N *National Semiconductor*

DS14196
EIA/TIA-232 5 Driver x 3 Receiver

General Description

The DS14196 is a five driver, three receiver device which conforms to the EIA/TIA-232-E standard.

The flow-through pinout facilitates simple non-crossover board layout. The DS14196 provides a peripheral side one-chip solution for the common 9-pin serial RS-232 interface between data terminals and data communications equipment.
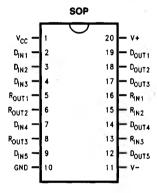
The DS14196 offers optimum performance when used with the DS14185 3 x 5 Driver/Receiver, a host side one-chip solution for the common 9-pin serial RS-232 interface between data terminals and data communications equipment.

Features

■ Replaces two 1488s and one 1489
■ Conforms to EIA/TIA-232-E
■ 5 drivers and 3 receivers
■ Flow-through pinout
■ Failsafe receiver outputs
■ 20-pin wide SOIC package
■ LapLink® compatible—300 kbps data rate
■ Pin compatible with: SN75196
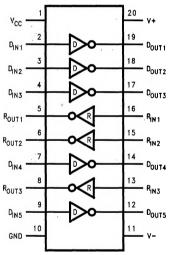   GD7532

Connection Diagram

SOP

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Order Number DS14196WM
See NS Package Number M20B

Functional Diagram

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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 ($V+$)	+15V
Supply Voltage ($V-$)	−15V
Driver Input Voltage	0V to V_{CC}
Driver Output Voltage (Power Off)	±15V
Receiver Input Voltage	±25V
Receiver Output Voltage (R_{OUT})	0V to V_{CC}
Maximum Power Package Dissipation @ +25°C	
M Package	TBD
Derate M Package	TBD
Storage Temperature Range	−65°C to +150°C

Lead Temperature Range (Soldering, 4 sec.)	+260°C
ESD Ratings (HBM. 1.5 kΩ, 100 pF)	≥1.5 kV

Recommended Operating Conditons

	Min	Nom	Max	Units
Supply Voltage (V_{CC})	+4.75	+5.0	+5.25	V
Supply Voltage ($V+$)	+9.0	+12.0	+13.2	V
Supply Voltage ($V-$)	−13.2	−12.0	−9.0	V
Operating Free Air Temperature (T_A)	0	+25	+70	°C

Electrical Characteristics

Over recommended operating supply and temperature ranges unless otherwise specified (Note 2)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DEVICE CHARACTERISTICS							
I_{CC}	V_{CC} Supply Current	No Load, All Inputs at +5V				TBD	mA
$I+$	$V+$ Supply Current (Note 2)	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.8V or 2.4V.	$V+ = +9V, V- = -9V$			TBD	mA
			$V+ = +13.2V, V- = -13.2V$			TBD	mA
$I-$	$V-$ Supply Current (Note 2)		$V+ = +9V, V- = -9V$			TBD	mA
			$V+ = +13.2V, V- = -13.2V$			TBD	mA
DRIVER CHARACTERISTICS							
V_{IH}	High Level Input Voltage			2.0			V
V_{IL}	Low Level Input Voltage					0.8	V
I_{IH}	High Level Input Current (Note 2)	$V_{IN} = 5V$				10	µA
I_{IL}	Low Level Input Current (Note 2)	$V_{IN} = 0V$				TBD	mA
V_{OH}	High Level Output Voltage (Note 2)	$R_L = 3 kΩ, V_{IN} = 0.8V, V+ = +9V, V- = -9V$		6	7		V
		$R_L = 3 kΩ, V_{IN} = 0.8V, V+ = +12V, V- = -12V$		8.5	10		V
		$R_L = 7 kΩ, V_{IN} = 0.8V, V+ = +13.2V, V- = -13.2V$		10	11.5		V
V_{OL}	Low Level Output Voltage (Note 2)	$R_L = 3 kΩ, V_{IN} = 2V, V+ = +9V, V- = -9V$			−7	−6	V
		$R_L = 3 kΩ, V_{IN} = 2V, V+ = +12V, V- = -12V$			−8	−7.5	V
		$R_L = 7 kΩ, V_{IN} = 2V, V+ = +13.2V, V- = -13.2V$			−11	−10	V
$I_{OS}+$	Output High Short Circuit Current (Note 2)	$V_{OUT} = 0V, V_{IN} = 0.8V$		−6	−9	−14	mA
$I_{OS}-$	Output Low Short Circuit Current (Note 2)	$V_{OUT} = 0V, V_{IN} = 2.0V$		6	9	14	mA
R_O	Output Resistance	$-2V \leq V_{OUT} \leq +2V, V+ = V- = V_{CC} = 0V$		300			Ω
		$-2V \leq V_{OUT} \leq +2V, V+ = V- = V_{CC} = $ Open Circuit		300			Ω

