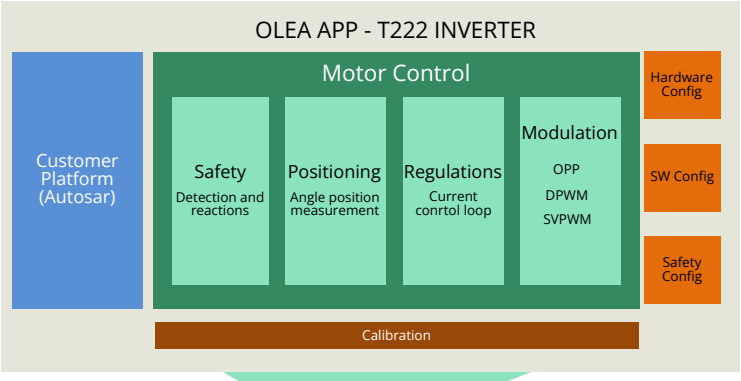
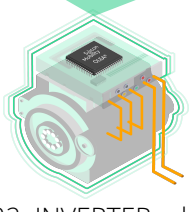
OLEA® APP - T222 INVERTER

Motor control software application for OLEA FPCU delivering unmatched efficiency & performance



- Supports any type of electric motor and position sensors
- Fast control loop and advanced modulation technics (OPP)
- Safety, Control, Configuration and Calibration API
- Safety Interface: Gate drivers and system I/O I/F
- Functional I/O, EPIOs, PWMs and ADC channels
- Gate drivers interface: 3 or 6 phases
- Default and custom safety fault detection and reaction
- ISO26262 ASIL-D Certified



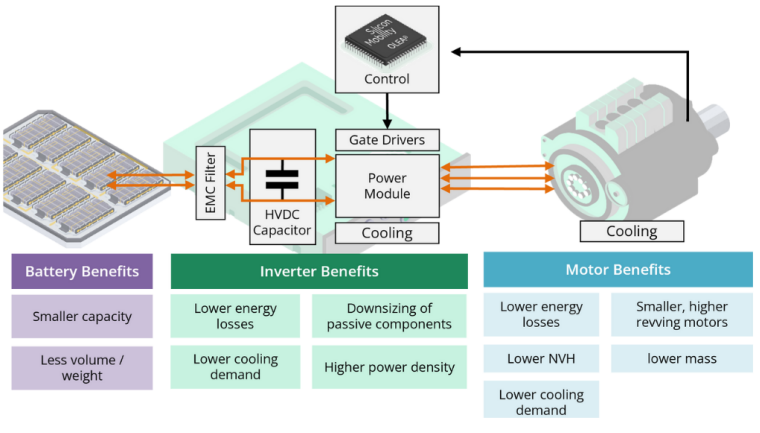
Complete e-motor control application

The OLEA APP - T222 INVERTER platform is an **embedded software designed for the OLEA T222 FPCU** parallel architecture, enabling high-performance, real-time control of inverter and electric motors. It offers efficient and safe control of torque, speed, current, and rotor using cutting-edge algorithms. This versatile software **suits a wide range of powertrain system** supports the latest technology inverters, and leverages parallel hardware for fast control loops. It also includes a **separate functional safety stack** and supports a model-based design flow for seamless integration.

Adv. Performances | **ASIL-D Certified** | **Fast time to market** | **Flexible & Modular**

Less weight, noise & cost

- Higher control loop and switching frequencies (up to 100 kHz) with optimized Dead Time Compensation
- Short Circuit Withstand Time guarantee at < 300ns
- Advanced modulations (SVPWM, DPWM, 6-step PWM, OPP)
- Improve Total Harmonics Distortion (THD)
- Reduce HVDC Link Voltage Ripple
- High speed machine support (upto 10 kHz electrical frequency



Vehicle benefits: less weight & cost

A proven technology

**These results are derived from actual bench measurements. For the complete document, kindly reach out to our support team.*

Up to 25%
E-motor downsizing*

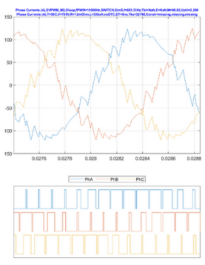
Up to 5%
Total efficiency improvement*

Up to 53%
Cooling downsizing*

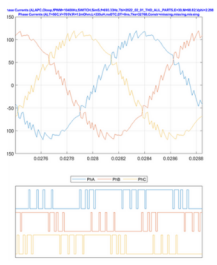
Reduced by 30%
DC-Link Capacitor & EMC*

Less switching = better efficiency & NVH

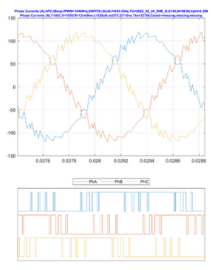
SVPWM @10 000 Hz - THD 10.3%



OPP @6 000 Hz - THD 6.25%



OPP SHE @6 000 Hz - THD 6.63%



Reduce losses, increase efficiency

With Optimized Pulse Pattern

OPP is part of the **Model-Based driven Predictive Control method** that enables the delivery of unprecedented system performance in terms of energy efficiency, NVH, HVDC ripple, and more. Unlike SVPWM which is time-based, OPP has a **variable number of switches** that can be freely placed on any angular position of the motor.

