Advanced semiconductor solutions for door electronics

Innovative, scalable system solutions for door electronics

October 2008

Door-actuator drivers

STMicroelectronics' actuator drivers are designed for state-of-the-art automotive door-module applications. Devices are characterised by a scalable actuator-driving concept, which includes a certain package and software compatibility to satisfy today's multiplicity of door electronics variants. The actuator drivers support all regular door-module loads such as lock motors, mirror leveling, mirror retract, defroster, and several lighting functions from incandescent bulbs to LEDs. For high-end cars a new electrochromic mirror glass control IP has been added to the family.

Actuator driver family reference table

	L9949	L9950	L9951	L9953	L9953L[2]	L9954	L9954L[2]	L99DZ70[2]
PowerSO-20	•	–	–	–	–	–	–	–
PowerSO-36	–	•	•	•[1]	•[1]	•[1]	•[1]	•[1]
PowerSSO-36	–	• XP	• XP	• XP	• XP	• XP	• XP	• XP
SPI	•	•	•	•	•	•	•	ST SPI
Reverse battery supply	–	•	•	•	•	•	•	•
PWM1	–	•	•	•	•	•	•	•
PWM2	–	•	•	•	•	•	•	•
Current monitor	Selected HS 3x	Selected HS 5x	All HS 5x	Selected HS 4x	Selected HS 4x	Selected HS 4x	Selected HS 4x	All HS 11x
Recovery mode		•	•	•	•	•	•	•
Heater control ($R_{DS(on)}$, I limit)	100 mΩ 6.3 A	100 mΩ 6 A	–	100 mΩ 6 A	100 mΩ 6 A	100 mΩ 6 A	100 mΩ 6 A	90 mΩ 6 A
Programmable HS $R_{DS(on)}$	–	–	–	–	2x 500 mΩ/ 1800 mΩ	–	2x 500 mΩ/ 1800 mΩ	2x 500 mΩ/ 1800 mΩ
LED mode	–	–	–	–	2 x	–	2 x	4 x
Bulb/LED control ($R_{DS(on)}$, I limit)	–	4x 800 mΩ 1.5 A	2x 800 mΩ 1.25 A	2x 500 mΩ 1.5 A	2x 500 mΩ 1.5 A	2x 500 mΩ 1.5 A	2x 500 mΩ 1.5 A	4x 500 mΩ 1600 mΩ 1800 mΩ
Lock control ($R_{DS(on)}$, I limit)	150 mΩ 6 A	150 mΩ 6 A	150 mΩ 7.4 A	150 mΩ 6 A	150 mΩ 6 A	–	–	150 mΩ 6 A
Deadlock control ($R_{DS(on)}$, I limit)	–	300 mΩ 3 A	200 mΩ 5 A	–	–	–	–	300 mΩ 3 A
Mirror adjustment ($R_{DS(on)}$, I limit)	800 mΩ 1.6 A	800 mΩ 1.5 A	–	800 mΩ 1.5 A	1600 mΩ 0.75 A	800 mΩ 1.5 A	1600 mΩ 0.75 A	1600 mΩ 0.75 A
Mirror fold ($R_{DS(on)}$, I limit)	–	300 mΩ 3 A	–	–	–	–	–	300 mΩ 3 A
EC control	–	–	–	–	–	–	–	6-bit resolution 1.2 V/1.5 V

1. On request only
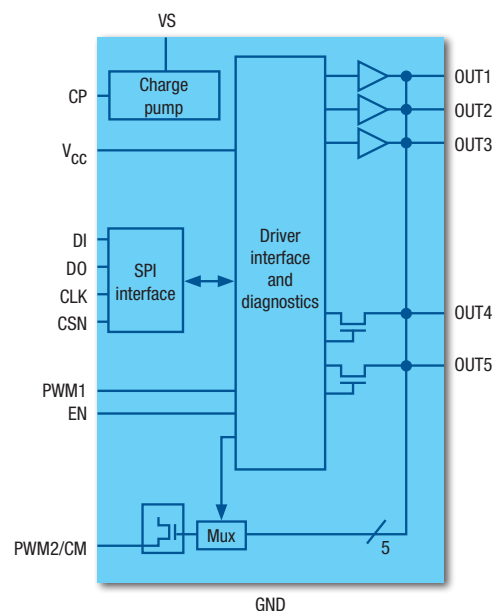2. Product in development

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L9949 features

- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- Three half bridges for 1.6 A load ($R_{DS(on)}$ = 800 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Very low current consumption in standby mode
  (I_S < 6 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- Separated half bridges for door lock motor
- Serial peripheral interface (SPI) to microcontroller
- Current monitor output for high-side drivers
  OUT1, OUT2 and OUT6
- Undervoltage and overvoltage switch off
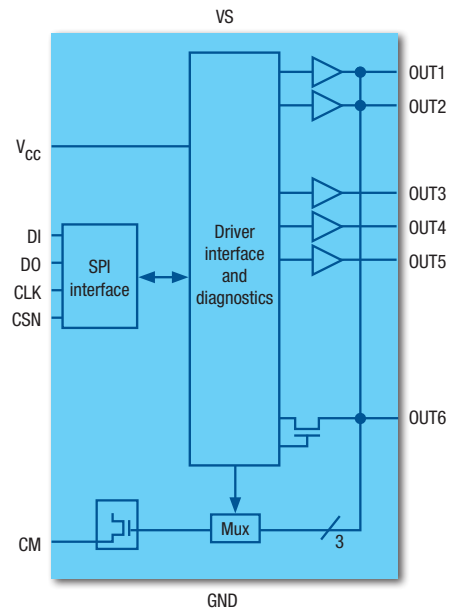
PowerSO-20

L9951 features

- One half bridge for 7.4 A load ($R_{DS(on)}$ = 150 mΩ)
- Two half bridges for 5 A load ($R_{DS(on)}$ = 200 mΩ)
- Two high-side drivers for 1.25 A load ($R_{DS(on)}$ = 800 mΩ)
- Programmable softstart function to drive loads with
  higher inrush currents (> 7.4 A, > 1.25 A)
- Very low current consumption in standby mode
  (I_S < 3 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers
  OUT1, OUT2, OUT3, OUT4 and OUT5
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
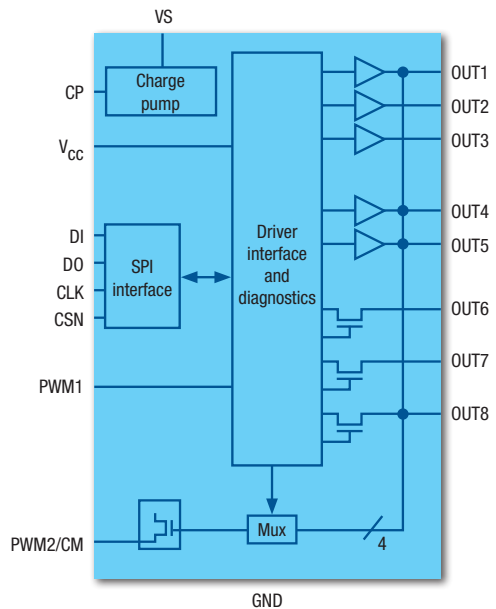- Undervoltage and overvoltage switch off

PowerSSO-36

PowerSO-36

3

L9953 features

- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- Three half bridges for 1.5 A load ($R_{DS(on)}$ = 800 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Two high-side drivers for 1.5 A load ($R_{DS(on)}$ = 500 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers OUT1, OUT4, OUT5 and OUT8
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- Separated half bridges for door lock motor
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
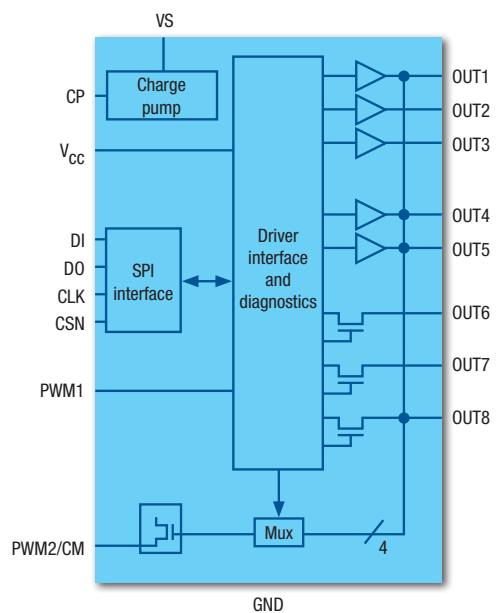- Undervoltage and overvoltage switch off

