

# Dual Multiprotocol Transceiver with Integrated Termination

## DESCRIPTION

Demonstration circuit 1851A showcases the LTC<sup>®</sup>2872 RS232/RS485 dual multiprotocol transceiver with integrated termination. Separate supply inputs power the interface and logic sections, permitting operation of the logic control and I/O down to 1.7V. LEDs indicate when supplies are present. Control pins are accessible via turrets for external connections, or they may be set high or low by means of a jumper. All logic I/O and interface I/O is routed to turrets. The RS485 interface lines are also

available at a terminal block for convenient connection of a transmission line. Because the LTC2872 contains half-/full-duplex switching, it is unnecessary to jumper A and B to Y and Z for half-duplex operation.

**Design files for this circuit board are available at <http://www.linear.com/demo>**

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## PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Supply	$V_{CC}$ Operating	3.0		5.5	V
	$V_L$ Operating	1.7		$V_{CC}$	V
Maximum Data Rate	RS232	500			kbps
	RS485	20			Mbps

## QUICK START PROCEDURE

### Overview

The LTC2872 dual multiprotocol transceiver contains two identical channels, each comprising two RS232 drivers, two RS232 receivers, and one RS485 driver and receiver. The two channels are largely independent, sharing only loopback and duplex control and a split supply generator. Operating power is derived from the  $V_{CC}$  input, while a separate logic I/O supply pin ( $V_L$ ) permits the LTC2872 to adapt to any logic level ranging from 1.7V up to  $V_{CC}$ .

Another key feature is that RS232 and RS485 inputs and outputs may be interconnected without regard to loading or voltage limitations. Allowing that only one interface type is enabled at any given moment, input and output characteristics of the selected standard are preserved without violating the limits of the disabled sections. The LTC2872 also includes selectable RS485 terminations, as well as switching for half- and full-duplex modes, permitting full digital control and eliminating the need for external jumpers or relays to change between modes.

DC1851A includes:

- Bananas and turrets for supply connections along the upper edge of the board.
- Green LEDs to indicate the presence of  $V_{CC}$  and  $V_L$ . Note that the  $V_L$  LED, D1, unavoidably dims and extinguishes at  $V_L < 2V$ .
- Turrets for logic I/O along the left edge of the board.
- Turrets for RS232 and RS485 interface connections along the right edge of the board.
- Terminal blocks J5 and J6 for RS485 connections.
- Turrets and jumpers for selecting modes along bottom edge of board. There are no pull-up or pull-down resistors on the control lines; known states must be asserted by jumpers or by applying a definitive logic level to the turrets.
- 10k pull-up resistors on driver inputs DY1, DZ1, DY2 and DZ2. They assert a known logic-1 state when these turrets are left open circuit.

In summary, DC1851A features a turret for each and every LTC2872 logic, interface and supply pin. In addition the supply pins have banana jacks, and the control pins are connected to jumper blocks to establish their states.

### Components

Components on DC1851A are divided into four basic groups:

- R1-R11: 100 $\Omega$  resistors included in series with the control signal turrets to limit fault current arising from any accidental misadventures with the turrets or jumpers.
- D1, D2, R16, R17:  $V_{CC}$  and  $V_L$  supply indicator LEDs and current limiting resistors.
- R12-R15: 10k $\Omega$  pull-ups to  $V_L$  on DY1, DZ1, DY2 and DZ2.
- C1-C5, L1: supply generation and bypassing components for the LTC2872 (U1).

### LTC2872 Operation

Each channel of the LTC2872 contains two RS232 drivers, two RS232 receivers, one RS485 driver and one RS485 receiver. The 485/ $\overline{232}$  control lines enable either the RS485 or RS232 elements for each channel.

The RS485 transceiver includes a special half-/full-duplex switching feature. In full-duplex mode, the receiver inputs are connected to the A and B pins, while the driver is connected to Y and Z. In half-duplex mode, the receiver inputs are moved to Y and Z so that there is no need to jumper A-B and Y-Z when switching between half- and full-duplex modes.

RS485 terminations are included in the LTC2872. The terminations are controlled by a termination enable control line, TE485.

