

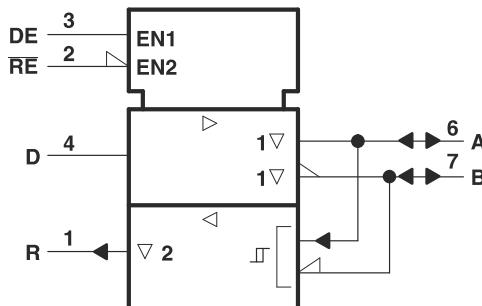
## SNx5LBC184 過渡電圧抑制機能搭載、差動トランシーバ

## 1 特長

- 過渡電圧抑制機能を搭載
- 以下を上回るバス端子の ESD 保護:
  - ±30kV IEC 61000-4-2 接触放電
  - ±30kV IEC 61000-4-2 気中放電
  - ±15kV EIA/JEDEC 人体モデル
- IEC 61000-4-5 に準拠した 400W ピーク (標準値) の回路損傷保護
- 制御されたドライバの出力電圧のスルーレートにより、より長いケーブル スタブ長を実現
- 電気的ノイズの多い環境で 250kbps
- 開路フェイルセーフ レシーバ設計
- 1/4 の単位負荷でバス上に 128 のデバイスを接続可能
- サーマル シャットダウン保護機能
- パワーアップ / パワーダウン グリッチ保護
- 各トランシーバが TIA/EIA-485 (RS-485) および ISO/IEC 8482:1993(E) 規格を満たすか上回る性能
- ディセーブル時の低い電源電流 (最大 300μA)
- SN75176 とピン互換

## 2 アプリケーション

- 産業用ネットワーク
- ユーティリティメーター
- モータ制御

論理記号<sup>1</sup>

## 3 概要

SN75LBC184 および SN65LBC184 デバイスは、SN75176 の業界標準のフットプリントで、高エネルギーノイズ過渡に対する保護機能が組み込まれた差動データライントランシーバです。この特長により、ほとんどの既存のデバイスよりも信頼性が大きく向上し、データケーブルに結合されたノイズ過渡に対する耐性が強化されます。これらの回路を使用することで、外付け部品なしで、信頼性の高い低コストの直接結合 (絶縁トランジスなし) データラインインターフェイスを実現できます。

SN75LBC184 および SN65LBC184 は、400W ピーク (標準値) の過電圧過渡に耐えられます。IEC 61000-4-5 で規定されている従来型の組み合わせ波形で、過電圧過渡をシミュレートし、スイッチングおよび 2 次側雷過渡による過電圧によって引き起こされる単方向のサージをモデル化します。

## パッケージ情報

部品番号	パッケージ <sup>(1)</sup>	パッケージ サイズ <sup>(2)</sup>
SN65LBC184、 SN75LBC184	SOIC (8)	4.9mm × 6mm
	PDIP (8)	9.81mm × 6.35mm

(1) 詳細については、セクション 11 を参照してください。

(2) パッケージ サイズ (長さ × 幅) は公称値であり、該当する場合はピンも含まれます。

<sup>1</sup> この記号は ANSI/IEEE 規格 91-1984 と IEC Publication 617-12 に準拠しています。

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## 4 Pin Configuration and Functions

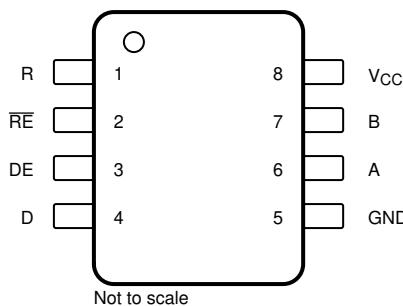


図 4-1. D Package (SOIC), P Package (PDIP)  
(Top View)

表 4-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
A	6	Bus input/output	Driver output or receiver input (complementary to B)
B	7	Bus input/output	Driver output or receiver input (complementary to A)
D	4	Digital input	Driver data input
DE	3	Digital input	Active-HIGH driver enable
GND	5	Reference potential	Local device ground
R	1	Digital output	Receiver data output
RE	2	Digital input	Active-LOW receiver enable
V <sub>CC</sub>	8	Supply	4.75V to 5.25V supply

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage <sup>(2)</sup>	-0.5	7	V
	Continuous voltage range at any bus terminal	-15	15	V
	Data input/output voltage	-0.3	7	V
$I_O$	Receiver output current	-20	20	mA
	Continuous total power dissipation <sup>(3)</sup>	Internally Limited		
$T_{stg}$	Storage temperature	160		°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under [セクション 5.3](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values, except differential input/output bus voltage, are with respect to network ground terminal.

(3) The driver shuts down at a junction temperature of approximately 160°C. To operate below this temperature, see the [セクション 5.9](#).

### 5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	A, B, GND	±15000	V
		All pins	±3000	
	Contact discharge (IEC61000-4-2) <sup>(2)</sup>	A, B, GND <sup>(3)</sup>	±30000	
		A, B, GND <sup>(3)</sup>	±30000	
	All pins (Class 3A)		±8000	
	All pins (Class 3B)		±200	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

(3) GND and bus pin ESD protection is beyond readily available test equipment capabilities for IEC 61000-4-2, EIA/JEDEC test method A114-A and MIL-STD-883C method 3015. Ratings listed are limits of test equipment; device performance exceeds these limits.

### 5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN <sup>(1)</sup>	TYP	MAX	UNIT
$V_{CC}$	Supply voltage	4.75	5	5.25	V
$V_I$ or $V_{IC}$	Voltage at any bus terminal (separately or common mode)	-7		12	V
$V_{IH}$	High-level input voltage	D, DE, and $\overline{RE}$	2		V
$V_{IL}$	Low-level input voltage	D, DE, and $\overline{RE}$		0.8	V
$ V_{ID} $	Differential input voltage			12	V
$I_{OH}$	High-level output current	Driver	-60		mA
		Receiver	-8		
$I_{OL}$	Low-level output current	Driver		60	mA
		Receiver		4	
$T_A$	Operating free-air temperature	SN75LBC184	0	70	°C
		SN65LBC184	-40	85	

(1) The algebraic convention, in which the less-positive (more-negative) limit is designated minimum, is used in this data sheet.

## 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	P (PDIP)	D (SOIC)	UNIT
	8 PINS		
R <sub>θJA</sub> Junction-to-ambient thermal resistance	108.7	116.3	°C/W
R <sub>θJC(top)</sub> Junction-to-case (top) thermal resistance	34.8	41.3	°C/W
R <sub>θJB</sub> Junction-to-board thermal resistance	23.6	61.4	°C/W
Ψ <sub>JT</sub> Junction-to-top characterization parameter	12	4.2	°C/W
Ψ <sub>JB</sub> Junction-to-board characterization parameter	23.5	60.3	°C/W
R <sub>θJC(bot)</sub> Junction-to-case (bottom) thermal resistance	N/A	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 5.5 Electrical Characteristics: Driver

over recommended operating conditions (unless otherwise noted)

PARAMETER	ALTERNATE SYMBOLS	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
I <sub>CC</sub>	Supply current	NA	DE = $\overline{RE}$ = 5V No Load	12	25	mA
			DE = 0 V $\overline{RE}$ = 5V No Load	175	300	$\mu$ A
I <sub>IH</sub>	High-level input current (D, DE, $\overline{RE}$ )	NA	V <sub>I</sub> = 2.4V		50	$\mu$ A
I <sub>IL</sub>	Low-level input current (D, DE, $\overline{RE}$ )	NA	V <sub>I</sub> = 0.4V	-50		$\mu$ A
I <sub>OS</sub>	Short-circuit output current OS <sup>(2)</sup>	NA	V <sub>O</sub> = -7V	-250	-120	mA
			V <sub>O</sub> = V <sub>CC</sub>		250	
			V <sub>O</sub> = 12V		250	
I <sub>OZ</sub>	High-impedance output current	NA	See Receiver I <sub>I</sub>			mA
V <sub>O</sub>	Output voltage	V <sub>oa</sub> , V <sub>ob</sub>	I <sub>O</sub> = 0	0	V <sub>CC</sub>	V
V <sub>OC(PP)</sub>	Peak-to-peak change in common-mode output voltage during state transitions	NA	See <a href="#">FIGURE 6-4</a> and <a href="#">FIGURE 6-5</a>		0.8	V
V <sub>OC</sub>	Common-mode output voltage	V <sub>os</sub>	See <a href="#">FIGURE 6-3</a>	1	3	V
ΔV <sub>OC(ss)</sub>	Magnitude of change, common-mode steady-state output voltage	V <sub>os</sub> - V <sub>osl</sub>	See <a href="#">FIGURE 6-5</a>		0.1	V
V <sub>OD</sub>	Magnitude of differential output voltage  V <sub>A</sub> - V <sub>B</sub>	V <sub>O</sub>	I <sub>O</sub> = 0	1.5	6	V
			R <sub>L</sub> = 54Ω, See <a href="#">FIGURE 6-3</a>	1.5		V
Δ V <sub>OD</sub>	Change in differential voltage magnitude between logic states	V <sub>t</sub>   -  V <sub>t</sub>	R <sub>L</sub> = 54Ω		0.1	V

(1) All typical values are measured with T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

(2) This parameter is measured with only one output being driven at a time.

