HIGH-VOLTAGE MOTOR DRIVER: OVERVIEW

There are motors and motor control all around us. In this design, we highlight a high-voltage motor application suitable for appliances, HVAC compressors and fans, etc. We combine power factor correction (PFC), now required by many power providers, to produce a clean and stable 390VDC to the motor control sub-system. The heart of the motor control is a 32 bit high-performance RISC processor, the RX23T, containing a floating point unit (FPU) to simplify the algorithm implementation. Utilizing a 3-phase timer with complementary outputs, the RX23T supports a wide variety of algorithms that can be downloaded. In this particular block diagram, we are showing hardware to support sensor-less Field Oriented Control (FOC) utilizing multi-shunt phase-current sampling.

Key Features:

- Single-phase PFC boost controller to provide stable bus voltage (390VDC) for the system
- Universal input voltage support (85-240VAC)
- Power factor as high as 0.999, efficiency up to 98%
- High performance op-amps for conditioning the shunt voltage for fast sampling.
- High-speed ADC (1uS) with multi S/H to simplify motor phase current sampling.
- Efficient FOC algorithm that leaves plenty of MCU cycles for other tasks (communication typical)

WC#: US016-D25



HIGH-VOLTAGE MOTOR DRIVER: BLOCK DIAGRAM



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RX23T: INDUSTRIAL CONTROL MCU

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Industrial Applications MCU series within the Renesas RX family

Features	Benefits	Applications		
 RX microcontrollers with RXv2 core Enhanced security Single Precision Floating point Enhanced DSP functions 64k/128k KB 0 wait-state FLASH 64k/128k KB 0 wait-state FLASH RAM 640 KB Data Flash 32 KB 1uS ADC with 3 simultaneous S/H Built-in Analog Comparators (3 ch) Safety Functions 	 Compact code size Low cost / high performance for Control applications. Fast sampling ADC for sensors Fast math processing BLDC Algorithms available In-circuit scope for Motor Control 	 Motor Control HVAC, Fan control General Industrial 		
Typical application and key performances				
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Industrial Applications

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Easy and Fast to Use RX Driver Package real-time OS Package

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ISL85415:WIDE VIN 500MA SYNCHRONOUS BUCK REGULATOR

Selectable PFM or PWM mode operation

Features	Benefits	Applications
 Synchronous Operation for high efficiency No compensation required Selectable PFM or forced PWM mode at light loads Internal fixed (500kHz) or adjustable Switching frequency 300kHz to 2MHz Internal or external soft-start Minimal external components required Power-good and enable functions available 	 It provides an easy to use, high efficiency low BOM count solution for a variety of applications. It will provide a very robust design for high voltage Industrial applications as well as an efficient solution for battery powered applications 	 Industrial control Medical devices Portable instrumentation Distributed Power supplies Cloud Infrastructure
Typical application and key performances		
Typical application ci	rcuit	V _{IN} = 15V V _{IN} = 12V V _{IN} = 5V V _{IN} = 24V V _{IN} = 33V V _{IN} = 24V V _{IN} = 33V 0 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 OUTPUT LOAD (A) EFFICIENCY vs LOAD, PFM, V _{OUT} = 3.3V
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ISL6730B: POWER FACTOR CORRECTION CONTROLLER

Active PFC controller in Continuous Conduction Mode

Features	Benefits	Applications
 Continuous Conduction Mode (CCM) 62kHz switching frequency Pulse skip mode during light load conditions Up to 2kW and over the universal line input The internally clamped 12.5V gate driver delivers 1.5A peak current to the external power MOSFET Full protection features: cycle-by-cycle overcurrent, over power limit, overtemperature, input brownout, output overvoltage and undervoltage protection 	 Reduce component size requirements Enables smaller, thinner AC/DC adapters Choke and cap size can be reduced Lower cost of materials Excellent power factor over line & load regulation Internal current compensation CCM Mode with smaller EMI filter Better light load efficiency Automatic pulse skipping Programmable or automatic shutdown High reliable design with full protection features 	 Desktop computer AC/DC adaptor Laptop computer AC/DC adaptor TV AC/DC power supply AC/DC brick converters

Typical application and key performances

The ISL6730B is active Power Factor Correction (PFC) controller ICs that use a boost topology, potential for high power factor, Low THD and high conversion efficiency. A patent pending breakthrough negative capacitance technology minimizes zero crossing distortion and reduces the magnetic components size. The small external components result in a low cost design without sacrificing performance.



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ISL28148: 4.5MHZ GBW OPAMP, SMALL SOT-23 PKG

Single and Dual Precision Rail-to-Rail Input-Output Op Amps with Very Low Input Bias Current

Features	Benefits	Applications
 4.5MHz gain bandwidth product 900µA supply current (per amplifier) 1pA typical input bias current Down to 2.4V single supply operation Rail-to-rail input and output Enable pin (ISL28148 SOT-23 package only) -40°C to +125°C operation Pb-free (RoHS compliant) 	The parts are optimized for single supply operation from 2.4V to 5.5V, allowing operation from one lithium cell or two Ni-Cd batteries	 Low-end audio 4mA to 20mA current loops Medical devices Sensor amplifiers ADC buffers DAC output amplifiers
Typical application and key performances		
GAIN vs FREQUENCY vs SUPPLY VOLT (B) NY OCT (B) NY	AGE Pinout 8 LD SOIO TOP VIEW OUT_A INA INA IN+_A IN+_A IN+_A	C 8 LD MSOP TOP VIEW V+ OUT_A 1 OUT_B INA 2 INB IN+_A 3 IN+_B V- 4 IN+_B V- 4

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HIGH-VOLTAGE MOTOR DRIVER

System benefits

- RX23T supports a wide variety of algorithms that can be downloaded and contains a floating point unit (FPU) to simplify the algorithm implementation
- Power factor correction (PFC) produces a clean and stable 390VDC to the motor control sub-system
- High performance DC/DC with Integrated FETs to reduce system parts count

Device Category	P/N	Key Features
MCU	RX23T	RXv2 Core, FPU, DSP, Low Cost and High Performance for Control Applications
Power	ISL85415	36V, 500mA buck switching regulator with integrated FETs.
Analog	ISL28148	Precision Rail-to-Rail Input-Output Op Amps with Very Low Input Bias Current, 4.5MHz GBW
Analog	ISL6730B	Active PFC Controller in Continuous Conduction Mode, High Conversion Efficiency