



**Ambarella**

# **Ambarella Automotive Camera**

A7LA Introduction

**[2013-Q1] Version 1.5**



**Ambarella**

# **Company Update**

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# Ambarella is HD Video



- ◆ Ambarella is driving the high-definition video transition
  - Focus on content creation and distribution
- ◆ Emerging leader for digital media products
  - Consumer Cameras – DSC, Camcorder, Sports
  - Broadcast infrastructure
  - Video Networking and Surveillance
  - Automotive



# Enabling Capture , Delivery and Management of Video



Wearable Sports  
Cameras



IP Security  
Cameras



Automotive Aftermarket  
Cameras



Infrastructure

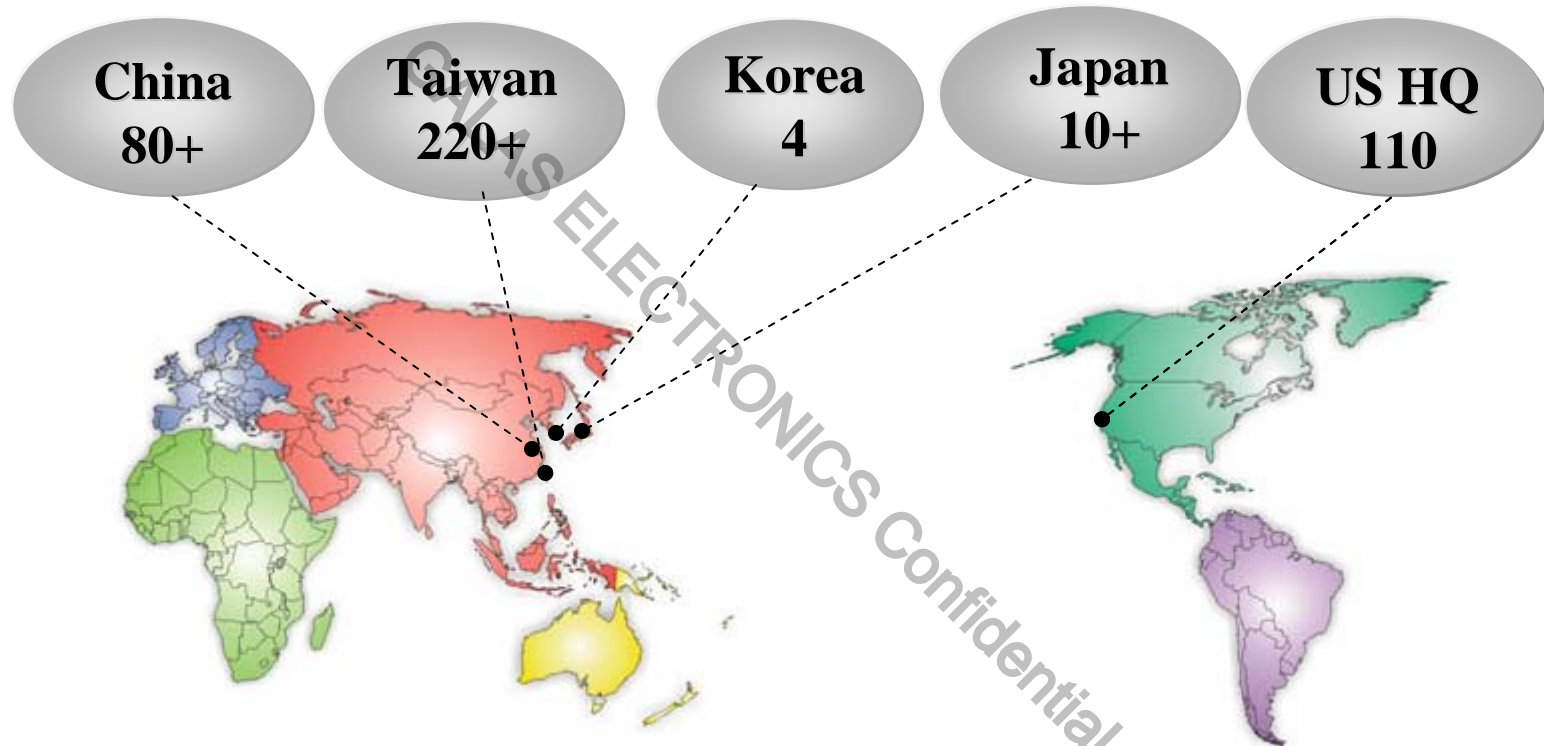


Telepresence



HD DSC

# Growing Company



**US HQ:** Architecture, Algorithm, VLSI, Microcode  
**Taiwan:** System, Software, Operations, Sales  
**China:** System, Software, Sales  
**Japan:** Business Development, Customer Support  
**Korea:** Customer Support

