LTC2873
Single-Bus RS485/RS232 Multiprotocol Transceiver with Switchable Termination

DESCRIPTION

Demonstration circuit 2364A showcases the LTC®2873 RS232/RS485 multiprotocol transceiver with integrated termination. The DC2364A operates as a stand-alone evaluation platform or can be used as a shield with a Linduino® or Arduino microcontroller board for quick and versatile evaluation of the LTC2873.

Control signals on the LTC2873 are accessible via test points for external monitoring or control, or they can be set by jumpers or by the Linduino GPIO. Bus lines are routed to test points as well as a terminal block for convenient connections to a transmission line. The DC2364A operates from external supplies or directly from the Linduino's regulated output supplies, configured to 3.3V or 5V with a jumper setting.

Design files for this circuit board are available at http://www.linear.com/demo/DC2364A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Supply	V_{CC} Operating V_L Operating	3.0 1.7		5.5 V_{CC}	V V
Maximum Data Rate	RS232 RS485	1 20			Mbps Mbps

BOARD LAYOUT

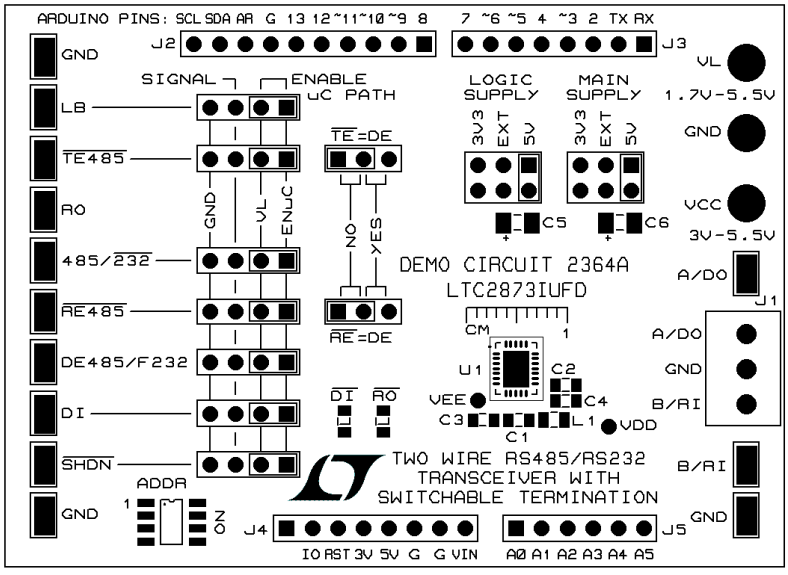


Figure 1. DC2364A. Default Jumper Settings Indicated by the Rectangles at the Jumpers. Default Is for Use with Linduino

QUICK START PROCEDURE

OVERVIEW

The LTC2873 multiprotocol transceiver comprises one RS485 driver and receiver and one RS232 driver and receiver. A two-pin bus interface is shared with the RS485 and RS232 transceivers and only one can be active at a given time. The LTC2873 requires a Main Supply, V_{CC} (3V to 5.5V) and a Logic Supply, V_L (1.7V to 5.5V).

The DC2364A is designed to be used stand-alone or interface directly with a Linduino microcontroller board (DC2026) in a shield configuration. It is equally compatible with Arduino, although Linduino is preferred because it adds a fully isolated USB port, offering added protection to the connecting computer. A Linduino sketch is provided that, when loaded and run, displays a menu of options for controlling and using the DC2364A. This sketch can be customized as needed.

The DC2364A provides a means to control and observe nearly every pin on the LTC2873. The control pins can be driven externally, set high or low with a jumper, or controlled with a Linduino microcontroller (when attached).

Level shifting buffers are included on the DC2364A so that the Linduino can control the signals to the LTC2873, yet support and preserve the full range of V_L voltages and logic levels applied to the LTC2873 from 1.7V to V_{CC}.

