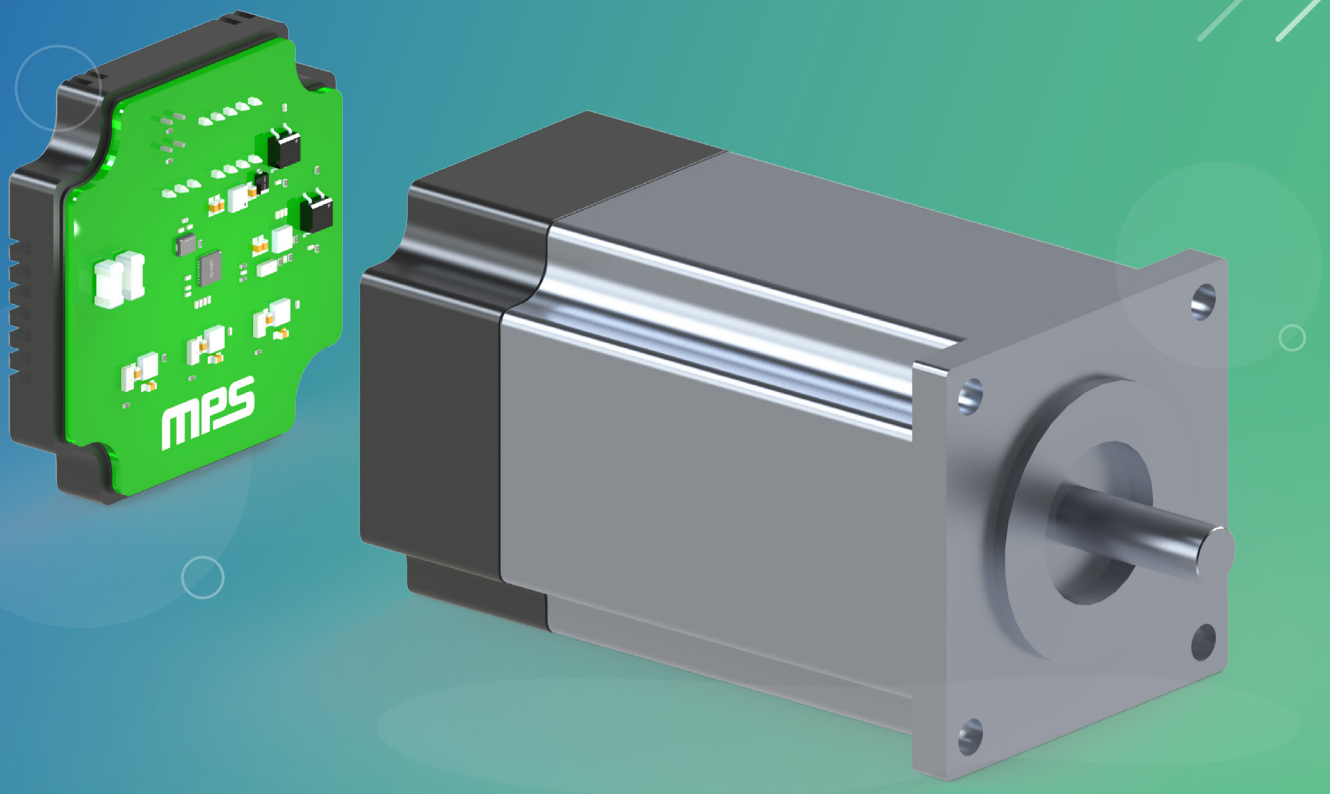
MOTOR DRIVERS

Motion Control Solutions



MonolithicPower.com

Quality Assurance & Reliability Commitment

The MPS Quality Assurance organization develops, coordinates, and champions strategic quality initiatives throughout MPS Inc., its foundries, and subcontractors. Its mission is to enable MPS to design, develop, manufacture, and deliver products to our customers with world-class quality and reliability that meet and exceed our customers' expectations.

MPS and Its Supplier Quality Systems and Certificates:

- ISO9001:2008 (MPS)
- EU RoHS/HF/REACH Compliant (MPS)
- Sony Green Partner (MPS & Suppliers)
- TS16949 (Suppliers)
- ISO14001 (Suppliers)

Product Quality:

- Automotive Products Qualified per AEC-Q100 Standard
- Standard Products Qualified per JEDEC and Military Standard
- Reliability Failure Rate <10FIT
- Product Quality Level <1.0ppm

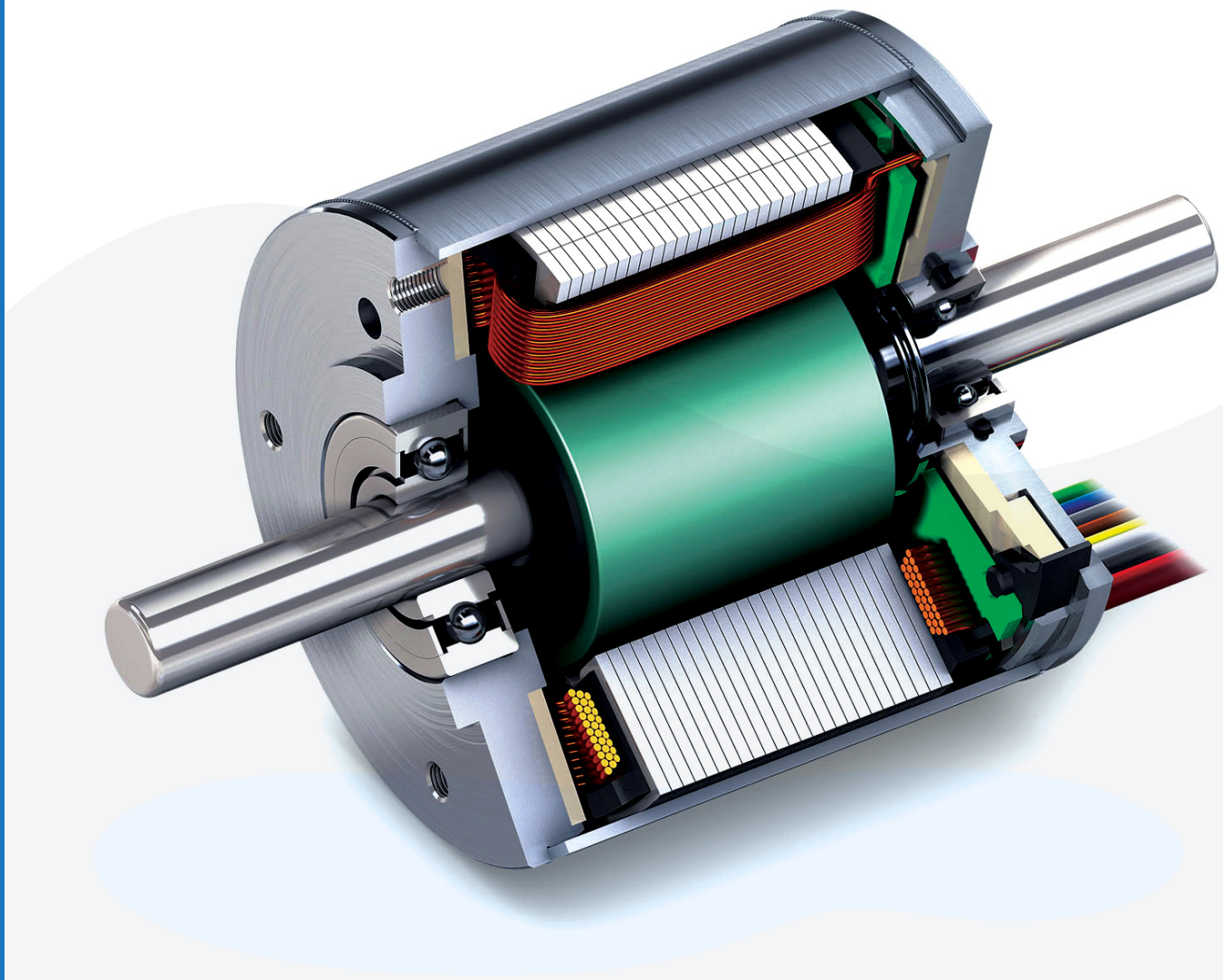
Quality Control and Monitoring:

- On-Site Foundry and Assembly Teams for Real-Time Actions
- Quarterly Supplier Quality Review and Annual Supplier Audit
- Short-Term Reliability Monitoring Test – Daily
- Long-Term Reliability Monitoring Test – Monthly
- Real-Time Engineering Actions on Monitored Failures
- Quarterly Reliability Monitoring Reports

IN THIS GUIDE

DRIVING THE MARKET IN RELIABILITY & EFFICIENCY

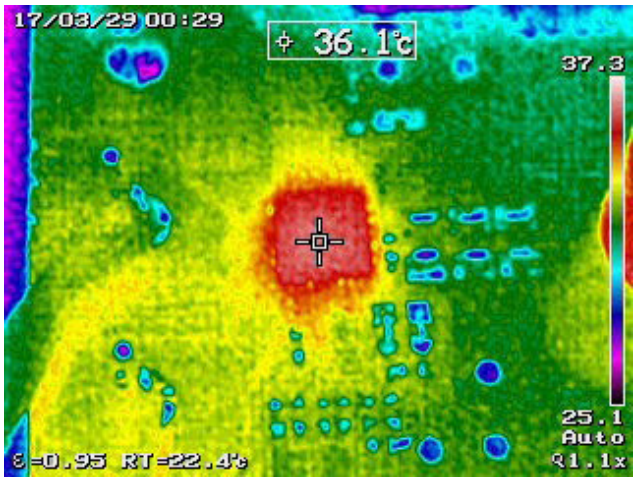
MPS motor driver solutions offer a wide range of high-performance, cost-effective, and reliable solutions for stepper motors, brushless DC (BLDC) motors, brushed DC motors, and solenoids. Using industry-leading semiconductor processes and advanced packaging technologies, MPS motor drivers achieve the highest efficiency, best thermal performance, and smallest solution size.



SUPERIOR MOTOR DRIVER SOLUTIONS

Thermal Performance

Lowest Power Loss

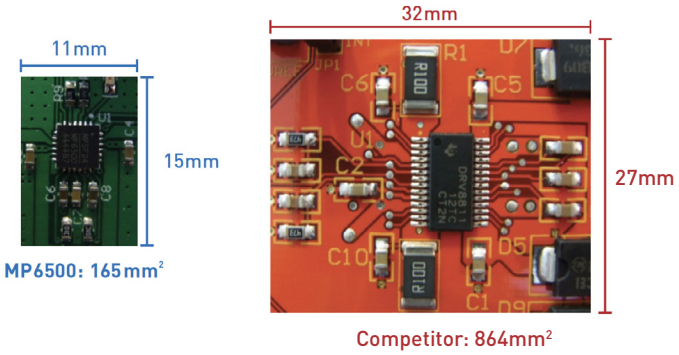


MPS's proprietary Sixth-Generation BCD™ process technology is the key to its competitive advantage. Many conventional analog technologies are hindered by an inability to support the integration of power devices at high power levels. This results in unacceptably large semiconductors and/or significant levels of power loss.

High power loss results in significant heat dissipation, which must be managed to avoid damaging or reducing the overall performance and efficiency of the system. To address this, MPS has created superior motor driver solutions for multiple applications.

Integration & Packaging

Smallest Solution Sizes



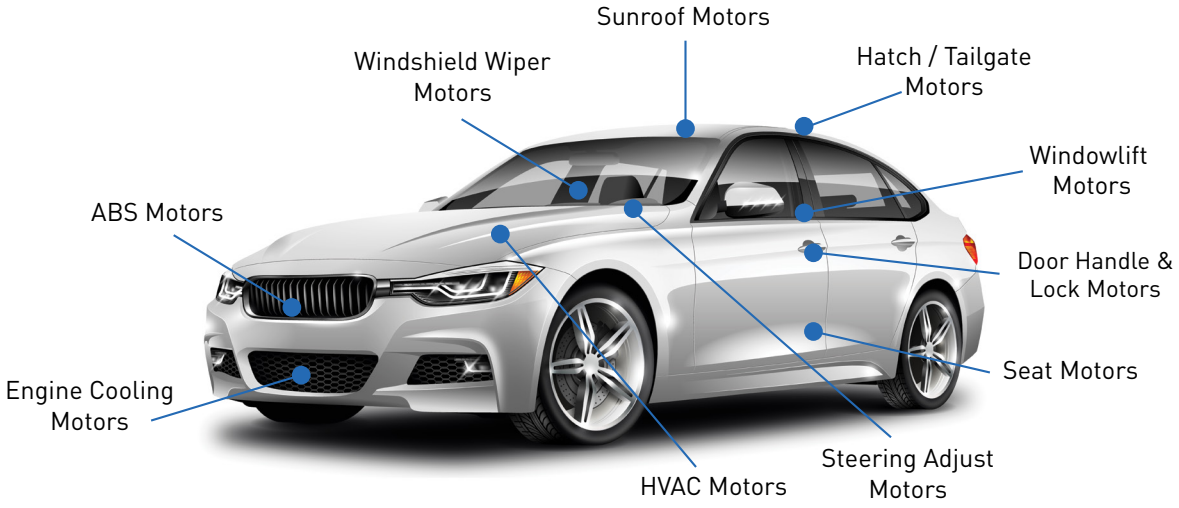
Multiple package options, including tiny flip-chip QFN packages, allow the implementation of motor drive systems in the smallest possible PCB area.

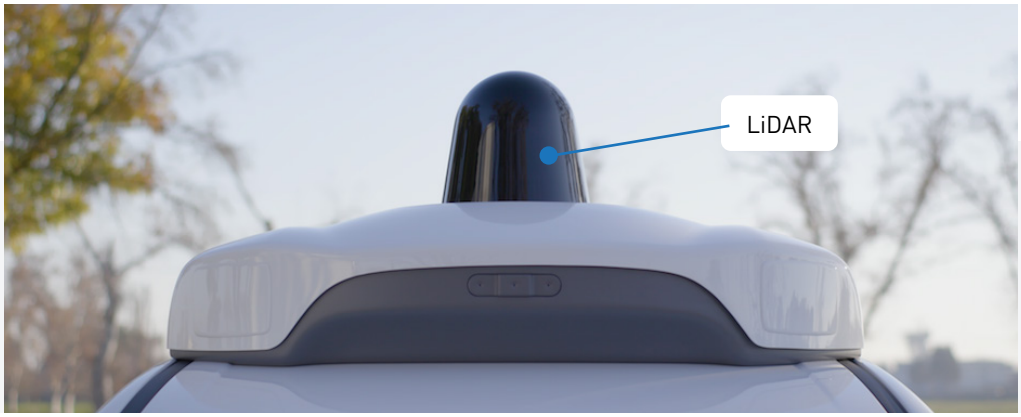
High integration, including the integration of features such as internal current sensing and slew rate control, allows for a dramatic reduction in the system component count. This lowers cost and increases reliability.

TYPICAL APPLICATIONS

AUTOMOTIVE

MPS offers motor drivers specifically tailored to automotive applications. From tiny brushed DC motors that direct airflow inside a climate control unit to body control like power liftgates, latches, and compact brushless DC (BLDC) motor drivers used in LiDAR, MPS has a driver solution for your automotive application.





ROBOTICS

MPS offers the smallest, most highly integrated drivers for brushless and stepper motors used in robotics. Our three-phase power stages can deliver up to 10A of current and pack an entire drive stage into a tiny, single-chip solution, enabling electronics to be integrated right at the motor. Our stepper motor drivers offer better current control and require less PCB area than other drivers on the market.

PRINTERS

From tiny, low-power point-of-sale (POS) printers all the way up to large office printers and copiers, MPS has motor drivers for all types of printers. The portfolio includes small brushed DC motor drivers, stepper motor drivers for small and large motors alike, and pre-drivers for large brushless motors, such as those used in copiers.

POWER TOOLS

All kinds of power tools are moving away from gasoline engines to rechargeable electric power. MPS's brushless motor drivers and pre-drivers power all kinds of tools, such as small power screwdrivers and electric lawn mowers. Our portfolio showcases a wide range of drivers up to 100V.

INDUSTRIAL

Many types of small- and medium-sized industrial equipment — such as textile machinery, 3D printers, and laser engravers — require stepper and brushless DC motors. MPS motors are well-suited for many of these applications.

STEPPER MOTOR DRIVERS

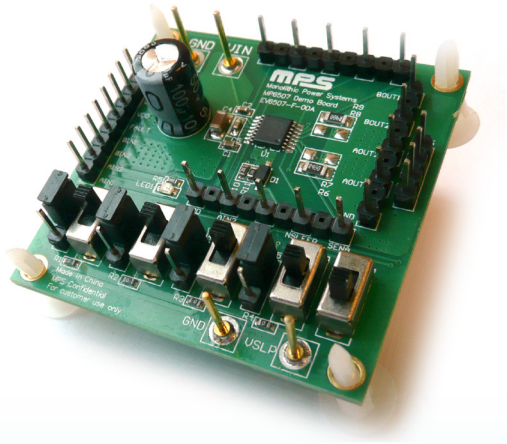
MPS stepper motor drivers are optimized to drive bipolar stepper motors used in printers, document scanners, robots, and other office and factory automation equipment. The MPS stepper motor driver family includes both low-voltage and high-voltage devices, as well as parts with or without indexer or translator logic. Several MPS parts feature internal current regulation with no shunt resistors, and feature the most accurate current control in the industry, providing microstepping capability.

Features

- Two Internal Full-Bridge Drivers
- Stepper Indexer or Parallel Control
- Low On Resistance
- No Control Supply Required
- Sink and Source Over-Current Protection (OCP)
- Thermal Shutdown and Under-Voltage Lockout (UVLO) Protection
- Thermally Enhanced Packages
- High Breakdown Voltage

MPS Advantages

- Low On Resistance Significantly Improves Thermal Performance
- Smooth Torque and Accurate Stepping Control
- Extensive Protection Functions Increase System Reliability



STEPPER MOTOR DRIVERS | MOTOR DRIVERS

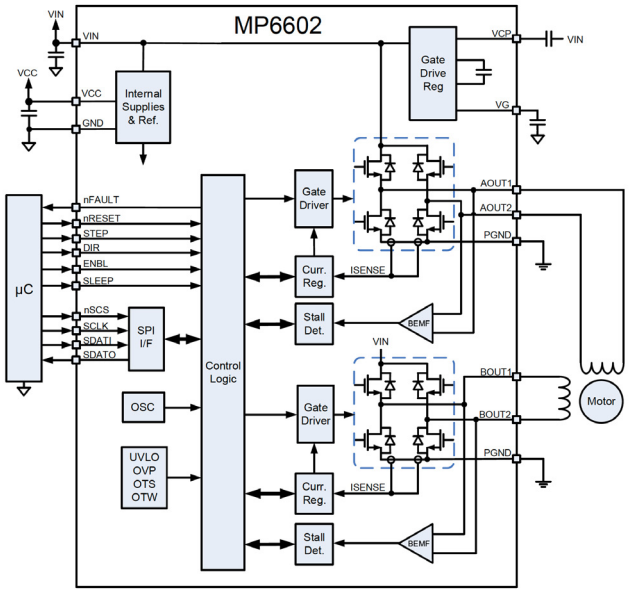
Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	I_{OUT} (Max) (A)	Step Mode	Control Interface	Package	Notes
MP6500	4.5	35	2.5	1, ½, ¼, ⅛	Indexer	QFN-24 (5x5), TSSOP-28	Bipolar stepper, microstepping, internal current sense
MP6500A	4.5	35	2.5	1, ½, ¼, ⅛	Indexer	TSSOP-28EP, QFN-24 (5x5)	Bipolar stepper, microstepping, internal current sense, programmable voltage
MP6500L	4.5	35	2.5	1, ½, ¼, ⅛	Indexer	QFN-24 (5x5)	Bipolar stepper, microstepping, internal current sense, latch-off function
MP6501A	8	35	2.5	1, ½, ¼, ⅛	Indexer	TSSOP-28EP	Bipolar stepper, microstepping
MP6504	8	32	2	1, ½, ¼, ⅛	Indexer	QFN-28 (4x5)	Bipolar stepper, microstepping
MP6506	2.7	15	0.5	1, ½	Parallel	QFN-16 (3x3)	Bipolar stepper
MP6507	2.7	15	0.7	1, ½	Parallel	TSSOP-16EP, QFN-16 (3x3), QFN-16 (4x4), TSSOP-16	Bipolar stepper
MP6508	2.7	18	1.2	1, ½	Parallel	TSSOP-16EP, QFN-16 (4x4)	Bipolar stepper
(N) **MP6508A**	2.7	18	1.2	1, ½	Parallel	QFN-16 (3x3)	Bipolar stepper
MP6509	2.7	18	1.2	1, ½	Parallel	TSSOP-20EP	Bipolar stepper, current attenuation
MP6518	8	35	1.5	1, ½, ¼, ⅛,	Indexer	TSSOP-28EP	Bipolar stepper, microstepping
MP6520	8	32	1.5	1, ½, ¼, ⅛	Indexer	QFN-28 (4x5)	Stepper, integrated MOSFETs
MP6600	4.5	35	1.5	1, ½, ¼, ⅛	Indexer	QFN-24 (4x4)	Bipolar stepper, microstepping, internal current sense
MP6600L	4.5	35	1.5	1, ½, ¼, ⅛	Indexer	QFN-24 (4x4)	Bipolar stepper, microstepping, internal current sense, latch-off function

