

Welcome to **E-XFL.COM** 

#### **Understanding Embedded - Microprocessors**

Embedded microprocessors are specialized computing chips designed to perform specific tasks within an embedded system. Unlike general-purpose microprocessors found in personal computers, embedded microprocessors are tailored for dedicated functions within larger systems, offering optimized performance, efficiency, and reliability. These microprocessors are integral to the operation of countless electronic devices, providing the computational power necessary for controlling processes, handling data, and managing communications.

#### **Applications of Embedded - Microprocessors**

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Active
Core Processor	ARM® Cortex®-A9, ARM® Cortex®-M4
Number of Cores/Bus Width	2 Core, 32-Bit
Speed	227MHz, 1GHz
Co-Processors/DSP	Multimedia; NEON™ MPE
RAM Controllers	LPDDR2, LVDDR3, DDR3
Graphics Acceleration	Yes
Display & Interface Controllers	Keypad, LCD
Ethernet	10/100/1000Mbps (2)
SATA	-
USB	USB 2.0 + PHY (1), USB 2.0 OTG + PHY (2)
Voltage - I/O	1.8V, 2.5V, 2.8V, 3.15V
Operating Temperature	-20°C ~ 105°C (TJ)
Security Features	A-HAB, ARM TZ, CAAM, CSU, SNVS, System JTAG, TVDECODE
Package / Case	400-LFBGA
Supplier Device Package	400-MAPBGA (17x17)
Purchase URL	https://www.e-xfl.com/pro/item?MUrl=&PartUrl=mcimx6x3evo10ab

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong



### Six Generations of Application Processors

1995

2001

2003

2005

2009

2011

**Dragonball** 

1st FSL Apps Processor

i<sub>MX1</sub>

1st FSL ARM9 **Apps Processor**  i.MX2 Series

90nm LP **HW Video Accel Analog Integration**  i.MX3 Series

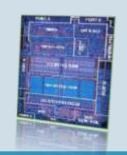
ARM11 **GPU Integration** 

i.MX5 Series 65nm LP/GP

ARM Cortex-A8 >1GHz

i.MX 6 Series

40nm LP ARM Cortex-A9 Multi-core family













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)



### Freescale i.MX Applications Processors

i.MX 6Quad



High Performance Tablet



Media Box



Luxury Infotainment



Advanced HMI

Capability Performance/ Multimedia

**Technology Driver** 

Content Creation,

Differentiation Best Better, Good,

i.MX 6Dual i.MX 6DualLite

i.MX53



Color eReader



Business Tablet



Mainstream Infotainment



Medical

i.MX 6Solo i.MX 6SoloLite

i.MX28, i.MX233, i.MX25, i.MX35, i.MX50



Monochrome eReader



Single Function Tablet



Connected Radio



Smart Energy Meter

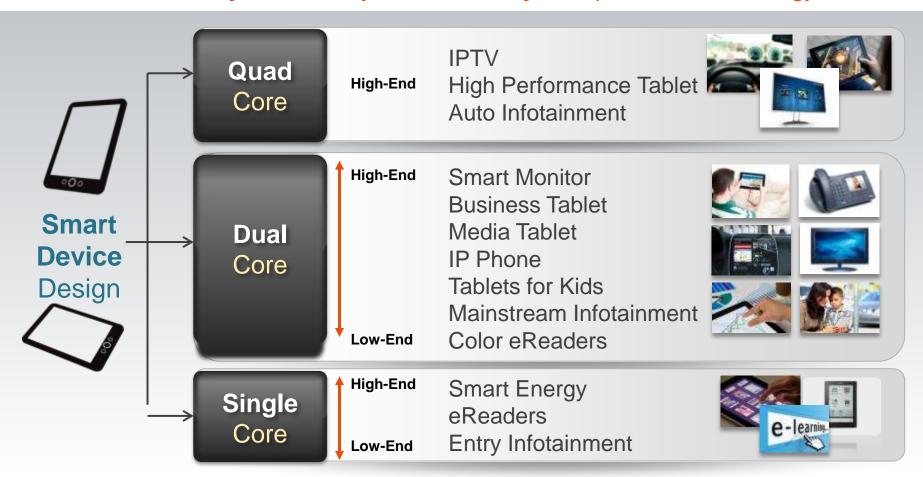




### i.MX 6: One Platform, Differentiated Products

Saves development costs and improves time to market.

Scalability with multiple cores is key to implement this strategy.





### 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

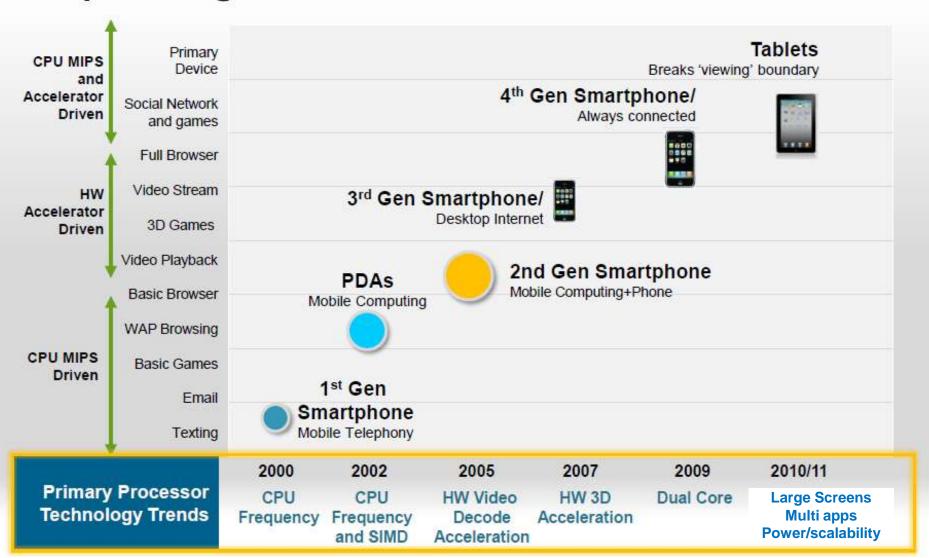
- HD 1080p encode and decode (except 6SL)
- 3D video playback in High definition (except 6SL)
- Low power 1080p playback at 350mW Integrated IO's that include HDMI v1.4, MIPI and LVDS display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0 and PCI-Express
- SW support: Google Android™, Windows® Embedded CE, Ubuntu, Linux®, Skype™

Features vary by product family





### Optimizing the Processor Platform







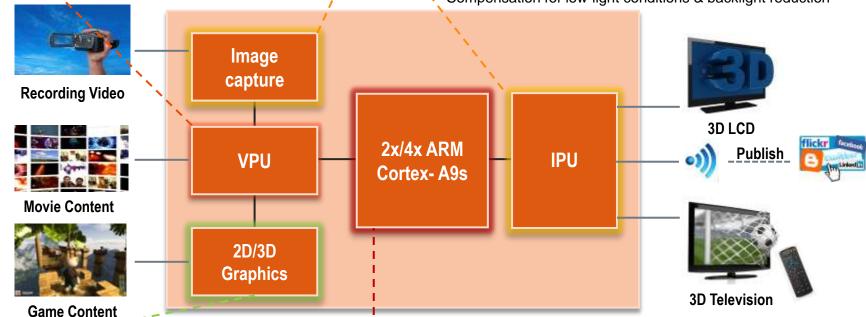
# Intelligent Integration of Multi-Media

#### i.MX 6Dual/6Quad VPU

- -H.264 MVC1080p60 decode
- -H.264 MVC 720p60 encode
- 350mW power consumption for single video!

#### i.MX 6Dual/6Quad IPU

- Four Display support (2x MIPI-DSI, Parallel, HDMI v1.4a)
- Stereoscopic camera input
- Color adjustments and gamut mapping
- Gamma correction and contrast stretching
- Compensation for low-light conditions & backlight reduction



### i.MX 6Dual/6Quad Triple-Play Graphics

- 3 engines: 3D, OpenVG and BLT
- 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)

### freescale™

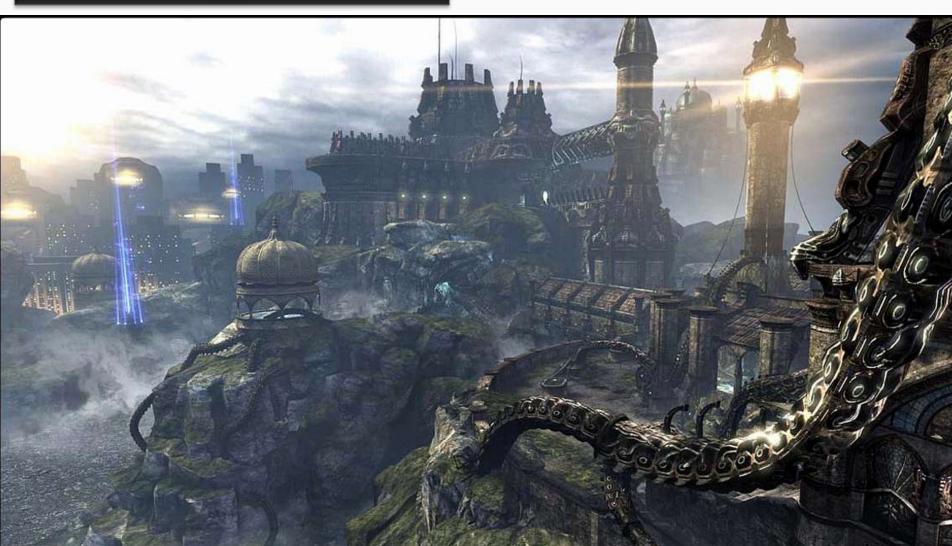
#### i.MX 6Dual/6Quad-2x/4x cores

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





### Vivante GC2000 Ultra-threaded GPU







# Why Dual or Quad Core?

Webkit Browser page rendering and scrolling

2D 'Fish Tank'

(HTML5)



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



# NP

# 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



- 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

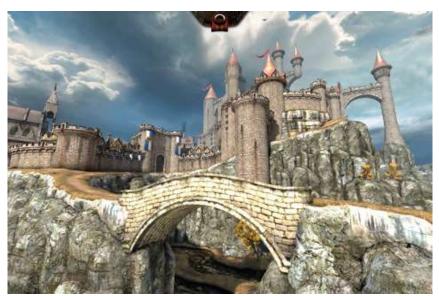
Recommend Dual Core + 64-bit Memory Bus for 1080p Playback





# **User Interfaces – Characteristics and Implications**

Screenshots of Unreal Citadel Running on i.MX 6Quad











# i.MX 6 Series VPU: Multi-streams

			Max # Streams				
	Standard	Profile	D1@ 30fps	720p@ 30fps	1080p@ 24fps	1080p@ 30fps	
	H.264	BP/MP/HP	8	3	2	1	
HW	On2 VP8	-	4	2	1	1 (iMX6Q/D, <b>TBD</b> ) 1 (iMX6D/S)	
Decoder	VC1	SP/MP/AP	8	3	2	1	
	MPEG4	SP/ASP	8	3	2	1	
	H.263	P0/P3	8	3	2	1	
HW	H.264	ВР	6	2	2 ( <b>TBD</b> )	1	
Encoder	MPEG4- SP/H.263	MPEG4-SP H.263-P0/P3	6	2			





### i.MX 6 Series Software – Current BSP Releases

- All public software releases are available at www.freescale.com/imx6tools
- Future releases will support Linux 3.10 kernel and Android JB 4.3

BSP	Distribution	Kernel	SoC Supported	Release Date
L3.0.35_4.0.0	LTIB	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	5/13/2013
L3.0.35_2.1.0	LTIB	3.0.35	i.MX 6SoloLite	6/4/2013
JB4.2.2_1.1.0	Android JB 4.2.2	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	7/11/2013
R13.4.1	Android ICS 4.0.4	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	12/12/12
R13.5.0	Android ICS 4.0.4	3.0.35	i.MX 6SoloLite	11/16/12





### i.MX 6Series – Power Consumption Summary











Sleep	3.8mW	Sleep	3.8mW	Sleep	3.9mW	Sleep	3.1mW	Sleep	2.6mW
IDLE	227mW	IDLE	220mW*	IDLE	151mW	IDLE	143mW	IDLE	14.5mW
Video	867mW	Video	867mW	Video	772mW	Video	695mW	Video	n/a
3D	1.6W	3D	1.6W	3D	1.1W	3D	1.1W	3D	n/a
ТурМах	3.8W	ТурМах	n/a	ТурМах	2.4W	ТурМах	1.7W	ТурМах	n/a

n/a = results pending release june 30th

- All results include power at the chip (cores, accelerators, peripherals, DDR I/O) as well as the power consumption of the external DDR3 ICs.
- Power application notes listed in the presentation contain the full breakouts for the chip and DDR3. Note that use of LPDDR2 memory will substantially reduce memory IC power consumption

Scalable Performance and Power Consumption 'One Series fits all'



<sup>\* 6</sup>Dual cores are estimated on 6Quad by clock gating two cores



# i.MX 6 Series feature list (4/4)

#### Red indicates change from column to the left

	i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad	
UART SPI I2C	5x UART, 4x SPI 4x I2C	4x SPI 5x UART 4x I2C	4x SPI 5x UART 4x I2C	5x SPI 5x UART 3x I2C	5x SPI 5x UART 3x I2C	
ADC	-	-	-	-	-	
Temp. Monitor	Yes	Yes	Yes	Yes	Yes	
PMU	Partial PMU integration					
Security	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	
Commercial Qual.	Available	Available	Available	Available	Available	
Automotive Qual. AEC-Q100	-	Available	Available	Available	Available	
Industrial Qual.	-	Available	Available	Available	Available	
Package	13x13 0.5P BGA		0.8P BGA vith i.MX 6Dual/Quad	21x21 0.8P FCBGA Pin compatible with i.MX 6DualLite/Solo		





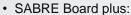
# **SABRE Platforms: Enabling Faster Time to Market**

i.MX 6 series development tools are Freescale designed and Freescale supported

#### SABRE Platform for

#### **Smart Devices**

- i.MX 6Quad/6DualLite 1 GHz ARM Cortex-A9
- Multiple connectivity options: Wi-Fi®, Bluetooth®, GPS, Ethernet, SD, parallel/serial interfaces, SATA (i.MX 6Quad only), PCIe and MIPI CSI



- 10.1" capacitive multi-touch display
- Battery charging ICs
- · The SPI NOR Flash
- · MIPI display and MIPI camera connectors
- · 2x MIPI camera sensors
- Digital microphones
- · Ambient light sensor, GPS
- EPDC connector (i.MX 6DualLite only)



### SABRE for Auto Infotainment

- · Available to Tier 1 automotive OEMs
- i.MX 6Quad or i.MX6DualLite CPU card and i.MX 6 series base board
- Support for terrestrial and satellite radio tuners, Wi-Fi, Bluetooth, GPS, cellular modem, iAP authentication modules, MOST vehicle networking, cameras and displays
- Processor capability ranges from single ARM Cortex-A9 core at 800 MHz up to a quad core at up to 1 GHz

#### **SABRE Board** for

#### **Smart Devices**

- · i.MX 6Quad 1 GHz ARM Cortex-A9
- Intelligently designed with connectors on only two sides of board to eliminate 'octopus effect' on lab tables
- Evaluate the smartly integrated features of the i.MX 6Quad processor including an LVDS controller, USB PHYs, HDMI PHYs, SATA, PCI Express<sup>®</sup>, on-board power management and Ethernet



- · i.MX 6SoloLite 1 GHz ARM Cortex-A9
- Integrated E Ink® display controller
- Enables EPD and/or LCD or HDMI display, touch control and audio playback, and the ability to add WLAN, a 3G modem or Bluetooth technology
- E Ink display available separately





# ....IX 6 Quad SABRE Lite Board (TO1.0 Silicon)

### http://boundarydevices.com/products/sabre-lite-imx6-sbc/

### **Low Cost Community Board**



- 1GByte of 64-bit wide DDR3 @ 532MHz
- Three display ports (24-bit RGB, LVDS, HDMI)
- Two camera ports (1xParallel, 1xMIP!)
- Serial ATA (SATA)
- Dual SDHC card slots (1 std, 1 micro)
- PCI express port
- Analog (headphone/mic) and Digital (HDMI) audio
- Compact size (3½"x3½")
- 10/100/1G Ethernet
- 10-pin JTAG interface
- 3 High speed USB ports (2xHost, 1xOTG)
- CAN port
- UART debug port
- I2C
- Purchase directly from Boundary Devices
  - PO, Credit Card or PayPal placed directly with Boundary Devices
  - Schematics and user manual available on Boundary website
- Additional supply partners available in Q3

SABRE-Lite will not be stocked, sold, or supported by Freescale All support from Boundary Devices, partners or IMXCommunity.org





A Freescale supported open web community of developers sharing common interest in transforming i.MX applications processors into practically anything imaginable.

### **Community Facts at a Glance**

- Over 3,800 members and over 200 Freescale engineers and marketers interacting with you
- Support and enablement for i.MX processors and software
- Forums, Groups and Blogs Posts
- News, Photos and Videos
- Training, Events and Promotions





# i.MX 6 Series Triple-Play Graphics support

### i.MX 6Solo / i.MX 6DualLite



Composition (2D BLIT)



3D + GP GPU 1 shader core

#### i.MX 6Dual



Composition (2D BLIT)



**Vector Graphics** 



3D + GP GPU 4 shader cores

### i.MX 6Quad



Composition (2D BLIT)



**Vector Graphics** 



3D + GP GPU 4 shader cores

Same GPU drivers for all i.MX 6 Processors





# SABRE Platform for Smart Devices (SDP)

i.MX 6Quad 1GHz Cortex-A9 Processor i.MX 6DualLite 1GHz Cortex-A9 Processor

Freescale MMPF0100 PMIC

• 1 GB DDR3 memory (non terminated)

• 3" x 7" 8-layer PCB

**Part Numbers:** 

MCIMX6Q-SDP (\$999)

MCIMX6DL-SDP (\$999)

Display (4.3"): WiFi:

MCIMX28LCD (\$199) Silex WiFi module Connectivity

• 2x Full-size SD/MMC card slot

• 22-pin SATA connector

• 10/100/1000 Ethernet port

• 1x high-speed USB OTG port

mPCI-e connector

#### **Display connectors**

 Native 1024x768 LVDS display (comes with kit)

• 2<sup>nd</sup> LVDS connector

 Connector for 24 bit 4.3" 800x480 WVGA with 4-wire touch screen

HDMI Connector

MIPI DSI connector

#### **Audio**

Wolfson Audio Codec

· Microphone and headphone jacks

Dual 1W Speakers

#### **Expansion Connector**

Enables parallel LCD or HDMI output

Camera CSI port signals

• I2C, SSI, SPI signals

### **Tools Support**

 Lauterbach, ARM (DS-5), Macraigor debug/IDE tool chain

#### Debug

- JTAG connector
- Serial to USB connector

#### **Additional Features**

- 3-axis Freescale accel
- GPS receiver
- Ambient Light Sensor
- eCompass
- Dual 5MP Cameras
- Power supply
- Battery Charger
- Battery connectors

#### **OS Support**

- Linux and Android IceCream Sandwich from Freescale;
- Others: support by 3<sup>rd</sup> parties

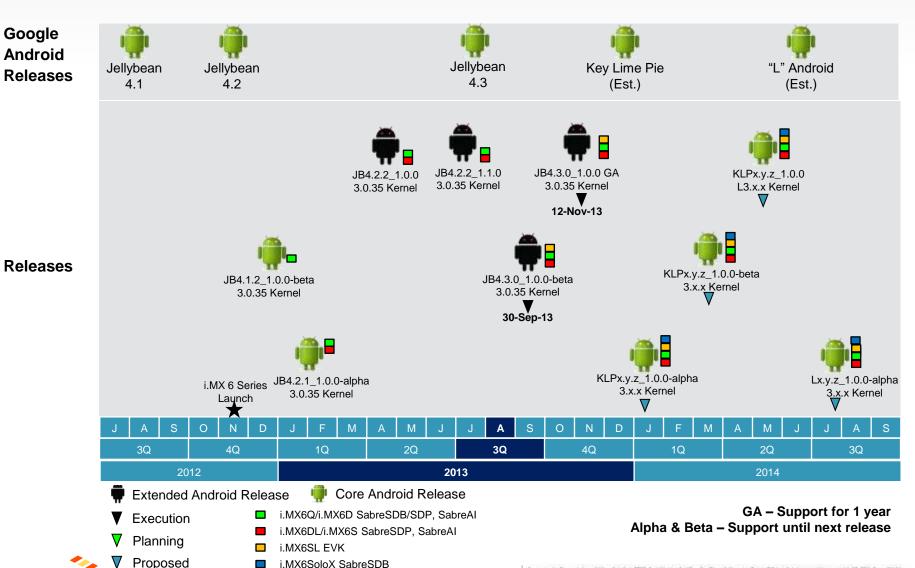




# **Android Roadmap**

freescale **\*** 

Google **Android** Releases



Presents, the Francolo logs, AWIvo, D.S., Code/EST, CadeMartor, CateFire, CodeFires, C. Mare, the Energy Efficient Solutions legs, Xinsta, mobileCT, PSC, ForeerQUCC. Processor Eaguer, Contil, Commus, Establishan, the Sate-Feature logic, StatiCore: Symptomy and Vontile are trademarks of Freezista Earniconductor, etc., Reg. U.S. Par. 5 7m. 0 ft. Arrian, Beefil, BeeStack, CoreAst, Flests, Layersope, Magniff, MRC, Platforn in a Partiage, GoriG Gorivega, 'QUIDC Engire, Ready Play, SWAPTMOS, Tower, TuboLink, Vytrad and Enterior are trademorks of Prescues Semiconductor, Inc. All other product or service remain the progress of their respective invitings. © 2019 Freedom Semiconductor; Inc.