# US086
# 20V Cordless Leaf Blower

May 2020

# 20V Cordless Leaf Blower

- **Overview**

  This solution is designed for cordless and rechargeable battery-powered gardening tool applications, with a battery front end to monitor and control the battery life, and a specialized Renesas motor control microcontroller (MCU) to drive the motor. In this application, the 20V leaf blower supports adjustable speeds to match usage and preserve battery life, and the battery can be easily connected to a stand-alone charging dock.

- **System Benefits**
  - Renesas' RL78 MCUs provide a compact size, the industry's lowest current consumption, and advanced motor control functionality, including rotor position detection
  - Power products with high efficiency and accuracy, as well as added safety features to support motor applications
  - Highly configurable and effective battery management products to support consumer battery-driven systems

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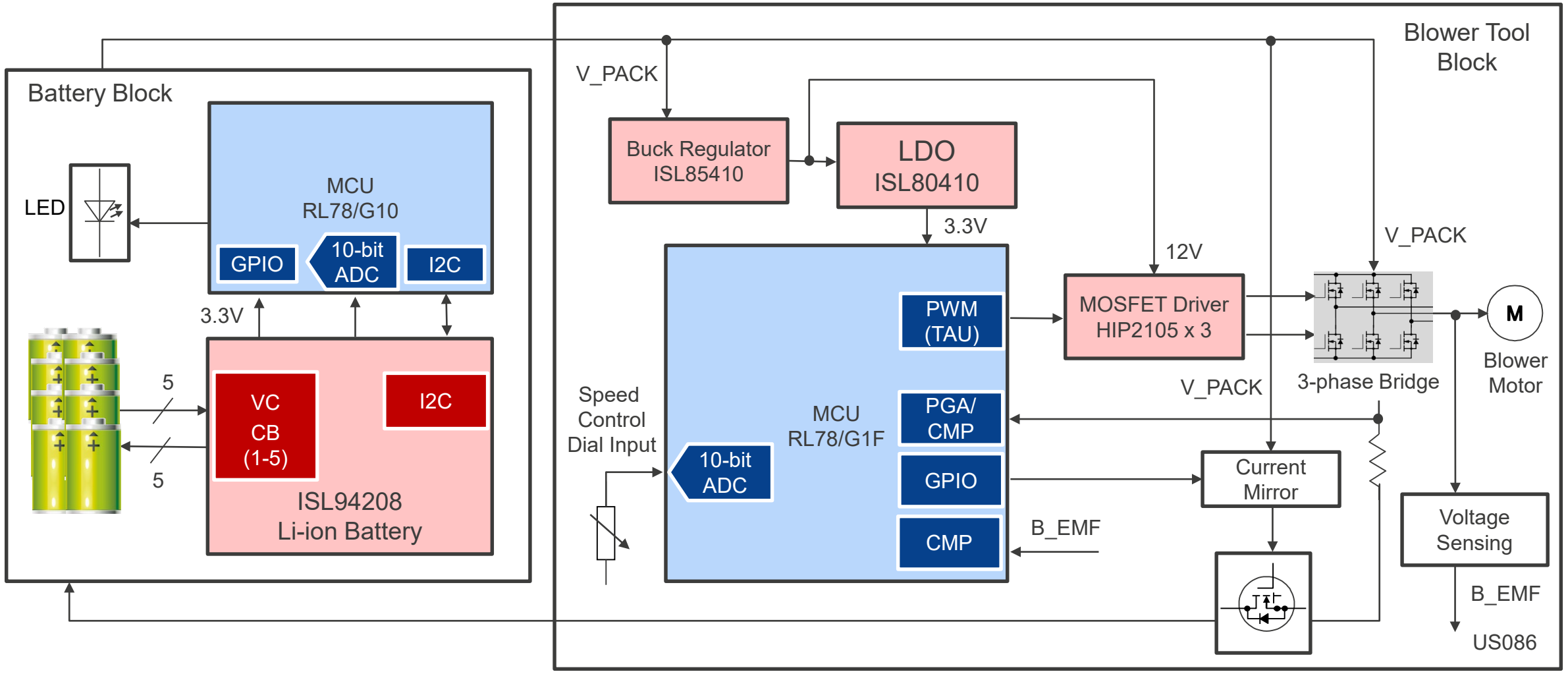

# 20V Cordless Leaf Blower

| Device Category | P/N | Key Features |
|---|---|---|
| MCU | RL78/G1F | Ultra-low power consumption with operating supply voltage of 1.6 - 5.5V, enhanced analog functions and timers, and PGA/comparator for advanced motor control, as well as rotor position detection |
| | RL78/G10 | General-purpose MCU with industry's lowest level of current consumption (CPU: 46 µA/MHz), with 10 and 16-pin package lineup to support compact systems |
| Power | ISL94208 | 6-cell battery manager designed for use with a microcontroller to accurately manage each cell voltage. Includes cell balancing, and variable overcurrent protection. |
| | HIP2105 | High-frequency, low voltage driver for 2 N-channel MOSFETs with single supply for minimizing switching losses, and 4A sink current capability |
| | ISL85410 | 1A synchronous buck with a wide input voltage range (3 - 40V) and high efficiency and small package size (3mm x 4mm) |
| | ISL80410 | High-voltage adjustable LDO with low quiescent current, a wide input range of 6V - 40V, and thermal shutdown/current limit protection |

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# RL78/G1F – General MCU with Enhanced Functions

## Upward-compatible with the RL78/G14 and has enhanced analog functionality

### Main Improvements Compared with RL78/G14

- Rotor position detection for high torque
- Programmable-gain amplifier (PGA): high slew rate of 3.0 V/µs (min.) (VDD ≥ 4.0 V)
- 2-channel comparator (CMP0 and CMP1): Fast response time of 70 ns (typ.) (1/8 that of RL78/G14)
- IrDA communication function

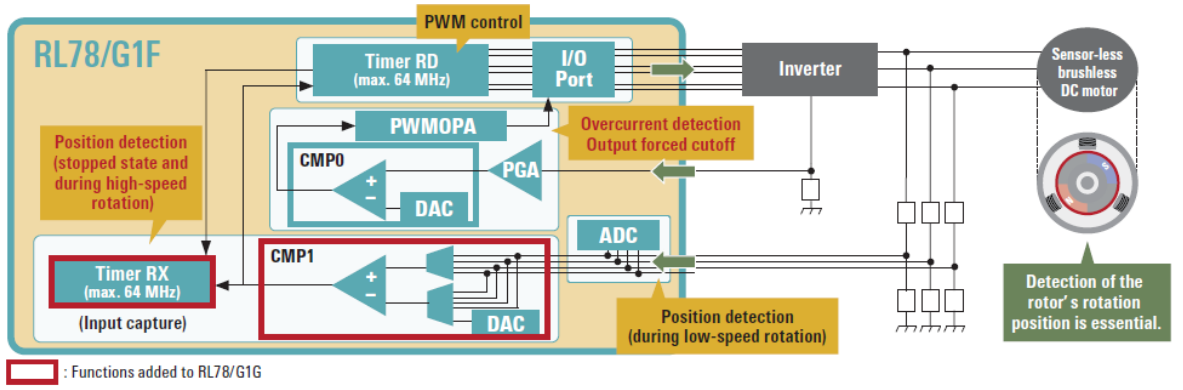
### Motor Control Functions

- 120-degree conducting control for sensor-less brushless DC motors, On-chip 4-input-selectable high-speed comparator (CMP1) and timer RX
- Overcurrent detection and forced cutoff of PWM output, On-chip high-speed PGA for overcurrent detection + high-speed CMP0 and control output signal forced cutoff function (PWMOPA)

