

DS90LV011AQ

Automotive LVDS Differential Driver

General Description

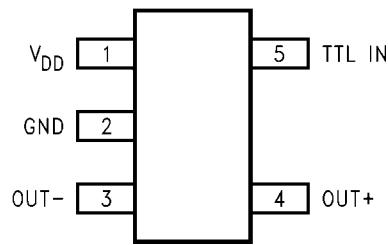
The DS90LV011AQ is an LVDS driver optimized for high data rate and low power applications. The DS90LV011AQ is a current mode driver allowing power dissipation to remain low even at high frequency. In addition, the short circuit fault current is also minimized. The device is designed to support data rates in excess of 400Mbps (200MHz) utilizing Low Voltage Differential Signaling (LVDS) technology.

The device is offered in a 5-lead small outline transistor package. The LVDS outputs have been arranged for easy PCB layout. The differential driver outputs provide low EMI with its typical low output swing of 350 mV. The DS90LV011AQ can be paired with its companion single line receiver, the DS90LT012AQ, or with any of National's LVDS receivers, to provide a high-speed LVDS interface.

Features

- AECQ-100 Grade 3
- Conforms to TIA/EIA-644-A Standard
- >400Mbps (200MHz) switching rates
- 700 ps (100 ps typical) maximum differential skew
- 1.5 ns maximum propagation delay
- Single 3.3V power supply
- ± 350 mV differential signaling
- Power Off Protection (outputs in TRI-STATE)
- Pinout simplifies PCB layout
- Low power dissipation (23 mW @ 3.3V typical)
- SOT-23 5-lead package
- Pin compatible with SN65LVDS1

Connection Diagram

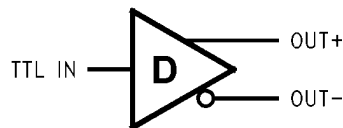


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(Top View)

Order Number DS90LV011AQMF
See NS Package Number MF05A

Functional Diagram



30063802

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

| | |
|---|------------------------------|
| Supply Voltage (V_{DD}) | -0.3V to 4.0V |
| LVC MOS input voltage (TTL IN) | -0.3V to ($V_{DD} + 0.3V$) |
| LVDS output voltage (OUT_{\pm}) | -0.3V to +3.9V |
| LVDS output short circuit current | 24mA |
| Maximum Package Power Dissipation @ +25°C | |
| MF Package | 344 mW |
| Derate MF Package | 7.22 mW/°C above +25°C |
| Thermal resistance (θ_{JA}) | 232.5°C/Watt |
| Thermal resistance (θ_{JC}) | 107.0°C/Watt |
| Storage Temperature | -65°C to +150°C |

| | |
|--|--------------|
| Lead Temperature Range Soldering (4 sec.) | +260°C |
| Maximum Junction Temperature | +105°C |
| ESD Ratings | |
| HBM (1.5 k Ω , 100 pF) | $\geq 8kV$ |
| EIAJ (0 Ω , 200 pF) | $\geq 250V$ |
| CDM (0 Ω , 0 pF) | $\geq 1250V$ |

Recommended Operating Conditions

| | Min | Typ | Max | Units |
|-----------------------------|-----|-----|-----|-------|
| Supply Voltage (V_{DD}) | 3.0 | 3.3 | 3.6 | V |
| Temperature (T_A) | -40 | +25 | +85 | °C |

Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified. (Notes 2, 3, 8)

| Symbol | Parameter | Conditions | Pin | Min | Typ | Max | Units | |
|-----------------|--|--|--------------------------|----------|---------|----------|----------|---------|
| $ V_{OD} $ | Output Differential Voltage | $R_L = 100\Omega$ | OUT+, OUT- | 250 | 350 | 450 | mV | |
| ΔV_{OD} | V_{OD} Magnitude Change | (Figure 1 and Figure 2) | | | | 3 | 35 | mV |
| V_{OS} | Offset Voltage | $R_L = 100\Omega$ | | 1.125 | 1.22 | 1.375 | V | |
| ΔV_{OS} | Offset Magnitude Change | (Figure 1) | | 0 | 1 | 25 | mV | |
| I_{OFF} | Power-off Leakage | $V_{OUT} = 3.6V$ or GND, $V_{DD} = 0V$ | | | | ± 1 | ± 10 | μA |
| I_{OS} | Output Short Circuit Current (Note 4) | V_{OUT+} and $V_{OUT-} = 0V$ | | | -6 | -24 | mA | |
| I_{OSD} | Differential Output Short Circuit Current (Note 4) | $V_{OD} = 0V$ | | | -5 | -12 | mA | |
| C_{OUT} | Output Capacitance | | | | 3 | | pF | |
| V_{IH} | Input High Voltage | | TTL IN | 2.0 | | V_{DD} | V | |
| V_{IL} | Input Low Voltage | | | GND | | | 0.8 | V |
| I_{IH} | Input High Current | $V_{IN} = 3.3V$ or 2.4V | | | ± 2 | ± 10 | μA | |
| I_{IL} | Input Low Current | $V_{IN} = GND$ or 0.5V | | | ± 1 | ± 10 | μA | |
| V_{CL} | Input Clamp Voltage | $I_{CL} = -18$ mA | | -1.5 | -0.6 | | V | |
| C_{IN} | Input Capacitance | | | | 3 | | pF | |
| I_{DD} | Power Supply Current | No Load | $V_{IN} = V_{DD}$ or GND | V_{DD} | | 5 | 8 | mA |
| | | $R_L = 100\Omega$ | | | | 7 | 10 | mA |

