Continental
The Future in Motion

SCHAEFFLER

Gasoline Technology Car II

New benchmark on fuel efficiency

"The second-generation Gasoline Technology Car demonstrates the huge potential of a mild hybrid when the 48 V electrical system, the internal combustion engine and the operating strategies are optimized holistically as a complete system."

José Avila, Member of the Executive Board of Continental and President of the Powertrain Division

"The GTC II, just like the GTC I, is a milestone in terms of the successful integration of highly efficient hybrid operating strategies in a manual-transmission vehicle. The GTC II's electronic clutch supports functions such as electric launch, electric stop-go operation and energy recuperation at speeds almost down to standstill."

Dr.-Ing. Peter Gutzmer, Member of the Schaeffler Executive Board responsible for Research & Development

"The Ford Focus with its 1.0-liter Ecoboost engine, which has won multiple International Engine of the Year awards, provides an excellent starting point for a hybrid vehicle, showing the potential that hybridization offers even for an engine that starts from such a high baseline. When integrating the GTC II concept, the focus was therefore on overall powertrain optimization."

Carsten Weber, Manager Engine & Powertrain Systems Research & Advanced Engineering, Ford Europe

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Content

Introduction

Gasoline Technology Car II

Presented at the Vienna Motor Symposium in 2014, the first-generation Gasoline Technology Car (GTC I) stole the show with a 17% improvement in New European Driving Cycle (NEDC) fuel efficiency compared with the reference model, and CO_2 emissions of just under 95 g/km. The already highly efficient Ford Focus reference model was equipped with a turbocharged 3-cylinder 1-liter gasoline engine (GTDI) and 12 V start-stop system. Now the project partners Continental and Schaeffler, in close cooperation with Ford, present the second-generation Gasoline Technology Car (GTC II):
The GTC II showcases the potential of intelligent, latest-generation 48 V hybridization in its most highly advanced form. The GTC II promises an improvement of about 25% on the NEDC fuel consumption compared to the reference vehicle. The most obvious difference between the GTC II and the GTC I is the highly efficient integration of the electric motor between the internal combustion engine and the transmission in the second-generation model ("48 V P2 Architecture").

Gasoline Technology Car I

Features

- Ford Focus, equipped with a turbocharged 3-cylinder 1-liter gasoline engine (GTDI)
- No geometrical changes on the engine
- Continental Fuel Injection System
- 48 V P0 Architecture: Belt-driven Starter Generator (BSG) in front of the combustion engine
- Euro 6c
- CO_2 emission = 95g/km

Gasoline Technology Car II

Features

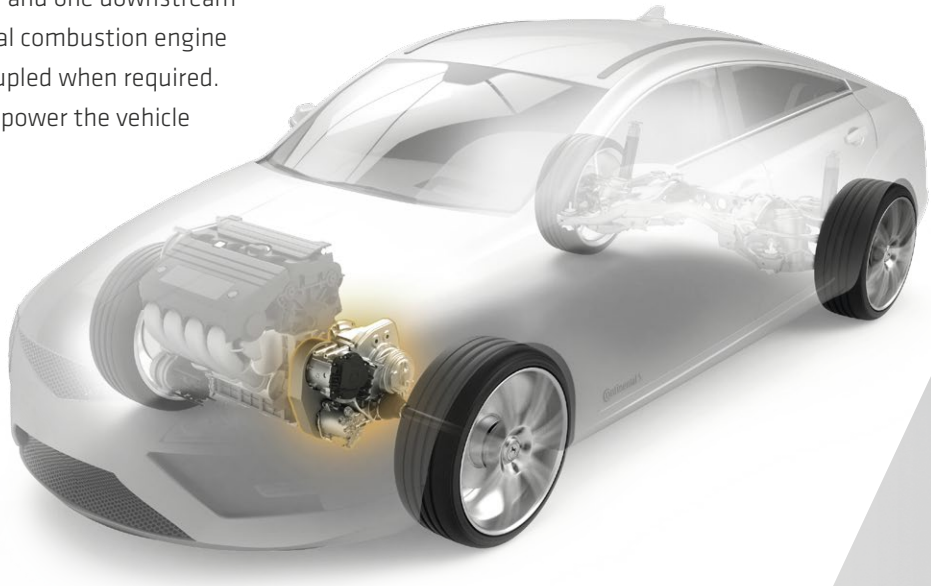
- Ford Focus 1,0L 3cyl Eco-Boost, increased compression ratio CR=12, modified intake camshaft, RAAX™ Turbocharger
- Continental Fuel Injection System
- 48 V P2 Architecture: Belt-driven Starter Generator (BSG) between combustion engine and transmission
- Euro 6c
- CO_2 emission target < 85 g/km