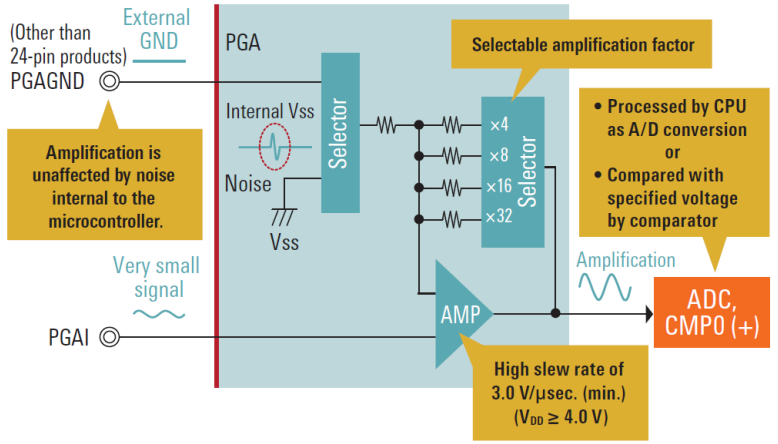
### Other Key Features

- Programmable-gain amplifier (PGA) for boosting sensor signals
- 36-pin LGA package (4 × 4 mm) situable for mobile devices

| Part # | Flash ROM | RAM | DAC | Package |
|---|---|---|---|---|
| R5F11B7x | 32/64 KB | 5.5 KB | 1ch | HWQFN-24 (4 × 4, 0.5 mm pitch) |
| R5F11BBx | 32/64 KB | 5.5 KB | 2ch | LQFP-32 (7 × 7, 0.8 mm pitch) |
| R5F11BCx | 32/64 KB | 5.5 KB | 2ch | WFLGA-36 (4 × 4, 0.5 mm pitch) |
| R5F11BGx | 32/64 KB | 5.5 KB | 2ch | LFQFP-48 (7 × 7, 0.5 mm pitch) |
| R5F11BLx | 32/64 KB | 5.5 KB | 2ch | LFQFP-64 (10 × 10, 0.5 mm pitch) |




RL78/G1F Sensor-less Brushless DC Motor Control




PGA for Boosting Sensor Signals

# RL78/G10 – Low Pin Low Power Compact MCU

## Ideal for Small Electronic Devices and Sub-microcontrollers

### High Performance with Rich Peripheral Functions

- 16bit MCU with Max. frequency 20 MHz
- $V_{DD}$ = single power supply voltage of 2.0 to 5.5 V
- On-chip oscillator,16-bit TAU, 10-bit A/D converter, comparator, CSI/UART/IIC
- WDT(no window function),TRAP instruction for safety functions

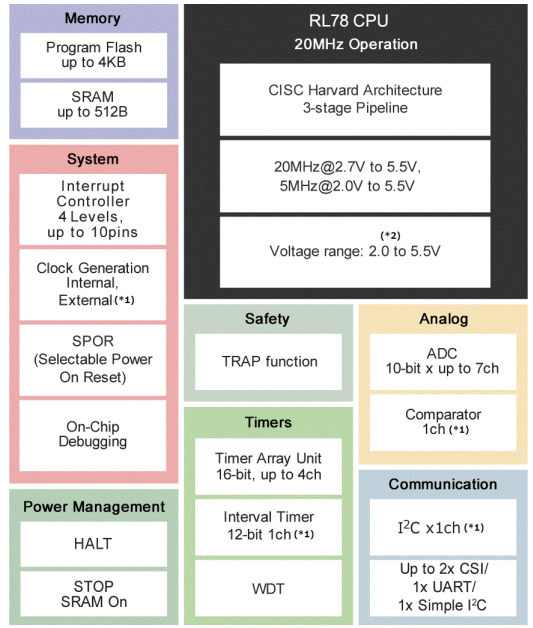
### Low Power Consumption

- CPU: 46 μA/MHz, standby (stop mode): 560 nA
- HALT, STOP, 2 kind of mode to save power

