



# Freescale Consumer and Industry **Analog** Products' Introduction

## APF-IND-T1015

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# Agenda

- ➔ • Analog product Alignment
  - Freescale Strategic Focus & Roadmap
  - Freescale Extreme Switch definition & benefits
  - Target Applications and System costs reduction
  - Freescale other Auto products using in the industry
  - Freescale Consumer products
  - Summary



# Analog Product Alignment

	Appliances	Automotive	Consumer / Gaming	Embedded Board	Healthcare	Robotics / Factory Automation	Smart Energy	Smart Home
High side/Low side switch	Yellow	Green	Yellow	Red	Yellow	Green	Red	Yellow
H-Bridges	Yellow	Green	Yellow	Red	Yellow	Green	Yellow	Yellow
LED Backlight Drivers	Yellow	Red	Yellow	Red	Yellow	Green	Red	Red
Valve & Gate Drivers *	Yellow	Green	Red	Red	Yellow	Green	Red	Yellow
SBCs & Transceivers	Yellow	Green	Red	Yellow	Yellow	Green	Red	Yellow
PMIC & Audio	Red	Green	Green	Green	Yellow	Green	Yellow	Yellow
Switch Detect	Yellow	Green	Red	Yellow	Yellow	Green	Red	Red
Battery Mgmt & Chargers	Red	Green	Yellow	Red	Yellow	Yellow	Yellow	Red
IDC	Yellow	Green	Red	Red	Yellow	Green	Red	Red

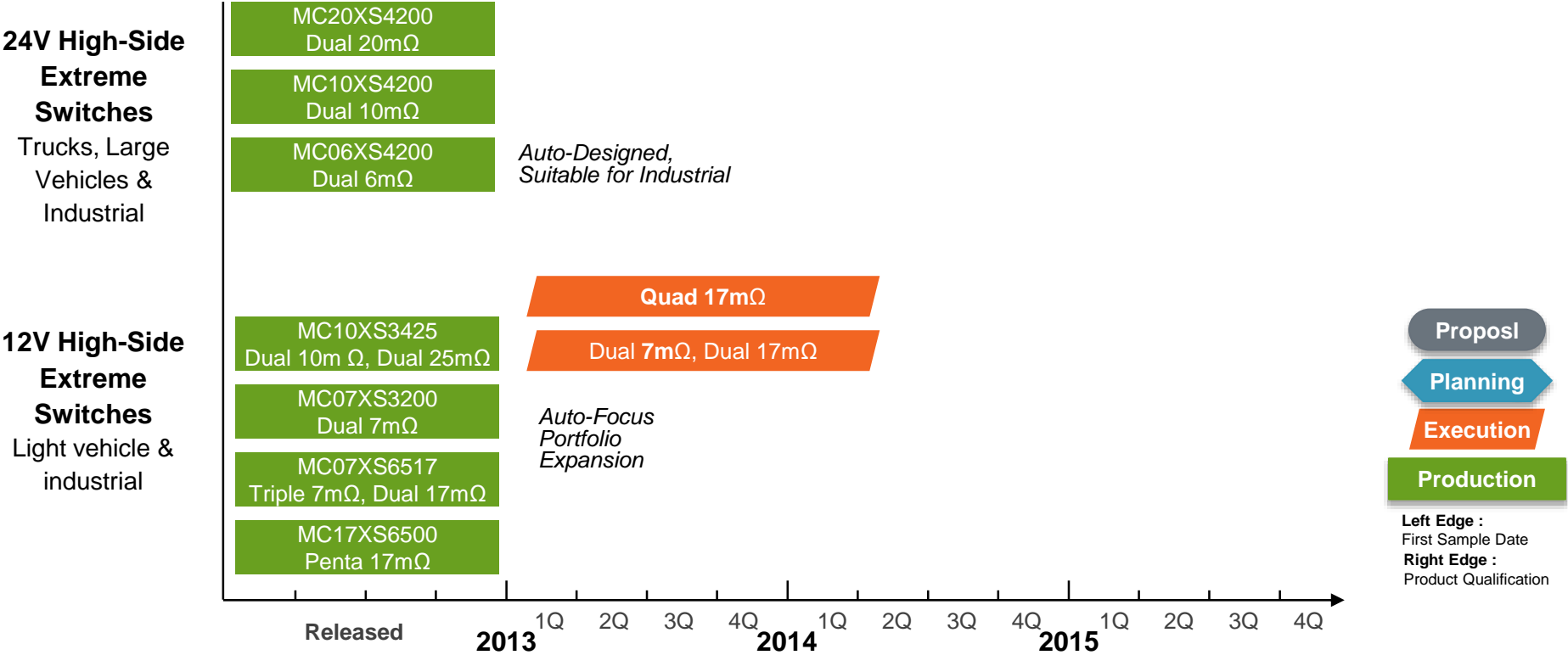
\* Includes Small Engine ICs

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# Analog *Extreme Switch* Roadmap



**Roadmap Development:**

- Expand into industrial
- Extend voltage operation
- Proliferate the portfolio



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# Inside an eXtreme Switch ?

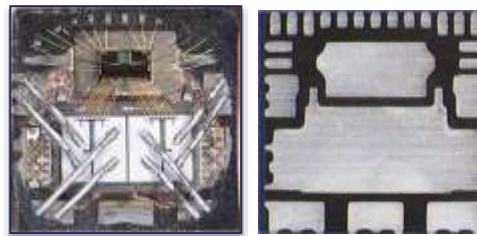
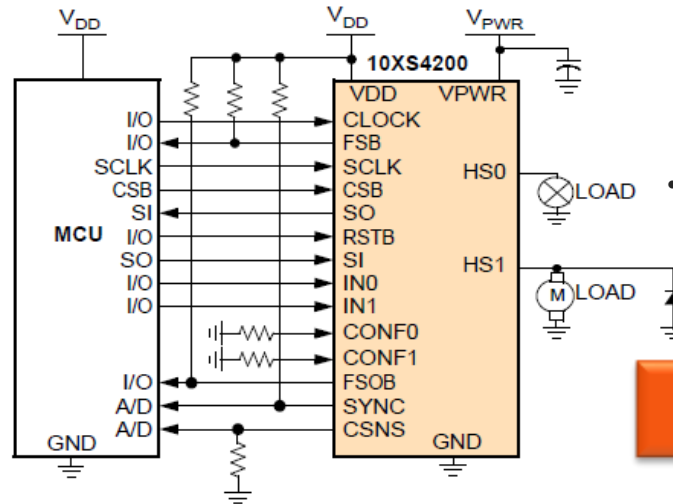
## SMARTMOS™

### Protection and diagnostic

- Over temperature (175°C)
- Over current shutdown
- Over/under voltage
- Short circuit
- Reverse battery
- Loss of ground/Vbat
- Energy discharge protection

### SPI Interface

- Easy connection to the uP
- Programmability
- Daisy chain using SPI
- Programmable over current trip level
- Watchdog
- Embedded PWM module



## Vertical Power stage

### • Best-in-class Technology

- Planar HD5 and TrenchFet LFET
- 45V & 65V Breakdown Voltage

### • Protection in the power stage

- Temperature sensor
- Current sensor

## Power package

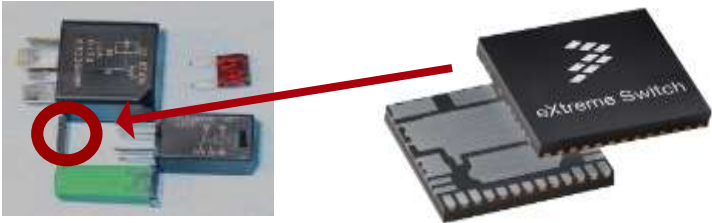
### • PQFN low cost power package

- 0.5 mm thick lead frame
- Die soldered attached
- Rthj-c < 0.5°C/W

### • SOICeP32 and 54

- designed for high power
- Large Aluminium wire capability
- ELV compliancy

# 24V eXtreme Switch Benefits



## Versus Relay



### Design Simplification



**Self protection**, protects circuit board and wiring, eliminates fuses  
**Diagnostic** features

### Switching Capability



**PWM** capability  
EMC, di/dt and dv/dt control

### Reduce Power Dissipation



Standby current **few**  $\mu\text{A}$   
No relay coil driver losses

## Versus Basic Smart Power Devices



### Integration



**Increased** integration is designed to provide lighter-weight, smaller systems

### Flexibility



Provides programmability and **flexibility** needed to control all aspects of loads

