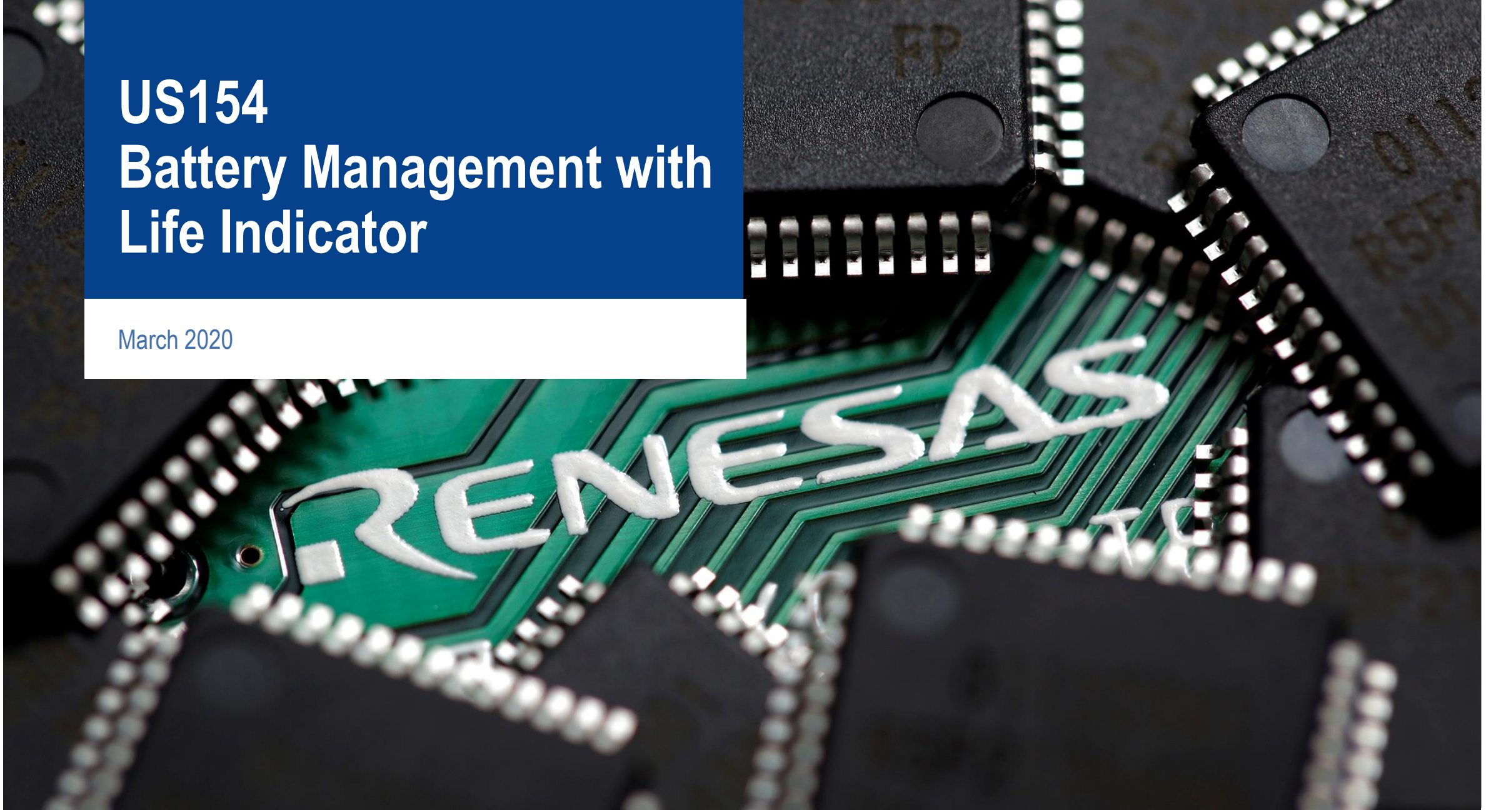
US154
Battery Management with Life Indicator

March 2020



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Battery Management with Life Indicator

Overview

This winning combination is a reference design for battery-powered applications that require a charging system with a mechanism to display the battery life. The E-paper display provides a low power option for a life indicator that the user can access at any time.

