

AS102 Fleet Tracking Solution

October 2019

Fleet Tracking Solution

▪ Overview

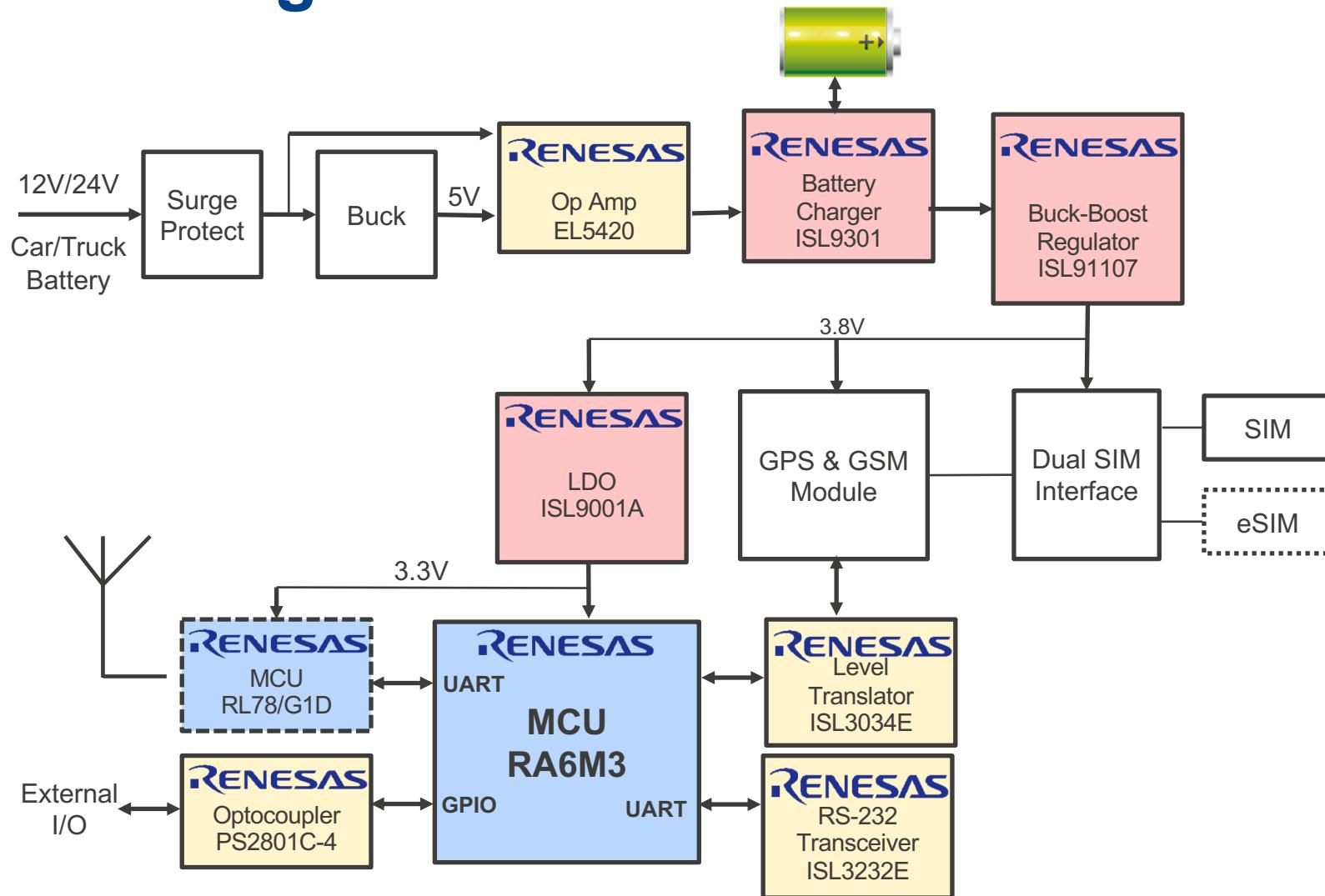
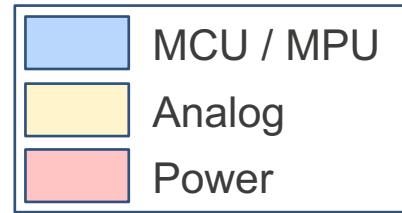
The global vehicle tracking market is expected to grow at a CAGR of 19.9%, a size of \$14.9 billion in 2025. The solutions are as diverse as the vehicles they track, but they all incorporate technologies such as GPS, cellular, computers, hardware interfaces, and others.

