National Semiconductor

March 2000

DS90LV017A
LVDS Single High Speed Differential Driver

General Description

The DS90LV017A is a single LVDS driver device optimized for high data rate and low power applications. The DS90LV017A 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 600Mbps (300MHz) utilizing Low Voltage Differential Signaling (LVDS) technology.

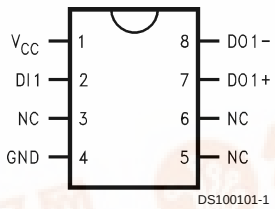
The device is in a 8-lead small outline package. The DS90LV017A has a flow-through design for easy PCB layout. The differential driver outputs provides low EMI with its typical low output swing of 355 mV. The DS90LV017A can be paired with its companion single line receiver, the DS90LV018A, or with any of National's LVDS receivers, to provide a high-speed point-to-point LVDS interface.

Features

- >600 Mbps (300 MHz) switching rates
- 0.3 ns typical differential skew
- 0.7 ns maximum differential skew
- 1.5 ns maximum propagation delay
- 3.3V power supply design
- ±355 mV differential signaling
- Low power dissipation (23 mW @ 3.3V static)
- Flow-through design simplifies PCB layout
- Interoperable with existing 5V LVDS devices
- Power Off Protection (outputs in high impedance)
- Conforms to TIA/EIA-644 Standard
- 8-Lead SOIC package saves space
- Industrial temperature operating range (−40˚C to +85˚C)

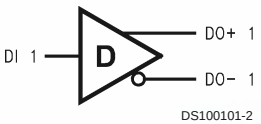
Connection Diagram

Dual-In-Line



Order Number DS90LV017ATM
See NS Package Number M08A

Functional Diagram



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_{CC})	−0.3V to +4V
Input Voltage (DI)	−0.3V to +3.6V
Output Voltage (DO±)	−0.3V to +3.9V
Maximum Package Power Dissipation @ +25˚C	
M Package	1190 mW
Derate M Package	9.5 mW/˚C above +25˚C
Storage Temperature Range	−65˚C to +150˚C
Lead Temperature Range Soldering (4 sec.)	+260˚C

ESD Ratings

(HBM 1.5 kΩ, 100 pF)	≥ 8kV
(EIAJ 0 Ω, 200 pF)	≥ 1000V
(CDM)	≥ 1000V
(IEC direct 330 Ω, 150 pF)	≥ 4kV

Recommended Operating Conditions

	Min	Typ	Max	Units
Supply Voltage (V_{CC})	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, 7)

Symbol	Parameter	Conditions		Pin	Min	Typ	Max	Units
DIFFERENTIAL DRIVER CHARACTERISTICS								
V_{OD}	Output Differential Voltage	R_L = 100Ω (*Figure 1*)		DO+, DO−	250	355	450	mV
ΔV_{OD}	V_{OD} Magnitude Change					1	35	mV
V_{OH}	Output High Voltage					1.4	1.6	V
V_{OL}	Output Low Voltage				0.9	1.1		V
V_{OS}	Offset Voltage				1.125	1.2	1.375	V
ΔV_{OS}	Offset Magnitude Change				0	3	25	mV
I_{OXD}	Power-off Leakage	V_{OUT} = V_{CC} or GND, V_{CC} = 0V				±1	±10	µA
I_{OSD}	Output Short Circuit Current					−5.7	−8	mA
V_{IH}	Input High Voltage			DI	2.0		V_{CC}	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
I_{CC}	Power Supply Current	No Load	V_{IN} = V_{CC} or GND	V_{CC}		5	8	mA
		R_L = 100Ω				7	10	mA

Switching Characteristics

Over Supply Voltage and Operating Temperature Ranges, unless otherwise specified. (Notes 3, 4, 5, 6)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DIFFERENTIAL DRIVER CHARACTERISTICS						
t_{PHLD}	Differential Propagation Delay High to Low	R_L = 100Ω, C_L = 15 pF (*Figure 2* and *Figure 3*)	0.3	0.8	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 8)		0	0.3	0.7	ns
t_{SKD3}	Differential Part to Part Skew (Note 9)		0		1.0	ns
t_{SKD4}	Differential Part to Part Skew (Note 10)		0		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 11)			350		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_{CC} = +3.3V and T_A = +25˚C.

