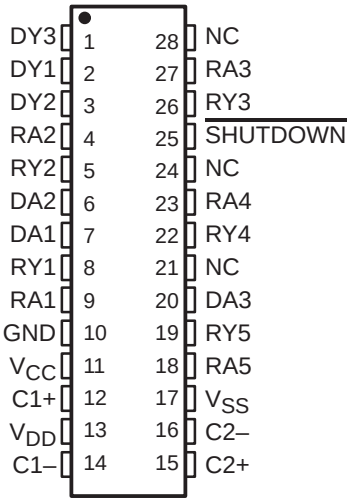
- **Single IC and Single 5-V Supply Interface for Serial Communication Ports**
- **Meets or Exceeds the Requirements of ANSI Standards EIA/TIA-232-E-1991, EIA/TIA-562, and ITU Recommendation V.28**
- **Switched-Capacitor Voltage Converter Eliminates Need for ±12-V Supplies**
- **Voltage Converter Operates With Low Capacitance . . . 0.1 μF Min**
- **Designed for Data Rates up to 120 kb/s Over 3-m Cable**
- **Available in Shrink Small-Outline 25-mil-Pitch Package**
- **Shutdown Mode to Save Power When Not in Use**
- **±30-V Receiver Input Voltage Range**
- **LinBiCMOS™ Process Technology**
- **Applications**
  - **Laptop or Notebook Computers**
  - **Portable Terminals**
  - **Single-Board Computers**
  - **Portable Test Equipment**

DB PACKAGE
(TOP VIEW)



NC – No internal connection

description

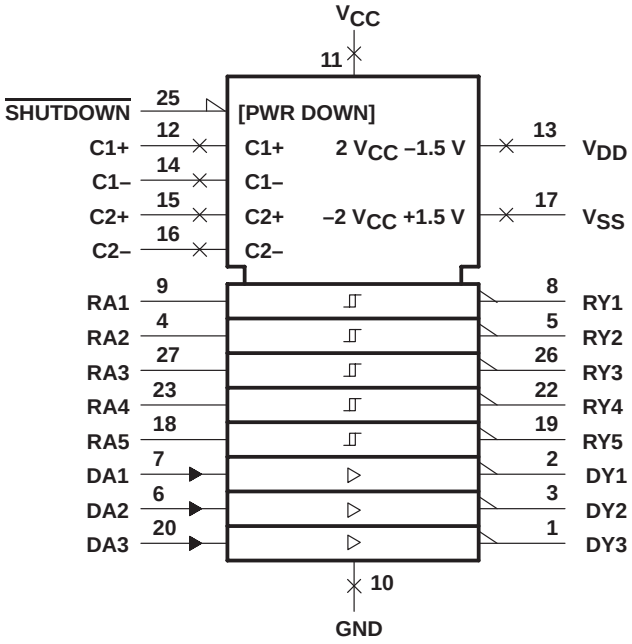
The SN75LBC187 is a low-power LinBiCMOS™ device containing three drivers, five receivers, and a switched-capacitor voltage converter. The SN75LBC187 provides a single chip and single 5-V supply interface between the asynchronous communications element and the serial port connector of the data terminal equipment (DTE). This device has been designed to conform to ANSI Standards EIA/TIA-232-E, EIA/TIA-562, and ITU recommendation V.28.

The switched-capacitor voltage converter of the SN75LBC187 uses four small external capacitors to generate the positive and negative voltages required by EIA/TIA-232-E (and V.28) line drivers from a single 5-V input. The drivers feature output slew-rate limiting to eliminate the need for external filter capacitors. The receivers can accept ±30 V without damage. The device also features a reduced power or shutdown mode that cuts the quiescent power to the IC when not transmitting data between the CPU and peripheral.

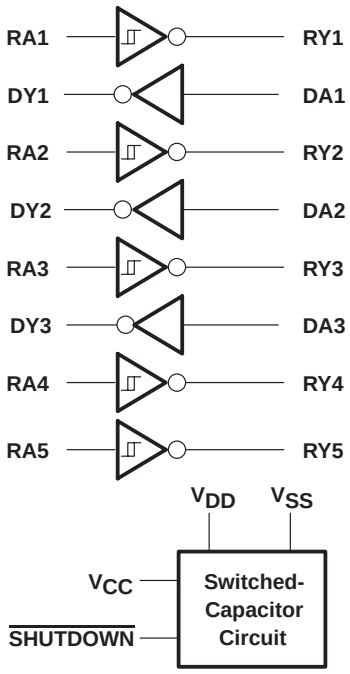
The SN75LBC187 has been designed using LinBiCMOS™ technology and cells contained in the Texas Instruments LinASIC™ library. The SN75LBC187 is characterized for operation from 0°C to 70°C.

NOTE:
This device includes circuit designs and process technologies that have patents pending.

logic symbol†



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V_{CC} (see Note 1) . . . . . 0.3 V to 6 V
Positive output supply voltage range, V_{DD} . . . . . V_{CC} –0.3 V to 15 V
Negative output supply voltage range, V_{SS} . . . . . 0.3 V to –15 V
Input voltage range, V_I: RA . . . . . ±30 V
All other inputs . . . . . –0.3 V to V_{CC} + 3 V
Output voltage range, V_O: DY . . . . . –2 V_{CC} + 1.2 V to 2 V_{CC} – 1.2 V
All other outputs . . . . . –0.3 V to V_{CC} + 3 V
Continuous total power dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C

‡ 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 “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltages are with respect to the network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
DB	1025 mW	8.2 mW/°C	656 mW

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.5	5	5.5	V
High-level input voltage, V_{IH}	DA	2			V
	RA, $\overline{\text{SHUTDOWN}}$	2.4			
Low-level input voltage, V_{IL}	RA, DA, $\overline{\text{SHUTDOWN}}$			0.8	V
Receiver input voltage, V_I		–25		25	V
High-level output current, I_{OH}	RY			–1	mA
Low-level output current, I_{OL}	RY			3.2	mA
Output current, I_O	V_{DD}			±10	µA
	V_{SS}			±10	µA
C1, C2, C3, C4 charge pump capacitors		0.1	0.47		µF
Operating free-air temperature, T_A		0		70	°C

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V_{OH}	High-level output voltage	Receiver	I_O = –1 mA	3.5			V
		Driver	R_L = 3 kΩ to GND	5	7		
V_{OL}	Low-level output voltage	Receiver	I_O = 3.2 mA			0.4	V
		Driver	R_L = 3 kΩ to GND		–7	–5	
V_{IT+}	Receiver positive-going input voltage threshold				1.7	2.4	V
$V_{IT–}$	Receiver negative-going input voltage threshold			0.8	1.2		V
V_{hys}	Receiver input hysteresis voltage ($V_{IT+} – V_{IT–}$)				0.5	1	V
r_i	Receiver input resistance		V_{CC} = 5 V, T_A = 25°C	3	5	7	kΩ
r_o	Driver output resistance		V_{CC} = 0, V_O = ±2 V	300			Ω
I_I	Input current (DA, $\overline{\text{SHUTDOWN}}$)		V_I = 0 to V_{CC}			±50	µA
I_{OS}	Driver output short-circuit current		V_O = 0	±10			mA
I_{CC}	Supply current	Normal operation	All outputs open, $\overline{\text{SHUTDOWN}}$ at 2.4 V		15	30	mA
		Shutdown mode	All outputs open, $\overline{\text{SHUTDOWN}}$ at 0.1 V			10	µA

† All typical values are at V_{CC} = 5 V and T_A = 25°C.

