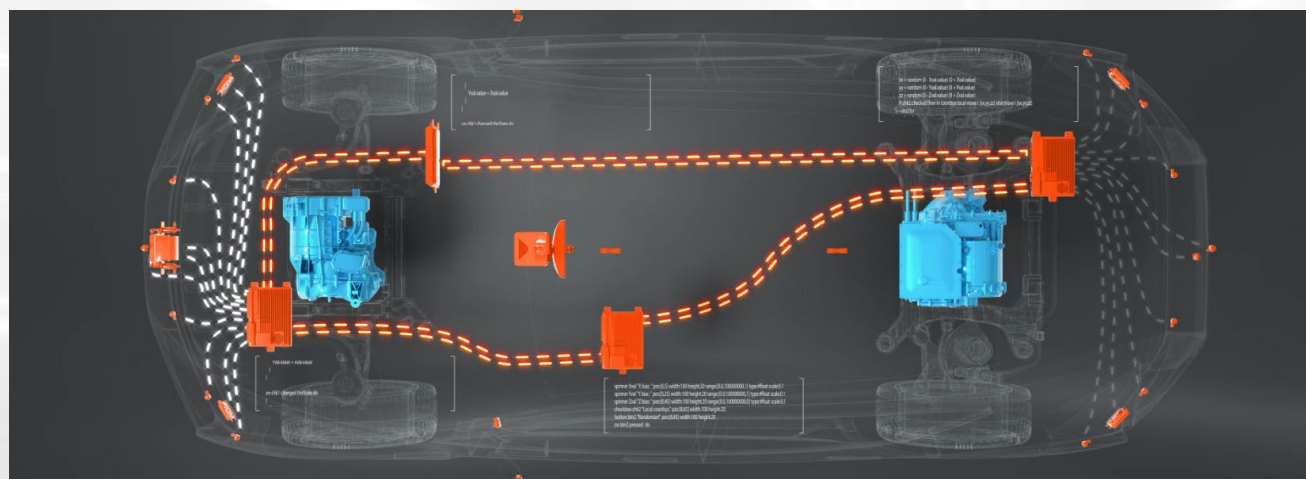


# Powertrain Cross Domain Display

# Energy & Motion Control

Functional modular software platform for BEV and (P)HEV. Magna delivers an operating strategy including advanced and predictive vehicle functions for energy & motion control independent of the powertrain layout and E/E architecture. Delivery of software as a product (SaaS).



## Features and Specifications

- Vehicle physics model incl. active sideslip angle control
- Longitudinal and lateral torque vectoring incl. integrated eDrive and brake controls
- Disconnect strategy
- Traction Predictor incl. Road State Observer
- Vehicle State Observer and Predictor
- Vehicle Energy Broker
- Vehicle Thermal Control
- Customer specific functionalities allow OEM exclusivity
- Specific calibration of platform functionalities ensures differentiation and supports individual brands image

## Core Technologies

- Service oriented architecture
- Distributed Data Services (DDS)
- Containerization based on WebAssembly & OCI\*
- Fully functional safety ISO 26262 compliant
- Cyber security ISO 21434
- Over-the-air updates / continuous deployment to support Always New Vehicle (ANV)

\* OCI: Open Container Initiative

## Additional Takeaways

- Connectivity to off-board information enables predictive features e.g., friction data, route information (online digital twins)
- Full-scale energy management supports max range – for hybrids and BEVs
- Highly adaptable to various vehicle characteristics/driver modes
- In production for torque vectoring and disconnect strategy
- Multiple software licensing models



# Automotive Applications & Cloud Services

The SmartBridge™ software applications extend the user experience by connecting the driver with vehicle and environment. They advance the user-vehicle-relationship by incorporating smartphone and web platforms. The customer satisfaction is increased by revealing relevant vehicle KPIs and mobility behavior is improved by gamification.



## Features and Specifications

Collection and analysis of data, visualization of relevant measures, comprehensive customization of vehicle settings

- **Metrix**  
Translate raw data from CAN bus to relevant vehicle KPIs during evolutionary phase and presentation of vehicle features
- **Easet**  
Make complex vehicle settings intuitively transparent to the driver and translate them into values familiar to the end-consumer like efficiency, dynamics, convenience
- **Driva**  
Live data view and tracking of trips incl. visualization of enhanced statistics both within the app and in a web-portal

## Core Technologies

- Cross-platform mobile apps with Flutter
- Android and iOS native apps
- Web services and web apps
- Highly scalable serverless cloud architecture
- Secure IoT environment
- Highest security level with certificate-based authentication and data protection

## Additional Takeaways

- Multiple target groups (OEM, vehicle driver, fleet operator) 🌈
- Reduce complexity of vehicle customization through the driver 🟡
- Seamless user experience in ONE environment (mobile and web) 🟡
- Real-time and posterior online data insights 🔴

Customer Release

Ideation

Discovery

Concept

Development

Integration & Deployment

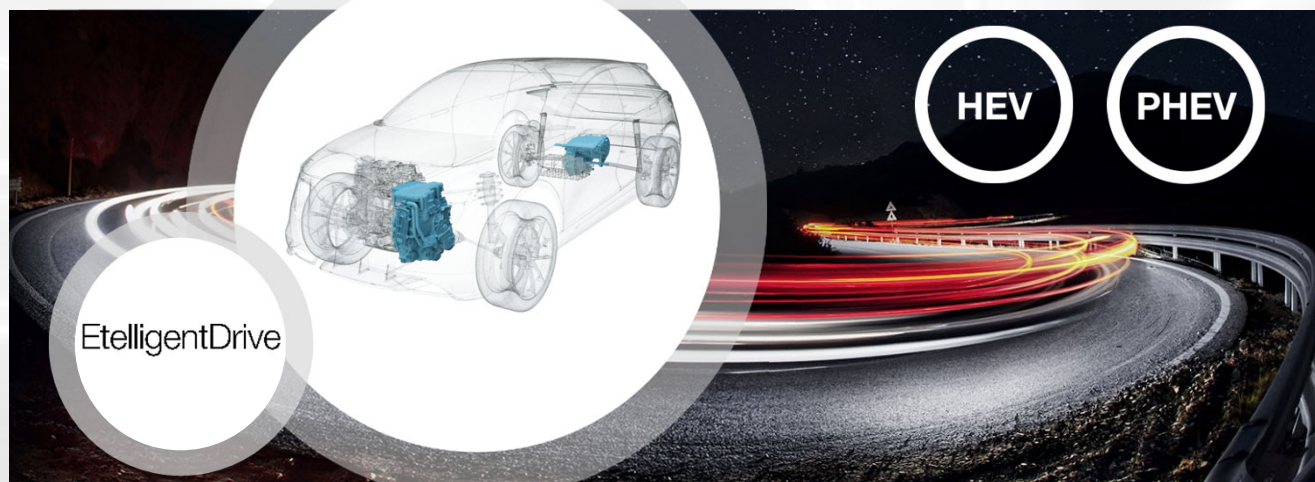
Operation

Monitoring & Maintenance



# Magna EtelligentCommand

EtelligentCommand is a PHEV/HEV system featuring a dedicated hybrid drive DHD Plus at the front and an eDrive Mid+ with torque vectoring at the rear, combined with advanced software and controls. Various driving modes are available on command with uncompromised performance, outstanding drivability, as well as superior power handling and control.



