Display Solutions for Smartphones and Tablets

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Mobile Devices – The Trend

- Smartphones (up to 6”) / Tablets (6” to 10”)
  - Low Power Consumption
  - High Display Resolution
  - In-cell Touch Control
Part 1 – Display Driver IC

Solution on Smartphones and Tablets

System Board

Display Interface Controller

- Color Management
- Image Processing
- Data Compression
- Power Management

Application Processor

Touch Controller

Display & Touch Panel

- HV Driver
- Color Management
- Data Compression
- Power Management

Touch Controller

Power Management
Key Technology – HD720/WXGA Series

- Low Power Solution – Metal Oxide
- Low Power Solution – with Memory
- Low Power Solution – MIPI 2 to 3 lanes
- In-cell Mutual Cap Touch Display Driver IC
Low Power Solution – Metal Oxide

Oct 2004
E-Paper Driver Controller IC drives the world’s 1st e-paper watch

2004
World’s 1st single chip Mobile TFT Driver with built-in cap

Oct 2002
World’s 1st single chip 2D GIGA CSTN LCD Driver Controller IC

Oct 2005
Microdisplay Controller for binocular display module products

May 2006
World’s 1st MIPI Master Bridge Chip

Nov 2006
Bistable Display Driver drives the world’s 1st e-paper mobile phone

May 2009
Single Chip Capacitive Multi-Touch IC

Sep 2011
4-lane MIPI Master Bridge Chip for Full HD display

Oct 2001
World’s 1st single chip OLED Driver IC with Controller

Oct 1999
World’s 1st grayscale 32 MUX LCD Driver/Controller

Oct 2004
World’s 1st MIPI Master Bridge Chip

May 2008
MagusCore™ Multimedia System Solution

Jul 2008
Microdisplay Controller for binocular display module products

Aug 2010
DSP Integrated Dimmable LED Driver IC

Dec 2012
Metal Oxide TFT Display Driver IC

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Low Power Solution – Metal Oxide

- Silicon Proven HD720 Ramless Driver IC
- Panel Refresh Rate down to 7.5Hz with Power Save of 30mW

GIP signal output at normal panel refresh rate 60Hz

GIP signal output at panel refresh rate 7.5Hz
Low Power Solution – with Memory

- Silicon Proven HD720 w/Ram Driver IC for Metal Oxide
- With Half-RAM Data Compression in Command Mode, Power Save of 40mW could be achieved
- Panel Refresh Rate further down to 2Hz with extra Power Save of 20mW
Low Power Solution – with MIPI 2 or 3 Lanes

- Silicon Proven HD720 Driver IC
- With MIPI 3-Lane operation, Power Save of 12mW could be achieved
- With MIPI 2-Lane operation, further 8mW power save could be achieved

SSD2075 with 5” a-Si Module
In-Cell Mutual-Cap Touch Control Display Driver IC

- AP
- SSD208x
- Touch Controller IC
- In-Cell Mutual Cap Panel

Signals:
- Display Driving Signals
- Touch Driving Signals
- Touch Control Signals (Tx)
- Synchronization
- Touch Sensing Signals
- I2C/SPI/Ext_Reset
- MIPI
Touch Drive Signal from SSD208x

- Silicon Proven for 5” Panel with Touch Control IC

![Diagram showing touch drive signals](image-url)

- Touch Control Signal (Synchronization)
- Touch Control Signal (Tx)
- Touch Drive Signal
Part 2 – Display Interface Controller

Solution on Smartphones and Tablets

System Board

Display Interface Controller

Application Processor

Touch Controller

Display & Touch Panel

a-Si / Oxide / LTPS / AMOLED Driver

Module
Key Technology – SSD2858

- Silicon Proven MIPI DPHY @ 1.5Gbps
- Scaler and Rotation for Low System Power
- Up to 3-DSI MIPI Transmitter (Split or Broadcast)
1.5Gbps MIPI-Receiver

- Silicon Proven 1.5Gbps MIPI performance
- Low Power Performance – 23mA for 4 x 1.5Gbps MIPI receiver module

Eye Diagram for Data lanes
Clock Lane at 750MHz DDR (1.5Gbps)
Poor Eye Diagram from Test Generator but the MIPI-Receiver in SSD2858 can still receive correctly
1.5Gbps MIPI-Receiver

- **Application**
  - **Bridge** 1.5Gbps x 4 Lanes Application Processor with 2 x 1Gbps x 4 lanes (dual-LCD drivers), to **support Display of WQXGA resolution (1600 x 2560)**
Scaler and Rotation for Low System Power

High Quality Fractional Scaler

- qHD – 540 x 960
- Scaled FHD – 1080 x 1920
- qHD -> FHD Demo
Scalor and Rotation for Low System Power

- **Low System Power**
  - Application Processor processes images/videos at low resolution (e.g. UI or YouTube Video), and let SSD2858 do the up-scaling

  - Save System Power by more than half!
  - Lesser processing (1/4) and memory access (1/4) for images/videos of qHD resolution compared to FHD
Scaler and Rotation for Low System Power

- Further System Power Reduction: Display Rotation
  - Application Processor needs not spend expensive memory bandwidth for rotating the landscape display to match a portrait panel

**Further System Power Saving!**

No processing and memory access required to do rotation for a video playback
Up to 3-DSI MIPI Transmitter (Split or Broadcast)

- Concurrent Display Output (Broadcast) for 2 DSI output

SSD2858 Demo for 2 DSI broadcasting
Up to 3-DSI MIPI Transmitter (Split or Broadcast)

- Foldable Smart Phone Display
  - Simplify Application Processor Image Processing
  - Illustration using 2160 x 1280 input with three 720 x 1280 panels

Split into 3 Panels

Downscale
(Any scaling factors, and any combinations of panel outputs)

Downscale, Rotate and Broadcast
(Any scaling factors, and any combinations of panel outputs)

Gap Handling!
Using a ‘Cross’ as illustration:

Panel Gap
Up to 3-DSI MIPI Transmitter (Split or Broadcast)

- SSD2858 Demo for 2 DSI splitting
Solomon Systech – Product Portfolio

- LED
- L-TFT
- E-paper
- OLED (AM/PM)
- a-TFT / LTPS / Oxide
- STN
- Display Panel Technology
- Display System Solution
- Mobile System
  - Touch Panel
  - Display Interface
  - Graphic Controller / 3D Multimedia
- Green Power
  - LED Backlight
  - LED Lighting
SSL - Your Best Display Technology Partner for Smartphones & Tablets

**Display Driver IC**

- **LCD**
  - HD720: SSD2075
  - WXVGA: SSD2080/81
  - FHD: SSD209X

**Display Interface Controller**

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<th>Part</th>
<th>Resolution</th>
<th>MIPI</th>
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<th>OUT</th>
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<td>SSD2805</td>
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<td>350Mbps</td>
<td>MCU/MCU</td>
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<td>WXGA</td>
<td>600Mbps</td>
<td>RGB/MCU</td>
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<td>1Gbps</td>
<td>RGB/MCU</td>
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<tr>
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<td>WUXGA</td>
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<tr>
<td>SSD2858</td>
<td>WQXGA</td>
<td>1.5Gbps</td>
<td>4-Lane</td>
<td>8-Lane</td>
</tr>
</tbody>
</table>

**Touch Controller**

- **Single Layer**
  - 1-5”
    - SSD2542
      - SSD2531
      - SSD2532
      - SSD2533
      - SSD2541
      - SSD2542
      - SSD2543

- **Double Layers**
  - 2-13.6”

- **On Cell / In Cell**
  - Developing IP

**System IP**

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Thank You

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