System Benefits

- The RAJ240045 is a fuel gauge IC (FGIC) that provides a full battery management system
- The ISL9238 is a charging IC that has a wide range input of 3.2V to 23.4V and an output range of 2.4V to 18.30V
- The RL78/G14 is a highly flexible MCU that provides low current consumption and high performance

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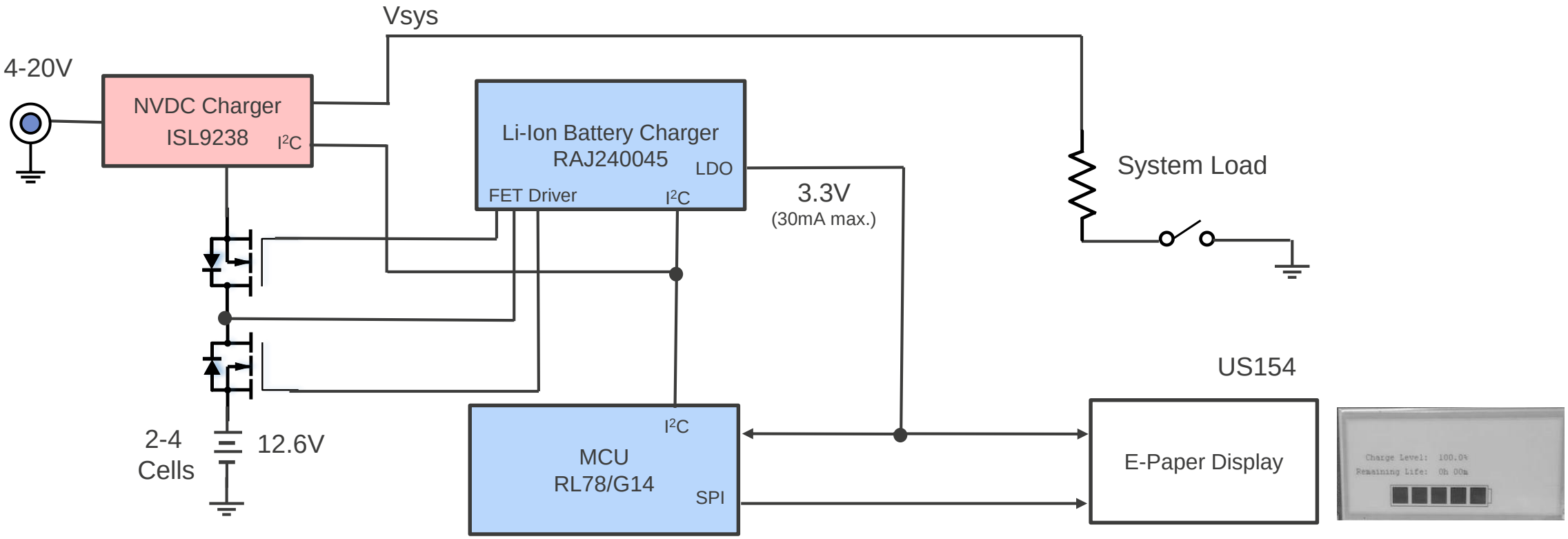

MCU / MPU Analog Power

Battery Management with Life Indicator

Device Category	P/N	Key Features
MCU	RL78/G14	16-bit 32MHz, low power consumption, high function general-purpose microcontrollers suitable for motor control, as well as industrial and metering applications
	RAJ240045	2 to 4 series Li-Ion battery manager
Power	ISL9238	Buck-boost narrow VDC battery charger with SMBus interface and USB OTG

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RL78/G14 – Advanced Functions MCU

Suitable for Motor Control as well as Industrial and Metering Applications

Added Instruction Functions to CPU Core

- Added multiply, divide, and multiply-accumulate instructions that enable high-speed operation by direct execution without needing to utilize library functions
- High calculation performance: 51.2 DMIPS (32 MHz)

High Performance Peripheral Functions

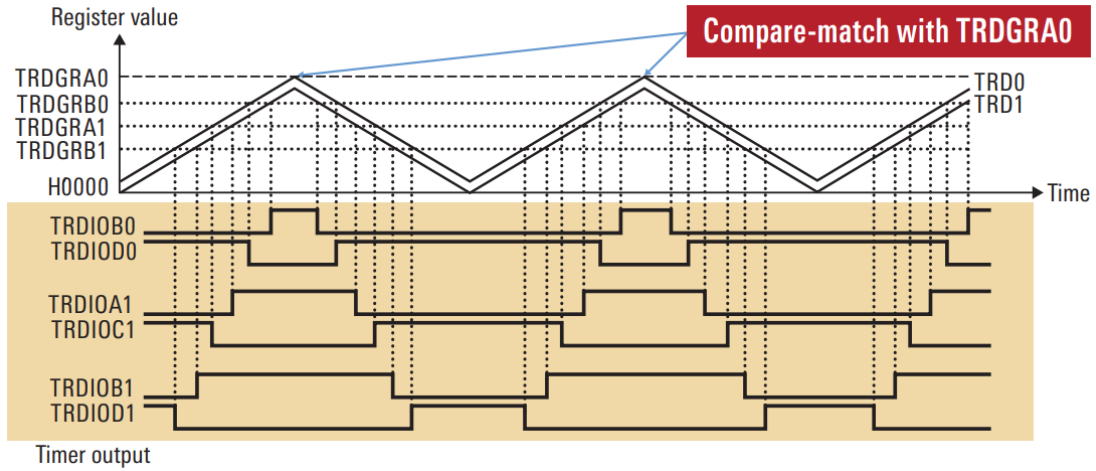
- Timer RD (Complementary PWM Mode for brushless DC motor control), Timer RG (Phase Count Mode), Timer RJ (asynchronous timer)
- Data Transfer Controller (DTC); Event Link Controller (ELC)
- Comparator, 8bit Digital Analog Converter

Easy to Develop and Use

- Scalable lineup packages, pin-counts and Flash ROM, RAM
- Released Starter Kit and Motor Solution Evaluation Kit

Part #	Flash ROM	RAM	Package(mm)
R5F104A	16 ~ 128 KB	2.5 ~ 16 KB	30-LSSOP(7.62)
R5F104B			32-HWQFN(5 × 5), 32-LQFP(7 × 7)
R5F104C			36-WFLGA(4 × 4)
R5F104E	16 ~ 192 KB	2.5 ~ 20 KB	40-HWGFN(6 × 6)
R5F104F	16 ~ 256 KB	2.5 ~ 24 KB	44-LQFP(10 × 10)
R5F104G	16 ~ 512 KB	2.5 ~ 48 KB	48-LFQFP(7 × 7), 48-HWQFN(7 × 7)
R5F104J	32 ~ 256 KB	4 ~ 24 KB	52-LQFP(10 × 10)
R5F104L	32 ~ 512 KB	4 ~ 48 KB	64-LFQFP(10 × 10), 64-LQFP(12 × 12), 64-LQFP(14 × 14)*, 64-WFLGA(5 × 5)
R5F104M	96 ~ 512 KB	12 ~ 48 KB	80-LFQFP(12 × 12), 80-LQFP(14 × 14)
R5F104P			100-LFQFP(14× 14), 100-LQFP(14 ×20)

*This product do not exist 384KB/512KB.



Complementary PWM mode operation example

RL78 Family Motor Solution Evaluation Kit

Renesas Starter Kit for RL78/G14

24V Motor Control Evaluation System for RX23T

RL78/G14 CPU Card for Motor Control

RAJ240045 – 2 to 4 Series Li-Ion Battery Manager IC

2-4 Series (4-25V) Battery Management for One-Chip Solution

Safety Features

- Built-in self-diagnostic functions for microcontroller and analog front-end (AFE)
- Low power mode for safe storage
- Support various Li-Ion chemistries (up to 25V)

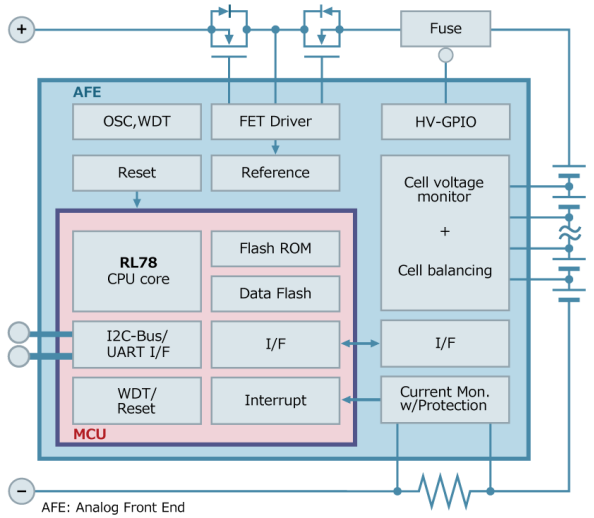
High Accuracy

- High-precision delta-sigma A/D converter specialized for current, voltage, and temperature detection
- Battery-level calculation takes battery deterioration into account

