

## DS26F31MQML Quad High Speed Differential Line Drivers

Check for Samples: [DS26F31MQML](#)

### FEATURES

- Operation from Single +5.0V Supply
- Outputs Won't Load Line When  $V_{CC} = 0V$
- Output Short Circuit Protection
- Meets the Requirements of EIA Standard RS-422
- High Output Drive Capability for 100 $\Omega$  Terminated Transmission Lines

### DESCRIPTION

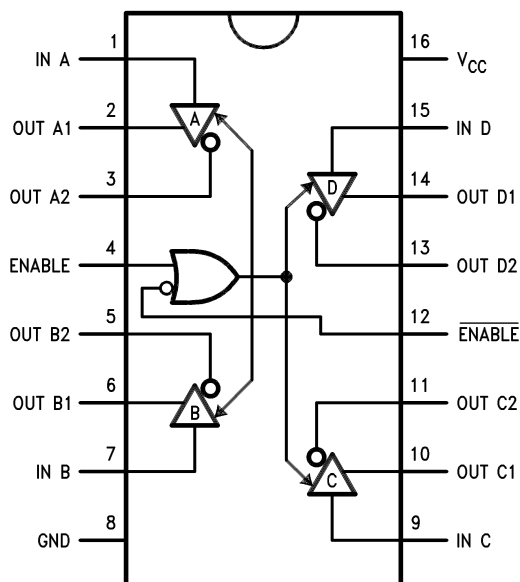
The DS26F31M is a quad differential line driver designed for digital data transmission over balanced lines. The DS26F31M meets all the requirements of EIA Standard RS-422 and Federal Standard 1020. It is designed to provide unipolar differential drive to twisted-pair or parallel-wire transmission lines.

The DS26F31M offers improved performance due to the use of state-of-the-art L-FAST bipolar technology. The L-FAST technology allows for higher speeds and lower currents by utilizing extremely short gate delay times. Thus, the DS26F31M features lower power, extended temperature range, and improved specifications.

The circuit provides an enable and disable function common to all four drivers. The DS26F31M features TRI-STATE outputs and logical OR-ed complementary enable inputs. The inputs are all LS compatible and are all one unit load.

The DS26F31M offers optimum performance when used with the DS26F32 Quad Differential Line Receiver.

### Connection and Logic Diagrams

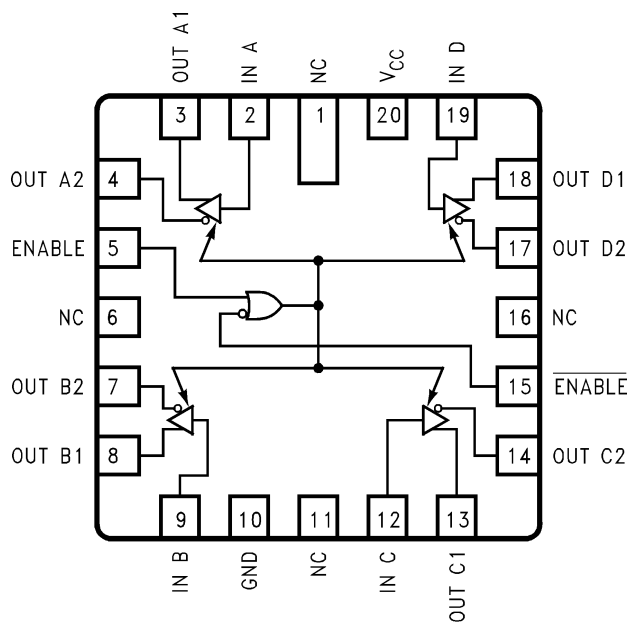


**Figure 1. 16-Lead CDIP Package- Top View**  
See Package Numbers NFE0016A, NAD0016A, NAC0016A

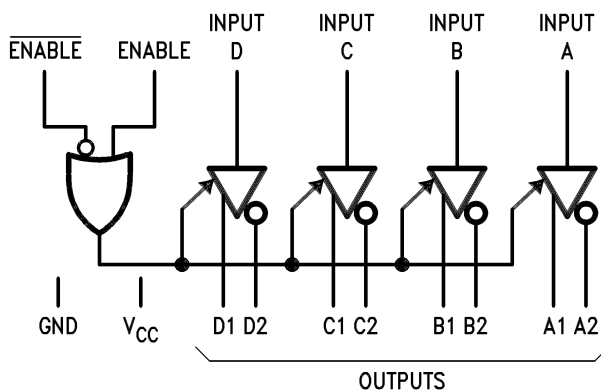


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**Figure 2. 20-Lead LCCC Package**  
See Package Number NAJ0020A



**Figure 3. Logic Symbol**



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>

Storage Temperature Range	$-65^{\circ}\text{C} \leq T_A \leq +175^{\circ}\text{C}$
Lead Temperature (Soldering, 60 sec.)	300°C
Supply Voltage	7.0V
Input Voltage	7.0V
Output Voltage	5.5V
Maximum Power Dissipation at 25°C <sup>(2)</sup>	450mW
Thermal Resistance	
$\theta_{JA}$	
NFE0016A, derate above +25°C @ 11.4mW/°C	88°C/mW
NAD0016A, derate above +25°C @ 6.6 mW/°C	151°C/mW
NAJ0020A, derate above +25°C @ 12.3 mW/°C	81°C/mW
$\theta_{JC}$	
NFE0016A	14°C/mW
NAD0016A	13°C/mW
NAJ0020A	15°C/mW

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not verify specific performance limits. For verified specifications and test conditions, see the Electrical Characteristics. The verified specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
- (2) Power dissipation must be externally controlled at elevated temperatures.

## Recommended Operating Range

Temperature	$-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$
Supply Voltage	4.5V to 5.5V

**Table 1. Radiation Features**

DS26F31MJFQMLV	300 krad (Si)
DS26F31MWFQMLV	300 krad (Si)
DS26F31MWGFQMLV	300 krad (Si)

## Quality Conformance Inspection

**Table 2. 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
12	Settling time at	25
13	Settling time at	125
14	Settling time at	-55

**DS26F31M Electrical Characteristics DC Parameters <sup>(1)</sup>**

Parameter		Test Conditions	Notes	Min	Max	Units	Sub-groups
V <sub>IH</sub>	Logical "1" Input Voltage	V <sub>CC</sub> = 4.5V	(2)	2.0		V	1, 2, 3
V <sub>IL</sub>	Logical "0" Input Voltage	V <sub>CC</sub> = 5.5V	(2)		0.8	V	1, 2, 3
V <sub>OH</sub>	Logical "1" Output Voltage	V <sub>CC</sub> = 4.5V, I <sub>OH</sub> = -20mA, V <sub>IL</sub> = 0.8V, V <sub>IH</sub> = 2V		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, V <sub>IL</sub> = 0.8V, V <sub>IH</sub> = 2V			0.5	V	1, 2, 3
I <sub>IH</sub>	Logical "1" Input Current	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 2.7V	(3)	-2.0	20	μA	1, 2, 3
I <sub>IL</sub>	Logical "0" Input Current	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 0.4V	(3)	100	-200	μA	1, 2, 3
I <sub>I</sub>	Input Reverse Current	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 7V	(3)	-0.01	0.1	mA	1, 2, 3
I <sub>OZ</sub>	TRI-STATE Output Current	V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 0.5V			-20	μA	1, 2, 3
		V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 2.5V			20	μA	1, 2, 3
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = 4.5V, I <sub>I</sub> = -18mA			-1.5	V	1, 2, 3
I <sub>SC Min</sub>	Output Short Circuit Current	V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 0V		-30		mA	1, 2, 3
I <sub>SC Max</sub>	Output Short Circuit Current	V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 0V			-150	mA	1, 2, 3
I <sub>CC Dis</sub>	Power Supply Current	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 0.8V or 2V, V <sub>En</sub> = 0.8V, V <sub>En</sub> = 2V			50	mA	1, 2, 3
I <sub>CC En</sub>	Power Supply Current	V <sub>CC</sub> = 5.5V, V <sub>En</sub> = 2V, V <sub>En</sub> = 0.8V			40	mA	1, 2, 3

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics, except as listed in the Post Radiation Limits Table — if applicable. Radiation end point limits for the noted parameters are specified only for the conditions, as specified.

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

(3) The minimum limits apply to device Class Q & V. The limits specified for the INPUT LOW CURRENT represents the numerical range in which this parameter will pass.

**DS26F31M Electrical Characteristics AC Parameters - Propagation Delay Time**

The following conditions apply, unless otherwise specified.

AC: V<sub>CC</sub> = 5V, C<sub>L</sub> = 50pF or equivalent impedance provided by diode load

Parameter		Test Conditions	Notes	Min	Max	Units	Sub-groups
t <sub>PLH</sub>	Input to Output	C <sub>L</sub> = 30pF	(1)		16	nS	9
			(1)		24	nS	10, 11
			(2)		15	nS	9
			(2)		23	nS	10, 11
t <sub>PHL</sub>	Input to Output	C <sub>L</sub> = 30pF	(1)		17	nS	9
			(1)		25	nS	10, 11
			(2)		15	nS	9
			(2)		23	nS	10, 11
t <sub>LZ</sub>	Disable Time	C <sub>L</sub> = 10 pF	(1)		38	nS	9
			(1)		56	nS	10, 11
			(2)		35	nS	9
			(2)		53	nS	10, 11
t <sub>HZ</sub>	Disable Time	C <sub>L</sub> = 10 pF	(1)		23	nS	9
			(1)		30	nS	10, 11
			(2)		20	nS	9
			(2)		27	nS	10, 11

(1) Tested at 50pF, system capacitance exceed 10 and 30pF.

(2) Testing at 50pF specifies limits at 10 and 30pF.

## DS26F31M Electrical Characteristics AC Parameters - Propagation Delay Time (continued)

The following conditions apply, unless otherwise specified.

AC:  $V_{CC} = 5V$ ,  $C_L = 50pF$  or equivalent impedance provided by diode load

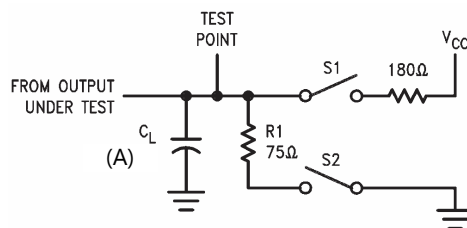
Parameter		Test Conditions	Notes	Min	Max	Units	Sub-groups
$t_{ZL}$	Enable Time	$C_L = 30pF$	(1)		28	nS	9
			(1)		40	nS	10, 11
			(2)		25	nS	9
			(2)		37	nS	10, 11
$t_{ZH}$	Enable Time	$C_L = 30 pF$	(1)		32	nS	9
			(1)		52	nS	10, 11
			(2)		30	nS	9
			(2)		50	nS	10, 11
Skew	Output to Output	$C_L = 30pF$	(1)		6.0	nS	9
			(1)		9.0	nS	10, 11
			(2)		4.5	nS	9
			(2)		7.0	nS	10, 11

## DS26F31M Electrical Characteristics DC Drift Parameters

This section applies to -QMLV devices only and shall be read & recorded at  $T_A = +25^{\circ}C$  before and after each burn-in & Subgroup B5, and shall not change by more than the limits indicated. The delta rejects shall be included in the PDA calculations.

Parameter		Test Conditions	Notes	Min	Max	Units	Sub-groups
$V_{OH}$	Logical "1" Output Voltage	$V_{CC} = 4.5V$ , $I_{OH} = -20mA$ , $V_{IL} = 0.8V$ , $V_{IH} = 2V$ .		-250	250	mV	1
$V_{OL}$	Logical "0" Output Voltage	$V_{CC} = 4.5V$ , $I_{OL} = 20mA$ , $V_{IL} = 0.8V$ , $V_{IH} = 2V$ .		-50	50	mV	1
$I_{CC\ En}$	Power Supply Current	$V_{CC} = 5.5V$ , $V_I = 0.8V$ or $2V$ , $V_{En} = 2V$ , $V_{En} = 0.8V$ .		-8.0	8.0	mA	1
$I_{CC\ Dis}$	Power Supply Current	$V_{CC} = 5.5V$ , $V_I = 0.8V$ or $2V$ , $V_{En} = 0.8V$ , $V_{En} = 2V$ .		-8.0	8.0	mA	1

## TEST CIRCUIT AND TIMING WAVEFORMS

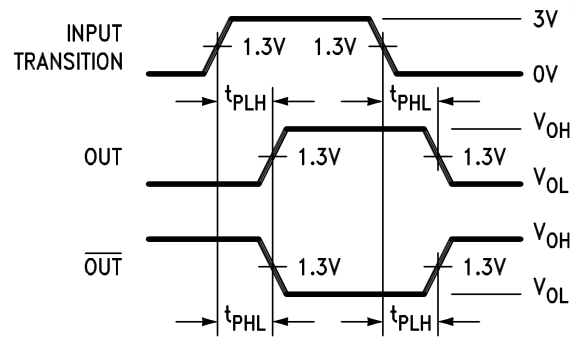


A. Parameter tested go-no-go only.

S1 and S2 of Load Circuit are closed except where shown.

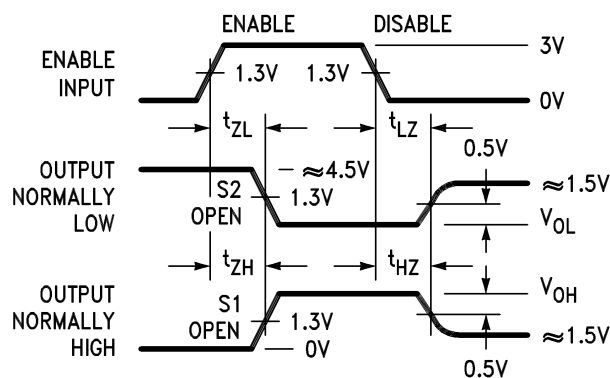
$C_L$  includes probe and jig capacitance.

**Figure 4. AC Load Test Circuit for TRI-STATE Outputs**



Pulse Generator for all Pulses: Rate  $\leq 1.0$  MHz,  $Z_O = 50\Omega$ ,  $t_r \leq 6.0$  ns,  $t_f \leq 6.0$  ns.

**Figure 5. Propagation Delay** <sup>(1)</sup> <sup>(2)</sup>



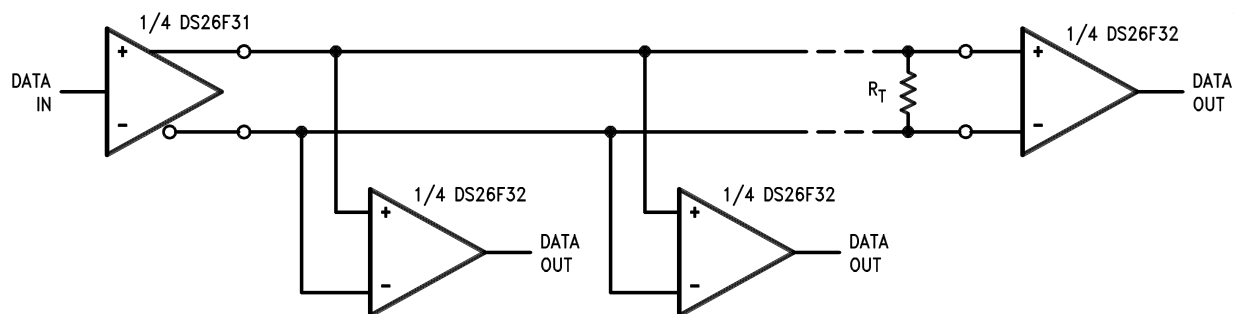
Pulse Generator for all Pulses: Rate  $\leq 1.0$  MHz,  $Z_O = 50\Omega$ ,  $t_r \leq 6.0$  ns,  $t_f \leq 6.0$  ns.

Diagram shown for Enable Low. Switches S1 and S2 open.

**Figure 6. Enable and Disable Times** <sup>(2)</sup>

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not verify specific performance limits. For verified specifications and test conditions, see the Electrical Characteristics. The verified specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
- (2) All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.

## TYPICAL APPLICATION



**Figure 7. Typical Application**

**REVISION HISTORY**

Released	Revision	Section	Originator	Changes
3/01/06	*	New Release, Corporate format	L. Lytle	1 MDS data sheet converted into one Corp. data sheet format. MNDS26F31M-X-RH Rev 0B0 will be archived.
4/15/2013	A			Changed layout of National Data Sheet to TI format

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
5962-7802302M2A	ACTIVE	LCCC	NAJ	20	50	TBD	Call TI	Call TI	-55 to 125	DS26F31ME/ 883 Q 5962-78023 02M2A ACO 02M2A >T	<a href="#">Samples</a>
5962-7802302MFA	ACTIVE	CFP	NAD	16	19	TBD	Call TI	Call TI	-55 to 125	DS26F31MW /883 Q 5962-78023 02MFA ACO 02MFA >T	<a href="#">Samples</a>
5962F7802302VFA	ACTIVE	CFP	NAD	16	19	TBD	Call TI	Call TI	-55 to 125	DS26F31MWF QMLV Q 5962F78023 02VFA ACO 02VFA >T	<a href="#">Samples</a>
DS26F31ME/883	ACTIVE	LCCC	NAJ	20	50	TBD	Call TI	Call TI	-55 to 125	DS26F31ME/ 883 Q 5962-78023 02M2A ACO 02M2A >T	<a href="#">Samples</a>
DS26F31MW/883	ACTIVE	CFP	NAD	16	19	TBD	Call TI	Call TI	-55 to 125	DS26F31MW /883 Q 5962-78023 02MFA ACO 02MFA >T	<a href="#">Samples</a>
DS26F31MWFQMLV	ACTIVE	CFP	NAD	16	19	TBD	Call TI	Call TI	-55 to 125	DS26F31MWF QMLV Q 5962F78023 02VFA ACO 02VFA >T	<a href="#">Samples</a>

(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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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#### **OTHER QUALIFIED VERSIONS OF DS26F31MQML, DS26F31MQML-SP :**

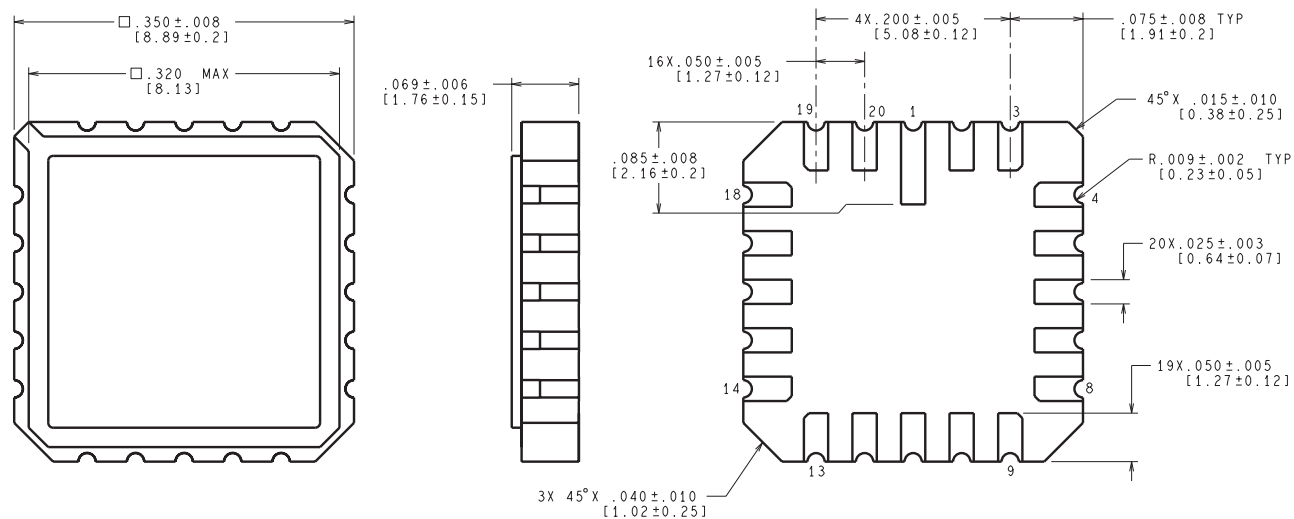
● Military: [DS26F31MQML](#)

● Space: [DS26F31MQML-SP](#)

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

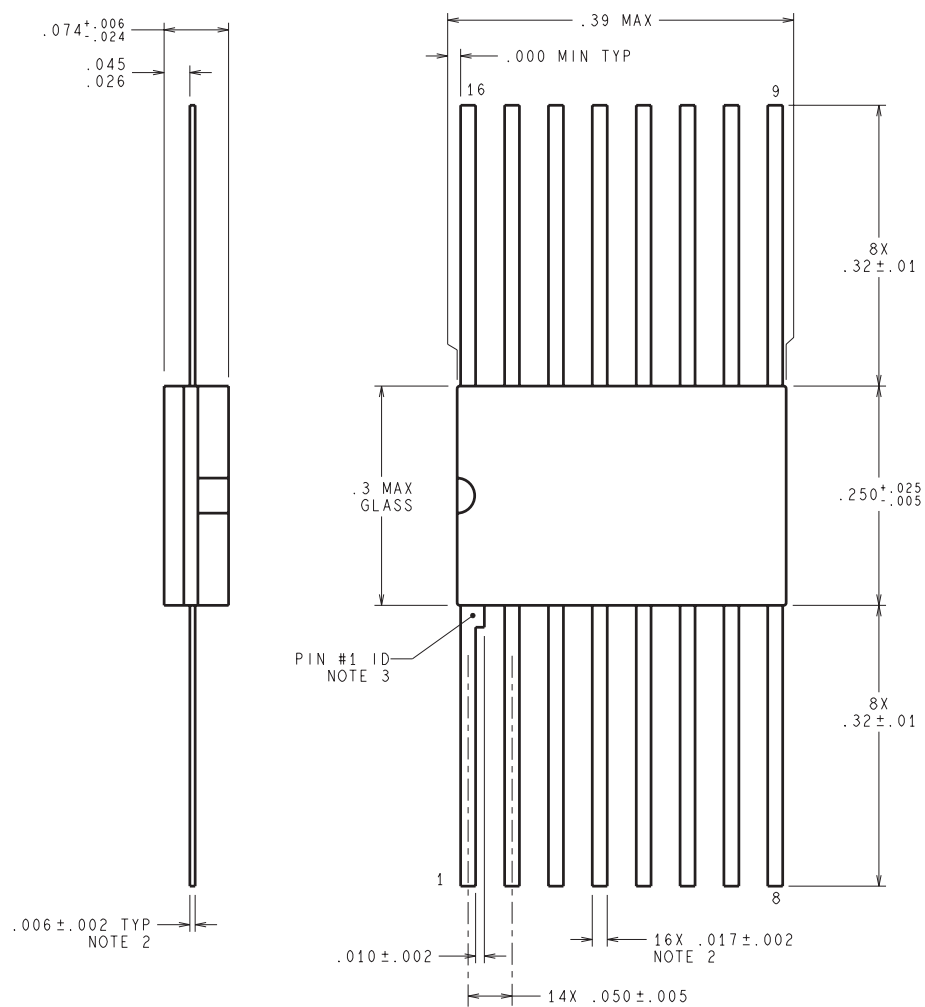
NAJ0020A



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E20A (Rev F)

NAD0016A



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W16A (Rev T)

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### Applications

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