OPP are generated for a defined set of operating points (speed/ torque) **using an OPP Generator / Solver** delivered by Silicon Mobility. This tool uses motor loss models to find the OPPs suited for a targeted system

The generated OPPs are used online, in the OLEA APP - T222 INVERTER control software, depending on the operating points. Silicon Mobility goes even further by **offering the possibility to apply the right modulation (between SVPWM, DPWM and OPP) upon the torque/speed need.** This is the Adaptive PWM switching mechanism or APC.

With Auxiliary Function

The OLEA APP - T222 INVERTER software can be used in two ways: either **combined with a software platform (AUTOSAR or custom)** within the OLEA T222 FPCU, or as a **stand-alone software** in the OLEA T222 FPCU using the Auxiliary Function component. The Auxiliary Function is a recent feature of the OLEA APP – T222 INVERTER platform that allows customers to **preserve their existing software platform in a remote MCU.**

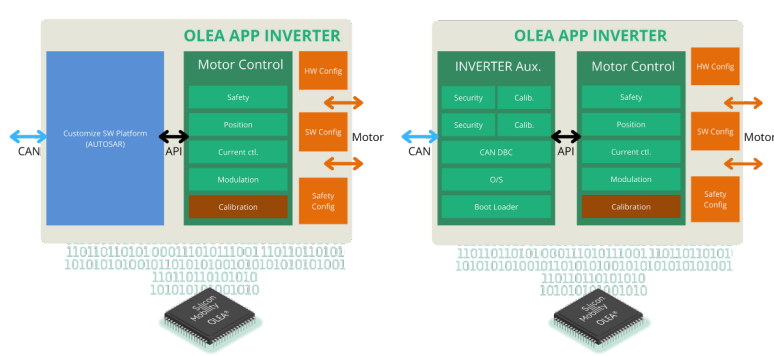
The Auxiliary Function reduces the integration effort when keeping a legacy software platform while benefiting from OLEA performance boost.

1

Combine with customer's software platform (AUTOSAR or custom)

2

Stand-alone software using the AUXILIARY Functions



SGS TÜV SAAR
FUNKTIONALE SICHERHEIT GEPRÜFT
FUNCTIONAL SAFETY APPROVED

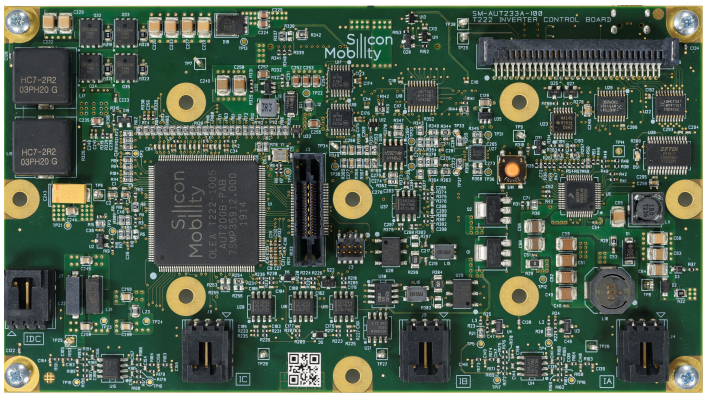
ASIL-D certified

OLEA APP – T222 INVERTER is **ISO 26262 certified ASIL-D** applications combined with OLEA T222 FPCU. Our solution includes essential documentation and safety work products for integration into tracking inverter application.

Get your own Starter Kit

For more information about our solutions, visit our website

OLEA COMPOSER – T222 HVIC Starter Kit is based on a reference design board for inverter/electric motor control to enable OLEA technology evaluation, proof of concept, and rapid prototyping.



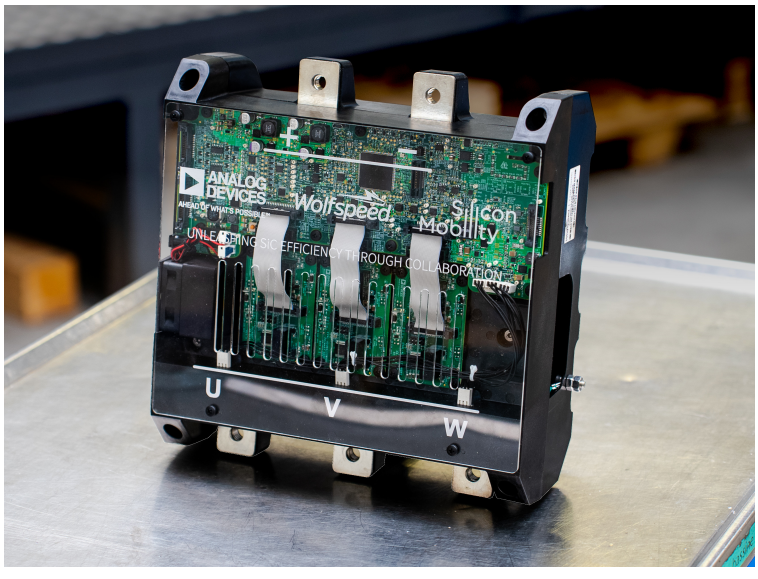
The Starter Kit includes:

- OLEA COMPOSER HVIC Control Board with OLEA T222 FPCU & OLEA APP - T222 INVERTER
- Functional Vehicle Dependent Software demo code includes:
  - Remote Control Unit, XCP interface via CAN-FD
  - Diagnostics Interface
- Post-build Measurement, configuration, calibration, and firmware update GUI software for PC Windows
- Schematics, BoM, and User's guide for a fast configuration and calibration

Alternatively, begin with our partnered solution

300 kW SiC inverter platform

Best-in-class system-level power density and efficiency obtained by combining ADI's gate drivers, power, isolation, and signal chain solutions with Wolfspeed's efficient SiC MOSFET technology all controlled with Silicon Mobility's software & chip.



Features:

- 800VDC bus nominal (900V max)
- 360ARMS output
- 80kHz maximum control and switching frequency
- Controller board with OLEA T222 FPCU & OLEA APP - T222 INVERTER
- Supports both SVPWM and DPWM (OPP on request)
- ISO 26262 ASIL-D Certified
- More on the website

Wolfspeed. ANALOG DEVICES

SIC INVERTER Reference Design

This reference design partnered with CISSOID offers the best of both worlds: fast prototyping and adaptable to the application requirements.

Features:

- 1200V SiC-based power module
- Up to 350kW/850V operation
- Integrated Gate Driver board
- Control board with ultra-fast OLEA T222 FPCU
- Supports both SVPWM and DPWM
- ISO26262 ASIL-D ready
- More on the website

CISSOID
POWER SEMICONDUCTORS

Fully Featured

Type of e-motor

- PMSM (Permanent Magnet Synchronous Motor)
- WRSM (Wound Rotor Synchronous Motor)
- ASYM (Asynchronous motor)
- Configurable number of pole pairs
- Uniform air gap (Non-Salient pole machine): when d/q inductances are the same (Ld=Lq)
- Non uniform air gap (Salient pole machine): when d/q inductances are different (Ld≠Lq)
- AFM (Axial Flux Machine)
- RFM (Radial Flux Machine)
- 3 Phases Motor with star connection
- 6 Phases Motor controlled as two-3 phases star connection motors

Modulation

- SVPWM (Space Vector Pulse Width Modulation)
- DPWM (Discontinuous Pulse Width Modulation)
- OPP (Optimized Pulse Pattern)
- Variable switching frequency based on the electrical speed
- Dead-time compensation

Motor sensors signal processing

- Position Tracking Loop algorithm for SIN/COS signals with a configurable number of e-motor/resolver configurable pole pairs number
- Position Sensor phase auto calibration at boot
- Position delta phase LUT calibration update at high speed
- Position Gain and Offset auto adjustment of SIN/COS ADC
- AMR-GMR
- Sensorless

VCU interface

- E-motor Control FSM supporting the VCU operating states
- Fully features set of APIs (control, diagnostics, safety, calibration/ configuration) allowing integration with a VCU

Auxiliary functions

- CAN Messaging Compliance with CAN DBC
- Pre-emptive O/S Execution
- Real-time Safety Monitoring
- EVITA Light Implementation enables secure firmware updates with storage
- API Access through CAN DBC
- Packaged Auxiliary Software Modules

E-motor control

- Flux Weakening management
- Active Discharge
- FOC (Field Oriented Control) inc:
- Clarke/Park and Inverse Clarke/park transforms
- D/Q currents filtering using a MAF (Moving Aver. Filter)
- PID coefficient computing with Lambda and bandwidth LUT
- D/Q voltages decoupling
- D/Q voltages saturation
- D/Q inductances LUT
- Fct. of D/Q currents for PMSM
- Fct. of D/Q currents & rotor excitation current for WRSM
- Torque derating LUT based on Speed/DC-Link and T°
- Slew rate limitation: D/Q Currents, switching frequency and rotor DC excitation current (WRSM)
- Filtering of DC Voltage, motor speed, measured T° and rotor DC excitation current (WRSM)
- T° monitoring: filtered and interpolated using 8 post-build configurable LUT
- Torque control:
- LUT of D/Q Currents based on speed and torque (PMSM)
- LUT of D/Q Currents and LUT of rotor excitation current based on speed and torque (WRSM)
- Current control
- Speed control
- Rotor control
- Enabled automatically for WRSM
- Rotor current regulator parameters computing
- Clockwise/Anti-clockwise direction support

Safety & diagnostics

- ISO 26262 ASIL-D Ready Design
- Safety Finite State Machine (FSM) managing the faults containment
- Configurable safety faults detections
- Warning detections: Over/under temperature warning

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