ST(意法) VNH2SP30-E PDF

深圳创唯电子有限公司

http://www.st-ic.com

Advanced door electronics solutions

STMicroelectronics

Door-actuator drivers

STMicroelectronics' actuator drivers are designed for state-of-the-art automotive door-module applications. Devices are characterized by a scalable actuator-driving concept which includes 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, and the control of electrochromic mirror glasses. For high-end cars, a new bridge driver IP has been added to the family to support PWM driven power windows.

Part number	Package	SPI	Reverse battery supply	PWM	Current monitor	Recovery mode	Heater control $R_{DS(on)}$	Programmable HS $R_{DS(on)}$	LED mode	Bulb/LED control ($R_{DS(on)}$, I_{limit})	Lock control ($R_{DS(on)}$, I_{limit})	Deadlock control ($R_{DS(on)}$, I_{limit})	Mirror adjustment ($R_{DS(on)}$, I_{limit})	Mirror fold ($R_{DS(on)}$, I_{limit})	EC control	External MOSFET control (power windows/H-Bridge)	Additional features
L9949	PowerSO-20	•	–	–	Selected HS 3x	–	100 mΩ 6.3 A	–	–	–	150 mΩ 6 A	–	800 mΩ 1.6 A	–	–	–	–
L9950	PowerSO-36 PowerSSO-36	•	•	2 x PWM	Selected HS 5x	•	100 mΩ 6 A		–	4x 800 mΩ 1.5 A	150 mΩ 6 A	300 mΩ 3 A	800 mΩ 1.5 A	300 mΩ 3 A	–	–	–
L9951	PowerSO-36 PowerSSO-36	•	•	1 x PWM	All HS 5x	•	–	–	–	2x 800 mΩ 1.25 A	150 mΩ 7.4 A	200 mΩ 5 A	–	–	–	–	–
L9953XP	PowerSSO-36	•	•	2 x PWM	Selected HS 4x	•	100 mΩ 6 A	–	–	2x 500 mΩ 1.5 A	150 mΩ 6 A	–	800 mΩ 1.5 A	–	–	–	–
L9953LXP	PowerSSO-36	•	•	2 x PWM	Selected HS 4x	•	100 mΩ 6 A	2x 500 mΩ/ 1800 mΩ	2 x	2x 500 mΩ 1.5 A	150 mΩ 6 A	–	1600 mΩ 0.75 A	–	–	–	–
L9954XP	PowerSSO-36	•	•	2 x PWM	Selected HS 4x	•	100 mΩ 6 A	–	–	2x 500 mΩ 1.5 A	–	–	–	–	–	–	–
L9954LXP	PowerSSO-36	•	•	2 x PWM	Selected HS 4x	•	100 mΩ 6 A	2x 500 mΩ/ 1800 mΩ	2 x	2x 500 mΩ 1.5 A	–	–	1600 mΩ 0.75 A	–	–	–	–
L99MM70XP	PowerSSO-36	ST SPI	• Active for power Passive for Vreg	3 x PWM	All HS 9x	•	90 mΩ 6 A	1x 600 mΩ/ 1800 mΩ	3 x	3x 600 mΩ 1600 mΩ 1800 mΩ	–	–	1600 mΩ 0.5 A	300 mΩ 3 A	6-bit resolution 1.2 V/ 1.5 V negative discharge	–	VREG: 5 V/ 150 mA LIN 2.1/ SAEJ2602 Time out watchdog INH input
L99DZ70XP	PowerSSO-36	ST SPI	•	2 x PWM	All HS 11x	•	90 mΩ 6 A	2x 500 mΩ/ 1600 mΩ 1800 mΩ	4 x	4x 500 mΩ 1600 mΩ 1800 mΩ	150 mΩ 6 A	300 mΩ 3 A	1600 mΩ 0.75 A	300 mΩ 3 A	6-bit resolution 1.2 V/ 1.5 V	–	–
L99DZ80EP	TQFP64	ST SPI	•	4 x PWM internal	All HS 11x	•	100 mΩ 5 A	1x 500 mΩ/ 1600 mΩ 1x 800 mΩ/ 1600 mΩ	4 x	4x 500 mΩ 800 mΩ 1600 mΩ	150 mΩ 6 A	300 mΩ 3 A	1600 mΩ 0.5 A	300 mΩ 3 A	6-bit resolution 1.2 V/ 1.5 V negative discharge	• Adjustable slew rate	Time out watchdog
L99DZ81EP*	TQFP64	ST SPI	•	4 x PWM internal	All HS 7x	•	–	1x 500 mΩ/ 1600 mΩ 1x 800 mΩ/ 1600 mΩ	4 x	4x 500 mΩ 800 mΩ 1600 mΩ	150 mΩ 6 A	300 mΩ 3 A	–	–	–	• Adjustable slew rate	Time out watchdog

Note:
* In development

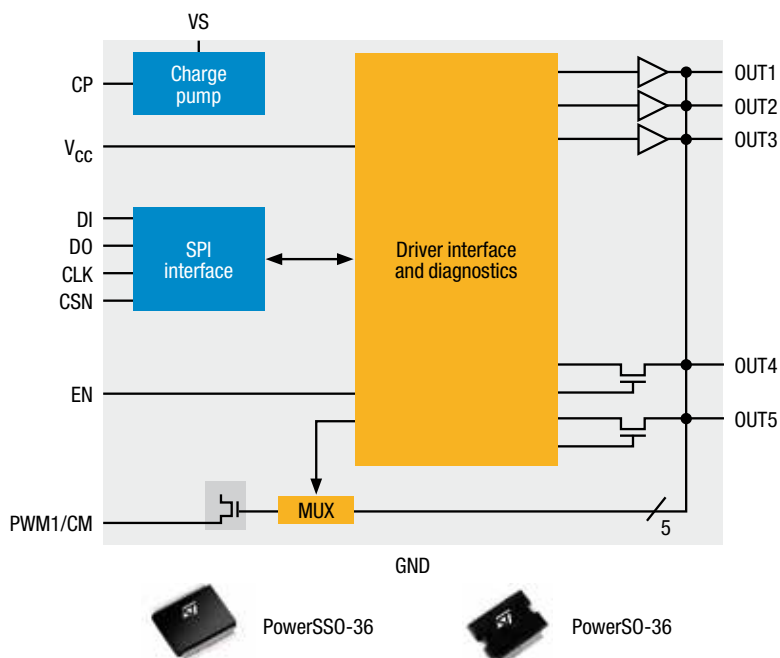## L9949 features

- 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, typ. 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
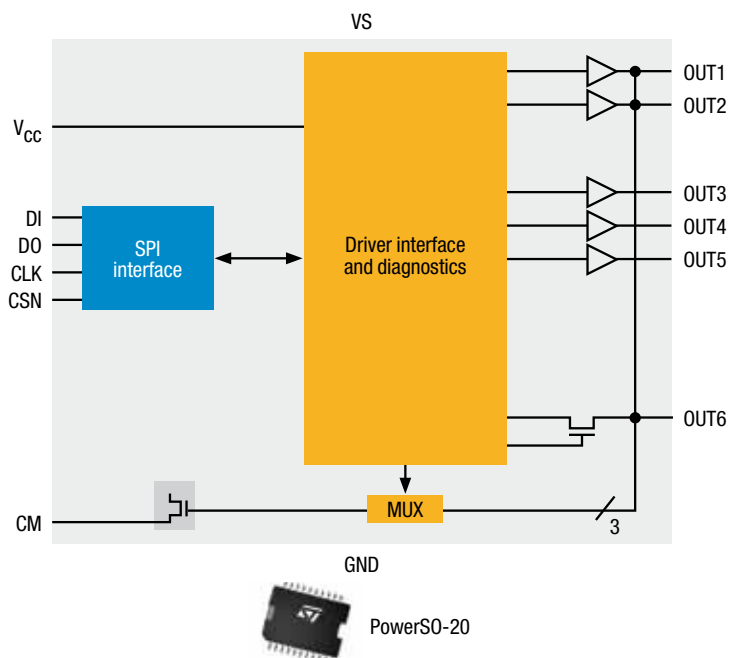
L9951XP features

- 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 soft start 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, typ. 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
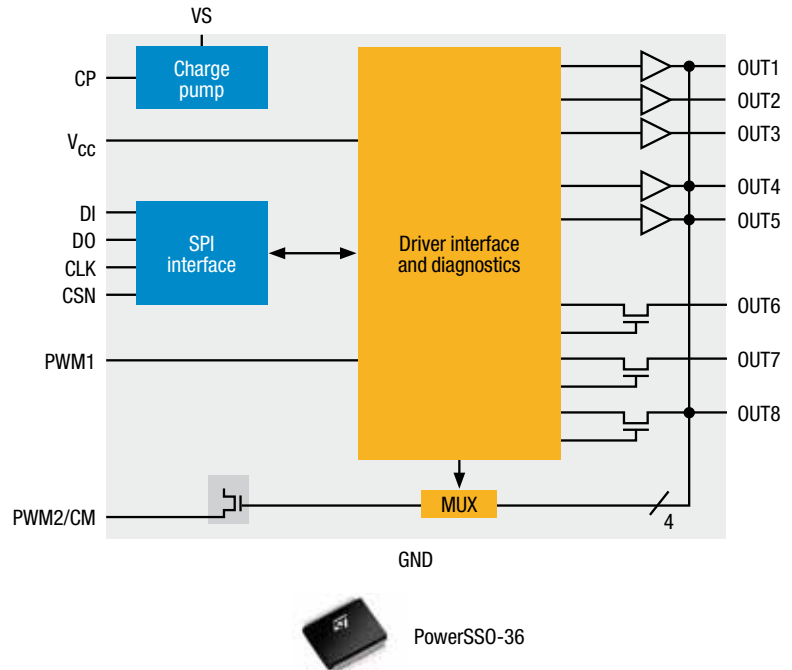- Undervoltage and overvoltage
  switch off

