



S I L I C O N   L A B S

Introducing the World's Smallest,  
Lowest Loss AC Current Sensor

# Differentiated Power Portfolio

- ◆ Leveraging expertise in isolation, high-voltage and digital control technologies
- ◆ All parts based on mixed-signal CMOS design
- ◆ Expanding portfolio of unique power products

Digital Isolator



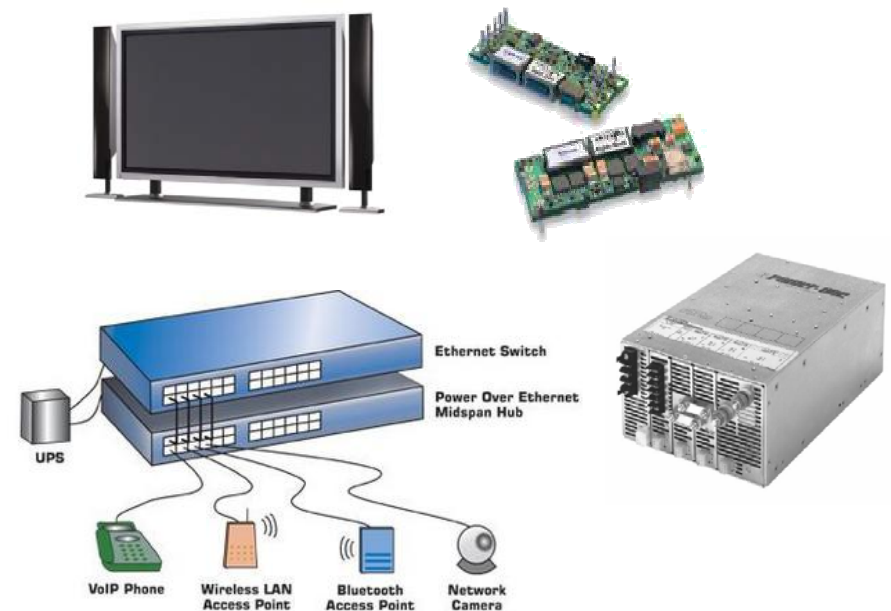
AC Current Sensor



PoE Powered Device Controller

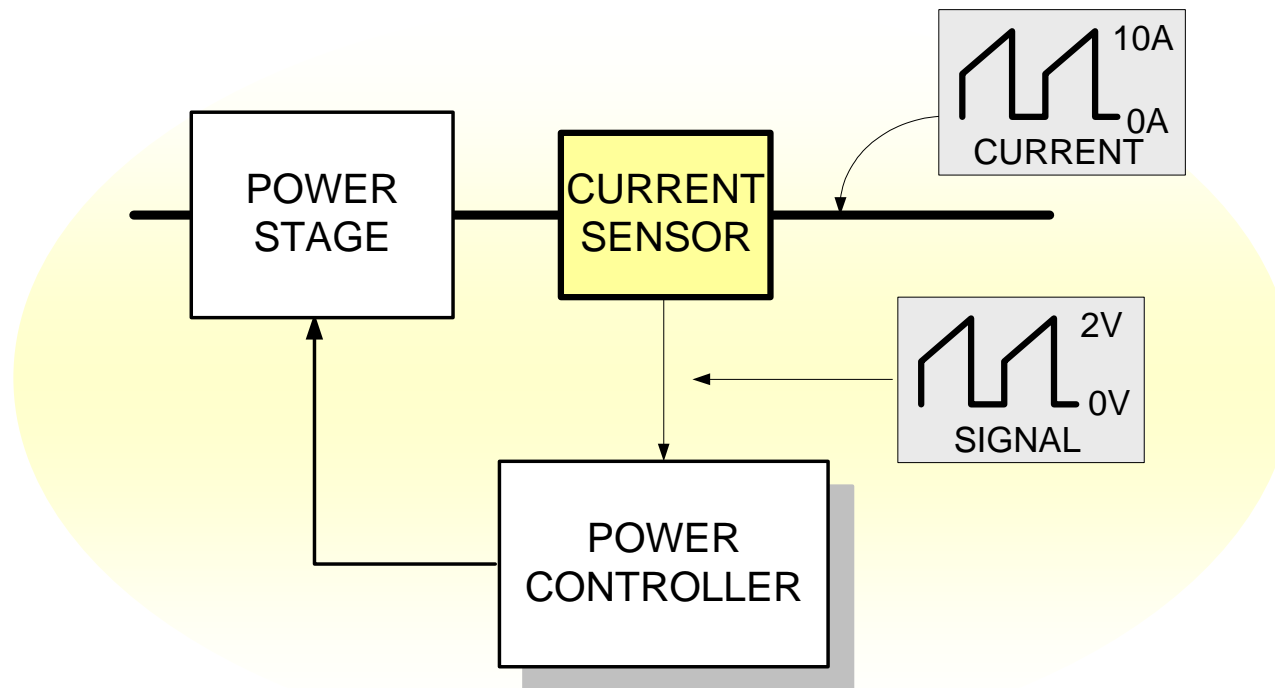


Digital Power Controller



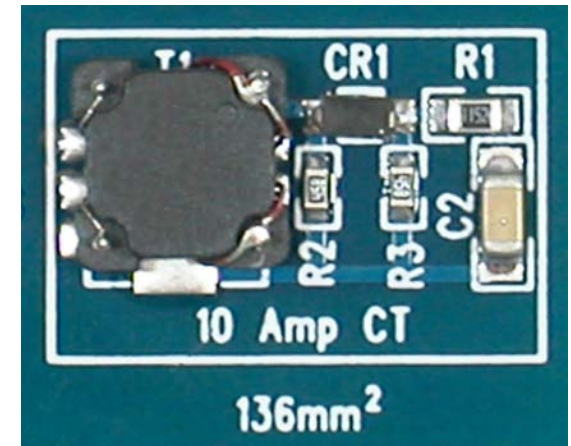
# AC Current Sensor Market

- ◆ AC Current Sensors are used in power system of all kinds
  - Power supplies, motor controls, lighting controls
- ◆ AC Current Sensors provide critical information for system control and safety
  - Generate an output signal proportional to measured current



# Customer Challenges

- ◆ Power dissipation
  - Low series R: A 50mΩ current sensor in a 20A supply burns 20 Watts
- ◆ Accuracy
  - Factory system calibration required
- ◆ Quality and reliability
  - Hand-wound current transformers result in poor lead alignment and mechanical failures
  - Discrete sensing approaches require a large bill of materials reducing reliability and yields
- ◆ Size
  - Shrinking power system form factors afford less space
  - Traditional current transformers are large bulky magnetic components that are at least 0.25 in<sup>3</sup> and can be larger than 1 in<sup>3</sup>



**Typical Current Transformer**

# Introducing the Si85xx AC Current Sensor

- ◆ Highly integrated AC Current Sensor
  - Integrates the entire current sensing bill-of materials in a tiny footprint
- ◆ Industry's lowest power dissipation
  - Higher efficiency
- ◆ Ease of design and manufacturing
  - Very low parasitics and no need for factory calibration at assembly

