Motor control designed to drive your innovations
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Designed to drive your innovations: Infineon motor control solutions

Satisfying the demand for more efficient, feature-rich designs

SPURRED BY ENVIRONMENTAL LAWS mandating higher efficiency as well as consumer demand for more features and better functionality, designers have been turning to low-voltage 5 V to 48 V electric motor drives in recent years. The need for more efficient designs is prompting engineers to move from unipolar or H-Bridge motors to 3-Phase motors, tapping their simple control DC drives for small motors to 100 A 3-Phase motors.

THE VARIETY OF LOW-VOLTAGE MOTORS used is as diverse as the features they enable. Easiest to implement, DC brush motors are the most common electric motor used today. Stepper motors are wide use in position actuator applications. Engineers turn to brushless DC motors for high-temperature, high-reliability control applications, and when size constraints limit the use of DC Brush motors. High-current, high-reliability applications demand Permanent Magnet Synchronous Motors (PMSM).

Reliable, viable, undeniable

INFINEON HAS SEIZED THE NO. 1 SPOT in automotive power semiconductors by creating innovative power control solutions. Engineers value the reliability and versatility designed into these low-voltage motor control products, and have used them successfully in many non-automotive applications.

Innovative technologies, advanced techniques

INFINEON LEVERAGES MANY TECHNOLOGIES to create these innovations, for example trench N- and P-Channel MOSFETs, S-Smart power and logic, and Smart Power Technologies (SPT) featuring monolithic analog, digital and power. We also use advanced assembly techniques such as chip-by-chip, chip-on-chip and power bond for high-current wire bonding.

Step up to the next generation

BY COMBINING THESE TECHNOLOGIES, Infineon produces forward-looking products designed to enable the next generation of innovative motor control solutions. Alongside a broad portfolio of motor control power products, we also offer all the building blocks for end-to-end motor control solutions, including voltage regulators, communication ICs, microcontrollers and hall sensors.

Motor control designed to drive your innovations

INFINEON’S CREDO is Never stop thinking. If you wish to discover how this abstract idea translates into concrete reality, take a moment to review our wide range of motor control products. We’re sure to find the perfect solution to drive your products among our offering of motor control products. We’re looking forward to talking to you about how we can help you realize your next innovation.

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Motor drives application segments

Automotive
- Windshield wipers
- Climate control
- HVAC fans
- Engine cooling fans
- Power windows
- Sunroofs
- Door locks
- Power steering

Industry
- Automation and control
- Cordless drills and battery-driven power tools
- Power-adjustable seats (as used in first-class cabins)
- Medical: Dental chairs, ceiling arms for clean rooms, hospital beds, etc.
- Robotics
- Home appliances
- Printers and cutting printers
- Toys

Snowmobiles and boats

Sailboats

Toys

Automation and control

Printers and cutting printers

Power-adjustable seats (as used in first-class cabins)

Medical: Dental chairs, ceiling arms for clean rooms, hospital beds, etc.
The right driver for every motor

The search for a solution to drive applications powered by low-voltage motors ends with Infineon. From 0.1 to 100 A, and from stepper to 3-Phase drives, we offer the right solution for every current range and application requirement.

Example block diagrams

- Unipolar motor control
- H-Bridge motor control
- Half-Bridge motor control
- 3-Phase motor control

5 VDC to 48 VDC

Reverse battery protection
Temperature sensor
DC brush
Shunt 1 to 3
Shunt 1 to 3
3-Phase motor
3~
Reverse battery protection
Temperature sensor
DC brush
Shunt 1 to 3
### Product overview

#### Automotive MOSFETS

<table>
<thead>
<tr>
<th>Product name</th>
<th>P.D. (on)</th>
<th>Voltage</th>
<th>Example applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>OptiMOS F</td>
<td>4.7 mΩ</td>
<td>55 V</td>
<td>Power steering, water / fuel pump, braking, battery-operated drill / portable tools, wheel chairs, golf cart, electric scooter</td>
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</tbody>
</table>

#### High Current motor drivers

<table>
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<th>Product name</th>
<th>P.D. (on)</th>
<th>Voltage</th>
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<tr>
<td>IPD90N03S4L-02</td>
<td>4.7 mΩ</td>
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<td>N-Channel</td>
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#### Bridge Driver ICs

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<tr>
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<th>Operating</th>
<th>Over-temperature, over- / undervoltage, current sense, mirror fold, mirror heating, puddle lamps, open load off</th>
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<tbody>
<tr>
<td>Door Module ICs</td>
<td>TLE8201R</td>
<td>1.25, 1.8, 8 - 20</td>
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<tr>
<td>Multi-Half-Bridge</td>
<td>TLE4208G</td>
<td>3 x 0.6 6 - 18</td>
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<tr>
<td>Stepper</td>
<td>TLE4729G</td>
<td>2 x 0.75 5 - 50</td>
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<td>Motor Drivers</td>
<td>TLE4729G</td>
<td>5 - 16</td>
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<tr>
<td>Servo Drivers</td>
<td>TLE4206G</td>
<td>0.8 6 - 32</td>
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#### Smart Power DC Motor Bridges

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<th>Operating</th>
<th>Over-temperature, over- / undervoltage, short-circuit</th>
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<td>TLE6280GP</td>
<td>8 - 30 V</td>
<td>0 - 95% No Yes</td>
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<tr>
<td>TLE 7183F</td>
<td>5.5 - 28 V</td>
<td>0 - 100% Yes Yes</td>
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<tr>
<td>TLE 7189F</td>
<td>5.5 - 28 V</td>
<td>0 - 100% Yes Yes</td>
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<tr>
<td>TLE 7185E</td>
<td>5.5 - 33 V</td>
<td>0 - 95% Yes Yes</td>
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#### H-Bridges

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<th>Over-speed and throttle control</th>
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<td>TLE 6209</td>
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<tr>
<td>TLE 7209-2R</td>
<td>6 x 5 - 40 Protected</td>
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**www.infineon.com / DC Motor Bridges**
Motor Control N-Channel MOSFETS 30V, 40V, 55V

Optimos-T 40V, 55V and OptiMOS-T 30V can serve as basic building blocks for unipolar, H-Bridge and 3-Phase motor solutions. Pair these products with driver IC products to create a complete motor drive solution.

Features:
- Extended current capability: up to 180 A in D2PAK; 90 A in DPAK
- Improved RDS(on): as low as 1.6 Ω in D2PAK and 2.1 Ω in DPAK
- Best-in-class quality and reliability: full automotive qualifications with MSL1, 260 °C reflow

www.infineon.com/automotivemosfet

Bridge Driver ICs

Bridge Driver ICs control and protect the MOSFET power stage in high-current motor applications. The Bridge Driver ICs can be combined with Power MOSFETs to realize a complete motor drive solution.

Features:
- Low quiescent current (hysteresis mode)
- Diagnostic ERR flag provides detailed feedback
- Adjustable dead time / deactivation possible

www.infineon.com/Driver-IC

An example of 3-Phase motor control:

Reverse battery protection

Temperature sensor

30 V OptiMOS-T2 or 40 V OptiMOS-T

www.infineon.com/automotivemosfet
3-Phase driver ICs

3-Phase driver ICs control the motors for various applications such as power steering, fuel pumps and cooling fans. There are also many applications beyond automotive.

Features:
- 3-Phase driver
- Compatible to very low side, normal level input
- N-Channel MOSFETs
- PWM frequency up to 30 kHz
- Meet specifications down to 5.5 V supply voltage
- Low EMC sensitivity and emission
- Power package VQNF-48
- TTL-compatible control inputs
- Separate gate-source connection for each MOSFET
- Integrated minimum dead time
- Shoot-through protection
- Short-circuit protection with fixed detection level
- Disable function and sleep mode
- Detailed diagnosis
- Thermal overload warning for driver IC
- Integrated overcurrent warning
- Integrated current sense amplifier
- 0 to 100% duty cycle without refresh pulses

Example application in a headlight

Integrated DC Power Bridges

The TrilithIC family provides excellent drive solution for high-current DC motors. Infineon’s broad TrilithIC portfolio covers a wide range of automotive and industrial applications. Integrating a Full-Bridge in a single package, it enables compact designs. This line features overtemperature and short-circuit protection, as well as undervoltage detection. Its sophisticated diagnostic and protection capabilities bring remarkable robustness and flexibility to diverse applications.

Features:
- High-current H-Bridge in a single package
- Path RDS(on) down to 50 mΩ
- Short-circuit protection
- Diagnostic feedback

Example application in a headlight

www.infineon.com/Driver-IC

www.infineon.com/TrilithIC
The NovalithIC is a fully integrated high-current Half-Bridge for motor drive applications. It contains one p-channel high-side MOSFET, one N-Channel low-side MOSFET and an integrated driver IC in one package. The integrated driver IC, featuring logic level inputs makes interfacing to a microcontroller easy. The control chip also ships with integrated current-sensing diagnosis, slew rate adjustment and dead time generation, as well as overtemperature, overvoltage, undervoltage, overcurrent and short-circuit protection.

No charge pump for less EMI
A P-Channel for the high-side switch reduces the need for a charge pump, thus reducing EMI. The P-Channel high-side switch also enables active freewheeling and switch mode current limiting. Both significantly reduce power dissipation within devices.

Remarkably robust, the NovalithIC family reduces EMI, delivers good thermal performance and offers PWM capability ranging up to 25 kHz. And that makes it your first-choice solution for high-current motor drives.

Features:
- High-current Half-Bridges
- Built-in driver and protection
- Switch mode current limiting
- Current sensing capability
- Active freewheeling
- Best-in-class thermal performance

www.infineon.com/NovalithIC

Door module ICs
Enhanced reliability and performance for door modules

The TLE8201R is an application-specific standard product (ASSP) for automotive door modules. It comprises all power stages necessary to drive the loads in a typical front-door application. These include the central lock, safelock, mirror fold adjustment and defrost, as well as up to four 5/10 W lamps used for turn-signals, courtesy and warning lights, and control-panel illumination.

Featuring a monolithic design, it uses Infineon’s mixed technology SPT, which combines bipolar and CMOS control circuitry with DMOS power devices. Short-circuit and overtemperature protection, as well as detailed diagnostic feedback, satisfy the safety requirements for automotive applications. Its current-sense output improves overall system reliability and performance.

The standard SPI interface reduces microcontroller I/O lines while providing flexible control for power stages and detailed diagnostic feedback.

Features:
- Full-Bridge (150 mΩ) for the main door-lock motor
- Two Half-Bridges (400 mΩ) for deadbolt and mirror position or fold motor
- Two Half-Bridges (800mΩ) for mirror position
- High-side switch (100 mΩ) for mirror defrost
- Four high-side switches (500mΩ) for 5/10 W lamps
- Analog current-sense output and built-in multiplexer for lower µC/ADC channels
- All outputs with short-circuit protection and diagnosis
- Overtemperature protection with warning
- Open load diagnosis for all outputs
- Wiring optimized for efficient FSB layout
- Charge pump output for N-Channel MOSFET enabling reverse-polarity protection
- Very low current consumption in sleep mode
- Microcontroller Voltage regulator
- Reverse polarity protection
- Standard 16-bit SPI for control and diagnosis
- Open- and undervoltage lockout
- Power SO package with full-size heat slug for excellent thermal resistance
- Lead-free / halogen-free package

www.infineon.com/Door-Module-IC

Integrated DC Power Bridges
Smart DC Motor Bridges

NovalithIC
Advanced features for high-current motor drives

Application examples include automation blowers and power windows, battery-powered tools and wheelchairs for industrial applications.
The TLE 5205-2 and TLE5206-2 are integrated power H-Bridges with DMOS output stages for driving DC motors. The parts are built using the SPT® Smart Power Technology which allows bipolar and CMOS control circuitry plus DMOS power devices to exist on the same monolithic structure. Operation modes forward (cw), reverse (ccw), brake and high impedance are invoked from just two control pins with TTL / CMOS-compatible levels. The combination of an extremely low \( R_{\text{DS(ON)}} \) and the use of a power IC package with low thermal resistance and high thermal capacity helps to minimize system power dissipation. A blocking capacitor at the supply voltage is the only external circuitry due to the integrated freewheeling diodes.

Features:
- Delivers up to 5 A continuous / 6 A peak current
- Optimized for DC motor management applications
- Operates at supply voltages up to 40 V
- Very low \( R_{\text{DS(ON)}} \):
  - Typ. 200 m\( \Omega \) @ 25 °C per switch
- Output short-circuit protected
- Overtemperature protection with hysteresis and diagnosis
- Short-circuit diagnosis
- Open-load diagnosis (TLE 5205-2 only)
- Open-drain error flag
- Undervoltage lockout
- CMOS/TTL compatible inputs with hysteresis
- No crossover current
- Internal freewheeling diodes
- Wide temperature range:
  - 40°C ≤ \( T_J \) ≤ 150°C
5A H-Bridge

The TLE 6209R is an integrated power H-Bridge with DMOS output stages for driving DC motors. The parts are built using the SPT® Smart Power Technology which allows bipolar and DMOS control circuits plus DMOS power devices to exist on the same monolithic structure. Operation modes forward (cw), reverse (ccw), brake and high impedance are invoked by two control pins PWM and DIR. Protection and a reliable diagnosis of overtemperature, overspeed, short-circuit to ground, to the supply voltage or across the load are integrated. Detailed diagnostic information is given via the SPI status word. An integrated charge-pump circuit limits the current e.g. to reduce power dissipation during mechanical block of a DC motor. Several device parameters can be set by the SPI control word. A three-level temperature monitoring with warning, warning and shutdown is included for controlled operation under critical power loss conditions. The full protection and diagnostic capability make the device especially suitable for safety relevant applications, e.g. in automotive ECUs.

