

*National Semiconductor*

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## DSV14196

### +3.3V Supply EIA/TIA-232 5 Driver x 3 Receiver

#### General Description

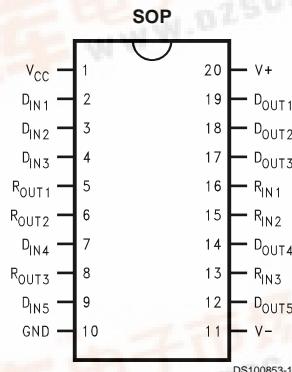
The DSV14196/DSV14196T is a five driver, three receiver device which conforms to the EIA/TIA-232-E and the ITU-T V.28 standards.

The flow-through pinout facilitates simple non-crossover board layout. The DSV14196/DSV14196T provides a peripheral side one-chip solution for the common 9-pin serial RS-232 interface between data terminals and data communications equipment.

#### Features

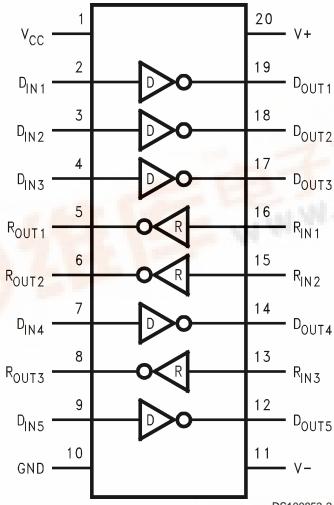
- Conforms to EIA/TIA-232-E and ITU-T V.28
- 5 drivers and 3 receivers
- Flow-through pinout
- Failsafe receiver outputs high when inputs open
- 20-pin wide SOIC package
- LapLink® compatible—230.4 kbps data rate
- +3.3V Logic Interface
- Commercial temperature range option DSV14196 (0°C to 70°C)
- Industrial temperature range option DSV14196T (-40°C to +85°C)

#### Connection Diagram



Order Number DSV14196WM, DSV14196TWM  
See NS Package Number M20B

#### Functional Diagram



LapLink® is a registered trademark of Travelling Software.

### 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)	$\pm 15V$
Receiver Input Voltage	$\pm 25V$
Receiver Output Voltage ( $R_{OUT}$ )	0V to $V_{CC}$
Maximum Power Package Dissipation @ +25°C M Package	1524 mW
Derate M Package	12.2 mW/°C above 25°C
Storage Temperature Range	-65°C to +150°C

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

### Recommended Operating Conditions

	Min	Nom	Max	Units
Supply Voltage ( $V_{CC}$ )	+3.0	+3.3	+3.6	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 ( $T_A$ )				
DSV14196	0	+25	+70	°C
DSV14196T	-40	+25	+85	°C

### Electrical Characteristics (Note 2) (Note 3) DSV14196

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DEVICE CHARACTERISTICS</b>						
$I_{CC}$	$V_{CC}$ Supply Current	No Load, All Inputs at +3.3V		8	16	mA
$I^+$	$V^+$ Supply Current	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.7V or 2.4V.	$V^+ = +9V, V^- = -9V$	16	26	mA
$I^-$	$V^-$ Supply Current		$V^+ = +13.2V, V^- = -13.2V$	23	36	mA
			$V^+ = +9V, V^- = -9V$	-18	-26	mA
			$V^+ = +13.2V, V^- = -13.2V$	-25	-36	mA
<b>DRIVER CHARACTERISTICS</b>						
$V_{IH}$	High Level Input Voltage		2.0			V
$V_{IL}$	Low Level Input Voltage				0.8	V
$I_{IH}$	High Level Input Current	$V_{IN} = 3.3V$			10	μA
$I_{IL}$	Low Level Input Current	$V_{IN} = 0V$		-1.1	-1.5	mA
$V_{OH}$	High Level Output Voltage	$R_L = 3 k\Omega, V_{IN} = 0.8V, V^+ = +9V, V^- = -9V$	6	7		V
		$R_L = 3 k\Omega, V_{IN} = 0.8V, V^+ = +12V, V^- = -12V$	8	9		V
		$R_L = 7 k\Omega, V_{IN} = 0.8V, V^+ = +13.2V, V^- = -13.2V$	10	11.5		V
$V_{OL}$	Low Level Output Voltage	$R_L = 3 k\Omega, V_{IN} = 2V, V^+ = +9V, V^- = -9V$		-7	-6	V
		$R_L = 3 k\Omega, V_{IN} = 2V, V^+ = +12V, V^- = -12V$		-10	-8	V
		$R_L = 7 k\Omega, V_{IN} = 2V, V^+ = +13.2V, V^- = -13.2V$		-11.5	-10	V
$I_{OS+}$	Output High Short Circuit Current (Note 4)	$V_{OUT} = 0V, V_{IN} = 0.8V$	-6	-12	-18	mA
$I_{OS-}$	Output Low Short Circuit Current (Note 4)	$V_{OUT} = 0V, V_{IN} = 2.0V$	6	12	18	mA
$R_O$	Output Resistance	$-2V \leq V_{OUT} \leq +2V, V^+ = V^- = V_{CC} = 0V$	300			Ω
		$-2V \leq V_{OUT} \leq +2V, V^+ = V^- = V_{CC} = \text{Open Circuit}$	300			Ω