PowerSSO-36

PowerSO-36

L9953LXP features

- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- Three half bridges for 0.75 A load ($R_{DS(on)}$ = 1600 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Two configurable high-side drivers for up to 1.5 A load ($R_{DS(on)}$ = 500 mΩ) or 0.35 A load ($R_{DS(on)}$ = 1800 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers OUT1, OUT4, OUT5 and OUT8
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- Separated half bridges for door lock motor
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
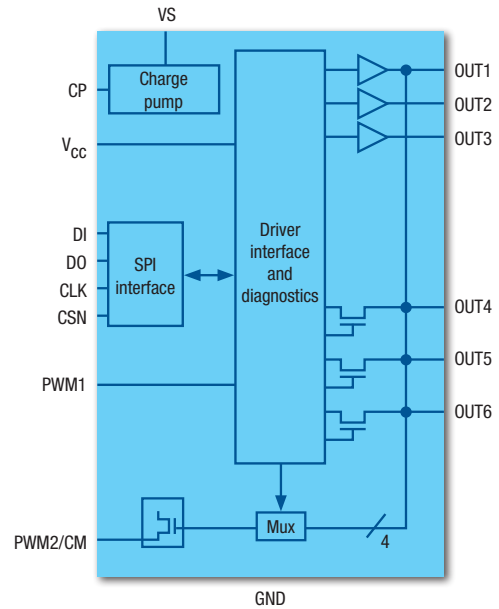- Undervoltage and overvoltage switch off

PowerSSO-36

L9954 features

- Three half bridges for 1.5 A load ($R_{DS(on)}$ = 800 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Two high-side drivers for 1.5 A load ($R_{DS(on)}$ = 500 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers OUT1, OUT4, OUT5 and OUT6
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
- Undervoltage and overvoltage switch off

PowerSSO-36

PowerSO-36

L9954LXP features

- Three half bridges for 0.75 A load ($R_{DS(on)}$ = 1600 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Two configurable high-side drivers for up to 1.5 A load ($R_{DS(on)}$ = 500 mΩ) or 0.35 A load ($R_{DS(on)}$ = 1800 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers OUT1, OUT4, OUT5 and OUT6
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
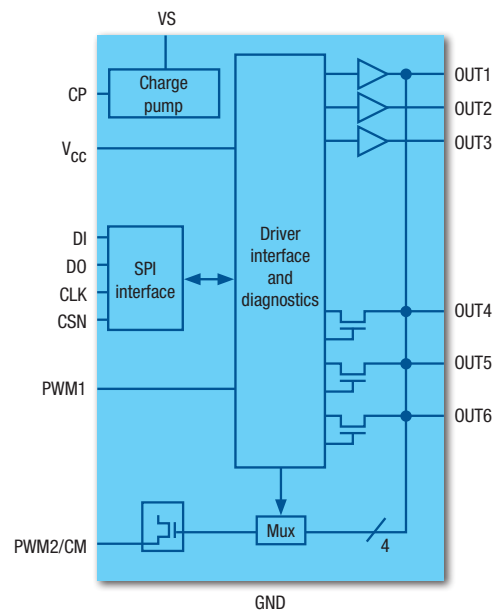- Undervoltage and overvoltage switch off

PowerSSO-36

L9950 features

- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- Two half bridges for 3 A load ($R_{DS(on)}$ = 300 mΩ)
- Two half bridges for 1.5 A load ($R_{DS(on)}$ = 800 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 100 mΩ)
- Four high-side drivers for 1.5 A load ($R_{DS(on)}$ = 800 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, I_{CC} < 25 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for high-side drivers OUT1, OUT4, OUT5, OUT6 and OUT11
- All outputs over-temperature protected
- Open load diagnostics for all outputs
- Overload diagnostics for all outputs
- Separated half bridges for door lock motor
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
- Undervoltage and overvoltage switch off

PowerSSO-36
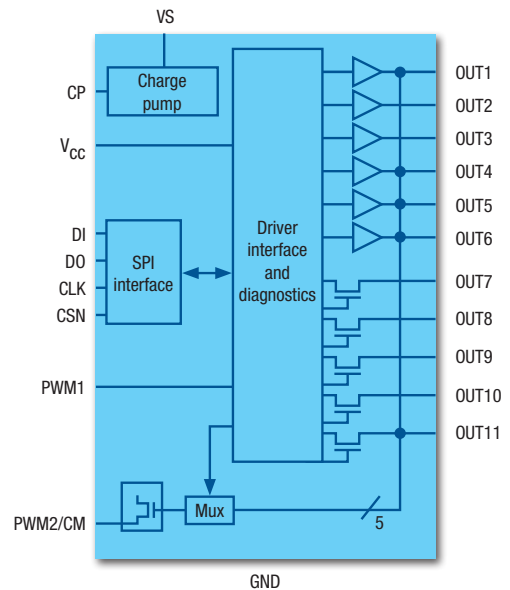
PowerSO-36

L99DZ70XP features

- Embedded electrochromic glass control block
- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- Two half bridges for 3 A load ($R_{DS(on)}$ = 300 mΩ)
- Two half bridges for 0.75 A load ($R_{DS(on)}$ = 1600 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 90 mΩ)
- Two configurable high-side drivers for up to 1.5 A load ($R_{DS(on)}$ = 500 mΩ) or 0.4 A load ($R_{DS(on)}$ = 1800 mΩ)
- Two high-side drivers for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ)
- Programmable softstart function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, I_{CC} < 5 µA, typical T_j < 85 °C)
- All outputs short-circuit protected
- Current monitor output for all high-side drivers
- All outputs over-temperature protected
- Open load and overcurrent protection and diagnostics for all outputs
- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Undervoltage and overvoltage switch off

PowerSSO-36
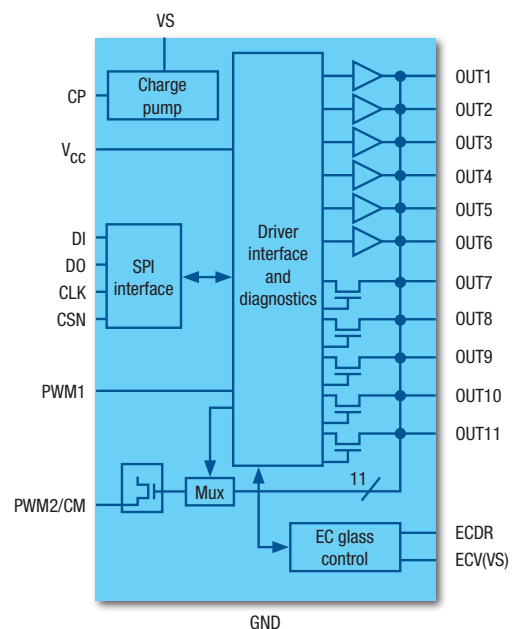
6

L99DZ70/L99PM62: high-end driver and passenger door

Contact monitoring

LIN

CAN

L99PM62

Power management system device

Power window

Child safety

SafeLED

Interior handle illumination

Puddle lamp

SPI

SPC560B/D

32-bit microcontroller

L99DZ70

Door actuator driver

Mirror adjustment

Mirror adjustment

Mirror fold

Lock

Dead lock

Turn indicator

Safety light

Switch illumination

Electrochromic glass

Defroster
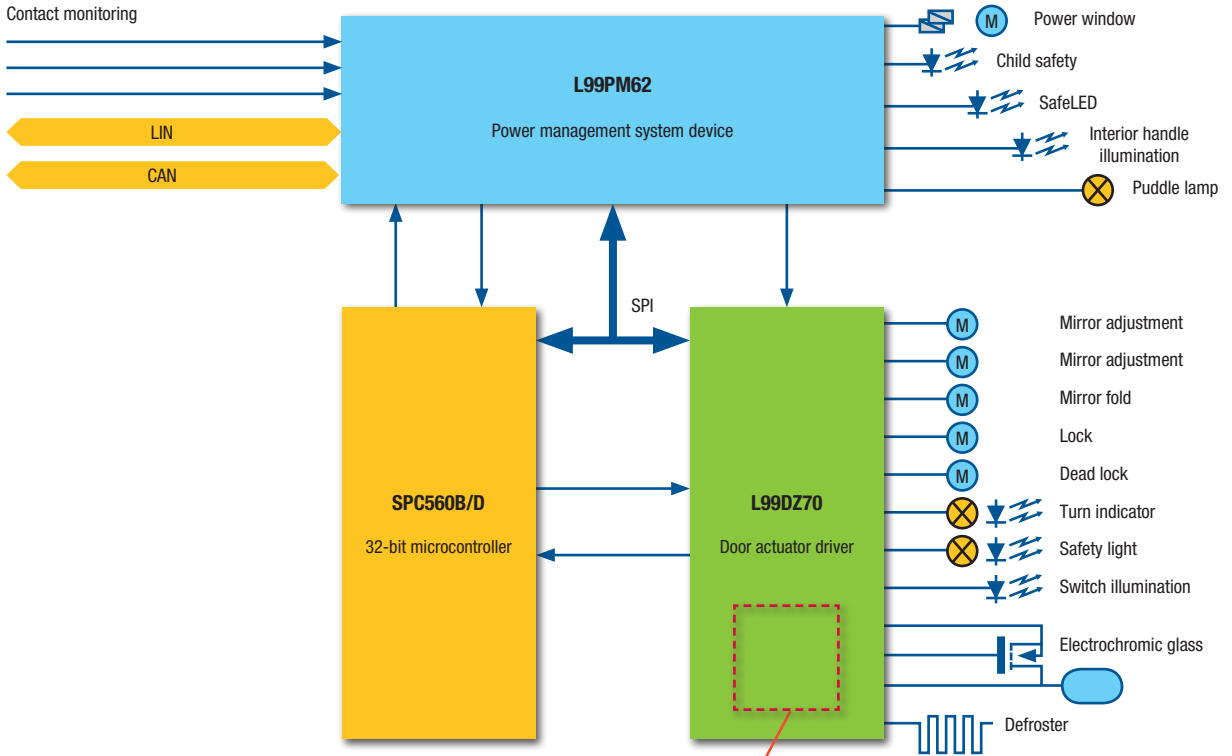
L99DZ70

Door-actuator driver with embedded electrochromic control block

VS

L99DZ70XP

Programmable EC voltage 6-bit resolution

Protected supply

| 1 | 0 | 1 | 0 | 1 | 0 |

SPI

Logic

DAC

OUT10

Maximum EC voltage 1.2 V/1.5 V

ECDR

STD18NF03L

Electrochromic mirror glass

EC voltage not reached EC voltage too high

ECV

Fast discharge

EC Control IP

GND
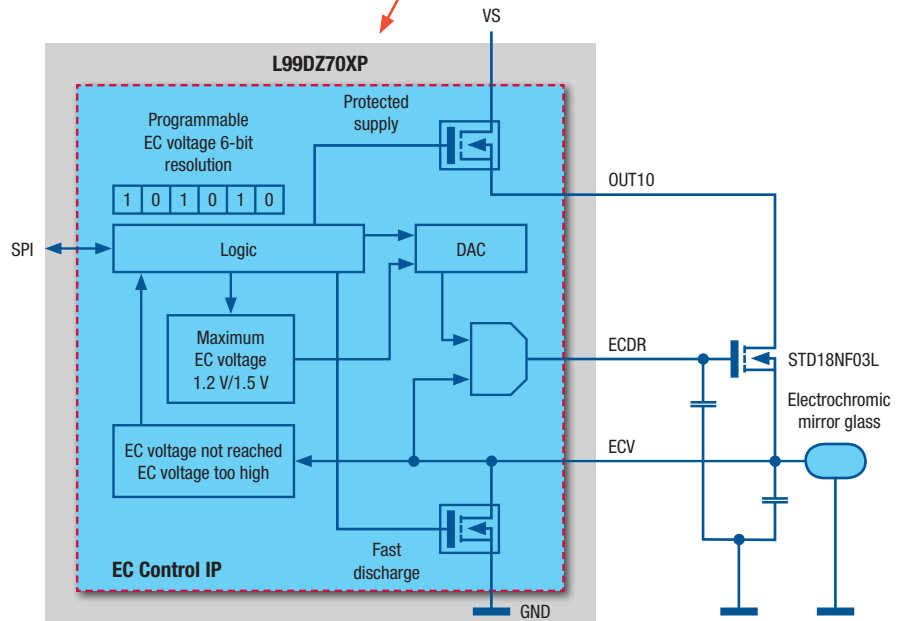
L99DZ70XP electrochromic (EC) control block features

- EC voltage control with 6-bit resolution (max voltage = 1.5 V)
- Maximum voltage limitation programmable at 1.2 V and 1.5 V to protect the external EC glass
- All programming and diagnosis via SPI
- Protected supply for external drop regulator MOSFET (STD18NF03L)
- Fast discharge switch to GND for fast brightening of EC glass
- Voltage-not-reached diagnosis
- Voltage-too-high diagnosis

Power management devices

STMicroelectronics' advanced power management devices contain LIN and HS-CAN physical layers. They enable the application to achieve an ultra low quiescent current down to 7 µA, while providing comprehensive fail-safe functionality to satisfy safety requirements for applications such as power window control.

Power management family reference table
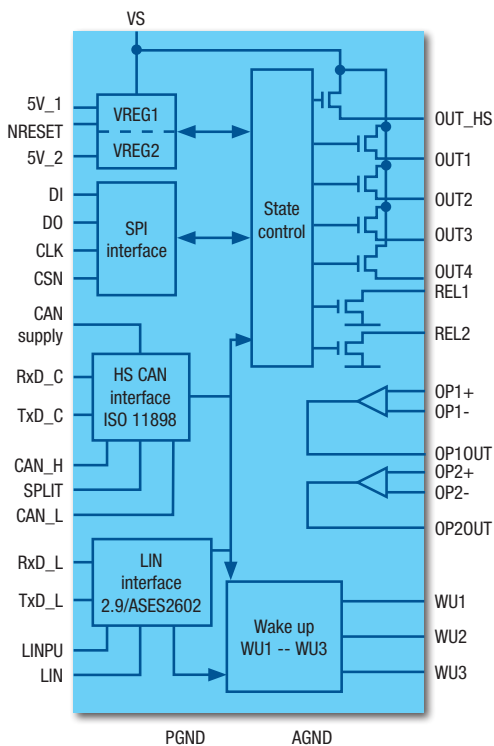
	PowerSSO-36	SO-16 narrow	SPI	LIN 2.1 SAEJ 2602 compliant	HS CAN ISO 11898	V1 regulator (mA)	V2 regulator (mA)	Window watchdog (ms)	Fail-safe output	Contact monitoring inputs	Cyclic contact monitoring	Cyclic wake	Direct drive for high-side drivers	Timers	PWM inputs	Vs/temp monitoring output	High-side drivers	Low-side drivers	Digital outputs	Operational amplifiers	Advanced thermal protection	Vs over/undervoltage detection
L9952GXP	•	–	•	•	–	250	100	10	•	4	•	–	–	2	2	–	1 x 1 Ω 4 x 7 Ω	2 x 2 Ω	2	2	•	•
L99PM62XP[1]	•	–	ST SPI	•	•	250	100	•[2]	•	3	•	•	–	2	4 x internal	–	1 x 1 Ω 4 x 7 Ω	2 x 2 Ω	–	2	•	•
L99PM60S[1]	–	•	ST SPI	•	–	100	–	10	•	–	•	–	Direct drive	–	Direct drive	•	2 x 7 Ω	2 x 2 Ω	–	–	•	•

1. Product in development
2. Programmable

L99PM62

Companion chip with embedded HS-CAN and LIN physical layers

VS

5V_1 — VREG1
NRESET
5V_2 — VREG2

DI
DO — SPI interface
CLK
CSN

CAN supply

RxD_C
TxD_C — HS CAN interface ISO 11898

CAN_H
SPLIT
CAN_L

RxD_L
TxD_L — LIN interface 2.9/ASES2602

LINPU
LIN

State control — Wake up WU1 -- WU3

OUT_HS
OUT1
OUT2
OUT3
OUT4
REL1
REL2

OP1+
OP1-
OP1OUT
OP2+
OP2-
OP2OUT

WU1
WU2
WU3

PGND   AGND

PowerSSO-36

L99PM62 features

- 5 V low-drop voltage regulator for microcontroller supply (250 mA)
- 5 V low-drop voltage regulator for peripheral supply (100 mA)
- Voltage regulator stable with 220 nF load capacitor
- Very low standby current
  - 12 µA in V_{bat} standby
  - 52 µA in V1 standby
  - 63 µA in cyclic wake-up (50 ms)
- Programmable window watchdog with fail-safe functionality
- Programmable V1 reset generator
- Programmable timeout interrupt
- Wake-up logic with cyclic contact monitoring
- Three configurable wake-up inputs
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- HS-CAN (ISO 11898) physical layer
- Separate GND pin for physical layer
- 24-bit SPI interface for mode control and diagnostics
- ST SPI with fail-safe functionality
- Seven output drivers
  - Four high-side drivers for LED or hall sensor supply ($R_{DS(on)} = 7\ \Omega$)
  - One high-side driver ($R_{DS(on)} = 1\ \Omega$)
  - Two low-side relay drivers ($R_{DS(on)} = 2\ \Omega$)
- Four internal PWM timers with phase shift
- All outputs short-circuit and temperature protected
- Two op-amps for GND compatible current sensing
- Temperature warning and thermal shutdown
- Programmable undervoltage and overvoltage switch off

