

# AC Servo Motor Control with Industrial Network Connections

## ■ Overview

This solution demonstrates a high-performance, highly integrated system design for industry automation. The RZ/T1 integrates the Arm® Cortex®-R4 processor with an FPU core, which was designed for real-time processing. It is capable of high-speed operation at up to 600 MHz. A key advantage is that access does not need to be performed via cache memory. Tightly-coupled memory capable of real-time response processing enables high-speed access from the CPU without passing through the cache memory.

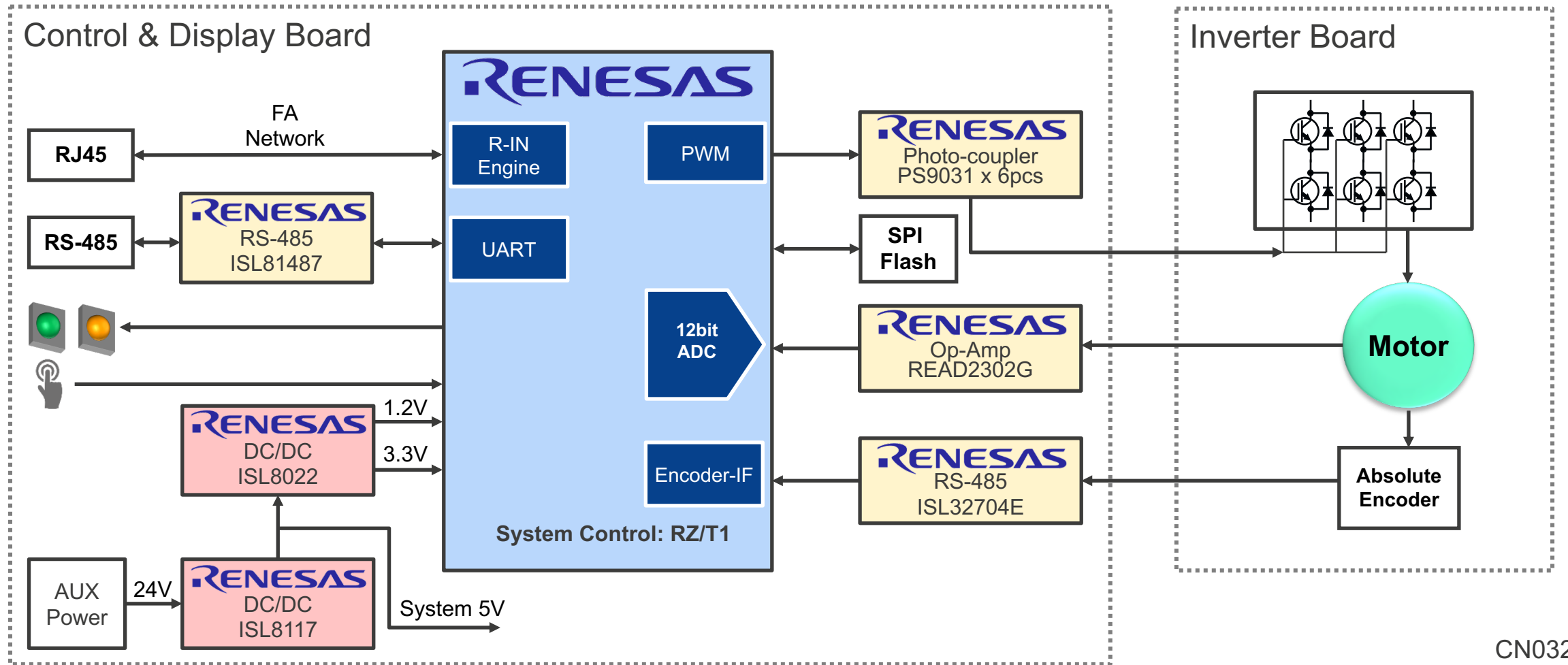
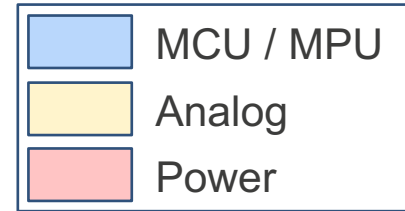
The high-performance power and analog system utilizes Renesas' DC/DC, high-speed digital output photocouplers for the motor driver, as well as a high-performance isolated RS-485 transceiver to ensure a high-quality industrial solution.

