

SN75ALS191 Dual Differential Line Driver

1 Features

- Meets or exceeds the requirements of ANSI standard EIA/TIA-422-B and ITU recommendation V.11
- Designed to operate at 20 Mbaud or higher
- TTL- and CMOS-input compatibility
- Single 5V supply operation
- Output short-circuit protection
- Improved replacement for the μ A9638

2 Applications

- [Factory automation](#)
- ATM and cash counters
- [Smart grid](#)
- AC and [servo motor drives](#)

3 Description

The SN75ALS191 is a dual, high-speed, differential line driver designed to meet ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11. The inputs are TTL- and CMOS-compatible and have input clamp diodes. Schottky-diode-clamped transistors minimize propagation delay time. This device operates from a single 5V power supply and is supplied in eight-pin packages.

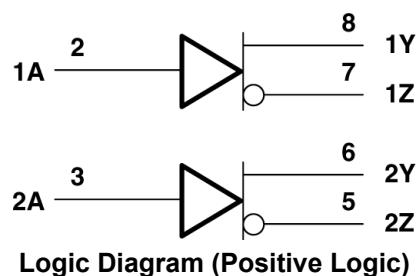
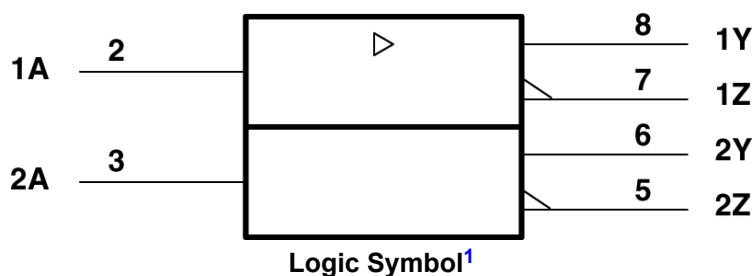
The SN75ALS191 is characterized for operation from 0°C to 70°C.

Package Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾
SN75ALS191	P (PDIP, 8)	9.81mm × 9.43mm
	D (SOIC, 8)	4.9mm × 6mm
	PS (SOP, 8)	6.2mm × 7.8mm

(1) For more information, see [Section 10](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



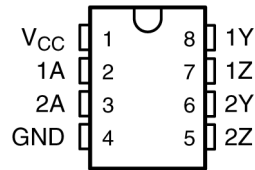
¹ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



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4 Pin Configuration and Functions



**Figure 4-1. D or P Package
(Top View)**

Table 4-1. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
1Z	7	O	Inverting Output of Differential Driver on Channel 1
1Y	8	O	Non-Inverting Output for Differential Driver on Channel 1
1A	2	I	Single Ended Data Input for Channel 1
GND	4	GND	Device Ground
2A	3	I	Single Ended Data Input for Channel 2
2Y	6	O	Non-Inverting Output for Differential Driver on Channel 2
2Z	5	O	Inverting Output of Differential Driver on Channel 2
V _{CC}	1	P	5V Power Supply Positive Terminal Connection

(1) Signal Types: I = Input, O = Output, I/O = Input or Output, P = Power, GND = Ground.

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage, see ⁽²⁾		7	V
V _I	Input voltage		7	V
	Continuous total dissipation	See <i>Dissipation Rating</i> table		
T _A	Operating free-air temperature range	0	70	°C
	Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds		260	°C
T _{stg}	Storage temperature range	-65	150	°C

- (1) 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.
- (2) All voltage values except differential output voltage (V_{OD}) are with respect to network ground terminal.

5.2 Dissipation Rating

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING
D	725mW	5.8mW/°C	464mW
P	1000mW	8mW/°C	640mW

5.3 Recommended Operating Conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V _{CC}	4.75	5	5.25	V
High-level input voltage, V _{IH}	2			V
Low-level input voltage, V _{IL}			0.8	V
High-level output current, I _{OH}			-50	mA
Low-level output current, I _{OL}			50	mA
Operating free-air temperature, T _A	0		70	°C

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		D	P	PS	UNIT
		8-Pins			
R _{θJA}	Junction-to-ambient thermal resistance	116.7	84.3	89.5	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	56.3	65.4	46.2	°C/W
R _{θJB}	Junction-to-board thermal resistance	63.4	62.1	50.7	°C/W
ψ _{JT}	Junction-to-top characterization parameter	8.8	31.3	23.5	°C/W
ψ _{JB}	Junction-to-board characterization parameter	62.6	60.4	60.3	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC package thermal metrics](#) application report.

