



**THE DATASHEET OF  
FXLN8361QR1**





# Introduction to the New Sensor Products

## APF-ENT-T0807

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Applications Engineer



April 2013

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# Consumer Sensor Applications

## Mobile Devices

- Mobile Phones
- Tablets
- Laptops / Hybrids
- MID



## Consumer Non-Mobile

- Digital Still Camera
- Remote Controls
- Gamin
- Pedometers
- GPS
- Watches



## Growing Customer Base



## Development

- Activity / fitness monitors
- Digital Cameras
- Sports training equip
- Hobbyist - RCs



# C&I Accelerometer Family



**MMA865x**



**MMA845x**



**MMA8450**



**MMA8491**



**FXLN83xx**

- Digital Output
- Cost Efficient
  - 1mg/count sensitivity
- High Perf.
- Rich Features
  - P/L detection
  - High Pass Filter
  - Transient Detect
- 2x2 mm package

(Newton)

- Digital Output
- Extreme Perf.
  - .25mg/count sensitivity
- Extended Features
  - FIFO
  - Configurable P/L trip angles
  - High Pass Filter
  - Transient Detect

(Veyron)

- Digital Output
- Low Voltage
  - 1.71-1.89V

(Proton)

- Digital Output
- Extreme Low Power
  - 0.35uA/Hz
- Cost Efficient
  - 1mg/count sensitivity
- Industrial Package

(Plutino)

- Analog Output
- High Bandwidth
  - 4.9kHz
- Low Voltage
  - 1.71-3.6V
- Industrial Package
- Extended Temp Range: 105C

(Pluto)

Consumer

Industrial

# Intrinsic Low-G Sensors (Newton)

## 3-axis High-Performance Digital Accelerometers

### Differentiating Points

- Output Noise (150ug/rHz)
- Offset and Sensitivity Accuracy
- Resolution up to 1mg/count

### Product Features

- 1.95V to 3.6V supply voltage
- $\pm 2g/\pm 4g/\pm 8g$  dynamically selectable
- Output data rate (ODR) from 800Hz to 1.563Hz
- I<sup>2</sup>C digital output interface w/interrupts
- Embedded orientation (Portrait/Landscape)
- Embedded High Pass Filter
- Embedded 32 sample FIFO

### Typical Applications

- Smart Mobile Devices
- Digital Cameras
- PCs



### MMA8652FC

12-bit output, 160ug/rHz noise  
High Pass Filter w/ DSP functions  
Configurable Orientation detect  
FIFO

### MMA8653FC

10bit output  
Orientation detect

### Package

2x2x1mm DFN, 0.4mm pitch

### Availability

Samples: NOW  
Production: NOW

# Intrinsic Low-G Sensors (VeyronSPI)

## 3-axis High-Performance Digital Accelerometer

### Differentiating Points

- Output Noise (99ug/rHz)
- Offset and Sensitivity Accuracy
- Resolution of 0.25mg/count



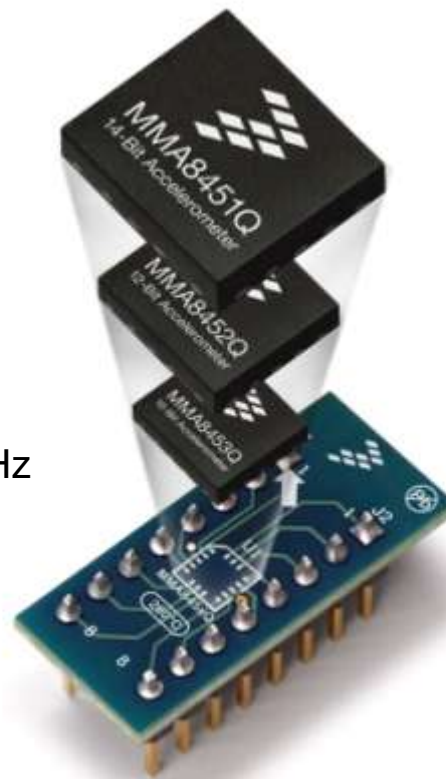
### Product Features

- 1.95V to 3.6V supply voltage
- $\pm 2g/\pm 4g/\pm 8g$  dynamically selectable
- Output data rate (ODR) from 800Hz to 1.563Hz
- SPI/I<sup>2</sup>C digital output interface w/interrupts
- Embedded orientation (Portrait/Landscape)
- Embedded High Pass Filter
- Embedded 32 sample FIFO



### Typical Applications

- Laptops: HDD drop protect
- Washing Machine: Out of Balance detect



**FXLS8471Q**  
 14-bit output, SPI  
 High Pass Filter w/ DSP  
 functions  
 Configurable Orientation detect  
 FIFO

### Package

3x3x1mm QFN, 0.5mm pitch

### Availability

Samples: NOW  
 Production: July '13

# Intrinsic Low-G Sensors (Pluto)

## 3-axis High-Performance Analog Accelerometers

### Differentiating Points

- Zero-g Level Offset Accuracy
- Board Mount Offset Shift
- Output Noise



### Product Features

- 1.71V to 3.6V supply voltage
- $\pm 2g/\pm 4g/\pm 8g/\pm 16g$  dynamically selectable
- $150\mu g/\sqrt{Hz}$  noise
- Non-ratiometric Analog Parallel Outputs
- High Bandwidth: Up to 4.9kHz Capable
- Visible Solder Inspection Leads
- QFN 3x3x1.05mm 0.65mm pitch package



### Typical Applications

- White Goods
- Factory Automation
- Gaming



### Industrial

#### FXLN8371Q

- 4.9kHz bandwidth
- $\pm 2g$ , 228mV/g sensitivity
- $\pm 8g$ , 57mV/g sensitivity

#### FXLN8372Q

- 4.9kHz bandwidth
- $\pm 4g$ , 115mV/g sensitivity
- $\pm 16g$ , 29mV/g sensitivity

#### FXLN8361Q

- $\pm 2g$ , 115mV/g sensitivity
- $\pm 8g$ , 29mV/g sensitivity

#### FXLN8362Q

- $\pm 4g$ , 115mV/g sensitivity
- $\pm 16g$ , 29mV/g sensitivity

### Consumer

#### FXLN8351Q

- 4.9kHz bandwidth
- $\pm 2g$ , 115mV/g sensitivity
- $\pm 8g$ , 29mV/g sensitivity

#### FXLN8352Q

- $\pm 4g$ , 115mV/g sensitivity
- $\pm 16g$ , 29mV/g sensitivity

### Package

3x3x1mm QFN, 0.65mm pitch

### Availability

Samples: April 2013

Production: November 2013

# Intrinsic MMA8491 (Plutino)

## 3-axis Extreme Low Power Digital Accelerometer

### Differentiating Points

- Power Consumption (<math><0.35\mu\text{A}/\text{Hz}</math>)
- Turn on time (<math><0.5\text{ms}</math>)
- Ease of use (XYZ 45° tilt detect outputs)



### Product Features

- 1.95V to 3.6V supply voltage
- $\pm 8g$  range, 1mg/count sensitivity
- Sample rate from <math><1\text{Hz}</math> to 800Hz+
- I<sup>2</sup>C digital output interface
- Enable pin for external power management
- 216 $\mu\text{g}/\sqrt{\text{Hz}}$  noise
- 3x3mm 0.65mm pitch w/ visual solder joint inspection



### Typical Applications

- Remote Controls
- Smart Grid: Tamper Detect
- White Goods Tilt



### Package

3x3x1mm QFN, 0.65mm pitch

### Availability

Samples: NOW

Production: NOW

# Xtrinsic MAG3110 (Maxwell) 3-Axis Magnetometer

## Differentiating Points

- High accuracy compass function
- Decimator allows for lowest noise implementation with oversampling to remove RF noise and Idd induced mag fields



## Product Features

- 1.95V to 3.6V supply voltage
- Maximum field of 10G (1000 uT)
- Output data rates (ODR) from 1.25Hz to 80Hz
- Magnetometer resolution of 0.1uT
- Current Consumption as low as 24uA at 1.25Hz
- I<sup>2</sup>C digital interface
- Extended temperature range of -40°C to +85°C.



## Typical Applications

- Electronic Compass
- Enhanced User Interface
- Location Based Services



## Package

2x2x0.85mm DFN, 0.5mm pitch

## Availability

Now

# Intrinsic FXOS8700CQ (Gauss)

## 6-Axis (3-axis Accelerometer, 3-axis Magnetometer)

### Differentiating Points

- Lowest noise gcell and mcell
- Embedded Functionality to allow system fast response and power savings
- 32 sample FIFO with burst read

### Product Features

- 1.95V to 3.6V supply voltage, I/O 1.6V – 3.6V
- $\pm 2g/\pm 4g/\pm 8g$  accelerometer,  $\pm 15$  Gauss Field range
- Output data rate (ODR) from 1.563Hz to 800Hz , 400Hz hybrid
- 14-bit gcell data, 800 counts per Gauss
- Low Offset Drift: 0.1mG per deg
- 4 channel motion detect ion- FF, Pulse, Transient, HPF, Tap
- Vector Magnitude for mcell, gcell

### Typical Applications

- Electronic Compass
- Enhanced User Interface
- Location Based Services

### Package

3x3x1.2mm QFN, 0.5mm pitch

### Availability

Samples: December 2012

Production: April 2013



# Intrinsic FXAS21000 (Leon) 3-Axis Digital Gyroscope

## Differentiating Points

- Angular acceleration resolution better than  $0.2^\circ/s$
- Programmable interrupts
- Power saving features



## Product Features

- 1.95-3.6V supply voltage
- Output data rates (ODR) from 1Hz to 200Hz
- Full scale range:  $\pm 1600^\circ/s$
- Bias stability over temperature:  $\pm 0.3^\circ/s$
- Random walk(over 1minute):  $\pm 0.007^\circ/s$



## Typical Applications

- Controllers: Remotes, Games
- Mobile: Phones, Tablets, eReaders
- Sports Monitoring