## Electrical Characteristics (Note 2) (Note 3)

### DSV14196 (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>RECEIVER CHARACTERISTICS</b>						
$V_{TH}$	Input High Threshold (Recognized as a High Signal)	$V_{OUT} \leq 0.4V$ , $I_O = 3.2 \text{ mA}$	1.5	1.85	2.4	V
$V_{TL}$	Input Low Threshold (Recognized as a Low Signal)	$V_{OUT} \geq 1.7V$ , $I_O = -0.5 \text{ mA}$	0.7	0.9	1.3	V
$R_{IN}$	Input Resistance	$V_{IN} = \pm 3V$ to $\pm 15V$	3.0	3.8	7.0	k $\Omega$
$I_{IN}$	Input Current	$V_{IN} = +15V$	2.1	4.0	5.0	mA
		$V_{IN} = +3V$	0.43	0.7	1.0	mA
		$V_{IN} = -15V$	-2.1	-4.0	-5.0	mA
		$V_{IN} = -3V$	-0.43	-0.7	-1.0	mA
$V_{OH}$	High Level Output Voltage (Note 7)	$I_{OH} = -0.5 \text{ mA}$ , $V_{IN} = -3V$	1.7	2.4		V
		$I_{OH} = -10 \mu\text{A}$ , $V_{IN} = -3V$	2.7	3.2		V
		$I_{OH} = -0.5 \text{ mA}$ , $V_{IN} = \text{Open Circuit}$	1.7	2.4		V
		$I_{OH} = -10 \mu\text{A}$ , $V_{IN} = \text{Open Circuit}$	2.7	3.2		V
$V_{OL}$	Low Level Output Voltage	$I_{OL} = 3.2 \text{ mA}$ , $V_{IN} = +3V$		0.2	0.4	V
$I_{OSR}$	Short Circuit Current	$V_{OUT} = 0V$ , $V_{IN} = 0V$ (Note 4)	-0.6	-1.8	-3.0	mA