## Complete powertrain solution with best-in-class functions

### Front Electric Drive System

- DHD Plus



### Software/Controls

- Magna drive controller
- Magna operating strategy



### Rear Electric Drive System

- eDS Mid+ w/ torque vectoring



### Connectivity

- Magna operating strategy



X Required for BIC Functionality			Covers all Real World Driving Situations			
			BIC Efficiency	BIC Safety	BIC Dynamics	BIC Convenience
Vehicle Sub Functions	Longitudinal	Launch - Accelerate	X	X	X	X
		Steady State - Sailing	X			X
		Brake - Regenerate	X	X	X	X
		Traction		X	X	X
	Lateral	Stability		X	X	X
		Handling		X	X	X
	Options	Decoupling	X	X	X	X
		Park-Lock		X		X
	ADAS / Cloud	On-Board Connectivity	X	X	X	X
		Off-Board Connectivity	X	X	X	X

## Concept & Demo Vehicle EtelligentEco

# Magna EtelligentEco

Magna EtelligentEco is an advanced PHEV solution that improves range and efficiency for high-volume SUVs with front-wheel drives without compromising drivability, even in electric mode. The software and DHD Eco hybrid drive reduce greenhouse gas emissions by up to 38%.



### Features and Specifications

- Engine type: 1.5 l gasoline engine
- Engine power: 100 kW
- Engine torque: 230 Nm
- Range (WLTP): 100 km

### Front Electric Drive Unit

#### Magna DHD Eco

- Up to 3,000 Nm axle torque with e-boost capability
- E-motor: 120 kW at 350 V, 200 Nm peak
- HV battery: 19 kWh (usable)

### Competitive advantage/differentiators

- **Efficiency**
  - Up to -38 % CO2 saving for vehicles in real world driving conditions and 100 km pure electric range (WLTP)
- **Convenience**
  - Up to 135 kph top speed in eDrive
  - Intelligent launch by 1 ms control loop
- **Dynamics**
  - Smooth BEV-like response behavior
  - Up to 3,000 Nm axle torque

### Applications / Benefits

- **Benefits**
  - Best-in-class value-for-money
  - Best-in-class torque-to-weight ratio (= 3,8 Nm/kg)



# Magna EtelligentForce

Magna EtelligentForce is a battery electric 4WD powertrain system for passenger trucks and light commercial vehicles, designed to maintain the full capabilities of these vehicles with uncompromised payload and towing.



## Complete powertrain solution with best-in-class functions

**Front Electric Drive System**

- eDS Mid+ w/ Decoupling

**Software/Controls**

- Drive controller
- Operating strategy
- Optional decoupling strategy

**Rear Electric Drive System**

- eBeam™ High



X Required for BIC Functionality

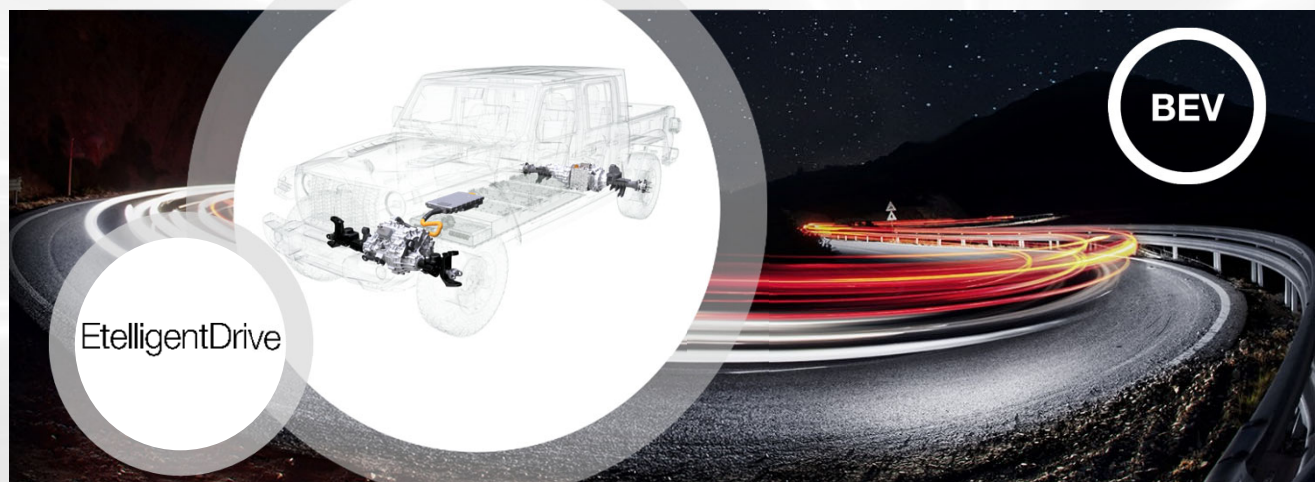
			Covers all Real World Driving Situations			
			BIC Efficiency	BIC Safety	BIC Dynamics	BIC Convenience
Vehicle Sub Functions	Longitudinal	Launch - Accelerate		X	X	X
		Steady State - Sailing	X			X
		Brake - Regenerate	X	X	X	X
		Traction		X	X	X
	Lateral	Stability		X	X	X
		Handling		X	X	X
	Options	Decoupling	X	X	X	X
		Park-Lock		X		X

Powertrain S/W Controls



# Magna EtelligentTerrain

Magna EtelligentTerrain is a battery electric 4WD powertrain system for sport and light utility vehicles, designed to maintain full on and off-road capabilities with uncompromised payload and towing.



## Complete powertrain solution with best-in-class functions

### Front Electric Drive System

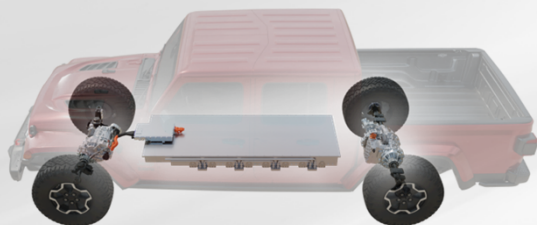
- eBeam™ Mid w/ Decoupling, Park-Lock and electric locking differential

### Software/Controls

- Drive controller
- Operating strategy
- Optional decoupling strategy

### Rear Electric Drive System

- eBeam™ High w/ Park-Lock and electric locking differential



X Required for BIC Functionality

		Covers all Real World Driving Situations			
		BIC Efficiency	BIC Safety	BIC Dynamics	BIC Convenience
Vehicle Sub Functions	Longitudinal	Launch - Accelerate	X	X	X
		Steady State - Sailing	X		X
		Brake - Regenerate	X	X	X
		Traction	X	X	X
	Lateral	Stability	X	X	X
		Handling	X	X	X
		Decoupling	X	X	X
	Options	Park-Lock	X	X	X
		Electric Locking Differential		X	X

## Concept & Demo Vehicle EtelligentTerrain

# Magna EtelligentTerrain

Magna EtelligentTerrain is a battery electric 4WD powertrain system for sport and light utility vehicles, designed to maintain full on and off-road capabilities with uncompromised payload and towing.



### Features and Specifications

#### Rear Axle Electric Drive Unit

##### Magna eBeam™ High

- Peak axle power: up to 238kW <sup>10sec</sup>
- Peak axle torque: 7,500 Nm
- Ratio rear axle : 12,67

#### Front Electric Drive Unit

##### Magna Steerable eBeam™ Mid

- Peak axle power: up to 188 kW
- Peak axle torque: 5,500 Nm
- Ratio front axle 13.96

#### Magna Operating Control Software

### Competitive advantage/differentiators

- **Efficiency**
  - Decoupling capability of front axle
- **Safety**
  - Robust coaxial beam axle design
- **Convenience**
  - Uncompromised on and off-road capabilities
- **Dynamics**
  - Up to 426 kW peak power

### Applications / Benefits

- **Vehicle Integration**
  - Totally customizable w/o need for architectural changes