5.5 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP ⁽¹⁾	MAX	UNIT			
V _{IK}	Input clamp voltage	V _{CC} = 4.75V,	I _I = -18mA			-1	-1.2	V			
V _{OH}	High-level output voltage	V _{CC} = 4.75V,	V _{IH} = 2V,	I _{OH} = -10mA	2.5	3.3		V			
		V _{IL} = 0.8V		I _{OH} = -40mA	2						
V _{OL}	Low-level output voltage	V _{CC} = 4.75V, I _{OL} = 40mA	V _{IH} = 2V,	V _{IL} = 0.8V,			0.5	V			
V _{OD1}	Differential output voltage	V _{CC} = 5.25V,	I _O = 0				2 V _{OD2}	V			
V _{OD2}	Differential output voltage	V _{CC} = 4.75V to 5.25V, See Figure 6-1			RL = 100Ω,	2			V		
Δ V _{OD}	Change in magnitude of differential output voltage ⁽²⁾								± 0.4		V
V _{OC}	Common-mode output voltage ⁽³⁾									3	
Δ V _{OC}	Change in magnitude of common-mode output voltage ⁽²⁾						± 0.4	V			
I _O	Output current with power off	V _{CC} = 0		V _O = 6V	0.1	100	μA				
				V _O = -0.25V	-0.1	-100					
				V _O = -0.25V to 6V		±100					
I _I	Input current	V _{CC} = 5.25 V,	V _I = 5.5V				50	μA			
I _{IH}	High-level input current	V _{CC} = 5.25 V,	V _I = 2.7V				25	μA			
I _{IL}	Low-level input current	V _{CC} = 5.25 V,	V _I = 0.5V				200	μA			
I _{OS}	Short-circuit output current ⁽⁴⁾	V _{CC} = 5.25 V,	V _O = 0			-50	-150	mA			
I _{CC}	Supply current (all drivers)	V _{CC} = 5.25 V,	No load,	All inputs at 0V		32	40	mA			

(1) All typical values are at V_{CC} = 5V and T_A = 25°C.

(2) |V_{OD}| and |V_{OC}| are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

(3) In ANSI Standard EIA/TIA-422-B, V_{OC}, which is the average of the two output voltages with respect to ground, is called output offset voltage, V_{OS}.

(4) Only one output at a time should be shorted, and duration of the short circuit should not exceed one second.

5.6 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 5V

PARAMETER		TEST CONDITIONS			MIN	TYP ⁽¹⁾	MAX	UNIT
t _{d(OD)}	Differential-output delay time	C _L = 15pF,	R _L = 100Ω,	See Figure 6-2		3.5	7	ns
t _{t(OD)}	Differential-output transition time					3.5	7	ns
	Skew					1.5	4	ns

(1) Typical values are at T_A = 25°C.

6 Parameter Measurement Information

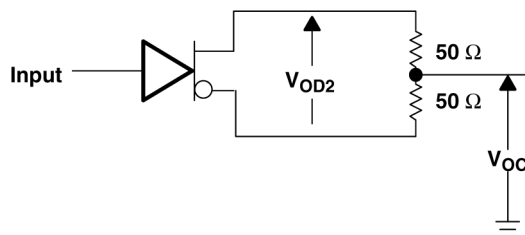
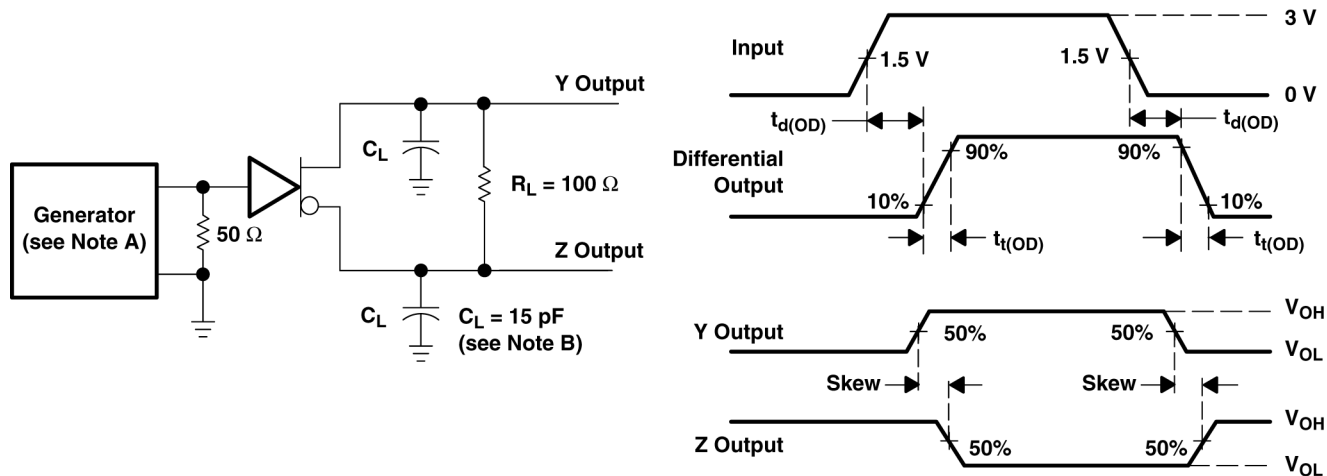


Figure 6-1. Differential and Common-Mode Output Voltages



TEST CIRCUIT

VOLTAGE WAVEFORMS

- A. The input pulse generator has the following characteristics: $Z_O = 50\Omega$, $PRR \leq 500\text{kHz}$, $t_w = 100\text{ns}$, $t_r = \leq 5\text{ns}$.
- B. C_L includes probe and jig capacitance.

