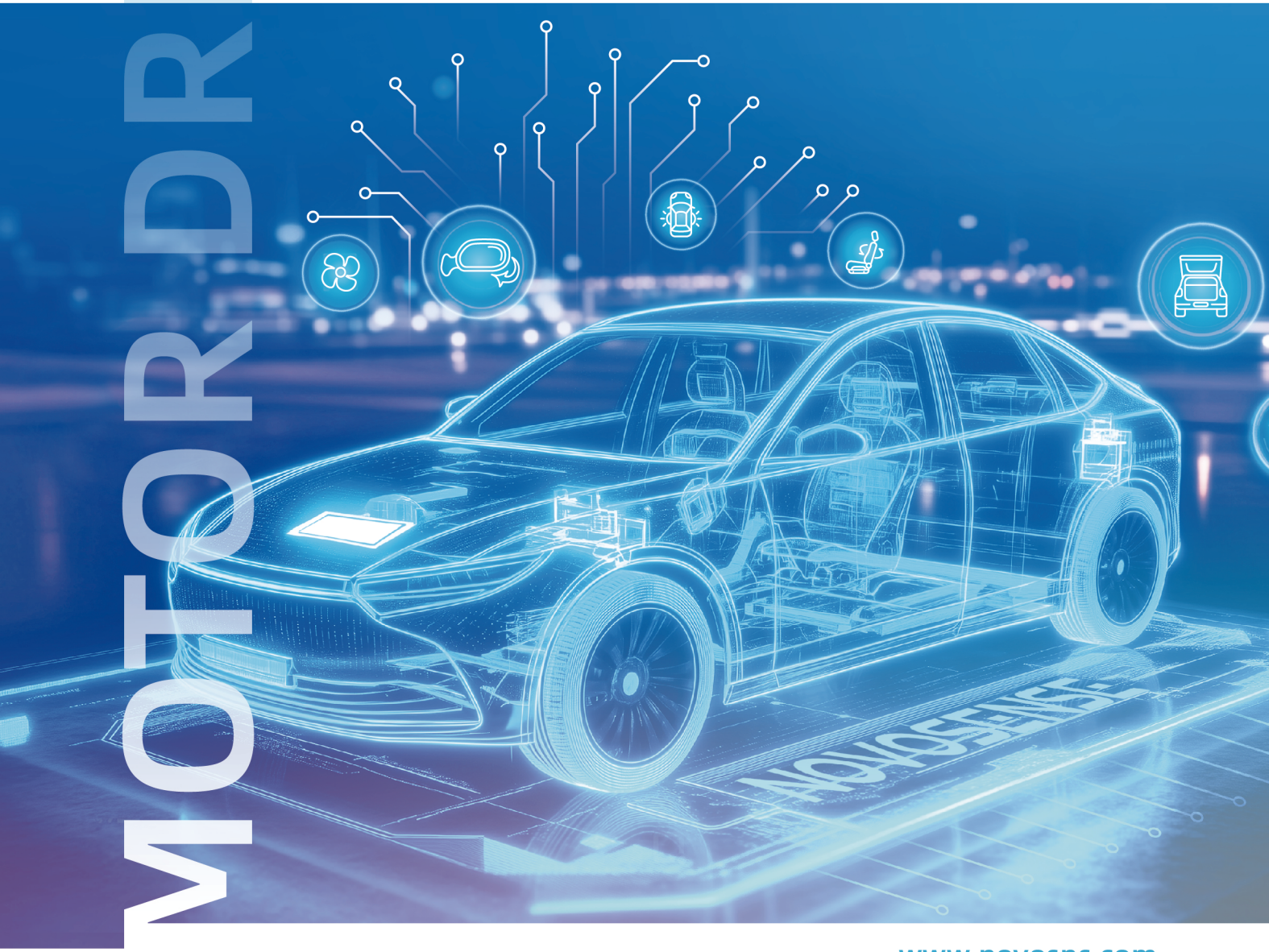
NOVOSENSE

MOTOR DRIVER

NOVOSENSE
Motor Driver IC Guide Book



www.novosns.com

NOVOSENSE: Highly Robust and Reliable Analog and Mixed Signal Chip Company

2013
Establishment

1200+
Employees

~USD 273 million
Revenue
(2024)

A leading chip provider for automotive applications

A provider for all-category analog & mixed signal chips

One-stop portfolio for automotive motor driver IC

NOVOSENSE Microelectronics (NOVOSENSE, SSE Stock Code 688052) is a highly robust & reliable analog and mixed signal chip company. Since its establishment in 2013, the company has been focusing on sensor, signal chain, and power management, providing comprehensive semiconductor products and solutions, which are widely used in automotive, industrial, information communication and consumer electronics markets.