48 V P2 Architecture

Integrated P2 Hybrid Module

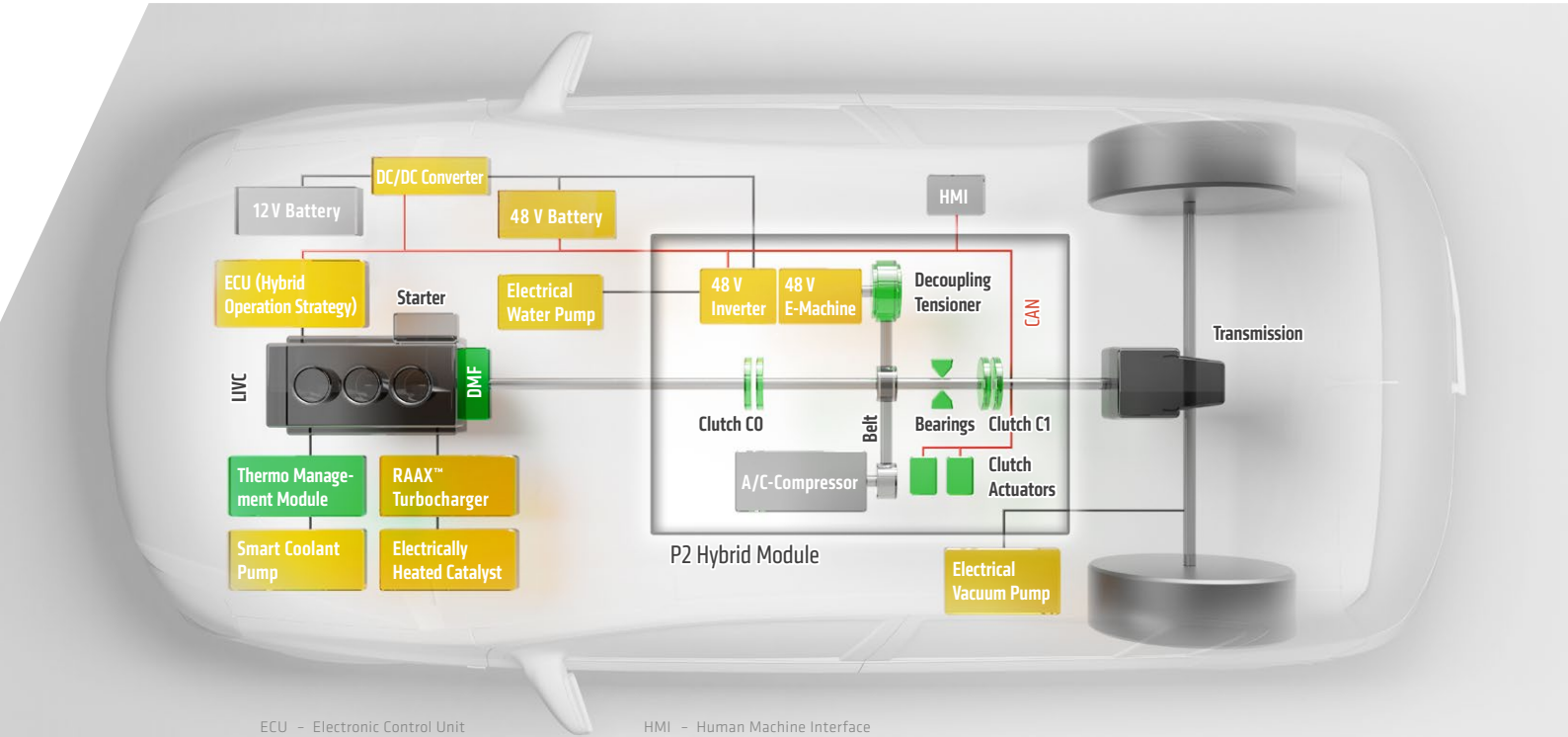
The GTC II's electric motor is integrated in the drive train by means of a belt that runs between the internal combustion engine and the transmission. Two clutches, one upstream and one downstream of the belt, allow the internal combustion engine (ICE) to be completely decoupled when required. The electric motor can then power the vehicle independently of the ICE.