## Package

4x4x1mm QFN, 0.5mm pitch

## Availability

Samples: March 2013

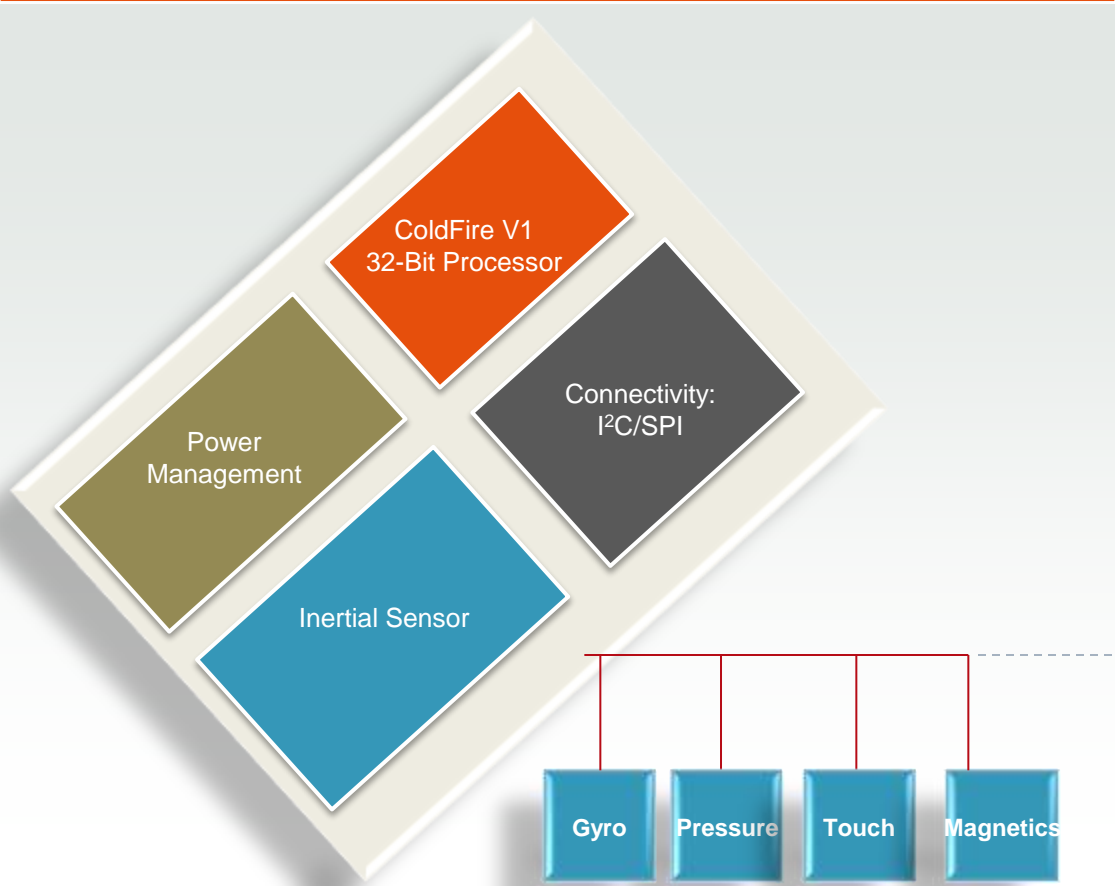
Production: July 2013



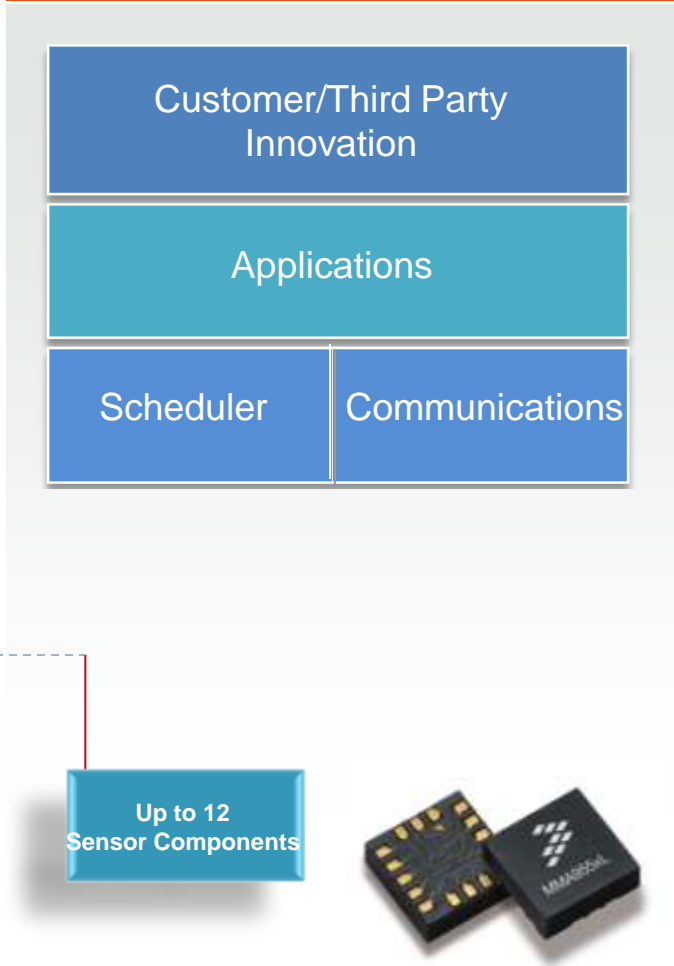
# MMA9550L At-a-Glance



## MMA9550L Sensor



## Sensing Software



# Intrinsic MMA955xL (Eve) 3-Axis Accelerometer plus 32-bit ColdFire MCU

## Differentiating Points

- Intelligent Motion Platform with embedded libraries
- Sensor hub capability
- Power management features and low power modes



## Product Features

- 1.71 to 1.89V supply voltage
- Output data rate (ODR) 488 Hz
- +/-2g, 4g, 8g configurable dynamic ranges available
- 14/12/10/8 bit resolution available
- 16K Flash, 2K RAM



## Typical Applications

- Mobile: Phones, Tablets, eReaders
- Controllers: Remotes, Games
- Sports Monitoring



## Variations

### MMA9550L

Infrastructure only functions  
User Flash: 6.5 Kbytes  
User RAM: 576 bytes

### MMA9551L

Infrastructure plus gestures  
User Flash: 4.5 Kbytes  
User RAM: 452 bytes

### MMA9553L

Infrastructure plus pedometer  
User Flash: 1.5 Kbytes  
User RAM: 200 bytes

### MMA9559L

Lightweight Infrastructure  
User Flash: 14 Kbytes  
User RAM: 1.5 bytes

## Package

3x3x1mm LGA, 0.5mm pitch

## Availability

Samples: NOW

Production: January 2013



# Xtrinsic FXLC95000L (Galla) 3-Axis Accelerometer plus 32-bit ColdFire MCU

## Differentiating Points

- Intelligent Motion Platform with embedded libraries
- Sensor hub capability
- Power management features and low power modes



## Product Features

- 1.72 to 3.6V I/O supply voltage
- Output data rate (ODR) 488 Hz
- +/-2g, 4g, 8g configurable dynamic ranges available
- 14/12/10/8 bit resolution available
- 128K Flash, 16K RAM



## Typical Applications

- Mobile: Phones, Tablets, eReaders
- Controllers: Remotes, Games
- Sports Monitoring
- Motion enabled accessories



## Package

3x5x1mm LGA, 0.5mm pitch

## Availability

Samples: NOW

Production: April 2013

# Intrinsic MPL3115A2

## Precision Digital Altimeter

### Differentiating Points

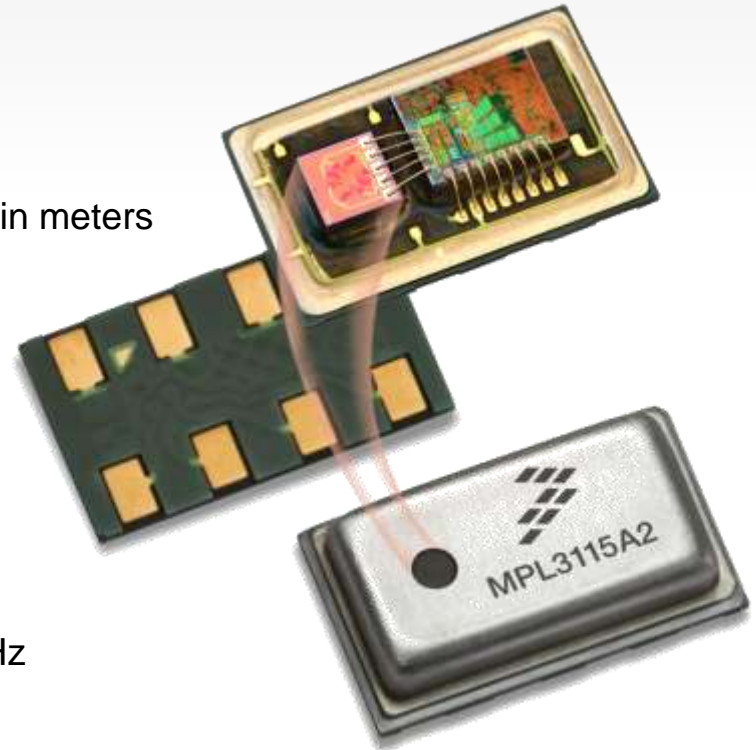
- Internally compensated, software is not needed
- Direct reading pressure in Pascals and altitude in meters
- On-board intelligence

### Product Features

- Altitude resolution : < 1 foot / 0.3 m
- Pressure resolution: 1.5 Pa
- Pressure range: 20 – 110 kPa
- Calibrated pressure range: 50 – 110 kPa
- 1.95V to 3.6V supply voltage
- Variable output sampling rate (OST) up to 140 Hz
- Current Consumption:
  - Standby mode: 2  $\mu$ A
  - Low-power mode: 8.5  $\mu$ A at 1 Hz
- I<sup>2</sup>C digital interface

### Typical Applications

- High Accuracy Altimeter
- Smartphones / Tablets
- GPS Enhancement for Location Based Services



### Package

3 x 5 x 1.1 mm LGA

In Production



# Windows 8 Freescale 12-Axis Xtrinsic Sensor Platform

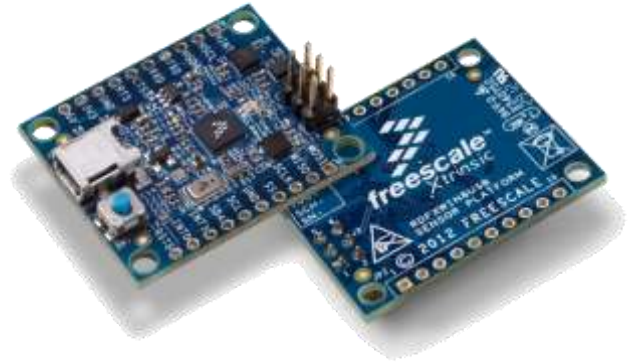
Xtrinsic sensor fusion in tablets, slates, convertible/non-convertible laptops and other portable devices



# Freescale 12-Axis Xtrinsic Sensor Platform

- **Freescale's parts:**

- Xtrinsic MMA8451Q 3-axis accelerometer
- Xtrinsic MAG3110 3-axis magnetometer
- Xtrinsic MPL3115A2 precision altimeter
- ColdFire+ MCF51JU128VHS MCU
- Xtrinsic FXAS21000 3 axis Gyroscope (Q2)



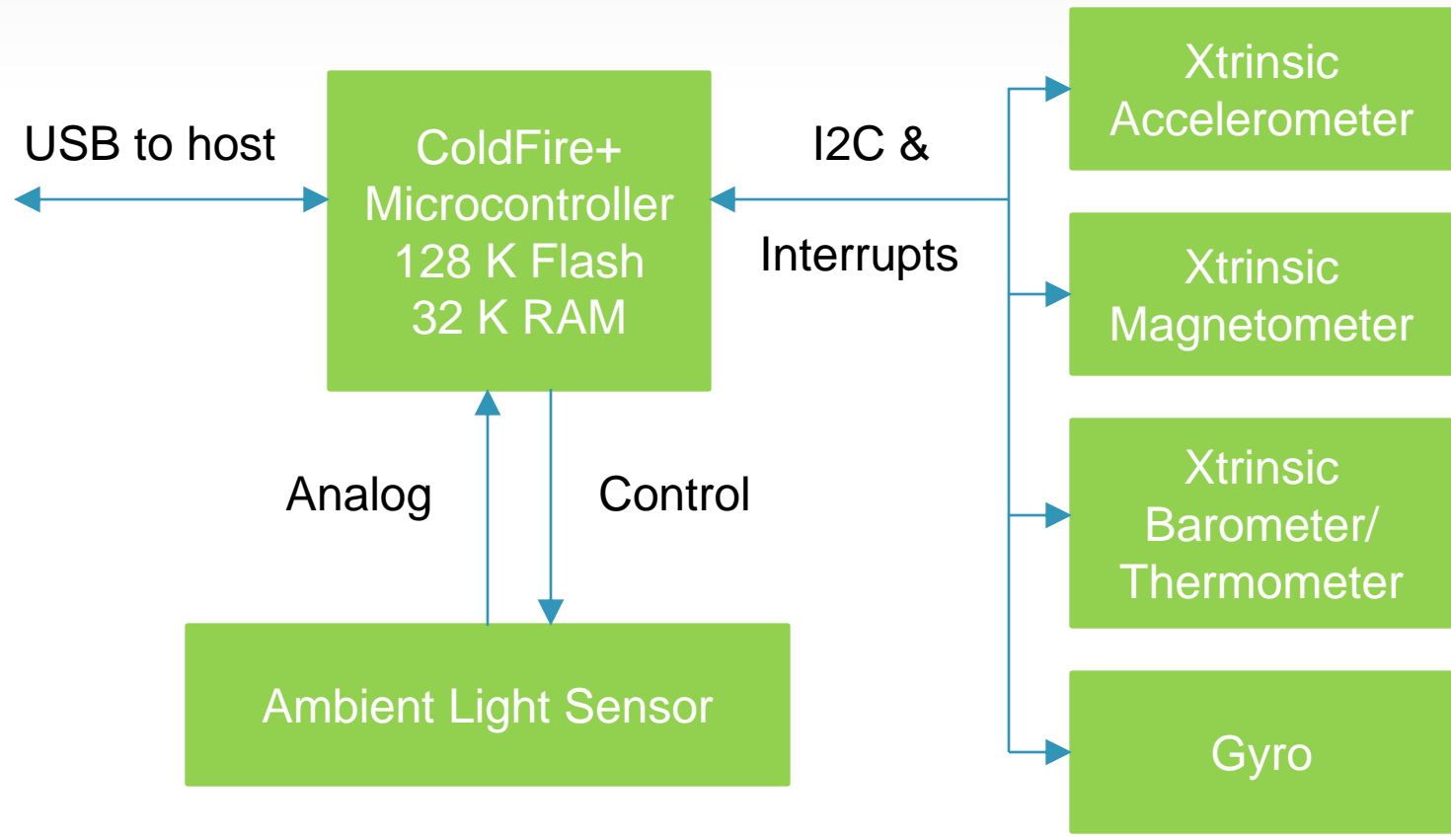
- **Other parts:**

- Ambient light sensor

- **12-axis solution** with IMU plus additional axes including ambient light sensor and temperature sensor

Learn more at [www.freescale.com/Windows8](http://www.freescale.com/Windows8)

# 12-Axis Xtrinsic Sensor Platform Block Diagram



# Android App: Xtrinsic Sensor Fusion Toolbox



- Educational variant of tool used internally for algorithm checkout.
- Experiment with various fusion techniques using the sensors already in your Android device
- Available today on Google Play. Search for “Sensor Fusion”.