Ideation

Discovery

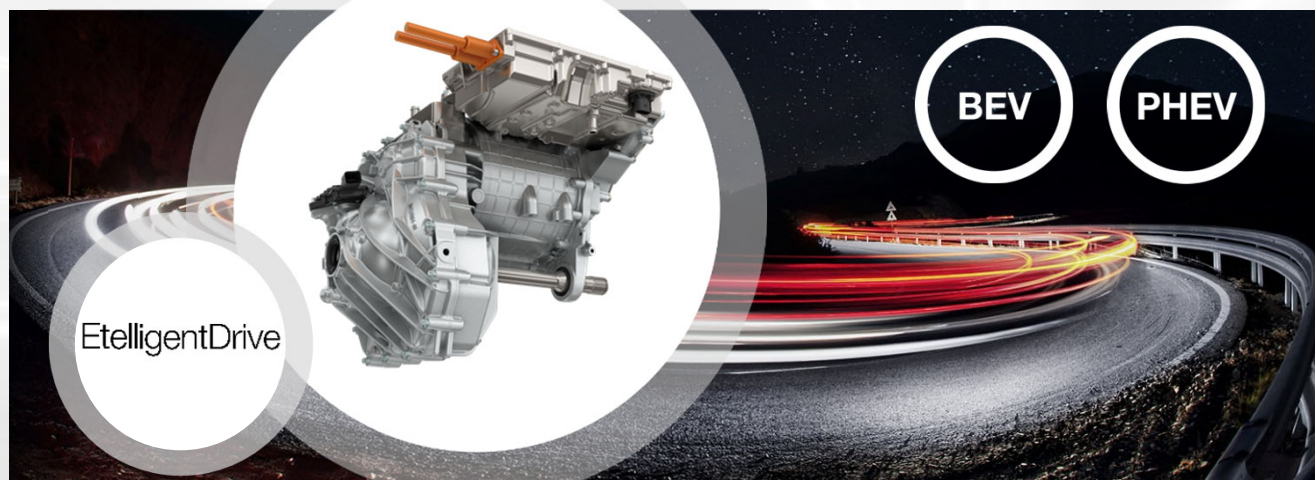
Concept



eMobility – HV electric drive (Mid+ Power)

# eDS – electric Drive System Mid+ w/ TV

The eDrive system is equipped with the small-packaged twin-clutch torque vectoring system. Together with next-gen technology options in the e-motor, inverter, gearbox and intelligent software strategy it contributes to best-in-class efficiency, safety, convenience and dynamics.



Smarter



Cleaner



Electrification



Driving Dynamics

## Competitive advantage/differentiators

- **Efficiency**
  - 150 W drag loss at 50 kph or
  - 94 % max. efficiency
  - 91.6 % avg. efficiency WLTC
- **Safety**
  - 2,250 Nm TV superposition torque
- **Convenience**
  - 1 ms control loop of native speed interface
- **Dynamics**
  - < 100 ms response time

## Applications / Benefits

- C, D, E VAN Segment BEVs / PHEVs
- **Package**
  - Package neutral torque vectoring clutch integration

Ideation

Discovery

Concept

Development

Serial Preparation

## Dedicated Hybrid Drive

# Dedicated Hybrid Drive DHD Eco

The DHD Eco is part of the 230 family using a smart modular scalability approach for Low Torque HV applications. The DHD Eco is reduced to four gears (acting as a dedicated hybrid drive) with eLaunch, eReverse and two gears in electric driving.