switching characteristics over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	Receiver	R_L = 5 kΩ, C_L = 50 pF, See Figure 1		1.25	µs
		Driver	R_L = 3 kΩ, C_L = 1200 pF, See Figure 2		1.25	µs
t_{PHL}	Propagation delay time, high- to low-level output	Receiver	R_L = 5 kΩ, C_L = 50 pF, See Figure 1		1.25	µs
		Driver	R_L = 3 kΩ, C_L = 1200 pF, See Figure 2		1.25	µs
t_r	Rise time, driver output		R_L = 3 kΩ, C_L = 50 pF, V_O = –3 V to 3 V, See Note 2	200		ns
			R_L = 3 kΩ, C_L = 2500 pF, V_O = –3.3 V to 3.3 V, See Note 3		1.5	µs
t_f	Fall time, driver output		R_L = 3 kΩ, C_L = 50 pF, V_O = 3 V to –3 V	200		ns
			R_L = 3 kΩ, C_L = 2500 pF, V_O = 3.3 V to –3.3 V		1.5	µs

NOTES: 2. The 200 ns for the output to change from –3 V to 3 V (or vice versa) corresponds to the 30 V/µs maximum slew rate of EIA/TIA-232-E, EIA/TIA-562, and ITU Recommendation V.28.

3. The more stringent requirement for transition times comes from the EIA/TIA-562, which requires the rise and fall times to be measured from 3.3 V.

PARAMETER MEASUREMENT INFORMATION

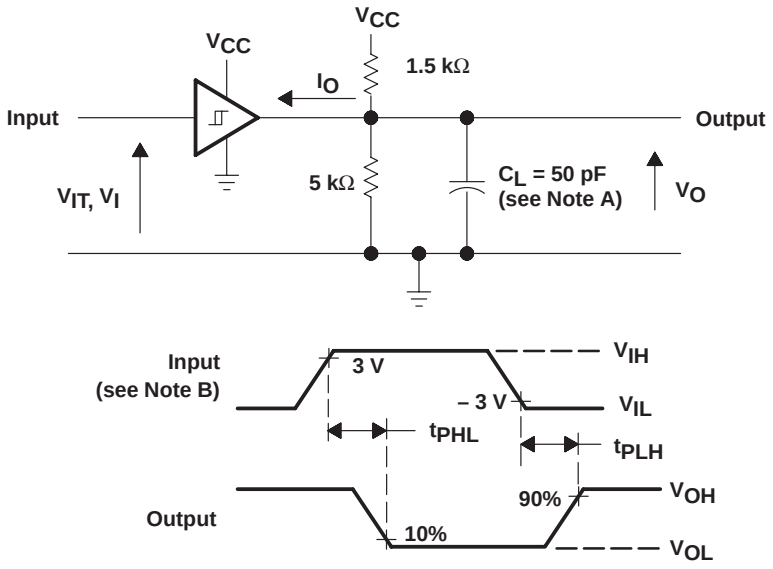
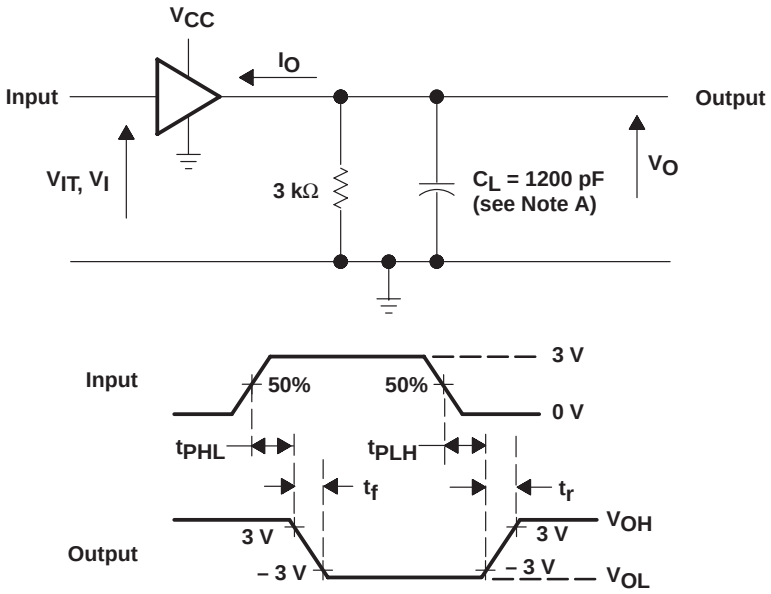


