

DS34LV86T 3V Enhanced CMOS Quad Differential Line Receiver

Check for Samples: [DS34LV86T](#)

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
- $\pm 7V$ Common Mode Range @ $V_{ID} = 3V$
- $\pm 10V$ Common Mode Range @ $V_{ID} = 0.2V$
- Receiver OPEN Input Failsafe Feature
- Ensured 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

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 ensured 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 $\pm 10V$. The receiver outputs (RO) are compatible with TTL and LVCMOS levels.

Connection Diagram

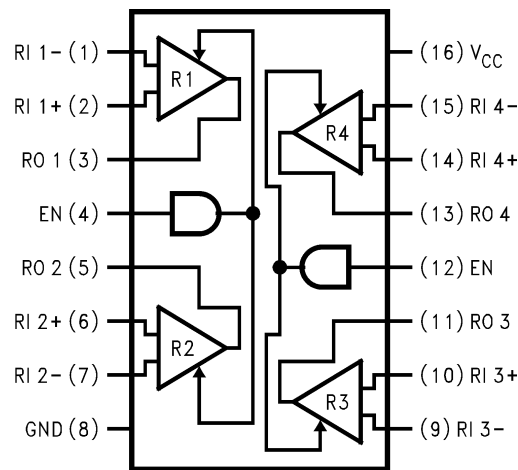


Figure 1. SOIC (Top View)
See Package Number D



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

TRUTH TABLE⁽¹⁾

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

- (1) L = Logic Low
H = Logic High
X = Irrelevant
Z = Tri-State
† = Open, Not Terminated



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾⁽²⁾

Supply Voltage (V_{CC})		+7V
Enable Input Voltage (EN)		+7V
Receiver Input Voltage	(V_{ID} : RI+, RI–)	±14V
Receiver Input Voltage	(V_{CM} : RI+, RI–)	±14V
Receiver Output Voltage (RO)		–0.5V to $V_{CC} + 0.5V$
Receiver Output Current (RO)		±25 mA
Maximum Package Power Dissipation @ +25°C	D Package	1190 mW
Derate D 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

- (1) Absolute Maximum Ratings are those values beyond which the safety of the device cannot be ensured. 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.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

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⁽¹⁾⁽²⁾

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		kΩ
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	$I_{OH} = -6\text{ mA}$, $V_{ID} = +1V$ $I_{OH} = -6\text{ mA}$, $V_{ID} = \text{OPEN}$	RO	2.4	3		V
V_{OH}	High Level Output Voltage	$I_{OH} = -100\text{ μA}$, $V_{ID} = +1V$ $I_{OH} = -100\text{ μA}$, $V_{ID} = \text{OPEN}$			$V_{CC} - 0.1$		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} $ See ⁽³⁾		-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

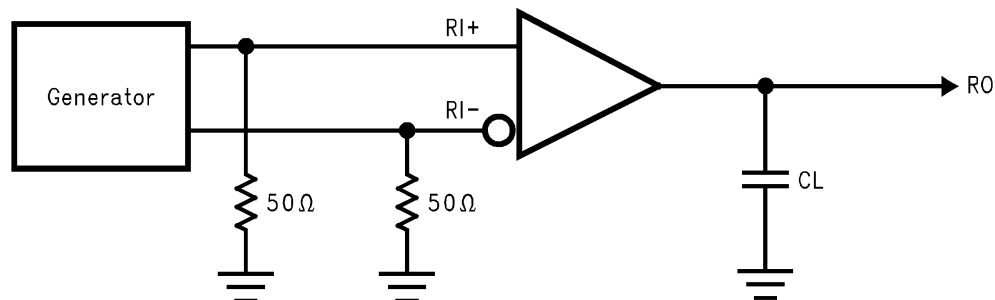
- (1) Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground except V_{ID} .
- (2) All typicals are given for: $V_{CC} = +3.3V$, $T_A = +25^\circ\text{C}$.
- (3) Short one output at a time to ground. Do not exceed package power dissipation ratings.