With the mission of “Sense & Drive the Future, Build a Green, Smart and Connected World with Semiconductors”, the company is committed to providing chip-level solutions to link the digital world and the real world.

For more information and sample application, please visit: **www.novosns.com**

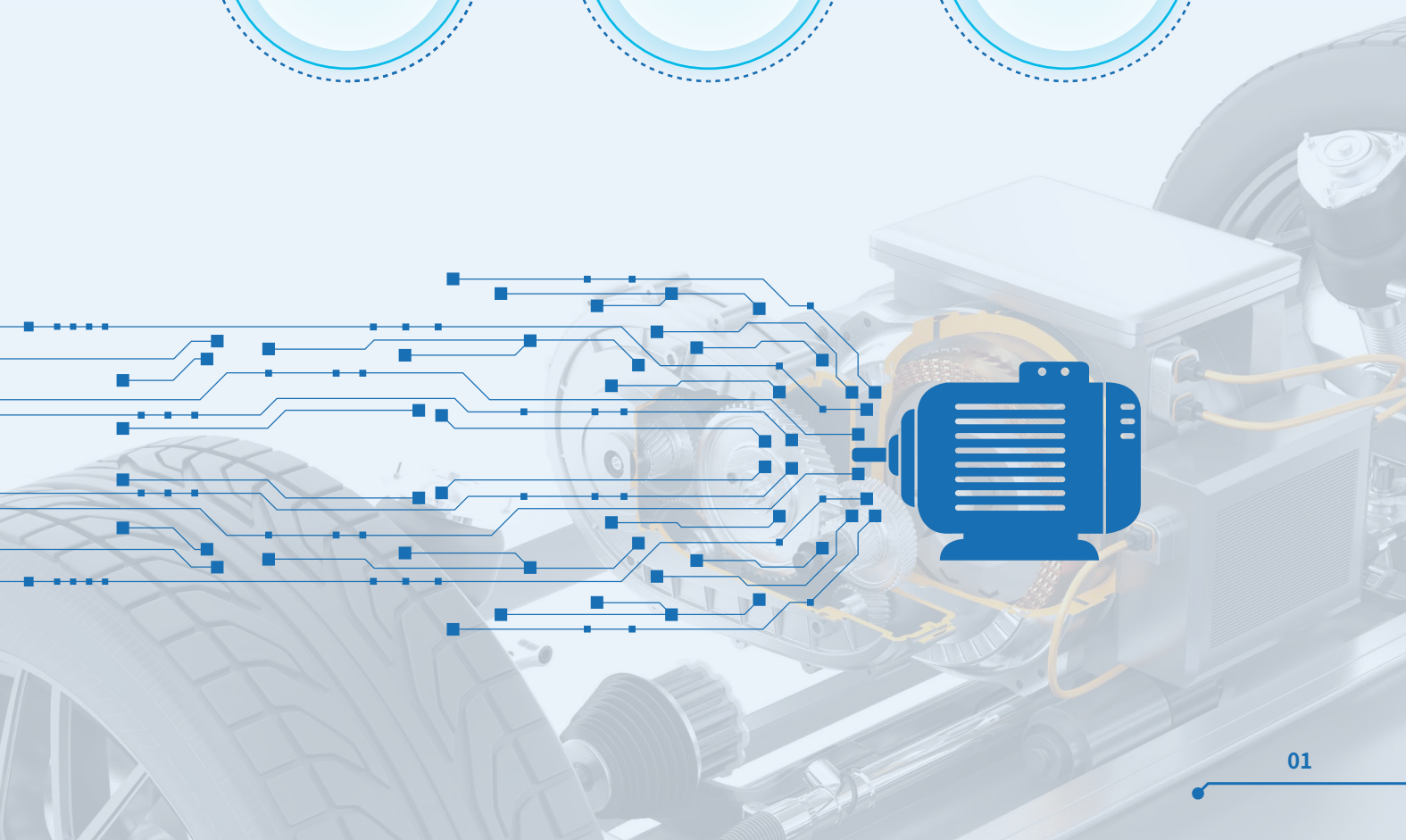
NOVOSENSE offers a comprehensive portfolio of motor driver products covering Brushed DC motors, Stepper motors, BLDC motors, Relays, Valves and Solenoids. The products' type range from low-current to high-current MOS integrated driver, smart pre-driver by external MOS, and from single-channel to multi-channel topolgy. With highly integration, precise control, flexible configurable features and advanced protection & diagnostic mechanisms, the products enable customers to design efficient, smooth, smart and safe motor drive systems, which are widely applicable to end equipments of industrial control and automotive electronics.

