Silicon Motion®, Inc.

SMI Display Output Control Specification

1 Overview & Scope

This Document is mainly describing the display output control logic for SM750 and SM718 display driver.

During cold boot, the period from CMOS setup to OS loading is controlled by system BIOS. The period for MS logo window is controlled by OS. This document is limited to the control after SMI driver is loaded.

The discussion is limited to using the DVI and CRT output of SM750/SM718 demo board. Some conditions may not work when primary output is connected directly to a digital TFT.

2 Glossary

Term	Definition
Single	One view on one monitor
Clone	One view on all active monitors
Dual	Two views enabled on the same display adapter, also called Extended View
Topology	Information that specifies which source is shown on which target for an adapter
EDID	Extended Display Identification Data (EDID): A string of data provided by display monitors to describe its capabilities to a video source (display adapter)
Display Mode	Combination of display resolution (width and height in pixels), color depth (in bits per pixel), and refresh rate (in Hertz) for one view

3 EDID & Display Mode List

3.1 When to read EDID:

1) During boot up, OS would call driver to query the EDID of all attached display devices.
2) When user clicks the "Force Read EDID" button on SMI Control Panel, OS will call driver to query the EDID of all attached display devices.

3.2 Display mode List

Each view has its own mode list. OS calls driver to query each view's mode list according to its attached display devices. In Single view case, if the lightened display device has EDID, driver filters its mode list according to its EDID capability, and report the filtered mode list to OS.
If Clone view case, more than one device would be attached onto one view. Driver reports the mode list of the primary device according to the devices' priority order.
The Priority order is as following:
{LCD1, LCD2, DVI, CRT1, CRT2}

Note:
For now, DVI and CRT1 is not listed on the SMI Control Panel, LCD1 represents DVI and/or CRT1.

4 Display Devices Switch & Display Mode Setting

4.1 From power on to enter desktop

During cold boot, the period from CMOS setup to OS loading is controlled by BIOS. The period for MS logo window is controlled by OS.

4.2 First time boot into desktop after install driver

Driver would check VBIOS version as following:

a) If CRT version VBIOS, 1st time boot in to desktop, display topology would be DVI/CRT1+CRT2 Clone View.
b) If Panel VBIOS, 1st time boot in to desktop, display topology would be LCD1+CRT2 Clone View.

The display mode is decided by OS.

4.3 Normally boot into desktop (exclude case 4.2)

During booting into Windows, OS will restore to the topology with the same view number as before last time's shut down. Windows is not sensitive to Single View and Clone View because the both work with one view, but it cares it is Dual View or not. Display mode of each view is kept in registry by OS. Driver doesn't have responsibility or legitimate reason to interfere with restoration of the display modes.

SMI driver's behavior for boot up configuration is as following:

<table>
<tr><th colspan="2" rowspan="2">Configuration at shut down</th><th colspan="2">Boot up</th></tr>
<tr><th>Device Detected</th><th>Configuration will be set</th></tr>
<tr><td rowspan="12">Single</td><td rowspan="4">LCD1(Only)</td><td>LCD1 (Only)</td><td rowspan="16">LCD1+CRT2 (Clone)</td></tr>
<tr><td>CTR2 (Only)</td></tr>
<tr><td>LCD1+CRT2</td></tr>
<tr><td>No Monitor</td></tr>
<tr><td rowspan="4">CTR2(Only)</td><td>LCD1 (Only)</td></tr>
<tr><td>CTR2 (Only)</td></tr>
<tr><td>LCD1+CRT2</td></tr>
<tr><td>No Monitor</td></tr>
<tr><td rowspan="4">Clone</td><td rowspan="4">LCD1+CRT2 (Clone)</td><td>LCD1 (Only)</td></tr>
<tr><td>CTR2 (Only)</td></tr>
<tr><td>LCD1+CRT2</td></tr>
<tr><td>No Monitor</td></tr>
<tr><td rowspan="8">Dual</td><td rowspan="4">LCD1(Primary) + CTR2</td><td>CTR2 (Only)</td><td>CTR2 (Primary) + LCD1</td></tr>
<tr><td>LCD1 (Only)</td><td rowspan="3">LCD1 (Primary) + CTR2</td></tr>
<tr><td>LCD1+CRT2</td></tr>
<tr><td>No Monitor</td></tr>
<tr><td rowspan="4">CTR2(Primary) + LCD1</td><td>LCD1 (Only)</td></tr>
<tr><td>CTR2 (Only)</td><td rowspan="3">CRT2 (Primary) + LCD1</td></tr>
<tr><td>LCD1+CRT2</td></tr>
<tr><td>No Monitor</td></tr>
</table>

Logic description:
1. If dual view when shut down, system will boot up with dual view because it's under OS's control.
2. If not dual view when shut down, driver will set to clone view no matter what device is detected or not.
3. If dual view with LCD1 primary when shut down but only CRT2 is detected when boot up, driver will set to dual view with CRT2 primary, otherwise, keep dual with LCD1 primary.
4. If dual view with CRT2 primary when shut down but only LCD1 is detected when boot up, driver will set to dual view with LCD1 primary, otherwise, keep dual with CRT2 primary.

4.4 Display device switch after boot into desktop

4.4.1 Use OS's Display Property Panel to change display topology

User could switch between Dual View and Clone View, and change each view's display mode. But there're two limitations:

1) User has no interface to select the display device to be lightened. Thus Single view will always turn into Clone view after change mode for Single view.
2) There's no bandwidth check for mode configuration because there's no chance to do so. Thus user can get dual view with two big mode resolutions but may cause noise on display. While use SMI Control Panel, there's no such problem because it automatically keeps you from selecting mode configurations that may cause noise.

4.4.2 Use SMI Control Panel

SMI Control panel provides following interfaces to change display device and display mode setting:

1) Display Topology change.
2) Display mode change.
3) Force to detect monitors' EDID.
4) Swap primary for dual view.
5) Hotkey for above features.

For details of SMI Control Panel, please reference "SMI Windows Control Panel User Manual".

5 History

Date	Changes made	Changed by
06/30/2010	Created	Cheok
07/20/2010	Update with latest display device logic	Ramon Wang
08/04/2010	Correct some issues proposed by Sasaki	Ramon Wang
09/15/2010	Update with selecting the device of primary view by detecting monitors at boot up	Amei Zhang
09/17/2010	Refine content	Xiuchao Sun