Isolated RS485 Transceiver

FEATURES

- **UL Rated Isolated RS485: 2500V_{RMS}**
  UL Recognized File #E151738
- **Eliminates Ground Loops**
- **250kBd Maximum Data Rate**
- **Self-Powered with 420kHz Converter**
- Half- or Full-Duplex
- Fail-Safe Output High for Open or Shorted Receiver Inputs
- Short-Circuit Current Limit
- Slow Slew Rate Control
- 68kΩ Input Impedance Allows Up to 128 Nodes
- Thermal Shutdown
- 8kV ESD Protection On Driver Outputs and Receiver Inputs
- Available in 28-Lead SW Package

APPLICATIONS

- Isolated RS485 Receiver/Driver
- RS485 with Large Common Mode Voltage
- Breaking RS485 Ground Loops
- Multiple Unterminated Line Taps

DESCRIPTION

The LTC®1535 is an isolated RS485 full-duplex differential line transceiver. Isolated RS485 is ideal for systems where the ground loop is broken to allow for much larger common mode voltage ranges. An internal capacitive isolation barrier provides 2500V_{RMS} of isolation between the line transceiver and the logic level interface. The powered side contains a 420kHz push-pull converter to power the isolated RS485 transceiver. Internal full-duplex communication occurs through the capacitive isolation barrier. The transceiver meets RS485 and RS422 requirements.

The driver and receiver feature three-state outputs, with the driver maintaining high impedance over the entire common mode range. The drivers have short-circuit current limits in both directions and a slow slew rate select to minimize EMI or reflections. The 68kΩ receiver input allows up to 128 node connections. A fail-safe feature defaults to a high output state when the receiver inputs are open or shorted.

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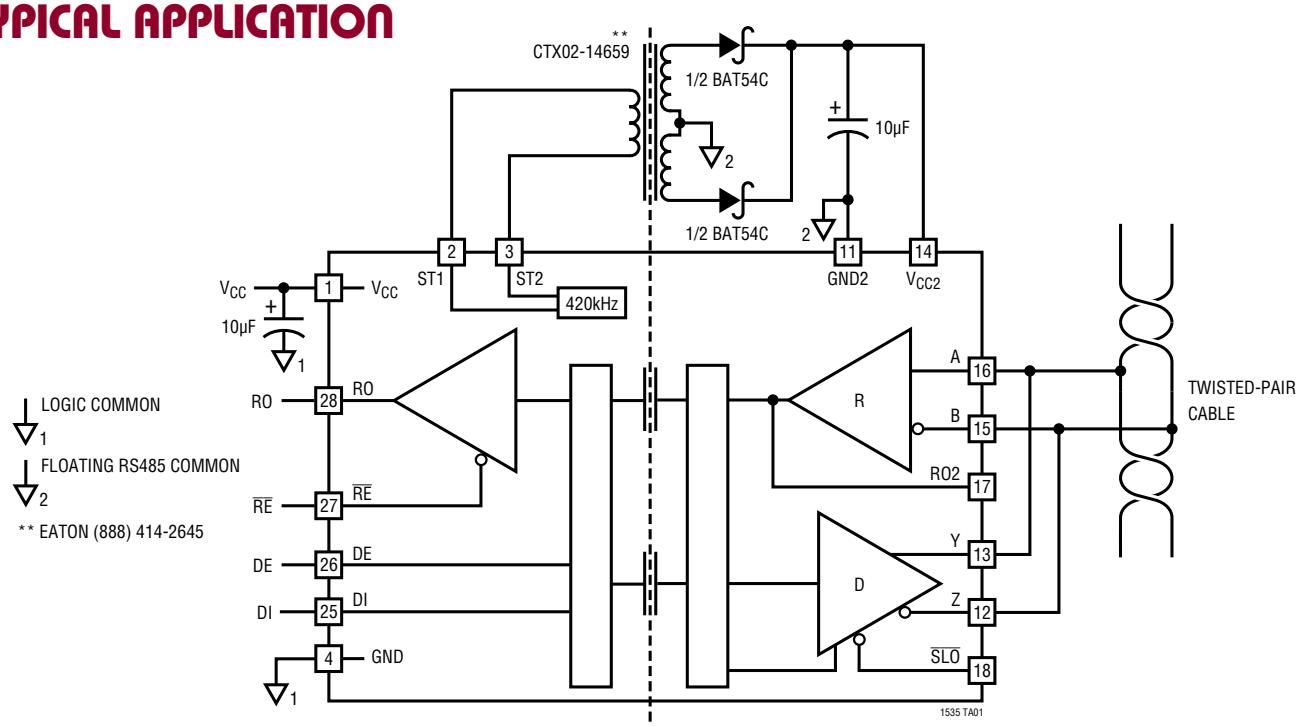
TYPICAL APPLICATION

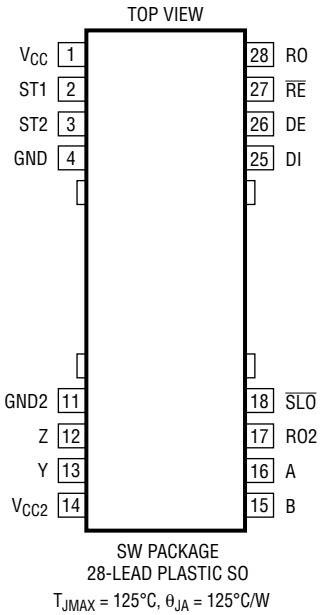


ABSOLUTE MAXIMUM RATINGS

(Note 1)

V_{CC} to GND 6V
V_{CC2} to GND2.....8V
Control Input Voltage to GND..... –0.3V to (V_{CC} + 0.3V)
Driver Input Voltage to GND.....–0.3V to (V_{CC} + 0.3V)
Driver Output Voltage
(Driver Disabled) to GND2 .....(V_{CC2} – 13V) to 13V
Driver Output Voltage
(Driver Enabled) to GND2..... (V_{CC2} – 13V) to 10V
Receiver Input Voltage to GND2..... ±14V
Receiver Output Voltage .....–0.3V to (V_{CC} + 0.3V)
Operating Temperature Range
LTC1535C .....0°C ≤ T_A ≤ 70°C
LTC1535I ..... –40°C ≤ T_A ≤ 85°C
Storage Temperature Range .....–65°C to 150°C
Lead Temperature (Soldering, 10 sec).....300°C

PIN CONFIGURATION



SW PACKAGE
28-LEAD PLASTIC SO
T_{JMAX} = 125°C, θ_{JA} = 125°C/W

ORDER INFORMATION

http://www.linear.com/product/LTC1535#orderinfo

LEAD FREE FINISH	TAPE AND REEL	PART MARKING*	PACKAGE DESCRIPTION	TEMPERATURE RANGE
LTC1535CSW#PBF	LTC1535CSW#TRPBF	1535	28-Lead Plastic SO	0°C to 70°C
LTC1535ISW#PBF	LTC1535ISW#TRPBF	1535	28-Lead Plastic SO	–40°C to 85°C

Consult LTC Marketing for parts specified with wider operating temperature ranges. *The temperature grade is identified by a label on the shipping container.

For more information on lead free part marking, go to: http://www.linear.com/leadfree/

For more information on tape and reel specifications, go to: http://www.linear.com/tapeandreel/. Some packages are available in 500 unit reels through designated sales channels with #TRMPBF suffix.