## ■ System Benefits

- RZ/T1 high integration for factory automation applications with a high-performance MPU, R-In engine and encoder interface
- High performance DC/DC, photocoupler and operational amplifier, RS-485 converter

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# AC Servo Motor Control with Industrial Network Connections



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Device Category	P/N	Key Features
MPU	RZ/T1 R7S9100xx	The RZ/T1 series has an Arm® Cortex®-R4 Processor with FPU core and is capable of high-speed operation at up to 600 MHz. RZ/T1 devices that are equipped with a built-in R-IN engine, an accelerator for industrial Ethernet communications, can perform industrial Ethernet processing without loss of real-time performance by Hardware RTOS (HW-RTOS).
Power	ISL8022	The ISL8022 is a high efficiency, dual synchronous step-down DC/DC regulator that can deliver up to 2A/1.7A continuous output current per channel.
	ISL8117	The ISL8117 is a synchronous buck controller used to generate POL voltage rails and bias voltage rails for a wide variety of applications in industrial and general purpose segments.
Analog	PS9031	High-speed digital output photocouplers
	READ2302GSP	Op Amp
	ISL81487	5V, half duplex, 5Mbps, RS-485/RS-422 transceiver
	ISL32704E	High performance isolated RS-485 transceiver

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# ISL8022 – Dual Synchronous Step-down DC/DC

## Dual 2A/1.7A Low Quiescent Current 2.25 MHz High-Efficiency Synchronous Buck Regulator

### Wide Operating Range

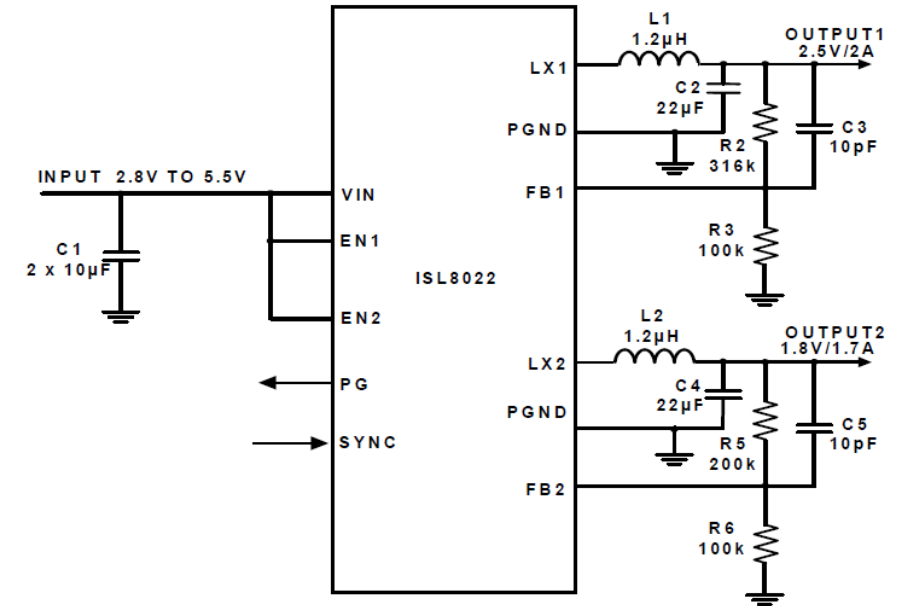
- Wide input voltage range: 2.8V to 5.5V
- Wide output voltage range: 0.6V to 5.5V

### High Efficiency, Low IQ

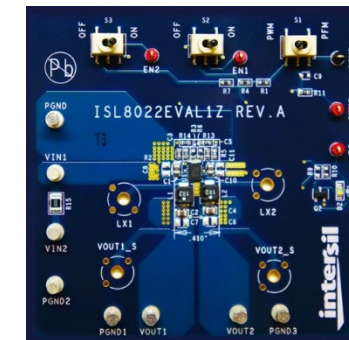
- Dual 2A/1.7A high efficiency synchronous buck regulator with up to 97% efficiency, low iq (40µA).

