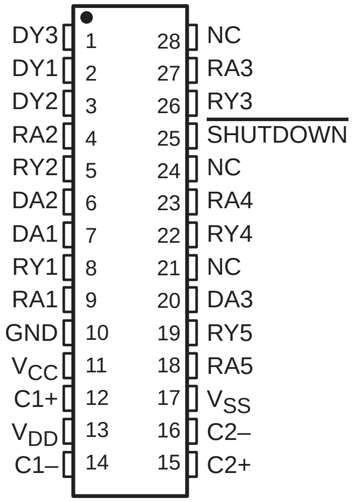
SN75LBC187
MULTICHANNEL EIA-232 DRIVER/RECEIVER WITH CHARGE PUMP

SLLS130C – SEPTEMBER 1991 – REVISED MAY 1995

- **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

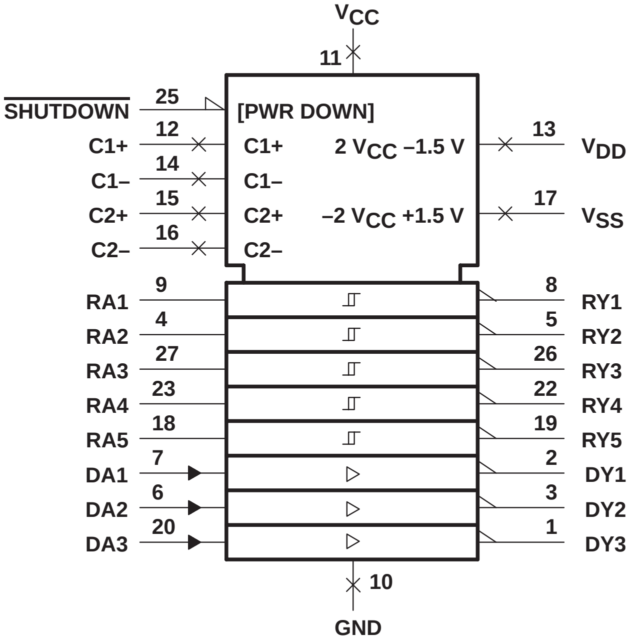
The SN75LBC187 is a low-power LinBiCMOS™ device containing three drivers, five receivers, and a switched-capacitor voltage converter. The SN75LBC187 provides a single chip and single 5-V supply interface between the asynchronous communications element and the serial port connector of the data terminal 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.

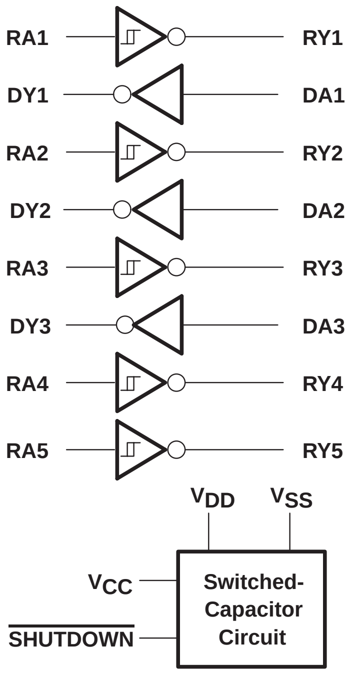
NOTE:
This device includes circuit designs and process technologies that have patents pending.

logic symbol†



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

logic diagram (positive logic)



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	$T_A \leq 25°C$ 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

