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**

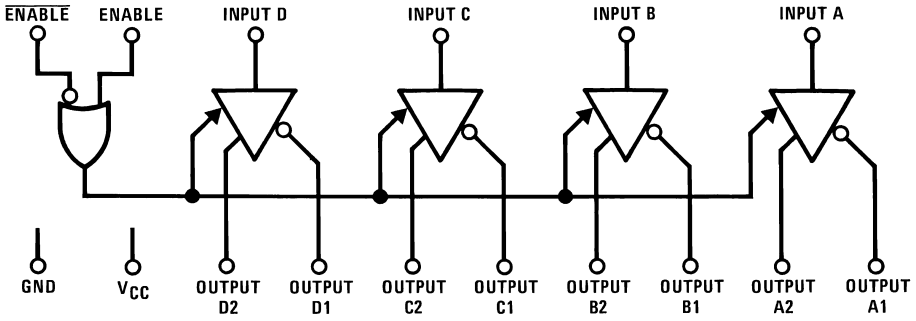
DESCRIPTION

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



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Top View

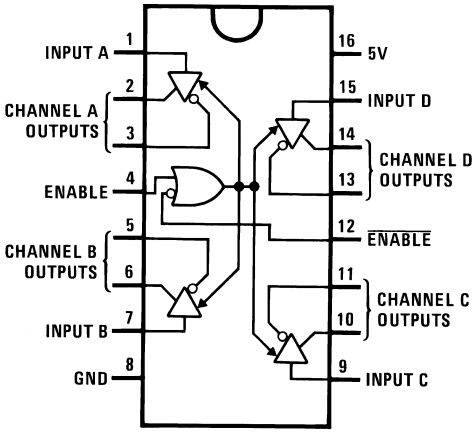

Figure 1. CDIP Package
See Package Numbers NAJ0020A, NFE0016A, NAD0016A

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(1)

Supply Voltage	7V
Input Voltage	7V
Output Voltage	5.5V
Output Voltage (Power OFF)	−0.25 to 6V
Maximum Power Dissipation at 25°C(2)	
NFE0016A Package	1400 mW
NAJ0020A Package	1600 mW
NAD0016A Package	850 mW
Junction Temperature (T_J)	+150°C
Thermal Resistance, Junction-to-Ambient θ_{JA}	
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_{JC}	
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_{CC}	4.5 V to 5.5 V
Temperature, T_A	−55°C to +125°C

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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_{CM} = 0V.(1)

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

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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.(1)

Parameter		Test Conditions	Notes	Min	Max	Unit	Sub-groups
t_{PLH}	Input to Output	C_L = 30 pF	See(2)		20	ns	9
					30	ns	10, 11
t_{PHL}	Input to Output	C_L = 30 pF	See(2)		20	ns	9
					30	ns	10, 11
t_{Skew}	Output to Output	C_L = 30 pF	See(2)		6	ns	9
					9	ns	10, 11
t_{PLZ}	Enable to Output	S2 Open, Enable, C_L = 10 pF	See(2)		35	ns	9
					53	ns	10, 11
		S2 Open, $\overline{\text{Enable}}$, C_L = 10 pF	See(2)		35	ns	9
					53	ns	10, 11
t_{PHZ}	Enable to Output	S1 Open, Enable, C_L = 10 pF	See(2)		30	ns	9
					45	ns	10, 11
		S1 Open, $\overline{\text{Enable}}$, CL = 10 pF	See(2)		30	ns	9
					45	ns	10, 11
t_{PZL}	Enable to Output	S2 Open, Enable, C_L = 30 pF	See(2)		45	ns	9
					68	ns	10, 11
		S2 Open, $\overline{\text{Enable}}$, C_L = 30 pF	See(2)		45	ns	9
					68	ns	10, 11
t_{PZH}	Enable to Output	S1 Open, Enable, C_L = 30 pF	See(2)		40	ns	9
					60	ns	10, 11
		S1 Open, $\overline{\text{Enable}}$, C_L = 30 pF	See(2)		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 mA	See(1)	-50	50	mV	1
V_{OH}	Output High Voltage	V_{CC} = 4.5, I_{OH} = -20 mA	See(1)	-250	250	mV	1
I_{CC}	Power Supply Current	V_{CC} = 5.5, All outputs disabled or active	See(1)	-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(1) and (2)	2		V	1, 2, 3
V_{IL}	Logical "0" Input Voltage		See(1) and (2)		.8	V	1, 2, 3
V_{OH}	Logical "1" Output Voltage	V_{CC} = 4.5V, I_{OH} = -20mA	See(2)	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.

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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 (2)		.5	V	1, 2, 3
I_{IH}	Logical "1" Input Current	V_{CC} = 5.5V, V_{IN} = 2.7V	See (2)		20	uA	1, 2, 3
I_{IL}	Logical "0" Input Current	V_{CC} = 5.5V, V_{IN} = .4V	See (2)		-200	uA	1, 2, 3
I_I	Input Reverse Current	V_{CC} = 5.5V, V_{IN} = 7V	See (2)		.1	mA	1, 2, 3
I_O	TRI-STATE Output Current	V_{CC} = 5.5V, V_O = .5V	See (2)		-20	uA	1, 2, 3
		V_{CC} = 5.5V, V_O = 2.5V	See (2)		20	uA	1, 2, 3
V_{IC}	Input Clamp Voltage	V_{CC} = 4.5V, I_{IN} = -18mA	See (2)		-1.5	V	1, 2, 3
I_{OS} (min)	Output Short Circuit Current	V_{CC} = 5.5V	See (2)	-30		mA	1, 2, 3
I_{OS} (max)	Output Short Circuit Current	V_{CC} = 5.5V	See (2)		-150	mA	1, 2, 3
I_{CC}	Power Supply Current	V_{CC} = 5.5V, All Outputs Disabled or Active	See (2)		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 (1) and (2)		15	ns	9
					30	ns	10, 11.
t_{PHL}	Input to Output		See (1) and (2)		15	ns	9
					30	ns	10, 11.
t_{Skew}	Output to Output		See (1) and (2)		6	ns	9
					9	ns	10, 11.
t_{PLZ}	Enable to Output	S2 Open, Enable	See (1) and (2)		35	ns	9
					53	ns	10, 11.
		S2 Open, /Enable	See (1) and (2)		35	ns	9
					53	ns	10, 11.
t_{PHZ}	Enable to Output	S1 Open, Enable	See (1) and (2)		25	ns	9
					45	ns	10, 11.
		S1 Open, /Enable	See (1) and (2)		25	ns	9
					45	ns	10, 11.
t_{PZL}	Enable to Output	S2 Open, Enable	See (1) and (2)		30	ns	9
					68	ns	10, 11.
		S2 Open, /Enable	See (1) and (2)		30	ns	9
					68	ns	10, 11.
t_{PZH}	Enable to Output	S1 Open, Enable	See (1) and (2)		30	ns	9
					60	ns	10, 11.
		S1 Open, /Enable	See (1) and (2)		30	ns	9
					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.

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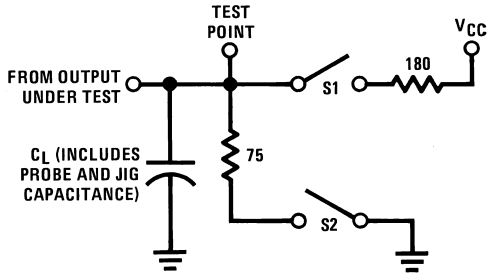
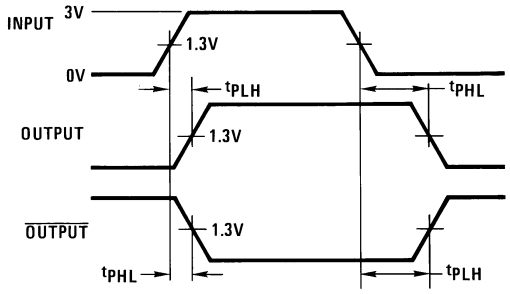
AC TEST CIRCUIT AND SWITCHING TIME WAVEFORMS



