

DS34LV86T 3V Enhanced CMOS Quad Differential Line Receiver

General Description

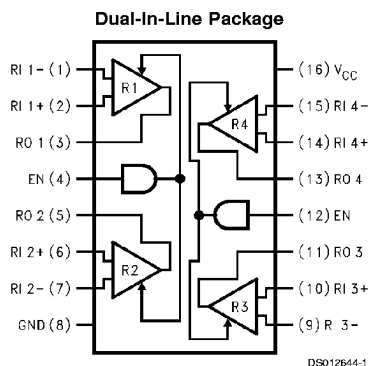
The DS34LV86T is a high speed quad differential CMOS receiver that meets the requirements of both TIA/EIA-422-B and ITU-T V.11. The CMOS DS34LV86T features typical low static I_{CC} of 9 mA which makes it ideal for battery powered and power conscious applications. The TRI-STATE® enables, EN, allow the device to be disabled when not in use to minimize power consumption. The dual enable scheme allows for flexibility in turning receivers on and off.

The receiver output (RO) is guaranteed to be High when the inputs are left open. The receiver can detect signals as low as ± 200 mV over the common mode range of ± 10 V. The receiver outputs (RO) are compatible with TTL and LVCMOS levels.

Features

- Low power CMOS design (30 mW typical)
- Interoperable with existing 5V RS-422 networks
- Industrial temperature range
- Meets TIA/EIA-422-B (RS-422) and ITU-T V.11 recommendation
- 3.3V Operation
- ± 7 V common mode range $V_{ID} = 3$ V
- ± 10 V common mode range $V_{ID} = 0.2$ V
- Receiver OPEN input failsafe feature
- Guaranteed AC parameter:
Maximum Receiver Skew: 4 ns
Transition time: 10 ns
- Pin compatible with DS34C86T
- 32 MHz Toggle Frequency
- 6.5k ESD Tolerance (HBM)
- Available in SOIC packaging

Connection Diagram



Top View

Order Number DS34LV86TN, DS34LV86TM
See NS Package Number M16A or N16E

Truth Table

Enable EN	Inputs RI+—RI—	Output RO
L	X	Z
H	$V_{ID} \geq +0.2$ V	H
H	$V_{ID} \leq -0.2$ V	L
H	Open†	H

L = Logic Low
H = Logic High
X = Irrelevant
Z = TRI-STATE
† = Open, Not Terminated

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

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})	+7V
Enable Input Voltage (EN)	+7V
Receiver Input Voltage (V_{ID} : RI+, RI-)	$\pm 14V$
Receiver Input Voltage (V_{CM} : RI+, RI-)	$\pm 14V$
Receiver Output Voltage (RO)	-0.5V to $V_{CC} + 0.5V$
Receiver Output Current (RO)	$\pm 25\text{ mA}$
Maximum Package Power Dissipation +25°C	
M Package	1190 mW
N Package	1645 mW
Derate M Package	9.8 mW/°C above +25°C

Derate N Package	13.9 mW/°C above +25°C
Storage Temperature Range	65°C to +150°C
Lead Temperature Range	
Soldering (4 Seconds)	+260°C
ESD Ratings (HBM, 1.5k, 100 pF)	
Receiver Inputs and Enables	$\geq 6.5\text{ kV}$
Other Pins	$\geq 2\text{ kV}$

Recommended Operating Conditions

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

Electrical Characteristics (Note 2) (Note 3)

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified.

