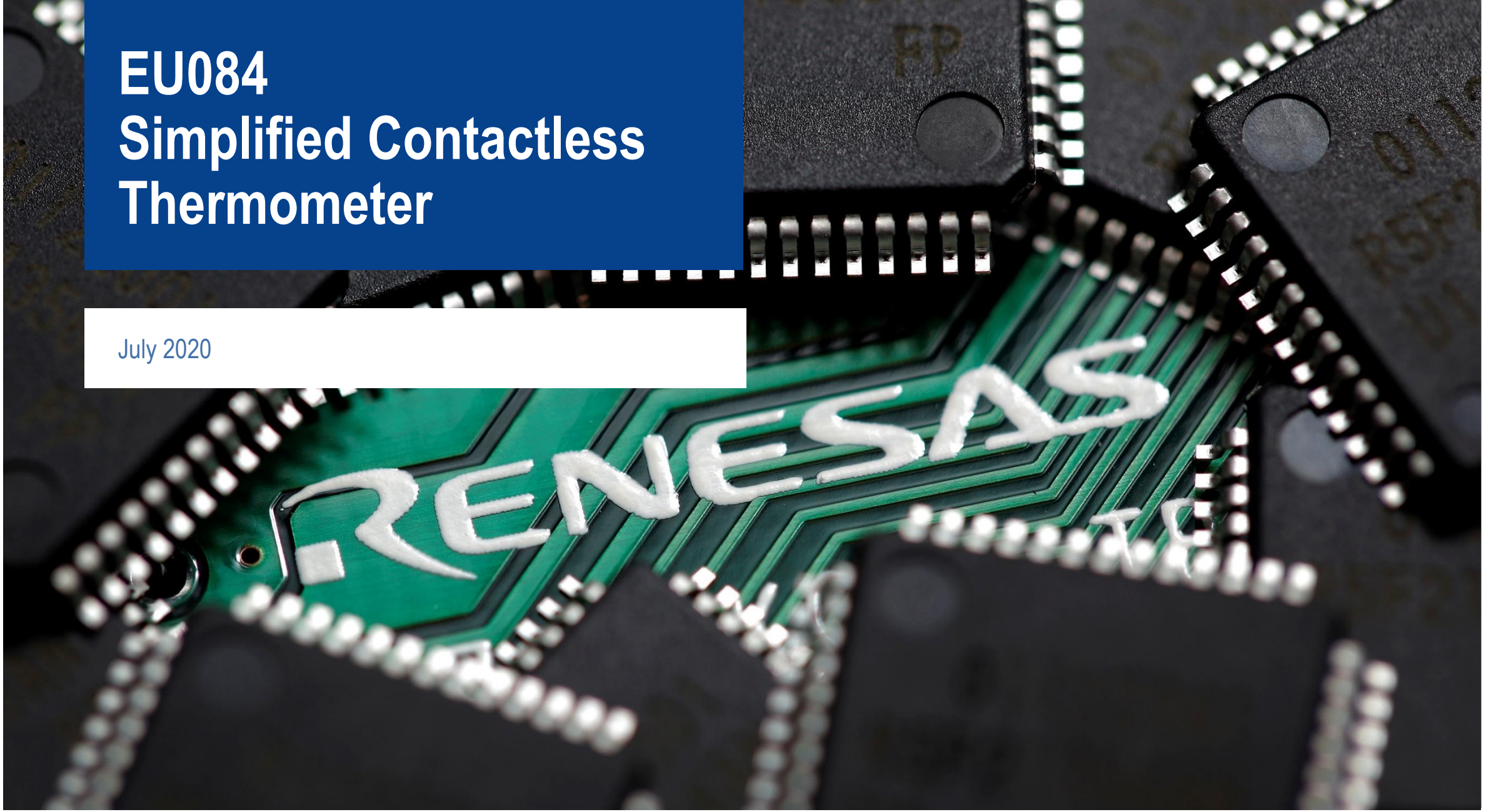
EU084
Simplified Contactless Thermometer



July 2020

Simplified Contactless Thermometer

- **Overview**

IR contactless thermometers are needed for medical applications to monitor an individual's body temperature before entering any public place. Depending on the target market and application, the thermal range to be monitored, as well as the required accuracy, may differ significantly. This is especially the case when comparing thermometers used in a medical environment versus those used in industrial applications. This reference design takes into account the thermometer's range of operation, accuracy, power considerations and display options. The design is one possible use case for designers.