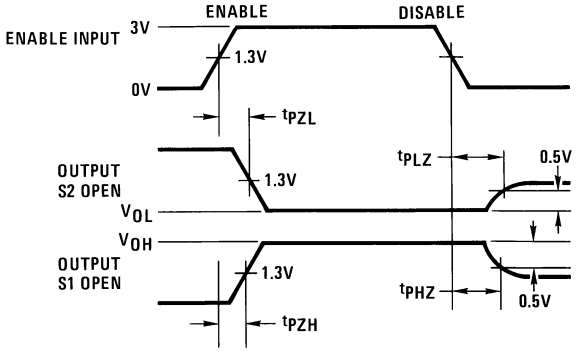
S1 and S2 of load circuit are closed except where shown.

Figure 2. AC Test Circuit



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

Figure 3. Propagation Delays

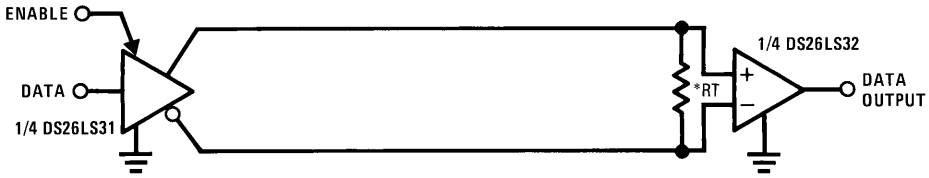


f = 1 MHz, $t_r \leq 15$ ns, $t_f \leq 6$ ns

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.

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Typical Performance Characteristics

DS26LS31MQMLCN Unloaded I_C vs Frequency vs T_A

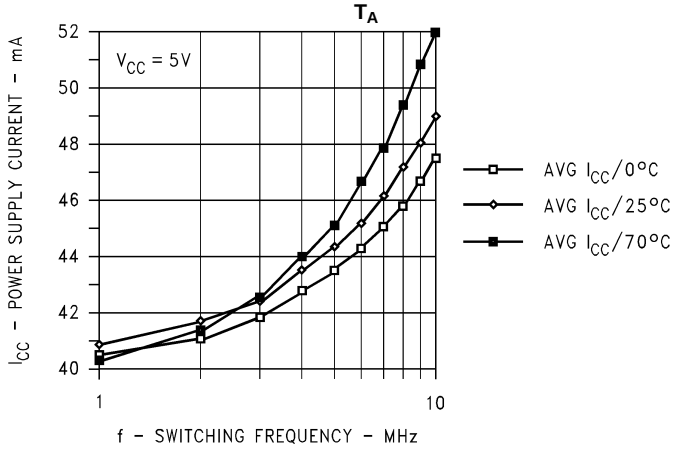

Figure 6.

DS26LS31MQML I_{CC} vs V_{CC} vs T_A

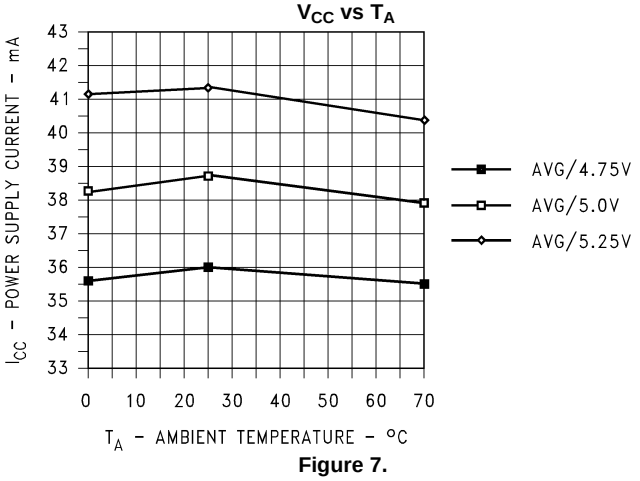

Figure 7.

