

# LTC2871IUHF

## RS232/RS485 Multiprotocol Transceiver with Integrated Termination

### DESCRIPTION

Demonstration circuit 1786A showcases the LTC2871 RS232/RS485 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. All control pins are accessible via a turret for external connections, or they may be set by jumpers. All logic I/O and interface I/O lines are routed to turrets. The RS485 interface lines are also available at a terminal

block for convenient connection of a transmission line. Because the LTC2871 contains half-/full-duplex switching control 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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### QUICK START PROCEDURE

The LTC2871 multiprotocol transceiver contains two RS232 drivers, two RS232 receivers, one RS485 driver and one RS485 receiver. All drivers and receivers may be accessed independently and simultaneously. The LTC2871 also includes on-chip supply generation for RS232, permitting operation from a single 3V to 5.5V  $V_{CC}$  supply. A separate logic I/O supply pin ( $V_L$ ) permits the LTC2871 to adapt to any logic level ranging from 1.7V up to  $V_{CC}$ .

The LTC2871 also includes selectable RS485 terminations, as well as switching for half- and full-duplex modes, eliminating the need for external jumpers or relays for configuration in different modes.

DC1786A Includes:

- Bananas and turrets for supply connections along the upper edge of the board

- 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
- A terminal block, J5, 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.
- Green LEDs to indicated the presence of  $V_{CC}$  and  $V_L$ . Note that the  $V_L$  LED, D1, unavoidably dims and extinguishes at  $V_L < 2V$ .
- 10k pull-up resistors on DI, DIN1 and DIN2 to assert a known logic-1 state when these turrets are left open

## QUICK START PROCEDURE

In summary, DC1786A features a turret for each and every LTC2871 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 DC1495A are divided into four basic groups:

R1-R9: 100 $\Omega$  resistors included in series with the control signal turrets to limit fault current arising from any accidental misconnections of the turrets or jumpers.

D1, D2, R11, R15:  $V_{CC}$  and  $V_L$  supply indicator LEDs and current limiting resistors.

R12, R13, R14: 10k pull-ups to  $V_L$  on DI and DIN1, DIN2.

C1-C5, L1: supply generation and bypassing components for the LTC2871 (U1).

### LTC2871 Operation

The LTC2871 contains two RS232 drivers, two RS232 receivers, one RS485 driver and one RS485 receiver. The input(s) and output(s) of each of these elements is separately available and can be interconnected with other elements without conflict between abs max ratings or loading in the disabled state.

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 to Y-Z when switching between half- and full-duplex modes.

Lastly, RS485 terminations are included in the LTC2871. The terminations can be engaged or disengaged as controlled by a termination enable control line, TE485.

### Jumpers

Jumper blocks are included to set the state of each control pin to  $V_L$  or GND. If the shorting jumper is set in the EXT position, the control pin is connected to its associated turret and external signalling may be applied. Failure to select one of the three positions results in a floating control pin. 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 DC1786A are set to enable all transmitters and receivers, with RS485 set to full duplex with terminations enabled.

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

**JP1, 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.

**JP2, 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.

**JP3, TE485:** RS485 Termination Enable. A logic high enables 120 $\Omega$  terminations across A-B and Y-Z. Default position high, RS485 terminations enabled.

**JP4, CH2:** RS232 Channel 2 Disable. A logic high disables RS232 driver 2 and receiver 2, independent of RX232 and DX232. Default position low, RS232 CH2 enabled.

**JP5, RX485:** RS485 Receiver Enable. A logic low enables the RS485 receiver. Default position low, RS485 receiver enabled.

**JP6, DX485:** RS485 Driver Enable. A logic high enables the RS485 driver. Default position high, RS485 driver enabled.

**JP7, DX232:** RS232 Driver Enable. A logic high enables the RS232 driver. Default position high, RS232 driver enabled.

**JP8, RX232:** RS232 Receiver Enable. A logic low enables the RS232 receiver. Default position low, RS232 receiver enabled.

**JP9, 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 low, fast enable disabled.

## Probe Pads

Probe pads are included on the bottom of the board for examination of the  $V_{CC}$ ,  $V_{DD}$ ,  $V_{EE}$ , SW and CAP pins. A GND probe pad is included nearby.  $V_{DD}$  and  $V_{EE}$  are also accessible from the top.

