

DS34LV86T

3V Enhanced CMOS Quad Differential Line Receiver

General Description

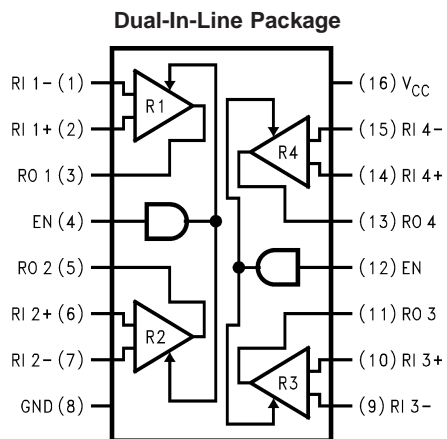
The DS34LV86T is a high speed quad differential CMOS receiver that meets the requirements of both TIA/EIA-422-B and ITU-T V.11. The CMOS DS34LV86T features typical low static I_{CC} of 9 mA which makes it ideal for battery powered and power conscious applications. The TRI-STATE® enables, EN, allow the 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



01264401

Top View
Order Number DS34LV86TM
See NS Package Number M16A

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

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)	± 25 mA
Maximum Package Power Dissipation @ +25°C	
M Package	1190 mW
Derate M Package	9.8 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

 ≥ 6.5 kV

Other Pins

 ≥ 2 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 (Notes 2, 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)	RI+, RI-	5.0	8.5		k Ω	
I_{IN}	Input Current (Other Input = 0V, Power On or $V_{CC} = 0V$)	$V_{IN} = +10V$		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	$I_{OH} = -6$ mA, $V_{ID} = +1V$ $I_{OH} = -6$ mA, $V_{ID} = OPEN$	RO	2.4	3		V	
V_{OH}	High Level Output Voltage	$I_{OH} = -100$ μA , $V_{ID} = +1V$ $I_{OH} = -100$ μA , $V_{ID} = OPEN$			$V_{CC} - 0.1$		V	
V_{OL}	Low Level Output Voltage	$I_{OL} = +6$ 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	$V_O = 0V$, $V_{ID} \geq 200$ 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 (Notes 3, 9, 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_{ID} .

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.

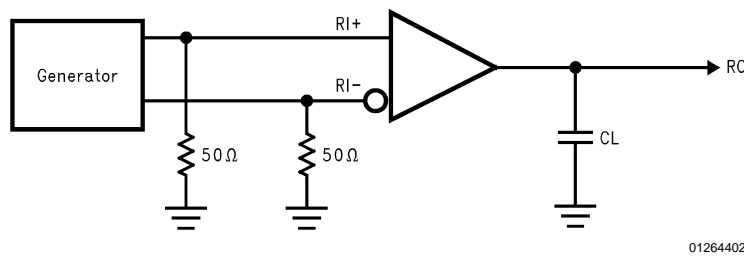
Note 5: t_{SK1} is the $|t_{PHL} - t_{PLH}|$ of a channel.

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.

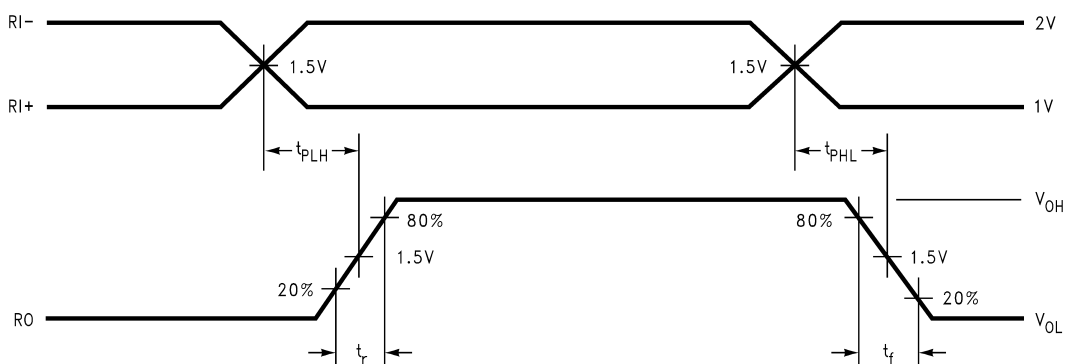
Note 8: All channels switching, output duty cycle criteria is 40%/60% measured at 50% Input = 1V to 2V, 50% Duty Cycle, $t_r/t_f \leq 5\text{ ns}$. This parameter is guaranteed by design and characterization.