As a result,the GTC II supports both constant-speed electric coasting at low load, as well as electric launch, for example in stop-start driving.



Vehicle Architecture

At a Glance



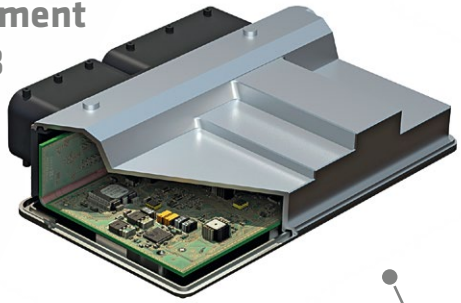
ECU – Electronic Control Unit
DMF – Dual Mass Flywheel
HMI – Human Machine Interface
LIVC – Late Intake Valve Closing

Vehicle Components

At a Glance

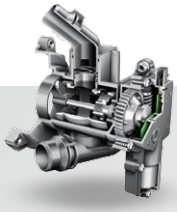
Thermal Management

Engine Management System (EMS) 3



Hybridization

Combustion Optimization and Exhaust After-treatment



Thermo Management Module

Smart Coolant Pump

Electrical Water Pump

Electrical Vacuum Pump

48 V P2 Hybrid Module

Decoupling Tensioner

Dual Mass Flywheel

48 V DC/DC Converter

48 V Belt-driven Starter Generator (BSG)

Multiple V-ripped Belt

Gasoline High Pressure Pump

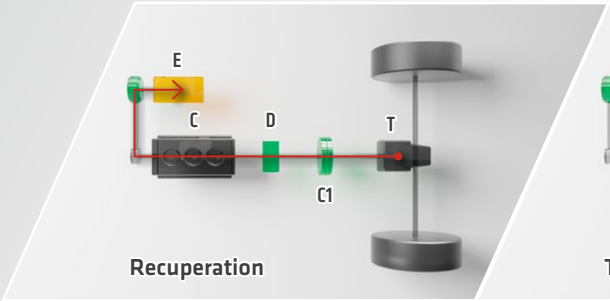
RAAX™ Turbocharger

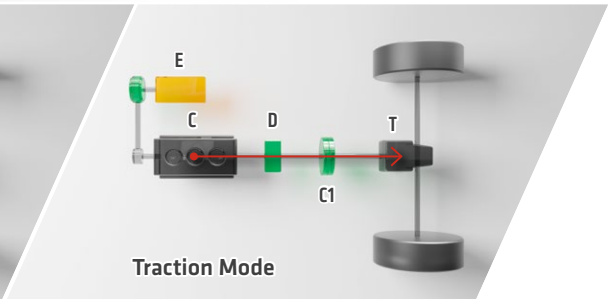
Electrically Heated Catalyst

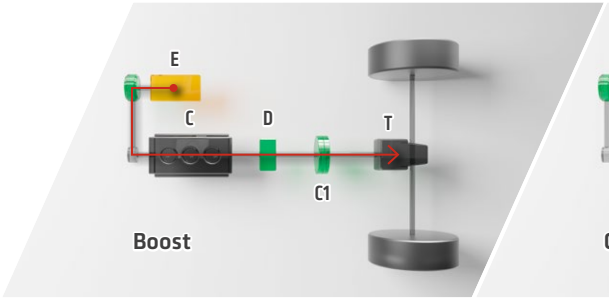
Injector

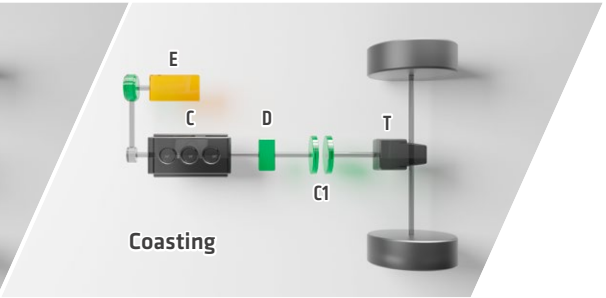
48 V P0 Architecture (GTC I)

