

## DS26LS31MQML Quad High Speed Differential Line Driver

Check for Samples: [DS26LS31MQML](#)

### FEATURES

- Operation from Single 5V Supply
- Outputs Won't Load Line When  $V_{CC} = 0V$
- Four Line Drivers in One Package for Maximum Package Density
- Output Short-Circuit Protection
- Complementary Outputs
- Meets the Requirements of EIA Standard RS-422
- Pin Compatible with AM26LS31
- Glitch Free Power Up/Down

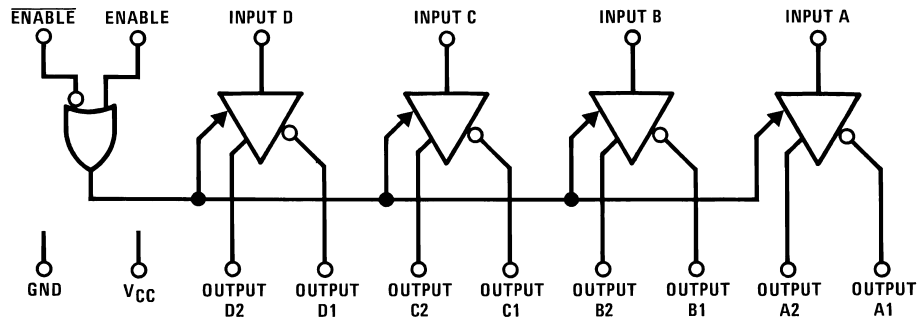
### DESCRIPTION

The DS26LS31MQML is a quad differential line driver designed for digital data transmission over balanced lines. The DS26LS31MQML meets all the requirements of EIA Standard RS-422 and Federal Standard 1020. It is designed to provide unipolar differential drive to twisted-pair or parallel-wire transmission lines.

The circuit provides an enable and disable function common to all four drivers. The DS26LS31MQML features TRI-STATE outputs and logically ANDed complementary outputs. The inputs are all LS compatible and are all one unit load.

The DS26LS31 features a power up/down protection circuit which keeps the output in a high impedance state (TRI-STATE) during power up or down preventing erroneous glitches on the transmission lines.

### Logic and Connection Diagrams

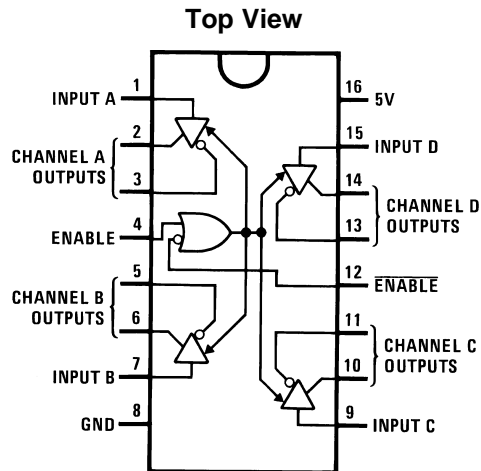


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

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

Copyright © 2005–2013, Texas Instruments Incorporated



**Figure 1. CDIP Package**  
**See Package Numbers NAJ0020A, NFE0016A, NAD0016A**



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### Absolute Maximum Ratings<sup>(1)</sup>

Supply Voltage	7V
Input Voltage	7V
Output Voltage	5.5V
Output Voltage (Power OFF)	–0.25 to 6V
Maximum Power Dissipation at 25°C <sup>(2)</sup>	
NFE0016A Package	1400 mW
NAJ0020A Package	1600 mW
NAD0016A Package	850 mW
Junction Temperature (T <sub>J</sub> )	+150°C
Thermal Resistance, Junction-to-Ambient θ <sub>JA</sub>	
NFE0016A Package	94°C/W derate above +25°C at 10.6 mW/°C
NAJ0020A Package	83°C/W derate above +25°C at 12 mW/°C
NAD0016A Package	163°C/W derate above +25°C at 6.1 mW/°C
Thermal Resistance, Junction-to-Case θ <sub>JC</sub>	
NFE0016A Package	16°C/W
NAJ0020A Package	19°C/W
NAD0016A Package	14°C/W
ESD Tolerance	2500V

(1) "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be specified. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

(2) Derate CDIP = 11.5 mW/°C, LCCC = 13mW/°C, CLGA = 7.4mW/°C above 25°C.

### Recommended Operating Conditions

Supply Voltage, V <sub>CC</sub>	4.5 V to 5.5 V
Temperature, T <sub>A</sub>	–55°C to +125°C

## Radiation Features

DS26LS31MEFQML	300 Krads (Si)
DS26LS31MJFQML	300 Krads (Si)
DS26LS31MJFQMLV	300 Krads (Si)
DS26LS31MWFQML	300 Krads (Si)
DS26LS31MWFQMLV	300 Krads (Si)

## Quality Conformance Inspection

MIL-STD-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

## DS26LS31M - SMD, QMLV & RH Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. +V = 5V, V<sub>CM</sub> = 0V. <sup>(1)</sup>

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
V <sub>IH</sub>	Logical "1" Input Voltage	V <sub>CC</sub> = 4.5V	See and <sup>(2)</sup> <sub>(3)</sub>	2		V	1, 2, 3
V <sub>IL</sub>	Logical "0" Input Voltage	V <sub>CC</sub> = 5.5V	See <sup>(2)</sup> <sub>(3)</sub> and		.8	V	1, 2, 3
V <sub>OH</sub>	Logical "1" Output Voltage	V <sub>CC</sub> = 4.5V, I <sub>OH</sub> = -20mA	See <sup>(3)</sup>	2.5		V	1, 2, 3
V <sub>OL</sub>	Logical "0" Output Voltage	V <sub>CC</sub> = 4.5V, I <sub>OL</sub> = 20mA	See <sup>(3)</sup>		.5	V	1, 2, 3
I <sub>IH</sub>	Logical "1" Input Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 2.7V	See <sup>(3)</sup>	-2.0	20	uA	1, 2, 3
I <sub>IL</sub>	Logical "0" Input Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = .4V	See <sup>(3)</sup>	100	-360	uA	1, 2, 3
I <sub>I</sub>	Input Reverse Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 7V	See <sup>(3)</sup>	-.01	.1	mA	1, 2, 3
I <sub>O</sub>	TRI-STATE Output Current	V <sub>CC</sub> = 5.5V, V <sub>O</sub> = .5V	See <sup>(3)</sup>		-20	uA	1, 2, 3
		V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 2.5V	See <sup>(3)</sup>		20	uA	1, 2, 3
V <sub>IC</sub>	Input Clamp Voltage	V <sub>CC</sub> = 4.5V, I <sub>IN</sub> = -18mA	See <sup>(3)</sup>		-1.5	V	1, 2, 3
I <sub>OS</sub>	Output Short Circuit Current	V <sub>CC</sub> = 5.5V	See <sup>(3)</sup>	-30	-150	mA	1, 2, 3
I <sub>CC</sub>	Power Supply Current	V <sub>CC</sub> = 5.5V, All Outputs Disabled or Active	See <sup>(3)</sup>		80	mA	1, 2, 3

- (1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD 883, Method 1019, Condition A.
- (2) Parameter tested go-no-go only.
- (3) Subgroups 1, 2 and 9, 10: Power dissipation must be externally controlled at elevated temperatures.

## DS26LS31M - SMD, QMLV and RH Electrical Characteristics AC Parameters - Propagation Delay Time

The following conditions apply, unless otherwise specified.  $V_{CC} = 5V$ ,  $V_{IN} = 1.3V$  to  $V_O = 1.3V$ ,  $V$  (pulse) = 0 to 3V.<sup>(1)</sup>

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
$t_{PLH}$	Input to Output	$C_L = 30\text{ pF}$	See <sup>(2)</sup>		20	ns	9
					30	ns	10, 11
$t_{PHL}$	Input to Output	$C_L = 30\text{ pF}$	See <sup>(2)</sup>		20	ns	9
					30	ns	10, 11
$t_{Skew}$	Output to Output	$C_L = 30\text{ pF}$	See <sup>(2)</sup>		6	ns	9
					9	ns	10, 11
$t_{PLZ}$	Enable to Output	S2 Open, Enable, $C_L = 10\text{ pF}$	See <sup>(2)</sup>		35	ns	9
					53	ns	10, 11
		S2 Open, $\overline{\text{Enable}}$ , $C_L = 10\text{ pF}$	See <sup>(2)</sup>		35	ns	9
					53	ns	10, 11
$t_{PHZ}$	Enable to Output	S1 Open, Enable, $C_L = 10\text{ pF}$	See <sup>(2)</sup>		30	ns	9
					45	ns	10, 11
		S1 Open, $\overline{\text{Enable}}$ , $C_L = 10\text{ pF}$	See <sup>(2)</sup>		30	ns	9
					45	ns	10, 11
$t_{PZL}$	Enable to Output	S2 Open, Enable, $C_L = 30\text{ pF}$	See <sup>(2)</sup>		45	ns	9
					68	ns	10, 11
		S2 Open, $\overline{\text{Enable}}$ , $C_L = 30\text{ pF}$	See <sup>(2)</sup>		45	ns	9
					68	ns	10, 11
$t_{PZH}$	Enable to Output	S1 Open, Enable, $C_L = 30\text{ pF}$	See <sup>(2)</sup>		40	ns	9
					60	ns	10, 11
		S1 Open, $\overline{\text{Enable}}$ , $C_L = 30\text{ pF}$	See <sup>(2)</sup>		40	ns	9
					60	ns	10, 11