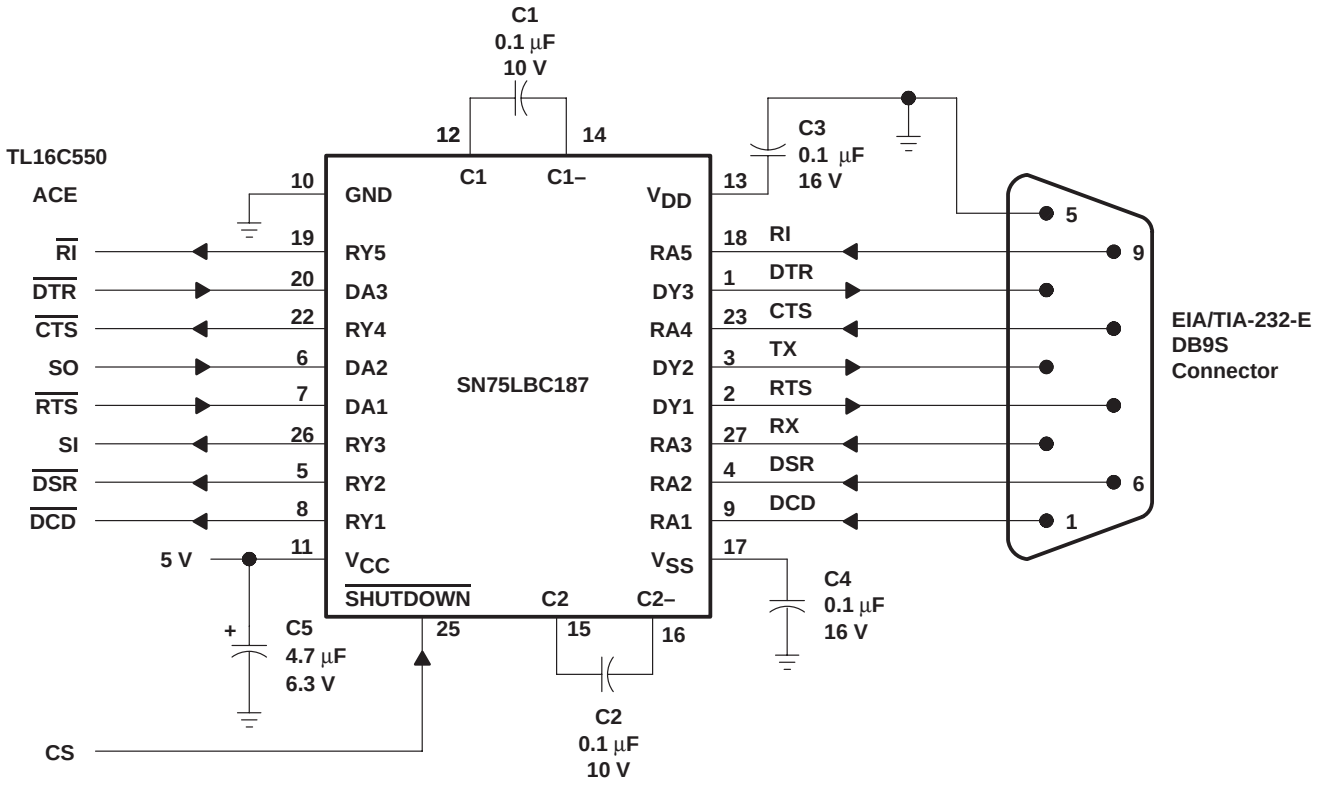
Figure 1. Receiver Test Circuit and Waveforms



NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: t_W = 8.33 µs, PRR = 60 kHz, $t_r = t_f \leq 50$ ns.