SWITCHING CHARACTERISTICS⁽¹⁾⁽²⁾⁽³⁾

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay High to Low	$C_L = 15\text{ pF}$ See (Figure 2 and Figure 3)	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	$C_L = 50\text{ pF}$ See (Figure 4 and Figure 5)			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} $ See ⁽⁴⁾	$C_L = 15\text{ pF}$		0.3	4	ns
t_{SK2}	Skew, Pin to Pin See ⁽⁵⁾			0.6	4	ns
t_{SK3}	Skew, Part to Part See ⁽⁶⁾			7	17	ns
f_{MAX}	Maximum Operating Frequency See ⁽⁷⁾	$C_L = 15\text{ pF}$	32			MHz

- (1) All typicals are given for: $V_{CC} = +3.3\text{V}$, $T_A = +25^\circ\text{C}$.
- (2) Generator waveform for all tests unless otherwise specified: $f = 1\text{ MHz}$, Duty Cycle = 50%, $Z_O = 50\Omega$, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.
- (3) C_L includes probe and jig capacitance.
- (4) t_{SK1} is the $|t_{PHL} - t_{PLH}|$ of a channel.
- (5) t_{SK2} is the maximum skew between any two channels within a device, on either edge.
- (6) t_{SK3} is the difference in propagation delay times between any channels of any devices. This specification (maximum limit) applies to devices within $V_{CC} \pm 0.1\text{V}$ of one another, and a Delta $T_A = \pm 5^\circ\text{C}$ (between devices) within the operating temperature range. This parameter is specified by design and characterization.
- (7) 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 ensured by design and characterization.

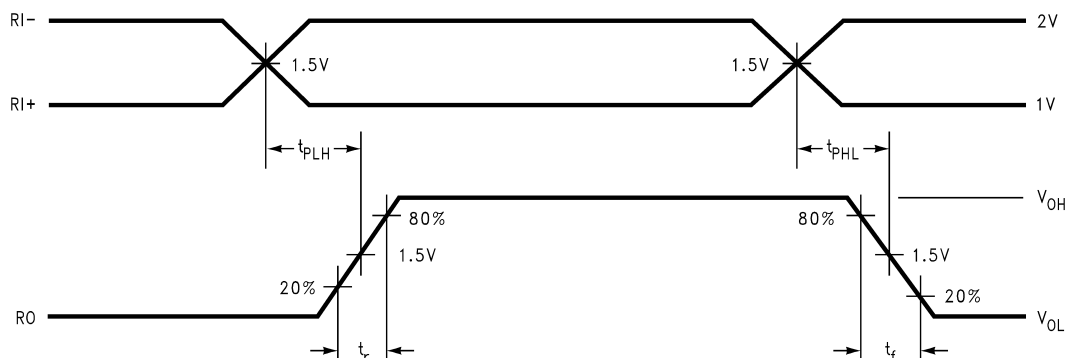
PARAMETER MEASUREMENT INFORMATION

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

C_L includes probe and jig capacitance.

Figure 2. Receiver Propagation Delay and Transition Time Test Circuit

PARAMETER MEASUREMENT INFORMATION (continued)



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

C_L includes probe and jig capacitance.

Figure 3. Receiver Propagation Delay and Transition Time Waveform

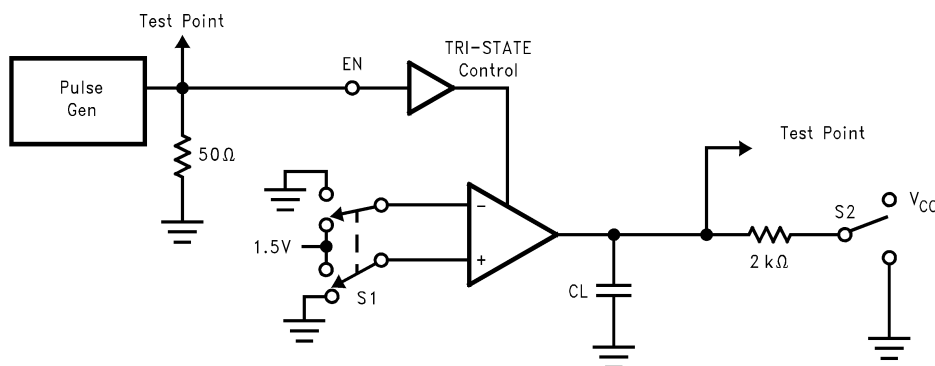
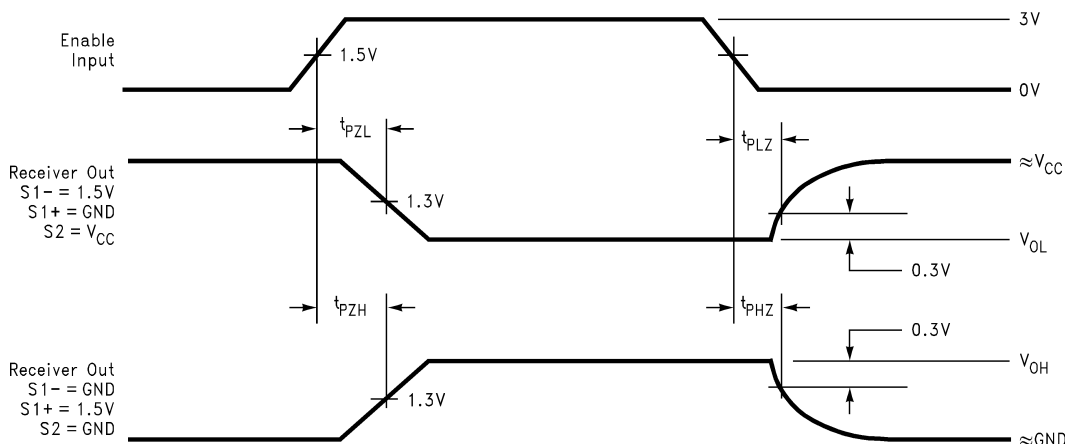


Figure 4. Receiver Tri-State Test Circuit



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

C_L includes probe and jig capacitance.

Figure 5. Receiver Tri-State Output Enable and Disable Waveforms

TYPICAL APPLICATION INFORMATION

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

AN-214 ([SNLA137](#)), AN-457 ([SNLA148](#)), AN-805 ([SNOA233](#)), AN-847 ([SNLA031](#)), AN-903 ([SNLA034](#)), AN-912 ([SNLA036](#)), AN-916 ([SNLA219](#))

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

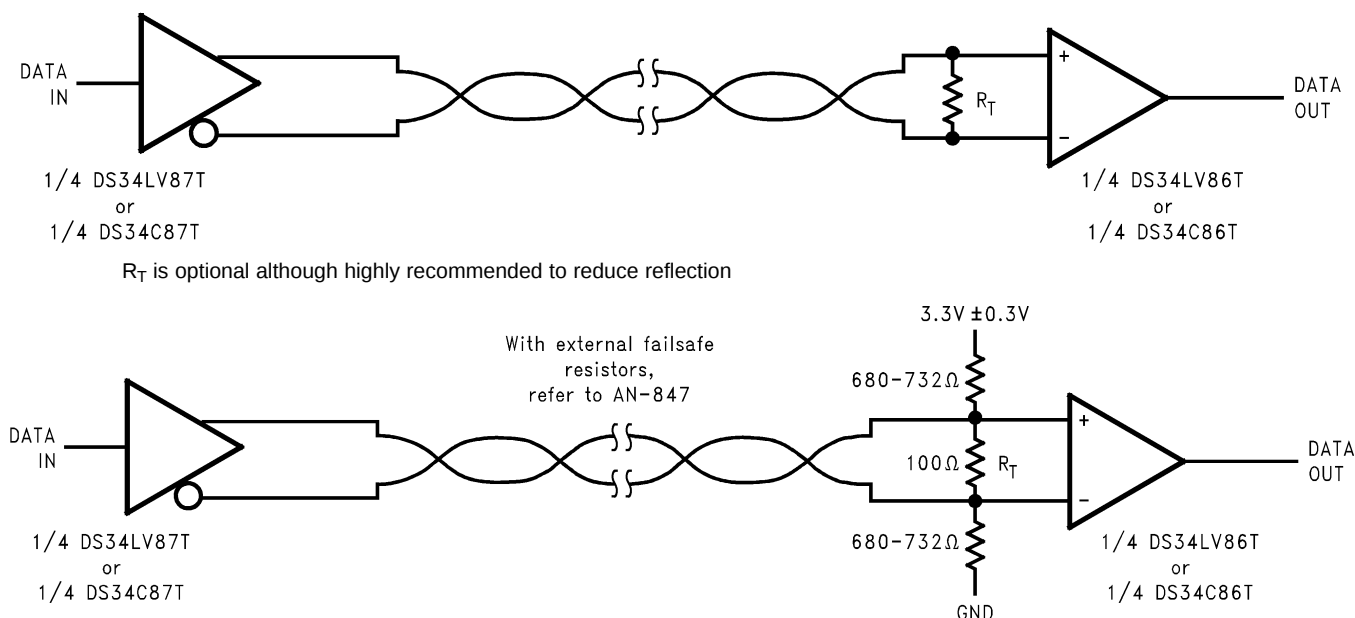


Figure 6. Typical Receiver Connections

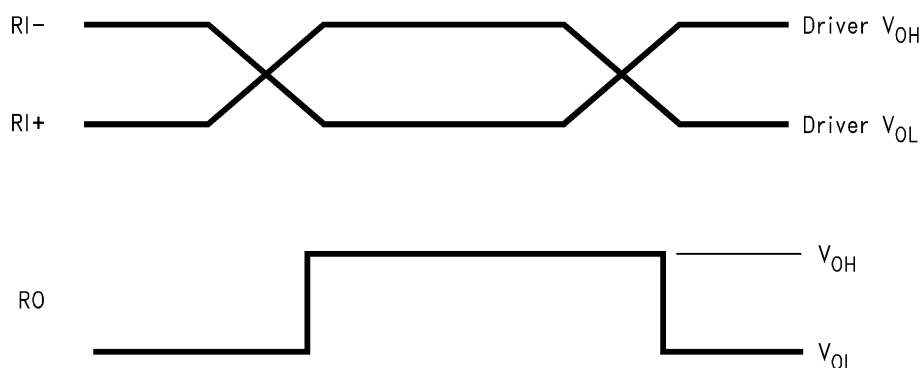


Figure 7. Typical Receiver Output Waveforms

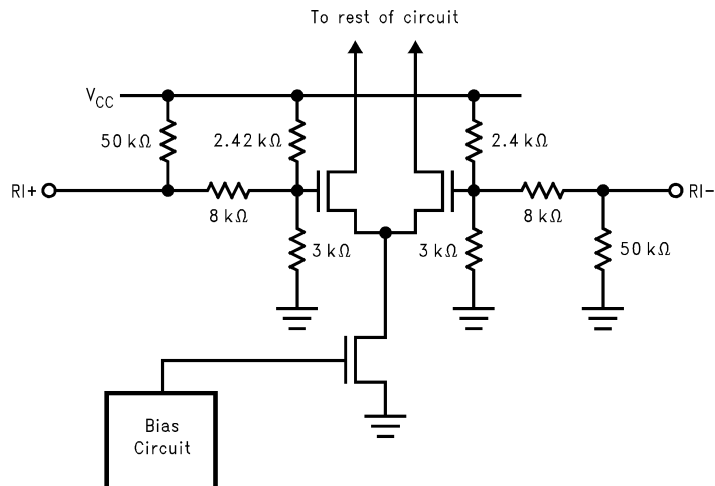


Figure 8. Typical Receiver Input Circuit

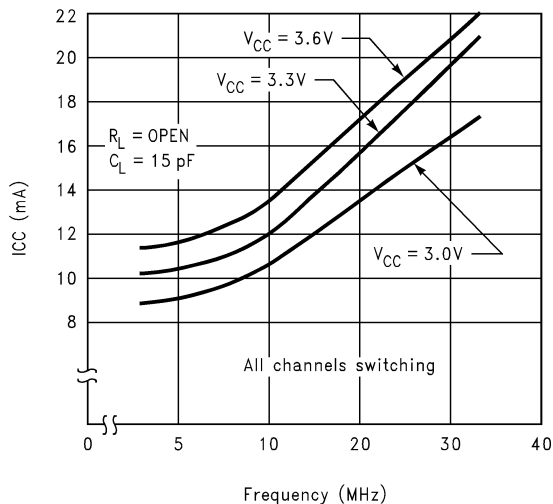


Figure 9. Typical I_{CC} vs Frequency

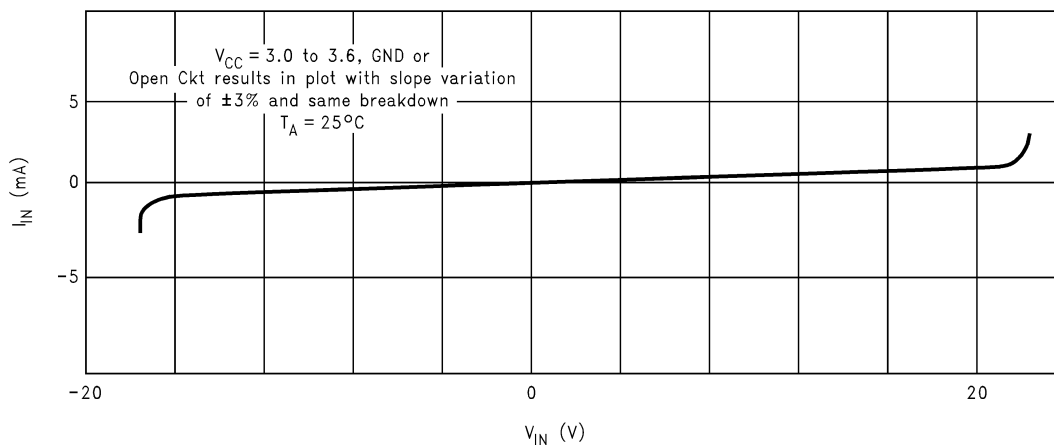
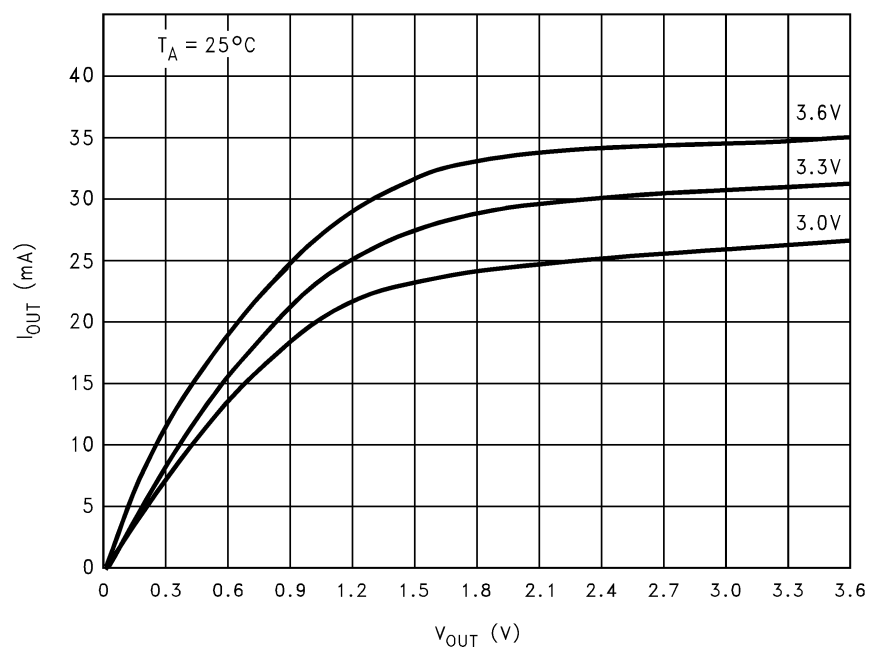
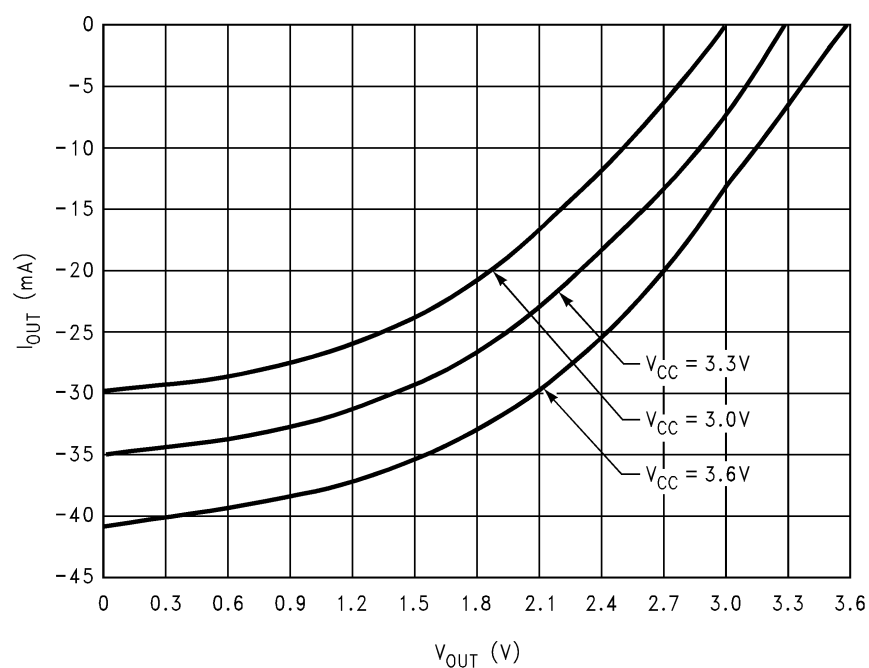


Figure 10. I_{IN} vs V_{IN} (Power On, Power Off)

Figure 11. I_{OL} vs V_{OL} Figure 12. I_{OH} vs V_{OH}

REVISION HISTORY

Changes from Revision C (April 2013) to Revision D

Page

- Changed layout of National Data Sheet to TI format [8](#)

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
DS34LV86TM/NOPB	Active	Production	SOIC (D) 16	48 TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 85	DS34LV86 TM
DS34LV86TM/NOPB.A	Active	Production	SOIC (D) 16	48 TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 85	DS34LV86 TM
DS34LV86TMX/NOPB	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	DS34LV86 TM
DS34LV86TMX/NOPB.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	DS34LV86 TM

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS34LV86TMX/NOPB	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS34LV86TMX/NOPB	SOIC	D	16	2500	367.0	367.0	35.0

TUBE

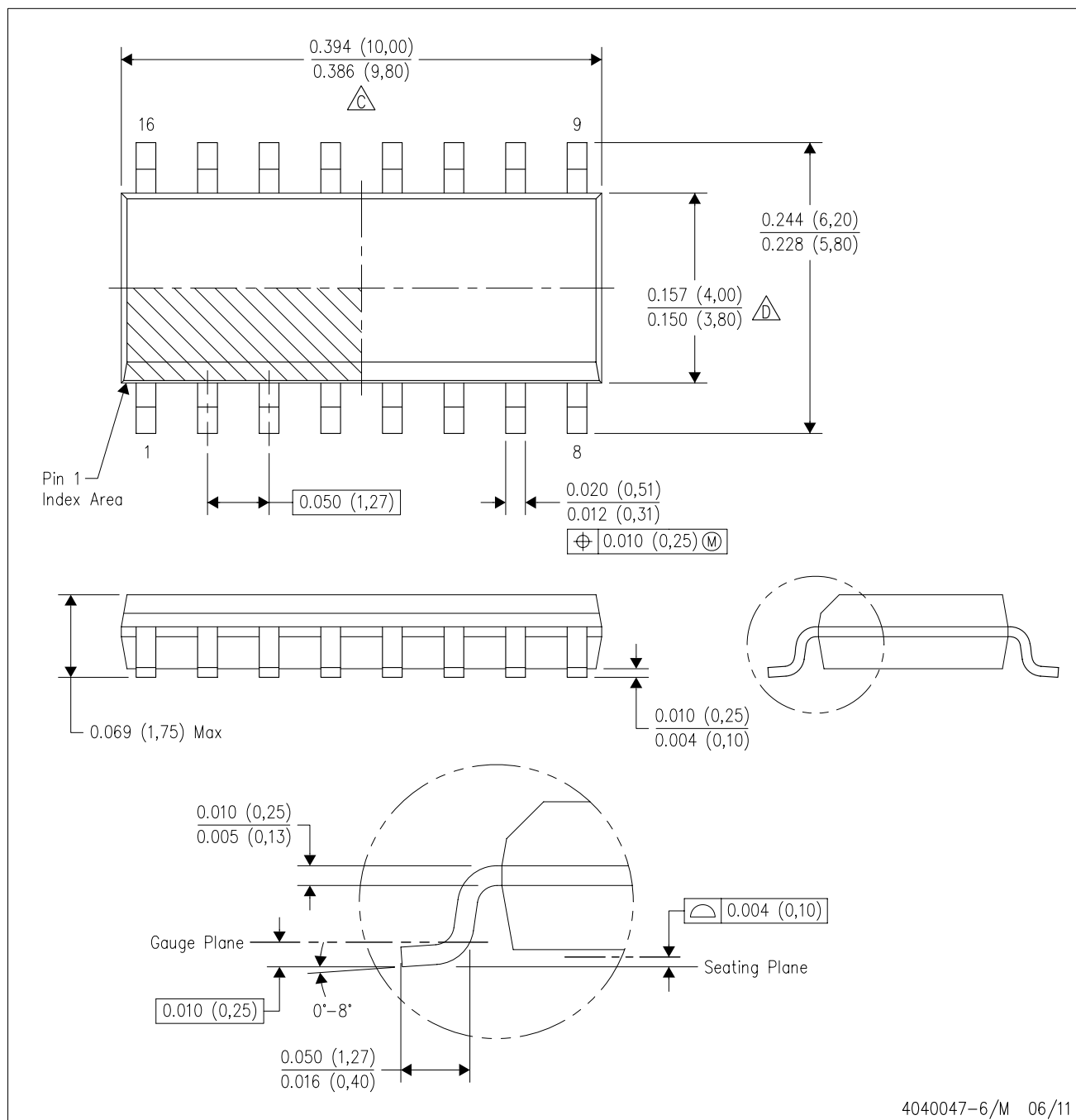


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
DS34LV86TM/NOPB	D	SOIC	16	48	495	8	4064	3.05
DS34LV86TM/NOPB.A	D	SOIC	16	48	495	8	4064	3.05

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 E. Reference JEDEC MS-012 variation AC.

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