



Our vision

We are the link between the real and the digital world.

Our values

We commit
We partner
We innovate
We perform

Our mission

We make life
easier, safer
and greener.

Part of your life. Part of tomorrow.



Webinar on Infineon solutions for Solar Pump Drives

Webinar on Infineon offerings
02 March 2021



02 March 2021

public

Agenda – Webinar on Infineon solutions for Solar Pump Drives

- 1 Introduction to Infineon Technologies & Infineon Design Challenge by Priyanka Naik (10mins)
- 2 Keynote by Mr Soumya Prasad Garnaik, BU Head – Lighting, Energy Efficiency Services Limited (10mins)
- 3 Brief technical overview of solar water pump drive system by Swaminathan Balasubramania Sarma (5mins)
- 4 Power Semiconductors by Sanjay Parab (5mins)
- 5 Power Management IC's by Harsha Savant (5mins)
- 6 XMC™ microcontrollers by Swarnam Panday (10mins)
- 7 PSoC® controllers, WIFI- BT products, Flash and RAM products CapSense®, by Winston Fernandes (10mins)
- 8 Current sensor products by Sourabh Pokale (5mins)
- 9 Smart sensor Application by Benedikt Zeyen (5mins)
- 10 Q&A followed by Closing remarks (20mins)

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Infineon is a globally leading semiconductor player



top 10
semiconductor
company

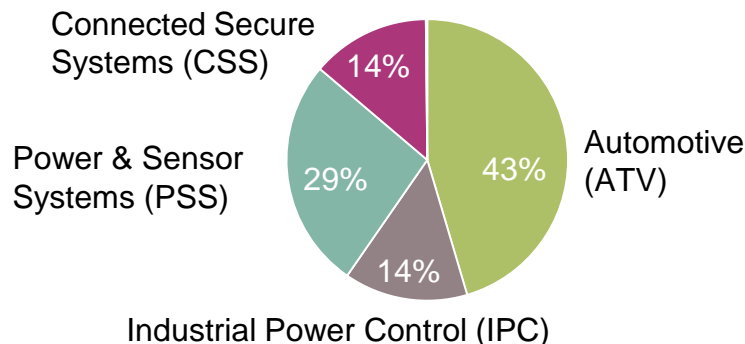
~46,700
total employees

~7,800
R&D employees

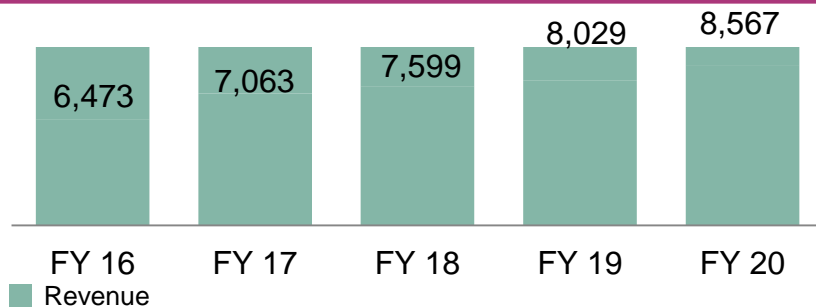
leading player
in automotive, systems for power
management and drives, sensor systems,
connected secure systems, wireless combos,
differentiated memories

Infineon at a glance

Business Segments Revenue*



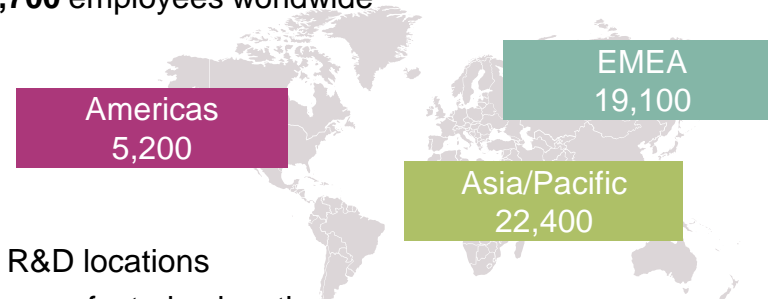
Financials



*Fiscal Year 2020 (as of 30 September 2020)

Employees

46,700 employees worldwide



54 R&D locations

21 manufacturing locations

Market Position



**based on the combined market share 2019 of Infineon and Cypress based on their individual figures

For further information: [Infineon Annual Report 2020](#)

Global megatrends underline the increasing importance of microelectronics



Demographic & social change



Climate change & resource scarcity



Urbanization



Digital transformation

Infineon Solar Pump Motor Drive Design Challenge 2021



Motivation

- Infineon “**solar pump drive design challenge**” initiative aims to encourage affordable and reliable solar powered irrigation systems for farmers – design and manufactured locally. This is in sync with the Indian Government initiatives including **PM-KUSUM** & **Make in India**

Value Proposition

- Support the Indian agrarian community with a unique motor drive design
- Develop the entrepreneurial spirit in the local industry to build domestic solutions for solar pumps – **Atmanirbhar Bharat**