More Features of the DC2364A:

- Turrets for supply connections are on the right edge of the board. These connections are optional if used with a Linduino.
- Test points and terminal block connections for bus pins on are on the right edge of the board.
- Test points and jumpers for logic-level signals are on the left edge of the board.
- A Green LED indicates the presence of a low on Data Input, DI.
- A Yellow LED indicates the presence of a low on Receiver Output, RO.
- 100k pull-up or pull-down resistors on all logic I/O pins provide a defined logic state in the absence of a driving signal or jumper.
- Four switches near the bottom left of the board can be used to give the board a unique address accessible by the Linduino, allowing the code to support multiple boards, uniquely addressed.

LTC2873 OPERATION

The LTC2873 enables a single channel RS232 driver and RS232 receiver or one RS485 driver and one RS485 receiver, selectable with the 485/$\overline{232}$ control pin.

In RS232 mode (485/$\overline{232}$ low), the driver and receiver are always active and DE485/F232 enables fast mode for up to 1Mbps.

In RS485 mode (485/$\overline{232}$ high), the driver and receiver are only active if their associated enable pins (DE485/F232 and $\overline{RE485}$) are driven high and low, respectively.

RS485 termination can be switched in by setting the $\overline{TE485}$ pin low. This enables a 120Ω resistor between A/DO and B/RI.

JUMPERS

Logic Level Jumpers:

Logic interface pins (LB, $\overline{TE485}$, 485/$\overline{232}$, $\overline{RE485}$, DE485/F232, DI, $\overline{SHDN}$) all have jumpers that can be set in three positions to control the pin state: "GND," "V_L" and "ENuC." "GND" and "V_L" are used to set the state of the pin low or high. "ENuC" enables Linduino control of the pin.

To drive the signal from an external source, set the jumper for that pin to the GND position. This connects a 50Ω termination resistor from the pin to ground that can be overdriven with an external source connected to the test point on the left side of the board. Alternately, the jumper can be removed entirely if the 50Ω load is undesirable.

Supply Jumpers:

There are two jumpers that control the Logic Supply (V_L) and Main Supply (V_{CC}) to the LTC2873. For each, the "3V3" or "5V" settings connects the Linduino 3.3V or 5V regulated supply to those pins. With the jumper in the "EXT" position, V_{CC} and V_L will be routed to the LTC2873 from the turrets on the right edge of the board. If the DC2364A is used without the Linduino, the "EXT" setting must be used.

QUICK START PROCEDURE

$\overline{TE}$ = DE and $\overline{RE}$ = DE Jumpers:

In some applications it may be beneficial to connect $\overline{TE}$ to DE or $\overline{RE}$ to DE. The two jumpers marked in this way, present a convenient means of making these connections.

PROBE PADS FOR VDD AND VEE

Probe pads are included on the board for examination of the VDD, and VEE generated supplies.

HOW TO OPERATE DC2364A WITHOUT A Linduino:

1. Move supply jumpers to "EXT" position.
2. Connect V_{CC} and V_L supplies and Ground to the turrets. There are no power supply sequencing restrictions.
3. Move logic level jumpers to the desired position to set the pin states or drive externally as described in the Logic Level Jumpers section.

HOW TO OPERATE DC2364A WITH A Linduino:

By default the DC2364A jumpers are arranged for Linduino control as indicated in Figure 1

1. Attach the DC2364A to the Linduino board by direct insertion, like a shield is installed.
2. Set the logic level jumpers to the "ENuC" position.
3. Set the V_L and V_{CC} jumpers to the desired position ("V_L," "EXT," and "V_{CC}" are all valid choices)
4. If using external supplies, connect them to the turrets; otherwise the Linduino will supply the board. The supply jumpers (see Step 3 above) must be set to match this configuration.
5. Plug the Linduino into a computer running the Arduino IDE application using a USB cable.
6. On the computer, open the sketch that is written for this board (this can be found at http://www.linear.com/solutions/linduino), and upload to the Linduino.
7. Open the Arduino serial monitor. Set communication rate to "115200 baud" and choose "Both NL & CR."
8. A menu is displayed offering options to run the program that exercises the demonstration circuit and the LTC2873 as shown in Figure 2.

The logic pins can be controlled individually by typing 1-7 and hitting ENTER. Selections 8 and 9 apply a 31.4kHz signal to DI. Options 10 to 26 control multiple pins, configuring the LTC2873 to the specified mode of operation.

