FTF FREESCALE TECHNOLOGY FORUM 2015

From Concept to Product: **Get Your Wearable to Market**

FTF-HCW-F1138

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J U N E . 2 0 1 5

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External Use

Agenda

Part 1:

- **Concept:** Understanding the Wearable Market
- **From Concept to Prototype**: Wearable Reference Designs
- **Prototype to Production:** When is a Prototype Ready

Part 2:

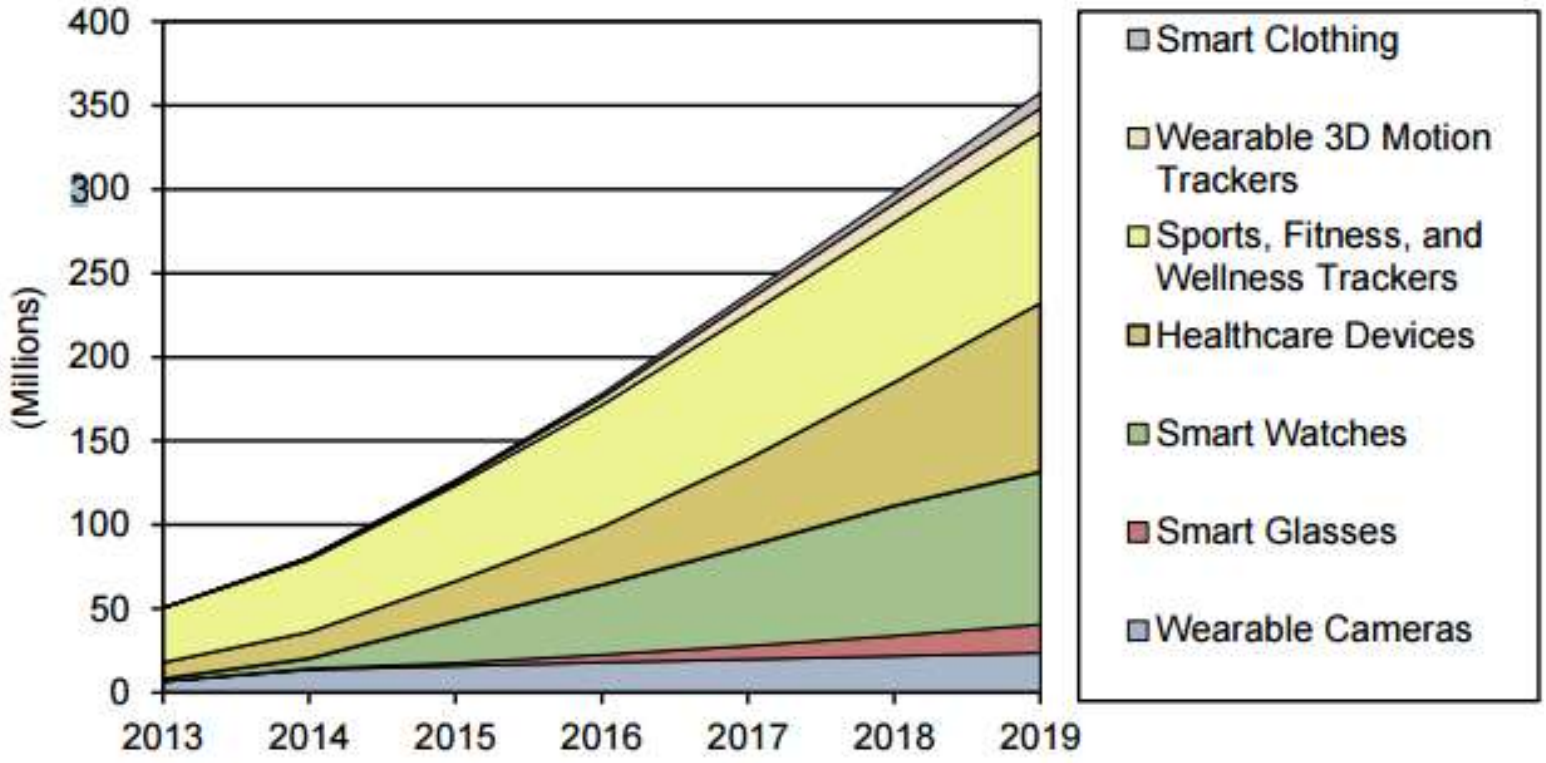
- **Freescale and Partner Boards**: From Concept to Product

Concept: Understanding The Wearable Market and the Customer

Wearable market Forecast. Why are we here?