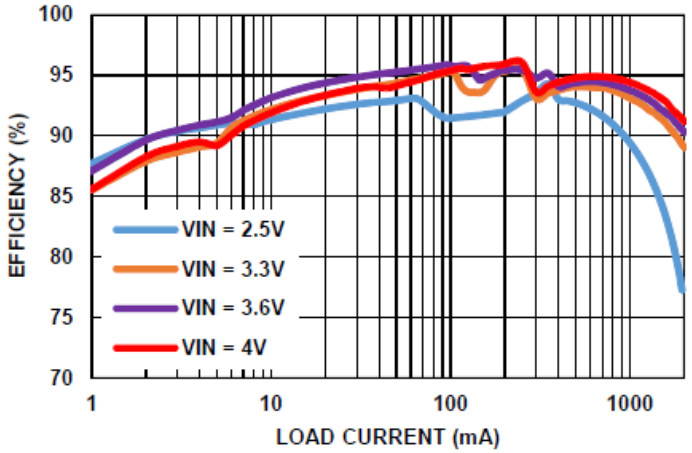
Design Support and Tools

- Starter Kits include evaluation board with reference design and sample firmware for fast prototyping
- Application notes and training videos
- Regional support

Part #	Vin (V)	Communication	Package
RAJ240045DNP	4-25V	SPI/UART/IIC/ Intel® DBPT	32Ld 4x4 QFN



Typical Application Circuit



Efficiency V_{OUT}=3.3V

ISL9238C – Buck-Boost Li-Ion Battery Charger with SMBus

Narrow VDC Battery Charger Up to 4-series Cell Li-ion Batteries with SMBus and USB OTG

High Performance with NVDC and Wide Input

- Buck-boost NVDC charger for 2-, 3-, or 4-cell Li-ion batteries
- Input voltage range: 3.9V to 23.4V (no dead zone) support conventional AC/DC charger adapter, USB PD ports and travel adapters
- System output voltage: 2.4V to 18.304V

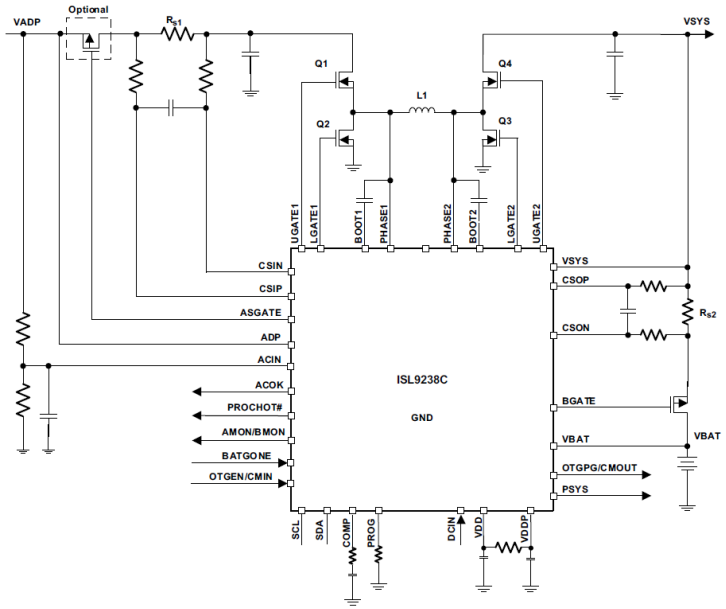
Integrated Functions and Easy Use

- System power monitor PSYS output, IMVP compliant
- Adapter current and battery current monitor (AMON/BMON)
- Allows trickle charging of depleted battery
- SMBus and auto-increment I^2C compatible, supports USB OTG

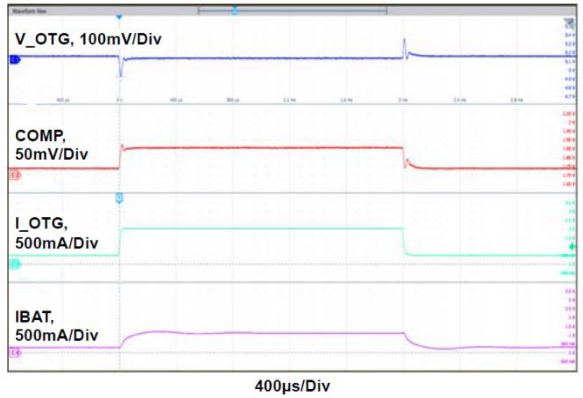
Safety and Small Package

- Two-level adapter current limit available, adapter OVP, system OVP, system voltage rail short protection, OTP, etc.
- 4x4 32 Ld TQFN package

Part #	OTG	OTG Current Limit LSB	Pass-Through Mode	Temp. Range	Package
ISL9238CHRTZ	5 to 20V	32mA	Yes	-10 – 100°C	32 Ld 4x4 TQFN
ISL9238CIRTZ	5 to 20V	32mA	Yes	-40 – 100°C	32 Ld 4x4 TQFN



Typical Application Circuit



OTG Mode 0.5A to 2A Transient Load, OTG Voltage = 5.12V

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