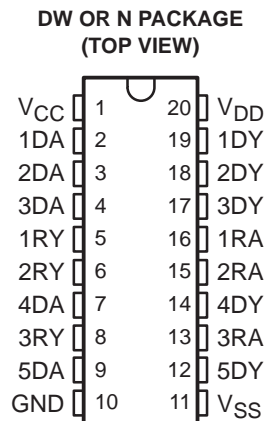


- **Single Chip With Easy Interface Between UART and Serial-Port Connector of an External Modem or Other Computer Peripheral**
- **Five Drivers and Three Receivers Meet or Exceed the Requirements of TIA/EIA-232-F and ITU Recommendation V.28**
- **Designed to Support Data Rates up to 120 kbit/s**
- **ESD Protection Meets Or Exceeds 10 kV on RS-232 Pins and 5 kV on All Other Pins (Human-Body Model)**
- **Complement to the SN75185**
- **Pin-to-Pin Replacement for the Goldstar GD75323**
- **Functional Replacement for the MC145405**



description

The SN75196 combines five drivers and three receivers from the trade-standard SN75188 and SN75189 bipolar quadruple drivers and receivers, respectively. The flow-through design of the SN75196 decreases the part count, reduces the board space required, and allows easy interconnection of the UART and serial-port connector. The all-bipolar circuits and processing of the SN75196 provide a rugged, low-cost solution for this function.

The SN75196 complies with the requirements of TIA/EIA-232-F and ITU (formerly CCITT) V.28 standards. These standards are for data interchange between a host computer and peripheral at signal rates of up to 20 kbit/s. The switching speeds of the SN75196 are fast enough to support rates of up to 120 kbit/s with lower capacitive loads (shorter cables). Interoperability at the higher signaling rates cannot be assured unless the designer has design control of the cable and the interface circuits at both ends. For interoperability at signaling rates of up to 120 kbit/s, use of TIA/EIA-423-B (ITU V.10) and TIA/EIA-422-B (ITU V.11) standards are recommended.

The SN75196 is characterized for operation over a temperature range of 0°C to 70°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

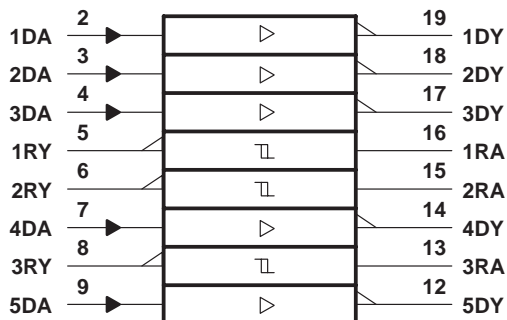
Copyright © 1998, Texas Instruments Incorporated

SN75196

MULTIPLE RS-232 DRIVERS AND RECEIVERS

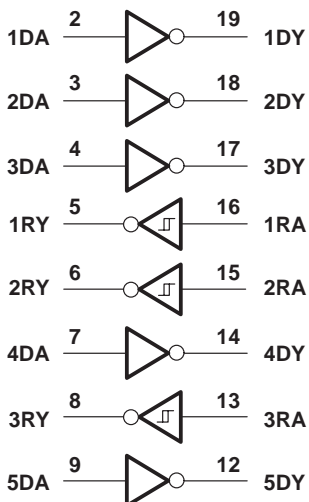
SLLS188B – MAY 1995 – REVISED APRIL 1998

logic symbol†

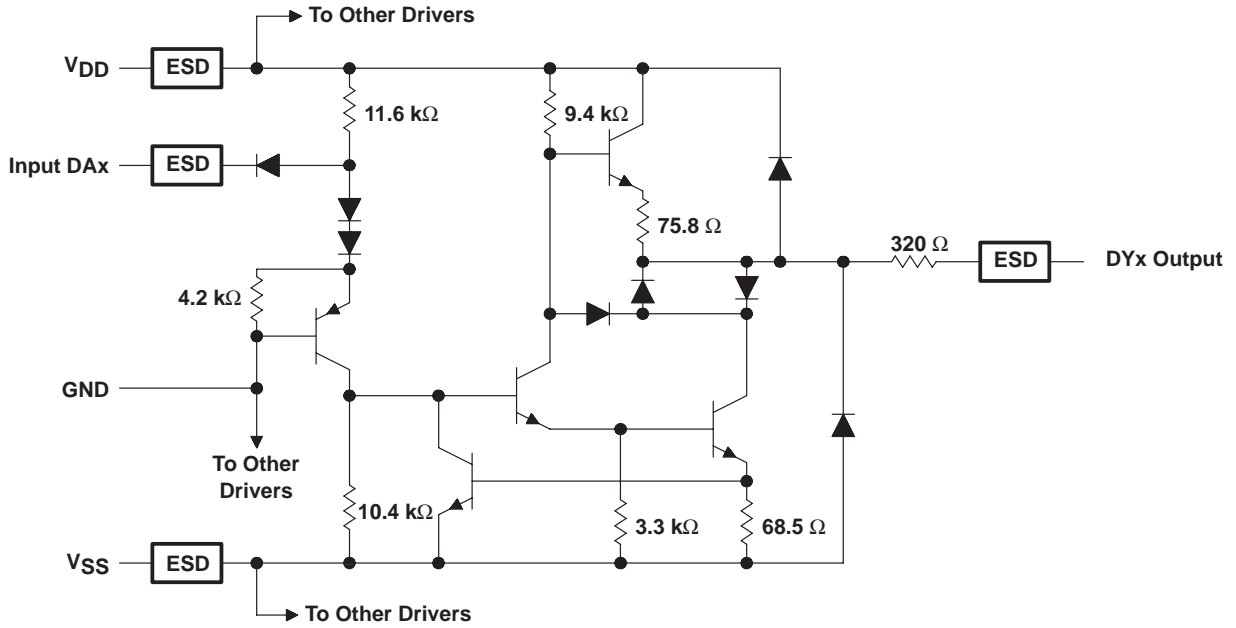


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)