PowerSSO-36

PowerSO-36

L9953XP 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 soft start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 μA, typ. 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
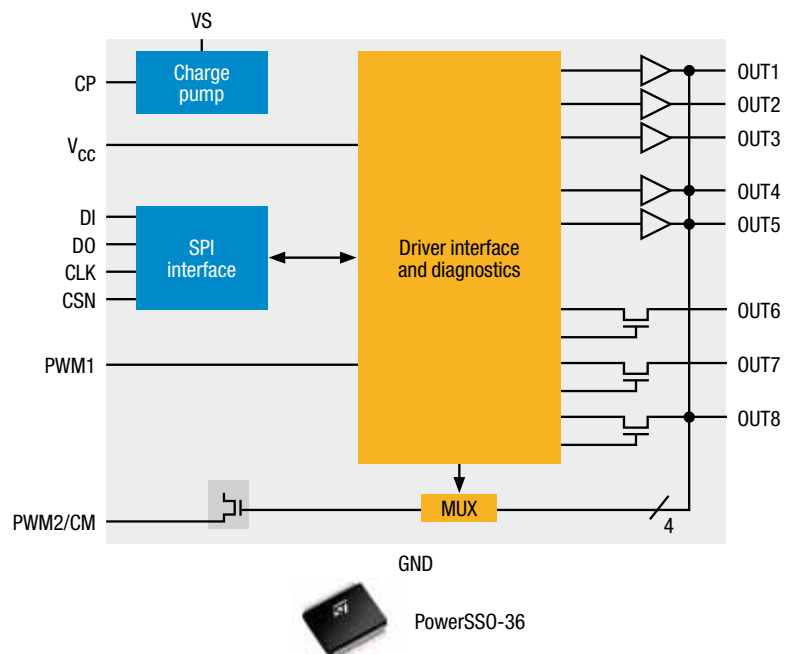- Undervoltage and overvoltage switch off

PowerSSO-36

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 soft start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 μA, typ. 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
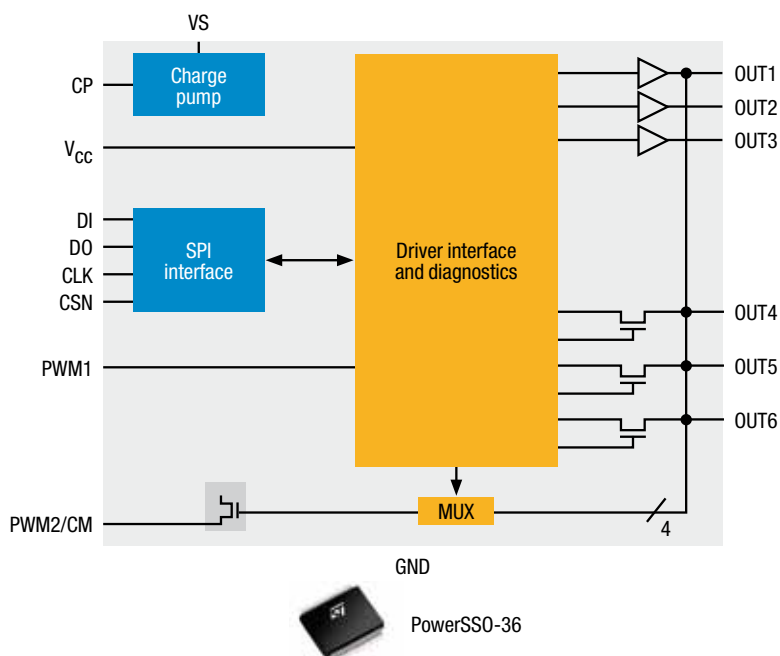- PWM control of all outputs
- Charge pump output for reverse polarity protection
- Serial peripheral interface (SPI) to microcontroller
- Undervoltage and overvoltage switch off

PowerSSO-36

L9954XP 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 soft start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_{IS} < 6 µA, typ. 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
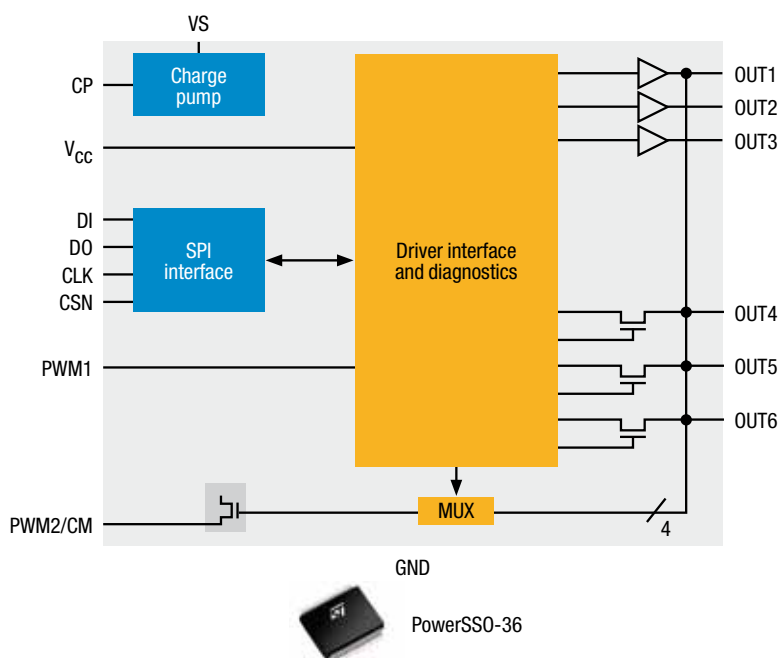- Undervoltage and overvoltage switch off

PowerSSO-36

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 soft start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6µA, typ. 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

L9950XP 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 soft start 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, typ. 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
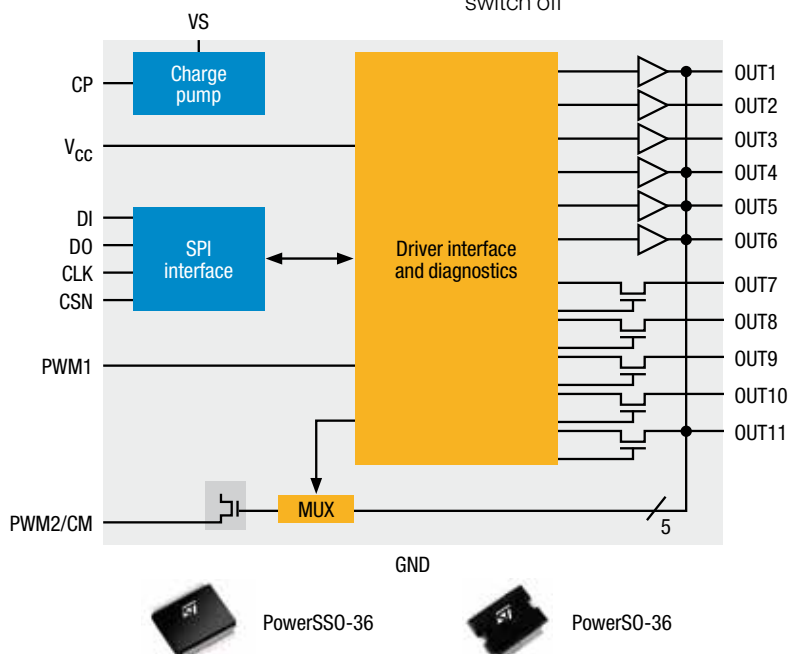- Undervoltage and overvoltage switch off

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 soft start 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 typ. 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
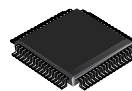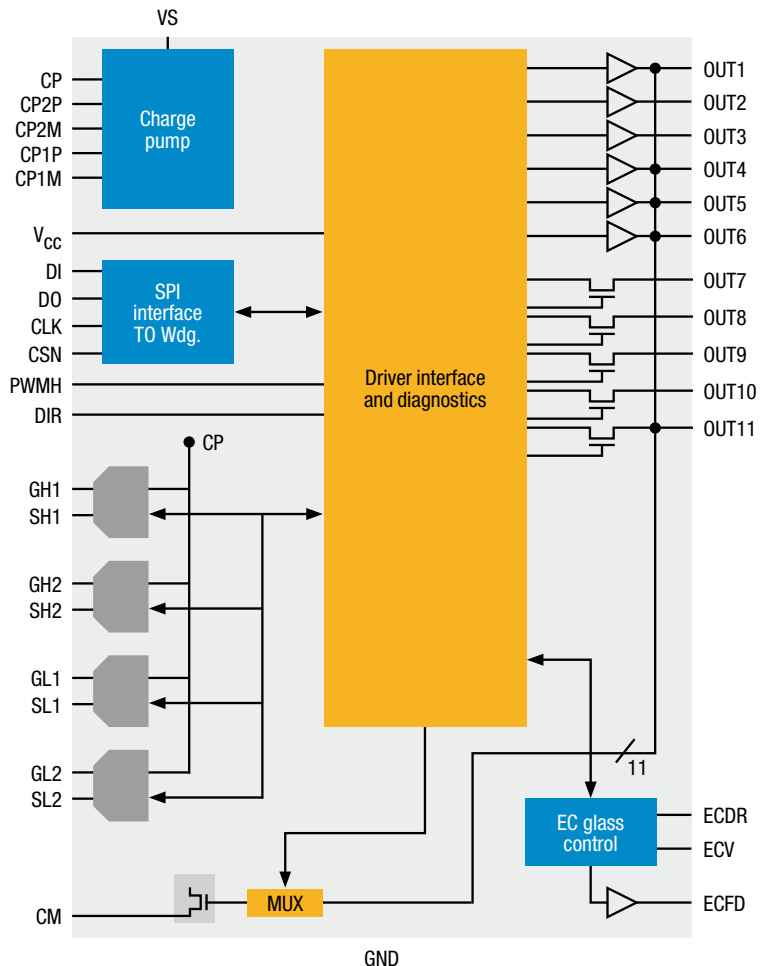- Undervoltage and overvoltage switch off

