REFRIGERATOR COMPRESSOR DIGITAL INVERTER: OVERVIEW

Due to today's power saving requirements, digital inverters for refrigerators are becoming more popular. A compressor driven by a digital controlled inverter has the power to adapt itself to the usage habit of the consumer throughout the day and it can operate at various speeds. It will speed up during the day as you open and close the doors, and at night, slow down to maintain the temperature. This simple action can save users 20-30% on their electric bill.

This design uses a combination of the 16-bit MCU (RL78/G14) and op-Amp (READ2302) to ensure an adaptable and robust solution for this type of application. Supporting a power rating up to 350W, this design uses the MCU to control the BLDC compressor motor (180 degree sine wave control) and the op-amp is used for motor current sensing using the 3-shunt control methodology.

Key Features:

- Adaptable to different compressors
- Improved system efficiency and energy usage
- 180 degree sensorless FOC control

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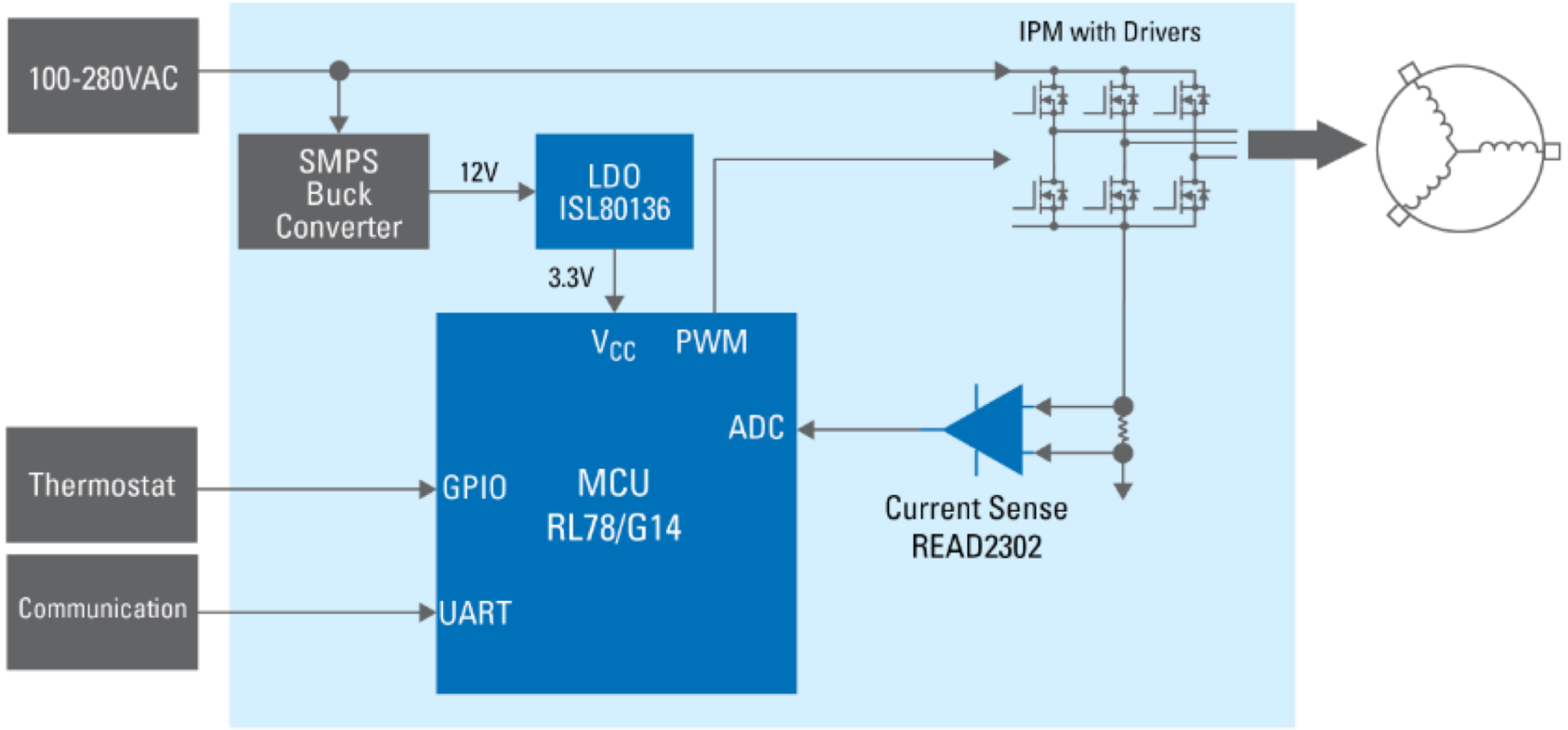
REFRIGERATOR COMPRESSOR DIGITAL INVERTER: BLOCK DIAGRAM



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REFRIGERATOR COMPRESSOR DIGITAL INVERTER: SUMMARY

- **System benefits**
  - Compressor over heat protection
  - Start lock detection
  - Communication timeout detection
  - Over power detection
  - Over current protection
  - IPM fault protection

Device Category	P/N	Key Features
MCU	RL78/G14	Controls the BLDC compressor motor (180 degree Sine wave control)
Power	ISL80136	High voltage linear regulator with ultra low quiescent current
Analog	READ2302	Motor current sensing using 3 shunt control methodology

RL78/G14: HIGH FUNCTION GENERAL PURPOSE MCU

Low power MCU series within the RL78 Family

Features

- True low power 16bit 32MHz uC
- Broad scalability w/ pin/FLASH/RAM options
- High performance w/ 1.6V to 5.5V operation
- High integration including oscillators, power-on-reset, low voltage detection, watchdog, real time clocks and analog functions
- Comprehensive tools and support
  - Advanced tools, 3rd party, online resources and training

