64 packages

Application Diagram



Selection Guide

Part Number	SSD1981 QFN32	SSD1983 QFN48	SSD1985 BGA64
Direct Drive LED	1	3	3
Host UART Interface	x	√	√
Host 4 Wire Serial Interface	x	√	√
GPIO	x	√	√
Stereo Audio Playback	x	√	√
ADC Serial Interface	x	√	√
NAND Flash Interface	x	x	√