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PowerSSO-36
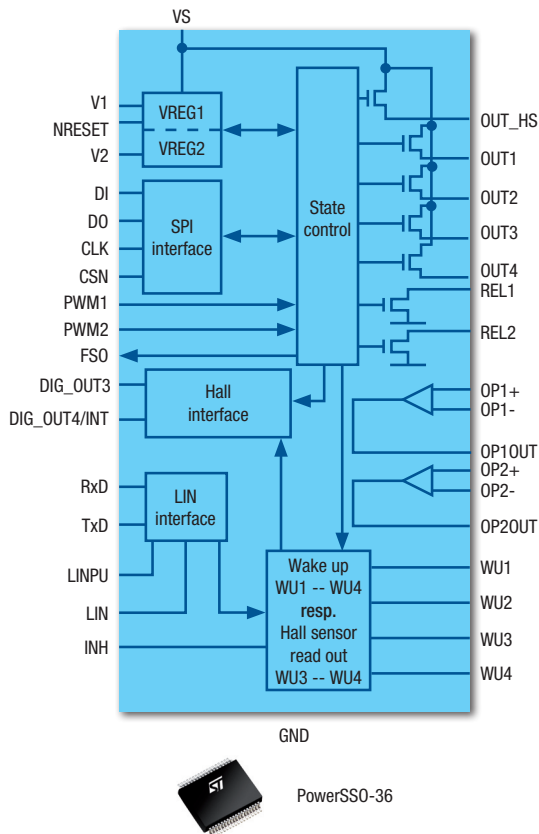
L9952GXP features

- 5 V low-drop voltage regulator for microcontroller supply (250 mA)
- 5 V low-drop voltage regulator for peripheral supply (100 mA)
- Voltage regulator stable with 220 nF load capacitor
- Very low standby current
  - 7 µA in V_{bat} standby
  - 45 µA in V1 standby
  - 75 µA in cyclic wake-up (50 ms)
- Window watchdog with fail-safe functionality
- Fail-safe output
- Wake-up logic with cyclic contact monitoring
- Four configurable wake-up inputs
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- Seven output drivers
  - Four high-side drivers for LED or hall sensor supply ($R_{DS(on)}$ = 7 Ω)
  - One high-side driver ($R_{DS(on)}$ = 1 Ω)
  - Two low side relay drivers ($R_{DS(on)}$ = 2 Ω)
- All outputs short-circuit and temperature protected
- Two op-amps for GND compatible current sensing
- Temperature warning and thermal shutdown
- Undervoltage and overvoltage switch off

L9952GXP: typical application overview
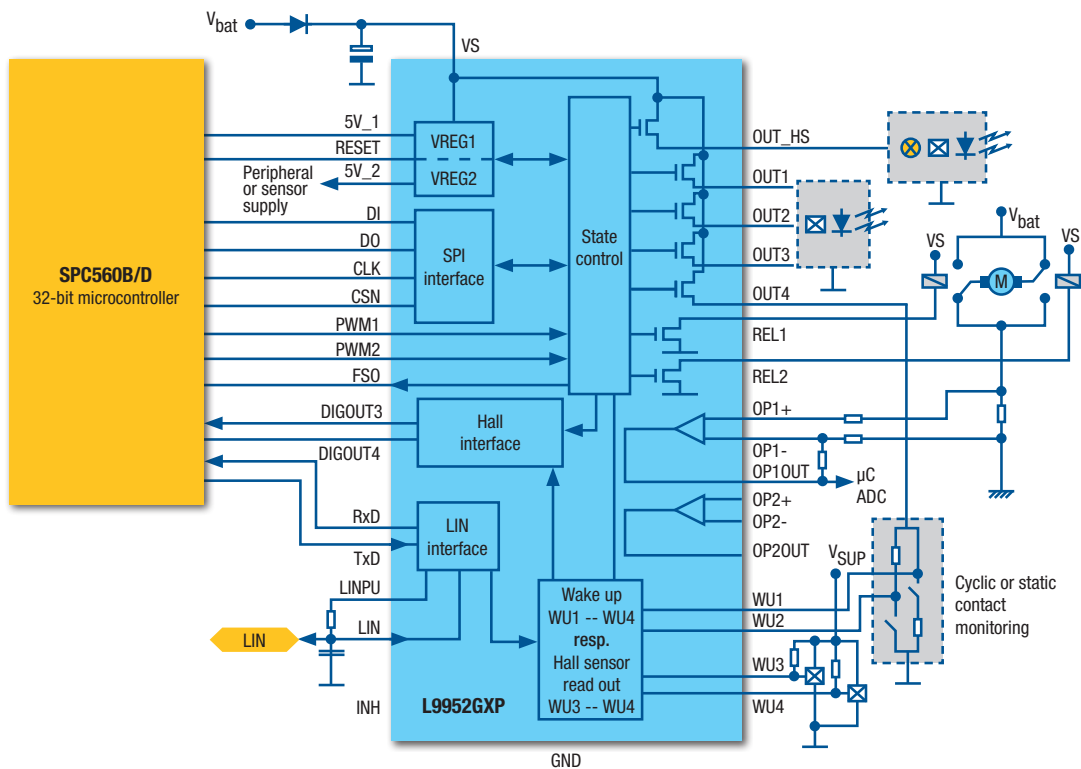
The companion chip L9952GXP provides power management for the entire door system and also controls several loads from the power window relay to PWMed LEDs. Furthermore, wake-up is provided via contact monitoring and Hall sensor inputs, as well as via the CAN and LIN transceivers.
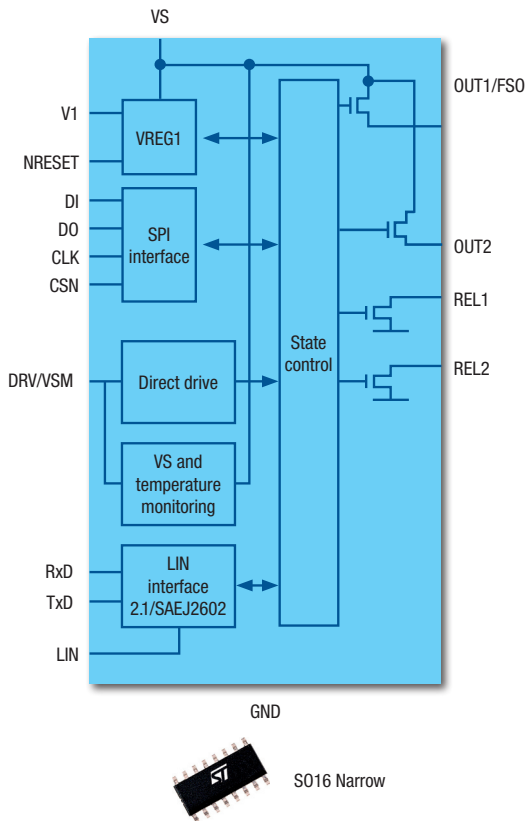
L99PM60 features

- 5 V low-drop voltage regulator (100 mA)
- Voltage regulator stable with 220 nF load capacitor
- Programmable V1 reset generator
- Very low standby current
  - 7 µA in V_{bat} standby
  - 45 µA in V1 standby
- Window watchdog with fail-safe functionality
- Fail-safe output
- 16-bit SPI interface with fail-safe functionality
- Supply voltage monitoring
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- High-speed LIN Flash mode up to 100 Kbit/s
- Two high-side drivers for LED, Hall sensor or contact supplies ($R_{DS(on)}$ = 7 Ω)
- Two relay drivers ($R_{DS(on)}$ = 2 Ω)
- All outputs short-circuit and temperature protected
- Temperature warning and thermal shutdown
- Analog temperature monitoring output
- Direct drive feature for high-side drivers
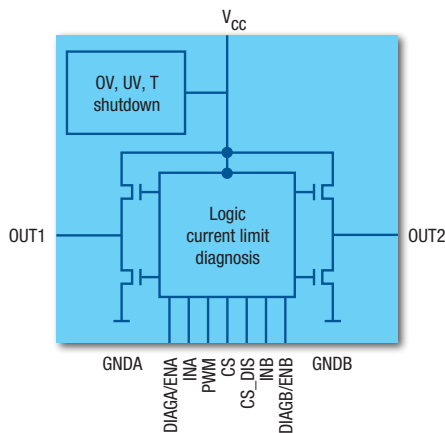- Undervoltage and overvoltage switch off