PowerSSO-36
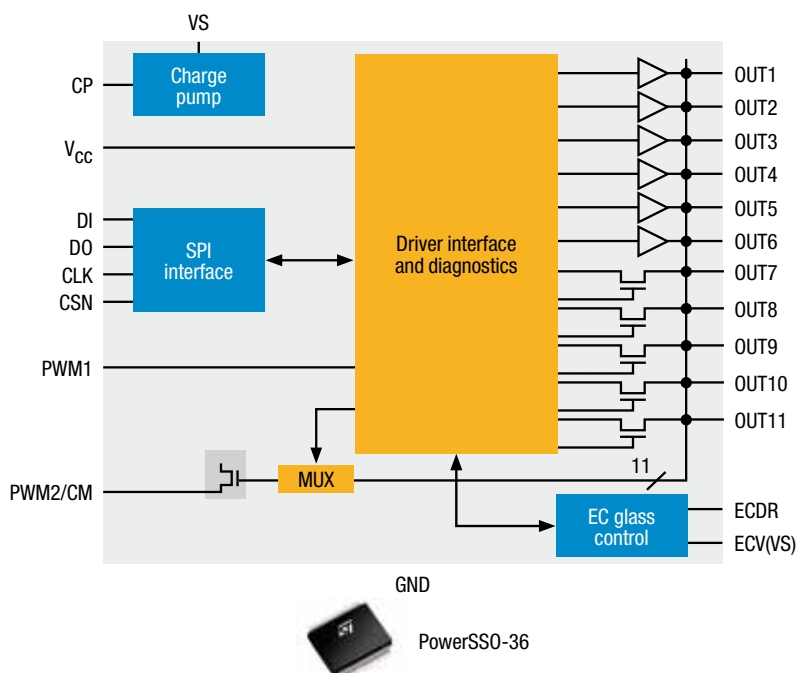
New generation devices: L99DZ80EP and L99DZ81EP

STMicroelectronics' new advanced door-zone driver family offers, as well as the well-known feature set, the possibilty to drive 4 external MOSFETs in H-bridge configuration to support PWM driven power window applications. With the embedded, SPI-programmable slew rate control IP for the external MOSFETs, a superior EMC performance is reached that offers a new level of comfort by supporting soft start, soft shutdown and supply-voltage-independent power-window speed.

L99DZ80EP features

- Motor bridge driver for external N-channel MOSFETs in H-bridge configuration used to drive a power window
- SPI adjustable slew rate for the external H-bridge
- Offline open load and short-circuit diagnosis for the external H-bridge
- Direct control of the external H-bridge by DIR and PWM input pins
- Prepared for additional fail-safe path for the external H-bridge
- Time out watchdog with fail-safe functionality
- Embedded electrochromic glass control block
- Negative discharge possibility for the electrochromic glass
- 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 0.5 A load ($R_{DS(on)} = 1600$ mΩ)
- One high-side driver for 5 A load ($R_{DS(on)} = 100$ mΩ)
- One configurable high-side driver for up to 1.5 A load ($R_{DS(on)} = 500$ mΩ) or 0.35 A load ($R_{DS(on)} = 1600$ mΩ)
- One configurable high-side driver for up to 0.7 A load ($R_{DS(on)} = 800$ mΩ) or 0.35 A load ($R_{DS(on)} = 1600$ mΩ)
- Two high-side drivers for 0.5 A load ($R_{DS(on)} = 1600$ mΩ)
- Programmable soft-start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode ($I_S < 6$ µA, $T_j \leq 85$ °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 embedded power output stages

- SPI programmable PWM control of all outputs
- Central 2-stage charge pump
- Control or reverse polarity protection MOSFET

- Undervoltage and overvoltage switch off
- Temperature prewarning and over-temperature shutdown

TQFP64 10x10
with Epad

L99DZ81EP features

- Motor bridge driver for external N-channel MOSFETs in H-bridge configuration used to drive a power window
- SPI adjustable slew rate for the external H-bridge
- Offline open-load and short-circuit diagnosis for the external H-bridge
- Direct control of the external H-bridge by DIR and PWM input pins
- Prepared for additional fail-safe path for the external H-bridge
- Time out watchdog
- One full bridge for 6 A load ($R_{DS(on)}$ = 150 mΩ)
- One half bridge for 3 A load ($R_{DS(on)}$ = 300 mΩ)
- One configurable high-side driver for up to 1.5 A load ($R_{DS(on)}$ = 500 mΩ) or 0.35 A load ($R_{DS(on)}$ = 1600 mΩ)
- One configurable high-side driver for up to 0.7 A load ($R_{DS(on)}$ = 800 mΩ) or 0.35 A load ($R_{DS(on)}$ = 1600 mΩ)
- Two high-side drivers for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ)
- Programmable soft-start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Very low current consumption in standby mode (I_S < 6 µA, 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 embedded power output stages
- SPI programmable PWM control of all outputs
- Central 2-stage charge pump
- Control or reverse polarity protection MOSFET
- Undervoltage and overvoltage switch off
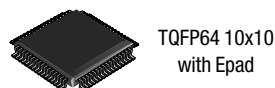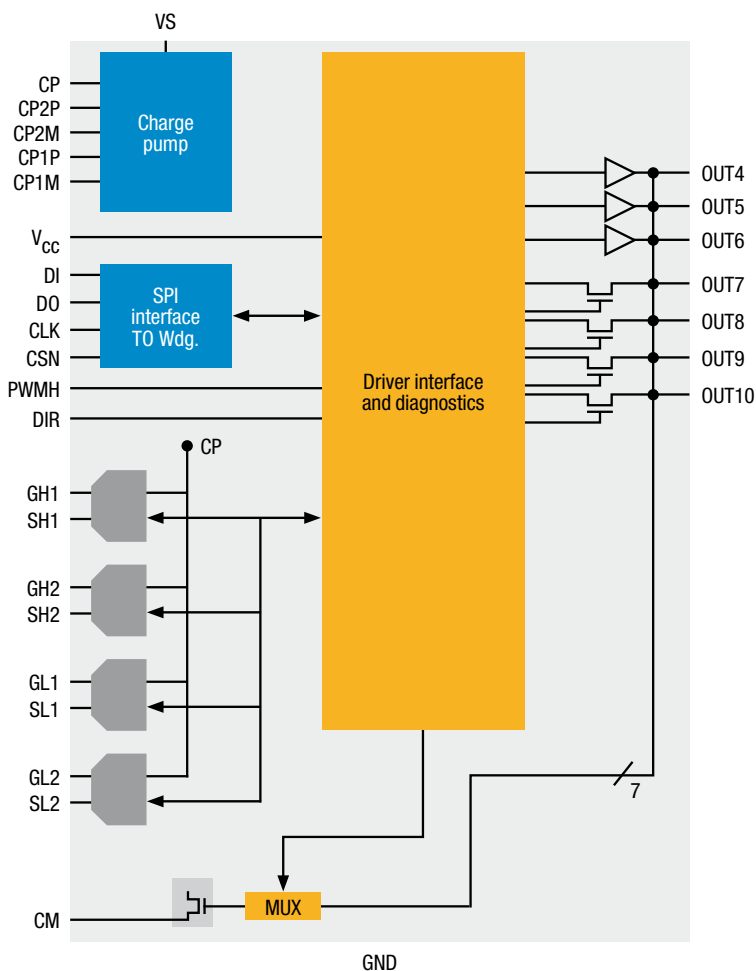- Temperature prewarning and over-temperature shutdown

TQFP64 10x10
with Epad

VNH7013XP features

- Smart MOSFET module (H-bridge)
- 13 mΩ per leg (HS + LS MOSFET)
- Output current: 40 A
- Maximum supply voltage: 72 V
- Embedded thermal sensor: -8 mV/K
- Very low leakage inductance
- 10 V compatible inputs

PowerSSO-36
Triple Island
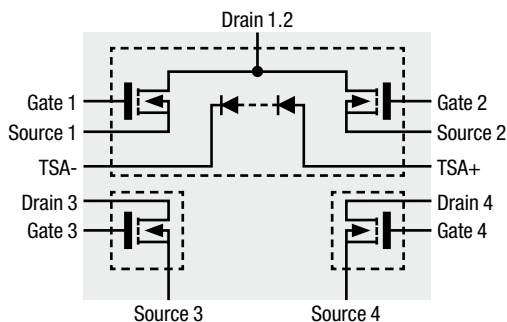
L99DZ80, L99PM72 and VNH7013: The new system solution for state-of-the-art high-end doors supporting PWM power windows and partial networking