Features:
- Delivers up to 4 A continuous DC for each
- Optimized for DC motor management applications
- Operates at supply voltages of 8 V and
- Very low RDS(on): typ. 200 mΩ per switch
- Output short-circuit protection
- Overtemperature protection with hysteresis and diagnosis
- Short-circuit diagnosis
- Open-load diagnosis (TLE 6209-2 only)
- Open-drain error flag
- CMOS / TTL compatible inputs with hysteresis
- No crossover current
- Internal freewheeling diodes
- Wide temperature range, -40°C to 150°C
- Overvoltage protection against
- Undervoltage protection against
- 0.5 – 2 kHz operating frequencies
- Enhanced power P-DSO-Package

7A H-Bridges with SPI Interface

The TLE 2709/28 is an intelligent full-H-Bridge, designed for the control of DC and stepper motors in safety-critical applications and under extreme environmental conditions. The H-Bridge is protected against overtemperatures and short circuits and has an undervoltage lockout for all the supply voltages “VS” (main DC power supply). All malfunctions cause the output stages to go inactive. The device is configurable by the DMS pin. When grounded, the device gives diagnostic information via a simple error flag. When supplied with VCC = 5 V, the device works in SPI mode. In this mode, detailed failure diagnosis is available via the serial interface.

Features:
- Operating supply voltage 5 V to 36 V
- Typical RDS(on) = 90 mΩ for each output transistor (at 25°C)
- Continuous DC load current 1 A (5°C ± 1°C)
- Output current limitation at typ. 6.6 A +/- 1.1 A
- Overtemperature protection
- Undervoltage double function
- Diagnosis by SPI or Status-Flag (configurable)
- Enable and disable input
- P-DSO-20 power package

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- Diagnosis by SPI or Status-Flag (configurable)
- Enable and disable input
- P-DSO-20 power package
Automotive quality, flexibility and toughness

System electronics designers are increasingly opting for low-power DC motor control systems to drive functions such as exterior and interior mirror adjustment and air flaps in climate control systems. The TLE 6208-x Multi-Half-Bridge family provides a flexible, system-optimized solution for applications such as these.

TLE 6208-x's protection and diagnostic features satisfy the requirements of modern automotive ECUs. A serial interface (SPI) sends all diagnostic feedback and power stage control commands.

These devices feature Infineon’s Smart Power Technology (SPT), which combines DMOS power stages with bipolar analog and CMOS digital control circuits. Robust technology, protection circuits and the discerning quality standards of the Infineon Automotive & Industrial division endow this family with the rugged road-readiness automotive applications demand.

**Multi-Half-Bridge: TLE6208-3G/TLE6208-6G smart power technology**

- Compact, cost-effective control courtesy of our Multi-Half-Bridges.
- DC brush motor controls that drive low-load currents (<1 A) are best implemented using cost and PCB space-effective IC solutions. With parallel control interfaces, smart power features, status feedback and thermally enhanced packaging, Infineon's single and dual Half-Bridge solutions are the best choices for this type of application.
- The DOPL Multi-Half-Bridge family features prominently in body electronics, for example, for mirror adjustment and HVAC flap applications. The benefits of its multifaceted feature set are many, making it very attractive for many applications.
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**Multi-Half-Bridge: TLE4207, TLE4208 bipolar technology**

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**Features:**
- Protected bipolar power stages
- Low saturation voltage
- Low current consumption
- Internal freewheeling diodes

**Watchdog**
- Voltage regulator
- Reverse polarity diode
- Standard serial SPI for control and diagnosis
- Enhanced power DSO package

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- Protected bipolar power stages
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- Low current consumption
- Internal freewheeling diodes

**Watchdog**
- Voltage regulator
- Reverse polarity diode
- Standard serial SPI for control and diagnosis
- Enhanced power DSO package

am schluß klapper platzieren
Servo Driver
Robust, reliable, roadworthy

The servo driver family comprises of three devices, TLE4206G, TLE4206-2G and TLE4209. They feature a fully integrated full-Bridge with freewheeling diodes and smart power protection features for automotive headlight beam leveling control applications. The standard thermally enhanced power P-DSO-14 package leverages low R_th for environments with high ambient temperatures of 150°C.