DS26LS31MQMLCN V_{OH} vs I_{OH} vs T_A

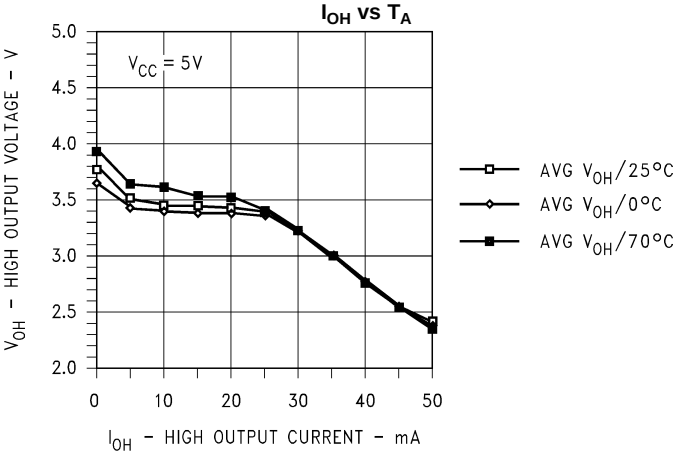

Figure 8.

DS26LS31MQMLCN V_{OL} vs I_{OL} vs T_A

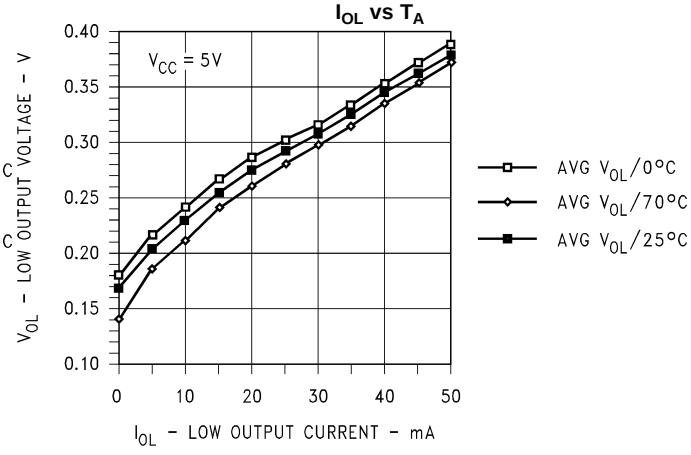

Figure 9.

DS26LS31MQMLCN V_{OD} vs I_O vs T_A

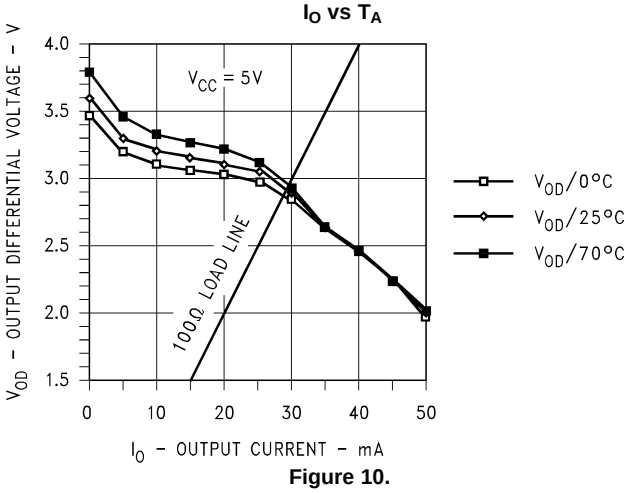

Figure 10.