STEPPER MOTOR DRIVERS | MOTOR DRIVERS

	Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	I_{OUT} (Max) (A)	Step Mode	Control Interface	Package	Notes
	MP6601	4.5	35	2.5	1, ½, ¼	Parallel	QFN-24 (5x5), TSSOP-28EP	Stepper, internal current sense
N	**MP6602**	4.5	35	4	1, ½, ¼, ⅛, 1/16, 1/32	Indexer	QFN-25 (4x5)	Stepper, stall detection, serial interface
N	**MP6604A**	4.5	45	2.5	-	IN/EN	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, IN/EN interface
N	**MP6604B**	4.5	45	2.5	-	PHASE/EN	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, PHASE/EN interface
N	**MP6604C**	4.5	45	2.5	-	HS/LS	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, HS/LS interface
N	**MP6605C**	4.5	60	1.5	-	I^2C	QFN-24 (4x4)	4-channel low-side driver, I^2C interface
N	**MP6605D**	4.5	60	1.5	-	Parallel	QFN-24 (4x4)	4-channel low-side driver
N	**MP6605E**	4.5	60	1.5	-	SPI	QFN-24 (4x4)	4-channel low-side driver
N	**MP6606**	4.5	60	0.75	-	SPI	TSSOP-20EP	8-channel low-side driver, SPI interface
S	**MPQ6600L-AEC1**	4.5	35	1.5	1, ½, ¼, ⅛	Indexer	QFN-24 (4x4)	Bipolar stepper, microstepping, internal current sense, latch-off function, AEC-Q100 qualified

MP6602 Stepper Motor Driver

Bipolar Stepper Motor Driver with Stall Detection & Back EMF Measurement



Features

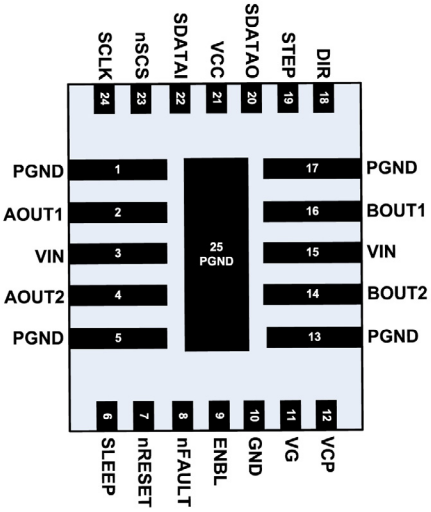
- 4.5V to 35V Operating Supply Voltage Range
  - 40V Absolute Maximum Voltage
- Two Internal Full-Bridge Drivers
- Up to 1/32-Step Microstepping
- Internal Current Sensing and Regulation
- Low On Resistance (HS=60mΩ, LS=30mΩ)
- Serial Control Interface
- Enable and Step Input Pins
- 3.3V and 5V Compatible Logic Supply
- Over-Current Protection (OCP)
- 4A Maximum Output Current
- Automatic Hold Current
- Automatic Current Decay
- Diagnostic Functions, Including:
  - Rotor Stall Detection
  - Back EMF Measurement
  - Over-Current Protection
  - Open-Load Detection
  - Over-Voltage and Under-Voltage Protection (OVP and UVP, Respectively)
  - Thermal Warning and Shutdown
- Available in a Space-Saving QFN-25 (4mmx5mm) Package
- Fault Indication Output

Small Solution Size with Integrated Current Sensing

The MP6602 has the ability to measure the back EMF of the stepper motor. Logic in the MP6602 processes the digitized back EMF information, and can provide an indication of rotor stall. These features are configured using an SPI interface. The back EMF value can also be directly read via a microcontroller, allowing for the use of more advanced diagnostics like load torque measurement.

Low $R_{DS(ON)}$ and Internal Current Sensing

The MP6602 H-bridges' $R_{DS(ON)}$ is very low, which allows up to 4A of motor winding current with very little power loss. In addition, current measurement is internal, so no external current measurement shunt resistors are required. Available in a very small QFN-25 (4mmx5mm) package, the MP6602 is the smallest stepper motor solution currently on the market that is capable of this level of current.



BRUSHED DC / SOLENOID DRIVERS

MPS H-bridge drivers are designed to drive brushed DC motors and solenoids in consumer appliances, toys, automotive, and industrial applications. Many different interfaces are supported, including SPI control, PWM interfaces, and separate high-side (HS) and low-side (LS) controls. This product family includes 1/2-H-bridge devices that can be used to regulate current in solenoids, as well as single and dual H-bridge parts to drive brushed DC motors of various sizes, from 2V to 60V and up to 5A. Some parts are also qualified for automotive use (AEC-Q100).

Features

- Integrated Half-/Full-Bridge Drivers
- Low On Resistance
- Internal Charge Pump
- Low Quiescent/Sleep Current
- Over-Current and Over-Temperature Protections (OCP and OTP, Respectively)
- Thermally Enhanced Packages

MPS Advantages

- Low On Resistance Significantly Improves Thermal Performance
- Extensive Protection Functions Increase System Reliability

BRUSHED DC MOTORS/SOLENOID DRIVERS | MOTOR DRIVERS

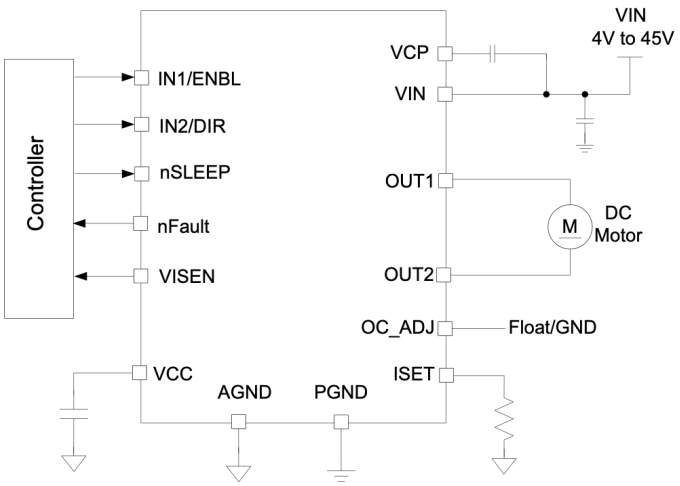
Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	# of Half-Bridges	I_{OUT} (Max) (A)	Control Interface	Package	Notes
MP6507	2.7	15	4	0.7	PWM	TSSOP-16EP, QFN-16 (3x3), QFN-16 (4x4)	Dual H-bridges
MP6508	2.7	18	4	1.2	PWM	TSSOP-16EP, QFN-16 (4x4)	Dual H-bridges
N **MP6508A**	2.7	18	4	1.2	PWM	QFN-16 (3x3)	Dual H-bridges
MP6513	2.5	21	2	0.8	PWM	TSOT23-6	Simple H-bridge
MP6513L	2.5	5.5	2	0.6	PWM	TSOT23-6	Low-power H-bridge
MP6515	5.4	35	2	2.8	PHASE/EN	QFN-20 (3x4), TSSOP-16EP	H-bridge motor driver
MP6516	5.4	35	2	2.8	PWM	TSSOP-16EP	Dual half-bridge driver
MP6519	3	28	2	5	PWM	QFN-19 (3x3)	H-bridge current regulator
MP6522	5.4	35	2	3.2	PWM	QFN-24 (5x5)	Simple H-bridge motor driver
MP6523	7	28	3	0.9	SPI	QFN-24 (4x4)	Motor driver with serial input control
MP6526	7	28	6	0.9	SPI	SOIC-28, QFN-24 (4x4), QFN-24 (5x5)	Serial input control
MP6527	5.5	40	10	0.8	SPI	TSSOP-28EP	Serial input control
MP6550	1.8	22	2	2	PWM	QFN-12 (2x2)	H-bridge
MP6551	2.5	14	2	5	PWM	QFN-14 (2.5x3)	Dual half-bridge driver
N **MP6604A**	4.5	45	4	2.5	IN/EN	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, IN/EN interface
N **MP6604B**	4.5	45	4	2.5	PHASE/EN	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, PHASE/EN interface
N **MP6604C**	4.5	45	4	2.5	HS/LS	QFN-28 (4x5), TSSOP-28EP	Simple dual H-bridge driver, HS/LS interface
MP6610	4	55	1	3	PWM	TSOT23-8, SOIC-8	Half-bridge, IN/EN control inputs