### Robust Design



Provide robust design, **intelligence** and **safety** for 24V applications





# eXtreme Switch – Intelligence and Safety

Protection Table		System Diagnostic				Switch protection				System Protection		
Product Family	Part Number	Open load ON-OFF-LED	Load Shorted to Battery	Temperature pre-warning Flag	Analog meas. I - T° - V	Overtemp hysteresis (w/ Flag)	Overtemp shutdown + time based retry (w/ Flag)	Ground loss - Reverse batt.	Load dump	Over / Under Voltage	ECU output short circuit lathoff	Load short circuit or overload lathoff
Main	MC33981ABHFK / R2	A - -	x	-	x - -	x	-	x x	41 V	x x	-	x
Main	MC33982CHFK / R2	A x -	-	-	x - -	x	-	x x	41 V	x x	-	x
Main	MC33984CHFK / R2	A x -	-	-	x - -	x	-	x x	41 V	x x	-	x
Main	MC33988CHFK / R2	A x -	-	-	x - -	x	-	x x	41 V	x x	-	x
12V	PC07XS3200EK	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC09XS3400AFK / R2	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC10XS3412DHFk / R2	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	PC10XS3425EK	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC10XS3435DHFk / R2	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC15XS3400DHFk / R2	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC35XS3400DHFk / R2	x x x	x	x	x - -	-	x	x x	41 V	x x	x	x
12V	MC06XS3517AFK / R2	x x x	x	x	x x -	-	x	x x	41 V	x x	x	x
12V	MC10XS3535HFk / R2	x - x	x	x	x x -	-	x	x x	40 V	x x	x	x
12V	MC35XS3500HFk / R2	x - x	x	x	x - -	-	x	x x	40 V	x x	x	x
24V	MC06XS4200FK / R2	x x x	x	x	x x -	-	x	x x	58 V	x x	x	x
24V	MC10XS4200FK / R2	x x x	x	x	x x -	-	x	x x	58 V	x x	x	x
24V	MC20XS4200FK / R2	x x x	x	x	x x -	-	x	x x	58 V	x x	x	x

A = available with analog current

"X" Feature available  
 "-" Feature not available

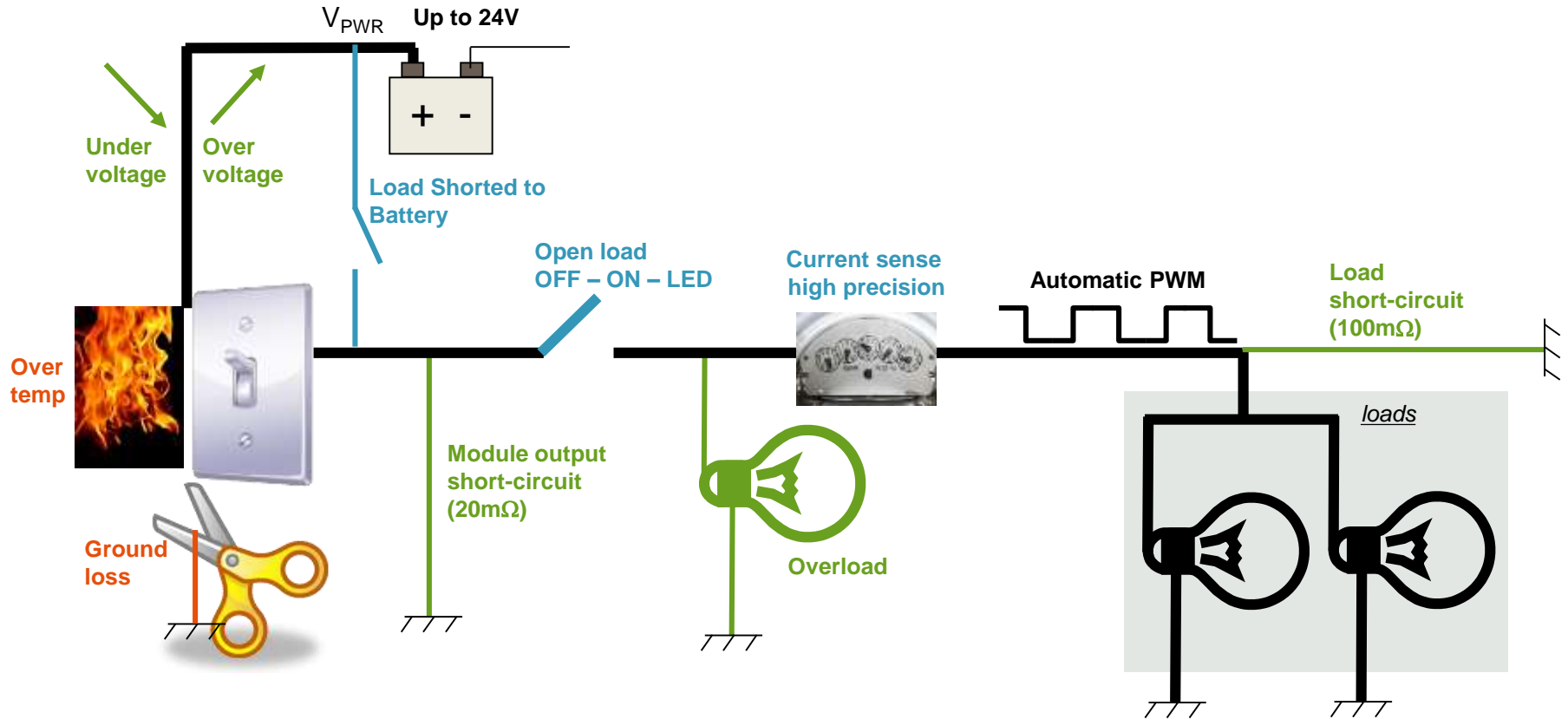


- Protections, diagnostics **SPI** configurable

- In case of **MCU failure**, device protects all the system

- During **system failure**, Fail Safe mode can activate loads with full protection

# Application and Protection Example



## System Diagnostic

- ✓ Open load ON – OFF – LED
- ✓ Load Shorted to Battery
- ✓ Current sense

## Switch Protection

- ✓ Over temp
- ✓ Ground loss
- ✓ Reverse Battery

## System Protection

- ✓ Over-under voltage
- ✓ Module output short-circuit
- ✓ Load short-circuit
- ✓ Overload

# Agenda

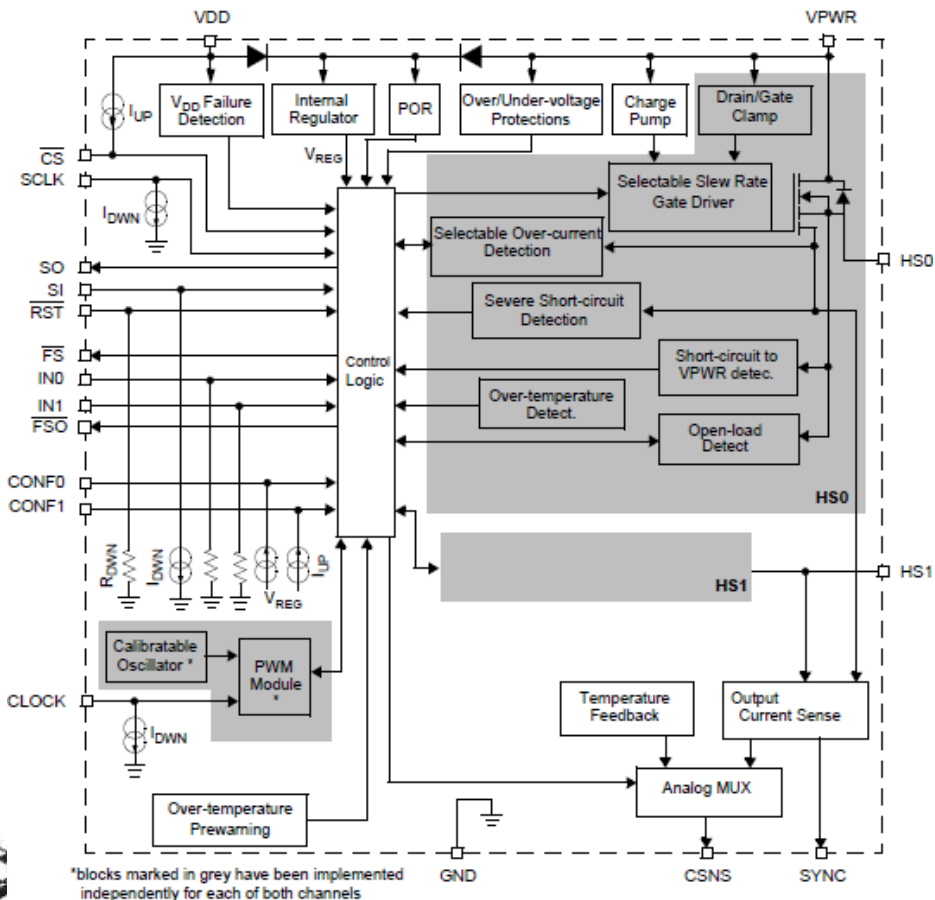
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# 24V Product Block Diagram and Features

