

KR002 Smart Earbuds Case Charger (Update)

May 2020

Smart Earbuds Case Charger (Update)

■ Overview

The smart wireless earbuds market is growing at an impressive rate. According to a [report](#) from market researcher, Arizton, the global earbuds market is estimated to reach revenues of around \$7 billion by 2023, growing at a CAGR of about 31% during 2018-2023.

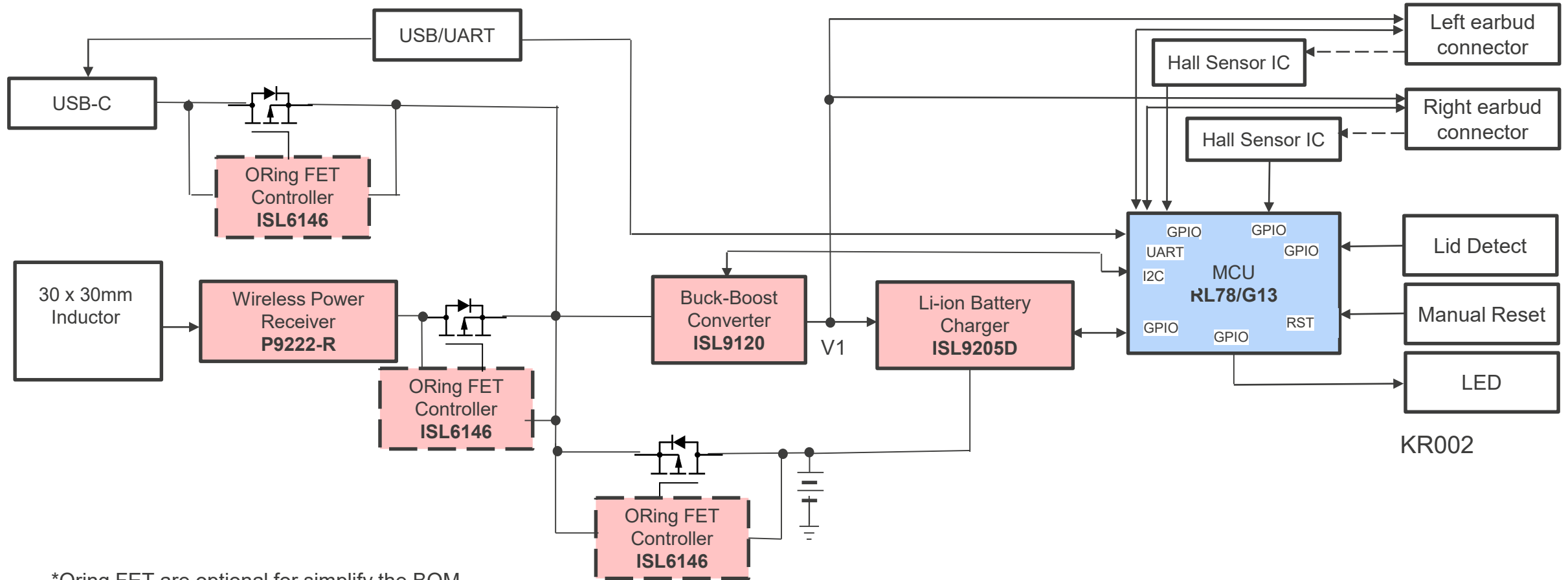
Optimized for compact and low-power applications, this design incorporates the P9222-R, an integrated single-chip wireless power receiver IC. It is highly efficient at light loads and very well-suited for applications like earbuds case charging.

■ System Benefits

- The P9222-R is an ultra-compact, efficient wireless power receiver for up to 5W applications
- The RL78/G13 microcontroller (MCU) provides a low power but flexible control unit
- The ISL9205D is a complete charger for single-cell Li-ion/polymer batteries

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*Oring FET are optional for simplify the BOM

MCU / MPU Analog Power

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Device Category	P/N	Key Features
MCU	RL78/G13	General-purpose microcontroller family with low power, high function, and large lineup
Power	P9222-R	Integrated single-chip wireless power receiver IC (Rx) for up to 5W applications
	ISL9205D	Integrated single-cell Li-ion or Li-polymer chargers capable of operating at an input voltage as low as 2.5V
	ISL6146	Low voltage ORing FET controller
	ISL9120	Compact high efficiency buck-boost regulator

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RL78/G13 – Standard Functions MCU