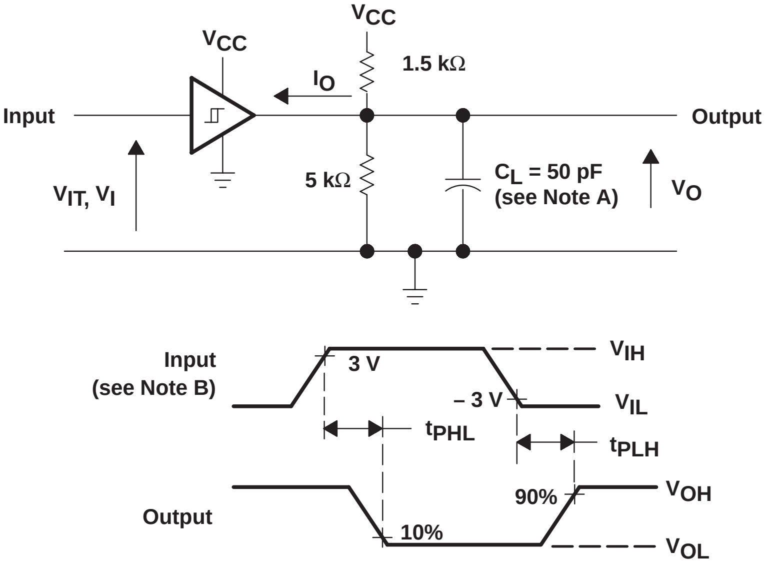
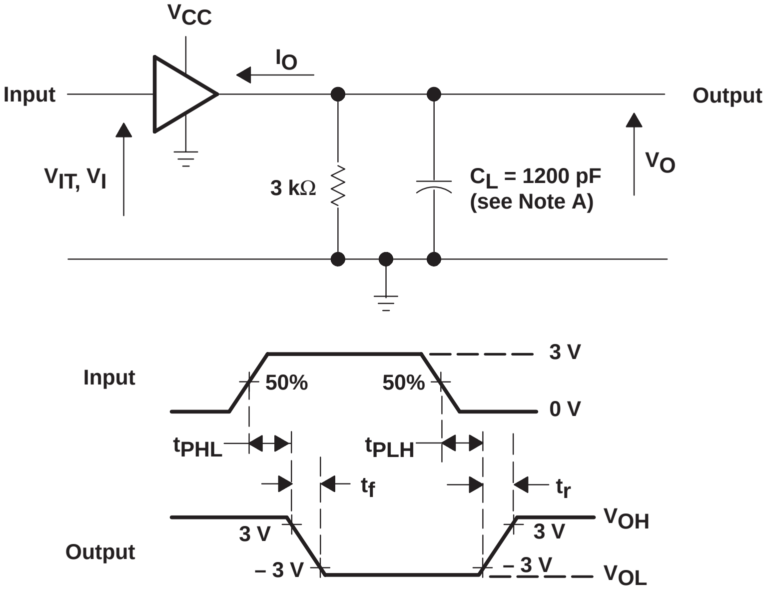


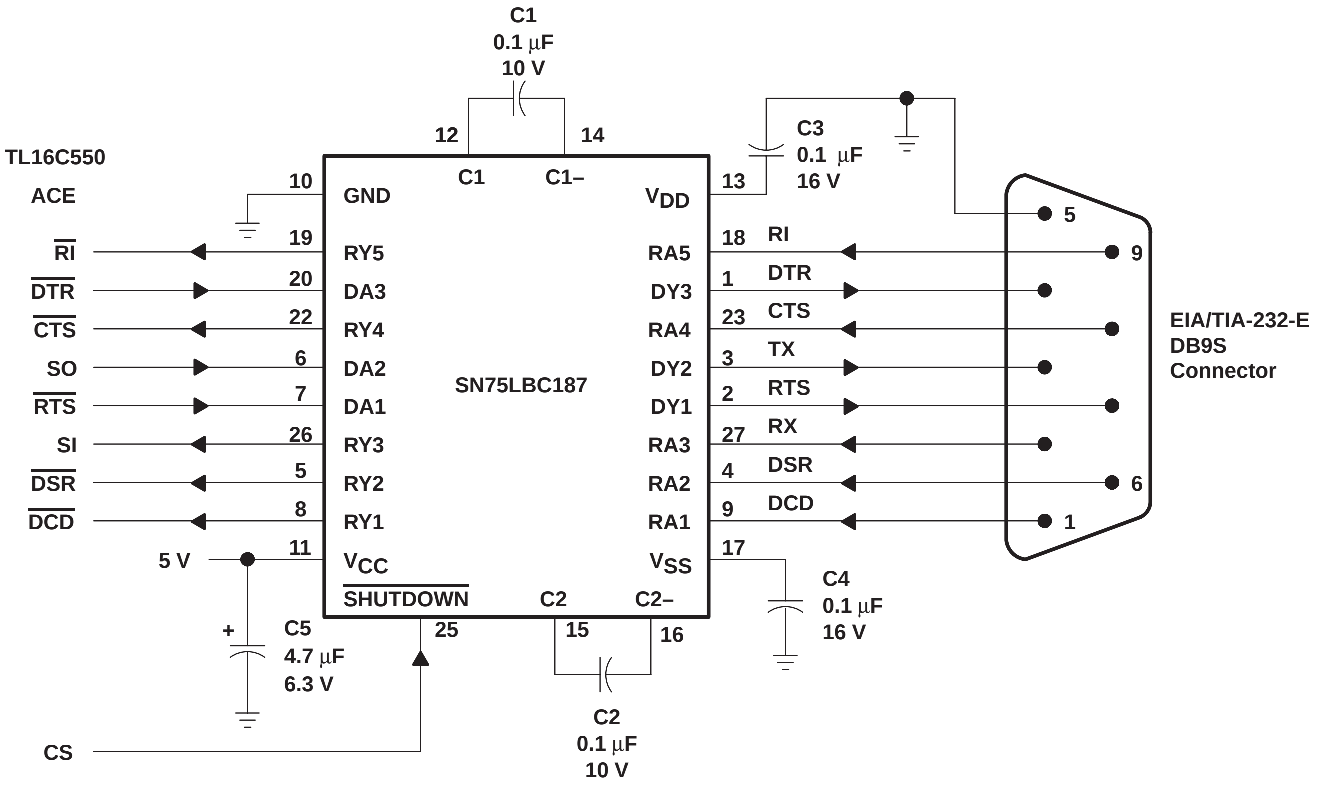
Figure 1. Receiver Test Circuit and Waveforms