- 2 High Side Switches with Parallel Output operating mode
- Flexibility Resistive / Capacitive / Inductive loads (up to 1kHz)
- Embedded PWM module
- External Current sense precision resistor shared among devices
- Synchronous / asynchronous current sensing
- Track & Hold current sensing mode
- Dynamic threshold over current protection
- Non-dissipative Inrush-current handling
- Accurate LED sensing (+/- 10 % over +/- 0.5A)
- Open Load detection @ 10mA max (LED loads)
- Fail Safe mode
- Daisy chainable
- Low J-C thermal resistance (< 1°C/W)



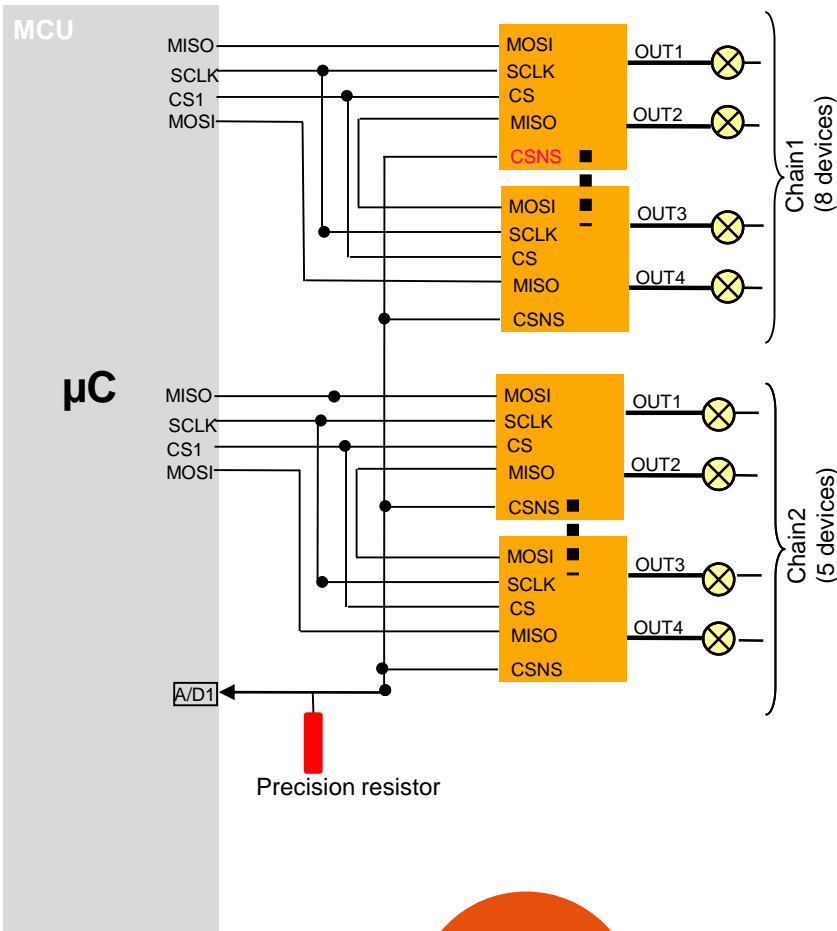
24 PQFN  
12 mm x 12 mm



**Flexible load management from 1A to 12A**  
**Few External Components required**



# Application Example with BOM Reduction



- **Application Needs**  
26 \* 2A loads with current sense
- **Freescale SPI Solution Requirement**  
All devices can be connected in Daisy Chain (2 in this example)
  - ✓ 8 I/O pins used for 26 loads SPI control
- **Freescale Current Sense Resistor Requirement**  
All non active current sense pins can be tri-stated
  - ✓ 1 Analog Input on μC used for current sensing
- **Freescale Solution Summary**
  - ✓ only 9 IOs of μC required
  - ✓ only 2 Resistors for Fail Safe (Output and Status)
  - ✓ only 1 high precision Resistor

- Freescale Advantages vs. Competition**  
(2 outputs, 2 current sense & no SPI)
- ❑ **SPI and Technology**
    - ✓ >30 IOs saved and >50 resistors saved !  
(no Resistors for MCU connection)
  - ❑ **Daisy Chainable and common Precision resistor**
    - ✓ 25 A/D saved and 25 high precision Resistors saved ! (and/or external analog multiplexer)

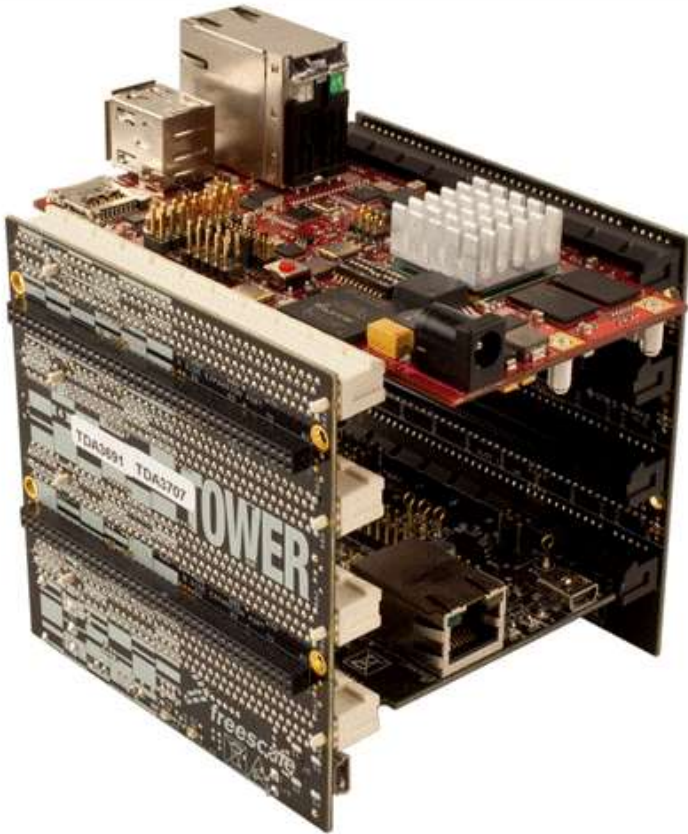


# Development Tools and Enablement

- **Evaluation kit**
  - KIT06XS4200EVBE for the 6 mOhm device
  - KIT10XS4200EVBE for the 10 mOhm device
  - KIT20XS4200EVBE for the 20 mOhm device
- **Reference design under development**
  - 16-bit MCU S12G, 4 eXtreme Switch devices, CAN Physical Layer, 5V regulator
- **Application Notes and tools**
  - MC06XS4200 / MC10XS4200 / MC20XS4200 Datasheets
  - AN2467: Power Quad Flat No-Lead (PQFN) Package
  - AN3298: Solder Joint Temperature and Package Peak Temperature
  - AN4516: IBIS Model File for Dual 24V High Side
  - AN4474: EMC and Fast Transient Pulses Performances for Dual 24 V High Side
  - AN4473: Compact Thermal Model for Dual 24V High Side Switch
  - AN4515: Lifetime Computation for Dual 24V High Side
  - AN4542: Repetitive Short-Circuit Performances for Dual 24V High Side
  - Microsoft Excel© Thermal Calculator
  - Cadence Orcad© Behavioral models