### System Safe Design

- The ISL8022 offers a 1ms Power-Good (PG) to monitor both outputs at power-up. When shutdown, ISL8022 discharges the outputs capacitor
- Other features include internal digital soft-start, enable for power sequence, overcurrent protection, and thermal shutdown



Typical Operation Circuits



ISL80019xEVAL1Z Evaluation Board

Part #	No. of Output	Vin Rang(V)	Iout (max)(A)	Vout Rang(V)	Package
ISL8022IRZ	Dual	2.7-5.5	2/1.7	0.6-Vin	12Ld 4x3 DFN

# ISL8117 – Synchronous Step-Down PWM Controller

## 60V Synchronous Step-Down PWM Controller with Wide Vin – Vout Range

### Easy to Use

- Low pin count, fewer external components, and default internal values makes the ISL8117 an ideal solution for quick to market simple power supply designs.

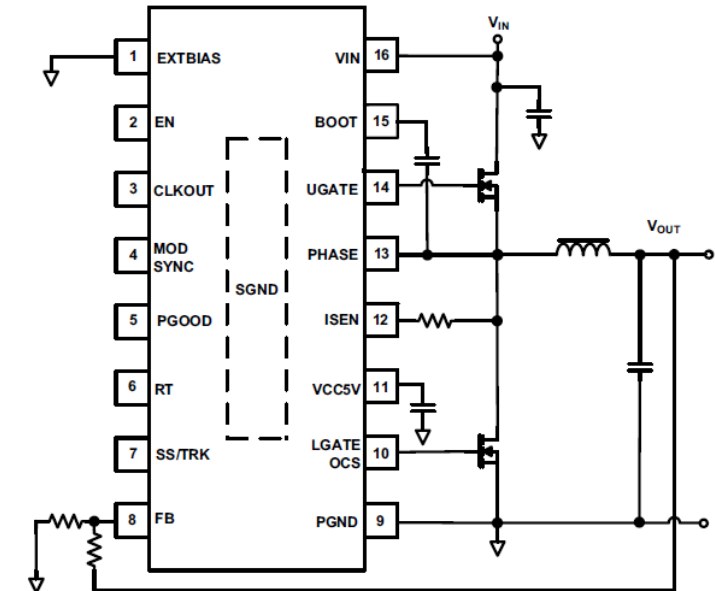
### Wide Working Range

- Wide input voltage range: 4.5V to 60V
- Wide output voltage range: 0.6V to 54V

### System Safe Design

- Programmable soft-start
- Supports pre-biased output with SR soft-start
- Adaptive shoot-through protection
- Complete protection: Overcurrent, overvoltage, over-temperature, undervoltage

Part #	#of output	Vin Rang(V)	Iout (max)(A)	Vout Rang(V)	Package
ISL8117FRZ	1	4.5-60	30	0.6-54	16Ld 4x4 DFN
ISL8117FVEZ	1	4.5-60	30	0.6-54	16Ld HTSSOP



Typical Operation Circuits



ISL80019xEVAL1Z Evaluation Board

## Realize Real-Time Control of Industrial Equipment and Networking at the Same Time

- Tightly coupled memory(TCM) provides practical no-wait access
- Vectored interrupt controller (VIC) improves interrupt latency
- ECC is supported for all memory

- Support protocols: EtherCAT, Profinet, Modbus TCP, EtherNet/IP, etc.

