iCE40 "Los Angeles" Family

Custom Mobile Devices for Smartphones and Tablets

The iCE40™ Los Angeles mobileFPGA™ family is designed for sensor management, video and imaging, custom connectivity and memory/storage expansion for Custom Mobile Device™ solutions.

Fabricated on a 40-nm low-power, standard CMOS process, the Los Angeles family has been optimized for mobile consumer applications such as smartphones, tablets, digital still cameras (DSCs), e-book readers, and portable navigation devices (PNDs). The Los Angeles family comes in two power/performance variants:

- **LP Series Smartphone** – Targeted series optimized for low power
- **HX Series Tablet** – Targeted series optimized for higher performance

Custom Mobile Device Solutions
Sensor Management in Smartphones

Sensors are changing the landscape of today's smartphones. Today's high-end smartphones can contain as many as 20 different sensors. Managing all these sensors while meeting power and performance targets can be a daunting task for smartphone designers. By using a Custom Mobile Device as a companion chip to an application processor (AP), various sensor related functions can be performed including:

- Sensor Detection: Perform battery insertion detection and audio insertion detection
- Sensor Expansion: Add sensors with different interfaces such as I^2C, SPI, and SLIMbus
- Event Filtering: Use intelligent conditional filtering to only send interrupts to the processor under specific conditions
- Interrupt Aggregation: Collect interrupts from sensors and combine them into efficient summaries to the processor
- Auto Polling: Periodically seek sensor data while keeping the processor in low-power mode
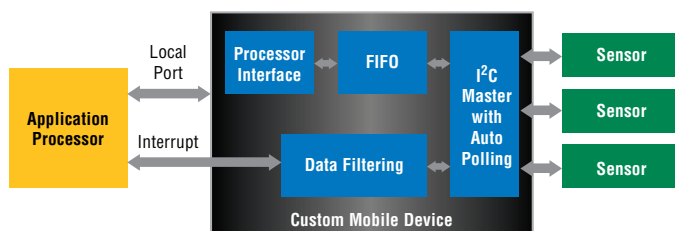
Battery-powered applications can save on power by using a Custom Mobile Device to offload sensor management functions from the processor, keeping the processor in a low-power sleep mode as much as possible.
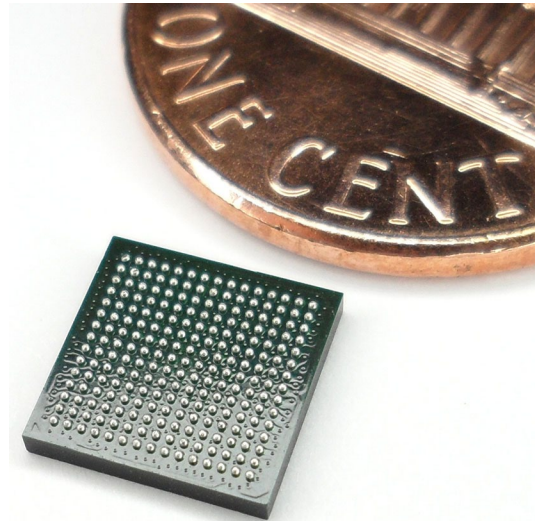
Key Features and Benefits

- **Sensor Management**
  - Battery and audio insertion detection with high-speed comparators
  - Support of MIPI SLIMbus interface
  - Interrupt filtering, interrupt aggregation, auto polling for AP offload
- **Video and Imaging**
  - High-speed LVDS channels up to 525 Mbps per channel
  - Supports displays up to WUXGA (1920x1200 resolution) dual LVDS
  - Supports 720p 30/60 Hz or 1080p 30 Hz video single lane LVDS
  - Supports MIPI DBI and MIPI DPI video interface standards
  - Ideal for 3D solutions
- **Custom Connectivity**
  - High speed USB 2.0 host and device controllers
  - ULPI/UTMI interface support
- **Faster Performance**
  - LP Series: Up to 50% faster performance compared to iCE65™ devices
  - HX Series: Up to 80% faster performance compared to iCE65 devices
- **Ultra-Low Power**
  - As low as 15 µA static current for extended battery life
  - iCEgate™ latch allows user to selectively freeze inputs on a pin-by-pin basis to reduce switching power
- **Industry's Broadest Portfolio of 0.4mm Pitch BGAs**
  - Footprints as small as 2.5x2.5 mm
  - Suited for smartphone and tablet applications
- **Single Chip**
  - Lattice's proprietary, on-chip Non-Volatile Configuration Memory (NVCM) enables your design to be securely stored on-chip
- **Low Cost**
  - 40nm standard CMOS technology enables ASIC-like cost

Solution for Video and Imaging in Tablets

Application processors (APs) used in tablets were originally designed for notebooks or smartphones. Many smartphone APs support only a single video output stream. With only one video stream, a problem arises when a tablet needs to drive an external display in addition to the local LCD. By using a Custom Mobile Device as a companion chip to an application processor, two video displays can be driven from the same video source. Typical video functions that can be supported include:

- Video Scaling: Upscaling or downscaling
- Color Space Conversion: Y CbCr to R GB
- Parallel-to-serial or serial-to-parallel conversion
- 3D Video
- Image Rotation
- Supports High Definition Video
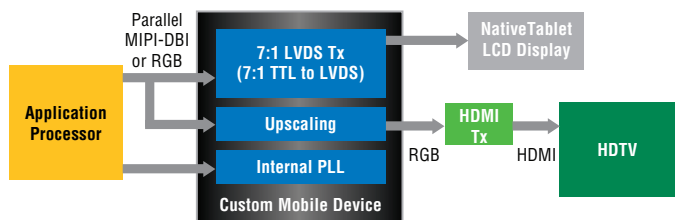
Tablet applications can easily drive both the native LCD display as well as an external display by using a Custom Mobile Device

Development Tools

Lattice's iCEcube2 development software is a feature-rich development platform that supports the development with Lattice's iCE40 mobileFPGA™ devices. The iCEcube2 development software integrates Synopsys' Synplify Pro® synthesis tool with Lattice's physical design tools (placement & routing).

The iCEcube2 design environment includes key features and functions that help facilitate design for mobile applications. They include a project navigator, constraint editor, floorplanner, package viewer, power estimator, and static timing analyzer.

iCE40 Device Selection Guide

Feature	LP-Series Optimized for ultra-low power applications (1.0 Volt and 1.2 Volt Operation)					HX-Series Optimized for display, memory and SERDES applications (1.2 Volt Operation)				
	LP640	LP1K	LP4K	LP8K	LP16K	HX640	HX1K	HX4K	HX8K	HX16K
Logic Cells	640	1280	3520	7680	16192	640	1280	3520	7680	16192
Embedded RAM Bits	32K	64K	80K	128K	384K	32K	64K	80K	128K	384K
Phase-Locked Loops	1	1	2	2	2	1	1	2	2	2
Core Icc @ 0KHz[1]	35µA	40µA	140µA	160µA	250µA	120µA	160µA	400µA	660µA	1500µA
Package[2]	Programmable I/O: Max I/O (LVDS Channels)									
M363 (2.5 x 2.5 mm)	25 (3)	25 (3)								
CM49 (3 x 3 mm)	35 (5)	35 (5)								
CM81 (4 x 4 mm)	63 (8)	63 (8)	63 (9)[4]							
CM121 (5 x 5 mm)		95 (12)	93 (13)	93 (13)						
CM225 (7 x 7 mm)			167 (20)	178 (23)	178 (23)				178 (23)	
QN84[3] (7 x 7 mm)		67 (7)								
CB132 (8 x 8 mm)							95 (11)	95 (12)	95 (12)	
CB284 (12 x 12 mm)										222 (25)
CT256 (14 x 14 mm)									206 (26)	206 (26)
VQ1003 (14 x 14 mm)						67 (8)	72 (9)			
TQ144 (20 x 20 mm)							96 (12)	107 (14)		335

1. At 1.2V Vcc
2. Packages: CB-0.5mm pitch Chip Scale Ball Grid Array, CM-0.4mm pitch Chip Scale Ball Grid Array, CT-0.8mm pitch Ball Grid Array, TQ-Thin Quad Flat Pack, VQ - Very Thin Quad Flat Pack
3. No PLL Available
4. Only 1 PLL Available

Applications Support

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