The servo driver family is offered in DOPL bipolar high-voltage power technology. With features such as overvoltage and undervoltage lockout as well as short-circuit and overtemperature built-in protections, these robust and reliable devices are perfect for automotive applications.

Features:
- Protected bipolar power stages
- Low saturation voltage
- Internal freewheeling diodes
- Optimized for Headlight Beam Control (HBC) applications
- TLE 4205 (for truck applications, 2 x 1 A)
- TLE 4206G (manual HBC, 2 x 0.8 A)
- TLE 4206-2G (automatic static HBC, 2 x 0.8 A)
- TLE 4209 (manual HBC, 2 x 0.8 A)

Automatic headlight beam control
European, Indian, Korean and Japanese laws mandate automatic headlight beam control systems for cars with XENON bulbs. An automatic system adjusts the angle of the headlight beams without requiring driver intervention.

Automatic static headlight beam control
This is the basic control system. Position sensors on the front and rear axles generate a differential feedback signal that apprises the Electrical Control Unit (ECU) of the car’s load status. The ECU then periodically corrects the vertical headlight position, with the car’s speed determining the frequency of adjustment.

Manual headlight beam control
A manual headlight beam control system enables the driver to adjust the angle of the headlight using a dedicated switch on the dashboard. The driver may adjust the headlight beam to suit the car’s current load. This system is the standard solution for headlights equipped with halogen bulbs. The TLE4206G servo driver is suitable for driving the DC brush motor used for this application.
Stepper Driver

Cost-efficient, durable and reliable

In body electronics, stepper motors are featured in headlight beam leveling and HVAC flap systems. They are also widely used in engine management systems. A typical application is rpm management, where a motor-driven valve in the bypass air inlet controls idling speed. Infineon has engineered a product family for 2-Phase stepper motors and loads lower than 1 A.

The TLE4727, TLE4728 and TLE4729 devices are flexible and offer a variety of feature sets for stepper motor applications in the automotive industry. Engineered to handle 24 V operating voltage, the TLE4726F is an excellent choice for applications in trucks. Designed for electronic sewing machines, ink-jet printers and more, the TCA3727 is well-suited to industry applications.

Features:
- Full to half-step operation
- Protected bipolar power stages
- Implemented current control
- Error flag for diagnosis
- TLE 4727 (suitable for industry applications, 2 x 0.75 A)

OptiMOS-T2® 30 V (Trench)

OptiMOS-T® 40 V (Trench)

30 V/40 V

Automotive N-Channel MOSFET

*See packages on page 35

*See packages on page 35
## Automotive N-Channel MOSFET

### Bridge Driver ICs

#### OptiMOS-T 55 V (Trench)

<table>
<thead>
<tr>
<th>Model</th>
<th>Type max.</th>
<th>( R_{DS(on)} ) [( m\Omega )]</th>
<th>( I_D ) [A] max.</th>
<th>( R_{thJC} ) [K/W]</th>
<th>Package*</th>
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<td>2.3</td>
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<td>IPD50N06S3-15</td>
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<td>IPD30N06S3L-20</td>
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<td>10</td>
<td>IPD30N06S3L-20</td>
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<td>IPD30N06S3-24</td>
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<td>10</td>
<td>IPD30N06S3-24</td>
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<tr>
<td>IPP/I100N06S3L-03</td>
<td>3.0</td>
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<td>0.5</td>
<td>2, 9</td>
<td>IPP/I100N06S3L-03</td>
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<td>100</td>
<td>0.5</td>
<td>2, 9</td>
<td>IPP/I100N06S3-03</td>
</tr>
<tr>
<td>IPP/I100N06S3L-04</td>
<td>3.8</td>
<td>100</td>
<td>0.7</td>
<td>2, 9</td>
<td>IPP/I100N06S3L-04</td>
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<td>4.4</td>
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<td>0.7</td>
<td>2, 9</td>
<td>IPP/I100N06S3-04</td>
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<tr>
<td>IPP/I80N06S3L-05</td>
<td>4.8</td>
<td>80</td>
<td>0.9</td>
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<td>80</td>
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<td>IPP/I80N06S3-05</td>
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<td>IPP/I80N06S3L-06</td>
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<td>IPP/I45N06S3L-13</td>
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<td>45</td>
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<tr>
<td>IPP/I45N06S3-16</td>
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<td>IPP/I45N06S3-16</td>
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<tr>
<td>IPP/I25N06S3L-22</td>
<td>21.6</td>
<td>25</td>
<td>3.3</td>
<td>2, 9</td>
<td>IPP/I25N06S3L-22</td>
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<td>12</td>
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<td>0.5</td>
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<td>80</td>
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<td>80</td>
<td>0.9</td>
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<tr>
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<td>80</td>
<td>1.1</td>
<td>12</td>
<td>IPB80N06S3L-06</td>
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<tr>
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<td>45</td>
<td>2.3</td>
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<td>IPB45N06S3L-13</td>
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<tr>
<td>IPB45N06S3-16</td>
<td>15.4</td>
<td>45</td>
<td>2.3</td>
<td>12</td>
<td>IPB45N06S3-16</td>
</tr>
<tr>
<td>IPB25N06S3L-22</td>
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<td>25</td>
<td>3.3</td>
<td>12</td>
<td>IPB25N06S3L-22</td>
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<tr>
<td>IPB25N06S3-25</td>
<td>24.8</td>
<td>25</td>
<td>3.3</td>
<td>12</td>
<td>IPB25N06S3-25</td>
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</tbody>
</table>

#### H-Bridge / Dual-Half-Bridge drivers family overview

<table>
<thead>
<tr>
<th>Control inputs</th>
<th>Supply voltage (operation)</th>
<th>Duty cycle</th>
<th>Low quiescent mode</th>
<th>OpAmps</th>
<th>Adjustable dead time level</th>
<th>Adjustable short-circuit detection level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 – 6</td>
<td>0 … 95 %</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 28 V</td>
<td>0 … 100 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 28 V</td>
<td>0 … 100 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 33 V</td>
<td>0 … 95 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>TLE 6280GP / TLE 6282G</td>
<td>0 – 95 %</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

#### 3-Phases drivers family overview

<table>
<thead>
<tr>
<th>Control inputs</th>
<th>Supply voltage (operation)</th>
<th>Duty cycle</th>
<th>Low quiescent mode</th>
<th>OpAmps</th>
<th>Adjustable dead time level</th>
<th>Adjustable short-circuit detection level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 – 35 V</td>
<td>0 … 95 %</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 28 V</td>
<td>0 … 100 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 28 V</td>
<td>0 … 100 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5.5 – 35 V</td>
<td>0 … 95 %</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*Note: packages on page 29.*
### NovalithIC

<table>
<thead>
<tr>
<th>Model</th>
<th>Peak current range (A)</th>
<th>Quiescent current range (µA)</th>
<th>Operating frequency (kHz)</th>
<th>Switching frequency (kHz)</th>
<th>Short-circuit current range (A)</th>
<th>Self-protection range (V)</th>
<th>Error</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTS/BTM 7930 R</td>
<td>25</td>
<td>18</td>
<td>7</td>
<td>55 – 28</td>
<td>28</td>
<td>55</td>
<td>25</td>
<td>load = GND + battery</td>
</tr>
<tr>
<td>BTS/BTM 7935 B1</td>
<td>25</td>
<td>18</td>
<td>7</td>
<td>55 – 28</td>
<td>28</td>
<td>55</td>
<td>25</td>
<td>load = GND + battery</td>
</tr>
<tr>
<td>BTS/BTM 7940 R</td>
<td>43</td>
<td>33</td>
<td>7</td>
<td>55 – 28</td>
<td>16</td>
<td>305</td>
<td>25</td>
<td>load = GND + battery</td>
</tr>
<tr>
<td>BTS/BTM 7945 B1</td>
<td>43</td>
<td>33</td>
<td>7</td>
<td>55 – 28</td>
<td>16</td>
<td>305</td>
<td>25</td>
<td>load = GND + battery</td>
</tr>
</tbody>
</table>

1) OL = Open load
2) OT = Overtemperature
3) OC = Overcurrent

*See packages on page 35

### TrilithIC

<table>
<thead>
<tr>
<th>Model</th>
<th>Peak current range (A)</th>
<th>Quiescent current range (µA)</th>
<th>Operating frequency (kHz)</th>
<th>Switching frequency (kHz)</th>
<th>Short-circuit current range (A)</th>
<th>Self-protection range (V)</th>
<th>Error</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTS/BTM 7700 G</td>
<td>4.3</td>
<td>9</td>
<td>II</td>
<td>5 – 42</td>
<td>200</td>
<td>540</td>
<td>load = GND</td>
<td>load + battery</td>
</tr>
<tr>
<td>BTS/BTM 7710 G</td>
<td>5.8</td>
<td>15</td>
<td>II</td>
<td>5 – 42</td>
<td>110</td>
<td>240</td>
<td>load = GND</td>
<td>load + battery</td>
</tr>
<tr>
<td>BTS/BTM 7740 G</td>
<td>4.2</td>
<td>8</td>
<td>II</td>
<td>5 – 42</td>
<td>210</td>
<td>500</td>
<td>load = GND</td>
<td>load + battery</td>
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</tbody>
</table>

*See packages on page 35

*BTM = Green TrilithIC
### Smart Power DC Motor Bridges

#### Door Module ICs (DoMoPo)

<table>
<thead>
<tr>
<th>Type</th>
<th>Configuration</th>
<th>Output (Max)</th>
<th>Peak current (A)</th>
<th>Quiescent current (µA)</th>
<th>Operating range (V)</th>
<th>Protection / diagnosis</th>
<th>Interface</th>
<th>Package*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLE 4207</td>
<td>2 x Half-Bridge</td>
<td>2 x 0.8</td>
<td>20</td>
<td>Status flag</td>
<td>6 – 18</td>
<td>Very low saturation voltage + over voltage at 0.4 A</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
</tr>
<tr>
<td>TLE 4208</td>
<td>4 x Half-Bridge</td>
<td>4 x 0.8</td>
<td>20</td>
<td>Status flag</td>
<td>6 – 18</td>
<td>Dual Full-Bridge</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
</tr>
<tr>
<td>TLE 6208-3</td>
<td>3 x Half-Bridge</td>
<td>3 x 0.6</td>
<td>10</td>
<td>Status flag</td>
<td>6 – 40</td>
<td>16-Bit SPI detailed diagnosis</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
</tr>
<tr>
<td>TLE 6208-6</td>
<td>6 x Half-Bridge</td>
<td>6 x 0.6</td>
<td>12</td>
<td>Status flag</td>
<td>6 – 40</td>
<td>16-Bit SPI single switch usage</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
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</table>

#### Motor control ICs

<table>
<thead>
<tr>
<th>Type</th>
<th>Configuration</th>
<th>Output (Max)</th>
<th>Peak current (A)</th>
<th>Quiescent current (µA)</th>
<th>Operating range (V)</th>
<th>Protection / diagnosis</th>
<th>Interface</th>
<th>Package*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLE 5205-2</td>
<td>Full-Bridge</td>
<td>4 x 5</td>
<td>10</td>
<td>Status flag</td>
<td>6 – 40</td>
<td>Break high and low</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
</tr>
<tr>
<td>TLE 5206-2</td>
<td>Full-Bridge</td>
<td>4 x 5</td>
<td>10</td>
<td>Status flag</td>
<td>6 – 40</td>
<td>Break high and low</td>
<td>SPI / via 25 °C</td>
<td>16-Bit SPI</td>
</tr>
</tbody>
</table>

*See packages on page 35

---

**Type Outputs**

- **Output current (A)** (max.)
- **R_DS(on) Driver stage**
- **Quiescent current (µA)**
- **Operating range (V)**
- **Protection / diagnosis**
- **Interface Package**

**TLE8201**

- **Out 1, 2**: 8150m
  - **T (max @ Tj=25 °C)**: 260m
  - **T (max @ Tj=150 °C)**: Half-Bridge 6
- **Out 5, 6**: 1.25
  - **T (max @ Tj=25 °C)**: 1.3
  - **T (max @ Tj=150 °C)**: Half-Bridge 6
- **Out 7**: 6.25
  - **T (max @ Tj=25 °C)**: 170m
  - **T (max @ Tj=150 °C)**: High side switch
- **Out 8 – 11**: 1.8
  - **T (max @ Tj=25 °C)**: 800m
  - **T (max @ Tj=150 °C)**: Lamp driver

**TLE8203**

- **Out 4**: 400m
  - **T (max @ Tj=25 °C)**: 700m
  - **T (max @ Tj=150 °C)**: Half-Bridge 6
- **Out 5, 6**: 1.25
  - **T (max @ Tj=25 °C)**: 1.3
  - **T (max @ Tj=150 °C)**: Half-Bridge 6
- **Out 7**: 6.25
  - **T (max @ Tj=25 °C)**: 170m
  - **T (max @ Tj=150 °C)**: High side switch (mirror defrost)