All logic inputs can be monitored at test points on left side of board at all times.

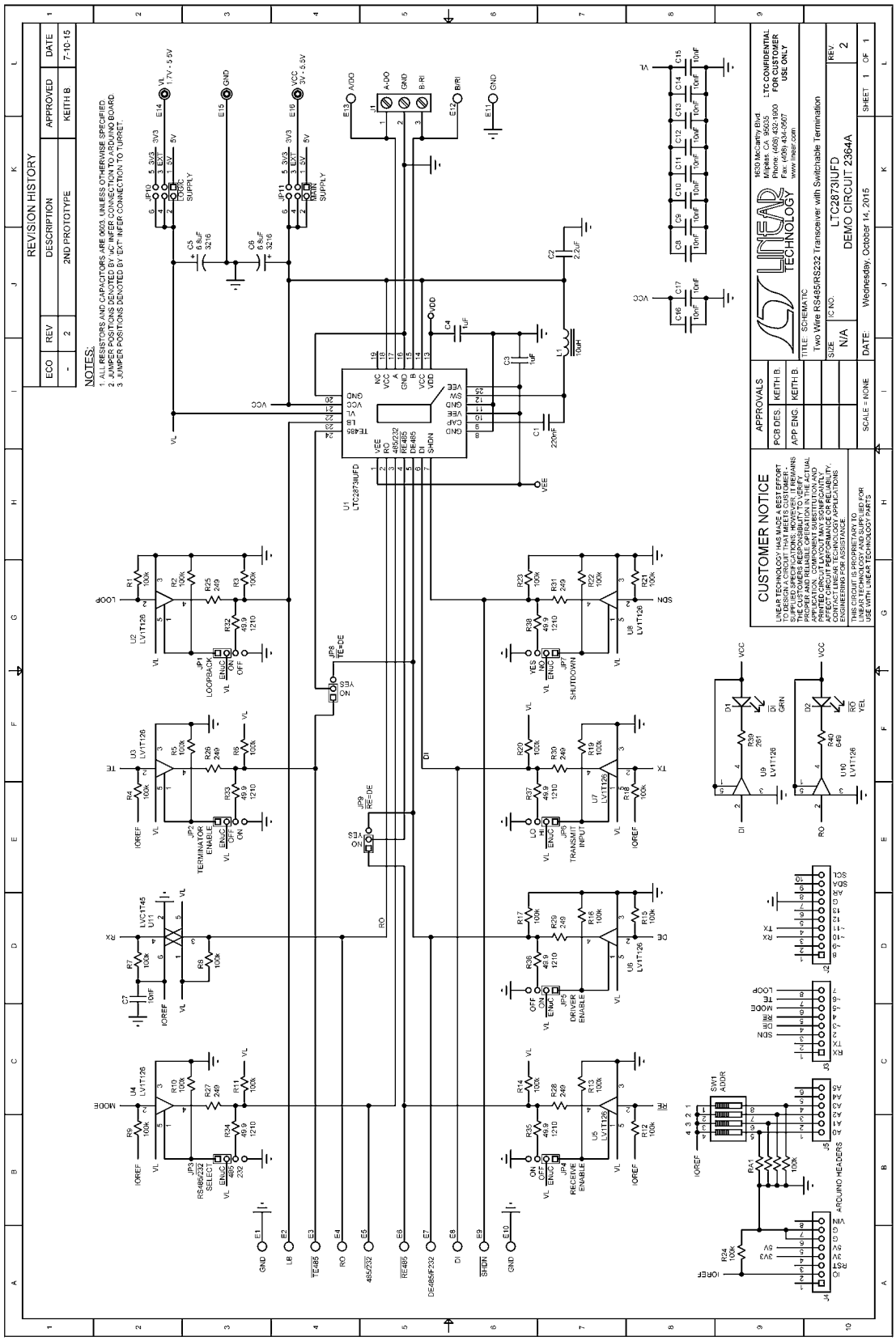
```
**************************************************************************
DC2364A Demonstration Board for the LTC2873
**************************************************************************
PIN CONTROL:            MODES:
1. Flip SHDNb           10. Shutdown              19. 485 Term
2. Flip 485/232b        11. 232 RX+TX Slow        20. 485 RX+Term
3. Flip RE485b          12. 232 RX+TX Fast        21. 485 TX+Term
4. Flip DE485/F232      13. 232 Loopbk+TX Slow    22. 485 RX+TX+Term
5. Flip TE485b          14. 232 Loopbk+TX Fast    23. 485 Loopbk
6. Flip LB              15. 485 Ready             24. 485 Loopbk+TX
7. Flip DI              16. 485 RX                25. 485 Loopbk+Term
8. 31.4kHz 50% on DI*   17. 485 TX                26. 485 Loopbk+TX+Term
9. 31.4kHz 10% on DI*   18. 485 RX+TX
**************************************************************************
Press m to stop 31.4 kHz signal

CURRENT STATE:
User Entry    SHDNb    485   RE485b   DE485   TE485b    LB      DI      MODE
--------------------------------------------------------------------------
               0       1      1       0       1       0       0       SHUTDOWN
```