- **System Benefits:**
  - The RL78/I1D microcontroller (MCU) has enhanced analog functions, such as operational amplifiers, a 12-bit A/D converter and window comparators. The MCU also supports very low power operation (124µA at 1MHz) and a high-speed 4µs wake up.
  - As another option for the design, the RL78/I1B MCU can be used if various enhanced analog functions like a 24-bit Delta-Sigma (ΔΣ) A/D converter are required.
  - The ISL9205 battery charger operates as a pulse charger, where the charge current is determined by the current limit of the AC adapter during the constant current phase. The ISL9205 battery charger operates in a linear mode during the constant voltage phase in both adapter cases.

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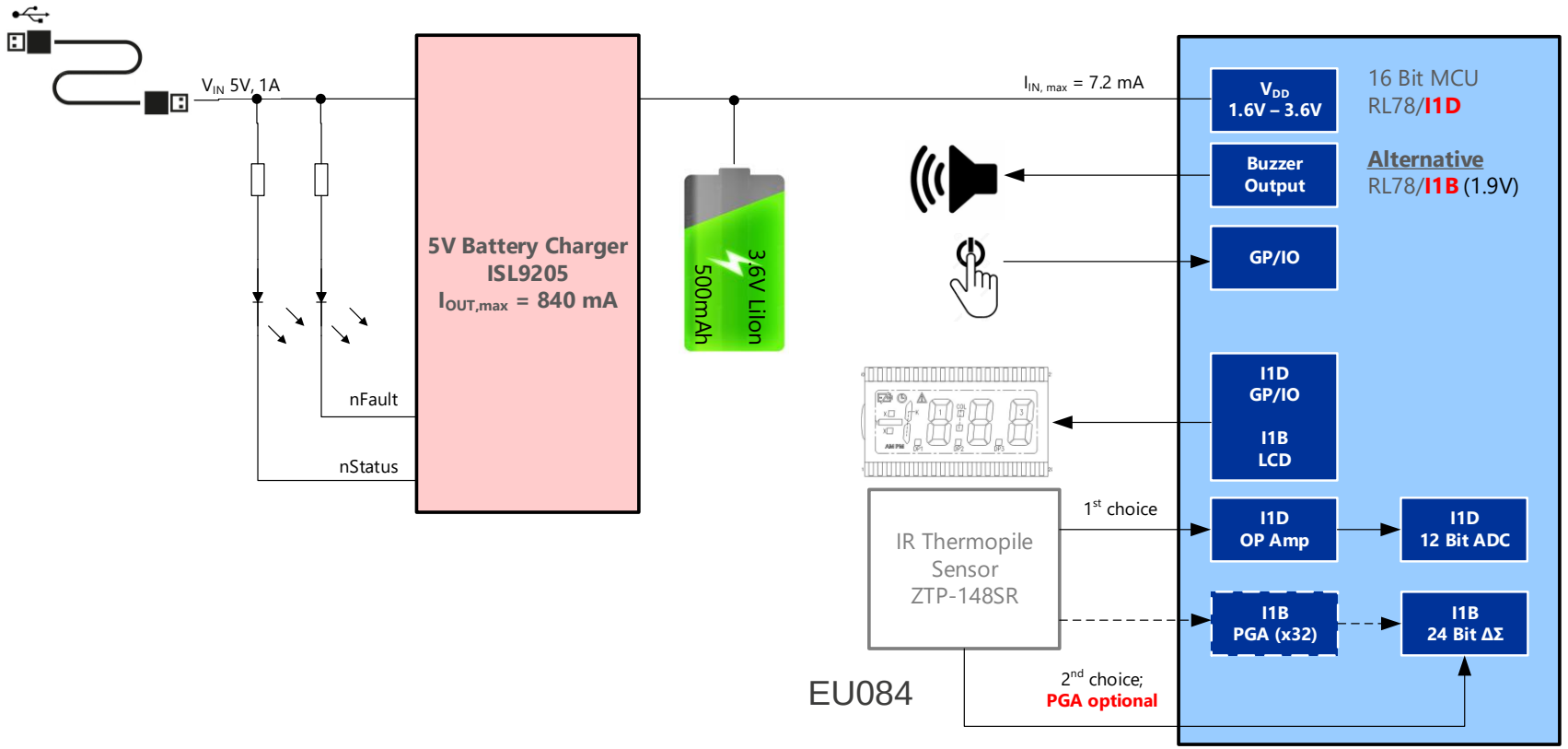

MCU / MPU Analog Power

Simplified Contactless Thermometer

Device Category	Part Number	Key Features
MCU	RL78/I1D	Ultra-Low Power Analog 16-Bit MCU
	RL78/I1B	High Precision Low Power Analog 16-Bit MCU
Power	ISL9205	Li-Ion Battery Charger

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RL78/I1D – Ultra-Low Power Analog MCU

Suitable for Detectors and Sensors Requiring Low Power and Analog Integration

Low Power Consumption for Extended Battery Life

- High-speed recovery from STOP mode in just 3.4 µs, and supply of operation current in 124 µA when operating at 1MHz
- Ability to operate peripheral circuits (sensor activation, signal amplification, obtaining A/D conversion results) without CPU intervention. Ability to determine whether it is necessary to activate the CPU based on A/D conversion results.
- VDD = single power supply voltage of 1.6 to 3.6 V

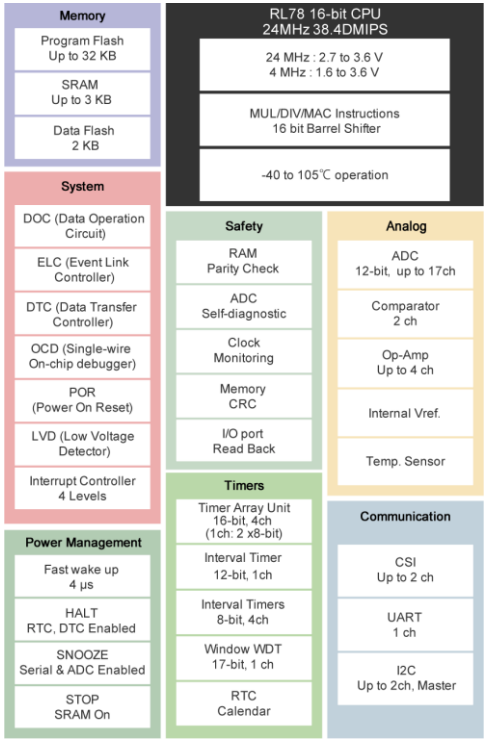
Rich Analog Functions

- On-chip ADC, 12-bit × 17 channels, conversion time: 3.375 µs
- Internal reference voltage (1.8 V)
- Op-amp × 4 channels (high-speed and low power modes)
- Comparator × 2 channels (window mode support)

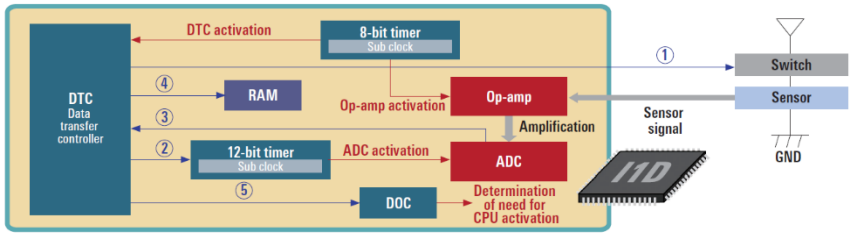
Safety and Small Package

- Compliant with European safety standard for household appliances (IEC/UL 60730)
- 4mm x 4mm small package line up

Part #	Flash ROM	RAM	12-bit ADC	OPA	Package
R5F1176xGxx	8-16 KB	0.7 ~ 2 KB	6ch	2ch	20-LSSOP(4.4 x 6.5mm 0.65 mm pitch)
R5F1177xGxx	8-16 KB	0.7 ~ 2 KB	6ch	2ch	24-HWQFN(4 x 4mm 0.5 mm pitch)
R5F1176AGxx	8-32KB	0.7 ~ 3KB	12ch	4ch	30-LSSOP(7.62mm 0.65 mm pitch)
R5F1176BGxx	16-32KB	2 ~ 3 KB	12ch	4ch	32-HVQFN(5 x 5mm 0.5 mm pitch) 32-LQFP(7 x 7mm 0.8 mm pitch)
R5F1176GGxx	16-32KB	2 ~ 3 KB	17ch	4ch	48-LQFP(7 x 7mm 0.5 mm pitch)



RL78/I1D Block Diagram



Snooze Mode Operation Example

RL78/I1B – High Precision Low Power Analog MCU

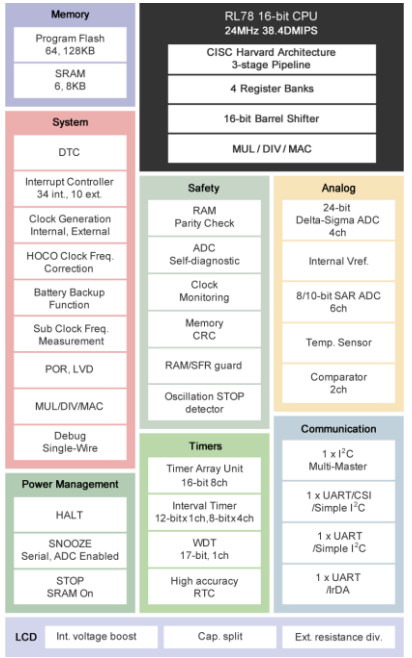
Industry's Lowest Power MCU for High-end Smart Electricity Meter Market

High Performance with High Precision Analog Functions

- Minimum instruction execution time: 0.03125 µs: @ 32 MHz selection with PLL clock
- Up to 256 KB flash line-up, 32-bit MAC (Multiply and Accumulation) function
- 24-bit Sigma Delta ADC with zero cross detection and PGA, 10/8-bit SAR ADC, internal reference voltage(1.45V) and temperature sensor
- 16-bit TAU,12/8-bit interval timer, CSI/UART/I²C/IrDA, DTC,ELC
- Segment LCD driver supports 8-COM

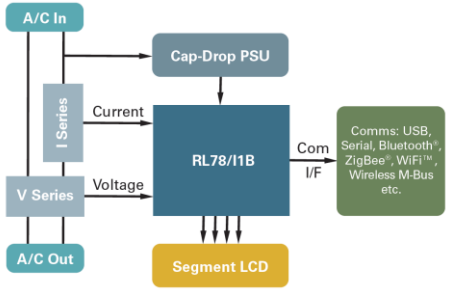
Improving Power Efficiency

- Independent power supply real-time clock: current consumption of 0.7 µA(typ.)
- Enhanced power supply monitoring function
- VDD = single power supply voltage of 1.7 to 5.5 V
- Standby function of MCU: HALT, STOP, SNOOZE



RL78/IB Block Diagram

Part #	Flash ROM	RAM	24-bit ADC	Package
R5F10MPGDFB	128KB	8KB	4ch	100 pin LQFP (14mm)
R5F10MPEDFB	64KB	6KB	4ch	100 pin LQFP (14mm)
R5F10MMGDFB	128KB	8KB	3ch	80 pin LQFP (12mm)
R5F10MMEDFB	64KB	6KB	3ch	80 pin LQFP (12mm)



