

**MNDS26F32M-X-RH REV 0A0**

Original Creation Date: 05/20/99  
Last Update Date: 05/27/99  
Last Major Revision Date:

**QUAD DIFFERENTIAL LINE RECEIVERS ALSO AVAILABLE  
GUARANTEED TO 300K RAD(Si) TESTED TO MIL-STD-883,  
METHOD 1019.5, CONDITION A**

**General Description**

The DS26F32 is a quad differential line receiver designed to meet the requirements of EIA Standards RS-422 and RS-423, and Federal Standards 1020 and 1030 for balanced and unbalanced digital data transmission.

The DS26F32 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.

The device features an input sensitivity of 200mV over the input common mode range of  $\pm 7.0V$ . The DS26F32 provides an enable function common to all four receivers and TRI-STATE outputs with 8.0 mA sink capability. Also, a fail-safe input/output relationship keeps the outputs high when the inputs are open.

The DS26F32 offers optimum performance when used with the DS26F31 Quad Differential Line Driver.

**Industry Part Number**

DS26F32

**Prime Die**

M632

**Controlling Document**

SEE FEATURES SECTION

**NS Part Numbers**

DS26F32ME/883  
DS26F32MEF-QML  
DS26F32MJ-QMLV  
DS26F32MJ/883  
DS26F32MJF-QML  
DS26F32MJFQMLV  
DS26F32MW-QMLV  
DS26F32MW/883  
DS26F32MWF-QML  
DS26F32MWFQMLV

**Processing**

MIL-STD-883, Method 5004

**Quality Conformance Inspection**

MIL-STD-883, Method 5005

| Subgrp | 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        |

## Features

- Military temperature range
- Input voltage range of  $\pm 7.0\text{V}$  (differential or common mode)  $\pm 0.2\text{V}$  sensitivity over the input voltage range.
- High input impedance
- Operation from single  $+5.0\text{V}$  supply
- Input pull-down resistor prevents output oscillation on unused channels
- TRI-STATE outputs, with choice of complementary enables, for receiving directly on a data bus

- CONTROLLING DOCUMENTS:

|                |                 |
|----------------|-----------------|
| DS26F32ME/883  | 5962-7802005M2A |
| DS26F32MEF-QML | 5962F7802005Q2A |
| DS26F32MJ-QMLV | 5962-7802005VEA |
| DS26F32MJ/883  | 5962-7802005MEA |
| DS26F32MJF-QML | 5962F7802005QEA |
| DS26F32MJFQMLV | 5962F7802005VEA |
| DS26F32MW-QMLV | 5962-7802005VFA |
| DS26F32MW/883  | 5962-7802005MFA |
| DS26F32MWF-QML | 5962F7802005QFA |
| DS26F32MWFQMLV | 5962F7802005VFA |

**(Absolute Maximum Ratings)**

(Note 1)

|                                                   |                 |
|---------------------------------------------------|-----------------|
| Storage Temperature Range                         | -65 C to +150 C |
| Operating Temperature Range                       | -55 C to +125 C |
| Lead Temperature<br>Soldering, 60 seconds         | 300 C           |
| Supply Voltage                                    | 7.0V            |
| Common Mode Voltage Range                         | ±25V            |
| Differential Input Voltage                        | ±25V            |
| Enable Voltage                                    | 7.0V            |
| Output Sink Current                               | 50mA            |
| Maximum Power Dissipation (Pd) @ +25C<br>(Note 2) | 500mW           |
| Thermal Resistance (JA)                           |                 |
| J package                                         | 100 C/W         |
| W package                                         | 142 C/W         |
| E package                                         | 87 C/W          |

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. 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.

Note 2: Derate J package 10.0mW/C above +25C, Derate W package 7.1mW/C above +25C, Derate E package 11.5mW/C above +25C

**Recommended Operating Conditions**

|                |                 |
|----------------|-----------------|
| Temperature    | -55 C to +125 C |
| Supply Voltage | 4.5V to 5.5V    |

## Electrical Characteristics

### DC PARAMETERS: (SEE Note 5)

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC:  $V_{CC} = 5V$

| SYMBOL                | PARAMETER                          | CONDITIONS                                                                                            | NOTES | PIN-NAME | MIN | MAX  | UNIT | SUB-GROUPS |
|-----------------------|------------------------------------|-------------------------------------------------------------------------------------------------------|-------|----------|-----|------|------|------------|
| I <sub>in</sub>       | Input Current                      | $V_{CC}=4.5V$ , $V_{in}=15V$ (Pin under test), other inputs $-15V \leq V_{in} \leq +15V$              | 5     |          |     | 2.3  | mA   | 1, 2, 3    |
|                       |                                    | $V_{CC}=5.5V$ , $V_{in}=-15V$ (Pin under test), other inputs $-15V \leq V_{in} \leq +15V$             | 5     |          |     | -2.8 | mA   | 1, 2, 3    |
| I <sub>il</sub>       | Logical "0" Enable Current         | $V_{CC} = 5.5V$ , $V_{en} = .4V$                                                                      | 5     |          |     | -360 | uA   | 1, 2, 3    |
| I <sub>ih</sub>       | Logical "1" Enable Current         | $V_{CC} = 5.5V$ , $V_{in} = 2.7V$                                                                     | 5     |          |     | 10   | uA   | 1, 2, 3    |
| I <sub>i</sub>        | Logical "1" Enable Current         | $V_{CC} = 5.5V$ , $V_{in} = 5.5V$                                                                     | 5     |          |     | 50   | uA   | 1, 2, 3    |
| V <sub>ik</sub>       | Input Clamp Voltage (Enable)       | $V_{CC} = 4.5V$ , $I_{in} = -18mA$                                                                    | 5     |          |     | -1.5 | V    | 1, 2, 3    |
| V <sub>oh</sub>       | Logical "1" Output Voltage         | $V_{CC} = 4.5V$ , $I_{oh} = -440uA$ , $\Delta V_{in} = 1V$ , $\overline{V_{en}} = .8 = V_{en}$        | 5     |          | 2.5 |      | V    | 1, 2, 3    |
| V <sub>ol</sub>       | Logical "0" Output Voltage         | $V_{CC} = 4.5V$ , $\overline{V_{en}} = .8V = V_{en}$ , $I_{ol} = 4mA$ , $\Delta V_{in} = -1V$         | 5     |          |     | .4   | V    | 1, 2, 3    |
|                       |                                    | $V_{CC} = 4.5V$ , $\overline{V_{en}} = .8V = V_{en}$ , $I_{ol} = 8mA$ , $\Delta V_{in} = -1V$         | 5     |          |     | .45  | V    | 1, 2, 3    |
| I <sub>cc</sub>       | Supply Current                     | $V_{CC} = 5.5V$ , All $V_{in} = Gnd$ , $V_{en} = 0V$ , $\overline{V_{en}} = 2V$                       | 5     |          |     | 50   | mA   | 1, 2, 3    |
| I <sub>oz</sub>       | Off-State Output Current           | $V_{CC} = 5.5V$ , $V_o = .4V$ , $V_{en} = .8V$ , $\overline{V_{en}} = 2V$                             | 5     |          |     | -20  | uA   | 1, 2, 3    |
|                       |                                    | $V_{CC} = 5.5V$ , $V_o = 2.4V$ , $V_{en} = .8V$ , $\overline{V_{en}} = 2V$                            | 5     |          |     | 20   | uA   | 1, 2, 3    |
| R <sub>in</sub>       | Input Resistance                   | $-15 \leq V_{cm} \leq 15V$                                                                            | 5     |          | 14  |      | KOhm | 1, 2, 3    |
| V <sub>th</sub>       | Differential Input Voltage         | $V_{CC} = 4.5V$ , $-7V \leq V_{cm} \leq 7V$ , $V_{en} = \overline{V_{en}} = 2.5V$ , $V_o = 0.45/2.5V$ | 2, 5  |          | -.2 | .2   | V    | 1, 2, 3    |
|                       |                                    | $V_{CC} = 5.5V$ , $-7V \leq V_{cm} \leq 7V$ , $V_{en} = \overline{V_{en}} = 2.5V$ , $V_o = 0.45/2.5V$ | 2, 5  |          | -.2 | .2   | V    | 1, 2, 3    |
| V <sub>il</sub>       | Logical "0" Input Voltage (Enable) | $V_{CC} = 5.5V$                                                                                       | 2, 5  |          |     | .8   | V    | 1, 2, 3    |
| V <sub>ih</sub>       | Logical "1" Input Voltage (Enable) | $V_{CC} = 4.5V$                                                                                       | 2, 5  |          | 2   |      | V    | 1, 2, 3    |
| I <sub>sc (min)</sub> | Output Short Circuit Current       | $V_{CC} = 4.5V$ , $V_o = 0V$ , $\Delta V_{in} = 1V$                                                   | 5     |          | -15 |      | mA   | 1, 2, 3    |
| I <sub>sc (max)</sub> | Output Short Circuit Current       | $V_{CC} = 5.5V$ , $V_o = 0V$ , $\Delta V_{in} = 1V$                                                   | 5     |          |     | -85  | mA   | 1, 2, 3    |

## Electrical Characteristics

### AC PARAMETERS: PROPAGATION DELAY TIME: (SEE NOTE 5)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC:  $V_{CC} = 5V$

| SYMBOL | PARAMETER    | CONDITIONS | NOTES | PIN-NAME | MIN | MAX | UNIT | SUB-GROUPS |
|--------|--------------|------------|-------|----------|-----|-----|------|------------|
| tPLH   |              | Cl = 50pF  | 4, 5  |          |     | 23  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 31  | nS   | 10, 11     |
|        |              | Cl = 15pF  | 3, 5  |          |     | 22  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 30  | nS   | 10, 11     |
| tPHL   |              | Cl = 50pF  | 4, 5  |          |     | 23  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 31  | nS   | 10, 11     |
|        |              | Cl = 15pF  | 3, 5  |          |     | 22  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 30  | nS   | 10, 11     |
| tPZH   | Enable Time  | Cl = 50pF  | 4, 5  |          |     | 18  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 29  | nS   | 10, 11     |
|        |              | Cl = 15pF  | 3, 5  |          |     | 16  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 27  | nS   | 10, 11     |
| tPZL   | Enable Time  | Cl = 50pF  | 4, 5  |          |     | 20  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 29  | nS   | 10, 11     |
|        |              | Cl = 15pF  | 3, 5  |          |     | 18  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 27  | nS   | 10, 11     |
| tPHZ   | Disable Time | Cl = 50pF  | 4, 5  |          |     | 55  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 62  | nS   | 10, 11     |
|        |              | Cl = 5pF   | 3, 5  |          |     | 20  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 27  | nS   | 10, 11     |
| tPLZ   | Disable Time | Cl = 50pF  | 4, 5  |          |     | 30  | nS   | 9          |
|        |              |            | 4, 5  |          |     | 42  | nS   | 10, 11     |
|        |              | Cl = 5pF   | 3, 5  |          |     | 18  | nS   | 9          |
|        |              |            | 3, 5  |          |     | 30  | nS   | 10, 11     |

## Electrical Characteristics

### DC PARAMETERS - DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC: NOTE::This section applies to -QMLV devices only and shall be read & recorded at TA = +25C before and after each burn-in and shall not change by more than the limits indicated. The delta rejects shall be included in the PDA calculation.

| SYMBOL | PARAMETER                  | CONDITIONS                                                              | NOTES | PIN-NAME | MIN   | MAX  | UNIT | SUB-GROUPS |
|--------|----------------------------|-------------------------------------------------------------------------|-------|----------|-------|------|------|------------|
| Voh    | Logical "1" Output Voltage | Vcc = 4.5V, Ioh = -440uA, Delta Vin = 1V, Ven = 0.8V = Ven              |       |          | -250  | 250  | mV   | 1          |
| Vol    | Logical "0" Output Voltage | Vcc = 4.5V, Iol = 4mA, Delta Vin = -1V, Ven = 0.8V = Ven                |       |          | -45   | 45   | mV   | 1          |
|        |                            | Vcc = 4.5V, Iol = 8mA, Delta Vin = -1V, Ven = 0.8V = Ven                |       |          | -45   | 45   | mV   | 1          |
| Iin    | Input Current              | Vcc = 4.5V, Vin=15V (Pin under test), other inputs -15V <= Vin <= +15V  |       |          | -0.28 | 0.28 | mA   | 1          |
|        |                            | Vcc = 5.5V, Vin=-15V (Pin under test), other inputs -15V <= Vin <= +15V |       |          | -0.28 | 0.28 | mA   | 1          |

Note 1: Power dissipation must be externally controlled at elevated temperatures.

Note 2: Parameter tested go-no-go only.

Note 3: Tested at 50pF guarantees limit at 15 & 5pF.

Note 4: Tested at 50pF, system capacitance exceeds 5 to 15pF.

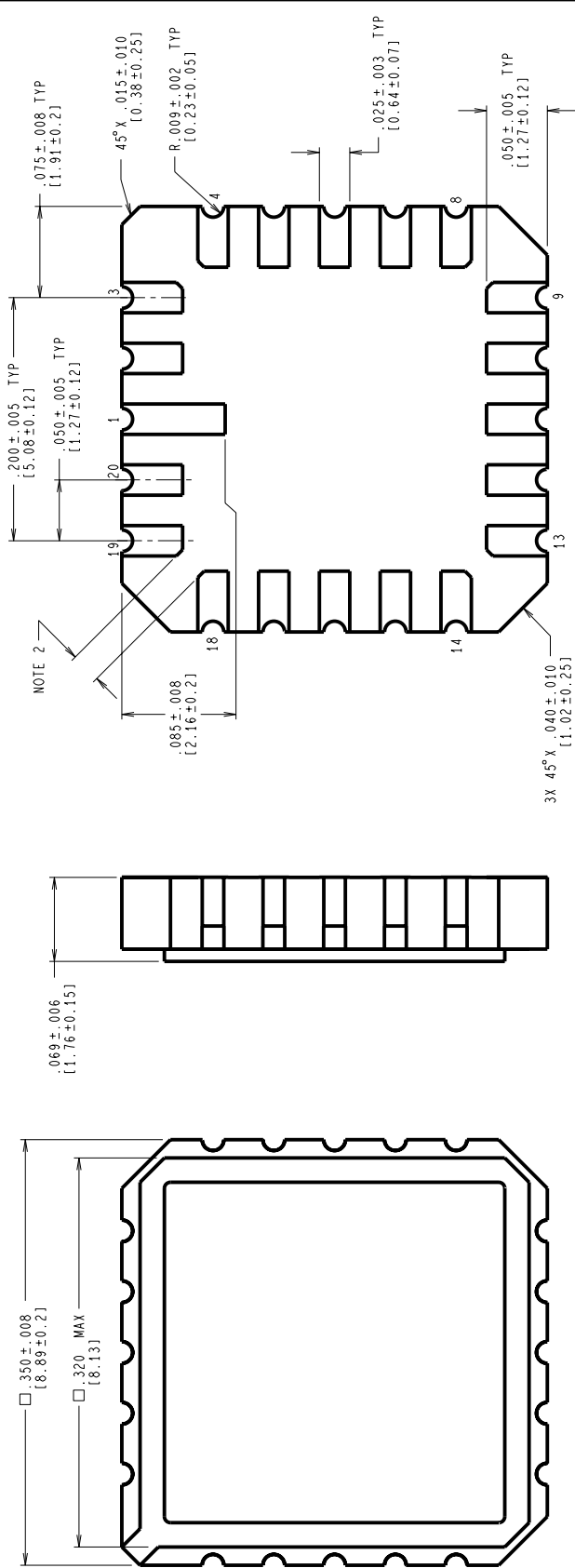
Note 5: Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are guaranteed only for the conditions as specified in MIL-STD-883, Method 1019.5, Condition A.

## Graphics and Diagrams

| GRAPHICS# | DESCRIPTION                            |
|-----------|----------------------------------------|
| E20ARE    | LCC (E), TYPE C, 20 TERMINAL (P/P DWG) |
| J16ARL    | CERDIP (J), 16 LEAD (P/P DWG)          |
| W16ARL    | CERPACK (W), 16 LEAD (P/P DWG)         |

See attached graphics following this page.

| REVISIONS |                   |        |               |
|-----------|-------------------|--------|---------------|
| LTR       | DESCRIPTION       | E.C.N. | DATE          |
| E         | REVISE AND REDRAW | 10005  | 02/10/94 DEG/ |



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

NOTES: UNLESS OTHERWISE SPECIFIED.

1. LEAD FINISH TO BE ONE OF THE FOLLOWING:

a. 50 MICRONS/12.7 MICROMETERS MINIMUM GOLD PLATING OVER 50-350 MICRONS/1.27-8.89 MICROMETERS NICKEL.

b. SOLDER DIP.  
SOLDER THICKNESS PER LATEST REVISION OF MIL-STD-1835.

2. CORNER PADS MAY HAVE A  $45^\circ$  X  $.020$  IN/0.51mm MAXIMUM CHAMFER TO ACCOMPLISH THE .015 IN/0.38mm DIMENSION.

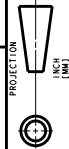
4. REFERENCE JEDEC REGISTRATION MS-004, VARIATION CB, DATED 7/90.

# MIL/AERO CONFIGURATION CONTROL

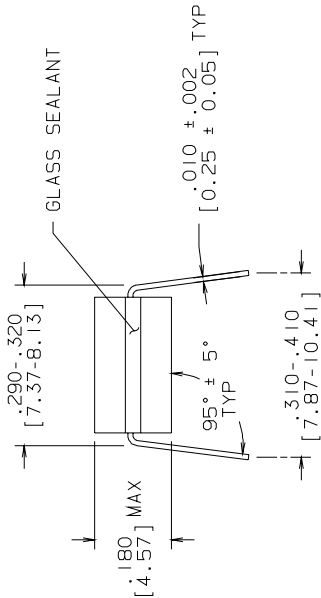
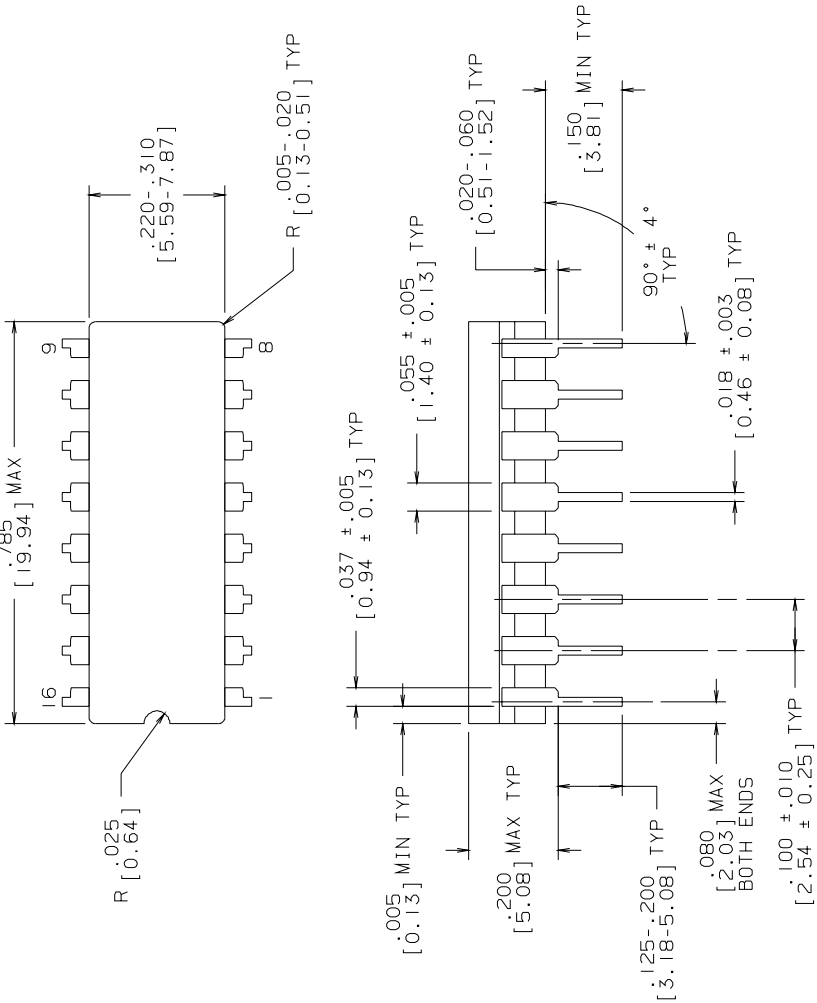
| APPROVALS |              | DATE     | SCALE |   | SIZE     | DRAWING NUMBER |                      | REV |
|-----------|--------------|----------|-------|---|----------|----------------|----------------------|-----|
| DESIGN    | Design Grady | 02/10/94 | N/A   | C | MKT-E20A | E              | DO NOT SCALE DRAWING |     |
| ESTD      | CHK          |          |       |   |          |                | SHEET 1 of 1         |     |
| ENGR      | CHK          |          |       |   |          |                |                      |     |
| APPROVAL  |              |          |       |   |          |                |                      |     |

**NATIONAL SEMICONDUCTOR CORPORATION**  
2000 Semiconductor Drive, Santa Clara, CA 95052-8000

**LEADLESS CHIP CARRIER,  
TYPE C,  
20 TERMINAL**



| R E V I S I O N S |                                |        |          |          |
|-------------------|--------------------------------|--------|----------|----------|
| LTR               | DESCRIPTION                    | E.C.N. | DATE     | BY/APP'D |
| L                 | REVISE PER CURRENT STD; REDRAW | 09996  | 09/15/93 | TL/      |



MIL/AERO

CONFIGURATION CONTROL

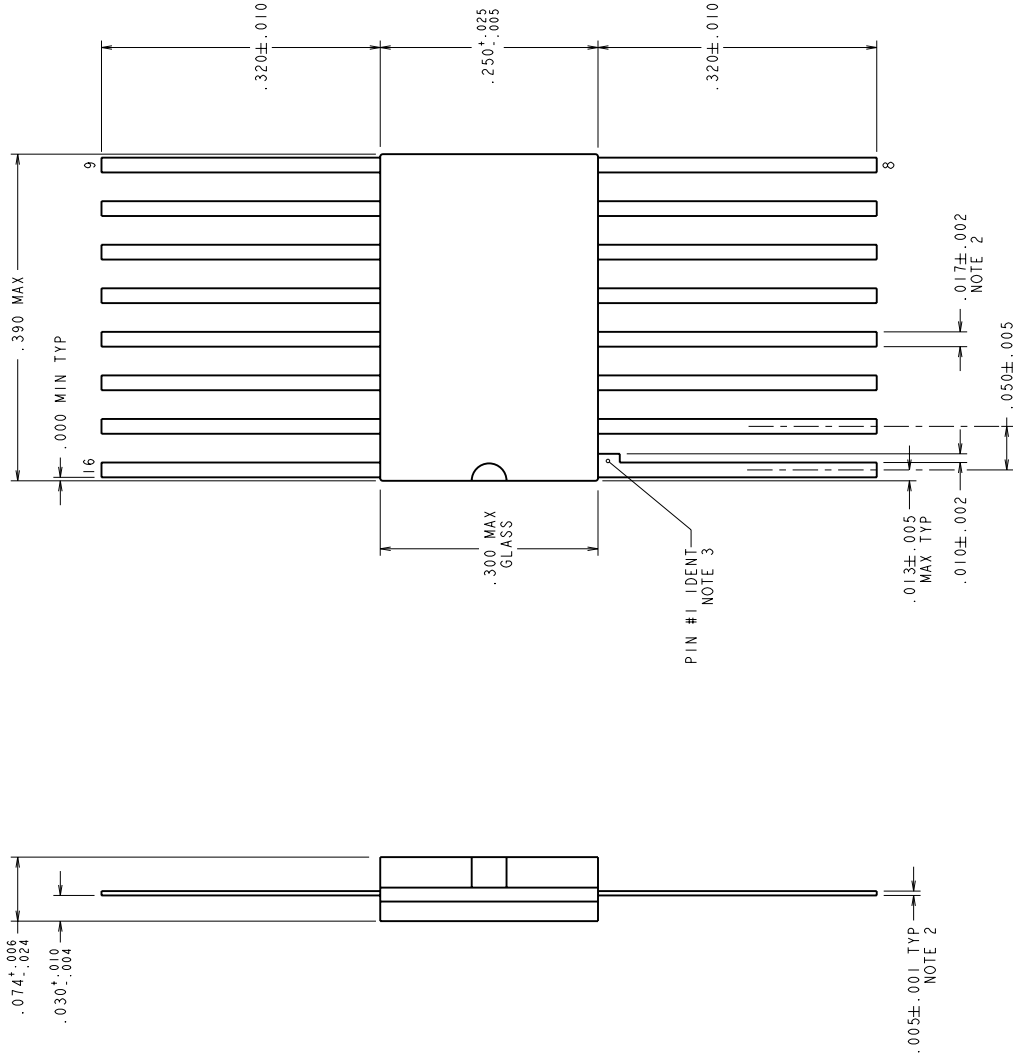
MIL-M-38510

CONFIGURATION CONTROL

| CONTROLLING DIMENSION: INCH   |          |                                                      |                |     |
|-------------------------------|----------|------------------------------------------------------|----------------|-----|
| APPROVALS                     | DATE     | NATIONAL SEMICONDUCTOR CORPORATION                   |                |     |
| DRAWN <b>LEQUANG</b>          | 09/15/93 | 2900 Semiconductor Drive, Santa Clara, CA 95052-8090 |                |     |
| DFTG. CHK.                    |          | CERDIP (J) ,<br>16 LEAD                              |                |     |
| ENGR. CHK.                    |          |                                                      |                |     |
| APPROVAL                      |          |                                                      |                |     |
| <br>PROJECTION<br>1 INCH [MM] | SCALE    | SIZE                                                 | DRAWING NUMBER | REV |
|                               | N/A      | B                                                    | MKT-J16A       | L   |
| DO NOT SCALE DRAWING          |          | SHEET                                                | 1 OF 1         |     |

- NOTES: UNLESS OTHERWISE SPECIFIED
- LEAD FINISH TO BE 200 MICRONS / 5.08 MICROMETERS MINIMUM SOLDER MEASURED AT THE CREST OF THE MAJOR FLATS.
  - JEDEC REGISTRATION M0-036, VARIATION AD, DATED 04/1981.

| REVISIONS |                                     |        |          |
|-----------|-------------------------------------|--------|----------|
| LTR       | DESCRIPTION                         | E.C.N. | DATE     |
| K         | REVISE AND REDRAW PER NEW STANDARD. | 10514  | 07/28/94 |
| L         | .017±.002 WAS .017±.020.            | 10656  | 10/21/94 |
|           |                                     |        | DEG/     |



NOTES: UNLESS OTHERWISE SPECIFIED.

1. LEAD FINISH: SOLDER DIPPED WITH Sn60 OR Sn63 SOLDER CONFORMING TO MIL-M-38510 TO A MINIMUM THICKNESS OF 200 MICROINCHES. SOLDER MAY BE APPLIED OVER LEAD BASIS METAL OR Sn PLATE.
2. MAXIMUM LIMIT MAY BE INCREASED BY .003 INCHES AFTER LEAD FINISH APPLIED.
3. LEAD 1 IDENTIFICATION SHALL BE:
  - a) A NOTCH OR OTHER MARK WITHIN THIS AREA
  - b) A TAB ON LEAD 1, EITHER SIDE
4. REFERENCE JEDEC REGISTRATION M0-092, VARIATION AC, DATED 04/89.

MIL/AERO  
CONFIGURATION CONTROL

MIL-M-38510  
CONFIGURATION CONTROL

| APPROVALS            |                    | DATE         |          |
|----------------------|--------------------|--------------|----------|
| DRN                  | <i>D. F. Grady</i> |              | 07/28/94 |
| DFTG. CHK.           |                    |              |          |
| ENGR. CHK.           |                    |              |          |
| PROJECTION           |                    |              |          |
|                      |                    |              |          |
| SCALE                | N/A                | SIZE         | C        |
| DRAWING NUMBER       | MKT-WI6A           |              |          |
| REV                  | L                  |              |          |
| DO NOT SCALE DRAWING |                    | SHEET 1 of 1 |          |

*National Semiconductor*  
2000 Semiconductor dr., Santa Clara, CA 95052-8090

CERPACK, I6 LEAD

**Revision History**

| Rev | ECN #    | Rel Date | Originator  | Changes                                                                                                                                             |
|-----|----------|----------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 0A0 | M0003443 | 05/27/99 | Rose Malone | Initial MDS Release: MNDS26F32M-X-RH, Rev. 0A0 - Added reference to Rad Hard. Archive MNDS26F32M-X, Rev. 0B0, Replace By MNDS26F32M-X-RH, Rev. 0A0. |