# Tower System development KIT



Development KIT under study for devices compatible with 24V industrial applications requirements

- Intelligent High Side Switches
- DC/DC regulator with advanced functional safety features
- Li-Ion Intelligent Battery Monitoring Sensor (V/I/T)

**Hardware Development Planned in 2013 !**

# 24V eXtreme Switch Summary

## ✓ Products in line with Market Trends

- **Power saving** to help CO<sub>2</sub> reduction (PWM, integration)
- **Robustness** and **Safety** requirements to secure behavior at failure
- **Flexibility** to accommodate with the large variations of modules (SPI, CSNS accuracy)

Summary			
	Item	SRP	Qty
Part Numbers	MC06XS4200FK/R2	\$3.06	10K
	MC10XS4200FK/R2	\$2.50	10K
	MC20XS4200FK/R2	\$2.21	10K
R2 suffix is tape and reel			
Development Tools	KIT06XS4200EVBE (supports MC06XS4200FK)	\$135.70	Each
	KIT10XS4200EVBE (supports MC10XS4200FK)	\$135.70	Each
	KIT20XS4200EVBE (supports MC20XS4200FK)	\$135.70	Each

## ✓ Top 3 reasons to choose Freescale device against competition

- **Robustness:** **unique diagnostics** and **protections** features with embedded failsafe mode. Optimized hardware and software
- **Integration:** **2 channels** per package with low R<sub>dson</sub> with **parallel output mode**
- **Flexibility:** **SPI** configurable to fit various applications requirements

## ✓ Help us identifying other industrial segments



# eXtreme Switch Overall Family Devices

12V Family Devices								
Part Number	Outputs # and On-Resistance	Total Outputs #	Package	Low Operating Voltage	High Operating Voltage	Pin to Pin Compatibility	SW Compatibility	Status / Launch
MC07XS3200EK	Dual 7mΩ	2	32-pin SOICEP	6V	20V	-	√	Launch Q2 2013
MC10XS3425EK	Dual 10mΩ, Dual 25mΩ	4	32-pin SOICEP	6V	20V	-		Launch Q2 2013
MC10XS3412DHFk	Dual 10mΩ, Dual 12mΩ	4	24-pin PQFN	6V	20V	√		In Production
MC10XS3435DHFk	Dual 10mΩ, Dual 35mΩ	4	24-pin PQFN	6V	20V			In Production
MC15XS3400DHFk	Quad 15mΩ	4	24-pin PQFN	6V	20V			In Production
MC35XS3400DHFk	Quad 35mΩ	4	24-pin PQFN	6V	20V			In Production
MC09XS3400AFK	Quad 9mΩ	4	24-pin PQFN	6V	20V	√	In Production	
MC10XS3535HFk	Triple 10mΩ, Dual 35mΩ	5	24-pin PQFN	7V	20V		In Production	
MC35XS3500HFk	Penta 35mΩ	5	24-pin PQFN	7V	20V		In Production	
MC06XS3517AFK	Triple 6mΩ, Dual 17mΩ	5	24-pin PQFN	7V	20V		√	In Production

24V Family Devices								
Part Number	Outputs # and On-Resistance	Total Outputs #	Package	Low Operating Voltage	High Operating Voltage	Pin to Pin Compatibility	SW Compatibility	Status / Launch
MC06XS4200FK	Dual 6mΩ	2	24-pin PQFN	8V	36V	√	√	Launch Jan 2013
MC10XS4200FK	Dual 10mΩ	2	24-pin PQFN	8V	36V			Launch Jan 2013
MC20XS4200FK	Dual 20mΩ	2	24-pin PQFN	8V	36V			Launch Jan 2013

Main Switch Devices								
Part Number	Outputs # and On-Resistance	Total Outputs #	Package	Low Operating Voltage	High Operating Voltage	Pin to Pin Compatibility	SW Compatibility	Status / Launch
MC33981ABHFk	Single 4mΩ, 60KHz	1	16-pin PQFN	6V	27V	-	-	In production
MC33982CHFk	Single 2mΩ	1	16-pin PQFN	6V	27V	√	√	In production
MC33984CHFk	Dual 4mΩ	2	16-pin PQFN	6V	27V			In production
MC33988CHFk	Dual 8mΩ	2	16-pin PQFN	6V	27V			In production

## **IMPORTANT : Extended operating range feature**

In extended mode, the functionality is guaranteed but not the electrical parameters specified

→ 12V Products: 4.0 to 28V (vs. 6.0 to 20V)

→ 24V Products: 6.0 to 58V (vs. 8.0 to 36V)

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# MC33879 – COSS LITE

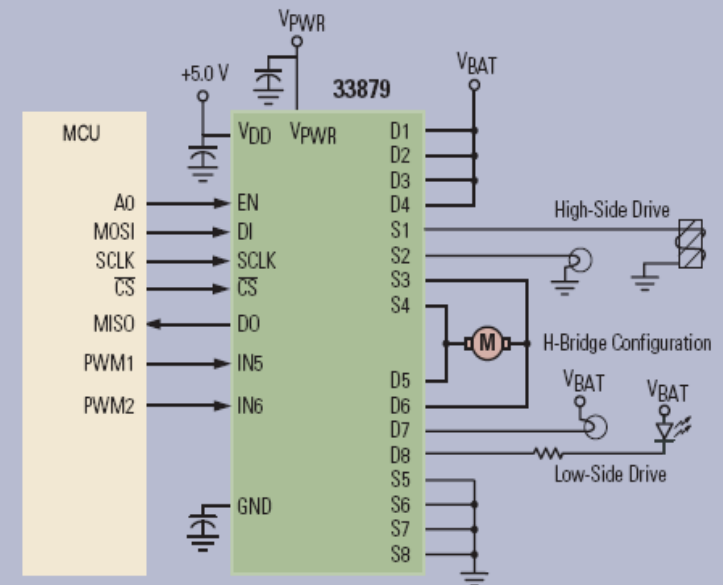
## • FEATURES

- All 8 Outputs Are High-Side/Low-Side Configurable
- Designed to Operate from  $5.5\text{ V} < V_{PWR} < 24.5\text{ V}$
- 16-bit SPI for Control and Fault Reporting, 3.3 V/5.0 V Compatible
- Current Limited Outputs (0.6 A to 2.0 A) to Drive Incandescent Lamps
- Output Voltage Clamp is +45 V Typical (Low-Side Drive) and -20 V Typical (High-Side Drive) During Inductive Switching
- Internal Reverse Battery Protection on VPWR
- Loss of Ground or Supply Will Not Energize Loads or Damage the IC
- Maximum IPWR Standby Current of 5.0  $\mu\text{A}$  with a VPWR of 13V up to 95°C
- RDS(ON) of 0.75  $\Omega$  at 25°C Typical
- Short Circuit Detect and Current Limit with Automatic Retry
- Independent Over temperature Protection
- Available in standard 32 Id thermal enhanced SOICW EP package

## • APPLICATIONS

- Automotive systems needing relay, small motor, and lighting control
- Multiple relay, solenoid, lamp and small motor driver for industrial and robotic systems
- Load control in Boats, RVs and Marine systems
- Appliance and White Goods electrical actuators
- Electronic gaming machines (Casino and Arcade)