## Intelligent Sensor Platform Framework

### Differentiating Points

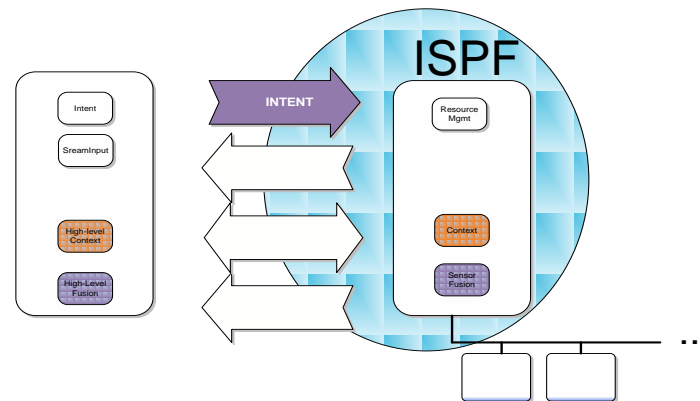
- Industry's First open Intelligent Motion Platform Framework
- Sensor hub capability
- Power management features enabling low power modes

### Product Features

- Provides a single unified interface for sensor data regardless of sensor types
- Enables developer to concentrate on using sensor data, not getting sensor data.
- Eliminates intensive sensor integration effort.
- Provides power management of the platform to achieve lowest power mode of operation

### Typical Applications

- Mobile: Phones, Tablets, eReaders
- Controllers: Remotes, Game
- Sports Monitoring Performance Monitoring
- Augmented Reality



### Availability

Download Available: April 2013

# Transition to ARM & Freescale Kinetis Family

- Leverage FSL infrastructure - Freedom Board Platform
- <http://www.freescale.com/freedom>
- Arduino-compatible form factor



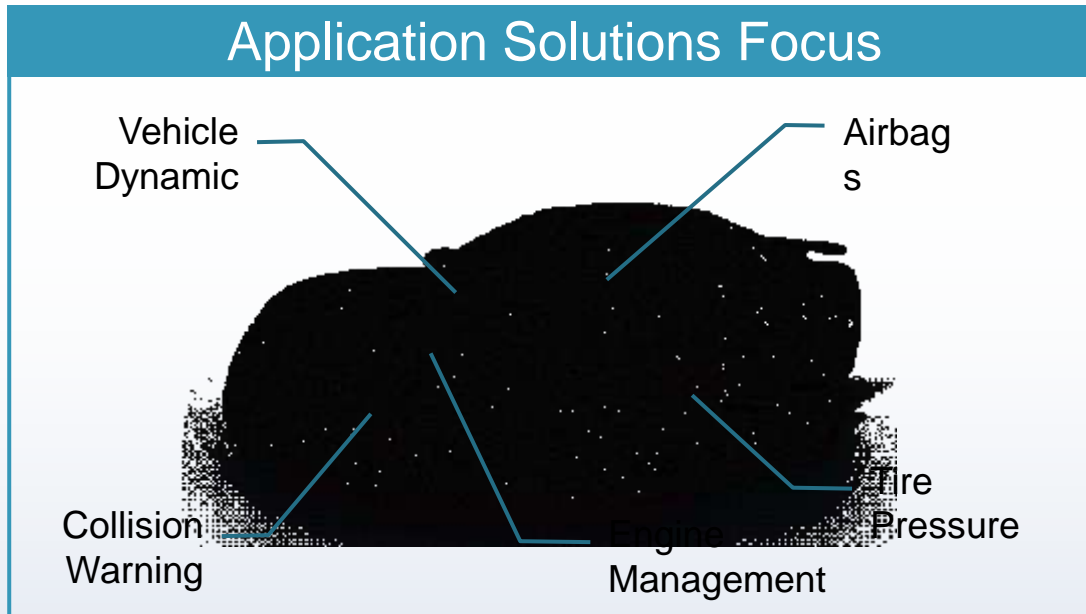
FRDM-KL25Z (available now for \$10)  
includes MMA8451Q on the board.

1<sup>st</sup> sensor “shield” available May 2013:

- FXAS2100 (Leon) Gyro
- Newton 3-axis accelerometer
- MAG3110 (Maxwell) 3-axis magnetometer
- FXOS8700CQ (Gauss) 6-axis mag + accel
- MMA9553LR1
- MPL3115A2 Pressure Sensor/Altimeter
- Optional Bluetooth Module

# Sensor Automotive Market Focus

## Automotive targeted Applications



- **Inertial Sensors: high g Accelerometers** for Airbag
- **Tire pressure: 9x9 mm system** in package
- **Engine management: Absolute Pressure sensor**

# Automotive Inertial Sensor Applications

## 1 to 20g - X, Z axis



**ABS - ESP:**  
1 to 2g



**Electrical Parking Brake:** 1 to 2 g



**Roll over:**  
1 to 5 g



**Navigation:**  
1 to 5 g



**Tilt monitoring:**  
1 to 5 g



**Suspension Control:**  
10 to 15 g

## 20 to 480g - X, Z, XY axis



**Crash detection:**  
20 - 100 g



**Side crash detection and motorcycle airbag:**  
100 - 480 g



# Airbag: You can find Freescale Sensors in ...

VW: Golf V, Passat  
 Opel: Corsa, Astra, Zafira, Insigna  
 Mercedes: Class A  
 PSA: C2, C3, C4 Picasso, 207cc  
 Renault: Logan, Mégane, Scénic  
 Volvo: C30, S40, S80  
 Fiat: Panda, Punto  
 Alfa Romeo: 147, 156  
 Ferrari: 612  
 Maserati: GT

And much more on:  
 Toyota, Honda, Nissan,  
 Chrysler, Ford, GM  
 BYD ...



# FSL Sensors in Vehicle Dynamic Control Applications



# MMA224xEG:

## Low g Sensors for Active Suspension

### Electronic Damper Control

- Resolving the conflict between high ride comfort and high driving safety and agility.
- Minimization of wheel load variation and chassis oscillation.

A low g sensor is mounted on each dampers and measures a displacement acceleration. Together with other information, it passes it along to the in-vehicle network. The vehicle's suspension and handling is then automatically adjusted based on this information.



**MMA2240/41KEG Features:**

- From 7g to 10g
- 2 pole filter
- Low voltage detect
- Clock monitor
- EPROM parity check status
- Calibrated Self-test
- SOIC16 package



# Vehicle Stability Control Sensors

- Dual XY axis Sensors with fully digital signal processing:
  - Overdamped Inertial sensing element
  - Digital output ( SPI 11-bits)
  - Low offset accuracy over temperature
  - 3.3V or 5V Power Supply
  - Bi-directional Self-test
  - Programmability (filters, ...)

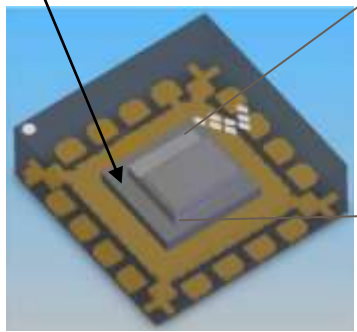


VSC Module

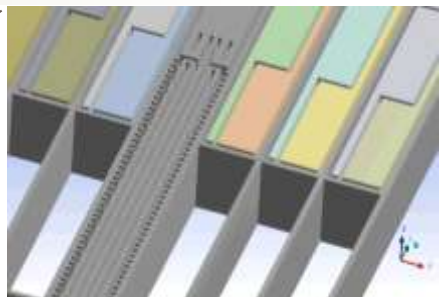


Car with and without VSC

Control ASIC



QFN Package



High Aspect Ratio MEMS Sensing Element

## Part Numbers:

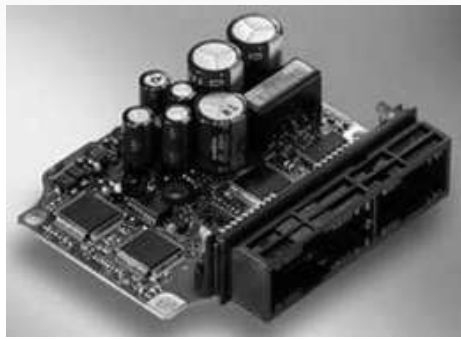
- MMA6900KQ ± 3.5g**
- MMA6910KQ ± 3.5g** (Higher Offset Accuracy)
- MMA6901KQ ± 5g**

SOP: Now



# Latest Generation Main ECU Airbag Sensors

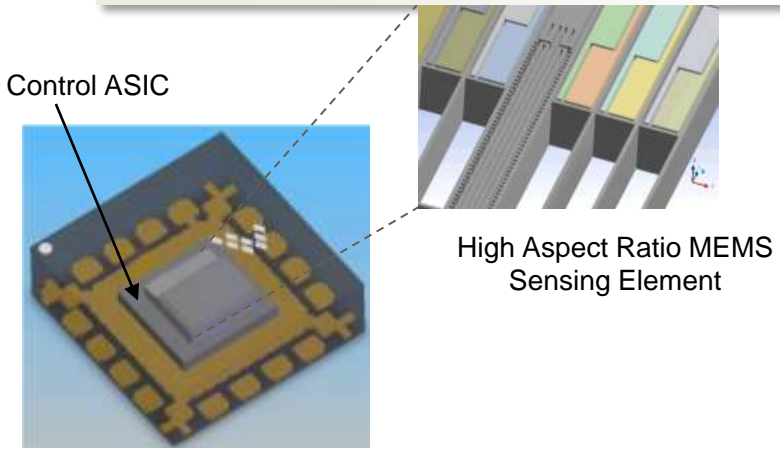
- **Dual XY-axis** Sensors with fully **digital** signal processing:
  - Overdamped inertial sensing element
  - Digital output (10-bits)
  - 3.3 V or 5 V power supply
  - Bi-directional self-test
  - Arming pins
  - Programmability



Airbag Central Module

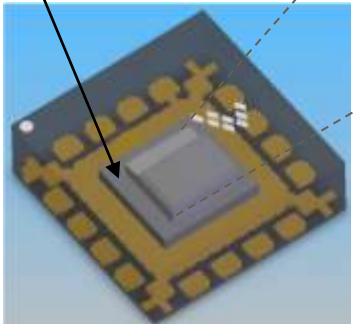


Front Airbags



Control ASIC

High Aspect Ratio MEMS Sensing Element



QFN Package

X Axis Range	X Axis Part Number
25g	MMA6851KWR2
35g	MMA6852KWR2
50g	MMA6853KWR2
75g	MMA6854KWR2
120g	MMA6855KWR2
60g	MMA6856KWR2

X Axis Range	Y Axis Range	XY Axis Part Number
60g	25g	MMA6811KWR2
50g	50g	MMA6813KWR2
120g	25g	MMA6821KWR2
120g	60g	MMA6823KWR2
60g	60g	MMA6826KWR2
120g	120g	MMA6827KWR2

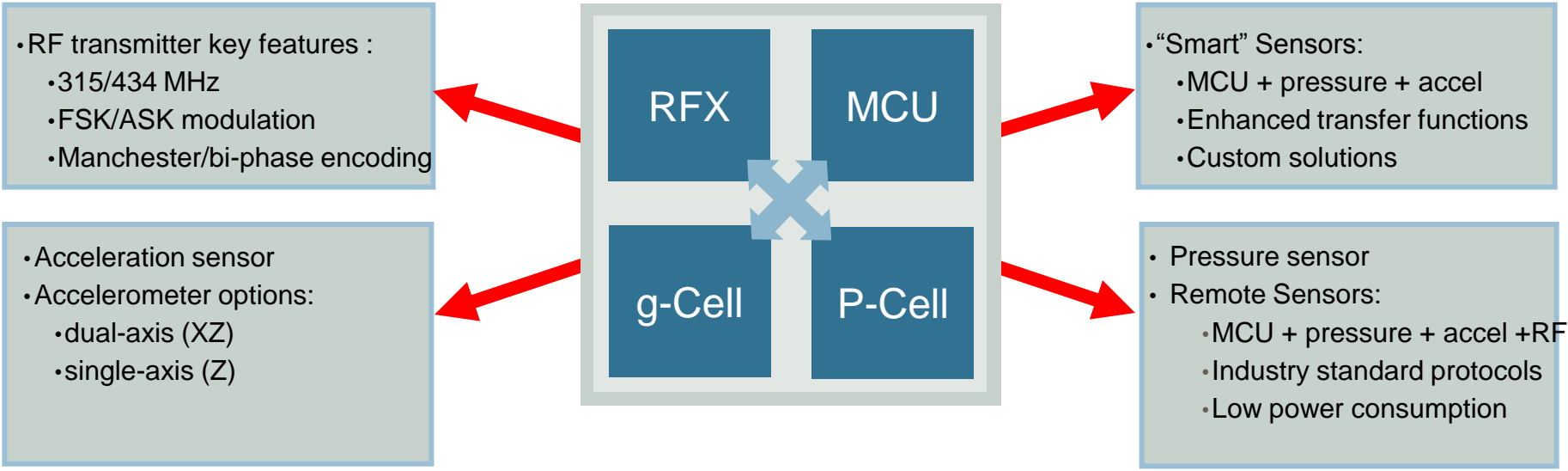
In production



# Remote Monitoring Systems

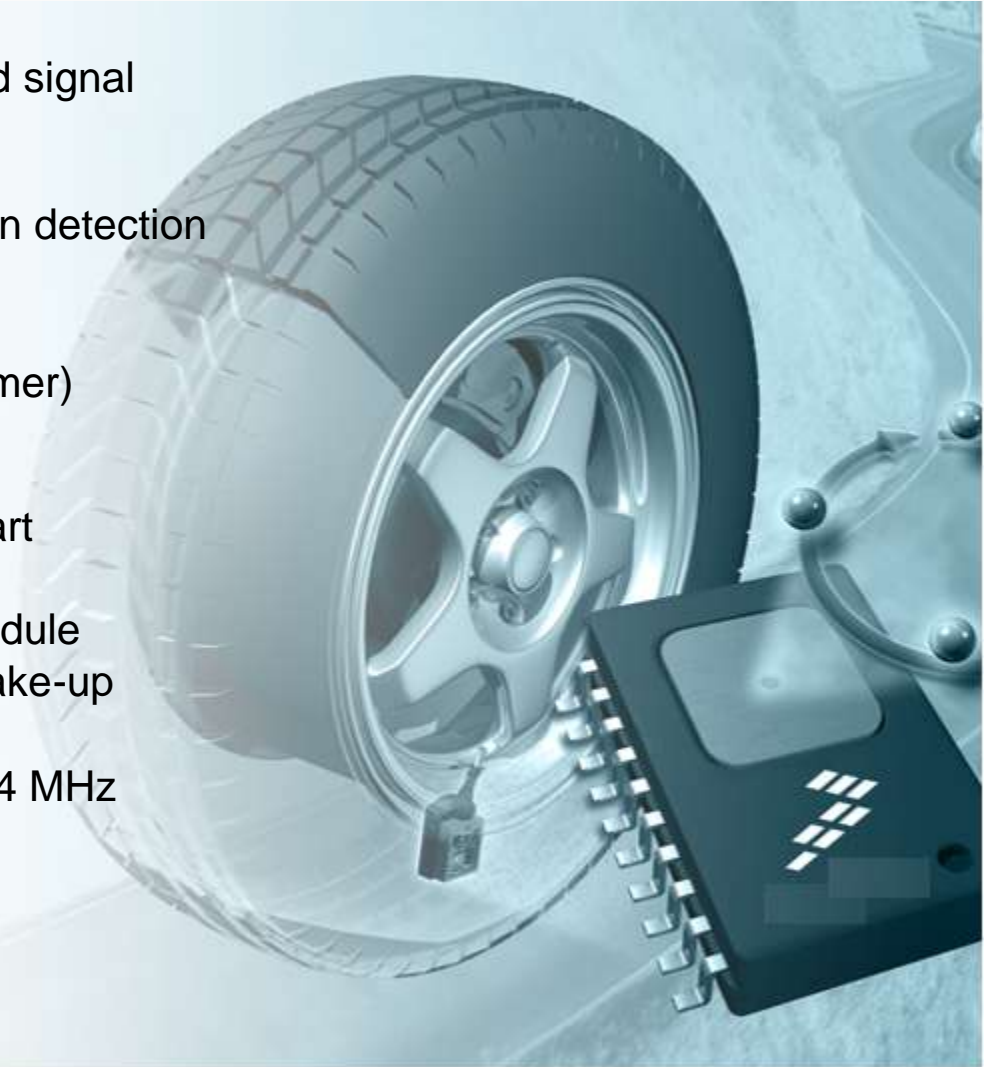
## MPXY8600 Series contains four devices:

- Pressure sensing device (P-Cell)
- Accelerometer device (g-Cell)
- 8-bit microcontroller (MCU)
- RF transmitter device (RFX)



# Freescale TPMS – MPXY8600 Series

- **Pressure sensor**
  - CMOS capacitive p-cell with integrated signal conditioning
- **Motion detection sensor**
  - Integrated XZ accelerometer for motion detection
- **Microcontroller**
  - 8-bit S08 core
  - 16KB flash (8KB firmware, 8KB customer) 512b RAM, 64 parameter registers
  - 10 bit ADC with 6 channels
  - Temperature sensor and thermal restart
  - LF detector and decoder
  - 2-channel 16-bit timer, pulse width module
  - Up to 8 MHz clock, 1 kHz LFO with wake-up
- **RF transmitter**
  - Frac-N PLL based transmitter, 315/434 MHz
  - FSK/ASK modulation
  - Manchester or bi-phase encoding
  - -10 dBm to +8 dBm output power
- **Package**
  - 9x9mm QFN with media protection



# NXP Patient Monitor

## 病人监护仪



**Blood Pressure Monitor Module**  
**MPXM2051 (Measurement)+MPXM2053(Protection)**  
**MPXV5050**  
**CO2 Module**  
**MPXV2010 (Flow measurement)**  
**MPL115A1 (Digital Barometer)**

### MPXM2051 key Features:

- Pressure range 0~50kPa Gauge
- Temperature Compensated Over 0°C to +85°C
- Linearity: +/- 0.3%
- Full Scale Span: 40 +/- 1.5mV
- Offset: 0+/- 1.0mV
- Available in Easy-to-Use Tape & Reel
- Ratiometric to Supply Voltage
- Gauge Ported

# NXP Respirator Machine 呼吸机



## IPS for Respiratory Device:

- Wide product portfolio for different pressure range requirement to cover from negative to positive pressure.
- Low pressure range family (+/- 2kPa, 4kPa, 6kPa, 10kPa) offer design flexibility.
- Easy to implement (no amplifier needed), ideally suited for Microprocessor or Microcontroller-Based Systems
- Barometer to offset altitude influence.



### *Air Flow Measurement*

**MPX2010**  
**MPXV7002DP**  
**MPXV5004DP**

### *Barometric Measurement*

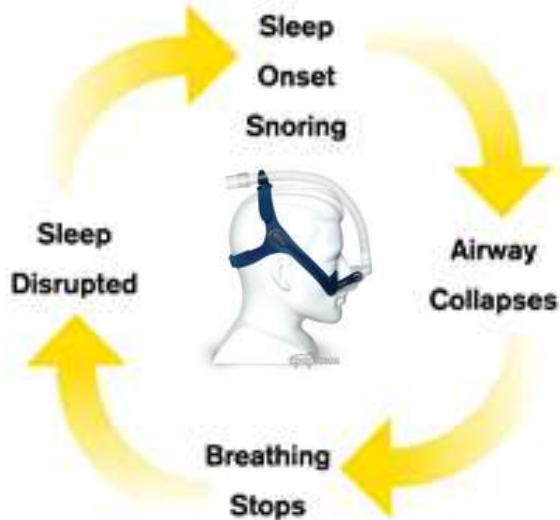
**MPXH6115A**  
**MPL115A**  
**MPL3115A**

System to support patient breathing during times of diminished lung capacity.

# Sleep Apnea Therapy

## 睡眠呼吸暂停治疗

### Cycle of Obstructive Sleep Apnea



- Positive Airway Pressure (PAP) is a method of respiratory ventilation used primarily in the treatment of sleep apnea.
- Barometric measurement is also critical in some application to avoid altitude deviation.

Continuous  
Positive  
Airway  
Pressure  
(C.P.A.P.)



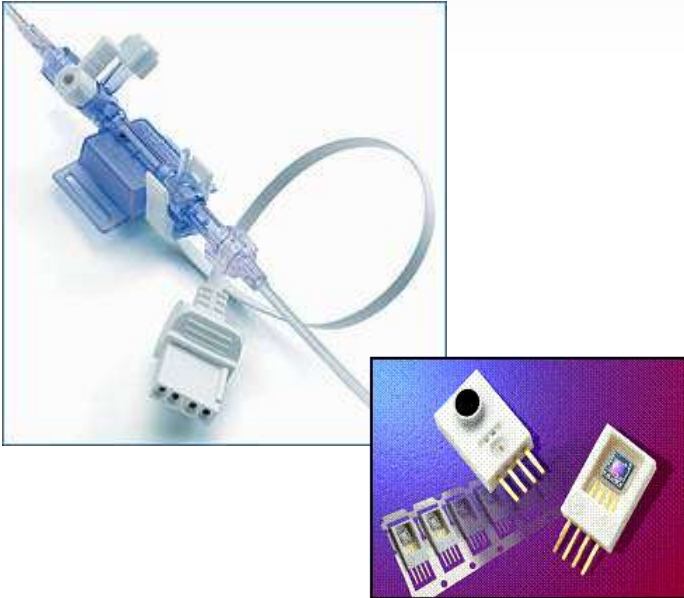
**Air Pressure Management System**

**MPXV5004GC6T1**  
**MPXV7002DP**

**Barometric Measurement**

**MPL115A**  
**MPL3115A**

# Invasive Blood Pressure 有创血压



In-line measurement Application:

- Pulse / Pressure measurement.
- IV Drip counting

## *Disposable Pressure Sensors MPX2300DT*

- **Key features:**

- Pressure range is from 0 to 300mmHg
- Low cost
- High volume
- Miniature package
- Integrated temperature compensation and calibration
- Ratiometric to Supply Voltage
- Polysulfone case material (Medical, Class V Approved)

A standard invasive blood pressure monitoring kits is sterile, single-use kits that relay blood pressure information from a pressure monitoring catheter to a patient monitoring system.

# Medical Bed / Air Mattress

## 病床 / 气垫

To avoid necrosis of the muscle and pressure sores ulceration.



### Application Needs:

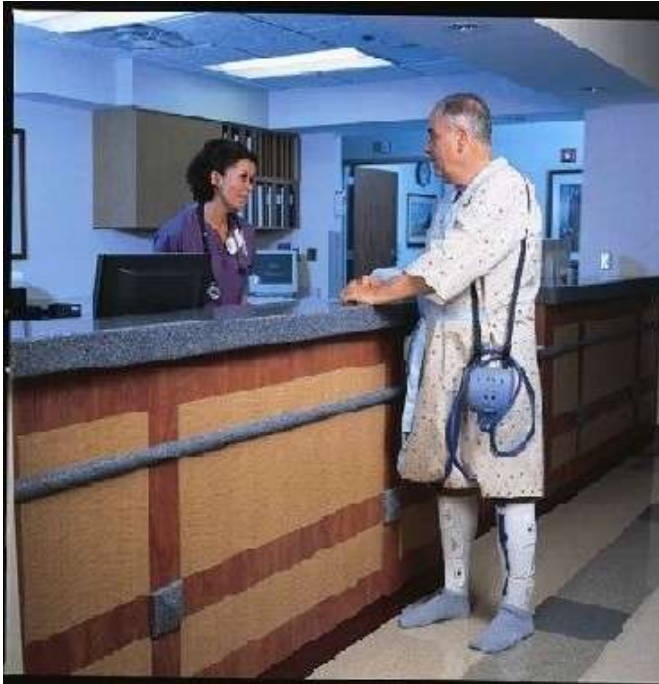
- Gage pressure measurement
- Pressure range <10kpa
- Potential for multiple sensors
- Calibrated / Compensated.
- MCU interface capability.



**Pressure Control**  
**MPX5010DP**  
**MPXM2010GS**

# Good Circulation Therapy

## 血液循环治疗



Continuous  
Enhanced  
Circulation  
Therapy  
(C.E.C.T.)



**Air Pressure Management System**

**MPX2010**  
**MP3V5010G**  
**MP3V5050G**

- The system provides the optimal hemodynamic profile by applying intermittent, sequential **pressure** to the patient's leg in a systematic pattern, increasing the peak venous velocity (PVV) of venous blood flow and reducing the risk of clot formation.

# Negative Pressure Wound Therapy

## 负压创口护理



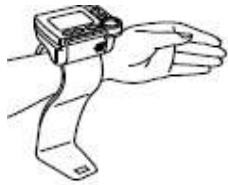
Negative  
Pressure  
Wound  
Therapy  
(N.P.W.T.)



**Air Pressure Management System**  
**MPL115A**  
**MPL3115A**  
**MPXM2053GS**  
**MPXV5100GC6U**

- Negative Pressure Wound Management, or Closed Wound Suction (CWS) is a noninvasive treatment by which controlled localized **negative pressure** (suction) is delivered to a wide variety of acute, subacute, and chronic wounds.

# Wrist Pressure Monitors 血压监测仪

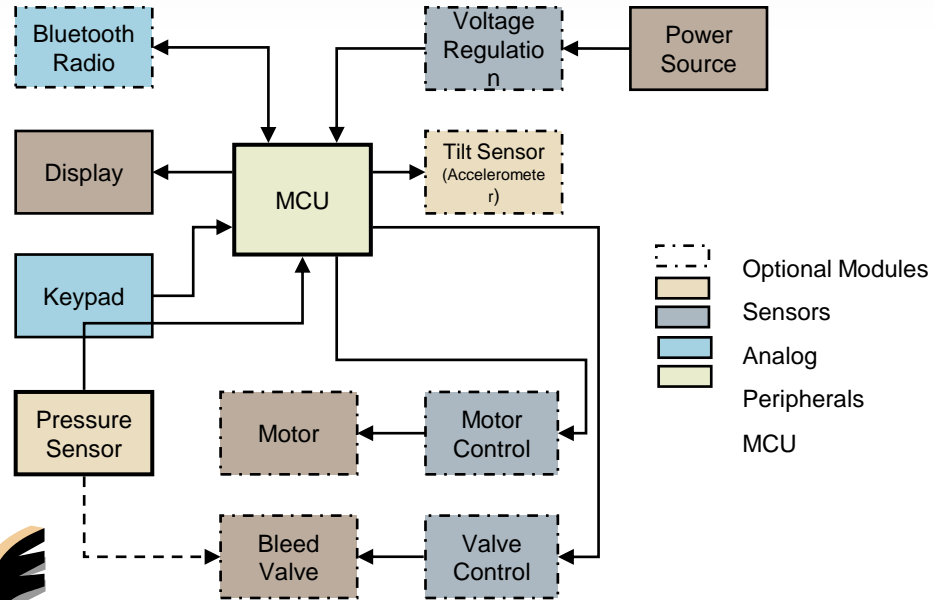


**Position** cuff on left wrist with left thumb facing upward

**Press start button.** Position sensor detects correct placement of arm in relation to the heart.

**Once wrist is in the correct position** the cuff will inflate and take the measurements.

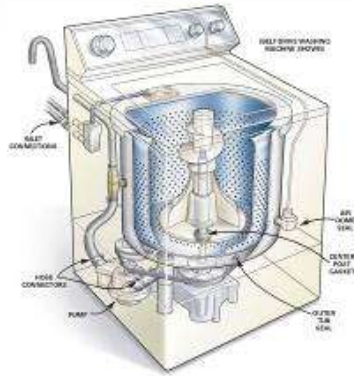
**Reading is displayed** on the LCD screen



**Pressure Monitoring**  
**MPXV5050GP**  
**MPXM2053GS**

# Water Level Monitor

## 水位监测



### Washing Machine:

- Tub Water Level Monitoring (up to ~100cm)
- Smart Washer Functions
- Blend Sensing
- Water Conservation

### Dishwasher:

- Basin water level monitoring
- Water Filter monitoring
- Countdown to Cycle completion
- Water Conservation