By 2019

- 455M devices generating $46.5B
- Healthcare devices biggest category 121 M units
- Smartwatches generate the most revenue, $21B



Sources: ABI Research, Credit Suisse Equity Research

Wearables.. One Size does not fit all

Wearables…A Diverse Market

Vertical	Categories
Fitness & Wellness	**Sports & Heart Rate Monitors** **Pedometers, Activity Monitors** Smart Sport Glasses Smart Clothing **Sleep Monitors** Emotional Measurements
Healthcare & Medical	CGM **(**Continuous Glucose Monitoring) **ECG Monitoring** **Pulse Oximetry** **Blood Pressure Monitors** Drug Delivery (Insulin Pumps) Wearable Patches (ECG, HRM, SpO2)
Infotainment	**Smart Watches** Augmented Reality Headsets **Smart Glasses** Wearable Imaging Devices
Industrial & Military	Hand-worn Terminals Augmented Reality Headsets **Smart Clothing**

Data Collection

- How long has this machine been working?
- What is its efficiency percentage?
- When will one of its parts break/need replacing?

- How long has the employee been working?
- What is their efficiency percentage?
- How fatigued are they?

Start at the End (user.)

Customer	• Are you developing something people will value
Cost	• Does your cost enable an end price that will meet customers perceived value
Competition	• How will you differentiate, is that differentiation sustainable, WWAD?
Context	• Will funding for wearables dry up • Does the supply chain for your device already exist ?

Concept To Prototype

Pi is the Answer?

Great tool but,

- Not open source
- Subsidized
- Limited ability to productize

Wearable Reference Designs?

Raspberry Pi

ToQ

Intel Curie

Udoo Neo

Arduino

WaRP

Intel Edison

RioT

Beagle Bone

Ingenic
Newton 2

SensoPlex
SP-10C

Pico

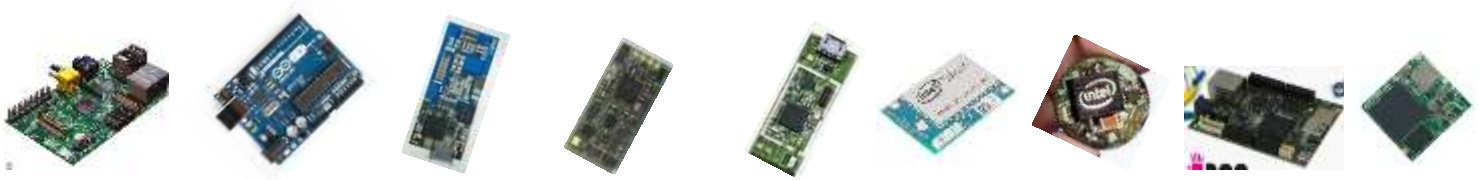
Wearable Reference Designs - Key Features

First decision: Microcontroller or Application Processor

Key Features
1. Wearable Form Factor
2. Battery Management
3. Ease of Use/Scalability
4. Open Source - Community
5. BOM Cost & Availability

Faster time to final product

Wearable Reference Designs



	Raspberry Pi 2	Arduino Uno	WarP	Ingenic Newton 2	SensoPlex SP-10C	Intel Edison	Intel Curie	UDOO Neo	Pico
Wearable Form Factor	3.4” × 2.2 ”	2.7” x 2.1”	1.4” x 0.6”	1.2” X 0.6”	1.4” x 1.0”	1.4” x 1.0”	0.7” diameter	2.2” x2.7”	2.1” x 2.8”
Battery Life									
Scalability	Arduino compatible	Shields	Daughter cards	External boards	Daughter boards	Arduino compatible		Arduino Compatible	Edison Compatible
Open Source									
BOM Cost / Availability									