*for B-C Segment*



Smarter



Cleaner



Lighter

### Competitive advantage/differentiators

- -74 % fuel consumption vs. DCT (WLTC)\*
- Adjustable drivability by clutch modulation & SW functions to support individual OEM branding
- Strong 120 kW e-motor peak power to support any all-day driving conditions with pure electric drive

### Applications / Benefits

- Low risk by reuse of matured technologies & building blocks, ASIL C
- Short y-length of 350 mm
- Suitable interchangeable flexibility to cope with market dynamics

Ideation

Discovery

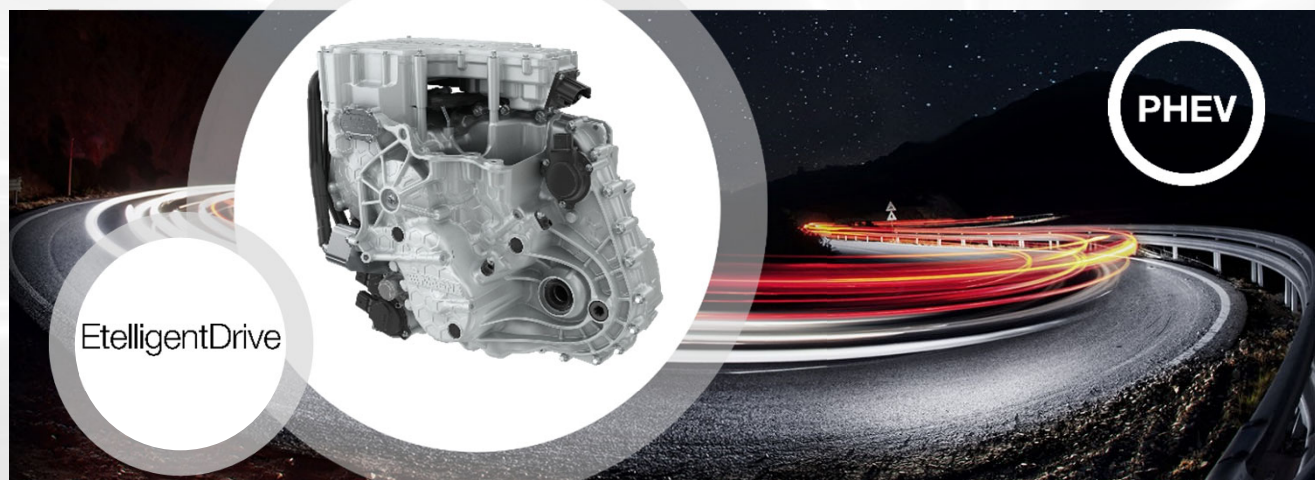
Concept

Development

## Dedicated Hybrid Drive

# Dedicated Hybrid Drive DHD Plus

The DHD Plus is part of the 400 family and uses a smart modular scalability approach for high torque, high voltage (HV) applications - acting as a dedicated hybrid transmission with eLaunch, eReverse and two gears in electric driving. It provides full powershift capability in all modes. Ideal for C- up to D-segment.



Smarter



Cleaner



Lighter



Electrification



Co-Development  
Opportunity



Autonomy



New Mobility

### Competitive advantage/differentiators

- -83 % fuel consumption vs. DCT (WLTC)
- Strong 120 kW e-motor peak power to support any all-day driving condition with pure electric drive eCrawler for creeping and high towing capability
- Short y-length of 360 mm  
Suitable interchangeable flexibility to cope with market dynamics
- Smooth e-power shiftability
- Best NVH behavior

### Applications / Benefits

- Low risk by reuse of matured technologies and building blocks with ASIL C

Ideation

Discovery

Concept

Development



eMobility – eBeam™ High

# eBeam™ – Electric Axle Drive System

Heavy Duty electric drive for frame-based vehicle usage. Structure-oriented design to support high payload and towing capability with matching power for continuous duty usage, high peak torque and robustness.



Cleaner



Electrification



Autonomy



Driving Dynamics



Design



Co-Development  
Opportunity

## Competitive advantage/differentiators

- **Safety**
  - Robust design for safe towing and hauling
- **Dynamics**
  - Scalable power to 225 kW<sub>cont</sub> / 300 kW<sub>peak</sub> and 12,000 Nm peak axle torque
- **Vehicle Integration**
  - Adaptable to current suspension, achieves required clearances during full suspension movement

## Applications

- Battery electric vehicle / FuelCell
- PUP / LCV
- Primary and complementary propulsion
- Coaxial e-motor for GAWR up to 3,250 kg and Offset e-motor w/banjo axle for GAWR up to 7,850 kg

Ideation

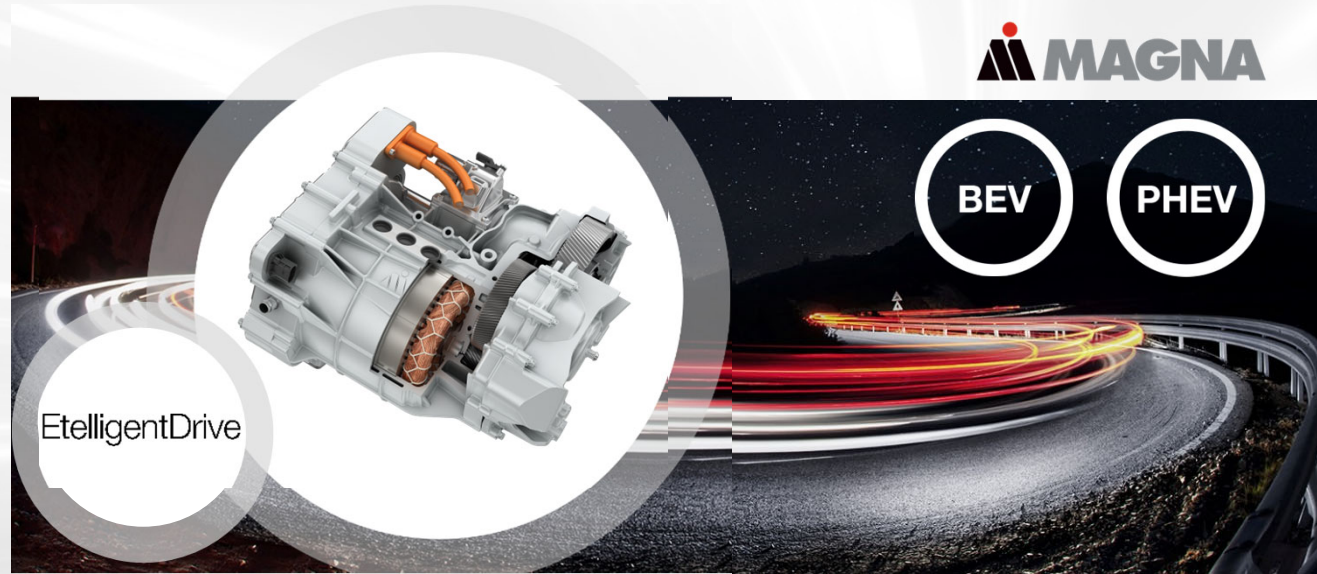
Discovery

Concept

eMobility – HV electric drive (Mid+ Power)

## eDS – electric Drive System Mid+ w/ Decoupling+

The eDrive system is equipped with Decoupling+ a combination of an integrated decoupling unit and a predictive controls strategy. Together with next-gen technology options in the e-motor, inverter, gearbox and intelligent software strategy it contributes to best-in-class efficiency, safety, convenience and dynamics.



**MAGNA**



Smarter



Cleaner



Electrification



Driving Dynamics

### Competitive advantage/differentiators

- **Efficiency**
  - 35 W drag loss at 50 kph or
  - 94 % max. efficiency
  - 91.6 % avg. efficiency WLTC
- **Safety**
  - < 200 ms fast reconnect time
- **Convenience**
  - 1 ms control loop of native speed interface
- **Dynamics**
  - + 8 % torque boost (7 sec.)
  - + 22 % power boost (7 sec.)

### Applications

- C, D, E, VAN Segment BEVs / PHEVs

Ideation

Discovery

Concept

Development

Serial Preparation

in Production





Forward. For all.