# GSA Awards, IPO

- ◆ 2008 - Outstanding financial performance award
- ◆ 2009 - Start-up to watch award
- ◆ 2010, 2011, 2012 - Most respected private semiconductor company
- ◆ 2012, October – IPO, NASDAQ: “AMBA”



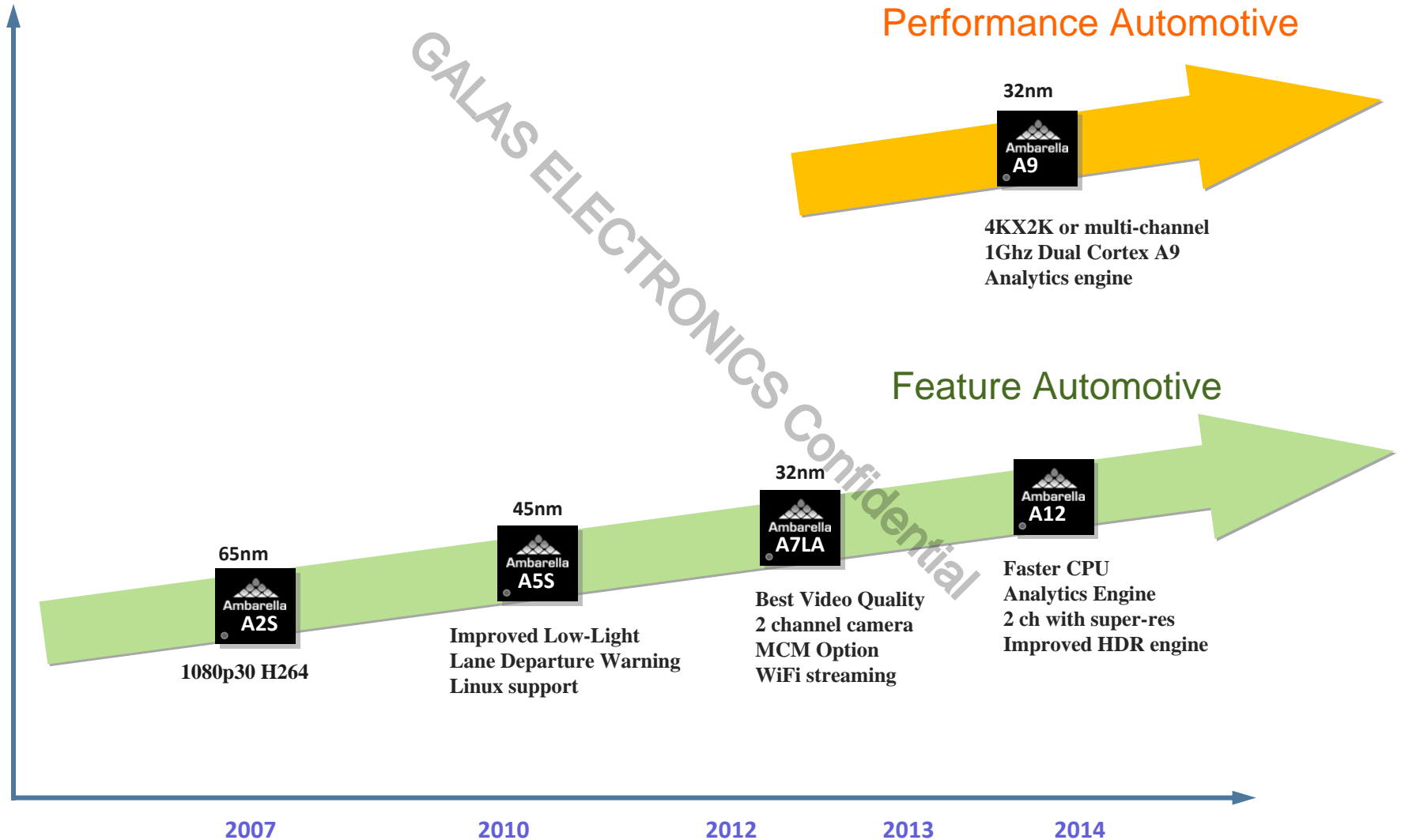


**Ambarella**

# **Product Roadmap**

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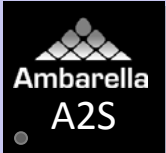
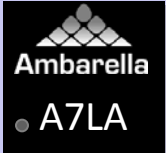
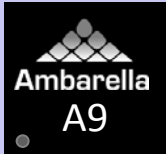
# Product Roadmap