REVISION HISTORY

Date Released	Revision	Section	Originator	Changes
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: Juction temp., Thermal Resistance θ_{JA} and θ_{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

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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)
AM26LS31MW/883	Active	Production	CFP (NAD) | 16	19 | TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MW /883 Q ACO /883 Q >T
DS26LS31ME-SMD	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
DS26LS31MJ-SMD	Active	Production	CDIP (NFE) | 16	25 | TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MJ-SMD 5962-7802301MEA Q
DS26LS31MJ/883	Active	Production	CDIP (NFE) | 16	25 | TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MJ/883 Q
DS26LS31MW/883	Active	Production	CFP (NAD) | 16	19 | TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	DS26LS31MW /883 Q ACO /883 Q >T

(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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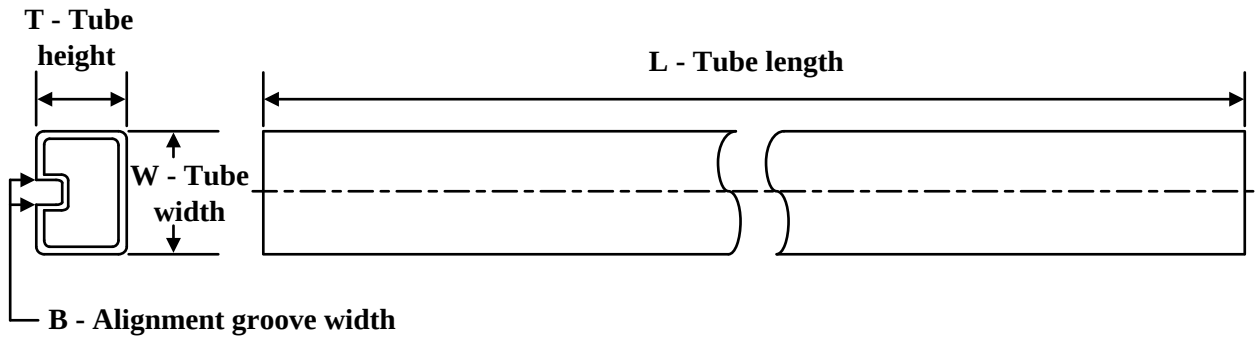
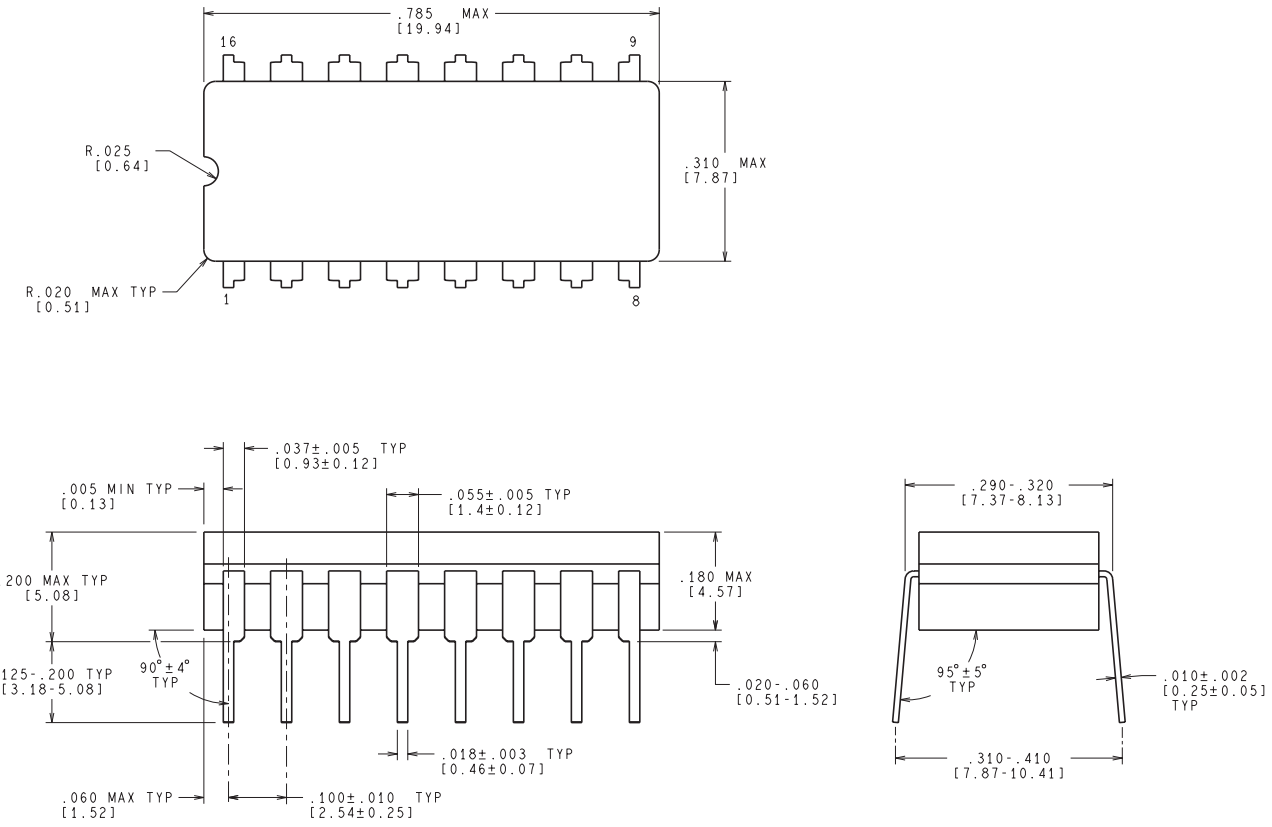
TUBE



*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)

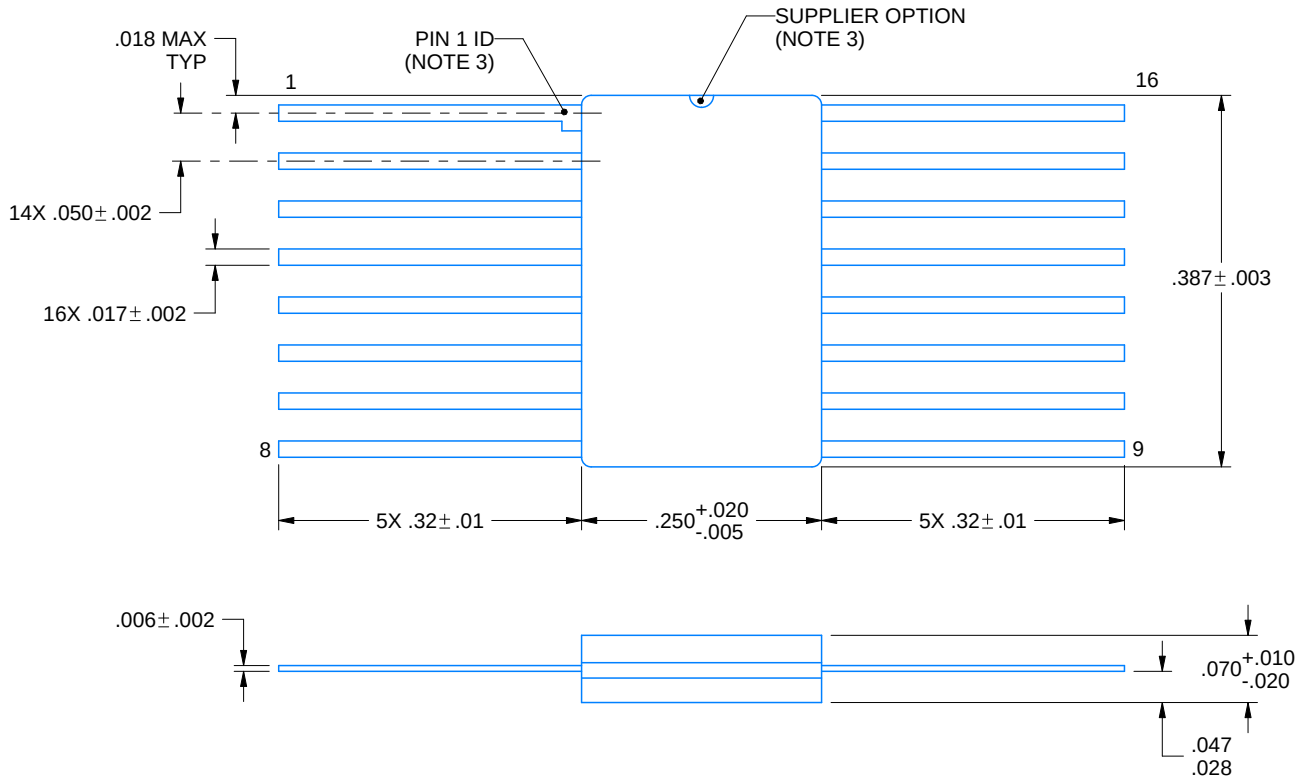
NAD0016A



PACKAGE OUTLINE

CFP - 2.03 mm max height

CERAMIC FLATPACK

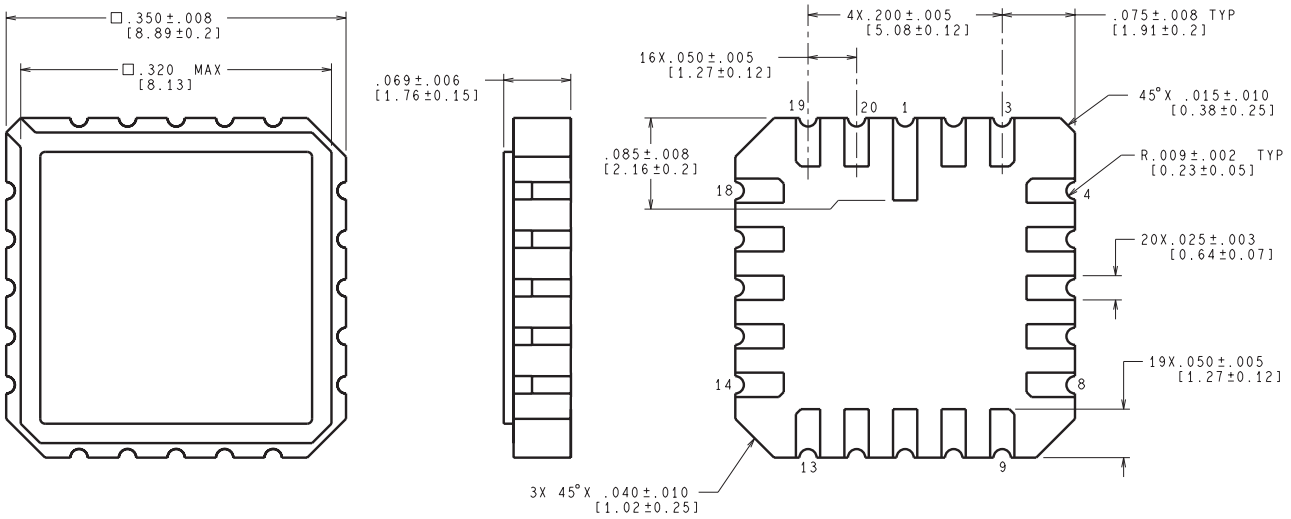


4215193/A 07/2026

NOTES:

1. All linear dimensions are in inches. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead 1 identification shall be:
   a) A notch or other mark within this area
   b) A tab on lead 1, either side

NAJ0020A



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

E20A (Rev F)

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