BRUSHED DC MOTORS/SOLENOID DRIVERS | MOTOR DRIVERS

	Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	# of Half-Bridges	I_{OUT} (Max) (A)	Control Interface	Package	Notes
S	**MP6612**	4	45	2	5	PWM	TSSOP-20EP	H-bridge with current sense, IN1 and IN2 inputs
S	**MP6612D**	4	45	2	5	DIR/ENBL	TSSOP-20EP	H-bridge with current sense, ENBL and DIR inputs
N	**MP6613**	4.5	45	2	5	Prog	QFN-28 (4x5), TSSOP-28EP	Simple H-bridge with programmable control modes
S	**MP6614**	5	35	2	1.5	PWM	SOIC-8EP	H-bridge
S	**MP6615**	4.75	40	2	8	PWM	TQFN-26 (6x6)	H-bridge
	MP6619	5.4	28	2	5	PWM	QFN-19 (3x3)	H-bridge
	MP8040	7.5	24	1	9	PWM	SOIC-8EP	H-bridge driver
	MP8046	7.5	28	2	5	PWM	TSSOP-20F	Full-bridge driver
	MP8049S	5	26	4	5.5	PWM	QFN-40 (5x5)	Dual full-bridge driver
	MPQ6519-AEC1	3	28	2	5	PWM	QFN-19 (4x4)	H-bridge current regulator, AEC-Q100 qualified
	MPQ6523-AEC1	7	28	3	0.9	SPI	QFN-24 (4x4)	Serial input control, AEC-Q100 qualified
	MPQ6524-AEC1	7	28	4	0.9	SPI	QFN-24 (4x4)	Serial input control, AEC-Q100 qualified
	MPQ6526-AEC1	7	28	6	0.9	SPI	QFN-24 (4x4), QFN-24 (5x5)	Serial input control, AEC-Q100 qualified
	MPQ6527-AEC1	5.5	40	10	0.8	SPI	TSSOP-28EP	Serial input control, AEC-Q100 qualified
	MPQ6610-AEC1	4	55	1	3	PWM	TSOT23-8, SOIC-8	Half-bridge, AEC-Q100 qualified
S	**MPQ6612A-AEC1**	4	45	2	5	PWM	QFN-18 (3x4)	H-bridge with current sense, IN1 and IN2 inputs, AEC-Q100 qualified
S	**MPQ6612A-D-AEC1**	4	45	2	5	PWM	QFN-18 (3x4)	H-bridge with current sense, ENBL and DIR inputs, AEC-Q100 qualified
S	**MPQ6614-AEC1**	5	35	2	1.5	PWM	QFN-8 (2x3)	H-bridge DC motor driver, AEC-Q100 qualified
S	**MPQ6615-AEC1**	4.75	40	2	8	PWM	TQFN-26 (6x6)	H-bridge, AEC-Q100 qualified
	MPQ6626-AEC1	5.5	40	6	0.8	SPI	TSSOP-28EP	Serial input control, AEC-Q100 qualified
	MPQ6628-AEC1	5.5	40	8	0.8	SPI	TSSOP-28EP	Serial input control, AEC-Q100 qualified

MP6612/MP6612D/MPQ6612A/MPQ6612A-D

45V, 5A, H-Bridge DC Motor Driver with Current Sense



Features

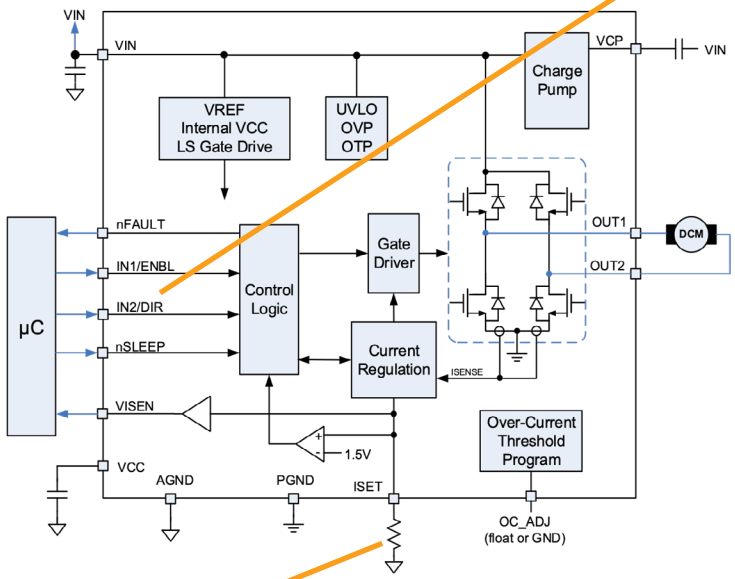
- Wide 4V to 45V Operating Input Voltage Range
- Internal Full H-Bridge Driver Supports 100% Duty Cycle with Internal Charge Pump
- Current Sense: <10% Accuracy
- 5A Continuous Driver Current
- Low On Resistance
- Cycle-by-Cycle Current Regulation/Limit
- IN1/IN2 and ENBL/DIR Logic Inputs
- Low I_Q (30μA) Brake Mode
- Configurable Current Limit and Protection
- Fault Indicator for Over-Current Protection (OCP) and Over-Temperature Protection (OTP)

MP6612 Family Introduction

Part Number	Input Interface	$R_{DS(ON)}$ (HS + LS) (mΩ)	Package (mm)	Notes
MP6612	IN1/IN2	70 + 45	TSSOP-20EP	-
MP6612D	ENBL/DIR	70 + 45	TSSOP-20EP	-
MPQ6612A	IN1/IN2	63 + 40	QFN-18 (3x4)	AEC-Q100 qualified
MPQ6612A-D	ENBL/DIR	63 + 40	QFN-18 (3x4)	AEC-Q100 qualified

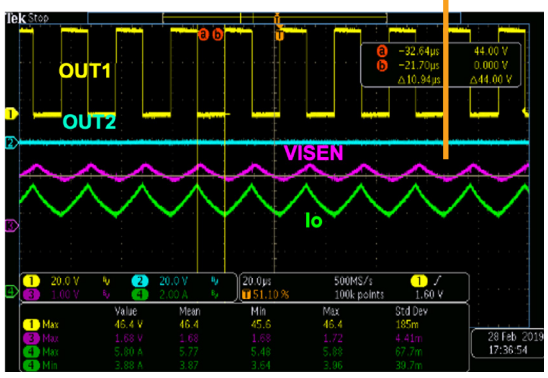
Current Limit and Brake Mode

If IN1 = IN2 = H or ENBL = L for ~1ms, then the part enters low-I_Q brake mode



To set the output current, I_{OUT} (A) = 15 / R_{ISET} (kΩ)

Internal current-sense output waveform (V_{ISEN}) scaled by R_{ISET}



BRUSHLESS DC PRE-DRIVERS

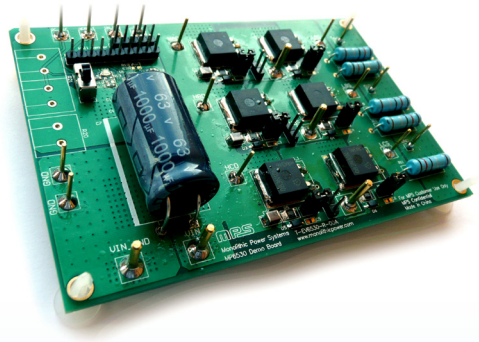
MPS brushless DC (BLDC) motor pre-drivers are designed to drive brushless DC motors and permanent magnet synchronous motors (PMSMs) used in robotics, industrial, automotive, and consumer applications, such as power tools, fans, pumps, and e-bikes. These MPS parts can operate from 5V to 100V, and can spin motors larger than 1,000W. Unique features include boosted gate drive supplies, configurable dead time, full protection features, and 100% duty cycle capability. Single-channel and three-channel parts are available with optional features like built-in buck regulators, current-sense amplifiers, and Hall commutation logic. Some parts are qualified for automotive use (AEC-Q100).

Features

- Single or Triple H-Bridge MOSFET Pre-Drivers
- Wide Input Voltage Range
- Internal Charge Pumps
- Over-Current Protection (OCP)
- Adjustable Dead Time to Prevent Shoot-Through
- Thermal Shutdown and Under-Voltage Lockout (UVLO) Protection

MPS Advantages

- Small Package Option Significantly Reduces PCB Space
- Wide Input Range to Support Different Applications
- Extensive Protection Functions Increase System Reliability



BRUSHLESS DC PRE-DRIVERS | MOTOR DRIVERS

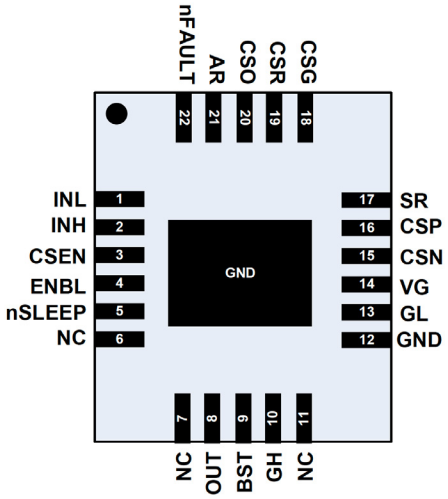
Part Number	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	V_{SW} (Max) (V)	# of Half-Bridges	I_{SINK} /I_{SOURCE} (A)	Hall Input	Package	Notes
MP1921A	9	18	100	1	2.5/1.5	-	SOIC-8EP, QFN-8 (3x3), QFN-9 (3x3), QFN-10 (4x4)	Half-bridge gate driver
MP1921B	9	18	100	1	2.5/1.5	-	QFN-10 (3x3)	Half-bridge gate driver
MP1922	5	15	100	1	4/3	-	QFN-22 (4x5)	Half-bridge pre-driver, current-sense amplifier, slew rate control
N **MP1923**	5	17	100	1	8/7	-	QFN-8 (4x4), QFN-10 (4x4), SOIC-8	High-frequency half-bridge gate driver
MP1924A	8	15	100	1	4.5/3	-	QFN-10 (4x4), SOIC-8	Half-bridge gate driver
MP1925	8	15	100	1	4.5/3	-	QFN-8 (4x4)	Half-bridge gate driver
MP6528	5	60	60	2	1/0.8	-	QFN-28 (4x4)	H-bridge pre-driver
MP6530	5	60	60	3	1/0.8	-	QFN-28 (4x4), TSSOP-28EP	3-phase pre-driver with PWM/EN control
MP6531A	5	60	60	3	1/0.8	-	QFN-28 (4x4), TSSOP-28EP	3-phase pre-driver with HS/LS inputs

BRUSHLESS DC PRE-DRIVERS | MOTOR DRIVERS

	Part Number	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	V_{SW} (Max) (V)	# of Half-Bridges	I_{SINK} /I_{SOURCE} (A)	Hall Input	Package	Notes
	MP6532	5	60	60	3	1/0.8	✓	QFN-28 (4x4), TSSOP-28EP	3-phase pre-driver with commutation logic
S	**MP6633A**	5	40	-	3	1/0.8	-	QFN-34 (4x5)	3-phase pre-driver with voltage regulator and single-channel sense amplifier
S	**MP6633B**	5	40	-	3	1/0.8	-	QFN-34 (4x5)	3-phase pre-driver with voltage regulator and 3-channel sense amplifier
	MP6534	5	55	55	3	1/0.8	-	QFN-40 (5x5)	3-phase pre-driver with buck regulator
	MP6535	5	55	55	3	1/0.8	✓	QFN-40 (5x5)	3-phase pre-driver with commutation logic and buck regulator
	MP6537	8	100	100	3	1/0.8	-	QFN-28 (4x5)	3-phase pre-driver with PWM/EN inputs
	MP6538	8	100	100	3	1/0.8	✓	QFN-28 (4x5)	3-phase pre-driver with Hall commutation logic
	MP6539	8	100	100	3	1/0.8	-	QFN-28 (4x5), TSSOP-28EP	3-phase pre-driver with HS/LS inputs
	MP6539B	8.5	14	100	3	1/0.8	-	QFN-28 (4x5), TSSOP-28EP	3-phase pre-driver
S	**MP6539C**	8.5	14	100	3	1/0.8	-	QFN-28 (4x5)	3-phase pre-driver with HS/LS inputs
	MPQ1922-AEC1	5	15	100	1	4/3	-	QFN-22 (4x5)	Half-bridge pre-driver, current-sense amplifier, slew rate control
N	**MPQ1923-AEC1**	5	17	100	1	8/7	-	QFN-8 (4x4), QFN-10 (4x4)	High-frequency half-bridge gate driver
	MPQ6528-AEC1	5	60	60	2	1/0.8	-	QFN-28 (4x5)	H-bridge pre-driver, AEC-Q100 qualified
	MPQ6531-AEC1	5	60	60	3	1/0.8	-	QFN-28 (4x5)	3-phase pre-driver, AEC-Q100 qualified
	MPQ6532-AEC1	5	60	60	3	1/0.8	✓	QFN-28 (4x5)	3-phase pre-driver with commutation logic, AEC-Q100 qualified
	MPQ6533-AEC1	6	40	-	3	1/0.8	-	QFN-32 (5x5)	3-channel pre-driver, AEC-Q100 qualified
S	**MPQ6539C-AEC1**	8.5	14	100	3	1/0.8	-	QFN-28 (4x5)	3-phase pre-driver with HS/LS inputs, AEC-Q100 qualified

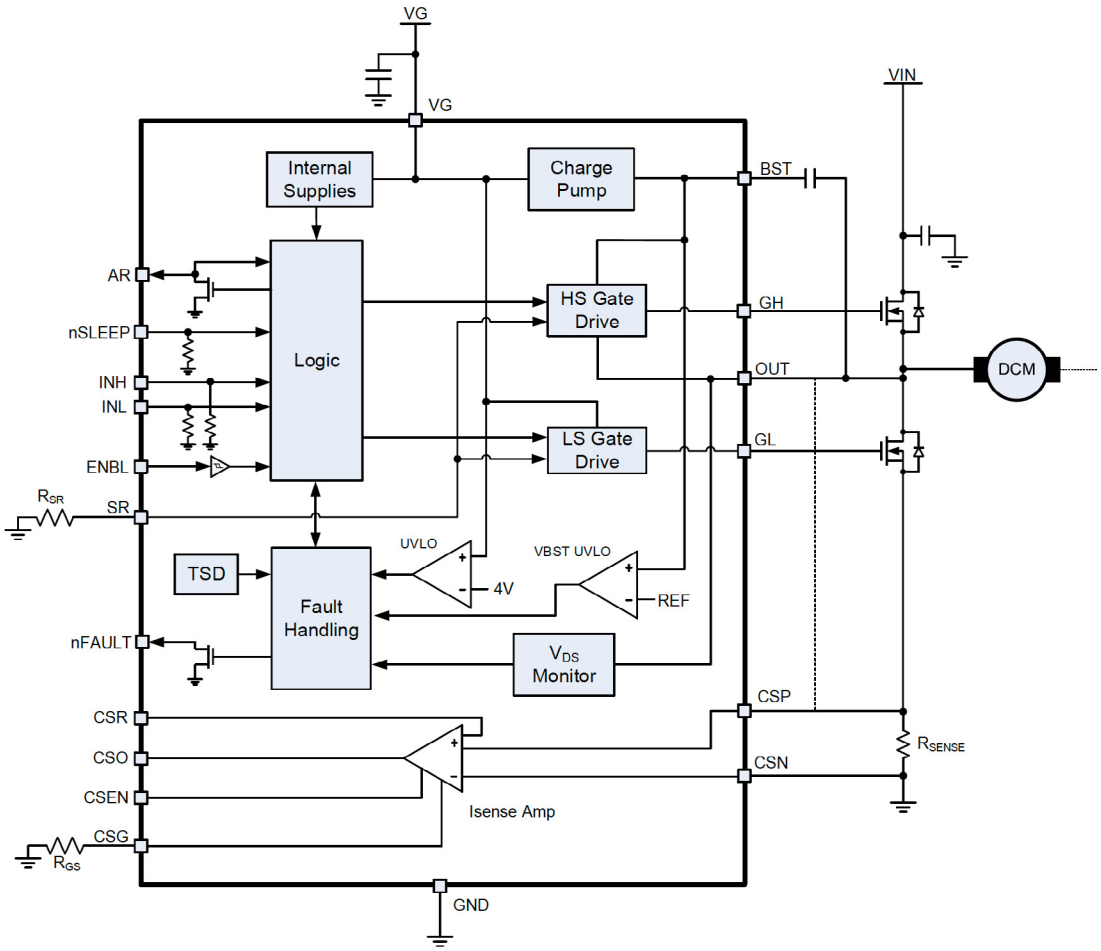
MP1922 / MPQ1922

100V, Single-Phase, BLDC Motor Pre-Driver with Integrated Current-Sense Amplifier and Slew Rate Control



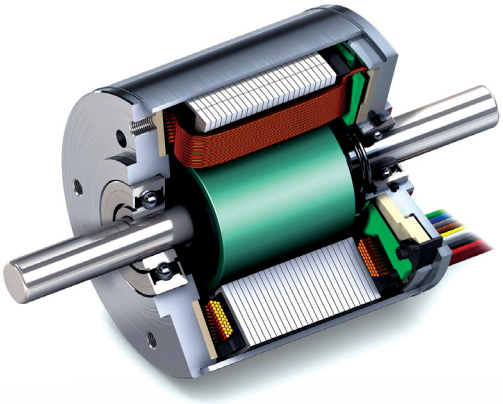
- Drives N-Channel MOSFET Half Bridge
- 4A / 3A Drive Current
- Up to 100V Input Voltage
- 4V to 15V Gate Drive Supply Voltage Range
- Integrated Current-Sense Amplifier
- Low-Power Sleep Mode
- Configurable Slew Rate
- MOSFET Desaturation Protection
- Internal Charge Pump for 100% Duty Cycle
- Under-Voltage Lockout (UVLO) Protection
- Available in a QFN-22 (4mmx5mm) Package

AEC-Q100 Available



INTEGRATED BLDC MOTOR DRIVERS

These integrated BLDC motor drivers use MPS's unique IC process technology, which allows for the integration of large, low-$R_{DS(ON)}$ power MOSFETs into ICs to directly drive BLDC motors, enabling the smallest single-chip BLDC driver solutions available on the market. MPS's integrated BLDC motor drivers are designed to drive BLDC motors and permanent magnet synchronous motors (PMSMs) used in robotics, industrial, automotive, and consumer applications, such as power tools, fans, pumps, and e-bikes. MPS solutions offer a variety of selectable input modes, such as PWM/ENBL inputs, HS/LS inputs, Hall signal inputs, and more. They also feature 100% duty cycle operation, robust protection functions, and an integrated current-sense amplifier. Some parts are qualified for automotive use (AEC-Q100).