Figure 6-2. Test Circuit and Voltage Waveforms

7 Detailed Description

7.1 Device Functional Modes

Table 7-1. Function Table (Each Driver)

INPUTS A ⁽¹⁾	OUTPUTS	
	Y	Z
H	H	L
L	L	H

(1) H = high level, L = low level, Z = high impedance

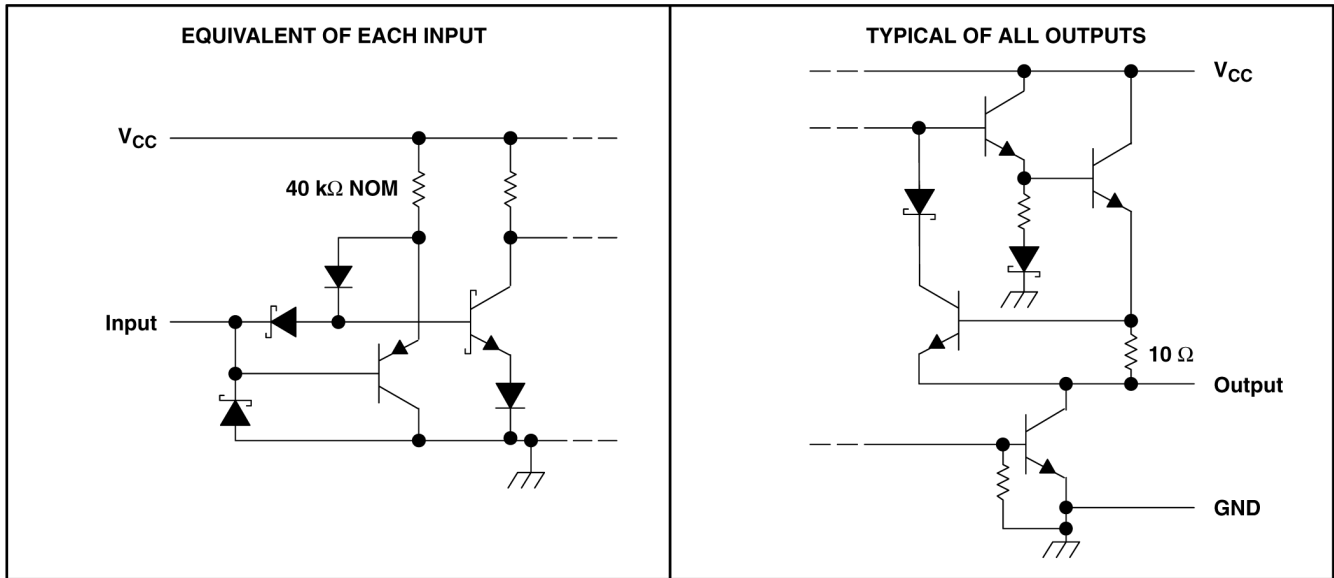


Figure 7-1. Schematics of Inputs and Outputs

8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

8.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

8.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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8.3 Trademarks

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8.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision B (May 1995) to Revision C (March 2024)	Page
• Changed the numbering format for tables, figures, and cross-references throughout the document.....	1

10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN75ALS191D	Obsolete	Production	SOIC (D) 8	-	-	Call TI	Call TI	0 to 70	75A191
SN75ALS191DR	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75A191
SN75ALS191P	Active	Production	PDIP (P) 8	50 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	75ALS191
SN75ALS191PSR	Active	Production	SO (PS) 8	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	0 to 70	V191

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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
SN75ALS191DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75ALS191DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75ALS191PSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN75ALS191PSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75ALS191DR	SOIC	D	8	2500	353.0	353.0	32.0
SN75ALS191DR	SOIC	D	8	2500	340.5	336.1	25.0
SN75ALS191PSR	SO	PS	8	2000	356.0	356.0	35.0
SN75ALS191PSR	SO	PS	8	2000	353.0	353.0	32.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN75ALS191P	P	PDIP	8	50	506	13.97	11230	4.32
SN75ALS191PE4	P	PDIP	8	50	506	13.97	11230	4.32



D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed $.006$ [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
 EXPOSED METAL SHOWN
 SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PS (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001 variation BA.

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