Figure 2. Driver Test Circuit and Waveforms

APPLICATION INFORMATION



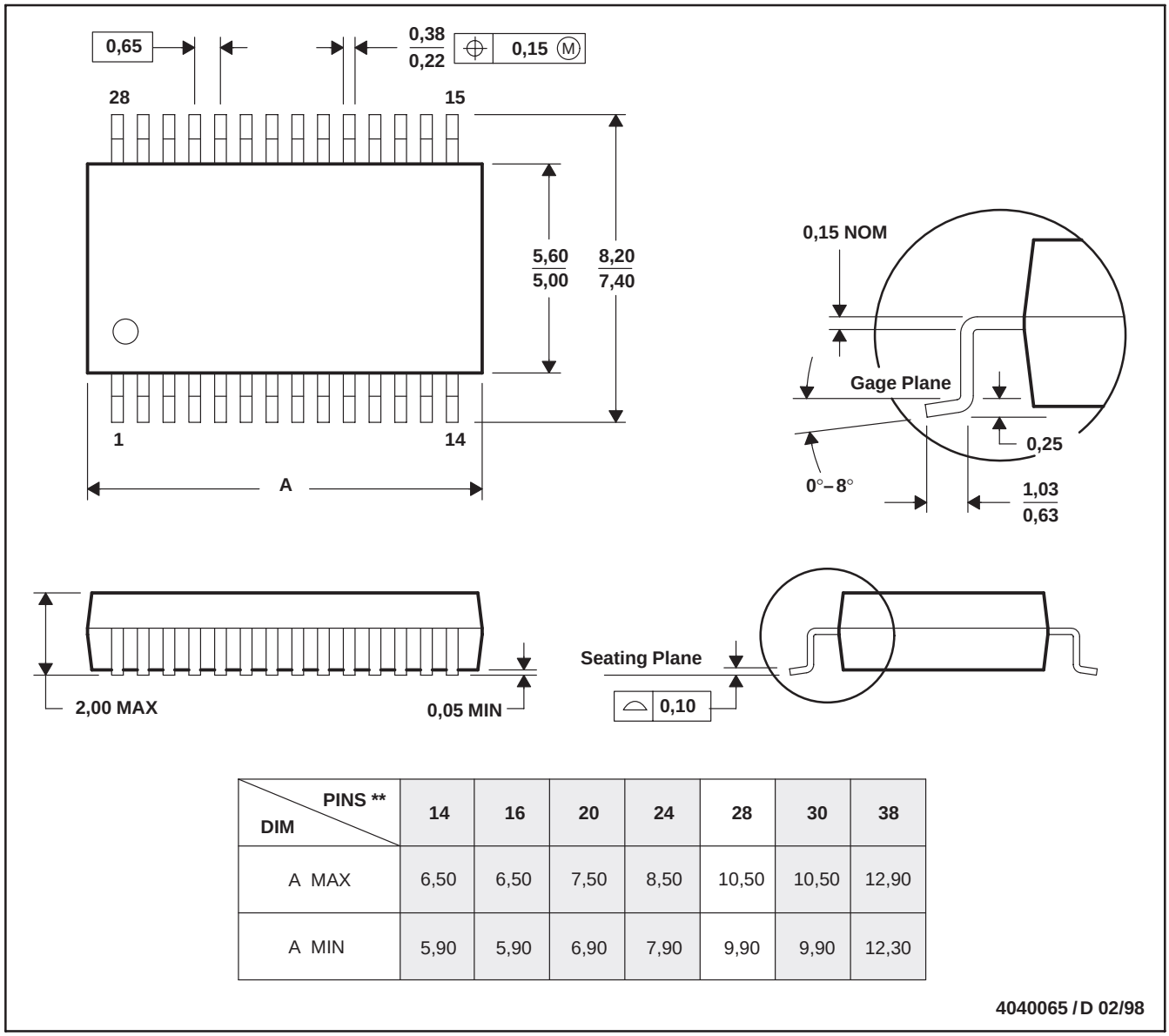
NOTE: C1, C2, C3, and C4 are Z5U-type ceramic-chip capacitors.

