National Semiconductor

March 1992

DS1692/DS3692
TRI-STATE® Differential Line Drivers

General Description

The DS1692/DS3692 are low power Schottky TTL line drivers electrically similar to the DS1691A/DS3691 but tested to meet the requirements of MIL-STD-188-114A (see Application Note AN-216). MIL-STD-188-114A type 1 driver specifications can be met by adding an external three resistor voltage divider to the output of the DS3692/1692. The DS3692/1692 feature 4 buffered outputs with high source and sink current capability with internal short circuit protection.

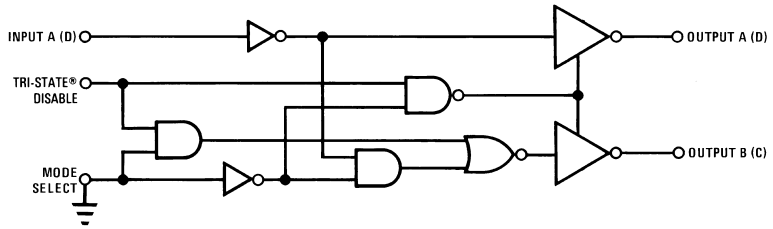
With the mode select pin low, the DS1692/DS3692 are dual differential line drivers with TRI-STATE outputs. They feature ±10V output common-mode range in TRI-STATE and 0V output unbalance when operated with ±5V supply.

Multipoint applications in differential mode with waveshaping capacitors is not allowed.

Features

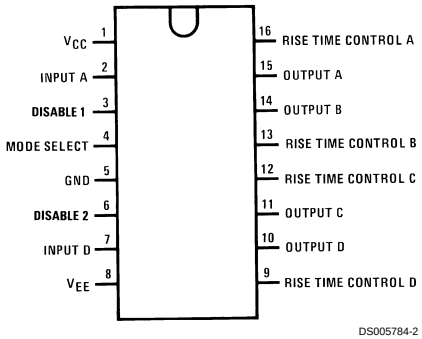
- Short circuit protection for both source and sink outputs
- 100Ω transmission line drive capability
- Low I_{CC} and I_{EE} power consumption: Differential mode: I_{CC} = 9 mA/driver typ, I_{EE} = 5 mA/driver typ
- Low current PNP inputs compatible with TTL, MOS and CMOS
- Adaptable as MIL-STD-188-114A type 1 driver

Logic Diagram (½ Circuit Shown)



DS005784-1

Connection Diagram



DS005784-2

*Contact Product Marketing for availability.

Top View
Order Number DS1692J, DS3692J, DS3692M or DS3692N
See NS Package Number J16A, M16A* or N16A

Inputs			Outputs	
Mode	A (D)	Disable1 (2)	A (D)	B (C)
0	0	0	0	1
0	0	1	TRI-STATE	TRI-STATE
0	1	0	1	0
0	1	1	TRI-STATE	TRI-STATE

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Absolute Maximum Ratings (Note 2)

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

Supply Voltage	
V_{CC}	7V
V_{EE}	−7V
Maximum Power Dissipation (Note 1) at 25˚C	
Cavity Package	1509 mW
Molded Package	1476 mW
Input Voltage	15V
Output Voltage (Power OFF)	±15V
Storage Temperature	−65˚C to +150˚C
Lead Temperature (Soldering, 4 sec.)	260˚C

Operating Conditions

	Min	Max	Units
Supply Voltage			
DS1692			
V_{CC}	4.5	5.5	V
V_{EE}	−4.5	−5.5	V
DS3692			
V_{CC}	4.75	5.25	V
V_{EE}	−4.75	−5.25	V
Temperature (T_A)			
DS1692	−55	+125	˚C
DS3692	0	+70	˚C

Note 1: Derate cavity package 10.1 mW/˚C; derate molded package 11.9 mW/˚C above 25˚C.

Electrical Characteristics

DS1692/DS3692 (Notes 3, 4, 5)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DS1692, V_{CC} = 5V ±10%, DS3692, V_{CC} = 5V ±5%, V_{EE} CONNECTION TO GROUND, MODE SELECT ≤ 0.8V							
V_O	Differential Output Voltage	R_L = ∞	V_{IN} = 2V	2.5	3.6		V
$\overline{V_O}$	$V_{A,B}$		V_{IN} = 0.8V	−2.5	−3.6		V
V_T	Differential Output Voltage	R_L = 100Ω	V_{IN} = 2V	2	2.6		V
$\overline{V_T}$	$V_{A,B}$	V_{CC} ≥ 4.75V	V_{IN} = 0.8V	−2	−2.6		V
V_{OS}, $\overline{V_{OS}}$	Common-Mode Offset Voltage	R_L = 100Ω			2.5	3	V
$\lvert V_T \rvert - \lvert \overline{V_T} \rvert$	Difference in Differential Output Voltage	R_L = 100Ω			0.05	0.4	V
$\lvert V_{OS} \rvert - \lvert \overline{V_{OS}} \rvert$	Difference in Common-Mode Offset Voltage	R_L = 100Ω			0.05	0.4	V
V_{SS}	$\lvert V_T - \overline{V_T} \rvert$	R_L = 100Ω, V_{CC} ≥ 4.75V		4.0	4.8		V
I_{OX}	TRI-STATE Output Current	V_O ≤ −10V			−0.002	−0.15	mA
		V_O ≥ 15V			0.002	0.15	mA
I_{SA}	Output Short Circuit Current	V_{IN} = 0.4V	V_{OA} = 6V		80	150	mA
			V_{OB} = 0V		−80	−150	mA
I_{SB}	Output Short Circuit Current	V_{IN} = 2.4V	V_{OA} = 0V		−80	−150	mA
			V_{OB} = 6V		80	150	mA
I_{CC}	Supply Current				18	30	mA
DS1692, V_{CC} = 5V ±10%, V_{EE} = −5V ±10%, DS3692, V_{CC} = 5V ±5%, V_{EE} = −5 ±5%, MODE SELECT ≤ 0.8V							
V_O	Differential Output Voltage	R_L = ∞	V_{IN} = 2.4V	7	8.5		V
$\overline{V_O}$	$V_{A,B}$		V_{IN} = 0.4V	−7	−8.5		V
V_T	Differential Output Voltage	R_L = 200Ω	V_{IN} = 2.4V	6	7.3		V
$\overline{V_T}$	$V_{A,B}$		V_{IN} = 0.4V	−6	−7.3		V
$\lvert V_T \rvert - \lvert \overline{V_T} \rvert$	Output Unbalance	$\lvert V_{CC} \rvert = \lvert V_{EE} \rvert$, R_L = 200Ω			0.02	0.4	V
I_{OX}	TRI-STATE Output Current		V_O = 10V		0.002	0.15	mA
			V_O = −10V		−0.002	−0.15	mA
I_S^+	Output Short Circuit Current	V_O = 0V	V_{IN} = 2.4V		−80	−150	mA
I_S^-			V_{IN} = 0.4V		80	150	mA
I_{SLEW}	Slew Control Current				±140		µA
I_{CC}	Positive Supply Current	V_{IN} = 0.4V, R_L = ∞			18	30	mA
I_{EE}	Negative Supply Current	V_{IN} = 0.4V, R_L = ∞			−10	−22	mA

Electrical Characteristics

$V_{EE} \leq 0V$ (Notes 3, 4)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{IH}	High Level Input Voltage			2			V
V_{IL}	Low Level Input Voltage					0.8	V
I_{IH}	High Level Input Current	V_{IN} = 2.4V			1	40	µA
		$V_{IN} \leq 15V$			10	100	µA
I_{IL}	Low Level Input Current	V_{IN} = 0.4V			−30	−200	µA
V_I	Input Clamp Voltage	I_{IN} = −12 mA				−1.5	V
I_{XA}	Output Leakage Current	$V_{CC} = V_{EE}$ = 0V	V_O = 15V		0.01	0.15	mA
I_{XB}	Power OFF		V_O = −15V		−0.01	−0.15	mA

Switching Characteristics

T_A = 25˚C

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{CC} = 5V, MODE SELECT = 0.8V						
t_r	Differential Output Rise Time	R_L = 100Ω, C_L = 500 pF (*Figure 1*)		120	200	ns
t_f	Differential Output Fall Time	R_L = 100Ω, C_L = 500 pF (*Figure 1*)		120	200	ns
t_{PDH}	Output Propagation Delay	R_L = 100Ω, C_L = 500 pF (*Figure 1*)		120	200	ns
t_{PDL}	Output Propagation Delay	R_L = 100Ω, C_L = 500 pF (*Figure 1*)		120	200	ns
t_{PZL}	TRI-STATE Delay	R_L = 100Ω, C_L = 500 pF (*Figure 2*)		180	250	ns
t_{PZH}	TRI-STATE Delay	R_L = 100Ω, C_L = 500 pF (*Figure 2*)		180	250	ns
t_{PLZ}	TRI-STATE Delay	R_L = 100Ω, C_L = 500 pF (*Figure 2*)		80	150	ns
t_{PHZ}	TRI-STATE Delay	R_L = 100Ω, C_L = 500 pF (*Figure 2*)		80	150	ns
V_{CC} = 5V, V_{EE} = −5V, MODE SELECT = 0.8V						
t_r	Differential Output Rise Time	R_L = 200Ω, C_L = 500 pF (*Figure 1*)		190	300	ns
t_f	Differential Output Fall Time	R_L = 200Ω, C_L = 500 pF (*Figure 1*)		190	300	ns
t_{PDL}	Output Propagation Delay	R_L = 200Ω, C_L = 500 pF (*Figure 1*)		190	300	ns
t_{PDH}	Output Propagation Delay	R_L = 200Ω, C_L = 500 pF (*Figure 1*)		190	300	ns
t_{PZL}	TRI-STATE Delay	R_L = 200Ω, C_L = 500 pF (*Figure 2*)		180	250	ns
t_{PZH}	TRI-STATE Delay	R_L = 200Ω, C_L = 500 pF (*Figure 2*)		180	250	ns
t_{PLZ}	TRI-STATE Delay	R_L = 200Ω, C_L = 500 pF (*Figure 2*)		80	150	ns
t_{PHZ}	TRI-STATE Delay	R_L = 200Ω, C_L = 500 pF (*Figure 2*)		80	150	ns

Note 2: "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 table of "Electrical Characteristics" provide conditions for actual device operation.

Note 3: Unless otherwise specified, min/max limits apply across the −55˚C to +125˚C temperature range for the DS1692 and across the 0˚C to +70˚C range for the DS3692. All typicals are given for V_{CC} = 5V and T_A = 25˚C. V_{CC} and V_{EE} as listed in operating conditions.

Note 4: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

Note 5: Only one output at a time should be shorted.