Focusing on the techncial trend of highly-integrated, precisely-controlled, and intelligence & reliability of motor drive systems, this handbook presents NOVOSENSE's technical roadmap and solutions of motor driver, by combining typical application scenarios with respective products.

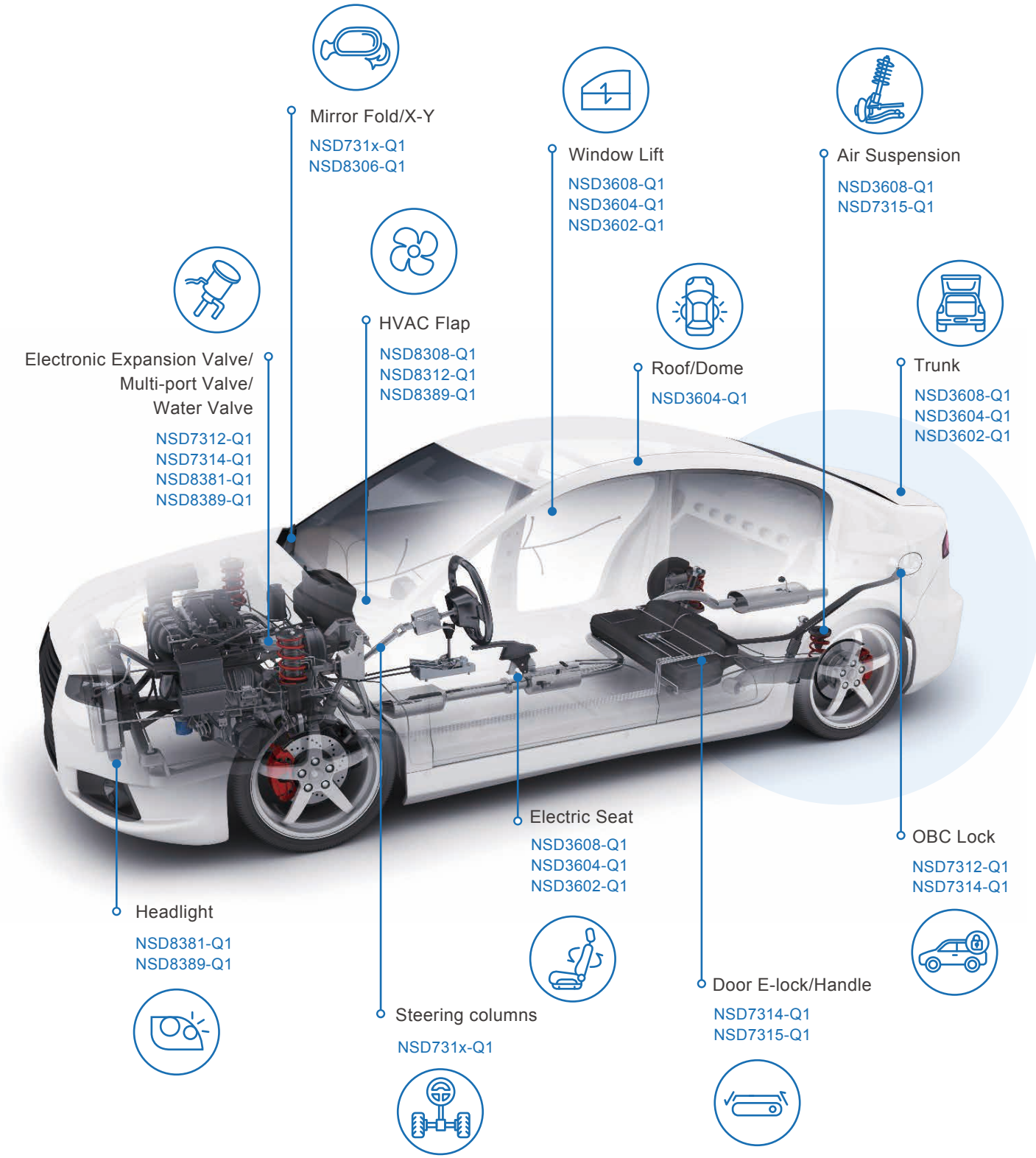
Highly Integrated Driving Capability

High-Precision Control

Comprehensive Protection and Diagnostics



NOVOSENSE Motor Driver IC for Body Electronics & Zone Controllers



01

Motor Driver Trend #1: Higher Integration for Improved System Efficiency and Reliability

Automotive electrical and electronic (E/E) architecture is undergoing a rapid transition from traditional distributed ECUs (Electronic Control Units) to centralized Zonal Control Units (ZCUs). In this new zonal architecture, a single controller is responsible for managing various loads—such as motors, relays, solenoids, and LEDs—within a specific zone (left, right, or rear). To replace the functionality of multiple ECUs, power and drive circuits are consolidated within the zonal controller, which significantly raises the requirements for integration, intelligence and reliability of driver ICs.

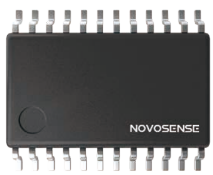
The NOVOSENSE NSD83xx series of multi-channel half-bridge drivers integrates up to 12 half-bridge channels in a single device. It features built-in PWM generators, SPI communication, and fault detection capabilities. This high level of integration makes the NSD83xx series ideal for use in zonal controllers and thermal management systems within next-generation automotive E/E architectures.

Hero Product

40V 8-channel Half-bridge Driver NSD8308-Q1