L99PM60, STM8A: flexible chip set, tailored for mechatronic power window applications
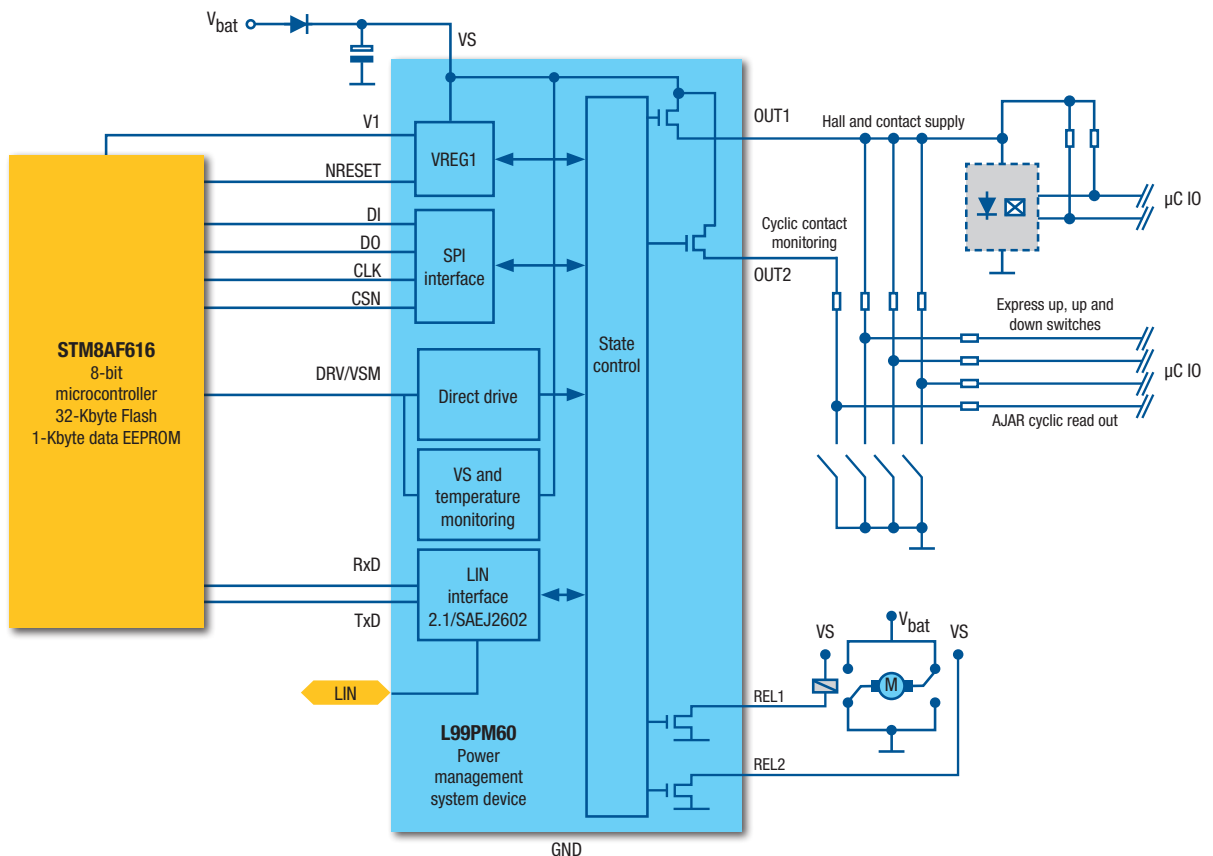
H-bridge motor drivers for power windows, door locks and mirror adjustment

STMicroelectronics' single-package power bridges (VNH3ASP30 and VNH5019) are able to support a load current of up to 30 A – ideal candidates for semiconductor-driven power window applications. They support PWM up to 20 kHz to allow soft start up and soft shutdown, increasingly required by the market. Door locks may be driven in standalone configuration using a device from the VN(5)77x H-bridge driver family.

The L99MC6 is a new device for standalone mirror adjustment. A key benefit of this circuit is the tiny PowerSSO-16 package, following the trend toward smaller PCB outlines.

MultiPowerSO-30

VNH3ASP30 features

- High side: 2 x 30 mΩ
- Low side: 2 x 12 mΩ
- 20 kHz PWM operation at low side
- Output current: 30 A
- Current sense output
- Current limitation
- 5 V logic level compatible inputs
- Undervoltage and overvoltage shutdown
- Thermal shutdown
- Cross-conduction protection
- Low standby power consumption
- Protection against loss of ground and loss of V_{cc}
- Package: MultiPowerSO-30
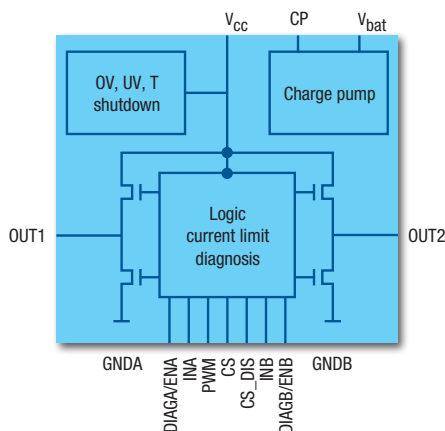
MultiPowerSO-30

VNH5019 features

- High side: 2 x 14 mΩ
- Low side: 2 x 5 mΩ
- 20 kHz PWM operation at low side
- Output current: 30 A
- Charge pump output to control reverse polarity MOSFET
- Current sense output
- Current limitation
- 3 V logic level compatible inputs
- Undervoltage and overvoltage shutdown
- Thermal shutdown
- Cross-conduction protection
- Low standby power consumption
- Protection against loss of ground and loss of V_{cc}
- Package: MultiPowerSO-30

SO-28
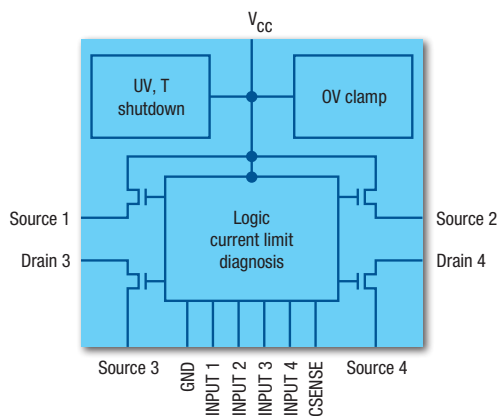
VN5772AK features

- High-side: 2 x 50 mΩ
- Low-side: 2 x 50 mΩ
- Output current: 18 A
- Current sense output
- Current limitation
- 5 V logic level compatible inputs
- Undervoltage shutdown
- Overvoltage clamp
- Thermal shutdown
- Low standby power consumption
- Protection against loss of ground and loss of V_{CC}
- Package: SO-28

H-bridge family reference table (mid-current)

Part number	$R_{DS(on)}$ (mΩ) per leg	I_{LIM}(A) typical	Operating range (V)	Status	Thermal shutdown	Package
VN770K	220	10	5.5 to 36	Digital	HS/LS	SO-28
VN771K	95	9	5.5 to 36	Digital	HS/LS	SO-28
VN772K	120	9	5.5 to 36	Digital	HS/LS	SO-28
VN5770AK	280	10	4.5 to 36	Analog	HS/LS	SO-28
VN5772AK	100	18	4.5 to 36	Analog	HS/LS	SO-28

H-bridge family reference table (high-current)

Part number	$R_{DS(on)}$ (mΩ) per leg	I_{LIM}(A) typical	Operating range (V)	Status	Thermal shutdown	Max PWM frequency (kHz)	Package
VNH2SP30	19	30	5.5 to 16	Analog	HS	20	MultiPowerSO-30
VNH3SP30	45	30	5.5 to 36	Digital	HS	10	MultiPowerSO-30
VNH3ASP30	45	30	5.5 to 16	Analog	HS	20	MultiPowerSO-30
VNH5019	19	30	4.5 to 24	Analog	HS/LS	20	MultiPowerSO-30

VNH5019/L99MC6: semiconductor driven power window and standalone mirror adjustment
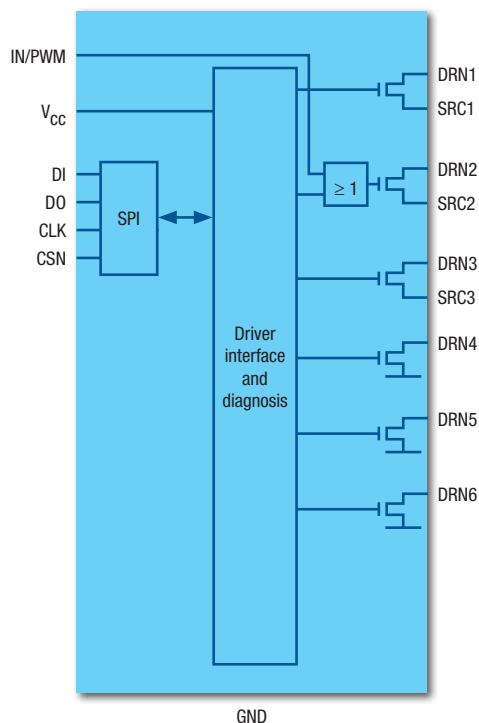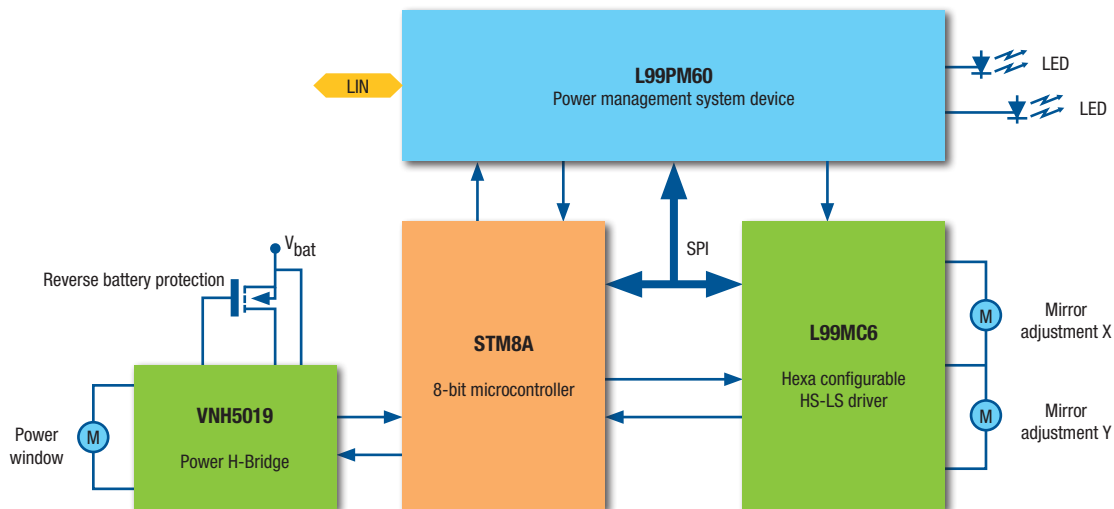
L99MC6 features