Challenge Statement

- Design of solar pump drives using Infineon product portfolio for mass proliferation in India market

www.infineon.com/designchallenge2021



#startupindia

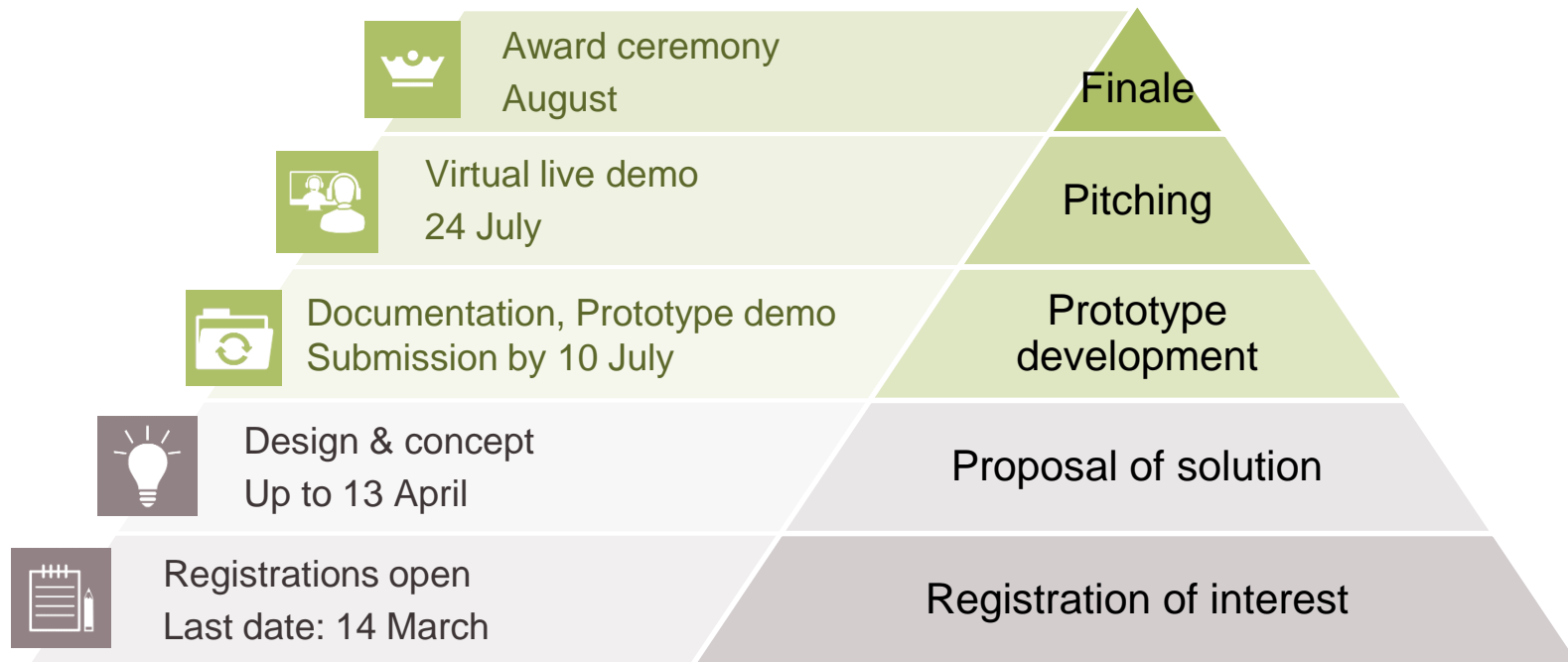
agnii
GROUP
2021

AVNET
Reach Further™

VIRTUAL
FOREST

amber™

Design Challenge key timeline



www.infineon.com/designchallenge2021

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Soumya Prasad Garnaik

Executive Director
Energy Efficiency Services Limited (EESL)

Mr Garnaik is presently working as Executive Director with EESL. He is leading several programs at EESL including nationally recognized program UJALA, Street Light National Program, Buildings Energy Efficient Programme, Atal Jyoti Yojana (AJAY), SEAC Program, NMRP, Global Environment Facility (GEF-5, GEF-6) projects, Consultancy and International Programs.

Over a career spanning 27 years in the field of energy management in various sectors of economy, Mr Garnaik has worked across ICF International, Bureau of Energy Efficiency, FICCI and NPC. Prior to joining EESL, he has served as the Principal in ICF International India.

He worked as Director at the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India where he served as the Program Manager for Perform, Achieve & Trade (PAT) and Standard & Labeling Schemes of BEE. Prior to this, he was associated with FICCI and NPC.