Overview of Driving Modes





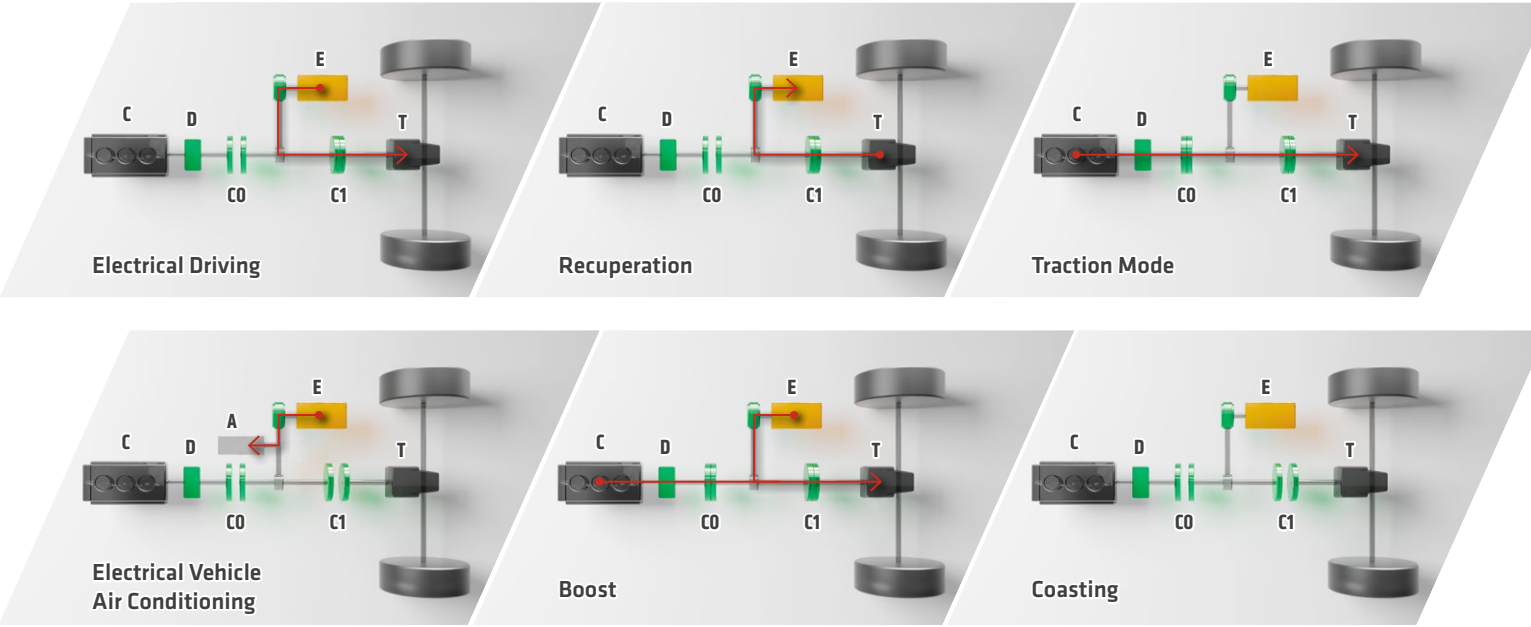




C = Combustion Engine **D** = Dual Mass Flywheel **E** = Electrical Machine **T** = Transmission

48 V P2 Architecture (GTC II)

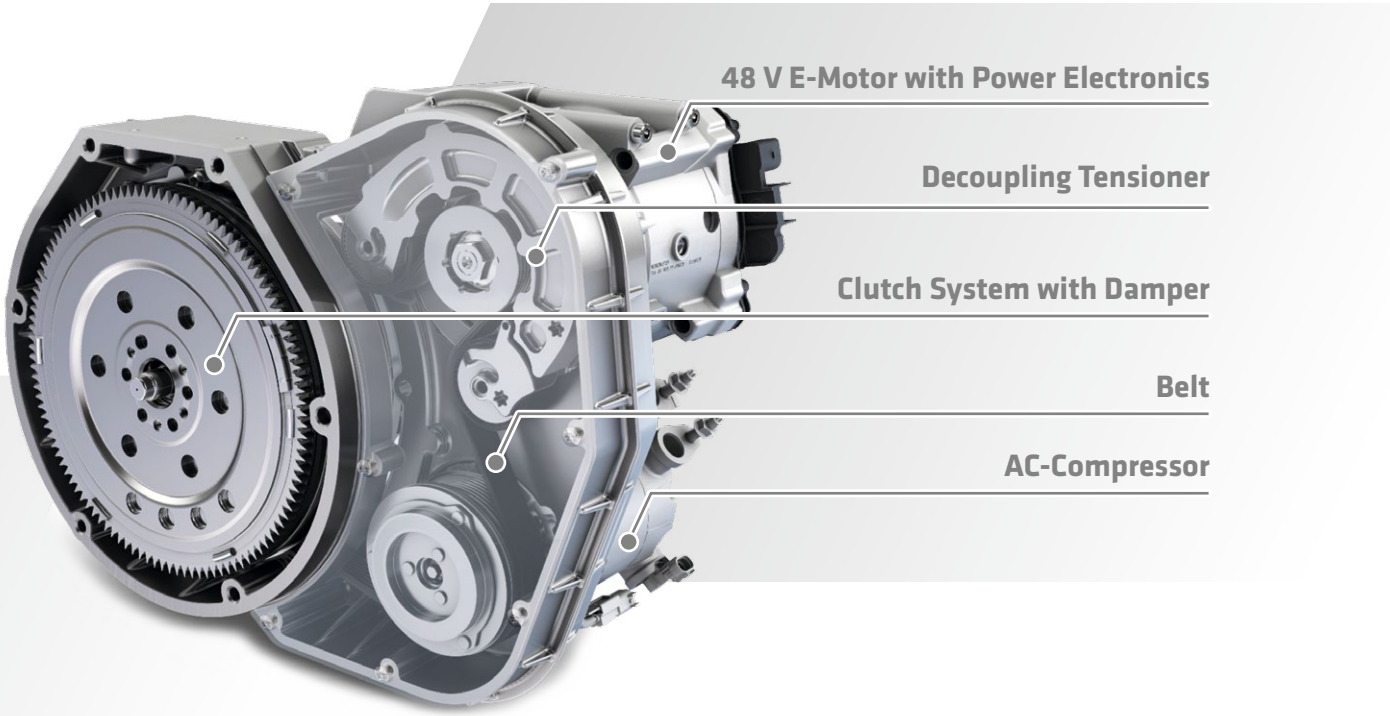
Overview of Driving Modes



A = Air Conditioning Compressor **C** = Combustion Engine **D** = Dual Mass Flywheel **E** = Electrical Machine **T** = Transmission