Symbol	Parameter	Conditions	Pin	Min	Typ	Max	Units
V_{TH}	Differential Input Threshold	$V_{OUT} = V_{OH}$ or V_{OL} $-7V < V_{CM} < +7V$	RI+, RI-	-200	± 17.5	+200	mV
V_{HY}	Hysteresis	$V_{CM} = 1.5V$			35		mV
V_{IH}	Minimum High Level Input Voltage		EN	2.0			V
V_{IL}	Minimum Low Level Input Voltage					0.8	V
R_{IN}	Input Resistance	$V_{IN} = -7V, +7V$ (Other Input = GND)		5.0	8.5		k Ω
I_{IN}	Input Current (Other Input = 0V, Power On or $V_{CC} = 0V$)	$V_{IN} = +10V$	RI+, RI-	0	1.1	1.8	mA
		$V_{IN} = +3V$		0	0.27		mA
		$V_{IN} = 0.5V$			-0.02		mA
		$V_{IN} = -3V$		0	-0.43		mA
		$V_{IN} = -10V$		0	-1.26	-2.2	mA
I_{EN}		$V_{IN} = 0V$ to V_{CC}	EN			± 1	μA
V_{OH}	High Level Output Voltage	$I_{OH} = -6\text{ mA}$, $V_{ID} = +1V$ $I_{OH} = -6\text{ mA}$, $V_{ID} = \text{OPEN}$	RO	2.4	3		V
V_{OH}	High Level Output Voltage	$I_{OH} = -100\text{ }\mu A$, $V_{ID} = +1V$ $I_{OH} = -100\text{ }\mu A$, $V_{ID} = \text{OPEN}$			$V_{CC} - 0.1$		V
V_{OL}	Low Level Output Voltage	$I_{OL} = +6\text{ mA}$, $V_{ID} = -1V$			0.13	0.5	V
I_{OZ}	Output TRI-STATE Leakage Current	$V_{IN} = V_{CC}$ or GND $EN = V_{IL}$				± 50	μA
I_{SC}	Output Short Circuit Current	$V_O = 0V$, $V_{ID} \geq 200\text{ mV} $ (Note 4)		-10	-35	-70	mA
I_{CC}	Power Supply Current	No Load, All RI+, RI- = Open, $EN = V_{CC}$ or GND	V_{CC}		9	15	mA

Switching Characteristics (Note 3) (Note 9) (Note 10)

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay High to Low	$C_L = 15 \text{ pF}$ (Figures 1, 2)	6	17.5	35	ns
t_{PLH}	Propagation Delay Low to High		6	17.8	35	ns
t_r	Rise Time (20% to 80%)			4.1	10	ns
t_f	Fall Time (80% to 20%)			3.3	10	ns
t_{PHZ}	Disable Time	$C_L = 50 \text{ pF}$ (Figures 3, 4)			40	ns
t_{PLZ}	Disable Time				40	ns
t_{PZH}	Enable Time				40	ns
t_{PZL}	Enable Time				40	ns
t_{SK1}	Skew, $ t_{PHL} - t_{PLH} $ (Note 5)	$C_L = 15 \text{ pF}$		0.3	4	ns
t_{SK2}	Skew, Pin to Pin (Note 6)			0.6	4	ns
t_{SK3}	Skew, Part to Part (Note 7)			7	17	ns
f_{MAX}	Maximum Operating Frequency (Note 8)	$C_L = 15 \text{ pF}$	32			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_{DD} .

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

Note 4: Short one output at a time to ground. Do not exceed package power dissipation ratings.

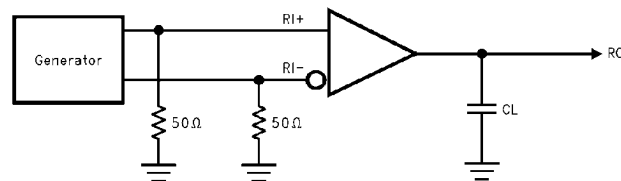
Note 5: t_{SK1} is the $|t_{PHL} - t_{PLH}|$ of a channel.

Note 6: t_{SK2} is the maximum skew between any two channels within a device, on either edge.

Note 7: t_{SK3} is the difference in propagation delay times between any channels of any devices. This specification (maximum limit) applies to devices within $V_{CC} \pm 0.1V$ of one another, and a $\Delta T_A = \pm 5^\circ C$ (between devices) within the operating temperature range. This parameter is guaranteed by design and characterization.

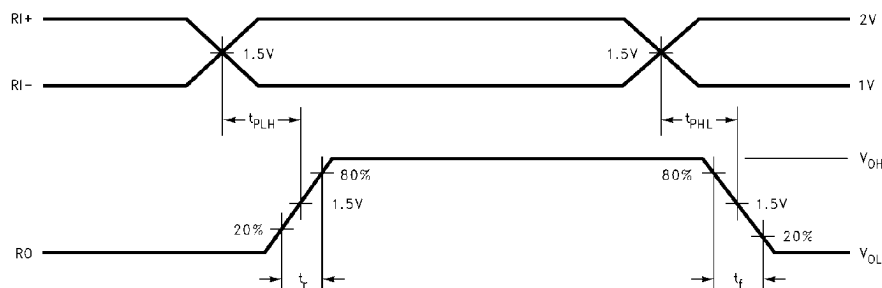
Note 8: All channels switching, output duty cycle criteria is 40%/60% measured at 50% Input = 1V to 2V, 50% Duty Cycle, $t_r/t_f \leq 5 \text{ ns}$. This parameter is guaranteed by design and characterization.

Parameter Measurement Information



DS012644-2

FIGURE 1. Receiver Propagation Delay and Transition Time Test Circuit (Note 9) (Note 10)



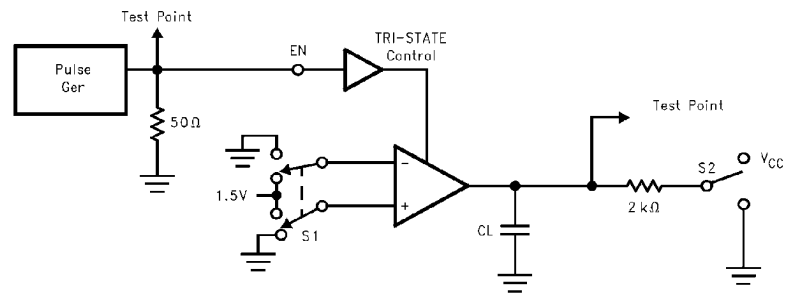
DS012644-3

FIGURE 2. Receiver Propagation Delay and Transition Time Waveform (Note 9) (Note 10)

Note 9: Generator waveform for all tests unless otherwise specified: $f = 1 \text{ MHz}$, Duty Cycle = 50%, $Z_O = 50\Omega$, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

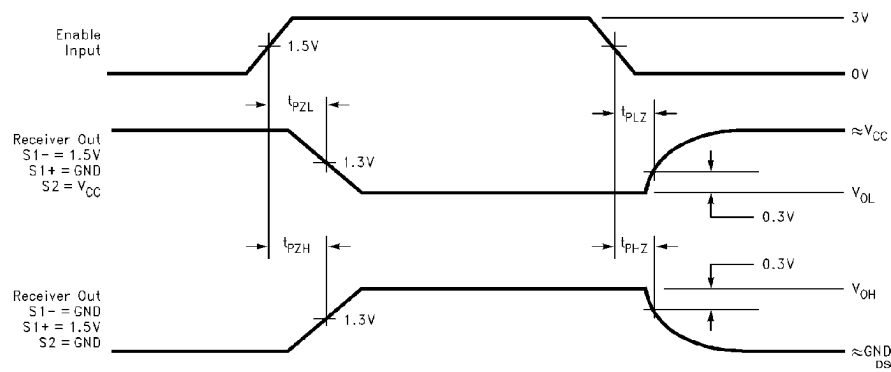
Note 10: C_L includes probe and jig capacitance.

Parameter Measurement Information (Continued)



DS012644-4

FIGURE 3. Receiver TRI-STATE Test Circuit



DS012644-5

FIGURE 4. Receiver TRI-STATE Output Enable and Disable Waveforms (Note 9) (Note 10)

Typical Application Information

General application guidelines and hints for differential drivers receivers may be found in the following application notes:

AN-214, AN-457, AN-805, AN-847, AN-903, AN-912, AN-916

Power Decoupling Recommendations: Bypass caps must be used on power pins. High frequency ceramic (surface mount is recommended) 0.1 μ F in parallel with 0.01 μ F at the power supply pin. A 10 μ F or greater solid tantalum or electrolytic should be connected at the power entry point on the printed circuit board.

Typical Application Information (Continued)