Note 4: These parameters are guaranteed by design. The limits are based on statistical analysis of the device performance over PVT (process, voltage, temperature) ranges.

Note 5: C_L includes probe and fixture capacitance.

Note 6: Generator waveform for all tests unless otherwise specified: f = 1 MHz, Z_O = 50Ω, $t_r \le 1$ ns, $t_f \le 1$ ns (10%-90%).

Switching Characteristics (Continued)

Note 7: The DS90LV017A is a current mode device and only function with datasheet specification when a resistive load is applied to the drivers outputs.

Note 8: 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 9: 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_{CC} and within 5˚C of each other within the operating temperature range.

Note 10: 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 |Max − Min| differential propagation delay.

Note 11: f_{MAX} generator input conditions: $t_r = t_f < 1$ ns (0% to 100%), 50% duty cycle, 0V to 3V. Output criteria: duty cycle = 45%/55%, $V_{OD} > 250$mV.

Parameter Measurement Information

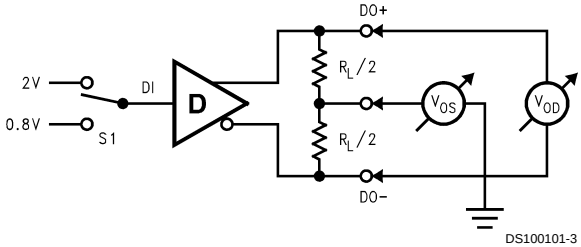


FIGURE 1. Differential Driver DC Test Circuit

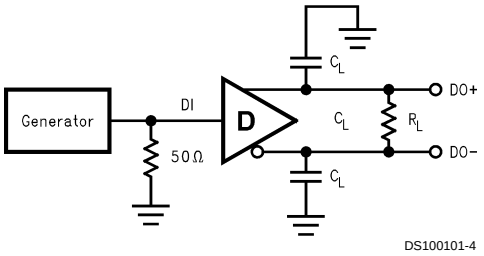


FIGURE 2. Differential Driver Propagation Delay and Transition Time Test Circuit

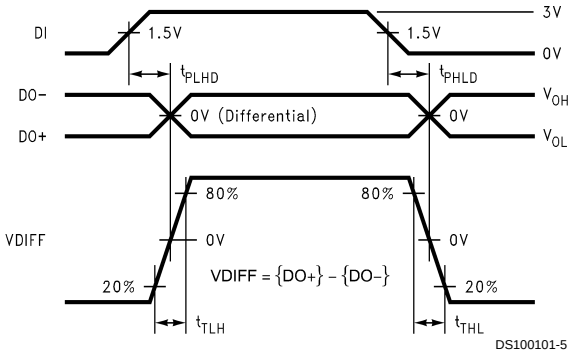


FIGURE 3. Differential Driver Propagation Delay and Transition Time Waveforms

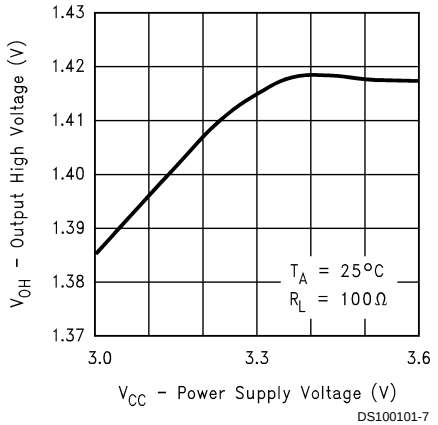
Application Information

TABLE 1. Device Pin Descriptions

Pin #	Name	Description
2	DI1	TTL/CMOS driver input pins
7	DO1+	Non-inverting driver output pin
8	DO1−	Inverting driver output pin
4	GND	Ground pin
1	V_{CC}	Positive power supply pin, +3.3V ± 0.3V
3, 5, 6	NC	No connect