AC Test Circuits and Switching Time Waveforms

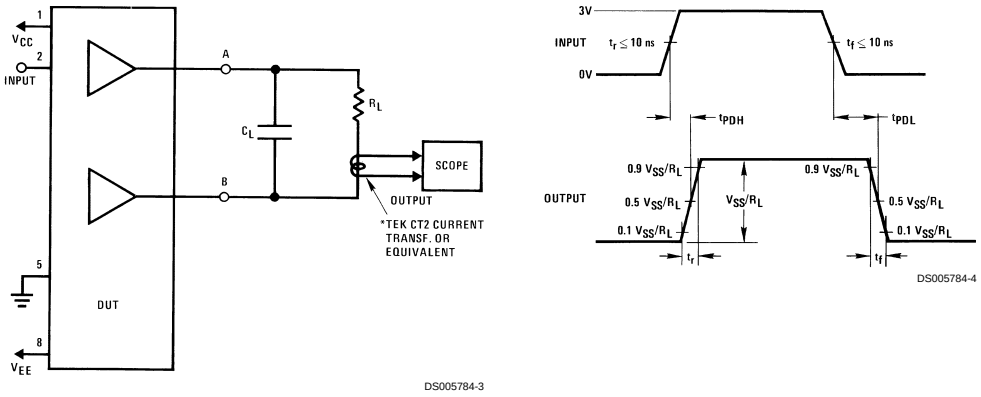


FIGURE 1. Differential Connection

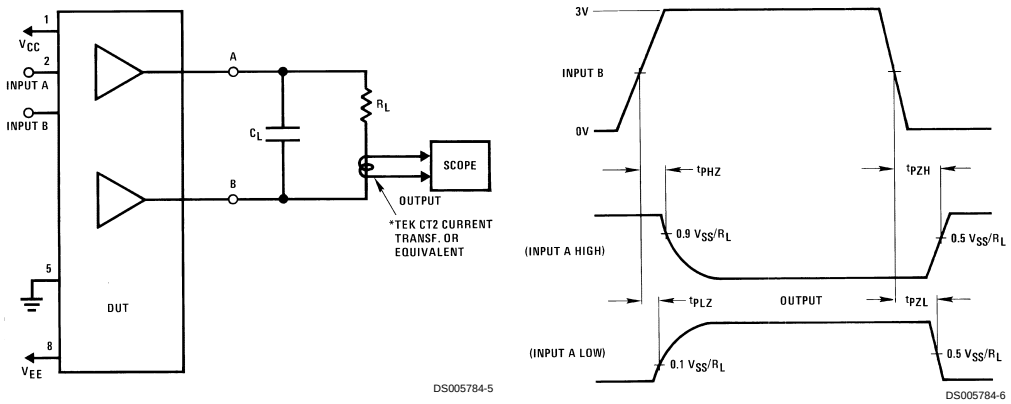
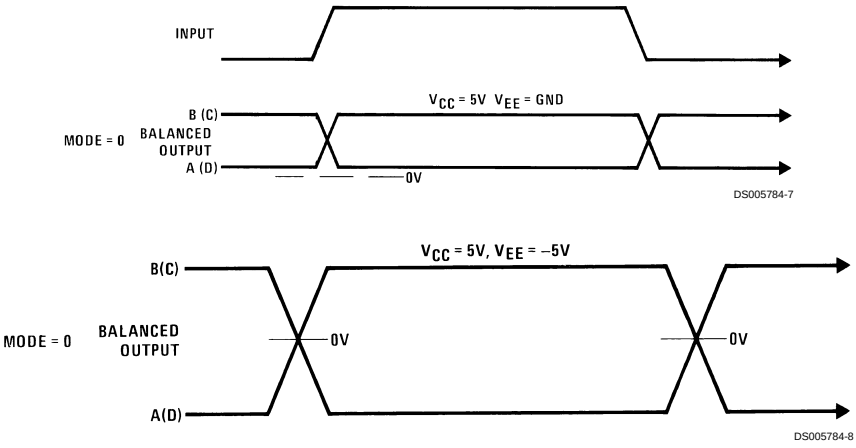
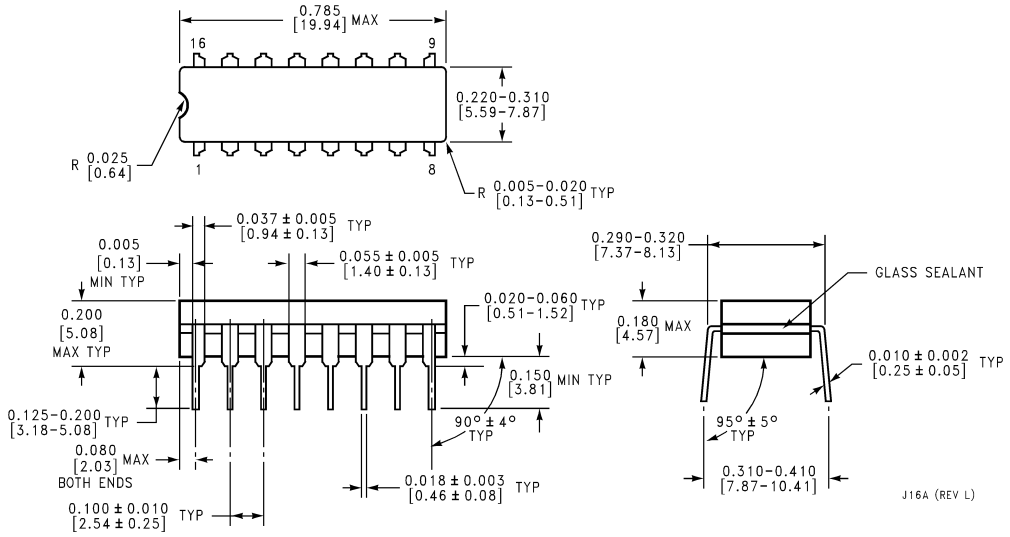