Electrical Characteristics
Over recommended operating supply voltage and temperature ranges, unless otherwise specified (Note 3) (Continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
RECEIVER CHARACTERISTICS						
V_{TH}	Input High Threshold (Recognized as a High Signal)	$V_{OUT} \leq 0.4V$, $I_O = 3.2$ mA		2.0	2.4	V
V_{TL}	Input Low Threshold (Recognized as a Low Signal)	$V_{OUT} \geq 2.5V$, $I_O = -0.5$ mA	0.8	1.0		V
R_{IN}	Input Resistance	$V_{IN} = \pm 3V$ to $\pm 15V$	3.0	4.1	7.0	kΩ
I_{IN}	Input Current (Note 2)	$V_{IN} = +15V$	2.1	4.1	5.0	mA
		$V_{IN} = +3V$	0.43	0.7	1.0	mA
		$V_{IN} = -15V$	−2.1	−4.1	−5.0	mA
		$V_{IN} = -3V$	−0.43	−0.65	−1.0	mA
V_{OH}	High Level Output Voltage (Note 7)	$I_{OH} = -0.5$ mA, $V_{IN} = -3V$	2.6	4.0		V
		$I_{OH} = -10$ μA, $V_{IN} = -3V$	4.0	4.9		V
		$I_{OH} = -0.5$ mA, $V_{IN} =$ Open Circuit	2.6	4.0		V
		$I_{OH} = -10$ μA, $V_{IN} =$ Open Circuit	4.0	4.9		V
V_{OL}	Low Level Output Voltage	$I_{OL} = 3.2$ mA, $V_{IN} = +3V$		0.2	0.4	V
I_{OSR}	Short Circuit Current (Note 2)	$V_{OUT} = 0V$, $V_{IN} = 0V$ (Note 4)	−1.7	−2.7	−4	mA

Switching Characteristics
Over recommended operating supply and temperature ranges, unless otherwise specified (Note 3)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DRIVER CHARACTERISTICS						
t_{PHL}	Propagation Delay High to Low	$R_L = 3$ kΩ, $C_L = 50$ pF (*Figures 1* and *2*)		90	350	ns
t_{PLH}	Propagation Delay Low to High			220	350	ns
t_r, t_f	Output Slew Rate (Note 8)			50		ns
RECEIVER CHARACTERISTICS						
t_{PHL}	Propagation Delay High to Low	$R_L = 1.5$ kΩ, $C_L = 15$ pF (includes fixture plus probe), (*Figures 3* and *4*)		60	100	ns
t_{PLH}	Propagation Delay Low to High			100	160	ns
t_r	Rise Time			87	175	ns
t_f	Fall Time			15	50	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 table of Electrical Characteristics specifies conditions of device operation.

Note 2: Current into device pins is defined as positive. Current out of the device pins is defined as negative. All voltages are referenced to ground unless otherwise specified. For current, minimum and maximum values are specified as an absolute value and the sign is used to indicate direction. For voltage logic levels, the more positive value is designated as maximum. For example, if −6V is a maximum, the typical value −6.8V is more negative.

Note 3: All typicals are given for: $V_{CC} = +5V$, $V^+ = +12V$, $V^- = -12V$, $T_A = +25°C$.
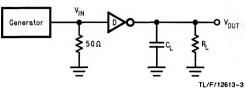
Note 4: Only one driver output shorted at a time.