- Encoder Interface eliminates external ASIC / FPGA to support various encoder master. We can support: HIPERFACE, BiSS, EnDat, A-Format



# PS9031 – IGBT Gate Drive Photocouplers

## 2.5A Output Current, High CMR, IGBT Gate Drive

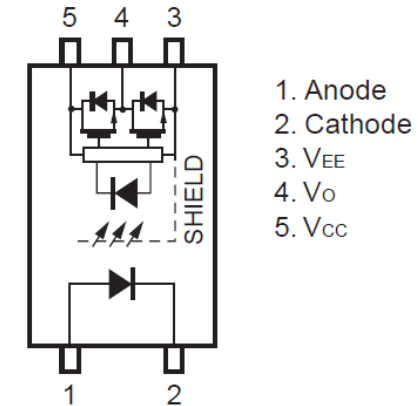
### High Performance

- Long creepage distance (8 mm MIN.)
- Large peak output current (2.5 A MAX., 2.0 A MIN.)
- High speed switching ( $t_{PLH}$ ,  $t_{PHL}$  = 175 ns MAX.)
- UVLO (Under Voltage Lock Out) protection with hysteresis

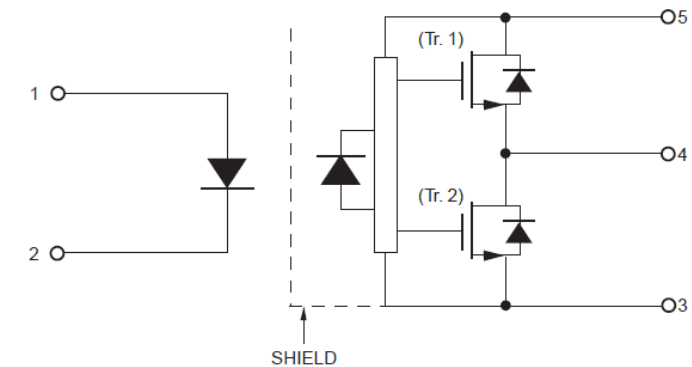
### Safety Standards

- UL approved: UL1577, Double protection
- CSA approved: CA5A, CAN/CSA-C22.2 No.60065, CAN/CSA-C22.2 No.60950-1, Reinforced insulation
- VDE approved: DIN EN 60747-5-5 (Option) Complete protection: Overcurrent, overvoltage, over-temperature, undervoltage

Part #	Output Current(A)	Safety Standard	Package
PS9031	2.5	UL, CSA	5-PIN SOP
PS9031-V	2.5	UL, CSA, VDE	5-PIN SOP



PIN Connection



Input	LED	Tr. 1	Tr. 2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Block Diagram