This winning combination shows a possible solution with GPS, cellular, Bluetooth® and battery backup capabilities using Renesas' RA6 MCU.

▪ System Benefits

- The highly-integrated Arm® Cortex®-M4 120MHz RA6M3 MCU is the communications hub for this system
- Features a full power map, with Renesas' single cell battery charger (ISL9301), high efficiency buck-boost regulator (ISL91107) and LDO (ISL9001)
- BLE communication solution with Renesas' BTM01 Bluetooth® Module

Fleet Tracking Solution



Block Diagram #AS102
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Device Category	P/N	Key Features
MCU	RA6M3 R7FA6M3AH3CF	MCU RA6 Arm® Cortex®-M4 120MHz 2M/640K QFP176
	RL78/G1D	Bluetooth® low energy microcontrollers for smart connectivity, with the lowest level of current consumption in the industry
Power	ISL9301	High Input Voltage Single-cell Li-ion Charger With Power Path Management
	ISL91107	High Efficiency Buck-Boost Regulator with 3.6A Switches
	ISL9001A	LDO with Low ISUPPLY, High PSRR
Analog	ISL3232E	QFN Packaged, $\pm 15\text{kV}$ ESD Protected, +2.7V to +5.5V, 150nA, 250kbps, RS-232 Transmitters/Receivers
	ISL3034E	6-Channel High Speed, Auto-direction Sensing Logic Level Translator
	EL5420	12MHz Rail-to-Rail Input-Output Op Amps
	PS2801C-4	DC input/single transistor output photocouplers (optocouplers)

AS102

RA6M3 – Ultra-Low Power 120-MHz Arm® Cortex®-M4 Core

Fully Featured for Applications Needing HMI/Control/Security/Graphical and Capacitive Touch

High Performance

- 120MHz Arm® Cortex®-M4 CPU

Highly Integrated Capabilities

- 1MB-2MB Flash Memory and 640kB SRAM
- 128-bit unique ID
- 12-Bit ADC (x2)
- 12-Bit DAC

Communication Interfaces

- USB 2.0 (Full Speed/ High Speed)
- Ethernet Controller with DMA
- SCI x10/SPIx2/IICx3

HMI Interface

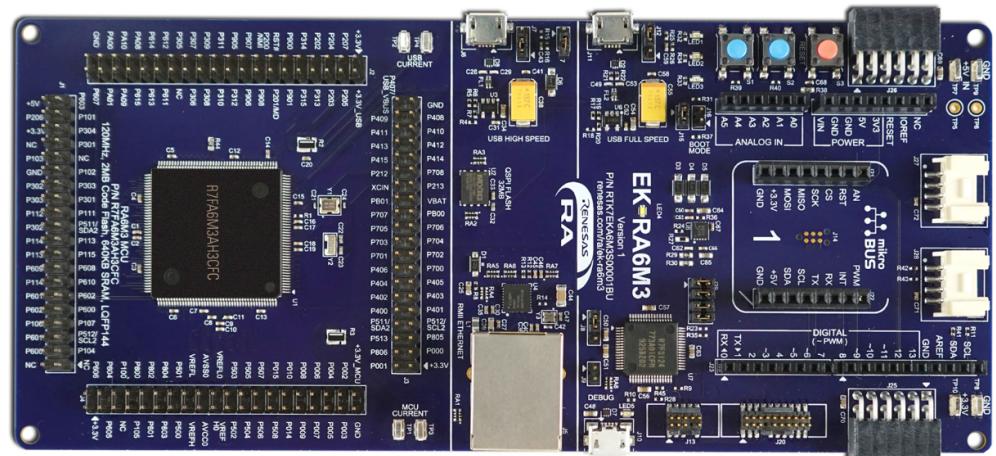
- Capacitive Touch Sensing Unit (18ch.)
- Graphics LCD Controller

