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# Solenoid Programmable Gate Driver ICs - PT2000, PT2001 and MC33816

NXP's bank programmable gate driver ICs for precision solenoid control applications consist of high- and low-side pre-drivers for external MOSFETs. The flexible MOSFETs gate drive solution has versatile control and optimized latency time allowing for customizable peak and hold-current profiles.

## TARGET APPLICATIONS

- ▶ Gasoline and diesel direct injection
- ▶ Transmissions valve driver
- ▶ Industrial and medical
- ▶ Solenoid and valve actuation

## OVERVIEW

NXP's programmable gate driver for solenoid control integrates microcores, external MOSFET high-side pre-drivers, and external MOSFET low-side pre-drivers. One/ two low-side drivers can be used as DC/DC converters.

Gate drive parameters, diagnosis and protection are managed through independent microcores with shared banks of code RAM and data RAM banks.

PT2000/1 and MC33816 also include diagnostics, automatic DC/DC control, current measurement and end of injection detection (only PT2000/1).

## FEATURES AND BENEFITS

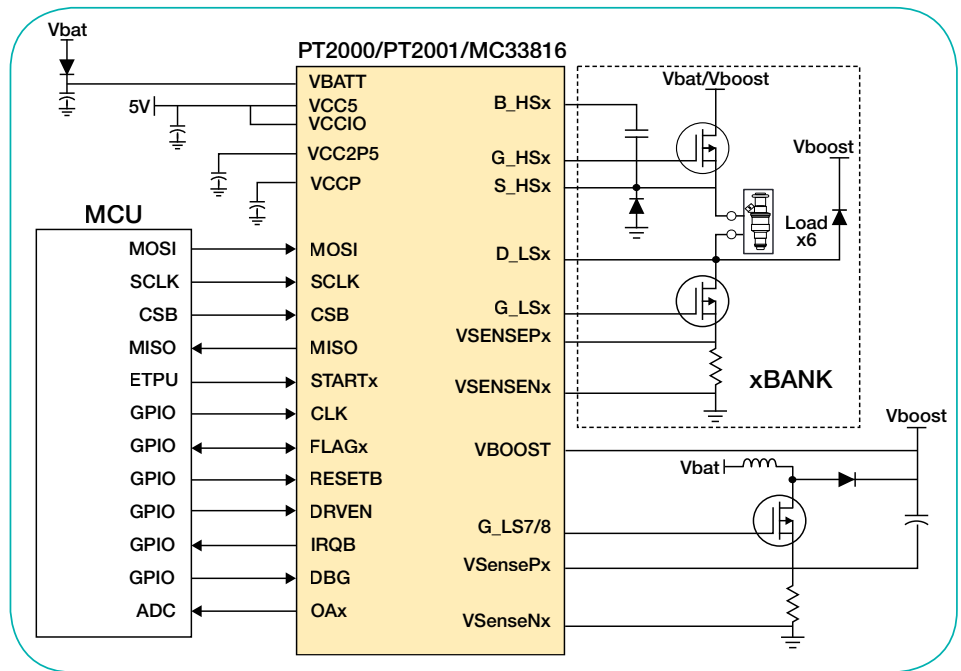
- ▶ Flexible current profile management through programmable microcores; allows concurrent and independent fine-grain control of solenoid parameters such as two cylinders per bank with inter-bank overlapping for 6-cylinder ICE
- ▶ Programmable VBOOST control optimizes performance versus power dissipation, per application requirements
- ▶ Dedicated DRVEN pin for safety helps to certify the system at ISO 26262
- ▶ Outputs configurable into 3-bank operation with full overlap (only PT2000) is mandatory for new 3-cylinder engine with turbo charging
- ▶ Programmable integrated diagnostics: overvoltage and undervoltage, open load, max current, overtemperature means faster fault detect response times, reduced computational load on MCU, and fewer external components
- ▶ ASIL C ISO 26262 certified (only PT2001)



## FEATURES AND BENEFITS CONTINUED

- ▶ Embedded encryption for microcode sent between MCU and driver results in increased security to protect customers against system hacking or IP theft
- ▶ SPI control with IRQB plus four interrupt flags enables fast hardware interrupt with efficient diagnosis reporting
- ▶ Integrated programmable end-of-injection (EOI) function (only PT2000/1) gives precise injector control, even for multiple injections per cycle, so injector times remain accurate, even as injector ages over time
  - Measurement parameters can be adjusted to match injectors from different manufacturers

## BLOCK DIAGRAM



## FEATURES TABLE

	MC33816	PT2000	PT2001
Typical application	4, 6 cyl.	3, 4 & 8 cyl.	4, 6 cylinder
Number of bank	2	3	2
Number of high-side pre-drivers	5	7	5
Number of low-side pre-drivers	7	8	7
Number of current sense channels	4	6	4
Number of programmable cores	4	6	4
Voltage monitoring	V <sub>BOOST</sub>	V <sub>BOOST</sub> & V <sub>BAT</sub>	V <sub>BOOST</sub> & V <sub>BAT</sub>
DC-DC boost modes	PWM, hysteretic	PWM, hysteretic, resonant	PWM, Hysteretic
Microcore programming language	Assembler	Assembler	Assembler (100% compatible with MC33816)
Code encryption (IP protection)	Yes	Yes	Yes
I/O short protection	18 V	36 V	36 V
Dedicated safety pin / ISO26262	No	Yes	Yes (ASIL C certified)
End of actuation detection	No	Yes	Yes
Package	LQFP-64	LQFP-80	LQFP-64 (100% compatible with MC33816)
<b>Development Tools</b>			
Hardware enablement	EVB 4 cylinder + DCDC + FP	EVB 3 cylinders + DCDC + FP EVB 6 cylinders + DCDC + FP	EVB 4 cylinder + DCDC + FP with S32K144 and KL25z (SPIGEN)
Software enablement	Development Studio (IDE) SPIGEN PSC simulator Tracer	Development Studio (IDE) SPIGEN PSC simulator Tracer	Development Studio (IDE) SPIGEN PSC simulator Tracer C Code example



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