# Automotive Camera Line Up - 2013



DSP Part	Market Segments	Key Benefits
	Main Stream Automotive Camera	<ul style="list-style-type: none"><li>• 720p30 / 1080p30</li><li>• Ultra-low BOM cost</li><li>• Good video quality</li></ul>
	New Generation Automotive Camera	<ul style="list-style-type: none"><li>• 1080p60 or 2ch 1080p30</li><li>• Superior video quality</li><li>• Super Resolution and WDR/HDR</li><li>• MCM Option</li><li>• Wireless video streaming support</li><li>• LDWS (Lane Departure Warning System)</li></ul>
	Performance Automotive Camera	<ul style="list-style-type: none"><li>• 4K2K or 2ch 1080p60 or 4ch 1080p30</li><li>• Dual Cortex A9 + Analytics engine</li><li>• Best video quality</li></ul>



**Ambarella**

# **A7LA – The Future of Automotive Camera**

# A7LA – Future of Automotive Camera



## Best Video Quality

- Excellent H.264 compression
- Super HD 3M (1296p) @ 30fps
- Full HD 1080p @ 60fps
- Super Night Vision
- Video super-resolution
- High Dynamic Range (WDR/HDR)

## Feature Rich

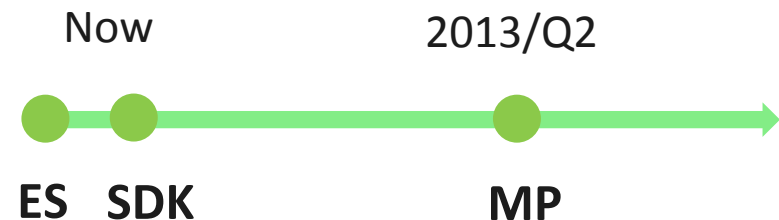
- Lane Departure Warning System
- WiFi video streaming
- MCM package option
- Capture Stills (<=8MP) without interrupting video record
- **< 1sec start-up time**

## Two Channel Support

- 2 channel 1080p30
- Super Wide Angle

### Key A7LA Features

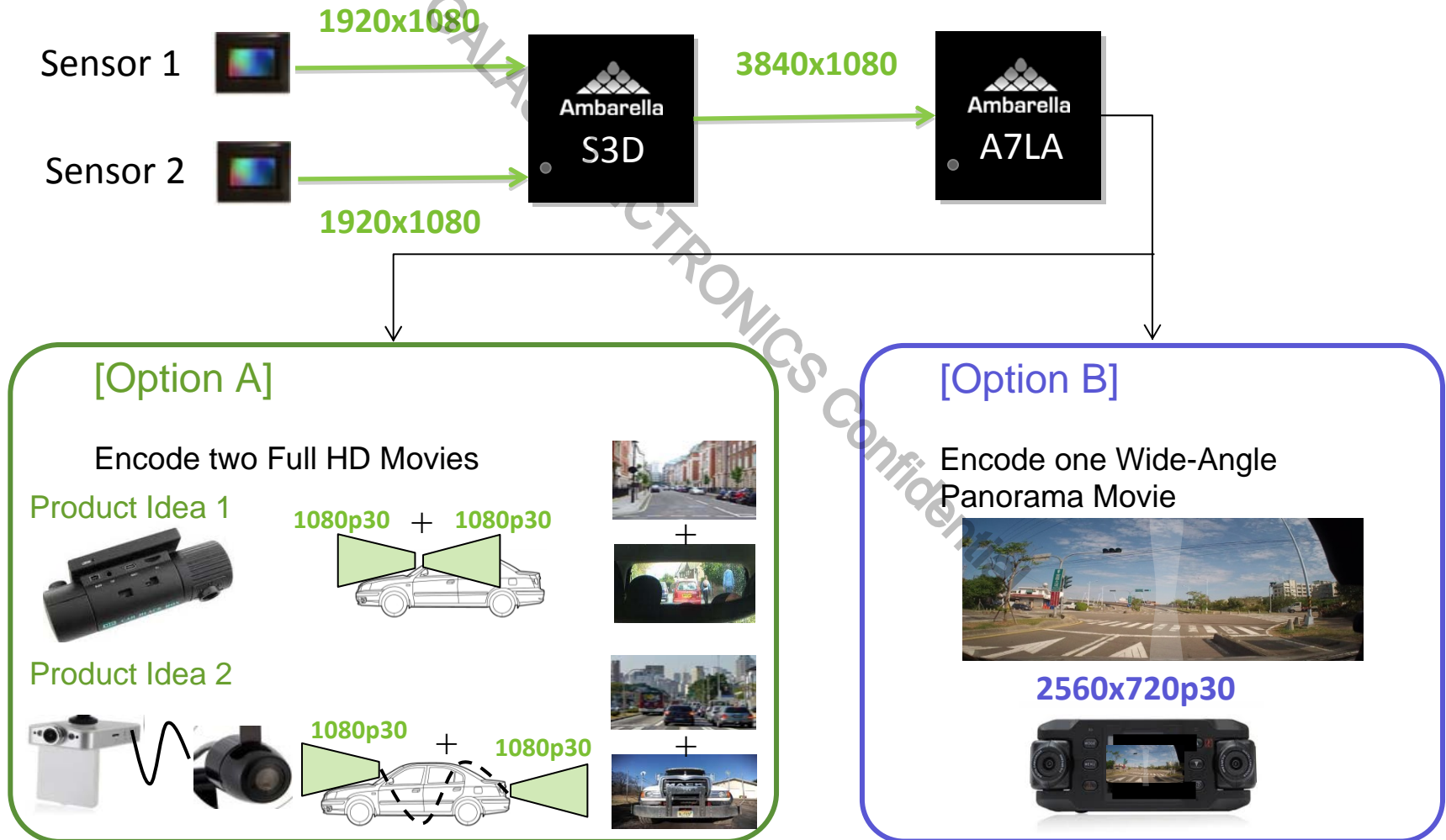
CPU	ARM11@ 700MHz
DRAM	DDR2, DDR3, LPDDR2
Video Spec	2-ch 1080p30 1-ch 1080p60 Super-Wide Angle
Super Resolution	Up to 8MP over sampling
IO Port	Dual SDIO for better WiFi performance
MCM Option	1GBits DDR3
Ultra Low Power	1080p30 REC (with LCD) Only <b>~500mW</b> (including DDR)



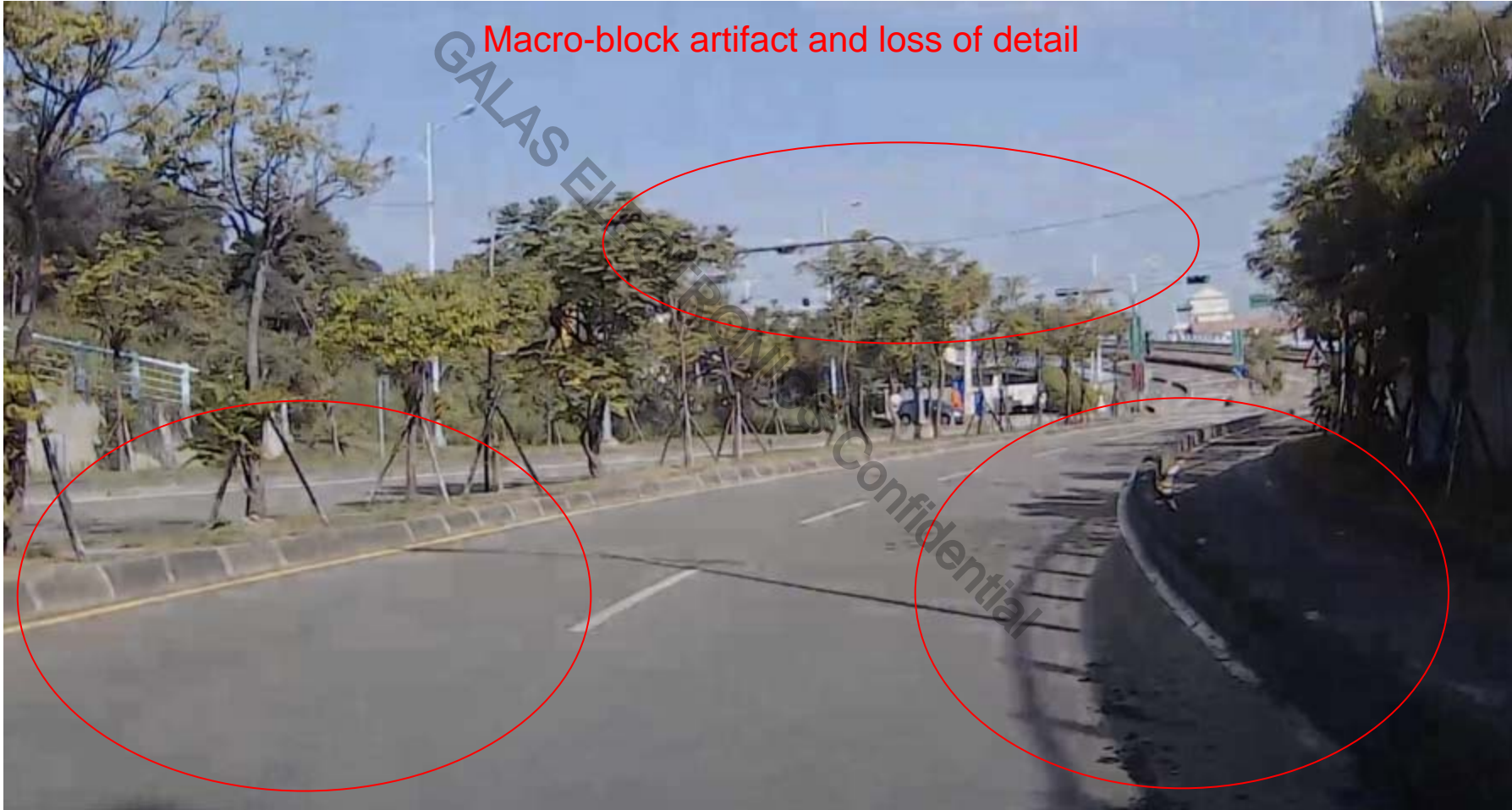
# 2-Ch 1080p30 Or Super Wide Angle



Companion chip allows encoding of two Full HD Movies simultaneously



# H.264 CODEC - Competitor





# H.264 CODEC - Ambarella



Clear image with good details



# Super HD – 3MP (1296p)

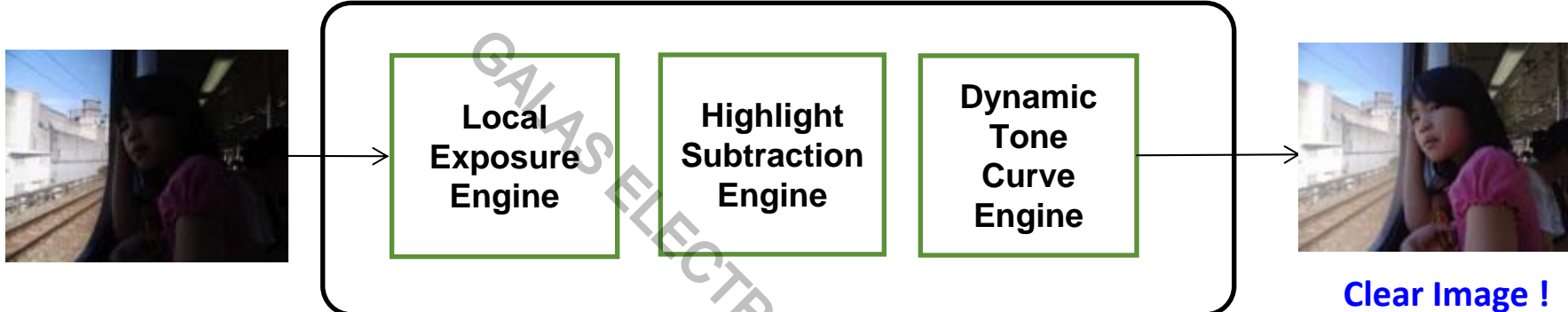


- Capture more details with 3MP video resolution
- Extract 3MP still image from any video frame

# Ambarella Automotive WDR



## CMOS Sensor



## Ambarella Automotive WDR Technology

- Digital dynamic range enhancement – with any CMOS sensor
- Up to 1080p60 real-time video processing
- Best video quality in challenging conditions
  1. Strong Back Light
  2. Driving in and out of the tunnel in the day time
  3. Side shadows (from buildings, etc..)



# Competitor Camera



# Ambarella WDR



Ambarella Automotive WDR provides clear shadow details even in challenging backlight condition



# Competitor Camera





# Ambarella WDR



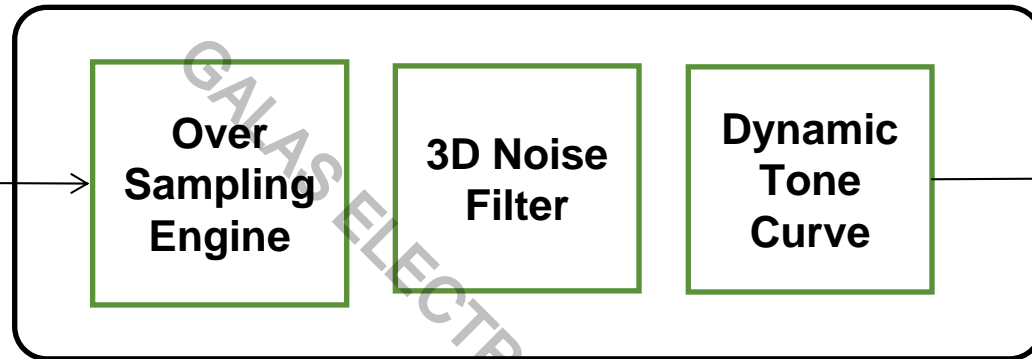
WDR + Smart AE preserve details in shadows and bright areas



# Super Night Vision



CMOS Sensor



Clear Image !