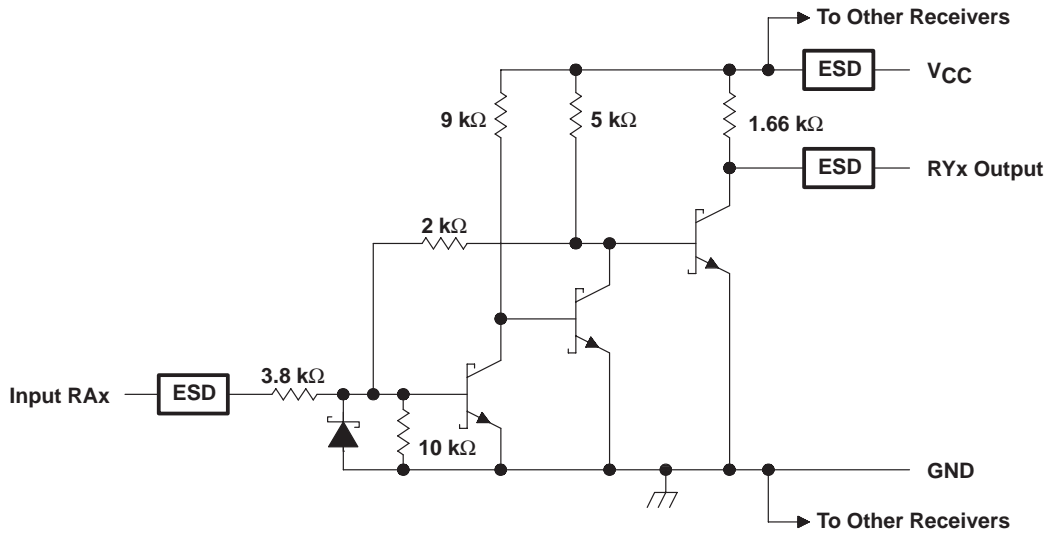


schematic of each driver



Resistor values shown are nominal.

schematic of each receiver



Resistor values shown are nominal.

SN75196 MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS188B – MAY 1995 – REVISED APRIL 1998

absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1)	10 V
Supply voltage, V_{DD} (see Note 1)	15 V
Supply voltage, V_{SS} (see Note 1)	-15 V
Input voltage range, V_i : Driver	-15 V to 7 V
Receiver	-30 V to 30 V
Output voltage range, V_O (Driver)	-15 V to 15 V
Low-level output current, I_{OL} (Receiver)	20 mA
Continuous total power dissipation	See Dissipation Rating Table
Electrostatic discharge: DY and RA to GND (see Note 2)	Class 3, A: 10 kV, B: 500 V
All pins (see Note 2)	Class 3, A: 5 kV, B: 300 V
Storage temperature range, T_{stg}	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltages are with respect to the network ground terminal.
2. Per MIL-PRF-38535, Method 3015.7

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR‡ ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
DW	1125 mW	9.0 mW/°C	720 mW
N	1150 mW	9.2 mW/°C	736 mW

‡ This is the inverse of the traditional junction-to-case thermal resistance ($R_{\theta JA}$).

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}		7.5	9	13.5	V
Supply voltage, V_{SS}		-7.5	-9	-13.5	V
Supply voltage, V_{CC}		4.5	5	5.5	V
High-level input voltage, V_{IH}	Driver	1.9			V
Low-level input voltage, V_{IL}	Driver			0.8	V
High-level output current, I_{OH}	Driver			-6	mA
	Receiver			-0.5	
High-level output current, I_{OL}	Driver			6	mA
	Receiver			16	
Operating free-air temperature, T_A		0		70	°C



supply currents over operating free-air temperature range

PARAMETER		TEST CONDITIONS			MIN	MAX	UNIT
I _{DD}	Supply current from V _{DD}	All inputs at 1.9 V, No load	V _{DD} = 9 V, V _{SS} = -9 V			25	mA
			V _{DD} = 12 V, V _{SS} = -12 V			32	
		All inputs at 0.8 V, No load	V _{DD} = 9 V, V _{SS} = -9 V			7.5	
			V _{DD} = 12 V, V _{SS} = -12 V			9.5	
I _{SS}	Supply current from V _{SS}	All inputs at 1.9 V, No load	V _{DD} = 9 V, V _{SS} = -9 V			-25	mA
			V _{DD} = 12 V, V _{SS} = -12 V			-32	
		All inputs at 0.8 V, No load	V _{DD} = 9 V, V _{SS} = -9 V			-5.3	
			V _{DD} = 12 V, V _{SS} = -12 V			-5.3	
I _{CC}	Supply current from V _{CC}	V _{CC} = 5 V, All inputs at 5 V, No load			20	mA	