## Electrical Characteristics (Note 2) (Note 3)

### DSV14196T

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DEVICE CHARACTERISTICS</b>						
$I_{CC}$	$V_{CC}$ Supply Current	No Load, All Inputs at +3.3V		8	16	mA
$I^+$	$V^+$ Supply Current	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.7V or 2.4V.	$V^+ = +9V$ , $V^- = -9V$	16	26	mA
$I^-$	$V^-$ Supply Current		$V^+ = +13.2V$ , $V^- = -13.2V$	23	36	mA
			$V^+ = +9V$ , $V^- = -9V$	-18	-26	mA
			$V^+ = +13.2V$ , $V^- = -13.2V$	-25	-36	mA
<b>DRIVER CHARACTERISTICS</b>						
$V_{IH}$	High Level Input Voltage		2.0			V
$V_{IL}$	Low Level Input Voltage				0.8	V
$I_{IH}$	High Level Input Current	$V_{IN} = 3.3V$			10	$\mu\text{A}$
$I_{IL}$	Low Level Input Current	$V_{IN} = 0V$		-1.1	-1.9	mA
$V_{OH}$	High Level Output Voltage	$R_L = 3 \text{ k}\Omega$ , $V_{IN} = 0.8V$ , $V^+ = +9V$ , $V^- = -9V$	5.5	7		V
		$R_L = 3 \text{ k}\Omega$ , $V_{IN} = 0.8V$ , $V^+ = +12V$ , $V^- = -12V$	7.5	9		V
		$R_L = 7 \text{ k}\Omega$ , $V_{IN} = 0.8V$ , $V^+ = +13.2V$ , $V^- = -13.2V$	9	11.5		V
$V_{OL}$	Low Level Output Voltage	$R_L = 3 \text{ k}\Omega$ , $V_{IN} = 2V$ , $V^+ = +9V$ , $V^- = -9V$		-7	-5.5	V
		$R_L = 3 \text{ k}\Omega$ , $V_{IN} = 2V$ , $V^+ = +12V$ , $V^- = -12V$		-10	-7.5	V
		$R_L = 7 \text{ k}\Omega$ , $V_{IN} = 2V$ , $V^+ = +13.2V$ , $V^- = -13.2V$		-11.5	-9	V
$I_{OS^+}$	Output High Short Circuit Current (Note 4)	$V_{OUT} = 0V$ , $V_{IN} = 0.8V$	-4	-12	-22	mA
$I_{OS^-}$	Output Low Short Circuit Current (Note 4)	$V_{OUT} = 0V$ , $V_{IN} = 2.0V$	4	12	22	mA
$R_O$	Output Resistance	$-2V \leq V_{OUT} \leq +2V$ , $V^+ = V^- = V_{CC} = 0V$	300			$\Omega$
		$-2V \leq V_{OUT} \leq +2V$ , $V^+ = V^- = V_{CC} = \text{Open Circuit}$	300			$\Omega$

## Electrical Characteristics (Note 2) (Note 3)

### DSV14196T (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>RECEIVER CHARACTERISTICS</b>						
$V_{TH}$	Input High Threshold (Recognized as a High Signal)	$V_{OUT} \leq 0.5V$ , $I_O = 3.2$ mA	1.4	1.85	2.8	V
$V_{TL}$	Input Low Threshold (Recognized as a Low Signal)	$V_{OUT} \geq 1.7V$ , $I_O = -0.5$ mA	0.5	0.9	1.4	V
$R_{IN}$	Input Resistance	$V_{IN} = \pm 3V$ to $\pm 15V$ , $TA = 0^\circ C$ to $70^\circ C$	3.0	3.8	7.0	k $\Omega$
$I_{IN}$	Input Current	$V_{IN} = +15V$ , $TA = 0^\circ C$ to $+70^\circ C$	2.1	4.0	5.0	mA
		$V_{IN} = +3V$ , $TA = 0^\circ C$ to $+70^\circ C$	0.43	0.7	1.0	mA
		$V_{IN} = -15V$ , $TA = 0^\circ C$ to $+70^\circ C$	-2.1	-4.0	-5.0	mA
		$V_{IN} = -3V$ , $TA = 0^\circ C$ to $+70^\circ C$	-0.43	-0.7	-1.0	mA
$V_{OH}$	High Level Output Voltage (Note 7)	$I_{OH} = -0.5$ mA, $V_{IN} = -3V$ , $V_{CC} = 3.3V$	1.8	2.4		V
		$I_{OH} = -10$ $\mu$ A, $V_{IN} = -3V$ , $V_{CC} = 3.3V$	3.0	3.2		V
		$I_{OH} = -0.5$ mA, $V_{IN}$ = Open Circuit, $V_{CC} = 3.3V$	1.8	2.4		V
		$I_{OH} = -10$ $\mu$ A, $V_{IN}$ = Open Circuit, $V_{CC} = 3.3V$	3.0	3.2		V
$V_{OL}$	Low Level Output Voltage	$I_{OL} = 3.2$ mA, $V_{IN} = +3V$		0.2	0.5	V
$I_{OSR}$	Short Circuit Current	$V_{OUT} = 0V$ , $V_{IN} = 0V$ (Note 4)	-0.4	-1.8	-3.2	mA