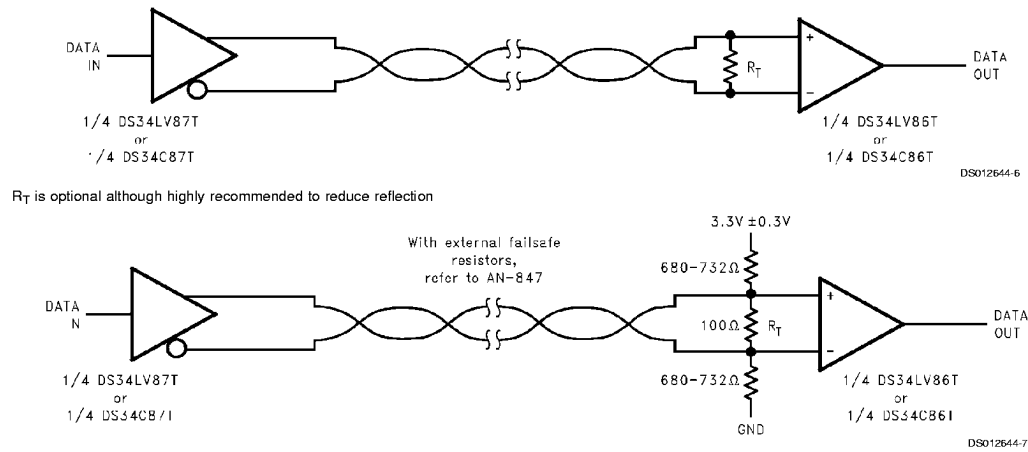


FIGURE 5. Typical Receiver Connections

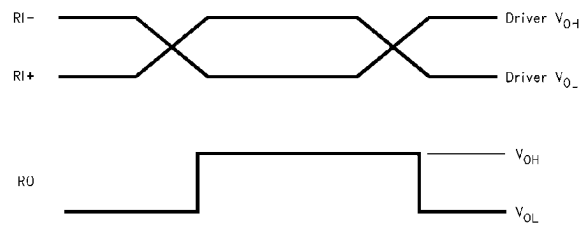


FIGURE 6. Typical Receiver Output Waveforms

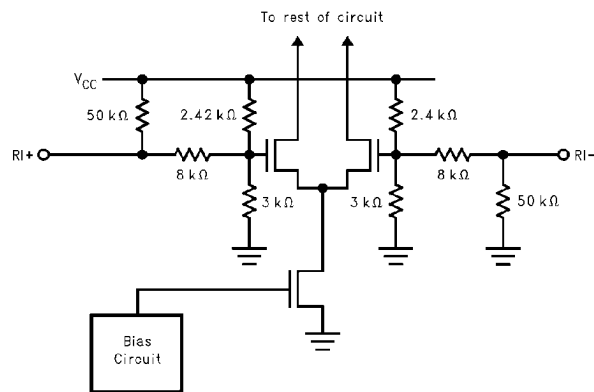


FIGURE 7. Typical Receiver Input Circuit

Typical Application Information (Continued)

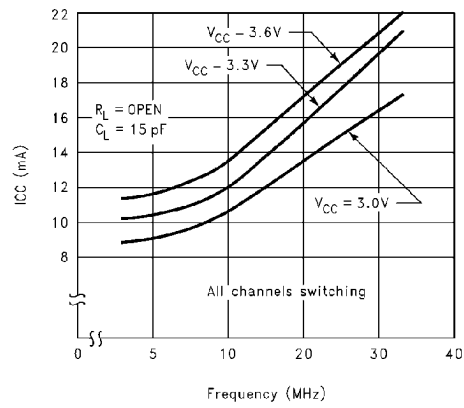


FIGURE 8. Typical I_{CC} vs Frequency

DS012644-10

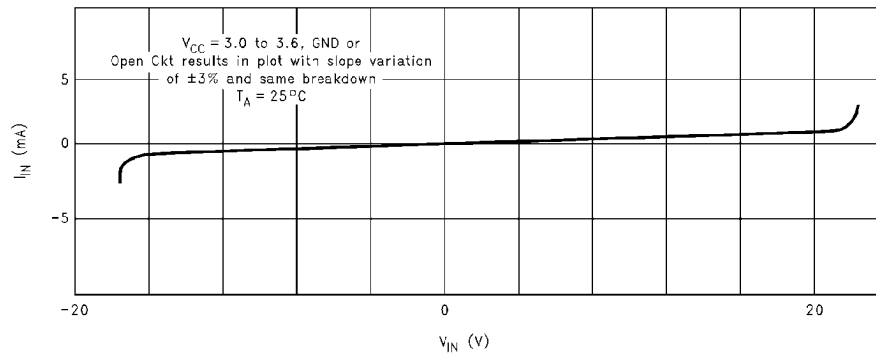


FIGURE 9. I_{IN} vs V_{IN} (Power On, Power Off)