DRIVER SECTION

electrical characteristics over operating free-air temperature range, V_{DD} = 9 V, V_{SS} = -9 V, V_{CC} = 5 V, (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
V _{OH}	High-level output voltage	V _{IL} = 0.8 V, R _L = 3 kΩ, See Figure 1			6	7.5		V
V _{OL}	Low-level output voltage (see Note 3)	V _{IH} = 1.9 V, R _L = 3 kΩ, See Figure 1				-7.5	-6	V
I _{IH}	High-level input current	V _I = 5 V, See Figure 2					10	μA
I _{IL}	Low-level input current	V _I = 0, See Figure 2					-1.6	mA
I _{OS(H)}	High-level short-circuit output current (see Note 4)	V _{IL} = 0.8 V, V _O = 0, See Figure 1			-4.5	-9	-19.5	mA
I _{OS(L)}	Low-level short-circuit output current (see Note 4)	V _{IH} = 2 V, V _O = 0, See Figure 1			4.5	9	19.5	mA
r _o	Output resistance (see Note 5)	V _{CC} = V _{DD} = V _{SS} = 0, V _O = -2 V to 2 V			300			Ω

- NOTES: 3. The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only, e.g., if -10 V is a maximum, the typical value is a more negative voltage.
 4. Output short-circuit conditions must maintain the total power dissipation below absolute maximum ratings.
 5. Test conditions are those specified by TIA/EIA-232-F and as listed above.

switching characteristics, V_{DD} = 12 V, V_{SS} = -12 V, V_{CC} = 5 V ±10%, T_A = 25°C

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t _{PLH}	Propagation delay time, low- to high-level output	R _L = 3 kΩ to 7 kΩ, C _L = 15 pF, See Figure 3				315	500	ns
t _{PHL}	Propagation delay time, high- to low-level output	R _L = 3 kΩ to 7 kΩ, C _L = 15 pF, See Figure 3				75	175	ns
t _{TLH}	Transition time, low- to high-level output (see Note 6)	R _L = 3 kΩ to 7 kΩ	C _L = 15 pF, See Figure 3			60	100	ns
			C _L = 2500 pF, See Figure 3 and Note 6			1.7	2.5	μs
t _{THL}	Transition time, high- to low-level output (see Note 7)	R _L = 3 kΩ to 7 kΩ	C _L = 15 pF, See Figure 3			40	75	ns
			C _L = 2500 pF, See Figure 3 and Note 7			1.5	2.5	μs

- NOTES: 6. Measured between -3-V and 3-V points of the output waveform (TIA/EIA-232-F conditions), all unused inputs are tied either high or low.
 7. Measured between 3-V and -3-V points of the output waveform (TIA/EIA-232-F conditions), all unused inputs are tied either high or low.

SN75196 MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS188B – MAY 1995 – REVISED APRIL 1998

RECEIVER SECTION

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V _{IT+}	Positive-going input threshold voltage	See Figure 5	T _A = 25°C	1.75	1.9	2.3	V
			T _A = 0°C to 70 °C	1.55		2.3	
V _{IT-}	Negative-going input threshold voltage	See Figure 5		0.75	0.97	1.25	V
V _{hys}	Input hysteresis (V _{IT+} - V _{IT-})	See Figure 5		0.5			V
V _{OH}	High-level output voltage	I _{OH} = -0.5 mA, See Figure 5	V _{IH} = 0.75 V	2.6	4	5	V
			Inputs open	2.6			
V _{OL}	Low-level input voltage	I _{OL} = 10 mA, V _I = 3 V, See Figure 5			0.2	0.45	V
I _{IH}	High-level input current	V _I = 25 V		3.6		8.3	mA
		V _I = 3 V		0.43			
I _{IL}	Low-level input current	V _I = -25 V		-3.6		-8.3	mA
		V _I = -3 V		-0.43			
I _{OS}	Short-circuit output current	See Figure 4		-3.4		-12	mA

† All typical values are at T_A = 25°C, V_{CC} = 5 V, V_{DD} = 9 V, and V_{SS} = -9 V.

switching characteristics, V_{CC} = 5 V, V_{DD} = 12 V, V_{SS} = -12 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t _{PLH}	Propagation delay time, low- to high-level output	C _L = 50 pF, R _L = 5 kΩ, See Figure 6			107	500	ns
t _{PHL}	Propagation delay time, high- to low-level output	C _L = 50 pF, R _L = 5 kΩ, See Figure 6			42	150	ns
t _{TLH}	Transition time, low- to high-level output	C _L = 50 pF, R _L = 5 kΩ, See Figure 6			175	525	ns
t _{THL}	Transition time, high- to low-level output	C _L = 50 pF, R _L = 5 kΩ, See Figure 6			16	60	ns



