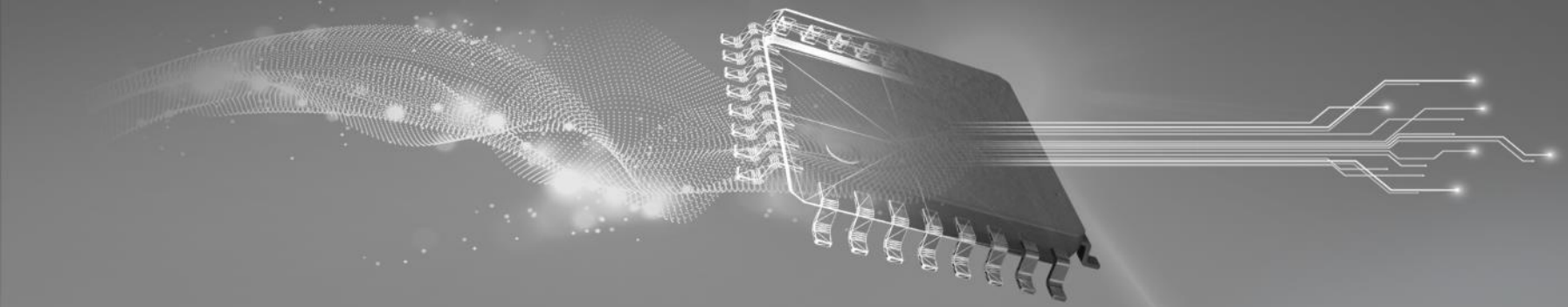
TI TECH DAYS



Getting started in low power IoT with Wi-Fi® connected temperature & humidity sensing

Amit Ashara & Michael Reymond

Temp Humidity Sensing & Connectivity

Texas Instruments

TI Temperature & Humidity Technology

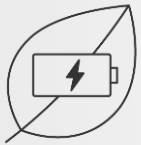
High Accuracy

Proprietary technology produces superior temperature accuracy, with ±0.1°C to ± 0.5°C, ± 1°C, and ± 2°C max accuracies

- Superior accuracy not only accurately protects and precisely compensates electronic system, but also provides added monitoring function, such as a smart thermostat, human body, and etc.

Ultra-Low Power

Optimized design reduces current consumption during temperature conversion, saving power for more power intensive components in a system



- Optimized ultra-low power core offering the lowest power sensing solution in the industry, when operating either as a thermostat or a critical protection device

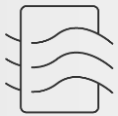
Small Size & Cost

LBC9 Mixed Signal Process + 300mm wafers, available in multitude of small package options

- Small size not only offers robust compact designs, with fast temperature response times, but smaller die size on 300mm wafer also ensures cost effective and stable supply in the long term

Humidity Sensing Option

Combining high accuracy temperature and humidity sensors makes TI humidity sensor the lowest power in the industry

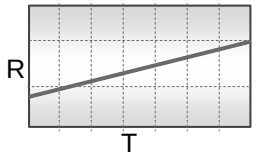


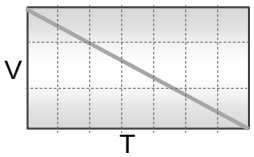
- Combining proven temperature sensing with humidity sensing element enables TI humidity sensor to have the lowest power in the industry, hence augments the thermostat capability to measure temperature and RH%, as well as enabling detection of system condensation

THS | Portfolio Overview

On board temperature solutions

Local
Measures temp at device itself

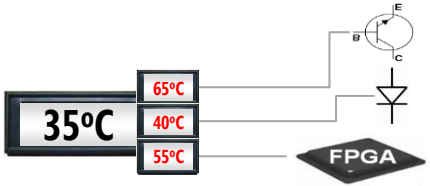
Linear Thermistor


Analog


Digital


I²C
SPI
UART
Pulse Count

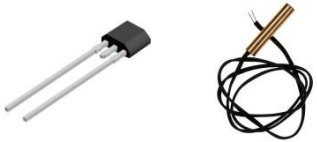
Remote
Multi-channel, Measures temp at external PN junction



Switch
Configurable & Preprogrammed Temperature Comparators with Hysteresis

Off board temperature solutions

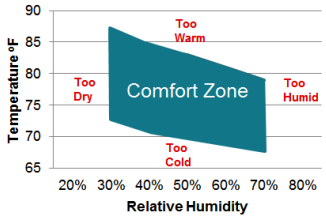
2 Pin Digital
Simple Pulse Count Interface
Can be integrated into probes
Up to 2 meters



Daisy Chain
String multiple sensors in a single cable
Up to 300 meters using standard UART interface

Humidity

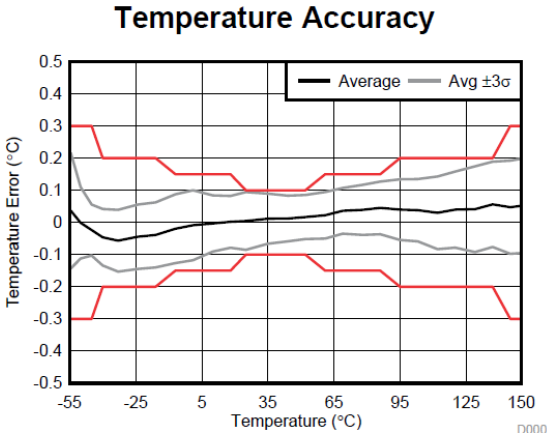
Integrated Humidity & Temperature Sensors



Texas Instruments

Digital Local Temperature Sensors

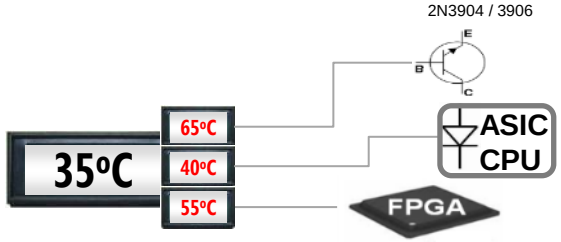
- Full integrated Temp Sensor
- Digital interface includes I²C-bus, SPI, UART or pulse count
- Simplest to design with these features:
  - Accuracies up to ±0.1°C max
  - Active current down to 3uA
  - Footprint down to 0.8 mm x 0.8 mm



	I²C-bus					UART	
	TMP117	**TMP112**	**TMP108**	**TMP1075**	**TMP103**	**TMP107**	**TMP144**
Accuracy (max)	±0.1°C	±0.5°C	±0.7°C	±1°C	±2°C	±0.4°C	±1°C
Resolution	16-Bit	12-Bit			9-bit	14-Bit	12-Bit
Supply Range	1.8V to 5.5V	1.4V o 3.6V	1.4V o 3.6V	1.7V to 5.5V	1.4V o 3.6V	1.7V to 5.5V	1.4V to 3.6V
IDDQ (max)	3.5uA	10 uA	8uA	4uA	3uA		3uA
Package Footprint	WSON (2 x 2mm) WCSP (1 x 1.6mm)	SOT-563 1.6 x 1.6mm	WLCSP (0.8 x 1.2 mm)	DFN (2 x 2 mm) MSOP (3 x 3mm), SOIC	WLCSP (0.8 x 0.8mm	SOIC8 (4.9 x 6mm)	WCSP (0.8 x 1mm)
NIST Traceable	✓	✓	-	✓	-	-	-

Remote Multi-channel Temperature Sensors

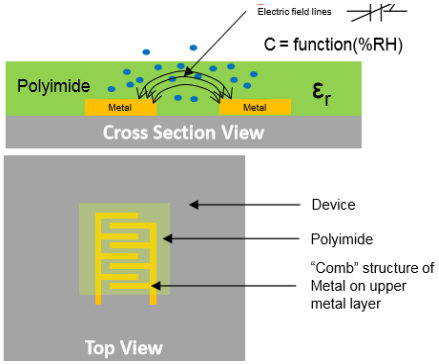
- Remotes offer the ability to monitor temperature at multiple locations using a single IC.
  - All remotes include a local digital temperature sensor
  - Any PN junction can be used for the external sensor element
    - Discrete: diodes & BJT transistors
    - Built-in diodes: CPUs, FPGAs, ASICs
  - 1 to 8 remote channels
  - Integrated current/boltage/power monitoring option
- Built-in series resistance cancellation, n-factor correction, offset, and beta compensation

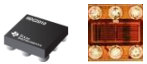


	TMP468	TMP464	TMP461	TMP451*	TMP432
# of Remote Channels	8	4	1	1	2
Local Accuracy (max)	**±0.75°C**	**+/-0.75C**	**+/-1C**	**+/-1C**	**+/-1C**
Remote Accuracy (max)	**+/-0.75C**	**+/-0.75C**	**+/-0.75C**	**+/-1C**	**+/-1C**
Supply Range	1.7V to 3.6V	1.7V to 3.6V	1.7V to 3.6V	1.7V to 3.6V	2.7V to 5.5V
Iq (max)	67uA	43uA	35uA	27uA	45uA
ADC Resolution	13-bit	13-bit	12-bit	12-bit	12-bit
Package	VQFN(3 x 3mm) DSBGA(1.6 x 1.6mm)	VQFN (3 x 3mm)	WQFN (2 x 2mm)	WSON (2 x 2mm)	VSSOP (3 x 3mm)

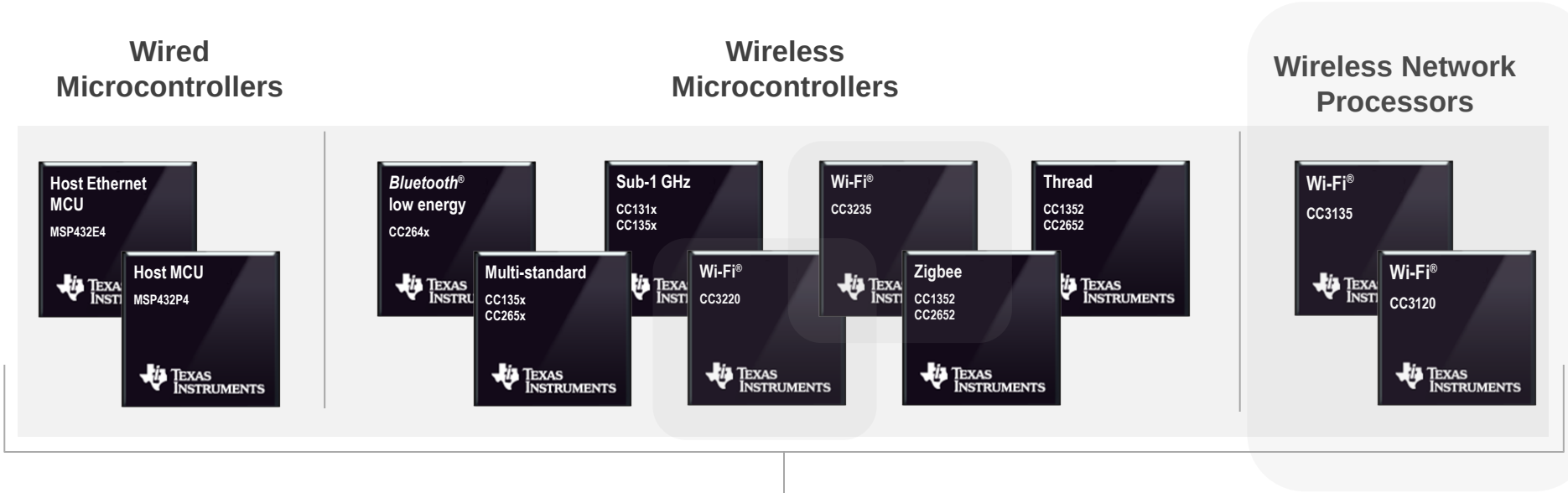
Humidity Sensors

- Integrated humidity and temp sensing element
- Accurately measure 0% to 100% RH, with typical 2% and ±0.2°C accuracy
- Lowest active current down to 0.6uA
- Small footprint down to 1.5 x 1.5 mm
- Support VCC down to 1.62V



	HDC1010	HDC1080	HDC2010	HDC2080	HDC2021	HDC2022
						
Minimize UV exposure	✓		✓			
Space Constraint Applications	✓		✓			
5V Support	✓	✓				
1.8V Support			✓	✓	✓	✓
Guaranteed RH% tolerance (±3%RH)			✓	✓	✓	✓
Conformal Coating, PCB Board Wash					✓	
Exposure to dust/debris/water						✓

SimpleLink™ MCU platform

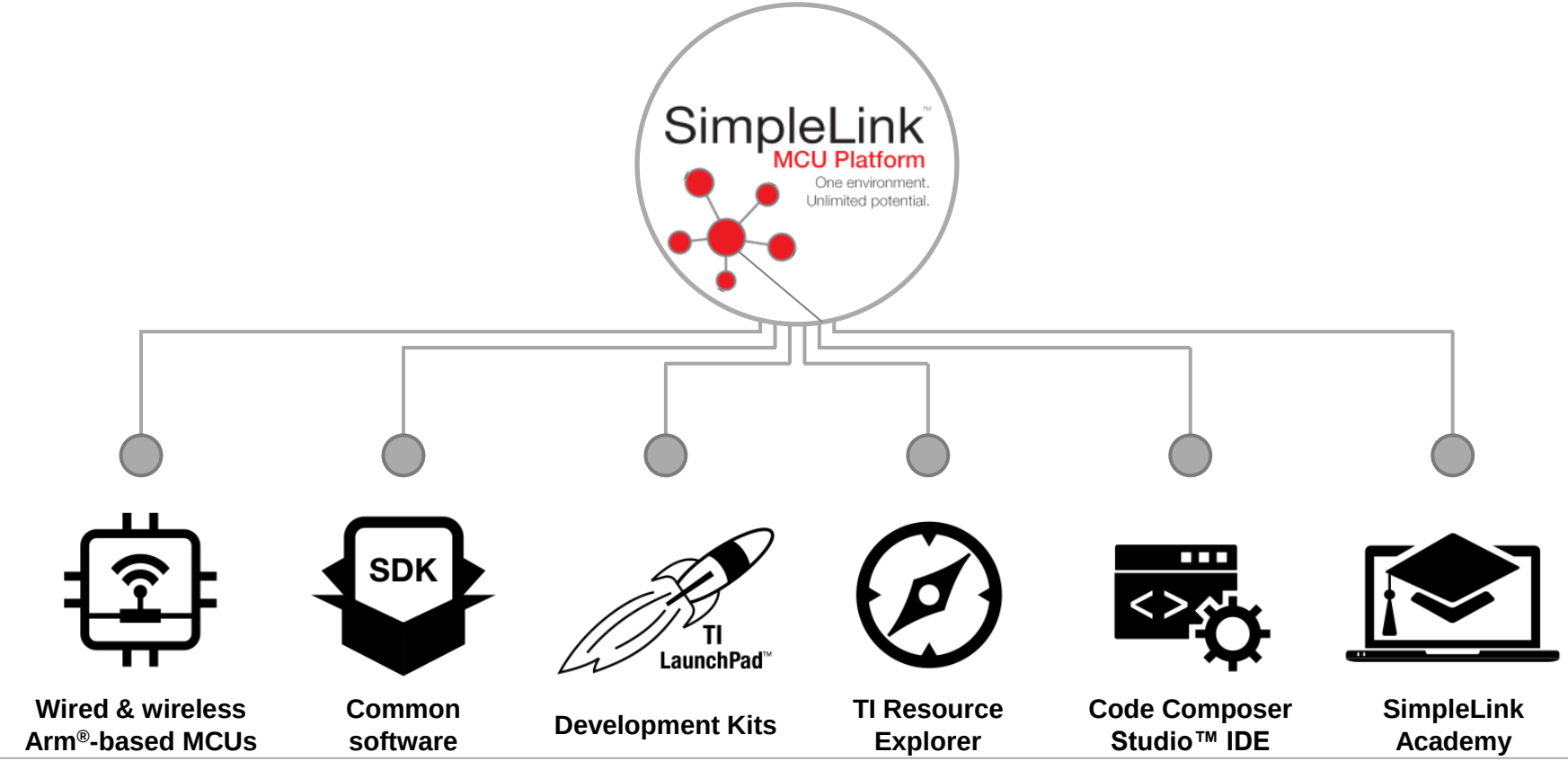


100% code reuse

SDK

Common software

End-to-end development resources



The SimpleLink™ SDK

SDK Plugins

Easily add functionality to your product
Sensor to Cloud design with sensing plugins, IoT plugins, and more…

Solve your design problem
Broad range of fully tested and certification-ready stacks with training and examples

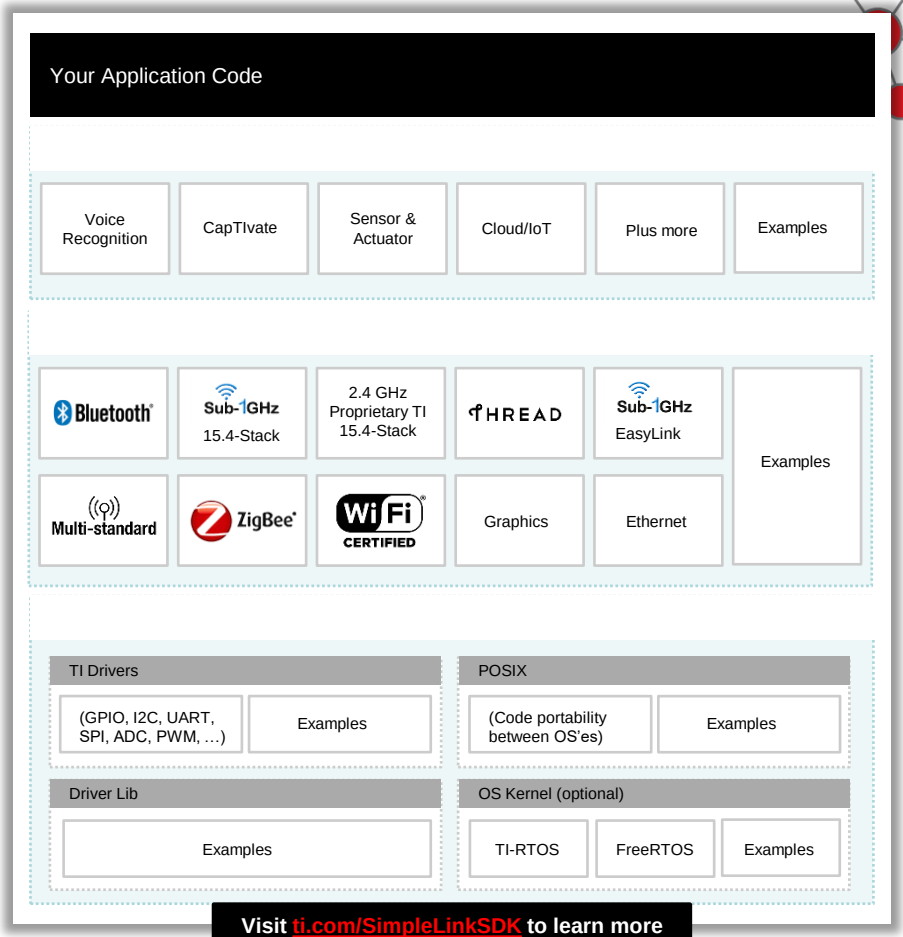
Expand and enhance your product offering
Application code portability between techlogies enables easy integration of wireless connectivity

Common Components

Return on software investment with 100% code portability
TI drivers abstract of the SimpleLink hardware functionality

Extend battery life and lower power consumption
TI-RTOS is optimized for SimpleLink hardware architecture

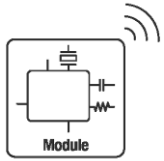
Flexible design support
POSIX-compatible APIs offer flexible OS/kernels support



Visit ti.com/SimpleLinkSDK to learn more

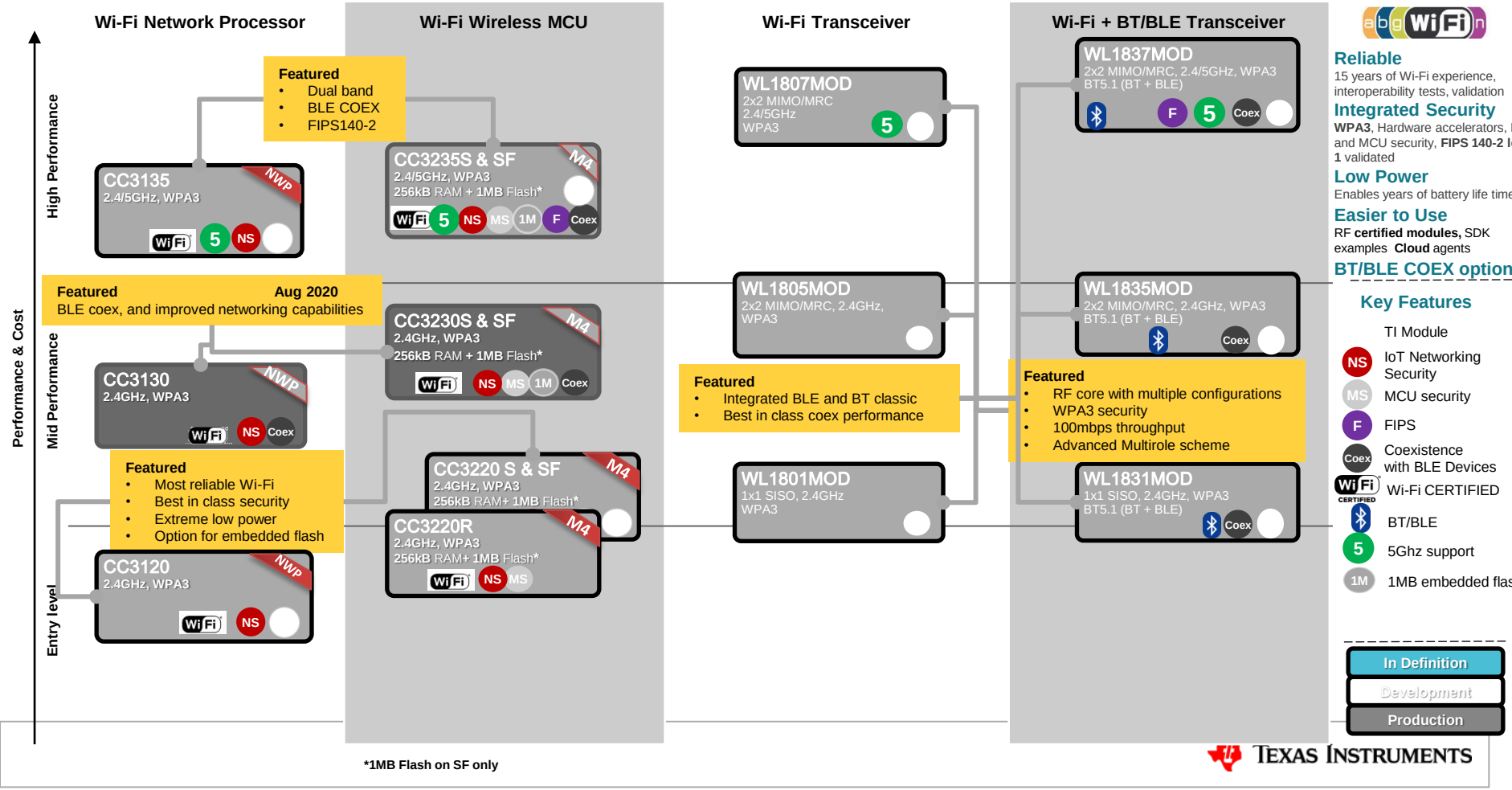
Texas Instruments

Connectivity | The most reliable & secured IoT Wi-Fi Portfolio



	Wi-Fi SoC (256-KB RAM)	Wi-Fi SoC (256-KB RAM and 1-MB Flash)	Wi-Fi network processor	Wi-Fi transceiver	Wi-Fi + Bluetooth LE transceiver
Frequency	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz
Host	Internal MCU	Internal MCU	External MCU	External MPU/MCU	External MPU/MCU
Security	MCU security with secure boot, FIPS 140-2*	MCU security with secure boot, FIPS 140-2*	Network security FIPS 140-2*	—	FIPS 140-2*
Bluetooth low energy support	External**	External**	External**	None	Integrated Bluetooth LE 5.1
Distinctive features	WFA certified Network learning algorithm	WFA certified Network learning algorithm	WFA certified Network learning algorithm	MIMO/MRC Mesh Multi-role	MIMO/MRC Mesh Multi-role
IC option 2.4 GHz	CC3220R, CC3220S, CC3230S	CC3220SF, CC3230SF	CC3120, CC3130	—	—
IC option 2.4/5 GHz	CC3235S	CC3235SF	CC3135	—	—
Module option 2.4 GHz	CC3220MODS, CC3220MODAS	CC3220MODSF, CC3220MODASF	CC3120MOD	WL1801MOD, WL1805MOD	WL1831MOD, WL1835MOD
Module option 2.4/5 GHz	CC3235MODS, CC3235MODAS	CC3235MODSF, CC3235MODASF	CC3135MOD	WL1807MOD	WL1837MOD

Connectivity | The most reliable & secured IoT Wi-Fi Portfolio



Reliable
15 years of Wi-Fi experience, interoperability tests, validation

Integrated Security
WPA3, Hardware accelerators, IoT and MCU security, **FIPS 140-2 level 1** validated