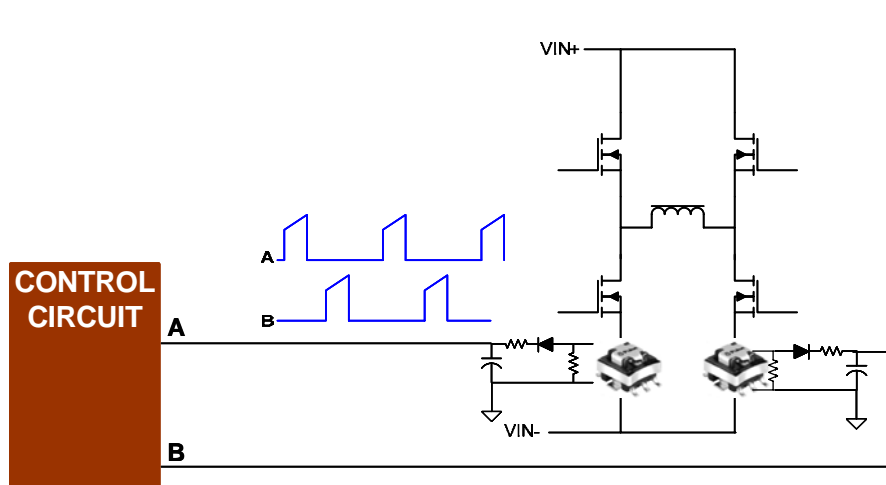


**Silicon Labs Si85xx  
AC Current Sensor**

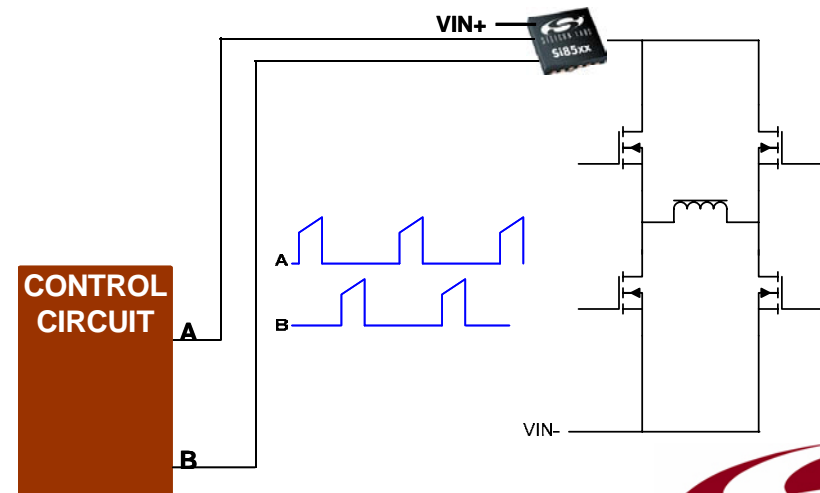
# Si8500: Complete Integration

- ◆ Tiny, 4 x 4 x 1 QFN package
  - Integrates current transformer, blocking diode, burden resistor and output RC filter
  - Decreases board space by up to 75%, reduces enclosure volume requirements by 80%
  - Integrates temperature and offset compensation circuitry

- ◆ Replaces two current transformer circuits
  - “Ping-pong” output Si851x supports most full-bridge applications
  - Enables a single Si851x to replace two current transformers in a Full Bridge



Traditional Implementation

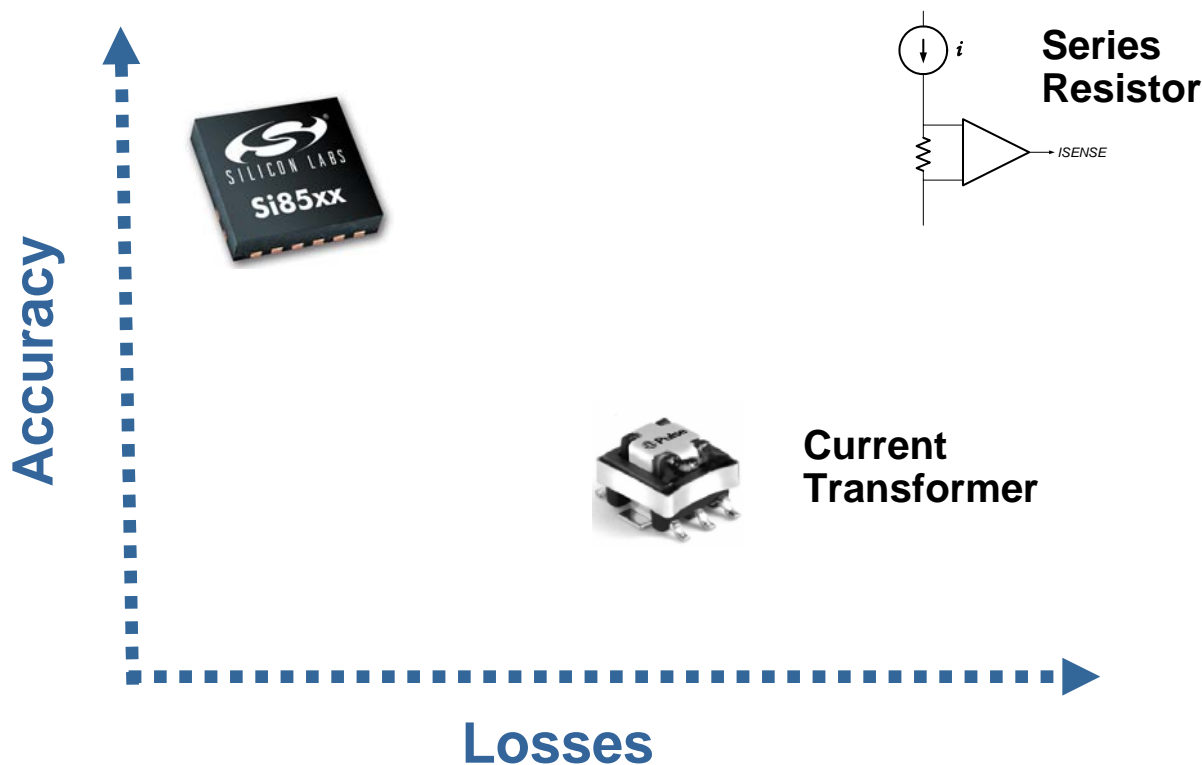


Silicon Labs Implementation



# Industry's Best Performance: Low Loss

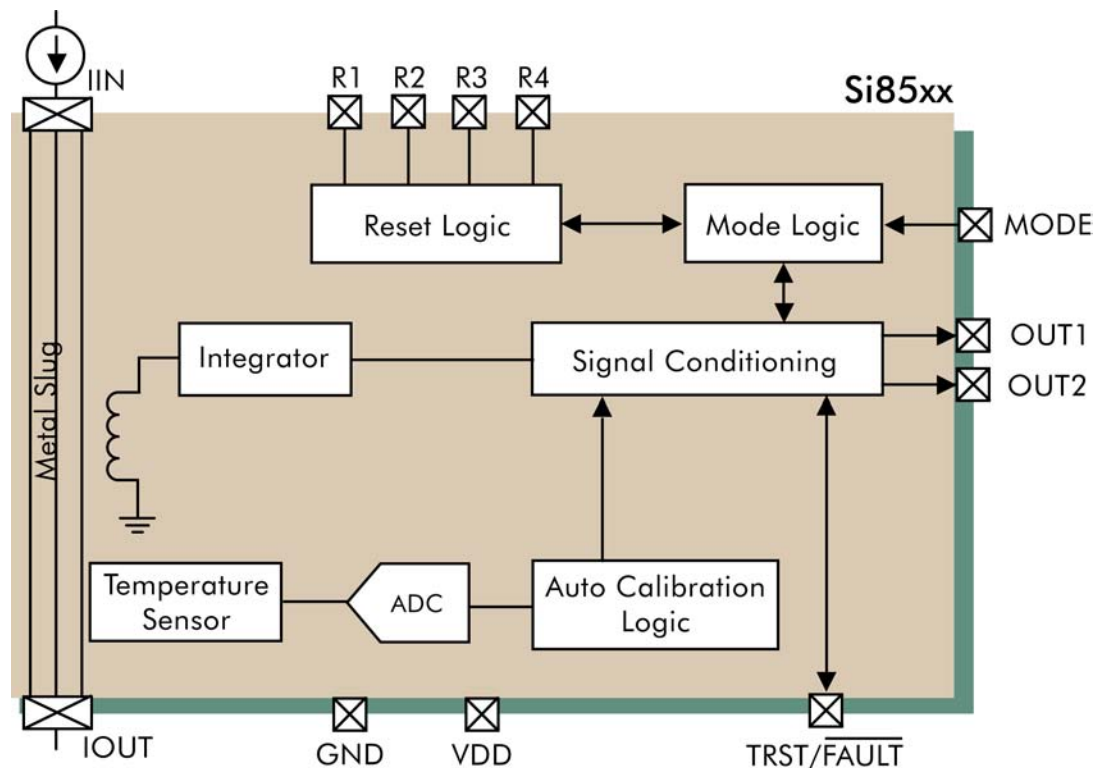
- ◆ Power efficiency is a critical performance metric for power supplies
- ◆ Si85xx has the industry's lowest power dissipation in the high current power path
  - $\sim 1\text{m}\Omega$  series resistance and  $< 2\text{nH}$  of series inductance
- ◆ Low resistance translates into high efficiency and simplified design
  - $\pm 5\%$  accuracy further simplifies design and eliminates need to oversize components to account for inaccuracies in the current measurement device



# Improved Reliability

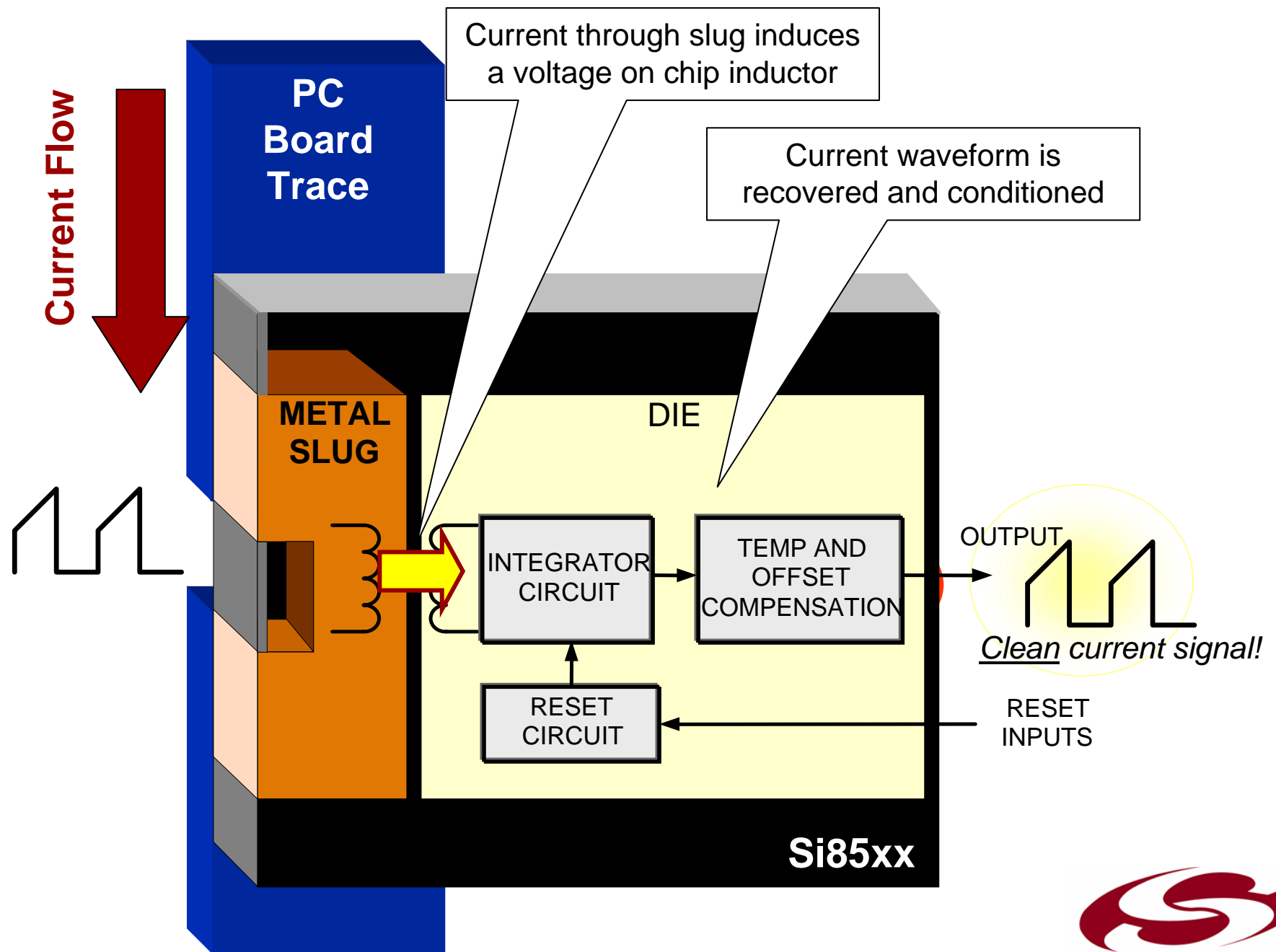
## ◆ Ease of design and manufacturing

- No hand winding or calibration at assembly required
- No variations in electrical characteristics that can cause design problems or require calibration at assembly
- Operates from -40C to +125C in a standard surface mount package, improving reliability and manufacturability



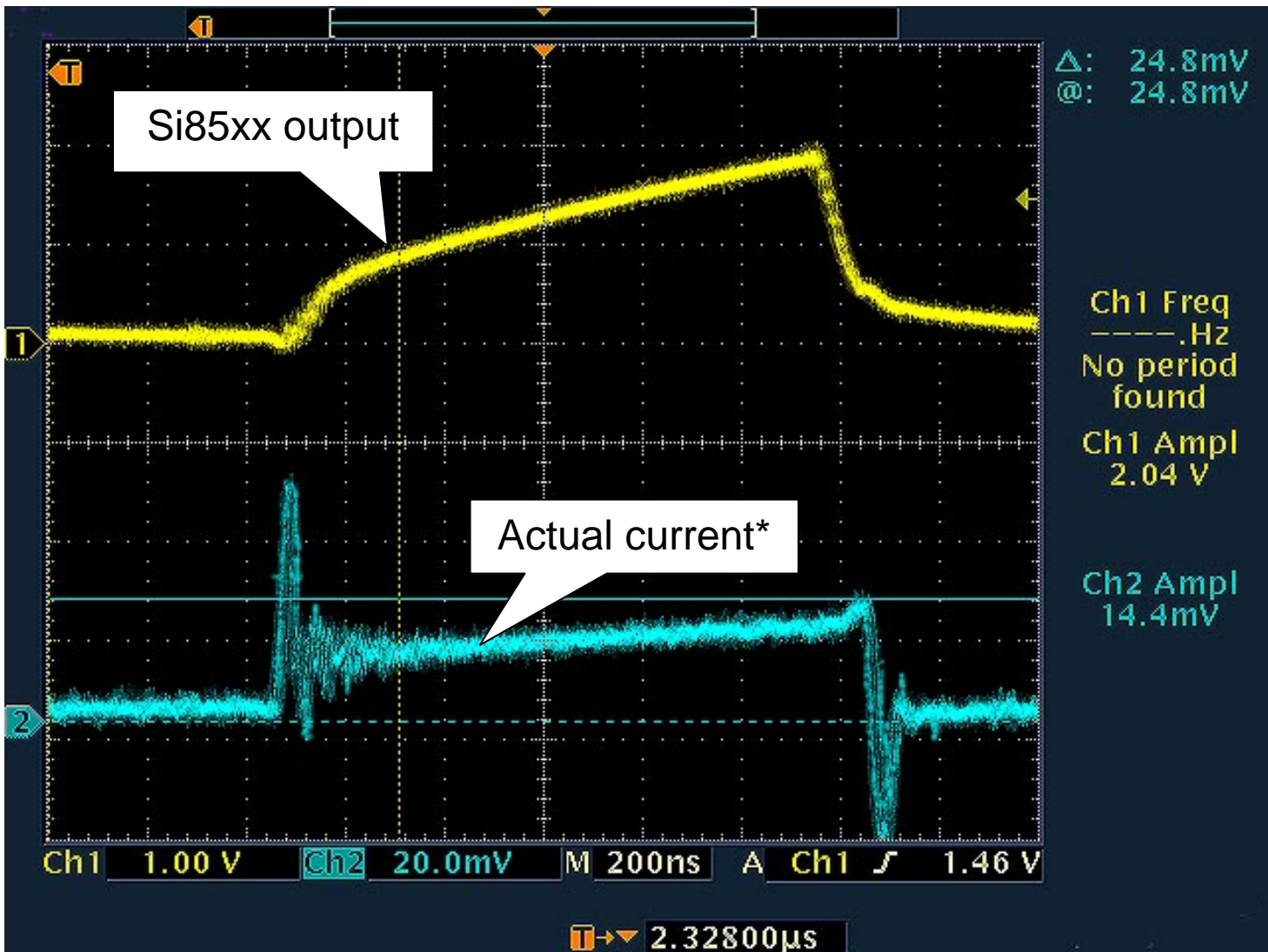


# Industry's Best Performance: How it Works



# Industry's Best Performance: Ultra-Clean Output

- ◆ No output filter needed or leading-edge blanking needed!

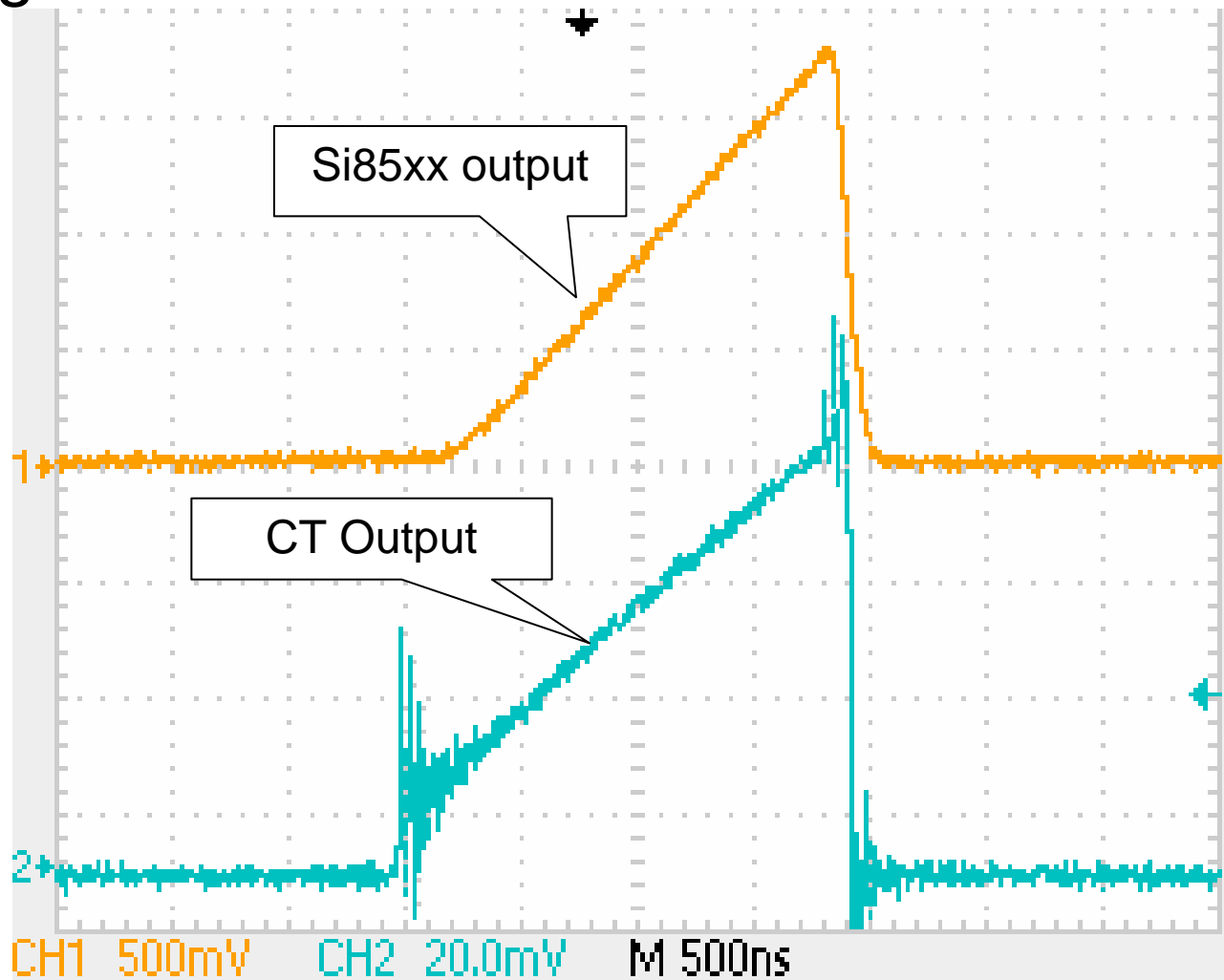


\* Differential oscilloscope probe across current sense resistor


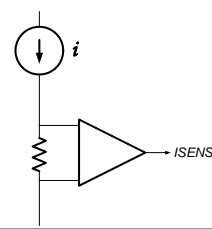
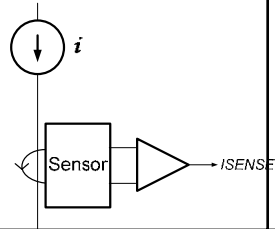

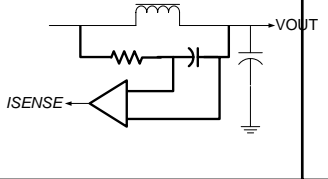
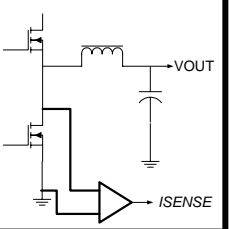


# Industry's Best Performance: Lower Noise

- ◆ Low series inductance and on-board signal processing reduces ringing commonly found in current transformer circuits

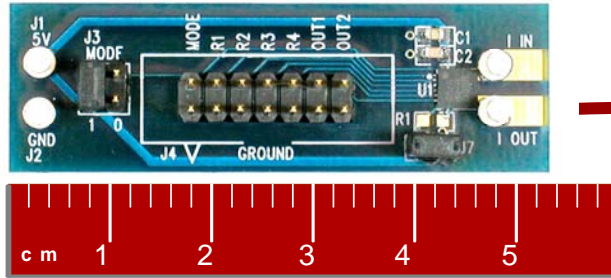


# Si85xx: The Competition

						
	<b>Si85xx</b>	<b>Series Resistor</b>	<b>Hall Effect/MR Sensor</b>	<b>CT</b>	<b>DCR</b>	<b>Low-Side MOSFET</b>
<b>Series R (mΩ)</b>	<b>1</b>	<b>10</b>	No loss	<b>6 - 20</b>	No loss	No loss
<b>Relative Cost</b>	<b>1.0</b>	<b>1.8</b>	<b>1.8</b>	1.0	0.5	0.5
<b>Bandwidth (KHz)</b>	<b>50-1,000</b>	<b>DC - 200</b>	<b>DC - 300</b>	50 - 1,000	50 - 1,000	50 - 1,000
<b>BOM</b>	<b>1C</b>	<b>1R, 1C</b>	<b>1R, 2C</b>	<b>1D, 1R, 1C</b>	<b>2 Opamps, 6R, 2C</b>	<b>Opamp, 4R, 1C</b>
<b>Accuracy (±%)</b>	<b>5</b>	5	<b>10 - 30</b>	<b>15</b>	<b>25</b>	<b>35</b>
<b>Output (mV)</b>	<b>2,000</b>	<b>10-200</b>	<b>10-100</b>	<b>100-500</b>	<b>100</b>	<b>10-100</b>
<b>Footprint (mm<sup>2</sup>)</b>	<b>16</b>	<b>20</b>	<b>25 -150</b>	<b>60</b>	<b>60</b>	<b>40</b>
<b>Height (mm)</b>	<b>1</b>	1	<b>2 -5</b>	<b>5</b>	<b>2</b>	<b>2</b>