PARAMETER MEASUREMENT INFORMATION

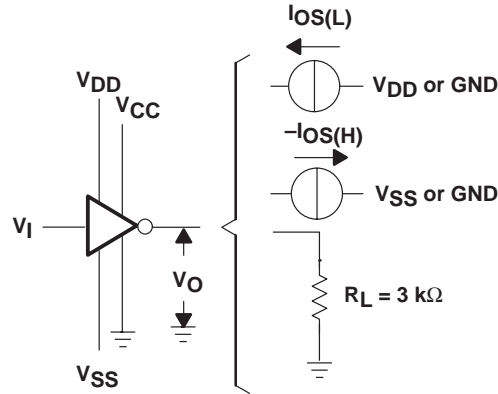


Figure 1. Driver Test Circuit for V_{OH} , V_{OL} , $I_{OS(H)}$, and $I_{OS(L)}$

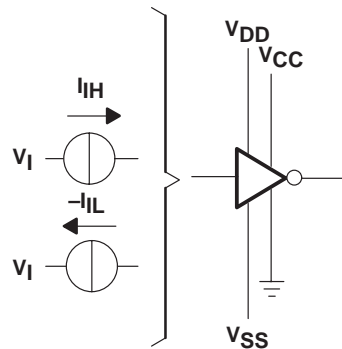
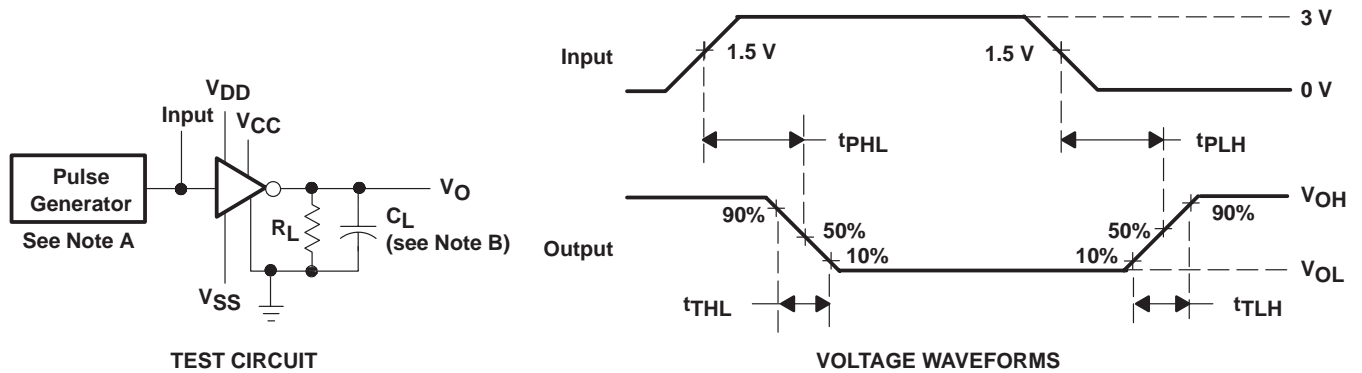


Figure 2. Driver Test Circuit for I_{IH} and I_{IL}



- NOTES: A. The pulse generator has the following characteristics: $t_w = 25\ \mu\text{s}$, $\text{PRR} = 20\ \text{kHz}$, $Z_O = 50\ \Omega$, $t_r = t_f < 50\ \text{ns}$.
 B. C_L includes probe and jig capacitance.

Figure 3. Driver Test Circuit and Voltage Waveforms

SN75196 MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS188B – MAY 1995 – REVISED APRIL 1998

PARAMETER MEASUREMENT INFORMATION

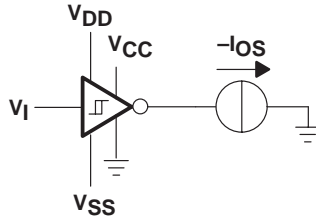


Figure 4. Receiver Test Circuit for I_{OS}

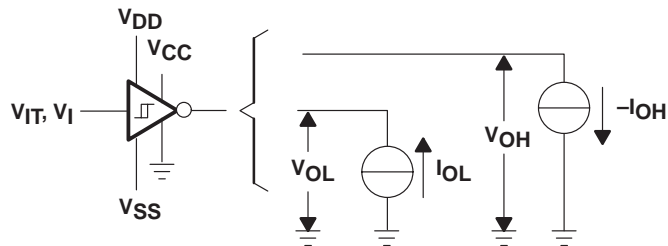
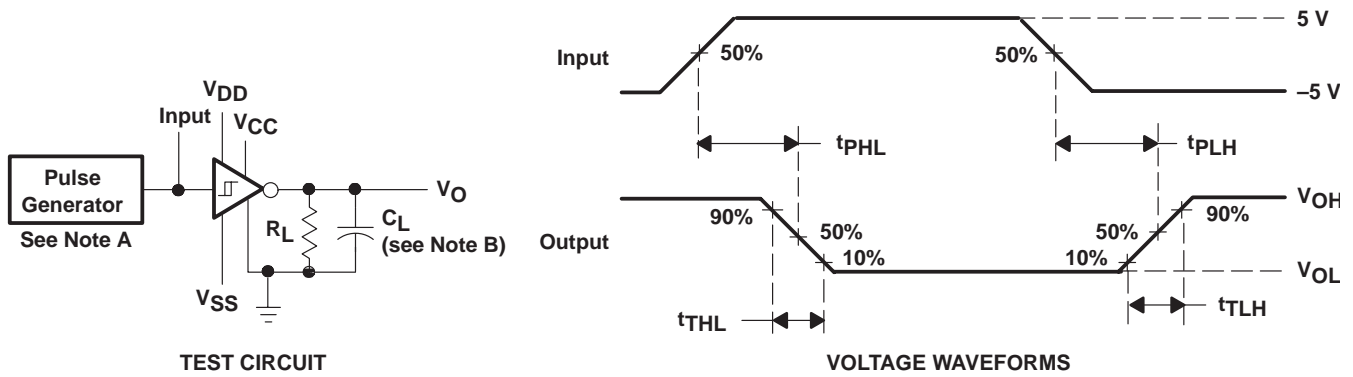


Figure 5. Receiver Test Circuit for V_{IT} , V_{OH} , and V_{OL}



NOTES: A. The pulse generator has the following characteristics: $t_w = 25 \mu s$, $PRR = 20 \text{ kHz}$, $Z_O = 50 \Omega$, $t_r = t_f < 50 \text{ ns}$.
B. C_L includes probe and jig capacitance.

Figure 6. Receiver Propagation and Transition Times

TYPICAL CHARACTERISTICS

DRIVER SECTION

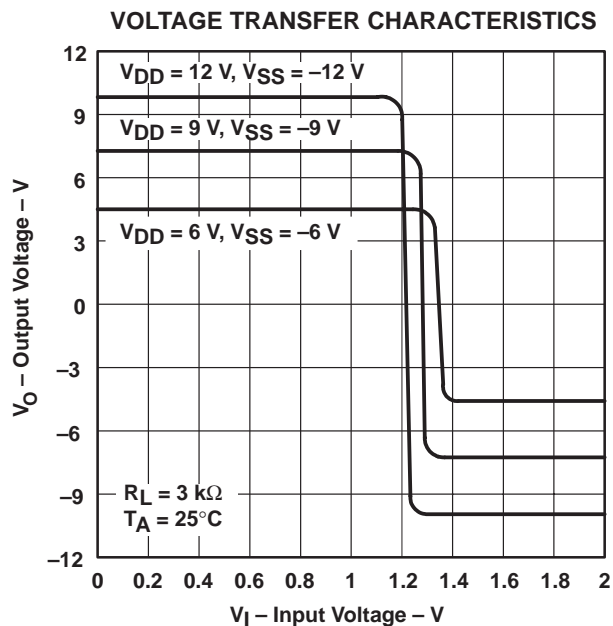


Figure 7

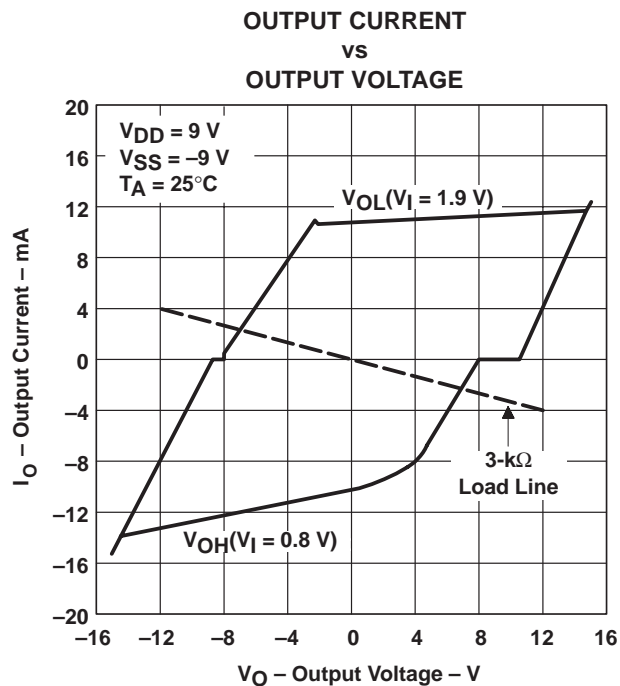


Figure 8

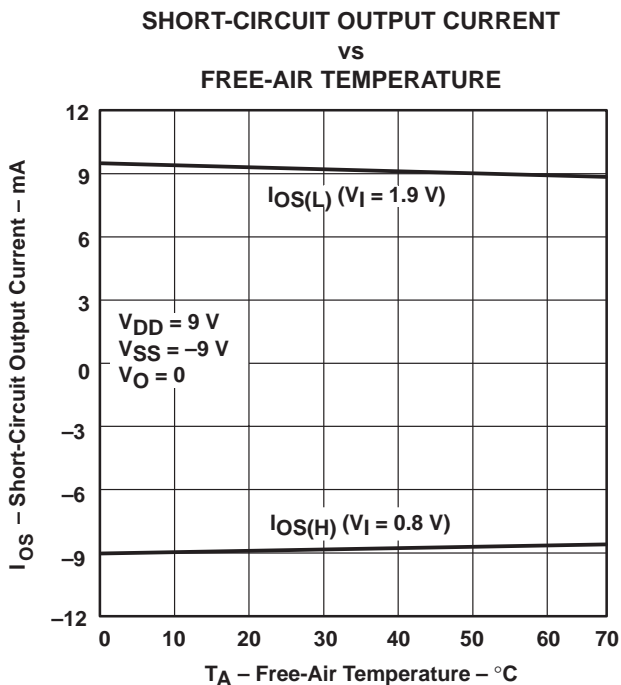


Figure 9

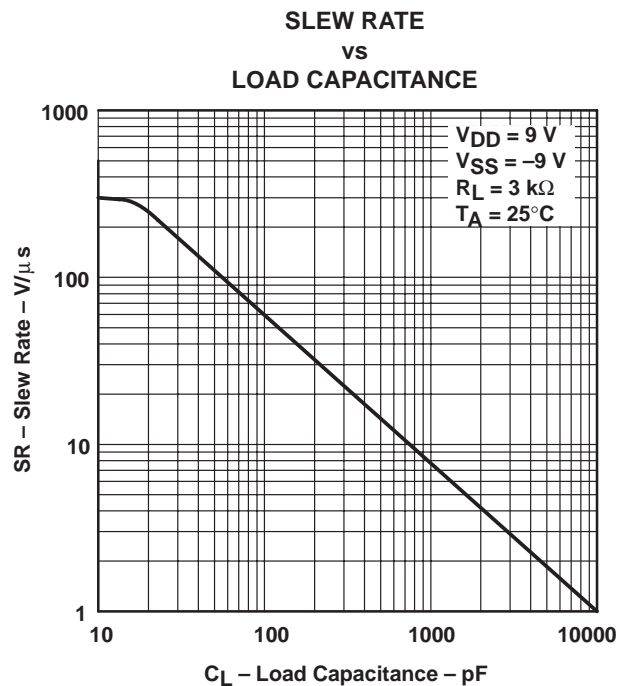


Figure 10

TYPICAL CHARACTERISTICS
 RECEIVER SECTION

INPUT THRESHOLD VOLTAGE
 vs