Low Power and Abundant Lineup for General Purpose Applications

High Performance Peripheral Functions

- 43.2 DMIPS (32 MHz)
- On-chip oscillator, data flash, 10-bit A/D converter
- Built-in safety features enable support for the household appliance safety standard (IEC/UL 60730)

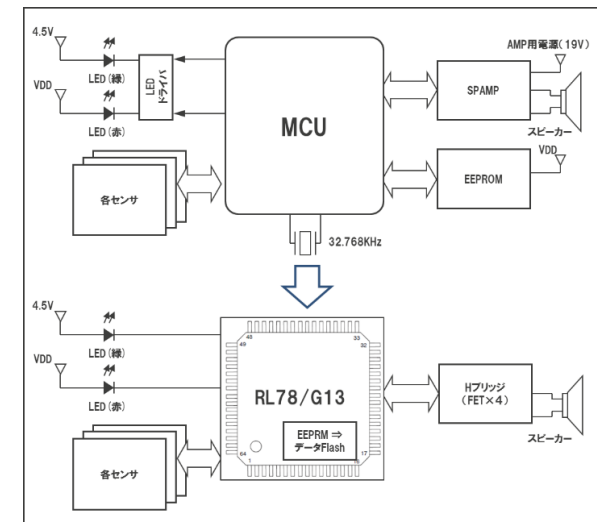
Low Power

- CPU: 66 μ A/MHz, standby (STOP): 230 nA
- 0.57 μ A (RTC_LVD, HALT mode)

Abundant Lineup

- 16-512KB ROM / 2-32KB RAM
- 20-128 pin package

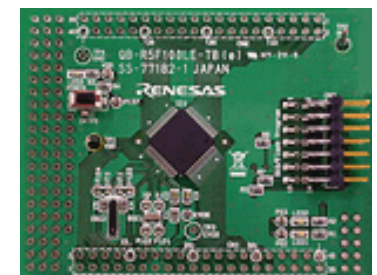
Part #	Flash ROM	RAM	Package(mm)
R5F1006/7/8x R5F1016/7/8x	16 ~ 64 KB	2 ~ 4 KB	20-LSSOP, 24-HWQFN(4 x 4), 25-WFLGA(3 x 3)
R5F100A/B/Cx R5F101A/B/Cx	16 ~ 128 KB	2 ~ 12 KB	20-LSSOP, 32-HWQFN(5 x 5), 36-WFLGA(4 x 4)
R5F100Ex R5F101Ex	16 ~ 192 KB	2 ~ 16 KB	40-HWQFN(6 x 6)
R5F100F/Gx R5F101F/Gx	16 ~ 512 KB	2 ~ 32 KB	44-LQFP(10 x 10), 48-LFQFP(7 x 7), 48-HWQFN(7 x 7)
R5F100J/Lx R5F101J/Lx	32 ~ 512 KB	2 ~ 32 KB	52-LQFP(10 x 10), 64-LQFP(12 x 12), 64-LFQFP(10 x 10), 64-VFBGA(4 x 4),
R5F100M/Px R5F101M/Px	96 ~ 512 KB	8 ~ 32 KB	80-LQFP(14 x 14), 80-LFQFP(12 x 12), 100-LQFP(14 x 20), 100-LFQFP(14 x 14),
R5F100Sx R5F101Sx	192 ~ 512 KB	16 ~ 32 KB	128-LFQFP(14 x 20)



BOM Cost Reduction Use Case



Renesas Starter Kit for RL78/G13



QB-R5F100LE-TB Easy Evaluation Kit

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

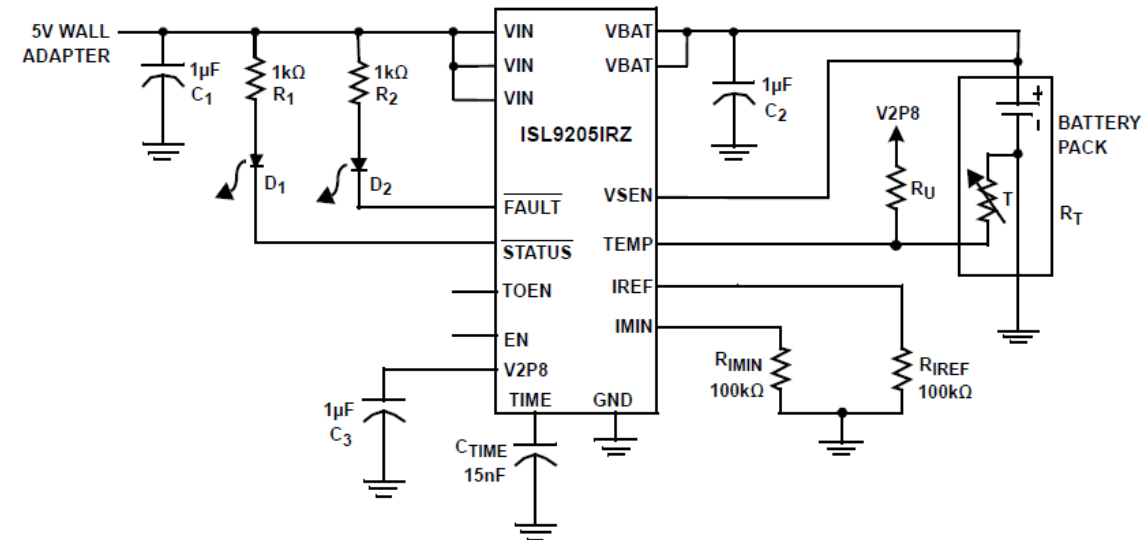
Multiple Charge Modes

- 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

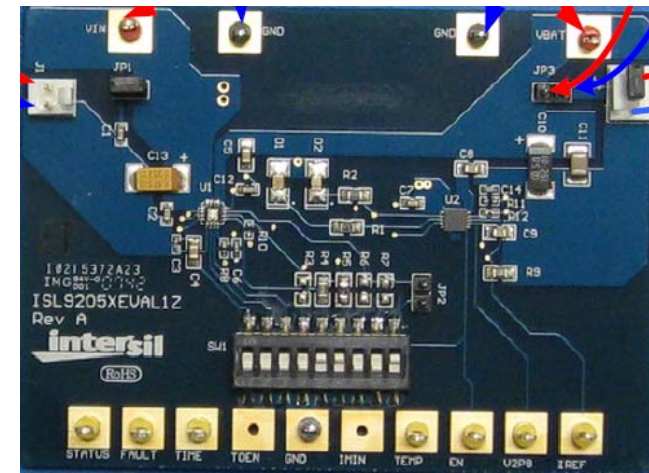
Protection Features

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

Part #	V _{BAT}	V _{sen}	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

ISL6146 – Low Voltage ORing FET Controller

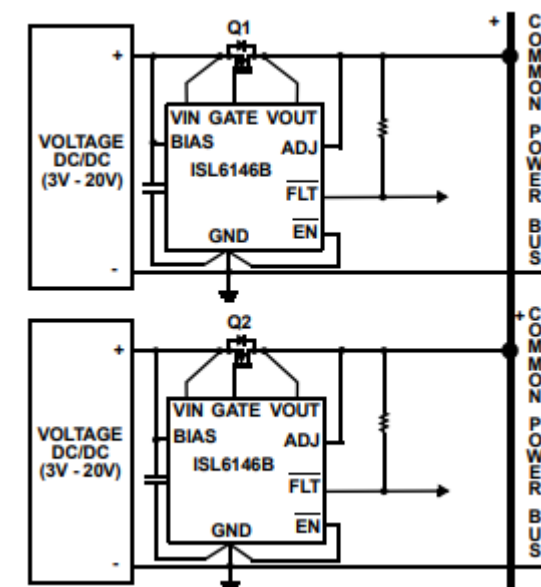
OR-ing voltages from 1V to 20V

Device Operation

- OR-ing down to 1V and up to 20V
- VIN hot swap transient protection rating to +24V
- High speed comparator provides fast <math><0.3\mu\text{s}</math> turn-off in response to shorts on sourcing supply
- Fastest reverse current fault isolation with 6A turn-off current

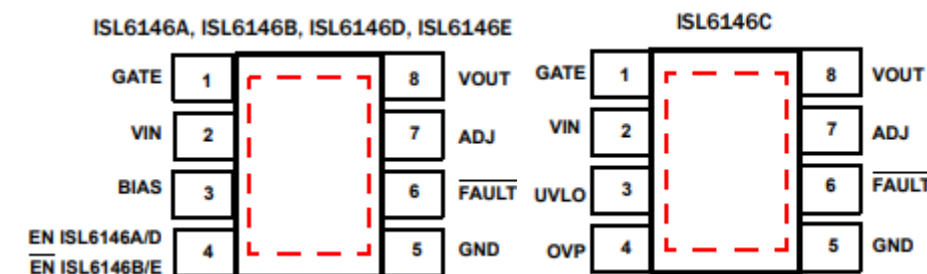
Device Options

- ISL6146A and ISL6146B are optimized for very low voltage operation
- ISL6146C provides a voltage compliant mode of operation down to 3V with programmable undervoltage lock out and overvoltage protection threshold levels.
- ISL6146D and E are like the A & B respectively, but do not have conduction state reporting via the fault output.



Typical Operating Circuits

Part #	Package
ISL6146AFUZ-T	8L 3x3 MSOP
ISL6146BFUZ-T	8L 3x3 MSOP
ISL6146CFUZ-T	8L 3x3 MSOP
ISL6146DFUZ-T	8L 3x3 MSOP
ISL6146EFUZ-T	8L 3x3 MSOP



PIN Outs

ISL9120 – High Efficiency Buck Boost

Integrated Buck-Boost for Single Cell Applications

Integrated Buck Boost

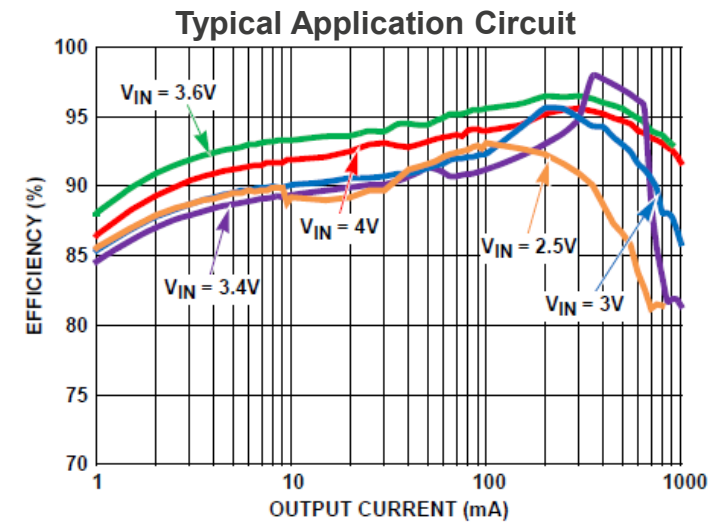
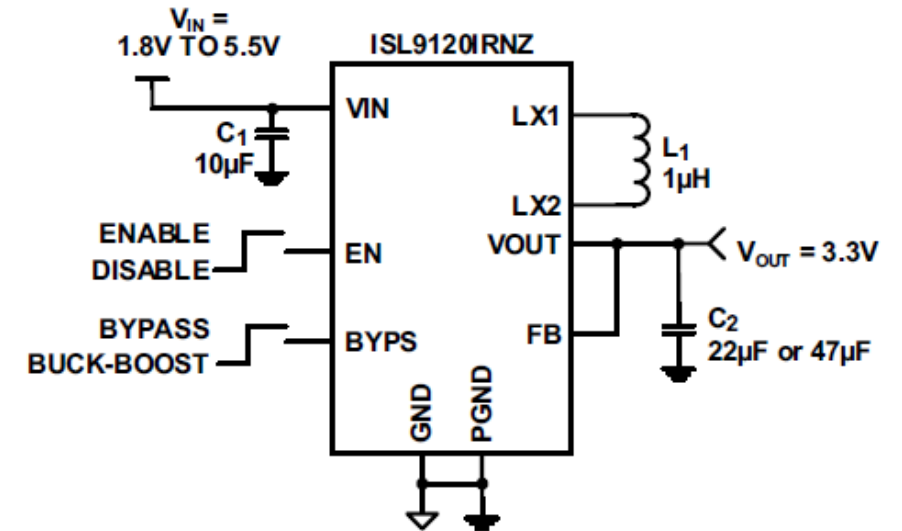
- 1.8V to 5.5V Input range
- Output current up to 800mA
- Efficiency up to 98%

Compact Design

- Default output of 3.3V, adjustable via resistors
- Integrated FETs for efficiency and space savings

High Performance

- 41uA quiescent current for light load efficiency
- Seamless transitions between buck/boost modes
- Forced bypass mode, utilizes only 3.5uA I_q
- Adaptive multilevel current limit scheme



Efficiency with 3.3V Output

Part #	V _{OUT}	Package
ISL9120IRTAZ	ADJ	12L 3x3 TQFN
ISL9120IRTNZ	3.3V	12L 3x3 TQFN

[Renesas.com/win](https://www.renesas.com/win)