Switching Characteristics

Over Supply Voltage and Operating Temperature Ranges, unless otherwise specified. (Notes 3, 5, 6, 7)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|------------|--|--|-----|-----|-----|-------|
| t_{PHLD} | Differential Propagation Delay High to Low | $R_L = 100\Omega$, $C_L = 15$ pF (Figure 3 and Figure 4) | 0.3 | 1.0 | 1.5 | ns |
| t_{PLHD} | Differential Propagation Delay Low to High | | 0.3 | 1.1 | 1.5 | ns |
| t_{SKD1} | Differential Pulse Skew $ t_{PHLD} - t_{PLHD} $ (Note 9) | | 0 | 0.1 | 0.7 | ns |
| t_{SKD3} | Differential Part to Part Skew (Note 10) | | 0 | 0.2 | 1.0 | ns |
| t_{SKD4} | Differential Part to Part Skew (Note 11) | | 0 | 0.4 | 1.2 | ns |
| t_{TLH} | Transition Low to High Time | | 0.2 | 0.5 | 1.0 | ns |
| t_{THL} | Transition High to Low Time | | 0.2 | 0.5 | 1.0 | ns |
| f_{MAX} | Maximum Operating Frequency (Note 12) | | | 250 | | MHz |

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 table of "Electrical Characteristics" specifies conditions of device operation.

Note 2: Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground except V_{OD} .

Note 3: All typicals are given for: $V_{DD} = +3.3V$ and $T_A = +25^\circ C$.

Note 4: Output short circuit current (I_{OS}) is specified as magnitude only, minus sign indicates direction only.

Note 5: These parameters are guaranteed by design. The limits are based on statistical analysis of the device performance over PVT (process, voltage, temperature) ranges.

Note 6: C_L includes probe and fixture capacitance.

Note 7: Generator waveform for all tests unless otherwise specified: $f = 1\text{ MHz}$, $Z_O = 50\Omega$, $t_r \leq 1\text{ ns}$, $t_f \leq 1\text{ ns}$ (10%-90%).

Note 8: The DS90LV011AQ is a current mode device and only function with datasheet specification when a resistive load is applied to the drivers outputs.

Note 9: t_{SKD1} , $|t_{PHLD} - t_{PLHD}|$, is the magnitude difference in differential propagation delay time between the positive going edge and the negative going edge of the same channel.

Note 10: t_{SKD3} , Differential Part to Part Skew, is defined as the difference between the minimum and maximum specified differential propagation delays. This specification applies to devices at the same V_{DD} and within $5^\circ C$ of each other within the operating temperature range.

Note 11: t_{SKD4} , part to part skew, is the differential channel to channel skew of any event between devices. This specification applies to devices over recommended operating temperature and voltage ranges, and across process distribution. t_{SKD4} is defined as $I_{Max} - I_{Min}$ differential propagation delay.

Note 12: f_{MAX} generator input conditions: $t_r = t_f < 1\text{ ns}$ (0% to 100%), 50% duty cycle, 0V to 3V. Output criteria: duty cycle = 45%/55%, $V_{OD} > 250mV$.

Parameter Measurement Information

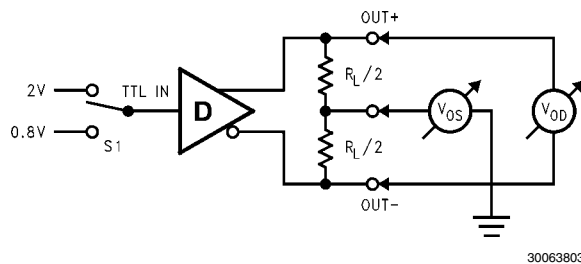


FIGURE 1. Differential Driver DC Test Circuit

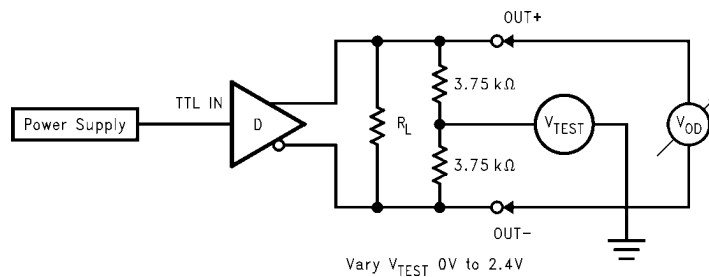


FIGURE 2. Differential Driver Full Load DC Test Circuit

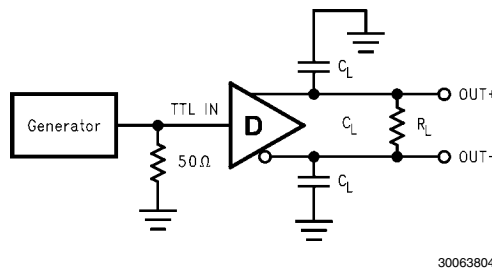


FIGURE 3. Differential Driver Propagation Delay and Transition Time Test Circuit

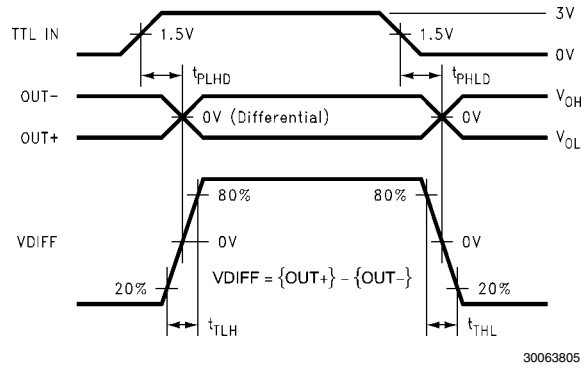


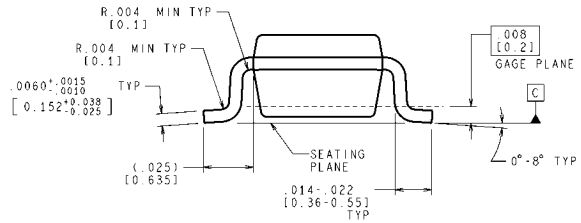
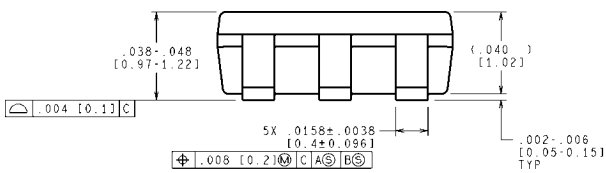
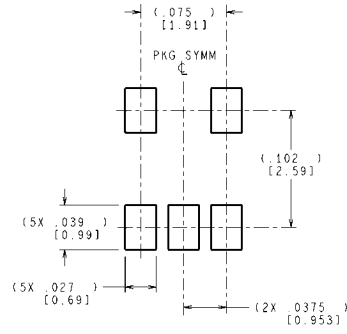
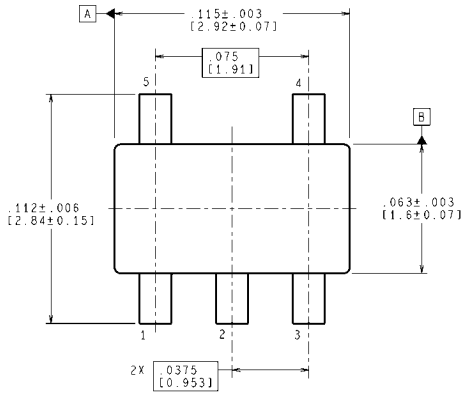
FIGURE 4. Differential Driver Propagation Delay and Transition Time Waveforms

Application Information

TABLE 1. Device Pin Descriptions

| Package Pin Number | Pin Name | Description |
|--------------------|-----------------|---------------------------------|
| SOT23 | | |
| 5 | TTL IN | LVTTTL/LVCMOS driver input pins |
| 4 | OUT+ | Non-inverting driver output pin |
| 3 | OUT- | Inverting driver output pin |
| 2 | GND | Ground pin |
| 1 | V _{DD} | Power supply pin, +3.3V ± 0.3V |

Physical Dimensions inches (millimeters) unless otherwise noted



CONTROLLING DIMENSION IS INCH
 VALUES IN [] ARE MILLIMETERS
 DIMENSIONS IN () FOR REFERENCE ONLY

MF05A (Rev C)

5-Lead SOT23, JEDEC MO-178, 1.6mm
Order Number DS90LV011AQMF
NS Package Number MF05A

Notes

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