# READ2302G – 6MHz GBW Dual OPAMP

High Drivability and High Slew Rate, Input Output Full Range

## High Performance

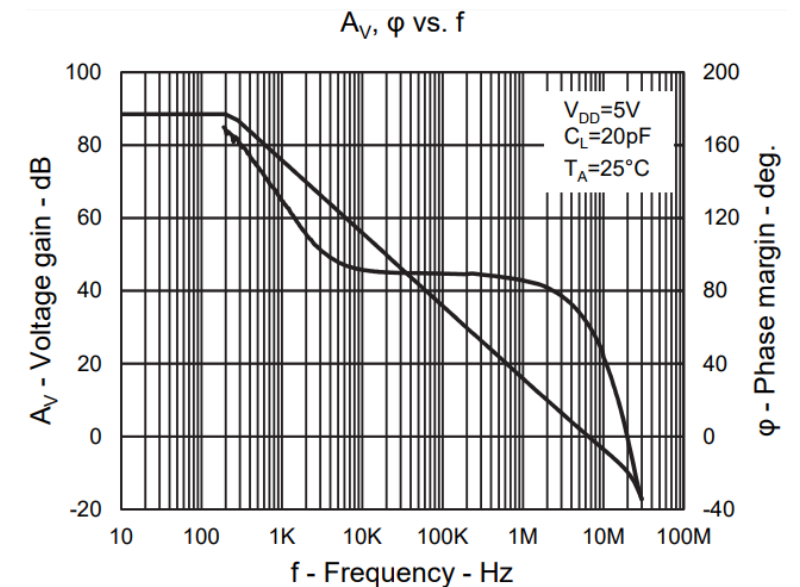
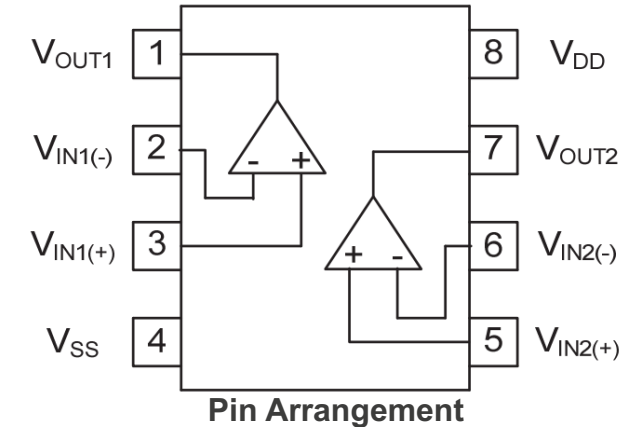
- High slew rate  $SR = 8V/\mu s$  Typ.
- 6MHz GBW
- Low input offset voltage  $V_{IO} \leq \pm 6.0mV$
- Low input bias current  $I_B \leq (1pA)$ .
- Supply current (per channel)  $I_{DD} = 0.75mA$  Typ.

## Easy to Use

- Low Voltage Single Supply :  $V_{DD} = 2.5V$  to  $5.5V$
- Output Full Range :  $V_{OUT} : V_{SS} + 0.1V$  to  $V_{DD} - 0.1V (@I_o = 5mA)$
- Wide Operating temperature :  $-40^\circ C$  to  $+105^\circ C$

## Compact Size

- Ultra-small 8 pins TSSOP packages
- Dual channel



Voltage Gain, Phase Margin vs Frequency



# ISL81487 – 5V, Half Duplex, RS-485/RS-422 Transceiver

## 5Mbps RS485/422 Transceiver for Industrial Networks

### High Speed 1/8 Unit Load to the RS-485 Bus

- Fractional unit load up to 256 devices
- High data rate version up to 5Mbps

### Robust ESD Optimized

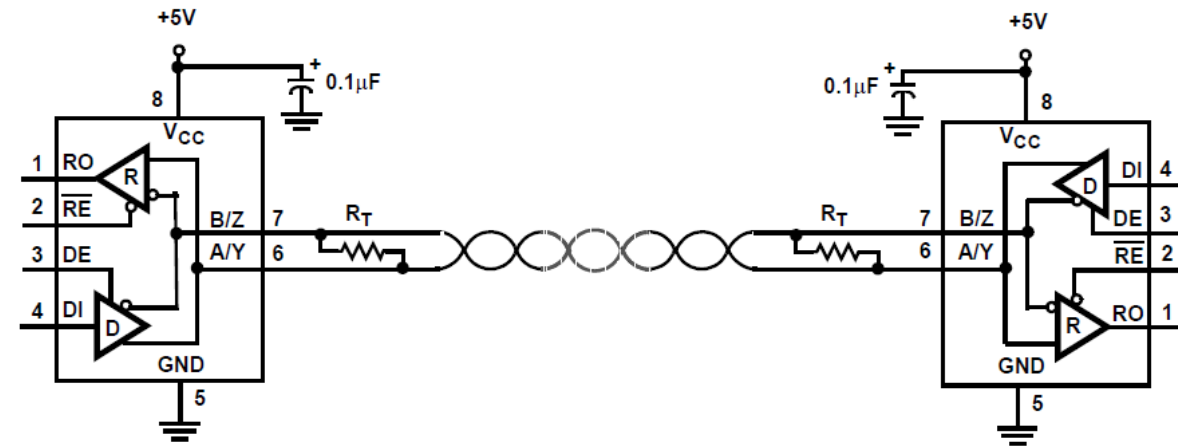
- Class 3 ESD protection (HBM) on all pins >7kV
- ISL81487E I/O pin ESD protection:  $\pm 15\text{kV}$  HBM