Design with the Right Components

- Components make up over 60% of your entire business costs

The Good

- Small Footprint
- Low Power

The Bad

- Price increases dramatically for small quantities

The Ugly

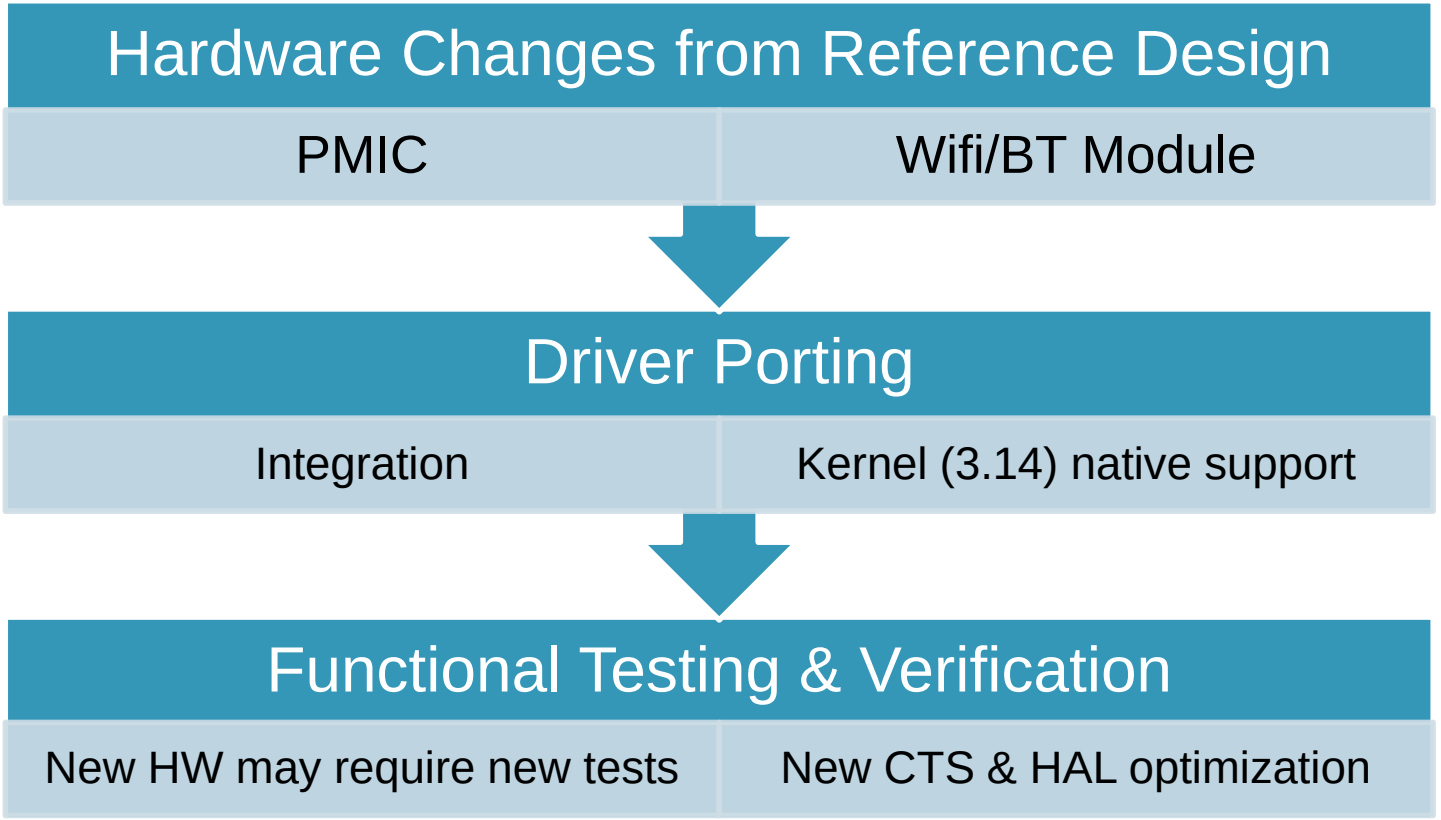
- Short life cycles
  Limited availability (distribution)