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD 883, Method 1019, Condition A.

(2) Subgroups 1, 2 and 9, 10: Power dissipation must be externally controlled at elevated temperatures.

## DS26LS31M - SMD, QMLV and RH Electrical Characteristics DC Parameters - Drift Values

The following conditions apply, unless otherwise specified. Delta calculations performed on QMLV only devices after burn-in and at Group B5.

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
$V_{OL}$	Output Low Voltage	$V_{CC} = 4.5$ , $I_{OL} = 20\text{ mA}$	See <sup>(1)</sup>	-50	50	mV	1
$V_{OH}$	Output High Voltage	$V_{CC} = 4.5$ , $I_{OH} = -20\text{ mA}$	See <sup>(1)</sup>	-250	250	mV	1
$I_{CC}$	Power Supply Current	$V_{CC} = 5.5$ , All outputs disabled or active	See <sup>(1)</sup>	-8	8	mA	1

(1) Subgroups 1, 2 and 9, 10: Power dissipation must be externally controlled at elevated temperatures.

## DS26LS31M - 883 Electrical Characteristics DC Parameters

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
$V_{IH}$	Logical "1" Input Voltage		See <sup>(1)</sup> and <sup>(2)</sup>	2		V	1, 2, 3
$V_{IL}$	Logical "0" Input Voltage		See <sup>(1)</sup> and <sup>(2)</sup>		.8	V	1, 2, 3
$V_{OH}$	Logical "1" Output Voltage	$V_{CC} = 4.5V$ , $I_{OH} = -20mA$	See <sup>(2)</sup>	2.5		V	1, 2, 3

(1) Parameter tested go-no-go only.

(2) Subgroups 1, 2 and 9, 10: Power dissipation must be externally controlled at elevated temperatures.

**DS26LS31M - 883 Electrical Characteristics DC Parameters (continued)**

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
$V_{OL}$	Logical "0" Output Voltage	$V_{CC} = 4.5V$ , $I_{OL} = 20mA$	See <sup>(2)</sup>		.5	V	1, 2, 3
$I_{IH}$	Logical "1" Input Current	$V_{CC} = 5.5V$ , $V_{IN} = 2.7V$	See <sup>(2)</sup>		20	uA	1, 2, 3
$I_{IL}$	Logical "0" Input Current	$V_{CC} = 5.5V$ , $V_{IN} = .4V$	See <sup>(2)</sup>		-200	uA	1, 2, 3
$I_I$	Input Reverse Current	$V_{CC} = 5.5V$ , $V_{IN} = 7V$	See <sup>(2)</sup>		.1	mA	1, 2, 3
$I_O$	TRI-STATE Output Current	$V_{CC} = 5.5V$ , $V_O = .5V$	See <sup>(2)</sup>		-20	uA	1, 2, 3
		$V_{CC} = 5.5V$ , $V_O = 2.5V$	See <sup>(2)</sup>		20	uA	1, 2, 3
$V_{IC}$	Input Clamp Voltage	$V_{CC} = 4.5V$ , $I_{IN} = -18mA$	See <sup>(2)</sup>		-1.5	V	1, 2, 3
$I_{OS} (min)$	Output Short Circuit Current	$V_{CC} = 5.5V$	See <sup>(2)</sup>	-30		mA	1, 2, 3
$I_{OS} (max)$	Output Short Circuit Current	$V_{CC} = 5.5V$	See <sup>(2)</sup>		-150	mA	1, 2, 3
$I_{CC}$	Power Supply Current	$V_{CC} = 5.5V$ , All Outputs Disabled or Active	See <sup>(2)</sup>		60	mA	1, 2, 3

**DS26LS31M - 883 Electrical Characteristics AC Parameters - Propagation Delay Time**

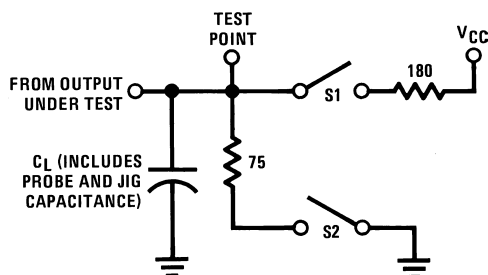
The following conditions apply, unless otherwise specified.  $V_{CC} = 5V$ ,  $C_L = 50pF$  or equivalent impedance provided by diode load.

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
$t_{PLH}$	Input to Output		See <sup>(1)</sup> and		15	ns	9
			(2)		30	ns	10, 11.
$t_{PHL}$	Input to Output		See <sup>(1)</sup> and		15	ns	9
			(2)		30	ns	10, 11.
$t_{Skew}$	Output to Output		See <sup>(1)</sup> and		6	ns	9
			(2)		9	ns	10, 11.
$t_{PLZ}$	Enable to Output	S2 Open, Enable	See <sup>(1)</sup> and		35	ns	9
			(2)		53	ns	10, 11.
		S2 Open, /Enable	See <sup>(1)</sup> and		35	ns	9
			(2)		53	ns	10, 11.
$t_{PHZ}$	Enable to Output	S1 Open, Enable	See <sup>(1)</sup> and		25	ns	9
			(2)		45	ns	10, 11.
		S1 Open, /Enable	See <sup>(1)</sup> and		25	ns	9
			(2)		45	ns	10, 11.
$t_{PZL}$	Enable to Output	S2 Open, Enable	See <sup>(1)</sup> and		30	ns	9
			(2)		68	ns	10, 11.
		S2 Open, /Enable	See <sup>(1)</sup> and		30	ns	9
			(2)		68	ns	10, 11.
$t_{PZH}$	Enable to Output	S1 Open, Enable	See <sup>(1)</sup> and		30	ns	9
			(2)		60	ns	10, 11.
		S1 Open, /Enable	See <sup>(1)</sup> and		30	ns	9
			(2)		60	ns	10, 11.

(1) Subgroups 1, 2 and 9, 10: Power dissipation must be externally controlled at elevated temperatures.

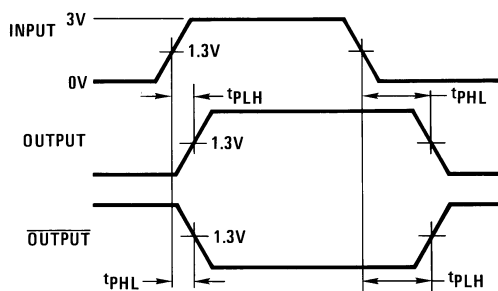
(2) Subgroup 10 and 11 specified but not tested.

## AC TEST CIRCUIT AND SWITCHING TIME WAVEFORMS



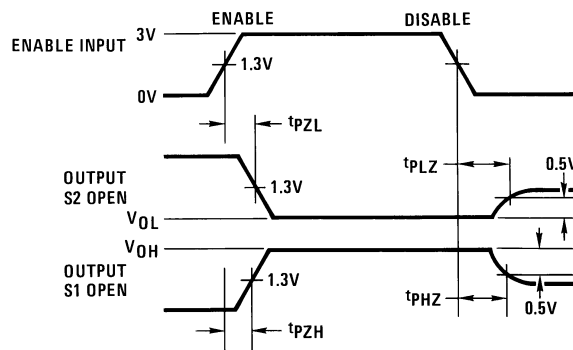
S1 and S2 of load circuit are closed except where shown.

**Figure 2. AC Test Circuit**



$f = 1 \text{ MHz}$ ,  $t_r \leq 15 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$

**Figure 3. Propagation Delays**

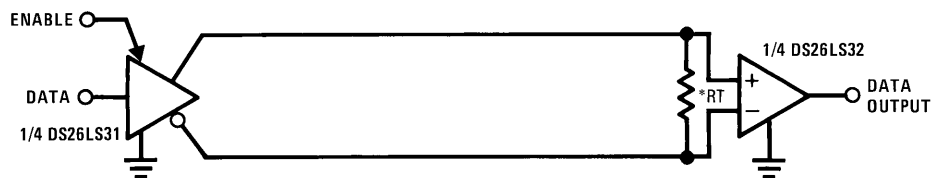


$f = 1 \text{ MHz}$ ,  $t_r \leq 15 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$

**Figure 4. Enable and Disable Times**

## TYPICAL APPLICATIONS

**Figure 5. Two-Wire Balanced System, RS-422**



$R_T$  is optional although highly recommended to reduce reflection.

## Typical Performance Characteristics

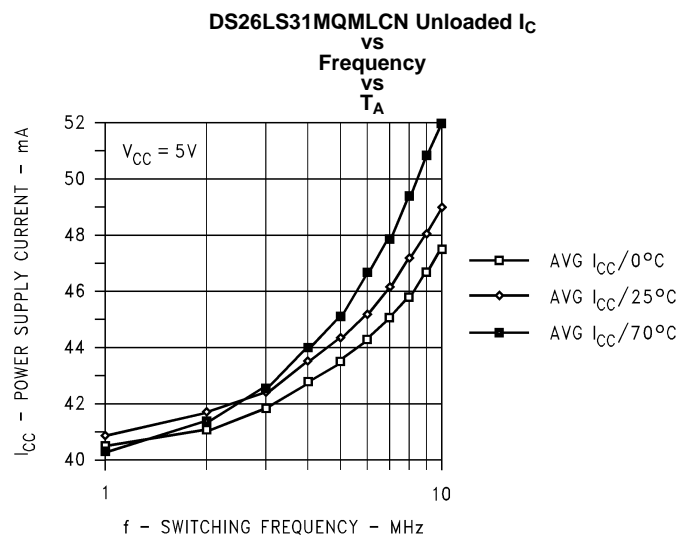


Figure 6.

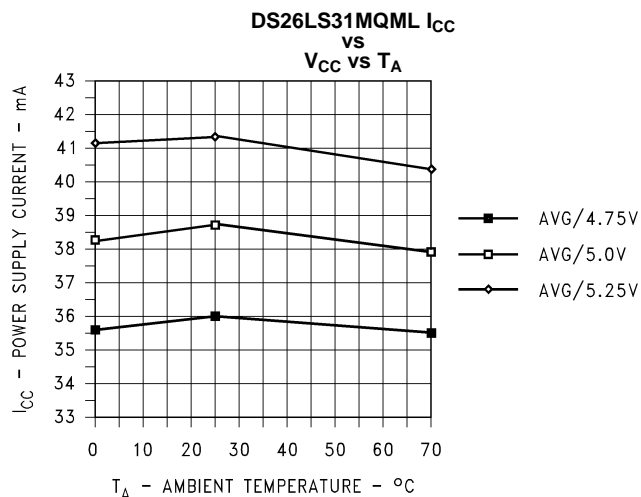


Figure 7.

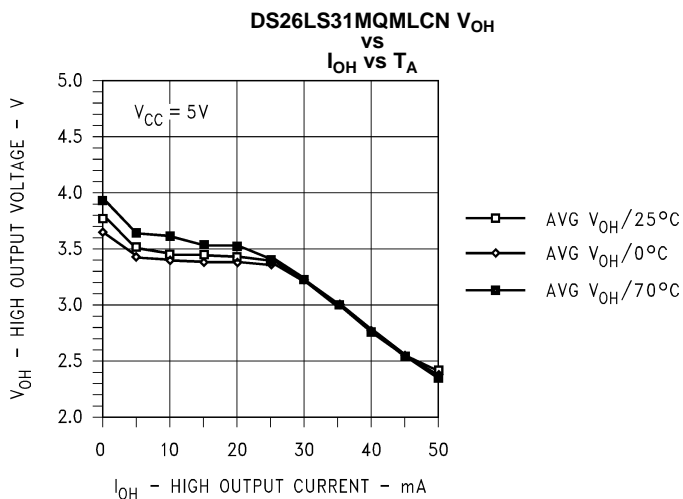


Figure 8.

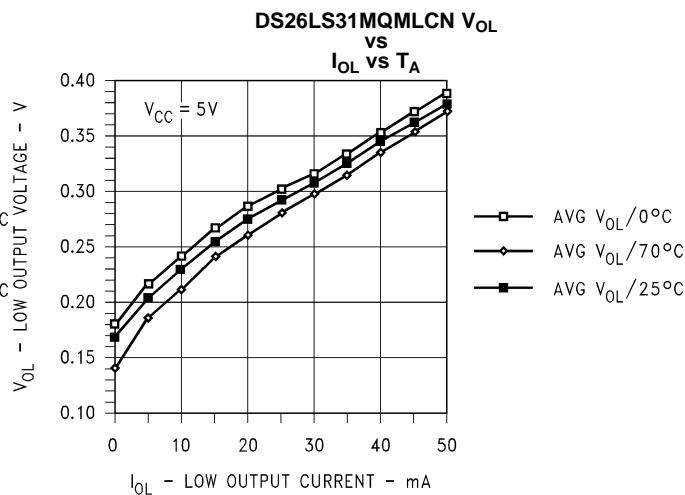


Figure 9.

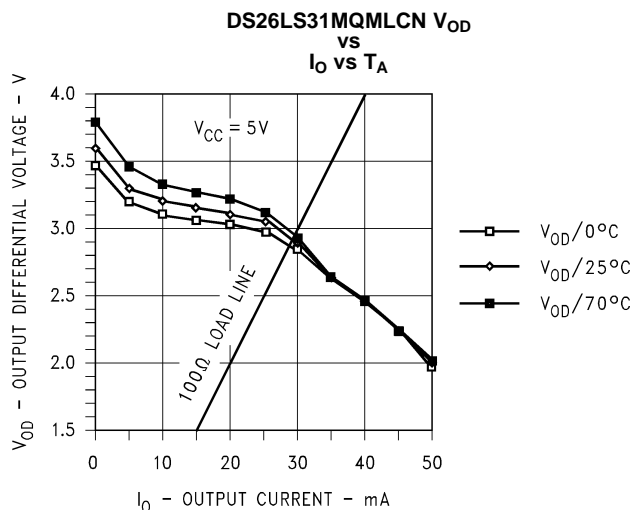


Figure 10.

**REVISION HISTORY**

<b>Date Released</b>	<b>Revision</b>	<b>Section</b>	<b>Originator</b>	<b>Changes</b>
8/04/05	A	New Release, Corporate format Ordering Info. Table, Absolute Ratings, Maximum Operating Conditions, New Radiation Section. Typos in QMLV & RH, 883 AC Electrical Characteristics Parameters Column	R. Malone	2 MDS data sheets converted into a Corp. data sheet format. Following MDS data sheets will be Archived MDDS26LS31M-X-RH, Rev.2A0, MNDS26LS31M-X, Rev. 0A0
3/01/06	A1		R. Malone	Added: Junction temp., Thermal Resistance $\theta_{JA}$ and $\theta_{JC}$ . Added a Radiation Section. Changed: Maximum Operating Conditions to Recommended Operating Conditions, Enable and Disable Time to Enable to Output. Revision A will be archived.
4/15/2013	B		TIS	Changed layout of National Data Sheet to TI format

## 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)
<a href="#">AM26LS31MW/883</a>	Active	Production	CFP (NAD)   16	19   TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MW /883 Q ACO /883 Q >T
<a href="#">DS26LS31ME-SMD</a>	Active	Production	LCCC (NAJ)   20	50   TUBE	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	DS26LS31ME -SMD Q 5962-78023 01Q2A ACO 01Q2A >T
<a href="#">DS26LS31MJ-SMD</a>	Active	Production	CDIP (NFE)   16	25   TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MJ-SMD 5962-7802301MEA Q
<a href="#">DS26LS31MJ/883</a>	Active	Production	CDIP (NFE)   16	25   TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MJ/883 Q
<a href="#">DS26LS31MW/883</a>	Active	Production	CFP (NAD)   16	19   TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MW /883 Q ACO /883 Q >T

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

<sup>(2)</sup> **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.

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

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

**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.

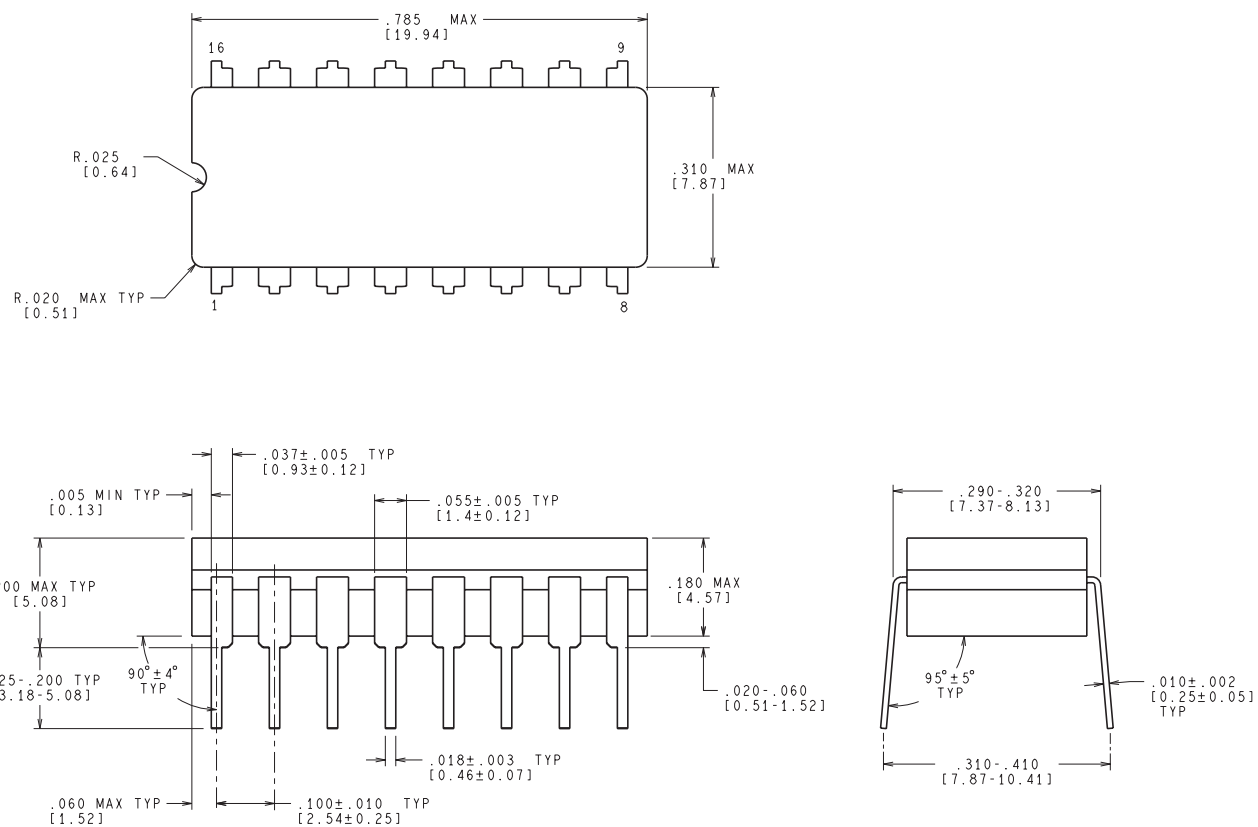
## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
AM26LS31MW/883	NAD	CFP	16	19	502	23	9398	9.78
DS26LS31ME-SMD	NAJ	LCCC	20	50	470	11	3810	0
DS26LS31MJ-SMD	NFE	CDIP	16	25	506.98	15.24	13440	NA
DS26LS31MJ/883	NFE	CDIP	16	25	506.98	15.24	13440	NA
DS26LS31MW/883	NAD	CFP	16	19	502	23	9398	9.78

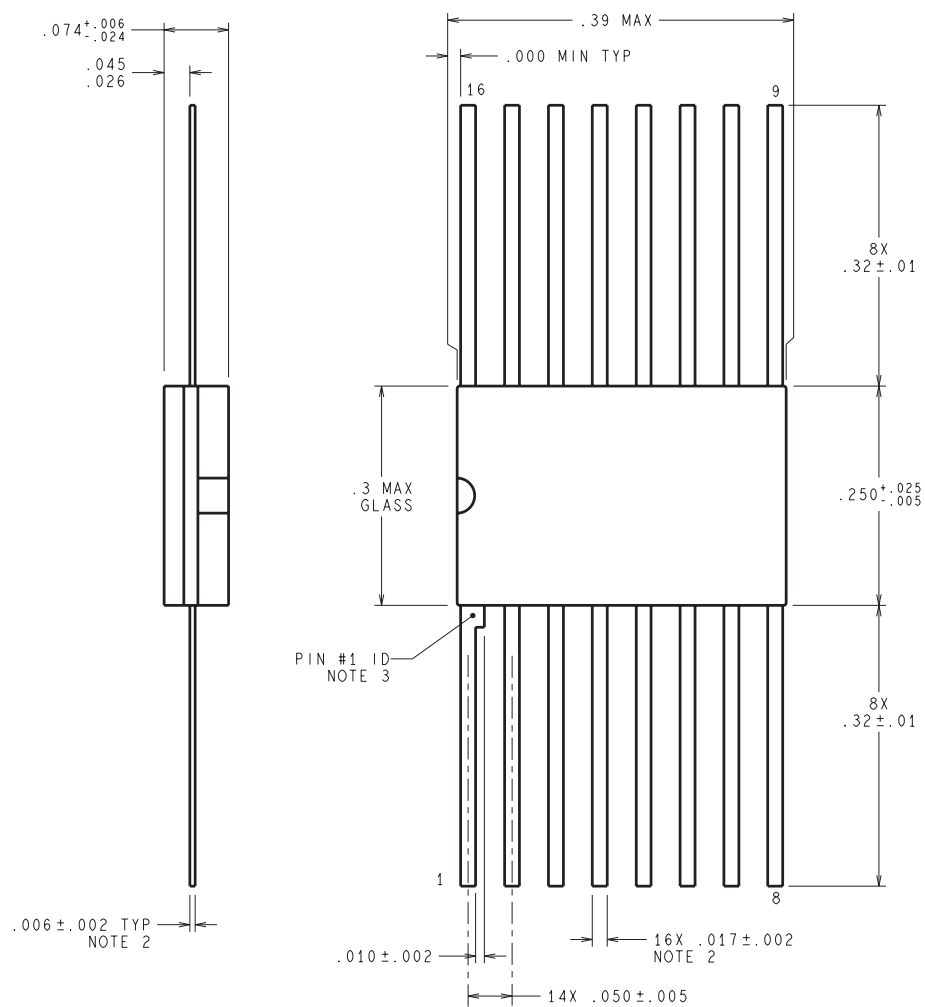
NFE0016A



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

J16A (REV L)

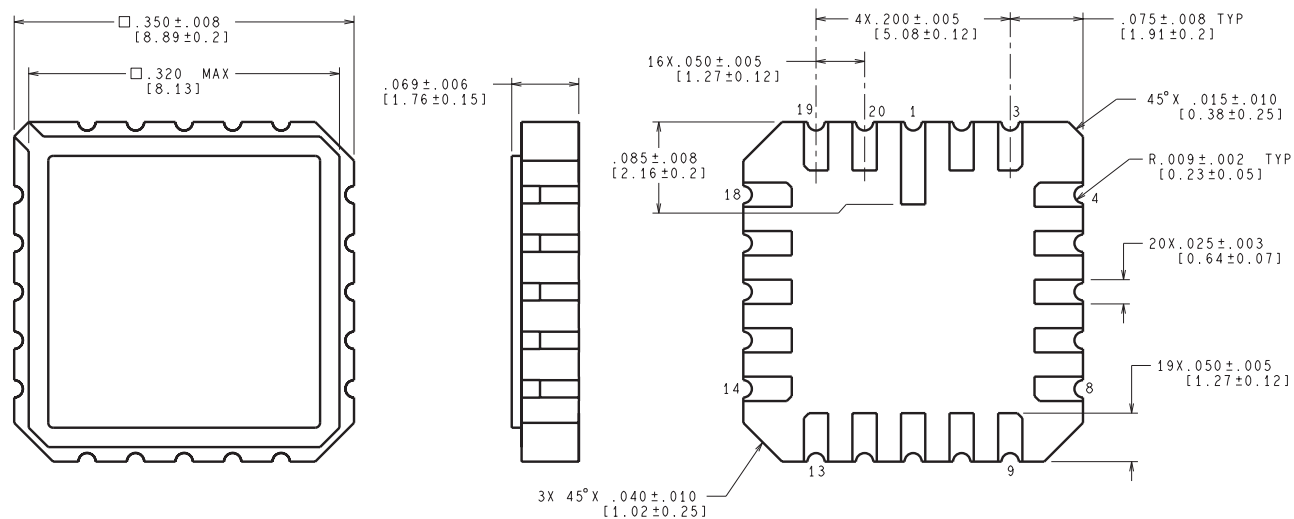
NAD0016A



DIMENSIONS ARE IN INCHES

W16A (Rev T)

NAJ0020A



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

E20A (Rev F)

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025