Typical Performance Curves

Output High Voltage vs Power Supply Voltage



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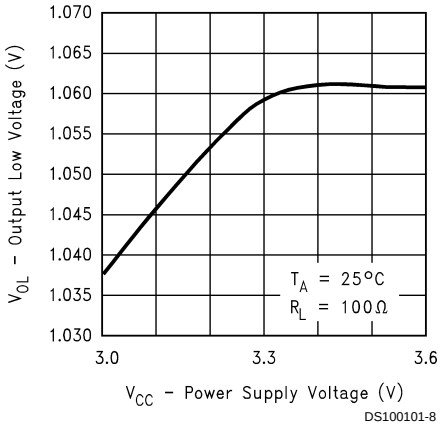
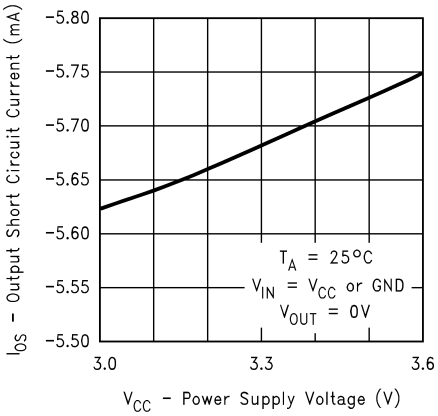
Output Low Voltage vs Power Supply Voltage