## 5.6 Electrical Characteristics: Receiver

over recommended operation conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
I <sub>CC</sub>	DE = $\overline{RE}$ = 0 V, No Load		3.9		mA
	$\overline{RE}$ = 5V, DE = 0 V, No Load		300		$\mu$ A
I <sub>I</sub>	Input current Other input = 0 V	V <sub>I</sub> = 12V		250	$\mu$ A
		V <sub>I</sub> = 12V, V <sub>CC</sub> = 0		250	
		V <sub>I</sub> = -7V	-200		
		V <sub>I</sub> = -7V, V <sub>CC</sub> = 0	-200		
I <sub>OZ</sub>	High-impedance-state output current	V <sub>O</sub> = 0.4V to 2.4V		±100	$\mu$ A
V <sub>hys</sub>	Input hysteresis voltage		70		mV
V <sub>IT+</sub>	Positive-going input threshold voltage			200	mV
V <sub>IT-</sub>	Negative-going input threshold voltage		-200		mV
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = -8mA, See <a href="#">FIGURE 6-6</a>	2.8		V
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 4mA, See <a href="#">FIGURE 6-6</a>		0.4	V

(1) All typical values are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

## 5.7 Driver Switching Characteristics

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{d(DH)}$ Differential output delay time, low-to-high-level output	$R_L = 54\Omega$ $C_L = 50\text{pF}$ See <a href="#">図 6-4</a>			1.3	$\mu\text{s}$
$t_{d(DL)}$ Differential output delay time, high-to-low-level output				1.3	$\mu\text{s}$
$t_{PLH}$ Propagation delay time, low-to-high-level output		0.5	1.3		$\mu\text{s}$
$t_{PHL}$ Propagation delay time, high-to-low-level output		0.5	1.3		$\mu\text{s}$
$t_{sk(p)}$ Pulse skew ( $ t_{d(DH)} - t_{d(DL)} $ )		75	150		ns
$t_r$ Rise time, single-ended		0.25	1.2		$\mu\text{s}$
$t_f$ Fall time, single-ended		0.25	1.2		$\mu\text{s}$
$t_{PZH}$ Output enable time to high level	$R_L = 110\Omega$	See <a href="#">図 6-1</a>		3.5	$\mu\text{s}$
$t_{PZL}$ Output enable time to low level	$R_L = 110\Omega$			3.5	$\mu\text{s}$
$t_{PHZ}$ Output disable time from high level	$R_L = 110\Omega$	See <a href="#">図 6-1</a>		2	$\mu\text{s}$
$t_{PLZ}$ Output disable time from low level	$R_L = 110\Omega$	See <a href="#">図 6-2</a>		2	$\mu\text{s}$

## 5.8 Receiver Switching Characteristics

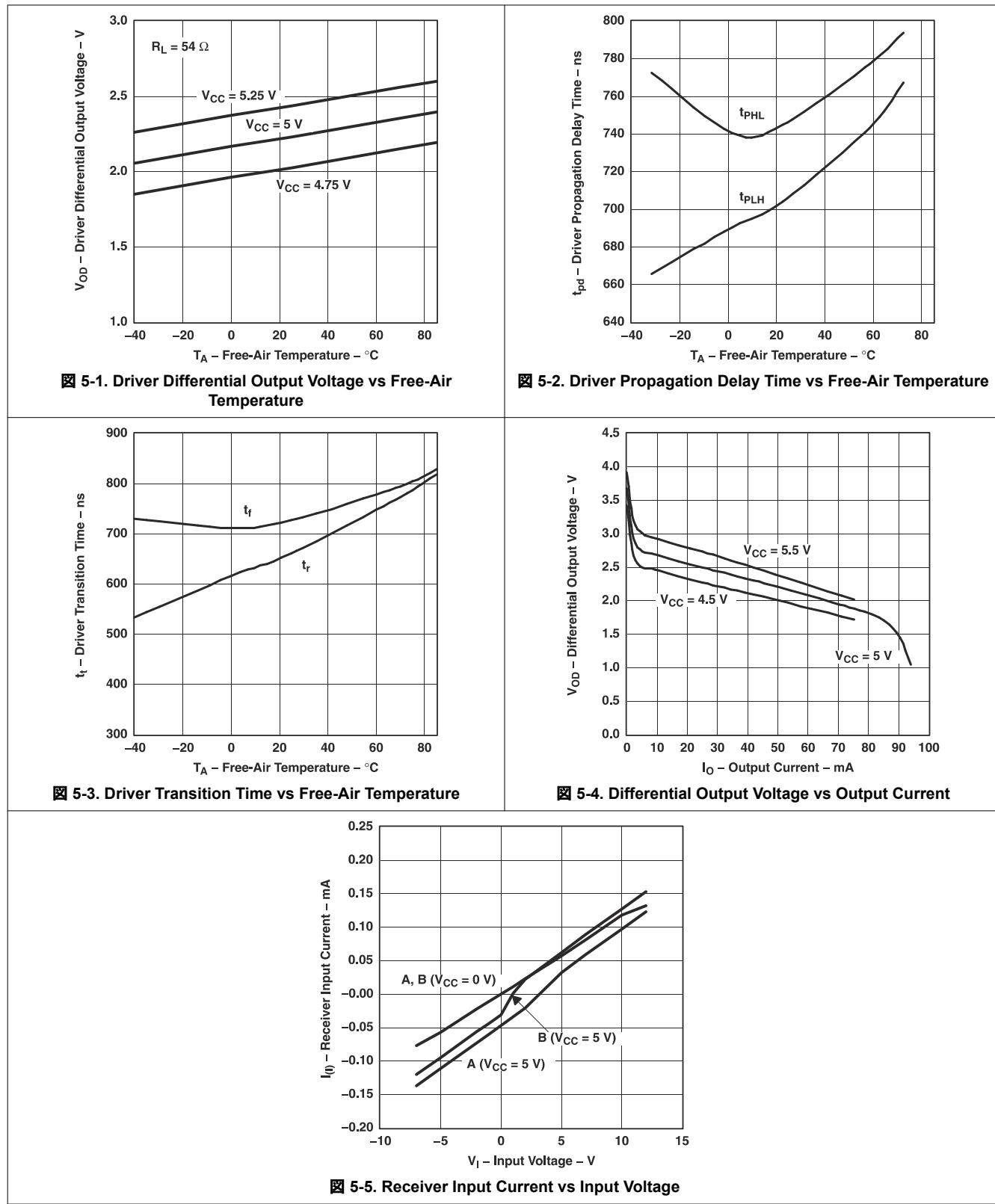
over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	$C_L = 50\text{ pF}$ , See <a href="#">図 6-6</a>			150	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output				150	ns
$t_{sk(p)}$ Pulse skew ( $ t_{PHL} - t_{PLH} $ )	See <a href="#">図 6-6</a>			50	ns
$t_r$ Rise time, single-ended		20			ns
$t_f$ Fall time, single-ended	See <a href="#">図 6-7</a>	20			ns
$t_{PZH}$ Output enable time to high level				100	ns
$t_{PZL}$ Output enable time to low level				100	ns
$t_{PHZ}$ Output disable time from high level				100	ns
$t_{PLZ}$ Output disable time from low level				100	ns

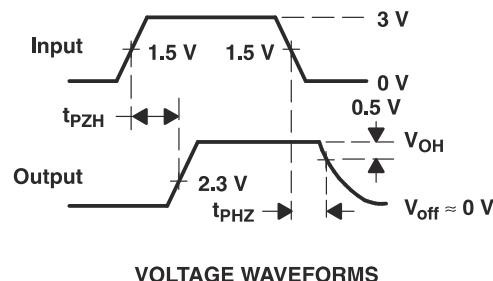
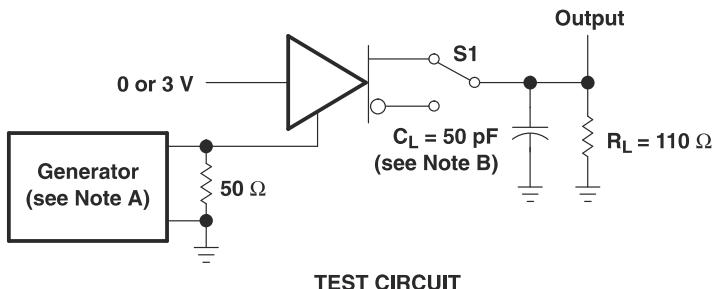
## 5.9 Dissipation Ratings

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T <sub>A</sub> = 25°C	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 85°C POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW
P	1150 mW	9.2 mW/°C	736 mW	598 mW

## 5.10 Typical Characteristics

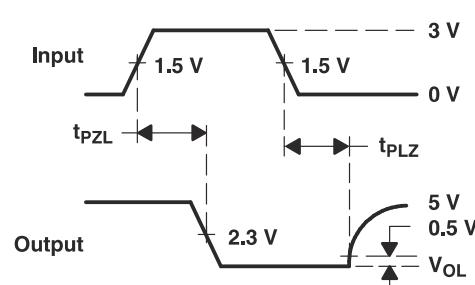
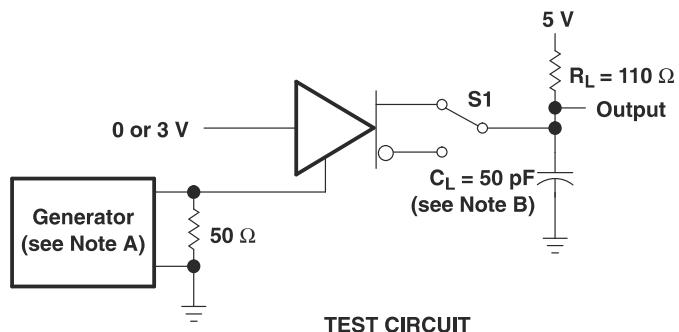


## 6 Parameter Measurement Information



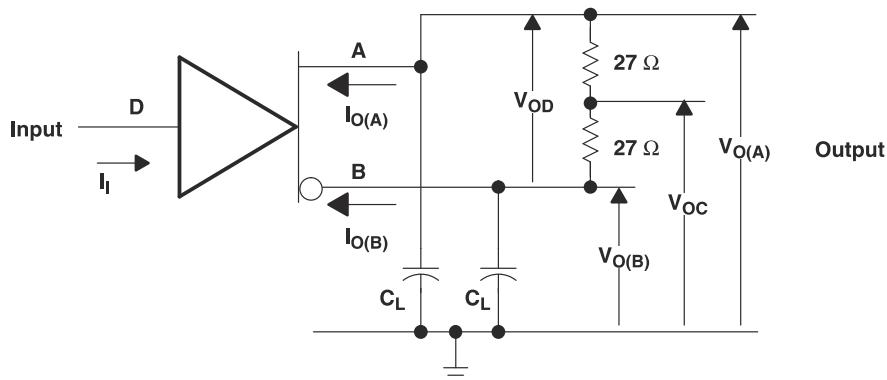
- A. The input pulse is supplied by a generator having the following characteristics: PRR = 1.25 kHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns,  $Z_0 = 50 \Omega$ .
- B.  $C_L$  includes probe and jig capacitance.

図 6-1. Driver  $t_{PZH}$  and  $t_{PHZ}$  Test Circuit and Voltage Waveforms



- A. The input pulse is supplied by a generator having the following characteristics: PRR = 1.25 kHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns,  $Z_0 = 50 \Omega$ .
- B.  $C_L$  includes probe and jig capacitance.

図 6-2. Driver  $t_{PZL}$  and  $t_{PLZ}$  Test Circuit and Voltage Waveforms



- A. Resistance values are in ohms and are 1% tolerance.
- B.  $C_L$  includes probe and jig capacitance.

図 6-3. Driver Test Circuit, Voltage, and Current Definitions

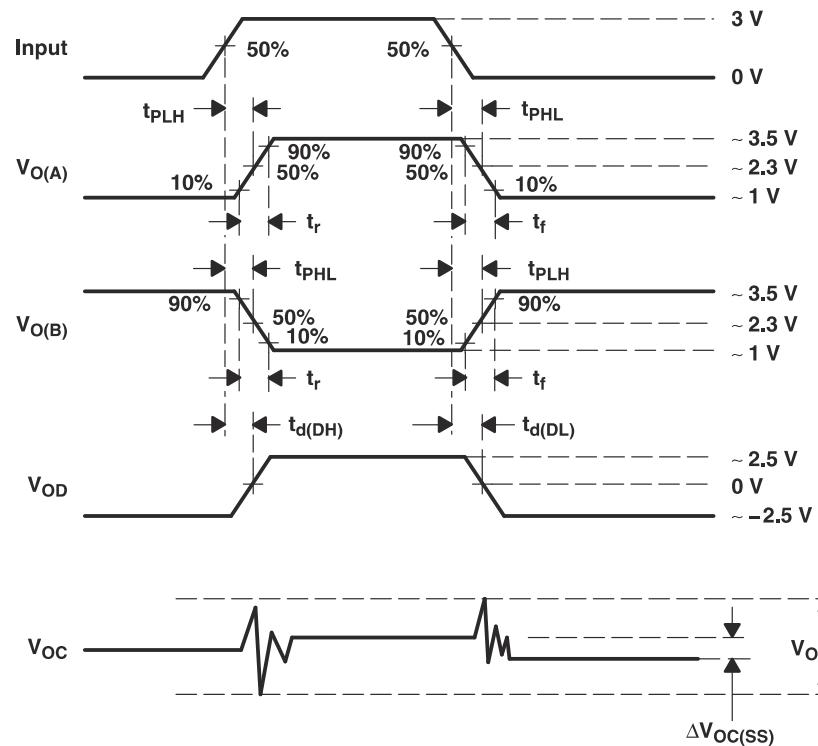
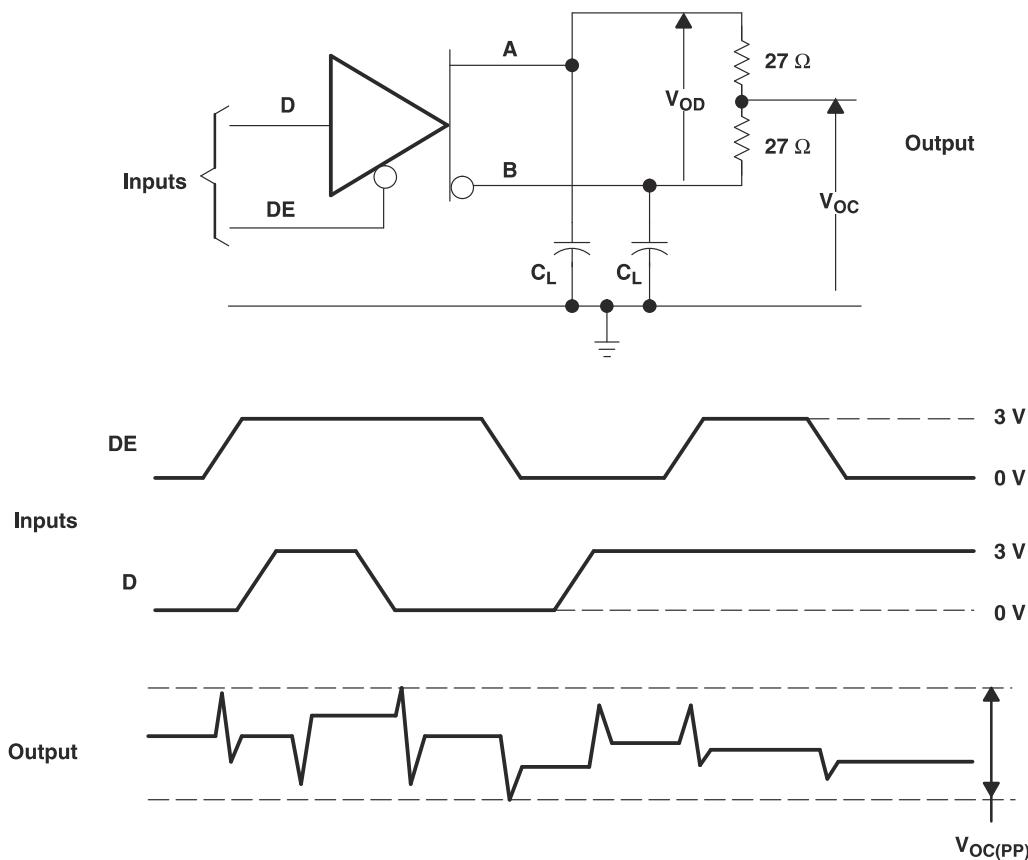


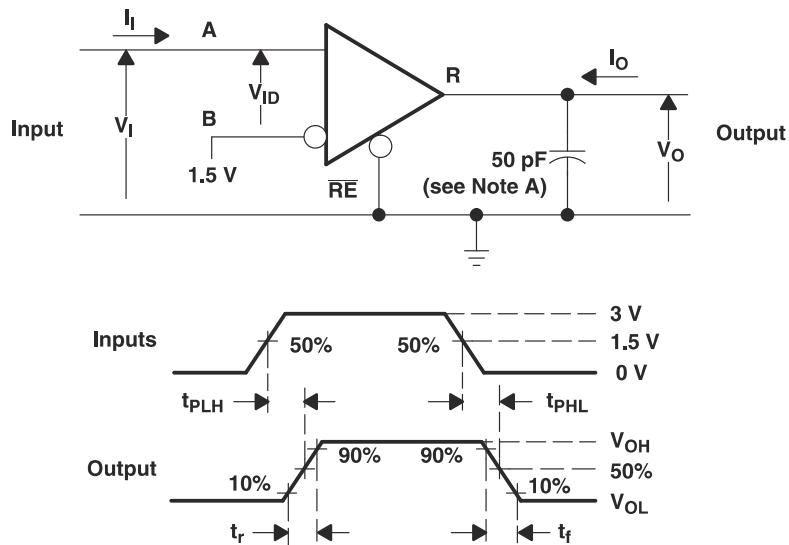
図 6-4. Driver Timing, Voltage, and Current Waveforms



A. Resistance values are in ohms and are 1% tolerance.

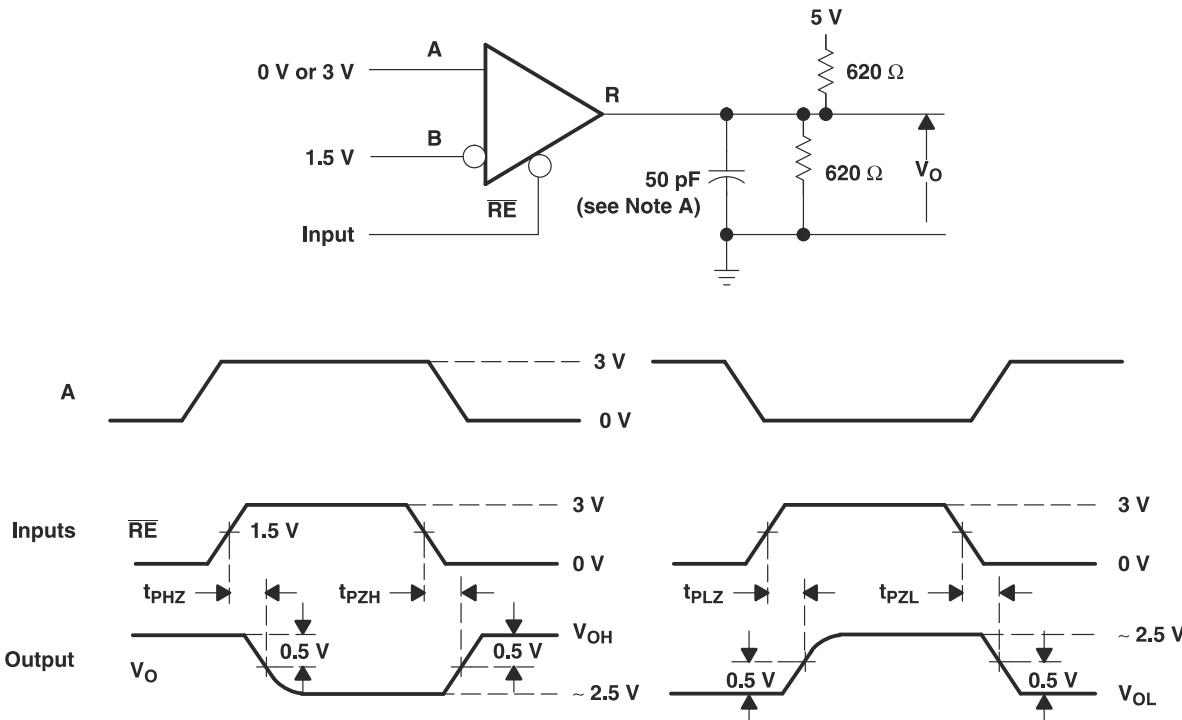
B.  $C_L$  includes probe and jig capacitance ( $\pm 10\%$ ).

図 6-5. Driver  $V_{OC(PP)}$  Test Circuit and Waveforms



A. This value includes probe and jig capacitance ( $\pm 10\%$ ).

図 6-6. Receiver  $t_{PLH}$  and  $t_{PHL}$  Test Circuit and Voltage Waveforms



A. This value includes probe and jig capacitance ( $\pm 10\%$ ).

図 6-7. Receiver  $t_{PZL}$ ,  $t_{PLZ}$ ,  $t_{PZH}$ , and  $t_{PHZ}$  Test Circuit and Voltage Waveforms

## 7 Detailed Description

### 7.1 Overview

The SNx5LBC184 device is a 5V, half-duplex, RS-485 transceiver with integrated transient voltage suppressors that prevent circuit damage in the presence of high-energy transients of up to 400W peak power. This transceiver has an active-HIGH driver enable and active-LOW receiver enable. The differential driver is suitable for data transmission up to 250kbps.

### 7.2 Functional Block Diagram

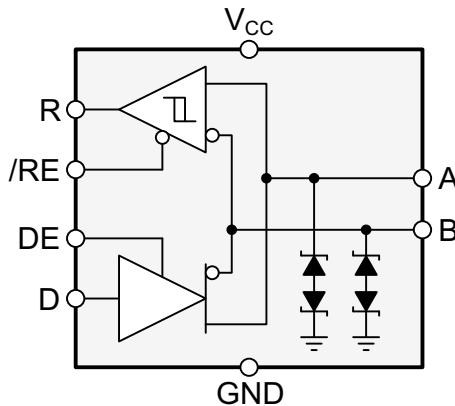


図 7-1. Functional Logic Diagram

### 7.3 Feature Description

Integrated transient voltage suppressors protect the transceiver against Electrostatic Discharges (ESD) according to IEC 61000-4-2 of up to  $\pm 30\text{kV}$  and surge transients according to IEC 61000-4-5 of up to 400W peak.

The differential driver incorporates slew-rate controlled outputs sufficient to transmit data up to 250kbps. Slew-rate control allows for longer unterminated cable runs and longer stub lengths from the main cable trunk than with faster voltage transitions. A unique receiver design provides a high level failsafe output when the inputs are left floating.

The SN65LBC184 is characterized from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  and the SN75LBC184 is characterized from  $0^\circ\text{C}$  to  $70^\circ\text{C}$ .

## 7.4 Device Functional Modes

When the driver enable pin (DE) is logic high, the differential outputs A and B follow the logic states at data input D. A logic high at D causes A to turn high and B to turn low. In this case, the differential output voltage defined as  $V_{OD} = V_A - V_B$  is positive. When D is low, the output states reverse, B turns high, A becomes low, and  $V_{OD}$  is negative.

When DE is low, both outputs turn high-impedance. In this condition, the logic state at D is irrelevant.

**表 7-1. Driver Functions**

INPUT <sup>(1)</sup>	ENABLE	OUTPUTS		FUNCTION
		A	B	
H	H	H	L	Actively drive bus High
L	H	L	H	Actively drive bus Low
X	L	Z	Z	Driver disabled

(1) H = high level, L = low level, ? = indeterminate, X = irrelevant, Z = high impedance (off)

When the receiver enable pin,  $\overline{RE}$ , is logic low, the receiver is enabled. When the differential input voltage defined as  $V_{ID} = V_A - V_B$  is positive and higher than the positive input threshold,  $V_{IT+}$ , the receiver output (R) turns high. When  $V_{ID}$  is negative and lower than the negative input threshold,  $V_{IT-}$ , the receiver output turns low. If  $V_{ID}$  is between  $V_{IT+}$  and  $V_{IT-}$ , the output is indeterminate.

When  $\overline{RE}$  is logic high, the receiver output is high-impedance and the magnitude and polarity of  $V_{ID}$  are irrelevant. When the transceiver is disconnected from the bus, the receiver provides a failsafe high output.

**表 7-2. Receiver Functions**

DIFFERENTIAL INPUT	ENABLE <sup>(1)</sup>	OUTPUT	FUNCTION
$V_{ID} = V_A - V_B$	$\overline{RE}$	R	
$V_{ID} > V_{IT+}$	L	H	Receive valid bus High
$V_{IT-} < V_{ID} < V_{IT+}$	L	?	Indeterminate bus state
$V_{ID} < V_{IT-}$	L	L	Receive valid bus Low
X	H	Z	Receiver disabled
OPEN	L	H	Receiver failsafe High

(1) H = high level, L = low level, ? = indeterminate, X = irrelevant, Z = high impedance (off)

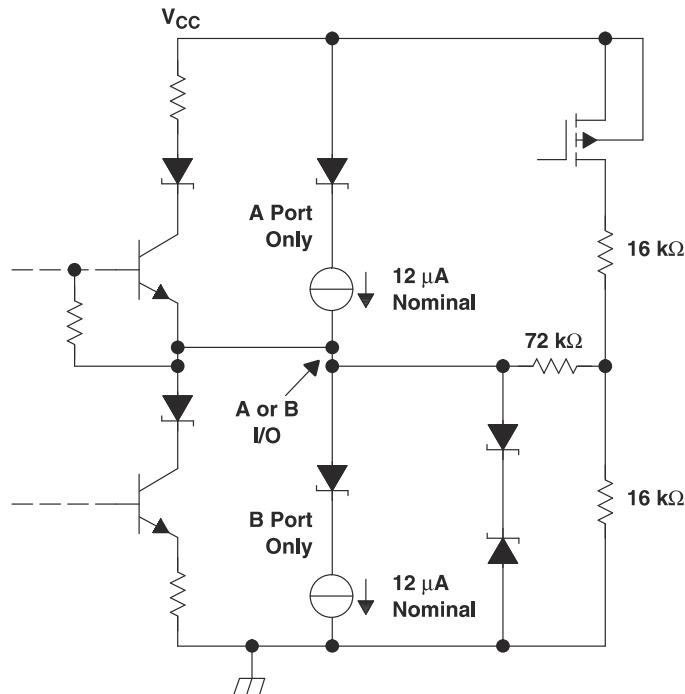


図 7-2. Schematic of Inputs and Outputs

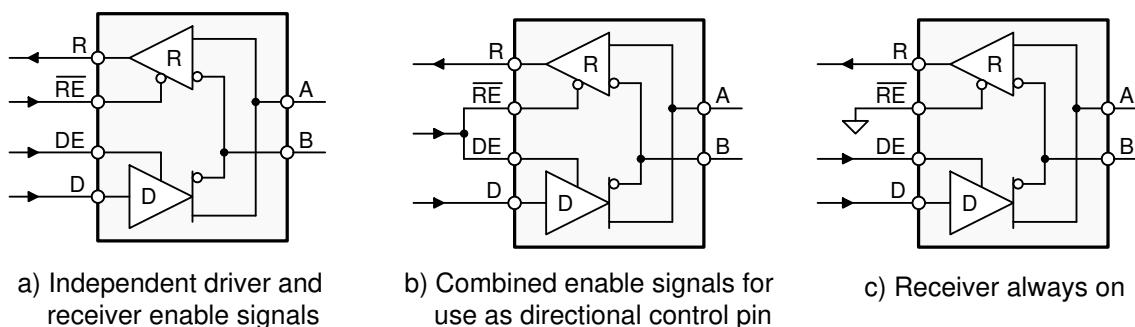
## 8 Application and Implementation

### 注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくことになります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

### 8.1 Application Information

The SN65LBC184 and SN75LBC184 devices are half-duplex, RS-485 transceivers commonly used for asynchronous data transmissions. The driver and receiver enable pins allow for the configuration of different operating modes.



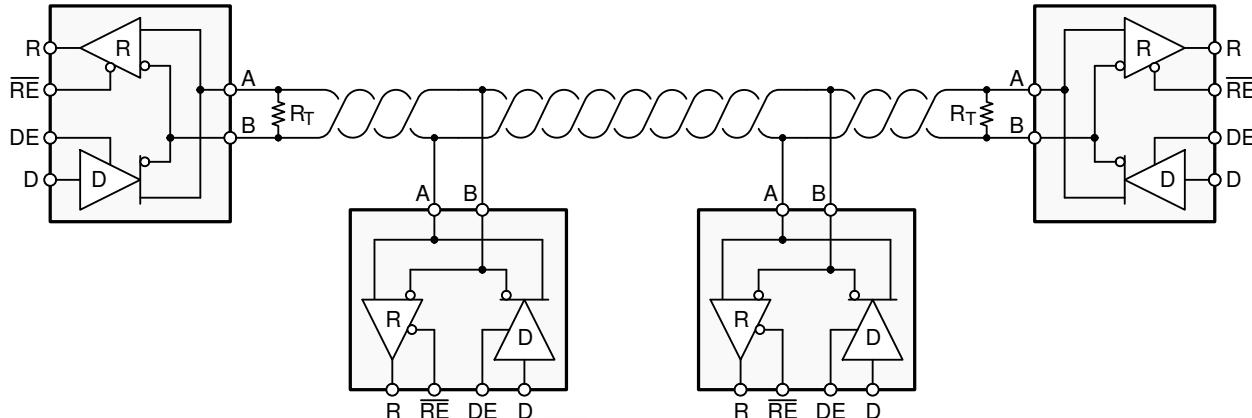
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**図 8-1. Half-Duplex Transceiver Configurations**

1. Using independent enable lines provides the most flexible control by allowing the driver and the receiver to be turned on and off individually. This configuration requires two control lines, allowing the selective listening into the bus traffic, whether the driver is transmitting data or not.
2. Combining the enable signals simplifies the interface to the controller by forming a single direction-control signal. In this configuration, the transceiver operates as a driver when the direction-control line is high, and as a receiver when the direction-control line is low.
3. Only one line is required when connecting the receiver-enable input to ground and controlling only the driver-enable input. In this configuration, a node not only receives the data from the bus, but also sends and verifies the correct data has been transmitted.

### 8.2 Typical Application

An RS-485 bus consists of multiple transceivers connected in parallel to a bus cable. To eliminate line reflections, each cable end is terminated with a termination resistor,  $R_T$ , whose value matches the characteristic impedance,  $Z_0$ , of the cable. This method, known as parallel termination, allows for higher data rates over a longer cable length.



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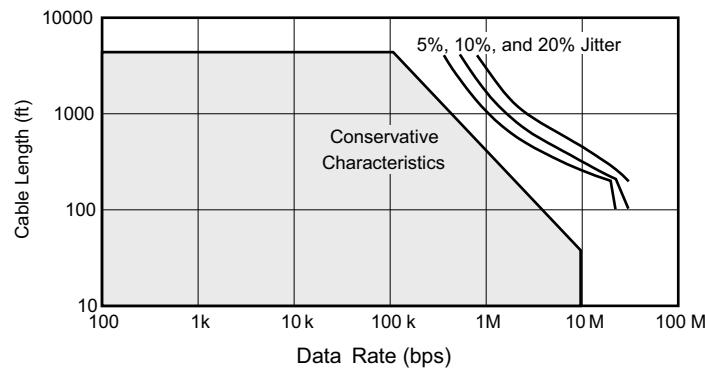
**図 8-2. Typical RS-485 Network With Half-Duplex Transceivers**

### 8.2.1 Design Requirements

RS-485 is a robust electrical standard suitable for long-distance networking that may be used in a wide range of applications with varying requirements, such as distance, data rate, and number of nodes.

#### 8.2.1.1 Data Rate and Bus Length

There is an inverse relationship between data rate and bus length, meaning the higher the data rate, the shorter the cable length; and conversely, the lower the data rate, the longer the cable may be without introducing data errors. While most RS-485 systems use data rates between 10kbps and 100kbps, some applications require data rates up to 250kbps at distances of 4000 feet and longer. Longer distances are possible by allowing for small signal jitter of up to 5% or 10%.



**図 8-3. Cable Length vs Data Rate Characteristic**

### 8.2.1.2 Stub Length

When connecting a node to the bus, the distance between the transceiver inputs and the cable trunk, known as the stub, should be as short as possible. Stubs present a nonterminated piece of bus line which can introduce reflections as the length of the stub increases. As a general guideline, the electrical length, or round-trip delay, of a stub should be less than one-tenth of the rise time of the driver, thus giving a maximum physical stub length as shown in [式 1](#).

$$L_{(STUB)} \leq 0.1 \times t_r \times v \times c \quad (1)$$

where

- $t_r$  is the 10/90 rise time of the driver
- $v$  is the signal velocity of the cable or trace as a factor of  $c$
- $c$  is the speed of light ( $3 \times 10^8$  m/s)

Per [式 1](#), cable-stub lengths when using the SN65LBC184 driver must be not greater than 5.85 meters (19 feet) for a signal velocity of 78% and minimum driver output rise or fall time of 250ns.

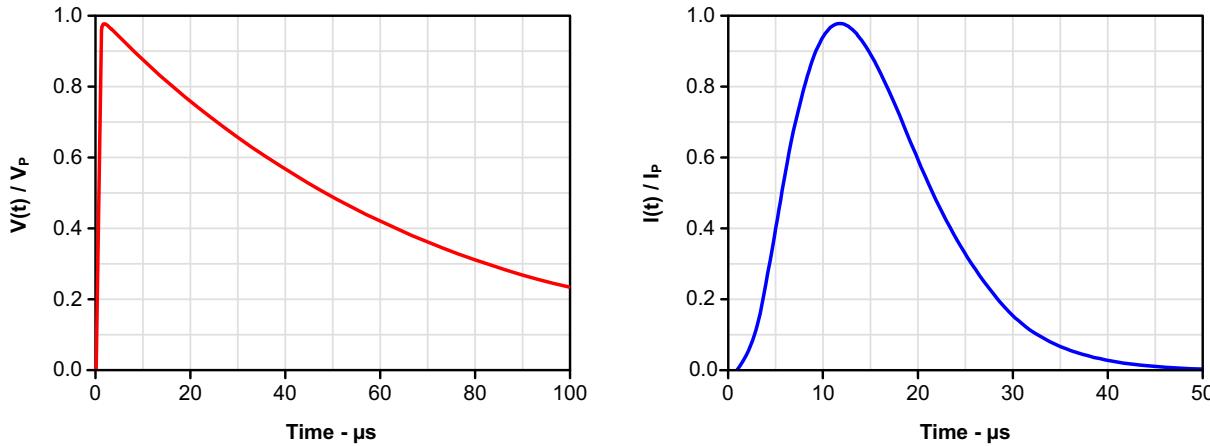
### 8.2.1.3 Bus Loading

The RS-485 standard specifies that a compliant driver must be able to drive 32 unit loads (UL), where 1 unit load represents a load impedance of approximately  $12\text{k}\Omega$ . Because the SN65LBC184 is a 1/4 UL transceiver, it is possible to connect up to 128 receivers to the bus.

## 8.2.2 Detailed Design Procedure

### 8.2.2.1 SN65LBC184 Test Description

The SN65LBC184 is tested against the IEC 61000-4-5 recommended transient identified as the combination wave. The combination wave provides a 1.2-/50 $\mu$ s open-circuit voltage waveform and a 8-/20 $\mu$ s short-circuit current waveform shown in [図 8-4](#). The testing is performed with a combination/hybrid pulse generator with an effective output impedance of  $2\Omega$ . The setup for the overvoltage stress is shown in [図 8-5](#) with all testing performed with power applied to the SN65LBC184 circuit.



**図 8-4. Open-Circuit Voltage and Short-Circuit Current Waveforms**

The SN65LBC184 is tested and evaluated for both maximum (single pulse) as well as life test (multiple pulse) capabilities. The SN65LBC184 is evaluated against transients of both positive and negative polarity and all testing is performed with the worst-case transient polarity. Transient pulses are applied to the bus pins (A and B) across ground as shown in [図 8-5](#).

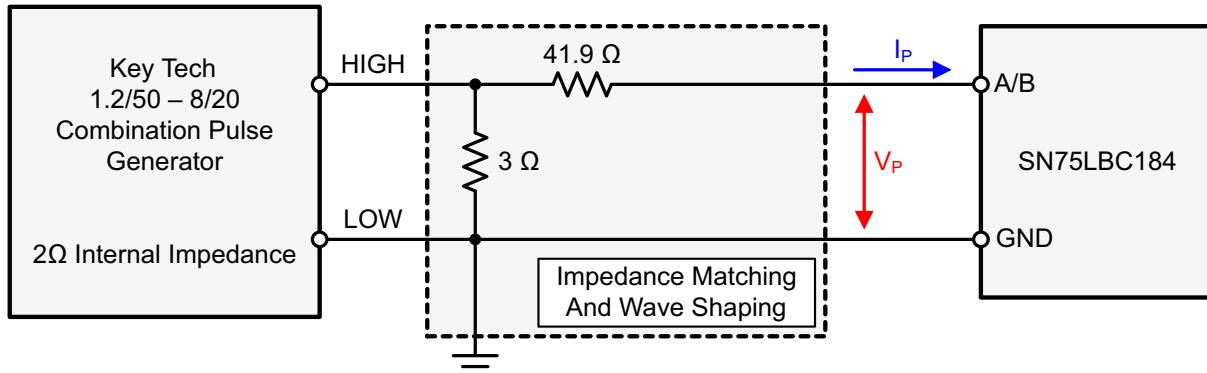


图 8-5. Overvoltage Stress Test Circuit

### 8.2.3 Application Curve

An example waveform as seen by the SN65LBC184 is shown in 图 8-6. The bottom trace is current, the middle trace shows the clamping voltage of the device and the top trace is power as calculated from the voltage and current waveforms. This example shows a peak clamping voltage of 33.6V and peak current of 16A, thus yielding an absorbed peak power of 538W.

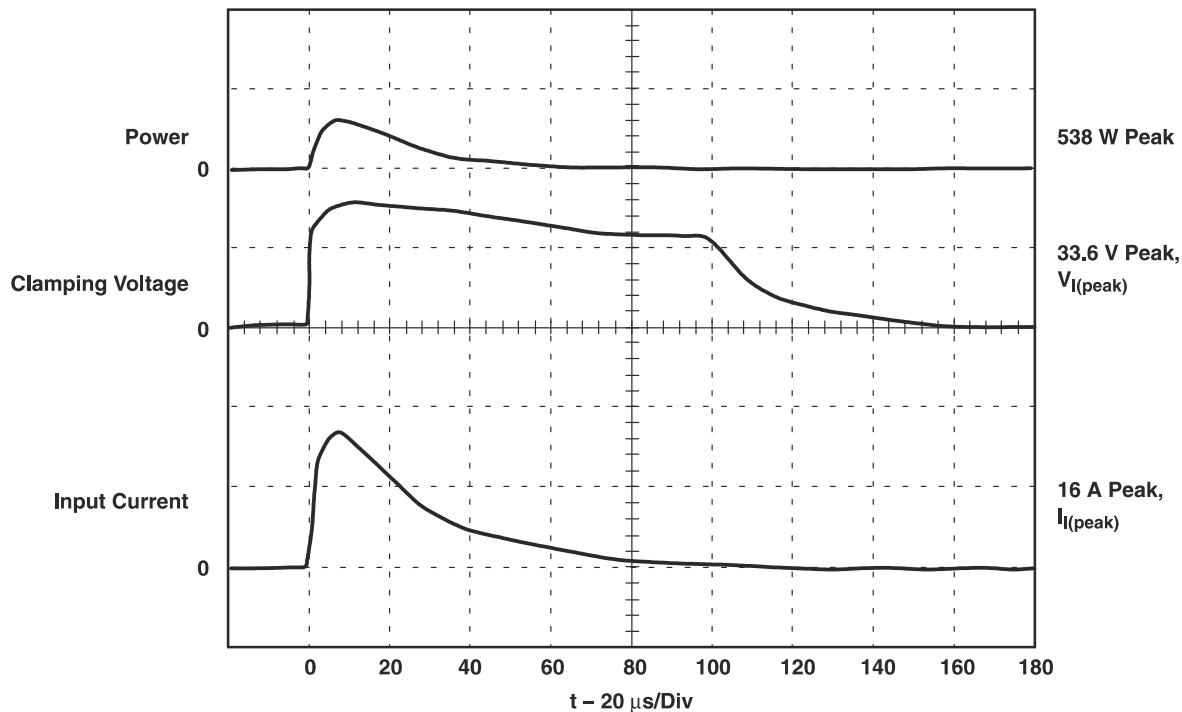


图 8-6. Typical Surge Waveform Measured at Pins 5 and 7

## 8.3 Power Supply Recommendations

For reliable operation at all data rates and supply voltages, each supply should be buffered with a 100nF ceramic capacitor located as close to the supply pins as possible. The TPS76350 is a linear voltage regulator suitable for the 5V supply.

## 8.4 Layout

### 8.4.1 Layout Guidelines

Because ESD transients have a wide frequency bandwidth from approximately 3MHz to 3GHz, high-frequency layout techniques must be applied during PCB design.

- Use  $V_{CC}$  and ground planes to provide low inductance. High frequency currents follow the path of least inductance and not the path of least impedance.
- Apply 100nF to 220nF bypass capacitors as close as possible to the  $V_{CC}$  pins of transceiver, UART, or controller ICs on the board.
- Use at least two vias for  $V_{CC}$  and ground connections of bypass capacitors to minimize effective via-inductance.
- Use 1k $\Omega$  to 10k $\Omega$  pullup or pulldown resistors for enable lines to limit noise currents in these lines during transient events.

### 8.4.2 Layout Example

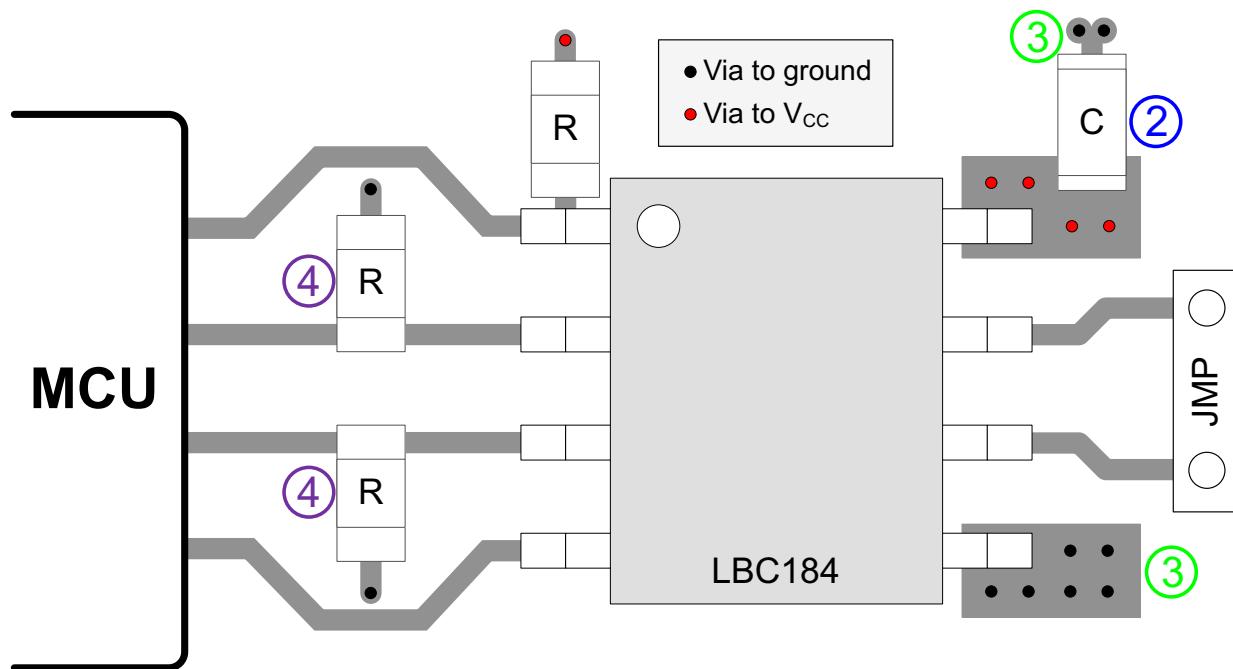


图 8-7. Layout Schematic

## 9 Device and Documentation Support

### 9.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates — go to the product folder for your device on [ti.com](http://ti.com). In the upper right-hand corner, click the *Alert me* button to register and receive a weekly digest of product information that has changed (if any). For change details, check the revision history of any revised document.

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### 9.5 用語集

#### テキサス・インスツルメンツ用語集

この用語集には、用語や略語の一覧および定義が記載されています。

## 10 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

### Changes from Revision I (June 2015) to Revision J (July 2024)

Page

- 「特長」の「 $\pm 15\text{kV}$  IEC 61000-4-2 エアギャップ放電」を次のように変更:  $\pm 30\text{kV}$  IEC 61000-4-2 エアギャップ放電.. 1
- Changed the value of "Air discharge" From:  $\pm 15000$  To:  $\pm 30000$  in the *ESD Ratings* table ..... 4
- Changed the D (SOIC) *Thermal Information* values..... 5
- Changed the  $V_{IT+}$  unit value From: 200 V To: 200 mV in the *Electrical Characteristics: Receiver* table..... 6

### Changes from Revision H (February 2009) to Revision I (June 2015)

Page

- 「ピン構成および機能」セクション、「ESD 定格」表、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」セクションを追加 ..... 1

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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**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)
<a href="#">SN65LBC184DR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(6LB184, SLB18U)
SN65LBC184DR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(6LB184, SLB18U)
SN65LBC184DRG4	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(6LB184, SLB18U)
<a href="#">SN65LBC184P</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	65LBC184
SN65LBC184P.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	65LBC184
<a href="#">SN75LBC184D</a>	Obsolete	Production	SOIC (D)   8	-	-	Call TI	Call TI	0 to 70	7LB184
<a href="#">SN75LBC184P</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	75LBC184
SN75LBC184P.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	75LBC184

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

<sup>(2)</sup> **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.

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

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

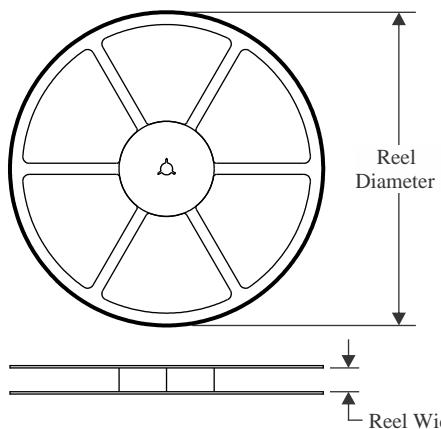
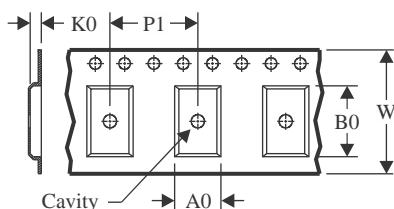
<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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.

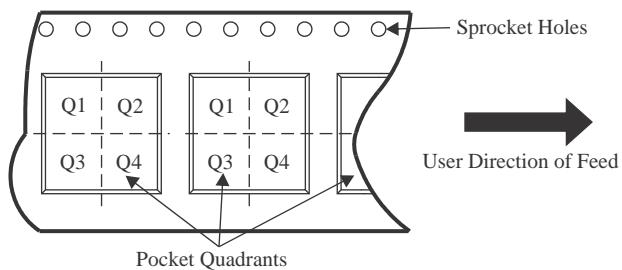
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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


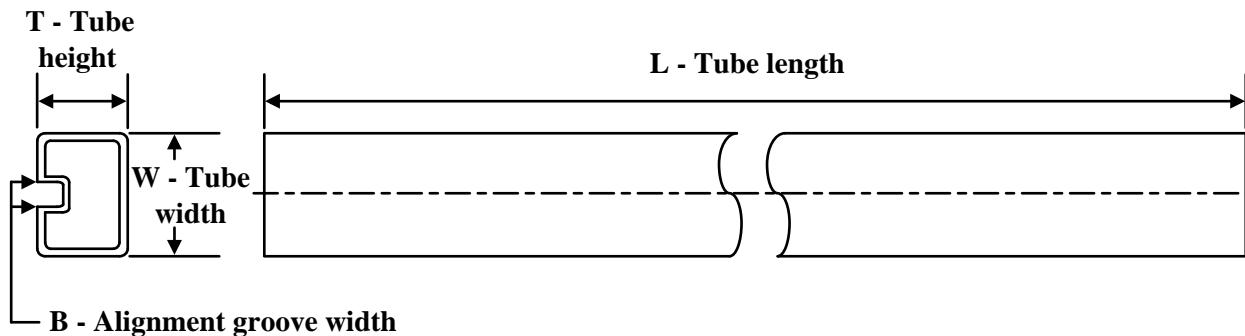
\*All dimensions are nominal

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
SN65LBC184DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LBC184DR	SOIC	D	8	2500	353.0	353.0	32.0

**TUBE**


\*All dimensions are nominal

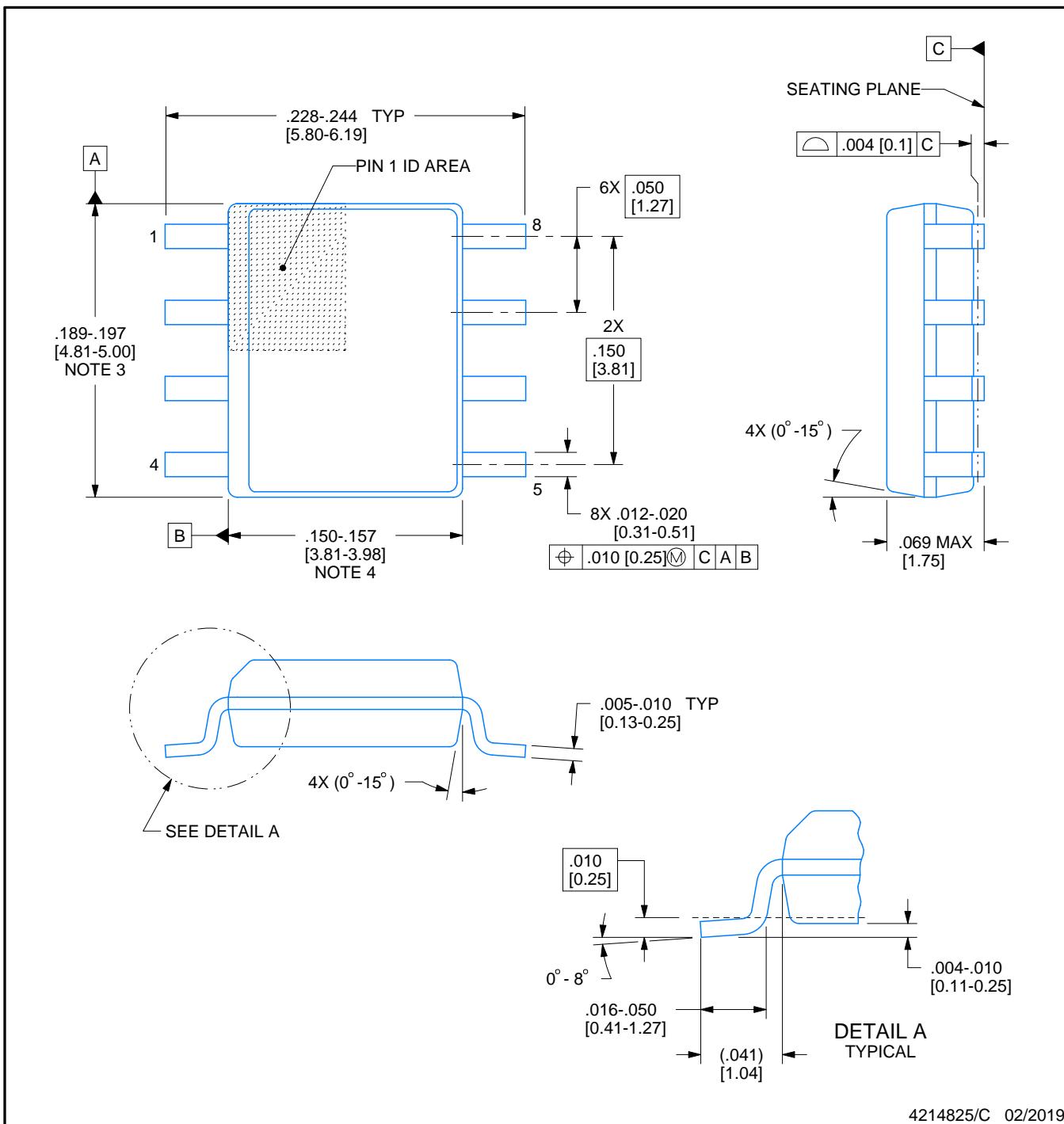
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN65LBC184P	P	PDIP	8	50	506	13.97	11230	4.32
SN65LBC184P.A	P	PDIP	8	50	506	13.97	11230	4.32
SN75LBC184P	P	PDIP	8	50	506	13.97	11230	4.32
SN75LBC184P.A	P	PDIP	8	50	506	13.97	11230	4.32



# PACKAGE OUTLINE

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



### NOTES:

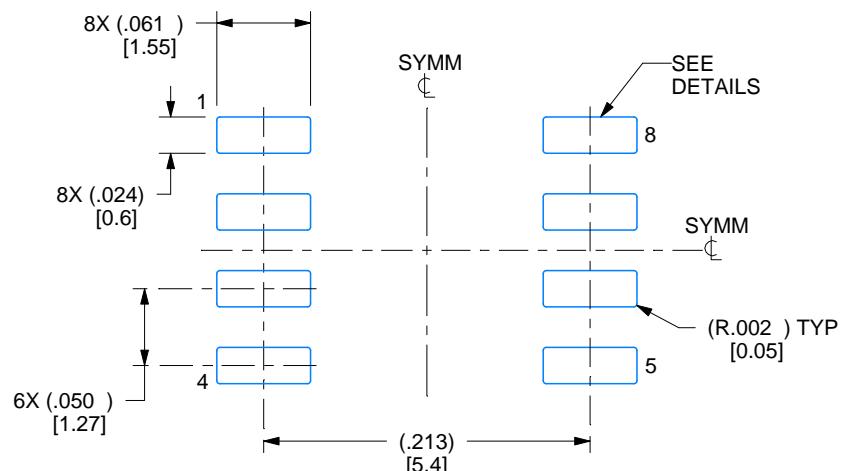
1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

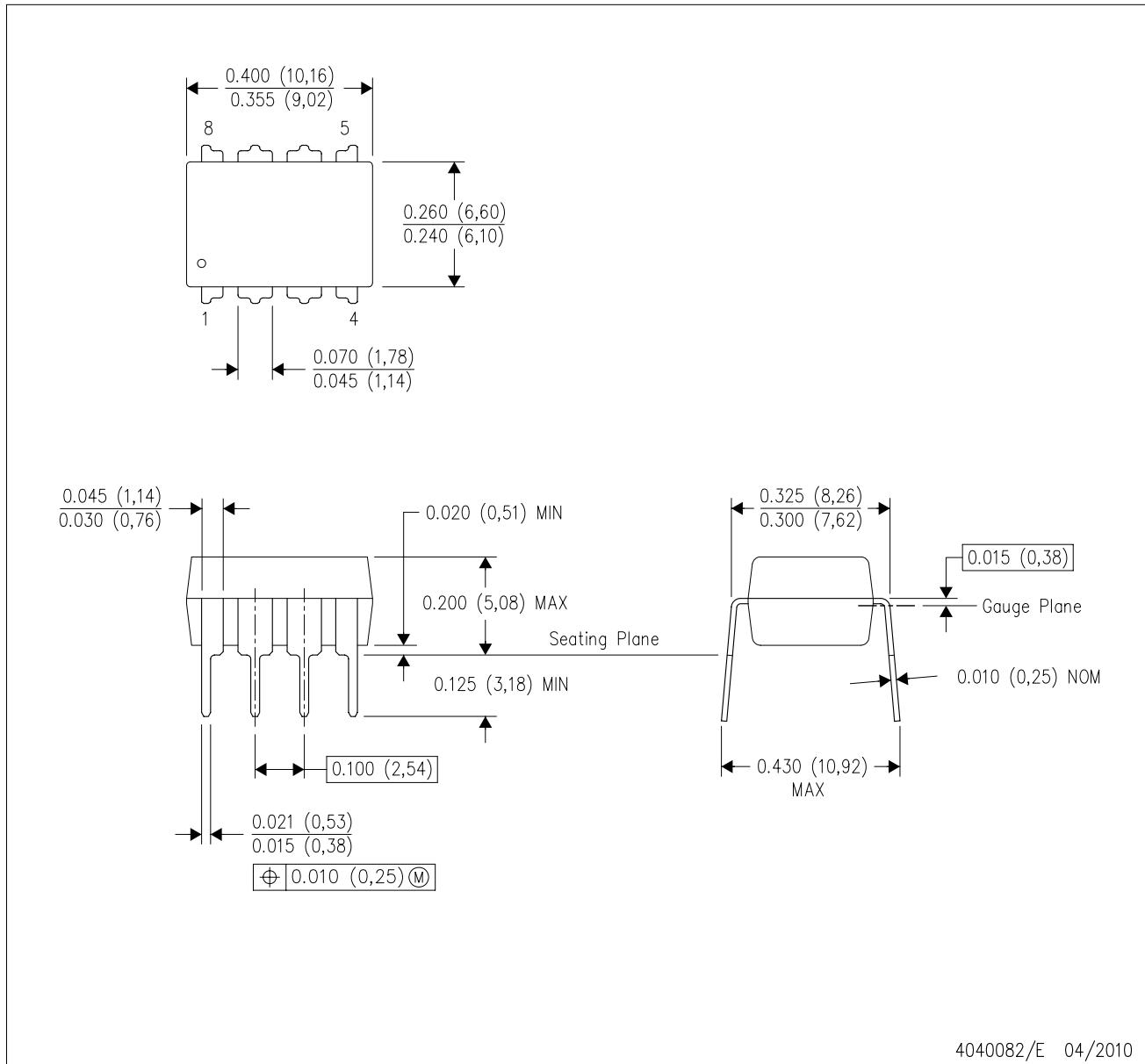
4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001 variation BA.

4040082/E 04/2010

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