- Wide operating voltage range: 4.5V-36V (withstand voltage of 40V)
- On-resistance(HS + LS): 1.7 Ω
- Peak current 1A
- PWM generator supports configurable frequency and duty cycle
- Open circuit diagnosis
- Undervoltage protection and overvoltage protection
- Operating temperature: -40°C~125°C
- AEC-Q100 qualified

Package

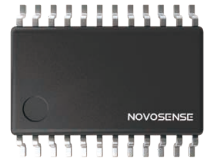


HTSSOP24

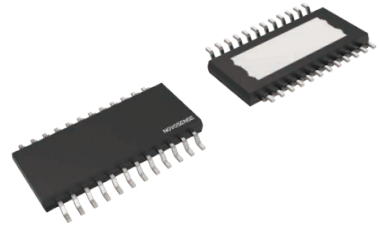
40V 12-channel Half-bridge Driver NSD8312-Q1

- Wide operating voltage range: 4.5V-36V (absolute max rating 40V)
- On-resistance(HS + LS): 1.5Ω
- Peak current 1A
- The PWM generator supports configurable frequency and duty cycle
- Open load diagnostics
- Undervoltage protection and overvoltage protection
- Operating temperature: Tj=-40°C~150°C
- AEC-Q100 qualified

Package



HTSSOP24



HTSOP24

NOVOSENSE NSD83xx Series Product Selection Guide

Part Number	Rds (on) (HS+LS) mΩ	Number of half -bridge channels	VM (V)	Feature	Qualification	Package
NSD8306-Q1HTSXR NSD8306A-Q1HTSBR	1700	6	4.5-36	Over-current protection, over-temperature protection, under-voltage protection, fault report	Automotive	HTSSOP24/ HTSOP24
NSD8308-Q1HTSXR	1700	8	4.5-36	Over-current protection, over-temperature protection, under-voltage protection, fault report	Automotive	HTSSOP24
NSD8310-Q1HTSXR NSD8310A-Q1HTSBR	1500	10	4.5-36	Over-current protection, over-temperature protection, under-voltage protection, fault report	Automotive	HTSSOP24/ HTSOP24
NSD8312-Q1HTSXR NSD8312A-Q1HTSBR	1500	12	4.5-36	Over-current protection, over-temperature protection, under-voltage protection, fault report	Automotive	HTSSOP24/ HTSOP24

Application

Body Control Module (BCM)

Zone Control Unit (ZCU)

HVAC Control Module

Thermal Management

40V, 3.6A Half-bridge Brushed DC Motor Driver NSD7310/12/10A/12A-Q1

Package

- Wide operation voltage range: 5V-36V (withstand voltage of 40V)
- On-resistance (HS + LS): 520mΩ
- Peak current 3.6A
- Supporting current modulation
- Undervoltage protection/Overcurrent protection /Over-temperature protection
- Operating temperature: -40°C~150°C
- AEC-Q100 qualified

HSOP8

40V, 6A Half-bridge Brushed DC Motor Driver NSD7314/NSD7314-Q1

Package

- Wide operation voltage range: 4.5V-36V (withstand voltage of 40V)
- On-resistance (HS + LS): 220mΩ
- Peak current 6A
- Supporting current modulation
- Undervoltage protection/Overcurrent protection/ Over-temperature protection
- Operating temperature: -40°C~150°C
- AEC-Q100 qualified

HTSSOP16

40V, 10A Half-bridge Brushed DC Motor Driver NSD7315-Q1

Package

- Wide operation voltage range: 4.5V-36V (withstand voltage of 40V)
- On-resistance (HS + LS): 150mΩ
- Peak current 10A
- Available in hardware and SPI interface versions
- Supports slew rate configuration
- Open-load detection supported
- Configurable control modes: Independent PWM (IN1/IN2) or PH/PWM
- Supporting current modulation
- Undervoltage protection/Overcurrent protection/Over-temperature protection
- Operating temperature: Tj = -40°C to 150°C
- AEC-Q100 qualified

HTSSOP24

NOVOSENSE NSD73xx Series Product Selection Guide												
Part Number	Load type	Rds (on) (HS+LS) mΩ	Peak current (A)	Number of half-bridge channels	VM (V)	Integrated current detector	Interface	Load diagnosis	Feature	Operating temperature (°C) Tj	Qualification	Package
NSD7310 -DHSPR	Brushed DC motor	520	3.6	2	5-36	No	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection	-40~150	Industrial	HSOP8
NSD7310A -DHSPR	Brushed DC motor	520	3.6	2	5-36	Yes	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection	-40~150	Industrial	HSOP8
NSD7312 -DHSPR	Brushed DC motor	520	3.6	2	5-36	No	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection, fault report	-40~150	Industrial	HSOP8
NSD7312A -DHSPR	Brushed DC motor	520	3.6	2	5-36	Yes	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection, fault report	-40~150	Industrial	HSOP8
NSD7310 -Q1DHSPR	Brushed DC motor	520	3.6	2	5-36	No	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection	-40~150	Automotive	HSOP8
NSD7312 -Q1HSPR	Brushed DC motor	520	3.6	2	5-36	No	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection, fault report	-40~150	Automotive	HSOP8
NSD7312A -Q1HSPR	Brushed DC motor	520	3.6	2	5-36	Yes	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection, fault report	-40~150	Automotive	HSOP8
NSD7314 -DHTSPR	Brushed DC motor	220	6	2	4.5-36	Yes	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection	-40~150	Industrial	HTSSOP16
NSD7314 -Q1HTSPR	Brushed DC motor	220	6	2	4.5-36	Yes	Parallel	No	Over-current protection, over-temperature protection, under-voltage protection	-40~150	Automotive	HTSSOP16
NSD7315S -Q1HTSXR	Brushed DC motor	150	10	2	4.5-36	Yes	SPI	Yes	Over-current protection, over-temperature protection, under-voltage protection, Open load diagnosis	-40~150	Automotive	HTSSOP24
NSD7315H -Q1HTSXR	Brushed DC motor	150	10	2	4.5-36	Yes	Parallel	Yes	Over-current protection, over-temperature protection, under-voltage protection, Open load diagnosis	-40~150	Automotive	HTSSOP24

Application

Mirror Fold/X-Y | OBC Lock | Door E-lock/Handle | Multi-port Valve/ Water Valve

02

Motor Driver Trend #2: High-Precision Control for Smoother Operation

With the evolution of automotive E/E architecture and increasing system intelligence, applications requiring precise position control—such as integrated thermal management, headlamp control, HUDs, and hidden air vents—are becoming more common. This drives growing demand from OEMs for automotive-grade stepper motor drivers. At the same time, performance expectations are rising, including finer microstepping resolution, smoother current and position control, and lower noise—all aimed at improving motor performance, reducing vibration, and enhancing stability.

