National Semiconductor

March 2006

DS26F31MQML
Quad High Speed Differential Line Drivers

General 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.

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 100Ω terminated transmission lines

Ordering Information

NS Part Number	SMD Part Number	NS Package Number	Package Description
DS26F31ME/883	5962–7802302M2A	E20A	20LD Leadless Chip Carrier
DS26F31MJ/883	5962–7802302MEA	J16A	16LD Ceramic DIP
DS26F31MW/883	5962–7802302MFA	W16A	16LD Ceramic FlatPack
DS26F31MWG/883	5962–7802302MZA	WG16A	16LD Ceramic SOIC
DS26F31MJ-QMLV	5962–7802302VEA	J16A	16LD Ceramic DIP
DS26F31MJFQMLV	5962F7802302VEA 300k rd(Si)	J16A	16LD Ceramic DIP
DS26F31MW-QMLV	5962–7802302VFA	W16A	16LD Ceramic FlatPack
DS26F31MWFQMLV	5962F7802302VFA 300k rd(Si)	W16A	16LD Ceramic FlatPack
DS26F31MWGFQMLV	5962F7802302VZA 300k rd(Si)	WG16A	16LD Ceramic SOIC

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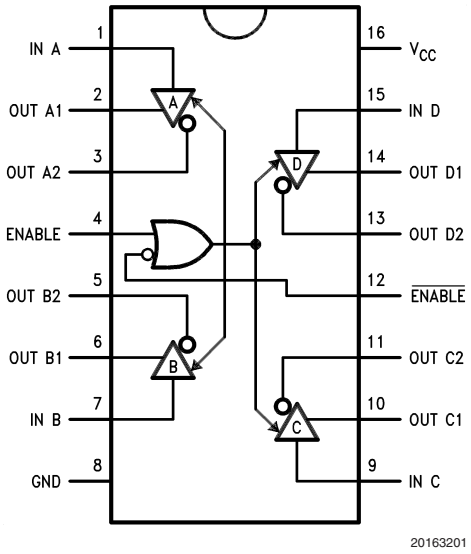
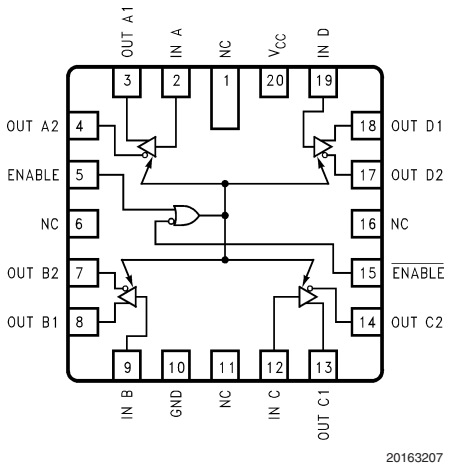
Connection and Logic Diagrams

16-Lead Ceramic DIP Pictured



Top View
See NS Package Numbers J16A, W16A, or WG16A

20-Lead Ceramic Leadless Chip Carrier (E)



See NS Package Number E20A

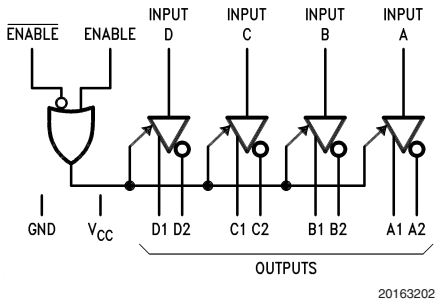


FIGURE 1. Logic Symbol

Absolute Maximum Ratings (Note 1)

Storage Temperature Range	$-65^{\circ}C \le T_A \le +175^{\circ}C$
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 (Note 3)	450mW
Thermal Resistance	
θ_{JA}	
Ceramic DIP, derate above +25˚C @ 11.4mW/˚C	88˚C/mW
Ceramic Flatpack, derate above +25˚C @ 6.6 mW/˚C	151˚C/mW
Leadless Chip Carrier, derate above +25˚C @ 12.3 mW/˚C	81˚C/mW
θ_{JC}	
Ceramic DIP	14˚C/mW
Ceramic Flatpack	13˚C/mW
Leadless Chip Carrier	15˚C/mW

Recommended Operating Range

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

Radiation Features

DS26F31MJFQMLV	300 krads (Si)
DS26F31MWFQMLV	300 krads (Si)
DS26F31MWGFQMLV	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
12	Settling time at	25
13	Settling time at	125
14	Settling time at	-55

DS26F31M Electrical Characteristics

DC Parameters (Note 8)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{IH}	Logical "1" Input Voltage	V_{CC} = 4.5V	(Note 4)	2.0		V	1, 2, 3
V_{IL}	Logical "0" Input Voltage	V_{CC} = 5.5V	(Note 4)		0.8	V	1, 2, 3
V_{OH}	Logical "1" Output Voltage	V_{CC} = 4.5V, I_{OH} = -20mA, V_{IL} = 0.8V, V_{IH} = 2V		2.5		V	1, 2, 3
V_{OL}	Logical "0" Output Voltage	V_{CC} = 4.5V, I_{OL} = 20mA, V_{IL} = 0.8V, V_{IH} = 2V			0.5	V	1, 2, 3
I_{IH}	Logical "1" Input Current	V_{CC} = 5.5V, V_I = 2.7V	(Note 7)	-2.0	20	µA	1, 2, 3
I_{IL}	Logical "0" Input Current	V_{CC} = 5.5V, V_I = 0.4V	(Note 7)	100	-200	µA	1, 2, 3
I_I	Input Reverse Current	V_{CC} = 5.5V, V_I = 7V	(Note 7)	-0.01	0.1	mA	1, 2, 3
I_{OZ}	TRI-STATE Output Current	V_{CC} = 5.5V, V_O = 0.5V			-20	µA	1, 2, 3
		V_{CC} = 5.5V, V_O = 2.5V			20	µA	1, 2, 3
V_I	Input Clamp Voltage	V_{CC} = 4.5V, I_I = -18mA			-1.5	V	1, 2, 3
$I_{SC\ Min}$	Output Short Circuit Current	V_{CC} = 5.5V, V_O = 0V		-30		mA	1, 2, 3
$I_{SC\ Max}$	Output Short Circuit Current	V_{CC} = 5.5V, V_O = 0V			-150	mA	1, 2, 3
$I_{CC\ Dis}$	Power Supply Current	V_{CC} = 5.5V, V_I = 0.8V or 2V, VEn = 0.8V, $V\overline{En}$ = 2V			50	mA	1, 2, 3
$I_{CC\ En}$	Power Supply Current	V_{CC} = 5.5V, VEn = 2V, $V\overline{En}$ = 0.8V			40	mA	1, 2, 3

AC Parameters - Propagation Delay Time

The following conditions apply, unless otherwise specified.

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

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
t_{PLH}	Input to Output		(Note 5)		16	nS	9
			(Note 5)		24	nS	10, 11
		C_L = 30pF	(Note 6)		15	nS	9
			(Note 6)		23	nS	10, 11
t_{PHL}	Input to Output		(Note 5)		17	nS	9
			(Note 5)		25	nS	10, 11
		C_L = 30pF	(Note 6)		15	nS	9
			(Note 6)		23	nS	10, 11
t_{LZ}	Disable Time		(Note 5)		38	nS	9
			(Note 5)		56	nS	10, 11
		C_L = 10 pF	(Note 6)		35	nS	9
			(Note 6)		53	nS	10, 11
t_{HZ}	Disable Time		(Note 5)		23	nS	9
			(Note 5)		30	nS	10, 11
		C_L = 10 pF	(Note 6)		20	nS	9
			(Note 6)		27	nS	10, 11
t_{ZL}	Enable Time		(Note 5)		28	nS	9
			(Note 5)		40	nS	10, 11
		C_L = 30pF	(Note 6)		25	nS	9
			(Note 6)		37	nS	10, 11

DS26F31M Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
t_{ZH}	Enable Time		(Note 5)		32	nS	9
			(Note 5)		52	nS	10, 11
		C_L = 30 pF	(Note 6)		30	nS	9
			(Note 6)		50	nS	10, 11
Skew	Output to Output		(Note 5)		6.0	nS	9
			(Note 5)		9.0	nS	10, 11
		C_L = 30pF	(Note 6)		4.5	nS	9
			(Note 6)		7.0	nS	10, 11

DC Drift Parameters

This section applies to -QMLV devices only and shall be read & recorded at T_A = +25˚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.

Symbol	Parameter	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, VEn = 2V, $V\overline{En}$ = 0.8V.		-8.0	8.0	mA	1
$I_{CC\ Dis}$	Power Supply Current	V_{CC} = 5.5V, V_I = 0.8V or 2V, VEn = 0.8V, $V\overline{En}$ = 2V.		-8.0	8.0	mA	1

Note 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 guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 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.

Note 3: Power dissipation must be externally controlled at elevated temperatures.

Note 4: Parameter tested go-no-go only.

Note 5: Tested at 50pF, system capacitance exceed 10 and 30pF.

Note 6: Testing at 50pF guarantees limits at 10 and 30pF.

Note 7: 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.

Note 8: 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 guaranteed only for the conditions, as specified.

Test Circuit and Timing Waveforms

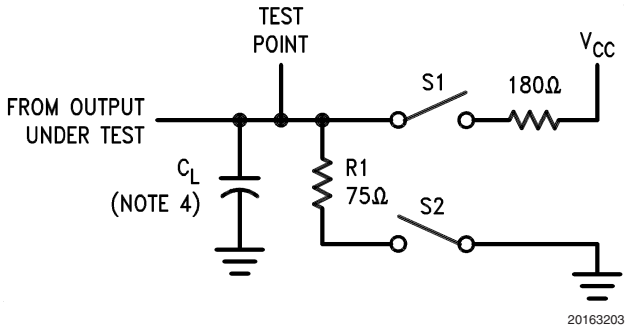


FIGURE 2. AC Load Test Circuit for TRI-STATE Outputs

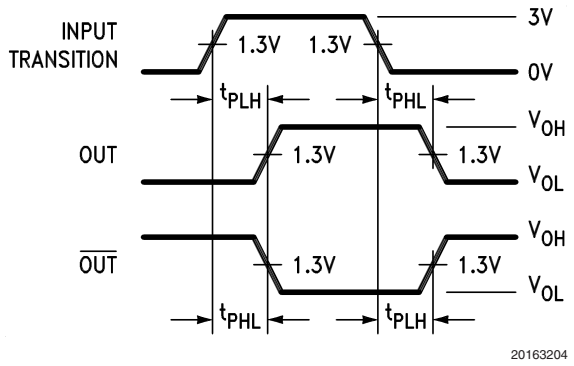


FIGURE 3. Propagation Delay (Notes 1, 2)

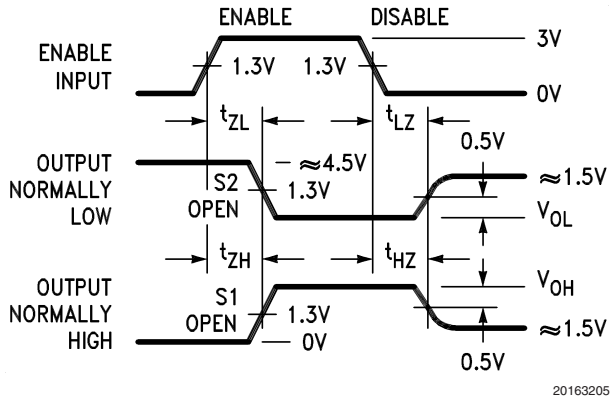


FIGURE 4. Enable and Disable Times (Note 2)

Note 9: Diagram shown for Enable Low. Switches S1 and S2 open.

Note 10: S1 and S2 of Load Circuit are closed except where shown.

Note 11: Pulse Generator for all Pulses: Rate ≤ 1.0 MHz, $Z_O = 50\Omega$, $t_r \leq 6.0$ ns, $t_f \leq 6.0$ ns.

Note 12: C_L includes probe and jig capacitance.

Typical Application

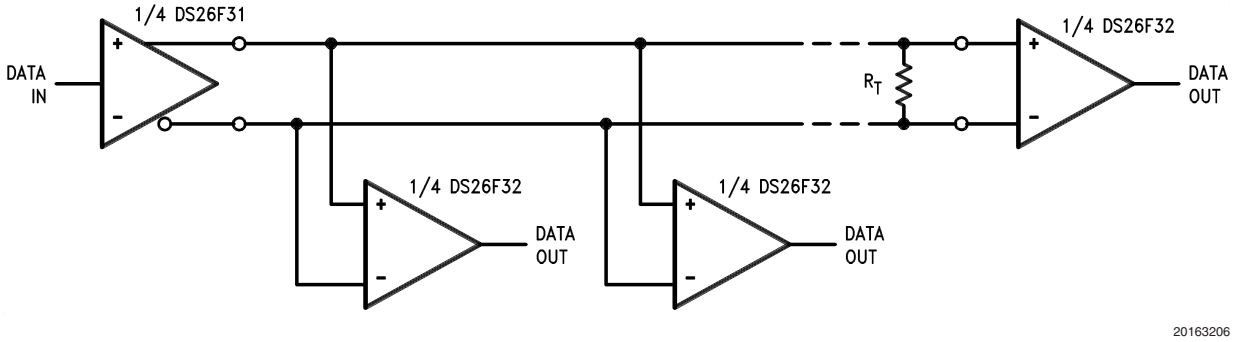
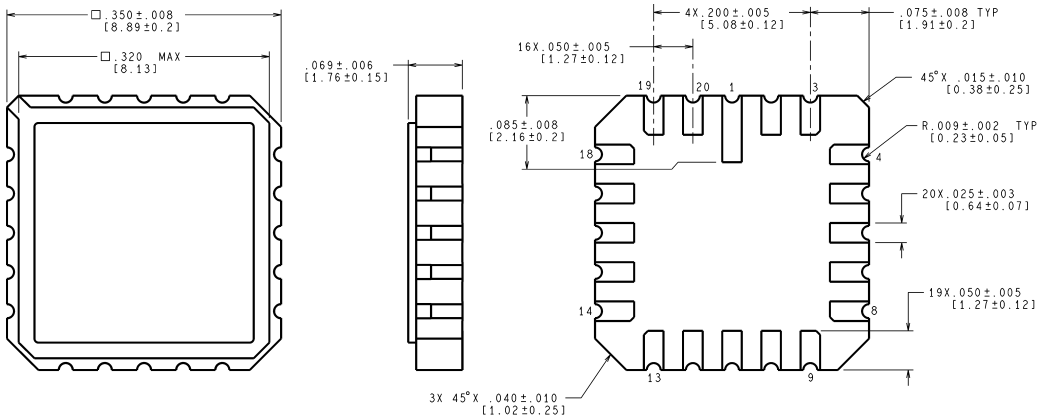


FIGURE 5. Typical Application

Revision History

Released	Revision	Section	Originator	Changes
03/01/06	A	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.

Physical Dimensions inches (millimeters) unless otherwise noted



CONTROLLING DIMENSION IS INCH
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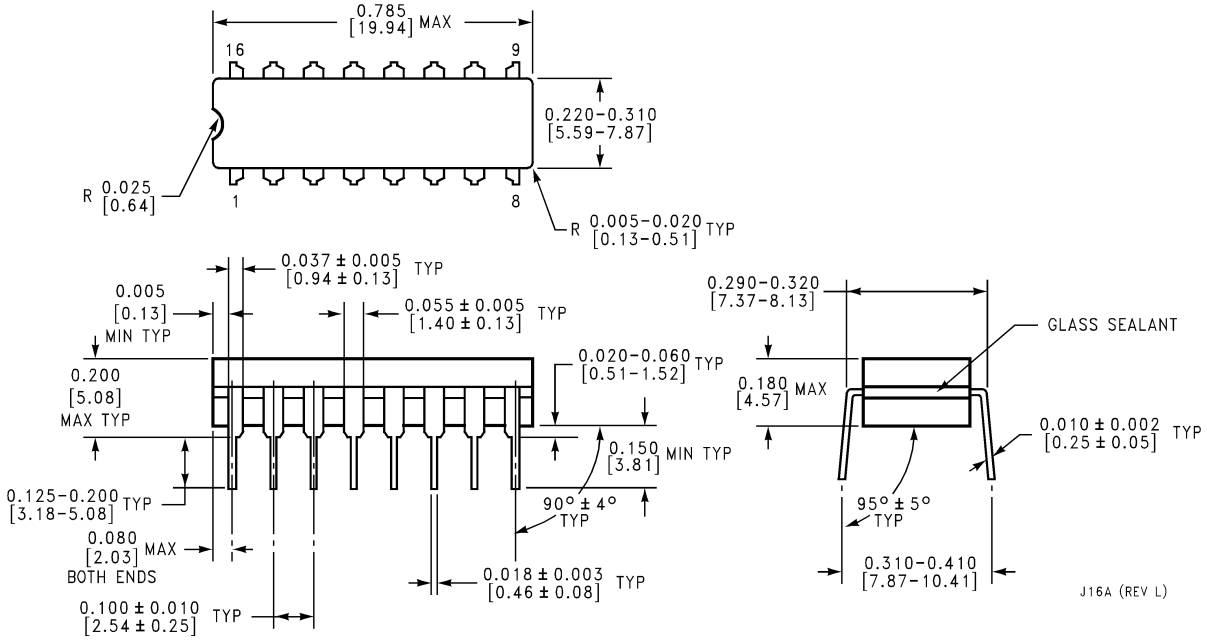
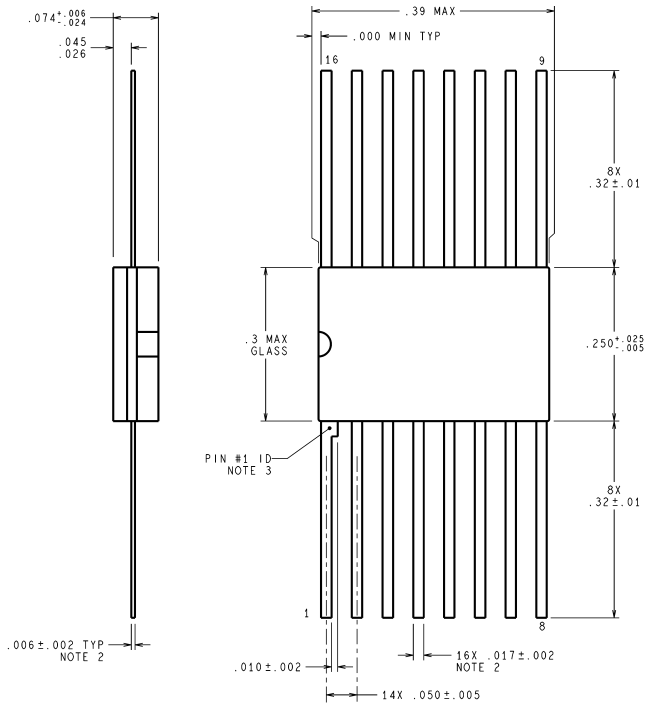
E20A (Rev F)

20-Lead Ceramic Leadless Chip Carrier (E)
NS Package Number E20A



16-Lead Ceramic Dual-In-Line Package (J)
NS Package Number J16A

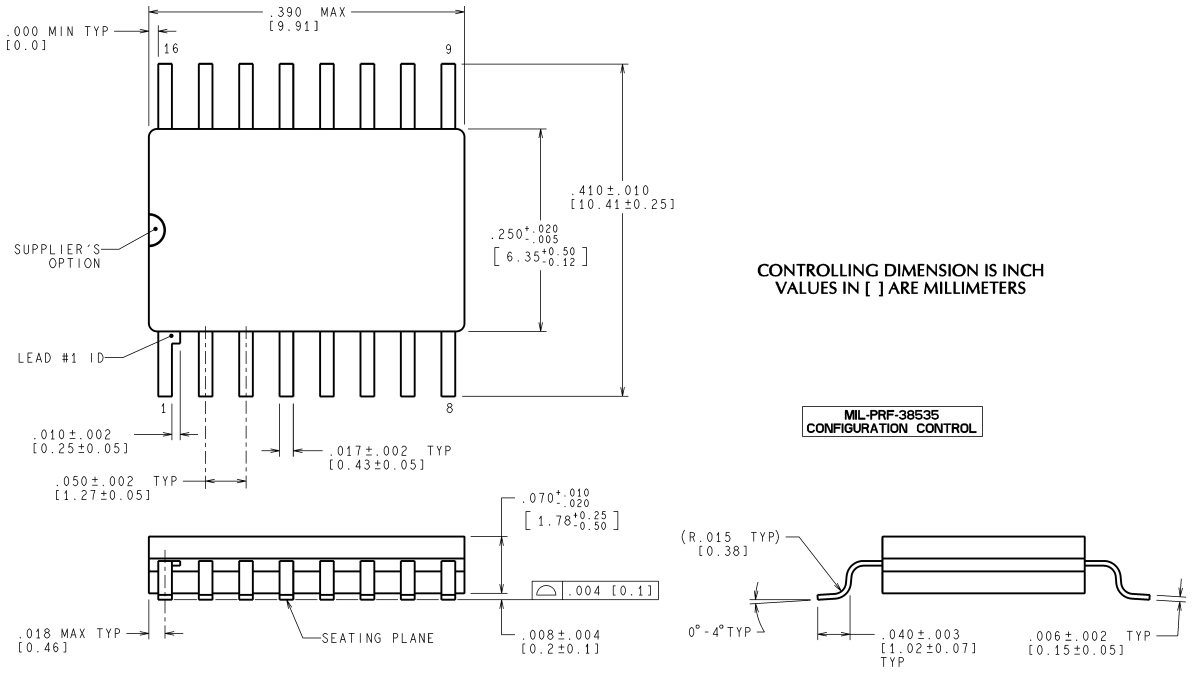
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN INCHES

W16A (Rev T)

16-Lead Ceramic Flatpak (W)
NS Package Number W16A



WG16A (Rev D)

16-Lead Ceramic SOIC (WG)
NS Package Number WG16A

Notes

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