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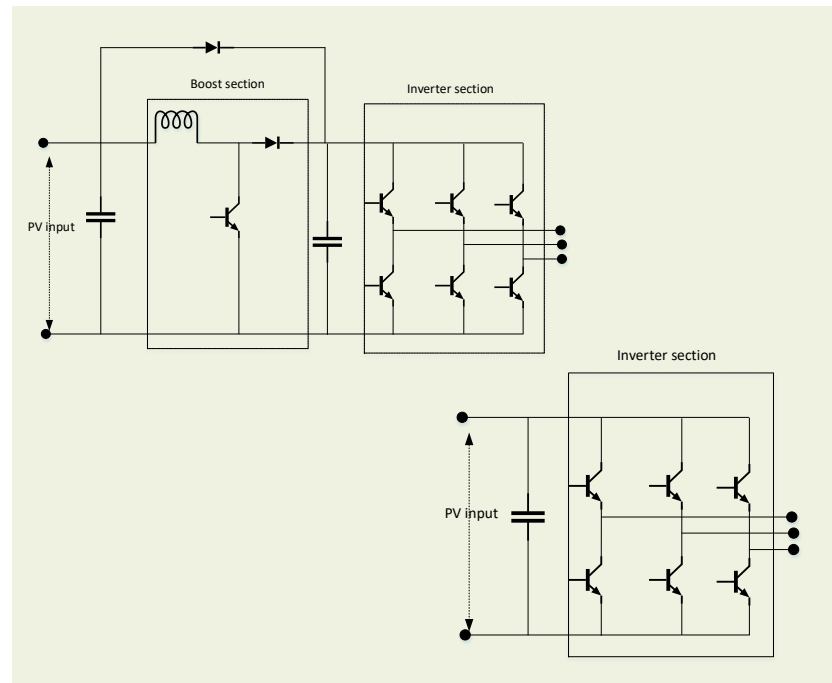
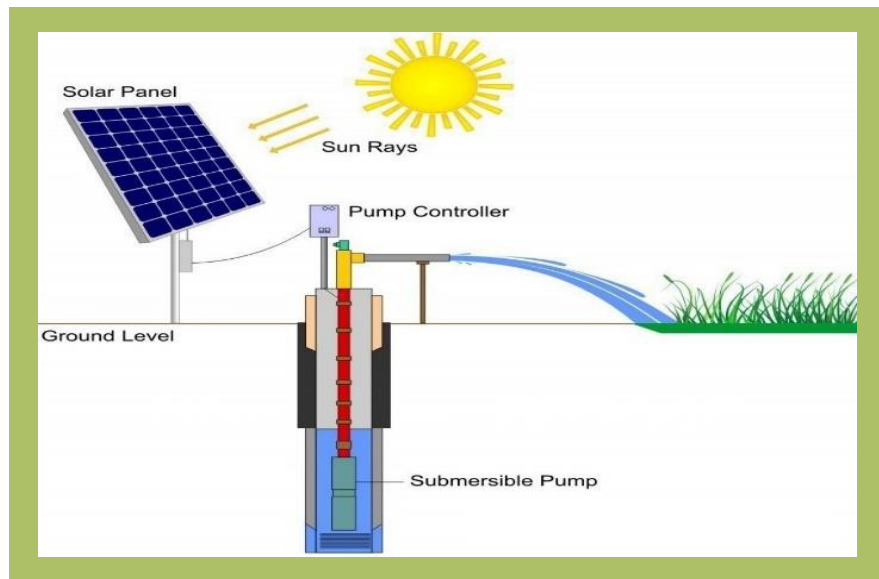
9

Smart sensor Application by Benedikt Zeyen (5mins)

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Q&A followed by Closing remarks (20mins)

Solar Pump working principle



Problem statement: Motor drive design challenge for Solar Pump

Requirement Overview

Problem Statement

- Growing demand for Solar pump drive, but limited availability of Indian designed products
- Weak local eco system for design and manufacturing of pump drive platforms, leading to mass import of drives

Technical Requirements:

- PV Input (DC) to (AC) Motor Load – **Offline (Refer table for specification)**
- Software based **MPPT** (Power Based)
- Scalable design from **1HP to 10HP (1/3 / 5 / 7.5 / 10)**
- **Motor model:** Induction or PMSM/BLDC **Pump model:** Submersible or Surface
- **Algorithms:** FOC or V/F, FOC will be preferred
- **Key protection features:** OVP, OCP, OTP, PV reverse protection, short circuit, motor jam protection, phase loss, dry run
- Interface to **RMS** (Remote Monitoring System) or RMS can be part of design will be added advantage. **LCD** display to show, voltage, current, power, fault, flow rate and status, **cloud** interface through RMS

Motor Power ratings	1HP	3HP	5HP	7.5HP	10HP
Input voltage (VDC) ¹⁾	111 - 135	370 - 450	592 - 720	444 - 540	592 - 720
Number of PV Panels	3 Panels	10 Panels	16 Panels	12 + 12 Panels	16 + 16 Panels
Output Voltage (3Ph AC)	80VAC	180VAC	300VAC	220VAC	300VAC

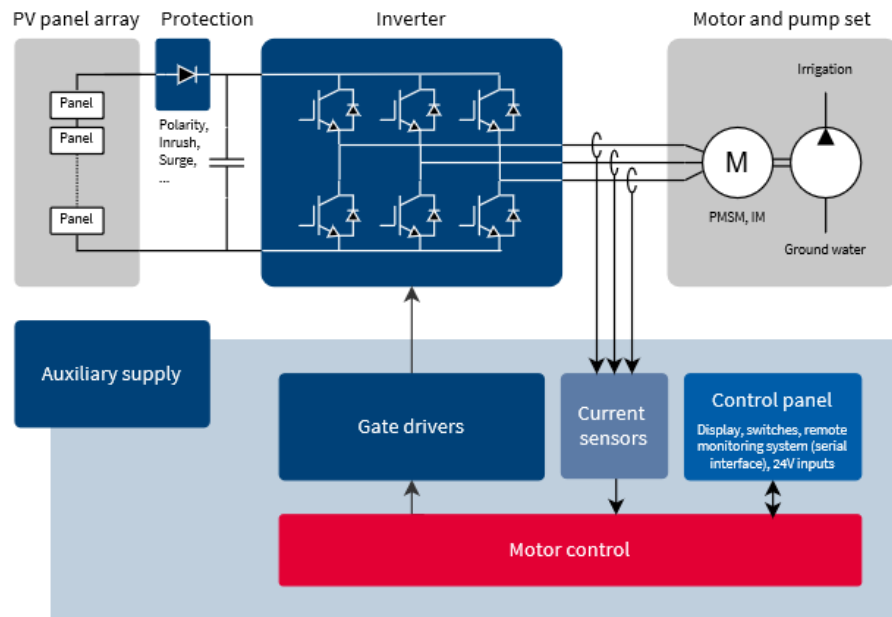
1) MPPT to OCV

Using Infineon components like power devices (IGBT power modules/ Discretes, MOSFET, IPM, Gate driver IC's), Controllers, Sensors, SMPS IC's and Connectivity chips, wherever applicable.

https://mnre.gov.in/img/documents/uploads/file_s-1584510667387.pdf

Requirement

Block diagram: Solar Pump System



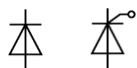
- › Inverter: Discrete IGBT's (TO247, TO247 Plus), IPM's, IGBT Modules
- › Gate Driver IC's
- › Motor control: iMOTION™, XMCTM, MCU & PSoC®, etc.
- › Current sensors
- › Auxiliary supply: MOSFET, SiC MOSFET, Controllers, etc.
- › Control Panel: CapSense®, Memory, communication, MCU & PSoC®, etc.