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{CC} = 5V, V_{CC2} = 5V unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
V_{CC}	V_{CC} Supply Range			●	4.5		5.5	V
V_{CC2}	V_{CC2} Supply Range			●	4.5		7.5	V
I_{CC}	V_{CC} Supply Current	Transformer Not Driven (Note 10)		●		13	28	mA
I_{CC2}	V_{CC2} Supply Current	R = 27Ω, Figure 2 No Load		● ●		63 7	73 12	mA mA
V_{OD1}	Differential Driver Output	No Load		●			5	V
V_{OD2}	Differential Driver Output	R = 50Ω (RS422) (Note 2), V_{CC2} = 4.5V R = 27Ω(RS485), Figure 2, V_{CC2} = 4.5V		● ●	2 1.5	 2		V V
V_{OC}	Driver Output Common Mode Voltage	DC Level, R = 50Ω, Figure 2		●	2.0	2.5	3.0	V
I_{OSD1}	Driver Short-Circuit Current V_{OUT} = HIGH V_{OUT} = LOW	Driver Enabled (DE = 1) –7V ≤ V_{CM} ≤ 10V –7V ≤ V_{CM} ≤ 10V		 ● ●	 60 60	 100 100	 150 150	 mA mA
V_{IH}	Logic Input High Voltage	DE, DI, $\overline{RE}$ $\overline{SLO}$		● ●	2 4	1.7 2.2		V V
V_{IL}	Logic Input Low Voltage	DE, DI, $\overline{RE}$ $\overline{SLO}$		● ●		1.7 1.8	0.8 1	V V
I_{IN}	Input Current (A, B)	(Note 3)	V_{IN} = 12V	●			0.25	mA
			V_{IN} = –7V	●			–0.20	mA
V_{TH}	Receiver Input Threshold	–7V ≤ V_{CM} ≤ 12V, (Note 4)		●	–200	–90	–10	mV
ΔV_{TH}	Receiver Input Hysteresis	–7V ≤ V_{CM} ≤ 12V	0°C ≤ T_A ≤ 70°C	●	10	30	70	mV
			–40°C ≤ T_A ≤ 85°C	●	5	30	70	mV
R_{IN}	Receiver Input Impedance			●	50	68	100	kΩ
V_{IOC}	Receiver Input Open Circuit Voltage					3.4		V
V_{OH}	RO Output High Voltage	I_{RO} = –4mA, V_{CC} = 4.5V		●	3.7	4.0		V
V_{OL}	RO Output Low Voltage	I_{RO} = 4mA, V_{CC} = 4.5V		●		0.4	0.8	V
I_{OZ}	Driver Output Leakage	Driver Disabled (DE = 0)				1		µA
V_{OH2}	RO2 Output High Voltage	I_{RO2} = –4mA, V_{CC} = 4.5V		●	3.7	3.9		V
V_{OL2}	RO2 Output Low Voltage	I_{RO2} = 4mA, V_{CC} = 4.5V		●		0.4	0.8	V
f_{SW}	DC Converter Frequency			●	290	420	590	kHz
R_{SWH}	DC Converter Impedance High			●		4	6	Ω
R_{SWL}	DC Converter Impedance Low			●		2.5	5	Ω
I_{REL}	$\overline{RE}$ Output Low Current	$\overline{RE}$ Sink Current, Fault = 0		●	–40	–50	–80	µA
I_{REH}	$\overline{RE}$ Output High Current	$\overline{RE}$ Source Current, Fault = 1		●	80	100	130	µA
V_{UVL}	Undervoltage Low Threshold	$\overline{RE}$ Fault = 1, (Note 5)		●	3.70	4.00	4.25	V
V_{UVH}	Undervoltage High Threshold	$\overline{RE}$ Fault = 0, (Note 5)		●	4.05	4.20	4.40	V
V_{ISO}	Isolation Voltage	1 Minute, (Note 6) 1 Second			2500 3000			V_{RMS} V_{RMS}

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{CC} = 5V, V_{CC2} = 5V, R = 27Ω (RS485) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
t_{SJ}	Data Sample Jitter	Figure 8, (Note 7)	●		250	285	ns
f_{MAX}	Max Baud Rate	Jitter = 10% Max, $\overline{SLO}$ = 1, (Note 8)	●	250	410		kBd
t_{PLH}	Driver Input to Output	DE = 1, $\overline{SLO}$ = 1, Figure 4, Figure 6 DE = 1, $\overline{SLO}$ = 0, Figure 4, Figure 6	● ●		600 1300	855 1560	ns ns
t_{PHL}	Driver Input to Output	DE = 1, $\overline{SLO}$ = 1, Figure 4, Figure 6 DE = 1, $\overline{SLO}$ = 1, Figure 4, Figure 6	● ●		600 1300	855 1560	ns ns
t_r, t_f	Driver Rise or Fall Time	DE = 1, $\overline{SLO}$ = 1, Figure 4, Figure 6 DE = 1, $\overline{SLO}$ = 0, V_{CC} = V_{CC2} = 4.5V	● ●	 150	20 500	100 1000	ns ns
t_{ZH}	Driver Enable to Output	DI = 1, $\overline{SLO}$ = 1, Figure 5, Figure 7	●		1000	1400	ns
t_{ZL}	Driver Enable to Output	DI = 0, $\overline{SLO}$ = 1, Figure 5, Figure 7	●		1000	1400	ns
t_{LZ}	Driver Disable to Output	DI = 0, $\overline{SLO}$ = 1, Figure 5, Figure 7	●		700	1300	ns
t_{HZ}	Driver Disable to Output	DI = 1, $\overline{SLO}$ = 1, Figure 5, Figure 7	●		700	1300	ns
t_{PLH}	Receiver Input to RO	$\overline{RE}$ = 0, Figure 3, Figure 8	●		600	855	ns
t_{PHL}	Receiver Input to RO	$\overline{RE}$ = 0, Figure 3, Figure 8	●		600	855	ns
t_{PLH}	Receiver Input to RO2	$\overline{RE}$ = 0, Figure 3, Figure 8			30		ns
t_{PHL}	Receiver Input to RO2	$\overline{RE}$ = 0, Figure 3, Figure 8			30		ns
t_r, t_f	Receiver Rise or Fall Time	$\overline{RE}$ = 0, Figure 3, Figure 8			20		ns
t_{LZ}	Receiver Disable to Output	Figure 3, Figure 9			30		ns
t_{HZ}	Receiver Disable to Output	Figure 3, Figure 9			30		ns
t_{START}	Initial Start-Up Time	(Note 9)			1200		ns
t_{TOF}	Data Time-Out Fault	(Note 9)			1200		ns
	ST1, ST2 Duty Cycle	0°C ≤ T_A ≤ 70°C –40°C ≤ T_A ≤ 85°C	● ●			56 57	% %

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: RS422 50Ω specification based on RS485 27Ω test.

Note 3: I_{IN} is tested at V_{CC2} = 5V, guaranteed by design from GND2 ≤ V_{CC2} ≤ 5.25V.

Note 4: Input fault conditions on the RS485 receiver are detected with a fixed receiver offset. The offset is such that an input short or open will result in a high data output.

Note 5: The low voltage detect faults when V_{CC2} or V_{CC} drops below V_{UVL} and re-enables when greater than V_{UVH}. The fault can be monitored through the weak driver output on $\overline{RE}$.

Note 6: Value derived from 1 second test.

Note 7: The input signals are internally sampled and encoded. The internal sample rate determines the data output jitter since the internal sampling is asynchronous with respect to the external data. Nominally, a 4MHz internal sample rate gives 250ns of sampling uncertainty in the input signals.

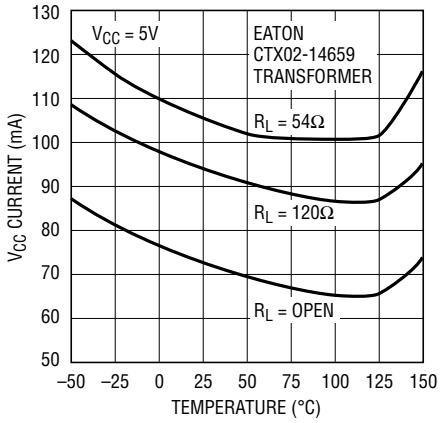
Note 8: The maximum baud rate is 250kBd with 10% sampling jitter. Lower baud rates have lower jitter.

Note 9: Start-up time is the time for communication to recover after a fault condition. Data time-out is the time a fault is indicated on $\overline{RE}$ after data communication has stopped.

Note 10: I_{CC} measured with no load, ST1 and ST2 floating.

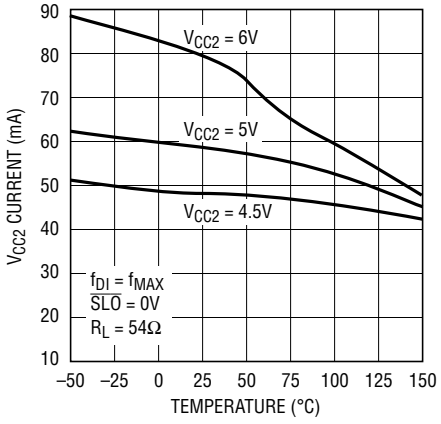
TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} Supply Current vs Temperature



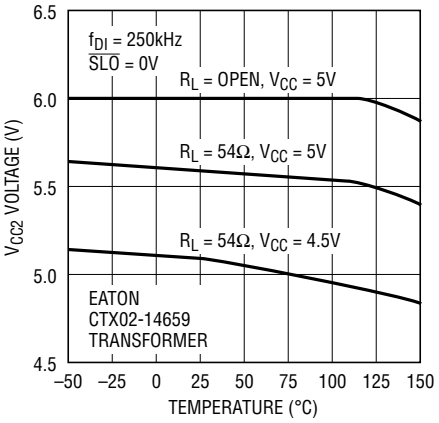
1535 G01

V_{CC2} Supply Current vs Temperature



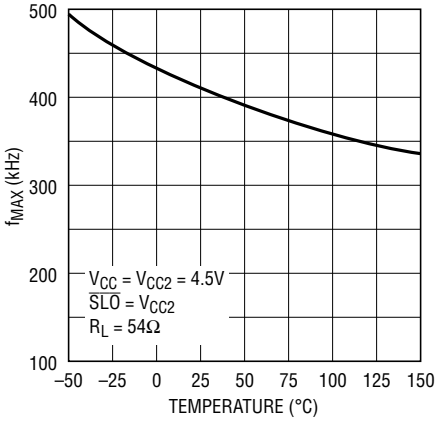
1535 G02

V_{CC2} Supply Voltage vs Temperature



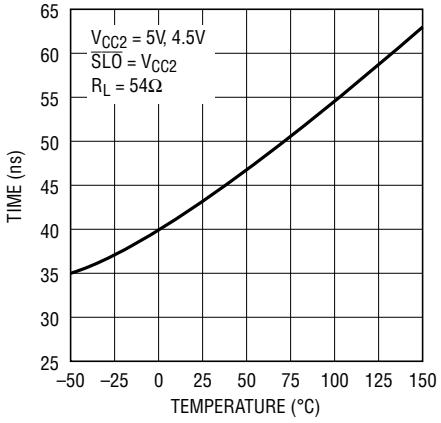
1535 G03

Maximum Baud Rate vs Temperature



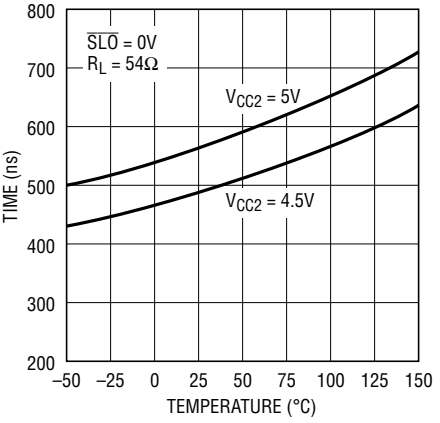
1535 G04

Driver Differential Output Rise/Fall Time vs Temperature



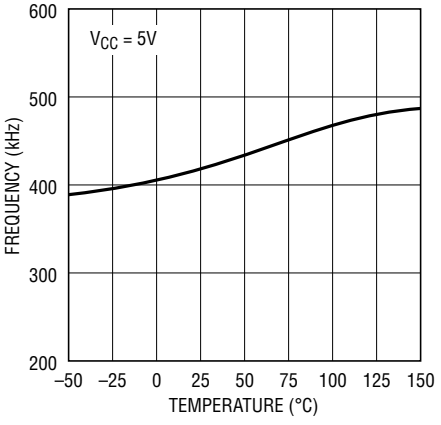
1535 G05

Driver Differential Output Rise/Fall Time vs Temperature



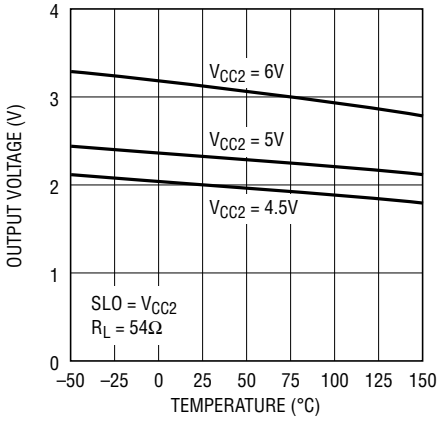
1535 G06

Switcher Frequency vs Temperature



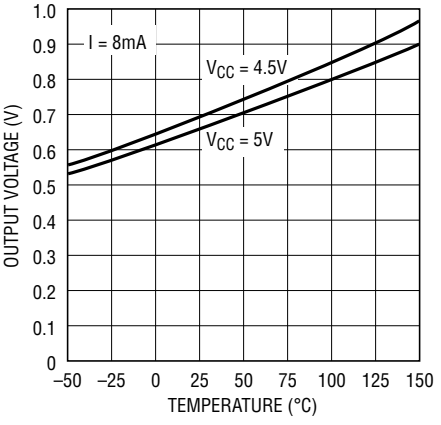
1535 G07

Driver Differential Output Voltage vs Temperature



1535 G08

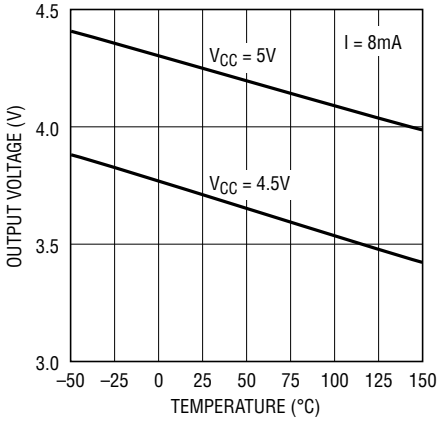
Receiver Output Low Voltage vs Temperature



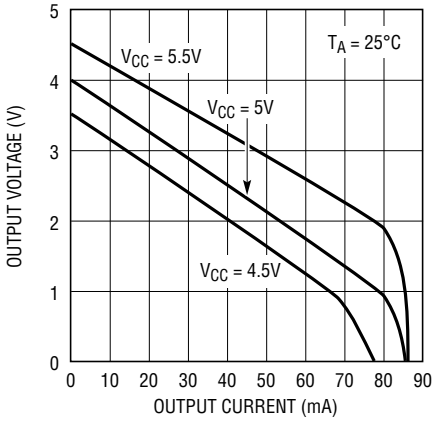
1535 G09

TYPICAL PERFORMANCE CHARACTERISTICS

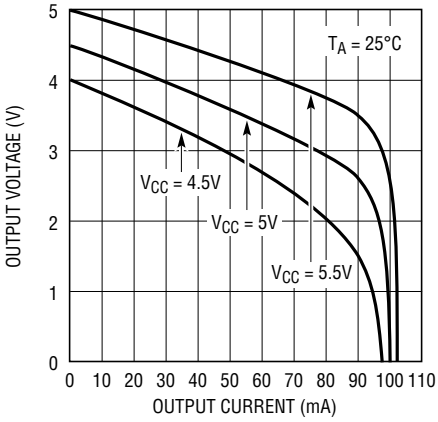
Receiver Output High Voltage vs Temperature



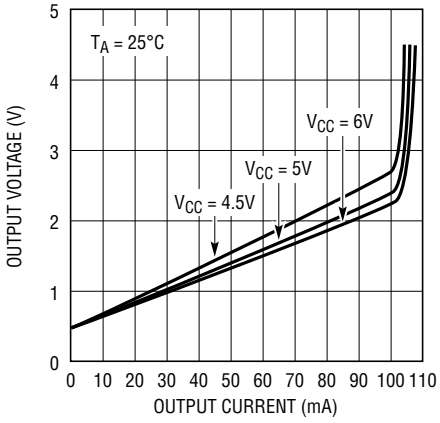
Driver Differential Output Voltage vs Output Current



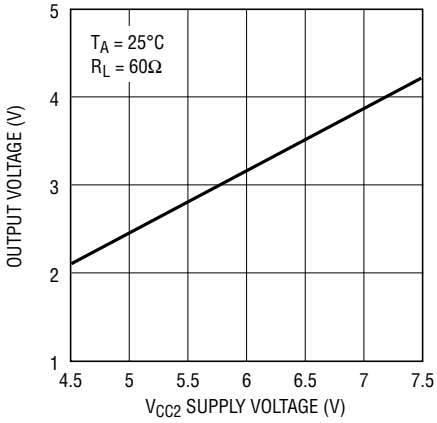
Driver Output High Voltage vs Output Current



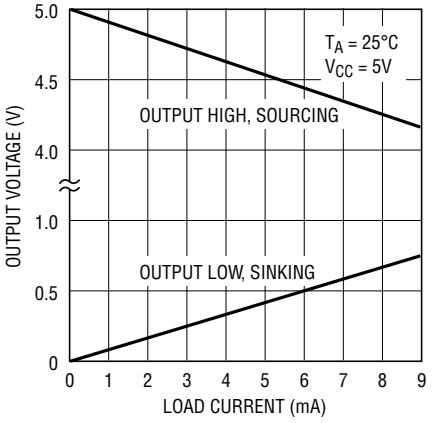
Driver Output Low Voltage vs Output Current



Driver Differential Output Voltage vs V_{CC2} Supply Voltage



Receiver Output Voltage vs Load Current



PIN FUNCTIONS

POWER SIDE

V_{CC} (Pin 1): 5V Supply. Bypass to GND with 10µF capacitor.

ST1 (Pin 2): DC Converter Output 1 to DC Transformer.

ST2 (Pin 3): DC Converter Output 2 to DC Transformer.

GND (Pin 4): Ground.

DI (Pin 25): Transmit Data TTL Input to the Isolated Side RS485 Driver. Do not float.

DE (Pin 26): Transmit Enable TTL Input to the Isolated Side RS485 Driver. A high level enables the driver. Do not float.

$\overline{RE}$ (Pin 27): Receive Data Output Enable TTL Input. A low level enables the receiver. This pin also provides a fault output signal. (See Figure 11.)

RO (Pin 28): Receive Data TTL Output.

ISOLATED SIDE

GND2 (Pin 11): Isolated Side Power Ground.

Z (Pin 12): Differential Driver Inverting Output.

Y (Pin 13): Differential Driver Noninverting Output.

V_{CC2} (Pin 14): 5V to 7.5V Supply from DC Transformer. Bypass to GND2 with 10µF capacitor.

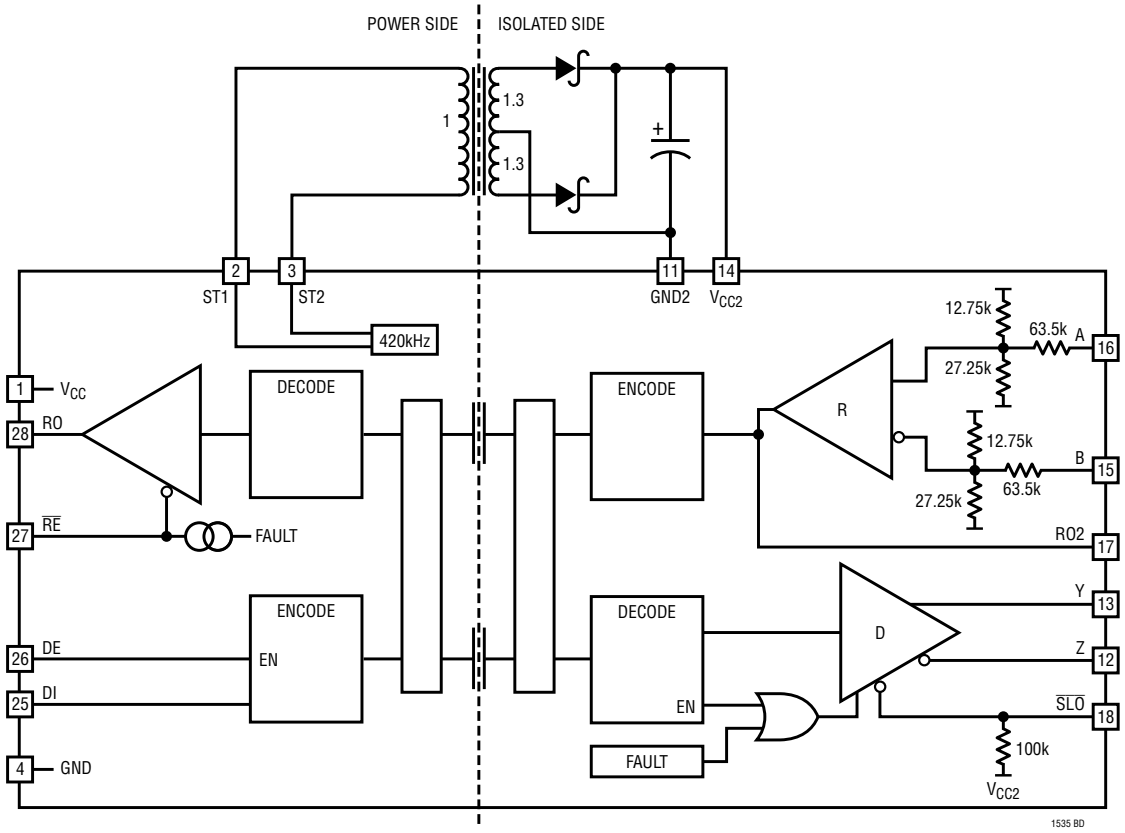
B (Pin 15): Differential Receiver Inverting Input.

A (Pin 16): Differential Receiver Noninverting Input.

RO2 (Pin 17): Isolated Side Receiver TTL Output. This output is always enabled and is unaffected by $\overline{RE}$.

$\overline{SLO}$ (Pin 18): Slow Slew Rate Control of RS485 Driver. A low level forces the driver outputs into slow slew rate mode.

BLOCK DIAGRAM



TEST CIRCUIT

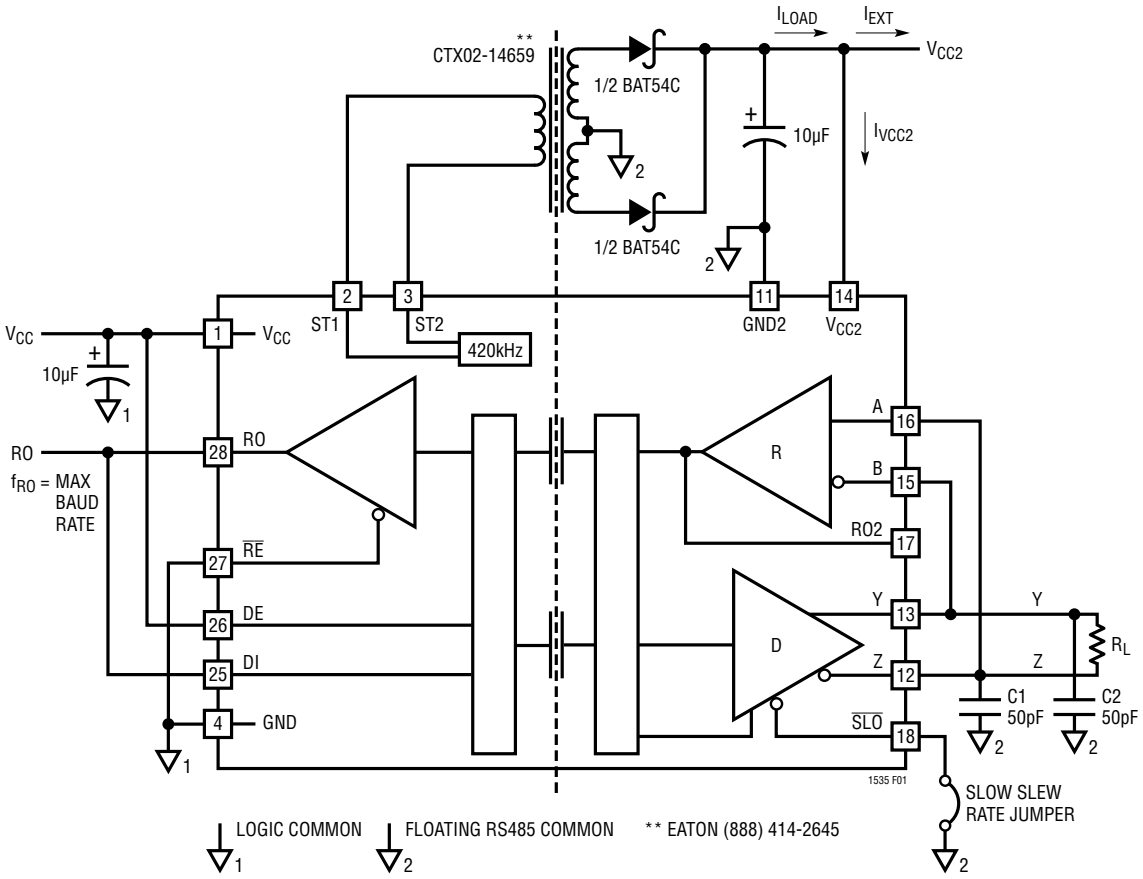


Figure 1. Self-Oscillation at Maximum Data Rate (Test Configuration for the First Six Typical Performance Characteristics Curves)