FIGURE 2. TRI-STATE Delays for DS1692/DS3692

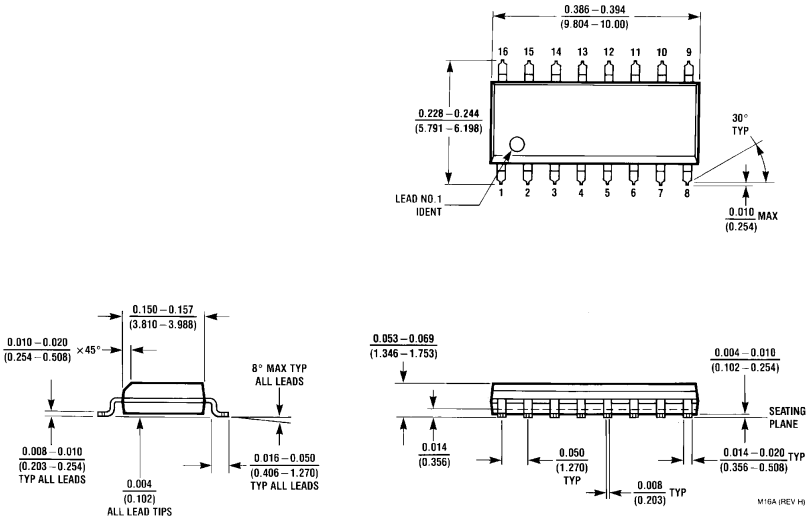
Switching Waveforms



Physical Dimensions inches (millimeters) unless otherwise noted

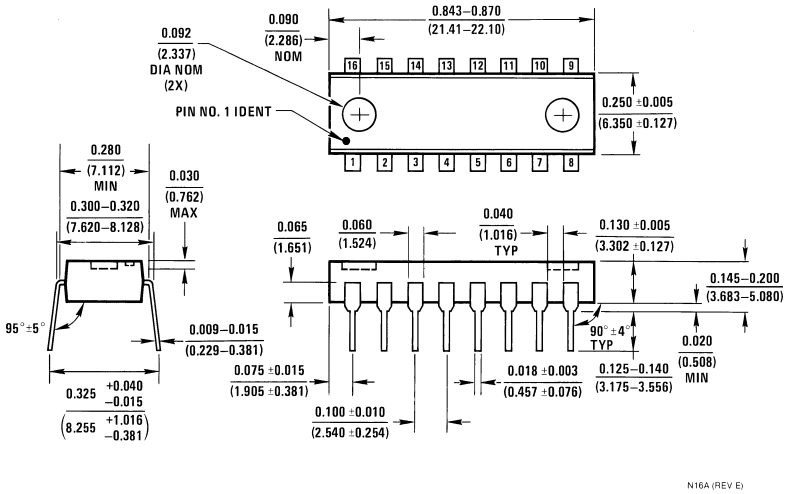


Ceramic Dual-In-Line Package (J)
Order Number DS1692J, DS3692J
NS Package Number J16A



Small Outline Package (M)
Order Number DS3692M
NS Package Number M16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Molded Dual-In-Line Package (N)
Order Number DS3692N
NS Package Number N16A

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