Product Overview

CCS-Compliant Electric Vehicle Service Equipment Reference Design for Level 1 and 2 EV Charger

Description

Electric vehicle service equipment (EVSE) facilitates power delivery to electric vehicles safely from the grid. An EVSE control system consists of an auxiliary power stage, an off-board AC/DC high power stage (only in DC charging stations), energy metering unit, AC and DC residual current detector, an isolation monitor unit, relays and contactors with drive, two-way communication over single wire, and service and user interfaces. This reference design highlights an ultra-low standby isolated AC/DC auxiliary power stage followed by converters and linear regulators, a comparator-based control pilot interface to meet the IEC61851 standard, an efficient relay and contactor drive, plug lock motor driver, flux gate circuit to detect AC and DC currents for RCD applications, and isolated line voltage sensing across the relay and contactor.

Features

- Ultra-low standby UCC28742-based isolated AC/DC stage to achieve ENERGY STAR® certification for electric vehicle (EV) charging stations
- Tight output voltage regulation (< ±5%) of LDOs and the high slew rate of the TLV1805 device for control pilot interface
- Ultra-low standby as well as cost-optimized converters and linear regulators to power up points-of-load
- DRV8220 current controller to drive high-current relays and contactors for thermal protection, RCD AC and DC detection, and plug lock control
- Isolated line voltage sensing using the ISO1212 digital-input receiver for welded relay and contactor detection

Applications

- AC charging (pile) station
TI Resources

- **Build a smart EV charging station with Vehicle-to-Grid (V2G) communication**
- TIDA-010239: CCS-compliant electric vehicle service equipment reference design for level 1 and 2 EV charger
- ATL431: 2.5-V low-IQ adjustable precision shunt regulator
- ADC122S051: 2 Channel, 200 kps to 500 kps 12-Bit A/D Converter
- DRV8220: 20-V, 1.76-A H-bridge motor driver with auto sleep mode
- INA293: -4-V to 110-V, 1.3-MHz, ultra-precise current sense amplifier
- ISO1212: Dual-channel Isolated 24-V to 60-V digital input receiver for digital input modules
- MSP430F5132: 25 MHz MCU with 8KB Flash, 1KB SRAM, 10-bit ADC, comparator, DMA, 16-bit High Resolution timer
- OPA202: Low noise (0.2-µVPP, 9-nV/√Hz), heavy capacitive drive (25-nF), super beta, precision op amp
- TLV1805: High voltage comparator with push-pull output and shutdown
- TLV7011: Low power, small size comparator with push-pull output
- TL7705A: 5-V single-supply voltage supervisor with programmable delay time
- TPS25947: 2.7-V to 23-V, 28-mΩ, 5.5-A eFuse with integrated reverse polarity protection
- TPS55330: Integrated 5-A 24-V Wide Input Range Boost/SEPIC/Flyback DC-DC Regulator
- TPS63210A: 17V Input, 3A Synchronous Step-Down Regulator in SOT-23 w/ Advanced Eco-mode™, PG, Soft Start
- TPS65130: Split-Rail Converter with Dual, Positive and Negative Outputs (300mA typ)
- TPS7A20: 300-mA, ultra-low-noise, low-IQ, low-dropout (LDO) linear regulator with high PSRR
- TPS7A39: 150-mA, 33-V, low-noise, high-PSRR, dual-channel positive and negative low-dropout voltage regulator
- SN74AUP1G08: Single 2-input, 0.8-V to 3.6-V low power AND gate
- UCC24612: High-frequency multi-mode synchronous rectifier controller
- UCC28742: High-efficiency flyback controller with 1% output regulation accuracy
IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated