National Semiconductor

March 1999

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 and the ITU-T V.28 standards.

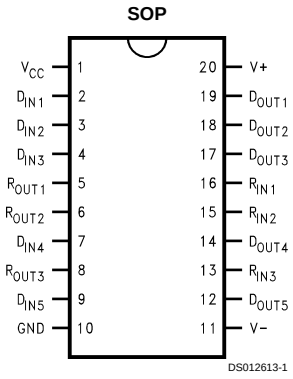
The flow-through pinout facilitates simple non-crossover board layout. The DS14196 provides a peripheral side one-chip solution for the common 9-pin serial RS-232 interface between data terminals and data communications equipment.

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

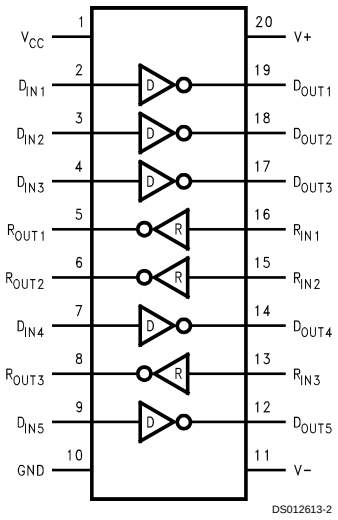
- Replaces two 1488s and one 1489
- Conforms to EIA/TIA-232-E and ITU-T V.28
- 5 drivers and 3 receivers
- Flow-through pinout
- Failsafe receiver outputs high when inputs open
- 20-pin wide SOIC package
- LapLink® compatible — 230.4 kbps data rate
- Pin compatible with: SN75196, GD75323

Connection Diagram



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	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)	≥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 (Note 2) (Note 3)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DEVICE CHARACTERISTICS							
I_{CC}	V_{CC} Supply Current	No Load, All Inputs at +5V			15	22	mA
I^+	V^+ Supply Current	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.8V or 2.4V.	V^+ = +9V, V^- = −9V		20	26	mA
			V^+ = +13.2V, V^- = −13.2V		30	36	mA
I^-	V^- Supply Current		V^+ = +9V, V^- = −9V		−20	−26	mA
			V^+ = +13.2V, V^- = −13.2V		−30	−36	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	V_{IN} = 5V				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 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	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	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			−10	−8	V
		R_L = 7 kΩ, 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 ≤ V_{OUT} ≤ +2V, V^+ = V^- = V_{CC} = 0V		300			Ω
		−2V ≤ V_{OUT} ≤ +2V, V^+ = V^- = V_{CC} = Open Circuit		300			Ω
RECEIVER CHARACTERISTICS							
V_{TH}	Input High Threshold (Recognized as a High Signal)	V_{OUT} ≤ 0.4V, I_O = 3.2 mA			2.1	2.4	V
V_{TL}	Input Low Threshold (Recognized as a Low Signal)	V_{OUT} ≥ 2.5V, I_O = −0.5 mA		0.7	1.0		V
R_{IN}	Input Resistance	V_{IN} = ±3V to ±15V		3.0	3.8	7.0	kΩ
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

Electrical Characteristics (Note 2) (Note 3) (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
RECEIVER CHARACTERISTICS						
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	V_{OUT} = 0V, V_{IN} = 0V (Note 4)	−1.7	−2.7	−4	mA

Switching Characteristics (Note 3) (Note 5) (Note 6)

T_A = 25˚C

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, 2*)		90	350	ns
t_{PLH}	Propagation Delay Low to High			210	350	ns
t_r, t_f	Rise/Fall Time (Note 8)			40		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, 4*)		40	100	ns
t_{PLH}	Propagation Delay Low to High			70	160	ns
t_r	Rise Time			40	175	ns
t_f	Fall Time			9	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

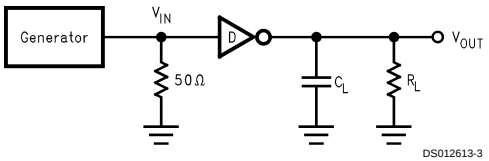


FIGURE 1. Driver Propagation Delay and Transition Time Test Circuit (Note 5)

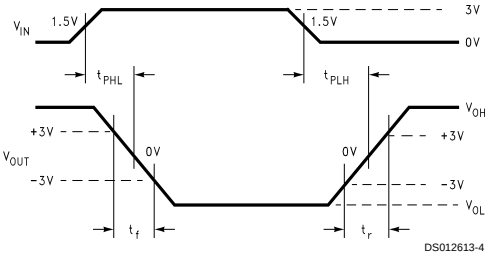


FIGURE 2. Driver Propagation Delay and Transition Time Waveforms Slew Rate (SR) = 6V/(t_r or t_f)

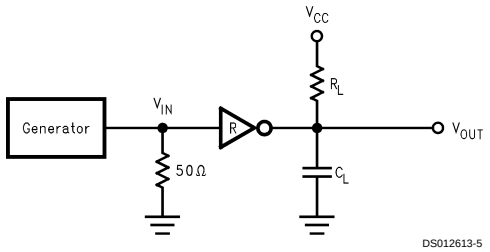


FIGURE 3. Receiver Propagation Delay and Transition Time Test Circuit (Note 6)

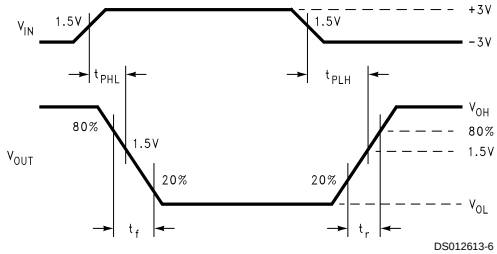


FIGURE 4. Receiver Propagation Delay and Transition Time Waveform

Pin Descriptions

Pin #	Pin Name	Description
2, 3, 4, 7, 9	D_{IN}	Driver Input Pins
12, 14, 17, 18, 19	D_{OUT}	Driver Output Pins, RS-232 Levels
13, 15, 16	R_{IN}	Receiver Input Pins, RS-232 Levels
5, 6, 8	R_{OUT}	Receiver Output Pins
10	GND	Ground
20	V^+	Positive Power Supply Pin ($+9.0 \le V^+ \le +13.2$)
11	V^-	Negative Power Supply Pin ($-9.0 \le V^- \le -13.2$)
1	V_{CC}	Positive Power Supply Pin (+5V ±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.

FAILSAFE RECEIVER OUTPUTS

The DS14196 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 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

Applications Information (Continued)

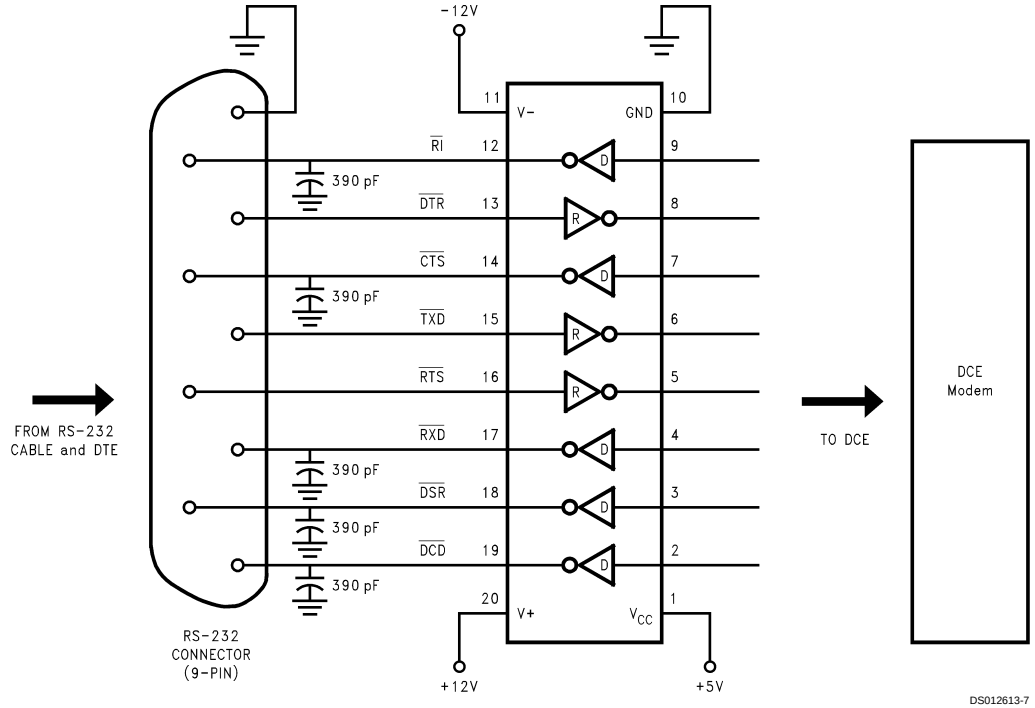
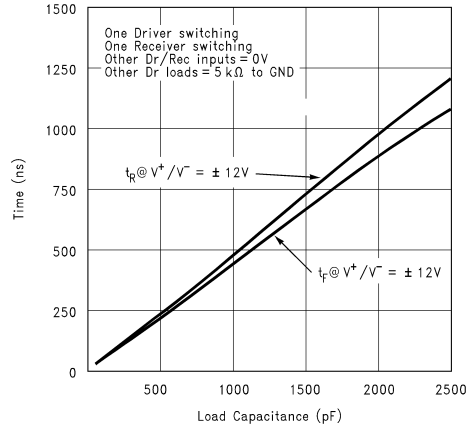


FIGURE 5. Typical DCE Application

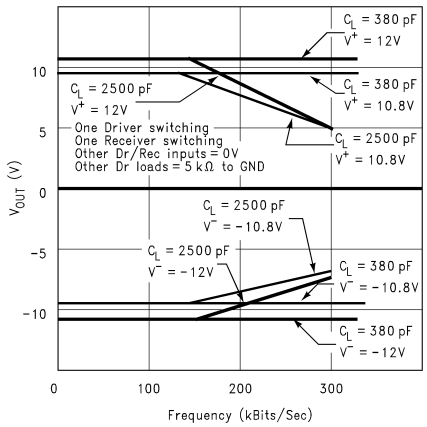
Typical Performance Characteristics

Driver Output Slew Rate between +3V and −3V vs Load Capacitance
Conditions: V_{CC} = 5V, R_L = 5 kΩ, T_A = 25˚C, f_{IN} = 64 kHz Square Wave



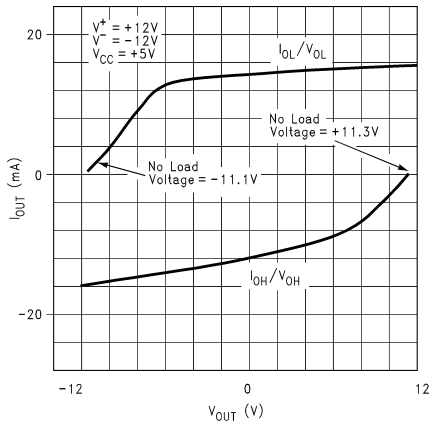
DS012613-8

Driver Output Voltage vs Frequency and C_L
Conditions: V_{CC} = 5V, R_L = 5 kΩ, T_A = 25˚C