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



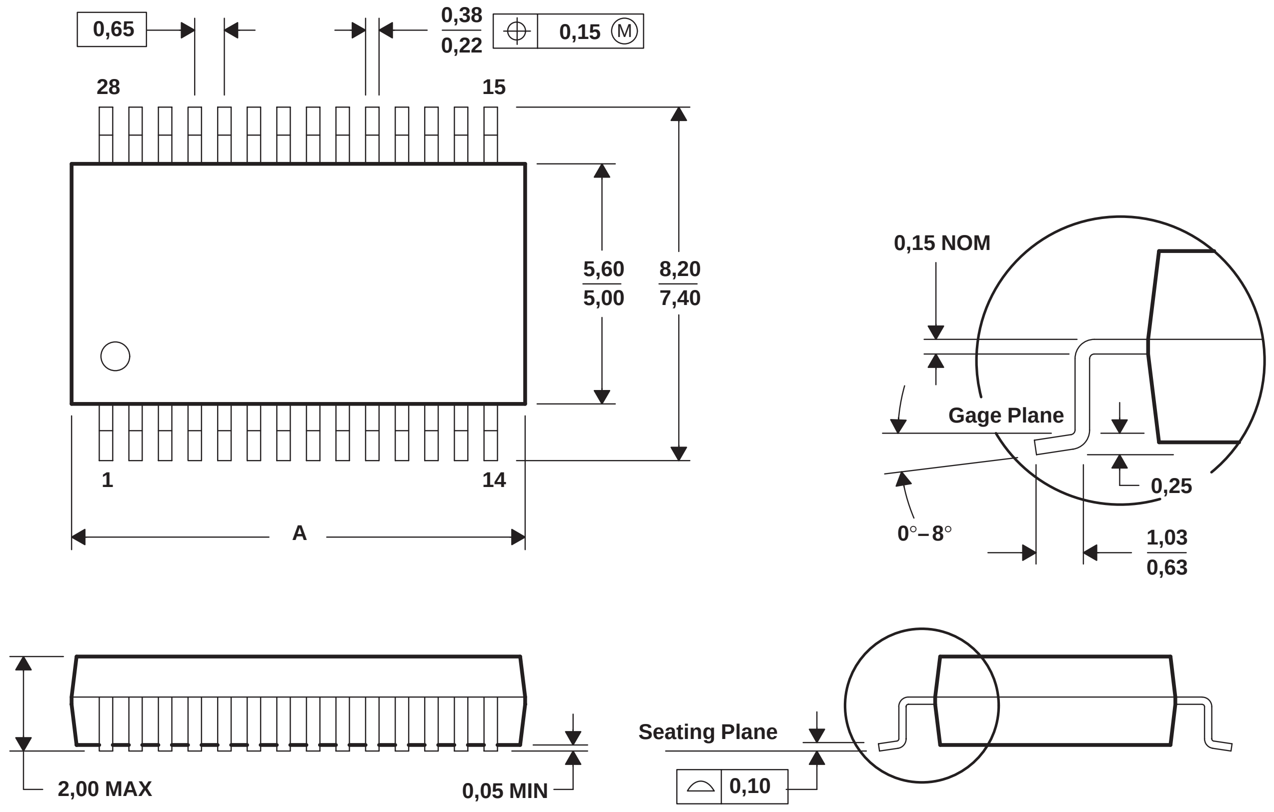
NOTE: C1, C2, C3, and C4 are Z5U-type ceramic-chip capacitors.