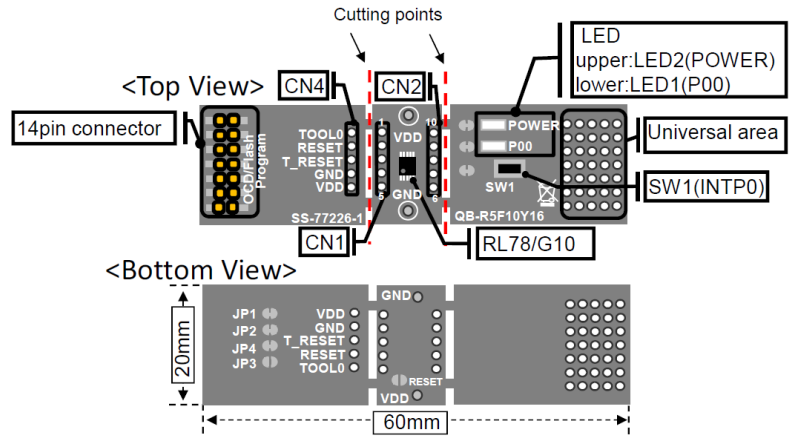
### Low Pin Count with Low Cost

- 10/16-pin package lineup with low cost is perfect for small consumer electronics
- Support more compact system size

| Part # | Flash ROM | RAM | I/O | Comparator | Package |
|---|---|---|---|---|---|
| R5F10Y14 | 1KB | 128B | 8 | None | 10-pin LSSOP |
| R5F10Y16 | 2KB | 256B | 8 | None | 10-pin LSSOP |
| R5F10Y17 | 4KB | 512B | 8 | None | 10-pin LSSOP |
| R5F10Y44 | 1KB | 128B | 14 | Yes | 16-pin SSOP |
| R5F10Y46 | 2KB | 256B | 14 | Yes | 16-pin SSOP |
| R5F10Y47 | 4KB | 512B | 14 | Yes | 16-pin SSOP |




RL78/G10 Block Diagram




QB-R5F10Y16-TB Target Board

# ISL94208 – 4 to 6-Cell Li-ion Battery Analog Front End

## Applications for Power Tools, Portable Equipment, Battery Backup Systems

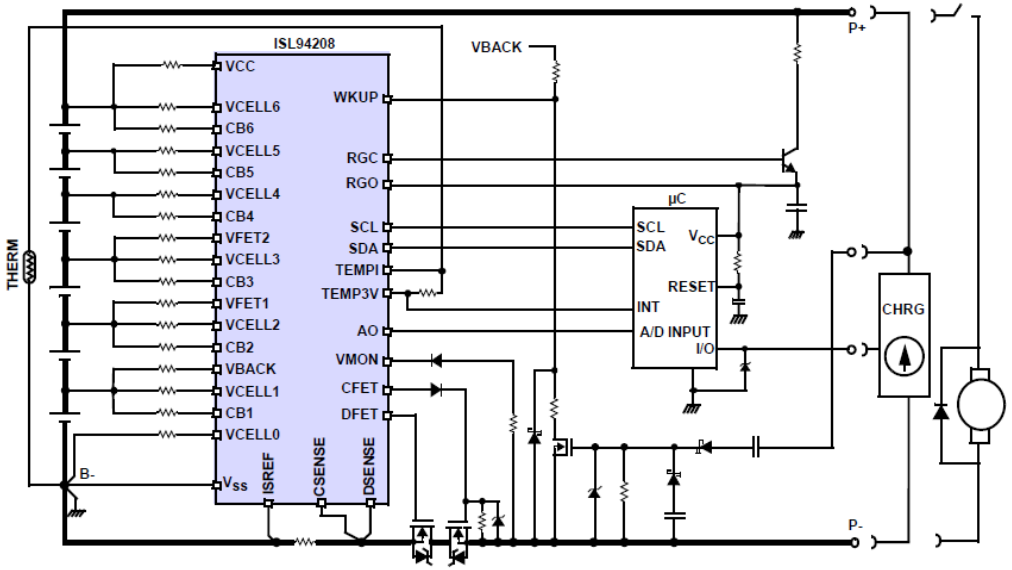
### High Performance Battery Front End (BFE)