 FREE-AIR TEMPERATURE

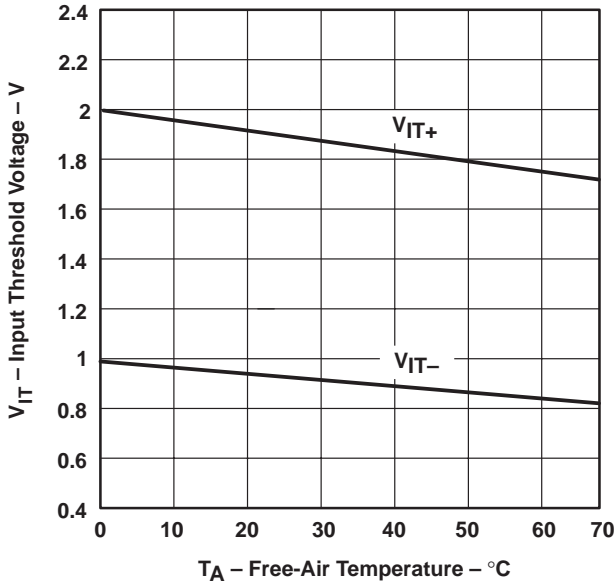


Figure 11

INPUT THRESHOLD VOLTAGE
 vs
 SUPPLY VOLTAGE

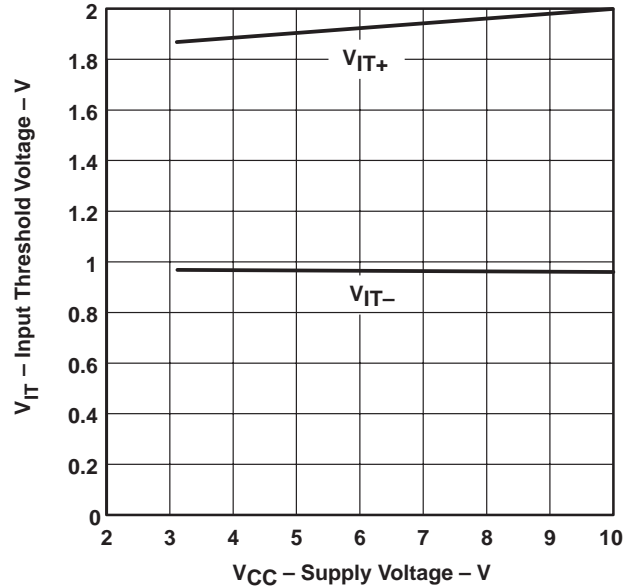
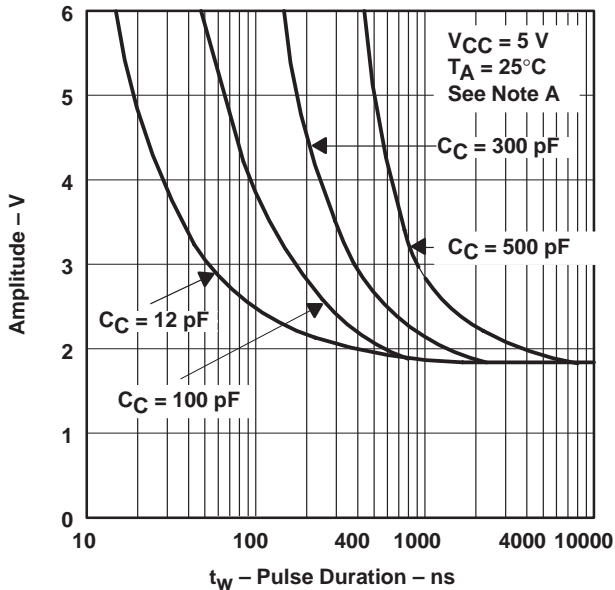


Figure 12

NOISE REJECTION



NOTE A: This figure shows the maximum amplitude of a positive-going pulse that, starting from 0 V, does not cause a change of the output level.