## Over Sampling

- Capture more than 1920x1080 from sensor for image processing.
- Use bigger sensor area to get more light

## 3D Noise Filter

- Based on professional camcorder technology
- Use information from multiple frames
- Remove noise, keeping details & texture

## Dynamic Tone Curve

- Automatically adjust color reproduction in low-light
- Best balance between color noise and brightness

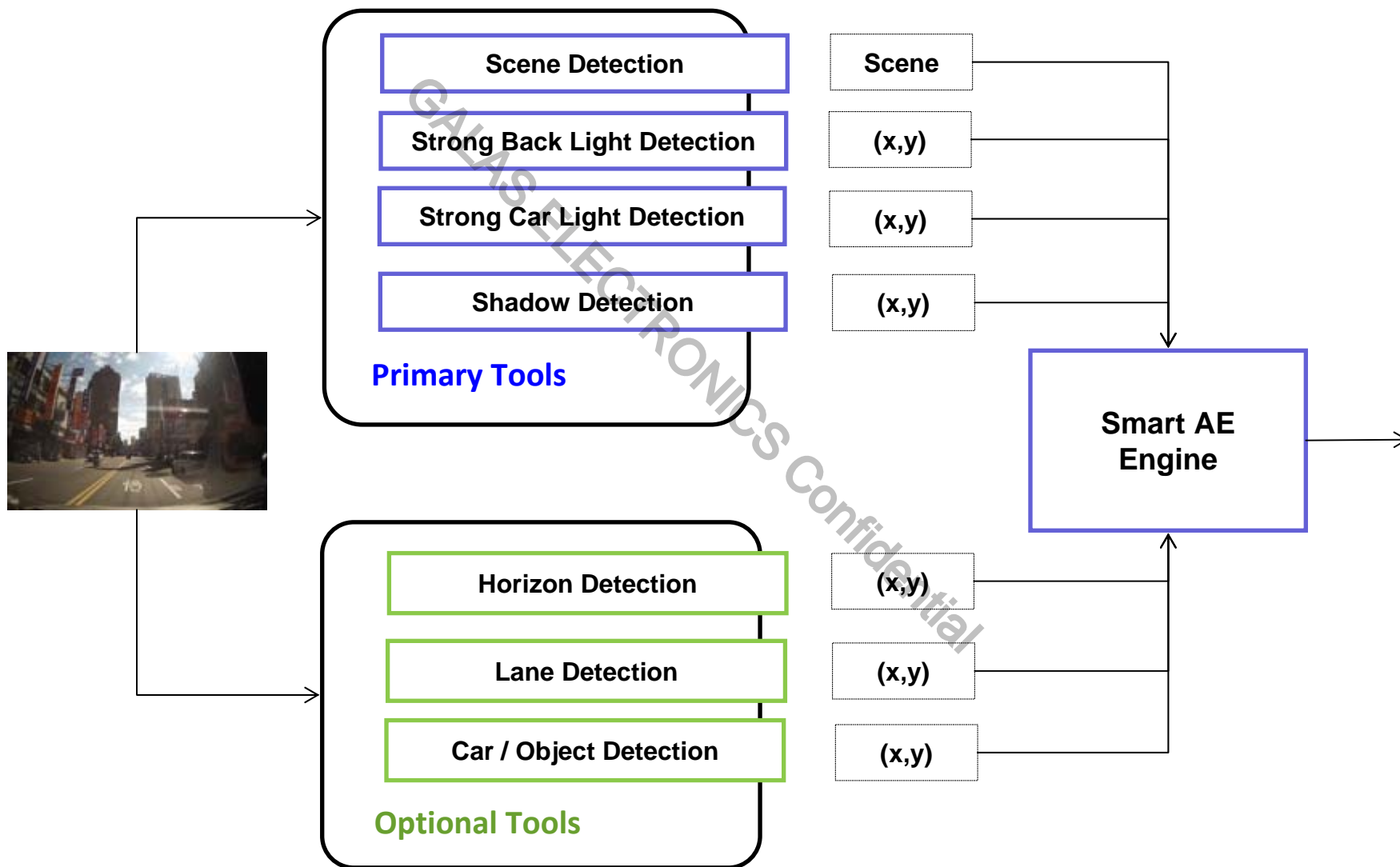
# Competitor Camera



# Ambarella Super Night Vision



# Automotive Smart AE





# Competitor



# Ambarella Smart AE

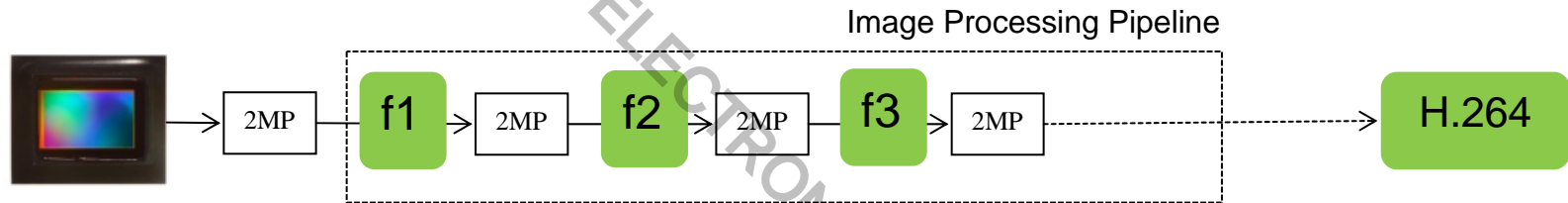


# Super Resolution Flow



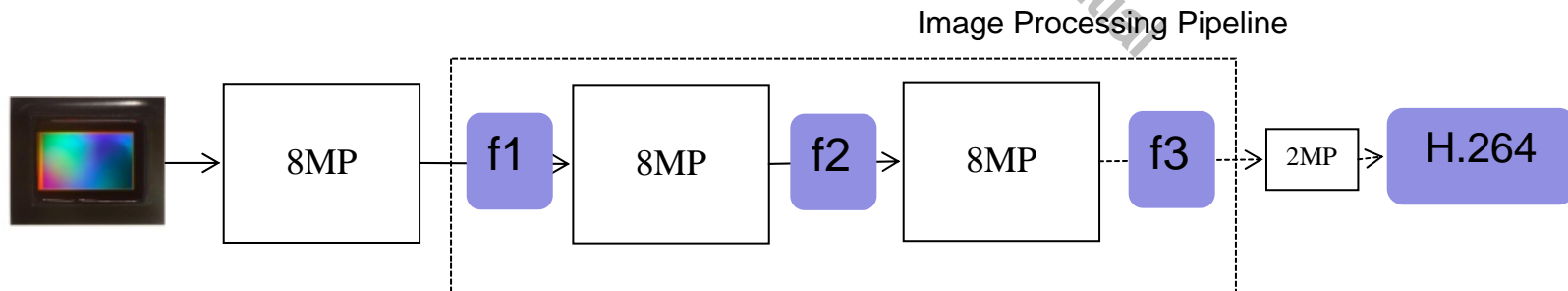
## Competitor - Image Processing (No Over-Sampling)

Image processing with only 2MP sensor data