MPS Advantages

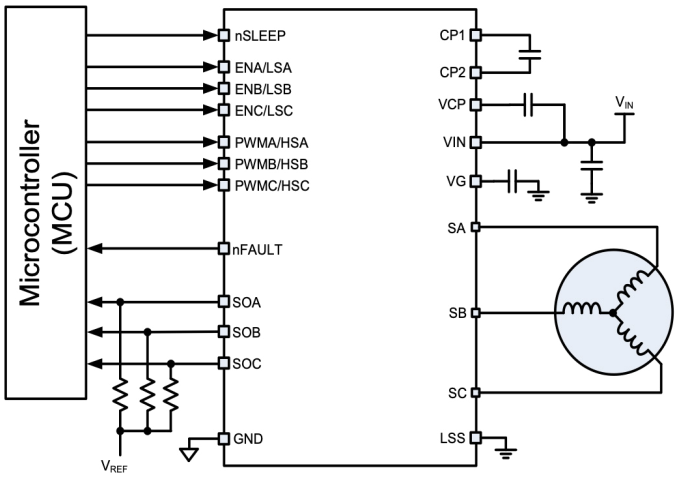
- Low On Resistance Significantly Improves Thermal Performance
- Wide Input Range to Support Different Applications
- Extensive Protection Functions Increase System Reliability
- Integrated Current-Sense Amplifier Reduces BOM Cost

INTEGRATED BLDC MOTOR DRIVERS | MOTOR DRIVERS

Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	# of Half-Bridges	I_{OUT} (Max) (A)	Hall Input	Package	Notes
MP6536	5	26	3	5.5	-	QFN-40 (5x5)	3-channel half-bridge driver
MP6540	5.5	35	3	3	-	QFN-26 (5x5)	3-phase power stage, PWM/ENBL inputs
MP6540A	5.5	35	3	3	-	QFN-26 (5x5)	3-phase power stage, HS/LS inputs
MP6540H	5.5	50	3	5	-	QFN-26 (5x5)	3-phase power stage, PWM/ENBL inputs
MP6540HA	5.5	50	3	5	-	QFN-26 (5x5)	3-phase power stage, HS/LS inputs
S **MP6541**	4.75	40	3	8	-	TQFN-26 (6x6)	3-phase power stage, PWM/ENBL inputs
S **MP6541A**	4.75	40	3	8	-	TQFN-26 (6x6)	3-phase power stage, HS/LS inputs
MP6543	3	12	3	2	-	QFN-24 (3x4)	3-phase power stage, PWM/ENBL inputs
MP6543A	3	12	3	2	-	QFN-24 (3x4)	3-phase power stage, HS/LS inputs
MP6543B	3	12	3	2	-	QFN-24 (3x4)	3-phase power stage, Hall signal inputs
MP6543H	3	22	3	2	-	QFN-24 (3x4)	3-phase power stage, PWM/ENBL inputs
MP6543H-A	3	22	3	2	-	QFN-24 (3x4)	3-phase power stage, HS/LS inputs
MP6543H-B	3	22	3	2	-	QFN-24 (3x4)	3-phase power stage, Hall signal inputs
MP6543C	3	22	3	1.2	-	QFN-24 (3x4)	3-phase power stage, PWM/ENBL inputs
N **MP6545**	4.5	45	3	2.5	-	QFN-28 (4x5), TSSOP-28EP	3-channel power stage, HS/LS inputs
N **MP6545A**	4.5	45	3	2.5	-	QFN-28 (4x5), TSSOP-28EP	3-channel power stage, separate GND for A/B/C phases
S **MP6546**	3.5	22	3	3	✓	QFN-20 (3x4)	3-phase power stage, 1MHz I^2C Interface
S **MPQ6541-AEC1**	4.75	40	3	8	-	TQFN-26 (6x6)	3-phase power stage, PWM/ENBL inputs, AEC-Q100 qualified
S **MPQ6541A-AEC1**	4.75	40	3	8	-	TQFN-26 (6x6)	3-phase power stage, HS/LS inputs, AEC-Q100 qualified

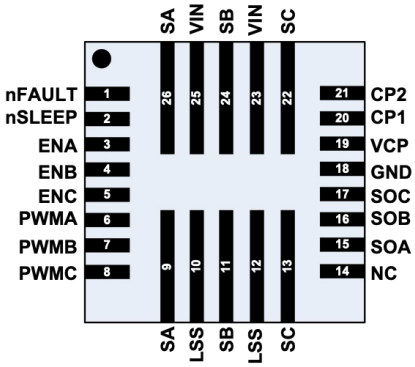
MP6541(A)/MPQ6541(A)

40V, 8A, Three-Phase Power Stage

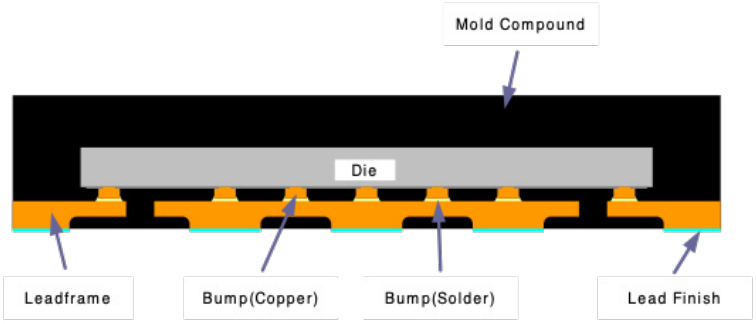


Features

- 4.75V to 40V Operating Supply Voltage
- Three Integrated Half-Bridge Drivers
- 8A of Continuous Output Current
- MOSFET On Resistance: 15mΩ per FET
- MP6541 & MPQ6541: PWM/ENBL Inputs, MP6541A & MPQ6541A: HS/LS Inputs
- Internal Charge Pump Supports 100% Duty Cycle Operation
- Automatic Synchronous Rectification
- Under-Voltage Lockout (UVLO) and Over -Voltage Protection (OVP)
- Thermal Shutdown Protection and Over -Current Protection (OCP)
- Integrated, Bidirectional Current-Sense Amplifiers
- Available in a TQFN-26 (6mmx6mm) Package
- The MPQ6541 & MPQ6541A Are Available in AEC-Q100 Grade 1



TQFN-26 (6mmx6mm)

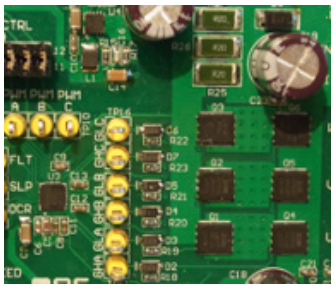


Mesh Connect™ (No Wire Bond)

MPQ6541 Size Comparison

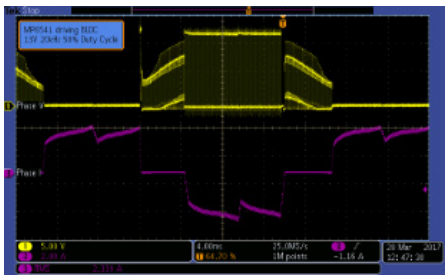
The MPQ6541 circuit can be 90% smaller than a pre-driver plus MOSFET solution

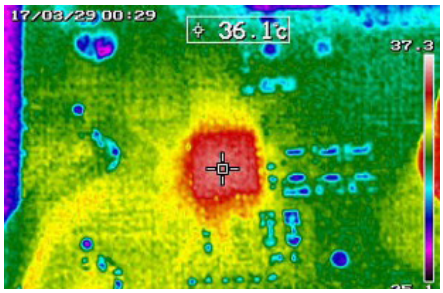
MPQ6541: 15mmx10mm



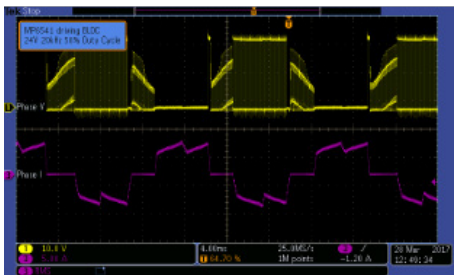
Pre-Driver plus 6 MOSFETs: 50mmx30mm

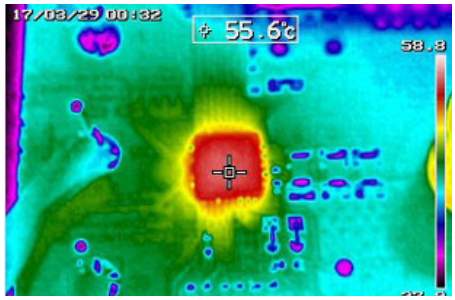
MPQ6541A Thermal Test Data



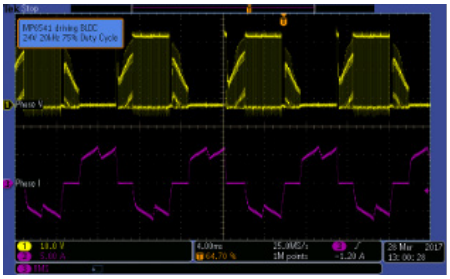


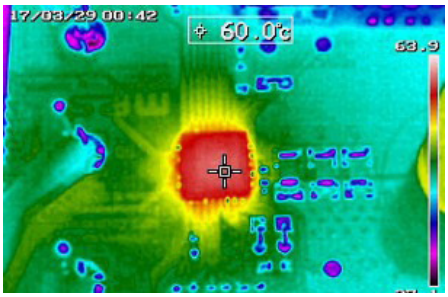
13V, 20kHz, 50% DC, 2.8A peak, 14°C temperature rise





24V, 20kHz, 50% DC, 5A peak, 33°C temperature rise





24V, 20kHz, 75% DC, 6A peak, 38°C temperature rise

BRUSHLESS DC COOLING FAN DRIVERS

MPS fan drivers are designed to drive consumer fans, industrial fans, automotive fans, notebook fans, PC fans, and more. These products include single-phase and three-phase drivers. Sine-wave control functionality can be optionally selected to meet different application scenarios. MPS fan drivers feature highly integrated, digital programming and open-/closed-loop speed control, as well as proprietary packaging and wafer process technology. Together, these advantages simplify design and minimize BOM for system applications. Some parts are qualified for automotive use (AEC-Q100).