Low Power
Enables years of battery life time

Easier to Use
RF **certified modules,** SDK examples **Cloud** agents

BT/BLE COEX options

Key Features

- TI Module
- NS — IoT Networking Security
- MS — MCU security
- F — FIPS
- Coex — Coexistence with BLE Devices
- Wi-Fi CERTIFIED
- BT/BLE
- 5 — 5Ghz support
- 1M — 1MB embedded flash

In Definition
Development
Production

SimpleLink™ Academy Philosophy

SimpleLink MCU Platform

Users Guides

- Brings depth to code examples
- Defines all possibilities of functionality
- Not easy to consume and move forward

Code examples

- Defined functionality usually built to express common use cases
- Can be complex
- Requires extensive comments

SimpleLink Academy

- Starts with code examples
- Establishes clear outcome from lab
- Simplified step-by-step while educating customers
- References Users Guides

TI-Designs & App Notes

- End-Equipment focused
- Advanced well beyond general code examples
- Great for specific applications

Understanding → Starting Point → Moving Forward → Advanced

The TI IoT Cloud Ecosystem

Visit TI's Overview for the Internet of Thing

TI Supported Plugins	HomeKit, amazon web services™, Microsoft Azure
3rd Party Enabled	IBM Watson IoT™, arrayent, Temboo, EXOSITE, bug labs, xively, Kaa IOT

Development Tools

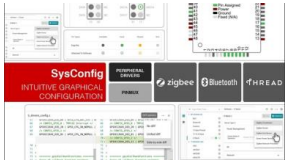
CCS

IAR

GCC

Additional Tools

UniFlash Programming Tool



Sysconfig

Software Development Kit (SDK)

Radiotool

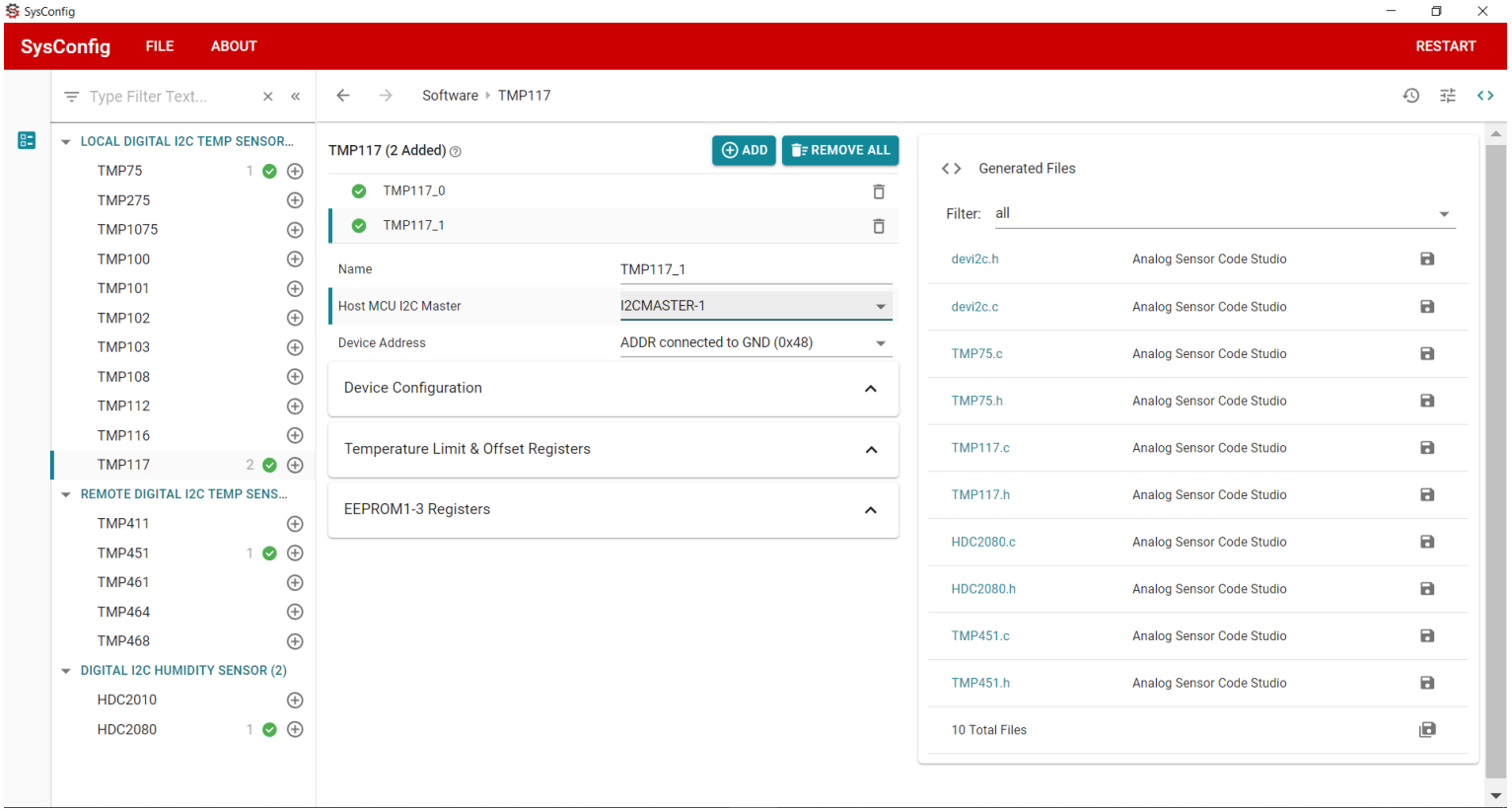
SimpleLink™

Wi-Fi Starter Pro App

Dev.ti.com


TI Cloud Tools
Explore
Develop
Help
Sign-in
Welcome to TI's Cloud Tools!
Access online tools to develop applications and to evaluate TI tools.
For the best experience, please install the TI CLOUD AGENT extension so we can detect your device.
Install Cloud Agent
Resource Explorer
Examples
Libraries
Documentation
CCS Cloud
Compile
Program
Debug
SysConfig
Pin Configuration
S/W Configuration
Code Generation
UniFlash
Flash
Program
Load
GUI Composer
Dashboards
GUI Applications
Dials and Gauges
Gallery
GUI Composer Apps
Demos
Examples
BoosterPack Checker
LaunchPads
BoosterPacks
Compatibility
PinMux
Pin Configuration
Auto Solver
Code Generation
E2E Community
Engineers
Questions
Discussions

SysConfig: Sensor Code Studio



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