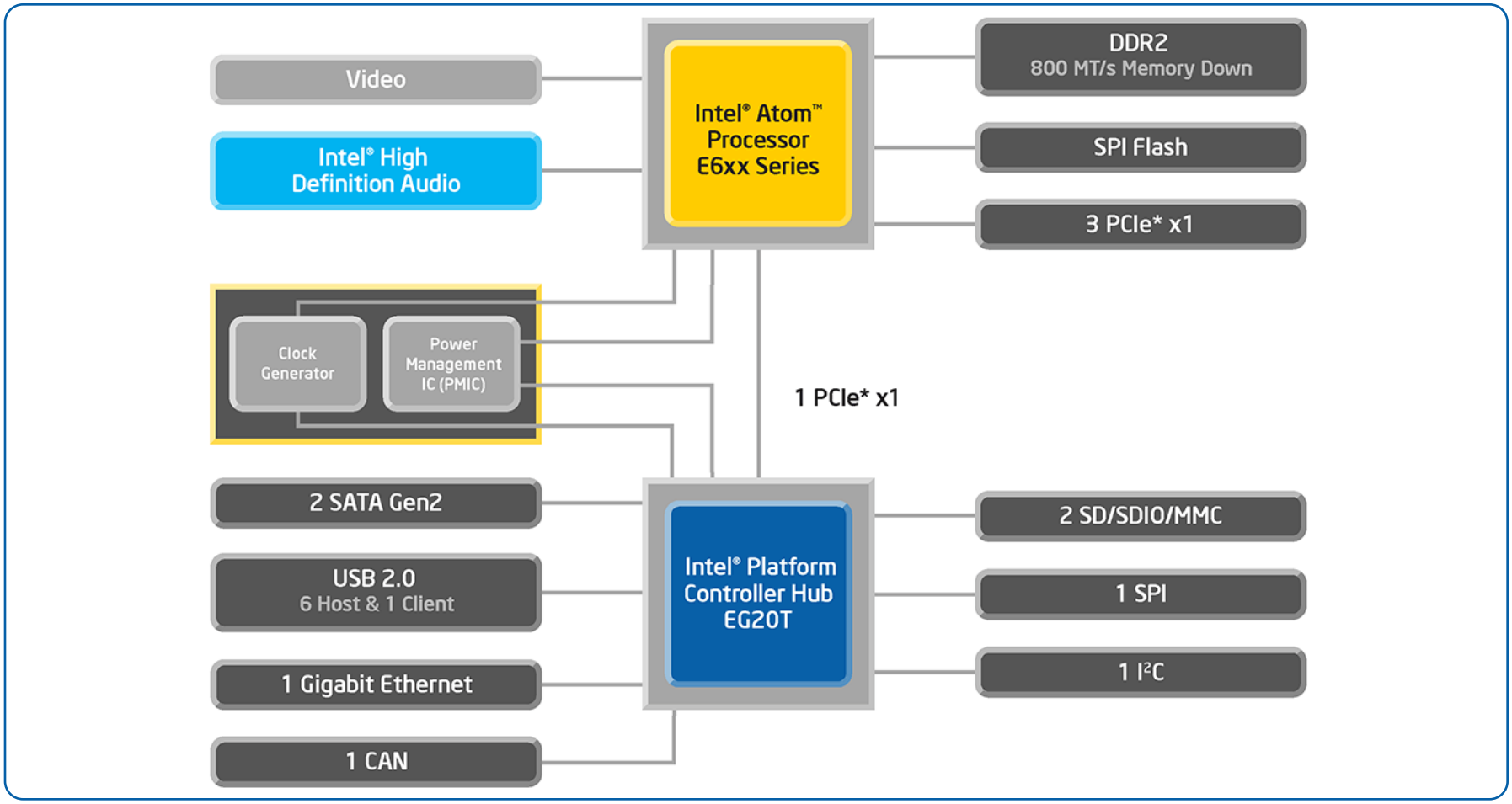
# Intel® Atom™ Processor E6xx Series

Intelligent Systems Group
Intel Corporation

# Legal Disclaimer

# Intel® Atom™ Processor E6xx Series Platform

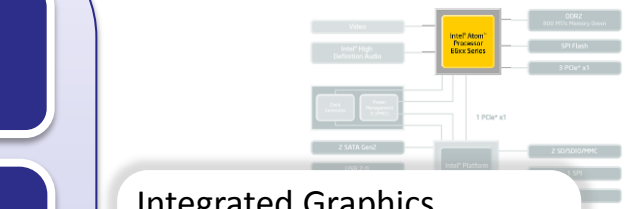


# Intel® Atom™ Processor E6xx Series (SOC)

### Intel® Atom™ Processor
- 0.6GHz to 1.6GHz
- 45 nm High K Process
- L1: 24K Data, 32K Instruction; L2: 512KB
- Enhanced Intel SpeedStep® Technology
- Intel® Hyper-Threading Technology and Intel® Virtualization Technology (Intel® VT) for IA-32, enabled

### Memory Support
- DDR2 800 MT/s
- 8 devices, up to 2GB
- 32-bit, Single Channel
- Memory down only

### Video Engine
- H/W accelerated video encode & decode
- Encode format: MPEG4, H.264
- Decode format: MPEG2, MPEG4, VC1, WMV9, H.264




### Integrated Graphics
- Up to 400MHz
- Supports OpenGL* ES2.0, OpenVG* 1.1

### Dual Display
- 24-bit single channel LVDS and SDVO

### PCI Express* Technology (PCIe*)
- Four x1 lanes (4 ports)
- Interface to IOH or any other PCIe devices

# Intel® Atom™ Processor E6xx Series SKUs

| Commercial Temperature | Industrial Temperature | Core Frequency (GHz) | Graphics Frequency (MHz) | Video Encode | Thermal Design Power (W) |
|---|---|---|---|---|---|
| Intel® Atom™ Processor E680 | Intel® Atom™ Processor E680T | 1.6 | 400 | Yes | 4.5* |
| Intel® Atom™ Processor E660 | Intel® Atom™ Processor E660T | 1.3 | 400 | Yes | 3.6 |
| Intel® Atom™ Processor E640 | Intel® Atom™ Processor E640T | 1.0 | 320 | Yes | 3.6 |
| Intel® Atom™ Processor E620 | Intel® Atom™ Processor E620T | 0.6 | 320 | No | 3.3* |