- Configurable up to three high-side or six low-side drivers
- $R_{DS(on)}$ max = 1.0 Ω @ T_j = 25 °C
- Current limit of each output: 0.6 A min
- Direct input for channel 2, configurable for other outputs
- ST SPI interface (16-bit) for data communication and diagnostics
- Diagnosis of open-load detection in off state
- Diagnosis of shorted-load detection in on state
- Programmable bridge, LED, bulb mode
- Logic supply voltage compatible with 3.3 V and 5 V
- Output voltage clamping
- Temperature pre-warning and thermal shutdown
- Package: PowerSSO-16

PowerSSO-16

L9950, L9953, L9954 family approach

- Actuator driver family covering various front-door variants
- Scalable family approach with:
  - Hardware (HW) compatibility, pin-to-pin
  - Software (SW) compatibility
- Devices can be changed using the same SW
  - Each physical pin/output is controlled by the same SPI bit
  - Each diagnostic data for the same physical pin/output is indicated by the same status bit
- Same PCB can be used for different door variants
  - To be defined at customer line end with the corresponding driver
  - Only 1 PCB to be developed, qualified and maintained by the customer
- Different packages available: PowerSO-36 and PowerSSO-36

L9950, L9953, L9954 family approach for front-door modules
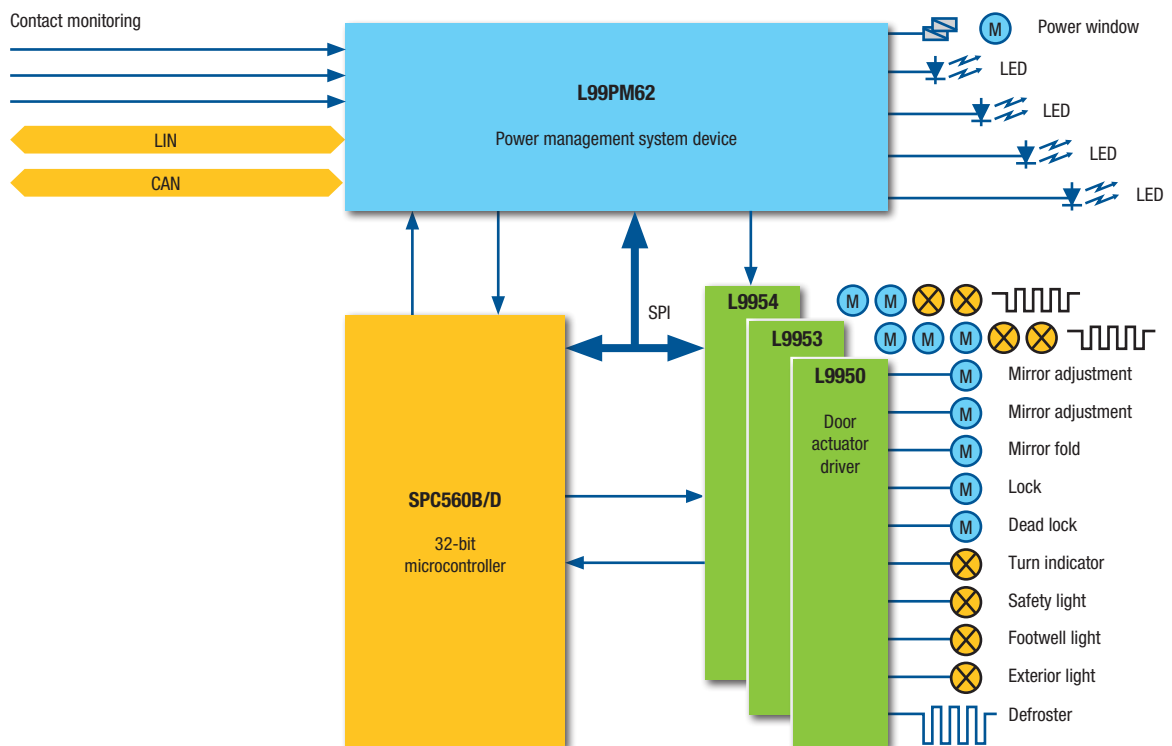
The actuator drivers L9950, L9953 and L9954 are interchangeable based on a common PC-board layout and wiring. A unique PC-board design may thus be used for the entire door module for a car. Even for software driving via the SPI interface, a modular structure, valid for all actuator drivers, may be developed.

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L9952, L9951: low-end rear door

Contact monitoring

L9952GXP

Power management system device

Power window

LED

LED

LED

LED

LIN

STM8A

8-bit microcontroller

SPI

L9951

Door actuator driver

Lock

Dead lock

Safety light

Footwell light
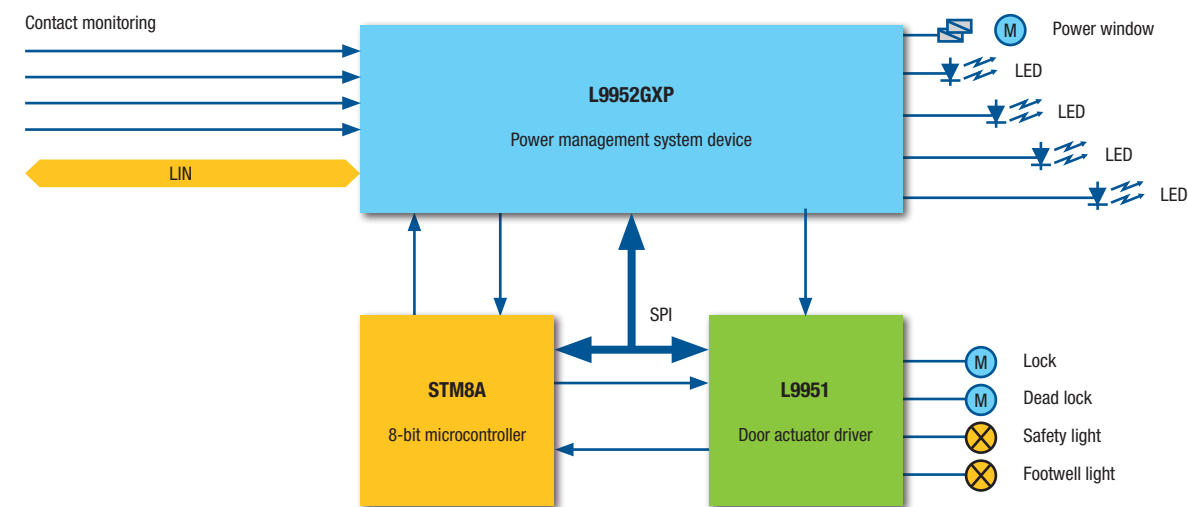
Typical network topology for door module applications

Electrochromic mirror glass

Mirror adjustment

Mirror adjustment

Mirror fold

Lock

Dead lock

Power window

Contact monitoring

Turn indicator

Safety light

Footwell light

Exterior light

Defroster

Footwell light

Safety light

Lock

Dead lock

Power window

Contact monitoring

Front door module
L99DZ70/50/53/54
L99PM62/52

LIN

Rear door module
L9951
L99PM60/52

HS-CAN

Gateway

Contact Monitoring

Mirror adjustment

Mirror adjustment

Mirror fold

Lock

Dead lock

Power window

Electrochromic mirror glass

Turn indicator

Safety light

Footwell light

Exterior light

Defroster

Front door module
L99DZ70/50/53/54
L99PM62/52

LIN

Rear door module
L9951
L99PM60/52

Footwell light

Safety light

Lock

Dead lock

Power window

Contact monitoring

The diagram shows a typical networking topology for how to interconnect four door modules to a central gateway. For a fast access time, front-door modules may best be addressed via a CAN bus, either high or low speed. For the rear-door modules, a cost-effective LIN-bus wiring is sufficient. STMicroelectronics offers a flexible, cost-effective driver approach for each system partitioning which supports the entire actuator portfolio available for all door-module applications.

