Detroit Tech Day - October 10, 2019

Time / Room	Analog OTHER Sapphire	Embedded Processing Ruby	Analog PRODUCT Pearl	Analog SYSTEMS Emerald	Analog HEV/EV Amethyst
8:00 - 9:00	**Registration and Exhibits Open**				
9:00 - 10:00	How to solve for V2X: The connected, autonomous future starts here	Interference management in radar systems	PCB thermal design with flip-chip packages: HotRod and the new Routable-Lead-Frame Technology	How to support automotive safety designs which require ASIL	Designing 6.6-kW bidirectional HEV/EV on-board-charger with SiC and embedded technologies
10:00-10:30	**Break / Exhibits**				
10:30 -11:30	Optimized power solutions for small camera modules: One size does not fit all	Soft-switching techniques for C2000-controlled boost PFC: Improving efficiency and THD across load conditions	FPD-Link III application quick diagnostic on ADAS and IVI systems	Troubleshooting Buck design issues: Common issues and debug tips and tricks	Isolated bias power supply architecture and topology trade-offs for HEV/EVs
11:30-1:00	**Lunch**				
1:00 - 2:00	Re-Moving the needle on automotive instrument clusters	Accelerating power management design for TI mmWave (xWR) devices	Advanced EMI mitigation IP developments – Active EMI Filter (AEF) + Advanced Frequency Modulation (AFM)	System-level design considerations for driving and diagnosing inductive loads	Top 10 gate driver pitfalls and how to address them
2:00 - 2:15	**Break / Exhibits**				
2:15 - 3:15	EMC and high-speed board layout for FPD-Link	The AWR1843 77GHz single-chip radar solution for multi-mode automotive applications: Automated parking systems using the TI AWR1843 mmWave sensor	Diagnostics and protection in body control modules	Solving EMI challenges in automotive rear light designs	Design challenges: Rotor position sensing, isolated current sense, and auxiliary power supplies
3:15 - 3:30	**Break / Exhibits**				
3:30 - 4:30	New type of front cameras w/o local processing: A new architecture leads to new challenges	Solving Next Generation Car Access System Design Challenges using Bluetooth Low Energy	Hall position sensor applications overview	External or internal FETs for motor drive in automotive applications	Technology and standards for high-voltage isolation

Track	Title	Abstract
Analog OTHER	How to solve for V2X: The connected, autonomous future starts here	From Smart Cities to Connected Cars, V2X is connecting it all. How will it change our daily commute? What type of protocols will it use? How will it operate with ADAS? When will V2X be adopted? Is there even a business case? These are all questions OEMs and Tier 1's may be asking but few have a clear answer. One thing we know is V2X may not be common on roads today but it is being designed right now. This presentation will discuss the future of V2X, the trends the market is seeing so far, what the systems looks like today and how TI can address these new systems from a product and system standpoint. With V2X enabling new technologies that have never existed before in the automotive sector, this presentation will address the new opportunities for semiconductor components to be designed into V2X systems.
Analog OTHER	Optimized power solutions for small camera modules: One size does not fit all	TBD
Analog OTHER	Re-Moving the needle on automotive instrument clusters	The automotive instrument cluster is the part of the car that we look at the most since it gives us all of the necessary information about our trip: how fast we are going, how much fuel we have, and whether the car is in good health. Over the last few years, the instrument cluster has begun evolving from a group of electro-mechanical gauges familiar to our grandparents to a set of virtual gauges displayed on an LCD screen. This change has brought with it increase electronics content. This presentation will discuss the evolution of the instrument cluster, market trends, changes in the systems, and how TI can address these changes from a product and a system standpoint.
Analog OTHER	EMC and high-speed board layout for FPD-Link	TBD
Analog OTHER	New type of front cameras w/o local processing: A new architecture leads to new challenges	TBD

Embedded Processing	Interference management in radar systems	As more and more 77Ghz radar-enabled cars enter the road, the probability of one radar intermittently interfering with another increases. Such cases of interference results in artifacts - ghost-objects, blind-spots at certain ranges and increased noise-floor. Like-wise as more 60Ghz radars are used in Industrial settings, similar interference related artifacts will appear there as well. Robust interference detection and mitigation schemes are needed to reduce or eliminate these artifacts, and are thus critical to on-field radar operations. This talk will start with an overview of interference in radars and discuss various detection and mitigation techniques. The talk will also introduce features that TI Radars have to sense, avoid and mitigate interference. These features include: 1) Hardware features to detect regions within ADC data that are corrupted by interferers. 2) Extremely fast-chirps to rapidly sense the spectrum during idle-periods. 3) Hooks to enable Pseudo-random dithering of various chirp parameters to reduce the effect of weak interferers. 4) Hooks to synchronize radars with a universal clock, and thereby allow different radars to use different time-frequency-slots for transmission. 5) Compute capability (HWA, DSP) to implement various interference mitigation schemes.
Embedded Processing	Soft-switching techniques for C2000-controlled boost PFC: Improving efficiency and THD across load conditions	As the EV charging market boosts rapidly, increasing charging efficiency becomes a hot topic. Valley switching is a soft-switching technique that improves the system efficiency especially under light load when the efficiency and THD are more difficult to improve. This technique can be applied to AC-DC and DC-DC converters. In this training session, a digital control valley switching technique is illustrated to significantly improve boost PFC converter performance especially the efficiency and THD under light load condition. This is achieved using the integrated digital control feature of the C2000 MCU F280049 without using complex external logic and sensing circuit. An independent math processor CLA is used to alleviate the C28x CPU burden. The CLA enablement for digital power solutions will be covered in this session as well since it can offer better integration option for EV/HEV customers when combining DC-DC and DC-AC on one controller.
Embedded Processing	Accelerating power management design for TI mmWave (xWR) devices	This presentation will cover two topics. The first session describes how to cascade multiple TI single chip radars to a high performance radar sensor with enhanced angle and range detection performance. A cascade radar system proposal will be presented followed by some demonstrate results based on TI 4-chip cascade radar system. The second session introduces multiple body and chassis automotive applications based on TI single chip radar. For each application, the corresponding hardware EVM and basic signal processing chain will be introduced.
Embedded Processing	The AWR1843 77GHz single-chip radar solution for multi-mode automotive applications: Automated parking systems using the TI AWR1843 mmWave sensor	AWR1843 is the latest TI 77GHz single-chip radar solution with enhanced performance features to enable multiple automotive applications. The AWR1843 device features 3 TX channels/ 4 RX channels, 2MB on-chip memory, 10MHz IF sampling frequency, integrated signal processing hardware accelerator and TX beam forming with programmable phase shifter. The larger memory and higher IF frequency makes it applicable for both short range radar and mid-range radar. The added hardware accelerator is capable to perform basic radar signal processing more efficiently so that the DSP can be used for more advanced signal processing algorithms. The TX beam forming feature can improve the detection range further and provide the flexibility to adjust the zone of interest. The 3rd TX also enables detection in elevation. This presentation focuses on the following topics: How AWR1843 is best suited for autonomous parking application, the short-range and mid-range radar applications of AWR1843, and how the TX beam forming feature enhances range and dynamic beam steering.
Embedded Processing	Solving Next Generation Car Access System Design Challenges using Bluetooth Low Energy	This training will provide an overview of Passive Entry Passive Start (PEPS) and Phone As A Key (PAAK) car access design challenges and why Bluetooth® Low Energy (BLE) is a good fit for these types of systems. TI reference designs and the Real Time Localization System Toolbox will be discussed to address several of these challenges specifically relay attack prevention and localization.

Analog PRODUCT	PCB thermal design with flip-chip packages: HotRod and the new Routable-Lead-Frame Technology	As ICs get smaller and smaller, new and innovative packaging techniques are required. In the past for a package with DAP, it was simple enough to get the θJA for a package and calculate out your expected die temperature. Now we must use different temperature parameters like θJC , ΨJB and ΨJT to accurately analyze a circuit. This presentation is a deep dive into thermal modeling and layout best practice, with emphasis on these ultra small packages. Many examples are shown using the evaluation board layout along with actual thermal camera images. A head-to-head design design challenge between a traditional SOIC-8 package with DAP and TI's new "Hotrod" packaging is discussed.