### Low Power Mode

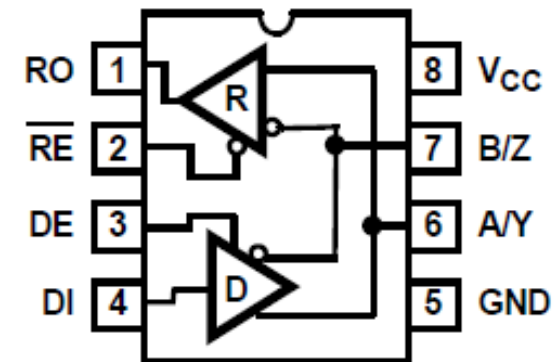
- Low quiescent supply current: 420uA(Max.)

### Fail Safe Design

- Three state Rx and Tx outputs
- Specified for 10% tolerance supplies
- Current limiting and thermal shutdown for driver overload protection



Typical Operation Circuits



Pin Assignment

Part #	Half/Full Duplex	No. of Devices	Data Rate Mbps	I/O ESD Protect	Package
ISL81487IBZ	Half	256	5	>7KV	8L 5x6 SOIC
ISL81487EIBZ	Half	256	5	+/-15KV	8L 5x6 SOIC

# ISL32704E – Smallest Package Isolated RS-485 Transceiver

## Ultra-Low EMI, High drive capability, robust ESD

### High Speed

- 4Mbps data rate

### High Reliability

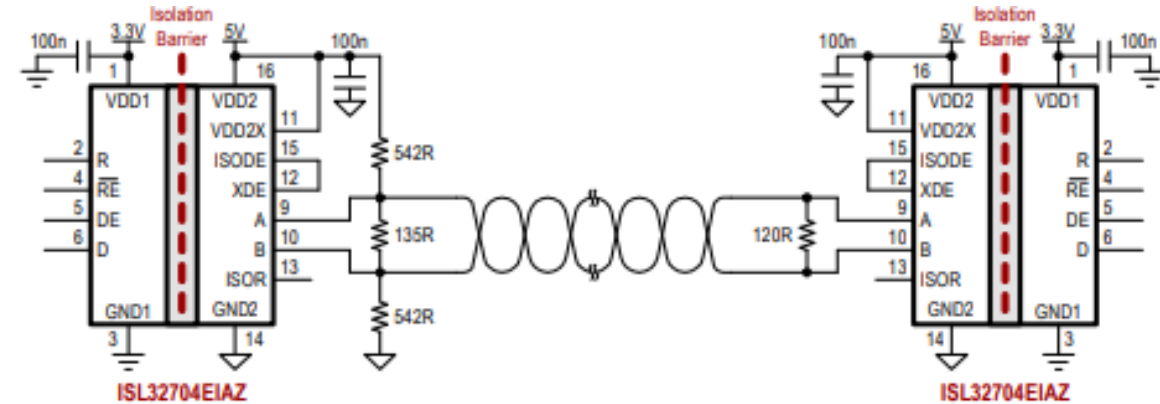
- 2.5kVRMS isolation per UL 1577
- 600VRMS working voltage per VDE 0884
- 15kV ESD bus-pin protection

### Good Connectivity

- The device is compatible with 3V and 5V input supplies

### Industry Standard

- UL 1577 recognized
- VDE V0884-10 certified



Typical Operating Circuits

Part #	HALF/FULL DUPLEX	Temp. Rang	Data Rate Mbps	Isolation Rating	Package
ISL32704EIAZ	Half	-40 to +85	4	2.5kV	16 Ld QSOP
ISL32704EIBZ	Half	-40 to +85	4	2.5kV	16 Ld SOIC



ISL32704EVAL1Z Evaluation Board