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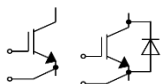
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Power Semiconductors

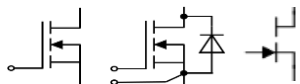
DIODE, THYRISTOR



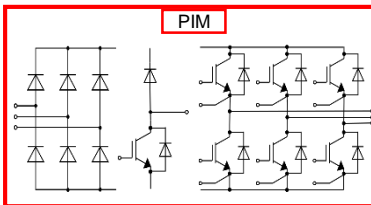
IGBT



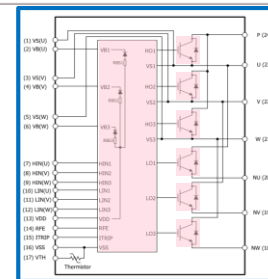
MOSFET, SiC MOSFET, GaN



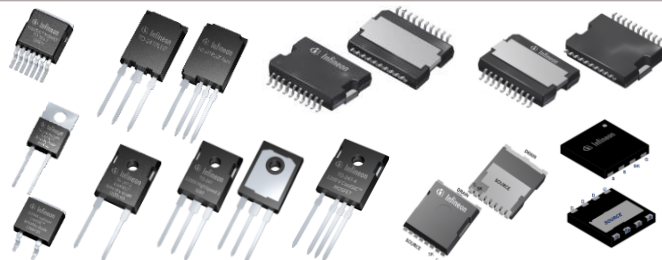
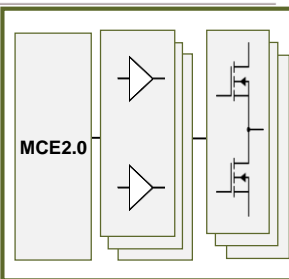
PIM



Available in various topologies



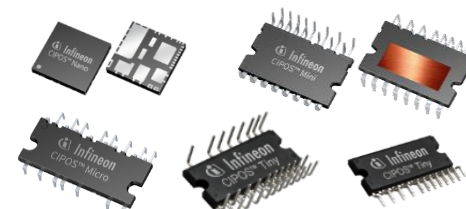
MCE2.0



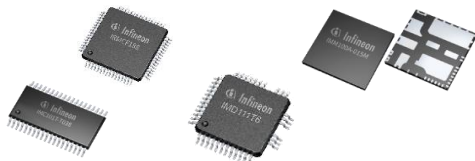
IGBT, MOSFET, SiC, GaN & Diode Discrete



IGBT & SiC Modules



IPM



Digital motion controller iMOTION™



Driver ICs & Solid State Relays



Thyristor & Diode Modules & Disc

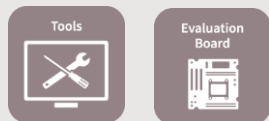
Support material

Collaterals and Brochures



- Product Briefs
- Selection Guides
- Application Brochures
- Presentations
- Press Releases, Ads

Technical Material



- Application Notes
- Technical Articles
- Simulation Models
- Datasheets, MCDS Files
- PCB Design Data

Videos



- Technical Videos
- Product Information Videos

Contact



- Support
- Forum

- www.infineon.com/IGBT
- www.infineon.com/coolmos
- www.infineon.com/optimos
- www.infineon.com/strongirfet
- www.infineon.com/SiC
- www.infineon.com/gatedriver
- www.infineon.com/iMOTION
- www.infineon.com/IPM
- www.infineon.com/GaN
- www.infineon.com/solderbond
- www.infineon.com/pressure-contact
- www.infineon.com/tools
- www.infineon.com/evaluationboards

- see links above
- or
- www.infineon.com/mediacenter

- www.infineon.com/support
- www.infineonforums.com

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Overview of SMPS IC product portfolio

PFC stage	Main stage		
CCM PFC	Flyback		
Fixed frequency ICE2PCS02G (65 kHz) ICE2PCS03G (100 kHz)	Type	Fixed frequency	Quasi-resonant
	Standalone PWM controller	ICE3AS03LJG (100 kHz) ICE5ASAG (100 kHz) ICE3BS03LJG (65 kHz) ICE3GS03LJG (133 kHz) ICE5GSAG (125 kHz)	ICE2QS02G ICE2QS03G ICE5QSAG
Adjustable frequency ICE2PCS01G (50~250 kHz) ICE2PCS05G (20~250 kHz) ICE3PCS01G (2 nd OVP + brown out) ICE3PCS02G (2 nd OVP) ICE3PCS03G (brown out)	PWM controller with integrated MOSFET	650 V MOSFET ICE3Axx65Z / ICE3Bxx65J ICE3BRxx65J ICE3RBRxx65JZ/G 700 V MOSFET ICE5ARxx70AG/BZS 800 V MOSFET ICE3ARxx80JZ ICE3ARxx80(C)(V)JZ/G ICE3BRxx80JZ ICE5A/GRxx80AG/BZS	650 V MOSFET ICE2QRxx65/Z/G 700 V MOSFET ICE5QRxx70AZ/G 800 V MOSFET ICE2QRxx80Z/G ICE5QRxx80AZ/G
CrCM PFC	HB LLC resonant		
TDA4863-2G	ICE1HS01G-1		
IRS2505L	ICE2HS01G		
CrCM PFC + LLC Combo IC			
IDP2303(A), IDP2308			