## J5

Terminal block J5 is included for easy connection of an RS485 cable. For half-duplex operation only Y and Z need be connected. Terminal block J5 is hardwired to turrets A, B, Y and Z.

## How to Operate DC-1786A

Operation of DC1486A is straightforward: connect a  $V_{CC}$  supply of 3V to 5.5V, and a  $V_L$  supply of 1.7V up to  $V_{CC}$ . There are no special supply sequencing restrictions, although if  $V_L > V_{CC}$  the logic I/O signalling may not operate properly. Note that D1, the  $V_L$  supply indicating LED will extinguish at  $V_L < 2V$ .

Once power is connected, all drivers and receivers will be active.

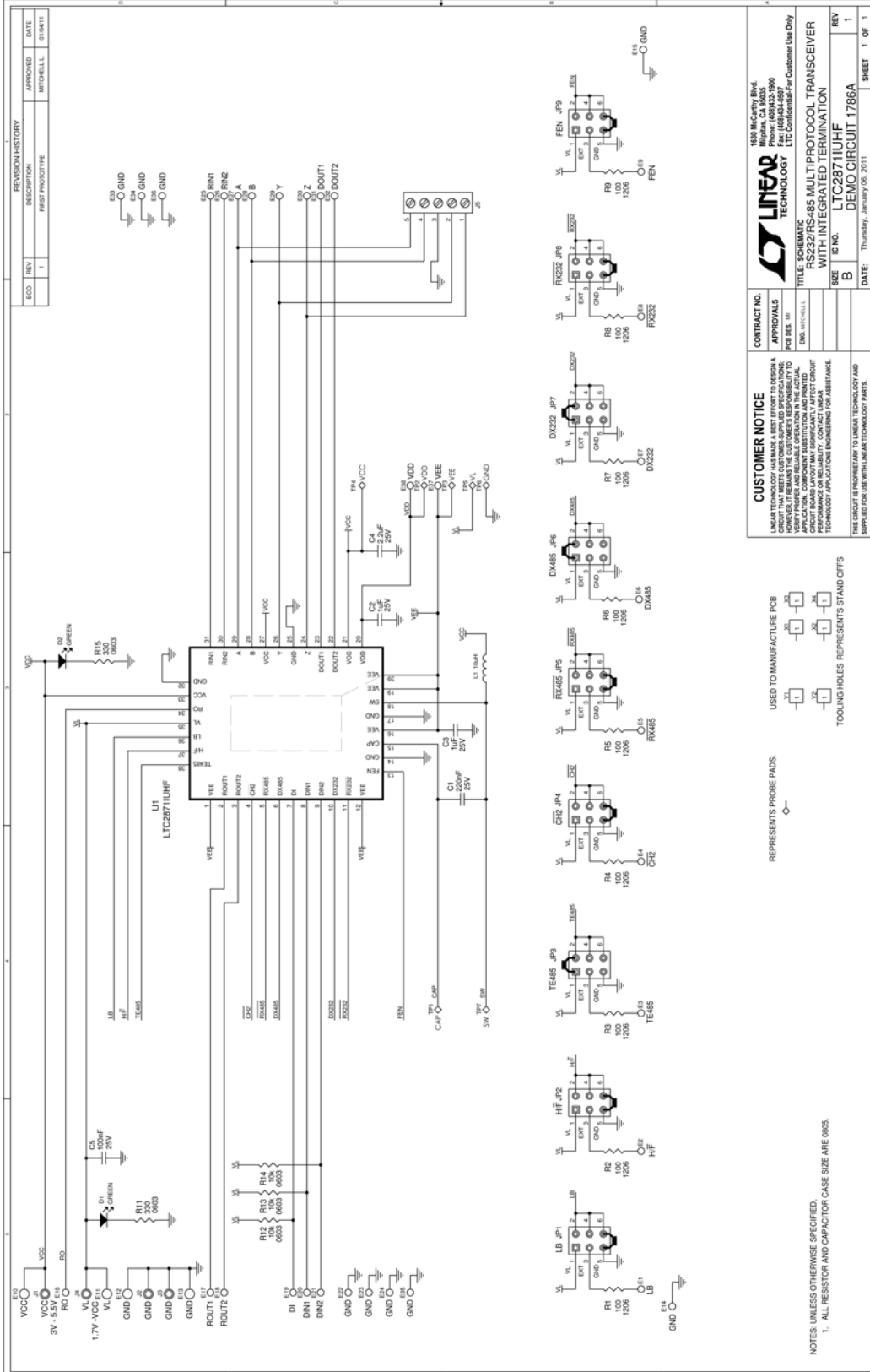
The LTC2871 may be made to self-oscillate by connecting all of the drivers and receivers in one all-encompassing loop, and adding one inversion. The inversion may be introduced with a logic inverter, or by cross-connecting the RS485 driver and receiver (connect Y to B and Z to A). With  $V_{CC} = V_L = 3.3V$ , the frequency of oscillation is typically 275kHz. Use the default jumper positions for this test.