MPS Advantages

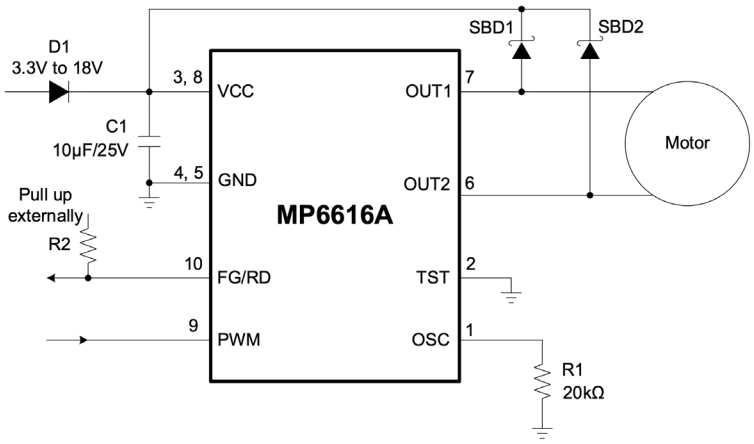
- Integrated MOSFETs and Hall Sensor Minimize Solution Size
- Digital Programming Capability Simplifies Design
- Proprietary Packaging Technology Improves Thermal Performance
- Extensive Protection Functions Enhance System Reliability

FAN DRIVERS | MOTOR DRIVERS

Part Number	V_{IN} (Min) (V)	V_{IN} (Max) (V)	# of Half-Bridges	I_{OUT} (Max) (A)	Hall Input	Package	Notes
MP6505	4.5	16	2	0.4	Yes	TSSOP-16EP	Single-phase BLDC
MP6510	4.5	16	2	1.2	Yes	TSSOP-16EP	Single-phase BLDC
MP6517	3.3	18	2	1.2	Yes	TSOT23-6, TSOT23-6-SL	Programmable, single-phase BLDC, integrated Hall sensor
MP6517A	3.3	16	2	2	Yes	TSOT23-6, TSOT23-6-SL	Programmable, single-phase BLDC, integrated Hall sensor
MP6517B	3.3	16	2	2	Yes	TSOT23-6-L, TSOT23-6-R, TSOT23-6-SL, TSOT23-6-RSL	Programmable, single-phase BLDC, integrated Hall sensor
MP6616	3.3	18	2	4	Yes	QFN-10 (2x3)	Single-phase BLDC, for closed-loop applicaitions
N **MP6616A**	3.3	18	2	4	Yes	QFN-10 (2x3)	I_{STB} ≤ 0.5mA compared to the MP6616
N **MP6616L**	3.3	18	2	3	Yes	QFN-10 (2x3)	Single-phase BLDC, for closed-loop applicaitions
MP6650	3.3	18	2	2	Yes	TSOT23-6-L, TSOT23-6-R, TSOT23-6-SL, TSOT23-6-RSL	Single-phase BLDC, integrated Hall sensor
MP6651	3.3	18	2	4	Yes	QFN-10 (2x3), SOIC-8SL	Single-phase BLDC, for open-loop applicaitions
N **MP6652**	3	18	2	1.3	Yes	TSOT23-6-L, TSOT23-6-SL	Single-phase BLDC, integrated Hall sensor
N **MP6652A**	3	18	2	1	Yes	TSOT23-6-L, TSOT23-6-SL	Single-phase BLDC, integrated Hall sensor, enhanced ESD
S **MP6653**	3.3	32	2	1.2	Yes	TSOT23-6-L, TSOT23-6-SL	24V, single-phase BLDC, integrated Hall sensor
N **MP6654**	3	18	2	1	Yes	TSOT23-6-L, TSOT23-6-SL	Single-phase BLDC, integrated Hall sensor, enhanced ESD
MP9517	3.3	18	2	2	Yes	TSOT23-6-L, TSOT23-6-SL	Single-phase BLDC, integrated Hall sensor
MP9518	3.3	18	2	1.2	Yes	TSOT23-6, TSOT23-6-SL	Single-phase BLDC, integrated Hall sensor
MP6630	2	5.5	3	1.4	Yes	UTQFN-8 (2x3)	3-phase, for notebook applications, integrated Hall sensor
MP6630H	2	16	3	1.4	Yes	UTQFN-8 (2x3)	3-phase, for notebook applications, integrated Hall sensor
N **MP6631**	3.6	24	3	3	Yes	QFN-26 (3x4)	3-phase BLDC, external Hall sensor
N **MP6631H**	3.6	35	3	3	Yes	QFN-26 (3x4)	3-phase BLDC fan driver, external Hall sensor
S **MP6632A**	5.5	50	3	-	Yes	QFN-32 (4x4)	3-phase BLDC gate driver with trapezoid drive
S **MP6636**	3.3	18	3	4	-	SOIC-8EP	3-phase sensorless BLDC fan driver, closed-loop control
S **MPQ6517B-AEC1**	3.3	16	2	2	Yes	TSOT23-6-SL	Programmable single-phase BLDC fan driver, integrated Hall sensor, AEC-Q100 qualified

MP6616A

Single-Phase BLDC Fan Driver with Integrated Hall Sensor and Closed-Loop Speed Control

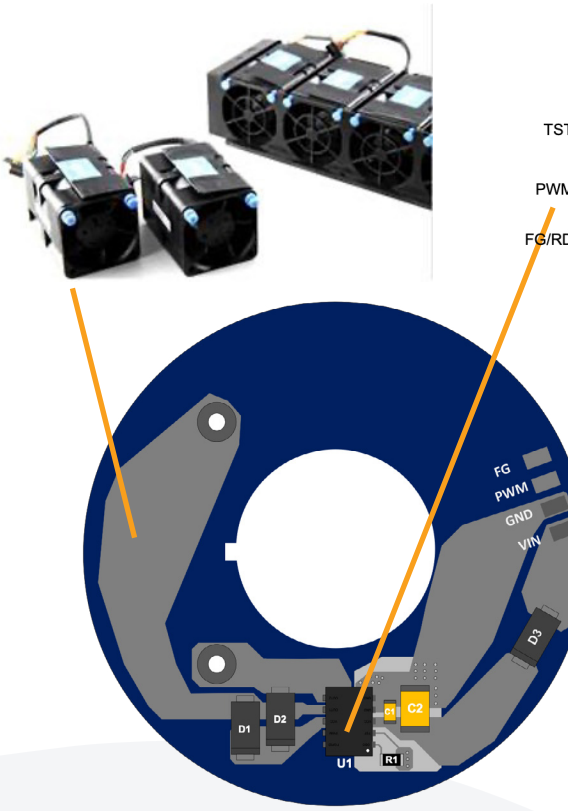


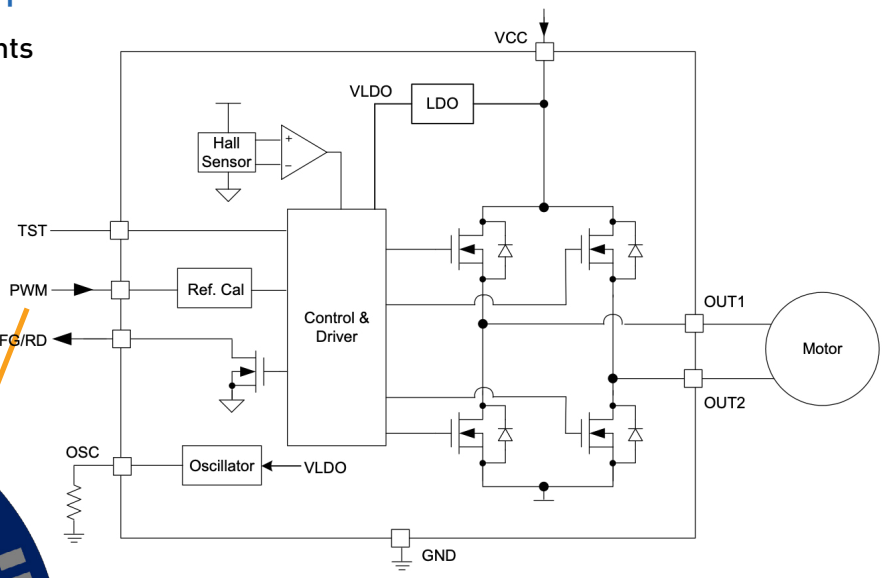
Features

- Embedded Hall-Effect Sensor
- 3.3V to 18V Operating Input Voltage Range
- 2A Continuous Current
- 100mΩ Integrated Power MOSFETs
- Closed-Loop or Open-Loop Speed Control
- High-Speed Accuracy with Closed-Loop Mode
- 45° Maximum Configurable Soft Commutation Angle
- ±45° Maximum Configurable Hall Offset Angle
- 4A Maximum Four-Step Configurable Current Limit
- 1kHz to 100kHz Pulse-Width Modulation (PWM) Input Range
- Configurable Soft-Start Time
- Standby Mode
- Rotor Lock Protection, Thermal Shutdown Protection, Over-Voltage Protection (OVP), Under-Voltage Lockout (UVLO), and Auto-Recovery
- Available in a QFN-10 (2mmx3mm) Package

High-Current, All-in-One, Single-Phase BLDC Fan Driver with Closed-Loop Speed Control

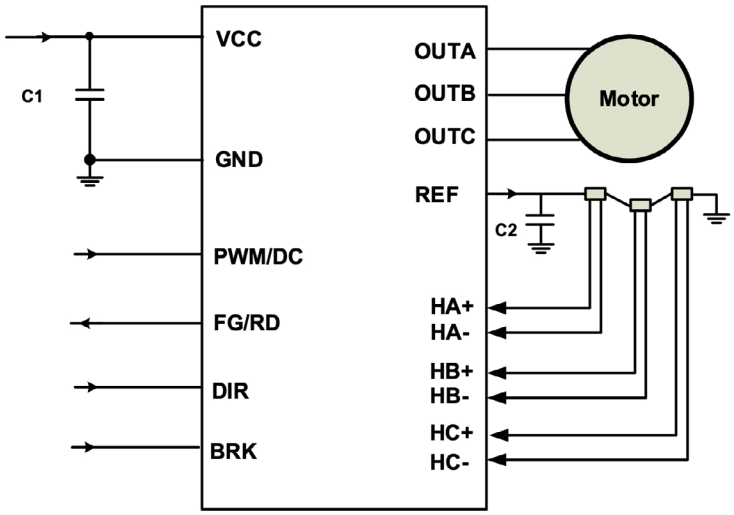
Small Size, Simple External Components





MP6631H

Three-Phase BLDC Motor Driver with Integrated MOSFETs



Features

- 3.6V to 35V Input Voltage Range
- Up to 3A Peak Phase Current
- 160mΩ High-Side and Low-Side Integrated MOSFETs (HS-FETs and LS-FETs, Respectively)
- Sinusoidal Drive
- Supports 0V to 1.2V DC Input or 1kHz to 100kHz PWM Input Speed Control
- Supports External Triple-Hall or Single-Hall Element Differential Input
- Closed-Loop or Open-Loop Speed Control
- Direction/Brake Input
- Power-Save Mode
- Rotor Lock Protection
- Over-Current Protection (OCP)
- Rotational Speed Indicator FG signal
- Soft Start for Low Noise and No Current Over-shoot
- Available in a QFN-26 (3mmx4mm) Package

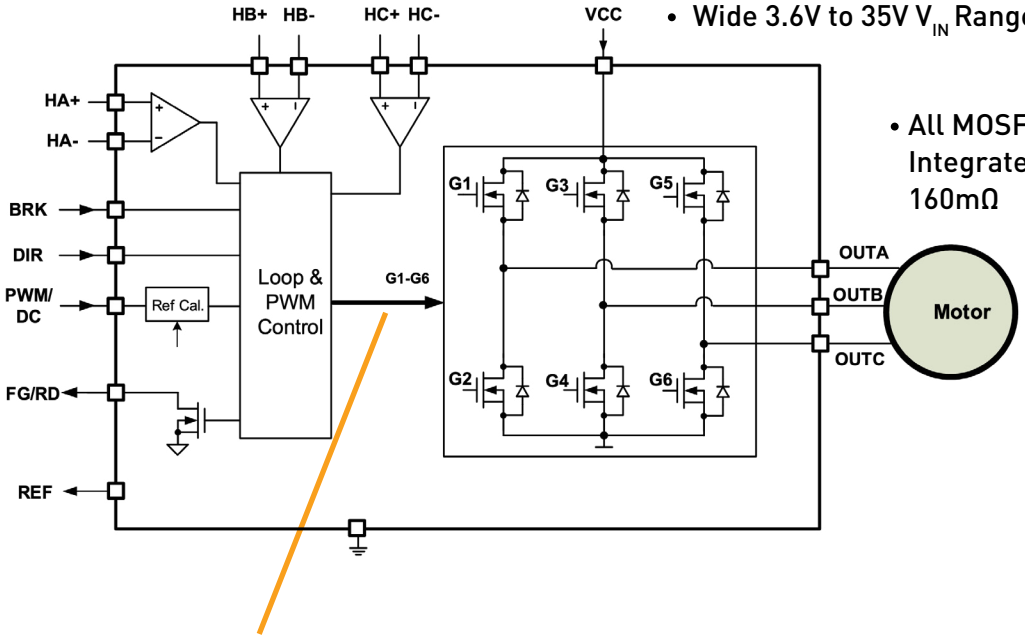
Code-Free Sinusoidal Three-Phase BLDC Motor Driver with Integrated MOSFETs and Closed-Loop Speed Control

Supports Single or Triple Hall

Brake and Direction Input

PWM Input or DC Input

FG or RD Output

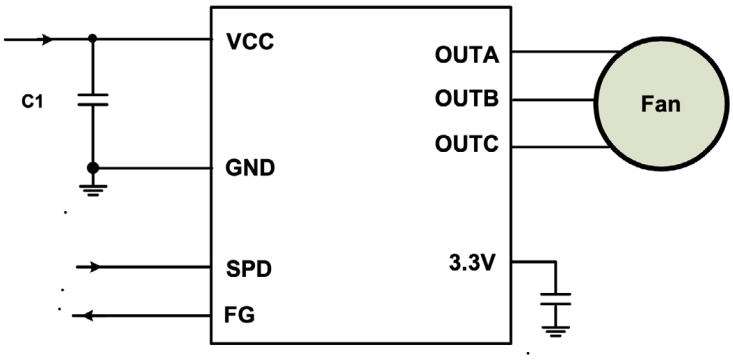


- Wide 3.6V to 35V V_{IN} Range
- All MOSFETs Integrated 160mΩ

Code-Free Sinusoidal 3-Phase BLDC Motor Driver

MP6636

Three-Phase Sensorless (FOC) BLDC Motor Driver with Integrated MOSFETs

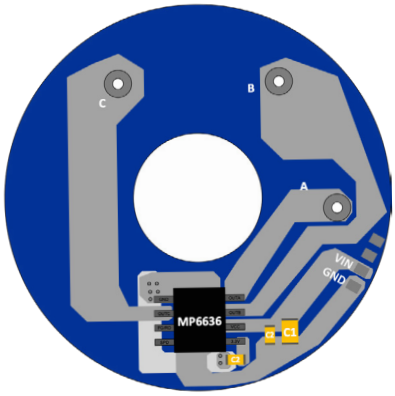


Features

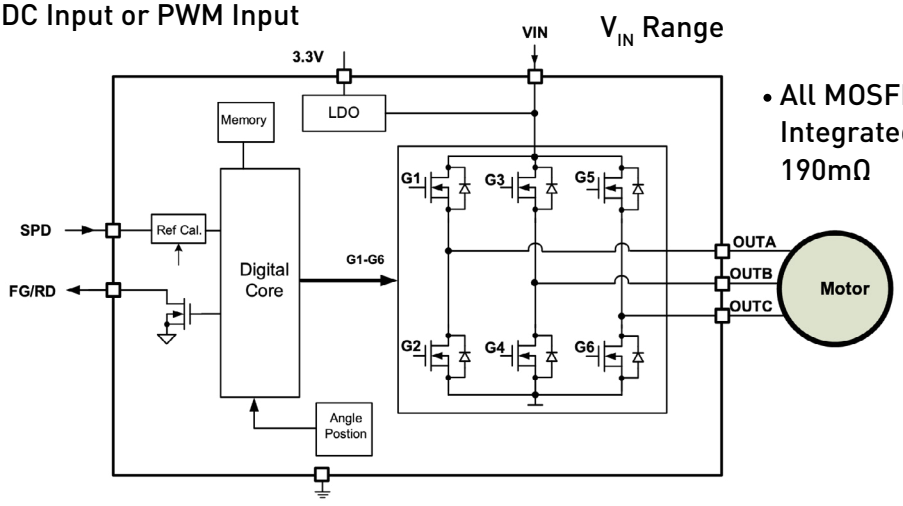
- 3.3V to 18V Input Voltage Range
- Up to 2A Continuous Current
- Sensorless FOC Control
- 190mΩ High-Side and Low-Side Integrated MOSFETs (HS-FETs and LS-FETs, Respectively)
- Supports 0.2V to 3.1V DC Input or 50Hz to 50kHz PWM Input Speed Control
- Curve Programming
- Selectable Open-Loop or Closed-Loop Speed Control
- Programmable Soft Acceleration Time
- Power-Save Mode
- Configurable Current Limit Up to 4A
- Short-Circuit Protection (SCP), Over-Voltage
- Protection (OVP), Phase Loss Protection, Rotor Lock Protection
- Selectable FG and RD Output
- Available in an SOIC-8EP Package

Code-Free, Three-Phase, Sensorless FOC BLDC Motor Driver with Integrated MOSFETs and Closed-Loop Speed Control

- Simple External Components



- DC Input or PWM Input
- Wide 3.3V to 18V V_{IN} Range



- All MOSFETs Integrated: 190mΩ
- Code-Free, Sensorless FOC Control, Closed-Loop Speed Control, Curve Programming

NOTES

ABOUT MONOLITHIC POWER SYSTEMS

Who we are

We are creative thinkers. We break boundaries. We take technology to new levels. As a leading international semiconductor company, Monolithic Power Systems (MPS) creates cutting-edge solutions to improve the quality of life with green, easy-to-use products.

What we do

We make power design fun! With our innovative proprietary technology processes, we thrive on reimagining and redefining the possibilities of high-performance power solutions in industrial applications, telecom infrastructures, cloud computing, automotive, and consumer applications.

Where we come from

It started with a vision. Michael Hsing, pioneering engineer and CEO, founded Monolithic Power Systems, Inc. in 1997 with the belief that an entire power system could be integrated onto a single chip. Under his leadership, MPS has succeeded not only in developing a monolithic power module that truly integrates an entire power system in a single package, but also it continues to defy industry expectations with its patented groundbreaking technologies.

Our values

We cultivate creativity

As a company, we believe in creating an environment that encourages and challenges our employees to collaborate and think outside the box to excel beyond their preconceived capabilities.

We do not accept the status quo

We do not believe in limitations. It is not about what is, but what can be. Possibilities are endless at MPS.

We are passionate about sustainability

It's about the future. From materials to finances, we are committed to conservation. We will not tolerate waste in an effort to improve and preserve the quality of life.

We are committed to providing innovative products to our customers

Let us do the heavy lifting. We relentlessly strive to make system design versatile and effortless to meet our customers'specific needs. We'll do the work, so our customers can have the fun!

CONTACT & ORDERING

FAST RESPONSE

Quotes, Availability, Engineering Support & Samples
MonolithicPower.com/Quote-Samples-Support

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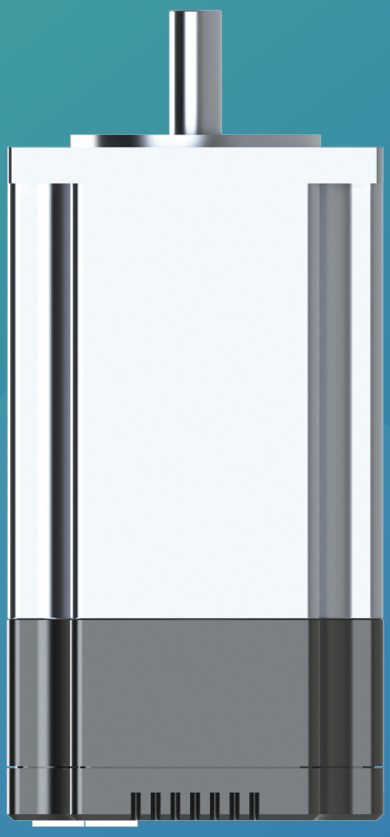

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