Figure 13

MAXIMUM SUPPLY VOLTAGE
 vs
 FREE-AIR TEMPERATURE

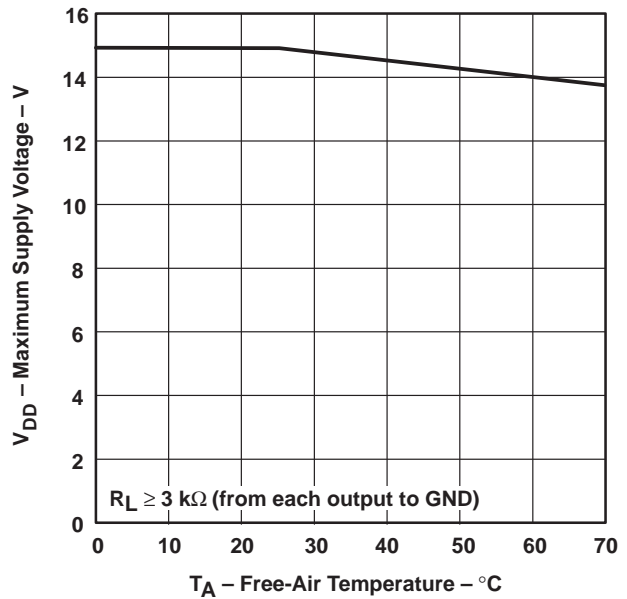


Figure 14

APPLICATION INFORMATION

Diodes placed in series with the V_{DD} and V_{SS} terminals protect the SN75196 in the fault condition when the device outputs are shorted to V_{DD} or V_{SS} and the power supplies are at low and provide low-impedance paths to ground (see Figure 15).

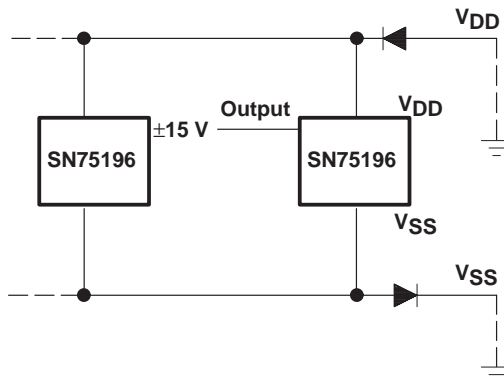
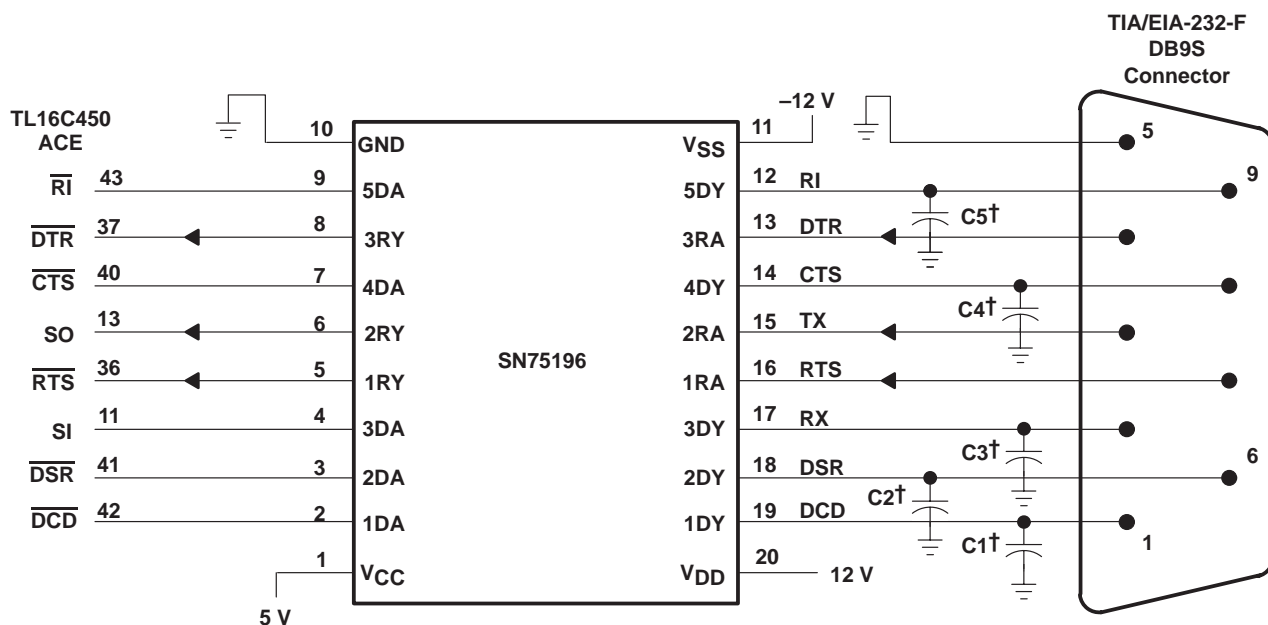


Figure 15. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F



† See Figure 10 to select the correct values for the loading capacitors (C1, C2, C3, C4, and C5), which may be required to meet the RS-232 maximum slew-rate requirement of 30 V/μs. The value of the loading capacitors required depends upon the line length and desired slew rate, but is typically 330 pF.

NOTE A: To use the receivers only, V_{DD} and V_{SS} must both be powered or tied to ground.