**Gauge Pressure Sensor: MPX10/12, MPX2010, MPXV4006G, MPXV5004G, MPXV5010G**

# Water Level Monitor

## 水位监测

### Calculation:

$$P_{out} = P_1 - P_{atm}$$

Where:

$$P_1 = P_{level} + P_{atm}$$

Result:

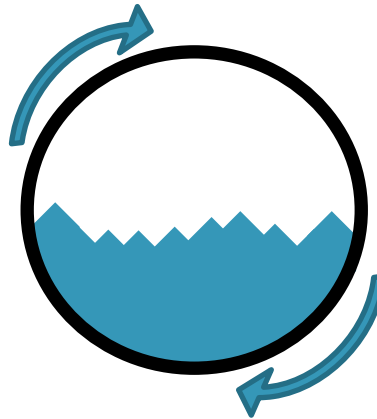
$$P_{out} = P_{level}$$

$$h = P_{out} / (r * g)$$

$r$  = density

$g$  = gravity constant

$h$  = liquid height



40cmH<sub>2</sub>O ~ 4kPa

Atmospheric pressure (Atm)

Pressure Sensor

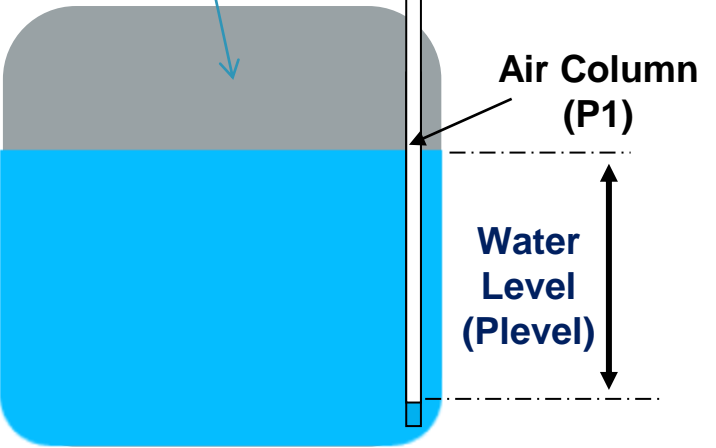
MPVZ4006G

Tubing

Tank

Air Column (P<sub>1</sub>)

Water Level (P<sub>level</sub>)

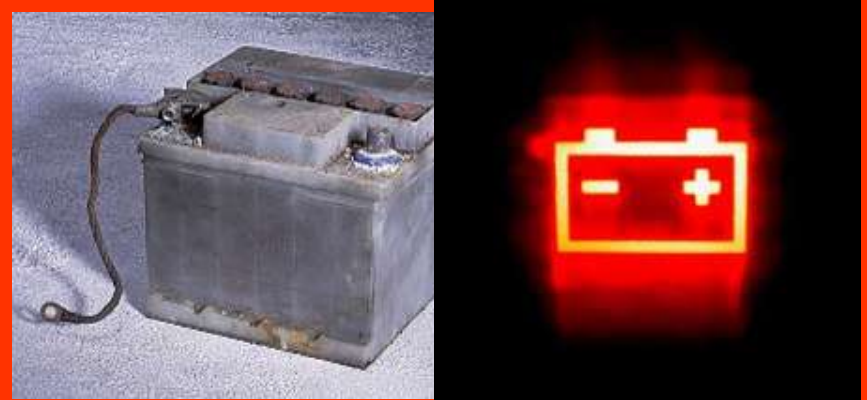


# ... what is the most probable reason for this stop in the middle of the desert?

- **Most probably a battery failure !!**



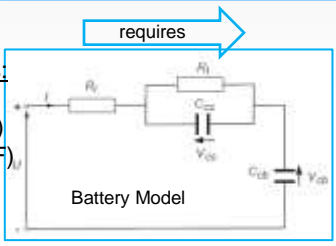
- **Battery field failure rates are ranging from 1000 to >10000 ppm for Batteries older 3+ years !**



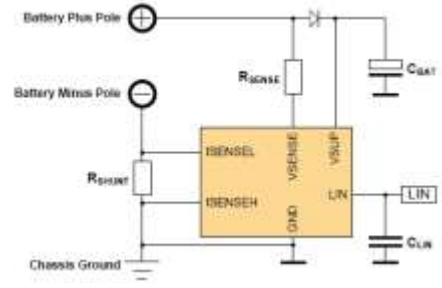
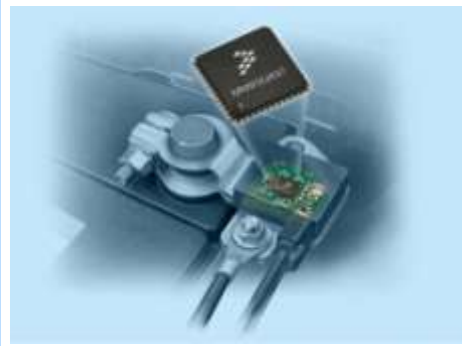
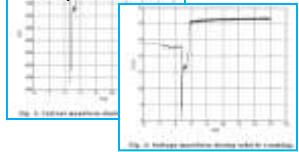
# Summary MM912J637 - Intelligent 12V Car Battery

## Primary Application: 12V Car Battery Monitoring

Determination of key battery characteristics:  
 State of Health (SoH)  
 State of Charge (SoC)  
 State of Function (SoF)



Precision Measurement of Battery Current, Voltage & Temperature



## MM912J637 – Key Characteristics

### MCU S12 (16-bit)

- Flash 128k
- Data Flash 4k
- RAM 6k

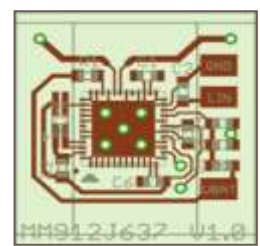
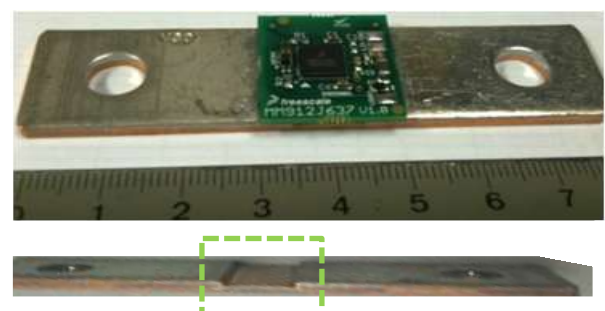
### Mixed-Signal Chip

- LIN Physical Layer (ESD 15kV w/o cap- 25kV w/ cap)
- Watchdog
- Standby Current <100µA (1sec Isense)
- Operating Voltage 3.5..28V
- RAM Contents Guaranteed :2.5...3.5V
- 3x ADC (2nd Order Sigma Delta) 16bit
- Current Measurement
  - Relative Accuracy <0.5%
  - Absolute Accuracy <500nV
- Voltage Measurement
  - Relative Accuracy <1%
  - Absolute Accuracy <5mV
- Temperature Measurement
  - Relative Accuracy <2K
  - Absolute Accuracy <0.5K



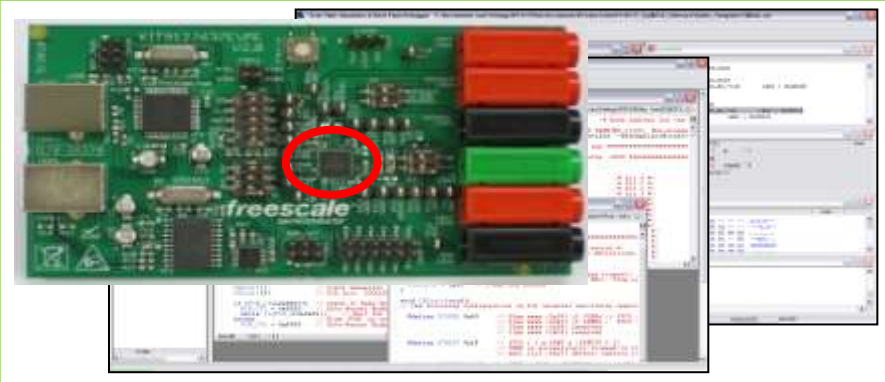
Operating Temperature -40°C<Ta<125°C

## Product Demonstrator Available



Shunt Resistor

## EVB Available



## Key Characteristics

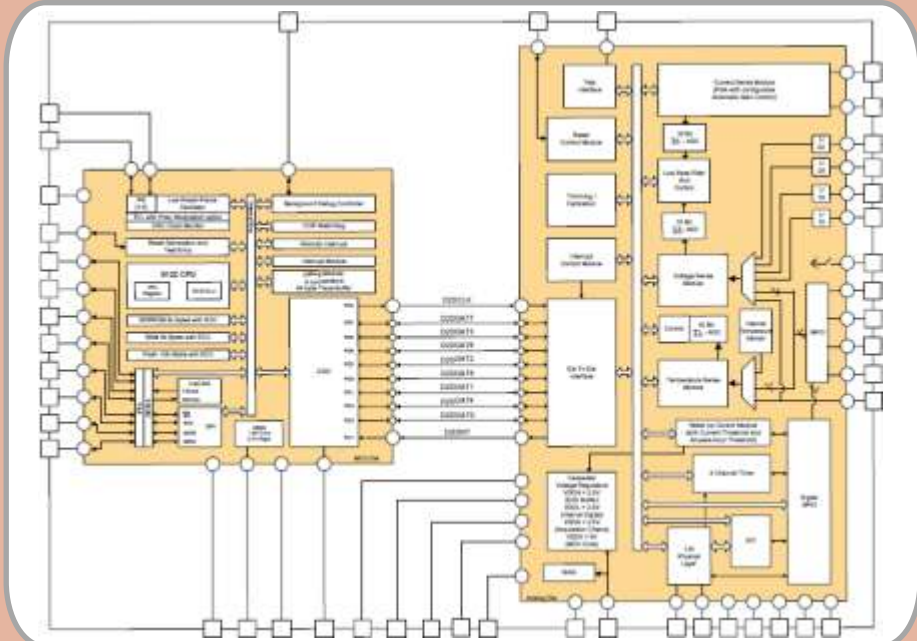
### MCU S12Z Core (32-bit ALU, 50MHz)

Flash 96k/128k  
 EEPROM 4k  
 RAM 8k  
 CAN controller

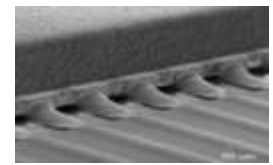
### Analog Mixed-Signal Chip

LIN Physical Layer  
 Watchdog  
 Standby Current <100µA (1sec Isense)  
 Vreg capability of 150mA  
 Operating Voltage 3.5..28V  
 RAM Contents Guaranteed :2.5...3.5V  
 3x ADC (2nd Order Sigma Delta) 16bit  
 Current Measurement  
     Relative Accuracy <0.5%  
 Voltage Measurement  
     Four attenuated Voltage inputs (10V, 16V, 28V, 52V ranges)  
     Up to five non-attenuated Voltage inputs  
     Relative Accuracy <0.15%  
 Temperature Measurement  
     One internal and up to five external Temp inputs  
     Relative Accuracy <2K  
 Operating Temperature -40°C<Ta<125°C

## System-In-Package Wiring Diagram



## Package: QFN with wet-able flanks

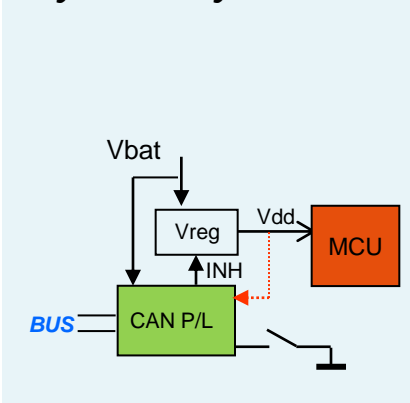


Enables more cost effective (optical) inspection of QFN package soldering at customer assembly, avoiding expensive X-ray inspection.