Analog PRODUCT	FPD-Link III application quick diagnostic on ADAS and IVI systems	In this presentation, we will introduce the FPD Link III typical application example in ADAS and IVI systems, and summarize the main problems we meet during such system developing. This session also summarizes the quick diagnostic solution based on the main problems phenomenon, helping the user find the root cause and fix their problems quickly. In the last part, we will introduce the ADAS and IVI system development trend and its requirements to the next generation FPD link requirement.
Analog PRODUCT	Advanced EMI mitigation IP developments – Active EMI Filter (AEF) + Advanced Frequency Modulation (AFM)	In this presentation, we discuss the advanced EMI features like Active EMI Filter (AEF) and Advanced Frequency Modulation (AFM) and their integration in future power products. The features are applicable for all power topologies and all power levels. Increasing power density, faster switching, and higher currents force designers to spend more time both considering the effects of ElectroMagnetic Interference (EMI) and debugging a design that has EMI problems but is otherwise complete. This presentation helps understand those problems to allow the developer to make choices that help mitigate EMI issues.
Analog PRODUCT	Diagnostics and protection in body control modules	Automotive Ethernet is now a widely adopted in-vehicle network solution. It is replacing CAN, Flexray, and MOST due to its higher data rates, scalability, and networking capabilities. To ensure reliability, understand and address issues before they cause catastrophic failure, built-in system diagnostics are being integrated into automotive Ethernet PHYs. This course will go over the various diagnostic tool functions within TI Ethernet PHYs, why the tools are important, how they are used, and where they can add the most value to a system. A live demo will be run at the end of the presentation.
Analog PRODUCT	Hall position sensor applications overview	Hall sensors sense magnetic fields from current-carrying wires, electromagnets and permanent magnets. The integration of a permanent magnet into a physical application with a hall sensor can let us sense if a door is open or closed, or how fast a fan is turning, or how much an analog trigger is depressed. This session will explain how hall sensors work, the types of hall sensors available, go through some simulations and design examples, and finally talk about some of the success stories where our hall sensors won business.

Analog SYSTEMS	How to support automotive safety designs which require ASIL	What TI devices in automotive designs are safety relevant? Where do I need devices design according to ISO26262 and where and how can I get away without it? 1) We start with a general overview about the requirements coming from the Automotive safety standard ISO26262. 2) Next, we explain which TI parts are designed according to ISO26262 and in what cases you get away with “normal” parts and how. 3) Examples for parts used in automotive systems which are non ISO26262 parts 4) Finally, we will show innovative concepts with TI parts like PMICs which are explicitly designed according to ISO26262
Analog SYSTEMS	Troubleshooting Buck design issues: Common issues and debug tips and tricks	Buck converters and controllers are popular for power delivery, But they can sometimes be tricky to implement: From determining the proper component selection to optimizing board layout. Customers often find a buck that isn’t working and the clues they provide can be used to find the root cause and fix the issue. This presentation details the process for pinpointing the reason for buck converter/controller issues as well as steps necessary to fix them. This presentation will go over quick and effective schematic reviews, what to look for in layout reviews, and what we can learn by just a few simple scope captures. This knowledge will assist in quick and reliable root cause analysis.
Analog SYSTEMS	System-level design considerations for driving and diagnosing inductive loads	Driving loads located far away from the driver using long cables, or driving loads that are inductive by their nature (for example, relays, solenoids and motors), require precautions during turn on and off due to the magnetic energy stored in the load. Proper system level design and smart high side switch selection play a critical role in designing the correct balance between a cost-optimized and a reliable solution. System complexity can further increase when solution requires fault protection and diagnostics. The process of de-magnetization of the load requires careful system level considerations, as well as understanding the capability of the driver device to withstand this stress. Various scenarios are examined through real system measurements and simulations in both industrial and automotive systems, showcasing optimal solutions to drive a range of inductive loads.