*pre-silicon estimates

**Find and compare Intel product information at: http://ark.intel.com/**

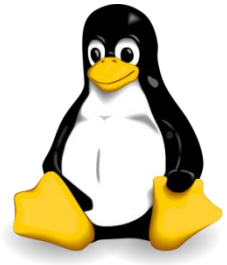
# Intel® Atom™ Processor E6xx Series OS Support

## Microsoft*

- Windows* XP SP3
- Windows* CE 6.0 R3
- Windows* Embedded Standard 2009
- Windows* 7 and WES7*

## Linux*

- Fedora* 11 /14
- MeeGo* 1.2
- Wind River* Linux*
- Android 2.3



## Real Time OS

- QNX* Neutrino*
- WindRiver* VxWorks*

# Video and Graphics

# Microsoft* OSs on Intel® Atom™ Processor Based Platform

| | | Windows* XP-XPE | | Windows* 7 / WES7* | | Windows* CE 6.0 | | WEC7* | |
|---|---|---|---|---|---|---|---|---|---|
| Platform | Graphics Engine | POR | Graphics Driver(s) | POR | Graphics Driver(s) | POR | Graphics Driver(s) | POR | Graphics Driver(s) |
| **Intel® Atom™ Processor Z510** | SGX 535 | Yes | Intel® Embedded Graphics Drivers Intel® EMGD | Yes | Intel® EMGD 1.8 | Yes | Intel Embedded Graphics Drivers (R2) | No | No |
| **Intel® Atom™ Processor E6xx** | SGX 535 | Yes | Intel EMGD | Yes | Intel EMGD 1.8 | Yes | Intel® EMGD 1.5.3 (R3) | Yes | Intel® EMGD 1.10 |
| **Intel® Atom™ Processor N4xx/N5xx** | Intel® GMA 3150 | Yes | Intel® Embedded Graphics Drivers 10.3.1 | Yes | Intel® GMA Q2 2010 | Yes | Intel® Embedded Graphics Drivers 10.3.1 | Yes | Intel® Embedded Graphics Drivers 10.4.1 |
| **Intel® Atom™ Processor Z6xx** | SGX 535 | No | N/A | Yes | Intel® GMA600 | No | N/A | No | N/A |
| **Intel® Atom™ Processor N2000/D2000** | SGX 545 | Yes | Intel® EMGD 1.12 | Yes | Intel GMA Dec 2011 | No | N/A | Yes | Intel® EMGD 1.12 |

Intel® EMGD: Intel® Embedded Media and Graphics Driver (Intel® EMGD)
Intel® GMA: Intel® Graphics Media Accelerator (Intel® GMA)

# Intel® Atom™ Processor Based Platform

| | | Fedora* | | MeeGo* | |
|---|---|---|---|---|---|
| Platform | Graphics Engine | POR | Graphics Driver(s) | POR | Graphics Driver(s) |
| Intel® Atom™ Processor Z510 | SGX 535 | F11<br>F11/F14 | Intel® EMGD 1.0, 1.5<br>Intel® EMGD 1.5.2 | V1.0<br>V1.1 | Intel EMGD 1.0, 1.5<br>Intel EMGD 1.5.2<br>IEGD 10.3.1 (Moblin 2.1) |
| Intel® Atom™ Processor E6xx | SGX 535 | F11<br>F11/F14<br>F14 | Intel EMGD 1.5<br>Intel® EMGD 1.5.2/1.6<br>Intel® EGMD 1.8/1.10 | V1.0<br>V1.1<br>V1.2 | Intel EMGD 1.5<br>Intel EMGD 1.5.2<br>Intel EMGD 1.6/1.8/1.10 |
| Intel® Atom™ Processor E6xx | Intel® GMA 3150 | F10 | Intel® Embedded Graphics Drivers 10.3.1 | V1.1 | Intel® GMA |
| Intel® Atom™ Processor Z6xx | SGX 535 | N/A | N/A | V1.1 | OTC |
| Intel® Atom™ Processor N2000/D2000 | SGX 545 | N/A | N/A | Yes | OTC |

Intel® EMGD: Intel® Embedded Media and Graphics Driver (Intel® EMGD)
Intel® GMA: Intel® Graphics Media Accelerator (Intel® GMA)

# Intel® Atom™ Processor E6xx Series (SOC)

CPU Core

Memory Controller

2D/3D Graphics

Intel® High Definition Audio

Display Controller

Hardware Video Engine

Legacy Controller

PCIe*

Integrated Graphics
- Up to 400MHz
- Supports OpenGL* ES2.0, OpenVG* 1.1

Dual Display
- 24-bit single channel LVDS and SDVO

Video Engine
- H/W accelerated video encode & decode
- Encode format: MPEG4, H.264
- Decode format: MPEG2, MPEG4, VC1, WMV9, H.264

# Video and Graphic feature

**Intel® Atom™ Processor E6xx Series Provides:**


- Ultra Low Power Integrated 3D Graphics Core
- Full HD HW Video Encode/Decode Engine, support in dedicated hardware H.264, MPEG1/2/4, VC1/WMV9 High Definition decode.

Offloads one of the most demanding tasks off of Intel® Atom™ processor core.

*Intel recommends developers to choose a media player that takes advantage of H/W accelerated video decode*

# Intel® Atom™ Processor Based Platform Graphics Features

| Graphics Feature | Benefit |
|---|---|
| **Hardware-Based Video Acceleration**<br>Supports full hardware acceleration of the following video compression standards:<br>• H.264 Baseline profile L3, Main profile L4.1, High profile L4.1<br>• MPEG2 Main profile high level<br>• MPEG4 Simple profile L3, Advanced simple profile L5<br>• VC1 all profiles up to L3<br>• WMV9 Simple profile Medium level<br>• WMV9 Main profile High level | Eliminates the need for SW codecs, thus offloading the CPU |
| **Support for 32 bit floating point operations** | High image quality |
| **UMA Memory architecture** | Reduced board space and cost |
| **Display Support**<br>• Dual Display Pipe with rotation support<br>• LVDS + SDVO for display output<br>• Supports Extended Desktop or Clone Mode | Robust display controller offers flexibility |

# LVDS

Differential interface used for local flat panels

Supports 18-bit or 24-bit color is supported

Max pixel clock of 80MHz

Panel timings must be supported by vBIOS

- Intel® Embedded Media and Graphics Driver (Intel® EMGD) tool exists to modify timings if not already supported by default vBIOS

# SDVO

Single SDVO channel

Use for any external display

- HDMI/DVI, Analog TV, VGA/CRT, LVDS

Up to 160 MHz pixel clock supported

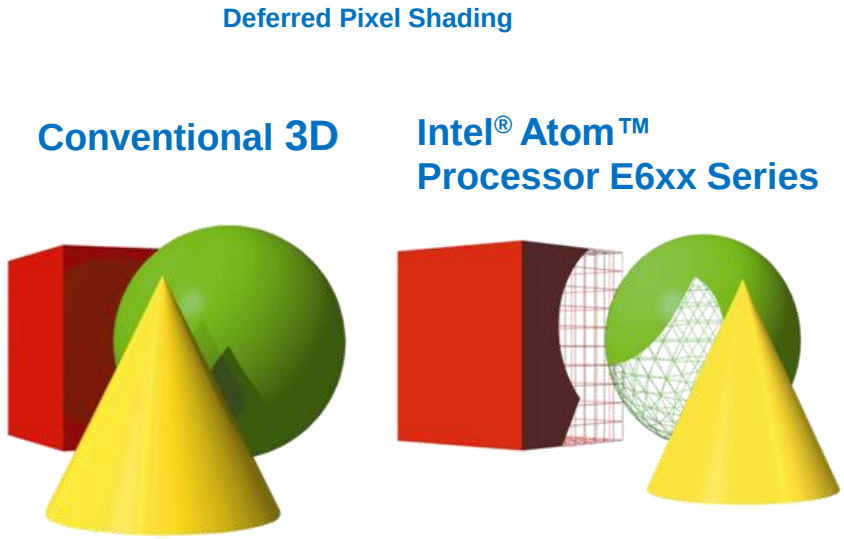
- Equates to 1280x1024 @ 85Hz
- Interface can physically go faster
- Includes 1920x1080p @60Hz (reduced blanking)

# Intel® Atom™ Processor E6XX Series Graphics Accelerator

## Deferred Pixel Shading

Key Features

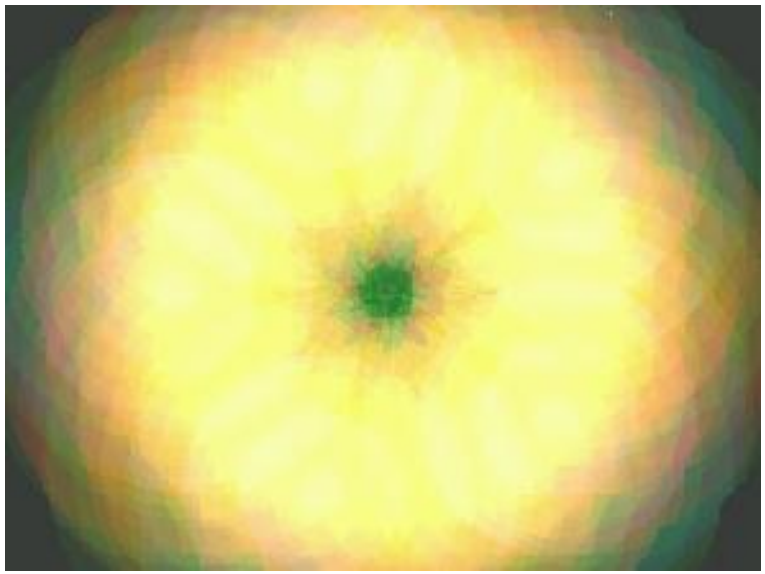
- Flexible Programmable Architecture
  - Shader based technology
  - 3D Graphics
  - 2D and advanced 2D Graphics
  - Video decode support
  - Image processing
- Deferred Pixel Shading
- High Performance
- Low Power
- Industry standard tool support
- Comprehensive OS/API support



# Tiling Benefits - Highest Image Quality

## Internal True Color Processing-32bit Floating points

The **Intel® Atom™ processor E6xx series** graphics core uses its on-chip tile buffer to process pixels at arbitrary pixel precisions up to 32 floating point even though the external frame buffer can be as low as 16-bit



Blending using 16bpp
Distinct visible artefacts

Blending using 32bpp
Internal True Color
More accurate visual results

# References


Intel AppUp℠ Developer Program http://appdeveloper.intel.com/

Intel® Atom™ Microarchitecture
http://www.intel.com/technology/atom/microarchitecture.htm

Intel® Atom™ Processor Web Site
http://www.intel.com/products/processor/atom/index.htm

Intel® Embedded Design Center http://edc.intel.com/

**Intel Press book: "Break Away with Intel® Atom™ Processors"**
http://www.intel.com/intelpress/sum_ms2a.htm

Intel Product Information http://ark.intel.com/

Intel® 64 and IA-32 Architectures Software Developer's Manuals
http://developer.intel.com/products/processor/manuals/

Intel® Software Network http://software.intel.com

Intel Tools for Intel Atom Processors
http://software.intel.com/en-us/articles/intel-tools-for-intel-atom-processors/

N.A. Software* Conversion tools
*http://www.nasoftware.co.uk/home/index.php/products/conversion-tools*

Klocwork Insight* code productivity tools http://www.klocwork.com/products/insight/

Video Encoding Accelerator Solution for Intel® Atom™ Processor E6xx Series
http://download.intel.com/design/intarch/PAPERS/324328.pdf

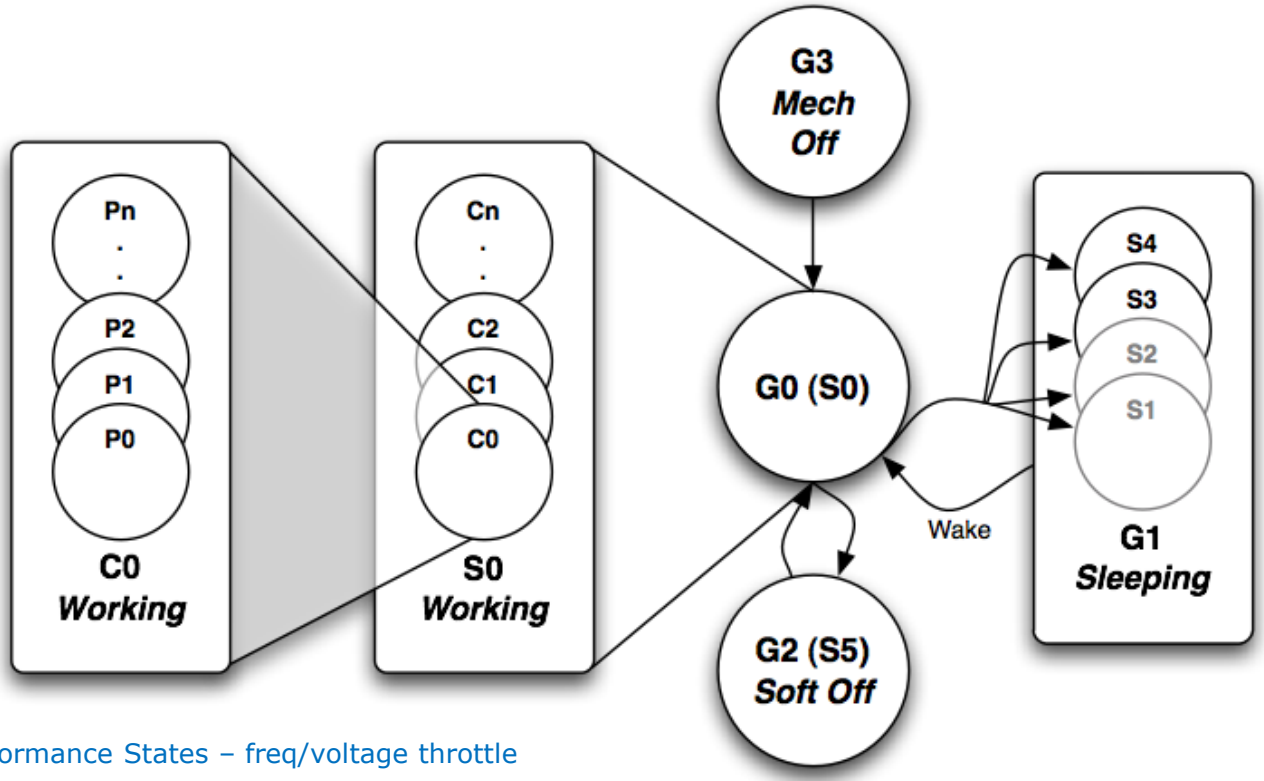
*Thank you!*

*Questions?*

# Backup

# Platform Power

# ACPI System Power States




**P-states** = Performance States – freq/voltage throttle
**C-states**= CPU power states –allows idle deep power saving
**S-states** = Sleep states – system power states
**G-states** = Global states – global power states

**T-states**= Thermal states – changes clock duty cycle
**D-states** = Device states – peripheral device power states

# System Sleep States – sub of G-states

| | | |
|---|---|---|
| **G0** Full-On | **S0** | **Full On:** Processor Operating. Individual devices may be shut down or be placed into lower power states to save power. |
| **G1** Sleeping | **S3** | **Suspend-to-Ram:** System context maintained in DRAM. Power shut off to non-critical circuits. Memory is retained and refreshes continue. All clocks are stopped except RTC clock. |
| | **S4** | **Suspend-to-Disk:** System context maintained on disk. All power is then shut off except for that needed to resume. |
| **G2** Soft-Off | **S5** | **Soft Off:** System context not maintained. All power is shut off except for that needed to restart. A full boot is required when waking. |
| **G3** Mechanical-Off | | Power is completely removed from the system except for the RTC. Hardware context is not retained. No "Wake" events are possible. |

# ACPI Global Power States

| Global System State | Sleep State | Software Runs? | Latency | Power consumption | OS restart required? | Exit state electronically/ mechanically |
|---|---|---|---|---|---|---|
| G0 (working) | S0 | Yes | 0 | High | No | Elec. |
| G1 (sleeping) | S1-S4 | No | Increasing with sleep state | Lower | No | Elec. |
| G2 (soft off) | S5 | No | Long | ~0 | Yes | Elec. |
| G3 (mech. off) | n/a | No | Long | RTC battery only | Yes | Mech. (big red on/off button!) |

- Applies to entire system; visible to user
- Instant-on PCs would use G0 and G1 almost exclusively

# ACPI Big Picture

| Global | Sleep | CPU | Processor State | System Clocks | Description |
|---|---|---|---|---|---|
| G0 | S0 | C0 | Full On | On | Full On |
| G0 | S0 | C1 | Auto-Halt | | Auto Halt |
| G0 | S0 | C2 | Stop Grant | | Stop Grant |
| G0 | S0 | C3 | Deep Sleep | | Deep Sleep, CPU clock halted |
| G0 | S0 | C4 | Deeper Sleep | | CPU voltage lowered |
| G0 | S0 | C6 | Deep Power Down | | CPU cached flushed and disabled |
| G1 | S3 | power off | Off | Off, except SUSCLK and RTC clocks | Suspend to RAM |
| G1 | S4 | | | Off, except RTC clocks | Suspend to Disk |
| G2 | S5 | | | | Soft Off |
| G3 | NA | | | power off | Hard Off |