National Semiconductor

February 1996

DS1603/DS3603 TRI-STATE® Dual Receivers

General Description

The DS1603/DS3603 are dual differential TRI-STATE line receivers designed for a broad range of system applications. They feature a high input impedance and low input current which reduces the loading effects on a digital transmission line, making them ideal for use in party line systems and general purpose applications like transducer preamplifiers, level translators and comparators.

The receivers feature a ±25 mV input sensitivity specified over a ±3V common mode range. Input protection diodes are incorporated in series with the collectors of the differential stage. These diodes are useful in applications that have multiple $V_{CC}+$ supplies or $V_{CC}+$ supplies that are turned off thus avoiding signal clamping. In addition, TTL compatible strobe and control lines are provide for flexibility in the application.

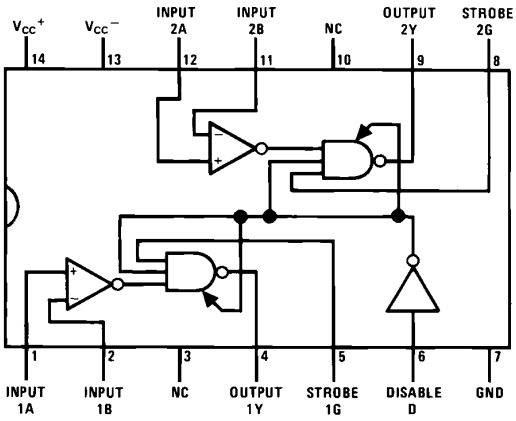
The DS1603/DS3603 are pin compatible with the DS75107, DS75108 and DS75208 series of dual line receivers.

Features

- Diode protected input stage for power ''OFF'' condition
- 17 ns typ high speed
- TTL compatible
- ±25 mV input sensitivity
- ±3V input common-mode range
- High-input inpedance with normal V_{CC}, or V_{CC} = 0V
- Strobes for channel selection
- TRI-STATE outputs for high speed buses

Connection Diagram

Dual-In-Line Package



TL/F/5781–2

Top View

Order Number DS3603N
See NS Package Number N14A

For Complete Military 883 Specifications, See RETS Data Sheet.
Order Number: DS1603J/883 or DS1603W/883
See NS Package Number J14A

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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC}^+)	7V
Supply Voltage (V_{CC}^-)	−7V
Differential Input Voltage	±6V
Common Mode Input Voltage	±5V
Strobe Input Voltage	5.5V
Storage Temperature Range	−65°C to +150°C
Maximum Power Dissipation* at 25°C	
Cavity Package	1308 mW
Molded Package	1207 mW
Lead Temperature (Soldering, 4 sec)	260°C

*Derate cavity package 8.7 mW/°C above 25°C; derate molded package 9.7 mW/°C above 25°C.

Operating Conditions

	DS1603			DS3603		
	Min	**Nom**	**Max**	**Min**	**Nom**	**Max**
Supply Voltage V_{CC}^+	4.5V	5V	5.5V	4.75	5V	5.25V
Supply Voltage V_{CC}^-	−4.5V	−5V	−5.5V	−4.75	−5V	−5.25V
Operating Temperature Range	−55°C	to	+125°C	0°C	to	+70°C

Electrical Characteristics $T_{MIN} \le T_A \le T_{MAX}$ (Notes 2, 3)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
I_{IH}	High Level Input Current into 1A, 1B, 2A or 2B	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{ID} = 0.5V, V_{IC} = -3V \text{ to } 3V$			30	75	μA
I_{IL}	Low Level Input Current into 1A, 1B, 2A or 2B	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{ID} = -2V, V_{IC} = -3V \text{ to } 3V$				−10	μA
I_{IH}	High Level Input Current into 1G, 2G or D	$V_{CC}^+ = \text{Max}$, $V_{CC}^- = \text{Max}$	$V_{IH(S)} = 2.4V$			40	μA
			$V_{IH(S)} = \text{Max } V_{CC}^+$			1	mA
I_{IL}	Low Level Input Current into D	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{IL(D)} = 0.4V$				−1.6	mA
I_{IL}	Low Level Input Current into 1G or 2G	$V_{CC}^+ = \text{Max}$, $V_{CC}^- = \text{Max}$, $V_{IL(G)} = 0.4V$	$V_{IH(D)} = 2V$			−40	μA
			$V_{IL(D)} = 0.8V$			−1.6	mA
V_{OH}	High Level Output Voltage	$V_{CC}^+ = \text{Min}, V_{CC}^- = \text{Min}, I_{LOAD} = -2 \text{ mA}, V_{ID} = 25 \text{ mV}, V_{IL(D)} = 0.8V, V_{IC} = -3V \text{ to } 3V$		2.4			V
V_{OL}	Low Level Output Voltage	$V_{CC}^+ = \text{Min}, V_{CC}^- = \text{Min}, I_{SINK} = 16 \text{ mA}, V_{ID} = -25 \text{ mV}, V_{IL(D)} = 0.8V, V_{IC} = -3V \text{ to } 3V$				0.4	V
I_{OD}	Output Disable Current	$V_{CC}^+ = \text{Max}$, $V_{CC}^- = \text{Max}$, $V_{IH(D)} = 2V$	$V_{OUT} = 2.4V$			40	μA
			$V_{OUT} = 0.4V$			−40	μA
I_{OS}	Short Circuit Output Current	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{IL(D)} = 0.8V$ (Note 4)		−18		−70	mA
I_{CCH}^+	High Logic Level Supply Current from V_{CC}^+	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{ID} = 25 \text{ mV}, T_A = 25°C$			28	40	mA
I_{CCH}^-	High Logic Level Supply Current from V_{CC}^-	$V_{CC}^+ = \text{Max}, V_{CC}^- = \text{Max}, V_{ID} = 25 \text{ mV}, T_A = 25°C$			−8.4	−15	mA
V_I	Input Clamp Voltage on G or D	$V_{CC}^+ = \text{Min}, V_{CC}^- = \text{Min}, I_{IN} = -12 \text{ mA}, T_A = 25°C$			−1	−1.5	V

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides 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 DS1603 and across the 0°C to +70°C range for the DS3603. All typical values are for $T_A = 25°C$ and $V_{CC} = 5V$.

Note 3: All current into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

Note 4: Only one output at a time should be shorted.

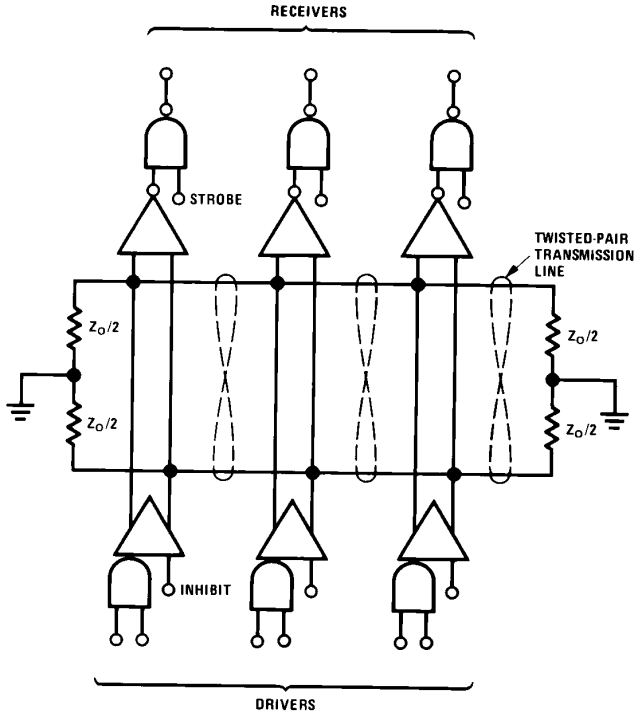
Switching Characteristics $V_{CC}^+ = 5V, V_{CC}^- = -5V, T_A = 25°C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PLH(D)}$	Propagation Delay Time, Low-to-High Level, from Differential Inputs A and B to Output	$R_L = 390\Omega$, $C_L = 50$ pF, (Note 1)		17	25	ns
$t_{PHL(D)}$	Propagation Delay Time, High-to-Low Level, from Differential Inputs A and B to Output	$R_L = 390\Omega$, $C_L = 50$ pF, (Note 1)		17	25	ns
$t_{PLH(S)}$	Propagation Delay Time, Low-to-High Level, from Strobe Input G to Output	$R_L = 390\Omega$, $C_L = 50$ pF		10	15	ns
$t_{PHL(S)}$	Propagation Delay Time, High-to-Low Level, from Strobe Input G to Output	$R_L = 390\Omega$, $C_L = 50$ pF		8	15	ns
t_{1H}	Disable Low-to-High to Output High to Off	$R_L = 390\Omega$, $C_L = 5$ pF			20	ns
t_{0H}	Disable Low-to-High to Output Low to Off	$R_L = 390\Omega$, $C_L = 5$ pF			30	ns
t_{H1}	Disable High-to-Low to Output Off to High	$R_L = 1k$ to 0V, $C_L = 50$ pF			25	ns
t_{H0}	Disable High-to-Low to Output Off to Low	$R_L = 390\Omega$, $C_L = 50$ pF			25	ns

Note 1: Differential input is +100 mV to −100 mV pulse. Delays read from 0 mV on input to 1.5V on output.

Typical Application

Line Receiver Used in a Party-Line or Data-Bus System



Line receivers are DS75107/DS75108 or DS3603

Line drivers are SN75109/μA75110/DS75110 or DS8831

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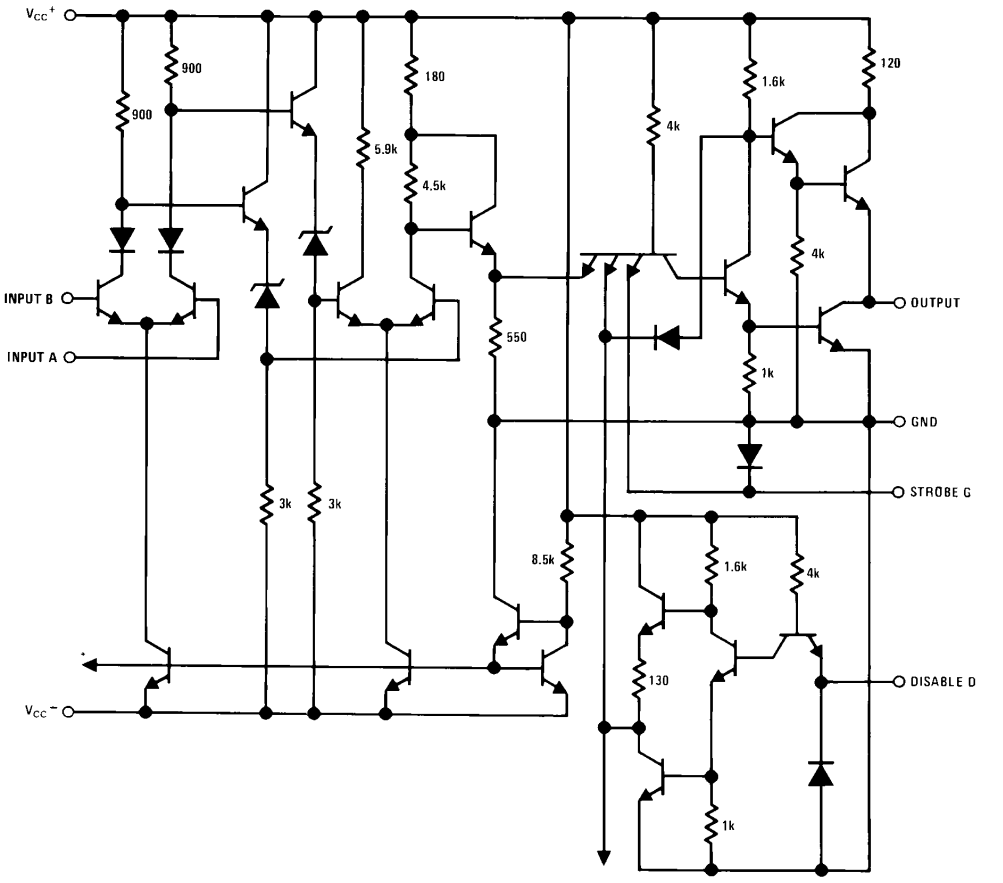
Schematic Diagram (Note 1)

DS1603/DS3603

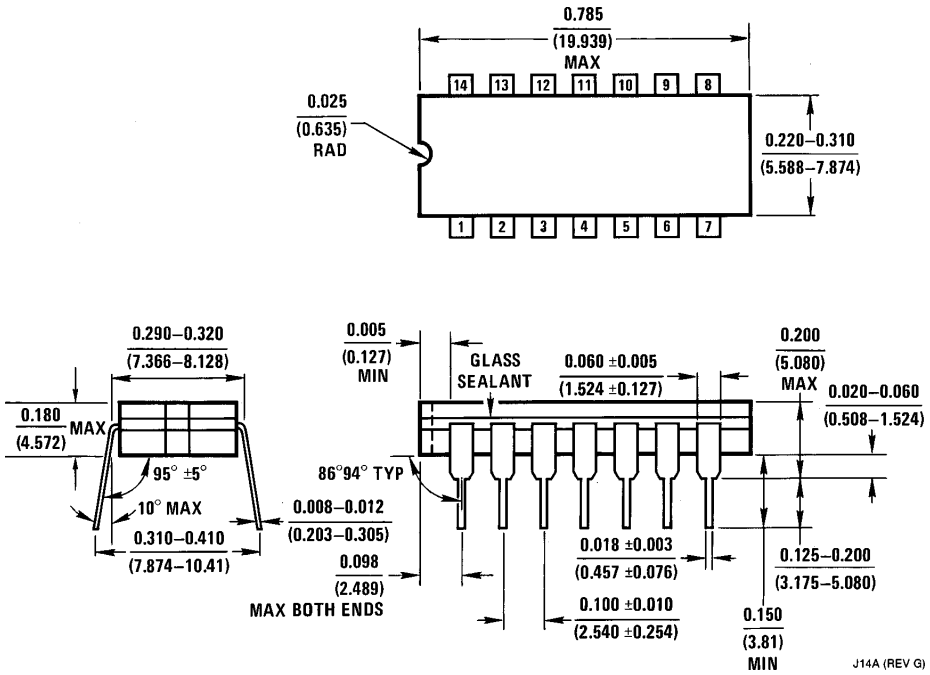


TL/F/5781–6

Note 1: ½ of the dual circuit is shown.

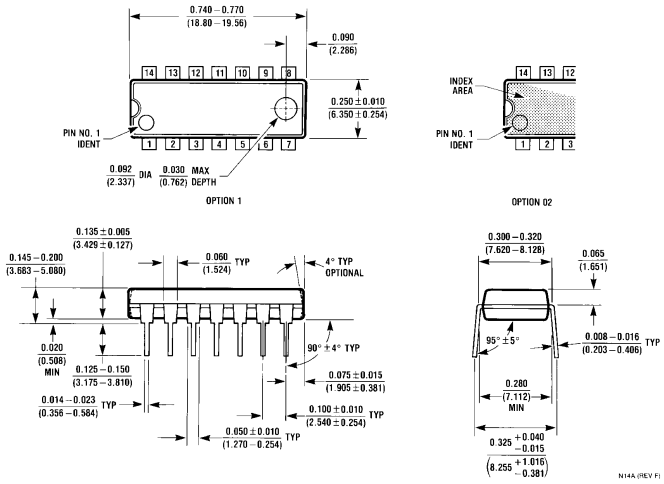
Note 2: *Indicates connections common to second half of dual circuit.

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number DS1603J or DS3603J
NS Package Number J14A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number DS3603N
NS Package Number N14A

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