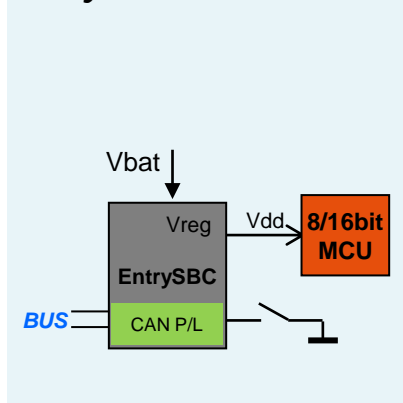
# Freescale SBC segmentation

Different standard Solutions for different system needs

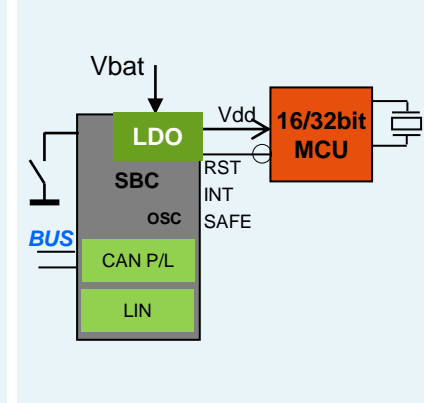
**Physical Layer**



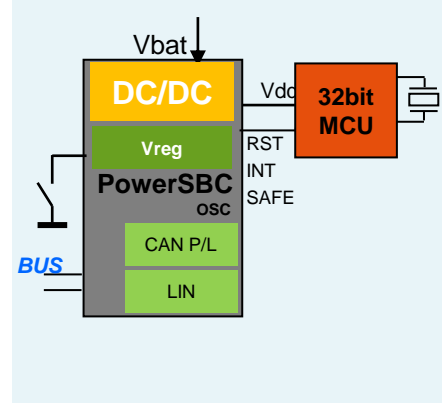
**entrySBCs**



**SBCs**



**PowerSBCs**



**Values**

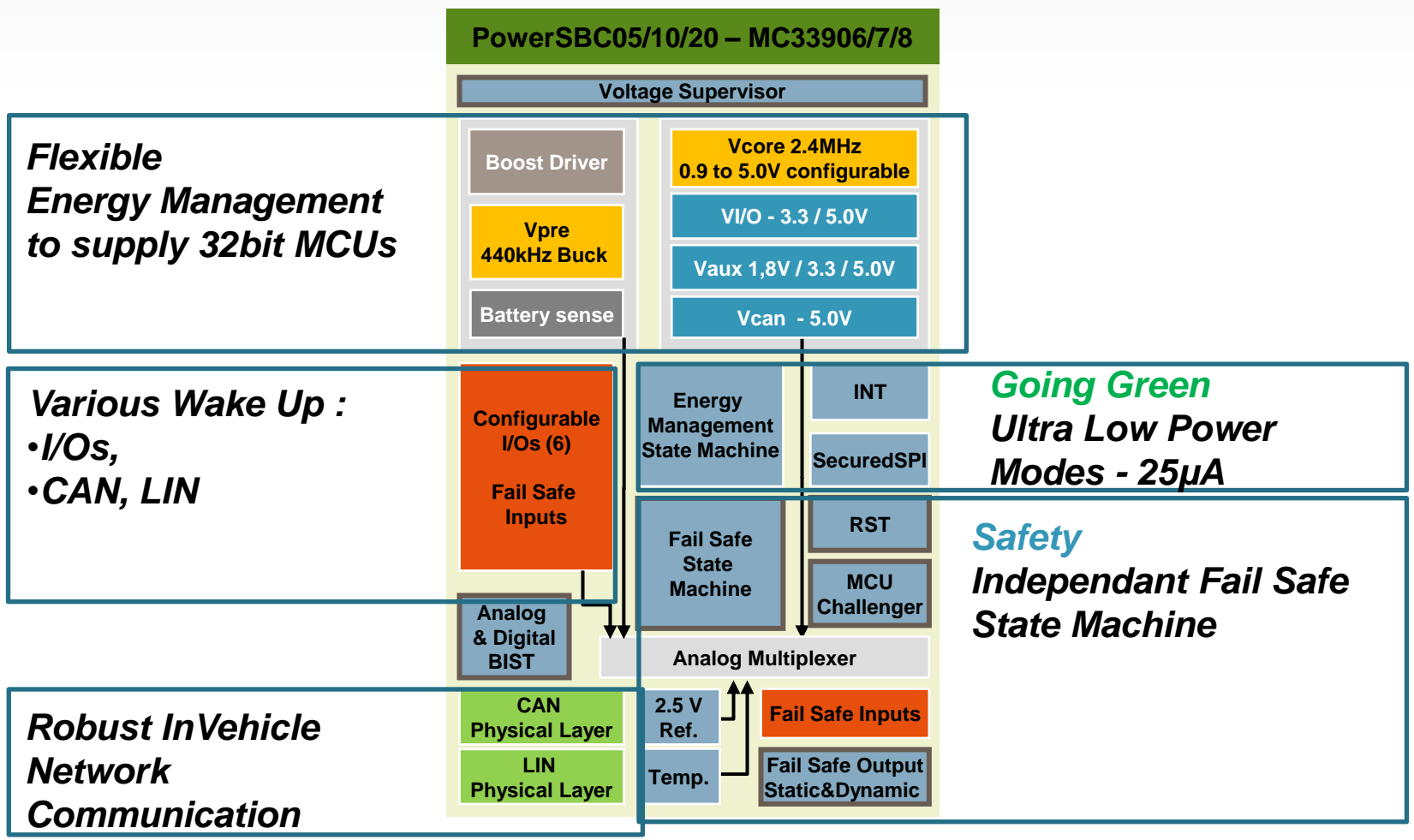
- High Robustness**  
EMC/ESD
- Design for Cost**
- CAN Partial Networking**  
Selective Wake up

- Simple Low Power Modes**
- Robustness**
- Design for Cost**

- Ultra Low Power Modes**
- Flexible Power Management**
- Medium Functional Safety**

- Energy efficient (>85%)**
- High Current (up to 2.0A)**
- High Functional Safety**  
(fit for ASILD applications)

# PowerSBC : Architecture overview





# System Basis Chip & Physical Layers Roadmap

## Features

### PowerSBCs

DC/DC architecture  
Low Power Modes  
Advanced Functional Safety (ISO26262)  
CAN HS & LIN P/Ls  
Target 32bit MCUs

Pin Compatible Families



MC33908 – PowerSBC20

MC33907 – PowerSBC10

MC33906 – PowerSBC05

MC33909 – CANopy LV

### SBCs

LDO architecture  
Ultra Low Power Modes  
Fail Safe features  
CAN & LIN P/Ls  
Target 16/32bits MCUs

MC33905

MC33904

MC33903

### entrySBCs

LDO architecture  
Low Power Modes  
Simple Safe modes  
CAN OR LIN P/Ls  
Target 8/16bits MCUs

MC33912

MC33911

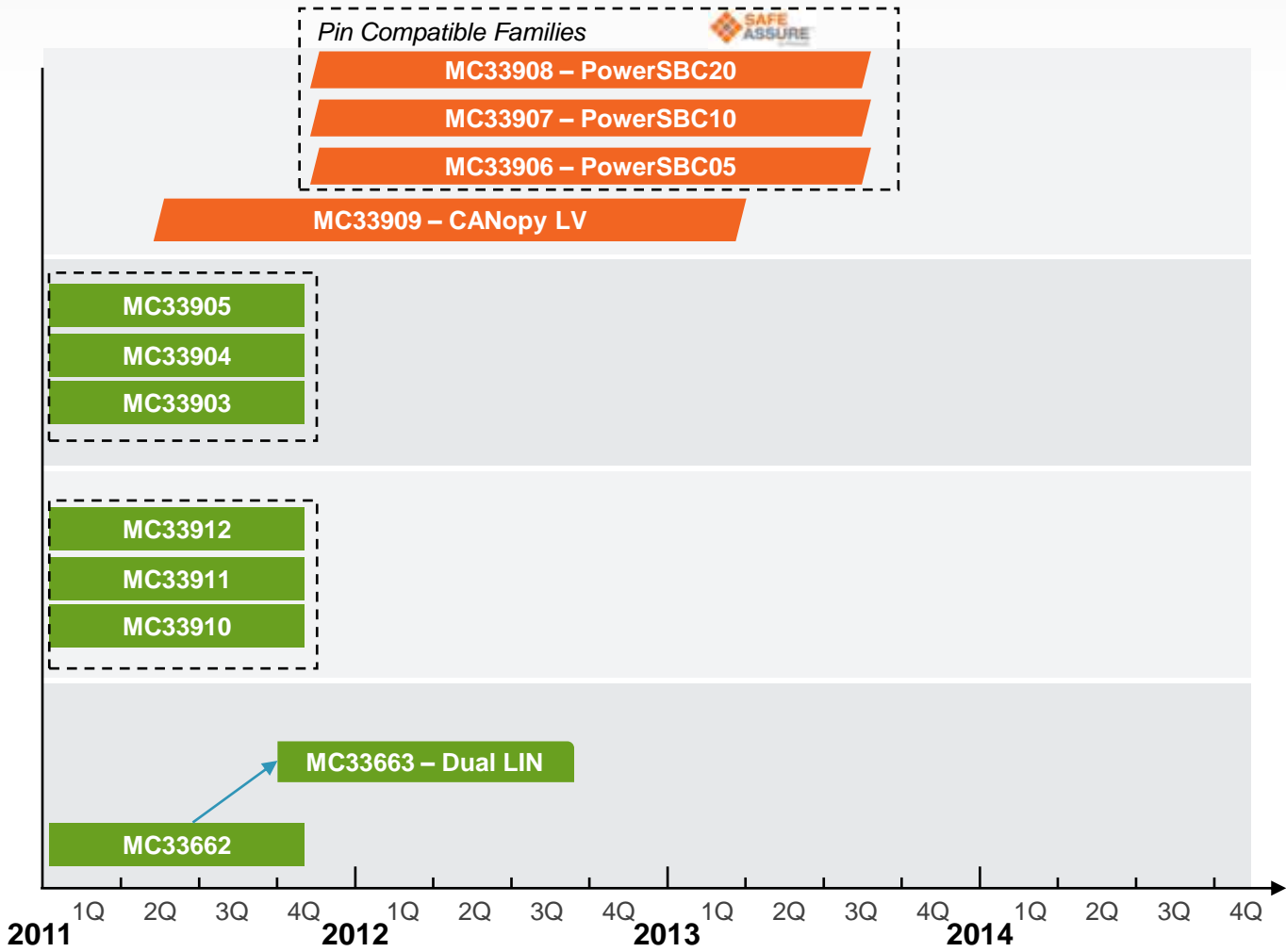
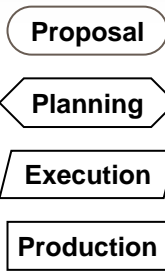
MC33910