33879 SIMPLIFIED APPLICATION DIAGRAM



# MC33981 - Viper

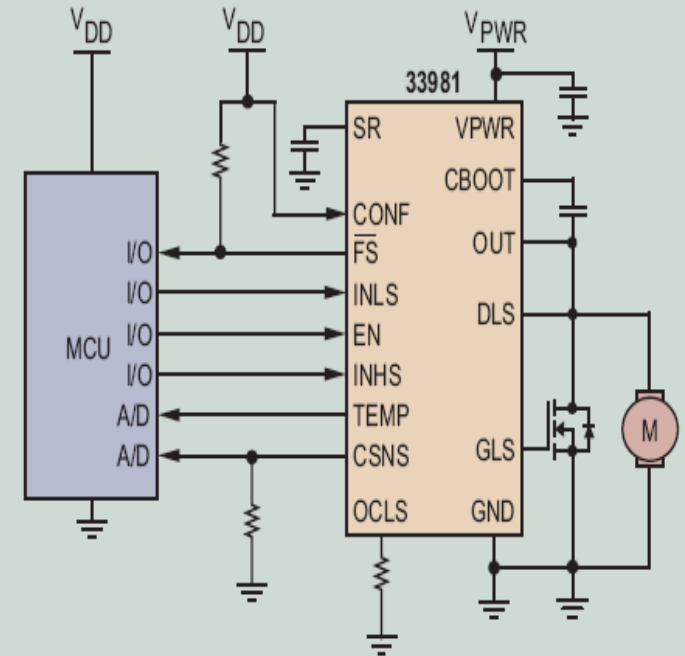
## • FEATURES

- Single 4.0 mΩ RDS(ON) Maximum High-Side Switch
- PWM Capability up to 60 kHz with Duty Cycle from 5% to 100%
- Very Low Standby Current
- Slew Rate Control with External Capacitor
- Overcurrent and Overtemperature Protection, Undervoltage Shutdown and Fault Reporting
- Reverse Battery Protection
- Gate Drive Signal for External Low-Side N-Channel MOSFET with Protection Features
- Output Current Monitoring
- Temperature Feedback

## • APPLICATIONS

- Automotive Systems
- Robotic Systems
- Marine Equipment
- Farm Equipment
- Actuator Controls
- Fractional Horsepower DC-Motor Controls
- Applications where high-side switch control is required

33981 SIMPLIFIED APPLICATION DIAGRAM



# MC33982 - SPSS

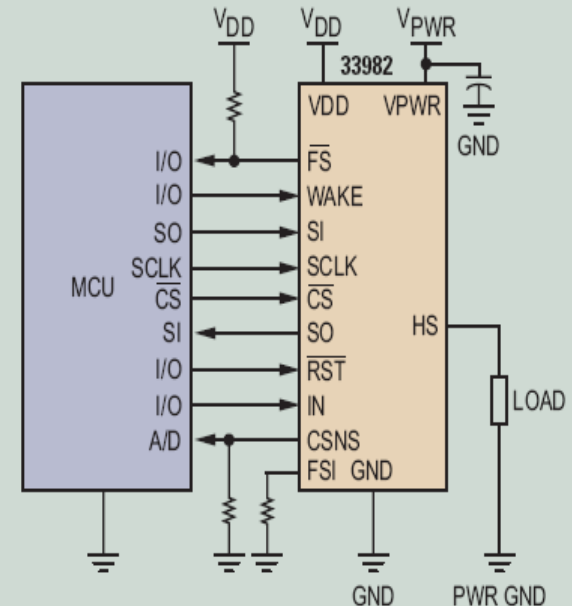
## • FEATURES

- Single 2.0 mΩ max high-side switch with parallel input or SPI control
- Output current monitoring with two SPI-selectable current ratios
- SPI control of overcurrent limit, overcurrent fault blanking time, output- OFF open load detection, output ON/OFF control, watchdog timeout, slew rates, and fault status reporting
- SPI status reporting of overcurrent, open and shorted loads, overtemperature shutdown, undervoltage and overvoltage shutdown, fail-safe terminal status, and program status
- Enhanced -16 V reverse polarity VPWR protection

## • APPLICATIONS

- Aircraft and Marine Systems
- Automotive and Robotic Systems
- Farm Equipment
- Industrial Actuator Control
- Lamp and Inductive Load Controls
- DC-Motor Control Applications Requiring Diagnostics

33982 SIMPLIFIED APPLICATION DIAGRAM



# 33931 - Overview

## Overview

The 33931 is a monolithic H-Bridge Power IC in a robust thermally enhanced package. It is designed primarily for automotive electronic throttle control, but is applicable to any low-voltage DC servo motor control application within the current and voltage limits stated in this specification.

## • Features

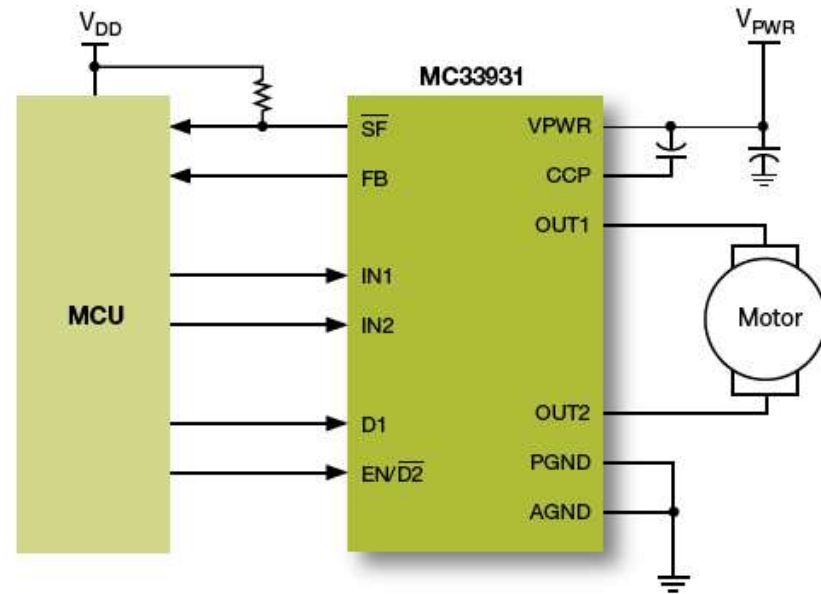
- H-Bridge configuration for bi-directional motors
- 235 mΩ maximum RDSON @ 150°C (for each H-Bridge MOSFET)
- Over current limiting (regulation) via internal constant-off-time PWM
- Output short circuit protection (short to VPWR or ground)
- Temperature dependent current limit threshold reduction
- Current feedback
- Sleep mode current < 50 μA

## • Benefits

- Robust solution for harsh environments
- Compact, easy to use package
- Protected against common failure conditions

## • Applications

- Electronic throttle control
- DC motor control



Product Launch:	FEB, 09
Samples:	Available
EVB :	Available

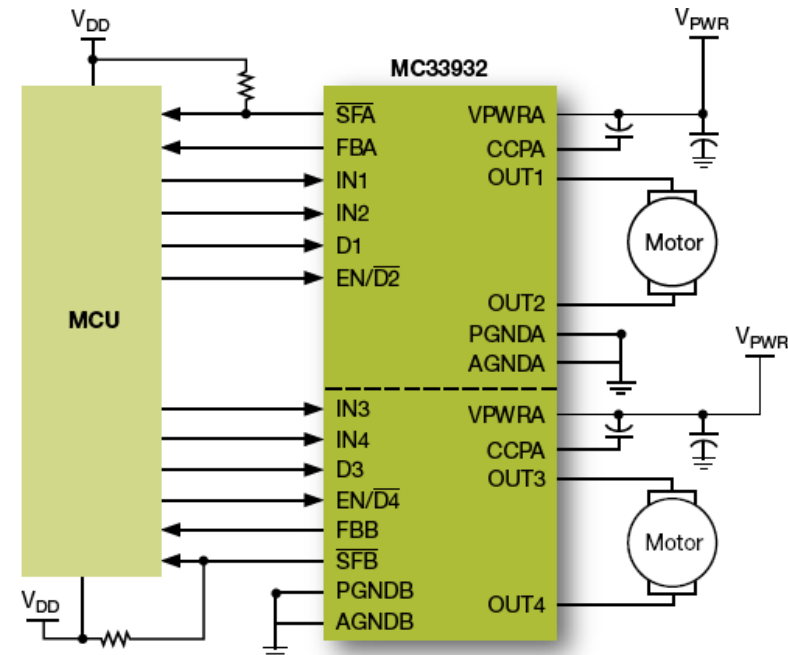
# MC33932 – Dual Merlot

## • Features

- 8.0V to 28V continuous operation (transient operation from 5.0V to 40V)
  - 225 mΩ maximum RDSON @ Tj=150°C (for each H-Bridge MOSFET)
  - 3.0V and 5.0V TTL/CMOS logic compatible inputs
  - Over-current limiting (regulation) via internal constant-off-time PWM
  - Output short-circuit protection (short to VPWR or GND)
  - Temperature-dependant current-limit threshold reduction
  - All inputs have an internal source/sink to define the default (floating input) states
  - Sleep Mode with current draw < 50 μA (each half with inputs floating or set to match default logic states)
- Benefits
- Robust solution for harsh environments
  - Compact, easy to use package
  - Protected against common failure conditions

## • Applications

- Electronic throttle control
- DC motor control
- Industrial motors and actuators



# 33899 - Overview

## Overview

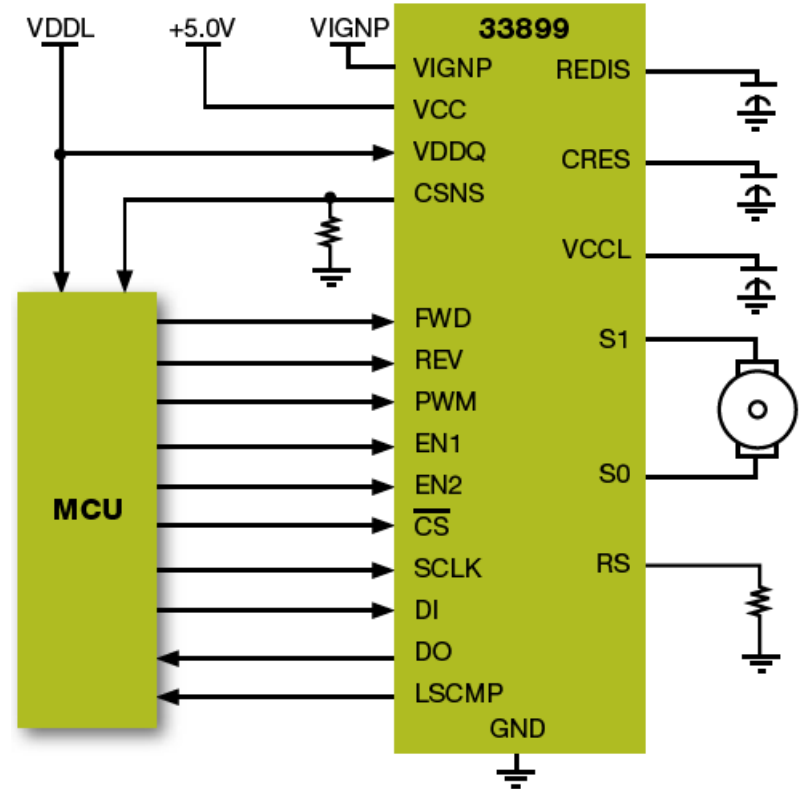
The 33899 is designed to drive a DC motor in both forward and reverse shaft rotation under pulse-width modulation (PWM) control of speed and torque. A current mirror output provides an analog feedback signal proportional to the load current. A serial peripheral interface (SPI) is used to select slew rate control, current compensation limits and to read diagnostic status (faults) of the H-Bridge drive circuits. SPI diagnostic reporting includes open circuit, short-circuit to VIGNP, short-circuit to ground, die temperature range, and under-voltage on VIGNP.

### Features

- Drives inductive loads in a full H-Bridge configuration
- Current mirror output signal (gain selectable via external resistor)
- Short-circuit current limiting
- Thermal shutdown (outputs latched off until reset via the SPI)
- Internal charge pump circuit for the internal high side MOSFETs
- SPI-selectable slew rate control and current limit control
- Over-temperature shutdown
- Outputs can be disabled to high-impedance state
- PWM-able up to 11kHz @ 3.0A
- Synchronous rectification control of the high side MOSFETs
- Low RDS(ON) outputs at high junction temperature ( $< 165\text{m}\Omega$  @  $T_A = 125^\circ\text{C}$ ,  $V_{IGNP} = 6.0\text{V}$ )
- Outputs survive shorts to  $-1.0\text{V}$
- Pb-free packaging designated by suffix code VW

### Benefits

- Configurability and programmability make this DC motor driver very versatile
- Selectable slew rate
- Unique fault restart
- Highly integrated solution
- Robust solution for harsh environment
- Improved reliability
- SPI selectable current limit
- Detailed fault diagnostics via SPI



## Applications

- Engine control
- Throttle control
- Motor control
- Automotive systems
- Industrial motors
- Actuator control



# 33937 - Overview

## Overview

The 33937 device is a field effect transistor (FET) pre-driver designed to drive three-phase motor control configurations with stable digital accuracy. It is easily configured for systems driving brushless DC (BLDC), permanent magnet (PM) or switched reluctance (SR) motors with or without sensors.

### • Features

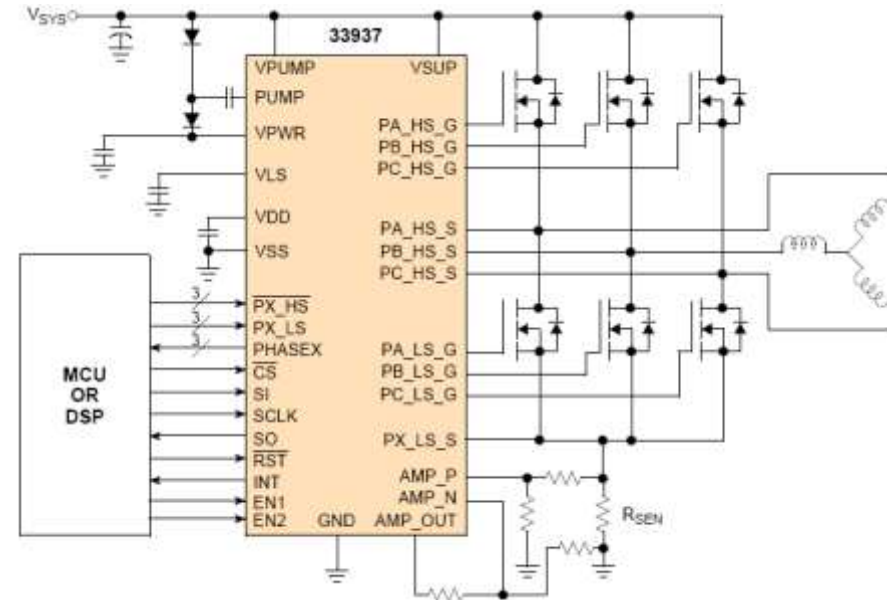
- Designed for 8.0V to 40V operation
- Extended operating range from 6.0V to 58V covers 12V, 24V and 42V systems by design
- Charge pump to support full FET drive at low battery voltages
- Programmable dead time via the SPI port • Simultaneous output capability via safe SPI command

### • Benefits

- Precise, complete control of speed, torque and power
- Explicit control of each driver
- Ideally suited for microcontroller interfacing
- Increased diagnostic and fault reporting that protect the driver and load
- Highly integrated solution
- Robust solution for harsh environment
- Improved reliability

### • Applications

- Cooling fan
- Water pump
- Actuator controls
- Fuel pump
- Electro-hydraulic and electric power steering



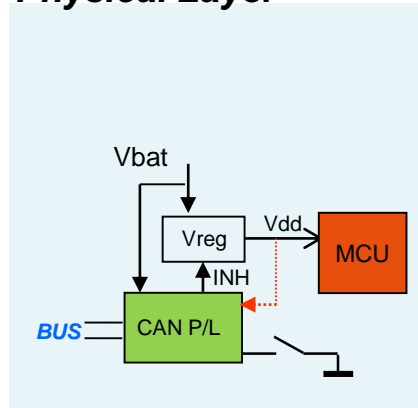
Product Launch:  
Samples:  
EV B :

Available  
Available  
Available

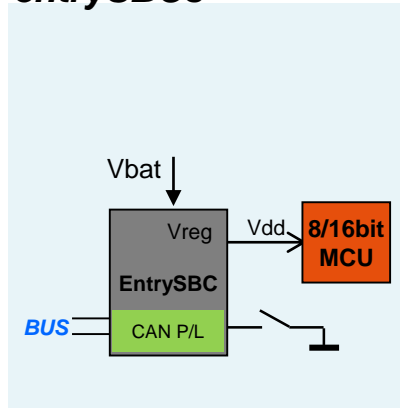
# Freescale SBC segmentation

Different standard Solutions for different system needs

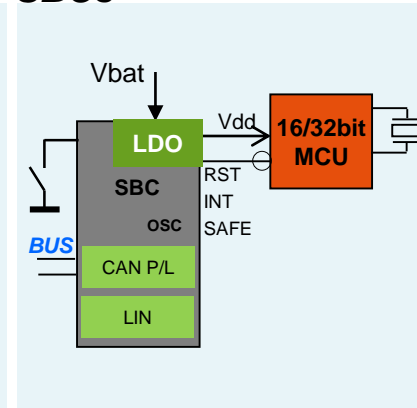
**Physical Layer**



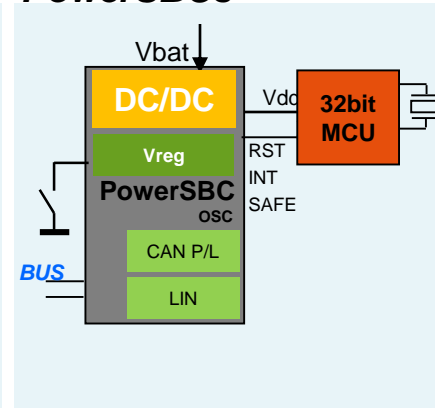
**entrySBCs**



**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)

# Freescal SBC solutions – Features Table Overview

Part Number	33903	33903P	33903S	33903D	33904	33905S	33905D
Pin to pin compatibility	33904 33905S 33905D	33903S 33903D	33903P 33903D	33903P 33903S	33903 33905S 33905D	33903 33904 33905D	33903 33904 33905S
V <sub>MCU</sub> (V <sub>dd</sub> )	5.0V/3.3V 100mA +/-2%	5.0V/3.3V 150mA +/-2%	5.0V/3.3V 150mA +/-2%	5.0V/3.3V 150mA +/-2%	5.0V/3.3V 150mA +/-2%	5.0V/3.3V 150mA +/-2%	5.0V/3.3V 150mA +/-2%
V <sub>MCU</sub> Pw Sharing.	-	+300mA	+300mA	+300mA	+300mA	+300mA	+300mA
V <sub>aux</sub> (ext ballast)	-	-	-	-	5.0/3.3V	5.0/3.3V	5.0/3.3V
V <sub>can</sub>	5V/100mA	5V/100mA	5V/100mA	5V/100mA	5V/100mA	5V/100mA	5V/100mA
CAN HS P/L	1	1	1	1	1	1	1
LIN2.1 / J2602 P/L	-	-	1	2	-	1	2
I/Os	1	3	3	3	4	4	4
LowQ V <sub>off</sub> /V <sub>on</sub>	15/25 µA	15/25 µA	15/25 µA	15/25 µA	15/25 µA	15/25 µA	15/25 µA
Battery sense	-	Yes	Yes	Yes	Yes	Yes	Yes
AMUX	-	Yes	Yes	Yes	Yes	Yes	Yes
Fail Safe	-	Yes	Yes	Yes	Yes	Yes	Yes
Watch Dog	Yes / Adv	Yes / Adv	Yes / Adv	Yes / Adv	Yes / Adv	Yes / Adv	Yes / Adv
SPI	16b / Safe	16b / Safe	16b / Safe	16b / Safe	16b / Safe	16b / Safe	16b / Safe
Package	SOIC32eP	SOIC32eP	SOIC32eP	SOIC32eP	SOIC32eP	SOIC32eP	SOIC54eP
Attach strategy MCU Supply	SO8 S12XS S12XE MPC5604B LE	S12XE MPC5604B MPC5604P MPC5634M	S12XE MPC5604B MPC5604P MPC5634M	S12XE MPC5604B MPC5604P MPC5634M	S12XE MPC5604B MPC5604P MPC5634M	S12XE MPC5604B MPC5604P MPC5634M	S12XE MPC5604B MPC5604P MPC5634M

Thermal simulations required according to Automotive environment conditions (tools available)



# Agenda

- Analog product Alignment
- Freescale Strategic Focus & Roadmap
- Freescale Extreme Switch definition & benefits
- Target Applications and System costs reduction
- Freescale other Automotive products used in the industry
- ➔ • Freescale Consumer products
- Summary

# MMPF0100

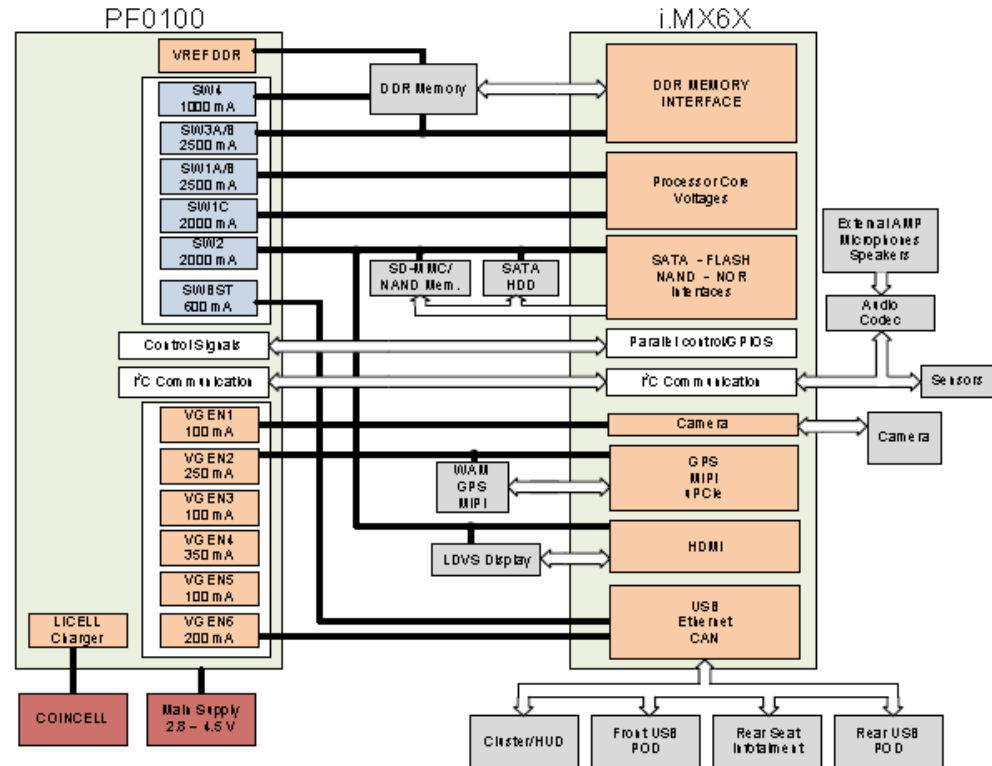
## 14 Channel Configurable Power Management Integrated Circuit

### Features:

- Four to six buck converters, depending on configuration
- Single/ Dual phase/ parallel options
- DDR termination tracking mode option
- Boost regulator to 5.0 V out
- Six general purpose linear regulators
- Programmable output voltage, sequence, and timing
- OTP (One Time Programmable) memory for device configuration
- Coin cell charger and RTC supply
- DDR termination reference voltage
- Power control logic with processor interface and event detection
- I2C control
- Individually programmable ON, OFF, and Standby modes

### Applications:

- Tablets
- eReaders
- Smartbooks
- Automotive infotainment
- Human-machine interface
- Portable medical
- IPTV
- IP phones
- Home energy management



### Key benefits:

- Highly integrated cost-effective solutions enable a reduced bill of materials
- Configurability and programmability allow a single device to be used across many applications enabling customers to develop a single solution for a whole family of products
- Highly efficient conversion maximizes power to application and reduces heat



# PF0100 Introduction

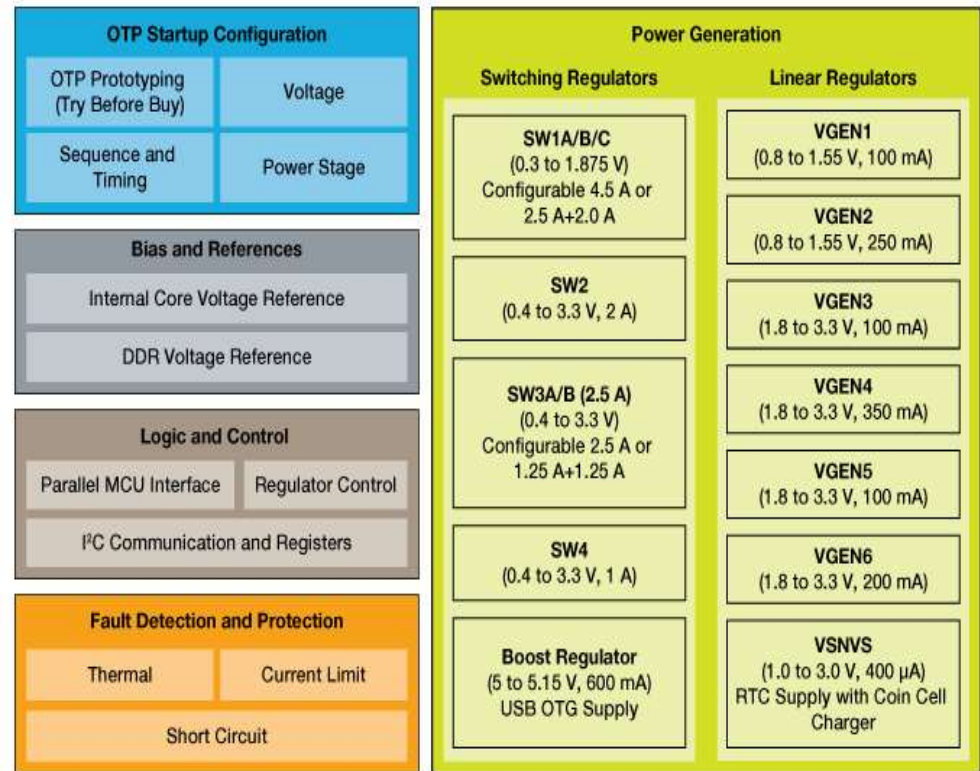
Configurable power management that simplifies designs, with a single chip solution for your most complex systems

- The PF0100 is a highly integrated, **configurable and programmable** 14-channel Power Management Integrated Circuit (PMIC)
- The PF0100 is designed to support today's advanced multi-core processing solutions, including the full range of Freescale's **i.MX 6 series** of applications processors
- The highly flexible architecture of the PF0100 enables system level power management across a broad range of applications in the **Consumer, Industrial and Automotive** Markets
- **Target applications** include
  - IP TV/ set top box
  - Tablet
  - Energy management
  - Embedded computing
  - Medical
  - Auto Infotainment
  - Industrial Control HMI
  - Home Automation & Security
  - POS

# MMPF0100 Features

- 4 to 6 buck converters depending on configuration
  - Single/ Dual phase/ parallel options
  - DDR termination tracking & DVS options
  - High efficiency at high and low current
- Boost regulator to 5V out
- Six general purpose linear regulators
- Programmable output voltage, sequence and timing
- OTP (One Time Programmable) memory configuration
  - Try-before-buy option
  - End customer programmable
- Coin cell charger and RTC supply
- DDR termination reference voltage
- Power control with processor interface and event detection
- I<sup>2</sup>C control
- Individually programmable ON, OFF and Standby modes
- Consumer/ Industrial and Automotive AEC-100 Grade 3 versions available

MMPF0100 Functional Internal Block Diagram



# PF0100 Key Differentiators

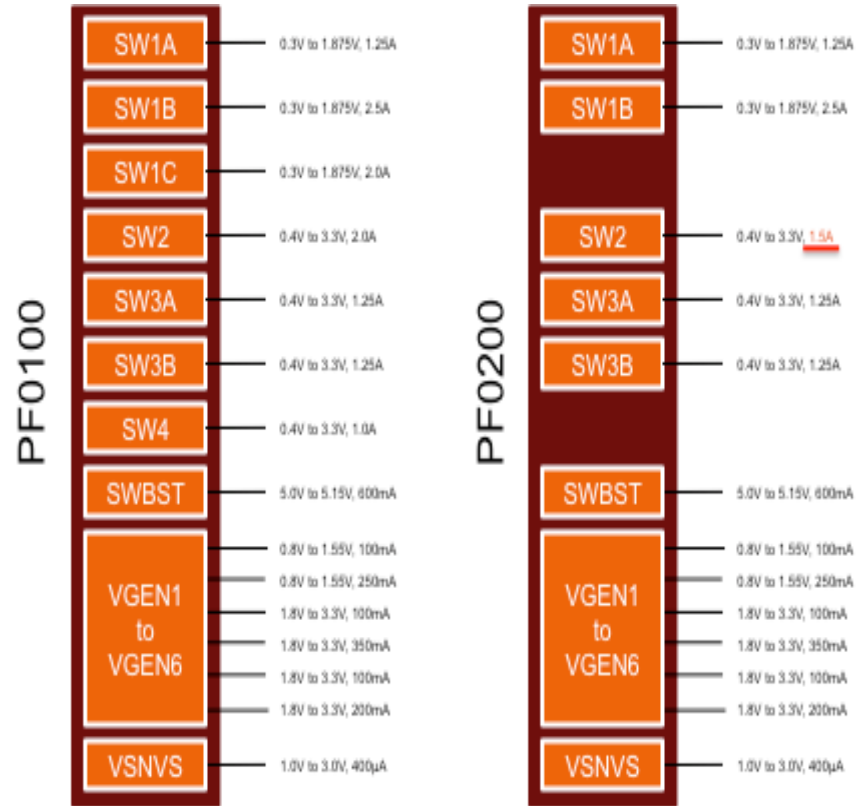
- System level power solution from a single IC
  - Reduces overall system BOM/ footprint/ cost
- Unique, configurable/ programmable architecture
  - Flexibility to support wide range of processors/ peripherals
- OTP memory with flexible programming options/ ease of use
  - Pre-programmed, customer programmed, or custom disti programming
- High efficiency conversion across the complete output range
  - Extends battery life/ reduces operating temperatures
- Proven i.MX6 reference designs w. schematics, layout and software
  - Provides fast time to market with reduced engineering effort
- Single supplier for i.MX and PMIC enables
  - Superior technical support
- Guaranteed long term availability
  - Registered on Freescale longevity program (10 years)





# PF0200 vs PF0200 Features

- PF0200 designed to support i.MX6SL/ i.MX6S
- Pin compatible to PF100
- SW1C and SW4 removed
- SW2 re-spec to 1.5A vs. 2.9A
- Sampling now!



# AMPD PF-Series Promotion

- **AMPD will continue to fully support the i.MX 6 platform PMIC's**
  - PF0100 C&I and Auto versions released
  - PF0200 samples available, MP release Q2'13
- **PF0100/200 should be promoted with i.MX 6 to all customers**
- **PF0100/0200 P2.0 silicon**
  - PF0100 P1.1 has 3 existing errata that will be fixed with P2.0 silicon
    - Work-around for P1.1 is proven
    - P1.3 engineering mask-set proven fix implemented on P2.0
    - Samples June '13, Release August '13 (Consumer)

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# Summary

Committed to provide world class **mixed signal and Packaging technology optimized for Industry and Consumer needs**

- Worldwide design and support in place
- Using Current Auto Analog products in the Industry
- Over 30 years experience in the Auto business(Auto products are mature)
- Focus in Motor Control in industry, Suitable products are E-switches & Drivers
- Wide range of systems expertise

Committed to meet & provide continuous improvement on **Quality, Delivery, and Customer Service** requirements

Committed to develop value added **Application Specific Standard Products & Customs ICs** for C&I solutions.





[www.Freescale.com](http://www.Freescale.com)