Figure 3. Typical SN75LBC187 Connection

MECHANICAL DATA

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

28 PIN SHOWN



PINS ** / DIM	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

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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

PACKAGE OPTION ADDENDUM

28-May-2007

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.

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TAPE AND REEL INFORMATION

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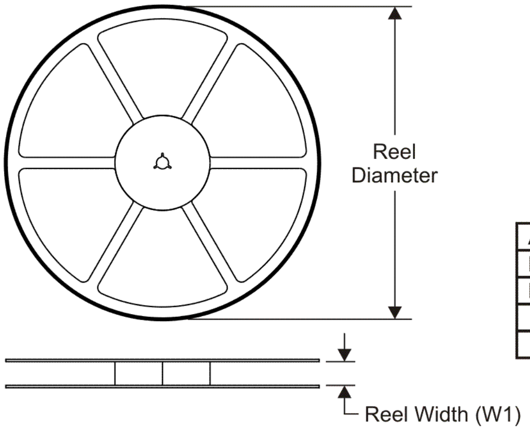
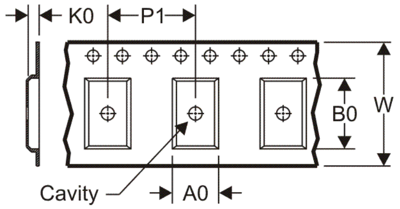
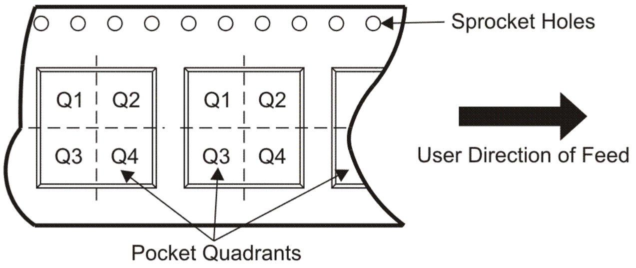


TAPE DIMENSIONS



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

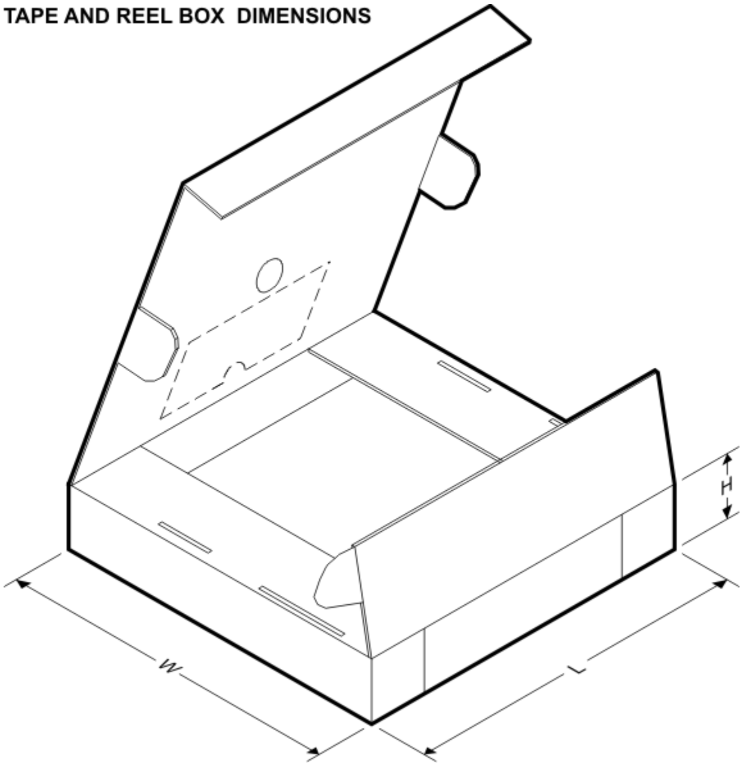


*All dimensions are nominal

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

PACKAGE MATERIALS INFORMATION

TAPE AND REEL BOX DIMENSIONS

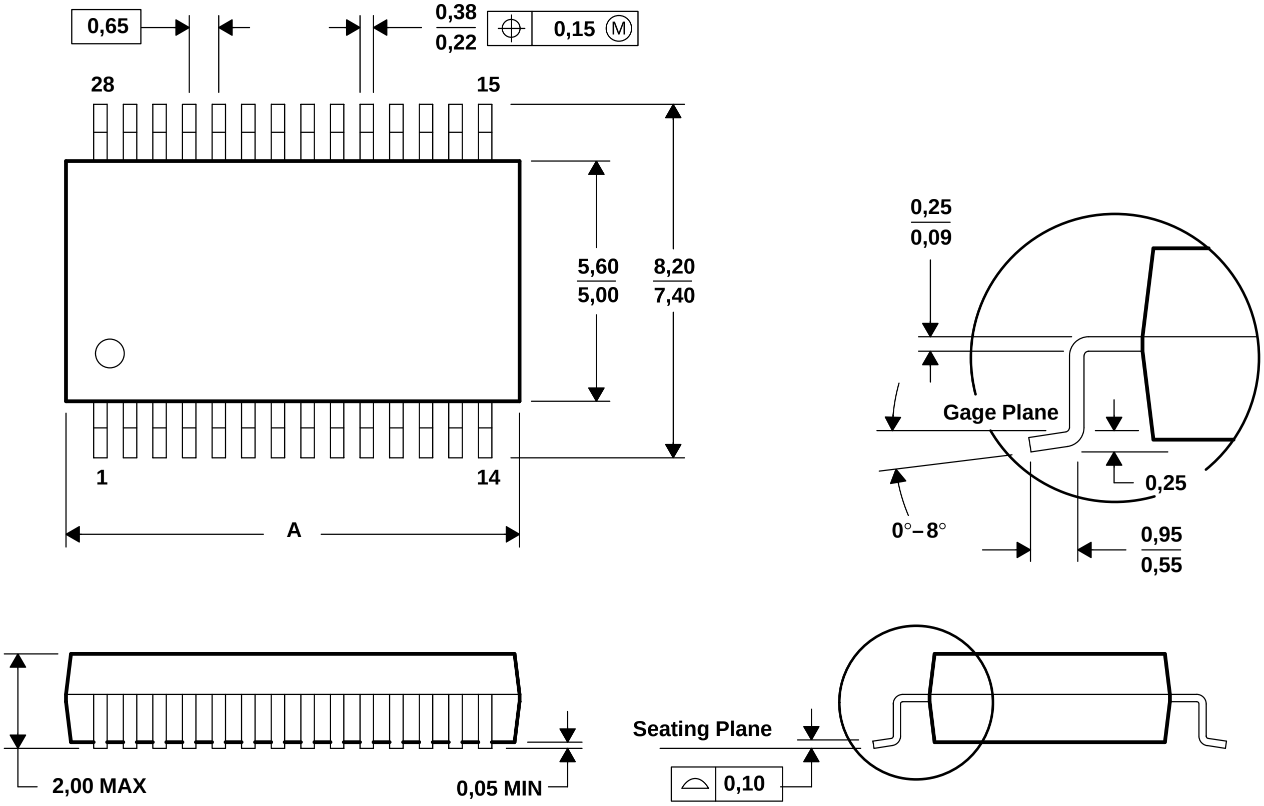


*All dimensions are nominal

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

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

28 PINS SHOWN



PINS ** DIM	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

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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

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