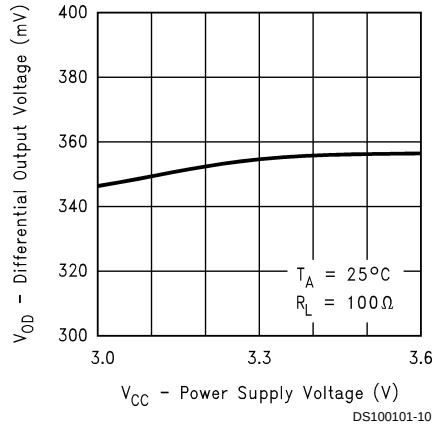
DS100101-8

Output Short Circuit Current vs Power Supply Voltage



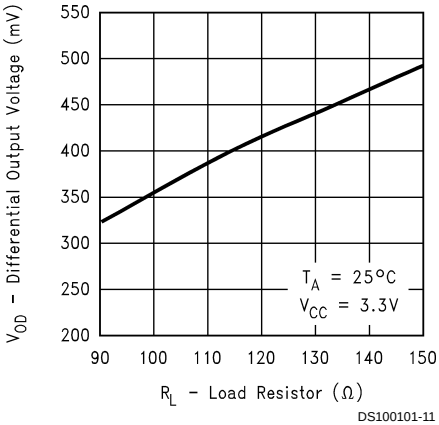
DS100101-9

Differential Output Voltage vs Power Supply Voltage



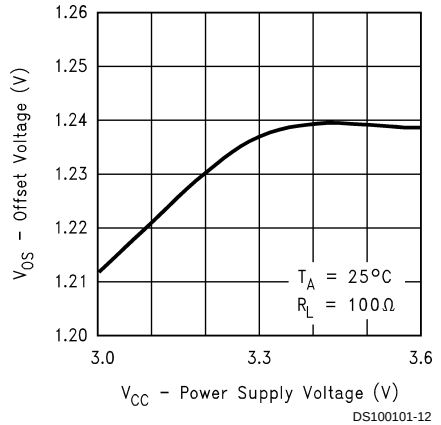
DS100101-10

Differential Output Voltage vs Load Resistor



DS100101-11

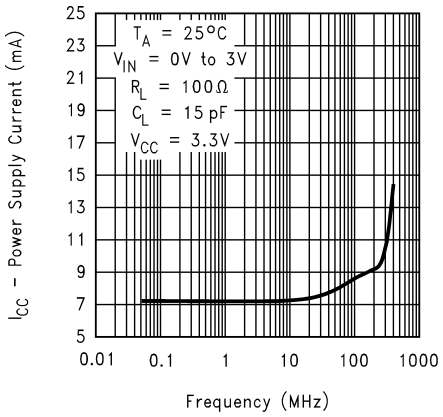
Offset Voltage vs Power Supply Voltage



DS100101-12

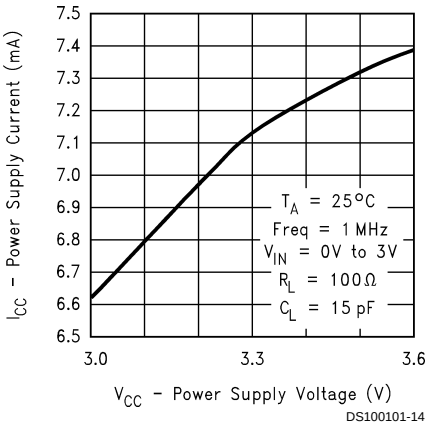
Typical Performance Curves (Continued)

Power Supply Current vs Frequency



DS100101-13

Power Supply Current vs Power Supply Voltage



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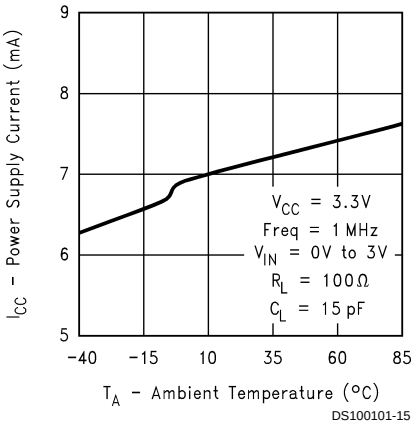
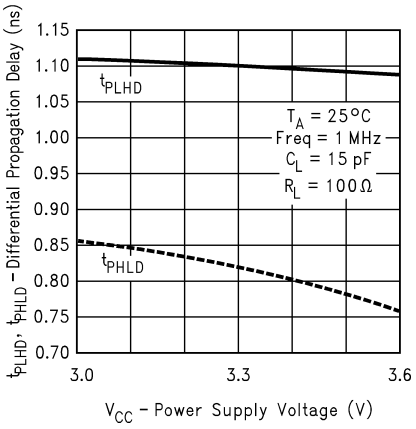
Power Supply Current vs Ambient Temperature



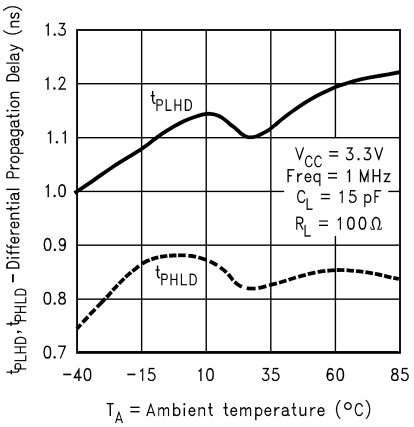
DS100101-15

Differential Propagation Delay vs Power Supply Voltage



DS100101-16

Differential Propagation Delay vs Ambient Temperature



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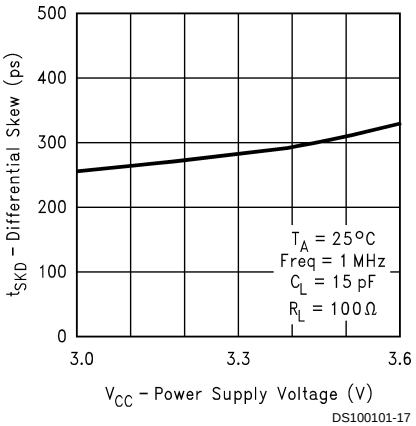
Differential Skew vs Power Supply Voltage