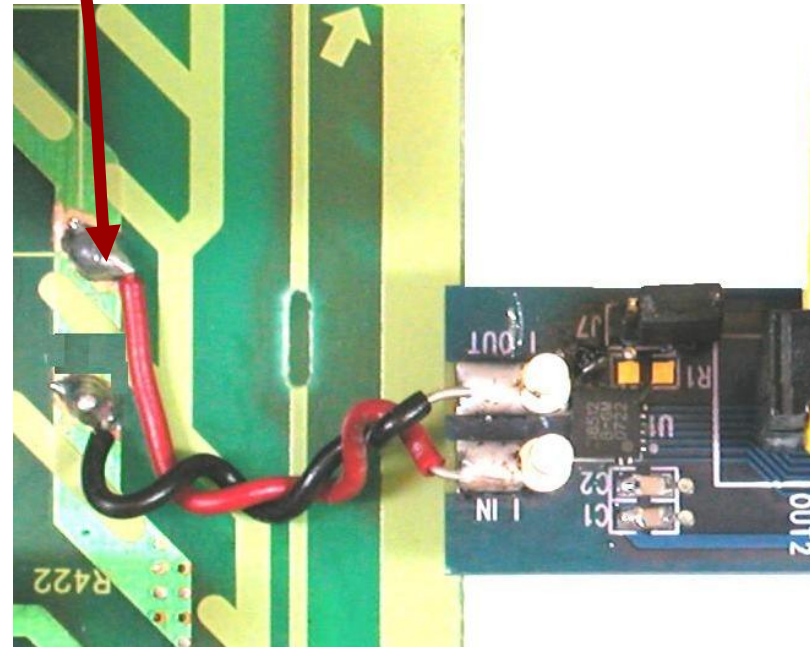


# Solder-In EVB Helps Customers



Solder it in!

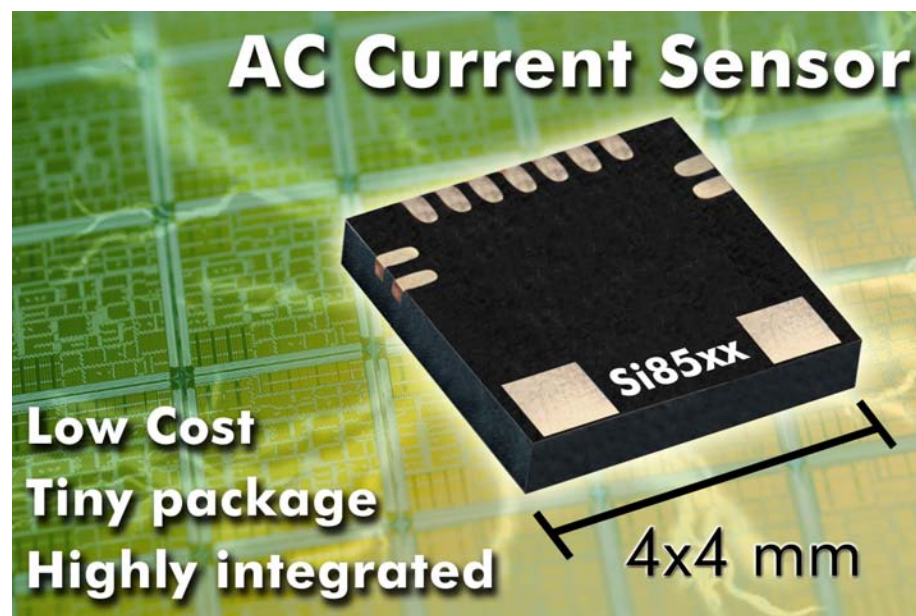
**Si85xx solder-in board**  
Enables customers to install the Si85xx in their system immediately and without laying-out a new board



*Customer's system*

# Summary

- ◆ AC Current Sensor integrates the entire current sensing bill-of materials in a tiny footprint
- ◆ Industry's lowest power dissipation results in higher efficiency
- ◆ Very low parasitics and no need for factory calibration ease design and manufacturing





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