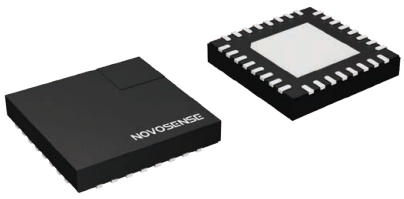
To meet these demands, NOVOSENSE has introduced the NSD8381-Q1 and NSD8389-Q1—two generations of automotive -grade high-performance stepper motor drivers that support the electrification and intelligence of modern vehicles.

Hero Product

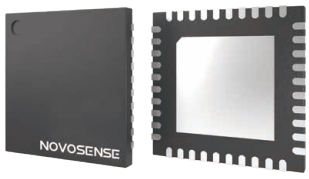
40V 1/32 Micro-step Stepper Motor Driver NSD8381-Q1

- Wide operating voltage: 4.5V-36V (absolute max rating 40V)
- Current up to 1.35A, Rdson (HS+LS): 1.2Ω
- Programmable micro-stepping, up to 1/32 micro-stepping mode
- 4 programmable decay modes
- IO direct control of clock/direction/hold, or direct half-bridge control
- Integrated current sensor and controller. Support 16-level (4-bit) current configuration for motor running and holding
- Support PWM frequency spread spectrum for EMC performance optimization
- Support slew rate and dead time configuration
- 24-bit, 4Mhz SPI communication
- Ultra-low power sleep mode
- Integrated BEMF detection for sensorless stall detection
- Support VBat undervoltage lockout (VSUV), overcurrent protection (OCP), temperature warn(OTW/UTW) and overtemperature protection (OTSD)
- Support open-circuit diagnosis and protection of load
- Operating temperature: Tj=-40°C~150°C
- AEC-Q100 qualified

Package



VQFN32

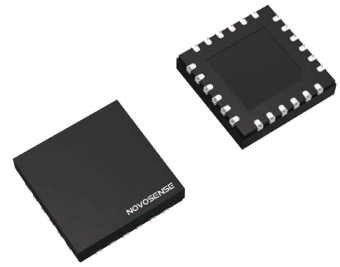


VQFN40

40V 1/256 Micro-step Stepper Motor Driver NSD8389-Q1

- Wide operating voltage: 4.5V-36V (absolute max rating 40V)
- Current up to 1.5A, Rdson (HS+LS): 900mΩ
- Programmable micro-stepping up to 1/256 usteps
- 8 Decay Modes: smart tune, slow, and mixed decay options
- STEP/DIR input & SPI controllable Hold Mode
- Phase Counter for high precision position control
- Configurable OPL_FILT&TBLANK, default DRV_DIS for A version
- Sensorless Stall detection (bemf, zero crossing)
- Support VBat undervoltage lockout (VSUV), overcurrent protection (OCP), temperature warn(OTW/UTW) and overtemperature protection (OTSD)
- Slew rate & dead time & spread spectrum configurable
- 16-bit SPI Interface with daisy chain mode
- Sleep mode with ultra low consumption
- Operating temperature: Tj=-40°C~150°C
- AEC-Q100 qualified

Package



VQFN24

HTSSOP24

NOVOSENSE NSD83xx Series Product Selection Guide

Part Number	Load type	Rds (on) (LS) mΩ	Peak current (A)	Micro-Stepping	VM (V)	Feature	Operating temperature (°C) Tj	Qualification	Package
NSD8381 -Q1QANR	Bipolar Stepper Motor	1200	1.35	1/32	4.5-36	Over-current protection, open load detection, over-temperature protection, under-voltage protection	-40~150	Automotive	VQFN32
NSD8381 -Q1QAIR	Bipolar Stepper Motor	1200	1.35	1/32	4.5-36	Over-current protection, open load detection, over-temperature protection, under-voltage protection	-40~150	Automotive	VQFN40
NSD8389/A -Q1QBBR	Bipolar Stepper Motor	900	1.5	1/256	4.5-36	Over-current protection, open load detection, over-temperature protection, under-voltage protection	-40~150	Automotive	VQFN24
NSD8389/A -Q1HTSXR	Bipolar Stepper Motor	900	1.5	1/256	4.5-36	Over-current protection, open load detection, over-temperature protection, under-voltage protection	-40~150	Automotive	HTSSOP24