- Supervises 4 to 6 series connected cells
- Integrated charge/discharge FET drive circuitry
- Internal cell balancing FETs handle up to 200mA of balancing current for each cell

### Low Power and Protection Features

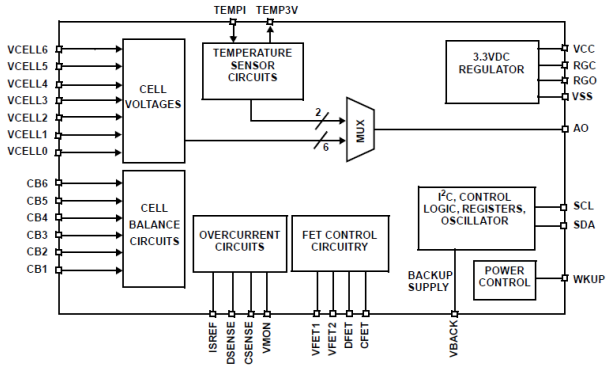
- Sleep operation with negative or positive edge wake-up, <10µA Sleep mode
- Automatic cell balance turn off on IC over-temperature
- Automatic FET turn-off and cell balance disable on reaching external (battery) or internal (IC) temperature limit
- Software selectable overcurrent protection levels and variable protect detection times
  - 4 discharge overcurrent thresholds, 4 short-circuit thresholds
  - 4 charge overcurrent thresholds
  - 8 overcurrent delay times (charge/discharge)
  - 2 short-circuit delay times (discharge)

| Part # | Cell Support (Max) | Package Voltage(Max) | Temp. Range | Package |
|---|---|---|---|---|
| ISL94208IRZ-T7A | 6 | 26.4V | -40 – 85°C | 32 Ld 5x5 QFN |




Typical Application


ISL94208EVZ Evaluation Board




Block Diagram

# HIP2105 – 5V, 4A, MOSFET Driver

## Low Voltage Driver for Synchronous Rectification

### Low Voltage and High Current Driver

- Supports 3.3V and 5V HI/LI input
- 0.4Ω ON-resistance and 4A sink current capability

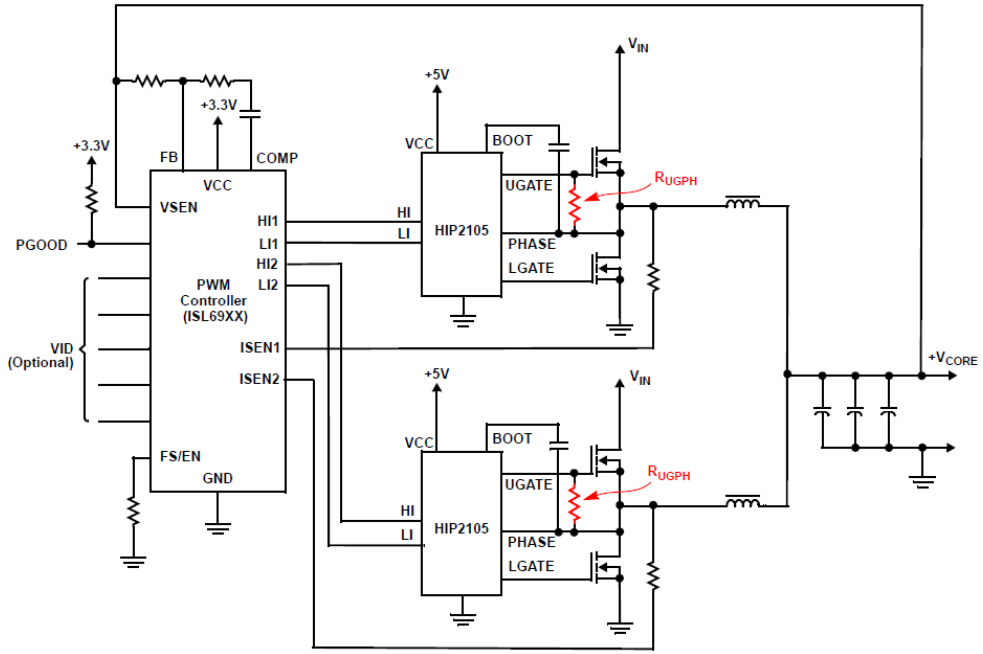
### High Frequency and Efficiency

- Each driver is capable of driving a 3nF load with less than 15ns rise/fall time
- Drives 1000pF load with typical rise time of 20ns and fall time of 10ns

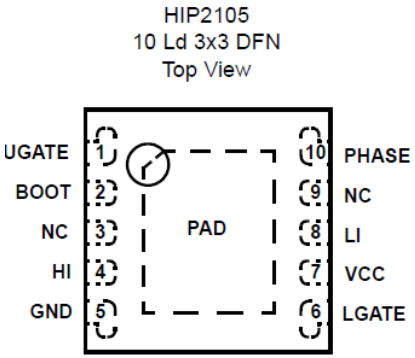
### Integrated Functions and Small Package

- Power-On Reset (POR)
- Biased by a single low voltage supply (5V), minimizing driver switching losses in high MOSFET gate capacitance and high switching frequency applications
- Dual Flat No-Lead (DFN) package
  - Compliant to JEDEC PUB95 MO-220 QFN-Quad Flat No Leads
  - Near chip-scale package footprint; improves PCB efficiency and thinner in profile

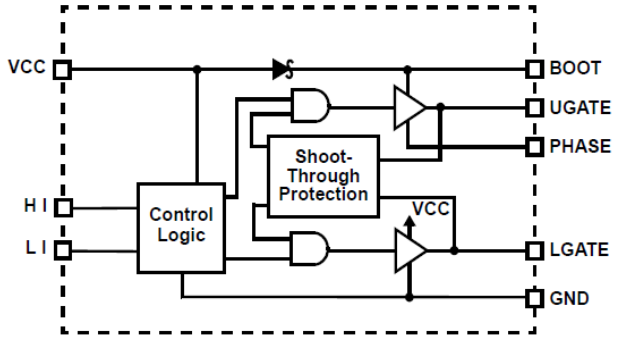
| Part # | Bias Supply Current | Temp (°C) | Package |
|---|---|---|---|
| HIP2105FRZ | 80µA | -40 to 85 | 10 LD 3x3 DFN |
| HIP2105FRZ-T | 80µA | -40 to 85 | 10 LD 3x3 DFN |




Typical Application Circuit




Pin Configuration




HIP2105

HIP2105 Block Diagram

# ISL85410 – 1A Synchronous Buck with Integrated FETs

## Support 3V-40V Input Voltage Range for Buck Output

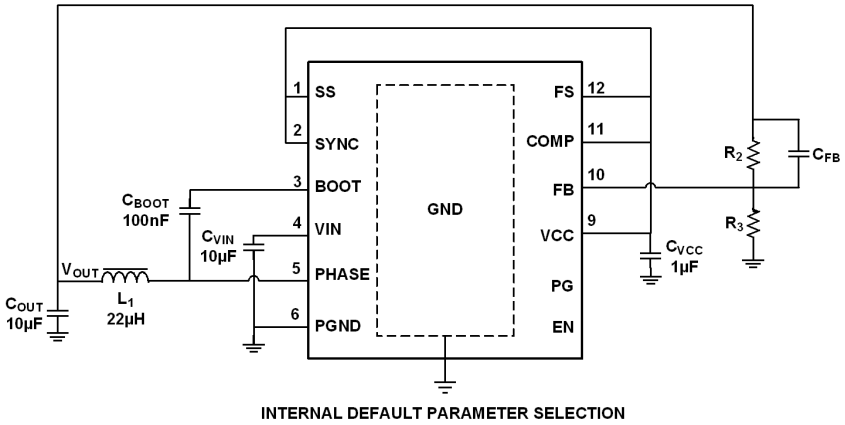
### Wide Working Range and Space-Limited Applications

- Power input voltage range from 3V to 40V
- Up to 1A load over full temperature range
- 4mm x 3mm DFN package
- Minimal external components required

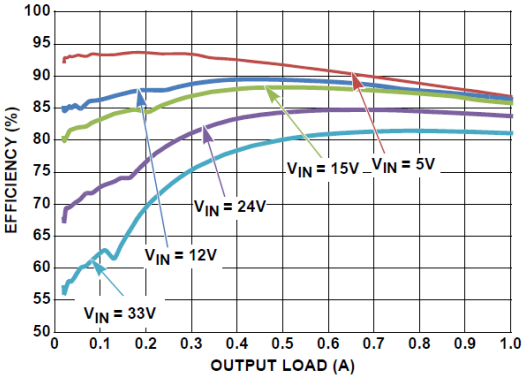
### High Efficiency and Performance

- Synchronous operation for high efficiency
- No compensation required
- Integrated High-side and Low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

| Part # | $V_{IN}$ Range(V) | Temp.(℃) | Package |
|---|---|---|---|
| ISL85410FRZ | 3 to 40 | -40 to 125 | 12 Ld DFN 4x3 |




Typical Application Circuit




Efficiency vs Load, PFM, $V_{OUT}$ = 3.3V


ISL8541xDEMO1Z Evaluation Board

# ISL80410 – High Voltage Adjustable $V_{OUT}$ LDO

## Low Quiescent Current and 40V/150mA Output

### High Performance and Wide Input Range

- Wide $V_{IN}$ range of 6V to 40V
- Adjustable output voltage from 2.5V to 12V
- Ensured 150mA output current
- ±1% accurate voltage reference (over temperature, load)

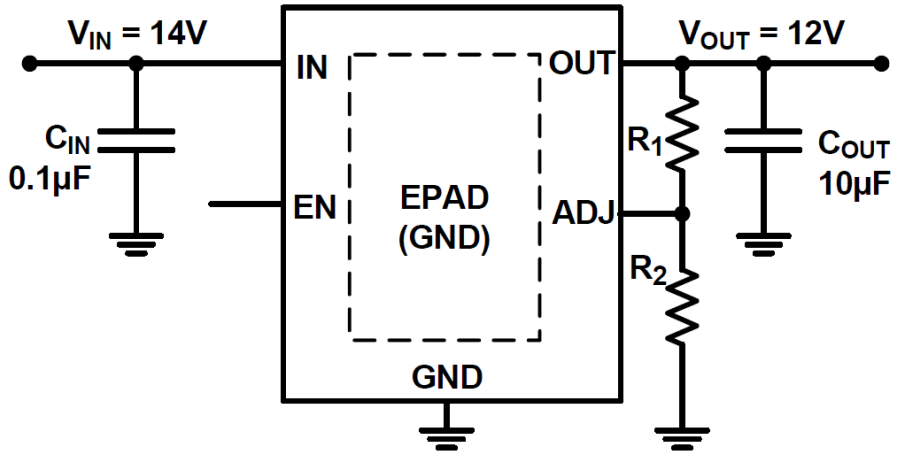
### High Efficiency

- Ultra low 18µA typical quiescent current
- Low 2µA of typical shutdown current
- Low dropout voltage of 295mV at 150mA
- Low 26µVRMS noise

### Excellent Safety

- 40V tolerant logic level (TTL/CMOS) enable input
- 5kV ESD HBM rated
- Thermal shutdown and current limit protection

| Part # | $V_{IN}$ Range(V) | $V_{OUT}$ Range(V) | Enable Pin | Package |
|---|---|---|---|---|
| ISL80410IBEZ | 6 to 40 | ADJ | Yes | 8 Ld EPSOIC |
| ISL80410IBEZ-T | 6 to 40 | ADJ | Yes | 8 Ld EPSOIC |
| ISL80410IBEZ-T7A | 6 to 40 | ADJ | Yes | 8 Ld EPSOIC |




Typical Application Circuit


ISL80410EVAL1Z Evaluation Board

Renesas.com