Parameter Measurement Information



01264402

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



01264403

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

Parameter Measurement Information (Continued)

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.

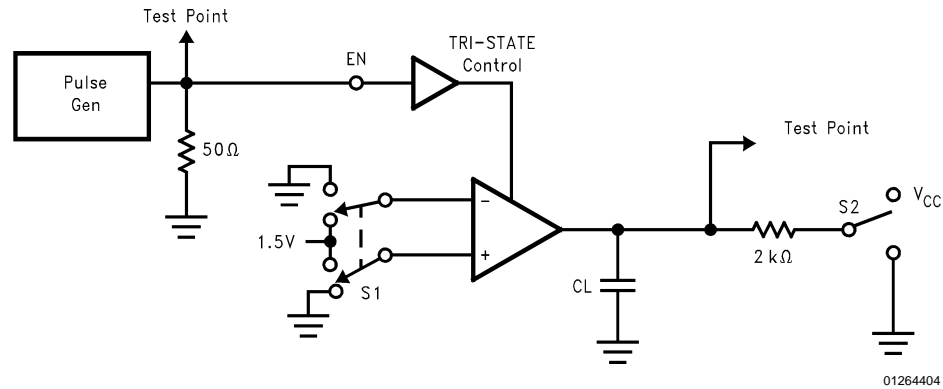


FIGURE 3. Receiver TRI-STATE Test Circuit

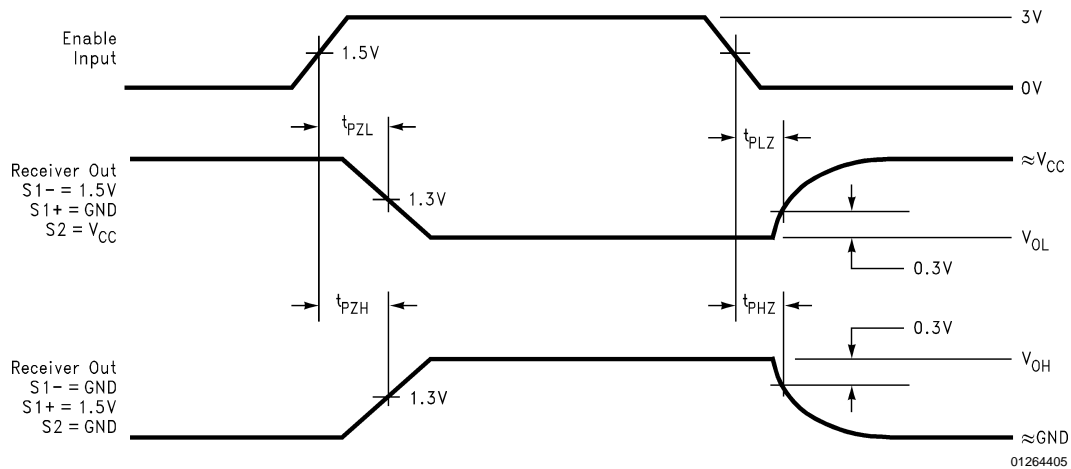


FIGURE 4. Receiver TRI-STATE Output Enable and Disable Waveforms (Notes 9, 10)

Typical Application Information

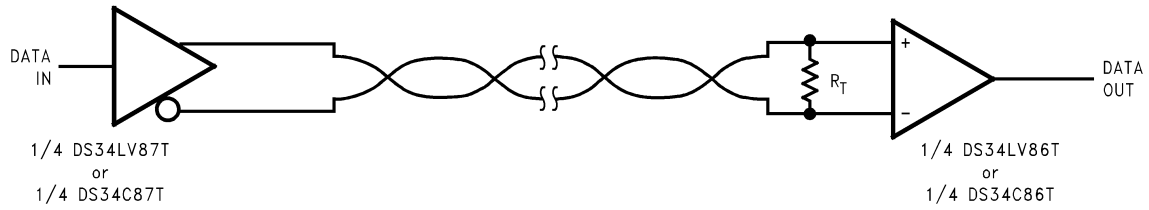
General application guidelines and hints for differential drivers receivers may be found in the following application notes:

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

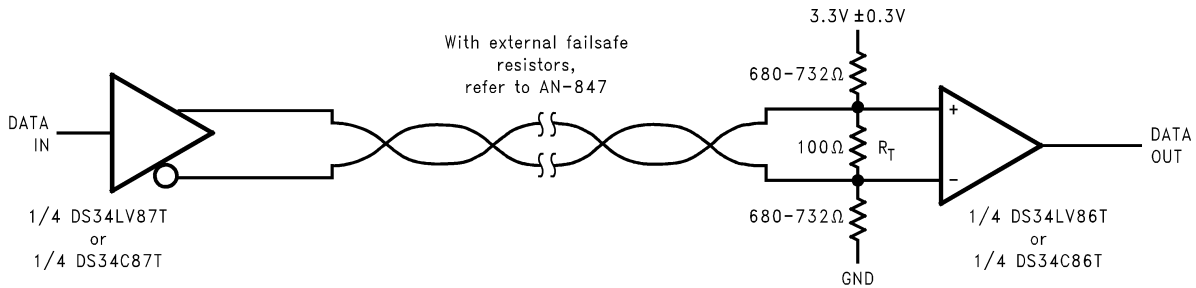
is recommended) $0.1 \mu\text{F}$ in parallel with $0.01 \mu\text{F}$ at the power supply pin. A $10 \mu\text{F}$ or greater solid tantalum or electrolytic should be connected at the power entry point on the printed circuit board.

Typical Application Information (Continued)



R_T is optional although highly recommended to reduce reflection

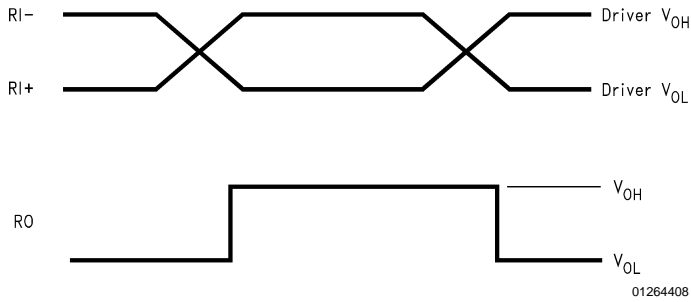
01264406



With external failsafe resistors, refer to AN-847

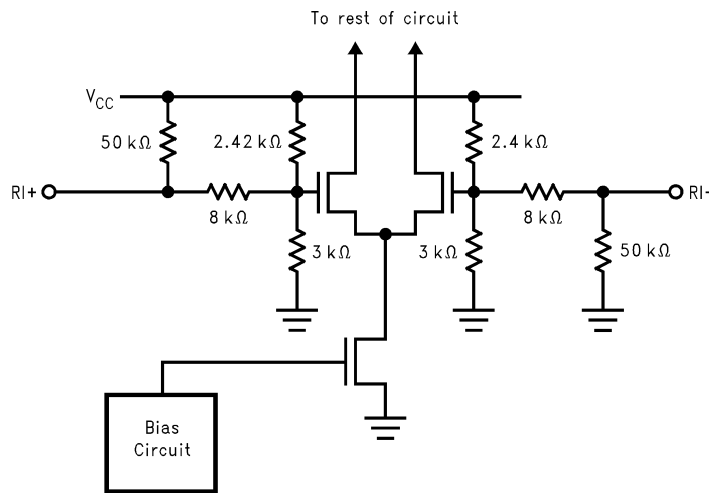
01264407

FIGURE 5. Typical Receiver Connections



01264408

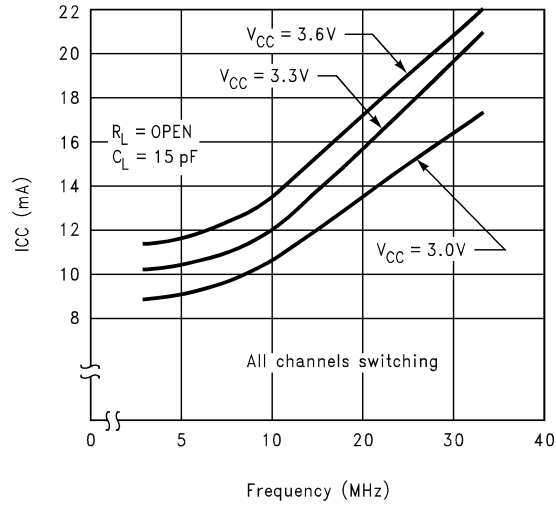
FIGURE 6. Typical Receiver Output Waveforms



01264409

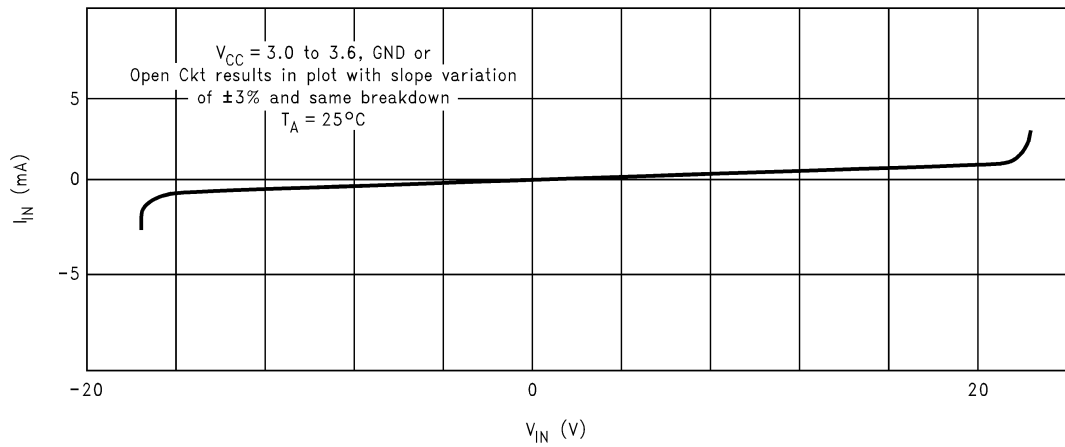
FIGURE 7. Typical Receiver Input Circuit

Typical Application Information (Continued)



01264410

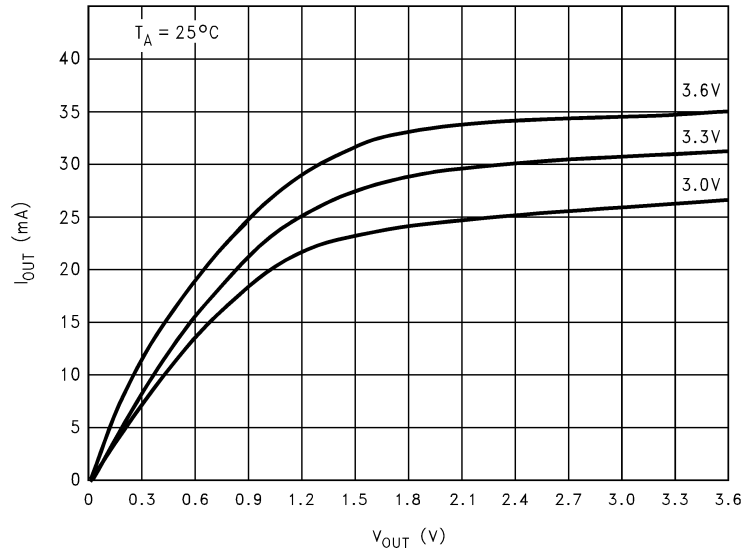
FIGURE 8. Typical I_{CC} vs Frequency



01264411

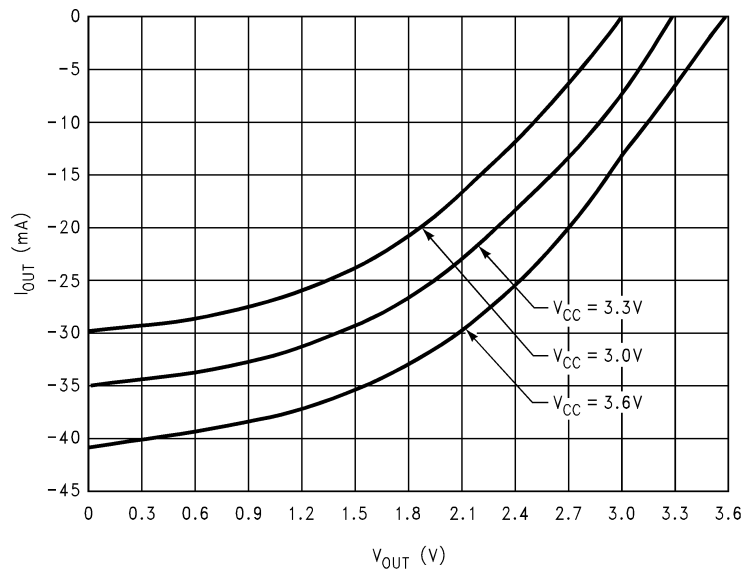
FIGURE 9. I_{IN} vs V_{IN} (Power On, Power Off)