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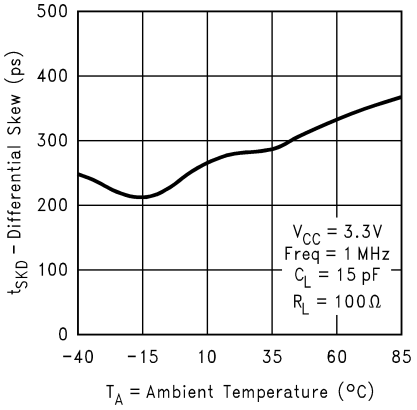
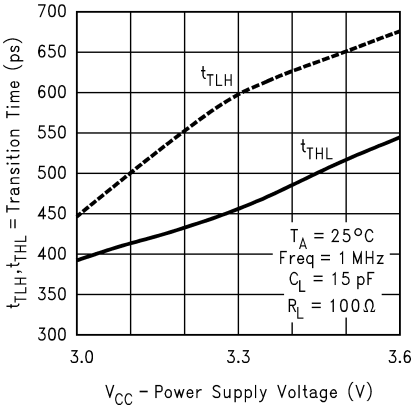
Typical Performance Curves (Continued)

Differential Skew vs Ambient Temperature



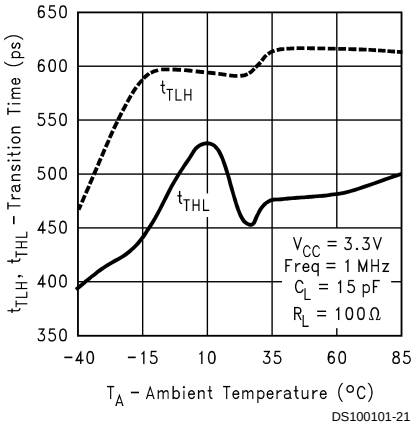
DS100101-20

Transition Time vs Power Supply Voltage



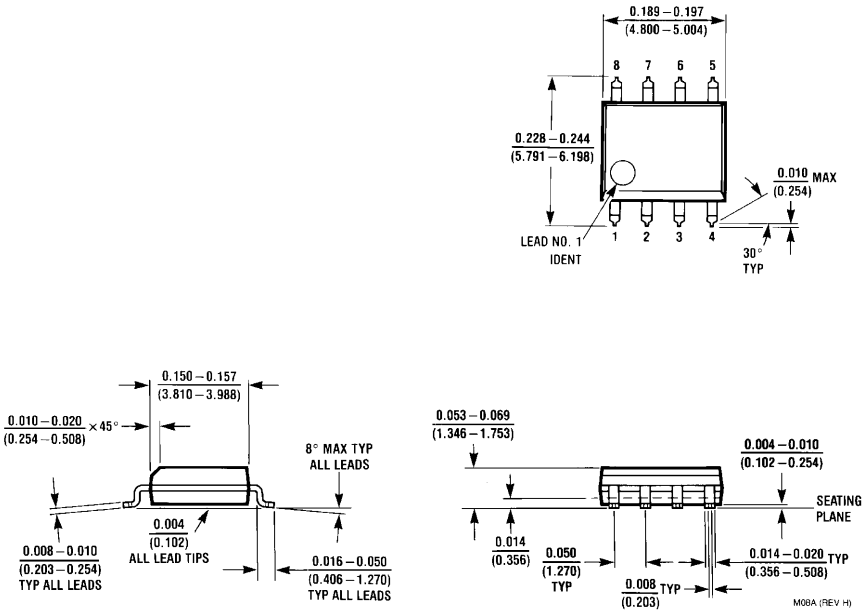
DS100101-18

Transition Time vs Ambient Temperature



DS100101-21

Physical Dimensions inches (millimeters) unless otherwise noted



Order Number DS90LV017ATM
NS Package Number M08A

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