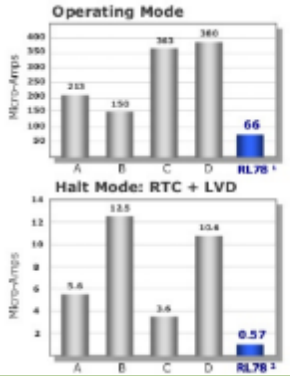
Benefits

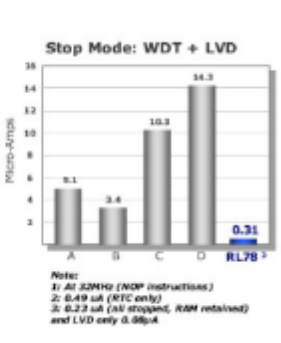
- RL78 provides many options in order to scale power based on application requirements by using combination of the clock selection and advanced power modes.
- RL78 offers scalability via > 600 devices with wide pin count, packages, I/O peripheral mapping and large memory options
- Integration options allow for many of the functions necessary to make the solution smaller, more reliable and lower cost

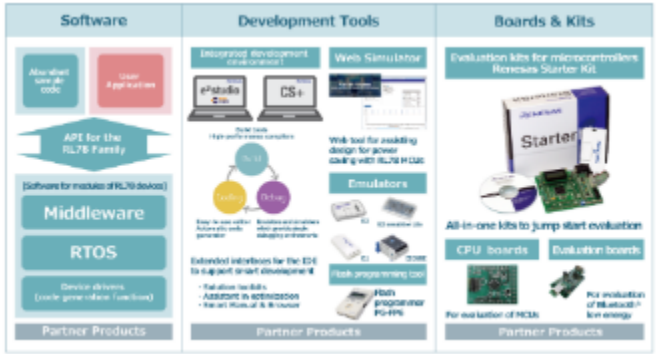
Applications

- HVAC systems
- Climate control systems
- Smart thermostats
- Bathroom fans
- Kitchen exhaust hoods
- Smart outlets & receptacles
- Home appliances
- Weather stations
- Industrial automation

Typical application and key performances







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ISL80136: LOW QUIESCENT CURRENT, HIGH ACCURACY

High voltage linear regulator with ultra low quiescent current

Features

- Ideal for “always-on” and “keep alive” applications. Only 18uA quiescent current.
- Wide VIN range of 6V to 40V
- ±1% accurate voltage reference (over temperature, load)
- Low 26µVRMS noise
- 5kV ESD HBM rated
- Ensured 50mA output current
- Rated across the -40°C to +125°C

Benefits

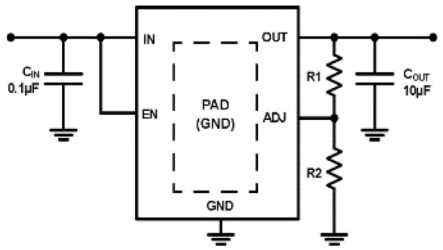
- The ISL80136 offers adjustable output voltages from 2.5V to 12V. It features an EN pin that can be used to put the device into a low-quiescent current shutdown mode where it draws only 1.8µA of supply current. The device features over-temperature shutdown and current limit protection.

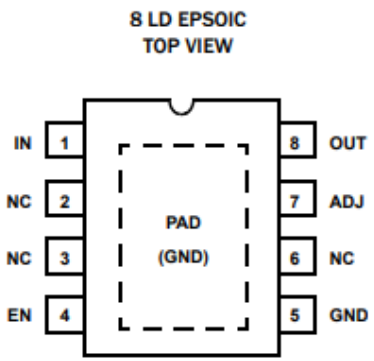
Applications

- Industrial
- Networking
- Telecom

Typical application and key performances

Typical application circuit





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READ2302G: 6MHZ GBW OPAMP, TSSOP8 PKG

Single and dual precision rail-to-rail input-output op amps with very low input bias current

Features

- 6MHz gain bandwidth product
- 750µA supply current (per amplifier)
- 1pA typical input bias current
- Down to 2.5V single supply operation
- Rail-to-rail input and output
- -40°C to +105°C operation
- Pb-free (RoHS compliant)

Benefits

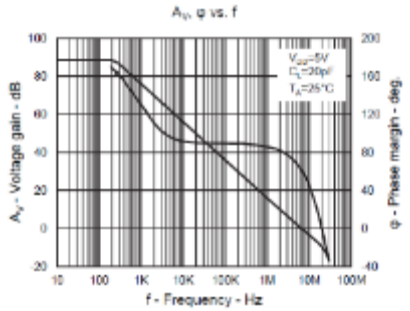
- The parts are optimized for single supply operation from 2.5V to 5.5V, allowing operation from one lithium cell or two Ni-Cd batteries

Applications

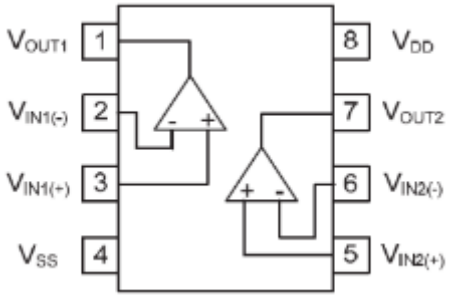
- Low-end audio
- 4mA to 20mA current loops
- Medical devices
- Sensor amplifiers
- ADC buffers
- DAC output amplifiers

Typical application and key performances

GAIN vs FREQUENCY vs SUPPLY VOLTAGE



Pinout TSSOP8



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