18 W adapter reference design



33W SMPS reference design



8 W auxiliary SMPS



3W/5V IOT reference design

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XMC, Sense2Go & Shields (products)



XMC2Go



XMC1100 bootkit



XMC4700 RelaxKit



XMC4800 EtherCAT kit

EtherCAT

Microcontrollers



TLE4964-3M
3D Magnetic Sensor



TLI4971 Current
Sense



TLE493DA1B6
3D magnetic
Sensor



IM69D130 Microphone
Shield2Go



DPS310 Pressure
Shield2Go

**S2Go
sensors**

XMC & Sensors can be
programmed using-



<https://www.arduino.cc>



New (BL)DC Motor
Control Shield with
IFX007T



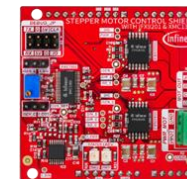
DC Motor Control
Shield with
BTN8982TA



24V Protected Switch
Shield



SHIELD_BTS7002-
1EPP



Stepper Motor Control
Shield with IFX9201 &
XMC1300

XMC™ MCU product portfolio

ARM® Cortex®-M4 (with FPU)

- › CPU Frequency up to 144MHz
- › **High Performance Flash technology**
- › Timers CCU4, CCU8, POSIF
- › USB / Up to 3x CAN / Up to 6x Serial Channels
- › Up to 4x 12Bit ADC / 2x DAC

XMC4100/4200

Up to 256kB Flash /
40kB RAM
48-64pins

XMC4400

Up to 512kB Flash /
80kB RAM
64-100pins

- › 120MHz Core
- › Ethernet
- › $\Delta\Sigma$ Demodulator

XMC4500

Up to 1MB Flash /
160kB RAM
100 – 144pins

- › EBU
- › SD Card

XMC4700

Up to 2MB Flash /
352kB RAM
100 – 196pins

- › 144MHz Core
- › 6ch CAN

XMC4800

Up to 2MB Flash /
352kB RAM
100 – 196pins

› **EtherCAT®**

XMC4300

256kB Flash / 352kB
RAM
100 pin

ARM® Cortex®-M0

- › Core up to 48MHz / Peripherals up to 96MHz
- › Capture Compare Units (CCU4)
- › 2x Serial Channels
- › 12Bit ADC
- › **1.8V-5.5V**
- › TA = -40C to 105C

XMC1100

up to 64kB Flash
16 – 40 pins

- › 9ch LED Control (BCCU)
- › 3x Analog Comparators

XMC1200

up to 200kB Flash
16 – 40 pins

XMC1300

up to 200kB Flash
16 – 40 pins

- › Math Co-Processor
- › CCU8 PWM Timer
- › Hall & Encoder I/F

XMC1400

up to 200kB Flash
40 – 64 pins

- › 48MHz/96MHz clock
- › 2x CAN
- › 2x CCU8
- › 4x Analog Comparators

>70% performance increase

Support Material on XMC

Dave download – [Link](#)
XMC product introduction – [Link](#)
XMC Cortex M0 – [Link](#)
XMC Cortex M4 – [Link](#)
Reference Manual XMC4700/4800 – [Link](#)
Infineon forums – [Link](#)
Product page Microcontroller- [Link](#)
Product page Sensors – [Link](#)
Product page Shields - [Link](#)

GitHub Support - [Link](#)
GitHub XMC for Arduino –[Link](#)
GitHub for Current Sensor - [Link](#)
GitHub for Magnetic Sensor – [Link](#)
GitHub for DPS Sensor- [Link](#)
GitHub for MEMS Microphone- [Link](#)
GitHub for BTN8982TA Shield – [Link](#)
GitHub for IFX007T Motor control – [Link](#)
GitHub for Stepper Motor Shield- [Link](#)

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Sense, Control, Connect & Store

CONTROLLERS

[PSoC 6 – CM0 + CM4](#)

[PSoC 5LP – CM3](#)

[PSoC 4 – CM0](#)



CONNECTIVITY

[WiFi + MCU](#)

[WiFi + BT Combo](#)

[Dual Mode Bluetooth](#)

[Bluetooth Low Energy](#)

[High Speed & Super
Speed USB](#)

[USB Type C PD
Controllers](#)

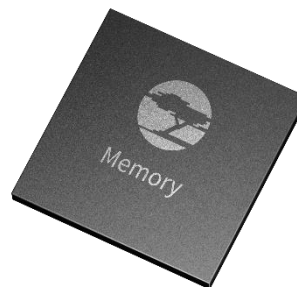


MEMORIES

[NOR Flash](#)

[FRAM - Non Volatile
RAM](#)

[SRAM](#)

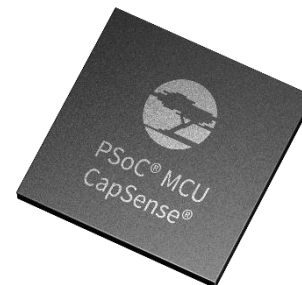


SENSORS

[MBR – Configurable](#)

[PSoC 4 CapSense](#)

[PSoC 6 CapSense](#)



Sense, Control, Connect & Store

Hardware

- PSoC 6 Wi-Fi BT Prototyping Kit ([CY8CPROTO-062-4343W](#)) : PSoC 6 + WiFi + BT + NOR Flash + CapSense (Low Cost Kit)
- PSoC 6 Wi-Fi-BT Pioneer Kit ([CY8CKIT-062-Wi-Fi-BT](#)) : PSoC 6 + WiFi + BT + NOR Flash + FRAM + CapSense
- PSoC® 4100S Plus Prototyping Kit ([PSoC 4 CY8CKIT-149](#)) – PSoC 4 MCU + CapSense + EzBLE Bluetooth Low Energy Module
- PSoC® 4 L-Series Pioneer Kit ([CY8CKIT-046](#)) : PSoC 4 MCU with USB device support + CapSense + Audio Codec
- PSoC 5LP Prototyping Kit ([CY8CKIT-059](#)) : PSoC 5LP MCU
- WiFi (CYW43907 / [CYW54907](#)) : CR4 MCU + WiFi Radio
- USB [CYUSB3KIT-003](#) EZ-USB® FX3™ SuperSpeed Explorer Kit
- USB Type C [EZ-PD](#)™ Barrel Connector Replacement (BCR)

Documentation

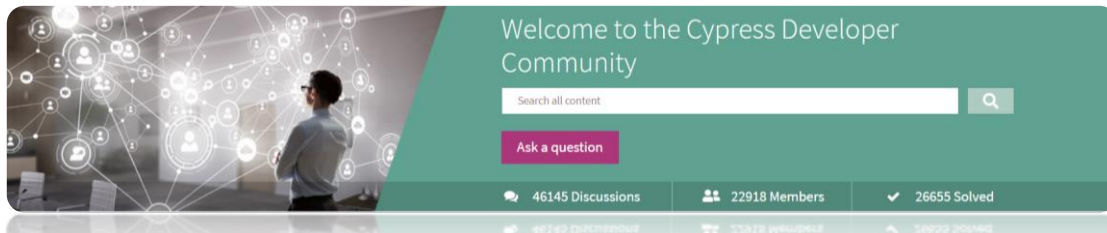
- App Notes : Liked below the Dev kit Pages
- [KBA's](#)
- [Code Examples](#)
- Code Examples by [Contributors](#)
- [Video Tutorials](#) – More on the Community Forum

Development Tools

- [Modus ToolBox](#) : PSoC 6, WiFi Combo, Dual Mode BT
- [PSoC Creator](#) : PSoC 4, PSoC 4 BLE, PSoC 5LP
- [WICED Studio](#) : CYW43907, CYW54907
- [USB](#) : FX3 SDK.

Design & Tech Support

[Cypress Developer Community](#)



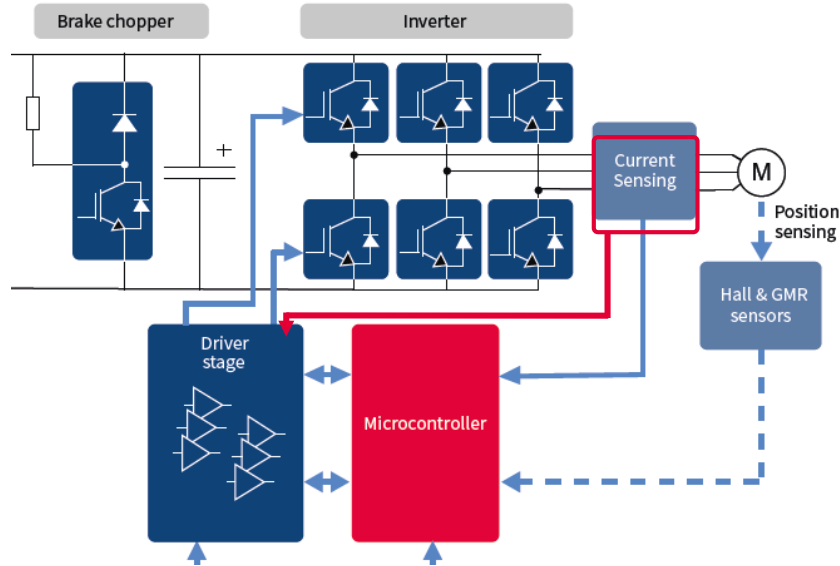
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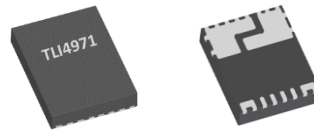
TLI4971 – Application example

Current sensor for in-phase measurement

Block diagram motor drive



TISON-8



Current sensor requirement

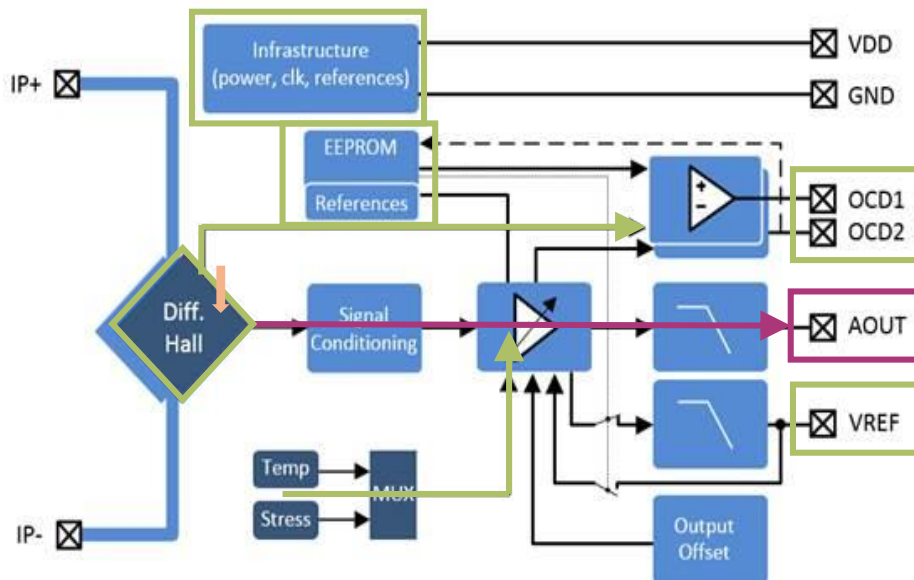
Enabling motor control for smooth operation