Figure 3. Typical SN75LBC187 Connection

MECHANICAL DATA

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

28 PIN SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 / D 02/98

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-150

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
SN75LBC187DBLE	OBSOLETE	SSOP	DB	28		TBD	Call TI	Call TI
SN75LBC187DBR	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC187DBRE4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC187DBRG4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

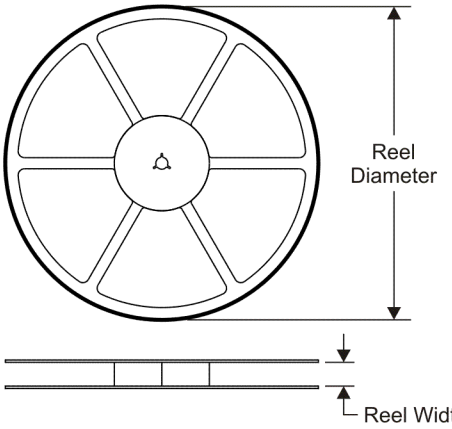
[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

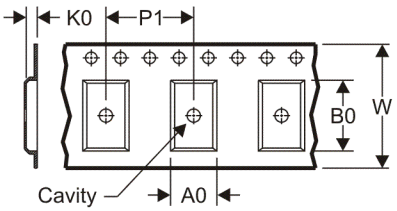
[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

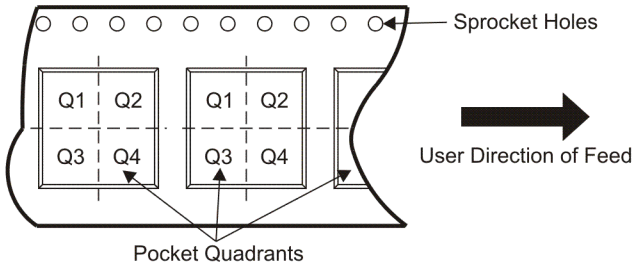


TAPE DIMENSIONS



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

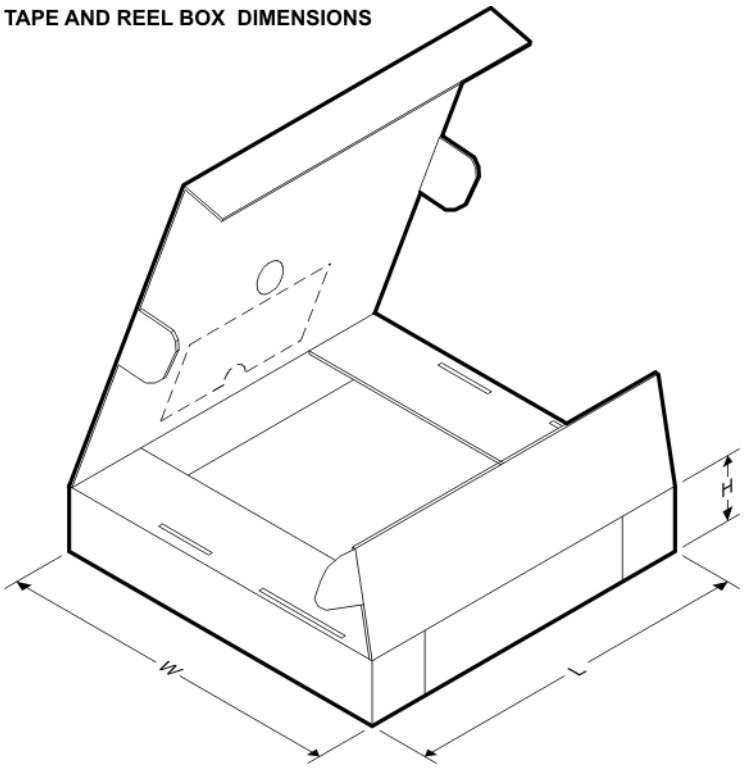
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN75LBC187DBR	SSOP	DB	28	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



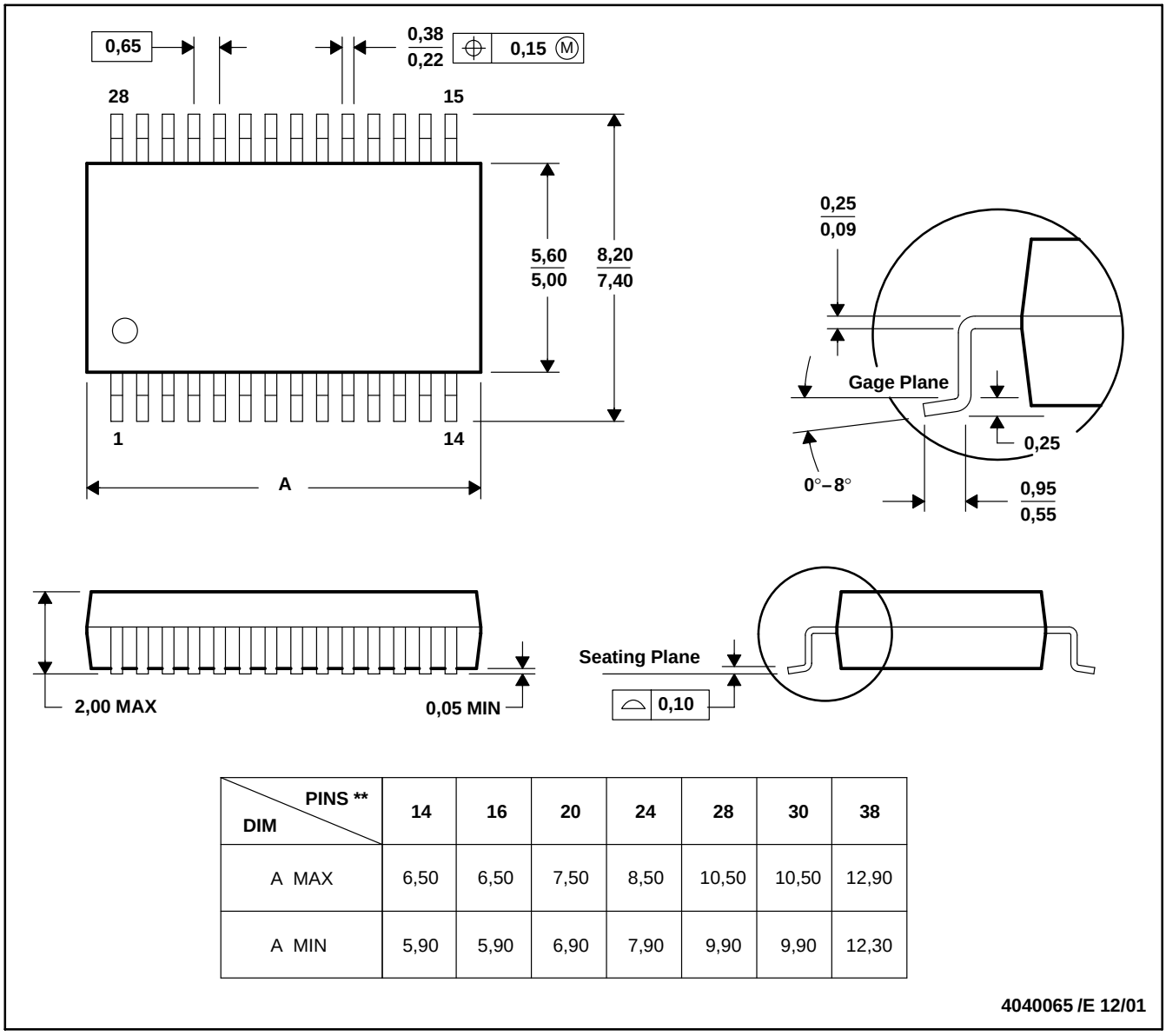
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LBC187DBR	SSOP	DB	28	2000	346.0	346.0	33.0

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-150

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265