National Semiconductor

# DS16F95, DS36F95
# EIA-485/EIA-422A Differential Bus Transceiver

## General Description

The DS16F95/DS36F95 Differential Bus Transceiver is a monolithic integrated circuit designed for bidirectional data communication on balanced multipoint bus transmission lines. The transceiver meets both EIA-485 and EIA-422A standards.

The DS16F95/DS36F95 offers improved performance due to the use of L-FAST bipolar technology. The L-FAST technology allows for higher speeds and lower currents by minimizing gate delay times. Thus, the DS16F95 and DS36F95 consume less power, and feature an extended temperature range as well as improved specifications.

The DS16F95/DS36F95 combines a TRI-STATE® differential line driver and a differential input line receiver, both of which operate from a single 5.0V power supply. The driver and receiver have an active Enable that can be externally connected to function as a direction control. The driver differential outputs and the receiver differential inputs are internally connected to form differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus whenever the driver is disabled or when $V_{CC}$ = 0V. These ports feature wide positive and negative common mode voltage ranges, making the device suitable for multipoint applications in noisy environments.

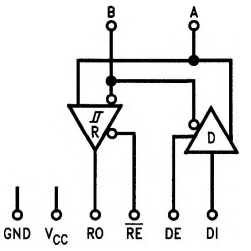
The driver is designed to accommodate loads of up to 60 mA of sink or source current and features positive and negative current limiting in addition to thermal shutdown for protection from line fault conditions.

The DS16F95/DS36F95 can be used in transmission line applications employing the DS96F172 and the DS96F174 quad differential line drivers and the DS96F173 and DS96F175 quad differential line receivers.

## Features

- Meets EIA-485 and EIA-422A
- Meets SCSI-1 (5 MHZ) specifications
- Designed for multipoint transmission
- Wide positive and negative input/output bus voltage ranges
- Thermal shutdown protection
- Driver positive and negative current-limiting
- High impedance receiver input
- Receiver input hysteresis of 50 mV typical
- Operates from single 5.0V supply
- Reduced power consumption
- Pin compatible with DS3695 and SN75176A
- Military temperature range available
- Qualified for MIL-STD 883C
- Standard Military Drawings (SMD) available
- Available in DIP (J), LCC (E), and Flatpak (W) packages

## Logic Diagram




TL/F/9629–20

## Function Tables

**Driver**

| Driver Input | Enable | Outputs | |
|---|---|---|---|
| DI | DE | A | B |
| H | H | H | L |
| L | H | L | H |
| X | L | Z | Z |

**Receiver**

| Differential Inputs | Enable | Output |
|---|---|---|
| A–B | $\overline{RE}$ | RO |
| $V_{ID} \geq 0.2V$ | L | H |
| $V_{ID} \leq -0.2V$ | L | L |
| X | H | Z |

H = High Level
L = Low Level
X = Immaterial
Z = High Impedance (Off)

## COMMERCIAL

### Absolute Maximum Ratings (Note 1)

**Specifications for the 883 version of this product are listed separately on the following pages.**

| | |
|---|---|
| Storage Temperature Range | −65°C to +175°C |
| Lead Temperature (Soldering, 60 sec.) | 300°C |
| Maximum Package Power Dissipation* at 25°C 'J' Package | 1300 mW |
| Supply Voltage | 7.0V |
| Input Voltage (Bus Terminal) | +15V/−10V |
| Enable Input Voltage | 5.5V |

*Derate 'J' package 8.7 mW/°C above 25°C.

### Recommended Operating Conditions

| | Min | Typ | Max | Units |
|---|---|---|---|---|
| Supply Voltage ($V_{CC}$) | | | | |
| DS36F95 | 4.75 | 5.0 | 5.25 | V |
| DS16F95 | 4.50 | 5.0 | 5.50 | V |
| Voltage at Any Bus Terminal (Separately or Common Mode) ($V_I$ or $V_{CM}$) | −7.0 | | +12 | V |
| Differential Input Voltage ($V_{ID}$) | | | ±12 | V |
| Output Current HIGH ($I_{OH}$) | | | | |
| Driver | | | −60 | mA |
| Receiver | | | −400 | μA |
| Output Current LOW ($I_{OL}$) | | | | |
| Driver | | | 60 | mA |
| Receiver | | | 16 | mA |
| Operating Temperature ($T_A$) | | | | |
| DS36F95 | 0 | +25 | +70 | °C |
| DS16F95 | −55 | +25 | +125 | °C |

### Driver Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified (Notes 2 & 3)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input Voltage HIGH | | | 2.0 | | | V |
| $V_{IL}$ | Input Voltage LOW | | | | | 0.8 | V |
| $V_{OH}$ | Output Voltage HIGH | $I_{OH}$ = −55 mA | 0°C to +70°C | 3.0 | | | V |
| $V_{OL}$ | Output Voltage LOW | $I_{OL}$ = 55 mA | 0°C to +70°C | | | 2.0 | V |
| $V_{IC}$ | Input Clamp Voltage | $I_I$ = −18 mA | | | | −1.3 | V |
| $\|V_{OD1}\|$ | Differential Output Voltage | $I_O$ = 0 mA | | | | 6.0 | V |
| $\|V_{OD2}\|$ | Differential Output Voltage | $R_L$ = 100Ω, *Figure 1* | | 2.0 | 2.25 | | V |
| | | $R_L$ = 54Ω, *Figure 1* | | 1.5 | 2.0 | | |
| $\Delta\|V_{OD}\|$ | Change in Magnitude of Differential Output Voltage (Note 4) | $R_L$ = 54Ω or 100Ω, *Figure 1* | −40°C to +125°C | | | ±0.2 | V |
| | | | −55°C to +125°C | | | ±0.4 | |
| $V_{OC}$ | Common Mode Output Voltage (Note 5) | | | | | 3.0 | V |
| $\Delta\|V_{OC}\|$ | Change in Magnitude of Common Mode Output Voltage (Note 4) | | | | | ±0.2 | V |
| $I_O$ | Output Current (Note 8) (Includes Receiver $I_I$) | Output Disabled | $V_O$ = +12V | | | 1.0 | mA |
| | | | $V_O$ = −7.0V | | | −0.8 | |
| $I_{IH}$ | Input Current HIGH | $V_I$ = 2.4V | | | | 20 | μA |
| $I_{IL}$ | Input Current LOW | $V_I$ = 0.4V | | | | −50 | μA |
| $I_{OS}$ | Short Circuit Output Current (Note 9) | $V_O$ = −7.0V | | | | −250 | mA |
| | | $V_O$ = 0V | | | | −150 | |
| | | $V_O$ = $V_{CC}$ | | | | 150 | |
| | | $V_O$ = +12V | | | | 250 | |
| $I_{CC}$ | Supply Current (Total Package) | No Load, All Inputs Open | DE = 2V, $\overline{RE}$ = 0.8V Outputs Enabled | | | 28 | mA |
| $I_{CCX}$ | | | DE = 0.8V, $\overline{RE}$ = 2V Outputs Disabled | | | 25 | |

## COMMERCIAL

### Driver Switching Characteristics $V_{CC}$ = 5.0V, $T_A$ = 25°C

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $t_{DD}$ | Differential Output Delay Time | $R_L$ = 60Ω, *Figure 3* | 8.0 | 15 | 20 | ns |
| $t_{TD}$ | Differential Output Transition Time | | 8.0 | 15 | 22 | ns |
| $t_{PLH}$ | Propagation Delay Time, Low-to-High Level Output | $R_L$ = 27Ω, *Figure 4* | 6.0 | 12 | 16 | ns |
| $t_{PHL}$ | Propagation Delay Time, High-to-Low Level Output | | 6.0 | 12 | 16 | ns |
| $t_{ZH}$ | Output Enable Time to High Level | $R_L$ = 110Ω, *Figure 5* | | 25 | 32 | ns |
| $t_{ZL}$ | Output Enable Time to Low Level | $R_L$ = 110Ω, *Figure 6* | | 25 | 32 | ns |
| $t_{HZ}$ | Output Disable Time from High Level | $R_L$ = 110Ω, *Figure 5* | | 20 | 25 | ns |
| $t_{LZ}$ | Output Disable Time from Low Level | $R_L$ = 110Ω, *Figure 6* | | 20 | 25 | ns |
| $t_{LZL}$ | Output Disable Time from Low Level with Load Resistor to GND | Load per *Figure 5* Timing per *Figure 6* | | 300 | | ns |
| $t_{SKEW}$ | Skew (Pulse Width Distortion) | $R_L$ = 60Ω, *Figure 3* | | 1.0 | 4.0 | ns |

### Receiver Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{TH}$ | Differential Input High Threshold Voltage | $V_O$ = 2.7V, $I_O$ = −0.4 mA | | | | 0.2 | V |
| $V_{TL}$ | Differential Input Low Threshold Voltage (Note 6) | $V_O$ = 0.5V, $I_O$ = 8.0 mA | | −0.2 | | | V |
| $V_{T+} - V_{T-}$ | Hysteresis (Note 7) | $V_{CM}$ = 0V | | 35 | 50 | | mV |
| $V_{IH}$ | Enable Input Voltage HIGH | | | 2.0 | | | V |
| $V_{IL}$ | Enable Input Voltage LOW | | | | | 0.8 | V |
| $V_{IC}$ | Enable Input Clamp Voltage | $I_I$ = −18 mA | | | | −1.3 | V |
| $V_{OH}$ | Output Voltage HIGH | $V_{ID}$ = 200 mV, $I_{OH}$ = −400 μA, *Figure 2* | 0°C to +70°C | 2.8 | | | V |
| | | | −55°C to +125°C | 2.5 | | | |
| $V_{OL}$ | Output Voltage LOW | $V_{ID}$ = −200 mV, *Figure 2* | $I_{OL}$ = 8.0 mA | | | 0.45 | V |
| | | | $I_{OL}$ = 16 mA | | | 0.50 | |
| $I_{OZ}$ | High Impedance State Output | $V_O$ = 0.4V to 2.4V | | | | ±20 | μA |
| $I_I$ | Line Input Current (Note 8) | Other Input = 0V | $V_I$ = +12V | | | 1.0 | mA |
| | | | $V_I$ = −7.0V | | | 0.8 | |
| $I_{IH}$ | Enable Input Current HIGH | $V_{IH}$ = 2.7V | | | | 20 | μA |
| $I_{IL}$ | Enable Input Current LOW | $V_{IL}$ = 0.4V | | | | −50 | μA |
| $R_I$ | Input Resistance | | | 14 | 18 | 22 | kΩ |
| $I_{OS}$ | Short Circuit Output Current | (Note 9) | | −15 | | −85 | mA |
| $I_{CC}$ | Supply Current (Total Package) | No Load, All Inputs Open | DE = 2V, $\overline{RE}$ = 0.8V Outputs Enabled | | | 28 | mA |
| $I_{CCX}$ | | | DE = 0.8V, $\overline{RE}$ = 2V Outputs Disabled | | | 25 | |

## COMMERCIAL

### Receiver Switching Characteristics $V_{CC}$ = 5.0V, $T_A$ = 25°C

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Time, Low-to-High Level Output | $V_{ID}$ = 0V to +3.0V, $C_L$ = 15 pF, *Figure 7* | 14 | 19 | 24 | ns |
| $t_{PHL}$ | Propagation Delay Time, High-to-Low Level Output | | 14 | 19 | 24 | ns |
| $t_{ZH}$ | Output Enable Time to High Level | $C_L$ = 15 pF, *Figure 8* | | 10 | 16 | ns |
| $t_{ZL}$ | Output Enable Time to Low Level | | | 12 | 18 | ns |
| $t_{HZ}$ | Output Disable Time from High Level | $C_L$ = 5.0 pF, *Figure 8* | | 12 | 20 | ns |
| $t_{LZ}$ | Output Disable Time from Low Level | | | 12 | 18 | ns |
| $\|t_{PLH} - t_{PHL}\|$ | Pulse Width Distortion (SKEW) | *Figure 7* | | 1.0 | 4.0 | ns |

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

**Note 2:** Unless otherwise specified min/max limits apply across the −55°C to +125°C temperature range for the DS16F95 and across the 0°C to +70°C range for the DS36F95. All typicals are given for $V_{CC}$ = 5V and $T_A$ = 25°C.

**Note 3:** All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.

**Note 4:** $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of $V_{OD}$ and $V_{OC}$, respectively, that occur when the input is changed from a high level to a low level.

**Note 5:** In TIA/EIA-422A and TIA/EIA-485 Standards, $V_{OC}$, which is the average of the two output voltages with respect to ground, is called output offset voltage, $V_{OS}$.

**Note 6:** The algebraic convention, where the less positive (more negative) limit is designated minimum, is used in this data sheet for common mode input voltage and threshold voltage levels only.

**Note 7:** Hysteresis is the difference between the positive-going input threshold voltage, $V_T+$, and the negative-going input threshold voltage, $V_T-$.

**Note 8:** Refer to TIA/EIA-485 Standard for exact conditions.

**Note 9:** Only one output at a time should be shorted.

### Order Number: DS16F95J, NS Package Number J08A
### DS36F95J, NS Package Number J08A

## MIL-STD 883C

### Absolute Maximum Ratings (Note 1)

**The 883 specifications are written to reflect the Rel Electrical Test Specifications (RETS) established by National Semiconductor for this product. For a copy of the RETS please contact your local National Semiconductor sales office or distributor.**

| | |
|---|---|
| Storage Temperature Range | −65°C to +175°C |
| Lead Temperature (Soldering, 60 sec.) | 300°C |
| Maximum Power Dissipation* at 25°C | |
| Ceramic 'E' Package | 1800 mW |
| Ceramic 'J' Package | 1300 mW |
| Ceramic 'W' Package | TBD |
| Supply Voltage | 7.0V |
| Input Voltage (Bus Terminal) | +15V/−10V |
| Enable Input Voltage | 5.5V |

*Above $T_A$ = 25°C, derate E package, J package 8.7 mW/°C, W package 12.5 mW/°C.

### Recommended Operating Conditions

| | Min | Max | Units |
|---|---|---|---|
| Supply Voltage ($V_{CC}$) | | | |
| DS16F95 | 4.50 | 5.50 | V |
| Voltage at Any Bus Terminal (Separately or Common Mode) ($V_I$ or $V_{CM}$) | −7.0 | +12 | V |
| Differential Input Voltage ($V_{ID}$) | | ±12 | V |
| Output Current HIGH ($I_{OH}$) | | | |
| Driver | | −60 | mA |
| Receiver | | −400 | μA |
| Output Current LOW ($I_{OL}$) | | | |
| Driver | | 60 | mA |
| Receiver | | 16 | mA |
| Operating Temperature ($T_A$) | | | |
| DS16F95 | −55 | +125 | °C |

### Driver Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified (Notes 2 & 3)

| Symbol | Parameter | Conditions | | Min | Max | Units |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Input Voltage HIGH | $V_{CC}$ = 5.5V | | 2.0 | | V |
| $V_{IL}$ | Input Voltage LOW | $V_{CC}$ = 5.5V | | | 0.8 | V |
| $V_{OH}$ | Output Voltage HIGH | $I_{OH}$ = −20 mA, $V_{CC}$ = 4.5V | | 3.0 | | V |
| $V_{OL}$ | Output Voltage LOW | $I_{OL}$ = +20 mA, $V_{CC}$ = 4.5V | | | 2.0 | V |
| $V_{IC}$ | Input Clamp Voltage | $I_I$ = −18 mA | | | −1.3 | V |
| $\|V_{OD1}\|$ | Differential Output Voltage | $I_O$ = 0 mA, $V_{IN}$ = 0.8V or 2V, $V_{CC}$ = 5.5V | | | 6.0 | V |
| $\|V_{OD2}\|$ | Differential Output Voltage | $R_L$ = 100Ω, $V_{CC}$ = 4.5V, *Figure 1* | | 2.0 | | V |
| | | $R_L$ = 54Ω, $V_{CC}$ = 4.5V, *Figure 1* | | 1.5 | | |
| $\Delta\|V_{OD}\|$ | Change in Magnitude of Differential Output Voltage (Note 4) | $R_L$ = 54Ω or 100Ω, *Figure 1*, $V_{CC}$ = 4.5V | | | ±0.2 | V |
| $V_{OD3}$ | Differential Output Voltage | $V_{CM}$ = −7V to +12V | | 1.0 | | V |
| $V_{OC}$ | Common Mode Output Voltage (Note 5) | $R_L$ = 54Ω or 100Ω | | | 3.0 | V |
| $\Delta\|V_{OC}\|$ | Change in Magnitude of Common Mode Output Voltage (Note 4) | $V_{CC}$ = 4.5V, $R_L$ = 54Ω or 100Ω | | | ±0.2 | V |
| $I_O$ | Output Current (Note 8) (Includes Receiver $I_I$) | Output Disabled $V_{CC}$ = 0V or 5.5V | $V_O$ = +12V | | 1.0 | mA |
| | | | $V_O$ = −7.0V | | −0.8 | |
| $I_{IH}$ | Input Current HIGH | $V_I$ = 2.4V | | | 20 | μA |
| $I_{IL}$ | Input Current LOW | $V_I$ = 0.4V | | | −50 | μA |
| $I_{OS}$ | Short Circuit Output Current (Note 9) | $V_O$ = −7.0V, $V_{IN}$ = 0V or 3V | | | −250 | mA |
| | | $V_O$ = 0V, $V_{IN}$ = 0V or 3V | | | −150 | |
| | | $V_O$ = $V_{CC}$, $V_{IN}$ = 0V or 3V | | | 150 | |
| | | $V_O$ = +12V, $V_{IN}$ = 0V or 3V | | | 250 | |
| $I_{CC}$ | Supply Current (Total Package) | No Load, DE = 2V, $\overline{RE}$ = 0.8V, Inputs Open | | | 28 | mA |
| $I_{CCX}$ | | No Load, DE = 0.8V, $\overline{RE}$ = 2V, Inputs Open | | | 25 | |

## MIL-STD 883C

### Driver Switching Characteristics $V_{CC}$ = 5.0V

| Symbol | Parameter | Conditions | Min | Typ | $T_A$ = 25°C Max | $T_A$ = 125°C Max | $T_A$ = −55°C Max | Units |
|---|---|---|---|---|---|---|---|---|
| $t_{DD}$ | Differential Output Delay Time | $R_L$ = 60Ω, *Figure 3* | 8.0 | 15 | 25 | 30 | 30 | ns |
| $t_{TD}$ | Differential Output Transition Time | | 8.0 | 15 | 25 | 30 | 30 | ns |
| $t_{PLH}$ | Propagation Delay Time, Low-to-High Level Output | $R_L$ = 27Ω, *Figure 4* | 6.0 | 12 | 18 | 25 | 25 | ns |
| $t_{PHL}$ | Propagation Delay Time, High-to-Low Level Output | | 6.0 | 12 | 18 | 25 | 25 | ns |
| $t_{ZH}$ | Output Enable Time to High Level | $R_L$ = 110Ω, *Figure 5* | | 25 | 35 | 45 | 45 | ns |
| $t_{ZL}$ | Output Enable Time to Low Level | $R_L$ = 110Ω, *Figure 6* | | 25 | 40 | 50 | 50 | ns |
| $t_{HZ}$ | Output Disable Time from High Level | $R_L$ = 110Ω, *Figure 5* | | 20 | 30 | 40 | 40 | ns |
| $t_{LZ}$ | Output Disable Time from Low Level | $R_L$ = 110Ω, *Figure 6* | | 20 | 30 | 40 | 40 | ns |
| $t_{LZL}$ | Output Disable Time from Low Level with Load Resistor to GND | Load per *Figure 5* Timing per *Figure 6* | | 300 | | | | ns |
| $t_{SKEW}$ | Skew (Pulse Width Distortion) | $R_L$ = 60Ω, *Figure 3* | | 1.0 | 6 | 12 | 12 | ns |

### Receiver Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified

| Symbol | Parameter | Conditions | | Min | Max | Units |
|---|---|---|---|---|---|---|
| $V_{TH}$ | Differential Input High Threshold Voltage | $V_O$ = 2.5V, $I_O$ = −0.4 mA, $V_{CM}$ = −7V, 0V, +12V $V_{CC}$ = 4.5V, 5.5V | | | 0.2 | V |
| $V_{TL}$ | Differential Input Low Threshold Voltage (Note 6) | $V_O$ = 0.5V, $I_O$ = 8.0 mA, $V_{CM}$ = −7V, 0V, +12V, $V_{CC}$ = 4.5V, 5.5V | | −0.2 | | V |
| $V_{T+} - V_{T-}$ | Hysteresis (Note 7) | $V_{CM}$ = 0V, $V_{CC}$ = 4.5V, 5.5V | | 35 | | mV |
| $V_{IH}$ | Enable Input Voltage HIGH | | | 2.0 | | V |
| $V_{IL}$ | Enable Input Voltage LOW | | | | 0.8 | V |
| $V_{IC}$ | Enable Input Clamp Voltage | $I_I$ = −18 mA, $V_{CC}$ = 5.5V | | | −1.3 | V |
| $V_{OH}$ | Output Voltage HIGH | $V_{ID}$ = 200 mV, $I_{OH}$ = −400 μA, *Figure 2*, $V_{CC}$ = 4.5V | −55°C to +125°C | 2.5 | | V |
| $V_{OL}$ | Output Voltage LOW | $V_{ID}$ = −200 mV, *Figure 2*, $V_{CC}$ = 4.5V | $I_{OL}$ = 8.0 mA | | 0.45 | V |
| | | | $I_{OL}$ = 16 mA | | 0.50 | |
| $I_{OZ}$ | High Impedance State Output | $V_O$ = 0.4V, 2.4V | | | ±20 | μA |
| $I_I$ | Line Input Current (Note 8) | Other Input = 0V $V_{CC}$ = 5.5V or $V_{CC}$ = 0V | $V_I$ = +12V | | 1.0 | mA |
| | | | $V_I$ = −7.0V | −0.8 | | |
| $I_{IH}$ | Enable Input Current HIGH | $V_{IH}$ = 2.7V | | | 20 | μA |
| $I_{IL}$ | Enable Input Current LOW | $V_{IL}$ = 0.4V | | | −50 | μA |
| $R_I$ | Input Resistance | | | 10 | | kΩ |
| $I_{OS}$ | Short Circuit Output Current | $V_{IN}$ = 1V, $V_{OUT}$ = 0.0V (Note 9) | | −15 | −85 | mA |
| $I_{CC}$ | Supply Current (Total Package) | No Load, DE = 2V, $\overline{RE}$ = 0.8V, Inputs Open | | | 28 | mA |
| $I_{CCX}$ | | No Load, DE = 0.8V, $\overline{RE}$ = 2.0V, Inputs Open | | | 25 | |

## MIL-STD 883C

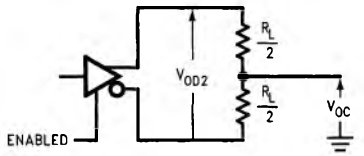
### Receiver Switching Characteristics $V_{CC}$ = 5.0V

| Symbol | Parameter | Conditions | Min | Typ | $T_A$ = 25°C Max | $T_A$ = 125°C Max | $T_A$ = −55°C Max | Units |
|---|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Time, Low-to-High Level Output | $V_{ID}$ = 0V to +3.0V<br>$C_L$ = 15 pF, *Figure 7* | 10 | 19 | 27 | 38 | 38 | ns |
| $t_{PHL}$ | Propagation Delay Time, High-to-Low Level Output | | 10 | 19 | 27 | 38 | 38 | ns |
| $t_{ZH}$ | Output Enable Time to High Level | $C_L$ = 15 pF, *Figure 8* | | 10 | 20 | 30 | 30 | ns |
| $t_{ZL}$ | Output Enable Time to Low Level | | | 12 | 20 | 30 | 30 | ns |
| $t_{HZ}$ | Output Disable Time from High Level | $C_L$ = 5.0 pF, *Figure 8* | | 12 | 20 | 30 | 30 | ns |
| | | $C_L$ = 20.0 pF, *Figure 8* (Note 14) | | 12 | 30 | 40 | 40 | ns |
| $t_{LZ}$ | Output Disable Time from Low Level | $C_{IL}$ = 50 pF, *Figure 8* | | 12 | 20 | 30 | 30 | ns |
| $\lvert t_{PLH} - t_{PHL} \rvert$ | Pulse Width Distortion (SKEW) | *Figure 7* | | 1.0 | 8 | 16 | 16 | ns |

**Ordering Number:** **DS16F95J/883, NS Package Number J08A**
**DS16F95E/883, NS Package Number E20A**
**DS16F95W/883, NS Package Number W10A**

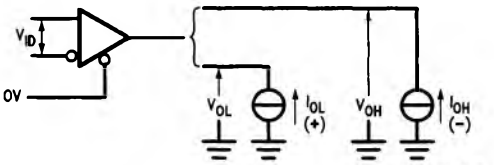
**SMD Number:** **DS16F95J/883 ⟷ 5962-896150PX**
**DS16F95E/883 ⟷ 5962-8961502X**
**DS16F95W/883 ⟷ 5962-896150HX**

## Parameter Measurement Information



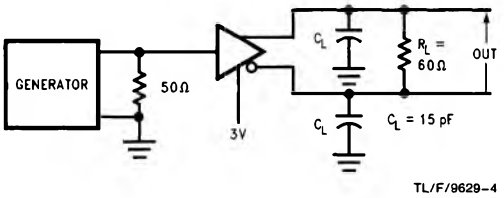

TL/F/9629-2

**FIGURE 1. Driver $V_{OD}$ and $V_{OC}$ (Note 13)**

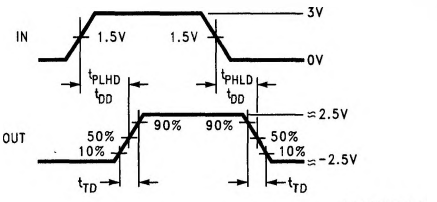



TL/F/9629-3

**FIGURE 2. Receiver $V_{OH}$ and $V_{OL}$**



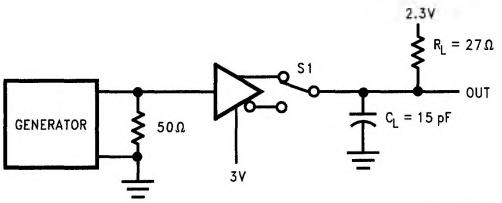

TL/F/9629-4



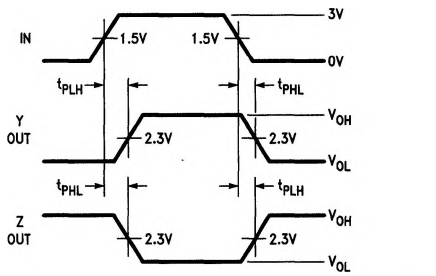

TL/F/9629-5

$t_{SKEW} = |t_{PLHD} - t_{PHLD}|$

**FIGURE 3. Driver Differential Output Delay and Transition Times (Notes 10, 12)**

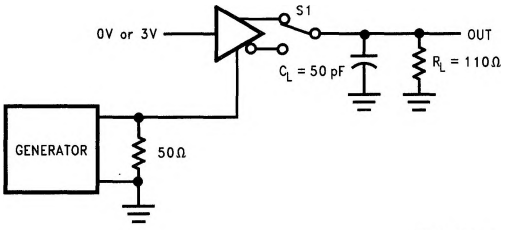



TL/F/9629-6

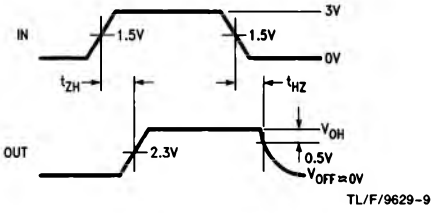



TL/F/9629-7

**FIGURE 4. Driver Propagation Times (Notes 10, 11)**

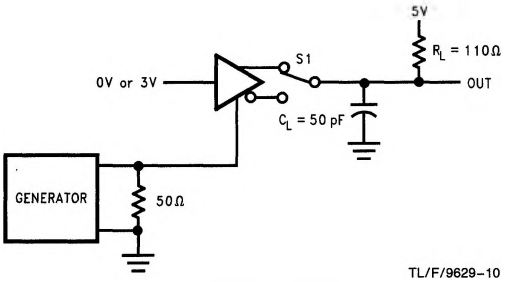



TL/F/9629-8

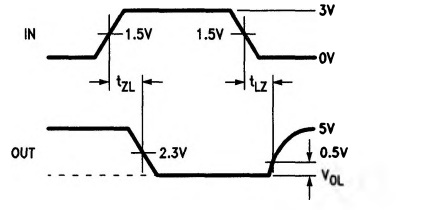



TL/F/9629-9

**FIGURE 5. Driver Enable and Disable Times ($t_{ZH}$, $t_{HZ}$) (Notes 10, 11, 12)**



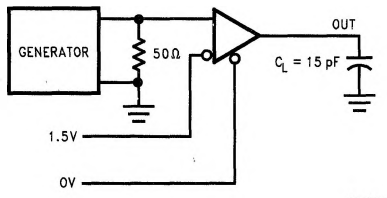

TL/F/9629-10



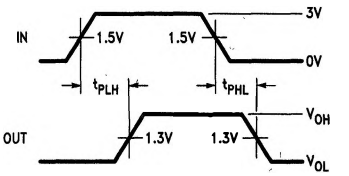

TL/F/9629-11

**FIGURE 6. Driver Enable and Disable Times ($t_{ZL}$, $t_{LZ}$, $t_{LZL}$) (Notes 10, 11, 12)**

## Parameter Measurement Information (Continued)

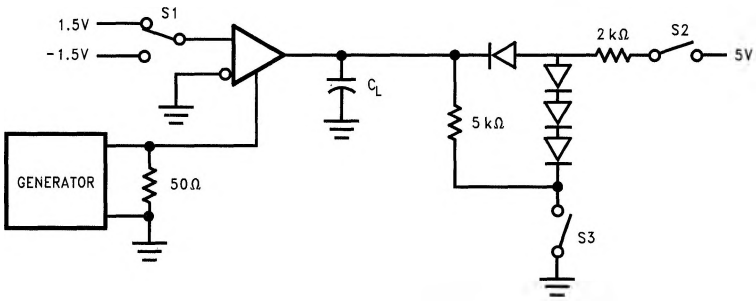



TL/F/9629–12

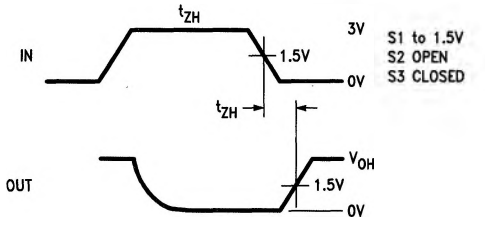



TL/F/9629–13

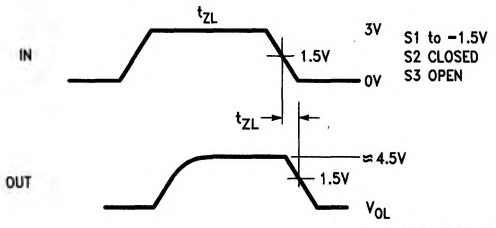
**FIGURE 7. Receiver Propagation Delay Times (Notes 10, 11)**



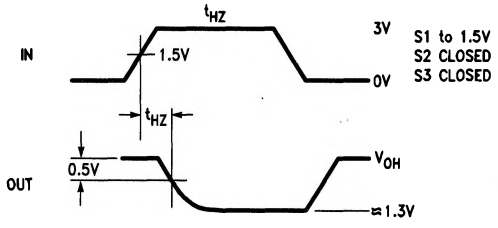

TL/F/9629–14



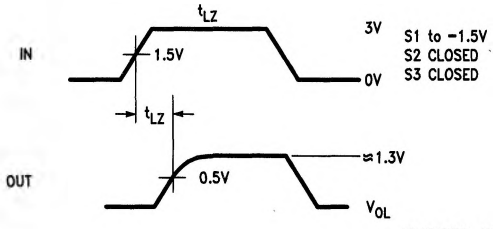

TL/F/9629–15




TL/F/9629–16




TL/F/9629–17




TL/F/9629–18

**FIGURE 8. Receiver Enable and Disable Times (Notes 10, 11, 13)**

**Note 10:** The input pulse is supplied by a generator having the following characteristics: PRR = 1.0 MHz, 50% duty cycle, $t_r \leq 6.0$ ns, $t_f \leq 6.0$ ns, $Z_O = 50\Omega$.

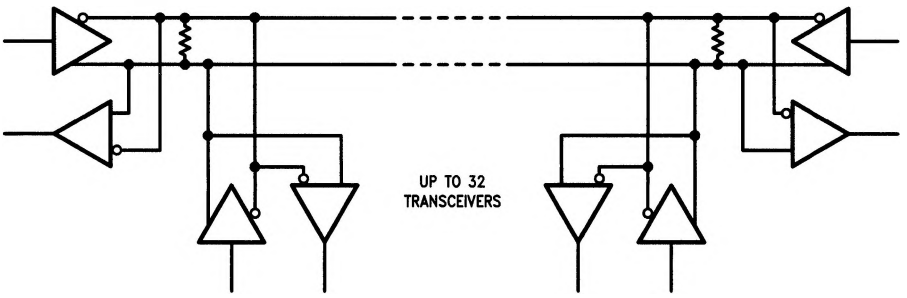
**Note 11:** $C_L$ includes probe and stray capacitance.

**Note 12:** DS16F95/DS36F95 Driver enable is Active-High.

**Note 13:** All diodes are 1N916 or equivalent.

**Note 14:** Testing at 20 pF assures conformance to 5 pF specification.

## Typical Application



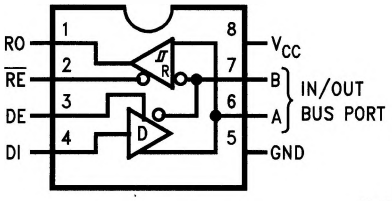

TL/F/9629–19

**Note:**

The line should be terminated at both ends in its characteristic impedance, typically 120Ω.
Stub lengths off the main line should be kept as short as possible.

## Connection Diagrams

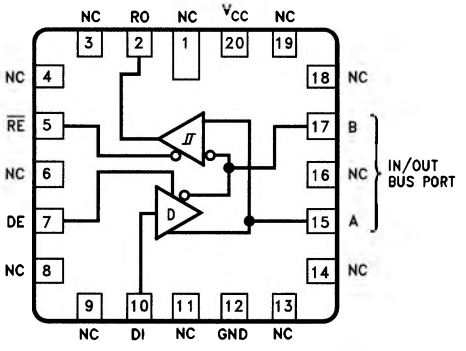
**8-Lead Dual-In-Line Package**




TL/F/9629–1

**Order Number DS16F95, DS16F95J/883, DS36F95J**
**See NS Package Number J08A**

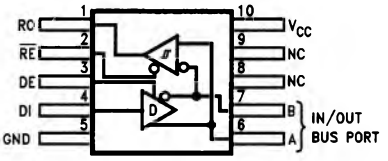
**20-Lead Ceramic Leadless Chip Carrier**




TL/F/9629–21

**Order Number DS16F95E/883**
**See NS Package Number E20A**

**10-Lead Ceramic Flatpak**




TL/F/9629–22

**Order Number DS16F95W/883**
**See NS Package Number W10A**

**For Complete Military 883 Specifications, See RETS Data Sheet**