**Switching Characteristics** (Note 3) (Note 5) (Note 6)  
**DSV14196 & DSV14196T**

$T_A = +25^\circ\text{C}$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DRIVER CHARACTERISTICS</b>						
$t_{PHL}$	Propagation Delay High to Low	$R_L = 3 \text{ k}\Omega, C_L = 50 \text{ pF}$ (Figures 1, 2)	60	350	ns	
$t_{PLH}$	Propagation Delay Low to High		240	350	ns	
$t_r, t_f$	Rise/Fall Time (Note 8)		40		ns	
<b>RECEIVER CHARACTERISTICS</b>						
$t_{PHL}$	Propagation Delay High to Low	$R_L = 1.5 \text{ k}\Omega, C_L = 15 \text{ pF}$ (includes fixture plus probe), (Figures 3, 4)	150	350	ns	
$t_{PLH}$	Propagation Delay Low to High		240	350	ns	
$t_r$	Rise Time		40	175	ns	
$t_f$	Fall Time		40	100	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  $-6\text{V}$  is a maximum, the typical value  $-6.8\text{V}$  is more negative.

**Note 3:** All typicals are given for:  $V_{CC} = +3.3\text{V}$ ,  $V^+ = +12\text{V}$ ,  $V^- = -12\text{V}$ ,  $T_A = +25^\circ\text{C}$ .

**Note 4:** Only one driver output shorted at a time.

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

**Note 6:** Generator characteristics for receiver input:  $f = 64 \text{ kHz}$  (128 kbps),  $t_r = t_f = 200 \text{ ns}$ ,  $V_{IH} = 3\text{V}$ ,  $V_{IL} = -3\text{V}$ , 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  $+3\text{V}$  to the  $-3\text{V}$  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  $30 \text{ V}/\mu\text{s}$  maximum slew rate, a minimum load capacitance of  $390 \text{ pF}$  for DSV14196 or  $620 \text{ pF}$  for DSV14196T is recommended.

## Parameter Measurement Information

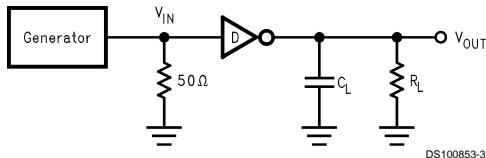


FIGURE 1. Driver Propagation Delay and Transition Time Test Circuit (Note 5)

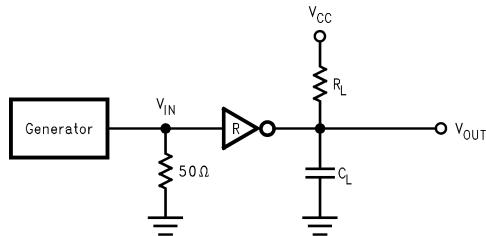


FIGURE 3. Receiver Propagation Delay and Transition Time Test Circuit (Note 6)

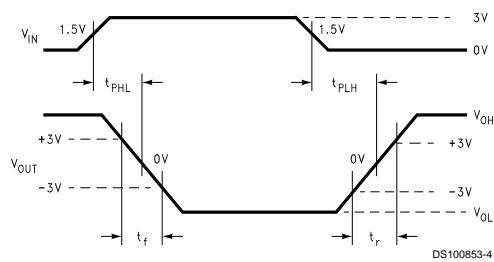


FIGURE 2. Driver Propagation Delay and Transition Time Waveforms Slew Rate (SR) =  $6V/(t_r \text{ or } t_f)$

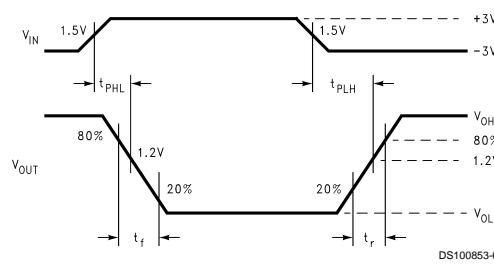


FIGURE 4. Receiver Propagation Delay and Transition Time Waveform

## Pin Descriptions

Pin #	Pin Name	Description
2, 3, 4, 7, 9	D <sub>IN</sub>	Driver Input Pins
12, 14, 17, 18, 19	D <sub>OUT</sub>	Driver Output Pins, RS-232 Levels
13, 15, 16	R <sub>IN</sub>	Receiver Input Pins, RS-232 Levels
5, 6, 8	R <sub>OUT</sub>	Receiver Output Pins
10	GND	Ground
20	V <sup>+</sup>	Positive Power Supply Pin (+9.0 ≤ V <sup>+</sup> ≤ +13.2)
11	V <sup>-</sup>	Negative Power Supply Pin (-9.0 ≤ V <sup>-</sup> ≤ -13.2)
1	V <sub>CC</sub>	Positive Power Supply Pin (+3.3V ±10%)

## 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 DSV14196/DSV14196T is a 5 x 3 Driver/Receiver and offers a single chip solution 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.

### FAILSAFE RECEIVER OUTPUTS

The DSV14196/DSV14196T features failsafe receiver outputs. In failsafe mode, if the receiver input becomes zero or an open-circuit, the receiver output is pulled to a high level.

### LapLink COMPATIBILITY

The DSV14196/DSV14196T can easily provide 128 kbps data rate under maximum driver load conditions of  $C_L = 2500 \text{ pF}$  and  $R_L = 3 \text{ k}\Omega$ , while power supplies are:

$$V_{CC} = +3.0V, V^+ = 10.8V, V^- = -10.8V$$

### 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:

$$10 \text{ mA at } +6V \quad 5 \text{ mA at } -6V$$

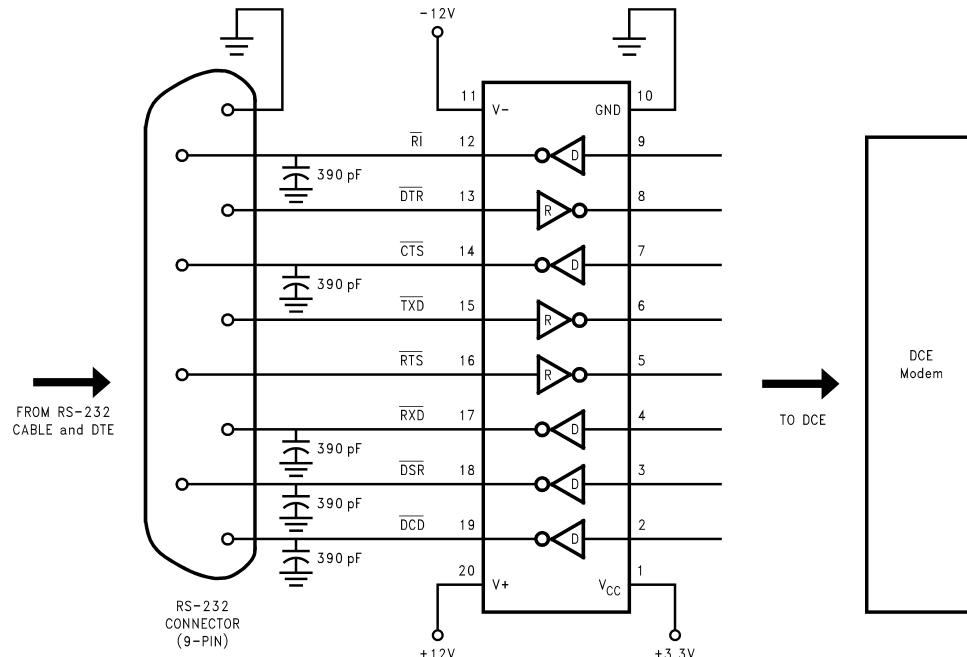


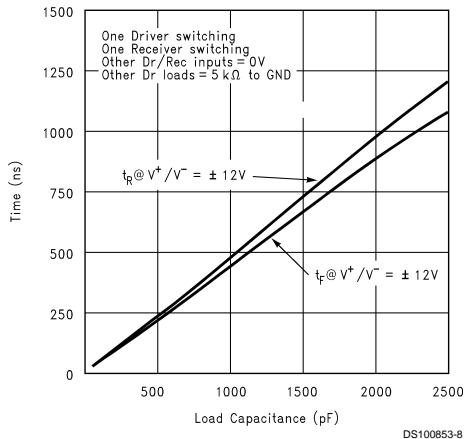
FIGURE 5. Typical DCE Application

DS100853-7

## Typical Performance Characteristics

### Driver Output Slew Rate between +3V and -3V vs Load Capacitance

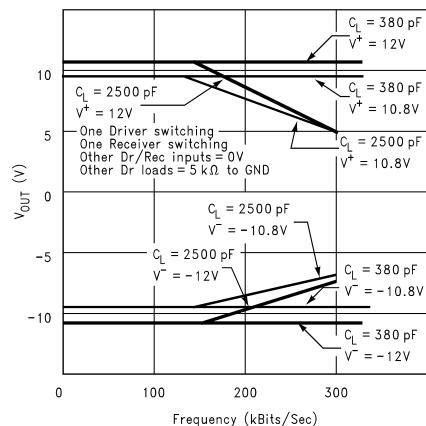
Conditions:  $V_{CC} = 3.3V$ ,  $R_L = 5 k\Omega$ ,  $T_A = 25^\circ C$ ,  $f_{IN} = 64$  kHz Square Wave



DS100853-8

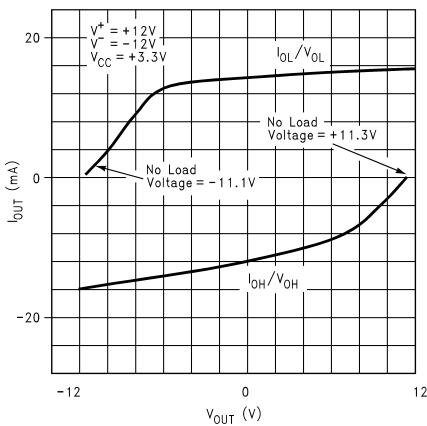
### Driver Output Voltage vs Frequency and $C_L$

Conditions:  $V_{CC} = 3.3V$ ,  $R_L = 5 k\Omega$ ,  $T_A = 25^\circ C$



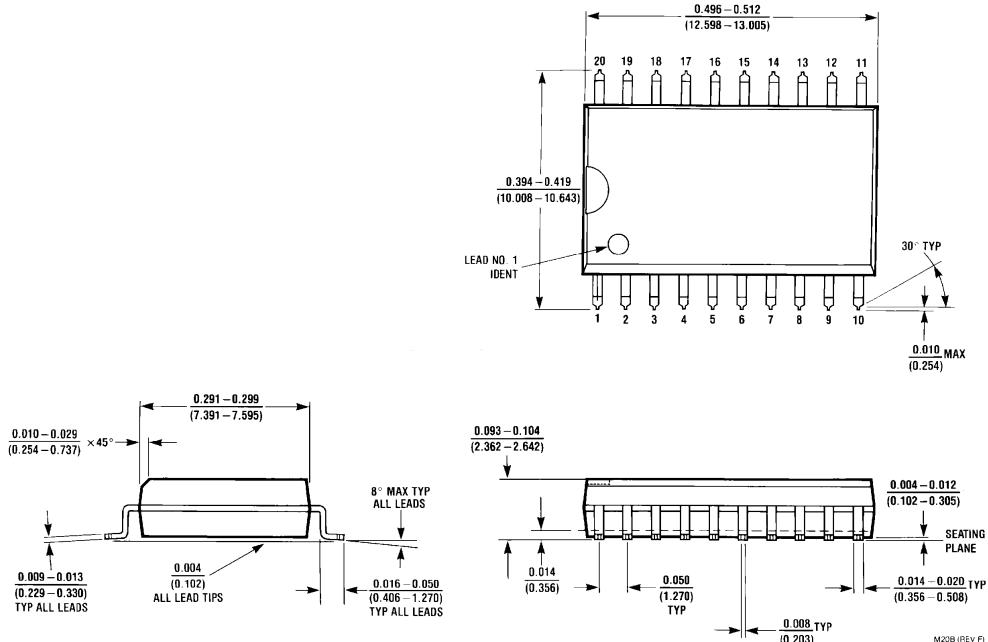
DS100853-9

### Driver Output Current vs Output Voltage



DS100853-10

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



20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC  
Order Number DSV14196WM  
NS Package Number M20B

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