### Physical Layers

Stand alone P/Ls  
High performance  
EMC/ESD

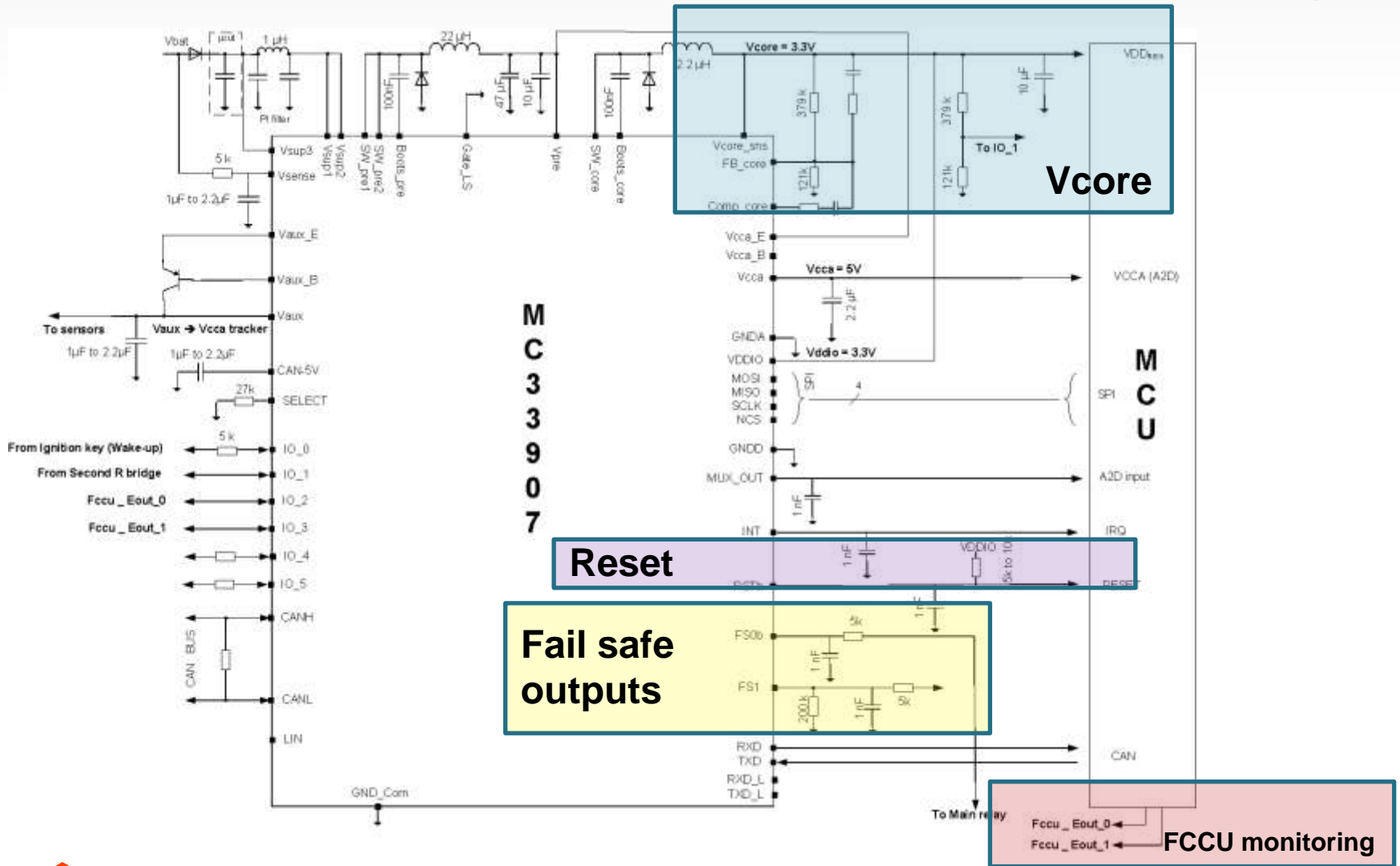
MC33663 – Dual LIN

MC33662





# ECU and PowerSBC connection



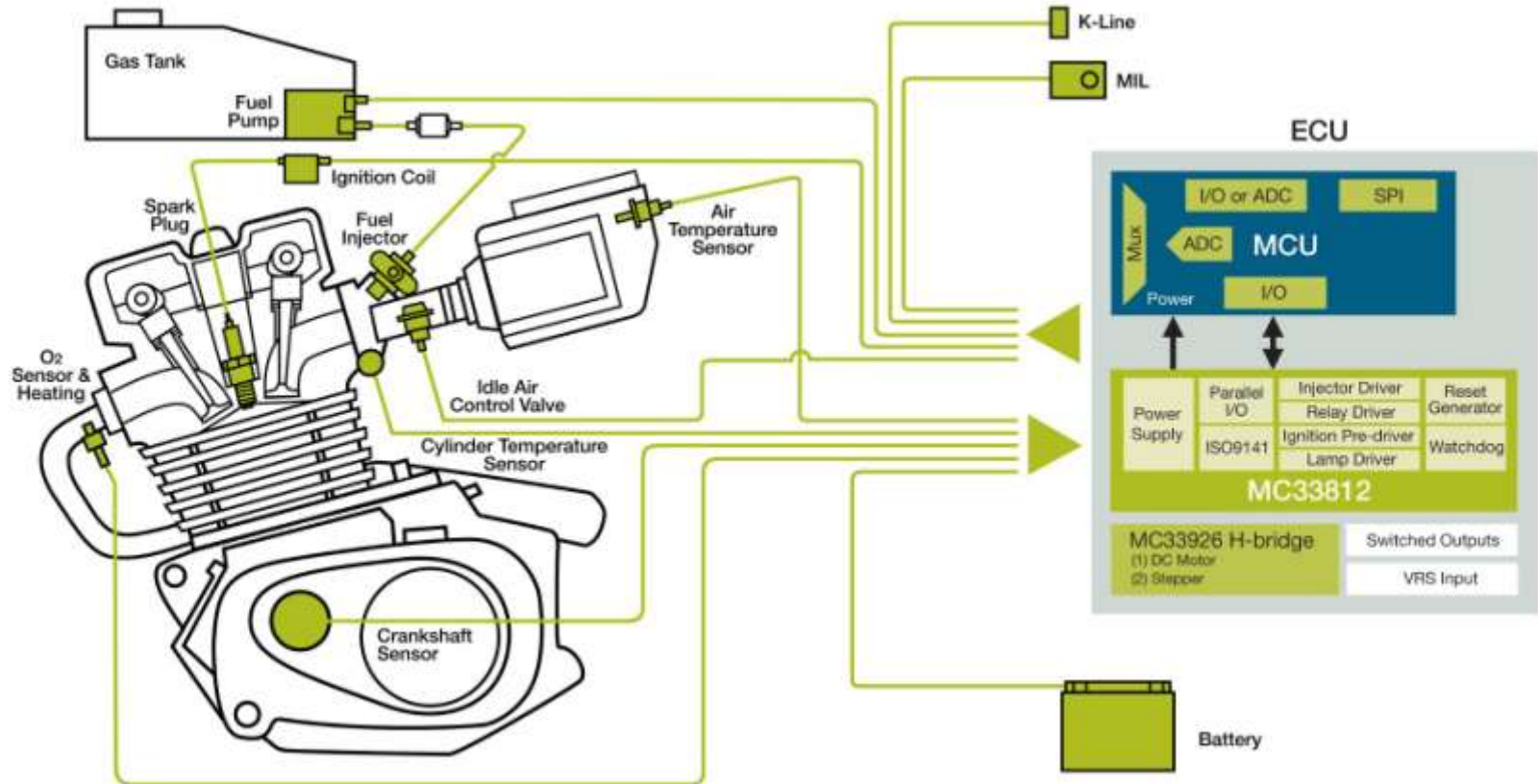


# reescale PowerSBC solutions – Features

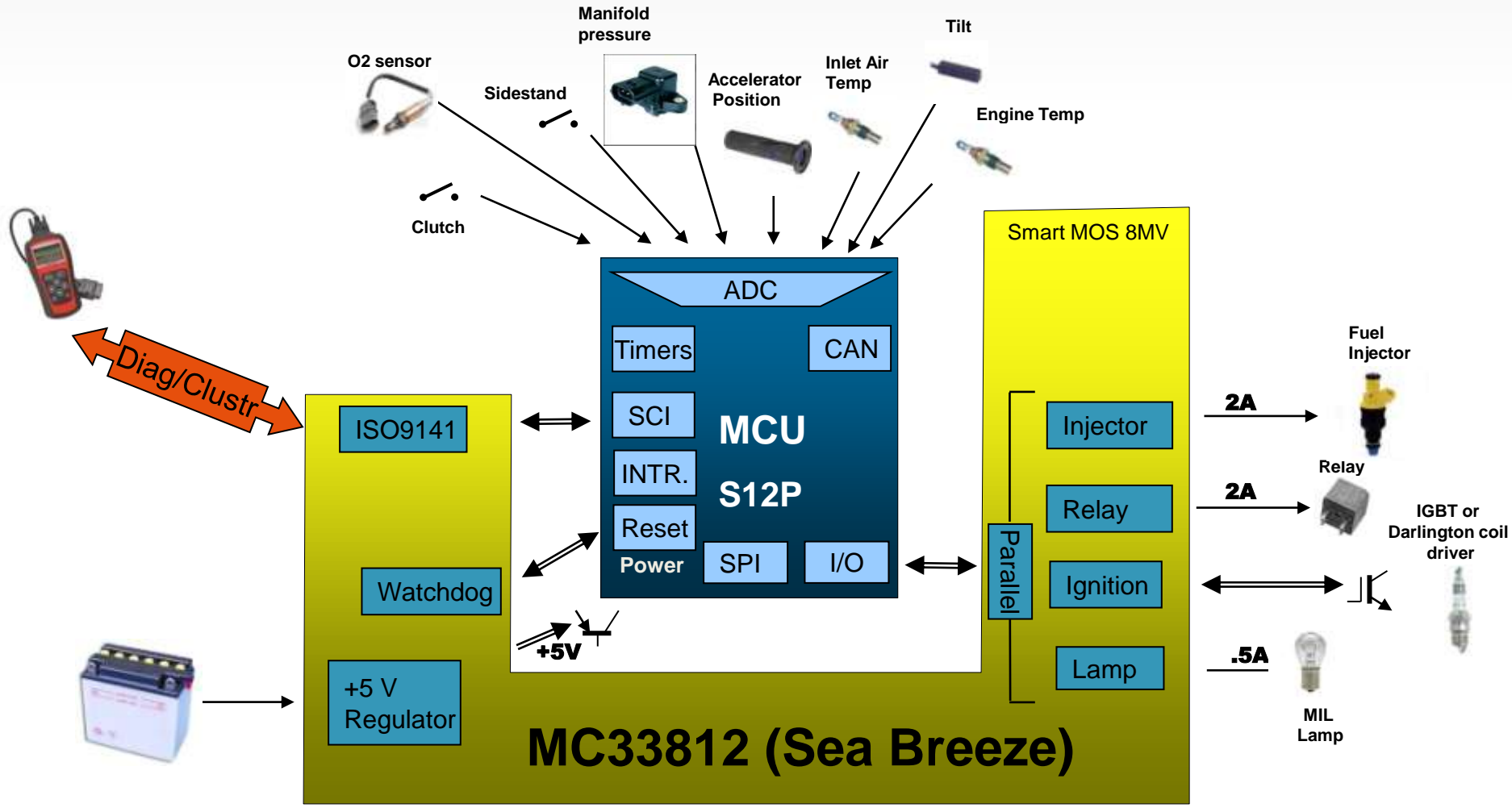
## Table Overview

Part Number	MC33909 CANopy	MC33906 PowerSBC05	MC33907 PowerSBC10	MC33908 PowerSBC20
Product Status	1st Silicon available	1st Silicon Dec 11	1st Silicon Dec 11	1st Silicon Dec 11
Pre-regulator 5%	1.0A (B-B_440kHz)	1.0A (B-B_440kHz)	1.5A (B-B_440kHz)	2A (B-B_440kHz)
MCU core supply VCore / 2%	0.5A (Linear)	0.5A (Linear)	0.8A (B_2.4MHz)	1.5A (B_2.4MHz)
MCU I/O / ATD supply VCCA /1%	No	No	100 mA (int) +/-1% Or 300mA (ext.) +/-3%	100 mA (int) +/-1% Or 300mA (ext.) +/-3%
Auxiliary ECU supply Vaux / 3%	200mA (Tracker)	Up to 300 mA Tracker / Auxiliary	Up to 300 mA Tracker / Auxiliary	Up to 300 mA Tracker / Auxiliary
Can_5V Supply -- VCAN	200mA	100mA	100mA	100mA
CAN Interfaces	2	1	1	1
LIN Interfaces	4	1	1	1
IOs	16	6 (incl. F/S inputs)	6 (incl. F/S inputs)	6 (incl. F/S inputs)
Watchdog	Timeout, window, random configurable	Challenger	Challenger	Challenger
LowQ Voff/Von	50µA	25µA	25µA	25µA
AMUX & Battery Sense	Yes	Yes	Yes	Yes
Fail Safe	Output (Static/Dynamic)	Independant I&O	Independant I&O	Independant I&O
Package	LQFP64eP	LQFP48eP	LQFP48eP	LQFP48eP
Target Market	BCM, HVAC	BCM HE, Transmission, HVAC, Dashboards	EPS, Radar, Battery Mgt, Gateway	Radar, Vision/ADAS, Engine Management,
FSL MCU Companion (90nm)	MPC560xB	MPC560xB, MPC563xM MPC560xP, MPC560xS	MPC564xL, MPC564xA, MPC5668G, MPC564xS	MPC567xK, MPC567xF, MPC577xR
Target MCU companion (55nm) precise assessment following Silicon availability	Calypso, Bolero	K2, Calypso	Mc Kinley, Panther	MatterHorn, Racerunner