Application

Integrated Thermal Management

Headlamp Control

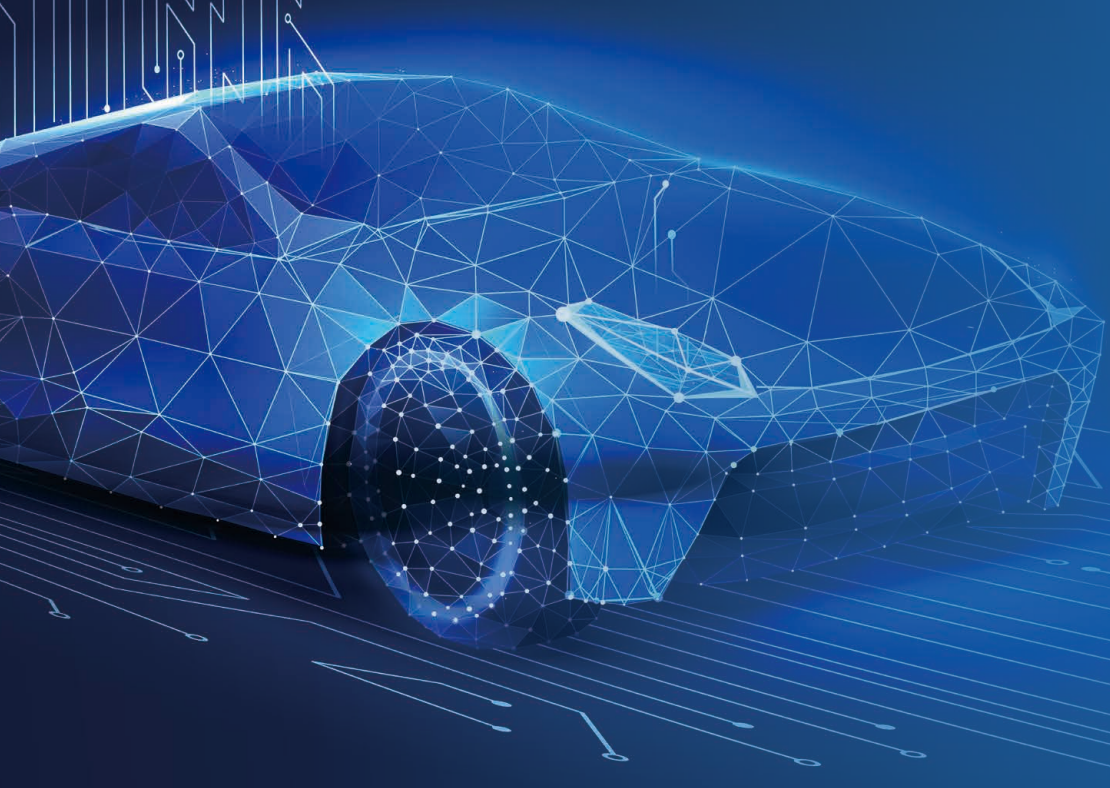
HUD

Hidden Air Vent

03

Motor Driver Trend #3: Intelligent and Digitalized Control Enables Platform-Based Design and Robust Diagnostic Protection

As automotive E/E architecture shifts from distributed ECUs to centralized domain controllers (ZCUs), system-level challenges for motor-driven loads are increasing. Engineers must ensure platform-level compatibility with motors of varying power levels, while also implementing external MOSFET and wiring protection during fault conditions. Additionally, real-time motor status monitoring and reporting is essential. These requirements call for advanced support from the underlying driver ICs.
NOVOSENSE NSD360x-Q1 series driver ICs are tailored for zonal controllers, integrating intelligent drive configuration, real-time monitoring, protection, and fault diagnostics.



Intelligent Drive Configuration

The CCPD (Configurable Charge/Discharge Current Profile Driver) enables programmable gate drive sequences. Users can optimize MOSFET switching behavior based on load parameters, duty cycle, and EMI constraints. Each switching event is divided into three stages—pre-charge/discharge, charge/discharge, and tail charge/discharge—with independently configurable current and timing.
Using internal comparators, the actual switching characteristics (MOSFET on/off delay, rise/fall time) are fed back, enabling MCU-driven closed-loop control by adjusting stage duration and current.

Real-Time Monitoring, Protection, and Diagnostics

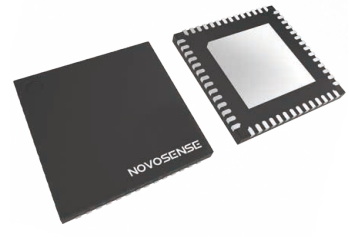
The NSD360x-Q1 provides comprehensive protection through real-time monitoring of supply and charge pump voltages, covering under/over-voltage protection (DVDD UV, PVDD OV/UV, VCP UV), gate/source and drain/source fault diagnostics (VGS, VDS), and detection of open or short loads even in the off state (via internal pull-up/down current sources). Additional features include over-temperature warning/protection, watchdog, brake protection in both sleep and active modes, and configurable SPI or pin-based fault reporting (shared DRVOFF/nFLT pin via SPI setting).

Hero Product

40V 8-channel Half-bridge Pre-driver NSD3608-Q1

- AEC-Q100 qualified
- Wide operating voltage: 4.9V-37V (absolute max rating 40V)
- 8-channel half-bridge gate driver
- Configurable Charge/Discharge Current Profile Driver (CCPD) for optimized EMC performance
- Integrated 2-stage charge pump for 100% PWM duty cycle
- Integrated 2-channel programmable current sensing amplifier supporting high common mode input voltage
- 16-bit 10MHZ SPI communication
- Load diagnostic and protection functions
- Operating temperature: Tj=-40°C~150°C

Package

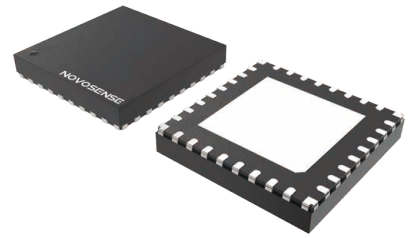


VQFN56

40V 2-channel Half-Bridge Pre-driver NSD3602-Q1

- AEC-Q100 qualified
- Wide operating voltage: 4.9V-37V (absolute max rating 40V)
- 2-channel half-bridge gate driver
- Configurable Charge/Discharge Current Profile Driver (CCPD) for optimized EMC performance
- Integrated 1-channel programmable current sensing amplifier supporting high common mode input voltage
- 16-bit 10MHZ SPI communication
- Load diagnostic and protection functions
- Operating temperature: Tj=-40°C~150°C

Package



VQFN32

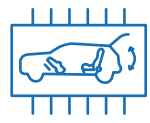
NOVOSENSE NSD36xx Series Product Selection Guide

Part Number	Number of Half Bridge Driver channels	VM (V)	Interface	Wide Common Mode Current Amplifier	Smart Driver CCPD	Diagnostics	Brake	Watchdog	Operating temperature (°C) Tj	Qualification	Package
NSD3608 -Q1QAJR	8	4.9-37	SPI & 4 x Input	2	Yes	Yes	Yes	Yes	-40~150	Automotive	VQFN56
NSD3604 -Q1QAJR	4	4.9-37	SPI & 4 x Input	2	Yes	Yes	Yes	Yes	-40~150	Automotive	VQFN56
NSD3604 -Q1QAIR	4	4.9-37	SPI & 4 x Input	2	Yes	Yes	Yes	Yes	-40~150	Automotive	VQFN40
NSD3602S -Q1QDAR	2	4.9-37	SPI & 2 x Input	1	Yes	Yes	Yes	Yes	-40~150	Automotive	VQFN32
NSD3602H -Q1QDAR	2	4.9-37	SPI & 2 x Input	1	Yes	No	Yes	No	-40~150	Automotive	VQFN32

Application

Body Control Module (BCM)

Zone Control Unit (ZCU)



Electric Seat/Tailgate Controller/ Power Running Board Controller

Comprehensive Motor Driver Portfolio Empowering Diverse Automotive Applications

NOVOSENSE offers a comprehensive portfolio of motor driver products for diverse automotive applications from thermal management to body control. Designed for high integration, precision, and intelligent control, these solutions meet the demands for compact design, flexible control, and reliable performance—empowering customers to build efficient, intelligent vehicle systems.

NOVOSENSE

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Company Brochure

NOVOSENSE
Product Selection Guide

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Automotive Solution

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Supply Application Solution

NOVOSENSE
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Control Solution

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Application Solution

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