# DEMO MANUAL DC1786A

## PARTS LIST

| ITEM | QTY | REFERENCE          | PART DESCRIPTION                  | MANUFACTURER/PART NUMBER         |
|------|-----|--------------------|-----------------------------------|----------------------------------|
| 1    | 1   | C1                 | CAP, 0805 220nF 10% 25V X7R       | AVX 08053C224KATxA               |
| 2    | 2   | C2,C3              | CAP, 0805 1µF 10% 25V X7R         | TDK C2012X7R1E105K               |
| 3    | 1   | C4                 | CAP, 0805 2.2µF 10% 25V X7R       | AVX 08053C225KAT2A               |
| 4    | 1   | C5                 | CAP, 0805 100nF 10% 25V X7R       | AVX 08053C104KAT2A               |
| 5    | 2   | D1,D2              | LED, GREEN                        | PANASONIC LN1351C                |
| 6    | 34  | E1-E9, E14-E38     | TURRET                            | MILL-MAX 2308-2-00-80-00-00-07-0 |
| 7    | 4   | E10, E11, E12, E13 | TURRET                            | MILL-MAX 2501-2-00-80-00-00-07-0 |
| 8    | 9   | JP1-JP9            | HEADER, 3PIN, DBL ROW 2mm         | SAMTEC TMM 103-02-L-D            |
| 9    | 4   | J1, J2, J3, J4     | JACK, BANANA                      | KEYSTONE 575-4                   |
| 10   | 1   | J5                 | TERMINAL BLOCK, 5 POSITION, 3.5mm | ON-SHORE TECH OSTTV051150        |
| 11   | 1   | L1                 | IND, 2016 (mm) 10µH 200mA         | TAIYO YUDEN CB2016T100M          |
| 12   | 9   | R1-R9              | RES, 1206 100Ω 5% 1/4W            | VISHAY CRCW1206100RJNEA          |
| 13   | 2   | R11, R15           | RES, 0603 330Ω 5% 1/10W           | NIC NRC0603J331TRF               |
| 14   | 3   | R12, R13, R14      | RES, 0603 10kΩ 5% 1/10W           | VISHAY CRCW060310K0JNEA          |
| 15   | 1   | U1                 | IC, RS232/RS485 TRANSCEIVER       | LINEAR TECH. LTC2871IUHF         |
| 16   | 9   | JP1-JP9            | SHUNT, 2mm                        | SAMTEC 2SN-BK-G                  |
| 17   | 4   |                    | STANDOFF, SNAP ON                 | KEYSTONE_8832                    |

**SCHEMATIC DIAGRAM**



| REVISION HISTORY |     |                 |          |
|------------------|-----|-----------------|----------|
| ECO              | REV | DESCRIPTION     | DATE     |
|                  | 1   | FIRST PROTOTYPE | 01/04/11 |
|                  |     |                 | MITCHELL |

**CONTRACT NO.**  
**APPROVALS**  
 PCB DES. BY: DWA, MITCHELL  
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**TITLE:** SCHEMATIC  
**RS232/RS485 MULTIPROTOCOL TRANSCEIVER WITH INTEGRATED TERMINATION**  
**SIZE:** B  
**IC NO.:** LTC2871UHF  
**DEMO CIRCUIT 1786A**

**DATE:** Thursday, January 05, 2011  
 SHEET 1 OF 1

USED TO MANUFACTURE PCB  
 REPRESENTS PROBE PADS  
 TOOLING HOLES REPRESENTS STAND OFFS

NOTES: UNLESS OTHERWISE SPECIFIED.  
 1. ALL RESISTOR AND CAPACITOR CASE SIZE ARE 0805.



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