Figure 2. Serial Monitor Start-Up Menu Screen

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	U1	IC, Single-Bus RS485/RS232 Transceiver	LINEAR, LTC2873IUFD#PBF
2	1	C1	Cap, 0.22µF 10% 0603 16V X7R	TDK, C1608X7R1C224K080AC
3	1	C2	Cap, 2.2µF 10% 0603 16V X7S	TDK, CGA3E1X7S1C225K080AC
4	2	C3-4	Cap, 1µF 10% 0603 16V X7R	TDK, C1608X7R1C105K080AC
5	2	C5-6	Cap, Tant, 6.8µF 10% 3216 16V	KEMET, T491A685K016AT
6	11	C7-17	Cap, 10nF 10% 0603 50V X7R	TDK, C1608X7R1H103K080AA
7	1	D1	Diode, LED, Green, 0805	WURTH ELEKTRONIK, 150080VS75000
8	1	D2	Diode, LED, Yellow, 0805	WURTH ELEKTRONIK, 150080YS75000
9	13	E1-13	SMT, Test Point	KEYSTONE, 5019
10	3	E14-16	Turret	MILL-MAX, 2501-2-00-80-00-00-07-0
11	1	J1	Term Block, 3 Pos, 3.5mm, Header	WURTH ELEKTRONIK, 691214110003
12	1	J2-5	Arduino Header Kit, 2x8pin, 1x6pin, 1x10pin	SPARKFUN, PRT-11417
13	7	JP1-7	Header, 1x4 0.1"	WURTH ELEKTRONIK, 61300411121
14	2	JP8-9	Header, 1x3 0.1"	WURTH ELEKTRONIK, 61300311121
15	2	JP10-11	Header, 2x3 0.1"	WURTH ELEKTRONIK, 61300621121
16	11	JP1-11	Shunt, 1x2 0.1", Blue	WURTH ELEKTRONIK, 60900213621
17	1	L1	Inductor, 10µH 0806 0.25Ω 1A	WURTH ELEKTRONIK, 74479778310
18	24	R1-24	Resistor, 100kΩ 1% 0603	VISHAY, CRCW0603100KFKEA
19	7	R25-R31	Resistor, 249Ω 1% 0603	VISHAY, CRCW0603249RFKEA
20	7	R32-38	Resistor, 49.9Ω 1% 1210	VISHAY, CRCW121049R9FKEA
21	1	R39	Resistor, 261Ω 1% 0603	VISHAY, CRCW0603261RFKEA
22	1	R40	Resistor, 649Ω 1% 0603	VISHAY, CRCW0603649RFKEA
23	1	RA1	Resistor Array, 100kΩ 5% 1206	CTS, 742C083104JP
24	1	SW1	Switch DIP 4-Pos Slide	COPAL, CHS-04TA
25	9	U2-10	IC, Buffer/Line Driver, Non-Inverting	TI, SN74LV1T126DCKR
26	1	U11	IC, Translator, Bidirectional, 3-State	TI, SN74LVC1T45DCKR

SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331