Prototype To Production

Software: From Reference Design to Production

About half the way there…

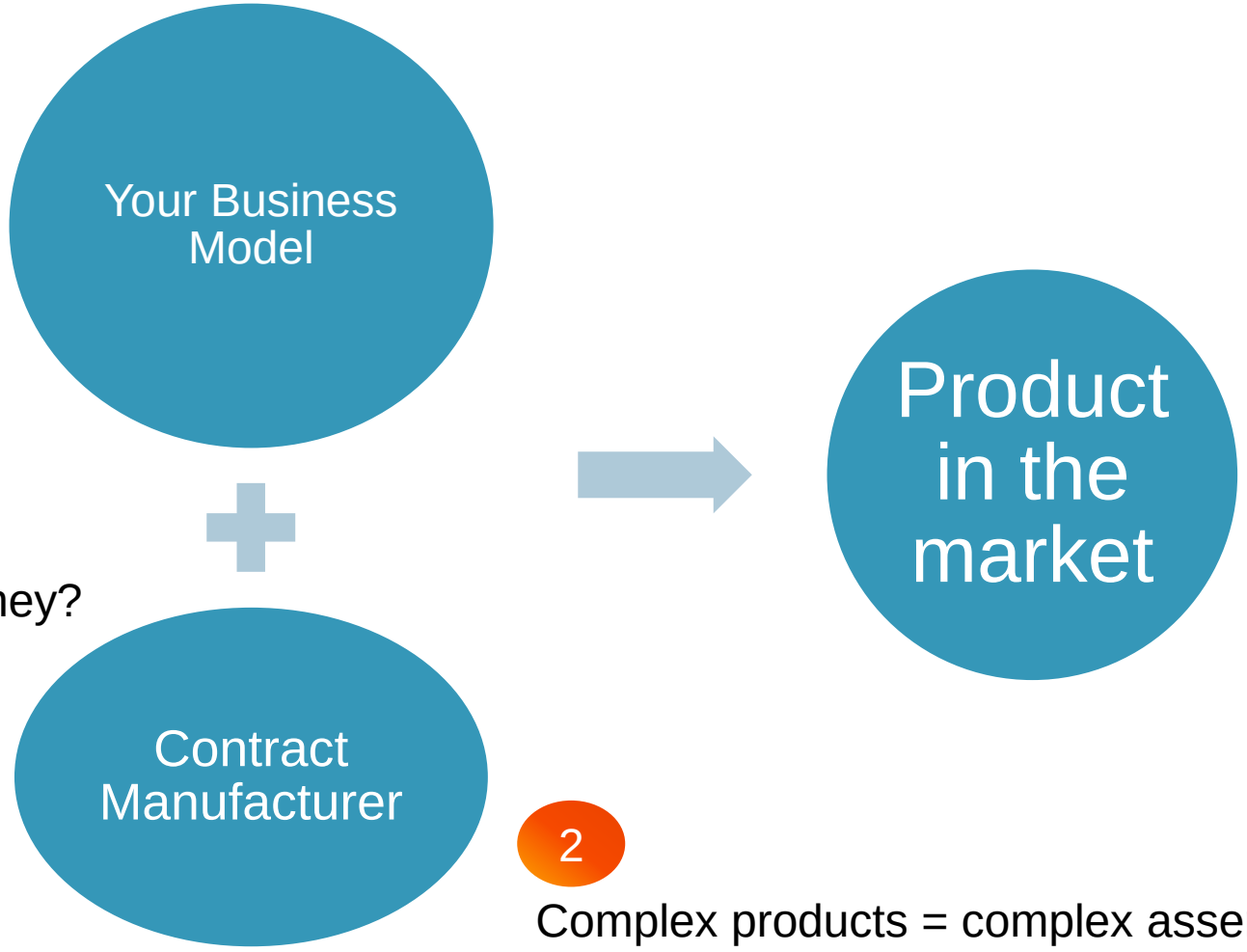
- Android is a framework it takes a considerable effort (develop & test) to deliver a system!



“No hardware plan survives contact with a factory”

Cyril Ebersweiler, Founder of HAXLR8R

Your Factory is your most Important Partner



1

How do they make money?

2

Complex products = complex assembly = lower yield

3

Component sourcing/financing

Concept To Prototype
Freescale's Participation

Speeds and eases development for creating wearable devices by **addressing key technology challenges**