Analog SYSTEMS	Solving EMI challenges in automotive rear light designs	Light emitting diode (LED)-based lighting is increasingly in popularity in automotive exterior lighting since they offer design flexibility, increased efficiency, and provide solutions for new functionalities. Various system architectures and power converter topologies are used in automotive exterior lighting applications, which brings design challenges that need to be solved. This training first shows current and future market trends in exterior lighting . The main architecture of both front and rear lighting are discussed, including TI solutions. The last main section presents Rear Lighting LED solutions, including pre-voltage regulators topologies and their design challenges.
Analog SYSTEMS	External or internal FETs for motor drive in automotive applications	Modern automobiles use electric motors to drive an increasing number of applications, such as power windows, locks, seats, mirror adjustments, blowers, and trunk lifts. Transistor-based solid-state drive circuits are used to switch the current to the motors used in these applications. Designers can choose motor drive integrated circuits (IC) with either external field-effect transistors (FETs) or internal FETs for the final drive stage. This presentation discusses some of the tradeoffs in choosing the external-FET or internal-FET approach. Additionally, this discussion focuses on key comparisons in terms of board size and thermal performance.

Analog HEV/EV	Designing 6.6-kW bidirectional HEV/EV on-board-charger with SiC and embedded technologies	Carbon dioxide (CO2) reduction plan is driven by the leading industrial countries in order to alleviate the global warming crisis we are facing today. For that cause, automotive industry has invested more and more resources on HEV/EV developments and sales. According to International Energy Agency statistic data, worldwide HEV/EV sales have increased exponentially from 0.35 million to 3.11 million from 2013 to 2017 and are increasing rapidly in 2018. Therefore, on-board-charger (OBC) as a key composition of a HEV/EV becomes main focus to TI key automotive customers. One of the key technological improvements is to use SiC MOSFETs which enables high voltage, high power density, and high efficiency designs. In this presentation, we will go through the HEV/EV market status and history, OBC specifications, technology trend, topology selections and design considerations of an OBC system. Complete test results of a 6.6kW OBC reference design (Including AC-DC rectifier and isolated DC-DC converter) will be shown in the end of this paper to demonstrate the performance of our TIDesigns as well as TI SiC and embedded Technologies. The design contains large variety of TI products: the C2000 digital controller, high power controllers, isolated gate drivers, current and voltage sensors, high voltage isolation products, and low power DC/DCs, etc.
Analog HEV/EV	Isolated bias power supply architecture and topology trade-offs for HEV/EVs	The flyback topology has historically been the most widely used solution for isolated bias power in HEV/EV powertrain due to its low-cost, wide-input voltage range, and ability to support multiple outputs. HEV/EV power electronics engineers are facing more stringent requirements for power density, EMC performance, and system cost. A variety of topologies including flyback, fly-buck, open-loop push-pull, and open loop half-bridge as well as different power architectures ranging from a single central transformer with multiple output windings to a distributed architecture with individual bias supply for each load are being considered to address these challenges. This presentation will cover the advantages and disadvantages of the various topologies and power architectures and will analyze test results from 4 TI designs to quantify the performance of the different topologies.
Analog HEV/EV	Top 10 gate driver pitfalls and how to address them	Look out for these 10 common mistakes when designing with gate drivers. In an engaging, interactive format, each problem will have a layout and/or scope shot showing the issue, which we will then discuss the causes and consequences before offering a solution on how to prevent the issue. This presentation covers problems that occur when the bias supply and bootstrap supply components are not correctly selected. It also covers the effects of high dv/dt noise and the negative effects of parasitic components in the circuit and proper layout considerations.
Analog HEV/EV	Design challenges: Rotor position sensing, isolated current sense, and auxiliary power supplies	TBD
Analog HEV/EV	Technology and standards for high-voltage isolation	Need isolation? When designing for applications requiring isolation, the different isolation technologies, qualification and reliability tests, and component-level standards should be considered. This presentation highlights different isolation technologies (i.e. capacitive, magnetic, optical) with a deep dive of how TI's capacitive technology structure is designed to achieve reinforced isolation. We will review high voltage tests for qualification and reliability, such as Surge and Ramp to Breakdown (RTB), and analyze test results across the different isolation technologies. Popular high voltage isolation component-level standards, such as IEC & VDE, that facilitate system certification will also be covered.