



**ams Full Service Foundry**

**CMP User Group Meeting 2015, Paris**

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# World of Sensors

Providing a seamless human-machine interface for a richer and more intuitive user experience

## Communications & Consumer



- Ambient light, color & proximity sensing
- Gesture recognition
- NFC based contactless payment solutions
- Active noise cancellation
- Power management solutions

## Automotive



- Safety systems
- Battery management
- Position sensing
- Comfort & chassis sensors
- Advanced driver assistance

## Industrial



- Industrial/building automation
- Motion control
- Heat, Ventilation & Air conditioning (HVAC)
- Position sensing

## Medical



- Digital x-ray
- Computer tomography
- Surgical Robots
- Diagnostic equipment

## Environment



- Lightning sensors
- Gas sensors
- Seismic analysis
- Temperature sensors
- Day light harvesting

## Health/Fitness



- Diabetes management
- Heart rate monitors
- Medication tracking
- Activity trackers





## Our focus

	<b>High performance analog ICs and foundry service</b>		
<b>Target markets</b>	Consumer and Communications	Industrial, Medical, & Automotive	
	59% of revenues 2013	41% of revenues 2013	
<b>Core expertise</b>	<b>Sensor and sensor interfaces</b>	<b>Power management</b>	<b>Wireless</b>

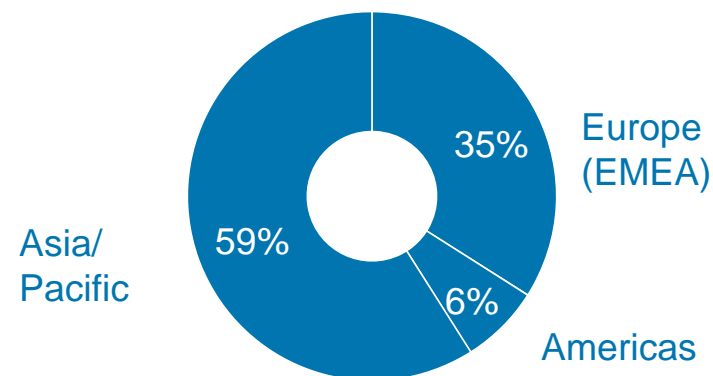
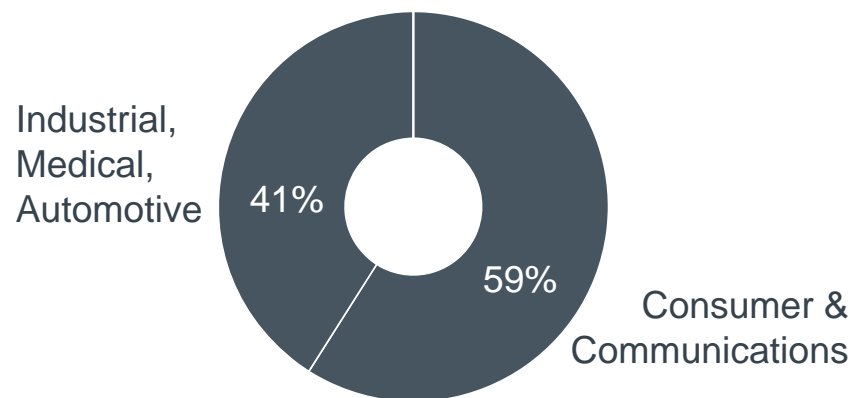
# Financial overview

EUR millions

Revenue 2013: **377,8 M€**

Revenue 2014: **464,4 M€**

**Total revenues by market and region 2013**



## Proven manufacturing model



### In-house capacity + partnerships: a scalable and robust growth model



### Wafer manufacturing

- Specialty analog processes
- 200mm in-house fab (over 155 kwafers p.a.)
- Technology nodes: 0.18 $\mu$ m – 0.35 $\mu$ m – 0.8 $\mu$ m
- Best-in-class efficiency
- Multi-source security: TSMC, UMC, IBM
- Zero-defect program



### Assembly and test

- In-house test in Austria and Philippines
- Multi-source assembly locations
- End-to-end fully integrated supply chain



# Capacity expansion

## Annual Wafer start capacity

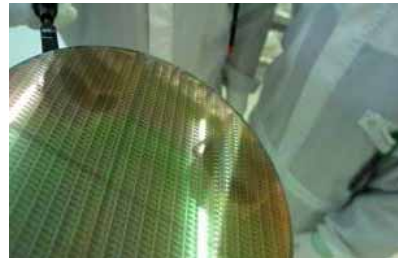
- Several capacity expansions since Q2-2013
- 2013 capacity: 120k WSPA
- First expansion +15k WSPA completed
- Second expansion +20k WSPA (total 155k) completed
- Third expansion: +25k WSPA (total 180k) ongoing
- Fourth expansion: Approval pending

## Test facility expansion

- Philippines test center fully loaded
- Philippines test center expansion Phase II started

# Full service foundry

Your one-stop-shop for turn-key high performance analog IC solutions



## Specialty processes

- 0.18 $\mu\text{m}$ , 0.35 $\mu\text{m}$ , 0.8 $\mu\text{m}$
- CMOS, HV, SiGe
- AUT & MED certified
- Extended temp range

## Foundry services

- MPW service
- Benchmark PDK: hitkit
- Highly accurate models
- Digital & analog base IP

## Turn-key solutions

- One-stop-shop
- Mixed-signal test
- Qualification services
- 2nd source capabilities



## More than silicon

- 3D IC using TSVs
- RGB & IR color coating
- Extended IP portfolio
- Advanced packages



# Specialty analog processes

ams process overview & roadmap

Technology details		0.8µm	0.35µm	0.18µm
	Max. number of metal layers	2	3 - 4	4 - 7
	Gates per mm <sup>2</sup>		23k	118k
	Embedded EEPROM / Flash		✓	
<b>Mixed-Signal / RF</b>	Max. operating frequency		~ 1 GHz	~ 4 GHz
<b>High Voltage CMOS</b>	Scalable voltage modules	50V	120V	50V
<b>SiGe BiCMOS</b>	Max. operating frequency		~7 GHz	
<b>Qualified for Automotive &amp; Medical</b>	Scalable and robust model for growth through partnerships	ams	ams 	ams 



# MPW & prototype service

Find our MPW schedule online: [http://asic.ams.com/cot/mpw/MPW\\_Shuttle\\_Service\\_2015.pdf](http://asic.ams.com/cot/mpw/MPW_Shuttle_Service_2015.pdf)

Process	Data and Order to	Tape In	Samples Out <sup>1)</sup>
<b>0.18 µm HV-CMOS 20V / 50V <sup>5)</sup></b>			
H18	ams	2-Mar-15	22-May-15
H18	ams	1-Jun-15	21-Aug-15
H18	ams	31-Aug-15	20-Nov-15
H18	ams	30-Nov-15	19-Feb-16
<b>0.18 µm CMOS 1.8V / 5V <sup>5)</sup></b>			
C18	ams	2-Mar-15	22-May-15
C18	ams	1-Jun-15	21-Aug-15
C18	ams	31-Aug-15	20-Nov-15
C18	ams	30-Nov-15	19-Feb-16
<b>0.35 µm HV-CMOS 20V / 50V / 120V (embedded Flash <sup>4)</sup></b>			
H35B4D3	ams	16-Feb-15	17-Apr-15
H35B4D3	ams	4-May-15	26-Jun-15
H35B4D3	ams	17-Aug-15	16-Oct-15
H35B4D3	ams	9-Nov-15	08-Jan-16
<b>0.35 µm CMOS 3.3V / 5V (embedded Flash <sup>4)</sup> and 0.35 µm Opto-CMOS <sup>3)</sup></b>			
C35 <sup>2)</sup>	ams	9-Feb-15	27-Mar-15
C35 <sup>2) 3)</sup>	Fraunhofer IIS	07-Apr-15	29-May-15
C35 <sup>2)</sup>	ams	1-Jun-15	17-Jul-15
C35 <sup>2)</sup>	Fraunhofer IIS	27-Jul-15	18-Sep-15
C35 <sup>2)</sup>	ams	21-Sep-15	6-Nov-15
C35 <sup>2) 3)</sup>	Fraunhofer IIS	16-Nov-15	08-Jan-16
<b>0.35 µm SiGe-BiCMOS 3.3V / 5V 2P/4M</b>			
S35	ams	9-Mar-15	08-May-15
S35	ams	15-Jun-15	14-Aug-15
S35	ams	7-Sep-15	06-Nov-15
S35	ams	23-Nov-15	15-Jan-16

## Advantages

- Low cost alternative to prototype designs
- Mask costs are shared by MPW participants
- Frequent schedules for all offered process technologies

## CMP (cmp.imag.fr)

- Long term partner
- Very reliable
- Experienced in using ams technologies
- Supporting small and mid size projects
- Supporting academic and start ups





Process Options	C18	H18	aC18	aH18
Metal	3-8	3-7	3-6	3-6
High Res	✓	✓	✓	✓
Precision Res	✓	✓	✓	✓
TaN Res	✓	✓		
HVT	✓	✓	✓	✓
SHVT		✓	LL*	LL*
5V	✓	✓	✓	✓
PI	✓		✓	
20V GOX		✓		10/2016
MIM	✓	✓	✓	✓
DUALMIM	✓	✓	✓	✓
HD MIM	✓	✓		
DUAL HD MIM	✓	✓		
Schottky	✓	✓	✓*	✓*
120V		(✓)		5/2016



## 0.18 $\mu$ m HV-CMOS process implementation status

	<b>50V</b>	<b>120V</b>	<b>20V GOX</b>
Project start	✓ <b>02.2014</b>	✓ <b>06.2014</b>	04.2015
Alpha hitkit to selected customers	✓ <b>01.2015</b>	10.2015	10.2015
Risk MPW participation possible	✓ <b>12.2014</b>	04.2015	
Process Freeze (engineering run capability)	04.2015	04.2016	04.2016
Conditional release	10.2015	05.2016	10.2016
Final design documents and hitkit	10.2015	06.2016	10.2016



# 0.18 $\mu$ m HV-CMOS process implementation status

Digital libraries & Memories

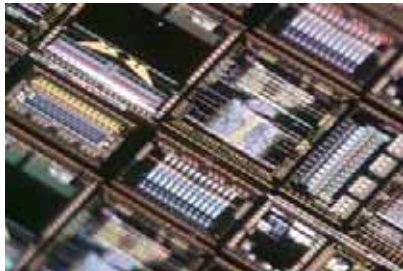
## Digital Library:

- High density digital core library Q1/2015

## Memory overview:

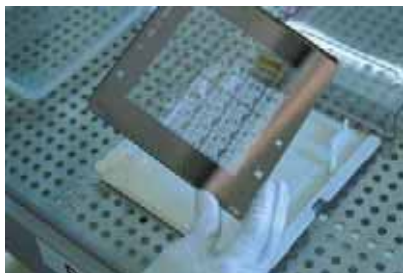
- **OTP:** Polyfuse. IP block available from ams ✓ Q4/2014
- **SRAM/ROM:** ams Memory compilers Q2/2015
- **EEPROM:** Synopsys 0-Mask EEPROM available (8 kBit) Q4/2015

## ams' prototyping portfolio, I.



### Multi project wafer (MPW)

- + Lowest costs
- Limited number of devices
- Fixed schedule



### Multi layer reticle wafer (MLR)

- + Tape out at any time
- + Manufacture as many samples as required
- + Moderate NRE due to reduced # of masks
- Mask set cannot be used for mass production



### Single die tooling (SDT)

- + Tape out at any time
- + Manufacture as many samples as required
- + Mask set can be immediately used for mass production

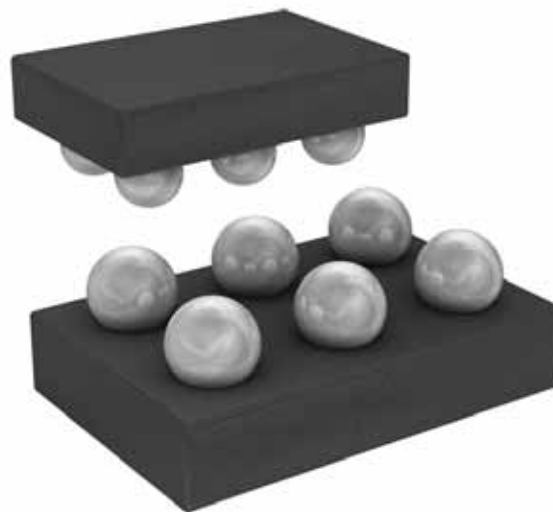
**New  
engineering  
option!**

## ams' prototyping portfolio, II.



### Multi project wafer (MPW)

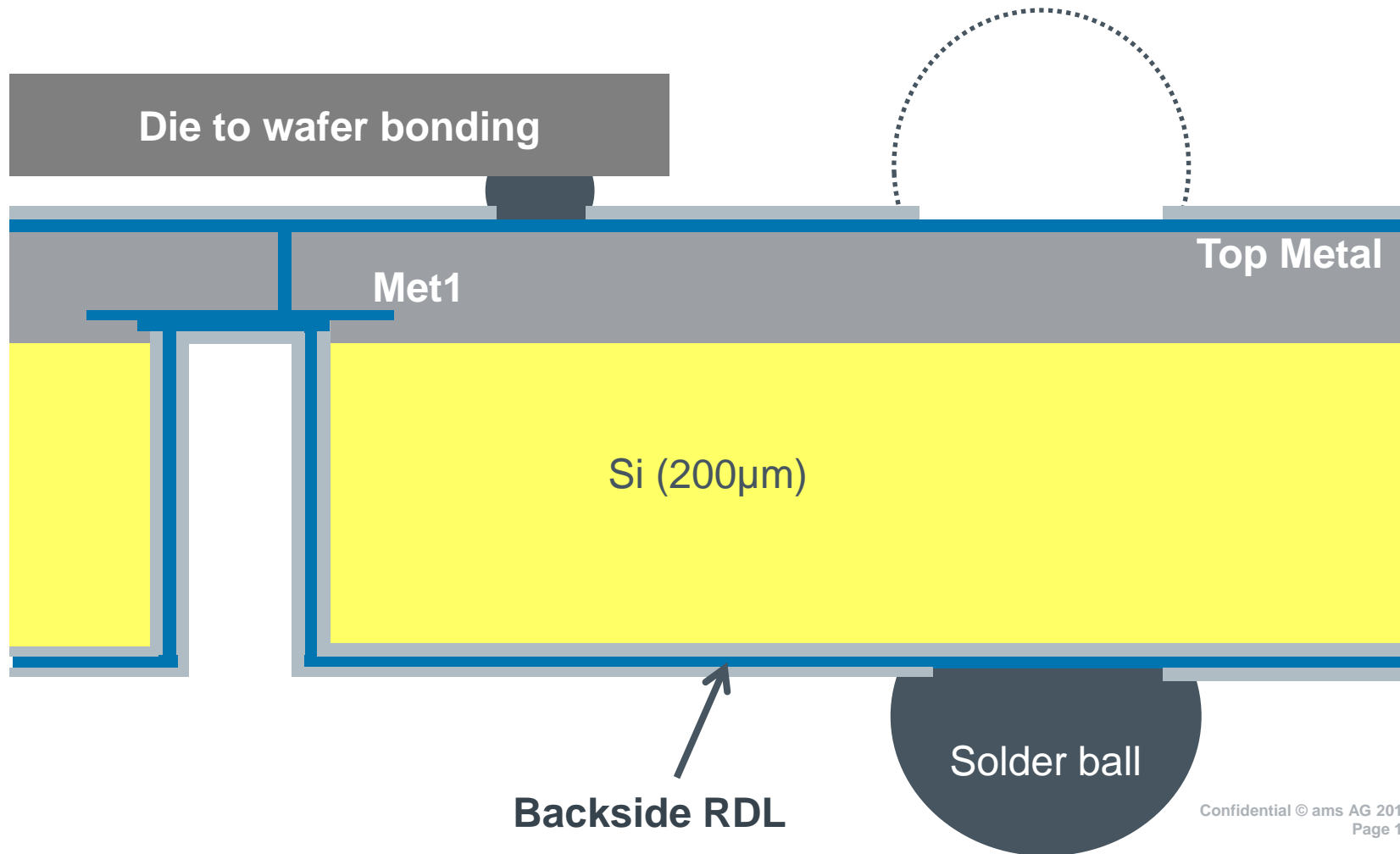
- New option: WLCSP
- Including RDL (Cu)
- 250 $\mu$ m bump diameter
- 400 $\mu$ m bump pitch



**New option!**  
**MPW with**  
**WLCSP**

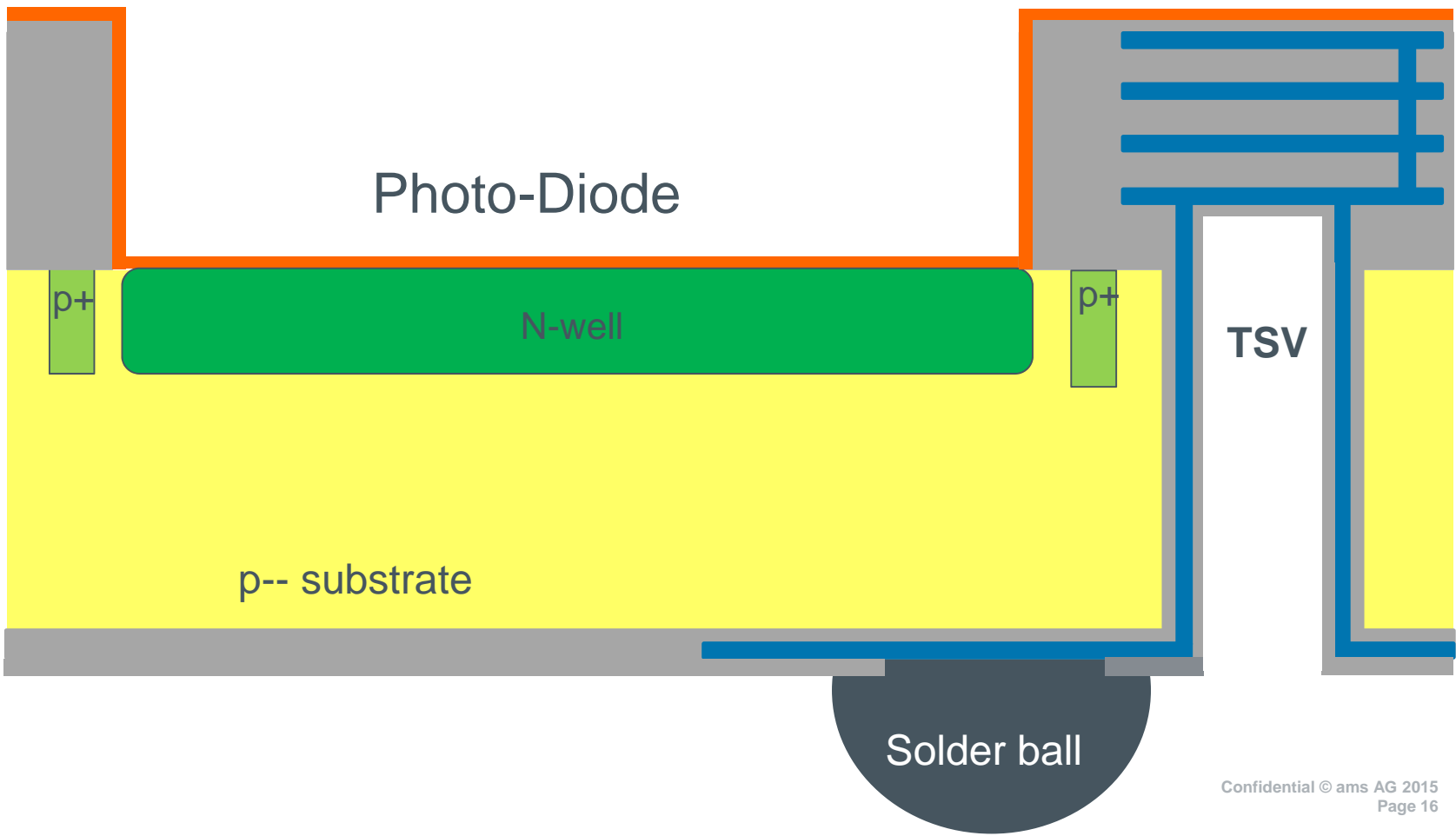
# Example 1: Active Interposer

TSV + Backside RDL



# Example 2: PD Wafer

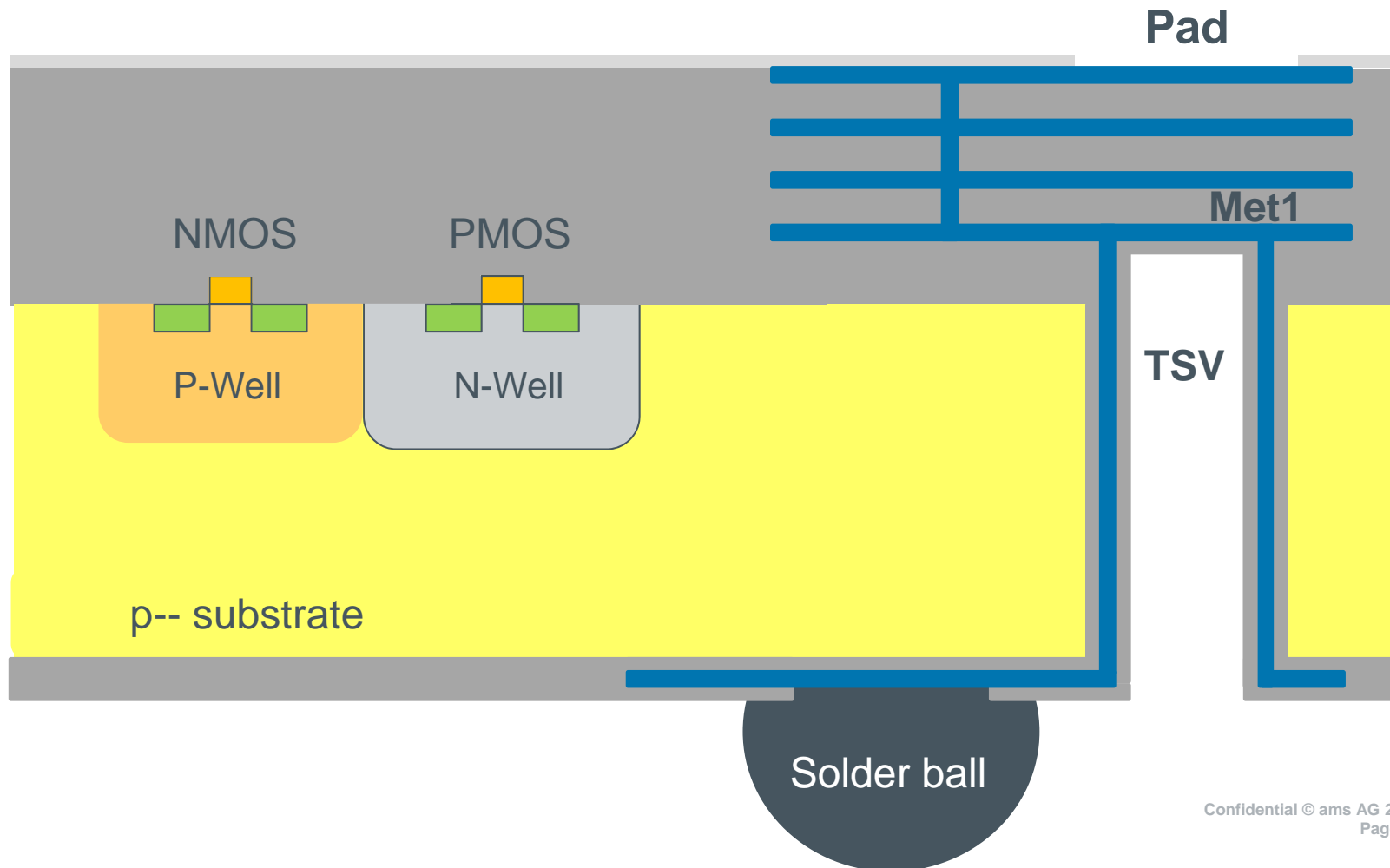
TSV + Backside RDL





# Example 3: Pad Replacement

TSV + Backside RDL



# Full Service Foundry

Your Analog Foundry Partner.

ams

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