STM8A MCU family: automotive 8-bit Flash microcontrollers

STMicroelectronics introduces the STM8A, a new product line of 8-bit Flash microcontrollers dedicated to the specific needs of automotive applications. From product specifications, on through design and manufacturing, our focus is on reliability, application robustness and low system cost.

The modularity and compatibility of this product family offer the perfect platform solution in an environment where requirements change and the ability to reuse design concepts leads to competitive cost advantages.

STM8A devices are particularly suited for applications requiring non-volatile data storage. The integrated true data EEPROM features state-of-the-art endurance and data retention throughout the full temperature range. Complex EEPROM emulation strategies are no longer required.

All products are optimized for reduced power and low EMC. The efficient STM8 core delivers leading-edge execution speed even at low CPU clock frequencies. Powertrain applications benefit from the extended temperature range up to 145 °C. The STM8A is the ideal and economic solution for the growing market of automotive 8-bit applications.

Applications

- Body controllers
- LIN nodes
- Actuators
- Sensors
- Safety microcontrollers
- Car radios
- DC motor control
- HVAC
- Keyless entry
- Immobilizers
- TPMS

STM8A block diagram
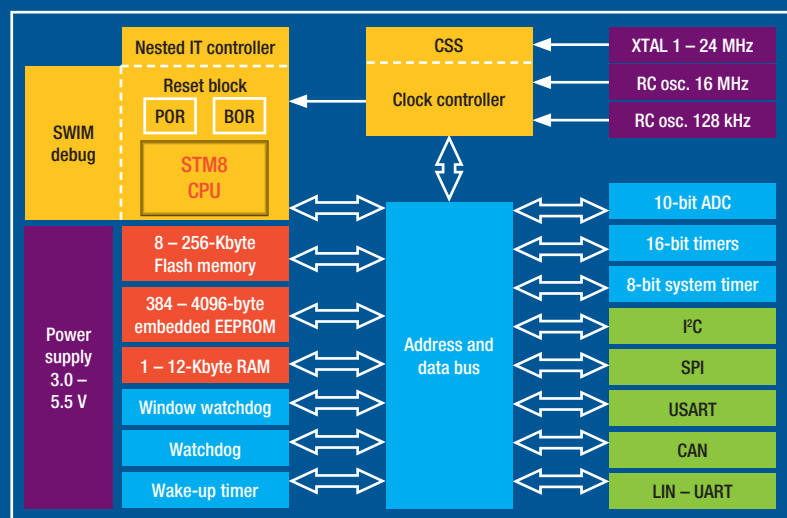
STM8A product lines

STM8A family overview

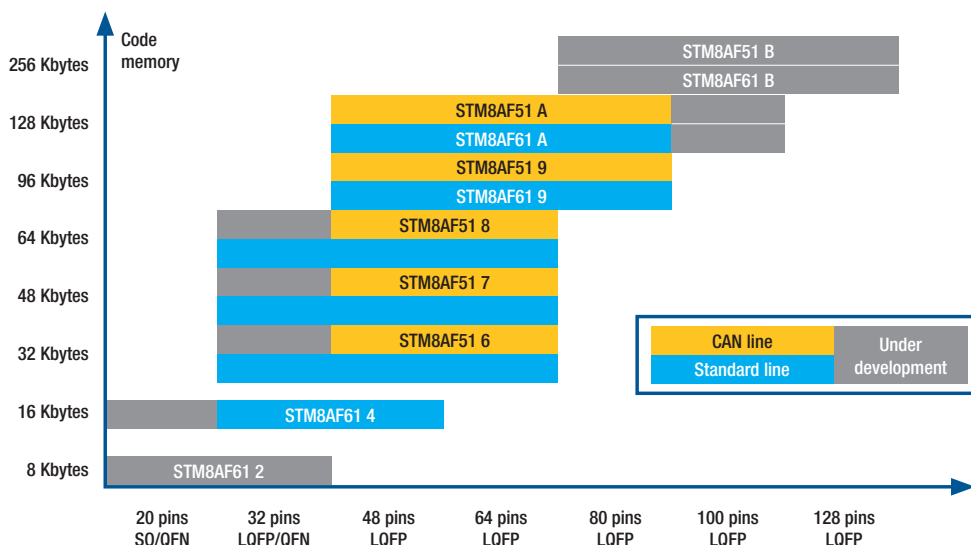| Part number		Prog. (bytes)	Data EEPROM (bytes)	RAM (bytes)	10-bit A/D	Timers (IC/OC/PWM)	Serial interfaces	CAN[1]	Other	VDD
128-pin LQFP	STM8AF61BC	256 K	4 K	12K	28	1 x 8-bit 4 x 16-bit (12/12/12)	LIN-UART, 2 x USART, UART, 2 x SPI, 2 x I²C	Optional	Window and standard watchdogs 16 MHz RC oscillator 128 kHz RC oscillator CSS	3 V to 5.5 V
100-pin LQFP	STM8AF61BB	256 K	4 K	12 K						
	STM8AF61AB	128 K	2 K	6 K						
80-pin LQFP	STM8AF61BA	256 K	4 K	12 K	16	1 x 8-bit 3 x 16-bit (9/9/9)	LIN-UART USART SPI, I²C			
	STM8AF61AA	128 K	2 K	6 K						
	STM8AF619A	96 K	2 K	6 K						
64-pin LQFP	STM8AF61A9	128 K	2 K	6 K						
	STM8AF6199	96 K	2 K	6 K						
	STM8AF6189	64 K	1.5 K	4 K						
	STM8AF6179	48 K	1.5 K	3 K						
	STM8AF6169	32 K	1 K	2 K						
48-pin LQFP/QFN	STM8AF61A8	128 K	2 K	6 K	10					
	STM8AF6198	96 K	2 K	6 K						
	STM8AF6188	64 K	1.5 K	4 K						
	STM8AF6178	48 K	1.5 K	3 K						
	STM8AF6168	32 K	1 K	2 K						
	STM8AF6148	16 K	0.5 K	1 K						
32-pin LQFP/QFN	STM8AF6186	64 K	1.5 K	4 K	7	1 x 8-bit, 3 x 16-bit (8/8/8)	LIN-UART SPI, I²C	In design		
	STM8AF6176	48 K	1.5 K	3 K						
	STM8AF6166	32 K	1 K	2 K						
	STM8AF6146	16 K	0.5 K	1 K		1 x 8-bit, 2 x 16-bit (6/6/6)	LIN-UART SPI	No		
20-pin SO/QFN	STM8AF6143	16 K	0.5 K	1 K	5					
	STM8AF6142	8 K	384	0.5 K						

1. The CAN version order-code prefix is STM8AF51xx

	Product	Description	Order code
Development software	ST MCU toolset	Toolset for building, debugging and programming applications includes assembler-linker, ST Visual Develop (STVD) IDE, integrated control of Cosmic and Raisonance C compilers, and ST Visual Programmer (STVP)	Free download
	RIDE	Raisonance IDE with C compiler, RBuilder and RFlasher programming software	(note 1)
Compiler	Cosmic	C Compiler for ST 8-bit microcontrollers. Available in free version that outputs up to 16 Kbytes of code	(note 1)
	Raisonance	C Compiler for ST 8-bit microcontrollers. Available in free version that outputs up to 16 Kbytes of code	(note 1)
Libraries and drivers	CAN driver	Certified CAN driver from Vector Software GmbH	(note 1)
	STM8 Library	ST standard firmware library covering all standard device peripherals	Free download
	LIN driver	ST LIN driver and package supporting STM8A LIN-UART	(note 3)
Emulation system	STICE	Advanced emulation system for ST microcontrollers provides configurable breakpoints, Trace, Code Coverage[2] and Profiling[2], plus in-circuit debugging/programming capability (SWIM)	CB-STICE-S001
In-circuit debugger/ programmer	RLink	Raisonance in-circuit debugger/programmer for ST microcontrollers supports SWIM interfaces	CB-STX-RLINK
Evaluation board	CB-8/128-EVAL	ST full-featured evaluation board for STM8A microcontrollers	CB-8/128-EV/WS

1. For ordering information pricing and order codes, refer to the respective third-party tool provider
2. Under development
3. Available free of charge, contact your nearest sales office

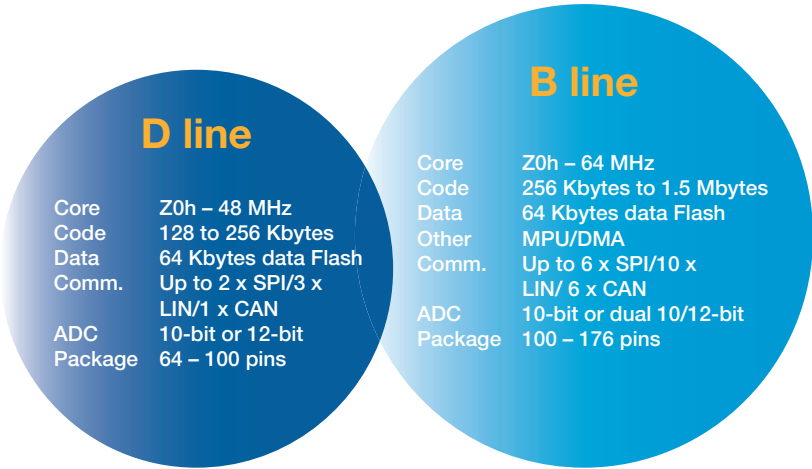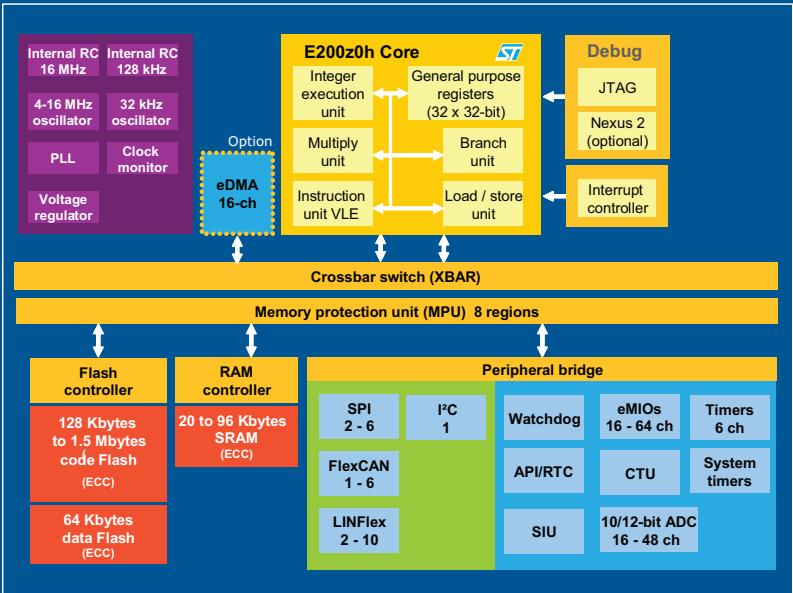# SPC56xD/B MCU family: automotive 32-bit Flash microcontrollers

STMicroelectronics' SPC56xB/D family of 32-bit Flash microcontrollers is dedicated to the specific needs of body and convenience applications.

The modularity and compatibility of the product family portfolio is set to an unmatched level. A new state-of-the-art technology combined with a high-performance core and tailor-made peripherals, make this family of products the perfect platform solution, achieving the best equilibrium between system cost and performance.

From product specification, on through design and manufacturing, focus is on reliability, application robustness and added value.

The use of an industry standard PowerPC® core, sharing standard peripherals with similar products across all application fields, increases integration, maximizes design reuse and shortens time to market.

SPC56xB/D block diagram

Internal RC 16 MHz	Internal RC 128 kHz
4-16 MHz oscillator	32 kHz oscillator
PLL	Clock monitor
Voltage regulator	

Option
eDMA 16-ch

E200z0h Core
- Integer execution unit
- General purpose registers (32 x 32-bit)
- Multiply unit
- Branch unit
- Instruction unit VLE
- Load / store unit

Debug
- JTAG
- Nexus 2 (optional)
- Interrupt controller

Crossbar switch (XBAR)

Memory protection unit (MPU) 8 regions

Flash controller
128 Kbytes to 1.5 Mbytes code Flash (ECC)
64 Kbytes data Flash (ECC)

RAM controller
20 to 96 Kbytes SRAM (ECC)

Peripheral bridge
- SPI 2 - 6
- I²C 1
- Watchdog
- eMIOs 16 - 64 ch
- Timers 6 ch
- FlexCAN 1 - 6
- API/RTC
- CTU
- System timers
- LINFlex 2 - 10
- SIU
- 10/12-bit ADC 16 - 48 ch

D line
Core	Z0h – 48 MHz
Code	128 to 256 Kbytes
Data	64 Kbytes data Flash
Comm.	Up to 2 x SPI/3 x LIN/1 x CAN
ADC	10-bit or 12-bit
Package	64 – 100 pins

B line
Core	Z0h – 64 MHz
Code	256 Kbytes to 1.5 Mbytes
Data	64 Kbytes data Flash
Other	MPU/DMA
Comm.	Up to 6 x SPI/10 x LIN/ 6 x CAN
ADC	10-bit or dual 10/12-bit
Package	100 – 176 pins

32-bit SPC56xB/D automotive microcontroller family overview

| Part number | Package | System | | Code Flash (Kbytes) | Data Flash (Kbytes) | RAM (Kbytes) | A/D | Timed I/Os | Serial interfaces | Other[1] |
		Core	Maximum frequency						SPI/LIN/CAN/I²C	
SPC560D30	LQFP64[2]	Z0h	48	128	64	16	16	6	2/2/1/0	12-bit ADC, CTU
SPC560D30	LQFP100	Z0h	48	128	64	16	32	24	2/3/1/0	
SPC560D40	LQFP64[2]	Z0h	48	256	64	20	16	6	2/2/1/0	
SPC560D40	LQFP100	Z0h	48	256	64	20	32	24	2/3/1/0	
SPC560B40	LQFP100	Z0h	64	256	64	24	28	28	3/3/2/1	10-bit ADC, CTU, MPU
SPC560B40	LQFP144	Z0h	64	256	64	24	36	56	3/3/2/1	
SPC560B44	LQFP100	Z0h	64	384	64	28	28	28	3/4/3/1	
SPC560B44	LQFP144	Z0h	64	384	64	28	36	56	3/4/3/1	
SPC560B50	LQFP100	Z0h	64	512	64	32	28	28	3/4/3/1	
SPC560B50	LQFP144	Z0h	64	512	64	32	36	56	3/4/3/1	
SPC560B54[2]	LQFP100	Z0h	64	768	64	64	26	34	3/4/6/1	Dual ADC 10/12-bit CTU, MPU, eDMA
SPC560B54[2]	LQFP144	Z0h	64	768	64	64	34	64	4/6/6/1	
SPC560B54[2]	LQFP176	Z0h	64	768	64	64	48	64	6/8/6/1	
SPC560B60[2]	LQFP144	Z0h	64	1024	64	80	34	64	4/6/6/1	
SPC560B60[2]	LQFP176	Z0h	64	1024	64	80	48	64	6/8/6/1	
SPC560B64[2]	LQFP176	Z0h	64	1536	64	96	48	64	6/10/6/1	

1. All products include 32 MHz oscillator, real-time clock, clock monitoring and register protection. Operating temperature range from - 40° C to 85° C up to - 40° C to 125° C.
2. In development. Contact your sales office.

Power management

A sophisticated low-power management allows for a quantum leap in power saving, avoiding the use of a secondary microcontroller. The low-power and wake-up concepts support LIN and CAN communication from standby mode with identification of the CAN message ID triggering wake-up.

Benefits

Reduced system cost
- Lighting module with diagnostics
- EEPROM emulation support
- Improved EMI
- Innovative power management concept
- Dual on-chip RC oscillators

Improved time to market
- Standard core for maximum reuse
- Designed for AUTOSAR
- Memory/pinout/performance scalability
- Compatility of product family
- Existing tools ecosystem and know-how

Power and robustness
- Z0h - Z4d PowerPC Core
- ECC on all memories
- Memory/register protections
- Clock security system/backup oscillator
- CPU clock independent watchdog
- Injection robust I/Os

Reduced cost of non-quality
- Zero defect strategy from design to production
- Latest 90 nm automotive focused technology
- Co-development of technology with Freescale
- Supply chain strengthened via dual source capability
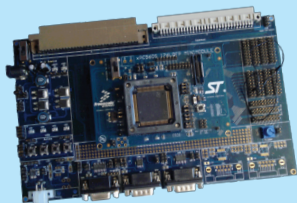
A comprehensive development tools offer
The SPC56 product family is supported by a wide range of development tools using a vast network of 3rd parties. This includes classical C compilers/debuggers/emulators, as well as advanced tools such as configuration tools or auto-code generators. Evaluation boards are available from ST.

Designed for AUTOSAR
All products are designed to fulfill AUTomotive Open System ARchitecture requirements. Available AUTOSAR packages include MCAL, basic software, OS, configuration tools and on-site support.

For more information on ST products and solutions,
visit www.st.com

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