Contact monitoring

Partial networking
ISO11898-6

LIN

CAN

L99PM72

Power management system device

Child safety

SafeLED

Interior handle
illumination

Puddle lamp

SPI

Temperature information
to adjust the slew rate
accordingly

SPC560D

32-bit microcontroller

VNH7013

Smart MOSFET bridge

PWM drive
power windows

M

L99DZ80

Door actuator driver

M Mirror adjustment
M Mirror adjustment
M Mirror fold
M Lock
M Dead lock
Turn indicator
Safety light
Switch illumination

Electrochromic glass

Defroster

VS

L99DZ80   Charge pump

VBAT

CP

VS

Programmable slew rate
5-bit resolution

1 0 1 0 1

SPI
DIR
PWMH

Logic
dead time generation

Slew rate control

$R_{DS(ON)}$ boost

Hard switch On
Hard switch Off

x 2

x 2

VS

GH1

SH1

CP

GL1

SL1

GH2
SH2

M

GL2
SL2

Gate drive with adjustable slew rate control

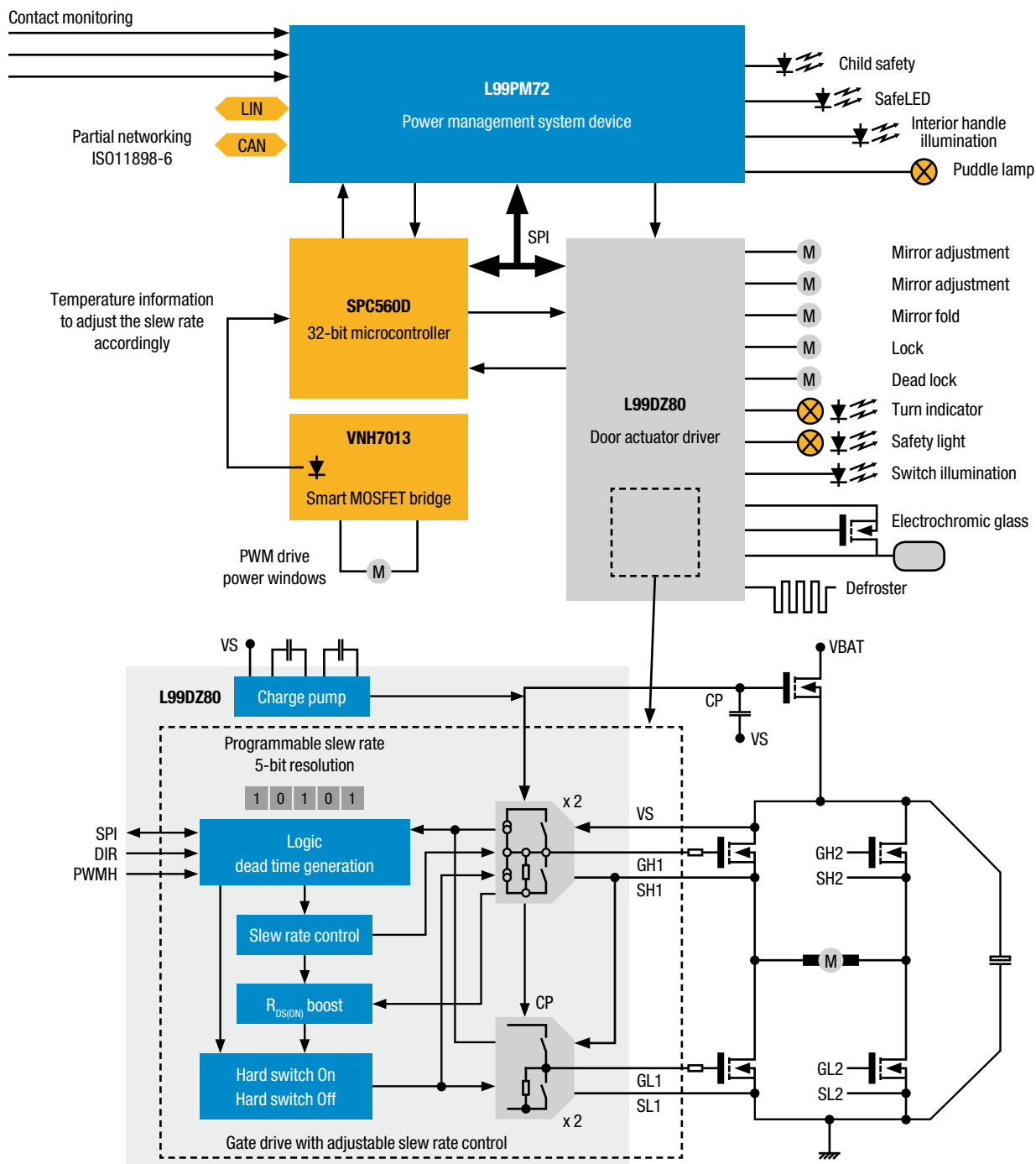## L99DZ80/81 door zone driver with embedded H-bridge driver

- Control of 4 external N-channel MOSFETs for PWM driven power window applications
- SPI programmable slew rate control
- $R_{DS(on)}$ boost feature
- Prepared for additional fail-safe path
- Hard switch on/switch off feature
- Passive gate source discharge resistance
- Full $R_{DS(on)}$ of external MOSFETs down to 6 V (supply voltage)
- SPI programmable cross-current protection and drain source monitoring

Mechatronic mirror driver – L99MM70XP

Driving the actuators of today's high-end exterior rear-view mirrors requires many wires, up to 20 cables. Since the mirror joint may have a limited space for the harness, a mechatronic approach using a LIN-bus interface can be the most appropriate way to minimize wiring harness complexity.
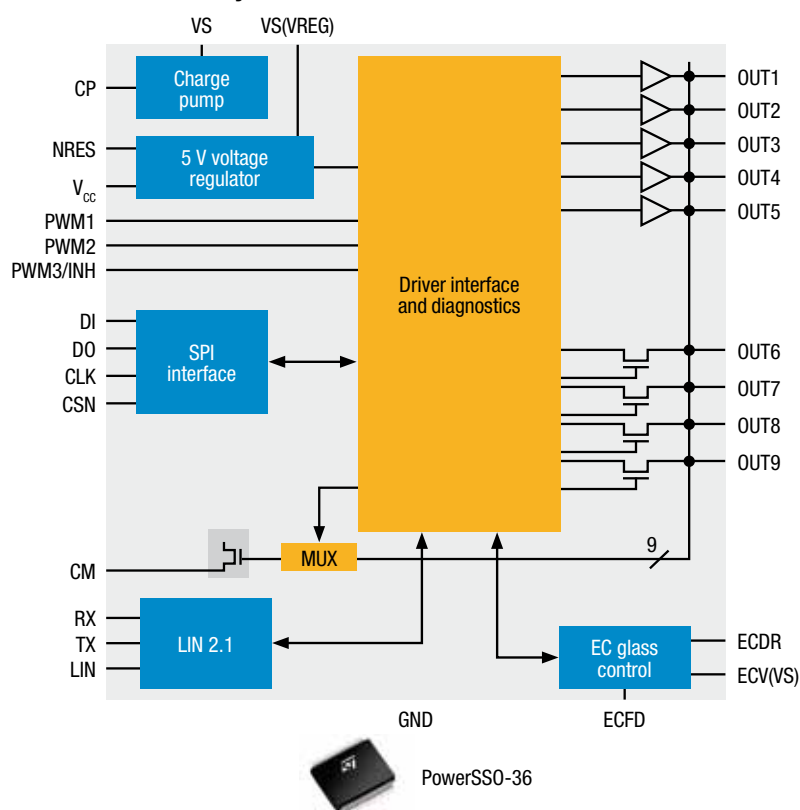
The L99MM70 is ST's latest development supporting such a mechatronic approach and offers a flexible and scalable system solution when combined with an STM8A.
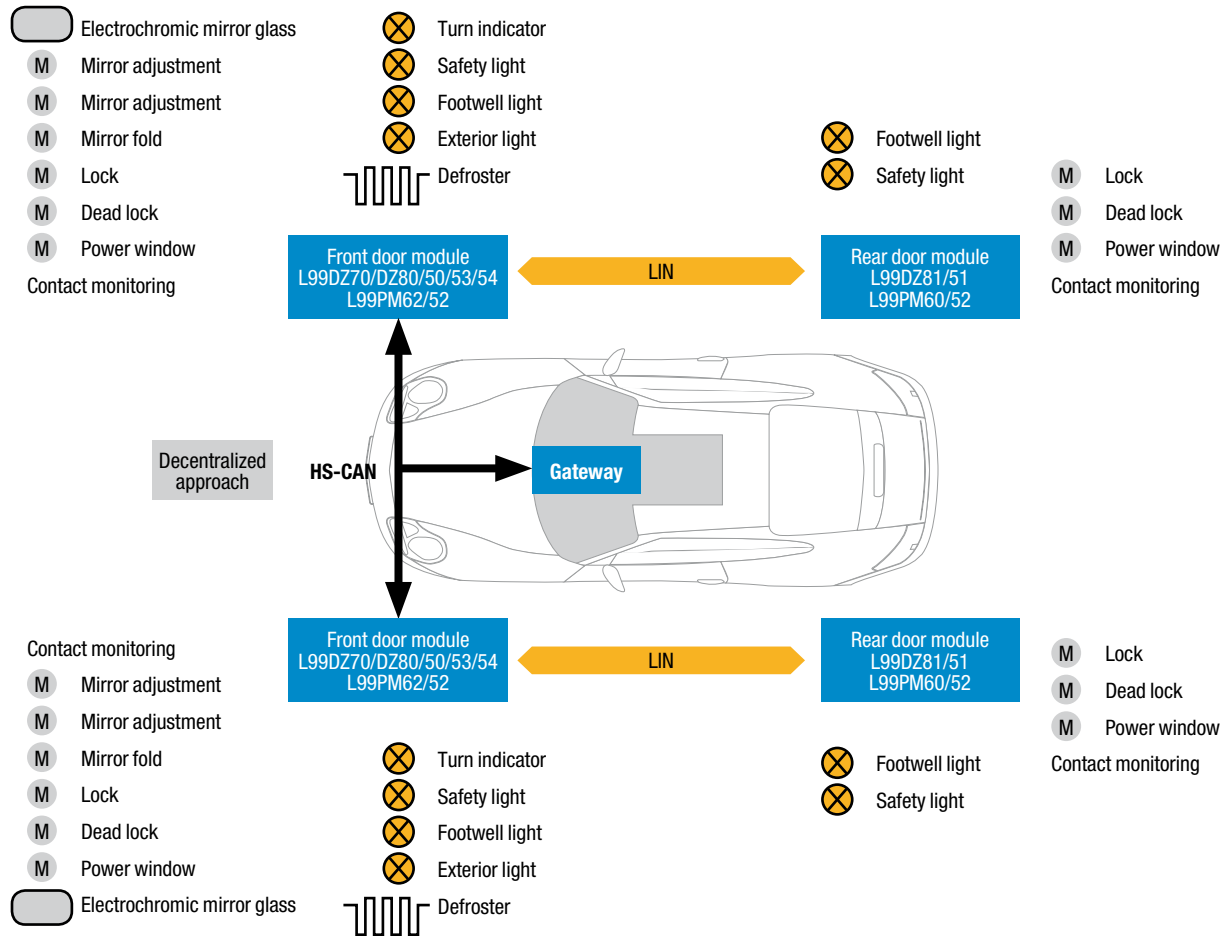
L99PMM70XP features

- 5 V low-drop voltage regulator for microcontroller supply (150 mA)
- Embedded LIN 2.1 (SAEJ2602) transceiver
- Independent control of mirror adjustment motors
- One full bridge for 3 A load ($R_{DS(on)}$ = 300 mΩ)
- Two (three) half bridges for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ)
- One low-side driver for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ) used as half bridge with high-side driver for independent mirror axis control
- One configurable high-side driver for up to 1.5 A load ($R_{DS(on)}$ = 500 mΩ) or 0.35 A load ($R_{DS(on)}$ = 1600 mΩ)
- One high-side driver for 6 A load ($R_{DS(on)}$ = 90 mΩ)
- Two high-side drivers for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ)
- One high-side driver for 0.5 A load ($R_{DS(on)}$ = 1600 mΩ) to supply an external MOSFET to drive an electrochromic glass
- Programmable soft-start function to drive loads with higher inrush currents (> 6 A, > 1.5 A)
- Embedded electrochromic glass control block
- Negative discharge option for the electrochromic glass
- Very low current consumption modes
  - 12 μA in V_{BAT} standby
  - 45 μA in V_{CC} standby (V_{CC} switched on)
- All outputs short-circuit protected
- Two thermal shutdown thresholds and early temperature warning
- Current monitor output for all high-side drivers
- Open-load diagnostic for all outputs
- Overload diagnostic for all outputs
- 3 PWM control inputs for all outputs
- INH input for external wake-up source

- Time out watchdog with fail-safe functionality
- Programmable V1 reset generator (5 V and 3.3 V)
- Control or reverse polarity protection MOSFET

- Undervoltage and overvoltage switch off
- 24-bit SPI interface for mode control and diagnostics
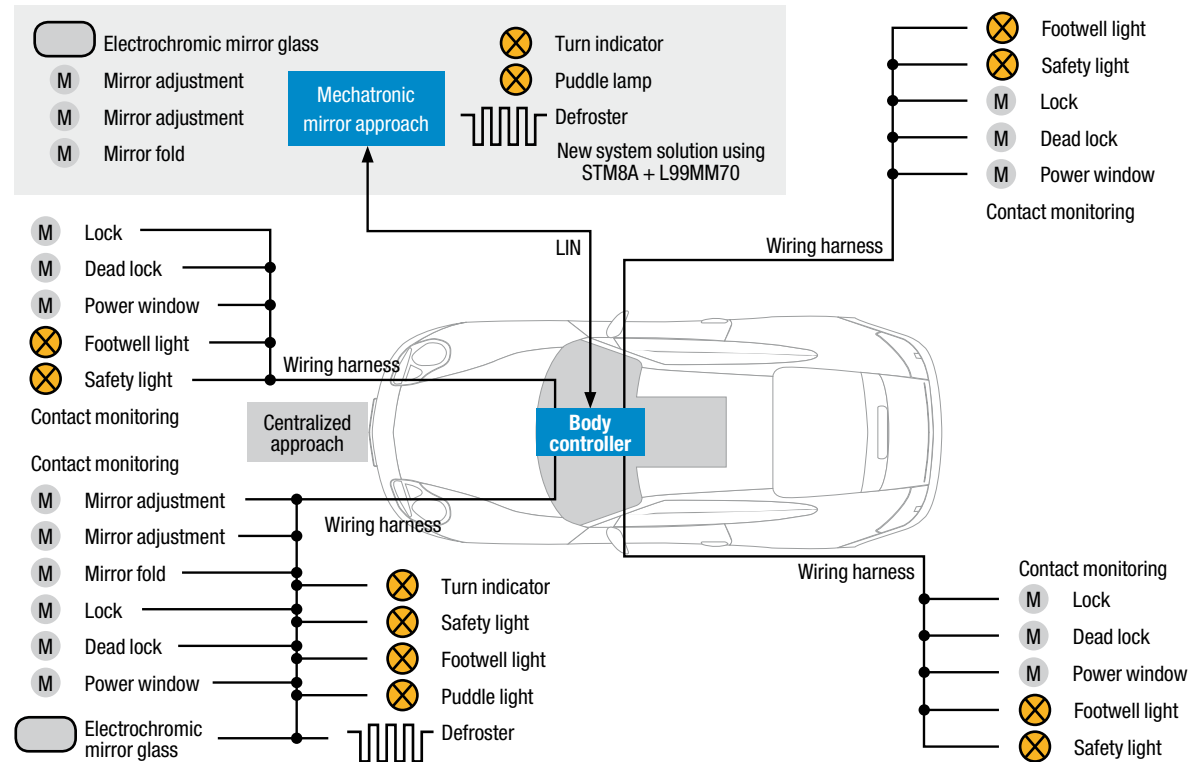- ST SPI with fail-safe functionality

L99MM70XP

Mechatronic mirror system driver

PowerSSO-36

10

Typical network topology for decentralized door-module applications

- Electrochromic mirror glass
- (M) Mirror adjustment
- (M) Mirror adjustment
- (M) Mirror fold
- (M) Lock
- (M) Dead lock
- (M) Power window
- Contact monitoring

- ⊗ Turn indicator
- ⊗ Safety light
- ⊗ Footwell light
- ⊗ Exterior light
- Defroster

- ⊗ Footwell light
- ⊗ Safety light
- (M) Lock
- (M) Dead lock
- (M) Power window
- Contact monitoring

Front door module L99DZ70/DZ80/50/53/54 L99PM62/52

LIN

Rear door module L99DZ81/51 L99PM60/52

Decentralized approach

HS-CAN → **Gateway**

Contact monitoring
- (M) Mirror adjustment
- (M) Mirror adjustment
- (M) Mirror fold
- (M) Lock
- (M) Dead lock
- (M) Power window
- Electrochromic mirror glass

Front door module L99DZ70/DZ80/50/53/54 L99PM62/52

LIN

Rear door module L99DZ81/51 L99PM60/52

- ⊗ Turn indicator
- ⊗ Safety light
- ⊗ Footwell light
- ⊗ Exterior light
- Defroster

- ⊗ Footwell light
- ⊗ Safety light

- (M) Lock
- (M) Dead lock
- (M) Power window
- Contact monitoring

Typical centralized network topology using a mechatronic mirror approach

- Electrochromic mirror glass
- (M) Mirror adjustment
- (M) Mirror adjustment
- (M) Mirror fold

Mechatronic mirror approach

- ⊗ Turn indicator
- ⊗ Puddle lamp
- Defroster

New system solution using STM8A + L99MM70

- ⊗ Footwell light
- ⊗ Safety light
- (M) Lock
- (M) Dead lock
- (M) Power window
- Contact monitoring

Wiring harness

LIN

- (M) Lock
- (M) Dead lock
- (M) Power window
- ⊗ Footwell light
- ⊗ Safety light
- Contact monitoring

Wiring harness

Contact monitoring
- (M) Mirror adjustment
- (M) Mirror adjustment
- (M) Mirror fold
- (M) Lock
- (M) Dead lock
- (M) Power window
- Electrochromic mirror glass

Centralized approach

Body controller

- ⊗ Turn indicator
- ⊗ Safety light
- ⊗ Footwell light
- ⊗ Puddle light
- Defroster

Wiring harness

Wiring harness

Contact monitoring
- (M) Lock
- (M) Dead lock
- (M) Power window
- ⊗ Footwell light
- ⊗ Safety light

Power management devices

ST's 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

| Part number	PowerSSO-36	PowerSSO-16	SPI	LIN 2.1	HS CAN ISO 11898-2-5	Partial networking (ISO 11898-6 working document)	V1 regulator	V2 regulator	Window watchdog	Fail-safe output	Contact monitoring inputs	Cyclic contact monitoring	Cyclic wake	Direct drive for high-side drivers	Timers	PWM inputs	V_s/temp monitoring output	Temp monitoring output	High-side drivers	Low-side drivers	Digital outputs	Operational amplifiers	Thermal protection	V_s over/undervoltage detection
L9952GXP	•	–	•	•	–	–	•	•	•	•	4	•	–	–	2	2	–	–	1 x 1 Ω / 4 x 7 Ω	2 x 2 Ω	2	2	•	•
L99PM62GXP	•	–	ST SPI	•	•	–	•	•	•	•	3	•	•	–	2	4 x internal	–	–	1 x 1 Ω / 4 x 7 Ω	2 x 2 Ω	–	2	•	•
L99PM60J	–	•	ST SPI	•	–	–	•	–	•	•	–	–	–	•	–	Direct drive	•	•	2 x 7 Ω	2 x 2 Ω	–	–	•	•
L99PM72PXP[1]	•	–	ST SPI	•	•	•	•	•	•	•	3	•	•	–	2	4 x internal	–	–	1 x 1 Ω / 4 x 7 Ω	2 x 2 Ω	–	2	•	•

1. in development

L99PM62GXP 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
  - 51 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
- 3 configurable wake-up inputs
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- HS-CAN (ISO 11898-2-5) physical layer
- Separate GND pin for physical layer
- 24-bit SPI interface for mode control and diagnostics
- ST SPI with fail-safe functionality
- 7 output drivers
- 4 high-side drivers for LED or Hall sensor supply ($R_{DS(on)}$ = 7 Ω)
- 1 high-side driver ($R_{DS(on)}$ = 1 Ω)
- 2 low-side relay drivers ($R_{DS(on)}$ = 2 Ω)
- 4 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

L99PM62(G)XP

Companion chip with embedded HS-CAN and LIN physical layers

PowerSSO-36
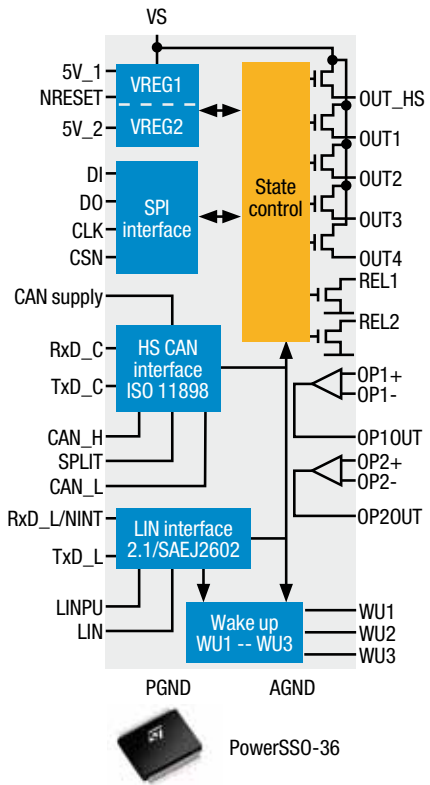
L9952GXP features

- 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 VBAT 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
- 4 configurable wake-up inputs
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- 7 output drivers
- 4 high-side drivers for LED or Hall sensor supply ($R_{DS(on)} = 7\ \Omega$)
- 1 high-side driver ($R_{DS(on)} = 1\ \Omega$)
- 2 low side relay drivers ($R_{DS(on)} = 2\ \Omega$)
- 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


PowerSSO-36
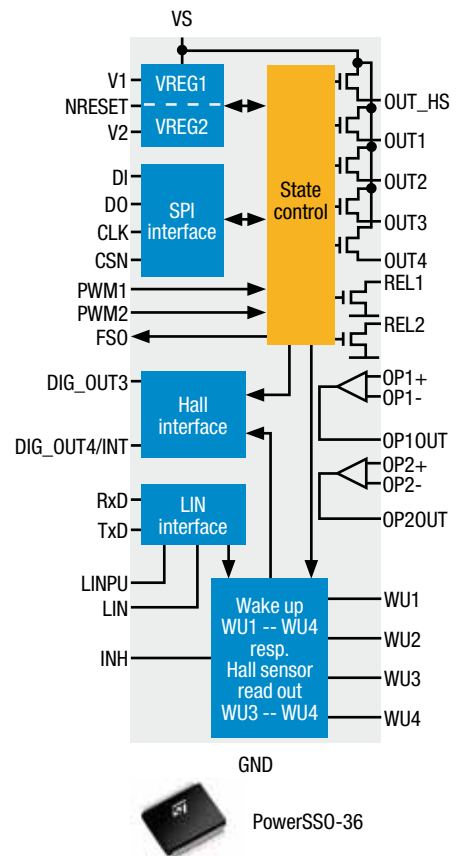
L9952GXP: typical application overview
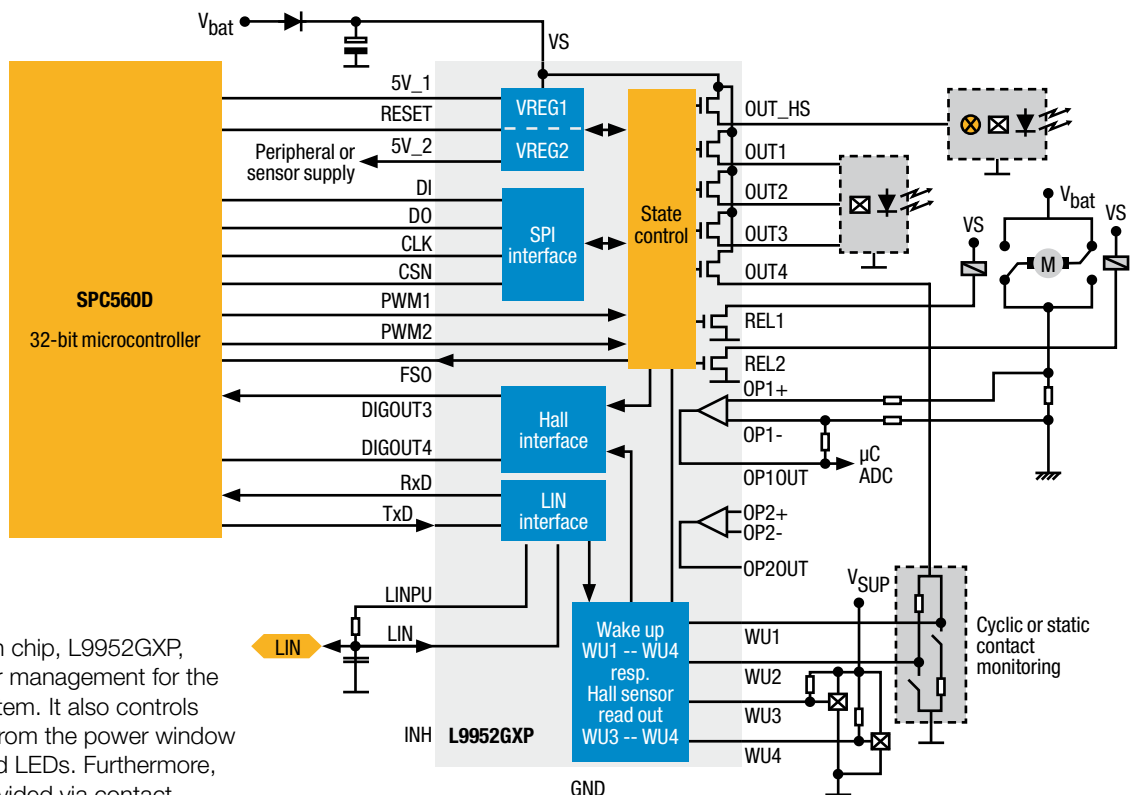
The companion chip, L9952GXP, provides power management for the entire door system. It also controls several loads, from the power window relay to PWMed LEDs. Furthermore, wake-up is provided via contact monitoring and Hall sensor inputs, as well as via the external CAN (via INH) and LIN transceivers.

L99PM60J 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
- 2 high-side drivers for LED, Hall sensor or contact supplies ($R_{DS(on)}$ = 7 Ω)
- 2 relay drivers ($R_{DS(on)}$ = 2Ω)
- 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

PowerSSO-16
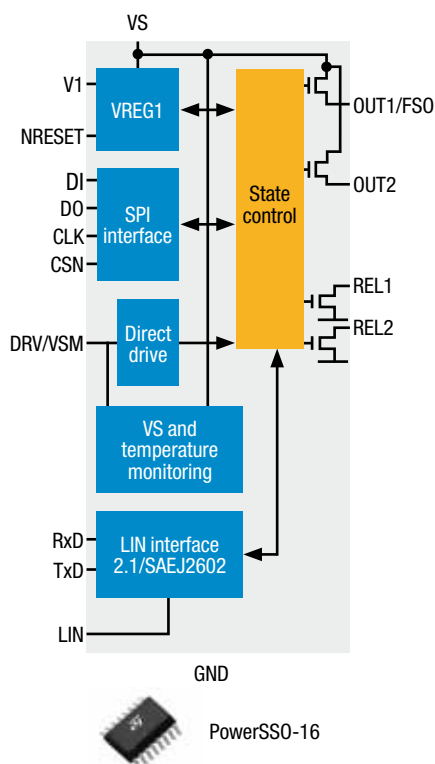
L99PM60, STM8A: flexible chip set, tailored for mechatronic power window applications
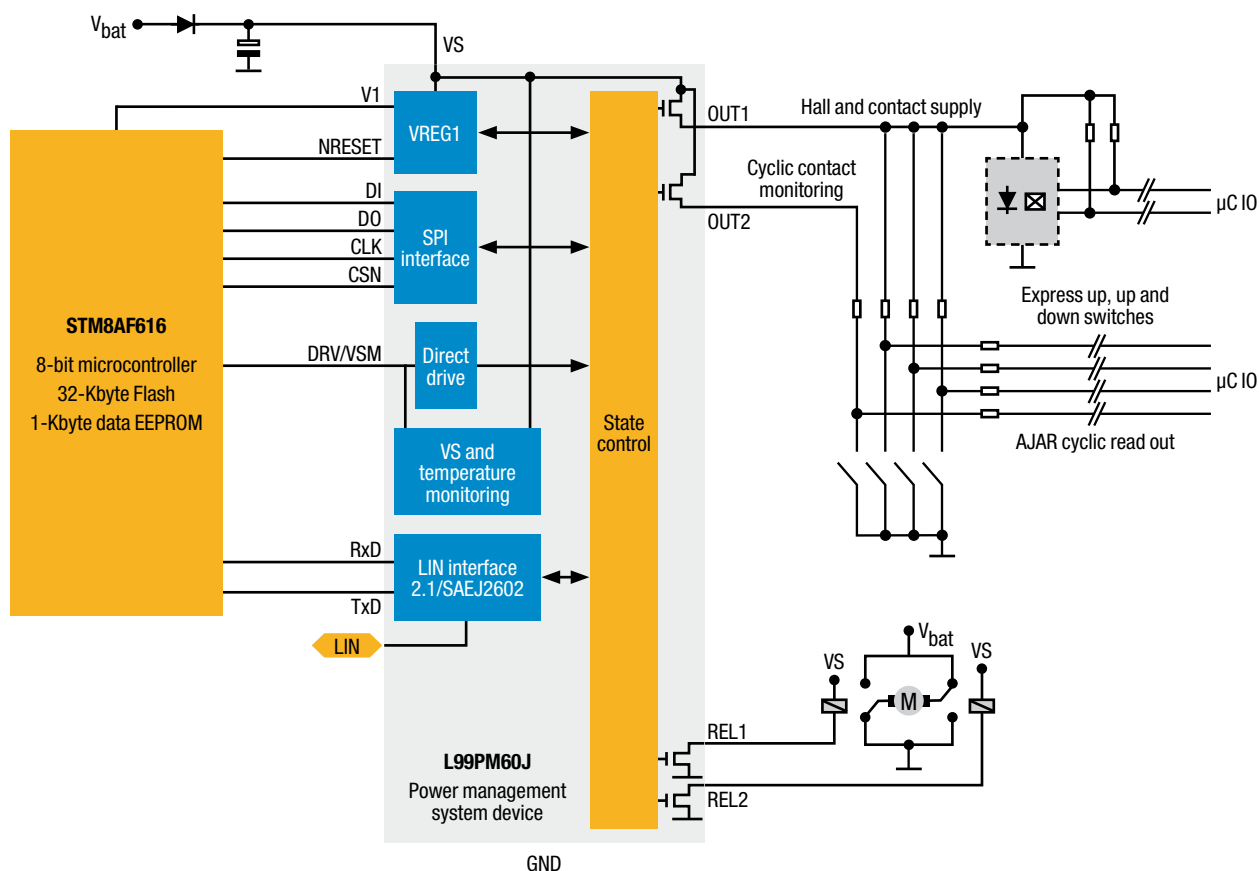
L99PM72PXP – partial networking

Since a large number of car ECUs are not needed at all times, one field of activity is the partial de-activation of bus systems (partial networking).

A working group consisting of several European carmakers and semiconductor manufacturers has defined a specification standardizing dedicated HS CAN transceivers which support this bus concept.

STMicroelectronics participated actively in this working group and is currently developing the first product, the power management system IC L99PM72PXP.

L99PM72PXP 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
  - 51 µA in V1 standby
  - 75 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
- 3 configurable wake-up inputs
- LIN 2.1 compliant (SAEJ2602 compatible) physical layer
- HS-CAN (ISO 11898-2-5) physical layer
- Supports partial networking according to ISO 11898-6 (working document)
- Separate GND pin for physical layer
- 24-bit SPI interface for mode control and diagnostics
- ST SPI with fail-safe functionality
- 7 output drivers
- 4 high-side drivers for LED or Hall sensor supply ($R_{DS(on)}$ = 7 Ω)
- 1 high-side driver ($R_{DS(on)}$ = 1 Ω)
- 2 low-side relay drivers ($R_{DS(on)}$ = 2 Ω)
- 4 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

PowerSSO-36
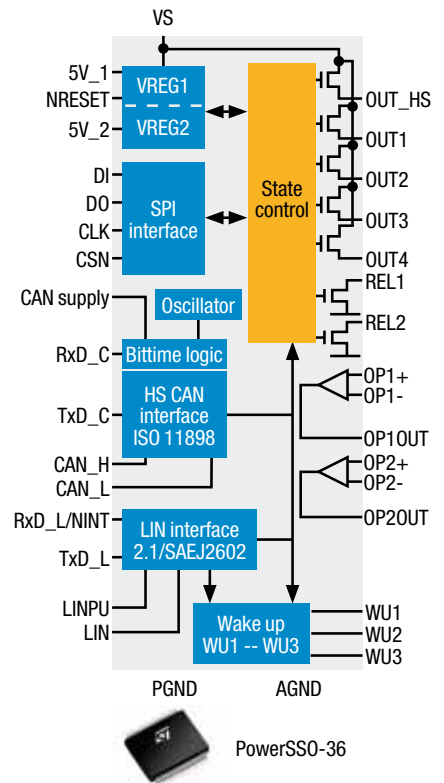
Standalone motor bridge drivers

ST's single-package power bridges (VNH2SP30-E, VNH3SP30-E, VNH3ASP30-E and VNH5019-E) are able to support a load current of up to 30 A, making them ideal candidates for standalone semiconductor-driven power window applications. Door locks, door closing assitance or roller sun blind may be driven in standalone configuration using a device from the VNH5xxx half-bridge driver family, housed inside the triple island PowerSSO-36.

All devices support PWM up to 20 kHz to allow soft start up and soft shutdown, increasingly required by the market.

The L99MC6 is a device tailored for standalone mirror adjustment. A key benefit of this circuit is the tiny PowerSSO-16 package, following the trend toward smaller PCB outlines.
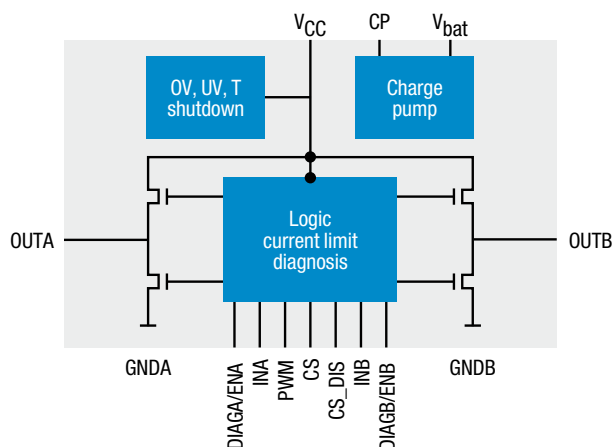
VNH3ASP30 –E features

- 40 mΩ per leg
- 20 kHz PWM operation on low side
- Output current: 30 A
- Current sense output
- Current limitation
- 5 V logic level compatible inputs
- Under/overvoltage shutdown
- Thermal shutdown
- Cross-conduction protection
- Low standby power consumption
- Protection against loss of ground and loss of V$_{CC}$
- Package: MultiPowerSO-30
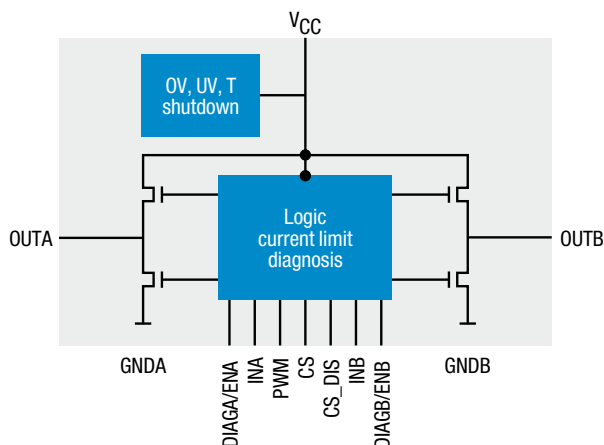

MultiPowerSO-30

VNH5019A-E features

- 19 mΩ per leg
- 20 kHz PWM operation on 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
- Under/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

VNH5050A-E features

- 50 mΩ per leg
- 20 kHz PWM operation on 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
- Under/overvoltage shutdown
- Thermal shutdown
- Cross-conduction protection
- Low standby power consumption
- Protection against loss of ground and loss of V_{CC}
- Package: MultiPowerSO-30
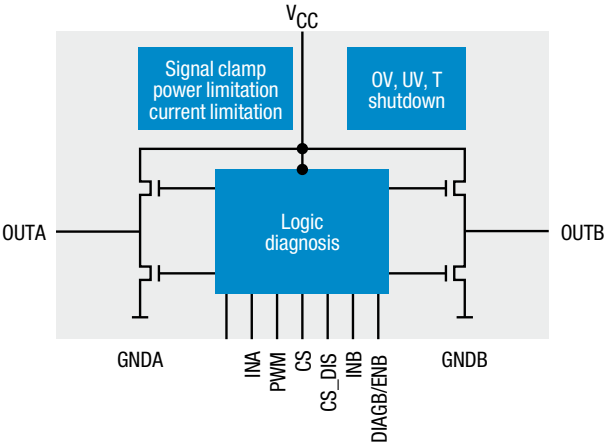
PowerSSO-36
Triple island

H-bridge family reference table

Part number	Package	$R_{DS(on)}$ max (mΩ)	Current Limitation(Ilim) typ (A)	Supply Voltage (V_{cc})	
				min (V)	max (V)
VN5770AKP-E	SO-28	280	8.5	4.5	16.5
VN5772AK-E	SO-28	100	18	4.5	36
VN770K	SO-28	220	10	5.5	36
VN770KP-E	SO-28	170	9	5.5	36
VN771K	SO-28	95	9	5.5	36
VN772K	SO-28	120	9	5.5	36
VN772KP-E	SO-28	95	9	5.5	36
VNH2SP30-E	MultiPowerSO-30	19	50	5.5	16
VNH3ASP30-E	MultiPowerSO-30	42	50	5.5	16
VNH3SP30-E	MultiPowerSO-30	45	50	5.5	36
VNH5019A-E	MultiPowerSO-30	18	50	5.5	24
VNH5050A-E	PowerSSO-36 Triple Island	50	42	5.5	18
VNH5180A-E	PowerSSO-36 Triple Island	180	12	5.5	18
VNH7013XP-E	PowerSSO-36 Triple Island	13	na	na	na

Low-end door module to drive power windows and mirrors
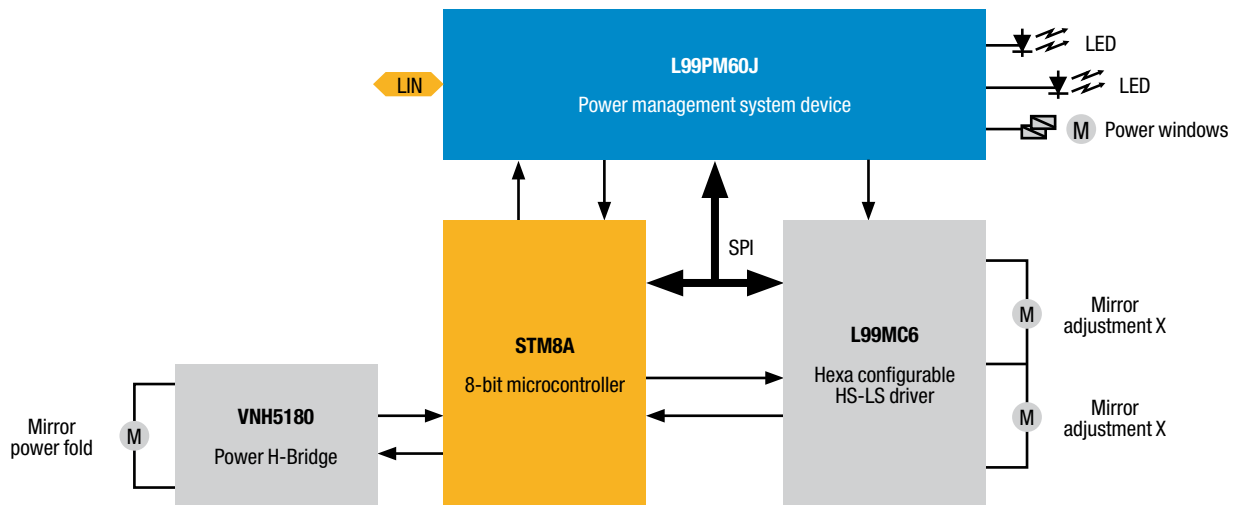
## L99MC6 features

- Configurable up to 3 high-side or 6 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 prewarning and thermal shutdown
- Package: PowerSSO-16

PowerSSO-16
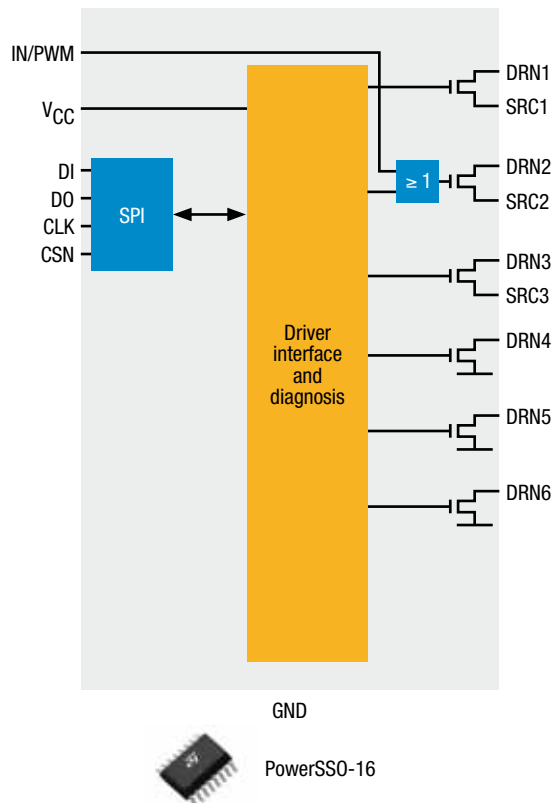
Scalable family approach: L995x and L99DZ8x

- Actuator driver family covering different door variants
  - Medium-end platform approach for L9950, L9953 and L9954
  - High-end platform approach for L99DZ80 and L99DZ81
- Scalable family approach with:
  - Hardware compatibility, pin-to-pin
  - Software 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
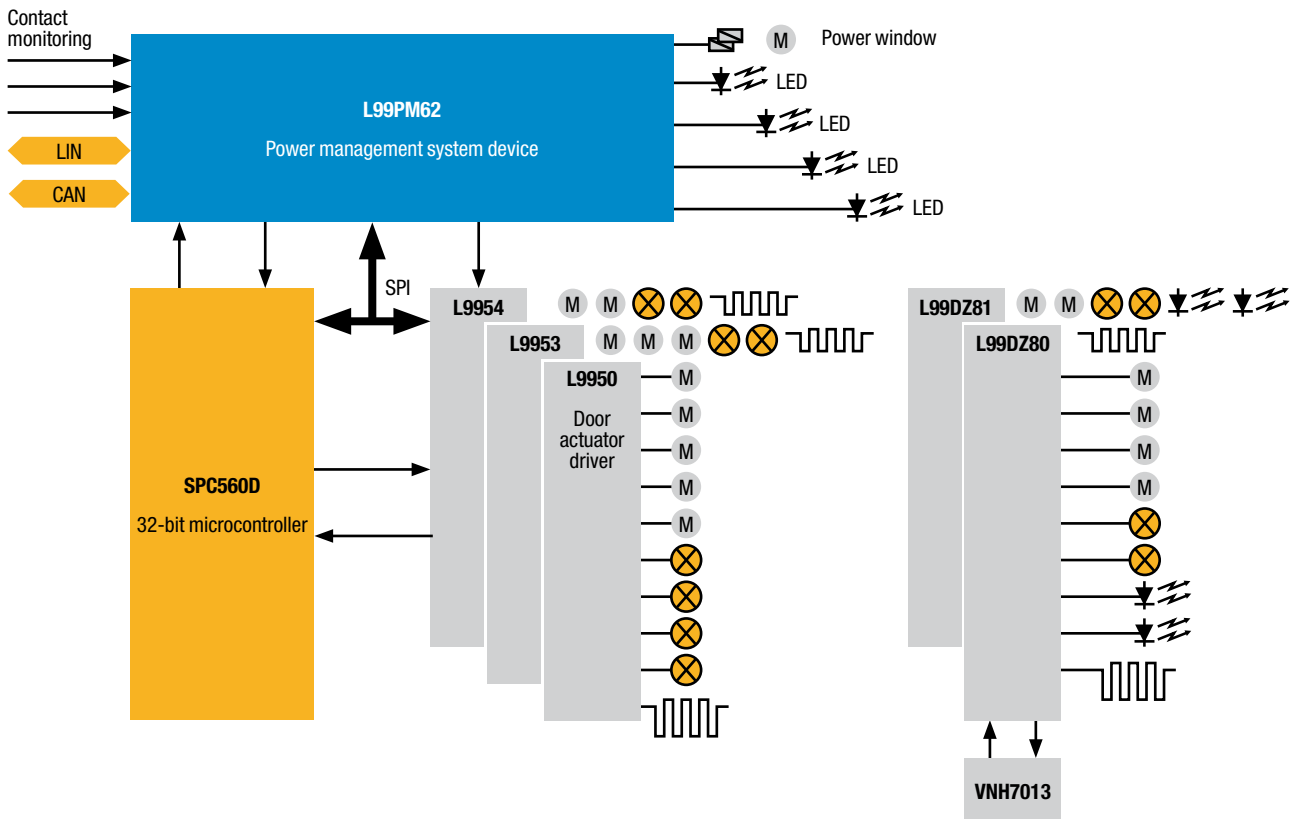
The actuator driver family L995x (L9950, L9953, L9954) and L99DZ8x (L99DZ80EP, L99DZ81EP) are respectively interchangeable based on a common PCB layout and wiring. A unique PCB design may thus be used for the entire door module for a car. Even for software driving via the SPI interface, a modular structure, valid for all actuator drivers, may be developed.