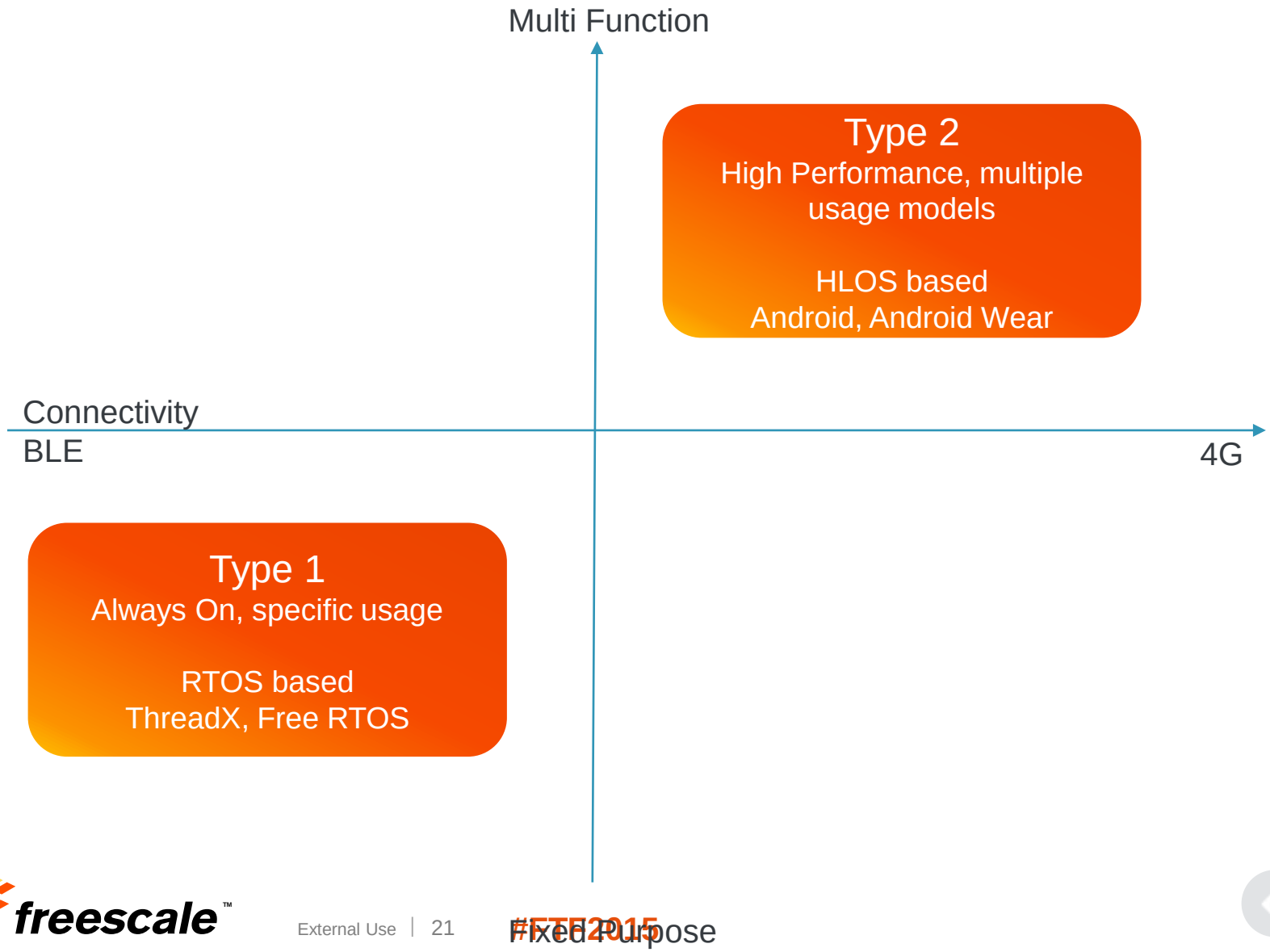
Wearable Form Factor

Maximizing Battery Life

Maximize Usability

Low cost BOM

Market Segmentation



Concept To Prototype

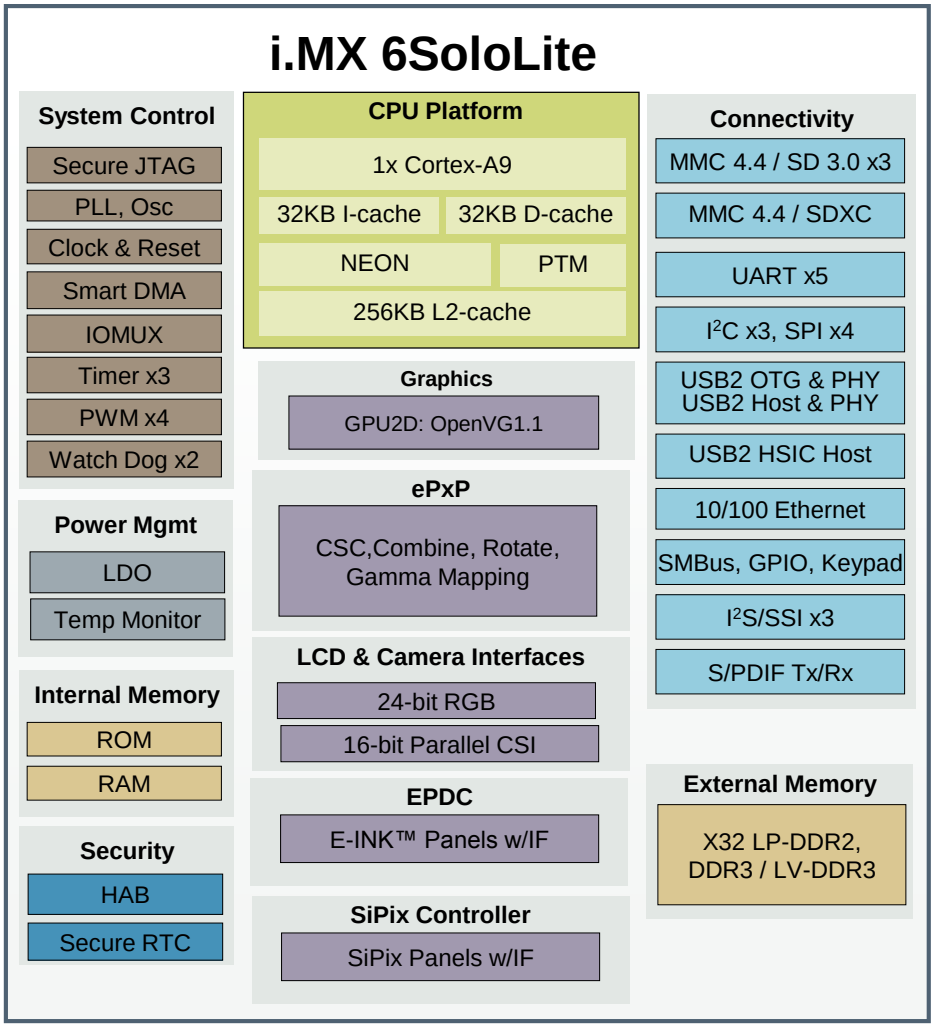
i.MX 6SoloLite Multimedia Processor

Specifications

- CPU: ARM® Cortex®-A9 @ 1GHz
- Package: 0.5mm 13x13 MAPBGA