Security and Encryption

- AES128/192/256, 3DES/ARC4, SHA1/SHA224/SHA256/MD5, GHASH, RSA/DSA/ECC
- True Random Number Generator (TRNG)

FLASH / RAM	2MB / 640kB	RA6M3	RA6M3	RA6M3	RA6M3	RA6M3
	1MB / 640kB	RA6M3	RA6M3	RA6M3	RA6M3	RA6M3
Pin Count Package Size Pitch	100pin LQFP 14x14 0.5mm	144pin LQFP 20x20 0.5mm	145pin LGA 7x7 0.5mm	176pin LQFP 24x24 0.5mm	176pin BGA 13x13 0.8mm	

Flash/ RAM/ Package Table



RTK7EKA6M3S00001BU

Part #	Flash Memory	RAM	Temp	Package
R7FA6M3AH3CFC	2MB	640KB	40 ~ 105°C	176 LQFP
R7FA6M3AF3CFC	1MB	640KB	40 ~ 105°C	176 LQFP

RL78/G1D – Bluetooth® Low Energy MCU



Bluetooth® Low Energy MCU with the Lowest Level of Current Consumption in the Industry

High Integration

- Power-efficient low-end microcontrollers with Bluetooth® Low Energy
- 2.4 GHz RF transceiver
 - Compliant with Bluetooth® v4.2 Low Energy (Master/Slave) specification
 - Reception sensitivity: -90 dBm
 - Max. transmission output power: 0 dBm

Easy to Develop and Use

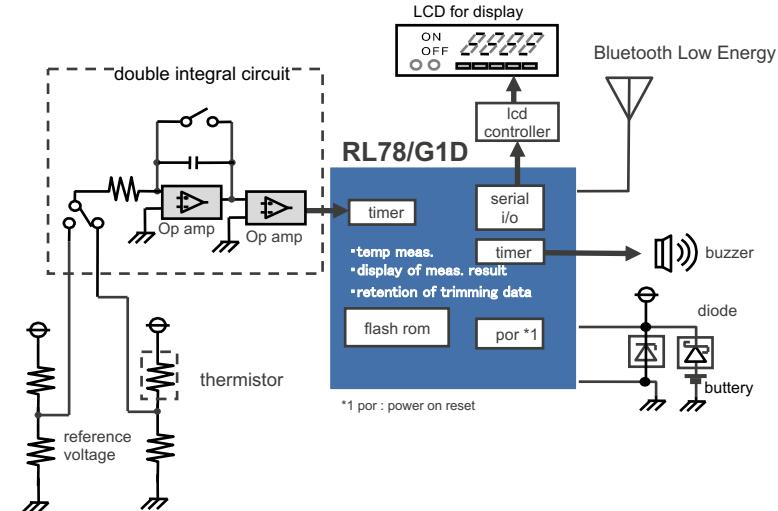
- Since circuit elements are necessary for connecting an antenna are built in, not only does this simplify circuit design for the antenna connection, but it also reduces BOM and overall costs.
- Software stack supports wireless updating, helping to make maintenance of user software more efficient.

Low Power Consumption

- Achieved the lowest level of current consumption in the industry (3 V operation)
 - . RF transmitter active normal mode: 4.3 mA, Low power mode: 2.6 mA
 - . RF receiver active normal mode: 3.5 mA
 - . Average current: 9.1 µA (1-second intervals, connection maintained, CC-RL compiler)
- Different standby mode for MCU:HALT, STOP, SNOOZE
- Low power saving mode with 6 setting (min. 0.1 µA) for RF part

Part #	Flash ROM	RAM	Package
R5F11AGG	128KB	12KB	48-pin HWQFN (6 × 6) (0.4mm pitch)
R5F11AGH	192KB	16KB	
R5F11AGJ	256KB	20KB	

BLE Evaluation Wireless module
(installation of RL78/G1D)
There is shield case.



RTK0EN0001D01001BZ
RL78/G1D Evaluation Board

ISL9001A – V_{OUT} 1.5V to 3.3V/300mA LDO

LDO with Low I_{SUPPLY} and High PSSR

High Performance

- Excellent load regulation: <0.1% voltage change across full range of load current
- High PSRR: 90dB @ 1kHz

Stable Output Voltage

- ±1.8% V_{OUT} accuracy over all operating conditions
- Stable with 1µF to 10µF ceramic capacitor

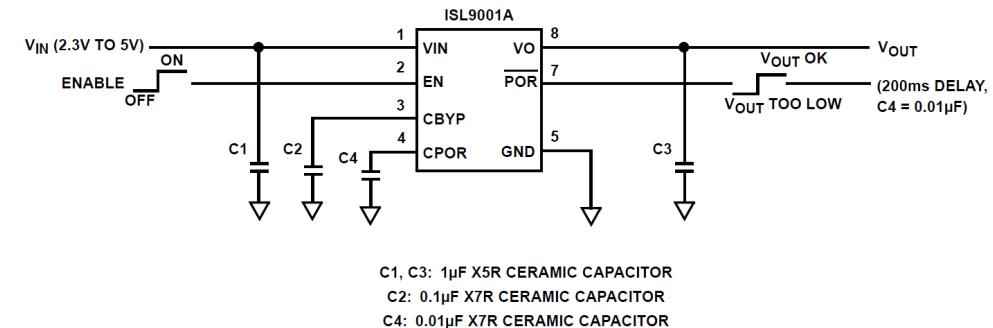
High Efficiency

- Extremely low quiescent current: 25µA
- Low dropout voltage: typically 200mV @ 300mA

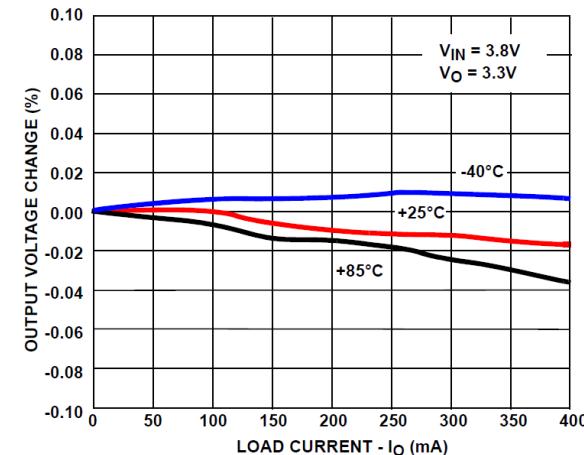
Excellent Safety

- Current limit and overheat protection

Part #	Vout (V)	Temp.(°C)	Package
ISL9001AIRBZ-T	1.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRCZ-T	1.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRFZ-T	2.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRJZ-T	2.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRKZ-T	2.85	-40 to +85	8Ld 2x3 DFN
ISL9001AIRNZ-T	3.3	-40 to +85	8Ld 2x3 DFN