Note 5: Generator characteristics for driver input: $f = 64$ kHz (128 kbps), $t_r = t_f < 10$ ns, $V_{IH} = 3V$, $V_{IL} = 0V$, duty cycle = 50%.
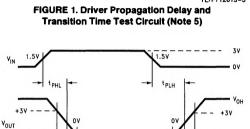
Note 6: Generator characteristics for receiver input: $f = 64$ kHz (128 kbps), $t_r = t_f = 200$ ns, $V_{IH} = 3V$, $V_{IL} = -3V$, duty cycle = 50%.

Note 7: If receiver inputs are unconnected, receiver output is a logic high.

Note 8: Refer to typical curves. Driver output slew rate is measured from the +3V to the −3V level on the output waveform. Inputs not under test are connected to V_{CC} or GND. Slew rate is determined by load capacitance. To comply with a 30 V/μs maximum slew rate, a minimum load capacitance of 390 pF is recommended.

Parameter Measurement Information

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FIGURE 1. Driver Propagation Delay and Transition Time Test Circuit (Note 5)
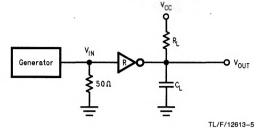

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FIGURE 3. Receiver Propagation Delay and Transition Time Test Circuit (Note 6)

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FIGURE 2. Driver Propagation Delay and Transition Time Waveforms Slew Rate (SR) = 6V/(t_r or t_f)

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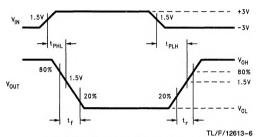**FIGURE 4. Receiver Propagation Delay and Transition Time Waveform**

Pin Descriptions

Pin #	No.	Description
2, 3, 4, 7, 9	D_{IN}	Driver Input Pins, RS-232 Levels
12, 14, 17, 18, 19	D_{OUT}	TTL Level Driver Outputs
13, 15, 16	R_{IN}	TTL Level Receiver Inputs
5, 6, 8	R_{OUT}	Receiver Output Pins, RS-232 Levels
GND	GND	Ground
20	V^+	Positive Power Supply Pin ($+9.0 \leq V^+ \leq +13.2$)
11	V^-	Negative Power Supply Pin ($-9.0 \leq V^- \leq -13.2$)
1	V_{CC}	Positive Power Supply Pin ($+5V \pm 5\%$)

Applications Information

In a typical Data Terminal Equipment (DTE) to Data Circuit-Terminating Equipment (DCE) 9-pin de-facto interface implementation, 2 data lines and 6 control lines are required. The data lines are TXD and RXD. The control lines are RTS, DTR, DSR, DCD, CTS and RI.

The DS14196 is a 5 x 3 Driver/Receiver and offers a single chip solutuion for this DTE interface. As shown in *Figure 5*, this interface allows for direct flow-thru interconnect. For a more conservative design, the user may wish to insert ground traces between the signal lines to minimize cross talk.

LapLink COMPATIBILITY

The DS14196 can easily provide 128 kbps data rate under maximum driver load conditions of C_L = 2500 pF and R_L = 3 kΩ, while power supplies are:

$$V_{CC} = +4.75V, V^+ = 10.8V, V^- = -10.8V$$

MOUSE DRIVING

A typical mouse can be powered from the drivers. Two driver outputs connected in parallel and set to V_{OH} can be used to supply power to the V^+ pin of the mouse. The third driver output is set to V_{OL} to sink the current from the V^- terminal. Refer to typical curves of V_{OUT}/I_{OUT}. Typical mouse specifications are:
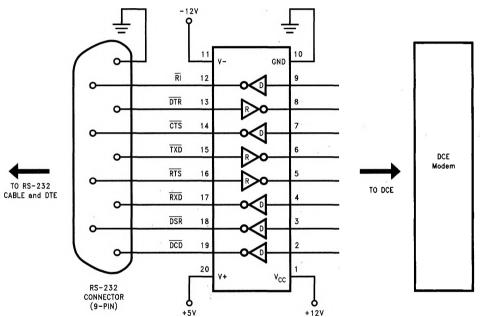
10 mA at +6V   5 mA at −6V

FIGURE 5. Typical DCE Application

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