WaRP Use Case

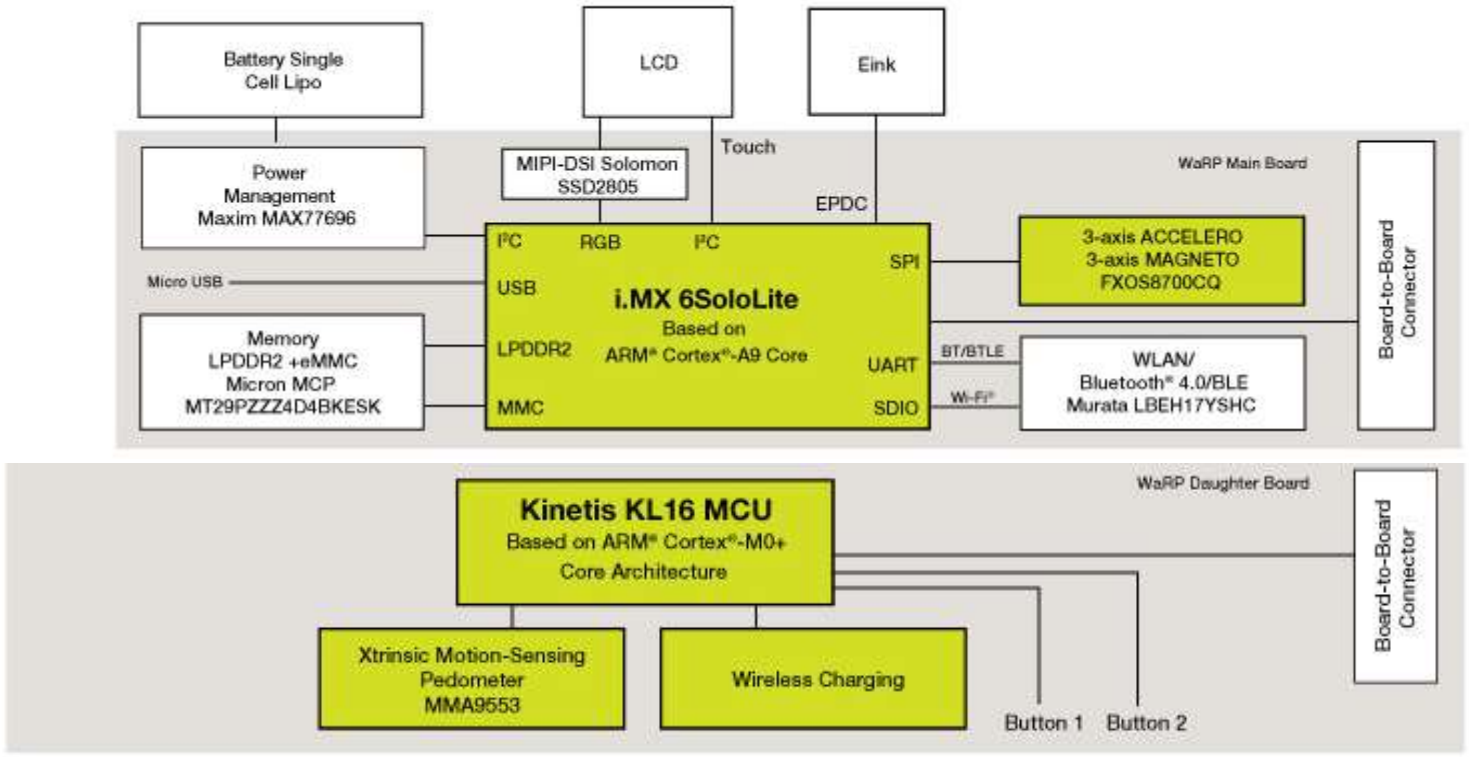
- Idle: 4.9 mW, Suspend 0.93 mW
  - Clock/power gating
- EPD /LCD Controller & 2D GPU
- x32 LP-DDR2 & managed NAND



WaRP Block Diagram

Main Board PCB size:
38 mm x 16 mm
(1.4”x 0.6”)

Daughter Board
PCB size:
42 mm x 42 mm
(1.65” x 1.65”)