# Small Engine Control Integration

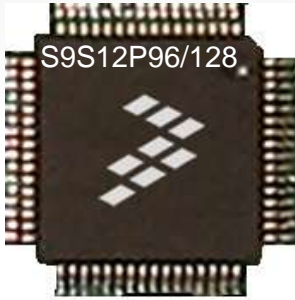


# MC33812 (Sea Breeze) One Cylinder



**Available today !**

# S12P96/128 S12XS128 & MC33812 SiP Packaging

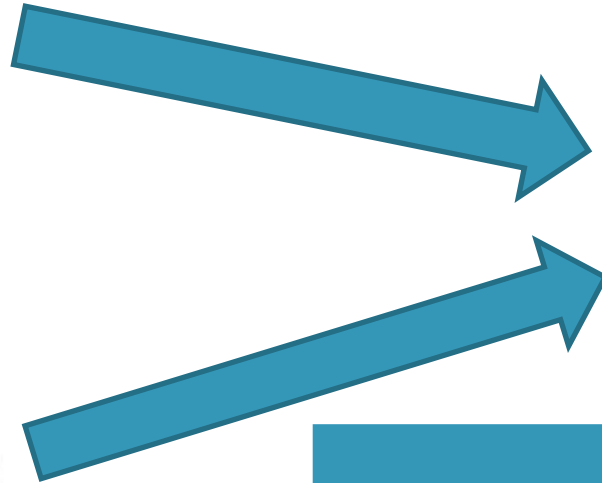


12 X 12 mm  
64 Lead LQFP



10.3 X 11 mm  
32 Lead SOICW-EP

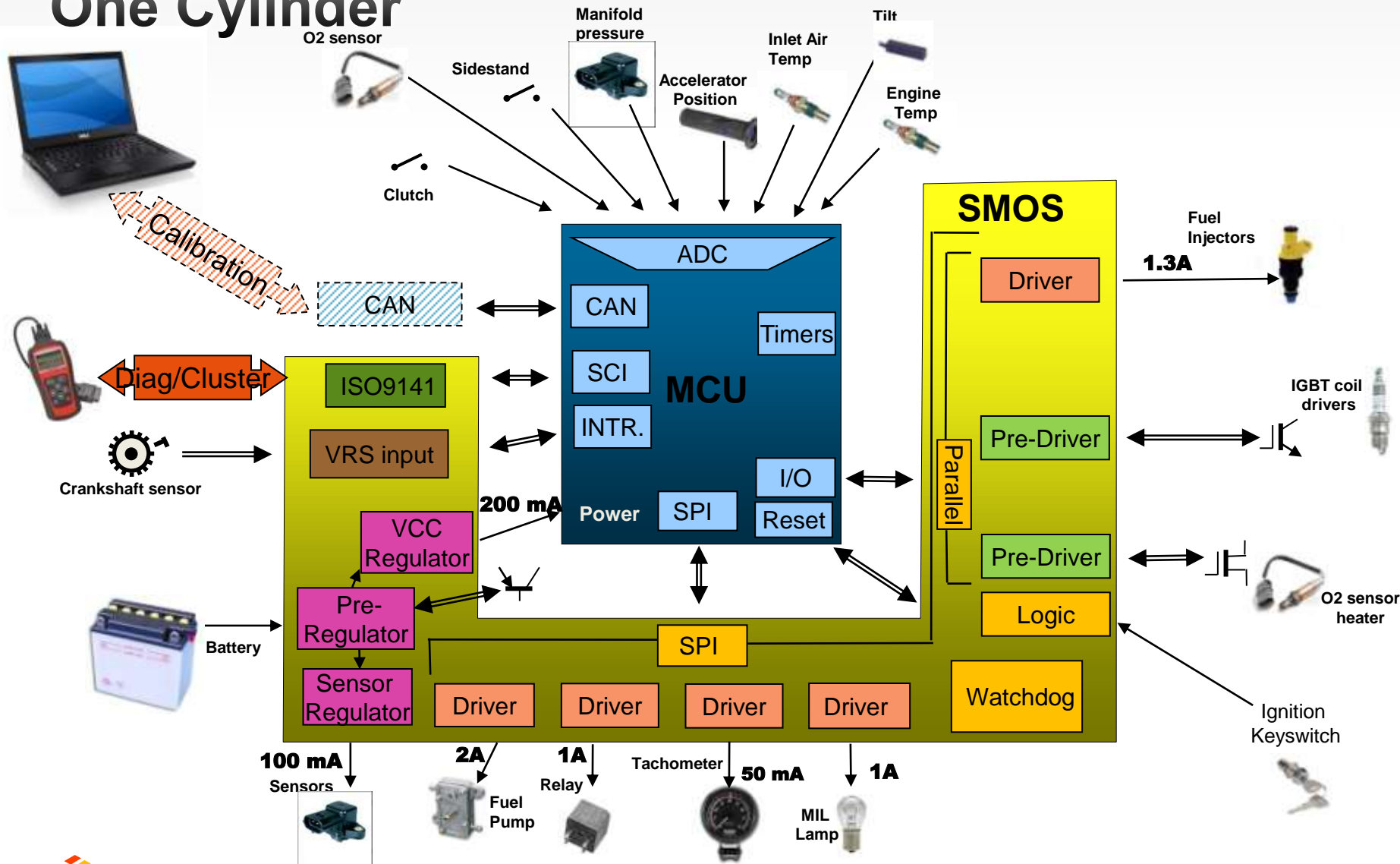
16 X 16 mm  
100 Lead LQFP



**Samples Available Now !**

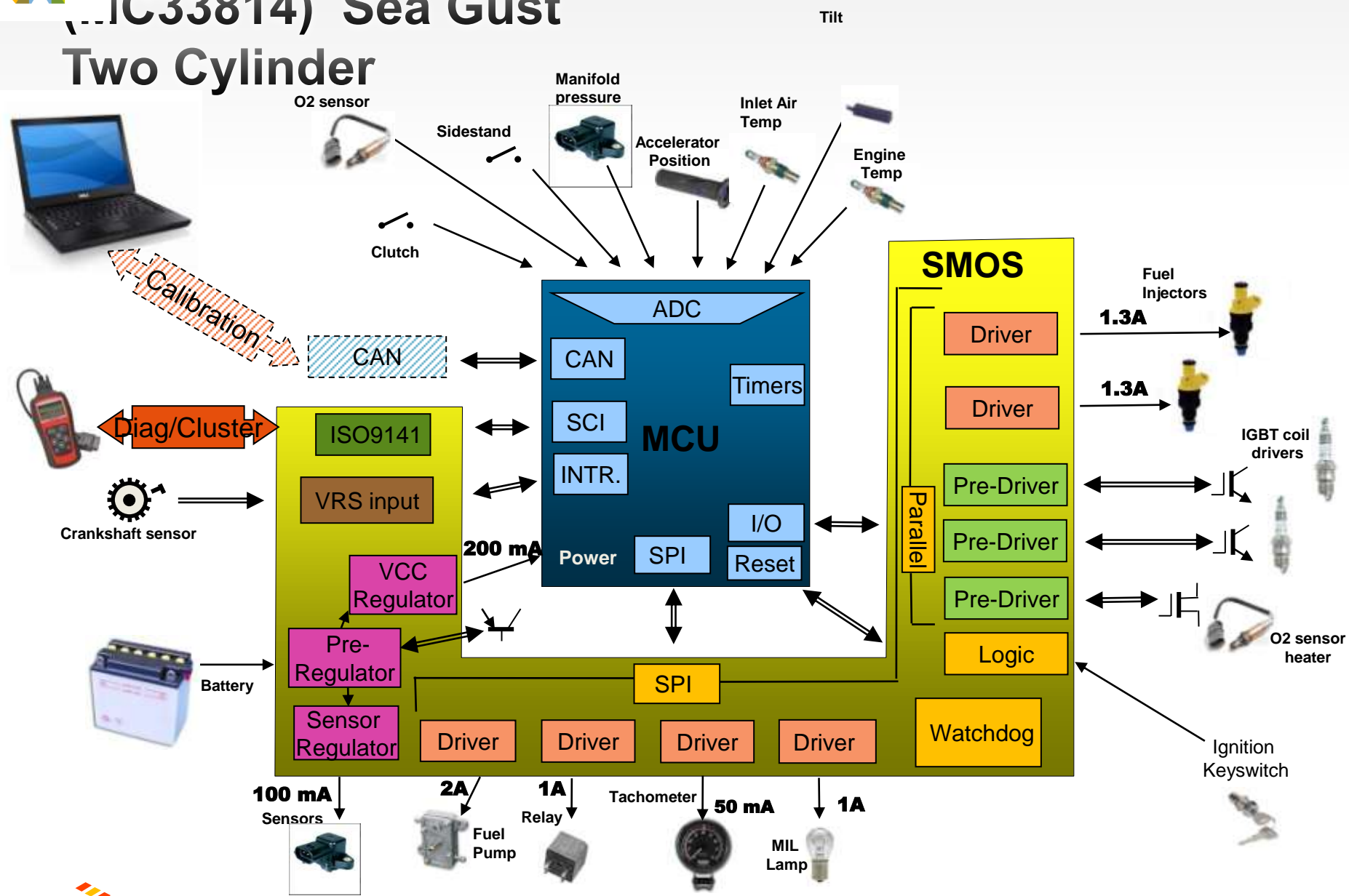
	Two Chip	One Chip
Board Area	271.2 mm <sup>2</sup>	256.0 mm <sup>2</sup>
Leads	96	100
Security	No	Yes
Cost	More	Less

# NXP IC33813) Sea Zephyr One Cylinder



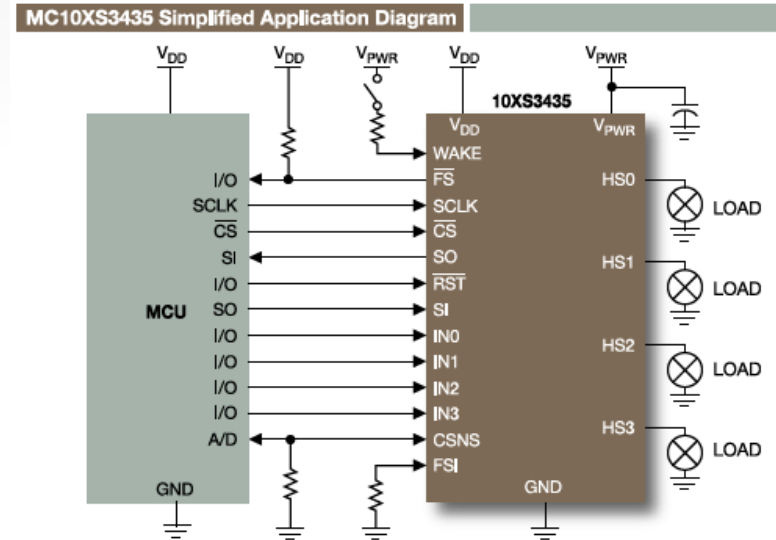


# MC33814) Sea Gust Two Cylinder



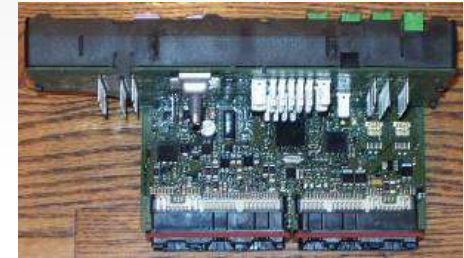
# Freescale eXtremeSwitch: *much more than a Switch*

- Example: MC10XS3435 GEN3 FEATURE List
  - Four protected 10 mΩ and 35 mΩ high side switches
  - Operating voltage range of 6.0V to 20V - extended mode from 4.0V to 28V
  - Ultra low standby current < 5.0 μA
  - 8 MHz 16-bit 3.3V and 5V SPI control and status reporting with daisy chain capability
  - PWM module using external clock or internal oscillator with programmable outputs delay management (MCU off load)
  - Protection Features: smart over-current shutdown, severe short-circuit, over-temperature protections with programmable # of auto-retry and fail-safe mode in case of MCU damage
  - Load type detection (bulb / LED) during OFF and ON states – Load failure diagnostic for bulb and LED
  - Short-to-battery detection
  - Analog current feedback with selectable ratio
  - PCB Temperature sensing



# eXamples

Application	Loads
Lighting	Halogen & incandescent lamps, LEDs, Xenon HID, ...
DC motor	Fuel pump, wiper, fan, ...
Solenoid	Xenon shutter, relay coil...
Resistor	O <sup>2</sup> heater, seat heater, ...



Fuse Box (Gen2)



Body / lighting (Gen3)



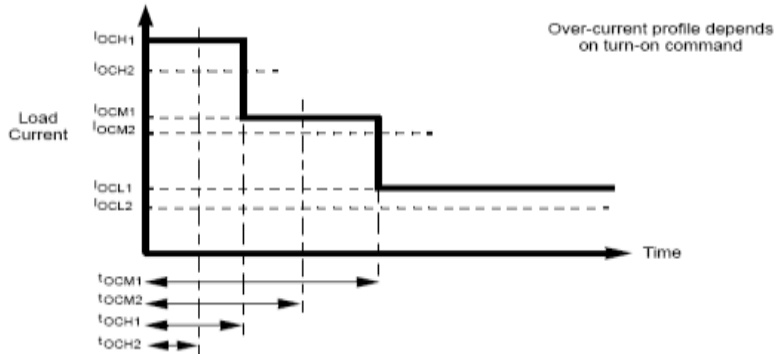
24V app SPDxx



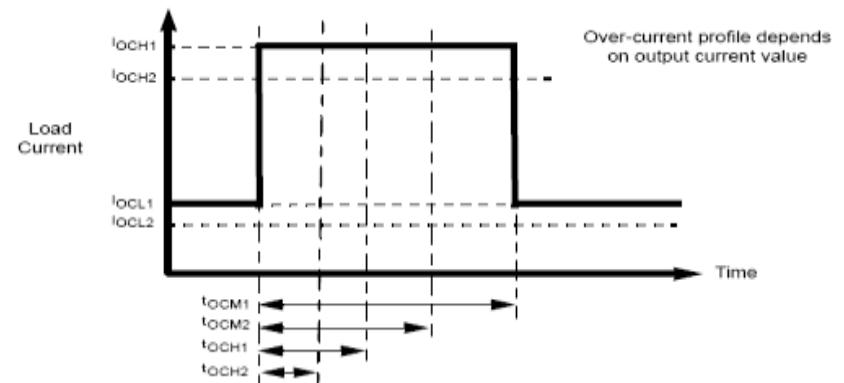
Fuel Pump (Viper)

# Extreme Switch Family

Part Number	Number of Outputs and On-Resistance	Over Current Protection Window Type See Below	Nickname	Package	System Voltage	Datasheet Status	Sample Date	Qualification Date	Evaluation Board
MC10XS3412D	Dual 10mΩ, Dual 12mΩ	Static	SPQ1012	24-pin PQFN	12V	final	in production	qualified	yes
MC10XS3435D	Dual 10mΩ, Dual 35mΩ	Static	SPQ1035	24-pin PQFN	12V	final	in production	qualified	yes
MC15XS3400D	Quad 15mΩ	Static	SPQ15	24-pin PQFN	12V	final	in production	qualified	yes
MC35XS3400D	Quad 35mΩ	Static	SPQ35	24-pin PQFN	12V	final	in production	qualified	yes
MC10XS3535	Triple 10mΩ, Dual 35mΩ	Static	SPP1035	24-pin PQFN	12V	final	in production	qualified	yes
MC35XS3500	Penta 35mΩ	Static	SPP35	24-pin PQFN	12V	final	in production	qualified	yes
MC10XS3425	Dual 10mΩ, Dual 25mΩ	Static	SPQL1025	<b>32-pin SOICEP</b>	12V	preliminary	Sept-11	Dec-12	Mar-12
MC09XS3400	Quad 9mΩ	Static	SPQL09	24-pin PQFN	12V	preliminary	Aug-11	qualified	yes
MC07XS3200	Dual 7mΩ	Static	SPDL07	<b>32-pin SOICEP</b>	12V	preliminary	Sept-11	Dec -12	Mar-12
MC06XS3517	Triple 6mΩ, Dual 17mΩ	Static	SPPL0617	24-pin PQFN	12V	preliminary	Aug-11	qualified	yes
MC06XS4200	Dual 6mΩ for trucks	Static/Dynamic	SPD6_24	24-pin PQFN	<b>24V</b>	preliminary	now	Sep-12	yes
MC10XS4200	Dual 10mΩ for trucks	Static/Dynamic	SPD10_24	24-pin PQFN	<b>24V</b>	preliminary	now	qualified	yes
MC20XS4200	Dual 20mΩ for trucks	Static/Dynamic	SPD20_24	24-pin PQFN	<b>24V</b>	preliminary	now	qualified	yes
MC33981B	Single 4mΩ, 60KHz	Motor control	Viper	16-pin PQFN	12V	final	in production	qualified	yes
MC33982C	Single 2mΩ	Dynamic	SPSS+	16-pin PQFN	12V	final	in production	qualified	yes
MC33984C	Dual 4mΩ	Dynamic	SPD4+	16-pin PQFN	12V	final	in production	qualified	yes
MC33988C	Dual 8mΩ	Dynamic	SPD8+	16-pin PQFN	12V	final	in production	qualified	yes



Over Current Protection Window Type -Static multi-stage over current protection



Over Current Protection Window Type-Dynamic over current protection window



## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- ⊖ [View FXLN8361QR1 on WIN SOURCE](#)
- ⊖ [Freescale Semiconductor - NXP Information](#)

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- ✓ Alternative Solution
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