## Ambarella – Image Processing (With Over-Sampling)

Entire image processing with up to 8MP of data from sensor -> **Super Sharp Result!**





# Super Resolution Comparison



Competitor



Ambarella – Super Resolution



# Lane Departure Warning System



## LDWS

- Detect driver changing lanes
- Give alert on an event
- Issue audio beep or light flashing
- Assists driver and enhance safety

## SDK Status

- LDWS is included in A5S and A7LA SDK



Lane Changing / Departure

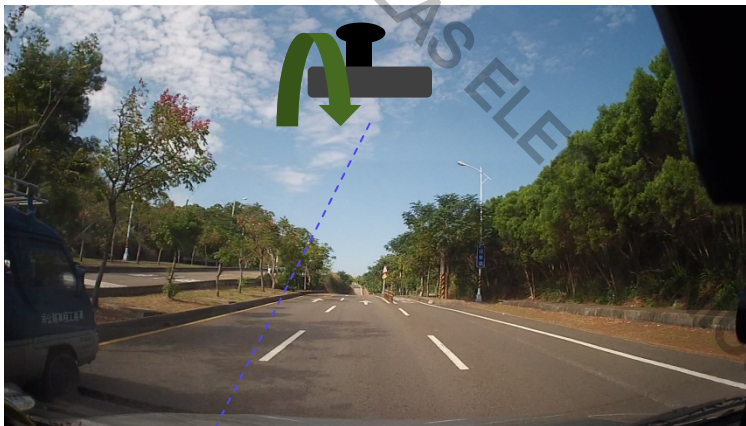


Night / Tough conditions

# WiFi Use Case – Live View



## Live View Display In Smartphone



*Live view on a smartphone to adjust camera position and angle during installation.*



