# LINEAR TECHNOLOGY

## LT1785/LT1791

# 60V Fault Protected RS485/RS422 Transceivers

December 1998

## FEATURES

- **Protected from Overvoltage Line Faults to ±60V**
- Pin Compatible with LTC485 and LTC491
- High Input Impedance Supports Up to 64 Nodes
- No Damage or Latchup to ESD
    - IEC-1000-4-2 Level 4: ±15kV Air Discharge
    - IEC-1000-4-2 Level 2: ±4kV Contact Discharge
- Controlled Slew Rates for EMI Emissions Control
- Outputs Assume a High Impedance When Off or Powered Down
- Short-Circuit Protection on All Outputs
- Thermal Shutdown Protection

## APPLICATIONS

- Industrial Control Data Networks
- CAN Bus Applications
- HVAC Controls

## DESCRIPTION

The LT®1785/LT1791 are half-duplex and full-duplex differential bus transceivers for RS485 and RS422 applications which feature on-chip protection from overvoltage faults on the data transmission lines. Receiver input and driver output pins can withstand voltage faults up to ±60V with respect to ground with no damage to the device. Faults may occur while the transceiver is active, shut down or powered off.

Data rates to 250kbaud on networks of up to 64 nodes are supported. Controlled slew rates on the driver outputs control EMI emissions and improve data transmission integrity on improperly terminated lines.

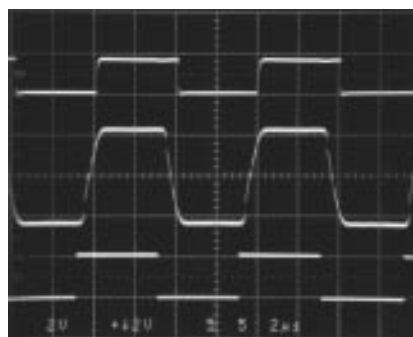On-chip ESD protection eliminates need for external protection devices.

The LT1785 is available in 8-lead DIP and SO packages and the LT1791 in 14-lead DIP and SO packages.

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## TYPICAL APPLICATION



1785/91 TA01
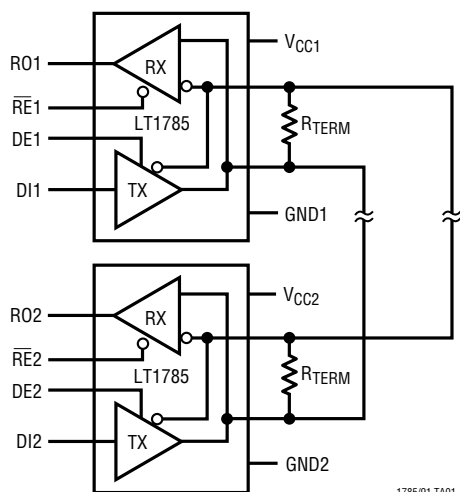
**Normal Operation Waveforms at 250kBaud**



1785/91 TA02

# ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage ($V_{CC}$) ............................................. 18V
Receiver Enable Input Voltage .................... −0.3V to 6V
Driver Enable Input Voltage ........................ −0.3V to 6V
Driver Input Voltage................................. −0.3V to 18V
Receiver Input Voltage ............................. −60V to 60V
Driver Output Voltage ............................... − 60V to 60V

Receiver Output Voltage ............................. −0.3V to 6V
Operating Temperature Range
　　LT1785C/LT1791C ................................. 0°C to 70°C
　　LT1785I/LT1791I.............................. −40°C to 85°C
Storage Temperature Range ............... −65°C to 150°C
Lead Temperature (Soldering, 10 sec)................. 300°C

# PACKAGE/ORDER INFORMATION

| TOP VIEW | ORDER PART NUMBER |
|---|---|
| RO [1]　[8] $V_{CC}$<br>$\overline{RE}$ [2]　[7] B<br>DE [3]　[6] A<br>DI [4]　[5] GND<br><br>N8 PACKAGE　　S8 PACKAGE<br>8-LEAD PDIP　8-LEAD PLASTIC SO | LT1785CN8<br>LT1785CS8<br>LT1785IN8<br>LT1785IS8 |
| $T_{JMAX}$ = 125°C, $\theta_{JA}$ = 130°C/ W (N8)<br>$T_{JMAX}$ = 125°C, $\theta_{JA}$ = 150°C/ W (S8) | **S8 PART MARKING**<br><br>1785<br>1785I |

| TOP VIEW | ORDER PART NUMBER |
|---|---|
| NC [1]　[14] $V_{CC}$<br>RO [2]　[13] NC<br>$\overline{RE}$ [3]　[12] A<br>DE [4]　[11] B<br>DI [5]　[10] Z<br>GND [6]　[9] Y<br>GND [7]　[8] NC<br><br>N PACKAGE　　S PACKAGE<br>14-LEAD PDIP　14-LEAD PLASTIC SO<br><br>$T_{JMAX}$ = 125°C, $\theta_{JA}$ = 130°C/ W (N)<br>$T_{JMAX}$ = 125°C, $\theta_{JA}$ = 150°C/ W (S) | LT1791CN<br>LT1791CS<br>LT1791IN<br>LT1791IS |

Consult factory for Military grade parts.

# DC ELECTRICAL CHARACTERISTICS $V_{CC}$ = 5V, $T_A$ = 25°C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $V_{OD1}$ | Differential Driver Output Voltage (Unloaded) | $I_O$ = 0 | ● | | 4.1 | 5 | V |
| $V_{OD2}$ | Differential Driver Output Voltage (With Load) | R = 50Ω (RS422), Figure 1 | ● | 2.0 | 2.70 | | V |
| | | R = 27Ω (RS485), Figure 1 | ● | 1.5 | 2.45 | | V |
| | | R = 18Ω | ● | 1.2 | 2.2 | | V |
| $\Delta V_{OD}$ | Change in Magnitude of Driver Differential Output Voltage for Complementary Output States | R = 27Ω or R = 50Ω, Figure 1 | ● | | | 0.2 | V |
| $V_{OC}$ | Driver Common Mode Output Voltage | R = 27Ω or R = 50Ω, Figure 1 | ● | 2 | 2.5 | 3 | V |
| $\Delta\lvert V_{OC}\rvert$ | Change in Magnitude of Driver Common Mode Output Voltage for Complementary Output States | R = 27Ω or R = 50Ω, Figure 1 | ● | | | 0.2 | V |
| $V_{IH}$ | Input High Voltage | DI, DE, $\overline{RE}$ | ● | 2 | | | V |
| $V_{IL}$ | Input Low Voltage | DI, DE, $\overline{RE}$ | ● | | | 0.8 | V |
| $I_{IN1}$ | Input Current | DI, DE, $\overline{RE}$ | ● | | | 5 | μA |
| $I_{IN2}$ | Input Current (A, B); (LT1791 or LT1785 with DE = 0V) | $V_{IN}$ = 12V | ● | | 0.3 | 0.6 | mA |
| | | $V_{IN}$ = −7V | ● | −0.15 | −0.08 | | mA |
| | | −60V ≤ $V_{IN}$ ≤ 60V | ● | −6 | | 6 | mA |
| $V_{TH}$ | Differential Input Threshold Voltage for Receiver | −7V ≤ $V_{CM}$ ≤ 12V | ● | −0.2 | | 0.2 | V |
| $\Delta V_{TH}$ | Receiver Input Hysteresis | −7V < $V_{CM}$ < 12V | | | 20 | | mV |
| $V_{OH}$ | Receiver Output High Voltage | $I_O$ = −400μA, $V_{ID}$ = 200mV | ● | 3.5 | 4 | | V |
| $V_{OL}$ | Receiver Output Low Voltage | $I_O$ = 1.6mA, $V_{ID}$ = −200mV | ● | | 0.3 | 0.5 | V |
| | Three-State (High Impedance) Output Current at Receiver 0V < $V_{OUT}$ < $V_{CC}$ + 6V | $\overline{RE}$ > 2V or Power Off | ● | −1 | | 1 | μA |
| $R_{IN}$ | Receiver Input Resistance (LT1791) | −7V ≤ $V_{CM}$ ≤ 12V | ● | 85 | 125 | | kΩ |
| | | −60V ≤ $V_{CM}$ ≤ 60V | ● | 85 | 125 | | kΩ |
| | LT1785 | −7V ≤ $V_{CM}$ ≤ 12V | ● | 25 | | | kΩ |
| | RS485 Unit Load | | | | | 0.5 | |
| | Supply Current | No Load, $\overline{RE}$ = 0V, DE = 5V | ● | | 5.5 | 9 | mA |
| | | No Load, $\overline{RE}$ = 5V, DE = 5V | ● | | 5.5 | 9 | mA |
| | | No Load, $\overline{RE}$ = 0V, DE = 0V | ● | | 4.5 | 8 | mA |
| | | No Load, $\overline{RE}$ = 5V, DE = 0V | ● | | 0.2 | 0.3 | mA |
| $I_{SC}$ | Driver Short-Circuit Current | $V_{OUT}$ = HIGH, Force $V_O$ = −7V | ● | 35 | | 250 | mA |
| | | $V_{OUT}$ = LOW, Force $V_O$ = 12V | ● | 35 | | 250 | mA |
| | Driver Output Fault Current | $V_O$ = 60V | ● | | | 6 | mA |
| | | $V_O$ = −60V | ● | −6 | | | mA |
| | Receiver Short-Circuit Current | 0V ≤ $V_O$ ≤ $V_{CC}$ | ● | | | ±30 | mA |
| | Driver Three-State Output Current | −7V ≤ $V_O$ ≤ 12V | ● | −0.2 | | 0.6 | mA |
| | | −60V ≤ $V_O$ ≤ 60V | ● | −6 | | 6 | mA |

# SWITCHING CHARACTERISTICS  $V_{CC}$ = 5V, $T_A$ = 25°C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Driver Input to Output | Figures 3, 5 | ● | | 700 | 2000 | ns |
| $t_{PHL}$ | Driver Input to Output | Figures 3, 5 | ● | | 700 | 2000 | ns |
| $t_{SKEW}$ | Driver Output to Output | Figures 3, 5 | | | 100 | | ns |
| $t_r$, $t_f$ | Driver Rise or Fall Time | Figures 3, 5 | ● | 200 | 800 | 2000 | ns |
| $t_{ZH}$ | Driver Enable to Output High | Figures 4, 6 | ● | | 500 | 3000 | ns |
| $t_{ZL}$ | Driver Enable to Output Low | Figures 4, 6 | ● | | 800 | 3000 | ns |
| $t_{LZ}$ | Driver Disable Time from Low | Figures 4, 6 | ● | | 200 | 3000 | ns |
| $t_{HZ}$ | Driver Disable Time from High | Figures 4, 6 | ● | | 800 | 3000 | ns |
| $t_{PLH}$ | Receiver Input to Output | Figures 3, 7 | ● | | 400 | 900 | ns |
| $t_{PHL}$ | Receiver Input to Output | Figures 3, 7 | ● | | 400 | 900 | ns |
| $t_{SKD}$ | Differential Receiver Skew | | | | 200 | | ns |
| $t_{ZL}$ | Receiver Enable to Output Low | Figures 2, 8 | ● | | 300 | 1000 | ns |
| $t_{ZH}$ | Receiver Enable to Output High | Figures 2, 8 | ● | | 300 | 1000 | ns |
| $t_{LZ}$ | Receiver Disable from Low | Figures 2, 8 | ● | | 400 | 1000 | ns |
| $t_{HZ}$ | Receiver Disable from High | Figures 2, 8 | ● | | 400 | 1000 | ns |
| $f_{MAX}$ | Maximum Data Rate | | ● | 250 | | | kbps |
| $t_{SHDN}$ | Time to Shut Down | Figures 2, 6, 8 | | | 3 | | µs |
| $t_{ZH(SHDN)}$ | Driver Enable from Shutdown to Output High | Figures 2, 6; $\overline{RE}$ = 5V | | | 12 | | µs |
| $t_{ZL(SHDN)}$ | Driver Enable from Shutdown to Output Low | Figures 2, 6; $\overline{RE}$ = 5V | | | 12 | | µs |
| $t_{ZH(SHDN)}$ | Receiver Enable from Shutdown to Output High | Figures 2, 8; DE = 0V | | | 4 | | µs |
| $t_{ZL(SHDN)}$ | Receiver Enable from Shutdown to Output Low | Figures 2, 8; DE = 0V | | | 4 | | µs |

The ● denotes specifications which apply over the full operating temperature range.

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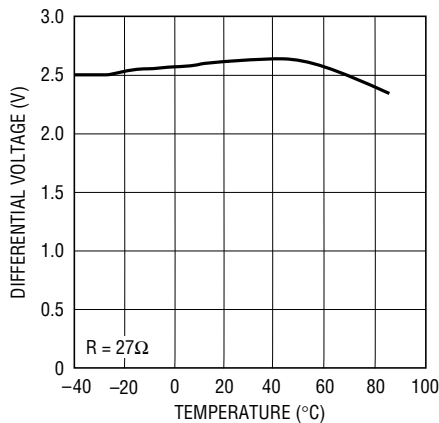
# TYPICAL PERFORMANCE CHARACTERISTICS

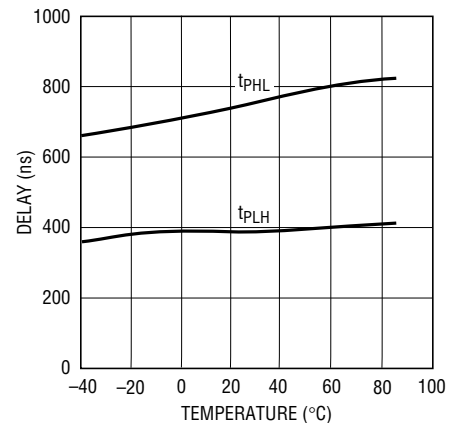**Driver Differential Output Voltage vs Load Resistance**
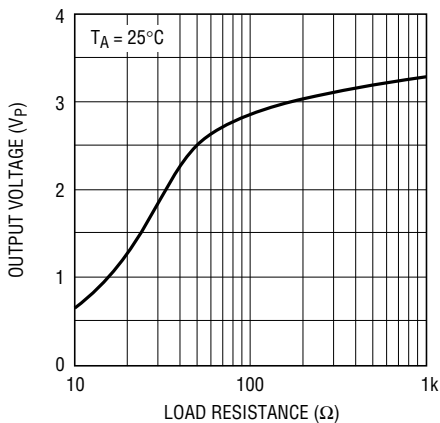


1785/91 G01

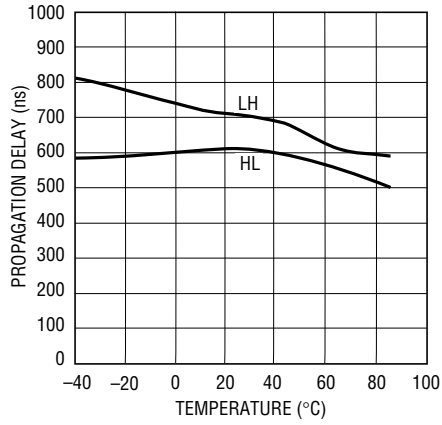**Driver Differential Output Voltage vs Temperature**



1785/91 G03

**Receiver Propagation Delay vs Temperature**
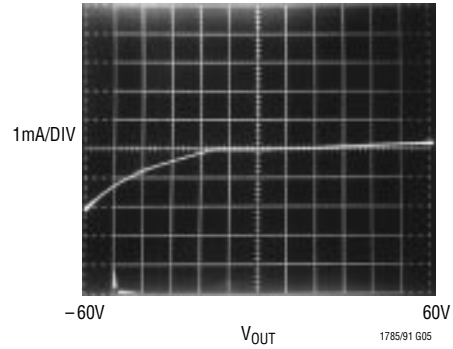


1785/91 G03

LINEAR TECHNOLOGY

# TYPICAL PERFORMANCE CHARACTERISTICS

**Driver Propagation Delay vs Temperature**
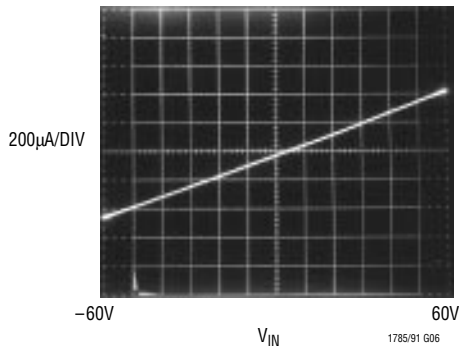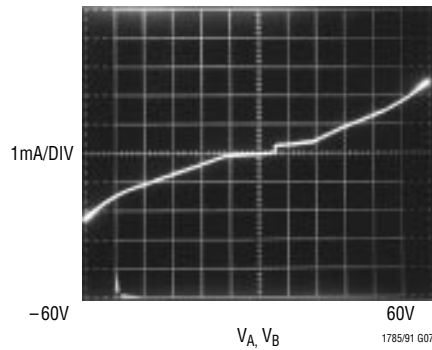


1785/91 G04

**LT1791 Driver Output Leakage DE = 0V**
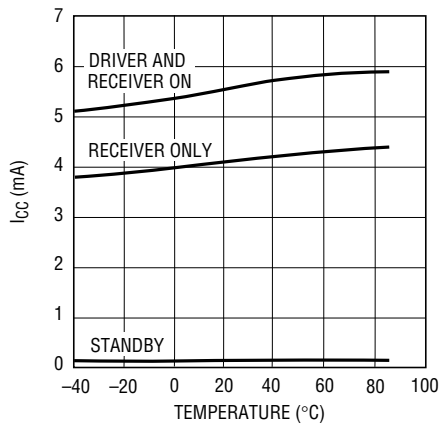


1785/91 G05

**LT1791 Receiver Input Current vs $V_{IN}$**



1785/91 G06

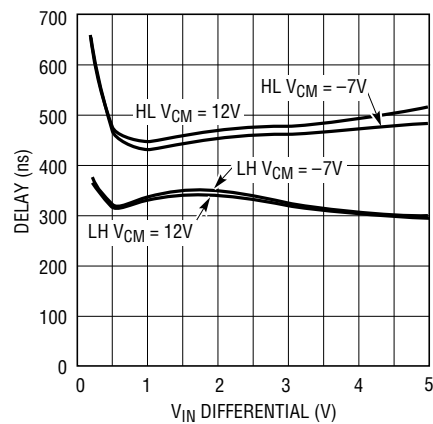**LT1785 Input Characteristics Pins A or B; DE = $\overline{RE}$ = 0V**



1785/91 G07

**Supply Current vs Temperature**



1785/91 G08

**Receiver Propagation Delay vs Differential Input Voltage**



1785/91 G09

# LT1785/LT1791

## PIN FUNCTIONS

**RO:** Receiver Output. TTL level logic output. If the receiver is active ($\overline{RE}$ pin low), RO is high if receiver input A ≥ B by 200mV. If A ≤ B by 200mV, then RO will be low. RO assumes a high impedance output state when $\overline{RE}$ is high or the part is powered off. RO is protected from output shorts from ground to $V_{CC}$ + 6V.

**$\overline{RE}$:** Receiver Output Enable. TTL level logic input. A logic low on $\overline{RE}$ enables normal operation of the receiver output RO. A logic high level at $\overline{RE}$ places the receiver output pin RO into a high impedance state. If receiver enable $\overline{RE}$ and driver enable DE are both in the disable state, the circuit goes to a low power shutdown state. Placing either $\overline{RE}$ or DE into its active state brings the circuit out of shutdown. Shutdown state is not entered until a 3µs delay after both $\overline{RE}$ and DE are disabled, allowing for logic skews in toggling between transmit and receive modes of operation. For CAN bus applications, $\overline{RE}$ should be tied low to prevent the circuit from entering shutdown.

**DE:** Driver Output Enable. TTL level logic input. A logic high on DE enables normal operation of the driver outputs (Y and Z on LT1791, A and B on LT1785). A logic low level at DE places the driver output pins into a high impedance state. If receiver enable $\overline{RE}$ and driver enable DE are both in the disable state, the circuit goes to a low power shutdown state. Placing either $\overline{RE}$ or DE into its active state brings the circuit out of shutdown. Shutdown state is not entered until a 3µs delay after both $\overline{RE}$ and DE are disabled, allowing for logic skews in toggling between transmit and receive modes of operation. For CAN bus operation the DE pin is used for signal input to place the data bus in dominant or recessive states.

**DI:** Driver Input. TTL level logic input. A logic high at DI causes driver output A or Y to a high state, and output B or Z to a low state. Complementary output states occur for DI low. For CAN bus applications DI should be tied low.

**GND:** Ground.

**Y:** Driver Output. The Y driver output is in phase with the driver input DI. In the LT1785 driver output Y is internally connected to receiver input A. The driver output assumes a high impedance state when DE is low, power is off or thermal shutdown is activated. The driver output is protected from shorts between ±60V in both active and high impedance modes. For CAN applications output Y is the CANL output node.

**Z:** Driver Output. The Z driver output is opposite in phase to the driver input DI. In the LT1785 driver output Z is internally connected to receiver input B. The driver output assumes a high impedance state when DE is low, power is off or thermal shutdown is activated. The driver output is protected from shorts between ±60V in both active and high impedance modes. For CAN applications output Z is the CANH output node.

**A:** Receiver Input. The A receiver input forces a high receiver output when V(A) ≥ [V(B) + 200mV]. V(A) ≤ [V(B) – 200mV] forces a receiver output low. Receiver inputs A and B are protected against voltage faults between ±60V. The high input impedance allows up to 64 LT1785 or LT1791 transceivers on one RS485 data bus.

**B:** Receiver Input. The B receiver input forces a high receiver output when V(A) ≥ [V(B) + 200mV]. V(A) ≤ [V(B) – 200mV] forces a receiver output low. Receiver inputs A and B are protected against voltage faults between ±60V. The high input impedance allows up to 64 LT1785 or LT1791 transceivers on one RS485 data bus.

**$V_{CC}$:** Positive Supply Input. For RS422 or RS485 operation 4.75V ≤ $V_{CC}$ ≤ 5.25V. Higher $V_{CC}$ input voltages increase output drive swing. $V_{CC}$ should be decoupled with a 0.1µF low ESR capacitor.

# FUNCTION TABLES

**LT1785 Transmitting**

| INPUTS | | | OUTPUTS | | |
|---|---|---|---|---|---|
| $\overline{RE}$ | DE | DI | A | B | RO |
| 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | X | Hi-Z | Hi-Z | Hi-Z |
| 1 | 1 | 0 | 0 | 1 | Hi-Z |
| 1 | 1 | 1 | 1 | 0 | Hi-Z |

**LT1785 Receiving**

| INPUTS | | | | OUTPUT |
|---|---|---|---|---|
| $\overline{RE}$ | DE | DI | A-B | RO |
| 0 | 0 | X | $\leq -200$mV | 0 |
| 0 | 0 | X | $\geq 200$mV | 1 |
| 0 | 0 | X | Open | 1 |
| 1 | 0 | X | X | Hi-Z |

**LT1791**

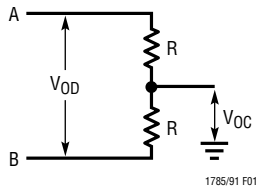| INPUTS | | | | OUTPUTS | | |
|---|---|---|---|---|---|---|
| $\overline{RE}$ | DE | DI | A-B | Y | Z | RO |
| 0 | 0 | X | $\leq -200$mV | Hi-Z | Hi-Z | 0 |
| 0 | 0 | X | $\geq 200$mV | Hi-Z | Hi-Z | 1 |
| 0 | 0 | X | Open | Hi-Z | Hi-Z | 1 |
| 0 | 1 | 0 | $\leq -200$mV | 0 | 1 | 0 |
| 0 | 1 | 0 | $\geq 200$mV | 0 | 1 | 1 |
| 0 | 1 | 0 | Open | 0 | 1 | 1 |
| 0 | 1 | 1 | $\leq -200$mV | 1 | 0 | 0 |
| 0 | 1 | 1 | $\geq 200$mV | 1 | 0 | 1 |
| 0 | 1 | 1 | Open | 1 | 0 | 1 |
| 1 | 0 | X | X | Hi-Z | Hi-Z | Hi-Z |
| 1 | 1 | 0 | X | 0 | 1 | Hi-Z |
| 1 | 1 | 1 | X | 1 | 0 | Hi-Z |

# TEST CIRCUITS



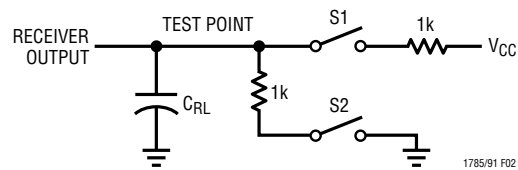Figure 1. Driver DC Test Load

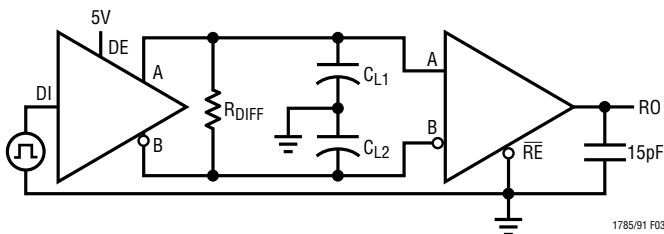

Figure 2. Receiver Timing Test Load



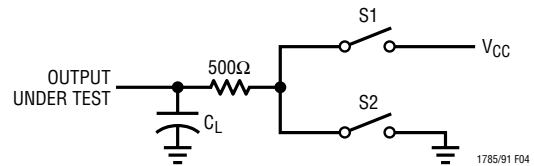Figure 3. Driver/Receiver Timing Test Circuit



Figure 4. Driver Timing Test Load

# SWITCHING TIME WAVEFORMS
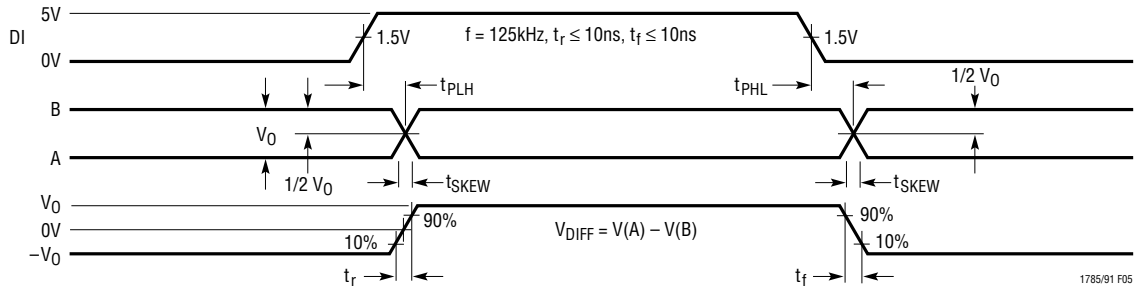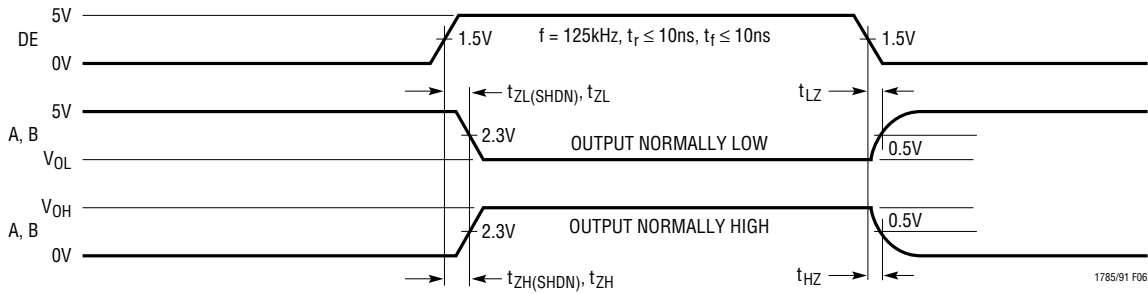


**Figure 5. Driver Propagation Delays**



**Figure 6. Driver Enable and Disable Times**
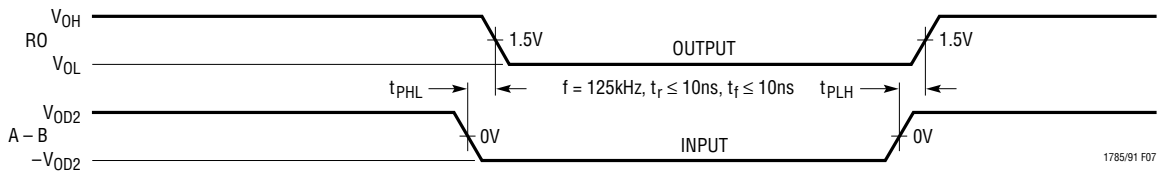


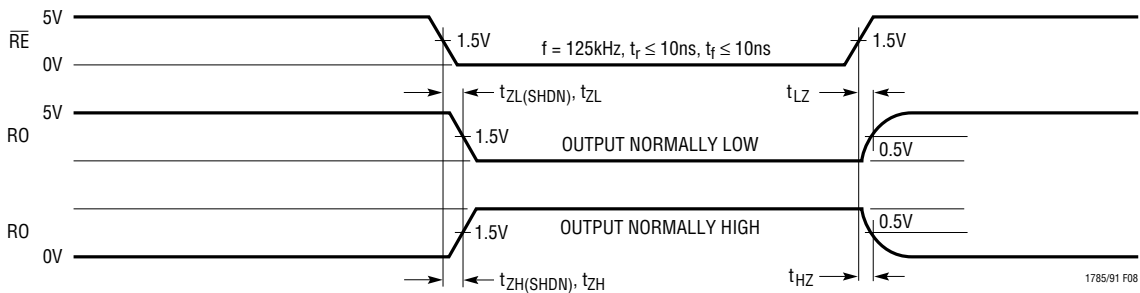**Figure 7. Receiver Propagation Delays**



**Figure 8. Receiver Enable and Disable Times**

# APPLICATIONS INFORMATION

### Overvoltage Protection

The LT1785/LT1791 RS485/RS422 transceivers answer an applications need for overvoltage fault tolerance on data networks. Industrial installations may encounter common mode voltages between nodes far greater than the –7V to 12V range specified for compliance to RS485 standards. CMOS RS485 transceivers can be damaged by voltages above their absolute maximum ratings of typically –8V to 12.5V. Replacement of standard RS485 transceiver components with the LT1785 or LT1791 devices eliminates field failures due to overvoltage faults or the use of costly external protection devices. The limited overvoltage tolerance of CMOS RS485 transceivers makes implementation of effective external protection networks difficult without interfering with proper data network performance within the –7V to 12V region of RS485 operation.

The high overvoltage rating of the LT1785/LT1791 facilitates easy extension to almost any level. Simple discrete component networks that limit the receiver input and driver output voltages to less than ±60V can be added to the device to extend protection to any desired level. Figure 11 shows a protection network against faults to the 120VAC line voltage.

The LT1785/LT1791 protection is achieved by using a high voltage bipolar integrated circuit process for the transceivers. The naturally high breakdown voltages of the bipolar process provides protection in powered-off and high impedance conditions. The driver outputs use a foldback current limit design to protect against overvoltage faults while still allowing high current output drive.

### Low Power Shutdown

The LT1785/LT1791 have $\overline{RE}$ and DE logic inputs to control the receive and transmit modes of the transceivers. The $\overline{RE}$ input allows normal data reception when in the low state. The receiver output goes to a high impedance state when $\overline{RE}$ is high, allowing multiplexing the RO data

line. The DE logic input performs a similar function on the driver outputs. A high state on DE activates the differential driver outputs, a low state places both driver outputs into high impedance. Tying the $\overline{RE}$ and DE logic inputs together may be done to allow one logic signal to toggle the transceiver from receive to transmit modes. The DE input is used as the data input in CAN bus applications.

Disabling both the driver and receiver places the device into a low supply current shutdown mode. An internal time delay of 3µs minimum prevents entering shutdown due to small logic skews when a toggle between receive and transmit is desired. The recovery time from shutdown mode is typically 12µs. The user must be careful to allow for this wake-up delay from shutdown mode. To allow full 250kbaud data rate transmission in CAN applications, the $\overline{RE}$ pin should be tied low to prevent entering shutdown mode.

### Slew Limiting for EMI Emissions Control

The LT1785/LT1791 feature controlled driver output slew rates to control high frequency EMI emissions from equipment and data cables. The slew limiting limits data rate operation to 250kbaud. Slew limiting also mitigates the adverse affects of imperfect transmission line termination caused by stubs or mismatched cable. In some low speed, short distance networks, cable termination may be eliminated completely with no adverse effect on data transmission.

### Data Network Cable Selection and Termination

Long distance data networks operating at high data transmission rates should use high quality, low attenuation cable with well-matched cable terminations. Short distance networks at low data rates may use much less expensive PVC cable. These cables may have characteristic impedance as low as 72Ω. The LT1785/LT1791 output drivers are guaranteed to drive cables as low as 72Ω.
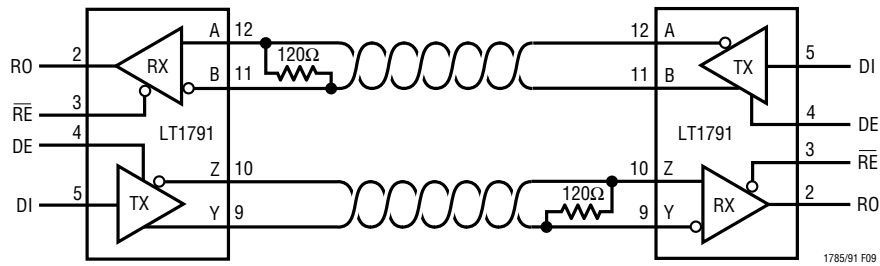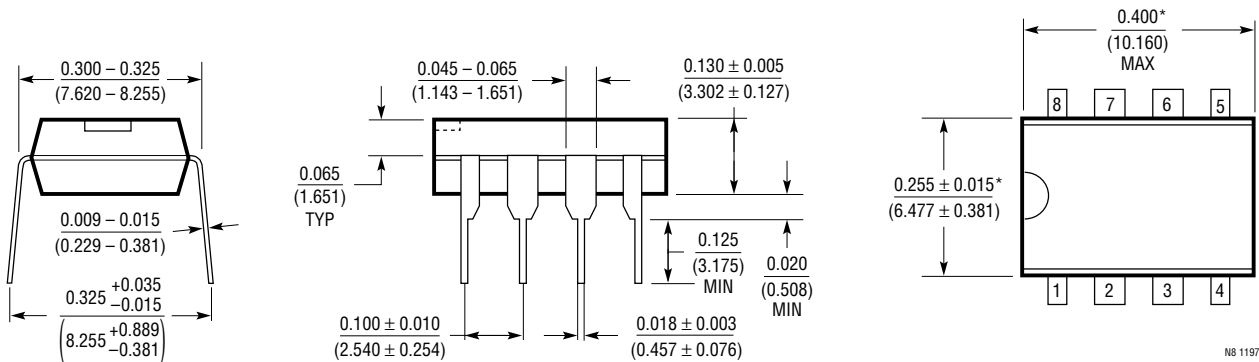
# APPLICATIONS INFORMATION



**Figure 9. Full-Duplex RS422**
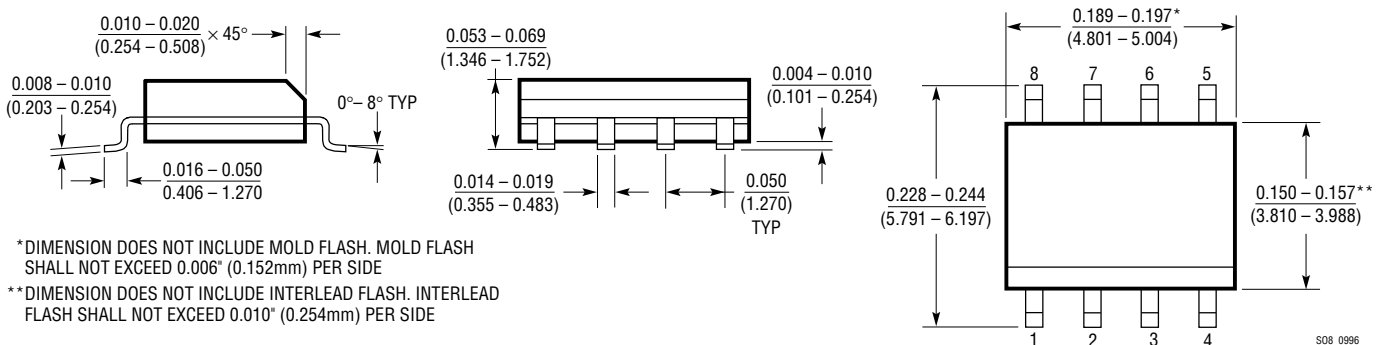
# PACKAGE DESCRIPTION
Dimensions in inches (millimeters) unless otherwise noted.

**N8 Package**
**8-Lead PDIP (Narrow 0.300)**
(LTC DWG # 05-08-1510)



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

**S8 Package**
**8-Lead Plastic Small Outline (Narrow 0.150)**
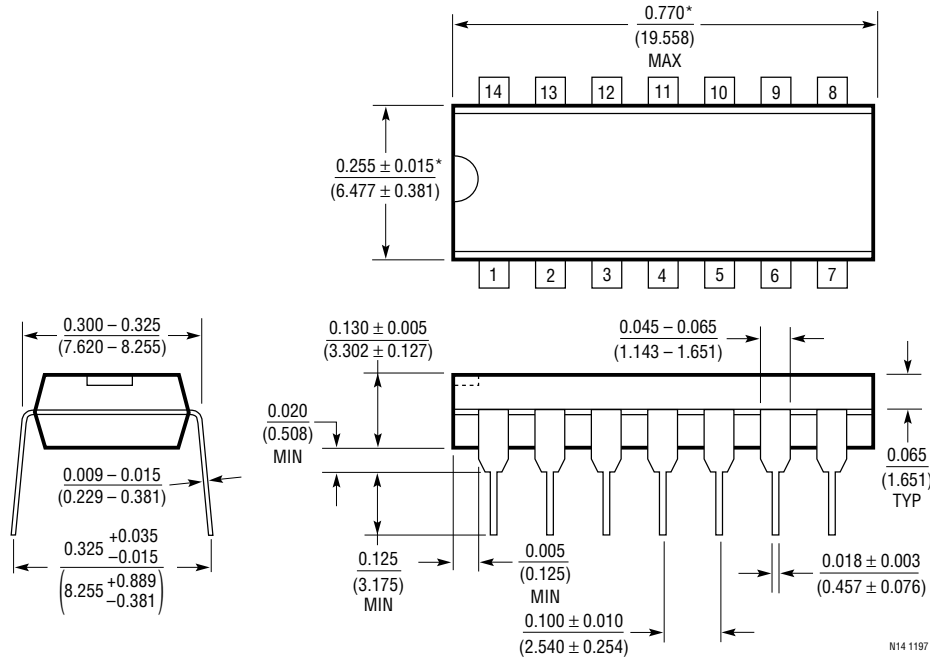(LTC DWG # 05-08-1610)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH
SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE
**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD
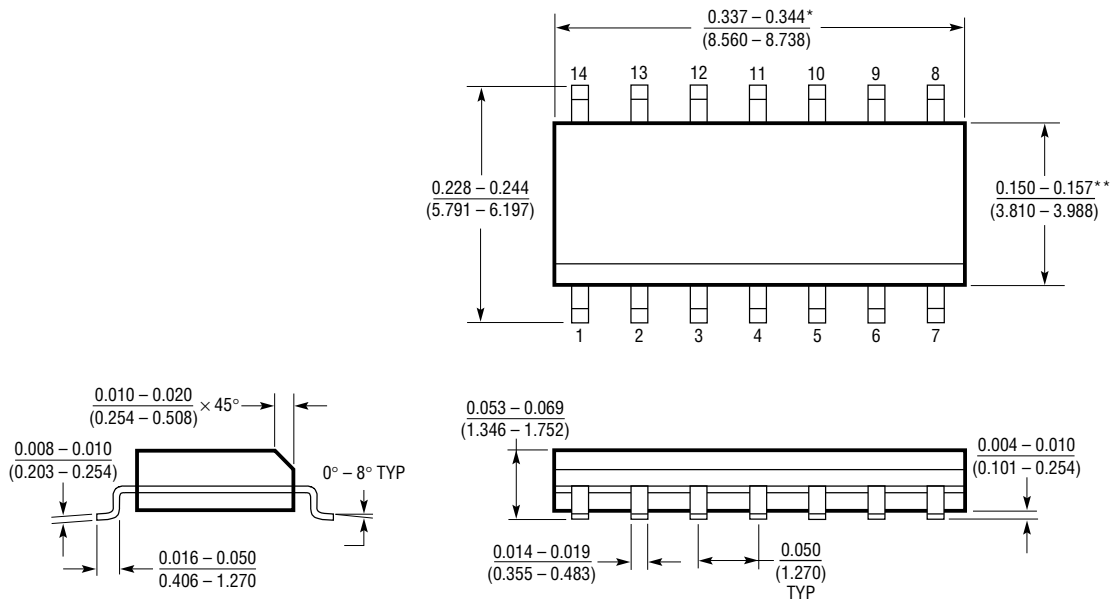FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

# PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

**N Package**
**14-Lead PDIP (Narrow 0.300)**
(LTC DWG # 05-08-1510)

0.770*
(19.558)
MAX

14  13  12  11  10  9  8

0.255 ± 0.015*
(6.477 ± 0.381)

1  2  3  4  5  6  7

0.300 − 0.325
(7.620 − 8.255)

0.009 − 0.015
(0.229 − 0.381)

$0.325\,^{+0.035}_{-0.015}$
$\left(8.255\,^{+0.889}_{-0.381}\right)$

0.130 ± 0.005
(3.302 ± 0.127)

0.020
(0.508)
MIN

0.125
(3.175)
MIN

0.005
(0.125)
MIN

0.100 ± 0.010
(2.540 ± 0.254)

0.045 − 0.065
(1.143 − 1.651)

0.065
(1.651)
TYP

0.018 ± 0.003
(0.457 ± 0.076)

N14 1197

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

**S Package**
**14-Lead Plastic Small Outline (Narrow 0.150)**
(LTC DWG # 05-08-1610)

0.337 − 0.344*
(8.560 − 8.738)

14  13  12  11  10  9  8

0.228 − 0.244
(5.791 − 6.197)

0.150 − 0.157**
(3.810 − 3.988)

1  2  3  4  5  6  7

0.010 − 0.020
(0.254 − 0.508) × 45°

0.008 − 0.010
(0.203 − 0.254)

0° − 8° TYP

0.016 − 0.050
0.406 − 1.270

0.053 − 0.069
(1.346 − 1.752)

0.004 − 0.010
(0.101 − 0.254)

0.014 − 0.019
(0.355 − 0.483)

0.050
(1.270)
TYP

S14 0695

*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH
SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD
FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE
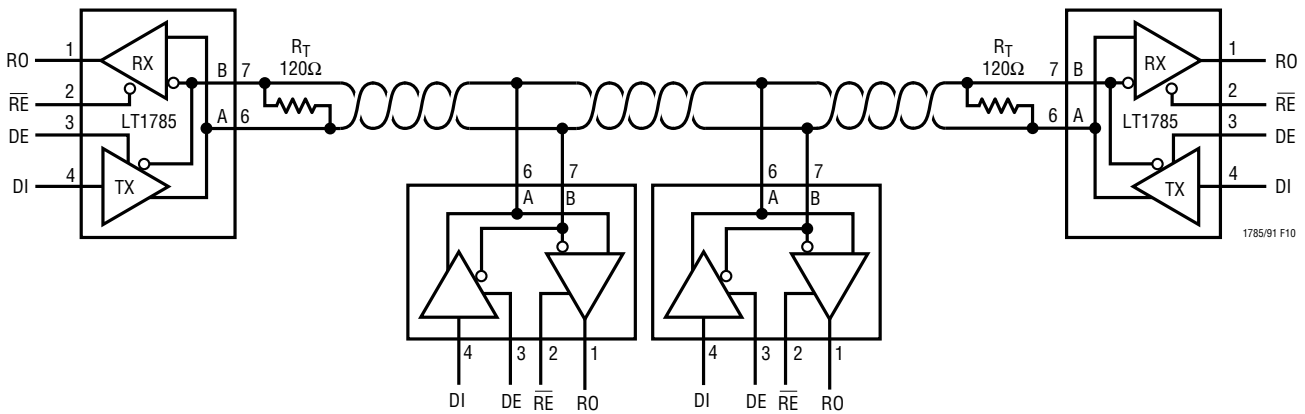
# TYPICAL APPLICATIONS
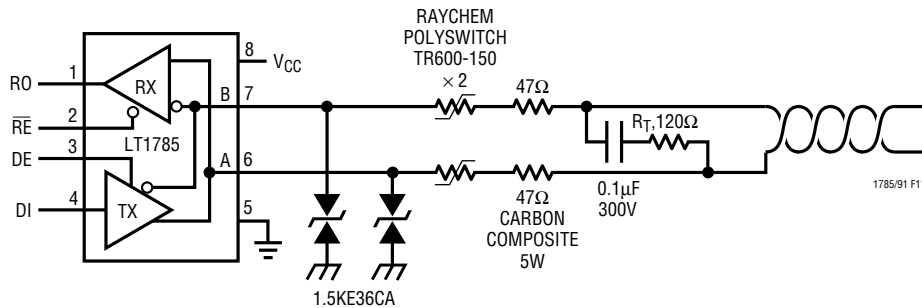


**Figure 10. Half-Duplex RS485 Network Operation**



**Figure 11. RS485 Network with 120V AC Line Fault Protection**

# RELATED PARTS

| PART NUMBER | DESCRIPTION | COMMENTS |
|---|---|---|
| LTC485 | Low Power RS485 Interface Transceiver | $I_{CC} = 300\mu A$ (Typ) |
| LTC491 | Differential Driver and Receiver Pair | $I_{CC} = 300\mu A$ |
| LTC1483 | Ultralow Power RS485 Low EMI Transceiver | Controlled Driver Slew Rate |
| LTC1485 | Differential Bus Transceiver | 10Mbaud Operation |
| LTC1487 | Ultralow Power RS485 with Low EMI, Shutdown and High Input Impedance | Up to 256 Transceivers on the Bus |
| LTC1520 | 50Mbps Precision Quad Line Receiver | Channel-to-Channel Skew 400ps (Typ) |
| LTC1685 | 52Mbps RS485 Half-Duplex Transceiver | Propagation Delay Skew 500ps (Typ) |
| LTC1687 | 52Mbps RS485 Full-Duplex Transceiver | Propagation Delay Skew 500ps (Typ) |