48 V Hybrid Module

In Detail



Benefits

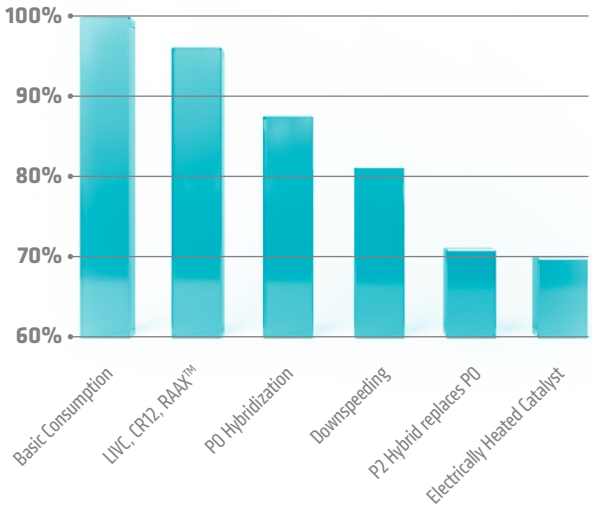
48 V Hybrid Module

- Disconnects crankshaft to reduce losses during electric driving, recuperation and sailing
- Enabler for pure e-drive with a 48 V System
- Enabler for air conditioning during standstill (ICE off)
- Modular approach for e-motor incl. power electronics
- Deletion of Front End Accessory Drive (FEAD) belt drive

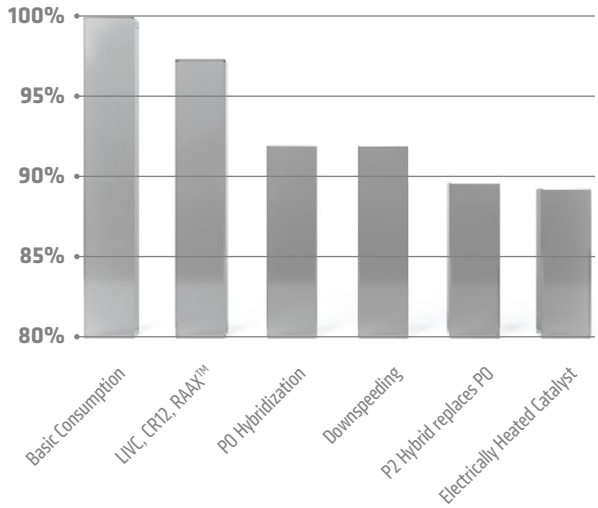
CO_2 Reduction Potential

Simulated Overall Savings

New European Driving Cycle (NEDC)



Worldwide Harmonized Light-Duty Vehicles Test Procedure (WLTP)



LIVC – Late Intake Valve Closing

Summary

- More than 25% CO_2 and fuel reduction compared to the reference vehicle (NEDC)
- High-volume segment solution: Milestone in terms of the successful integration of highly efficient hybrid operating strategies in a manual-transmission vehicle
- Innovative 48 V P2 Architecture – the electric motor is integrated between the internal combustion engine and the transmission
- New fuel saving functions: The electric motor can power the vehicle independently of the ICE. As a result, the GTC II supports both constant-speed electric sailing at low load, as well as electric launch, for example in stop-start driving
- The absence of any engine braking effect in deceleration phases means that more kinetic energy is available for recuperation
- First practical application for 48 V Electrically Heated Catalyst: GTC II complies with the strict requirements of emissions standard Euro 6c (2017/2018)

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