DS012644-11

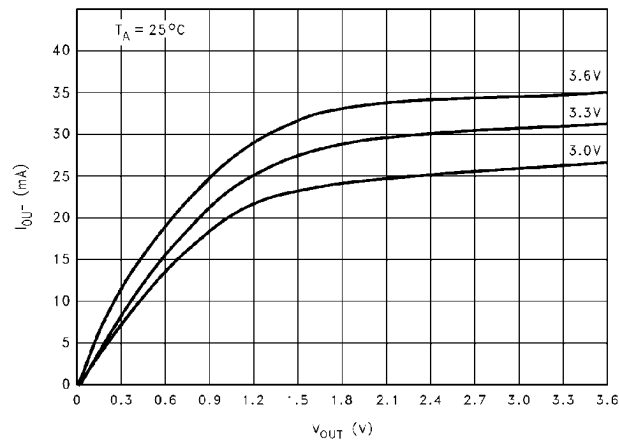


FIGURE 10. I_{OL} vs V_{OL}

DS012644-12

Typical Application Information (Continued)

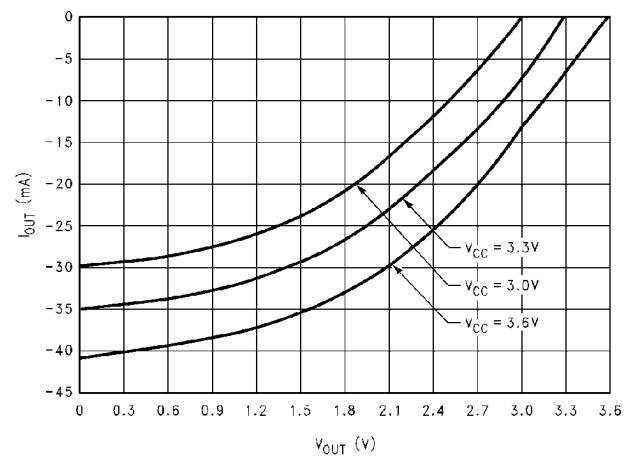
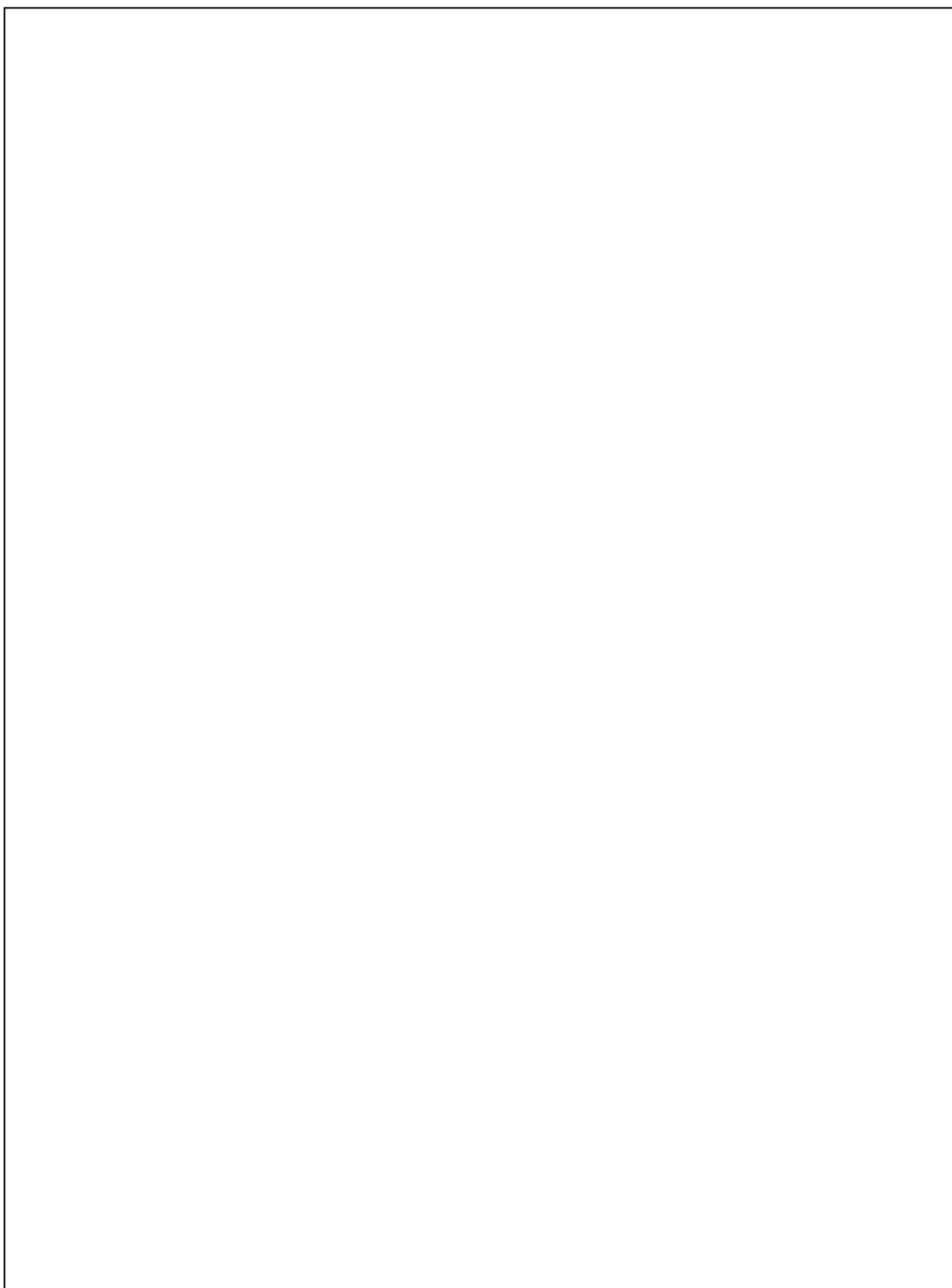
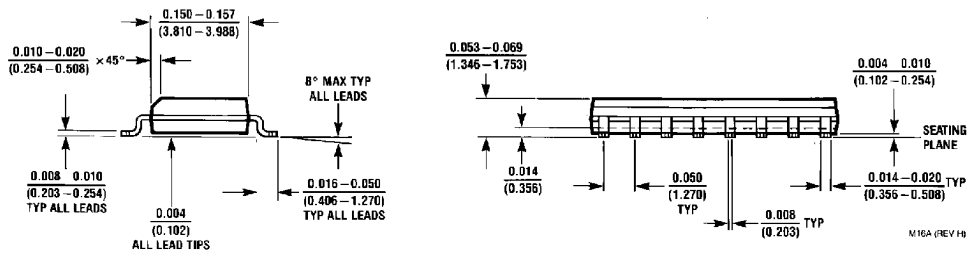
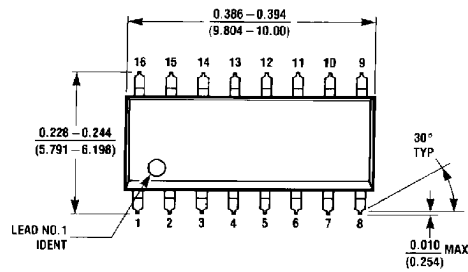