Figure 16. Typical TIA/EIA-232-F Connection

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN75196DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75196N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75196NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION



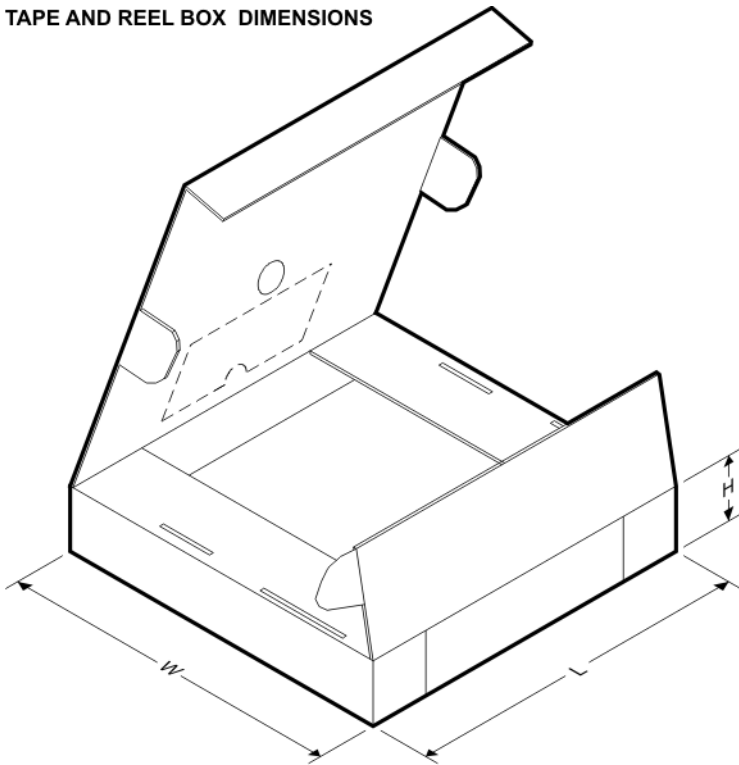
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75196DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

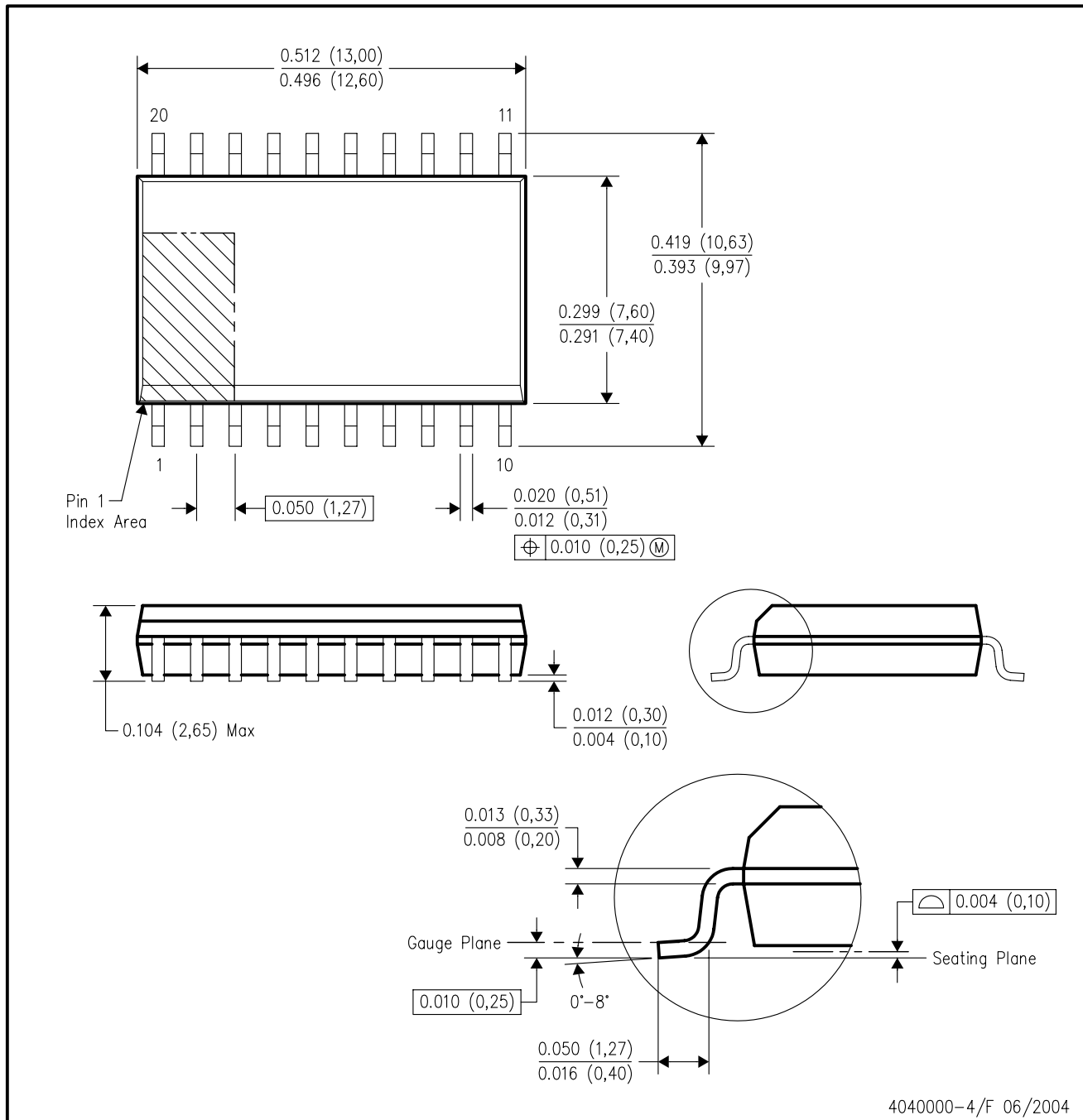


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75196DWR	SOIC	DW	20	2000	346.0	346.0	41.0

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - (C) Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - (D) The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated