National Semiconductor

March 2006

# DS26LV31QML
# 3V Enhanced CMOS Quad Differential Line Driver

## General Description

The DS26lV31 is a high-speed quad differential CMOS driver that is comparable to the TIA/EIA-422-B and ITU-T V.11 standards. The CMOS DS26LV31 features low static $I_{CC}$ of 125 µA Max which makes it ideal for battery powered and power conscious applications. Differential outputs have the same $V_{OD}$ guarantee (≥2V) as the 5V version. The EN and $\overline{EN}$ inputs allow active Low or active High control of the TRI-STATE outputs. The enables are common to all four drivers. Protection diodes protect all the driver inputs against electrostatic discharge. The driver and enable inputs (DI, EN, $\overline{EN}$) are compatible with low voltage LVTTL and LVCMOS devices.

## Features

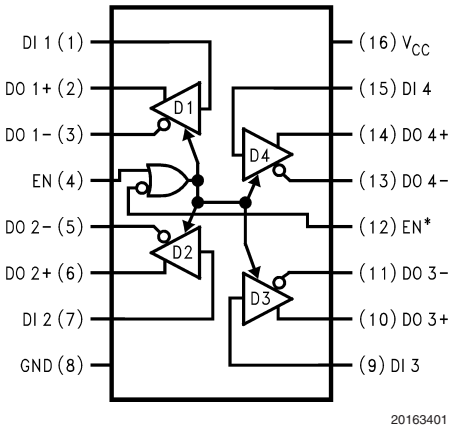
- Comparable to both TIA/EIA-422 and ITU-T V.11 standards.
- Interoperable with existing 5V RS-422 networks
- Low quiescent current
- Pin compatiable with DS26C31

## Ordering Information

| NS Part Number | SMD Part Number | NS Package Number | Package Description |
|---|---|---|---|
| DS26LV31W-QML | 5962–9858401QFA | W16A | 16 Lead Ceramic Flatpack |

## Connection Diagram

**Ceramic Flatpack**




**Top View**
**See NS Package Number W16A**

## Absolute Maximum Ratings (Notes 1, 2)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | -0.5V to 7.0V |
| DC Input Voltage ($V_I$) | -0.5V to $V_{CC}$+0.5V |
| DC Output Voltage ($V_O$) Power off | -0.5V to 7V |
| Clamp Diode Current ($I_{IK}$, $I_{OK}$) | ±20mA |
| DC Output Current, per Pin ($I_O$) | ±150mA |
| Storage Temperature Range ($T_{Stg}$) | -65˚C ≤ $T_A$ ≤ +150˚C |
| Lead Temperature ($T_L$) Soldering, 4 seconds | 260˚C |
| Maximum Power Dissipation +25˚C (Note 3) | 1119mW |
| Thermal Resistance | |
| $\theta_{JA}$ | 134˚C/W |
| $\theta_{JC}$ | 12.5˚C/W |

## Recommended Operating Conditions

| | |
|---|---|
| Supply Voltage ($v_{CC}$) | 3.0V to 3.6V |
| DC input or Output Voltage ($V_I$, $V_O$) | 0V to $V_{CC}$ |
| Operating Temperature Range ($T_A$) | –55˚C ≤ $T_A$ ≤ +125˚C |

## 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 |

# DS26LV31M Electrical Characteristics

## DC Parameters

| Symbol | Parameter | Conditions | Notes | Min | Max | Units | Sub-groups |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Logical "1" Input Voltage | | (Note 6) | 2.0 | | V | 1, 2, 3 |
| $V_{IL}$ | Logical "0" Input Voltage | | (Note 6) | | 0.8 | V | 1, 2, 3 |
| $V_{OD1}$ | Differential Output Voltage | $R_L$ = No Load, $V_{CC}$ = 3.0/3.6V | (Note 4) | | 4.0 | V | 1, 2, 3 |
| $V_{OD2}$ | Differential Output Voltage | $R_L$ = 100Ω, $V_{CC}$ = 3.0/3.6V | (Note 4) | 2.0 | | V | 1, 2, 3 |
| $V_{OD2}$-$\overline{V_{OD2}}$ | Difference in Differential Output | $R_L$ = 100Ω, $V_{CC}$ = 3.0/3.6V | (Note 4) | -0.4 | 0.4 | V | 1, 2, 3 |
| $V_{OD3}$ | Differential Output Voltage | $R_L$ = 3900Ω, $V_{CC}$ = 3.0/3.6V | (Note 4) | | 3.6 | V | 1, 2, 3 |
| $V_{OC}$ | Common Mode Output Voltage | $R_L$ = 100Ω, $V_{CC}$ = 3.0/3.6V | (Note 4) | | 2.0 | V | 1, 2, 3 |
| $V_{OC}$-$\overline{V_{OC}}$ | Difference in Common Mode Output | $R_L$ = 100Ω, $V_{CC}$ = 3.0/3.6V | (Note 4) | -0.4 | 0.4 | V | 1, 2, 3 |
| $I_{IL}$ | Low Level Input Current | $V_I$ = Gnd, $V_{CC}$ = 3.6V | | -10 | | µA | 1, 2, 3 |
| $I_{IH}$ | High Level Input Current | $V_I$ = $V_{CC}$, $V_{CC}$ = 3.6V | | | 10 | µA | 1, 2, 3 |
| $V_{CL}$ | Input Clamp Voltage | $I_I$ = -18mA, $V_{CC}$ = 3.0V | | | -1.5 | V | 1, 2, 3 |
| $I_{CC}$ | Quiescent Power Supply Current | $I_O$ = 0uA, $V_I$ = $V_{CC}$ or Gnd, $V_{CC}$ = 3.6V | | | 125 | µA | 1, 2, 3 |
| $I_{OZ}$ | TRI-STATE Output Leakage Current | $V_O$ = $V_{CC}$ or Gnd, Enable = Vil, $V_{CC}$ = 3.6V, $\overline{\text{Enable}}$ = $V_{IH}$ | | | ±20 | µA | 1, 2, 3 |
| $I_{SC}$ | Output Short Circuit Current | $V_I$ = $V_{CC}$ or Gnd, $V_{CC}$ = 3.0/3.6V, $V_O$ = 0.0V | (Note 4), (Note 5) | -30 | -160 | mA | 1, 2, 3 |
| $I_{Off}$ | Output Leakage Current "Power Off" | $V_{CC}$ = 0V, $V_O$ = 6.0V or 3.0V | | | 100 | µA | 1, 2, 3 |
| | | $V_{CC}$ = 0V, $V_O$ = -0.25V | | | -200 | µA | 1, 2, 3 |

## AC Parameters - Propagation Delay Time

The following conditions apply to all the following parameters, unless otherwise specified. AC: $V_{CC}$ = 3.0/3.6V

| Symbol | Parameter | Conditions | Notes | Min | Max | Units | Sub-groups |
|---|---|---|---|---|---|---|---|
| $t_{PLHD}$ | Differential Propagation Delay (Low to High) | $R_L$ = 100Ω, $C_L$ = 50pF | (Note 7) | 5.0 | 25 | nS | 9, 10, 11 |
| $t_{PHLD}$ | Differential Propagation Delay (High to Low) | $R_L$ = 100Ω, $C_L$ = 50pF | (Note 7) | 5.0 | 25 | nS | 9, 10, 11 |
| $t_{SKD}$ | Differential Skew $t_{PHLD}$-$t_{PLHD}$ (same channel) | $R_L$ = 100Ω, $C_L$ = 50pF | (Note 7) | | 5.0 | nS | 9, 10, 11 |
| $t_{SK1}$ | Pin to Pin Skew (same device) | $R_L$ = 100Ω, $C_L$ = 50pF | (Note 7) | | 5.0 | nS | 9, 10, 11 |
| $t_{PZH}$ | Output Enable Time | $R_L$ = 110Ω to Gnd, $C_L$ = 50pF | (Note 8) | | 40 | nS | 9, 10, 11 |
| $t_{PZL}$ | Output Enable Time | $R_L$ = 110Ω to $V_{CC}$, $C_L$ = 50pF | (Note 8) | | 40 | nS | 9, 10, 11 |
| $t_{PHZ}$ | Output Disable Time | $R_L$ = 110Ω to Gnd, $C_L$ = 50pF | (Note 8) | | 35 | nS | 9, 10, 11 |
| $t_{PLZ}$ | Output Disable Time | $R_L$ = 110Ω to $V_{CC}$, $C_L$ = 50pF | (Note 8) | | 35 | nS | 9, 10, 11 |

**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:** Unless otherwise specified, all voltages are referenced to ground. All currents into device pins are positive, all currents out of device pins are negative.

**Note 3:** Derate W package 7.5mW/°C above +25°C.

**Note 4:** See EIA specification RS-422 for exact test condition.

**Note 5:** This is a current sourced when a high output is shorted to Gnd. Only one output at a time should be shorted.

**Note 6:** Parameter tested Go-No-Go only.

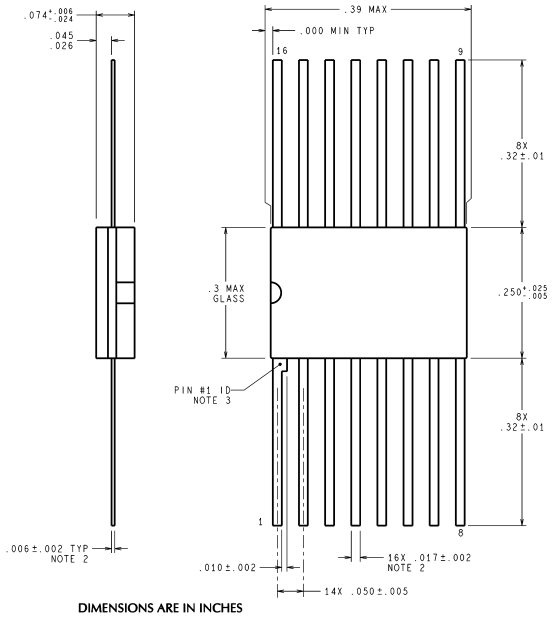
**Note 7:** Generator waveform is specified as follows: $f$ = 1MHz, Duty Cycle = 50%, $Z_O$ = 50Ω, $t_R$ = $t_F$ ≤ 6nS. Driver input = 0V to 3V with measure points equal to 1.5V. Differential output $V_{Diff}$ = $D_O$ - $\overline{D_O}$ with measure point equal to 0V.

**Note 8:** Generator waveform is specified as follows: $f$ = 1MHz, Duty Cycle = 50%, $Z_O$ = 50Ω, $t_R$ = $t_F$ ≤ 6nS. En/$\overline{\text{En}}$ inputs = 0V to 3V with measure points equal to 1.5V on the inputs, to 1.3V on the outputs for $Z_L$ and $Z_H$, and ($V_{OL}$ + 0.3V) for $L_Z$, and ($V_{OH}$.- 0.3V) for $H_Z$.

## Revision History

| Released | Revision | Section | Originator | Changes |
|---|---|---|---|---|
| 03/01/06 | A | New Release, Corporate format | L. Lytle | 1 MDS data sheets converted into one Corp. data sheet format. MNDS26LV31-X Rev 1A0 will be archived. |

## Physical Dimensions inches (millimeters) unless otherwise noted




**Cerpack Package (W)**
**NS Package Number W16A**



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