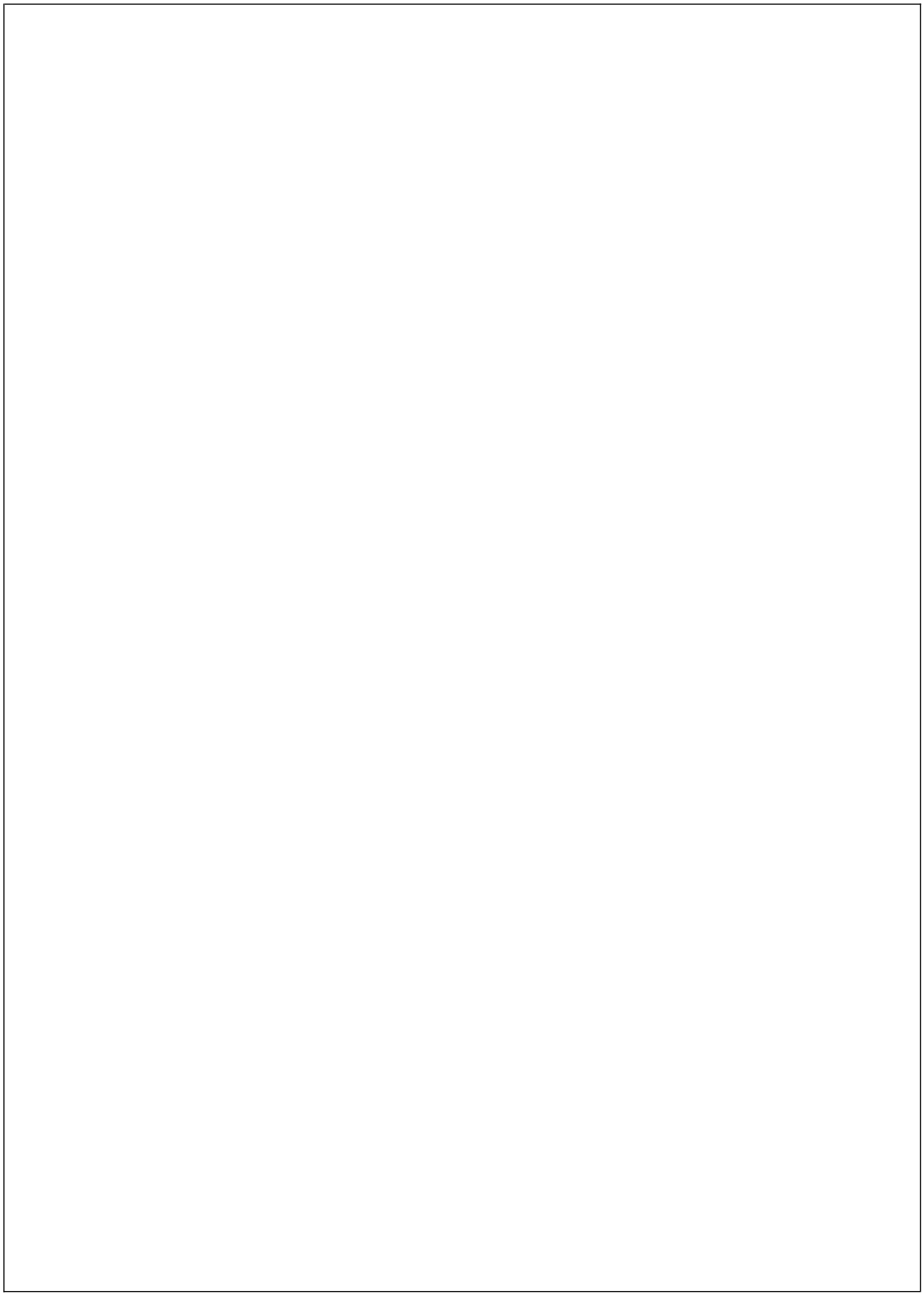


DS012613-9

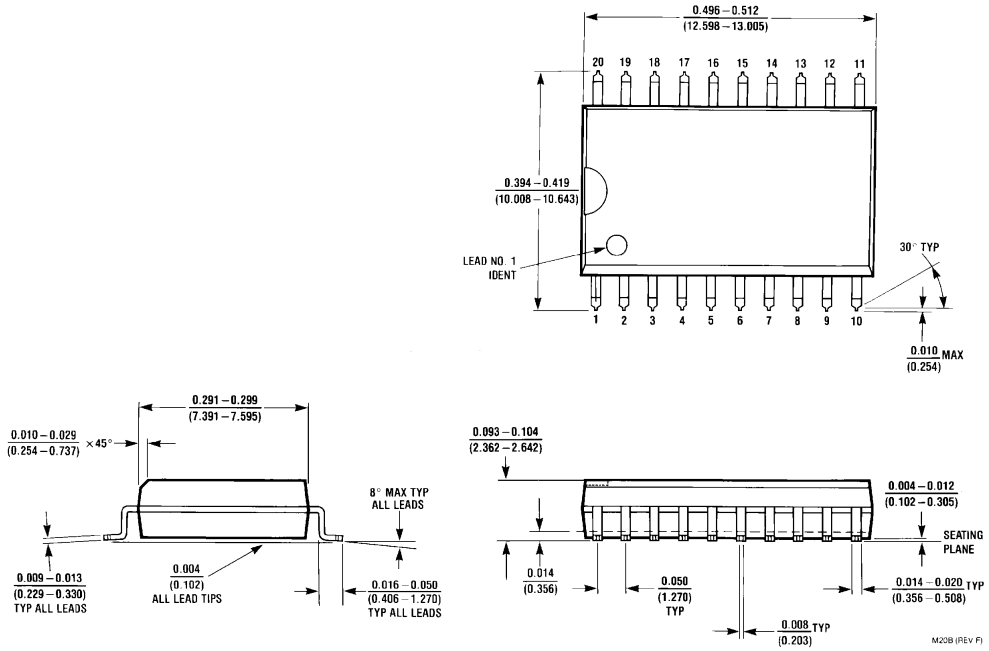
Driver Output Current vs Output Voltage



DS012613-10



Physical Dimensions inches (millimeters) unless otherwise noted



20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC
Order Number DS14196WM
NS Package Number M20B

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