Typical Application Information (Continued)



01264412

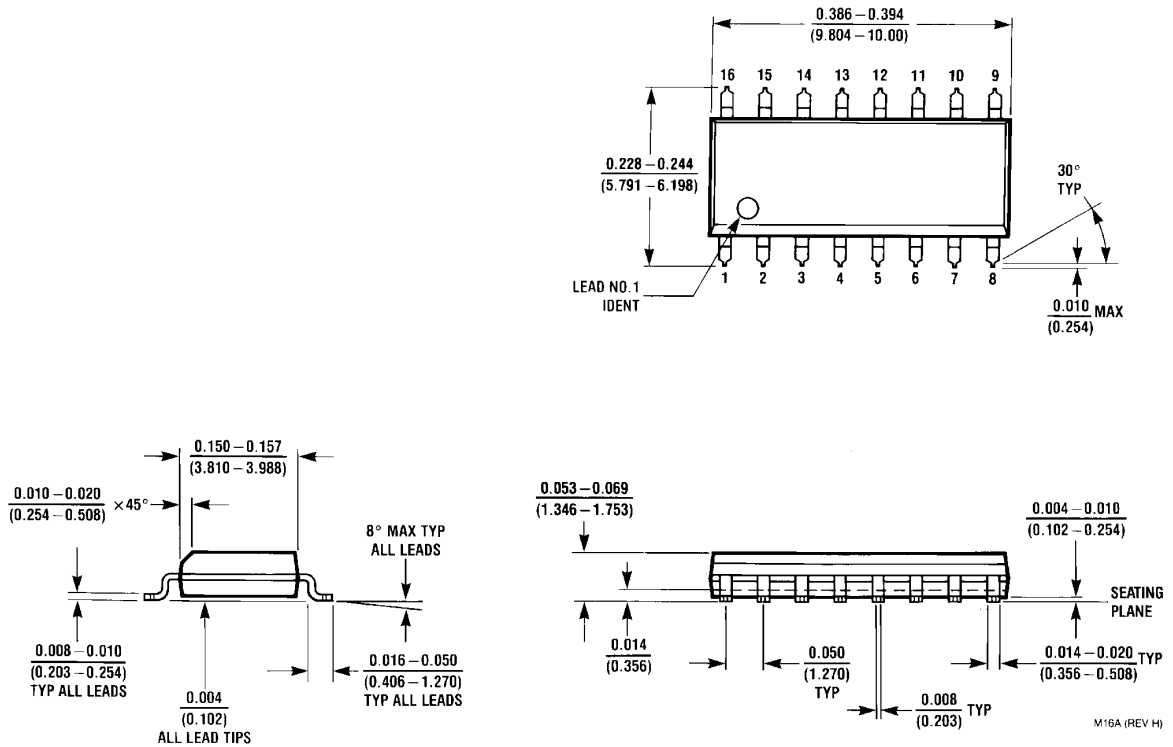
FIGURE 10. I_{OL} vs V_{OL}



01264413

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

Physical Dimensions inches (millimeters) unless otherwise noted



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

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
 Americas
 Email: support@nsc.com

National Semiconductor Europe
 Fax: +49 (0) 180-530 85 86
 Email: europe.support@nsc.com
 Deutsch Tel: +49 (0) 69 9508 6208
 English Tel: +44 (0) 870 24 0 2171
 Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Response Group
 Tel: 65-2544466
 Fax: 65-2504466
 Email: ap.support@nsc.com

National Semiconductor Japan Ltd.
 Tel: 81-3-5639-7560
 Fax: 81-3-5639-7507

www.national.com