## QUICK START PROCEDURE

### Jumpers

Jumper blocks are included to set the state of each control pin to VL or GND. If the shorting jumper is set in the EXT position, the control pin is connected to its associated turret and external signaling may be applied. Failure to select one of the three positions results in a floating control pin whose state is indeterminant. The turret is disconnected and there are no internal or on-board pull-ups to establish the logic state if the jumper block is open.

As shipped, jumpers on DC1851A are set to select full-duplex RS485 mode with terminations enabled for Channel 1, and RS232 mode for Channel 2.

See the data sheet Pin Functions and Function Tables for a complete description of the control pin functions and truth tables. A brief summary is given here:

### Shared Control

**JP5, LB:** Loopback Enable. A logic high loops driver input signals immediately back to associated receiver outputs. Loopback is interrupted when a receiver is disabled. Default position low, loopback disabled. Controls both channels simultaneously.

**JP6, H/F:** RS485 Half-Duplex Select Input. A logic low selects full-duplex operation where the RS485 receiver responds to signals on the A and B pins. A logic high selects half-duplex operation where the RS485 receiver responds to signals on the Y and Z pins. Default position low, full duplex enabled. Controls both channels simultaneously. H/F has no effect on a channel in RS232 mode. Note that it is also possible to operate in half duplex by selecting full-duplex mode and simply connecting A to Y and B to Z.

**JP7, FEN:** Fast Enable. A logic high enables fast enable mode; the internal supply generator remains operational regardless of the state of the driver, receiver and termination enables. Default position high, fast enable enabled. In this state, the internal supply generator remains operational in the event all drivers, receivers and terminations are disabled. If shut down, the supply generator requires about 200 $\mu$ s to power up again.

### Independent Control

**JP1, JP11,  $\overline{\text{RXEN}}$ :** Receiver Enable. A logic low enables the receivers. Default position low, receivers enabled.

**JP2, JP10,  $\text{DXEN}$ :** Driver Enable. A logic high enables the drivers. Default position high, drivers enabled.

**JP3, JP9, TE485:** RS485 Termination Enable. A logic high enables 120 $\Omega$  terminations across A-B and Y-Z. Default JP3 position high, RS485 terminations enabled. Note that in RS232 mode, TE485 is overridden and the RS485 termination for that channel is automatically disabled. Default JP9 position low.

**JP4, JP8, 485/ $\overline{\text{232}}$ :** RS485/RS232 Mode Select. A logic high enables the RS485 mode. Default Channel 1 RS485, Channel 2 RS232.

### Probe Pads

Probe pads are included on the bottom of the board for examination of the VCC, VDD, VEE, SW and CAP pins. A GND probe pad is located nearby.

### J5, J6

Terminal blocks J5 and J6 are included for easy connection of RS485 cables. For half-duplex operation, only Y and Z need be connected. Terminal block connections are hardwired to turrets A, B, Y and Z.

### How to Operate DC1851A

Operation is straightforward: as shown in Figure 1, connect a VCC supply of 3V to 5.5V, and a VL supply of 1.7V up to VCC. There are no special supply sequencing restrictions, although if VL > VCC the logic I/O signaling may not operate properly. Note that D1, the VL supply indicating LED, will extinguish at VL < 2V. Apply logic and interface signals to the desired inputs. Inputs may be driven with the supplies removed, without damage to the LTC2872.

# DEMO MANUAL DC1851A

## QUICK START PROCEDURE

The LTC2872 may be made to self-oscillate as a ring oscillator by connecting the drivers and receivers in one all-encompassing loop, and adding one inversion. The inversion may be introduced with a logic inverter, or by cross-connecting the RS485 driver and receiver in full-

duplex mode (connect Y to B and Z to A). The connection arrangement shown in Figure 2 forms a ring oscillator when used with the default jumper conditions. With  $V_{CC} = V_L = 3.3V$ , the frequency of oscillation is typically 260kHz.