Independent Power Supply RTC and Voltage Detection Circuits

ISL9205 – Li-Ion Battery Charger

Complete Charger for Li-Ion / Polymer batteries

Single IC Solution for Charging

- Integrated pass element and current sensor
- Charge current from 50mA to 900mA

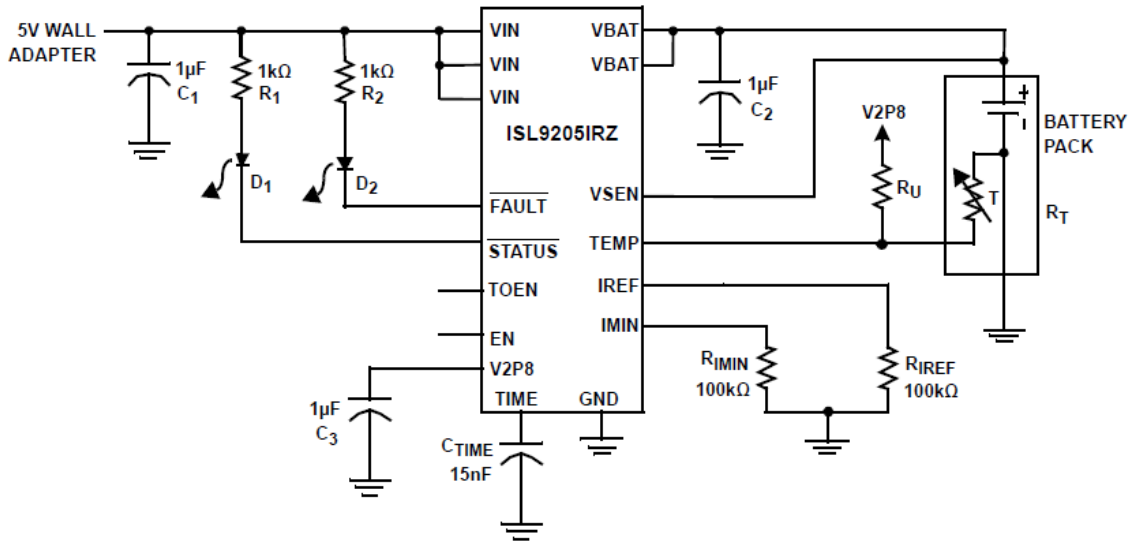
Multiple Charge Modes

- Adjustable CC & End of Charge current via external resistors
- Ability to operate as pulse charger for current limited inputs
- Trickle charge for fully discharged batteries

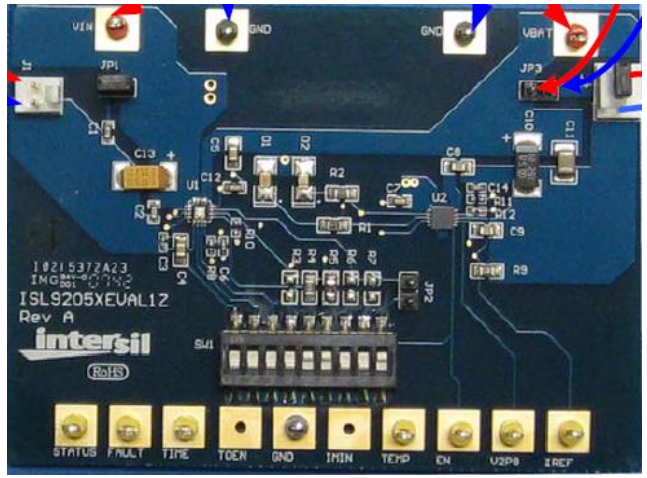
Protection Features

- Incorporates Therma guard to prevent over temperature
- Foldback of charge current during over temperature events
- Ability to monitor temperature of battery pack

Part #	V_{BAT}	Vsen	Temp	Timeout	Package
ISL9205IRZ-T	4.2	Yes	Yes	Yes	16L 3x3 TQFN
ISL9205AIRZ-T	4.2	Yes	No	No	10L 3x3 TQFN
ISL9205BIRZ-T	4.2	Yes	No	Yes	10L 3x3 TQFN
ISL9205CIRZ-T	4.256	Yes	No	Yes	10L 3x3 TQFN
ISL9205DIRZ-T	4.2	No	Yes	Yes	10L 3x3 TQFN



Typical Application Circuit



Evaluation Board

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