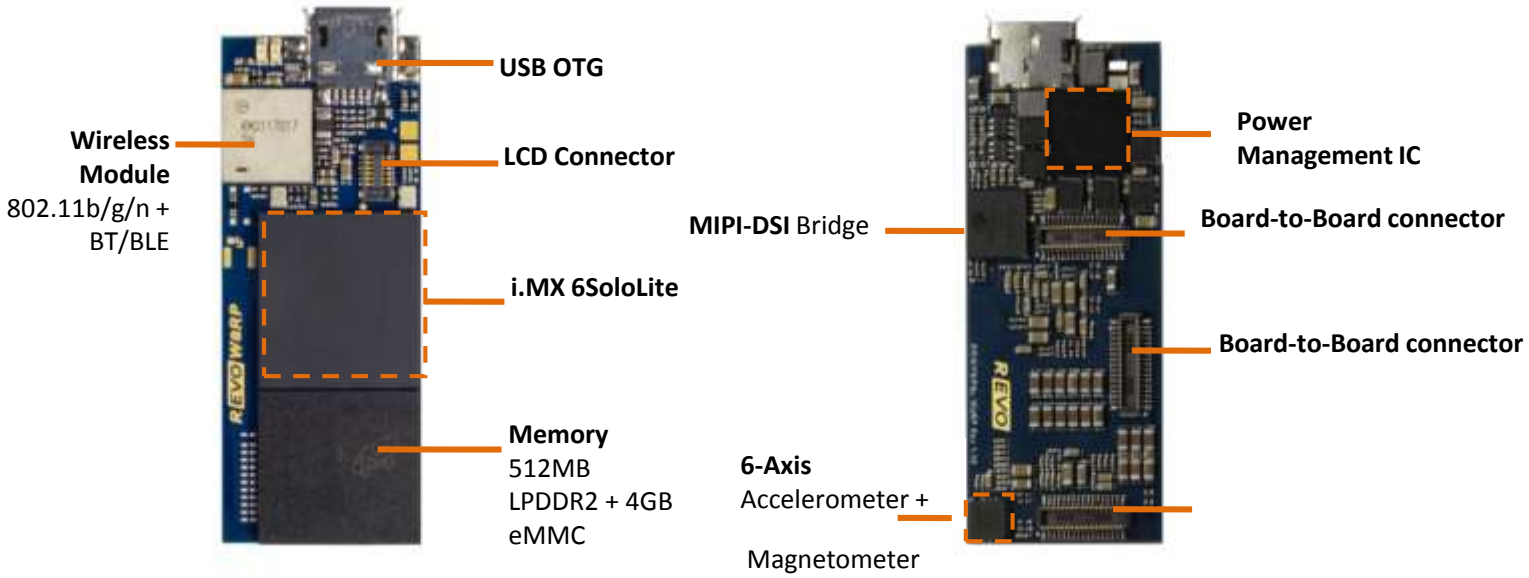


Freescale Technology

Designed to be able to productize

Wearable Form Factor.. WaRP Board

- Main Board PCB size: 38 mm x 16 mm (1.4” x 0.6”)



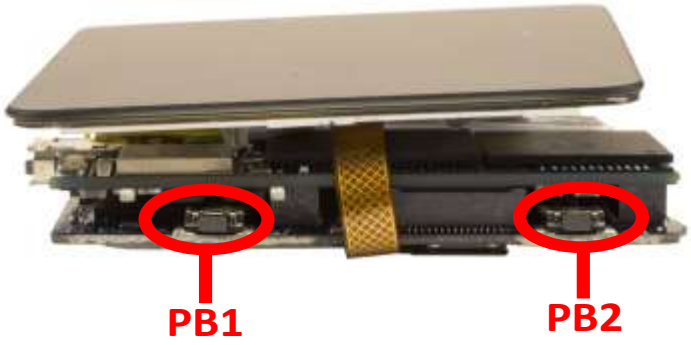
Battery Management/Scalability

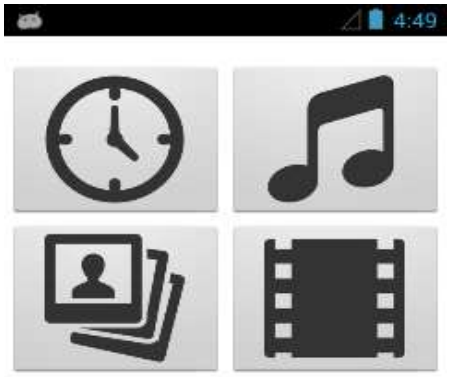
Top view

Bottom View

Daughter Board PCB size:
42 mm x 42 mm
(1.65” x 1.65”)

Usability


PB1
PB2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1:00


1:11
Settings
WIRELESS
Wi-Fi
Bluetooth
DEVICE
Sound

Open Source/ Community

WaRP

Wearable Reference Platform

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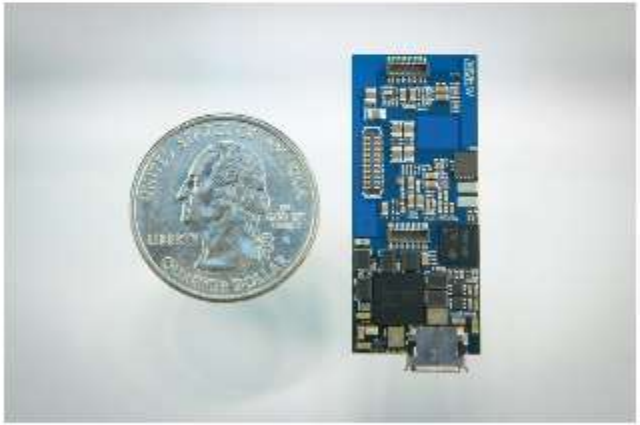
WaRPboard.org is a nonprofit community based organization providing service and support for the **wea**r**a**bles **r**eference **p**latform (WaRP). The solution's hardware and software will be open sourced and community driven. No closed development tools or licensing fees are required when used in conjunction with open source resources.

WaRPboard implements a hybrid architecture to address the evolving needs of the wearables market. The platform consists of a main board and an example daughtercard with the ability to add additional daughtercards for different usage models. In this hybrid architecture, the guts of the design is done on the main board with Freescale's i.MX 6SoloLite applications processor, and a secondary microcontroller, Freescale's Kinetis KL16 MCU, is implemented on the daughtercard, which is used as a sensor hub as well as a wireless charging MCU.

Technical Features



See the Technical Features page for additional board photos.

Availability…Bill Of Materials

Comment	Description	Designator	LibRef	Qty	Value	Footprint	Part No.
2450AT07A0100	Johanson Technology Inc 1mm x 0.5mm 2.4GHz Ultra Mini Chip Antenna	ANT1	2450AT07A0100	1		2450AT07A0100	2450AT07A0100
Coax RF		ANT2	Coax RF	1		W.FL-R-SMT-1	W.FL-R-SMT-1
Header 2	Header, 2-Pin	BAT	Header 2	1		Small Solder Pads	
CapacitorSM	Capacitor	C1, C4, C7, C11, C15, C56, C61, C75, C76, C77, C81	CapacitorSM	11	22uF	0603 (1608) Cap High Density	GRM188C80G226MEA0D
CapacitorSM	Capacitor	C2, C8, C9, C13, C18, C20, C21, C24, C27, C32, C33, C36, C43, C45, C49, C72, C73, C89, C112, C115, C117, C118	CapacitorSM	22	4.7uF	0402 (1005) Cap High Density	C1005X5R0J475M050BC
CapacitorSM	Capacitor	C3, C5, C6, C10, C12, C14, C16, C17, C19, C22, C23, C25, C26, C28, C29, C30, C31, C37	CapacitorSM	18	0.22uF	0201 (0603) Cap High Density	C0603X5R0J224K030BB
Capacitor	Capacitor	C34, C35, C119, C120	Capacitor	4	8pF	0201 (0603) Cap High Density	C0603C0G1E080D030BA
CapacitorSM	Capacitor	C38, C39, C40, C41, C44, C46, C47, C48, C52, C53, C54, C57, C58, C59, C62, C63, C64, C65, C68, C70, C91, C94, C95, C109, C110, C111, C113, C114, C116, C121, C134	CapacitorSM	31	0.1uF	0201 (0603) Cap High Density	GRM033R60J104ME19D
CapacitorSM	Capacitor	C42, C55, C60, C66, C67, C69, C71	CapacitorSM	7	0.01uF	0201 (0603) Cap High Density	GRM033R70J103KA01D
CapacitorSM	Capacitor	C50, C51, C79	CapacitorSM	3	4.7uF	0603 (1608) Cap High Density	GRM188R60J475ME19D
CapacitorSM	Capacitor	C74, C82, C84, C85, C87, C88, C93, C106, C107, C123, C124, C126, C127, C131, C132	CapacitorSM	15	1uF	0201 (0603) Cap High Density	C0603X5R0J105M030BC
CapacitorSM	Capacitor	C78, C80, C86, C122, C133	CapacitorSM	5	2.2uF	0402 (1005) Cap High Density	LMK105BJ225MV-F
CapacitorSM	Capacitor	C83, C96, C98, C102, C104, C125	CapacitorSM	6	1uF	0402 (1005) Cap High Density	C1005X5R1V105M050BC

Wearable Reference Design: WarP Score Card

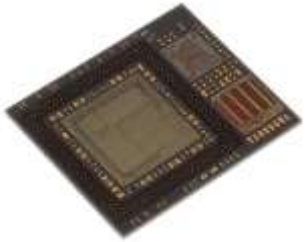
Key Features	Score
Wearable Form Factor	
Battery Management	
Ease Of Use/Scalability	
Open Source/Community	
BOM Cost /Availability	

Wearables…One size does not fit all

UDOO – Neo

DART – MX6

PICO –i.MX6-S



Single Chip Solution Module

Future Predications…

In 2017 a third of all wearables will come from…

Companies that don't exist today

www.Freescale.com