**Over-temperature, over-/under-voltage look-out, open load diagnosis, current sense**

**SPI for programming and diagnostic, INH and PWM input**

---

*(Product in development)*
## Smart Power DC Motor Bridges

### H-Bridges

#### Stepper motor drivers

<table>
<thead>
<tr>
<th>Type</th>
<th>Output current (A)</th>
<th>Peak current (A)</th>
<th>Step operations</th>
<th>Operating voltage (V)</th>
<th>Protected</th>
<th>Diagnostic interface</th>
<th>Package*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCA 3727</td>
<td>2 x 0.75</td>
<td>2.2 x</td>
<td>Fail to min step</td>
<td>5 – 50</td>
<td>Open</td>
<td>Status and flag</td>
<td>D</td>
</tr>
<tr>
<td>TLE 4726</td>
<td>2 x 0.75</td>
<td>2.2 x</td>
<td>Fail to min step</td>
<td>5 – 50</td>
<td>Over-temperature</td>
<td>Status and flag</td>
<td>D</td>
</tr>
<tr>
<td>TLE 4727</td>
<td>2 x 0.75</td>
<td>2.2 x</td>
<td>Fail to min step</td>
<td>5 – 16</td>
<td>Over, over-temperature, short circuit</td>
<td>Status and flag</td>
<td>D</td>
</tr>
<tr>
<td>TLE 4728</td>
<td>2 x 0.75</td>
<td>2.2 x</td>
<td>Fail to min step</td>
<td>5 – 16</td>
<td>Status and flag</td>
<td>Status and flag</td>
<td>D</td>
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</table>

For the complete Automotive Power package overview, please refer to the Automotive Power Selection Guide.

#### Servo drivers

<table>
<thead>
<tr>
<th>Type</th>
<th>Output current (A)</th>
<th>Peak current (A)</th>
<th>Consumption (mA)</th>
<th>Operating voltage (V)</th>
<th>Protected</th>
<th>Diagnostic interface</th>
<th>Package*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLE 4205</td>
<td>0.8</td>
<td>1</td>
<td>6 – 32</td>
<td>Over-power compensation for higher supply voltage 2.1 V at 0.6 A</td>
<td>No</td>
<td>SERVO DRIVER</td>
<td>D</td>
</tr>
<tr>
<td>TLE 4206</td>
<td>0.8</td>
<td>1</td>
<td>6 – 18</td>
<td>No</td>
<td>SERVO DRIVER</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>TLE 4206-2</td>
<td>0.8</td>
<td>1</td>
<td>6 – 18</td>
<td>No</td>
<td>Switching hysteresis on range input 1.2 V at 0.6 A</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>TLE 4209</td>
<td>0.8</td>
<td>1</td>
<td>6 – 18</td>
<td>No</td>
<td>Over-temperature, over-/under-voltage, lockout, short circuit</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

#### Bridges for idle speed and throttle control

<table>
<thead>
<tr>
<th>Type</th>
<th>Output current (A)</th>
<th>Peak current (A)</th>
<th>Consumption (mA)</th>
<th>Operating voltage (V)</th>
<th>Protected</th>
<th>Diagnostic interface</th>
<th>Package*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLE 5205-2</td>
<td>4</td>
<td>5</td>
<td>10</td>
<td>6 – 40</td>
<td>Open load detection status switch</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>TLE 5206-2</td>
<td>4</td>
<td>5</td>
<td>10</td>
<td>6 – 40</td>
<td>Low and high status flag</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>TLE 6209</td>
<td>6</td>
<td>7</td>
<td>30</td>
<td>5 – 40</td>
<td>Protected</td>
<td>SPI</td>
<td>D</td>
</tr>
<tr>
<td>TLE 7209-2R</td>
<td>6</td>
<td>7</td>
<td>50</td>
<td>5 – 28</td>
<td>Protected</td>
<td>SPI, chopper current limitation</td>
<td>D</td>
</tr>
</tbody>
</table>

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**Note:** See packages on page 35.
<table>
<thead>
<tr>
<th>Country/Area</th>
<th>Address</th>
<th>Phone</th>
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</tr>
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<tbody>
<tr>
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<td>Greschbachstraße 12, 76229 Karlsruhe</td>
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<td>(+49) 71 56-1 79 19 90</td>
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<tr>
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<td>Lemanstraat 67, 2018 Antwerpen, Belgium / Luxembourg</td>
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<td>(+31) 10 21 768 00</td>
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<tr>
<td>Brazil</td>
<td>São Paulo</td>
<td>(+55) 11-38 17 28 10</td>
<td>(+55) 11-38 17 28 10</td>
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<tr>
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<td>(+86) 10-82 35 61 18</td>
<td>(+86) 10-82 35 61 18</td>
</tr>
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</tr>
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<td>(+36) 14 71 28 25</td>
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</tr>
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