Protection of output stages against overcurrent events

Accurate in-phase measurement in harsh environment

Electrically isolated measurement for high voltage applications

TLI4971 Feature set overview & Eval boards



XENSIV™ magnetic
current sensors
TLI4971 – S2GO



Analog output
120 kHz Bandwidth

Differential measurement with high
sensitive hall cells

Temperature &
stress compensation

Overcurrent outputs

Integrated EEPROM

Reference voltage

Diagnosis Mode

Ultra-Low Resistance SMD Package

TLI4971 Infineon Web links

TLI4971 Datasheet -

<https://www.infineon.com/cms/en/product/sensor/current-sensors/tli4971-a120t5-e0001/>

TLI4971 MS2GO Kit -

https://www.infineon.com/cms/en/product/evaluation-boards/tli4971_ms2go/

App Note – High Voltage General purpose Drive with TLI4971

https://www.infineon.com/dgdl/Infineon-TLI4971_ElectricDrive_AN-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4626c1f3dc3016c236353970d55

App Note – Solder & PCB design & Thermal management guideline

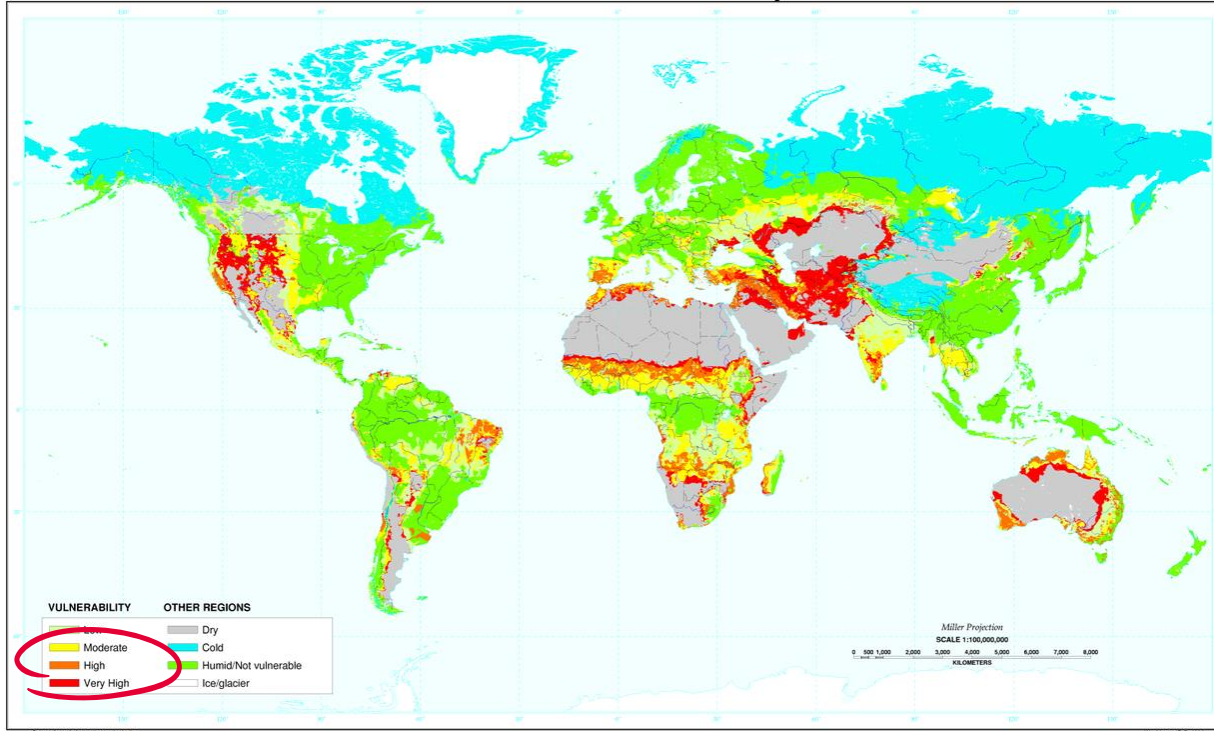
https://www.infineon.com/dgdl/Infineon-TLI4971_PCB_AN-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4626bfb5124016c1a2029262869

Agenda – Webinar on Infineon solutions for Solar Pump Drives

- 1 Introduction to Infineon Technologies & Infineon Design Challenge by Priyanka Naik (10mins)
- 2 Keynote by Mr Soumya Prasad Garnaik, BU Head – Lighting, Energy Efficiency Services Limited (10mins)
- 3 Brief technical overview of solar water pump drive system by Swaminathan Balasubramania Sarma (5mins)
- 4 Power Semiconductors by Sanjay Parab (5mins)
- 5 Power Management IC's by Harsha Savant (5mins)
- 6 XMCTM microcontrollers by Swarnam Panday (10mins)
- 7 PSoC® controllers, WIFI- BT products, Flash and RAM products Capsense®, by Winston Fernandes (10mins)
- 8 Current sensor products by Sourabh Pokale (5mins)
- 9 **Smart sensor Application by Benedikt Zeyen (5mins)**
- 10 Q&A followed by Closing remarks (20mins)