- Camera streams video to SmartPhone for live view
- SmartPhone sees live view of the camera
- Smartphone application is used for camera set-up
- User can adjust the camera location, field of view and lens focus position

# WiFi Use Case - Playback



## REC + Playback Of Previous Video



*It is likely that when some event happen, driver will park the car on the road side and want to check the previous video. However the REC should still continue for 100% coverage*



- 1080p30 video REC continues without impact
- Smartphone APP can connect to camera via WiFi
- Play previously recorded video fragment
- User can select proper video and upload to a smartphone (or using smartphone to the web)

# WiFi Live View Specification



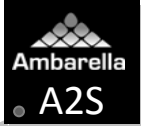
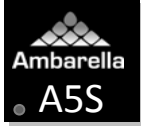

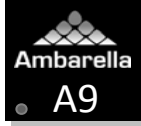
	Main Stream					2 <sup>nd</sup> Stream				
[1] Live View Only Mode	size	fps	codec	REC	WiFi	size	fps	codec	REC	WiFi
Streaming live view over WiFi, No REC to SD card. Maximize streaming resolution	WVGA	30	H.264	X	O					
	QWVGA	30	H.264	X	O					
	WVGA	15	MJPEG	X	O					
	QWVGA	25	MJPEG	X	O					
[2] REC + Live View Mode	size	fps	codec	REC	WiFi	size	fps	codec	REC	wifi
REC 1080p30 to SD Card + stream 2 <sup>nd</sup> video to WiFi	1080p	30	H.264	O	X	WQVGA	30	H.264	X	O
	1080p	30	H.264	O	X	WQVGA	30	MJPEG	X	O

- The above spec is for single sensor 1080p30 solution (not for 2-ch 1080p30)
- Both H.264 & MJPEG streaming options are provided
- Customer can select the streaming resolution, CODEC and protocol for the best user experience & SmartPhone APP development



# SoC Family Comparison



				
Image Processing Pipeline	2 <sup>nd</sup> Generation	4 <sup>th</sup> Generation	6 <sup>th</sup> Generation	7 <sup>th</sup> Generation
Highest Resolution	1080p30	1080p30	2-ch 1080p30 1-ch 1080p60	2-ch 1080p60 1-ch 4Kx2K
CPU Performance	ARM9 /216MHz	ARM11/500MHz	ARM11/700MHz	Dual 1Ghz A9
OS	uITRON	uITRON or Linux	uITRON + Linux	TBD
Automotive Smart AE	O	O	Better than A5S	Better than A5S
Automotive WDR		O	Better than A5S	Better than A5S
Automotive HDR		O	O	O
Super Resolution		O	Better than A5S	Better than A5S
Super Night Vision (1 Lux)		O	Better than A5S	Better than A5S
LDWS		O	O	O
Event REC / Emergency REC		O	O	O
Support 2-ch Camera			O	O
Full Lens Distortion Correction			O	O
SmartPhone Connectivity (WiFi)			O	O

# A7LA Part Comparison



	A7LA30	A7LA50	A7LA55	A7LA60	A7LA65	A7LA70	A7LA75	A7LA85
CPU Speed	700MHz	700MHz	700MHz	700MHz	700MHz	700MHz	700MHz	700MHz
DRAM Clock	336MHz	396MHz	396MHz	396MHz	396MHz	396MHz	396MHz	396MHz
Minimal DRAM	1GBits	1GBits	2GBits	1GBits	2GBits	1GBits	2GBits	2GBits
MCM Option	O	O				O		
Pitch Size (mm)	14x14	14x14	14x14	14x14	14x14	14x14	14x14	14x14
Super Resolution	O	O	O	O	O	O	O	O
LDWS		O	O	O	O	O	O	O
Video Resolution	1080p30	3MP@30 1080p45	3MP@30 1080p45	2ch x 720p	2ch x 720p 1080p+720p 1080p+VGAp	2x1080p30 3MP@30 1080p60	3MP@30 1080p60	2x1080p30 3MP@30 1080p60
2-ch Support				O	O	O		O
Super Wide Angle						O		O
WiFi			O		O		O	O
HDR		O	O	O	O	O	O	O
WDR	O	O	O	O	O	O	O	O



**Ambarella**

**THANK YOU**

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