Typical Application Circuit



Output Voltage Change vs Load Current

ISL9301 – High Input Voltage Charger With Power Path Management

Portable and Battery-Powered Instruments and Equipment

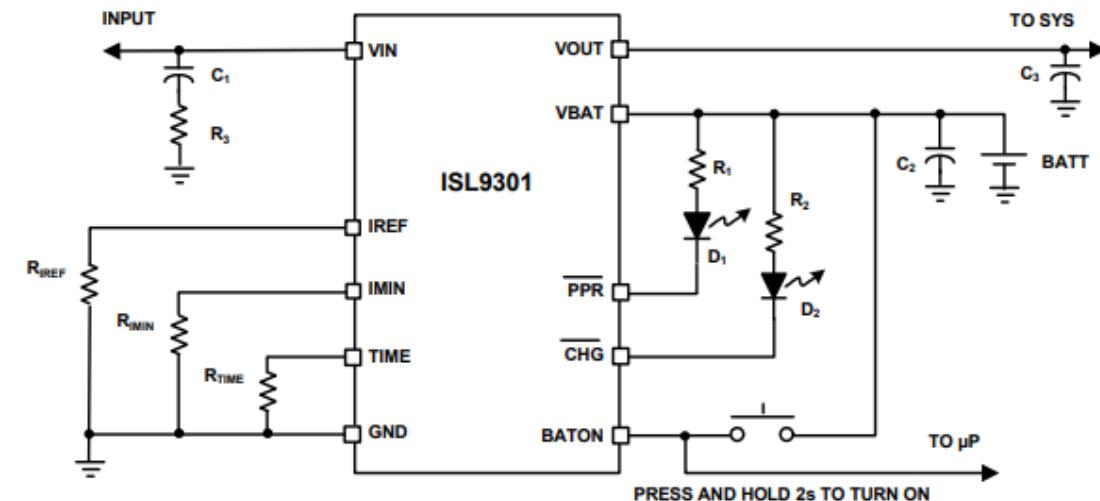
Integrated Functions and Small Package

- Complete Charger for Single-Cell Li-ion/Polymer Batteries
 - Power Path Management Optimize Charge and System Currents
 - Intelligent Timeout Interval Based on Actual Charge Current
 - Programmable Charge Current
 - Programmable End-of-Charge Current
 - Integrated Disconnect Switch to Disconnect the Battery

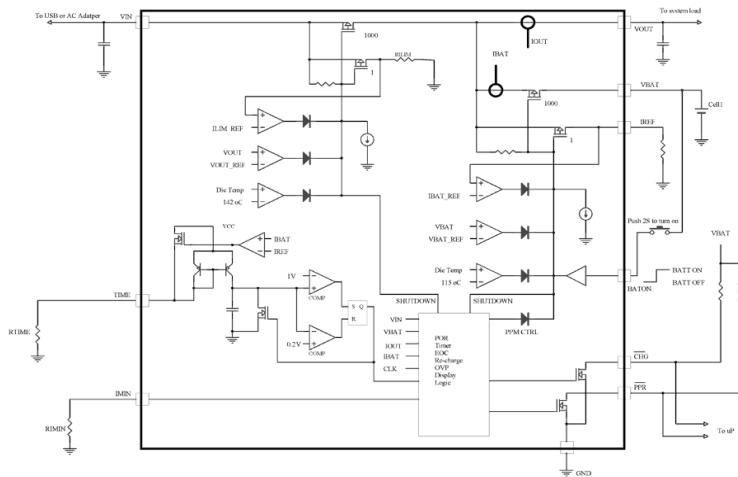
Input/Output Voltage Range

- 28V Maximum Voltage at VIN pin
 - The 28V rating eliminates the overvoltage protection circuit required in a low-voltage charger
 - 1% Charger Output Voltage Accuracy

Part #	Package
ISL9301IRZ	10Ld 3x3mm DFN
ISL9301IRZ-T	10Ld 3x3mm DFN



Typical Operating Circuits



Block Diagram

ISL91107 – High Efficiency Buck-Boost with 3.6A Switches

High Efficiency for Wireless communication and Handheld Devices

Flexible Operation Mode

- Accept input voltage above or below regulated V_{OUT}
- Automatic and seamless transitions between buck and boost mode

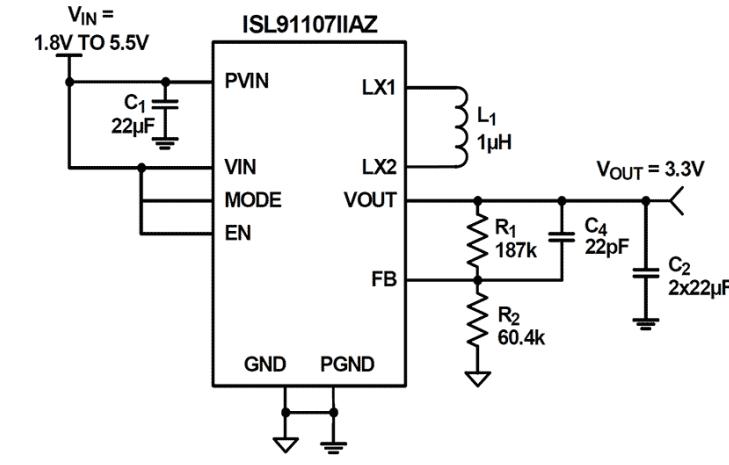
High Efficiency

- High efficiency: up to 96%
- 45 μ A quiescent current maximizes light-load efficiency

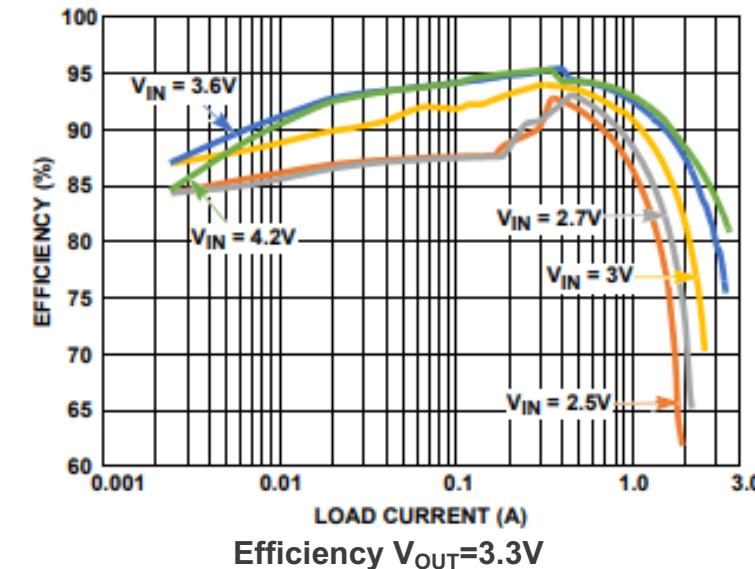
Compact space with Safety Design

- 2.5MHz switching frequency minimizes external component size
- Fully protected for short-circuit, over-temperature and undervoltage

Part #	Vin (V)	Vout (V)	Package
ISL91107IINZ-T7A	1.8V to 5.5V	3.3	15Ld 2x1.5mm WLCSP
ISL91107IIAZ-T7A	1.8V to 5.5V	ADJ	15Ld 2x1.5mm WLCSP



Typical Application Circuit



ISL3232E – Small Package RS-232 Transmitter/Receiver

Space-constrained Systems Requiring RS-232

Communication Speed

- 450Kbps data rate min.

Key Features

- Wide power supply range: single +2.7V to +5.5V
- Low supply current in power down state: 150nA
- ESD protection for RS-232 I/O pins to $\pm 15\text{kV}$ (IEC61000)
- On-chip voltage converters require only four external $0.1\mu\text{F}$ capacitors

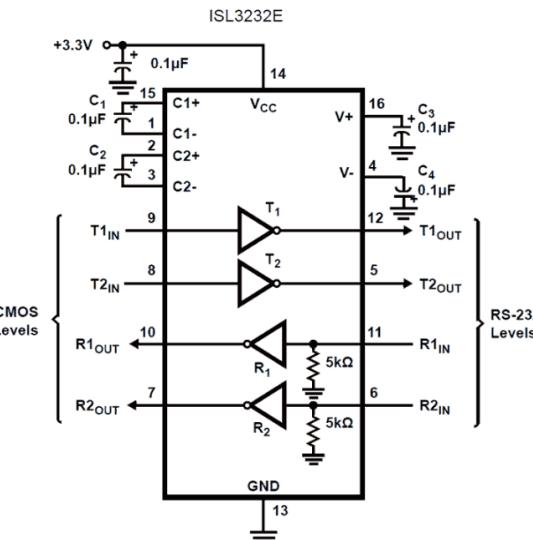
Good Connectivity

- RS-232 compatible with $\text{VCC} = 2.7\text{V}$

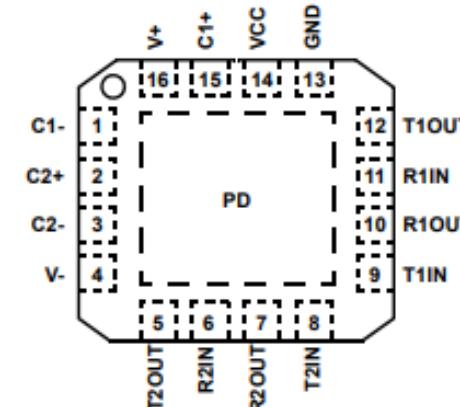
Industry Standard

- Meets EIA/TIA-232 and V.28/V.24 specifications at 3V

Part #	Temp. Rang	Package
ISL3232EIRZ-T7A	-40 to +85	16 Ld 5x5mm QFN
ISL3232EIRZ	-40 to +85	16 Ld 5x5mm QFN



Typical Operating Circuits



Pin out

ISL3034E – 6-Channel Auto-direction Sensing Logic Level Translator

High Speed Data Transfer Rates, Best-in-class ESD Protection

High Speed:

- 100Mbps data rate

High Reliability

- Best-In-Class ESD protection: $\pm 15\text{kV}$ IEC61000-4-2 ESD protection on all input, output, and I/O lines
- $+1.35\text{V} \leq V_L \leq +3.2\text{V}$ and $+2.2\text{V} \leq V_{CC} \leq +3.6\text{V}$ supply voltage range
- Six bidirectional channels

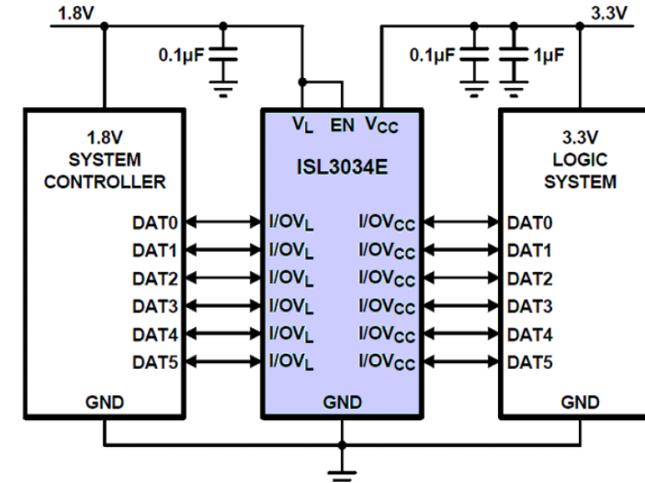
Good Connectivity

- Compatible with 4mA input drivers or larger

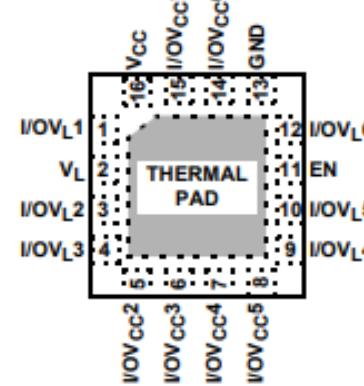
Industry Standard

- UL 1577 recognized
- VDE V0884-10 certified

Part #	ESD rating	Temp. Rang	Data Rate Mbps	MOQ	Package
ISL3034EIRUZ-T	15kV	-40 to +85	100	3K (T&R)	16 Ld TQFN
ISL3034EIRTZ	15kV	-40 to +85	100	2K (Bulk)	16 Ld UTQFN



Typical Operating Circuits



Pinout for TQFN

EL5420 – 12MHz Rail-to-Rail Input-Output Op Amps

Ultra-Small Package, Low Power, High Voltage, Rail-to-Rail Input-Output Amplifiers

Wide Bandwidth:

- 12MHz (-3dB) Bandwidth

Wide Voltage/ Low Current

- Supply Voltage = 4.5V to 16.5V
- Low Supply Current (per Amplifier) = 500 μ A

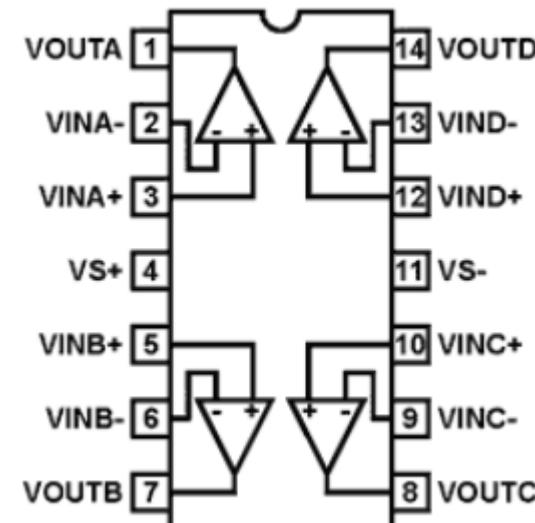
Fast Slew and Settling Times

- High Slew Rate = 10V/ μ s
- t_s = 500ns

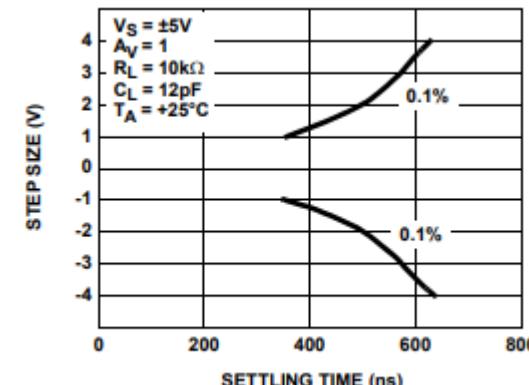
Key Features

- Unity-Gain Stable
- Beyond the Rails Input Capability
- Rail-to-Rail Output Swing

Part #	Temp. Rang	Package
EL5420CRZ	-40 to +125	14 Ld TSSOP



TSSOP Pin Out



SETTLING TIME vs STEP SIZE

PS2801C-4 – High Isolation Voltage Photocoupler

Applications Ranging From PLCs, Measuring instruments, Power Supplies to Hybrid IC's

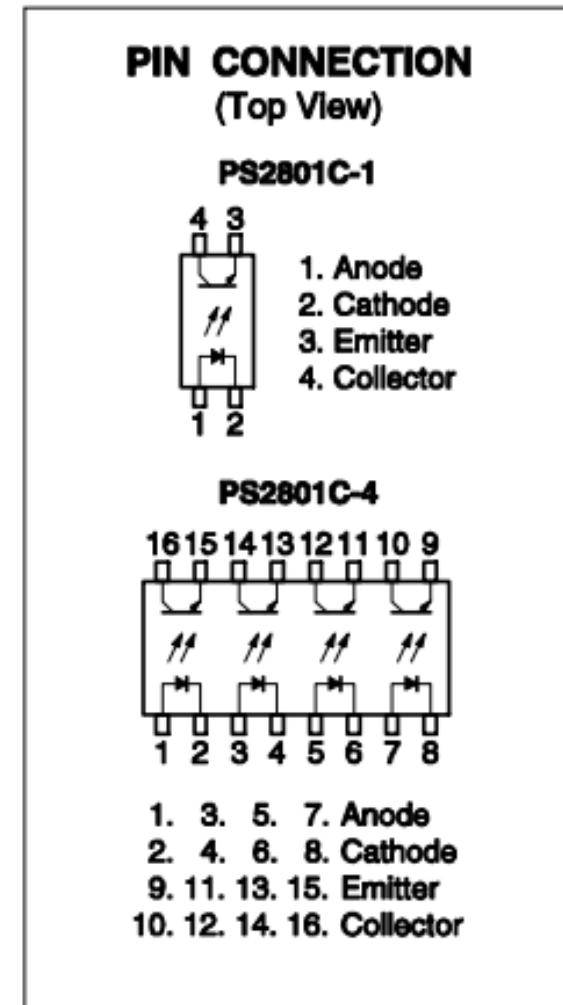
High Performance

- High isolation voltage ($BV = 2\ 500\ V_{r.m.s.}$)
- Small and thin package (4, 16-pin SSOP, Pin pitch 1.27 mm)
- High collector to emitter voltage ($VCEO : 80\ V$)

Safety Standards

- UL approved: UL1577, Single protection
- CSA approved: CAN/CSA-C22.2 No. 62368-1, Basic insulation
- BSI approved: BS EN 62368-1, Basic/Supplementary insulation
(PS2801C-1 only)
- VDE approved: DIN EN 60747-5-5 (Option)

Part #	Tube	Safety Standard	Package
PS2801C-4-A	10	UL, CSA, BSI	16 Ld 10x4.4mm SSOP
PS2801C-4-V-A	10	UL, CSA, BSI, DIN EN 60747-5-5	16 Ld 10x4.4mm SSOP



PIN Connection

Renesas.com