Large portions of the planet are arid and vulnerable to desertification

Desertification Vulnerability



Source: USDA.gov / Wikipedia

- › 70 – 90% of freshwater used for irrigation
- › 40% of Earth's surface at risk for desertification
- › Wrong / excessive irrigation top 4 reason for desertification

In most areas where we pump water for irrigation, increasing water efficiency will have a direct monetary impact for farmers



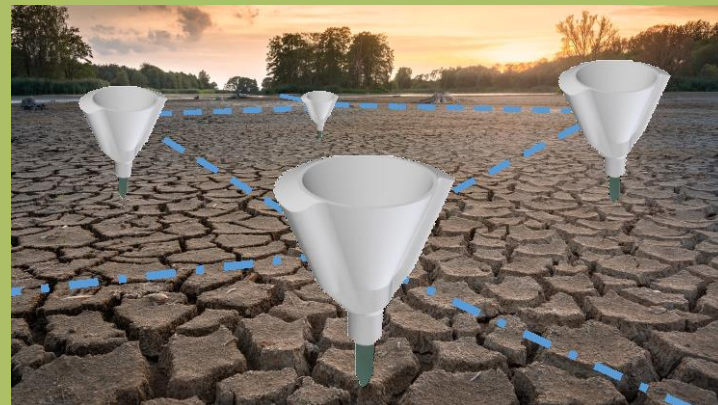
Monetary impact for farmers

- › Less cost for water
- › Larger fertile area for allotted water allowance
- › Higher yield from demand driven watering
- › Sustainability - Preservation of aquifers

Sources: UN Office for Disaster Risk Reduction, Intl Fund for Agricultural Development, US Dept of Agriculture, Wikipedia

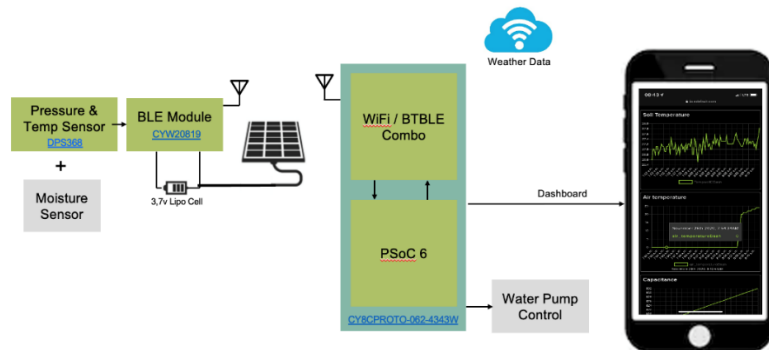
We think: Every pump should have a sensor!

- › Water demand could be lowered 20% with “smart irrigation”
- › Smart, low cost soil moisture sensors in connection with water pumps could be key for smart widespread irrigation



Sources: UN Office for Disaster Risk Reduction, Intl Fund for Agricultural Development, US Dept of Agriculture

We aim to publish an open source reference design for an IoT Moisture Sensor



Open Source

- › to guarantee widest-possible availability of concept
- › to allow community participation on requirements, algorithms, best practices

Measured data could include

- › Soil moisture
- › Temperature / air pressure / -humidity
- › Rainfall

Data could be augmented via cloud with

- › Weather forecast
- › Satellite data

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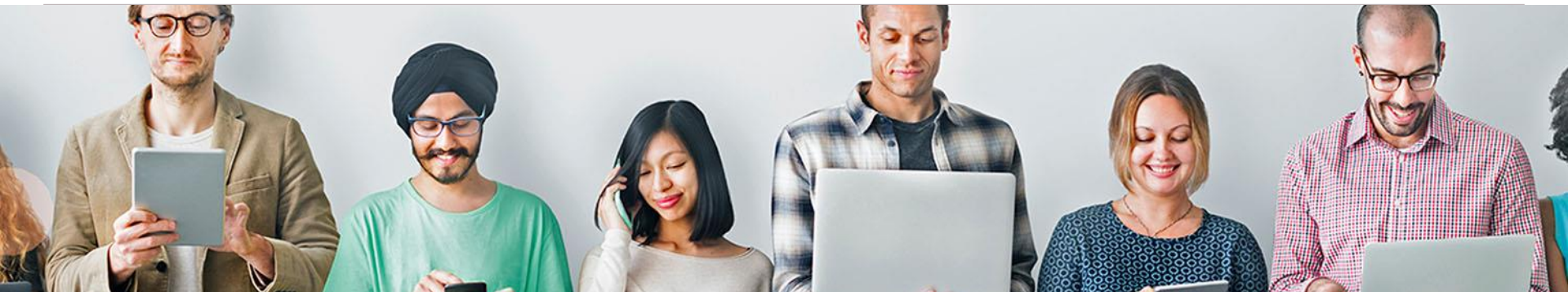
10

Q&A followed by Closing remarks (20mins)

Questions & answers



Contact us!



For any technical query regarding the webinar topics, please send an email at

Infineon.startupindia@investindia.org.in

For your feedback regarding this webinar, or any other non-technical query, please send email at

Priyanka.Naik@infineon.com

To register for our Design Challenge, please visit our website

www.infineon.com/designchallenge2021



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