FIGURE 11. I_{OH} vs V_{OH}

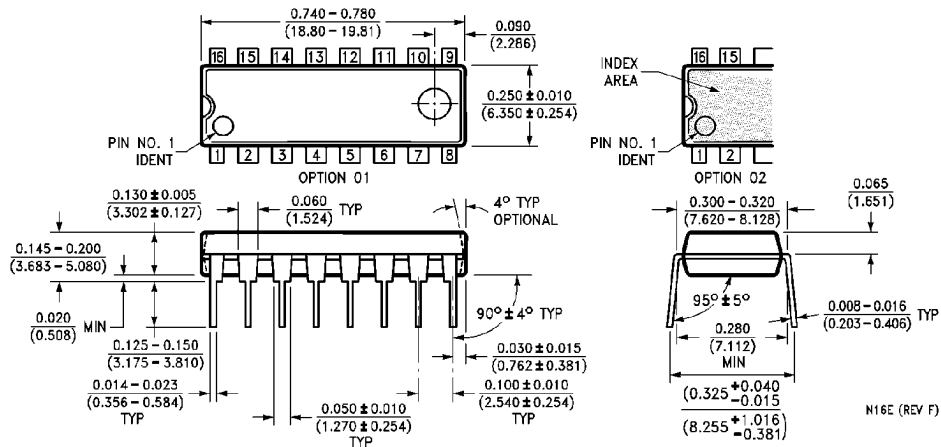
DS012644-13



Physical Dimensions inches (millimeters)



Dual-In-Line Package
Order Number DS34LV86TM
NS Package Number M16A



Dual-In-Line Package
Order Number DS34LV86TN
See NS Package Number N16E