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i.MX 6 Series Portfolio Overview AMF-CON-T0060

Pat Stilwell Product Marketing

August 2013

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INX Your Interface to the World

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CONFIRM DESTINATIO

i.MX families offer some of the most versatile platforms for multimedia and display applications, bringing personality and interactivity to a whole new world of products



Presents, the Freenak logs, AMNo, C.S., CodeTEST, OsdiManico, GleEFin, OxdFine, OxdFine, OxdFine, Dellaw, No.Evergy Ethilent Soldions logs, Xilvata, incluidUT, PEG, Preve/GMCC, Processor Reser, Cartti, Sonna, EsthAnama, Int SaldAnama logs, StarCare, Springer and Vortilia and trainfacture for the Interconductor, the U.S. Par. Str., Ott. Anima, SaveR, SedEst, Carvela, Fines, Layersona, Maryol, Mich. There is a Participa, Victor Genergy, OxfOC Engre, Bang, Pay, SaveR, Techola, Vyen, Anima, SaveR, SedEst, Carvela, Fines, Layersona, Maryol, Mich. There is a Participa, Victor Genergy, OxfOC Engre, Bang, Pay, SaveR, Tabolah, Vyen, and Ethios, an Stademotic of Feasous Remonduntar, Int. All other product or advice name and the property of their Inspective and States. O 2013 Feasous Sciencescote: In:



Objectives

- Learn about the Freescale i.MX 6 series of application processors' key features, capabilities, uses and market segment targets
- Learn about the Development Ecosystem available for the i.MX 6 Series family of processors
- Understand the power and performance advantages of the 6 Series family



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A Global Leader of Embedded Processing Solutions

Two Core Product Groups

- Automotive, Industrial & Multi-Market Solutions
 - Microcontrollers
 - Sensors
 - Analog
- Networking and Multimedia Solutions
- Communications Processors
- Applications Processors
- RF Power

>50 Year Legacy

>5,500 Engineers

>6,000 Patent Families

>18,000 Customers





- Automotive
- Industrial
- Networking
- Consumer



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Six Generations of Application Processors

1995	2001	2003	2005	2009	2011
Dragonball 1 st FSL Apps Processor	i.MX1 1st FSL ARM9 Apps Processor	i.MX2 Series 90nm LP HW Video Accel Analog Integration	i.MX3 Series ARM11 GPU Integration	i.MX5 Series 65nm LP/GP ARM Cortex-A8 >1GHz	i.MX 6 Series 40nm LP ARM Cortex-A9 Multi-core family
				PHB Print Control Print Contro	

50+ Products >150M Units

- Clear market leader for eReader apps processors (IDC)
- No. 1 in Apps Processors (IDC 12/2011)
- No. 2 in Auto Infotainment (Strategy Analytics)



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Giant Waterproof Tablet i.MX53



Maxtrack tablet for Brazilian Police with i.MX51

Sophia systems' non-contact card **Reader/Writer for** DoCoMo with i.MX51





i.MX233 based i'mWatch

Sharp e-**Dictionary with** i.MX28







Honeywell Lynx **Touch security panel** with the i.MX25



Avaak Vue Personal Video Network With the i.MX25



AMX 20.3" Modero X Series Panoramic Table Top Touch Panel with i.MX53



Harris military communication equipment with i.MX27

6

i.MX Smart Devices



Icephone, Medical Phone with i.MX31



Invoxia IP Phone - i.MX503



Televic in Belgium trams using MX51



Japanese Boarding Gate Pass Reader with i.MX27

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Navico **Marine Navigation** i.MX51

i.MX233











Self service touch screen terminal

Freescale i.MX Applications Processors





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i.MX 6: One Platform, Differentiated Products

Saves development costs and improves time to market. Scalability with multiple cores is key to implement this strategy.

Smart Device Design	Quad Core	High-End	IPTV High Performance Tablet Auto Infotainment	
	Dual Core	High-End	Smart Monitor Business Tablet Media Tablet IP Phone Tablets for Kids Mainstream Infotainment Color eReaders	
	Single Core	High-End Low-End	Smart Energy eReaders Entry Infotainment	



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NP i.MX 6 Series At a Glance

Red indicates change from column to the left

i.MX 6SoloLite

- Single ARM® Cortex™-A9 at 1.0GHz
- 256KB L2 cache, Neon, VFPvd16, Trustzone
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6Solo

- Single ARM Cortex-A9 at 1.0GHz
- 512KB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 1 shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller



i.MX 6DualLite

- Dual ARM Cortex-A9 at 1.0GHz
- 512KB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 1 shader
- 2D graphics
- 64-bit DDR3 and 2channel 32-bit LPDDR2 at 400MHz
- Integrated EPD controller



i.MX 6Dual

- Dual ARM Cortex-A9 at 1/1.2GHz
- 1 MB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II

i.MX 6Quad

- Quad ARM Cortex-A9 at 1.2GHz
- 1 MB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II



i.MX 6 Series Highlights

- ARM Cortex-A9 based solutions ranging up to 1.2GHz
- HD 1080p encode and decode (except 6SL)
- 3D video playback in High definition (except 6SL)
- Low power 1080p playback at 350mW Integrated IO's that include HDMI v1.4, MIPI and LVDS display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0 and PCI-Express
- SW support: Google Android[™], Windows[®] Embedded CE, Ubuntu, Linux[®], Skype[™] *Features vary by product family*



Applications Processor Family Roadmap



Freescale i.MX 6: unmatched pin-compatibility



freescale

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i.MX 6 Series Overview

Scalable series of five ARM Cortex A9-based SoC families

i.MX 6	i.MX 6	i.MX 6	i.MX 6	i.MX 6
i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
 1x 1GHz x32 400MHz DDR3 No HW video accel. 2D graphics (2 GPUs) LCD, EPD 	 1x 1GHz x32 400MHz DDR3 HD1080p video 2D+3D (2 GPUs), 53Mtri/s LCD, EPD 	 2x 1GHz x64 400MHz DDR3 HD1080p video 2D+3D (2 GPUs), 53Mtri/s LCD, EPD 	 2x 1/1.2GHz x64 533MHz DDR3 Dual HD1080p video 2D+3D (3 GPUs), 176 Mtri/s LCD 	 4x 1/1.2GHz x64 533MHz DDR3 Dual HD1080p video 2D+3D (3 GPUs), 176 Mtri/s LCD
		Pin-to-pin Cor	mpatible	
	Sof	tware Compatible		





Optimizing the Processor Platform





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Android Support Quad Core

The Good News: Heavy Lifting Already Done

The work required to go from 1 to 2 cores was much greater than to go from 2 to 4 (or more) cores... Android 3.0 (Honeycomb) natively supported Quad core out of the box in June 2011

If you have 4 threads and 4 cores, Android will schedule a thread per core





Intelligent Integration of Multi-Media

- 3 engines: 3D, OpenVG and BLT

freescale[™]

- 200 MT/s, 4 shaders, 3 separate engines

High quality 3D games optimized for mobile
 Augmented reality views (real world + 3D objects)
 Advanced 3D video formats (source/depth format)



15

- Create, transform, enhance, & publish multimedia fast!
- Intuitive User Interfaces for content viewing
- Scalability for 'the next big use case'

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Vivante GC2000 Ultra-threaded GPU





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NP i.MX 6 Series Triple-Play Graphics support



Same GPU drivers for all i.MX 6 Processors



Why Dual or Quad Core?



JPEG decode + encode 1024x768

- All workloads implemented on CPU
- Does not use HW
 accelerators at all
- Done in order to test CPU capabilities

CPU Utilization (1, 2 and 4 cores)

Android Honeycomb Application	1 Core	2 Core	4 Core	Quad speedup vs Dual Core
JPEG	.2 fps	~1fps	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	15	>50% faster
Browser FPS	3.45	27.58	64.4	>2x higher
Fish Tank FPS	~14-20fps	~18-25fps	~22-30fps	~25% higher

Watch it live! http://www.youtube.com/watch?v=JYFmBlk3itl#t=2m49s



od tablet application performance requires a balanced processor architecture (CPU speed, Memory BW, HW Accelerators)





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User Interfaces – Characteristics and Implications

UI content is inherently dynamic

- Unlike Games (which use pre-cached images/textures)
- User content can/will change at any time
- Therefore UI must refresh continuously in case new content emerges
- Requires high speed (533Mhz) and wide (64-bit) memory bus to ensure high frame rates

Recommend Dual Core + 64-bit Memory Bus

User Content is dynamic and (potentially) always changing. Especially true of streaming movies, YouTube, pictures, home moviews

User expects their 'latest' content to be instantly visible when scrolling (either touch or via 'remote with TV) Thumbnails must be visible and smooth as they scroll left to right.



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User Interfaces – Characteristics and Implications

- UI requires high resolution support \rightarrow 1080p TV or LCD is now the norm
- 1080p30 fps content is becoming a standard offering from websites and streaming
- 1080p60 is around the corner
- Must be able to decode h.264 High Profile 1080p at high bitrates (for user content decode as well as for video streaming over the net)



- Must be able to support newer 1080p TVs. Consumer devices starting to hit >1080p LCDs (iPAD HD) Requires large memory space, fast display capabilities, in hardware rotation/scaling
- Advantage Freescale i.MX 6: up to 4XGA, dual display engines, 64bit memory space @ 533Mhz
- Access to fast CPU MIPS → used for complicated transforms to augment visual experience
 - CPU cores useful to add in additional transforms that don't map well to 3D unit
 - Morphing effects and some fluid dynamics for innovative UI effects
 - CPU cores can also be used to augment 3D unit and act as a 'secondary' 3D unit
 - Advantage Freescale i.MX 6: up to Quad core Cortex A9 at 1.2Ghz → nearly 5Ghz of CPU horsepower



Book cover icon "blowing in the wind" when scrolling fast to visually indicate speed. Can use CPU power to calculate







User Interfaces in Action – Dual Core + 64-bit matters









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Browsing and Image Viewing



- All workloads implemented on CPU
- Does not use HW accelerators at all
- Done in order to test CPU capabilities

Арр	1 Core	2 Core	Dual Core vs Single Core	4 Core	Quad Core vs Dual Core
JPEG	.2 fps	~1fps	5x faster	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	>87% faster	15	>50% faster
Browser FPS	3.45	27.58	8x higher	64.4	>2x higher

Watch it live!

http://www.youtube.com/watch?v=JYFmBlk3itl#t=2m49s ...



Gaming Performance

- Benchmarking 3D game performance is tricky
 - Dependent upon the 3D HW, the CPU speed and memory BW
 - Must balance all three to get best performance
- **Review websites use generally available benchmarks to rate tablets** •
 - Example: Basemark, NenaMark, Antutu, Quadrant









Quadrant Benchmark



	6Quad	6DualLite	6Solo	Tegra2
Taiji Girl	25.65 fps	9.2 fps	7.67 fps	6 fps
NenaMark	49.2	30.5	27.2	21
AnTuTu	9605	5583	4531	4904
Quadrant	4011	3005	2414	2559



Video Playback and Streaming

 Video Playback or Streaming performance is highly dependent upon screen resolution



- 1080p playback on a 1024x768 screen takes less bandwidth than 1080p on a 1920x1080 LCD
- Available Memory bandwidth on 32bit DDR is ~1600MB/s
 - 64bit memory is up to 3200MB/s
 - This assumes 50% utilization of the interface (generous)
- Total Memory B/W required for 1080p playback
 - On 1024x768 screen: ~800MB/s
 - On 1920x1080 screen: ~1100MB/s
 - If performing parallel tasks, will add to memory bandwidth needs
 - System activity+screen size Can vary memory bandwidth by up to 500MBs

Recommend Dual Core + 64-bit Memory Bus for 1080p Playback



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