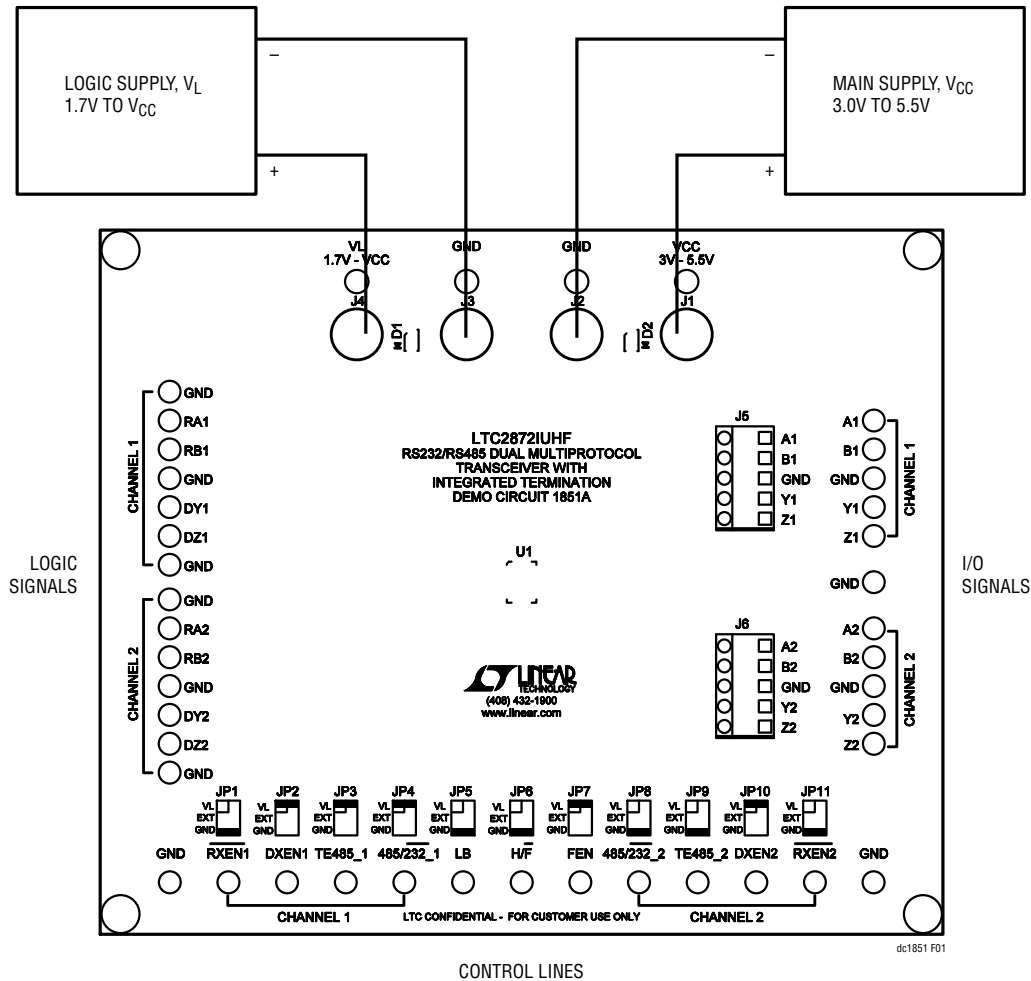
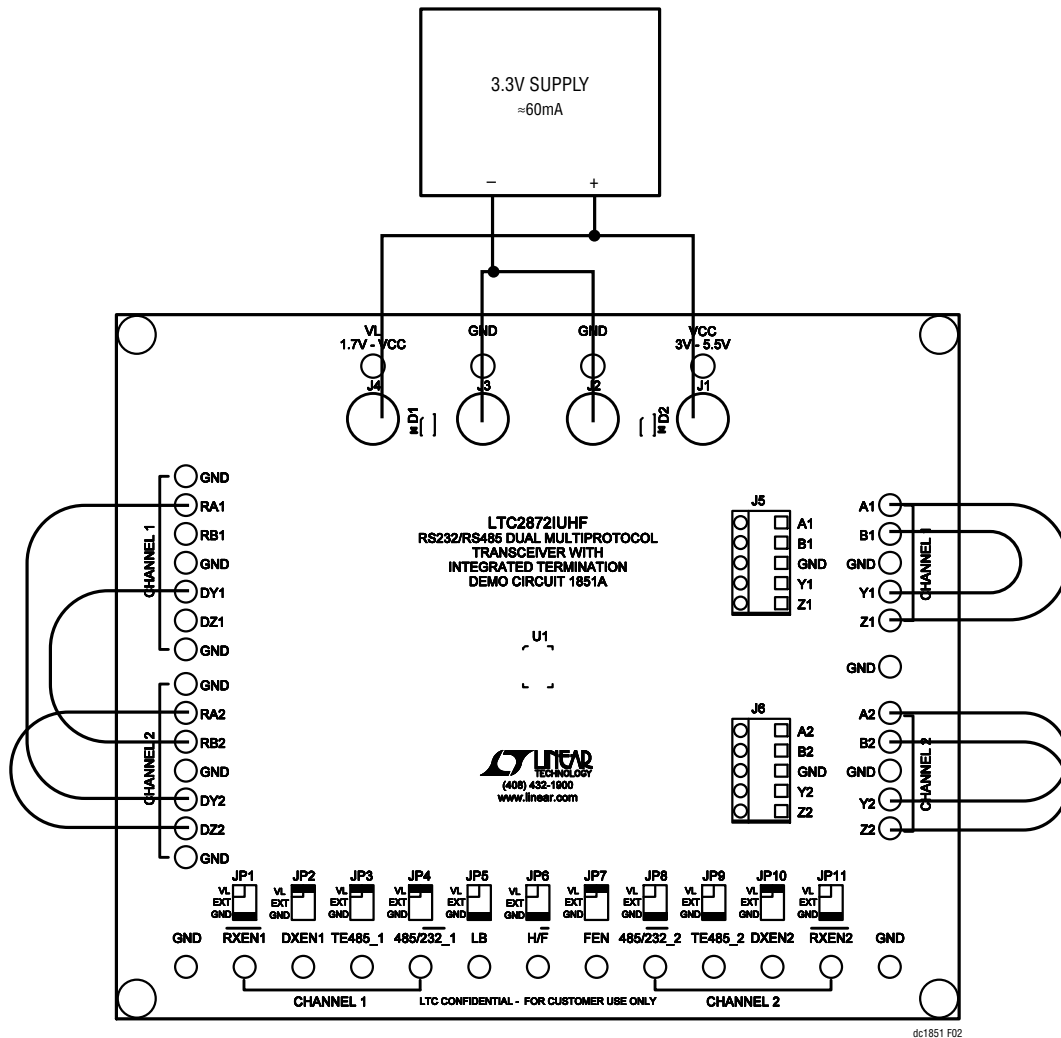


Figure 1. Basic Test Setup. As Shown, Channel 1 is Configured for Full-Duplex RS485, While Channel 2 Is Configured for 2 + 2 RS232.

**QUICK START PROCEDURE**



**Figure 2. Ring Oscillator Connection Permits Examination of All Waveforms Without the Need for a Signal Generator. Oscillation Frequency ≈260kHz**

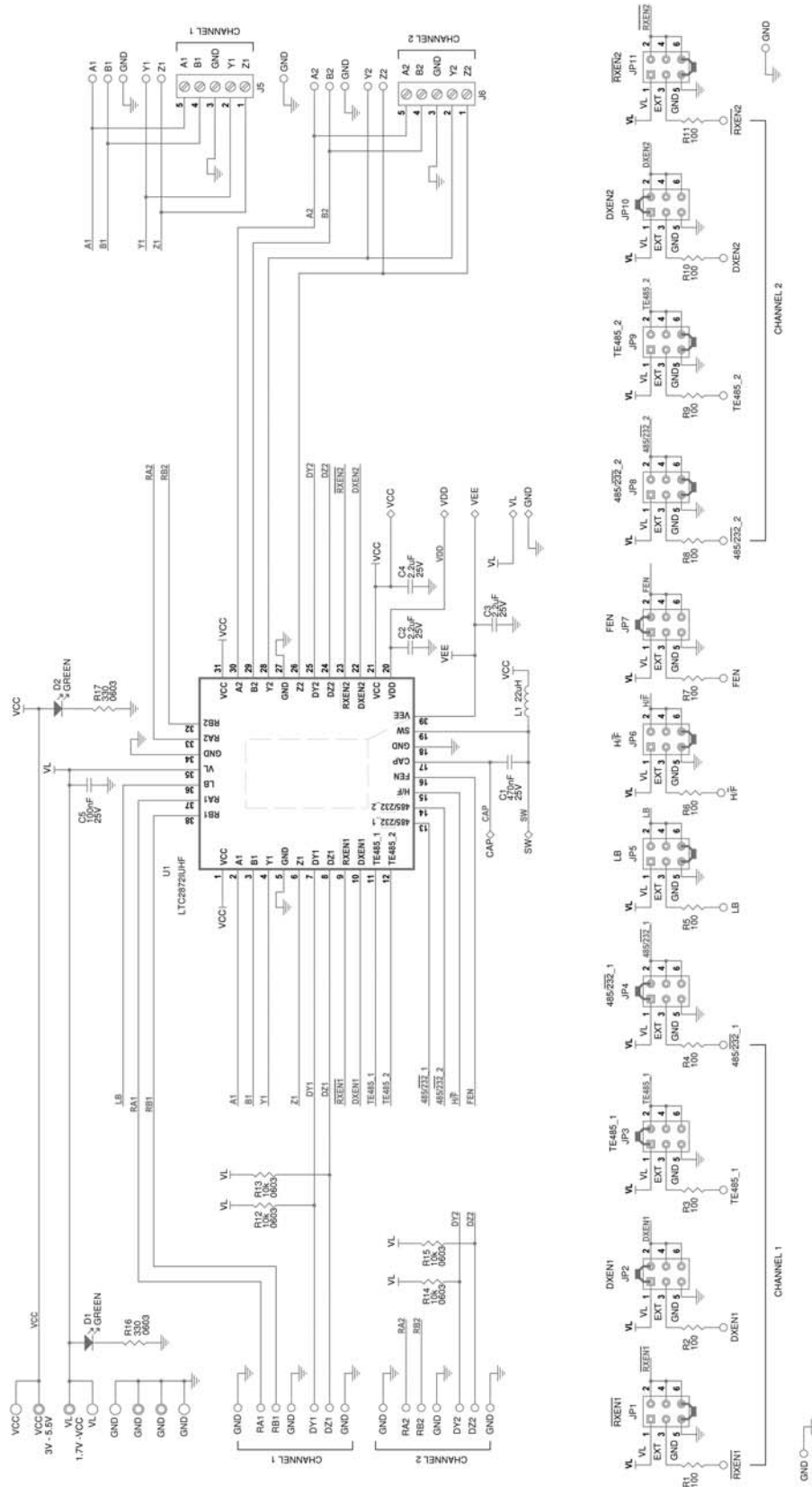
# DEMO MANUAL DC1851A

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## PARTS LIST

REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
C1	CAP, 0805, 470nF, 10%, 25V, X5R	AVX 08053D474KAT2A
C2, C3, C4	CAP, 0805, 2.2 $\mu$ F, 10%, 25V, X7R	AVX 08053C225KAT2A
C5	CAP, 0805 100nF, 10%, 25V, X7R	AVX 08053C104KAT2A
D1, D2	LED, GREEN	PANASONIC LN1351C-(TR)
L1	IND, 2016, 22 $\mu$ F, 200mA	TAIYO YUDEN BRC2016T220M
R1-R11	RES, 1206, 100 $\Omega$ , 5%, 1/4W	VISHAY CRCW1206100RJNEA
R12, R13, R14, R15	RES, 0603, 10k $\Omega$ , 5%, 1/10W	VISHAY CRCW060310K0JNEA
R16, R17	RES, 0603, 330 $\Omega$ , 5%, 1/10W	NIC NRC0603J331TRF
U1	IC, RS232/RS485 DUAL MULTIPROTOCOL TRANSCEIVER	LINEAR TECH. LTC2872IUHF

**SCHEMATIC DIAGRAM**



# DEMO MANUAL DC1851A

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