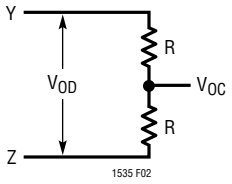


Figure 2. Driver DC Test Load

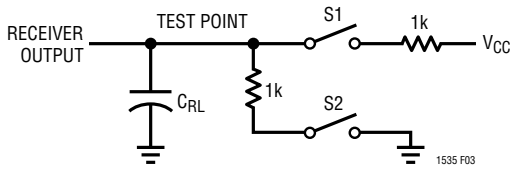


Figure 3. Receiver Timing Test Load

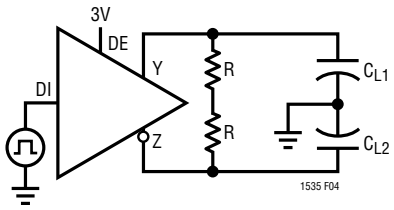


Figure 4. Driver Timing Test Circuit

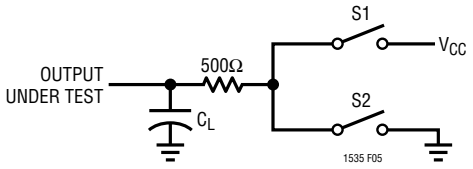


Figure 5. Driver Timing Test Load

SWITCHING TIME WAVEFORMS

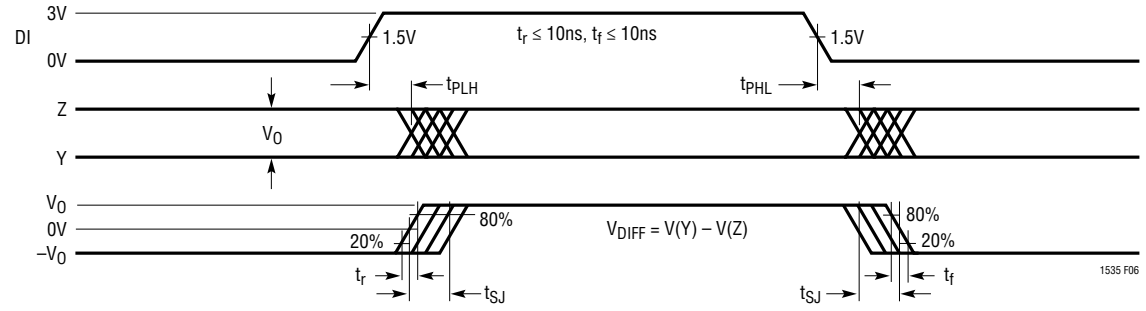


Figure 6. Driver Propagation Delays

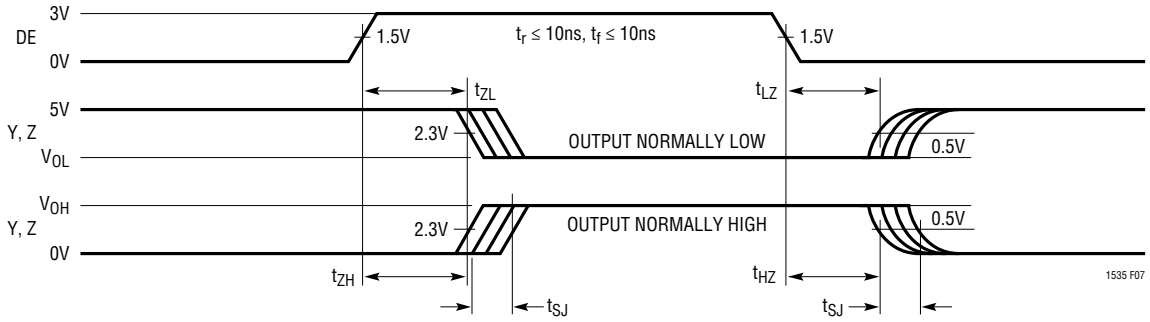


Figure 7. Driver Enable and Disable Times

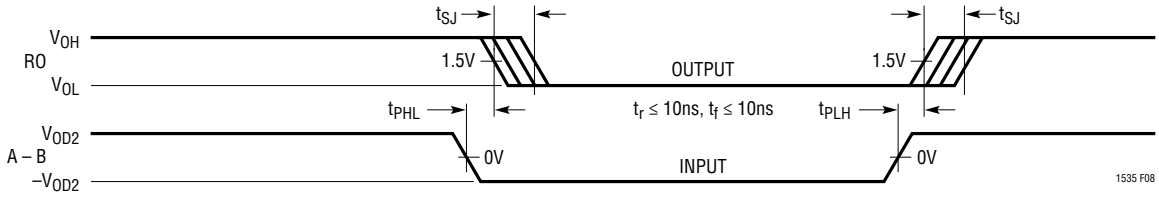


Figure 8. Receiver Propagation Delays

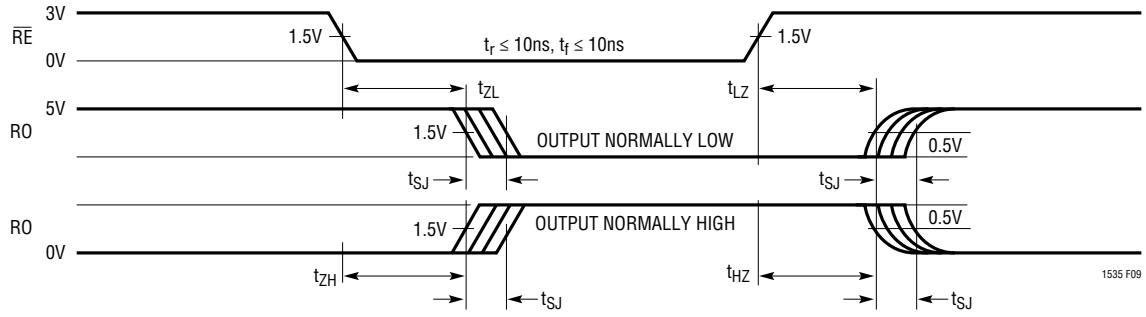


Figure 9. Receiver Enable and Disable Times

APPLICATIONS INFORMATION

Isolation Barrier and Sampled Communication

The LTC1535 uses the SW-28 isolated lead frame package to provide capacitive isolation barrier between the logic interface and the RS485 driver/receiver pair. The barrier provides 2500V_{RMS} of isolation. Communication between the two sides uses the isolation capacitors in a multiplexed way to communicate full-duplex data across this barrier (see Figure 20 and Block Diagram). The data is sampled and encoded before transmitting across the isolation barrier, which will add sampling jitter and delay to the signals (see Figures 13 and 14). The sampling jitter is approximately 250ns with a nominal delay of 600ns. At 250kBd rate, this represents 6.2% total jitter. The nominal DE signal to the driver output delay is 875ns ±125ns, which is longer due to the encoding. Communication start-up time is approximately 1µs to 2µs. A time-out fault will occur if communication from the isolated side fails. Faults can be monitored on the $\overline{RE}$ pin.

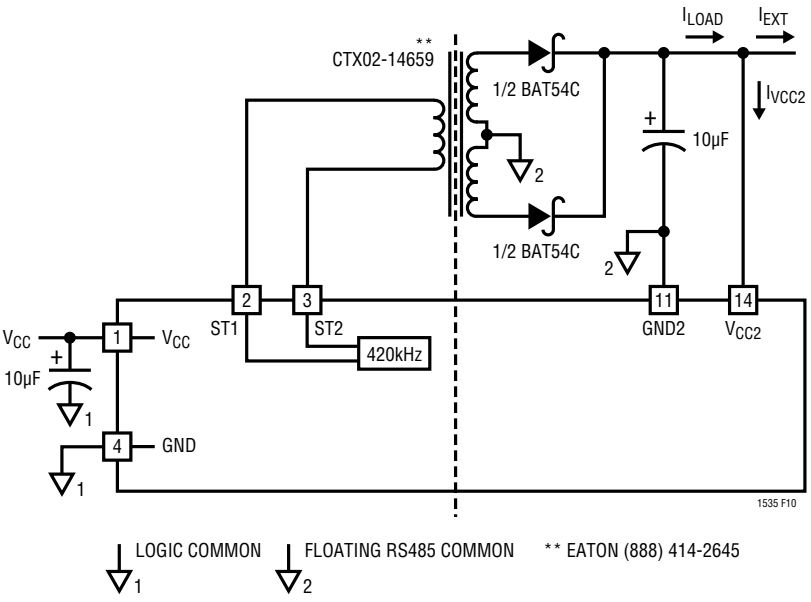
The maximum baud rate can be determined by connecting in self-oscillation mode as shown in Figure 1. In this configuration, with $\overline{SLO}$ = V_{CC2}, the oscillation frequency is set by the internal sample rate. With $\overline{SLO}$ = 0V, the frequency is reduced by the slower output rise and fall times.

Push-Pull DC/DC Converter

The powered side contains a full-bridge open-loop driver, optimized for use with a single primary and center-tapped secondary transformer. Figure 10 shows the DC/DC converter in a configuration that can deliver up to 100mA of current to the isolated side using a Eaton CTX02-14659 transformer.

Because the DC/DC converter is open-loop, care in choosing low impedance parts is important for good regulation. Care must also be taken to not exceed the V_{CC2} recommended maximum voltage of 7.5V when there is very light loading. The isolated side contains a low voltage detect circuit to ensure that communication across the barrier will only occur when there is sufficient isolated supply voltage. If the output of the DC/DC converter is overloaded, the supply voltage will trip the low voltage detection at 4.2V. For higher voltage stand-off, the Eaton CTX02-14608 transformer may be used.

Table 1 lists examples of transformers which are suitable for use in the LTC1535's DC/DC converter using the circuit topology shown in Figure 10. While this secondary circuit topology is recommended, other secondary circuit topologies are possible which allows for different



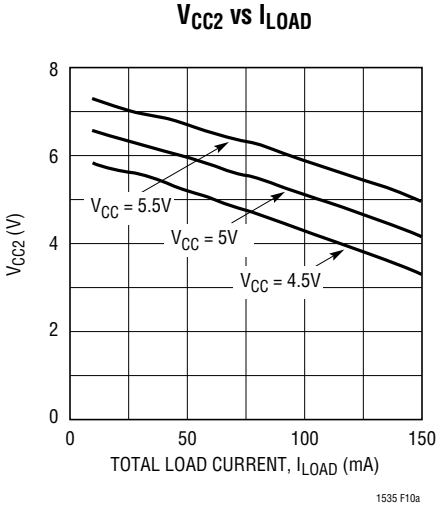


Figure 10

APPLICATIONS INFORMATION

transformer configurations. The DC/DC converter driver's Thévenin equivalent resistance is approximately 4Ω and the transformer's volt-second rating should be greater than 7μVs.

Driver Output and Slow Slew Rate Control

The LTC1535 uses a proprietary driver output stage that allows a common mode voltage range that extends beyond the power supplies. Thus, the high impedance state is maintained over the full RS485 common mode range. The output stage provides 100mA of short-circuit current limiting in both the positive and negative directions. Thus, even under short-circuit conditions, the supply voltage from the open-loop DC converter will remain high enough for proper communication across the isolation barrier. The driver output will be disabled in the event of a thermal shutdown and a fault condition will be indicated through the $\overline{RE}$ weak output.

The CMOS level $\overline{SLO}$ pin selects slow or fast slew rates on the RS485 driver output (see Figures 15, 16, 17, 18 for typical waveforms). The $\overline{SLO}$ input has an internal 100k pull-up resistor. When $\overline{SLO}$ is low, the driver outputs are slew rate limited to reduce high frequency edges. Left open or tied high, $\overline{SLO}$ defaults to fast edges. The part draws more current during slow slew rate edges.

Monitoring Faults on $\overline{RE}$

The $\overline{RE}$ pin can be used to monitor the following fault conditions: low supply voltages, thermal shutdown or a time-out fault when there is no data communication across the barrier. During a fault, the receiver output, RO, defaults to a high state (see Table 2). Open circuit or short-circuit conditions on the twisted pair do not cause a fault indication. However, the RS485 receiver defaults to a high output state when the receiver input is open or short-circuited.

The $\overline{RE}$ pin has a weak current drive output mode for indicating fault conditions. This fault state can be polled using a bidirectional microcontroller I/O line or by using the circuit in Figure 11, where the control to $\overline{RE}$ is three-stated and the fault condition read back from the $\overline{RE}$ pin. The weak drive has 100μA pull-up current to indicate a fault and 50μA pull-down current for no fault. This allows the $\overline{RE}$ pin to be polled without disabling $\overline{RE}$ on nonfault conditions.

Both sides contain a low voltage detect circuit. A voltage less than 4.2V on the isolated side disables communication.

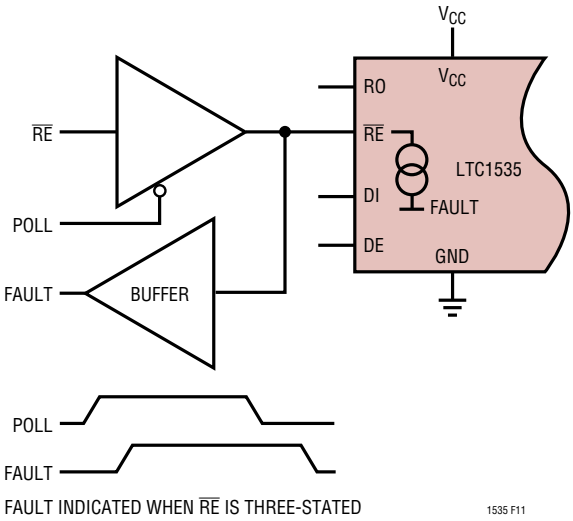


Figure 11. Detecting Fault Conditions

APPLICATIONS INFORMATION

Table 1. Examples of Transformers Compatible with the LTC1535

MANUFACTURER	PART NUMBER	DC ISOLATION VOLTAGE (1 SECOND)	PHONE NUMBER/WEBSITE
WE-Midcom	750311542	1.25kV	(800) 643-2661 http://www.we-online.com
	750031160 31160R	1.25kV	
	760390014	3.125kVAC	
	750313638	6.25kVAC	
Eaton	CTX02-14659 CTX02-14659-R	500V	(888) 414-2645
	CTX02-14608	3.75kVAC	
Murata Power Solutions	78253/55JC	1.5kV	http://www.murata-ps.com
	78253/55JVC	4kV	
Minntronix	4810796R	3kVAC	(605) 884-0195 http://minntronix.com/
Pulse Electronics	P1597NL	500V	http://www.pulseelectronics.com/
	PH9085.034NL	2.5kV	
Sumida (Japan)	S-167-5779	100V	03-3667-3320 http://www.sumida.com/

Table 2. Fault Mode Behavior

FUNCTION (PINS)		$V_{CC} > V_{UVH}$ $V_{CC2} > V_{UVH}$	$V_{CC} < V_{UVL}$ $V_{CC2} > V_{UVH}$	$V_{CC} > V_{UVH}$ $V_{CC2} < V_{UVL}$	$V_{CC} < V_{UVL}$ $V_{CC2} > V_{UVL}$	THERMAL SHUTDOWN
DC/DC Converter (2, 3)		On	On	On	On	Off
RO (28)	$\overline{RE}$ = 0V	Active	Forced-High	Forced-High	Forced High	Forced-High
	$\overline{RE}$ = V_{CC}	Hi-Z	Hi-Z	Hi-Z	Hi-Z	Hi-Z
	$\overline{RE}$ = Floating	Active	Hi-Z	Hi-Z	Hi-Z	Hi-Z
RO2 (17)		Active	Active	Active	Active	Active
Driver Outputs Y and Z (13, 12)		Active	Hi-Z	Hi-Z	Hi-Z	Hi-Z
Communications Across Isolation Barrier		Active	Disabled	Disabled	Disabled	Disabled
Fault Indicator on $\overline{RE}$ (27)		Low	High	High	High	High

Table 3. Driver Function Table

INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	Y	Z
X	1	1	1	0
X	1	0	0	1
X	0	X	Z	2

Note: Z = high impedance, X = don't care

Table 4. Receiver Function Table

INPUTS			OUTPUTS	
$\overline{RE}$	DE	A-B	RO	RO2
0	X	$\geq V_{TH(MAX}$	1	1
0	X	$\leq V_{TH(MIN)}$	0	0
0	X	Inputs Open	1	1
0	X	Inputs Shorted	1	1
1	X	$\geq V_{TH(MAX)}$	Z	1
1	X	$\leq V_{TH(MIN)}$	Z	0
1	X	Inputs Open	Z	1
1	X	Inputs Shorted	Z	1

Note: Z = high impedance, X = don't care

APPLICATIONS INFORMATION

High Voltage Considerations

The LTC1535 eliminates ground loops on data communication lines. However, such isolation can bring potentially dangerous voltages onto the circuit board. An example would be accidental faulting to 117V AC at some point on the cable which is then conducted to the PC board. Figure 12 shows how to detect and warn the user or installer that a voltage fault condition exists on the twisted pair or its shield. A small (3.2mm) glow lamp is connected between GND2 (the isolated ground) and the equipment's safety "earth" ground. If a potential of more than 75V AC is present on the twisted pair or shield, B1 will light, indicating a wiring fault. Resistors R3 and R4 are used to ballast the current in B1. Two resistors are necessary because they can only stand off 200V each, as well as for power dissipation. As shown, the circuit can withstand a direct fault to a 440V 3-phase system.

Other problems introduced by floating the twisted pair include the collection of static charge on the twisted pair, its shield and the attached circuitry. Resistors R1 and R2 provide a path to shunt static charge safely to ground. Again, two resistors are necessary to withstand high voltage faults. Electrostatic spikes, electromagnetically induced transients and radio frequency pickup are shunted by addition capacitor C1.

Receiver Inputs Fail-Safe

The LTC1535 features an input common mode range covering the entire RS485 specified range of –7V to 12V. Differential signals of greater than ±200mV within the specified input common mode range will be converted to TTL compatible signals at the receiver outputs, RO and RO2. A small amount of input hysteresis is included to minimize the effects of noise on the line signals. If the receiver inputs are floating or shorted, a designed-in receiver offset guarantees a fail-safe logic high at the receiver outputs. If a fail-safe logic low is desired, connect as shown in Figure 19.

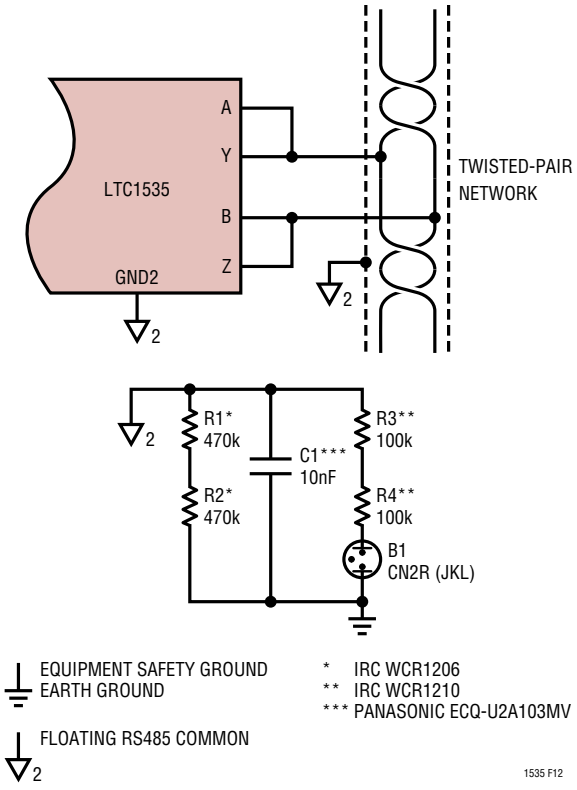


Figure 12. Detecting Fault Conditions

APPLICATIONS INFORMATION

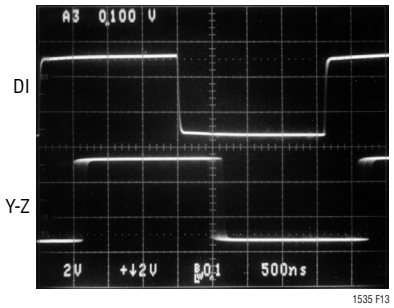


Figure 13. Driver Propagation Delay with Sample Jitter. $\overline{SLO}$ = V_{CC2}

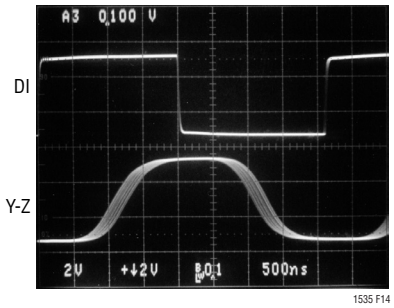


Figure 14. Driver Propagation Delay with Sample Jitter. $\overline{SLO}$ = 0V

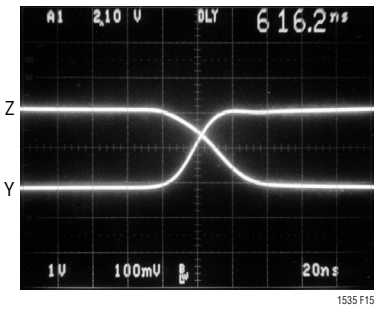


Figure 15. Driver Output. R = 27Ω, V_{CC2} = 5V, $\overline{SLO}$ = V_{CC2}

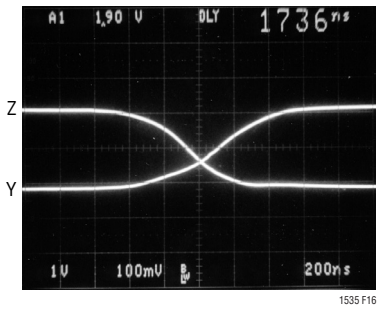


Figure 16. Driver Output. R = 27Ω, V_{CC2} = 5V, $\overline{SLO}$ = 0V

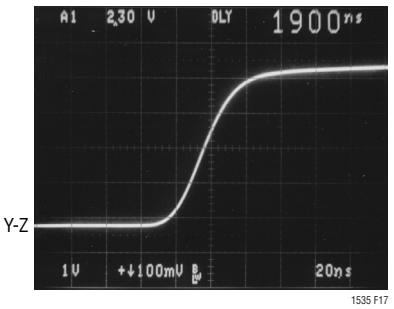


Figure 17. Driver Differential Output. R = 27Ω, V_{CC2} = 5V, $\overline{SLO}$ = V_{CC2}

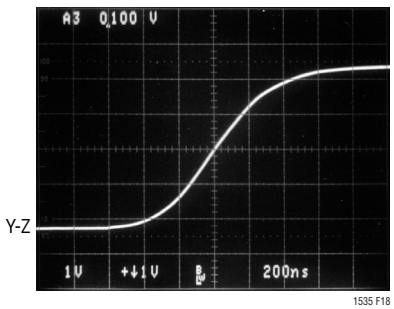


Figure 18. Driver Differential Output. R = 27Ω, V_{CC2} = 5V, $\overline{SLO}$ = 0V

TYPICAL APPLICATION

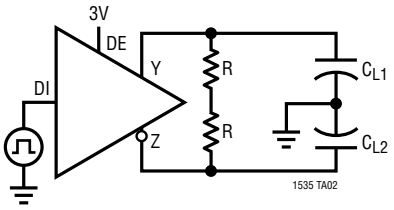
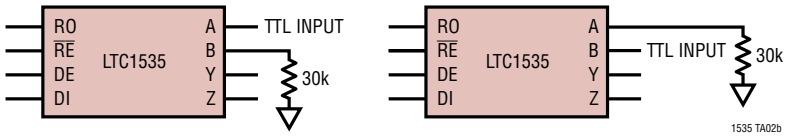


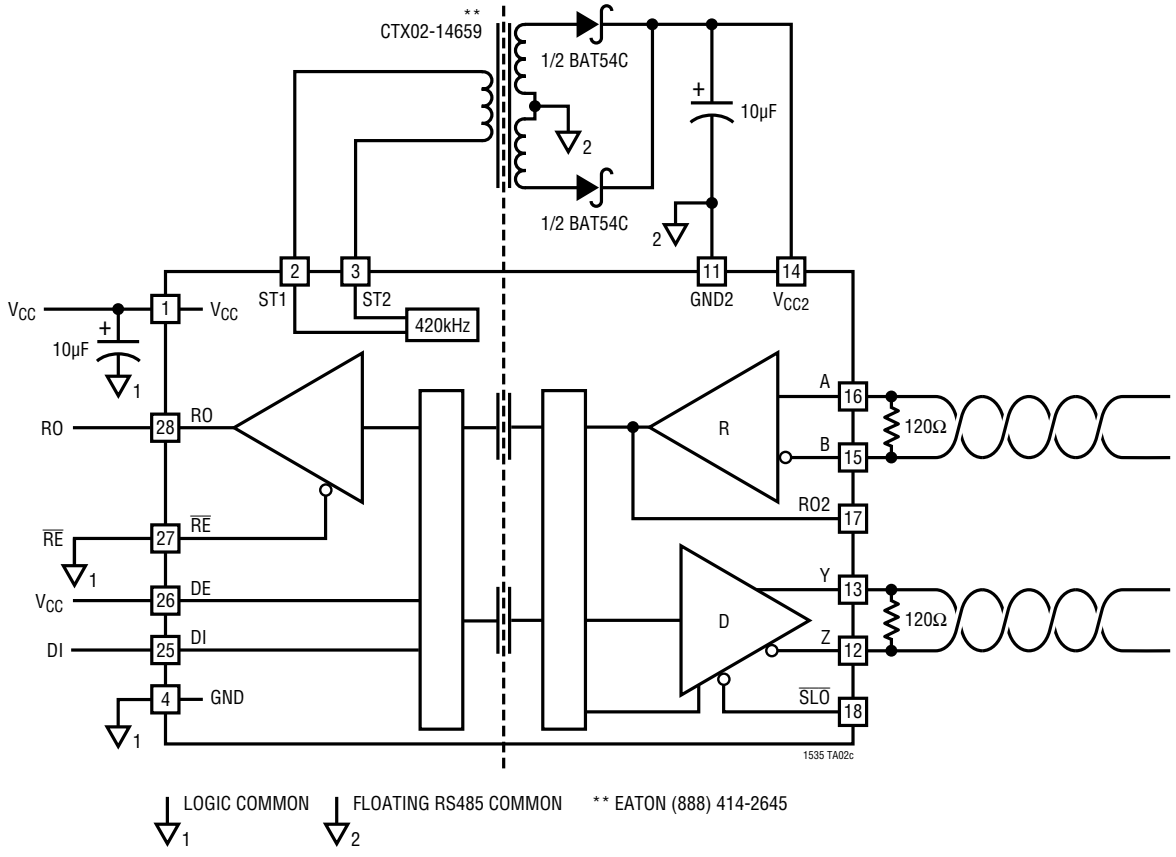
Figure 19. Fail-Safe Logic "0"



(20a) Noninverting **(20b) Inverting**

Figure 20. Configuring Receiver for TTL Level Input. Y and Z Outputs Are TTL Compatible with No Modification

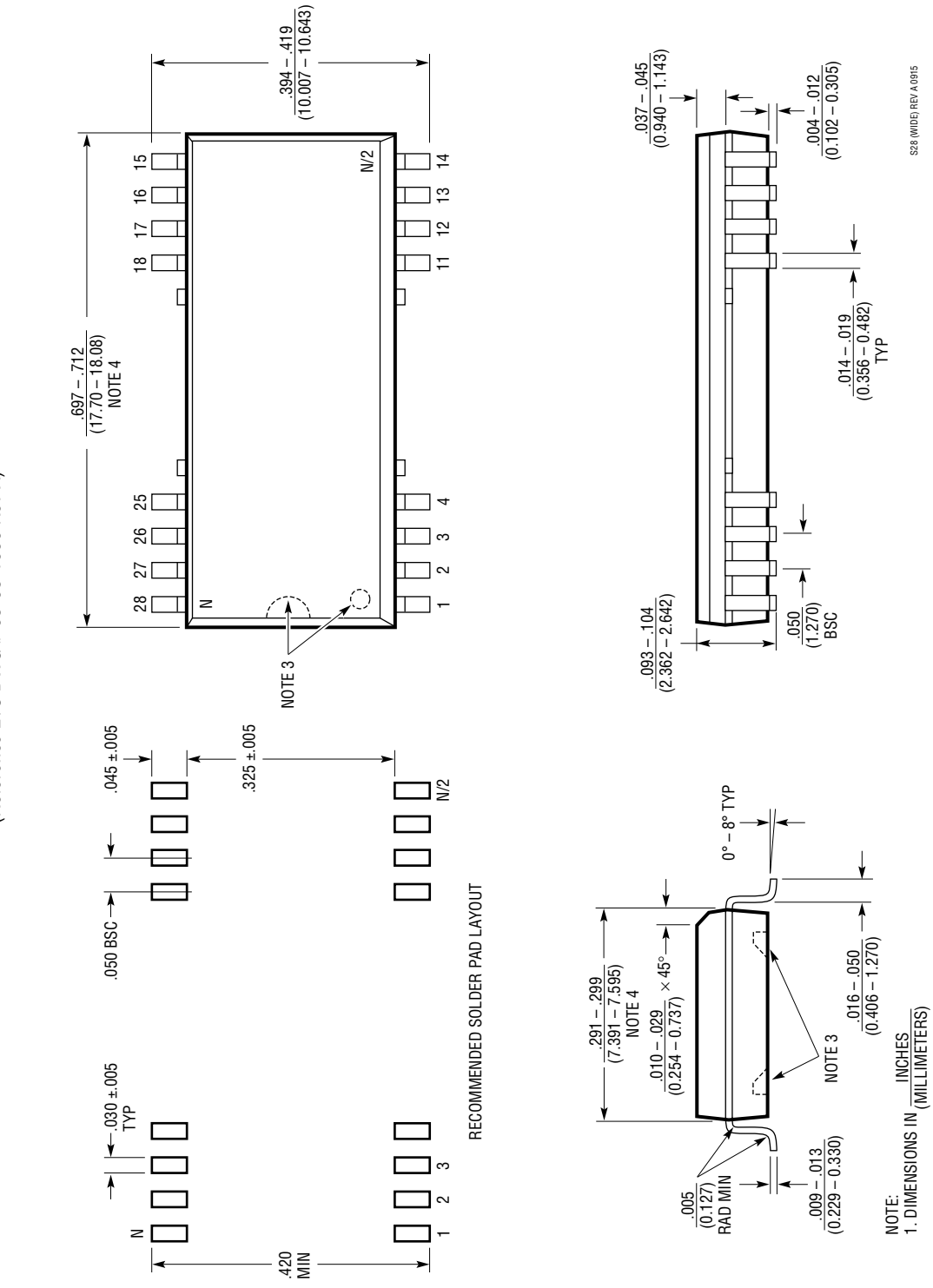
Full-Duplex Connection



PACKAGE DESCRIPTION

Please refer to http://www.linear.com/product/LTC1535#packaging for the most recent package drawings.

SW Package
Variation: SW28(16)
28-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1690 Rev A)



NOTE:
1. DIMENSIONS IN INCHES (MILLIMETERS)
2. DRAWING NOT TO SCALE
3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

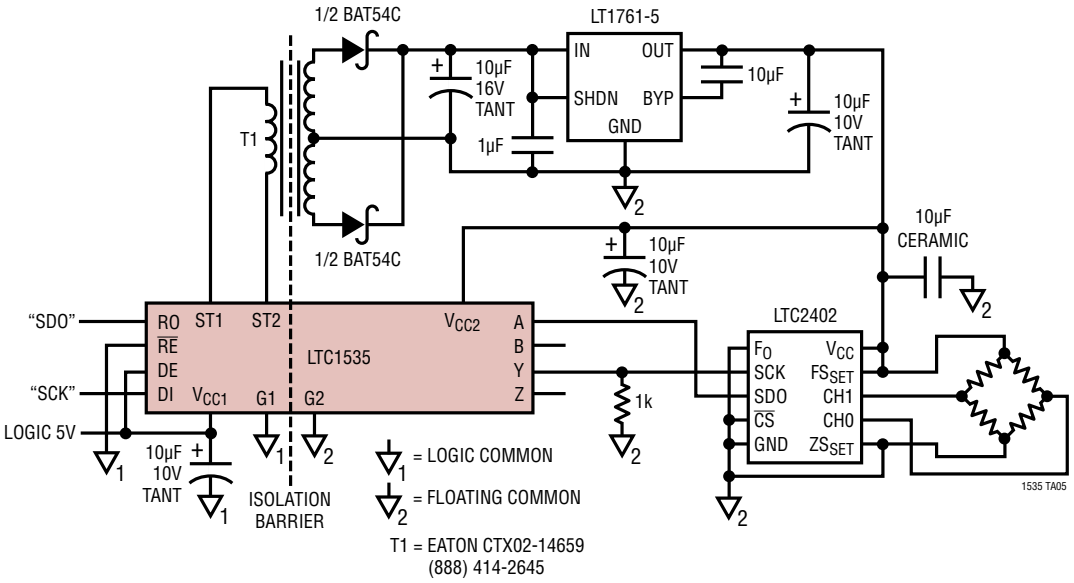
REVISION HISTORY (Revision history begins at Rev B)

REV	DATE	DESCRIPTION	PAGE NUMBER
B	12/09	Update Manufacturer's Information on Typical Application and Figure 10	1, 10
		Revise Receiver Input Hysteresis Conditions	3
		Revise Block Diagram	7
		Revise Figure 1.	8
		Update Tables 1 and 3	12
C	8/17	Updated External Transformer Recommendations	1, 5, 8, 10, 12, 15

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

TYPICAL APPLICATION

Complete, Isolated 24-Bit Data Acquisition System



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTM2881	Isolated RS485/RS422 µModule Transceiver + Power	20Mbps 2500V_{RMS} Isolation with Power in LGA/BGA Package
LTM2885	6500V_{RMS} Isolated RS485/RS422 µModule Transceiver + Power	20Mbps 6500V_{RMS} Isolation with Power in LGA/BGA Package
LTC2862A	±60V Fault Protected 3V to 5.5V RS485/RS422 Transceiver	±60V Tolerant, ±40kV HBM ESD, IEC Level 4 ESD and EFT, ±25V Common Mode Range, 20Mbps or 250kbps
LTC2861	20Mbps RS485 Transceivers with Integrated Switchable Termination Full Duplex	±15kV ESD
LTC2856/LTC2857/ LTC2858	20Mbps and Slew Rate Limited 15kV RS485/RS422 Transceivers	Low EMI 250kbps, Micropower Shutdown
LT1785/LT1791	±60V Fault Protected RS485 Transceiver, Half/Full-Duplex	±15kV ESD Protection, Industry Standard Pinout
LTC2870/LTC2871	RS232/RS485 Multiprotocol Transceivers with Integrated Termination	20Mbps RS485 and 500kbps RS232, ±26kV ESD, 3V to 5.5V Operation

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